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LIST OF ACRONYMS

BtB	Back-to-Back
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMF	Electro Magnetic Field
ENSTO	European Network of Transmission System Operators
EPFIs	Equator Principles Financial Institutions
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management and Monitoring Plan
ESMS	Environmental and Social Management System
ESS	Environmental and Social Standards
EU	European Union
EP	Equator Principles
LACF	Land Acquisition and Compensation Framework
LACP	Land Acquisition and Compensation Plan
GD	Government Decision
IBAs	Important Bird Areas
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ILO	International Labour Organization
IUCN	International Union for Conservation of Nature
kV	kilo Volt
ME	Ministry of Environment
MD	Republic of Moldova
MW	Megawatt
NIF	Neighbourhood Investment facility
NGO	Non- Governmental Organization
OHL	Over Head Line
OPGW	Optical Ground Wire
PRs	EBRD Performance Requirements
RO	Romania
WB	World Bank

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1. EXECUTIVE SUMMARY

Introduction

The MD-RO power interconnection Chisinau – Vulcanesti-Isaccea will enable the Republic of Moldova to diversify its electricity sources and integrate its power system with other European power systems through Romania. The project is the most feasible of the three interconnections proposed to be built between Moldova and Romania in the next ten years. The other two interconnections: (i) Straseni (Moldova) – Iasi (Romania); and (ii) Balti (Moldova) – Suceava (Romania) will have less capacity than the Chisinau- Vulcăneşti - Isaccea interconnection, but they will contribute to the further integration of the Moldovan power system with ENTSO-E.

The project will cover the construction, supply of equipment and placing into operation of: (i) a back-to-back substation at Vulcăneşti o allow the asynchronous connection of the electricity systems of Romania and Moldova, namely the European Network of Transmission System Operators of Electricity (ENTSO-E) and the Integrated Power System/United Power System (IPS/UPS); (ii) a 400kV transmission line between Vulcăneşti and Chisinau; (iii) the extension of the substation at Chisinau in Moldova; and (iv) the extension of the Vulcăneşti 400kV substation (together, the “Project”).

The total project cost is estimated at EUR 270m, and financing is expected to be provided by the European Bank for Reconstruction and Development (“EBRD”), the European Investment Bank (“EIB”) and the World Bank (“WB”) through senior sovereign loans, together with an investment grant from the Neighbourhood Investment facility (“NIF”).

OPERATIONAL FRAMEWORK

The Project proposal for construction *of “‘Back-to-Back” station at Vulcănești, that assures the asynchronous interconnection between the power system of Republic of Moldova with the power system of Romania and 400 kV OHL Vulcăneşti – Chişinău* is subject to Republic of Moldova EIA Law (Law no. 86/2014) in accordance to Annex 1, item 21 *“Lines of transportation of electrical power with a voltage of 220kV and more and a minimum length of 15 km”.* Therefore, the Project shall be subject to an EIA procedure in compliance with the national EIA legislation.

EBRD requires for category A projects, which includes high voltage overhead electric power lines, an Environmental and Social Impact Assessment (Appendix 2, item 21).

Also, the EIB requires for category A projects, including *"Construction of overhead electrical power lines with a voltage of 220 kV or more and a length of more than 15 km",* an Environmental Impact Assessment (Annex 3, item 20).

According with WB policy, the electrical transmission projects could be Category B if the impact are site-specific, limited in number, and mitigation measures are readily identifiable.

According with the gap analysis conducted in *chapter 2 Operational framework*, in order to respect the national legislation as well as the requirements of international financial institution, for the proposed Project, an ESIA has been carried out in order to meet several main objectives:

- To respect the environmental and social policy/framework of international financing institutions;
- To obtain the Environmental Agreement, according with Republic of Moldova legal framework;
- To ensure public consultation / stakeholder engagement input into the proposed project;
- To establish the baseline environmental and socio-economic conditions within the study area and to identify appropriate mitigation measures to be incorporated into the design and construction process in order to minimize those impacts;
- To incorporate all mitigation measures into an environmental and social management and monitoring Plan in order to facilitate Project construction and implementation.

ANALYSIS OF ALTERNATIVES

The "Do nothing" alternative considers that the proposed Project will not be developed.

As mentioned in Chapter 2 – Operational framework, the Project is included in the Energy Strategy of the Republic of Moldova for 2030, approved through the GD no. 102/2013, which will be adjusted by reiterating the Project as a priority in its current and final form (in particular the change from a 330 kV transmission line to a 400kV transmission line) by the Interministerial Committee on Strategic Investments by the end of August 2017.

One of the main objectives of the Strategy is to strengthen Republic of Moldova's role of power transmissions corridor, by building new interconnections with the ENTSO-E system and by consolidating the internal power transmission network. The "Back-to-Back" (BtB) station at Vulcăneşti substation and the OHL Vulcăneşti - Chişinău are identified in the Strategy as a priority electricity interconnection project between the Republic of Moldova and Romania.

By not implementing the Project, several potential environmental impacts at local scale would be completely avoided such as: noise (due to road traffic during construction and

construction activities), restrictions affecting local land use within the safe zone of the OHL route, visual-aesthetic impacts of towers and conductors, etc.

The "Do nothing" alternative would avoid the potential negative environmental and social impacts of the construction and operational stages but, on the other hand, will prolong the current situation of lack of security of supply of electricity for the Republic of Moldova and affect the following aspects:

- The integration of the Republic of Moldova's energy market with ENTSO-E and the European energy market, with negative consequences for fair, transparent and equitable prices and competition in the Moldovan electricity market;
- The enhancement and diversification of the security of supply of electricity in the Republic of Moldova, which is currently 80% dependent on imports from Ukraine and Transnistria, through the diversification of market participants; and
- Ensuring the generation-consumption balance when variations of electricity generation of internal power plants occur, especially of renewable power plants, whose operation schedule is less predictable.

PROJECT DESCRIPTION

The Project includes the following key features:

- New BtB station at Vulcăneşti substation and modification within the existing 400kV Vulcăneşti substation;
- New 400 kV OHL Vulcăneşti – Chişinău;
- New 400 / 330 kV autotransformer and 400 / 330 kV bay within the existing 330/110/35 kV Chişinău substation.

The Project will involve the construction, supply of equipment and placing into operation of: (i) a back-to-back station in Vulcăneşti substation to allow the asynchronous connection of the electricity systems of Romania and Moldova, namely the European Network of Transmission System Operators of Electricity (ENTSO-E) and the Integrated Power System/United Power System (IPS/UPS); (ii) a 400kV transmission line between Vulcăneşti and Chişinău; (iii) the extension of (and within) the existing 330/110/35 kV substation at Chisinau in Moldova involving the construction of a new 330 / 400 kV autotransformer bay with new autotransformer (AT 400 / 330 kV); (iv) the extension and modification of (and within) the existing Vulcanesti 400kV substation; (v) the modification of existing 330 kV, 110 kV and 35 kV OHLs at locations where they will be crossed by the new 400 kV OHL Vulcăneşti – Chişinău involving the relocation and/or modification of some towers; (vi) modification of the

existing 400 kV OHL Isaccea – Vulcăneşti local to Vulcăneşti substation, involving the replacement of some existing towers with new repositioned towers in order to facilitate the routing and connection of the OHL to the BtB substation). Based on the ESIA work findings there is a recommendation for a route deviation avoiding the Bugeac Steppe protected area.

ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE

The baseline data collection was focus on description of physical, biological and socio-economic characteristic of the study area, in order to establish the potential environmental and socio-economic impacts.

The study area for baseline condition (physical, biological and socio-economic), referred thereafter as ***survey corridor***, is defined as an area of 10 km on both sides of the proposed OHL route (from OHL's central axis). For some socio economic aspects was defined a ***close proximity corridor*** of 1 km width, each side of the OHL axis. Details related to the OHL survey and close proximity corridors are presented in chapter 4.2 Project description.

ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS, CHARACTERISATION OF IMPACTS AND MITIGATION MEASURES

The impact assessment conducted on a case-by-case basis, depending on certain environmental and socio-economic aspects, was focus on specific condition that has to be respected in order to ensure the safety and integrity of the Project.

As a result of evaluation the potential impacts of the Project on the physical, biological and socio-economic resources, mitigation measures were identified that the Project will take in order to avoid, minimise/reduce and mitigate adverse impacts and to enhance positive impacts where applicable.

Where relevant, the anticipated impact was compared with applicable environmental requirements and standards.

The impact assessment methodology considered potential change on the physical, biological and socio-economic environment in relation with criteria set out according to their extent/scale, duration, intensity/magnitude and probability.

The significance of potential impacts, a function of extent, duration, intensity/magnitude of the impact and the probability of impact occurring, was categorized into the following significance categories:

- Negligible: no detectable change to the environment;

- Minor: the impact magnitude is sufficiently small and well within relevant environmental limits and standards;
- Moderate: the impact magnitude is within relevant environmental limits and standards;
- High: the regulatory limits and standards may be extended or large magnitude impacts occur to resources/receptors.

The mitigation measures proposed in case of probability of significant damage on the environment are consistent with requirements of relevant legislation and policies, as well as international practices.

For socio-economic environment where positive impacts may occur, in order to establish the significance of impact the same matrix was used; in case of intensity/magnitude the same scale was used for assessing the positive impacts, marked as positive, e.g. Negligible (positive).

For positive impacts the following significance categories were defined:

- Negligible (positive): positive changes affecting a few individuals;
- Minor (positive): positive benefits to a small section of the community;
- Moderate (positive): changes affecting a significant section of the community;
- High (positive): massive changes positively affecting majority of population.

CONCLUSIONS

Legislation of Republic of Moldova and the Environmental and Social Policies of IFI's institutions require projects to identify the major positive and negative impacts on the environment and people and to develop and implement measures to avoid, reduce, or control those impacts. This can include changes in design, construction methods, and/or operation procedures as well as monitoring to identify negative impacts. It can also include compensation for impacts that cannot be avoided or reduced to acceptable levels.

The potential impacts can be avoided, controlled, or otherwise reduced to acceptable levels by the implementation of specific mitigation measures, and in some cases by the preparation and implementation of management plans.

The Environmental and Social Management and Monitoring Plan (ESMMP) describes the required actions required by the ESIA and how environmental and social impacts will be managed and monitored so they meet the requirements of national legislation and the environmental and social standards of the IFIs.

The Land Acquisition and Compensation Framework (LACF) were prepared to avoid or

minimise involuntary resettlement, to mitigate adverse social and economic impact from land acquisition, to provide compensation for loss of assets at replacement costs, to restore or improve the livelihoods and standards of living and to provide resettlement assistance.

An overview of the stakeholder consultation process throughout the ESIA process is presented in SEP Report (Stakeholders Engagement Plan). This plan identifies key stakeholders and describes how they will be provided with information on the project and given the opportunity to express their opinions, and even to submit complaints.

2. OPERATIONAL FRAMEWORK

2.1 Purpose of the Environmental and Social Impact Assessment

The MD-RO power interconnection Chişinău – Vulcăneşti-Isaccea will enable the Republic of Moldova to diversify its electricity sources and integrate its power system with other European power systems through Romania. The project is the most feasible of the three interconnections proposed to be built between Moldova and Romania in the next ten years. The other two interconnections: (i) Străşeni (Moldova) – Iaşi (Romania); and (ii) Bălţi (Moldova) – Suceava (Romania) will have less capacity than the Chişinău-Vulcăneşti-Isaccea interconnection, but they will contribute to the further integration of the Moldovan power system with the European Network of Transmission System Operators of Electricity (ENTSO-E).

The project will cover the construction, supply of equipment and placing into operation of: (i) a Back-to-Back (BtB) substation at Vulcăneşti to allow the asynchronous connection of the electricity systems of Romania and Moldova, namely the ENTSO-E and the Integrated Power System/United Power System (IPS/UPS); (ii) a 400kV transmission line between Vulcăneşti and Chişinău; (iii) the extension of the substation at Chişinău in Moldova; and (iv) the extension of the Vulcăneşti 400kV substation (together, the “Project”).

The total Project cost is estimated at EUR 270m, and financing is expected to be provided by the European Bank for Reconstruction and Development (“EBRD”), the European Investment Bank (“EIB”) and the World Bank (“WB”) through senior sovereign loans, together with an investment grant from the Neighbourhood Investment facility (“NIF”).

For this Project an Environmental and Social Impact Assessment (ESIA) has been prepared in accordance with national legal requirements as well as environmental and social policies and guidelines adopted by the potential international financing institutions (EBRD, EIB, WB).

The overall objective of the ESIA Report is to carry out an assessment of proposed Project in order to ensure that the significant environmental and social impacts have been considered and assessed for all project’s stages (planning, construction, operation and decommissioning).

The main objectives of the ESIA are to:

- Identify and assess the potential environmental and social impacts of the proposed Project;
- Identify and analyse alternatives to the proposed Project;

- Verify compliance with national environmental legislation and as well as environmental and social policies and guidelines adopted by the potential international financing institutions (EBRD, EIB, WB);
- Propose mitigation measures for negative impacts to be implemented during and after implementation of the Project;
- Prepare an Stakeholders' Engagement Plan compliance with the national legislation (Law no. 86/2014) and EBRD Environmental and Social Policy (PR 10), EIB Environmental and Social Practices and Standards (ESS 10) and WB Environmental and Social Standards Safeguards;
- Prepare an Environmental and Social Management and Monitoring Plan (ESMMP) compliance with EBRD Environmental and Social Policy (PR 1), EIB Environmental and Social Practices and Standards and WB Environmental and Social Standards Safeguards;
- Prepare a Land Acquisition and Compensation Framework (LACF) compliance with EBRD Environmental and Social Policy (PR 5), EIB Environmental and Social Practices and Standards (ESS 6) and WB Environmental and Social Standards Safeguards (WB OP4.2).

The ESIA presented in this document is performed by the consortium selected as Consultant for this Project, namely: ISPE, IVL Swedish Environmental Research Institute Ltd and ICPT Energoproiect (Chişinău).

2.2 Project status

The Project is included in the Energy Strategy of the Republic of Moldova for 2030, approved through the GD no. 102/2013, which will be adjusted by reiterating the Project as a priority in its current and final form (in particular the change from a 330 kV transmission line to a 400kV transmission line) by the Interministerial Committee on Strategic Investments by the end of August 2017.

For the Project, the Feasibility Study has been performed that includes enough details to establish the technical feasibility of the proposed investment as well as to assess the potential environmental and socio-economic impacts. The level of details includes OHL route within the corridor and proposed locations of the OHL towers.

The mitigation measures identified in the ESIA Report will be implemented during Project's lifetime, as part of construction and operation procedures.

2.3 Legal and policy framework

The Project will comply with national legislation, relevant EU Directives as well as environmental and social policies and guidelines adopted by international lenders: (i) *EBRD Environmental and Social Policy* (EBRD 2014); (ii) *EIB Environmental and Social Practices and Standards Handbook* (EIB 2013); and (iii) *WB Environmental and Social Safeguards policies*.

2.3.1 Republic of Moldova legal and policy framework

2.3.1.1 Environmental legal requirements

The legal requirements relevant for planning of environment protection measures and implementation of this type of project are the following:

Law on environmental protection

Law no. 1515/1993 on environmental protection defines main principles for environmental protection: respecting the environmental legislation as well as legislation related to the use of natural resources and energy consumption, pollution prevention and prevention of damages on biosphere and human health. In particular, the following articles shall be considered for the Project:

- The land withdrawal from agriculture use is allowed for economic objectives, subject to the Government approval (art. 36);

- The forests withdrawal from forest fund is allowed for special facilities, including OHLs, subject to the Government decision and positive permit of the Governmental Ecological Expertise; the losses caused by withdrawal from forest fund shall be compensated with equivalent land reforestation in terms of surface and quality of wooden material (art. 41);
- The conservation of biodiversity is required through natural protected areas (art. 63).

Water Law

Law no. 272/2011 establishes the legal framework for the management, protection and efficient use of surface water and groundwater, based on assessment, planning and decision process and also the mechanisms for protection, prevention of water pollution and restoring the aquatic habitat considering the EU requirements. The law partially transposes the provision of EU Directives.

The discharge of waste water in surface water or groundwater is forbidden, without a proper waste water management, established by the environmental permit (art. 34).

Law on natural areas protected by the State

Law no. 1538/1998 establishes the legal framework for setting up and operation of natural areas protected by the State, principles, conservation mechanisms as well as the attributions of central and local authorities, non-governmental organizations and public. The law stipulates the obligation to assess the impact of the economic activities on the protected areas (art. 9).

In order to reduce the anthropogenic impact on objects and complexes situated in protected area, in line with art. 83, specific protection zones are established by urban and landscaping planning documentation, approved by the Government. The specific protection zones for objects and complexes situated in the protected area shall be as following:

- Scientific reservation, national park, biosphere reservation: 100-150 m;
- Natural protected area:
    - Geological and paleontological, hydrological, zoological, botanical and mixed: 500-1000 m;
    - Old protected trees and rare plant species: 30-50 m;
- Natural reservation, landscape reservation, resources reservation, area with multi-operation management: 700-1000 m;
- Dendrological garden, landscape architecture monument and zoological gardens: 100-150m;

- Wetland of international importance: 1000-1500 m.

In the protection zones, the implementation of normal economic activities which don't affect the natural processes is allowed (art. 85) and is forbidden, among other, cutting of forests and construction of maintenance stations, industrial and agriculture facilities which may have an negative impact on the environment (art. 86).

Law related the Republic of Moldova Red Book

Law no. 325-XVI/2005 establishes the legal framework for protection, use and restoring the species of plants and animals included in the Republic of Moldova Red Book, and also the specific attribution of the public authorities and scientific institutions. The Red Book represents an official document including the list of plants and animals extinct, critically endangered, endangered, vulnerable, rare and indeterminate in Republic of Moldova and also general information related to their status, condition, distribution and protection and conservation methods.

The law stipulates the obligation to assure an appropriate protection of the species listed in the Red Book (art. 9).

The 3rd edition of the Republic of Moldova Red Book (2015) includes 218 species of plants and 216 species of animals and also new sections with rare species of fungi and algae.

Law on ecological network

Law no. 94-XVI/2007 on the ecological network establishes the legal framework for designation and management of the natural protected area of local, national and international interest.

Law on animal kingdom

The Law no. 439-XIII/1995 on animal kingdom imposes measures to avoid the negative impact on fauna and migration ways (art. 11, 12 and 14).

Law on vegetal kingdom

Law no. 239-XVI of 8.11.2007 on vegetal kingdom imposes measures for plant protection in order to avoid the negative impact of the economic activities (art. 15).

Strategy and Action Plan on biological diversity for 2015-2020

GD no. 274/2015 on approval of the Strategy and Action Plan on biological diversity for 2015-2020 assure by 2016 the compliance of the National legislation with the requirements of the Directive 2009/147/EC on conservation of wild birds, Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora and international treaties on biodiversity.

Strategy and Action Plan on environment for 2014-2023

GD no. 301/2014 on approval of the Strategy and Action Plan on environment for 2014-2023 require the development of the procedures related to the strategic environmental impact (SEA) and environmental impact assessment (EIA) in accordance with the EU legislation (Objective 1), enlargement of the national protected areas network by 8% of the country (Objective 6).

Law on monuments protection

GD no. 1531/1993 for implementation of Law no. 1530/1993 on monuments protection approves the Registry of cultural and natural heritage protected by the State. Law no. 1530/1993 defines the attributions of competent authorities for administration of the national or local registries and also, in order to prevent the monuments deterioration, establishes the need of developing the monuments protection zones list approved by the Government.

Law on protection of archaeological heritage

The protection of archaeological heritage is assures in line with provisions of Law no. 218/2010, which establishes the attributions of competent authorities for administration of the archaeological inventory and registry and also defines the protection zones for archaeological heritage: 50-200 m, depending on the objective's type and importance (art. 2, paragraph *"s"*).

Law no. 218/2010 establishes the necessary of a preventive archaeological research sustain by the investor in order to protect the sites from damage or destruction during construction works.

2.3.1.2 Environmental Impact Assessment

The legal framework in Republic of Moldova for assessment of the effects of certain public and private projects on the environment is assured by Law no. 86/2014 on Environmental Impact Assessment, which partially transpose the provision of EU Directive (Directive 2011/92/EU).

Law no. 86/2014 (EIA Law) establishes the EIAs principle, defines the scope of the EIA, the competent authorities attributions and the procedure for obtaining the Environmental Agreement (EA) for planned activities. The Law, as EIA Directive, requires an EIA for Annex 1 projects and screening of Annex 2 projects in order to decide the need of EIA.

The main stages for obtaining the EA are the following:

- The developer, in line with art. 7 of EIA Law, submits to Ministry of Environment (ME) an '*Application related planned activity',* containing information about planned activity, alternative solution (site and technologies) and potential environmental and socio-economic impact; the model for the Application is presented in Annex 3 of EIA Law;

- The ME, during the initial evaluation, reviews the Application and decides the need of EIA and also the scale (transboundary or national);
- The developer, in line with art. 19 of EIA Law, submits to ME the Environmental Impact Assessment Program, containing information about the timeline for EIA, including the consultation and public debate, the structure and the content of EIA documentation considering the particular aspects of planned activity and natural, social and technological aspects;
- The EIA documentation includes the comments issued during the public consultation process; the minimum content of EIA is presented in art. 20 of EIA Law;
- The ME, after reviewing the EIA, the permits issued by central and local authorities and by other institutions concerned and considering the written comments submitted by the public and the results of public consultation, shall approve one of the following decision:
    - To issue the Environmental Agreement;
    - To request the developer of the planned activity to complete the EIA documentation;
    - To decline the issue of the Environmental Agreement.

The Environmental Agreement is valid for 4 years.

The EIA procedure for obtaining the Environmental Agreement is presented in the figure 1.

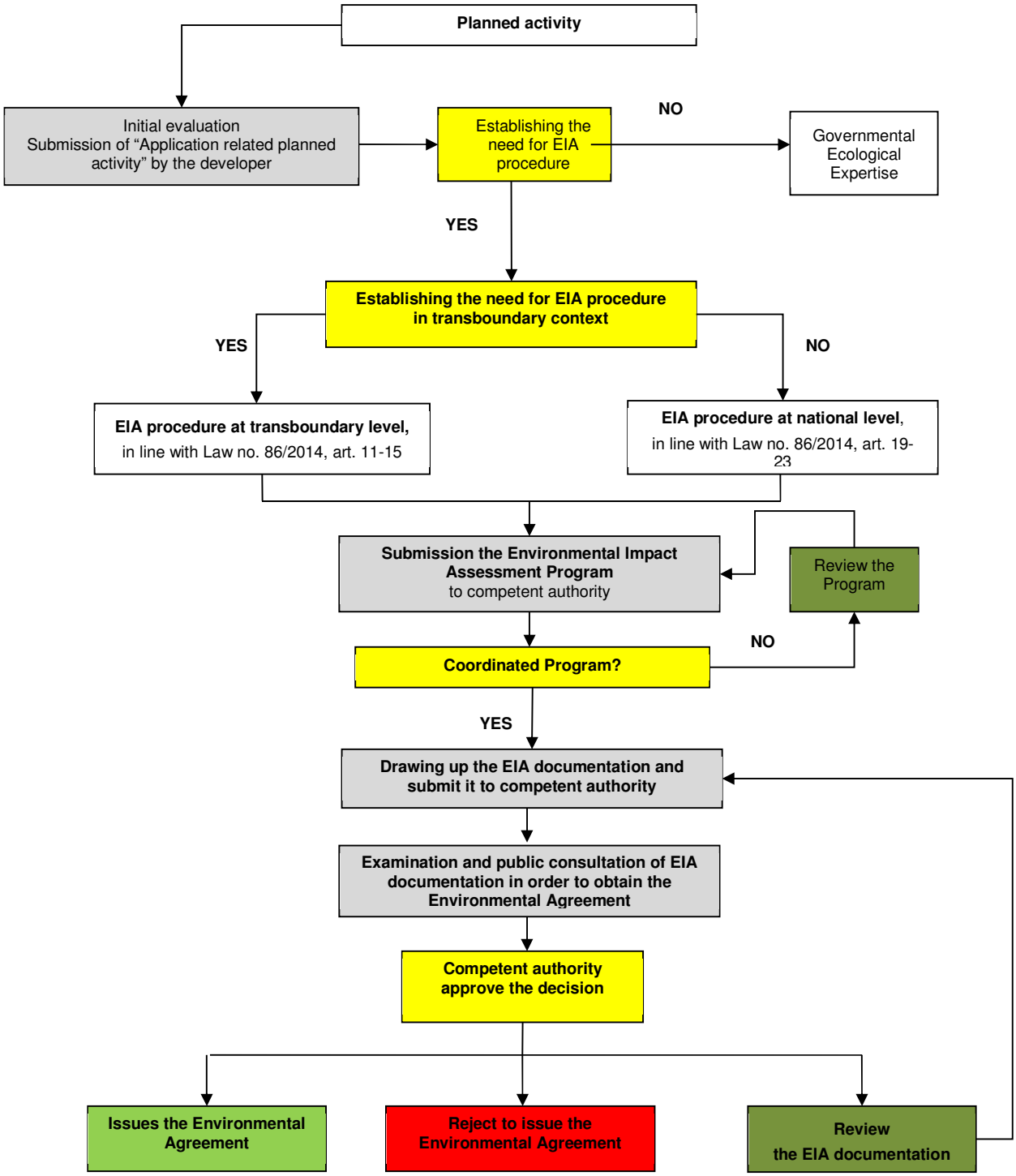


Figure no. 1. EIA procedure, according with Law no. 86/2014

The Project shall be subject to EIA procedure considering that the proposed activity is included in Annex 1 of Law no. 86/2014, "*Lines of transportation of electrical power with a voltage of 220 kV and more and a minimum length of 15 km*".

2.3.1.3 Legal framework for land acquisition and compensation

In order to ensure integrity, normal operation conditions and prevention of accidents, the provisions of GD no. 514/2002 for approval the Regulation regarding the protection of electrical network shall be respected. The following main provisions are relevant for the proposed investment:

- For OHLs construction and operation, the land will be assigned according to the legislation;
- Safety zones within certain distances from the outer conductors shall be established; for 400 kV OHL, the safety zone is defined as a distance of 30 m from outer conductors, resulting a total OHL safety corridor of 75 m;
- Minimum acceptable distances between OHLs and buildings, constructions, land and water areas shall be established;
- Delimitation of corridor clear of trees in massive woodlands and plantations shall be defined.

The land within the OHL safety corridor, not taken from land owners, will be used for agricultural works and other works, in strict compliance with GD no. 514/2002.

The planned works for repairing, technical maintenance and reconstruction of OHLs crossing agricultural land will be performed with the consent of the land owners and, usually, in period when the land are free of crops or the integrity of agricultural cultures is ensured.

Owners of the land crossed by the OHLs and within the safety corridors shall be compensated for damage to crops.

The regulatory framework related to change of land use, land sale/purchase and compensation of damages/losses in force in Republic of Moldova is assured by:

- ***Land Code no. 828-XII, 25 January 1991***, that includes the following provision related to change of land use, temporary land withdrawal from agricultural use and compensation of damages/losses:
    - Land with low land class and free of forests are assigned for construction of non-agricultural facilities, including OHLs projects (art. 15);
    - The possibility to change the use of agricultural land are allowed (art. 71), subject to different approval procedure, as follows:

    - Government decision, in case of agricultural land owned by the State, with the approval of council administrative-territorial unit where the land is located;
    - Decision of the councils of the administrative-territorial units, in case of agricultural land;
    - Decision of the councils of the administrative-territorial units, based on the applications of land owners;
  - Temporary land withdrawal from agricultural use and from forest fund is allowed in case of installation of OHLs (art. 74); the temporary land withdrawal is approved by local government authorities, with the consent of land owners;
  - The land owners shall be compensated in case of losses caused by temporary land use, restriction of the rights of land owners (e.g. in case of safety zones) or deterioration of land quality (art. 97); the compensation shall be assured by enterprises that caused losses; disputes related to recovery of losses and their amount shall be solved in courts or by arbitration;
  - Losses caused by temporary or permanent land withdrawal from agricultural use and forest fund shall be compensated (art. 99); the compensation of losses is performed from the state budged for restoring and increase of land fertility in parallel with repairing the damages;
- ***Law no. 488-XIV, 8 July 1999,*** on expropriation in case of public utility defines the procedure applicable in case of expropriation of land for public utilities projects, namely:
  - The public utilities projects have to be declared as national or local interest projects (the OHLs projects are included at art. 5 para 1, lit. “e”);
  - In case of land expropriation for public utilities projects, the land owner is entitled to compensation (art. 9, para. 2);
  - If the public administration authority and landowner do not reach an agreement related to the market price of the land, the price should be establish by the court, based on an expertise conducted by independent experts (art. 15);
- ***Law no. 1308, 25 July 1997***, on normative price for land and sale/purchase procedure establishes the following provisions relevant for the proposed investment:
  - The land withdrawal from agricultural use and from forest fund are allowed for public interest (art. 11);

- Losses caused by land withdrawal from agricultural use and from forest fund shall be compensated (art. 12);
- The land expropriation is allowed for public utilities projects (art. 15 para.3);
- The land may be expropriated at the market prices that are not allowed to be less than the normative price specified in the Annex, at item II (1,248.02 MD for one point-hectare); in case that the public administration authority and landowner do not reach an agreement related to the market price of the land, the price should be establish by the court, based on an expertise conducted by independent experts;

- ***Forest Code no. 887-XIII, 21 June 1996,*** establishes the following provisions relevant for the proposed investment:
  - The reduction of forest fund is forbidden, with exception of construction of special facilities; in case of OHLs investments, the withdrawal from the forests fund is allowed, subject to special Government degree (art. 78);
  - The withdrawal from the forest fund shall be compensated (art. 79);
- ***GD no. 1451, 24 December 2007***, for approval the procedure for land assignment, change of land use and land exchange includes the following provisions:
  - For state owned institutions and enterprises, public land (both state and administrative-territorial unit ownership) shall be available in order to use it in their business activities (Annex 1, chapter 2, para. 6);
  - For special facilities, including OHLs projects, land with low class and free of forest shall be assigned (Annex 1, chapter 2, para. 7);
  - The change of land use shall respect the procedure established by GD no.1451, 24 December 2007 (Annex 1, chapter 2, para. 32-41); the Government approves a decree related to the change of land use from agricultural and forest land within one month after transferring the funds to the state budget, equivalent to the losses caused by the land withdrawal from agricultural use.

2.3.1.4 Legal framework for occupational health and safety

Nine of the EU directives on health and safety at work and five of the EU labour law directives have been, or are in the process of being transposed to Republic of Moldova legal framework.

The Ministry of Labour, Social Policy and Family developed a roadmap that concerns the harmonization of EU legislation with Republic of Moldova legislation in the area of occupational health and safety. According to sources[1], there is no effective law enforcement on working condition and labour rights in Republic of Moldova at present.

The following laws and regulations are applicable:

- Law no. 186/2008 on Occupational Health and Safety amended by the Law no. 201/28.07.2016;
- Labour Code of Republic of Moldova no. 154-XV of 28 March 2003.
- Decision no. 766/2011 for approval the National Action Plan on preventing and eliminating the worst forms of child labour during 2011-2015;
- Law no. 278-XIV of 11.02.99 on how to recalculate the amount of compensation of the damage caused to employees after mutilation or other health injuries during the performance of duties;
- Law no. 332 of 23.12.2013 amending and completing the Law no. 289-XV of 22 July 2004 on invalidity allowances on temporary work incapacity benefits and other social security benefits;
- Law no. 756-XIV din 24.12.1999 on insurance for work accidents and occupational diseases, modified by Law no. 201/2016;
- Law no. 116/2012 on industrial safety of hazardous industrial facilities;
- Law no. 1515/1993 on environmental protection, with further modifications;
- Collective agreement (national level) - Occupational health and safety of employees working under individual employment contracts;
- GD no. 1101/2001 for approval the regulation related to the disability allowance for accidents at work or professional diseases, modified by GD no. 1289/2007;
- GD no. 513/1993 for approval the regulation on the payment to companies, organizations and institutions of the single allowance for the loss of working capacity or death of the employees following an accident at work or an occupational disease, with further modifications;
- GD no. 65/2013 on the determination of disability and working capacity;

[1] SWD(2017) 110 final "Association Implementation Report on the Republic of Moldova", 10 March 2017

- GD no. 95/2009 for approval norms related to the implementation of occupational health and safety Law no. 186-XVI of 10 July 2008;
- GD no. 559/2008 for approval supplements of the list of standard works and jobs in difficult and very difficult conditions harmful and particularly harmful for which compensations are established for employees approved by the GD no. 1487/2004;
- GD no. 168/1993 for approval the regulation on jobs attested for the confirmation of the right of pensions in advantageous conditions;
- GD no. 353/2010 for approval of minimum occupational health and safety requirements at work;
- GD no. 765/2008 on the State Inspectorate for Industrial Facilities Technical Surveillance, with further modifications;
- GD no. 937/2010 amending item 2 of the regulation on the evaluation of working conditions at work and method of applying works lists by branches.

The Republic of Moldova is part of ILO (International Labour Organization) and has ratified all of the fundamental conventions as well as the all of the governance conventions. In terms of technical conventions 30 of 177 have been ratified including convention on Safety and Health in Agriculture Convention, 2001 (No. 184) and Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187). Technical convention on Safety and Health in Construction Convention, 1988 (No. 167) have not been ratified.

2.3.2 European legal and policy framework

The Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, amended by Directive 2014/52/EU (**EIA Directive**), defines the requirements for assessment of potential impact on the environment by a wide range of public and private project defined in Annex I and II. Considering the characteristics of the proposed investment - electric power line of 400 kV and length 158 km – the Project fulfil the criterion of Annex I of EIA Directive:

"Construction of overhead electrical power lines with a voltage of 220 kV or more and a length of more than 15 km", and required a mandatory EIA procedure.

The EIA procedure, similar with Republic of Moldova EIA Law, may be summarized as follows:

- The developer shall request to the competent authority the guideline for the EIA report (scoping stage);

- The developer shall provide information on the environmental impact (EIA report – Annex IV);
- The environmental authorities and the public (and affected Member States) shall be informed and consulted;
- The competent authority decides, taken into consideration the results of consultations;
- The public is informed of the decision afterwards and can challenge the decision before the courts.

Other main EU Directives which shall be observed for the Project are the following:

- Directive 2000/60/EC establishing a framework for Community action in the field of water, modify by Directives 2008/32/CE, 2008/105/CE and 2009/31/CE and Decision 2455/2001/CE (Water Directive);
- Directive 2006/12/EC on waste (repeal by Directive 75/442/CEE), modify by Directives 2008/98/CE and 2009/31/CE (Waste Directive);
- Directive 2002/49/EC relating to the assessment and management of the noise in the environment (Noise Directive);
- Directive 92/43/EC on the conservation of natural habitats and of wild fauna and flora (Habitat Directive);
- Directive 97/62/EC which adapts the Habitat Directive to the scientific and technical progresses, substituting the Annexes I and II;
- Directive 79/409/EEC on the conservation of wild birds (Birds Directive);
- Decision 82/72/EEC related to the Convention on the conservation of wild life and natural environment in Europe;
- Decision 82/461/EEC related to the Convention on the conservation of the migratory species of wild fauna;
- Recommendation 75/65/CEE of 20 December 1974 on the protection of the Architectural and Natural Patrimony;
- Directive 89/391/EEC on the introduction of measure to encourage improvements in the safety and health of workers at work (OHS Framework Directive);
- 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) - the eighteenth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC;

- Directive 2013/35/EU on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) - 20th individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) and repealing Directive 2004/40/EC.

2.3.3 International conventions

The Convention on Environmental Impact Assessment in a Transboundary Context (**Espoo Convention**) brings together all stakeholders to prevent environmental damage before it occurs. The Espoo Convention requires that Member States notify and consult each other on all projects that might have an adverse transboundary environmental impact. The current situation regarding the Espoo Convention in Republic of Moldova and the neighbouring countries is the following:

- Republic of Moldova: signed the accession on 4.01.1994;
- Romania: ratified on 29.03.2001;
- Ukraine: ratified on 29.07.2001.

Therefore, Republic of Moldova shall notify Romania and Ukraine, as per the Espoo Convention Procedure, if trans-boundary impacts are expected from Project implementation or not.

The other **main international conventions** ratified by Republic of Moldova are the following:

- Convention on Long-Range Transboundary Air Pollution (Aarhus, Denmark, 1998); the Republic of Moldova's ratification document to the convention is the Ratification Law no. 10178-XV, 25 April 2002;
- United Nations Convention on Climate Change – UNFCCC (New York, 1992); the Republic of Moldova's ratification document to the convention is the Parliament Degree no. 404-XIII, 16 March 1995;
- United Nations Convention on Biological Diversity (Rio de Janeiro, 1992) ratified by the Decision of the Parliament of the Republic of Moldova no. 1546 – XII on 23.06.1993; the decision assures the legal framework for development of National Biodiversity Strategy and Action Plan (NBSAP);
- United Nations Convention on Wetlands of International Importance – Ramsar Convention (Ramsar, Iran, 1971) ratified by the Decision of the Parliament of the Republic of Moldova no. 504–XIV, 14 July 1999; in Republic of Moldova there are 3 Ramsar sites: Lower Prut Lakes, Lower Dniester, Unguri – Holosnița;

- United Nations Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 23 June 1979) ratified by Law no. 1244-XIV, 28 September 2000;
- Convention of the Conservation of European Wild Life and Natural Habitats – Bern Convention (Bern, 1982), ratified by the Decision of the Parliament of the Republic of Moldova no. 1546 – XII on 23.06.1993; in 2016, 48 candidate Emerald sites were accepted by the Standing Committee of the Council of Europe (T-PVS/PA (2016) 11);
- Convention Concerning the Protection of the World Cultural and Natural Heritage – UNESCO World Heritage Convention (Paris, 1972); the Republic of Moldova's ratification document to the convention is the Law no. 1113-XV, 06 June 2000;
- European Convention on Landscape (Florence, 2000); the Republic of Moldova's ratification document to the convention is the Ratification Law Parliament, 14 March 2002;
- UNECE Convention on Access to Information, Public Participation in Decision–making and Access to Justice in Environmental Matters – Aarhus Convention (Aarhus, Denmark, 1998); the Republic of Moldova's ratification document to the convention is the Parliament Degree no. 346-XIV, 07 April 1999;
- Republic of Moldova is part of ILO and ratified all fundamental conventions and the governance conventions.

2.3.4 International requirements and good practice standards

2.3.4.1 Environmental and Social Impact Assessment

Projects supported by international lenders are required to be in compliance with national standards as well as environmental and social policies and guidelines adopted by the lenders. The performance requirements / standards developed by the lenders set a framework for consideration of key aspects linked to environmental and social impacts. The framework provides a base on to which clients can improve the sustainability performance of the projects.

The point of departure is to avoid adverse impacts on the environment, communities and workers, but if this is not possible then any negative impacts should be reduced, mitigated or compensated. The performance requirements may go above national laws and regulations and are based on international best practice.

Therefore, in addition to strictly comply with EU and Republic of Moldova legal requirements, the Project will also need to meet the following specific requirements:

- *EBRD Environmental and Social Policy (EBRD 2014)* that includes a comprehensive set of specific Performance Requirements (PRs), covering a range of key areas of environmental and social impacts, occupational and public health and safety, resettlement and other issues and actions involved in the project development and operation;
- *EIB Environmental and Social Practices and Standards Handbook* (EIB 2013) that defines ten Environmental and Social Standards (ESSs) covering the full scope of environmental, climate and social impacts;
- *WB Environmental and Social Safeguards policies* that defines mitigation, monitoring, and institutional measures to be taken during implementation and operation of a project to eliminate adverse environmental and social risks and impacts, offset them, or reduce them to acceptable levels; ;
- *The Equator Principles,* a risk management framework adopted by financial institutions, defining ten principles that ensure that the financed projects are developed in a manner that is socially responsible and reflects environmental management practices.

EBRD requires for category A projects, which includes high voltage overhead electric power lines, an Environmental and Social Impact Assessment (Appendix 2, item 21).

Also, the EIB requires for category A projects, including *"Construction of overhead electrical power lines with a voltage of 220 kV or more and a length of more than 15 km",* an Environmental Impact Assessment (Annex 3, item 20).

According with WB policy, the electrical transmission projects could be Category B if the impact are site-specific, limited in number, and mitigation measures are readily identifiable. The differences between the national legislation and the international framework requirements related to Project development are presented in chapter 2.3.5.

2.3.5 Gap analysis

The gap analysis was conducted in order to identify the difference between the national legislation and the international framework requirements related to Project development and implementation for establishing the law/standards/requirements applicable for the Project.

The analysis of national legislation and the international framework requirements related to ESIA procedure and ESIA documentation was focus on the following law/ standards/ requirements:

- Republic of Moldova legal framework related to environmental impact assessment, land acquisition and compensation, health and safety;
- Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, amended by Directive 2014/52/EU (EIA Directive);
- EBRD Environmental and Social Policy (2014);
- EIB Environmental and Social Practices and Standards Handbook (2013);
- WB Environmental and Social Framework (2017).

The comparison between the Republic of Moldova requirements versus international requirements as well as EBRD, EIB, WB requirements is presented in Annex 1.

According with Republic of Moldova legal framework, for this type of project, an EIA procedure shall be conducted while the EBRD, EIB, WB standards require a compulsory ESIA.

For this Project, an ESIA Report has been developed in order to obtain the Environmental Agreement from Republic of Moldova environmental authority - Ministry of Environment and to respect the requirements of potential financing institutions (EBRD, EIB, WB).

The compensation requirements for land acquisition, involuntary resettlement and restriction of land use seem to be similar considering that land owners are entitled to compensation for land acquisition and restriction of land use.

~~Referring to electromagnetic exposure, both national and ICNIRP requirements will be respected.~~

For addressing EBRD, EIB, WB requirements, as part of ESIA package, the following documents has been developed:

- Environmental and Social Management and Monitoring Plan;
- Stakeholder Engagement Plan;
- Land Acquisition and Compensation Framework.

2.4 ESIA APPROACH AND METHODOLOGY

The Project proposal for construction *of "Back to back" station at Vulcănești, that assures the asynchronous interconnection between the power system of Republic of Moldova with the power system of Romania and 400 kV OHL Vulcăneşti – Chişinău* is subject to Republic of Moldova EIA Law (Law no. 86/2014) in accordance to Annex 1, item 21 *"Lines of transportation of electrical power with a voltage of 220kV and more and a minimum length of*

15 km". Therefore, the Project shall be subject to an EIA procedure in compliance with the national EIA legislation.

According with the gap analysis conducted in *chapter 2 Operational framework*, in order to respect the national legislation as well as the requirements of international financial institution, for the proposed Project, an ESIA has been carried out in order to meet several main objectives:

- To respect the environmental and social policy/framework of international financing institutions;
- To obtain the Environmental Agreement, according with Republic of Moldova legal framework;
- To ensure public consultation / stakeholder engagement input into the proposed project;
- To establish the baseline environmental and socio-economic conditions within the study area and to identify appropriate mitigation measures to be incorporated into the design and construction process in order to minimize those impacts;
- To incorporate all mitigation measures into an environmental and social management and monitoring Plan in order to facilitate Project construction and implementation.

The ESIA approach for this Project is described below.

2.4.1 Scoping stage

The ESIA process includes at the early stage at the process a ***scoping stage*** in order to identify the content and the extent of the information to be included in ESIA report related to:

- Potential future environmental and social impacts associated with the project;
- Technically and financially feasible alternatives of the project;
- Identification of types of potential environmental and social impacts to be investigated and reported in ESIA and measures to avoid, or minimize and mitigate the adverse impacts;
- Public disclosure and consultation process.

The scoping procedure for the Project was focus on main environmental aspects such as:

- Physical environment: geology, geomorphology and geo-hazards, soil, water, air quality and climate change, noise and vibration, landscape and visual environment;
- Biological environment: natural areas protected by the State;

- Socio-economic environment: communities, infrastructures, cultural and archaeological heritage, public health, occupational health and safety, land use.

As part of the scoping stage several actions were taken for stakeholder engagement, such as:

- Identification of target stakeholders groups, including concerned/interested public and internal stakeholders;
- Establishing the main steps of the disclosure process;
- Consulting and engagement of internal stakeholders in order to understand the potential Project area of influence and the potentially impacted stakeholders.

The method used for identification of potential significant impacts of the Project during the scoping stage consisted in:

- Site visit in April 2016 of the ESIA team (ISPE, IVL) and Energoproiect to Moldova, in order to see the potentially areas affected by the construction of the proposed routes for the 400kV OHL and to make preliminary identification of environmental, biological and socio- economic issues;
- Meetings in Republic of Moldova, between 28th of June and 1st of July 2016, with governmental officials, national NGOs and interviews with local communities' representatives along the proposed OHL route line, namely:
    - Ministry of Environment;
    - Ministry of Regional Development and Construction;
    - Ministry of Culture;
    - Chişinău Municipality - Băcioi locality;
    - Ialoveni District - Hanșca locality;
    - Hânceşti District - Fîrlădeni locality;
    - Cimişlia District - Ecaterinovca locality;
    - Cimişlia District - Topală locality;
    - ATU Găgăuzia - Congazcic locality;
    - ATU Găgăuzia - Congaz locality;
    - Tărăclia District - Muşaitu locality;
    - Cahul District - Iujnoe locality;
    - AgroInform Farmers Association;

- Moldelectrica.

- Review of reports related to existing environmental, biological and socio-economic conditions in Republic of Moldova;
- Scoping meetings between 28th of June and 1st of July 2016 with governmental organization, NGOs and local communities;

The key issues raised during the scoping stage were related to:

- Environment and cultural heritage:
  - Natural resources (land, minerals, forests etc.);
  - Sensitive / protected areas;
  - Presence of archaeological or culturally significant sites;
  - River crossings or major geological formations in close proximity to the OHL route line;
  - Sites where visual impacts may be experienced;
  - Extreme weather;
- Social issues:
  - Vulnerable groups;
  - Unemployment and labour migration;
  - Presence of agriculture equipment, land, new infrastructure projects;
  - Communication channels, procedures / mechanisms;
- Economic development:
  - Predominant income opportunities (e.g. agriculture, industry, etc.);
  - New projects, barriers (infrastructure – roads/power and heat/water and sewage/natural gas, irrigations, telecommunication, etc.).

2.4.2 Baseline data collection

As part of the scoping stage three possible route alternatives were identify for asynchronous interconnection between the power system of Republic of Moldova with the power system of Romania. The initial data collection was focus on preliminary environmental impacts of the considered route alternatives in order to identify the best solution from technical-economic and environmental point of view.

For the ***selected OHL route***, approved by is Moldelectrica, detailed analyses were performed for establishing the baseline environmental and socio-economic conditions, such as:

- Review of main data sources related to existing environmental, biological and socio-economic conditions, namely:
  - **Statistical databank,** National Bureau of Statistics of Republic of Moldova (http://www.statistica.md/pageview.php?l=en&idc=407&nod=1&);
  - **State of the Environment in Republic of Moldova 2007 - 2010,** elaborated by the Ministry of Environment, Academy of Science and Institute of Ecology and Geography (http://mediu.gov.md/index.php/starea-mediului/rapoarte);
  - **State of the Air Quality in Republic of Moldova for 2014**, elaborated by the State Hydro meteorological Service (http://www.meteo.md/monitor/anuare/2014/anuaraer_2014.pdf);
  - **State of Environment Report (SOER),** elaborated by the Ministry of Environment and published in 2011 for the period 2007-2010 (http://mediu.gov.md/images/Anunturi/SOER_agregated.docx);
  - **Cadastre of Protected Natural Areas,** Institute of Ecology and Geography, Academy of Sciences of Moldova (**http://www.ieg.asm.md/ro/cadastrul_ariilor_protejate**);
  - Public information on biodiversity and natural protected areas from Republic of Moldova;
- Collection of GIS data, through direct contact with Republic of Moldova's competent authorities in order to receive specific information related to positions of natural protected areas and archaeological sites located nearby the OHL Vulcănești - Chişinău route;
- **Oficial letter to Agency for Land Relations and Cadaster** (with the help of Moldelectrica) in January 2017 to obtain the permission to use the information of http://geoportal.md and other on soil, geological, cadaster and nucleus areas;
- Information from the Society for Nature and Bird Protection of Republic of Moldova;
- Expert' knowledge of the presence of the bird species recorded in Republic of Moldova;
- **Three Reports** on May, 2017 about the historical contamination and cleanup measures taken on Vulcanesti substation in 2005-2007 and 2010.
- Initial **public consultation** meetings for ESIA preparation, on 8th and 9th of November 2016 with Central Governmental Authorities, professional associations,

NGOs and mass-media in Chisinau (Moldelectrica office) and with local people in Comrat and Ecaterinova. (along OHL route); unfortunatly the rainy weather kept the people away of these two meetings;

- **Several sites visits** on March, April and May 2017 of ISPE team to observe the biodiversity/birds species along the OHL final route.

The baseline data collection was focus on description of physical, biological and socio-economic characteristic of the study area, in order to establish the potential environmental and socio-economic impacts.

The study area for baseline condition (physical, biological and socio-economic), referred thereafter as ***survey corridor***, is defined as an area of 10 km on both sides of the proposed OHL route (from OHL's central axis). For some socio economic aspects was defined a ***close proximity corridor*** of 1 km width, each side of the OHL axis. Details related to the OHL survey and close proximity corridors are presented in chapter 4.2 Project description.

2.4.3 Identification of potential impacts and mitigation measures

The identification of potential impacts of proposed Project on the environment and socio-economic condition was based on the existing information available related to the baseline condition, the technical characteristics of the investment and similar experience with other transmission line projects.

The impact assessment conducted on a case-by-case basis, depending on certain environmental and socio-economic aspects, was focus on specific condition that has to be respected in order to ensure the safety and integrity of the Project.

As a result of evaluation the potential impacts of the Project on the physical, biological and socio-economic resources, mitigation measures were identified that the Project will take in order to avoid, minimise/reduce and mitigate adverse impacts and to enhance positive impacts where applicable.

Where relevant, the anticipated impact was compared with applicable environmental requirements and standards.

The impact assessment methodology considered potential change on the physical, biological and socio-economic environment in relation with criteria set out according to their extent/scale, duration, intensity/magnitude and probability; the criteria used for impact assessment are presented in Table no.1.

Table no. 1. Matrix for evaluation of significance of potential impacts

Significance Criteria		
Extent/ Scale	On-site	Impacts limited to the boundaries of development site, namely: areas around the OHL route and Vulcăneşti and Chişinău stations locations
	Local	Impacts that affect areas nearby the boundaries of development site
	Regional	Impacts that affect important environmental resources at the regional scale, define by administrative boundaries, habitats/ecosystems types
	National	Impacts that affect important environmental resources or important areas at the national scale
Duration	Temporary	Impacts are predicted to be of short duration and intermittent / occasional
	Short-term	Impacts are predicted to be only during the construction period
	Long-term	Impacts are predicted to be only during the project lifetime
	Permanent	Impacts are predicted to cause a permanent change in the affected receptors or resources, beyond the project lifetime
Intensity/ Magnitude	Negligible	The impact on the environment is not detectable
	Low	Small detectable change to environment but with proper planning does not cause damage to the environment
	Moderate	Larger detectable change to environment that can be controlled by implementing the proper measures
	High	Fundamental change to the environment that altered the natural functions and processes
Probability	No probability	The impact should not occur during normal operation and conditions
	Average probability	The impact is likely to occur sometimes
	High probability	The impact is likely to occur during the project lifecycle

The significance of potential impacts, a function of extent, duration, intensity/magnitude of the impact and the probability of impact occurring, was categorized into the following significance categories:

- Negligible: no detectable change to the environment;
- Minor: the impact magnitude is sufficiently small and well within relevant environmental limits and standards;
- Moderate: the impact magnitude is within relevant environmental limits and standards;
- High: the regulatory limits and standards may be extended or large magnitude impacts occur to resources/receptors.

The mitigation measures proposed in case of probability of significant damage on the environment are consistent with requirements of relevant legislation and policies, as well as international practices.

For socio-economic environment where positive impacts may occur, in order to establish the significance of impact the same matrix was used; in case of intensity/magnitude the same

scale was used for assessing the positive impacts, marked as positive, e.g. Negligible (positive).

For positive impacts the following significance categories were defined:

- Negligible (positive): positive changes affecting a few individuals;
- Minor (positive): positive benefits to a small section of the community;
- Moderate (positive): changes affecting a significant section of the community;
- High (positive): massive changes positively affecting majority of population.

2.4.4 Information Disclosure and Stakeholder Engagement

Within the ESIA process period, a formal stakeholders engagement campaign is conducted along the 400 kV OHL route, carried out by Moldelectrica Project team working alongside the consultants' consortium, including information disclosure and public consultation events. An overview of the stakeholder consultation process throughout the ESIA process is presented in SEP Report (Stakeholders Engagement Plan).

SEP is an instrument for Moldelectrica for describing its strategy and program for engaging with stakeholders, through the various stages of 'MD-RO' Project:

- Planning – studies, consulting and engineering;
- Implementing - construction (including working site preparation and commissioning), operation & maintenance, decommissioning.

SEP ensures relevant and understandable information and provides to all project's targeted public, opportunities to express their views and receive responses. It also stipulates how stakeholders' concerns are to be considered in the different stages of the project through the grievance mechanism (grievance form and additional details are presented in SEP Report).

SEP is a living document which is to be periodically reviewed and adapted to new developments, as the project progresses.

An effective implementation of SEP generates mutual trust, respect and transparency between Moldelectrica and identified stakeholders aiming to: improve performance and corporate policy, reduce costs and risks, avoid conflict and, in the end, reach stakeholder's expectations.

The information disclosure package (NTS - Non-Technical Summary, ESIA - Environmental and Social Impact Assessment, LACF - Land Acquisition and Compensation Framework, ESMMP - Environmental and Social Management and Monitoring Plan and SEP) will be

made available, in Moldovan/Romanian and English languages, and where appropriate in Russian, too:

- Electronic versions will be uploaded online on the following websites:
  - Moldelectrica **www.moldelectrica.md**;
  - Republic of Moldova Ministry of Environment http://www.mediu.gov.md/index.php/transparenta-in-procesul-decizional/consultari-publice
  - EBRD - Chişinău Resident Office (63 Vlaicu Pârcălab Str. Sky Tower building, 10th floor, Chişinău MD-2012, Republic of Moldova) and EBRD website http://www.ebrd.com/work-with-us/project-finance/project-summary-documents.html
- Hard copies will be delivered at:
  - Moldelectrica headquarter and the administrative buildings of the existing electrical stations, near Chişinău and Vulcăneşti;
  - Local Moldelectrica offices within their regional branches: Filiala "RETI Centru" (Central region) and Filiala "RETI Sud" (South region);
  - Administrative buildings / mayoralties of the neighbouring communities (400 kV OHL route analysis corridor);

Announcements (Brief project description and grievance form) were displayed on the information boards of the concerned communities and prior to this disclosure process Moldelectrica will prepare and launch press announcement in local daily newspapers. The stakeholders engagement campaign and the program up to date are detailed in SEP Report.

Responsible for ensuring the information disclosure activities are:

- the consultant - during the Feasibility Study stage of the Project;
- Moldelectrica - during the other stages (engineering & design; construction-commissioning; operation & maintenance; decommissioning).

Information disclosure process and stakeholders engagement will be unrolled in compliance with the national legislation (Law no. 86/2014) and EBRD Environmental and Social Policy (PR 10), EIB Environmental and Social Practices and Standards (ESS 10) and WB Environmental and Social Standards Safeguards.

3. ANALYSIS OF ALTERNATIVES

The present chapter includes the analyzed alternatives for the OHL route, namely:

- "Do nothing" alternative;
- Considered alternatives for the OHL route;
- Multicriteria analysis for OHL route selection;
- Considered alternatives for BtB substation location;
- Comparision analysis for BtB substation location selection.

3.1 "Do nothing" alternative

The "Do nothing" alternative considers that the proposed Project will not be developed.

As mentioned in chapter 2 Operational framework, the Project is included in the Energy Strategy of the Republic of Moldova till 2030, approved through the GD no. 102/2013, which will be adjusted by reiterating the Project as a priority in its current and final form (in particular the change from a 330 kV transmission line to a 400 kV transmission line) by the Interministerial Committee on Strategic Investments by the end of August 2017.

One of the main objectives of the Strategy is to strengthen Republic of Moldova's role of power transmissions corridor, by building new intercorridors with the ENTSO-E system and by consolidating the internal power transmissions network. The BtB substation at Vulcăneşti substation and the OHL Vulcăneşti-Chişinău are identified in the Strategy as a priority electricity interconnection project between Republic of Moldova and Romania.

By non-implementation of the Project, several potential environmental impacts at local scale would be completely avoided such as: noise (due to road traffic and construction activities), restrictions affecting local land use within the safe zone of OHL route, visual-aesthetic impacts of towers and conductors, etc.

The "Do nothing" alternative would avoid the potential negative environmental and social impacts of the construction and operational stages but, on the other hand, will prolong the current situation of lack of security of supply of Republic of Moldova and affect the following aspects:

- The integration of Republic of Moldova's energy market with ENTSO-E and the European energy market, with negative consequences for fair, transparent and equitable prices and competition in the Moldovan electricity market;

- The enhancement and diversification of the security of supply of electricity in the Republic of Moldova, which is currently 80% dependent on imports from Ukraine and Transnistria, through diversification of market participants; and
- Ensuring the generation-consumption balance when variations of electricity generation of internal power plants occur, especially of renewable power plants, whose operation schedule is less predictable.

3.2 Considered alternatives for the OHL route

The selection of the optimum route is very important both from a technical and financial standpoint and in order to reduce the visual impact of OHL, also considering the coexistence with the current and/or future objectives.

The general principles in designing an OHL route is to avoid as much as is possible the following areas:

- Populated areas;
- Forested areas and implicitly avoid deforestations;
- Farming lands with vineyards and orchards;
- Parks and natural reserves;
- Geologically unstable areas;
- Special landscape or with an architectural and historical value.

Three route options were analysed in order to find an optimal route for the proposed OHL:

- Option 1, located at the West site and crossing the forest in the narrowest area;
- Option 2, the central option;
- Option 3, mainly along the Ukrainian border.

OHL route Option 1, red color

The 400 kV OHL Vulcănești - Chișinău route starts from the 400 kV Vulcănești BtB substation, situated at the West side of Vulcănești locality, the South part of Republic of Moldova, near the Ukrainian border. The route heads North, overpasses the decommissioned 750 kV OHL, the Burlăceni and Iujnoe localities, bypasses on the South - East side the Muşaitu locality, on the West side Vinogradovca locality and on the East side the Sălcia locality; the route is parallel with the national road M3. In this area, the route

overpasses the local roads: L696 (Burlăceni - Muşaitu), L673 (Vinogradovca - Orehovca) and L671 (Vinogradovca - Huluboaia).

The route continues to the North, bypasses on the East side the Hârtop, Albota de Jos, Albota de Sus and Sofievca localities, overpasses the road R38 (Vulcăneşti – Cahul - Tărăclia), bypasses the vineyards near the Svetlii, Alexeevca and Borceag localities. Near the Borceag locality, the route overpasses the local road L643 (Chioselia Mare - Dimitrova).

Then, the 400 kV OHL route overpasses the arable land and, near Congaz locality, it overpasses the local roads: L641 (Congaz – Cîietu - Cotovscoe) and L642 (Congaz - Chioselia Rusă). Moving to the West, near the Comrat locality, the OHL overpasses the 110 kV OHL Comrat - Iargara and Comrat - Sadâc, the 35kV OHL Comrat - Vişniovca and the national road R37 (Ceadîr – Lunga – Comrat - Cantemir).

After bypassing the Comrat town, the OHL route overpasses the railway near the Bugeac locality, it continues to north-east, overpasses the Ialpug river and, after the Topală and Dimitrovca localities. At West side of Cimişlia locality, bypasses vineyards and overpasses the 35 kV OHL Cimişlia - Javgur and the national road R47 (Cimişlia – Iargara - Sărata Nouă).

The OHL route overpasses the river meadow Cogâlnic, the 110 kV OHL Gura Galbenei - Cimişlia, the national road R3 (Chişinău – Hânceşti – Cimişlia - Basarabeasca), the local road L580 (Mihailovca – Sagaidac - Valea Perjei) and, again overpasses the 110kV OHL Gura Galbenei -Cimişlia.

The OHL route bypasses at the East side the Gura Galbenei, Ivanovca Nouă and Fârlădeni localities, avoiding the existing forest. Near the village Gura Gălbenei, the OHL route overpasses the 110 KV OHL (entry and exit in Gura Galbenei station) and the local road L578 (Albina - Fetiţa - Lipoveni - Munteni – Porumbrei).

After that, the route passes the South – East sides of Hansca, Costeşti and Mileştii Mici localities, overpassing the local roads: L461 (Moleşti – Costeşti – Ialoveni), L465 (Bardar – Costeşti, Zâmbreni – Horești – Țipală), L458 (Ialoveni – Sângera). The OHL route is parallel to the 110 kV OHL Chișinău - Hânceşti and overpasses it, at the South side of the Hansca village.

The OHL route is parallel to the two 330 kV OHL lines to MGRES and overpasses them near the Strănişteni village. The OHL route overpasses the 110 kV OHL double circuit Chișinău - Hânceşti and Chișinău - Gura Galbenei.

At the entry into the 400/330/110 kV Chisinau station, situated in the South side of the Chişinău municipality, the OHL route overpasses the 110kV OHL Chișinău - Anenii Noi.

The OHL route avoids construction areas along the route, lakes and most of the existing vineyards.

In option 1, the length of the 400 kV OHL Vulcăneşti - Chişinău is about 149 km.

OHL route Option 2, blue colour

The 400 kV OHL Vulcănești - Chișinău route starts from the 400 kV Vulcănești BtB substation, situated at the West side of Vulcănești locality. The route heads North, overpasses the decommissioned 750 kV OHL, following the red route and the area between Burlăceni and Iujnoe localities. Near Iujnoe village, the route separates from the red route and overpasses the areas between Vinogradovca and Ciumai localities, the West side of Chirilovca and the South side of Aluatu, the West side of Tărăclia, between Cazaclia and Corten localities and heading North towards Comrat. In the region Chirilovca, Vinogradovca and Burlăceni the OHL route overpasses the 110 kV OHL d.c Vulcăneşti - Tărăclia and the OHL d.c. Vulcăneşti - Balabanu and Vulcăneşti - Tărăclia.

At the North – West side of Chirilovca locality, the route turns right and overpasses the Ialpug river, at the West side of Tărăclia. The route overpasses the 35 kV OHL d.c. Tărăclia - Svetlîi, Tărăclia - Moscovei. The OHL route, along the Lunguţa river, intersects it twice in Valea Baurci.

At the West side of the Ferapontievca village, the OHL route overpasses the 110 kV OHL Cimişlia - Tomai and the national road Cimişlia – Ceadîr - Lunga.

The OHL route overpasses the local road L631 (Başcalia – Comrat), the railway and 110 kV OHL Comrat - Başcalia, at the North side of Başcalia village. After the national road R35 (Comrat -Basarabeasca), the OHL route overpasses the area between the Bogdanovca Veche and Sadaclia, at the East side of Ciucur - Mingir village and at the West side of Cioc - Maidan and Başcalia villages.

The OHL route overpasses the national road M3 (Chişinău - Vulcăneşti) and 35 kV OHL Cişmila -Mihailovca and reaches the nearby Cimişlia city, through the West side of Porumbei and Sagaidac localities.

After the Moleşti forest and the West part of the Zâmbrei village, the OHL route turns to left side, overpasses the 110 kV OHL Chişinău - Gura Galbenei and the East part of the Cigîrleni village.

The OHL route overpasses the local road L645 (Zîmbreni - Costeşti) towards Iasloveni locality, from where the route is common with the red route up to 400/330 kV Chişinău station.

The OHL route avoids construction areas along the route and most of the existing vineyards.

In option 2, the length of the 400 kV OHL Vulcăneşti - Chişinău is about 150 km.

OHL route Option 3, green color

The 400 kV OHL Vulcănești - Chișinău route starts from the 400 kV Vulcănești BtB substation, situated at the West side of Vulcănești locality.

The route heads North, overpasses the decommissioned 750 kV OHL, the area between Burlăceni and Iujnoe localities and, respectively, between Vinogradovca and Ciumai localities. Near the Vinogradovca and Ciumai localities, the route separates from the blue route and turns to the East, bypassing the Copceac locality. At the South side of the Chirilovca village, the OHL route overpasses the Iaipug and Lunga rivers, the railways and the national road Chişinău – Vulcăneşti.

The OHL route overpasses the 400 kV OHL MGRES - Vulcăneşti, near the Copceac village; the route turns right near Valea Perjei village and overpasses twice the 110 kV OHL Vulcăneşti –Ceadîr - Lunga. The OHL route overpasses the national road R36 (Ceadîr – Lunga -Basarabeasca), at the East part of the Beşghioz village and Ceadîr - Lunga city. Between Joltai and Tvardiţa villages, the OHL overpasses the 100 kV OHL d.c (110 kV Tvardiţa station), the railway and the river Lunga.

The OHL route overpasses the national road R35 (Cimişlia - Basarabeasca) and the local road L639 (Avdarma – Chiriet - Lunga).

Between Iardanovca and Abaclia villages, the OHL route overpasses the 110 kV OHL Başcalia – Basarabeasca. Also, overpasses the 110 kV OHL Tărăclia Nord – Basarabeasca and near the Carabetovca village follows the existing OHL.

The OHL route overpasses the West side of Troiţcoe village, between Ivanovca and Iserlia villages, at the East side of Sadaclia village and the 35 kV OHL Tărăclia Nord – Mihailovca.

Thereafter, the OHL overpasses the areas between Ciufleşti and Surchiceni villages, Batîr village and Tărăclia city, the national road R29 (Răzeni – Pervomaisc), the area between Nileştii Noi and Gangura, Chircăieştii Noi and Căinari, the East side of Carbura village and the 35 kV OHL Văratic – Răzeni.

The OHL route overpasses the North side of Răzenişi storage lake, follows the Botna river and intersects it at the North - East side of Mileştii Noi village.

At the East side of Horeşti village the route overpasses the national road M3 (Chişinău – Vulcăneşti) and twice the 110 kV OHL Chişinău – Horeşti. Near the Străişteni village, the route overpasses two 330 kV OHL Chişinău – MEGRES. After bypassing the Străişteni village, the OHL route heads to the 400/330/110 kV Chişinău station, at the South side of

Chişinău municipality. At entering into Chişinău station the route overpasses the 110 kV OHL Chişinău – Anenii Noi.

In option 3, the length of the 400 kV OHL Vulcăneşti - Chişinău is about 163 km. The route is near the border between Republic of Moldova and Ukraine (around 85 km).

The considered alternatives for the OHL route are presented in Figure no, 2.

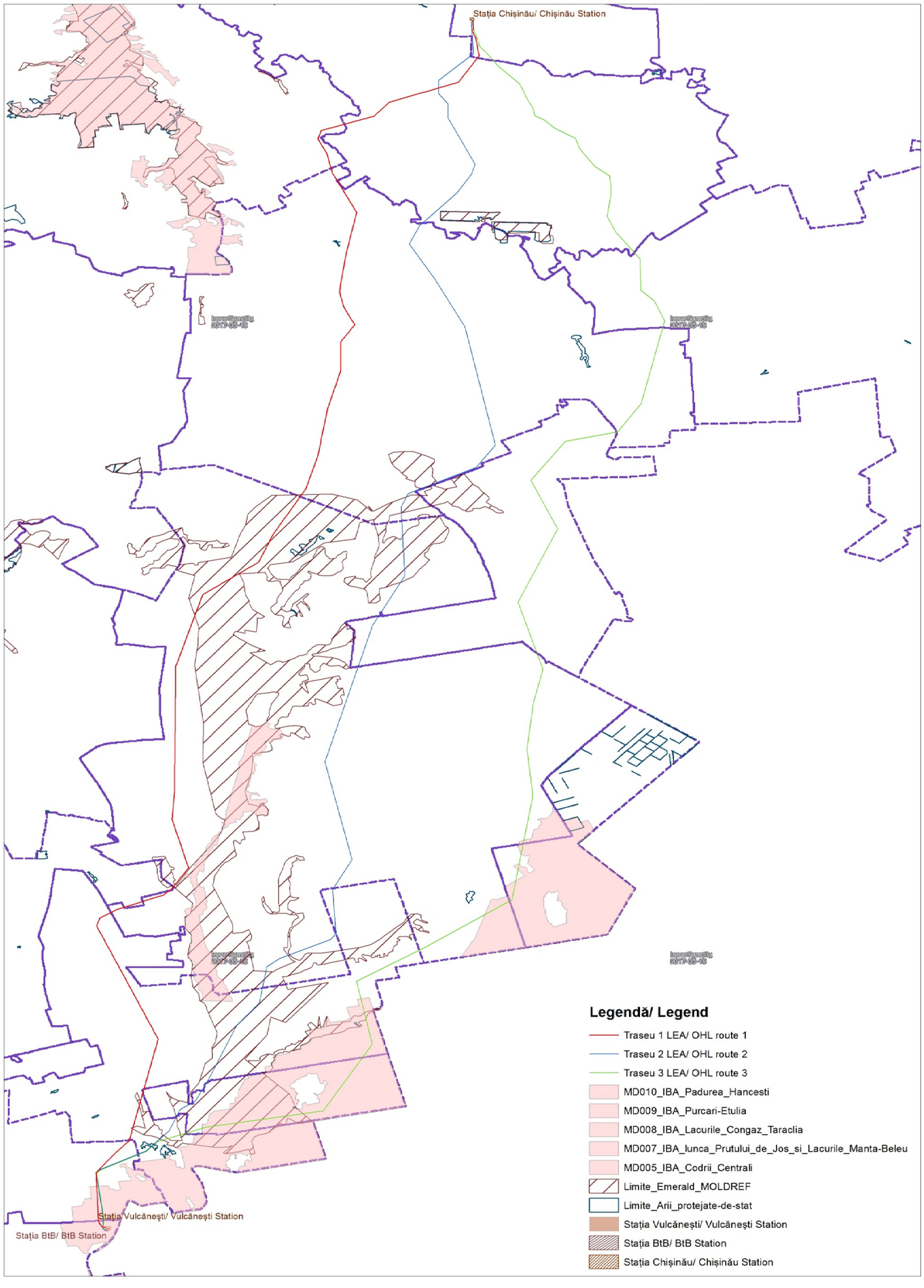


Figure no. 2. 400 kV Vulcănești – Chișinău OHL alternatives routes compared to protected areas by State

The summary of the OHL route lines and their coexistence with existing infrastructure are presented in Table no. 2.

Table no. 2. Objects crossed by the OHLs

Indicators	**OHL route Option 1, red color**	**OHL route Option 2, blue color**	**OHL route Option 3, green color**
Route length, km	149	150	163
Forests, bushes, km	2.173 km	6.32	4.6
Main cross sections			
Roads	• ***National roads*** • R3 Chişinău – Hânceşti - Cimişlia - Basarabeasca; • R37 Ceadir – Lunga - Comrat - Cantemir; • R38 Vulcăneşti – Cahul - Tărăclia; • R47 Cimişlia – Iargara - Sarata Nouă; • ***Local roads:*** • L458 Ialoveni - Singera; • L461 Iasloveni – Moleşti; • L465 Pojareni - Tipova; • L547 Răzeni - Moleşti; • L578 Albina – Fetita – Lipoveni – Munteni - Porumbei; • L580 Mihailovca – Sagaidac - Valea Perjei; • L 641 Congaz - Cîietu; • L642 Congaz - Chioselia Rusa; • L643 Chioselia Mare - Dimitrova; • L673 Salcia - Orehova; • L696 Burlăceni - Muşaitu;	• ***Regional and magistral roads:*** • R26 Comrat - Ciumai; • R35 Comrat - Basarabeasca; • Regional Cimişlia - Ceadir; • M3 Chişinău - Vulcăneşti; • Local roads: • L631 Bascalia - Comrat; • L645 Zimbreni - Costeşti; • L649 Ceadir – Lunga - Baurci; • L696.2 Iujnoe - Burlaceni;	• ***Regional and magistral roads:*** • R29 Răzeni - Pervomaisc; • R35 Cimişlia - Basarabeasca; • R36 Ceadir – Lungu - Basarabeasca; • M3 Chişinău - Vulcăneşti; • Local road: • L639 Avdarma - Chiriet - Lunga;
Railways	• OHL route crosses the railway near Bugeac village;	• OHL route crosses the railway at North side of Bascalia village;	• OHL route crosses the railways in the region of Joltai and Tvardita villages and Chirilovca village;
400 kV OHLs	• -	• -	• 400 kV OHL MGRES - Vulcăneşti;
330 kV OHLs	• Two OHLs Chişinău - MGRES	• Two OHLs Chişinău - MGRES	• Two OHLs Chişinău - MGRES
110 kV OHLs	• 110 kV OHL Chişinău - Anenii Noi; • 110 kV OHL d.c, Chişinău - Hânceşti and Chişinău - Gura Galbeni; • 110 kV OHL entry and exit of Gura Galbeni substation; • 110 kV OHL Gura Galbeni - Cimişlia;	• 110 kV OHL Chişinău - Gura Galbenei; • 110 kV OHL Comrat - Bascalia; • 110 kV OHL Cimişlia - Tomai; • 110 kV OHL d.c Vulcăneşti -Balabanu and Vulcăneşti - Taraclia; • 110 kV OHL d.c.	• 110 kV OHL Chişinău - Anenii Noi; • 110 kV OHL Chişinău - Horesti • 110 kV OHL Tărăclia Nord -Basarabeasca; • 110 kV OHL Bascalia - Basarabeasca; • 110 kV OHL Vulcăneşti-Ceadir - Lunga;

Indicators	OHL route Option 1, red color	OHL route Option 2, blue color	OHL route Option 3, green color
	• 110 kV OHL Vulcăneşti - Vulcăneşti Nord; • 110 kV OHL Comrat - Iargara; • 110 kV OHL Comrat - Sardic;	Vulcăneşti – Tărăclia, in the region Chirilovca, Vinogradovca and Burlăceni;	• D.C. Inlet at 110 kV D.C. substation Tvardita;
35 KV OHLs	• 35 kV OHL Comrat - Visniovca; • 35 kV OHL Cimişlia - Javgur.	• 35 kV OHL d.c Tărăclia - Svetlii,Taraclia - Moscovei; • 35 kV OHL Cimişlia - Mihailovca.	• 35 kV OHL Varatic - Răzeni; • 35 kV OHL Tărăclia Nord - Mihailovca.
Rivers	• Sălcia Mare river; • Salcia river; • Ialpugel river; • Chirsova Mare river; • Ialpug river; • Cogâlnic river; • Botnişoara river; • Botna river; • Işnovăţ river.	• Sălcia Mare river; • Ialpug river; • Lunguţa river, forth times; • Baurci river; • Cogâlnic river • Botnişoara river; • Botna river; • Işnovăţ river	• Ialpug river; • Sălcia Mare river; • Lunga river, twice; • Cogâlnic river; • Răzenişi storage lake; • Schinoasa river; • Ceaga river; • Botnişoara river; • Botna river; • Işnovăţ river.
Protected areas	IBA Site Puricari-Etulia 4.9 km	• Multiple-use management areas representative sectors of steppe vegetation Sector of South - Bugeac steppe- (Core Areas of International Level) • IBA Site Puricari-Etulia 5 km	• Multiple-use management areas representative sectors of steppe vegetation Sector of South - Bugeac steppe- (Core Areas of International Level) • IBA Site Puricari-Etulia 34.57 km

3.2.1 Multicriteria analysis for OHL route selection

The multi - criteria analyses of the route option for 400 kV OHL Vulcănești – Chișinău considered the following technical, socio – economic and environment aspects:

- *Technical aspects:*
- Length of the line;
  - Number of special towers;
  - Number of special foundations (the nature of the foundation soil);
  - Presence of polluting or aggressive areas on the route;
  - Co-existence with other objectives (roads, railways, water streams, OHLs, telecommunication lines, pipes, etc.);
  - Route accessibility (level of difficulty);
  - Investment costs;
- *Socio – economic:*

- Crossing built area of localities;
- Crossing highly productive areas (vineyards, farm lands);

- *Environment:*
  - Visual impact;
  - Impact on ecological systems;
  - Crossing protected areas;
  - Crossing forest areas;
  - Electric and magnetic fields' impact.

In order to establish the optimum 400 kV OHL Vulcănești - Chișinău route, considering the technical-economic criterion and the environmental criterion, the multicriteria analysis is used. There will be considered equal share (50%) for both criteria: technical-economic and environmental.

Within the technical-economic criterion, the five defined indicators are weighted depending on their importance in making the decision regarding the OHL route line.

Within the environmental criterion the four defined indicators are weighted, depending on their importance in making the decision regarding the OHL impact on the environment.

A mark will be assigned for each indicator, as follows:

- 3 - for the best solution;
- 2 - for the average solution;
- 1 - the most unfavourable solution.

The optimum alternative is corresponding to the alternative with the closest score to mark 3.

The length of the line is the main technical-economic indicator that, basically, has the greatest impact on the investment values.

Consequently, when selecting the 400 kV OHL route it is imposed to be as close as possible to the straight line joining the end points: Vulcănești substation, respectively, Chișinău substation.

The route alternative analyses considered the *line length* indicator, which is very important from the impact on the investment values point of view. The deviations from the right line are due to natural obstacles, existing/proposed objectives and environmental issues.

This indicator is quantified through the percentage of exceeding the length of the route alternative, as compared to the straight line, which is 136.88 km.

According to this indicator, percentages are the following:

- Option 1 - red: 109.15% (149.41 km OHL);
- Option 2 - blue: 109.84% (150.35 km OHL);
- Option 3 - green: 119.14% (163.08 km OHL).

The assessment of the indicators considering route line alternatives for 400 kV OHL Vulcănești - Chișinău is presented in Table no. 3.

Table no. 3. The multicriteria analysis for route line selection

CRITERION	SPECIFIC INDICATORS	Weight of indicators as part of the criterion	OPTION 1 - RED		OPTION 2 - BLUE		OPTION 3 - GREEN	
			Rating	Weighted average	Rating	Weighted average	Rating	Weighted average
TECHNIC -ECONOMIC	Length of the line	15%	3	0.45	2	0.30	1	0.15
	Percentage of special towers	15%	2	0.30	3	0.45	2	0.30
	Nature of the foundation soil (geological stability)	15%	3	0.45	3	0.45	3	0.45
	Accessibility of the route (difficulty level)	20%	3	0.60	2	0.40	1	0.20
	Coexistence with objectives (roads, railways, waters, OHLs)	35%	2	0.70	3	1.05	2	0.70
	Total technical and economic criterion	**100%**		**2.50**		**2.65**		**1.80**
ENVIRONMENT	Occupying highly productive areas	20%	3	0.60	2	0.40	2	0.40
	Visual impact	25%	2	0.50	1	0.25	2	0.50
	Crossing protected areas	25%	3	0.75	1	0.25	1	0.25
	Crossing the built area of localities	30%	3	0.90	3	0.90	3	0.90
	Total environmental criterion	**100%**		**2.75**		**1.80**		**2.05**
TOTAL				**2.625**		**2.225**		**1.925**

The results of the multi-criteria analysis indicate that option 1 is the preferred route for 400 kV OHL Vulcănești – Chișinău, as presents the following advantages compared with options 2 and 3:

- *Technical-economic criterion:*
  - has the smallest length;
  - has an accessible route;
  - has the lowest investment values;
- *Socio-economic and environmental criterions:*
  - has the lowest visual impact;

- does not cross protected areas;
- does have less impact on highly productive lands.

As it can be seen in table 5, option 1 – red is the best considering mostly the environmental criterion.

The hierarchy of the three proposed route lines is presented in Table no. 4.

Table no. 4. Hierarchy of route line options by sections

ROUTE OPTION	WEIGHTED AVERAGE	PLACE
1 - red	2.625	1
2 - blue	2.225	2
3 - green	1.925	3

A sensitivity analysis has been made for the proposed criteria to demonstrate that the hierarchy is correct, considering different shares for the two criteria, thus 40% - 60% and 60% - 40%. The results of the sensitivity analysis are presented in Table no. 5.

Table no. 5. Hierarchy of route line alternatives based on the sensitivity analysis

ROUTE OPTIONS	HYPOTHESES					
	40% - 60%		50% - 50%		60% - 40%	
	Weighted average	Place	Weighted average	Place	Weighted average	Place
1 - red	2.65	1	2.625	1	2.60	1
2 - blue	2.41	2	2.225	2	2.31	2
3 - green	1.95	3	1.925	3	1.90	3

The sensitivity analysis strengthens the option 1 - red, as optimum alternative for 400 kV OHL Vulcănești – Chișinău. The hierarchy is not affected by hypotheses related to the shares of criteria and indicators.

The option 1 - red has been approved by Moldelectrica that required the correction of the route in the areas where it overpasses the high voltage OHLs, as follows:

- To avoid the simultaneously overpassing of 330 kV OHLs Chișinău - MGRES 1 and 2, there are necessary separate investments MGRES - Chișinău 1 OHL and MGRES - Chișinău 2 OHL, by identifying a location where one of 330 kV OHL MGRES - Chișinău will be relocated so that to ensure the possibility to install an enough number of towers for the new OHL Vulcănești - Chișinău, between 330 kV OHLs MGRES - Chișinău 1 and 2;

- To avoid the intersection with the section 110 kV double circuit of 110 kV OHL Chișinău - Hânceşti and 110kV OHL Chișinău - Gura Galbenei, by ensuring the passing through a location where 110 kV double circuit section is divided in separated circuits (North of Zimbreni); an alternative to be anaylzed is passing over 110 kV Chișinău - Gura Galbenei North to Zîmbreni OHL, the route line going towards South-West up to South of Hansca on the East side of OHL Chișinău - Hânceşti, avoiding to pass over it;
- Minimizing the crossings with 110 kV OHL Gura Galbenei – Cimișlia in the region Valea Pierjei, Grădiște, Ecaterinovca.

The route of 400 kV OHL Vulcănești – Chișinău (Option 1 - red) has been optimized considering Moldelectrica recommendation, which involves the following changes:

- The crossing of 330 kV - 110 kV - 35 kV OHLs with the new 400 kV transmission line will be done as follows:
  - The existing 330 kV - 110 kV - 35 kV towers in the crossing span will be dismantled and new towers with lower height than the existing will be installed in place in such manner that the imposed electrical clearance to be achieved.
  - The modification of the existing 330 kV - 110 kV - 35 kV lines will be done on a max length of 300 m from the crossing point.

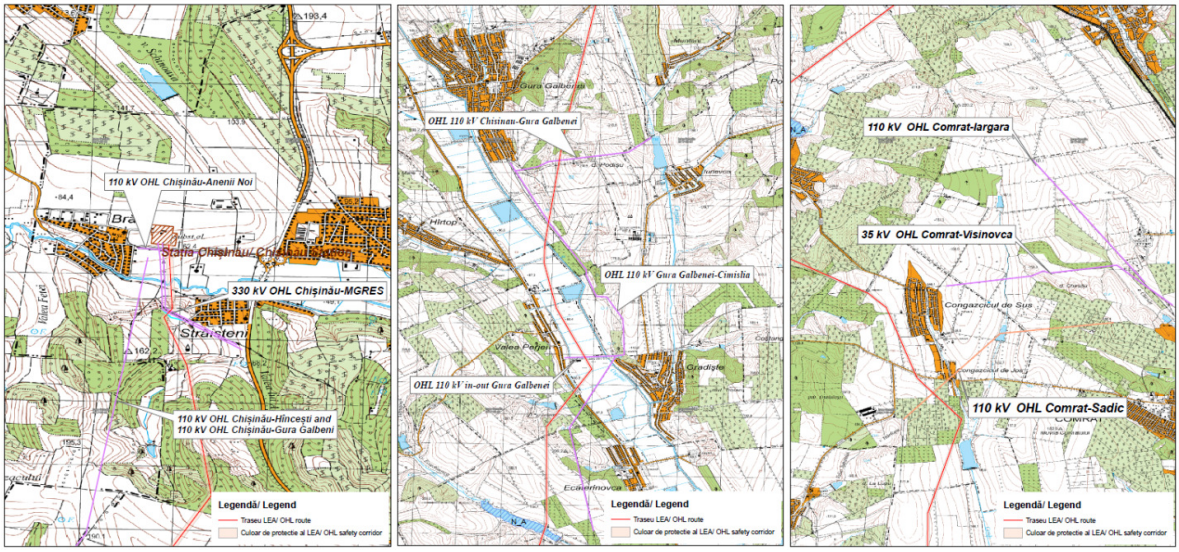


Figure no. 3.400 kV Vulcănești – Chișinău OHL crossing other 330 kV - 110 kV - 35 kV OHLs

- For the crossing of the low voltage lines it will be used 400 kV towers with bigger height in such way to ensure the electrical clearance imposed by the norm without any change in the low voltage OHL;

- The 400 kV OHL Vulcăneşti – Chişinău crosses two 330 kV OHLs (Strășeni and Cuciurgani) between towers no. 506-507-508, at the entry of Chişinău substation. In one 330 kV OHL it will be installed 2 new metallic angle towers as presented below (the yellow line represent the modification of the route line) and the markers represent the new tower location). The existing 330 kV OHL will be dismantled in the modified section (1 tower will be dismantled also). The length of the 330 kV modifications is about 310 m.

  The other 330 kV line will not be modified.

Figure no. 4. Modification on one 330 kV OHL near Chișinău substation

The 400 kV OHL Vulcănești Chisinau will pass across the modified 330 kV in the span 506-507, and in span 507-508 will cross the other 330 kV line.

This solution was adopted in such manner that both 330 kV lines not to be crossed by the 400 kV line in the same span, due to impossibility to retrieve from the operation both 330 kV lines at the same time.

- In order to connect the 400 kV OHL Isaccea-Vulcăneşti to the BtB Vulcăneşti substation are necessary the followings:
  - The existing 400 kV OHL Isaccea – Vulcanesti will be modified in the area near the road M3 by installing new towers as indicated in the picture;
  - Thus, it will be installed one angle tower in the existing line route and one dead end tower in front of the BtB substation;

- The existing OHL section from the point where modification of the line started and to the last existing dead end tower in front of Vulcanesti substation (except the dead end tower) will be dismantled. Two towers will be dismantled (one suspension tower and one angle tower).

- The connection of BtB Vulcăneşti substation with 400 kV Vulcăneşti substation needs an overhead connection outside the substation perimeter. The proposed solution is to re-erect the previously dismantled angle tower of the 400 kV OHL Isaccea Vulcanesti in front of the BtB Vulcăneşti substation gantry and to perform electrical connections between this tower and the existing terminal tower of OHL Isaccea. Thus, the final electrical connection will be BtB substation Vulcăneşti exit gantry – angle tension tower re-erected - existing dead-end tower of 400 kV OHL Isaccea - Vulcanesti – 400kV Vulcăneşti substation gantry.

Figure no. 5. Modification in order to connect BtB Vulcănești substation with existing 400 kV Vulcăneşti substation

During Task 1 Preliminary Technical analysis was performed the multicriterial analysis of OHL route options. At this stage of the Project for the assessment of biological environment were available only the National Protected Areas boundaries provided by the Ministry of Environment and the Important Bird Areas boundaries. The Task 1 submission was

completed in 14 September 2016. At that date the information regarding Emerald Sites Boundary weren't available yet, they were published on EIONET CDR Repository starting with 12 January 2017.

Taking into consideration all the above mentions during ESIA the team experts recommended the deviation of option 1 OHL route in order to avoid if possible the crossing of Bugeac Steppe. As the result of this deviation the OHL length increased at 158 km comparing with the previous option (149 km) and the number of towers increased consequently (511 towers comparing with 492 towers).

The assessment of the indicators considering new red route line alternatives for 400 kV OHL Vulcănești - Chișinău is presented in Table no. 6.

Table no. 6. The multicriteria analysis for route line selection

CRITERION	SPECIFIC INDICATORS	Weight of indicators as part of the criterion	OPTION 1 – NEW RED		OPTION 2 - BLUE		OPTION 3 - GREEN	
			Rating	Weighted average	Rating	Weighted average	Rating	Weighted average
TECHNIC -ECONOMIC	Length of the line	15%	2	0.30	3	0.45	1	0.15
	Percentage of special towers	15%	1	0.15	3	0.45	2	0.30
	Nature of the foundation soil (geological stability)	15%	3	0.45	3	0.45	3	0.45
	Accessibility of the route (difficulty level)	20%	3	0.60	2	0.40	1	0.20
	Coexistence with objectives (roads, railways, waters, OHLs)	35%	2	0.70	3	1.05	2	0.70
	Total technical and economic criterion	**100%**		**2.20**		**2.80**		**1.80**
ENVIRONMENT	Occupying highly productive areas	20%	3	0.60	2	0.40	2	0.40
	Visual impact	25%	2	0.50	1	0.25	2	0.50
	Crossing protected areas	25%	3	0.75	1	0.25	1	0.25
	Crossing the built area of localities	30%	3	0.90	3	0.90	3	0.90
	Total environmental criterion	**100%**		**2.75**		**1.80**		**2.05**
TOTAL				**2.475**		**2.300**		**1.925**

The hierarchy of the three proposed route lines is presented in Table no. 7.

Table no. 7. Hierarchy of route line options by sections

ROUTE OPTION	WEIGHTED AVERAGE	PLACE
1 - new red	2.475	1
2 - blue	2.300	2
3 - green	1.925	3

The results of the multi-criteria analysis indicate that new option 1 is the preferred route for 400 kV OHL Vulcănești – Chișinău, as presents the following advantages compared with options 2 and 3:

- *Socio-economic and environmental criterions:*
  - has the lowest visual impact;
  - does not cross protected areas;
  - does have less impact on highly productive lands.

The results of the sensitivity analysis are presented in Table no. 8.

Table no. 8. Hierarchy of route line alternatives based on the sensitivity analysis

ROUTE OPTIONS	HYPOTHESES					
	40% - 60%		50% - 50%		60% - 40%	
	Weighted average	Place	Weighted average	Place	Weighted average	Place
1 -new red	2.53	1	2.475	1	2.42	1
2 - blue	2..20	2	2.30	2	2.40	2
3 - green	1.95	3	1.925	3	1.90	3

As conclusion, the final OHL route that consider all Moldelectrica requirements as well as environmental constrains, crosses the following infrastructure features:

- *Roads:*
  - *National roads:* R3 (Chişinău – Hânceşti - Cimişlia – Basarabeasca); R37 (Ceadir – Lunga -Comrat – Cantemir); R38 (Vulcăneşti – Cahul –Tărăclia); R47 (Cimişlia – Iargara -Sarata Nouă);
  - *Local roads:* L458 (Ialoveni – Singera); L465 (Pojareni – Tipova); L461 (Iasloveni – Moleşti); L547 (Răzeni – Moleşti); L578 (Albina – Fetita –Lipoveni – Munteni – Porumbei); L582 (Valea Perjei – Javgur); L585 (Cimișlia - Javgur), L583 (R47 – Access road to Dimitrovca); L586 (Ciucur Mingir - Cenac), L635 (Bugeac – Dezghingea - Cenac); L636 (Congazcicul de Jos – Iargara) L637

(R37 – Sadîc – Tărăclia); L 641 Congaz - Cîietu; L642 Congaz - Chioselia Rusa; L643 Chioselia Mare - Dimitrova; L673 Salcia - Orehova; L696 Burlăceni - Muşaitu;

- *Railways:* OHL route crosses the railway near Bugeac village;
- OHLs:
  - *330 kV OHLs:* Two OHLs Chişinău - MGRES;
  - *110 kV OHLs:* 110 kV OHL Chişinău – Anenii Noi; 110 kV OHL d.c, Chişinău - Hânceşti and Chişinău - Gura Galbeni; 110 kV OHL entry and exit of Gura Galbeni substation; 110 kV OHL Gura Galbeni - Cimişlia; 110 kV OHL Vulcăneşti - Vulcăneşti Nord; 110 kV OHL Comrat - Iargara; 110 kV OHL Comrat - Sardic;
  - *35 KV OHLs:* 35 kV OHL Comrat – Visniovca; 35 kV OHL Cimişlia - Javgur.

To perform the construction works for the transmission line, during Detailed Design Stage the final position of the tower will be coordinated by all th utilities administrators (for crossing the roads, gas pipeline, telecommunication lines, transmissions and distribution grid, and so on).

3.3 Considered alternatives for BtB substation location

3.3.1 General considerations

In the existing 400/110/20 kV Vulcanesti substation there is enough free space to construct the BtB substation. 40 years ago that space was contaminated with PCB oil leakages from capacitors batteries. Two successive explosions take place and damaged the capacitors.

In that time, approximately 1000 capacitors exploded in each incident and 4 pits were made inside the substation to bury the ones removed. An assessment of each pit shows contained up to 15-20 tons of material contaminated with PCBs, but it is not really known how many damaged capacitors were buried and if other contaminated places inside substation may be found.

In 2005 an investigation of soil contamination documented high levels of PCB in the top soil under or close to the places where the capacitors batteries were.

A feasibility study for cleanup activities of the contaminated soil at the Vulcănești substation was developed. The following cleanup criteria were used to propose the remedial actions:

- 50 ppm PCB for top soil with restricted access;
- 100 ppm for soil under a 50 cm “clean” soil cap;

- Unrestricted PCB levels, if isolated and contained by protective liners and a 50 - 100 cm soil cap.

As the results of the analysis made in the feasibility study the following cleanup activities were carried out in 2007:

- Removal of damaged capacitors stored in containers at the substation;
- Removal of all capacitors hanging in metal frames in the capacitor batteries;
- Excavation of the burial pits 1 and 2 and removal of all damaged capacitors (1,270 capacitors). The contaminated excavated soil is collected in two coffer dams with protective liner and soil cap.
- Excavation of burial pit 3 and 4 and removal of all damaged capacitors. The contaminated excavated soil is refilled in pit 4, but soil from pit 3 is stored openly with no protective cap.

The objective of the excavation was to remove all primary sources of future PCB contamination (the capacitors).

In 2010 the soil excavated around pit 3 and the soil (10 cm) under the capacitors frames was removed and placed in another 2 coffer dams in the same area as the first 2 cofferdams. These second 2 cofferdams were prepared with a bottom liner, a double top liner and a layer of clean soil. All 4 cofferdams are located at south-west limit of the substation and were secure with fence and indicators. The area of the cofferdams will not be disturbed in the current investigation or by the new BtB substation.

In the area where the capacitors frames were originally located, acacia trees were planted and now a small forest is found (**Annex 12**- *Investigated area Vulcanesti*).

Further investigation is needed of the area, including the area where clean-up activities were taken 10 years ago, to ensure there are no risks to workers' health impact during BtB construction and further operation.

Therefore, it is necessary to determine the current level of soil contamination in the interest areas. This will allow decision on (a) if the area is safe for workers now and (b) if it is not, if it can be made safe for a reasonable investment.

During the fires after capacitor explosions, the high temperature may have caused the creation of dioxins. There has been no investigation to determine if dioxins are present.

An investigation to identify the values of PCB and dioxin in the area where the BtB substation can be build must be done to see if is safe like it is or if it can be made safe by remediation.

If the remediation of the existing area is not feasible for technical or economic reasons, the BtB substation would have to be constructed on an alternative site.

An investigation plan of the interest area inside Vulcanesti substation is presented in Annex 12.

3.3.2 Comparison analysis for BtB substation location selection

The location of the alternative site of BtB substation was selected from four options in the vicinity of Vulcanesti substation described below:

- *Option 1* - North of the Vulcănești SS, with access to M3;
- *Option 2* - South of the Vulcănești SS, beyond the 750 kV OHL pillars, with access to M3;
- *Option 3* - West of the Vulcănești SS, on a hill;
- *Option 4* - South-west of the Vulcănești SS, to the Vulcăneşti town, with access to M3.

The location of these four options is presented in **Annex 11** (*Alternative location BtB cadaster, images and soil*). A comparison between the four options was made to select the alternative site to construct the BtB substation. The considered criteria are as follows:

- How is technical feasible the connections with existing 400 OHL Isaccea Vulcanesti and with the new 400 kV Vulcanesti – Chisinau;
- The access roads available to transport the equipments;
- Main land characteristics, like slope and eroded soils;
- Information on proprety (public or private), destination, cadastral.

The details on comparison with advantages and disavantages are presented in the table of Annex 11.

Considering the criteria mentioned above the analysis of the four possible locations proposedoption 2 as alternative site to construct BtB substation.

The selected option 2 is located on the south of the Vulcănești SS, beyond the 750 kV OHL pillars and with access from M3. The land is extraurban and private propriety formed by several plots with agriculture destination. A partial local road with 230 length has to be rebuild.

4. PROJECT DESCRIPTION

4.1 Project location

The main elements of the proposed Project include 158 km 400 kV overhead power line, a new BtB substation and upgrading of the current 330/110/35 kV Chişinău substation.

The BtB substation will be located in the existing 400/110/35 kV Vulcănești substation at 6.160 km distance in the North - East of Vulcănești city.

The 400 kV OHL route that connect the 400/110/35 kV Vulcăneşti and 400/330/110/35 kV Chişinău substations passes through eight districts in the south part of Republic of Moldova namely: Chișinău, Ialoveni, Hânceşti, Cimișlia, Leova, Tărăclia, Cahul and one Autonomous Territorial Unit of Găgăuzia.

The 330/110/35 kV Chişinău substation is situated at 6.0 km in the south part of Chişinău city. The distance is measured from the substation to the outskirts of the city (last building or yard).

Project location is presented in Figure no. 6.

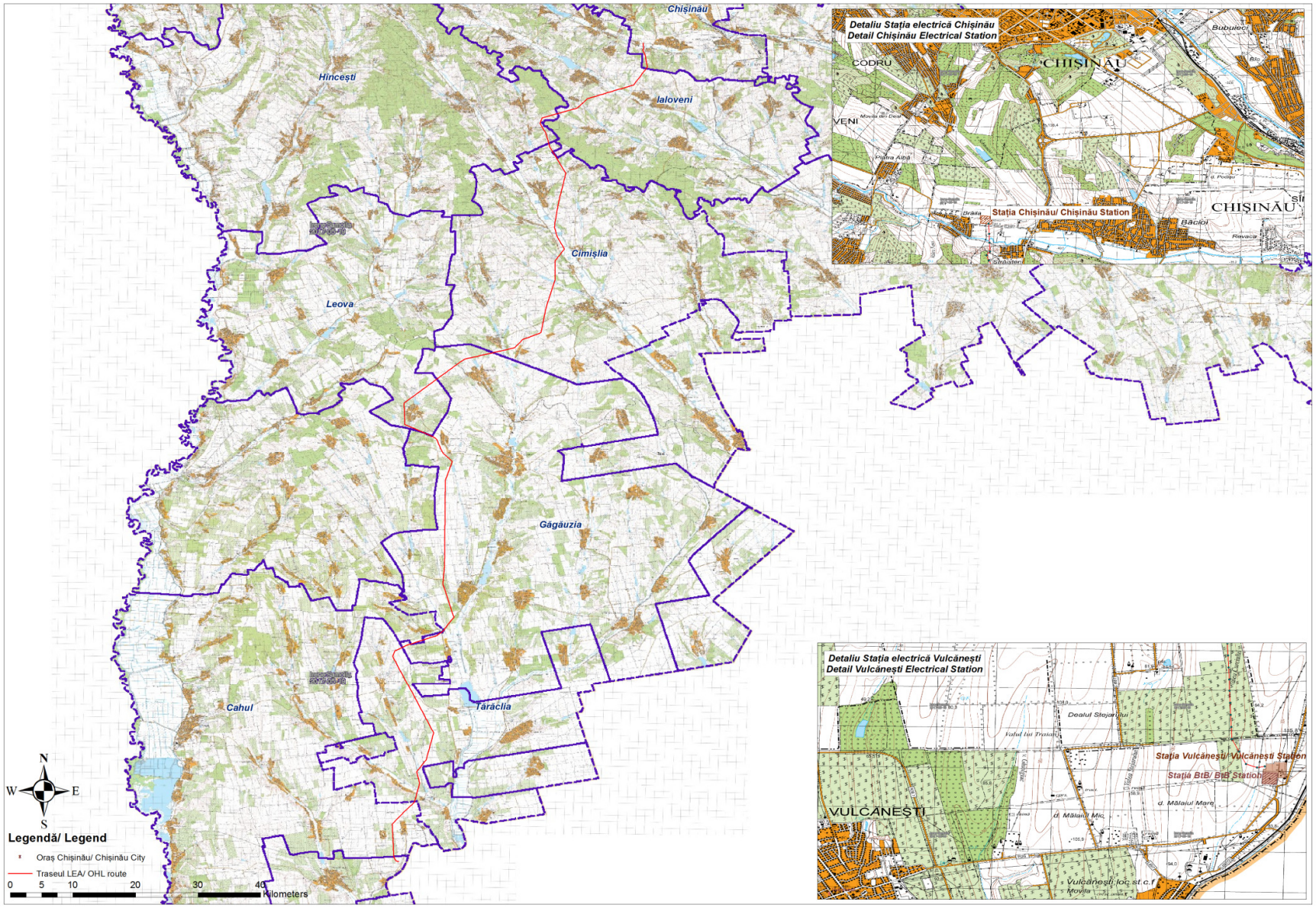


Figure no. 6.The Project location

4.2 Project description

The Project includes the following key features:

- New 400 kV OHL Vulcăneşti – Chişinău;
- New BtB station at Vulcăneşti substation and modification within the existing 400 kV Vulcăneşti substation;
- Modification within the existing 330/110/35 kV Chişinău substation consisting of the construction of a new 400 kV substation and extension of the existing substation with anew autotransformer bay (AT 400 / 330 kV).

The Project will involve the construction, supply of equipment and placing into operation of: (i) a BtB station in Vulcăneşti substation to allow the asynchronous connection of the electricity systems of Romania and Moldova, namely the European Network of Transmission System Operators of Electricity (ENTSO-E) and the Integrated Power System/United Power System (IPS/UPS); (ii) a 400kV transmission line between Vulcăneşti and Chişinău; (iii) the extension of (and within) the existing 330/110/35 kV substation at Chişinău in Moldova involving the construction of a new 330 / 400 kV autotransformer bay with new autotransformer (AT 400 / 330 kV); (iv) the extension and modification of (and within) the existing Vulcăneşti 400kV substation; (v) the modification of existing 330 kV, 110 kV and 35 kV OHLs at locations where they will be crossed by the new 400 kV OHL Vulcăneşti – Chişinău involving the relocation and/or modification of some towers; (vi) modification of the existing 400 kV OHL Isaccea – Vulcăneşti local to Vulcăneşti substation, involving the replacement of some existing towers with new repositioned towers in order to facilitate the routing and connection of the OHL to the BtB substation.

Based on the ESIA work findings there is a recommendation for a route deviation avoiding the Bugeac Steppe Emerald Site.

4.2.1 400 kV OHL Vulcăneşti - Chişinău

The planned 400 kV OHL Vulcăneşti – Chişinău, with the total length of 158 km, crosses territorial administrative units of Autonomous Territorial Unit of Găgăuzia, Cahul, Tărăclia, Leova, Cimișlia, Hânceşti, Ialoveni and Chișinău districts. The route line description is included in *Chapter 3.2 Considered alternatives for the OHL route* (OHL route Option 1, red color).

The 400 kV OHL Vulcăneşti – Chişinău, single circuit type, is designed in compliance with the Norms for Electrical Installations Arrangement (Chapter 2.5).

The OHL consists of 511 towers along the route, spaced apart at an average distance of 309 m.

The main *technical characteristics* of the 400 kV OHL Vulcăneşti – Chişinău are presented below.

OHL towers

The OHL towers for 400 kV OHL Vulcăneşti – Chişinău will be self-supporting latticed steel towers of suspension and tension type. Depending on their position on the OHL route, the types of towers will be:

- Suspension towers, used for straight section of the line;
- Angle (tension) towers, used where the line changes direction;
- Terminal towers, in Vulcăneşti and Chişinău substations.

The proportion of angle tension towers is about 15-16 % of the total number of towers erected along the OHL route.

The steel towers proposed to be used have standard height up to conductor clamp point of 21 m.

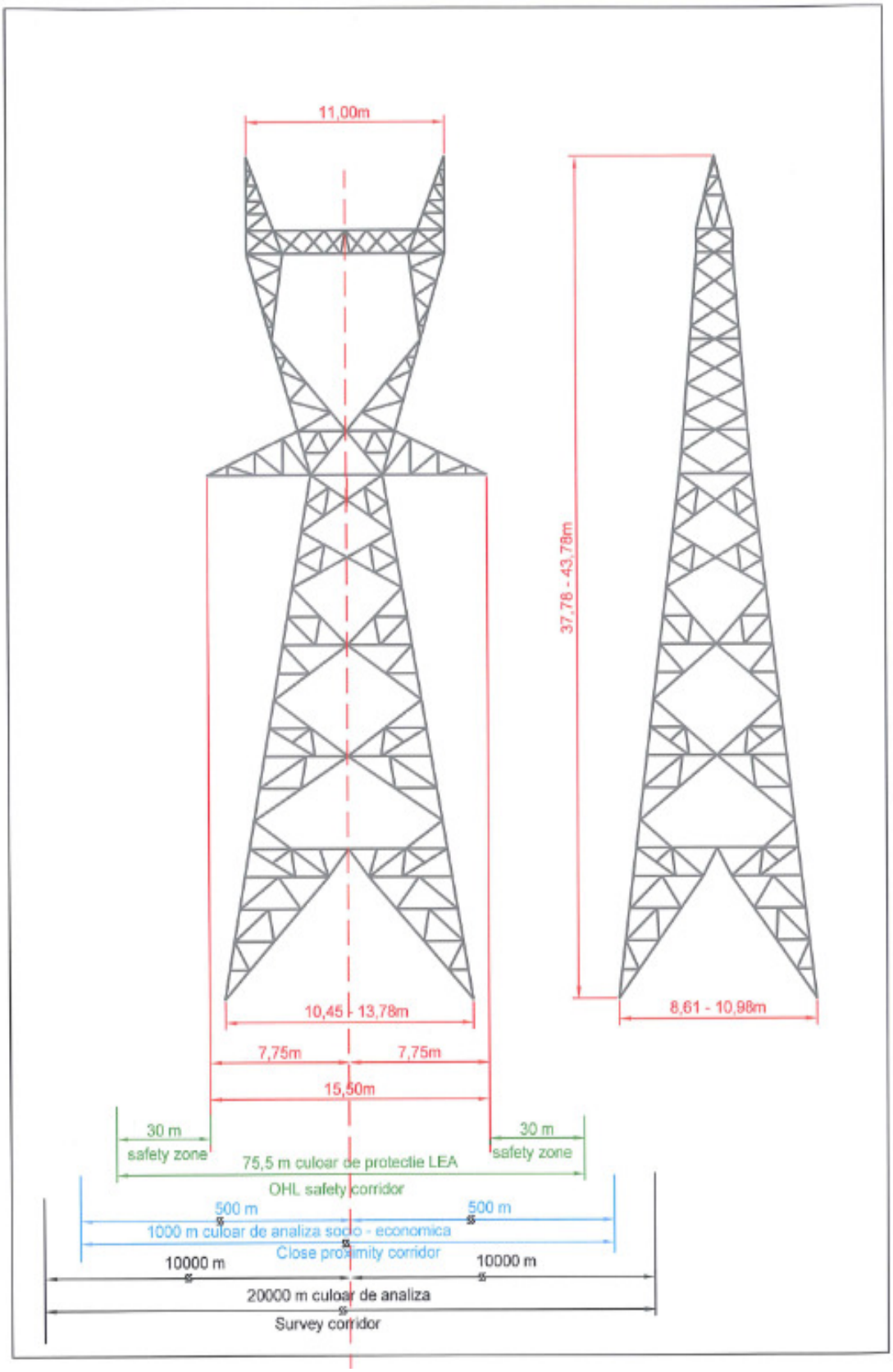
At crossings over OHLs, national roads, the crossing towers provided are tension towers equipped with insulator strings with multiple columns.

Steel towers will be equipped with support for identification plates, support for number and support for warning plates. Supports for aerial numbering may be installed on the top of the suspension and/or angle towers.

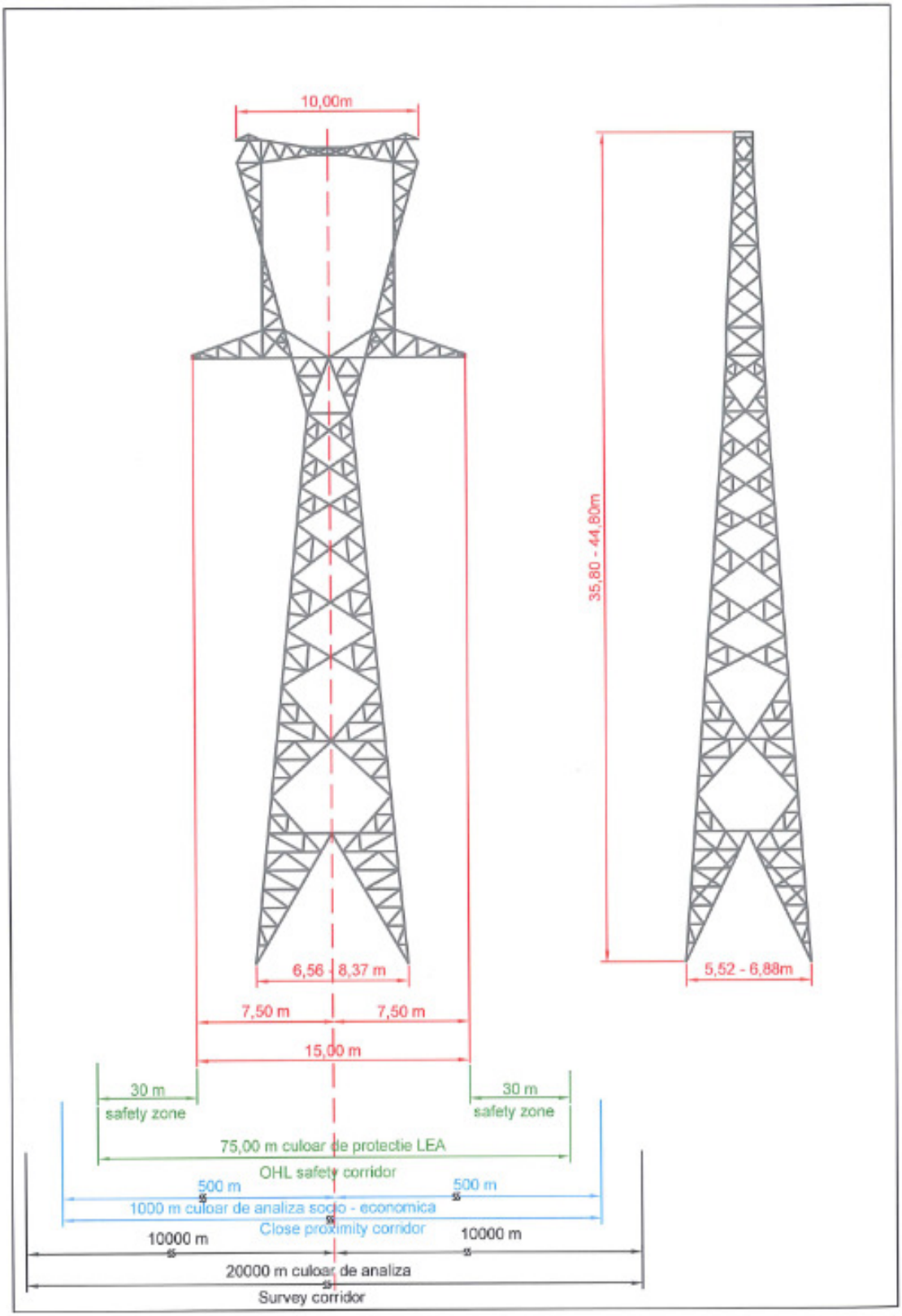
Overall dimensions electrical distances are complying with the provisions of the current design norm related to electrical installations.

Towers anti-corrosive protection will be made by zinc coating (thermal covering system – TC) executed in the factory not on site.

The “Y” type tower designs for suspension and tension tower as well as the zones and corridors used for the baseline and impact assessments are provided in the figure below. The tower heights vary depending on the topography and objects crossed by the OHL route. Tension and suspension towers for 400 kV OHL Vulcăneşti – Chişinău are presented in Figure no. 7.



a. Tension tower type "Y"(longitudinal view/ lateral view)



b. Suspension tower type "Y"(longitudinal view/ lateral view)

Figure no. 7. Tension (a) and suspension (b) towers for 400 kV OHL Vulcăneşti - Chişinău

OHL conductors

The 400 kV OHL Vulcăneşti – Chişinău will be equipped with 3 active/phase conductors, type ACSR 300/39 mm^2. The phase conductors will be protected against short and average waves oscillations (vibrations) using spacer dampers installed in spans, at unequal intervals, not exceeding the distance of 60 m. In order to diminish the effects against short waves oscillations (vibrations), if necessary, Stockbridge vibration dampers with 4 resonant frequencies are recommend to be used.

Two ground wires will be installed, one optical fiber conductor type (OPGW 95) and the other one classical conductor type (Aluminium Clad Steel, ACS 95), that will be grounded for each tower; the protection against vibrations for both types of protection conductors will be ensured by Stockbridge vibration dampers with 4 working frequencies.

OHL insulation

The 400 kV OHL Vulcăneşti – Chişinău will be equipped with insulator strings with toughened glass cap and pin elements sized for 400 kV according to the pollution levels in the crossed areas. The insulator strings will be provided with upper and lower guarding rings.

Artificial earthing system

The artificial earthing system will be installed at each tower. The types of used systems will depend on the specific location areas (e.g. in low traffic areas, the towers earthing system will be made of zinc coated steel strip; for towers located in high traffic areas the earthing system with several outlines will be executed in order to achieve the value imposed for touch and step voltages).

Tower foundations

The tower foundations will be cast or drilled, of reinforced concrete pad and chimney type, sized according to the geotechnical characteristics of soil.

During this design stage, in order to estimate the types of foundations along the 400 kV OHL route, drilling works and laboratory analyses related to soil structure have been performed. According to the performed drillings most of the soil intercepted down to the depth of 8.00 m is yellow-brown sandy clay, hard; grey clay, hard or brown-dark brown sandy clay, hard. Thus, the soil is included in the category of soils good for foundation (plasticity Ip > 20%; pores index e < 1.1; consistency index Ic >= 0.75).

Notification, warning and aerial plates

After completion of tower erection works, the following installation works will be executed at OHL towers: support plates; warning plates; number plates, marked with the width of safe passage corridor; aerial plates, on tower top – if necessary.

The *specific requirements* to be observed for the 400 kV OHL Vulcăneşti - Chişinău are presented below:

- For protection of the 400 kV OHL Vulcăneşti - Chişinău, based on the results of field work, a 75 m wide corridor (safety corridor) where no construction is allowed has been established; the 75 m corridor is sufficient to fulfil the provisions of GD no. 514/2002, the Regulation regarding the protection of electrical network, which specifies that the 400 kV OHL safety zone (the land and airspace limited by vertical planes, on both sides of line), shall be 30 m either side of the outer conductors.
- The minimum clearance and sizes at crossing and near other objects (OHL, cables, roads etc.) are presented in Table no. 9 and Table no. 10:

Table no. 9. Minimum sizes at crossing

Crossing	M.U.	Value
Normal land	m	8
In localities	m	15.5
Main roads	m	9.5
Railways	m	13.5
Power lines	m	4
Trees	m	6

Table no. 10. Minimum clearance between towers and the following structures

	M.U.	Value
Main roads	m	Tower height +5m
Railways	m	Tower height +5m
Secondary roads	m	Tower height
Power lines	m	5
Underground telecommunication lines	m	10-50

Where underground gas pipes are crossed the following conditions will be observed:

- The crossing angle should be as close to 90°;
- The horizontal distance for high pressure gas at parallel passage from the edge conductor should be not less than 50 m;
- It is not allowed to cross above-ground conductors; the maximum distance from the edge conductor to the pipe should be no less than 300 m in all parts.

4.2.2 New BtB substation

The proposed investments are related to the construction of the new BtB substation.

The main technical characteristics of the investments are presented below.

BtB substation, including 400 kV substations towards Romania and Republic of Moldova Power Systems

The BtB substation includes two identical High Voltage Direct Current (HVDC) modules, each installed in a dedicated valve hall, as well as their external AC circuits, including interface transformers. Both HVDC modules will feature converters of the VSC (Voltage Source Converter) type and will be sized to a power of 300 MW each.

Each of the two converters has two ends, located in the same room, one converts electrical current from AC to DC and the other converts DC to AC. The block / basic arrangement of the converter is a bridge with several "valves" (containing several transistor modules with transistors of the insulated gate bipolar transistor (IGBT) type).

The valve halls will have an internal metal screen all over walls, roof and floor. This screen creates a Faraday cage in order to stop the electromagnetic interferences generated by the operation of the valves.

Inside the hall, between the two ends of the converter, a DC installation is built, consisting of capacitors, DC smoothing reactors, capacitive dividers, arresters, disconnectors, resistors, etc.

The valves are constantly cooled by a forced cooling system in order to minimize losses in the transistors and in other components and to reduce the temperature of these components.

The cooling system, with ultra-pure deionized water, includes the following components: filtering system; de-ionization system; circulation pumps; heat exchangers (coolers); by-pass circuit; expansion tank; make-up system.

The HVDC modules will be installed in two identical hall type industrial buildings, placed on the ground mirroring each other; the approximate sizes in plan of each building: 65 x 92 m, height about 35 m.

The four interface transformers 400/110*/20*kV, two for each converter, provided between the circuits of the BtB substation and of substations connecting the power systems, will be three phased. The tertiary winding outputs of two of the transformers, one towards Romania Power System and the other towards Republic of Moldova Power System will be used to supply AC auxiliary services of the substation. The transformers will be provided with water spray extinguishing equipment (flow rate 90.0 l/s, spraying intensity 0.3 l/s/m^2, pressure 9.0

bar) and with transformer vats and oil collecting tank (sized for 100% collection of accidentally leaked oil).

Between each transformer and converter there are provided single phase smoothing reactors which control the flow of active and reactive power by stabilizing the current which is crossing them. The reactors also serve as AC filters, reducing the high frequency harmonic content of the AC currents occurring during the IGBT switching operation.

The BtB substation is provided with a control unit, common with the one for 400 kV substations towards Romania and Republic of Moldova Power Systems. The HVDC control room, together with the other rooms (auxiliary services, cooling installation, storage batteries, workshops, offices) will be located inside a new building, with approximate sizes in plan 18 x 40 m, height about 10 m. The connection with the two BtB buildings will be achieved through a closed passage at level ± 0.00

Each of the 400kV substations towards Romania and Republic of Moldova Power Systems, outdoor type, will have a bus bar for connection of the following bays: one line (OHL Isaccea, respectively, OHL Vulcăneşti); two transformers of 400/110*/20*kV - 315* MVA (one for each module of converters).

NOTE: Values marked with an asterisk (*) will be selected by the supplier of the HVDC system.

For the new 400 kV substations to Romania and Republic of Moldova Power Systems, the following primary equipment are provided, sized at 2000 A, 40 kA / 1s: high voltage circuit breakers, with sulphur hexafluoride (SF_6) as extinguishing environment; disconnectors; current and voltage transformers, oil insulated; surge arresters; high-frequency line traps on 400 kV Isaccea line.

The BtB substation including 400 kV substations towards Romania and Republic of Moldova Power Systems is provided with the following main installations/systems:

- *Earthing system*, sized for the 400 kV substations, valves halls and control unit building;
- *Installation for direct lightning* strikes protection for the 400 kV substations and valves halls;
- *DC and AC auxiliary services installation* that will supply all consumers of the BtB substation (outdoor 400 kV substations connecting the power systems, valves halls, transformers on both sides of the converters, control room) and includes: 220 V DC auxiliary services; 48 V DC auxiliary services; AC auxiliary services; in order to ensure the supply of AC vital consumers, in case of failure of both normal supply sources, the Diesel generating units have been provided, as security sources;
- *Outdoor and perimeter lighting* equipment of the BtB substation;

- *Water supply installation* for ensuring the drinking water demand of the control unit's consumers (through a branch from the existing drinking water network) and the water volume for extinguish the fire with water spray at the interface transformers (through a storage tank, V = 30 m3 and a pumping station);
- *Sewage system* for discharging the domestic waste water and rainwater:
  - For the domestic waste water from control unit building's sanitary groups, an outdoor sewage plant will be provided, consisting of: sewer manholes, sewer pipes and emptying septic tank (prefabricated, composite material) with volume of 4,000 l; septic tanks are emptied regularly by emptying trucks;
  - For discharging the rainwater from each vat of the 4 transformers, four pumping stations (Q = 1.5 l/s, H pumping = 12 mWC) will be provided; the rainwater mixed with oil will be conducted through two oil separators and evacuated into the existing rainwater sewage system;
- *Indoor installations for control unit building*: lighting and power; electric heating; air conditioning; natural ventilation; sanitary installations (water-sewage); inert gas extinguishing systems; water supply; facilities for first intervention in case of fire;
- *Monitoring and securing system* for BtB substation.

4.2.3 Modification within 400 kV Vulcăneşti substation

The existing 400 kV Vulcăneşti substation will be extended with a new 400 kV line bay situated on the north side of 400 kV substation, near by the current bay 2AT, inside the substation. The new bay will be provided with 2 circuit breakers on the circuit.

The bay is provided with the following primary equipment, sized at 2000 A, 40 kA / 1s: high voltage circuit breakers, with sulphur hexafluoride (SF_6) as extinguishing environment; disconnectors; current and voltage transformers, oil insulated; surge arresters; outdoor post insulators; double tension or suspension insulator strings, composite / glass material.

The new 400 kV line bay will involve the following modification within the existing Vulcăneşti substation:

- The existing earthing system will be adapted to new civil works and equipment;
- The protection equipment against direct lightning strikes will be extended in the area of the new bay, by installing on the towers of new frames;
- The control protection system will be extended;
- The consumers of new HV bay will be supplied from the existing DC and AC auxiliary services installation of the 400/110/35 kV substation;

- The outdoor lighting of the 400 kV Vulcănești substation will be extended;
- The flexible conductors will be supported by steel frames (towers and beams).

4.2.4 Modification within the existing 330/110/35 kV Chişinău substation

The proposed investments, performed inside the existing Chişinău substation, are related to the extension of the existing 330 kV substation as well as to the construction of a new 400 kV substation. The main technical characteristics of the investments to be performed in the existing Chişinău substation are presented below.

330 kV Chisinau substation

The existing 330 kV Chişinău substation will be extended with a new bay pertaining to the 400/330 kV autotransformer (AT). The new bay, provided with 2 circuit-breakers on the circuit, will be built on the east side of 330 kV substation, near the current OHL MGRES 2 bay, inside the substation.

The bay is provided with the following primary equipment, sized at 2000 A, 40 kA / 1s: high voltage circuit breakers, with sulphur hexafluoride (SF_6) as extinguishing environment; disconnectors; current and voltage transformers, oil insulated; arresters; post insulators; double tension or suspension insulator strings, composite / glass material.

The new 400 kV line bay will involve the following modifications within the existing Chişinău substation:

- The existing earthing system in the area of the new bay will be adapted to new civil works and equipment;
- The protection equipment against direct lightning strikes will be extended in the area of the new bay, by installing new lightning rods on the frames of new towers ;
- The control protection system will be extended;
- The consumers of new HV bay will be supplied from the existing DC and AC auxiliary services installation of the 330/110/35 kV substation;
- The outdoor lighting of the 330 kV bay of Chisinau substation will be extended;
- The flexible conductors will be supported by steel frames (towers and beams).

400 kV Chişinău substation

Near the 330 kV Chisinau substation, a new 400 kV substation will be built, consisting of an autotransformer and Vulcăneşti line bays, including the bus bars. The substation will be located in the eastern part of the existing 330 kV substation. The 400 kV Chişinău substation diagram will consist of a bus-bar for connecting the following bays: Vulcăneşti line and 400/330/38.5 kV autotransformer – 630 MVA. The autotransformer tertiary winding output will be accessible and used at 35 kV, for supplying the auxiliary services of the substation. Therefore, the substation diagram includes a 35 kV bay connected to the new autotransformer tertiary winding.

The new 400 kV substation is provided with the following primary equipment, sized at 2000 A, 40 kA / 1s: high voltage circuit breakers, with sulphur hexafluoride (SF6) as extinguishing environment; disconnectors; current and voltage transformers, oil insulated; surge arresters; line traps installed on 400 kV Vulcănești line; post insulators; double tension or suspension insulator strings, composite / glass material.

The new autotransformer will be of 630 MVA, consisting of three single-phase units of 210 MVA each. The tertiary winding output will be used for supplying AC auxiliary services of the substation. The autotransformer will be equipped with all necessary accessories, including a monitoring installation. The 35 kV bay supplied by the autotransformer tertiary winding will include a transformer for connection to the 35 kV existing substation. The autotransformer will be provided with water spray extinguishing equipment (flow rate 90.0 l/s, spraying intensity 0.3 l/sm^2, pressure 9.0 bar). The autotransformer will be provided with transformer vats and oil collecting tank (sized for 100% collection of accidentally leaked oil).

The protection cubicles of 400 kV substation will be located inside an existing building (plan dimensions 6.00 x 12.00 m, height 6 m) which will be rehabilitated.

The new 400 kV substation is provided with the following main installations/systems:

- Earthing system, connected to the existing system of the 330 kV substation;
- Installation for direct lightning strikes protection;
- DC and AC auxiliary services installation;
- Outdoor and perimeter lighting equipment;
- Water supply for ensuring the fire-fighting with water sprayed at the three new transformers in the limits of the substations, through two pipelines (Dn 355 x 3.2 mm) connected to the existing sprayed water firefighting network;
- Sewage system: for discharging the rainwater from each vat of the three transformers, three pumping stations (Q = 1.5 l/s, H pumping = 12 mWC) will be provided; the rainwater, mixed with oil, will be conducted through an oil separator and evacuated into the existing rainwater sewage system; the rain water from the

extension area of the enclosure will be conducted through several outlets and discharged into the existing rainwater sewage system;

- Indoor installations for 400 kV protection cubicles building: lighting and power; lightning conductor; electrical heating; air conditioning; ventilation; first intervention equipment in case of fire.

4.3 Construction

4.3.1 400 kV OHL Vulcăneşti – Chişinău

For the 400 kV OHL Vulcăneşti – Chişinău there are needed permanent land areas (for OHL tower foundations) and temporary land areas (during investment execution period) for the OHL tower erection platforms and the corridor for OHL phase conductors and ground wires stringing.

The land areas which will be permanently occupied for OHL tower foundations vary according to tower types and heights.

The land areas which will be temporarily occupied are the following:

- Working platform for suspension towers erection (about 825 m^2);
- Working platform pertaining to tension towers for erection and phase conductors and ground wires sagging operations (about 1500 m^2);
- OHL working corridor (access zone) 3 m width, for phase conductors and ground wires erection (tension).

The lands necessary for 400 kV OHL Vulcăneşti – Chişinău construction are state-owned or owned by natural and legal persons; their legal status will be clarified or settled according to the legal provisions in force in the Republic of Moldova.

The OHL construction requires preliminary surveys such land survey for establishing the coordinates of tower, soil survey for setting the towers foundations (cast or drilled) and other subsequent activities. Once the contract will be awarded, the contractor will detail activities like clearing, foundation building, erection of towers and line stringing among others. However, at this phase, the estimated construction time for 400 kV OHL Vulcăneşti – Chişinău is 27 months from the starting date and includes the following activities:

- Refurbishment of the access roads, 2 months;
- Foundation building, 12 months;
- Erection of the towers, 16 months;
- Installation of the insulator string, 16 months

- Installation of phase conductors, ground wires and OPGW conductor, 16 months;
- Installation of artificial earthing system, 9 months;
- Inscription of OHL's towers, 2 months;
- Environmental restoration, 1 month;
- Tests, checking, 1 month;
- Acceptance inspection, 1 month.

During construction stage, the use of the existing roads will be preferred for access to the construction sites; a combination of access roads to towers locations will be used by combining the existing roads with new ones. After completing the construction works, the access roads will be maintained for maintenance activities. Any other access roads disturbed by construction activities will be improved in comparison to their original stage.

4.3.2 BtB substation

The works for the construction of the new BtB substation and for the extension with a bay of the existing 400 kV Vulcăneşti substation do not require new land[2], outside the fenced perimeter of the outdoor substation.

BtB substation (HVDC system and interconnection substations)

The BtB substation (HVDC system and interconnection substations) will be built in a space located on a land belonging to the existing transformer substation Vulcănești or in location 2 (see chapter 3.3).

For the construction of BtB substation, the following works are provided:

- Construction of the buildings for the two HVDC modules, inside which will be installed the IGBT valves, the AC and DC adjacent circuits, the DC filters, including pertaining control and automation system, as well as the de-ionized water-cooling system; outside of which will be install the buildings housing the single phase smoothing reactors and AC filter circuits (if required), including the supporting elements and the foundations;

[2] No land will be required if the land of the existing Vulcănești substation is not contaminated for use (see section 3.3 for further details)

- Installing the interface transformers to the 400 kV substations towards the power systems of Romania and Republic of Moldova, on foundations provided with oil retention bunds and drains;
- Construction of the control unit building for the BtB substation, common with the one for 400 kV substations towards the power systems of Romania and Republic of Moldova.

For the construction of the 400 kV substations towards Romania and Republic of Moldova Power Systems the following works will be performed:

- *Primary circuits*: installation of primary equipment, including current paths corresponding to the 6 bays, performing the installation of bus-bars and earthing system;
- *Control protection*: performing control protection installation, laying secondary circuit cables;
- *Telecommunications*: performing transmission installations for the lines connecting the two power systems;
- *Auxiliary services*: installing DC and AC auxiliary services;
- *Civil works* and architecture: frames, equipment supports including their foundations; control unit building; foundations for the MV substations and Diesel units; internal and access roads, including those for transformers transport; concrete platforms for equipment storage; cable bus bars channels; substation fence, including the access gates; land arrangement;
- *Installations afferent to buildings*: outdoor and perimeter lighting installation; indoor lighting installation in the rooms of the control building (common with the BtB substation); air conditioning, ventilation and sanitary installations in the control unit building; outdoor substation utilities (water supply and rainwater and domestic sewage installations); security, monitoring and burglary system.

The land where the new substation will be built has a slope of about 7.5% that requires land arrangement works consisting in execution of steps flanked by embankments inside the substation and execution of a supporting wall on the side having minimum elevation. The side having high elevation of the platform arranged will be executed in excavation and will be protected by a guarding trench.

The works for land arrangement and vertical systematization will include: stripping the vegetal layer (around 0.30 m); excavations and diggings for platform construction; storage of vegetable soil on site for reusing it to cover the substation platform with a layer with a thickness of 10 cm; evacuation of the rest of the vegetable soil.

The vehicles access inside the new substation (HVDC system and interconnection substations) will be assured by inner roads (three access roads of 25.00 m length each) connected to the existing road. In cross section, the inner roads will have width of 4.00 m (for normal traffic) and 10.00 m (for oversized transport, in front of the transformer foundations).

The estimated construction time for BtB Vulcăneşti substation is 21 months from the starting date.

4.3.3 Modification within 400 kV Vulcăneşti substation

The new line bay will be built in a space located on a land belonging to the existing 400 kV substation.

The works for land arrangement and vertical systematization will include: stripping the vegetal layer (cca. 0.30 m); digging the foundation holes for the construction objects (frame and supports foundations, roads cassette, cable channels, etc.); storage of vegetable soil on site for reusing it to cover the substation platform (around 1/3 of the amount); evacuation of the rest of the vegetable soil (around 2/3 of the amount).

The vehicles access inside the new bay inner will be assured by inner roads (3.50 m width) connected to the existing roads of 400 kV substation.

The estimated construction time for *400 kV Vulcăneşti substation* is 7 months from the starting date.

4.3.4 Modification within the existing 330/110/35 kV Chişinău substation

The new 330 kV bay and the new 400 kV substation will be executed inside the existing 330 kV Chişinău substation.

For the construction of the new 400 kV substation, inside the existing substation, the following works will be performed:

- *Primary circuits:* installation of primary equipment, including current paths corresponding to the 2 bays, performing the installation of the bus-bars and earthing system; installation of single phase units of autotransformer;
- *Control protection*: performing control protection system, laying secondary circuit cables;
- *Telecommunications*: performing transmission installations for the line to Vulcăneşti substation;
- *Auxiliary services*: installing DC and AC auxiliary services;

- *Civil works and architecture*: frames, equipment supports including their foundations; oil retention vats and autotransformer runway; adapting the existing building for installation of protection cubicles; medium voltage transformer foundation building; internal and access roads; land arrangement;
- *Installations afferent to buildings*: outdoor lighting installation; indoor lighting installation in the building with protection cubicles; air conditioning and heating installations in the building with protection cubicles; firefighting installation and rainwater sewage installation for the autotransformer.

The works for land arrangement and vertical systematization will include: stripping the vegetal layer (cca. 0.30 m); digging the foundation holes for the construction objects (transformer foundations, frame and support foundations, roads box and cable channels, etc.); storage of vegetable soil on site for reusing it to cover the substation platform (around 1/3 of the amount); evacuation of the rest of the vegetable soil (around 2/3 of the amount).

The vehicles access inside the new bay inner will be assured by inner roads (3.50 m width) connected to the existing roads of 330 kV substations.

The estimated construction time for *modification within the existing 330/110/35 kV Chişinău substation* is 19 months from the starting date.

4.4 Operation

The Project will be designed for operation 24 hours/day, 7 days/week, 365 days/year depending on the regime and parameters of power transmissions grid.

During operation, maintenance activities for OHL are required to be implemented in compliance with legal requirements stipulated by technical standards for operation and maintenance of electro-energy systems. The maintenance activities will include regular maintenance (visual inspections and routine maintenance works) and overhauls (detailed examination and elimination of eventual faults). Thus, the maintenance of the 400 kV OHL route would require vehicle access; the vehicles will use mainly the public road system.

4.5 Decommissioning

For 400 kV OHL Vulcăneşti-Chişinău decommissioning there will be prepared programs for the respective lines decommissioning and if necessary, for intersections with other networks, under cooperation with the electricity distribution branch or the respective networks operator.

The works for dismounting/mounting networks components, as well as demolition works including works at tower foundations and works in substations will be executed by means of

adequate equipment and by adopting occupational safety measures particularly established for these categories of works.

The location of the project will be subject of restoration and returning to the initial condition. The biggest part of the OHL equipment may be recycled or reused and may be offered to other interested licensed companies.

5. ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE

In order to understand the potential Project's impact on the environment, the existing environmental and socio–economic conditions within the OHL's survey corridor were analysed. The survey corridor is defined as an area of 10 km on both sides of the proposed OHL route (from OHL's central axis).

5.1 Physical environment

The monitoring of environmental condition in Republic of Moldova is assured by the State Hydrometeorological Service which performs systematic monitoring of the quality of air, surface waters, soil and radioactivity.

5.1.1 Climate conditions, including climate change

Republic of Moldova has a temperate-continental climate characterized by short winters and long warm summers.

According with the data recorded in 2014 by the meteorological stations (Chişinău and Cahul), the annual average temperature is around 11°C, with maximum annual temperature around 35°C and minimum annual temperature around -20°C.

Annual rainfall in the area is around 600 mm, with the highest monthly value registered in Cahul in May (103 mm) and July (113 mm).

The annual average wind speed is around 3 m/s, with the highest monthly value registered in Cahul in April (3.8 m/s).

Table no. 11. Temperature, precipitation and wind speed data, 2014

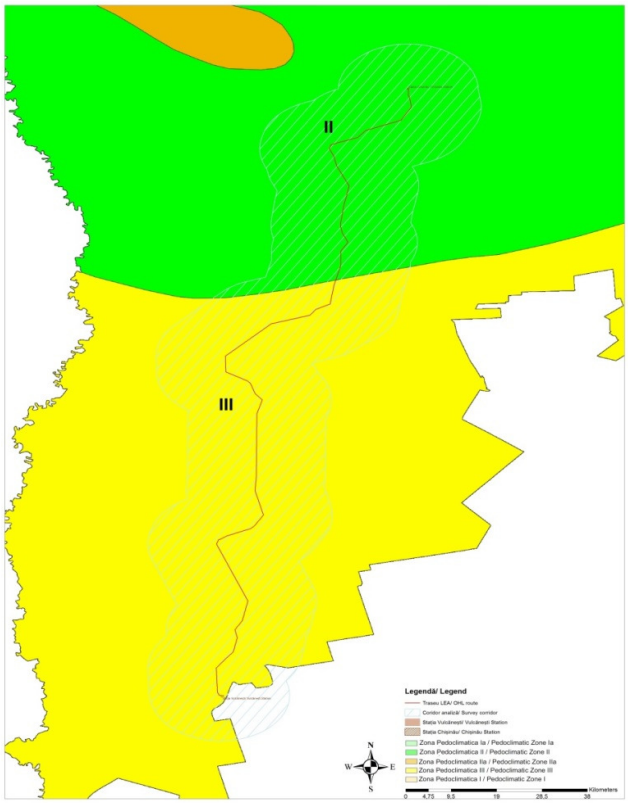
Parameters	Station	Month												Year
		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	
Air temperature, monthly and annual average values (°C)	Chişinău	-1.9	-1.2	8.1	11.6	16.8	19.5	23.0	23.2	18.6	9.8	3.6	-0.1	10.9
	Cahul	-1.0	+0.2	8.5	11.5	16.5	19.6	22.7	23.1	18.6	11.0	4.8	0.3	11.3
Air temperature, absolute monthly and maximum values (°C)	Chişinău	13.0	10.7	20.2	23.5	30.5	31.6	32.9	36.5	31.4	25.1	16.5	13.6	36.5
	Cahul	12.6	11.4	21.0	23.6	29.4	30.4	32.5	35.2	30.7	24.4	17.8	14.9	35.2
Air temperature, absolute monthly and minimum values (°C)	Chişinău	-20.9	-19.5	-0.4	-0.3	4.3	9.4	14	11.3	4.7	-3.6	-5.1	-14.1	-20.9
	Cahul	-19.2	-16.4	-0.9	1.3	3.2	11.7	13.1	11.8	2.0	-3.6	-4.4	-14.7	-19.2
Atmospheric	Chişinău	63	9	16	41	86	36	85	54	16	43	121	34	604

precipitation, monthly and annual quantity (mm)	Cahul	42	10	28	70	103	24	113	45	6	41	74	55	611
Wind speed, monthly and annual (m/s)	Chişinău	2.5	2.0	3.5	2.7	2.2	2.8	2.7	2.6	2.6	2.4	2.6	3.1	2.6
	Cahul	3.6	3.4	3.5	3.8	3.3	2.9	3.2	3.0	2.9	2.9	2.8	3.8	3.3

Source: National Bureau of Statistics of Republic of Moldova

In terms of temperature and precipitation, Republic of Moldova may be divided in three major agro-ecological zones: Northern, Central and Southern; the Project is located within the Central and Southern zones, namely:

- Pedo-climatic zone II: terraces of the Dniester, Prut, Raut, Bîc, etc. rivers;
- Pedo-climatic zone III: South Republic of Moldova plain, inferior terraces of the Dniester and Prut rivers.



Source: http://geoportal.md/en/default/wms/private

Figure no. 8. Pedo-climatic zones within OHL survey corridor

The Central agro-ecological zone has the following characteristics[3]:

- Landscape: the zone is composed of hilly terrain and deep valley and covers the Codru highland;
- Temperature: annual mean temperature between 7.5 ℃ and 10℃;
- Precipitation: annual mean precipitation for the majority of the zones between 500 - 550 mm;
- Agriculture condition: the zone is best for different types of perennial crops, including orchards and vineyards.

The Southern agro-ecological zone has the following characteristics:

- Landscape: the zone is undulating with hilly terrain interspersed with plains and large valleys and incorporates the Bugeac Plain in the south area;
- Temperature: annual mean temperature between 8.3 ℃ and 11.5 ℃;
- Precipitation: annual mean precipitation for the majority of the zones between 450 - 550 mm;
- Agriculture condition: in this area, characterised by high temperatures and low rainfall, tobacco, grapes and cereal crops (maize and wheat) are grown widely.

Republic of Moldova is likely to be affected by the climate change[4]. The measurements performed by the hydro-meteorological monitoring network since 1886 reveal a clear increase of mean annual temperature and precipitation, namely:

- The mean annual temperature measured during the period 1981 - 2010 increases with 0.7^0C, comparing with the period 1887 - 1980;
- The mean annual precipitation measured during the period 1981 - 2010 increases with 26.5 mm comparing with the period 1887 - 1980.

Since 1980s, droughts are a major problem for Republic of Moldova, especially in the south area; the extreme droughts registered in 2007 and 2012 affected more than 70 % of the country area and sharply reduced agricultural production.

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[3] **World Bank, 2010,** http://siteresources.worldbank.org/ECAEXT/Resources/258598-1277305872360/7190152-1303416376314/moldovacountrynote.pdf

[4] National Climate Change Adaptation Strategy till 2020, approved by GD no. 1009/2014

Also, the floods periodically affect Republic of Moldova; in the last 70 years 10 major floods occurred on the Dniester and Prut rivers, as well as, locally, on several small rivers.

The Project is located in the Pedo-climatic zones II and III, with the following characteristics in terms of climate change:

- Pedo-climatic zone II: high risks of soil erosion, salinization, desertification and flood increase;
- Pedo-climatic zone III: high risks of soil erosion, salinization, desertification and medium risks of flood increase.

In the Third National Communication of the Republic of Moldova under United National Framework Convention on Climate Change (2013), three climate change scenarios were developed for assessing the future climate (temperature and precipitation).

All general circulation models (GCMs) used agree that in future considered periods (2020s, 2050s and 2080s), an increase of the annual mean temperature and a decrease of the annual precipitation, relative to the 1961-1990 reference periods, will be expected.

The characteristics of future climate in the ***Project area*** (south region of Republic of Moldova), relative to the 1961-1990 reference periods, are the following:

- The annual mean air temperature will increase with 1.2 - 1.4 ^{0}C by 2020s, with 2.2 - 2.8^{0}C by 2050s and with 2.7 - 4.2 ^{0}C by 2080s;
- The winter mean air temperature will increase with 0.9 - 1.2 ^{0}C by 2020s, with 2.0 - 2.5^0 C by 2050s and with 2.6 - 3.9 ^{0}C by 2080s;
- The summer mean air temperature will increase with 1.4 - 1.7 ^{0}C by 2020s, with 2.5 - 3.2 ^{0}C by 2050s and with 3.1 - 5.2 ^{0}C by 2080s;
- The annual average precipitation will increase with around 2 % by 2020s; the rate of decreasing in precipitation varying from - 1.1 % to – 6.9 % by 2050s and from - 1.8 % to - 13.5 % by 2080s, depending on the climate scenarios;
- The largest decrease in precipitation is expected during summer varying from - 0.6 % to - 1.4 % by 2020s, from - 3.3 % to - 15.9 % by 2050s and from - 8.4 % to -26.4 % by 2080s, depending on the climate scenarios;
- The duration of the period with temperatures above 0°C is expected to increase with 9-11 days by the 2020s, with 32 - 45 days by the 2050s and with 37 - 66 days by the end of 2080s, depending on the climate scenarios.

The decrease of the electricity demand for winter heating as a result of the increase of the average temperature does not compensate for the increase of electricity need for the performance of the air conditioners and of the cooling devices during the hot days.

Climate changes will modify the seasonal demand of electricity which will be lower during the winter and higher during the summer.

The transmission electricity infrastructure is affected by extreme weather phenomena such as stronger and/or more frequent storms; there were situations in which, almost 300 localities suffered power supply disruptions in January 2009 because of strong winds and related events[5].

According to the vulnerability assessment of the magnitude of impacts with the probability of risk due to possible climate change, the Project area is exposed to the following climate change related risks:

- Increase in energy used for residential and commercial refrigeration and industrial process cooling: ***high probability;***
- Increase in damage to supply grids which presents a threat to electricity transmission and distribution: ***medium probability;***
- Changes in the balance of energy use among fuel types: ***medium probability***;
- Growing water scarcity may become the main obstacle to enhancing hydro- and cogeneration power production: ***high probability;***
- Decrease of biomass yield: ***high probability;***
- Increased risk of drought and water scarcity: ***medium probability;***
- Increased irrigation requirements: ***high probability;***
- Soil erosion, salinization, desertification: ***high probability;***
- Flood increase in frequency and intensity: ***high probability.***

The opportunities associated with climate impacts in the Project area consist in:

- Decrease in energy used in residential, commercial, and industrial water heating: ***high probability;***

[5] Third National Communication of the Republic of Moldova under United National Framework Convention on Climate Change (2013)

- Wind speed and direction may increase wind generation potential: ***high probability;***
- Cloudiness, which may increase solar generation potential: ***high probability***.

5.1.2 Topography and landscape

5.1.2.1 Topography

The OHL route runs from Vulcănești city, located in south of Republic of Moldova, to Chișinău, municipality located in the centre of the country.

In the centre of the Republic is the Republic of Moldova's Central Plateau, which has a general inclination from northwest to southeast. The plateau is characterized by high, narrow and elongated hills that alternate with deep valleys and hollows of 150 - 250 m high. Interfluves chains have the appearance of hills with steep slopes.

In south of the Republic stretches Southern Republic of Moldova's Plain (Bugeac Plain) having a surface fragmented by large valleys and dissected by cliffs. Maximum altitude of Southern Republic of Moldova Plain is 247 m. Interfluves reach several kilometers in width, are flat and slightly wavy.

In the interfluve of Cogâlnic and Schinoasa rivers, the topography presents an area significant high, altitude's absolute values reaching 260 m in the north and 195 m in the southeast. The slopes of the basin are crossed by wide valleys and gorges, complemented by deep cliffs and landslides block.

Between Ialpug and Prut rivers highlights Tigheciului Hills (Tigheci Plateau), a continuation of Republic of Moldova's Central Plateau. Tigheciului Plateau is a hilly region located in the southwest of the country, has a tilt from north to south, reaching altitudes absolute values of about 280 - 300 m.

5.1.2.2 Landscape

Most of the land affected by the propose OHL route is used for agriculture, as vineyards and crops (main wheat and corn); a few areas are used for orchards and pastures for rising cows, sheep and coats. The OHL route cross and run nearby the following landscape features: rivers, lakes, roads and railways, agricultural areas. The OHL route crosses 9 rivers, several roads (4 national roads and 11 local roads) and a railway (near Bugeac village); details related to the landscape features crosses by the OHL route are presented in *Chapter 3. Analysis of alternatives.*

Some photos of the Project area indicating the landscape features are presented in the following figure.

End of the route, Chişinău substation

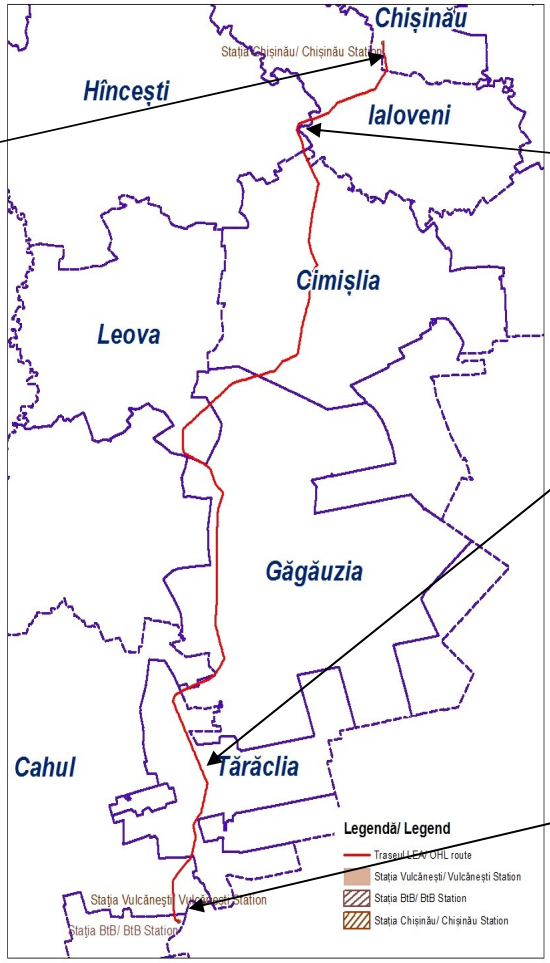
Staţia Chişinău, sfârşit traseu LEA

Specific area along the proposed OHL route

Zonă specifică de-a lungul traseului LEA

Area with vineyards

Culturi de viţă de vie



Gap in the forest area

Culoar liber în zona de pădure

Bugeac steppe

Stepa Bugeac

Beginning of the route, Vulcăneşti substation

Staţia Vulcăneşti, început traseu LEA

Figure no. 9. Landscape features in the Project area

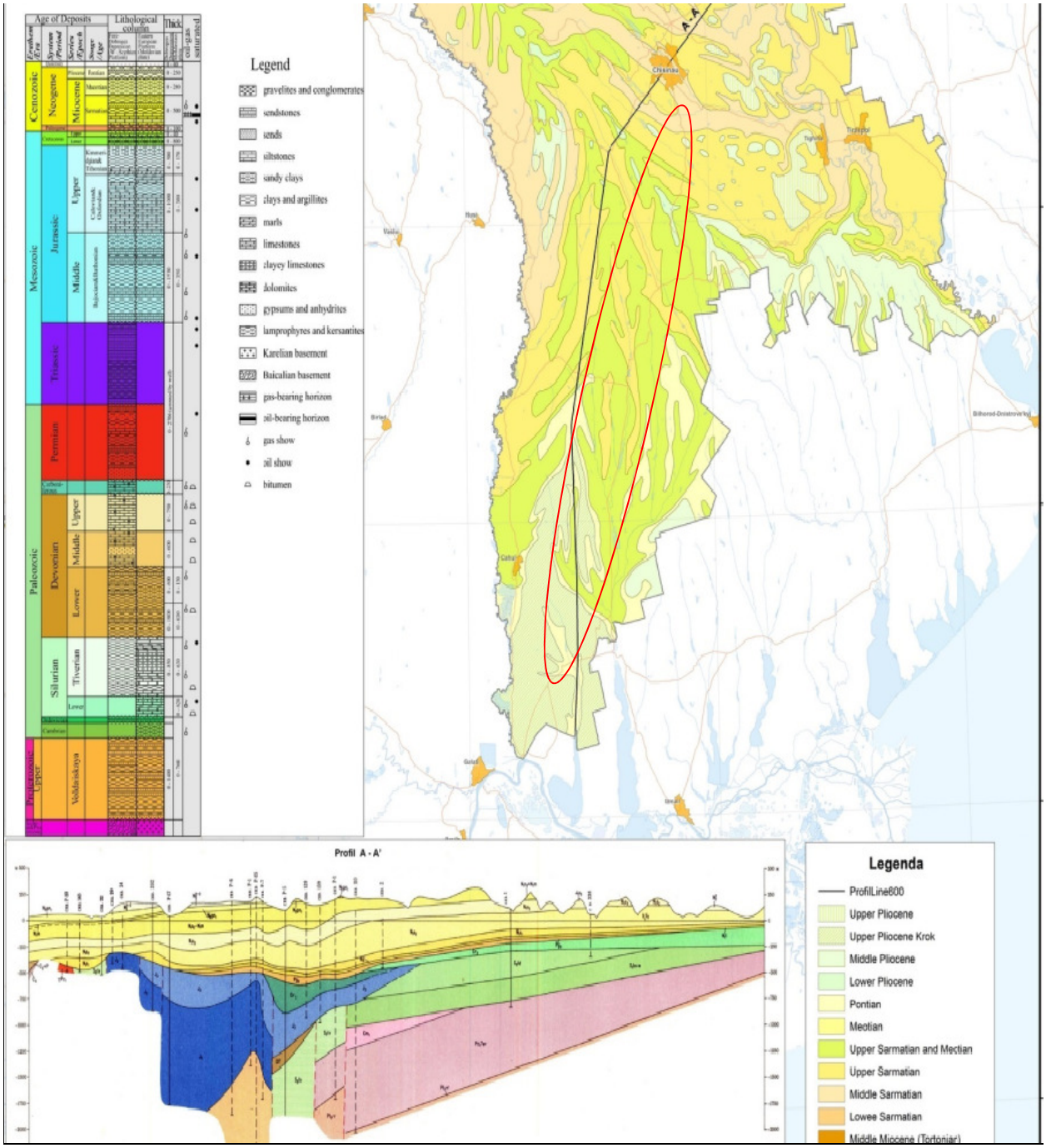
5.1.3 Geology

The geological structure consists of different formations of Pre-Cambrian, Paleozoic, Mesozoic and Cenozoic. At the surface, the Neogene and Quaternary rocks are present.

The litho – stratigraphic distributions are as follows:

- Sarmatian, represented by a layer of sedimentary rocks;
- Middle Sarmatian, represented by gray-green and gray-blue clays with intermediate layers of sands with grey-gold mica;
- Upper Sarmatian, with thickness up to 40 m, represented by gray-green and gray-blue clays and small amount of sands and a aleurite;
- Upper Sarmatian and Meotian, with thickness up to 200 m, represented by continental gray-blue and gray-green class, with intermediate sands layers and lenses;
- Pontian, with thickness of 60 - 70 m, represented by gray-green clays and fine-grained sands;
- Middle Pliocene, with thickness up to 30 m, represented by alternation of fine-grained sands and plastic clays with thin intermediate layers of limestone;
- Upper Pliocene, with thickness between 10 m and 65 m, represented in the lower part by coarse sands layers with lenses of gravel, pebble, clay aleurite and at the upper part with clay-sandy soils and clays;
- Upper Pliocene Quaternary, with thickness between 5 - 6 m and 35 m, represented by clay-sandy soils with loess, clay-sandy soils, argillaceous- sandy soils and sands with intermediate layers of fossil soils.

The geological structure within the OHL survey corridor is presented in the following figure.



Source: Agency for Geology and Mineral Resources, http://agrm.gov.md/ro/contact/harti

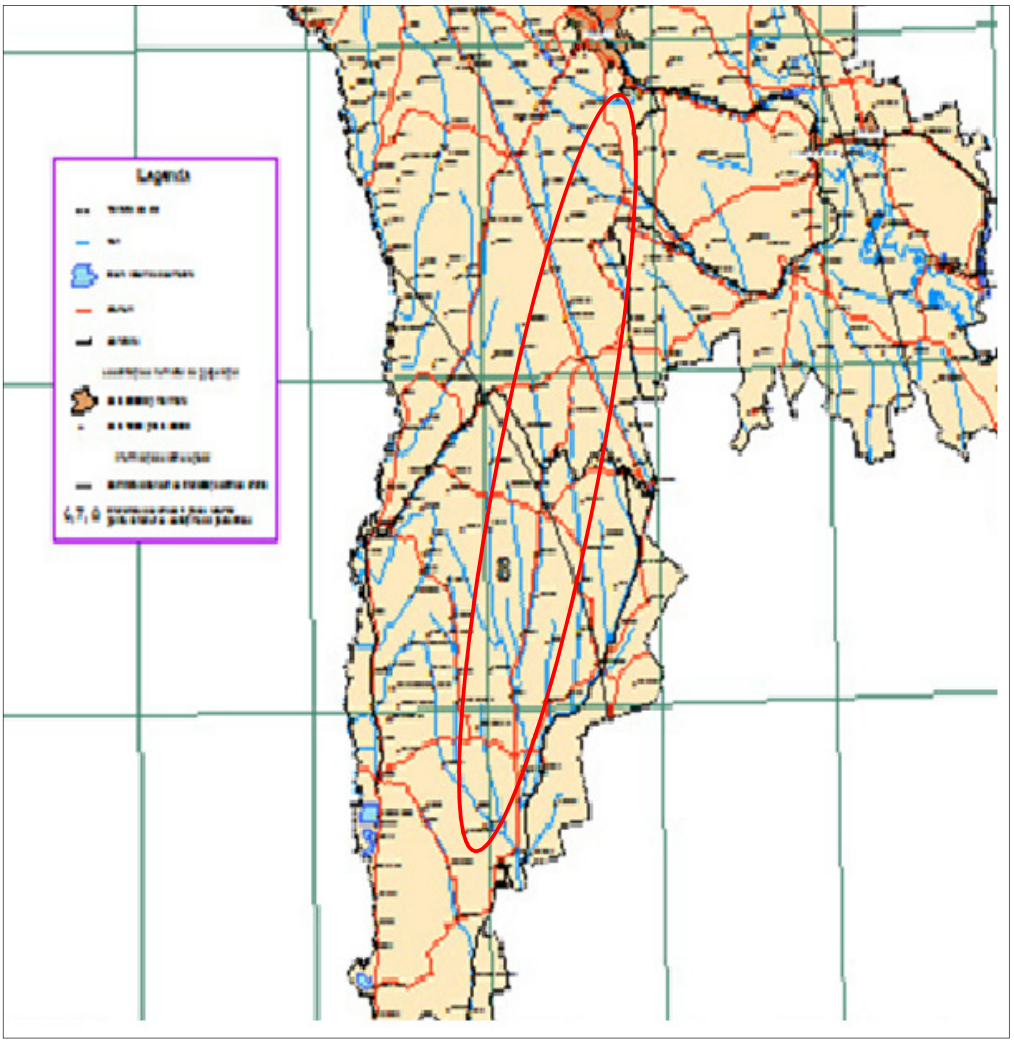
Figure no. 10. Geological structure within the OHL survey corridor

In order to identify the engineering-geological conditions of the proposed Project's area, the Institute for Research, Design and Technology ENERGOPROIECT, as part of the study developed for MOLDELECTRICA, performed the drilling of 40 exploration wells with depth of 8.00 m each. 160 samples of undisturbed land (monoliths) were selected and analyzed in the stationary geotechnical laboratory to determine the specific parameters (physical properties and durability of land subsidence, groundwater chemical composition).

In the geological structure of the field activates quaternary alluvial layers (alluvial soil, alluvions and muddy) and alluvial-colluvial represented by sandy clays, cuaterner clays, sand and accumulated landslides, followed by neogene clays.

The Project area is characterised by a high seismic activity determinate by the alpine region of the East Carpathians (Vrancea), where earthquakes epicentres are located.

According with the seismic map developed by the Institute of Geology and Seismology of Science Academy of Republic of Moldova (AŞM) presented below, and the results of prospection works developed by ENERGOPROIECT Institute, as part of study developed for Moldelectrica, the seismic activity in the analysed area are between 7 – 8 on Richter scale (7 Richter degrees for wells no. 1 - 20 and 8 Richter degrees for wells no. 21 - 40).



Source: Institute of Geology and Seismology of AŞM, http://iges.asm.md/node/124

Figure no. 11. Seismic map

5.1.4 Soils

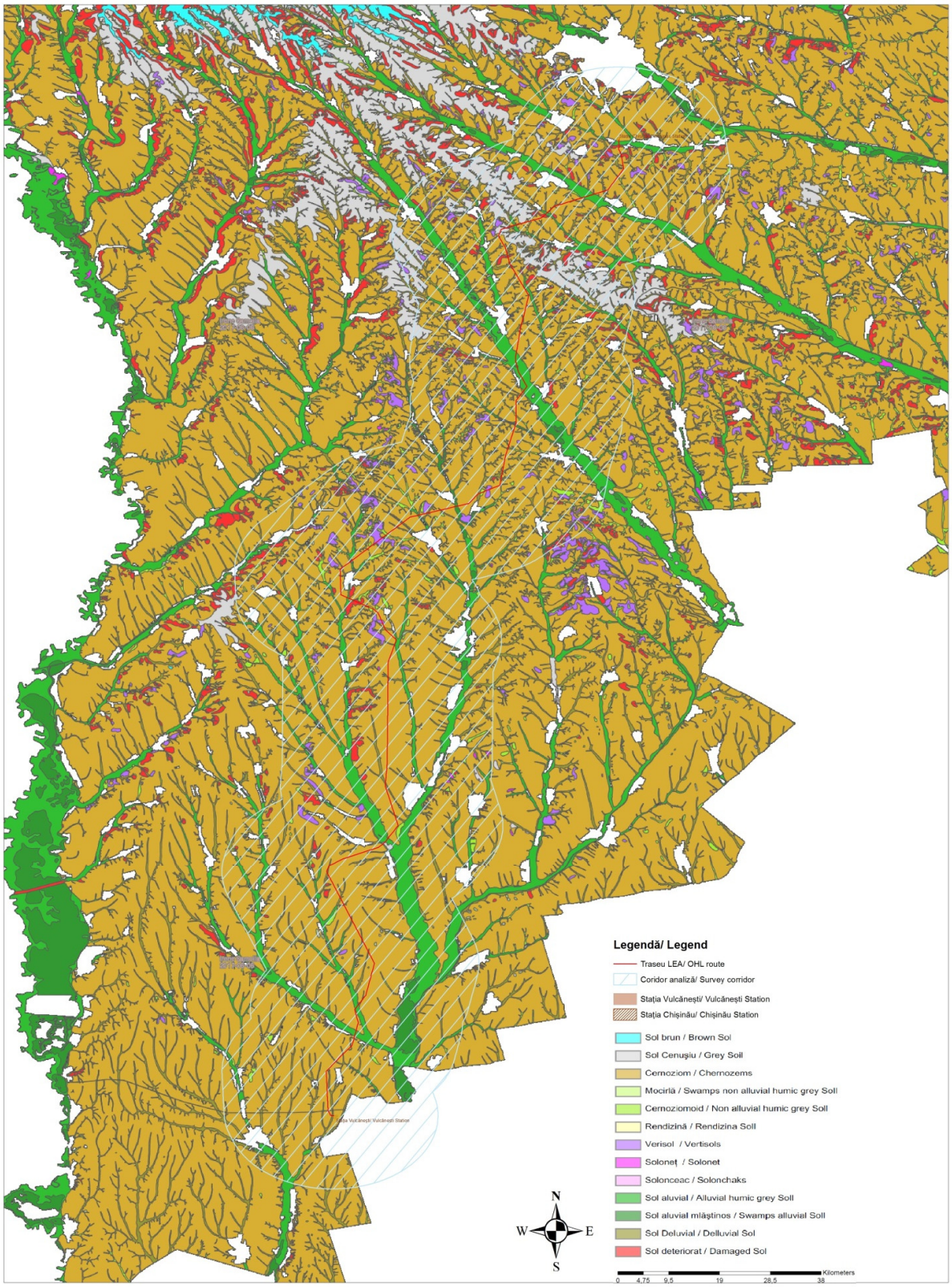
In Republic of Moldova the main type of soils are chernozems, characterized by relatively high humus content in the upper layer and covering approx. 75% of Republic of Moldova; in terms of the types of chernozems, there are the following subtypes:

- *Argillic chernozems (podzolite),* specific for the areas where the oak forests with well-developed coating grassy meet the mesophyte meadows and steppes;
- *Leached chernozems,* spread in the Southern Plain and on the periphery of Codri forest, that are specific for mesophyte meadows and steppes of the steppe zone, but also are found in oak forests with coated herbs;
- *Typical chernozems,* specific for steppe areas, sometimes with patches of downy oak; there are two types of chernozioms: moderate humiferous, specific for mesophyte steppe and mesophyte steppe with clumps of downy oak and low humiferous specific for xerophilic steppes with Stipa capillata and fescue;
- *Calcareous chernozems,* specific for steppe areas with fescue, stipa capillata and warmwood, that occurs on loessoide clays; these types of chernozems are specific for lower teracess of rivers, slopes and lower parts of the same altitudes as low lands and terraces.

The other types of soils are alluvial soils (14.2%), grey soils (9.5%), other soils (5.9%) and brown soils (0.7%). [6]

The types of soils within the OHL survey corridor are mainly chernozems; the other types of soils are delluvial soils, alluvial soils and other soils (grey, solonetz, delluvial).

[6] " Yearbook of soils quality status in Republic of Moldova for 2014", State Hydrometeorological Service, http://www.meteo.md/monitor/anuare/2014/anuarsol_2014.pdf



Source: http://geoportal.md/en/default/wms/private

Figure no. 12. Soils types within the OHL survey corridor

According with the prospection works mentioned in Chapter 5.1.3 the soil and under soil structure of:

- Vulcănești substation enclosure presents topsoil at 0.00-0.50 m depth and brown sandy clay, yellow-brown soil at 0.50-8.00 m depth. Between 0.50-3.50 m the brown sandy clay presents grains and carbonates intercalation;
- Chișinău substation enclosure presents topsoil at 0.00-0.70 m depth and brown sandy clay, hard, macro-pores at 0.70-8.00 m depth. Between 0.50-3.50 m the brown sandy clay presents grains and carbonates intercalations;
- the land along the OHL route contains yellow-brown sandy clay, hard; grey clay, hard or brown-dark brown sandy clay, and hard soils down to the depth of 8.00 m.

The land surface in the survey corridor is covered with topsoil of 0.4 up to 1.8 thicknesses. The soil is included in the category of soils good for foundation having the following coefficients:

- plasticity Ip > 20%;
- pores index e < 1.1;
- consistency index Ic >= 0.75.

The results of prospection works for each well (absolute land elevation, well depth, soil type and groundwater level appeared/stable) are presented in Annex 2.

The soils quality in Republic of Moldova is strongly influenced by climatic conditions (high temperatures, low rainfall), inappropriate agricultural practices (ineffective methods for agricultural exploitation, use of fertilizers and pesticides) and abusive deforestation. As a result, the soil is affected by erosion, degradation and landslides.

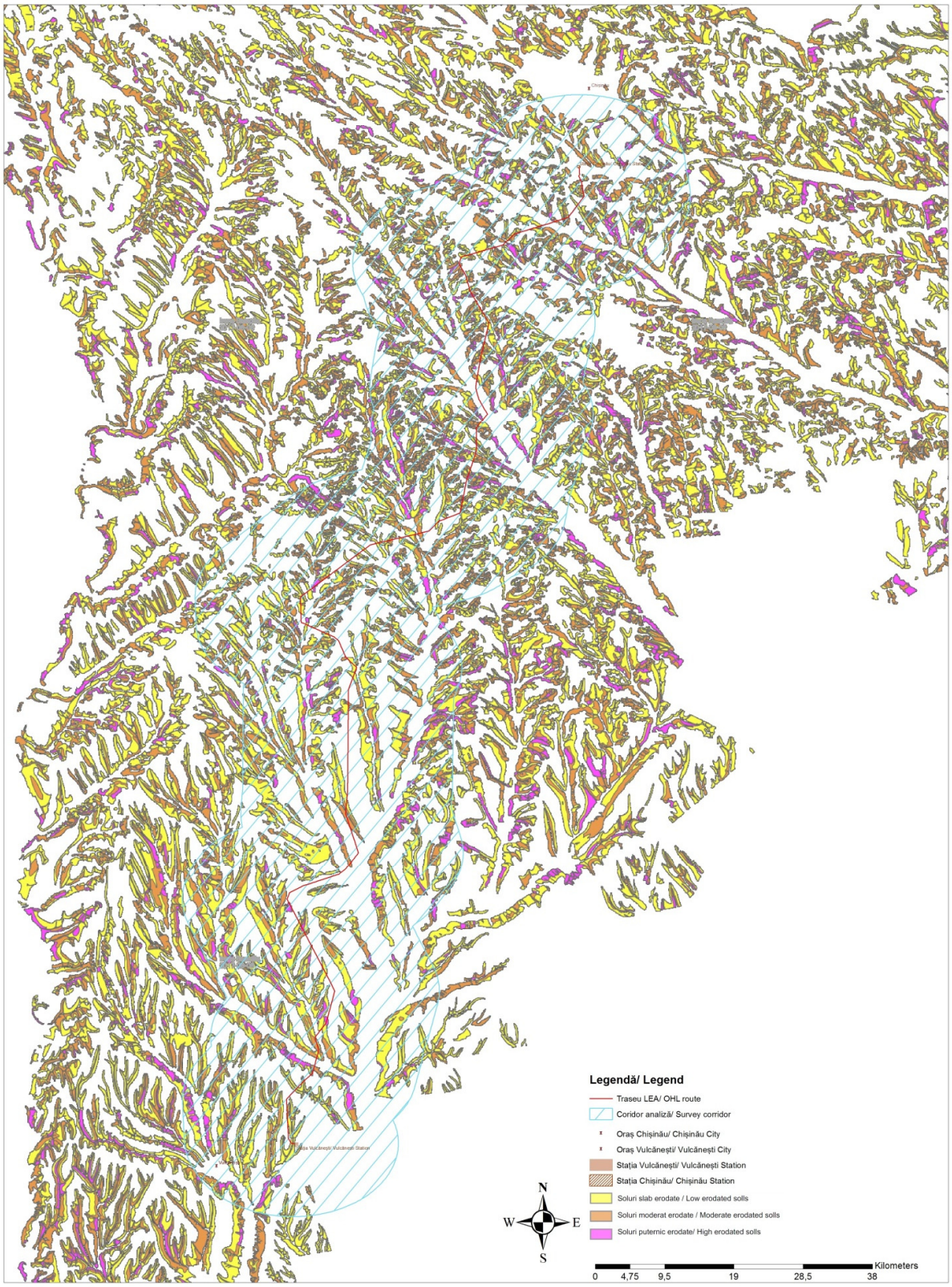
At national level, the eroded soils (877,644 ha), cliffs (11,765 ha) and landslide areas (24,331 ha) are differently distributed; the eroded soils, cliffs and landslide areas in the districts that are crossed by the proposed Project are presented in the following table.

Table no. 12. Eroded soils, cliffs and landslides in the crossed districts

Municipality/ District	Eroded soils, ha	Cliffs, ha	Landslides, ha
Chişinău	11,936	89	298
Cahul	52,105	642	94
Cantemir	27,042	644	3,509
Cimişlia	33,749	314	476
Hânceşti	41,002	349	1,049
Ialoveni	27,710	393	1,037
Tărăclia	16,179	282	26
ATU Găgăuzia	57,337	594	123

Source: *'Natural resources and environment in Republic of Moldova", National Bureau of Statistics of Republic of Moldova, 2012*

Distribution of eroded soils within OHL survey corridor is presented in Figure 13.



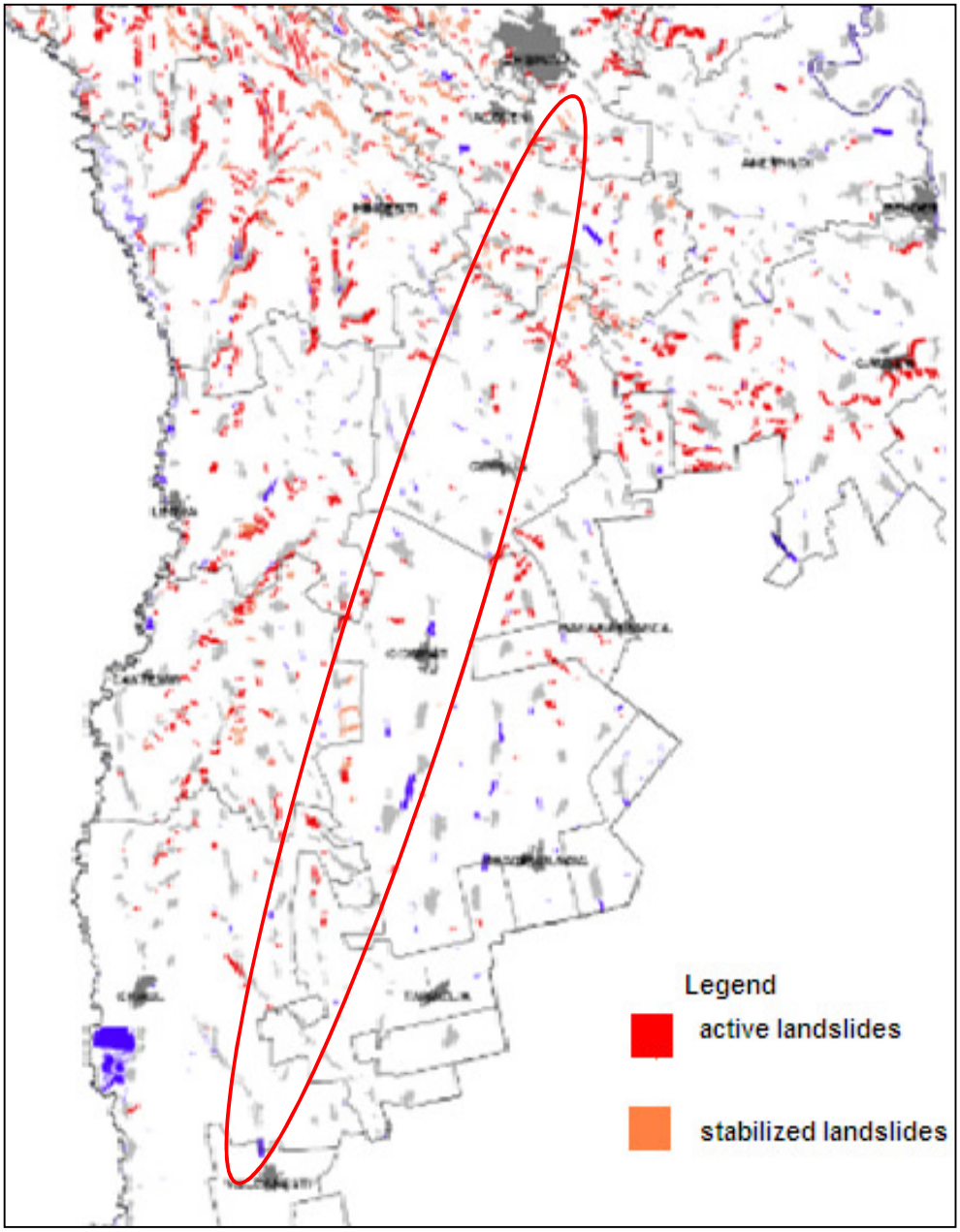
Source: http://geoportal.md/en/default/wms/private

Figure no. 13. Distribution of eroded soils within OHL survey corridor

In terms of landslides, the Cantemir district is the most affected (14.4 % of total land area subject to landslides in the country).

The largest area of eroded soil are located in Găgăuzia (6.53 % of total land eroded at national level) and Cahul (5.93 % of total land eroded at national level).

The proposed area for the OHL route, presented in the figures below, is characterized by an non—uniform distribution of landslides, the most active and stabilized landslides being located in Ialoveni district and Chişinău municipality.



Source: http://www.ipaps.md/maps/index.php?id=6

Figure no. 14. Distribution of landslides within OHL survey corridor

According with the prospection works developed by the Institute for Research, Design and Technology ENERGOPROIECT, as part of the study developed for Moldelectrica, the physical-geological processes and phenomena (erosion, landslides, land subsidence, etc.) were not observed within a radius of 100-200 m from the drilling wells. Also, within a radius of 100-200 m from the drilling points, the superficial water leaks are distributed without activation of the erosion process.

Even so, the avoidance of the high and moderate eroded soils zones will be an important criterion in establishing and mounting the OHL's towers along the OHL route during the construction works.

5.1.4.1. 400/110/20 kV Vulcanesti substation site

The substation comprises an area of about 22 hectares (500 x 440 m) and is located in a rural area; no domestic housing is present within the immediate vicinity of the substation.

The station was put in operation in 1972 as part of a network for export of electricity from the Soviet Union to Bulgaria (920 MW/year). A capacitor battery grouped in 18 sections and containing 12,800 capacitors was built in southwest part of the substation.

Due to voltage surges in two incidents in 1974 and 1978 capacitors exploded and were removed and buried in pits on the substation. It is assessed that approximately 1000 capacitors exploded in each incident.

The four burial pits were without any lining and are located as shown on **Annex 10** (*Capacitors and burial pits in Vulcanesti substation*). Each pit was assessed to contain up to 15-20 tons of PCBs, but is not known sure how many capacitors damaged were buried and if there are other places inside where may be find.

Now in the substation are not used capacitor batteries anymore, as the electricity export decrease. The Vulcanesti substation continues to operate as a transformer station and transformers and high voltage supply towers occupy a greater part of the site.

In the Feasibility Study Report toxicological, chemical, physical and degradation properties of PCBs were described and international soil and groundwater cleanup criteria were compared. PCB´s are persistent chemicals and are harmful to human health, fauna, flora and the environment. PCBs are probably carcinogenic to humans.

Under the capacitor frames, the PCB concentrations in top soil measured in 2005-2007 range from 1 – 7100 mg/kg. The area under capacitor frames is approximately 9,000 m² and the average concentration in the top 10 cm´s was about 500 mg/kg. The average PCB concentration in 50 cm´s depth was about 40 mg/kg, which is below the soil criteria of 50 ppm. The volume of contaminated soil above 50 ppm was estimated to be about 2000 m³.

The following clean-up criteria were used for the remediation at the Vulcanesti site:

- 50 ppm PCB for top soil with restricted access;
- 100 ppm for soil under a 50 cm clean soil cap;
- Unrestricted PCB levels if isolated and contained by protective liners and a 50 - 100 cm soil cap.

The cleanup activities carried out in 2007 have comprised the following elements:

- Removal of damaged capacitors stored in containers at the substation;
- Removal of all capacitors hanging in metal frames in the capacitor batteries;
- Excavation of the burial pits 1 and 2 and removal of all damaged capacitors (1,270 capacitors). The contaminated excavated soil is collected in two coffer dams with protective liner and soil cap.
- Supplementary excavation of pit 3 and 4 and removal of all damaged capacitors.

The objective of the excavation was to remove all primary sources of future PCB contamination, i.e. the capacitors.

Investigation of soil contamination in 2005 documented high levels of PCB in the top soil under or close to the capacitors batteries.

The residual soil contamination was investigated in July 2007 after the removal of all capacitors hanging from the metal frames or stored in containers as well as the excavation of old capacitors buried in the pits 1 and 2.

The soil excavated from pits 1 and 2 was placed in two coffer dams prepared with a bottom liner and a double top liner and a layer of clean soil.

Two more pits (pit 3 and 4), were subsequently identified by Moldelectrica. In September 2007 was excavated pit 3, removed and transported to destruction the capacitors buried.

The soil from and around pit 3 and the soil (10 cm) under the capacitors frames was excavated by Moldelectrica in 2010 and removed in two other coffer dams build in the same way as the first ones.

The location of the four cofferdams is secured with a fence and warning indicators as is presented in **Annex 10** (*Cofferdams location in Vulcanesti substation and 3 images*).

In the area where the capacitors frames were after removing the contaminated soil Acacia trees were planted, they grew and now a small forest can be found in place (Annex 10 – 2 images with the trees).

The analysis of groundwater samples was repeated in July 2007 with due consideration to the pre-pumping and sampling technique. Water samples were also taken of tap water from the guard room and from the two boreholes related to the kitchen. The results show no significant contamination.

Analyses show that the water has an acceptable quality with respect to the Moldovian drinking water criterion for PCBs,

No local surface water bodies have been identified during site investigations.

No direct contact is possible with the contaminated soil remaining in the three excavated pits or with the contaminated soil present in the four coffer dams as a double layer of liner and a clean soil cap have been established above the contaminated soil.

5.1.5 Water resources

Republic of Moldova has a hydrographical network, belonging to the Black Sea, quite developed (total length that exceeds 16,000 km) comprising all type of aquatic units: rivers, lakes and ground waters:

- ***Rivers:*** although rivers network is dense (over 3,600), small rivers and streams prevail, permanent or temporary, and large rivers are few. Of over 3,100 rivers only 250 rivers are longer than 10 km each, and only 8 of these (Dniester, Prut, Raut, Bîc, Botna, Ikel, Cogâlnic, Ialpug) have a length of more than 100 km.

  The main basins are Prut and Dniester, which marks the border between Republic of Moldova, Ukraine and Romania. The general orientation of the relief determines that the Prut and Dniester rivers receive the main affluent from north and north-west. The rivers may be classified as follows: Dniester Basin Rivers, Danube Basin Rivers and small southern rivers flowing into the Black Sea limans;

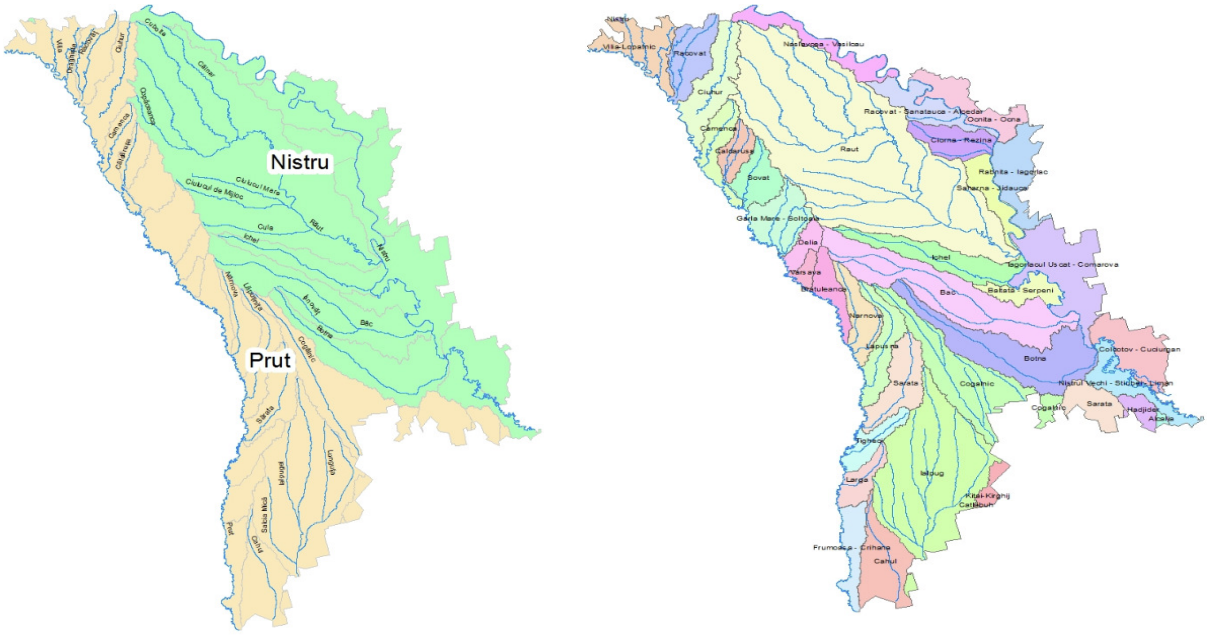
- ***Lakes:*** in the Republic of Moldova there are few natural lakes located either in the meadows of lower courses of river Prut (Beleu, Rotunda, La Font) and Dniester (Dniester Old) valleys, called meadow lakes or in the limans river, such as Sălaş, Cahul and Cuciurgan lakes. Also, among natural lakes, the natural reservoirs lakes may be mentioned that are formed due to landslides. Although the majority of these lakes are small, in some cases their surface may reach few hectares (lakes from region "Hundred Mounds").

  The number of artificial lakes for the production of electricity, irrigation, fisheries, water supply for industry and population is large (over 3,000).

- ***Groundwater:*** Groundwater resources are relatively low. By the purpose of use, groundwater can be: potable, technical, mineral, industrial and thermal.

  Groundwater provides drinking water for the 100% of rural and 30% of urban population or 65% of the entire population. Depth ground waters, with a constant regime, in relation to the ground waters, sometimes are mineralized with curative qualities (Cahul, Kamenka, Varniţa etc.).

The Rivers Basins Districts and Rivers Basins of Republic of Moldova are presented in Figure no. 15.



Rivers Basins Districts

Rivers Basins

Source: Agency "Republic of Moldova Waters" ***http://www.apelemoldovei.gov.md/pageview.php?l=ro&idc=134***

Figure no. 15. Rivers Basins Districts and Rivers Basins, Republic of Moldova

The route of 400 kV OHL Vulcăneşti – Chişinău crosses the Dniester river basin district (Bîc and Botna basin rivers) and Danube Prut and Black Sea rivers basins districts, namely the Danube river basin (Cahul, Ialpug and Cogâlnic basins rivers).

The 400 kV OHL route and the rivers basins locations and presented in Figure no. 16.

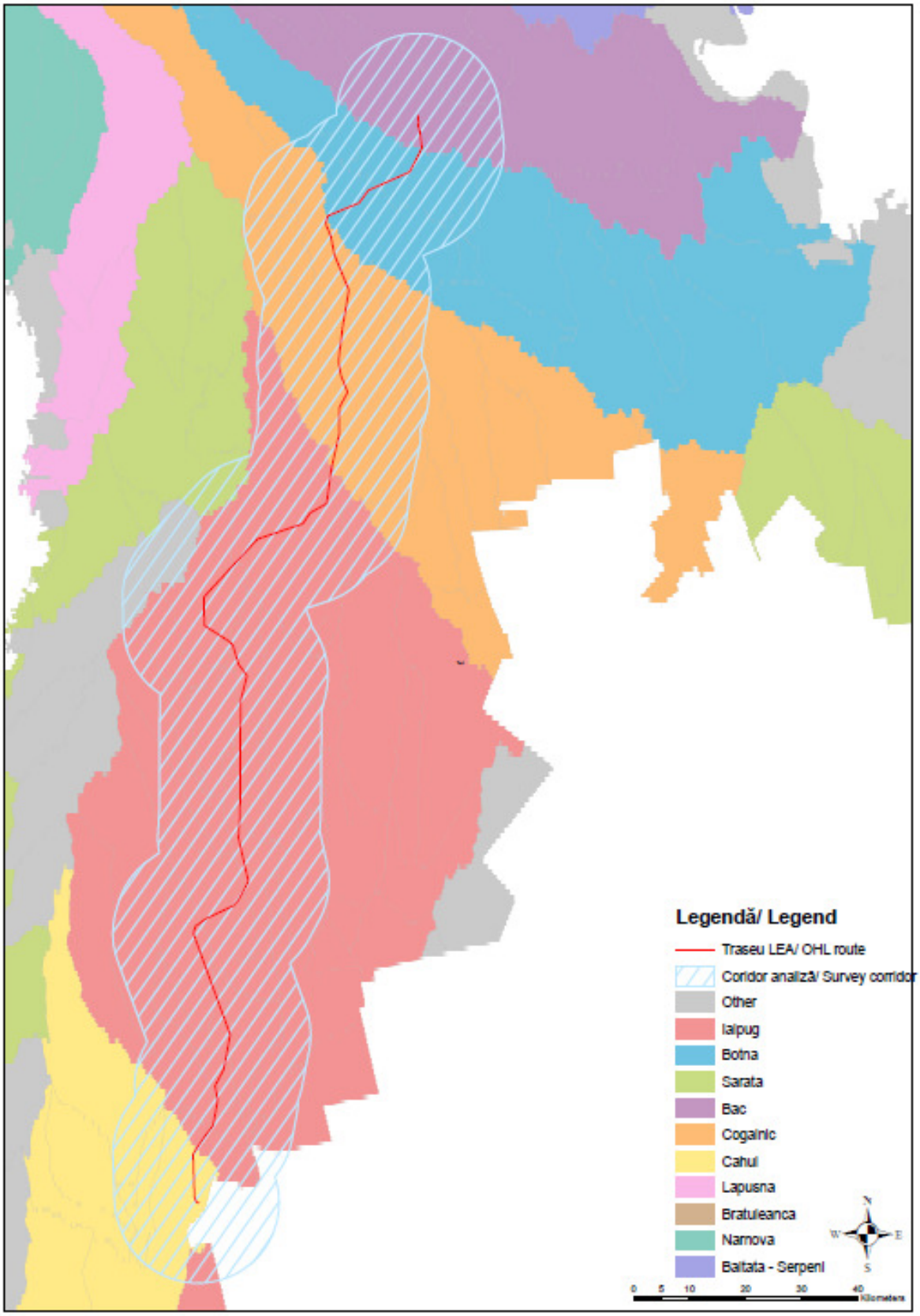
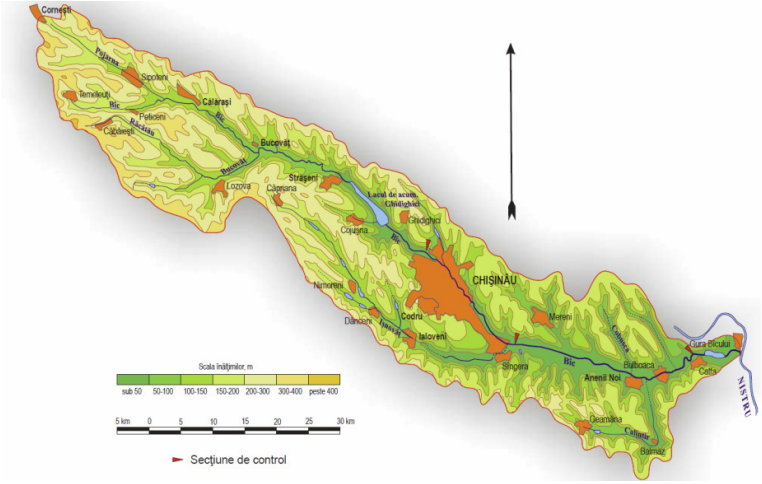


Figure no. 16. Map of Republic of Moldova river basins within OHL survey corridor

5.1.5.1 Dniester River basin district

5.1.5.1.1 Bîc River Basin

Bîc River has a length of 155 km, an area of 2,040 km^2 and flows in the Dniester River, at 225 km from its mouth, 1 km southwest of s. Gura - Bîcului (Figure no. 17).



Source: Yearbook of surface water quality as hydro-chemical indicators, 2014

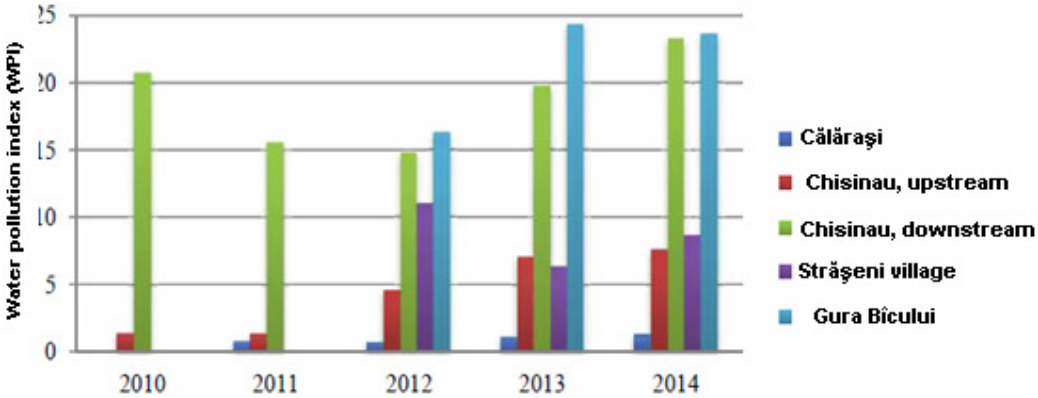
Figure no. 17. Bîc River Basin from the source to the mouth in the river Dniester

The monitoring of Bîc River water quality was carried out systematically in 5 sections: two sections upstream and downstream of Chişinău, and one section in Călăraşi, Străşeni (downstream) and in Gura Bîcului village.

River water is characterized by a high degree of mineralization (with values between 832 - 1,865 mg/l) due to the nature of soil and rocks in the region through the river flows. The 90 percentile value for mineralization ranks the quality of the river in class III for section of the Chişinău – downstream, in class IV for sections: Strășeni, Gura Bîcului and in class V for section Chişinău - upstream.

In 2014, the water quality of the Bîc River did not registered significant changes compared to 2013, the water pollution index (WPI) ranging within the quality classes III (moderately polluted) in Călăraşi section and VII (extremely polluted) in Chisinau downstream and village Gura Bîcului sections.

The evolution of Bîc River water quality (according WPI) for the period 2010 - 2014 is presented in the following figure.



Source: Yearbook of surface water quality as hydro-chemical indicators, 2014

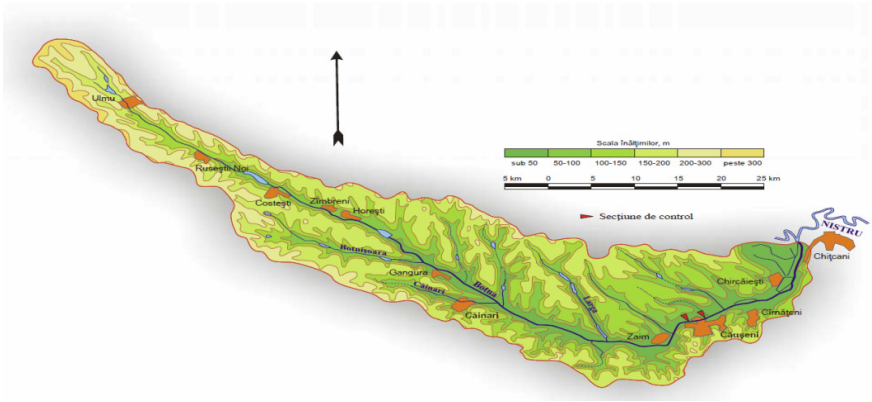
Figure no. 18. Bîc River water quality according with WPI, period 2010 - 2014

According with the registered data, the river reached a high degree of pollution, especially in Chişinău downstream and Gura Bîcului sections. During the analysed period, the WPI ranged from 0.76 (quality class II - clean) in Călăraşi section in 2012 to 24.35 (quality class VII - extremely polluted) in Gura Bîcului section, in 2013.

In Bîc River Basin, the 400 OHL kV Vulcăneşti - Chişinău crosses the Șnovăț River, a tributary of the Bîc River, between Brăila and Strănişteni towns.

5.1.5.1.2 Botna River Basin

Botna River has a length of 152 km, an area of 1,540 km^2 and flows in the Dniester River at 201km from its mouth, 5 km above Tiraspol. (Figure no. 19)



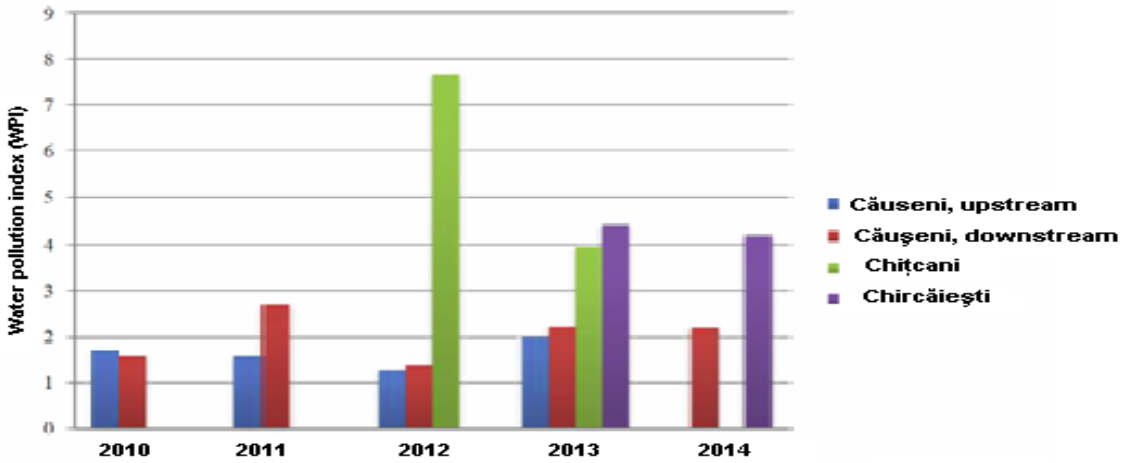
Source: Yearbook of surface water quality as hydro-chemical indicators, 2014

Figure no. 19. Botna River Basin from the source to the mouth in the river Dniester

The monitoring of Botna River water quality is carried out in two sections - in Căuşeni upstream from town and Chircăieşti village where samples were collected according to schedule.

In 2014, the Botna River water quality did not registered significant changes compared to 2013, the WPI ranging between the quality class III (moderately polluted) in Căuşeni section and quality class IV (polluted) in Chircăieşti section.

The evolution of Botna River water quality (according with WPI) for the period 2010 - 2014 is presented in the following figure.



Source: Yearbook of surface water quality as hydro-chemical indicators, 2014

Figure no. 20. Botna River water quality according with WPI, period 2010 - 2014

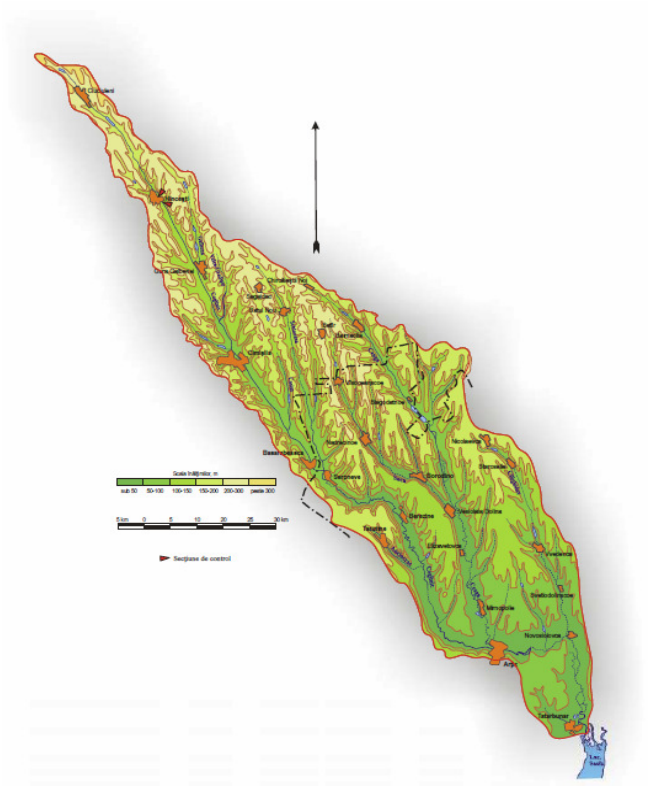
According with the registered data, the river reached a high degree of pollution, especially in the Chiţcani section. During the analysed period, in 2012, the WPI ranged from 1.37 (quality class III - moderately polluted) in Căuşeni upstream section to 7.67 (quality class VI - highly polluted) in Chiţcani section.

In Botna River Basin, the 400 OHL kV Vulcăneşti - Chişinău route crosses the Botnişoara River, a tributary of the Botna River, near Hansca village, the Botna River, between Costeşti and Zimbreni villages and a permanent water course from Zîmbreni Valley.

5.1.5.2 Prut-Danube and Black Sea Basin district

5.1.5.2.1 Cogâlnic River Basin

Cogâlnic River is the longest river in the south part of the country with a length of 221 km, an area of 3,910 km^2 and flows through two arms (right arm with a greater flow of water) in the north of the Sasîc lake, 5 km south-east of Tatarbunar village, Odessa region, Ukraine (Figure no. 21).



Source: Yearbook of surface water quality as hydro-chemical indicators, 2014

Figure no. 21. Cogâlnic River Basin in Republic of Moldova and Odessa region, Ukraine

River basin is elongated from northwest to southeast, asymmetric, more developed on the left bank. The upper and central parts are in Central Republic of Moldova Plateau and are characterized by hilly, very fragmented relief and the lower part is the Black Sea Plain with low-form relief.

From the total area of river basin 60 - 65% is plow, 1.6% is covered by hardwood forests, predominantly located in the upper part of the basin (up to Hânceşti city).

The monitoring of Cogâlnic River water quality is carried out in Hânceşti and Cimișlia sections.

During 2014 there were no cases of high or extremely high pollution.

In 2014, the Cogâlnic River water quality was improved in Cimişlia section, ranging from quality class IV (degraded) to quality class III (moderately polluted) and WPI values ranging from 1.46 in 2013 to 1.27 in 2014. In Hânceşti section, the water quality remained stable, maintaining the quality class III (moderately polluted), WPI values being 2.05 in 2013 and 1.97 in 2014.

In Cogâlnic River Basin, the 400 kV OHL Vulcăneşti - Chişinău route crosses an impermanent water course in North-West of Ivanovca Nouă village and the Cogâlnic River, near the Hîrtop village.

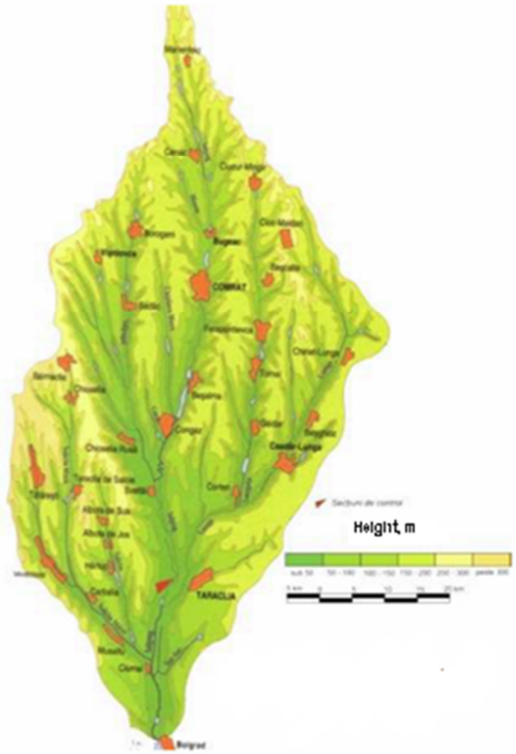
At West of Lipoveni village the OHL route goes nearby an impermanent water course.

5.1.5.2.2 Ialpug River Basin

Ialpug River has a length of 114 km, an area of 3,180 km^2 and flows into Ialpug Lake near the Bolgrad town, Odessa region, Ukraine (Figure no. 22).

The basin is located in Bugeac Steppe, Ialpug Depression, being elongated from north to south, wider in the middle. The relief is fragmented plain. Eastern slopes of the valleys and the cliffs are steep and very steep, heavily dismantle and those of the west are tame and moderate inclines.

From the total reception basin area, mostly is plow (70%), the forests (oak, acacia) covers only 7%, being located on watersheds as groves, especially on the left bank; large areas are occupied by vineyards and less by orchards, lands improper for agriculture are covered with steppe vegetation.



Source: Yearbook of surface water quality as hydro-chemical indicators, 2014

Figure no. 22. Ialpug River Basin on the territory of Republic of Moldova

The monitoring of Ialpug River water quality, in 2014, was conducted in the section Mirnoe village.

During 2014, one extremely high pollution was registered in the Chirsova village section, for dissolved oxygen.

In 2014, the water quality of Ialpug River did not registered significant changes compared to 2013, ranging the WPI within the quality classes III (moderately polluted).

Ialpugel River

Ialpugel River has a length of 45 km, an area of 507 km^2 and flows into the Ialpug River 1.5 km northwest of s. Alexeevca.

The reception basin located in Bugeac Steppe, is relatively narrow, elongated from north to south, the landscape is wavy, light fragmented. Most of the area is covered by field crops, only small areas are planted with vineyards and orchards.

5.1.5.2.3 Sălcia Mare River Basin

Sălcia Mare River has a length of 45 km, an area of 590 km^2 and flows into the Ialpug River, at 1.5 km northwest of s. Alexeevca (Figure no. 23).

Catchment located in Bugeac Steppe is relatively narrow, elongated from north to south; the landscape is wavy, light fragmented. Most of the area is covered by field crops, only small areas are planted with vineyards and orchards.

The basin is elongated from north to southeast widened in the middle, asymmetric, more developed on the left. It is located in the northern part of Bugeacului Steppe, upper part of the Baimacliei hills, characterized by many valleys and cliffs. The surface is used, planted with vineyards and orchards.

Source: Yearbook of surface water quality as hydro-chemical indicators, 2014

Figure no. 23. Sălcia Mare River Basin on the territory of Republic of Moldova

The monitoring of water quality of Sălcia Mare River was carried out in Section s. Vinogradovca. In 2014, Sălcia Mare River water quality falls in quality class III (moderately polluted), WPI with 1.81 value.

In Ialpug River Basin, the 400 kV OHL Vulcăneşti - Chişinău route crosses an impermanent water course in the North of Topală localities, the Ialpug River in the South of Cenac localities, an impermanent water course in the North of Dezghingea village, a permanent water course in the North of Borogani village, Ialpugel River (tributary of the Ialpug River) in the South of Borogani and in the East of Borceag localities, a permanent water course in the North of Congaz, Sălcia River (tributary of Ialpug Rive) in the South of Sălcia localities and Sălcia Mare river (tributary of Ialpug River) between Muşaitu and Vinogradovca localities.

In the South of Congazcicul de Jos village OHL route goes nearby (about 133 m) the course of Chirșova Mare (a tributary of the Ialpug River) and nearby the reservoir constructed on Chirșova Mare (Carsău) course (155 m).

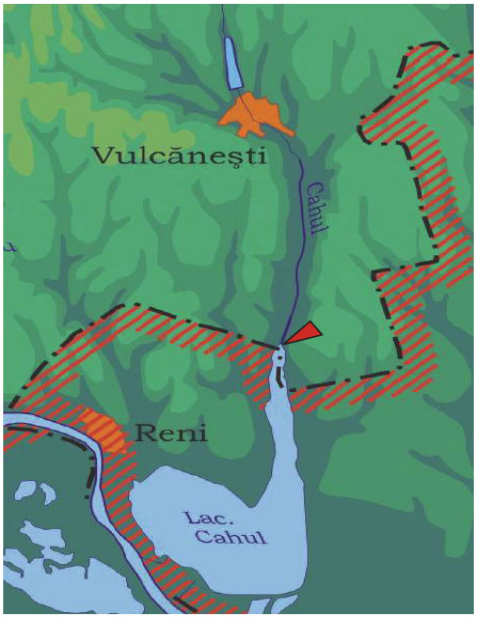
5.1.5.2.4 Cahul River Basin

Cahul River has a length of 39 km, an area of 605 km^2 and flows into Cahul Lake, on the southern outskirts of the Etulia village (Figure no. 24).

The basin is located in the middle of the Bugeac Steppe. Catchment is asymmetric, more developed in the central part of the left bank, relatively narrow (5 km) in the lower course, slightly elongated from northwest to south.

The monitoring of Cahul River water quality was conducted in the Etulia-Nouă section. During 2014, high and extremely high pollution cases occurred. Compared with 2013, the Cahul River water quality has decreased for the following parameters: chloride, color, phenols and dissolved oxygen.

In terms of the WPI, the water quality did not registered significant changes in 2014 compared to 2013, maintaining quality class III (moderately polluted).



Source: Yearbook of surface water quality as hydro-chemical indicators, 2014

Figure no. 24. Cahul River in the south part of the country

In Cahul Basin, the 400 kV OHL Vulcăneşti - Chişinău route does not cross any river.

5.1.5.3 Lakes

Along the 400 kV OHL Vulcăneşti - Chişinău route, in rivers basins crossed, there are lakes and ponds, whose water is used for irrigation, fisheries, technical water supply, recreation and other uses, such as:

- in Botna River Basin the main lakes are: Ulm, Costeşti, Răzeni. In the table below are presented the lakes and ponds (some of them with no name) found in the survey corridor:

Table no. 13. Botna River Basin's lakes and ponds in the OHL survey corridor

Lake/ reservoir pond name	Location	Distance form OHL route	Comments
Costeşti reservoir	Ialoveni, in north-eastern of Costeşti village	5.13 km	Covers an area of 201 ha and has a volume of 8.1 million m^3.
Horești pond	Ialoveni, North-West of Horești village,	2.78 km South-East	Covers an area of 2 ha
Străștioara pond	Ialoveni, North-West of Horești village	4.1 km South-East	-
Petihatka Lake	Ialoveni, North-East of Petihatka village	8.5 km South-East	-
Cigîrleni pond	Ialoveni, North of Cigîrleni village	7.5 km South-East	-
Molești pond	Ialoveni, North of Molești village	2.94 km South	-

- In Cogâlnic River Basin are built four reservoirs and approx. 100 ponds. In the table below are presented the lakes and ponds (some of them with no name) found in the survey corridor:

Table no. 14. Cogîlnic River Basin's lakes and ponds in the OHL survey corridor

Lake/ reservoir pond name	Location	Distance form OHL route	Comments
Buteni pond	Hânceşti, North from Buteni village	4.73 km North	-
Fîrlădeni pond	Hânceşti, South of Fîrlădeni village,	1.83 km West	-
Gura Galbenei pond	Cimișlia, South of Gura Galbenei village	1.83 km West	-
Mereni pond	Cimișlia, between Mereni and Hîrtop villages	4.30 km West	-
Iurievca pond	Cimișlia, North of Iurievca village	1.80 km East	-
Ecaterinovca Lake	Cimișlia, South-West of Ecaterinovca village	Crossed by the OHL route in the span of 337 and 338 towers	
Two no name lakes	North to Cimișlia city	about 2.11 km and at 5.37 km	

- *in Ialpug River Basin* are built 19 reservoirs and about 140 small water reservoirs – ponds. In the table below are presented the lakes and ponds (some of them with no name) found in the survey corridor:

Table no. 15. Ialpug River Basin's lakes and ponds in the OHL survey corridor

Lake/ reservoir pond name	Location	Distance form OHL route	Comments
Vasey pond	Cimișlia, South of Ialpujeni village	6.16 km West	-
Artemonovskoe pond	Cimișlia, between Maximeni and Javgur villages,	8.52 km West	-
Big Pond	Cimișlia, North of Cenac village	3.14 km North	-
Zmeu and Covrig Ponds	Cimișlia, North-West of Cenac village	2.10 km North-West	-
Lake no. 1and no.2	Leova, South-West of Iargara village	4.5 m North-West	-
Tigheci pond	Leova, South-West of Ecaterinovca village	7.85 km West	-
Borogani Pond	Leova, North of *Borogani* village	188 m North	-
Iazul de la răzășie pond	Leova, West of *Borogani* village	990 m West	-
Sadîc Pond	Cantemir, North of Sadîc village	4.45 km West	-
No name Pond	Cantemir, South of Vișinovca village	9.11 km West	-
Dezghingea Lake	ATU Găgăuzia, North of Dezghingea village	150 m South	-
Topală Lake	ATU Găgăuzia, South of Topală village	1.66 km South	-
Comrat reservoir	ATU Găgăuzia	7.94 km East	The reservoir has an area of 170 ha and the water volume of 4 million m^3. The basin is riverbed type - with seasonal mode of runoff regularization and is exploited in cascade with Congaz Lake. According with the registered data, Comrat reservoir waters have a level of pollution with insignificant changes, the WPI values ranging from 1.37 (quality class III - moderately polluted) in 2012, up to 1.70 (quality class III - moderately polluted) in 2011 (year with lack of rainfalls)
No name pound	ATU Găgăuzia, in the catchment of Chirșova Mare river South of Congazcicul de Jos village	143 m East	-
Kirsovskoe lake	ATU Găgăuzia, West of Chirșova village	2.11 km East	-
Coțofeni lake	ATU Găgăuzia, North of Cotovscoe village	3.40 km West	-
Congaz reservoir	ATU Găgăuzia, between	3.97 km East	covers an area of 507 ha with a

Lake/ reservoir pond name	Location	Distance form OHL route	Comments
	Congaz and Beşalma villages		volume of 3.08 million m^3 and is used for recreational activities
Tărăclia reservoir	ATU Găgăuzia, between Balaban and Svetlîi villages	5 km East	Covers an area of 1,510 ha, has a volume of 62 million m^3 and an average depth by 4.1 m and is used for recreational activities. Tărăclia reservoir water is characterized by a high degree of mineralization, increased concentrations of sulphates and chlorides, sodium ions and potassium, magnesium and calcium, which gives high hardness of water based on specifics and nature of soil and rocks in the region. Over the last 5 years, Tărăclia reservoir water quality, according to WPI, recorded insignificant changes, maintaining the quality class III (moderately polluted). The WPI values during the mentioned period varied in the range of 1.14 in 2010 to 1.55 in 2011.
Hîrtop lake	between Hîrtop and Sălcia villages	2.31 km North-West	-
Pond	North of Vinogradovca village	800 m West	-

- In Cahul River Basin there are two reservoirs and 12 small water reservoirs (ponds). In the survey corridor the lake north to Vulcănești city is situated at 7.88 km West form OHL route.

The surface water crossed by the transmission line are summarised in the table below:

Table no. 16. Surface water crossed by / close to the transmission line

No	Name	Basin	Location	Notes
1.	Șnovăț River	Bîc River	between Brăila and Strănişteni	OHL crosses the river
2.	Permanent water course from Zîmbreni Valley	Botna River	Zîmbreni Valley	OHL crosses the water course
3.	Botna River		between Costeşti and Zimbreni	OHL crosses the river
4.	Botnişoara River		a tributary of the Botna River, near Hansca	OHL crosses the river
5.	Impermanent water course	Cogâlnic River	North-West of Ivanovca Nouă	OHL crosses the water course At 360 m East from the OHL route there is an water storage reservoir
6.	Impermanent water course		West to Lipoveni	OHL goes nearby (about 216 m)

No	Name	Basin	Location	Notes
7.	Cogâlnic River		Near Hîrtop	OHL crosses the river
8.	No name Canal		In the South of Valea Perjei	OHL crosses the canal At 120 m North from the OHL route there is an water storage reservoir
9.	Ecaterinovca lake		In the South-West of Ecaterinovca	OHL crosses the reservoir constructed on the Ecaterinovca Valley water course
10.	Impermanent water course		In the North of Topala	OHL crosses the water course
11.	Ialpug River		In the South of Cenac	OHL crosses the river
12.	Impermanent water course		In the North of Dezghingea	OHL crosses the water course At 400 m South from the OHL route there is the Dezghingea Lake
13.	Permanent water course		In the North of Borogani	OHL crosses the water course At 300 m South from the OHL route there is the Borogani pool
14.	Ialpugel River	Ialpug River	In the South of Borogani In the East of Borceag	OHL crosses the river
15.	Chirșova Mare (Carsău) course		In the South of Congazcicul de Jos	OHL goes nearby (about 133 m) the course and the reservoir constructed on Chirșova Mare (Carsău) course (155 m)
16.	Permanent water course		In the North-West of Congaz	OHL crosses the water course after that it goes along the course for about 5.5 km
17.	Sălcia River		In the South of Sălcia	OHL crosses the river
18.	Sălcia Mare River		between Musaitu and Vinogradovca	OHL crosses the river

The surface waters from the table no. 16 are shown in the map of **Annex 3.**

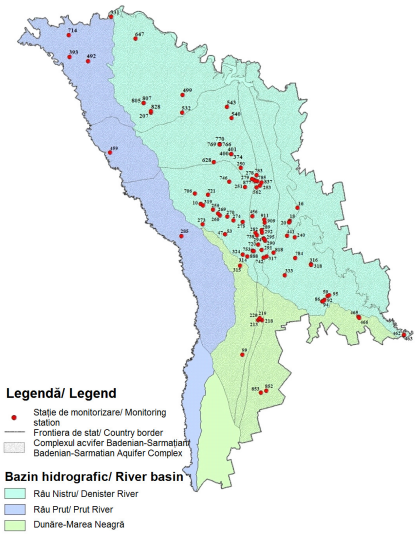
5.1.5.4 Underground waters

Around the 400 kV OHL Vulcăneşti - Chişinău route, within the OHL survey corridor, there are the following complex and aquifers:

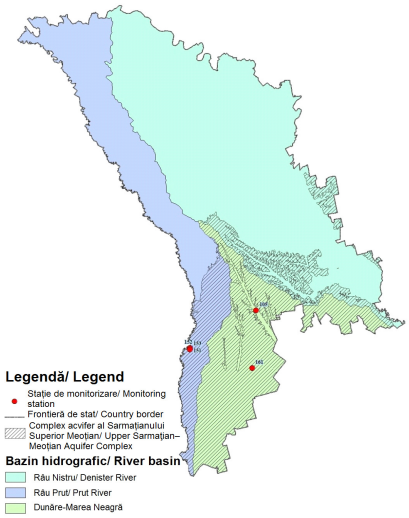
- ***Badenian - Sarmatian (N1-S1) Aquifer Complex*** - is the only hydraulic aquifer complex, uniting in the north, Sarmatian and Badenian lower, while in the central and south, connecting Lower and Middle Sarmatian. Water-bearing rocks are limestone reefs, which contain insertions in some areas overlapping marl and sands. The abundance of water complex Badenian-Sarmatian varies depending on territory, recording values between 0.1 - 2.2 l / sec;
- ***Upper Sarmatian - Meoţian (N1S3-m) Aquifer Complex*** is spread mostly in central and southern Moldovan Artesian Basin. Rock aquifer thickness is uneven and varies from 20.0m to 300 m (in the south). Water-bearing rocks are fine-grained and petty sands infilled clays, limestone and sandstone, with thickness from 2 m to 28 m. Bedrock are represented by sandy clay sediments stratigraphically assigned to the middle Codrului. Groundwater in this neighbourhood do not have pressure, but with

sinking sediments south, they acquire piezometric pressure, which can reach the height of 65 - 100 m;

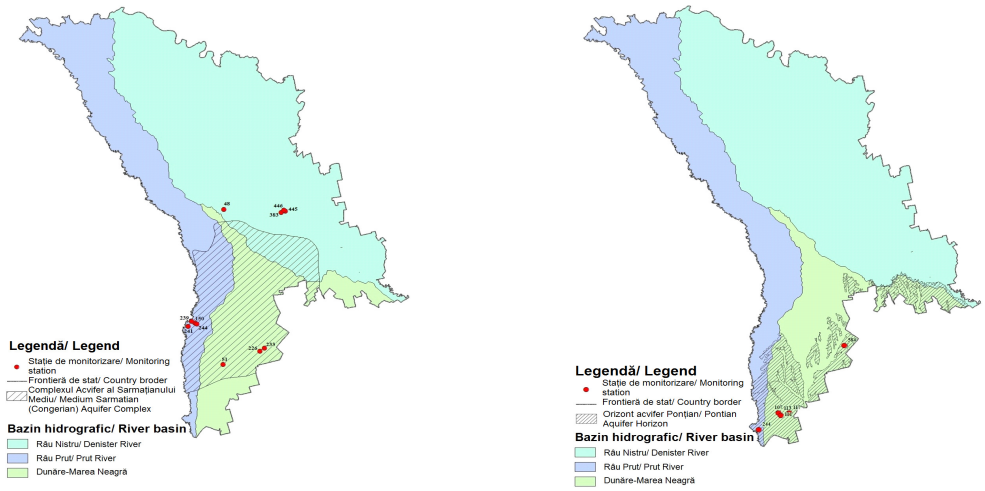
- ***Medium Sarmatian (Congerian) (N1S2) Aquifer Complex*** comprises the sands of Medium Sarmatian and is spread in the south-western territory between the Dniester and Prut. Water-bearing rocks are fine-grained and petty sands in which are layered specific intercalations of clay, sandstone and limestone. The thickness of the aquifer varies from 5 - 15 m to 20 to 30 m, and in the south reach up to 40 - 50 m. The smallest thickness of the horizon is recorded in Batir, Tărăclia, Troiţcoe, Stoianovca, Cebolaccia villages;
- ***Pontian aquifer*** is spread in the south of the country. Water-bearing rocks are sediment of the Novorossiysk sublevel, represented by granular sands containing limestone-cochilifer at the bottom of the section. In some sectors are noticed several (up to 4) sand intercalations studied as separate aquifers holding specific pressure level (insertions from 3 - 5 cm to 25 cm, total thickness is 80 to 100 m). Groundwater level of the Pontian aquifer recorded at a depth of 1 - 5 m (Giurgiulesti village) and 5 - 10 m along the Prut (Slobozia-Mare village - Suvorova).



Bedanian – Sarmaţian Aquifer Complex



Upper Sarmaţian– Meoţian Aquifer Complex



Medium Sarmatian (Congerian) Aquifer Complex *Pontian aquifer*

Source: *http://www.ehgeom.gov.md/ro/proiecte-din-bugetul-de-stat/monitorizarea-apelor-subterane*

Figure no. 25. Position of aquifer and aquifer complexes along the OHL route

In order to identify the hydrological condition and groundwater chemistry of the proposed Project's area a geological study was conducted by Institute for Research, Design and Technology ENERGOPROIECT.

The result on hydrological condition of the geological study revealed the following aspects:

- In the *Bîc River basin* were performed three wells at a depth of 8 m each, in two of them no groundwater was found, in the third one groundwater was found at 4 m depth;
- In the *Botna River basins* were performed three wells at a depth of 8 m each, in two of them groundwater was found at 5.5 m depth (near Zîmbrenilor Valley), and respectively 6 m depth (in the East of Socii hill), in the third one no groundwater was found;
- In the *Cogîlnic River basin* were performed nine wells at a depth of 8 m each, in two of them groundwater was found at 2.7 m depth (in the North-East of Valea Perjei village), and respectively 6 m depth (in the North-West of Ecaterinovca village), in the other seven no groundwater was found;
- In the *Ialpug River basin* were performed twenty-two wells at a depth of 8 m each, in four of them groundwater was found at 3 m depth (in the East of Congazcicul de Jos village), 2.5 m depth (in the South of Congazcicul de Jos village), 2.5 m depth (near Ciocrac hillock in the East of Cotovscoe village), and respectively 5.5 m depth (at the crossroad of L643 and R26 near Borceag village), in the other eighteen no groundwater was found;

- In the *Cahul basin* were performed three wells at a depth of 8 m each and no groundwater was found.

5.1.6 Air quality

In Republic of Moldova the monitoring of air quality is perform by State Hydro meteorological Service that has a dense network of stations all over the country.

In 2014, the national network for monitoring of the air quality consists in 19 monitoring stations, namely:

- 17 manual monitoring stations located in 5 industrial areas (Chișinău - 6 stations, Bălți - 2 stations, Bender - 4 stations, Tiraspol - 3 stations, Rybnita - 2 stations) that involve the manual collection of the samples (3 times per day); the following pollutant substances were measured: sulphur dioxide, carbon monoxide, nitrogen dioxide, soluble sulphates, nitrous oxide, phenol, formaldehyde; the monitoring stations do not measure pollutant such as particulate matter 10 (PM10) and ground-level ozone (O_3);
- 2 automated monitoring stations located at Mateuţi (for CO, O_3, total particulate matter) and Leova (for particulate matter PM10, Cl^-, NO_{3-} , SO_4-S, SO_2-S and NO_2).

The air pollution in Republic of Moldova is due to the emissions generated by mobile sources (transport and agriculture machinery) and stationary sources (mainly power and heat generation sector and the industry).

The evolution of the pollutant emissions from transport sector during the period 2012 - 2013, per types of transport, reflects an increase of pollutant emissions from road transport, mainly due to fleet evolution, the fuels used and the roads technical condition.

The evolution of the pollutant emissions from industrial sources (power plants and industrial enterprises) during the period 2011 - 2013 reflects a decrease of pollutant emissions, mainly due to degreasing number of enterprises.

In the Project area, located in the south part of Republic of Moldova, there are no monitoring stations for air quality and no information about the pollutant substances emitted in atmosphere.

The nearest air monitoring station is located in Chişinău municipality, located at 6 km North - East from the end of 400 kV OHL Vulcăneşti – Chişinău route.

In Chişinău municipality, the major impact on air quality were due to the industrial sector, namely: SA “Edilitate”, SRL “Moldovatransgaz”, I.S. “Fabrica de sticlă”, SA “Macon”, SA “Apă Canal Chişinău”.

For characterizing the air quality, the State Hydro meteorological Service uses the Index of Atmospheric Pollution (IAP) that is calculated by summarizing the concentration of six main pollutants (SO_2, CO, N_2O, phenol, suspended solids and formaldehyde). The pollution classes in use depend on the IAP vales: low (0 - 4), moderate (5 - 6), high (7 - 13) and very high (>14).

In 2014, in Chişinău municipality the pollution class was high (IPA = 9) and the average annual concentration exceeded the national standards (maximum allowable concentrations) for NO_2.

5.1.7 Noise and vibration

There is no monitoring of noise and vibration in Republic of Moldova[7].

5.2 Biological Environment

In Republic of Moldova there are 312 natural protected designated, covering 5.61% of the country's area; part of these categories are classified according to the classification of the International Union for Conservation of Nature (IUCN), some categories are national and one category is international (Wetlands of International Importance - Ramsar sites).

In addition, the Republic of Moldova is involved, along with the East European and NIS countries, in the implementation of the Joint Programme of the Council of Europe and European Union to establish, under Bern Convention, the Emerald Network as part of the EU's Natura 2000 Network. A number of 48 candidate Emerald sites, including the 12 proposed Important Bird Areas (IBA), have been accepted by the Standing Committee of the Council of Europe in 2016 (T-PVS/PA (2016) 11).

In order to establish the baseline for biological environment, the natural protected areas already included in the National network, the candidate Emerald sites (including IBAs) crossed by the OHL route or situated within survey corridor, were considered. The designated and candidate protected areas (Emerald sites including IBAs) within OHL survey corridor are presented in the following chapters and **Annex 4.**

[7] GD no. 301/24.04.2014 approving the Environmental Strategy and the Action Plan for period 2014-2023

5.2.1 Protected Areas

The OHL survey corridor crosses ATU Găgăuzia, Cahul, Tărăclia, Leova, Cantemir, Cimişlia, Hânceşti, Ialoveni, Chişinău districts.

The characterization of protected areas (classification, surface and width of protection area) located within OHL survey corridor, including the distance up to OHL route is presented in the following table (Table no. 17).

Table no. 17. Protected Areas within the OHL survey corridor

District	Type	Name of protected area	Surface (ha)	Width of protection area (m)	Owner	Distance to OHL route (km)
ATU Găgăuzia	MNGP	Geological section of the Ialpug valley	5.6	500 – 1,000	State forestry Iargara	5.61
	AMMSRVS	Bugeacului North (Dezghingea) Steppe Sector	15	700 – 1,000	Agricultural enterprise "Rodina"	3.45
	AMMSRVS	Bugeacului North Steppe Sector	4	700 – 1,000	Agro industrial Complex Bugeac	3.45
Cahul	MNGP	Fossil site near the Moscow village	10	500 – 1,000	State forestry Cahul	11.05
	MNGP	Tartaul Cliff	2	500 – 1,000	Agricultural enterprise "Tărăclia de Salcie"	6.5
	RNS	"Bolgrad Highschool"	54	700 – 1,000	State forestry Iargara	10.00
	MNBSRVS	Borceag	11.3	500 – 1,000	State forestry Iargara	1.85
Tărăclia	MNGP	Muşaitu Cliff	5	500 – 1,000	Agricultural enterprise "Musaitu"	2.75
	MNGP	Budăi Cliff	5	500 – 1,000	Agricultural enterprise "Drujba"	6.40
	AMMSRVS	Bugeacului South Steppe Sector	50	700 – 1,000	Agricultural enterprise "Ciumai"	1.00
Cantemir	MNBSRVS	Cîietu	4	500 – 1,000	State forestry Iargara	9.15
	MNGP	Cariera Cociulia	1	500 – 1,000	Agricultural enterprise "Patria"	8.48
	RP	Codrii Ţigheci	2,519	700 – 1,000	State forestry Iargara	6.8
Leova	RNS	Ostianova	211.2	700 – 1,000	State forestry Iargara	4.75
Cimişlia	MNGP	Coţofana Cliff	10	500 – 1,000	State forestry Cimişlia	0.63
Hânceşti	RNS	Caracui Villa	84	700 – 1,000	State forestry Hânceşti	8.40
Ialoveni	RP	Cărbuna	607	700 – 1,000	State forestry Cimişlia	10.20
	RNS	Moleşti - Răzeni	250.7	700 – 1,000	State forestry Cimişlia	6.15
	RNS	Moleşti	5	700 – 1,000	State forestry Cimişlia	6.15
	MNGP	Outcrops Costeşti	1	500 – 1,000	Costeşti City hall	3.71
	MNGP	Ialoveni Cliff	3	500 – 1,000	Scientific Association "Codru"	3.70
Chişinău	GZ	Chişinău Zoo	20	500 – 1,000	Chişinău City hall	5.9

District	Type	Name of protected area	Surface (ha)	Width of protection area (m)	Owner	Distance to OHL route (km)
ATU Găgăuzia	MNGP	Geological section of the Ialpug valley	5.6	500 – 1,000	State forestry Iargara	5.61
	AMMSRVS	Bugeacului North (Dezghingea) Steppe Sector	15	700 – 1,000	Agricultural enterprise "Rodina"	3.45
	AMMSRVS	Bugeacului North Steppe Sector	4	700 – 1,000	Agro industrial Complex Bugeac	3.45
	GB	Botanical Garden	104	500 – 1,000	Institute of the Academy of Sciences of Moldova	6.2

Source: *http://www.ieg.asm.md/en/protected_areas*
Legend:
MNGP: Geological and paleontological monuments of nature; **RNS**: Natural forest reserves; **MNBSRVS:** Natural monuments biological sectors with forest vegetation representative; **AMMSRVS:** Areas with multifunctional management representative sectors steppe; **RP:** Landscape reserves; **GZ:** Zoological garden; **GB**: Botanical garden

The planning of the OHL route was performed in order to avoid crossing the protected areas, situated at distances between 0.63 - 11.05 km from the proposed OHL route.

For the protected areas mentioned above the specific plant and animal species were identified as a result of documentation the relevant available data[8], detailed in the following sections.

5.2.1.1 Natural protected areas

5.2.1.1.1 ATU Găgăuzia

5.2.1.1.1.1 Geological section of Ialpug Valley

The protected area, located 4 km north of Comrat city, on the left side of the Ialpug River valley is considered geological and paleontological site of Upper Miocene in southern Republic of Moldova, requiring further scientific research.

[8] „Cadastre of natural protected areas", Institute of Ecology and Geography, Academy of Sciences of Moldova; "Book of core areas of the National Ecological Network of Moldova", Biotica 2012

Figure no. 26. Ialpug River valley

Source: http://www.ieg.asm.md/sites/default/files/Sectiunea_geologica_din_valea_r_Ialpug_MNGP.pdf

5.2.1.1.1.2 Bugeacului North (Dezghingea) steppe Sector

In this sector, located near Ialpugel River, a small tributary of the Ialpug River, steppe plants are characteristic, namely: Big Bluestem (*Andropogon gerardii*), covering approx. 60% of the area, species of feather-grass covering approx. 30% of the area accompanied by abundant Fescue (*Festuca* sp.), Yellow Spring Bedstraw (*Galium verum*), Cornflower (*Centaurea jacea*), Sage (*Salvia officinalis*), etc.

Source: http://www.ieg.asm.md/sites/default/files/Sector_de_stepa_in_Nordul_Bugeacului(Dezghingea)_AMMsrvs.pdf

Figure no. 27. Bugeacului North (Dezghingea)steppe Sector

Source: http://www.ieg.asm.md/sites/default/files/Sector_de_stepa_in_Nordul_Bugeacului(Dezghingea)_AMMsrvs.pdf

Figure no. 28. Plant species, North Bugeacului (Dezghingea) steppe Sector

The rare and characteristic plant and animal species within the Bugeacului North (Dezghingea) steppe Sector listed in Republic of Moldova Red Book 3rd edition and in the IUCN Red List are presented in Annex 5.

The plant and animal species classified as endangered (EN), critically endangered (CR) and vulnerable (VU) are as follows:

- Republic of Moldova Red Book:
  - *Endangered:* Tatarian Sea-Kale *(Crambe tataria Sebeok),* different types of *Stipa tirsa Stev*, Stipa ucrainica *(dasyphylla),* Grass Lizard *(Podarcis tauricus Pallas*), Hazel Snake (Coronella austriaca Laur.);
  - *Critically endangered:* Yarrow *(Achillea ochroleuca),* Astragalus *(Astragalus excapus L.),* Carnation *(Dianthus pallidiflorus Ser.),* Mountain Sandwort (Eremogone cephalotes Bieb. Fenzl.), Eremogone Rigida (*Eremogone rigida Bieb. Fenzl.*), *Cladonia rangiformis Hoffm., Xanthoparmelia vagans Nyl. Hale*, Earth Frog (*Pelobatas fuscus Laur.*);
  - *Vulnerable:* Volga Adonis *(Adonis wolgensis Stev.),* Sea Grape *(Ephedra distachya L.)*, *Nepeta parviflora Bieb.*, *Allium inaequale Janka,* Speckled Ground Squirrel *(Spermophilus suslicus);*
- IUCN Red List: *Stipa pulcherrima* K. Koch is clasified as vulnerable and the Speckled Ground Squirrel (*Spermophilus suslicus*) is clasified as near threatened.

5.2.1.1.1.3 Bugeacului North steppe sector

The steppe vegetation sector, located near the Bugeacului village, is a sector with steppe vegetation characteristic in southern Republic of Moldova that was formed under moisture deficit; among steppe plant species (Big Bluestem, Fescue, smooth-stalked meadowgrass,

etc.) are present the species: Asparagus (*Asparagus tenuifollus),* Bells (*Clematis integrifolia* L.), Whitish Cosac (*Astragalus albidus* Waldst. et Kit).

The Bugeacului North steppe sector (4 hectares) is part of Bugeacului Steppe Sector that also includes the Bugeac natural reservation (56 hectares).

The rare and characteristic plant and animal species within the Bugeacului North steppe sector, listed in Republic of Moldova Red Book 3rd edition and in the IUCN Red List are presented in Annex 5.

The plant and animal species classified as endangered (EN), critically endangered (CR) and vulnerable (VU) are as follows:

- Republic of Moldova Red Book:
  - *Endangered:* Sand Saffron *(Colchicum fominii Bordz.)*, Tatarian Sea-Kale *(Crambe tataria Sebeok)*, Montain Lusca *(Ornithogalum oreoides Zahar.), G*rass Lizard *(Podarcis tauricus Pallas),* Hazel Snake *(Coronella austriaca Laur.);*
  - *Critically endangered:* Carnation *(Dianthus pallidiflorus Ser.)*, Mountain Sandwort *(Eremogone cephalotes Bieb. Fenzl.)*, Eremogone Rigida *(Eremogone rigida Bieb. Fenzl.)*, Garden Bumblebee *(Bombus fragrans Pall.),* Hen Harrier *(Circus cyaneus L.)*;
  - *Vulnerable:* Woronow *(Bellevalia sarmatica Georgi)*, Sea Grape *(Ephedra distachya L.)*, Clay Bumblebee *(Bombus argillaceus Scopoli)*;
- IUCN Red List: all species are classified as least concern.

5.2.1.1.2 Cahul District

5.2.1.1.2.1 Fossil site near the Moscow village

The fossil site, placed between Moscova (Cahul District) and Dermengi (Tărăclia District) villages, presents scientific interest due to the presence of deposits of alluvial Pliocene, containing important fossils of representatives and characteristics species of fauna Moldovian complex, namely: Rabbit (*Alilepus lascarevi)*, Pika (*Ochotona antiqua)*, Blindly (*Nannospalax macoveii)*, Kowalski Mouse (*Pliomys Kowalski)*, Flying Squirrel (*Pliopentaurista Moldaviensis)*, Alexeev Camel (*Paracamelus alexejevi*), etc.

Figure no. 29. Fossil site near the Moscow village
Source: *http://www.ieg.asm.md/sites/default/files/Amplasamentul_fosilifer_s_Moscovei_MNGP.pdf*

5.2.1.1.2.2 Tartaul Cliff

The geological and paleontological monument of nature Tartaul Cliff is placed at 0.5 km north of Tartaulul de Salcie village, Cahul district, on the left side of Salcia Mică River, minor tributary of the Salcia Mare River.

The Outcrop of Tartaul Cliff is considered as a reference geological site with etulia clay and a layer of raw coal with sulfur crystals. On the territory of the protected area there are several main sources of drinking water.

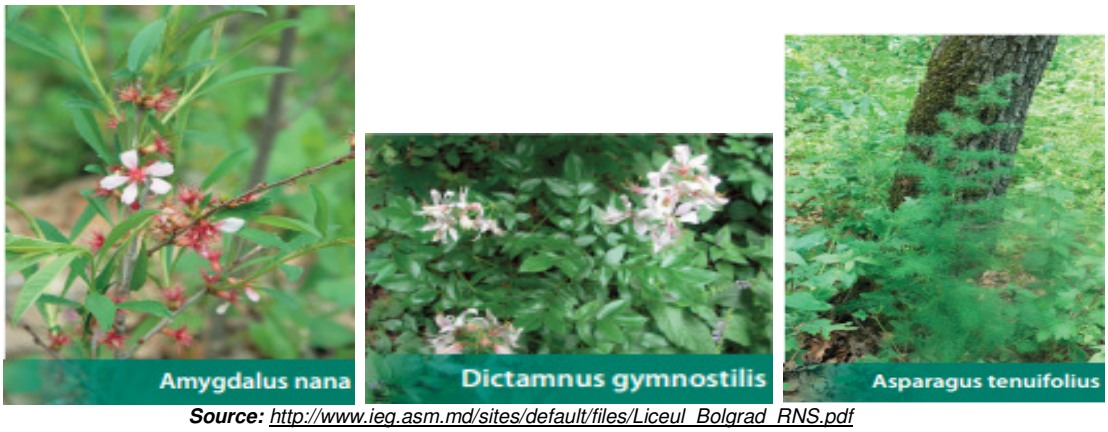
Source: *http://www.ieg.asm.md/sites/default/files/Rapa_Tartaul_MNGP.pdf*
Figure no. 30. The outcrop of Tartaul Cliff

5.2.1.1.2.3 Bolgrad Highschool

The protected area “Bolgrad Highschool”, located near the Frumuşica, Cahul District, is a forest sector with stand-natural valuable fundamental Downy Oak (*Quercus pubescens*) and

Gray Oak (*Quercus pedunculiflora*), characteristic for forests in southern Republic of Moldova.

The protected area, that includes a genetic fund consisting of 82 species of vascular plants, (4 tree species, 10 shrub species and 68 herbaceous plant species). The importance of this area is given by the presence of rare species such as Rabbit Shadow (*Asparagus tenuifolius*) and Periwinkle (*Vinca herbacea*) and a geographical variation of the *Dictamnus gymnostylis* Stev, classified in the Red Book of Republic of Moldova as endangered species.



Source: *http://www.ieg.asm.md/sites/default/files/Liceul_Bolgrad_RNS.pdf*

Figure no. 31. Characteristic plants, "Bolgrad Highschool"

5.2.1.1.2.4 Borceag

The "Borceag" natural monument biological sector with forest vegetation representative is located near the Borceag village (between Frumusica and Biruinţa villages). This area occupying two plots from natural forest found: 18 plot, subplot F surface of 3.9 ha and plot 19, subplot C with a surface of 7.5 ha.

The dominant species are the Downy Oak (*Quercus pubescens*) with 0.63 density and Gray Oak (*Quercus pedunculiflora*) with 0.48 density, reaching the age of 60-70 years. Also, is noted Ash (*Fraxinus excelsior*) for about 30 years and 0.06 density. Among bushes is highlight Rosehip (*Rosa canina*), Hawthorn (*Crataegus curvisepala*), Blackthorn (*Prunus spinosa*), etc.

Source: http://www.ieg.asm.md/sites/default/files/Borceag_MNB.pdf
Figure no. 32. Downy oak (left) and blackthorn (right)

5.2.1.1.3 Tărăclia District

5.2.1.1.3.1 Muşaitu Cliff

Musaitu Cliff is located in the Musaitu village, Taraclia District, on the right slope of Salcia Mare River.

The main criteria for which the Musaitu Cliff was declared a monument of nature are pontian marine clay deposits with fruits, seeds and leaves fossilized footprints of various plants and brown coal lenses. Above these deposits is a layer of clay brown-red followed by *Pictris Carpathian* alluviums. These alluviums dating from lower Pliocene and contain skeletal remains of freshwater molluscs and valuable vertebrate specific to Moldovian fauna complex: the Snake (*Viper kucurganica)*, Ostrich (*Struthio sp.*), Monkey (*Ruscinensis cf. Dolicopithecus),* Flying Squirrel (*Pliopentaurista Moldaviensis)*, *Promimomys moldavicus*, Mastodon (*Mammut borsoni)*, Boar Pond *(Propotamochoerus provincialis)*, Antelope (*Parable boodon)*, etc.

Source: http://www.ieg.asm.md/sites/default/files/Rapa_Musaitu_MNGP.pdf

Figure no. 33. Muşaitu Cliff

The rare and characteristic plant and animal species within the Musaitu Cliff, listed in Republic of Moldova Red Book 3rd edition and in the IUCN Red List are presented in Annex 5.

The plant and animal species classified as endangered (EN), critically endangered (CR) and vulnerable (VU) are as follows:

- Republic of Moldova Red Book:
  - *Endangered:* Grass Lizard (*Podarcis tauricus* Pallas), Hazel Snake (Coronella austriaca Laur.), Coluber Caspius Gmelin, European Honey Buzzard *(Pernis apivorus* L.);
  - *Critically endangered: Bombus fragrans Pall.,* Earth Frog *(Pelobates fuscus* Laur.), Lesser Spotted Eagle *(Aquila pomarina* Brehm.), Hen Harrier *(Circus cyaneus* L.*),* Saker Falcon *(Falco cherrug* Gray), Stock Dove (*Columba oenas L.*);
  - *Vulnerable:* Volga Adonis *(Adonis wolgensis Stev.)*, Giant Hornet *(Scolia maculata Drury)*, *Papilio machaon L.,* Southern Festoon *(Zerynthia polyxena Den. et Sch.)*, Black Gaia *(Milvus migrans* Bodd.), Speckled Ground Squirrel *(Spermophilus suslicus* Guld.);
- IUCN Red List: Turtledove (*Streptopelia decaocto*) is clasified as vulnerable, but is not included in the Republic of Moldova Red Book, Saker Falcon (*Falco cherrug*) is classified as endangered and Speckled Ground Squirrel (*Spermophilus suslicus*) is classified as near threatened.

5.2.1.1.3.2 Budăi Cliff

The Budai Cliff is located on the western outskirts of the Budăi village, Tărăclia District, on the right bank of the Salcia Mare River.

The main criteria for which the site of Budai Cliff was declared as a geological and paleontological monument of nature are lower Pliocene alluvial deposits containing old skeletal remains of reptiles and mammals, among which: Smooth Snake (*Coronella austriaca)*, Monkey (*Dolicopithecus cf. Ruscinensis)*, Climber Rabbit (*Pliopentalagus moldaviensis)*, Beaver (*Trogontherium cf. Minus)*, Micromamammal (*Promimomys moldavicus)*, mastodonts (*Mammut borsoni* and *Anancus arvernensis)*, Deer (*Procapreolus cusanus)*, etc.

Source: http://www.ieg.asm.md/sites/default/files/Rapa_Budai_MNGP.pdf
Figure no. 34. Budăi Cliff fossil site

The rare and characteristic plant and animal species within the Budăi Cliff, listed in Republic of Moldova Red Book 3rd edition and in the IUCN Red List are presented in Annex 5.

The plant and animal species classified as endangered (EN), critically endangered (CR) and vulnerable (VU) are as follows:

- Republic of Moldova Red Book:
  - *Endangered:* Grass Lizard *(Podarcis tauricus* Pallas*),* Hazel Snake (Coronella austriaca Laur.), European Honey Buzzard *(Pernis apivorus L.)*;
  - *Critically endangered: Astragalus excapus L.,* Earth Frog (Pelobatas fuscus Laur.), Saker Falcon *(Falco cherrug Gray.)*, Hen Harrier *(Circus cyaneus L.)*,

Lesser Spotted Eagle *(Aquila pomarina Brehm.)*, Stock Dove *(Columba oenas L.);*

- *Vulnerable:* Clay Bumblebee *(Bombus argillaceus Scopoli)*, Southern Festoon *(Zerynthia polyxena Den. et Sch.),* Black Kite *(Milvus migrans Bodd.)*, Speckled Ground Squirrel *(Spermophilus suslicus Guld.)*.

- IUCN Red List: Turtledove (*Streptopelia decaocto*) is clasified as vulnerable, but is not included in Republic of Moldova Red Book, Saker Falcon (*Falco cherrug*) is classified as endangered species and Speckled Ground Squirrel (*Spermophilus suslicus*) is classified as near threatened.

5.2.1.1.3.3 Bugeac South Steppe

The steppe sector located at south-east of the Vinogradovca village, Taraclia District, has a fairly fragmented relief, sectioned by 6 cliffs with depth between 5 - 30 m.

Source: http://www.ieg.asm.md/sites/default/files/Sector_de_stepa_in_Sudul_Bugeacului_AMMsrvs.pdf

Figure no. 35. Bugeac South Steppe

The steppe vegetation is represented by the smooth-stalked Meadowgrass *(Poa angustifolia)*, Common Agrimony (*Agrimonia eupatoria), D*ropwort (*Filipendula vulgaris), C*hicory *(Cichorium intybus)*. Fescue occupy most of the steppe and is found on North and North-East slopes (*Festuca valesiaca, Salvia nutans, Poterium sanguisorba, Euphorbia stepposa*, etc.) and barnyardgrass ocuppy usually steep slopes, with eroded and damaged landslides.

In cliffs, on the background of excess moisture, grows some hydrophilic Common Reed (*Phragmites australis), F*ield Horsetail (*Equisetum arvense)*, etc. On the middle slopes of

cliffs are individuals shrubs, like Russian Olive *(Elaeagnus angustifolia),* Hawthorn *(Crataegus curvisepala*), Wild Rose *(Rosa canina),* Dogwood *(Swida sanguinea).*

In addition to the gramineae enlightening community steppe - *Poa sp. and Festuca sp.,* there are found multiple xerophyte: Yellow Bluestem (*Bothriochloa ischaemum*), Lesser Hairy-brome (*Bromopsis benekenii*), Purple-stem Cat's-tail (*Phleum phleoides*), Crested Wheat Grass (*Agropyrion pectinatum*), Couch Grass (*Elytrigia repens*), Yarrow (*Achillea ochroleuca*), Camphorosma Annua, Field Brome (*Bromus arvensis*), Austrian Flax (*Linum austriacum*), Common Wormwood (*Artemisia absinthium*), *Euphorbia salicifolia*, Woodland Sage (*Salvia nemorosa*), Everlasting (*Xeranthemum annuum*), Willow Leaved Inula (*Innula salicina*), Thyme (*Tymus marchallianus*), Linnaeus (*Jurinea multiflora*), Silene Latifolia (*Melandrium album*), Field Eryngo (Eryngium campestre), Yellow Toadflax (*Linaria vulgaris*), Alyssum Hirsutum (*Alyssum hirsutum*), Common Milkwort (*Polygala vulgaris*), *Descurainia sophia*, Flixweed (*Verbascum blattaria*), Onobrychis (*Onobrychis arenaria*). On often shaded and moist these sectors are found: Creeping Cinquefoil, (*Potentilla reptans*), Argentina Anserina (*Potentilla anserina*), Glandular Globe-thistle (*Echinops sphaerocephalus*), Narrow-leaved Asparagus (*Asparagus tenuifolius*), Ground Ivy (*Glechoma hirsute*), Meadow-rue (*Thalictrum minnus*), Spring Milletgrass (*Milium vernale*), Horehound (*Marubium peregrinum*), Green Foxtail (*Setaria viridis*), and in cliffs were water flows: Cyperus Sedge (*Carex pseudocyperus*), Rough Horsetail (*Equisetum hiemale*), Dropmore Purple (*Lythrum virgatum*), Dewberry (*Rubus caesius*), Common Privet (*Ligustrum vulgare*), Red Dead-nettle (*Lamium purpureum*), Wild Strawberry (*Fragaria vesca*), Tuoksukirveli (*Chaerophyllum aromaticum*).

As mushrooms is found: Locust (*Russula angiunea*) and lichens covering the surface strains trees: 30% by Ciliate Wreath Lichen (*Physcia ciliata*), 10% by *Xanthoria parietina*, 5% by *Candelariella yolk*, 3% by *Physcia aipolia*, 3% by *Pertusaria globulifera,* 1% by *Palmer sulcata,* 1 % by *Ramalina fraxinea* and 1% by *Ramalina roesieri.*

The rare and characteristic plant and animal species within the Bugeac South Steppe, listed in Republic of Moldova Red Book 3rd edition and in the IUCN Red List are presented in Annex 5.

The plant and animal species classified as endangered (EN), critically endangered (CR) and vulnerable (VU) are as follows:

- Republic of Moldova Red Book:
    - *Endangered:* Montain Lusca *(Ornithogalum oreoides Zahar.), Ornithogalum amphibolum Zahar., Gagea ucrainica Klok.,* Hazel Snake *(Coronella austriaca Laur.)*, European Honey Buzzard *(Pernis apivorus L.);*

- *Critically endangered:* Yarrow *(Achillea ochroleuca),* Common Milkwort *(Polygala vulgaris), Colchicum triphyllum G.Kunze,* Carnation *(Dianthus pallidiflorus Ser.)*, Eremogone Rigida *(Eremogone rigida Bieb. Fenzl), Allium guttatum Stev., Catapyrenium squamulosum Arch. Breuss, Cladonia rangiformis Hoffm, Bombus zonatus Smith*, Earth Frog *(Pelobates fuscus Laur.),* Short-toed Snake Eagle *(Circaetus gallicus Gmel.)*, Hen Harrier *(Circus cyaneus L.)*, Montagu's Harrier *(Circus pygargus L.)*, Lesser Spotted Eagle *(Aquila pomarina Brehm.)*, Golden Eagle *(Aquila chrysaetos L.)*, Booted Eagle *(Hieraaetus pennatus Gmel.)*, Saker Falcon *(Falco cherrug Gray)*;
- *Vulnerable:* Spring Pheasant's Eye *(Adonis vernalis L.),* Bellevalia Sarmatica *(Bellevalia sarmatica Georgi Woronow), Gypsophila pallasii Ikonn, Chrysopogon gryllus L.,* Mahaon Buterfly *(Papilio machaon L.);*

- IUCN Red List: only Saker Falcon *(Falco cherrug)* is classified as endangered.

5.2.1.1.4 Cantemir District - Câietu

The Câietu monument of nature with forest vegetation representative, located between the Câietu and Chioselia villages, is a sector with cherry oak forest with century-old specimens of English oak trees, with the following characteristics:

- The dominant tree is Oak (*Quercus robur*) and the base trees are represented by species of: Downy Oak (*Quercus pubescens*), Cherry (*Cerasus avium*), Pear (*Pyrus Pyraster*), White Elm (*Ulmus laevis*) and Tatarian Maple (*Acer tataricum*);
- Shrubs: Hawthorn (*Crataegus curvisepala*), Horn (*Cornus mas*), Common Privet *(Ligustrum vulgare*), Dogwood (*Swida sanguinea*), Spindle (*Euonymus europaea*);
- Carpet grassy weak: Wood Sanicle (*Sanicula europaea*), Meadow-rue (*Thalictrum minnus*), Oregano (*Origanum vulgare*), Cape Gooseberry (*Physalis alkekengi*), Woodland Sage (*Salvia nemorosa*), Common Marshmallow (*Althaea officinalis*), Perforate St John's-wort (*Hypericum perforatum*);
- Fauna: Sand Lizard (*Lacerta agilis).*

Source: http://www.ieg.asm.md/sites/default/files/Caietu_MNB.pdf

Figure no. 36. Câietu

5.2.1.1.5 Hânceşti District - Caracui Villa

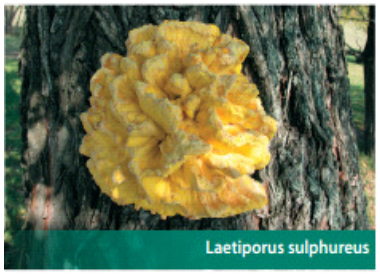
The "Vila Caracui" natural forest reserve covers an area of 80.5 hectares and is part of the OS Bozieni, Villa Caracui, plot 45. It is located at southeast side of the Caracui village at an altitude of about 210-270 m.

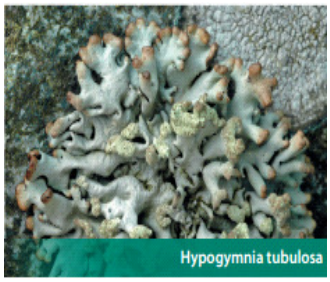
Sursa: *http://www.ieg.asm.md/sites/default/files/Vila_Caracui_RNS.pdf*

Figure no. 37. Natural forest reserve "Caracui Villa"

Along with the dominant downy oak species (*Quercus pubescens*) were recorded mix species: Oak (*Quercus robur*), Maple Tartar (*Acer tataricum*), Cherry (*Cerasus avium*), Ash (*Fraxinus excelsior*), Acacia (*Robinia pseudacacia*).

Through the shrubs species predominant are Hawthorn (*Crataegus curvisepala*), Wood Itchy (*Euonymus verrucosa*), Privet (*Ligustrum vulgare*), Spindle (*Euonymus europaea*), etc.





Source: *http://www.ieg.asm.md/sites/default/files/Vila_Caracui_RNS.pdf*

Figure no. 38. Flora from forestry natural reservation "Caracui Villa"

The carpet of herbaceous plants is poorly developed, the most common being Goldmoss Stonecrop (*Sedum acre*) and Large Sedum (*Sedum maximum*); ephemeroids: Solomon's Seal (*Polygonatum latifolium*), Violet (*Scilla bifolia*), Figwort Vernal (*Ficaria verna*); sciafils: Wood Cow-wheat (*Melampyrum nemorosum*), Dog's Mercury (*Mercurialis perenis*), Meadow-rue (*Thalictrum minus*), Solitary Clematis (Clematis integrifolia) and heliofils: Lesser Honeywort (*Cerinthe minor*), Lady's Bedstraw (*Galium verum*), mezoxerophytes: Clustered Bellflower (*Campanula glomerata*), Wallroth's Valerian (*Valeriana collina*) and Hydrophilic-yellow Iris (*Iris pseudacorus*).

Some rare species were found: Asparagus (*Asparagus officinalis)*, *Asparagus verticillatus*, *Crocus reticulatus*, Oxlip (*Primula Veris*). Moss: *Leske polycarpa*. Mushrooms: Reishi Mushroom *(Ganoderma lucidum*), Crab-of-the-woods (*Laetiporus sulphureus*). Lichens cover the strains surface up to: 25% *Evernia prunastri*, 15% *Parmelia acetabulum*, 10% *Hypogymnia physodes*, 7% *Xanthoria parietina*, 5% *Parmelia capers,* 5%, *Hypogymnia tubulosa*, 3% *Ramalina fraxinea* and 3% *Parmelia sulcata*.

The fauna is represented by: the Black Woodpecker (*Dryocopus martius*) classified in Republic of Moldova Red Book as Endangered, Deer (*Capreolus capreolus*), Wild Boar (*Sus scrofa*), Green Lizard (*Lacerta viridis*), Sand Lizard (*Lacerta agilis*) and Stag Beetle (*Lucanus cervus*) classified in Republic of Moldova Red Book as vulnerable.

5.2.1.6 Cimișlia District - Coțofana Cliff

The “Coțofana Cliff” geological and paleontological monument of nature is located at the east of Gura Galbenei (fourth cliff in number, to the north, arranged on the left of the “Valea Cotofenei” dale, Cimislia District. The surface of the protected area is 10 ha.

In 1912, paleontologist I.Homenco found in Coțofana Cliff the fangs of a Hiparion (Hipparion sp.). In 1932 geologist Suhov I. discovered here a tooth of mastodon, then a whole layer of fossils of various mammals (Suhov 1935, 1967). Later, paleontological materials from “Valea Cotofenei” dale were investigated by other specialists.

Source: http://www.ieg.asm.md/sites/default/files/Rapa_Cotofana_MNGP.pdf
Figure no. 39. Forest near Gura Galbenei Village were is localised Coțofana Cliff

As a result of fossils research of meotian deposits from Coțofana Cliff was found a rich complex of mammals: *Lagomorpha-Leporinae,* tiger *Mahairodus*, mastodon *Mammut borsoni*, hiparion *Hipparion moldavicum*, rhino polled *Chilotherium Schlosser* boar *Microstonyx major*, deer *Cervavitus variabilis*, giraffe *Helladotherium duvernoyi,* etc.

The fauna complex of this paleontological site may be attributed to fauna complex hiparion type turolian in Western Europe, showing a deep interest for biostratigraphic correlations deposit nu only of meoţiene deposit, but also those from neighboring regions.

5.2.1.1.7 Ialoveni District

5.2.1.1.7.1 Cărbuna Landscape Reserve

The Cărbuna landscape reserve is located in the central part of the country, at 35 km south of Chişinau, within Codrilor Plateau, Ialoveni District. The protected area covers 607 hectares and is owned by State forestry Cimişlia.

The core area is located at the boundary of two areas - forest steppe and steppe: terraced steppe plains region of the Lower Dniester and plateau Codrilor region.

The reserve has a great interest in terms of vegetation and habitats diversity. Here is the contact area of Central-European forests with sub–Mediterranean forests. In Carbuna Reserve predominates Holm (*Quercus petraea*), the tall and fluffy oaks (Q*uercus robur and Quercus pubescens*), Ash (*Fraxinus excelsior*) and Acacia (*Robinia pseudacacia*). On small surfaces are spread conifers, linden and birch. Privet shrubs are represented by Wood Itchy (*Ligustrum vulgare*), Rosehip (*Rosa canina*), Blackthorn (*Prunus spinosa*) and Hawthorn (*Crategus curvisepala*). The coatings of herbal plants are quite varied, being found

representatives of Balkan-Mediterranean flora, including Motley Tulip (*Fritillaria meleagris*), Stagber Weed (*Corydalis cava*), Bulgarian Onion (*Nectaroscordum bulgaricum*) and Pasqueflower Woolly (*Digitalis lanata*). It is common ivy that clings to tree stems up to 9m high. Near the Zloti village was kept an evergreen sector with hornbeam. The area between the Zloti and Carbuna villages is unique in Republic of Moldova where it meets European Hornbeam (*Carpinus betulus*), characteristic of the Mediterranean region.

The rare and characteristic plant and animal species within the Cărbuna landscape reserve, listed in Republic of Moldova Red Book 3rd edition and in the IUCN Red List are presented in Annex 5.

The plant and animal species classified as endangered (EN), critically endangered (CR) and vulnerable (VU) are as follows:

- Republic of Moldova Red Book:
  - *Endangered:* Oriental Hornbeam *(Carpinus orientalis Mill.)*, Service Tree *(Sorbus domestica L.)*, *Serratula coronata L., Ornithogalum boucheanum Kunth, Stipa dasyphylla Lindem, Stipa tirsa Stev.,* Click Beetles *(Elater ferrugineus L.)*, Common European Viper *(Vipera berus L.)*, Hazel Snake *(Coronella austriaca Laur.),* European Honey Buzzard *(Pernis apivorus L.)*, Nathusius' Pipistrelle *(Pipistrellus nathusii Keyserling & Blasius);*
  - *Critically endangered:* Grecian Foxglove *(Digitalis lanata)*, Eremogone Rigida *(Eremogone rigida Bieb. Fenzl)*, Casey's Larkspur *(Delphinium fissum Waldst. et Kit.)*, Lesser Spotted Eagle *(Aquila pomarina Brehm.)*, Stock Dove *(Columba oenas L.),* Parti-coloured Bat *(Vespertilio murinus L.)*;
  - *Vulnerable:* Mottled Tulip *(Fritillaria meleagris Hoppe)*, Bulgarian Onion *(Nectaroscordum bulgaricum Janka)*, *Chrysopogon gryllus L*, *Securigera elegans Panc.*, Bellevalia Sarmatica *(Bellevalia sarmatica Georgi Woronow),* Stag Beetle *(Lucanus cervus (L.)*, Southern Festoon *(Zerynthia polyxena Den. et Sch.)*, Mahaon Buterfly *(Papilio machaon L.),* Grey Long-eared Bat *(Plecotus austriacus Fischer)*, Daubenton's Bat *(Myotis daubentonii Kuhl)*, European Wildcat *(Felis silvestris Schreber)*, European Pine Marten *(Martes martes L.)*, Kuhl's Pipistrelle *(Pipistrellus kuhlii Kuhl);*
- IUCN Red List: two bird species are classified Turtledove (*Streptopelia decaocto*L.) as vulnerable and Yellowhammer (*Emberiza citrinella* L.) as endangered; the Common European Viper (*Vipera berus*) is classified near threatened.

5.2.1.1.7.2 Molesti-Răzeni

The Molesti-Răzeni natural forest reserve is located in the central part of the country, Ialoveni district, 35 km south of Chisinau, within Cogâlnicului Middle Plateau. The topography of the area is the watershed of rivers and hillsides bordering Schinoasa and Botnişoara rivers with little impact of anthropogenic processes and an average impact of natural processes.

The Moleşti-Răzeni protected area is an area of fundamental natural forest with stands of Sessile Oak (*Quercus petraea*). Category of forestry systems is sessile oak, oak and beech in central Republic of Moldova. The Molești-Răzeni protected area belongs to forest district, Răzeni forest enterprises.

Source: http://www.gradinabotanica.asm.md/en/node/65

Figure no. 40. Sessile oak with linden and ash forest (left) and sessile oak with smoketree (right)

The Molești-Răzeni protected area is located on a plateau from which descends the slopes with an exhibition Northeast and exhibition southwest, intersected by valleys. The altitude varies between 145 - 255 m and the soil is forest gray.

In the Molești-Răzeni protected area 18 trees species were found. In stand prevails Sessile Oak (*Quercus petraea*). In the depressions were recorded small areas with Oak *(Quercus robur*). The spred of linden (*Tilia tomentosa, Tilia cordata*) and Ash (*Fraxinus excelsior*) is higher especially on plains.

The Molești-Răzeni protected area includes a genetic backgound consisting of 200 vascular plant species, of which 18 trees species, 13 shrub species and 169 herbs species.

The rare and characteristic plant and animal species within the Moleşti-Răzeni area, listed in the Republic of Moldova Red Book 3rd edition and in the IUCN Red List are presented in Annex 5.

The plant and animal species classified as endangered (EN), critically endangered (CR) and vulnerable (VU) are as follows:

- Republic of Moldova Red Book:
  - *Endangered:* Solitary Bee *(Rhophitoides canus Eversm.)*, Hazel Snake *(Coronella austriaca Laur.)*, Common European Viper *(Vipera berus L.),* European Honey Buzzard *(Pernis apivorus L.);*
  - *Critically endangered:* Lesser Spotted Eagle *(Aquila pomarina Brehm.)*, Stock Dove *(Columba oenas L.)*;
  - *Vulnerable:* Stag Beetle *(Lucanus cervus L.)*, Southern Festoon *(Zerynthia polyxena Den. et Sch.)*, Clouded Apollo *(Parnassius mnemosyne L.),* European Fire-bellied Toad *(Bombina bombina L.)*, Common Toad *(Bufo bufo L.)*, Agile Frog *(Rana dalmatina Bonaparte)*, Speckled Ground Squirrel *(Spermophilus suslicus* Guld.);

IUCN Red List: Turtledove (Streptopelia turtur L.) is classified as vulnerable and Yellowhammer (Emberiza citrinella L.) is classified as endangered.

5.2.1.1.7.3 Moleşti

The Moleşti natural forest reserve, located in Ialoveni District, 2 km south of the Moleşti village, occupies an area of 5 hectares and includes forestry Răzeni, Villa Moleşti - Răzeni, plot 11, subplot 1; plot 12, subplot 3.

5.2.1.1.7.4 Costeşti outcrop

The Costeşti geological and paleontological monument of nature is located at north part of the Costeşti village, on the left coast of Botna River valley, near the road to Mileştii Mici. The surface of protected area is 1 ha.

5.2.1.2 Ramsar Sites

In Republic of Moldova there are three wetlands of international importance (Lower Prut Lakes, Nistru de Jos River and Unguri-Holoşnita), located far away from the Project area and therefore not affected by the construction or operation of the Project.

5.2.1.3 Important Bird Areas

Important Bird Areas (IBA) is a joint effort worldwide to maintain a favourable state of bird populations and their habitats.

To be declared Important Bird Areas must meet the following conditions:

- Host significant effects of one or more globally threatened species.
- To form part of a series of areas that contains a wide range of species with restricted distribution.
- Host particularly large flocks of migratory birds or gregarious.

The first inventory of Important Bird Areas by Birdlife International was launched in 1989 and is an effective way to identify conservation priorities in important areas for birds. Program accepted by the EU as being of great importance for the conservation and protection of wild birds and habitats, it is used for management actions on those important areas for nesting, migration, feeding and wintering bird populations.

Source: Birdlife International (2017) Important Bird Areas factsheet: Bazinul Tărăclia.

Figure no. 41. Important Bird Areas in Republic of Moldova recognized in 2000 by Birdlife International

In 2000 Birdlife International recognizes 12 sites in Republic of Moldova as IBA (Figure 46). Due to a deficiency of data available on the ecology of many species of birds, as well as reduced funding programs for research and monitoring, the project "Monitoring of Important Bird Areas in the Republic of Moldova to improve conservation management" ("Monitoring Important Bird Areas in Republic of Moldova to Improve Conservation Management") had been initiated. As a result, BirdLife recognizes 11 importance Bird areas (Figure 42).

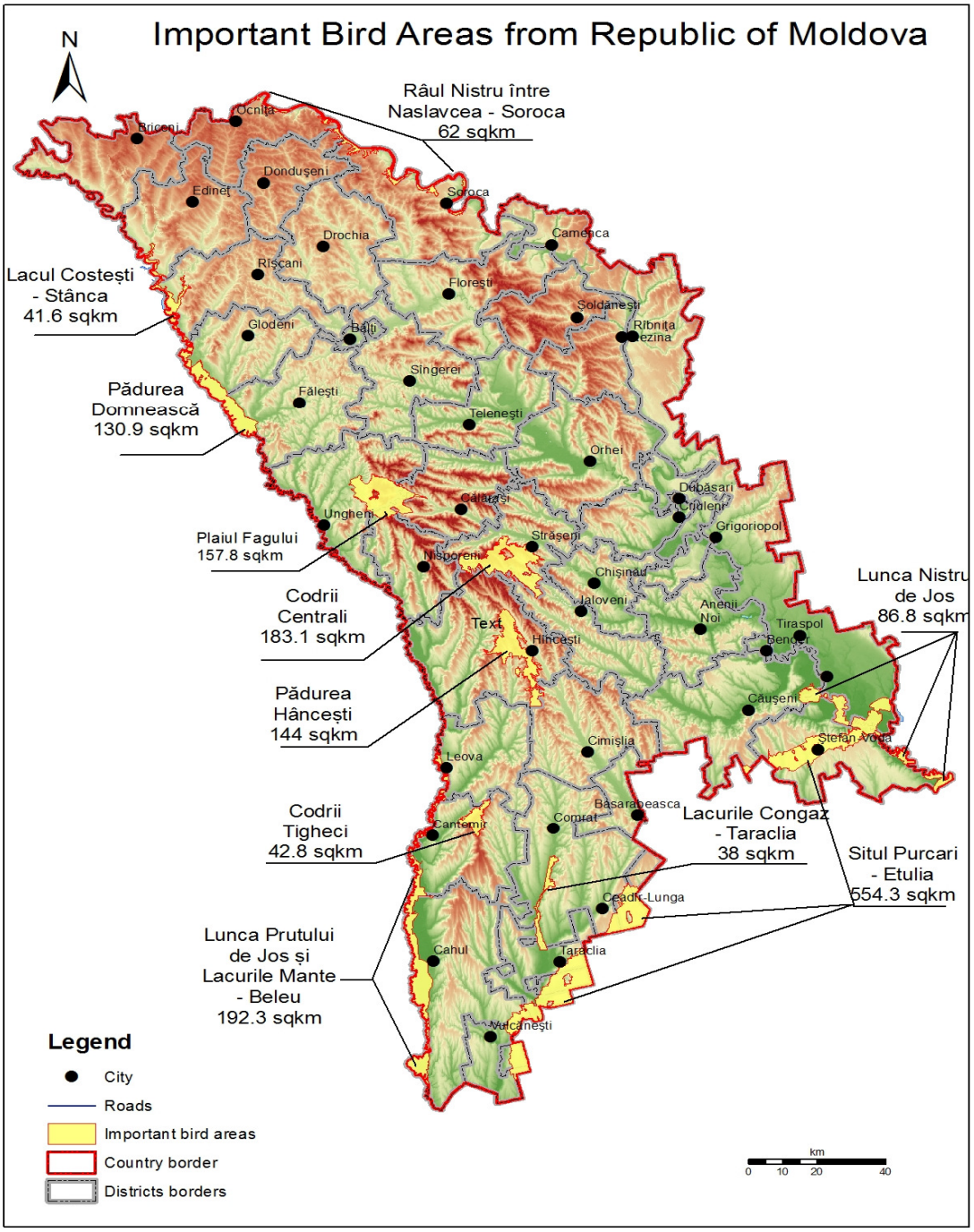


Figure no. 42. New Important Bird Areas in Republic of Moldova by BirdLife International

From the 11 important bird areas, IBA site Purcari - Etulia is intersected by the OHL (Annex 4). This site is the largest of all IBA, having an area of 19228 ha, MD009 code is recorded. The IBA is located in the south of Republic of Moldova and includes the mainly agricultural land (Table 18).

Table no. 18. Habitat structure in IBA Purcari – Etulia

Habitat type	Area (ha)
Aquatic	899.5
Arable land	43750.8
Artificial	1503.4
Meadows	4488.8
Forest	2879.9
Vineyards	1495
Orchards	140.3
Missing data	48.6

The Purcari - Etulia site is the most important nesting site for several species, particularly for the falcon (Falco cherrug), endangered by IUCN criteria (Endangered), and the trend is decreasing population. This species is included in the latest edition of the Red Book of Republic of Moldova (2015).

Purcari - Etulia area includes the steppe agricultural fields where they are predominantly non-intensive agriculture.

The site was included in the list of sites IBA according to several criteria (Table 19)

Table no. 19. The criteria and classifying species for Purcari - Etulia site in IBA list

No.	Name of species	Number of pairs / individuals	Status	IBA Criteria	SPEC	Red Book of Moldova
1	Saker Falcon (*Falco cherrug*)	5-9p	Nesting	B2	1	CR
2	Red-footed Falcon (*Falco vespertinus*)	30-40	Nesting	B2	3	VU
3	European Roller (*Coracias garrulus*)	20-30p	Nesting	B2	2	VU
4	Red-backed Shrike (*Lanius collurio*)	250-300	Nesting	B2	3	NA
5	Lesser Grey Shrike (*Lanius minor*)	150-180p	Nesting	B2	2	NA
6	Barred Warbler (*Sylvia nisoria*)	20-35p	Nesting	B2	N	NA
7	Long-legged Buzzard (*Buteo rufinus*)*	2-5p	Nesting	B2	3	NA
8	Ortolan Bunting (*Emberiza hortulana*)	50-60p	Nesting	-	2	NA
9	Western Marsh-harrier (*Circus aeruginosus*)	7-10p	Nesting	-	N	NA
10	Eurasian Hobby (*Falco subbuteo*)	8-10p	Nesting	-	N	NA

Legend:

P - pairs, CR - critically endangered, VU - vulnerable NA - Not evaluated (no data)

SPEC - Species of European conservation interest (Species of European Conservation Concern)

* New breeding species for Republic of Moldova (Baltag and Ajder 2011)

Another site encompassed in the list of Important Avifaunistic Areas which is not intersected by OHL, but is at a distance of about 100 m from the latter. IBA website is called "Lakes Congaz-Tărăclia", it covers an area of 3804 ha and habitats that dominate this site are the aquatic and meadows, and the opposite can highlight small size artificial habitats or forest (Table 20). The site is registered with MD008 code and the combination of aquatic habitats of steppe areas with large areas of meadows provides a good passage during migration, but also a good place for nesting of many species.

Table no. 20. Structure IBA habitats Lakes Congaz – Tărăclia

Habitat type	Area (ha)
Aquatic	1292.5
Arable land	315.8
Artificial	72.2
Meadows	2123
Forest	0
Vineyards	0.8

The Lakes Congaz - Tărăclia was included as IBA site based on the following criteria (Table 21).

Table no. 21. Structure IBA habitats Lakes Congaz – Tărăclia

No.	Name of species	Number of pairs / individuals	Status	IBA Criteria	SPEC	Red Book of Moldova
1	Red-footed Falcon (*Falco vespertinus*)	10-16p	Nesting	B2	3	VU
2	Ruddy Shelduck (*Tadorna ferruginea*)	1-3p	Nesting	B2	3	VU
3	Ortolan Bunting (*Emberiza hortulana*)	70-90	Nesting	B2	2	
4	Eurasian Hobby (*Falco subbuteo*)	1-3p	Nesting		N	
5	Red-backed Shrike (*Lanius collurio*)	50-60p	Nesting		3	
6	Lesser Grey Shrike (*Lanius minor*)	25-40p	Nesting		2	
7	Tundra Swan (*Cygnus columbianus*) *	8-14i	Wintering		3W	
8	Whooper Swan (*Cygnus cygnus*)	6-8i	Migratory, wintering		N	VU
9	European Roller (*Coracias garrulus*)	8-12p	Nesting		2	
10	Barred Warbler (*Sylvia nisoria*)	16-24p	Nesting		N	
11	Western Marsh-harrier (*Circus aeruginosus*)	3-8p	Nesting		N	
12	Long-legged Buzzard (*Buteo rufinus*)	1-3p	Nesting		3	
13	Peregrine Falcon (*Falco peregrinus*)	1-2i	Nesting		N	CR
14	Black Stork (*Ciconia nigra*)	2-8i	Migratory		2	CR

No.	Name of species	Number of pairs / individuals	Status	IBA Criteria	SPEC	Red Book of Moldova
15	White-tailed Sea-eagle (*Haliaeetus albicilla*)	2-4i	Migratory		1	CR
16	Pied Avocet (*Recurvirostra avosetta*)	300-400i	Migratory		N	VU
17	Stilt Sandpiper (*Himantopus himantopus*)	30-60i	Migratory		N	VU
18	Red-breasted Goose (*Branta ruficollis*)	5-10i	Migratory, wintering		1W	VU
19	Ruff (*Philomachus pugnax*)	160-200i	Migratory		2	
20	Arctic Loon (*Gavia arctica*)	4-8i	Wintering		3	
21	Osprey (*Pandion haliaetus*)	2-4i	Migratory		3	CR

Legend:

P - pairs. I - individuals

CR: critically endangered; EN: endangered; VU: Vulnerable species; NT: Almost endangered species; LC: not at risk disappearance species.

SPEC - Species of European conservation interest (Species of European Conservation Concern)

* Species new to Republic of Moldova (Ajder et al. 2014)

According to the information available on Bird Life, the Lakes Congaz – Tărăclia reservoir is an important stop –over site for the following passage water birds:

- Pygmy Cormorant (*Phalacrocorax pygmeus* Pall.*),* classified in the Republic of Moldova Red Book as Critically Endangered (CR);
- Great White Pelican (*Pelecanus onocrotalus* L.), classified in the Republic of Moldova Red Book as Critically Endangered (EN) and in the IUCN Red List as Least Concern (LC);
- Dalmatian Pelican (*Pelecanus crispus*), classified in the Republic of Moldova Red Book as Critically Endangered (CR) and in the IUCN Red List as Vulnerable (VU);
- Mute Swan (*Cygnus olor*), classified in the Republic of Moldova Red Book as Vulnerable (VU) and in the IUCN Red List as Least Concern (LC);
- Eurasian Oystercatcher (*Haematopus ostralegus*), classified in the Republic of Moldova Red Book as Vulnerable (VU) and in the IUCN Red List as Near Threatened (NT);
- Stilt (*Himantopus himantopus*), classified in the Republic of Moldova Red Book as Vulnerable (VU) and in the IUCN Red List as Least Concern (LC);
- Pied Avocet (*Recurvirostra avosetta* L.), classified in the Republic of Moldova Red Book as Vulnerable (VU) and in the IUCN Red List as Least Concern (LC).

5.2.1.4 Emerald network

With ratification in 1993 of the Bern Convention on the Conservation of European Wildlife and Natural Habitats (1979), Republic of Moldova undertook the obligation, in line with the other EU Member States, to participate actively inthe ensuring of natural habitats conservation, spontaneous flora and fauna, including the migratory species on the way of disappearance.

The Emerald network is based on the same principles as Nature 2000 network, representing its extension for non-EU countries. The candidate Emerald sites within the OHL survey corridor are presented in the following table.

Table no. 22. Candidate Emerald Sites within the OHL survey corridor

Emerald Sites	Surface (ha)	Distance to OHL route	Observation
MD0000016 Bugeac Steppe	49,610.00	200 m to 7 km	**Cover the following areas:** **- State protected area/multifunctional areas:** Bugeacului North (Dezghingea) Steppe Sector, Bugeacului North Steppe Sector, Bugeacului South Steppe Sector - **IBAs:** MD008 Congaz-Taraclia Lakes, MD009 Purcari-Etulia (partial overlapped).
MD0000019 Hîncești Forest	11,350.00	6 – 8 km	**Cover the following areas:** **- State protected area:** Hîncești Forest and Caracui Villa - **IBAs:** MD010 Hîncești Forest
MD0000009 Tigheci Forests	6,466.00		**Cover the IBA:** Tigheci Forests

5.2.1.5 The National Ecological Network of Republic of Moldova

The National Ecological Network of Republic of Moldova, established by *Decision no. 593/2011 on the approval of the National Program to create the national ecological network for the period 2011 - 2018* was founded to contribute to the conservation of biological and landscapes diversity by including all of natural ecosystems, physically and functionally merge for establishing an ecological balance. This network includes the following functional elements[9]:

- *Core areas:* areas with special value for the conservation of habitats, species and landscapes;

[9] Law no. 94 from 05.04.2007 on the ecological network

- *Ecological corridors:* linear diffuse elements that assures the functional and terrestrial connections between the network's ecological elements, as well as their integrity at large scale;
- *Buffer areas*: areas that protect the core area or have a particular importance to maintain the geosystemic equilibrium; the buffer areas may be: protective buffer area, geosystemic buffer area;
- *Ecological restoration areas:* areas subject to ecological restoration and/or geomorphological (reforestation, restoration of vegetation cover, re-cultivation) as part of the future element of the ecological network.

The Project's location compared to planned ecological corridors and core areas is presented the following figure.

Source: National ecological network and OHL route, Biotica Ecological Society

Figure no. 43. Project's location and planned ecological corridors and core areas

As is seen in Figure 43, the OHL route crosses two planned national ecological corridors, in the north of the core area Dezghingea - Bugeac steppe, respectively, in the north of the core area Moleşti – Răzeni. Also passes nearby the following planned core areas:

- Core area *Muşaitu Cliff*, that includes the Muşaitu Cliff geological and paleontological monument of nature, presented in chapter 5.2.1.2.1, situated at approx. 2.75 km from the OHL route;
- Core area *Tărăclia Reservoir*, situated at approx. 1.9 km from the OHL route;
- Core area *Congaz Reservoir*, situated at approx. 3.96 km from the OHL route;
- Core area *Comrat Reservoir*, situated at approx. 3.17 km from the OHL route;
- Core area *Dezghingea-Bugeac Steppe*, that includes the North Bugeac steppe (Dezghingea) protected area, presented in chapter 5.2.1.4.2, situated at approx. 3.45 km from the OHL route;
- Core area *Cărbuna*, that includes the protected area Cărbuna, presented in chapter 5.2.1.6.2, situated at approx. 10.20 km from the OHL route;
- Core area *Moleşti - Răzeni*, that includes the protected area Moleşti – Răzeni, presented in chapter 5.2.1.6.3 situated at approx. 6.15 km from the OHL route.

As noted, some of the core areas include the protected areas already characterized in the previous sections; the protected species within the rest of the core areas are presented in Annex 6.

5.2.2 Bird species in the Project area

As a consequence of its geographical setting, Republic of Moldova assures the condition for 276 bird species, of which 5 are vulnerable and 5 are critically endangered at international level, according to IUCN Red Book.

Republic of Moldova is crossed by Sarmatic, Pontic and East-Elbic flyways, the main East European migration corridor for birds. Because of the overlapping of the migration ways in the the Southern part of Republic of Moldova, the abundance of bird species is very high (Figure 44). Also, during the winter, the lakes offers good food and resting conditions for approximately 23 bird species and over 40,000 individuals/year.

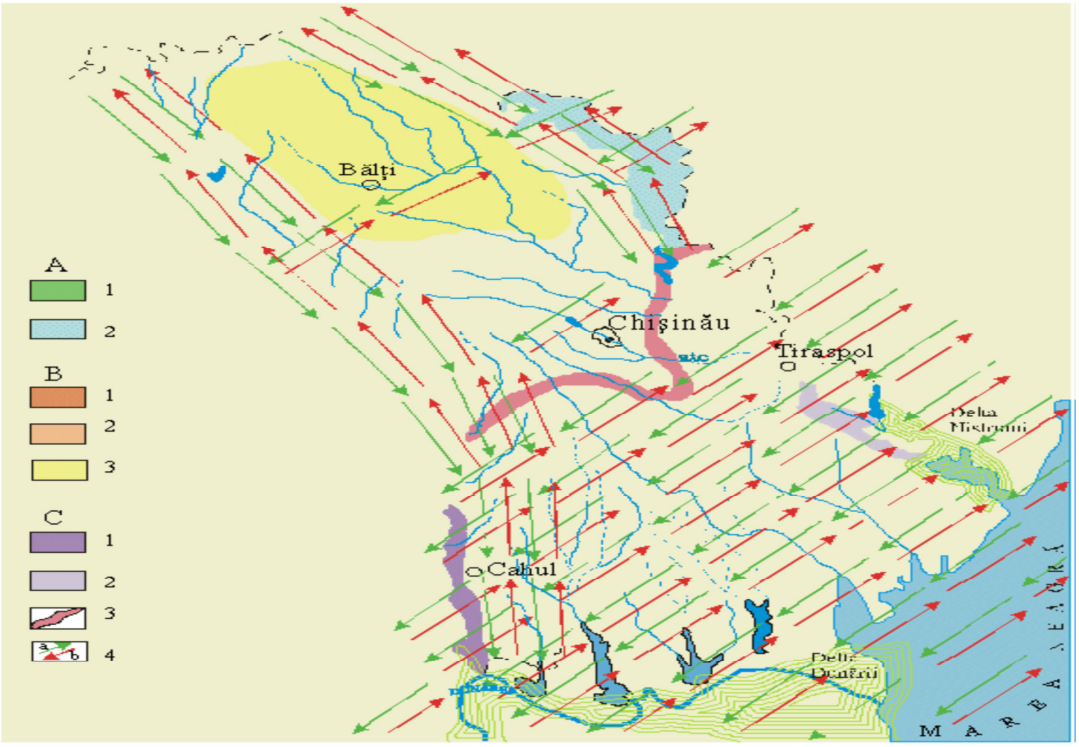


Figure no. 44. Migration ways

Legend:
A – Steppic forests areas: 1 – Codrii, 2 – Rîbnița;
B – Continental steppes areas: 1 – Bugeac, 2 – Tiraspol, 3 – Bălți;
C – Overlapped areas: 1 – Lower Prut, 2 – Lower Nistru, 3 – Border area, 4 – migration ways: a) autumn, b) spring.

The proposed OHL route mostly crossed the agricultural lands and grasslands, but also some areas with important habitats for bird species – lakes, slopes, continental steppes, forest belts etc. For this reason, the impact assessment was focused on a large area of 10 km on both sides of the OHL route, taking into consideration the natural protected areas occurred on this surface and the requirement of migratory bird species.

In the Table no. 23 are presented the species/habitats of conservative interest from the occurred in the Project area.

Table no. 23. Species/habitats of conservative interest from the designated and candidate natural protected areas

Category	Code and/or name	Species/habitats of conservative interest
Natural Protected Areas		
Geological Monument of Nature (MNGP)	Ialpug Valley	Situated at 4 km North of Comrat city, on the left side of the Ialpug River is considered geological and paleontological site of Upper Miocene in Southern Republic of Moldova, requiring further scientific research.
Multifunctional area (AMMSRVS)	Bugeacului North (Dezghingea) Steppe Sector	This area is included in Emerald area MD0000016 Bugeac Steppe. The continental steppes situated at 3.45 km from the OHL route host seven summer visitor species, but these are not birds that can be affected by the Project.

Category	Code and/or name	Species/habitats of conservative interest
Multifunctional area (AMMSRVS)	Bugeacului North Steppe Sector	This area is included in Emerald area MD0000016 Bugeac Steppe. In this area there are nesting 18 bird species, another 5 species are migratory, 12 species are seen in short flights for feeding (trophic migration in the summer); the characteristic species are: Quail (*Conturnix conturnix* L.*),* Grey Partridge *(Perdix perdix* L.*),* Ring-necked Pheasants *(Phasianus colchicus* L.*),* Cuckoo (*Cuculus canorus* L.*),* Common Hoopoe (*Upupa epops* L.*),* Crested Lark (*Galerida cristata* L.*),* Eurasian Skylark *(Alauda arvensis* L.*),* Tawny Pipit *(Anthus campestris* L.*),* White Wagtail *(Motacilla alba* L.*),* Great Whinchat *(Saxicola rubetra* L.*),* Red-backed Shrike *(Lanius collurio* L.*),* Greenfinch *(Carduelis chloris* L.*),* Goldfinch *(Carduelis carduelis* L.*),* Corn Bunting *(Miliaria calandra* L.*),* Hen Harrier *(Circus cyaneus* L.*).*
Geological Monument of Nature (MNGP)	Fossil site near to the Moscow village	Scientific interest for fossils of representatives and characteristics species of fauna Moldavian complex, namely: Rabbit (*Alilepus lascarevi)*, Pika (*Ochotona antiqua)*, Blindly (*Nannospalax macoveii)*, Kowalski Mouse (*Pliomys kowalski)*, Flying Squirrel (*Pliopentaurista Moldaviensis)*, Alexeev Camel (*Paracamelus alexejevi*), etc.
Geological Monument of Nature (MNGP)	Tartaul Cliff	The outcrop is considered as a reference geological site with etulia clay and a layer of raw coal with sulphur crystals. There are several main sources of drinking water.
Forestry Natural Reserve (RNS)	Bolgrad Highschool	There are forests situated at 10.00 km from OHL route, with stand-natural valuable fundamental Downy Oak (*Quercus pubescens*) and Grey Oak (*Quercus pedunculiflora*), characteristic for forests in Southern Republic of Moldova. There are 82 species of vascular plants, (4 tree species, 10 shrub species and 68 herbaceous plant species). The importance of this area is given by the presence of rare species such as Rabbit Shadow (*Asparagus tenuifolius*) and Periwinkle (*Vinca herbacea*) and a geographical variation of the *Dictamnus gymnostylis* Stev, classified in Republic of Moldova Red Book as endangered species.
Monument of Nature - botanical or forestry interest (MNBSRVS)	Borceag	Forest habitats situated at 1.85 km from OHL route, including the dominant species of Oak (*Quercus pubescens*) with 0.63 density and Grey Oak (*Quercus pedunculiflora*) with 0.48 density, reaching the age of 60-70 years. Also, is noted Ash (*Fraxinus excelsior*) for about 30 years and 0.06 density. Among bushes is highlight Rosehip (*Rosa canina*), Hawthorn (*Crataegus curvisepala*), Blackthorn (*Prunus spinosa*), etc.
Geological Monument of Nature (MNGP)	Mușaitu Cliff	The area is in Mușaitu village, on the right slope of Salcia Mare River. The main criteria for declared as monument of nature are the Pontian marine clay deposits with fruits, seeds and leaves fossilized footprints of various plants and brown coal lenses. Above these deposits is a layer of clay brown-red followed by *Pictris Carpathian* alluviums. These alluviums dating from lower Pliocene and contain skeletal remains of freshwater molluscs and valuable vertebrate specific to Moldavian fauna complex: Snake (*Viper kucurganica)*, Ostrich (*Struthio sp.*), Monkey (*Ruscinensis cf. Dolicopithecus),* Flying Squirrel (*Pliopentaurista Moldaviensis)*, *Promimomys moldavicus*, Mastodon (*Mammut borsoni)*, Boar Pond *(Propotamochoerus provincialis)*, Antelope (*Parable boodon)*, etc.
Geological Monument of Nature (MNGP)	Budăi Cliff	The area is located on the western outskirts of the Budăi village, Tărăclia District, on the right bank of the Salcia Mare River. The main criteria for which the site of Budai Ravine was declared as a geological and paleontological monument of nature are the lower Pliocene alluvial deposits containing old skeletal remains of reptiles and mammals, among which: Smooth Snake (*Coronella austriaca)*,

Category	Code and/or name	Species/habitats of conservative interest
		Monkey (*Dolicopithecus cf. Ruscinensis)*, Climber Rabbit (*Pliopentalagus moldaviensis)*, Beaver (*Trogontherium cf. Minus)*, Micromamammal (*Promimomys moldavicus)*, Mastodonts (*Mammut borsoni* and *Anancus arvernensis)*, Deer (*Procapreolus cusanus)*, etc.
Multifunctional area (AMMSRVS)	Bugeacului South Steppe Sector	This area is included in Emerald area MD0000016 Bugeac Steppe. The area is important for the following birds: *Accipiter gentilis, Accipiter nisus, Buteo buteo, Falco tinnunculus, Coturnix coturnix, Phasianus colchicus, Merops apiaster, Upupa epops, Athene noctua, Asio otus, Picus canus, Dendrocopos major, Turdus merula, Turdus philomelos, Corvus corax, Pica pica, Garrulus glandarius, Pernis apivorus, Circaetus gallicus, Circus cyaneus, Circus pygargus, Aquila pomarina, Aquila chrysaetos, Hieraaetus pennatus, Falco cherrug.* Continental steppes are situated at 1.00 km from the project' area, the vegetation being represented by the smooth-stalked Meadowgrass *(Poa angustifolia)*, Common Agrimony (*Agrimonia eupatoria),* Dropwort (*Filipendula vulgaris), C*hicory *(Cichorium intybus)*. Fescue occupies most of the steppe and is found on North and North-East slopes (*Festuca valesiaca, Salvia nutans, Poterium sanguisorba, Euphorbia stepposa*, etc.) and barnyard grass on steep slopes, with eroded and damaged landslides.
Monument of Nature - botanical or forestry interest (MNBSRVS)	Cîietu	The forest situated at 9.15 km from the OHL route is a sector with century-old specimens of oak (*Quercus robur*).
Geological Monument of Nature (MNGP)	Coțofana Cliff	The fauna complex of this paleontological protected area may be attributed to fauna complex hiparion type Turonian in Western Europe. There were founded a rich complex of mammals: *Lagomorpha-Leporinae,* tiger *Mahairodus*, mastodon *Mammut borsoni*, hiparion *Hipparion moldavicum*, rhino polled *Chilotherium Schlosser* boar *Microstonyx major*, deer *Cervavitus variabilis*, giraffe *Helladotherium duvernoyi,* etc.
Forestry Natural Reserve (RNS)	Caracui Villa	This area is included in Emerald area MD0000019 Hînceşti Forest. The forest situated at 8.40 km from the project' area is dominated by oak species (*Quercus pubescens*). There were recorded Maple Tartar (*Acer tataricum*), Cherry (*Cerasus avium*), Ash (*Fraxinus excelsior*) and Acacia (*Robinia pseudacacia*). Through the shrubs species predominant are Hawthorn (*Crataegus curvisepala*), Wood Itchy (*Euonymus verrucosa*), Privet (*Ligustrum vulgare*), Spindle (*Euonymus europaea*), etc.
Landscape reserve (RP)	Cărbuna	Located in the central part of the country, at 35 km south of Chișinău, within Codrilor Plateau, the reserve has a great interest in terms of vegetation and habitats diversity (forest steppe and steppe) and not represents an important area for targeted bird species.
Forestry Natural Reserve (RNS)	Moleşti - Răzeni	Situated at 6.15 km from OHL route, Moleşti – Răzeni is an area of fundamental natural forest dominated by Sessile Oak (*Quercus petraea*). There are recorded 49 bird breeding species, 5 summer visitor and 8 migratory, as follows: Northern Goshawk (*Accipiter gentilis*), Eurasian Sparrowhawk (*Accipiter nisus*), Ratter (*Buteo buteo*), Kestrel (*Falco tinnunculus*), Turtledove (*Streptopelia decaocto*), Cuckoo (*Cuculus canorus*), Long-eared Owl (*Asio otus*), European Nightjar (*Caprimulgus europaeus*), Common Hoopoe (*Upupa epops*), Eurasian Wryneck (*Jynx torquilla*), Great Spotted Woodpecker (*Dendrocopos major*), Little Spotted Woodpecker (*Dendrocopos minor*), European Robin

Category	Code and/or name	Species/habitats of conservative interest
		(*Erithacus rubecula*), Thrush Nightingale (*Luscinia luscinia*), Common Redstart (*Phoenicurus phoenicurus*), Song Thrush (*Turdus philomelos*), Common Blackbird (*Turdus merula*), Eurasian Blackcap (*Sylvia atricapilla*), Common Chiffchaff (*Phylloscopus collybita*), Eurasian Blue Tit (*Cyanistes caeruleus*), Great Tit (*Parus major*), Red-backed Shrike (*Lanius collurio*), Eurasian Magpie (*Pica pica*), Jay (*Garrulus glandarius*), Raven (*Corvus corax*), Hooded Crow (*Corvus cornix*), Common Starling (*Sturnus vulgaris*), Common Chaffinch (*Fringilla coelebs*), Greenfinch (*Carduelis chloris*), Hawfinch (*Coccothraustes coccothraustes*), Yellowhammer (*Emberiza citrinella*); among the ***rare species*** are found: European Honey Buzzard (*Pernis apivorus*), Lesser Spotted Eagle (*Aquila pomarina*.) and Stock Dove (*Columba oenas*).
Forestry Natural Reserve (RNS)	Moleşti	Forest habitats situated at 6.15 km from the OHL route.
Geological Monument of Nature (MNGP)	Costeşti Outcrop	Geological monument of nature located on 1 ha in the North part of the Costeşti village, on the left coast of Botna River valley, near the road to Mileştii Mici.
Important Bird Areas		
Important Bird Area	MD009 Purcari-Etulia	This is one of the most important area for *Falco cherrug.* Other breeding species are *Falco vespertinus, Buteo buteo, Circus aeruginosus, Falco subbuteo, Coracias garrulus.* The OHL route intersects the MD009 Purcari-Etulia at Jujnoi (tower 18). No potential negative on breeding habitats have been found, but cca.1.443 m^2 of the feeding habitats will be lost because the set-up of the 18 voltage poles. This loss will not affect the birds' populations and the integrity of IBA.
Important Bird Area	MD008 Congaz-Taraclia	Stop-over site for the following passage waterbirds: *Haliaeetus albicila, Falco subbuteo, Buteo rufinus, Pandion haliaetus, Cygnus columbianus, Cygnus cygnus, Coracias garrulus, Ciconia nigra, Branta ruficollis, Gavia arctica.* Breading place for ***Tadorna ferruginea*** and *Falco vespertinus.* There are predominant wetlands and meadows and some small forests. The OHL route is parallel with the site along 35 de km. The Project will not affect the breeding habitats, but 9,200 m^2 of the feeding habitats of *Falco vespertinus, Falco subbuteo, Buteo ruffinus, Ciconia nigra, Branta ruficollis,* placed outside of the IBA can be losses. This loss will not affect the birds' populations and the integrity of IBA.
Important Bird Area	MD011 Tigheci Forests	Qualified as IBA under C6 criteria for *Dendrocopos syriacus, Lullula arborea, Ficedula parva* and *Ficedula albicollis.* The towers 257- 268 are parallel with the site.
Important Bird Area	MD010 Hîncești Forest	Qualified as IBA under C6 criteria for *Dendrocopos medius, Ficedula parva* and *Ficedula albicollis* and B2 criteria for *Lullula arborea.* The IBA is situated on the West of the OHL route at cca. 6 – 8 km between towers 390 – 446.
Emerald sites		
Emerald site	MD0000016 Bugeac Steppe	Cover the following areas: - State protected area/multifunctional areas: Bugeacului North (Dezghingea) Steppe Sector, Bugeacului North Steppe Sector, Bugeacului South Steppe Sector;

Category	Code and/or name	Species/habitats of conservative interest
		- IBAs: MD008 Congaz-Taraclia Lakes, MD009 Purcari-Etulia (partial overlapped). Besides Dimitrivca, the OHL route is parallel with this site by Vulcănești, at a variable distance between 200 m to 7 km and the area situated between towers 54 - 56 crossed the wetlands included in the site.
Emerald site	MD0000019 Hîncești Forest	Cover the following areas: - State protected area: Caracui Villa; - IBAs: MD010 Hîncești Forest. The Emerald site is situated on the West of the OHL route; the nearest distance (cca. 6 – 8 km) is between towers 390 - 446.
Emerald site	MD0000009 Tigheci Forests	Cover the IBA Tigheci Forests. The OHL route is parallel with the site; the nearest distance is between towers 257 - 268.

Taking into account the bird species occurred in Republic of Moldova, the data on habitats crossed by the power line project and the bibliographic data on power line impact on birds, firstly was selected the species of conservative interest that can be affected by the implementation of the project 400 kV OHL Vulcănești – Chișinău and secondly the species of non-conservative interest which appears to be subject to high numbers of collisions or electrocution in some regions/countries. The species and their legal status at international level are presented in **Annex 7**. A special attention has been done in the impact assessment to the bird species considered vulnerable (VU) and endangered (EN) according to IUCN.

5.2.3 Forest Fund

In Republic of Moldova, most of the national forest fund is owned by the state; in 2014, the total national forest area was 446.438 thousand ha, distributed as follows:

- Public property of the State: 362.094 thousand ha;
- Public property of the administrative-territorial units: 81.727 thousand hectares;
- Private property: 2.616 thousand hectares[10].

The forests structure is mostly hard and soft hardwood (353.6 thousand ha, respectively 16.9 thousand ha) and resinous (7.0 thousand ha)[11].

[10] Decision no. 432 of 06.09.2014 regarding the approval of the Land Cadastre as of 1 January 2014, **http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=353458**

[11] "Natural resources and environment in Republic of Moldova" National Bureau of Statistics of the Republic of Moldova

In terms of distribution of areas covered with forests there is a varied territorial grouping, the central region being the most covered by forests (60% of the space forestry), followed by the north (26% of the space forestry) and south districts (14% of forest area)[12].

In terms of the composition of forest areas, within the OHL survey corridor there are:

- In Hânceşti and Ialoveni districts, sessile oak forests with linden and ash, pubescent oak forests, oak forests with blackthorn and forestry plantations are present; also, within these districts the natural forest reserves Villa Caracui (chapter 5.2.1.5) Moleşti-Răzeni (chapter 5.2.1.6.2) and Moleşti (chapter 5.2.1.6.3) are located;
- In the south part, pubescent oak forests, forest plantations and floodplain forests (water meadows willow, poplar and oak) are present; also, within this part the natural forest reserve “Bolgrad Highschool” (chapter 5.2.1.1.3) are located.

The land crossed by OHL route is mainly agricultural, followed by land used for vineyards or orchards (see figure below). However, the transmission line crosses small areas of forests, protection belts, shrubs and groves areas.

[12] Decision regarding the strategy of Republic of Moldova to adapt to climate change by 2020 and the Action Plan for its implementation

Source: *http://geoportal.md/en/default/wms/private*

Figure no. 45. Republic of Moldova forests map within OHL survey corridor

5.3 Socio-economic environment

5.3.1 Administrative organization

Republic of Moldova is divided into thirty-two districts, three municipalities (Bălți, Chişinău, Bender) and two autonomous regions (ATU Găgăuzia and Transnistria). The cities of Comrat and Tiraspol, the administrative seats of the two autonomous regions, also have municipality status.

Furthermore, within the larger administrative organizations, Republic of Moldova has a total of 1,533 localities of which 55 localities have the status of city and -846 are villages with commune status. These 901 localities have their own mayor and local council. Another 632 villages are not large enough to have a separate administration, and are part of either cities or communes[13].

The proposed OHL route and the BtB substation are within the boundaries of the following districts/municipalities/regions (from South to North):

- Autonomous Territorial Unit (ATU) of Găgăuzia;
- Cahul District;
- Tărăclia District;
- Cantemir district (the district is included in the survey corridor but the OHL route does not cross it);
- Leova District:
- Cimişlia District;
- Hânceşti District;
- Ialoveni District;
- Chişinău Municipality.

The Project's involves modifications within the existing Vulcănești and Chișinău substations, the construction of BtB Vulcănești substation and the construction of a new 400 kV line transmission between the two substations.

The proposed OHL will be constructed in close vicinity to the Ukrainian border. The closest point between the project and the Ukrainian border is at Vulcăneşti substation where the

[13] Population statistics 2014 **http://www.statistica.md/category.php?l=en&idc=103&** (accessed 2016-09-19)

distance is about 800 meters. However, planned works in Vulcănești substation will be developed inside the substation enclosure (see reference no. 2).

5.3.2 Demographics

Demographic data described here include population, age distribution, ethnic makeup as well as literacy and education rates. Here information is provided both on a national level to give a background, as well as for affected districts areas.

5.3.2.1 Population

The total number of inhabitants in Republic of Moldova (January 2016) is approximately 3.5 million (excluding Transnistria), with 42.5 % living in urban areas and 57.5 % living in rural areas. Regarding gender, 52% of the total populations are women while 48% are men. Republic of Moldova has a large share (65 %) of its population in working age (15-56/61 years)[14] while 17 % of the total population are under working age (under 15 years) and 18% are over working age (over 57/62 years)[15]. Comparing urban and rural areas, there is a higher percentage of population under 15 years in rural areas (19%) than in urban areas (14.5%) while there is a higher percentage of population in working age in urban areas (67.5%) than in rural areas (63%). Percentage of population over working age is more or less same in both urban and rural areas (18%)[16]. Important to note is that the population in Republic of Moldova is slowly declining due to emigration, low fertility rate and ageing[17].

The number and structure of the population in the Project area are presented below, in Table no. 24.

Table no. 24. Population in the Project area

Name of District / Municipality	Number of inhabitants*	Rural / urban (%)*		Men/women (%)*		Urban of which men/women (%)*		Rural of which men/women (%)*	
ATU Găgăuzia	161,876	59	41	48	52	47	52	49	51
Cahul	124,647	68	32	48	52	46	54	49	51
Tărăclia	43,563	53	47	49	51	48	52	50	50
Cantemir	61,954	91	9	50	50	47	53	50	50
Leova	52,834	71	29	50	50	49	51	50	50
Cimişlia	60,069	76	24	49	51	48	52	50	50
Hânceşti	120,176	85	15	49	51	47	53	50	50
Ialoveni	101,331	84	16	49	51	48	52	50	50

[14] Working age is counted up to 62 years for men and 56 years for women.
[15] Population statistics 2016 **http://www.statistica.md/newsview.php?l=ro&idc=168&id=5210** (accessed 2016-09-19)
[16] Population statistics 2014 **http://www.statistica.md/category.php?l=en&idc=103&** (accessed 2016-09-19)
[17] Kinnunen, 2015 and Population statistics 2000-2016, **www.statistica.md/category.php?l=en&idc=103**

Name of District / Municipality	Number of inhabitants*	Rural / urban (%)*		Men/women (%)*		Urban of which men/women (%)*		Rural of which men/women (%)*	
Chișinău**	814,147	9	91	47	53	47	53	49	51
* January 1, 2016[18] ** The substation, situated in the South of Chișinău municipality, will not directly affect people in Chișinău city.									

The population density of the districts affected by the OHL route is relatively low as the population is predominately rural in most districts. Most affected districts have a low population density between 60 - 75 persons per sq. km (Cimişlia, Hânceşti, Leova, Cantemir and Tărăclia) to 75 - 90 people per sq. km (Cahul and ATU Găgăuzia) and 120 - 150 people per sq. km (Ialoveni). The most populated area along the route is Chișinău municipality (1,300 - 1,800 persons per sq. km). However, as the substation is situated in the South of Chișinău municipality, it will not directly affect people in most dense areas of Chișinău municipality (e.g. Chișinău city)[19].

5.3.2.2 Ethnicity/language

Moldovans are the largest ethnic group in Republic of Moldova as a whole (75.1%). Moreover, several other ethnic groups exist, where about 7.0% are Romanian, 6.6 % are Ukrainians, 4.1% are Russian, 4.6% are Găgăuz, 1.9% are Bulgarian, 0.3% are Roma and 0,5 % belong to other nationalities[20]. Looking at the affected districts they are not homogenous when it comes to ethnicity composition (Table no. 25).

[18] Population statistics 2016 **http://www.statistica.md/category.php?l=en&idc=103&** (accessed 2016-09-19)
[19] Population Density 2015 **http://www.statistica.md/public/files/Aplicatii/Harta_populatia/en/population.html** (Accessed 2016-09-19)
[20] Population Census 2014 **http://www.statistica.md/pageview.php?l=en&idc=479&** (Accessed 2017-05-17)

Table no. 25. Ethnicity composition of the population in municipalities/districts crossed by the proposed OHL

Name of District / Municipality	Moldovians (%)*	Romanians (%)*	Ukrainian (%)*	Russian (%)*	Găgăuz (%)*	Bulgarian (%)*	Roma (%)*	Other nationalities (%)*
ATU Găgăuzia	4.7	0.0	2.5	3.2	83.8	4.9	0.3	0.6
Cahul	71.3	11.6	4.9	4.6	2.7	4.1	0.2	0.6
Tărăclia	14.0	0.2	5.2	4.5	9.0	66.1	0.5	0.5
Cantemir	83.3	7.3	1.4	1.0	0.7	6.0	0.1	0.2
Leova	84.8	3.7	1.9	1.6	0.7	6.8	0.3	0.2
Cimişlia	84.7	4.0	4.9	3.7	0.4	2.0	0.1	0.2
Hânceşti	86.4	7.8	4.1	1.1	0.1	0.2	0.3	0.2
Ialoveni	85.9	11.0	0.9	0.8	0.1	0.8	0.1	0.2
Chişinău**	67.2	14.5	5.9	9.3	0.7	1.1	0.1	1.3

* Population census 2014[21]
** The substation is found in the very South of Chişinău and will not directly affect people in Chişinău city.

The languages usually used for communication in Republic of Moldova follows, to a large degree, the ethnicity composition in the country. According to a Population census 2014, main languages used are Moldavan /Romanian spoken by 78.6 % (54.6 % and 24.0 %) of the population. Other languages used are Russian (14.5 %), Ukrainian (2.7 %), Găgăuz (2.7 %), Bulgarian (1.0%), Romani (0.2%) and other/unspecified (0.3%)[22]. In most districts along the proposed OHL route, main used language is Moldovan/Romanian. In ATU Găgăuzia the official language is Găgăuz, which is spoken by most population belonging to the Gagăuzia ethnic group. However, a large share of the population in ATU Găgăuzia also speaks Russian, while knowledge in Moldovan/ Romanian is less common[23].

5.3.2.3 Vulnerable groups

Republic of Moldova, like other countries in Europe, has groups in the society that are more vulnerable, excluded from different part of society and/or discriminated. The type and severity of vulnerability differ from one vulnerable group to another. In a vulnerability study carried out in 2011 by the government together with United Nations Development Programme (UNDP) and UN Women, the following vulnerable groups in Republic of Moldova (with relevance to the Project) were outlined: people in extreme and absolute poverty; unemployed young people; older abandoned persons; persons with disabilities; the Roma community; non-orthodox religious communities, women (especially from other vulnerable groups), LGTB (Lesbian, Gay, Bisexual and Transgender/Transsexual) persons and farmers or employees in agriculture[24]. Each of these groups is shortly presented below.

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[21] Population Census 2014 **http://www.statistica.md/pageview.php?l=en&idc=479&** (Accessed 2017-05-17)
[22] Population Census 2014 **http://www.statistica.md/pageview.php?l=en&idc=479&** (Accessed 2017-05-17)
[23] Interviews during onsite Scoping mission June 2016 as well as Population Census 2014 **http://www.statistica.md/pageview.php?l=en&idc=479&** (Accessed 2017-05-17)
[24] Joint Integrated Local Development Programme (UN). (2011). Summary of vulnerability Study. Available at: **http://eca.unwomen.org/en/digital-library/publications/2011/03/vulnerability-study-taxonomy**

Poverty is an important factor for vulnerability in Republic of Moldova. The share of population in Republic of Moldova below national poverty line (absolute poverty ratio) is at 11.4 % (2014), which is 10.5 % lower as compared to 2010. About 0.1% of the population in Republic of Moldova is estimated to live in extreme poverty, a share that has decreased from 1.4% in 2010[25]. Poverty is to large extent concentrated in rural towns and rural areas, and women in poverty are especially vulnerable[26].

Unemployed young people in Republic of Moldova suffer a clear disadvantage on the labour market. The unemployment rate among youth (15 - 24 years) is as high as 12.8 %, with youth unemployment being higher in urban areas (16.5%) than rural areas (10.1%) and slightly higher among women (13.5%) than among young men (12.4 %)[27]. Migration for working abroad is especially evident among young people meaning that in some towns there is a growing number of elder people and children staying during the periods when young people are outside the village working.

Older abandoned persons are extremely vulnerable due to limited resources that allow them to ensure normal living standards. The expenses necessary for their health care further contributes to their vulnerability[28].

Persons with disabilities represents about 5.2% of total population of the country (approximately 184,800 persons), and children with disabilities constitute approximately 2% of all children from Republic of Moldova. Almost every seventh person with disability falls into the category of severe disability. About 62 % of persons with disabilities live in rural areas, with the number of persons with disabilities in rural areas increasing with 5.4 % since 2010. 52.2 % of disabled persons are men. Disability is seen as a serious and increasing challenge in Republic of Moldova[29]. The insufficient access of people with disabilities to the labour market makes this group vulnerable to the risk of marginalization, poverty and exclusion[30].

The *Roma community* is seen as an especially vulnerable group in Republic of Moldova in terms of discrimination and exclusion. According to the census data from 2014, 9,323 Roma live in Republic of Moldova, which is around 0.3 % of the total population in the country[31].

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[25] MDG statistics 2014 **http://www.statistica.md/pageview.php?l=en&idc=421&** (Accessed 2016-09-19)
[26] Joint Integrated Local Development Programme (UN). (2011). Summary of vulnerability Study. Available at: **http://eca.unwomen.org/en/digital-library/publications/2011/03/vulnerability-study-taxonomy**
[27] Labour Force Statistics 2015: **http://www.statistica.md/newsview.php?l=ro&idc=168&id=5147** (Accessed 2016-09-19)
[28] Joint Integrated Local Development Programme (UN). (2011). Summary of vulnerability Study. Available at: **http://eca.unwomen.org/en/digital-library/publications/2011/03/vulnerability-study-taxonomy**
[29] National Bureu of Statistics. The situation of disabled persons in the Republic of Moldova 2015. **http://www.statistica.md/newsview.php?l=en&id=4976&idc=168** (Accessed 2016-09-19)
[30] Joint Integrated Local Development Programme (UN). (2011). Summary of vulnerability Study. Available at: **http://eca.unwomen.org/en/digital-library/publications/2011/03/vulnerability-study-taxonomy**
[31] Population Census 2014 **http://www.statistica.md/pageview.php?l=en&idc=479&** (Accessed 2017-05-17)

However, the UNDP notes that censuses tend to underestimate the true size of the Roma population and Roma leaders, on the other hand, estimate that there could be as many as 250,000 Roma in Republic of Moldova. Roma are more than twice as likely to live in poverty as non-Roma in Republic of Moldova and also face serious problems in accessing education. Furthermore, Roma in Republic of Moldova live predominantly in rural areas and in small towns which can further exacerbate poor access to education, employment, and healthcare[32]. Negative stereotypes and intolerance are also assigned to Roma by the majority population. Roma women are especially vulnerable as they have lower levels of education, higher rates of unemployment, poorer health, and significantly lower incomes than the wider population, both Roma and non-Roma[33].

Non-orthodox religious communities are a minority in Republic of Moldova, where 90% of the population belongs to the Orthodox Church[34]. Adherents of other religious groups hence constitute just above 10 % of the population and include for example Roman Catholics, Baptists, Muslims, Jehovah's Witnesses, Jews, Lutherans and evangelical Christian groups[35]. Non-orthodox religious communities in Republic of Moldova have reported e.g. denial of confession registration, discrimination and restriction of religious activities[36].

Women in general are stereotyped for their role in society in Republic of Moldova, with less access to decision-making in political and public life as well as political representation[37]. Furthermore, women are paid in average wage 13 % less than men[38]. Certain groups of women with additional grounds for discrimination and marginalization, such as ethnic and religious identity or disability, are more vulnerable. There is also an increased feminization of poverty, of particularly among vulnerable groups of women such as rural women, single women heads of households, women belonging to ethnic groups, in particular Roma women, women with disabilities and older women[39].

Lesbian, gay, bisexual, and transgender (LGBT) persons and communities face legal challenges, discrimination in society and have been target to human rights violations against the freedom of association (to have LGBT Pride demonstrations)[40].

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[32] Mihalache, I. and Rusanovschi, S., *Study on the situation of Romani Women and Girls in the Republic of Moldova*, UN Women, 2014
[33] Cace, S., Cantarji, V., Sali, N. and Alla, M., *Roma in the Republic of Moldova*, UNDP, 2007
[34] Population Census 2014 **http://www.statistica.md/pageview.php?l=en&idc=479&** (Accessed 2017-05-17)
[35] Around 7.1% of the population has not stated religion in the Population Census 2014, or have stated to be atheist (0.2%) or agnostic (0.02%)
[36] Joint Integrated Local Development Programme (UN). (2011). Summary of vulnerability Study. Available at: **http://eca.unwomen.org/en/digital-library/publications/2011/03/vulnerability-study-taxonomy**
[37] Joint Integrated Local Development Programme (UN). (2011). Summary of vulnerability Study. Available at: **http://eca.unwomen.org/en/digital-library/publications/2011/03/vulnerability-study-taxonomy**
[38] MDG statistics 2014 **http://www.statistica.md/pageview.php?l=en&idc=421&** (Accessed 2016-09-19)
[39] Joint Integrated Local Development Programme (UN). (2011). Summary of vulnerability Study. Available at: **http://eca.unwomen.org/en/digital-library/publications/2011/03/vulnerability-study-taxonomy**
[40] Joint Integrated Local Development Programme (UN). (2011). Summary of vulnerability Study. Available at: **http://eca.unwomen.org/en/digital-library/publications/2011/03/vulnerability-study-taxonomy**

The LGBT community has faced several adverse reactions in national media, with no resulting trials. *Farmers/employees in agriculture* are at a high risk of economic exclusion, as their incomes depend highly on weather and access to markets. Many people in this group are depending on seasonal labour and the payment is normally low. Small farms (under 10 ha) including household farms assure a large part of the total agricultural production in the country[41].

According to the interviews with stakeholder along the OHL route, the main vulnerable group in the area is people in poverty. In terms of how this is handled in the communities, the typical response would be that these groups are society's concern and therefore this issue is properly managed. Still, poverty is widespread and the resilience in the livelihoods of the families and people living in many of the affected areas are low. This is also seen in the number of people working in other areas of Republic of Moldova, but more commonly outside the border. As a consequence, many of the working age people are not present in the villages, while the elderly and children are still found. Social services and also the communities' organization will be affected by this.

5.3.2.4 Education/Literacy rates

The literacy rate of the population in Republic of Moldova, over the age 15 that can read and write (i.e. adult literacy) is reported at 99.5 %[42].

The School Life Expectancy[43] in primary to tertiary education in Republic of Moldova is 11.3 years with a slighter higher expectancy for girls (11.6 years) than for boys (11.0 years).[44] The Gross Enrolment Ratio in general compulsory education is at 89.3 %[45].

5.3.3 Economic activities

5.3.3.1 GDP and economic sectors

In the last years, Republic of Moldova has experienced fluctuations in GDP growth rate, from a decrease in GDP with -6.0% in 2009 and -0.7% in 2012 to an increase in GDP with 9.4% in 2013 and 4.8% in 2014.

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[41] See **http://www.fao.org/family-farming/countries/mda/en/**
[42] MDG statistics 2014 **http://www.statistica.md/pageview.php?l=en&idc=421&** (Accessed 2016-09-19)
[43] School Life Expectancy is a measure of how many years of education a child of school entering age would receive during the life time, if the school enrollment rates stay the same as of today.
[44] Population statistics 2013/2014 **http://www.statistica.md/public/files/publicatii_electronice/Educatia/Educatia_RM_2016.pdf** (accessed 2016-09-19)
[45] MDG statistics 2014 **http://www.statistica.md/pageview.php?l=en&idc=421&** (Accessed 2016-09-19)

During 2015, however, the GDP growth rate was -0.5%[46]. GDP per capita is currently at 1,645 EUR, which is among the lowest in Europe[47]. Despite recent economic progress, Republic of Moldova is still one of the poorest countries in Europe.

The GDP share (by sector) in Republic of Moldova is 16.2 % agriculture, 20.7% industry and 63.2% services (including public administration)[48].

The share of industrial and agricultural activities within each sector in Republic of Moldova is described in Table 26 and Table 27 below.

Table no. 26. Structure of the Agricultural sector in Republic of Moldova

Agricultural activities	Share (%)*
Plant production, of which:	*67.8*
Cereals	25.4
Sugar beet	3
Tobacco	0.1
Sunflower	7.9
Potatoes	4.4
Vegetables, melons and gourds	6.4
Fruits, nuts and berries	6.4
Grapes	6.8
Forage crops and others	6.3
Animal production, of which:	*32.2*
Cattle	1.6
Pigs	9.4
Sheep and goats	0.5
Poultry	6.8
Milk	9.8
Eggs	3.1
Wool	0
* 2014 (% comparable prices)[49]	

Being predominately rural areas, the primary economic activity in the districts affected by the proposed OHL is agriculture. The main crops produced differ between the districts and areas. Further information on land use in the affected areas is presented in chapter 5.3.5.

Table no. 27. Share of activities within the Industrial sector in Republic of Moldova

Industrial activities	Share (%)*
Mining and quarrying	*1.8*
Production and distribution of electricity and heat, gas, hot water and conditioning air	*11.1*
Water supply, sewerage, waste management and remediation activities	*5.7*
Manufacturing industry, of which:	*81.4*
Manufacture of food products	30.1
Manufacture of tobacco products	0.8
Manufacture of textile	3.8
Manufacture of wearing apparel	4.1

[46] Eurostat **http://ec.europa.eu/eurostat/web/products-datasets/-/enpr_sigeb** (Accesses 2016-09-25)
[47] Eurostat **http://ec.europa.eu/eurostat/web/products-datasets/-/enpr_ecnagdp** (Accesses 2016-09-25)
[48] Statistics 2015: **https://www.cia.gov/library/publications/the-world-factbook/geos/md.html** (Accessed 2016-09-25)
[49] Agricultural statistics 2014 **http://www.statistica.md/pageview.php?l=en&idc=315&id=2278** (Accessed 2016-09-25)

Industrial activities	Share (%)*
Manufacture of leather products	0.9
Manufacture of wood and wood products	0.5
Manufacture of paper and paper products	1.2
Printing	0.9
Manufacture of chemicals and chemical products	2.0
Manufacture of pharmaceuticals	1.1
Manufacture of rubber and plastic products	3.8
Manufacture of other non-metallic mineral products	8.9
Metallurgical industry	0.2
Manufacture of fabricated metal product	2.6
Manufacture of computer, electronic and optical products	1.2
Manufacture of electrical equipment	2.9
Manufacture of machinery and equipment	1.2
Manufacture of furniture	2.4
Manufacture of jewellery, bijouterie and related articles	0.1
*2014[50]	

The main industrial production and manufacturing is concentrated in Chișinău municipality and the North Region of Republic of Moldova, where 56.5 % and 20.5 % of industrial production is achieved. In the districts along the proposed OHL route, (except Chișinău municipality), the industrial production is low (Only between 0.3 - 2.9 % of industrial production in the country is achieved, depending on district)[51].

Industrial activities in the districts among OHL route are hence limited. There is a winery industry and some manufacturing and building activities. Comrat had earlier a number of industries but these are no longer in operation. In Comrat there are also some considerations to establish industrial parks with the ambition to attract new industrial activities.

Figure no. 46. Railway track leading to one of the abandoned industrial sites outside Bugeac

[50] Industry statistics 2014 http://www.statistica.md/category.php?l=en&idc=127& (Accessed 2016-09-25)
[51] Industry statistics 2014 http://www.statistica.md/category.php?l=en&idc=127& (Accessed 2016-09-25)

According to the information received during interviews with stakeholders, several opportunities for establishing new industries have been raised. Still, the mayors are rather aware that perhaps the most promising sector at the moment would be agriculture. In Ecaterinovca City Hall it was specifically mentioned that future opportunity consists in establishment of an agro-tourism site in the area (further details are presented in chapter 5.3.4 Tourism).

5.3.3.2 Employment

In 2015, the economically active population (employed and unemployed) amounted to 1,265,600 persons, making up approximately 35 % of the total population or 54.5 % of the population in working age (16 - 56/61 years). The employment rate of the population in working age is 47%.[52]

Among the employed population in Republic of Moldova, 31.7% work in the agricultural sector. Out of these, 40% (or 13% of total employed population) are persons engaged in the production of agricultural products exclusively for their own consumption or needs.

Furthermore, 12.3% of the employed population works in industry while 5.4 % works in construction. However, the largest share of the employed population (50.5%) works in the service sector (including public administration)[53].

Being predominately rural, employment in the agricultural sector is most common in the area affected by the proposed OHL route.

The average net monthly earnings in Republic of Moldova counting all economic activities is around 3,400 Moldovan Lei (MDL), with lower average net monthly earnings in agriculture (2,300 MDL) than within, for example, industry (3,600 MDL) or public administration (4,450 MDL)[54].

The disposable income (average monthly per capita) among the population in Republic of Moldova is 1,770 MDL per capita, with the disposable income being lower in rural areas (1,500 MDL) than in urban areas (2,110 MDL) [55]

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[52] Labour Force Statistics 2015: **http://www.statistica.md/newsview.php?l=ro&idc=168&id=5147** (Accessed 2016-09-19)
[53] Labour Force Statistics 2015: **http://www.statistica.md/newsview.php?l=ro&idc=168&id=5147** (Accessed 2016-09-19)
[54] Earning statistics 2014 **http://www.statistica.md/category.php?l=en&idc=452&** (Accessed 2016-09-19)
[55] the Republic of Moldova in figures 2015
http://www.statistica.md/public/files/publicatii_electronice/Moldova_in_cifre/2015/Moldova_cifre_2015_eng_fra.pdf (Accessed 2016-09-19)

The unemployment rate (% of unemployed persons in the economically active population) in Republic of Moldova is 4.9 % (2015). The unemployment rate is slightly higher amongst men (6.2%) than amongst women (3.6 %). There are discrepancy between urban areas (6.4%) and rural areas (3.5 %)[56] and also differences among groups in the society, such as for young people, Roma people, etc.

Even though the unemployment is low, the employment rate - number of working age people that have a job is only about 35% - 45%.This indicates a high percentage of people that do not have an activity with a formal job. Informal agriculture and household survival activities are not accounted for as employment.

The economically inactive population includes e.g. students, housewives, pensioners or people that for other reasons are not actively seeking employment in Republic of Moldova. One of the main features in the economic and social landscape in Republic of Moldova is emigration.

In 2015, the population that declared going abroad to work or look for work (around 325,400 persons), represented approximately 9% of the total number of population or 14% of the population in working age (15 - 56/61 years). Out of those who left the country for work, 64.8% are men and 68.8% are from rural areas.[57] This pattern of emigration is also confirmed in interviews with stakeholders in many villages and towns along the proposed OHL route, where some villages report to have as many as 30% of its population in working age emigrating abroad for work, leaving their children and elderly in the villages[58].

During 2000 – 2012, in terms of volume, remittances grew at an annual rate of close to 10%, making Republic of Moldova one of the world's top countries in terms of the GDP share of private transfers from abroad and the share of its labour force that has emigrated. From May 2014, Moldovan citizens are no longer required to obtain visas to travel to the European Union (EU) which is expected to increase emigration and remittances in the following years.

Annual remittance from the population working abroad is an important source of income for many families and increase household consumption in Republic of Moldova as a whole. However, remittances are unevenly distributed, favouring mainly households that, according to Republic of Moldova standards and in large part thanks to the remittances, are relatively prosperous[59].

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[56] Labour Force Statistics 2015: **http://www.statistica.md/newsview.php?l=ro&idc=168&id=5147** (Accessed 2016-09-19)
[57] Labour Force Statistics 2015: **http://www.statistica.md/newsview.php?l=ro&idc=168&id=5147** (Accessed 2016-09-19
[58] Interviews with stakeholders along the proposed OHL-route during scoping mission (June 2016).
[59] Kinnunen 2015

5.3.4 Tourism

Today, tourism contribution to the national economy is relatively insignificant. Low quality accommodation facilities, poor travel infrastructure and low revenues from tourism activity places Republic of Moldova among the countries with reported underdeveloped tourism industries[60].

In 2015, the number of foreign visitors staying in tourist accommodation amounted to 94,400 persons, which represents an increase of foreign visitors with 37% comparing with 2004. Domestic tourism (184,500 persons in 2015) is similar with the reported annual data over the last 10 years[61]. The total number of foreign visitor arriving at the state border of Republic of Moldova was about 2,9 million in 2015, with a growth of 28,1% compared with 2014. Out of the total arrivals of foreign visitors to Republic of Moldova in 2015, most came from Romania (45.5%), Ukraine (35.5%), Russian Federation (9.0%), Bulgaria (1.7%), Italy (1.2%), Turkey (0.8%), Germany (0.7%), Israel and the United States (0.6% each).

The main mean of transport for foreign visitors arriving during 2015 was by car (81.5%), by air (16.5%) and by railway (2.0%)[62].

Considering the existing low level tourism contribution to Republic of Moldova economy, today there is a good potential for development of this sector. In the “Sustainable Tourism Development Strategy”, adopted by the Government of Republic of Moldova in 2014, it is highlighted that Republic of Moldova is a small country with a great diversity of tourist attractions located at short distance from major cities. For example, the Strategy underlines that there are 312 natural protected areas and thousands of tourist attractions in Republic of Moldova, including architectural monuments, settlements from different historical epochs and medieval fortresses. The relatively evenly distribution of cultural, natural and archaeological heritage around the country is one motivation behind future tourist development.

Other tourist attractions that may lead to possible tourism development include wineries, cultural events and recreation facilities, such as spas[63].

Republic of Moldova government is actively working on tourism development, which is seen as one of the priority areas of the national economy. The first Sustainable Tourism Development Strategy was adopted by the Moldavian government in 2003, outlining the potential for tourism and priorities in tourism developments until 2015. A revised strategy until 2020 was adopted in 2014. Some of the areas of improvement identified in the latest Strategy

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[60] **http://www.ceeweb.org/wp-content/uploads/2013/02/Final_NTDS-Assessment_Moldova.pdf**
[61] Number of tourists placed in establishments of collective touristic accommodation (2004-2015). Tourism statistics 2015 **http://www.statistica.md/category.php?l=en&idc=293&** (Accessed 2016-09-25)
[62] International visitors arrivals to the Republic of Moldova 2015. Tourism statistics 2015 **http://www.statistica.md/newsview.php?l=en&idc=168&id=5070** (Accessed 2016-09-25)
[63] Tourism Development Strategy 'Tourism 2020' **http://www.turism.gov.md/index.php?pag=sec&id=39&l**= (Accessed 2016-09-25)

include the need for better and more tourism accommodation, improved access to relevant tourism information, restoration of historical monuments and sites, as well as improved tourism infrastructure to and around major touristic sites.

The districts along proposed OHL route differ in term of current capacity to accommodate tourism with between 10 available rooms in Leova to 3,959 available rooms in Chișinău municipality (Table no. 28). These numbers indicate that tourism is not yet widely developed in most districts along the proposed OHL route (except Chișinău).

Table no. 28. Existing capacity of establishments of collective touristic reception with functions of accommodation, by district

Name of District / Municipality	Number of rooms*	Number of beds*
ATU Găgăuzia	207	1,483
Cahul	425	984
Tărăclia	27	258
Cantemir	-	-
Leova	10	23
Cimişlia	49	251
Hânceşti	151	856
Ialoveni	55	274
Chişinău	3,959	8,707
*2015[64]		

Important current tourism attractions in the districts within the impact area include wineries (e.g. in Ialoveni, Hânceşti, Cahul, ATU Găgăuzia), museums and art galleries (e.g. Chişinău, Ialoveni, Hânceşti, Cahul, Cimişlia, ATU Găgăuzia), festivals (e.g. International Folk Music Festival in Cahul), mineral springs with spa (e.g. Cahul) and resorts (e.g. Ialoveni)[65].

5.3.5 Land use and ownership

Most of the available land in Republic of Moldova (73.9%) is used for agricultural purposes, consisting of arable land, perennial plantations, pastures, hayfields or fallow lands. Furthermore, forests or lands covered with forestry vegetation represent about 14% of the total available land in the country (Table no. 29).

[64] Tourism Statistics 2015 **http://www.statistica.md/pageview.php?l=en&idc=349&** (Accessed 2016-09-25)
[65] See also the Republic of Moldova travel, **http://www.moldovaholiday.travel/index.php?lang=en** (Accessed 2016-11-15)

Table no. 29. Available land by use, Republic of Moldova

Land use	Share (%)*
Agricultural lands, of which:	**73.9**
Arable land	53.9
Perennial plantations (orchards/vineyards)	8.5
Pastures	10.2
Hayfields	0.1
Fallow lands	1.2
Forests and lands covered with forestry vegetation	**13.7**
Rivers, lakes, reservoirs and bogs	**2.9**
Other lands	**9.5**
* January 1, 2016 (% of available land)[66]	

At regional level, the highest share of arable land (40.6%) is found in Northern Region, followed by Central Region (27.5 %), Southern Region (24.4 %), ATU Găgăuzia (6.5 %) and Chișinău Municipality (1%). The largest share of permanent crops is in the Central Region (40.3%), followed by the Southern Region (27.2%), the Northern Region (24.0%), ATU Găgăuzia (6.1%) and Chișinău Municipality (2.4%). The largest share of natural pastures and hayfields is in the Northern Region (39.4%), followed by the Central Region (32.0 %), Southern Region (22.3%), ATU Găgăuzia (5.5%) and Chișinău Municipality (0.8%)[67],

Figure no. 47. Picture of agricultural land, also displaying the scenery of valleys and undulating landscape

Most of the agricultural land in Republic of Moldova is privately owned. Arable land, perennial land and fallow lands are to a much higher degree privately owned (85.5 % - 88.7 %) while pastures and hayfields to a large extent is owned by the public. For example, 98.5% of all pastures are public land (Table no. 30).

[66] Land and forest statistics 2016,**http://www.statistica.md/category.php?l=en&idc=99&** (Accessed 2016-09-25)
[67] General Agricultural Census 2011 - **http://www.statistica.md/public/files/publicatii_electronice/Recensamint_agricol/RGA_Vol_2.pdf** (Accessed 2016-10-05)

Table no. 30. Agricultural lands by forms of ownership, Republic of Moldova

Agricultural lands (land plots used systematically for obtaining agricultural production)	Of which public (%)*	Of which private (%)*
Arable land	14.5	85.5
Perennial plantations (orchards/vineyards)	12.9	87.1
Pastures	98.5	1.5
Hayfields	76.2	23.8
Fallow lands	11.3	88.7
Total:	*26.0*	*74.0*
*** January 1, 2016 (% of agricultural lands)**[68]		

In general, agricultural land is owned and/or operated by agricultural enterprises (with juridical status), farms (without juridical status) or individual households (small size agricultural units). Agricultural enterprises are, for example, agricultural production cooperatives, joint stock companies, limited liability companies or state enterprises. Farms are defined as agricultural units operating plots around the house(s), gardens and/or land in fields in its vicinity. Agricultural activities of individual households include auxiliary population households in urban areas or privatized horticultural plots holders[69].

Figure no. 48. Example of "Other land" category. Here with grazing cattle. In the back of the picture the forest close to Moleşti is seen

There are approximately 902,000 agricultural enterprises and farms in the Republic of Moldova (both active and temporary non-active) of which about 99.6% are farms (without juridical status) and 0.4% are agricultural enterprises (with juridical status). However, as most farms are small (under 1 ha) and most agricultural enterprises are large (between 100 ha and 500 ha or above), the major part of the agricultural area (61 %) in the country is *operated* by (private or state owned) agricultural enterprises. In general terms, agricultural enterprises are

[68] Plant production statistics 2015, **http://www.statistica.md/pageview.php?l=en&idc=315&id=2279** (Accessed 2016-09-25)
[69] 2011 General Agricultural Census in the Republic of Moldova, **http://www.statistica.md/public/files/publicatii_electronice/Recensamint_agricol/RGA_principalele_rezultate_eng.pdf** and Statistics of Plant Production and Agricultural Land 2016, **http://www.statistica.md/public/files/Metadate/en/Fitotehnia_en.pdf** (Accessed 2016-11-17)

more active in the North Region of the Republic of Moldova, while farms are to a larger degree operating agricultural land (land in fields, plots around the house(s) and gardens) in the Central and South Region. A very small share of the total agricultural land in the country (less than 1%) is operated by individual household, or small size agricultural unit, that have an average size of 0.06 ha[70].

Farms and agricultural enterprises can either own or lease the agricultural land they operate. In many cases the land areas *owned* are relatively small and it is a common practice that land is leased out to other farmers for more efficiently land use. Most *farms* (97%) own the agricultural land they are operating, while only 1 of 2 *agricultural enterprises* is operating agricultural land under their own ownership. The remaining agricultural enterprises are operating agricultural land that is either fully leased, a combination of leased and owned land or land having other types of tenures. Approximately 43% of the total agricultural land area operated by agricultural enterprises is leased while only 3% of total agricultural land operated by farms is under this type of tenure[71].

Looking at the districts along the proposed OHL route (Figure no. 49), the differences are in terms of share of agricultural land under “fully owned” tenure or “fully leased” tenure. While agricultural land in Chișinău, Ialoveni, Hânceşti, Cimişlia, Leova, Cantemir and Cahul is operated to a larger extent under own ownership, agricultural land in Tărăclia is mainly operated under “fully leased” tenure. In ATU Găgăuzia, there are equal shares of land under “fully owned” and “fully leased”[72]. Land leases are typically no longer than 3 years due to legal reasons. For vineyards and orchards, however, the leasing will be longer, up to 15 years.

[70] 2011 General Agricultural Census in the Republic of Moldova, **http://www.statistica.md/public/files/publicatii_electronice/Recensamint_agricol/RGA_principalele_rezultate_eng.pdf** (Accessed 2016-11-17).
[71] 2011 General Agricultural Census in the Republic of Moldova, **http://www.statistica.md/public/files/publicatii_electronice/Recensamint_agricol/RGA_principalele_rezultate_eng.pdf** (Accessed 2016-11-17).
[72] 2011 General Agricultural Census in the Republic of Moldova, **http://www.statistica.md/public/files/publicatii_electronice/Recensamint_agricol/RGA_principalele_rezultate_eng.pdf** (Accessed 2016-11-17).

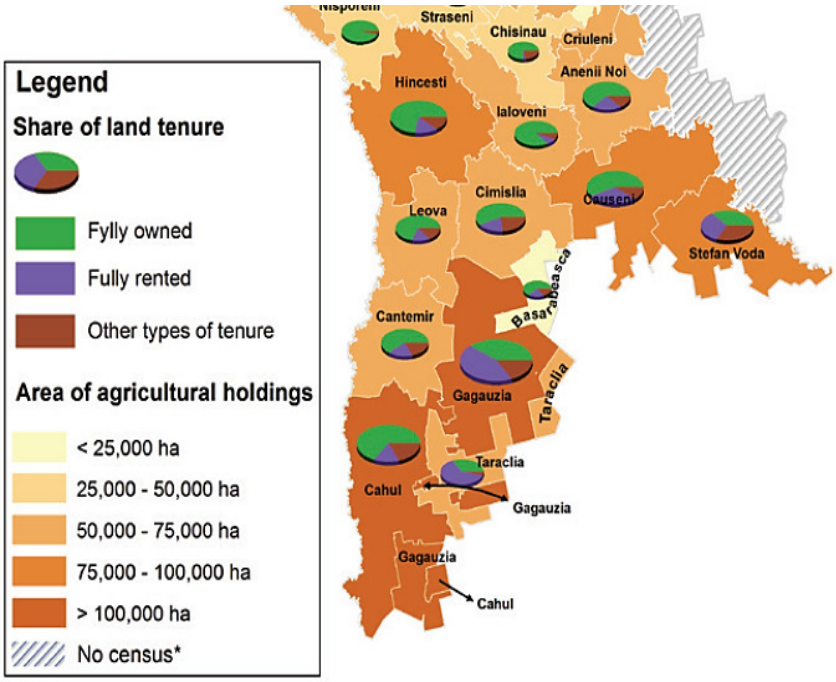

Figure no. 49. Distribution of total land area of agricultural farms and enterprises by districts, by type of tenure[73]

The OHL route is about 158 km long and the land affected by the construction, operation and then decommissioning works is predominantly agricultural. There are both crops grown, but also vineyards and orchards found in the area. The OHL route crosses also other land where there are no buildings and the land is not forested land. Forests are not commonly found in the area, except for smaller areas.

[73] 2011 General Agricultural Census in the Republic of Moldova, **http://www.statistica.md/public/files/publicatii_electronice/Recensamint_agricol/RGA_principalele_rezultate_eng.pdf** (Accessed 2016-11-17).

Figure no. 50. Grazing sheep on land category 'Other land'

The BtB Vulcăneşti substation will be built inside already existing substation and no new land will not be required outside the enclosure (see reference no. 2).

Based on a study of the land areas in GIS databases (geoportal.md), topographic maps (2013), as well as aerial pictures of the analysed areas in Google earth (aerial photos from 2016) an assessment of the different land area types have been performed.

For assessing and identifying the type of land along the OHL route, a safety corridor (75 m having in the centre the OHL axis) have been applied basically looking at the immediate area underneath the OHL. The type of crops planted can change and there are indications that there are some new vineyards (based on the aerial photos) established, as compared to the topographic maps. The category Vineyards also include some orchards where mainly peaches are grown. The category of other land includes public land and land that is not presently under visible active management. The category of other land can thus be either public or private land. There are some smaller areas where bush/ grove or some tree vegetation is found where based on the aerial photos an assessment have been made either to categorise these as forest or other land (amount of this land is less than 1,000 m). This approach gives an indication of the land use in connection to the OHL. The affected land type is given as a length in meter instead of an area.

Table no. 31. OHL's length per districts and types of lands

	OHL length [m]	Other land [m]	Forest [m]	Vineyard and orchards [m]	Farmland [m]
ATU Găgăuzia*	50,836	2,187	0	11,203	37,446
Cahul	8,529	0	0	4,489	4,040
Tărăclia	22,985	1,885	2,065	3,771	15,263
Cantemir	0	0	0	0	0
Leova	13,585	2,865	0	4,055	6,665
Cimişlia	40,271	6,222	3,667	3,501	26,880
Hânceşti	3,412	269	718	988	1,437
Ialoveni	14,724	3,232	359	3,053	8,080
Chişinău	3,771	1,167	0	898	1,706
Total	**158.112**	**17,828**	**6,810**	**31,957**	**101,517**

* ATU Găgăuzia is not one connected land area, but consists of four different areas of which the proposed OHL will pass through three.

The longest distances of the proposed OHL route are in ATU Găgăuzia, Cimişlia, Tărăclia and Ialoveni districts, while the shortest are in Hânceşti and Chişinău districts.

Looking more specifically on the different land categories, the OHL route will pass different types of lands, as is presented in Figure no. 51.

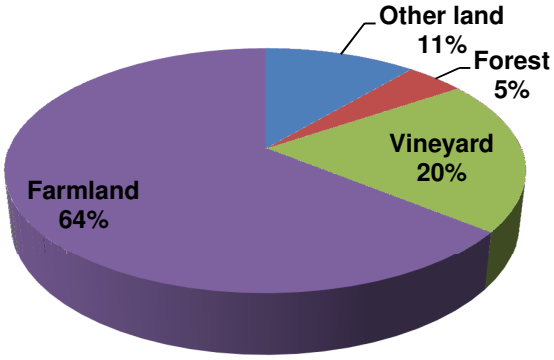

Figure no. 51. Land categories along the OHL route

The main category of land along the OHL route is farmland, followed by vineyards. The towers should be positioned in such a way that land requirement and impact on access to land is minimised. Still the OHL will restrict the possibility to stay prolonged periods underneath the OHL during for example harvest or other activities. This is further discussed under the section of impacts. Comparing the land areas along the OHL route with the national average of land types in Republic of Moldova, the indication is that forest and areas covered with forestry vegetation are mainly avoided, while farmland, vineyards and orchards are slightly higher than the national average. This can be explained by the higher prevalence of these land uses in the area. 18% of the proposed route would pass above what has been identified as vineyards or orchards.

The different land categories along the proposed OHL route, per districts, are further presented.

In ATU Găgăuzia, the OHL route will have the longest passing, almost 51 km. The main land category along the OHL route is farmland, followed by vineyards and other land.

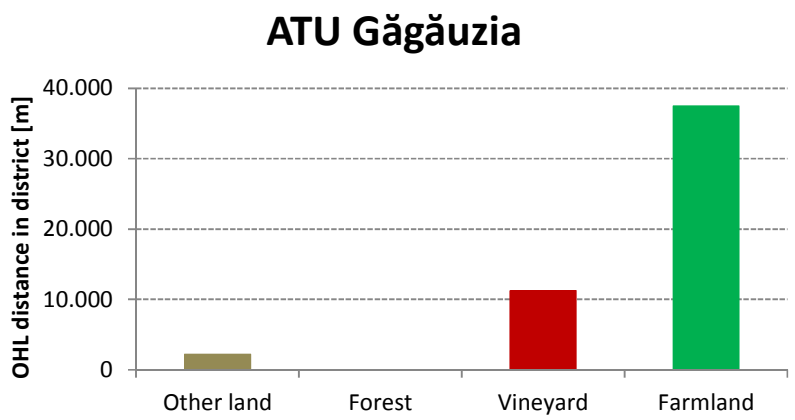

Figure no. 52. Land categories in ATU Găgăuzia passed by the proposed OHL route

In ATU Găgăuzia there are four different enclaves. The OHL route will pass two of these areas: the Southern part, just close to Vulcăneşti substation (total OHL length about 1,300 m) and the central enclave (where Comrat city is found) for the rest of OHL length.

In Cahul, the OHL route will pass about 8.5 km of a farming area in the North East of the district and here the most affected land category is vineyards followed by farmland. No forests or other lands were identified.

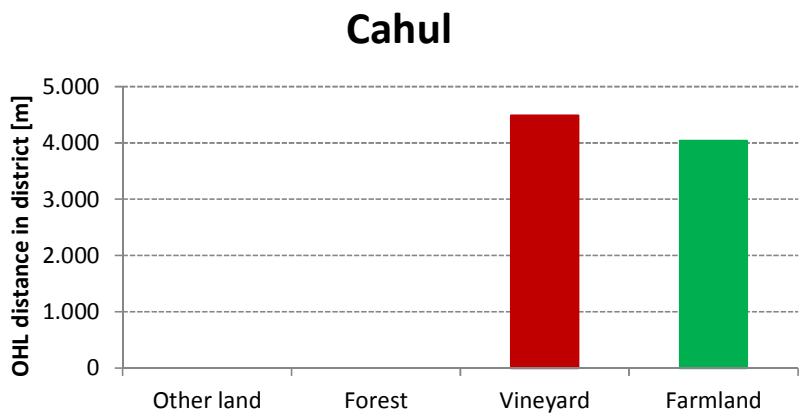

Figure no. 53. Land categories in Cahul passed by the proposed OHL route

In Tărăclia district, the OHL route will pass a total of about 23 km, mostly farmlands followed by vineyards.

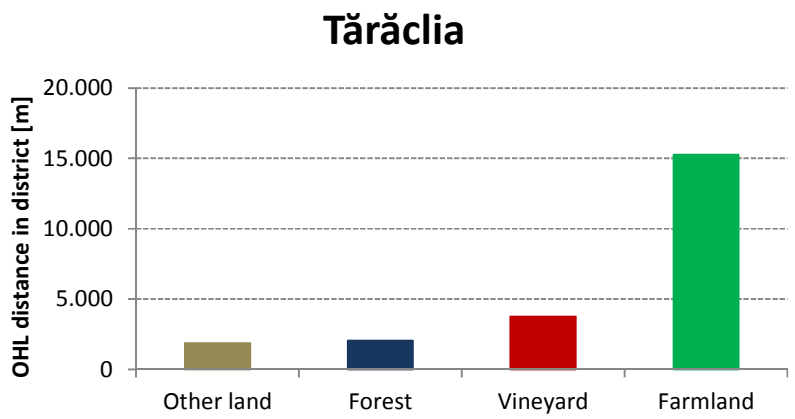

Figure no. 54. Land categories in Tărăclia passed by the proposed OHL route

Tărăclia district is within the close proximity corridor of the OHL but there are no physical artefacts that will be put on land belonging to Tărăclia district.

In Leova district, the OHL will pass a total almost 14 km of land, mainly farmland and vineyards. There are also some areas of other land.

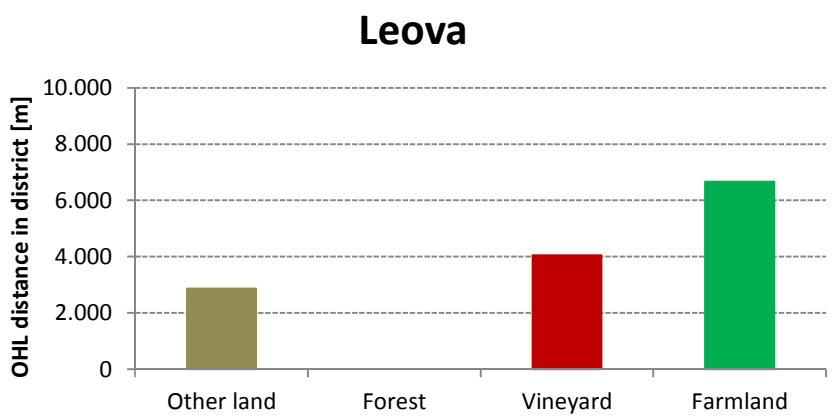

Figure no. 55. Land categories in Leova passed by the proposed OHL route

Cimişlia has the second longest stretch of land along the proposed OHL route, about 40 km. Here again farmland is the main land category.

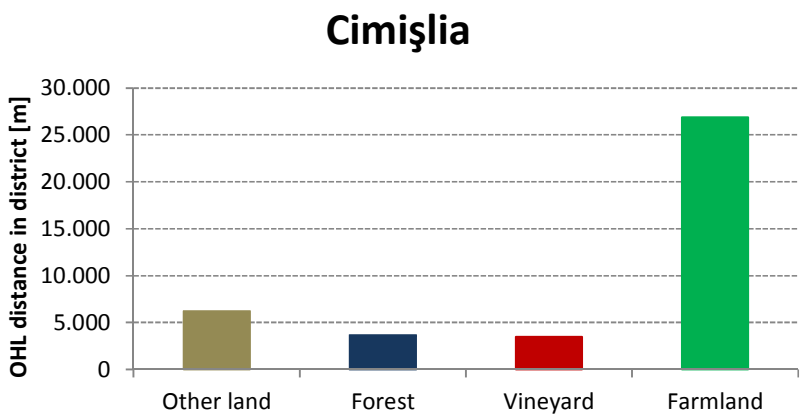

Figure no. 56 Land categories in Cimişlia passed by the proposed OHL route

In Hânceşti district, about 3.5 km of OHL will pass; the main land's categories are farmland, vineyards and some forested areas.

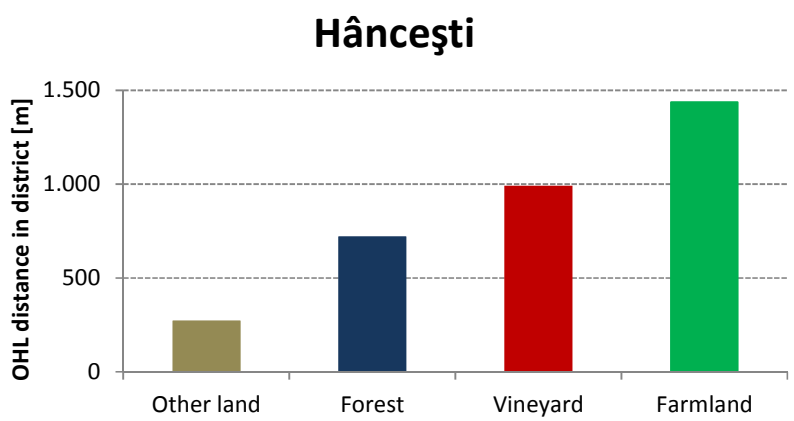

Figure no. 57. Land categories in Hânceşti passed by the suggested OHL route

In Ialoveni, the OHL will pass almost 15 km of farmland followed by other land and vineyards.

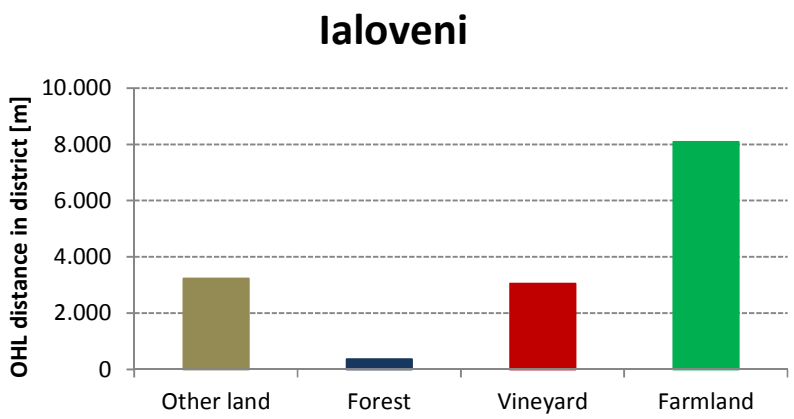

Figure no. 58. Land categories in Ialoveni passed by the proposed OHL route

In Chişinău, there is almost 4 km OHL routes; main land categories are farmland and other land, followed by vineyards/orchards.

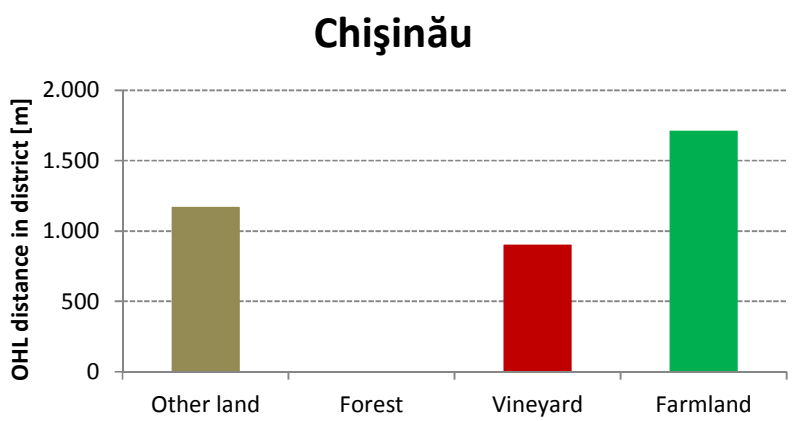

Figure no. 59 Land categories in Chişinău passed by the proposed OHL route

The OHL's towers will represent new artefacts in the landscape. At this stage of the Project (Feasibility Study), as assessment may be conducted related to the land categories that could be affected.

Table no. 32. Cross table indicating the land where initial tower positioning is considered

	Other land [number of towers]	Forest [number of towers]	Vineyard [number of towers]	Farmland [number of towers]	Total [number of towers]	Total [%]
Găgăuzia	6	0	41	99	**146**	**29**
Cahul	0	0	14	22	**36**	**7**
Tărăclia	6	7	12	62	**87**	**17**
Leova	8	0	12	18	**38**	**7**
Cimişlia	14	8	12	91	**125**	**24**
Hânceşti	3	0	5	13	**21**	**4**
Ialoveni	12	1	7	21	**41**	**8**

	Other land [number of towers]	Forest [number of towers]	Vineyard [number of towers]	Farmland [number of towers]	Total [number of towers]	Total [%]
Chişinău	4	0	8	5	**17**	**3**
Total [number of towers]	**53**	**16**	**111**	**331**	**511**	**-**
Total [%]	**10**	**3**	**22**	**65**	**-**	**100**

The analysis presented in Table no. 32 does not consider different types of towers or options for avoiding certain land areas via small adjustments (e.g. positioning of a tower in order to be placed between fields, etc.). These aspects are further discussed in Chapter 6.3.1.

The BtB substation will be constructed inside the premises of already existing substation and thus no new land (see reference no. 2) will be required to be used outside these stations.

5.3.6 Main infrastructure and settlements in the Project area

5.3.6.1 Roads and railway

Republic of Moldova has been affected by an intensive process of road degradation of both national and local roads over the past decades. From about two thirds of the length of national roads being in good condition in 1992, only 7% of the national roads have the status "good" in 2006. Although the condition of local roads was less examined, a study of 1,500 km (out of approximately 6,000 km) of local roads conducted in 2006 found a bad and very bad condition of about 96% of their length. This degradation of roads has mainly been due to insufficient funding for maintenance and repairs. The poor condition of roads in Republic of Moldova has had significant negative impact on Republic of Moldova's social-economic impact. For example, it is highlighted that Republic of Moldova cannot fully capitalize on the economic and investment potential of the country because of poor roads that limit accessibility to e.g. work places for workers, to local and foreign markets for farmers and to cultural attractions for tourists[74].

However, a trend of improved roads condition has been observed since 2010 as a result of increased maintenance expenditures from national funds since 2009 as well as a number of road improvement programs and loans financed (e.g. by EBRD and WB). Despite recent efforts, the available resources for maintenance and developing the roads network in Republic of Moldova are as well below the desired levels[75].

[74] The Republic of Moldova National Development Strategy 2020, **http://particip.gov.md/public/files/Moldova_2020_ENG1.pdf**
[75] World Bank 2015, **http://documents.worldbank.org/curated/en/333461468184774414/pdf/PAD1406-PAD-P150357-R2015-0200-1-IDA-R2015-0265-1-Box393220B-OUO-9.pdf**

In the National Development Strategy of Republic of Moldova, one aim is to have roads of good quality in all of Republic of Moldova by 2020[76].

Likewise, the railway infrastructure in Republic of Moldova is in need of rehabilitation and modernization to provide adequate services and compete with other means of transport, and several investments has been made in railway infrastructure improvement during the last years[77].

In the areas affected by the proposed Project, some road rehabilitation has been carried, mainly on national roads e.g. local roads, however, are generally still in poor condition.

The proposed OHL route is crossing several roads on its way between Vulcăneşti and Chișinău Further details are presented in chapter 3.2.

According to GD no. 827/2013 for approval of Republic of Moldova Strategy for transport and logistic 2013 - 2022, the Ministry of Transport and Road Infrastructure is planning to rehabilitate and upgrade, in two stages 2018 and 2022, the existing road and railway infrastructure, with small new investments mainly related to cities ring-roads:

- 2018 - rehabilitation, modernization, repair and maintenance of 1,730 km of national roads;
- 2022 - rehabilitation, modernization, repair and maintenance of 1,360 km of national roads and repair and maintenance of 6,008 km of local roads.

In the area along the 400 kV OHL route, the Action Plan includes the following rehabilitation and upgrading works for existing road infrastructure:

- R3: Chişinău-Hânceşti-Cimișlia-Basarabeasca (km 30 - km 70) - rehabilitation works;
- R47: Cimişlia-Sarata Nouă (km 0 - km 40) - rehabilitation works;
- Vulcăneşti city ring-road - new investment; depending on the design of this investment it could be passing beneath the proposed OHL route.

The Action Plan also includes R37 Ceadir-Lunga - Comrat (km 5 - km 36), but this sector/segment is outside the survey corridor.

[76] Moldova National Development Strategy 2020, **http://particip.gov.md/public/files/Moldova_2020_ENG1.pdf**
[77] EBRD 2014, http://www.ebrd.com/news/2014/ebrd-and-partners-put-moldovan-railway-on-track-for-change.html

5.3.6.2. Electricity, water and gas supply network

In Republic of Moldova, according to WB statistics, the access to grid electricity is 100% both in rural and urban areas.

The access to an improved water source is 88.4% as a national average, with 81.4% in the rural areas and 96.9% in the urban areas. The settlements that were visited during the preparation of this ESIA report confirm this situation. A number of settlements presented projects linked to improve, or rehabilitate the water systems.

There is also gas infrastructure in Republic of Moldova. On a national scale over 90% of localities have gas connections. Natural gas infrastructure is commonly found in the areas along OHL route.

There are no power plants along the proposed OHL route or in the survey corridor.

5.3.6.3 Airports

There are two functional airports in Republic of Moldova, Chişinău International Airport and Bălți International Airport. Chişinău airport is situated 5 km from the Chişinău substation. There are already several OHLs connected to Chişinău substation and the proposed 400 kV OHL will not add structures affecting the operation at Chişinău international airport.

5.3.6.4 Public utilities

There are no hospitals or medical institutions within the close proximity corridor from the OHL. In the survey corridor of the OHL there are a total of 13 hospital services or emergency medical service institutions found. The majority of these are in Chişinău district and many are inside the city border which is about 5 km from the substation. In Table no. 33 a list of identified hospital and medical service institutions are listed.

Table no. 33. Hospital service or emergency medical service institutions within the OHL survey corridor (source Regional map Republic of Moldova)

Name of institution	District	Distance (km)	Type
Vulcănești Hospital	Găgăuzia	8.6	Hospital service
Emergency Medical Assistance Area Station “ATU Găgăuzia"	Găgăuzia	4.6	Emergency medical service
Comrat Hospital	Găgăuzia	5.8	Hospital service
Cimişlia Hospital	Cimişlia	5.4	Hospital service
Ialoveni Hospital	Ialoveni	6.8	Hospital service
Republican Dermatology Hospital	Ialoveni	4.0	Hospital service
Clinical Hospital of Psychiatry	Chişinău	4.2	Hospital service
Municipal Children’s Hospital "V. Ignatenco”	Chişinău *	7.8	Hospital service
Municipal Clinical Hospital for Phthisiopneumology	Chişinău *	8.3	Hospital service

Name of institution	District	Distance (km)	Type
Oncological Institute	Chişinău *	8.7	Hospital service
Emergency Medical Assistance Area Station “Centru"	Chişinău *	8.7	Emergency medical service
Republican Clinical Hospital	Chişinău *	8.7	Hospital service
Institute of Neurology and Neurosurgery	Chişinău *	9.1	Hospital service
Municipal Clinical Hospital for Contagious Disease for Children	Chişinău *	9.4	Hospital service
Municipal Clinical Hospital no. 1	Chişinău *	9.9	Hospital service

* These medical facilities are in Chişinău city.

There are no tertiary school institutions within the close proximity corridor. Looking at a distance of 10 km there are seven tertiary educational facilities identified (Table no. 34).

Table no. 34. Tertiary education facilities within the OHL survey corridor (source Regional map Republic of Moldova)

Name of institution	District	Distance (km)	Type
State University of Tărăclia	Tărăclia	9.6	Tertiary education
State University of Comrat	Găgăuzia	5.9	Tertiary education
University of Applied Studies Moldova	Chişinău *	7.8	Tertiary education
International Institute of Management "IMI - NOVA"	Chişinău *	8.3	Tertiary education
Transport, Computer and Communication Academy	Chişinău *	8.9	Tertiary education
University of Science Academy of Moldova	Chişinău *	9.6	Tertiary education
"Ştefan cel Mare" Academy of Ministry of Internal Affairs	Chişinău *	9.9	Tertiary education

* These education facilities are in Chişinău city.

Preschools, primary and secondary schools are typically found in some of the settlements along the proposed OHL route. These are typically inside the settlements and would thus be part of the general impact assessment linked to the settlement.

5.3.6.4 Settlements

There are several towns and settlements that will be found within the OHL survey corridor. The distance to the border of Ukraine is 800 meter at the substation in Vulcăneşti and the closest distance to the border of Romania is about 25,000 meters.

Table no. 35. Estimated distances from OHL to nearest building in settlements.

Settlement or building	Estimate distance to closed build [m]	Population (2014)	District	Comment
Vulcăneşti	6,000	12,185	UTAG	
Vulcăneşti Gară	2,000	267 (2004)	UTAG	Building closest to OHL and substation

Settlement or building	Estimate distance to closed build [m]	Population (2014)	District	Comment
Vulcăneşti Gară - industrial site	2,590	-	UTAG	South West of town
Iujnoe	730	707	Cahul	Building South East
Burlăceni	**500**	**1,688**	Cahul	**Building North West**
Greceni	2,660	135 (2004)	Cahul	
Vinogradovca	**440**	**1,548**	**Tărăclia**	**Building at South West in forest**
Muşaitu	**190**	**838**	Tărăclia	**House in the very South East of the village**
Budăi	4,160	834	Tărăclia	
Sălcia	1,710	293	Tărăclia	
Aluatu	3,000	704	Tărăclia	
Novosiolovca	3,270	1,384	Tărăclia	
Balabanu	2,520	864	Tărăclia	Building in the north-west of the town
Albota de Jos	2,030	1,425	Tărăclia	Building in the East of the town
Albota de Sus	1,530	1,944	Tărăclia	Building in the North West of the town
Samurza	3,340	269 (2004)	Tărăclia	
Cealîc	3,090	857	Tărăclia	
Sofievca	1,340	830 (2004)	Tărăclia	
Sofievca - industrial	**420**	**-**	Tărăclia	**Buildings East of the village - could be abandoned**
Roşiţa	1,560	144 (2004)	Tărăclia	
Alexeevca	1,110	388 (2004)	UTAG	Also Svetlîi (pop 1,622) and Cortenul Nou (pop 4200 (2004))
Borceag	650	1,293	Cahul	
Chioselia Rusă	3,730	595	UTAG	
Congaz	890	11,123	UTAG	
Cotovscoe	3,750	873	UTAG	
Tărăclia	3,290	342 (2004)	Cantemir	East of town
Chirsova	5,290	6,298	UTAG	
Sadîc	2,800	2,033	Cantemir	
Congazcicul de Jos	**350**	**273 (2004)**	**UTAG**	**Building in the South of the village**
Congazcicul de Sus	340	1,480	UTAG	
Congazcicul de Sus - industrial	870	-	UTAG	
Industry West of OHL	1,400	-	UTAG	
Comrat	3,500	20,113	UTAG	West of town
Duduleşti	2,000		UTAG	Village of about 9 houses
Borogani	**120**	**3,708**	**Leova**	**West of town**
Cenac	280	1,683	Cimişlia	South of Town
Cenaz	220	-	Cimişlia	Building South East of town
Topala	240	719	Cimişlia	North of Town
Cenac	3,700	2 098	Cimişlia	

Settlement or building	Estimate distance to closed build [m]	Population (2014)	District	Comment
Dimitrovca	670	336 (2004)	Cimişlia	
Cimișlia	2,800	11,997	Cimişlia	Houses in the West of the town
Ecaterinovca	1,380	1,512	Cimişlia	
Grădiște	620	2,109	Cimişlia	
Valea Perjei	**220**	**670**	Cimişlia	**Houses in the East areas – note: these could be barns**
Valea Perjei - industrial	**330**	**-**	Cimişlia	
Hârtop	830	1,974	Cimişlia	
Iurievca - Industrial site	1,850		Cimişlia	South of town possibly abandoned
Iurievca	2,470	526 (2004)	Cimişlia	
Gura Galbenei	1,060	3,795	Cimişlia	
Gura Galbenei - Industrial site	840	-	Cimişlia	North East of town
Munteni	1,750	554 (2004)	Cimişlia	
Lipoveni	570	1,761	Cimişlia	
Lipoveni - industrial	**370**	**-**	Cimişlia	**Industrial building - South of town**
Ivanovca Nouă	1,660	694	Cimişlia	
Fîrlădeni	1,070	925	Hânceşti	House in the North East of village
Buțeni	2,000	3,399	Hânceşti	South of the village
Moleşti	2,940	2,776	Ialoveni	
Hansca	**410**	**1,092**	Ialoveni	**House in the South East of the town**
Costeşti	1,250	10,907	Ialoveni	House in the South East of the Village
Găureni	2,000	534 (2004)	Ialoveni	
Găureni - industrial	1,900	-	Ialoveni	Industrial site South West of town
Zîmbreni	1,040	2,588	Ialoveni	
Horești	3,070	3,511	Ialoveni	
Mileştii Mici	2,900	4,969	Ialoveni	
Frumuşica	2,190	555 (2004)	Chişinău	
Piatra Albă	2,670	704 (2004)	Ialoveni	
Ialoveni	3,000	12,515	Ialoveni	Compounds in the South East part of the town
Strănişteni	**200**	**514 (2004)**	Chişinău	**House in North West corner**
Băcioi	1,270	10,175	Chişinău	
Brăila	**390**	**905 (2004)**	Chişinău	
Chisinau	4,000	469,402	Chisinau	About 4 km to South border of Chisinau town

The list of settlements starts from South to North. Identified settlements/buildings which are found within a distance less than 500 meters are indicated in bold style. The list also includes some industrial buildings. Population is according to 2014 census[78].

There are no settlements that will be passed directly by the proposed OHL route. The closest village is Borogani (Leova district) where the OHL route will pass houses on a distance of about 120 meters. The second closest village is Muşaitu (Tărăclia district) where there is a house situated at a distance of 190 m from the proposed OHL route.

5.3.7 Cultural heritage

The term cultural and natural heritage includes several categories of heritage. **Tangible cultural heritage** include movable cultural heritage (e.g. painting, sculptures, manuscripts etc.) as well as immovable cultural heritage (e.g. monuments, archaeological sites, cave dwellings, historical buildings etc.) that are of outstanding universal value from the point of view of history, art or science, or are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view[79]. **Intangible cultural heritage** includes traditions or living expressions inherited from our ancestors and passed on to our descendants, such as oral traditions, performing arts, social practices, rituals, and festive events[80]. **Natural heritages** include natural sites with cultural aspects such as cultural landscapes, physical, biological or geological formations that are of outstanding universal value from the point of view of aesthetics, science, conservation or natural beauty[81].

As previously outlined, there are thousands of cultural or natural sites in Republic of Moldova, including architectural monuments, settlements from different historical epochs and medieval fortresses. This cultural and natural heritage is relatively evenly distributed around the country.

Important archaeological sites as well as by the state protected cultural monuments are outlined in national registries by the National Archaeological Agency.

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[78] In the cases where population using data from 2004 is given this is for villages which in the 2014 census no longer received specific village level information.

[79] UNESCO, **http://whc.unesco.org/en/conventiontext/** and **http://www.unesco.org/new/en/culture/themes/illicit-trafficking-of-cultural-property/unesco-database-of-national-cultural-heritage-laws/frequently-asked-questions/definition-of-the-cultural-heritage/**

[80] UNESCO **http://www.unesco.org/culture/ich/en/what-is-intangible-heritage-00003**

[81] UNESCO, **http://whc.unesco.org/en/conventiontext/** and **http://www.unesco.org/new/en/culture/themes/illicit-trafficking-of-cultural-property/unesco-database-of-national-cultural-heritage-laws/frequently-asked-questions/definition-of-the-cultural-heritage/**

The national Registry of cultural monuments protected by the state contains around 5500 monuments in the whole country. A number of protected cultural monuments can be found in the affected districts. Cultural monuments in the affected districts include cathedrals, churches[82], monasteries, historically important settlements, war monuments and memorials as well as historically important buildings.

There is no available information on the exact location of protected monuments in the Registry. Proposal has been made on national level to take action related to cultural heritage mapping and GIS no such information is yet available[83].

Based on interviews carried out in villages as well as discussions with the Ministry of Culture, however, protected monuments are generally located in the central areas of villages near the city hall, with very few exceptions in the cementaries. Below in Table 36 is a list of protected monuments in communes and villages inside the analysed corridor of the proposed OHL route.

Table no. 36. List of monuments in survey corridor

Rayon / District	Municipality / City / Commune / Village	Monument	Type
Cimişlia	Ecaterinovca	Monument to the 1944 fallen soldiers tombs, in memory of fellow villagers who died in the first world war 1941-1945	Historical
Cimişlia	Gura Galbenă	Church «Sf. Trei Ierarhi»	Architectural
Cimişlia	Gura Galbenă	Monument in memory of villagers who died in the first world war 1941-1945	Historical
Cimişlia	Topala	Monument to the fallen soldiers tombs, in memory of fellow villagers who died in the first world war 1941-1945	Historical
Cimişlia	Valea Perjei	Monument to the fallen soldiers tombs, in memory of fellow villagers who died in the first world war 1941-1945	Historical
Comrat*	Congaz	Church «Sf. Treime»	Historical
Comrat*	Congaz	Monument of the war heroes 1941-1945	Historical
Comrat*	Dezghingea	Church «Sf. Treime»	Architectural
Comrat*	Dezghingea	Monument of the war heroes 1941-1945	Historical
Hânceşti	Fârlădeni	Monument at the common tomb of fallen soldiers (8) in 1944	Historical
Ialoveni	Băcioi	Church “Sf. Nicolae”	Architectural
Ialoveni	Băcioi	Monument in memory of villagers who died in the first world war 1941-1945	Historical

[82] Churches which are not considered cultural monuments are not included in the national registry
[83] Cavruc, V., 2010, Safeguarding of the national cultural heritage of Rp.MD", Akademos - Science, Innovation, Culture and Art Magazine, no. 2(17), June 2010, ISSN 1857-0461 (http://www.akademos.asm.md/files/Academos_2_2010_PDF.pdf)

Rayon / District	Municipality / City / Commune / Village	Monument	Type
Ialoveni	Băcioi	Monument in memory of victims of Stalin's terror and famine in 1946-1948	Historical Art
Ialoveni	Băcioi	Common tomb of fallen soldier in 1944	Historical
Ialoveni	Hansca	Church "Sf. Împăraţi Constantin şi Elena"	Architectural
Ialoveni	Hansca	Popular sculpture. At the cemetery	Popular architecture
Tărăclia	Borceag	Church «Sf. Apostoli Petru şi Pavel»	Architectural
Tărăclia	Muşaitu	Church «Sf. Dumitru»	Architectural
Tărăclia	Muşaitu	Monument in memory of villagers who died in the first world war 1941-1945	Historical
Vulcănești*	Iujnoe	Monument in memory of villagers who died in the first world war 1941-1945	Historical
Vulcănești*	Iujnoe	Monument to fallen soldiers tomb in 1944	Historical
Vulcănești*	Burlăceni	Monument of the war heroes 1941-1945	Historical
* In ATU Găgăuzia archaeological sites are presented according to its three districts: Comrat, Ceadîr-Lunga and Vulcănești			

There is, however, exact information on the location of important identified archaeological sites. Below, in Table no. 37 archaeological sites in closest proximity to the proposed OHL route is outlined.

Table no. 37. Archaeological sites in proximity to the proposed OHL.

Archaeological sites	District/city	Distance from OHL (m)
Valul lui Traian de Jos (segment)	Vulcănești*	66
Svetlîi Tumulul	Comrat*	56
Dezghingea Tumulul	Comrat*	35
Ecaterinovca	Cimișlia	180
Ecaterinovca I	Cimișlia	445
Valul lui Traian de Sus (segment)	Cimișlia	153
Hansca Livadă	Ialoveni	54
Strănişteni II	Ialoveni	136
Strănişteni I	Ialoveni	95
* In ATU Găgăuzia archaeological sites are presented according to its three districts: Comrat, Ceadîr-Lunga and Vulcănești		

Regarding intangible cultural heritage, no such sites has been reported along the proposed OHL route. This information was collected via phone-interviews carried out specifically with central stakeholders in villages along the proposed project. In case of important cultural events in the villages, the stakeholders argued that these were generally organized inside the cultural house or outside, in the central area of the village.

5.3.8 Occupational health and safety

During OHL's construction, operation and decommissioning, Moldelectrica will hold a key-responsibility for ensuring that the existing legislation and recommendations on occupational

health and safety are followed. Moldelectrica has in place a system to ensure that any accidents or deviations are reported and followed-up by the company. This is also reported back to central authorities and actions are taken, when necessary. Training of new personal in terms of proper health and safety and also routines training are held. The outcomes from these training sessions are followed-up.

In the vicinity of the transmission line there will also be farmers that cultivate farmland as well as shepherds. These working groups would often be considered informal employment, but also formally employed agricultural workers would be found. The number of people exposed, as well as the period of time that will be spent on a certain location will depend on activity and thus be seasonal.

Informal agricultural workers will not be covered by occupational health and safety laws in the same way as formal employed workers. Both employment groups will be found along the OHL route.

6. ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS, CHARACTERISATION OF IMPACTS AND MITIGATION MEASURES

The impact assessment, conducted in order to identify potential Project's impacts on the existing environment and the associated mitigation measures, that follows the methodology described in Chapter 2, refers to different Project implementation stages: construction; operation and maintenance; decommissioning.

As part of impact assessment for each environmental aspect were established the potential impacts in absence of mitigation measures and appropriate mitigation measures.

6.1 Physical environment

6.1.1 Geology and soils

Characterization of soil impact

During construction work of the investment, the main impact on soil/ undersoil is the consequence of land occupation, land that currently have other uses, as well as the physical degradation due to the investments works.

Other possible effects on soil/ undersoil may be due to accidental leakage of fuel/ lubricants and improper storage of the materials to be used or of the waste generated during construction works.

The Projects planned construction works will be developed inside of existing Vulcănești[84] and Chișinău substations and on the land crossed by OHL 400 kV Vulcănești – Chișinău route (158 km).

The works planned at the ***Vulcănești and Chișinău substations***, will be performed in the substations fenced enclosure (see reference no. 84), industrial site, avoiding damages to adjacent areas. To do this, the contractor will agree with the client the construction site location and organization will mark it with barriers not to affect other areas beyond that necessary set by the project.

[84] If Vulcănești substation land is not subject to contamination

The potential sources of impact on soil/ undersoil at Vulcănești and Chișinău substations are the following:

- Land preparation work and vertical systematization;
- Accomplishment of technological platforms for the new planned substations;
- Excavation works of the foundation pits (for constructions objects in the enclosure (see reference no. 84), for new equipment's, for transformers foundations, frame and supports foundations, cable channels, a.s.o);
- Inner roads construction works;
- Road traffic indirectly by means of air pollutants, in particular deposition of powders, and directly by means of spillage of fuel or lubricants;
- Storage of construction materials and waste on land areas not waterproof.

The land area affected by the construction works held at the substations is about 2.1 ha at Chișinău substation and about 6.9 ha at Vulcăneşti substation m^2 (of which 6.477 ha for BtB substation).

Construction works for the OHL 400 kV Vulcănești - Chisinau will take place on lands along the line route, the main impact on the ground being the result of land occupation that currently has other uses.

The potential sources of impact on soil/ undersoil of the works performed on the land alongside the OHL route are the following:

- Accomplishment of working platforms for towers erection and for phase conductors and ground wires sagging operations,
- Foundations pits excavation and foundations pouring;
- Preparation of the existing roads, unless this is required by the conditions of the area;
- Road traffic indirectly by means of air pollutants, in particular deposition of powders, and directly by means of spillage of fuel or lubricants;
- Storage of construction materials and waste on land areas not waterproof.

For the OHL investments are needed permanent land areas (OHL tower foundations) and temporary land areas (during investment execution period) for the OHL tower erection platforms and the corridor for OHL phase conductors and ground wires stringing.

Land areas that are to be temporarily occupies are the following:

- Working platform for suspension towers erection (about 825 m^2);

- Working platform pertaining to tension towers for erection, phase conductors and ground wires sagging operations (about 1500 m^2);
- OHL working corridor (access zone) 3 m width, for phase conductors and ground wires erection (tension).

The temporarily occupied land area is about 94.85 ha, including the area for towers erection working platform, area for phase conductors and ground wires sagging operations working platform and OHL working corridor (access zone).

About 85% of temporarily occupied land are chernozems, 7.25% are delluvial soils, 6.45% are alluvial soil and about are 1.3% are other soils.

The permanently occupied land area depends on the height and type of tower and ranges from 65 - 193 m^2. The average area of land required for the foundation of 511 towers is estimated to about 40,889 m^2. About 3,362 hectares of this area are chernozems, 0.235 ha are delluvial soils, 0.261 ha are alluvial soil, 0.058 ha are cernosiomoid soils, 0.042 ha are grey soil, 0.045 are vertic soils and 0.013 ha are swamp alluvial soils.

OHL towers will be placed mainly in non-eroded areas (about 73.63 % of the total of 511 towers); the remaining ones might be placed in slightly (16%) /moderately (7.5%) eroded areas according to the assessment of the digital map of soils in Republic of Moldova. Visual inspections of the towers proposed sites are recommended in areas with potentially eroded soils before carrying out the actual construction work and if necessary conducting the punctual geological investigations.

The potential impact on soil/ undersoil related to investments works could be:

- Increased vulnerability to erosion due to the action of wind and precipitation through surface cover (vegetation and soil top layer) removal, as well as land preparation works for construction of the OHL, access roads preparation, if necessary, and pits excavation works;
- Increased vulnerability to landslides in areas susceptible to erosion;
- Temporary soil compaction due to site organization, land preparation works and vehicles and other special equipment traffic along access roads. In addition, the increased humidity conditions might favour mud carrying away off the site on vehicle tires and could result in sedimentation in off-site areas;
- Increased probability of soil pollution as a result of poor management of construction materials and waste from construction activities;
- Increased probability of soil contamination due to improper use and operation as well as spillage of hazardous substances (fuel, lubricants, transformer oil, paint).

The Project's investments impact on soil and undersoil in the absence of mitigation measures is expected to be **high**.

During the ***operation stage*** the potential sources of impact on soil/ undersoil of the proposed Project, are the substations and OHL's maintenance and repair activities and the potential impacts consist of:

- Increased vulnerability to erosion due to vegetation periodic deforestation as part of normal maintenance of access and protection corridor;
- Soil compaction due to the traffic of maintenance vehicles on the access road along the OHL route;
- Increased probability of soil pollution as a result of accidents (fuel, lubricants, and paint spillage) that might appear during maintenance works.

The impact on soil/ undersoil of Projects operation stage in the absence of mitigation measures is expected to be is expected to be **minor.**

During the decommissioning stage of OHL and of the substations equipments subject of the proposed investment the potential sources of impact on soil/ undersoil are the following:

- Soil compaction due to site organization works, accomplishment of working areas and traffic of vehicles and equipments involved in decommissioning works;
- Increased probability of soil pollution due to an inappropriate management of materials and waste generated from decommissioning activities;
- Increased probability of soil pollution due to improper management of hazardous substances.

The impact on soil and undersoil of decommissioning works The Project's investments impact on soil and undersoil in the absence of mitigation measures is expected to be **moderate**.

The characterization of the Project's impact on soil/ undersoil, in accordance with the methodology described in Chapter 2, without mitigation measures, is presented in the following table.

Table no. 38. Matrix for evaluation of potential impacts on soil/ subsoil, without mitigation measures

	Description	Scale	Duration	Magnitude	Probability	Significance
Construction	Increased vulnerability to erosion as a result of surface cover loss and excavations	On-site	Short-term	High	High	High
	Increased vulnerability to landslides as a result of surface cover loss and excavations	On-site	Short- term	High	High	High
	Soil compaction due to	Local	Short- term	High	High	High

	site organization works, accomplishment of working areas and vehicles traffic					
	Inappropriate management of construction materials and waste	On-site	Short- term	Low	Average	Minor
	Accidental spillage of fuel and lubricants	On-site	Short- term	Low	Average	Minor
Operation	Soil compaction on access road during maintenance activities	Local	Long-term	Low	Average	Minor
	Accidental spillage of fuel, lubricants or paint	On-site	Short- term	Low	No	Negligible
Decommissioning	Soil compaction due to site organization works, accomplishment of working areas and vehicles traffic	Local	Short- term	High	High	High
	Improper management of waste and materials form decommissioning	On-site	Short- term	High	Average	Moderate
	Accidental spillage of fuel or lubricants	On-site	Short- term	High	Average	Moderate

Mitigation measures

In order to protect soil/ undersoil and minimize, reduce and where possible offset the potential effects of the Project the following mitigation measures will be implemented:

- Jointly investor-constructor establishment of the areas for site organization, (headquarters and branches along the OHL route);
- Barriers marking of the site organization to not affect other areas beyond that necessary for the project;
- Controlled storage of construction materials and waste generated during the execution and decommissioning stages on distinct areas of the site;
- Avoidance of ground storage of materials that exposed to rainfall might lead to soil and groundwater aquifer infiltrations (sealing of storage areas);
- Minimize excavation and removal of surface cover in the areas affected by the Project's activities;
- Provision of parking areas for the vehicles and equipment involved in Project's works. All the equipment and vehicles shall be maintained in good working order and possible defects will be reported in the shortest time and addressed to specialized units not on site. In order to reduce the risk of spillage fuel supply and oil change will

be undertaken only in places intended to these purposes. Work area shall be equipped with absorbent materials and/ or neutralizing substances for rapid intervention in case of accidental spillage of fuel and/or lubricants;

- Deposits of fertile soil resulting from the pits excavation will be placed in secure location with run-off and erosion prevented and close to the working area not affecting adjacent surfaces. The maximum height of the piles shall ensure their stability.
- During wet weather periods, open excavations will be protected by covering with polythene, off-road driving shall be avoid and ruts shall be repaired as soon as possible;
- Limit, where it is possible, vehicle movements in off-road areas mainly in areas with softer soils and on steeper slopes;
- Steep terrain shall be avoided during the transportation of construction material by using alternative routes or use light vehicles where appropriate. Suitable engineering will be undertaken to ensure that the stability of the slope is maintained, including in areas prone to slides;
- For the transport of construction elements and new equipment shall be used, wherever possible, existing roads and way-leaves;
- The waste and package waste generated during Project's activities will be managed in compliance with the relevant legal provisions (selective collection without contact with soil, water; reuse or disposal);
- Upon completion of works will be undertaken activities for land restoration and revegetation, including re-vegetation/ seeding with native species to complement natural vegetation regeneration and to improve ground cover.

The measures listed above are good construction practice measures and are designed to ensure that the construction activities do not generate excessive impact on soil/ undersoil. Implementation of such measures will ensure that no high impact on soil/ undersoil occur during project construction of the proposed transmission line. Further mitigation measures will be developed on a site-specific basis based on a review of the planned construction activities and their proximity to the receptors.

The site specific mitigation measures will need to ensure that the land affected by earthworks will not be subject to significant erosion, slides and soil compaction. These measures will be focused on the mitigation of soil impact from key activities including access roads construction and earthworks for substations and OHL line and will be included in appropriate technical documents.

6.1.2 Hydrology

Characterization of water impact

The impact of the Project's activities on surface water is not anticipated to be on long-term, more than that on groundwater there are not anticipated impacts

Taking into account that there are no consumptive uses or large amounts of water needed for withdrawal for construction, maintenance or operation of the planned project water availability is not a significant issue.

Construction stage

For the Project's activities developed inside substations enclosure (see reference no. 84) the impact on water and groundwater resources will be minor taking into consideration that the construction works will be performed on industrial sites, the size of foundation are limited and the construction good practices measures will be undertaken (waterproof technological platforms, fuel and lubricants change on waterproof areas, a.s.o).

In the sections below will be detailed the impact of OHL line related activities.

During OHL's construction activities, the potential sources of impact on surface water and groundwater are represented by

- Access roads construction;
- Excavation of towers pits and substation's foundations;
- Clearing and grubbing of vegetation for the transmission line routes;
- Accidental spillage of fuel and lubricants.

The potential impact on surface water and groundwater related to Project's investment works might be:

- Impact on water quality: Increment in turbidity and sediment deposition in receiving water bodies due to erosion of exposed soil, fugitive dust and particulate matter washing. Tower construction activities and soil disturbance from vegetation clearing done in close proximity to water streams will introduce sediment carried in runoff into these streams. The Project will cross five rivers basins (Bâc, Botna, Cogâlnic, Ialpug, Cahul) and some sediment could be carried into these streams during construction.

  At locations of shallow groundwater conditions, dewatering operations may be required in order to temporarily lower groundwater levels in order to install the proposed new foundations and towers

  There will also be some potential for water pollution and contamination from hazardous material or fuel accidental loss during construction activities.

- Disrupt water flows: Altering the natural vegetation and topography on a site may increase runoff flow rates, resulting in more water moving offsite and carrying sediment with it. The increased storm water runoff may accelerate erosion downstream, increase deposits of sediments and increase the potential for flooding. Such phenomena are particularly of concern in areas that exhibit steep topography, such as hillsides, cliffs, mountain slopes and similar areas. Placement of towers in floodplains can disrupt water flow and could trap debris in the river, which could further disrupt river flow. During storm events, this could result in flooding of upstream areas. There are at least six towers located in areas that are likely floodplains. During Project's detailed design stage the final position of the towers will be established in coordination with the Ministry of the Environment, the authority in charge with the natural resources management and environmental protection as well as with Ministry of Health. That will insure the protection of surface/underground water sources.

The Project's investments impact on waters in the absence of mitigation measures is expected to be **moderate**.

During operation stage the impact on surface water will be related to operation and maintenance activities that may affect water quality from the improper use, handling and accidental spills of hazardous substances (insulating oils, lubricants, paints, and other toxic substances which could be used during the operation and maintenance of the project).

The impact of Project's operation and maintenance activities on in the absence of mitigation measures is expected to be **minor.**

During decommissioning stage the impact on surface water will be related to water quality. Water contamination can occur from soil erosion, runoff of sediments and soil that lead to an increment of turbidity, accidental spillage of oil and lubricants from vehicle and equipment involved in decommissioning activities.

The impact of Project's decommissioning activities on waters in the absence of mitigation measures is expected to be **moderate.**

The characterization of the Project's impact on water, in accordance with the methodology described in Chapter 2, without mitigation measures, is presented in the following table.

Table no. 39. Matrix for evaluation of potential impacts on water, without mitigation measures

	Description	Scale	Duration	Magnitude	Probability	Significance
Construction	Increased turbidity	Local	Short-term	Moderate	Average	Moderate
	Accidental spillage of fuel and lubricants	Local	Short- term	Moderate	Average	Moderate
	Water flow changes	Local	Short- term	Moderate	Average	Moderate
Operation	Accidental spillage of fuel, lubricants or paint	Local	Long-term	Low	No	Minor

	Description	Scale	Duration	Magnitude	Probability	Significance
Decommissioning	Increased turbidity	Local	Short-term	Moderate	Average	Moderate
	Accidental spillage of fuel and lubricants	Local	Short- term	Moderate	Average	Moderate

Mitigation measures

In order to protect water and minimize, reduce and where possible offset the potential effect of the Project the following mitigation measures will be implemented:

- Providing portable toilets for the workers involved in construction and decommissioning stages;
- Establishment of all construction zones alongside OHL route at distance from nearby surface waters so that the impact on water to be diminished (to be established at the next technical stage – detailed design);
- Establishment, if possible, of tower foundations in dry locations with well consolidated geology, and avoiding wetland areas or floodplains. However, where this was not possible it was chosen drilled columns foundation types an environmental more friendly solution compared to classic solution foundation;
- Minimize work on soft ground in wet weather, wherever possible;
- Keep all engines in good working condition and repair any leaking equipment immediately in special areas;
- Prevent erosion and run-off of sediment from construction works, including roads, to watercourses;
- Controlled storage of construction materials and waste generated during the execution and decommissioning stages on distinct areas of the site;
- Avoidance of ground storage of materials that exposed to rainfall might lead to groundwater aquifer infiltrations (sealing of storage areas);
- Forbidding watercourse crossing by vehicles and machinery during construction
- Forbidding discharges of any water or other materials to watercourses, the storage of soil or other materials close to watercourses;
- Provision of oil/ storm water tank, placed bellow energy transformer on a concrete foundation for protection against transformer oil spill. Regular inspections throughout

substation operation period are recommended to be performed to ensure security of the containment.

The measures listed above are good construction practice measures and are designed to ensure that the Project's activities do not generate excessive impact on surface and underground water.

6.1.3 Air quality

Impact characterisation

During the ***construction stage*** of the proposed Project, the main source of air pollution is local, due to site preparation and construction activities, including road traffic associated with these activities.

The pollutant emissions likely to occur during the construction stage are as follows:

- *Dust emissions*, during the working hours of the construction activities, such as :
  - Soil excavation, handling, storage;
  - Site preparation and restoration after completion;
  - Construction of 400 kV OHL Vulcăneşti-Chişinău (towers and access roads);
  - Internal construction works in existing substations (BtB Vulcăneşti and 400/330 kV Chişinău);
  - Road traffic associated with construction activities on unpaved roads;
- *Pollutant emissions* (NOx, SO_2, CO, hydrocarbons and particulate matter), due to the diesel and gasoline vehicles and equipments used for construction works.

The impact of dust and pollutant emissions on air quality during the construction stage is expected to be ***moderate***, with no significant effects outside the boundaries of the construction sites, considering the following aspects:

- The construction works in existing substations (Vulcăneşti and Chişinău) will use the existing interior roads networks for equipments and construction elements transport;
- The average distance between two OHL's towers is 309 m (511 towers among the entire OHL route with total length of 158 km), so the accumulation of pollutant emissions in certain areas is excluded;
- The areas where constructions works will be perform are without agglomeration of buildings, with positive effects on pollutants dispersion in the atmosphere.

During the ***operation stage*** of the proposed Project, the potential impacts on air quality are due to:

- *Pollutant emissions* (NOx, SO_2, CO, hydrocarbons and particulate matter), due to the vehicle traffic on access roads, for routine inspection and maintenance activities and Diesel units provided in Vulcănești substation;
- *Ozone formation* that may appear in certain atmospheric conditions (rain, fog or rime), due to Corona discharge around the wires.

The impact of pollutant emissions on air quality is expected to be ***minor*** and occurs mainly during rout line inspection and maintenance activities. The Diesel units are occasionally used, only as a security sources for AC vital consumers.

Corona discharges occur at the surface of a conductor of 400 kV OHL when the electric field intensity on the conductor surface exceeds air dielectric strength. On the conductor surface, an irregularity, such as contaminated particles, causes a concentration of voltage gradient which can become the point of a discharge. The breakdown of air in this region produces light, acoustic noise, radio noise, conductor vibration, ozone and other products.

Corona discharges, as other any natural and anthropogenic electrical discharge, produce air ionization and ozone formation.

At soil level, the ozone formation due to Corona discharge depends on several factors: atmospheric condition, wind direction and speed, air turbulence.

Generally, the ozone concentration at soil surface is negligible; within the area without urban or industrial activities the ozone concentration is 50 ppm. In the vicinity of 750 kV OHL in specific meteorological condition (heavy rain, low wind with parallel with conductors) the ozone concentration reaches 7 - 9 ppm (1ppm =one ozone molecule over a milliard air molecules)[85].

Considering the characteristics of the proposed Project, the ozone concentration associated with 400 kV OHL, at soil surface, is expect to be ***minor.***

The ozone concentration has to respect the Republic of Moldova and EU legislation related the air quality, namely:

85 „Power facilities environmental impact. Neuro-fuzzy methods approach", Politehnica University of Timişoara, http://www.wseas.us/e-library/conferences/2011/Paris/ECC/ECC-26.pdf

Table no. 40. Ozone concentration in Republic of Moldova and EU legislation

Legislation	Parameter/ Objective	Averaging period	Value
EU (Directive 2008/50/EC)	***Target values***		
	Protection of human health	Maximum daily eight-hour mean[1)]	120 µg/m^3, not to be exceeded on more than 25 days per calendar year, averaged over three years[2)]
	Protection of vegetation	May to July	AOT40 (calculated from 1h values) 18,000µg/m^3 x h, averaged over five years [2)]
	Long-term objectives		
	Protection of human health	Maximum daily eight-hour mean within a calendar year	120 µg/m^3
	Protection of vegetation	May to July	AOT40 (calculated from 1h values) 6,000 µg/m^3 x h
Republic of Moldova	Maximum allowable concentration (CMA_{md})	Daily average	0.03 mg/ m^3
	Maximum allowable concentration (CMA_{mm})	Maximum, registered 20 minutes	0.16 mg/ m^3

[1)] The maximum daily eight-hour mean concentration shall be selected by examining eight-hour running averages, calculated from hourly data and updated each hour. Each eight -hour average so calculated shall be assigned to the day on which it ends. i.e. the first calculation period for any one day will be the period from 17:00 on the previous day to 01:00 on that day; the last calculation period for any one day will be the period from 16:00 to 24:00 on the day.

[2)] If the three or five year averages cannot be determined on the basis of a full and consecutive set of annual data, the minimum annual data required for checking compliance with the target values will be as follows:
- for the target value for the protection of human health: valid data for one year;
- for the target value for the protection of vegetation: valid data for three years.

During the ***decommissioning stage***, in the local area, a negligible increase of air pollution from mobile sources is expected; the pollutant emissions likely to occur are the following:

- *Dust emissions*, from road traffic, dismantling the infrastructure and equipments and restoration of the environment to initial condition;
- *Pollutant emissions* (NOx, SO_2, CO, hydrocarbons and particulate matter), due to the vehicles used for transport of waste resulted from dismantling activities, as well as the equipments used for decommissioning.

The impact of dust and pollutant emissions on air quality is expected to be ***moderate***, considering the following aspects:

- The dismantling works will be performed in existing substations (Vulcăneşti and Chişinău) and will use the existing interior roads networks;
- The average distance between two OHL's towers is 309 m (511 towers among the entire OHL route with total length of 158 km), so the accumulation of pollutant emissions from dismantling works in certain areas is excluded;
- The areas where the dismantling works of OHL's towers will be performed are without agglomeration of buildings, with positive effects on pollutants dispersion in the atmosphere.

The characterisation of the Project's impact on air quality, in accordance with the methodology described in chapter 2, without mitigation measures, is presented in the following table.

Table no. 41. Matrix for evaluation of potential impacts on air quality, without mitigation measures

	Description	Scale	Duration	Magnitude	Probability	Significance
Construction	Dust emissions from construction activities	On-site	Short-term	Moderate	High	Moderate
	Pollutant emissions from traffic (construction activities)	Local	Short- term	Moderate	High	Moderate
Operation	Pollutant emissions from traffic (routine inspection and maintenance)	Local	Long-term	Low	Average	Minor
	Ozone formation	Local	Temporary	Low	Average	Minor
	Diesel units	On-site	Temporary	Low	Average	Minor
Decommissioning	Dust emissions from road traffic (dismantling and decommissioning activities)	On-site	Short- term	Moderate	High	Moderate
	Pollutant emissions from traffic (dismantling and decommissioning activities)	Local	Short- term	Moderate	High	Moderate

Mitigation measures

During the ***construction stage***, several good construction practices may be applied in order to mitigate dust and vehicle emissions, such as:

- Minimize the open excavation areas and proper coordination of excavation activities (excavation, grading, compacting, etc.);
- The number of transport means used for materials and equipments for OHL's towers erection are rather small, in line with associated quantities;
- The equipments used for erection of each OHL's tower will not work simultaneously and will respect the sequence works, according with specific technical norms;
- Apply water sprinkling measures to reduce dust, in case of visible dust generated by vehicles or other activities;
- Reduce speeds on unpaved roads until water sprinkling measures are in place;
- Maintain all construction machinery and equipments in good working order;
- Vehicles carrying aggregate materials will be sheeted at all times.

As part of ***operation stage,*** after Project's commissioning, measurements campaigns for ozone concentration among specific areas nearby the OHL route are recommended to be

performed in order to compare the measurement results with legal limits; the measurement results will made available for interested parties and institutions.

During the ***decommissioning stage***, several good practices may be applied in order to mitigate the air pollution, such as:

- Apply water sprinkling measures to reduce dust, in case of visible dust generated by vehicles or demolition activities;
- Reduce speeds on unpaved roads;
- Maintain all equipments in good working conditions;
- Proper management of waste from demolition activities in compliance with waste hierarchy (reuse, recycle, recovery).

6.1.4 Climate change, mitigation and adaptation

Climate change is one of the most complex issues involving two approaches focus on the need to reduce the greenhouse gas (GHG) emissions by proper mitigation measures and to adapt to the climate change by adjustment to actual or expected future climate.

Mitigation of climate change

In order to assess the Project's impact on climate change, the GHG emissions expected to be associated with the Project were estimated in line with EBRD Methodology for Assessment of Greenhouse Gas Emissions, considering the following:

➢ ***SF_6 emissions***

During the ***operation stage*** of the proposed Project, the potential impact on climate change is due to SF_6 emissions, use as extinguishing environment for high voltage circuit breakers provided in Vulcănești and Chișinău substations.

The new equipments for substations include installation of hermetically sealed gas-filled (SF_6 –sulphur hexafluoride) equipments, such as electrical switching equipments. Considering that the SF_6 is a greenhouse gas with a significantly higher global warming potential than CO_2, the use of SF_6 should be minimized and used only in equipments with low leakage rate.

For estimation the annual SF_6 emissions were considered the following parameters:

- Number of circuits breakers provided in the substations, 12 pcs. (8 in Vulcăneşti substation and 4 in Chişinău substation);

- Total quantity of SF_6 in circuits breakers, 660 kg (55 kg SF_6/circuit breaker, based on technical specification);

➢ The charge lost each year (according with technical norms 0.1 % of the existing SF_6 charge lost each year);

➢ The Global Warming Potential (GWP) for SF_6 (22,800).

Considering these assumptions, the GHG emissions are estimated to reach ***15 tons $CO_{2\ equiv.}$ / year.***

As mitigation measures, the appropriate handling of SF_6 gas is recommended to be implemented, according with manufacturer's instruction.

➢ ***GHG emissions savings***

The GHG emissions savings potential has been estimated considering the following assumptions:

- By implementation of the Project, the Republic of Moldova will import annually 2,400,000 MWh from Romania;
- In absence of the Project, the electricity generation is assumed to be produce in Republic of Moldova, in a high efficient CCGT on natural gas (estimated annual consumption 15,725.551TJ);
- The CO_2 emission factor for natural gas is 56.1 t CO_2/TJ (IPCC 2006).

Considering these assumptions, the GHG emissions saving are estimated to reach ***882,203 tons $CO_{2\ equiv.}$ /year.***

Per total, the Project implementation will provide ***GHG emissions saving in order of 882,188 tons $CO_{2\ equiv.}$/year,*** representing around 10 % of total GHG emissions in Energy sector registered in 2010 (8.9465 Mt $CO_{2\ equiv.}$).

The Project will have ***positive impact on climate change***, considering the expected annual GHG emissions saving.

Adaptation to climate change

Climate change challenges the energy production and transmission due to progressive temperature increase, an increasing number and severity of extreme weather events and changing precipitation patterns. The climate change risks and vulnerabilities should be properly assessed in order to integrate proper adaptation measures into project planning, design and implementation.

Considering the characteristics of Project's area, the key impacts of climate change on proposed Project due increase variable weather and potentially stronger storms consist in:

- Strong winds and storms that can damage the conductors through trees damage;
- Increased risks of flooding, landslides and other natural hazards;
- High temperature that may reduce the OHL load capacity and increase the consumption of auxiliary services within the substations and transformers.

The level of impact is expected to be ***moderate*** due to the adaptation measures integrated as part of Project's planning, design and implementation such as:

- The OHL design considered the main climate–meteorological condition specific for the Project area; the reference values for OHL design are:
  - Basic dynamic pressure:
    - wind non-simultaneous with ice: 65 - 80 daN / m^2;
    - wind simultaneous with ice: 16.3 - 20 daN / m^2;
  - Maximum temperature: + 40 ℃;
  - Minimum temperature: - 32 ℃;
  - Average temperature: + 9.7 ℃;
  - Ice thickness: 25 - 30 mm;
  - Ice volumetric weight: 0.9 daN / m^2;
  - Ice creation temperature: - 5.0 ℃;
  - Humidity: 90 %;
- The OHL route considered the results of preliminary prospection works developed by the Institute for Research, Design and Technology ENERGOPROIECT; the physical-geological processes and phenomena (erosion, landslides, land subsidence, etc.) were not observed within a radius of 100-200 m from the drilling wells;
- The Project is provided with appropriate measures aiming to promote climate resilience, such as:
  - Modern installations/systems: forced cooling system for valves, with ultra-pure deionized water, for minimizing losses in the transistors and in other components and reducing the temperature of these components; installations for direct lightning strikes protection;

- The OHL towers will be self-supporting latticed steel tower with anti-corrosive protection; the tower foundations will be cast or drilled, of reinforced concrete, depending on specific geotechnical characteristics of soil;
- The OHL route avoids, as much as possible, the trees areas, several rerouting being performed in order to be away from trees; the minimum size at crossing the trees will be observed (6 m);

- Considering that in the Project area, there might be eroded soils and landslides, for establishing the final positions of OHL towers, a detailed site investigation shall be performed during the next stage of the Project (Technical Project and Detailed Design).

During Project's operation, as adaptation measures to climate change, regular inspection of OHL route and emergency response planning are required.

As part of maintenance program the following types of works shall be periodically performed:

- The width of OHL safety corridor will be maintained clear, according to the GD no. 514/2002 for approval the Regulation regarding the protection of electrical network, without any trees exceeding the high of 4.0 m;
- Visual inspection of the OHL's technical status (towers, conductors, towers foundation);
- Performing the necessary replacement works (faulty insulation elements, damaged conductors, inadequate clamps and bindings);
- Performing the necessary repairing works (damaged towers, deteriorate foundations, etc.).

The emergency response planning in case of natural hazards and extreme events (floods, storms, lighting, landslides, seismic events, etc.) is presented in section 6.4.

6.1.5 Noise and vibration

The 400 kV OHL is associated during its operation with specific noise due to corona discharge.

Corona discharges occur at the surface of a conductor of 400 kV OHL when the electric field intensity on the conductor surface exceeds air dielectric strength. On the conductor surface, an irregularity, such as contaminated particles, causes a concentration of voltage gradient which can become the point of a discharge. The breakdown of air in this region produces light, acoustic noise, radio noise, conductor vibration, ozone and other products.

The noise intensity generated by Corona discharge depends on the conductor radius, the number of conductors in the bundle and atmospheric humidity.

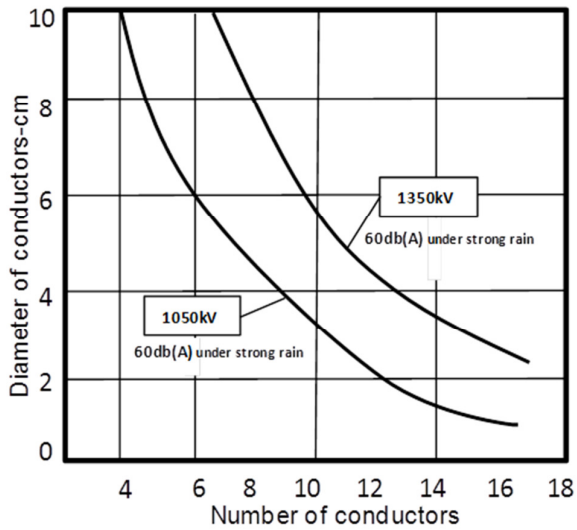


Figure no. 60. Diameter and number of conductors in the bundle to limit noise level to 55-60 dB, at 15 m from the outer phase during wet conditions

For the 400 kV OHL, equipped with 3 x 3 x 300/39 mm^2 conductors, the noise level produced by Corona discharge will not exceed the level of 55 - 60 dB during wet conditions at a distance of 15 m from the outer phase. The value of 55 dB characterizes the noise level of a normal conversation.

Corona discharge which will occur at 400 kV OHL will be associated with the occurrence of a sequence of short time current impulses. The propagation of these currents causes, around the circuits, the occurrence of disturbing electromagnetic fields with different frequency and amplitude leading to disturbance of radio and TV signals.

The high frequency interferences produced by Corona discharge are present both in radio installations operating in the frequency band of (0.5...1.6) MHz, in TV ones (24...216) MHz and in high frequency telephony through carrier currents.

The radiofrequency interferences depend on: conductor surface voltage gradient; number and dimension of conductors in the bundle; distance of radio receiver as to high voltage line; meteorological conditions.

During fine weather, the radio interferences level, in the case of 400 kV OHL may reach 50 dB (at 20 m of the line axis and reported to 1mV/m); during wet conditions (rain), the interferences level can reach 70 dB.

TV emission interferences are determined by two factors:

- Passive interferences due to the presence of electrical installations and useful signal reflections caused by them;
- Active interferences due to the useful signal distortion by the high frequency disturbing field caused by Corona discharge.

High frequency electromagnetic interferences due to Corona discharge increase with the rain intensity and occur mainly in areas with weak TV signal intensity and in the case of the receiver inadequate installation. Disturbing levels of (40...70) dB at 75 MHz frequency may be reached.

The 400 kV OHL equipping does not lead to values of interferences level higher than admissible limits.

Impact characterisation

During the ***construction stage***, the main source of noise and vibration generators is the transport vehicles and machinery/equipment used. Noise from construction can cause nuisance and disturbances, both for workers and nearby local communities.

For OHL, construction noise will be limited in time (one tower take 30 days) and vary in intensity over this period of time.

Execution works of the new 400 kV station and extending to a cell of the existing 330 kV Chisinau substation, as well as the realization of new BtB substation and extending to a cell of the existing 400 kV Vulcăneşti substation will be carried out inside existing substations (see reference no. 84) belonging to Moldelectrica, noise and vibration impact on the population and residential areas being neutral.

OHL towers sites and related technological platforms will not be close to residential areas, most of them are outside populated areas (at a distance of 200 m), the impact of noise and vibration on population and housing being neutral.

Sources of noise and vibration will consist of machines and vehicles used by the manufacturer as follows:

- Non-road mobile vehicles (excavators, bulldozer, compactors, etc.);
- Operations of cutting by welding and assembly of metal elements;
- Traffic due to materials supply.

The perception of noise in the far field depends on a number of external factors such as weather conditions, the effect of soil, air absorption, topography, vegetation, etc.

Associated acoustic powers related to equipment used (bulldozer, loader, excavator, compactor, tipper), will be between 75 - 115 dB, based on technical specifications of each equipment.

Noise level due to the use of equipment required to carry out necessary works, exceeds the permissible sound level during execution of works in the front of it, while being inevitable.

Based on the noise associated to equipments it is estimated that there will be at construction sites noise levels up to 100 dB (A) for certain periods of time. Taking into account the legislation in the field of reduction of noise and taking into account its decreasing with distance, it is estimated that from the distance of 100 m from the boundary of the construction site will record the equivalent noise level of less than 50 dB (A).

In the areas of transportation, comprising at certain work stages the populated areas, can generate equivalent levels of noise for the reference periods of 24 hours, over 50 dB (A) only if the number of transport vehicle to supply equipment required for construction (tippers) exceeds 20.

For outside populated areas, taking into account the decrease of the noise with distance, the effect of the soil, absorption in the atmosphere, the time intervals of equipment use lower than the reference period (one day), resulting, regarding the noise generated by the traffic of vehicles, equivalent levels of noise of less than 50 dB (A) starting from 100 m from the main circulation path or the construction site.

Vibrations that occur during the execution works get below 20 Hz, the threshold at which the human body is affected.

Due to the above mentioned it is considered that the impact of noise on the population will be **moderate** and on the short time period.

At the ***operation stage*** of 400 kV OHL and electrical substations, noise occurs because:

- Corona discharges that produce sounds as crackling and sizzling of low intensity, perceptible only in the vicinity of the line, in the protection and safety;
- "Buzzing of electric line" – low intensity noise audible only in the protection and safety areas;
- Power transformers and reactance coils with the iron core, at which the noise is produced by vibration of the core;
- Transformer cooling forced installations and the compensation coil consisting of recirculating fans and oil pump;
- Pumps for transistor valves cooling system;
- Diesel generators for power supply of internal services;

- Certain activities in the period of revisions/repairs work (materials handling, mechanical processing, transportation, etc.).

The corona discharges will typically increase during wet weather conditions (fog, rain etc.). The sound can potentially reach levels that will be experienced as disturbing but as the sound is in fact an energy loss, the design of transmission lines will be made to avoid and minimize any corona discharges.

For the 400 kV OHL equipped with 3 x 3 x 300/39 mm^2 conductors' corona discharge noise level will not exceed the level of 55-60 dB in rainy weather at a distance of 15 m from the outer phase. The value of 55 dB noise is characteristic for a normal conversation.

Power transformers and autotransformers generate noise, composed of a fundamental tone of 100 Hz and harmonics thereof, distributed according to the type and characteristics of the equipment. These harmonics decrease with frequency. The noise is due to vibration of the magnetic core and windings which are transmitted through the insulating oil and the drum. Intermittent noises are given also by air vents that serve to cool the transformers when they are running.

Noise generated by equipments in the substations will be permanent and impact on population will be minor.

Noise problems on the OHL line are of low intensity and will not have any impact on the population and fauna.

During the ***decommissioning stage*** of construction related to OHL and substation (foundations, towers, conductors, insulators, transformers, cells etc.), transport of waste and ecological reconstruction of land occupied by towers/electrical substations related equipments, will be noise and vibration from car transport vehicles and equipment used by demolition / removal, from the activities undertaken by employees with different equipment.

Workers will be provided with hearing protection equipment whenever necessary.

OHL towers locations are outside inhabited areas, the impact on the population and residential areas will be moderate.

The characterisation of the Project's impact of noise and vibrations, in accordance with the methodology described in chapter 2, without mitigation measures, is presented in the following table.

Table no. 42. Matrix for evaluation of potential impacts, without mitigation measures

	Description	Scale	Duration	Magnitude	Probability	Significance
Construction	Noise and vibration from construction activities of OHL (access tracks, tower foundations, tower assembly and erection, attachment of conductors)	On-site	Short-term	Moderate	High	Moderate
	Noise and vibration from construction activities of substations	On-site	Short-term	Moderate	High	Moderate
Operation	Corona effect from OHL and substations	On-site	Temporary	Low	High	Minor
	Operational noise from substations: transformer operational noise transformer coolers/ switchgear noise	On-site	Permanent	Low	High	Minor
Decommissioning	Noise and vibration from dismantling and decommissioning activities of OHL	On-site	Short-term	Moderate	High	Moderate
	Noise and vibration from dismantling and decommissioning activities of substations	On-site	Long-term	Moderate	High	Moderate

Mitigation measures

During construction stage, protection against noise and vibration is achieved by:

- Use of vehicles and machines with a high degree of quietness, equipped with vibration damper with regular technical inspections carried out to date
- Compliance with daily working hours:
  - during day time, procedures will be established to reduce the noise causing nuisance and disturbances, both for workers and local communities;
  - activities during the holidays, nights or at the weekend will be avoided;
- Movement of the vehicles transporting material and equipment on dirt or ballasted with roads with speeds up to 20 km/h.

At the operation stage, noise and vibration from OHL line will be reduced by constructive methods installation of antivibrators and spacers.

After completion of the execution works, another measure that the Contractor will take is to make a study of noise level inside the substations and at substations fence.

The sounds produced by the corona discharge are of low intensity and does not cause discomfort to the surrounding areas, these sounds cannot be eliminated or reduced.

It is recommended at the start and stop of diesel groups to wear personal protective equipment against noise, even if the exposure is on short period of time.

Noise characteristics of technological and technical equipment according to NCM E.04.02-2006 will be specified in their technical documentation.

It is estimated that the activities of the power station will comply with noise limits at the site fence imposed by NCM E.04.02-2006 and to sensitive and residential areas, will be respected the noise limit imposed for the period of the day: 55 dBA.

In the ***decommissioning stage***, protection against noise and vibration is achieved by:

- Use of vehicles and machines with a high degree of quietness, equipped with vibration damper with regular technical inspections carried out to date;
- Compliance with daily working hours:
  - during day time, procedures will be established to reduce the noise causing nuisance and disturbances, both for workers and local communities;
  - activities during the holidays, nights or at the weekend will be avoided
- Movement of the transporting vehicles of waste from the decommissioning of the power line on the ground or ballasted roads with speeds up to 20 km/h.

6.2 Biological environment

6.2.1 Biodiversity/bird species

In order to assess the potential impact on biodiversity, the natural protected areas already included in the National network and the candidate Emerald sites (including IBAs) crossed by the OHL or within the OHL survey corridor, were considered.
The results of impact assessment for the designated and candidate natural protected areas within the OHL survey corridor are presented in the following table.

Table no. 43. State Natural Protected Areas taken into consideration from impact assessment point of view

District	Category	Code and/or name	Surface (ha)	Distance to OHL route (km)	Species/habitats of conservative interest
Ialoveni	Landscape reserve	Cărbuna	607.00	10.20	No potential negative impact. Reason: located in the central part of the country, at 35 km south of Chișinău, within Codrilor Plateau, the reserve has a great interest in terms of vegetation and habitats diversity - forest steppe and steppe and not represent a key area for targeted bird species. There are included bat' species, but because the distance from the OHL is higher than 10 m.
	Forestry Natural Reserve	Moleşti - Răzeni	250.70	6.15	Situated at 6.15 km from the project' area, Moleşti – Răzeni is an area of fundamental natural forest dominated by Sessile Oak (*Quercus petraea*). There are recorded 49 bird breeding species, 5 summer visitor and 8 migratory, as follows: Northern Goshawk (*Accipiter gentilis*), Eurasian Sparrowhawk (*Accipiter nisus*), Ratter (*Buteo buteo*), Kestrel (*Falco tinnunculus*), Turtledove (*Streptopelia decaocto*), Cuckoo (*Cuculus canorus*), Long-eared Owl (*Asio otus*), European Nightjar (*Caprimulgus europaeus*), Common Hoopoe (*Upupa epops*), Eurasian Wryneck (*Jynx torquilla*), Great Spotted Woodpecker (*Dendrocopos major*), Little Spotted Woodpecker (*Dendrocopos minor*), European Robin (*Erithacus rubecula*), Thrush Nightingale (*Luscinia luscinia*), Common Redstart (*Phoenicurus phoenicurus*), Song Thrush (*Turdus philomelos*), Common Blackbird (*Turdus merula*), Eurasian Blackcap (*Sylvia atricapilla*), Common Chiffchaff (*Phylloscopus collybita*), Eurasian Blue Tit (*Cyanistes caeruleus*), Great Tit (*Parus major*), Red-backed Shrike (*Lanius collurio*), Eurasian Magpie (*Pica pica*), Jay (*Garrulus*

					glandarius), Raven (*Corvus corax*), Hooded Crow (*Corvus cornix*), Common Starling (*Sturnus vulgaris*), Common Chaffinch (*Fringilla coelebs*), Greenfinch (*Carduelis chloris*), Hawfinch (*Coccothraustes coccothraustes*), Yellowhammer (*Emberiza citrinella*); among the ***rare species*** are found: European Honey Buzzard (*Pernis apivorus*), Lesser Spotted Eagle (*Aquila pomarina*) and Stock Dove (*Columba oenas*). The last three species are considered EN and CR in Republic of Moldova and can be affected.
	Forestry Natural Reserve	Moleşti	5.00	6.15	No potential negative impact. Reason: the area is designated in order to protect the forest habitats situated at 6.15 km from the project' area,
	Geological Monument of Nature	Costeşti Outcrop	1.00	3.71	No potential negative impact Reason: the conservation subject is the geological monument of nature located on 1 ha in the North part of the Costeşti village, on the left coast of Botna River valley, near the road to Mileştii Mici.
Cimişlia	Geological Monument of Nature	Coțofana Cliff	10.00	0.63	No potential negative impact. Reason: the fauna complex of this paleontological protected area may be attributed to fauna complex hiparion type Turonian in Western Europe. There were founded a rich complex of mammals: *Lagomorpha-Leporinae,* tiger *Mahairodus*, mastodon *Mammut borsoni*, hiparion *Hipparion moldavicum*, rhino polled *Chilotherium Schlosser* boar *Microstonyx major*, deer *Cervavitus variabilis*, giraffe *Helladotherium duvernoyi,* etc.
Hînceşti	Forestry Natural Reserve	Caracui Villa	84.00	8.40	No potential negative impact. Reason: the forest situated at 8.40 km from the project' area is dominated by oak species (*Quercus pubescens*). There were recorded Maple Tartar (*Acer tataricum*), Cherry (*Cerasus avium*), Ash (*Fraxinus excelsior*) and Acacia (*Robinia pseudacacia*). Through the shrubs species predominant are Hawthorn (*Crataegus curvisepala*), Wood Itchy (*Euonymus verrucosa*), Privet (*Ligustrum vulgare*), Spindle (*Euonymus europaea*), etc.
	Landscape Reserve	Hînceşti Forest	4,499.00	?	No potential negative impact from landscape point of view.
ATU Găgăuzia	Geological Monument of Nature	Ialpug Valley	5.60	5.61	No potential negative impact. Reason: situated at 4 km North of Comrat city, on the left side of the Ialpug River is considered geological and paleontological site of Upper Miocene in Southern Moldova, requiring further scientific research.
	Multifunctional area	Bugeacului North (Dezghingea) Steppe Sector	15.00	3.45	No potential negative impact. Reason: the continental steppes situated at 3.45 km from the project' area host seven summer visitor species, but these are not birds that can be affected by power line presence

	Multifunctional area	Bugeacului North Steppe Sector	4.00	3.45	In this area there are nesting 18 bird species, another 5 species are migratory, 12 species are seen in short flights for feeding (trophic migration in the summer); the characteristic species are: Quail (*Conturnix conturnix* L.), Grey Partridge (*Perdix perdix* L.), Ring-necked Pheasants (*Phasianus colchicus* L.), Cuckoo (*Cuculus canorus* L.), Common Hoopoe (*Upupa epops* L.), Crested Lark (*Galerida cristata* L.), Eurasian Skylark (*Alauda arvensis* L.), Tawny Pipit (*Anthus campestris* L.), White Wagtail (*Motacilla alba* L.), Great Whinchat (*Saxicola rubetra* L.), Red-backed Shrike (*Lanius collurio* L.), Greenfinch (*Carduelis chloris* L.), Goldfinch (*Carduelis carduelis* L.), Corn Bunting (*Miliaria calandra* L.), Hen Harrier (*Circus cyaneus* L.).
Cantemir	Monument of Nature - botanical or forestry interest	Cîietu	4.00	9.15	No potential negative impact. Reason: the forest situated at 9.15 km from the project' area is a sector with century-old specimens of oak (*Quercus robur*).
Cahul	Geological Monument of Nature	Fossil site near to the Moscow village	10.00	11.05	No potential negative impact. Reason: scientific interest for fossils of representatives and characteristics species of fauna Moldavian complex, namely: Rabbit (*Alilepus lascarevi*), Pika (*Ochotona antiqua*), Blindly (*Nannospalax macoveii*), Kowalski Mouse (*Pliomys kowalski*), Flying Squirrel (*Pliopentaurista Moldaviensis*), Alexeev Camel (*Paracamelus alexejevi*), etc.
	Geological Monument of Nature	Tartaul Cliff	2.00	6.50	Not the case. The outcrop is considered as a reference geological site with etulia clay and a layer of raw coal with sulphur crystals. There are several main sources of drinking water.
	Forestry Natural Reserve	Bolgrad Highschool	54.00	10.00	No potential negative impact. Reason: there are forests situated at 10.00 km from the project' area, with stand-natural valuable fundamental downy oak (*Quercus pubescens*) and grey oak (*Quercus pedunculiflora*), characteristic for forests in Southern Moldova. There are 82 species of vascular plants, (4 tree species, 10 shrub species and 68 herbaceous plant species). The importance of this area is given by the presence of rare species such as Rabbit Shadow (*Asparagus tenuifolius*) and Periwinkle (*Vinca herbacea*) and a geographical variation of the *Dictamnus gymnostylis* Stev, classified in the Red Book of Moldova as endangered species.
	Monument of Nature - botanical or forestry interest	Borceag	11.30	1.85	No potential negative impact. Reason: forest habitats situated at 1.85 km from the project' area, including the dominant species of Oak (*Quercus pubescens*) with 0.63 density and Grey Oak (*Quercus pedunculiflora*) with 0.48 density, reaching the age of 60÷70 years. Also, is noted Ash

					(*Fraxinus excelsior*) for about 30 years and 0.06 density. Among bushes is highlight Rosehip (*Rosa canina*), Hawthorn (*Crataegus curvisepala*), Blackthorn (*Prunus spinosa*), etc.
Tărăclia	Geological Monument of Nature	Mușaitu Cliff	5.00	2.75	Not the case. The area is in Mușaitu village, on the right slope of Salcia Mare River. Reason: the main criteria for declared as monument of nature are the Pontian marine clay deposits with fruits, seeds and leaves fossilized footprints of various plants and brown coal lenses. Above these deposits is a layer of clay brown-red followed by *Pictris Carpathian* alluviums. These alluviums dating from lower Pliocene and contain skeletal remains of freshwater molluscs and valuable vertebrate specific to Moldavian fauna complex: the snake (*Viper kucurganica)*, ostrich (*Struthio sp.*), monkey (*Ruscinensis cf. Dolicopithecus),* flying squirrel (*Pliopentaurista Moldaviensis)*, *Promimomys moldavicus*, mastodon (*Mammut borsoni)*, boar pond *(Propotamochoerus provincialis)*, antelope (*Parable boodon)*, etc.
	Geological Monument of Nature	Budăi Cliff	5.00	6.40	Not the case. Reason: the area is located on the western outskirts of the Budăi village, Tărăclia District, on the right bank of the Salcia Mare River. The main criteria for which the site of Budai Ravine was declared as a geological and paleontological monument of nature are the lower Pliocene alluvial deposits containing old skeletal remains of reptiles and mammals, among which: smooth snake (*Coronella austriaca)*, monkey (*Dolicopithecus cf. Ruscinensis)*, climber rabbit (*Pliopentalagus moldaviensis)*, beaver (*Trogontherium cf. Minus)*, micromamammal (*Promimomys moldavicus)*, mastodonts (*Mammut borsoni* and *Anancus arvernensis)*, deer (*Procapreolus cusanus)*, etc.
	Multifunctional area	Bugeacului South Steppe Sector	50.00	1.00	From the project impact point of view the area is important for the following birds: *Accipiter gentilis, Accipiter nisus, Buteo buteo, Falco tinnunculus, Coturnix coturnix, Phasianus colchicus, Merops apiaster, Upupa epops, Athene noctua, Asio otus, Picus canus, Dendrocopos major, Turdus merula, Turdus philomelos, Corvus corax, Pica pica, Garrulus glandarius, Pernis apivorus, Circaetus gallicus, Circus cyaneus, Circus pygargus, Aquila pomarina, Aquila chrysaetos, Hieraaetus pennatus, Falco cherrug.* Continental steppes are situated at 1.00 km from the project' area, the vegetation being represented by the smooth-stalked meadowgrass *(Poa angustifolia)*, common agrimony (*Agrimonia eupatoria),* dropwort (*Filipendula vulgaris),* chicory *(Cichorium*

					intybus). Fescue occupy most of the steppe and is found on North and North-East slopes (*Festuca valesiaca, Salvia nutans, Poterium sanguisorba, Euphorbia stepposa*, etc.) and barnyard grass on steep slopes, with eroded and damaged landslides.

Table no. 44. *Candidate Emerald Sites/Important Bird Areas taken into consideration from impact assessment point of view*

Emerald Sites/ Important Bird Areas	Surface (ha)	Distance to OHL route	Observation
MD0000016 Bugeac Steppe	49,610.00	200 m to 7 km	**Cover the following areas:** **- State protected area/multifunctional areas:** Bugeacului North (Dezghingea) Steppe Sector, Bugeacului North Steppe Sector, Bugeacului South Steppe Sector - **IBAs:** MD008 Congaz-Taraclia Lakes, MD009 Purcari-Etulia (partial overlapped). Besides Dimitrivca, the power line is parallel with this site by Vulcănești, at a variable distance between 200 m to 7km and the area situated between the voltage poles 56 – 54 crossed the wetlands included in the site.
MD0000019 Hîncești Forest	11,350.00	6 – 8 km	**Cover the following areas:** **- State protected area:** Hîncești Forest and Caracui Villa - **IBAs:** MD010 Hîncești Forest Situated on the West of the power line between the voltage poles 446 – 390 is at cca. 6 – 8 km.
MD0000009 Tigheci Forests	6,466.00		**Cover the IBA:** Tigheci Forests The voltage poles 268 -257 are parallel with the site.
Important Bird Areas			
MD009 Purcari-Etulia	55,400.00	intersection	The power line intersects the MD009 Purcari-Etulia at Jujnoi (voltage pole 18).
MD008 Congaz-Tărăclia	3,800.00	100 m to 6,6 km;	The power line is parallel with the site along 35 de km.
MD011 Tigheci Forests	4,280.00		The voltage poles 268 -257 are parallel with the site.
MD010 Hîncești Forest	14,400.00	6 – 8 km	Situated on the West of the power line between the voltage poles 446 – 390 is at cca. 6 – 8 km.

As is presented in the above table, no potential impact on natural protected areas already included in the National network is expected, due to the measures undertaken as part of feasibility study in order to ensure that the OHL is routed away from these areas.

Even so, considering that the OHL route is along the candidate Emerald sites (including IBAs) a detailed analysis was conducted for establishing the risks associated with power lines (chapter 6.2.1.1) and group of birds species taken into consideration for the impact assessment (chapter 6.2.2.2).

6.2.1.1 Risks associated with power lines

The risks associated with power lines can vary and depend upon a variety of factors. Such factors include proximity and orientation of transmission lines to important habitats, species behaviour in terms of both avoidance and use of the lines, altitude of bird flight heights, daily and flock movements as well as local factors such design of cables and towers and even weather conditions. Indirect loss can be caused by the reduction in habitats.

Electrocution and collisions risks

Bird casualties due to collision with above-ground powerlines can happen to any species of bird, capable of flight. Particularly at risk are birds migrating at night, birds flying in flocks, immature birds and / or large and heavy birds of limited manoeuvrability (Haas et al. 2005).

High-voltage powerlines are almost exclusively above ground. Because of their long-suspended insulators, the risk of electrocution is low. Nevertheless, fatalities by electrocution are reported in humid weather, troops of small birds can cause arcing; arcing can also be caused by the urination jet (defecates) of large birds roosting on the cross arm above the insulators. The latter can be avoided by suitably arranged bird rejecters above the insulators.

Also, the technical installations of the powerline can be damaged from bird accidents: collisions can cause conductor cables to sever or to strike together. Short-circuits to ground can damage insulators. Bird accidents can lead to outages and economic damage. To a large extent, bird safety is also in the economic interest of the utility companies and enterprises.

The solution is to make all medium-voltage power towers safe for birds by:

- changing to constructions, that are safe for birds according to recognised technical standards;
- retrofitting the existing „killer towers“ in accordance with recognised technical standards.

Species differences are extremely important in understanding the dynamics of electrocutions. The species reported to most often fall victim to electrocution belong to Ciconiiformes, Falconiformes, Strigiformes and Passeriformes (Bevanger, 1998; Rubolini et al., 2005). Species in this latter group are often not large-bodied, but fly or roost in dense flocks, and may also cause short-circuits, due to the electric current passing through several individuals (Bevanger, 1998). An overview of the main species groups involved in the conflict between birds and power lines a give an indication to what extent electrocution mortality impacts bird populations is given in Table no. 45.

Table no. 45. Main species groups affected by electrocution (Source: CMS)

Bird families in Eurasia identified as vulnerable at international level to electrocution	Electrocution
Pelicans (*Pelicanidae*)	I
Cormorants (*Phalacrocoracidae*)	I
Herons, Bitterns (*Ardeidae*)	I
Storks (*Ciconidae*)	III
Ibisses (*Threskiornithidae*)	I
Raptors (*Accipitriformes* and *Falconiformes*)	II - III
Shorebirds / Waders (*Charadriidae* + *Scolopacidae*)	I
Skuas (*Sterkorariidae*) and Gulls (*Laridae*)	I
Terns (*Sternidae*)	0 - I
Pigeons, Doves (*Columbidae*)	I - II
Owls (*Strigiformes*)	II - III
Hoopoes (*Upudidae*) and Kingfishers (*Alcedinidae*)	I
Bee-eaters (*Meropidae*)	0 - I
Rollers (*Coraciidae*)	I - II
Woodpeckers (*Picidae*)	I
Ravens, Crows, Jays (*Corvidae*)	II
Medium-sized and small songbirds (*Passeriformes*)	I

Legend:
0 = no causalities reported or likely.
I = casualties reported, but no apparent threat to the bird population.
II = regionally or locally high casualties, but with no significant impact on the overall species population.
III = casualties are a major mortality factor; threatening a species with extinction, regionally or at a larger scale
CMS = Convention on Migratory Species

Bird species can become victims of collisions with low-voltage, medium-voltage and high-voltage powerlines. High losses are reported from lines with thin and low-hanging wires in sensitive areas: rails, waders / shorebirds, cranes, waterfowl and sand grouses. A bird collision occurs when a flying bird physically collides with an overhead cable. The bird is typically killed by the impact with the cable, the subsequent impact with the ground, or dies from the resulting injuries. Transmission lines not only caused direct mortality of birds, they can also cripple individuals, which can result in delayed and inhumane deaths (Bevanger 1998, Pandey et al. 2008).

The species most at risk from collision with power cables are likely to be large, heavy bodied waterfowl (e.g. geese, herons, ducks, pelicans, cranes, storks) (Bevanger 1994, Bevanger 1998), with awkward flight characteristics and low manoeuvrability.

Birds migrating at night and birds flying regularly between feeding areas and resting areas are particularly at risk when powerlines cut across their migration corridors or their staging / wintering areas. At such locations, bird losses can exceed 500 casualties per kilometre of powerline in one year. Especially long-distance migratory birds have to cross a large number of powerlines during their autumn and spring migrations - at considerable risk.

Breeding birds, which are mostly resident birds, can adapt to obstacles in their habitat. Not so birds on migration and during stopovers, because they remain in the area only for a limited time. Flight manoeuvres, which can lead to collisions with cables and wires, are observed more often from migratory birds, than from resident birds. Especially in the case of rare

species, collision losses can represent an additional, substantial mortality factor (Hass et. al 2003).

Collisions with power lines are rarely observed in the field (Beaulaurier 1981, Alonso and Alonso 1999); therefore, collision rates are estimated via direct searches for carcasses either by observers, or by observers with dogs. Consequently, estimates of collision rates are highly influenced by variation in detection rates. **In order to mitigate collision losses, bird protection must be taken into account early in the planning stage of any new above-ground powerline. Prior to or in the initial stages of planning, one year of field work is necessary for ornithological evaluation and for the investigation of local flight routes and patterns during migration, breeding and post-breeding seasons. The resulting findings and recommendations must be reflected in the routing and in the construction features of the powerline.**

High risk potential can be stated for:

- Areas of high birds' importance including with large size populations and a high percentage of migratory birds, especially during migration; particularly high losses are reported where powerlines cut across important flyways and migration corridors, such as river valleys, valleys between mountains, straits, etc;
- Wetlands, marshes, coastal areas, steppes, especially in staging and wintering areas, in particular when above ground powerlines separate resting areas and feeding areas or are otherwise in the flight approach of important staging and feeding areas, in particular close to water; powerlines thus, in effect, degrade the quality of staging and wintering habitats;
- Migrating birds, when powerlines are perpendicular to their flight path;
- Birds migrating at night are at highest risk.

Influences and conditions that increase the risk of collision are:

- Any disturbances leading to panic flight movements (as often caused by hunting);
- Bad visibility of conductor cables, which are coated with aluminium oxide (grey coloured);
- Unfavourable weather conditions, like fog, precipitation, strong head winds; these conditions tend to concentrate bird migration at a lower height – often level with overhead cables, as well as reducing visibility and manoeuvrability of flying birds;

Most collision accidents happen during the night and during dawn and dusk.

Table no. 46 presents an overview of the main species groups involved in the conflict between birds and power lines and gives an indication if collision mortality impacts bird populations.

Table no. 46. Main species groups affected by collision with power lines

Bird families in Eurasia identified at international level as vulnerable to collision	Collision
Loons (*Gaviidae*) and Grebes (*Podicipedidae*)	II
Shearwaters, Petrels (*Procellariida*)	II
Boobies, Gannets (*Sulidae*)	I
Pelicans (*Pelicanidae*)	II - III
Cormorants (*Phalacrocoracidae*)	I
Herons, Bitterns (*Ardeidae*)	II
Storks (*Ciconidae*)	II
Ibisses (*Threskiornithidae*)	II
Flamingos (*Phoenicopteridae*)	II
Ducks, Geese, Swans, Mergansers (*Anatidae*)	II
Raptors (*Accipitriformes* and *Falconiformes*)	I - II
Partridges, Quails, Grouse (*Galliformes*)	II - III
Rails, Gallinules, Coots (*Rallidae*)	II
Cranes (*Gruidae*)	III
Bustards (*Otidae*)	III
Shorebirds / Waders (*Charadriidae + Scolopacidae*)	II - III
Skuas (*Sterkorariidae*) and Gulls (*Laridae*)	II
Terns (*Sternidae*)	I - II
Auks (*Alcidae*)	I
Sandgrouse (*Pteroclididae*)	II
Pigeons, Doves (*Columbidae*)	II
Cuckoos (*Cuculidae*)	I - II
Owls (*Strigiformes*)	II
Nightjars (*Caprimulgidae*) and Swifts (*Apodidae*)	I - II
Hoopoes (*Upudidae*) and Kingfishers (*Alcedinidae*)	I - II
Bee-eaters (*Meropidae*)	I - II
Rollers (*Coraciidae*)	I - II
Woodpeckers (*Picidae*)	I - II
Ravens, Crows, Jays (*Corvidae*)	I - II
Medium-sized and small songbirds (*Passeriformes*)	I - II

Legend:
I = casualties reported, but no apparent threat to the bird population.
II = regionally or locally high casualties, but with no significant impact on the overall species population.
III = casualties are a major mortality factor; threatening a species with extinction, regionally or at a larger scale.

Disturbance and habitat loss

Beside risk of electrocution and collision, power lines have the potential to have a negative influence on birds through disturbance and habitat loss.

Disturbance is caused by the noise generated by the conductors, the effect of magnetic and electrical field, the increased risk of predation and the barriers formed by the presence of the power line, which can effectively result in habitat loss. These factors influence breeding, foraging and roosting birds.

One of the more specific possible disturbing effects of power lines on birds is formed by the presence of the electrical and magnetic fields. The strength of these electric and magnetic fields depend on the voltage of the line, the distance to the source and the configuration of the line (Fernie & Reynolds, 2005; Foster & Repacholi, 2002). Many speculations exist as to the possible effects of electromagnetic fields on birds; however, hardly any quantitative studies have been carried out. Fernie and Reynolds (2005) reviewed the issue and state that most studies that were performed indicate that exposure of birds to electromagnetic fields: "generally changes, but not always consistently in effect or in direction, their behaviour, reproductive success, growth and development, physiology and endocrinology, and oxidative stress". It is clear that the presence of electromagnetic fields influence (some) bird species, however, there is still a lot of uncertainty about the nature, direction and impact of these effects.

It is clear that for some species the presence of a power line can lead to disturbance and subsequent habitat loss. However, it is also evident that much additional research is needed in order to determine the importance, impact and species- and location-specific nature of these effects.

Positive side effects for birds

On the other hand, towers offer perching, roosting and nesting sites for some large birds, such as storks, raptors and corvids, especially in areas where suitable natural nest sites and roosting substrates are rare, such as in cultivated areas, plains, semi-deserts or deserts.

Species using power line towers as nesting sites:

- **White Storks** (Ciconia ciconia) commonly use towers (medium-voltage) as bases on which to nest throughout the region, especially in Eastern and Southern Europe. For example, by 1994, almost 80% of the Hungarian stork population nested on towers (Lovaszi, 1998). Similarly, in Poland approximately 60%, and regionally even 80%, of the White Storks breed on towers (Dolata, 2006; Schürenberg et al., 2010). In Ukraine, White Storks have been using towers for nesting since the late 1950s. The number of nests has also grown quickly and nowadays it is the most commonly used nest site, with more than 60% of nests being on towers in some regions (Grishchenko, 2008);
- **Raptors** - In open areas without natural vantage points, such as trees and shrubs, towers and conductor wires are readily used as alternative hunting posts by raptors, often offering the highest point for miles around from where raptors can scan the surrounding terrain.

Raptors also use towers as roost sites. Roosts in towers may be selected for protection from inclement weather and predators or for their proximity to food sources.

Nesting raptors on towers and in towers and other electricity installations have been well documented in the literature. Most raptors use towers and towers for nesting because of the absence of suitable natural nest sites in the area where they prefer to hunt. Therefore, utility companies can easily enhance raptor nesting opportunities by providing stable nest substrate in the form of artificial platforms or nestboxes and thus help raptor population increase and ranges expand. A number of falcon species, amongst others Saker Falcon (Falco cherrug), Peregrine Falcon (Falco peregrinus), Common Kestrel (Falco tinnunculus) and Hobby (Falco subbuteo), are known to regularly nest in electricity towers, often in old nests of corvids, but also in nest boxes.

- **Other species** - Many other bird species use electricity installations, such as towers and conductors, for perching and/or hunting. In many open steppe and semi-desert areas, shrikes and wheatears often hunt from towers and wires of distribution lines, while the same holds true for kingfishers in wetland areas where they can perch-hunt from conductor wires when these overhang ditches, pools, etc. Many songbirds from open agricultural and semi-natural areas also use these structures for advertising their territory by song. Flocking birds, such as swallows and Common Starling (Sturnus vulgaris), often use power lines for perching, for example during pre-roost gathering (Hass et al, 2003). Cormorants and corvids are well known to use towers for roosting. For example, in the Netherlands, several large roosts of Great Cormorant (Phalacrocorax carbo) are situated in towers of high voltage power lines where these lines cross water bodies in which the cormorants feed during the day. Such roosts can hold up to many hundreds of birds in one tower (Hass et al, 2003).

6.2.1.2 Characterisation of impact

6.2.1.2.1 Analysis of the areas crossed by the 400kV OHL Vulcănești – Chișinău

The analysis is based on satellite images and experts opinions.

Taking into account the special characteristic of the lands and the habitat types importance for birds, the area was spliced for impact assessment in 3 main zones starting from Vulcăneşti to Chişinău – Southern area, Central area and Northern area.

The ***Southern area*** was delineated between Tărăclia and Vulcănești (towers 01 - 204). In this area occur agricultural lands, vineyards, orchards, meadows and pastures.

Balabanu – Vulcănești area (towers 01 - 85)

- At Jujnoi (tower 18), the OHL route intersects the MD009 Purcari-Etulia;

- In front of tower 38, at around 1km distance on the South-East direction is the Vinogradovca-Ciumai natural protected area, area of international importance for steppe habitats;
- The OHL route between towers 42 - 54 is parallel with Salcia Mare River, and crosses the river between towers 54 - 56. There are wetlands included in the MD0000016 Bugeac Steppe (candidate Emerald site).

For this area was taken into consideration also the Ialpug Lake from Ukraine, an important wetland for migratory birds.

The groups of species taken into account: Day Raptors, White and Black Storks, Waterbirds, Waders, Passeriformes.

Figure no. 61. Landscape in Bugeac Steppe, Vinogradovca
Source: http://www.panoramio.com (Google Earth)

Figure no. 62. Landscape near to Vulcănești
Source: http://www.panoramio.com (Google Earth)

Tărăclia - Balabanu area (towers 85 - 204)

Areas taken into consideration for the impact assessment:

- The OHL route between towers 85 - 204 gets down beside the South, parallel with IBA MD008 Congaz-Tărăclia; the distance between the OHL route and IBA is from 100 m to 6.6 km;
- The OHL route between towers 133 - 138 crosses the Ialpugel River, who joints the Iapulg River in the nearest area, Alexeevca; at the Northern and Southern areas are wetlands included in the MD0000016 Bugeac Steppe (candidate Emerald site);
- The area situated between towers 169 - 204 and MD008 Congaz-Taraclia is crossed by many wetlands, Chirsovskoe Lake and other two lakes with unknow name and is part of the MD0000016 Bugeac Steppe (candidate Emerald site);
- At cca. 3.5 km on the West of towers 169 - 204 is the Coțofeni Lake (Cotovscoe).

The groups of species taken into account: Day and Night Raptors, White and Black Storks, waterbirds, Waders, Passeriformes.

The ***Central area*** was delineated between Dimitrovca and Taraclia (towers 205 - 328). In the area, there are agricultural lands, vineyards, orchards and meadow and pastures too, but at 5 km form Dimitrovca, in the South of OHL route, start the MD0000016 Bugeac Steppe, candidate Emerald site.

Borogani – Tărăclia area (towers 205 - 257)

Areas taken into consideration for the impact assessment:

- The OHL route between towers 224 – 230 is parallel with a lake/slope situated in the catchment of Chirsova Mare River (South of Congazcicul de Jos and East of Sadâc);
- The OHL route between towers 252 – 255 crosses the wetlands/meadows of the Ialpug River; in the Southern part of this area there are wetlands too;
- At the West of the OHL route, between towers 229 - 257, at approximative 13 km is situated the Capaclia Forest.

The groups of species taken into account: Day Raptors, White and Black Storks, Waterbirds, Waders, some Passeriformes.

Dimitrovca – Borogani area (towers 257 - 328)

Areas taken into consideration for the impact assessment:

- At around 1 km distance of the OHL route between towers 260 – 264 is a pond/slop on a branch of Ialpugel River;
- To the West, at aproximatelly 9km of the OHL route between towers 257 – 268 is the Capaclia Forest, key area for Day Raptors;

- The OHL route between towers 272 – 274 is at approximately 270 m of the Upper Pond of Ialpugel River, near Borogoni; this pond is part of the MD0000016 Bugeac Steppe, candidate Emerald site;
- The OHL route between towers 300 – 302 is situated at 200 m of the Dezghingea Lake;
- The OHL route between towers 311 – 314 crosses the wetland of the Ialpugul Mare River. There are abandoned fish ponds used as habitat for waterfowl species. Many wetlands and two lakes (Cenac and Topala) occurred both in the Northern and Southern part of the Ialpug River.

The groups of species taken into account: Day Raptors, White and Black Storks, Waterbirds, Waders, some Passeriformes.

Figure no. 63. Upper Pond, Borogani
(Source: http://www.panoramio.com (Google Earth)

The ***Northern area*** was delineated between Chișinău (Brăila, Băcioi) and Dimitrovca. In this area occur agricultural lands, vineyards, orchards and also meadow and pastrures, as follow:

Lipoveni – Dimitrovca area (towers 328 - 416)

Areas taken into consideration for the impact assessment:

- The OHL route between towers 355 – 357 crosses the Ecaterinovca Lake, situated in the meadow of the Cogâlnic River;
- The OHL route between towers 392 – 395 is at 700 – 800 m to a pond of Hîrtop village (Gura Galbenei), near to Cogâlnic River;
- The OHL route between towers 408 – 410 is beside a degraded forest (800m) near to Gura Galbenei.

The groups of species taken into account: Day Raptors, White and Black Storks, Waterbirds, some Passeriformes.

Figure no. 64. Hîrtop Pond
(Source: http://www.panoramio.com (Google Earth)

Figure no. 65. Ecaterinovca Lake
(Source: http://www.panoramio.com (Google Earth)

Brăila – Lipoveni area (towers 416 - 511)

Areas taken into consideration for the impact assessment:

- On the West of the OHL route between towers 390 - 446 is MD010 Hîncești Forest, at cca. 6 – 8 km;
- The OHL route between towers 416 - 444 gets down beside the Zloți Forest, the nearest tower being at 130m (443) and the farthermost at 2.8 km (416);
- The OHL route between towers 444 – 462 crosses around 5 km of agriculture lands situated between two forests: Zloți Forest and Costești Forest; the width of the agriculture land is 1.3 km;
- The OHL route between towers 461 - 462 crosses forest habitats on 300 m;

- Near to Zîmbreni village, at 200 m and at 620 m distance of the tower 484 there are two wetlands (slopes);
- Șnovăț Valley, situated at 600 m from 330/110/35/kV Chișinău substation. The OHL route between towers 509 – 510 will cross a river sector of 80 m width (including the meadow); the area is situated at 460 m from Brăila and 320 m from Străisteni.

The groups of species taken into account: Day and Night Raptors, Storks, Passeriformes, Waders.

Figure no. 66. View of Zloți Forest (Source: http://www.panoramio.com (Google Earth)

Because the Project area is very important for bird migration, been designed perpendicular on the migration way, the assessment taken into account all migratory birds that crossed the area, a special attention given to the vulnerable, endangered and critically endangered at national and international level.

The impact assessment of the 400 kV OHL Vulcănești-Chișinău on biodiversity have been focused on the main risks – electrocution, collision and habitat loss.

6.2.1.2.2 Assessment of electrocution and collision risk

Electrocution risk

The sensitive birds to electrocution risk are listed in the Table no. 47. These species use the area for breeding and mostly during migration and have been identified taking into account the following information:

- Studies undertaken at international level on the electrocution risk associated to the power line development;
- OHL location;
- Behaviour and habitat requirement of sensitive birds.

Table no. 47. Sensitive birds to electrocution

No.	Species	Casualties due to electrocution according to CMS and NABU	Moldova Red Book
1.	Black Stork (*Ciconia nigra*)	III	CR
2.	White Stork (*Ciconia ciconia*)	III	VU
3.	White-tailed Eagle (*Haliaeetus albicilla*)	III	CR
4.	Osprey (*Pandion haliaetus*)	III	CR
5.	Lesser Spotted Eagle (*Clanga pomarina*)	III	NA
6.	Short-toed Snake-eagle (*Circaetus gallicus*)	III	CR
7.	Booted Eagle (*Hieraaetus pennatus*)	III	CR
8.	Black Kite (*Milvus migrans*)	III	VU
9.	Marsh Herrier (*Circus aeroginosus*)	II	NA
10.	Hen Harrier (*Circus cyaneus*)	III	CR
11.	Montagu's Harrier (*Circus pygargus*)	III	CR
12.	Lonf-legged Buzzard (*Buteo rufinus*)	III	NA
13.	Common Buzzard (*Buteo buteo*)	III	NA
14.	Rough-legged Buzzard (*Buteo lagopus*)	III	NA
15.	European Honey-buzzard (*Pernis apivorus*)	0	EN
16.	Eurasian Sparrowhawk (*Accipiter nisus*)	0	NA
17.	Northern Goshawk (*Accipiter gentilis*)	0	NA
18.	Levant Sparrowhawk (*Accipiter brevipens*)	0	NA
19.	Common Kestrel (*Falco tinnunculus*)	II-III	NA
20.	Red-footed Kestrel (*Falco vespertinus*)	II-III	VU
21.	Eurasian Hobey (*Falco subbuteo*)	II-III	NA
22.	Peregrine Falcon (*Falco peregrinus*)	II-III	CR
23.	Merlin (*Falco columbarius*)	II-III	NA
24.	Saker Falcon (*Falco cherrug*)	II-III	CR
25.	Little Owl (*Athene noctua*)	0	NA
26.	Long-eared Owl (*Asio otus*)	II-III	NA
27.	Short-eared Owl (*Asio flammeus*)	0	CR
28.	Tawny Owl (*Strix aluco*)	0	NA
29.	Eurasian Scops Owl (*Otus scops*)	0	NA
30.	Rook (*Corvus frugilegus*)	0	NA
31.	Carrion Crow (*Corvus corone*)	0	NA
32.	Raven (*Corvus corax*)	0	EN

Legend:
0 = no data about causalities, but mentioned in literature as susceptible species to risk of electrocution.
I = casualties reported, but no apparent threat to the bird population.
II = regionally or locally high casualties, but with no significant impact on the overall species population.
III = casualties are a major mortality factor in different countries; threatening a species with extinction, regionally or at a larger scale.
CR – Critically endangered, VU – Vulnerable, EN – Endangered, NA – Not available data

In the survey corridor have been identified up to 32 birds' species considered likely to be at significant risk from electrocution, 10 of them being considered critically endangered, 2 endangered and 3 vulnerable, according to their status in the Republic of Moldova (National Red Book). According to the IUCN Red List only Saker Falcon (*Falco cherrug*) is endangered (EN), the other being considered Last Concern (LC).

The most electrocution can occur in the project area during the adverse weather, both spring and autumn migration, as a result of the electric arc produced when the birds intend to sit on lines or towers.

In order to limit the mortality risk associated with electrocution, mitigation measures have been proposed, in comparison with relevant international legislation and the environmental standards of potential financing institutions (EBRD, EIB, WB).

Mitigation will be required to ensure that the risks associated with electrocution (although considered to be low) are minimised in order to ensure that the performance requirements of potential financing institutions (EBRD, EIB, WB) are met.

Collision risk

Literature acknowledges that the collision is the most common risk of mortality associated with power line. Taking into account that the proposed power line is perpendicular on the migration way, all sensitive species have been taken into consideration, although for some of them the impact will be a minimum one.

The sensitive birds to collision risk are listed in the Annex 8. These species use the area for breeding and mostly during migration, being sedentary or migratory species and have been identified taking into account the following information:

- Studies undertaken at international level on the electrocution risk associated to the power line development;
- OHL location;
- Behaviour and habitat requirement of sensitive birds.

The number of species possible to be affected by collision emphasizes the magnitude of the impact of the power line in the absence of the mitigation measures. Sensitive species to collision are presented in Annex 8.

As shown in Annex 8 have been identified 162 birds possible affected by collision with power line and 29 birds rare, very rare or accidental for Republic of Moldova, 14 of them being critically endangered, 15 vulnerable and 5 endangered, according to the Red Book of Moldova.

The impact has been assessed on the “umbrella species” - Great White Pelican, Dalmatian Pelican, White Stork, Black Stork, Saker Falcon, Roller, the mitigation measures assuring the protection for all breeding, sedentary or migratory species.

1. **Great White Pelican *(Pelecanus onocrotalus)*** and **Dalmatian Pelican (*Pelecanus crispus*)**

Great White Pelican: IUCN - LC; RBM - EN;

Dalmatian Pelican: IUCN – VU; RBM - CR;

Location: MD008 Congaz-Tărăclia (IBA) during the autumn migration in big flocks of hundreds individuals. Dalmatian Pelican is very rare in the Southern part of the country, probably they are coming from Danube Delta looking for food before the migration in the South direction..

In order to mitigate the impact on the feeding and resting areas and on the migration route special measures have been established on the power line situated between Vulcănești and Comrat (tower 230).

2. **White Stork (*Ciconia ciconia*)**

White Stork: IUCN – LC; RBM - VU

Location: Republic of Moldova is close to the centre of the global density of population (Romania 5,000 – 6,000 pairs, Ukraine- 30,000 pairs) being important for breeding and migration. According to the data, there are hundreds of pairs, but the number is considered underestimated. The collision, especially during prevailing weather can leads to population decline, being one the most important cause of mortality.

In order to mitigate the impact special measures have been established on the all power line location, between Vulcănești and Chișinău.

3. **Black Stork (*Ciconia nigra*)**

Black Stork: IUCN – LC; RBM - CR

There are not data on breeding population, although the species was often recorded in the last years, especially in the South of Republic of Moldova, during migration. In MD009 Purcari-Etulia (IBA) the population size is estimated at 2-8 individuals.

In order to avoid the collision risk with the OHL, the mitigation measures have been established for the South part of the power line, as well as in the neighbourhood of the Zloți, Costești, and Hânceşti forests (towers 390-462) and the parallel area with MD0000009 Tigheci Forests (Emerald site and IBA) (towers 257-268).

4. **Saker Falcon (*Falco cherrug*)**

Saker Falcon: IUCN – EN, RBM - CR

The entire population is breeding in MD009 Purcari-Etulia (IBA). The new researches emphasize that the most pairs breed in the South-West part of the IBA, at the OHL start. The collision can affect individuals, but not the entire population.

Mitigation measure has been established, especially during the project development.

5. Roller (*Coracias garullus*)

Roller: IUCN – LC; RBM-VU

The population size is unknown in Republic of Moldova, but there are available data for IBA MD009 Purcari-Etulia (20-30 pairs) and IBA MD008 Congaz-Tărăclia (8-12 pairs). According to the literature the collision has not a significant impact on species, but taking into account the population decline at international level, it was considered an "umbrella species" for the similar bird crossed the open areas from the OHL project.

The mitigation measure will avoid the risks for all species characteristic for open lands.

6.2.1.2.3 Assessment of habitat loss

The land areas which will be permanently occupied by OHL tower foundations vary according to tower types (two types) and heights and will be in total about 40,889 m^2.

The temporarily occupied land areas will be about 94.85 ha including the area for towers erections working platform, area for phase conductors and ground wires sagging operations working platform and OHL working corridor (access zone).

Almost all towers are placed in agricultural lands, meadows and pastures. These areas can be used by birds especially for feeding or/and resting. Just some small birds, like larks, can use it for breeding, if ecological requirements are full fill.

In MD009 Purcari-Etulia no potential negative on breeding habitats have been found, but cca. 1,443 m^2 of the feeding habitats will be lost because the set-up of the 18 voltage poles. Taking into account that the IBA' surface is 55,400 ha, this loss will not affect the birds' populations and the integrity of IBA.

In MD008 Congaz-Taraclia the project will not affect the breeding habitats, but 9,200 m^2 of the feeding habitats of *Falco vespertinus, Falco subbuteo, Buteo ruffinus, Ciconia nigra, Branta ruficollis,* placed outside of the IBA can be losses.

Taking into account that the IBA' surface is 3,800 ha, this loss will not affect the birds' populations and the integrity of IBA.

These habitats are not of community interest types.

Conclusions:

Important areas for birds, such as reedbed habitats, forests, wetlands will not be directly affected by OHL. No important bird species for conservation will be affected by loss of breeding habitat.

The loss of feeding/resting habitats will be minimum; therefore the associated risk is far lower. However, mitigation will be required to ensure that the risk associated with loss of potentially important feeding / resting habitat are minimised in order to ensure that the requirements of potential financing institutions (EBRD, EIB, WB) are met.

6.2.1.3. Measures for impact mitigation

6.2.1.3.1 Mitigation principles

OHL routing

Once it has been determined that an above ground power line is necessary, the best mitigation option is to ensure that it is routed away from areas that are home to, or attract, bird species that are known to be susceptible to electrocution or collision. Our understanding of the variables (and their interaction) influencing where electrocutions and collisions take place is certainly not complete. However, we do know that certain landscape and vegetation features are likely to be associated with higher rates of electrocution or collisions. In the case of electrocution, topography affects where birds will perch and roost, and vegetation height affects the availability of natural perches in the area.

In the case of collision, topography affects whether birds will fly lower (*i.e.* down valleys) or higher (*i.e.* over mountains and hill slopes) as they optimize their energy efficiency in travelling. Vegetation height can also affect flight height, with short vegetation enabling lower flight. In addition to study area characteristics, it is important to take into account the protection status of the land.

The final decision on the routing of new power lines should at least also be based on all available ornithological knowledge.

Corridors and alternatives

In order to achieve the optimal routing, it is useful if project planners identify more than one alternative route, as this allows for the selection of the optimal route with respect to bird factors. In addition, the use of a corridor (for example of ten kilometers wide) for assessment rather than a single line provides an opportunity for small refinements to the route to be made within that corridor.

Grouping with other infrastructure

In certain cases, it may be possible to route a new power line adjacent to an existing taller power line with safe configuration, partially mitigating for electrocution through the likelihood

that birds would naturally tend to perch on the taller power line and partially mitigating for collisions because birds will be abler to see the combined obstruction as well as have a greater likelihood of safely passing a second nearby line if this is of the same or lower height.

6.2.1.3.2 Mitigating for electrocution

Electrocution mitigation can be far more controlled than collision mitigation. Since the problem is a physical one, whereby a bird bridges certain clearances on a tower structure, the solution is relatively straightforward, and involves ensuring that a bird cannot touch the relevant components. Below the most important techniques are summarized.

Tower design

As mentioned above birds' electrocution on high voltage or transmission lines is typically low and the most causality is happening on bad weather. Nevertheless, fatalities by electrocution are reported in humid weather, troops of small birds can cause arcing.

The tower design plays a major role with respect to bird electrocution related faults. Vertically configured designs with ample perching space on top of the tower away from the cross-arms, experience fewer faults than horizontally configured designs. The reason for this is that with the latter, the birds roost relatively closer to the conductors, therefore increasing the risk of flashovers.

With the former, depending on the design, the birds first utilize the available space on top of the tower, thereby reducing the risk of flashovers. Similarly, almost no bird electrocution faulting is experienced on the cross-rope suspension type towers, presumably due to the unavailability of convenient perching space for birds above the conductors.

Also, research showed that air gaps of just under one-meter, on either side of the conductor would need to be protected from potential bird electrocution. Because bird guards are made in lengths of 500 mm, 750 mm and 1000 mm for practical reasons, fitting them one meter on both sides of the centerline of the conductor has become the standard at all voltages. (Refer to critical distance in picture below). No gap of greater than 150mm should be left between two adjacent bird guards.

Transmission uses a variety of tower designs, with each design having as much as ten variations. Final fitting strategies will have to be confirmed with subject specialist for final vetting.

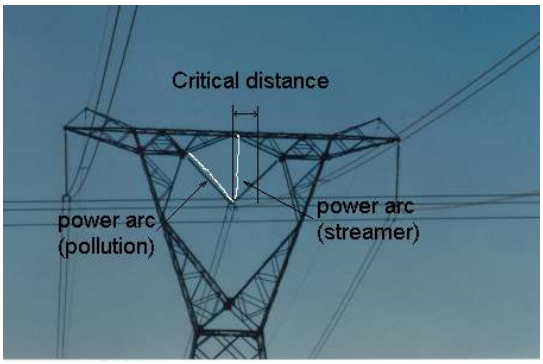


Figure no. 67. A distance of one meter either side of the conductor is regarded as critical in protection against electrocution

Fitting on Outer Phases

Experience revealed that faults occurred on the outer phases where the landing plates were not fully protected, which left roosting space for birds. Care must be taken not to leave any roosting space at the outer phase extremes of towers.

Figure no. 68. Picture of incorrect fitting leaving the landing plates exposed

It should be stated that transmission lines, towers and towers may be of benefit to birds, such as storks, raptors and corvids, for nesting, roosting or perching, especially in areas where suitable natural nest sites and roosting substrates are rare, such as in cultivated areas and plains.

6.2.1.3.3 Mitigating for collision

A measure that has been proved to be reasonably successful in reducing collisions is to fit the earth wire with anti-collision devices. Success rates of up to 60% reduction in mortality and even more have been documented (Ferrer and Janns, 1999). There are several devices

available for the marking of power lines. These devices will be described below and the advantages and disadvantages discussed.

Static devices

Static devices are mechanically more durable than dynamic devices because they lack the element of wear and tear that moving parts inevitably have. However, for example in South Africa, static devices, particularly the so called Bird Flight Diverter (also known as the pigtail) has had limited success (Anderson 2001). The most obvious reason seems to be that they are simply less visible, especially the small ones. A better option would be to use the bigger pigtail, although it is still not the preferred option.

Figure no. 69. Example of static device - Pigtail

Reflective devices

Experiments have shown the visibility of these reflective device to be superior to coloured (red, yellow, white, black) objects especially during the low light conditions at dawn and dusk when birds may be flying from roosting areas to feeding areas and back.

For example, Inotec BFD88 reflective device due to the spherical shape reflects any available light in all directions and is therefore visible from all directions including above or below the diverter. The diverter does not require direct sunlight and is effective during overcast conditions and the low light conditions before sunrise and after sunset. When viewed during these low light conditions the device is particularly visible against dark backgrounds such as the ground, trees or high ground. It is also particularly visible against bright cloud when viewed from below. Due to the relatively small size of the spheres, it would need to be spaced very close together to make it effective, maximum 5 meters apart on both earth wires.

Dynamic devices

Dynamic devices (usually called bird flappers), have moving parts as opposed to static devices where there are none. Dynamic devices are very effective in reducing collisions as the birds seem to see them very well probably because of the movement that attracts attention.

Figure no. 70. Example of dynamic devices

In 2009 Bureau Waardenburg carried out research into the numbers of collision victims with a new type of marking device “bird flaps”, using black and white colors. The research revealed that this type of 'bird flaps' led to a 67% reduction in the number of collision victims for bird that crossed the line during the day. The 'bird flaps' apparently allowed birds to detect the power line at a greater distance and adjust their altitude accordingly. In particular, the number of ducks, which made up a large proportion of the collision victims, is reduced by around 80%. This is particularly interesting as most ducks passed the line at night. This suggests that the 'bird flaps' even increase the visibility of the line during periods of darkness.

Figure no. 71. The new type of marking device “bird flaps”

Portion of span to be marked

Only the middle 60% of each span needs to be marked as this is where most of the collisions occur.

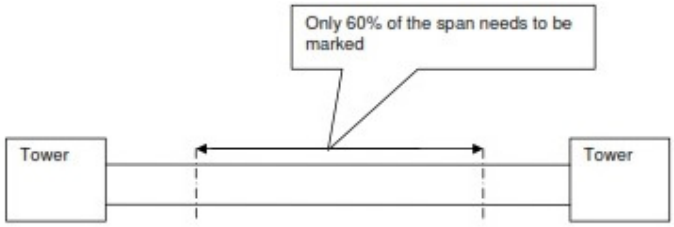


Figure no. 72. Portion of span to be marked

6.2.1.3.4 Proposed mitigation measures

Vulcănești and Chișinău end sub-stations of the line designed dictates the general orientation of OHL routeline on South-North direction.

From biodiversity point of view, the general principles in designing an OHL route were to avoid as much as possible the following areas:

- Forested areas;
- Parks and natural reserves;
- Important bird areas.

The selected 400 kV OHL Vulcănești - Chișinău route avoids almost all protected areas, with the following exception: the line between towers 141 – 142 is crossing Stepa Bugeacului Emerald site (near to Borceag village); about 10 km of line is crossing Purcari – Etulia IBA (towers 01- 18).

A summary of the mitigation to be put in place in order to minimize the impact of electrocution and collision is presented in the table 48.

Table no. 48. Proposed mitigation measures for electrocution and collision risks

Area	Specific location	Risk	Possible affected species/or groups	Mitigation	Comments
Southern part of OHL	Along Congaz – Tărăclia Lakes IBA; Crossing Purcari – Etulia IBA	Electrocution Collision	Waterfowls, pelicans, White Stork, Black Stork, raptors, geese, Sacker Falcon, Raptors.	Birds flaps on OHL between towers 01-205 (Annex 9, fig. 7) Bird guards against electrocution in air gaps and on outer phases.	This area is the most important for bird migration, including pelicans, waterfowls and raptors. Final fitting strategies will have to be confirmed with a specialist prior to construction (during detailed design).
Borogani - Tărăclia	Lake below Congazcicul de Jos village	Electrocution Collision	Waterfowls, stork, herons, egrets	Birds flaps on OHL between towers 224 – 230 (Annex 9, fig. 6) Bird guards against electrocution in air gaps and on outer phases.	Final fitting strategies will have to be confirmed with a specialist prior to construction (during detailed design).
Dimitrovca - Borogani	Crossing wetlands (near Cenac village)	Electrocution Collision	Stork, Waders	Birds flaps of diverse construction will be positioned 20 - 25 m distance on line between towers 310 – 314 (Annex 9, fig. 4); Bird guards against electrocution in air gaps and on outer	Area surrounded by lakes/ponds. Final fitting strategies will have to be confirmed with a specialist prior to construction (during detailed design).

Area	Specific location	Risk	Possible affected species/or groups	Mitigation	Comments
				phases.	
	About 200 m near Lake Dezghingea	Electrocution Collision	Waterfowls, stork, herons, egrets	Birds flaps on line between towers 268 - 277 (Annex 9, fig. 5); Bird guards against electrocution in air gaps and on outer phases.	Final fitting strategies will have to be confirmed with a specialist prior to construction (during detailed design).
Lipoveni - Dimitrovca	Crossing Ecaterinovca Lake	Electrocution Collision	Waterfowls, stork, herons, egrets	Birds flaps will be positioned 10 m distance on line between towers 355 – 355 and 25 m distance on line between towers 357-358 and 354-355 Bird guards against electrocution in air gaps and on outer phases.	Final fitting strategies will have to be confirmed with a specialist prior to construction (during detailed design).
Brăila - Lipoveni	Near Zloți and Costești forests	Electrocution Collision	Raptors, owls, Black Stork	Birds flaps will be positioned 25 m distance on line between towers 390 -465 (Annex 9, fig. 3); Bird guards against electrocution in air gaps and on outer phases.	Final fitting strategies will have to be confirmed with a specialist prior to construction (during detailed design).
	Near two ponds (Zimbreni village)	Electrocution Collision	Ducks, White Stork	Birds flaps will be positioned 20 - 25 m distance on line between towers 482 -485 (Annex 9, fig. 2); Bird guards against electrocution in air gaps and on outer phases.	Final fitting strategies will have to be confirmed with a specialist prior to construction (during detailed design).
	Crossing Isnovat Valey	Electrocution Collision	Ducks, White Stork, Raptors	Birds flaps will be positioned 20 - 25 m distance on line between towers 508 – 509 (Annex 9, fig. 1); Bird guards against electrocution in air gaps and on outer phases.	Final fitting strategies will have to be confirmed with a specialist prior to construction (during detailed design).

Specific mitigation measures for birds are presented in the following table.

Species	Specific location	Risk	Mitigation	Comment
Sacker Falcon (*Falco cherrug*	Purcari–Etulia IBA	Injury and death by electrocution and collision leading to decrease in population size; Disturbance during construction	Bird guards against electrocution in air gaps and on outer phases. Construction of 01 – 18 towers and Vulcănești substantion outside the breeding period of the species – end of March – end of July	Recommended period for construction: September – November

Recommendations for bird nesting on OHL towers

It should be stated that transmission lines, towers and towers may be of benefit to birds, such as storks, raptors and corvids, for nesting, roosting or perching, especially in areas where suitable natural nest sites and roosting substrates are rare, such as in cultivated areas and plains.

The most likely reasons for birds using electricity structures for nesting are:

- Lack of alternative nesting sites such as trees and cliffs.
- Safe and sturdy substrate. Electricity structures offer a sturdy platform for birds to build their nests, especially in areas where the natural substrate is unsuitable or scarce. In these circumstances, birds often deliberately choose electricity structures over natural sites.

Species known as breed on power lines: Crows, Pied Crow, Raptors (e.g. Sacker Falcon, buzzards, falcons).

We recommend placing nests on tower especially for Sacker Falcon which is an endangered species according to IUCN Red List.

The places for the nests and nest configuration will be established with specialists (e.g. SPPN (Nature and Bird Protection Society; specialists involved in this evaluation also has experience in nest construction and selection of the location for the nest – as an assistant project in Conservation of *Falco cherrug* in NE Bulgaria, Hungary, Romania and Slovakia LIFE09 NAT/HU/00384). It is possible that a preliminary field study/visit will be needed in order to select the appropriate locations for the nests.

6.2.1.3.5 Monitoring and evaluation of mitigation effectiveness

Recommendations:

- A during construction monitoring programme will be needed in order to gain more data about birds and new measures will be taken if needed.
- A post construction monitoring programme along particular sections of diverter-marked and unmarked transmission line would take place to assess the effectiveness of the bird diverters.
- This programme of bird mortality will be carried out during first three years of the OHL operation.
- The monitoring would be more intensive during breeding /fledging period and during migration period.
- The monitoring programme will be carried out by the local specialist (e.g. SPPN (Nature and Bird Protection Society)

6.2.2 Forest fund

As part of feasibility study, the OHL route was established so that to avoid as much as possible land area covered by forests. However the OHL route crosses very few forest bodies, some shrubs zones and several protection belts.

Regarding the forest bodies, some of them are administrated by the Agency MoldSilva (central public administration body) such as:

- ”Cîinele” forest body crossed on 363 m length, near Gura Galbenei village;
- ”Cenac” forest body crossed on 330 m length, near Cenac village;
- „La Fermă” forest body crossed on 135 m length, near Borogan village;
- ”Trîndal” forest body crossed on 180 m length, near Sofievca village and
- ”Stejarii” forest body crossed on 1,944 m length near Albota de Sus village.

The others forests bodies are administrated by local public administration (near Hansca village the OHL crosses on 329 m length a forest body and between Vinogradovca and Muşaitu villages the route crosses on 250 m length another forest body).

The OHL route crosses 2,402 m of shrubs zones distributed along the entire route (east and south of Fîrlădeni village, south-east of Gura Galbenei, north-west of Ecaterinovca village, north of Topală village, south-west of Borceag village).

Prior to OHL construction, a corridor of 3 m length (working corridor) will be cleaned of vegetation (trees, shrubs, etc.). The estimated surface of cut trees is about 1 ha, representing 0.0002 % of national forest fund of Republic of Moldova. Details related to the distribution

within the OHL safety corridor per district are presented in chapter 6.3.1 Access to land and land use.

The exact number of trees to be cut, including the species and the owners, will be established during detailed design. The significance of impact due to forestry clearance was assessed as **moderate** in absence of proper mitigation measures. As mitigation measures, the following are foreseen:

- An appropriate vegetation management plan shall be developed in order to minimize the trees cutting within the working corridor and to ensure a proper management of cutting trees;
- For loss of trees within the working corridor, adequate compensation shall be established, by planting the same trees species in locations agreed with relevant authorities;
- The trees cutting will be outside the breeding and nesting period in the forests.

During OHL ***operation***, within the OHL safety corridor are not expected any forestry clearance, considering that as part of regular maintenance activities vegetation control measures are implemented for keeping the high of trees less than 4.0 m.

Thus, the significance of impact during Project operation that could be defined as fragmentation effect on very limited surface assessed as **minor**, in absence of mitigation measures. Therefore, an integrated vegetation management approach shall be implemented consisting in removal of tall growing tree species and the encouragement of low-growing shrubs.

6.3 Socio-economic environment

This socio-economic impact assessment put forward an analysis of the possible impacts from the proposed transmission line on people and communities along the proposed route. Potential significant direct and indirect socio-economic impacts from implementing the proposed project are assessed. Furthermore, recommendations on how the identified impact may be mitigated and who should be responsible for implementing these mitigation measures are included in this assessment.

The main socio-economic impact in the Project area will be from changes in land use and access both during the construction and operation. This comes both from the need to use land during construction and the physical occupation of land for the towers, but also from some restrictions in how people can work beneath the transmission lines. One major challenge as part of detailed design of the Project will be to identify and ensure that all land owners have been able to react and take part in the process of establishing the transmission line and substations as well as issues of compensation for permanent loss of land. This process is defined in Republic of Moldova legislation linked to the detailed EIA required as

part of the legal framework (see chapter 2.3) in Republic of Moldova. The importance of ensuring proper assessments, as well as mitigation actions, linked to land acquisition, resettlement and economic displacement is also acknowledged in EBRD Performance Requirement 5 as well as corresponding World Bank OP 4.12 - Involuntary Resettlement.

The assessed OHL route is not final, considering the present stage of the Project (feasibility study). There is a option which enables small alignments of the transmission line to additionally reduce impacts. In the present project the possibility to align the OHL with edges of properties and land plots and to position towers in ways that would reduce negative impacts on the land and to land owners will provide further mitigation of impacts as well as support an effective land acquisition process. The assessment of impacts is made based on the technical documentation, including tower positioning, provided to the ESIA team.

The transmission line provides national opportunities in terms of energy security, as well as opportunities to access power markets that are not accessible today. These opportunities, if realised, could provide added benefits on a national scale in terms of strengthened industrial and service sectors also involving creation of job opportunities. These impacts are motivations for the project, but are not considered as part of the assessment of socio-economic impacts.

6.3.1 Access to land and land use

The 400 kV OHL requires consideration of a safety corridor formed by the land and airspace limited by vertical planes, on both sides of the transmission line from the marginal conductors without deviation. This distance is of 30 m, according to the GD no. 514/2002 for approval the *Regulation regarding the protection of electrical network*. This means that there is a 75 meter corridor of land, 30 meter on each side from the marginal conductors and then the space between the tower marginal conductors (15 m or 15.5 m), which will be directly affected land.

The proposed Project will inevitable require land for construction, physical project structures during operation (e.g. towers) and decommissioning. The main affected land type is agricultural land – about 64%. Land used for vineyards or orchards along with “other land” category accounts for about 20% of the affected land.

The ***construction stage*** will include temporarily occupied land for foundations preparation, tower mounting and erection (working platforms) as well as for the corridor for OHL phase conductors and ground wires stringing. Access roads are needed to each tower so in case there is not access road, temporary solution will have to be arranged. After construction the temporary roads and land occupied for construction can be turned back to original land use.

Land areas which will be temporarily occupied are the following:

- Working platform for suspension towers erection (about 825 m^2);

- Working platform pertaining to tension towers for erection, phase conductors and ground wires sagging operations (about 1,500 m^2);
- OHL working corridor (access zone) 3 m width, for phase conductors and ground wires erection (tension).

Temporary impacts will occur as the ordinary land use will be not possible during construction phase. In the case where vineyards or orchards are found, the impacts will be seen over a longer period of time as some damage or clearing of vine or trees is required.

The temporarily occupied land will result in impacts in land access. These impacts will depend on season when the construction of the transmission line is made, the time period needed for the construction and the land use type. Compensation measures need to be taken to the person, company or entity that are in control of the respective land area. The overall impact is considered **moderate** to **high** depending on type of land. For vineyards and orchards the impacts will be higher compared to the impacts on other land and forest due to the fact that these areas (last ones) are not as dominating as farmland and vineyard and orchards.

The area where tower and possible additional anchoring are found will be permanently used. There are a total of 511 towers. The amount of land required for the permanently affected area will differ between the different types of tower. In the case where private land-owners are affected, compensation for the land needed for the tower footprints will be required. The impact will depend on livelihood situation of the farmers affected and level of compensation. Land plots can be small, but improper tower positioning may lead to relative high impact on such land plots. The overall impact is considered **moderate** to **high,** depending on the type of land.

Table no. 49. Land type and surface area, in hectares, affected by the safety corridor

	OHL including safety corridor [ha]	Other land [ha]	Forest [ha]	Vineyard [ha]	Farmland [ha]
UTA Găgăuzia*	381.3	16.4	0.0	84.0	280.8
Cahul	64.0	0.0	0.0	33.7	30.3
Tărăclia	172.4	14.1	15.5	28.3	114.5
Cimişlia	101.9	21.5	0.0	30.4	50.0
Hânceşti	302.0	46.7	27.5	26.3	201.6
Ialoveni	25.6	2.0	5.4	7.4	10.8
Chisinau	110.4	24.2	2.7	22.9	60.6
Total	**1,157.6**	**125.0**	**51.1**	**233.0**	**748.6**

Note: In order to reach these areas the length of OHL passing each land type is multiplied with the safety corridor.
* ATU Găgăuzia is not one connected land area, but consists of four different areas of which the proposed OHL will pass through two.

The total surface area of the OHL safety corridor is about 1,150 ha.

Vineyards and orchards represent land that has certain added qualities, as compared to farmland. The vines, as well as trees in the orchard are perennial but also the soil and other land aspects needs certain characteristics in order to provide good quality products. Impacts

on other land and forest are considered smaller but these areas are also not as dominating as farmland and vineyard and orchards thus the assessment.

The OHL route is not passing any large area of forested areas, but would pass smaller areas with tree cover. The restrictions in access to forested areas are expected to be **minor**.

The BtB Vulcăneşti substation and modification within Chişinău substation will be constructed inside already existing substations premises and there will thus be no new land (see reference no. 2) that has to be used outside these locations. Roads to the substations exist. The impact is expected to be **minor**.

During the operation of the OHL the potential impacts will be expected due to:

- Tower footprint on the land used today for other purposes;
- Restrictions in certain activities linked to for example operation of machinery, etc.;
- Restrictions in terms of construction of houses within the OHL safety corridor.

There is a first suggested positioning of the towers, as part of feasibility study, but this does not include consideration of positioning of towers in such a way to reduce/minimize impacts on productive land and impacts on peoples' livelihoods. The total permanently affected land, by tower's footprints is almost 41 ha (26.6 ha as farmland and 8.6 ha as vineyards or orchards). This land will lead to economic displacement.

Table no. 50. Land type and surface area, in square meters, permanently affected by tower constructions (tower footprint)

District/ Land category	Total [m^2]	Other [m^2]	Forest [m^2]	Vineyard [m^2]	Farmland [m^2]
Găgăuzia	11,531	733	0	2,993	7,805
Cahul	2,839	0	0	1,129	1,710
Tărăclia	6,597	492	455	869	4,781
Leova	2,763	520	0	882	1,361
Cimişlia	10,365	1,209	520	971	7,665
Hânceşti	1,658	195	0	325	1,138
Ialoveni	3,308	1,022	65	665	1,556
Chisinau	1,768	451	0	751	566
Total	**40,829**	**4,622**	**1,040**	**8,585**	**26,582**

Both publically and privately owned land will be affected by the proposed Project; considering that the ownership is fragmented, including many farms owning less than 1 ha land, a high number of land owners is expected to be affected. Due to a high level of outmigration in the affected area, many land owners might be abroad.

Apart from the land permanently occupied by towers, the land between the towers can continue to be used for agricultural or other purposes during the operational stage of the transmission line but there will be restrictions associated with use of certain equipment (high vehicles for example) and activities (for example standing on top of higher objects such as a wagon underneath the power line) in the direct vicinity of the OHL. The electric and magnetic

fields generated in the power line will not exceed allowed levels at ground level meaning that there are no restrictions in terms of working or standing below the transmission line.

According to existing legislation in Republic of Moldova, there are no houses for residence allowed within the OHL safety corridor of 75 m. No buildings are within this corridor and based on this assessment no physical resettlement will be needed. Thus in terms of physical relocation the potential impact is **minor**. Below the OHL there should be no future constructions, as defined in national legislation. *Note: this assessment is based on the proposed OHL route and make the assumption that any deviations from this route does not take it closer to habited places, but rather tries to increase distances.*

The impacts on access to land will exist and proper compensation needs to be provided to affected parties. The economic displacement due to OHL will impact people in different ways depending on their situation. In the Project area many of the land plots are small and therefore for some individuals or enterprises the impact can be high. With proper choice of tower's locations and with appropriate compensation for land loss, the socio-economic impacts are estimated to be **moderate** to **high**.

Information to farmers and agricultural workers, including workers at vineyards and orchards, will be needed in order to increase awareness related to the magnetic and electric fields generated from the OHL, the exposure and associated risks. Employers need to be informed about their obligations and responsibilities towards their workers. Impacts on workers from magnetic field and/or electric field are expected to be **moderate**. The risk of unhealthy exposure will persist and necessary follow-up and training is critical.

The BtB Vulcăneşti substation and modification within Chişinău substation will be constructed inside already existing substations premises and there will thus be no new land that has to be used outside these locations (see reference no. 2). Roads to the substations exist.

The lifetime of a transmission line is 30 - 40 years, but with appropriate maintenance activities, this can be longer.

Decommissioning impacts will be similar to the construction stage. Impacts will be linked with possibility to have access to land. Compensation will be offered to affected land users. The impact, strongly depending on compensation level is expected to be **moderate to high.**

After decommissioning, the land previously occupied by the towers can be taken into productive use again therefore the impact is expected to be **moderate (positive).**

The BtB Vulcăneşti substation and modification within Chişinău substation will be constructed inside already existing substations premises (see references no. 84). It is difficult to say if the land will be made available after decommissioning. The land, if used for farming, should be tested for any contamination prior to use. The social impacts are expected to be **minor.**

Table no. 51. Matrix for evaluation of potential impacts on access to land and land use, without mitigation measures; compensation is not considered a mitigation measure and included

	Description	Scale	Duration	Magnitude	Probability	Significance
Construction	Restricted access to land	On-site	Short-term	Moderate to high	High	High
	Physical impacts on land due to access roads, clearing and foundation work	Local	Short-term	Moderate to high	High	High
	Restrictions in access to forested areas	On-site	Short-tem	Low	High	Minor
	Land for BtB Vulcăneşti substation and modification within Chişinău substation	On-site	Short-term	Low	High	Minor
Operation	Permanent loss of land access where towers are placed	On-site	Long-term	Low to moderate	High	Moderate
	Exposure to magnetic and electric fields when working	On-site	Long-term	Low to moderate	High	Moderate
	Resettlement of people outside the safety corridor	On-site	Long-term	Negligible (no houses in corridor)	Average	Minor
Decommissioning	Restricted access to land during decommissioning	On-site	Short-term	Moderate to high	High	High
	Physical impacts on land due to decommissioning activities	Local	Short-term	Moderate to high	High	High
	Land is released for productive purposes when decommissioning is completed	On-site	Permanent	Moderate (Positive)	Average	Moderate (positive)
	Decommissioning within the substations requires land use	On-site	Short-term	Low	High	Minor

Mitigation measures

There are technical options to reduce the footprint of the towers. This would be especially important for those towers that will be found in vineyards or orchards. There are also options to position the towers in agricultural field border rather than inside the agricultural fields and by this reducing the impacted area. For the proposed Project the potential to reduce the impacts as compared to the first technical design is large. As land plots often are small the possibility to find areas between fields is good. Also, there is room to adjust the route in such a way that it makes better use of less productive land. In case of adjustments, special attention should be given to distances to habited places not less than 200 m.

Compensation for access to land during construction stage should be given according to applicable rules and regulations. The magnitude of the compensation will affect the level of impact on socio-economic situation of the land owner and land user. Still, people may

consider the compensation level to be too small and not up to par with their income losses. At the same time, the opposite may also comply where people want to release land for the construction in order to get the compensation. Market prices for land may be lower than compensation levels as prescribed by laws. There is a need to inform people on the Project and ensure that people are able to prepare and plan their work on land that will have restricted access in order to avoid unnecessary costs for them.

The process to ensure a land acquisition in accordance to performance requirements of potential financing institutions (EBRD, EIB, WB) could prove to be challenging as the number of land plots temporarily affected during the construction and decommissioning stage is large. The number of land owners linked to land used for towers foundations is possibly also large. In addition to this it is possible that many of the land owners are working outside of the area. The EBRD Performance Requirements are stringent in terms of how to reach acceptable compensation levels as well as to have the informed participation of affected groups.

Access to land will be restricted during the construction stage. Proper planning of construction works over the year in such a way that could be achieved a reduced impact on farming, would be beneficial and mitigate negative impacts.

The temporary roads should be decommissioned as soon as possible after these are no longer needed.

For establishing the compensation mechanism and the associated costs, detailed information is required on the affected areas and owners.

6.3.2 Property and income

The change of land use due to construction, operation and decommissioning of the proposed OHL will have impact on property, income and livelihood (mainly due to changed agricultural use) in local communities along the proposed route.

The impacts from restricted and changed access to land are presented in chapter 6.3.1 Access to land and land use. Direct jobs created as part of construction and operation is presented in chapter 6.3.3 Industrial production and jobs.

During construction work increased traffic, noise and other disturbances may occur. It is considered that these events would not affect income opportunities or activities such as cattle grazing, as long as the proper measures are taken to plan and mitigate these effects - **moderate social impacts.**

Main impact is expected to be related restricted land use. This economic displacement will require compensation measures and was presented in chapter 6.3.1 Access to land and land use.

Indirectly, the Project may result in reduced opportunity for seasonal workers as a consequence of temporary land requirement for the Project, as well as the permanent requirements. But the affected land, as compared to total farm land, is small and this effect is thus assessed as **minor impact.**

There are typically only few local direct jobs generated through this type of project. But there will be a certain amount of indirect and induced income opportunities generated as construction work takes place. These income opportunities will be on short term. The impact is expected to be **minor** (**positive).**

OHL does not cross over any settlements and there are no buildings inside the safety distances for magnetic and electric fields thus no resettlements of households will be needed.

The BtB Vulcăneşti substation and modification within Chişinău substation will be constructed inside (see reference no. 84) the already existing substations and will not directly impact incomes in the affected area. It could generate some indirect and induced income opportunities as people are working with construction. The impact is expected to be **minor (positive).**

During operation the lands located in the safety corridor can still be used for agriculture, viticulture, orchards and grazing. Operation and maintenance of the OHL should be performed with the consent of the land owners and preferably in the period when the lands are not occupied by crops or when it is possible to ensure the integrity of existing land use.

The land area permanently occupied by towers is relative to the overall land area under nominal management. Compensation shall be given to the land owners for land needed for the towers. Still, land owners may think the compensation being too low in relation to their losses.

During meetings in the area, the issue of how magnetic fields would affect the viticulture and quality of produced wines were raised. People argued that the magnetic field would harm the viticulture and quality of end product. There is no evidence in science supporting this argument. Still, the concern indicates that information is needed to clearly state how magnetic and electric fields will affect living tissue and that it will not affect this in order to avoid income losses as a consequence of false information - **minor to moderate impact**. A certain risk related to this concern may affect income and activities in the area.

There are no suggestions that the operation of the OHL would affect vulnerable groups or women in any other way than other groups in the society.

The BtB Vulcăneşti substation and modification within Chişinău substation will be constructed inside (see reference 84) the already existing substations and will not directly impact incomes in the affected area. It could generate some indirect and induced income opportunities as

people are working with operation and maintenance (the direct jobs are presented in chapter 6.3.3 Industrial production and jobs - **minor (positive)** impact.

Impact during ***decommissioning*** is similar as during construction.

Certain land will be made available again. This land could be offered back to farmers with adjacent land and thus create **moderate (positive) impact** income opportunities.

The BtB Vulcăneşti substation and modification within Chişinău substation will be constructed inside the already existing substations (see reference 84) and will not directly impact incomes in the affected area. It could generate some indirect and induced income opportunities as people are involved in decommissioning - **minor (positive)** impact.

Table no. 52. Matrix for evaluation of potential impacts on income

	Description	Scale	Duration	Magnitude	Probability	Significance
Construction	Increased traffic, noise and disturbances during construction	Local	Temporary	Low	High	Moderate
	Reduced income opportunities for seasonal workers	Local	Short-term	Low	Average	Minor
	Indirect and induced income opportunities linked to OHL and BtB substation construction	Regional	Short-term	Low (Positive)	Average	Minor (positive)
Operation	Reduced income opportunities for seasonal workers due to permanent loss of land for towers footprint.	Local	Long-term	Low	Average	Minor
	Resettlement of people inside the safety corridor	On-site	Long-term	Negligible (no houses in corridor)	Average	Negligible
	Indirect and induced income opportunities linked to OHL and BtB substation operation	Local	Long-term	Low (Positive)	Average	Minor (positive)
Decommissioning	Increased traffic, noise and disturbances	Local	Temporary	Low	High	Moderate
	Reduced income opportunities for seasonal workers	Local	Short-term	Low	Average	Minor
	Indirect and induced income opportunities linked to OHL and BtB substation decommissioning stage	Regional	Short-term	Low (positive)	Average	Minor (positive)

	Description	Scale	Duration	Magnitude	Probability	Significance
	Land is released for productive purposes when decommissioning is completed	Local	Long-term	Moderate (positive)	High	Moderate (positive)

Note – impacts related to access to land considered in chapter 6.3.1 Access to land and land use

Mitigation measures

Compensation levels may be considered low as compared to the restrictions and impacts that the construction and operation of the OHL will have on peoples' access to land. At the same time, the opposite may also comply where market prices for land may be lower than compensation levels as prescribed by laws. Proper information and a transparent process are required.

Ensuring routines during OHL operation minimises the need to perform maintenance, routine repairs etc. during seasons that would negatively affect the agricultural and wine production.

During the detailed design stage, the people perception regarding the effect of magnetic and electric fields on quality and yield of the viticulture inside the safety corridor is recommended to be assessed. Depending on results, further information on this issue might be developed and disseminated.

6.3.3 Industrial production and jobs

There is currently very limited industrial production in the Project area. There are not any direct increases or decreases in industrial production in the project area as consequence of the proposed OHL.

The proposed Project will, however, create some temporary income opportunities (direct, indirect and induced) for members of the local, regional and wider communities during the different stages.

The Project is expected to create some temporary employment opportunities ***during the construction*** period and there is also a potential for indirect and induced income opportunities in the area as presented in section 6.3.2 Property and Income.

No impacts on local industrial production are foreseen considering that the equipment and materials for the construction will be sources from outside the area - **minor impact.**

The construction of OHL is not expected to generate any new permanent jobs locally, but could result in a few direct shorter contract jobs - **minor (positive) impact.** One possible limiting factor to local employment could be the lack of skilled construction workers due to outmigration.

The construction of BtB substation is not expected to generate any new permanent jobs locally, but could result in a few direct shorter contract jobs – **minor (positive) impact.** One possible limiting factor to local employment could be the lack of skilled construction workers.

At ***operation stage***, the main work will cover monitoring and maintenance of the transmission lines and substations (BtB and existing ones). The BtB substation in Vulcăneşti will generate employment opportunities in terms of operation and maintenance. The maintenance and operation of the transmission line as well as BtB substation will be managed by employees with possible work opportunities in the area - **moderate (positive) impact**. One possible limiting factor to local employment could be the lack of skilled workers due to outmigration.

The ***decommissioning*** of OHL is not expected to generate any new permanent jobs locally, but could result in a few direct shorter contract jobs - **minor** (**positive) impact**. One possible limiting factor to local employment could be the lack of skilled construction workers due to outmigration.

The decommissioning of BtB substation is not expected to generate any new permanent jobs locally, but could result in a few direct shorter contract jobs - **minor** (**positive) impact.** One possible limiting factor to local employment could be the lack of skilled construction workers.

Table no. 53. Matrix for evaluation of potential impacts on industrial services and jobs.

	Description	Scale	Duration	Magnitude	Probability	Significance
Construction	Impact on industrial production	Local	Short-term	Low (positive)	Average	Minor (positive)
	Impact on industrial production – provision of materials (the Republic of Moldova)	Regional	Short-term	Low (positive)	Average	Minor (positive)
	Short term contract linked to construction of OHL and BtB substation	Local	Short-term	Low (positive)	Average	Minor (positive)
Operation	Job opportunity for maintenance and operation – OHL and BtB substation	Local and regional	Long-term	Low (positive)	High	Moderate (positive)
Decommissioning	Short term contract linked to decommissioning of OHL and BtB substation	Local	Short-term	Low (positive)	Average	Minor (positive)

Mitigation measures

No mitigation measures linked to Industrial production and jobs in the Project area.

6.3.4 Societal services and infrastructure

The current status of societal services such as schools, hospitals and other infrastructure such as roads, water, electricity and gas has been outlined in the socio-economic baseline. The main potential impact from the proposed Project will be seen linked to road infrastructure. Currently, the road infrastructure is in poor condition, especially looking at local roads in rural areas. Potential Project's impact on infrastructure is assessed as mainly positive.

The international airport in Chișinău is situated 5 km from the Chișinău substation. However, no impact on the airport's operation is expected.

The ***construction*** of OHL will increase the traffic on the national, regional and local roads available in the Project area, for accessing the construction areas. Hence, the Project will need to establish that existing roads have the ability to handle the planned volume and intensity of the traffic during the construction stage. As a result, there is a possible need for upgrading existing roads and to build new (temporary and permanent) access roads to handle construction traffic.

This possible upgrading of roads and construction of new road in the Project area, especially local roads, would benefit local communities, including vulnerable groups, by increasing transport network and access to e.g. work places, health care, local markets and, for tourists, to cultural attractions - **minor (positive) impact.** Certain risk of using poor roads during construction work and leave them in a worse state than prior to entering the area might appear.

School, medical and other societal services are typically found inside the towns or villages. No town or villages are within the safety corridor of the OHL - **negligible impact** is foreseen linked to the operation of these services. There is an increased risk of traffic accidents due to the increased traffic in the area but the magnitude will depend on how transportation to and from the service institutions are made. School buses are for example already found to transport children to and from school if there are longer distances.

Along the OHL route there are wells at the distances ranging from 50 m to 2.6 km length. The closest ones are at the crossing of Botna river between Costești and Zîmbreni villages (50 m length), north to Topală village (65 m length), south-west of Ecaterinova village (70 m length), between Cernac and Topală villages (72 m length), south to Străisteni village (77 m length).

Regarding the tanks and water collection installations, along the OHL route are some located at distances ranging from 100 m length (west to Congaz village) and 1.17 km in the north of Dezghingea village.

In the area of Sofievca there are springs located at distances ranging from 50 m to 700 m length from the OHL route. In the area of Albota de Sus the spring is located at 40 m from the OHL route. There are some springs also in the area of Valea Hîrtop, south-west of Borgeag but at greater distances (740-1200 m length) from the OHL route.

According to topographic maps (geoportal.md 2013) between Hîrtop and Valea Perjei villages the OHL route crosses an area with irrigation channels but from the discussions with local authorities these are not functional.

During Project's detailed design stage the final position of the towers will be established in coordination with the Ministry of the Environment, the authority in charge with the natural resources management and environmental protection as well as with Ministry of Health in order to insure the protection of communities drinking water supply.

Furthermore, during Detailed Design Stage the final position of the tower will be coordinated by all the utilities administrators (for crossing the roads, gas pipeline, telecommunication lines, transmissions and distribution grid, water supply sources, irrigation systems and so on).

No socio-economic impacts are foreseen as associated with services from water, electricity or gas system inside the settlements. OHL will pass outside all settlements. Proper caution should be taken when passing any infrastructure pipes, cables or roads - **minor impact.**

There are no suggestions that the construction of the OHL would affect vulnerable groups or women access to societal services in any other way than other groups in the society.

No impact from the construction of BtB substation on societal services.

During ***operation*** of the OHL there is no expected impact on societal services. No impact from the operation of BtB substation on societal services.

Impacts from ***decommissioning*** are similar as during construction.

Table no. 54. Matrix for evaluation of potential impacts on societal services and infrastructure

	Description	Scale	Duration	Magnitude	Probability	Significance
Construction	Need for good roads during construction	Local	Long-term	Low (positive)	Average	Minor (positive)
	Impacts on utilities (water, electricity gas supply, etc.)	Local	Short-term	Low	Average	Minor
	Impacts on existing schools, medical centres etc. operations	Local	Short-term	Low	No probability	Negligible
Operation	No impacts identified.	-	-	-	-	-
Decommissioning	Need for good roads during decommissioning	Local	Short-term	Low (positive)	Moderate	Minor (positive)
	Impacts on utilities (water, electricity gas supply, etc.)	Local	Short-term	Low	Average	Minor
	Impacts on existing schools, medical centres	Local	Short-term	Low	No probability	Negligible

Mitigation measures

Ensure that routines are in place to safeguards roads and other infrastructure and that these are not left in more severe conditions than before entering in the working area – this is especially important during construction and decommissioning stages.

Ensure routines are in place to secure that existing infrastructure crossed by OHL are properly marked and actions are taken to avoid any unnecessary disturbance in these services

Inform any worker linked to the construction, operation and maintenance and decommissioning activities to drive safely and responsibly not to disturb or put local people in harm.

6.3.5 Scenery and visual amenity

There will be visual impacts from the OHL in the Project area due to the physical changes in the landscape from the proposed project. These changes include removal of trees, addition of psychical structures (e.g. OHL towers) or other features, such as temporary access roads and material storage areas. Visual effects are closely related to changes in the landscape and relates to people's perception and response to those changes.

The ***construction*** of the proposed OHL will inevitably change the landscape, i.e. by the temporary storage of construction material, machineries and temporary access roads, construction of tower foundations and building of towers. Each tower will take approximately 30 days (20-25 days for the foundation and 5-10 for the erection) to assemble and build. The impact is considered **moderate to high.**

This temporary change in the landscape due to construction may have short-term effect on the development of tourism in the area, especially where the OHL construction is visible in connection to tourist attraction such as cultural monuments and recreational areas. Today the tourism industry is relatively small so impacts will **be minor**, but ambitions to explore new opportunities might be hindered by the OHL. Based on interviews it seems that tourism might be somewhat bigger closer to Chisinau as people from town will travel outside of town during weekends and holidays.

BtB Vulcăneşti substation and modification within Chişinău substation will be constructed inside the already existing substations (see reference no. 2) and will not affect the scenery as compared to situation today - **minor** impact.

During ***operation***, the proposed 400 kV OHL is likely to be visible from the roads in both the immediate and wider area around the route of the line. Normally, OHL towers are not observed from a distance beyond 10 km. Visual effects are most likely, however, in areas closest to the line.

In general, OHL towers will be more noticeable just as they are raised and before people get accustomed to them as part of the scenery. As a consequence, the impacts will be reduced with time. Some houses and town will be relatively close to the OHL (see Table 39) and to these the new construction will represent a major new item in the scenery. Still, no house is inside the safety corridor. Hence, to the majority of people inside the survey corridor no long term impact (visual effect) is expected among the local population. The impact is considered **moderate** but for some households close to the proposed OHL route there will be a **high** impact.

Figure no. 73. New artefacts placed in the landscape could potentially be visible from large distances

The changes in the landscape and visual effects represent a risk of potential long-term negative impact on the development of tourism in the Project area. The degree of tourism in the Project area is currently low but tourism development is one of the priority areas of the national economy. There is therefore expected that efforts will be made in affected districts to establish more tourism industry. The OHL route could potentially reduce the attractiveness of some tourism activities, e.g. eco-tourism in “untouched” rural areas, or tourist attractions such as historical heritages and wineries. At the point of this ESIA the potentials were only expressed in general wording and no specific sites were identified.

BtB Vulcăneşti substation and modification within Chişinău substation will be constructed inside the already existing substations (see reference no. 2) and will not affect the scenery as compared to situation today.

During ***decommissioning***, the impact is similar as for construction stage.

As the OHL is removed the scenery will change back again to its natural state - **moderate** (**positive) impact.**

Table no. 55. Matrix for evaluation of potential impacts on scenery and visual amenity

	Description	Scale	Duration	Magnitude	Probability	Significance
Construction	OHL construction impact on the landscape scenery	Local	Short-term	Moderate to high	High	High
	OHL impact on existing tourism	Local	Short-term	Moderate	No probability	Minor
	BtB Vulcăneşti substation and modification within Chişinău substation	Limited	Short-term	Negligible	High	Minor
Operation	OHL impact on the landscape scenery	Local and regional	Long-term	Low to moderate, in some cases high	High	Moderate (in a few cases high)
Decommissioning	Short term OHL impact on the landscape scenery, as part of decommissioning work	Local and regional	Short-term	Moderate	High	Moderate
	OHL impact on existing tourism	Local and regional	Short-term	Moderate	No probability	Minor
	BtB substation decommissioned	Local	Short-term	Negligible	High	Minor
	Long-term impact as the OHL is removed from scenery	Local and regional	Long-term	Moderate (positive)	High	Moderate (positive)

Mitigation measures

In the detailed design of the OHL, attention should be given to the landscape formation in order to avoid unnecessary exposure of the towers on the top of the hills in the landscape. This would also be favourable to avoid collisions in the case of migratory birds.

6.3.6 Electric and magnetic fields

A power system in operation represents as significant source of electric and magnetic fields (EMF).

EMF consists of an electric field and a magnetic field perpendicular to each other and perpendicular on the propagation direction. The propagation direction oscillates sinusoidal between the positive and the negative values with a specific frequency. The difference between two maximum positive (or negative) values called the wavelength is inversely proportional to the frequency. The EMF is a rotating field and propagates in the form of electromagnetic waves, with a speed depending on the permissiveness and permeability of the environment. The propagation speed of electromagnetic waves in air is light speed (300.000.000 m/s).

Electromagnetic radiation is a variable flow of invisible lines of electric and magnetic forces. These simultaneous forces propagate in space and time at the speed light speed.

The EMF has two main components, one component reactive and the other radiative. The reactive component represents the energy stored around the source and is has a potential effect on human. This field around the source, called *near field* is up to a distance of about 1/6 - 2 m. Measurements are difficult, even probe insertion can change the field. The radiation component appears at distances longer than a wavelength, called *distant field* where the electromagnetic wave is plane. In this distant field the ratio between the intensity of electric and magnetic fields is constant.

There is a transition area between near and distant fields where the radiation component predominates. Since the wavelength is inversely proportional to the frequency these regions are variable, from 1 mm to 100 km in the radio frequency band. Two parameters characterized the magnetic field: the field power (H), measured in Ampers per meter (A /m), and the flux density (B) measured in gauss (G) and tesla (T). The field intensity is measured in volts per meter (V/m).

The power system in operation is sources of:

- Electric field of low frequency (50Hz);
- Magnetic field of low frequency (50Hz);
- EMF in different frequencies during abnormal regimes of operation, like transitory regimes or due to Corona discharge on different elements of the installations.

Electromagnetic emissions are divided as follows:

- Ionizing radiation (capable of breaking molecular bonds or ionizing atoms, processes having effects on living matter);
- Non-ionizing radiation (the electromagnetic emissions with energy not sufficient to modify the interaction substances, but may produce some thermal, physico-chemical effects, etc.).

The effects of low frequencies EMFs on public health were recently considered as a potential risk.

The intensity of electric field depends directly on the OHL voltage.

The field effects on environment are divided in two categories:

- Effects at the ground level or 1.8 m height;
- Effects at the conductors and clamps surfaces where the electric field is hundred times higher than on ground level.

On ground level the electric field may produce the following:

- induced currents in conductive objects;

- induced voltage in objects isolated from the earth;
- direct perception of people;
- indirect biological effects, direct effects on humans and animals in the case of prolonged exposure.

6.3.6.1 EMF of 400 kV OHL

In specific studies, there are numerous indications of the intensity of the electric field and the magnetic field in 400 kV installations based on calculations and measurements. In Table no. 56 there are presented common values for 400 kV transmission lines.

Table no. 56. Usual values of EMF intensity for 400 kV OHL

Tower type	Value category	Electric field (kV/m)	Magnetic field (μ T)
Steel tower High (275 - 400 kV)	Maximum value under OHL	11	100
	Average value under OHL	3 - 5	5 - 10
	Average value at 25 m to the OHL axis	0.2 - 0.5	1 - 2
	Average value at 65 m to the OHL axis	0.1	0.2

Measurements for the EMF were made in certain sections of the corridor of the transmission line, as illustrated in Figure no. 74. The results of the measurements are shown in Figure no. 75, where the average and maximum values for the field strength under the monitored line are indicated during the whole measurement campaign, according to Hoeffelman (2004). On the other hand, the limit values of the same size are indicated in Table no. 57, depending on the characteristics of the area that the line crosses. Table no. 57 shows the average value of the 400 kV OHL magnetic field, the standard deviation and the confidence limits for a 0.95 for positions 1, 2 3 and 4 of Figure no. 74.

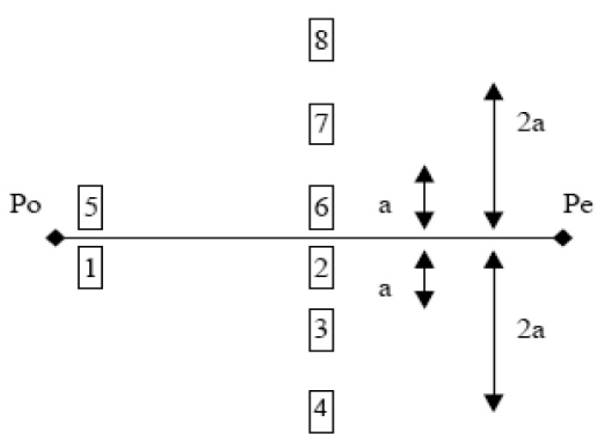
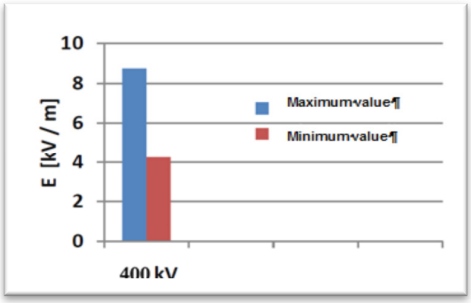


Figure no. 74. Measurement point of EMF between two towers P0 and P1. Lateral distance is 40 m



Electric field limits (kV/m)	
Position	
Living area	5
Road crossing	7
Others	10

Figure no. 75. Maximum and average values of electric field under 400 kV OHL and recommended values in different areas according to Hoeffelman (2004)

Table no. 57. Statistic data of magnetic field along transmission line, according to Hoeffelman (2004)

Position	Limits of magnetic field (μT)		
	Average value	Standard deviation	Limit of confidence coefficient 95%
1	1.4 - 2.0	1.3 - 1.9	4.2 - 6.0
2	2.1 - 3,2	1.9 - 2.7	6.2 - 9.0
3	0.8 - 1,3	0.8 - 1.2	2.4 - 2.7
4	0.3 - 0.7	0.3 - 0.7	1.0 - 2.2

The results lead to the conclusion that the intensity of the electric field at the ground level or near by decreases with the square root of the distance between the measurement or calculation point and the OHL axis.

The intensity of the electric field in the vicinity of the conductors under voltage can reaches values of hundreds or tens of kV/m at 6 cm, respectively 20 cm. These values must be considered during work under voltage.

The magnetic field is generated by the currents flowing through the OHL conductors. In case of a transmission line the magnetic induction depends on the currents values, phase configuration and the height of the conductors from ground level.

The magnetic field may produce the following effects:

- Induced voltage in the metallic length structures parallel with the OHL;
- Direct biological effects on people and animals;
- Indirect biological effects;
- Direct perception of people;
- Effects on vegetation.

These effects are generated by the magnetic field at the ground level or nearby with some exception around conductors and must be careful when the work is done under voltage. The magnetic field at ground level decrease with the square root of the distance between the measurement or calculation point and the OHL axis.

The magnetic field can reach values between 2.4 and 3.3 mT to a distance of 6 cm from conductors.

There are techniques to reduce the magnetic field in the vicinity of the 400 kV OHL. The most used magnetic field attenuation solutions are increasing the height of the towers and conducting system management. Thus, when the phases configuration on the towers are chosen the distances between the phases are established and the composition of the conductor beams on the phases, solutions are adopted to reduce of the magnetic field.

Figure no. 76 presents how increasing the towers height is a good solution when the terrain conditions need only a small decrease of the magnetic field value inside the transmission line corridor. Outside of the corridor the magnetic field is insignificant.

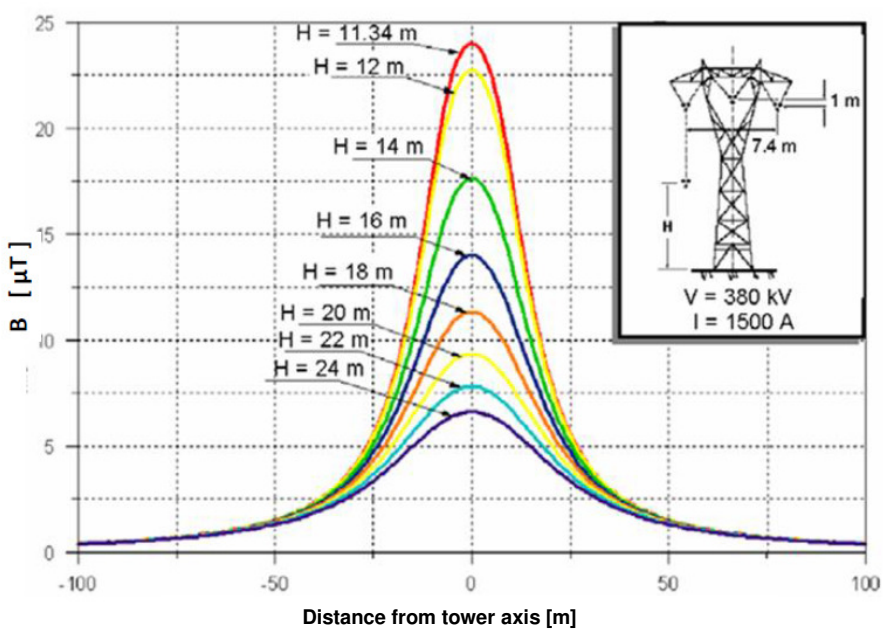


Figure no. 76. Magnetic field attenuation trough increasing the towers height (values calculate at 1 m from ground level) according CIGRE (2009)

The design of a 400 kV OHL includes construct solutions to comply with the guidelines for avoiding the negative effects of the EMF generated by power systems.

The strength of the EMF emitted by the transmission line depends on the line geometric configuration and its rated voltage.

6.3.6.2 Potential impact on public and occupational health

At international level, in order to ensure that the exposure to EMF avoids the negative effects on human health, international guidelines and standards were established based on consistent studies available.

In 1989, the International Commission on Non-Ionizing Radiation Protection (ICNIRP), recognized by World Health Organisation (WHO) and European Commission (EC) in non-ionizing radiation protection field (NIR), presents recommendations for exposure limits in *"Guidelines for Limiting Exposure to Time –Varying Electric, Magnetic and Electromagnetic Fields (up to 300GHz)"*.

The ICNIRP exposure guidelines have been reviewed through members of the affiliated global radiation protection society (IRPA) and, more recently, the analysis process has been extended to include ICNIRP's International Partners in Non-ionized Radiation Protection.

The main objective of the ICNIRP Guidelines is to provide protection against known adverse health effects, namely the effects that cause detectable negative damage to the health of exposed persons or their descendents. The guidelines published by ICNIRP to limit exposure to EMFs variable over time make the distinction between general and occupational exposures public. The guidelines recommend basic restrictions that are directly based on the established health effects and specify that protection against adverse health effects requires that these basic restrictions are not exceeded. For the electromagnetic field, the physical quantity used to specify the basic restrictions is the density of the current intended as an internal dosimetric quantity.

Table no. 58. Basic restriction and reference levels - ICNIRP

Exposure	Basic restrictions	Reference levels at 50Hz	
	Current density (mmA/m^2)	Electric field (kV/m)	Magnetic field (µT)
Occupational	10	10	500
General public	2	5	100

Current density cannot be measured in living tissues, so ICNIRP has introduced reference levels for practical exposure assessment purposes to determine if basic restrictions are likely to be exceeded. The reference levels to be applied in a given exposure situation depend on the frequency, the situation where there is potential for indirect effects and the situation where the fields are pulsating. The reference levels are expressed in terms of field intensity and magnetic induction.

Compliance with the reference levels ensures compliance with the corresponding base restrictions, but the reference levels are not limits, so if they are exceeded by the measured or calculated values, it does not necessarily mean that the basic restrictions will be exceeded. The guidelines specify that whenever a reference level is exceeded, it is

necessary to test compliance with the corresponding base restriction and to determine whether additional protection measures are needed.

Reference levels for EMF strength and for magnetic flux density are quantised as square values of the arithmetic mean and this makes it easy to compare with measurements since most commercially available tools display square magnitude quantities of arithmetic average. In 2010, ICNIRP released the *"New Guideline for Limiting exposure to Time-Varising Electric and Magnetic Fields (from 1 to 100 kHz)".*

Table no. 59. EMF reference levels - ICNIRP

Exposure	**Reference levels at 50Hz**	
	Electric field (kV/m)	**Magnetic field** (µT)
Occupational	10	1000
General public	5	200

In Republic of Moldova there are limit values only for electric field:

- Buildings 0.5 kV/m;
- Residential areas 1.0 kV/m;
- In villages, outside residential areas 5.0 kV/m.

The limits values of electric field in case of Over Head Lines are as follows:

- Crossing roads 10 kV/m;
- Inside living areas (without buildings) 15 kV/m;
- Difficult access areas and inaccessible areas 20 kV/m.

For the 400 kV OHL tower configuration proposed in this Project, the values of electric field are presented in Figure no. 77and Figure no. 78.

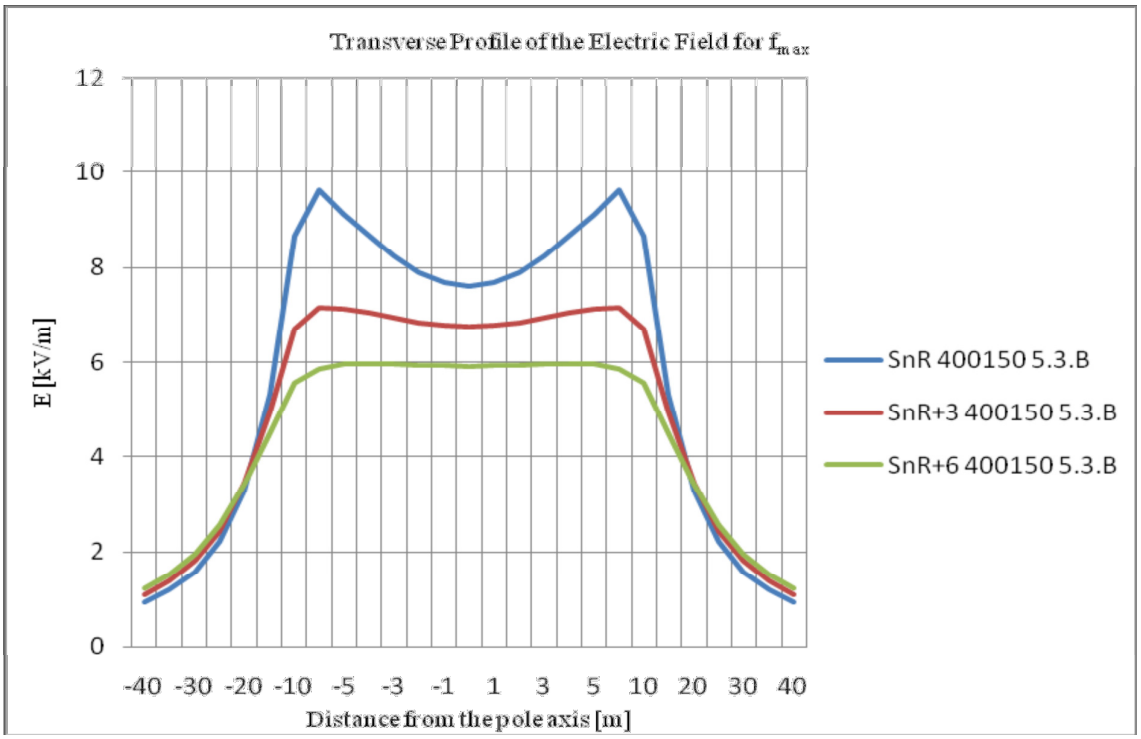


Figure no. 77. Electric field cross section (kV/m) generate by 400 kV OHL for a maximum arrow

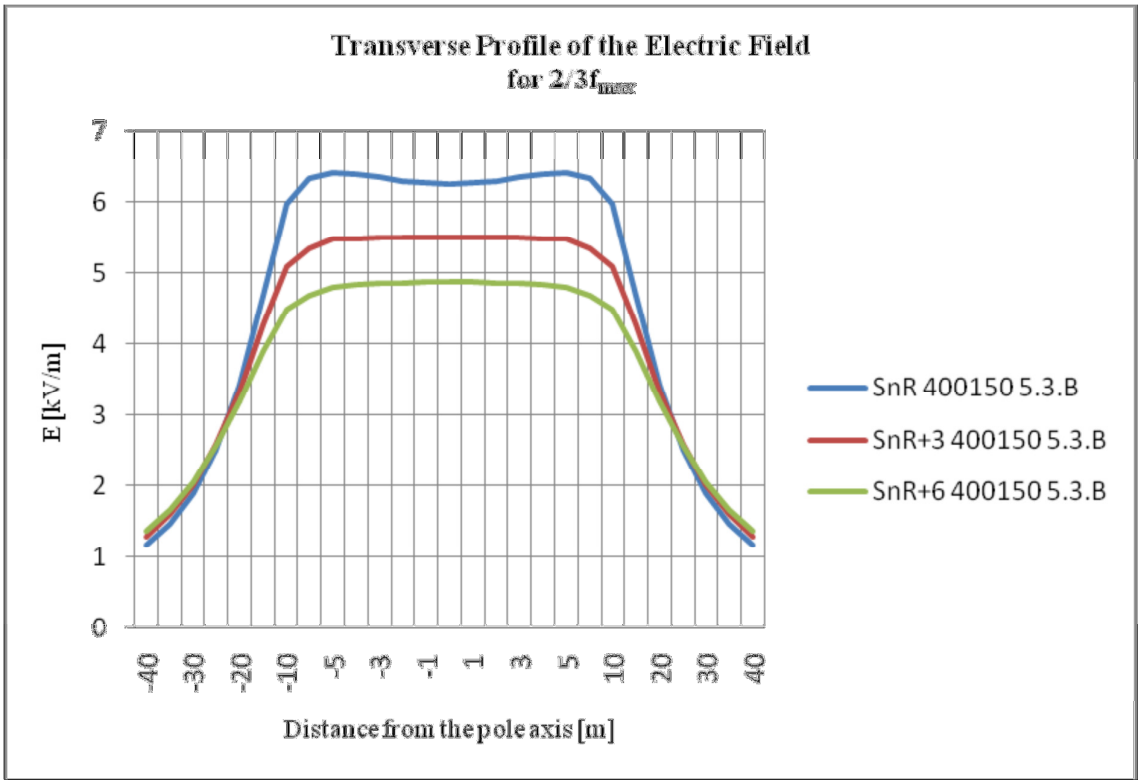


Figure no. 78.Electric field cross section (kV/m) generate by 400 kV OHL for 2/3 of maximum arrow

The calculation shows that the values of undisturbed electric field are less 5 kV/m in an area with a width of 16 m on the both sides of the transmission line.

The electric field is often low to the ground level because of the screening effect of trees, buildings, fences, vehicles, etc.

In case of buildings the screening effect of the walls is considerable, the electric field generated outside can decrease from ten to hundred times.

The electric and magnetic fields generated from the operation of the OHL will continuously affect the surrounding area. The field generated will decline rapidly when moving away from the OHL.

During ***construction*** no electric or magnetic fields are present as the OHL is not under operation but testing might take place before full operation - **negligible impact.**

During construction of the BtB Vulcăneşti substation and modification within Chişinău substation work will take place inside already operational substations. This means that all personnel will be required to have knowledge about safety regulations and proper safety distances. Moldelectrica have clear routines for this - **minor impact.** Certain risks might appear due to number of people involved in construction activities.

During ***operation*** both magnetic and electric fields are generated along the transmission line Similar there will be magnetic field generated around the stations. No houses are found within the OHL safety corridor and thus in operation there are **minor impact** for those staying inside the settlements or houses.

For anyone working close to the OHL there will be potentially a risk associated. This is the case for those working on farmland, vineyards, orchards or herding animals or cattle or involved in the operation and maintenance of the OHL or in the substations. There is negligible risk associated to be staying underneath the OHL as the levels are below the thresholds considered safe. Prolonged periods of stay underneath the OHL should possibly be avoided. Impacts in the land areas affected, inside the safety corridor, will be **moderate impacts**.

Workers linked to the operation of the OHL and substations will comply with the regulatory framework of working under these conditions and the exposure should not reach harmful levels. Impact is expected to be **moderate.**

During **decommission** no electric or magnetic fields are present as the OHL is not under operation - **negligible impact.**

During ***decommissioning*** within the existing Vulcăneşti and Chişinău substations, work will take place inside already operational substations. This means that all personnel will be required to have knowledge about safety regulations and proper safety distances. Considering that Moldelectrica have clear routines for this, the impact is expected to be **minor.** Certain risks might appear due to number of people involved in decommissioning activities.

Table no. 60. Matrix for evaluation of potential impacts from exposure of electric and magnetic fields

	Description	Scale	Duration	Magnitude	Probability	Significance
Construction	Electric or magnetic fields during construction	Limited	Short-term	Negligible	No probability	Negligible
	BtB substation constructed inside premises with electric and magnetic fields – proper routines in place	Limited	Short-term	Low	High	Minor
Operation	Impact on people inside houses or settlements.	Limited	Long-term	Low	Moderate	Minor
	People working on farmland, vineyards, orchards or herders within OHL safety corridor	Limited	Long-term	Moderate	High	Moderate
	Workers at the substations, or operation and maintenance of OHL	Limited	Long-term	Moderate	High	Moderate
Decommissioning	Electric or magnetic fields during decommissioning	Limited	Short- term	Negligible	No probability	Negligible
	BtB substation decommissioned inside premises with electric and magnetic fields – proper routines in place	Limited	Short-term	Low	High	Minor

Mitigation measures

Mitigation measures will be critical in order to reduce the risks associated with harmful exposures to magnetic and electric fields. Information should be prepared and disseminated to all land owners within the safety corridor as well as displayed in towns and village information boards. Apart from informing on the electric and magnetic fields, information on health and safety in the vicinity of the OHL should be provided. It is also suggested the follow-up on the information dissemination is done after 3 years of operation.

Workers needs to be informed about their rights and obligations in terms of working in environments with electric and magnetic fields to ensure that they comply with safety regulations.

6.3.7 Public and occupational health and safety

Main potential impact on health and safety of workers and the public is expected during the construction of the proposed OHL, but some long-term impacts on public and occupational health and safety are foreseen also during the operation and decommissioning stages.

Occupational safety hazards ***during the construction*** work include, among others, exposure to physical risks due to use heavy equipment and cranes, working at heights, falling objects, exposure to dust, noise and hazardous materials as well as electrical hazards from the use of tools and machinery. As the public will not have access to the construction area, these risks are mainly relevant for workers at the construction site. Impacts are considered **moderate**, need to ensure that proper skills and training is found for the workforce.

Furthermore, as traffic on public and access roads will increase during construction, there will be increased risks of traffic accidents, such as collision other vehicles, animals, local population and project workforce. This is an increased risk and the magnitude would not be more than in many more urban areas or along the main roads**, minor impact**.

Increased risk of pollution and release of harmful substances into the local environment or large amounts of waste generated with potential impact on public health. Proper routines for managing these aspects are required, **minor impact**.

A risk factor during the construction stage is increased risk of gender based and sexual violence linked to the inflow of workers from outside that in cases will spend longer periods of time on the construction sites. The impact is **minor** and proper measures should be taken to ensure that the risk is mitigated and any occurrence of gender based and sexual violence is stopped and reacted on.

During ***the operation*** of the transmission line the main risks are associated with repairs and maintenance for workers. Any person involved in these activities must have proper training and comply with safety regulations. If this is done the risk of accidents are considered **minor.** Systematic follow-up of routines and training is required in order to keep a high level of awareness among any personnel involved in operation and maintenance of the risks associated with this equipment.

People living around the transmission line should be informed of the restrictions in terms of activities in close proximity to the OHL imposed on them. There are risks associated with coming too close to the transmission wires during operation. This also includes situations when sitting in vehicles, or machinery. The impact is **minor.**

The operation of the BtB substation would include maintaining equipment containing harmful and toxic substances and also waste generation. Proper systems should be in place to ensure safe and environmentally sound handling and disposing of waste - **minor impact.** Risks to health exist to the workers handling and operating this equipment if proper routines are not followed.

Specific impacts relating to personnel exposure to electric and magnetic fields have been discussed in section on Electric and Magnetic fields.

From ***decommissioning*** same impacts are found as for construction stage.

Table no. 61. Matrix for evaluation of potential impacts public and occupational health and safety

	Description	Scale	Duration	Magnitude	Probability	Significance
Construction	Potential risks linked to construction work	Local	Short-term	Moderate	Average	Moderate
	Increased traffic exposing people for accidents	Local	Short-term	Low	High	Minor
	Pollution and/or release of harmful substances	Local or regional	Short-term	Moderate	No probability	Minor
	Increased risk of sexual and gender based violence	Local	Short-term	Moderate	No probability	Minor
Operation	Risk of accidents linked to operation and maintenance of OHL	Local	Long-term	Low	Average	Minor
	Risk of exposure to harmful and toxic material during maintenance and operation of BtB substation	Local	Long-term	Low	Average	Minor
	OHL represent a potential risk for accidents for people staying in the area	Local	Long-term	Low to moderate	Average	Minor
Decommissioning	Potential risks linked to decommissioning work	Local	Short-term	Moderate	Average	Moderate
	Increased traffic exposing people for accidents	Local	Short-term	Low	High	Minor
	Pollution and/or release of harmful substances	Local or regional	Short-term	Moderate	No probability	Minor

Mitigation measures

Protection of employees as well as local population is recognized as a key priority in the construction and operation of the proposed transmission line.

Risks and hazards during construction and operation of the proposed OHL will be prevented by putting in place measures and procedures for work protection as well as regularly training of the workers. The risks on and around construction sites will be reduced by implementing an *Action Plan on Occupational Health and Safety* imposed to the construction company, which together with the commitment to comply with Law no. 186/2008 regarding the Occupational Health and Safety will provide the basis on which the welfare of employees and workers health and safety will be based. Also, the construction company will prepare emergency response plans in order to respond to accidental and emergency situations based on the prior identification of major risks and hazards connected to construction, operation/maintenance and decommissioning.

It is of essence that the access to construction sites is limited, not allowing unauthorized individuals or animals to enter the site, in order to ensure community safety. This issue needs to be carefully considered, including securing the site by fences and guards to prevent the entrance of unauthorized people and informing the local population of the dangers with entering the construction site.

As the construction of the proposed Project will require intensive transport, it is also important that proper mitigation measures are implemented to adopt transport safety practices and prevent traffic incidents. For example, the use of driver trainings and skilled operational personal will significantly reduce the risk of traffic accidents. These risks can be further reduced if the access roads are selected in coordination with local authorities and traffic rules are followed.

Mandatory information to workers contracted to the Project about proper *Code of Conduct* relating to working and staying in the Project locations should be presented to all personnel. This *Code of Conduct* should include aspects of zero-tolerance of sexual and gender based violence (in line with performance requirements of potential financing institutions: EBRD, EIB, WB). It is advisable that adherence of agreed *Code of Conduct* shall be monitored at certain point of the construction process.

Moldelectrica have procedures and safety regulations in place that need to be followed during the operational stage. Their staff will regularly be participating in mandatory training courses. There are special routines that ensure that the safety regulations, in case there are accidents, are followed up and improvements of routines are made. One challenge is that in this type of project outside entrepreneurs will be hired. It will be central that also these people have the necessary training to minimize risk of working accidents.

For OHLs decommissioning there is need of routines for the respective lines decommissioning and if necessary, for intersections with other networks, under cooperation with the electricity distribution branch or the respective networks operator. All provisory works necessary for the works execution will be made according to solutions which will observe entirely the occupational safety requirements. The same conditions will be imposed both for provisory works execution and for works for resuming the normal operation diagrams.

During works progress, all personnel attending the works will be equipped and will use unconditionally electrical insulated Personal Protective Equipment checked whenever definite conditions on site require checking.

6.3.8 Cultural heritage

Republic of Moldova is a country abundant of cultural heritage, evenly distributed in the whole country. Hence, the proposed Project will most likely have impact on existing, known and unknown, cultural heritage during construction, operation and decommissioning.

Impact from construction

The baseline show that a number of archaeological sites are in close proximity to the proposed OHL, where the nearest known archaeological site is situated 35 m away from the planned 400 kV OHL route. The archaeological sites closest to the proposed OHL will potentially be affected negatively during the construction of the transmission line. This impact will have to be avoided or mitigation actions taken according to national legislation before the construction of the proposed OHL (see mitigation measure below).

According to the national legislation (Law no. 218/2010 regarding protection of archaeological heritage), projects that plan for construction in an area where there is a potential archaeological site has to be approved by Ministry of Culture, based on the expertise made by National Archaeological Agency. The procedure for obtaining a necessary *Permit for archaeological discharge* is financed by the investor and realized by the National Archaeological Agency. Only when a *Permit for archaeological discharge* is in place can construction works continue, if not the route line has to avoid the archaeological site or take the proper measures for its protection.

Due to the lack of exact location of cultural monuments protected by the state in the affected districts, it is not fully clear if any protected cultural monuments are located in close proximity of the proposed OHL route. However, as protected monuments are, with very few exceptions, located in village central areas it is not expected that any protected cultural monuments today will be affected by the proposed OHL as settlements are avoided by the proposed Project. Likewise, no major impact on intangible cultural heritage is expected due to the proposed Project as events of cultural importance are reported to take place in central parts of the villages such as in cultural houses or by the mayoralty. **The impact is moderate.**

It may be that the planned tower locations and construction, including temporary roads, will result in exposure of not yet identified archaeological sites along the route. Due to the rich history of Republic of Moldova the risk of finding new archaeological sites along the route is assessed as high and will need to be properly addressed during the construction stage of the Project. Known hot-spots will need more detailed study before the start of the Project. **Risk that important cultural and archaeological artefacts would be discovered and harmed during the construction stage – this risk is moderate to high.**

BtB Vulcăneşti substation and modification within Chişinău substation will be constructed inside already existing (see reference no. 84) industrial sites meaning that the chance that there are any unidentified cultural or archaeological findings in the ground is small - **negligible impact.**

No impact on cultural heritage is anticipated from ***the operation*** and maintenance of the proposed OHL or the BtB substation.

From ***decommissioning*** none as it can be supposed that any cultural or archaeological sites were already discovered during the construction stage of the OHL.

Table no. 62. Matrix for evaluation of potential impacts on cultural heritage

	Description	Scale	Duration	Magnitude	Probability	Significance
Construction	Impact on identified cultural and archaeological sites close to OHL	Local	Short-term	High	Average	High
	Impact on identified cultural and archaeological sites on a distance to the OHL	Local	Short-term	Low	High	Moderate
	Impact on un-identified cultural and archaeological sites	Local	Short-term	High	Average	High
	BtB substation already on industrial site	Local	Short-term	Low	No probability	Negligible
Operation	No impacts identified	-	-	-	-	-
Decommissioning	No impacts identified	-	-	-	-	-

Mitigation measures

Proper training and protocols will need to be put in place to ensure that the workers are aware of routines for the case when archaeological artefacts or sites are found during the construction work. Note that this should also include a system to ensure that also suspicion of possible artefact should be in place. Considering the knowledge and already identified sites for cultural and archaeological findings in the Project area, the chance to expose new findings is **high.** It is advisable that at a certain stage of the construction process a follow-up on aspects linked to identification of new archaeological artefacts is made.

Apart from further details on the archaeological sites already identified in the Project area, the ESMMP will include sections on routines and monitoring of training and routines for ensuring consideration of new archaeological sites.

6.4 Emergency response planning

Potential risks and hazards that may be associated with the Project during the construction and operation stages are:

- Natural hazards and extreme events, that may include: floods, storms, lighting, landslides, soil erosion, seismic events;
- Risk from electric hazard;
- Risk of traffic accident during construction works due to increase transport operations in the Project area;
- Risk of fires due to improper management of wood debris left on the ground from vegetation management along OHL safety corridor involving cutting/trimming trees;
- Risk of hazardous substances leakages such as incidental leakage of diesel fuel used by construction vehicles, as well as transformer oil at substations;
- Risk of dust and noise during construction works from excavation, drilling and transport operations;
- Injury of workers that may be associated with: exposure at dust, noise and vibration from excavation, drilling, transport activities; operation at heights; potential electrocution near powered OHL towers / conductors or substation devices.

Prior to construction and operation stages of the Project, an Emergency Response Plan will be developed for potential risks and hazards identified above in order to protect the public health, safety and environment when hazards may create an emergency situation.

The Project will be implemented in Moldelectrica installations as well as along transmission line route and will be complying with the Fire fighting and Emergency Plan that is in force in Chişinău and Vulcăneşti substations. The Contractor of 400 kV OHL construction will prepare its own Emergency Response Plan.

The Emergency Response Plan shall include organisational structures, responsibilities, procedures, communication, training, resources and other aspects required to implement in order to ensure the capacity to respond effectively to emergencies associated with Project hazards.

In particular, the following should be included in the Emergency Response Plan:

- Roles and responsibilities during emergency situations;
- Identification of emergency conditions which may affect the integrity of the Project;

- Operational procedures to follow in the event that the emergency conditions are identified;
- Communication procedure of necessary information to relevant emergency services and authorities, as well as to the potentially affected workers and public.

The procedures within the Emergency Response Plan shall include at least the following:

- *The Emergency Call Procedure* to the territorial Inspectorate for Emergency Situations;
- The *Procedure of calling the Emergency Medical Service* in case of accidents with human victims;
- Identify and manage the types of risks (natural and technological);
- The *Procedure of Informing and Preventive Preparation of the Population* regarding the potential dangers, self-protection measures, means of protection provided, obligations, recommended actions during the emergency situations;
- The *Procedure for Organizing and Executing the Operative Intervention* for the reduction of the loss of human lives, limiting and removing the effects of natural calamities and other civil protection situations;
- The Procedure for protection of population, assets, cultural and archival values and environment against the effects of disasters;
- The *Fire Prevention Plan* according with the work place;
- Plan for firefighting equipment, acquisition and allocation methods;
- Workers training plan, etc.

Workers will be trained in accordance with the legislation in force.

6.5 Synthesis of mitigation measures

As a result of impact assessment conducted in order to identify potential Project's impacts, for each environmental and socio-economic aspects were established the potential impacts in absence of mitigation measures and appropriate mitigation measures.

Considering that the potential negative or positive impacts identified for different stages of the Project (construction, operation and decommissioning) involve certain actions from parties involved during project lifetime, the synthesis of impact assessment was listed in tabular format (Table 63); the following information is provided:

- Environmental and socio-economic aspects that may be affected during project lifetime;

- Brief description of potential impact;
- Significance of potential impact, in absence of mitigation measures (negative impact, unless shown otherwise);
- Mitigation measures/good construction practices required to be implemented;
- The extent of any residual impacts (after implementation of recommended mitigation measures).

Further details related to mitigation measures that have to be implemented are presented in ESMMP, part of the ESIA package.

Table no. 63. Mitigation measures and residual impact

Project phase	Aspect	Potential impact	Significance of potential impact*	Mitigation measures /good construction practices	Residual impact
Physical Environment					
Construction	Geology and soils	Increased vulnerability to erosion and landslides as a result of surface cover loss and excavations	High	• Controlled storage of construction materials and waste generated during the construction works on distinct areas of the site; • Avoidance of ground storage of materials that exposed to rainfall might lead to soil and groundwater aquifer infiltrations (sealing of storage areas); • Minimize excavation and removal of surface cover in the areas affected by the Project's activities; • Provision of parking areas for the vehicles and equipment involved in Project's works. Work area shall be equipped with absorbent materials and/ or neutralizing substances for rapid intervention in case of accidental spillage of fuel and/or lubricants; • Deposits of fertile soil resulting from the pits excavation will be placed in secure location with run-off and erosion prevented and close to the working area not affecting adjacent surfaces. During wet weather periods, open excavations will be protected by covering with polythene, off-road driving shall be avoid and ruts shall be repaired as soon as possible; • Limit, where it is possible, vehicle movements in off-road areas mainly in areas with softer soils and on steeper slopes; • Steep terrain shall be avoided during the transportation of construction material by using alternative routes or use light vehicles where appropriate. Suitable engineering will be undertaken to ensure that the stability of the slope is maintained, including in areas prone to slides; • For the transport of construction elements and new equipment shall be used, wherever possible, existing roads and way-leaves; • The waste and package waste generated during Project's activities will be managed in compliance with the relevant legal provisions (selective collection without contact with soil, water; reuse or disposal); • Upon completion of works will be undertaken activities for land restoration and revegetation, including re-vegetation/ seeding with native species to complement natural vegetation regeneration and to improve ground cover; • Detailed site investigation for establishing the final positions of OHL towers, shall be performed during the next phase of the Project (Technical Project and Detailed Design) in order to avoid eroded soils and landslides.	Moderate
		Soil compaction due to site organization works, accomplishment of working areas and vehicles traffic	High		Moderate
		Inappropriate management of construction materials and waste	Minor		Negligible
		Accidental spillage of fuel and lubricants	Minor		Negligible
	Hydrology	Increased turbidity	Moderate	• Providing portable toilets for the workers involved in construction stage; • Establishment of all construction zones alongside OHL route at distance from nearby surface waters so that the impact on water to be diminished (to be established at the next technical stage – detailed design); • Establishment, if possible, of tower foundations in dry locations with well consolidated geology, and avoiding wetland areas or floodplains. However, where this was not possible it was chosen drilled columns foundation types an environmental more friendly solution compared to classic solution foundation; • Minimize work on soft ground in wet weather, wherever possible; • Keep all engines in good working condition and repair any leaking equipment immediately in special areas; • Prevent erosion and run-off of sediment from construction works, including roads, to watercourses; • Controlled storage of construction materials and waste generated during the execution stage on distinct areas of the site; • Avoidance of ground storage of materials that exposed to rainfall might lead to	Minor
		Accidental spillage of fuel and lubricants	Moderate		Minor
		Water flow changes	Moderate		Minor

Project phase	Aspect	Potential impact	Significance of potential impact*	Mitigation measures /good construction practices	Residual impact
				groundwater aquifer infiltrations (sealing of storage areas); • Forbidding watercourse crossing by vehicles and machinery during construction • Forbidding discharges of any water or other materials to watercourses, the storage of soil or other materials close to watercourses; • Provision of oil/ storm water tank, placed bellow energy transformer on a concrete foundation for protection against transformer oil spill.	
	Air quality	Dust emissions from construction activities	Moderate	• Minimize the open excavation areas and proper coordination of excavation activities (excavation, grading, compacting, etc.); • The number of transport means used for materials and equipments for OHL's towers erection are rather small, in line with associated quantities; • The equipments used for erection of each OHL's tower will not work simultaneously and will respect the sequence works, according with specific technical norms; • Apply water sprinkling measures to reduce dust, in case of visible dust generated by vehicles or other activities; • Reduce speeds on unpaved roads until water sprinkling measures are in place; • Maintain all construction machinery and equipments in good working condition; • Vehicles carrying aggregate materials will be sheeted at all times.	Minor
		Pollutant emissions from traffic (construction activities)	Moderate		Minor
	Climate change	Climate change related risks on proposed Project (e.g. strong winds and storms, increased risks of flooding, landslides and other natural hazards, high temperature)	High	• As part of Project's planning and design several measures have been integrated in order to consider the characteristics of the Project area (main climate–meteorological condition, results of preliminary prospection works) and to promote climate resilience (modern installations/systems, types of OHL towers, routing the OHL for avoiding the trees area); • Detailed site investigation for establishing the final positions of OHL towers, shall be performed during the next phase of the Project (Technical Project and Detailed Design) in order to avoid eroded soils and landslides. • An Emergency Response Plan shall be developed for potential risks and hazards (natural hazards and extreme events that may include floods, storms, lighting, landslides, soil erosion, seismic events) in order to protect the public health, safety and environment when hazards may create an emergency situation.	Moderate
	Noise	Noise and vibration from construction activities of OHL (access tracks, tower foundations, tower assembly and erection, attachment of conductors)	Moderate	• Use of vehicles and machines with a high degree of quietness, equipped with vibration damper with regular technical inspections carried out to date; • Compliance with daily working hours; • During day time, procedures will be established to reduce the noise causing nuisance and disturbances, both for workers and local communities; • Activities during the holidays, nights or at the weekend will be avoided; • Movement of the vehicles transporting material and equipment on dirt or ballasted with roads with speeds up to 20 km/h. • After completion of the construction works, the Contractor will perform a study related to the noise level inside the substations and at substations fence.	Minor
		Noise and vibration from construction activities of substations	Moderate		Minor
Operation	Geology and soils	Soil compaction on access road during maintenance activities	Minor	• For maintenance activities the existing roads and way-leaves shall be used	Negligible
		Accidental spillage of fuel, lubricants or paint	Negligible		-

Project phase	Aspect	Potential impact	Significance of potential impact*	Mitigation measures /good construction practices	Residual impact
	Hydrology	Accidental spillage of fuel, lubricants or paint	Minor	• Regular inspections throughout substation operation period are recommended to be performed to ensure security of the containment.	Negligible
	Air quality	Pollutant emissions from traffic (routine inspection and maintenance)	Minor	• Maintain all vehicles used for OHL inspection and maintenance activities in good working condition; • Measurements campaigns for ozone concentration among specific areas nearby the OHL route are recommended to be performed in order to compare the measurement results with legal limits.	Negligible
		Ozone formation	Minor		Negligible
		Diesel units	Minor		Negligible
	Climate change	GHG emissions	Minor	• The appropriate handling of SF_6 gas is recommended to be implemented, according with manufacturer's instructional and best practice guidelines.	Negligible
		Climate change related risks on proposed Project (e.g. strong winds and storms, increased risks of flooding, landslides and other natural hazards, high temperature)	High	• Regular inspection of OHL route as part of maintenance program shall be performed; • Emergency response planning is required for natural hazards and extreme events (floods, storms, lighting, landslides, seismic events, etc.).	Moderate
	Noise and vibration	Corona effect from OHL and substations	Minor	• The noise and vibration from OHL line will be reduced by constructive methods (antivibrators and spacers).	Minor
		Operational noise from substations (transformers, transformer coolers/ switchgear)	Minor		Negligible
Decommissioning	Geology and soils	Soil compaction due to site organization works, accomplishment of working areas and vehicles traffic	High	• Controlled storage of materials and waste generated during the decommissioning stages on distinct areas of the site; • Avoidance of ground storage of materials that exposed to rainfall might lead to soil and groundwater aquifer infiltrations (sealing of storage areas); • Provision of parking areas for the vehicles and equipment involved in Project's works. Work area shall be equipped with absorbent materials and/ or neutralizing substances for rapid intervention in case of accidental spillage of fuel and/or lubricants; • Limit, where it is possible, vehicle movements in off-road areas mainly in areas with softer soils and on steeper slopes; • Steep terrain shall be avoided for transport activities by using alternative routes or use light vehicles where appropriate. Suitable engineering will be undertaken to ensure that the stability of the slope is maintained, including in areas prone to slides; • For the transport activities existing roads and way-leaves shall be used; • The waste and package waste generated during decommissioning will be managed in compliance with the relevant legal provisions (selective collection without contact with soil, water; reuse or disposal); • Upon completion of works will be undertaken activities for land restoration and revegetation, including re-vegetation/ seeding with native species to complement natural vegetation regeneration and to improve ground cover.	Moderate
		Improper management of waste and materials from decommissioning	Moderate		Minor
		Accidental spillage of fuel or lubricants	Moderate		Minor
	Hydrology	Increased turbidity	Moderate	• Providing portable toilets for the workers involved in decommissioning stage; • Controlled storage of resulting materials and waste generated during decommissioning stage on distinct areas of the site; • Keep all engines in good working condition and repair any leaking equipment immediately in special areas; • Forbidding watercourse crossing by vehicles and machinery; • Forbidding discharges of any water or other materials to watercourses, the storage of soil or other materials close to watercourses.	Minor
		Accidental spillage of fuel and lubricants	Moderate		Minor
	Air quality	Dust emissions from road traffic (dismantling and decommissioning activities)	Moderate	• Apply water sprinkling measures to reduce dust, in case of visible dust generated by vehicles or demolition activities;	Minor

Project phase	Aspect	Potential impact	Significance of potential impact*	Mitigation measures /good construction practices	Residual impact
		Pollutant emissions from traffic (dismantling and decommissioning activities)	Moderate	• Reduce speeds on unpaved roads; • Maintain all equipments in good working condition; • Proper management of waste from demolition activities in compliance with waste hierarchy (reuse, recycle, recovery).	Minor
	Noise and vibration	Noise and vibration from dismantling and decommissioning activities of OHL	Moderate	• Use of vehicles and machines with a high degree of quietness, equipped with vibration damper with regular technical inspections carried out to date; • Compliance with daily working hours: • During day time, procedures will be established to reduce the noise causing nuisance and disturbances, both for workers and local communities; • Activities during the holidays, nights or at the weekend will be avoided; • Movement of the transporting vehicles of waste from the decommissioning of the power line on the ground or ballasted roads with speeds up to 20 km/h.	Minor
		Noise and vibration from dismantling and decommissioning activities of substations	Moderate		Minor
Biological Environment					
Construction	Integrity of the natural protected areas	MD0000016 Stepa Bugeacului (Emerald site): loss of the feeding habitats if the area will be crossed by e OHL route on 38 km	Minor	• The 400 kV OHL Vulcănești - Chișinău route will cross protected areas as follow: only the line between towers 141 – 142 will cross Stepa Bugeacului Emerald site (near to Borceag village) and about 10 km of line will cross Purcari – Etulia IBA (towers 01- 18).	Negligible
		MD009 Purcari-Etulia (IBA): loss of the feeding habitats if the area will be crossed by e OHL route on 28 km	Minor		
		MD008 Congaz-Tărăclia: 9200 m^2 of the feeding habitats of *Falco vespertinus, Falco subbuteo, Buteo ruffinus, Ciconia nigra, Branta ruficollis,* placed outside of the IBA can be losses	Negligible		
	Electrocution Collision	Injury and death of Ducks, White Storks, Raptors crossing Isnovăț Valey	Moderate	• Birds flaps will be positioned 20 - 25 m distance on line between the towers 508 – 509; • Bird guards against electrocution in air gaps and on outer phases.	Negligible
		Injury and death of Ducks, White Storks next to two ponds (Zîmbreni village)	Moderate	• Birds flaps will be positioned 20 - 25 m distance on line between the towers 485 – 482; • Bird guards against electrocution in air gaps and on outer phases.	Negligible
		Injury and death of Raptors, Owls, Black Storks next to Zloți and Costești forests	Moderate	• Birds flaps will be positioned 25 m distance on line between the towers 465 – 390; • Bird guards against electrocution in air gaps and on outer phases.	Negligible
		Injury and death of Waterfowls, Storks, Herons, Egrets crossing Ecaterinovca Lake	Moderate	• Birds flaps will be positioned 10 m distance on line between the towers 355 – 355 and 25 m distance on line between towers 357-358 and 354-355; • Bird guards against electrocution in air gaps and on outer phases.	Negligible
		Injury and death of Stork, Waders crossing wetlands (near Cenac village)	Moderate	• Birds flaps of diverse construction will be positioned 20 - 25 m distance on line between the towers 314 – 310; • Bird guards against electrocution in air gaps and on outer phases.	Negligible
		Injury and death of Waterfowls, Storks, Herons, Egrets next to about 200 m by Lake Dezghingea	Moderate	• Birds flaps on line between the towers 268 - 277; • Bird guards against electrocution in air gaps and on outer phases.	Negligible
		Injury and death of Waterfowls, Storks, Herons, Egrets next to the lake below	Moderate	• Birds flaps on line between the towers 224 – 230; • Bird guards against electrocution in air gaps and on outer phases.	Negligible

Project phase	Aspect	Potential impact	Significance of potential impact*	Mitigation measures /good construction practices	Residual impact
		Congazcicul de Jos village			
		Injury and death of Waterfowls, Pelicans, White Storks, Black Storks, Raptors, Geese, Sacker Falcons along Congaz – Tărăclia Lakes IBA and crossing Purcari – Etulia IBA	Moderate	• Birds flaps on line between the towers 205 – 01; • Bird guards against electrocution in air gaps and on outer phases.	Negligible
		Injury and death leading to decrease in population size of the endangered species Sacker Falcon (*Falco cherrug)*	Moderate	• Bird guards against electrocution in air gaps and on outer phases; • Construction of 01 – 18 towers and Vulcănești substation outside the breeding period of the species – end of March – end of July.	Negligible
	Forested land	Cutting trees, land clearance within the working corridor	Moderate	• An appropriate vegetation management plan shall be developed in order to minimize the trees cutting within the working corridor and to ensure a proper management of cutting trees; • For loss of trees within the working corridor, adequate compensation shall be established, by planting the same trees species in locations agreed with relevant authorities; • The trees cutting will be outside the breeding and nesting period in the forests.	Minor
Operation	Electrocution Collision	Injury and death of birds species	Minor	• Annual control of birds flaps during regular maintenance, replacements if needed	Negligible
	Forested land	Cutting trees, land clearance within the OHL safety corridor	Minor	• Integrated vegetation management approach shall be implemented consisting in removal of tall growing tree species and the encouragement of low-growing shrubs.	Negligible
Socio-economic environment					
Construction phase	Impacts on access to land and land use	Restricted access to land	High	• Consider land use (formal and informal) in final technical design and positioning of towers in order to minimise impact on access to land. • Inform stakeholders and affected people in the area about the construction activities and restriction in terms of access to land well before actual construction is begun. • Plan the construction time with consideration to season and agricultural activities to minimise negative impacts linked to affected agriculture production • Any land used for temporary road or other installation required during construction, affecting land, should be restored to original state as soon as possible after construction completed.	Moderate
		Physical impacts on land due to access roads, clearing and foundation work	High		Moderate
		Restrictions in access to forested areas	Minor		Minor
		BtB substation requiring of land	Minor		Minor
	Impacts on income	Increased traffic, noise and disturbances during construction	Moderate	• Construction work should take place during normal working hours in order to minimise disturbing traffic • Assess the people/stakeholders perception regarding the effect of magnetic and electric fields on quality and yield of the viticulture inside the safety corridor. Depending on results, further information on this issue might be developed and disseminated.	Moderate
		Reduced income opportunities for seasonal workers	Minor		Minor
		Indirect and induced income opportunities generated linked to OHL and BtB substation construction	Minor (positive)		Minor (positive)

Project phase	Aspect	Potential impact	Significance of potential impact*	Mitigation measures /good construction practices	Residual impact
	Impacts on industrial services and jobs	Impact on industrial production	Minor (positive)	-	Minor (positive)
		Impact on industrial production – provision of materials (the Republic of Moldova)	Minor (positive)		Minor (positive)
		Short term contract linked to construction of OHL and BtB substation	Minor (positive)		Minor (positive)
	Impacts on societal services and infrastructure	Need for good roads during construction	Minor (positive)	• Careful identification, detection and marking of existing infra-structure that is within the safety corridor during the construction, including underground cables, pipelines and other. • Ensure that any roads or other infra-structure used/affected during construction phase is not left in worse condition after construction phase	Minor (positive)
		Impacts on water, electricity, and gas supply	Minor		Negligible
		Impacts on existing schools, medical centres etc. operations	Negligible		Negligible
	Impacts on scenery and visual amenity	Impact the landscape scenery from OHL construction	High	• In final detailed design of OHL route consideration of landscape formation should be taken to avoid unnecessary exposure of the towers on top of hills.	Moderate
		Impact on existing tourism from OHL	Minor		Minor
		BtB substation construction	Minor		Minor
	Impacts from electric and magnetic fields	Electric or magnetic fields present during construction	Negligible	• Personnel working with construction of BtB substation should be informed of the restrictions and safety procedures linked to work within the substations. • Follow-up that workers and contractors comply to safety regulations	Negligible
		BtB substation constructed inside premises with electric and magnetic fields – proper routines in place	Minor		Minor
	Impacts on public and occupational health and safety	Potential risks for accidents linked to construction work	Moderate	• Ensure implementation and compliance with the Action Plan on Occupational Health and Safety. • Preparation of Emergency Response Plan – construction sites and operations • Preparation of code of conduct to be adhered to by personnel and subcontractors involved in construction work linked to the OHL and BtB substation. • Routines for traffic and transportation to construction sites, especially considering safety issues linked to passing settlements, schools and close to habited places. • Routines to follow-up and to ensure that all workers and contractors are aware and comply with existing safety regulations and action plans. • Ensure that access to construction sites from outside is limited during construction work – fences and guards along with information around the construction sites. •	Minor
		Increased traffic exposing people for accidents	Minor		Minor
		Pollution and/or release of harmful substances	Minor		Minor
		Increased risk of sexual and gender based violence	Minor		Negligible
	Impacts on cultural heritage	Impact on identified cultural and archaeological sites close to OHL	High	• Preparation of protocols to ensure that workers and subcontractors have proper routines to identify and take action whenever unknown/new archaeological artefacts or sites are found during construction work. • Preparation of protocols to ensure that workers and subcontractors have proper routines to safeguard already identified archaeological artefacts and sites. • Training of relevant employees and subcontractors in above mentioned protocols.	Minor
		Impact on identified cultural and archaeological sites on a distance to the OHL	Moderate		Negligible
		Impact on un-identified cultural and archaeological sites	High		Moderate
		BtB substation already on industrial sites	Negligible		Negligible

Project phase	Aspect	Potential impact	Significance of potential impact*	Mitigation measures /good construction practices	Residual impact
Operation	Impacts on access to land and land use	Permanent loss of land access where towers are placed.	Moderate	• With mitigation action during final technical design adjusting OHL route and positioning towers on locations with low impact on productive land-use impacts should be reduced during operation phase	Moderate
		Exposure to magnetic and electric fields when working	Moderate		Minor
		Resettlement of people inside the safety corridor	Minor		Minor
		Removal of high trees in safety zone	Minor		Minor
	Impacts on income	Reduced income opportunities for seasonal workers due to permanent loss of land where towers are placed.	Minor	-	Minor
		Resettlement of people inside the safety corridor	Negligible		Negligible
		Indirect and induced income opportunities generated linked to OHL and BtB substation operation	Minor (positive)		Minor (positive)
	Impacts on industrial services and jobs	Job opportunity for maintenance and operation – OHL and BtB substation	Moderate (positive)	-	Moderate (positive)
	Impacts on societal services and infrastructure	No impacts identified.	-	-	-
	Impacts on scenery and visual amenity	Impact the landscape scenery from OHL	Moderate (in a few cases high)	• With mitigation actions applied during detailed technical design and final position of towers and OHL route impacts should be reduced.	Minor to moderate
	Impacts from exposure of electric and magnetic fields	Impact on people inside houses or settlements.	Minor	• Personnel working with operation and maintenance of transmission line and BtB station should be informed and trained in safety procedures linked to work in environments where they are exposed to electric- and magnetic fields. • Ensure that follow-up routines are in place and implemented to document that workers and contractors comply with safety regulations. In case of deviations ensure that actions are taken to rectify the situation.	Minor
		People working on farmland, vineyards, orchards or herders.	Moderate		Minor
		Workers at the substation, or operation and maintenance of OHL	Moderate		Minor
	Impacts on public and occupational health and safety	Risk of accidents linked to operation and maintenance of OHL	Minor	• Ensure implementation and compliance with the Action Plan on Occupational Health and Safety. • Keep Emergency Response Plan updated and relevant for operation and maintenance • Routines for traffic and transportation linked to operation and maintenance of the OHL, and at BtB station is in place. Special attention should be given to safety when passing settlements, schools and close to habited places. • Routines to follow-up and to ensure that all workers and contractors are aware and comply with existing safety regulations and action plans. • Ensure that access to the towers is restricted and that safety measures to avoid people climbing towers are functional. Ensure that fences and/or guards around the BtB substation are in place. • Information material on towers displaying warning signs and instructions on what to do in case of accidents. This should be assigned in appropriate	Minor
		Risk of exposure to harmful and toxic material during maintenance and operation of BtB substation	Minor		Negligible
		OHL represent a potential risk for accidents for people staying in the area	Minor		Negligible

Project phase	Aspect	Potential impact	Significance of potential impact*	Mitigation measures /good construction practices	Residual impact
				languages considering the position of the tower.	
	Impacts on cultural heritage	No impacts identified.	-	-	-
Decommissioning	Access to land and land use	Restricted access to land during decommissioning	High	• Inform stakeholders and affected people in the area about the decommissioning activities and restriction in terms of access to land well before actual decommissioning work begin. • Plan the time for decommissioning with consideration to season and agricultural activities to minimise negative impacts linked to affected agriculture production • Any land used for temporary road or other installation required during decommissioning, affecting land, should be restored to original state as soon as possible after construction completed. • Prepare a plan for offering previously occupied agricultural land back to land owners.	Moderate
		Physical impacts on land due to access roads, clearing and foundation work	High		Moderate
		Land is released for productive purposes when decommissioning is completed	Moderate (positive)		Moderate(positive)
		Decommissioning of BtB substation requires land use	Minor		Minor
	Impacts on income	Increased traffic, noise and disturbances during construction	Moderate	• Decommissioning work should take place during normal working hours in order to minimise disturbing traffic	Minor
		Reduced income opportunities for seasonal workers	Minor		Minor
		Indirect and induced income opportunities generated to OHL and BtB substation decommissioning	Minor (positive)		Minor (positive)
		Land is released for productive purposes when decommissioning is completed	Moderate(positive)		Moderate (positive)
	Impacts on industrial services and jobs	Short term contract linked to decommissioning of OHL and BtB substation	Minor (positive)	-	Minor (positive)
	Impacts on societal services and infrastructure	Need for good roads during decommissioning	Minor (positive)	• Careful identification, detection and marking of existing infra-structure that is within the safety corridor during the decommissioning, including underground cables, pipelines and other. • Ensure that any roads or other infra-structure used/affected during decommissioning phase is not left in worse condition after decommissioning phase is over.	Minor (positive)
		Impacts on water, electricity, and gas supply	Minor		Negligible
		Impacts on existing schools, medical centres etc. operations	Negligible		Negligible
	Impact on scenery and visual amenity	Short term impact on the landscape scenery as part of decommissioning work from OHL	Moderate	-	Moderate
		Impact on existing tourism from decommissioning of OHL	Minor		Minor
		BtB substation decommissioned	Minor		Minor
		Long-term impact as the OHL is removed from scenery	Moderate (positive)		Moderate (positive)
	Impacts from exposure of electric and magnetic	Electric or magnetic fields present during decommissioning	Negligible	• Comply with safety regulations	Negligible
		BtB substation decommissioned inside premises with electric and magnetic fields	Minor		Minor

Project phase	Aspect	Potential impact	Significance of potential impact*	Mitigation measures /good construction practices	Residual impact
	fields	– proper routines in place			
	Impacts on public and occupational health and safety	Potential risks linked to decommissioning work	Moderate	• Ensure implementation and compliance with the Action Plan on Occupational Health and Safety. • Comply with Emergency Response Plan • Code of conduct to be adhered to by personnel and subcontractors involved in decommissioning work linked to the OHL and BtB substation. • Routines for traffic and transportation to decommissioning sites, especially considering safety issues linked to passing settlements, schools and close to habited places. • Routines to follow-up and to ensure that all workers and sub-contractors are aware and comply with existing safety regulations and action plans. • Ensure that access to construction sites from outside is limited during construction work – fences and guards along with information around the decommissioning sites.	Minor
		Increased traffic exposing people for accidents	Minor		Minor
		Pollution and/or release of harmful substances	Minor		Minor
	Impacts on cultural heritage	-	-	-	-

7. CONCLUSION

ESIA identifies the major positive and negative impacts on the environment and people and implements measures to avoid, reduce, or control those impacts. This can include changes in design, construction methods, and/or operation procedures as well as monitoring to identify negative impacts. It can also include compensation for impacts that cannot be avoided or reduced to acceptable levels.

The construction and operation of the new 400 kV transmission line, of the BtB and 400 kV substations will not cause significant impacts in the project area.

The routing of the transmission line was carefuly choose to prevent and to minimize the impact on biodiversity. Crossing through protected areas was avoided as much as possible. The proposed project will not have adverse effect or damage on the natural and social environment.

The environmental and social impacts of the project identified and proposed mitigate measures within ESIA are according to the legislation of Republic of Moldova and of the requirements of the EBRD, EIB and WB.

8. REFERENCES

8.1 Laws, conventions and guidelines

Republic of Moldova

- Law no. 86/2014 on Environmental Impact Assessment;
- Law no. 1515/1993 on environmental protection;
- Water Law no. 272/2011;
- Law no. 1538/1998 on natural areas protected by the State;
- Law no. 325-XVI/2005 related the Moldova Red Book;
- Law no. 94-XVI/2007 on the ecological network;
- Law no. 439-XIII/1995 on animal kingdom;
- Law no. 239-XVI of 8.11.2007 on vegetal kingdom;
- GD no. 274/2015 on approval of the Strategy and Action Plan on biological diversity for 2015-2020;
- GD no. 301/2014 on approval of the Strategy and Action Plan on environment for 2014-2023;
- GD no. 1531/1993 for implementation of the Law no. 1530/1993 on monuments protection;
- Law no. 218/2010 on protection of archaeological heritage;
- Land Code no. 828-XII, 25 January 1991, for land acquisition and compensation;
- Law no. 488-XIV, 8 July 1999, on expropriation in case of public utility;
- Law no. 1308, 25 July 1997, on normative price for land and sale/purchase procedure;
- Forest Code no. 887-XIII, 21 June 1996;
- GD no. 1451, 24 December 2007, on approval of provisions for procedure on the assignment, land use change and land exchange;
- GD no. 514/2002 for approval the Regulation regarding the protection of electrical network;
- Law no. 186/10.07.2008 on Occupational Health and Safety amended by the Law no. 201/28.07.2016;
- Labour Code of Republic of Moldova no. 154-XV of 28.03.2003;

- GD no. 766 of 11.10.2011 approving the National Action Plan on preventing and eliminating the worst forms of child labour during 2011-2015;
- Law no.278-XIV of 11.02.99 on how to recalculate the amount of compensation of the damage caused to employees after mutilation or other health injuries during the performance of duties;
- Law no. 332 of 23.12.2013 for modification of and Law no. 289-XV of 22.07.2004 on allowances for temporary work incapacity and other social insurance;
- Law no. 756-XIV of 24.12.1999 on insurance for work accidents and occupational diseases;
- Law no. 116/2012 on industrial safety of hazardous industrial facilities;
- Collective agreement (national level) - Occupational health and safety of employees working under individual employment contracts;
- GD no. 1101 of 17.10.2001 approving the regulation related to the disability allowance for accidents at work or professional diseases;
- GD no. 513 of 11.08.1993 approving the regulation on the payment to companies, organizations and institutions of the single allowance for the loss of working capacity or death of the employee following an accident at work or an occupational disease
- GD no. 65 of 23.01.2013 on the determination of disability and working capacity;
- GD no. 95 of 05.02.2009 for approving norms related to the implementation of occupational health and safety law no. 186-XVI of 10 July 2008;
- Decision no. 559 of 30.04.2008 on approving supplements of the list of standard works and jobs in difficult and very difficult conditions harmful and particularly harmful for which compensations are established for employees approved by the GD no. 1487 of 31 December 2004;
- GD no.168 of 05.04.1993 approving the regulation on jobs attested for the confirmation of the right of pensions in advantageous conditions;
- GD no. 353 of 05.05.2010 on the approval of minimum occupational health and safety requirements at work;
- GD no. 765 of 24.06.2008 on the State Inspectorate for Industrial Facilities Technical Surveillance;
- GD no. 937 of 08.10.2010 on amending item 2 of the regulation on the evaluation of working conditions at work and method of applying works lists by branches.

EU, international convention, international requirements of finance institution

- Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment;
- Directive 2000/60/EC establishing a framework for Community action in the field of water, modify by Directives 2008/32/CE, 2008/105/CE and 2009/31/CE and Decision 2455/2001/CE;
- Directive 2006/12/EC on waste (repeal by Directive 75/442/CEE), modify by Directives 2008/98/CE and 2009/31/CE;
- Directive 2002/49/EC relating to the assessment and management of the noise in the environment;
- Directive 92/43/EC on the conservation of natural habitats and of wild fauna and flora;
- Directive 97/62/EC which adapts the Habitat Directive to the scientific and technical progresses, substituting the Annexes I and II;
- Directive 79/409/EEC on the conservation of wild birds;
- Decision 82/72/EEC related to the Convention on the conservation of wild life and natural environment in Europe;
- Decision 82/461/EEC related to the Convention on the conservation of the migratory species of wild fauna;
- Recommendation 75/65/CEE of 20 December 1974, on the protection of the Architectural and Natural Patrimony;
- Directive 89/391/EEC on the introduction of measure to encourage improvements in the safety and health of workers at work;
- 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) - the eighteenth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC;
- Directive 2013/35/EU on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) - 20th individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) and repealing Directive 2004/40/EC;
- Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention);
- Convention on Long-Range Transboundary Air Pollution (Aarhus, Denmark, 1998);

- United Nations Convention on Climate Change – UNFCCC (New York, 1992);
- United Nations Convention on Biological Diversity (Rio de Janeiro, 1992);
- United Nations Convention on Wetlands of International Importance – Ramsar Convention (Ramsar, Iran, 1971);
- United Nations Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 23 June 1979);
- Convention of the Conservation of European Wild Life and Natural Habitats – Bern Convention (Bern, 1982);
- Convention Concerning the Protection of the World Cultural and Natural Heritage – UNESCO World Heritage Convention (Paris, 1972);
- European Convention on Landscape (Florence, 2000);
- UNECE Convention on Access to Information, Public Participation in Decision–making and Access to Justice in Environmental Matters – Aarhus Convention (Aarhus, Denmark, 1998);
- EBRD Environmental and Social Policy, 2014;
- EIB Environmental and Social Practices and Standards Handbook, 2013;
- Equator Principles;
- WB Environmental and Social Safeguards policies ;
- International Commission on Non-Ionizing Radiation Protection (ICNIRP).

8.2 Environmental, biological and socio-economic references

- Statistical databank, National Bureau of Statistics of Republic of Moldova, http://www.statistica.md/;
- State of the Environment in Republic of Moldova 2007 - 2010, Ministry of Environment, Academy of Science and Institute of Ecology and Geography, http://mediu.gov.md/index.php/starea-mediului/rapoarte;
- State of the Air Quality in Republic of Moldova for 2014, State Hydrometeorological Service, http://www.meteo.md/monitor/anuare/2014/;
- State of Environment Report (SOER), Ministry of Environment, http://mediu.gov.md/images/Anunturi/SOER_agregated.docx;
- Cadastre of Protected Natural Areas, Institute of Ecology and Geography, Academy of Sciences of Moldova, http://www.ieg.asm.md/ro/cadastrul_ariilor_protejate;
- National geospatial data fund, http://www.geoportal.md/ro;

- Geological map, Agency for Geology and Mineral Resources, http://agrm.gov.md/ro/contact/harti;
- Seismic map, Institute of Geology and Seismology of AŞM, http://iges.asm.md/node/124;
- “Yearbook of soils quality status in Republic of Moldova for 2014”, State Hydrometeorological Service,

  http://www.meteo.md/monitor/anuare/2014/anuarsol_2014.pdf;
- Soils types, landslides, eroded soils, Institute of Pedology, Agrochemistry and Soil Protection “Nicolae Dimo”, http://www.ipaps.md/maps/;
- Agency Republic of Moldova Waters, http://www.apelemoldovei.gov.md/pageview.php?l=ro&idc=134;
- “Cadastre of natural protected areas", Institute of Ecology and Geography, Academy of Sciences of Moldova;
- "Book of core areas of the National Ecological Network of Moldova", Biotica 2012;
- Important Bird Areas factsheet, Birdlife International, http://www.birdlife.org;
- National ecological network and OHL route, Biotica Ecological Society;
- Biodiversity Impact Assesment, Report for the OHL Project, prepared by SC NATURA MANAGENENT SRL, May 2017, Bucharest
- Joint Integrated Local Development Programme (UN), 2011, Summary of vulnerability Study, http://eca.unwomen.org/en/digital-library/publications/2011/03/vulnerability-study-taxonomy;
- Tourism Development Strategy 'Tourism 2020' http://www.turism.gov.md/index.php?pag=sec&id=39&l=\;
- The Republic of Moldova travel, http://www.moldovaholiday.travel/index.php?lang=en;
- The Republic of Moldova National Development Strategy 2020, http://particip.gov.md/public/files/Moldova_2020_ENG1.pdf;
- World Bank 2015, http://documents.worldbank.org/curated/en/333461468184774414/pdf/PAD1406-PAD-P150357-R2015-0200-1-IDA-R2015-0265-1-Box393220B-OUO-9.pdf;
- UNESCO, http://whc.unesco.org/en/conventiontext/, http://www.unesco.org/new/en/culture/themes/illicit-trafficking-of-cultural-property/unesco-database-of-national-cultural-heritage-laws/frequently-asked-questions/definition-of-the-cultural-heritage/;

- National Greenhouse Gases Inventory of the Republic of Moldova to the United National Framework Convention on Climate Change (2013), http://unfccc.int/resource/docs/natc/mdanir.pdf
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories, http://www.ipcc-nggip.iges.or.jp/public/2006gl/
- Adaptation Strategy of the Republic of Moldova to Climate Change by 2020, approved by the GD no. 1009/2014
- Third National Communication of the Republic of Moldova under United National Framework Convention on Climate Change (2013), http://unfccc.int/resource/docs/natc/mdanc3.pdf
- Cavruc, V., 2010, Safeguarding of the national cultural heritage of Rp.MD, Akademos - Science, Innovation, Culture and Art Magazine, no. 2(17), June 2010, ISSN 1857-0461, http://www.akademos.asm.md/files/Academos_2_2010_PDF.pdf.
- The Sixth International Zoological Congress of “Grigore Antipa” Museum (CZGA 2014), 19-22 November 2014,: New bird species recorded in Republic of Moldova during 2011 – 2014, autors: Vitalie Ajder, Vlad Cioflec, Lucian Eugen Bolboacă, Ion Grosu, Emanuel Ștefan Baltag
- The Third Annual Zoological Congress of "Grigore Antipa" Museum (CZGA 2011), Bucharest, Romania, Long-legged Buzzard (Buteo rufinus) expansion in the Historical Region of Moldavia, authors: Emanuel Ş. BALTAG, Vitalie Ajder.
- Important Bird Area in Republic of Moldova (Birdlife International Report) - Vitalie Ajder, Igor Rosca, Lucian Bolboaca, Laurențiu Petrencu, Emanuel Ștefan Baltag, 2015
- Red Book of Republic of Moldova, “Editura Știința” 2015, redactors: Gheorghe Duca, Lazăr Chirică, Ion Toderaş, Alexandru Teleuţă.
- Saker falcon (Falco cherrug) ecology from Republic of Moldova, Raport Bursă Milvus, Ajder Vitalie;
- Vulcanesti sub-station pre-excavation/equipment removal site assessment and burial pit excavation, Consultancy Services CS – 1/TF-055875, Task 3 – NIRAS, April 2007;
- Vulcanesti sub-station post-excavation and removal - site assessment, Consultancy Services CS – 1/TF-055875, Task 5 – NIRAS, November 2007;
- Vulcanesti sub-station Clean up Feasibility Study Report, Consultancy Services CS – 1/TF-055875, Task 6 – NIRAS, December 2007;
- Implementation Completition and Results Report (TF-55875, TF-90384) - Persistent Organic Pollutants (POPs) Stockpiles Management and Destruction Project to the Republic of Moldova, June 2011.

ANNEXES

ANNEX 1

Annex 1

Gap analysis between national legislation versus international framework requirements

Republic of Moldova requirements	Directive 2011/92/EU (EU EIA Directive)	EBRD Environmental and Social Policy (2014)	EIB Environmental and Social Practices and Standards (2013)	WB Environmental and Social Safeguards	Gap	Applicable law/ standards/ requirements
ESIA procedure						
Mandatory EIA procedure for: *"Lines of transportation of electrical power with a voltage of 220kV and more and a minimum length of 15 km"* (Law no. 86/2014, Annex1, item 21).	Mandatory EIA procedure for: *"Construction of overhead electrical power lines with a voltage of 220 kV or more and a length of more than 15 km"* (Annex I, item 20).	Mandatory ESIA procedure for category A projects: *"Construction of high voltage overhead electric power lines"* (Appendix 2, item 21)	Mandatory EIA procedure for: *"Construction of overhead electrical power lines with a voltage of 220 kV or more and a length of more than 15 km"* (Annex 3, item 20).	The electrical transmission projects could be Category B if the impact are site-specific, limited in number, and mitigation measures are readily identifiable.	• No gap between national, EU and EIB requirements • EBRD, WB requirements are stricter for category A project	• National and international requirements
Scoping stage						
Scoping stage not explicitly mentioned; the developer prepares an EIA Program, containing information about EIA timeline, including consultation and public debate, the structure and the content of EIA documentation considering the particular aspects of planned activity and natural, social and technological aspects.	Scoping stage not explicitly mentioned; the competent authority should, where requested by the developer, to issue an opinion on the scope and level of detail of the environmental information to be included in the EIA report.	Mandatory for category A projects at early stage of ESIA process in order to identify the key issues to be addressed as part of ESIA, as a result of engagement of identified stakeholders. As part of the scoping stage an SEP should be developed.	Mandatory for projects included in Annex I of EU EIA Directive in order to identify the key issues to be addressed as part of ESIA, as a result of engagement of identified stakeholders. As part of the scoping stage an SEP should be developed.	The client, in consultation with the Bank, will identify and use appropriate methods and tools, including scoping, to identify and assess the potential environmental and social risks and impacts of the proposed project.	• No gap between national, EU, EBRD, EIB requirements • The national legislation, even if not include explicitly the scoping stage, requests to develop an Environmental Impact Assessment Program that include planning of stakeholder involvement	• National and international requirements • Environmental Impact Assessment Program including planning of stakeholder engagement SEP outlining information disclosure and consultation process presented as part of ESIA package

Republic of Moldova requirements	Directive 2011/92/EU (EU EIA Directive)	EBRD Environmental and Social Policy (2014)	EIB Environmental and Social Practices and Standards (2013)	WB Environmental and Social Safeguards	Gap	Applicable law/ standards/ requirements
Environmental and Social Monitoring Plan (ESMP)						
Not mentioned	Not mentioned	PR 1 sets requirements to develop and implement an ESMP, in order to address the identified project's environmental and social impacts and issues and other performance improvement measures to meet the PRs. The ESMP will respect the mitigation hierarchy (avoidance and prevention, minimisation, mitigation or compensation) and ensure that all relevant stage of the project meet applicable laws and regulatory requirements and the PRs. For ensuring on-going compliance with relevant national regulatory requirements and the PRs, an organisational structure that defines roles, responsibilities and authority to implement the ESMP shall be establish and maintain. The client will ensure that adequate system are in place to carry out monitoring of actions specified in the ESMP, will review the result of monitoring and initiate corrective and preventive actions, as agreed with EBRD.	ESMP is a key element to address the environmental and social impacts that have been identified and to ensure that the project comply with national law, relevant international standards and frameworks and meet the EIB E&S standards. Component of such plan may include: resettlement action plan, livelihood restoration framework, biodiversity action plan, indigenous peoples plan, community development plan, cultural heritage management plan and/or other specific plans and agreements. The promoter shall establish procedure to monitor and measure the implementation of ESMP; in case of the need for corrective and preventive actions, the ESMP shall be amended, subject to EIB approval.	ESMP prepared for the project consists of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation of a project to eliminate adverse environmental and social risks and impacts, offset them, or reduce them to acceptable levels. The ESMP will take into account the findings of ESIA and the results of engagement with stakeholders. The ESMP shall include the measures and actions required to avoid, minimize, reduce or mitigate the potential environmental and social risks and impacts of the project. The client will review the status of implementation the measures and actions identified in the ESMP as part of its monitoring and reporting.	• No requirements in national and EU legislation	• International requirements • ESMP presented as part of ESIA package

Republic of Moldova requirements	Directive 2011/92/EU (EU EIA Directive)	EBRD Environmental and Social Policy (2014)	EIB Environmental and Social Practices and Standards (2013)	WB Environmental and Social Safeguards	Gap	Applicable law/ standards/ requirements
Public Consultation/ Stakeholder Engagement Plan						
Through the EIA procedure the public is informed of the followings: • the result of preliminary assessment, available on the competent authority's website; • the draft EIA Program, subject to written comments of public authorities and public; • brief description of the project, published by the developer on national and local newspapers, that mandatory contains details related to web address where are available relevant information (the request, the EIA Program and the deadlines for comments); • the draft EIA Report, available on the competent authority's and developer's websites; also, the developer announces the EIA Report on national and local newspapers, subject to written comments and public debate; • the public debates date, announced by the competent authority	The public shall be informed electronically and by public notices or other appropriate means of the followings: • the request for development consent; • the project is subject to EIA procedure; • details of the competent authorities for taking the decision; • nature of possible decision and the draft decision; • time and place and means by which the relevant information will be made available; • details of the arrangements for public participation.	PR10 sets up the requirements for information disclosure and Stakeholder Engagement. The stakeholder engagement, as an on-going process covering the project preparation and implementation phases, involves: • public disclosure of appropriate information; • meaningful consultation with stakeholders; • effective procedure or mechanism by which people can make comments or raise grievances.	ESS 10 defines requirements for stakeholder engagement through project preparation and implementation phases that involves: • stakeholder analysis and engagement planning; • timely disclosure and dissemination of information; • public consultations and stakeholders participation; • mechanism ensuring access to grievance and remedy.	WB safeguards policies define requirements for stakeholder engagement through project life cycle that involves: • stakeholder identification and analysis; • planning how the engagement with stakeholders will take place; • disclosure of information; • consultation with stakeholders • addressing and responding to grievances; • responding to stakeholders.	• Similar requirements for national and EU legislation focus on public consultation	• National and international requirements • SEP presented as part of ESIA package

Republic of Moldova requirements	Directive 2011/92/EU (EU EIA Directive)	EBRD Environmental and Social Policy (2014)	EIB Environmental and Social Practices and Standards (2013)	WB Environmental and Social Safeguards	Gap	Applicable law/ standards/ requirements
(website, public places) and by the developer (website and newspapers) with at least 10 days prior to public debates; after public debates, the developer prepares a public participation report, an integral part of EIA documentation; • the Environmental Agreement, announced by the competent authority (website) and by the developer (website and newspapers).						
Grievance mechanism						
Not mentioned	Not mentioned	PR 10 sets up the need to establish an effective grievance mechanism, process or procedure to receive resolution of stakeholders' concern and grievances related to client's environmental and social performance. The client will inform the affected communities about the grievance process and report regularly to the public on grievance process implementation.	ESS 10 establishes the need to design a grievance mechanism at project level that is: • legitimate and trusted; • scaled to the risk and potential adverse impact of the project; • publicised and accessible; • free of cost for stakeholders; • includes the anonymity option, if requested; • fair, transparent and inclusive.	WB safeguards policies establishes the need to design and implement a grievance mechanism at project level that will be proportionate to the potential risks and impacts of the project and will be accessible and inclusive. The grievance mechanism may include the following: • different ways for submitting the grievances; • a log where grievances are registered in writing and maintained as a database • publicly advertised	• No requirements related to grievance mechanism in national and EU legislation	• International requirements • Grievance mechanism, presented as part of ESIA package (SEP Report).

Republic of Moldova requirements	Directive 2011/92/EU (EU EIA Directive)	EBRD Environmental and Social Policy (2014)	EIB Environmental and Social Practices and Standards (2013)	WB Environmental and Social Safeguards	Gap	Applicable law/ standards/ requirements
			The promoter will inform the affected communities about the grievance process and report regularly to the public on grievance process implementation.	procedures; • transparency about grievance procedure, governing structure and decision makers; • appeals process when resolution of grievance has not been achieved.		
Land acquisition , involuntary resettlement and restriction on land use						
In case of land expropriation for public utilities projects, the land owner is entitled to compensation (Law no. 488-XIV, 8 July 1999, art. 9, para. 2). The land may be expropriated at the market prices that are not allowed to be less than the normative price established (Law no. 1308, 25 July 1997). The land owners shall be compensated in case of losses caused by temporary land use, restriction of the rights or deterioration of land quality (Land Code no. 828-XII, 25 January 1991).	Not mentioned	PR 5 states that *"involuntary resettlement refers to both physical and economic displacement and to economic displacement as a result of project-related land acquisition or restriction of access to natural resources. Resettlement is considered involuntary when affected individuals or communities do not have the right to refuse land acquisition which results in displacement"*. Affected people shall be consulted and shall be given the opportunity to participate in the eligibility requirements, negotiations of the compensation packages, resettlement assistance, suitability of proposed resettlement sites and proposed timing. A Resettlement Framework will be developed where the exact nature or magnitude of land acquisition or restrictions on	ESS 6 applies to affected persons, groups and communities subject to involuntary resettlement as well as host communities at relocation sites. The requirements are focus on: • resettlement planning and implementation through carrying out a census and socio-economic baseline assessment and preparing and implementation an resettlement action plan; • the rights to property shall be recognised and taken into account; the compensation shall be provided at full replacement cost; • establishing a project specific grievance mechanism; • arrangement for the	WB OP4.12, recognizing that project-related land acquisition and restriction on land use can have adverse impacts on communities and persons, establishes the need to avoid or, when unavoidable, minimize involuntary resettlement by exploring project design alternatives. In order to mitigate unavoidable adverse social and economic impacts from land acquisition or restriction of land use, compensation shall be provided for loss of assets at replacement cost. The grievance mechanism will set up as early as possible in order to address specific concerns about compensation and relocation. For addressing physical and/or economic displacement, depending on the nature of the impacts expected from a project,	• No specific requirements in national legislation for developing a resettlement framework/plan and for establishing a grievance mechanism applicable to resettlement.	• International requirements • Land Acquisition and Compensation Framework presented as part of ESIA package A specific grievance mechanism set up by SEP applicable to resettlement

Republic of Moldova requirements	Directive 2011/92/EU (EU EIA Directive)	EBRD Environmental and Social Policy (2014)	EIB Environmental and Social Practices and Standards (2013)	WB Environmental and Social Safeguards	Gap	Applicable law/ standards/ requirements
		land use related to a project is unknown due to the project development stage. The grievance mechanism will set up as early as possible in order to receive and address specific concerns about compensation and relocation. Compensation shall be provided for loss of assets calculated at full replacement cost.	resettlement monitoring shall be define by the resettlement plan.	resettlements plans are required.		
Health and safety						
These two are the main laws on occupational safety and health: • Labour Code of the Republic of Moldova No. 154-XV of 28 March 2003; • Law no. 186/2008 on Occupational Health and Safety amended by the Law no. 201/2016. One of the basic principles of the Labour Code is to ensure the right of every worker to fair working conditions, including the conditions which meet the requirements of occupational safety and health.	The EU Directive on Safety and Health at Work (Directive 89/391 EEC). The Directive guarantees minimum safety and health requirements throughout Europe. Member States are allowed to maintain or establish more stringent measures.	PR 2 and PR 4 are related to Occupational health and safety issues. The objectives of PR 2 on labour and working conditions are: • respect and protect the fundamental principles and rights of workers; • promote the decent work agenda, including fair treatment, non-discrimination and equal opportunities of workers; • establish, maintain and improve a sound worker-management relationship; • promote compliance with any collective agreements to which the client is a party, national labour and employment laws; • protect and promote the safety and health of workers,	• ESS 8. Labour Standards ESS 8 aims at ensuring that the promoter respects the Core Labour standards of the International Labour Organisation (ILO), as well as at promoting the relevant rights under the UN Guiding Principles on Business and Human Rights for the project to be financed. • ESS 9. Occupational and Public health, safety and security. With this standard the EIB stresses the employers' duty of care towards project workers and society, in safeguarding occupational and public health, safety and wellbeing within the area of influence of their operations and at	WBG Environmental, Health and Safety Guidelines (EHSGs) include requirements for: safety and health at work; • ; • to anticipate and avoid adverse impacts on the health and safety of project-affected communities during the project life cycle from both routine and non-routine circumstances; • to avoid or minimize community exposure to project-related traffic and road safety risks, diseases and hazardous materials; • to have in place effective measures to address emergency events; • to ensure that the safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the	• Nine of the EU health and safety at work directives and five of the EU labour law directives have been, or are in the process of being transposed to Republic of Moldova legal framework. The Ministry of Labour, Social Policy and Family developed a roadmap that concerns the harmonization of EU legislation with Republic of Moldova legislation in the area of occupational health and safety. • Key ILO conventions have been ratified by the Republic of Moldova. • The main gap is linked to follow-up and enforcing of the existing national legislation and regulation	• National and international requirements

Republic of Moldova requirements	Directive 2011/92/EU (EU EIA Directive)	EBRD Environmental and Social Policy (2014)	EIB Environmental and Social Practices and Standards (2013)	WB Environmental and Social Safeguards	Gap	Applicable law/ standards/ requirements
		especially by promoting safe and healthy working conditions; •prevent the use of forced labour and child labour (as defined by the ILO) as it relates to project activities. The objectives of PR 4 on health and safety are: •protect and promote the safety and health of workers by ensuring safe and healthy working conditions and implementing a health and safety management system, appropriate to the relevant issues and risks associated with the project; •anticipate, assess, and prevent or minimise adverse impacts on the health and safety of project-affected communities and consumers during the project life cycle from both routine and non-routine circumstances.	associated facilities.	project-affected communities.	framework.	

ANNEX 2

Annex 2 Results of prospection works conducted by Institute for Research, Design and Technology ENERGOPROIECT

Well no.	Absolute land elevation, m	Well depth m	Soil type	Groundwater level appeared/stable, m
1	59.10	0.80	Topsoil	-/-
		5.80	Yellow-gray sandy clay, thick with macropores with wires and carbonate insertions	
		8.00	Dusty sand, low humidity	
2	114.56	8.00	Dusty sand, low humidity, with nests and clay stratifications	-/-
3	118.87	2.00	Muddy, dark gray, hard	-4.00/-3,00
		8.00	Yellow-gray sandy clay, hard, plastic from a depth of 3.50 m	
4	121.18	0.80	Topsoil	-5.50/-5.00
		3.00	Alluvial (clay) hard	
		5.00	Yellow-gray clay, hard	
		8.00	Clay, neogene, hard from 5.50 to 6.50 m, with nests and sand aquifers stratifications	
5	123.38	1.60	Muddy, hard	-6.00/-5.00
		8.00	Clay, fawn-brown, hard in the range of 5.00-6.00 m, stratifications of sand aquifers	
6	178.76	0.80	Topsoil	-/-
		8.00	Yellow-gray, sandy clay, hard, interstitial carbonate	
7	244.57	1.00	Topsoil	-/-
		3.50	Yellow-gray clay, hard	
		8.00	Gray clay, hard (neogen)	
8	226.23	0.70	Topsoil	-/-
		1.50	Fawn-brown hard clay	
		7.70	Dusty sand, low humidity, hard clay in range 5.30-5.50 m	
		8.00	Dark gray clay, hard	
9	187.18	0.70	Topsoil	-/-
		8.00	Yellow-gray clay, with greenish-gray spots, hard, dusty sand between 1.80-2.00m	
10	187.18	0.70	Topsoil	-/-
		8.00	Yellow-gray clay, with greenish-gray spots, hard, dusty sand between 1.80-2.00m	
11	186.20	0.70	Topsoil	-/-
		8.00	Sandy clay, fawn-brown, hard, macropores	
12	175.45	0.50	Topsoil	-/-
		3.50	Sandy clay, brown, hard	
		5.00	Dusty sand, low humidity	
		7.00	Gray clay, hard	
		7.50	Dusty sand	
		8.00	Greenish-gray clay, hard, neogene	
13	148.17	1.80	Topsoil	-6.00/-5.50
		6.00	Sandy clay, yellow-fawn, hard, macropores	

Well no.	Absolute land elevation, m	Well depth m	Soil type	Groundwater level appeared/stable, m
		8.00	Green clay, hard	
14	148.17	1.80	Topsoil	-6.00/-5.50
		6.00	Sandy clay, yellow-fawn, hard, macropores	
		8.00	Green clay, hard	
15	114.74	0.60	Topsoil	-/-
		8.00	Sandy clay, fawn-brown, with wire and carbonate insertions	
16	154.68	0.50	Topsoil	-/-
		8.00	Sandy clay, fawn-brown, with wire and carbonate insertions	
17	140.96	0.40	Topsoil	-/-
		6.00	Sandy clay, yellow-fawn, hard	
		8.00	Greenish-gray clay, hard, neogene	
18	151.88	0.70	Topsoil	-/-
		8.00	Sandy clay, fawn, hard, with macropores with wire and carbonate insertions	
19	151.88	0.70	Topsoil	-/-
		8.00	Sandy clay, fawn, hard, with macropores with wire and carbonate insertions	
20	69.81	2.50	Yellow clay. vigorous, carbonate insertions	-/-
		8.00	Yellow-gray clay, hard, neogene	
21	142.14	0.50	Topsoil	-/-
		8.00	Sandy clay, yellow, hard, with macropores with wire and carbonate insertions	
22	141.11	0.50	Topsoil	-/-
		8.00	Gray clay, hard, with nests and stratifications of dusty sand, low humidity	
23	103.48	0.70	Topsoil	-/-
		4.50	Dusty, dark-gray, plastic from a depth of 2.50 m, vigorous	
		8.00	Yellow-brown clay, hard	
24	95.70	0.50	Topsoil	-3.00/-2.00
		8.00	Sandy clay. yellow-gray, hard, plastic from a depth of 4.0 m	
25	150.10	0.50	Topsoil	-/-
		8.00	Sandy clay, yellow-fawn, hard, in the range 0.5-3.5 m with wire and carbonate insertions	
26	177.76	0.70	Topsoil	-/-
		5.00	Fawn-yellow clay, hard	
		8.00	Greenish-gray clay, hard	
27	173.61	0.50	Topsoil	-/-
		8.00	Sandy clay. yellow-fawn, hard, micropores with nests of Dusty sand, low humidity	
28	95.53	0.50	Topsoil	-2.50/-2.50

Well no.	Absolute land elevation, m	Well depth m	Soil type	Groundwater level appeared/stable, m
		8.00	Sandy clay, plastic from depth of 2.5 m, soft from depth of 6.00 m, fluid	
29	91.65	0.50	Topsoil	-/-
		8.00	Sandy clay, yellow-fawn, hard, macropores	
30	28.26	0.40	Topsoil	-5.50/-4.80
		3.50	Sandy clay, fawn, plastic, macropores	
		8.00	Fawn-gray clay, plastic, with nests and stratifications of dusty sand, wet	
31	199.48	0.50	Topsoil	-/-
		8.00	Sandy clay, brown, hard, micropores	
32	192.82	0.50	Topsoil	-/-
		8.00	Sandy clay, brown, hard, micropores	
33	187.62	0.60	Topsoil	-/-
		8.00	Sandy clay, fawn-brown, micropores with carbonate wire	
34	172.22	0.50	Topsoil	-/-
		8.00	Sandy clay, fawn-gray, hard, micropores	
35	172.22	0.50	Topsoil	-/-
		8.00	Sandy clay, fawn-gray, hard, micropores	
36	58.65	0.50	Topsoil	-/-
		8.00	Sandy clay, fawn-gray, hard, micropores	
37	115.12	0.50	Topsoil	-/-
		8.00	Sandy clay, yellow-brown, hard, micropores with carbonate insertions	
38	139.72	0.60	Topsoil	-/-
		8.00	Sandy clay, yellow-gray, hard, nests of dusty sand, low humidity	
39	106.43	0.50	Topsoil	-/-
		8.00	Sandy clay, fawn-brown, hard, micropores ,nests of dusty sand, low humidity	
40	71.95	1.00	Topsoil	-/-
		3.00	Soft alluvial soil	
		8.00	Sandy clay, fawn-gray, soft, fawn-yellow from depth of 5.00 m,	

ANNEX 3

Legendă/ Legend

- Traseu LEA/ OHL route
- Arii_protejate-de-stat/ Areas protected by state
- Rețeaua_Emerald/ Emerald Network
- MD005_IBA_Codrii_Centrali
- MD007_IBA_Iunca_Prutului_de_Jos_si_Lacurile_Manta-Beleu
- MD008_IBA_Lacurile_Congaz_Taraclia
- MD009_IBA_Purcari-Etulia
- MD010_IBA_Padurea_Hancesti
- Culoar de protecție LEA/ OHL safety corridor
- Stația Chișinău/ Chișinău Station

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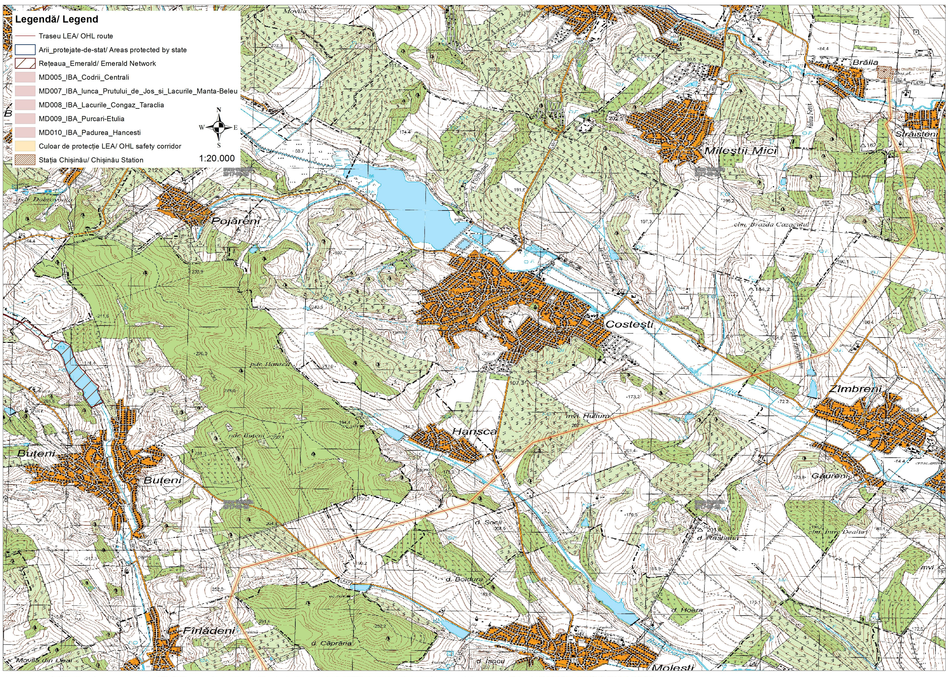

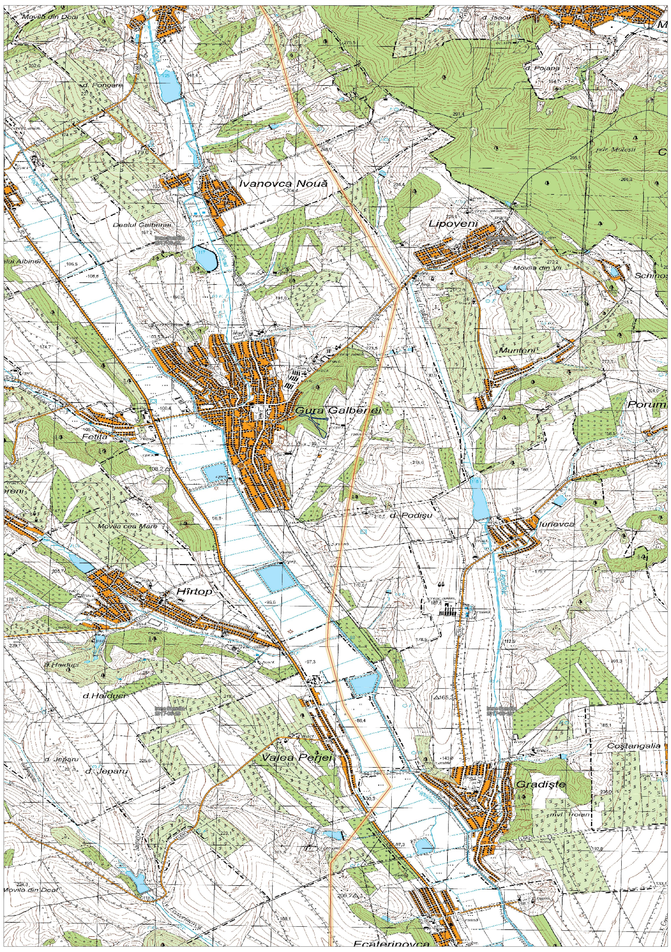

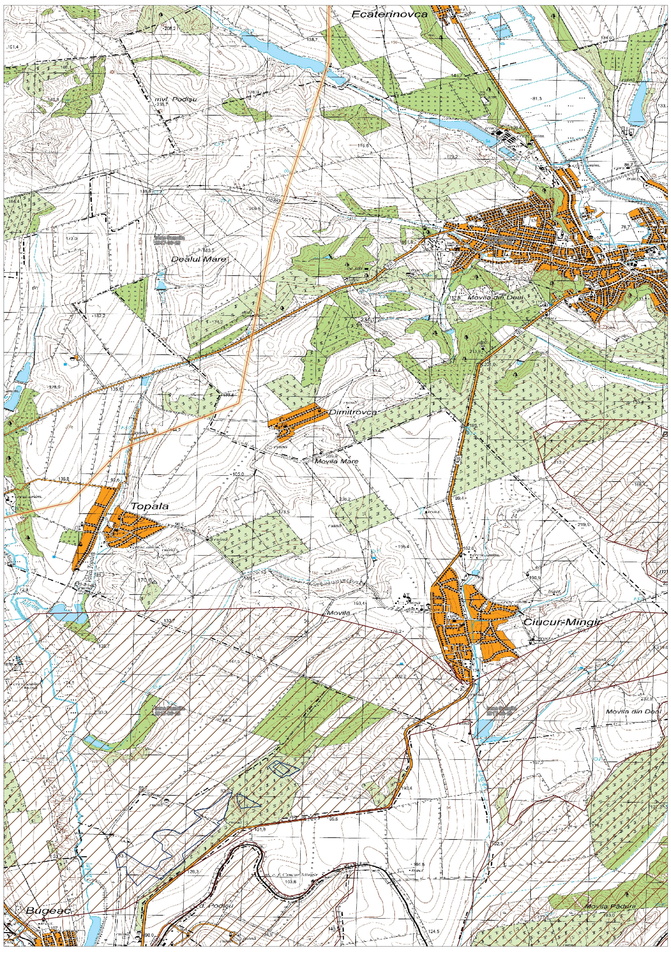

Băiuș
Cociulia Nouă
Dezghingea
Borogani
Bugeac
Congazcicul de Sus
Congazcicul de Jos
Sadic
Taraclia
Cotovscoe
Ciietu
Chioselia Mare
Chioselia Rusă
Borceag
Alexeevca
Sofievca
Albota de Sus
Albota de Jos
Cealîc
Balabanu
Salcia
Musaitu
Vinogradovca
Burlăceni
Iujnoe
Legendă/ Legend
Traseu LEA/ OHL route
Arii_protejate-de-stat/ Areas protected by state
Rețeaua_Emerald/ Emerald Network
MD005_IBA_Codrii_Centrali
MD007_IBA_lunca_Prutului_de_Jos_si_Lacurile_Manta-Beleu
MD008_IBA_Lacurile_Congaz_Taraclia
MD009_IBA_Purcari-Etulia
MD010_IBA_Padurea_Hancesti
Culoar de protecție LEA/ OHL safety corridor
Stația Vulcănești/ Vulcănești Station
Stația BtB/ BtB Station
Stația Chișinău/ Chișinău Station
N
W
E
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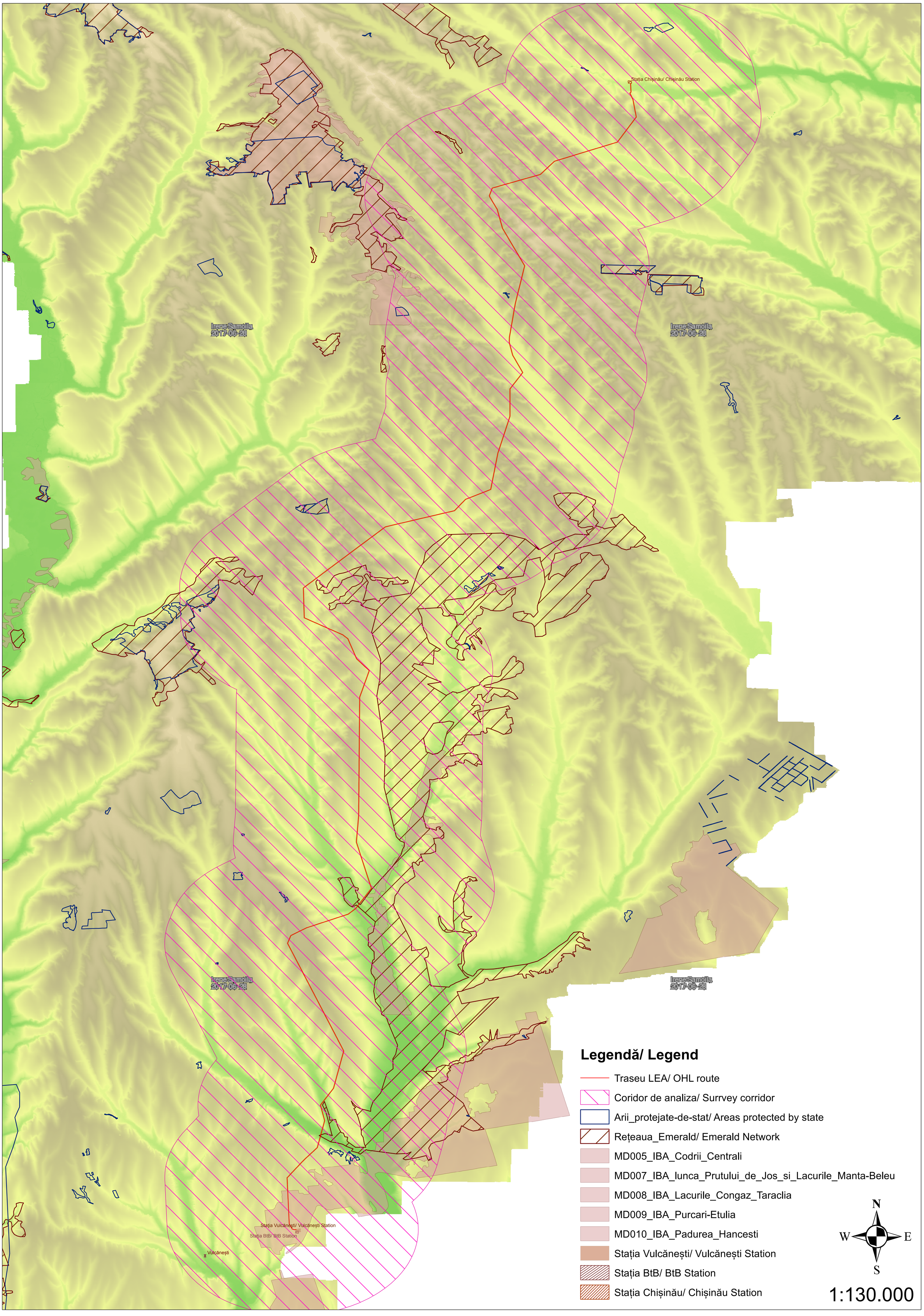
1:20.000

ANNEX 4


Stația Chișinău/ Chișinău Station
Irene Samoila
2017-06-23
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Irene Samoila
2017-06-23
Irene Samoila
2017-06-23
Stația Vulcănești/ Vulcănești Station
Stația BtB/ BtB Station
Vulcănești
Legendă/ Legend
Traseu LEA/ OHL route
Coridor de analiza/ Surrvey corridor
Arii_protejate-de-stat/ Areas protected by state
Rețeaua_Emerald/ Emerald Network
MD005_IBA_Codrii_Centrali
MD007_IBA_Iunca_Prutului_de_Jos_si_Lacurile_Manta-Beleu
MD008_IBA_Lacurile_Congaz_Taraclia
MD009_IBA_Purcari-Etulia
MD010_IBA_Padurea_Hancesti
Stația Vulcănești/ Vulcănești Station
Stația BtB/ BtB Station
Stația Chișinău/ Chișinău Station
N
W
E
S
1:130.000

ANNEX 5

Table no. 1. List of rare and characteristic plant and animal species, North Bugeac steppe sector (Dezghingea)

Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
Plants	Yarrow *(Achillea ochroleuca)*	CR			
	Volga Adonis *(Adonis wolgensis* Stev.)	VU			
	Astragalus (*Achillea ochroleuca* L.)	CR			
	Tatarian Sea-kale (*Crambe tataria* Sebeok)	EN		AII	
	Carnation *(Dianthus pallidiflorus* Ser.*)*	CR			
	Sea Grape *(Ephedra distachya L.)*	VU	LC		
	Mountain Sandwort *(Eremogone cephalotes* Bieb. Fenzl.*)*	CR			
	Eremogone Rigida *(Eremogone rigida* Bieb. Fenzl.*)*	CR			
	Nepeta parviflora Bieb.	VU			
	Needle Grass *(Stipa lessingiana)*	EN	LC		
	Stipa pulcherrima K. Koch		VU		
	Stipa tirsa Stev.	EN			
	Stipa ucrainica (dasyphylla)	EN			
	Allium inaequale Janka	VU			
	Cladonia rangiformis Hoffm.	CR			
	Xanthoparmelia vagans Nyl. Hale	CR			
Insects	Praying Mantis (*Mantis religiosa* L.)		LC		
Herpetofauna	Green Lizard *(Lacerta viridis* Laur.*)*		LC	AIV	
	Wall Lizard *(Podarcis taurica* Wagler*)*		LC	AIV	
	Sand Lizard *(Lacerta agilis* L.*)*		LC	AIV	
	Grass Lizard *(Podarcis tauricus* Pallas*)*	EN	LC	AIV	
	Grass Snake or Viper *(Natrix natrix* L.*)*		LR/LC		
	Green Toad *(Bufo viridis* Laur.*)*		LC	AIV	
	Hazel Snake (*Coronella austriaca* Laur.)	EN		AIV	
	Earth Frog (*Pelobatas fuscus* Laur.)	CR			
Birds	Crested Lark *(Galerida cristata* L.*)*		LC		
	Eurasian Skylark *(Alauda arvensis* L.*)*		LC		AII/C
	White Wagtail *(Motacilla alba* L.*)*		LC		
Mammals	European Mole *(Talpa europaea* L.*)*		LC		
	European Hare *(Lepus europaeus* Pall.*)*		LC		
	House Mouse *(Mus musculus L.)* Steppe Mouse *(Mus spicilegus Petenzi)* Pygmy Wood Mouse *(Apodemus uralensis Pall.)* Common Vole *(Microtus arvalis Pall.)*		LC		
	Red Fox *(Vulpes vulpes* L.*)*		LC		
	Least Weasel *(Mustela nivalis* L.*)*		LC		
	Speckled Ground Squirrel (*Spermophilus suslicus*)	VU	NT	AII, AIV	

Table no. 2. List of rare and characteristic plant and animal species, North Bugeac steppe sector

Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
Plants	Woronow (*Bellevalia sarmatica* Georgi)	VU			
	Sand Saffron *(Colchicum fominii* Bordz.*)*	EN	LC		
	Tatarian Sea-kale (*Crambe tataria* Sebeok)	EN		AII	
	Carnation (*Dianthus pallidiflorus* Ser.)	CR			
	Sea Grape *(Ephedra distachya* L.)	VU	LC		
	Mountain Sandwort *(Eremogone cephalotes* Bieb. Fenzl.*)*	CR			
	Eremogone Rigida *(Eremogone rigida* Bieb. Fenzl.*)*	CR			
	Montain Lusca (*Ornithogalum oreoides* Zahar.)	EN			
Insects	Praying Mantis (*Mantis religiosa* L.)		LC		
	Clay Bumblebee (*Bombus argillaceus* Scopoli)	VU			
	Garden Bumblebee (*Bombus fragrans* Pall.*)*	CR			
Herpetofauna	Sand Lizard *(Lacerta agilis* L.*)*		LC	AIV	
	Grass Lizard *(Podarcis tauricus* Pallas*)*	EN	LC	AIV	
	Green Toad *(Bufo viridis* Laur.*)*		LC	AIV	
	Hazel Snake (*Coronella austriaca* Laur.)	EN		AIV	
Birds	Gray Partridge *(Perdix perdix* L.*)*		LC		AII, AIII
	Ring-necked Pheasants *(Phasianus colchicus* L.*)*		LC		AII, AIII
	Cuckoo *(Cuculus canorus* L.*)*		LC		
	Common Hoopoe *(Upupa epops* L.*)*		LC		
	Crested Lark *(Galerida cristata* L.*)*		LC		
	Eurasian Skylark *(Alauda arvensis* L.*)*		LC		AII/C
	Tawny Pipit *(Anthus campestris* L.*)*		LC		AI
	White Wagtail *(Motacilla alba* L.*)*		LC		
	Great Whinchat (*Saxicola rubetra* L*)*		LC		
	Red-backed Shrike *(Lanius collurio)*		LC		AI
	Greenfinch *(Carduelis chloris* L.*)*		LC		
	Goldfinch *(Carduelis carduelis* L.*)*		LC		
	Corn Bunting *(Miliaria calandra* L.*)*		LC		
	Hen Harrier *(Circus cyaneus* L.*)*	CR	LC		AI
Mammals	European Mole *(Talpa europaea* L.*)*		LC		
	European Hare *(Lepus europaeus* Pall.*)*		LC		
	House Mouse *(Mus musculus L.)* Steppe Mouse *(Mus spicilegus Petenzi)* Common Vole *(Microtus arvalis Pall.)*		LC		
	Red Fox *(Vulpes vulpes* L.*)*		LC		
	Least Weasel *(Mustela nivalis* L.*)*		LC		
	Hedgehog *(Erinaceus europaeus* L.*)*		LC		

Table no. 3. List of rare and characteristic plant and animal species, Muşaitu Cliff

Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
Plants	Volga Adonis *(Adonis wolgensis* Stev.)	VU			
	Pale Garlic *(Allium paniculatum* L.*).*		LC		
Insects	Praying Mantis *(Mantis religiosa* L.)		LC		
	Bombus fragrans Pall.	CR			
	Giant Hornet *(Scolia maculata* Drury)	VU			
	Papilio machaon L.	VU			
	Southern Festoon *(Zerynthia polyxena* Den. et Sch.)	VU		AIV	
Herpetofauna	Sand Lizard *(Lacerta agilis* L)		LC	AIV	
	Green Lizard *(Lacerta viridis* Laur.)		LC	AIV	
	Grass Lizard (*Podarcis tauricus* Pallas)	EN	LC	AIV	
	Grass Snake or Viper (*Natrix natrix* L.)		LR/ LC		
	Hazel Snake *(Coronella austriaca* Laur.)	EN		AIV	
	Coluber caspius Gmelin	EN	LC	AIV	
	Green Toad *(Bufo viridis* Laur.*)*		LC	AIV	
	Earth Frog *(Pelobates fuscus* Laur.)	CR	LC	AIV	
Birds	Black Gaia *(Milvus migrans* Bodd.)	VU	LC		AI
	Northern Goshawk *(Accipiter gentilis* L.)		LC		
	Eurasian Sparrowhawk *(Accipiter nisus* L.)		LC		
	Ratter *(Buteo buteo* L.)		LC		
	European Honey buzzard *(Pernis apivorus* L.)	EN	LC		AI
	Kestrel *(Falco tinnunculus* L.)		LC		
	Eurasian Hobby *(Falco subbuteo* L.*)*		LC		
	Collared Dove *(Columba palumbus* L.)		LC		AII/A, AIII
	Turtledove *(Streptopelia decaocto)*		VU		AII/B
	Cuckoo *(Cuculus canorus* L.)		LC		
	Long-eared owl *(Asio otus* L.*)*		LC		
	Common hoopoe *(Upupa epops* L.)		LC		
	Eurasian wryneck *(Jynx torquilla* L.)		LC		
	Great Spotted Woodpecker *(Dendrocopos major* L.)		LC		
	Syrian Woodpecker *(Dendrocopos syriacus* Gengl et Ehrenb.)		LC		AI
	Woodlark (*Lullula arborea* L.)		LC		AI
	Thrush Nightingale (*Luscinia luscinia* L.)		LC		
	European Robin *(Erithacus rubecula* L.)		LC		
	Common Redstart *(Phoenicurus phoenicurus* L.)		LC		
	Common Blackbird *(Turdus merula* L.)		LC		AII/B
	Song Thrush *(Turdus philomelos* Brehm.)		LC		AII/B
	Garden Warble *(Sylvia borin* Bodd.)		LC		
	Eurasian Blackcap *(Sylvia atricapilla* L.)		LC		
	Red-breasted Flycatcher *(Ficedula parva* Bechst.)		LC		AI
	Collared Flycatcher *(Ficedula albicollis* Temm.)		LC		AI
	Great Tit *(Parus major* L.)		LC		
	Eurasian Blue Tit *(Parus caeruleus* L.)		LC		
	Eurasian Jay *(Garrulus glandarius* L.)		LC		AII/B
	Common Raven *(Corvus corax* L.)		LC		
	Greenfinch *(Carduelis chloris* L.)		LC		
	Goldfinch *(Carduelis carduelis* L.)		LC		
	Hawfinch *(Coccothraustes coccothraustes* L.)		LC		
	Yellowhammer *(Emberiza citrinella* L.)		LC		
	European Honey Buzzard *(Pernis apivorus* L.)	EN	LC		AI
	Saker Falcon (*Falco cherrug* Gray.)	CR	EN		AI
	Hen Harrier *(Circus cyaneus* L.*)*	CR	LC		AI

Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
	Lesser Spotted Eagle *(Aquila pomarina* Brehm.)	CR	LC		AI
	Stock Dove *(Columba oenas* L.)	CR	LC		AII/B
Mammals	Hedgehog *(Erinaceus europaeus* L.)		LC		
	European Mole *(Talpa europaea* L.)		LC		
	European Hare *(Lepus europaeus* Pall.)		LC		
	Striped Field Mouse *(Apodemus agrarius* Pall.)		LC		
	Common Vole *(Microtus arvalis* Pall.)		LC		
	Red Fox *(Vulpes vulpes* L.)		LC		
	Least Weasel *(Mustela nivalis* L.)		LC		
	Speckled Ground Squirrel *(Spermophilus suslicus* Guld.)	VU	NT	AII, AIV	

Table no. 4 List of rare and characteristic plant and animal species, Budăi Cliff

Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
Plants	*Astragalus excapus* L.	CR			
Insects	Praying Mantis (*Mantis religiosa* L.)		LC		
	Clay Bumblebee (*Bombus argillaceus* Scopoli)	VU			
	Southern Festoon (*Zerynthia polyxena* Den. et Sch.)	VU		AIV	
Herpetofauna	Sand Lizard *(Lacerta agilis* L.*)*		LC	AIV	
	Grass Lizard *(Podarcis tauricus* Pallas*)*	EN	LC	AIV	
	Grass Snake or Viper *(Natrix natrix* L.*)*		LR/LC		
	Green Toad *(Bufo viridis* Laur.*)*		LC	AIV	
	Hazel Snake (*Coronella austriaca* Laur.)	EN		AIV	
	Earth Frog (*Pelobatas fuscus* Laur.)	CR			
Birds	Black Kite *(Milvus migrans* Bodd.*)*	VU	LC		AI
	Northern Goshawk *(Accipiter gentilis* L.*)*		LC		
	Eurasian Sparrowhawk (*Accipiter nisus* L.*)*		LC		
	Ratter *(Buteo buteo* L.*)*		LC		
	Kestrel *(Falco tinnunculus* L.*)*		LC		
	Eurasian Hobby *(Falco subbuteo* L.*)*		LC		
	Collared Dove *(Columba palambus)*		LC		
	Turtledove *(Streptopelia turtur* L.*)*		VU		
	Cuckoo *(Cuculus canorus* L.*)*		LC		
	Long-eared Owl *(Asio otus)*		LC		
	Common Hoopoe *(Upupa epops* L.)		LC		
	Eurasian Wryneck *(Jynx torquilla* L.*)*		LC		
	Great spotted Woodpecker *(Dendrocopos major* L.*)*		LC		
	Syrian Woodpecker *(Dendrocopos syriacus* Gengl et Ehrenb.*)*		LC		AI
	Woodlark *(Lullula arborea* L.*)*		LC		AI
	Thrush Nightingale *(Luscinia luscinia* l.*)*		LC		
	European Robin *(Erithacus rubecula* l.*)*		LC		
	Common Redstart *(Phoenicurus phoenicurus* l.*)*		LC		
	Common Blackbird *(Turdus merula* l.*)*		LC		AII/B
	Song Thrush *(Turdus philomelos* brehm*)*		LC		AII/B
	Garden Warble *(Sylvia borin* bodd.*)*		LC		
	Eurasian Blackcap *(Sylvia atricapilla* l.*)*		LC		
	Red-breasted Flycatcher *(Ficedula parva* bechst.)		LC		AI
	Collared Flycatcher *(Ficedula albicollis* temm.)		LC		AI
	Great Tit *(Parus major* l.)		LC		
	Eurasian Blue Tit *(Parus caeruleus* l.)		LC		
	Eurasian Jay *(Garrulus glandarius* l.)		LC		AII/B
	Common Raven *(Corvus corax* l.)		LC		
	Greenfinch *(Carduelis chloris* l.)		LC		

Class	**Species**	**Moldova Red Book**	**IUCN Red List**	**Habitats Directive**	**Birds Directive**
	Goldfinch *(Carduelis carduelis* l.)		LC		
	Hawfinch *(Coccothraustes coccothraustes* l.)		LC		
	Yellowhammer *(Emberiza citrinella* l.)		LC		
	European Honey Buzzard *(Pernis apivorus* l.)	EN	LC		AI
	Saker Falcon (*(Falco cherrug* gray)	CR	EN		AI
	Hen Harrier *(Circus cyaneus* l.*)*	CR	LC		AI
	Lesser Spotted Eagle *(Aquila pomarina* brehm.)	CR	LC		AI
	Stock Dove *(Columba oenas* l.)	CR	LC		
Mammals	Hedgehog *(Erinaceus europaeus* L.*)*		LC		
	European Mole *(Talpa europaea* L.*)*		LC		
	European Hare *(Lepus europaeus* Pall*)*		LC		
	Red Fox *(Vulpes vulpes* L.*)*		LC		
	Least Weasel *(Mustela nivalis* L.*)*		LC		
	Speckled Ground Squirrel (*Spermophilus suslicus*)	VU	NT	AII, AIV	

Table no. 5. List of rare and characteristic plant and animal species, Bugeac South Steppe

Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
Plants	Yarrow *(Achillea ochroleuca)*	CR			
	Common Milkwort *(Polygala vulgaris)*	CR			
	Spring Pheasant's eye (*Adonis vernalis* L.)	VU			
	Bellevalia Sarmatica (*Bellevalia sarmatica* Georgi Woronow)	VU			
	Colchicum triphyllum G.Kunze	CR			
	Carnation *(Dianthus pallidiflorus* Ser.)	CR			
	Eremogone Rigida (*Eremogone rigida* Bieb. Fenzl)	CR			
	Lușcă Ambigua (*Ornithogalum amphibolum* Zahar.)	EN			
	Montain Lusca (*Ornithogalum oreoides* Zahar.)	EN			
	Gypsophila pallasii Ikonn	VU			
	Allium guttatum Stev.	CR			
	Chrysopogon gryllus L.	VU			
	Gagea ucrainica Klok.	EN			
	Catapyrenium squamulosum Arch. Breuss	CR			
	Cladonia rangiformis Hoffm.	CR			
Insects	*Bombus zonatus* Smith.	CR			
	Praying Mantis (*Mantis religiosa* (L.))		LC		
	Mahaon Buterfly (*Papilio machaon* L.)	VU			
Herpetofauna	Green Lizard *(Lacerta viridis* Laur.)		LC	AIV	
	Wall Lizard *(Podarcis taurica* Wagler)		LC	AIV	
	Grass Snake or Viper *(Natrix natrix* L.)		LR/ LC		
	Green Toad (*Bufo viridis* Laur.*)*		LC	AIV	
	Sand Snake *(Coluber caspius* Gmelin)		LC	AIV	
	Hazel Snake *(Coronella austriaca* Laur.)	EN		AIV	
	Earth Frog *(Pelobates fuscus* Laur.*)*	CR	LC	AIV	
Birds	Northern Goshawk (*Accipiter gentilis* L.)		LC		
	Eurasian Sparrowhawk (*Accipiter nisus* L.)		LC		
	Ratter (*Buteo buteo L.*)		LC		
	Kestrel (*Falco tinnunculus* L.)		LC		
	Common Quail *(Coturnix coturnix* L.)		LC		
	Ring-necked Pheasant *(Phasianus colchicus* L.)		LC		AII, AIII
	European Bee-eater *(Merops apiaster* L.)		LC		
	Common Hoopoe *(Upupa epops* L.)		LC		
	Crested Lark *(Galerida cristata* L.)		LC		
	Tawny Pipit *(Anthus campestris* L.)		LC		AI
	White Wagtail *(Motacilla alba* L.)		LC		
	Cuckoo *(Cuculus canorus* L.)		LC		
	Little Owl *(Athene noctua* Scop.)		LC		
	Long-eared Owl *(Asio otus* L.)		LC		
	European Nightjar *(Caprimulgus europaeus)*		LC		AI
	Eurasian Wryneck *(Jynx torquilla* L.)		LC		
	Grey-headed Woodpecker *(Picus canus* Gmel.)		LC		
	Great spotted Woodpecker *(Dendrocopos major* L.)		LC		
	Woodlark *(Lullula arborea* L.)		LC		AI
	Thrush Nightingale *(Luscinia luscinia* L.)		LC		
	Common Blackbird (*Turdus merula* L.)		LC		AII/B
	Song Thrush *(Turdus philomelos* Brehm)		LC		AII/B
	Barred Warbler *(Sylvia nisoria* Bechst.)		LC		
	Garden Warble *(Sylvia borin* Dodd.)		LC		
	Eurasian Blue Tit *(Cyanistes caeruleus* L.)		LC		
	Great Tit *(Parus major* L.)		LC		
	Raven *(Corvus corax* L.)		LC		
	Eurasian Magpie *(Pica pica* L.)		LC		AII/B
	Eurasian Jay (*Garrulus glandarius* L.)		LC		AII/B
	Greenfinch *(Carduelis chloris* L.)		LC		
	European Honey Buzzard *(Pernis apivorus* L.)	EN	LC		AI

Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
	Short-toed Snake Eagle *(Circaetus gallicus* Gmel.)	CR	LC		
	Hen Harrier *(Circus cyaneus* L.)	CR	LC		AI
	Montagu's Harrier *(Circus pygargus* L.)	CR	LC		
	Lesser Spotted Eagle *(Aquila pomarina* Brehm.)	CR	LC		AI
	Golden Eagle *(Aquila chrysaetos* L.)	CR	LC		AI
	Booted Eagle *(Hieraaetus pennatus* Gmel.)	CR	LC		AI
	Saker Falcon *(Falco cherrug* Gray)	CR	EN		AI

Table no. 6. List of rare and characteristic plant and animal species, Cărbuna landscape reserve

Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
Plants	Oriental Hornbeam *(Carpinus orientalis* Mill.*)*	EN	LC		
	Grecian Foxglove (*Digitalis lanata*)	CR			
	Eremogone Rigida *(Eremogone rigida* Bieb. Fenzl*)*	CR			
	Mottled Tulip *(Fritillaria meleagris* Hoppe*)*	VU	DD		
	Bungarian Onion *(Nectaroscordum bulgaricum* Janka*)*	VU			
	Service Tree *(Sorbus domestica* L.*)*	EN			
	Serratula coronata L.	EN			
	Chrysopogon gryllus L	VU			
	Securigera elegans Panc.	VU			
	Casey's Larkspur *(Delphinium fissum Waldst. et Kit.).*	CR	CR		
	Bellevalia Sarmatica (*Bellevalia sarmatica* Georgi Woronow)	VU			
	Ornithogalum boucheanum Kunth	EN			
	Stipa dasyphylla Lindem.	EN			
	Stipa tirsa Stev.	EN			
Insects	Elateridae (Click Beetles) *(Elater ferrugineus L.)*	EN			
	Stag Beetle (*Lucanus cervus (L.)*)	VU		AII	
	Southern Festoon (*Zerynthia polyxena* Den. et Sch.)	VU		AIV	
	Mahaon Buterfly *(Papilio machaon* L.*)*	VU			
Herpatofauna	Green Lizard *(Lacerta viridis* L.*)*		LC	AIV	
	Grass Snake or Viper (*Natrix natrix* L.)		LR/ LC		
	Common European viper (*Vipera berus* L.)	EN	NT		
	Hazel Snake (*Coronella austriaca* Laur.)	EN		AIV	
Birds	Northern Goshawk (*Accipiter gentilis* L.)		LC		
	Eurasian Sparrowhawk (*Accipiter nisus L.*)		LC		
	Ratter (*Buteo buteo* L.)		LC		
	Kestrel (*Falco tinnunculus* L.)		LC		
	Turtledove (*Streptopelia decaocto*L.)		VU		AII/B
	Cuckoo (*Cuculus canorus* L.)		LC		
	Long-eared Owl (*Asio otus* L.)		LC		
	European Nightjar (*Caprimulgus europaeus* L.)		LC		
	Common Hoopoe (*Upupa epops* L.)		LC		
	Eurasian Wryneck (*Jynx torquilla* L.)		LC		
	Great Spotted Woodpecker (*Dendrocopos major* L.)		LC		
	Little Spotted Woodpecker (*Dendrocopos minor* L.)		LC		
	European Robin (*Erithacus rubecula* L.)		LC		
	Thrush Nightingale (*Luscinia luscinia* L.)		LC		
	Common Redstart (*Phoenicurus phoenicurus* L.)		LC		
	Song Thrush (*Turdus philomelos* Brehm.)		LC		AII/B
	Common Blackbird (*Turdus merula* L.)		LC		AII/B

Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
	Eurasian Blackcap (*Sylvia atricapilla* L.)		LC		
	Common Chiffchaff (*Phylloscopus collybita* Vieill.)		LC		
	Eurasian Blue Tit (*Cyanistes caeruleus* L.)		LC		
	Great Tit (*Parus major* L.)		LC		
	Red-backed Shrike (*Lanius collurio* L.)		LC		AI
	Eurasian Magpie (*Pica pica* L.)		LC		
	Eurasian Jay (*Garrulus glandarius* L.)		LC		AII/B
	Raven (*Corvus corax* L.)		LC		
	Hooded Crow (*Corvus cornix* L.)		LC		
	Common Starling (*Sturnus vulgaris* L.)		LC		
	Common Chaffinch (*Fringilla coelebs* L.)		LC		
	Greenfinch (*Carduelis chloris* L.)		LC		
	Hawfinch (*Coccothraustes coccothraustes* L.)		LC		
	Yellowhammer (*Emberiza citrinella* L.)		EN		
	European Honey Buzzard (*Pernis apivorus* L.)	EN	LC		AI
	Lesser Spotted Eagle (*Aquila pomarina* Brehm.)	CR	LC		AI
	Stock Dove (*Columba oenas* L.)	CR	LC		
Mammals	European Mole (*Talpa europaea* L.)		LC		
	Wood Mouse (*Apodemus sylvaticus L.*)		LC		
	Yellow-necked Mouse (*Apodemus flavicollis* Melchior)		LC		
	Least Weasel (*Mustela nivalis* L.)		LC		
	Red Fox (*Vulpes vulpes* L.)		LC		
	Hazel Dormouse (*Muscardinus avellanarius* L.)		LC		
	Wild Boar (*Sus scrofa* L.)		LC		
	Deer (*Capreolus capreolus* L.)		LC		
	Common Noctule (*Nyctalus noctula* Schreber)		LC	AIV	
	Soprano Pipistrelle (*Pipistrellus pygmaeus* Leach)		LC	AIV	
	Grey Long-eared Bat (*Plecotus austriacus* Fischer)	VU	LC	AIV	
	Daubenton's Bat (*Myotis daubentonii* Kuhl)	VU	LC	AIV	
	Lesser Noctule (*Nyctalus leisleri* Kuhl)		LC	AIV	
	European Wildcat (*Felis silvestris* Schreber)	VU	LC	AIV	
	European Pine marten (*Martes martes* L.)	VU	LC	AV	
	Nathusius' Pipistrelle (*Pipistrellus nathusii* Keyserling & Blasius)	EN	LC	AIV	
	Kuhl's Pipistrelle (*Pipistrellus kuhlii* Kuhl)	VU	LC	AIV	
	Parti-coloured Bat (*Vespertilio murinus* L.)	CR	LC	AIV	

Table no. 7. List of rare and characteristic animal species, Moleşti-Răzeni

Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
Insects	Stag Beetle (*Lucanus cervus* L.)	VU		AII	
	Solitary Bee (*Rhophitoides canus* Eversm.)	EN			
	Southern Festoon (*Zerynthia polyxena* Den. et Sch.)	VU		AIV	
	Clouded Apollo (*Parnassius mnemosyne* L.)	VU		AIV	
Herpetofauna	Green Lizard (*Lacerta viridis* Laur.)		LC	AIV	
	Grass Snake or Viper (*Natrix natrix* L.)		LR/ LC		
	European Fire-bellied Toad (*Bombina bombina* L.)	VU	LC	AII, AIV	
	Common Toad (*Bufo bufo* L.)	VU	LC		
	Agile Frog (*Rana dalmatina* Bonaparte)	VU	LC	AIV	
	Hazel Snake (*Coronella austriaca* Laur.)	EN		AIV	
	Common European Viper (*Vipera berus* L.)	EN	NT		
Birds	Northern Goshawk (*Accipiter gentilis* L.)		LC		
	Eurasian Sparrowhawk (*Accipiter nisus* L.)		LC		
	Ratter (*Buteo buteo* L.)		LC		
	Kestrel (*Falco tinnunculus* L.)		LC		
	Turtledove (*Streptopelia turtur* L.)		VU		
	Cuckoo (*Cuculus canorus* L.)		LC		
	Long-eared Owl (*Asio otus* L.)		LC		
	European Nightjar (*Caprimulgus europaeus* L.)		LC		
	Common Hoopoe (*Upupa epops* L.)		LC		
	Eurasian Wryneck (*Jynx torquilla* L.)		LC		
	Great Spotted Woodpecker (*Dendrocopos major* L.)		LC		
	Little Spotted Woodpecker (*Dendrocopos minor* L.)		LC		
	European Robin (*Erithacus rubecula* L.)		LC		
	Thrush Nightingale (*Luscinia luscinia* L.)		LC		
	Common Redstart (*Phoenicurus phoenicurus* L.)		LC		
	Song Thrush (*Turdus philomelos* Brehm.)		LC		AII/B
	Common Blackbird (*Turdus merula* L.)		LC		AII/B
	Eurasian Blackcap (*Sylvia atricapilla* L.)		LC		
	Common Chiffchaff (*Phylloscopus collybita* Vieill.)		LC		
	Eurasian Blue Tit (*Cyanistes caeruleus* L.)		LC		
	Great Tit (*Parus major* L.)		LC		
	Red-backed Shrike (*Lanius collurio* L.)		LC		AI
	Eurasian Magpie (*Pica pica* L.)		LC		
	Eurasian Jay (*Garrulus glandarius* L.)		LC		AII/B
	Raven (*Corvus corax* L.)		LC		
	Hooded Crow (*Corvus cornix* L.)		LC		
	Common Starling (*Sturnus vulgaris* L.)		LC		
	Common Chaffinch (*Fringilla coelebs* L.)		LC		
	Greenfinch (*Carduelis chloris* L.)		LC		
	Hawfinch (*Coccothraustes coccothraustes* L.)		LC		
	Yellowhammer (*Emberiza citrinella* L.)		EN		
	European Honey Buzzard (*Pernis apivorus* L.)	EN	LC		AI
	Lesser Spotted Eagle (*Aquila pomarina* Brehm.)	CR	LC		AI
	Stock Dove (*Columba oenas* L.)	CR	LC		
Mammals	European Mole (*Talpa europaea* L.)		LC		
	Common Shrew (*Sorex araneus* L.)		LC		
	Forest Dormouse (*Dryomys nitedula* Pallas)		LC		
	Hazel Dormouse (*Muscardinus avellanarius* L.)		LC		
	Wood Mouse (*Apodemus sylvaticus* L.)		LC		
	Bank Vole (*Clethrionomys glareolus* Schreber)		LC		
	Least Weasel (*Mustela nivalis* L.)		LC		
	European Polecat (*Mustela putorius* L.)		LC	AV	
	Red Fox (*Vulpes vulpes* L.)		LC		
	Speckled Ground Squirrel (*Spermophilus suslicus* Guld.)	VU	NT	AII, AIV	

Legend:

CR: CRITICALLY ENDANGERED; **EN:** ENDANGERED; **VU:** VULNERABLE; **NT:** NEAR THREATENED; **LC:** LEAST CONCERN; **DD**: DATA DEFICIENT

Habitats Directive:

AII: Annex II - ANIMAL AND PLANT SPECIES OF COMMUNITY INTEREST WHOSE CONSERVATION REQUIRES THE DESIGNATION OF SPECIAL AREAS OF CONSERVATION

AIV: Annex IV - ANIMAL AND PLANT SPECIES OF COMMUNITY INTEREST IN NEED OF STRICT PROTECTION

AV: Annex V - ANIMAL AND PLANT SPECIES OF COMMUNITY INTEREST WHOSE TAKING IN THE WILD AND EXPLOITATION MAY BE SUBJECT TO MANAGEMENT MEASURES

Birds Directive:

AI: Annex I - SPECIES THAT SHALL BE THE SUBJECT OF SPECIAL CONSERVATION MEASURES CONCERNING THEIR HABITAT IN ORDER TO ENSURE THEIR SURVIVAL AND REPRODUCTION IN THEIR AREA OF DISTRIBUTION BY SPA

AII/A: Annex II/A – SPECIES THAT MAY BE HUNTED IN THE GEOGRAPHICAL SEA AND LAND AREA WHERE THIS DIRECTIVE APPLIES;

AII/B: Annex II/B - SPECIES THAT MAY BE HUNTED IN ONLY IN THE MEMBER STATES IN RESPECT OF WHICH THEY ARE INDICATED

AIII/A: Annex III/A - BIRDS THAT HAVE BEEN LEGALLY KILLED OR CAPTURED OR OTHERWISE LEGALLY ACQUIRED

AIII/B: Annex III/B - BIRDS THAT HAVE BEEN LEGALLY KILLED OR CAPTURED OR OTHERWISE LEGALLY ACQUIRED ONLY IN INDICATED MEMBER STATE

ANNEX 6

Table no. 1 List of rare and characteristic plant and animal species in the core areas

Core area	Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
Tărăclia Reservoir	**Zoobentos**	*Lymnaea auricularia*		LC		
	Herpetofauna	Green lizard (*Lacerta viridis* Laur.)		LC	AIV	
		Wall lizard *(Podarcis taurica)*	EN	LC	AIV	
		Grass snake or viper *(Natrix natrix* L.)		LR/LC		
		European fire-bellied toad (*Bombina bombina* L.)	VU		AII, AIV	
		Green toad *(Bufo viridis* Laur.)		LC	AIV	
		Edible frog (*Rana esculenta* L.)		LC	AV	
		Marsh frog *(Rana ridibunda* Pallas)		LC	AV	
		Coluber caspius	EN	LC	AIV	
		Hazel snake (*Coronella austriaca* Laur.)	EN		AIV	
		Earth frog (*Pelobatas fuscus* Laur.)	CR			
	Birds	Great crested grebe (*Podiceps cristatus* L.)		LC		
		Mallard *(Anas platyrhynchos* L.)		LC		AII/A
		Garganey (*Anas querquedula* L.)		LC		AII/A
		Northern lapwing (*Vanellus vanellus* L.)		NT		AII/B
		Common kingfisher *(Alcedo atthis* L.)		LC		AI
		White wagtail *(Motacilla alba* L.)		LC		
		Codobatura galbenă *(Motacilla flava* L.)		LC		
		Common grasshopper warbler (*Locustella naevia* Bodd.)		LC		
		Marsh warbler (*Acrocephalus palustris* Bechst.)		LC		
		Great reed warbler *(Acrocephalus arundinaceus* L.)		LC		
		Great white pelican (*Pelecanus onocrotalus* L.)	EN	LC		AI
		Great egret *(Ardea alba* L.)	EN	LC		AI
		Common spoonbill *(Platalea leucorodia* L.)	CR	LC		AI
		Whooper swan *(Cygnus cygnus* L.)	VU	LC		AI
		Mute swan *(Cygnus olor)*	VU	LC		AII/B
		Lesser white-fronted goose (*Anser erythropus* L.)	VU	VU		AI
		Red-breasted goose *(Branta ruficollis* Pall.)	VU	VU		AI
		Osprey *(Pandion haliaetus* L.)	CR	LC		AI
		Common shelduck *(Tadorna tadorna* L.)	VU	LC		
		Ruddy shelduck *(Tadorna ferruginea* Pallas)	VU	LC		AI
	Mammals	European mole *(Talpa europaea* L.)		LC		
		Common shrew *(Sorex araneus* L.)		LC		
		European hare *(Lepus europaeus* Pall.)		LC		
		Striped field mouse *(Apodemus agrarius* Pall.)		LC		
		Common vole *(Microtus arvalis* Pall.)		LC		
		Red fox *(Vulpes vulpes* L.)		LC		
		Least weasel *(Mustela nivalis* L.)		LC		
		Hedgehog *(Erinaceus europaeus* L.)		LC		
Congaz Reservoir	**Zoobentos**	Swan mussel *(Erythromma viridulum)*		LC		
		Lymnaea auricularia		LC		
	Herpetofauna	Green lizard (*Lacerta viridis* Laur.)		LC	AIV	
		Wall lizard *(Podarcis taurica)*	EN	LC	AIV	
		Grass snake or viper *(Natrix natrix* L.)		LR/LC		
		European fire-bellied toad (*Bombina bombina* L.)	VU	LC	AII, AIV	
		Green toad *(Bufo viridis* Laur.)		LC	AIV	
		Edible frog (*Rana esculenta* L.)		LC	AV	

Core area	Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
		Marsh frog *(Rana ridibunda* Pallas*)*		LC	AV	
		Coluber caspius	EN	LC	AIV	
		Hazel snake (*Coronella austriaca* Laur.)	EN		AIV	
		Earth frog (*Pelobatas fuscus* Laur.)	CR			
	Birds	Great crested grebe (*Podiceps cristatus* L.*)*		LC		
		Mallard *(Anas platyrhynchos* L.*)*		LC		AII/A
		Garganey (*Anas querquedula* L.*)*		LC		AII/A
		Common moorhen *(Gallinula chloropus* L.*)*		LC		AII/B
		Northern lapwing (*Vanellus vanellus* L.*)*		NT		AII/B
		Common kingfisher *(Alcedo atthis* L.*)*		LC		AI
		White wagtail *(Motacilla alba* L.*)*		LC		
		Western yellow wagtail *(Motacilla flava* L.*)*		LC		
		Common grasshopper warbler (*Locustella naevia* Bodd.*)*		LC		
		Marsh warbler (*Acrocephalus palustris* Bechst.*)*		LC		
		Great reed warbler *(Acrocephalus arundinaceus* L.*)*		LC		
		Great white pelican (*Pelecanus onocrotalus* L.*)*	EN	LC		AI
		Great egret *(Ardea alba* L.*)*	EN	LC		AI
		Common spoonbill *(Platalea leucorodia* L.*)*	CR	LC		AI
		Whooper swan *(Cygnus cygnus* L.*)*	VU	LC		AI
		Mute swan *(Cygnus olor)*	VU	LC		AII/B
		Lesser white-fronted goose (*Anser erythropus* L.*)*	VU	VU		AI
		Red-breasted goose *(Branta ruficollis* Pall.*)*	VU	VU		AI
		Osprey *(Pandion haliaetus* L.*)*	CR	LC		AI
		Common shelduck *(Tadorna tadorna* L.)	VU	LC		
		Ruddy shelduck *(Tadorna ferruginea* Pallas)	VU	LC		AI
	Mammals	European mole *(Talpa europaea* L.*)*		LC		
		Brown rat *(Rattus norvegicus* Berk.*)*		LC		
		European water vole *(Arvicola terrestris* L.*)*		LC		
		European hare *(Lepus europaeus* Pall.*)*		LC		
		Red fox *(Vulpes vulpes* L.*)*		LC		
Comrat Reservoir	**Zoobentos**	Small Red-eyed Damselfly *(Erythromma viridulum)*		LC		
		Lymnaea auricularia		LC		
		Swan mussel *(Anodonta cygnea)*		LC		
	Herpetofauna	Green lizard (*Lacerta viridis* Laur.)		LC	AIV	
		Wall lizard *(Podarcis taurica)*	EN	LC	AIV	
		Grass snake or viper *(Natrix natrix* L.*)*		LR/LC		
		European fire-bellied toad (*Bombina bombina* L.*)*	VU	LC	AII, AIV	
		Green toad *(Bufo viridis* Laur.*)*		LC	AIV	
		Edible frog (*Rana esculenta* L.*)*		LC	AV	
		Marsh frog *(Rana ridibunda* Pallas *)*		LC	AV	
		Earth frog (*Pelobatas fuscus* Laur.)	CR			
	Birds	Great crested grebe (*Podiceps cristatus* L.*)*		LC		
		Purple heron *(Ardea purpurea* L.*)*	VU	LC		AI
		Mallard *(Anas platyrhynchos* L.*)*		LC		AII/A
		Common moorhen *(Gallinula chloropus* L.*)*		LC		AII/B

Core area	Class	Species	Moldova Red Book	IUCN Red List	Habitats Directive	Birds Directive
		Northern lapwing (*Vanellus vanellus* L.)		NT		AII/B
		Common kingfisher *(Alcedo atthis* L.)		LC		AI
		White wagtail *(Motacilla alba* L.)		LC		
		Great reed warbler *(Acrocephalus arundinaceus* L.)		LC		
		Great egret *(Egretta alba* L.)	EN	LC		AI
		Mute swan *(Cygnus olor)*	VU	LC		AII/B
	Mammals	European mole *(Talpa europaea* L.)		LC		
		European hare *(Lepus europaeus* Pall.)		LC		
		Brown rat *(Rattus norvegicus* Berk.)		LC		
		European water vole *(Arvicola terrestris* L.)		LC		
		Speckled ground squirrel (*Spermophilus suslicus*)	VU	NT	AII, AIV	
		Hedgehog *(Erinaceus europaeus* L.)		LC		

Legend:

CR: CRITICALLY ENDANGERED; **EN:** ENDANGERED; **VU:** VULNERABLE; **NT:** NEAR THREATENED; **LC:** LEAST CONCERN

ANNEX 7

Bird species occurred in the project area and their status according to IUCN, CMS, AEWA and Birds Directive

No.	Species	IUCN Red List status	Bern Convention	CMS Appendix I	CMS Appendix II	AEWA Annex 2	Birds Directive Annex I	Observation regarding some species in RM
1	Mute Swan (*Cygnus olor*)	LC	III		x	x		
2	Whooper Swan (*Cygnus cygnus*)	LC	II		x	x	x	
3	Tundra Swan (*Cygnus columbianus*)	LC	II		x	x	x	
4	Graylag Goose (*Anser anser*)	LC	III		x	x		
5	White-fronted Gosse (*Anser albifrons*)	LC	III		x	x		
6	Lesser White-fronted Goose (*Anser erythropus*)	VU	II	x	x	x	x	Rare
7	Red-breasted Goose (*Branta ruficollis*)	EN	II	x	x	x	x	Rare
8	Raddy Shelduck (*Tadorna feruginea*)	LC	II		x		x	
9	Common Shelduck (*Tadorna tadorna*)	LC	II		x	x		
10	Gadwall (*Anas strepera*)	LC	III		x	x		
11	Mallard (*Anas platyrhynchos*)	LC	III		x	x		
12	Northern Shoveler (*Anas clypeata*)	LC	III		x	x		
13	Garhaney (*Anas querquedula*)	LC	III		x	x		

No.	Species	IUCN Red List status	Bern Convention	CMS Appendix I	CMS Appendix II	AEWA Annex 2	Birds Directive Annex I	Observation regarding some species in RM
14	Green – winged Teal (*Anas crecca*)	LC	III		x	x		
15	Northen Pintail (*Anas acuta*)	LC	III		x	x		
16	Eurasian Wigeon (*Anas penelope*)	LC	III		x	x		
17	Red-crested Pochard (*Netta rufina*)	LC	III		x	x		
18	Common Pochard (*Aythya ferina*)	LC	III		x	x		
19	Ferruginous Duck (*Aythya nyroca*)	NT	III	x	x	x	x	
20	Tufted Duck (*Aythya fuligula*)	LC	III		x	x		
21	Greater Scaup (*Aythya marila*)	LC	III		x	x		Rare
22	Goldeneye (*Bucephala clangula*)	LC	III		x	x		
23	Smew (*Mergellus albellus*)	LC	II		x	x	x	
24	Common Merganser (*Mergus merganser*)	LC	III		x	x		
25	Red-breasted Merganser (*Mergus serrator*)	LC	III		x	x		
26	White-headed Duck (*Oxyura leucocephala*)	EN	II	x	x	x	x	Rare
27	Long-tailed Duck (*Clangula hyemalis*)	VU			x	x		Rare
28	Velvet Scoter (*Melanitta fusca*)	EN	III		x	x		Rare
29	Ring-necked Pheasant (*Phasianus*	LC						

No.	Species	IUCN Red List status	Bern Convention	CMS Appendix I	CMS Appendix II	AEWA Annex 2	Birds Directive Annex I	Observation regarding some species in RM
	colchicus)							
30	Grey Partridge (*Perdix perdix*)	LC	III					
31	Common Quail (*Coturnix coturnix*)	LC	III		x			
32	Corncrake (*Crex crex*)	LC	II		x		x	
33	Black- throated Loon (*Gavia stellata*)	LC	II		x	x	x	
34	Red-throated Loon (*Gavia arctica*)	LC	II		x	x	x	
35	Little Grebe (*Tachybaptus ruficollis*)	LC	II					
36	Great Crested Grebe (*Podiceps cristatus*)	LC	III					
37	Eared Greabe (*Podiceps nigricollis*)	LC	II					
38	Red-necked Grebe (*Podiceps grisegena*)	LC	II		x	x		Rare
39	Great White Pelican (*Pelecanus onocrotalus*)	LC	II	x	x	x	x	
40	Dalmatian Pelican (*Pelecanus crispus*)	VU	II	x	x	x	x	
41	Great Cormorant (*Phalacrocorax carbo*)	LC	III					
42	Pygmy Cormorant (*Phalacrocorax pygmeys*)	LC	II		x	x	x	
43	Black Stork (*Ciconia nigra*)	LC	II		x	x	x	
44	White Stork (*Ciconia ciconia*)	LC	II		x	x	x	

No.	Species	IUCN Red List status	Bern Convention	CMS Appendix I	CMS Appendix II	AEWA Annex 2	Birds Directive Annex I	Observation regarding some species in RM
45	Great bittern (*Botaurus stellaris*)	LC	II		x	x	x	
46	Little Bittern (*Ixobrychus minutus*)	LC	II		x	x	x	
47	Gray Heron (*Ardea cinerea*)	LC	III					
48	Purple Heron (*Ardea purpurea*)	LC	II		x	x	x	
49	Great Egret (*Ardea alba*)	LC	II		x	x	x	
50	Little Egret (*Egretta garzetta*)	LC	II				x	
51	Squaco Heron (*Ardeola raloides*)	LC	II				x	
52	Black-crowned Night Heron (*Nycticorax nycticorax*)	LC	II				x	
53	Glossy Ibis (*Plegadis falcinellus*)	LC	II		x	x	x	
54	Eurasian Spoonbill (*Platalea leucorodia*)	LC	II		x	x	x	
55	White-tailed Eagle (*Haliaeetus albicilla*)	LC	II	x	x		x	
56	Cinereous Vulture (*Aegypius monachus*)	LC	II		x		x	Accidental/ reported as extinct
57	Griffon Vulture (*Gyps fulvus*)	LC	II		x		x	Very rare
58	Egyptian Vulture (*Neophron percnopterus*)	EN	II	x	x		x	Very rare
59	Osprey (*Pandion haliaetus*)	LC	II		x		x	
60	Lesser Spotted Eagle (*Clanga pomarina*)	LC	II		x		x	

No.	Species	IUCN Red List status	Bern Convention	CMS Appendix I	CMS Appendix II	AEWA Annex 2	Birds Directive Annex I	Observation regarding some species in RM
61	Greater Spotted Eagle (*Clanga clanga*)	VU	II	x	x		x	Rare
62	Golden Eagle (*Aquila chrysaetos*)	LC	II		x		x	Rare
63	Eastern Imperial Eagle (*Aquila heliaca*)	VU	II	x	x		x	Very rare
64	Steppe Eagle (*Aquila nipalensis*)	LC	II		x			Very rare
65	Short-toed Snake-eagle (*Circaetus gallicus*)	LC	II		x		x	
66	Booted Eagle (*Hieraaetus pennatus*)	LC	II		x		x	
67	Black Kite (*Milvus migrans*)	LC	II		x		x	
68	Red Kite (*Milvus milvus*)	NT	II		x		x	Accidental
69	Marsh Herrier (*Circus aeroginosus*)	LC	II		x		x	
70	Hen Harrier (*Circus cyaneus*)	LC	II		x		x	
71	Montagu's Harrier (*Circus pygargus*)	LC	II		x		x	
72	Pallid Harrier (*Circus macrourus*)	NT	II		x		x	Very rare
73	Lonf-legged Buzzard (*Buteo rufinus*)	LC	II		x		x	
74	Common Buzzard (*Buteo buteo*)	LC	II		x			
75	Rough-legged Buzzard (*Buteo lagopus*)	LC	II		x			
76	European Honey-buzzard (*Pernis apivorus*)	LC	II		x		x	

No.	Species	IUCN Red List status	Bern Convention	CMS Appendix I	CMS Appendix II	AEWA Annex 2	Birds Directive Annex I	Observation regarding some species in RM
77	Eurasian Sparrowhawk (*Accipiter nisus*)	LC	II		x			
78	Northern Goshawk (*Accipiter gentilis*)	LC	II		x			
79	Levant Sparrowhawk (*Accipiter brevipens*)	LC	II		x		x	
80	Common Kestrel (*Falco tinnunculus*)	LC	II		x			
81	Red-footed Kestrel (*Falco vespertinus*)	NT	II		x		x	
82	Eurasian Hobey (*Falco subbuteo*)	LC	II		x			
83	Peregrine Falcon (*Falco peregrinus*)	LC	II		x		x	
84	Merlin (*Falco columbarius*)	LC	II		x		x	
85	Lesser Kestrel (*Falco naumanni*)	LC	II	x	x		x	Very rare
86	Saker Falcon (*Falco cherrug*)	EN	II		x		x	
87	Spotted Crake (*Porzana porzana*)	LC	II		x	x	x	
88	Bailon's Crake (*Porzana pusilla*)	LC	II		x	x	x	
89	Common Crane (*Grus grus*)	LC	II		x	x	x	Rare
90	Demoiselle Crane (*Grus virgo*)	LC	II		x	x	x	Very rare
91	Water Rail (*Rallus aquaticus*)	LC	III					
92	Eurasian Moorhen (*Gallinula chloropus*)	LC	III					
93	Eurasian Coot (*Fulica atra*)	LC	III		x	x		

No.	Species	IUCN Red List status	Bern Convention	CMS Appendix I	CMS Appendix II	AEWA Annex 2	Birds Directive Annex I	Observation regarding some species in RM
94	Black-winged Stilt (*Himantopus himantopus*)	LC	II		x	x	x	
95	Pied Avocet (*Recurvirostra avoseta*)	LC	II		x	x	x	
96	Eurasian Oystercatcher (*Haemantopus ostralegus*)	LC	III			x		Rare
97	Northen Lapwing (*Vanellus vanellus*)	LC	III		x	x		
98	Golden Plover (*Pluvialus apricaria*)	LC	III		x	x	x	Rare
99	Whimbrel (*Numenius phaeopus*)	LC	III		x	x		Rare
100	Eurasian Curlew (*Numenius arquata*)	NT	III		x	x		
101	Black-tailed Godwit (*Limosa limosa*)	NT	III		x	x		
102	Eurasian Woodcock (*Scolopax rusticola*)	LC	III		x			
103	Common Snipe (*Gallinago gallinago*)	LC	III		x	x		
104	Common Redshank (*Tringa totanus*)	LC	III		x	x		
105	Spotted Redshank (*Tringa erythropus*)	LC	III		x	x		
106	Common Greenshank (*Tringa nebularia*)	LC	III		x	x		
107	Green Sandpiper (*Tringa ochropus*)	LC	II		x	x		
108	Marsh Sandpiper (*Tringa stagnatilis*)	LC	II		x	x		
109	Ruff (*Philomachus pugnax*)	LC	III		x	x	x	

No.	Species	IUCN Red List status	Bern Convention	CMS Appendix I	CMS Appendix II	AEWA Annex 2	Birds Directive Annex I	Observation regarding some species in RM
110	European Herring (*Larus argentatus*)	LC				x		Accidental
111	Black-headed Gull (*Chroicocephalus ridibundus*)	LC	III					
112	Pallas's Gull (*Larus ichthyaetus*)	LC	III			x		Rare
113	Common Gull (*Larus canus*)	LC	III					
114	Yellow-logged Gull (*Larus michahellis*)	LC	III					
115	Caspian Gull (*Larus cachinnans*)	LC	III					
116	Whiskered Tern (*Chlidonias hybrida*)	LC	II				x	
117	Black Tern (*Chlidonias niger*)	LC	II		x	x	x	
118	White-winged Tern (*Chlidonias leucopterus*)	LC	II		x	x		
119	Common Tern (*Sterna hirundo*)	LC	II		x	x	x	
120	Little Tern (*Sterna albiforns*)	LC	II		x	x	x	
121	Rock Dove (*Columbia livia*)	LC	II					
122	Stock Dove (*Columba oenas*)	LC	III					
123	Common Wood-Pigeon (*Columba palumbus*)	LC						
124	European Turtle-Dove (*Streptopelia turtur*)	LC	II		x			

No.	Species	IUCN Red List status	Bern Convention	CMS Appendix I	CMS Appendix II	AEWA Annex 2	Birds Directive Annex I	Observation regarding some species in RM
125	Eurasian Collared-Dove (*Streptopelia decaocto*)	LC	III					
126	Eurasian Eagle Owl (*Bubo bubo*)	LC	II				x	
127	Little Owl (*Athene noctua*)	LC	II					
128	Long-eared Owl (*Asio otus*)	LC	II					
129	Short-eared Owl (*Asio flammeus*)	LC	II				x	
130	Tawny Owl (*Strix aluco*)	LC	II					
131	Ural Owl (*Strix uralensis*)	LC	II				x	Rare
132	Eurasian Scops Owl (*Otus scops*)	LC	II					
133	Common Barn Owl (*Tyto alba*)	LC	II					Rare
134	Bee-Eater (*Merops apiaster*)	LC	II		x			
135	Roller (*Coracias garrulus*)	NT	II		x		x	
136	Hoopoe (*Upupa epops*)	LC	II					
137	Northern Wheatear (*Oenanthe oenanthe*)	LC	II		x			
138	Ring Ouzel (*Turdus torquatus*)	LC	II		x			
139	Blackbird (*Turdus merula*)	LC	III		x			
140	Fieldfare (*Turdus pilaris*)	LC	III		x			

No.	Species	IUCN Red List status	Bern Convention	CMS Appendix I	CMS Appendix II	AEWA Annex 2	Birds Directive Annex I	Observation regarding some species in RM
141	Song Thrush (*Turdus philomelos*)	LC	III		x			
142	Redwing (*Turdus iliacus*)	NT	III					
143	Red-backed Shrike (*Lanius collurio*)	LC	II				x	
145	Lesser Grey Shrike (*Lanius minor*)	LC	II				x	
146	Great Grey Shrike (*Lanius excubitor*)	LC	II					
147	Woodchat Shrike (*Lanius senator*)	LC	II					very rare
148	Jay (*Garrulus glandarius*)	LC						
149	Magpie (*Pica pica*)	LC						
150	Jackdow (*Corvus monedula*)	LC						
151	Rook (*Corvus frugilegus*)	LC						
152	Carrion Crow (*Corvus corone*)	LC						
153	Raven (*Corvus corax*)	LC	III					
154	Grey-headed Woodpecker (*Picus canus*)	LC	II				x	
155	European Green Woodpecker (*Picus viridis*)	LC	II					
156	Great Spotted Woodpecker (*Dendrocopos major*)	LC	II					
157	Middle Spotted woodpecker	LC	II				x	

No.	Species	IUCN Red List status	Bern Convention	CMS Appendix I	CMS Appendix II	AEWA Annex 2	Birds Directive Annex I	Observation regarding some species in RM
	(*Dendrocopos medius*)							
158	Little Spotted Woodpecker (*Dendrocopos minor*)	LC	II					
159	Syrian Woodpecker (*Dendrocopos syriacus*)	LC	II				x	
160	White-backed woodpecker (*Dedrocopos leucotos*)	LC	II				x	Rare
161	Black Woodpecker (*Dryocopus martius*)	LC	II				x	
162	Starling (*Sturnus vulgaris*)	LC						
163	Rose-colored Starling (*Pastor (Sturnus) roseus*)	LC	II					Rare
164	Yellowhammer (*Emberiza citrinella*)	LC	II					
165	Corn Bunting (*Emberiza (Miliaria) calandra*)	LC	III					

ANNEX 8

Sensitive species to collision

No.	Species (breeding and migrating)	Casualties due to collision	Moldova Red Book	Likely location of interaction across LEA
1	Mute Swan (*Cygnus olor*)	II	VU	Near water
2	Whooper Swan (*Cygnus cygnus*)	II	VU	Near water
4	Graylag Goose (*Anser anser*)	II	NA	Throughout, near water
5	White-fronted Gosse (*Anser albifrons*)	II	NA	Throughout, near water
8	Raddy Shelduck (*Tadorna feruginea*)	0	VU	Near water
9	Common Shelduck (*Tadorna tadorna*)	0	VU	Near water
10	Gadwall (*Anas strepera*)	0	NA	Near water
11	Mallard (*Anas platyrhynchos*)	II	NA	Near water
12	Northern Shoveler (*Anas clypeata*)	II	NA	Near water
13	Garhaney (*Anas querquedula*)	II	NA	Near water
14	Green – winged Teal (*Anas crecca*)	0	NA	Near water
15	Northern Pintail (*Anas acuta*)	0	NA	Near water
16	Eurasian Wigeon (*Anas penelope*)	II	NA	Near water
17	Red-crested Pochard (*Netta rufina*)	0	VU	Near water
18	Common Pochard (*Aythya ferina*)	0	NA	Near water
19	Ferruginous Duck (*Aythya nyroca*)	0	NA	Near water
20	Tufted Duck (*Aythya fuligula*)	0	NA	Near water
22	Goldeneye (*Bucephala clangula*)	0	NA	Near water
23	Smew (*Mergellus albellus*)	0	NA	Near water
24	Common Merganser (*Mergus merganser*)	0	NA	Near water
25	Red-breasted Merganser (*Mergus serrator*)	0	NA	Near water
30	Grey Partridge (*Perdix perdix*)	0	NA	Throughout
31	Common Quail (*Coturnix coturnix*)	II-III	NA	Throughout
32	Corncrake (*Crex crex*)	II	EN	Wetlands

No.	Species (breeding and migrating)	Casualties due to collision	Moldova Red Book	Likely location of interaction across LEA
33	Black- throated Loon (*Gavia stellata*)	0	NA	Near water
34	Red-throated Loon (*Gavia arctica*)	0	NA	Near water
35	Little Grebe (*Tachybaptus ruficollis*)	0	NA	Near water
36	Great Crested Grebe (*Podiceps cristatus*)	0	NA	Near water
37	Eared Greabe (*Podiceps nigricollis*)	0	NA	Near water
39	Great White Pelican (*Pelecanus onocrotalus*)	II-III	EN	Throughout, near water
40	Dalmatian Pelican (*Pelecanus crispus*)	II-III	CR	Throughout, near water
41	Great Cormorant (*Phalacrocorax carbo*)	II	NA	Near water
42	Pygmy Cormorant (*Phalacrocorax pygmeys*)	0	NA	Near water
43	Black Stork (*Ciconia nigra*)	III	CR	Throughout, near water
44	White Stork (*Ciconia ciconia*)	III	VU	Throughput, near water
45	Great bittern (*Botaurus stellaris*)	0	VU	Near water
46	Little Bittern (*Ixobrychus minutus*)	0	NA	Near water
47	Gray Heron (*Ardea cinerea*)	II	NA	Near water
48	Purple Heron (*Ardea purpurea*)	II	NA	Near water
49	Great Egret (*Ardea alba*)	0	EN	Near water
50	Little Egret (*Egretta garzetta*)	0	NA	Near water
51	Squaco Heron (*Ardeola raloides*)	0	EN	Near water
52	Black-crowned Night Heron (*Nycticorax nycticorax*)	0	NA	Near water
53	Glossy Ibis (*Plegadis falcinellus*)	0	CR	Near water
54	Eurasian Spoonbill (*Platalea leucorodia*)	II	CR	Near water
55	White-tailed Eagle (*Haliaeetus albicilla*)	II	CR	Throughout, near forest
59	Osprey (*Pandion haliaetus*)	II	CR	Throughout, near forest
60	Lesser Spotted Eagle (*Clanga pomarina*)	II	NA	Throughout, near forest

No.	Species (breeding and migrating)	Casualties due to collision	Moldova Red Book	Likely location of interaction across LEA
65	Short-toed Snake-eagle (*Circaetus gallicus*)	II	CR	Throughout, near forest
66	Booted Eagle (*Hieraaetus pennatus*)	II	CR	Throughout
67	Black Kite (*Milvus migrans*)	II	VU	Throughout
69	Marsh Herrier (*Circus aeroginosus*)	II		Throughout, near water
70	Hen Harrier (*Circus cyaneus*)	II	CR	Throughout
71	Montagu's Harrier (*Circus pygargus*)	II	CR	Throughout
73	Lonf-legged Buzzard (*Buteo rufinus*)	II	NA	Throughout, near forest
74	Common Buzzard (*Buteo buteo*)	II	NA	Throughout, near forest
75	Rough-legged Buzzard (*Buteo lagopus*)	II	NA	Throughout
76	European Honey-buzzard (*Pernis apivorus*)	0	EN	Throughout, near forest
77	Eurasian Sparrowhawk (*Accipiter nisus*)	0	NA	Throughout
78	Northern Goshawk (*Accipiter gentilis*)	0	NA	Throughout
79	Levant Sparrowhawk (*Accipiter brevipens*)	0	NA	Throughout
80	Common Kestrel (*Falco tinnunculus*)	II	NA	Throughout
81	Red-footed Kestrel (*Falco vespertinus*)	II	VU	Throughout
82	Eurasian Hobey (*Falco subbuteo*)	II	NA	Throughout
83	Peregrine Falcon (*Falco peregrinus*)	II	CR	Throughout
84	Merlin (*Falco columbarius*)	II	NA	Throughout
86	Saker Falcon (*Falco cherug*)	II	CR	Throughout
91	Water Rail (*Rallus aquaticus*)	II	NA	Near water
92	Eurasian Moorhen (*Gallinula chloropus*)	II	NA	Near water
93	Eurasian Coot (*Fulica atra*)	II	NA	Near water
94	Black-winged Stilt (*Himantopus himantopus*)	0	VU	Near wetlands
95	Pied Avocet (*Recurvirostra avoseta*)	0	VU	Near wetlands
97	Northen Lapwing (*Vanellus*	II-III	NA	Near wetlands

No.	Species (breeding and migrating)	Casualties due to collision	Moldova Red Book	Likely location of interaction across LEA
	vanellus)			
100	Eurasian Curlew (*Numenius arquata*)	II-III	NA	Near wetlands
101	Black-tailed Godwit (*Limosa limosa*)	II-III	NA	Near wetlands
102	Eurasian Woodcock (*Scolopax rusticola*)	II-III	NA	Near wetlands
103	Common Snipe (*Gallinago gallinago*)	II-III	NA	Near wetlands
104	Common Redshank (*Tringa totanus*)	II-III	NA	Near wetlands
105	Spotted Redshank (*Tringa erythropus*)	0	NA	Near wetlands
106	Common Greenshank (*Tringa nebularia*)	0	NA	Near wetlands
107	Green Sandpiper (*Tringa ochropus*)	0	NA	Near wetlands
108	Marsh Sandpiper (*Tringa stagnatilis*)	0	NA	Near wetlands
109	Ruff (*Philomachus pugnax*)	II-III	NA	Near wetlands
111	Black-headed Gull (*Chroicocephalus ridibundus*)	II	NA	Near water
113	Common Gull (*Larus canus*)	0	NA	Near water
114	Yellow-logged Gull (*Larus michahellis*)	0	NA	Near water
115	Caspian Gull (*Larus cachinnans*)	0	NA	Near water
116	Whiskered Tern (*Chlidonias hybrida*)	0	NA	Near water
117	Black Tern (*Chlidonias niger*)	I-II	NA	Near water
118	White-winged Tern (*Chlidonias leucopterus*)	0	NA	Near water
119	Common Tern (*Sterna hirundo*)	0	NA	Near water
120	Little Tern (*Sterna albiforns*)	0	NA	Near water
121	Rock Dove (*Columbia livia*)	0	NA	Throughout
122	Stock Dove (*Columba oenas*)	0	CR	Throughout
123	Common Wood-Pigeon (*Columba palumbus*)	0	NA	Throughout
124	European Turtle-Dove (*Streptopelia*	0	NA	Throughout

No.	Species (breeding and migrating)	Casualties due to collision	Moldova Red Book	Likely location of interaction across LEA
	turtur)			
125	Eurasian Collared-Dove (*Streptopelia decaocto*)	0	NA	Throughout
126	Eurasian Eagle Owl (*Bubo bubo*)	0	NA	Near woods, steppe areas
127	Little Owl (*Athene noctua*)	0	NA	Near woods, open areas, villages
128	Long-eared Owl (*Asio otus*)	II	NA	Near forest
129	Short-eared Owl (*Asio flammeus*)	0	CR	Open forest
130	Tawny Owl (*Strix aluco*)	0	NA	Near forest
132	Eurasian Scops Owl (*Otus scops*)	0	NA	Near
135	Roller (*Coracias garrulus*)	I-II	VU	Throughout
143	Red-backed Shrike (*Lanius collurio*)	0	NA	Throughout
145	Lesser Grey Shrike (*Lanius minor*)	0	NA	Throughout
146	Great Grey Shrike (*Lanius excubitor*)	0	NA	Throughout
148	Jay (*Garrulus glandarius*)	I-II	NA	Throughout
149	Magpie (*Pica pica*)	I-II	NA	Throughout
150	Jackdow (*Corvus monedula*)	I-II	NA	Throughout
151	Rook (*Corvus frugilegus*)	I-II	NA	Throughout
152	Carrion Crow (*Corvus corone*)	I-II	NA	Throughout
153	Raven (*Corvus corax*)	I-II	VU	Throughout
154	Grey-headed Woodpecker (*Picus canus*)	I-II	NA	Near forest, meadow
155	European Green Woodpecker (*Picus viridis*)	I-II	NA	Near forest, meadow
156	Great Spotted Woodpecker (*Dendrocopos major*)	I-II	NA	Near forest, meadow, villages
157	Middle Spotted woodpecker (*Dendrocopos medius*)	I-II	NA	Near forest
158	Little Spotted Woodpecker (*Dendrocopos minor*)	I-II	NA	Near forest, meadow
159	Syrian Woodpecker (*Dendrocopos syriacus*)	I-II	NA	Near forest, meadow, villages
161	Black Woodpecker (*Dryocopus*	I-II	NA	Near forest, meadow

No.	Species (breeding and migrating)	Casualties due to collision	Moldova Red Book	Likely location of interaction across LEA
	martius)			
162	Starling (*Sturnus vulgaris*)	I-II	NA	Throughout
Rare, very rare or accidental birds in Republic of Moldova and sensitive to collision risk				
1.	Tundra Swan (*Cygnus columbianus*)	II	Rare	Near water
2.	Lesser White-fronted Goose (*Anser erythropus*)	0	VU, Rare	Near water
3.	Red-breasted Goose (*Branta ruficollis*)	II	VU, Rare	Near water
4.	Greater Scaup (*Aythya marila*)	0	Rare	Near water
5.	White-headed Duck (*Oxyura leucocephala*)	0	Rare	Near water
6.	Long-tailed Duck (*Clangula hyemalis*)	0	Rare	Near water
7.	Velvet Scoter (*Melanitta fusca*)	0	Rare	Near water
8.	Red-necked Grebe (*Podiceps grisegena*)	0	Rare	Near water
9.	Cinereous Vulture (*Aegypius monachus*)	II	Accidental	Throughout
10.	Griffon Vulture (*Gyps fulvus*)	II	Very rare	Throughout
11.	Egyptian Vulture (*Neophron percnopterus*)	II	Very rare	Throughout
12.	Greater Spotted Eagle (*Clanga clanga*)	II	Rare	Throughout
13.	Golden Eagle (*Aquila chrysaetos*)	II	Rare	Throughout
14.	Eastern Imperial Eagle (*Aquila heliaca*)	II	Very rare	Throughout
15.	Steppe Eagle (*Aquila nipalensis*)	II	Very rare	Throughout
16.	Red Kite (*Milvus milvus*)	II	Accidental	Throughout
17.	Pallid Harrier (*Circus macrourus*)	III	Very rare	Throughout
18.	Lesser Kestrel (*Falco naumanni*)	II	Very rare	Throughout
19.	Common Crane (*Grus grus*)	III	Rare	Throughout
20.	Demoiselle Crane (*Grus virgo*)	III	Very rare	Throughout
21.	Eurasian Oystercatcher (*Haemantopus ostralegus*)	II-III	Rare	wetlands

No.	Species (breeding and migrating)	Casualties due to collision	Moldova Red Book	Likely location of interaction across LEA
22.	Golden Plover (*Pluvialus apricaria*)	II-III	Rare	wetlands
23.	Whimbrel (*Numenius phaeopus*)	II-III	Rare	wetlands
24.	European Herring (*Larus argentatus*)	II	Accidental	Near water
25.	Pallas's Gull (*Larus ichthyaetus*)	0	Rare	Near water
26.	Ural Owl (*Strix uralensis*)	II	Rare	Near forest
27.	Common Barn Owl (*Tyto alba*)	0	Rare	Near forest
28.	Woodchat Shrike (*Lanius senator*)	0	Very rare	Throughout
29.	White-backed woodpecker (*Dedrocopos leucotos*)	I-II	Rare	Near forest

Legend:
0 = no data about causalities, but mentioned in literature as a susceptible species to risk of electrocution.
I = casualties reported, but no apparent threat to the bird population.
II = regionally or locally high casualties, but with no significant impact on the overall species population.
III = casualties are a major mortality factor in different countries; threatening a species with extinction, regionally or at a larger scale.
CR – Critically endangered, VU – Vulnerable, EN – Endangered, NA – Not available data

ANNEX 9

MITIGATION AREAS FOR BIRD COLLISION AND ELECTROCUTION

Fig. 1. Șnovăț Area (pylons 509 – 510)

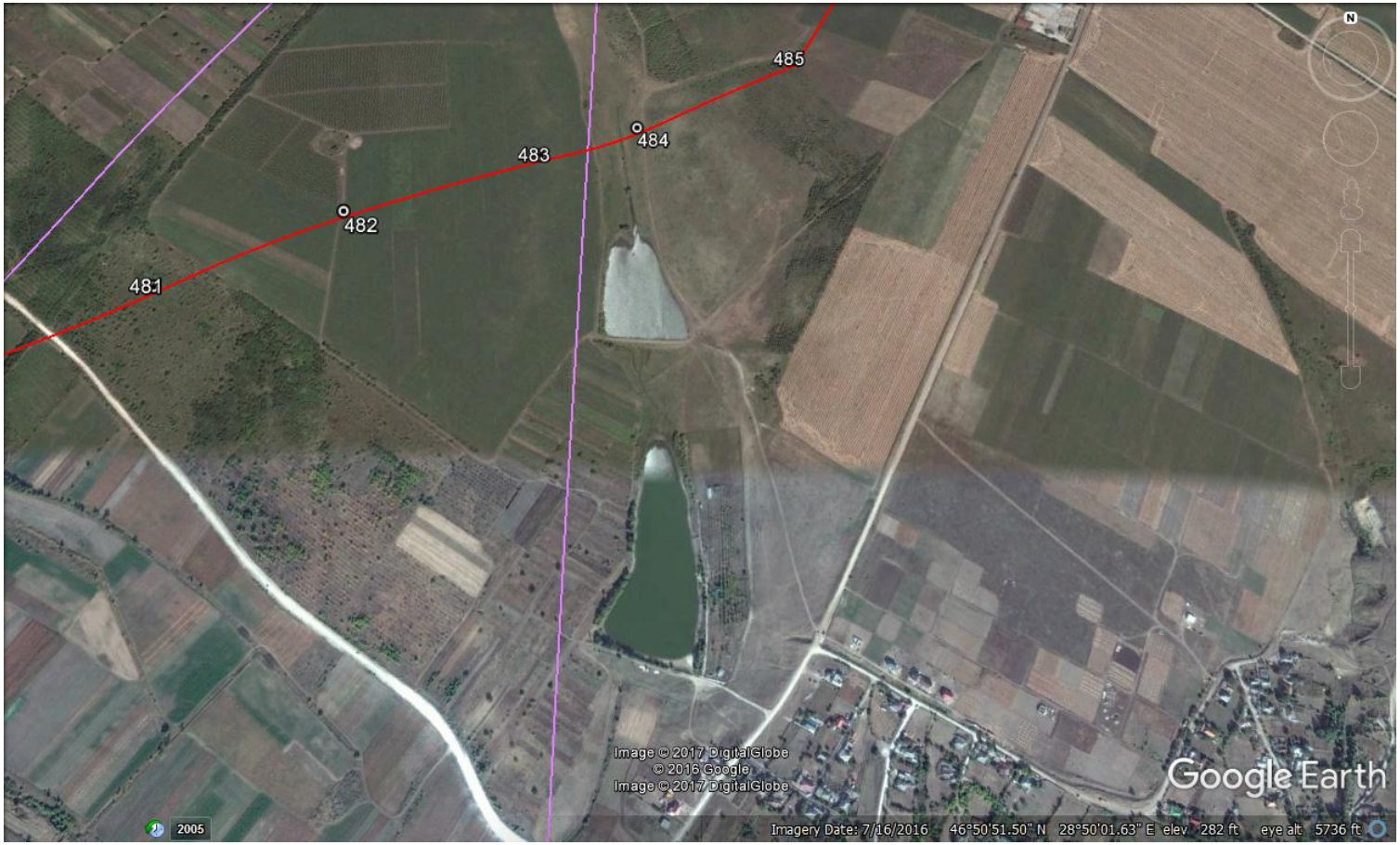

485
484
483
482
481
Image © 2017 DigitalGlobe
© 2016 Google
Image © 2017 DigitalGlobe
Google Earth
2005
Imagery Date: 7/16/2016 46°50'51.50" N 28°50'01.63" E elev 282 ft eye alt 5736 ft

Fig. 2. Zâmbreni area: line is passing near to two ponds (distance about 200 m)

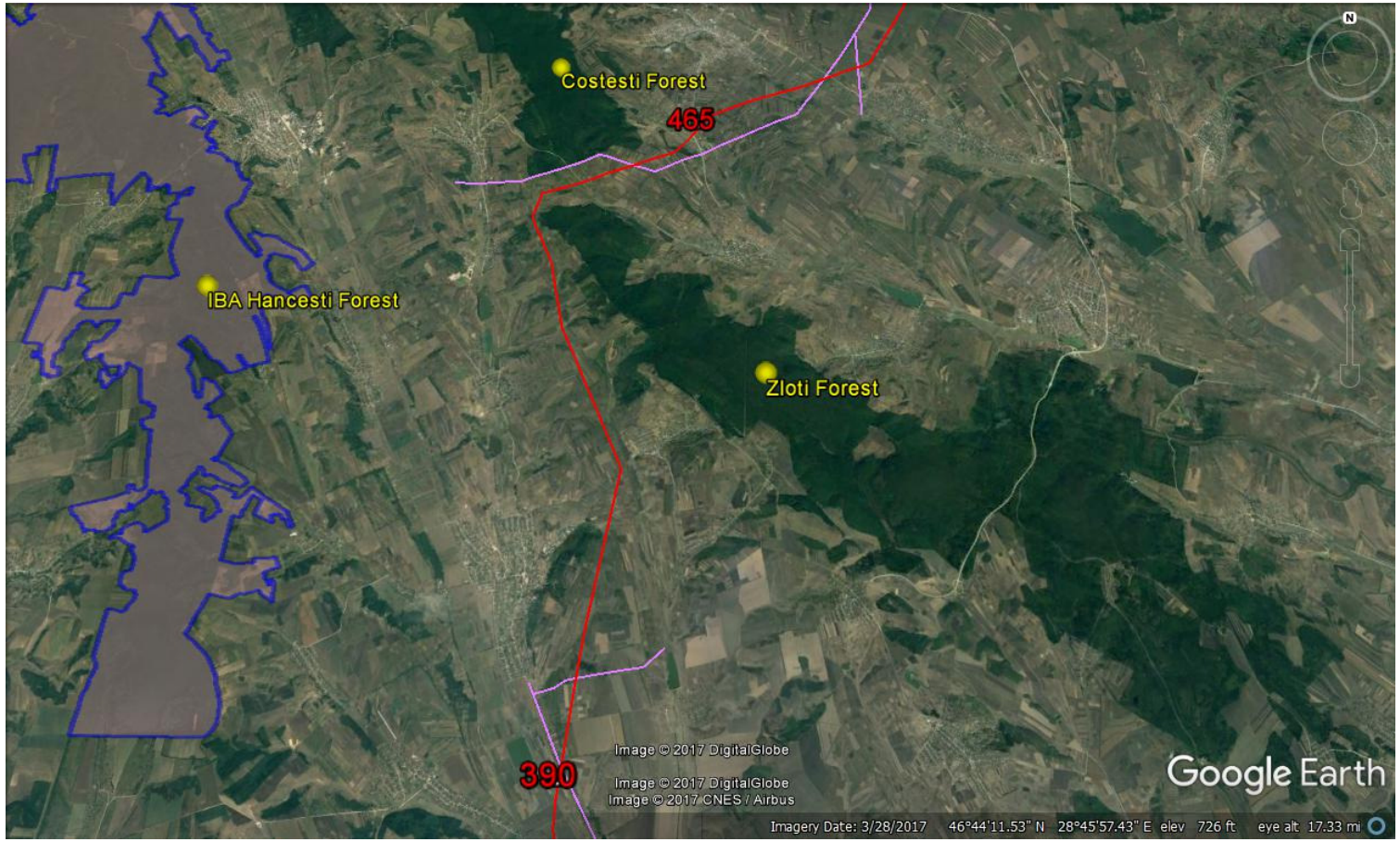


Fig. 3. Zloți and Costești Forest

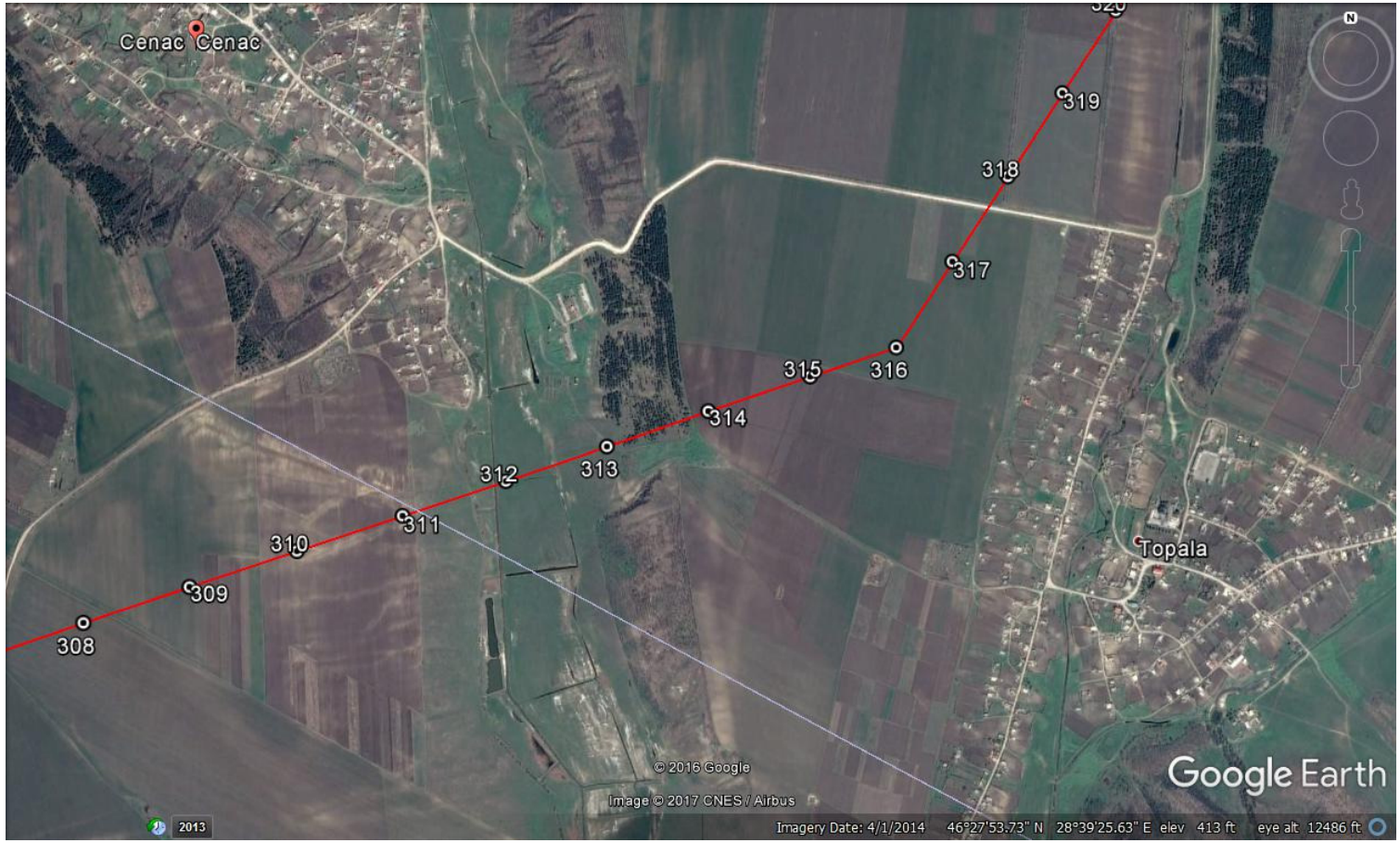


Fig. 4. Cenac wetlands

Fig. 5. Dezghingea Lake

Fig.6. Congazcic Lake

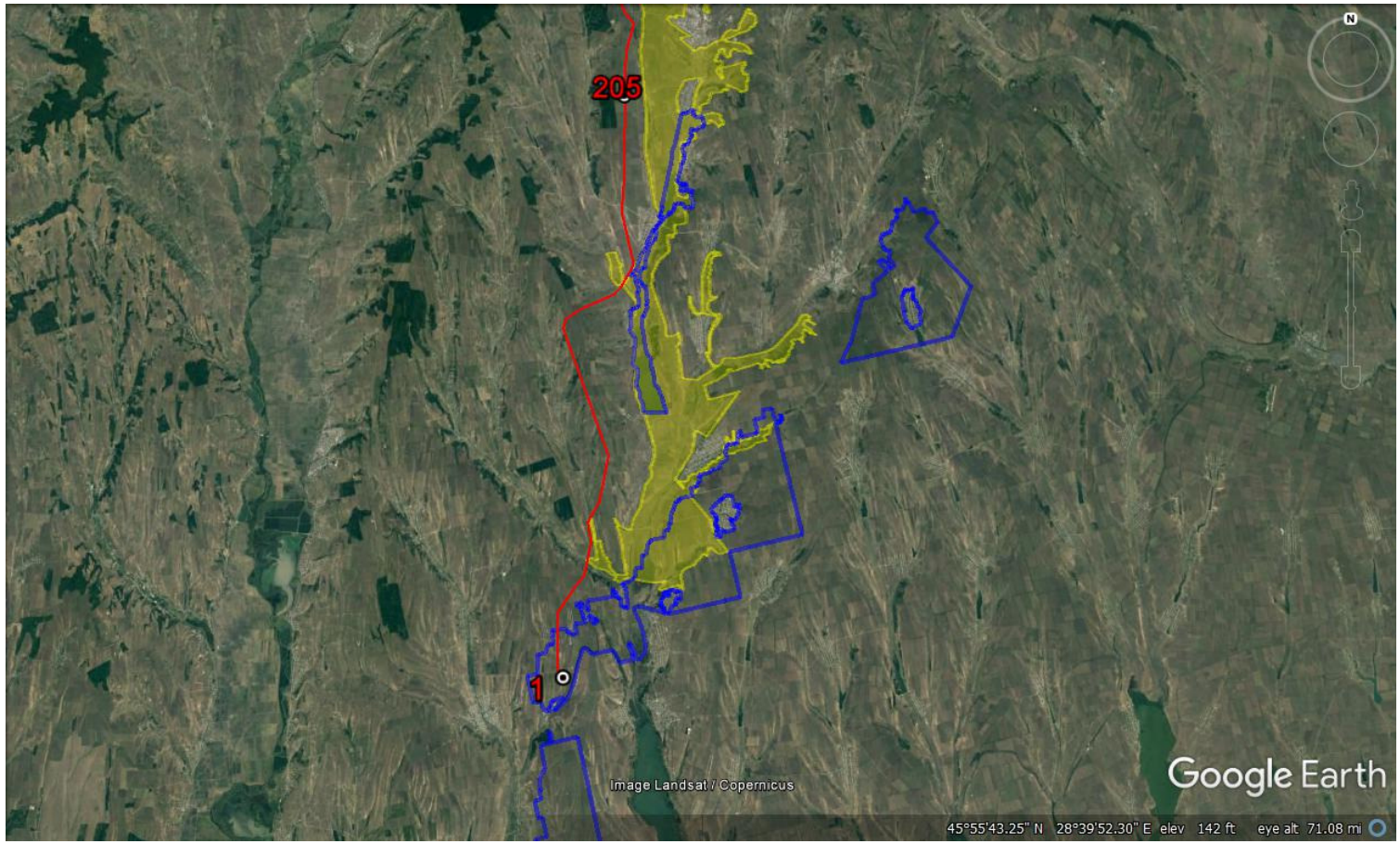
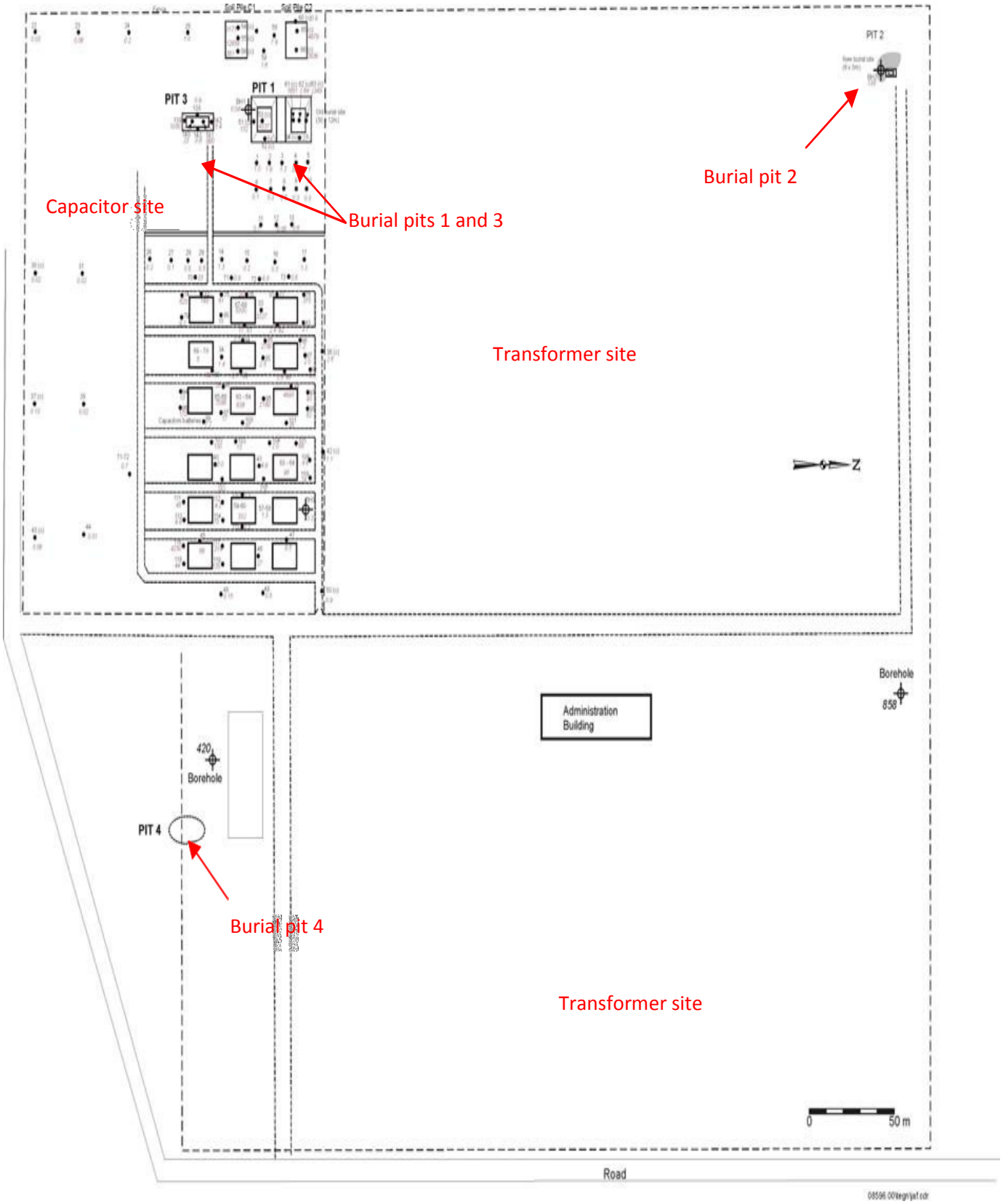


Fig.7. Concaz- Taraclia Lakes and Purcari-Etulia IBAs

ANNEX 10



Vulcanesti substation area with capacitors and burial pits

400/110/20 kV
Vulcanesti substation

Cofferdams_1

Cofferdams_2

Cofferdams_3

Acacia trees_Vulcanesti 1

Acacia trees_Vulcanesti 2

ANNEX 11

ALTERNATIVE SITE OF BACK-TO-BACK SUBSTATION

ALTERNATIVE SITE	LOCATION	CONNECTIONS FOR 400 KV ISACCEA AND VULCĂNEȘTI OHLS	ACCESS ROADS	LAND CHARACTERISTICS	CADASTRAL INFORMATION **	CONCLUSIONS (WITH FINANCIAL AND TIME IMPLICATIONS)
1	North of the Vulcănești SS, with access to M3	Additional OHL connections are required (1.4+0.9 km) including 9 additional pillars, which **intersect** with 400 kV MGRES and Chişinău OHL routes (or with the six 110 kV OHL routes, if the route would be on the east side of Vulcănești SS)	**Direct access** to the road M3 – E584	- the land has an estimated slope of **4.25%** * - the land does not include areas with eroded soils * - the estimated required area is 8.0 ha (320 x 250 m) ***	- BtB is located on a **land with no cadastral information** (could be public or private property), planted with **vineyards** (total estimated area = **30 ha**) - the new OHL pillars are located both on BtB land, planted with vineyards, and private property lands having cadastral numbers 9603303.190, 9603303.198, 9603303.171, 9603303.193, 9603303.196, 9603303.174, 9603303.177	***ADVANTAGES*** - direct access to M3 ***DISADVANTAGES*** - OHL connections intersect with 400 kV MGRES and Chişinău OHL routes - land planted with vineyards - for the BtB, 8 ha *** out of 30 ha have to be expropriated - land with no cadastral information
2	South of the Vulcănești SS, beyond the 750 kV OHL pillars, with access to M3	Additional OHL connections are required (0.4+1.1 km) including 9 additional pillars	**Direct access** to the road M3 – E584 The location overlaps partially over a local road and therefore this **road has to be rebuilt** on another location with an estimated length of 230 m (in fact the road is registered as agricultural land	- the land has an estimated slope of **5.25%** * - the land includes areas with **low eroded soils** * - the estimated required area is 8.0 ha (320 x 250 m) ***	- BtB is located on extra urban private property lands having cadastral numbers 9603304.024, 025, 066, 026, 027, 028, 068, 064, 033, 067, 032 and 031, with agricultural destination (total area = **16.9570 ha**) - the new OHL pillars are located on private property lands having cadastral numbers 9603303.177, 9603303.172, 9603304.089 (3 times), 9603305.038, 9603304.028, 9603303.175,	***ADVANTAGES*** - direct access to M3 ***DISADVANTAGES*** - BtB is located on numerous lands (cadastral numbers) - it overlaps partially over a local road which has to be rebuilt on another location - it overlaps partially over an area with low eroded soils - for the BtB, 8 ha *** out

ALTERNATIVE SITE	LOCATION	CONNECTIONS FOR 400 KV ISACCEA AND VULCĂNEȘTI OHLS	ACCESS ROADS	LAND CHARACTERISTICS	CADASTRAL INFORMATION **	CONCLUSIONS (WITH FINANCIAL AND TIME IMPLICATIONS)
			having cadastral numbers 9603304.068 and 064)		9603303.178	of 17 ha have to be expropriated
3	West of the Vulcănești SS, on a hill	Additional OHL connections are required (0.4+0.9 km) including 5 additional pillars	Access to the road M3 – E584 via a **local road which has to be updated** for heavy gauge, on an estimated length of 1100 m	- the land is roughly flat and has an estimated slope of **2.5%** * - the land does not include areas with eroded soils * - the estimated required area is 7.0 ha (280 x 250 m) ***	- BtB is located on extra urban private property lands having cadastral numbers 9603305.067, 068, 073, 072 and 071, with agricultural destination, although the last 3 seem to be pillar foundations (total area = **14.7876 ha**) - the access road has no cadastral information for 440 m, then it has number 9603303.219 for 230 m and number 9603303.220 for 440 m (total area = **0.8048 ha**) - the new OHL pillars are located on private property lands having cadastral numbers 9603303.177, 9603303.171, 9603303.166, 9603305.067, 9603303.176	***ADVANTAGES*** - optimal land slope of 2.5% ***DISADVANTAGES*** - BtB is located 1 km from the road M3 and the access road has to be updated (value 100,000 euros) - for the BtB, 7 ha *** out of 15 ha have to be expropriated and may be 0.8 ha for the road, too
4	South-west of the Vulcănești SS, to the Vulcăneşti town, with access to	Additional OHL **long** connections are required (2+2.4 km) including 15 additional pillars	A**ccess** to the road M3 – E584 via one to three road connections, with a total length of 100-250 m	- the land is roughly flat and has an estimated slope of **2.0%** * - the land does not include areas with eroded soils *	- BtB is located on extra urban private property lands having cadastral numbers 9603306.049, 055 and 048, planted with **vineyards** (049 and 048 have 'buildings' registered as 'vineyards')	***ADVANTAGES*** - land slope of 2.0% - BtB is located near the road M3 ***DISADVANTAGES*** - long OHL connections

ALTERNATIVE SITE	LOCATION	CONNECTIONS FOR 400 KV ISACCEA AND VULCĂNEȘTI OHLS	ACCESS ROADS	LAND CHARACTERISTICS	CADASTRAL INFORMATION **	CONCLUSIONS (WITH FINANCIAL AND TIME IMPLICATIONS)
	M3 NOTE: the BtB substation could be located on the same land, but rotated by 90 degrees			- the estimated required area is 7.25 ha (290 x 250 m) ***	(total area = **17.6405 ha**) - the access road has no cadastral information - the new OHL pillars are located on private property lands having cadastral numbers 9603303.177, 9603303.172, 9603304.089 (2 times), 9603305.040, 9603305.054, 9603305.053 (2 times), 9603306.047, 9603306.048 (de 2 times), 9603305.052, 9603305.033, 9603305.039, 9603303.178, partially planted with vineyards	- the access road has no cadastral information - land planted with vineyards - for the BtB, 7.25 ha *** out of 18 ha have to be expropriated

NOTE: * data according to 'geoportal.md' website, including some inconsistent overlay layers 'ortofoto', 'relief' and 'cadastru' in the roads and OHL pillars area

** data according to 'cadastru.md' website

*** the area necessary for site organization is not taken into account

Alternative BtB locations_cadaster

Alternative BtB locations_images

Alternative BtB locations_soil

ANNEX 12

Annex 12

Investigation Plan to determine soil and groundwater contamination on Vulcăneşti substation

1. INTRODUCTION

A historical contamination 40 years ago in 400/200/20 kV Vulcăneşti substation took place as the result of two successive explosions of capacitor batteries. This equipment contained oil with PCBs (Polychlorinated Biphenyls), persistent chemicals harmful to human health, fauna, flora and the environment.

In that time, approximately 1000 capacitors exploded in each incident and 4 pits were made inside the substation to bury the ones removed. An assessment of each pit shows contained up to 15-20 tons of material contaminated with PCBs, but it is not really known how many damaged capacitors were buried and if other contaminated places inside substation may be found.

In 2005 an investigation of soil contamination documented high levels of PCB in the top soil under or close to the places where the capacitors batteries were.

A feasibility study for cleanup activities of the contaminated soil at the Vulcănești substation was developed. The following cleanup criteria were used to propose the remedial actions:

- 50 ppm PCB for top soil with restricted access;
- 100 ppm for soil under a 50 cm “clean” soil cap;
- Unrestricted PCB levels, if isolated and contained by protective liners and a 50 - 100 cm soil cap.

As the results of the analysis made in the feasibility study the following cleanup activities were carried out in 2007:

- Removal of damaged capacitors stored in containers at the substation;
- Removal of all capacitors hanging in metal frames in the capacitor batteries;
- Excavation of the burial pits 1 and 2 and removal of all damaged capacitors (1,270 capacitors). The contaminated excavated soil is collected in two coffer dams with protective liner and soil cap.
- Excavation of burial pit 3 and 4 and removal of all damaged capacitors. The contaminated excavated soil is refilled in pit 4, but soil from pit 3 is stored openly with no protective cap.

The objective of the excavation was to remove all primary sources of future PCB contamination (the capacitors).

Annex 12

Investigation Plan to determine soil and groundwater contamination on Vulcăneşti substation

In 2010 the soil excavated around pit 3 and the soil (10 cm) under the capacitors frames was removed and placed in another 2 coffer dams in the same area as the first 2 cofferdams. These second 2 cofferdams were prepared with a bottom liner, a double top liner and a layer of clean soil. All 4 cofferdams are located at south-west limit of the substation and were secure with fence and indicators. The area of the cofferdams will not be disturbed in the current investigation or by the new BtB substation.

In the area where the capacitors frames were originally located, acacia trees were planted and now a small forest is found (**Annex 12**- *Investigated area Vulcanesti*).

2. SCOPE

The existing free area inside Vulcănești substation where the capacitor batteries were located is sufficient to build the new BTB, and is the most technically adequate to connect with both 400 kV transmission line Isaccea-Vulcănești and 400 kV cell of existing substation. It also means no new land will have to be acquired.

Further investigation is needed of the area, including the area where clean-up activities were taken 10 years ago, to ensure there are no risks to workers' health impact during BtB construction and further operation.

Therefore, it is necessary to determine the current level of soil contamination in the interest areas. This will allow decision on (a) if the area is safe for workers now and (b) if it is not, if it can be made safe for a reasonable investment.

During the fires after capacitor explosions, the high temperature may have caused the creation of dioxins. There has been no investigation to determine if dioxins are present.
.

An investigation to identify the values of PCB and dioxin in the area where the BtB substation can be build must be done to see if is safe like it is or if it can be made is safe by remediation.

If the remediation of the existing area is not feasible for technical or economic reasons, the BtB substation would have to be constructed on an alternative site.

3. METHODS TO INVESTIGATE

Annex 12

Investigation Plan to determine soil and groundwater contamination on Vulcăneşti substation

The Basel Convention has defined PCBs as any substances or material with a PCB concentration of above 50 ppm. Many countries have established different safe levels for soil and water, as shown in the table.

Representative Maximum PCB Limits in Soil and Drinking Water			
	ppm (mg/kg) in soil		*ppb (guy/kg)*
	Unrestricted/ sensitive land use (e.g., housing)	*Restricted access/no water (no direct contact)*	*Drinking water*
Moldova	0.06		1.0
Romania	0.01		
Sweden	0.02	7	
Germany	0.8	40	
Netherlands	1		
USA	1	100 (industrial, with cap)	
Various EU countries			0.01s (PCB) – 1 (sum of chrlorinated organics

In Vulcanesţi substation the first measurements (2005) of PCB in surface soil samples show soil concentration between 0.01 and 7,098 mg/kg. Subsurface soil has never been sampled. Water samples taken in July 2007 were below the Moldovan drinking water criteria of 1 µg/l, but still showed traces of PCBs. Only very low traces of PCB (less than 0.07µg/l) were found in the tap water supplied from the two deep wells located on the site.

Additional information is needed before a decision can be made whether this site is, or can be made, safe for workers at a new BtB substation. Specific questions include:

1. What concentrations of PCBs and dioxins in surface soil are considered safe for workers?
2. What are concentrations of PCBs and dioxins in surface soils and groundwater at the BtB location?
3. Are the concentrations in surface soil safe for workers?
4. Is the groundwater safe for drinking water at the substation?

5. Did PCBs infiltrate into the subsurface -- what concentrations are found at depths between 10cm and 1m?
6. If the risk to workers from exposure to soil is too high (that is, if it is not safe), can it be made safe If concentrations of PCBs and/or dioxins exceed the safe levels? Is it possible to (a) remove soil with unsafe levels (and if so, what locations and to what depth?), (b) cover the soil so there is no exposure (and if so, where and how deep to cover?), and (c)) prevent disturbance of the surface and exposure of unsafe soils by designing the construction process)?
7. If the risk to workers from drinking water from the boreholes, is there another source?

This investigation plan is intended to answer questions 2 and 5, and to provide information to use in future consideration of questions 1, 3, 4, 6, and 7. To answer question 2, soil samples will be collected from two areas, as shown on the figure **Annex 12**- *Investigated area Vulcăneşti*:

- *Area 1* the largest of 57,000 m^2, where the BtB is proposed to be located. ;
- *Area 2* with a surface of 300 m^2, where the tower for the connection between 400 kV OHL and 400 kV substation is proposed to be located.

In addition, groundwater samples will be collected from the two deep wells on the site.

A detailed investigation plan will require soil samples to be taken from the surface (0-10cm) and at depths up to one meter to determine if and where PCB oils may have penetrated into the ground, and how deep. Up to 110 samples will be collected from locations selected using the following criteria:

PCB concentration measured last time in 2007 (0.01-7,000 mg/kg);

- The location of the previous sampling points
- Some randomly selected locations
- At depth to determine soil layer contaminated.

Based on the previous measured PCB values, three areas were selected for sampling: :

- Sampling area **a** – previous PCB values 3,000-7,000 mg/kg (red colour);
- Sampling area **b** – previous PCB values 7.0-3,000 mg/kg (orange colour);
- Sampling area **c** - previous PCB values 0.01-7.0 mg/kg (yellow colour).

Annex 12

Investigation Plan to determine soil and groundwater contamination on Vulcăneşti substation

The three sampling areas (a, b and c) are delimited as is presented in figures **Annex 12**- *Area1 Vulcanesţi* and **Annex 12**- *Area1 Vulcanesţi*).

In those areas where concentrations of PCB were highest, it is likely that significant quantity of capacitors oil has drained into the soil, so the possibility of encountering contamination at depth is high. To determine how deep the PCB contamination has reached in these areas, samples will be collected follows:

- **Area a –** samples for PCB analysis from 10, 30, 50, 70, and 100 cm.
- **Area b –**samples for PCB analysis from 10, 30 and 50 cm.
- **Area c –** the chemical analysis of PCB will be done for a depth 10 cm.

In areas a and b, 10 surface soil samples will also be collected for dioxin analysis (specifically, policlorodibenzodioxin (PCDD) and policlorodibenzofurani (PCDF)) from the locations where previous PCB concentrations were highest, since this is likely where high temperatures from the explosions of capacitors occurred.

A detailed sampling and analysis plan will be prepared, and will describe, *inter alia*, sampling methods (equipment, volume, etc.), sampling and field preservation methods, sampling locations and rationales, sample preparation and shipping requirements, laboratory sample preparation, laboratory analytical methods (including desired detection limits, and data presentation. It is expected that methods of analysis for PCB in soil and groundwater will be SR EN ISO 6468:2000, respectively SR EN ISO 103822:2007, and dioxin in soil and ground water will be analysed using method EPA 8290A.

4. TIME AND BUDGET

The schedule is expected to take about 120 days until the data report is received from the laboratory, at which time questions 1, 3, 4, 6, and 7 can be answered.

- Contractor procurement: 30 days;
- Preparation and approval of sampling and analysis plan: 30 days;
- Collection of 110 samples for PCBs and 16 for dioxins: one week;
- PCB analysis: 30 days;
- Dioxin analysis: 15 days (at same time as PCB analysis);
- Preparation of laboratory report: 30 days.

The total budget is expected to be approximately 40,000 euros, most for laboratory analysis.

5. RESULTS AND CONCLUSION

The data would then be used to prepare a final report that answers the questions regarding safety – what levels are considered "safe" for a substation site? what remediation measures could make the site safe? How much would remediation cost, and is it technically and economically feasible?

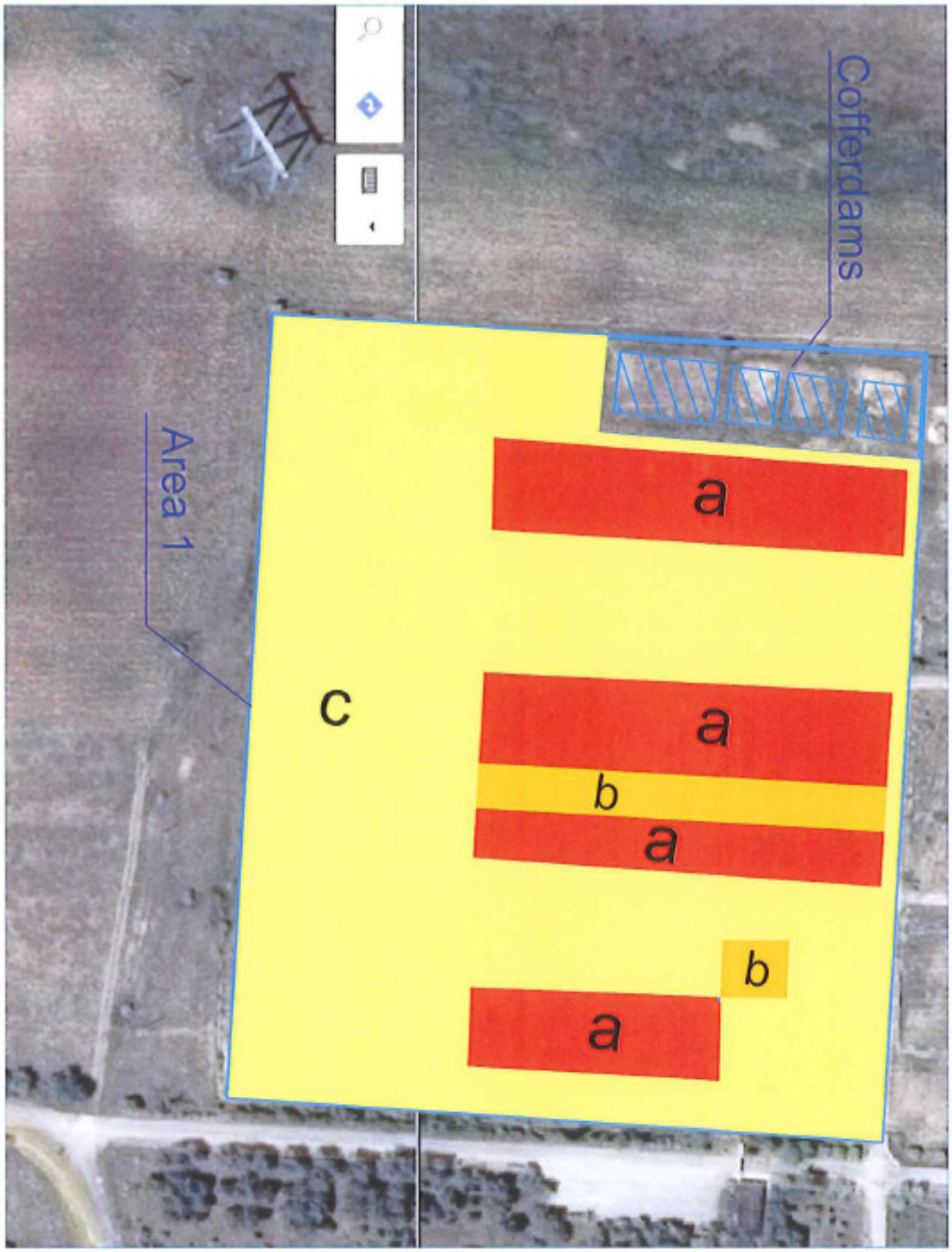
In summary, this feasibility study will reach a conclusion about whether the new BtB substation can be located at the current substation site, or at the alternative location identified in the ESIA. This final report would take another 90 days, including extensive consultations within Moldelectrica and with the Ministry of Environment and the Ministry of Labor, Social Protection and Family .

Annex 12

Investigation Plan to determine soil and groundwater contamination on Vulcăneşti substation

Annex 12

Investigation Plan to determine soil and groundwater contamination on Vulcăneşti substation



Sampling Area:

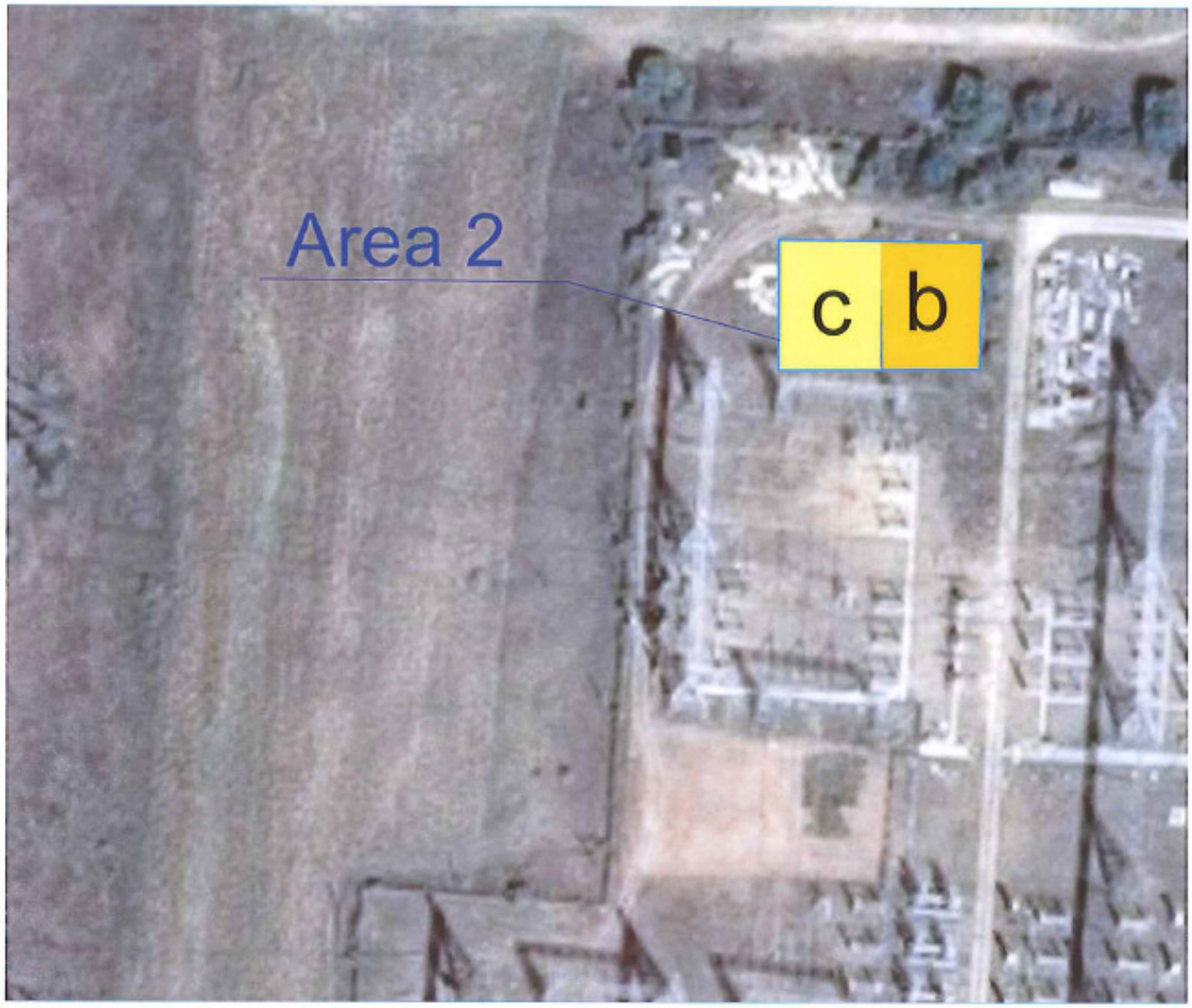
a 0÷100 cm

b 0÷50 cm

c 0÷10 cm

Annex 12

Investigation Plan to determine soil and groundwater contamination on Vulcăneşti substation



Sampling Area: b 0÷50 cm
c 0÷10 cm