Gas Interconnector
North Macedonia - Greece

CBA, Feasibility Study update, Environmental and Social Impact Assessment, Basic (detailed) Design and Tender Dossier

Environmental Impact Assessment Report

February, 2021

Technical Assistance to connectivity in the Western Balkans

EuropeAid/137850/IH/SER/MULTI

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MOTT MACDONALD CONNECTA CONSORTIUM

Issue and revision record

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	01/02/2021	Magdalena Trajkovska Trpevska Borka Stojkova Mitko Karadelev Naum Gapkovski	Yannis Stergiopoulos	Ole Johansen	Final Report

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Contents

List of Abbreviations

Abbreviation	Meaning
CARDS	Community Assistance for Reconstruction, Development and Stabilisation
CONNECTA	Technical Assistance to Connectivity in the Western Balkans
DESFA	Gas transmission system operator in Greece
EBRD	European Bank for Reconstruction and Development
EC	European Community
EEC	European Economic Community
EIB	European Investment Bank
EUNIS	European Nature Information System
hs	High sensitivity
IUCN	International Union for Conservation of Nature
ls	Low sensitivity
ms	Medium sensitivity
PECI	Projects of Energy Community Interest
PMI	Projects of Mutual Interest
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
vhs	Very high sensitivity
GDP	Gross Domestic Product
BOD	Biological Oxygen Demand
WMA	Water Management Area
VPR	Vardar Planning Region
MK	Republic of North Macedonia
MoEPP	Ministry of Environment and Physical Planning
Mott MacDonald-CONNECTA Consortium	The Consortium carrying out the present project
MMRS	Main Measuring Regulation Stations
SSO	State Statistical Office
EBRD	European Bank for Reconstruction and Development
EEC	European Economic Community
EC	European Community
EIB	European Investment Bank
ELEM	Macedonian Power Plants
EU	European Union
PA	Protected Area

Abbreviation	Meaning
IBA	Important Bird Area
IPA	Important Plant Area
IPPC	Integrated Pollution Prevention and Control
IFI	International Financial Institutions
SEPR	Southeast Planning Region
PUC	Public Utility Company
PE	Public Enterprise
PESR	Public Enterprise for State Roads

MOTT MACDONALD CONNECTA CONSORTIUM

Synopsis

project Title:	TA to Connectivity in the Western Balkans (CONNECTA)
project Number:	Europe Aid/137850/IH/SER/MULTI
Sub-project Title	Gas interconnector North Macedonia – Greece CBA, Feasibility Study update, Environmental and Social Impact Assessment, Basic (detailed) Design and Tender Dossier
Sub-project Number:	CONNECTA-ENE-INFR-MK-CBA+FS+ESIA+BD+TD-03
Contract number:	2016/382-382 plus 2018/402-907 – Addendum No 1
Contracting Authority:	European Commission, DG NEAR
Beneficiaries:	Albania, Bosnia and Herzegovina, North Macedonia, Montenegro, Serbia and Kosovo*
Region:	South Eastern Europe (SEE)
Contractor:	Mott MacDonald Romania Srl in Consortium with WYG SAVJETOVANJE d.o.o., COWI A/S, CeS COWI d.o.o. (renamed CESTRA d.o.o.), TRENECON Consulting & Planning Ltd and SYSTEMA Consulting SMLTD
Contract signed:	19 December 2016
Full Mobilisation of 3 KE:	20 January 2017 (date of Kick-off Meeting in Brussels)
project Duration:	72 months and 13 days (following Addendum No 1)
Anticipated completion:	31 December 2022 (following Addendum No 1)
Contractor's project Director:	Andrei Penescu is the project Director Dusan Savkovic is the Consortium's project Manager Report
project office:	Kneginje Zorke 2, 1st floor, 11000 Belgrade, Serbia
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* This designation is without prejudice to positions on status, and is in line with UNHCR 1244 and the ICJ Opinion on Kosovo declaration of independence

1 INTRODUCTION

Pursuant to the efforts of the Government of the Republic of North Macedonia related to the developmental construction of the National Gasification System in the country, i.e., the development of the existing gas infrastructure at the level of the entire country, a project was developed in terms of the construction of an interconnector gas pipeline between North Macedonia and Greece.

This project is supported by the European Investment Bank (EIB) and it will be implemented and operated respectively (each party in its segment, in North Macedonia and in Greece) by the operators National Energy Resources (NER – former MER) in our country and DESFA S.A– the gas transmission system operator in Greece.

The section of the gas pipeline which is in the Republic of North Macedonia starts at the border with Greece in the vicinity of Idomeni village and the town of Gevgelija, where the Greek part of the gas pipeline ends. The end point of this section will be at the already built valve station (block station BS 8), in the vicinity of the town of Negotino. This section is 67.194km long with a diameter of 700mm.

This section Gas Interconnector North Macedonia – Greece will become an integral part of the National Gasification System in the Republic of North Macedonia.

Pursuant to the Law on Environment and the Decree on determining projects and the criteria on the basis of which the need is established for implementing a procedure for an environmental impact assessment, this project titled Gas Interconnector North Macedonia - Greece is classified in Annex 1 – Projects that require a mandatory environmental impact assessment, item 13 – Pipelines for the transmission of gas, oil or chemicals with a diameter larger than 700mm and/or a length exceeding 40km, which requires the conducting of an EIA procedure and the development of a related Study.

The development of this EIA study has been carried out by a team of environmental and social experts (pursuant to Contract No. 0801-168 dated 23.05.2019 and No. 03-465/1 dated 23.05.2019). The expert responsible for the Environmental Impact Assessment of the project is:

- Ms. Magdalena Trajkovska Trpevska M.Sc., graduate chemical engineer.

The development of this Study was conducted by a multidisciplinary team of experts and professionals and it has been prepared in accordance with the Rulebook on the contents of the requirements which are to be met by an environmental impact assessment study (Official Gazette of the RM 33/2006), as well as pursuant to the EU legislation and the EIB policy on the environmental and social principles and standards.

The Administration of Environment within the Ministry of Environment and Physical Planning (MoEPP) is the Competent Authority for the conducting of the EIA procedure.

The Investor (NER JSC Skopje, state-owned joint stock company for performing energy activities) submitted a Letter of Intent regarding the execution of the project to the MoEPP, based upon which the Competent Authority adopted a Decision under which the need is established for an Environmental Impact Assessment, as well as the scope of the Environmental Impact Assessment Study (the Letter of Intent and the Decision have been enclosed with ANNEX 1).

1.1 Purpose of the EIA

The Law on Environment and the respective by-laws define the conditions for the conducting of an assessment of the potential environmental impacts from public and private projects which are likely to have a significant environmental impact.

Prior to issuing a consent regarding the commencement of certain types of projects in the Republic of North Macedonia, it is necessary to conduct a procedure for environmental impact assessment (EIA).

The subject of this environmental impact assessment are the projects which, as a result of their nature, scope or location of performance, could produce a significant environmental impact. The assessment is performed by means of defining, describing and assessing the impacts that the particular project has or could have in the course of its construction, operation and decommissioning in terms of: the people and the biodiversity, the soil, the water, the air, the natural resources, the climate, the historical and cultural heritage, as well as the interaction between these elements.

The purpose of this EIA process is to anticipate any potential adverse environmental impacts and to avoid or reduce any such adverse impacts, while balancing the environmental, economic and social aspects.

The purpose of the conducting of an EIA procedure is to verify whether the project is compliant with the environmental standards, i.e. the assessment needs to ensure that the project includes all the required environmental protection measures as the main prerequisite for obtaining consent for the implementation thereof.

2 ADMINISTRATIVE AND LEGAL FRAMEWORK

2.1 Administrative framework

The competent authority for the conducting of the EIA procedure is the Administration of Environment, which is a unit within the Ministry of Environment and Physical Planning.

The Department of Environment makes an assessment of any possible impacts from particular projects on the environment and it prescribes measures for protection against pollution, degradation and impact on the and particular environmental media and areas (protection from ozone layer depletion, prevention of offensive noise and vibration, protection against ionizing and non-ionizing radiation, protection against offensive odours and use and disposal of waste, as well as other types of environmental protection), it ensures the implementation of international conventions, the laws and regulations that pertain to the protection of natural resources, the protection of the air, the water, the soil and the environment, and it also performs laboratory analysis and researches of all environmental media and areas.

The Department of Environment is comprised of five divisions:

- Division for Environmental Impact Assessment
- Division for Soils
- Division for Protection against Noise
- Division for Documentation
- Division for Laboratory

According to the existing systematization of the Ministry of Environment and Physical Planning, the Division for Environmental Impact Assessment is in charge of assessing any possible impacts from particular projects on the environment and defining the measures for protection against pollution, degradation and impact on the particular environmental media and areas. The Division for Environmental Impact Assessment operates pursuant to the Law on Environment and the respective by-laws.

The competencies of this Division are as follows:

- Conduct environmental impact assessment procedures
- Organize public hearings for ensuring public participation in the decision-making related to environmental impact assessment
- Make an assessment of the impact of particular projects on the environmental areas and media with an assessment of the studies on environmental protection
- Prepare acts that arise from the environmental impact assessment procedure
- Implement international documents in the sphere of environmental impact assessment
- Participate in the drafting of laws and by-laws from an environmental perspective

2.2 Legal framework

Pursuant to the requirements of the Law on Environment and the respective by-laws, in the Republic of North Macedonia it is mandatory to conduct an environmental impact assessment of certain projects.

During the preparation of this Environmental Impact Assessment Study for the Gas Interconnector North Macedonia – Greece project, the following was taken into consideration: the national legislation, the international documents and conventions ratified by the Republic of North Macedonia, EU Directives and international standards relevant for the preparation of the Environmental and Social Impact Assessment Study of the project.

2.2.1 National legislation

- Law on Environment (Official Gazette of the Republic of North Macedonia No. 53/05, 81/05, 24/07, 159/08, 83/09, 48/10, 124/10, 51/11, 123/12, 93/13, 187/13, 42/14, 44/15, 129/15, 192/15, 39/16 and 99/18);
- Decree determining the projects for which and the criteria on the basis of which the need for an environmental impact assessment is established (Official Gazette of the Republic of North Macedonia no. 74/05, 109/09 and 164/12);
- Rulebook on the information contained in the notification of intent to undertake a project and the procedure for establishing the need for an environmental impact assessment (Official Gazette of the Republic of North Macedonia No. 33/06);
- Rulebook on the content of the announcement of the notification of intent to implement a project, the decision on the necessity of an environmental impact assessment, the study on project environmental impact assessment, the report on the adequacy of the study on environmental impact assessment, and of the decision for approval or rejection of the project implementation, as well as the manner of public consultation (Official Gazette of the Republic of North Macedonia No. 33/06);
- Rulebook on the content of the requirements that are to be met by the study on the environmental impact assessment (Official Gazette of the Republic of North Macedonia No. 33/06);
- Rulebook on the format, content, procedure and manner of developing a report on the adequacy of the study on environmental impact assessment and the procedure for the authorisation of persons from the list of experts in environmental impact assessment responsible for the preparation of the report (Official Gazette of the Republic of North Macedonia No. 33/06);
- Rulebook on the amount of the expenses covered by the investor for the implementation of the environmental impact assessment procedure (Official Gazette of the Republic of North Macedonia No. 116/09).

<u>Access to information related to the environment and public participation in the decision-making process regarding the environment:</u>

- Law on Environment (the chapter that pertains to transboundary EIA, information diffusion, public participation and access to justice) (Official Gazette No. 53/05, 81/05, 24/07, 159/08, 83/09, 124/10, 51/11);
- Espoo Convention ratified by the Republic of North Macedonia (Official Gazette No. 44/99);
- Aarhus Convention ratified by the Republic of North Macedonia (Official Gazette No. 40/99)

Air quality

- Law on Ambient Air Quality (Official Gazette of the Republic of North Macedonia No. 67/04, 92/07, 35/10, 47/11, 59/12, 100/12, 163/13, 10/15, 146/15);
- Law on the Ratification of the United Nations Framework Convention on Climate Change (Official Gazette of the Republic of North Macedonia No. 61/97);
- Law on the Ratification of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (Official Gazette of the Republic of North Macedonia No. 49/04);
- Decree on limit values of the levels and types of pollutants in ambient air and alert thresholds, deadlines for achieving the limit values, margins of tolerance for limit values, target values and long-term objectives (Official Gazette of the Republic of North Macedonia No. 50/05 and 4/13);
- Rulebook on quantities of limit values-maximum values of pollutant emissions in order to determine projections for a particular period of time related to the reduction in the quantities of pollutant emissions at an annual level (Official Gazette of the Republic of North Macedonia No. 2/10, 156/11 and 111/14);
- Rulebook on the methodology, manners, procedures, methods and means to measure emissions from stationary sources (Official Gazette of the Republic of North Macedonia No. 11/12);
- Rulebook on limit values for permissible emission levels and types of pollutants in waste gases and vapours emitted from stationary sources into the air (Official Gazette of the Republic of North Macedonia No. 141/10);
- Rulebook on the methodology of making an inventory and determining the level of emissions of pollutants into the atmosphere in tonnes per year for all types of activities, and other data regarding the submission of the European Monitoring and Evaluation Programme (EMEP) (Official Gazette of the Republic of North Macedonia No. 142/07);
- List of zones and agglomerations for ambient air quality (Official Gazette of the Republic of North Macedonia No. 23/09);
- Rulebook on the content and method of transmission of data and information on the conditions in the management of ambient air quality (Official Gazette of the Republic of North Macedonia No. 138/09, etc.

Water quality and management:

- Law on Waters (Official Gazette of the Republic of North Macedonia No. 87/08, 6/09, 161/09, 83/10, 51/11, 44/12, 23/13, 163/13, 180/14, 146/15, 52/16);
- Law on the Supply of Drinking Water and Disposal of Urban Wastewater (Official Gazette of the Republic of North Macedonia No. 68/04, 28/06, 103/08, 17/11, 18/11, 54/11, 163/13, 10/15, 147/15, 31/16);
- Law on Water Classification (Official Gazette of the Republic of North Macedonia No. 18/99);
- Decree on categorization of watercourses, lakes, reservoirs and groundwater (Official Gazette of the Republic of North Macedonia No. 18/99 and 71/99);
- Rulebook on the detailed requirements for the collection, disposal and treatment, the manner and conditions for the design, construction and exploitation of systems and plants for the purification of urban waste waters, as well as the technical standards, the parameters, the emission standards and the norms for the quality of pre-treatment, disposal and purification

of wastewaters, taking into account the load and the method of treatment of urban wastewaters discharged into areas sensitive to urban wastewater (Official Gazette of the Republic of North Macedonia No. 73/11);

- Rulebook on the detailed conditions, manner and maximum allowable concentrations of values and parameters of treated wastewater for re-use (Official Gazette of the Republic of North Macedonia No. 73/11);
- Rulebook on the conditions, manner and emission limit values for discharges of wastewater after their treatment, the method of their calculation, taking into account the specific requirements for the protection of the buffer zones (Official Gazette of the Republic of North Macedonia No. 81/11);
- Rulebook on the methodology, the reference measurement methods, the manner and the parameters for the monitoring of wastewater, including sewage sludge from the treatment of urban wastewater (Official Gazette of the RM No. 108/11);
- Rulebook on hazardous and harmful substances and the standards for their emissions that can be discharged into the sewer or drainage system, in surface or underground water bodies as well as coastal lands and wetlands (Official Gazette of the RM No. 108/11);
- Rulebook on the manner of transmission of information from the monitoring of wastewater discharged, and the format and content of the data submission form (Official Gazette of RM No. 108/11);
- Rulebook on the form and content of an application based on the non-issuance of a permit or a failure to adopt a decision rejecting the application for a permit to discharge (Official Gazette of the Republic of North Macedonia No. 129/11);
- Rulebook on the criteria for determining the areas vulnerable to discharges of urban wastewater (Official Gazette of the Republic of North Macedonia No. 130/11).

Waste management

- Law on Waste Management (Official Gazette of the Republic of North Macedonia No. 68/04, 71/04, 107/07, 102/08, 134/08, 124/10, 51/11, 123/12, 147/13, 163/13, 27/14, 51/15, 146/15, 156/15, 192/15, 39/16, 63/16);
- Law on the Ratification of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Official Gazette of the Republic of North Macedonia No. 48/97, 49/04);
- Law on the Management of Electrical and Electronic Equipment and Waste from Electrical and Electronic Equipment (Official Gazette of the Republic of North Macedonia No. 6/12, 163/13, 146/15, 39/16);
- Law on Management of Batteries and Accumulators and Waste from Batteries and Accumulators (Official Gazette of the Republic of North Macedonia No. 140/10, 47/11, 148/11, 39/12, 163/13, 146/15, 39/16);
- Law on Management of Packaging and Waste Packaging (Official Gazette of the Republic of North Macedonia No. 161/09, 17/11, 47/11, 136/11, 6/12, 39/12, 163/13, 146/15, 39/16);
- List of types of waste (Official Gazette of the Republic of North Macedonia No. 100/05);
- Rulebook on the common rules for handling municipal and other non-hazardous types of waste (Official Gazette of the Republic of North Macedonia No. 147/07);

- Rulebook on the form and content of the application for obtaining a permit for processing, treatment and/or storage of waste, the form and content of the permit and the minimum technical requirements for the activity of processing, treatment and/or storage of waste (Official Gazette of the Republic of North Macedonia No. 76/07, 122/08, 126/12 and 9/13);
- Rulebook on the form and content of the permit, the application and the register of issued permits for trade in non-hazardous waste, the manner of keeping records and the conditions on the manner of conducting trade activity with non-hazardous waste (Official Gazette of the Republic of North Macedonia No. 115/07, 55/12 and 41/13);
- Rulebook on the form and content of an application based on non-issuance of a permit or a failure to adopt a decision rejecting the application for a permit to collect and transport municipal and other types of non-hazardous waste (Official Gazette of the Republic of North Macedonia No. 146/11);
- Rulebook on the form and the requirements for waste storage, as well as the requirements that are to be met by the locations at which waste storage is performed (Official Gazette of the Republic of North Macedonia No. 29/07);
- Rulebook on the form and the content of the record-keeping related to waste management, the form and the content of the forms for the identification and transport of waste and the content of the forms for annual reports on waste management (Official Gazette of the Republic of North Macedonia No. 7/06, 68/14);
- Rulebook on the detailed conditions for hazardous waste management and the manner of packaging and marking hazardous waste (Official Gazette of the Republic of North Macedonia No. 15/08);
- Rulebook on the form and the content of the permit for hazardous waste collection and transport (Official Gazette of the Republic of North Macedonia No. 118/10);
- Rulebook on the manner of waste tire management, as well as the requirements to be met by legal entities and natural persons that import used tires (Official Gazette of the Republic of North Macedonia No. 108/09);
- Rulebook on the procedures and the manner of collecting, transporting, processing, storing, treatment and disposal of waste oils, the method of record-keeping and data submission (Official Gazette of the Republic of North Macedonia No. 156/07 and 109/14);
- Rulebook on the content and the manner of keeping, storing and maintaining records in the waste register (Official Gazette of the Republic of North Macedonia No. 39/09);
- Rulebook on the manner and the requirements for the operation of the integrated waste disposal network (Official Gazette of the Republic of North Macedonia No. 7/06);
- Rulebook on the amount of biodegradable components in the waste that may be deposited (Official Gazette of the Republic of North Macedonia No. 108/09 and 142/09);
- Rulebook on the waste acceptance criteria for the depots in terms of each class, the preparatory waste acceptance procedures, the general procedures for testing, sampling and waste acceptance (Official Gazette of the Republic of North Macedonia No. 8/08);
- National Waste Management Strategy (2008- 2020);
- National Waste Management Plan (2009-2015), etc.

Noise

- Law on Protection against Environmental Noise (Official Gazette of the Republic of North Macedonia No. 79/07, 124/10, 47/11, 163/13, 146/15);
- Rulebook on the application of noise indicators, additional noise indicators, the method of measuring the noise and assessment methods with indicators for environmental noise (Official Gazette of the Republic of North Macedonia No. 107/08);
- Rulebook on limit values of the environmental noise level (Official Gazette of the Republic of North Macedonia No. 147/08);
- Rulebook on the detailed requirements for the necessary equipment which is to be possessed by authorized scientific professional organizations and institutions, as well as other legal entities and individuals in order to perform professional activities for noise monitoring (Official Gazette of the Republic of North Macedonia No. 152/08);
- Rulebook on specific types of noise sources and the requirements which are to be met by the plants, equipment, installations and devices used outdoors in terms of the emitted noise and the noise protection standards (Official Gazette of the Republic of North Macedonia No. 142/13);
- Rulebook on the locations of the monitoring stations and monitoring points (Official Gazette of the Republic of North Macedonia No. 120/08);
- Decision on determining in which cases and under what conditions the peace of citizens is deemed to have been disturbed by offensive noise (Official Gazette of the Republic of North Macedonia No. 1/09, 38/13).

Nature

- Law on Nature Protection (Official Gazette of the Republic of North Macedonia No. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/13, 163/13, 27/14, 41/14, 146/15, 39/16, 63/16);
- Law on the Ratification of the Bonn Convention on the Conservation of Migratory Species of Wild Animals (Official Gazette of the Republic of North Macedonia No. 38/99);
- Law on the Ratification of the Bern Convention on the Conservation of European Wildlife and Natural Habitats (Official Gazette of the Republic of North Macedonia No. 49/97);
- Law on the Ratification of the London Agreement on the Conservation of Populations of European Bats (Official Gazette of the Republic of North Macedonia No. 38/99);
- Decree on the Ratification of the Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat (Official Gazette of the Republic of North Macedonia No. 9/77).
- Law on Forests (Official Gazette of the Republic of North Macedonia No. 64/09, 24/11, 53/11, 25/13, 79/13, 147/13, 43/14, 160/14, 33/15, 44/15, 147/15, 07/16 and 39/16)
- Law on the Protection and Welfare of Animals (Official Gazette of the Republic of North Macedonia No. 113/07, 136/11, 149/14, 149/15, 53/16)
- Law on the Protection of Plants (Official Gazette of the Republic of North Macedonia No. 25/98, 6/00).

Social aspects, occupational health and safety

- Law on Social Protection (Official Gazette of the Republic of North Macedonia No. 79/09, 36/11, 51/11, 166/12, 15/13, 79/13, 164/13, 187/13, 38/14, 44/14, 116/14, 180/14, 33/15, 72/15, 104/15 and 150/15);
- Labour Law (Official Gazette of the Republic of North Macedonia No. 62/05, 106/08, 161/08, 114/09, 130/09, 50/10, 52/10, 124/10, 47/11, 11/12, 39/12, 13/13, 25/13, 170/13, 187/13, 113/14, 20/15, 33/15, 72/15, 129/15, 27/16);
- Law on Expropriation (Official Gazette of the Republic of North Macedonia No. 95/12, 131/12, 24/13, 27/14, 104/15, 192/15, 23/16, 178/16);
- Law on Health Protection (Official Gazette of the Republic of North Macedonia No. 43/12, 145/12, 87/13, 164/13, 39/14, 43/14, 132/14, 188/14, 10/15, 61/15, 154/15, 192/15, 17/16, 37/16, 93/17);
- Law on Health and Safety at Work (Official Gazette of the Republic of North Macedonia No. 92/07, 136/11, 23/13, 25/13, 137/13, 164/13, 158/14, 15/15, 129/15, 30/16);
- Rulebook on the minimum requirements for occupational health and safety at the working place (Official Gazette of the Republic of North Macedonia No. 154/2008);
- Rulebook on the personal protective equipment used by the employees at work (Official Gazette of the Republic of North Macedonia No. 116/07);
- Rulebook on occupational health and safety for workers exposed to the risk of noise at work (Official Gazette of the Republic of North Macedonia No. 21/08);
- Rulebook on the manner of preparing a safety statement, its contents, as well as the data on which the risk assessment is to be based (Official Gazette of the Republic of North Macedonia No. 2/09);
- Rulebook on the personal protective equipment used by the employees at work (Official Gazette of the Republic of North Macedonia No. 116/07);
- Rulebook on health and safety while using working equipment (Official Gazette of the Republic of North Macedonia No. 116/07);
- Rulebook on the minimum requirements for the health and safety of the workers at the workplace (Official Gazette of the Republic of North Macedonia No. 154/08);
- Rulebook on the minimum health and safety requirements for working at temporary and mobile construction sites (Official Gazette of the Republic of North Macedonia No. 105/08);
- Rulebook on the form and the content of the form for the notice regarding the commencement of the performance of an activity (Official Gazette of the Republic of North Macedonia No. 136/07);
- Rulebook on occupational health and safety for workers exposed to the risk of mechanical vibration (Official Gazette of the Republic of North Macedonia No. 26/08);
- Rulebook on occupational health and safety signs (Official Gazette of the Republic of North Macedonia No. 127/07);
- Rulebook on occupational safety and health for manual handling of loads (Official Gazette of the Republic of North Macedonia No. 135/07).

Cultural heritage

- Law on the Protection of Cultural Heritage (Official Gazette of the Republic of North Macedonia No. 20/04, 71/04, 115/07, 18/11, 148/11, 23/13, 137/13, 164/13, 38/14, 44/14, 199/14, 104/15, 154/15, 192/15, 39/16, 11/18);
- Law on the Ratification of the Council of Europe Framework Convention on the Value of Cultural Heritage for Society (Official Gazette of the Republic of North Macedonia No. 25/11);
- Law on the Ratification of the Convention for the Safeguarding of the Intangible Cultural Heritage (Official Gazette of the Republic of North Macedonia No. 59/06).

Other national legislation relevant for the project:

- Law on Construction (Official Gazette of the Republic of North Macedonia No. 130/09, 124/10, 18/11, 36/11, 54/11, 13/12, 144/12, 25/13, 79/13, 137/13, 163/13, 27/14, 28/14, 42/14, 115/14, 149/14, 187/14, 44/15, 129/15, 217/15, 226/15, 30/16, 31/16, 39/16, 71/16, 132/16, 35/18, 64/18 and 168/18);
- Law on Spatial and Urban Planning (Official Gazette of the Republic of North Macedonia No. 51/05, 137/07, 24/08, 91/09, 124/10, 18/11, 53/11, 60/11, 199/14, 44/15, 193/15, 31/16, 163/16, 64/18 and 168/18);
- Energy Law (Official Gazette of the Republic of North Macedonia No. 16/11, 136/11, 79/13, 164/13, 41/14, 151/14, 33/15, 192/15 and 06/16);
- Law on Local Self-Government (Official Gazette of the Republic of North Macedonia No. 5/02);
- Law on Expropriation (Official Gazette of the Republic of North Macedonia No. 33/95, 20/98, 40/99, 31/03, 46/05, 10/08, 106/08, 156/10 and 06/12);
- Law on Agricultural Land (Official Gazette of the Republic of North Macedonia No. 135/07, 18/11, 42/11, 148/11, 95/12, 79/13, 87/13, 106/13, 164/13, 39/14, 130/14, 166/14, 72/15, 98/15, 154/15, 215/15, 07/16 and 39/16);
- Law on Construction Land (Official Gazette of the Republic of North Macedonia No. 17/11, 53/11, 15/15, 44/15, 98/15, 193/15, 226/15, 30/16 and 31/16);
- Spatial Plan of the Republic of North Macedonia for 2002-2020;
- Law on Fire Fighting (Official Gazette of the Republic of North Macedonia No. 67/04, 81/07, 55/13, 158/14, 193/15 and 39/16);
- Law on Protection and Rescue (Official Gazette of the Republic of North Macedonia No. 36/04, 49/04, 86/08, 124/10, 18/11);
- Rulebook on the technical norms for the fire extinguisher hydrant network (Official Gazette of the Republic of North Macedonia No. 31/06);
- Law on Crisis Management (Official Gazette of the Republic of North Macedonia No. 36/11, 29/05);
- Law on the Protection against Ionizing Radiation and Radiation Safety (Official Gazette of the Republic of North Macedonia No. 48/02, 135/07, 154/10, 53/11, 164/13, 43/14, 149/15, 37/16).

Technical national regulations on the construction of gas pipelines

- Network Rules for Natural Gas Transmission (Official Gazette of the Republic of North Macedonia No. 45/2009)
- Rulebook on the technical conditions and norms for safe transport of liquid and gaseous hydrocarbons by means of main oil and gas pipelines and international oil and gas pipelines (Official Gazette of SFRY No. 26/85 and Official Gazette of the Republic of North Macedonia No. 18/97);
- Decision on the technical conditions and norms for the construction of distribution gas pipeline systems in the Republic of North Macedonia (Official Gazette of the Republic of North Macedonia No. 45/90);
- Rulebook on the manner and the conditions for regulating the prices for natural gas transmission, distribution and supply (Official Gazette of the Republic of North Macedonia No. 94/05);
- Natural Gas Transmission Tariff System (Official Gazette of the Republic of North Macedonia No. 94/05);
- Decision on defining the general conditions for natural gas delivery (Official Gazette of the Republic of North Macedonia No. 36/99).

Plans and strategic documents at a national level relevant for the project:

- Sustainable Development
    - National Strategy for Regional Development of the Republic of North Macedonia 2009 – 2019;
    - National Strategy for Sustainable Development in the Republic of North Macedonia 2009- 2030, adopted in 2010 by the Government of MK;
    - Plan for the institutional development of national and local environmental management capacities 2009 – 2014, approved by the Government of the MK in February 2009.
- Communication and public awareness
    - Environmental Communication Strategy, adopted in 2004 by the MoEPP;
    - Environmental Public Awareness Strategy, adopted in 2004 by the MoEPP;
    - Strategy for Environmental Data Management, adopted in 2004 by the MoEPP.
- Climate change
    - National Environment and Climate Change Strategy (2014-2020);
    - Third National Plan on Climate Change (2013).
- Social policy
    - ESRP 2020 – Employment and Social Reform Program;
    - National strategy for reduction of poverty and social exclusion in the Republic of North Macedonia (revised 2010-2020);
    - National action plan for the implementation of the Law on the Prevention and Protection against Discrimination 2015 – 2020;
    - National strategy for equality and non-discrimination 2016-2020;
    - Strategy for gender equality 2013-2020;
    - Istanbul Convention on action against violence against women and domestic violence.

2.2.2 International agreements and conventions relevant for the project

In the process of transposition of the EU acquis communautaire into the national legal and political framework, the Republic of North Macedonia has ratified numerous international agreements and conventions. The following international conventions ratified by the Republic of North Macedonia have been taken into consideration during the preparation of this ESIA:

- Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters: UNECE (Aarhus, Denmark, 1998) (Official Gazette of the Republic of North Macedonia No. 40/99);
- Espoo Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, Finland, 1991) (Official Gazette of the Republic of North Macedonia No. 44/99);
- United Nations Framework Convention on Climate Change (New York, 1992) (Official Gazette of the Republic of North Macedonia No. 61/97);
- Convention on Biological Diversity (United Nations, 1992) (Official Gazette of the Republic of North Macedonia No. 54/97);
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn, 1979) (Official Gazette of the Republic of North Macedonia No. 38/99);
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1972) (Official Gazette of the Republic of North Macedonia No. 49/97);
- Species of fungi protected with the European Red List of Fungi (1978);
- Species of fungi proposed for protection by the European Council for the Conservation of Fungi (33 species of fungi according to the Bern Convention, 2003);
- The UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (November, 1972), ratified in 1974;
- Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat (February, 1071);
- Convention on Long-Range Transboundary Air Pollution (Geneva, 1979) (Official Gazette of SFRY No. 11/86), taken over by the Republic of North Macedonia by way of succession on 17.11.1991;
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Official Gazette of the Republic of North Macedonia No. 49/97);
- Conventions of the International Labour Organization (ILO): North Macedonia has ratified numerous ILO conventions.

2.2.3 EU Directives relevant for the ESIA

- Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment;
- Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe;
- Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC,

86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council;

- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives (Waste Framework Directive);
- Directive 2006/11/EC of the European Parliament and of the Council of 15 February 2006 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community;
- Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration;
- Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC;
- Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise;
- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora;
- Directive 2009/147/EC on the conservation of wild birds;
- Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work;
- Directive 2003/35/EC of the European Parliament and of the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice as per Council Directives 85/337/EEC and 96/61/EC and;
- EEC Birds and Habitats Directive. Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds and Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

2.2.4 EU Legislation and EIB Policy regarding the environmental and social principles and standards

EIB's Principles and Standards on environmental and social protection are based on the EU approach on environmental sustainability defined in the EU's EIA Directive. EIA Directive 85/337/EEC and its three amendments have been codified with Directive 2011/92/EU as of 13 December 2011. The EIA Directive defines the requirements for the assessment of potential effects on the environment by some public and private projects that are expected to have a significant impact on the environment. EIA is conducted prior the issuance of a construction permit and an approval for the implementation of the project. Environmental impact may refer to impact on human beings and biological diversity, soil, water, air and other natural resources and climate, historical and cultural heritage, as well as the interaction among these elements. The EIA process is aimed at anticipating the potential risks and avoiding or mitigating any potential damages, while concurrently balancing the social and economic objectives with the environmental protection objectives.

The EIB Environmental and Social Policy requires from all projects, regardless of the location, to be compliant with the process and the contents of the EU EIA Directive requirements. This is reflected in the foundations and the objectives of the Corporate Operational Plan with a view to environmental and social protection.

For all projects supported by the EIB, the Bank requires for the criteria to be meet through addressing the following:

1. Assessment and management of environmental and social impacts and risks;
2. Pollution prevention and abatement;
3. Biodiversity and ecosystems;
4. EIB climate-related standards;
5. Cultural heritage;
6. Involuntary resettlement;
7. Rights and interests of vulnerable groups;
8. Labour standards;
9. Community and occupational health, safety and security;
10. Stakeholder engagement.

EIB uses a large number of basic environmental and social protection measures that reflect good international practices. For all the projects, EIB requires the following:

- Application of European environmental standards, such as compliance with the EU environmental principles, standards and practices, if it is practical and feasible in particular regions;
- Compliance with the EU legislation on the environment and on environmental assessment, as defined in EIB;
- Using references from the EU Directives on environmental protection;
- Compliance with the international conventions and agreements ratified by the EU;
- Compliance with the EU legislation pertaining to the social aspects, as defined in the EIB EU-related Reference Guidelines, the Social Rulebook as well as through the EIB Social Handbook;
- Application of the best available techniques, as appropriate;
- Application of good environmental management practices during the implementation and operation of the project and;
- Compliance with other specific good international practices related to the environment and social aspects.

Directive 2003/4/EC of the European Parliament and of the Council on public access to environmental information is aimed at ensuring that the environmental information is systematically available and distributed in the public. Such information, inter alia, also includes information on the environmental impact studies and risk assessments. This Directive is closely connected to the UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters - Aarhus Convention (Aarhus, Denmark, 1998), which ensures public access to information, right to participation in environment-related decision-making and access to justice.

It may be concluded that the environmental and social impact assessment constitutes a part of the evaluation and monitoring process undertaken by the Bank. The EIB Environmental and Social Policy requires from all projects, regardless of the location, to be compliant with the process and the contents of the EU EIA Directive requirements.

Pursuant to the EIB Standards, the projects are initially categorized in the following four (4) groups:

- A – minimum or no negative impact – low risk;
- B – the environmental and social impacts can be easily identified and mitigated and/or measures for their abatement can be established – moderate risk;
- C – there are numerous significant, adverse and/or long-term environmental and social impacts, the magnitude of which is difficult to establish in the screening phase – high risk;
- D – unacceptable as per the EIB Policy.

Pursuant to the EIB Environmental and Social Practices Handbook, the project has been initially categorized in the B category, which means that "the environmental and social impacts can be easily identified and mitigated and/or measures for their abatement can be established – moderate risk".

Pursuant to the national framework relevant for the project, a comprehensive environmental and/or social assessment is to be conducted. The competent authority determines the need for EIA according to the specified criteria (Annex II of the Directive, with reference to Annex III) and, as described above, pursuant to the national legislation, an environmental impact assessment is compulsory.

2.2.5 EBRD's Environmental and Social Policy and Performance Requirements (PR)

By means of such environmental and social evaluation and monitoring processes, EBRD strives to ensure funding for projects which:

- are socially and environmentally sustainable;
- respect the rights of affected workers and communities; and
- have been designed and managed in accordance with the applicable regulatory requirements and good international practices.

For the purposes of ensuring successful practical results, EBRD has adopted a comprehensive set of specific performance requirements (PR) which the clients are expected to comply with, comprising key environmental and social impact areas. The EBRD Environmental and Social Policy (the Policy) and the mandatory performance requirements (PR) specify the commitments of the Bank to promote, within its entire range of activities, a healthy environment and sustainable development.

EBRD categorizes the proposed projects as A, B or C, based upon the environmental and social criteria.

- A category A project denotes a significant environmental and social impact, including both direct and cumulative impacts, which are new and additional and, during the categorization, they cannot be easily identified or assessed;
- A category B project denotes that the environmental and social impacts typical for the location can be easily identified and effective mitigation measures can be addressed; and
- A category C project denotes a minimum or no adverse environmental and social impact.

These criteria:

- reflect the level of potential environmental and social impacts related to the proposed project and;
- define the nature and the level of environmental and social research, require public information availability and the need for stakeholder engagement in each project, having regard to the nature, the location, the sensitivity and the scope of the project, as well as the nature and magnitude of any possible environmental and social impacts from the project.

Pursuant to Annex 2, item 7, of the EBRD Environmental and Social Policy, it is stipulated that pipelines with a diameter exceeding 800 mm and a length of more than 40 km constitute A category projects. The Gas Interconnector North Macedonia - Greece project envisages a diameter of 700 mm and a length of 67 km, i.e. it has a smaller diameter than the one defined in Annex 2. This project is categorized in B category, according to the EBRD criteria, i.e. the potential environmental and social impacts from the project are typical for the location and can be easily identified and effective mitigation measures can be addressed.

In principle, an EBRD funded project is to be compliant with the Bank's Performance Requirements (PR):

- PR 1 - Assessment and Management of Environmental and Social Impacts and Issues;
- PR 2 – Labour and Working Conditions;
- PR 3 - Resource Efficiency and Pollution Prevention and Control;
- PR 4 - Health and Safety;
- PR 5 - Land Acquisition, Involuntary Resettlement and Economic Displacement;
- PR 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- PR 7 – Indigenous Peoples (inapplicable to this project);
- PR 8 - Cultural Heritage;
- PR 9 – Financial Intermediaries (inapplicable to this project);
- PR 10 - Information Disclosure and Stakeholder Engagement.

2.2.6 Equator Principles

The Equator Principles constitute a benchmark for the financial institutions in terms of determining, assessing and managing the social and environmental risks in terms of project funding. Projects need to conform to the Principles:

- Principle 1: Review and Categorisation;
- Principle 2: Environmental and Social Assessment;
- Principle 3: Applicable Environmental and Social Standards;
- Principle 4: Environmental and Social Management System and Equator Principles Action Plan;
- Principle 5: Stakeholder Engagement;
- Principle 6: Grievance Mechanism;
- Principle 7: Independent Review;
- Principle 8: Covenants;
- Principle 9: Independent Monitoring and Reporting;
- Principle 10: Reporting and Transparency.

2.3 An overview of the EIA procedure and public participation

2.3.1 Legal procedure for environmental impact assessment of projects

The request for drafting up an Environmental Impact Assessment for certain projects in the Republic of North Macedonia is in accordance with Articles 76-94 of the Law on Environment. A 'project' denotes a developmental document in which the final solutions for the use of natural and man-made resources are analysed and defined, including also those pertaining to the use of mineral raw materials, and also the construction of facilities and installations is regulated, including the performance of other activities that have an impact on the environment, the landscape and human health.

The type of projects that require the preparation of an EIA has been defined pursuant to Article 77 of the Law on Environment and they have been specified by the Government of the Republic of North Macedonia in the Decree determining the projects for which and the criteria on the basis of which the screening for an environmental impact assessment shall be carried out.

This Decree defines two categories of projects:

- Projects which compulsorily require the conducting of an environmental impact assessment procedure prior to the issuance of a decision on the implementation of the project (defined in Annex1 to the Decree) and
- Generally defined projects, which could have a significant environmental impact due to which a need is established for conducting an environmental impact assessment procedure prior to the issuance of a decision on the implementation of the project (defined in Annex 2 of the Decree).

The Gas Interconnector North Macedonia - Greece project belongs to the first group, i.e., projects defined in Annex 1 to the Decree – item 13 – Pipelines for the transmission of gas, oil or chemicals with a diameter larger than 700 mm and/or length of more than 40 km, for which it is mandatory to conduct an environmental impact assessment, since its length is 67km+193m, which means that it is congruent with the second part of Annex 1 to the Decree – item 13.

The EIA procedure is composed of several steps or phases, such as: notice of the intent to implement the project, screening process, scoping (contents), assessment and evaluation of any direct and indirect environmental impacts as a result of the implementation or non-implementation of the project. The project's environmental impact is assessed according to the environmental condition in the affected area at the moment when the notice of the intent to implement the project is submitted.

In the course of the environmental impact assessment, the following elements are taken into consideration:

- Preparation, performance, implementation and decommissioning of the execution of the project, including also the results and the effects from the decommissioning of the project;
- Elimination of any pollutants and reinstatement of the affected area into the original condition, if such an obligation has been stipulated with special regulations;
- Regular operation of the projects, as well as the hazards arising from the possibility of accidents.

The phases of the conducting of an EIA procedure are presented in the flowchart in Figure 2-1.

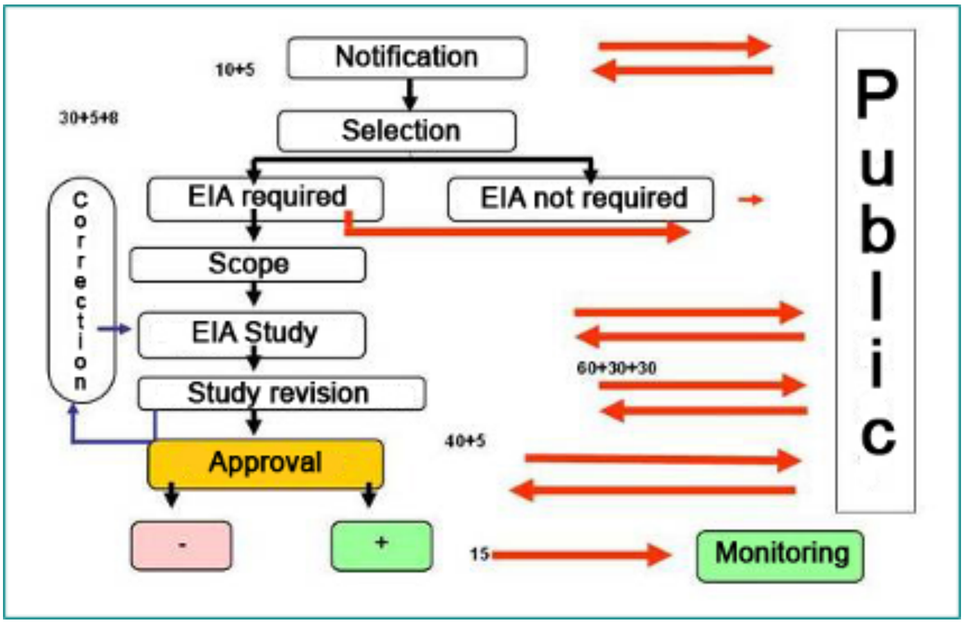


Figure 2-1: EIA procedure

<u>Projects subject to EIA</u>

By means of the environmental impact assessment of the project, the following aspects have been covered:

- Determining the need for an EIA;
- EIA scope;
- Establishing the adequacy and approving the EIA study, including also a public opinion;
- Announcement.

The EIA study comprises data/information pertaining to the current status, identification of the impacts, as well as a comparative assessment of the impacts as a result of several project alternatives. The EIA is conducted by authorized experts, pursuant to the defined methodology, notice structure and required documents. Public participation is mandatory throughout the entire process, as per the Law on Environment.

The investor that intends to implement a project which is likely to be referred to in Articles 77 and 78 of the Law on Environment, shall be obliged to submit to the MoEPP a **notice of the intent to implement the project**, as well as the opinion thereof on the need to conduct an environmental impact assessment. The MoEPP shall notify the Investor within ten days as of the receipt of the notice regarding any need to supplement such notice, while within five days as of the receipt of the finalized notice, it shall be obliged to publish it in the daily press.

The determining of the need is a phase of the EIA process in which the MoEPP analyses the need for preparing an EIA for the respective project. Once the need for preparing an EIA is established, all the required activities comprised in the EIA will be defined, i.e. scoping will be undertaken.

The phase of scoping in terms of the environmental impact assessment of the project constitutes a process in which the state administration authority competent for environmental issues, pursuant to Articles 81(4) and 82(1) of the Law on Environment, determines the scope and the content of the EIA study.

During the drafting of the Opinion on the scoping of the environmental impact assessment of the project, the MOEPP takes the investor's opinions into consideration.

The main objective of this phase is informing the investor of the concerns that are to be addressed in the final version of the EIA Study. This also includes the special requirements defined on the basis of the features and specificities of the proposed project.

Furthermore, one of the tasks in terms of the scoping of the study is identification of the alternatives and of mitigation measures that could be appropriate and that the investor would consider during the preparation of the project draft.

Once the scope is established, **the preparation of the EIA Study** commences. The preparation of an environmental impact assessment study in terms of the implementation of the project is in accordance with Article 2 of the Rulebook on the content of the requirements which are to be met by the environmental impact assessment of the project.

Once the environmental impacts are established and assessed in the developed EIA Study, the process continues with **a review (establishing the adequacy of the study).** The investor submits the EIA Study to the MoEPP for establishing the adequacy and for improvements.

Public participation via public hearings is a part of the process of establishing the adequacy of the study as per Article 91 of the Law on Environment. The establishing of the adequacy is a process of verifying the adequacy of the EIA Study by means of a Report on the adequacy of the environmental impact assessment study. The procedure for establishing the quality of the prepared Study actually constitutes a basic protective procedure which is embedded in the entire EIA procedure. If necessary, the quality of the Study will be improved after the conducted review, which ensures better results in terms of the environment, as well as a positive perception of the project as a generally accepted one, both by the experts and by the public.

The establishment of the adequacy (review) ensures an identification of all the concerns in the EIA Study. The review is focused on the identification and rectification of major and minor concerns which could have a direct impact on the decision-making process in terms of the quality of the study. If no major concerns have been established, such fact should be noted.

Remarks pertaining to minor concerns are included in an Annex to the report on establishing the adequacy of the study. In the end, the review provides recommendations as to how and when the major concerns in the study are to be rectified, as well as the measures that are to be undertaken during the implementation of the project. In the event of at least one answer marked as 'inadequate' in the checklist, the MoEPP returns the study to the Investor for further fine-tuning.

The EIA Study will be **approved** by the MoEPP only when all the answers from the checklist are assessed as adequate. Based upon the EIA Study, the Report on the adequacy of the EIA Study, the public hearing conducted as per Article 91 of the Law on Environment and the obtained opinions, within 40 days as of the submission of the Report, the MoEPP shall adopt a decision under which it shall grant its consent or reject the request for the implementation of the project.

The decision comprises an assessment as to whether the environmental impact assessment study of the project meets the requirements stipulated in the Law on Environment and the requirements for the issuance of a permit for the implementation of the project, as well as measures for the mitigation or reduction of any harmful impacts.

Projects for which no environmental impact assessment is conducted

Under special circumstances, the Government of the Republic of North Macedonia may decide, after having performed a case-by-case examination, not to conduct an environmental impact assessment, fully or partially, in terms of particular projects, in the following cases:

- war or state of emergency;
- for the needs of the defence of the Republic of North Macedonia, if it is established that the conducting of an environmental impact assessment procedure has a negative effect on the defence;
- a need for an urgent prevention of any contingencies which could have a serious impact on the health, safety or the property of people or on the environment.

In such cases, upon the proposal of the MOEPP, an alternative environmental impact assessment method is implemented. To that end, the minister shall be obliged to:

- adequately inform the public and explain the decision for not conducting an environmental impact assessment;
- inform the stakeholder of the findings obtained by means of the alternative environmental impact assessment methods.

2.3.2 Other relevant guidelines and rulebooks

In 2006, within CARDS 2004, Guidelines where developed in the terms of the implementation of the entire EIA procedure (screening, scoping and review). The guidelines are closely related to the laws that regulate the conducting of an EIA in the Republic of North Macedonia. These documents address all the relevant laws. The main goal of the guidelines is to assist in the practical implementation of the legal regulations. These guidelines are harmonized with the guidelines on screening, scoping and review of the European Commission. The guidelines constitute a significant segment during the implementation of the EIA directive in the Republic of North Macedonia, as well as an important tool for the investors, the state administration bodies and the other stakeholders in terms of the achievement of the highest standards for environmental impact assessment.

2.4 Approach to the preparation of this EIA Study

This Study has been developed in accordance with the requirements arising from the national legislation and pursuant to the requirements of the international financial institutions (EIB and EBRD) wherein consideration has been given primarily to the opinion on the need for and the scope of the study related to the Gas Interconnector North Macedonia - Greece project, set forth in the decision of the Administration of Environment within the Ministry of Environment and Physical Planning (MoEPP) which is the authority competent for the implementation of the EIA procedure, as well as in accordance with the best worldwide practices in this sphere.

A multidisciplinary team of experts and professionals participated in the preparation of the Study, with an extensive and relevant experience in the sphere of environment, led by an authorized expert in environmental impact assessment, as the person responsible for the Study, as follows:

- Environmental impact assessment experts;
- Experts in habitats, flora and fauna, valorisation, protected areas, landscapes;
- Experts in social aspects;

- Experts in environmental monitoring;
- Experts in occupational safety and health.

During the preparation of the Study, data were used from the Feasibility Study drafted for this Gas Interconnector North Macedonia - Greece project[1], as well as the technical documentation prepared for the purpose of the Basic (detailed) Design.

The process of preparing this study comprised the following activities:

- Gathering the required data relevant for the current status in terms of the environment in the areas where the gas pipeline passes;
- Field visits to the locations where the gas pipeline passes and basic monitoring of the ambient air, the surface waters, the soil, the ambient noise and the biodiversity. Adequate reports have been prepared for the purposes of such monitoring, which have been presented in this study;
- As regards the social aspects, during the first field visit initial findings were collected related to the stakeholders. During the following visits at the locations comprised in the footprint of the project, individual informal interviews were conducted with inhabitants at particular potentially affected locations;
- Integration and analyses of the gathered data and preparations for the drafting of the study;
- Formatting the Study (textual and graphic format) pursuant to the previously defined contents which fully meet the requirements in terms of the scope of the Study for the Gas Interconnector North Macedonia – Greece.

2.5 Public participation and stakeholder engagement

2.5.1 Need for public consultations

Public engagement and participation in the EIA procedure is regulated in the Law on Environment, Article 90 – Access to environmental documents and information, and Article 91 – Public hearing, as well as in the international conventions signed and ratified by the Republic of North Macedonia and, certainly, the best international practices.

The key principles for the best international practices in terms of public participation rely on the following:

- Providing important information in a format and language that is easily understood and adjusted to the needs of the stakeholder target groups;
- Providing information related to the consultation activities and the decision-making in advance;
- Providing information in a manner and at locations that will enable easy access to the stakeholders and that are culturally adequate;
- Observance of the local traditions, languages, timeframes and decision-making processes;

[1] Feasibility Study - Natural Gas Interconnector Greece – FYRoM, DESFA, MER JSC, Jan 2019.

- Bilateral dialogue which ensures an exchange of opinions and information by both parties, as well as an opportunity for identifying and addressing any concerns;
- Presence of various groups, including various ages, genders, vulnerable and/or minority groups;
- Work free of any threats, forced actions or bribery;
- Clear response mechanisms in terms of the questions, proposals and complaints; and
- Whenever possible and sustainable, it is recommended to include feedback in the preparation of the project or the program and once again notify the stakeholders.

The main objectives of public participation are as follows:

- to obtain local and traditional knowledge that could be useful during the decision-making process;
- to assist in the considerations of the alternatives and the mitigation measures;
- to ensure that no major impacts have been neglected, while the benefits are at a maximum level;
- to reduce any conflicts by means of an early identification of any concerns;
- to ensure an opportunity for the public to be able to have an impact on the project design in a positive manner (thus creating a sense of ownership regarding the draft project);
- to improve the transparency of the entire EIA process and to increase the public trust in the entire process.

The stakeholder engagement process starts in the earliest phase of project planning, while the related activities continue in the course of the project preparations, the pre-constructions phase, the construction phase, the operation and, possibly, the decommissioning of the project.

Public participation in the decision-making process is conducted by means of:

1. Announcing information for the public;
2. Public participation – the public should be actively engaged in open, public hearings, as well as in the submission of written opinions and questions within the various phases of the EIA procedure;
3. Access-to-justice mechanism – the public can influence decisions by filing complaints to the court or the second-instance commission of the Government.

Below is a description of the activities undertaken for the purposes of enabling public participation and stakeholder engagement in the earliest phase of the development of this ESIA for the Gas Interconnector North Macedonia – Greece project.

A careful identification was made of all the involved stakeholders and their interests, expectations and preferences, in order to ensure a significant and efficient consultations process. The stakeholder engagement process started early, during the project planning phase. The technical documentation for this project is being developed by a company that specializes in project design and, during that phase, the local authorities and the institutions were consulted in order to gather relevant information that will enable the definition of a design solution of a satisfactory quality.

Meetings were held with the following:

- the General Contractor for the project - Joint Stock Company for Performing Energy Activities National Energy Resources Skopje (NER) and
- the Ministry of Environment and Physical Planning (written communication – project Implementation Intent)

Written communication has been established also with the following institutions:

- Regional Protection and Rescue Unit – Negotino;
- Elektrodistribucija Dooel, Skopje;
- Public Enterprise for State Roads;
- Ministry of Culture;
- Civil Aviation Agency;
- Municipality of Gevgelija, Division for Urban Planning, Municipal and Environmental Matters;
- Makedonski Telekom AD – Skopje;
- Authority for Technological–Industrial Development Zones,
- Institute for Protection of Cultural Monuments and the Strumica Museum;
- Meetings and consultations with representatives from the municipalities: Bogdanci, Demir Kapija, Gevgelija and Negotino.

The purpose of the meetings and the consultations with the governmental agencies and other organizations was to present the details of the project, the environmental and social issues, the scope of the ESIA study and the individual researches related thereto, as well as to present the project Program. The results from the consultations were applied for the purposes of the development of the infrastructural and basic design and for defining the project route.

On 25.10.2019, a consultative meeting was held between representatives of the MoEPP Department of Environment (competent authority for the approval of the ESIA Study), representatives from Tehnolab doo Skopje – a company assigned for the elaboration of the EIA Study and a representative from the company Chakar-Partners, which is developing the basic design for the gas pipeline.

The following aspects were considered:

- Possible alternatives for the gas pipeline route;
- Avoidance of protected areas and the related possibility and method;
- Biological diversity and respective impact mitigation;
- Harmonization of the findings from the Strategic Environmental Assessment in terms of the energy strategy and development in the Republic of North Macedonia and;
- The importance of obtaining information regarding the remaining infrastructure, access roads, agricultural roads and protected areas.

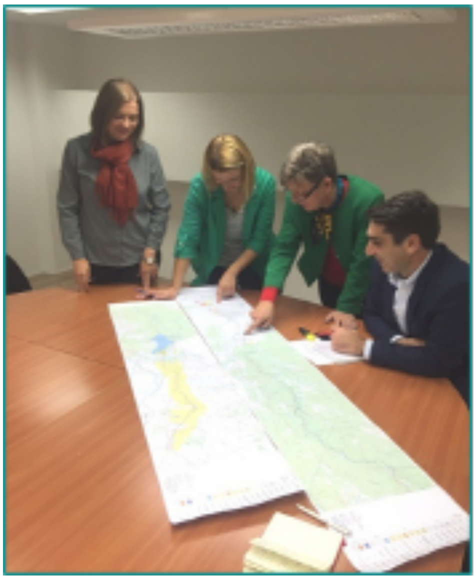



Figure 2-2: Meeting and consultations with representatives from MoEPP

Municipalities

Meetings and consultations have been conducted with representatives of the municipalities of Negotino, Demir Kapija, Gevgelija and Bogdanci. The purpose of the meetings was to present the need for and the objectives of the project, the details regarding the gas pipeline route and the location of the stations, the scope of the environmental and social impact assessment, the access to and acquisition of land, the benefits from the project both for the community and the municipalities.

The individual meetings were attended by representatives of the Local Economic Development (LED) Units, the Energy Division, the Urban Planning and Environment Division, the Social Protection and Primary Health Care Division and the mayors of the municipalities.

The key issues that were addressed at these meetings were as follows:

- Details about the gas pipeline route and the sub-station locations;
- Ensuring a safe distance from housing and the impacts on the environment and on the community health and safety;
- The process of land compensation;
- The possibilities for the development of a secondary gas distribution network and the advantages from using gas by the community in the future;
- The relation between this project and other projects in the municipalities and the possible positive cumulative impact;
- Defining the width of the buffer zone of the gas pipeline and;
- The access to land and the possible negative social and economic impacts and their prevention and avoidance by means of the project.

At the meetings, interest in and support for the development of this project were expressed. Furthermore, a method was established in terms of the communication and sharing the necessary data, as well as the coordination between the municipalities and the project team for the development of the project for the purposes of an adequate and efficient elaboration of an ESIA and the remaining documentation pertaining to socio-economic aspects. Figure 2-3 shows photographs of the meetings held for presenting the project in the municipalities, within the process of ESIA scoping.

Figure 2-3: Meetings with representatives of the municipalities through which the gas pipeline passes

Non-governmental Organizations

The following non-governmental organizations from the municipalities through which the gas pipeline passes were informed in writing about the elaboration of the project documentation:

- Civic Association ECOVITA, from the Municipality of Negotino;
- Environmental Association ZRAK, from the Municipality of Bogdanci;
- Association for Development, Education and Ecological Ethics POLYMATH 13, from the Municipality of Bogdanci;
- Association ECO-CUBE, from the municipality of Demir Kapija;
- Civic Association ENVIRONMENTAL ASSOCIATION ECO-CIFLIK, Ciflik village, from the Municipality of Demir Kapija;
- Civic Association CLIMATE CHANGE CENTER, from the Municipality of Gevgelija.

Transboundary Communication

The environmental impact assessment process for a particular project includes transboundary matters and stakeholder engagement. Pursuant to the Law on Environment, the authority responsible for transboundary matters (information regarding the imminent project, transboundary stakeholder engagement, feedback collection, etc.) is the Ministry of Environment and Physical Planning (MoEPP). For the needs of the project, also an Environmental Impact Assessment process has been implemented and it is underway, starting with the Letter of Intent of the project's investor, published on the website of MoEPP (22.08.2019).

In terms of the development of the Gas Interconnector North Macedonia – Greece project, in the context of transboundary communication, the following has been implemented:

1. The MoEPP, via the Ministry of Foreign Affairs of the Republic of North Macedonia, submitted a Letter of Intent regarding the implementation of the project to the Greek national authorities (the Ministry of Environment and Energy (MoEE) of the Republic of Greece) on 04.09.2019 and

2. An official reply was received from the Ministry of Environment and Energy of the Republic of Greece (17.10.2019), in which it was stated: “After having considered the environmental information comprised in your notice, we have concluded that no significant environmental impacts are anticipated on the Greek territory as a result of the construction and operation of this project in your country; therefore, there is no need for the Greek environmental authorities and public to participate in the environmental impact assessment of the project.

2.5.2 Community survey of the project

During the period summer/autumn 2019 and winter 2019/2020, for the needs of this project, a socio-economic survey was conducted in the municipalities of Bogdanci, Negotino, Gevgelija and Demir Kapija, which addressed issues in the sphere of revenues, education, available resources, access to financial resources and access to public utility services, such as: water, electrical energy and sewage systems.

The selection process comprised identification of adequate respondents in each municipality, who represent specific groups in society, including also representatives from the villages, community leaders, women and men, vulnerable groups, etc.

Based upon the conducted survey, as well as the meetings held, it may be concluded that the major part of the respondents have a positive opinion of the project, since it will ultimately provide a benefit for the local communities and the region. Interest in the project was expressed, with an emphasis on harmonizing this project with the developmental plans of the municipalities and on defining the benefits and the possibility for developing a secondary gas supply network in the populated areas.

Figure 2-4 contains photographs from meetings and consultations with representatives of the local communities through which the gas pipeline passes.

Figure 2-4: Meetings representatives of the local communities through which the gas pipeline passes

Generally, all respondents in the local communities approve and support the project. They expect an improvement in the quality of life and lower energy consumption costs, since most of them use energy from wood combustion, pellets and electrical energy in their homes. Furthermore, there is an awareness of the fact that the project will have a positive environmental impact, especially in terms of the ambient air quality. The local population expects that the project will have a positive effect on the local economy, as well as on the emigration of the local population, whereby the number of young people and families leaving the area will be reduced.

The community representatives stated their concerns and proposals that pertain to land acquisition and the possible reduced access and mobility of the roads used for agricultural activities.

2.5.3 project announcement and consultations

Pursuant to the national legislation, within the process of stakeholder engagement and consultations regarding the process for this specific ESIA, the MOEPP is going to publish the Environmental and Social Impact Assessment Study. The notification regarding the announcement is to be published in at least one daily newspaper available on the entire territory of the Republic of North Macedonia, on the website of the MOEPP, as well as on local radio and TV stations on the territory of the project.

The local announcement is aimed at:

- Ensuring insight for the stakeholders into the Draft Environmental and Social Impact Assessment Study,
- Collecting feedback from the stakeholders in terms of the draft environmental impact assessment and the related management/mitigation measures.

The activities related to the announcement and the consultations with the public and the stakeholders will be developed and organized according to the following principles:

- The events and the possibilities for consultations will be widely and proactively announced, at least 2-3 weeks prior to the meeting for the public presentation of the Study;
- The non-technical summary will be available prior to each event in order to ensure conditions for sufficient informing of the public regarding the contents and the conclusions on the environmental impact assessment, before the consultations take place;
- The location and the time of any meeting will be organized in order to enable the availability of the stakeholders in the project;
- Active following of the public events needs to be enabled and ensured so that the stakeholders can express their concerns and opinions on the project, and so that adequate answers can be provided to the raised questions.

During the stakeholder engagement process feedback forms need to be developed which will be enclosed with the documentation that will be published on the Operator's website. Such documentation will also be available in a hard copy format at the Contractor's offices and the municipal offices. The inhabitants of the affected areas will be notified of the availability of these documents with a Notification published at the municipal centres.

Once the stakeholders' comments are received and included, the ESIA Study will be finalized and adopted by the competent authority.

2.5.4 Access-to-justice mechanism - complaints

The grievance system will be published through the website of the institution responsible for the project – National Energy Resources (NER) – and also informative materials will be prepared which will be available at the municipal administrations in the footprint of the project.

Complaints may be filed by filling in a written complaint form. This form will be available at the municipal administration of the municipalities through which the gas pipeline passes, as well as the Contractor's offices. In addition to the written form, complaints can also be filed by contacting the engineer in charge of environmental and social policy matters on the part of the gas pipeline Contractor, by telephone or personally.

3 DESCRIPTION AND CHARACTERISTICS OF THE PROJECT

3.1 Importance of the project

The Gas Interconnector North Macedonia – Greece is a project aimed at enabling security of gas supply for the Republic of North Macedonia and the region (Kosovo and southern Serbia) via Greece.

This gas pipeline section is a part of the National Gasification System of the Republic of North Macedonia. The preparation of this National Gasification System was preceded by the preparation of a Feasibility Study for the Gasification System with a Conceptual Design.

This section will connect the existing main gas pipeline network of the Republic of North Macedonia with the gas network in Greece.

On July 10, 2015, in Dubrovnik, within the framework of the Regional Central Eastern and South-Eastern European Gas Connectivity (CESEC) initiative, a Memorandum of Understanding was signed between NER and DESFA SA (Hellenic Gas Transmission System Operator). That marked the beginning of the cooperation for the realization of the project for construction of gas interconnector between the two countries.

Figure 3-1: Gas Interconnector North Macedonia – Greece (prepared by JSC MER

In 2015, NER, with the support of DESFA, submitted an application for gas interconnection between North Macedonia and Greece to the Call for Projects of Energy Community Interest (PECIs) and Projects of Mutual Interest (PMIs) selection procedure, organized by the Energy Community Secretariat. The Energy Community identified the project as project of Mutual Interest with project Code GAS-04B, listed in the ENTSO-g Ten Year Network Development Plan (TYNDP) under project Code TRA-N-980.

In 2017, once again an application was submitted to the Call for Projects of Energy Community Interest (PECIs) and Projects of Mutual Interest (PMIs) selection procedure, organized by the Energy Community Secretariat. This time the application was submitted as a joint process of NER and DESFA. After the evaluation of the projects by the Energy Community, the project Gas Interconnector

North Macedonia-Greece was pre-selected as a project of Mutual Interest (PMI) of the Energy Community.

The Gas Interconnector North Macedonia-Greece is a strategic section that will provide an alternative in the supply of gas for the Republic of North Macedonia through this new section in length of 55 km on the territory of Greece and 68 km on the territory of North Macedonia from where through the existing network and the new planned network towards Kosovo and Serbia, will enable security of supply of gas for the region as well (Kosovo; Southern Serbia).

In April 2018, a preliminary Route Report and a Cost Assessment Report for the Gas Interconnector North Macedonia – Greece were prepared.

A Common Feasibility Study was prepared by NER and DESFA. NER submitted the draft version of the Feasibility Study (FS) to the relevant stakeholders for review (Status Renewal).

On November 12, 2018, at the request of NER and the Government, the European Investment Bank (EIB) confirmed its interest in the project as part of a broader investment program for the national gas transmission infrastructure funded by the EIB under its usual terms and conditions.

In order to implement the project, NER submitted a Request for Technical Assistance to CONNECTA (Technical Assistance to Connectivity in the Western Balkans). The Technical Assistance consists of a complete Environmental and Social Impact Assessment, Cost-Benefit Analysis and Basic Design.

In January/February 2019, NER and DESFA completed the Feasibility Study on the Gas Interconnector.

The start point of the route in North Macedonia is at the border with Greece near the village of Idomeni and the town of Gevgelija where the Greek part of the gas pipeline ends. The end point is at the already built block station (block station BS 7) of the new gas pipeline Shtip - Negotino, near the town of Negotino.

As a general concept, the idea is for the pipeline route to be a straight line connecting the start and end point, thus minimizing the length of the route. This route is oriented in the south-east to north-west direction.

The morphology of the terrain in the region limits the possible alternatives due to the natural obstacles on both sides of the corridor:

- To the north of the proposed route is the Vardar river/canyon with steep hills, mountains and narrow river beds.
- To the south of the proposed route is mountain range with elevation of app. 1,300m.

It should be noted that the same general direction has been chosen for the construction of the oil pipeline that connects the port of Thessaloniki with the OKTA refinery in Skopje.

According to the Feasibility Study, the length of the gas pipeline route is approximately 55 km in Greece and 68 km in North Macedonia.

The Feasibility Study identifies the following advantages of project implementation:

- Support to the gasification efforts of the country by providing an interconnection point that can supply large quantities of gas to meet the expected growth in demand;
- Ensure security of gas supply by offering diversification of sources of gas supply;

- Ensure market integration so as to enable the consumers in North Macedonia to pay gas prices comparable to those of the neighbouring countries;
- Provide a sustainable source of energy for the country that has a low carbon index.

Each part of the interconnector (in Greece and in North Macedonia) will be built and operated by the respective sponsor as a stand-alone project supported by a Bilateral Agreement.

3.2 Description of the gas pipeline route

The Interconnector section North Macedonia – Greece is 67+193,98 km long with a diameter of Ø 700. The section starts at the border with Greece in the vicinity of Idomeni village and the town of Gevgelija, where the Greek part of the gas pipeline ends. The end point of this section will be at the already built valve station (block station BS 7), in the vicinity of the town of Negotino (Figure No.3-2).

The route starts from the border with Greece, near the locality Sredno Bilo and through the arable agricultural land in the locality Maleolu it heads to the hilly area of the Goli Rid from where it continues through the Stojakovo area passing southwest of the settlement where it intersects with the local asphalt road Bogorodica-Stojakovo touching upon the planned construction right-of-way of Stojakovo and through the locality Rudina (touching upon archaeological site of Rudina) it approaches the route of the oil pipeline Thessaloniki - Skopje and at a safe parallel distance from the oil pipeline (greater than 50m), at 6 km + 185.00 it crosses a 400Kv overhead power line and at a distance of 6 km + 220 a 110 Kv overhead power line, from where it moves towards the regional asphalt road Gevgelija- Bogdanci. Before crossing with the regional road Gevgelija-Bogdanci at km 6+500, in the locality Belik Cair, it is planned to construct the first line Block Station, Pig Launcher/Receiver, as well as a section Block Station for future connection with the section for gas supply of the south-eastern region (Gevgelija, Bogdanci, Strumica)

Figure 3-2: Overview of the gas intrconnection in North Macedonia

After crossing the regional road Gevgelija-Bogdanci, the route continues westward to the locality of Dolna Ada where it passes under the Vardar River and the confluence of the Sermeninska River at km 9+783, and at km 10+452 it intersects with 110 kV overhead power lines, and through the locality Keramidarnica (touching upon the archaeological site of Keramidarnica) and locality Gladno Pole in the southern part of the village of Prdejci it crosses the Thessaloniki-Skopje oil pipeline, the Thessaloniki-Skopje (Athens-Munich) railway line and the new A1 Gevgelija-Skopje-Kumanovo motorway. In this segment, the route passes through agricultural areas with plantations, without slopes and at a standard parallel distance greater than 50 meters from the oil pipeline Thessaloniki – Skopje. After crossing the A1 Motorway, the gas pipeline also crosses the Asphalt Road Prdejci - Negorci and continues to the north, passes under the Kovanska River and turns northwest, touching the archaeological site Glavica on its southern side and at km 17 +125 it once again crosses the oil pipeline Thessaloniki – Skopje, touching the archaeological site Konjari on its eastern side. Further on, the route continues through the mountainous part, bypassing the concession for quarrying in the locality of Lira and from km 19 + 000, passing along the ridges Bilo, Goli Rid, Maslinski Rid, Vrla Strana and Kamenliv Rid, and through the highland part of the locations Shirini, Gladno pole and Gojkova Chuka, touching upon the archaeological site Gradiste and the Mitivir hill on the south side, it passes under the Petruska river, wherein km 28 + 700 the second line Block Station is planned to be built. Immediately after the Block Station, at km 28+800, the route passes under the local asphalt road Miravci-Gabrovo-Petrovo and through the locality Gradiste, it heads towards the valley of Stara Reka where it crosses a 400 kV overhead power line and, following the route of the oil pipeline Thessaloniki-Skopje on its right side, through the ridges Pribilski Rid, Chukata, Drevenot and Gola Chuka, it moves towards the project scope of the wind farm "Kaltun Energy". Due to the unfavourable mountain terrain and the requirements for proper distance from the wind turbines, the gas pipeline route from 35 km + 000 to 41 km + 000 passing through the localities Andonov Rid, Stefan, Zhurot and Begovi Nivi intersects with the Thessaloniki-Skopje oil pipeline in three places and continues to the locality Studena Glava and ridges Usov Grov, Golem Vlas and Mal Vlas and descends to the valley of Drenska river passing under the riverbed of Maminska river and the riverbed of Drenska river, downstream from the Reservoir on the Drenska river it crosses 400kv overhead power line, bypassing the village of Dren on its eastern side, through the locality Vchjak and the archaeological site Orizarski Grobishta, it moves east of the village of Chiflik, where at 51 km + 200 the third line Block Station is planned to be built. Immediately after the Block Station, the route passes under the regional route of the asphalt road D.Kapija - Dren and at 51 km + 650 it intersects with the Thessaloniki-Skopje oil pipeline and moves towards the mouths of the rivers Doshnica and Boshava, passing directly in front of their confluence and in the immediate vicinity of the local fishpond, and moves towards the locality Golemo Brdo, passing under the local asphalt road D. Kapija - Besvica. Further on, through the localities Kozinovi Gorniki, Gerenot and Gagovi Nivi, it crosses the 400 Kv overhead power line and approaches the village of Przhdevo, bypassing it from its eastern side, west of the archaeological site Bugdashna Glava. After passing under the local asphalt road to the village of Przdevo through the Tiklik slope and the localities Atanasica, Agupka, Sokolce and Poroite, the route crosses a 400 Kv overhead power line and continues to the newly designed pressure reduction station and the existing Block Station No. 8 which should be the connection point with the existing main gas pipeline.

The main intersections of the gas pipeline with watercourses, ravines, roads, railways, oil pipelines and overhead power lines are given in APPENDIX 4.

The graphical situational solutions with the kilometre division of the route of the gas pipeline are shown in the figures given in APPENDIX 2.

3.3 Technical characteristics of the project

Gas pipeline components:

- Pipeline, DN 28”; L≈66.3km;
- Block Stations (BS-01 km 6+600; BS-02 km 6+800; BS-03 km 28+730; BS-04 km 51+060; BS-05 km 66+300);
- Pig Launcher/Pig Receiver, DN 32” / 28”; km 6+600;
- Pig Receiver, DN 32” / 28”; km 66+000;
- Pressure Reduction Station P= (70/54) bar, km 66+150;
- Cathodic protection devices, (CS-1 at km 6+800; CS-2 at km 28+730; KC-3 at km 51+060);
- Power Supply, (PS-1 at km 6+800; PS-2 at km 28+730; PS-3 at km 51+060; PS-4 at km 66+000);
- Telecommunication network ducts.

The block stations will be equipped with closing elements (valves, taps, shutters, etc.) with the necessary fittings and devices for closing and discharging the individual sections of the gas pipeline.

The gas flow diagram of the Gas Interconnection North Macedonia-Greece is presented in Figure No.3-3.

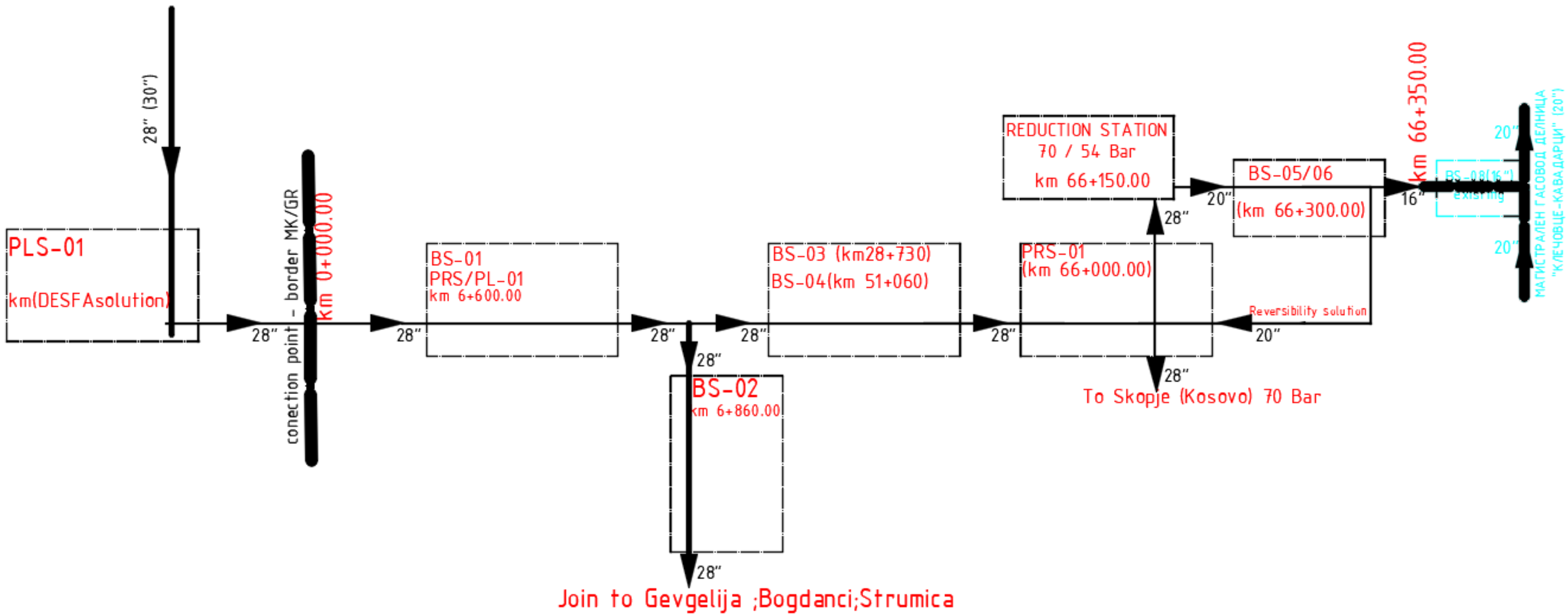


Figure 3-3: Gas flow diagram

Next to the facilities whose safety or operation may be endangered by the construction, buffer zones are established.

A buffer zone in terms of the dimensioning of the pipeline is an area that is 200 m wide on each side of the pipeline, measured from the axis of the pipeline, in which other facilities affect the safety of the pipeline in accordance with Article 5 paragraph 31 of the "Rulebook on technical conditions and regulations for safe transport of liquid and gaseous hydrocarbons using main oil pipelines and gas pipelines and oil pipelines and gas pipelines for international transport”.

A buffer zone in terms of the construction of residential or housing buildings is an area that is 30 m wide on each side of the pipeline, measured from the axis of the pipeline, in accordance with Article 9 of the "Rulebook on technical conditions and regulations for safe transport of liquid and gaseous hydrocarbons using main oil pipelines and gas pipelines and oil pipelines and gas pipelines for international transport”.

The pipes are dug to a depth of cover that is the distance between the upper edge of the pipeline or the encasement (protective) pipe and the elevation of the ground. The minimum depth of cover of the pipeline is 0.80 meters, in order to avoid exposing the pipeline to possible freezing of the land. This depth of cover increases and decreases depending on the gas pipeline class and the facilities near the pipeline zone, as prescribed in Article 31 of the “Rulebook on technical conditions and regulations for safe transport of liquid and gaseous hydrocarbons using main oil pipelines and gas pipelines and oil pipelines and gas pipelines for international transport” (Official Gazette of SFRY No. 26/1985 and RM No. 18/1997).

A cross section of the work area is given in Figure no. 3-4, whereas the widths of the work area and buffer zone are given in Figure 3-5.

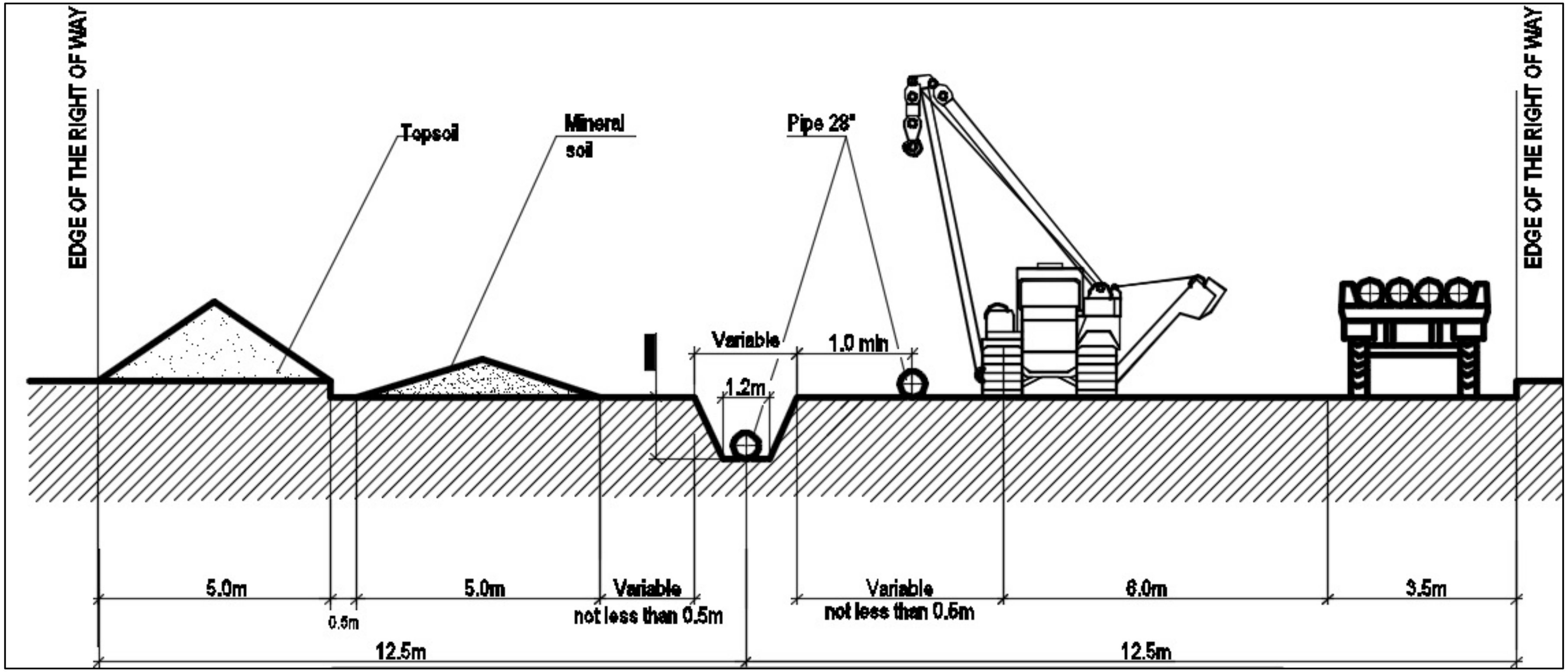


Figure 3-4: Work area cross-section

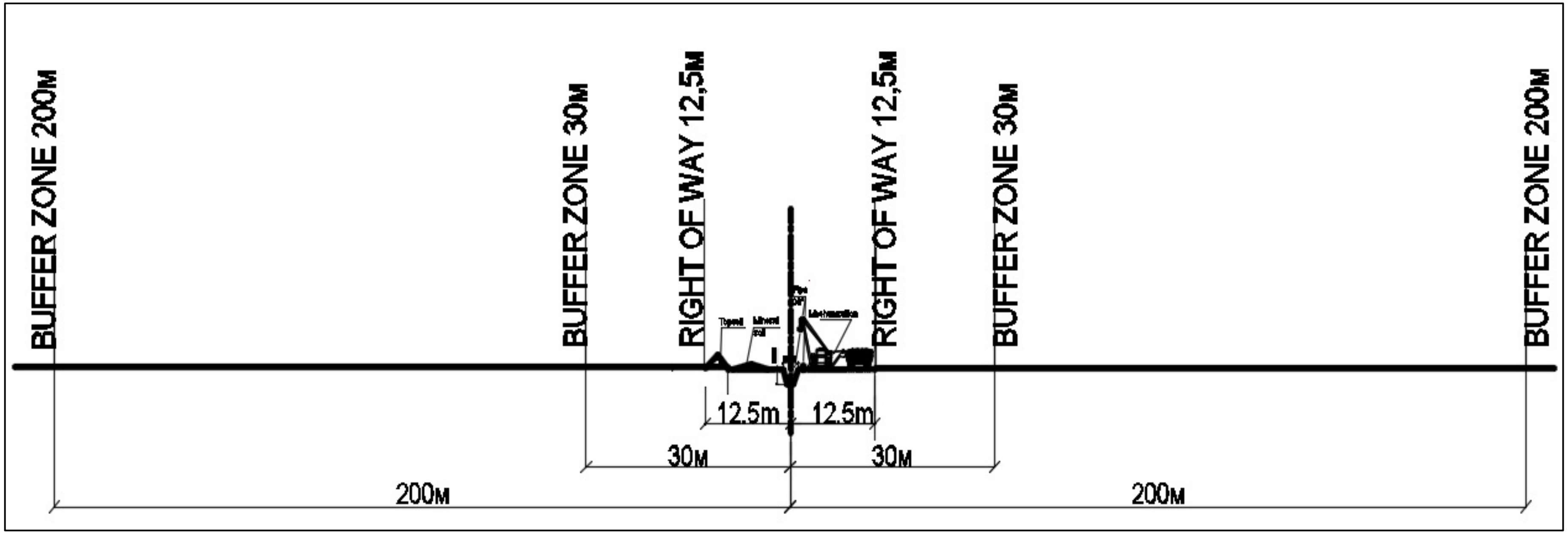


Figure 3-5: Work Area and Buffer Zone појас

3.3.1 Construction phase

3.3.1.1. Construction of the pipeline

In order to construct the main gas pipeline, first the area needs to be cleared i.e. adequate pipeline right-of-way needs to be built along the gas pipeline. This pipeline right-of-way is essentially a work area and it is necessary to be constructed along the entire length of the route, continuously.

Clearing of the area and building the pipeline right-of-way (ROW) can be done on several sections simultaneously depending on the accessibility of the area, the regulation of the property and legal relations (Expropriation) and the contractor's capacities (Availability of machinery).

Access to each construction site will be provided through the existing road network in the area of intersection with the route or the closest lateral approach to the route by observing all legal norms for regulation of temporary traffic, proper marking of entrances and exits to the construction site and obtaining all permits from the relevant institutions.

The width of the pipeline right-of-way is different and varies depending on the diameter of the pipeline, the longitudinal and cross slope of the terrain, the need to overcome various natural obstacles, any existing buildings or infrastructure, the type and quality of the local agricultural plantations from the expropriated area and other factors.

In the work area (25 meters, 12.5 m left and right of the axis of the pipe), the access road and staging area for the construction machinery such as trenchers, bulldozers, loaders, side booms, etc. are located. In addition, it is necessary to provide access to heavy transport vehicles for local transport and distribution of steel pipes. In inaccessible areas, this transport can be organized with tractors and other similar machinery capable of unhindered movement at dirt roads.

The pipeline right-of-way should also include the trench for laying the pipes, as well as the area for stockpiling the excavated earth or other material, or the supplied sandy material for the initial backfilling of the pipes with fine material. The pipeline right-of-way (staging areas and storage yards) is usually cleared using a wide excavation with bulldozers or powerful loaders. Depending on the cross slope of the terrain and the category of soil material, the method of excavation and the type of earth-moving machinery are determined.

First the pipes are delivered and laid down above the ground along the pipeline right-of-way. Then the individual pipes in longer pipe sections are welded. Then, the trench for the pipeline is excavated and after the control of the welded joints and their coating, the assembled pipeline is lowered into the trench using side booms.

Figure 3-6: Part of the procedure for pipeline construction

Before lowering the pipes in the trench, it must be ensured that the bottom of the trench is flat and clean, and in case of rocky terrain or weather conditions causing frozen ground, the trench should be covered with 15cm fine sand or loose unfrozen soil aggregate. Backfilling in such conditions is done using the same material to a depth of app. 20 cm above the upper edge of the pipe, with light compacting of the material.

If such material is to be transported from a remote location, a layer of straw, wooden slats, styrofoam, and the like may be placed around the pipe for mechanical protection of the coating. After this, the trench can be backfilled first with fine soil material up to a depth of 20-25 cm above the upper edge of the pipe, and then with the original excavated material.

Figure 3-7: Procedure for backfilling the pipeline trench

In places where the gas pipeline passes through agriculturally cultivated areas, it is necessary to return the removed humus to each agricultural plot separately so as not to disrupt the previously established land-capability classification. After this, each plot is restored.

The construction machinery and auxiliary equipment shown in the following table are most often used for the construction works during the construction of the gas pipeline.

Table 3-1: Machinery and equipment to be used for the construction of the gas pipeline

Machinery and equipment	
Excavator	*Pipe welding manipulator*
Trencher	*Pipe welding machine*
Bulldozer	*Side boom*
Power shovel	*Compressor*
Roller	*Heavy haul transportation vehicle*
Concrete mixer	*Crew Transport Bus*
Crawler loader	*Pickup truck*
Tractor unit	*Water tanker truck*
Truck	*Ambulance*
Trailer	*Double cabin vehicle*
Pipe hauling equipment	*Diesel power generator*
Crawler Crane	*Other smaller equipment and tools*

The number of machinery and equipment used, as well as the number of workers employed during the construction will be variable during the construction phase depending on the construction conditions.

<u>Terrain category and permitted gas pipeline slopes</u>

The trench excavation method and the type of digging machines are selected based on the characteristics of the area and the category of the soil at the terrain.

Earthworks, during construction activities in rocky soils and flat areas, with a slope of up to 8^{O}, are performed in the following order:

- Temporary removal and relocation (stockpiling) in an embankment of fertile topsoil from the working area of the route, or excavation of topsoil that covers the hard-rocky soils;
- Crushing the rocky soils with probing and blasting;
- Excavation of crushed rock material and soil with a single-bucket crawler excavator;
- Laying a bedding of sand or soft soil at the bottom of the trench.

After lowering of the pipeline in the trench, the following works are performed:

- Backfilling the pipeline with crushed soft soil;
- Construction of temporary partitions in the channel at longitudinal slopes;

- Backfilling the pipeline with rocky soil;
- Restoration of the fertile topsoil.

The total longitudinal alignment of the route in terms of the absolute value of the longitudinal slopes and their total length with adequate statistics is presented in the following table.

Table 3-2: Total longitudinal alignment of the route in terms of the absolute value of the longitudinal slopes and their total length with appropriate statistics.

Section Greek border – Negotino							
Statistics on length of longitudinal slopes							
Slope in %	*From*	*Longitudinal slope*	*To*	*Slope in %*	=	*Total length in meters*	*Percentage in total length (%)*
0	>	*i*	<	*10*	=	*40.650,43*	*59,73*
10	>	*i*	<	*20*	=	*14.875,23*	*22,57*
20	>	*i*	<	*30*	=	*7.312,11*	*11,09*
30	>	*i*	<	*40*	=	*3.595,44*	*5,45*
40	>	*i*	<	*50*	=	*630,09*	*0,96*
50	>	*i*	<	*60*	=	*99,29*	*0,15*
60	>	*i*	<	*70*	=	*31,39*	*0,05*
70	>	*i*	<	*80*	=	*0,00*	*0,00*
80	>	*i*	<	*90*	=	*0,00*	*0,00*
90	>	*i*	<	*100*	=	*0,00*	*0,00*
100	>	*i*	<		=	*0,00*	*0,00*
						67.193,98	

The table shows that 82% of the total length of the section has a longitudinal slope of less than 20%, whereas about 11% or 7 km of the total length has a longitudinal slope of less than 30%. The longitudinal slopes of 30% to 50% are considered more difficult, and their total percentage representation is about 6% or about 4 km.

Slopes above 50% are considered extremely difficult and their total percentage representation is about 0. 2% or a total length of around 130 m'. Individually speaking these are slopes that are normally seen when passing the steep sides of the valleys and are very short, usually covered with one or two 12m pipes. In the phase of preparation of the Basic and As-Built Design, these extremely difficult slopes will be significantly reduced. The statistics clearly point to the route difficulty in terms of its vertical alignment.

According to the statistics it can be said that the route is relatively good and easy to build.

Route alignment at longitudinal slopes

On the sections of the route with a longitudinal slope of up to 15°, in dry soil, the trenches are dug with bucket-wheel excavators or crawler excavators, with single-pass, by the method of scooping - one scoop.

On the sections of the route with a longitudinal slope of over 15^{O}, in sandy soils, in crushed rocky soils, in wet soils, at crossings over swamps, small rivers and gorges, the trenches are dug with single-bucket crawler excavators and bulldozers. For slopes greater than 15^{O} construction machines must be winched, whereas in rocky soils with a slope greater than 10^{O} the stability of the excavator needs to be checked to prevent sliding.

On longitudinal slopes up to 22^{O} the direction of digging of the soil with single-bucket crawler excavators is carried out from bottom-to-top or from top-to-bottom along the slope. In order to secure the stability of the excavators at longitudinal slopes above 22^{O,} they should be permitted to operate in the following cases:

- front shovel excavators - just bottom-to-top along the slope;
- backhoe excavators - only top-to-bottom along the slope, with the shovel on the rear side in terms of the direction of movement of the excavator.

On the longitudinal slopes above 36^{O}, a chute way channel is used as a trench digging method. The channel method uses the slope area to move the excavated material, by applying its weight, where a bulldozer digs at the bottom of the trench, whose width is equal to the width of the bulldozer's shovel. Digging is done from top-to-bottom along the entire length of the slope, wherein it is necessary for the bulldozer to be winched to a second bulldozer behind it.

<u>Route alignment at cross slopes</u>

When aligning the route of the gas pipeline on steep areas with lateral (cross) slope over 8^{O}, cut-and-fill grading is used where the soil from the high side is excavated and moved to the low side to create a safe and level work terrace. Terraces are created with the moving (entrance and exit) of the construction machinery, to and from them. The terraces should be backfilled in such a way as to guarantee the necessary stability of their backfilled section, to ensure the easy operation of the construction equipment.

On sloping terrains, with lateral (cross) slope above 8^{O} and below 15^{O}, the terraces are excavated with bulldozers. At the beginning of the process it is necessary winch the bulldozer. The excavation of terraces on the sloping terrain, with lateral (cross) slope above 15^{O} and below 25^{O} is performed with bulldozers with longitudinal movement. With the longitudinal movement of the bulldozer the high side of the slope is excavated and moved to the low side of the slope. The excavation of terraces on the sloping terrain, with a lateral (cross) slope of over 25^{O}, is done with single-bucket front shovel excavators.

<u>Zones intersecting with natural obstacles or other existing infrastructure</u>

The main gas pipelines, as very long facilities, cross a multitude of natural (streams, ravines, irrigated lands, swamps, small and large rivers) and artificial barriers (irrigation canals, dams, embankments, roads, railways). Due to the presence of such obstacles, it is necessary to build crossings through them. The construction of the crossings and the ways of their implementation depend exclusively on the characteristics of the respective obstacles. The construction of the crossings should be completed before the start of the construction of the gas pipeline.

The wall thickness of the pipes which are used for road and railway crossings should correspond to the gas pipeline category requirements in accordance with the relevant regulations.

Crossings over bodies of water

Some basic rules that need to be considered when crossing rivers:

- Straight, stable and narrowest parts of the river should be chosen as crossing points;
- The underwater crossing to be vertical to the flow dynamic axis, wherein the angle can be reduced to 60°;
- The upper end of the gas pipeline to be at least 0.5m below the flood limit level of the riverbed spillway, for a period of 25 years, but not less than 2.5m below the riverbed bottom during the installation;
- Underwater gas pipeline sections, at the crossings, within the boundaries of high waters horizon and through muddy areas (or high groundwater), to be designed and planned with protection against floating (to ensure they will remain in position).

Crossings through small rivers and streams are built basically based on the underground method (open-cut method), below the water surface. There are several ways to construct underground crossings:

- Building a temporary dam in the excavation with embankment;
- Digging with an excavator at the bottom of the water body;
- Diverting the water elsewhere during the construction and installation works;
- Building an embankment, so as to enable lowering the gas pipeline, by diverting the water through flume pipes;
- Work with an excavator from the shore.

The temporary dam of the river with an embankment (dam) is built with the installation of the partition net, which serves as a skeleton. The width of the embankment should ensure the mobility of construction machinery. Single-bucket front shovel excavators moving along the bottom of the water barrier are used to dig canals in streams, shallow rivers, and stable soils. When there are two, or more, depressions, the gas pipeline is lowered after the water courses are temporary diverted towards one of them. In case of small river valleys, an embankment (trench) is built, in which the gas pipeline is lowered, and the water course is diverted to the flume pipes that are placed transversely through the embankment.

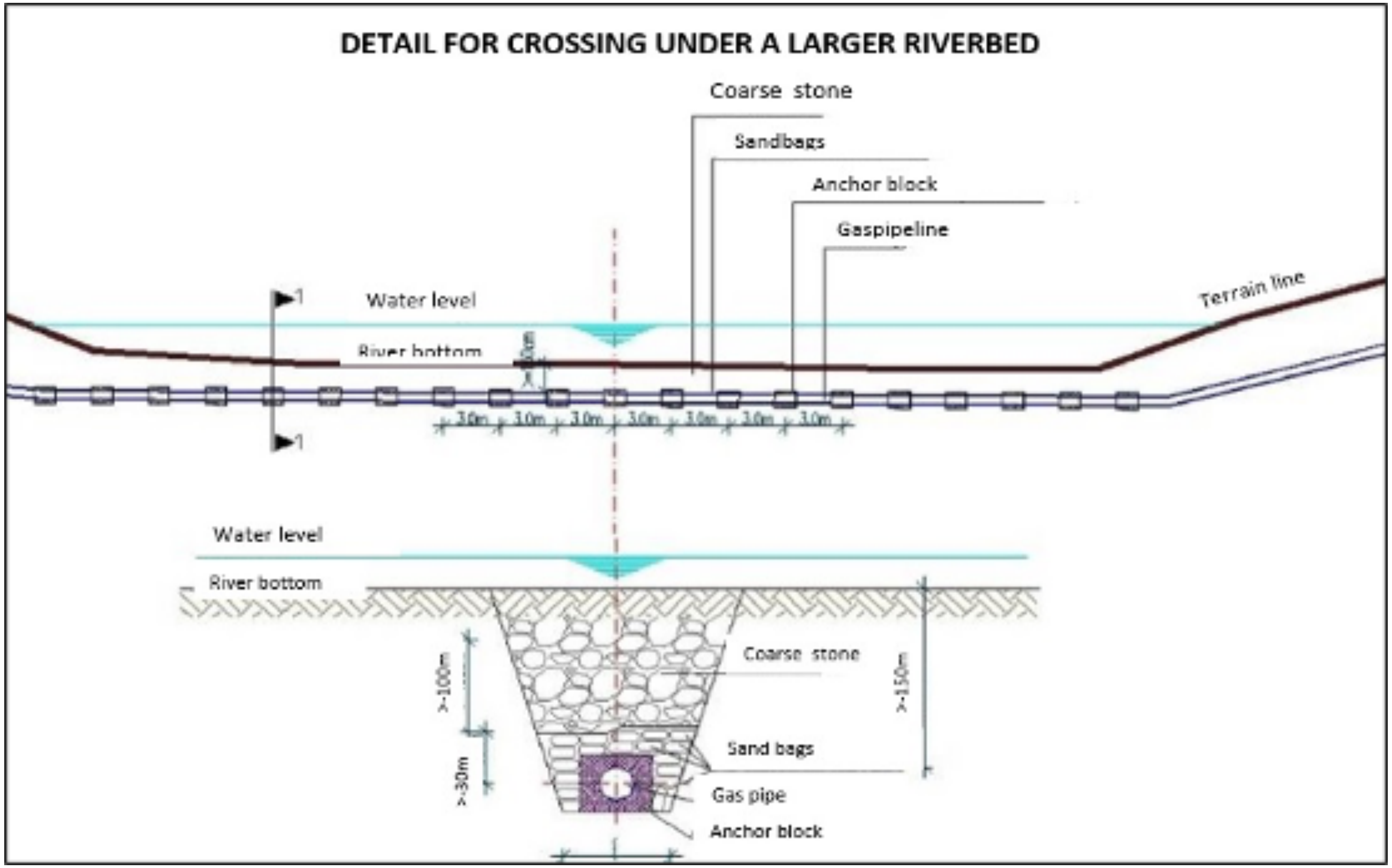


Figure 3-8: Gas pipeline crossing under a large riverbed

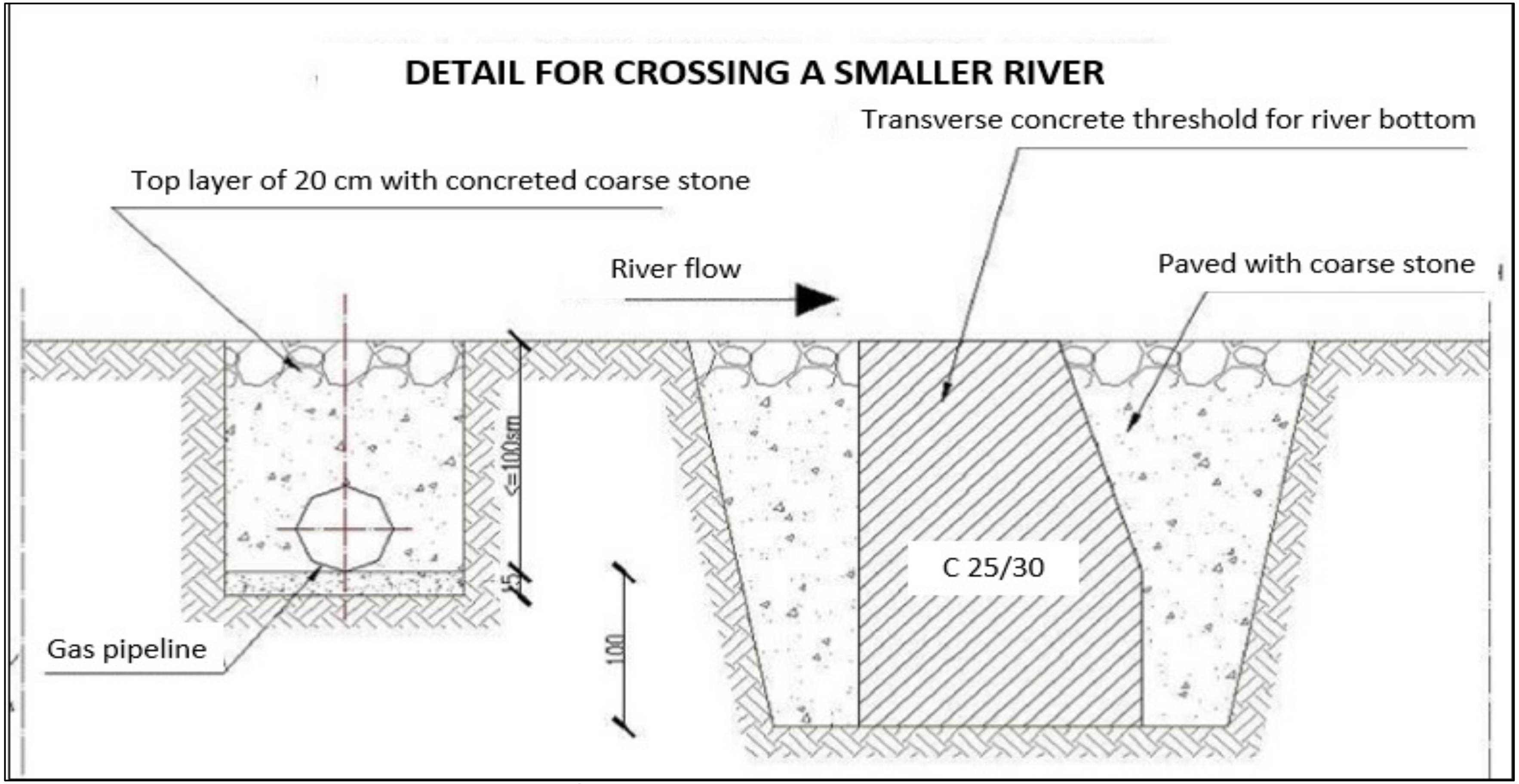


Figure 3-9: Gas pipeline crossing under a smaller river

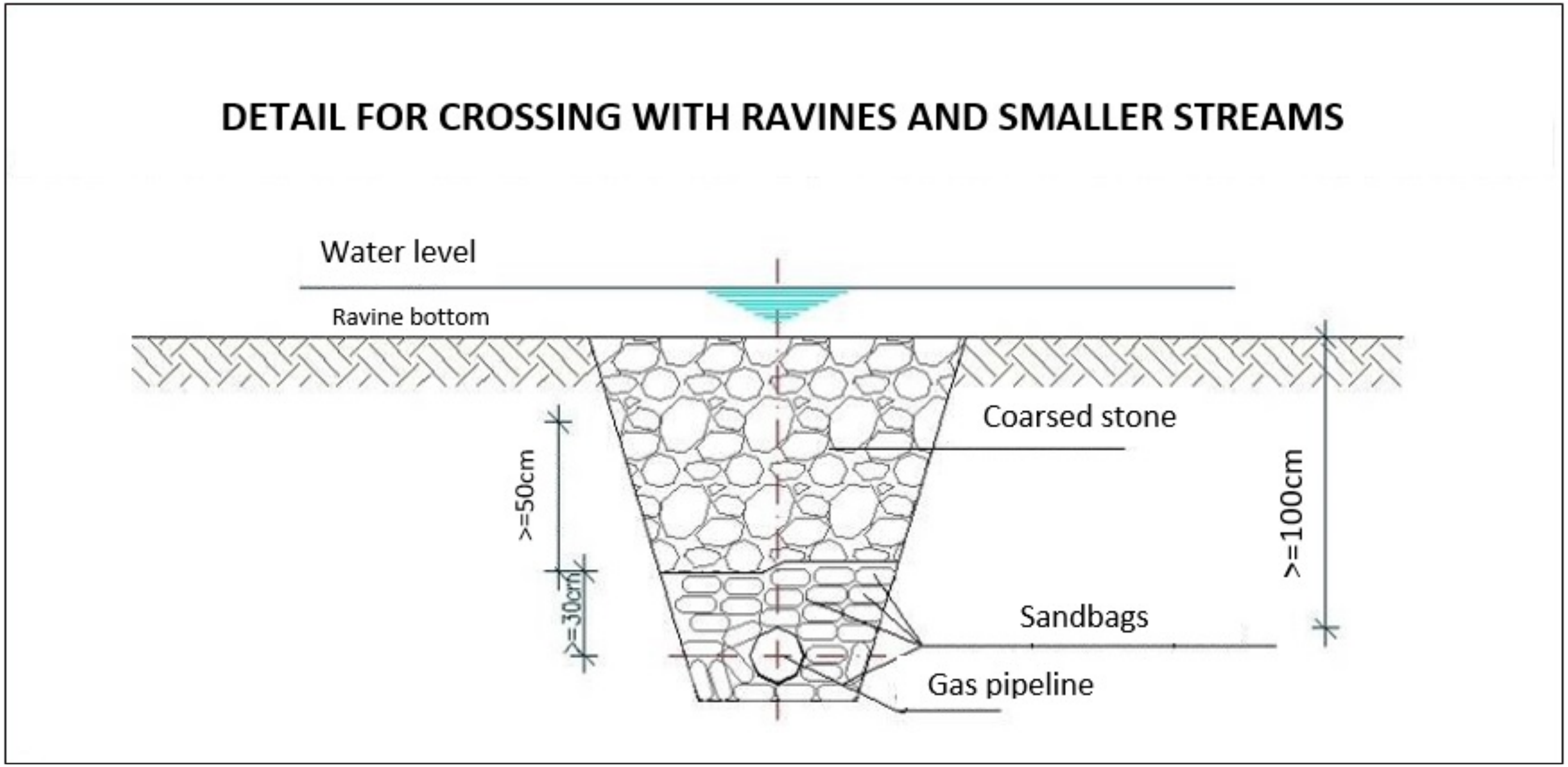


Figure 3-10: Gas pipeline crossing under a valley or smaller watercourses

Muddy and swampy surface crossings

When laying the pipeline through muddy and swampy areas, ordinary or mud-recycling machines are used, and temporary or permanent roads are built if necessary. The road type and width are determined in a separate design.

The underground (trenchless) and over-ground (trenched) method of laying the pipeline through such areas is done in several ways:

- Standard - from the edge of the trench;
- By welding the individual parts/sections;
- Push-and-pull technique along the bottom of the trench (bottom-towing);
- In embankments built specifically for that purpose;
- With the help of pillars (sand, etc.).

Road and railroad crossings

In order to ensure the safety of traffic on motorways and railways, and to carry out smooth repairs, gas pipelines are installed in encasement pipes (casings). The encasement pipe is a steel casing pipe, whose diameter is 150-200 mm larger than the diameter of the gas pipeline. The ends of the encasement pipe should be placed at a radius of 25m from the end of the railway line, the railway infrastructure, at a radius of 15m from the industrial roads, and at a radius of 10m from the edge of the road lane, but not less than 2m from the embankment base.

The crossing is constructed at locations where motorways and railways cross over an embankment or are at ground level, wherein the crossing angle should be in the range of 90° to 60°. It is not allowed for the gas pipelines to cross through the body of the embankment, or under railways or roads.

Figure 3-11: Road crossing

Figure 3-12: Railroad crossing

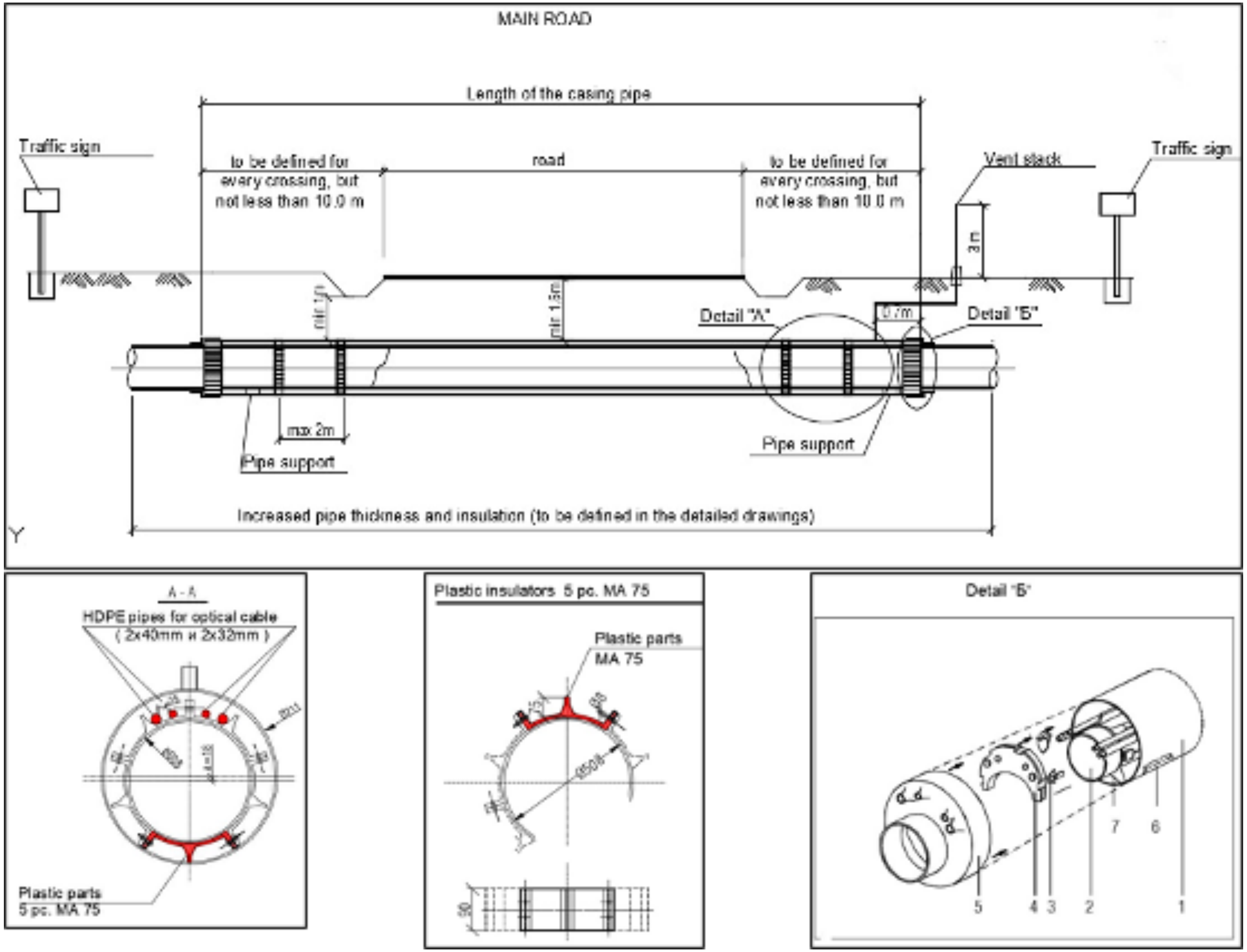


Figure 3-13: Cross-section of road crossing

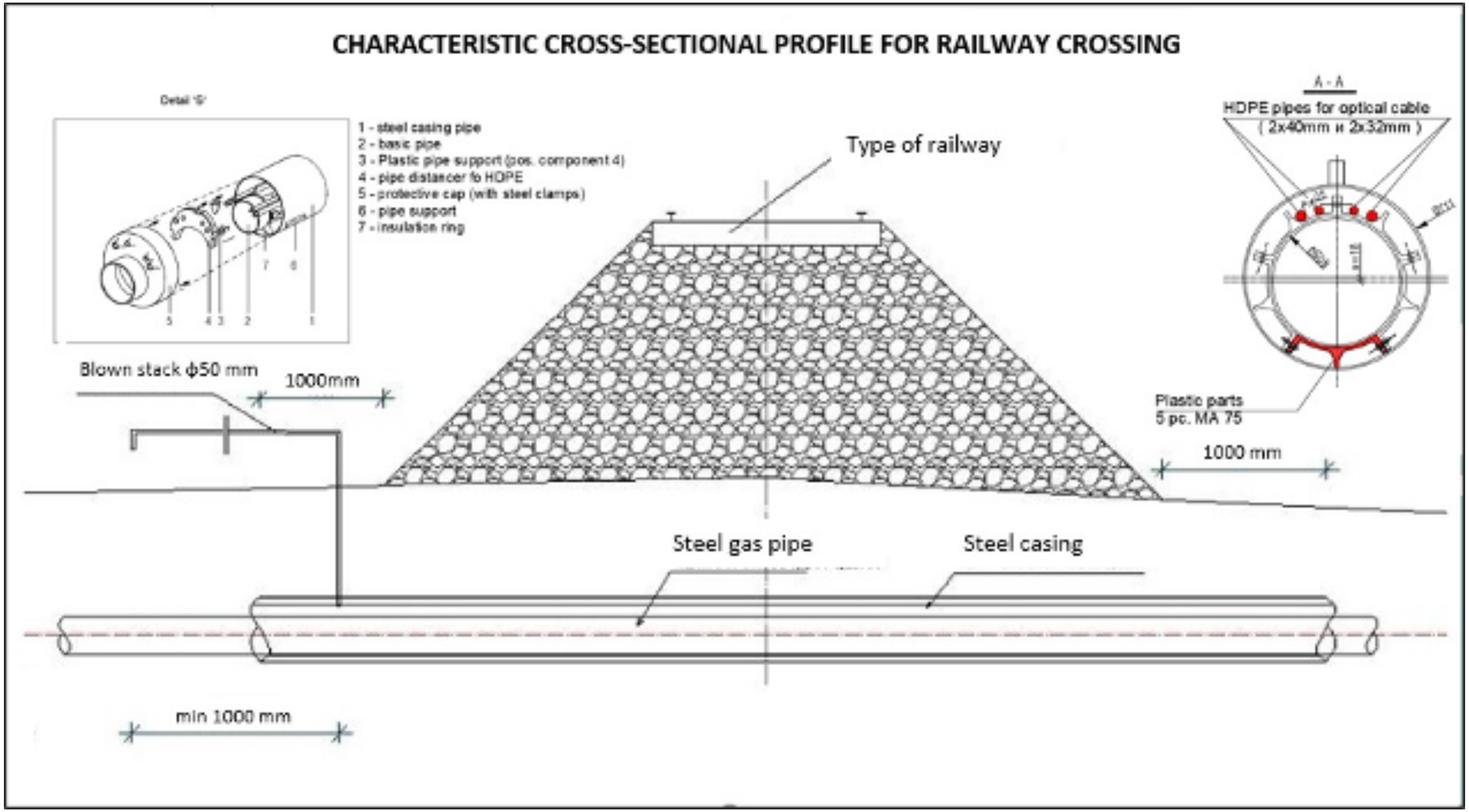


Figure 3-14: Cross-section of railway crossing

Sources of material

In view of the physical location, as well as the micro-location of most of the route, it can be said with certainty that there will be no need for additional earth material for primary and secondary backfilling of the gas pipeline installed and lowered in the trench. In most cases, local soil and terrain conditions will provide the earth material for initial and final backfilling of the gas pipeline and the rest of the trench.

Along the route, at location identified by engineering-geological and geotechnical conditions, there are places where the excavated material will contain both coarse and sharp rocky or stony material, which if used for backfilling of the main gas pipeline could cause damage to the insulation coating applied to the steel pipes. Therefore, where the supervisory body finds that there is a danger of such a phenomenon, it will issue an order for the supply of earth or sand material which will be used for the initial backfilling of the gas pipelines to a height of about 30 cm above the upper edge of the pipeline, and the remaining part of the excavated trench will be backfilled with the original natural material.

Pipe storage

The Investor/Supervisor approves the storage locations for the pipes and other installations offered by the Contractor. The Contractor shall fully comply with the procedures and methodologies approved by the Investor/Supervisor pertaining to the transport, handling and storage of pipes and installations, in order to avoid damaging the pipes or their coating.

The pipes must be stored according to the material type, size and specifications. The materials shall be delivered sorted by colour/type so as to distinguish them according to their purpose / types of material. Materials must be checked against the colour coding. All pipes and ancillary materials, when stored outside, will be lifted above the ground, in order to ensure their protection.

3.3.1.2. Construction of surface facilities

Within the Gas Interconnector North Macedonia – Greece project the following surface facilities shall be built:

- Metering and regulating station (MRS – Greek side of the project);
- Pig Launcher, DN 32”/28” (Greek side of the project);
- Block Stations (BS-01 km 6+600; BS-02 km 6+800; BS-03 km 28+730; BS-04 km 51+060; BS-05 km 66+300);
- Pig Launcher/Receiver, DN 32” / 28”; km 6+600;
- Pig Receiver, DN 32” / 28”; km 66+000;
- Pressure Reduction Station P= (70/54) bar, km 66+150;
- Cathodic protection devices, (CS-1 at km 6+800; CS-2 at km 28+730; CS-3 at km 51+060);
- Power Supply, (PS-1 at km 6+800; PS-2 at km 28+730; PS-3 at km 51+060; PS-4 at km 66+000).

Facilities within the Greek side of the project

The Metering and Regulating Station (MRS), and Pig Launcher (PCS-01) for cleaning and control of the cross-border gas pipeline section are part of the project on the Greek side.

<u>Facilities within the North Macedonian side of the project</u>

The Pig Launcher/Receiver (PL/PR-01) and the first Block Station (BS-I01) are planned to be constructed at km 6 + 600. Their purpose is to ensure the proper operation of the system within the cross-border section on both sides of the border.

A Section Block Station BS-I02 is installed at km 6 + 800 so as to provide the necessary quantities of gas for the southeast planning region (Gevgelija, Bogdanci, Valandovo and Strumica, Radovish) with a possibility to be connected in the future to the existing block station BS-06 near Shtip.

The Line Block Stations BS-I03 at km 28 + 730 and BS-I04 at km 50 + 060 ensure the proper operation of the gas pipeline during exploitation.

At the end of the route, the Pig Receiver, the Pressure Reduction Station and the Block Station BS-05/06 are located. Their purpose is to provide cleaning of the section on the North North Macedonian side and quality control of the pipeline, regulation, i.e. equalization of the pressure with the existing built section Klechovce-Stip-Negotino-Bitola as well as to ensure the proper operation in the other direction, i.e. movement of gas from Negotino to Gevgelija.

Figure 3-15: Measuring and Regulating Station

Figure 3-16: Surface Block Station

Figure 3-17: Pig Launcher surface facility

Figure 3-18: Intelligent pig

3.3.1.3. Pipeline testing

Once the construction of the gas pipeline is completed, it should be tested for possible leaks. The testing can be either hydrostatic testing or pneumatic (air/gas) testing.

The hydrostatic testing is certainly more complicated than the pneumatic testing, as it requires highly efficient water drainage, because the amounts of water entering the pipeline will need to be properly drained.

Hydrostatic testing

The water used for hydrostatic testing must to be clean, fresh and free from impurities, which may damage the material of which the pipes are made. A filter with adequate capacity to adjust to the pump filling capacity will be installed between the water source and the pump suction flanges and it will be maintained in good condition for the entire duration of the operations. The pipes need to maintain a static pressure for a period of 24 hours without any drop in pressure for the test to be acceptable. Pressure measuring instrument shall be connected to the gas pipeline for the duration of the test. After the hydrostatic testing the water must be drained and the pipeline must be dried. It is critical that water is removed completely. The pipeline will be tested in several segment - sections. Water used in the first section will be sampled to ensure that it can be used for testing the other sections.

In the end, once the hydrostatic testing is successfully completed the water shall be drained and the pipeline dried. The test water shall be discharged in specially designed tanks (coated with impermeable polyethylene foil), whereupon it shall be treated. After the treatment, the water will be discharged as specified in the environmental permit issued by the MoEPP.

It is critical that water is removed completely from the pipeline. The pipeline shall be dried either by vacuum drying or by dry nitrogen at ambient temperature in order to prevent operating problems that could potentially be caused by the water remaining in the pipeline.

Pneumatic testing

Air or nitrogen can be used as a test medium. The air used for blowing and testing must be clean, dry and oil-free. The air system will be tested with its own medium, and when that is not available, an oil-free compressor shall be used as air source.

The pneumatic test shall be conducted at full operating pressure. The pipelines subject of the pneumatic test shall be tested at 110 percent of the operating pressure, or up to the maximum allowable operating pressure, whichever is higher. In pneumatic testing the pressure shall be continuously maintained for a minimum time of 10 min.

Magnetic cleaning pig and geometry pig

Magnetic cleaning pigs shall be run through the entire route of the gas pipeline until the Contractor and the Supervisor are satisfied that the pipeline is cleaned from any ferrous debris resulting from the pipeline construction. Once the pipeline has been cleaned with magnetic cleaning pigs, the contractor will run the geometry pigs. After the successful running of the geometry pigs, a positive pressure of at least 2 bar will be established in the pipeline. Dry air or dry nitrogen shall be used as a medium. The debris will consist of metal pieces/ metal shavings which will be deposited at an approved landfill.

Drying

The pipeline shall be dried either by vacuum drying or by dry nitrogen at ambient temperature in order to prevent operating problems that could potentially be caused by the water remaining in the pipeline

Once the construction of the gas pipeline is completed, the construction sites will be cleared and the area restored.

3.3.2 Operational phase

Regular operation

During the regular operation of the gas pipeline, the pressures and conditions along the gas pipeline will be routinely monitored. Regular maintenance and monitoring of the gas pipeline will consist of:

- Monitoring the valves and control points of the gas pipeline. Gas leaks are routinely detected with the help of gas detection sensors,
- Valve boxes are maintained and the level is raised whenever necessary,
- The cathodic protection of the "flange adapters" is checked with readings of voltage and replacement of anodes whenever necessary

Repairs and replacement

If leakage or damage to any part of the pipeline is detected, the damaged pipe is replaced. The following procedures are commonly applied:

- Stopping the leaking line;
- Excavating the affected part (in case of distribution valve or underground installation line);
- Emptying the line;
- Removing the defective pipe;
- Replacing the part and welding the new one at both ends;
- Backfilling and restoration of the area.

3.3.3 Decommissioning

The exploitation period of the gas pipeline system is a minimum of 30 years.

After the expiration of this period, a detailed examination of the current situation is made and in accordance with the actual situation, a new exploitation period is determined which will ensure safe exploitation.

In case of need for decommissioning the gas pipeline, it is necessary to restore the area to its original condition, or if that is not possible, to provide for the adaptation of the area to the environment. In any case, after the adoption of the decision of the Operator for decommissioning of the pipeline, it is necessary to undertake administrative and operational actions for the realization of this postoperative phase.

Namely, the Operator should first inform all competent institutions about the intention for decommissioning (competent ministries, EVN, telephone operators, etc.). From environmental protection aspect, part of the administrative activities that the Operator shall undertake, is to timely notify the competent authority within the MoEPP about its intentions, in order to find an acceptable solution that will have the lowest adverse impact on the environment.

The operator will prepare a plan and program that will list the conceptual solutions related to the decommissioning of the gas pipeline, i.e. which facilities will be dislocated/left, the way of restoration the buffer zone, whether and how the facilities and infrastructure installations can be repurposed converted, etc. In this specific case, it would mean:

- Dismantling of all auxiliary stations (pumping, compressor, treatment and other stations);
- Dismantling the pipeline and equipment;
- Planning of appropriate vegetation on the buffer zone of the gas pipeline route, like the one in the immediate surroundings;
- The main surface facilities, after dismantling the plant and other equipment, to be repurposed (for example: into hospitality facilities or similar), and if that is not possible, to be completely dismantled and removed from the location,
- Underground cables should not be dismantled and used for other users, or should be left in the ground disconnected from the power grid, whereas the pipe installation should continue be used.

In any case, the decommissioning of the pipeline will not pose a threat to the environment in terms of contamination of the soil, surface and groundwater and air pollution in this area. The adverse effects can be only visual, but with proper restoration of the area they will be eliminated.

All the above activities, in case of need for decommissioning, shall be carried out by the Operator during the exploitation.

4 ALTERNATIVES ANALYSIS

4.1 Best option selection process

During the preparation of the planning and design documentation which foresees the execution of projects which are subject to an environmental impact assessment, mandatory attention is paid to a comparative analysis of the alternative solutions that would be considered by the investor, including also a zero alternative, i.e. an alternative which entails not implementing the project. An alternatives analysis is conducted in terms of the best selected solution regarding the location, as well as the application of the feasible and best available technologies and techniques. These aspects are subject to consideration in order to find the best possible solution which will contribute to a maximum possible environmental protection.

4.1.1 Main prerequisites for the best option selection

During the phase of preparing the Feasibility Study for the Gasification System in the Republic of North Macedonia with a conceptual design, one of the objectives was to define the natural gas distribution network on the entire territory of the country and to select the priority sections based upon the demand volume, the consumers density and the distance from the connection points.

For the purposes of achieving the defined objectives, the Feasibility Study comprises consideration of alternative solutions having regard to the factors that have an impact on the best option selection. Special attention was dedicated to the factors that are mainly defined by means of:

- the gas pipeline network parameters (pressure, length, diameters, consumption);
- the technical mobility of the gas pipeline network route;
- network reliability;
- diversification of natural gas sources.

4.1.2 Gas pipeline network parameters

<u>Maximum operating pressure of the network</u>

Currently, in the Republic of North Macedonia, the maximum operating pressure in the main gas pipeline networks is 54 bar and it is indispensable to increase it. All alternatives include operation with a maximum operating pressure of 54 bar on the territory of the country. The gas pressure from the supply connection points of the main gas pipeline network of the Republic of North Macedonia from the Republic of Bulgaria, Republic of Serbia and the Republic of Kosovo is approximately 50 bar and it is indispensable to additionally regulate it. The gas supply pressure of the main gas pipeline network of the Republic of North Macedonia from the Republic of Albania and the Republic of Greece is above 54 bar (it varies between 70 and 100 bar) and it is indispensable to additionally reduce it to 54 bar in the region of the respective border. As regards the maximum operating pressure in the main gas pipeline networks, there are no differences in the particular options.

<u>Length</u>

The length of the routes in the proposed options is approximately the same. A certain difference appears due to the number of incoming gas pipelines from various sources to the main ring. In some of the options, such incoming gas pipelines can also be outgoing – during natural gas transit towards the neighbouring countries.

Diameters

The diameters, alongside the network length, constitute the main factors that have an impact on the expenditures of the main gas pipeline network. At the beginning of the design activities, a minimum diameter was allowed which would be used for the main ring and its main gas pipeline branches, of 20″ and 16″ - DN 500 and DN 400, respectively. The minimum has been observed in all alternatives, except for the ones with a smaller number of connection points for natural gas supply and with a maximum hourly consumption until 2040, wherein an increase of the diameters of the main gas pipeline network was imposed. In order to meet the threshold requirements for a maximum allowed speed of 25 m/s and for a minimum final pressure of at least 20 bar before each Main Measuring and Regulation Station (MMRS), the following diameters are used: DN 600, DN 700, DN 800, DN 900 and DN 1000.

Consumption

The consumption in populated areas had a significant impact on the best option selection. During the consideration of the alternative solutions, the consumption was taken as equal in terms the options that cover 100% of the consumption until 2040. Nevertheless, some of the options with one, two or three sources of natural gas are planned to meet only a particular percentage of the consumption until 2020 or until 2040. Another difference in the consumption with the particular options is yielded by the different quantities of natural gas that can transit towards the neighbouring countries. This factor also had a significant impact on the selection of the most favourable option.

4.1.3 Technical mobility of the gas pipeline network route

The technical difficulties encountered during the installation of the main gas pipeline network route constitute a significant factor in terms of the best option selection. The generally accepted logics is based on the fact that the cheaper option is also a better one, but the technical difficulties can alter the balance in favour of an option that is more expensive, but still easier and safer to implement. Furthermore, it is important for the technical issues to be properly assessed since, otherwise, an incorrect evaluation could lead to a domino effect of additional complications.

One crossing over natural obstacles at an inaccessible location, with increased technical difficulties, could lead to slowing down the construction and installation works, failure to meet the deadlines, necessity of additional equipment, material and construction techniques, as well as an increase in the price of the project.

The proposed options do not differ significantly among each other in terms of the technical mobility of the route and, therefore, a comparative classification based on this indicator cannot be made.

4.1.4 Network reliability

Increasing the potential of the main gas pipeline network can be achieved in two manners:

- by increasing the expectations and improving the quality of the network elements;
- by applying adequate methods for designing the network, wherein the expectations from the network exceed the expectations from its individual elements.

The increase of the expectations and the quality of the elements of the main gas pipeline network is achieved through full compatibility of the invested materials with the particular design and benchmark requirements.

4.1.5 Diversification of natural gas sources

The diversification of the natural gas sources is one of the most important factors in terms of the best option selection. Each country strives to ensure a maximum number of natural gas sources which would preferably include an equal distribution of the natural gas quantities, thus guaranteeing the supply capacity and continuity.

Naturally, options that comprise a larger number of connection points for natural gas supply (a higher level of diversification) have a significant advantage as compared to those with two connection points. On the other hand, it is not really fair to mutually compare them because of the obvious advantages of the options with a larger number of natural gas sources. In order to make a proper decision, the options were grouped and considered as per the number of supply connection points: one, two, three, four and five. Thereafter, the best option was determined within the respective group, according to the number of sources. Then, from amongst them the best option was selected, wherein, once again those with a maximum number of sources (four or five) had an advantage.

In terms of the diameter of the main gas pipeline, this section for interconnection between North Macedonia and Greece constitutes one whole unit. From its starting point in the vicinity of Idomeni village and the town of Gevgelija, all the way to the town of Negotino, a cross section of Φ700mm has been adopted.

4.2 Determining the route

When determining the route of the gas pipeline in the phase of a Feasibility Study, conditions and criteria have been taken into consideration which constitute the basis also for the determining of the definitive route in terms of the elaboration of the Basic design. Those are:

1. Restrictions from the national and local authorities;
2. The shortest distance, having regard to the defined start and end points, all intermediate fixed points, all the restrictions of the route and the implications on the project costs;
3. The changes in the gas pipeline route should be as much as possible within the range of the corridor of 1km on both sides of the centre of the gas pipeline defined in the preliminary tracing of the gas pipeline and/or in the Environmental Study;
4. Consideration should be taken of the defined distance for a divergence between the gas pipeline and any other existing underground infrastructure, as well as the working width of the gas pipeline of 28'' in open soil and in forest/mountainous areas;
5. Interception of the gas pipeline route:
   - Protected areas, such as national parks, should be avoided for as long as it is allowed to cross through their peripheral zone;
   - The sites classified as NATURA may be allowed, but only after consulting the environmental consultant;
   - Public places or areas with a low land price should be preferred;
6. The distance between the gas pipeline and the towns and industrial areas should be as short as possible;
7. The gas pipeline route should be as facilitating as possible in terms of the construction activities;
8. Consideration should be given to the access during the construction;

9. Steep slopes should be avoided as much as possible;

10. The longitudinal slope should be of a maximum of 45 degrees;

11. Large side slopes should be avoided (side or cross slopes), as much as possible;

12. Placing the route of the gas pipeline near or parallel to water courses, regional roads, motor ways, railroads, seismically risky areas, other large pipelines and overhead power lines, should be avoided. When determining the route of the gas pipeline, all of the afore-stated installations should be taken into consideration and the required distance is to be ensured;

13. When the gas pipeline route intersects with an existing or planned infrastructure, such intersection should be at a normal angle or an intersection angle of not less than 70°, or as required by the competent authorities. At locations where the gas pipeline route crosses over rivers, it should be ensured that the crossing directly intersect with the river in order to minimize any active corrosion of the river bank and that such intersection is at the most adequate part of the riverbed, as well as to avoid any side slopes at the access paths to the river and any fast river flows wherever possible;

14. The minimum distance from the gas pipeline route to the existing facilities should be at least 20m;

15. The crossing of the gas pipeline route through the following areas should be avoided wherever possible or minimized:

   – Areas with geological/geotechnical implications, such as: instable slopes, erosive soils, rocky terrains, potential landslides, etc.;
   – Areas prone to flooding and areas with high levels of groundwater;
   – Existing or planned construction areas;
   – Areas which are of historical and archaeological interest;
   – Legally protected areas;
   – Recreational areas, airports, etc.;
   – Military restricted areas;
   – Areas zoned for future development purposes;
   – Areas comprising planned future projects;
   – Dangerous areas that could have an impact of the integrity of the gas pipeline, such as areas with reservoirs, factories for storing explosives, mines and other dangerous installations;
   – Areas with underground man-made obstacles.

16. Other requirements:

   – A cathodic protection system for other facilities;
   – Low and high voltage earthed cables;
   – Earthing systems;
   – Power transformer stations;
   – Solar cell stations;
   – Wind turbine stations;
   – Aggressive (corrosive) areas.

When determining the gas pipeline route, possibilities were considered for selecting corridors which are realistically possible for a further engineering analysis. Concurrently, the corridors of the analysed routes are according to the type of obstacles which are, in principle, divided into natural and man-made.

As regards the natural obstacles, adequate lengths have been determined that go through various terrain categories (level, hilly and mountainous). The lengths of the longitudinal slopes have been determined in % for each corridor, the length of excavations has been determined in each terrain category, as well as the number and magnitude of handling various water obstacles (large rivers, valleys and dry valleys, marshes). Furthermore, a possibility has been determined for the occurrence of constructions at steep cross slopes with major cuts in the terrain, a screening has been conducted in terms of the occurrence of intersections and possibly parallel stretching of inactive and active fault zones, sites have been recorded where it is likely for instable land and landslides to occur, as well as sites of natural rarities and protected zones.

As regards man-made obstacles, analyses have been conducted according to: the character of the land ownership (private or state) of the land through which the route passes, the type and quality of the cadastre culture, the vicinity of populated areas (towns, villages, individual facilities), the gas pipeline class according to the population density, any collisions, i.e., intersections with road infrastructure (main, regional, local and earth roads), any intersections with the railroad infrastructure, intersections with electrical energy high- and low-voltage line installations, intersections with audio and video underground and overhead line installations, intersections with main and local water supply and sewage line installations, intersections with main oil pipelines and collision with potential cultural and historical heritage sites.

For the purposes of determining the gas pipeline route, the following basic determinations have been taken into consideration:

- As a general concept, the idea in terms of the determining of the route is a straight line which connects the start and end point, thereby minimizing the route length. This determination resulted with defining the route from the start to the end point of the gas pipeline in the north-west direction;
- It was decided, whenever possible, for this gas pipeline to be parallel to the existing oil pipeline. Such determination has mainly been applied in agricultural areas. With the exception of several special cases, it has been accepted that a distance of 30 meters between the pipelines would be adequate in order to ensure the integrity of both pipelines during the construction of the gas pipeline, as well as during their operation;
- At instances where there is not enough space for the gas pipeline to stretch in parallel to the existing oil pipeline route due to the limited useful width, a different route of the gas pipeline has been opted for.

This determination according to which, whenever possible, the gas pipeline should be parallel to the existing oil pipeline, practically defines Alternative 1 (Figure no. 4-1).

At those instances where there is not enough space for the gas pipeline to stretch in parallel to the existing oil pipeline route, a different route of the gas pipeline has been opted for, which actually defines Alternative 2 (Figure no. 4-1).

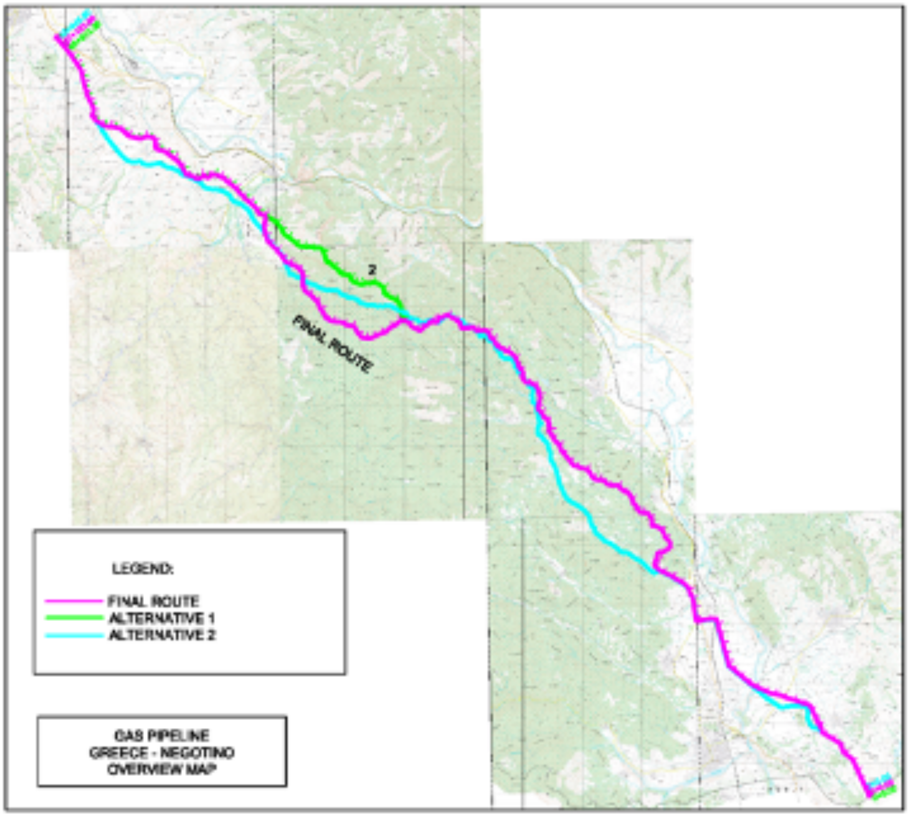


Figure 4-1: Alternative routes and adopted route of the Gas Interconnector North Macedonia - Greece

In terms of such manner of determining the route, in a certain segment of the route it has been established that Alternative 2 passes through three Important Bird Areas: IBA Dolno Povardarie, Demir Kapija and Tikves, one protected area according to the Spatial Plan of North Macedonia from 2004 – the Monument of Nature Demir Kapija and one area which is a proposed protected area according to the Spatial Plan of North Macedonia – Studena Glava. MN Demir Kapija overlaps in a various ratio with the eponymous IBA, IPA and the Emerald Area (Figure 4-2) and it constitutes the richest ornithological reserve in the country, important for the breeding of several types of birds of prey (griffon vulture, Egyptian vulture, golden eagle, short-toed snake eagle, several falcon species, etc.). Here, there are also important species of mammals, reptiles and insects, as well as rare and endemic plant species. In the beginning part of the route, at a distance of 2 km north-west, there is the Emerald area Negorski Banji – a wetland ecosystem with specific plant species.

Table 4-1 comprises a comparative analysis of the gas pipeline routes from Alternative 1, Alternative 2 and the Adopted Route in terms of the distance from/penetration in protected areas and proposed protected areas.

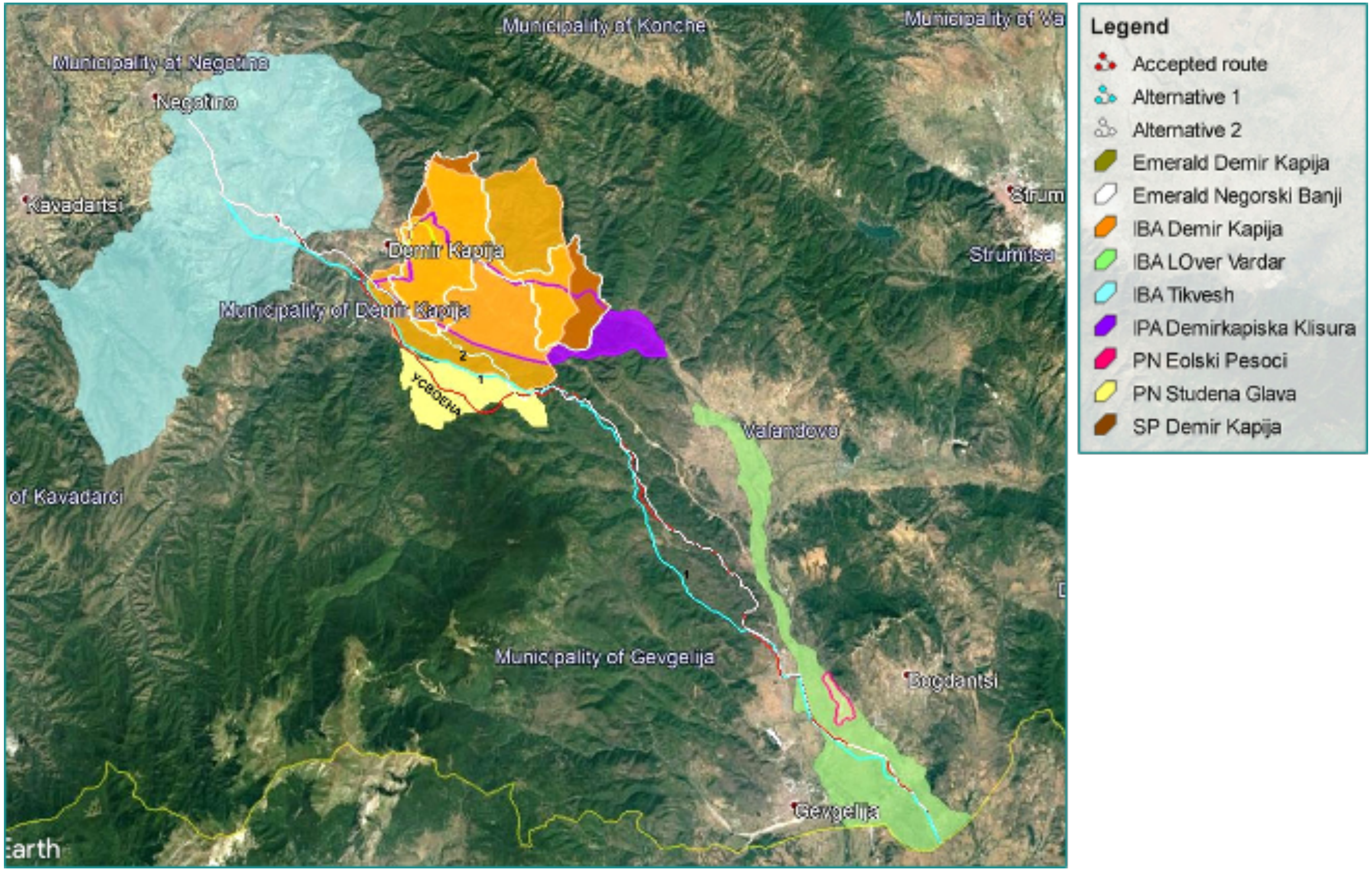


Figure 4-2: Adopted and alternative routes of the Gas Interconnector North Macedonia - Greece

Table 4-1. A comparative analysis of the gas pipeline routes alternatives n terms of the distance from/penetration in protected areas and proposed protected areas.

Area name	Protection category	Alternative 1 Distance (-) Penetration (+) of the route (km)	Alternative 2 Distance (-) Penetration (+) of the route (km)	Adopted route Distance (-) Penetration (+) of the route (km)
Demir Kapija	MN, protected area – MoEPP	-0,8	1.77	- 1,1
Studena Glava	NP, proposed protected area – Spatial Plan of MK	+5,37	+2,2	+7,1
Aeolian sands - Vardar	NP, proposed protected area – MES (UNDP/GEF)	-0,7	- 0,7	- 0,7
Negorski Banji	MN, proposed protected area – Spatial Plan of MK	-2	-2	-2
Negorski Banji	Important plant area (IPA)	-2	-2	-2
Demir Kapija Canyon	Important plant area (IPA)	-0,4	0	-0,62
South Vardar	Important bird area (IBA)	+12,06	12	12
Demir Kapija Canyon	Important bird area (IBA)	+5,26	+9,15	3
Tikves region	Important bird area (IBA)	10	+10,2	+10,2
Negorski Banji	Emerald area (EA)	-2	-2	-2
Demir Kapija Canyon	Emerald area (EA)	-2,7	-2,3	-2,6

After conducting the analyses, an adjustment was made of the route comprised in Alternative 2 and a route was chosen that actually constitutes the Adopted Route (Figure 4-2). This Adopted Route goes through all the three important bird areas: (IBA) Dolno Povardarie, Tikves and Demir Kapija Canyon, and it fully intersects with the proposed protected area Studena Glava. In the central part of the corridor, the route turns towards south whereby it avoids MN Demir Kapija, IPA Demir Kapija Canyon and the eponymous Emerald Area. Thus, the impact, primarily on the rare species of birds of prey, as well as on rare and endemic plants, has been minimized in this region.

Below is the comparative analysis of the gas pipeline routes from Alternative 1, Alternative 2 and the Adopted Route, as regards the environmental media and areas.

- SOIL

The following table presents the construction areas that will have a negative impact on the soil, i.e., soil degradation as a result of the construction activities, per alternatives.

Table 4-2: Construction right-of-way which will be affected by negative impact on the soil

Alternative	Route length (km+m)	Construction right-of-way (ha)
Alternative 1	63+947,60	159,87
Alternative 2	65+913,36	164,78
Adopted alternative	66+290,79	165,72

The comparative analysis has been conducted on the basis of the size of the soil area that will be degraded in the construction phase. Accordingly, the smallest area will be degraded with Alternative 1, i.e. the most favourable in this respect is Alternative 1.

- SURFACE WATER

The following table presents the chainages of the intersections of the alternatives with the surface water flows.

Table 4-3: Chainages of intersection of the alternatives with surface water flows

No.	Intersection chainages with rivers in Alternative 1 (km+m)	Intersection chainages with rivers in Alternative 2 (km+m)	Intersection chainages with rivers in the Adopted Alternative (km+m)
1.	8+679	8+400	8+400
2.	9+266	9+000	9+000
3.	15+013	14+700	14+700
4.	18+844	15+900	15+900
5.	28+636	18+700	18+700
6.	30+081	28+650	28+650
7.	47+925	29+950	29+950
8.	48+588	53+000	41+030
9.	53+519	59+500	48+000
10.		64+550	53+000
11.			59+500
12.			64+550

The comparative analysis has been conducted on the basis of the number of intersections of the alternatives with surface water flows. Accordingly, the smallest number of intersections with water flows are recorded with Alternative 1, i.e. Alternative 1 is the most favourable one in this respect.

- GROUNDWATER

During the construction, the occurrence of groundwater is expected at the locations which are in the vicinity of the intersection of the gas pipeline with the rivers whose chainages have been presented in Table 4-2 above.

In addition to these locations in the vicinity of the rivers, it is likely that groundwater would occur in the course of the construction also at the locations listed in Table 4-4. At these locations, geodetic surveys have been conducted on exploratory boreholes and wells in terms of the level of groundwater. All three alternative routes overlap in the segments of these locations and pass by these exploratory boreholes and wells.

Table 4-4: Exploratory boreholes and wells

Exploratory boreholes and wells	***Chainage (km+m)***
Location	*5+410*
Location	*5+745*
Location	*7+088*
Location	*8+480*
Location	*8+697*
Location	*9+065*
Location	*9+105*
Location	*9+638*
Location	*47+352*
Location	*52+174*
Location	*52+223*

The comparative analysis has been conducted on the basis of the number of locations where the occurrence of groundwater is expected, presented in Table 4-5.

Table 4-5: Number of locations where the occurrence of groundwater is expected

Alternative no.	***Number of locations of intersection with rivers***	***Number of locations near exploratory boreholes and wells***	***Total number of locations***
Alternative 1	*9*	*11*	*20*
Alternative 2	*10*	*11*	*21*
Adopted alternative	*12*	*11*	*23*

Accordingly, the lowest number of locations where the occurrence of groundwater is expected has been recorded in Alternative 1, i.e. Alternative 1 is the most favourable one in this respect.

- AIR

The comparative analysis of the impact on the air has been conducted on the basis of the distance of the receptors (populated areas and important areas) from the air pollution caused by the construction activities during the construction of the alternative gas pipeline routes. Furthermore, also the length of penetration of the alternative routes in the important areas has been taken into consideration. During the conducting of this analysis, consideration has been given to the average distance of populated areas and important areas from the alternative routes, as well as the total length of penetration of the alternative routes in the important areas. The following table presents the distance of the populated areas from the alternative routes.

Table 4-6: Distance from populated areas

Populated area	Distance of the populated area from the alternative gas pipeline routes (km)		
	Alternative 1	Alternative 2	Adopted alternative
Stojakovo	0,062	0,062	0,062
Prdejci	0,21	0,21	0,21
Smokvica	3,06	0,78	0,78
Gabrovo	0,06	0,52	0,275
Petrovo	1,18	1,213	1,213
Dren	0,09	1,32	0,09
Ciflik	0,35	0,71	0,238
Demir Kapija	0,86	0,673	0,673
Przdevo	0,37	0,24	0,24
Tremnik	0,72	0,653	0,653
AVG DISTANCE	**0,6962**	**0,6381**	**0,4434**

As regards the impact on the air, in terms of the distance from the populated areas, Alternative 1 is the most favourable one since it is the most distant from the populated areas.

Table 4-7 presents the distance of important areas from the alternative routes and the length of penetration of these routes in the important areas.

Table 4-7: Distance from/penetration in important areas

Important areas	Protection category	Alternative 1		Alternative 2		Adopted alternative	
		distance of the area from the gas pipeline (km)	length of penetration of the gas pipeline in the area (km)	distance of the area from the gas pipeline (km)	length of penetration of the gas pipeline in the area (km)	distance of the area from the gas pipeline (km)	length of penetration of the gas pipeline in the area (km)
Demir Kapija	MN, protected area – MoEPP	0,8			1,77	1,1	
Studena Glava	NP, proposed protected area – Spatial Plan of MK		5,37		2,2		7,1
Aeolian sands - Vardar	NP, proposed protected area – MES (UNDP/GEF)	0,7		0,7		0,7	
Negorski Banji	MN, proposed protected area – Spatial Plan of MK	2		2		2	
Negorski Banji	Important plant area (IPA)	2		2		2	
Demir Kapija Canyon	Important plant area (IPA)	0,4		0,01		0,62	
South Vardar	Important bird area (IBA)		12,06		12		12
Demir Kapija Canyon	Important bird area (IBA)		5,26		9,15		3
Tikves region	Important bird area (IBA)		10		10,2		10,2
Negorski Banji	Emerald Area (EA)	2		2		2	
Demir Kapija Canyon	Emerald Area (EA)	2,7		2,3		2,6	
TOTAL			**32,69**		**35,32**		**32,3**
AVERAGE		**1,51**		**1,50**		**1,57**	

In terms of the impact of the gas pipeline construction per alternatives in the segments of the route that are in the vicinity of important areas, the most favourable one is the Adopted Alternative. As regards the penetration in important areas, the Adopted Alternative is the most favourable one.

As regards the impact on the air, in terms of the distance from populated areas, the most favourable is Alternative 1, whereas in terms of the distance from important areas, the most favourable is the Adopted Alternative.

➢ NOISE

In the comparative analysis of the impact from noise, the same input parameters have been used as for the analysis of the impact on the air and the same methodology has been applied, i.e. the distance of the receptors from the noise has been used (populated areas and important areas) from the alternative routes. Furthermore, also the length of penetration of the alternative routes in the important areas has been taken into consideration. As regards the impact from noise, in terms of the distance from populated areas, the most favourable is Alternative 1, whereas in terms of the distance from important areas, the most favourable is the Adopted Alternative.

➢ WASTE GENERATION

The comparative analysis of the impact from the generated waste has been conducted on the basis of the length of the alternative routes. This simplification was made on the basis of the fact that the largest quantity of waste generated during the construction phase – 17 05 excavated soil, will be returned for covering up the gas pipeline trench. No major quantities of excess excavated soil are expected which are to be disposed of at other locations.

During the construction phase, approximately the following quantities of soil will be excavated, as presented in the following table:

Table 4-8: Approximate quantities of excavated soil

Alternative	*Excavated soil (m^3)*
Alternative 1	*255.788*
Alternative 2	*263.652*
Adopted alternative	*265.160*

Accordingly, the most favourable alternative in terms of the generated waste is Alternative 1.

Table 4-9: Comparative analysis of alternatives in terms of the environmental media and areas

Environmental media and areas	*Alternative 1*	*Alternative 2*	*Adopted alternative*
Protected and proposed protected areas			*X*
Soil	*X*		
Surface water	*X*		
Groundwater	*X*		
Air (populated areas)	*X*		
Air (important areas)			*X*

Environmental media and areas	*Alternative 1*	*Alternative 2*	*Adopted alternative*
Noise (populated areas)	*X*		
Noise (important areas)			*X*
Waste generation	*X*		

Based upon the conducted comparative analysis it may be discerned that the most favourable is Alternative 1. Nevertheless, this Alternative 1 has not been selected due to the fact that the gas pipeline route with this alternative cannot meet the determination of a parallel alignment with the oil pipeline. In terms of the segment of the gas pipeline route which is adjacent to important areas, this requirement (distance of 30 m from the oil pipeline) cannot be met due to the terrain configuration and, therefore, Alternative 1 has been abandoned and Alternative 2 and the Adopted Alternative remained for consideration in the selection of the most favourable route. Having regard to the fact that Alternative 2 goes even deeper through important areas (refer to Figure 4-2, Table 4-1 and the ***text in bold and italics*** below Table 4-1), the Adopted Alternative has been selected as the most favourable one.

4.3 Zero alternative

Zero alternative or also known as the Do-Nothing alternative actually denotes no implementation, i.e. not executing the project. It is deemed a baseline condition against which the environmental impacts from the project are to be analysed. The consideration of this alternative implies that the project would not be implemented and, therefore, the effects would be as follows:

- An unchanged condition of the current existing natural gas supply through the only existing section from Deve Bair,
- There will be no fulfilment of the commitments for diversification of the natural gas sources, which is the aspiration of our country in terms of ensuring the required capacity and continuity in the supply with this energy source.
- The failure to implement this project would impose the necessity of seeking new connection points as a source of natural gas, which would certainly depend both on the needs and the possibilities for connection with the neighbouring countries.
- The forecasts in the strategic documents which pertain to the use of energy in the Republic of North Macedonia will not be fully accomplished and it will be necessary to make new strategic prognoses.
- In addition, by not implementing this project a large number of workers would not be engaged in the construction and the operational phase of the project.
- By all means, the non-implementation of this project would denote that the biodiversity would remain unaltered and in the current condition, in terms of the footprint of the adopted route.

5 BASELINE ENVIRONMENTAL DATA FOR THE SITE AREA

5.1 Geographical position of the route location

The route of the gas pipeline is located in the south-eastern part of the Republic of North Macedonia (marked with a green line in Figure no. 5-1). The length of the route is 67.194 km. The coverage area is 168.53 ha.

Figure 5-1: Location of the route of the gas interconnector North Macedonia - Greece

The route passes through the municipalities: Bogdanci, Gevgelija, Demir Kapija and Negotino (Figure no. 5-2).

Figure 5-2: Administrative map of the MK with marked municipalities through which the gas pipeline passes

The further part of the text describes the geographical position of the following main municipalities through which the gas interconnector passes: Bogdanci, Gevgelija, Demir Kapija and Negotino.

Municipality of Bogdanci [2]

The Municipality of Bogdanci is located in the South Vardar region of MK. It covers an area of 114.54 km^2. This municipality is bordered on the west by the Municipality of Gevgelija, on the north by the Municipality of Valandovo, on the east by the Municipality of Dojran, and on the south side, the border of the Municipality coincides with the state border with the Republic of Greece.

Within the municipality there are 4 populated areas, of which only the town of Bogdanci is urban while Gjavato, Selemli and Stojakovo are rural populated areas.

The route of the gas pipeline starts on the border line in the territory of the Municipality of Bogdanci, near the locality Sredno Bilo (Figure no. 5-3).

Figure 5-3: Connection point at km 0+000.00

Further on, over arable agricultural land, through the locality Maleolu, it heads to a hilly area in the locality Goli Rid, from where it continues through the area of Stojakovo, passing southwest of the settlement, where it intersects with the local asphalt road Bogorodica-Stojakovo, touching the planned construction right-of-way of Stojakovo (Figure No. 5-4) and through the locality Rudina (it touches the archaeological site of Rudina) it approaches the route of the oil pipeline Thessaloniki - Skopje.

[2] The data for the municipality of Bogdanci are taken from: LEAP for the municipality of Bogdanci 2019-2025

Figure 5-4: Route of the Gas Interconnector (green colour) on the the territory of the municipality of Bogdanci

At a safe parallel distance from the oil pipeline (greater than 50 m), at km 6+185.00 it crosses a 400 kV overhead power line (Figure no. 5-5) and at km 6+220 a 110 kV overhead power line, from where it moves towards the regional asphalt road Gevgelija- Bogdanci. Before the crossing with the Regional Road Gevgelija-Bogdanci at km 6+500, in the locality Belik Cair, it is planned to construct the first line Block Station, Pig Launcher/Receiver, as well as a sectional Block Station for future connection with the section for gas supply of the south-eastern region (Gevgelija, Bogdanci, Strumica).

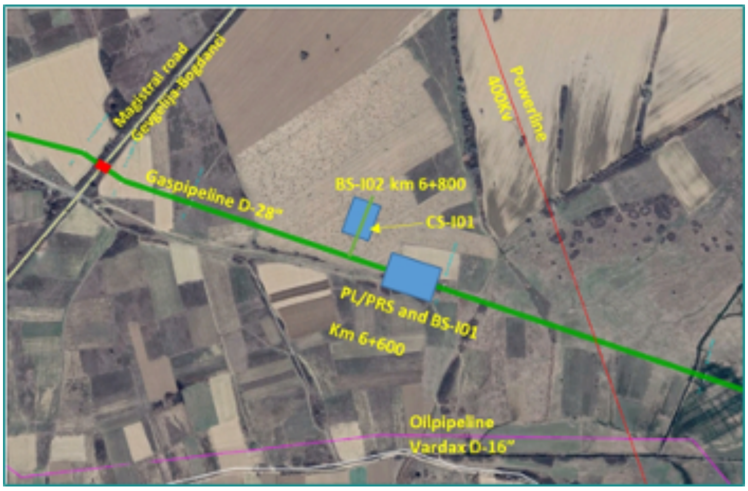


Figure 5-5: Location of PL/PRS-01, BS-I01 km 6+600 and BS-I02 km 6+800

After crossing the regional road Gevgelija-Bogdanci, the route continues westward to the locality of Dolna Ada where it passes under the Vardar River (Figure no. 5-6) and the inflow of the Sermeninska River at km 9+783, and at km 10+452 it intersects with 110 kV overhead power lines.

Figure 5-6: Crossing under the Vardar River km 8+500

Municipality of Gevgelija [3]

The Municipality of Gevgelija, along with the municipalities of Bogdanci, Bosilovo, Valandovo, Vasilevo, Dojran, Konce, Novo Selo, Radovis and Strumica make up the Southeast Planning Region, situated on the very border with the Republic of Greece. The area of this municipality is 485 km^2. Gevgelija is located at an altitude of 64m and it is one of the lowest municipalities in the country.

Figure 5-7: Route of the Gas Interconnector on the the territory of the municipality of Gevgelija

[3] The data for the municipality of Gevgelija are taken from: gevgelija.gov.mk/opstina-gevgelija/

The Municipality of Gevgelija is located in the southern part of the country at 41° north latitude and 22° east longitude, along the valley of the Vardar River and the E75 motorway.

Its favourable location has resulted in development of the commercial facilities, which require extensive transport of raw materials and finished products with the southern neighbour - the Republic of Greece, in which regard the proximity of the port of Thessaloniki is a significant comparative advantage.

To the north and to the east it is bordered by the municipalities of Valandovo and Bogdanci, to the west by the municipalities of Demir Kapija and Kavadarci, and to the south by the Machukovo (Evzoni) in the neighbouring country of Greece.

Within the municipality of Gevgelija there are 17 populated areas: Gevgelija, Bogorodica, Gabrovo, Davidovo, Kovanec, Konsko, Miletkovo, Miravci, Moin, Mrzenci, Negorci, Novo Konsko, Petrovo, Prdejci, Smokvica, Sermenin and Huma. The town of Gevgelija is located only 3 km from the border crossing Bogorodica, on the North Macedonian-Greek border. It is 158 km away from the capital city of North Macedonia, Skopje, and 70 km away from Thessaloniki, the largest port on the Aegean Sea.

On the territory of the Municipality of Gevgelija, the route starts in the locality Keramidarnica (it touches the archaeological site of Keramidarnica) and through the locality Gladno Pole in the southern part of the village of Prdejci it crosses the Thessaloniki-Skopje oil pipeline, the Thessaloniki-Skopje (Athens-Munich) railway line and the new motorway “Prijatelstvo” (Friendship) A1 Gevgelija-Skopje-Kumanovo (Figure no. 5-8). In this segment, the route passes through agricultural areas with plantations, without slopes and at a standard parallel distance greater than 50 meters from the oil pipeline Thessaloniki – Skopje. After crossing the A1 Motorway, the gas pipeline also crosses the Asphalt Road Prdejci - Negorci and continues to the north, passes under the Kovanska River and turns northwest, touching the archaeological site Glavica on its southern side and at km 17 +125 it once again crosses the oil pipeline Thessaloniki – Skopje, touching the archaeological site Konjari on its eastern side.

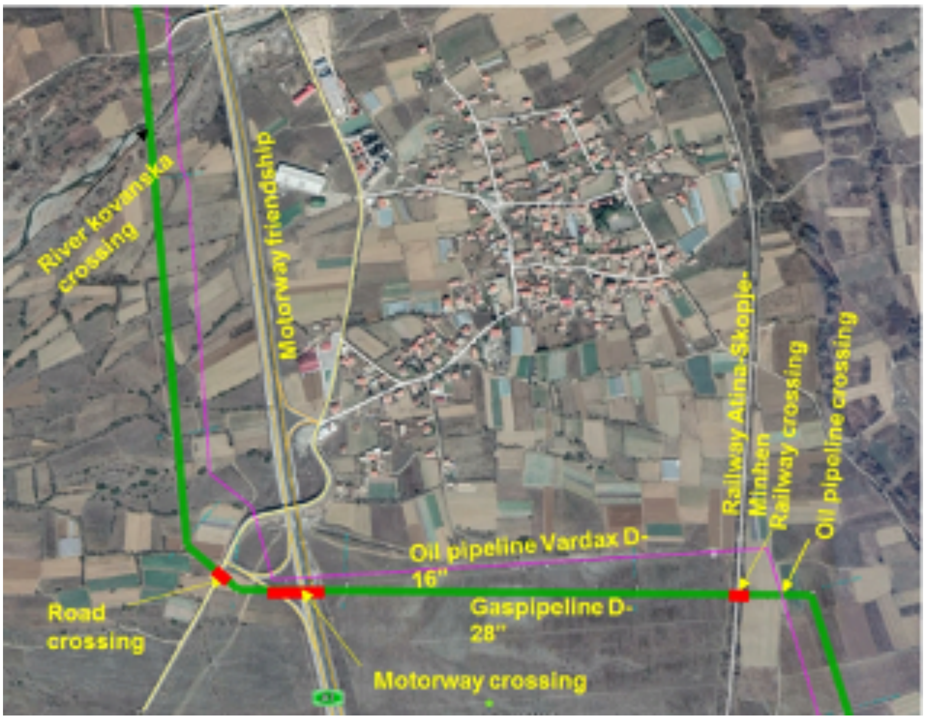


Figure 5-8: Passage under the oil pipeline at km 12+700, Railway line at km 12+755, Motorway A1 at km 13+600 , Regional road at km 13+700 and Kovanska River at km 14+650

Further on, the route continues through a mountainous part, bypassing the quarry concession in the locality of Lira and from km 19+000, passing along the ridges of Bilo, Goli Rid, Maslinski Rid, Vrla Strana and Kamenlliv Rid, and through the highland part of the localities Sirini, Gladno Pole and Gojkova Chuka, touching the archaeological site Gradiste and the hill Mitivir on the south side, it passes under the river Petruska (Figure no. 5-9), wherein at km 28+700, the second line Block Station is planned. Immediately after the Block Station, at km 28+800, the route passes under the local asphalt road Miravci-Gabrovo-Petrovo and through the locality Gradiste, it heads towards the valley of Stara Reka where it crosses a 400 kV overhead power line and, following the route of the oil pipeline Thessaloniki-Skopje on its right side, through the ridges Pribilski Rid, Chukata, Drevenot and Gola Chuka, it moves towards the project scope of the wind farm "Kaltun Energy".

Figure 5-9: Crossing under asphalt road at km 28+780, BS-I03 at km 28+730, Cathodic Protection Station CS-I02 and passage under Petrushka River at km 28+600

Municipality of Demir Kapija [4]

The municipality of Demir Kapija is located in the southern part of North Macedonia, i.e. in the south-eastern part of the Tikves valley. The municipality lies on the coordinates between 22°00″ and 22°30″ latitude and 41°15″ and 41°30″ longitude, with an average altitude of 622 m above sea level. The Tikves valley mainly covers the area in the middle course of the Vardar River, from its outflow from the Veles Gorge on the northwest all the way to the Demir Kapija Canyon on the south-east.

The term Tikves refers to the flat terrains on both sides of the Vardar River, known as Povardarie, starting something northwest from the mouth of Bregalnica in Vardar all the way to southeast at the mouth of Bosavica, then the valley of Crna Reka from the outflow and the flow through the Tikvesh Gorge to the inflow and into the Vardar River, the uneven terrains and the river valleys located between Crna and Bosavica, as well as the low sloping areas of the mountains that separate the valley from the neighbouring areas.

[4] The data for the municipality of Demir Kapija are taken from the LEAP for Demir Kapija, 2011

Figure 5-10: Route of the Gas Interconnector on the the territory of the municipality of Demir Kapija

The municipality of Demir Kapija is bordered by the neighbouring municipalities: Negotino, Kavadarci, Gevgelija, Valandovo and Konce. It borders the municipality of Negotino from Crveni Rid after the inflow of the Przdevska River in Vardar and the mountain Svracka, then it continues through a footing above the village of Przdevo, it passes across Golem Rid and ends at Boskova Padina. The border with the municipality of Kavadarci starts from Boskova Padina through the mountains Omot and Chuka, it passes along the Marjanska mountain to the top Kuso Boce from where, along the top Studena Glava to Studer, Veternikot, through the Vardar River along Lutkova River to Mali Karadak, it borders the municipality of Valandovo. Along the Krk Dzamija Mountain, the Bel Kamen peak, through Beli Rid and Visok Rid, the border with Konce ends at Crveni Rid.

The route of the gas pipeline passes through the territory of the Municipality of Demir Kapija through its central part, initially crossing the project area of the wind farm "Kaltun Energy" (Figure no. 5-11), whereby, due to the bad mountainous terrain and the requirements for proper distance from the Wind Turbines, the gas pipeline route, from km 35+000 to km 41+000, passing through the localities Andonov Rid, Stefan, Zhurot and Begovi Nivi, intersects with the Oil Pipeline Thessaloniki – Skopje in three places and continues to the locality Studena Glava and the ridges Usov Grov, Golem Vlas and Mal Vlas and descends to the valley of Drenska River passing under the riverbed of the Maminska River and the riverbed of Drenska River, downstream from the Reservoir on the Drenska River it crosses a 400 kV overhead power line and, bypassing the village Dren from its eastern side, through the locality Vcjak and the archaeological site Orizarski Grobista it moves east of the village Chiflik, where at km 51+200 the third line Block Station is planned (Figure no. 5-12). Immediately after the Block Station, the route passes under the regional route of the asphalt road Demir Kapija - Dren and at km 51+ 650 it intersects with the Oil Pipeline Thessaloniki-Skopje and moves towards the mouth of the rivers Doshnica and Boshava (Figure no. 5-13) passing directly in front of their junction and after passing near the local fishery, it moves towards the locality Golemo Brdo going under the local asphalt road Demir Kapija - Besvica. Further on, through the localities Kozinovi Gornici, Gjerenot and Gagovi Nivi, it crosses a 400 kV overhead power line and approaches the village of Przdevo, and bypassing it from its eastern side, west of the archaeological site Bugdasna Glava it continues towards Negotino.

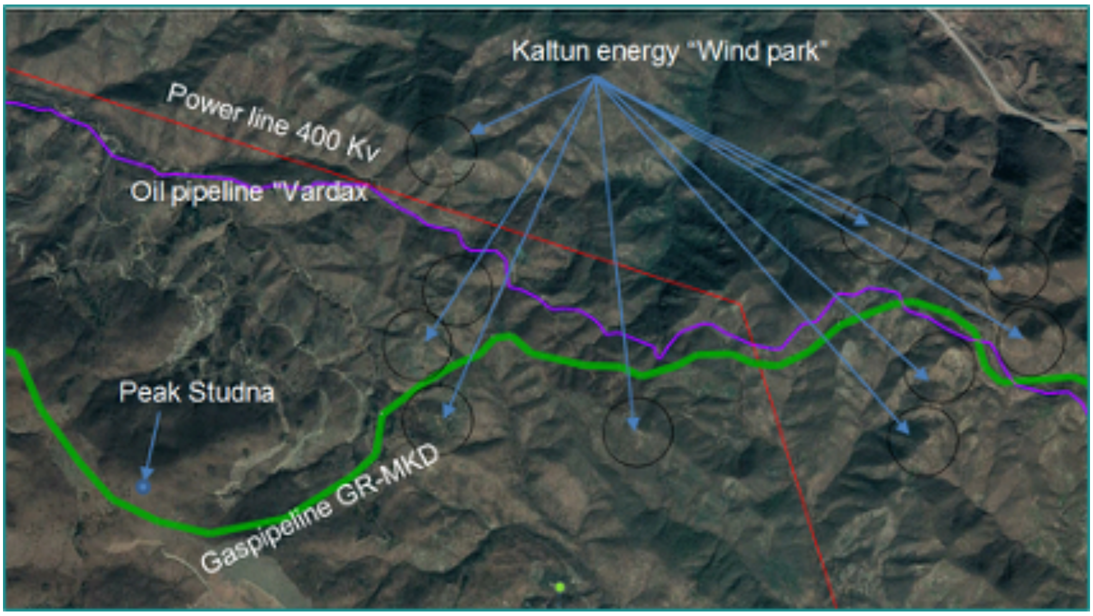


Figure 5-11: Crossing in the area of the Kaltun energy wind park from km 35+700 to km 40+000

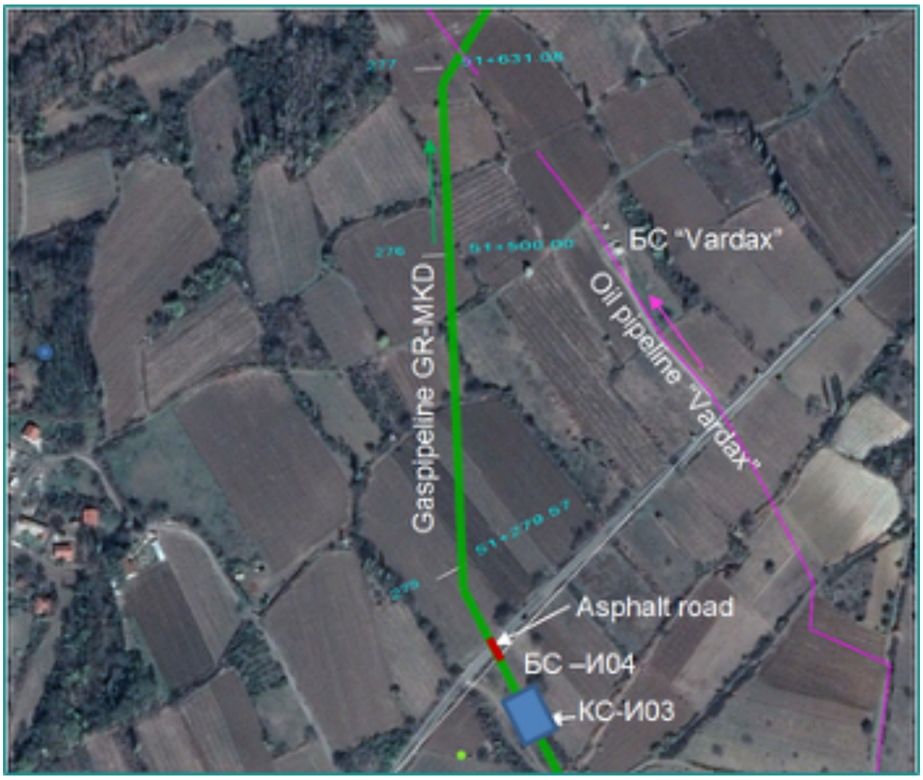


Figure 5-12: Crossing under asphalt road at km 51+250, block station BS-I04 and CS-I03 and passage under the oil pipeline "Vardax" at km 51+630

Figure 5-13: Crossing under the rivers of Boshava and Doshnica at km 52+200, asphalt road at km 52+530

Municipality of Negotino [5]

The Municipality of Negotino is located in the central part of the Republic of North Macedonia, in the area of the middle Povardarie. It belongs to the Vardar region, and as a distinct natural environment it belongs to the Tikves-Vardar region, i.e. the Tikves-Raec micro-region. It covers the eastern part of the Tikves Valley, on both sides of the Vardar River and on the south-east side it borders with Demir Kapija. It is bordered by 6 municipalities, as follows: to the north by the municipality of Stip, to the east by Konche, to the south by Kavadarci, to the west by Rosoman and to the northwest by Gradsko. It covers an area of 414 km^2 and is inhabited by 19,212 inhabitants who live in the town of Negotino and in 18 other populated areas: Brusnik, Veshje, Vojshanci, Gorni Disan, Dolni Disan, Dubrovo, Janoshevo, Kalanjevo, Krivolak, Kurija, Lipa, Pepelishte, Peshternica, Timjanik, Tremnik, Crveni Bregovi, Dzidimirci and Sheoba, 4 of which have no inhabitants.

[5] The data for the municipality of Negotino are taken from: http://www.negotino.gov.mk/

Figure 5-14: Route of the Gas Interconnector on the territory of the municipality of Negotino

Bypassing the village of Przdevo from its east side, the route of the gas pipeline continues to Negotino, bypassing the village of Tremnik on its southwest side, passing through the Tiklik slope and the localities of Atanasica, Agjupka, Sokolce and Poroite where the route crosses a 400 kV overhead power line and heads towards the new designed Reduction Station and the existing Block Station no. 8 which should be a connection point with the existing main gas pipeline network (Figure no. 5-15)

Figure 5-15: RLS, Reduction Station, BS-I05/06 and connection with BS-8

5.2 Climate and meteorological characteristics of the area

The area of the municipalities of Bogdanci, Gevgelija, Demir Kapija and Negotino where the gas pipeline passes is influenced by Mediterranean and continental climate. Here, there is a special local climate with changed Mediterranean and milder moderate continental climate characteristics, which is manifested by hot summers and relatively cold winters.

This area has an average annual temperature of 14.2 ^{0}C and is among the warmest in the Republic of North Macedonia (Figure No. 5-16). The summers are characterized by high maximum temperatures. The total number of hours of sunshine per year is 2,392, which is comparable to several places near the Adriatic Sea and the Mediterranean in general.

The warmest month is July with an average monthly temperature of 25 ^{0}C. The winters are not very cold and they do not last long. The average temperature in the three winter months is 4.7 ^{0}C (Tables from 5-1 to 5-5).

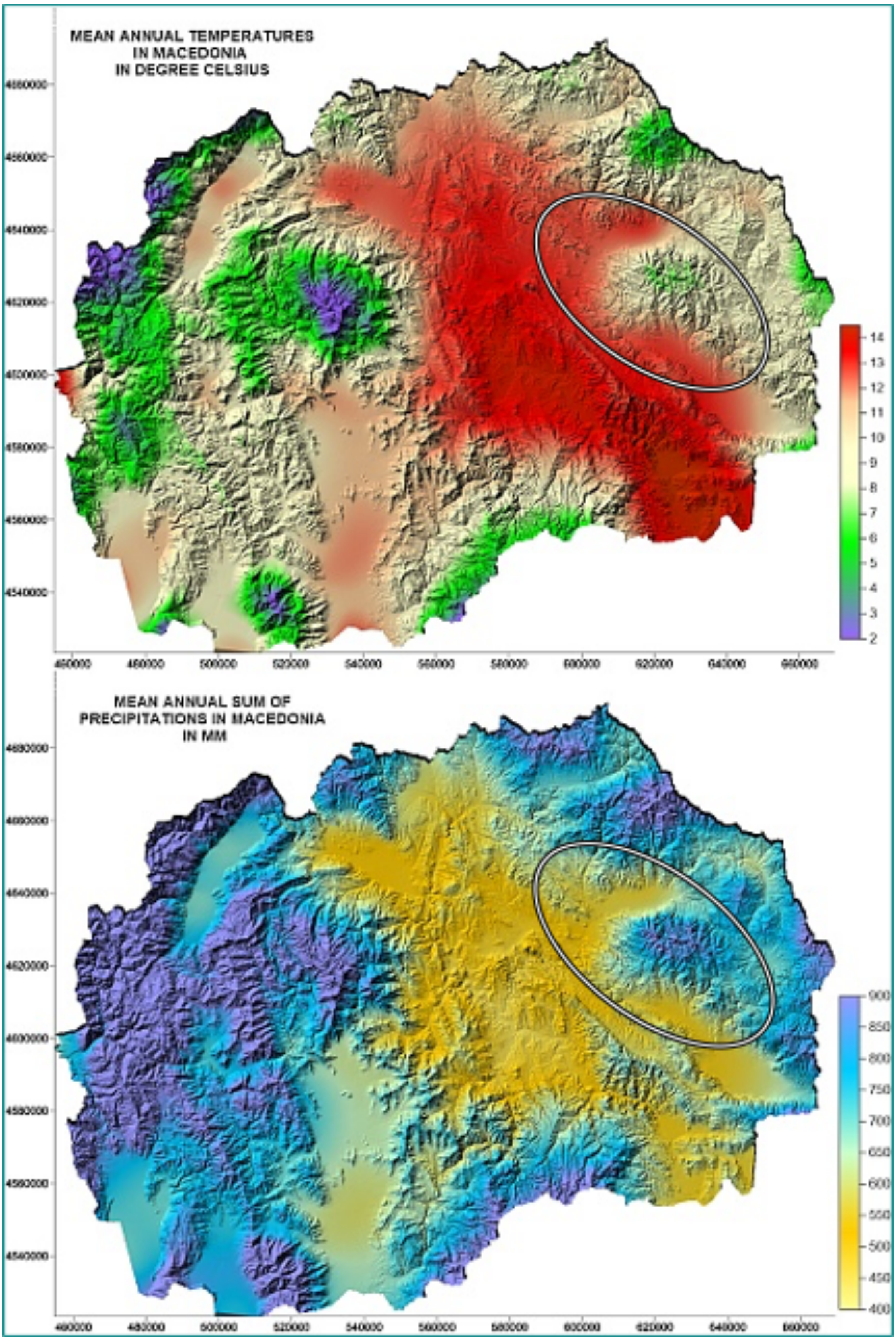


Figure 5-16: Map display of temperature and precipitation in MK

Table 5-1: Average monthly and annual air temperatures [^{0}C] [6]

Meteorological Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Demir Kapija	1.6	4.6	8.5	13.5	18.3	22.2	24.4	23.9	20.2	14.0	8.2	3.3	13.5
Valandovo	3.6	5.5	8.8	13.5	18.3	22.3	24.8	24.3	20.4	14.7	9.3	5.2	14.2
Gevgelija	3.5	5.4	8.6	13.3	18.4	22.8	25.1	24.5	20.3	14.2	9.2	5.1	14.2

Table 5-2: Average maximum monthly and annual air temperatures [^{0}C]

Meteorological Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Demir Kapija	5.3	9.1	13.6	19.3	24.5	28.7	31.3	31.2	27.1	20.2	12.6	19.1	20.1
Valandovo	7.6	10.2	13.8	19.3	24.3	29.0	31.7	31.7	27.3	23.9	15.0	9.7	20.3
Gevgelija	8.0	10.4	14.0	19.6	24.9	28.6	32.0	31.7	27.7	21.1	14.4	9.8	20.2

Table 5-3: Average minimum monthly and annual air temperatures [^{0}C]

Meteorological Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Demir Kapija	-1.9	0.2	3.6	7.2	11.6	15.3	17.3	16.5	13.4	8.5	4.5	1.0	8.2
Valandovo	0.2	1.5	3.5	7.5	11.2	15.2	17.3	18.9	13.7	9.4	5.4	1.6	8.7
Gevgelija	-0.5	0.8	3.4	7.0	11.5	15.3	17.3	16.7	13.3	8.3	4.6	0.9	8.2

[6] Source: National Hydrometeorological Service of the Republic of North Macedonia

Table 5-4: Absolute maximum monthly and annual air temperatures [^0C]

Meteorological Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Demir Kapija	19.3	22.7	28.7	35.3	36.1	39.5	43.6	41.4	36.7	32.2	25.6	20.8	43.6
Valandovo	19.0	23.5	27.8	31.5	34.4	39.5	43.5	40.4	37.2	32.6	25.6	20.0	43.5
Gevgelija	19.5	23.0	30.0	31.0	37.0	40.0	44.3	42.5	38.6	33.6	27.0	21.6	44.3

Table 5-5: Absolute minimum monthly and annual air temperatures [^0C]

Meteorological Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Demir Kapija	-18.5	-18.6	-11.0	-2.5	1.4	5.7	7.8	6.1	1.1	-5.7	-8.4	-15.4	-18.5
Valandovo	-12.5	-14.1	-9.5	-0.7	1.9	7.5	10.5	8.8	3.2	-3.5	-10.5	-12.5	-14.1
Gevgelija	-19.5	-15.0	-10.7	-0.3	0.5	5.1	8.4	6.8	0.0	-5.7	-9.5	-10.1	-19.5

The average annual precipitation is from 660 to 745.2 mm^3 (Tables no. 5-6 and 5-7). Precipitation is most common in autumn, while in summer the precipitation level is lowest. The average number of precipitation days is 8.3. The average air humidity is 71-72%, where in winter it is 81-82%, and in summer it drops to 56%. Fog is a rare occurrence in this municipality. The average number of days with fog is 16.4. Fogs occur in the autumn and winter months, and are most pronounced in December (3.3 days on average).

Table 5-6: Average monthly and annual precipitation [mm]

Meteorological Station	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Demir Kapija	48.0	46.8	49.0	44.7	58.1	41.1	32.5	21.0	31.0	50.8	63.9	71.5	561.0
Valandovo	48.7	51.3	50.8	51.7	62.3	42.9	31.9	27.8	35.5	60.0	83.8	64.0	610.8
Gevgelija	53.6	65.3	67.4	53.9	62.7	47.5	30.7	32.2	35.0	71.5	99.0	75.8	694.6

Source: National Hydro-meteorological Service of the Republic of North Macedonia

Table 5-7: Temperature (A) and precipitation (B) by season

	Winter		Spring		Summer		Autumn	
Meteorological station	A	B	A	B	A	B	A	B
Demir Kapija	3.1	166.3	13.4	151.8	23.5	94.6	14.1	145.8
Gevgelija	4.4	128.2	13.4	184.0	23.8	109.8	14.6	190.0

Source: National Hydro-meteorological Service of the Republic of North Macedonia

Winds are important factor of climate. They are the most characteristic features of the area between Demir Kapija and Gevgelija. Their direction of movement is determined by the morphoplasticity of the region. The southern and northern winds are the most common. Southern winds carry heat in the winter because they carry warm sea air masses. Northern winds are cold and carry cold continental air. The winds from northwest (Vardarec) and from southeast (Jug) are dominant in the Demir Kapija region. Vardarec is the most common in summer (July, 237‰), although it is present throughout the year with high frequency. The wind speed of Vardarec is much lower in the Demir Kapija region. Its average monthly speed is 1.9 m/s in October to 2.8 m/s in February and March, while its maximum speed is 15.5 m/s. Jug is the second most frequent wind in the Demir Kapija region after Vardarec. It blows along the Vardar River and is characterized as a warm wind. This wind is present throughout the year, and especially in April, March, and November. The average speed of Jug in September is constant and it varies from 4.5 m/s to 7.1 m/s in December. Winds of different directions are not very prominent in the Demir Kapija region, with the exception of the eastern wind (it ranks third in terms of frequency). Its average monthly speed varies from 4.5 m/s in July to 7.0 m/s in January.

In addition to these local constant winds, there are also local rotation winds that occur as a result of the instability of the air mass with storm clouds. These winds are most common in spring and summer. Sometimes they are of high intensity and can damage vegetation and crops.

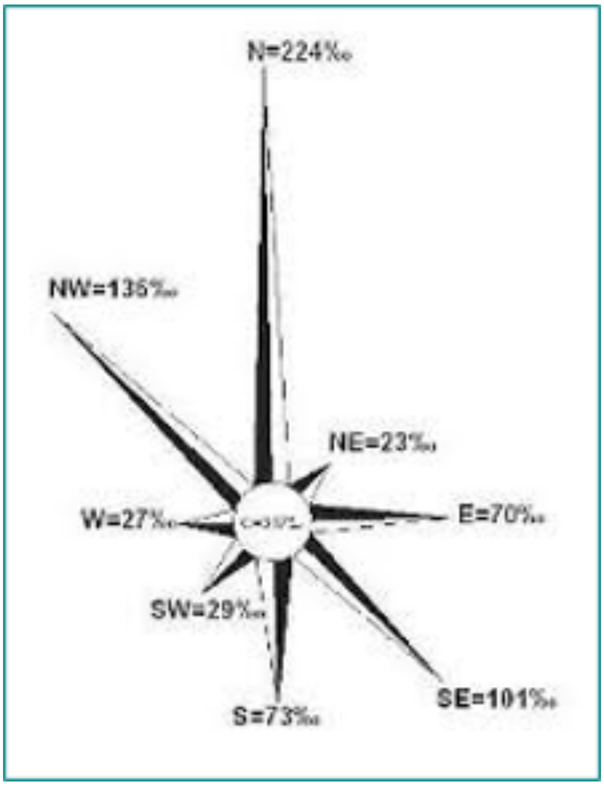


Figure 5-17: Wind rose for the municipality of Gevgelija

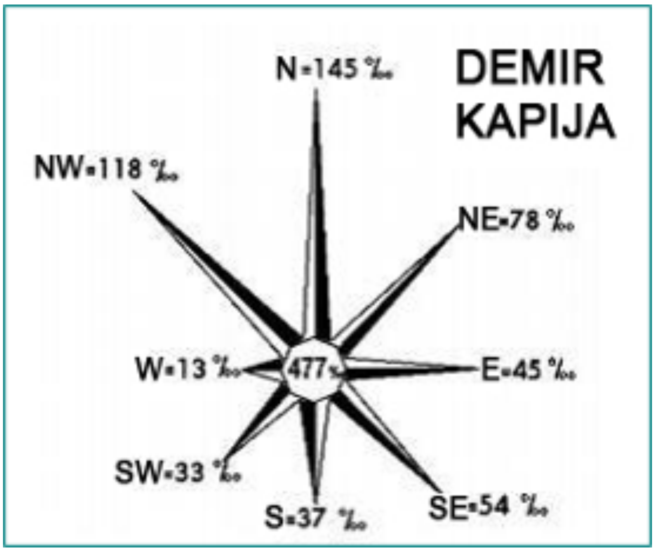


Figure 5-18: Wind rose for the municipality of Demir Kapija

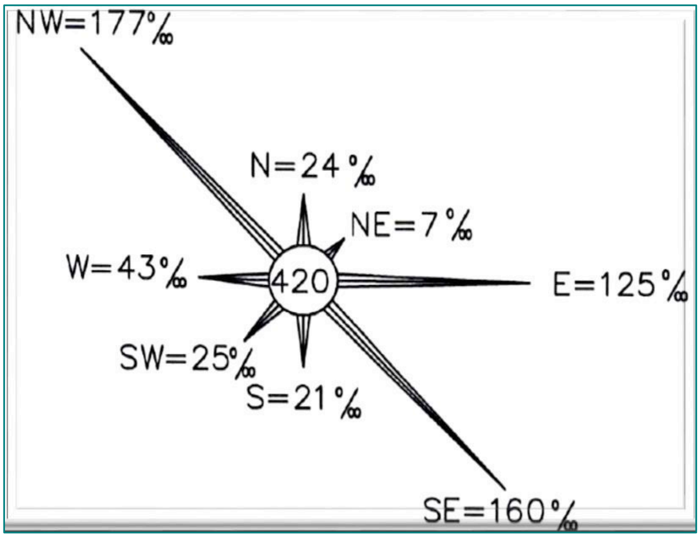


Figure 5-19: Wind rose for the municipality of Negotino

5.3 Relief

The gas pipeline section starts on the border with Greece in the area of the municipality of Bogdanci, in the highland area with an altitude of about 120 m above sea level, through predominantly agricultural arable land. Then, the route climbs through a slightly hilly terrain to an elevation of 135 m above sea level after which it descends to the village of Stojakovo and the Vardar River to an elevation of about 50 m above sea level and continues through the area of the Municipality of Gevgelija.

The route of the gas pipeline passes through the Gevgelija Valley where the terrain is mostly flat, with an altitude difference from 50 m above sea level to 75 m above sea level, crosses the railway and road corridor Skopje-Gevgelija and the riverbed of Kovanska River from where it continues through hilly and mountainous terrain towards the area of the villages of Petrovo and Gabrovo at an altitude up to 270 m above sea level, and then crosses the Petrushka and Stara Reka, from where it climbs along a mountainous terrain to an elevation of 700 m above sea level following the route of the existing Vardar oil pipeline.

On the territory of the Municipality of Demir Kapija, the route of the gas pipeline, from the Begovi Nivi area (Territory of the future wind farm "Kaltun Energy") heads to the peak Studena Glava at an altitude of 900 m above sea level, bypassing it from its northwest side, where it descends to the Demir Kapija Valley to an elevation of 120 m above sea level from where the route climbs to the locality Golemo Brdo at about 300 m above sea level and continues to the village of Przdevo at an altitude of about 270 m above sea level.

In the area of the municipality of Negotino, the route is in a highland area with an altitude of about 220 m above sea level, and in the locality Grozd it ends with a connection to the existing gas pipeline network.

5.4 Geological and hydrogeological characteristics

5.4.1 Geological characteristics

From a geological point of view, based on the carried out geological prospecting, the route of the Gas Interconnector with the Republic of Greece - Negotino is characterized by the following:

From km 0 to km 2+300 the route is mostly located in a flat area composed of proluvial diluvial forms, which is characterized by excavation in III and IV category.

Further on, to km 3+300, the terrain is slightly hilly with a pronounced rocky structure that corresponds to excavations in IV and V category. Then, the route continues through a lowland area with arable agricultural land and it intersects with the riverbeds of the Vardar River and the Kovanska River. This section is mostly composed of alluvial and diluvial deposits mixed with gravel structures that correspond to excavations in II and III category and to III and IV category. In this zone, occurrence of high groundwater levels is possible, which would require special measures aimed at preventing the gas pipeline from floating.

From km 15+000 to km 50+000 the route is mostly located in mountainous terrain where diabases and spilites are predominant in the form which is tightly tied, stony, massive, medium-grained, compact, solid and tough. Keratophyre and quartz-keratophyre rocks are found on certain sections, with a bright reddish or greenish colour, that are characterized as solidly bound stone rocks and occur in the form of veins (veinlets) in the diabases, and which are massive and solid. This section can be categorized for the most part as excavation in category IV and V with an addition of excavation with blasting of 20%, and in one part as excavation in category V and VI with an addition of excavation in a rock with blasting of 80% and in one part as an excavation in a solid compact rock with blasting of 100%.

From km 50+000 to km 53+000 the route passes through the Demir Kapija Valley and crosses the river Doshnica through a landscape characterized by alluvial and proluvial formations of colluvial sediments, large blocks, pebbles and gravel from the basic rocks and diluvial formations of sharp-edged pieces of the basic rocks, mixed with sandy-clay materials. This area can be characterized as an excavation in III and IV category.

Further on, the route continues again in a hilly-mountainous area characterized by gravel-sandy loam soil and fine-grained grey sandstones, as well as a series of multi-coloured clays that are moderately plastic and that, in the presence of water become softer, are mostly sandy and with weak and medium permeability characteristics. In this area, the excavation can be characterized as excavation in III and IV category for the most part and excavation in IV and V category with an addition of excavation with blasting of 20%.

From km 63+000 to the end of the route it passes mostly through flat terrain where there are diluvial formations composed of sharp-edged pieces of basic rocks, mixed with sandy-clay materials which are relatively well compacted, which represent weak heterogeneous collectors, at place next to heterogeneous insulators with weak characteristics in terms of permeability, covered with a thick humus layer. In this area, the excavation can be characterized as an excavation in III and IV category.

The following figures show a geological map of the pipeline route (from Figure no. 5-20 to Figure no. 5-30).

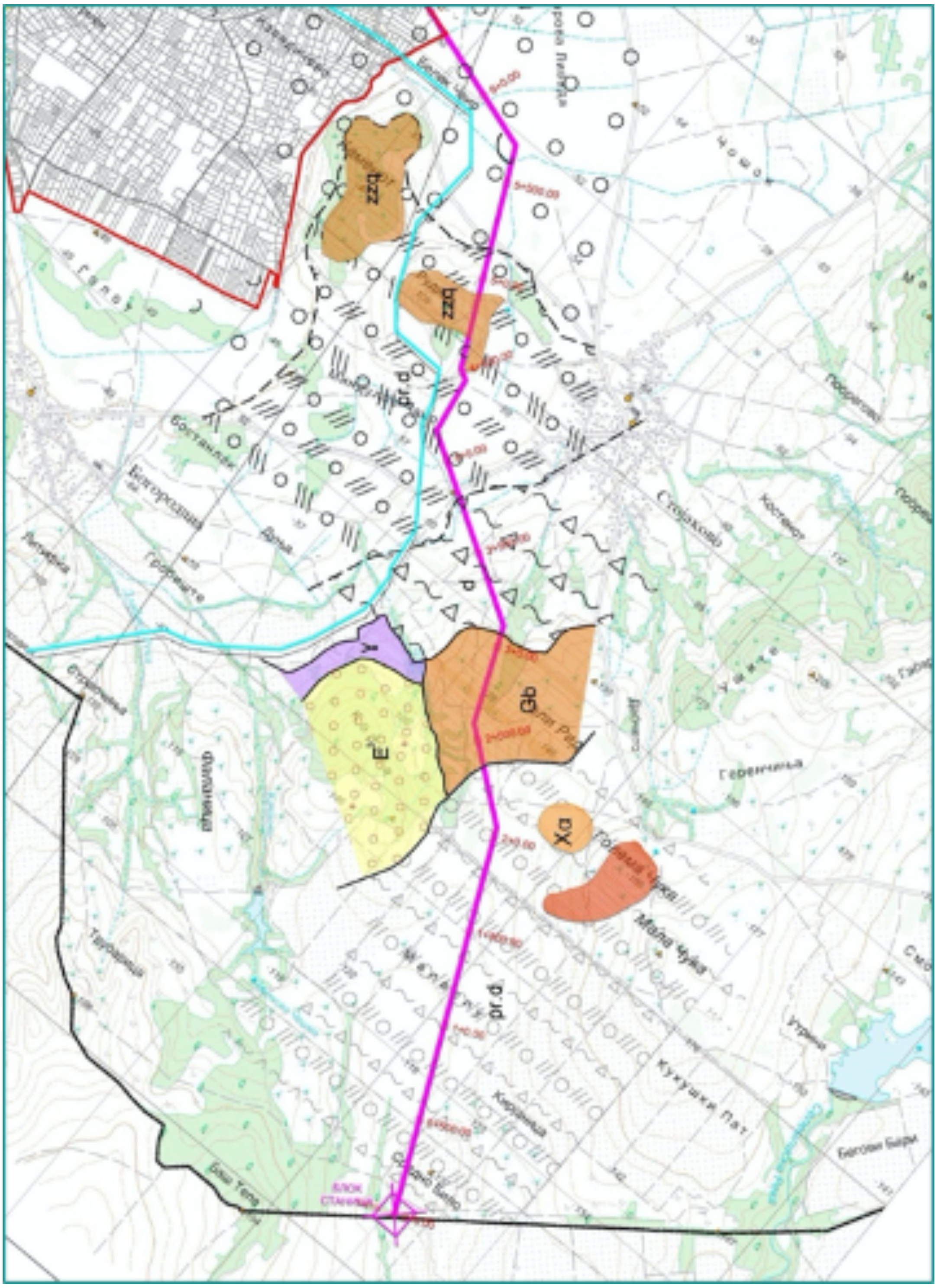


Figure 5-20: Geological map for the gas pipeline route from 0km to 6km

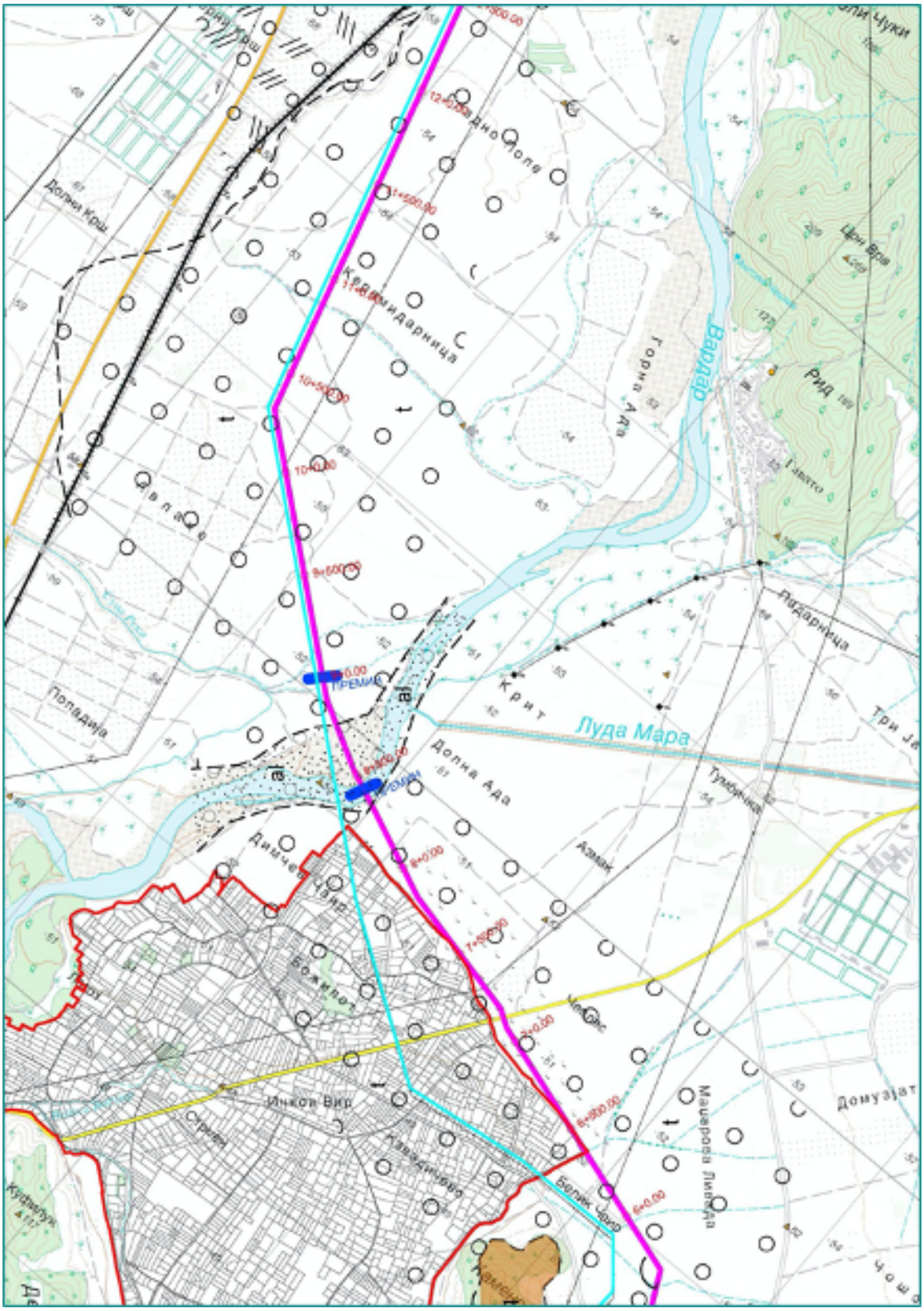


Figure 5-21: Geological map for the gas pipeline route from 6km to 12km

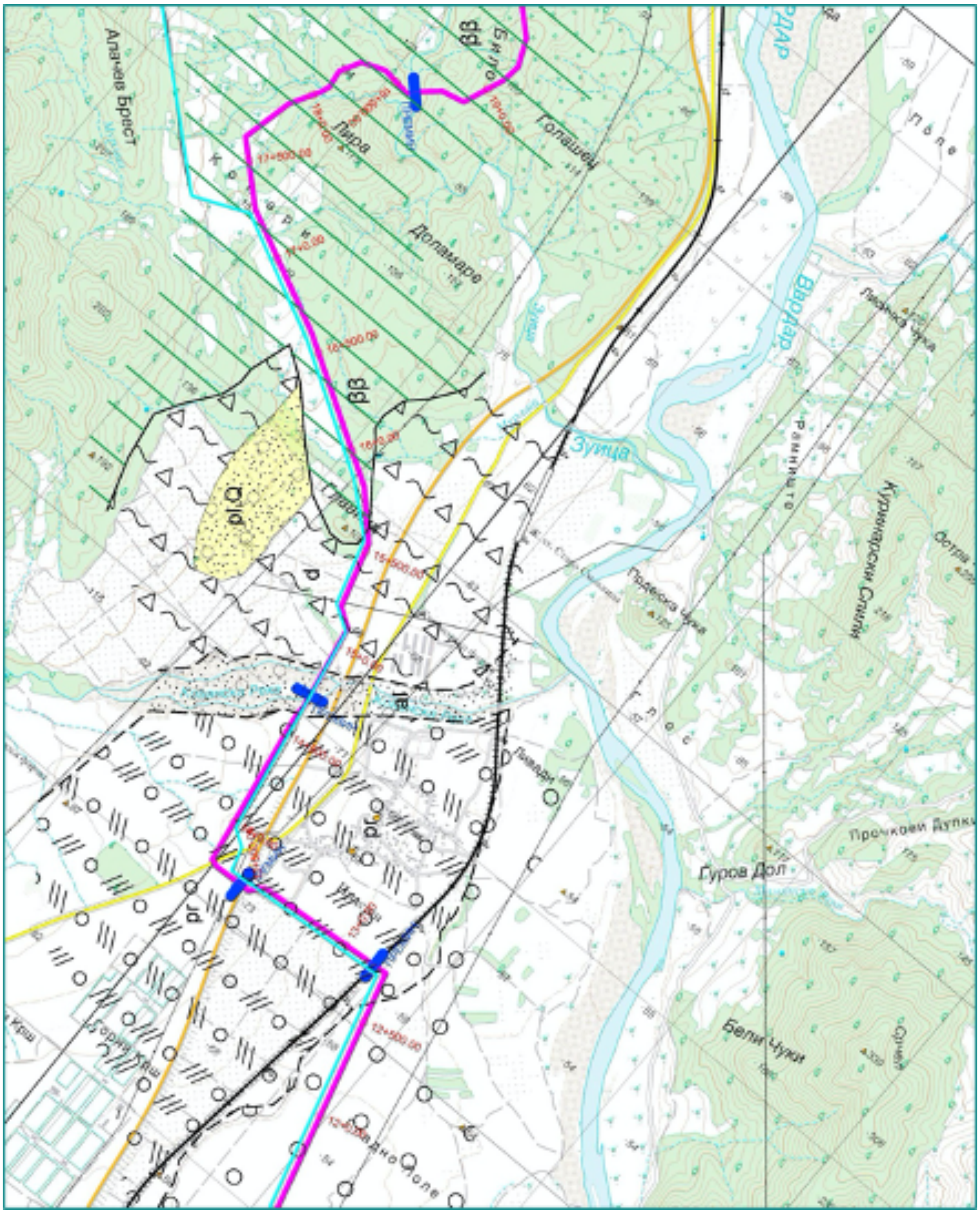


Figure 5-22: Geological map for the gas pipeline route from 12km to 19km

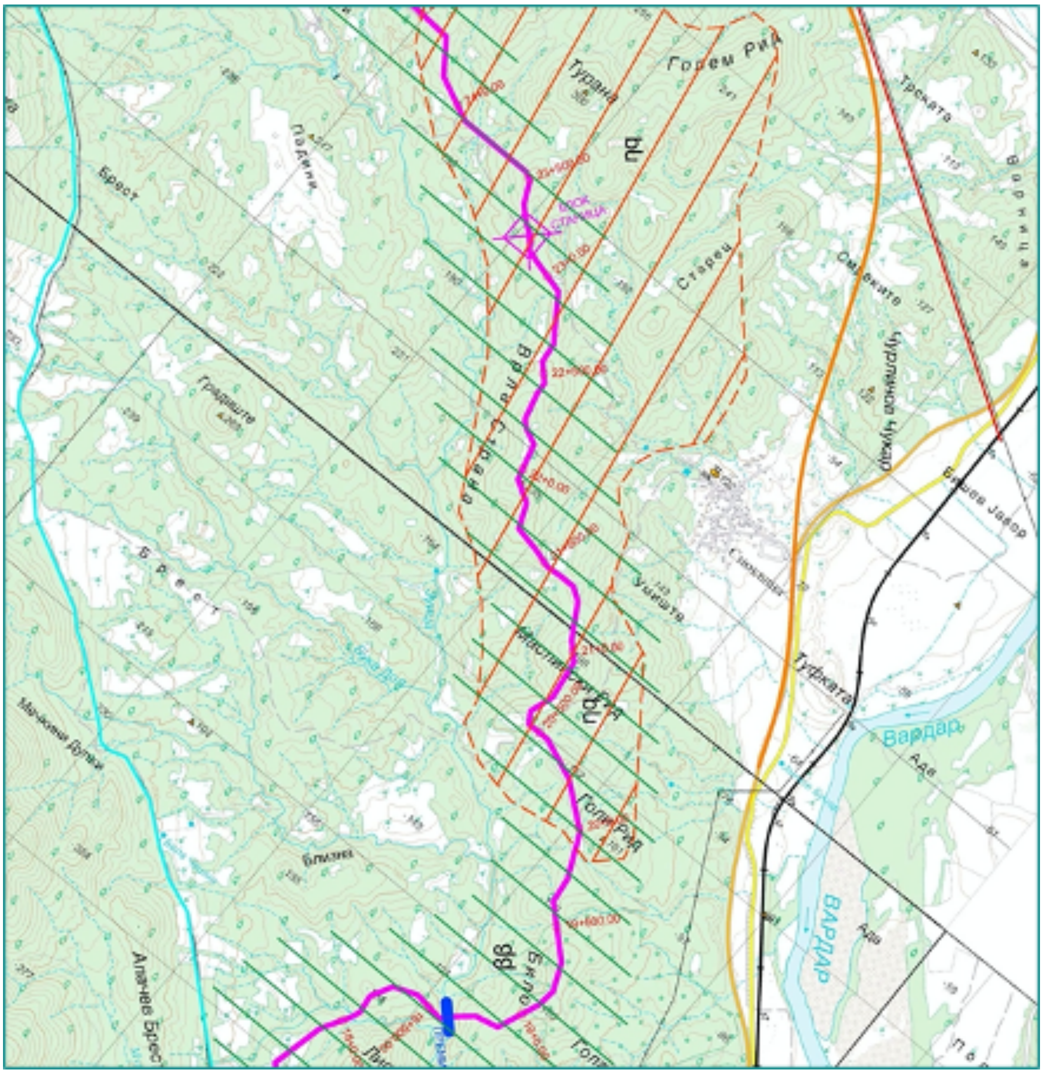


Figure 5-23: Geological map for the gas pipeline route from 19km to 24km

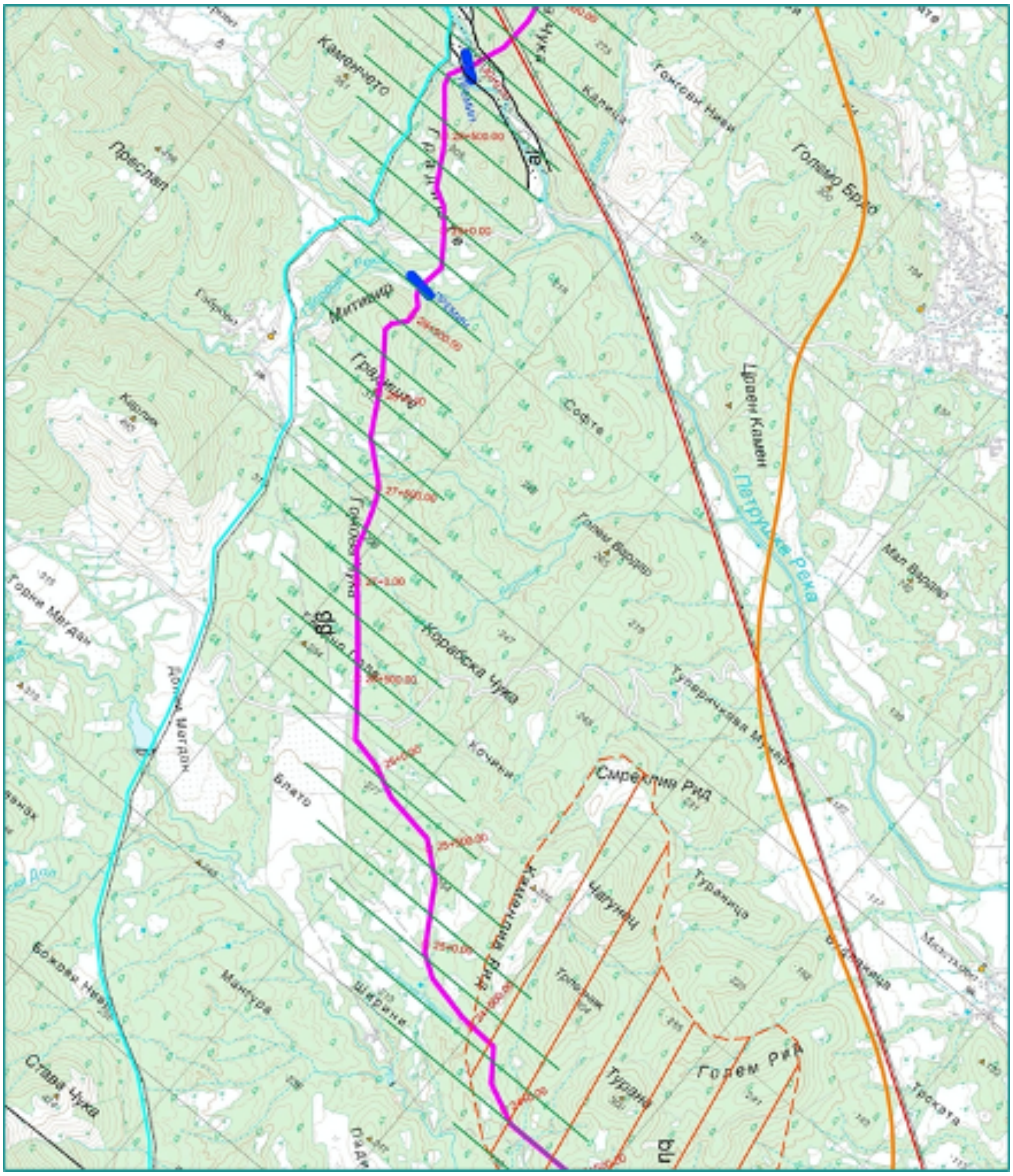


Figure 5-24: Geological map for the gas pipeline route from 24km to 30km

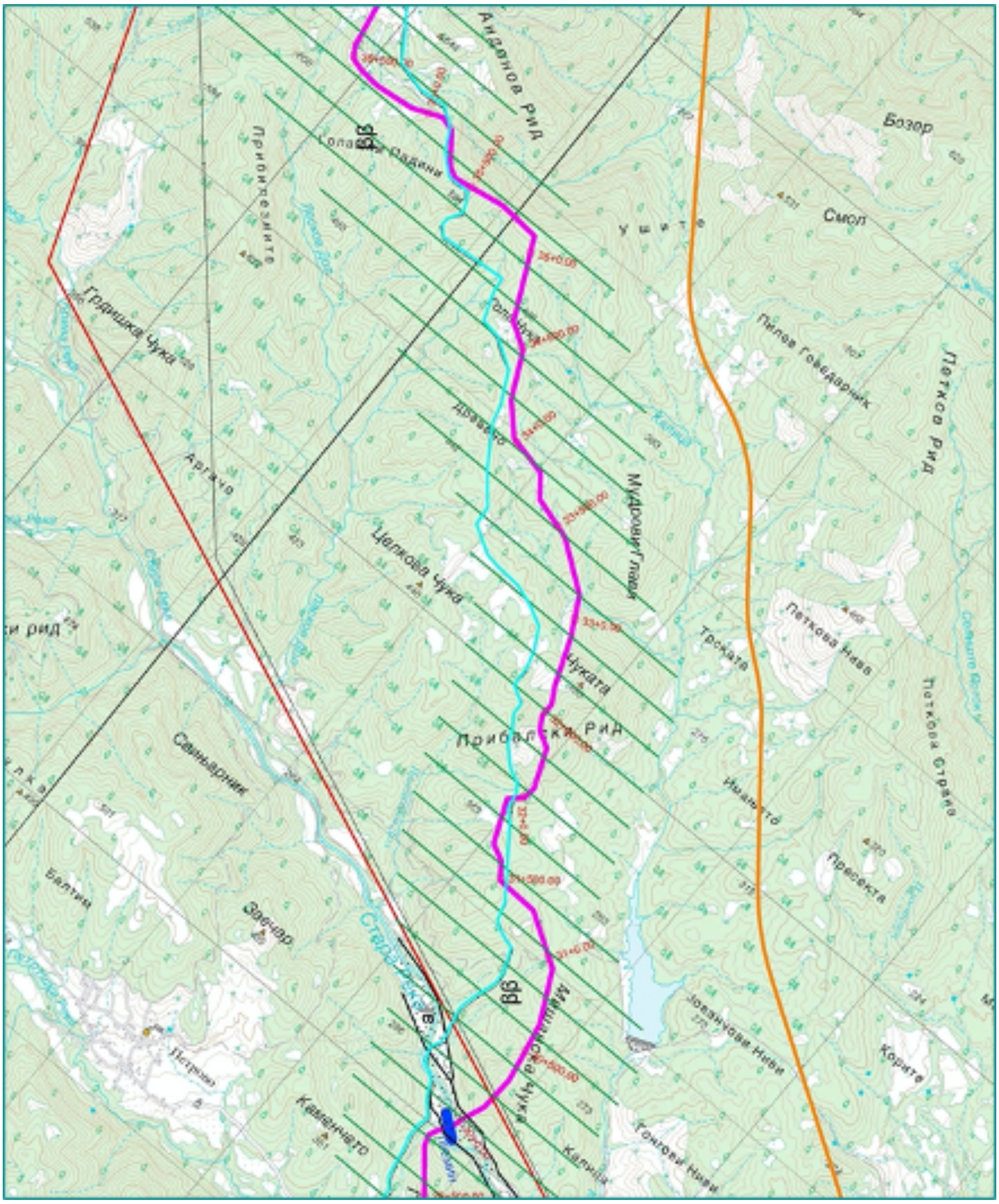


Figure 5-25: Geological map for the gas pipeline route from 30km to 36km

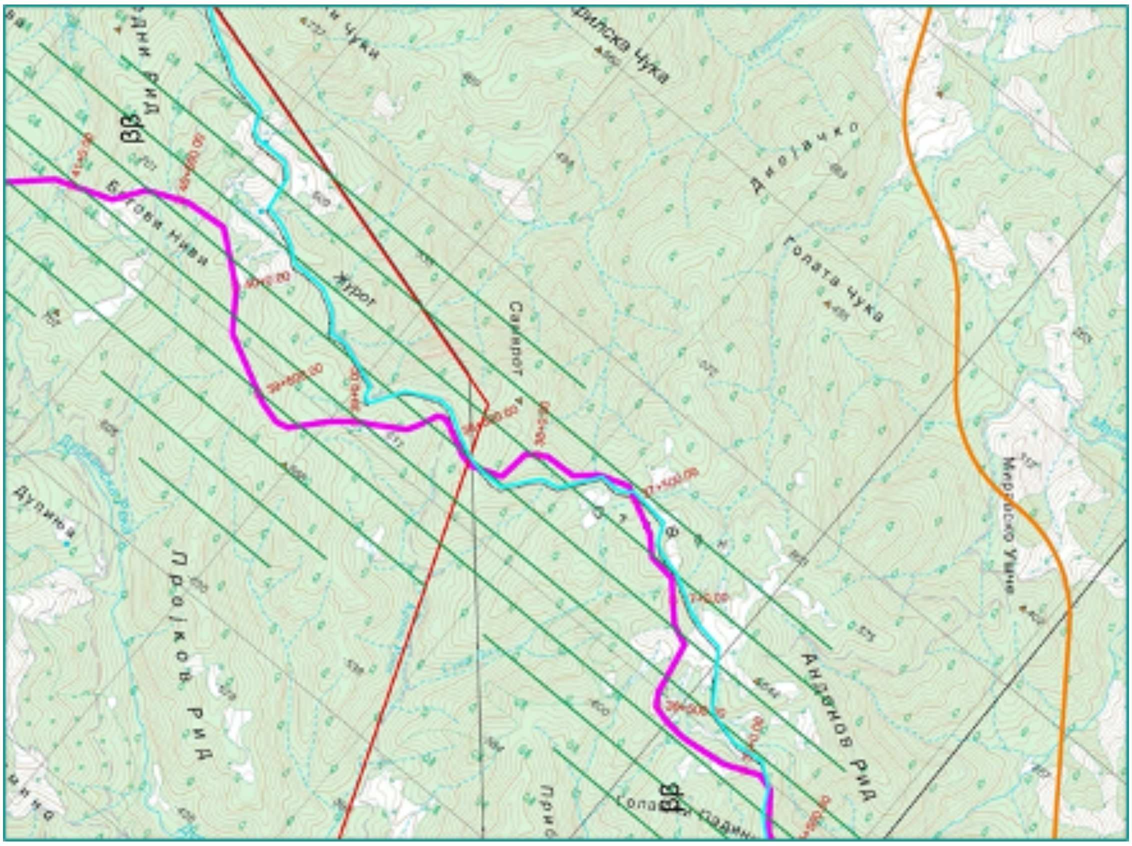


Figure 5-26: Geological map for the gas pipeline route from 36km to 41km

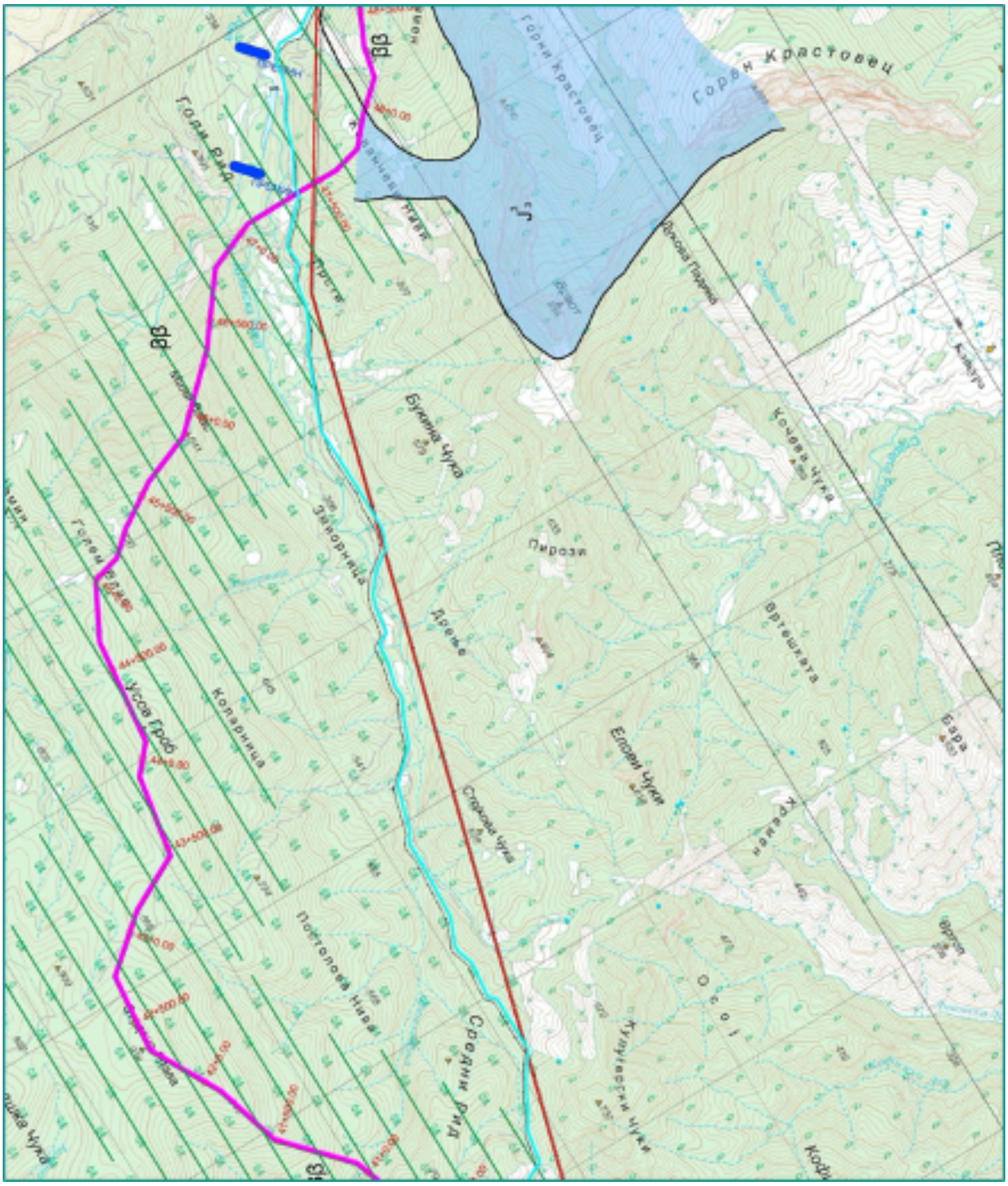


Figure 5-27: Geological map for the gas pipeline route from 41km to 48km

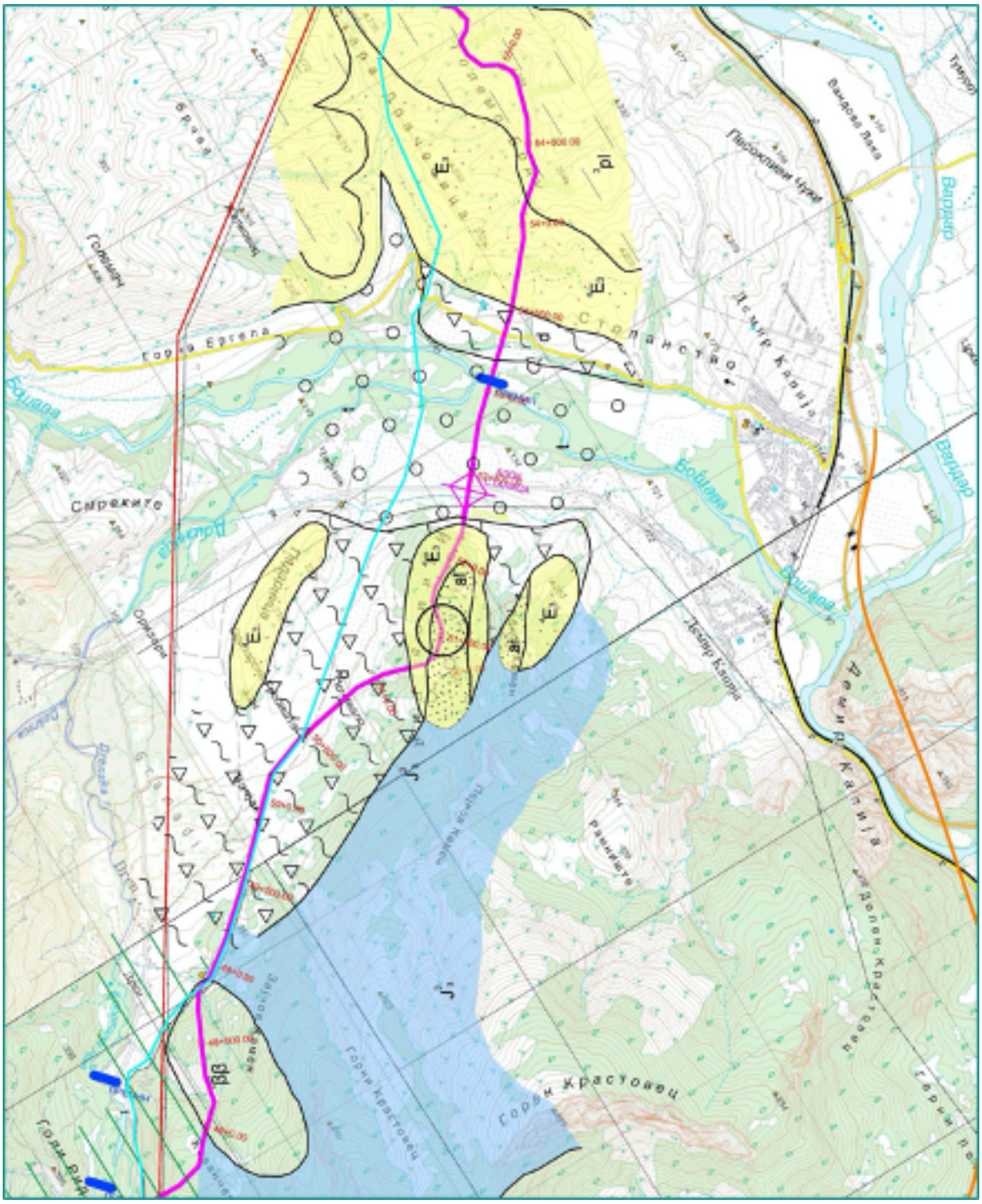


Figure 5-28: Geological map for the gas pipeline route from 48km to 55km

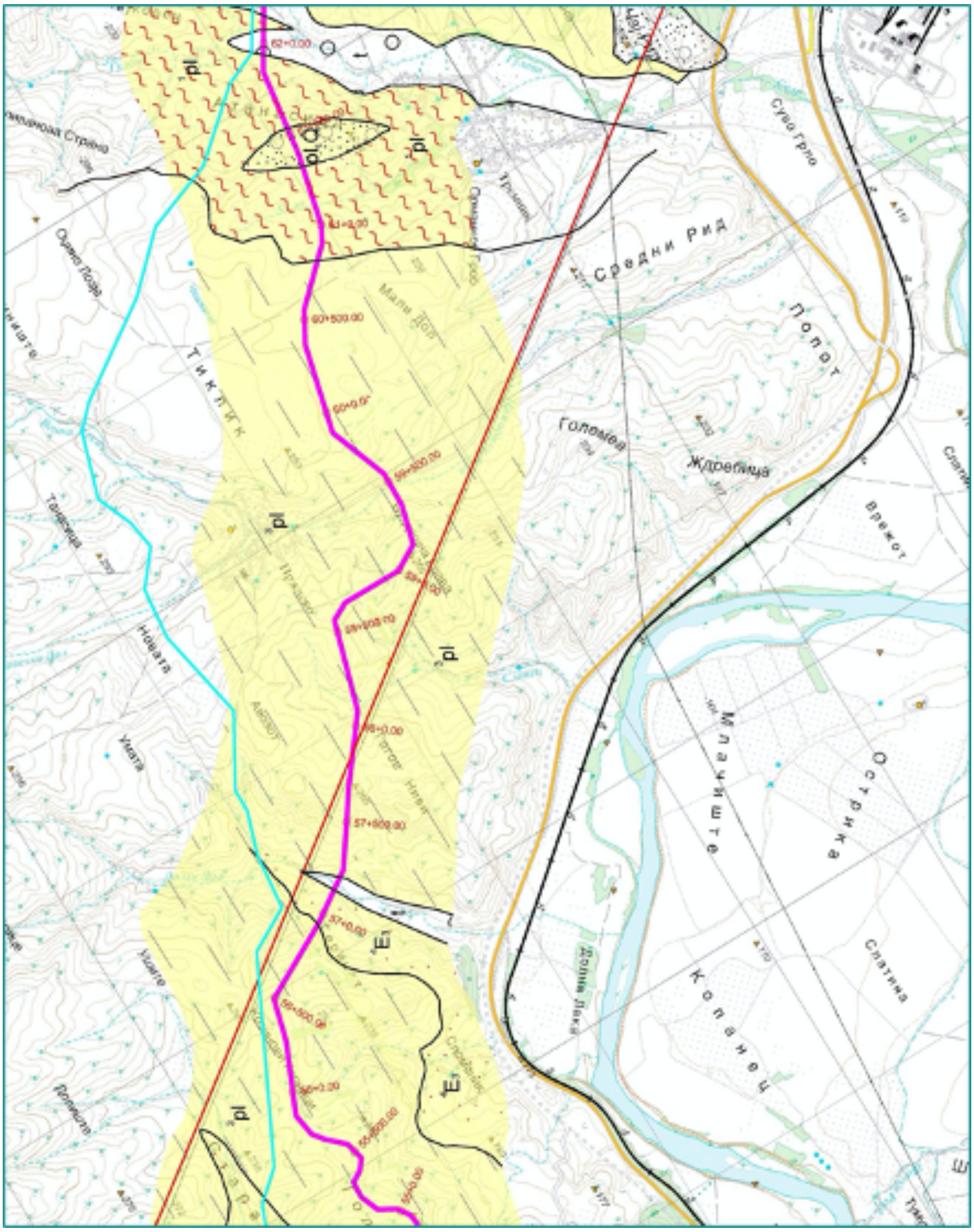


Figure 5-29: Geological map for the gas pipeline route from 55km to 62km

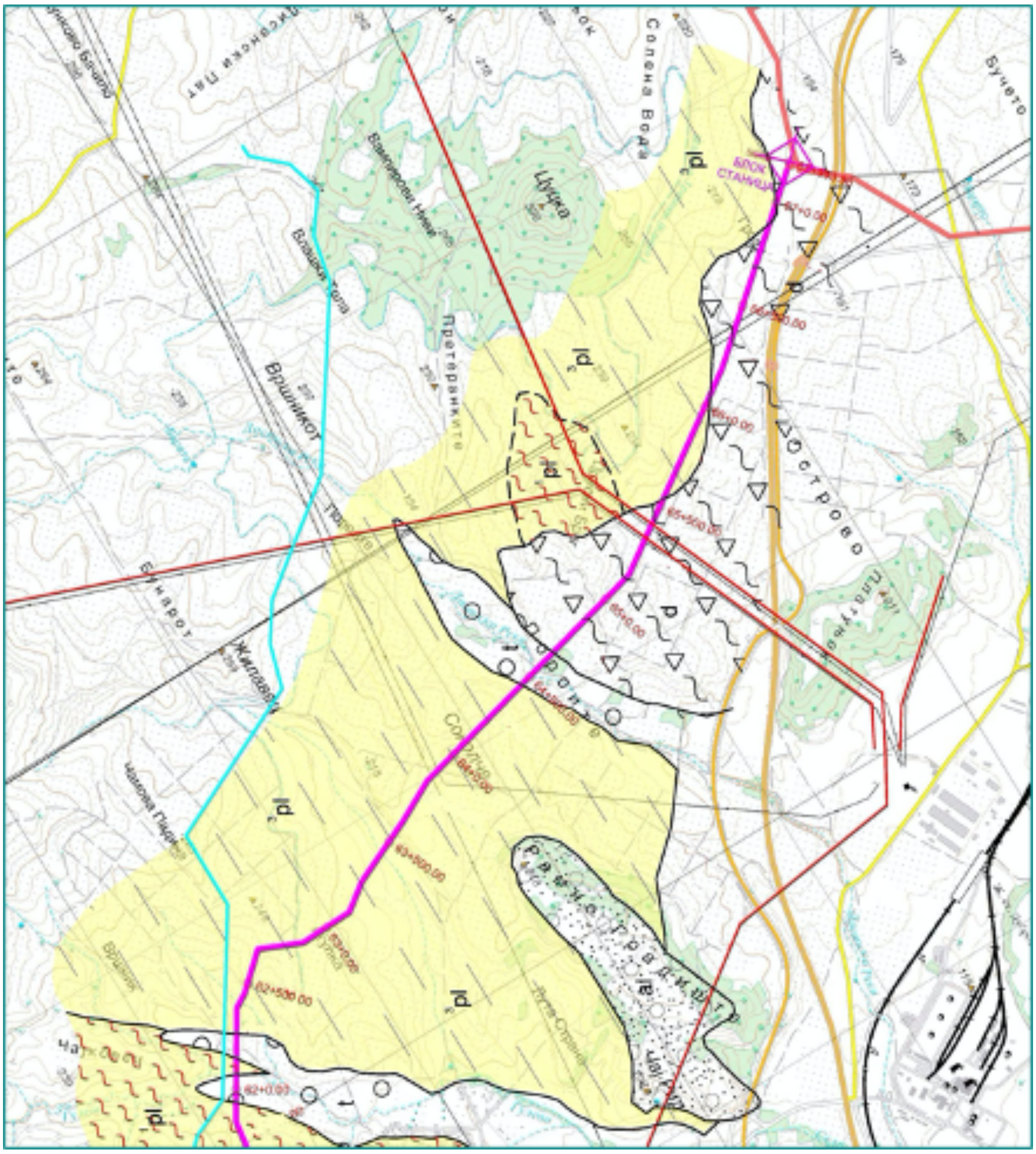


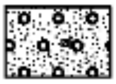
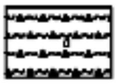
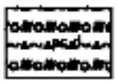
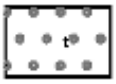
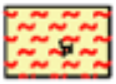
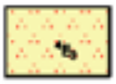
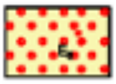
Figure 5-30: Geological map for the gas pipeline route from 62km to 67+193,98km

LEGEND:

- NEW AXIS OF PIPELINE
- POWER LINE
- OIL PIPELINE
- HIGH WAY D. KAPIJA - SMOKVICA
- GAS PIPELINE LOT 1
- BLOCK STATION
- CROSSING

GEOLOGICAL MAP
1:25000
WITH LAYOUTS OF ENGINEERING-GEOLOGY (E.G.) AND HYDROGEOLOGY (H.G.)

LEGEND
LITHOLOGY

GEOLOGICAL AGE	GEOLOGICAL HATCH AND SYMBOL	TYPE OF ROCK MASS, SOIL	MORE IMPORTANT ENGINEERING-GEOLOGICAL AND HYDROGEOLOGICAL PROPERTIES
1	2	3	4
QUATERNARY - Q		Recent fluvial deposits: gravel, sands and their mixtures with boulders from the bedrocks	With low density to loose, hg collectors with intergranular porosity, present perched type of aquifer
		Diluvial creations: angular fragments from the bedrocks, mixed with sandy-clayey materials	same as „al"
		Diluvial creations: angular fragments from the bedrocks, mixed with sandy-clayey materials	Relatively good density, poor hg collectors, at some parts to hg isolators with poor permeable properties
		Proluvial-diluvial creations: sandy clayey coarse-grained and gravely materials	Medium dence, relative hydro-collector medium with formed perched aquifer at some parts
		Terrace (fluvial) creations: gravels and sands with negligible silty sandy component	Relatively very dense hg collectors with intergranular porosity, with formed distinct perched aquifer
ТЕРЦИЕР / TERTIARY		Sands and gravels at the border Pliocene-Quaternary	Very dense and granulated hg collectors with intergranular porosity, with formed indistinct perched aquifer
		Sandy series, quite homogeneous, yellow color, negligibly present gravelly-sandy claystones and fine-grained gray sandstones.	Very dense, locally also bound into claystones and sandstones, hg colictors with medium permeable properties
		Series of differently colored clays (colorful clays)	Poorly present, medium plastic, with water become softer, mainly sandy
		Quartz-latite, the youngest volcanic rock	Quite fresh wel bound rock, with thickly bedded and platy formation, stable hg, no problems
		Sandstones, yellow, upper zone of Eocene flysch, at some parts red-yellow	Well bound petrified to semi-petrified rocks, compact, composed of fine-grained limestone sandstones
		Conglomerate, grey-reddish	Well bound petrified rocks, massive and thickly bedded, at some parts platy, composed of boulders (2-60cm) from various rocks

MESOZOIC	J_3	Limestones of upper Jurassic, with white to grey-white color	Well bound petrified rocks, massive to thickly bedded and platy with large fractures and karstified, in monolith fresh and compact
	ηq	Keratophyre and quartz, keratophyre, color light reddish or greenish	Well bound petrified rocks, they appear as veinlets (veins) in the diabase, massive and strong
	ββ	Diabase, spilite with typical dark green color	Well bound, petrified, massive, medium-grained, compact, strong and tough
PALEOZOIC	γ	Granite	Well bound, petrified, with grained texture, greyish, massive, in monolith strong and compact
PRECAMBRIAN	Gb	Gneiss	Well bound petrified rocks with schistose structure, in monolith quite strong
OTHER ADOPTED SIGNS			
		Border between lithological units and complexes, determined and assumed	
	10	Dip elements of bedding	

Figure 5-31: Legend for Figures no.5-20 to 5-30

5.4.2 Hydrogeological characteristics

The following Figure 5-32 shows the types of permeability of water and the hydrogeological characteristics in the Republic of North Macedonia. [7]

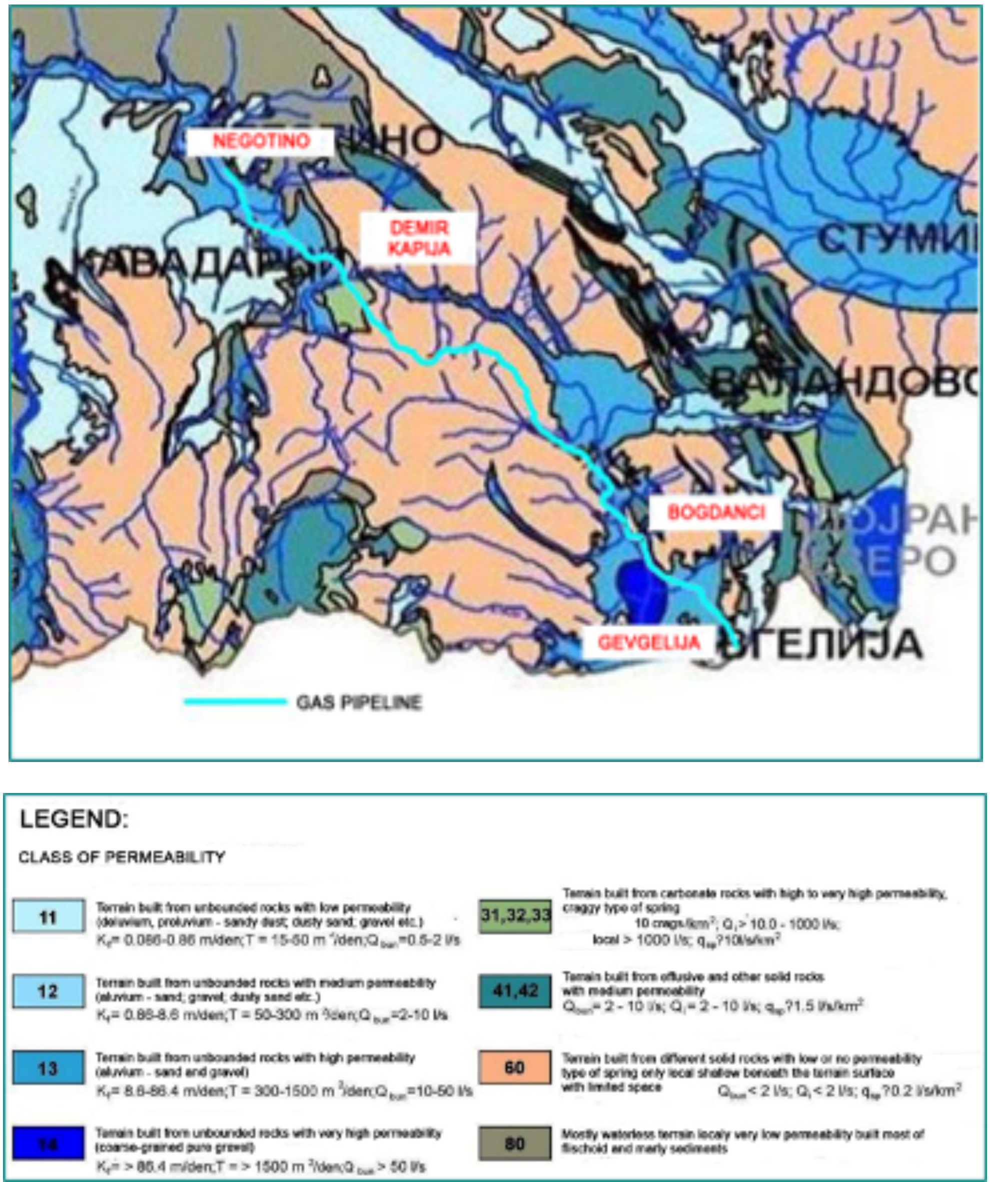


Figure 5-32: Types of permeability of water and hydrogeological characteristics in the gas pipeline area

[7] Source: Water Strategy of the Republic of North Macedonia (2012 - 2042)

Materials that according to their hydrogeological characteristics can be placed in the groups of relative hydrogeological insulators and hydrogeological insulators can be found in the researched area.

- Relative hydrogeological insulators

  This group includes sandy silt, in some places clayey, clayey silt, in some places diagenized and sandy silt with fragments of marls and sandstones. In these sediments, a compact type of aquifers with a free level of groundwater has been developed and they are characterized with porosity between the grains and low permeability of water.

- Hydrogeological insulators

  This group includes marly clays, silty, in places diagenized, marls diagenized with a series of loams and sandstones from the Eocene Flysch. These sediments are characterized by crack porosity and water tightness and in them, there is a possibility for formation of a crack type of aquifer with a free level of groundwater.

5.5 Seismic characteristics

Figure 5.33 shows the seismic map of the area of the gas pipeline route with the corresponding legends.

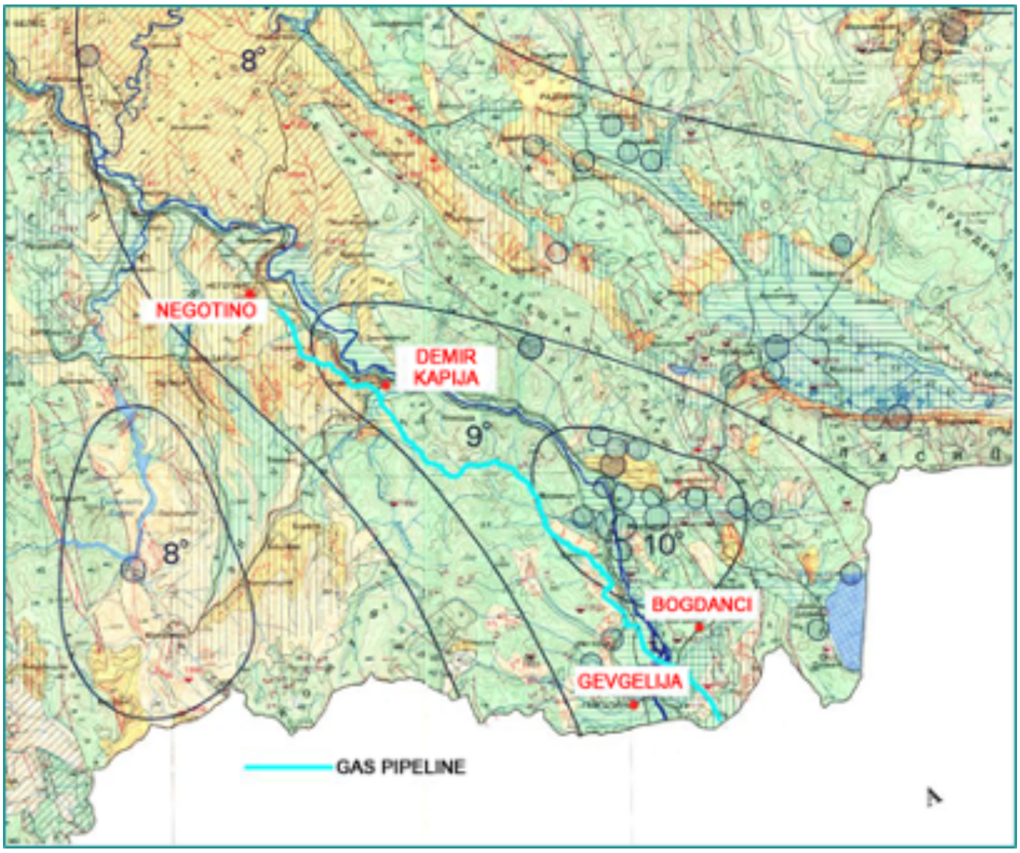


Figure 5-33: Seismic map of the area

I	TERRAIN CATEGORIZATION BY STABILITY
	MOSTLY STABLE TERRAIN: built from rocks with permanent physical-mechanical properties, which compared with the longevity of the object is not subjected to important changes under the influence of outside factors or human action
	MOSTLY UNSTABLE TERRAIN: built from rocks whose parameters of physical-mechanical properties are often with relatively low values. Mostly stable in natural conditions, but can get pretty unstable during human action and change of conditions.
	MOSTLY UNSTABLE TERRAIN: built from rocks generally with low values of physical-mechanical properties. Very pronounced processes of erosion and other terrain deformities in natural conditions and during human action.

	V		SEISMIC ZONING OF THE TERRAIN ACCORDING TO THE ENGINEER-GEOLOGICAL GROUND CONDITIONS
GOOD SEISMICALLY CONDITIONS	A A_1	n—0°MCS	BASIC GEOLOGICAL ENVIRONMENT
	A_2	n—0,5°MCS	SEISMICALLY VERY LOW SENSITIVE ENVIRONMENT
MEDIUM CONDITIONS	B	n—1°MCS	SEISMICALLY LOW SENSITIVE ENVIRONMENT
BAD SEISMICALLY CONDITIONS	C C_1	n—2°MCS	SEISMICALLY SENSITIVE ENVIRONMENT
	C_2	n—3°MCS	SEISMICALLY VERY SENSITIVE ENVIRONMENT

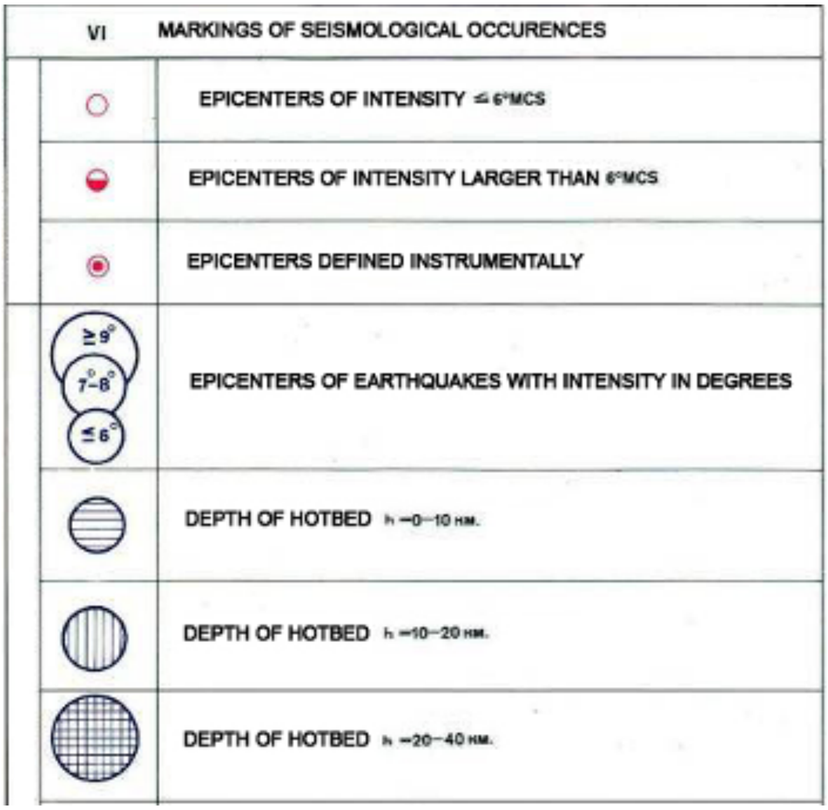


Figure 5-34: Legend for figure no.5-33 (seismic map)

The following part of the text describes the seismic characteristics of the region through which the gas interconnector passes:

The seismic dynamics of this epicentral area is based on its tectonic structure. In basic terms, that structure is very simple. Among the horsts of old formations (crystalline shales from group I), in the shape of a kind of tectonic trench, the Vardar zone is narrowed. Its main horsts are the blocks of the Rhodope mass from the east and the blocks of the Pelagonija mass from the west. In fact, before the formation of the Vardar zone, the two massifs represented one whole - the Rhodope Massif.

With the disintegration of this massif, some parts (blocks) between the faults separated, while some parts (blocks) between them sank and were covered with younger formations, thus creating tectonic depressions or trenches. Such a trench is the Vardar zone. The trenches are subject to various pressures and hence various movements are applied on them that are occasionally manifested by seismic phenomena (earthquakes) of different types and intensities.

The strongest earthquake disasters ever recorded in this area occurred in 1931. After this earthquake disaster, the period was relatively calm, with the exception of 21.12.1990 when a strong earthquake hit, with a magnitude of ML = 5.6 on Richter scale, with an epicentre 25 km south of Gevgelija.

The terrain of the Municipality of Gevgelija belongs to the area of the Vardar zone, which is characterized by occasional seismic activity. The Municipality of Bogdanci also belongs to the same earthquake area. From a geotectonic point of view, the area Demir Kapija-Gevgelija belongs to the unstable geotectonic unit in the Republic of North Macedonia known as the Vardar zone of foliation. The Vardar River that passes through this geotectonic unit forms a complex valley, i.e. it flows through many plains and gorges.

The Municipality of Demir Kapija is located in a zone in which there are deep layers that differ from each other in terms of genesis, age, level of activity and expression of the relief with NW-SE direction of geological formation. Along the entire length, the east-northeast boundary layer, from the Neogene period, was an unstable tectonic zone along which there was volcanic activity, while in modern conditions, the activity is manifested through many post-volcanic phenomena and thermal springs. The western-southwestern layer is characterized by cracked serpentines whose contacts with the neighbouring rocks are contrastingly emphasized, and many of them are active even today.

In terms of seismic, the region through which the gas pipeline is expected to pass, as part of the Vardar zone, is an area with high seismic risk, with occurrence of earthquakes of maximum intensity of 10 degrees and 7 degrees on the Richter scale. Most of the registered earthquakes are related to the Valandovo seismogenic focus, which is one of the most active seismogenic sources in the Republic of North Macedonia. The high seismic activity in this area is the result of tectonic movements where the radial movements associated with the deep layers play a dominant role. The seismic activity of the Valandovo Valley is related to the deep layers with NW-SE direction and the layer Miletkovo - Valandovo with meridional direction.

The activity of the above-mentioned layers is caused by the pressure from the southern part of the Serbian-North Macedonian mass to the gabbro - diabase massif, an activity that lasts with variable intensity from the Jurassic period until today. The high degree of tectonic crushing of the basic rocks in that part of the Vardar zone is related to the foregoing. The highest values of the expected earthquakes for the Valandovo valley in the future are 6.5 - 7, while for the Gevgelija area they are maximum 6 degrees on the Richter scale.

The area of the municipality of Negotino, according to the information and the findings of the research, is under the influence of external epicentre hotspots about 100 km away.

Within the macro-seismic zoning of the territory of the Republic of North Macedonia, and based on the research of the local and the impact of the distant earthquakes and the relative parameters, the upper limit of the magnitude of the expected earthquakes is defined as a summary long-term maximum intensity which in the town would be VIIIO on the Mercalli Scale.

Due to the lack of micro-seismic zoning, the macro-seismic zoning indicators can be used as valid options for the necessary parameters that identify areas unsuitable for construction.

According to the engineering-geological characteristics, the terrain is mostly stable with constant physical-mechanical properties that are not subject to significant changes under the influence of the external factors or human action.

The planning scope is in the zone of VIII^{O} on the Mercalli scale of expected earthquakes, which suggests meeting the conditions and requirements for achieving a technically consistent and economically viable level of seismic protection in the construction of new facilities.

5.6 Hydrological characteristics

5.6.1 Surface water

According to the hydrographic division, on the territory of the Republic of North Macedonia there are four basins: Vardar, Crn Drim, Strumica and the basin of South Morava.

The Vardar basin covers the basin of the Vardar River with its tributaries on the territory of the Republic of North Macedonia to the North Macedonian-Greek state border, including the Dojran Lake basin on the territory of the Republic of North Macedonia, and it covers 80% of the country's waters.

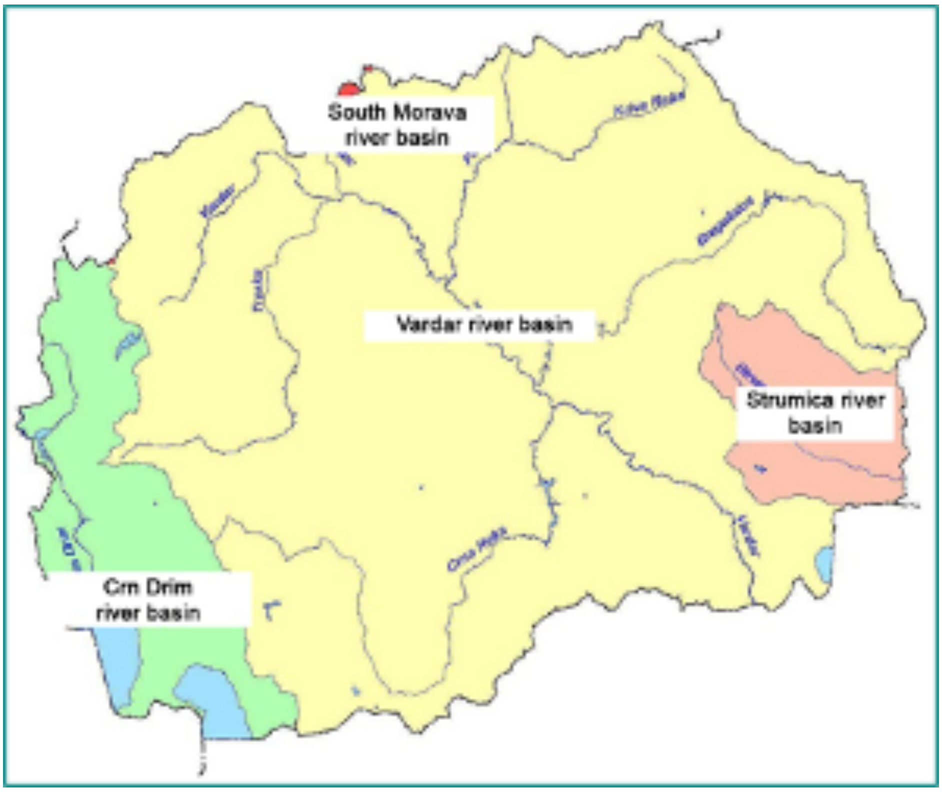


Figure 5-35: River basins in the Republic of North Macedonia

Vardar is the longest and largest river in North Macedonia, with a total length of 388 km, of which 301 km flow in North Macedonia, while the rest is in Greece, with an average altitude of 793 m, with an amplitude from 2,748 m at Titov Vrv to 44 m near Gevgelija. The spring is located on the Shar Mountain massif in the vicinity of the village Vrutok near Gostivar at an altitude of 683 m.

Larger right tributaries of the Vardar River are Crna Reka (207 km) and the river Treska (138 km), while the longest left tributaries are the river Bregalnica (225 km) and the river Pchinja (135 km).

The total amount of estimated exploitation reserves is 1,580 million m^3 per year or 50.15 m^3/s. An overview of the estimated static and exploitation reserves by water management areas is shown in Figure 5-36.

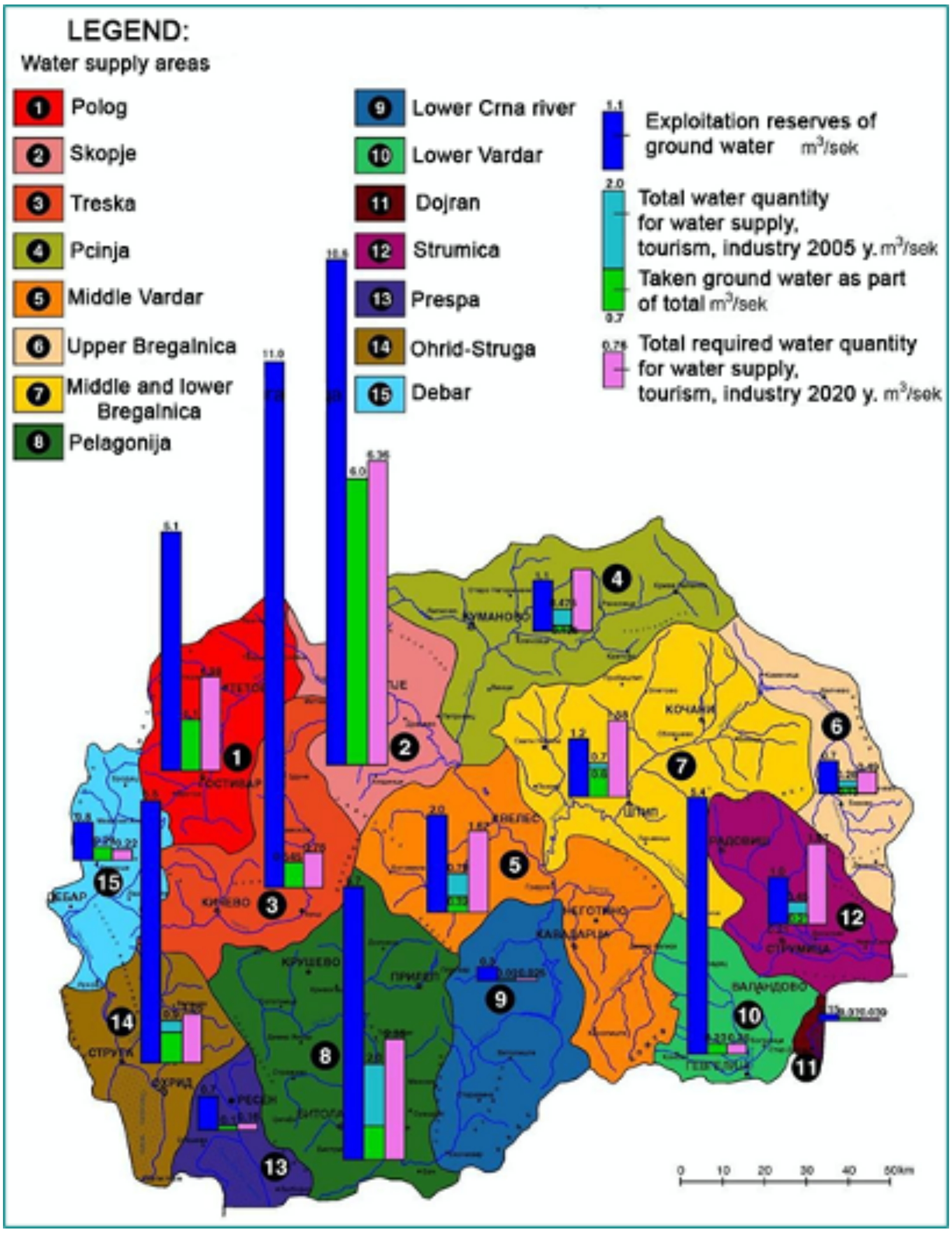


Figure 5-36: Map of reserves and use of groundwater by water management areas (Source: Z. Ilijoski, 2015)

The hydrological characteristics of the municipalities through which the gas interconnector passes are as follow:

<u>Municipality of Gevgelija</u>

The project area belongs to the lower catchment area of the river Vardar. On the section from Udovo to Gevgelija, the river Vardar has all the characteristics of a typical plain river. The average inclination in the Gevgelija valley is 0.72 ‰. The river rapids are only present in places where the river is affected by floods that have deposited a large amount of coarse material. The erosion of the coasts in the Gevgelija-Valandovo valley is a particularly intensive process. As a result, the destruction of river banks and the horizontal dislocation of the Vardar riverbed is a common phenomenon.

The section of Vardar that runs through the Valandovo - Gevgelija Valley, from Udovo to Gevgelija, is susceptible to demolition and lateral displacement of the banks, as well as accumulation of sedimentary material, especially in the Gevgelija area. Due to this, in Gevgelisko Pole, the course of

Vardar is broken into several sleeves, in which, in summer, due to the low water level, only swampy areas are observed. On this section Vardar receives 6 tributaries, four on the right: Stara River (25.0 km), Kovanska River (24.0 km), Sermeninska River (24.0 km) and Konska River (30.0 km) and two on the left: Anska Reka (22.0 km) and Luda Mara (19.5 km), which make up the local basin.

Konska Reka is the last major tributary of Vardar in the Republic of North Macedonia. It springs from Kichi Kaj at Kozuf at an altitude of 1,520 m, it flows to the east - southeast and near Gevgelija it flows into Vardar as its right tributary at an altitude of 44 m. It is 30 km long, covers a catchment area of 180 km2 and has a relative slope of 49 ‰.

The hydrographic structure also includes the reservoirs in Bogorodica, Toplec, Dos, Kalica and others. The municipality has rich springs of mineral and thermo-mineral water. One of the most famous mineral water springs is located on the tourist site Smrdliva Voda. Also, near the Negorski Banji and near the village Smokvica, there are rich springs of thermomineral water.

Municipality of Bogdanci

The Municipality of Bogdanci belongs to the water management area (WMA) "Dollen Vardar", which covers the basin of the river Vardar from the water meter profile "Demir Kapija" to the border with the Republic of Greece.

In the local basin, significant tributaries of the river Vardar on the right are the rivers: Kovanska, Sermeninska and Konska, and on the left: Anska Reka and Luda Mara.

The available water quantities expressed through the spatial distribution of the surface runoff, i.e. through the specific runoff $l/s/km^2$, indicate that this water management area is poor in water. The specific runoff is from 6.3 $l/s/km^2$ at the water meter profile D. Kapija, up to 6.5 $l/s/km^2$ at the water meter profile Gevgelija.

In the water management area "Dolen Vardar", 227 springs have been registered, but none of them has been registered as a spring with significant yield.

Groundwater is formed mainly in the valleys and their yield depends on the climatic, morphological and hydrogeological characteristics of the area. These waters are important due to their special quality and can be useful for meeting the water needs, but in the North Macedonia they are insufficiently studied and additional research is needed in terms of their capacity and quality. The sites with thermal, thermomineral and mineral waters are singled out as a special type of groundwater, of which in the region of the WMA "Dolen Vardar" examples with significant quality and capacity have been observed in the area Smokvica - Negorci - Gevgelija.

In order to improve the regime of the watercourses, i.e. to fully utilize their hydrological potential, in the WMA "Dolen Vardar" the accumulation Paljurci was built on the river Luda Mara. The main purpose of the waters from the reservoir is the irrigation of the arable lands in Bogdanecko Pole. In the future, it is planned to construct the Gjavato reservoir on the river Vardar.

The main purpose of the reservoir is to provide water for irrigation of the arable land and to improve the watercourse regime during periods of low water. In accordance with the Spatial Plan of the Republic of North Macedonia, the main goal in terms of the development of the water economy is to provide quality water, primarily for the water supply of the population and the food industry, and then for all other activities arising from the current and the planned spatial development.

The territory of the Municipality of Bogdanci is generally poor with watercourses and springs. An area richer in water is the alluvium of the river Vardar where wells for water supply and irrigation of arable land have also been built. Near the populated area Gjavoto, wells have been built for water supply of the population in Bogdanci and Gjavoto, in addition to the wells as part of the project "Save the Dojran Lake" aimed at providing additional water quantities for the Dojran Lake. The system was built with a capacity of 1,000 l/s, with the basic purpose of supply of additional quantities of water in the Dojran Lake.

The river Vardar flows through the territory of the Municipality. From the inflow of the Poganska River into Vardar, the border of the Municipality mainly moves along the course of river Vardar, which in this part often overflows from the riverbed.

In terms of surface water, the main watercourse is the river Luda Mara, which is not characterized by larger and permanent flows. The Paljurci reservoir has been built on the river and it is intended for irrigation of the arable lands. The reservoir has a useful volume of 2.8 x 106 m^3 and since the construction of the reservoir the riverbed of the river Luda Mara is often dry.

The tributaries of the river Luda Mara are of a torrential nature, they often dry out, whereas during heavy rains they cause problems by carrying sediments and flooding. The tributaries of the river on the right are: Gabrovska, Medurska and Kamilska River that pass through Bogdanci. On the left side of the river, the most important tributaries are: Polandere which flows into Luda Mara after the Paljurci reservoir, while Suva Reka, Matorska Reka and Taljusnica are rivers that flow directly into the reservoir.

North of the village of Gjavoto is Maminska Reka which flows into the river Vardar and has a non-permanent water flow. On the territory of the Municipality there is a larger number of other non-permanent water flows or gullies that cause problems during more intense rains.

Near the village of Selemli on the Selemliska River, the reservoir "Selemli" was built with a useful volume of 0.84x106 m^3, the main purpose of which is to irrigate arable land. 7 micro-reservoirs have been built on the territory of the Municipality for providing water for irrigation and for livestock water drinking.

The rivers Luda Mara, its right tributary Gabroshka River and several temporary watercourses – gullies flow through the town of Bogdanci. The environmental protection also entails protection of the river network and regulation of the riverbed.

In the future developments for protection of the river network and for protection from the negative effect of the waters, especially in case of occurrence of large waters, the activities should be directed towards:

- Taking forest reclamation measures in the entire basin of the main watercourse;
- Arrangement and improvement of the degraded riverbeds;
- Maintenance of the river network and the systems for protection against large waters in constant good operational condition; -
- Maintenance and improvement of the riparian vegetation;
- Construction of new protection systems and upgrade of the existing ones.

Municipality of Demir Kapija

The area of Demir Kapija is rich in much groundwater and many springs, as well as artificial watercourses, depending on the relief, the geological structure and the climatic characteristics.

Three important rivers pass through the municipality of Demir Kapija that meet the needs of the population, namely:

- Vardar - length in the municipality 24 km
- Dosnica - length in the municipality 18 km
- Bosavica - length in the municipality 15 km

These rivers are an important factor of water supply because the largest plains are located along the river Vardar, so they represent the lowest parts of the valley, and at the same time they are the most fertile terrains for growing agricultural, industrial, forrage and other crops. Apart from these three rivers, the Chelevechka River, which is protected at the state level, also flows through the territory of the municipality of Demir Kapija.

Groundwater appears in the alluvial plains along the river courses in the plains. So far they have not been tested and there is no clear picture about the characteristics of the groundwater.

The planned stone-embankment dam Buchevnik on the river Doshnica with the capacity of accumulating 14.5 million m^3 will meet the greatest water needs of the whole municipality.

There are water springs in several parts of the municipality, but an analysis of their quality is needed and thus special examinations should be undertaken by the adequate institutions responsible for that field.

There is a local water supply system in the municipality to which several rural areas are connected. It is shown in the following table:

Table 5-8: Water supply system of the rural areas in Demir Kapija

No.	Populated area	Water-supply
1.	Barovo	Yes
2.	Besvica	Yes
3.	Bistrenci	Yes
4.	Dracevica	/
5.	Dren	Yes
6.	Iberli	/
7.	Klisura	/
8.	Koprisnica	/
9.	Koresnica	Yes
10.	Kosarka	/
11.	Przdevo	Yes
12.	Strmasevo	/
13.	Celevec	Yes
14.	Chiflik	Yes

Water supply problems occur in the populated areas of Besvica and Barovo. The municipality is planning to make investments in order to overcome this problem. In the populated area Klisura, a water supply system should be built in order to improve the water supply system.

Municipality of Negotino

From a hydrographic point of view, the municipality of Negotino has terrains with streams that have a poor yield. The hydrographic network comprises the river Vardar and its tributaries.

The river Vardar is the most important water flow. It is the largest and the only river, which, although it has variable water levels, it never dries up. The water level is the highest in spring, when the snow melts and in autumn when the rains are more frequent. The water levels are the lowest during the summer months, July and August.

The following surface flows flow into the river Vardar: on the right side there are the rivers Disanska, Timjanicka, Kurjacka, and on the left side of the river Vardar there is the Vojshanichka River.

The sources of the rivers which flow on the territory of the municipality of Negotino are located on the lake plateau Vitachevo and the mountain Kozuf.

The water level of all these rivers shows large oscillations. The water level is the highest in the spring, while in the summer months it decreases, and some riverbeds dry up.

Timjanicka River that flows through the town of Negotino springs near the populated area Timjanik.

It flows into the river Vardar near the railway station Negotino. This river dries up almost completely during the summer, while in the spring it sometimes happens that it flows like a torrent.

The riverbed of Timjanichka River is regulated in a length of 1500 m, while the other rivers are not regulated. The terrains around the Timjanicka River in the town of Negotino have high groundwater at 1.5 to 2 m, which indicates the need for additional measures for their protection. According to the conducted geological and other drilling, underground water-carrying horizontals were identified at about 1 km south of the town of Negotino at a depth of 9.3 m, and in the west at about 1 km at a depth of 16m, with a capacity from 5 to 15 l/s.

5.6.2 Quality of surface water

The quality of the watercourses in the Republic of North Macedonia is monitored by the National Hydro-meteorological Service within the state network of watercourse monitoring. At the measurement points near the project area (Gevgelija and Demir Kapija), the organoleptic, mineralization and oxygen indicators were continuously monitored, as well as the indicators of acidity, eutrophication determinants, organic micropollutants and harmful and dangerous substances.[8]

The quality of the water in the rivers, in terms of oxygen indicators, is shown through an analysis of the average annual concentrations of the following parameters: dissolved oxygen, five-day biological oxygen demand - BOD5 and chemical oxygen demand - COD, compared to the prescribed values for water classification (Decree on Water Classification, Official Gazette of the RM No. 18/99, 99/16, 264/18 and 276/19).[8] (Figures from 5-37 to 5-41)

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[8] *Source: Quality of the Environment in the Republic of North Macedonia, ANNUAL REPORT, 2018, MoEPP*

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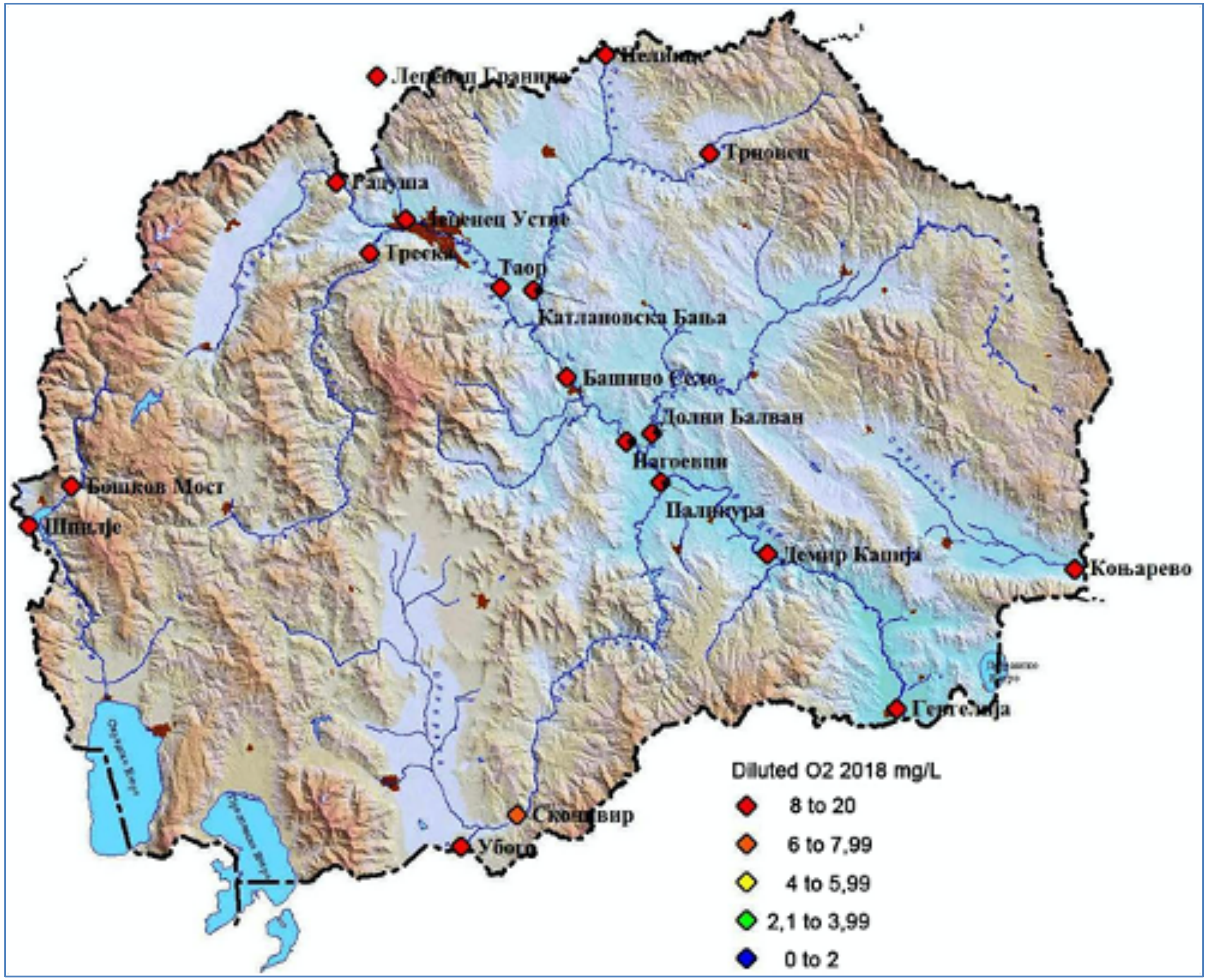

Figure 5-37: Quality of the watercourses monitored in terms of dissolved oxygen concentration (mg/L) in 2018

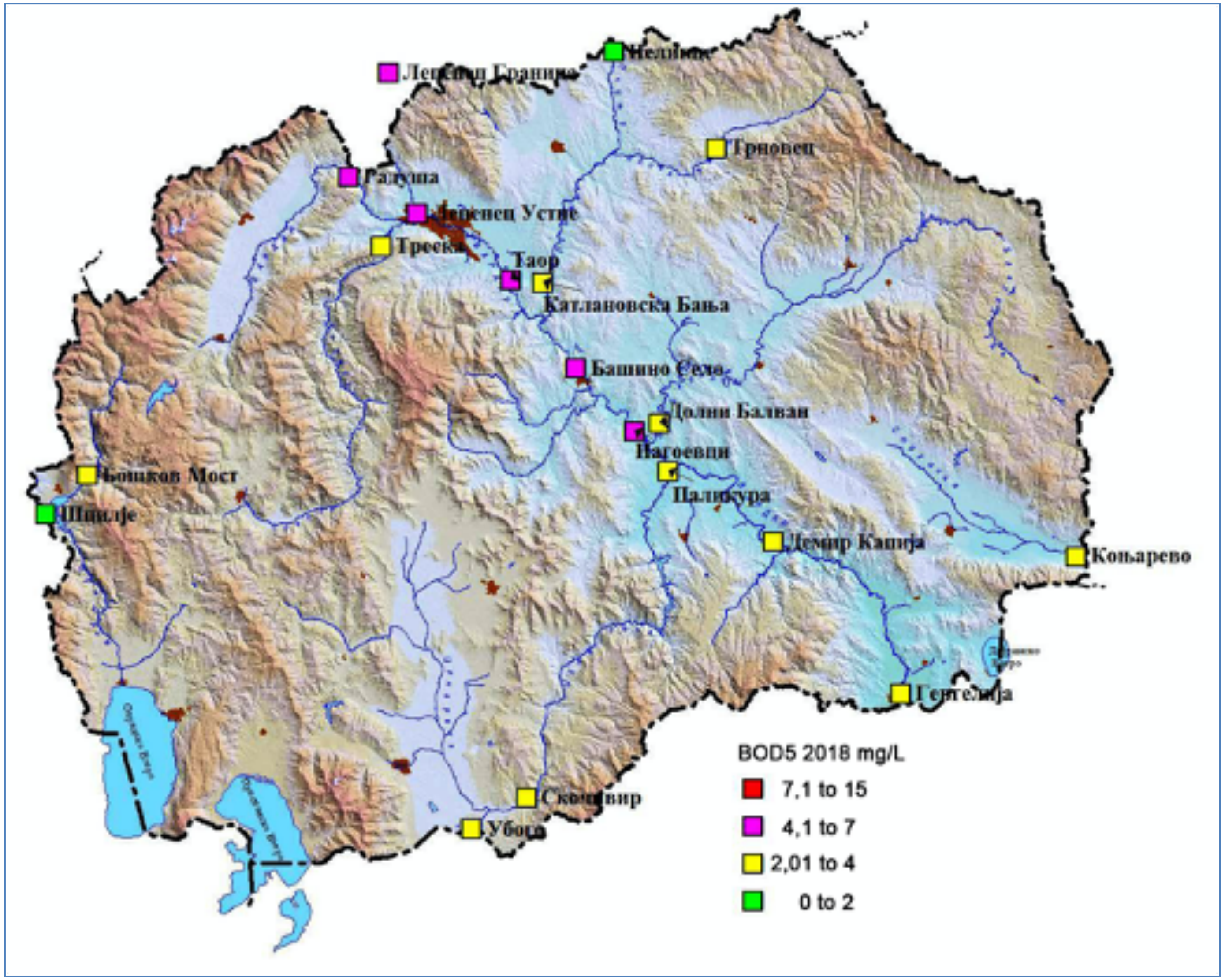

Figure 5-38: Quality of the watercourses monitored in terms of the concentration of five-day biological oxygen demand - BOD5 (mg/L) in 2018

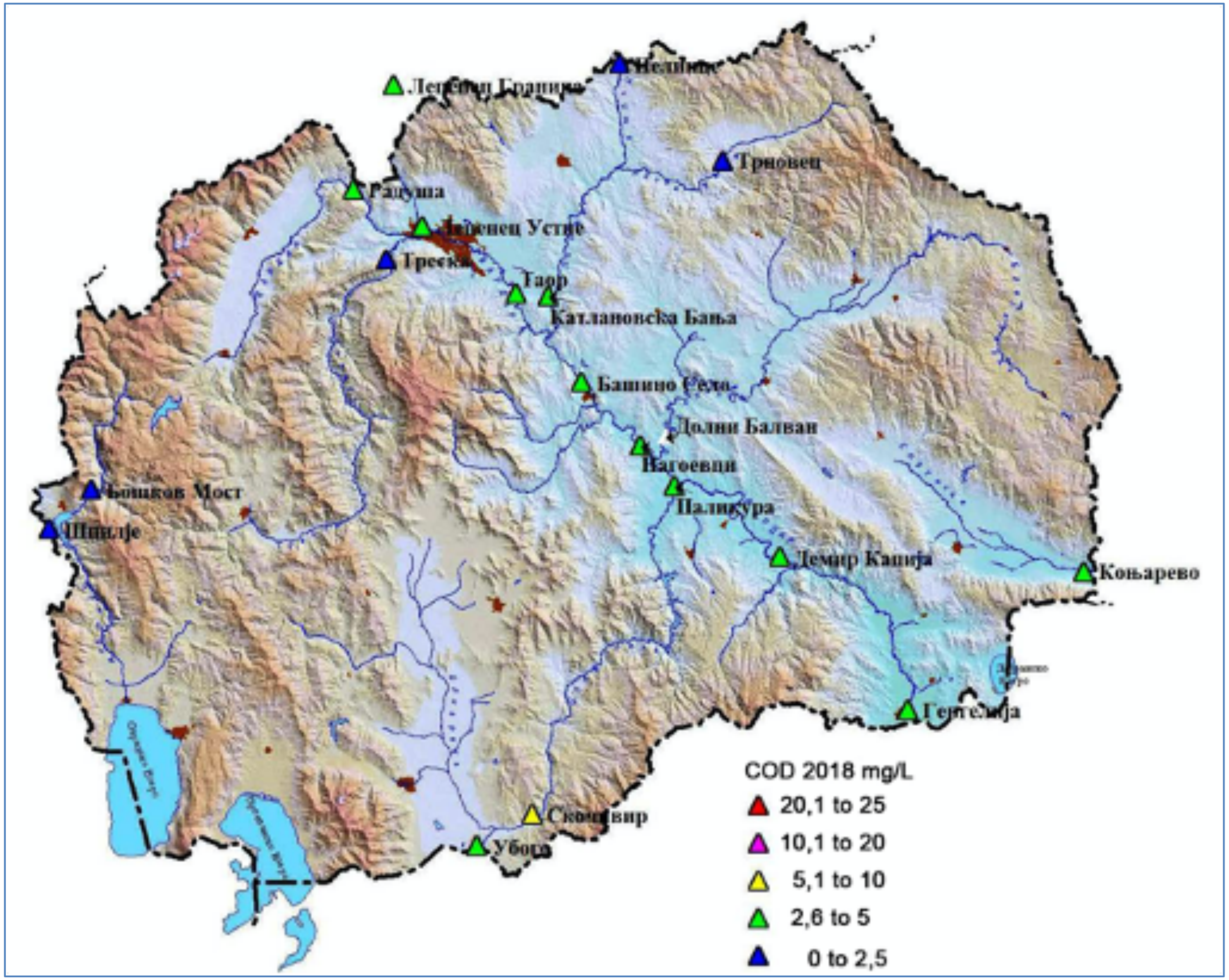

Figure 5-39: Quality of the watercourses monitored in terms of the concentration of chemical oxygen demand - COD (mg/L) in 2018

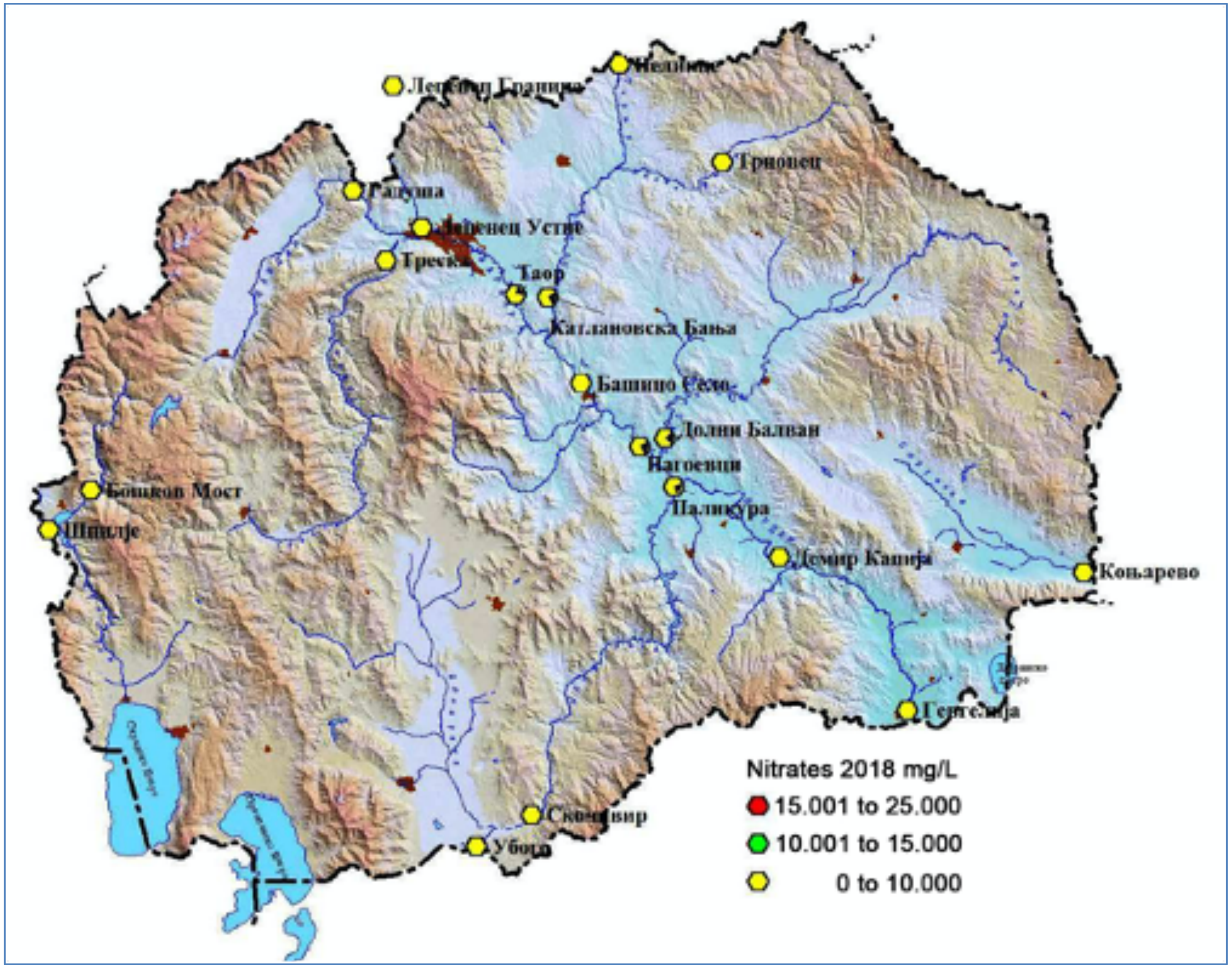

Figure 5-40: Quality of the water monitored in terms of the concentration nitrates (µg/L) in 2018

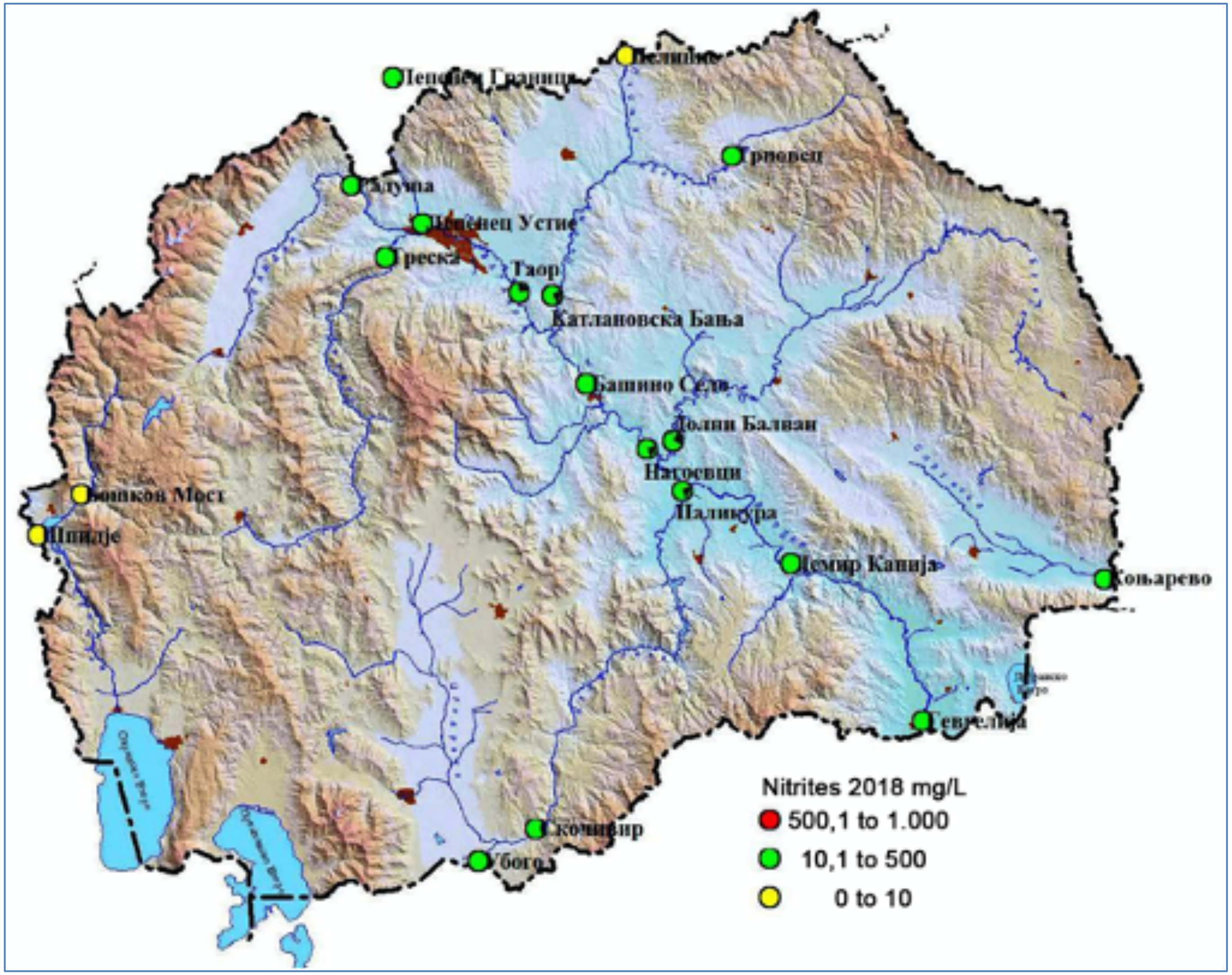

Figure 5-41: Quality of the watercourses monitored in terms of the concentration of nitrites (μg/L) in 2018

When analysing the measured data on the average annual concentrations of nitrates in the rivers, it can be seen that the quality of the water near the measurement points corresponds to the prescribed quality values of class I - II. In terms of the average annual concentrations of nitrites, in most measurement points it can be noticed that the water quality corresponds to class III - IV.

In terms of the data obtained from the monitoring of heavy metals[9], in the rivers, at 20 measurement points, it was observed that the concentration of dangerous and harmful substances monitored through the concentrations of iron, manganese and zinc (Figures no. 5-42, no. 5-43 and no. 5-44) does not show any major deviations in values compared to the measurements from previous years, when the concentrations of the same indicators were within the prescribed concentrations for water classification.

At all measurement points, with the exception of the measurement point Skocivir on Crna Reka and the measurement point Konjarevo, the waters are of quality corresponding to class I-II. According to the Decree on Water Classification (Official Gazette of the RM no. 18/99, 99/16, 264/18 and 276/19), the waters belong to class I - II if the concentration of the iron parameter is lower than 300 µg/l.

At the measurement points Dolni Balvan on the river Bregalnica and Skocivir on the Crna Reka, the waters, according to the manganese parameter, belong to class III - IV. At all other measurement points, the waters belong to class I - II. The classification is made according to the Decree on Water Classification.

At all measurement points, according to the zinc parameter, the waters belong to class I - II. According to the Decree on Water Classification, waters with a zinc concentration below 100 µg/l belong to class I - II.

[9] Source: Quality of the Environment in the Republic of North Macedonia, ANNUAL REPORT, 2018, MoEPP

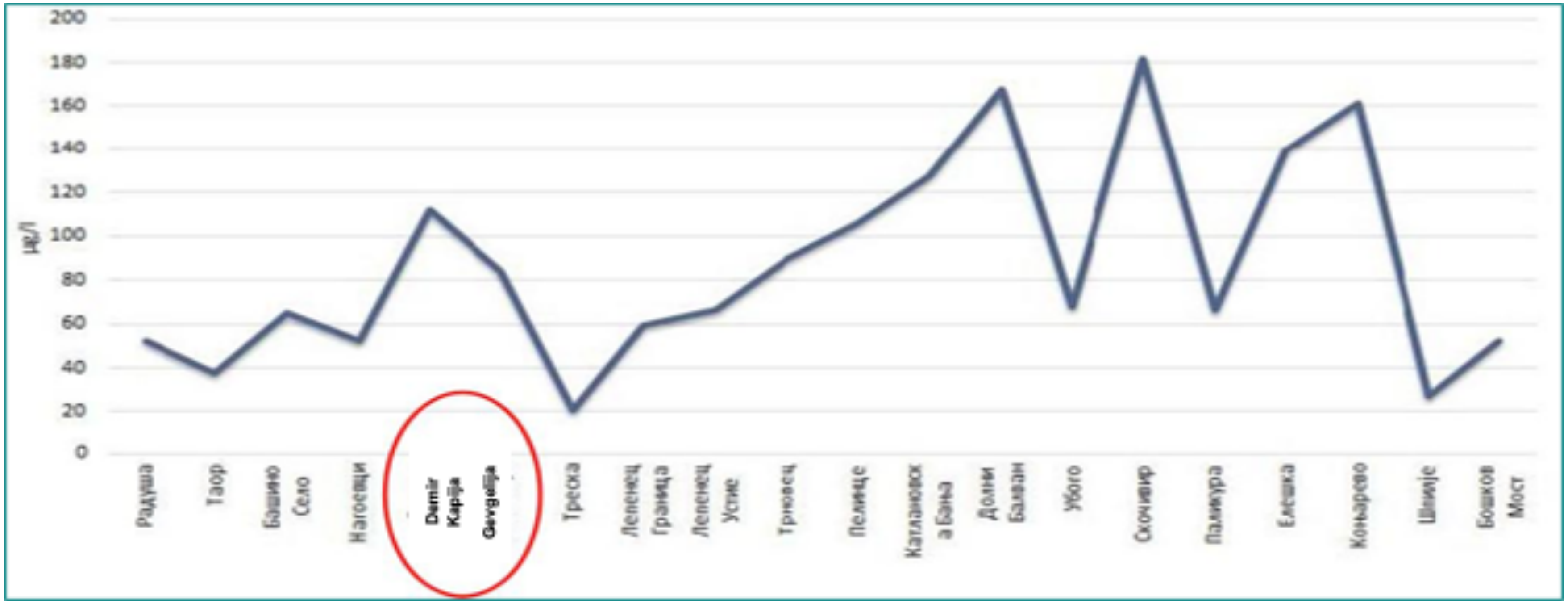

Figure 5-42: Annual average concentrations of iron (Fe) in 2018

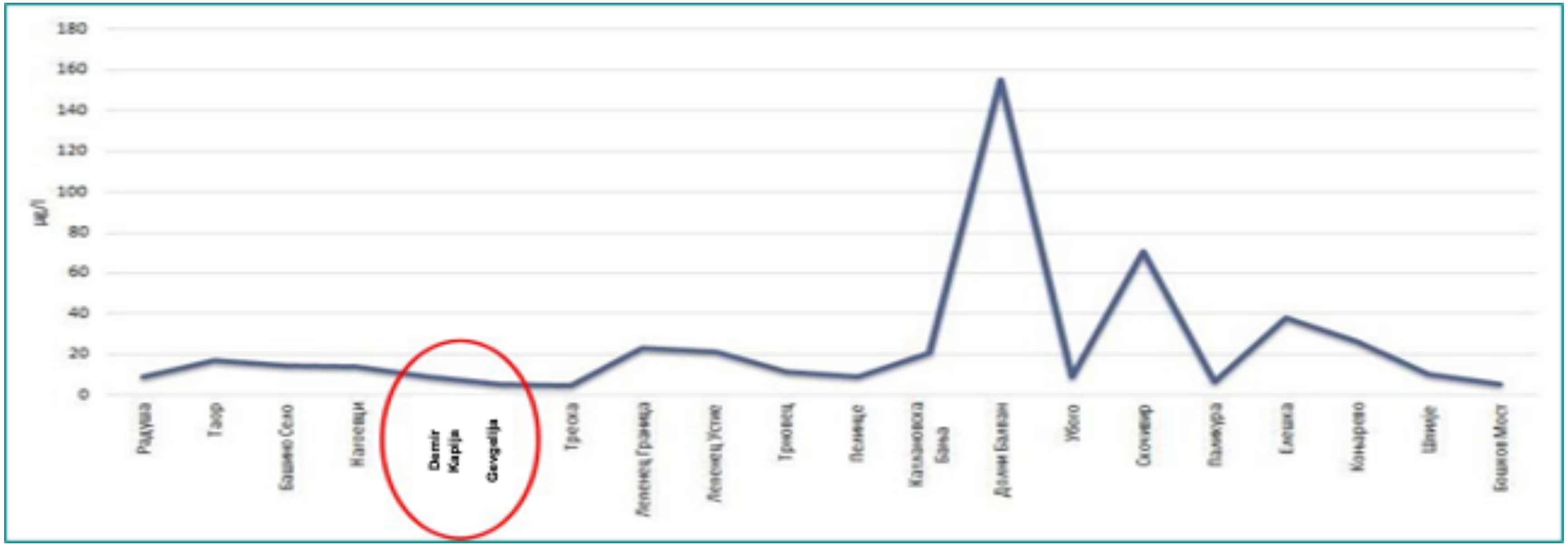

Figure 5-43: Annual average concentrations of Manganese (Mn) in 2018

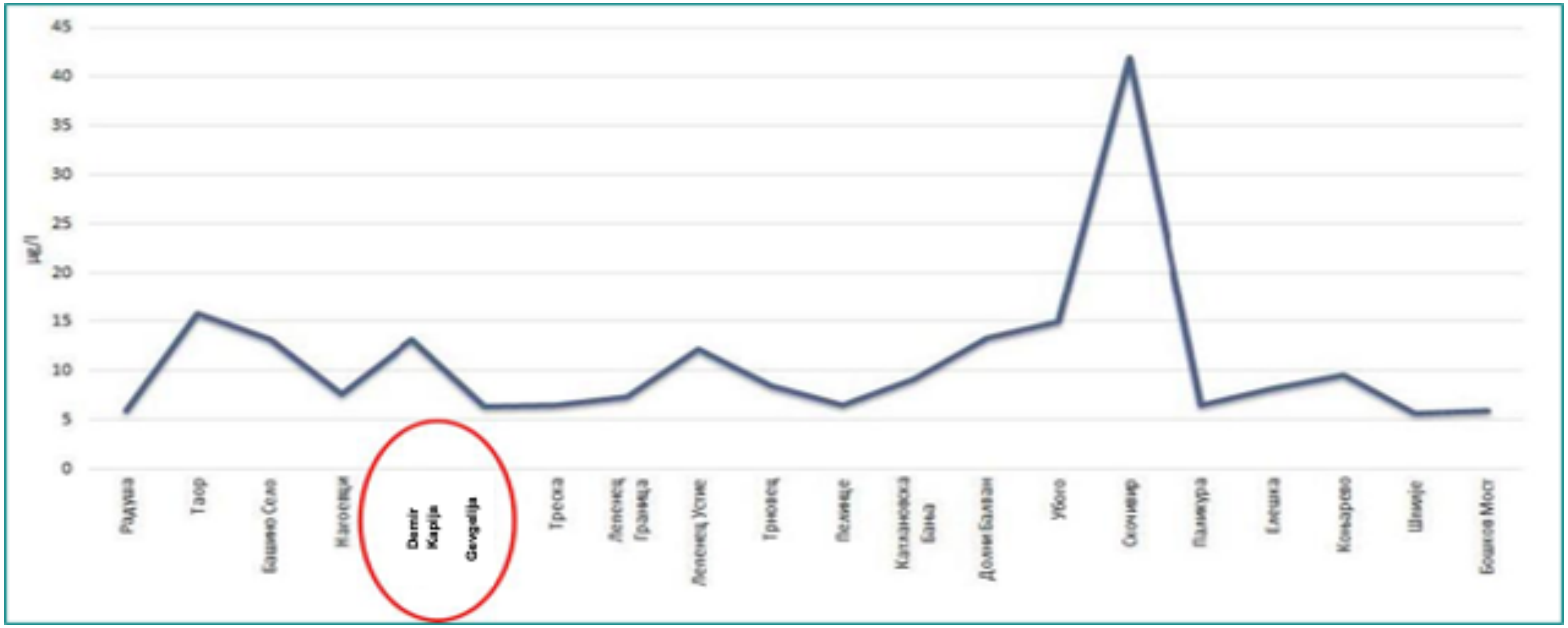

Figure 5-44: Annual average concentrations of Zinc (Zn) in 2018

The quality of the surface water in the municipality of Negotino is monitored by the Public Health Centre - Veles, Regional Unit Negotino. In terms of the condition of the quality of the water of the rivers that flow through the territory of the municipality of Negotino, data exist for the river Vardar, at the measurement point Pepelishte. From the performed examinations, it can be concluded that the waters from the river Vardar are loaded with organic substances, which is evidenced by the established values for: ammonia, BOD5, as well as bacteriological pollution. The waters of the river Vardar are classified in class IV in terms of bacteriological pollution in accordance with the Decree on categorization of watercourses, lakes, reservoirs and groundwater ("Official Gazette of the RM" No. 18/99 and 71/99).

In the municipality of Negotino, a serious problem is the polluted water from the river Luda Mara, which comes from the municipality of Kavadarci and passes through the area of the populated area Kurija in the municipality of Negotino and flows into the river Vardar. This river is polluted with organic, microbiological and toxic substances.

5.6.3 Report of the monitoring of the surface water quality in the project area

As part of the monitoring for establishing the baseline status of the environment, the laboratory for ecological research and safety at work of Tehnolab doo Skopje, in the period September 2019 - January 2020 performed sampling of water samples from 5 (five) locations (watercourses) within the project area. The samples were taken from locations at the rivers where the gas interconnector will cross these rivers. Table 5-9 shows the locations from which samples were taken.

Table 5-9: Locations of water samples taken

Measurement point	Location Description	Coordinates	
		N	E
1.	r. Bosava	41,39908°	22,22450°
2.	r. Drenska	41,34549°	22,31931°
3.	r. Stara	41,30160°	22,40145°
4.	r. Gabreska	41,29221°	22,40757°
5.	r. Vardar	41,17129°	22,53182°

Figure no. 5-45 shows the locations of the places where water samples were taken.

Figure 5-45: Locations of measuring points for water

From the water samples taken, the following parameters were analysed:

- Content of chemical elements (Al, As, Sb, Cu, Ba, Cd, Co, Sn, Li, Cr, Sr, Mn, Ni, Pb, Se, Ag, Fe, Hg, Zn, V);
- Organoleptic and physico-chemical properties, pH, electrolyte conductivity, turbidity, dissolved oxygen, O_2, carbonate hardness, total hardness, *p* - alkalinity, *m* – alkalinity;
- Determination of dissolved ions (S^{2-}, Cl^-, P, NH^{4-} , NO^2, NO^3);
- Dry residue (total substances at 105^0C).

Table 5-10 shows the results of completed analyses of the waters from the rivers Boshava, Drenska, Stara River, Grabeshka River and the Vardar River on the territory of the project area for construction of the gas interconnector North Macedonia - Greece.

Table 5-10: Results from performed water analyses - period September 2019-January 2020

No	Parameter	Unit measure	Measurement points – results					
			Bosava River	Drenska River	Stara River	Gabreska River	Vardar River	M.A.C.
1.	pH		8.15	8.24	8.30	8.27	7.20	6.5-6.3
2.	Electrolyte conductivity	µS/cm	365.00	376.00	281.00	290.00	328.00	/
3.	Turbidity	NTU	<1.00	<1.00	<1.00	<1.00	9.00	0.5-1.0
4.	Dissolved oxygen, O_2	[mgO_2/L]	3.00	8.10	8.86	8.56	8.80	7.99-6.00
5.	Carbonate hardness	[°D]**	8.39	15.29	8.86	8.39	9.49	/
6.	Total hardness	[°D]**	8.51	16.79	8.90	8.81	10.73	/
7.	p - alkalinity	[mg$CaCO_3$/l] equivalents	0.00	0.00	0.00	0.00	0.00	/
8.	m - alkalinity	[mg$CaCO_3$/l] equivalents	32.00	38.00	33.00	35.00	36.00	200-100
9.	COD	[mgO_2/l]	4.80	5.00	3.70	2.90	6.00	2.51-5.00
10.	BOD_5	[mgO_2/l]	1.15	1.49	1.38	1.23	0.88	2.01-4.00
11.	Aluminium	[mg/L]	0.084	0.132	0.031	0.029	0.132	1.50
12.	Arsenic	[mg/L]	<0.01	<0.01	<0.02	<0.01	<0.01	0.03
13.	Antimony	[mg/L]	<0.02	<0.02	<0.02	<0.02	<0.02	0.03
14.	Copper	[mg/L]	0.001	0.003	0.001	0.001	0.003	0.01
15.	Barium	[mg/L]	0.037	0.021	0.005	0.005	0.021	1.00
16.	Cadmium	[mg/L]	<0.02	<0.02	<0.02	<0.02	<0.02	0.0001
17.	Cobalt	[mg/L]	<0.01	<0.01	<0.01	<0.01	<0.01	0.10
18.	Tin	[mg/L]	<0.02	<0.02	<0.02	<0.02	<0.02	0.10
19.	Lithium	[mg/L]	<0.02	<0.02	<0.02	<0.02	<0.02	0.0002
20.	Chromium	[mg/L]	0.002	0.008	0.004	0.004	0.008	0.05
21.	Strontium	[mg/L]	0.163	0.136	0.057	0.058	0.136	/
22.	Manganese	[mg/L]	0.001	0.001	0.002	0.002	0.001	0.05
23.	Nickel	[mg/L]	<0.02	<0.02	<0.02	<0.02	<0.02	0.05
24.	Lead	[mg/L]	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
25.	Selenium	[mg/L]	0.02	<0.01	<0.01	0.02	<0.01	0.01
26.	Silver	[mg/L]	<0.01	0.005	<0.01	<0.01	0.005	0.002
27.	Iron	[mg/L]	0.013	0.183	0.007	0.008	0.183	0.30
28.	Mercury	[mg/L]	<0.01	<0.01	<0.01	<0.01	<0.01	0.20
29.	Zinc	[mg/L]	<0.01	<0.01	<0.01	<0.01	<0.01	0.10
30.	Vanadium	[mg/L]	0.005	0.018	0.006	0.007	0.018	0.10
31.	Dry residue (total substances at 105^0C)	[mg/L]	237.00	381.00	217.00	224.00	255.00	500.00
32.	Sulfides	[mg/L]	<0.002	<0.02	<0.02	<0.02	<0.02	<0.002
33.	Chlorides	[mg/L]	6.81	6.81	13.61	13.61	21.78	/
34.	Phosphorus total	[mgP/l]	0.62	0.33	0.24	0.35	5.72	0.004-0.007
35.	Ammonium	[mgN/l]	0.12	0.14	0.0057	0.0138	0.59	1.00
36.	Nitrites	[mgN/l]	0.028	0.013	0.016	0.018	0.30	0.04
37.	Nitrates	[mgN/l]	0.16	0.093	0.36	0.34	2.45	10.00

Based on the data obtained from the performed analyses of the surface waters, it can be concluded that according to the limit values for II (second) class from the "Decree on Water Classification", Official Gazette no. 18, 1999, the limit values are exceeded for the following parameters:

- Measurement point 1 - r. Boshava: pH, dissolved oxygen, selenium and total phosphorus;
- Measurement point 2 - r. Drenska: pH, dissolved oxygen, BOD_5 and total phosphorus;
- Measurement point 3 - r. Stara: pH, dissolved oxygen, BOD_5 and total phosphorus;
- Measurement point 4 - r. Gabreska: pH, dissolved oxygen, BOD_5, selenium and total phosphorus.

According to the analysis of the sample from the river Vardar, it can be concluded that the water quality is in the second and third class, according to the: "Decree on Water Classification ", Official Gazette No.18, 1999.

5.7 Quality of the ambient air

In the Republic of North Macedonia, ambient air quality monitoring is performed by the Ministry of Environment and Physical Planning, which manages the State Automatic Air Quality System, as well as the Institute of Public Health (IPH) with the Public Health Centres in Skopje and Veles. Additionally, the air quality monitoring is also performed by certain installations that have such an obligation in accordance with the requirements of the IPPC permits.

The Ministry of Environment and Physical Planning manages the State Automatic Ambient Air Quality Monitoring System, which consists of 17 fixed and one mobile monitoring station. The locations of the monitoring stations are shown in the following Figure no. 5-46. [10]

[10] Source: Quality of the Environment in the Republic of North Macedonia, ANNUAL REPORT, 2018, MoEPP

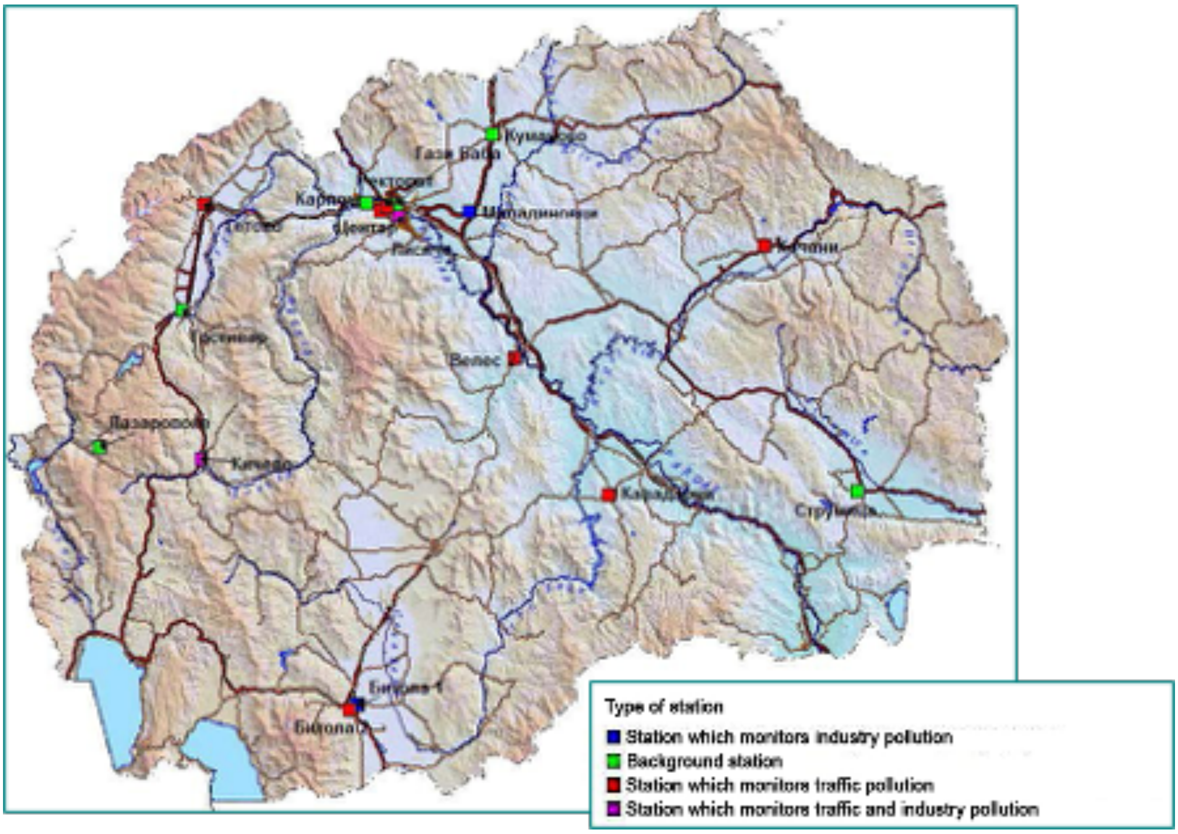

Figure 5-46: Locations of the State Automatic Ambient Air Quality Monitoring System

In the areas (Negotino - Demir Kapija - Bogdanci - Gevgelija) where the gas interconnector passes, no measuring stations have been installed by the State Automatic Ambient Air Quality Monitoring System.

5.7.1 Report of the monitoring of the ambient air quality in the project area

In order to obtain the actual situation of the ambient air quality, as part of the monitoring for establishing the baseline status of the environment, the accredited laboratory of Tehnolab Skopje, in the period September 2019 - January 2020 performed measurements of suspended particulate matter in the air with a size of up to 10 micrometers (PM10), at 11 measurement points along the route of the gas pipeline (Figure no. 5-47).

Figure 5-47: Locations of measuring points for air

Table 5-11 provides information on the measurement points.

Table 5-11: Measurement points including geographical coordinates

Measurement point	Location	Geographical coordinates	Altitude
m.p.1	Negotino (400m before the connection station on the gas pipeline route)	N 41,46890^{0} E 22,11696^{0}	185m
m.p.2	South of the village Tremnik (on the route of the gas pipeline)	N 41,42979^{0} E 22,15200^{0}	201m
m.p.3	At the entrance to the village of Przhdevo (on the route of the gas pipeline)	N 41,42589^{0} E 22,16785^{0}	196m
m.p.4	Demir Kapija (on the river Boshava near the fisheries on the route of the gas pipeline)	N 41,39914^{0} E 22,22440^{0}	126m
m.p.5	On the road Demir Kapija - village Chiflik (on the route of the gas pipeline)	N 41,39507^{0} E 22,23007^{0}	140m
m.p.6	After village Dren (Drenska river near the reservoir, 1600m southwest of the gas pipeline route)	N 41,35699^{0} E 22,26214^{0}	307m
m.p.7	village Miravci (Stara Reka on the route of the gas pipeline)	N 41,30163^{0} E 22,40198^{0}	218m
m.p.8	village Miravci (Grabeska Reka on the route of the gas pipeline)	N 41,29215^{0} E 22,40689^{0}	229m

Measurement point	Location	Geographical coordinates	Altitude
m.p.9	village Smokvica (between the village and the route)	N 41,25868^0 E 22,46469^0	134m
m.p.10	village Prdejci (south of the village on the route of the gas pipeline)	N 41,20285^0 E 22,49933^0	77m
m.p.11	village Stojakovo (south of the village on the road to the village of Bogorodica on the route of the gas pipeline)	N 41,14935^0 E 22,57206^0	67m

The results of the measured concentrations of PM10 at the examined locations in the project area are given in Table 5-12.

Table 5-12: Results of the measured concentrations of PM10 at the locations in the project area

Measurement point	Location	Geographical coordinates	Measured PM10 values [μg/m^3]	Limit value [μg/m^3]
m.p.1	Negotino (400m before the connection station on the gas pipeline route)	N 41,46890^0 E 22,116960	46.80	50.00
m.p.2	South of the village Tremnik (on the route of the gas pipeline)	N 41,42979^0 E 22,152000	32.48	50.00
m.p.3	At the entrance to the village of Przhdevo (on the route of the gas pipeline)	N 41,42589^0	30.35	50.00
m.p.4	Demir Kapija (on the river Boshava near the fisheries on the route of the gas pipeline)	N 41,39914^0 E 22,167850	42.20	50.00
m.p.5	On the road Demir Kapija - village Chiflik (on the route of the gas pipeline)	N 41,39507^0 E 22,230070	43.65	50.00
m.p.6	After village Dren (Drenska river near the reservoir, 1600m southwest of the gas pipeline route)	N 41,35699^0 E 22,262140	28.95	50.00
m.p.7	village Miravci (Stara Reka on the route of the gas pipeline)	N 41,30163^0 E 22,401980	45.13	50.00
m.p.8	village Miravci (Grabeska Reka on the route of the gas pipeline)	N 41,29215^0 E 22,406890	44.95	50.00
m.p.9	village Smokvica (between the village and the route)	N 41,25868^0 E 22,464690	44.35	50.00
m.p.10	village Prdejci (south of the village on the route of the gas pipeline)	N 41,20285^0 E 22,499330	46.63	50.00
m.p.11	village Stojakovo (south of the village on the road to the village of Bogorodica on the route of the gas pipeline)	N 41,14935^0 E 22,572060	31.68	50.00

Based on the obtained results it can be concluded that there is no exceeding of the allowed average 24-hour value.

The interpretation of the results of the performed measurements and analyses was made on the basis of the Decree on the limit values for the levels and types of pollutants in the ambient air (Official Gazette of RM no. 50/2005 and no. 4/2013).

A graphical representation of the concentrations of suspended particulate matter with a size of up to 10 micrometers (PM10), measured at 11 measurement points is given in Figure no. 5-48.

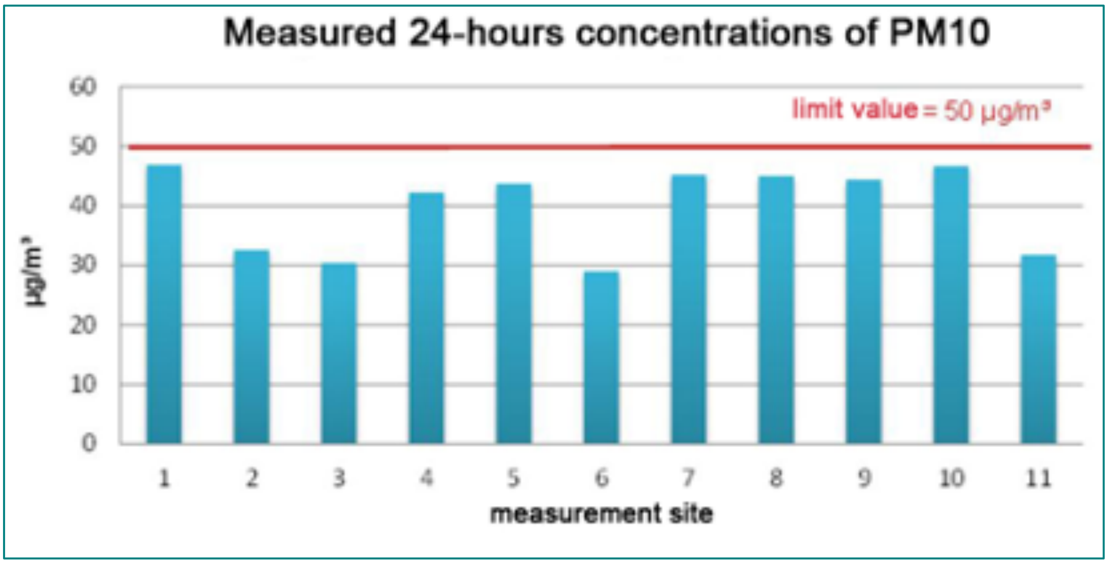

Figure 5-48: Graphical representation of concentrations of suspended particulate matter with a size of up to 10 micrometers (PM10)

5.8 Noise

Noise can have a negative impact on the environment and it is an unwanted or harmful outdoor sound created by human activities that causes discomfort and anxiety. The biggest sources of noise in the environment are the road, rail and air traffic vehicles and the industrial activities. When it comes to the emissions of harmful noise, the construction activities can have a particularly negative impact.

Pursuant to the Law on Protection from Environmental Noise (Official Gazette of the RM no. 79/2007), noise disturbance shall mean annoyance caused by emission of frequent or long-lasting sound created in determined time and place, preventing or influencing the customary activity and work, concentration, relaxation and sleep of the people; Noise annoyance is defined based on the degree of community noise annoyance as determined by means of field surveys or controls. The limit values for the basic noise indicators in the environment are determined in the Rulebook on the limit values of the level of noise in the environment. (Official Gazette of the RM No. 147/2008).

There are no available relevant data on the noise levels in the area where the construction of the gas pipeline route is planned due to the absence of a continuous noise monitoring system.

5.8.1 Ambient noise monitoring report in the project area

In order to obtain the actual state of the level of noise in the area through which the gas interconnector (Negotino - Demir Kapija - Bogdanci - Gevgelija) will pass, the accredited laboratory of Tehnolab doo

Skopje performed ambient noise measurements in order to obtain the so-called baseline noise level in the pre-construction phase.

The location of the measurement points is shown in Figure no. 5-49, and Table 5-13 shows the location information and geographical coordinates of the measurement points.

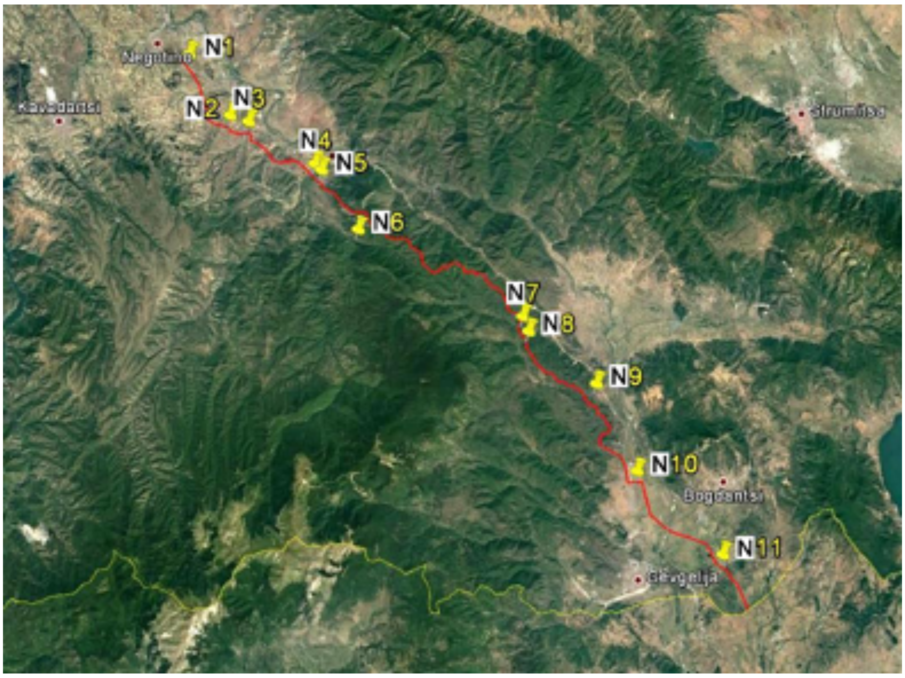

Figure 5-49: Locations of measuring points for noise

Table 5-13: Information about the measurement points and the performed noise measurements

Measurement point	Location	Geographical coordinates	Altitude
m.p.1	*Negotino (400m before the connection station on the gas pipeline route)*	*N 41,46890^0 E 22,11696^0*	*185m*
m.p.2	*South of the village Tremnik (on the route of the gas pipeline)*	*N 41,42979^0 E 22,15200^0*	*201m*
m.p.3	*At the entrance to the village of Przhdevo (on the route of the gas pipeline)*	*N 41,42589^0 E 22,16785^0*	*196m*
m.p.4	*Demir Kapija (on the river Boshava near the fisheries on the route of the gas pipeline)*	*N 41,39914^0 E 22,22440^0*	*126m*
m.p.5	*On the road Demir Kapija - village Chiflik (on the route of the gas pipeline)*	*N 41,39507^0 E 22,23007^0*	*140m*
m.p.6	*After village Dren (Drenska river near the reservoir, 1600m southwest of the gas pipeline route)*	*N 41,35699^0 E 22,26214^0*	*307m*
m.p.7	*village Miravci (Stara Reka on the route of the gas pipeline)*	*N 41,30163^0 E 22,40198^0*	*218m*

Measurement point	Location	Geographical coordinates	Altitude
m.p.8	village Miravci (Grabeska Reka on the route of the gas pipeline)	N 41,29215^0 E 22,40689^0	229m
m.p.9	village Smokvica (between the village and the route)	N 41,25868^0 E 22,46469^0	134m
m.p.10	village Prdejci (south of the village on the route of the gas pipeline)	N 41,20285^0 E 22,49933^0	77m
m.p.11	village Stojakovo (south of the village on the road to the village of Bogorodica on the route of the gas pipeline)	N 41,14935^0 E 22,57206^0	67m

The results of the performed noise measurements are given in Table 5-14.

Table 5-14: Results of performed measurements of noise in the environment

Measurement point	Location	Measured value LAeq	Limit value* Ld	Measured value LAmax-	Limit value LAmax day
		[dBA]	[dBA]	[dBA]	[dBA]
m.p.1	Negotino (400m before the connection station on the gas pipeline route)	48.26	70	62.8	110
m.p.2	South of the village Tremnik (on the route of the gas pipeline)	45.14	70	56.5	110
m.p.3	At the entrance to the village of Przhdevo (on the route of the gas pipeline)	54.09	70	83.5	110
m.p.4	Demir Kapija (on the river Boshava near the fisheries on the route of the gas pipeline)	51.35	70	55.3	110
m.p.5	On the road Demir Kapija - village Chiflik (on the route of the gas pipeline)	37.16	70	52.0	110
m.p.6	After village Dren (Drenska river near the reservoir, 1600m southwest of the gas pipeline route)	45.96	70	73.2	110
m.p.7	village Miravci (Stara Reka on the route of the gas pipeline)	49.61	70	54.7	110
m.p.8	village Miravci (Grabeska Reka on the route of the gas pipeline)	32.35	70	51.4	110
m.p.9	village Smokvica (between the village and the route)	36.76	70	53.1	110

Measurement point	Location	Measured value LAeq	Limit value* Ld	Measured value LAmax-	Limit value LAmax day
		[dBA]	[dBA]	[dBA]	[dBA]
m.p.10	village Prdejci (south of the village on the route of the gas pipeline)	46.65	70	64.7	110
m.p.11	village Stojakovo (south of the village on the road to the village of Bogorodica on the route of the gas pipeline)	45.48	70	56.4	110

**Limit value for a day period, for an area with IV degree of noise protection, i.e. an area where activities are allowed in the environment, with no apartments, intended for industrial activities.*

According to the obtained results from the conducted measurements and in accordance with the Rulebook on the limit values of the level of noise in the environment (Official Gazette of RM no. 147/08) and the Rulebook on the locations of the measuring stations and measurement points (Official Gazette of RM no. 120/08) it can be concluded that the measured noise level in the phase before the construction is within the allowed limits at all measurement points.

5.9 Soil

The following figure shows the soil characteristics of the area covered by the project:

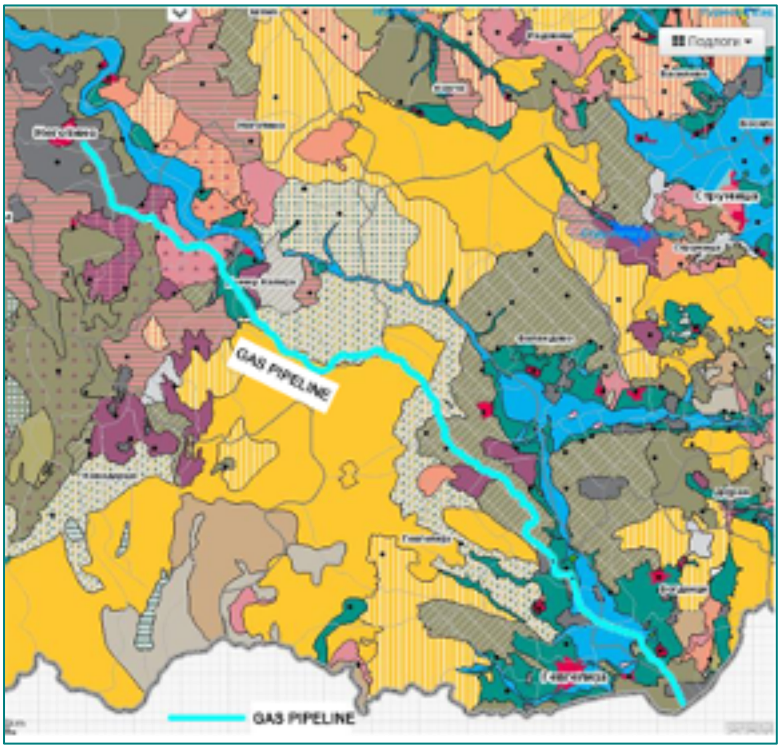

Figure 5-50: Soil characteristics of the area along the pipeline[11]

[11] Source: North Macedonian Soil Information System (http://www.maksoil.ukim.mk/masis)

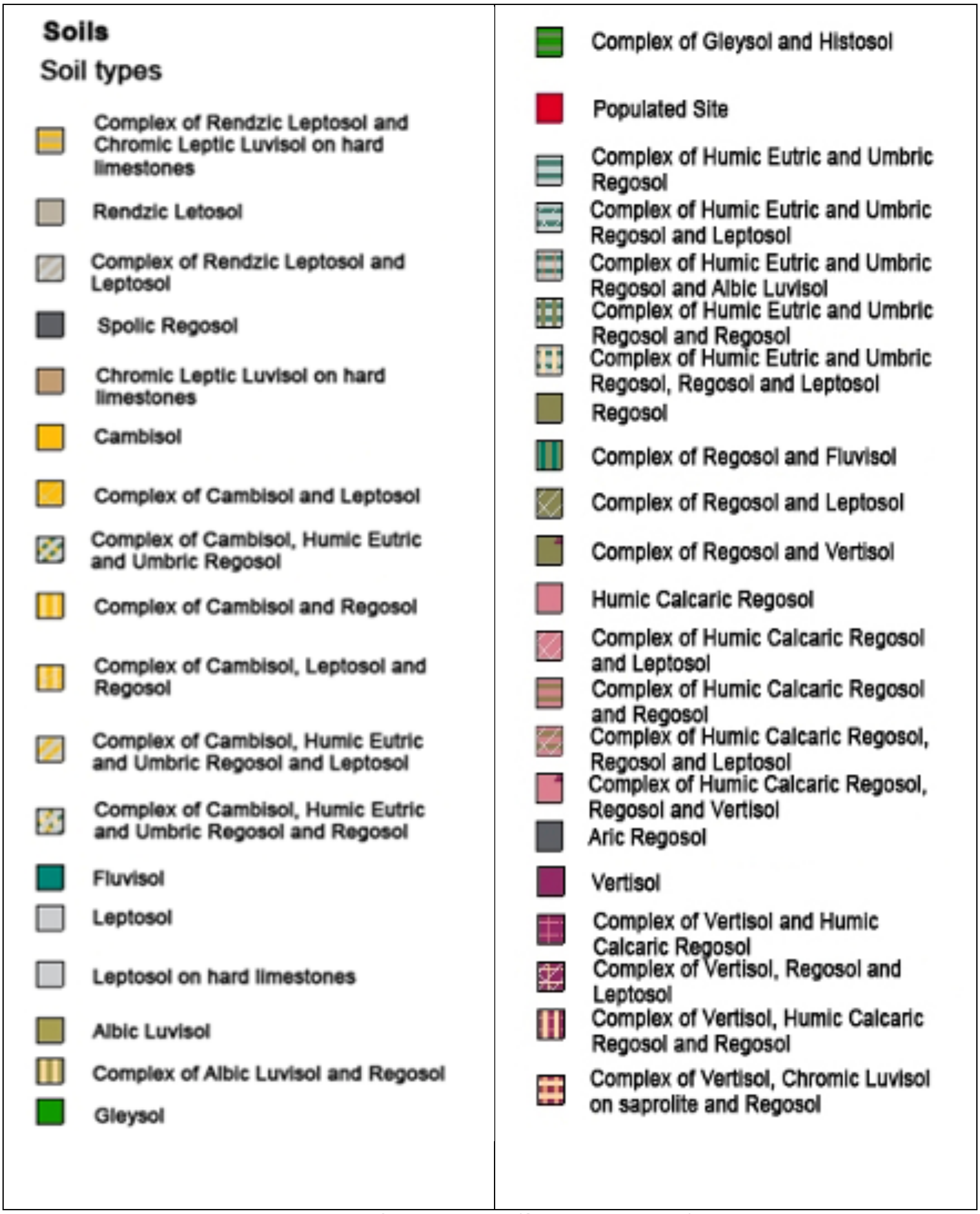

Figure 5-51: Legend for Figure 5-50 (Soil characteristics) – part one

Figure 5-52: Legend for Figure 5-51 (Soil characteristics) – part two

The route starts with the presence of soil of the regosol type, and after the initial few kilometres it enters a part with gleysol, before the part with fluvisol around the river Vardar. After the fluvisol, the route once again passes through gleysol, and then enters an area with regosol and leptosol. As the altitude of the terrain rises, the route passes through an area with cambisol, complex of humic eutric and umbric regosol and regosol, and then, in a significantly longer area, as it approaches the proposed area Studena Glava, it enters an area with cambisol. After the cambisol, the route, near Demir Kapija re-enters gleysol, followed by an area with rendzina, regosol and vertisol. This is followed by an area with regosol and vertisol, as well as an area with vertisol and rendzina. Eventually, as it approaches Negotino, the route ends with a larger area of aric regosol.

5.9.1 Report of the monitoring of the soil quality in the project area

As part of the monitoring for establishing the baseline status of the environment in the pre-construction phase, the accredited laboratory of Tehnolab Skopje performed sampling and analyses of soil samples from the area through which the gas interconnector passes. Figure 5-53 shows the places where the soil samples were taken, and Table 5-15 shows the coordinates of those places and the soil types.

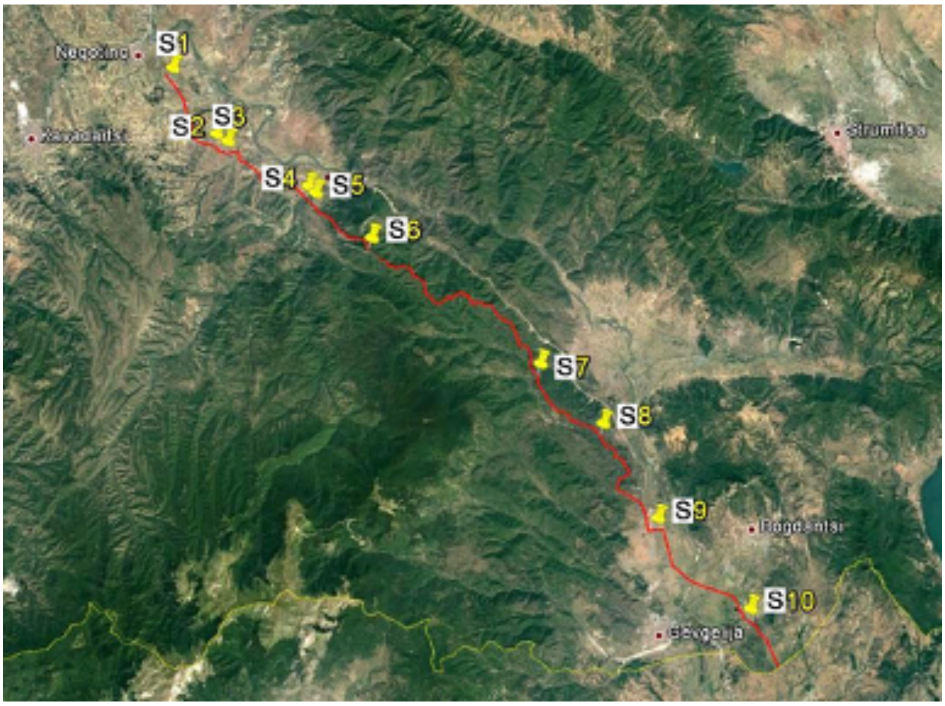

Figure 5-53: Measuring points, places where the soil samples for determining the soil quality were taken

Table 5-15: Places of sampling for determining the soil quality

Measurement point no.	Coordinates	Soil Type
1.	N 41.46885; E 22.11689	aric regosol
2.	N 41.42978; E 22.15196	aric regosol
3.	N 41.42557; E 22.16074	vertisol and rendzina
4.	N 41.39915; E 22.22437	rendzina, regosol and vertisol
5.	N 41.39505; E 22.23002	rendzina, regosol and vertisol
6.	N 41.36808; E 22.27522	cambisol
7.	N 41.29451; E 22.40692	cambisol, complex of humic eutric and umbric regosol and regosol
8.	N 41.25914; E 22.45628	regosol and leptosol
9.	N 41.20306; E 22.49964	gleysol
10.	N 41.14935; E 22.57206	fluvisol

Table 5-21 shows the results of the performed chemical analyses of the soil samples taken.

Table 5-16: Results from performed soil analyses - period September 2019-January 2020

N⁰	Parameter	Unit	Measurement points – results										
			MP1	MP2	MP3	MP4	MP5	MP6	MP7	MP8	MP9	MP10	Limit value
1.	Amount of moisture	%	4.12	3.43	4.51	1.03	3.58	6.29	9.09	2.12	1.66	1.94	
2.	Silver, Ag	mg/kg CM	<1.87	<1.87	116.7	<1.87	<1.87	<1.87	<1.87	<1.87	<1.87	<1.87	15[1]
3.	Aluminium, Al*	g/kg CM	1.97	6.11	6.41	2.60	3.44	8.19	3.61	7270	7810	14024	/[1]
4.	Barium, Ba	mg/kg CM	67.65	176.01	199.31	301.51	125.54	101.71	58.45	341	101	264	625[1]
5.	Cadmium, Cd	mg/kg CM	<1.87	<1.87	<1.87	<1.87	<1.87	<1.87	<1.87	<1.87	<1.87	<1.87	12[1]
6.	Cobalt, Co	mg/kg CM	23.91	22.68	23.12	22.04	29.41	37.51	42.42	36.17	29.37	14.30	240[1]
7.	Chromium, Cr	mg/kg CM	188.18	222.96	217.41	118.63	206.32	197.42	260.74	62.81	210.94	198.75	38[1]
8.	Copper, Cu	mg/kg CM	37.83	22.87	21.25	20.48	41.93	40.77	54.65	70.77	47.06	33.77	190[1]
9.	Lithium, Li	mg/kg CM	210.8	191.9	204.6	230.2	252.1	305.0	354.7	357.74	329.57	131.40	/[1]
10.	Nickel, Ni	mg/kg CM	119.22	100.65	95.21	37.35	87.84	78.59	105.94	48.40	74.43	97.58	210[1]
11.	Lead, Pb	mg/kg CM	<2.02	<2.02	<2.02	<2.02	<2.02	<2.02	<2.02	<2.02	<2.02	<2.02	530[1]
12.	Strontium, Sr	mg/kg CM	17.62	60.61	93.14	267.02	70.39	33.54	54.08	221.61	116.91	58.34	/[1]
13.	Zinc, Zn	mg/kg CM	80.39	67.56	73.41	63.73	79.18	96.73	70.34	98.13	70.29	65.35	720[1]
14.	Arsenic, As	mg/kg CM	24.44	20.61	18.49	20.31	42.95	15.41	<2.53	6.03	4.57	6.31	55[1]
15.	Antimony, Sb	mg/kg CM	<1.90	<1.90	<1.90	<1.90	<1.90	<1.90	<1.90	<1.90	<1.90	<1.90	15[1]
16.	Selenium, Se	mg/kg CM	<2.90	<2.90	<2.90	<2.90	<2.90	<2.90	<2.90	<1.90	<1.90	<1.90	100[1]
17.	Tin, Sn	mg/kg CM	<1.90	<1.90	<1.90	<1.90	<1.90	<1.90	<1.90	4.77	<1.90	<1.90	900[1]
18.	Vanadium, V	mg/kg CM	171.0	156.0	189.4	256.5	271.7	317.6	376.4	151.13	176.70	46.41	250[1]
19.	Iron, Fe	g/kg CM	30.30	27.56	31.01	34.05	35.29	44.88	48.83	44.9	41.4	17.3	/[1]
20.	Manganese, Mn	mg/kg CM	839.8	807.5	813.6	831.0	918.7	1131.8	1110.0	1017.2	914.9	366.6	/[1]

[1]-Dutch Target and Intervention Values, 2000

In the Republic of North Macedonia, there are no laws and regulations that regulate and sanction the issue of soil pollution and contamination. Therefore, the intervention values of the *Dutch Soil Decree* are used to interpret the results. (Dutch Target and Intervention Values, 2000 (the New Dutch List) which provides values for **optimal concentrations** of soil parameters that are considered to be so-called "background" concentration values to which the soil is not considered polluted, as well as **activity concentration values** of parameters above which the soils are considered to be polluted, which requires decontamination and revitalization of the soil.

According to the results of the performed analyses, it can be concluded that the examined samples do not exceed the limit values in accordance with the **intervention values** defined in the *Dutch Soil Decree*.

The obtained results from the performed measurements and analyses presented in the Monitoring reports on the environmental media and areas give a picture of the condition of the environment in the area of the gas pipeline in the pre-construction phase (zero condition).

This makes it possible to make comparative analyses of these results in the future with the results obtained from the following monitoring activities for the other two phases - the construction phase and the operational phase. It will be the basis for assessing and documenting the impact of this project on the environmental media and areas.

APPENDIX 5 shows photos from the field measurements.

5.10 Waste management

Municipality of Bogdanci

Most of the waste of the Municipality of Bogdanci is disposed of at the municipal landfill "Sveta Gora", but there are also a large number of landfills with smaller areas, especially in the rural parts of the Municipality.

Pursuant to Article 42-a of the Law on Waste Management, the management of the municipal waste in the Municipality of Bogdanci is entrusted to the PE "Komunalna Cistota" which is established by the Municipality.

Organized municipal waste collection service is provided in the town of Bogdanci and the rural places of Gjavato, Selemli and Stojakovo. The collection and transportation of municipal waste is organized throughout the year, and the schedule of collection and transportation of municipal waste is twice a week in the town of Bogdanci and once a week in the rural settlements. The number of users of the municipal waste service in the Municipality of Bogdanci is 2,600 households, from all populated areas covered by the service.

In the Municipality of Bogdanci there are three larger landfills, one of which is the town landfill at the level of the Municipality, and the other two are smaller.

- Town landfill - "Sveta Gora" with a surface area of 20,000 m^2, is located at a distance of 800 m from the nearest populated area Bogdanci, and there are no water areas (rivers, lakes, etc.) nearby;
- Ceste javori - with a surface area of 600 m^2, is located at a distance of 2,000 m from the nearest populated area Bogdanci, and it is only 50 m away from the nearest river Luda Mara;

- Stojakovo - with a surface area of 2,100 m^2, at a distance of 600 m from the nearest populated area Stojakovo, and nearby there are gullies, which when there are larger amounts of rainfall turn into torrential rivers.

In terms of the occurrence of illegal landfills, it can be concluded that they are mainly municipal waste dump sites and are mainly observed in those populated areas that do not receive a waste collection service. In any case, the awareness of the population is not raised to a level that can guarantee proper waste management.

Municipality of Gevgelija

The waste at the level of the municipality of Gevgelija is collected by JPKD "Komunalec" - Gevgelija, in the town of Gevgelija and the populated areas Smokvica, Prdejci, Negorci, Bogorodica, Miravci, Miletkovo, Davidovo, Mrzenci, Stojakovo, Moin, Novo Konsko, Konsko with the weekend settlement “Smrdliva Voda", as well as the migrant camp.

The review of the situation with the waste management in the municipality of Gevgelija was made on the basis of the Waste Management Plan in the municipality (2017 - 2022) and the Feasibility Analysis for Improved Solid Waste Management in the Municipality.

JPKD "Komunalec" carries out organized waste collection for 15,497 inhabitants in the town of Gevgelija and 6,880 inhabitants in the populated areas Smokvica, Prdejci, Negorci, Bogorodica, Miravci, Miletkovo, Davidovo, Mrzenci, Stojakovo, Moin, Novo Konsko, Konsko with the weekend settlement “Smrdliva Voda", as well as the migrant camp. The other rural settlements in the municipality do not receive services due to the trend of migration of the inhabitants. Having in mind that only about 500 inhabitants of the rural areas are not covered by organized waste collection, the Municipality and JPKD "Komunalec", in terms of the served population, cover 98.14% of the population.

According to the data from the Plan, the estimated quantities of generated waste in the municipality are 10,333.41 tons/year, which according to the rate of coverage with waste collection services means annual collection of 10,141 tons. According to the data, the daily production of municipal solid waste per capita based on the attached data is 1,310 kg.

Municipality of Demir Kapija

The municipal solid waste includes household waste, along with the waste collected in the streets and parks, the commercial-institutional waste and the industrial waste that has the same characteristics as the household waste.

The regular waste collection service is limited only to urban areas, while very little attention is paid to the rural settlements.

The utility companies use different types and sizes of waste collection vehicles, as well as different types of containers, which means that there is a lack of standardization. In rural settlements, limited waste collection is provided, mostly by tractors or by small multi-purpose vehicles. The collected waste is disposed of at the municipal landfills or on illegal landfills, without proper pre-treatment. Waste selection is not practiced yet, except for collection of bulky waste.

Municipality of Negotino

The public enterprise "Komunalec" is responsible for waste management[12] in the town of Negotino and some of the surrounding settlements.

As a result of the lack of equipment, as well as its obsolescence, as well as due to the remoteness of rural settlements from the municipal centre, the public enterprise is not able to cover the entire territory of the municipality.

The other of the inhabited rural settlements do not receive the services from the PE due to the small number of inhabitants and the economic unprofitability.

The quantities vary because there is a possibility that commercial entities and natural persons dispose of waste on their own, out of the records of the PE that provides the municipal waste collection services. In terms of all these vehicles that transport waste to the landfill, there is no record of the existing quantities of disposed of waste. In addition to the "official" landfill, there are a number of illegal landfills that are not registered, and they can often be seen along the local roads in the municipality.

The annual amount of collected solid waste from the households served by PE "Komunalec" is about 4,000 tons, i.e. 1,053 tons/households/year, i.e. 0.323 tons/inhabitant/year or 0.855 kg/inhabitant/day.

The collection, transportation and disposal of municipal solid waste is carried out in accordance with the Decision on communal order of the municipality of Negotino. The dynamics of the collection, transportation and disposal of municipal solid waste is dimensioned depending on the population density, the amount of waste and the conditions for its collection. The system of collection of waste twice a week in the town centre and once a week in the other parts has been introduced as a standard practice.

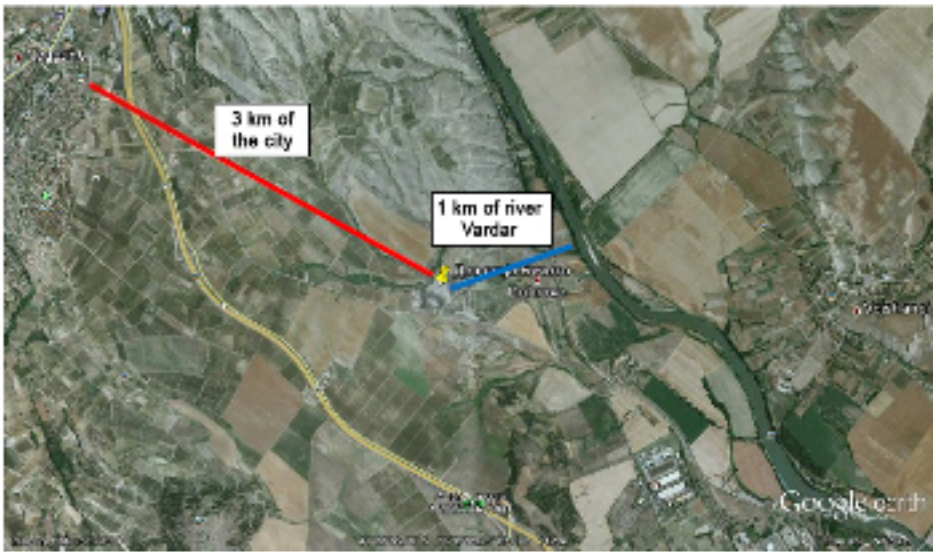

Figure 5-54: Location of the landfill Bucheto, Negotino

[12] Source: Plan and program for waste management in the municipality of Negotino (2012 - 2017)

5.11 Biological diversity

5.11.1 Description of habitats and species

This section summarizes the results of the mapping of habitats (May-December 2019), field observations, and data from literature on the composition of the flora and fauna in the planned gas pipeline corridor. It contains description of the habitats, characterization of their distribution and importance at local and regional level and recommendations for their preservation during the construction of the gas pipeline. Furthermore, it contains data on the flora and the composition of the species in all areas.

The mapping of habitats and the researches on the composition of the flora and fauna were conducted to identify the existing habitats, make a list of habitats and present them on adequate maps. The ultimate goal was to make an assessment of the biological diversity of the existing ecosystems, different areas and localities (hereinafter referred to as habitats) along the planned gas pipeline, based on established and described habitats, and then to identify important areas in terms of the biological diversity and natural heritage. All of this is aimed at protecting against disruption and destruction of ecosystems and populations during the construction of the gas pipeline.

The study refers to a **400 m wide corridor** (200 m on each side of the gas pipeline). This width is sufficient to cover all impacts during the construction activities and the use of the planned gas pipeline.

APPENDIX 6 includes seven maps of habitats covering the entire length of the gas pipeline corridor.

5.11.1.1 Overview of the findings

In terms of the origin, the habitats in the area of the gas pipeline corridor are divided into two main categories: natural and anthropogenic habitats. Natural habitats include: forest, shrubland, grassland and aquatic habitats. The division of these categories was made on the basis of the following criteria: the presence of different plant communities, distribution, level of degradation and geomorphological features. Nevertheless, the main criterion was the division for classification of habitats in accordance with EUNIS (http://eunis.eea.europa.eu/habitats.jsp).

The description of the habitats follows this model: description of plant community, dominant and most common plant species and specific species of fungi. The fauna is represented by vertebrates (amphibians, reptiles, birds and mammals) and selected groups of invertebrates (dragonflies, locusts and daily butterflies).

The area of interest is located in the zone of a typical sub-Mediterranean oak forest. It is a dominant type of vegetation that spreads along the hilly landscape in the higher sections of the gas pipeline corridor. The riparian habitats that follow the water courses are represented by plane-tree and willow zones, with smaller alder forests appearing in certain places. All three types of habitats have been under intense anthropogenic pressure for centuries, due to the occupation of larger areas of arable land. They are in different phases of degradation. The other main types of habitats are represented by various types of grasslands and hilly pastures with sparse shrubs. A significant part of the researched area is modified and/or agriculturally abandoned or otherwise cultivated and/or urbanized.

The planned corridor of the project runs through various complexes of habitats that can be divided into five sections:

- First section (Greek border – village of Prdejci): lowland area (46-80m altitude) agricultural arable land, fields and farmlands (KM 0+000 up to KM 16+000)
- Second section (between the villages of Prdejci and Davidovo): hilly area (80-470m altitude) dominated by kermes oak pseudomaquis, plane-tree covered zones appear along the streams (KM 16+000 up to KM 34+500).
- Third section (between the villages of Davidovo and Demir Kapija): hilly area (400-950m altitude) dominated by well-developed oak- hornbeam forest, plane-tree and willow-covered zones appear along the streams (KM 33+500 up to KM 53+000).
- Fourth section, the areas between the villages of Chiflik and Demir Kapija: alder community along the river Bosava (130m altitude), (KM 53+000).

Fifth section (village of Demir Kapija – city of Negotino): hilly area (130-300m altitude) degraded oak forests, hilly pastures with sparse shrubs and agricultural land (KM 53+000 up to KM 67+140).

Lack of information and unreliable data

The lack of red book and red lists of the North Macedonian flora, fauna and fungi was an obstacle for evaluation of the species. In October 2019, the official National Red Lists of plants (14 species) and herpetofauna were published, see http://redlist.MoEPP.gov.mk/. There are no vegetation and maps of habitats for the area. However, these deficiencies were partially rectified through field researches.

HABITATS

During the researches, 19 types of habitats were established that are distributed mosaically in the space of the area of interest. The covered surface area refers to a corridor with a width of 2 x 200 metres. The habitats with their main features are presented in the following table (Table 5-17).

Table 5-17: Habitats in the area of interest

	Type of habitat	*EUNIS code*	*N2000 code*	*Surface area in the footprint of the project (ha)*
1	*Pseudomaquis - shrublands with kermes oak and hornbeam*	*F5.31*	*/*	*689,5*
2	*Degraded shrublands with kermes oak and hornbeam*	*/*	*/*	*155,6*
3	*Downy oak and hornbeam forests (Querco Carpinetum orientalis)*	*G1.7C22*	*91AA*	*413*
4	*Degraded downy oak and hornbeam forests*	*/*	*/*	*204,93*
5	*Alder-covered riparian zone*	*G1.12*	*91E0*	*10,5*
6	*Plane-tree covered riparian zones*	*G1.38*	*92C0*	*8,42*
7	*Willow and poplar-covered riparian zones*	*G1.1121*	*92AO*	*3,35*

Type of habitat		EUNIS code	N2000 code	Surface area in the footprint of the project (ha)
8	Hilly pastures with sparse shrubs	E1.332	6220	187,65
9	Chasmophytic vegetation on rocks	H3.62	8230	/
10	Rivers wider than 5 metres (Vardar and Bosava)	/	/	5,03
11	Rivers narrower than 5 meters	C2.22	3260	/
12	Occasional water courses	C2.5	3290	/
13	Fields and farmlands	I1.3	/	566,41
14	Deposits of sand	/	/	3,46
15	Fruit plantations	G1.D4	/	19,38
16	Vineyards	FB.41	/	220,28
17	Coniferous plantations	G3.F12	/	3,91
18	Abandoned farmlands with ruderal vegetation	E5.11	/	96,61
19	Populated areas and urban areas	I1.22	/	10,81

NATURAL FORESTS AND SHRUBLAND HABITATS

Forest and shrubland habitats are divided into the following three types: pseudomaquis, oak forest and riparian habitats. Almost the entire area is located in a typical zone of downy oak and hornbeam forest. It is a dominant type of vegetation that determines the features of the hilly areas and represents the lower vegetation zone in the area of the gas pipeline corridor. It belongs to the Central European Balkan sub-region and the Scardo-Pindhian region. In the river canyons of this zone, there are Hungarian oak forests penetrating higher than their main vertical distribution (above 600 m). It is mainly found in the areas gravitating towards the foot of the Kozuf Mountain. The riparian forests and zones develop in river canyons and valleys, in thermophilic areas with kermes oak. Along the gas pipeline corridor, these habitats are present from the lowest levels up to 400-500 m altitude. Alder riparian forest is present along the course of the river Bosava.

All three habitat types have been exposed to a strong anthropogenic influence over the centuries. Almost every habitat has a different level of degradation. The level of degradation is the second criterion for the division of forest and shrubland habitats, especially for oak communities of kermes oak, downy oak and Hungarian oak.

OAK FOREST ZONE

1. *Pseudomaquis - shrublands with kermes oak and hornbeam*

- *Reference to EUNIS Habitats: F5.31 Helleno-Balcanic pseudomaquis*
- *Reference to Habitat Directive: No specific reference*
- *Reference to Palaearctic Habitats: 32.71 HellenoBalcanic pseudomaquis*

Main features: According to Lopatin & Matvejev's suggestions (1995) pseudomaquis, as a vegetation type, can be included in the zone biome of Mediterranean coastal forests and maquis, in the eastern Mediterranean area. The biotope is represented by the community of evergreen kermes oak, *Quercus coccifera*, which in this area forms typical plant communities **Querco cocciferae-Carpinetum orientalis** Oberd. 1948 emend. Ht. 1954. In North Macedonia, this community has a climate zonal distribution up to Demir Kapija, which is its most northern border.

The community is present in steep and rocky places, up to 600 m altitude (Figure no. 5-55). In the better-preserved places, the main ecosystem engineer is *Quercus pubescens*. *Carpinus orientalis* is very abundant. Dominant evergreen species are: *Quercus coccifera* and *Phillyrea media*, but *Juniperus oxycedrus* and *Juniperus excels* are also common. Other important plant species are: *Pistacia terebinthus*, *Fraxinus ornus*, *Coronilla emeroides*, *Colutea arborescens*, *Crataegus heldreichii*, *Lonicera etrusca*, *Cornus mas*, *Paliurus spina-christi*, *Jasminum fruticans*, *Ruscus aculeatus*, *Cistus vilosus*, *Aristolochia rotunda*, *Colchicum latifolium*, *Juniperus oxycedrus*, *Juniperus excelsa*, *Cardamine graeca*, *Cyclamen neapolitanum*, *Asplenium adianthum nigrum*, *Symphytum bulbosum,* etc.

Figure 5-55: Pseudomaquis with kermes oak (Quercus coccifera) in the area of the village of Smokvica.

Distribution in the area of the gas pipeline corridor: Well developed pseudomaquis with dominance of shrublands with kermes oak are found in the south section of the corridor, starting from the surroundings of the village of Prdejci (KM 17+500) all the way to KM 34+500 in the north along the corridor, and also in the surroundings of the village of Dren (south exposition) between KM 47+000 and KM 48+500 (see map of habitats).

- Fungi

  Characteristic representatives of fungi for this biotope are thermophilic Mediterranean species. In view of the fact that the climate conditions are not favourable for development of terricolous fungi, this habitat is dominated by mainly lignicolous species. The most characteristic thermophilic species for this habitat are the following: *Peniophora meridionalis*, *Pulcheritium caeruleum*, *Meruliopsis hirtellus* and *Vuilleminia megalospora*.

  Thermophilic trees and shrubs, with limited distribution in the region, are various substrates for specific fungal species and allow for the development of rare species. The most characteristic species for this biotope are the following: *Peniophora quercina, Peniophora meridionalis* and *Vuilleminia megalospora* (on *Quercus coccifera*), *Antrodia albida* (on *Phillyrea media*), *Peniophora jinipericola*, *Hyphodontia juniperi*, (on *Juniperus oxycedrus*), *Phellinus torulosus* (on *Carpinus orientalis*) etc. Important terricolous species are: *Boletus aestivalis*, *Amanita caesarea, Tricholoma scalpturatum*, *Russula albonigra* etc.

- Fauna

  The fauna in this habitat is relatively poor. Most of the species that inhabit the scrub habitats of this biotope are typical inhabitants of dry and warm regions, i.e. the Mediterranean and sub-Mediterranean region. One of the most common species which is typical for many arid regions in North Macedonia is *Scolopendra cingulata* (Myriapoda, Chilopoda). The most common representative of scorpions in shrub communities is the *Mesobuthus gibbosus*. The insects are mainly represented by species belonging to Lepidoptera (butterflies), Orthoptera (orthopterans), Coleoptera (runners) and Hymenoptera (hymenopterans). The most characteristic species for this habitat are *Iphiclides podalirius* (Papilionidae) and same species from the Saturidae family. The species *Scolia flavifrons* (Scoliidae) is one of the largest representatives of wasps in North Macedonia. The Carabidae family is represented with more common species, of which the most important is *Zabrus brevicollis*. Representatives of the Scarabaeidae family have adapted to the specific living conditions in this community – they mainly develop on mammalian feces.

  Herpetofauna is typical for this habitat in North Macedonia. Reptiles are represented by thermophilic representatives. *Ophisaurus apodus* – European Glass Lizard is a species that prefers warm and dry habitats. It is a very rare species in North Macedonia, but there are very scarce data on its distribution in North Macedonia. Other species of shake-lizard that inhabits the scrub habitats is *Anguis fragilis*, which is quite common in other parts of the region. The green lizard (*Lacerta viridis*) should also be mentioned - a thermophilic reptile, very common in this habitat. The most common species of reptile is probably the Greek tortoise (*Testudo graeca*). The snake *Elaphe situla* is a typical representative for the shrub communities.

  Many species of birds can be indicated for this habitat, but not many of them are characteristic species. Most of the birds use shrub communities as feeding places or only for flying, but not for nesting. The species *Lanius collurio, L. senator, Emberiza spp., Streptopelia turtur, Perdix* and *Passer hispanioliensis* are the most characteristic representatives that use this habitat for nesting. *Merops apiaster* is a very common species, because it feeds on locusts, wasps, and bees that are present in this habitat. The species *Buteo rufinus* uses the shrub communities as a feeding place, constantly flying over it in a search for prey. Mammals that have been registered in this habitat are: wild rabbit (*Lepus europaeus*), *Mustela nivalis, Martes foina* and *Vulpes*.

2. Degraded pseudimaquis – degraded shrublands with kermes oak and hornbeam

Main features: This biotope differs from the previous one mainly in that the evergreen and deciduous shrub species are much less common. Represented species in the degraded natural pseudomaquis are: *Paliurus spina christi*, *Pyrus amygdaliformis*, *Prunus spinosa*, *Juniperus oxicedrus*, etc. (Figure no.5-56). In some places, smaller or larger grasslands are found. From the grassland plants, the following high grass is characteristic: *Chrysopogon grylus*, *Andropogon ishemum* etc. This plant community was established as a result of the strong anthropogenic influence, due to which the characteristic elements of the natural vegetation are rarely or occasionally found. The natural vegetation has been cut down to increase the agricultural areas or pastures. The typical biotope of highly degraded pseudomaquis usually has a secondary origin because the aforementioned elements conquer abandoned farmlands and pastures. In fact, this type of biotope is usually found near populated areas and arable lands.

Distribution in the area of the gas pipeline corridor: Degraded pseudomaquis is found in the hilly areas above the village of Prdejci between KM 15+500 and KM 17+500, then above the village of Dren (between KM 48+500 and KM 49+500) and above the village of Chiflik, between KM 50+500 and KM 52+000 (see map of habitats).

- Fungi

  No characteristic lignicolous species have been registered that define this biotope, mainly due to the absence of adequate substrates. The presence of other woody species such as *Paliurus spina christi* and *Pyrus amygdaliformis* enable the development of fungi such as *Peniophora incarnata* on *Paliurus spina christi*, *Lopharia spadicea*, *Laeticorticium polygonioides*, *Phlebia rufa* and others on *Pyrus amygdaliformis*. However, the terricolous species in this biotope are characterized by higher diversity. Specific to this habitat are: *Pisolithus arrizus*, *Amanita vitadinii*, *Myriostoma coliforme, Tulostoma brumale*, *Scleroderma meridionale* etc.

Figure 5-56: Degraded pseudomaquis with dominance of kermes oak near the village of Prdejci

- Fauna

  The fauna is similar to the one in the previous habitat. The biggest difference is that species characteristic for open areas are dominating instead of typical species for kermes oak communities. This refers to butterflies (*Hipparchia fagi, Satyrus statilinus*, *Pontia edusa, Pieris mannii, Aporia crataegi*) and birds (species of the genus *Emberiza*). In the open areas in the shrublands there are many orthoptera species, such as: *Saga natoliae, Ancistrura nigrovittata, Poecilimon macedonicus, Dociostaurus marrocanus*, and the most common is the *Acrida hungarica* species.

Figure 5-57: Paliurus spina christi in degraded pseudomaquis

Figure 5-58: Pyrus amygdaliformis with a fruit

3. *Downy oak and hornbeam forests (Querco-Carpinetum orientalis)*

- *Reference to EUNIS Habitats: G1.737 Eastern sub-Mediterranean white oak - G1.7372 Moesian white oak woods*
- *Reference to EU HD Annex I: Eastern white oak woods 91AA Reference to CoE BC Res. No. 4 1996: 41.7 Thermophilous and supra-Mediterranean oak woods*

Main features: These forests belong to the wood community **QuercoCarpinetum orientalis macedonicum** Rud. 39 apud Ht. 1946 (Figure no.5-59). This thermophilic and xerophilic community develops under the regional climate influence on the soil. Main edificators in these forests are the downy oak (*Quercus pubescens*) and the eastern (white) hornbeam (*Carpinus orientalis*). In addition to these species, other woody species are commonly found in the community: *Fraxinus ornus*, *Colutea arborescens*, *Coronilla emeroides*, *Acer onspessulanum*, *Rhamnus rhodopaea*, and characteristic grassland plants are *Cyclamen neapolitanum* and *Carex halleriana*.

Distribution in the area of the corridor: Well developed downy oak and hornbeam forests are found in the highest section of the route (from 400 to 950 m), between KM 33+500 and KM 35+500, as well as between KM 37+000 and KM 47+000 (see map of habitats).

Figure 5-59: Well developed downy oak and hornbeam forest near the village of Koprishnica

- Fungi

  Fungi are represented by the typical lignicolous species of deciduous trees, such as: *Daedalea quercina*, *Dichomitus campestris*, *Exidia truncata*, *Hapalopilus nidulans, Peniophora quercina*, *Radulomyces molaris*, *Stereum hirsutum*, *Vuilleminia comedens* etc. (on *Quercus pubescens*) and *Hyphodontia crustosa*, *Phellinus punctatus*, *Steccherinum ochraceum* etc. (on *Carpinus orientalis*). The following thermophilic representatives of terricolous fungi are important: *Amanita caesarea*, *Leccinum griseum*, *B. aereus, Boletus aestivalis, Boletus fechtneri* etc.

- Fauna

  Mammals are represented by the wild cat (*Felis silvestris*), wild boar (*Sus scrofa*), rodents (*Apodemus agrarius, A. flavicollis, A. sylvaticus, Mus macedonicus*).

  There are also hedgehogs (Erinaceus concolor), squirrels (Sciurus vulgaris), moles (Talpa europea), edible dormouse (Glis glis), wild rabbits (Lepus europeus), foxes (Vulpes vulpes).

  The most common birds that inhabit the oak forests are: common blackbird (Turdus merula), Euroasian jay (Garrulus glandarius), common chaffinch (Fringilla coelebs), great tit (Parus major), robin redbreast (Erithacus rubecula). The following birds can also be found: Parus lugubris, Streptopelia decaocto, S. turtur, Otus scops, Phoenicurus phoenicurus, Oriolus oriolus, Buteo buteo, Picus canus, Picus viridis, Dendrocopus syriacus, Troglodytes troglodytes, Turdus philomelos, Turdus viscivorus, Aegithalos caudatus, Carduelis carduelis, C. chloris and Coccothraustes coccothraustes.

  More characteristic species of reptiles are: wall lizard (Lacerta erhardii riveti), green lizard (Lacerta viridis), Balkan green lizard (Lacerta trilineata), the snake species Elaphe longissima and Coluber najadum, etc. The most characteristic species of amphibians are: salamander (Salamandra salamandra), common toad (Bufo bufo), European green toad (Bufo viridis), European tree frog (Hyla arborea) etc.

  Characteristic species of insects are Morimus funereus and Cerambyx cerdo, and the following can also be found: Carabus convexus, Calosoma sycophanta, Cymindis axillaris, Brachinus explodens, B. crepitans, Calathus fuscipes, C. melanocephalus. Forests are not typical butterfly habitats, and the following species appear occasionally: Nymphalis polychloros, Lybithea celtis, Vanessa atalanta, Colias crocea, Pararge aegeria. The fauna of Coleoptera (runners) is similar to the one of the pseudomaquis. The most interesting species are: Laemostenus cimmerius, Carabus coriaceus emgei and Carabus preslii jonicus.

4. Degraded downy oak and hornbeam forests

Main features: This habitat is represented by the same plant community. It differs from the previous habitat in that the deciduous trees (*Carpinus orientalis, Quercus pubescens, Fraxinus ornus*, etc.,) are less present as a result of their excessive use in the past and today, due to which reason the habitat's physiognomy has changed (Figure no. 5-60). In the degraded natural habitats which represent this habitat, common species are Paliurus *spinachristi*, *Pyrus amygdaliformis*, *Prunus spinosa*, etc. Other features that distinguish this habitat from the previous one are: very well developed herb layer, which is due to the presence of open areas and clearings between the shrubs, shallow eroded soil, system of dense canyons, smaller or larger bare rocks etc. The most important plants in the tree layer are: *Quercus pubescens, Paliurus spinachristi, Fraxinus ornus, Juniperus oxycedrus* and *Pistacia terebinthus* (in certain places).

The herb layer consists of: *Minuartia glomerata, Euphorbia myrsinites, Ajuga laxmanii, Knautia orientalis, Tunica illyrica, Althea* sp. etc.

Distribution in the area of the gas pipeline corridor: This habitat is common in North Macedonia, but in the area of the route it is fragmented in several locations, mostly in the hilly area between KM 35+000 and KM 37+500, (see map of habitats).

- Fungi

  The fungi representatives are similar to the ones of the previous biotope, in view of the fact that the same habitat and the same species of trees and shrubs are present. Lignicolous species characteristic for the biocenosis that define this biotope are not present as a result of the absence of adequate substrates.

- Fauna

  The most common mammals in this habitat are: hedgehog (Erinaceus concolor), marbled polecat (Vormela peregusna), and Günther's vole (Microtus guentheri). Also, the presence of Apodemus flavicolis, Apodemus agrarius, Rattus rattus, Mus macedonicus, Lepus europeus, Canis lupus, Vulpes vulpes, Mustela nivalis, Meles meles, Felis sylvestris, Sus scrofa, Capreolus capreolus is expected because these species live in very diverse habitats.

  This habitat provides greater diversity of microhabitats, ecological niches and nesting sites for birds. The number of nesting birds is higher than in the well-preserved downy oak and hornbeam forests, but there are fewer inhabitants. The increased presence of nesting birds is due to the presence of species such as: Hippolais pallida, some species of the genus Sylvia, Lanius collurio, Lanius minor, Lanius senator, Passer hispaniolensis and some species of the genus Emberiza that are typical for hilly pastures.

  Amphibians and reptiles are represented by the same representatives as in the downy oak and hornbeam forests.

  The diversity of butterflies is characterized by the presence of typical types of habitats with dry, shrub vegetation such as: Thymelicus sylvestris, Phengaris arion, Melitaea phoebe, Arethusana arethusa, as well as common species for many habitats: Iphiclides podalirius, Papilio machaon, Aporia crataegi, Carcharodus alceae, Gonepteryx rhamni, Limenitis reducta, Nymphalis antiopa, N. polychloros, Brintesia circe, Erebia medusa, Argynnis niobe, Aglais io, Plebeius agestis, Vanessa cardui, V. atalanta, Melanargia larissa, Coenonympha pamphilus, Leptidea sinapis, Colias crocea, Satyrium acacia, Hamearris lucina etc. The fauna of Coleoptera (runners) is represented by species that are typical for hilly pastures and downy oak forests. There are no specific species in the degraded downy oak forests. The fauna of longhorn beetles in this habitat is similar to the previous one. Due to the presence of open grounds with sparse vegetation, there is a significant number of orthopterans, the most common of which are: Tylopsis lilifolia, Ancistrura nigrovittata, Poecilimon thoracicus, Polysarcus denticauda, Tettigonia viridissima, Decticus albifrons, Platycleis affinis, Odontopodisma decipiens, Omocestus rufipes, Chorthippus bornhalmi, Euchorthippus declivus etc.

Figure 5-60: Degraded downy oak and hornbeam forest with dominance of Juniperus oxycedrus near the village of Przdevo

RIPARIAN HABITATS

These forest and shrub communities develop along the rivers and streams in the entire researched area. Well preserved forests of this type are very rare. People clear these habitats to get fertile alluvial soil. Forest communities belong to two alliances, Platanion orientalis I. et V. Kárpáti 1961 and Salicion albae Soó (30) 1940.

1. ***Plane-tree zones***

- *Reference to EUNIS Habitats: G1.38 Platanus orientalis woods Reference to Habitat Directive: 92C0 Platanus orientalis and Liquidambar orientalis woods (Platanion orientalis)*
- *Reference to Palaearctic Habitats: 44.711 - Helleno-Balkanic riparian plane forests*

Main features: The plane-tree zones in the area of the gas pipeline corridor are often found along rivers, streams and canals or along valleys and canyons (Figure no. 5-61). These zones are more common than the well-developed forests. They are fragments of the **Juglando-Platanetum orientalis** Em et Dzekov 1961 community. Here, the plane-tree (*Platanus orientalis*) dominates, defining the community's physiognomy. There are optimum conditions for development of white willow (*Salix alba*) in this community, while the walnut (*Juglans regia*) is usually absent. Characteristic species for the shrub layer are *Rubus caesius, Cornus sanguinea* etc. There are also some liana species (*Hedera helix, Humulus lupulus, Clematis vitalba*) that are an important component of the community.

The most important species in the herb layer are: *Ficaria grandiflora*, *Cynanchum acutum*, *Thalictrum angustifolium*, *Rumex tuberosus*, *Plumbago europaea*, *Dracunculus vulgaris* etc.

Distribution in the area of the gas pipeline corridor: The plane-tree zones are usually found along all canyons and valleys in the researched gas pipeline corridor. These zones are also present along the course of the rivers Gabreshka (KM 28+500) and Stara Reka (KM 30+000) and their tributaries (see map of habitats).

Figure 5-61 Narrow plane-tree zone along the course of Stara Reka

- Fungi

A small number of fungi have been registered in this community. All representatives are lignicolous species, typical for *Platanus orientalis*. Part of the registered species, such as *Fomes fomentarius, Auricularia mesenterica, Schizopora paradoxa, Panus tigrinus, Stereum hirsutum* and *Stereum rugosum* are common on *Platanus*.

- Fauna

The presence of water and deciduous trees provides good shelters for mammals, with a variety of food and water. Therefore, this habitat has a large diversity of mammals. The following are one of the most characteristic: *Erinaceus concolor, Talpa europea, Lepus europeus, Vulpes vulpes* and *Felis sylvestris*. Certain species of bats can be found in the tree holes (*Pipisterllus pipistrellus, Nyctalus noctula* and *Myotis mystacinus*).

A characteristic species of bird is the Levant sparrowhawk (*Accipiter brevipes*), which rarely uses grasslands for nesting. Common species are goldfinch (*Carduelis carduelis*), European greenfinch (*Carduelis chloris*), sparrows (*Parus major*, *Parus caeruleus*), common blackbird (*Turdus merula*), Euroasian jay (*Garrulus glandarius*) etc.

Representatives of reptiles from the neighbouring habitats are usually found here. Certain species such as Aesculapian snake (*Elaphe longissima*) and leopard snake, (*Elaphe situla*) are more common here than in the pseudomaquis.

As a result of higher humidity, the diversity of amphibians is more pronounced. Common species are: Greek stream frog (*Rana graeca*), European tree frog (*Hyla arborea*), common toad (*Bubo bufo*), salamander (*Salamandra salamandra*) etc.

The fauna of Coleoptera (runners) in these forests is represented by species that are also common in the other riparian habitats. The most characteristic species are: *Bembidion* spp., *Platynus assimilis, Paranchus albipes* and *Pterostichus niger*. The fauna of the butterflies is represented by several species related to the habitats of the riparian communities. Such species are: *Limenitis reducta, Apatura iris*, *Maniola jurtina, Kirinia roxelana* etc.

2. Alder zones

- *Reference to EUNIS Habitats: G1.12 Mixed riparian floodplain and gallery woodland*
- *Reference to EU 92/43/EEC (Annex I): 91E0 *Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*

Main features: The alder zones are usually found along the major rivers and streams in the higher and northern parts of the country. Such forest formations belong to the community of **Carici elongatae-Alnetum glutinosae.**

The most typical woody species is alder (*Alnus glutinosa*), while the species *Salix alba, S.amplexicaulis, Rubus discolor, Clematis vitalba, Humulus lupulus, Sambucus nigra* etc., appear in smaller groups or individually (Figure no. 5-62). The most common species in the herb layer are: *Caltha palustris, Ranunculus ficaria, Lamium purpureum, Lamium maculatum* etc. These communities have been less studied and there is little data on the composition of flora and fauna.

A small number of fungi species are characteristic for this type of habitat. All species are lignicolous and they are parasites or saprobes on willow and alder trees (*Alnus glutinosa*). Part of the registered species such as: *Laetiporus sulphureus, Phellinus igniarius* and *Panus tigrinus* are typical for a willow tree.

Characteristic birds for this habitat are: Cetti's warbler (*Cettia cetti*) and Eurasian penduline tit (*Remiz pendulinus*). Many other species use alder trees as places for nesting and protection and the most common are *Motacilla cinerea, Motacilla alba, Cinclus cinclus* etc. Many migratory species, especially herons (Ardeidae), use alder trees as nesting sites.

Distribution in the area of the gas pipeline corridor: A well-developed alder zone can be found at the inflow of Dosnica river into Bosava river (KM 53+000), see maps of habitats.

Figure 5-62: Riparian alder-covered zone along the Bosava river

3. River banks represented by sand reefs

- *Reference to Habitat Directive: no specific reference*
- *Reference to Palaearctic Habitats: no specific reference*

Main features: Most of the river banks in the area of the road corridor are either protected embankments or solid limestone ridges. In certain places there are soft sandstone ridges cut by the actions of the river. They are not very high (usually a few meters) and usually distributed around the sharp river curves. Usually these places are not covered with vegetation, because they go through frequent changes as a result of erosion by water.

They are very suitable as nesting sites for some species of birds such as *Riparia riparia* and *Merops apiaster*. This type of biotope is very rare in North Macedonia. It is present in certain places along the upper course of the river Vardar, the river Pcinja and the valley of Kriva Reka and some other places.

Distribution in the area of the gas pipeline corridor: It is a rare habitat in the area of the gas pipeline corridor. It is found on the right bank of the river Vardar (KM 8+500) at the spot where the route of the gas pipeline corridor intersects the river, (see map of habitats).

Figure 5-63: Sand reefs on the river Vardar near the village of Gjavoto

OPEN AREAS – GRASSLANDS

The grasslands in the area of the gas pipeline corridor are not a common type of vegetation. They can be covered with kermes oak or sessile oak and by cutting the shrubs they have been turned into arable land. Therefore, the grasslands are present only in a small portion of the researched area and very few are of natural origin. Most of them occur as secondary formations surrounded by dispersed vegetation with different level of degradation.

1. Dry grasslands – hilly pastures

- *Reference to EUNIS Habitats: E1.33 East Mediterranean xeric grassland (E1.332 Heleno-Balkanic shrot grass and therophyte communities)*
- *Reference to EU HD Annex I: 6220 Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea*
- *Reference to CoE BC Res. No. 4 1996: 34.5 Mediterranean xeric grasslands*

Main features: This type of grasslands was formed by devastation of larger areas of natural vegetation, primarily in the vicinity of populated areas or along main roads. It is represented by areas covered in grassland vegetation and surrounded by kermes oak, with different levels of degradation.

A dominant plant community on the dry pastures is **Tunico-Trisetetum myrianthi** Mic. 1972. (Figure no. 5-64). These pastures consist of therophyte plants that dry out at the beginning of the summer. Characteristic and differential species are:

Onobrychis caput-galli, *Valerianella coronata*, *Trifolium stellatum* and *Trifolium angustifolium*.

The flora's composition that defines the physiognomy of this biotope is very similar to the neighbouring habitats with sparse shrubs. It is dominated by thermophilic species, and some low shrubs which are very common. Also, various thorny tall grassland plants are very common (*Eryngium campestre*, *Cirsium* spp., *Echinops* spp., etc.) The vegetation of grasslands that develop near the roads is usually represented by floral elements from the neighbouring biotopes, but the present of ruderal plants is an important feature.

Distribution in the area of the gas pipeline corridor: These habitats are generally spread in the hilly areas along the village of Stojakovo (from KM 2+000 to KM 3+000) and along the stretch between Demir Kapija and the village of Przdevo (from KM 54+000 to KM 59+500), (see map of habitats).

Figure 5-64: Typical dry grassland near the village of Przdevo

- Fungi
  The composition of fungi in this habitat is characterized by the dominance of grassland species such as: *Agaricus campestris, Astraeus hygrometricus, Bovista plumbea, Calvatia excipuliformis, Hygrocybe conica, Marasmius oreades* etc. Occasionally certain mycorrhizal species can be found of the genus *Amanita*, *Cortinarius, Lactarius, Russula*.

- Fauna
  The fauna's representatives are identical to the ones in the pseudomaquis and downy oak and hornbeam communities with different level of development or degradation. The habitat is characterised by a large diversity of mammals. The most common species are: wolf, rabbit, fox, etc. In view of the fact that this habitat has a very small surface area, there are not many characteristic bird species. The most common are crested lark (*Galerida cristata*) and corn bunting (*Miliaria calandra*), however many other species come from the neighbouring habitats searching for food. There are also some predators such as hawks and common kestrels. This habitat is rich in reptiles, some of which are very important. Some lizards and many species of snakes (*Coluber caspius, Elaphe quatourlineata* etc.,) are quite common. Only two species of amphibians are common, however several other species of neighbouring habitats are likely to

be found here as they come searching for food. The most common species is the European green toad (*Bufo viridis*). The daily butterflies in this habitat are very common.

ROCKY AREAS

In some places, in the upper parts of the river valleys, stony fields appear as a result of erosion. They are characterized by extremely low biologic production, but they are very important for the biological diversity of certain areas. As a result of the mineral composition of the rocks and the extreme ecological conditions, this habitat is unfavourable for a rich biological diversity and specific plant and animal communities have been adapted here.

1. ***Hazmophytic vegetation on rocks***
   - *References to EUNIS Habitats: H3.62 Sparsely vegetated weathered rock and outcrop habitats*
   - *References to EU HD Annex I: 8230 Siliceous rock with pioneer vegetation of the Sedo-Scleranthion or of the Sedo albi-Veronicion dillenii*
   - *References to CoE BC Res. No. 4 1996: none*

Main features: The physiognomy of this habitat is defined by the form and the appearance of rocks, while the plant cover has only a sporadic role. The vegetation is characterised by the presence of lithophytic mosses and petricolous lichenous fungi. Characteristic plants are the hazmophytic species of the genera *Jovibarba* and *Sedum*. Other grassland plants are also present, but they have a very little cover. The community of **Helianthemo-Euphorbietum thessalae** K. Micevski develops on rocky sites in the clearings of Coccifero-Carpinetum orientalis on the rocky areas. Only a small number of plant species can be found: *Euphorbia thessala, Alyssum minimum, Alyssum murale, Tunica saxifrage, Moenchia graeca, Aethionema graeca, Trifolium stellatum* etc.

Distribution in the area of the gas pipeline corridor: The rocky areas are present in the canyons of certain river courses such as Stara Reka, Gabreska Reka and Drenska Reka. Due to the small coverage size of these areas, they are not included in the map of habitats.

The most common moss species are *Tortula muralis* and *Grimmia pulvinata*. Typical petricolous lichenous species of fungi are present that are specialised for living on silicate rocks (Figure no. 5-65). Most common species are: *Dermatocarpon miniatum, Hypogymnia tubulosa, Lecidea fuscoatra, Physcia dubia, Rhizocarpon geographicum, Rinodina lecanorina* and *Xanthoparmelia stenophylla*. The fauna of mammals and birds is similar to the one of the pseudomaquis. The same goes for amphibians and reptiles, except that the Balkan green lizard (*Lacerta trilineata*) can be found as well. The fauna of butterflies is similar to the one of the pseudomaquis.

Figure 5-65: Rocky parts in the canyon of Stara Reka

AQUATIC HABITATS

There are four types of aquatic habitats in the researched area and they are as follows: rivers wider than 5 metres (Vardar and Babuna); streams and rivers approximately narrower than 5 m, hyporitral rivers (Stara Reka, Gabreska Reka), intermittent water courses (that dry out during the summer) and irrigation channels, typical for the Gevgelija-Valandovo Valley.

1. *Rivers (~ wider than 5 m)*

- *Reference to Habitat Directive: No specific reference*
- *Reference to Palaearctic Habitats: 24. Rivers and streams Reference to Water Framework Directive (EEC 60/2000): lowland medium/small river type*

- River Vardar

The spring of the river Vardar is in the area of Sharr Mountain, near the village of Vrutok, and it flows into the Aegean Sea in Greece. It is the main river in the country and it is 388 km long from the spring to the mouth, of which 300.7 km are on the territory of North Macedonia. The basin of the river Vardar is the largest in North Macedonia and irrigates 80% of the territory (Figure no. 5-66).

The vascular vegetation that defines the physiognomy of the river banks and the water near the banks is not well developed as a result of the rapid flow and water pollution. Nevertheless, there are certain plant species related to the aquatic ecosystems such as: *Veronica anagalis-aquatica*, *Veronica beccabunga*, *Stelaria aquatica*, *Lycopus europaeus*, *Myosotis scorpioides*, *Alisma plantago-aquatica*, *Phragmites communis*, *Rumexcristatus*, *Polygonum hydropiper*, *Ranunculus repens,* etc. The rocky riverbed enables the thriving of *Cladophora* spp. during the summer and epilithic diatom communities and cyanobacteria during the winter and the spring. Eutrophic diatom species *Cyclotella menghiniana*, *Navicula capitatoradiata*, *Nitzschia palea* etc, are abundant as well.

From the animals, the presence of the following mammal species is important: *Neomys anomalus*, *Ondatra zibethicus*, *Arvicola terrestris*, *Microtus rossiaemeridionalis* and *Myocastor coypus*. There are no characteristic bird species nesting along the river. Several migratory species can be found in the winter season such as: *Phalacrocorax carbo* and *Anas plathyrhynchos,* whereas the species *Anas crecca*, *A. acuta* and *A. querquedula* can be found only during the migration period. From the common species, the most important are *Alcedo atthis* and the white-throated dipper (*Cinclus cinclus*). Several semi-aquatic species of amphibians and reptiles can be found in this habitat as well. There are two characteristic species of frogs: Greek stream frog (*Rana graeca*) and marsh frog (*Pelophylax ridibundus*), and less common are the toads (*Bufo bufo* and *Bufo viridis*). The following reptiles can be found: the grass snake (*Natrix natrix*) and the aquatic tortoise *Emys orbicularis* and *Mauremys caspica.*

Dominant species of fish are *Rhodeus amarus, Alburnoides bipunctatus, Barbus peloponnesius, Leuciscus cephalus* and *Pseudorasbora parva*. The latter was known as introduced species in the river Vardar since the period of 1996-1998 and there is still data on its presence in the water. Unlike this species, the *Ameiurus nebulosus* species, which was also introduced, was first registered in 1998, but the latest researches did not confirm its presence in the river.

Figure 5-66: River Vardar near the village of Gjavoto

- River Bosava

According to its characteristics, the river Bosava is completely different than the river Vardar. It has the characteristics of a mountain river for most of its flow, i.e. it has a very fast flow, rocky riverbed and generally clean water (oligosaprobic). With regards to the lowest part, in the last 2 km before the mouth of the river Vardar, it becomes very similar to Vardar in all its features, as a result of the human influence (Figure no. 5-67). The riparian vegetation is also affected by the waste materials, although natural plant communities are present on the right river bank. During the spring, the green algae *Cladophora glomerata* dominates and it is covered with epiphytic diatom communities. These communities are comprised of cosmopolitan diatom species such as *Navicula tripunctata*, *Diatoma vulgaris*, *Gomphonema olivaceum*. Some rare species of diatom algae have been found in the river Bosava such as *Mastogloia smithii var. lacustris, Stauroneis agrestis* and *Navicula lesmonesis*.

The fauna of vertebrates is more or less typical of larger rivers and streams. The white-throated dipper (*Cinclus cinclus*) is a more specific bird. Several semi-aquatic species of amphibians and reptiles can be found in this habitat as well. Two species of frogs are characteristic: the Greek stream frog (*Rana graeca*) and the marsh frog (*Pelophylax ridibundus*), and the following reptiles: the grass snake (*Natrix natrix*) and the aquatic tortoise *Emys orbicularis* and *Mauremys caspica.*

Figure 5-67: View of the river Bosava near Demir Kapija

2. *Rivers - streams (~ narrower than 5 m)*

- *Reference to EUNIS Habitats: C2.22 Hiporhithral streams*
- *Reference to EU HD Annex I: HD Annex I: 3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation Reference to Water Framework Directive (EEC 60/2000): Lowland calcareous streams*

Main features: The area of the gas pipeline corridor is characterised by well developed hydrographic network. All water courses are part of the basin area of the river Vardar. The most permanent water courses are the streams Gabreska Reka and Stara Reka (Figure no. 5-68). The strong eutrophication impact from the agriculture enables a massive development of microphytes in the rivers. The microphytesre psent during the year. The most dominant species during the summer is *Potamogeton fluitans*, while the *Lemna minor* species is present in the slow water courses and covers the water surface. During the spring, the green algae *Cladophora glomerata* is dominant. Such composition of microphytes allows intensive development of epiphytic diatom communities. The fauna of vertebrates is more or less similar to the larger rivers and streams. The white-throated dipper (*Cinclus cinclus*) is a more specific bird. Several semi-aquatic species of amphibians and reptiles can be found in this habitat as well. Two species of frogs are characteristic: the Greek stream frog (*Rana graeca*) and the marsh frog (*Pelophylax ridibundus*), and the following reptiles: the grass snake (*Natrix natrix*) and the aquatic tortoise *Emys orbicularis* and *Mauremys caspica*.

The stream Petruska Reka is formed from the streams Gabreska and Stara Reka and as a right tributary it flows into the river Vardar in the region between the villages of Miletkovo and Miravci. It is a typical oligosaprobic water course, with rocky riverbed, fast flowing water and rich community of epilithic algae. There is data on the composition of the diatom algae with typical oligotrophic species such as: *Amphipelura pelucida*, *Encyonema caespitosum, Cymbella neocistula, Cymbella Langebertalotii*, lthough there are less common species such as: *Diploneis margenstriata*, *Gomphoneis ohridana, Gomphonema sp*. etc.

Figure 5-68: Stara Reka

3. Intermittent water courses

- *Reference to EUNIS Habitats: C2.5 Temporary running waters*
- *Reference to EU HD Annex I: HD Annex I: 3290 Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion Reference to CoE BC Res. No. 4 1996: none*

Main features: These water courses are typical for canyons in the region of the gas pipeline corridor, on the right side of the river Vardar (Figure no. 5-69). The water is present only during the wet period of the year. After the snow on the Kozuf Mountain melts, in early spring, the water level is high, while during the rest of the year, the stream beds are dry. Due to this reason, these water courses are not very important as aquatic ecosystems. However, the canyons they flow through are usually covered in dense or sparse forests or plane-tree or willow zones, which make them very different from the surrounding grasslands or agricultural areas. The bottom of the streams is mainly covered in *Cladophora glomerata* and *Spirogyra* spp which provides a good layer for epiphytic growth of diatom species. The diatom composition mainly consists of species that are tolerant to eutrophication such as the representatives of the species *Nitzschia* and *Navicula.*

The following amphibians are present in this habitat: the yellow-bellied toad (*Bombina variegata*), the common toad (*Bufo bufo*) and the European green toad (*Pseudepidalea viridis*). The most common species of butterflies in this habitat are: *Carcharodus flocciferus, Pygus alveus, P. sidae, Spialia orbifer, Parnassius mnemosyne, Zerynthia cerisy, Apanthopus hyperantus, Arethusana arethusa, Lasiommata petropolitana, Pyronia tithonus, Vanessa atalanta* etc.

Figure 5-69: Drenska Reka as an intermittent water course

4. Channels

In the area of interest, there are several open channels belonging to the Gevgelija-Valandovo-Bogdanci irrigation system. The agricultural area has a great influence on the water quality. The channels are overgrown with willows (*Salix amplexicaulis*), common reed (*Phragmites australis*) and bulrush (*Typha latifolia*). A massive development of aquatic microphytes can be observed during the summer, and the most dominant species is *Cladophora glomerata*. Several diatoms are present in the epiphytic communities that are typical indicators of water eutrophication. The aquatic fauna of these channels is very similar to the ones of the rivers and streams. The most typical inhabitant of these channels is *Mauremys caspica rivulata*, Balkan pond turtle with south distribution. The fauna of birds and insects is almost identical to the fauna described in the surrounding habitats.

ANTHROPOGENIC HABITATS

This section refers to anthropogenic habitats such as coniferous and deciduous plantations and arable lands (fields, orchards, vineyards, abandoned farmlands).

FORESTS AND PLANTATIONS

1. Coniferous plantations

- *Reference to EUNIS Habitats: G3.F12 Native pine plantations*
- *Reference to EU HD Annex I: none*
- *Reference to CoE BC Res. No. 4 1996: none*

Main features: Certain species of conifers (*Pinus halepensis*, *Cupressus arizonica* and *Cupressus sempervirens*) are very well adapted to the climate conditions of the southernmost part of the corridor. However, only small areas of coniferous plantations can be found in the researched corridor They are represented by mixed plantations of *Cupressus arizonica* and *Cupressus sempervirens* with *Pinus halepensis*.

Mediterranean floral elements are often present that are typical for the entire area. Species of the genus *Cupressus*, with thin and tall tree crowns, define the physiognomy of the biotope. The cypresses are resistant to parasitic fungi, due to which reason such species of fungi are very rare. The situation with terricolous species is similar, with the exception of species associated with pine trees. There are no typical representatives of birds, although many species use these habitats for food. Common species are the Eurasian jay (*Garrulus glandarius*), European greenfinch (*Carduelis chloris*), certain species of sparrows and certain representatives of the Fringillidae family. The most common reptiles are lizards (*Lacerta* spp.), and sometimes snakes (Colubridae) can be found. Due to the unfavourable hydrographic conditions and soil layers, this habitat is very poor in amphibians.

Distribution in the area of the gas pipeline corridor: The coniferous plantations are present only on one location in the corridor, near the village of Stojakovo between KM 4+500 and KM 5+000 (see map of habitats).

2. Anthropogenic zones of trees and lines of trees

- *Reference to EUNIS Habitats: G5.1 Lines of trees*
- *Reference to EU HD Annex I: none*
- *Reference to CoE BC Res. No. 4 1996: none*

Main features: The anthropogenic zones of trees and lines of trees do not represent a specific plant community or a separate habitat. The lines of trees along the edges of the fields, farmlands and gardens are of great importance because they serve as corridors for spreading many species. The woody and shrub species that can be found in this biotope have natural and anthropogenic origin. Some trees are remnants of natural vegetation (*Ulmus* spp., *Celtis australis*, *Pyrus amygdalyformis*, *Prunus spinosa*, *Crataegus monogyna*, *Rosa canina*, *Rubus* spp. и други), while other species have been introduced by humans (*Populus* cv *italica*, *Prunus cerasifera*, *Robinia pseudoacacia*, *Ailanthus glandulosa*). Part of the fields are fenced with hedgerows, usually planted with fruit trees, the most common of which are: *Ficus carica*, *Morus* spp., *Punica granatum*, *Cydonia oblonga*, *Pyrus* spp. and *Juglans regia*. The grassland species are represented by elements from the neighbouring ruderal communities.

Distribution in the area of the gas pipeline corridor: The lines of trees are unevenly distributed and they are most common in Bogdansko Pole and near the populated areas in the lowlands of the gas pipeline corridor.

Figure 5-70: Wind protection black locust zones in Bogdansko Pole

GRASSLANDS OF ANTHROPOGENIC ORIGIN

1. ***Abandoned farmlands***
   - *Reference to EUNIS Habitats: E5.1 Anthropogenic herb stands, including: E5.11 Lowland habitats colonized by tall nitrophilous herbs*
   - *Reference to EU HD Annex I: none*
   - *Reference to CoE BC Res. No. 4 1996: none and*

Main features: The most important feature of this biotope in terms of the flora is the dominance of weeds and ruderal plants that are typical for the grasslands (Figures no. 5-71 and 5-72). The vegetation cover is well developed and dense which indicates that these areas have been abandoned many years ago.

Species of natural grasslands are present in the herb layer and they are as follows: *Cynodon dactilon*, *Lolium* spp., *Bromus* spp., *Hordeum vulgare* etc. The *Andropogon ishemum* species is often present. Other grassland plants are also typical for this habitat (mostly weeds), and they are common in places with warm and dry climate, such as the *Tribulus terrestris* species. Tall grassland plants are quite often, such as *Arctium lappa*, *Hyosciamus niger*, *Datura stramonium*, *Cichorium intybus, Xantium spinosum, Onopordon* sp.*, Cirsium* spp. and many more.

From mycological aspect, the main feature of this habitat is the presence of fungi that are characteristic of grasslands.

Figure 5-71: Meadows near the village of Stojakovo

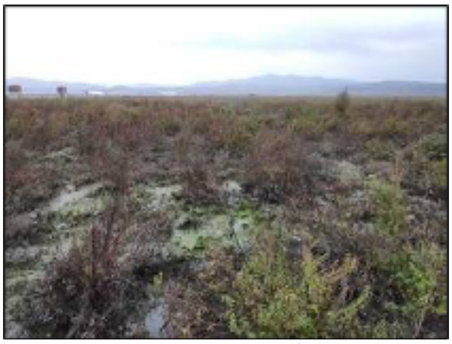

Figure 5-72: Abandoned farmland with ruderal vegetation near the village of Stojakovo

The most common mammals in this habitat are: the hedgehog (*Erinaceus concolor*), the European badger (*Meles meles*), the European mole (*Talpa europea*), the wolf (*Canis lupus*), the least weasel (*Mustela nivalis*), the wild boar (*Sus scrofa*) etc. This habitat type is very similar to the dry pastures and therefore similar species of birds and reptiles can be found. Also, the amphibians are very rare, with the exception of the common toad (*Bufo bufo*) which is more common. Coleoptera (runners) are represented by species that are characteristic of agricultural lands and hilly pastures. The most common are: *Amara aenea, Harpalus distinguendus, Harpalus serripes, Harpalus triseriatus* и *Zabrus incrassatus*.

Distribution in the area of the gas pipeline corridor: Abandoned farmlands and meadows can be found on smaller or larger parcels between agricultural lands. They can be found in the initial section of the gas pipeline route between KM 0+000 и KM 2+000 and in the final section of the route, between KM 59+500 and KM 62+500 (see map of habitats).

AGRICULTURAL LANDS

The agricultural lands in the area of the corridor are mostly present in Strumicko Pole, while the remaining part covers the area near the populated areas and in the section where the corridor passes through Bogdansko Pole. The agricultural lands in the area of the corridor are represented by fields, farmlands, gardens and meadows. Although most of the parcels occupy small surface areas, hedgerows are not common. Also, there are large areas with plantations of monocultures of corn and grapes.

1. ***Orchards***
   - *Reference to EUNIS Habitats: G1.D4 Fruit orchards and*
   - *FB.31 Shrub and low-stem tree orchards*
   - *Reference to EU HD Annex I: none*
   - *Reference to CoE BC Res. No. 4 1996: none*

Main features: Orcharding in the area of the corridor is not a characteristic type of agricultural activity. The fruit trees are usually planted in the villages or in their immediate vicinity. The most common fruit trees in the region are: almonds, peaches, pears, plums and apricots. There are peach plantations in some places in the area of the city of Negotino.

The composition of the fauna in the orchards is identical to the one in the agricultural lands. The main difference are the species related to certain cultivated plants. The most common birds are the Eurasian jay (*Garrulus glandarius*), the European goldfinch (*Carduelis carduelis*), the Indian golden oriole (*Oriolus oriolus*), the common starling (*Sturnus vulgaris*) etc. Certain species of lizards and snakes can be found from the reptiles. The most common species of amphibians is the European tree frog (*Hyla arborea*).

Distribution in the area of the gas pipeline corridor: In the final section of the pipeline route (between KM 60+000 and KM 62+000) there are plantations of peaches, whereas in the initial section (KM 1+000) there are plantations of apples (see map of habitats).

2. ***Fields, farmlands and vegetable gardens***
   - *Reference to EUNIS Habitats: I1.3 Arable land with unmixed crops grown by low-intensity agricultural methods*
   - *Reference to EU HD Annex I: none*
   - *Reference to CoE BC Res. No. 4 1996: none*

The fields, farmlands and vegetable gardens in the area of the designed corridor are represented by different cultures. Annual crops are dominating here such as: tomatoes, peppers, watermelon, alfalfa, tobacco, eggplant, cabbage, potatoes, wheat, corn, etc. An important feature is that the climate allows the cultivation of two crops per year. The most common replacement of crops is between the cornfields and vegetable gardens. The replacement of two biotopes, even if they are similar, in the same place, does not play a significant role in the value of the biological diversity of the biotopes; however, it has a great economic value. In the section between Demir Kapija and Negotino, the agricultural lands are represented by wheat fields.

Certain species of fungi such as: *Agaricus hortensis*, *Coprinus* spp., *Anelaria semiovata*, *Volvariella speciosa* etc., are characteristic for different types of agricultural lands.

The fauna is represented by species that are common for this habitat type in many regions in North Macedonia. Most of the species are typical for the urban and rural areas. Such species are the hedgehog (*Erinaceus concolor*), the European mole (*Talpa europea*), the least weasel (*Mustela* *nivalis*), the beech marten (*Martes foina*), the house mouse (*Mus domesticus*), the black rat (*Rattus rattus*) etc. There are no characteristic bird species that inhabit this habitat, and the most common are the Eurasian skylark, some bush birds, and certain species that come in search of food (crows, pigeons).

Distribution in the area of the gas pipeline corridor: The farmlands and vegetable gardens are typical for the Bogdanci-Geveglija Valley and they are spread in the lowland area between the villages of Stojakovo and Prdejci (between KM 3+500 and KM 15+500), then between the villages of Dren and Demir Kapija (from KM 48+500 to KM 53+500), whereas in the final section of the route, in the vicinity of the village of Tremnik (between KM 59+500 and KM 67+000), they are represented by wheat fields (see map of habitats).

Figure 5-73: Watermelon field in Bogdansko Pole

Figure 5-74: Typical green pepper fields in Bogdansko Pole

3. Vineyards

- *Reference to EUNIS Habitats: FB.41 Traditional vineyards*
- *Reference to EU HD Annex I: none*
- *Reference to CoE BC Res. No. 4 1996: none*

The vineyards are common and one of the most represented agricultural crops in the area of the gas pipeline corridor. The most characteristic varieties of wine are: Vranec, Cardinal, Kratoshija, Drenak, Kilibar, Afus-Ali and many more. In terms of biodiversity, vineyards are more important than fields and gardens.

In view of the fact that this habitat provides good conditions in terms of food for birds, they are present in large numbers. One of them is the common starling (*Sturnus vulgaris*), which is the most common species. Many species use this habitat for breeding, such as the common blackbird (*Turdus merula*), the sparrows (*Passer domesticus*, *Passer montanus*) etc. Many species of butterflies can also be found here, the most common of which are: *Leptotes pirithous, Celastrina argiolus, Polyommatus icarus, Artogia rapae, Pieris brassicae, Colias alfacariensis, Polyommatus icarus, Artogeia napi* etc.

Figure 5-75: Vineyards near the village of Dren

<u>Distribution in the area of the gas pipeline corridor:</u> Vineyards are represented mainly by plantations on large surface areas, but also by smaller individual plantations.

They are most present in the final section of the corridor route, between KM 59+500 and KM 66+000, then in the central section near the village of Chiflik, between KM 50+000 and KM 53+300, as well as in the initial section near the Greek border (KM 0+500 and KM 2+000) and near the village of Prdejci (between KM 12+000 and KM 16+000), (see map of habitats).

4. Populated areas and urban areas

- *Reference to EUNIS Habitats: J1.2 Residential buildings of villages and urban peripheries; I1.22 Small-scale market gardens and horticulture, including allotments*
- *Reference to EU HD Annex I: none*
- *Reference to CoE BC Res. No. 4 1996: none*

Urban areas in the gas pipeline corridor mainly refers to the rural settlements (villages), of which the most important are the villages of Stojakovo and Przdevo which are located in the immediate vicinity of the gas pipeline route. These areas are characterised by vegetation with mosaic structure in which introduced species are very common, mostly Mediterranean.

The richness of vegetables, livestock and poultry makes the villages favourable habitats for mammals, both herbivores and carnivores. Most common species are: the red squirrel (*Sciurus vulgaris*), the yellow-necked mouse (*Apodemus flavicollis*), the wood mouse (*Apodemus sylvaticus*), the striped field mouse (*Apodemus agrarius*), the edible dormouse (*Glis glis*), the black rat (*Rattus rattus*), the house mouse (*Mus domesticus*), the fox (*Vulpes vulpes*), the least weasel (*Mustela nivalis, Mustela putorius*), the beech marten (*Martes foina*), the European badger (*Meles meles*), theh wild cat (*Felis sylvestris*).

Species of birds related to anthropogenic habitats are present: *Pica pica, Corvus monedula, Corvus cornix, Corvus corax, Passer domesticus, Passer montanus, Ciconia ciconia, Falco tinnunculus, Columba livia, Streptopelia decaocto* etc.

Figure 5-76: The village of Przdevo, along which the gas pipeline route passes

5. Industrial, commercial and other man-made facilities

- *Reference to Habitat Directive: No specific reference*

In addition to growing crops in open gardens, an important feature of the area of the gas pipeline corridor is also the cultivation of early vegetables in greenhouses. Green peppers, cucumbers and tomatoes are mainly grown in them. The greenhouses are covered with nylon and they are temporary agricultural facilities. They are not important as habitats. They are present in the section of the route that passes through Bogdansko Pole. Various industrial and commercial facilities of permanent type are also present.

Figure 5-77: Greenhouses with tomatoes and green peppers (left) and purchase point for early vegetables in Bogdansko Pole (right)

5.11.2 Protected areas / areas proposed for protection

The Spatial Plan of the Republic of North Macedonia valid until 2020 was used as a basis for defining the protected areas along the gas pipeline corridor, as well as data from a UNDP project implemented by the North Macedonian Ecological Society.[13] It contains the areas through which the line corridor passes or which are near the line corridor and which have significant natural values. In addition to the already declared protected natural areas, none of the other listed areas under the North Macedonian laws has a status that would fully guarantee its protection. It includes the following:

[13] Source: UNDP project 00058373 - PIMS 3728 (2011) "Strengthening the Ecological, Institutional and Financial Sustainability of North Macedonia's Protected Area System"

- Declared protected natural areas;
- Areas proposed for declaration;
- Important Plant Areas (IPA);
- Important Bird Areas (IBA);
- Emerald Areas.

More detailed information on the listed areas, their categorisation, the surface areas they cover and their relation with the gas pipeline route is presented in Table 5-19.

Protected areas and areas proposed for protection under the North Macedonian legislation

In accordance with the Law on Nature Protection 67/2004, there are six categories of protected areas in the Republic of North Macedonia: Strict Natural Reserve, National Park, Nature Monument, Nature Park, Protected Landscape, and Multi-purpose Area. The categorization of protected areas has been made in accordance with the International Union for Conservation of Nature.

There are three areas in the wider footprint of the project, which were proposed for protection under the Spatial Plan of MK (2001-2020) or within the UNDP/GEF project dated 2010 “Development of representative network of protected area in the Republic of North Macedonia” implemented by the North Macedonian ecological Society. They are presented and stated in the table below:

Table 5-18: Protected areas and areas proposed for protection in the footprint of the project

Code	Name of the area	Protected/Proposed category of protection
482	Demir Kapija	Nature Monument (protected area)
481	Studena Glava	Nature Park (proposed for protection under the Spatial Plan of MK)
537	Aeolian sands - Vardar	Nature Park (proposed for protection under the UNDP/GEF project dated 2010)
241	Negorski Banji	Nature Monument (proposed for protection under the Spatial Plan of MK)

The following figure shows the protected and proposed areas for protection the area in which the gas pipeline will be constructed (the proposed corridor is shown in black).

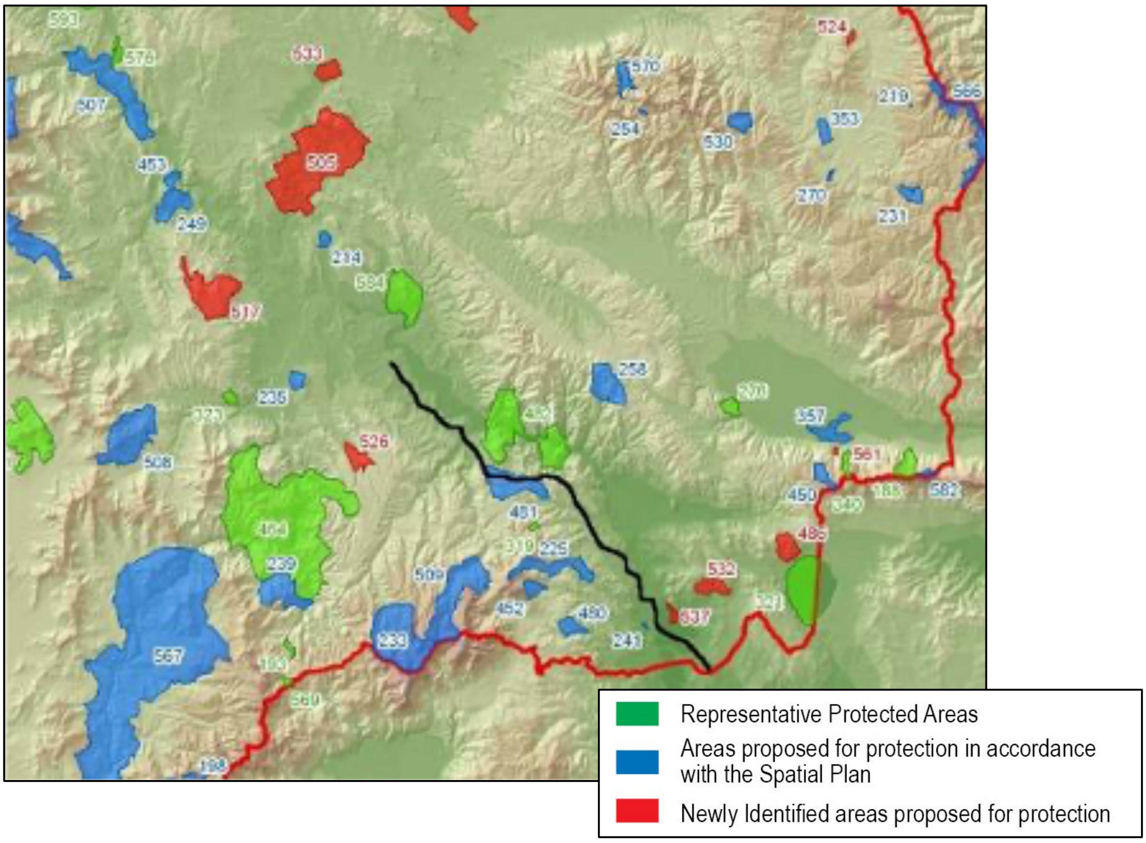

Figure 5-78: Map of protected and proposed areas for protection[14]

Protected Areas

- *Demir Kapija (482)*

  Near the gas pipeline corridor there is one protected area – Demir Kapija, that belongs to the category of Nature Monument. The area covers the Demir Kapija Canyon and extends from the populated area Demir Kapija to the village of Udovo in the south (Figure no. 5-79). This area includes several existing protected and proposed areas for protection: Demir Kapija, Iberliska Reka, Klisurska Reka, the caves Bela Voda and Goren Zmejovec, Krastovec, Shtuder, Mala Javorica. It is the farthest northern part of the modified Mediterranean area along the river Vardar. It is characterized by the presence of significant thermophilic communities and hazmophytic vegetation. Interesting riparian vegetation develops in the canyons from the plane-tree communities. Very rare species of plants can be found on the calcareous rocks and stony fields. The area is widely known for its importance for the birds of pray and many Mediterranean species can be found as well. One of the three North Macedonian colonies of griffon vulture, booted eagle, golden eagle, Egyptian vulture, black stork can be found here. Especially noteworthy is the cave fauna of Bela Voda represented by several troglobiont and troglophilic species. Endogean habitats are also known to have several endemic species. The caves are also important because of the bat colonies that can be found in there. Interesting species of invertebrates live in the small tributaries of the river Vardar (Iberian crab, caddisflies, *Epallage fatime*), and also several species of fish spawn.

[14] Source: Brajanoska et all. 2011

The protected area of Demir Kapija is located out of the projected gas pipeline route. The nearest point of contact is at approximately 450 metres from the route.

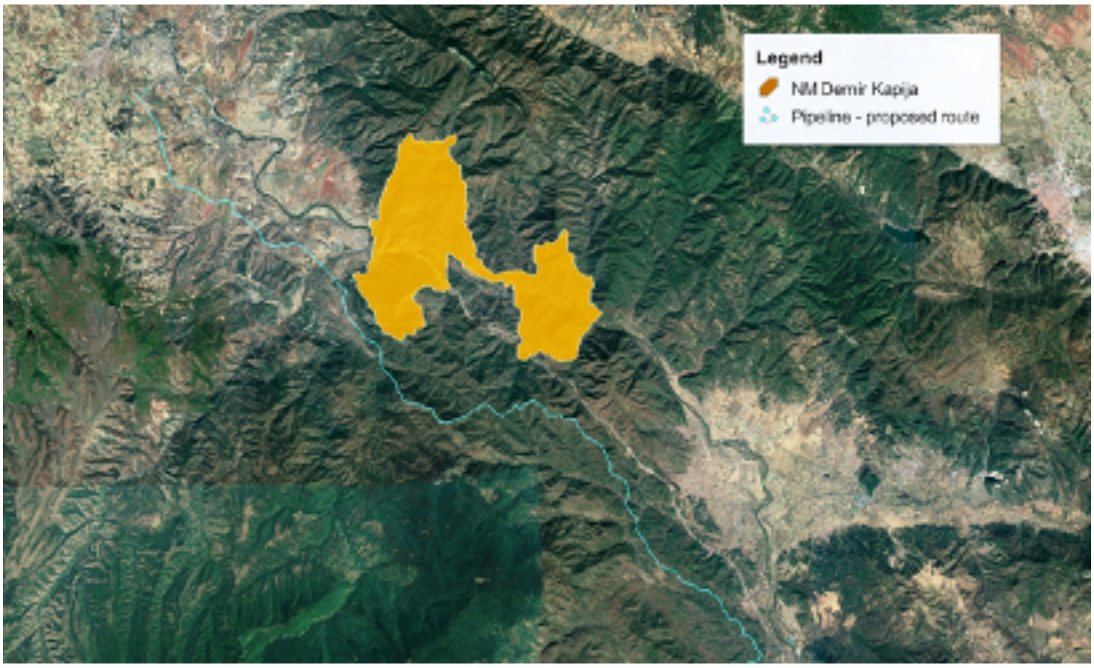

Figure 5-79: Location of PA Demir Kapija compared to the gas pipeline route

Areas proposed for protection

- Studena Glava (481)

  It covers parts of the Marjanska Planina (Kozuf), between the villages of Koprishnica and Dren (Demir Kapija) and Projkov Rid. The locality is characterised by beech forests, few rare species of plants and insects. It is characterized by the presence of beech stands at low altitudes, in places even lower than the Platanus communities. The area is proposed for protection under the Spatial Plan of the Republic of North Macedonia dated 1999.

  The gas pipeline route fully penetrates and fragments the area of Studena Glava from KM 38+700 to KM 47+200 (Figure no. 5-80).

Figure 5-80: Location of the proposes area for protection Studena Glava compared to the gas pipeline route

- *Negorski Banji (241)*

  The area is proposed for protection under the Spatial Plan of the Republic of North Macedonia dated 1999. The locality is situated south of the populated area Negorci in the circle of the thermal spa. The area belongs to the Mediterranean biogeographical region and covers surface areas with relict swamp habitats with *Cladium mariscus*. The presence of the riparian plant community of narrow-leafed ash is noteworthy (*Fraxinus angustifolia* ssp. *macrocarpa*). The location of the area fully overlaps with the namesake Important Plant Area (IPA Negorski Banji) and the Emerald Area Negorski Banji. It is located approximately 2 KM from the nearest point of the gas pipeline route (Figure no. 5-81).

- *Aeolian sands – Vardar (537)*

  The area is located along the river Vardar, west and southwest from the village of Gjavoto (Gevgelija). It is proposed in the category of Nature Park in 2011. The sandy habitats around the river Vardar and the riparian habitats with tamarix are important for the area. The largest colony of sand martin (*Riparia riparia*) in the country can be found along the riverbed, and the only nesting site of the little tern *Sterna albifrons* is located on the river island, which is nesting in a mixed colony with the common tern, *Sterna hirundo.* The area is located approximately 700 metres from the nearest point of the gas pipeline route (Figure no. 5-81).

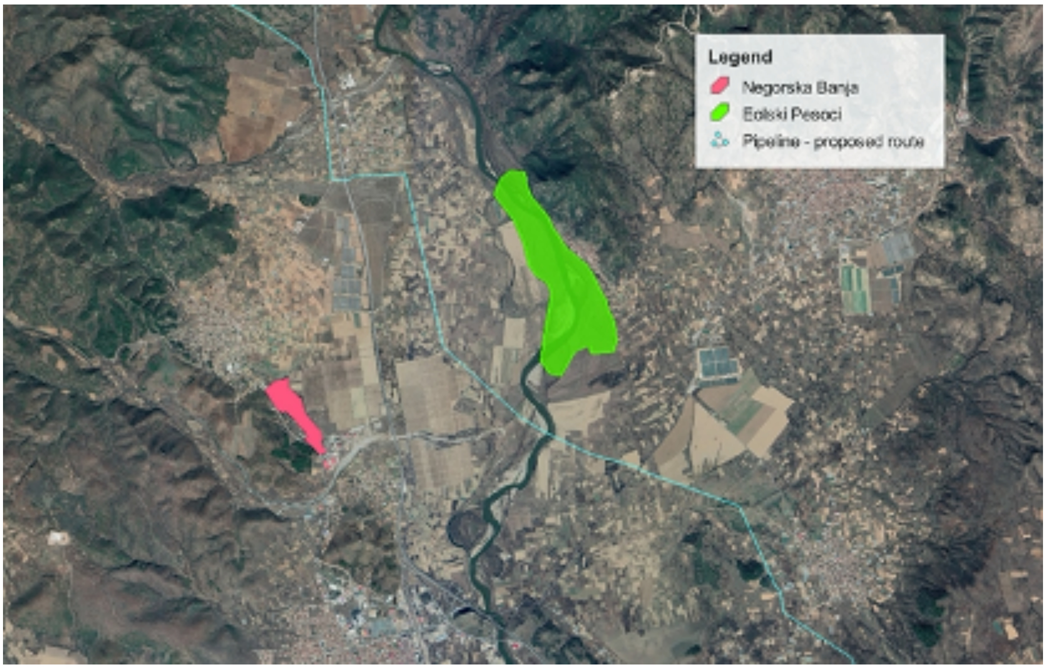

Figure 5-81: Location of the proposed areas for protection Negorski Banki and Aeolian sands – Vardar – compared to the gas pipeline route

Important plant areas (IPA)

The designation of important plant areas (IPAs) was initiated by Plantlife International to identify areas that are important for the diversity of wild plants based on the presence of endangered plant species, endangered habitats and species diversity. Informative lists of the North North Macedonian important plant areas are available at http://www.plantlifeipa.org. Two important plant areas are located near the line gas pipeline corridor and they are IPA Negorski Banji and IPA Demir Kapija Canyon.

- *IPA Negorski Banji*

  The location of the area fully overlaps with the namesake area proposed for protection in the category of Nature Monument. It is located approximately 2 KM from the nearest point of the gas pipeline route (Figure no. 5-61).

- *IPA Demir Kapija Canyon*

  The area is located in the south-central part of North Macedonia on 100 to 900 metres altitude. It mainly covers areas with xero-thermophilic kermes oak shrublands, thermophilic oak forests and thermophilic Greek juniper forests on the rocky biotopes. It includes important habitats on European level in relation of the EUNIS classification E1, F3, F9, G1, G3 and H3. Also, three important plant

  species are present of which the species *Anthemis meteorica* meets the criterion A(iv), whereas the species *Heptaptera macedonica* and *Verbascum macedonicum* meet the criteria A(iii). The line gas pipeline corridor does not intersect the locations of the species mentioned above.

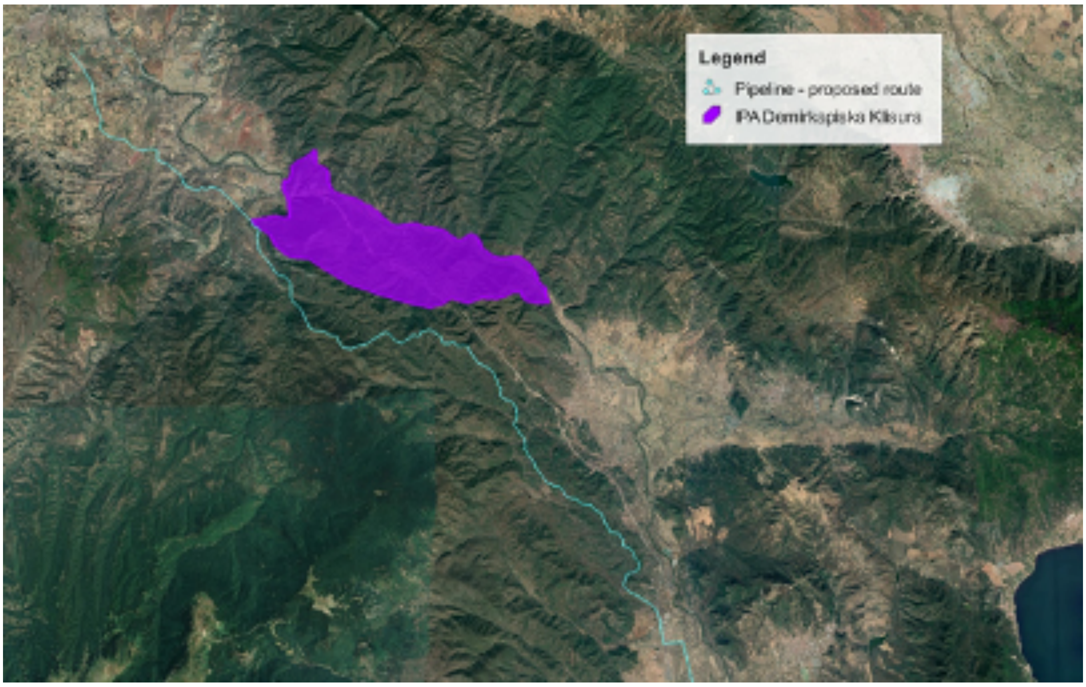

Figure 5-82: Location of the IPA Demir Kapija Canyon compared to the gas pipeline route

Important Bird Areas (IBA)

The North Macedonian IBA list comprise 24 areas that cover 6.907 KM2 or 26.9% of the entire territory of North Macedonia. The line gas pipeline corridor intersects with three important bird areas as follows: – IBA Lower course of the river Vardar (South Vardar), IBA Demir Kapija Canyon and IBA Tikves region (Figure no. 5-83). The areas are declared in accordance with the methodology of BirdLife International and they are important localities for aquatic species of birds, birds of prey and they serve as a potential corridor for flyover of the migratory birds. The line gas pipeline corridor intersects the IBA South Vardar and Tikves region, while it penetrates very little in the western part of the IBA Demir Kapija Canyon.

- *IBA Lower course of the river Vardar (South Vardar)*

  The area has been identified as an important area for nesting of two species of terns (*Sterna hirundo* and *Sternula albifrons*), as a nesting area of almost 10% of the national white stork population (*Ciconia ciconia*) and as a potential bottleneck for migration of large floating species of birds (birds of prey, storks, etc.) In addition, the flood meadow of the Gjol area (in the vicinity of the village of Bogorodica) is an important stop-over site for many wintering species in this part of North Macedonia. This includes several species of duck and egret families, and the greater flamingo (*Phoenicopterus roseus*) has been spotted on several occasions. Also, this locality is crucial in the feeding of the breeding non-resident species such as the large nesting populations of white storks in the villages of Stojakovo and Bogorodica. The line gas pipeline corridor intersects the area between KM 0+000 and KM 9+500 and KM 10+500 and KM 13+000, in the total length of 12 KM.

- *IBA Demir Kapija Canyon*

  The conyon covers a surface area of 9.665 ha and it is the longest canyon of the river Vardar (19 KM). It runs through the zone of limestone and eruptive rocks which separates the Tikves Valley in the northwest from the Gevgelija-Valandovo Valley in the southeast. The Demir Kapija Canyon is one of the richest ornithological reserves in Europe by the presence of rare birds of prey: the griffon vulture *(Gyps fulvus)*, the Egyptian vulture *(Neophron percnopterus),* the golden eagle *(Aquila chrysaetos)*, the short-toed snake eagle *(Circaetus gallicus),* the long-legged buzzard *(Buteo rufinus),* various falcons *(Falco peregrinus, Falco naumanni),* as well as some less common species of birds such as *Hieraaetus pennatus, Milvus migrans, Falco biarmicus, Cerchotrichas galactotes* etc. The line gas pipeline corridor intersects the area between KM 47+250 to KM 48+800 and from KM 50+800 to KM 52+250, in the total length of 3 KM.

- *IBA Tikves region is located in the south-central part of North Macedonia, south of the city of Negotino, on a surface area of 18.696 ha.*

  The area is important because of the presence of two Egyptian vultures (Neophron percnopterus) in its southern part, and also because of the presence of 230 to 250 nesting pairs of the lesser kestrel (Falco naumanni), which is nesting only in the villages and it is present in the northern part of the area. In the northern part of the area, 1-2 pairs of eastern imperial eagle (Aquila heliaca) are nesting, as well as at least one pair of lanner falcon (Falco biarmicus). Also, the largest colony (60 to 90 pairs) of grey heron (Ardea cinerea) exists in this region. The line gas pipeline corridor penetrates more than 10 KM in the area (point KM 57+000).

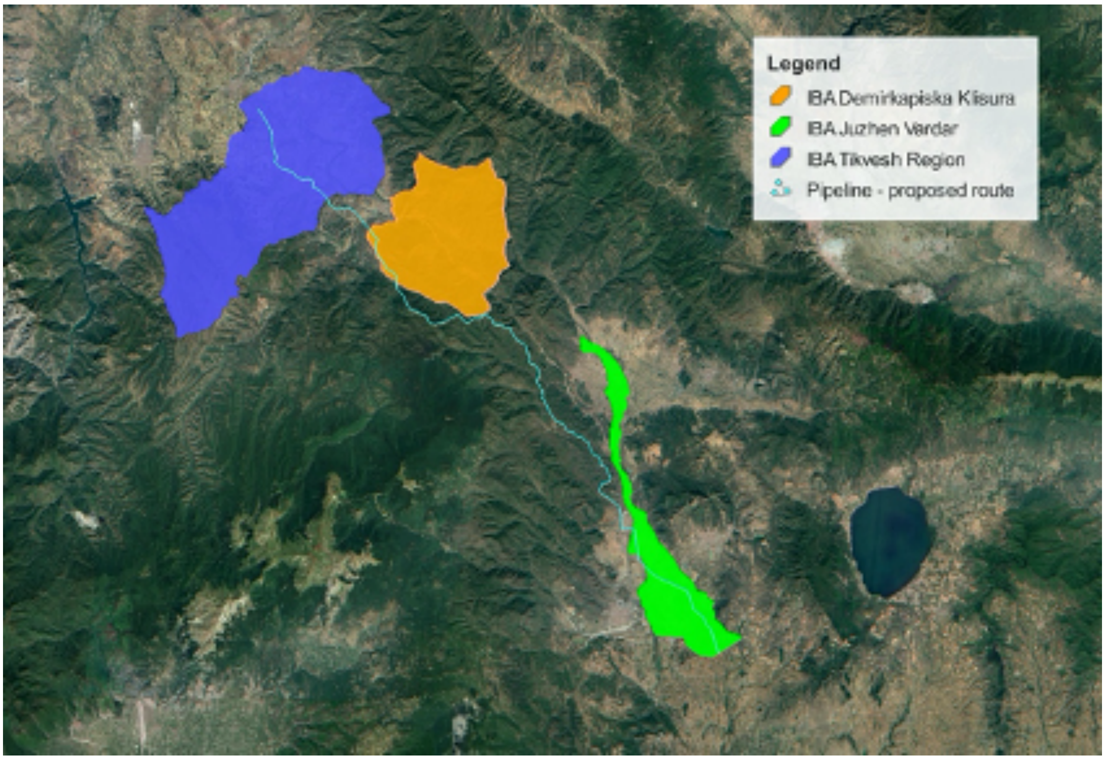

Figure 5-83: Location of Important Bird Areas South Vardar, Demir Kapija Canyon and Tikves region compared to the gas pipeline route

Emerald Areas

The Emerald Network is a network of areas of special interest for conservation, designated to preserve the natural habitat network and is being developed on the territory of the member states of the Berne Convention (Convention on the Conservation of Wildlife and Natural Habitats in Europe). The Council of Europe has not officially approved them yet. In the vicinity of the line gas pipeline corridor there are two emerald areas: Negorski Banji and Demir Kapija Canyon (Figure no. 5-84). The Emerald area Negorski Banji fully overlaps with the IPA Negorski Banji, as well as with the namesake area proposed for protection in the category of Nature Monument. The area is located approximately 2 KM from the nearest point of the gas pipeline route. The Emerald area Demir Kapija Canyon covers a surface area of 30.08 hectares and it is located more than 5 KM away from the gas pipeline route. A very small part of it overlaps with the Nature Monument Demir Kapija (0.6%) in its easternmost borders.

Figure 5-84: Location of the Emerald area Negorski Banji compared to the gas pipeline route

Table 5-19: Basic information on the protected and proposed areas for protection, their categorisation and relation to the gas pipeline route

Name of the area	Category of protection	Surface area (ha)	Distance from the route (KM)	Penetration of the route (KM)
Demir Kapija	NM, Protected area - MoEPP	4.698,05	0,45	/
Studena Glava	NP, Proposed for protection – Spatial plan of MK	1.840,82	/	7,1
Aeolian sands - Vardar	NP, Proposed for protection – MES (UNDP/GEF)	190,78	0,7	/
Negorski Banji	NM, Proposed for protection – Spatial plan of MK	24,51	2	/
Negorski Banji	Important Plant Area (IPA)	24,51	2	
Demir Kapija Canyon	Important Plant Area (IPA)	7.767,62	0,05	/
South Vardar	Important Bird Area (IBA)	5.636	/	12
Demir Kapija Canyon	Important Bird Area (IBA)	9.665	/	3
Tikves region	Important Bird Area (IBA)	18.696	/	10,2
Negorski Banji	Emerald Area (EA)	24,51	2	/
Demir Kapija Canyon	Emerald Area (EA)	30,08	5	/

Notes:

- NM – Nature Monument
- NP – Nature Park
- MES – North Macedonian Ecological Society

5.11.3 Bio-corridors

Bio-corridors connect different parts of one habitat, allowing free movement of animals and plants through it. This movement can be an important factor in the survival of many species in terms of the changes in the land use and the climate changes. Their function is to preserve the vital environmental relationships by maintaining the connection between habitats and species populations. Bio-corridors allow daily, periodic and seasonal movements and migrations of different animal species, as well as plant distribution. The most important part through which the gas pipeline route passes is the protection zone[15] that refers to the bottleneck Demir Kapija 16 (see Figure no. 5-85. The gas pipeline is shown in black).

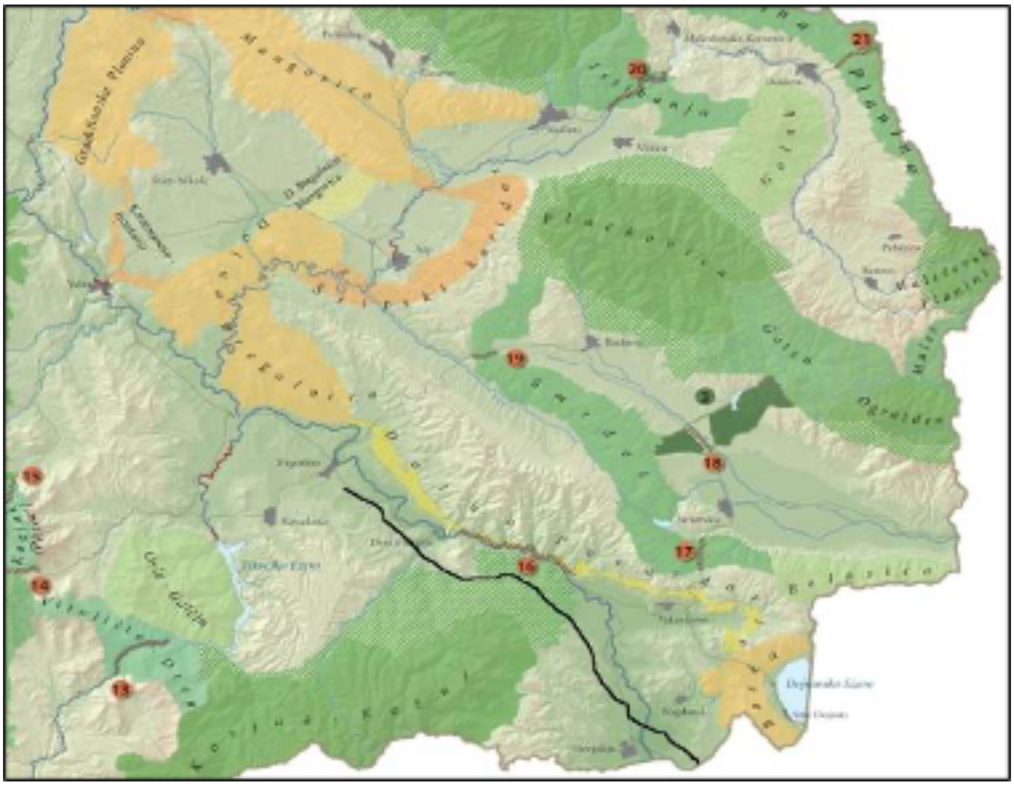

Figure 5-85: Location of the bio-corridors compared to the gas pipeline route

Protection zones are very important because they separate areas where the primary purpose is to mitigate the harmful external influences, caused by inappropriate forms of land use. The protection zones allow got sustainable use of the nature. This protection zone is important because it connects the Kozuf Mountain and the higher parts of the Vardar Valley with the river Vardar and other rivers and streams in the area, providing access to drinking water. This is especially important for the normal life cycle of many animals, such as:

- amphibians – migrations during breeding to the nesting areas (common toad, European green toad);
- Brown bear – movements in search for food from Kozuf mountain to the Vardar Valley; the brown bear is especially rare in this area and these corridors are very important for maintaining their small number, the bear cannot be found on the left side of the river Vardar;

[15] Source: project for development of the national ecological network in the Republic of North Macedonia (MAK-NEN), implemented by the North Macedonian Ecological Society and the European Center for Nature Conservation (ECNC), in cooperation with the MoEPP, 2008 - 2011

- grey wolf – movements in search for pray;
- ungulates, especially deer – movements and seasonal migrations for grazing;
- small mammals – periodical and seasonal movements.

5.11.4 Sensitivity of habitats and ecosystems

A specially designed matrix was used to assess the sensitivity. The matrix was used exclusively to assess the sensitivity of natural habitats.

The below stated 21 habitats were assessed according to the criteria shown in columns of the matrix table:

- Pseudomaquis;
- Degraded pseudomaquis;
- Downy oak and hornbeam forests;
- Degraded downy oak and hornbeam forests;
- Riparian alder zones;
- Riparian willow zones;
- Riparian plane-tree zones;
- Sand reefs;
- Dry grasslands;
- Rocky areas;
- Rivers wider than 5 meters;
- Rivers narrower than 5 meters;
- Intermittent water courses;
- Coniferous plantations;
- Anthropogenic deciduous zones and lines;
- Abandoned farmlands with ruderal vegetation;
- Vineyards;
- Orchards;
- Fields, farmlands and vegetable gardens;
- Rural areas (villages);
- Industrial, commercial and other man-made facilities.

A total of 12 criteria for assessment of the sensitivity of the above-mentioned ecosystems and habitats were applied. The criteria were selected in order to show the national and global importance of the habitats and the composition of their species that can be found in the researched corridor and the wider analysed area. The more valuable the habitat (more valid criteria), the more sensitive it is.

1. EU Directive 92/43/EEC;
2. Rare communities in North Macedonia;
3. Well preserved natural communities;
4. Presence of species from the IUCN Global Red List;
5. Presence of species from the Habitat Directive;
6. Endangered bird species;

7. Presence of endemic species;
8. Presence of rare species;
9. Landscape values;
10. Economic value;
11. Protection against erosion;
12. Value of protection against pollution.

Criterion 1 – Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora). The list of important habitats is given in **Annex I -** Natural habitat types of community interest whose conservation requires the designation of special areas of conservation.

Criterion 2 - Rare communities in North Macedonia.The rareness of the communities was estimated on the basis of experts' experience and the current knowledge about the distribution of the communities.

Criterion 3 –Wellpreserved natural communities.The degree of naturalness i.e. the extent of the human intervention and land use pattern was evaluated on the basis of expert judgement.

Criterion 4 - Presence of species listed in IUCN Global Red List.The number of species listed in IUCN Global Red List in the habitat determines its value. The categories of the IUCN Red List are described below:

Criterion 5 - Presence of species important for Europe.This criterion takes into account the Habitats Directive. The important species in the Habitats Directive are listed in:

Annex II - Animal and plant species of community interest whose conservation requires designation of special areas of conservation

Annex IV - Animal and plant species of community interest in need of strict protection

Criterion 6 - Presence of endangered birds. This criterion is based on several conventions. The birds were evaluated separately because of their good elaboration in the international conventions. The following conventions were taken into account:

A. Bird Directive - Council Directive 79/409/EEC on the conservation of wild birds

Annex I - Species of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. In this regard, the following should be taken into account:

- Species in danger of extinction;
- Species vulnerable to specific changes in their habitat;
- Species considered rare because of the small populations or the restricted local distribution;
- Other species requiring particular attention due to the specific nature of their habitat.

Annex II - Due to their population level, the geographical distribution and the reproductive rate throughout the community, the species listed in Annex II may be hunted under the national legislation.The member states must ensure that the hunting of these species does not jeopardize the conservation efforts in their distribution area.

Annex II/1 - The species referred to in Annex II/1 may be hunted at sea and land area where this directive applies.

Annex II/2 - The species referred to in Annex II/2 may be hunted only in the member states as stated in their legislation.

Annex III – The member states must prohibit, for all of naturally occurring birds in the wild state in the European territory of the member states, the sale, transport for sale and keeping for sale and the offering for sale of live or dead birds and of any readily recognizable parts or derivatives of such birds.

B. Bonn Convention

Appendix I - Endangered migratory species

Appendix II - Migratory species conserved through Agreements

The migratory species that have an unfavourable conservation status or would benefit significantly from international co-operation based on the reached agreements are listed in Appendix II to the Convention. Therefore, the Convention encourages the signatory states to implement the concluded global or regional Agreements for the conservation and management of individual species or, more often, groups of related species.

C. SPEC - Species of European Conservation Concern (for birds only)

- SPEC 1 European species of global conservation concern
- SPEC 2 Unfavourable conservation status in Europe, concentrated in Europe
- SPEC 3 Unfavourable conservation status in Europe, not concentrated in Europe
- Non-SPEC^{E} Favourable conservation status in Europe, concentrated in Europe
- Non-SPEC Favourable conservation status in Europe, not concentrated in Europe

D. European Threat Status (ETS)

- CR - Critically endangered - if the European population meets any of the IUCN Red List Criteria for Critically Endangered;
- EN - Endangered - if the European population meets any of the IUCN Red List Criteria for Endangered;
- VU - Vulnerable - if the European population meets any of the IUCN Red List Criteria for Vulnerable;
- D - Declining - if the European population does not meet any of the IUCN Red List Criteria, but is declined by more than 10% over 10 years or three generations;
- R - Rare - if the European population does not meet any of the IUCN Red List Criteria and is not Declining, but numbers fewer than 10000 breeding pairs (or 20000 breeding individuals or 40000 wintering individuals) and is not marginal to a larger non-European population;
- H - Depleted - if the European population does not meet any of the IUCN Red List Criteria and is not Rare or Declining, but has not yet recovered from a moderate or large decline suffered during 1970-1990;
- L - Localised - if the European population does not meet any of the IUCN Red List Criteria and is not Declining, Rare or Depleted, but is heavily concentrated, with more than 90% of the European population occurring at 10 or fewer sites;
- S - Secure - if the European population does not meet any of the criteria listed above.

- DD - Data Deficient - if there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status
- NE - Not evaluated - if its European population has not yet been evaluated against the criteria

Criterion 7 - Presence of endemic species. This criterion evaluates the number of endemic species present in the habitat.The score presented in Table 5-20 is average of the scores for endemic species of flora and fauna.

Criterion 8 - Presence of rare species.This criterion evaluates the number of rare species present in the habitat. The score presented in Table 5-20 is average of the scores for rare species of flora, fauna and fungia.

Criterion 9 - Landscape value. The landscape value was estimated based on several characteristics: structural and functional importance of certain landscape, aesthetic value, rarity in North Macedonia etc.

Criterion 10 - Economic value. The importance of the economy determines this criterion.The most important economic values in the project area concern forestry, water potential and livestock breeding.

Criterion 11 - Erosion prevention.One of the important features for preservation of the natural conditions is the erosion prevention potential of the habitat.

Criterion 12 - Pollution prevention value. The absorption capacity for pollutants is a very important feature of the ecosystems. It is based on expert judgement.

The scoring of the habitats for each of the listed 12 criteria was from 0 to 3. The meaning of these scores is the following:

0 - No occurrence/importance

1 - Low occurrence/importance

2 - Medium occurrence/importance

3 - High occurrence/importance

The sum of scores for a habitat determines its sensitivity. The highest possible score is 36. The rating of the sensitivity was performed on the basis of the following table:

0 - 9 - low sensitivity (ls)

9-18 - medium sensitivity (ms)

18-27 - high sensitivity (hs)

28-36 - very high sensitivity (vhs)

The meaning of each degree of sensitivity is described as follows:

ls – There are no special obstacles for construction works; however, the aesthetic value of the landscape should be protected and redundant destruction and excessive perturbation should be avoided; the impacts on these habitats will have lower significance.

ms – The construction works are permitted but the work should be done with precaution measures; the destruction of these habitats or their parts should be avoided; if the destruction is inevitable than the recultivation measures should be undertaken; the impacts on these habitats will have medium significance.

hs – such sites, biotopes or localities have great importance concerning natural, or economic value; any kind of construction work should be avoided; if no other solution is possible, maximum measures for protection of the site or locality should be undertaken; when natural sites are concerned, special construction regime should be applied (e.g. seasonal restrictions, strict territorial recommendations etc.); the damage done to these kinds of ecosystems should be revitalized and compensated in compliance with the Law on Nature Protection. Permanent monitoring during the construction works is to be organized by the Investor.

vhs – any kind of construction work is forbidden; any kind of construction work close to such sites or localities should be restricted and measures should be undertaken as in the case with highly sensitive habitats/localities. Very high adverse impacts will cause irreversible changes in these habitats/localities i.e. they will be permanently lost. Permanent monitoring during the construction works is to be organized by the Investor as in the case of highly sensitive habitats/localities.

The results from the sensitivity of the habitats are shown in Table 5-20 and are presented on the maps. None of the habitats was rated as very highly sensitive.Three habitats were rated as highly sensitive (hs), the riparian zones and alder forests, the riparian zones with willows and the riparian zones with plane tree.7 habitatas fall in the medium sensitivity (ms) group, while the remaining 11 were rated with low sensitivity (ls).

Table 5-20:Habitat sensitivity assessment matrix

HABITATS	Habitats Directive	Rare communities	Well preserved natural communities	Presence of species on IUCN Red List	Presence of species from the Habitat Directive	Protected bird species	Presence of endemic species	Presence of rare species	Landscape values	Economic value	Erosion prevention	Pollution prevention value	SUM	Sensitivity
Pseudomaquis	2	0	1	1	2	1	1	1	2	1	2	2	8	ls
Degraded pseudimaquis	0	0	0	1	1	1	1	1	0	0	1	1	7	ls
Downy oak and hornbeam forests	3	0	2	1	2	1	1	1	2	1	2	2	18	ms
Degraded downy oak and hornbeam forests	1	0	0	1	1	1	1	1	0	0	1	1	8	ls
Riparian zones and alder forests	3	2	3	2	2	1	0	1	3	2	2	2	23	hs
Willow covered riparian zones	2	1	1	2	2	1	0	1	3	0	3	3	20	hs
Plane-tree covered riparian zones	2	1	3	2	2	1	0	1	3	1	3	3	22	hs
Sand reefs	1	0	1	1	1	1	0	1	1	0	0	1	8	ls
Dry grasslands	3	0	1	2	2	2	2	2	1	1	1	1	18	ms
Rocky areas	2	0	1	1	2	2	1	1	3	2	0	0	15	ms
Rivers wider than 5 meters	2	0	1	1	2	1	1	1	3	3	1	2	18	ms
Rivers narrower than 5 meters	2	0	1	1	2	1	1	1	3	2	1	1	16	ms
Occasional water courses	1	0	1	2	1	0	0	1	1	1	0	0	8	ls
Coniferous plantations	0	0	0	0	1	1	0	1	1	1	2	1	8	ls

HABITATS	Habitats Directive	Rare communities	Well preserved natural communities	Presence of species on IUCN Red List	Presence of species from the Habitat Directive	Protected bird species	Presence of endemic species	Presence of rare species	Landscape values	Economic value	Erosion prevention	Pollution prevention value	SUM	Sensitivity
Anthropogenic zones and lines of deciduous trees	0	0	0	0	1	1	0	1	2	0	1	2	8	**ls**
Fields and farmlands and vegetable gardens	0	0	0	0	0	1	0	1	1	3	1	1	8	**ls**
Abandoned farmlands with ruderal vegetation	0	0	0	0	0	1	0	0	1	1	1	0	4	**ls**
Vineyards	0	0	0	0	0	1	0	1	2	3	1	0	8	**ls**
Orchards	0	0	0	0	0	1	0	1	2	3	1	0	8	**ls**
Rural settlements (villages)	0	0	0	0	1	0	0	0	2	3	1	0	7	**ls**
Industrial, comercial and other artificial objects	0	0	0	0	0	0	0	0	0	3	0	0	3	**ls**

5.11.5 Important habitats and species – evaluation

- **Habitats**

Within the researched corridor, there are a small number of habitats, most of which are frequent and widespread in North Macedonia.For their evaluation, European documents such as the Habitats Directive (Council of the European Union Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) and the Bern Convention, resolution no. 4 (1990) were used. A detailed description of the habitat types and their distribution along the route of the transmission line is given in a separate chapter and they are presented on the attached map of habitats.Based on an analysis of the sensitivity of the habitats (Chapter 5.11.4 Table 5-20), three habitats rated as highly sensitive (hs) or **critical habitats** were selected.These include riparian zones and alder forests and plane-tree and willow-covered riparian zones.The group of medium sensitive (ms) includes 7 habitats:pseudomaquis and downy oak and hornbeam forests, dry grasslands, rocky areas, as well as rivers with occasional water courses.

Critical habitatas - alder, plane-tree and willow-covered riparian zones. The alder zone is considered a priority habitat (*) for conservation under EU Directive 92/43/EEC.A well-developed alder zone can be found at the inflow of Dosnica river into Bosava river. The plane-tree zones are usually found along all canyons and valleys in the researched corridor. Well developed zones are also present along the course of the rivers Gabreshka and Stara Reka and their tributaries.The plane-tree zones are important habitats for conservation in Europe and represent Special Areas of Conservation (SACs) in accordance with the Habitats Directive.Their locations in the corridor of the gas pipeline route are given in the table below. The alder stands, as well as the riparian habitats, have a very important environmental function in preventing and mitigating floods, reducing pollution, they are natural corridors for the movement of the animals and have significant landscape value.

Table 5-21:Location of the critical habitats in the corridor of the gas pipeline route

Habitat type	Location
Riparian zones and alder forests *HD: 91E0 *Alluvial forests with Alnus glutinosa and Fraxinus excelsior*	*Inflow of Dosnica river into Bosava river (KM 53+000)*
Plane-tree covered riparian zones *HD: 92C0 Platanus orientalis and Liquidambar orientalis woods (Platanion orientalis)*	▪ *Gabreska Reka (KM 28+500)* ▪ *Stara Reka (KM 30+000)* ▪ *Vardar (KM 8+500), degraded community* ▪ *Vardar tributaries (KM 16+000; KM 18+500)* ▪ *Drenska Reka (KM 47+500), dominated by willows*

The forest communities represented by **pseudomaquis** and **downy oak and hornbeam** are categorized as medium sensitive habitats. Pseudomaquis is a climate zonal community which in Macedonia is developed up to Demir Kapija as the most north point. It is a shrub formation dominated by the evergeren kermes oak. It is present in steep and rocky places, at the lower parts of the corridor, up to 600 m altitude.It is important for protection against erosion and pollution, and it has landscape values due to the presence of species defined in the Habitats Directive.Downy oak and hornbeam forests are found in the highest part of the route (from 400 to 950 m).They are a very common type of vegetation in Macedonia and important for protection against erosion and pollution; they have landscape values, while their economic value is low and they are often degraded.

Rivers Vardar and Bosava with their tributaries are categorized as habitats with medium sensitivity due to a number of reasons. River Vardar has presence of important species (especially fish), and it has economic and landscape value.It is very important for the local population due to its use in the irrigation system. Similarly, to this, the Bosava River is used for irrigation in the Demir Kapija region.The other permanent watercourses are important as natural habitats, they have a high landscape value, and are important as bio corridors along with their riparian vegetation.

Dry grasslands. This habitat type is of high conservation importance in Europe (it is a priority habitat type (*) according to the Habitats Directive - Annex I: 6220 * Pseudosteppe with grasses and annuals of the Thero-Brachypodietea). It is characterised by extraordinary species richness, although represented only by smaller areas usually in the clearings in pseudomaquis or on abandoned farmlands and fields.It is a widely distributed habitat in N. Macedonia, it has secondary origin and it is not very important on national scale, due to which it is categorized as a habitat with medium sensitivity.

The rocky areas are present in the canyons of certain river flows such as Stara Reka, Gabreska Reka and Drenska Reka. In addition to their biological importance, as a habitat for typical (hazmophytic) vegetation, plants and birds, they are also important for their economic value, and they have landscape values, as well. There are very few typical rocky areas in the area of the route.They are categorized as medium sensitive

The anthropogenic habitats (stands with coniferous plantations, farmlands and fields, orchards, ruderal vegetation, rural settlements, urban areas, etc.), are more important from a social and economic aspect, than as habitats. The degraded pseudomaquis and downy oak and hornbeam forests, the sand reefs and the intermittent water courses have low natural value. All of them are categorized as low sensitive habitats.

- **Flora**

In the area of interest, no plants are found that are listed in Annex II or IV of the Habitats Directive. Only the species *Ruscus aculeatus* is part of the list of species of the Habitats Directive (Annex V - Animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures). Species from the National Red List and the List of Protected and Strictly Protected Species in Macedonia were also not found in the area of the gas pipeline route. Regarding the national legislation in accordance with the Act for denoting of rare tree species in forests (Official Gazette of RM, 23:1350), important plants identified in the researched area are the following: *Juglans regia, Platanus orientalis* and *Amygdalus webbii.*During the field researches, some rare plant species were identified. They include: *Marsdenia erecta, Cistus incanus, Crocus olivieri, Polycarpon tetraphyllum, Parietaria lusitanica, Romulea bulbocodium, Serapias vomeracea, Periploca graeca, Bunias orientalis, Ophris aranifera* ssp. *atrata, Rumex cristatus, Viola hirta, Chenopodium hybridum, Clematis viticella* and *Astragalus parnassi* – which is a steppe species of Astragalus, distributed in Macedonia, Balkan endemic plant. The listed species are characteristic for the southern part of the country with greater Mediterranean influence. The species *Astragalus parnassi* – which is a steppe species of Astragalusis is a Balkan endemic plant distributed in Central Macedonia. The data on their distribution, as well as the results from the field researches are given in Table 5-22.

In the researched area, the following relict species were established: *Acer campestre, Carpinus orientalis, Clematis vitalba, Coryllus avellana, Fraxinus ornus, Hedera heli x, Lonicera etrusca, Phillyrea media* and *Salix alba.*

Although they are relics of the Tertiary period, these species are common in North Macedonia and in the area of interest. From the invasive species, the species *Robinia pseudacacia, Ailanthus altissima* and *Amorpha fruticosa* were present in the corridor of the gas pipeline.

Table 5-22:Rare species of vascular plants in the corridor of the gas pipeline route

Species	Locality	Habitat
*Marsdenia erecta**	*Vicinity of the village of Tremnik*	*dry grasslands*
Cistus incanus (figure 5-68)*	*Vicinity of the villages of Prdejci and Dren*	*on clearings in degraded pseudomaquis*
*Crocus olivieri**	*Village of Stojakovo*	*on clearings in degraded oak forest*
Polycarpon tetraphyllum	*Vicinity of the villages of Przdevo and Tremnik*	*dry grasslands, rocky areas*
Parietaria lusitanica	*Gabreska Reka and Stara Reka*	*riparian plane-tree zones, rocky areas*
*Romulea bulbocodium**	*Vicinity of the villages of Stojakovo, Prdejci and Dren*	*on clearings in degraded oak forest and pseudomaquis*
Serapias vomeracea (figure 5-67)*	*Bosava River*	*grasslands, by the river*
Periploca graeca (figure 5-66)*	*Kriva Reka*	*plane-tree covered riparian zones*
Bunias orientalis	*Village of Prdejci*	*abandoned farmlands with ruderal vegetation*
*Ophris aranifera ssp. atrata**	*Village of Dren*	*grasslands, by the river*
Rumex cristatus	*Bosava River*	*riparian vegetation*
Viola hirta	*Vicinity of the villages of Stojakovo, Prdejci and Dren, Kriva Reka*	*oak forest, pseudomaquis, plane-tree covered zones*
Chenopodium hybridum	*Village of Stojakovo*	*abandoned farmlands with ruderal vegetation*
*Clematis viticella**	*Village of Dren*	*oak forest and pseudomaquis*
Astragalus parnassi (figure 5-69)*	*Vicinity of the village of Przdevo*	*dry grasslands*

**The species was registered during the field researches*

Figure 5-86: Rare thermophilous plant species: Periploca graeca (top left), Serapias vomeracea (topright), Cistus incanus (bottom left) and Astragalus parnassi (bottom right)

- **<u>Fungi</u>**

The data on the fungi in the footprint of the project were obtained from own researches, as well as from the data from the Mycological laboratory (other collectors, field activities with students), as well as the available mycological literature for this area.The following criteria were used during the evaluation of the data:

- Species that are on the European Red List of Fungi (Ing 1993)
- Species that are on the ECCF – European Council for Conservation of Fungi
- Species that are on the Red List of fungi of the Republic of N. Macedonia (Karadelev & Rusevska 2014)
- Species that are registered in the area of interest, but on the territory of the Republic of N. Macedonia they have limited distribution.

Table 5-23:Assessment of the importance of the population of key species of fungi and distribution in the area of interest

Species	ERL	MRLF	ECCF	RS	Distribution	Substrate/habitat
Astraeus hygrometricus	C				Common species	dry grasslands
Amanita caesarea *	C		√		Common commercial species	oak forest, pseudomaquis
Boletus queletii *	B				Common species in forests	oak forest, pseudomaquis
*Dichomytus campestris**	C				Common species	on oak trees, oak forests
Gyroporus castaneus	C			√	Common species	oak forest, pseudomaquis
Inonotus hispidus	C			√	Drenska river	on willow trees, riparian zones
Lactarius sanguifluus *		LC			Common species, v. Bogorodica	pine plantations
*Meruliopsis hirtellus**				√	Village of Prdejci	on kermes oak trees, pseudomaquis
*Phaeomarasmius erinaceus**				√	Village of Prdejci	on kermes oak trees, pseudomaquis
Phallus hadriani *				√	Village of Stojakovo	abandoned farmlands with ruderal vegetation
*Pisolithus arhizus**		NT	√		Village of Dren	by forest paths
Pleurotus eryngii		EN			Common species, edible	dry grasslands
*Scleroderma polyrhizum**				√	Village of Przdevo	dry grasslands
*Tulostoma brumale**	C			√	Village of Stojakovo	dry grasslands
*Volvariella bombycina**	C				Kriva Reka	on plane-trees, riparian zones

*The species was registered during the field researches

Abbreviation key:

- *ERL – species from the European Red List of Fungi; (B) – affected species of wider scale, populations of species with moderate level of extinction; (C) - affected species of smaller scale, populations of species with low level of extinction*
- *ECCF – species from the list of the European Council for Conservation of Fungi*
- *MRLF – species on the North Macedonian Red List of Fungi; EN – Endangered, NT - Near Threatened; LC - Least Concern; DD - Data Deficient.*
- *RS – Species with limited distribution (assessment of the author)*

More than a dozen species can be used for human consumption.These include: Agaricus arvensis, Agaricus Campestris and Agaricus silvicola; Bolletus Edulis and Boletus Aereus, Auricularia auricula-judae, Amanita caesarea, Agrocybe cylindracea; Lactarius deliciosus; Marasmius oreades; Suillus granulatus; Tricholoma, etc.Poisonous species are: *Agaricus xanthodermus, Amanita pantherina, Amanita phalloides, Stropharia coronilla*, *Coprinus micaceus,Lepiota subincarnata, etc.*

- **Mammals**

A total of 20 species of mammals were evaluated in accordance with the Bern Convention, the Habitats Directive, the Bonn Convention (important for the bats) and the IUCN Red List. All species of bats are listed in an annex to the Bonn Convention. Bats are not included in the description of the habitats because there is lack of specific data on their distribution.It is assumed that they are present in almost all habitats in search of food.They use different habitats as shelters:natural or artificial caves, cracks of the rocks, holes in trees, roofs of houses etc.

HABITATS DIRECTIVE: Council Directive (92/43/EEC) on the conservation of natural habitats and of wild fauna and flora. **Annex II:** Animal and plant species of community interest whose conservation requires designation of special areas of conservation **Annex IV -** Animal and plant species of community interest in need of strict protection
BERN: Convention on the conservation of natural habitats and of wild fauna and flora.**Appendix II:**Strictly Protected Fauna Species. **Appendix III:**Protected Fauna Species.
BONN: Convention on the Conservation of Migratory Species of Wild Animals.**Appendix I:**Endangered Migratory Species. **Appendix II:**Migratory species conserved through Agreements.
IUCN:2019 Red list of threatened Species. **LC:**Least Concern, **NT:**Near Threatened; **DD:**Data Deficient.

Table 5-24:Evaluation of mammals

Scientific name	*North Macedonian name*	*Habitats directive:*	*BERN*	*BONN*	*IUCN*
*Erinaceus concolor**	*Hedgehog*	-	-	-	*LC*
Spalax leucodon	*Lesser mole-rat*	-	*III*	-	*DD*
*Talpa europaea**	*European mole*	-	-	-	*LC*
Rhinolophus ferrumequinum	*Greater horseshoe bat*	*II/IV*	*II*	*II*	*LC*
Rhinolophus hipposideros	*Lesser horseshoe bat*	*II/IV*	*II*	*II*	*LC*
Myotis myotis	*Greater mouse-eared bat*	*II/IV*	*II*	*II*	*LC*

Scientific name	*North Macedonian name*	*Habitats directive:*	*BERN*	*BONN*	*IUCN*
Myotis mystacinus	*Whiskered bat*	*IV*		*II*	*LC*
Barbastella barbastellus	*Western barbastelle*	*II/IV*		*II*	*NT*
Pipistrellus pipistrellus	*Pipistrelles*	*IV*	*III*	*II*	*LC*
Plecotus austriacus	*Grey long-eared bat*	*IV*		*II*	*LC*
Miniopterus schreibersi	*Common bent-wing bat*	*II/IV*	*II*	*II*	*LC*
*Lepus europaeus**	*European hare*	-	*III*	-	*LC*
Apodemus agrarius	*Striped field mouse*	-	-	-	*LC*
Apodemus mystacinus	*Eastern broad-toothed field mouse*				*LC*
Mus macedonicus	*North Macedonian mouse*	-	-	-	*LC*
Canis lupus	*Wolf*	*II/IV*	*II*	-	*LC*
Vulpes vulpes	*Red fox*	-	-	-	*LC*
Mustela nivalis	*Least weasel*	-	*III*	-	*LC*
Martes foina	*Beech marten*	-	*III*	-	*LC*
*Sus scrofa**	*Wild boar*	-	-	-	*LC*

**The species was registered during the field researches*

- <u>**Birds**</u>

The EU Bird Directive and the international conventions were used for evaluation of the birds.

a) Bird Directive - Council Directive 79/409/EEC on the conservation of wild birds

Annex I - Species of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. In this regard, the following should be taken into account:

Species in danger of extinction;

(b) Species vulnerable to specific changes in their habitat;

(c) Species considered rare because of small populations or restricted local distribution;

(d) Other species requiring particular attention due to the specific nature of their habitat.

Annex II - Due to their population level, the geographical distribution and the reproductive rate throughout the community, the species listed in Annex II may be hunted under the national legislation.The member states must ensure that the hunting of these species does not jeopardize the conservation efforts in their distribution area.

Annex II/1 - The species referred to in Annex II/1 may be hunted at sea and land area where this directive applies.

Annex II/2 - The species referred to in Annex II/2 may be hunted only in the member states as stated in their legislation.

Annex III – The member states must prohibit, for all of naturally occurring birds in the wild state in the European territory of the member states, the sale, transport for sale and keeping for sale and the offering for sale of live or dead birds and of any readily recognizable parts or derivatives of such birds.

b) Bern Convention

Appendix 2 - Strictly Protected Fauna Species

Appendix 3 - Protected Fauna Species

c) Bonn Convention

Appendix I - Species threatened by extinction

Appendix II - Migratory species conserved through Agreements.The migratory species that have an unfavourable conservation status or would benefit significantly from international cooperation based on the reached agreements are listed in Appendix II to the Convention. Therefore, the Convention encourages the signatory states to implement the concluded global or regional Agreements for the conservation and management of individual species or, more often, groups of related species.

d) SPEC - Species of European Conservation Concern (for birds only)

SPEC 1	European species of global conservation concern
SPEC 2	Unfavourable conservation status in Europe, concentrated in Europe
SPEC 3	Unfavourable conservation status in Europe, not concentrated in Europe
Non-SPEC^{E}	Favourable conservation status in Europe, concentrated in Europe
Non-SPEC	Favourable conservation status in Europe, not concentrated in Europe

e) European Threat Status (ETS)

CR - Critically endangered - if the European population meets any of the IUCN Red List Criteria for Critically Endangered.

EN - Endangered - if the European population meets any of the IUCN Red List Criteria for Endangered.

VU - Vulnerable - if the European population meets any of the IUCN Red List Criteria for Vulnerable.

D - Declining - if the European population does not meet any of the IUCN Red List Criteria, but is declined by more than 10% over 10 years or three generations

R - Rare - if the European population does not meet any of the IUCN Red List Criteria and is not Declining, but numbers fewer than 10000 breeding pairs (or 20000 breeding individuals or 40000 wintering individuals) and is not marginal to a larger non-European population.

H - Depleted - if the European population does not meet any of the IUCN Red List Criteria and is not Rare or Declining, but has not yet recovered from a moderate or large decline suffered during 1970-1990.

L - Localised - if the European population does not meet any of the IUCN Red List Criteria and is not Declining, Rare or Depleted, but is heavily concentrated, with more than 90% of the European population occurring at 10 or fewer sites.

S - Secure - if the European population does not meet any of the criteria listed above.

DD - Data Deficient - if there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status.

NE - Not evaluated - if its European population has not yet been evaluated against the criteria.

Table 5-25:Evaluation of birds

Species	SPECs	ETS	Bird Directive	Bern	Bonn
Accipiter brevipes	2	R	I	II	II
Accipiter gentilis		S		II	II
Accipiter nisus		S		II	II
Acrocephalus arundinaceus		(S)		II	II
Acrocephalus schoenobaenus	4	(S)		II	II
Acrocephalus scirpaceus	4	S		II	II
Actitis hypoleucos		S		II	II
Aegithalos caudatus		S		II	
Alauda arvensis	3	VU	II	III	
Alcedo atthis	3	D	I	II	
Alectoris graeca	2	(VU)	II	III	
Anas crecca		S		III	II
Anas plathyrhynchos		S		III	II
Anthus pratensis	4	S		II	
Anthus trivialis		S		II	
Apus apus		S		III	
Apus melba		(S)		II	
Aquila chrysaetos	3	R	I	II	II
Aquila fasciatus	3	EN	I	II	II
Ardea cinerea		S		III	
Ardea purpurea	3	VU	I	II	II
Asio otus		S		II	

Species	*SPECs*	*ETS*	*Bird Directive*	*Bern*	*Bonn*
Athene noctua	*3*	*D*		*II*	
Aythia fuligula		*S*		*III*	*II*
Aythya ferina	*4*	*S*	*II/III*	*III*	*II*
Aythya nyroca	*1*	*VU*	*I*	*III*	*II*
Botaurus stellaris	*3*	*(VU)*	*I*	*II*	*II*
*Buteo buteo**		*S*		*II*	*II*
Buteo rufinus (figure 5-72)	*3*	*(EN)*	*I*	*II*	*II*
Calandrella brachydactyla	*3*	*VU*	*I*	*II*	
Calidris minuta		*(S)*		*II*	
Calidris pugnax	*4*	*(S)*	*I/II*	*III*	*II*
Carduelis carduelis		*(S)*		*II*	
Cettia cetti		*S*		*II*	*II*
Charadrius dubius		*(S)*		*II*	*II*
Chloris chloris	*4*	*S*		*II*	
Chroicocephalus ridibundus		*S*		*III*	
Chroicocephalus cachinnans		*(S)*		*III*	
*Ciconia ciconia (figure 5-71)**	*2*	*VU*	*I*	*II*	*II*
Ciconia nigra					
Circaetus gallicus	*3*	*R*	*I*	*II*	*II*
Circus aeruginosus		*S*	*I*	*II*	*II*
Circus cyaneus	*3*	*VU*	*I*	*II*	*II*
Circus pygargus	*4*	*S*	*I*	*II*	*II*
Clanga clanga	*1*	*EN*	*I*	*II*	*I/II*
Coccothraustes coccothraustes		*S*		*II*	
*Columba livia **		*S*		*III*	
Columba palumbus	*4*	*S*	*I/II/III*	*III*	
Coracias garrulus	*2*	*(D)*	*I*	*II*	*II*
*Corvus corax**		*(S)*		*III*	
*Corvus cornix**		*S*		*III*	
Corvus monedula	*4*	*(S)*		*X*	
Coturnix coturnix	*3*	*VU*		*III*	*II*

Species	SPECs	ETS	Bird Directive	Bern	Bonn
*Cuculus canorus**		S		III	
Cyanistes caeruleus	4	S		II	
*Delichon urbica **		S		II	
Dendrocopos major		S		II	
Dendrocopos minor		S		II	
Dendrocopos syriacus	4	(S)	I	II	
Egretta garzetta		S	I	II	
Egtetta alba		S	I	II	
Emberiza calandra	4	(S)		III	
Emberiza cia	3	VU		II	
Emberiza cirlus	4	(S)		II	
*Emberiza citronella**	4	(S)		II	
Emberiza hortulana	2	(VU)	I	III	
Erithacus rubecula	4	S		II	II
Falco biarmicus	3	(VU)	I	II	II
Falco columbarius		S	I	II	II
Falco naumanni	1	(VU)	I	II	II
Falco peregrinus	3	R	I	II	II
Falco subbuteo		S		II	II
*Falco tinnunculus**	3	D		II	II
Ficedula albicollis	4	S	I	II	II
*Fringilla coelebs **	4	S		III	
*Fulica atra**		S		III	
*Galerida cristata**	3	(D)		III	
Gallinago gallinago		(S)		III	
Gallinula chloropus		S		III	
*Garrulus glandarius**		(S)		III	
Granativora melanocephala	2	(VU)		II	
Grus grus	3	VU	I	II	II
Gyps fulvus	Non-Spec	S	I	II	II
Hieraaetus pennatus	3	R	I	II	II

Species	*SPECs*	*ETS*	*Bird Directive*	*Bern*	*Bonn*
Himantopus himantopus		*S*	*I*	*II*	*II*
Hippolais icterina	*4*	*S*		*II*	*II*
*Hirundo daurica**		*S*		*II*	
*Hirundo rustica**	*3*	*D*		*II*	
Induna pallida	*3*	*(VU)*		*II*	*II*
Ixobrichus minutus	*3*	*(VU)*	*I*	*II*	*II*
Jynx torquilla	*3*	*D*		*II*	
Lanius collurio	*3*	*(D)*	*I*	*II*	
Lanius excubitor	*3*	*D*		*II*	
Lanius minor	*2*	*(D)*	*I*	*II*	
*Lanius nubicus **	*2*	*(VU)*		*II*	
Lanius senator (figure 5-70)	*2*	*VU*		*II*	
Limosa limosa	*2*	*VU*	*II*	*II*	*III*
Linaria cannabina	*4*	*S*		*II*	
Lullula arborea	*2*	*VU*	*I*	*III*	
*Luscinia megarhynchos**	*4*	*(S)*		*II*	*II*
Mareca penelope		*S*		*III*	*II*
Melanocorypha calandra	*3*	*(D)*	*I*	*II*	
Merops apiaster	*3*	*D*		*II*	*II*
Microcarbo pygmeus	*2*	*VU*	*I*	*II*	*II*
Motacilla alba		*(S)*		*II*	
Motacilla flava		*S*		*II*	
Muscicapa striata	*3*	*D*		*II*	*II*
Neophron percnopterus	*3*	*EN*	*I*	*II*	*I/II*
Nycticorax nycticorax	*3*	*D*	*I*	*II*	
Oenanthe hispanica (figure 5-72)	*2*	*VU*		*II*	*II*
Oenanthe oenanthe		*S*		*II*	*II*
Oriolus oriolus		*S*		*II*	
Otus scops	*2*	*(D)*		*II*	
Panurus biarmicus		*(S)*		*II*	
*Parus major**		*S*		*II*	

Species	SPECs	ETS	Bird Directive	Bern	Bonn
Passer domesticus *		S		III	
Passer hispaniolensis		(S)		III	
Passer montanus		S		III	
Pelecanus crispus	1	VU	I	II	I/II
Perdix perdix	3	VU	II/III	III	
Periparus ater		S		II	
Phalacrocorax carbo		S		III	
Phoenicopterus roseus	3	L	I	II	II
*Phoenicurus ochruros**		S		II	II
Phoenicurus phoenicurus	2	VU		II	II
Phylloscopus collybita		(S)		II	II
Phylloscopus sibilatrix	4	(S)		II	II
Phylloscopus trochilus		S		II	II
*Pica pica**		S		III	
*Picus viridis**	2	D		II	
Podiceps cristatus		S		III	
Podiceps nigricollis		S		II	
Pyrrhula pyrrhula		S		III	
Rallus aquaticus		(S)		III	
Regulus ignicapillus	4	S		II	II
Regulus regulus	4	(S)		II	II
Remiz pendulinus		(S)		III	
Riparia riparia	3	D		II	
Saxicola rubetra	4	S		II	II
Saxicola torquata	3	(D)		II	II
Schoeniculus schoeniclus		S		II	
*Sitta europea**		S		II	
Spatula clypeata		S		III	II
Spatula querquedula	3	VU		III	II
Sterna hirundo		S	I	II	
Sternula albifrons	3	D	I	II	II

Species	*SPECs*	*ETS*	*Bird Directive*	*Bern*	*Bonn*
*Streptopelia decaocto**		*(S)*		*III*	
*Streptopelia turtur **	*3*	*D*	*II*	*III*	
Sturnus roseus		*(S)*		*II*	
*Sturnus vulgaris**		*S*		*III*	
*Sylvia atricapilla**	*4*	*S*		*II*	*II*
Sylvia cantillans	*4*	*S*		*II*	*II*
*Sylvia communis**	*4*	*S*		*II*	*II*
Sylvia curruca		*S*		*II*	*II*
Sylvia hortensis	*3*	*VU*		*II*	*II*
Sylvia melanocephala	*4*	*S*		*II*	*II*
Tachybaptus ruficollis		*S*		*II*	
Tringa erythropus		*S*		*III*	*II*
Tringa glareola	*3*	*D*	*I*	*II*	*II*
Tringa ochropus		*(S)*		*II*	*II*
Tringa totanus	*2*	*D*	*II*	*III*	*II*
Troglodytes troglodytes		*S*		*III*	
*Turdus merula**	*4*	*S*	*II*	*III*	*II*
Turdus philomelos	*4*	*S*	*II*	*III*	*II*
Turdus viscivorus	*4*	*S*	*II*	*III*	*II*
Tyto alba	*3*	*D*		*II*	
Upupa epops		*S*		*II*	
Vanellus vanellus		*(S)*		*III*	*II*

**The species was registered during the field researches*

Figure 5-87: Specific birds for various habitats: Lanius senator (top left), Ciconia ciconia (top right), Buteo rufinus (bottom left) and Oenanthe hispanica (bottom right)

The analysis from the evaluation of birds present in the region, at and in the vicinity of the planned corridor of the gas pipeline demonstrates that:

- Out of all 168 registered bird species, none has the status of critically endangered (CR).Only three bird species have status *endangered* (EN), and about fifty species have the status *vulnerable* (VU) or species with *declining populations* (D).The species in these three categories are: *Pelecanus crispus*, *Sternula albifrons* (nesting near the water habitats) *Clanga clanga, Buteo rufinus, Alectoris graeca, Sylvia hortensis, Lanius nubicus, Coracias garrulous, Merops apiaster* (typical representatives of pseudomaquis) and *Lanius excubitor*, *Grus grus* (typical wintering species).
- The situation is similar with the SPEC criteria – a total of three species are European species of global conservation concern SPEC1 (*Clanga clanga, Pelecanus crispus, Aythia nyroca*), and and as high as 11% of the registered species have Unfavourable conservation status in Europe and are concentrated in Europe.
- According to the Bird Directive, 40 of the registered species are defined as Annex 1 species, and almost 2/3 of the species are defined as strictly protected species under the Bern Convention.
- *Pelecanus crispus, Neophron percnopterus* and *Clanga clanga* are identified as Appendix 1 and 2 bird species under the Bonn convention.

- **Amphibians and reptiles**

The evaluation of the amphibians and reptiles is done in accordance with international conventions and laws for the protection of affected species at European or global level.The foregoing includes: The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), the EU Habitats Directive, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (known as CITES Convention) and the Emerald network.Given the fact that North Macedonia does not have a National Red List of affected species, the official IUCN Red List was used.

Table 5-26:Evaluation of amphibians and reptiles

		Bern	HD	Emerald	CITES	Global IUCN list	National red list	Distributed in MK endemism
Amphibians								
2	*Salamandra salamandra*	App.III				LC	LC	
3	*Bombina variegata **	App.II	Ann.IV	App.X		LC	LC	Balkan endemic species
4	*Rana graeca**	App.III	Ann.IV			LC	NT	Balkan endemic species
5	*Pelophylax ridibundus*	App.III				LC	LC	
6	*Rana dalmatina*	App.II	Ann.IV			LC	NT	
7	*Bufo bufo*	App.III				LC	LC	
9	*Hilla arborea**	App.II	Ann.IV			LC	NT	
Reptiles								
10	*Eurotestudo hermanni*	App.II	Ann.IV	App.X	App.II	/	VU	Balkan endemic species
11	*Testudo graeca**	App.II	Ann.IV	App.X	App.II	VU	VU	
12	*Anguis fragilis*	App.III				/	/	
14	*Podarcis muralis**	App.II	Ann.IV			LC	LC	
16	*Podarcis tauricus*	App.II	Ann.IV			LC	NT	
17	*Lacerta viridis **	App.II	Ann.IV			LC	/	
18	*Lacerta trilineata **	App.II	Ann.IV			LC	/	

		Bern	HD	Emerald	CITES	Global IUCN list	National red list	Distributed in MK endemism
20	*Zamenis longissimus*	*App.II*	*Ann.IV*			*LC*	*/*	
21	*Elaphe quatuorlineata*	*App.II*	*Ann.IV*	*App.X*		*/*	*/*	
24	*Natrix natrix**	*App.III*				*LR/LC*	*/*	
25	*Natrix tessellata*	*App.II*	*Ann.IV*			*NT*	*/*	
26	*Vipera ammodytes**	*App.II*	*Ann.IV*			*LC*	*/*	

**The species was registered during the field researches*

The last column presents the species that are limited to small areas in North Macedonia, also species or subspecies that are endemic to the Balkans, such as *Bombina variegata, Rana graeca* and *Eurotestudo hermanni* (Figure no. 5-88 and No. 5-89).

As we can see in Table 5-26, there are no endangered species in North Macedonia.All species are from Appendix II or III of the Bern Convention, and 14 species are listed in the Habitats Directive (4 species of amphibians and 10 species of reptiles), 4 species from the Emerald list (one amphibian and 3 species of reptiles).

The species *Eurotestudo hermanni* and *Testudo graeca* are on the CITES list, and the reason is the illegal trade with these species, which is also present in North Macedonia.

According to the IUCN Red List, all amphibians and 7 reptiles are labelled LC (Least Concern), *Natrix tessellata* is labelled NT (Near Threatened) and *Testudo graeca* is labelled VU (vulnerable) due to the small range of distribution on a European level.

Figure 5-88: Horned Viper (Vipera ammodytes)

Figure 5-89: Yellow-bellied toad Balkan endemic frog (Bombina variegata)

- **<u>Insects</u>**

The evaluation of the insects was done according to the IUCN Global Red List, the EU Habitats Directive and the Bern Convention. A total of 12 species of insects were processed.These species belong to three groups of insects:Butterflies (Lepidoptera), beetles (Coleoptera) and dragonflies (Odonata).Most of them (7) belong to the dragonflies group listed in the categories Least Concern- LC or Near Threatened - NT (one species).Only the *Cerambyx cerdo* species is categorized as vulnerable species and it is part of the lists of the EU Habitats Directive and the Berne Convention.Very rare and endemic species were not identified.

Table 5-27:Evaluation of insects

Species		IUCN Red List	EU Habitats Directive	Bern Convention
Anax imperator	*Odonata*	*LC*		
Calopteryx splendens	*Odonata*	*LC*		
Cordulegaster bidentata	*Odonata*	*NT*		
Orthetrum brunneum	*Odonata*	*LC*		
Orthetrum cancellatum	*Odonata*	*LC*		
Platycnemis pennipes	*Odonata*	*LC*		
Sympetrum sanguineum	*Odonata*	*LC*		
Carabus intricatus	*Coleoptera*	*LR/NT*		
Cerambyx cerdo	*Coleoptera*	*VU*	*Appendix II*	*Annex II*
Lucanus cervus	*Coleoptera*	-	*Appendix II*	*Annex II, III*
Lycaena dispar	*Lepidoptera*	*NT*	*Appendix II*	*Annex II*
Zerynthia polyxena	*Lepidoptera*		*Appendix II*	*Annex IV*

Several subendemic subspecies of ground beetles were registered: *Carabus preslii jonicus, Carabus graecus thessalonicensis* and *Carabus coriaceus emgei,* as well as *Saga natoliae* and *Scarabaeus typhon.*These species are common in the pseudomaquis, the oak forests and other secondary habitats (Figure No. 5-90 and No. 5-91).

Figure 5-90: Saga natoliae – thermophilic species from the south part of MK

Figure 5-91: Scarabaeus typhon – frequent species on dry grassland

5.12 Landscape diversity

There are three types of landscapes in the researched area, designed based on the degree of the anthropogenic impact:

- anthropogenic (agricultural land, settlements, roads and auxiliary buildings);
- semi-natural (degraded oak forests);
- natural (pseudomaquis, oak forests and plane-tree, willow and alder-covered riparian forest zones).

Based on the methodology for identification and delineation of the landscapes of the researched area (use of computer tools, available cartographic bases and visual interpretation), the following four primary landscape types have been identified:

- Agricultural rural landscapes;
- Hilly landscapes with evergreen shrublands (pseudomaquis);
- Hilly areas with deciduous oak forests;
- Hilly areas with degraded oak forests.

Figure 5-92: Map of the landscape of the analysed route of the gas pipeline

The typical landscapes along the researched route are given in the following table:

Table 5-28:Typical morphological and landscape types

Section /line	Altitude (m)	Landscape form	Land use	Landscape type
km 0+000 – km 15+700	*46 – 120*	*Level to uneven terrain*	*Agricultural land and urban areas*	*Agricultural land (vineyards, orchards, farmlands and greenhouses) and settlements intertwined with degraded oak forests and coniferous plantations.*
km 15+700 – km 32+600	*80 – 430*	*Hilly areas*	*Combination of sparse forests (shrublands) and scarce agricultural land*	*Hilly landscape with evergreen shrublands with Quercus coccifera, in some places degraded, and well-developed riparian zones of Platanus orientalis*
km 32+600 – km 52+000	*200 – 920*	*Hilly areas*	*Combination of forests and scarce agricultural land*	*Hilly landscape with oak forests and riparian zones of sparse willows.*
km 48+200 – km 53+700	*120 – 220*	*Level to uneven terrain*	*Agricultural lands*	*Agricultural land, rural parts and riparian zone of alder*
km 53+700 – km 59+300	*180 – 300*	*Hilly areas*	*Combination of sparse forests and scarce agricultural land*	*Hilly landscape with degraded oak forests and dry grasslands.*
km 59+300 – km 67+140	*160 – 260*	*Uneven and hilly areas*	*Agricultural land and urban areas*	*Hilly landscape with agricultural land and parts of settlements*

The main features of the identified landscape types are described below:

- **Agricultural rural landscapes**

  Agricultural rural landscapes extend along the valleys of the rivers Vardar and Bosava and some of their tributaries and cover the initial and final part of the route (Figure no. 5-99).They are characterized by the dominance of agricultural land with small fragments of degraded oak forests and several riparian zones of willows (Vardar and Drenska Reka) and alder (Bosava).Agricultural rural landscapes in the area of interest can be divided into flat area and hilly part.

  The flat area part is mostly presented with agricultural land in Bogdansko Pole, as an intensively cultivated agricultural area, while the remaining covers the areas around the town of Gevgelija and the village of Prdejci. The agricultural land is represented by fields, farmlands and vegetable gardens. In addition, there is abandoned agricultural land (uncultivated fields), as well as ruderal vegetation (along the roads, near the villages, etc.). Annual crops such as tomatoes, peppers, watermelons, alfalfa, tobacco, eggplants, cabbage, potatoes, wheat, corn and others are most commonly grown. Although most plots occupy small areas, borders are not common. There are also large areas of monoculture plantations, mostly cereals. Fruit growing is not a characteristic type of agricultural activity, so orchards are represented only sporadically and occupy small areas. In contrast, vineyards are common and are represented by plantations of different grape varieties. In addition to growing crops in open gardens, the mosaic look of the area is also a result of the greenhouses with early season crops. Peppers, cucumbers and tomatoes are mainly grown in them. The greenhouses are covered with plastic cover and are temporary agricultural facilities, while in the vicinity of the towns of Gevgelija and Bogdanci there are greenhouses with early season crops.

The hilly agricultural rural landscape consists of two parts separated by a landscape of degraded downy oak and hornbeam forests and dry grasslands.The first part (between KM 48 + 200 and KM 53 + 700) covers the valleys of the rivers Dosnica and Bosava and is characterized by a predominance of vineyards, and along the rivers there is a well-developed zone of riparian vegetation represented by alder (*Alnus glutinosa*).This landscape also includes degraded forests that are a result of the exploitation of the forest elements of the communities of the kermes oak. This is evident at the locations where there is degraded pseudomaquis. In addition, due to the predominant presence of the kermes oak, the landscape has a special visual appearance.The second part of the hilly agricultural rural landscape is located in the final part of the route of the gas pipeline and is represented by the predominant fields with cereals and vineyards.The villages of Przdevo and Tremnik are rural settlements in this area.

The main characteristic of the anthropogenic influence in the *Agricultural rural landscapes* in the section of the route is the A1 motorway (Friendship) and the railway line Skopje - Gevgelija which extends in parallel with the motorway.

The naturalness of the *Agricultural rural landscapes* is significantly weak.The riparian elder and willow zones are primary semi-natural habitats.The zones with riparian vegetation are best preserved and are important areas for the biodiversity that increase the natural value of the *Agricultural rural landscapes*.

The main landscape types seen from the route of the gas pipeline are the settlements, the agricultural land and the riparian vegetation.

Figure 5-93: Agricultural rural landscape in Bogdansko Pole

Figure 5-94: Agricultural rural landscape in the Demir Kapija region

- **Hilly areas with degraded oak forests**

This landscape is typical of hilly areas and is characterized by semi-natural and natural features. The largest areas are found between the village of Przdevo and the valley of the river Bosava.The matrix is represented by degraded downy oak and hornbeam forests, in places with complete dominance of Juniperus oxycedrus and dry grasslands, as a secondary stage of degradation of the oak forest.Of the woody species, *Paliurus spina-christi, Pyrus amygdaliformis, Prunus spinosa,* etc. are the most common. This habitat is characterized by a very well-developed herb layer, then shallow eroded soil, smaller or larger bare rocks, etc. The grasslands consist of therophyte plants that dry out at the beginning of the summer, and are often represented by a variety of thorny tall grassy plants.

The degraded oak forests include smaller fragments of arable land with various sizes that are gradually descending to the villages.Despite the fact that forests are degraded, the connection of the landscape is relatively large due to the absence of large obstacles, and this gives the landscape a significant functional value.

The primary landscape types seen from the planned route of the gas pipeline are degraded oak forests, dry grasslands, fields, small areas of oak forests and rural settlements.

Figure 5-95: Hilly landscape with degraded oak forests and dry grasslands in the vicinity of the village of Przdevo

- **Hilly areas with deciduous oak forests**

This type of landscape is typical of hilly areas and it is characterized by natural features (Figure No.5-102). From a structural point of view, the relief is characterized by steeper and softer sides. The slopes are intersected by ravines and gullies. The soil is cambisol, medium deep to shallow. The flora is of a therophytic-hemicryptophytic character, which is a result of the dominant Mediterranean character of the climate in this area and the connection of the flora with the Mount Kozuf, in the environment where the climate is more pronounced as continental. This character of most of the habitats in this region should also be connected with the influence of the sub-Mediterranean climate that comes through the valley of the river Vardar. The positive temperature influence has enabled the formation of bio corridors that have contributed to the presence of representatives of the Mediterranean and sub-Mediterranean element of the flora. In addition to the climatic factors, another factor for the predominantly arid character of the habitats is the predominance of the carbonate geological substrate, which is characterized by a high degree of permeability of water, which concurrently contributes to its greater heating.

The vegetation is represented by well-developed deciduous oak forests and they occupy the highest part of the route, between 400 and 950 meters above sea level, descending towards the pseudomaquis that develops in the lower parts of the route or on the steep slopes of the hilly parts. These forests belong to the downy oak and hornbeam forest community and they are located in the middle of the route. The community is dominated by the downy oak and the oriental (white) hornbeam, and in addition to them there is mana ash, mountain maple, terebinth and several species of shrubs. In the part of the route between the villages of Koprishnica and Dren (Demir Kapija) and Projkov Rid, the locality Studena Glava is located, which is characterized by beech stands at low altitude, which represent the occurrence of beech at lowest altidude in the country.

The primary landscape types seen from the gas pipeline route are: degraded oak forests, shrublands with well-developed and degraded kermes oak, riparian zones and fields. Rural populated areas are not present in the area.

Figure 5-96: Downy oak and hornbeam forests

- **Hilly landscapes with evergreen shrublands (pseudomaquis)**

This landscape type is characteristic of the extreme southeast of the country and it covers the parts along the river Vardar south of Demir Kapija.

The distribution of the landscape coincides with the area in which the influence of the Mediterranean climate is most pronounced. This landscape type is mostly represented by well-distributed shrubby stands of the evergreen kermes oak, which is an ecosystem engineer of a specific community called pseudomaquis. Over the centuries, the pseudomaquis was under strong anthropogenic influence of the local population that used the deciduous trees, and for this reason, today there are mostly degraded stages dominated by the kermes oak (*Quercus coccifera*). Species such as *Paliurus spina christi*, *Pyrus amygdaliformis*, *Prunus spinosa*, *Juniperus oxicedrus* and others are also present in the degraded pseudomaquis, and in some places there are smaller areas of low shrub formations covered with *Cistus incanus*. In addition to these, in certain places in this landscape type, surrounded by scattered vegetation of different degree of degradation, there are smaller or larger areas of dry grasslands. They are secondary formations formed by deforestation of larger areas with natural vegetation and a very small part of them are of natural origin. These areas consist of therophyte plants, which dry in early summer.

The hilly landscape type is also characterized by the riparian forests and zones with Platanus orientalis which in this part usually develop in the river gorges and valleys. These areas are occasionally flooded during the rainy season. The plane-tree (*Platanus orientalis*) is dominant here, giving physiognomy to the community, with occasional appearance of the white willow (*Salix alba*), while the walnut (*Juglans regia*) is not usually present. There are such zones along the course of Stara Reka and its tributaries, but well-preserved forests of this type are very rare.

In some places in the higher parts of the area, as a result of erosion, there are rocks that give a special landscape character to the hilly landscape type. The rocky areas and cliffs are present on the tops of the hills, as well as in the gorges of some river streams.

The landscape, which is completely dominated by degraded shrubby stands of evergreen kermes oak (pseudomaquis), does not have significant landscape (visual) values.

The primary landscape types seen from the gas pipeline route are: degraded pseudomaquis, riparian zones of Platanus orientalis, fields, the Vardar River and the A1 motorway.

Figure 5-97: Pseudomaquis with dominance of kermes oak trees

5.13 Demographic characteristics

In the Republic of North Macedonia eight (8) planning regions have been established as functional territorial units for the needs of development planning and implementation of measures and instruments for encouragement of the development. In addition to the regions, the first-order administrative division of North Macedonia comprises the municipalities.

The route of the gas pipeline passes through the Southeast and the Vardar planning regions. The municipalities of Negotino and Bogdanci are part of the Southeast Planning Region, and the municipalities of Demir Kapija and Gevgelija are part of the Vardar Planning Region.

The Vardar planning region[16] covers an area of 4.042 km^2 or 16% of the area of the country. It consists of 9 municipalities. According to the 2002 census, the Vardar Planning Region had 154,535 inhabitants. The region is characterized by an extremely low population density of 38 inhabitants/km^2 and a high concentration of population in the urban areas.

[16] Vardarregion.gov.mk

The Southeast region[17] covers an area of 2,835 km^2, i.e. 10.9% of the total area of the country. It consists of a total of 10 municipalities, 171,416 inhabitants and a population density of 63.2 inhabitants per km^2.

The impact area of the project includes all the communities that will potentially be affected by the project, as well as the region covered by the project where social interaction will take place and where the local communities will probably be affected by the project, indirectly or directly.

The location of the project for the gas pipeline project Interconnector is distributed in the municipalities of Gevgelija, Bogdanci, Demir Kapija and Negotino. Most of the population in the villages and towns and administrative centers affected by the project live in these four municipalities.

The gas interconnector is located near the following populated areas (Figures no. 5-98 to 5-101):

- The towns: Negotino, Demir Kapija, Gevgelija and Bogdanci;
- The villages: Bogorodica, Stojakovo, Selemli, Mrzenci, Gjavato, Negorci, Prdejci, Smokvica, Miletkovo, Miravci, Gabrovo, Petrovo, Dren, Chiflik, Przedevo, Tremnik, Timjanik, Dubrovo and Dolni Disan.

Figure 5-98: Populated areas km 0+000 - 12+000

[17] https://www.rdc.mk/southeastregion/index.php/mk/

Figure 5-99: Populated areas km 12+000 - 28+000

Figure 5-100: Populated areas km 28+000 - 59+000

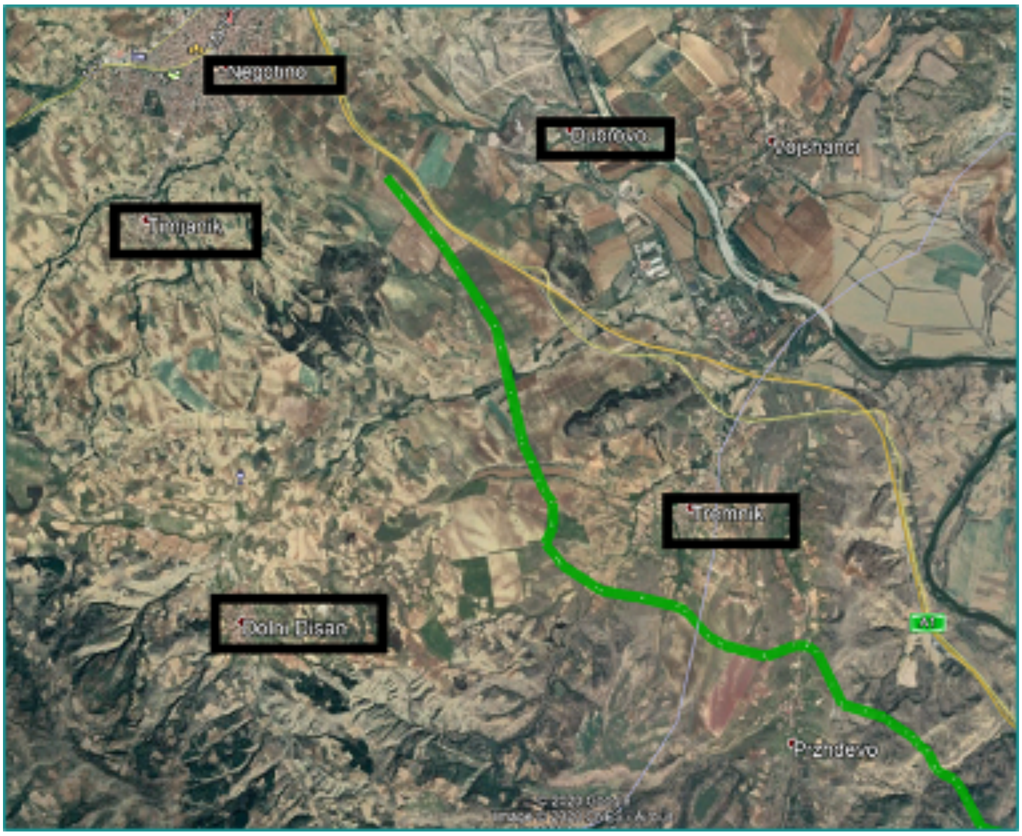

Figure 5-101: Populated areas km 59+000 - 67+200

Municipality of Gevgelija has an area of 485 km². Gevgelija is an urban and municipal center, and the municipality of Gevgelija includes several villages: Bogorodica, Gabrovo, Miletkovo, Miravci, Mrzenci, Negorci, Petrovo, Prdejci, Smokvica.

According to the Census, the average population density is 47 inhabitants per km², which is significantly less than the population density in the Republic of North Macedonia.

In the total population, the share of men and women is almost equal, i.e. 11,420 are men (49.7%) and 11,568 are women (50.3%). In terms of age structure, 3,835 inhabitants (16.7%) are aged 0 to 14 years, 16,498 inhabitants (71.8%) are aged 16 to 64 years, and 2,648 (11.5%) are older than 65 years.

Municipality of Bogdanci has an area of 114.54 m², and the centre of the municipality is the town of Bogdanci. The municipality of Bogdanci includes only four populated areas, of which Bogdanci is the central urban place and seat of the municipality, and the other settlements Stojakovo, Selemli and Gjavato are rural.

According to the Census of Population, Households and Dwellings of 2002 taken by the State Statistical Office, the municipality has 5.1% of the population in the Southeast region, i.e. an average of 76 per km².

According to certain estimates for the total population of the municipality of Bogdanci for the period 2005-2011, there is an average annual decrease of 0.43%. During this period, the municipality had a negative natural increase. (source: Third National Report on the UN Framework Convention on Climate Change - Southeast Region).

Municipality of Demir Kapija has an area of 309 km^2, and the populated areas in that area are the town of Demir Kapija and the villages of Dren, Przhdevo and Chiflik.

According to the 2016 estimate, in the municipality of Demir Kapija[18] the population density is 14.61 inhabitants per km^2.

Municipality of Negotino covers an area of 414 km^2 and according to the last Census of Population, Households and Dwellings of 2002 taken by the State Statistical Office, the population density in the municipality is 46.5 inhabitants per km^2.

Negotino is the urban center and the following inhabited places are part of the municipality: Timjanik, Tremnik, Dubrovo and Dolni Disan.

Natural movement of population

The basic components of the natural movement of the population are the birth rate and the mortality. The natural movement of the population in the municipalities where the gas pipeline will pass is presented in the following table.

Table 5-29: Birth rate for the period 2008 - 2018 in the urban areas where the gas pipeline will pass

Towns:	Total births in 2008			Total births in 2018		
	Total	Male	Female	Total	Male	Female
Gevgelija	265	146	119	232	121	111
Bogdanci	67	32	35	79	40	39
Demir Kapija	49	28	21	33	21	12
Negotino	197	100	97	183	103	80

Source: State Statistical Office

Table 5-30: Mortality in 2018 in the urban areas where the gas pipeline will pass

Towns:	Total	0-4	5 - 14	15 - 24	25 - 44	45 - 64	65 and more and unknown
Gevgelija	276	2	-	1	8	47	218
Bogdanci	90	1	-	1	4	20	64
Demir Kapija	53	-	-	-	-	15	38
Negotino	184	1	-	-	4	38	141

Source: State Statistical Office

[18] Source: LEAP of Demir Kapija

Table 5-31: Population on 31.12.2018 in the municipalities where the gas pipeline will pass by specific age groups and gender

Municipality		Total	0	1-2	3-4	5-6	7-9	10-14	15-19	20-24	25-27	28-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80+	unknown
Gevgelija	total	22647	232	470	446	412	683	1040	1083	1191	792	574	1734	1803	1698	1616	1628	1727	1683	1385	1003	760	687	0
	male	11253	121	244	221	213	352	531	563	615	392	293	871	941	893	843	812	846	809	629	467	318	279	0
	female	11394	111	226	225	199	331	509	520	576	400	281	863	862	805	773	816	881	874	756	536	442	408	0
Bogdanci	total	8078	78	143	138	135	189	377	383	462	317	212	652	620	549	539	687	662	598	468	346	263	257	3
	male	4048	40	66	62	61	91	188	200	240	158	113	350	337	292	286	351	320	306	227	149	105	106	0
	female	4030	38	77	76	74	98	189	183	222	159	99	302	283	257	253	336	342	292	241	197	158	151	3
Demir Kapija	total	3982	33	85	86	77	127	199	194	223	155	94	285	263	292	289	291	327	242	268	187	126	139	0
	male	2053	21	40	42	37	71	91	101	111	86	48	164	133	168	162	154	176	115	139	83	54	57	0
	female	1929	12	45	44	40	56	108	93	112	69	46	121	130	124	127	137	151	127	129	104	72	82	0
Negotino	total	19244	183	381	395	392	560	1015	1050	1203	811	570	1444	1446	1358	1393	1412	1395	1286	1166	790	563	431	0
	male	9722	103	192	210	203	299	497	541	617	402	295	745	761	724	717	735	713	625	583	361	236	163	0
	female	9522	80	189	185	189	261	518	509	586	409	275	699	685	634	676	677	682	661	583	429	327	268	0

Migration of the Population

The basic components of the natural movement of the population are the birth rate and the mortality rate. The following table shows the natural movement of the population in the municipalities where the gas interconnector is located.

Table 5-32: Birth rates in the period 2008-2018 in the urban areas where the gas pipeline is located

Town	Total births in 2008			Total births in 2018		
	Total	Male	Female	Total	Male	Female
Gevgelija	265	146	119	232	121	111
Bogdanci	67	32	35	79	40	39
Demir Kapija	49	28	21	33	21	12
Negotino	197	100	97	183	103	80

Table 5-33: Mortality rates in 2018 in the urban areas where the gas pipeline is located

Town	Total	0-4	5 - 14	15 - 24	25 - 44	45 - 64	65 and more
Gevgelija	276	2	-	1	8	47	218
Bogdanci	90	1	-	1	4	20	64
Demir Kapija	53	-	-	-	-	15	38
Negotino	184	1	-	-	4	38	141

Another component of the natural movement of the population is the migration. In the municipalities where the project is being developed, there was a significant increase in the migration from rural to urban areas during the period of industrialization, which continued in the last years of the last century, as well as in this century. In the last ten years, a process of reverse migration has been taking place, especially among the older population. In the same period, the migration of the active working population from the municipalities outside the borders of the Republic of North Macedonia has significantly increased. The following tables show the basic statistical data on the migration in the municipalities and the towns in the affected area for 2017 (Migration Report 2017, SSO).

Table 5-34: Emigrants and immigrants in 2017 in the municipalities where the project passes

Municipality	Emigrants/ Immigrants	Total	Employement	Marriage	Family reasons	Education	Other
Gevgelija	Emigrants	42	9	38	17	/	22
	Immigrants	42	4	33	19	/	10
Bogdanci	Emigrants	24	3	27	8	1	8
	Immigrants	12	1	18	4	/	4

Municipality	Emigrants/ Immigrants	Total	Employement	Marriage	Family reasons	Education	Other
Demir Kapija	Emigrants	14	/	22	11	/	/
	Immigrants	22	1	13	15	/	6
Negotino	/	/	/	/	/	/	/

Table 5-35: Total immigration and emigration of citizens and migration balance by towns

Town	Total population	Total immigrants	Total emigrants	Migration balance in the Republic of North Macedonia in other countries
Gevgelija	22,988	75	77	- 2
Bogdanci	8,707	21	30	- 9
Demir Kapija	4,545	28	35	- 7
Negotino	19,212	138	142	- 4

5.14 Utility infrastructure

The solid municipal waste in the area of the project is disposed of at the local landfills of the municipalities, which do not meet the basic sanitary-technical standards for safe waste disposal. No landfill has a protective layer for protection of the soil and groundwater. Also, another threat to the environment and the population are the illegal landfills in the area of the municipalities where the project extends. The problems with waste and waste disposal are covered in more detail in the chapter on Waste Management of this EIA.

In the town of Gevgelija, water supply is provided with six pumping stations (wells), two near the river Vardar and four near the village of Moin. According to the strategic plan for development of the municipality, the construction of the Konsko dam will be the most important facility for the area of Gevgelija. The dam is located on the river Konska, 17 km west of the town of Gevgelija. The main purpose of the reservoir is to be used for water supply of the town of Gevgelija, as well as for irrigation of arable land.

Municipality of Bogdanci is supplied with water from the “Paljurci” Reservoir, which is also used for irrigation of arable land.

The public utility company "Komunalec" - Negotino provides drinking water to the town of Negotino, from the spring "Lukar". The town water supply network provides water to the citizens and the industrial facilities in the town. The green areas in the town and the agricultural areas are irrigated using water from the "Tikveshko Pole" hydro system, and "Negotino 1 and 2".

In the municipality of Demir Kapija, the water supply in the town is provided by the public utility company "Boshava". The town uses water from a local reservoir with a volume of 380 m^3 of water, and the rural areas use water from local wells. There is no wastewater treatment in the municipality, and also there is no organized wastewater treatment or wastewater treatment plant. Some of the wastewater from the households in the settlements and from the industry is discharged directly into the rivers, and some is discharged into separate septic tanks.

In the town of Negotino, the municipal wastewater from the households and the other consumers is discharged along with stormwater through the existing sewerage network. The industrial wastewater from most facilities is discharged directly into the Negotinska River, without prior treatment. The town of Negotino and the settlement of Timjanik are 100% covered by a sewage system for collection and disposal of wastewater. The works for construction of sewerage in the village of Tremnik are underway.

The general overview is that the households in the project area are supplied with drinking water in the urban and the rural areas, although some populated areas face the problem of lack of drinking water due to high average per capita consumption, as well as large water losses in the old supply systems. The situation with wastewater treatment is quite bad. In the area of the project, the wastewater from the urban settlements is collected and discharged without any treatment directly on the surface watercourses of the recipient. In some of the rural areas where septic tanks are used, they do not have sufficient capacity and it results in direct discharge of wastewater into various surface waters or agricultural land. An exception is the treatment plant in Gevgelija with a capacity for 30,000 inhabitants.

The motorways and the highways (A1, 42 km long and A4, 90 km long) pass through the project area and are in relatively good condition. The section of the highway A1 Demir Kapija – Smokvica is 28 km long (connection with A2). A1 is the main state artery (North-South Corridor) through which a large number of people and goods transit and their number and quantity are constantly increasing. The length of the local road network in the region is shorter than in the other regions.

The railway line Skopje-Veles-Gevgelija-border passes in the project area.

In terms of energy potential, the region is not rich in hydropower and is completely dependent when it comes to electricity. The Negotino thermal power plant is of particular importance, and the Dubrovo substation is a central location for transmission of electricity in the country to/from Greece, and the project intersects with the 400kV overhead power line Dubrovo.

What is important for this region is that it goes along the Thessaloniki-Skopje oil pipeline and along the K-10 road corridor.

The crossings and the intersection of the project - Natural Gas Interconnector with the communal, road and other infrastructure are given in APPENDIX 4.

5.15 Land use

The zone of the gas pipeline corridor and the land use are shown in this EIA, in the pictures included in the section on habitats, Chapter on biodiversity. The fields and vegetable gardens are typical of the Bogdanci-Gevgelija valley and are spread in the lowland area between the villages of Stojakovo and Prdejci (between km 3+500 and km 15+500), then between the village of Dren and the town of Demir Kapija (km 48+500 to km 53+500), while in the last part of the route, in the vicinity of the village of Tremnik (between km 59+500 and km 67+000) they are represented as grainfields.

Perennial agricultural plants and vegetables that dominate the corridor region are tomatoes, peppers, watermelon, alfalfa, tobacco, eggplant, cabbage, potatoes, wheat, corn and others. In the part between Demir Kapija and Negotino, the agricultural areas are used for growing cereals.

Orchards are not a typical type of agricultural activity in the project area. The fruit trees are usually planted in or near the villages. The most common fruit trees in the region are almonds, peaches, pears, plums and apricots. Peach plantations are present in the area of the town of Negotino.

In the last part of the pipeline route (between km 60+500 and km 62+000), there are plantations for growing peaches, while in the initial part (km 1+000) there are apple orchards.

Vineyards are common and are one of the most common crops in the area of the pipeline corridor.

The vineyards are represented mainly by large area plantations, but also by smaller individual plantations. They are most present in the last part of the zone of the corridor between km 59+500 and km 66+000, then in the central part around the village of Chiflik, between km 50+000 and km 53+300, as well as in the initial part near the border with Greece (km 0+500 and km 2+000) and in the vicinity of the village of Prdejci (between km 12+000 and km 16+000).

The villages of Stojakovo and Przhdevo are closest to the route of the pipeline and the area is characterized by a mosaic structure of vegetation and agriculture.

5.16 Economic development

Agriculture is the primary source of income in the municipality of Gevgelija. The secondary sector in the municipality includes industry, power supply and construction. Trade, tourism and tourism-related services are the tertiary part that supports the economy in the municipality. Due to the favorable climate, the richness of thermal waters, the proximity of Mount Kozuf and the proximity of the border with Greece, in the municipality of Gevgelija there are favorable conditions for the development of tourism and hospitality.

The main economic areas in the municipality of Bogdanci are light industry, agriculture, trade, financial services, public services, education, health and administration. There are textile factories that fall into the category of light textile industry, milk and dairy processing facilities, as well as a factory for processing and canning of agricultural products. There are no facilities and infrastructure for tourism development.

Viticulture and winemaking are the most important business branches in the municipality of Demir Kapija. In addition to viticulture, individual animal husbandry has been developed on a small scale, mainly by the local population. The largest poultry farm in the municipality has about 120,000 poultry birds. The relief characteristics of this area are excellent elements for tourist activity. Eco-cultural tourism can play a significant role in the development of the municipality.

Agriculture (agribusiness, forestry) and especially viticulture is significantly developed on the territory of the municipality of Negotino and the agricultural production is the main economic activity. The municipality of Negotino has an annual production of 20-25 million kilograms of grapes. The industrial crops include tobacco, opium poppy, horticultural crops and cereals. The second largest winery in Macedonia, Povardarie, is located in Negotino.

The following table shows the number of legal entities in different sectors of economic activity in the municipalities.

Table 5-36: Number of economic entities in different sectors in the municipalities

Sector	Gevgelija	Bogdanci	Demir Kapija	Negotino
Agriculture, forestry and fisheries	62	12	7	31
Mining and quarrying	-	1	-	2
Manufacturing	149	28	9	114
Electricity, gas and air conditioning supply	3	-	1	1
Water supply, sewerage, waste management and remediation activities	2	1	1	4
Construction	71	11	6	48
Wholesale, retail trade, repair of motor vehicles and motorcycles	354	107	34	240
Transportation and storage	166	51	16	149
Accommodation and food service activities	92	25	6	49
Information and communication	23	4	1	8
Financial and insurance activities	5	-	-	2
Sale of real estate	16	1	-	-
Professional, scientific and technical activities	131	10	4	57
Administrative and support service activities	20	-	-	7
Public administration and defence; social work activities	4	1	1	2
Education	14	6	1	10
Health and social work activities	53	10	5	35
Arts, entertainment and recreation	30	5	2	12
Other services	82	21	7	31
Total	**1.277**	**294**	**101**	**802**

Source-State Statistical Office - Makstat

5.17 Population health

The health system consists of three segments: primary, secondary and tertiary health care. The primary health care in the North Macedonia is based on a network of private and public healthcare institutions: clinics and healthcare centers. The primary healthcare system includes preventive, promotional and treatment services provided by various profiles of health professionals and associate professionals: doctors, general practitioners, dentists, pediatricians, school medicine specialists, gynecologists and occupational medicine specialists. The secondary health care is practiced throughout the system of specialized councils, general and special hospitals and institutes. The tertiary health care is practiced in the clinical hospitals and the University Clinical Centre in Skopje.

These two levels are responsible for providing preventive, curative and rehabilitative healthcare services provided by various specialists and subspecialists.

In the Republic of North Macedonia there is an occupational health system, geographical and financial approach, disease control and almost complete coverage of the population with vaccination.

The health system is mainly funded through the compulsory health insurance, which gives all citizens the opportunity to be health insured. The compulsory health insurance is funded by allocating funds from the salaries, intended for health insurance. Furthermore, the country's central budget provides funds to cover the health insurance costs for citizens who are not covered by health insurance on any grounds, including groups such as: minor children under 18 (26 if they are students), pregnant women, nursing mothers, persons over 65 years of age, etc.

The public health is constantly monitored by the Institute of Public Health, and the latest health care data and analyses are included in the health report for the population in the Republic of North Macedonia dated 2017.

An excerpt from the situation with the coverage with medical staff by health regions is presented in the following table. The health region of Gevgelija also includes the area of Demir Kapija, and the health region of Negotino includes Bogdanci.

Table 5-37: Overview of the situation with the coverage with medical staff by health regions

2017	**Negotino**	**Gevgelija**	**MK**
Population per doctor	*496.3*	*392.5*	*333.6*
Total number of doctors	*47.0*	*87.0*	*6 219.0*
General practice	*18.0*	*19.0*	*1 770.0*
General practice (% of the total number of doctors)	*38.3%*	*21.8%*	*28.5%*
On specialization	*7.0*	*19.0*	*699.0*
On specialization (% of the total number of doctors)	*14.9%*	*21.8%*	*11.2%*
Specialists	*22.0*	*49.0*	*3 750.0*
Specialists (% of the total number of doctors)	*46.8*	*56.3%*	*60.3%*
Number of dentists	*15.0*	*30.0*	*1 811.0*
Population per 1 dentist	*1 554.9*	*1 138.3*	*1 145.5*
Number of pharmacists	*8.0*	*11.0*	*1 070.0*
Population per 1 pharmacist	*2 915.5*	*3 104.5*	*1 938.8*
Number of health workers in medical institutions in rural areas, in the Health Regions, in the MK			
Permanent doctors	*2.0*	*11.0*	*321.0*
Temporary doctors	*4.0*	*0.0*	*5.0*
Health workers with completed secondary education and professional health workers with secondary and vocational school	*3.0*	*11.0*	*354.0*

5.18 Cultural and historical heritage

The country is rich in immovable cultural heritage with exceptional cultural, historical and artistic value that confirms the existence, continuity and identity of the North Macedonian people, as well as nations living within its borders that are part of the Albanian, Turkish, Vlach, Serbian, Roma and Bosnian community, and other nations through the centuries.

The National Institute for the Protection of Cultural Monuments, for the purposes of the development of the Spatial Plan of the country, has prepared an expert report on the protection of the immovable cultural heritage, in which the Inventory of Immovable Cultural Heritage is of particular importance. The Inventory contains a list of registered immovable cultural sites with a designated status: archaeological sites, churches, monasteries, mosques, baths, towers, clocks, türbes (tombs), mausoleums, accommodation places, bridges, buildings, old bazaars, old city cores and other monuments with their names, locations, surrounding settlements, period of occurrence and the municipalities where the monuments are located.

Due to its geographical location, in the central southern Balkans, North Macedonia is a treasure trove in almost all major cultural, historical epochs that mark the European civilization.

The National Conservation Centre of Cultural Heritage – Skopje and the Institute for Protection of Cultural Monuments and Museum – Strumica conducted an initial survey in order to determine the registered archaeological and cultural sites and submitted information on the archaeological and cultural heritage located along the route of the Natural Gas Interconnector North Macedonia - Greece.

These sites have archaeological and cultural significance and archaeological-expert research should be conducted in order to determine further actions for protection and mitigation measures.

The following table lists the registered archaeological and cultural sites along the route of the natural gas pipeline North Macedonia - Greece. The images with archaeological heritage show the location and the distance from the pipeline route.

Table 5-38: Archaeological and cultural sites along the pipeline route

Gevgelija	*Bogdanci*	*Demir Kapija*	*Negotino*
Goli Rid *Keramidarnica* *Glavica* *Golasec* *Konjari*	*Rudina* *Gradiste*	*Ilimov Rid* *Orizarski Grobista*	*Bugdaska Glava*

Figure 5-102¨: Location of the archeological site Rudina

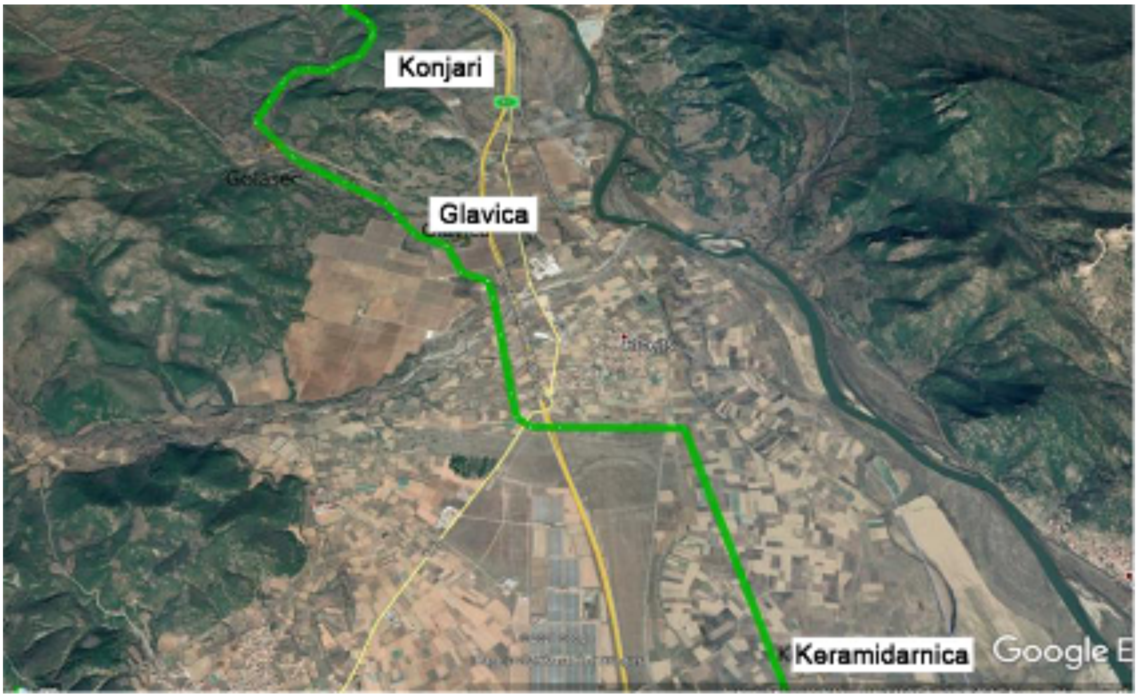

Figure 5-103¨: Location of the archeological sites Keramidarnica, Konjari and Glavica

Figure 5-104¨ Location of the archeological site Goli Rid

Figure 5-105¨ Location of the archeological site Gradiste

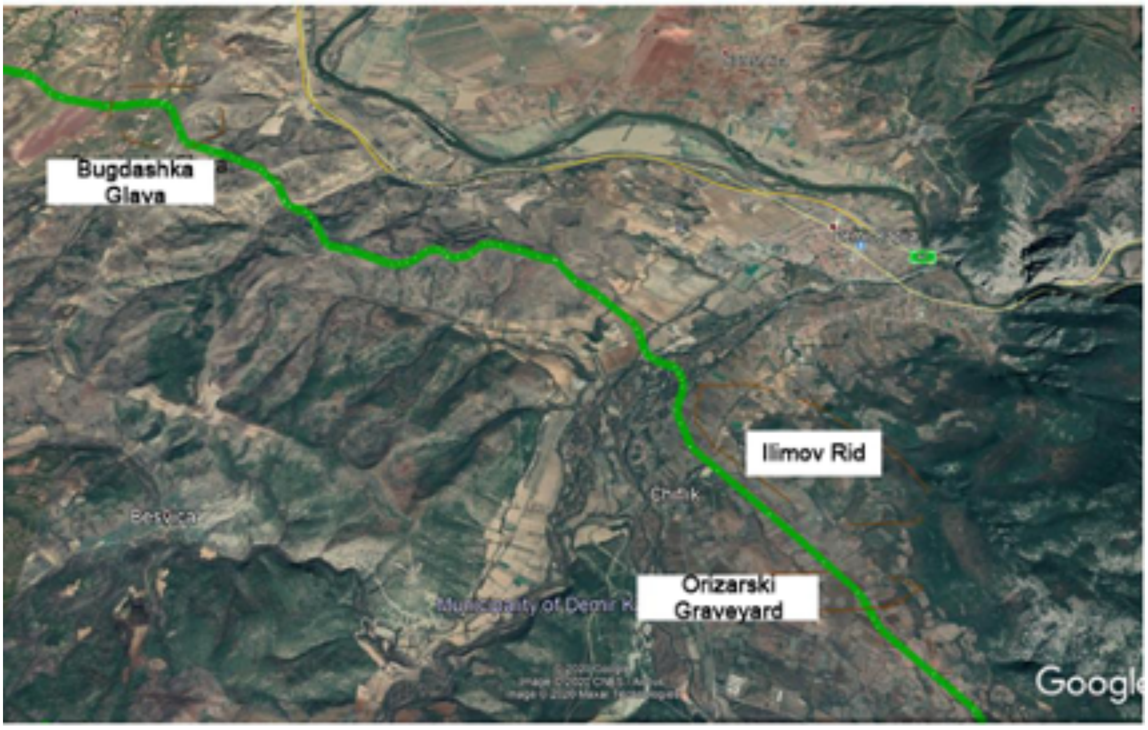

Figure 5-106¨ Location of the archeological sites Bugdashka Glava, Ilimov Rid and Orizarski Grobista

6 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT OF THE PROJECT

Pursuant to the procedure for conducting an EIA procedure and the Rulebook on the content of the requirements to be met by the Environmental Impact Assessment Study, in the analysis of the possible impacts of this project on the environment, the main source of guidance was the opinion of the MoEPP on the scoping of the Study, considered in the construction phase and the operational phase.

The analysis of the possible impacts of the project for the gas pipeline system was made in the **construction phase** and in the phase of its operation, i.e. the **operational phase,** based on the environmental media and areas and the social aspects.

The following activities were taken into account in the construction phase:

- Preparatory works for marking and clearing the terrain at the construction site, the route of the gas pipeline system and the access roads,
- Construction activities related to earth excavation (digging trenches) and reinforced concrete works intended for construction of foundations for the gas pipeline system and for the auxiliary facilities: access paths and excavations for infrastructure installations (lightning protection installation, etc.),
- Transfer of part of the equipment, lowering and stacking the gas pipeline, as well as the structural elements of the facilities, construction and installation works, using land transport and mechanization for installation of the equipment, etc.
- Pipeline testing;
- Final construction works and clearance of the construction site.

The following was taken into account in the operational phase:

- The operation of the gas pipeline system, i.e. its operation when performing its basic function
- The maintenance of the functionality of the system,
- The maintenance of the route of the gas pipeline system and the buffer zone.

6.1 Impact assessment methodology and criteria

The process of impact assessment and identification was implemented based on the following principles: Basic conditions and value/sensitivity of the resources/receptors, and project activities as a source of impacts.

As a result of this process, appropriate level of significance was assigned to each impact. The potential impacts on the baseline conditions were assessed based on the following criteria:

Table 6.1: Impact Assessment Criteria

Criterion	Further Description of Criteria	Indicative Assessment Thresholds used for each Rating Criteria	
		Threshold	Typical Descriptions
Characterization of Impact	Direction of the impact	Positive	The impact improves the current situation or is desirable.
		Negative	The impact worsens the current situation or is not desirable.
Type of impact	Type of impact	Direct	The project results in a direct impact upon an aspect/receptor/resource.
		Indirect	Indirect effect upon an aspect/receptor/resource.
		Cumulative	Cumulative effect upon an aspect/receptor/resource.
Reversibility	Reversibility is the ability for a physical parameter, biological or social community to return to the conditions that existed prior to the impact.	Reversible	The effect is reversible.
		Irreversible	The effect is potentially permanent and not reversible.
Geographic extent	It describes the area over which the particular impact will occur and is related to the spatial boundaries of the assessment.	Local	The impact is limited to specific individuals or population groups/communities or environmental receptors at or close to the project.
		Regional	The impact extends across a region (several municipalities).
		National or transboundary	The impact extends nationally or across borders.
		Global	The effect extends globally.
Time when the impact occurs	Associated with when the impact will occur.	Immediately	The effect occurs immediately following the project activity/action.
		Delayed	The effect is delayed and occurs some time after the project activity/action.

Criterion	Further Description of Criteria	Indicative Assessment Thresholds used for each Rating Criteria	
		Threshold	Typical Descriptions
Duration	*It refers to how long an impact will last and it is closely related to the project phase or activity that could cause the impact.*	*Short-term*	*The impact is expected to last in the short-term (e.g. less than two years).*
		Medium-term	*The impact is expected to last in the medium-term (e.g. between two and ten years).*
		Long-term	*The impact extends throughout the operation of the project and/or beyond 10 years.*
Likelihood of occurrence	*The likelihood that the impact will occur.*	*Unlikely*	*The impact can be considered to be unlikely to occur.*
		Likely	*The impact can be considered to have a medium likelihood of occurrence.*
		Certain	*The impact can be considered to have a high likelihood of occurrence.*

The significance of each impact was considered as a function of the estimated Sensitivity of Resources/Receptors and the Magnitude of the Impact, or more specifically:

- **The sensitivity (value)** of the receiving environment/community/receptor and the affected numbers (where relevant)
- **The magnitude** of the impact and whether it is negative or positive is estimated based on:
  - The type (direct/indirect/cumulative);
  - The Geographic extent (local/regional/national);
  - The Reversibility (reversible/irreversible impact);

Sensitivity (value) of the receptors and resources: the analysed social and environmental resources that are likely to be affected include soil, water, landscape, habitats, cultural heritage, public health, and economic livelihood. The applied descriptive elements and criteria for assessment of the sensitivity of the resources / receptors are given in the following table.

Table 6-2: General Social/Environmental Sensitivity Criteria

Sensitivity	*Typical descriptors*
Very High	*Very high importance and rarity, international scale and very limited potential for substitution.*
High	*High importance and rarity, national scale, and limited potential for substitution.*
Medium	*High or medium importance and rarity, regional scale, and limited potential for substitution.*
Low	*Low or medium importance and rarity, local scale.*
Negligible	*Very low importance and rarity, local scale.*

Magnitude of the impacts: The descriptors and criteria used in order to define the magnitude of impact for the purposes of the project are given in the following table.

Table 6-3: Magnitude of the impact and typical descriptors

Magnitude of impacts	*Typical descriptors of the criteria*
High	*Negative: Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements.* *Positive: Large scale or high improvement of resource quality; extensive restoration or enhancement; major improvement in the quality of the attributes.*
Moderate	*Negative: Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.* *Positive: Benefit to, or addition of, key characteristics, features or elements; improvement of the quality of the attributes.*
Low	*Negative: Some measurable change in resource or its quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.* *Positive: Minor benefits to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on resource or reduced risk of negative impact occurring (positive).*
Negligible	*Negative: Very small loss or adverse change in one or more characteristics, features or elements.* *Positive: Very small benefit to, or addition of one or more characteristics, features or elements.*
No change	*No loss or change in the characteristics, features or elements; absence of any notable impact in any direction.*

<u>Effect significance:</u> Five categories of significance (**very high, high, moderate, low and Insignificant**) are used to assess the significance of each impact (in the table below).

Table 6-4: Descriptors for significance of impact

Significance Category	***Typical descriptors of effects***
Very high	*Only negative effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not always, associated with sites or features of international, national or regional importance that are likely to suffer the most damaging impact and loss of resource integrity. However, a major/high change in a site or feature of local importance may also enter this category.*
High	*These positive or negative effects are considered very important considerations and are likely to be crucial in the decision-making process.*
Moderate	*These positive or negative effects may be important, but it is unlikely that they will be key decision-making factors. The cumulative effects of such factors may affect the decision-making if they lead to an increase in the overall negative effect on a particular resource or receptor.*
Low	*These positive or negative effects may be referred to as local factors. It is unlikely that they will be critical in the decision-making process, but they are important in strengthening the subsequent design of the project.*
Insignificant	*There are no effects, or if any, they are below the level of perception, within the normal limits of variation or within the limits of predictive error.*

Finally, **a significance category** is assigned to each impact using the aforementioned criteria: sensitivity of resources (receptors) and magnitude (size) of the impacts (table below).

Table 6-5: Defining the Significance Categories of the Impacts

		MAGNITUDE OF THE IMPACT (DEGREE OF CHANGE)				
		No change	***Negligible***	***Minor***	***Moderate***	***Major***
SENSITIVITY (VALUE) OF THE ENVIRONMENT	***Very High***	*Insignificant*	*Low*	*Moderate or High*	*High or Very high*	*Very High*
	High	*Insignificant*	*Low*	*Low or Moderate*	*Moderate or High*	*High or Very high*
	Medium	*Insignificant*	*Insignificant or Low*	*Low or Moderate*	*Moderate*	*Moderate or High*
	Low	*Insignificant*	*Insignificant or Low*	*Insignificant or Low*	*Low*	*Moderate*
	Negligible	*Insignificant*	*Insignificant*	*Insignificant or Low*	*Insignificant or Low*	*Low*

For each resource / receptor, **the impacts are determined based on the period of occurrence: Construction Phase and Operational Phase.**

The assessment was made without taking into consideration the application of preventive and corrective measures that could decrease the magnitude (size) of the impact.

6.2 Impacts on soil

The impacts on the soil will mainly appear in the construction phase of the gas pipeline, and they will be the result of the clearance of the terrain along the route, the operation of the construction machinery for performance of construction activities, the movement of the transport vehicles and possibly, contamination of the soil with pollutants.

In the phase of regular operation of the gas pipeline, no impacts on the soil are expected, except in cases of underground gas pipeline defects, where in case of leakage or damage to the underground part of the pipeline, construction works will be performed for repair or replacement of the damaged part of the pipeline.

Potential impacts on the soil during the **construction phase** of the gas pipeline are:

- *Change in the soil quality as a result of the presence (emission) of pollutants that could undermine the soil quality*
- *Soil erosion due to vegetation removal*
- *Loss of fertile topsoil*
- *Landslides due to excavations*

The potential impacts on the soil during the **operational phase** are:

- *Impacts due to construction activities for the rectification of underground pipeline defects*

Construction phase

Change in the soil quality as a result of the presence (emission) of pollutants that could undermine the soil quality

Soil can potentially be contaminated by improper storage, handling and disposal of waste, as well as by potential leaks of fuel and oil during the construction activities from the construction machinery and the transportation vehicles.

The following table shows the sensitivity of the soil along the route of the gas pipeline. The table shows the data on the parts of the chainage where the soil is located, the altitude, land use and description of the landscape.

Table 6-6: Sensitivity of the soil – presence of pollutants

Section / line	Altitude (m)	Form of landscape	Land use	Type of landscape	Sensitivity
km 0+000 – km 15+700	46 – 120	Level to uneven terrain	Agricultural and urban areas	Agricultural areas (vineyards, orchards, fields and greenhouses) and populated areas intertwined with degraded oak forests and coniferous plantations.	medium
km 15+700 – km 32+600	80 – 430	Hilly areas	Combination of sparse forests (shrublands) and scarce agricultural areas	Hilly landscape with evergreen shrublands with Quercus coccifera, in some places degraded, and well-developed riparian zones of Platanus orientalis.	high
km 32+600 – km 52+000	200 – 920	Hilly areas	Combination of forests and scarce agricultural areas	Hilly landscape with oak forests and riparian zones of sparse willows.	high
km 48+200 – km 53+700	120 – 220	Level to uneven terrain	Agricultural land	Agricultural areas, rural parts and riparian zone of alder.	medium
km 53+700 – km 59+300	180 – 300	Hilly areas	Combination of sparse forests and scarce agricultural areas	Hilly landscape with degraded oak forests and dry grasslands.	high
km 59+300 – km 67+140	160 – 260	Uneven and hilly areas	Agricultural and urban areas	Hilly landscape with agricultural areas and parts of populated areas	medium

Table 6-7: Impact assessment - Change in the soil quality as a result of the presence (emission) of pollutants that could undermine the soil quality

Criteria	Assessment Thresholds	
	Threshold	Description
Characterization of Impact	Negative	Not desirable
Type of impact	Direct	The soil contamination is a direct result of the construction activities.
Reversibility	Reversible	The soil contamination can be remediated by natural means if contaminants are biodegradable and are in low concentrations. For severe contamination episodes, an active remediation would be needed.
Geographic extent	Local	The impact will be limited locally, in the immediate vicinity of the construction sites.
Time when the impact occurs	Immediately	Soil contamination occurs as the pollutants are released
Duration	Short-term	As long as soil contamination is not too severe, the self-purification of the soil will eliminate contaminants in relatively short periods of time.
Likelihood of occurrence	Likely	The impact has a medium likelihood of occurrence.
Magnitude	Low	The magnitude is evaluated as low.

The following table gives data on the significance of the impact.

Table 6-8: Significance of the impact - Change in the soil quality as a result of the presence (emission) of pollutants that could undermine the soil quality

Section / line	Form of landscape	Land use	Type of landscape	Sensitivity	Significance
km 0+000 – km 15+700	*Level to uneven terrain*	*Agricultural and urban areas*	*Agricultural areas (vineyards, orchards, fields and greenhouses) and populated areas intertwined with degraded oak forests and coniferous plantations.*	*medium*	*low or moderate*
km 15+700 – km 32+600	*Hilly areas*	*Combination of sparse forests (shrublands) and scarce agricultural areas*	*Hilly landscape with evergreen shrublands with Quercus coccifera, in some places degraded and well-developed riparian zones of Platanus orientalis.*	*high*	*low or moderate*
km 32+600 – km 52+000	*Hilly areas*	*Combination of forests and scarce agricultural areas*	*Hilly landscape with oak forests and riparian zones of sparse willows.*	*high*	*low or moderate*
km 48+200 – km 53+700	*Level to uneven terrain*	*Agricultural land*	*Agricultural areas, rural parts and riparian zone of alder.*	*medium*	*low or moderate*
km 53+700 – km 59+300	*Hilly areas*	*Combination of sparse forests and scarce agricultural areas*	*Hilly landscape with degraded oak forests and dry grasslands.*	*high*	*low or moderate*
km 59+300 – km 67+140	*Uneven and hilly areas*	*Agricultural and urban areas*	*Hilly landscape with agricultural areas and parts of populated areas*	*medium*	*low or moderate*

Taking into consideration the above-defined levels of sensitivity and the low magnitude, the significance of the impact - *Change in the soil quality as a result of the presence (emission) of pollutants that could undermine the soil quality* **is low or moderate.**

Soil erosion due to vegetation removal

Soil erosion is the result of its exposure to wind and water and the removal of its top layer. In the construction phase of the gas pipeline, impacts are expected in the form of degradation and erosion of the rock masses/sediments due to the formation of the work space (working area) of the gas pipeline, earth excavation (digging trenches), as well as construction plateau for foundation engineering of the pipeline system.

Table 6-9: Soil sensitivity – soil erosion

Section / line	Altitude (m)	Form of landscape	Land use	Type of landscape	Sensitivity
km 0+000 – km 15+700	46 – 120	Level to uneven terrain	Agricultural and urban areas	Agricultural areas (vineyards, orchards, fields and greenhouses) and populated areas intertwined with degraded oak forests and coniferous plantations.	medium
km 15+700 – km 32+600	80 – 430	Hilly areas	Combination of sparse forests (shrublands) and scarce agricultural areas	Hilly landscape with evergreen shrublands with Quercus coccifera, in some places degraded and well-developed riparian zones of Platanus orientalis.	high
km 32+600 – km 52+000	200 – 920	Hilly areas	Combination of forests and scarce agricultural areas	Hilly landscape with oak forests and riparian zones of sparse willows.	high
km 48+200 – km 53+700	120 – 220	Level to uneven terrain	Agricultural land	Agricultural areas, rural parts and riparian zone of alder.	medium
km 53+700 – km 59+300	180 – 300	Hilly areas	Combination of sparse forests and scarce agricultural areas	Hilly landscape with degraded oak forests and dry grasslands.	high
km 59+300 – km 67+140	160 – 260	Uneven and hilly areas	Agricultural and urban areas	Hilly landscape with agricultural areas and parts of populated areas	medium

Table 6-10: Impact assessment - Soil erosion due to vegetation removal

Criteria	Assessment Thresholds	
	Threshold	Description
Characterization of Impact	Negative	Not desirable
Type of impact	Direct	Erosion occurs as a result of the construction activities.
Reversibility	Irreversible	Eroded soil cannot be replaced.
Geographic extent	Local	The impact will be limited locally, in the immediate vicinity of the construction sites.
Time when the impact occurs	Immediately	Soil erosion will occur when the soil is exposed to the surface
Duration	Short-term	During the construction works
Likelihood of occurrence	Likely	The impact has a medium likelihood of occurrence
Magnitude	Low	Partial damage to the soil characteristics.

Table 6-11: Significance of the impact - Soil erosion due to vegetation removal

Section / line	Form of landscape	Land use	Type of landscape	Sensitivity	Significance
km 0+000 – km 15+700	*Level to uneven terrain*	*Agricultural and urban areas*	*Agricultural areas (vineyards, orchards, fields and greenhouses) and populated areas intertwined with degraded oak forests and coniferous plantations.*	*medium*	*low or moderate*
km 15+700 – km 32+600	*Hilly areas*	*Combination of sparse forests (shrublands) and scarce agricultural areas*	*Hilly landscape with evergreen shrublands with Quercus coccifera, in some places degraded and well-developed riparian zones of Platanus orientalis.*	*high*	*low or moderate*
km 32+600 – km 52+000	*Hilly areas*	*Combination of forests and scarce agricultural areas*	*Hilly landscape with oak forests and riparian zones of sparse willows.*	*high*	*low or moderate*
km 48+200 – km 53+700	*Level to uneven terrain*	*Agricultural land*	*Agricultural areas, rural parts and riparian zone of alder.*	*medium*	*low or moderate*
km 53+700 – km 59+300	*Hilly areas*	*Combination of sparse forests and scarce agricultural areas*	*Hilly landscape with degraded oak forests and dry grasslands.*	*high*	*low or moderate*
km 59+300 – km 67+140	*Uneven and hilly areas*	*Agricultural and urban areas*	*Hilly landscape with agricultural areas and parts of populated areas.*	*medium*	*low or moderate*

Taking into consideration the above-defined levels of sensitivity and the low magnitude, the significance of the impact - *Soil erosion due to vegetation removal* **is low or moderate.**

Loss of fertile topsoil

The activities of construction and installation of the gas pipeline will directly impair the quality of the soil and will reflect in a change of the specific soil characteristics. This impairment will consist of localized changes in the soil profile in the immediate vicinity of the excavations and soil compaction due to the manipulation of the vehicles and the construction equipment. However, the excavation will take place to a depth of 2 m along the route of the pipeline, so that most of the excavated material will be placed back.

The earthworks that will potentially affect the soil characteristics and therefore the soil quality are as follows:

- Removal of the topsoil (humus);
- Levelling of the surface;
- Compaction to the required density.

All these works result in impairment of the quality of the soil in the zone of the gas pipeline and in the surrounding where the construction works are performed, i.e. in the area covered with temporary structures for the needs of the construction site, as well as the construction of the access roads.

Compaction is not expected to pose a serious environmental risk. Agricultural productivity is expected to return on most of the soil affected by this impact once construction is completed.

Table 6-12: Soil sensitivity – Loss of fertile topsoil

Section / line	Altitude (m)	Form of landscape	Land use	Type of landscape	Sensitivity
km 0+000 – km 15+700	*46 – 120*	*Level to uneven terrain*	*Agricultural and urban areas*	*Agricultural areas (vineyards, orchards, fields and greenhouses) and populated areas intertwined with degraded oak forests and coniferous plantations.*	*medium*
km 15+700 – km 32+600	*80 – 430*	*Hilly areas*	*Combination of sparse forests (shrublands) and scarce agricultural areas*	*Hilly landscape with evergreen shrublands with Quercus coccifera, in some places degraded and well-developed riparian zones of Platanus orientalis.*	*low*
km 32+600 – km 52+000	*200 – 920*	*Hilly areas*	*Combination of forests and scarce agricultural areas*	*Hilly landscape with oak forests and riparian zones of sparse willows.*	*low*
km 48+200 – km 53+700	*120 – 220*	*Level to uneven terrain*	*Agricultural land*	*Agricultural areas, rural parts and riparian zone of alder.*	*high*
km 53+700 – km 59+300	*180 – 300*	*Hilly areas*	*Combination of sparse forests and scarce agricultural areas*	*Hilly landscape with degraded oak forests and dry grasslands.*	*low*
km 59+300 – km 67+140	*160 – 260*	*Uneven and hilly areas*	*Agricultural and urban areas*	*Hilly landscape with agricultural areas and parts of populated areas*	*medium*

Table 6-13: Impact assessment – Loss of fertile topsoil

Criteria	Assessment Thresholds	
	Threshold	Description
Characterization of Impact	*Negative*	*Not desirable*
Type of impact	*Direct*	*Loss of top soil occurs due to land acquisition required for the construction of the gas pipeline route.*
Reversibility	*Irreversible*	*The top soil is removed and cannot be replaced.*
Geographic extent	*Local*	*The impact will be limited locally, in the immediate vicinity of the construction sites.*
Time when the impact occurs	*Immediately*	*Top soil is lost when the construction works start.*
Duration	*Long-term*	*The fertile top soil will be lost forever.*
Likelihood of occurrence	*Certain*	*The fertile top soil needs to be removed to construct the gas pipeline.*
Magnitude	*Moderate*	*The magnitude is evaluated as moderate.*

Table 6-14: Significance of the impact – Loss of fertile topsoil

Section / line	Form of landscape	Land use	Type of landscape	Sensitivity	Significance
km 0+000 – km 15+700	Level to uneven terrain	Agricultural and urban areas	Agricultural areas (vineyards, orchards, fields and greenhouses) and populated areas intertwined with degraded oak forests and coniferous plantations.	medium	moderate
km 15+700 – km 32+600	Hilly areas	Combination of sparse forests (shrublands) and scarce agricultural areas	Hilly landscape with evergreen shrublands with Quercus coccifera, in some places degraded and well-developed riparian zones of Platanus orientalis.	low	low
km 32+600 – km 52+000	Hilly areas	Combination of forests and scarce agricultural areas	Hilly landscape with oak forests and riparian zones of sparse willows.	low	low
km 48+200 – km 53+700	Level to uneven terrain	Agricultural land	Agricultural areas, rural parts and riparian zone of alder.	high	moderate or high
km 53+700 – km 59+300	Hilly areas	Combination of sparse forests and scarce agricultural areas	Hilly landscape with degraded oak forests and dry grasslands.	low	low
km 59+300 – km 67+140	Uneven and hilly areas	Agricultural and urban areas	Hilly landscape with agricultural areas and parts of populated areas	medium	moderate

Taking into consideration the above-defined levels of sensitivity and the moderate magnitude, the significance of the impact - *Loss of fertile topsoil* is **moderate or high.**

Landslides due to excavations

When performing the preparatory works on the construction sites (cutting trees, removing humus and levelling the terrain) and performing the excavations, conditions are created for landslides and rockfalls. The improper protection of the excavations (cuts) and the embankments can reflect upon the stability in the form of landslides of different magnitudes and with different effects. The impacts on the soil are mainly the result of the work related to the excavations and the embankments for laying the gas pipeline in the hilly and mountainous areas.

Basically, two types of slope stability problems are defined, i.e. we distinguish between deep and shallow slides. The deep disturbances of the slope stability are of geo-mechanical nature and can only be solved by proper geometry of the cut. For the shallow disturbances, the problem is the difficulty of quantifying the depth, i.e. the type of measure needed in order to solve this problem. They also occur on slopes that have been determined to be stable by geo-mechanical analyses, but where, due to intensified precipitation, rockfalls may occur.

Along the route, three locations were observed where landslides may occur, at a chainage of 29+650 km, 29+867 km and 40+837 km. Their sensitivity is evaluated as **low**.

All occurrences have small dimensions and, with careful construction, would not constitute a more serious problem, so the magnitude of the impact can be evaluated as low.

Table 6-15: Impact assessment – Landslides due to excavations

Criteria	***Assessment Thresholds***	
	Threshold	***Description***
Characterization of Impact	*Negative*	*Not desirable*
Type of impact	*Direct*	*The landslide is a result of the earthworks.*
Reversibility	*Irreversible*	*The landslide can be prevented, but if it happens, it is irreversible.*
Geographic extent	*Local*	*The impact will be limited locally, in the immediate vicinity of the construction sites.*
Time when the impact occurs	*Immediately*	*The landslide occurs when the construction works start.*
Duration	*Short-term*	*During the construction activities.*
Likelihood of occurrence	*Likely*	*The impact has a high likelihood of occurrence.*
Magnitude	*Low*	*The magnitude is evaluated as low.*

Taking into consideration the above-defined levels of sensitivity and the low magnitude, the significance of the impact - *Landslides due to excavations* **is insignificant or low.**

Operational phase

Impacts due to construction activities for the rectification of underground pipeline defects

In the regular operation of the gas pipeline, no impacts on the soil are expected. In the regular operation of the gas pipeline (routine check of valves and of control points and cathodic protection, which is carried out by means of detection sensors), no impact on the soil is expected. In case of leakage or damage to an underground part of the pipeline, construction works will be performed for repair or replacement of the damaged part of the pipeline. In such case, the construction activities are the same as the construction activities in the construction phase, with the **same significance**.

SUMMARY OF THE SOIL IMPACTS	
CONSTRUCTION PHASE	○ *Change in the soil quality as a result of the presence (emission) of pollutants that could undermine the soil quality* – **low or moderate** significance. ○ *Soil erosion due to vegetation removal* - **low or moderate** significance. ○ *Loss of fertile topsoil* – **moderate or high** significance. ○ *Landslides due to excavations*–**insignificant or low** significance.
OPERATIONAL PHASE	○ *In the regular operation of the gas pipeline, no impacts on the soil are expected. In case of defects on the underground part of the gas pipeline, the construction activities will be the same as the construction activities in the construction phase, with the* ***same significance.***

6.3 Impacts on the groundwater

When the route is in a side cut or a cut, it results in an interception of the course of the groundwater. In such case, when the amount of groundwater is greater than the ground, with the rise of groundwater, the disturbance of the groundwater regime affects the surrounding land.

Digging a gas pipeline usually does not exceed a depth of 2.0 meters. In the project area, groundwater higher than 2.0 meters can appear at several locations. During the construction, groundwater is expected to appear at the locations near the intersection of the gas pipeline with the rivers listed in Table 6-16. In addition to these locations near the rivers, groundwater is also expected at the locations listed in Table 6-17, which are obtained based on the construction of geotechnical exploratory boreholes and wells.

Tables 6-16 and 6-17 define the sensitivity of the groundwater locations estimated based on the hydro-geological characteristics of the area. These characteristics are given on the map presented in Appendix 4.

Table 6-16: Sensitivity of the groundwater locations near the crossings of the gas pipeline with the rivers

Location with groundwater	Chainage (km+m)	Sensitivity
Vardar River	8+400	high
Suva River	9+000	medium
Kovanska River	14+700	high
Murlat River	15+900	low
Zuica River	18+700	low
Gabeska River	28+650	low
Stara River (Petruska)	29+950	high
Drenska River	41+030	low
Drenska River	48+000	low
Bosava River	53+000	medium
Przdevska River	59+500	medium
Disanska River	64+550	medium

In addition to these locations near the rivers, groundwater is also expected at the following locations:

Table 6-17: Sensitivity of the groundwater locations near exploratory boreholes and wells

Exploratory boreholes and wells	Chainage (km+m)	Sensitivity
Location	5+410	medium
Location	5+745	medium
Location	7+088	medium
Location	8+480	high
Location	8+697	high
Location	9+065	medium
Location	9+105	medium
Location	9+638	medium
Location	47+352	low
Location	52+174	low
Location	52+223	low

Potential impacts on the groundwater during the **construction phase** of the gas pipeline are:

- *Change in the groundwater flow pattern,*
- *Change in the groundwater quality as a result of pollution with pollutants*

The potential impacts on the groundwater during the **operational phase** are:

- *Impacts due to construction activities for the rectification of underground pipeline defects (identical to the ones in the construction phase)*

Construction phase

Change in the groundwater flow pattern

The hydrological regime of groundwater can be modified due to the compaction of the soil layers when using heavy construction machinery, which will increase the area of the layers with poor porosity, which will directly affect the groundwater regime.

For the purposes of reinforcement, i.e. increase of the stability of the pipeline in areas where there the level of the groundwater is high and when crossing rivers, the pipe is anchored with anchor blocks, sandbags, piled stones, etc. All this is a barrier to the natural course of groundwater.

Physical obstruction of the groundwater course may occur when the pipeline is constructed in an embankment. In such case, these waters may be retained in the surrounding terrain and result in excessive wetting of the area. If drainage is performed with surface pumps, in case of prolonged drainage, effects on the hydrology of the area may occur.

Table 6-18: Impact assessment – Change in the groundwater flow pattern

Criteria	Assessment Thresholds	
	Threshold	Description
Characterization of Impact	Negative	The change in the groundwater flow pattern may have a negative impact on the supply of water from a river and from wells.
Type of impact	Direct	The change in the groundwater flow pattern is a result of the construction activities.
Reversibility	Irreversible	The barrier effect is permanent.
Geographic extent	Local	The impact will be limited locally, in the immediate vicinity of the construction sites.
Time when the impact occurs	Immediately	The impact occurs immediately after the completion of the construction at the respective site.
Duration	Long-term	The change in the groundwater flow pattern as a result of the construction of the gas pipeline is permanent.
Likelihood of occurrence	Likely	The groundwater structural elements are expected to be built at locations where water is very close to the surface, so these elements are likely to affect the groundwater regimes.
Magnitude	Moderate	The magnitude is evaluated as moderate.

Table 6-19: Significance of the impact on the groundwater locations near the crossings of the gas pipeline with the rivers – Change in the groundwater flow pattern

Location with groundwater	Chainage (km+m)	Sensitivity	Significance
Vardar River	8+400	high	moderate or high
Suva River	9+000	medium	moderate
Kovanska River	14+700	high	moderate or high
Murlat River	15+900	low	low
Zuica River	18+700	low	low
Gabeska River	28+650	low	low
Stara River (Petruska)	29+950	high	moderate or high
Drenska River	41+030	low	low
Drenska River	48+000	low	low
Bosava River	53+000	medium	moderate
Przdevska River	59+500	medium	moderate
Disanska River	64+550	medium	moderate

Table 6-20: Significance of the impact on the groundwater locations near exploratory boreholes and wells – Change in the groundwater flow pattern

Exploratory boreholes and wells	Chainage (km+m)	Sensitivity	Significance
Location	*5+410*	*medium*	*moderate*
Location	*5+745*	*medium*	*moderate*
Location	*7+088*	*medium*	*moderate*
Location	*8+480*	*high*	*moderate or high*
Location	*8+697*	*high*	*moderate or high*
Location	*9+065*	*medium*	*moderate*
Location	*9+105*	*medium*	*moderate*
Location	*9+638*	*medium*	*moderate*
Location	*47+352*	*low*	*low*
Location	*52+174*	*low*	*low*
Location	*52+223*	*low*	*low*

Taking into consideration the above-defined levels of sensitivity at the locations where groundwater is expected to appear and the moderate magnitude, the significance of the impact - *Change in the groundwater flow pattern* **is moderate or high.**

Change in the groundwater quality as a result of pollution with pollutants

Improper waste management, especially hazardous waste, can cause soil and groundwater pollution. During the construction of the gas pipeline, there is a danger of accidental leakage of oil or fuel from the vehicles and the machinery used in the construction of the gas pipeline.

The pollution of the aquifer comes as a result of the penetration of pollutants that will appear on the surface (spillage of oil, fuel, etc.) through the soil structures. This pollution depends on the time of vertical travel of the pollutants until the infiltration in the groundwater. The vertical travel time depends primarily on the thickness and permeability of the sediments.

Table 6-21: Impact assessment - Change in the groundwater quality as a result of pollution with pollutants

Criteria	Assessment Thresholds	
	Threshold	Description
Characterization of Impact	*Negative*	*Not desirable*
Type of impact	*Indirect*	*The pollution of the groundwater will follow a previous pollution of the soil.*
Reversibility	*Reversible*	*If the pollution is detected in time and the contaminated soil layer is removed, then the impact is reversible.*
Geographic extent	*Local*	*The impact will be limited locally, in the immediate vicinity of the construction sites.*
Time when the impact occurs	*Delayed*	*The pollution of the groundwater will occur after pollution of the soil.*

Criteria	Assessment Thresholds	
	Threshold	Description
Duration	Medium-term	The self-purification of the groundwater can last a long period of time even after the source of the pollution has been removed, which, if not removed, will have a long-term impact.
Likelihood of occurrence	Unlikely	The pollution of the groundwater is unlikely because of the low likelihood of occurrence of an accident with leakage of large quantities of pollutants.
Magnitude	Moderate	The magnitude is evaluated as moderate.

Table 6-22: Significance of the impact on the groundwater locations near the crossings of the gas pipeline with the rivers – Change in the groundwater quality as a result of pollution with pollutants

Location with groundwater	Chainage (km+m)	Sensitivity	Significance
Vardar River	8+400	high	moderate or high
Suva River	9+000	medium	moderate
Kovanska River	14+700	high	moderate or high
Murlat River	15+900	low	low
Zuica River	18+700	low	low
Gabeska River	28+650	low	low
Stara River (Petruska)	29+950	high	moderate or high
Drenska River	41+030	low	low
Drenska River	48+000	low	low
Bosava River	53+000	medium	moderate
Przdevska River	59+500	medium	moderate
Disanska River	64+550	medium	moderate

Table 6-23: Significance of the impact on the groundwater locations near exploratory boreholes and wells – Change in the groundwater quality as a result of pollution with pollutants

Exploratory boreholes and wells	Chainage (km+m)	Sensitivity	Significance
Location	5+410	medium	moderate
Location	5+745	medium	moderate
Location	7+088	medium	moderate
Location	8+480	high	moderate or high
Location	8+697	high	moderate or high
Location	9+065	medium	moderate
Location	9+105	medium	moderate
Location	9+638	medium	moderate
Location	47+352	low	low
Location	52+174	low	low
Location	52+223	low	low

Taking into consideration the above-defined levels of sensitivity at the locations where occurrence of underground water is expected and the moderate magnitude, the significance of the impact - Change *in the groundwater quality as a result of pollution with pollutants* **is moderate or high**.

Operational phase

Impacts due to construction activities for the rectification of underground pipeline defects (identical to the ones in the construction phase)

In the regular operation of the gas pipeline, no impacts on the groundwater are expected. In the regular operation of the gas pipeline (routine check of valves and of control points and cathodic protection, which is carried out by means of detection sensors), no impact on the groundwater is expected. In case of leakage or damage to an underground part of the pipeline, construction works will be performed for repair or replacement of the damaged part of the pipeline. In such case, the construction activities are the same as the activities in the construction phase. If defects occur in the locations with high groundwater, the impacts will be identical as the ones in the construction phase, with the **same significance**.

SUMMARY OF THE SOIL IMPACTS ON GROUNDWATER	
CONSTRUCTION PHASE	○ *Change in the groundwater flow pattern -* ***moderate or high*** *significance.* ○ *Change in the groundwater quality as a result of pollution with pollutants -* ***moderate or high*** *significance.*
OPERATIONAL PHASE	○ *In the regular operation of the gas pipeline, no impacts on the groundwater are expected. If defects occur in the sensitive locations with high groundwater, the impacts will be identical as the ones in the construction phase, with the* ***same significance****.*

6.4 Impacts on the surface water

When performing the activities of digging and laying the piping system in locations that are in immediate vicinity to water streams, short-term temporary contamination of the water can occur with soil and solid particles that will cause water turbidity. In addition, increased turbidity of the water may also occur during horizontal drilling under the riverbeds, as a result of the drilling, due to the presence of suspended solids.

The construction of the gas pipeline will cause destruction of the soil and the rocks into smaller fractions, which will accumulate on the slopes, i.e. near the riverbeds. During more intense precipitations, these fractions will enter the riverbeds. The rocks and soil that have been removed or decomposed during the construction of the gas pipeline will lead to an increase in the amount of suspended solid particles in the water bodies.

The amount of water required during the construction works (concreting, spraying in dry periods in order to reduce the amount of dust, etc.) is not expected to significantly have an effect of reduction of available water for irrigation and other needs in the area. This water will be delivered to the construction sites with tank trucks.

When testing the gas pipeline in terms of performance quality (in order to detect any potential leaks) it will be necessary to provide significant amounts of water. The water that will be used to test the gas pipeline before it is put into operation could potentially be taken from the reservoirs located near the route of the gas pipeline.

Due to the configuration of the terrain, the testing of the gas pipeline with water under high pressure will be performed segmentally, i.e. parts of the gas pipeline pipe will be examined in segments. The water that will be used for the examination of one segment, after the completion of the examination of that segment, will be used for the examination of the next segment, etc. In the end, the discharge of this test water used for examination will be done in specially constructed tanks (coated with impermeable polyethylene foil) where it will be treated. After the treatment, the water will be discharged on the basis of an approval issued by the MoEPP.

The discharge of wastewater will be done in the recipient nearest to the gas pipeline, based on an approval issued by the MoEPP.

Table 6-24 Criteria for sensitivity of the surface water bodies

Sensitivity	Criteria
Very High	*Large natural rivers with unlimited retention capacity and constant flow*
High	*Natural rivers with unlimited retention capacity and constant natural flow*
Medium	*Small natural rivers with unlimited retention capacity and constant flow*
Low	*Small natural rivers with unlimited retention capacity and intermittent flow*
Negligible	*Artificial water channels without any retention capacity*

Based on the sensitivity criteria defined in the above given table, the sensitivity of the surface water bodies is defined in the table below:

Table 6-25: Sensitivity of the surface water bodies

Surface water body	Chainage (km+m)	Sensitivity
Vardar River	*8+400*	*high*
Suva River	*9+000*	*low*
Kovanska River	*14+700*	*low*
Murlat River	*15+900*	*low*
Zuica River	*18+700*	*low*
Gabeska River	*28+650*	*low*
Stara River (Petruska)	*29+950*	*low*
Drenska River	*41+030* *48+000*	*low*
Bosava River	*53+000*	*low*
Przdevska River	*59+500*	*low*
Disanska River	*64+550*	*low*

Potential impacts on the surface water during the construction phase are:

- *Change in the surface water quality as a result of pollution with pollutants;*
- *Change in the riverbed morphology and/or the physical properties of the water;*

The potential impacts on the surface water during the **operational phase** are:

- *Impacts due to construction activities for the rectification of underground pipeline defects (identical to the ones in the construction phase)*

Construction phase

Change in the surface water quality as a result of pollution with pollutants

Causes of surface water pollution can be the following:

- wastewater generated from construction activities;
- municipal wastewater generated as a result of the activities of the construction workers;
- construction waste generated as a result of granular material (sand) and concrete residues;
- municipal waste generated as a result of the activities of the construction workers;
- accidental leaks of oil and fuel and other pollutants (solvents, paints, greases, lubricants) from the construction machinery and the transport vehicles;

Table 6-26: Impact assessment - Change in the surface water quality as a result of pollution with pollutants

Criteria	Assessment Thresholds	
	Threshold	Description
Characterization of Impact	Negative	Not desirable
Type of impact	Direct	Water pollution is created by emissions and polluted effluents as a result of the construction activities.
Reversibility	Reversible	The impact is reversible only during the phase of construction near the surface water zones. However, the water bodies have a self-purification capacity that allows them to return to their natural state.
Geographic extent	Local	The change in the surface water quality is limited to the footprint of the project, and only when crossing over surface water.
Time when the impact occurs	Immediately	The change in the surface water quality is limited to the footprint of the project, and only when crossing over surface water
Duration	Short-term	At each location, the impact will last throughout the duration of the construction activity.
Likelihood of occurrence	Likely	The performance of the construction works generates effluents and emissions into the soil that can reach the surface water bodies.
Magnitude	Moderate	The magnitude is evaluated as moderate.

Table 6-27: Impact assessment - Change in the surface water quality as a result of pollution with pollutants

Surface water body	Chainage (km+m)	Sensitivity	Significance
Vardar River	8+400	high	moderate or high
Suva River	9+000	low	low
Kovanska River	14+700	low	low
Murlat River	15+900	low	low
Zuica River	18+700	low	low
Gabeska River	28+650	low	low
Stara River (Petruska)	29+950	low	low
Drenska River	41+030 48+000	low	low
Bosava River	53+000	low	low
Przdevska River	59+500	low	low
Disanska River	64+550	low	low

Taking into consideration the above-defined levels of sensitivity and the moderate magnitude, the significance of the impact - *Change in the groundwater quality as a result of pollution with pollutants* **is moderate or high**.

Change in the riverbed morphology and/or the physical properties of the water

In the construction phase, at the crossing of the gas pipeline with the river flows, interventions will be made that will cause temporary change of the morphology of the riverbed during the installation (fitting) of the gas pipeline. Thereby, there will be an increase in the sediment as a result of the increased concentration of suspended solids in the water of the water streams, i.e. sedimentation of sludge at the bottom of the water streams in downstream direction. There will also be temporary changes in the surface flow and the hydrological flow regime.

The assessment of the magnitude of this impact on the surface water is made based on the intensity and methods that will be applied when crossing the water streams (described in 3.3.1.1. *Construction of the pipeline*). When crossing smaller water streams, construction activities with lower intensity and simpler methods will be used, while when crossing over the Vardar River, more complex construction activities with higher intensity and more complex methods will be used. Therefore, in terms of the crossing over the Vardar River, a **high** magnitude of this impact is evaluated, while in terms of the crossings over the other rivers, a **low** magnitude of this impact is evaluated.

Table 6-28: Impact assessment – Change in the riverbed morphology and/or the physical properties of the water

Criteria	Assessment Thresholds	
	Threshold	Description
Characterization of Impact	*Negative*	*The impact is negative because the change in the riverbed morphology and excessive particle deposition in water streams can affect the ecology of the river habitat and the biological diversity of the water.*
Type of impact	*Direct*	*With the construction activities during the crossing of the water streams, the morphology of the riverbeds will be changed.*
Reversibility	*Reversible*	*With the completion of the construction activities and the appropriate rehabilitation, the original condition will be restored.*
Geographic extent	*Local*	*The impact will be localized at the crossing point across the rivers.*
Time when the impact occurs	*Immediately*	*The stated influence will occur immediately at the time of the crossing of the water streams.*
Duration	*Short-term*	*With the completion of the construction activities and the appropriate rehabilitation, the original condition will be restored.*
Likelihood of occurrence	*Certain*	*The change in morphology will occur due to the applied construction methodology.*
Magnitude	*High*/Low***	*The magnitude is evaluated as high in terms of the Vardar River, and as low in terms of all other rivers (see text above).*

**High magnitude in terms of the Vardar River.*
***Low magnitude in terms of all other rivers.*

Table 6-29: Significance of the impact – Change in the riverbed morphology and/or the physical properties of the water

Surface water body	Chainage (km+m)	Sensitivity	Magnitude	Significance
Vardar River	*8+400*	*high*	*high*	*high or very high*
Suva River	*9+000*	*low*	*low*	*low*
Kovanska River	*14+700*	*low*	*low*	*low*
Murlat River	*15+900*	*low*	*low*	*low*
Zuica River	*18+700*	*low*	*low*	*low*
Gabeska River	*28+650*	*low*	*low*	*low*
Stara River (Petruska)	*29+950*	*low*	*low*	*low*
Drenska River	*41+030* *48+000*	*low*	*low*	*low*
Bosava River	*53+000*	*low*	*low*	*low*
Przdevska River	*59+500*	*low*	*low*	*low*
Disanska River	*64+550*	*low*	*low*	*low*

Taking into consideration the above-defined levels of sensitivity and magnitudes, the significance of the impact - *Change in the riverbed morphology and/or the physical properties of the water* **is high or very high** in terms of the Vardar River, i.e. **low** in terms of all the other rivers**.**

Operational phase

Impacts due to construction activities for the rectification of underground pipeline defects (identical to the ones in the construction phase)

In the regular operation of the gas pipeline, no impacts on the surface water are expected. In the regular operation of the gas pipeline (routine check of valves and of control points and cathodic protection, which is carried out by means of detection sensors), no impact on the surface water is expected. In case of leakage or damage to an underground part of the pipeline, construction works will be performed for repair or replacement of the damaged part of the pipeline. In such case, the construction activities are the same as the activities in the construction phase. If defects occur in the vicinity of the locations with surface flows, the impacts will be identical as the ones in the construction phase, with the **same significance**.

SUMMARY OF THE SURFACE WATER IMPACTS	
CONSTRUCTION PHASE	○ *Change in the surface water quality as a result of pollution with pollutants -* ***moderate or high*** *significance.* ○ *Change in the riverbed morphology and/or the physical properties of the water* ***- high or very high*** *in terms of the Vardar River, i.e.* ***low*** *in terms of all the other rivers.*
OPERATIONAL PHASE	○ *In the regular operation of the gas pipeline, no impacts on the surface water are expected. If defects occur in the vicinity of the locations with surface flows, the impacts will be identical as the ones in the construction phase, with the* ***same significance****.*

6.5 Impacts on the air

Air pollution is a major health risk for the people associated with the environment. Air pollutants are emitted as a result of human activities.

The population in the vicinity of the gas pipeline is a receptor on which the emissions of pollutants could have a negative impact.

The important areas and their characteristics can be affected by air pollution. When assessing the impact on the air quality, these areas should also be taken into consideration, if their characteristics are sensitive to the pollutants in the air.

Table 6-30 shows the sensitivity of the populated areas to air pollution, and Table 6-31 shows the sensitivity of the important area.

Table 6-30: Sensitivity of the populated areas to air pollution

Populated area	Left/Right of the route	Position from/to	Distance of the populated area from the gas pipeline	No of inhabitants	Sensitivity
Stojakovo	right of the route	from 3+500 km to 5+000 km	62 m	1931	high
Prdejci	right of the route	from 13+000 km to 14+500 km	210 m	514	medium
Smokvica	right of the route	from 21+500 km to 22+500 km	780 m	263	low
Gabrovo	left of the route	from 28+000 km to 28+500 km	275 m	20	medium
Petrovo	left of the route	from 29+500 km to 30+000 km	1213 m	206	negligible
Dren	left of the route	from 48+500 km to 49+500 km	90 m	94	high
Chiflik	left of the route	from 51+500 km to 52+500 km	238 m	90	medium
Demir Kapija	right of the route	from 52+500 km to 54+000 km	673 m	3275	low
Przdevo	left of the route	from 58+500 km to 59+500 km	240 m	235	medium
Tremnik	right of the route	from 61+000 km to 62+500 km	653 m	827	low

Table 6-31: Sensitivity of the important areas to air pollution

Name of the area	Category of protection	Position from/to	Distance of the area from the gas pipeline (km)	Length of pipeline penetration in the area (km)	Left/Right of the route or the route passes through the area	Sensitivity
Demir Kapija	NM, Protected area - MoEPP	from 47+500 km to 52+000 km	1,1		right of the route	insignificant
Studena Glava	NP, Proposed for protection – Spatial Plan of MK	from 39+000 km to 47+500 km		7,1	the route passes through the area	high
Aeolian sands - Vardar	NP, Proposed for protection – North Macedonian Ecological Society (UNDP/GEF)	from 9+000 km to 9+500 km	0,7		right of the route	low
Negorski Banji	NM, Proposed for protection – Spatial Plan of MK	from 9+500 km to 10+500 km	2		left of the route	insignificant
Negorski Banji	Important Plant Area (IPA)	from 9+500 km to 10+500 km	2		left of the route	insignificant
Demir Kapija Canyon	Important Plant Area (IPA)	from 50+500 km to 52+500 km	0,62		right of the route	low
South Vardar	Important Bird Area (IBA)	from 0+000 km to 12+000 km		12	the route passes through the area	high
Demir Kapija Canyon	Important Bird Area (IBA)	from 48+500 km to 51+500 km		3	the route passes through the area	moderate
Tikves region	Important Bird Area (IBA)	from 57+000 km to the end (67+200 km)		10,2	the route passes through the area	high
Negorski Banji	Emerald Area (EA)	from 9+500 km to 10+500 km	2		left of the route	insignificant
Demir Kapija Canyon	Emerald Area (EA)	from 51+500 km to 53+500 km	2,6		right of the route	insignificant

Potential impacts on the air during the **construction phase** of the gas pipeline are:

- *Air pollution as a result of pollutant emissions caused by the construction activities*

Potential impacts on the air during the **operational phase** of the gas pipeline are:

- *Air pollution as a result of pollutant emissions caused by the regular daily work*

Construction phase

Air pollution as a result of pollutant emissions caused by the construction activities

In the construction phase of the gas pipeline, the impacts will be the result of the work of the construction machinery and the movement of the vehicles for transportation of construction materials needed for the construction, the vehicles for disposal of waste materials, the movement of the vehicles for transporting workers and other persons present at the construction sites on a daily basis for monitoring and control, wherein they will result in the occurrence of dust emissions.

Dust will occur as a result of the performance of the earthworks and the activities for the preparation and clearing of the terrain, excavation, trench expansion, levelling and the like. When placing the gas pipeline in a rocky environment, the need for interventions with explosive may arise. According to the previous research and the processing of data from those studies, the section from 43+000 km to 46+300 km can be singled out, where it is possible to carry out blasting in certain parts. These activities will also generate dust and solid particles.

The movement of the vehicles transporting pipes and equipment in the areas of the construction sites is expected to be another source of dust. The frequency and the importance of dust generation will depend on the meteorological and soil conditions at the time and location of the activities.

In the course of the construction, the operation of the construction machinery and equipment (trench excavators, bulldozers and excavators, trucks, tank truck and diesel engines) and of the means of transport results in emissions of exhaust gases (mainly composed of CO_2, CO, SO_X, NO_X, NMVOC, TSP). Generally low concentrations of these pollutants are expected, but when the machinery is working, or in situations where the engine is not operating in the prescribed manner (due to poor maintenance of the construction machinery), potentially harmful pollutants may be released.

In addition to these air emissions, in the construction phase, to a smaller extent, there will be emissions due to welding, waterproofing fumes, fumes from paint coatings and anticorrosion protection products, as well as the release of natural gas into the atmosphere in order to regulate and put into operation the technical-technological equipment.

Namely, after the completion of all construction works and the implementation of all phases of examination and testing of the gas pipeline, the gas pipeline is initially filled with pressurized gas in order to remove the air from the pipeline. During this initial filling of the gas pipeline and activation of the safety discharge valves and the check of the functionality of the automatic safety elements of the gas pipeline, controlled gas discharge (leakage) in the atmosphere is performed.

Table 6-32: Assessment of the impact - Air pollution as a result of pollutant emissions caused by the construction activities

Criteria	Assessment Thresholds	
	Threshold	**Description**
Characterization of Impact	Negative	The deterioration of the air quality has a negative impact on the health of the workers and the surrounding population.
Type of impact	Direct	Air pollution is a direct result of the emission of dust during the performance of the construction activities and the exhaust gases from the construction machinery and vehicles.
Reversibility	Reversible	The pollution will stop when the construction activities stop.
Geographic extent	Local	The impact will be limited locally, in the immediate vicinity of the construction sites.
Time when the impact occurs	Immediately	Dust and exhaust gases occur immediately at the start of the works.
Duration	Short-term	The air pollution will stop with the completion of the construction activities.
Likelihood of occurrence	Certain	The dust and the exhaust gases cannot be avoided during the performance of the construction activities.
Magnitude	Low	The magnitude is evaluated as low.

Table 6-33: Significance of the impact in populated areas - Air pollution as a result of pollutant emissions caused by the construction activities

Populated area	***No of inhabitants***	**Left/Right of the route**	**Position from/to**	**Distance of the area from the gas pipeline**	***Sensitivity***	***Significance of the impact***
Stojakovo	*1931*	*right of the route*	*from 3+500 km to 5+000 km*	*62 m*	*high*	*low or moderate*
Prdejci	*514*	*right of the route*	*from 13+000 km to 14+500 km*	*210 m*	*medium*	*low or moderate*
Smokvica	*263*	*right of the route*	*from 21+500 km to 22+500 km*	*780 m*	*low*	*insignificant or low*
Gabrovo	*20*	*left of the route*	*from 28+000 km to 28+500 km*	*275 m*	*medium*	*low or moderate*
Petrovo	*206*	*left of the route*	*from 29+500 km to 30+000 km*	*1213 m*	*negligible*	*insignificant or low*
Dren	*94*	*left of the route*	*from 48+500 km to 49+500 km*	*90 m*	*high*	*low or moderate*
Chiflik	*90*	*left of the route*	*from 51+500 km to 52+500 km*	*238 m*	*medium*	*low or moderate*
Demir Kapija	*3275*	*right of the route*	*from 52+500 km to 54+000 km*	*673 m*	*low*	*insignificant or low*
Przdevo	*235*	*left of the route*	*from 58+500 km to 59+500 km*	*240 m*	*medium*	*low or moderate*
Tremnik	*827*	*right of the route*	*from 61+000 km to 62+500 km*	*653 m*	*low*	*insignificant or low*

Table 6-34: Significance of the impact in important areas - Air pollution as a result of pollutant emissions caused by the construction activities

Name of the area	Category of protection	Position from/to	Distance of the area from the gas pipeline (km)	Length of pipeline penetration in the area (km)	Left/Right of the route or the route passes through the area	Sensitivity	Significance of the impact
Demir Kapija	NM, Protected area - MoEPP	from 47+500 km to 52+000 km	1,1		right of the route	insignificant	insignificant or low
Studena Glava	NP, Proposed for protection – Spatial Plan of MK	from 39+000 km to 47+500 km		7,1	the route passes through the area	high	low or moderate
Aeolian sands - Vardar	NP, Proposed for protection – North Macedonian Ecological Society (UNDP/GEF)	from 9+000 km to 9+500 km	0,7		right of the route	low	insignificant or low
Negorski Banji	NM, Proposed for protection – Spatial Plan of MK	from 9+500 km to 10+500 km	2		left of the route	insignificant	insignificant or low
Negorski Banji	Important Plant Area (IPA)	from 9+500 km to 10+500 km	2		left of the route	insignificant	insignificant or low
Demir Kapija Canyon	Important Plant Area (IPA)	from 50+500 km to 52+500 km	0,62		right of the route	low	insignificant or low
South Vardar	Important Bird Area (IBA)	from 0+000 km to 12+000 km		12	the route passes through the area	high	low or moderate
Demir Kapija Canyon	Important Bird Area (IBA)	from 48+500 km to 51+500 km		3	the route passes through the area	medium	low or moderate
Tikves region	Important Bird Area (IBA)	from 57+000 km to the end (67+200 km)		10,2	the route passes through the area	high	low or moderate
Negorski Banji	Emerald Area (EA)	from 9+500 km to 10+500 km	2		left of the route	insignificant	insignificant or low
Demir Kapija Canyon	Emerald Area (EA)	from 51+500 km to 53+500 km	2,6		right of the route	insignificant	insignificant or low

Taking into consideration the above-defined levels of sensitivity and the low magnitude, the significance of the impact - *Air pollution as a result of pollutant emissions caused by the construction activities* **is low or moderate**.

Operational phase

Air pollution as a result of pollutant emissions caused by the regular daily work

During the operation of the gas pipeline, damage to the airtightness (impermeability) of the gas pipeline is possible, as a result of which the part where the damage occurs should be emptied of gas. In this case, at the block stations, there is a basic valve with a bypass and a discharge pipe. The height of this discharge pipe is at least 3 meters and through it the gas is released into the atmosphere, as a result of which the damaged part of the pipeline is emptied. Such discharges are very rare in practice (in cases of a defect). Such cases are not part of the regular operation of the gas pipeline and can be categorized as accident cases. In such a case, during the intervention for the rectification of defects on the underground facilities, the same impacts that are characteristic for the construction phase (occurrence of dust from excavations, exhaust gases from machinery and vehicles, cutting, welding, etc.) will occur, with the same **significance**.

SUMMARY OF THE IMPACTS ON THE AIR	
CONSTRUCTION PHASE	○ *Air pollution as a result of pollutant emissions caused by the construction activities -* ***low or moderate*** *significance.*
OPERATIONAL PHASE	○ *In the regular operation of the gas pipeline, no impacts on the air are expected. In case of defects on the underground part of the gas pipeline, the construction activities and the impacts will be identical as in the construction phase, with the same* ***significance****.*

6.6 Impact of climate change

When considering the impact of the project on climate change, not only the impact of the project on climate change is analysed, but also the impact of climate change on the project, i.e. its elasticity or climate resilience is also considered.

Climate resilience refers to the capacity of the system or its components to cope with a dangerous event or trend by responding in manners that maintain its basic function, identity and structure, while at the same time maintaining the capacity for adaptation, learning and transformation.

The climate resilience of a system consists of *robustness, capability* and *renewal*.

- *Robustness:* the ability of a system to withstand extreme weather events, as well as gradual changes (e.g. sea level rise) and to continue to operate;
- *Capability:* it is the ability to effectively manage the operations during extreme weather events;
- *Renewal:* the ability to renew the operations to the desired level of performance once a disruption has occurred.

Multiple natural events can affect a system and it depends on its purpose, functionality, location (where it is located), and so on. In this project, the following natural events could be relevant:

1. windstorms;
2. extremely low temperatures (snow and ice);
3. extreme precipitation and landslides;
4. floods;
5. extremely high temperatures (heat waves);
6. fires;
7. lightning strikes.

1. Given that the gas pipeline is for the most part an underground facility (except for the block stations, which are fenced - Figure 6-1), the impact of the windstorms is not expected to have a significant effect on the gas pipeline. An impact from falling trees is not expected because within the buffer zone of the gas pipeline, regular vegetation removal will be performed, especially tall vegetation.

Figure 6-1: Appearance of a surface block station facility (BS)

2. Given that the gas pipeline is for the most part an underground facility dug into a sufficient depth of 2.0 m, the external low temperature and the presence of snow and ice will not affect the gas pipeline. The steel pipes from which the pipeline is made are resistant to low temperatures.
3. When designing the route of the gas pipeline, and especially during the construction, special attention is paid to the stability of the gas pipeline so that it would not be disturbed in case of landslides.
4. Most of the gas pipeline route passes through areas that are not subject to flooding. In parts where the likelihood of flooding is the highest (where the pipeline intersects with rivers), the construction is done with a reinforced structure by anchoring the pipeline in order to prevent its "floating".
5. In conditions of extremely high temperatures and heat waves, the operation of the gas pipeline will be stable since for the most part it is underground. Only the block stations will be exposed to

high temperatures and possibility of increasing the pressure, but the elimination of the increased pressure will be done through the automatic safety valves with which the gas pipeline is equipped.

6. In the case of the underground gas pipelines, the danger of spreading of fire that started in the vicinity of the gas pipeline is present only in the aboveground parts. Therefore, these parts are fenced and are regularly cleared of vegetation.

7. As a protection against lightning strikes, the gas pipeline is protected by a lightning protections system.

During the implementation of the project, the project is expected to have impacts on climate change in the construction phase and in the operational phase of the gas pipeline. These impacts mainly affect the local microclimate, as a result of the operation of the construction machinery and equipment and the global climate, as a result of greenhouse gas emissions arising from the operation of the construction machinery and equipment and the increase in greenhouse gases due to the biomass loss when clearing the route of the gas pipeline. The global climate will also be impacted by the emission of greenhouse gases (natural gas leakage) during the regular operation of the gas pipeline. Given that the natural gas is usually composed of the greenhouse gas methane CH_4 (about 97%), the emission of this gas has a direct impact on the global climate, i.e. climate change.

Potential impacts on climate changes during the **construction phase** of the gas pipeline are:

- *Impact on the local microclimate*
- *Greenhouse gas emission from the work of construction machinery, equipment and transport vehicles*
- *Increase in the greenhouse gases from biomass loss*

Potential impacts on climate changes during the **operational phase** of the gas pipeline are:

- *Greenhouse gas emission from the regular operation of the gas pipeline*

Construction phase

Impact on the local microclimate

In the construction phase, the heat generated from the work of the internal combustion engines, construction machines, mobile diesel aggregates, welding equipment and other rotating equipment, has a little impact on the space at the local level.

Table 6-35: Impact assessment – Impact on the local microclimate

Criteria	***Assessment Thresholds***	
	Threshold	***Description***
Categorization of Impact	*Negative*	*Not desirable.*
Type of impact	*Direct*	*The impact on the local microclimate is a direct result of the construction activities.*
Reversibility	*Reversible*	*The impact on the local microclimate will cease when the construction activities cease.*
Geographic extent	*Local*	*The change in the local microclimate is limited to the area of performance of construction works*

Criteria	Assessment Thresholds	
	Threshold	*Description*
Time when the impact occurs	*Immediately*	*The impact on the local microclimate occurs immediately as a result of the work of the machines, vehicles and equipment.*
Duration	*Short-term*	*It will last during the performance of the construction works.*
Likelihood of occurrence	*Certain*	*The performance of the construction works will certainly have an impact on the local microclimate.*
Magnitude	*Negligible*	*Very little change in the local microclimate, which ceases after the completion of the construction activities.*

The assessment of the significance is based on the matrix given above in the chapter on methodology (Table 6-5). The significance of the impact *Impact on the local microclimate* is **insignificant or low**.

Greenhouse gas emission from the work of construction machinery, equipment and transport vehicles

In the construction phase, as a result of the work of the construction and transport machinery, emission of greenhouse gases will occur – mainly carbon dioxide CO_2, while the other gases - nitrogen oxide (N_2O), perfluorocarbons (PFC), chlorofluorocarbons (CFC) and sulphur hexafluoride (SF_6) are significantly less present.

The greenhouse gas emission from the work of engines of construction machinery and equipment and transport trucks (stated in Table 3-1) is calculated on the basis of the amount and type of fuel that will be consumed during the construction of the gas pipeline and the use of emission factors for each of the greenhouse gases. To determine the amount of consumed fuels, the number of construction machines, equipment and transport trucks that will be engaged in the construction phase and the number of effective working hours is required. These calculations cannot be made at the moment due to the lack of these data.

Increase in greenhouse gases from biomass loss

In the construction phase, when the vegetation is removed from gas pipeline route in the width of 12.5 meters to the left and right of the pipeline axis, biomass will be lost. It will cause increase in the greenhouse gases, mainly CO_2. The methodology defined in 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Agriculture, Forestry and Other Land Use was used to calculate this amount of CO_2.

According to that methodology, the amount of CO_2 is calculated with the formulas given below.

$$C = A \times K$$

where:

C – amount of bound carbon in the cut biomass in unit of measurement in kilotons [kt]
A – activity rate – area of effective biomass loss in unit of measurement in hectares [ha]
K – coefficient of carbon content in biomass [kt/ha]

The value for A is obtained on the basis of a table of biomass areas, wherein the vegetation with significant biomass was taken (forest areas). The area of effective biomass loss [ha] is a forest area which depends on the quality of the forests (strongly developed or degraded forests). They are given in the following table:

Table 6-36: Area of effective biomass loss

Forests	Area of effective biomass loss [ha]
Pseudomaquis	*27,04*
Degraded pseudomaquis	*4,76*
Downy oak and hornbeam forest	*22,48*
Degraded downy oak and hornbeam forest	*4,04*
Riparian zone and alder forest	*0,86*
Plane-tree and willow-covered riparian zone	*0,56*
Total	***59,73***

The amount of the greenhouse gas CO_2 is obtained with the use of a conversion factor which for CO_2 is 44/12. According to the calculations, the obtained amount of CO_2 is 49,2 t.

Table 6-37: Impact assessment – Increase in the greenhouse gases from biomass loss

Criteria	Assessment Thresholds	
	Threshold	Description
Categorization of Impact	*Negative*	*Not desirable.*
Type of impact	*Indirect*	*The biomass is destroyed and as a result there is a less binding of CO_2*
Reversibility	*Irreversible*	*The biomass is permanently destroyed.*
Geographic extent	*Local*	*The impact will be limited to local level along the strip of the route.*
Time when the impact occurs	*Immediately*	*The biomass is destroyed during the clearance of the route.*
Duration	*Mid-term*	*It takes time for the biomass to naturally recover.*
Likelihood of occurrence	*Certain*	*The clearance of the route will certainly lead to destruction of the biomass and thus to an increase of the greenhouse gases.*
Magnitude	*Negligible*	*The magnitude is evaluated as negligible (see quantities above).*

The assessment of the significance is based on the matrix given above in the chapter on methodology (Table 6-5). The significance of the impact *Increase in greenhouse gases from biomass loss* is **insignificant or low**.

Operational phase

Greenhouse gas emission from the regular operation of the gas pipeline

In the operational phase, during the transport of the natural gas, there will be fugitive emission as a result of discharge through the safety and exhaust valves, and also as a result of situations of gas leakage due to disruption of the pipeline impermeability.

In accordance with the Feasibility Study, for the calculation of greenhouse gas emissions, values of 1.5 bcm (billion cubic meters) or $1,5x10^9$ cubic meters of natural gas were taken for the needs of the

Republic of Northern Macedonia, which are expected to be reached in the next 10 years. The emission of greenhouse gases CH_4 and CO_2 is calculated in accordance with the IPCC Guidelines for National Greenhouse Gas Inventories 2006, using emission factors for fugitive emissions for developing countries and countries with economies in transition. Accordingly, values were obtained for annual CH_4 emissions of 949.5 t / year and CO_2 of 4.03 t / year, or 23.74 kt CO_{2eq} / year.

Table 6-38: Impact assessment - Greenhouse gas emission from the regular operation of the gas pipeline

Criteria	Assessment Thresholds	
	Threshold	Description
Categorization of Impact	Negative	Not desirable.
Type of impact	Direct	The greenhouse gases are discharged directly as a result of the gas pipeline operation.
Reversibility	Reversible	The impact on the climate will cease when the work on the gas pipeline ceases.
Geographic extent	Local	The impact will be limited on local level in the vicinity of the gas pipeline.
Time when the impact occurs	Immediately	With the start of the operation of the gas pipeline the greenhouse gas emission will start as well.
Duration	Long-term	The impact will last during the entire life cycle of the gas pipeline.
Likelihood of occurrence	Certain	The start of the operation of the gas pipeline will certainly result in greenhouse gas emission.
Magnitude	Low	The magnitude is evaluated as low (see quantities above).

The assessment of the significance is based on the matrix given above in the chapter on methodology (Table 6-5). The significance of the impact *Greenhouse gas emission from the regular operation of the gas pipeline* is **low**.

SUMMARY OF THE IMPACTS ON CLIMATE CHANGES	
CONSTRUCTION PHASE	○ *Impact on the local microclimate - **insignificant or low** significance.* ○ *Greenhouse gas emission from the work of construction machinery, equipment and transport vehicles – **no data.*** ○ *Increase in the greenhouse gases from biomass loss – **insignificant or low** significance.*
OPERATIONAL PHASE	○ *Greenhouse gas emission from the regular operation of the gas pipeline – **low** significance*

6.7 Impacts caused by waste generation

During the project implementation, waste will be generated in the construction phase and in the operational phase. In accordance with the legal regulation, the Contractor of the construction works or the Investor (in the construction phase) and the gas pipeline Operator (in the operational phase) will be responsible for the management of this generated waste.

Waste will be generated along the entire length of the project execution and the sensitivity along the route will be low. In this regard, special attention is paid to the important areas in which the gas pipeline route penetrates and the sensitivity of these areas is indicated in the following table:

Table 6-39: Sensitivity of the important areas in which the gas pipeline penetrates in terms of generating waste

Name of the area	Category of protection	Position from/to	Length of pipeline penetration in the area (km)	Left/Right of the route or the route passes through the area	Sensitivity
Studena Glava	*NP, Proposed for protection – Spatial Plan of MK*	*from 39+000 km to 47+500 km*	*7,1*	*the route passes through the area*	*high*
South Vardar	*Important Bird Area (IBA)*	*from 0+000 km to 12+000 km*	*12*	*the route passes through the area*	*high*
Demir Kapija Canyon	*Important Bird Area (IBA)*	*from 48+500 km to 51+500 km*	*3*	*the route passes through the area*	*medium*
Tikves region	*Important Bird Area (IBA)*	*from 57+000 km to the end (67+200 km)*	*10,2*	*the route passes through the area*	*high*

Potential impacts from waste generation during the **construction phase** of the gas pipeline are:

- *Waste generation from the construction phase*

Potential impacts from waste generation during the **operational phase** of the gas pipeline are:

- *Waste generation during the regular operation of the gas pipeline*

Construction phase

Waste generation from the construction phase

During the construction of the gas pipeline, the generated waste will come from the construction activities and construction machines. Primary forms of solid waste that will be generated during the construction phase will be the following:

- Excess of excavated soil and sand;
- Waste from packaging;
- Construction debris and construction waste;
- Remains from steel pipes;
- Waste parts from the construction machinery and equipment in case of small interventions and repairs.

Most of the soil from the excavations during the construction will be put back in the trenches. The excess will be transported with trucks away from the location to the nearest landfill or it will be distributed on agricultural land (potentially it can be used for remediation of existing landfills, remediation of excavation slopes when constructing the gas pipeline in rocky terrain etc.) The excess soil and construction waste from the construction (e.g. concrete) are inert materials. The inadequate disposal of such materials can only have negative aesthetic effects on the location where the disposal was made. The Law on Waste Management stipulates that these types of waste should be disposed of at locations designated by the local authorities to minimise the negative effects on the landscape and the visual effects of the inert waste.

The maintenance of the construction machinery and other vehicles, as well as their servicing will not be performed within the construction zones. Due to these reasons, waste generation typical for this type of activity (used tires, batteries and oils from vehicles, etc.) is not expected. Nevertheless, if such waste occurs, it will be handed over to licensed waste management operators.

During the construction of the gas pipeline, the following types of waste are expected to be generated in accordance with the List of Waste:

Group 15 – Waste Packaging

15 01	Waste from packaging made of paper and cardboard, plastics, wood, metal, composite packaging, glass, etc.;
15 01 10[19]	Packaging containing residues of or contaminated by hazardous substances.

Group 17 – Construction and demolition waste

17 03	Waste from bituminous mixtures, coal tar and tarred products [19];
17 04	Waste from metals;
17 05	Waste from excavated soil;
17 06 04	Insulation materials (not containing asbestos and dangerous substances);
17 09 04	Other construction waste (mixed waste).

Group 20 - Municipal waste (+ similar industrial waste), including fractions of selected waste

20 01	Separately collected fractions (solvents, paints, adhesives, etc.)[19];
20 02 01	Biodegradable waste;
20 03 01	Mixed municipal waste;
20 03 07	Bulky waste.

[19] Categorized as dangerous waste

Table 6-40: Impact assessment – Waste generation from the construction phase

Criteria	Assessment Thresholds	
	Threshold	Description
Categorization of Impact	Negative	Not desirable.
Type of impact	Direct	The waste will be generated during the performance of the construction activities.
Reversibility	Reversible	By applying a proper waste management system, the generated waste can be used, recycled, etc.
Geographic extent	Local	The impact will be limited on local level in the vicinity of the construction sites.
Time when the impact occurs	Immediately	The waste starts to generate immediately at the moment of commencement of the work.
Duration	Short-term	The impact will last for the same period as the construction activities.
Likelihood of occurrence	Certain	The waste cannot be avoided during the performance of the construction activities.
Magnitude	Low	The magnitude is evaluated as low.

Table 6-41: Impact significance – Waste generation from the construction phase

Name of the area	Category of protection	Position from/to	Length of pipeline penetration in the area (km)	Sensitivity	Significance
Studena Glava	NP, Proposed for protection – Spatial Plan of MK	from 39+000 km to 47+500 km	7,1	high	low or medium
South Vardar	Important Bird Area (IBA)	from 0+000 km to 12+000 km	12	high	low or medium
Demir Kapija Canyon	Important Bird Area (IBA)	from 48+500 km to 51+500 km	3	medium	low or medium
Tikves region	Important Bird Area (IBA)	from 57+000 km to the end (67+200 km)	10,2	high	low or medium

Taking into account the above stated sensitivities and low magnitude, the significance of the impact *Waste generation from the construction phase* is **low or medium**.

Operational phase

Waste generation during the regular operation of the gas pipeline

During the regular operation, the following waste is expected to be generated:

- Biodegradable waste from the maintenance of the route;
- Waste spare parts and waste from coatings and paints in the course of the maintenance of above ground and underground facilities;
- Waste generated in the event of a defect of the underground pipeline (similar to the waste in the construction phase). In the event of leakage or damage to the underground part of the pipeline, construction works will be performed to repair or replace the damaged part of the

pipeline. In such case, the construction activities are the same as the activities during the construction phase.

Table 6-42: Impact assessment - Waste generation during the regular operation of the gas pipeline

Criteria	Assessment Thresholds	
	Threshold	Description
Categorization of Impact	*Negative*	*Not desirable.*
Type of impact	*Direct*	*The waste will be generated during the performance of the activities for maintenance of the gas pipeline.*
Reversibility	*Reversible*	*By applying a proper waste management system, the generated waste can be used, recycled, etc.*
Geographic extent	*Local*	*The impact will be limited on local level in the vicinity of the gas pipeline route.*
Time when the impact occurs	*Immediately*	*The waste starts to generate immediately at the moment of commencement of the maintenance.*
Duration	*Long-term*	*The impact extends throughout the project operation.*
Likelihood of occurrence	*Certain*	*The waste cannot be avoided during the performance of the maintenance activities.*
Magnitude	*Negligible*	*The magnitude is evaluated as negligible.*

Table 6-43: Impact significance - Waste generation during the regular operation of the gas pipeline

Name of the area	Category of protection	Position from/to	Length of pipeline penetration in the area (km)	Sensitivity	Significance
Studena Glava	*NP, Proposed for protection – Spatial Plan of MK*	*from 39+000 km to 47+500 km*	*7,1*	*high*	*low*
South Vardar	*Important Bird Area (IBA)*	*from 0+000 km to 12+000 km*	*12*	*high*	*low*
Demir Kapija Canyon	*Important Bird Area (IBA)*	*from 48+500 km to 51+500 km*	*3*	*medium*	*insignificant or low*
Tikves region	*Important Bird Area (IBA)*	*from 57+000 km to the end (67+200 km)*	*10,2*	*high*	*low*

Taking into account the above stated sensitivities and negligible magnitude, the significance of the impact *Waste generation during the regular operation of the gas pipeline is* **low**.

SUMMARY OF THE IMPACTS FROM WASTE GENERATION	
CONSTRUCTION PHASE	○ *Waste generation from the construction phase –* ***low or medium*** *significance.*
OPERATIONAL PHASE	○ *Waste generation during the regular operation of the gas pipeline –* **low** significance.

6.8 Impacts caused by noise and vibrations

During the project implementation, noise will occur in the construction phase and in the operational phase.

In the construction phase of the gas pipeline, noise is expected to occur as a result of the work of the construction machinery and equipment and the movement of the transport vehicles. Furthermore, in the construction phase, there may also be a need for blasting in certain sections and consequently a noise can occur as a result of the blasting.

In accordance with the previous researches and processing of the data from those researches, the section 43+000 km to 46+300 km can be singled out, where it may be required to perform blasting in certain spots of this part of the route. There are no populated areas near this section (the nearest populated area is the village of Dren which is 1.5 km away). This part of the route passes through the proposed area for protection Studena Glava and it is near the important bird area Demir Kapija Canyon.

The blasting of rocks is performed in three phases:

- drilling mine holes;
- filling and igniting the mines;
- removing the material excavated by the blast.

The intensity of the noise created from the blasting process depends on the composition of the rock, the type of explosive that will be used, the detonation strength and the topography of the terrain and the surroundings. The type of explosive to be used will be selected by the Contractor of the construction works in accordance with the work conditions and the applied methodology for obtaining loose material that is to be removed. The choice of blasting method that will be performed will influence on the intensity of the noise that will occur in this process.

In the operational phase there will be no noise, except in cases of underground defects in the gas pipeline, for which activities will be undertaken to eliminate the defect, in which case a noise will occur that will be the same as the one in the construction phase.

When assessing the impact of the noise, the following receptors are taken into account: populated areas and important areas. The distance of the populated areas from the gas pipeline is given in Table 6-44, and the distance of the important areas from the gas pipeline is given in Table 6-45. This table also includes the length of gas pipeline penetration in the areas through which it passes.

The sensitivity in terms of the noise in the populated areas near the gas pipeline (given in Table 6-44) is **high**. Furthermore, the sensitivity - in terms of the noise in the important areas near the gas pipeline (natural monument, proposed area for protection, important plant area, important bird area and emerald area, given in Table 6-45), where the impact is expected, is **high**.

Table 6-44: Distance of the populated areas near the gas pipeline

Populated area	Left/Right of the route	Position from/to	Distance of the area from the gas pipeline	No of inhabitants
Stojakovo	right of the route	from 3+500 km to 5+000 km	62 m	1 931
Prdejci	right of the route	from 13+000 km to 14+500 km	210 m	514
Smokvica	right of the route	from 21+500 km to 22+500 km	780 m	263
Gabrovo	left of the route	from 28+000 km to 28+500 km	275 m	20
Petrovo	left of the route	from 29+500 km to 30+000 km	1 213 m	206
Dren	left of the route	from 48+500 km to 49+500 km	90 m	94
Chiflik	left of the route	from 51+500 km to 52+500 km	238 m	90
Demir Kapija	right of the route	from 52+500 km to 54+000 km	673 m	3 275
Przdevo	left of the route	from 58+500 km to 59+500 km	240 m	235
Tremnik	right of the route	from 61+000 km to 62+500 km	653 m	827

Table 6-45: Important areas near the gas pipeline

Name of the area	Category of protection	Position from/to	Distance of the area from the gas pipeline (km)	Length of pipeline penetration in the area (km)	Left/Right of the route or the route passes through the area
Demir Kapija	NM, Protected area- MoEPP	from 47+500 km to 52+000 km	1,1		right of the route
Studena Glava	NP, Proposed for protection – Spatial Plan of MK	from 39+000 km to 47+500 km		7,1	the route passes through the area
Aeolian sands - Vardar	NP, Proposed for protection – North Macedonian Ecological Society (UNDP/GEF)	from 9+000 km to 9+500 km	0,7		right of the route
Negorski Banji	NM, Proposed for protection – Spatial Plan of MK	from 9+500 km to 10+500 km	2		left of the route
Negorski Banji	Important Plant Area (IPA)	from 9+500 km to 10+500 km	2		left of the route
Demir Kapija Canyon	Important Plant Area (IPA)	from 50+500 km to 52+500 km	0,62		right of the route
South Vardar	Important Bird Area (IBA)	from 0+000 km to 12+000 km		12	the route passes through the area

Name of the area	Category of protection	Position from/to	Distance of the area from the gas pipeline (km)	Length of pipeline penetration in the area (km)	Left/Right of the route or the route passes through the area
Demir Kapija Canyon	*Important Bird Area (IBA)*	*from 48+500 km to 51+500 km*		*3*	*the route passes through the area*
Tikves region	*Important Bird Area (IBA)*	*from 57+000 km to the end (67+200 km)*		*10,2*	*the route passes through the area*
Negorski Banji	*Emerald Area (EA)*	*from 9+500 km to 10+500 km*	*2*		*left of the route*
Demir Kapija Canyon	*Emerald Area (EA)*	*from 51+500 km to 53+500 km*	*2,6*		*right of the route*

Potential impacts of noise during the **construction phase** of the gas pipeline are:

- *Impact of the noise from construction activities*

Potential impacts of noise during the **operational phase** are:

- *Impacts due to construction activities for removal of underground defects in the pipeline (identical to the construction phase)*

Construction phase

Impact of the noise from construction activities

In the construction phase of the gas pipeline, increased noise levels are expected to be generated due to the work of the construction machines, the movement of trucks and vehicles, as well as the equipment used on the construction sites. The noise levels would be similar to those that occur on typical construction sites, i.e. similar to activities such as clearing, digging trenches, drilling, placing a buffer and movement of vehicles.

Construction machines and load trucks have a large number of noise sources with different acoustic volumes that form the overall sound field in the environment. These include: propulsion device, exhaust and air intake systems, hydraulic systems, transmissions, chain and worm drive, working bodies and parts moving on the machine. The main source of acoustic radiation is the internal combustion engine housing along with the exhaust system.

The noise generated by construction activities at the construction sites will be temporary, uneven and intermittent. The noise level will vary and have increased intensity during the operation of vehicle engines, and maximum values will be reached during the engagement of construction machines and equipment.

Table 6-46 includes the machines most commonly used in construction and the noise levels at a reference distance of 15 m from the source. The values given in the table are based on data from the available literature.

Table 6-46: Noise levels of construction equipment

Source of noise during construction	Noise level (dBA) at 15m from the source	Source of noise during construction	Noise level (dBA) at 15m from the source
Air compressor	81	Truck	88
Trench excavator	80	Tractor unit	77
Bulldozer	85	Diesel power generator	81
Crawler loader	85	Pneumatic drill	88
Compactor	82	Rock drilling machine	98
Concrete mixer	85	Hacksaw	90
Mobile crane	83	Pneumatic tool	85

In accordance with this data, 90 dB is considered as envisaged noise level from a construction site at a distance of 15 m. The noise level decreases as the distance between the source and the receptor increases. In accordance with the data from the available literature, the noise level decreases by six (6) dB when the distance is doubled. This decrease refers to cases when there are no obstacles between the source and the receptor. Otherwise, the decrease will be higher.

This decrease in the noise level, which depends on the increase in the distance between the source and the receptor, is shown in the following table:

Table 6-47: The noise level decreases as the distance between the source and the receptor

Distance from the source to the receptors (m)	Sound equivalent level of the receptor (dB)
15	90
30	84
60	78
80	76
100	74
200	68
400	62
600	59
800	56
1000	54
1500	51
1600	50
2000	49
2500	47
3000	45
3200	44

The Law on Noise and the relevant bylaws regulate the noise intensity and the period of exposure at the work place, alongside the limit values of ambient noise for different types of urban and rural areas.

Table 6-48: Limit values for basic environmental noise indicators

Area differentiated according to the degree of noise protection	Noise level stated in dBA		
	Ld	Le	Ln
Area with a first degree of noise protection (I)	50	50	40
Area with a second degree of noise protection (II)	55	55	45
Area with a third degree of noise protection (III)	60	60	55
Area with a fourth degree of noise protection (IV)	70	70	60

In accordance with the Rulebook on environmental noise level limit values (Official Gazette No. 147/08) and the Rulebook on locations of measuring stations and measuring points (Official Gazette No. 120/08), for the populated areas near the gas pipeline, the assumed basic noise level is 55 dB as an area with a second degree of noise protection (II), whereas for the important areas, the assumed basic noise level is 50 dB as an area with a first degree of noise protection (I).

The magnitude of the impact is calculated on the basis of the increase in the noise level which is obtained as a difference between the sound equivalent level of the receptor (dB) at the adequate distance and the basic noise level.

Table 6-49: Change in the noise levels and the magnitude of the impacts

Increase in the noise level, dB (A)	Subjective answer	Magnitude of the impact
0	Unnoticeable	No change
0,1-2,9	Barely noticeable	Negligible
3 to 4,9	Noticeable	Low
5,0 to 9,9	Up to double increase or decrease of the volume	Medium
>10	More than double increase or decrease of the volume	High

Table 6-50: Magnitude of the impact in the populated areas near the gas pipeline

Populated area	Distance of the area from the gas pipeline (km)	Sound equivalent level of the receptor (dB)	Basic noise level	Increase in the noise level (dB)	Magnitude of the impact
Stojakovo	62 m	78	55	23	high
Prdejci	210 m	68	55	13	high
Smokvica	780 m	56	55	1	negligible
Gabrovo	275 m	66	55	11	high
Petrovo	1 213 m	53	55	-2	no change
Dren	90 m	75	55	20	high
Chiflik	238 m	67	55	12	high
Demir Kapija	673 m	58	55	3	low
Przdevo	240 m	67	55	12	high
Tremnik	653 m	58	55	3	low

Table 6-51: Magnitude of the impact in the important areas near the gas pipeline

Name of thet area	*Distance of the area from the gas pipeline (km)*	*Length of pipeline penetration in the area (km)*	*Sound equivalent level of the receptor (dB)*	*Basic noise level*	*Increase in the noise level (dB)*	*Magnitude of the impact*
Demir Kapija	*1,1*		*53*	*50*	*3*	*low*
Studena Glava		*7,1*	*90*	*50*	*40*	*high*
Aeolian sands - Vardar	*0,7*		*58*	*50*	*8*	*medium*
Negorski Banji	*2*		*49*	*50*	*-1*	*no change*
Negorski Banji	*2*		*49*	*50*	*-1*	*no change*
Demir Kapija Canyon	*0,62*		*59*	*50*	*9*	*medium*
South Vardar		*12*	*90*	*50*	*40*	*high*
Demir Kapija Canyon		*3*	*90*	*50*	*40*	*high*
Tikves region		*10,2*	*90*	*50*	*40*	*high*
Negorski Banji	*2*		*49*	*50*	*-1*	*no change*
Demir Kapija Canyon	*2,6*		*47*	*50*	*-3*	*no change*

Table 6-52: Impact assessment – Impact of the noise from construction activities

Criteria	*Assessment Thresholds*	
	Threshold	*Description*
Categorization of Impact	*Negative*	*Not desirable.*
Type of impact	*Direct*	*The noise will directly occur as a result of the performance of construction activities.*
Reversibility	*Reversible*	*The noise levels will return to the initial level when the construction activities are completed.*
Geographic extent	*Local*	*The impact will be limited to local level in the vicinity of the gas pipeline route.*
Time when the impact occurs	*Immediately*	*The noise levels will increase immediately when the vehicles, machinery and construction equipment enter the construction site.*
Duration	*Short-term*	*The impact will last for the same period as the construction activities.*
Likelihood of occurrence	*Certain*	*The noise cannot be avoided during the performance of the construction activities.*
Magnitude	*Diverse*	*See text above.*

Table 6-53: Significance of the impact in populated areas near the gas pipeline

Populated area	Distance of the area from the gas pipeline	Magnitude of the impact	Significance
Stojakovo	62 m	high	high of very high
Prdejci	210 m	high	high of very high
Smokvica	780 m	negligible	low
Gabrovo	275 m	high	high of very high
Petrovo	1 213 m	no change	insignificant
Dren	90 m	high	high of very high
Chiflik	238 m	high	high of very high
Demir Kapija	673 m	low	low or medium
Przdevo	240 m	high	high of very high
Tremnik	653 m	low	low or medium

Table 6-54: Significance of the impact in important areas near the gas pipeline

Name of the area	Distance of the area from the gas pipeline (km)	Length of pipeline penetration in the area (km)	Magnitude of the impact	Significance
Demir Kapija	1,1		low	low
Studena Glava		7,1	high	high of very high
Aeolian sands - Vardar	0,7		medium	medium or high
Negorski Banji	2		no change	insignificant
Negorski Banji	2		no change	insignificant
Demir Kapija Canyon	0,62		medium	medium or high
South Vardar		12	high	high of very high
Demir Kapija Canyon		3	high	high of very high
Tikves region		10,2	high	high of very high
Negorski Banji	2		no change	insignificant
Demir Kapija Canyon	2,6		no change	insignificant

Taking into account the high sensitivity and the above stated magnitudes, the significance of the impact – *Impact of the noise from construction activities* is **diverse**.

Operational phase

Impacts due to construction activities for removal of underground defects in the pipeline (identical to the construction phase)

No impacts of the noise are expected during the regular operation of the gas pipeline. During the regular operation of the gas pipeline (routine check of valves and control points and cathodic protection that is performed by means of detection sensors) no noise is expected to occur. In the event of a leakage or damage to an underground part of the pipeline, construction works will be performed for the purpose of repairing or replacing the damaged part of the pipeline. In that case, the construction activities are the same as the activities in the construction phase. The impacts will be identical to the ones in the construction phase, with **the same significances**.

SUMMARY OF THE IMPACTS FROM NOISE	
CONSTRUCTION PHASE	○ *Impact of the noise from construction activities – **diverse** **significance**.*
OPERATIONAL PHASE	○ *During the regular operation of the gas pipeline, no noise impacts are anticipated. In the event of defects in the underground part of the gas pipeline, the construction activities and the impacts will be identical to the ones in the construction phase, with the **same significances**.*

Regarding Vibration impact, in the construction phase, the vibrations that occur during the movement of trucks, the work of the construction machinery for excavation and the operation of the soil compaction equipment, are not expected to be felt at a distance larger than 15 m according to the available literature. Vibrations from the foregoing activities are not expected to be felt on larger distances out of the footprint of the project of the gas pipeline route. Also, vibrations created during the blasting process are not expected to be felt outside of the footprint of the project.

During the regular operation of the gas pipeline, no vibrations are expected. In the event of defects in the underground part of the gas pipeline, the construction activities and vibrations will be identical to the ones in the construction phase.

6.9 Impacts on the biodiversity

6.9.1 Impacts on the habitats

Assessment of the impacts and level of significance

The impacts on the habitats are mainly related to destruction of the habitats, use and change of the land, as well as fragmentation of the habitats. The following potential impacts on the habitats during the construction and operational phase of the project were established in this study:

During the Construction phase

- *loss of habitats (direct destruction)*

During the Operational phase

- *fragmentation of habitats*

Construction phase

Loss of habitats (direct destruction)

When calculating the total surface of habitats that will be destroyed, 25-meter-wide area is taken into consideration (12.5 meters on either side of the pipeline axis).

The magnitude of the impact – Loss of habitats – is calculated by taking into consideration the entire surface (equivalent surface) of the habitat that will be directly destroyed. The equivalent surface is quantified through the following matrix:

Table 6-55: Weight coefficient to calculate the equivalent surface of the habitat

Categories of habitat sensitivity	Weight coefficient
Very high	1
High	0,75
Medium	0,5
Low	0,25

The table below provides an overview of the areas of respective habitats that will be lost as a result of the project implementation.

Table 6-56: Loss of habitats as a result of the project implementation

Habitats	Loss of habitats [ha]	Sensitivity	Equivalent surface [ha]
Pseudomaquis	36,05	ms	18,02
Degraded pseudomaquis	9,52	ls	2,38
Downy oak and hornbeam forest	22,48	ms	11,24
Degraded downy oak and hornbeam forest	8,07	ls	2,01
Riparian zone and alder forest	0,86	hs	0,64
Plane-tree and willow-covered riparian zone	0,56	hs	0,42
Dry grasslands	16,12	ms	8,06
Total	**93,66**		

The equivalent surface of directly destroyed, highly sensitive habitats (black alder forests and plane-tree and willow zones indicated in Annex 1 of the Habitat Directive) is 1.06 ha. The equivalent surface of lost forest habitats that are moderately sensitive (kermes oak and downy oak forests), which are also included in Annex 1 of the Habitat Directive, is 29.26 ha. The dry grasslands, although widespread in the country, are a priority habitat under the Habitats Directive. They cover an equivalent surface of 8.06 ha.

The following manner of ranking the magnitude of impact has been applied:

Table 6-57: Criterion for assessment of the magnitude of impact from the loss of habitats

Equivalent surface of lost habitat [ha]	Magnitude of impact
0-0,5	Negligible / No changes
0,6-12,0	Low
12,0-29,9	Medium
+30	High

In accordance with the foregoing ranking, the magnitude of direct destruction of highly sensitive habitats (alder, willow and plane-tree covered riparian zones) is **low**. The magnitude of loss of the moderately sensitive habitats such as downy oak and hornbeam forest and pseudomaquis is **medium**, while of the dry grasslands is **low**.

As shown in the table below, the total magnitude of impact from the loss of habitats is low.

Table 6-58: Magnitude of impact – loss of habitats (direct destruction)

Criteria	Assessment Thresholds	
	Threshold	Description
Categorization of Impact	Negative	Undesired
Type of impact	Direct	The loss of the habitat is a result of direct destruction of the land that is required for construction of the gas pipeline
Reversibility	Irreversible	The loss of the habitats will be irreversible on the long run due to practical reasons
Geographic extent	Local	The loss of the habitats is limited to the area covered by the project
Time when the impact occurs	Immediately	The loss of the habitat occurs immediately when the land is cleared
Duration	Long-term	It will last during the operational phase of the project
Likelihood of occurrence	Certain	The land needs to be cleared for the purpose of constructing the gas pipeline
Magnitude	Low	See above

Taking into consideration the sensitivity of the habitats, from moderately to highly sensitive and the low impact, the consequences of the activities within this project, without mitigation measures, are ranging from **Low** to **Medium**.

Operational phase

Fragmentation of habitats

The cleared strip of the land along the gas pipeline corridor will be permanent and it will be maintained in such condition. The fragmentation will be manifested mainly on the forest habitats. The effects of the fragmentation will be more significant in the areas with predominantly highly sensitive habitats, i.e. alder, plane-tree and willow-covered riparian forest zones on both sides of the gas pipeline route. Furthermore, there will be effects in the moderately sensitive forest habitats as well, such as pseudomaquis and downy oak and hornbeam forests.

The areas where fragmentation of the habitats can occur and where sensitive habitats are present, are given in the following table:

Table 6-59: Assessment of the impact from fragmentation

Section	Type of habitat	Sensitivity	Magnitude of fragmentation
Greek border – village of Prdejci	Agricultural arable land, fields and farmlands	ls	insignificant
between the villages of Prdejci and Davidovo	pseudomaquis, plane-tree covered zones appear along the streams	ms and hs	low
between the villages of Davidovo and Demir Kapija	well-developed oak- hornbeam forest, plane-tree and willow-covered zones appear along the streams	ms and hs	low

Section	Type of habitat	Sensitivity	Magnitude of fragmentation
between the villages of Chiflik and Demir Kapija	*alder community along the river Bosava*	*hs*	*low*
village of Demir Kapija – city of Negotino	*degraded oak forests, hilly pastures with sparse shrubs and agricultural land*	*ls and ms*	*insignificant*

The magnitude of impact resulting in fragmentation of habitats is small. It can be seen in the table below.

Table 6-60: Magnitude of impact – Fragmentation of habitats

Criteria	Assessment Thresholds	
	Threshold	Description
Categorization of Impact	*Negative*	*Undesired*
Type of impact	*Direct*	*The fragmentation is a result of the physical presence of the gas pipeline.*
Reversibility	*Irreversible*	*Effects of fragmentation after they appear, yet, part of the populations will be reinstated into the current condition.*
Geographic extent	*Local*	*Generally, it refers to the forest habitats*
Time when the impact occurs	*Delayed*	*The effects of fragmentation of forest habitats will be visible after a longer period of time (after many years).*
Duration	*Long-term*	*The effects of fragmentation of forest habitats will also continue during the operational phase of the motorway.*
Likelihood of occurrence	*Likely*	*Forest habitats will suffer the most serious consequences of the fragmentation*
Magnitude	*Low*	*See above*

According to the matrix for assessment of the significance of the fragmentation, the consequences of the actions within this project, without the mitigation measures, are **Low**.

SUMMARY OF THE IMPACTS ON HABITATS	
CONSTRUCTION PHASE	○ *Impact on the habitats –* ***Low to Medium***
OPERATIONAL PHASE	○ *Impact on the habitats –* ***Low***

6.9.2 Impact on the flora, fungi and fauna

There are no populations of sensitive plant and fungus species in the gas pipeline corridor (buffer zone of 2x200) which are characterized by limited distribution. Endemic plant species present in the IPA "Negorski Banji" and IPA "Demir Kapija Canyon" were not found in the area of interest. Plant species from the National Red List and the List of Protected and Strictly Protected Species in Macedonia were also not found. The only Balkan endemic species *Astragalus parnassi* is widespread in the steppe areas of the country.

The most important impacts on the fauna are on the birds, and that impact is a result of the degradation/destruction/fragmentation of their habitats or from impacts on their hosts, i.e. certain species of plants. Also, there are significant impacts on the habitats of amphibians and fish.

The following potential impacts on animals were identified in the Construction phase and Operational phase of the project.

During the Construction phase

- *Disruption in the nesting cycle (birds)*
- *Modification, interruption or destruction of the habitats of amphibians and fish*

During the Operational phase

- *Availability of natural resources*

Construction phase

Disruption in the nesting cycle (birds)

The construction of the gas pipeline will cause disturbance and direct disruption in the bird nesting cycle, as well as reduction in the breeding success of the birds nesting along the corridor. The blasting works will have the most prominent negative effect. The most affected will be the species of birds nesting in the oak forest, of which a significant number of species have unfavourable conservation status. This is also the case for the arable fields and riparian forests. Sparrow species (Laniidae, Turdidae, Parulidae, Paridae, Fringillidae, and other families) will suffer the most from the fragmentation and direct loss of habitats.

The magnitude of impact from the disruption in the bird nesting cycle is **low**.

Table 6-61: The magnitude of impact - Disruption in the bird nesting cycle

Criteria	***Assessment Thresholds***	
	Threshold	***Description***
Categorization of Impact	*Negative*	*Undesired*
Type of impact	*Direct*	*The disruption in the nesting cycle is a result of the physical presence of the gas pipeline.*
Reversibility	*Reversible*	*The effects of disruption of the cycle after they appear, yet, most of the populations will be reinstated into the current condition.*
Geographic extent	*Local*	*Generally, it refers to the forest habitats, arable fields and riparian forests.*
Time when the impact occurs	*Immediately*	*The effects of disruption in the nesting cycles will be visible in a short time*
Duration	*Short-term*	*The effects of disruption in the nesting cycle will only be present in the construction phase*
Likelihood of occurrence	*Likely*	*The most serious consequences of the disruption in the nesting cycle will be present in the section though which the route passes within the Important Bird Area*
Magnitude	*Low*	*See above*

Modification, interruption or destruction of the habitats of amphibians and fish

Disturbance, interruption or destruction of the habitats of populations of amphibians and fish can occur as a result of clearance and destruction of riparian vegetation and temporary diversion of the water, as well as blasting works that can be mechanical (destruction of habitats), sound, vibrations and can cause direct pollution (dust, etc.) The Balkan endemic species of frogs *Rana graeca* and *Bombina variegata* are significant among the amphibians, and the terrestrial turtle *Testudo graeca*, which is on the list of CITES due to illegal trade, among the reptiles. As a result of the construction activities, fragmentation and isolation of their population is expected, as well as mortality of certain number of individuals. Certain impacts in terms of the movement and migration of amphibians and reptiles is expected.

Table 6-62: Magnitude of impact – Modification, interruption or destruction of the habitats of amphibians and fish

Criteria	***Assessment Thresholds***	
	Threshold	***Description***
Categorization of Impact	*Negative*	*Undesired*
Type of impact	*Direct*	*The modification, interruption or destruction of the habitats is a result of the physical presence of the gas pipeline.*
Reversibility	*Reversible*	*The effects on the habitats of amphibians and fish after they appear, yet, most of the populations will be reinstated into the current condition.*
Geographic extent	*Local*	*It refers to aquatic habitats*
Time when the impact occurs	*Immediately*	*The effects of the modification, interruption or destruction of the habitats of amphibians and fish will be visible in a short time*
Duration	*Short-term*	*The effects will only be present in the construction phase*
Likelihood of occurrence	*Likely*	*The most serious consequences of the modification, interruption or destruction of the habitats of amphibians and fish will be present in the section where the route cuts the rivers and streams.*
Magnitude	*Low*	*See above*

Operational phase

No significant impacts on plants, fungi and animals are expected during the operational phase. Nevertheless, the use of the road along the route or the access roads, will improve the access to certain localities that can have a negative impact when it comes to collectors of medicinal or rare plants and fungi, i.e. hunting, fishing, collecting and the like.

SUMMARY OF THE IMPACTS ON THE WILDLIFE	
The construction of the gas pipeline will cause disruption in the bird nesting cycle, as well as reduction in the breeding success of the birds nesting along the corridor. Furthermore, the disturbance and destruction of the habitats of populations of amphibians and fish can occur as a result of clearance and destruction of riparian vegetation and temporary diversion of the water. However, these are short-term impacts allowing for rapid adaptation of organisms to the changes in the habitats due to which the magnitude of the impact is **low**.	
CONSTRUCTION PHASE	○ *Impact on the wildlife – **Low***
OPERATIONAL PHASE	○ *Impact on the wildlife – **Insignificant***

6.9.3 Impacts on protected and designated areas for protection

Many important areas that are protected by law, proposed for protection, or areas without legal status (IBA, IPA and Emerald areas) can be found within the gas pipeline project corridor or in the wider corridor area.Part of the protected areas, such as the Monument of Nature Demir Kapija, the proposed protected areas, Negorski Banji and Eolski Pesoci, the Important Plant Areas (Demir Kapija Canyon and Negorski Banji) and the Emerald areas (Demir Kapija and Negorski Banji) are out of the gas pipeline route.In contrast, the pipeline route penetrates completely and fragments the areas listed in Table 6-63.They are NP "Studena Glava" which is proposed for protection in accordance with the Spatial Plan of the Republic of North Macedonia and the three Important Bird Areas: "Demir Kapija Canyon", "Tikves Region" and the "Lower course of the Vardar River".

Table 6-63: Areas within the footprint of the gas pipeline route and assessment of the impacts in the Construction Phase

Name of the area	Type of protection	Importance of the area/impact	Impact footprint [ha]	Assessment of the impact/ Construction Phase	Rationale
Studena Glava	*Natural park (proposed)*	*Downy oak and hornbeam forests with occurrence of beech at lower altitude* *- Habitat fragmentation*	*19,36*[20]	*Low*	*The area was proposed for a Nature Park in accordance with the Spatial Plan of Macedonia dated 1999 due to the occurrence of beech stands (approximately 20ha) at a low altitude. Within the route footprint that stretches along the hill ridges no beech stand has been recorded which usually stretches down the ravines.The downy oak and hornbeam forest is dominant in the route footprint with more than 90%, and the rest are agricultural areas. Due to that, the impact in the construction phase is low and pertains to the fragmentation of the downy oak and hornbeam forest which is of medium sensitivity.* *Revision is necessary of the borders and the natural values of the NP "Studena Glava" due to obsoleteness of the data (expert opinion).*
Demir Kapija Canyon	*Important Bird Area*	*Presence of rare birds of prey* *Disturbance and disruption of the nesting cycle*	*265*[21]	*Medium*	*The route goes along the edges of the IPA through agricultural areas consisted of fields and vineyards (37.2%) and pseudomaquis (62.8%). Due to the presence of many rare birds of prey in the IPA, the impact in the Construction phase is assessed as medium. Nests of important types of birds of prey have not been recorded in the route footprint.*

[20]The footprint of the impact pertains to a zone around the route with width of 25 metres.

[21]The footprint of the impact pertains to a zone around the route with width of 500 metres.

Name of the area	Type of protection	Importance of the area/impact	Impact footprint [ha]	Assessment of the impact/ Construction Phase	Rationale
Tikves region	*Important Bird Area*	*Presence of rare birds of prey* *- Disturbance and disruption of the nesting cycle*	*530*[22]	*Medium*	*Agricultural areas (60%) are dominant in the route footprint, and the rest is mainly dry grasslands and deserted fields with ruderal vegetation.* *Due to the presence of many rare birds of prey in the IPA, the impact in the construction phase is assessed as medium. Nests of the Egyptian Vulture, the Eastern imperial eagle and the Lesser kestrel that are listed for the area, are not identified in the route footprint.*
Lower flow of Vardar River (South Vardar)	*Important Bird Area*	*Presence and migration of big soaring bird species* *- Disturbance and disruption of the nesting cycle*	*525*[23]	*low*	*The route stretches through agricultural areas (70.3%) and degraded oak forests, pine plantations and deserted fields with ruderal vegetation (29.7%).The flood meadow of the "Gjolj" area (in the vicinity of the v. Bogorodica) is an important locality for rest and hibernation (nesting) of numerous bird species (terns, ducks, herons, white storks, etc.).. The gas pipeline route is approximately 1.5 km away from the "Gjolj" area, due to which the impacts on the birds is assessed low.*

SUMMARY OF THE IMPACTS ON PROTECTED AND DESIGNATED AREAS FOR PROTECTIONS*	
CONSTRUCTION PHASE	○ *Impact on the fragmentation of the habitats and disturbance of the birds –* ***Low to Medium***
OPERATIONAL PHASE	○ *Impact on the fragmentation of the habitats and disturbance of the birds –* ***Insignificant***

** without the mitigation measures*

6.9.4 Impacts on the wildlife corridors

The gas pipeline does not cross any of the core areas, but goes through the buffer zone of the bottle neck Demir Kapija. This buffer zone provides accessibility to drinking water for the animals due to which certain impact is possible through disturbance of the animals in the construction phase.

[22] The footprint of the impact pertains to a zone around the route with width of 500 metres.

[23] *The footprint of the impact pertains to zone around the route with width of 500 metres.*

Due to those reasons, the impact assessment would be **low** in the construction phase and **insignificant** in the operational phase.

6.10 Impacts on the landscape and visual effects

6.10.1 Assesssment of the landscape sensitivity

The assessment of the value or the sensitivity of the landscapes identified or described in Chapter 5.11 is based on the visual quality and the fragility.

The visual quality is assessed based on the following:

- The lowest values pertain to the areas in which the elements are distributed randomly, with spontaneous vegetation mixed with the natural vegetation, as well as presence of anthropogenic factors (populated areas, the existing A1 motorway, the Skopje – Gevgelija railway, waste depot, etc.);
- The higher values pertain to the areas with well-distributed elements (agricultural rural landscapes) or those that tend towards natural (hilly areas of degraded or well-developed forests);
- The aesthetic features and the visual impressions of the tourists are included here as well: the positive aesthetic features pertain to a more comprehensive view from the gas pipeline route to the natural and semi-natural landscapes, as well as the view to the Vardar River and its tributaries.

The fragility of the landscapes is related to their capability to fit in the planned gas pipeline route in the existing landscapes. The forest landscapes on hilly or uneven terrains have the highest degree of fragility due to the excavations and their filling, as well as due to the caused erosion, as a result of which they stand out in the surrounding.

The scoring scale of the landscape sensitivity pertains to every landscape type via individual assessment of the visual quality and the visual fragility. The scoring is as follows:

- Inapplicable (1);
- Low (2);
- Medium (3);
- High (4) and;
- Very high (5).

The sensitivity pertains to the different landscape types in correlation with the scoring given in the table below:

Table 6-64: Assessment of the sensitivity of the landscape in the researched area

Landscape types	*Visual quality*	*Fragility*	*Total value*	*Sensitivity*
Agricultural rural landscapes	*1*	*2*	*3*	*Inapplicable*
Degraded forests on hilly areas	*2*	*3*	*5*	*Low*
Well-developed forests on hilly areas	*3*	*4*	*7*	*Medium*

It can be concluded that the landscapes in the researched area will not suffer significant changes as a result of the anthropogenic impact. The assessment results are as follows:

- The natural and semi-natural landscapes have higher value compared to the anthropogenic landscapes.;
- The well-developed forests on the hilly areas have significantly higher values that distinguish them from the degraded forests, as a result of their higher visual quality and fragmentation.

6.10.2 Impacts on the landscape

The impacts on the landscape will come from the presence of the new elements that will change the landscape, both temporarily and permanently. The temporary changes, generally, will be related to the physical presence of workers, construction materials and construction machines, while the temporary impacts will be related to the construction of the gas pipeline. The consequences on the landscape will be noticeable at the beginning of the construction phase, and they will continue to be noticeable in the operational phase, as well.

In this part, the impacts during the construction phase will be of temporary character. The long-term impacts on the landscape were analysed as part of the operational phase.

The following potential impacts on the landscapes are identified in the construction phase and the operational phase:

Construction phase

Change of the landscape appearance as a result of performing construction activities, presence of workers and other additional activities;

The main activities in the construction phase that are envisaged to have short-term effects on the landscape include:

- The construction site itself, where the presence of the workers, the heavy-duty machinery, the earth movements, the deposits of construction material, the piles of waste, the nude soil, etc. will disturb the local landscape, especially for nearby populated areas. This landscape disturbance will disappear as the construction front advances to other areas;
- Portable toilets, temporary parking lots for the machinery and trucks will occupy previously bare spaces. In addition, this will contribute to the decrease of the impact on the landscape on a local level.

The magnitude of the impact on the landscape is anticipated to be low during the construction phase since the above-mentioned activities are not expected to be noticed by a large number of people, they will occupy a limited space with relatively small dimensions next or close to the route. The impact magnitude is shown in Table 6-65.

Table 6-65: Impact magnitude - Change of the landscape appearance as a result of performing construction activities, presence of workers and other additional activities

Criteria	Assessment Thresholds	
	Threshold	Description
Characterization of Impact	Negative	Not describable
Type of impact	Direct	The change of the landscape occurs due to the presence of construction facilities
Reversibility	Reversible	The change of the landscape due to the presence of construction activities will disappear when the construction is complete and when the construction elements are removed.
Geographic extent	Local	The change of the landscape is limited to the footprint of the project.
Time when the impact occurs	Immediately	The change of the landscape occurs as the construction elements are installed
Duration	Short-term	It will last during the construction period
Likelihood of occurrence	Certain	The presence of the construction elements will be notices by the nearby residents, road users, etc.
Impact magnitude	Low	See above.

Taking into consideration the overall medium sensitivity of the landscape (see above – chapter Assessment of Landscape Sensitivity), the significance of this impact, without mitigation measures is ***low***.

Operational phase

Change of the landscape appearance as a result of the construction of the gas pipeline (excavations and their filling, bridging over rivers and streams, etc.).

During the development of this project, the impacts on the landscape will arise from:

- occurrence of linear and geometric forms;
- colour changes with textures and colours that will differ from the surrounding ones, due to the removal of the vegetative cover;
- the creation of clearings (the newly open substrates will have clearer and brighter colours compared to the natural substrates) and embankments.

The changes of the natural appearance of the landscape will pertain to:

- the intensity of the activities, assessed based on the size and the exposure of the local population, visitors and passengers;
- visual vulnerability (appearance), assessed based on the position and the number of visitors.

For the assessment of the landscape impacts, the immediate surroundings and the midway distance (800 to 1000 meters) have been taken into consideration.

The impact magnitude of the project activities has been assessed based on the sensitivity of the landscape types where the activities will take place, the intensity of the project activities and the number of potential landscape observers in the areas where the project activities will take place.The biggest impact will be present while observing the sections of the gas pipeline corridor that pass through uneven and hilly areas with well-developed oak forests in the middle section of the route (from KM 34+000 to KM 49+000).

A quantitative method has been used to assess the visibility and the intensity of the impact caused by the activities in each landscape type, by applying a scoring scale to both parameters.

- Inapplicable (1);
- Low (2);
- Medium (3);
- High (4) and;
- Very high (5).

It is estimated that the intensity of the work will be low in most of the sections.Only the work in the section where the route crosses the Vardar River is estimated to be with medium intensity.

The population density in the surrounding villages, as well as the number of observers, are low. Only the surrounding of the villages Prdejci and Stojakovo has a denser population, where the visibility is **medium.**

The impact magnitude, obtained as the average score for the landscape sensitivity, the visibility and the intensity of the impact of the taken activities are shown in the table below.In addition, the average impact magnitude score has also been calculated for each section.

Table 6-66: Estimation of the impact magnitude

Landscape type	Landscape quality	Visibility	Intensity of the impacts of the activities	Impact magnitude
Agricultural rural landscapes	*Low*	*Medium*	*Medium*	*Medium*
Hilly landscapes with degraded forests	*Medium*	*Low*	*Low*	*Low*
Well-developed forests on hilly areas	*High*	*Low*	*Low*	*Low*

The impact magnitude is given below (Table 6-67).

Table 6-67: Impact magnitude - Change of the landscape appearance as a result of the gas pipeline construction

Criterion	Assessment Threshold	
	Threshold	Description
Characterization of the impact	*Negative*	*Not describable*
Type of impact	*Direct*	*The change of the landscape occurs due to the presence of construction facilities.*
Reversibility	*Irreversible*	*Pertains to the section with well-developed forests*
Geographic extent	*Local*	*The change of the landscape is limited to the footprint of the project.*
Time when the impact occurs	*Immediately*	*The change of the landscape occurs as a result of the gas pipeline construction*
Duration	*Long-term*	*It will last during the operational phase.*

Criterion	Assessment Threshold	
	Threshold	Description
Likelihood of occurrence	*Certain*	*The linear corridor of the gas pipeline can be observed from several locations.*
Impact magnitude	*Low*	*See above.*

The overall importance of the impact on the landscape during the operational phase is low.

SUMMARY OF THE IMPACTS ON PROTECTED AND DESIGNATED AREAS FOR PROTECTIONS*	
CONSTRUCTION PHASE	○ *Change of the landscape appearance as a result of performing construction activities, presence of workers and other additional activities – **low.***
OPERATIONAL PHASE	○ *Change of the landscape appearance as a result of the construction of the gas pipeline – **low.***

SOCIAL ASPECTS

6.11 Impacts on the demographics

Construction phase

No modifications of the demographic status or the traditional lifestyle of the communities in the vicinity of the gas pipeline are anticipated during the construction phase.No need for relocation of the population from their homes on account of the construction activities or expropriation is expected.

Operational phase

No impacts on the demographics are anticipated in the operational phase.

6.12 Impacts on the stakeholder engagement

Construction phase

During the activities that will take place during the construction, increased sensitivity is possible in this population which can be even higher due to the lack of communication with the General Contractor and the contractor for the construction of the project.

Usually, after the start of the construction activities, the investors and the contractors neglect the need for maintaining good relations with all stakeholders, especially the local communities and perform the tasks for the purpose of efficient construction.It should be taken into account that during the construction period there may be changes in the structure of the stakeholders and various interests and concerns may arise.In a situation of insufficient communication between the investor, the contractor and the stakeholders, especially when it comes to the local population, there may be misunderstandings and conflict situations, and that is the reason for establishing communication.

Operational phase

The insufficient communication between the investor and the stakeholders during the operational phase, especially in terms of the schedule of the activities that will take place in the field of project maintenance, servicing of defects can lead to misinformation and concern of various groups of stakeholders.

Table 6-68: Impact magnitude - Stakeholder engagement

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of impact	Negative	The impact will create negative opinion about the project
Type of impact	Direct	The project will result in direct impact and interaction
Reversibility	Reversible	The effect is reversible if mitigation measures are applied
Geographic extent	Local	The impact will not extend far beyond the place of the event/source
Time when the impact occurs	Delayed	This impact of the project will appear with delayed effect, but still during the construction period
Duration	Long-term	The impact extends from the construction and throughout the operation of the project
Likelihood of occurrence	Probable	The impact can be considered to have a medium likelihood of occurring.
Magnitude	Medium	It is possible to generate a group of people who support a dissatisfied person.

6.13 mpacts on the use, ownership and access to land and property

These impacts were considered from multiple aspects:

- *Disruption of the everyday life, caused by limited access to populated areas, land, property, communal and road infrastructure*
- *Loss of land and livelihood.*
- *Disruption of the everyday life, caused by limited access to populated areas, land, property, communal and road infrastructure*

Construction phase

In the construction phase, there may be disruption of the everyday life, caused by limited access to populated areas, land, property, communal and road infrastructure, i.e., the existing network roads, water supply, sewage, power supply and petrol networks.In several places, the gas pipeline route intersects with the existing local roads, the existing power transmission line, as well as the water supply and sewage network.The impacts on the material goods, i.e., the disruption of the communal goods that the local population receives from the respective enterprises, are manifested as disruption of the water supply, irrigation and sewage network, then disruption in power supply, and temporary limited access to a certain affected road. The intersection with the local roads and the access to land, assets and the neighbouring populated areas and villages are as follows:

- Intersection with a local road and access to agricultural land between the villages of Stojakovo and Bogorodica;
- Intersection of the road infrastructure near the village Prdejci;
- Intersection with the regional road 1109 that connects the city of Gevgelija with Bogdanci and the village of Gjavato;
- Intersection with local road network and access between the village of Chiflik and the town of Demir Kapija;
- Intersection with infrastructure near the village Przhdevo;
- Intersection with local road network and access in the vicinity of the villages Tremnik and Przhdevo.

Part of the existing road network in the populated areas that will be affected by the project will suffer a certain short disruption. Local inhabitants may be distressed about the impeded access to the desired destinations and their property, even in the short-term.This distress can cause minor social tensions between locals on one and the contractor and the investor on the other hand

During the construction works, these infrastructure networks can be damaged which can result in financial costs both in terms of the cause of the damage and the end user. Also, the damaging of the infrastructure networks can cause incidents (floods, fires, etc.) that can cause negative effects on the environmental media, and they can endanger the health and safety of the workers and the population.

The magnitude can be assessed as low, short-term and reversible, because the project does not go through the urban areas and densely populated areas, the access intersection is minimized, and concurrently, the existing roads from the existing oil pipeline will be maximally used as access roads to the construction sites.

Table 6-69: Impact magnitude - Disruption of the everyday life, caused by limited access to populated areas, land, property, communal and road infrastructure

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of impact	*Negative*	*The impact is undesirable*
Type of impact	*Direct*	*The project results in direct impact on the construction activities*
Reversibility	*Reversible*	*All changes in the utility infrastructure will be restored to their previous state.*
Geographic extent	*Local*	*The impact can be extended beyond the construction site, but not beyond the perimeter of the Municipality*
Time when the impact occurs	*Immediately*	*This impact will occur during the construction*
Duration	*Short-term*	*Every disruption and disturbance will last very briefly*
Likelihood of occurrence	*Unlikely*	*Such event is not expected to occur; however, occurrence of this impact is not ruled out*
Magnitude	*Negligible*	*The caused disturbance and disruption are temporary and considered a negligible measure*

Operational phase

Impact is not expected in the operational period.During the operational period, no impact is expected from the project with separation and barrier effect.

Loss of land and livelihood

With the performance of the project, it will be necessary to temporarily and permanently acquire land and the potential damage to the cultures.During the design of the project, the land acquisition requirements were one of the key conditions for consideration. The project and the route of the selected alternative have been selected in order to reduce the potential level of impact that may be caused by the land acquisition process and to minimize the physical and economic repopulated area of the local communities as much as possible, so that no physical displacement will occur.

In accordance with the project documentation, for the construction of the gas pipeline, the working zone, i.e., the minimum space along the route of the gas pipeline required for its uninterrupted and safe construction is 25 meters, 12.5 meters left and right of the pipeline axis.In this zone, temporary and permanent land acquisition will be performed.

A total area of 1 685 320 m^2 will be covered, of which, 1 079 595 m^2 are state-owned and 605 725 m^2 are private- owned. 981 cadastral parcels will be covered, of which, 445 are state-owned and 536 are private-owned. The land data required for the permanent and temporary acquisition will be shown in more details in the Geodetic survey, which is part of the Basic Design.Data on temporarily and permanently affected land are shown in the following tables. The data show that the project will affect more state-owned land, i.e., 77.71% of the total land is state-owned and the percentage of private-owned affected land is 22.29 %. The areas by land class and land ownership are shown in the following table.

Table 6-70: Areas by land class and land ownership in the 25-meter working zone of the gas pipeline

Land class (area in m^2)	*State*	*Private*	*Total*
1	*8 417.25*	*18 747.82*	*27 165.07*
2	*23 684.23*	*36 592.44*	*60 276.67*
3	*161 374.81*	*57 077.28*	*218 452.09*
4	*153 663.16*	*71 554.23*	*225 217.39*
5	*102 994.14*	*130 611.10*	*233 605.24*
6	*408 525.55*	*167 586.04*	*576 111.59*
7	*83 269.48*	*102 904.24*	*186 173.72*
8	*3 472.00*	*18 387.03*	*21 859.03*
0	*134 195.04*	*2 264.52*	*136 459.56*
Total area (m^2)	***1 079 595.66***	***605 724.70***	***1 685 320.36***

Within the 25-meter zone, the 7-meter-wide private land (3.5 meters left and right of the pipeline axis) will be permanently expropriated.A total area of 470 358 m^2 will be covered with this 7-meter zone, of which, 365 537 m^2 are state-owned and 104 821 m^2 are privately owned. The areas by land class and land ownership are shown in the following table.

Table 6-71: Areas by land class and land ownership in the 7-meter zone of the gas pipeline

Land class (area in m^2)	State	Private	Total
1	2 606.79	4 929.74	7 536.53
2	6 847.72	10 527.71	17 375.43
3	46 961.55	17 167.96	64 129.51
4	45 996.06	16 378.35	62 374.41
5	40 693.58	24 816.03	65 509.61
6	137 167.41	27 343.50	164 510.91
7	43 623.52	2 627.10	46 250.62
8	5 508.03	773.37	6 281.40
0	36 132.39	256.87	36 389.26
Total area (m^2)	**365 537.05**	**104 820.63**	**470 357.68**

Construction phase

The construction activities related to this project will result in permanent loss of agricultural land in certain places, as well as temporary disturbance of the routine economic activities and economic practices in the local businesses or agricultural holdings.

Some people will lose fertile land that supports their livelihood and household income. Others will experience temporary burden of delivering the products to their final destination, which can slightly increase the costs of producing crops used for the market and/or for personal use.

The loss of agricultural land and the associated use for livelihood, along with the interrupted access to agricultural property and the transportation of products, will have a moderate negative impact, because it will affect many landowners. However, most of the gas pipeline goes through state-owned land that is not used and is in non-agricultural areas.

The loss of land, agricultural land and adequate provision of livelihood, together with the interrupted access to property and the transportation of agricultural products, will have a big impact due to the scope of the project, which is a long linear infrastructure, and will affect many landowners.The impact magnitude is presented in the following table:

Table 6-72: Impact magnitude - Loss of land and livelihood

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of impact	Negative	The impact is not desirable, because they will lose fertile land.
Type of impact	Direct	The project results in direct impact on the receptors, i.e., the owners and the users
Reversibility	Irreversible	The effect is irreversible
Geographic extent	Local	The impact is limited to a specific number of persons who own or use property in the footprint of the project.
Time when the impact occurs	Immediate	This project impact will occur immediately with and before the start of the construction

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Duration	Long-term	People will permanently lose their land and that will affect their lifestyle
Likelihood of occurrence	Certain	The impact will certainly appear
Magnitude	High	It impacts the agricultural land

Operational phase

No impacts are anticipated in the operational phase.

6.14 Impacts on community health, safety and security

Multiple impacts are possible in the construction phase, from the aspect of:

- *Increased threat to the population and the livestock due to the existence of a construction site*
- *Increased volume of traffic and transport through the populated areas*
- *Noise and vibration disturbance as a result of construction activities*
- *Prevented access by the social and health services to vulnerable groups*
- *Workers' behaviour towards the local environment*

Potential impacts in the operational phase are:

- *Natural gas release and accidents*

Construction phase

Increased threat to the population and the livestock due to the existence of a construction site

The gas pipeline route stretches mainly outside populated areas and, thereby, the accessibility of the population to the construction site is low.Nevertheless, due to the great length of the linear structure, it is impossible to fence the entire construction site and, therefore, there is a likelihood of incidents at the construction sites related to unlawful presence of persons or accidental intrusion of livestock.

Table 6-73: Impact magnitude - Increased threat to the population and the livestock due to the existence of a construction site

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of impact	Negative	Temporary negative changes
Type of impact	Direct	The project results in direct impact
Reversibility	Reversible	The impact will stop with the completion of the construction
Geographic extent	Local	The impact is at the site of the performance of the construction activities
Time when the impact occurs	Delayed	This project impact does not have to occur immediately

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Duration	Medium-term	The impact extends to the construction period of the project
Likelihood of occurrence	Certain	Will occur certainly, at every construction site
Magnitude	Low	Usually, the construction sites have adequate protection, safety and health procedures in place

Increased volume of traffic and transport through the populated areas

This may especially impact the populated areas located in the vicinity of the gas pipeline route, i.e., the villages of Stojakovo, Bogorodica, Chiflik, Prdejci, Dren, Tremnik, Temjanik and Przhdevo.

There is a probability of increased traffic and transport intensity that will disrupt the normal traffic regime in the footprint of the project.The increased presence of trucks and traffic on the local roads will reduce the safety of the local streets and roads and may increase the rate of traffic accidents.

Table 6-74: Impact magnitude - Increased volume of traffic and transport through the populated areas

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of impact	Negative	Impact is not desirable
Type of impact	Direct	The impact is a result of direct and instantaneous interaction between the project activities and the receptors
Reversibility	Reversible	The potential impact is occasional and reversible
Geographic extent	Local	The impact effects will be felt in a diameter of 20 km from the footprint of the project
Time when the impact occurs	Immediately	This project impact will occur immediately after the start of the project
Duration	Medium-term	The impact extends throughout the construction period of the project
Likelihood of occurrence	Certain	It will certainly appear due to the needs of transport of materials and people from/to the construction sites
Magnitude	Medium	Medium impact, because the traffic increase generated on the local roads of the project will be moderate

Noise and vibration disturbance as a result of construction activities

Noise and vibrations will possibly be the main problems in the construction phase. In addition to the performance of the construction activities at the planned locations, the increased volume of vehicle traffic and transport of people and materials on the local roads in the footprint of the project and near the populated areas will significantly contribute for disturbing the population in these populated areas.

Table 6-75: Impact magnitude - Noise and vibration disturbance as a result of construction activities

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of impact	Negative	The impact will cause a negative attitude towards the project
Type of impact	Direct	The project will result in a direct impact on the local population
Reversibility	Reversible	The impact is reversible
Geographic extent	Local	The impact is on the location itself
Time when the impact occurs	Immediately	The impact will appear immediately with the start of construction near the populated areas
Duration	Short-term	The impact will be short-term during the construction period near the populated areas
Likelihood of occurrence	Certain	Noise and vibration cannot be avoided during the construction activities
Magnitude	Low	The project is far from populated areas

Prevented access by the social and health services to vulnerable groups

In some places, the construction activities will block the local access roads to remote populated areas for a short period of time.During this period, there may be a delay in the delivery of social or health care.Social and health institutions must be able to provide the necessary care and assistance to the beneficiaries of such assistance, even if the access road is interrupted.

Table 6-76: Impact magnitude - Prevented access by the social and health services to vulnerable groups

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of impact	Negative	Impact is not desirable
Type of impact	Indirect	Indirect impact from increased traffic and construction activities on accesses and roads
Reversibility	Reversible	After the completion of the construction activities, the routine will be re-established
Geographic extent	Local	The impact effects will be felt in the populated areas in a diameter of 5 km from the footprint of the project
Time when the impact occurs	Immediately	This project impact will occur immediately after the start of the project in the vicinity of the populated areas
Duration	Short-term	The impact extends in the construction period of the project in the vicinity of certain accesses and roads
Likelihood of occurrence	Probable	It is likely to occur in populated areas
Magnitude	Low	Small, but notable change

Workers' behaviour towards the local environment

If they do not come from the local population, the employees who work for the contractors often disrespect the property, the needs and the values of the local population and can cause a conflict between the investor and the members of the local community, as a result of local population disturbance due to loss of property, endangered domestic security, thefts and disturbance of domestic peace.

During the construction phase, the nature of these impacts is negative, the likelihood of occurrence is possible, and the impact magnitude is low and short-term.

Table 6-77: Impact magnitude - Workers' behaviour towards the local environment

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of impact	Negative	Impact is not desirable
Type of impact	Direct	The impact is a result of direct (immediate) interaction between the project activity and the receptors
Reversibility	Reversible	The potential impact is occasional and reversible
Geographic extent	Local	It occurs in the area of and near the construction activities
Time when the impact occurs	Delayed	The impact does not occur at the beginning of the construction activities.
Duration	Short-term	The occurrence of the impact requires urgent action by the management to calm the situation and reorganize the construction process in order for it to flow uninterruptedly.
Likelihood of occurrence	Probable	In such process, it is difficult to control all workers.
Magnitude	Low	See above

Operational phase

<u>Natural gas release and accidents</u>

During the regular operation of the gas pipeline, no significant negative impacts are anticipated in terms of local community health and safety.

Uncontrolled release of a significant amount of natural gas from the gas pipeline can occur in the operational phase of the gas pipeline, which can cause negative impacts in terms of local community health and safety.These impacts fall in the sphere of accidents and they are elaborated in the chapter Risk Management.

Table 6-78: Impact magnitude - Natural gas release and accidents

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of impact	Negative	The impact can cause unwanted situations with negative consequences
Type of impact	Direct	This impact has direct impact on the receptors
Reversibility	Irreversible	If accident occurs, it will be irreversible
Geographic extent	Local	It occurs in the space limited around the footprint of the project
Time when the impact occurs	Immediately	Sometimes even during construction activities
Duration	Long-term	If it occurs, the impact can be long-term, if human lives are threatened
Likelihood of occurrence	Unlikely	It is unlikely to occur
Magnitude	Low	Small and limited to the space where such materials are kept

6.15 Impacts on safety, security and health at work

In the **construction phase**, several impacts are possible in terms of:

- *Impact of the risk of injuries during unloading and loading of bulky construction materials*
- *Impact of the risk of injury from falling*
- *Impact on the workers due to exposure to noise risk*
- *Impact of the exposure to the sun and high temperatures*
- *Impact of the risk of injury as a result of failure to use personal protective equipment or its improper use*

Potential impacts in the **operational phase** are:

- *Impact of the risk of injury as a result of failure to use personal protective equipment or its improper use during repairs or controls*

Construction phase

Impact of the risk of injuries during unloading and loading of bulky construction materials

During the construction of the gas pipeline, bulky construction materials (pipes, joints, valves, etc.) will be unloaded or unused parts of the construction materials will be loaded. This unloading and loading will be done with construction machinery (hoists, loaders), and in that regard there is a risk of injury. The magnitude of this impact is presented below.

Table 6-79: Magnitude of the impact - Impact of the risk of injuries during unloading and loading of bulky construction materials

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of Impact	Negative	The impact can cause unwanted situations with negative consequences.
Type of impact	Direct	Direct impact.
Reversibility	Irreversible	If an accident happens it may be irreversible
Geographic extent	Local	It occurs in the space limited around the footprint of the project.
Time when the impact occurs	Immediately	The impact may occur immediately.
Duration	Short-term	The risk will last for the same period as the construction activities.
Likelihood of occurrence	Unlikely	It is unlikely to occur.
Magnitude	High	The magnitude is assessed as high.

Impact of the risk of injury from falling

On the construction sites, there is always a risk of workers falling, especially in places where there is a danger of falling, yet the worker has to move there. At this infrastructure facility, where an underground gas pipeline is constructed, the highest altitudes occur near the excavated trench and during the possible getting in and out of the construction machinery and transportation vehicles (there is no construction of high buildings, use of scaffolding, etc.). The magnitude of this impact is given in the following table.

Table 6-80: Magnitude of the impact - Impact of the risk of injury from falling

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of Impact	Negative	The impact can cause unwanted situations with negative consequences.
Type of impact	Direct	Direct impact.
Reversibility	Irreversible	If an accident happens it may be irreversible
Geographic extent	Local	It occurs in the space limited around the footprint of the project.
Time when the impact occurs	Immediately	The impact may occur immediately.
Duration	Short-term	The risk will last for the same period as the construction activities.
Likelihood of occurrence	Unlikely	It is unlikely to occur.
Magnitude	Low	The extent is assessed as low.

Impact on the workers due to exposure to noise risk

In the construction phase, construction machinery and equipment is used, which generates a high level of noise. The workers are the ones who are most exposed to such noise levels. The exposure to noise levels cannot be avoided and that is why workers need to wear appropriate personal protective equipment on a regular basis. The magnitude of this impact is given in the following table.

Table 6-81: Magnitude of the impact - Impact on the workers due to exposure to noise risk

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of Impact	Negative	The impact can cause unwanted situations with negative consequences.
Type of impact	Direct	Direct impact.
Reversibility	Reversible	The impact is reversible.
Geographic extent	Local	It occurs in the space limited around the footprint of the project.
Time when the impact occurs	Immediately	The impact may occur immediately.
Duration	Short-term	The impact will last for the same period as the construction activities.
Likelihood of occurrence	Certain	The noise cannot be avoided.
Magnitude	High	The magnitude is assessed as high.

Impact of the exposure to the sun and high temperatures

Given that the construction of the gas pipeline is carried out outdoors all the time, the workers are exposed to the effects of the weather. One of them is the constant exposure to the sun and high temperatures in the summer. The magnitude of this impact is given in the following table.

Table 6-82: Magnitude of the impact - Impact of the exposure to the sun and high temperatures

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of Impact	*Negative*	*The impact can cause unwanted situations with negative consequences.*
Type of impact	*Direct*	*Direct impact.*
Reversibility	*Reversible*	*The impact is reversible.*
Geographic extent	*Local*	*It occurs in the space limited around the footprint of the project.*
Time when the impact occurs	*Immediately*	*The impact may occur immediately.*
Duration	*Short-term*	*The impact will last for the same period as the construction activities.*
Likelihood of occurrence	*Likely*	*If the work activities are performed in the summer, it is likely that there will be high temperatures.*
Magnitude	*High*	*The magnitude is assessed as high.*

Impact of the risk of injury as a result of failure to use personal protective equipment or its improper use

In accordance with the Law on Safety and Health at Work, workers are obliged to wear personal protective equipment (PPE) depending on the professional activity of the employee. In practice, it sometimes happens that some workers do not wear PPE or use it improperly. That is why, in the event of an accident, there are major consequences for the employee. The magnitude of this impact is given in the following table.

Table 6-83: Magnitude of the impact - Impact of the risk of injury as a result of failure to use personal protective equipment or its improper use

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of Impact	*Negative*	*The impact can cause unwanted situations with negative consequences.*
Type of impact	*Direct*	*Direct impact.*
Reversibility	*Irreversible*	*If an accident happens it may be irreversible*
Geographic extent	*Local*	*It occurs in the space limited around the footprint of the project.*
Time when the impact occurs	*Immediately*	*The impact may occur immediately.*
Duration	*Short-term*	*The impact will last for the same period as the construction activities.*
Likelihood of occurrence	*Unlikely*	*It is unlikely to occur.*
Magnitude	*High*	*The magnitude is assessed as high.*

Operational phase

Impact of the risk of injury as a result of failure to use personal protective equipment or its improper use during repairs or controls

In the operational phase, when performing regular controls and possible repairs, workers are obliged to use personal protective equipment (PPE). In practice, it sometimes happens that some workers do not wear PPE or use it improperly. That is why, in the event of an accident, there are major consequences for the employee. The magnitude of this impact is given in the following table.

Table 6-84: Magnitude of the impact - Impact of the risk of injury as a result of failure to use personal protective equipment or its improper use during repairs or controls

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of Impact	Negative	The impact can cause unwanted situations with negative consequences.
Type of impact	Direct	Direct impact.
Reversibility	Irreversible	If an accident happens it may be irreversible
Geographic extent	Local	It occurs in the space limited around the footprint of the project.
Time when the impact occurs	Immediately	The impact may occur immediately.
Duration	Short-term	The impact will last for the same period as the construction activities.
Likelihood of occurrence	Unlikely	It is unlikely to occur.
Magnitude	High	The magnitude is assessed as high.

6.16 Impacts on the archaeological and cultural-historical heritage

Potential destruction and loss of undiscovered archaeological sites

Construction phase

In the area of the footprint of the project, the human presence and habitation has been recorded for centuries and there are some archaeological sites.

The Directorate for Protection of Cultural Heritage has identified Registered Immovable Goods (REG) in the vicinity of the route of the Gas Interconnector North Macedonia - Greece Along the planned route within the location selected for the construction of the gas pipeline, specifically at the locations where the gas pipeline will be laid, there are no archaeological sites with cultural heritage that would be a limiting factor in the process of planning and design of the gas pipeline.

However, since the footprint of the project has been inhabited for centuries, during the construction works of the project that stretches in a line of about seventy kilometres, it is possible to discover unknown archaeological, historical or cultural heritage and locations during the construction.Uninformed employees will not be able to identify them and warn of a possible discovery. Therefore, it is possible to lose or destroy important undiscovered archaeological sites, along with potentially valuable evidence. Therefore, it is necessary to implement good practices during the construction activities at the appropriate locations in order to eliminate all possible impacts on the potential archaeological sites.

Any new archaeological site will require additional time and money to be fully explored. The discovery of such a new site will initiate a temporary stoppage of the construction activities and will cause a delay in the implementation of the planned project activities, along with unplanned costs for the General Contractor.

Table 6-85: Impact magnitude - Potential destruction and loss of undiscovered archaeological sites

Criterion	Indicative Assessment Thresholds used for each Rating Criteria	
	Threshold	Description
Characterization of impact	Negative	Negative impact may occur
Type of impact	Direct	The construction activities will have a direct impact on the receptors
Reversibility	Irreversible	The state cannot be restored
Geographic extent	Local	It occurs in the space limited within the construction footprint of the project
Time when the impact occurs	Immediately	Sometimes even during construction activities
Duration	Short-term	The impacts last during the construction activities
Likelihood of occurrence	Unlikely	It is unlikely to occur
Magnitude	Medium	There are certain consequences for the Contractor

Operational phase

There are no impacts on the archaeological sites in the operational phase.

6.17 Impacts on economic development

The impacts were considered from the aspect of:

- *Employment opportunities*
- *Indirect economic possibilities from the increased economic activity in the area*
- *Vulnerable groups and gender equality*

Employment opportunities

Construction phase

The project will create a range of opportunities for direct employment (temporary and permanent) during the construction.The local community could provide temporary workforce in the construction phase, depending on the availability of the workforce with the necessary skills as well as the strategies of the contractors.

In order to maximize the employment opportunities for the inhabitants of the local communities, it is necessary to organize training for currently unqualified workers. Workplace training can also increase the opportunities of the local workforce for the temporary construction jobs, as well as the opportunities for long-term employment where available.

Operational phase

The project will create opportunities for direct long-term employment during the operational phase. The project envisages engagement of a permanent workforce in the operational phase and it could be provided by the local community, depending on the required skills, as well as the strategy of the gas pipeline management operator.

The nature of this impact is positive, the likelihood of occurrence is certain, and the impact is long-term.

Indirect economic possibilities from the increased economic activity in the area

Construction phase

The project will create opportunities for indirect economic benefits at the local and regional level during the construction through the implementation of a large number of activities in the service chain, as follows:

- Performing work tasks and providing construction materials;
- Providing services for transport, forwarding and storage of material goods required for the realization of the project;
- Providing transport services for the workers;
- Providing and supplying food, catering and cleaning services;
- Providing appliances, electronic devices, communication equipment and measuring equipment;
- Security personnel;
- Providing retail services;
- Fuel supply;
- Providing accommodation services for the workers and engineers.

Operational phase

Indirect economic benefits at the local, regional and national level during the operation of the project are expected through:

- Strengthening the national gas supply network;
- Possibility for diversification of energy source types and reducing the dependence on electricity, as well as import and use of liquid fossil fuels;
- The construction of the natural gas supply line will ensure a benefit by providing an energy source for the local industries that will indirectly create job opportunities;
- Providing construction and auxiliary materials and accessories in the maintenance phase;
- Hiring security personnel;
- Providing retail services.

The nature of this impact is positive, the likelihood of occurrence is certain, and the impact is long-term.

Vulnerable groups and gender equality

Construction phase

The impacts on the vulnerable and sensitive group of people in the community are limited and are part of the potential economic impact.During the construction of the gas pipeline, economic resettlement of the vulnerable population including the elderly, widows and people with disabilities, is possible.

Regarding the impacts on the gender equality, the construction phase will result in employment of a number of people. Many of the job positions are for qualified workers which will probably result in gender bias towards men.This can impact the female population, mainly in the local communities in the villages, but also potentially in the towns.The indirect employment opportunities in this phase could contribute to reducing the gender bias through an increased support for the local businesses that employ women.

Operational phase

No impact on the vulnerable and sensitive group of people in the community during the operational phase is expected.

In terms of the impacts on the gender equality, the operational phase will result in the employment of a large number of people, whereas the Operator will not limit the employment to men only. In addition, the indirect employment opportunities in this phase could contribute to reducing the gender bias through an increased support for the local businesses that employ women.

The nature of this impact is negative, low, the likelihood of occurrence is possible/certain, and the impact is long-term.

6.18 Cumulative impacts

Cumulative impacts are impacts that are the result of activities for implementation of the respective project in combination with other similar past, present or future activities within the observed area. The assessment of the cumulative impacts takes into account the effects of other installations which are operational, under construction or approved near the project, and which, together with the effects of the respective project, may have an increased effect.

The cumulative impacts from this project will occur in the construction phase and in the operational phase. In the construction phase, the cumulative impact on air quality is most prominent. The following roads with which the gas pipeline route intersects have been taken into consideration:

Table 6-86: Significant roads with which the gas pipeline route intersects

Chainage	*Element*
km 7+190.44	*Asphalt road Gevgelija - Bogdanci (R1109)*
km 12+831.37	*Railroad Skopje - Gevgelija*
km 13+557.30	*Motorway “Prijatelstvo” (Friendship)*
km 13+584.42	
km 13+729.75	*Asphalt road (R103 Gevgelija-Skopje)*
km 13+735.79	

In addition to these roads, there are intersections with local asphalt and dirt roads.

During the construction phase, at the intersections with these roads, there will be cumulative impacts as a result of the emission of exhaust gases from the construction machinery and the transportation vehicles and occurrence of dust during the construction.

The cumulative impacts on air quality will occur only in the construction phase and not in the operational phase.

When defining the cumulative impacts of this project in relation to the existing oil pipeline, it was taken into account that it was decided, whenever possible, to place the gas pipeline in parallel to the existing oil pipeline. It was agreed that a distance of 30 meters between the pipelines would be appropriate in order to ensure the integrity of both pipelines during the construction of the gas pipeline, as well as during their operation (e.g.: for the purpose of ensuring cathodic protection of the pipelines). Where this distance between the pipelines cannot be ensured, a different pipeline route has been chosen. Figure 6-2 shows in two parts the route of the planned gas pipeline in relation to the route of the existing oil pipeline.

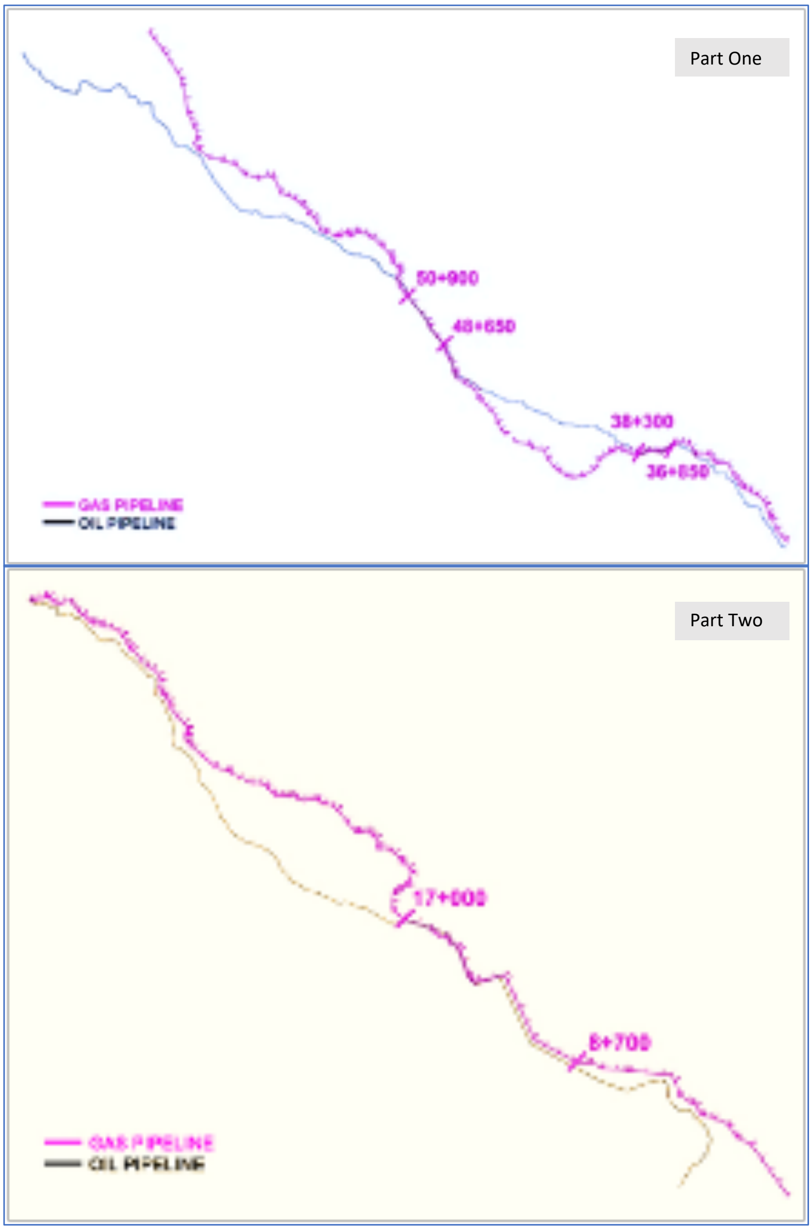

Figure 6-2: The route of the planned gas pipeline in relation to the route of the existing oil pipeline

In the sections of the gas pipeline route from the chainage 8+700 to km 17+000 and in the chainage km 36+850 to km 38+300 and km 48+650 to km 50+900, the planned gas pipeline touches the existing oil pipeline in a total length of about 11 km. The following table shows the chainage of the intersections of the route of the planned gas pipeline with the existing oil pipeline:

Table 6-87: Intersections of the planned gas pipeline with the existing oil pipeline

Chainage	***Element***
km 12+754.37	*Oil pipeline*
km 17+129.63	*Oil pipeline*
km 35+761.19	*Oil pipeline*
km 36+244.80	*Oil pipeline*
km 36+770.43	*Oil pipeline*
km 51+657.07	*Oil pipeline*

At the intersections of the gas pipeline and its approximation (touching) to the oil pipeline, cumulative impacts are expected from the aspect of fragmentation, especially in the forest and mountainous areas. In the parts where the gas pipeline moves away from the oil pipeline, there is no cumulative effect in terms of the fragmentation.

The existing oil pipeline and the planned gas pipeline are underground line facilities that have a barrier effect on the movement of high groundwater. During the construction of the gas pipeline, i.e. in the parts where occurrence of groundwater is expected, and which are in the area where the existing oil pipeline passes, the occurrence of cumulative barrier effects is possible. However, they will not be significant given the fact that in these parts the construction of the gas pipeline will be carried out at a greater distance from the oil pipeline in order to avoid its damaging. Thus, the barrier effect of the gas pipeline will also be at a greater distance from the barrier effect of the existing oil pipeline, so that no significant cumulative impact with synergistic effect is expected.

6.19 Transboundary impacts

In the construction phase of the gas pipeline, no significant negative impacts are expected that would have a transboundary character. Having regard to the fact that this project is a gas interconnector pipeline between two neighbouring countries, the Republic of North Macedonia and the Republic of Greece, it practically means that at the place where the gas pipeline section in Greece ends, the gas pipeline section in North Macedonia begins.

The impacts that will occur in the construction phase, at the location of the border and in the immediate vicinity, are identical and mutual, so they will not cause any special environmental impact in any of the countries on either side.

Regarding the crossing of the gas pipeline over the Vardar River and the impacts that will occur during the construction of that crossing (water turbidity; increase of the sediment during the construction of crossings through water obstacles, as a consequence of increased concentration of suspended solids in the water, i.e. sedimentation of sludge at the bottom of the watercourse in downstream direction; temporary changes in the surface flow and the hydrological regime of the watercourse), it should be noted that the gas pipeline crosses the Vardar River at a distance of about 6 km from the place where this river enters in the neighbouring country. This indicates that the above-defined influences will be at a sufficiently large distance from the border crossing of the river and the effects of such impacts will be low.

In accordance with the legal procedure for transboundary impact, the Ministry of Environment and Physical Planning of the Republic of North Macedonia informed the concerned country - Republic of Greece about the intention to carry out this project and about their participation in the environmental impact assessment procedure. The concerned state - Republic of Greece sent a notification stating that they have no interest in participating in the EIA procedure because the project is not expected to have a significant environmental impact on the Greek territory (see Decision given in ANNEX 1).

There will be no transboundary impacts in the operational phase.

7 MITIGATION MEASURES FOR NEGATIVE ENVIRONMENTAL IMPACTS AND SOCIAL ASPECTS AND RESIDUAL IMPACTS

The measures taken for the purposes of environmental protection most often comprise activities undertaken and aimed at a direct control over the pollution by means of applying special devices, systems or techniques. The implementation of such measures is not always easily feasible not only due to the substantial investment efforts, which are usually required for the purposes of implementing such adequate devices, systems or techniques, but also due to their further maintenance.

During the definition of the mitigation measures for negative environmental impacts arising from this project, initially consideration was given to the technical-technological and organizational solutions offered in the project documentation, which could be considered as integrated measured for protection against, reduction and neutralization of any negative impacts.

In terms of the determination of the final measures aimed at preventing, neutralizing and reducing the negative impacts, measures were proposed that could actually be implemented in the course of the construction phase and the operational phase.

7.1 Mitigation measures for impacts on soil

Construction phase

During the construction phase, for the purposes of reducing the impacts caused by the change in the soil quality as a result of pollution by means of pollutants, the following measures should be taken:

- Careful planning of the construction works with a view to reducing the negative effects and ensuring the prevention of any soil pollution;
- Safe storage of the construction materials;
- The vehicles and the construction equipment are to be maintained in a functional condition in order to prevent any undesired leakage of fuels, lubricants and other pollutants;
- Any maintenance and repair of the vehicles and the machinery along the gas pipeline route is forbidden. In the event of an accidental leakage of fuels, lubricants and other harmful substances, it is mandatory to reinstate the polluted surfaces in the prior condition in order to protect the soil;
- In the event of any leakage of fuels, lubricants and other pollutants, the contaminated soil layer is to be covered with absorbents, the contaminated soil layer is to be collected and removed and, thereafter, disposed of at an adequate hazardous substances depot;
- Fuel filling should be performed at specially designated spots at a distance from the water courses. If the afore-stated is impossible, mobile concrete tanks should be provided over which the fuel filling would be performed;
- In the event of a defect in the machinery and the transport vehicles, the fuels, lubricants and other pollutants may not be directly discharged onto the ground; rather, they should be adequately collected in suitable containers and removed from the construction site;
- In the event of a leakage of pollutants on asphalt surfaces, they should be absorbed by means of an absorbent and disposed of at an adequate hazardous substances depot;
- Ensuring adequate sewage systems;
- The construction debris is to be regularly removed from the construction site and disposed of at an adequate depot.

For the purposes of reducing the impacts caused by soil erosion as a consequence of vegetation removal, the following measures are to be taken:

- It is necessary to develop a plan for protection against erosion at places where the likelihood of erosion is substantial, in order to prevent any transport of erosion sediments from slopes and dams and protect the water courses and other water bodies from erosion sediments;
- Minimizing the loss of vegetation along the construction site;
- The construction works may not take place during downpours;
- Rehabilitation of temporary trenches by planting grass, trees, and other plants (revegetation);
- Rehabilitation of eroded channels and their reinstatement into their natural condition/revegetation, if applicable.

The following measures, proposed for the purposes of mitigating the environmental impact, can reduce the loss of fertile topsoil during the construction of the gas pipeline:

- The excavated material, if possible, should be re-used in the construction or applied as a layer for covering the trenches intended for the gas pipeline pipes. The remaining surplus material should be disposed of at a designated location/depot indicated by the competent authority;
- The size of the construction sites should be minimized to the greatest possible extent so as to minimize the land affected by a negative impact and in order to reduce the loss of fertile topsoil.

For the purposes of reducing the impact caused by landslides as a consequence of excavations, the following measures should be taken:

- During the excavation process, all defined measures in terms of the stability of the slopes, set forth in the project documentation, should be duly complied with. The afore-stated also refers to the enhancement of the geomechanical features and enhancement of the soil load-bearing capacity (ensuring adequate foundations, replacement of the soil material with a better one, compaction, etc.);
- Implementing preventive measures in terms of landslides, stabilizing the slopes (supporting walls, etc.), if necessary;
- Proper construction and installation of drainage channels and their regular cleaning, aimed at minimizing the risk of the occurrence of landslides.

Cleaning the construction site and its reinstatement once the construction works are completed.

Operational phase

In the event of a leakage or damage to an underground part of the pipeline, construction works will be performed with a view to repairing or replacing the damaged part of the pipeline. Such construction works are identical to the ones undertaken in the construction phase and, accordingly, they will give rise to the same type of impacts on the soil. Therefore, it is necessary to undertake adequate measures as in the construction phase.

7.2 Mitigation measures for impacts on groundwater

Construction phase

During the construction phase, for the purposes of reducing the impact caused by any changes in the groundwater flow pattern, the following measures should be taken:

- The performance of construction works at locations where the occurrence of groundwater is anticipated should take place at a time of the year when there is no significant rainfall;
- In the event of the occurrence of groundwater during the performance of the construction works, such works are to be completed as soon as practicable in order to reduce as much as possible the alteration of the of groundwater flow pattern.

For the purposes of reducing the impact on the quality of the groundwater as a result of the pollution caused by various pollutants, it is necessary to undertake the following measures:

- Transport vehicles should be filled with fuel at the nearest petrol stations, whereby filling trucks with fuel at the construction site will be avoided;
- The procedure for fuel filling of the construction machinery should take place on an impervious ground cover or, if the latter is impossible, mobile concrete tanks should be used on which the fuel filling would be performed, at a distance of 10m from water courses and 50m from springs, while in the vicinity there should be piles of sand and soil to absorb any possible leakages;
- The construction machinery and the vehicles should be parked on an impervious sealed ground cover which is to be regularly checked;
- Any maintenance and repair of the vehicles and the machinery along the gas pipeline route is forbidden. In the event of an accidental leakage of fuels, lubricants and other harmful substances, it is mandatory to reinstate the polluted surfaces in the prior condition in order to protect the groundwater;
- The fuels and lubricants that are to be used for filling up the construction machinery and equipment should be adequately stored. They should be kept on an impervious ground cover at a distance of 10m from water courses and 50m from springs, fenced and covered;
- Capture of any sewage waste water along the route in portable toilets and their proper emptying should be ensured;
- Timely removal and disposal of any waste should be ensured.

Operational phase

During the phase of regular operation of the gas pipeline, no negative impacts on groundwaters are anticipated. Solely in the event of a leakage or damage to an underground part of the pipeline, if there are defects in the vicinity of the locations with high levels of groundwater, construction works will be performed for the purposes of repairing or replacing the damaged part of the pipeline, wherein such construction works will be identical to the ones performed in the construction phase, and, accordingly, it will be necessary to undertake adequate measures as in the construction phase.

7.3 Mitigation measures for impacts on surface water

Construction phase

A plan should be developed for surface water protection.

For the purposes of reducing the impact on the quality of the surface water as a result of the pollution caused by various pollutants, it is necessary to undertake the following measures:

- Transport vehicles should be filled with fuel at the nearest petrol stations, whereby filling trucks with fuel at the construction site will be avoided;
- The procedure for fuel filling of the construction machinery should take place on an impervious ground cover or, if the latter is impossible, mobile concrete tanks should be used on which the fuel filling would be performed, at a distance of 10m from water courses and 50m from springs, while in the vicinity there should be piles of sand and soil to absorb any possible leakages;
- The construction machinery and the vehicles should be parked on an impervious sealed ground cover which is to be regularly checked;
- Any maintenance and repair of the vehicles and the machinery along the gas pipeline route is forbidden. In the event of an accidental leakage of fuels, lubricants and other harmful substances, it is mandatory to reinstate any polluted surfaces in the prior condition in order to protect the surface water;
- The fuels and lubricants that are to be used for filling up the construction machinery and equipment should be adequately stored. They should be kept on an impervious ground cover at a distance of 10m from water courses and 50m from springs, fenced and covered;
- Capture of any effluent discharge along the route in portable toilets and their proper emptying should be ensured;
- Timely removal and disposal of any waste should be ensured.

For the purposes of mitigating any impact on the riverbed morphology and/or the physical properties of the water, it is necessary to undertake the following measures:

- In the event of the gas pipeline crossing through riverbeds, the construction works are to be completed as soon as practicable in order to minimize the impact as much as possible in terms of any alteration of the riverbed morphology and/or the physical properties of the water;
- A method for crossing the riverbeds should be chosen that will give rise to as few as possible changes to the riverbed morphology.

Operational phase

During the phase of regular operation of the gas pipeline, no negative impacts on surface waters are anticipated. Solely in the event of a leakage or damage to an underground part of the pipeline, if there are defects in the vicinity of surface water sites, construction works will be performed for the purposes of repairing or replacing the damaged part of the pipeline, wherein such construction works will be identical to the ones performed in the construction phase, and, accordingly, it will be necessary to undertake adequate measures as in the construction phase.

7.4 Mitigation measures for impacts on the air

Construction phase

The following measures, proposed for the purposes of mitigating the environmental impact, can reduce the air pollution during the construction of the gas pipeline:

- Careful planning of construction works, including also the work performed in the vicinity of populated areas (prohibition for construction works during particular periods of the day);
- Restricting the speed of the construction vehicles at the construction site and in the populated areas for the purposes of reducing the occurrence of dust;
- Strict control of the construction methods and the used machinery and other equipment;
- Using proper construction equipment and transport vehicles with a statement on meeting the exhaust emission limit requirements as determined during their homologation, whereby the exhaust emission limit should be reduced to the practicable minimum;
- Spraying the construction site with water should be ensured (the path along which the transport vehicles move, the excavated material required for covering the pipeline, the surplus of excavated land which is to be removed from the construction site, etc.). During dry periods, the emission of dust should be minimized;
- Good maintenance and coverage should be ensured in terms of the vehicles that deliver construction materials with a view to mitigating the emission and dispersion of any pollutants.

Operational phase

During the phase of regular operation of the gas pipeline, no negative impacts on the air are anticipated. Solely in the event of a leakage or damage to an underground part of the pipeline, construction works will be performed for the purposes of repairing or replacing the damaged part of the pipeline, wherein such construction works will be identical to the ones performed in the construction phase, and, accordingly, it will be necessary to undertake adequate measures as in the construction phase.

7.5 Mitigation measures for impacts on climate change

Construction phase

During the construction phase, for the purposes of reducing the greenhouse gas emission from the work related to the construction machinery, equipment and transport vehicles, it is necessary to undertake the following measures:

- Application of good construction practices for a more efficient performance of the construction works, thereby reducing the fuel consumption and the greenhouse gas emission;
- Using proper construction machinery, equipment and transport vehicles for the purposes of avoiding any increase in the fuel consumption, thereby also preventing any increase in the greenhouse gas emission.

Operational phase

During the operational phase, it will be required to conduct a regular control of the safety devices for overpressure relief, whereby natural gas discharge will be reduced. Furthermore, it is necessary to conduct regular control of the impermeability of the gas pipeline in order to minimize any undesired natural gas discharge into the atmosphere.

7.6 Mitigation measures for any impacts caused by waste generation

Construction phase

A waste management plan should be developed.

The mitigation measures for environmental impact related to waste actually propose compliance with good waste management practices and waste disposal at designated locations.

It should be ensured that any cut down trees and humus occurred during the preparatory activities are used by the local inhabitants for heating, construction materials and composting. The remaining waste should be disposed of at a designated location approved by the investor.

The waste generated during the excavation of the trenches for the gas pipeline pipes, if possible, should be re-used as construction material, i.e. as a layer for covering the trenches. The remaining surplus material should be disposed of at a designated depot, approved by the investor. During the transport of surplus excavated material, it is advisable to avoid any overloading of the vehicles.

The waste generated during possible repairs as a consequence of a defect in the machinery, equipment and the vehicles at the construction site should be selected and, pursuant to the legal regulations, the hazardous waste should be separated from the non-hazardous one and handled accordingly as such.

Any empty lubricant and grease containers should be handled as waste from packaging which contains residues or is polluted with hazardous substances, they should be collected accordingly and taken over by an authorized waste management company.

In order to avoid any negative impact from liquid waste, the collection, treatment and disposal of such waste is to be conducted in compliance with the national regulations pertaining to the respective type of liquid waste.

Operational phase

During the phase of using the gas pipeline waste will be generated from the removal of the vegetation along the strip of the gas pipeline route of 7m. Such vegetation waste should be handled in the same manner as the waste generated during the vegetation removal in the course of the construction phase.

The waste generated during any intervention in the surface parts of the gas pipeline (waste spare parts from the block stations, etc.) is to be timely removed from the gas pipeline route.

In the event of a leakage or damage to an underground part of the pipeline, construction works will be performed with a view to repairing or replacing the damaged part of the pipeline. Such construction works are identical to the ones undertaken in the construction phase and, accordingly, they will generate identical waste. Therefore, it is necessary to undertake adequate measures as in the construction phase.

7.7 Mitigation measures for impacts caused by noise and vibration

Construction phase

A noise control plan should be developed.

The mitigation measures for the impacts caused by noise and vibration during the construction phase comprise the following:

- careful planning of the preparatory works in order to reduce the acoustic pollution;
- careful planning of the timing for the works in populated areas (e.g. prohibition of construction works during particular hours);
- mandatory avoidance of equipment which emits a noise exceeding 90dB;
- control of the construction methods and use of the machinery and regular maintenance of the equipment with a view to a possible minimization of any high levels of noise. No vehicles and construction equipment should be used which create excessive noise due to the poor condition of the engines or the noise control devices;
- the construction machinery should comply with the requirements set forth in the EU Directive 2000/14/EC on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors;
- equipment should be used that comprises adequate noise suppression devices;
- avoidance of loud acoustic signals in populated areas/minimizing any disturbance of the citizens' peace and quiet;
- limitation of the speed of construction vehicles, especially in populated areas;
- in the nearest populated areas, it is necessary to timely inform the population of any short-term blasting plans;
- blasting activities should not be performed during the period of bird nesting between 1st March and 30th September.

Operational phase

In the event of a leakage or damage to an underground part of the pipeline, construction works will be performed with a view to repairing or replacing the damaged part of the pipeline. Such construction works are identical to the ones undertaken in the construction phase and, accordingly, they will generate such noise and vibration. Therefore, it is necessary to undertake adequate measures as in the construction phase.

7.8 Mitigation measures for impacts on the flora and fauna

Construction phase

During the construction works along the entire gas pipeline corridor, the following are to be applied as general measures:

- A biodiversity protection plan should be developed.

- Temporary invasion and/or destruction of the surrounding areas should be avoided. During the use of the areas that are not included in the project design it is mandatory to obtain a prior approval from the owner or another type of a permit;
- The locations for storing substances that are harmful for the water should be minimized. It is indispensable to arrange adequate handling and storage;
- Permanent presence of a fire engine should be ensured in the event of fires and accidents;
- After the completion of the construction works, if there is no need to use the workers' camps, it is necessary to dismount them and then reintegrate the location with the surrounding environment, which requires certain biotechnical activities; In addition to the general mitigation measures which pertain to the entire corridor, also certain specific measures are recommended in terms of important habitats, localities and areas:
  - There should be no access roads crossing through any sensitive habitat (refer to ANNEX 6 – Habitat Sensitivity Maps):
    - Alder-covered riparian zones (KM 53+000);
    - Plane-tree and willow-covered riparian zones (KM 16+000; KM 18+500; KM 28+500 and KM 30+000; KM 47+000).
  - Permanent or occasional supervision by an expert (ecologist) during the activities performed in riparian habitats and rivers and streams.
  - All locations that will be used as temporary depots for construction and raw materials should be previously indicated by the contractor in order to avoid any negative environmental impact. Riparian habitats, rivers and streams are not to be used as raw material depots.
  - The areas in which the construction activities will be performed, but which are not indispensable for the operationalization phase, will be rehabilitated, such as locations at which disturbances occurred as the result of cutting down trees, landslides, blasting, etc. In order to neutralize the negative impact from the loss of forest, reforestation with autochthonous types of trees and shrubs, typical for the region, will be required. If possible, the plants should be locally procured, in order to maintain the genetic identity of the local communities. The following trees are recommended for reforestation purposes: *Quercus pubescens, Q. frainetto, Carpinus orientalis, Pyrus amygdaliformis, Acer campestre, Crataegus monogyna, Ulmus minor, Prunus spinosa, Platanus orientalis, Alnus glutinosa, Salix alba, S. fragilis,* etc. The reforestation activities are to be performed according to the No Net Loss principle, i.e. a Reforestation Plan should be developed. The riparian vegetation along the rivers and the streams should be restored according to the afore-stated principle (the Reforestation Plan should be based on a ratio of at least 2:1, e.g. for each destroyed hectare of mature trees, 2 hectares should be planted).
  - Mitigation measures for rivers and streams. The impacts should be minimized by undertaking the following measures:
    - The construction materials or excavated land depots are to be located far away from any water streams;
    - Any change of the course of water streams should be as close as possible to the natural water stream;
    - Any mortar (concrete) works near the water streams is to be controlled in order to reduce the risk of releasing wet mortar into the water streams;

  - All access roads, loading sites and parking lots for the machinery should be maintained clean and neat in order to prevent any increased leakage of lubricants and dirt in the water streams during downpours;
  - It is necessary to minimize the vegetation removal along the rivers and the streams in order to ensure their self-purification.
- The removal of shrubs and trees should be performed during the winter, outside of the bird nesting period, which is between 1st March and 30th September, especially in hilly areas. Blasting should also be performed outside of the bird nesting period.

Operational phase

No significant impacts on the habitats and the species are anticipated in the course of the operational phase.

7.9 Mitigation measures in protected and designated areas

The gas pipeline route enters in an area proposed as a protected area – Studena Glava – and three Important Bird Areas (South Vardar, Demir Kapija Canyon and Tikves Region). In addition to the general mitigation measures which pertain to the entire corridor, also certain specific measures are recommended in terms of these areas:

The area of Studena Galva is covered with a downy oak and hornbeam forest, which also includes stands of beech trees, at a low altitude. The impact range is small (a strip with a width of 20 meters around the route) and it pertains to the fragmentation of the downy oak and hornbeam forest which is moderately sensitive. Due to the importance of the area, in addition to the afore-stated proposed specific measures, the following are also recommended in terms of important habitats, localities and areas:

- Constant supervision by an expert – botanist – during the activities along the area boundaries.

As regards the Important Bird Areas (Demir Kapija Canyon and the Tikves Region) which are characterized by the presence of rare species of birds of prey, the impact during this phase has been estimated as moderate, whereas in terms of IBA South Vardar it has been estimated as low. The impact range in these regions has been analysed in terms of a strip with a width of 500 meters around the route. Due to the importance of the areas and the presence of birds which are of international importance, in addition to the afore-stated proposed specific measures which pertain to the birds, also the following is recommended:

- Constant supervision by an expert – ornithologist – during the activities along the area boundaries.

7.10 Mitigation measures for impacts on the landscape and visual effects

Construction phase

The mitigation measures for environmental impact, in addition to the mitigation recommendations for reducing the size of the construction site, applying good practices of design and construction, carefully and adequately maintaining and cleaning the construction site, also include the following:

- Land exploitation, especially in sensitive areas, should be minimized as much as possible.
- Fast disposal of construction debris to approved locations should be ensured;
- If possible, the excavated material should be used for filling in the holes/borrow pits created while excavating sand;
- Repairing the footpaths and roads immediately after completing the works for installing the gas pipeline pipes and burying/levelling the trenches;
- Carefully sealing the construction sites/depots/cleaning the construction site after the completion of the construction works/reforestation of the area;
- Compensation of the vegetation by planting fire-resistant trees, shrubs and grass for the purposes of improving the visual effects.
- Planting indigenous plant species in the surroundings of:
  - the rivers and the streams,
  - the waste material depots and
  - landslides as a consequence of blasting the terrain.

Operational phase

During the phase of using the gas pipeline no negative impact is anticipated; thus, no measures are required.

7.11 Mitigation measures for impacts on the demographics

No modifications of the demographic status of the communities in the vicinity of the gas pipeline are anticipated during the construction phase. The population will not be required to relocate on account of the activities aimed at the construction or expropriation of the gas pipeline. Therefore, no measures are required.

7.12 Mitigation measures for impacts on local population and stakeholder engagement

Construction phase

The gas pipeline Operator will be required to develop and define the Stakeholder Engagement Plan (SEP) as early as in the course of the preparations for the construction of the gas pipeline. Thus, all the stakeholders and the manner of communication with them will be defined. It is indispensable for the public to be informed of the existence of the project and the planned project development phases.

It is recommended for the gas pipeline Operator to conduct a series of consultative activities with the stakeholders, especially those that own land within the footprint of the project. The established grievance system will be available to the public and all comments and complaints will be recorded, alongside the logs pertaining to the activities undertaken for the purposes of providing an adequate solution.

During the construction phase, the Operator, together with the General Contractor, will maintain communication with the stakeholders. The Operator and the General Contractor will communicate openly with the stakeholders in the project during the construction phase, since not all stakeholders are capable or willing to file a complaint. The Contractor, together with the Operator, will hold regular semi-annual meetings with the representatives of the local community and other stakeholders. A strong emphasis must be placed on the presence of women at such meetings.

The grievance mechanism will be publicly available at the headquarters of the Operator and in the premises of the Contractor at the construction site, as well as in the premises of the municipalities and the populated areas through which the gas pipeline crosses.

The Contractor and the Operator will maintain proactive communication with the local communities.

The Contractor will display bulletin boards comprising information on the project at the entrance of populated areas in whose vicinity the project is implemented. They should comprise information on the project activities on a monthly basis. Furthermore, relevant information should be shared through the local radio/TV stations for the purposes of managing the movement or the traffic flow through the locations where construction works will be performed.

Operational phase

The grievance mechanism will be publicly available in every municipality where the gas pipeline crosses, as well as in the Operator's headquarters, so as to enable the stakeholders to be informed and to communicate regarding various issues or concerns.

7.13 Mitigation measures for impacts on the use, ownership and access to land and property

Construction phase

During the construction of crossings with the local roads, the best possible construction practices will be applied in order to minimize any damage to such roads. In addition, after the completion of the construction activities, the Contractor will be obliged to repair any damaged local roads that are used for the transport of goods and passengers.

In the vicinity of the populated areas, measures will be taken and attentive work will be performed for the purposes of minimizing the effect of the impacts as much as possible in terms of any populated areas; furthermore, it is expected for the duration of the construction activities at any location to be rather short.

If it is necessary to set a construction camp for the workers, the location of the camp should be in the vicinity of a populated area or a main road. The location of the workers' camp will be decided upon prior to the commencement of the construction activities.

In the event of a disruption of the access to the utility infrastructure, the Contractor will repair such disruption as soon as possible or ensure an alternative access, as well as compensate for any incurred damages.

During the construction of crossings with the local roads, the best possible construction practices will be applied in order to minimize any damage to such roads. In addition, after the completion of the construction activities, the Contractor will repair any damaged local roads that are used for the transport of goods and passengers.

For the purposes of mitigating the negative impacts from the process of land loss, as well as loss of other goods and property, an adequate measure is provided with the implementation of good international practices in terms of the acquisition of the property required for this project, which includes the development of a Land Acquisition and Resettlement Framework (LARF) and, consequently, a Land Acquisition Plan (LAP).

This document and process will be developed in accordance with the legislation of the Republic of North Macedonia. The land owners and land users will be compensated accordingly, in compliance with the standards of the national legislation and the competent international financial institution. The land acquisition for the project will be performed on the basis of the win-win principle. In the event of a failure of the negotiations approach, the legally defined expropriation processes will be applied, as per the Law on Expropriation of the Republic of North Macedonia and the respective by-laws, with reference to projects of public interest, and the respective international good practices. The land acquisition will be based upon mutual consent and costs defined by experts in the sphere of land assessment/agriculture and the local self-government institutions. The respective compensation will be defined on the basis of the market value of the land and, if necessary, as a substitute for the value of the affected assets. Based upon the foregoing, there will be no involuntary economic resettlement.

Operational phase

During the operational period of the project, a fee will be paid for a temporary loss and/or difficult access to land for agricultural purposes or other means of living related to the use of the land for maintaining, servicing or repairing the gas pipeline. In the event of any damage to the land, or other economic assets, also an indemnification amount has been foreseen as compensation for the damages and reinstatement and improvement of the condition of the property and the means of living.

Summary of the expropriation process

Proposal for expropriation

The expropriation procedure commences with the submission of the proposal for expropriation to the authorized expropriation authority (i.e. a competent office at the Property and Legal Affairs Office within the Ministry of Finance). In this case, the proposal for expropriation is prepared by the National Energy Resources Skopje (NER) and it is submitted on the behalf of the state (and NER) by the state prosecutor. The proposal for expropriation comprises the following information:

- The proposer of the expropriation;
- The property proposed for expropriation;
- The owner of the property and the holders of other property-related rights;
- The type of facilitating acts by means of which the expropriation is proposed.

A set of supporting documents is to be provided alongside the proposed expropriation, including information from the expropriation study and the land survey, as well as an inventory of the property, and evidence pertaining to the compensation and damages funds.

Notification to the affected owners and an Invitation for a hearing

The affected property owners are individually invited for a hearing and notified regarding the submission of the proposal for expropriation and the proposed compensation amount. In this phase, an amicable settlement of the compensation can be achieved and expropriation can be avoided.

Decision on expropriation

If an amicable settlement is not achieved and if the submitted documentation is proper, a final decision on expropriation may be adopted by the expropriation authority within 20 days as of the day of the receipt of the proposal for expropriation. If there are no further (court) appeals (refer below), the decision on expropriation becomes legally effective.

Appeals by the affected owners

Court appeals

The affected owners can file a court appeal to the relevant administrative court (including also a second court appeal to the Higher Administrative Court), upon whose order the decision on expropriation becomes legally binding. The Law on Expropriation stipulates the deadlines within which the administrative courts are obliged to decide upon the submitted appeals, as well as sanctions in terms of any failure to comply with such deadlines.

Hearing pertaining to the decision on expropriation

When the decision on expropriation becomes legally valid, one more hearing is to be held by the expropriation authority within 8 days in order to discuss and determine the compensation amount for each affected owner. In the event of a failure to achieve an agreement on the compensation amount, the case is submitted to the courts to decide, within 8 days as of the hearing.

Compensation payment

The proposer of the expropriation proceeds with the payment of the compensation or with measures for property replacement within 30 days as of the day of the signing of the agreement on the compensation or the decision on indemnification becomes legally effective (interest rates will apply accordingly in the event of any payment default).

The most important aspect in this process is proper sharing of information, communication and consultation with the persons whose land and property are subject to expropriation, as early as possible, during the initial phases of the project. The affected persons are to be consulted at the very beginning and a solution is to be found according to the needs and the possibilities in terms of the land and the property.

As for privately owned lots, the Operator should initiate a process of consultations, negotiations with the owners and the users of the land, conclusion of an agreement for access to the land/purchasing the land with the determined owners of such land, so that the owners of the land are provided with adequate compensation, pursuant to the requirements of the Environmental and Social Policy of the respective international financial institutions, as well as the national legislation. The land acquisition will be based upon mutual consent and a cost value defined by experts in the sphere of assessment of land, property and agricultural assets and the local self-government institutions. The respective compensation will be defined on the basis of the market value of the property and the manner and purpose of use, and, if necessary, as a substitute for the value of the affected assets.

During the compensation process consideration will be given to the restoration of the needs for means of living, quality of life and, especially, providing adequate reimbursement for the vulnerable groups. It is possible to also consider other alternatives in addition to monetary compensation, since a monetary fee is not always the best alternative taking into account that money can be spent fast. A better compensation option could be replacement of the land with land that has easy access and a similar or better quality and a possibility for using such land. Based upon the foregoing, there will be no involuntary economic resettlement.

It is necessary to maintain contact with these persons until the completion of the compensation and the payment of the funds, as well as the elimination of any adverse consequences. The application of these practices should be in accordance with the national legislation.

7.14 Mitigation measures for impacts on community health, safety and security

Construction phase

The mitigation measures for the negative impacts on the population and on human health practically mean measures that should be undertaken in the course of the construction phase, which pertain to reducing the likelihood of any possible injuries at the workplace, protection from traffic accidents caused by the frequency of transport vehicles, protection from exhaust emissions, as well as protection from increased noise from the construction machinery and from the vehicles used for transporting the equipment and the materials.

The measures will be presented and implemented according to a duly developed Community Health, Safety and Security Plan which applies for the duration of the construction and the work on the project, including also emergency prevention, preparedness and response. The plan will be developed in accordance with the national legislation and the international requirements, i.e. EIB (European Investment Bank) – ESS (Environmental and Social Standards) 9: Occupational and Public Health, Safety and Security.

The proposed measures are related to the implementation of adequate measures for protection against air pollution, noise and vibration, as well as measures for protection against any injuries of the local population and the involved workers and, certainly, use of adequate tools and personal protection equipment by the workers during the construction works in accordance with the Law on Safety and Health at Work. A mitigation measure for the impact on human health comprises the establishment of adequate waste management (collection, transport and disposal) in order to prevent any possibility of infections and diseases.

For the purposes of mitigating any potential for fire breakouts, it is necessary to apply safety measures and to regularly monitor the location in the immediate vicinity of the gas pipeline.

It is necessary to prepare periodic analyses and statistics in terms of any accidents at the site, including recommendations for reducing the related risks in the course of the subsequent construction works.

The gas pipeline route stretches mainly outside populated areas and, thereby, the accessibility of the population to the construction site is low. Nevertheless, due to the substantial length of the line structure, it is impossible to fence the entire construction site and, therefore, there is a likelihood of incidents at the construction sites related to an unlawful presence of persons or accidental intrusion of livestock. In order to prevent any such situations, it is necessary for the Operator, and especially the Contractor, to inform the local public of the planned construction activities, of the gas pipeline route and of the timing for the performance of such activities, as well as to establish an adequate security service at the construction site.

The use of acoustic signals should be avoided and the speed of the transport vehicles should be adjusted in the populated areas.

At locations where the construction activities block the local access roads from distant populated areas, the Contractor is to ensure that such blockages are in place for an as short as possible time span or, if this is not feasible, to provide alternative access to such areas, so that the social and health institutions could provide the required care and assistance to the beneficiaries of such assistance.

The Contractor should especially make sure that the workers respect the property, the needs and the values of the local population, so as to avoid any conflict between the investor and the members of the local community.

Operational phase

During the regular operation of the gas pipeline no significant negative impacts are anticipated in terms of local community health and safety. The measures will be presented and implemented according to a duly developed Community Health, Safety and Security Plan which applies for the duration of the construction and the work on the project, including also emergency prevention, preparedness and response. The plan will be developed in accordance with the national legislation and the international requirements, i.e. EIB (European Investment Bank) – ESS (Environmental and Social Standards) 9: Occupational and Public Health, Safety and Security.

Adequate mitigation measures will be implemented in terms of the negative impacts during the construction process on the populated areas in order to minimize such impact as much as possible. Furthermore, it is expected that the duration of the construction activities at each location will span over a short period of time. If it is necessary to set a construction camp for the workers, the location of the camp should be in the vicinity of a populated area or a main road. The location of the workers' camp will be decided on prior to the commencement of the construction activities.

During the early construction phases, prior to the commencement of the construction activity, the Contractor should prepare adequate documents and plans pertaining to the community health, safety and security. These will be implemented in the overall project documentation. Such documents and plans include the following:

- Community Health, Safety and Security Plan;
- Emergency Preparedness and Response Plan.

The foregoing should be compliant with the national regulations, as well as the requirements of the respective international institution (e.g. EIB – Performance Standard 9: Occupational and Public Health, Safety and Security).

The Contractor will develop and implement procedures for the protection of the health and safety of the local communities, the population and their property. Such procedures should include introducing the workers to the rules on safety and on the construction site, as well as to the obligation to prevent any unauthorized access to the construction site, the transport vehicles, the construction machinery and the warehouses. The Contractor will develop and implement a Construction Management Plan for ensuring a response in the event of any accidents and emergencies in a manner that is suitable for the risks in the sphere of construction. This Plan is to include a prior identification of the risks for increased incidents and the required measures for the prevention thereof, as well as mitigate the consequences therefrom upon the local community.

The Contractor is obliged to ensure a safe pedestrian and road traffic corridor via the construction site, on the request of the local community and the inhabitants.

The Contractor should also conduct a safety campaign for the population that lives in the areas in the vicinity of the construction sites, which will include educational and informative activities for the population. The major part of this campaign is to be implemented prior to the commencement of the construction activities, while the remainder during the construction phase. The campaign is to be supported by the media and the local radio stations with information, publication of manuals, leaflets and recommendations in hard copy, available to the local population, as well as in an electronic format on the website of the municipality, as well as other local institutions, including also on the website of the Investor.

The Contractor is advised, in coordination with NER and the local self-government, to hold several meetings with the local community at which an explanation would be provided in terms of the impacts from the project, especially, noise, vehicle frequency and also information regarding the safety of the population during the forthcoming period of construction works. It is desirable for such meetings to be held prior to the commencement of the construction activities.

7.15 Mitigation measures for impacts on occupational safety, security and health

Construction phase

An Occupational Safety and Health Plan is to be developed.

As regards the mitigation measures for the risk of suffering injuries during the unloading and loading of bulky construction material, the following is required:

- At loading and unloading sites, it is not allowed for anyone to be present except for the driver of the motor vehicle and the signalist of the load driver;

- No movement or presence is allowed in the manipulation space of the working machine that performs the loading and the unloading;
- Checks of the working machines used for loading and unloading will be performed in terms of their safe use periodically and prior to the commencement of the work control checks will be performed on a daily basis by the working machine operator;
- No load should be transported over heads of the other workers and persons, or over the truck cabins;
- Attention should be paid to aerial electrical cables;
- The working machine should not be overloaded in excess of its declared load-bearing capacity;
- The vehicles should be driven slowly on surfaces that are not level or that are slippery and uneven;
- Driving too close to the edge should be avoided, since the weight of the machine could cause landslides-ruins;
- When moving backwards, the signalling devices should function properly;
- Standing over the construction material which is being loaded or unloaded is forbidden.

As regards the mitigation measures for the risk of suffering injuries due to falls, the following is required:

- In the event of placing a crossing path for the workers over the excavated trench for the pipeline (bridges), it is required to ensure that these are safe, with a sufficient width (more than 60 cm) and with a protective fence on both sides;
- When climbing on or stepping down from construction machinery and transport vehicles, the handrails should be used and no jumping is allowed;
- When stepping down in the pipeline trench or coming out of it, it is mandatory to use ladders in a proper and safe condition.

In terms of the mitigation measures for the impact on the workers due to their exposure to the risk of noise, the following is required:

- When performing work tasks where the noise exceeds 80dB, it is necessary to use earplugs or headphones;
- Avoiding any hazard factors by means of a good organization of the work and application of safe work practices in order to reduce the exposure to noise (limiting the duration and the intensity of the exposure, as well as ensuring adequate working schedules with periods of rest);
- Adequate information and training for the workers in order to enable them to properly use the working equipment so as to minimize their exposure to noise.

As regards the mitigation measures for the impact from exposure to sun and high temperatures, the following is required:

- No work should be performed with a direct sun exposure at a time when the sunlight is the strongest;
- The head should be protected from direct sun exposure in order to avoid a heat stroke;
- Non-alcoholic beverages should be consumed and light cotton clothing should be worn.

As regards the mitigation measures for the impact of the risk of injury as a result of failure to use personal protective equipment (PPE) or its improper use, the following is required:

- The PPE should be in accordance with the standards of the European Union, as well as the international regulations on its design and production, especially in terms of the safety and health of the workers;
- The PPE should be adequate for protection against the risk for which it is intended and it should not give rise to any additional risks;
- The PPE should be adequate for the existing conditions at the workplace;
- The PPE should be aligned with the ergonomic requirements and the worker's health condition;
- The PPE should fit the worker, with a possibility for adjustments;
- The use of the PPE, especially the time period during which it is worn, should be determined on the basis of the severity of the risk, the frequency of exposure to such risk, the features of the job position of each worker and the properties of the personal protection equipment.

Operational phase

As regards the mitigation measures for the impact of the risk of injury as a result of failure to use personal protective equipment (PPE) or its improper use during repairs or controls, the following is required:

- The PPE should be in accordance with the standards of the European Union, as well as the international regulations on its design and production, especially in terms of the safety and health of the workers;
- The PPE should be adequate for protection against the risk for which it is intended and it should not give rise to any additional risks;
- The PPE should be adequate for the existing conditions at the workplace;
- The PPE should be aligned with the ergonomic requirements and the worker's health condition;
- The PPE should fit the worker, with a possibility for adjustments;
- The use of the PPE, especially the time period during which it is worn, should be determined on the basis of the severity of the risk, the frequency of exposure to such risk, the features of the job position of each worker and the properties of the personal protection equipment.

7.16 Mitigation measures for impacts on the archaeological and cultural-historical heritage

Construction phase

Accidental Discovery Protocol for cultural heritage

In the event of an unforeseen, accidental discovery at an archaeological site, the Contractor is obliged to immediately notify the Operator and the Ministry of Culture and to comply with their instructions, wherein this measure is in accordance with the North Macedonian Law on Protection of Cultural Heritage.

The construction works will be temporarily interrupted, whereas the competent authorities will decide whether it is necessary to conduct a research or apply all available protective measures. The Contractor is obliged to comply with the guidelines provided by the competent authorities for the protection of cultural heritage. The Contractor is obliged to keep any discovered objects at the place of discovery and in the condition in which they were discovered.

The workers should be provided with a basic training related to the Accidental Discovery Protocol at archaeological sites.

For the purposes of protecting the inhabitants of the affected populated areas from any possible negative consequences arising from the disruption of religious customs and events, especially burials of the deceased, and in order to avoid any misunderstandings with the community in this respect, the Contractor is obliged to prepare information with a weekly schedule of activities that will produce a strong noise and display such information at public locations in the populated areas. Furthermore, such information may be published by means of notices in the local media and radio stations, as well as in the municipality, in order to ensure easier distribution of this information.

Operational phase

During the regular operation of the gas pipeline, no negative impacts on the archaeological and cultural-historical heritage are anticipated. Therefore, no measures are required.

7.17 Enhancement measures for impacts on the economic development

During the construction phase and in the operational phase, positive impacts are anticipated (employment opportunities and an increased economic activity in the area). Therefore, no measures are required.

As regards the impact on the vulnerable groups and gender equality, in the event of any direct threats to the vulnerable population as a result of the gas pipeline construction, the Operator and the local community will be required to assist in the efforts for preventing any economic displacement of these groups. Indirect employment opportunities in this phase could contribute for reducing the gender bias through an increased support for the local businesses that employ women.

NER and the Contractors will enable employments that support the local community. It will be developed through consultations with the local stakeholders, the municipalities and other local affected parties, including women and vulnerable groups. The foregoing should be compliant with the national regulations, as well as the requirements of the respective international institution (e.g. EIB – Performance Standard 8: Labour Standards).

- NER, alongside the Contractors, is going to establish a method for easier local employment and publish the job positions in manners and during periods in which it is possible for the local population to participate. It is important for the employment process to be well managed and for the local community to have a possibility to actively participate in the measures;
- NER will encourage local employments, with priority being given to the following four municipalities: Negotino, Demir Kapija, Gevgelija and Bogdanci, including also the neighbouring villages along the route of the gas pipeline;

- The local inhabitants will be informed in a timely manner of the employment opportunities and the required qualifications, whereby it will be ascertained that the advertising process is adequate for the lifestyle and the administrative requirements;
- The local businesses will be informed in a timely manner regarding any contracting possibilities;
- NER will make sure that the engagement process is being implemented as transparently as possible in order to help the community understand the strategic decisions of the project workers;
- NER is going to develop and apply a Worker Code of Conduct which will regulate issues such as anti-social behaviour, drugs and alcohol abuse and discrimination of women as per the applicable national regulations. The Contractors will be required to comply with the afore-stated Code of Conduct;
- NER will ensure that all complaints filed by the local businesses are managed in an adequate and timely manner. In the event of a necessity of corrective activities, they will be implemented in an effective and timely manner;
- NER will develop a Workforce Development Strategy – an obligation to increase the employment opportunities and the skills of the local population;
- NER will advise the Contractor to increase the employment of the local population which will be based on the required qualifications and skills;
- NER and the Contractors will prepare and develop a capacity building program, including mentorship, training and learning opportunities for the local inhabitants in order to maximize the development of the skills of the local population. The employment of the local inhabitants in higher-level job positions should be increased in order to facilitate the good relations in the community;
- NER will develop a program on corporate social responsibility (CSR) which will be designed and implemented through coordination with the municipalities with a view to creating business opportunities for the local community. The CSR program will be available to the local community, including also the workforce that is no longer involved in the project after the completion of the construction works;
- The CSR programs will also attempt to improve the education and skills levels of the persons affected by the project.

7.18 Residual impacts

The implementation of the mitigation measures proposed in this study will not result in mitigation of all identified impacts. The remaining impacts (residual impacts) pertain to the environmental impacts that are foreseen to endure after the application of the mitigation measures.

Below we have provided an assessment of the significance of such residual impacts. The assessment has been made on the basis of a prior basic impact analysis (impacts without the application of mitigation measures), the likelihood and the level of success of the respective mitigation measures, as well as an assessment of the size (magnitude) of the impact by applying mitigation measures. The significance of the residual impacts is determined in the construction phase and in the operational phase, depending on their place of occurrence.

- **SOIL**

- **Construction phase**

Change in the soil quality as a result of the introduction (emission) of pollutants that could impair the soil quality

The significance of this impact without the application of mitigation measures is **low or moderate**.

The likely success of the mitigation measures is high.

The size (magnitude) of the impact by applying mitigation measures is negligible.

The significance of the residual impact is **insignificant or low.**

Soil erosion due to vegetation removal

The significance of this impact without the application of mitigation measures is **low or moderate**.

The likely success of the mitigation measures is low.

The size (magnitude) of the impact by applying mitigation measures is low.

The residual impact significance is **low**.

Loss of fertile topsoil

The significance of this impact without the application of mitigation measures is **moderate or high**.

The likely success of the mitigation measures is low.

The size (magnitude) of the impact by applying mitigation measures is moderate.

The residual impact significance is **moderate**.

Landslides due to excavations

The significance of this impact without the application of mitigation measures is **insignificant or low**.

By means of a proper design and application, the likely success of the mitigation measures is high.

The size (magnitude) of the impact by applying mitigation measures is negligible.

The significance of the residual impact is **insignificant**.

- **Operational phase**

Impacts due to construction activities for the repair of underground pipeline defects

During the regular operation of the gas pipeline, no impacts on the soil are anticipated. Impact is solely possible in the event of a defect in the underground parts of the gas pipeline, wherein construction works will be performed identical to the ones in the construction phase. Accordingly, the impacts and the measures in the operational phase will be identical to the ones taken in the construction phase. Therefore, also the residual impacts will be identical to the ones from the construction phase, with **the same significance**.

- **GROUNDWATER**

- **Construction phase**

Change in the groundwater flow pattern

The significance of this impact without the application of mitigation measures is **moderate or high**.

The likely success of the mitigation measures is high.

The size (magnitude) of the impact by applying mitigation measures is low.

The residual impact significance is **low**.

Change in the groundwater quality as a result of pollution with pollutants

The significance of this impact without the application of mitigation measures is **moderate or high**.

The likely success of the mitigation measures is high.

The size (magnitude) of the impact by applying mitigation measures is low.

The residual impact significance is **low**.

- **Operational phase**

Impacts due to construction activities for the repair of underground pipeline defects (identical to the ones in the construction phase)

During the regular operation of the gas pipeline, no impacts on groundwater are anticipated. Impact is solely possible in the event of a defect in the underground parts of the gas pipeline, wherein construction works will be performed identical to the ones in the construction phase. Accordingly, the impacts and the measures in the operational phase will be identical to the ones taken in the construction phase. Therefore, also the residual impacts will be identical to the ones from the construction phase, with the **same significance**.

➢ **SURFACE WATER**

- **Construction phase**

Change in the surface water quality as a result of pollution with pollutants

The significance of this impact without the application of mitigation measures is **moderate or high**.

The likely success of the mitigation measures is high.

The size (magnitude) of the impact by applying mitigation measures is low.

The residual impact significance is **low**.

Change in the riverbed morphology and/or the physical properties of the water

The significance of this impact, without the application of mitigation measures, is **high or very high** in terms of River Vardar, i.e. **low** in terms of all the other rivers.

The likely success of the mitigation measures is high.

The size (magnitude) of the impact by applying mitigation measures is low in terms of River Vardar, and negligible in terms of all the other rivers.

The significance of the residual impact is **low** in terms of River Vardar, i.e. **insignificant** in terms of all the other rivers.

- **Operational phase**

Impacts due to construction activities for the repair of underground pipeline defects (identical to the ones in the construction phase)

During the regular operation of the gas pipeline, no impacts on surface waters are anticipated. Impact is solely possible in the event of a defect in the underground parts of the gas pipeline, wherein construction works will be performed identical to the ones in the construction phase. Accordingly, the impacts and the measures in the operational phase will be identical to the ones taken in the construction phase. Therefore, also the residual impacts will be identical to the ones from the construction phase, with the **same significance**.

- **AIR**

- **Construction phase**

  Air pollution as a result of pollutant emissions caused by the construction activities

  The significance of this impact without the application of mitigation measures is **low or moderate**.

  The likely success of the mitigation measures is high.

  The size (magnitude) of the impact by applying mitigation measures is negligible.

  The significance of the residual impact is **insignificant or low**.

- **Operational phase**

  Air pollution as a result of pollutant emissions caused by the regular operation

  During the regular operation of the gas pipeline, no impacts on the air are anticipated. Impact is solely possible in the event of a defect in the underground parts of the gas pipeline, wherein construction works will be performed identical to the ones in the construction phase. Accordingly, the impacts and the measures in the operational phase will be identical to the ones taken in the construction phase. Therefore, also the residual impacts will be identical to the ones from the construction phase, with the **same significance**

- **CLIMATE CHANGE**

- **Construction phase**

  Increase of greenhouse gas due to loss of biomass

  The significance of this impact without the application of mitigation measures is **insignificant or low**.

  The significance of the residual impact is **insignificant or low**.

- **Operational phase**

  Greenhouse gas emission from the regular operation of the gas pipeline

  The significance of this impact without the application of mitigation measures is **low**.

  The likely success of the mitigation measures is high.

  The size (magnitude) of the impact by applying mitigation measures is low.

  The significance of the residual impact is **insignificant or low**.

- **WASTE GENERATION**

- **Construction phase**

  Waste generation in the construction phase

  The significance of this impact without the application of mitigation measures is **low or moderate**.

  The likely success of the mitigation measures is high.

  The size (magnitude) of the impact by applying mitigation measures is negligible.

The significance of the residual impact is **insignificant or low**.

- **Operational phase**

  <u>*Waste generation during the regular operation of the gas pipeline*</u>

  The significance of this impact without the application of mitigation measures is **low**.

  The likely success of the mitigation measures is high.

  The size (magnitude) of the impact by applying mitigation measures is negligible.

  The significance of the residual impact is **insignificant or low**.

➢ **NOISE AND VIBRATION**

- **Construction phase**

  <u>*Noise impact from the construction activities*</u>

  When determining the residual impacts in terms of noise, this impact as such, without the application of mitigation measures, is considered to be of the highest significance. Accordingly, without the application of mitigation measures, the significance of *the noise impact from the construction activities*, is **high or very high**.

  The likely success of the mitigation measures is moderate.

  The size (magnitude) of the impact by applying mitigation measures is moderate.

  The residual impact significance is **low or moderate**.

- **Operational phase**

  <u>*Impacts due to construction activities for the repair of underground pipeline defects (identical to the ones in the construction phase)*</u>

  During the regular operation of the gas pipeline, no noise impacts are anticipated. Impact is solely possible in the event of a defect in the underground parts of the gas pipeline, wherein construction works will be performed identical to the ones in the construction phase. Accordingly, the impacts and the measures in the operational phase will be identical to the ones taken in the construction phase. Therefore, also the residual impacts will be identical to the ones from the construction phase, with the **same significance**.

➢ **SOCIAL ASPECTS**

Having regard to the proposed impact mitigation measures, the total residual impact from the construction and the operation of the project is expected to be of an **insignificant or low** significance.

8 RISK ANALYSIS AND CONTINGENCY PLANNING

The Contingency Plan is defined as an action plan which is to be implemented in the event of any hazards that pose a risk to the environment and mankind, or cause damages to material goods. In terms of defining the risks, the reasons for the occurrence of any contingencies are considered to be a prerequisite for the development of a Contingency Plan.

In this project, the following are considered to be such reasons:

1. Contingencies that could occur as the result of natural disasters;

2. Incidents (risks) related to the workers' safety, security and health;

3. Contingencies that could occur as a consequence of the inadequate development and non-compliance with the guidelines on occupational safety and the use of personal and collective protection equipment, in the course of the regular project activities (both in the construction and in the operational phase);

4. Contingencies that could occur as a consequence of an inadequate maintenance of the equipment and the installations.

Concurrently, consideration has been given to the possibility of the occurrence of the following:

- Accidents during the installation of the pipeline or during the construction of any surface facilities – block stations and a reducing station;
- Conditions as a result of any disturbances of the operational system (e.g. during the maintenance of the stations, in the event of various repairs, sudden damages, etc.) During the operation of the gas pipeline, which could have major environmental impacts.

In the course of the development of this Plan, the following activities were performed:

- The instances that are most likely to occur, such as disturbance of the operation of the system/unforeseen damages to the facilities/plants, have been identified as a risk;
- An attempt has been made to assess the likelihood of their occurrence;
- The possible negative environmental impacts have been presented;
- Impact mitigation actions have been proposed;
- A responsible institution/organization has been determined that will take action in the event of any unforeseen hazards.

Having regard to the fact that the gas pipeline constitutes a transport system comprised of steel pipes with a high operating pressure through which natural gas will be transported, its construction and operation have been regulated by the legislator in the Rulebook on Technical Conditions and Norms on the Safe Transport of Liquid and Gaseous Hydrocarbons with Main Oil and Gas Pipelines and International Oil and Gas Pipelines (Official Gazette of SFRY No.26/1985 and RM No.18/1997). In that context, the project solutions that have been integrated in the construction performance of the gas pipeline, the adequate armature works and the performed geo-technical research works, are congruent with ensuring preventive protection against any undesired situations that would cause a disturbance of the safety during the construction and the regular operation of the gas pipeline.

8.1 Risk assessment and taking measures in the event of any contingencies during the construction

The construction of the gas pipeline has a feature specific for line infrastructure facilities that mainly refers to: the substantial length, various conditions of the terrain through which the route goes, various types of obstacles (natural and artificial), distance from the urban areas, performance of all activates outdoors (whereby the entire equipment and all the persons present at the construction site are exposed to impacts from natural disasters – storms with strong winds, rain, snow, thunder strikes, fog, earthquakes, low and high temperatures, fires in the immediate vicinity, occurrence of landslides, etc.).

As regards the risks that exist as a result of the impacts from natural disasters – generally, measures will be taken which pertain to: timely monitoring of the weather conditions and adjustment thereto (if necessary, the work will be interrupted on a short-term basis); consistent compliance with the rules on setting fires – especially during the dry periods of the year; ensuring stability of the construction machinery in terms of the possible occurrence of landslides, etc.

As regards inadequate preparations for work and non-compliance with the guidelines on occupational safety and the use of personal and collective protection means, the main emphasis is on the application of a good working practice adjusted to each part of the sections that are to be constructed, while adequately adhering to the requirements of the Law on Safety and Health at Work.

Generally speaking, in order to minimize the risk of injuries and fatalities (both in terms of the workers and in terms of other visitors related to the construction, such as: supervision, control, material supplies, etc.), measures are to be put in place which pertain to safety, warning and precaution, which are to be compulsorily implemented by the Contractor. The work supervision engineer is obliged to control the compliance of all measures and actions taken by the Contractor.

The Contractor's staff must be trained for contingency and emergency management (including fires, floods, earthquakes, etc.). Of a special importance is also the arrangement of the construction site with a view to avoiding accidents and/or minimizing incidents during the construction. The Contractor is to fully comply with the legal obligations in terms of fencing, lighting, traffic regime and ensuring a safe environment for the workers. The heavy machinery and vehicles used by the Contractor are to be in accordance with the requirements defined in the Basic design.

8.2 Risk assessment and taking measures in the event of any contingencies during the operation of the gas pipeline

The accidents that could occur during the phase of the operation of the gas pipeline have been assessed in terms of the entire process of operation, including also the activities related to the ongoing maintenance, the regular check-ups and repairs and any major dismantling.

In principle, the risks are divided in two groups:

- Risks from external factors (earthquakes, natural disasters, vandalism) which cannot be controlled or prevented, while the damage could be reduced by applying adequate measures in the course of the construction process;
- Risks arising from the technological process and equipment (cracks, inadequate treatment, fires and explosions),

Protection against earthquakes has been provided for by means of the seismic design and securing of the pipeline and the supporting facilities. The proper construction of the gas pipeline by applying all prescribed measures and guidelines set forth in the Main and As-Built Design will substantially decrease the possibilities of any incidents in the operational phase.

Some of the least predictable and most serious accidents are fires and explosions, which might occur despite the application of all preventive and safety measures. The nature of the project is such that an incident related to the functioning of the gas pipeline could lead to the discharge of significant quantities of natural gas in the surrounding environment. The possibility of igniting such gas implies that there is an environmental risk and a threat to the safety of individuals, the public and the material goods. Therefore, it is mandatory to develop a prior detailed contingency planning in terms of such incidents, so as to include as many as possible safety elements in the plan.

In that context, a detailed risk assessment is required, which is going to cover the following:

- Reviewing the documentation of the relevant facilities;
- Conducting a physical survey of the gas pipeline route in order to identify any potential hot spots;
- Identification of the weather conditions on the terrain;
- Defining security threat criteria;
- Development of an ignition hazard assessment;
- Development of a sensitivity analysis;
- Defining scenarios in which ignited gas is released;
- Definition and analysis of consequences;
- Definition of defect frequency;
- Preparing a risk assessment;
- Risk assessment in accordance with the globally adopted acceptable risk levels;
- Considering applicable steps aimed at reducing the risks and taking corrective measures.

As a preventive measure, automatic valve closure systems will be installed so as to prevent any undesired leaks in the event of a defect. Along the route of the gas pipeline, the most sophisticated measuring and regulation equipment will be installed with a signalling alarm system that also detects any incidents in the gas pipeline. In addition to the automatic valves, also other manually controlled valves will be installed in the gas pipeline so as to minimize any leakage and potential accidents. Flow measurements will be taken in the gas pipeline so as to be able to promptly detect any leakage.

The surface facilities will be constructed as per all prescribed measures for protection against fires and explosions.

By means of a proper and consistent application of the measures and the recommendations for working on facilities, in the event of the existence of a possibility for explosions to occur (in instances when there is scintillation or during welding and similar activities) the occurrence of accidents during repairs and interventions in the gas pipeline will be prevented. Therefore, in such instances the work should be performed only by professionally trained and experienced persons.

The Risk Assessment and the Contingency Planning during the construction and the operation of the gas pipeline are presented in Table 8-1 and in Table 8-2.

Table 8-1: Risk Assessment and Contingency Planning during the construction of the gas pipeline

Location	Risk	Impact magnitude	Measures	Responsibility
Construction phase				
At the gas pipeline construction site	Interruption of underground installations intercepted by the gas pipeline route (water supply pipes, electrical and telecommunication cables, other pipelines, etc.)	Significant	• Preventive application of the instructions set forth in the Basic design with the listed chainages for the underground cadastre • Arrangement of the electrical installations at the construction site by professionally trained and qualified workers, as well as applying protective earthing; • Performance of the preparatory activities related to informing the public; • In the event of such accidents, it is necessary to comply with the recommendations and the guidelines for reducing the damages, as set forth in the Basic design.	The Contractor and the respective institutions that possess information on the underground cadastre
At the gas pipeline construction site	Incidents related to encountering surface obstacles (roads, railways, rivers, valleys, working under overhead power lines, etc.)	Significant	• Consistent application of the guidelines stipulated in the Main and the As-Built Design • Preparing a Rescue and Protection Plan in the event of any emergencies and making sure that all employees are familiar with it; •	Contractor
At the gas pipeline construction site and the surface facilities	Damages caused by fire (buildings, people, the environment)	Significant	• Adequate protective and preventive measures in terms of fires are to be taken during the construction. • Ensuring first aid equipment and implementation of an emergency response plan; • Providing fire protection equipment; • Adequate training for the employees.	Contractor
At the gas pipeline construction site and the surface facilities	Flooding of the construction site	Significant	• Implementation of adequate measures for protection against erosion and floods; • Installation of drain pumps at the boreholes (trenches) • Protecting the excavation trenches against landslides • Safe storage of equipment, materials and chemicals • Adequate training for the employees.	Contractor
At the gas pipeline construction site in the route parts located on steep slopes	Accidents due to instability in the work of heavy machinery,	Significant	• Proper stabilization of the machinery as per the guidelines provided for in the Main and the As-Built Design	Contractor

Location	*Risk*	*Impact magnitude*	*Measures*	*Responsibility*
		Construction phase		
Places of storage, transport and construction of the gas pipeline in route parts located on hard rock ground	*Improper use of explosive devices while breaking up rocky soil with exploration and blasting works*	*Significant*	• *Consistent application of the explosives storage and manipulation guidelines and measures*	*Contractor*
At the gas pipeline construction site and the surface facilities	*Accidents from falling in any open trenches by the workers and other persons present at the construction site (for the purposes of supervision and control, supply of materials)*	*Significant*	• *During the excavation works all measures should be taken for the protection of the construction site and adequate marking* • *Development of an Occupational Safety and Health Plan at temporary and mobile construction sites;* • *Appointing an occupational safety expert;*	*Contractor*
At the pipes storage sites and the gas pipeline construction site and the surface facilities	*Accidents during the loading, unloading and manipulation of materials and equipment*	*Significant*	• *Preparation of a Safety Statement with a risk assessment for all work positions at the construction site;* • *Preparing a program and delivering trainings for a safe work performance;* • *Procuring personal protection equipment adequate for the work positions at the construction site;* • *Consistent application of the measures defined in the rulebooks on the manipulation of bulky waste and crane operation*	*Contractor*
Along the path from the loading site to the unloading site at the construction site or at a another site designated for storage	*Accidents during the transport of materials and equipment along the main and side roads*	*Moderate*	• *Full implementation of the traffic plan defined in the Basic design;* • *Proper placement of the traffic signalling (vertical and horizontal);* • *Adequate lighting during night time;* • *Coordination with the traffic police for the purposes of an adequate road traffic regulation.*	*Contractor* *Transporter*
At the gas pipeline construction site and the surface facilities	*Accidents due to sudden defects in the heavy machinery, such as cranes, trenchers, etc.* *Occurrence of incidental local fires*	*Significant*	• *The Contractor is obliged to fully comply with the safety rulebooks and the safety legal measures for the protection of the workers;* • *Procurement of fire extinguishing equipment, providing first aid and implementing evacuation.* • *Emergency medical care is to be available at any time at the construction site.*	*Contractor*

Location	Risk	Impact magnitude	Measures	Responsibility
Construction phase				
At the gas pipeline construction site and the surface facilities	*Accidents due to the workers' negligence*	*Significant*	• *The workers are obliged to wear protective equipment (clothing, protective helmets, etc.);* • *The workers are to be trained in contingency management and first aid;* • *Emergency medical care is to be available at any time at the construction site.* • *Placing signs and short instructions related to warnings in terms of occupational safety and health* • *Preparation and implementation of procedures for safe working*	*Contractor*

Table 8-2: Risk Assessment and Contingency Planning during the operation of the gas pipeline

Location	Risk	Impact magnitude	Measures	Responsibility
Operational phase				
At the gas pipeline and the surface facilities	*Accidents caused by natural disasters (storms with strong winds, rains, snow, thunder strikes, fog, earthquakes, high and low temperatures, fire breakouts in the immediate vicinity, occurrence of landslides)*	*Significant*	• *The protection against natural disasters has been resolved in the designing phase (with the seismic design and securing the pipeline and the supporting facilities) Proper construction of the gas pipeline by applying all prescribed measures for the protection of the surface facilities against strong winds, rain, snow, floods. Ensuring proper foundations for the underground installations such as protection against flooding and landslides.*	*project designer and Contractor*
At the gas pipeline and the surface facilities	*Cracks, damages to the hermeticity (impermeability) of the gas pipeline*	*Moderate*	• *Installing control operation devices with a fast response and sealing of the damaged part. A fast intervention by professionally qualified and trained persons and repairing the defect.*	*project designer, Contractor, Operator*
At the gas pipeline and the surface facilities	*Occurrence of fires and explosions*	*Significant*	• *Installing control operation devices with a fast response and closing the part that is damaged and captured by fire. A fast intervention by the fire brigade and by professionally qualified and trained persons and repairing the defect.*	*project designer and Contractor, fire brigade, Operator*

8.3 Additional obligations of the Contractor/subcontractors in terms of ensuring occupational safety, security and health

The Contractor is obliged to develop and implement an **Occupational Health and Safety Management Plan.** This management system is to be binding for the contractors, including also the subcontractors. It comprises aspects such as: appointing an occupational safety and health expert, identification and use of personal protection equipment, regular training and monitoring, as well as ongoing security checks and other measures.

The Occupational Safety and Health Plan is aimed at eliminating or minimizing the risks and the sources of such risks in terms of the workers' safety and health. All Contractors and subcontractors are obliged to meet the Plan requirements. The Contractor is to provide all the resources, workforce and materials from a verified source wherein, in addition to the price, also other factors will be taken into consideration, such as the quality, the reputation, the rendered projects and services.

The Occupational Health and Safety Management Plan is to include a **grievance mechanism,** in accordance with the national laws, as well as pursuant to the requirements of the International Financial Institutions (IFI). The grievance mechanism for the workers obliges the Contractor to receive and adequately resolve the complaints of the workers in a fair and reasonable manner.

As regards the **workers' rights**, all workers (including contractors and subcontractors) will be provided with contracts comprising clearly expressed legal rights and requirements in terms of their employment. Such contracts will be explicitly explained to all the workers so as to enable them to understand their rights. The contracts will have to be concluded prior to the commencement of the work activities.

All employees, including also the subcontractors, will be obliged to sign a **Code of Conduct**, which is to be available and visible, while each worker will have to understand the importance of the document and the consequence from non-compliance with it. The Contractor is obliged to deliver a training for the workers in terms of the methods of avoiding any conflicts with the local community.

The Contractor is obliged to prepare and implement a **Local Employment Plan** in terms of workforce for the needs of the project, in cooperation with the local employment office, wherein special attention will be paid to engaging the available local workforce. The Plan is going to comprise all aspects, from an analysis of the current labour market condition at a local, regional and national level, to the organization and systematization of the job positions required for the project. The engagement of an adequate workforce for this project from the entire project area should ensure special priority for the applicants from rural populated areas within the project footprint.

It is recommended for the tender documentation to include a requirement for the contractors to submit a specification with the number of required engaged workers according to the construction phase and their qualifications, which are planned to be engaged if they participate in the project construction phase.

If a need arises, the Contractor will develop a **Plan for the Accommodation of the Workers** which will be in accordance with the standards arising from good international practices, as well as the IFI experience and standards. If it is necessary to organize a workers' camp, it must not be in the vicinity of any of the affected rural areas. Prior to the construction of the accommodation capacities for the workforce, an audit is to be conducted of the design and the manner of its implementation in accordance with the instructions given by EBRD and IFI, prior to the launching of the project and on an annual basis (each year following the launching).

The Contractor is obliged to ensure compliance with the local legislation in the sphere of labour and social policy, the Law on Health and Safety at Work (Official Gazette of the Republic of North Macedonia No. 92/2007, 136/2011, 23/2013, 25/2013, 137/2013, 164/2013, 158/2014, 15/2015,129/2015, 192/2015, 30/2016, 27/2018) and the EU Directives on occupational safety and health, as well as on the use of personal protection equipment 89/654/EEC, 89/656/EEC, 89/686/EEC and 2009/104/EC.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

The Environmental and Social Management and Monitoring Plan (ESMMP) identifies the impacts on the environmental media and areas that will be affected during the implementation of this project. The Plan defines the measures for neutralization and/or mitigation of the negative impacts, the objective, i.e. the anticipated achievement from the implementation of the measures, the holder of the responsibility for implementing the measures and the timeframe for the completion of such implementation.

The Plan provides an analysis and a definition of the impacts and the measures in the construction phase and in the operational phase, whereby the Contractor (including also any sub-contractors) and the Operator will be provided with a clear insight into the environmental impacts that could occur in the course of the construction of the gas pipeline and during its use.

The Plan elaborates on environmental media and areas, as well as socio-economic aspects:

- Soil;
- Groundwater;
- Surface water;
- Air;
- Climate change;
- Waste generation;
- Noise and vibration;
- Biodiversity (flora and fauna);
- Landscape and visual effects;
- Demographic;
- Stakeholder engagement;
- Use, ownership and access to land and property;
- Community health, safety and security;
- Archaeological and cultural-historical heritage;
- Economic development.

The Environmental and Social Management Plan is presented in a tabular format (Table 9-1), wherein an indication has been made as to which project phase a specific activity refers to (construction phase and operational phase).

The Plan comprises the following information:

- Impact;
- Proposed impact mitigation measures;
- Objective;
- Competent institution;
- Time schedule.

Table 9-1: Environmental and Social Management Plan

<table>
<tr><th>Impact</th><th>Proposed impact mitigation measures</th><th>Objective</th><th>Competent institution</th><th>Time schedule</th></tr>
<tr><td colspan="5">ENVIRONMENTAL ASPECTS</td></tr>
<tr><td colspan="5">Soil
Construction phase</td></tr>
<tr><td>The potential impacts on soil during the gas pipeline construction phase are as follows:
○ Change in the soil quality as a result of the introduction (emission) of pollutants that could impair the soil quality – low or moderate significance
○ Erosion of the soil due to vegetation removal – low or moderate significance
○ Loss of fertile topsoil – moderate or high significance.
○ Landslides due to excavations – insignificant or low significance.</td><td>During the construction phase, for the purposes of reducing the impacts caused by the change in the soil quality as a result of pollutant emissions, the following measures should be taken:
– Careful planning of the construction works with a view to reducing the negative effects and ensuring the prevention of any soil pollution.
– Safe storage of the construction materials.
– The vehicles and the construction equipment are to be maintained in a functional condition in order to prevent any undesired leakage of fuels, lubricants and other pollutants.
– Any maintenance and repair of the vehicles and the machinery along the gas pipeline route is forbidden. In the event of an accidental leakage of fuels, lubricants and other harmful substances, it is mandatory to reinstate the polluted surfaces in the prior condition in order to protect the soil.
– In the event of any leakage of fuels, lubricants and other pollutants, the contaminated soil layer is to be covered with absorbents, the contaminated soil layer is to be collected and removed and, thereafter, disposed of at an adequate hazardous substances depot.
– Fuel filling should be performed at specially designated spots at a distance from the water courses. If the afore-stated is impossible, mobile concrete tanks should be provided over which the fuel filling would be performed.
– In the event of a defect in the machinery and the transport vehicles, the fuels, lubricants and other pollutants may not be directly discharged onto the ground; rather, they should be adequately collected in suitable containers and removed from the construction site.
– In the event of a leakage of pollutants on asphalt surfaces, they should be absorbed by means of an absorbent and disposed of at an adequate hazardous substances depot.
– Ensuring adequate sewage systems.</td><td>Protection of soil against degradation and pollution.</td><td>The Contractor, under the control of the supervisory authority and the competent inspection authorities.</td><td>For the entire duration of the construction phase in accordance with the monitoring plan.</td></tr>
</table>

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
	– *The construction debris is to be regularly removed from the construction site and disposed of at an adequate depot.* *For the purposes of reducing the impacts caused by soil erosion as a consequence of vegetation removal, the following measures are to be taken:* – *It is necessary to develop a plan for protection against erosion at places where the likelihood of erosion is substantial, in order to prevent any transport of erosion sediments from slopes and dams and protect the water courses and other water bodies from erosion sediments.* – *Minimizing the loss of vegetation along the construction site.* – *The construction works may not take place during downpours.* – *Rehabilitation of temporary trenches by planting grass, trees, and other plants (revegetation).* – *Rehabilitation of eroded channels and their reinstatement into their natural condition/revegetation, if applicable.* *The following measures, proposed for the purposes of mitigating the environmental impact, can reduce the loss of fertile topsoil during the construction of the gas pipeline:* – *The excavated material, if possible, should be re-used in the construction or applied as a layer for covering the trenches intended for the gas pipeline pipes. The remaining surplus material should be disposed of at a designated location/depot indicated by the competent authority.* – *The size of the construction sites should be minimized to the greatest possible extent so as to minimize the land affected by a negative impact and in order to reduce the loss of fertile topsoil.* *For the purposes of reducing the impact caused by landslides as a consequence of excavations, the following measures should be taken:* – *During the excavation process, all defined measures in terms of the stability of the slopes, set forth in the project documentation, should be duly complied with. The afore-stated also refers to the enhancement of the geomechanical features and enhancement of the soil load-bearing capacity (ensuring adequate foundations, replacement of the soil material with a better one, compaction, etc.).* – *Implementing preventive measures in terms of landslides, stabilizing the slopes (supporting walls, etc.), if necessary.*			

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
	– *Proper construction and installation of drainage channels and their regular cleaning, aimed at minimizing the risk of the occurrence of landslides.* *Cleaning the construction site and its reinstatement once the construction works are completed.*			
	Soil *Operational phase*			
The potential impacts on the soil during the operational phase are as follows: ○ *During the regular operation of the gas pipeline, no impacts on the soil are anticipated. In the event of any defects in the underground part of the gas pipeline, the construction activities will be identical to the ones of the construction phase, with* ***the same significance****.*	*In the event of a leakage or damage to an underground part of the pipeline, construction works will be performed with a view to repairing or replacing the damaged part of the pipeline. Such construction works are identical to the ones undertaken in the construction phase and, accordingly, they will give rise to the same type of impacts on the soil. Therefore, it is necessary to undertake adequate measures as in the construction phase.*	*Protection of soil against degradation and pollution.*	*The Operator/Contractor for the defect repair activities*	*During the operational phase/during the performance of repairs to any defects in the underground part of the gas pipeline.*
	Groundwater *Construction phase*			
The potential impacts on groundwater during the gas pipeline construction phase are as follows: ○ *Change in the groundwater flow pattern –* ***moderate or high*** *significance* ○ *Change in the groundwater quality as a result of pollution with pollutants –* ***moderate or high*** *significance.*	*During the construction phase, for the purposes of reducing the impact caused by any changes in the course of groundwater flow, the following measures should be taken:* – *The performance of construction works at locations where the occurrence of groundwater is anticipated should take place at a time of the year when there is no significant rainfall.* – *In the event of the occurrence of groundwater during the performance of the construction works, such works are to be completed as soon as practicable in order to reduce as much as possible the alteration of the groundwater flow pattern.* *For the purposes of reducing the impact on the quality of the groundwater as a result of the pollution caused by various pollutants, it is necessary to undertake the following measures:* – *Transport vehicles should be filled with fuel at the nearest petrol stations, whereby filling trucks with fuel at the construction site will be avoided.* – *The procedure for fuel filling of the construction machinery should take place on an impervious ground cover or, if the latter is impossible, mobile concrete tanks should be used on which the fuel filling would be performed, at a distance of 10m from*	*Protection of groundwater against change in the groundwater flow pattern and pollution.*	*The Contractor, under the control of the supervisory authority and the competent inspection authorities.*	*For the entire duration of the construction phase in accordance with the monitoring plan.*

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
	water courses and 50m from springs, while in the vicinity there should be piles of sand and soil to absorb any possible leakages. – *The construction machinery and the vehicles should be parked on an impervious sealed ground cover which is to be regularly checked.* – *Any maintenance and repair of the vehicles and the machinery along the gas pipeline route is forbidden. In the event of an accidental leakage of fuels, lubricants and other harmful substances, it is mandatory to reinstate the polluted surfaces in the prior condition in order to protect the groundwater.* – *The fuels and lubricants that are to be used for filling up the construction machinery and equipment should be adequately stored. They should be kept on an impervious ground cover at a distance of 10m from water courses and 50m from springs, fenced and covered.* – *Capture of any effluent discharge along the route in portable toilets and their proper emptying should be ensured.* – *Timely removal and disposal of any waste should be ensured.*			
	Groundwater *Operational phase*			
The potential impacts on groundwater during the operational phase are as follows: ○ *During the regular operation of the gas pipeline, no impacts on groundwater are anticipated. In the event of any defects at sensitive sites with high levels of groundwater, the impacts will be identical to the ones of the construction phase, with **the same significance**.*	*During the phase of regular operation of the gas pipeline, no negative impacts on groundwaters are anticipated. Solely in the event of a leakage or damage to an underground part of the pipeline, if there are defects in the vicinity of the locations with high levels of groundwater, construction works will be performed for the purposes of repairing or replacing the damaged part of the pipeline, wherein such construction works will be identical to the ones performed in the construction phase, and, accordingly, it will be necessary to undertake adequate measures as in the construction phase.*	*Protection of groundwater against change in the groundwater flow pattern and pollution.*	*The Operator/Contractor for the defect repair activities*	*During the operational phase/during the performance of repairs to any defects in the underground part of the gas pipeline.*
	Surface water *Construction phase*			
The potential impacts on surface water in the course of the construction phase are as follows: ○ *Change in the surface water quality as a result of pollution with pollutants – **moderate or high** significance.* ○ *Change in the riverbed morphology and/or the physical properties of the*	*A plan should be developed for surface water protection.* *For the purposes of reducing the impact on the quality of the surface water as a result of the pollution caused by various pollutants, it is necessary to undertake the following measures:* – *Transport vehicles should be filled with fuel at the nearest petrol stations, whereby filling trucks with fuel at the construction site will be avoided.*	*Protection of surface water against pollution and against change in the riverbed morphology.*	*The Contractor, under the control of the supervisory authority and the competent inspection authorities.*	*For the entire duration of the construction phase in accordance with the monitoring plan.*

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
*water – **high or very high** significance in terms of River Vardar, i.e., **low** significance in terms of the other rivers.*	– *The procedure for fuel filling of the construction machinery should take place on an impervious ground cover or, if the latter is impossible, mobile concrete tanks should be used on which the fuel filling would be performed, at a distance of 10m from water courses and 50m from springs, while in the vicinity there should be piles of sand and soil to absorb any possible leakages.* – *The construction machinery and the vehicles should be parked on an impervious sealed ground cover which is to be regularly checked.* – *Any maintenance and repair of the vehicles and the machinery along the gas pipeline route is forbidden. In the event of an accidental leakage of fuels, oils and other harmful substances, it is mandatory to reinstate any polluted surfaces in the prior condition in order to protect the surface water.* – *The fuels and lubricants that are to be used for filling up the construction machinery and equipment should be adequately stored. They should be kept on an impervious ground cover at a distance of 10m from water courses and 50m from springs, fenced and covered.* – *Capture of any effluent discharge along the route in portable toilets and their proper emptying should be ensured.* – *Timely removal and disposal of any waste should be ensured.* *For the purposes of mitigating any impact on the riverbed morphology and/or the physical properties of the water, it is necessary to undertake the following measures:* – *In the event of the gas pipeline crossing through riverbeds, the construction works are to be completed as soon as practicable in order to minimize the impact as much as possible in terms of any alteration of the riverbed morphology and/or the physical properties of the water.* – *A method for crossing the riverbeds should be chosen that will give rise to as few as possible changes to the riverbed morphology.*			

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
Surface water Operational phase				
The potential impacts on surface water during the operational phase are as follows: ○ During the regular operation of the gas pipeline, no impacts on surface waters are anticipated. In the event of any defects at surface water sites, the impacts will be identical to the ones of the construction phase, with **the same significance**.	During the phase of regular operation of the gas pipeline, no negative impacts on surface waters are anticipated. Solely in the event of a leakage or damage to an underground part of the pipeline, if there are defects in the vicinity surface water sites, construction works will be performed for the purposes of repairing or replacing the damaged part of the pipeline, wherein such construction works will be identical to the ones performed in the construction phase, and, accordingly, it will be necessary to undertake adequate measures as in the construction phase.	Protection of surface water against pollution and against change in the riverbed morphology.	The Operator/Contractor for the defect repair activities	During the operational phase/during the performance of repairs to any defects in the underground part of the gas pipeline.
Air Construction phase				
The potential impacts on the air during the gas pipeline construction phase are as follows: ○ air pollution as a result of pollutant emissions caused by the construction activities **- low or moderate** significance.	A plan for protection of the air should be developed. The following measures, proposed for the purposes of mitigating the environmental impact, can reduce the air pollution during the construction of the gas pipeline: – Careful planning of construction works, including also the work performed in the vicinity of populated areas (prohibition for construction works during particular periods of the day); – Restricting the speed of the construction vehicles at the construction site and in the populated areas for the purposes of reducing the occurrence of dust; – Strict control of the construction methods and the used machinery and other equipment; – Using proper construction equipment and transport vehicles with a statement on meeting the exhaust emission limit requirements as determined during their homologation, whereby the exhaust emission limit should be reduced to the practicable minimum. – Spraying the construction site with water should be ensured (the path along which the transport vehicles move, the excavated material required for covering the pipeline, the surplus of excavated land which is to be removed from the construction site, etc.). During dry periods, the emission of dust should be minimized. – Good maintenance and coverage should be ensured in terms of the vehicles that deliver construction materials with a view to mitigating the emission and dispersion of any pollutants.	Protection of the air against pollution.	The Contractor, under the control of the supervisory authority and the competent inspection authorities.	For the entire duration of the construction phase in accordance with the monitoring plan.

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
Air *Operational phase*				
The potential impacts on the air during the gas pipeline operational phase are as follows: ○ *During the regular operation of the gas pipeline, no impacts on the air are anticipated. In the event of any defects in the underground part of the gas pipeline, the construction activities and the impacts will be identical to the ones of the construction phase, with **the same significance.***	*During the phase of regular operation of the gas pipeline, no negative impacts on surface waters are anticipated. Solely in the event of a leakage or damage to an underground part of the pipeline, if there are defects in the vicinity surface water sites, construction works will be performed for the purposes of repairing or replacing the damaged part of the pipeline, wherein such construction works will be identical to the ones performed in the construction phase, and, accordingly, it will be necessary to undertake adequate measures as in the construction phase.*	*Protection of the air against pollution.*	*The Operator/Contractor for the defect repair activities*	*During the operational phase/during the performance of repairs to any defects in the underground part of the gas pipeline.*
Climate change *Construction phase*				
The potential impacts on the climate change during the gas pipeline construction phase are as follows: ○ *Impact on the local microclimate – **insignificant or low** significance.* ○ *Greenhouse gas emission from the operation of the construction machinery, equipment and transport vehicles – **no data**.* ○ *Increase of greenhouse gas due to loss of biomass – **insignificant or low** significance.*	*During the construction phase, for the purposes of reducing the greenhouse gas emission from the work related to the construction machinery, equipment and transport vehicles, it is necessary to undertake the following measures:* – *Application of good construction practices for a more efficient performance of the construction works, thereby reducing the fuel consumption and the greenhouse gas emission* – *Using proper construction machinery, equipment and transport vehicles for the purposes of avoiding any increase in the fuel consumption, thereby also preventing any increase in the greenhouse gas emission*	*Greenhouse gas reduction.*	*The Contractor, under the control of the supervisory authority and the competent inspection authorities.*	*For the entire duration of the construction phase in accordance with the monitoring plan.*
Climate change *Operational phase*				
The potential impacts on the climate change during the gas pipeline operational phase are as follows: ○ *Greenhouse gas emission from the regular operation of the gas pipeline – **low** significance.*	*During the operational phase, it will be required to conduct a regular control of the safety devices for overpressure relief, whereby natural gas discharge will be reduced. Furthermore, it is necessary to conduct regular control of the impermeability of the gas pipeline in order to minimize any undesired natural gas discharge into the atmosphere.*	*Greenhouse gas reduction.*	*The Operator*	*During the operational phase.*

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
Waste generation Construction phase				
The potential impacts on waste generation during the gas pipeline construction phase are as follows: ○ Waste generation from the construction phase – **low or moderate** significance.	A waste management plan should be developed. The mitigation measures for environmental impact related to waste actually propose compliance with good waste management practices and waste disposal at designated locations. It should be ensured that any cut down trees and humus occurred during the preparatory activities are used by the local inhabitants for heating, construction materials and composting. The remaining waste should be disposed of at a designated location approved by the investor. The waste generated during the excavation of the trenches for the gas pipeline pipes, if possible, should be re-used as construction material, i.e. as a layer for covering the trenches. The remaining surplus material should be disposed of at a designated depot, approved by the investor. During the transport of surplus excavated material, it is advisable to avoid any overloading of the vehicles. The waste generated during possible repairs as a consequence of a defect in the machinery, equipment and the vehicles at the construction site should be selected and, pursuant to the legal regulations, the hazardous waste should be separated from the non-hazardous one and handled accordingly as such. Any empty lubricant and grease containers should be handled as waste from packaging which contains residues or is polluted with hazardous substances, they should be collected accordingly and taken over by an authorized waste management company. In order to avoid any negative impact from liquid waste, the collection, treatment and disposal of such waste is to be conducted in compliance with the national regulations pertaining to the respective type of liquid waste.	Protection of environmental media and areas against pollution; minimizing the impacts on the sensitive receptors by means of proper waste management.	The Contractor, under the control of the supervisory authority and the competent inspection authorities.	For the entire duration of the construction phase in accordance with the monitoring plan.
Waste generation Operational phase				
The potential impacts on waste generation during the gas pipeline operational phase are as follows: ○ Waste generation during the regular operation of the gas pipeline – **low** significance.	During the phase of using the gas pipeline waste will be generated from the removal of the vegetation along the strip of the gas pipeline route of 7m. Such vegetation waste should be handled in the same manner as the waste generated during the vegetation removal in the course of the construction phase.	Protection of environmental media and areas against pollution; minimizing the impacts on the	The Operator/Contractor for the defect repair activities	During the operational phase/during the performance of repairs to any defects in the underground

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
	The waste generated during any intervention in the surface parts of the gas pipeline (waste spare parts from the block stations, etc.) is to be timely removed from the gas pipeline route. In the event of a leakage or damage to an underground part of the pipeline, construction works will be performed with a view to repairing or replacing the damaged part of the pipeline. Such construction works are identical to the ones undertaken in the construction phase and, accordingly, they will generate identical waste. Therefore, it is necessary to undertake adequate measures as in the construction phase.	sensitive receptors by means of proper waste management.		part of the gas pipeline.
Noise and vibration Construction phase				
The potential impacts from noise during the gas pipeline construction phase are as follows: ○ Impact from the noise of construction activities - **diverse** (refer to table Impacts) significance. In the course the construction phase, the vibrations that occur during the movement of heavy vehicles, during the operation of the construction machinery and during the operation of the soil compaction equipment, are not expected to be felt at a distance of more than 15m as per the available professional literature. The afore-stated vibrations are not expected to be felt at larger distances beyond the footprint of the project along the gas pipeline route. Furthermore, the vibrations that occur during blasting are not expected to be felt beyond the footprint of the project.	A noise control plan should be developed. The mitigation measures for the impacts caused by noise and vibration during the construction phase comprise the following: – careful planning of the preparatory works in order to reduce the acoustic pollution; – careful planning of the timing for the works in populated areas (e.g. prohibition of construction works during particular hours); – mandatory avoidance of equipment which emits a noise exceeding 90dB; – control of the construction methods and use of the machinery and regular maintenance of the equipment with a view to a possible minimization of any high levels of noise. No vehicles and construction equipment should be used which create excessive noise due to the poor condition of the engines or the noise control devices; – the construction machinery should comply with the requirements set forth in the EU Directive 2000/14/EC on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors. – equipment should be used that comprises adequate noise suppression devices; – avoidance of loud acoustic signals in populated areas/minimizing any disturbance of the citizens' peace and quiet; – limitation of the speed of construction vehicles, especially in populated areas; – in the nearest populated areas, it is necessary to timely inform the population of any short-term blasting plans;	Meeting the requirements arising from the standards on the allowed noise level in the environment as per the legal regulations and minimization of the impacts on the sensitive receptors.	The Contractor, under the control of the supervisory authority and the competent inspection authorities.	For the entire duration of the construction phase in accordance with the monitoring plan.

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
	– *blasting activities should not be performed during the period of bird nesting between 1st March and 30th September.*			
Noise and vibration *Operational phase*				
The potential impacts from noise during the operational phase are as follows: ○ *During the regular operation of the gas pipeline, no noise impacts are anticipated. In the event of any defects in the underground part of the gas pipeline, the construction activities and the impacts will be identical to the ones of the construction phase, with* ***the same significance****.* *During the regular operation of the gas pipeline, no vibrations are anticipated. In the event of any defects in the underground part of the gas pipeline, the construction activities and the vibrations will be identical to the ones of the construction phase.*	*In the event of a leakage or damage to an underground part of the pipeline, construction works will be performed with a view to repairing or replacing the damaged part of the pipeline. Such construction works are identical to the ones undertaken in the construction phase and, accordingly, they will generate such noise and vibration. Therefore, it is necessary to undertake adequate measures as in the construction phase.*	*Meeting the requirements arising from the standards on the allowed noise level in the environment as per the legal regulations and minimization of the impacts on the sensitive receptors.*	*The Operator/Contractor for the defect repair activities*	*During the operational phase/during the performance of repairs to any defects in the underground part of the gas pipeline.*
Biodiversity *Construction phase and operational phase*				
IMPACTS ON THE HABITATS - *Construction phase:* − *habitat loss (direct destruction) –* ***low to moderate*** - *Operational phase:* − *habitat fragmentation –* ***low*** *IMPACTS ON FLORA, FUNGI AND FAUNA* - *Construction phase:* − *Disruption of the nesting cycle (birds) –* ***low*** − *Alteration, impairment or destruction of the habitat of amphibians and fish -* ***low*** - *Operational phase:* − *Access to natural resources –* ***insignificant***	*MITIGATION MEASURES FOR IMPACTS ON THE FLORA AND FAUNA* • ***Construction phase*** *During the construction works along the entire gas pipeline corridor, the following are to be applied as general measures:* - *A biodiversity protection plan should be developed.* - *Temporary invasion and/or destruction of the surrounding areas should be avoided. During the use of the areas that are not included in the project design it is mandatory to obtain a prior approval from the owner or another type of a permit;* - *The locations for storing substances that are harmful for the water should be minimized. It is indispensable to arrange adequate handling and storage;* - *Permanent presence of a fire engine should be ensured in the event of fires and accidents;*	*Integrity and conservation of natural values should be ensured.*	*The Contractor, under the control of the supervisory authority and the competent inspection authorities.*	*Foreseen for the preliminary and the detailed project design phases* *Implementation in the course of the construction phase*

Impact	*Proposed impact mitigation measures*	*Objective*	*Competent institution*	*Time schedule*
IMPACTS ON PROTECTED AND DESIGNATED AREAS *- Construction phase:* *- Impact on habitat fragmentation and bird disturbance – **low to moderate*** *- Operational phase:* *- Impact on habitat fragmentation and bird disturbance – **insignificant*** *IMPACTS ON WILDLIFE CORRIDORS* *The gas pipeline route does not intersect with any of the core areas, but it does cross the buffer zone which pertains to the Demir Kapija bottleneck. This buffer zone enables access to drinking water for the animals due to which a certain impact is possible on account of the disturbance of such animals during the construction phase. Therefore, the impact assessment would be **low** during the construction phase and **insignificant** during the operational phase.*	*- If it is necessary to set camps, such setting should not take place on alluvial terrains due to high groundwater levels and the possibility for polluting such water;* *- After the completion of the construction works, it is necessary to reintegrate the location with the surrounding environment, which requires certain biotechnical activities;* *In addition to the general mitigation measures which pertain to the entire corridor, also certain specific measures are recommended in terms of important habitats, localities and areas:* *– There should be no access roads crossing through any sensitive habitat (refer to ANNEX 6 – Habitat Sensitivity Maps):* *▪ Alder-covered riparian zones (KM 53+000)* *▪ Plane-tree and willow-covered riparian zones (KM 16+000; KM 18+500; KM 28+500 and KM 30+000; KM 47+000)* *– Permanent or occasional supervision by an expert (ecologist) during the activities performed in riparian habitats and rivers and streams.* *– All locations that will be used as temporary depots for construction and raw materials should be previously indicated by the contractor in order to avoid any negative environmental impact. Riparian habitats, rivers and streams are not to be used as raw material depots.* *– The areas in which the construction activities will be performed, but which are not indispensable for the operationalization phase, will be rehabilitated, such as locations at which disturbances occurred as the result of cutting down trees, landslides, blasting, etc. In order to neutralize the negative impact from the loss of forest, reforestation with autochthonous types of trees and shrubs, typical for the region, will be required. If possible, the plants should be locally procured, in order to maintain the genetic identity of the local communities. The following trees are recommended for reforestation purposes: Quercus pubescens, Q. frainetto, Carpinus orientalis, Pyrus amygdaliformis, Acer campestre, Crataegus monogyna, Ulmus minor, Prunus spinosa, Platanus orientalis, Alnus glutinosa, Salix alba, S. fragilis, etc. The reforestation activities are to be performed according to the No Net Loss principle, i.e. a Reforestation Plan should be developed. The riparian vegetation along the rivers and the streams should be restored according to the afore-stated*			

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
	principle (the Reforestation Plan should be based on a ratio of at least 2:1, e.g. for each destroyed hectare of mature trees, 2 hectares should be planted). – *Mitigation measures for rivers and streams. The impacts should be minimized by undertaking the following measures:* ▪ *The construction materials or excavated land depots are to be located far away from any water streams;* ▪ *Any change of the course of water streams should be as close as possible to the natural water stream;* ▪ *Any mortar (concrete) works near the water streams is to be controlled in order to reduce the risk of releasing wet mortar into the water streams;* ▪ *All access roads, loading sites and parking lots for the machinery should be maintained clean and neat in order to prevent any increased leakage of lubricants and dirt in the water streams during downpours;* ▪ *It is necessary to minimize the vegetation removal along the rivers and the streams in order to ensure their self-purification.* ▪ *The removal of shrubs and trees should be performed during the winter, outside of the bird nesting period, which is between 1st March and 30th September, especially in hilly areas. Blasting should also be performed outside of the bird nesting period.* • ***Operational phase*** *No significant impacts on the habitats and the species are anticipated in the course of the operational phase.* *MITIGATION MEASURES IN PROTECTED AND DESIGNATED AREAS* *The gas pipeline route enters in an area proposed as a protected area – Studena Glava – and three Important Bird Areas (South Vardar, Demir Kapija Canyon and Tikves Region). In addition to the general mitigation measures which pertain to the entire corridor, also certain specific measures are recommended in terms of these areas:* *The area of Studena Glava is covered with a downy oak and hornbeam forest, which also includes stands of beech trees, at a low*			

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
	altitude. The impact range is small (a strip with a width of 20 meters around the route) and it pertains to the fragmentation of the downy oak and hornbeam forest which is moderately sensitive. . Due to the importance of the area, in addition to the afore-stated proposed specific measures, the following are also recommended in terms of important habitats, localities and areas: – *Constant supervision by an expert – botanist – during the activities along the area boundaries.* *As regards the Important Bird Areas (Demir Kapija Canyon and the Tikves Region) which are characterized by the presence of rare species of birds of prey, the impact during this phase has been estimated as moderate, whereas in terms of IBA South Vardar it has been estimated as low. The impact range in these regions has been analysed in terms of a strip with a width of 500 meters around the route. Due to the importance of the areas and the presence of birds which are of international importance, in addition to the afore-stated proposed specific measures which pertain to the birds, also the following is recommended:* – *Constant supervision by an expert – ornithologist – during the activities along the area boundaries.*			
Landscape and visual effects *Construction phase*				
The potential impacts on the landscape during the gas pipeline construction phase are as follows: − *Change of the landscape and the visual effects as a result of the performance of construction activities, the presence of workers and other additional activities; –* ***low****.*	*The mitigation measures for environmental impact, in addition to the mitigation recommendations for reducing the size of the construction site, applying good practices of design and construction, carefully and adequately maintaining and cleaning the construction site, also include the following:* – *Land exploitation, especially in sensitive areas, should be minimized as much as possible;* – *Fast disposal of construction debris to approved locations should be ensured;* – *If possible, the excavated material should be used for filling in the holes/borrow pits created while excavating sand;* – *Repairing the footpaths and roads immediately after completing the works for installing the gas pipeline pipes and burying/levelling the trenches;* – *Carefully sealing the construction sites/depots/cleaning the construction site after the completion of the construction works/reforestation of the area;*	*There should be no significant visual changes for the purposes of protecting the landscape values.*	*project manager/Contractor*	*Construction phase*

Impact	*Proposed impact mitigation measures*	*Objective*	*Competent institution*	*Time schedule*
	– *Compensation of the vegetation by planting fire-resistant trees, shrubs and grass for the purposes of improving the visual effects.* – *Planting indigenous plant species in the surroundings of:* ▪ *the rivers and the streams,* ▪ *the waste material depots and* ▪ *landslides as a consequence of blasting the terrain.*			
Landscape and visual effects *Operational phase*				
The potential impacts on the landscape during the gas pipeline operational phase are as follows: – *Change in the landscape and the visual effects as a consequence of the gas pipeline construction –* ***low****.*	*During the phase of using the gas pipeline no negative impact is anticipated; thus, no measures are required.*	*There should be no significant visual changes for the purposes of protecting the landscape values.*	*Operator*	*Operational phase*
SOCIAL ASPECTS				
Demographic *Construction phase and operational phase*				
• ***Construction phase*** *No modifications of the demographic status or the traditional lifestyle of the communities in the vicinity of the gas pipeline are anticipated during the construction phase. The population will not be required to relocate from the dwelling on account of the activities aimed at the construction or expropriation of the gas pipeline.* • ***Operational phase*** *No impacts on the demographic are anticipated in the operational phase.*	*No modifications of the demographic status of the communities in the vicinity of the gas pipeline are anticipated during the construction phase. The population will not be required to relocate on account of the activities aimed at the construction or expropriation of the gas pipeline. Therefore, no measures are required.*	/	/	/
Stakeholder engagement *Construction phase and operational phase*				
During the construction and the operational phase, it is assessed with a ***moderate*** *magnitude.*	• ***Construction phase*** *The gas pipeline Operator will be required to develop and define the Stakeholder Engagement Plan (SEP) as early as in the course of the*	*Reducing the possibility of incidents.*	*Contractor and Operator*	*During the construction phase and*

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
	preparations for the construction of the gas pipeline. Thus, all the stakeholders and the manner of communication with them will be defined. It is indispensable for the public to be informed of the existence of the project and the planned project development phases. It is recommended for the gas pipeline Operator to conduct a series of consultative activities with the stakeholders, especially those that own land within the project area. The established grievance system will be available to the public and all comments and complaints will be recorded, alongside the logs pertaining to the activities undertaken for the purposes of providing an adequate solution. *During the construction phase, the Operator, together with the General Contractor, will maintain communication with the stakeholders. The Operator and the General Contractor will communicate openly with the stakeholders in the project during the construction phase, since not all stakeholders are capable or willing to file a complaint. The Contractor, together with the Operator, will hold regular semi-annual meetings with the representatives of the local community and other stakeholders. A strong emphasis must be placed on the presence of women at such meetings.* *The grievance mechanism will be publicly available at the headquarters of the Operator and in the premises of the Contractor at the construction site, as well as in the premises of the municipalities and the populated areas through which the gas pipeline crosses.* *The Contractor and the Operator will maintain proactive communication with the local communities.* *The Contractor will display bulletin boards comprising information on the project at the entrance of populated areas in whose vicinity the project is implemented. They should comprise information on the project activities on a monthly basis. Furthermore, relevant information should be shared through the local radio/TV stations for the purposes of managing the movement or the traffic flow through the locations where construction works will be performed.* • ***Operational phase*** *The grievance mechanism will be publicly available in every municipality where the gas pipeline crosses, as well as in the Operator's headquarters, so as to enable the stakeholders to be informed and to communicate regarding various issues or concerns.*			*during the operational phase.*

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
Use, ownership and access to land and property Construction phase				
Impact: Disturbance of the daily life caused by limited access to populated areas, land, property, utility and road infrastructure – during the construction phase it is assessed with a ***negligible*** *magnitude.* *Impact: Loss of land and means of living during the construction phase it is assessed with a* ***high*** *magnitude.*	*During the construction of crossings with the local roads, the best possible construction practices will be applied in order to minimize any damage to such roads. In addition, after the completion of the construction activities, the Contractor will be obliged to repair any damaged local roads that are used for the transport of goods and passengers.* *In the vicinity of the populated areas, measures will be taken and attentive work will be performed for the purposes of minimizing the effect of the impacts as much as possible in terms of any populated areas; furthermore, it is expected for the duration of the construction activities at any location to be rather short.* *If it is necessary to set a construction camp for the workers, the location of the camp should be in the vicinity of a populated area or a main road. The location of the workers' camp will be decided upon prior to the commencement of the construction activities.* *In the event of a disruption of the access to the utility infrastructure, the Contractor will repair such disruption as soon as possible or ensure an alternative access, as well as compensate for any incurred damages.* *During the construction of crossings with the local roads, the best possible construction practices will be applied in order to minimize any damage to such roads. In addition, after the completion of the construction activities, the Contractor will repair any damaged local roads that are used for the transport of goods and passengers.* *For the purposes of mitigating the negative impacts from the process of land loss, as well as loss of other goods and property, an adequate measure is provided with the implementation of good international practices in terms of the acquisition of the property required for this project, which includes the development of a Land Acquisition and Resettlement Framework (LARF) and, consequently, a Land Acquisition Plan (LAP).* *This document and process will be developed in accordance with the legislation of the Republic of North Macedonia. The land owners and land users will be compensated accordingly, in compliance with the standards of the national legislation and the competent international financial institution. The land acquisition for the project will be performed on the basis of the win-win principle. In the event of a failure of the negotiations approach, the legally defined expropriation*	*Reducing the possibility of incidents.* *Full and fair compensation for the executed expropriation.*	*Operator*	*The period prior to the commencement of the construction, during the construction phase and during the operational phase in the event of activities for repairing defects in the underground part of the pipeline.*

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
	processes will be applied, as per the Law on Expropriation of the Republic of North Macedonia and the respective by-laws, with reference to projects of public interest, and the respective international good practices. The land acquisition will be based upon mutual consent and costs defined by experts in the sphere of land assessment/agriculture and the local self-government institutions. The respective fee will be defined on the basis of the market value of the land and, if necessary, as a substitute for the value of the affected assets. Based upon the foregoing, there will be no involuntary economic resettlement. *Summary of the expropriation process* ***Proposal for expropriation*** *The expropriation procedure commences with the submission of the proposal for expropriation to the authorized expropriation authority (i.e. a competent office at the Property and Legal Affairs Office within the Ministry of Finance). In this case, the proposal for expropriation is prepared by the National Energy Resources (NER) and it is submitted on the behalf of the state (and NER) by the state prosecutor. The proposal for expropriation comprises the following information:* • *The proposer of the expropriation;* • *The property proposed for expropriation;* • *The owner of the property and the holders of other property-related rights;* • *The type of facilitating acts by means of which the expropriation is proposed.* *A set of supporting documents is to be provided alongside the proposed expropriation, including information from the expropriation study and the land survey, as well as an inventory of the property, and evidence pertaining to the compensation and damages funds.* ***Notification to the affected owners and an Invitation for a hearing*** *The affected property owners are individually invited for a hearing and notified regarding the submission of the proposal for expropriation and the proposed compensation amount. In this phase, an amicable settlement of the compensation can be achieved and expropriation can be avoided.* ***Decision on expropriation*** *If an amicable settlement is not achieved and if the submitted documentation is proper, a final decision on expropriation may be adopted by the expropriation authority within 20 days as of the day of the receipt of the proposal for expropriation. If there are no further*			

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
	(court) appeals (refer below), the decision on expropriation becomes legally effective. *Appeals by the affected owners* ***Court appeals*** *The affected owners can file a court appeal to the relevant administrative court (including also a second court appeal to the Higher Administrative Court), upon whose order the decision on expropriation becomes legally binding. The Law on Expropriation stipulates the deadlines within which the administrative courts are obliged to decide upon the submitted appeals, as well as sanctions in terms of any failure to comply with such deadlines.* ***Hearing pertaining to the decision on expropriation*** *When the decision on expropriation becomes legally valid, one more hearing is to be held by the expropriation authority within 8 days in order to discuss and determine the compensation amount for each affected owner. In the event of a failure to achieve an agreement on the compensation amount, the case is submitted to the courts to decide, within 8 days as of the hearing.* ***Compensation payment*** *The proposer of the expropriation proceeds with the payment of the compensation or with measures for property replacement within 30 days as of the day of the signing of the agreement on the compensation or the decision on indemnification becomes legally effective (interest rates will apply accordingly in the event of any payment default).* *The most important aspect in this process is proper sharing of information, communication and consultation with the persons whose land and property are subject to expropriation, as early as possible, during the initial phases of the project. The affected persons are to be consulted at the very beginning and a solution is to be found according to the needs and the possibilities in terms of the land and the property.* *As for privately owned lots, the Operator should initiate a process of consultations, negotiations with the owners and the users of the land, conclusion of an agreement for access to the land/purchasing the land with the determined owners of such land, so that the owners of the land are provided with adequate compensation, pursuant to the requirements of the Environmental and Social Policy of the respective international financial institutions, as well as the national legislation. The land acquisition will be based upon mutual consent and a cost*			

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
	value defined by experts in the sphere of assessment of land, property and agricultural assets and the local self-government institutions. The respective compensation will be defined on the basis of the market value of the property and the manner and purpose of use, and, if necessary, as a substitute for the value of the affected assets. *During the compensation process consideration will be given to the restoration of the needs for means of living, quality of life and, especially, providing adequate reimbursement for the vulnerable groups. It is possible to also consider other alternatives in addition to monetary compensation, since a monetary fee is not always the best alternative taking into account that money can be spent fast. A better compensation option could be replacement of the land with land that has easy access and a similar or better quality and a possibility for using such land. Based upon the foregoing, there will be no involuntary economic resettlement.* *It is necessary to maintain contact with these persons until the completion of the compensation and the payment of the funds, as well as the elimination of any adverse consequences. The application of these practices should be in accordance with the national legislation.* • ***Operational phase*** *During the operational period of the project, a fee will be paid for a temporary loss and/or difficult access to land for agricultural purposes or other means of living related to the use of the land for maintaining, servicing or repairing the gas pipeline. In the event of any damage to the land, or other economic assets, also an indemnification amount has been foreseen as compensation for the damages and reinstatement and improvement of the condition of the property and the means of living.*			
Use, ownership and access to land and property *Operational phase*				
None				
Community health, safety and security *Construction phase and operational phase*				
*Impact: An increased threat to the population and the livestock due to the existence of the construction site – during the construction phase it is assessed with a **low** magnitude.*	• ***Construction phase*** *The mitigation measures for the negative impacts on the population and on human health practically mean measures that should be undertaken in the course of the construction phase, which pertain to*	*Maximum protection of the population and the local*	*Contractor and Operator*	*During the construction phase and*

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
*Impact: An increased intensity of the traffic and transport through the populated areas – during the construction phase it is assessed with a **moderate** magnitude.* *Impact: Disturbance by noise and vibrations as a result of the construction activities – during the construction phase it is assessed with a **low** magnitude.* *Impact: Disabled access to social and health services by vulnerable groups – during the construction phase it is assessed with a **low** magnitude.* *Impact: Workers' behaviour in terms of the local surroundings – during the construction phase it is assessed with a **low** magnitude.* *Impact: Natural gas discharge and accidents - during the construction phase it is assessed with a **low** magnitude.*	*reducing the likelihood of any possible injuries at the workplace, protection from traffic accidents caused by the frequency of transport vehicles, protection from exhaust emissions, as well as protection from increased noise from the construction machinery and from the vehicles used for transporting the equipment and the materials.* *The measures will be presented and implemented according to a duly developed Community Health, Safety and Security Plan which applies for the duration of the construction and the work on the project, including also emergency prevention, preparedness and response. The plan will be developed in accordance with the national legislation and the international requirements, i.e. EIB (European Investment Bank) – ESS (Environmental and Social Standards) 9: Occupational and Public Health, Safety and Security.* *The proposed measures are related to the implementation of adequate measures for protection against air pollution, noise and vibration, as well as measures for protection against any injuries of the local population and the involved workers and, certainly, use of adequate tools and personal protection equipment by the workers during the construction works in accordance with the Law on Safety and Health at Work.* *A mitigation measure for the impact on human health comprises the establishment of adequate waste management (collection, transport and disposal) in order to prevent any possibility of infections and diseases.* *For the purposes of mitigating any potential for fire breakouts, it is necessary to apply safety measures and to regularly monitor the location in the immediate vicinity of the gas pipeline.* *It is necessary to prepare periodic analyses and statistics in terms of any accidents at the site, including recommendations for reducing the related risks in the course of the subsequent construction works.* *The gas pipeline route stretches mainly outside populated areas and, thereby, the accessibility of the population to the construction site is low. Nevertheless, due to the substantial length of the line structure, it is impossible to fence the entire construction site and, therefore, there is a likelihood of incidents at the construction sites related to an unlawful presence of persons or accidental intrusion of livestock. In order to prevent any such situations, it is necessary for the Operator, and especially the Contractor, to inform the local public of the planned construction activities, of the gas pipeline route and of the timing for*	*community health and safety.*		*during the operational phase in the event of accidental gas discharges.*

Impact	Proposed impact mitigation measures	Objective	Competent institution	Time schedule
	the performance of such activities, as well as to establish an adequate security service at the construction site. *The use of acoustic signals should be avoided and the speed of the transport vehicles should be adjusted in the populated areas.* *At locations where the construction activities block the local access roads from distant populated areas, the Contractor is to ensure that such blockages are in place for an as short as possible time span or, if this is not feasible, to provide alternative access to such areas, so that the social and health institutions could provide the required care and assistance to the beneficiaries of such assistance.* *The Contractor should especially make sure that the workers respect the property, the needs and the values of the local population, so as to avoid any conflict between the investor and the members of the local community.* • ***Operational phase*** *During the regular operation of the gas pipeline no significant negative impacts are anticipated in terms of local community health and safety. The measures will be presented and implemented according to a duly developed Community Health, Safety and Security Plan which applies for the duration of the construction and the work on the project, including also emergency prevention, preparedness and response. The plan will be developed in accordance with the national legislation and the international requirements, i.e. EIB (European Investment Bank) – ESS (Environmental and Social Standards) 9: Occupational and Public Health, Safety and Security.* *Adequate mitigation measures will be implemented in terms of the negative impacts during the construction process on the populated areas in order to minimize such impact as much as possible. Furthermore, it is expected that the duration of the construction activities at each location will span over a short period of time. If it is necessary to set a construction camp for the workers, the location of the camp should be in the vicinity of a populated area or a main road. The location of the workers' camp will be decided on prior to the commencement of the construction activities.* *During the early construction phases, prior to the commencement of the construction activity, the Contractor should prepare adequate documents and plans pertaining to the community health, safety and security. These will be implemented in the overall project documentation. Such documents and plans include the following:*			

Impact	*Proposed impact mitigation measures*	*Objective*	*Competent institution*	*Time schedule*
	• Community Health, Safety and Security Plan; *• Emergency Preparedness and Response Plan.* *The foregoing should be compliant with the national regulations, as well as the requirements of the respective international institution (e.g. EIB – Performance Standard 9: Occupational and Public Health, Safety and Security)* *The Contractor will develop and implement procedures for the protection of the health and safety of the local communities, the population and their property. Such procedures should include introducing the workers to the rules on safety and on the construction site, as well as to the obligation to prevent any unauthorized access to the construction site, the workers camps, the transport vehicles, the construction machinery and the warehouses. The Contractor will develop and implement a Construction Management Plan for ensuring a response in the event of any accidents and emergencies in a manner that is suitable for the risks in the sphere of construction. This Plan is to include a prior identification of the risks for increased incidents and the required measures for the prevention thereof, as well as mitigate the consequences therefrom upon the local community.* *The Contractor is obliged to ensure a safe pedestrian and road traffic corridor via the construction site, on the request of the local community and the inhabitants.* *The Contractor should also conduct a safety campaign for the population that lives in the areas in the vicinity of the construction sites, which will include educational and informative activities for the population. The major part of this campaign is to be implemented prior to the commencement of the construction activities, while the remainder during the construction phase. The campaign is to be supported by the media and the local radio stations with information, publication of manuals, leaflets and recommendations in hard copy, available to the local population, as well as in an electronic format on the website of the municipality, as well as other local institutions, including also on the website of the Investor.* *The Contractor is advised, in coordination with NER and the local self-government, to hold several meetings with the local community at which an explanation would be provided in terms of the impacts from the project, especially, noise, vehicle frequency and also information regarding the safety of the population during the forthcoming period*			

Impact	*Proposed impact mitigation measures*	*Objective*	*Competent institution*	*Time schedule*
	of construction works. It is desirable for such meetings to be held prior to the commencement of the construction activities.			
	Archaeological and cultural-historical heritage *Construction phase*			
*Impact: Potential destruction and loss of undiscovered archaeological sites - during the construction phase it is assessed with a **moderate** magnitude.*	• ***Construction phase*** *Accidental Discovery Protocol for cultural heritage* *In the event of an unforeseen, accidental discovery at an archaeological site, the Contractor is obliged to immediately notify the Operator and the Ministry of Culture and to comply with their instructions, wherein this measure is in accordance with the North Macedonian Law on Protection of Cultural Heritage.* *The construction works will be temporarily interrupted, whereas the competent authorities will decide whether it is necessary to conduct a research or apply all available protective measures. The Contractor is obliged to comply with the guidelines provided by the competent authorities for the protection of cultural heritage. The Contractor is obliged to keep any discovered objects at the place of discovery and in the condition in which they were discovered.* *The workers should be provided with a basic training related to the Accidental Discovery Protocol at archaeological sites.* *For the purposes of protecting the inhabitants of the affected populated areas from any possible negative consequences arising from the interruption of religious customs and events, especially burials of the deceased, and in order to avoid any misunderstandings with the community in this respect, the Contractor is obliged to prepare information with a weekly schedule of activities that will produce a strong noise and display such information at public locations in the populated areas. Furthermore, such information may be published by means of notices in the local media and radio stations, as well as in the municipality, in order to ensure easier distribution of this information.* • ***Operational phase*** *During the regular operation of the gas pipeline, no negative impacts on the archaeological and cultural-historical heritage are anticipated. Therefore, no measures are required.*	*Protection of the archaeological heritage and proper handling of cultural-historical heritage.*	*Contractor and Operator*	*During the construction phase.*

Impact	*Proposed impact mitigation measures*	*Objective*	*Competent institution*	*Time schedule*
	Archaeological and cultural-historical heritage *Operational phase*			
	None.			
	Economic development *Construction phase and operational phase*			
*Impact: Employment opportunities – during the operational phase it is assessed with a **high** magnitude.* *Impact: Indirect economic opportunities from an increased economic activity in the area – during the operational phase it is assessed with a **high** magnitude.* *Impact: Vulnerable groups and gender equality – during the operational phase it is assessed with a **low** magnitude.*	*During the construction phase and in the operational phase, positive impacts are anticipated (employment opportunities and an increased economic activity in the area). Therefore, no measures are required.* *As regards the impact on the vulnerable groups and gender equality, in the event of any direct threats to the vulnerable population as a result of the gas pipeline construction, the Operator and the local community will be required to assist in the efforts for preventing any economic displacement of these groups. Indirect employment opportunities in this phase could contribute for reducing the gender bias through an increased support for the local businesses that employ women.* *NER and the Contractors will enable employments that support the local community. It will be developed through consultations with the local stakeholders, the municipalities and other local affected parties, including women and vulnerable groups. The foregoing should be compliant with the national regulations, as well as the requirements of the respective international institution (e.g. EIB – Performance Standard 8: Labour Standards).* *• NER, alongside the Contractors, is going to establish a method for easier local employment and publish the job positions in manners and during periods in which it is possible for the local population to participate. It is important for the employment process to be well managed and for the local community to have a possibility to actively participate in the measures.* *• NER will encourage local employments, with priority being given to the following four municipalities: Negotino, Demir Kapija, Gevgelija and Bogdanci, including also the neighbouring villages along the route of the gas pipeline;* *• The local inhabitants will be informed in a timely manner of the employment opportunities and the required qualifications, whereby it will be ascertained that the advertising process is adequate for the lifestyle and the administrative requirements;* *• The local businesses will be informed in a timely manner regarding any contracting possibilities;*	*Additional employments according to the principle of gender equality and economic growth of the community.*	*Contractor and Operator*	*During the construction phase and during the operational phase.*

Impact	*Proposed impact mitigation measures*	*Objective*	*Competent institution*	*Time schedule*
	• NER will make sure that the engagement process is being implemented as transparently as possible in order to help the community understand the strategic decisions of the project workers; *• NER is going to develop and apply a Worker Code of Conduct which will regulate issues such as anti-social behaviour, drugs and alcohol abuse and discrimination of women as per the applicable national regulations. The Contractors will be required to comply with the afore-stated Code of Conduct;* *• NER will ensure that all complaints filed by the local businesses are managed in an adequate and timely manner. In the event of a necessity of corrective activities, they will be implemented in an effective and timely manner;* *• NER will develop a Workforce Development Strategy – an obligation to increase the employment opportunities and the skills of the local population;* *• NER will advise the Contractor to increase the employment of the local population which will be based on the required qualifications and skills;* *• NER and the Contractors will prepare and develop a capacity building program, including mentorship, training and learning opportunities for the local inhabitants in order to maximize the development of the skills of the local population. The employment of the local inhabitants in higher-level job positions should be increased in order to facilitate the good relations in the community;* *• NER will develop a program on corporate social responsibility (CSR) which will be designed and implemented through coordination with the municipalities with a view to creating business opportunities for the local community. The CSR program will be available to the local community, including also the workforce that is no longer involved in the project after the completion of the construction works;* *• The CSR programs will also attempt to improve the education and skills levels of the persons affected by the project.*			

10 ENVIRONMENTAL AND SOCIAL MONITORING PLAN

By implementing the Environmental and Social Monitoring Plan, data will be collected which could serve for the purposes of documenting the status of the environmental media and areas and social issues, as well as for monitoring the effects of the applied mitigation measures. Furthermore, this Plan enables the establishment of an interactive connection between all stakeholders and it constitutes a basis for the competent institutions to control the process of enforcing the legal regulations and to adopt proper decisions.

The main objectives of the Plan are:

- To confirm that the agreed and imposed requirements are adequately complied with during the approval of the project;
- To confirm that the impacts are within the scope of the foreseen or allowed limit values;
- To enable unforeseen impacts or changes management and;
- To ascertain that the application of the mitigation measures gives rise to an increase in the benefits in terms of environmental and social protection.

The Monitoring Plan includes monitoring of the parameters related to the environmental media and areas and social aspects:

- Soil;
- Groundwater;
- Surface water;
- Air;
- Waste generation;
- Noise and vibration;
- Biodiversity (flora and fauna);
- Landscape and visual effects;
- Local community and stakeholders;
- Use, ownership and access to land and property;
- Community health, safety and security;
- Occupational safety, security and health.

The Monitoring Plan is presented in a tabular format (Table 10-1), wherein it is stated in which project phase the monitoring of the parameters and the aspects is performed (construction phase and operational phase).

The Plan comprises the following information:

- monitored medium/area;
- project phase;
- location of the monitored parameter;
- method of monitoring the parameter and/or the type of equipment used;
- the frequency of the monitoring;
- the reasons for the need to monitor the parameter;
- the responsible entity for the monitoring of the parameters.

Table 9-2: Monitoring Plan

Medium/area	project phase	Monitoring parameter	Monitoring location	Method of monitoring/ Type of monitoring equipment	Frequency of monitoring	Reason for monitoring	Responsibility
ENVIRONMENTAL ASPECTS							
Soil	Construction	Slope stability	At the construction site and in the immediate vicinity	Detailed field research with hydrogeological and geotechnical drilling	Depending on the gas pipeline progress – if necessary	Documenting the slope stability status	Operator/Contractor
	Construction	Soil quality; Lubricants, oils, metals	At the construction site and in the immediate vicinity – at the same monitoring locations as in the baseline monitoring	Taking samples/laboratory analyses	Depending on the gas pipeline progress, taking samples from the same monitoring locations as in the baseline monitoring	Documenting the soil quality status during the construction and ensuring the implementation of the mitigation measures	Operator/Contractor
Surface water	Construction	Water quality – Parameters as per the Decree on Water Classification	At the construction site where the gas pipeline intersects with water streams and downstream	Taking samples/laboratory analyses	Depending on the gas pipeline progress, taking samples from the same monitoring locations as in the baseline monitoring	Documenting the soil quality status during the construction and ensuring the implementation of the mitigation measures	Operator/Contractor
Groundwater	Construction	Water quality – Parameters pursuant to the Decree on the Categorization of Water Streams, Lakes, Reservoirs and Groundwater	At locations where high groundwater levels occur	Taking samples/laboratory analyses	If necessary	Documenting the groundwater quality status during the construction	Operator/Contractor

Medium/area	project phase	Monitoring parameter	Monitoring location	Method of monitoring/ Type of monitoring equipment	Frequency of monitoring	Reason for monitoring	Responsibility
Air	*Construction*	*Pursuant to the legal regulations on ambient air quality, especially particulate matter (PM10), gases: SO_2, CO, NOx, VOC*	*At the construction site and in the immediate vicinity of populated areas as receptors.*	*Monitoring by means of adequate equipment/laboratory analyses*	*At least twice per monitoring location during the construction phase*	*Documenting the air quality status during the construction and ensuring the implementation of the mitigation measures*	*Operator/Contractor*
Waste	*Construction*	*Sort and quantity of waste, types and fractions of waste (hazardous, non-hazardous, utility, inert)*	*At the site and in the surrounding areas of the gasification system construction site*	*By counting/measuring/ visually. In terms of non-utility waste, an authorized company should be engaged.*	*Regular record-keeping regarding the waste type and quantity, as well as the manner of disposal of various types of waste*	*Documenting the waste status during the construction and ensuring the implementation of the mitigation measures*	*Operator/Contractor (authorized companies for waste collection, transport and final disposal)*
Noise	*Construction*	*Pursuant to the legal regulations on ambient noise levels*	*At the gas pipeline construction site, at the same monitoring locations as in the baseline monitoring and in the vicinity of populated areas as receptors.*	*Monitoring by means of adequate equipment*	*At least twice during the construction of the gas pipeline at the same monitoring locations as in the baseline monitoring*	*Documenting the noise level status during the construction and ensuring the implementation of the mitigation measures*	*Operator/Contractor*
Habitats	*Construction*	*Habitat loss level due to deforestation, landslides, blasting, etc.*	*Along the gas pipeline route*	*Visual inspections of all sensitive habitats*	*Once a month*	*Minimizing as much as possible the impact on and degradation of sensitive habitats.*	*Operator/Contractor*
Habitats	*Construction and operational*	*Implementation of a Revegetation Plan*	*Riparian habitats*	*Visual inspections of all riparian habitats*	*Once a year*	*Minimizing as much as possible the impact on and degradation of riparian habitats.*	*Operator/Contractor*

Medium/area	project phase	Monitoring parameter	Monitoring location	Method of monitoring/ Type of monitoring equipment	Frequency of monitoring	Reason for monitoring	Responsibility
Landscapes	*Operational*	*Erosion level and deforestation of the area along the route*	*Along the entire gas pipeline route, especially the forest areas and the riverbeds and streams.*	*Visual inspection for any signs of erosion, poor vegetation cover*	*At the end of the construction activities* *Once a year, in springtime*	*For the purposes of ensuring effective landscape management*	*Contractor*
SOCIAL ASPECTS							
Local community and stakeholders	*Construction*	*Informing the local community by the Operator and the Contractor*	*Local newspapers, radio/TV stations, municipal bulletins.*	*Recording the announcements aimed at informing the local community*	*Twice in the course of the gas pipeline construction phase on the territory of one municipality.*	*Documenting the local community information status*	*Operator/Contractor*
Use, ownership and access to land and property	*Construction*	*Number of complaints*	*Field offices of the Operator and the Contractor and municipal offices*	*Recording the complaints by number and content*	*Twice in the course of the gas pipeline construction phase on the territory of one municipality.*	*Documenting the complaints status*	*Operator/Contractor*
Community health, safety and security	*Construction*	*Number of possible accidents suffered by the local population during the construction and number of health complaints related to the construction*	*Field offices of the Operator and the Contractor and municipal offices*	*Recording the accidents and the complaints by number and content*	*Twice in the course of the gas pipeline construction phase on the territory of one municipality.*	*Documenting the complaints and accidents status*	*Operator/Contractor*
Occupational safety, security and health (OSSH)	*Construction*	*Number of possible accidents suffered by the workers during the construction and number of health complaints related to the construction*	*Field offices of the Operator and the Contractor*	*Recording the accidents and the complaints by number and content*	*Twice in the course of the gas pipeline construction phase on the territory of one municipality.*	*Documenting the complaints and accidents status*	*Contractor*

Medium/area	*project phase*	*Monitoring parameter*	*Monitoring location*	*Method of monitoring/ Type of monitoring equipment*	*Frequency of monitoring*	*Reason for monitoring*	*Responsibility*
	Operational	*Number of accidents suffered by the workers during the operational phase and number of health complaints related to the regular operation of the gas pipeline*	*Operator's offices*	*Recording the accidents and the complaints by number and content*	*Pursuant to the OSSH Plan (OSSH Statement) of the Operator.*	*Documenting the complaints and accidents status*	*Operator*

11 DIFFICULTIES DURING THE DEVELOPMENT OF THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY

During the process of preparation of the ESIA Study, the expert team of the author Tehnolab Skopje was faced with certain difficulties which arise from the lack of data related to the environmental media and areas (water, air, soil, noise, biodiversity and social aspects) regarding the regions through which the gas pipeline passes, especially the segments comprised in the footprint of the project.

Therefore, in the course of the development of the Study, its author and the expert teams made field visits to the locations where the gas pipeline passes and conducted a basic monitoring of the ambient air, the surface waters, the soil, the ambient noise and the biodiversity. Adequate reports have been prepared for the purposes of such monitoring, which have been presented in the Study.

As regards the social aspects, during the first field visit initial findings were obtained related to the stakeholders. During the following visits at the locations comprised in the footprint of the project, individual informal interviews were conducted with inhabitants at particular potentially affected locations.

During this phase of the project there was no knowledge as to the period of time in which the gas pipeline is to be constructed, the required construction machinery and transport vehicles that would participate in the construction and the number of working hours for their engagement; thence, it was impossible to make a calculation of the air pollutant emissions and the quantities of greenhouse gas emissions.

12 CONCLUSIONS

The Gas Interconnector North Macedonia - Greece project is a result of the efforts of the Government of the Republic of North Macedonia related to the developmental construction of the National Gasification System in the country, i.e., the development of the existing gas infrastructure on the entire territory of the country.

The review of the entire available planning and design documentation pertaining to the gasification of the Republic of North Macedonia and the analyses arising from it constitute the basis for the multidisciplinary team of experts and professionals who participated in the development of this Study to conduct an Environmental Impact Assessment of the project. Concurrently, consideration was given to the findings regarding the environmental condition of the footprint of the construction site and the immediate vicinity, as well as the legal regulations in this respect. As a result, the following conclusions may be made:

- The construction of the Gas Interconnector North Macedonia - Greece will have a long-term positive impact on the country and it will contribute for the enhancement of a reliable and high-quality energy supply for the users by means of the possibility for an increased use of natural gas;
- This project will produce long-term positive impacts on the population in terms of the improvement of the energy and heat supply for the households, the industry and the service sector, which will also reflect on the quality and consistency of the energy and heat supply in the entire country;
- The project activities that will be performed during the execution of this project, especially during the construction phase, will have an impact on the environmental media and areas and social aspects by causing short-term and localized negative impacts, such as:
  - The gas pipeline construction and installation activities will disturb the soil quality which will give rise to a change in the specific geological features. This disturbance will comprise localized changes in the soil profile in the immediate vicinity of the excavations and soil compaction due to the manipulation of the construction vehicles and equipment which could lead to erosion as a result of vegetation and topsoil removal.
  - During the activities aimed at excavation and installation of the gas pipeline system at locations which are in the immediate vicinity of water courses, i.e. at crossings between the gas pipeline and water courses, it is expected that a short-term pollution of the soil would occur which includes dirt and hard particles that will cause turbidity of the water.
  - Emissions in the air during the construction will occur as a result of exhaust fumes from the construction machinery. Such emissions will contain pollutants such as SOx, NOx, CO, VOC, etc. Generally, low concentrations are expected. Also, the occurrence of dust is expected that will be generated during the construction of the gas pipeline, which will occur as a result of the earthing works and the activities performed for preparing the terrain, clearance, excavation, levelling, etc. The effects of these impacts are expected to be of a localized and short-term significance.
  - Impact on climate change will occur both during the construction phase and the operational phase. During the construction phase there will be greenhouse gas emissions, mainly CO_2, as a result of the operation of the construction machinery and the transport vehicles. Biomass loss will occur as a consequence of vegetation removal from the gas pipeline route. It will cause an increase in greenhouse gases, mainly CO2. In the course of the operational phase, during the natural gas transmission through the gas pipeline (which is composed of approximately 97% greenhouse gas methane - CH4) a fugitive emission will occur as a result of minor leaks through

the safety and relief valves, as well as a result of gas leakage instances due to disruptions of the pipeline impermeability. These impacts will not be significant.

- During the gas pipeline construction phase a negative impact is expected on the flora and fauna which are located on the territory of the construction site. Due to the possible degradation of the habitats and disruption of the geographic range limits, displacement of some of the fauna is expected to the surrounding region with the same properties. Mainly, the impacts are expected to be more prominent during the construction, with a short-term and localized effect. During the operational phase, no significant negative impacts are expected in terms of the vegetation species, the plant communities and habitats, as well as in terms of terrestrial animals (amphibians and reptiles) and most of the insects.
- A change of the landscape during the construction phase will occur as a result of the performance of construction activities, the presence of workers and other additional activities. This impact will be of a temporary character, for the duration of the construction works. During the operational phase, the changes in the landscape due to the already constructed gas pipeline will be permanent.

In line with the impacts, i.e., the reasons which contribute for the project to have negative environmental impacts, measures have been proposed in the Study for the purposes of the reduction and neutralization of such impacts. They will be incorporated in this project in order to ensure protection against, reduction and mitigation of any negative impacts on the environment and the human health. To that end, an Environmental and Social Management Plan has been presented in the Study which will enable the Contractor and the Operator to have a clear picture of the environmental impacts in the course of the gas pipeline construction and its use. The Plan defines the measures for neutralization and/or mitigation of the negative impacts, the purpose, i.e. the anticipated achievements from the implementation of the measures, the holder of the responsibility for implementing the measures and the timeframe for the completion of such implementation.

The Monitoring Plan, included in this Study, will enable for the data obtained from the monitoring to be used for checking the achievements against the proposed measures.

Having regard to the conducted analyses and observations, while concurrently applying the observations from the respective legal regulations, as well as the scientific and expert knowledge regarding the methods of environmental impact assessment, the ***general conclusion*** is that this project will not give rise to any significant disturbances of the environmental quality, either by means of its construction and the installation of the envisaged equipment, or by means of a full implementation of the environmental impact mitigation measures and the contingency planning.

13 APPENDICES

APPENDIX 1 - Information on the submitted Notice of Intention and Decision for determining the need for EIA and scope of the Study

APPENDIX 2 - Graphic illustration of the pipeline route

APPENDIX 3 - Graphic presentation of the methodology of performing the works in stages

APPENDIX 4 - The main intersections of the gas pipeline with watercourses, catchments, roads, railway, oil pipeline and transmission lines

APPENDIX 5 - Photos from measurements on site

APPENDIX 6 - Map of habitats along the route of the pipeline

APPENDIX 1 - Information on the submitted Notice of Intention and Decision for determining the need for EIA and scope of the Study

Република Северна Македонија
Министерство за животна средина и просторно планирање

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УПРАВА ЗА ЖИВОТНА СРЕДИНА DREJTORIA PËR MJEDIS JETËSOR

Информација за поднесено известување за намера за изведување на проектот: Интерконективен гасовод Северна Македонија - Грција

Министерството за животна средина и просторно планирање ја известува заинтересираната јавност дека инвеститорот Акционерско друштво за вршење на енергетски дејности "Македонски Енергетски Ресурси" Скопје во државна сопственост, со седиште на бул. "Климент Охридски" бр. 58б, Скопје, достави известување за намера за изведување на проектот: Интерконективен гасовод Северна Македонија - Грција и преглед со утврдување на потребата од оцена на влијанието на проектот врз животната средина и листа на проверка за определување на обемот на оцена на влијанието на проектот врз животната средина.

Целта на проектот е изградба на магистрален гасовод како внатрешен транспортен систем од челични цевки со висок работен притисок низ кој ќе се транспортира природен гас од мерно-регулациони станици до приклучокот на гасодистрибутивната мрежа во градовите и/или индустриски и други постројки на големите корисници на гас во Република Северна Македонија. Трасата на гасоводот поминува низ општините: Гевгелија, Богданци, Демир Капија и Неготино. Површината на опфатот изнесува 168,53 ха.

Надлежен орган за донесување на одлуката е Министерството за животна средина и просторно планирање.

Целосното известување за намера за изведување на проектот: Интерконективен гасовод Северна Македонија - Грција, може да се види на интернет страната на Министерството за животна средина и просторно планирање - www.moepp.gov.mk.

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Инвеститор:

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УПРАВА ЗА ЖИВОТНА СРЕДИНА
DREJTORIA PËR MJEDIS JETËSOR

Арх.бр. 11-3946/3
Дата. 10-12-2019

ДО: АД "Македонски Енергетски ресурси"
бул. "Климент Охридски" бр.58б
1000 Скопје

ПРЕДМЕТ: Доставување на Решение

Почитувани,

Согласно Вашето известување за намера за изведување на проектот: "Интерконективен гасовод Северна Македонија - Грција" и барањето за определување на обемот на Студијата за оцена на влијанието на проектот врз животната средина со број 11-3946/1 во прилог на овој допис Ви го доставуваме Решението со кое се утврдува потреба од оцена на влијанието на проектот: "Интерконективен гасовод Северна Македонија - Грција", како и обемот на Студијата за оцена на влијанието на проектот врз животната средина.

МИНИСТЕР
Naser Nuredini

Изработил: Александар Петковски
Согласен: Билјана Петковска
Одобрил: Директор на Управа за животна средина
Xhezmi Saliu

Министерство за животна средина и просторно планирање на Република Северна Македонија
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УПРАВА ЗА ЖИВОТНА СРЕДИНА
DREJTORIA PËR MJEDIS JETËSOR

Врз основа на член 81 став 8 од Законот за животна средина (Службен Весник на Република Македонија број 53/2005, 81/2005, 24/2007, 159/2008, 83/2009, 48/2010, 124/2010, 51/2011, 123/2012, 93/2013, 42/2014, 44/2015, 129/2015 и 39/2016), Министерот за животна средина и просторно планирање донесе

РЕШЕНИЕ

1. Со ова Решение се утврдува потребата од оцена на влијанието на проектот: "Интерконективен гасовод Северна Македонија - Грција", поднесено од страна на Акционерско друштво за вршење на енергетски дејности "Македонски Енергетски ресурси" , со седиште на бул. "Климент Охридски" бр.58б, Скопје, како и обемот на студијата за оцена на влијанието на проектот врз животната средина.
2. Обемот на Студијата за оцена на влијанието на проектот врз животната средина е определен во Листата на проверка за определување на обемот на студијата за оцена на влијанието на проектот врз животната средина: прашања за карактеристиките на проектот, која е составен дел на ова решение.
3. Обемот на Студијата за оцена на влијанието на проектот врз животната средина покрај Листата на проверка за определување на обемот на студијата за оцена на влијанието на проектот врз животната средина: прашања за карактеристиките на проектот, треба ги опфати и прашањата кои се однесуваат на: визуелни аспекти, биолошка разновидност, кумулативни влијанија и социо-економски аспекти.
4. Засегнатата држава Република Грција е известена за намерата за изведување на проектот: "Интерконективен гасовод Северна Македонија - Грција" во општина Гевгелија, Општина Богданци, Општина Демир Капија и општина Неготино и истото не известија дека немаат интерес за учество во постапката за оцена на влијанието врз животната средина бидејќи со проектот не се очекува позначајно влијание врз животната средина на грчка територија.
5. Ова Решение влегува во сила со денот на донесувањето, а ќе се објави во најмалку еден дневен весник достапен на целата територија на Република Северна Македонија, на интернет страницата, како и на огласната табла во Министерството за животна средина и просторно планирање.

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УПРАВА ЗА ЖИВОТНА СРЕДИНА
DREJTORIA PËR MJEDIS JETËSOR

Образложение

На ден 14.11.2019 година од страна на Акционерско друштво за вршење на енергетски дејности "Македонски Енергетски ресурси" до Министерството за животна средина и просторно планирање доставено е известување за намера за изведување на проектот: "Интерконективен гасовод Северна Македонија - Грција" и барање за определување на обемот за оцена на влијанието на проектот врз животната средина со број 11-3946/1.

Со овој проект се предвидува интерконекција на Северна Македонија со Грција како дел од Националниот Гасификационен систем во Република Северна Македонија. Значењето на проектот се истакнува со стратегиската определба на Република Северна Македонија за вклучување на природниот гас во енергетиката , а со тоа и развој на постоечката гасна инфраструктура на ниво на цела Државата, односно обезбедување на можност за долгорочна гасификација на подрачјето на целата терирорија на државата.

Интерконективниот гасовод е со дијаметар од DN 700(28") и истиот се состои од: компресорски и пумпни станици, станици за преточување, помошни резервоари и контејнери под притисок, блок станици, уреди за катодна заштита, арматура, вентилски станици, мерни станици , регулаторни станици , телекомуникациска мрежа и цевковод.

Трасата на гасоводот поминува низ општините: Гевгелија, Богданци, Демир Капија и Неготино и зафаќа површина на опфат 168,53ха. Почетна точка на трасата е границата со Грција во близина на селото Идомени и градот Гевгелија , додека крајна точка во северна Македонија е веќе изградената вентил станица на новоизградениот гасовод Штип - Неготино.

Согласно Законот за животна средина (Службен Весник на Република Македонија број 53/2005, 81/2005, 24/2007, 159/2008, 83/2009, 48/2010, 124/2010, 51/2011, 123/2012, 93/2013, 42/2014, 44/2015, 129/2015 и 39/2016) и Уредбата за определување на проекти и за критериумите врз основа на кои се утврдува потребата за спроведување на постапката за оцена на влијанијата врз животната средина Службен Весник на Република Македонија број 74/2005, 109/2009, 164/2012 и 202/2016) предложениот проект се наоѓа во Прилог I – Проекти за кои задолжително се врши оцена на влијанијата врз животната средина, точка 13-цевководите за пренос на гас, нафта или хемикалии со дијаметра поголем од 700mm и/или должина повеќе од 40km.

За таа цел се пристапи кон пополнување на Листата на проверка за определување на обемот на студијата за оцена на влијанието на проектот врз животната средина: прашања за карактеристиките на проектот и се изврши определување на обемот на студијата за оцена на влијанието на проектот врз животната средина. Покрај прашањата опфатени во Листата на проверка за определување на обемот на студијата за оцена на влијанието на проектот врз

Министерство за животна средина и просторно планирање на Република Северна Македонија
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Министерство за животна средина и просторно планирање

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Ministria e Mjedisit Jetësor dhe Planifikimit Hapësinor

УПРАВА ЗА ЖИВОТНА СРЕДИНА
DREJTORIA PËR MJEDIS JETËSOR

животната средина, инвеститорот треба подетално да ги разработи следните прашања:

Визуелни аспекти
Овие аспекти се важни во релација со животната средина во текот на оперативната фаза. Од тие причини, тие претставуваат важен сегмент на Студијата за ОВЖС, која треба да опфати ефекти врз пределот.

Биолошка разновидност
Обемот на ОВЖС треба да вклучи анализа на состојбите со билошката разновидност на подрачјето, евентуално присуство на заштитени и засегнати видови живеалишта, присуство на заштитени подрачја, евидентирани подрачја за заштита, присуство на еколошки мрежи, како и потенцијалните влијанија од спроведување на проектот. Согласно мислењето од општина Богданци укажуваме дека посебно внимание во Студијата за ОВЖС е потребно да се обрне на штрковите.

Кумулативни влијанија
Во случај да постојат проекти/инсталации со потенцијал за слични влијанија врз животната средина во опкружувањето на предвидениот проект, Студијата за ОВЖС треба да вклучи анализа на кумулативните ефекти.

Социо-економски аспекти
Оцената на социо-економските аспекти ќе даде осврт на потенцијалните директни и индиректни ефекти од проектот врз економијата и социјалните состојби во подрачјето од спроведување на истиот.

Врз основа на горенаведеното го одлучи како во диспозитивот на ова решение.

Правна поука: Против ова решение инвеститорот, засегнатите правни или физички лица, како и здруженијата на граѓани формирани за заштита и за унапредување на животната средина, можат да поднесат жалба до Комисијата на Владата на Република Македонија за решавање на управните работи во втор степен од областа на животната средина, во рок од осум дена од денот на објавувањето на решението.

МИНИСТЕР
Naser Nuredini

Изработил: Александар Петковски
Согласен: Билјана Петкоска
Одобрил: Директор на Управата за животна средина
Xhezmi Saliu

Министерство за животна средина и просторно планирање на Република Северна Македонија
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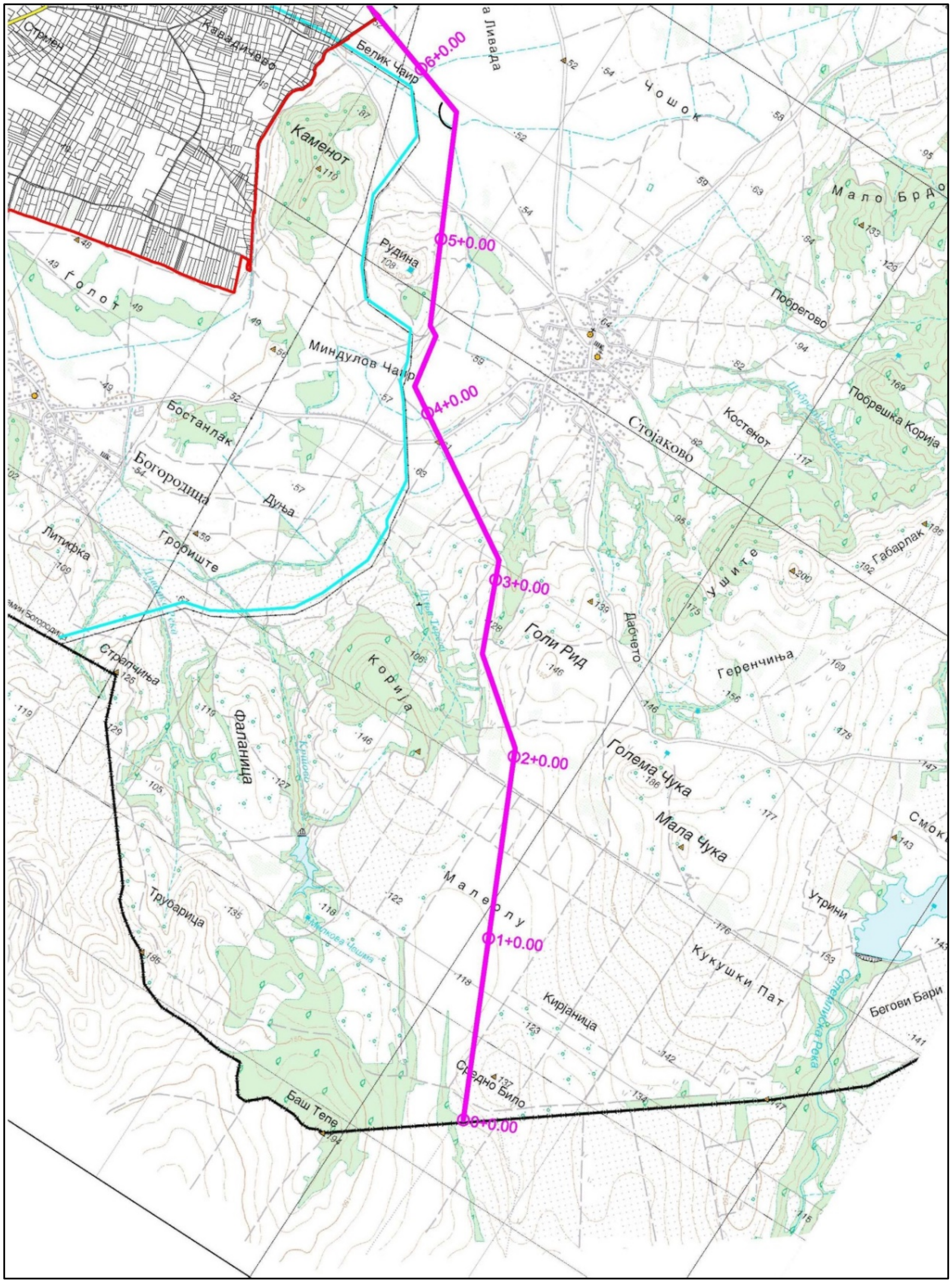
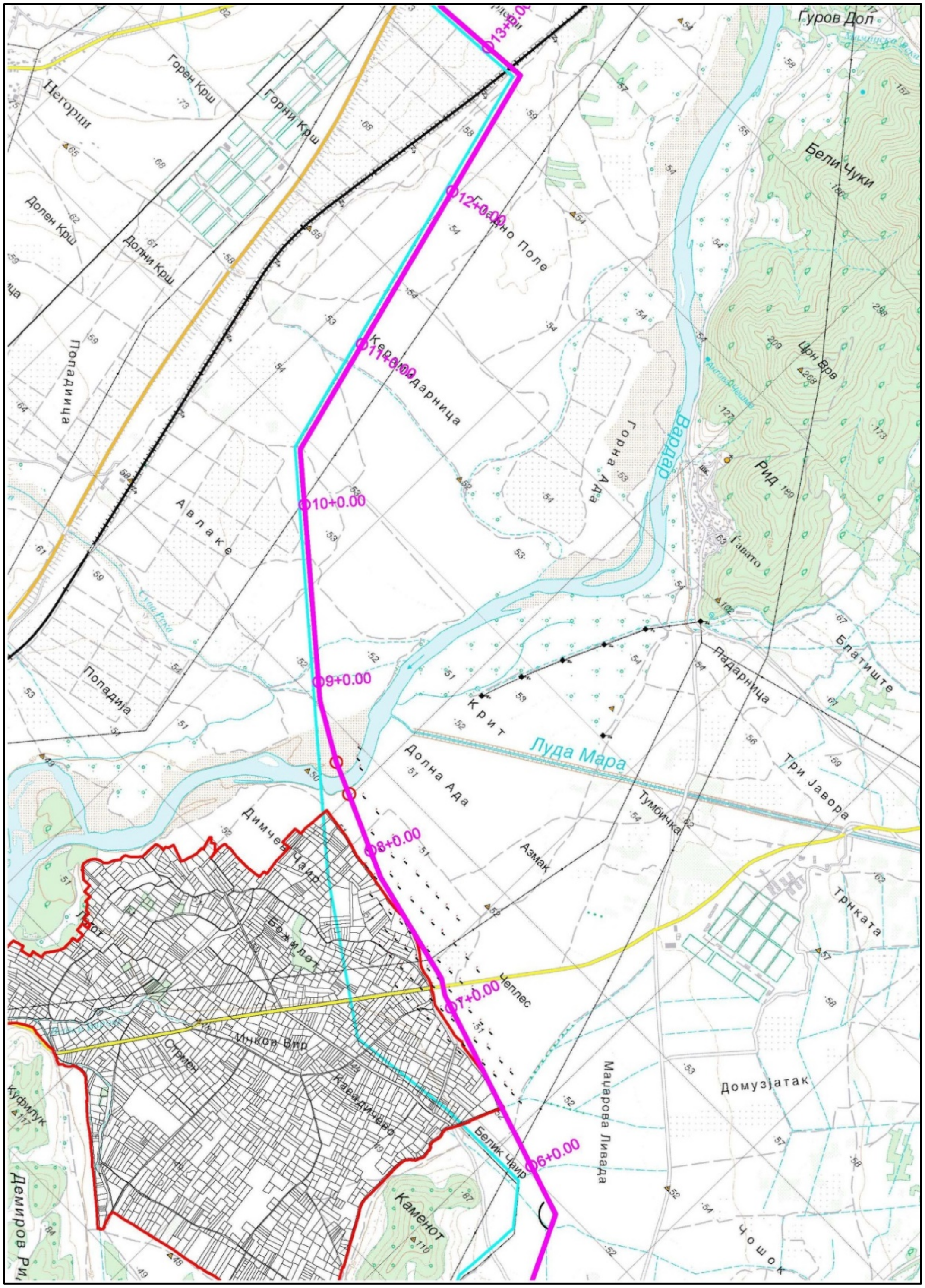
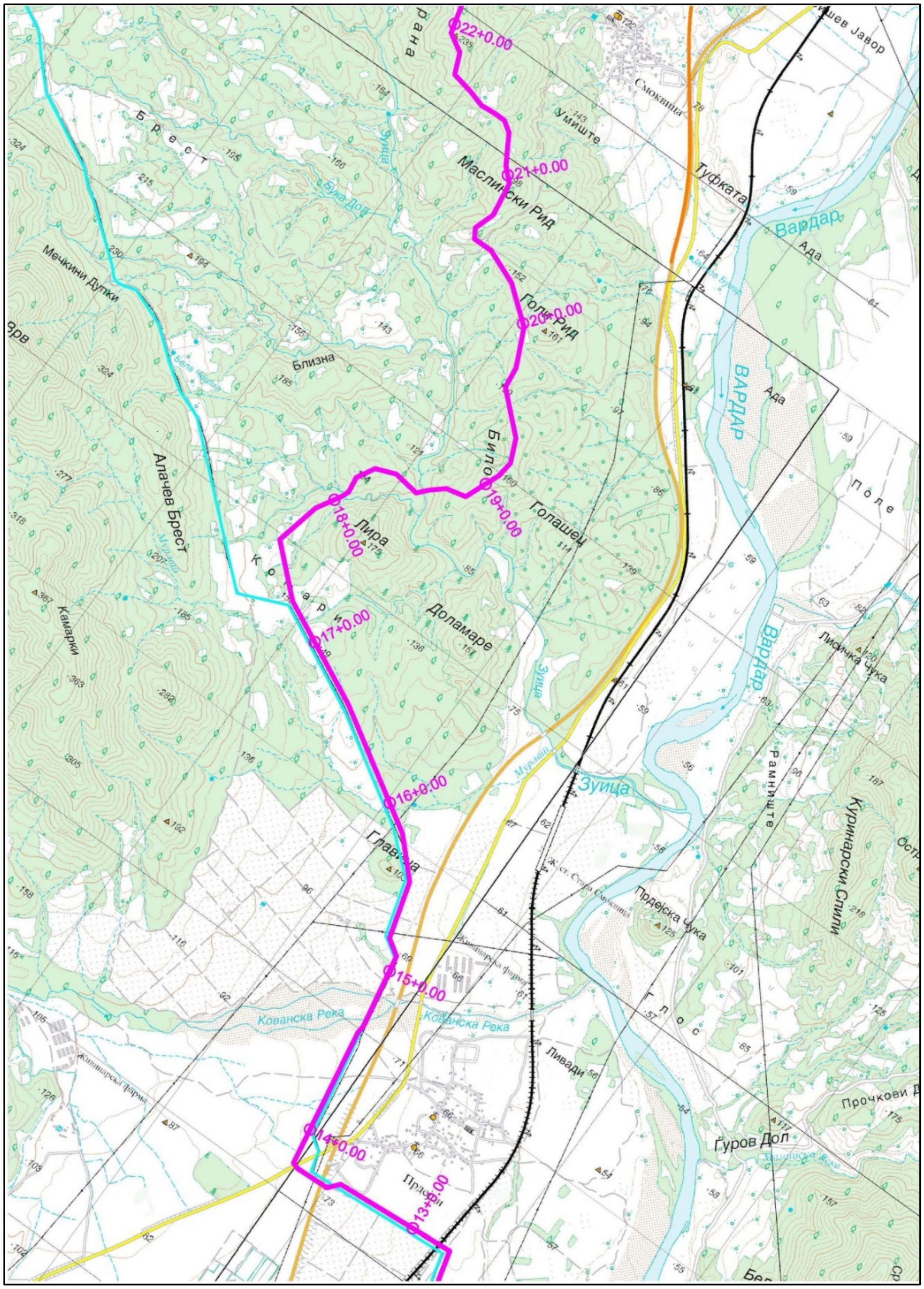
APPENDIX 2 - Graphic illustration of the pipeline route



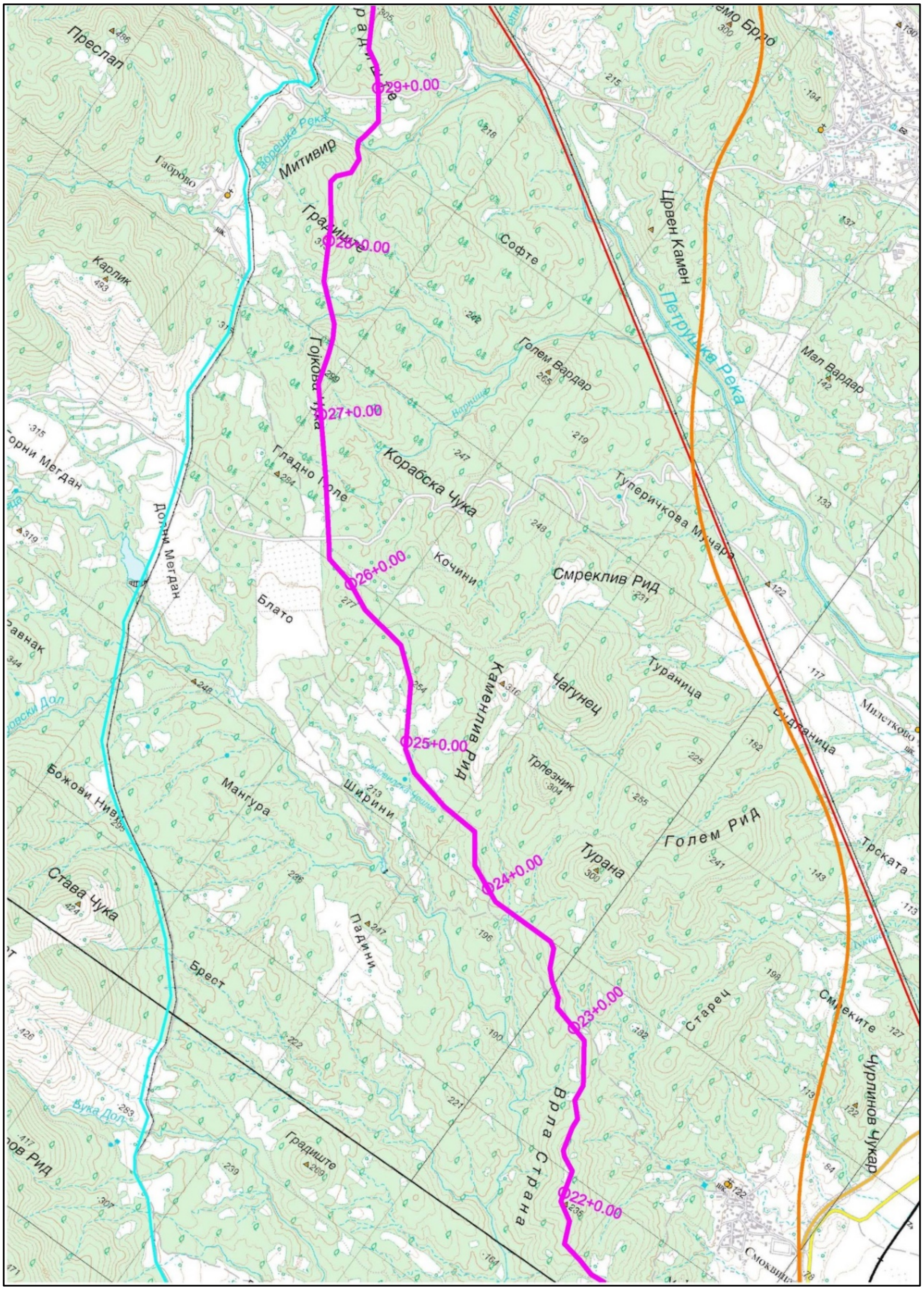
Interconnection Pipeline North Macedonia - Greece from 0km to 6km



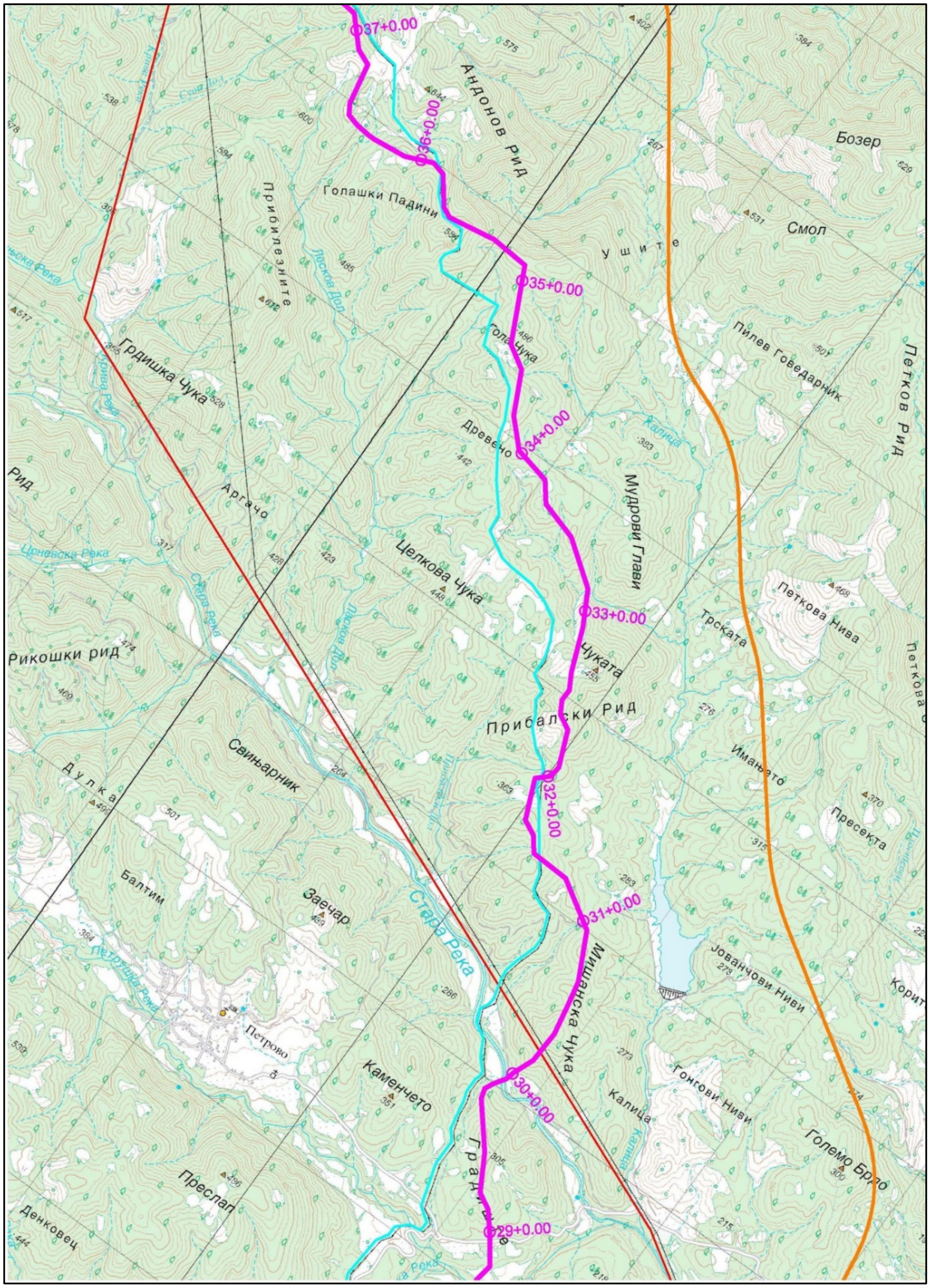
Interconnection Pipeline North Macedonia - Greece from 6km to 13km



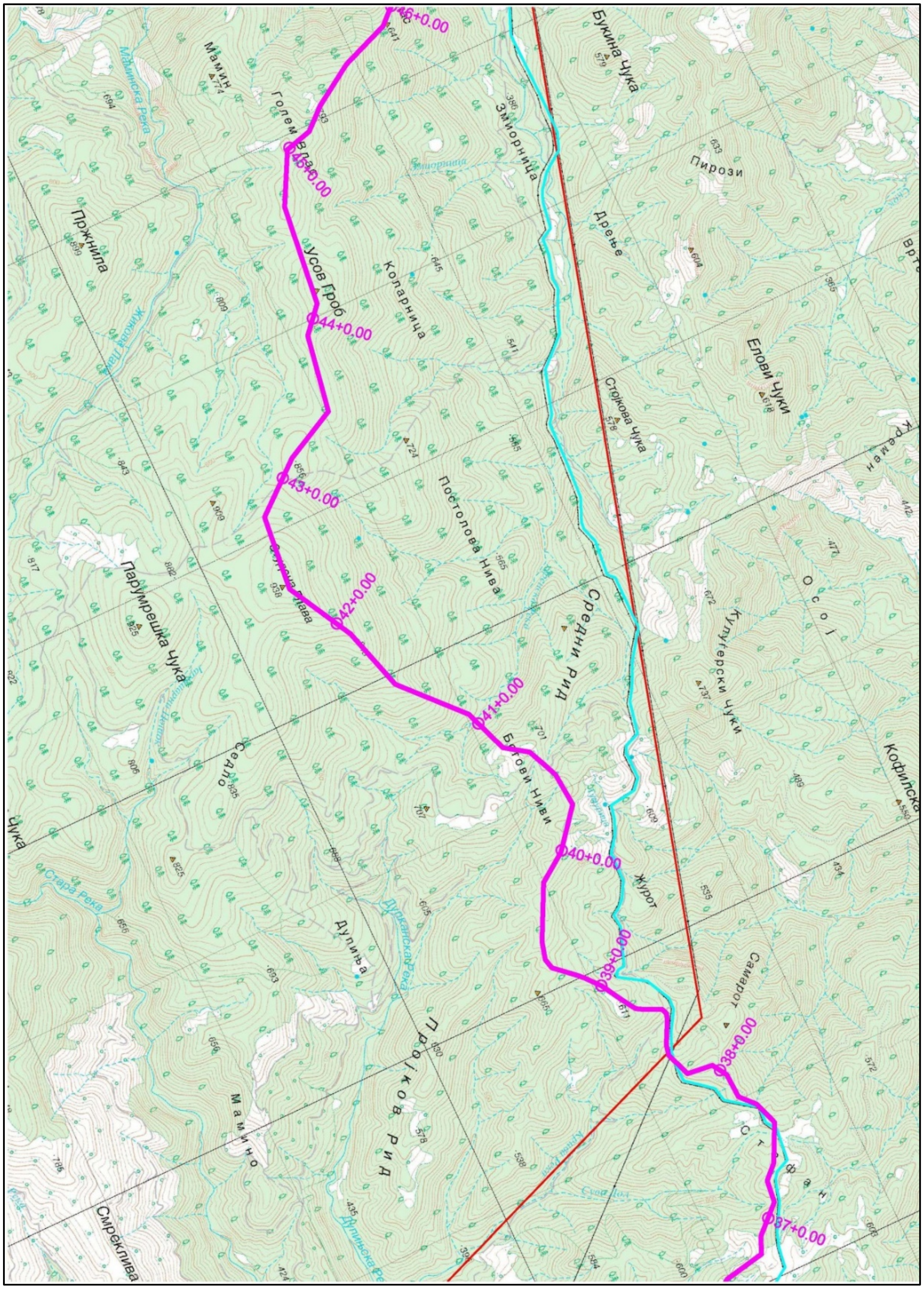
Interconnection Pipeline North Macedonia - Greece from 13km to 22km



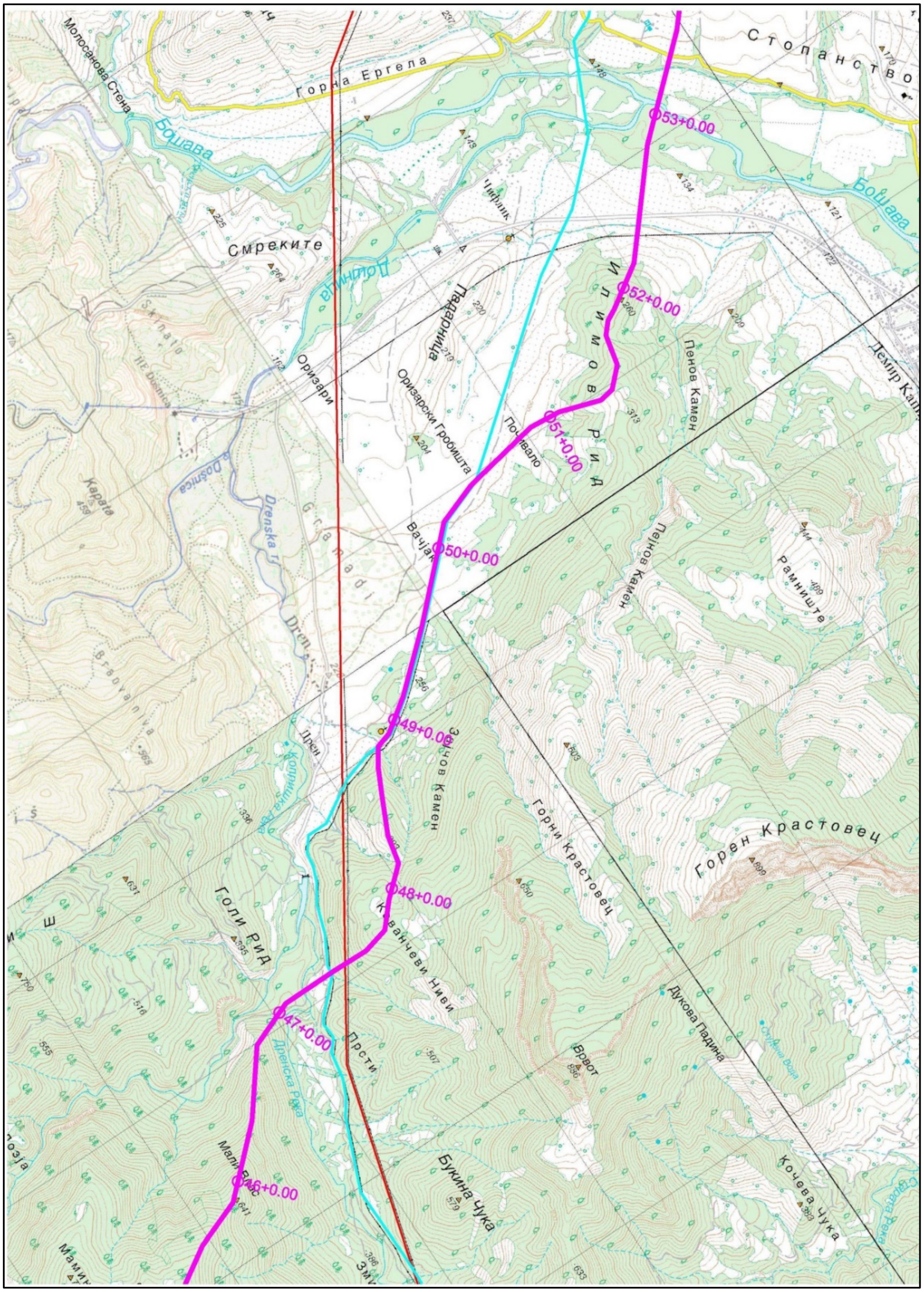
Interconnection Pipeline North Macedonia - Greece from 22km to 29km



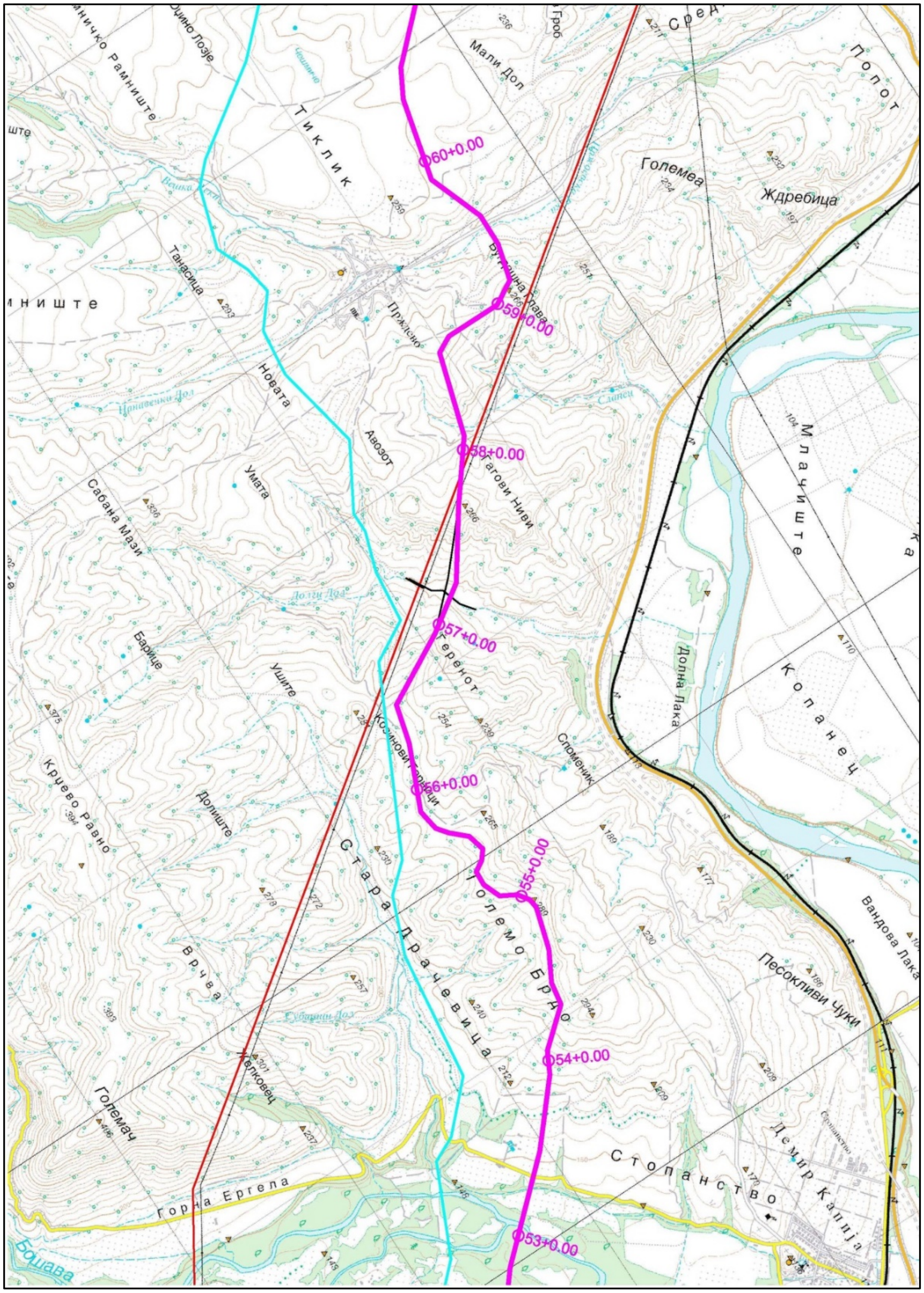
Interconnection Pipeline North Macedonia - Greece from 29km to 37km



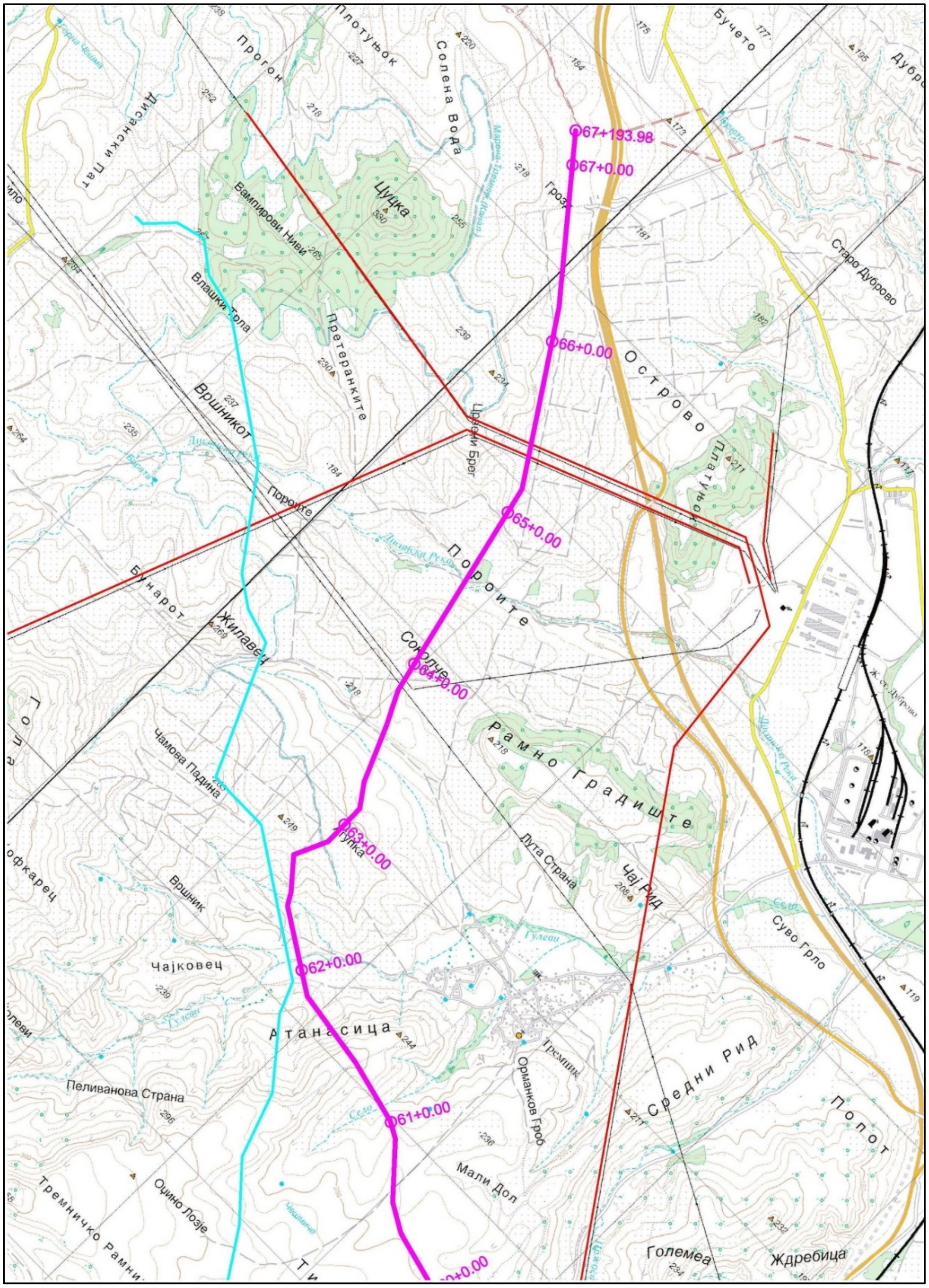
Interconnection Pipeline North Macedonia - Greece from 37km to 46km



Interconnection Pipeline North Macedonia - Greece from 46km to 53km



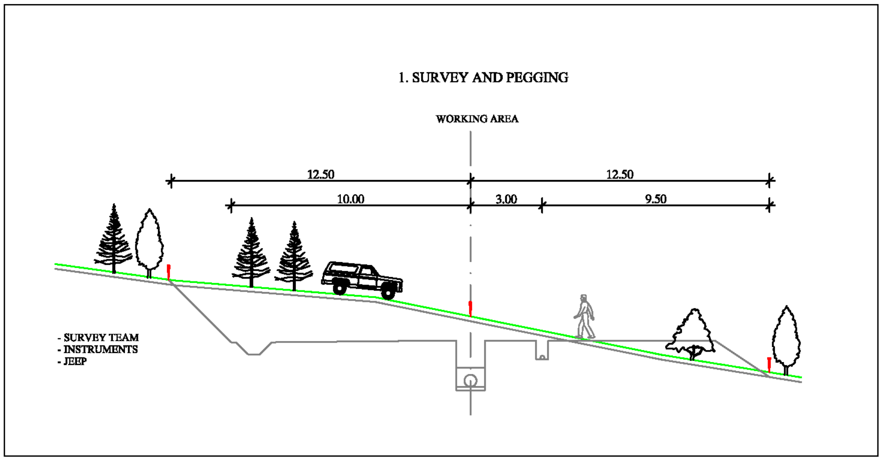
Interconnection pipeline North Macedonia - Greece from 53km to 60km

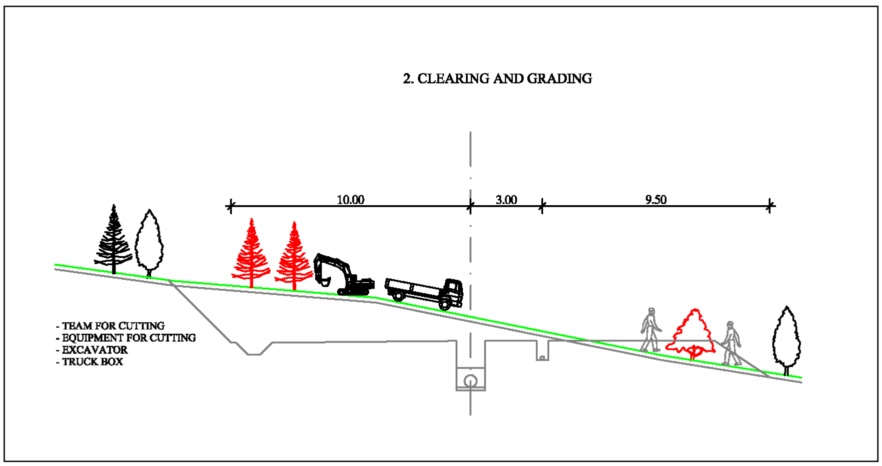


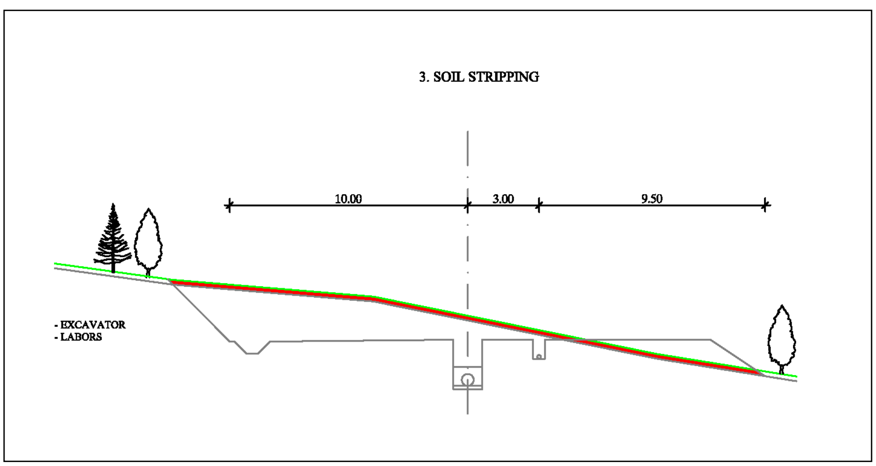
Interconnection Pipeline North Macedonia - Greece from 61km to 67 + 193.98km

MOTT MACDONALD CONNECTA CONSORTIUM

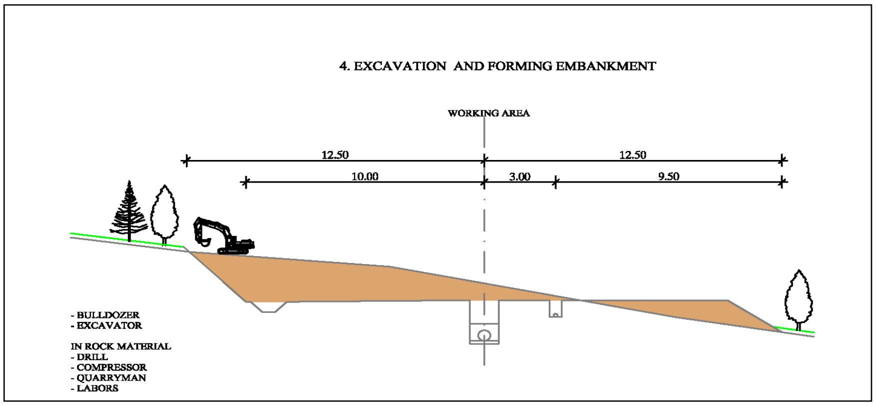
APPENDIX 3 - Graphic presentation of the methodology of performing the works in stages

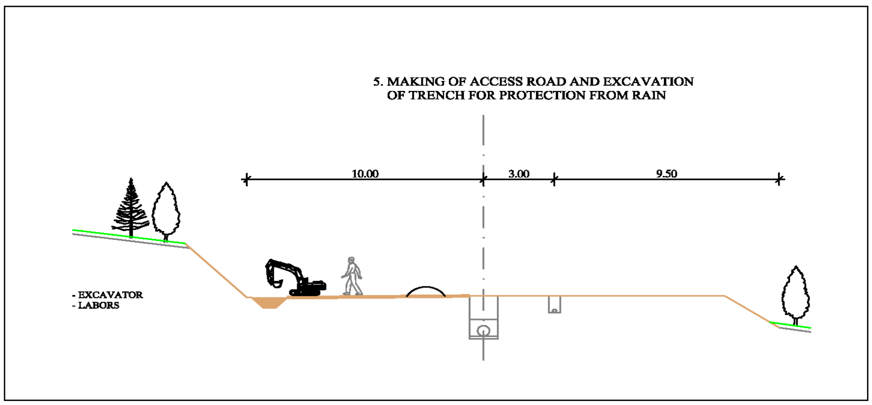


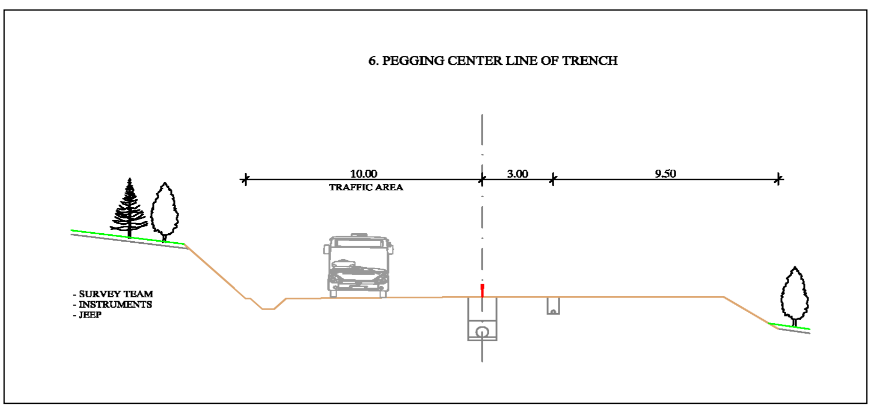


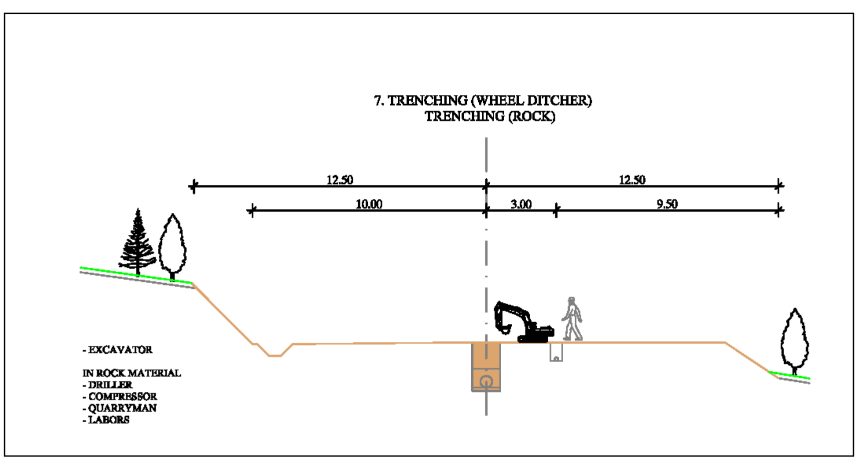


MOTT MACDONALD CONNECTA CONSORTIUM

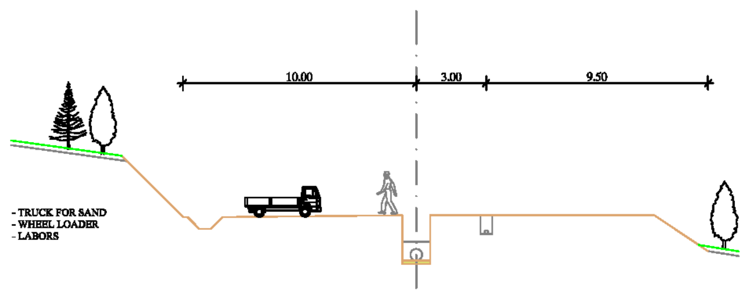




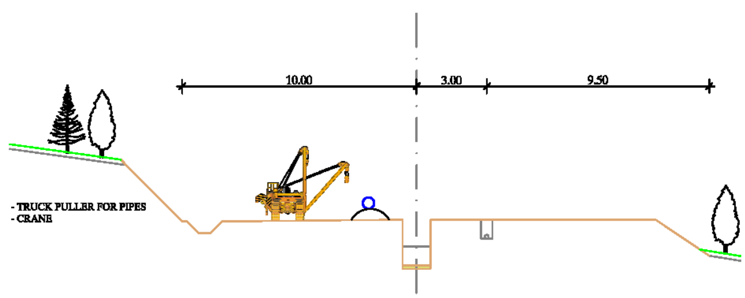




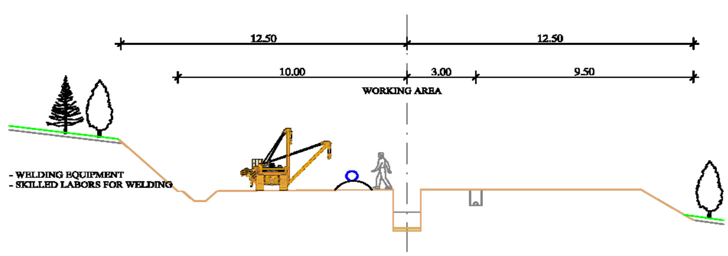
8. PLACING SAND IN THE BOTTOM OF TRENCH



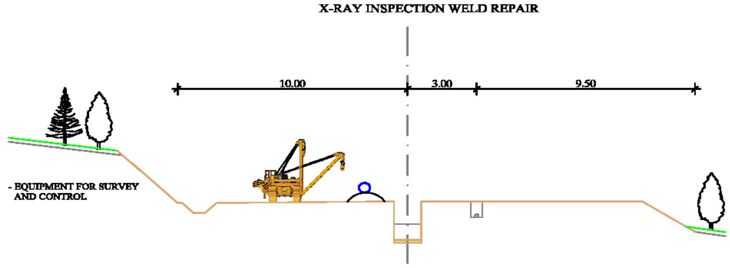
9. TRANSPORT AND STRINGING PIPE
LANDING PIPE

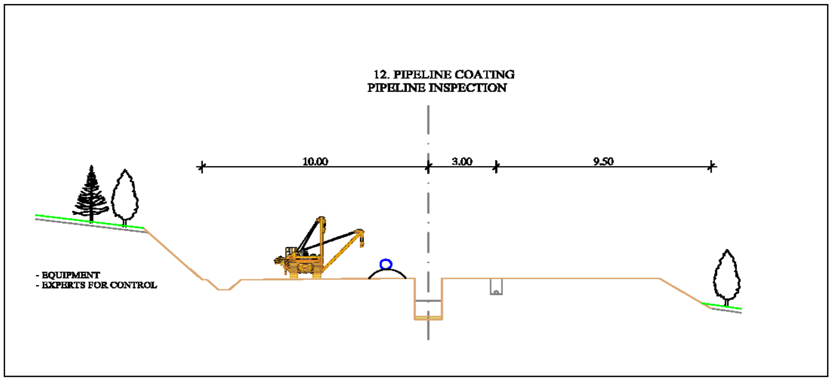


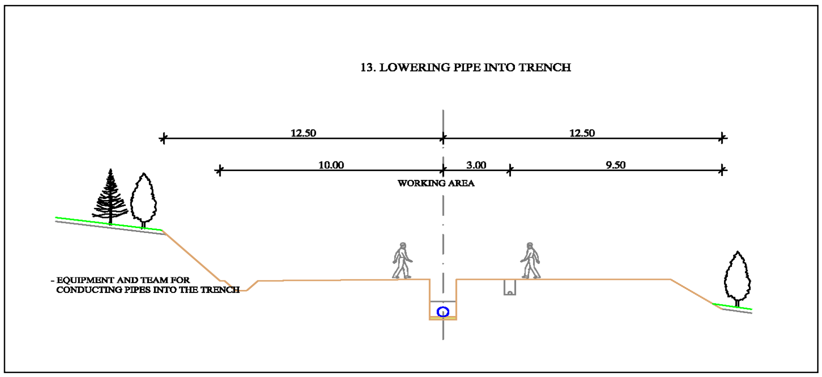
10. LINE-UP INITIAL WELD
FINAL WELD

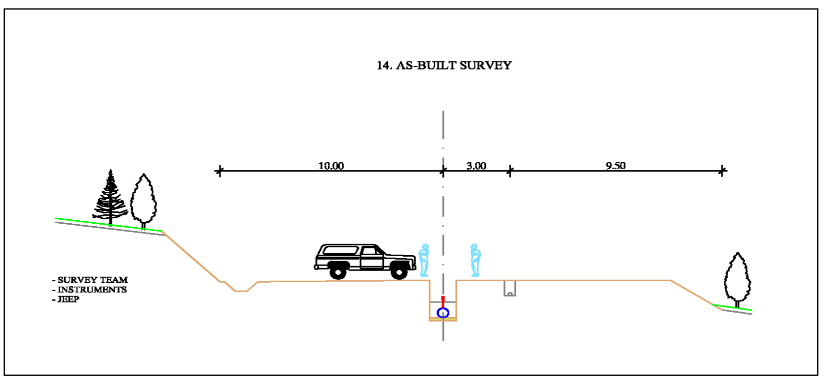


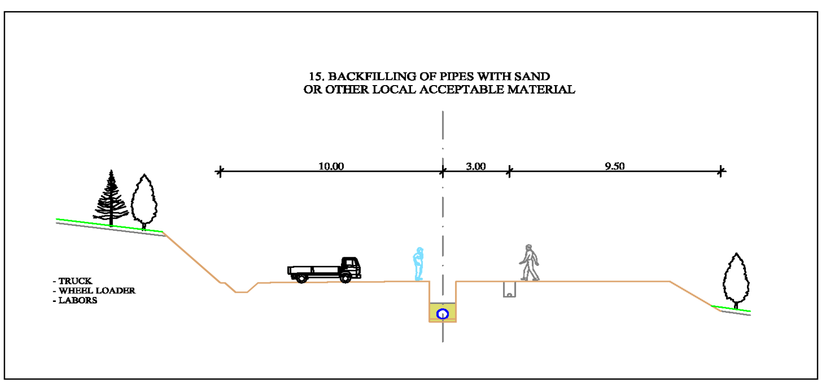
11. AS-BUILT FOOTAGE
X-RAY INSPECTION WELD REPAIR

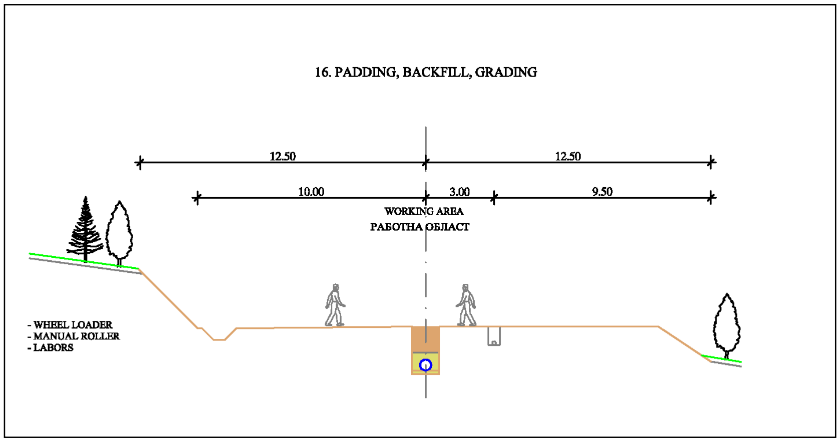


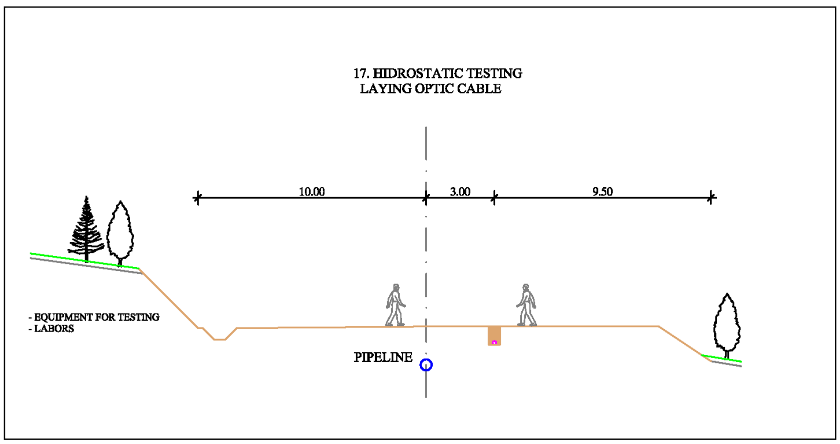

12. PIPELINE COATING
PIPELINE INSPECTION
10.00
3.00
9.50
- EQUIPMENT
- EXPERTS FOR CONTROL

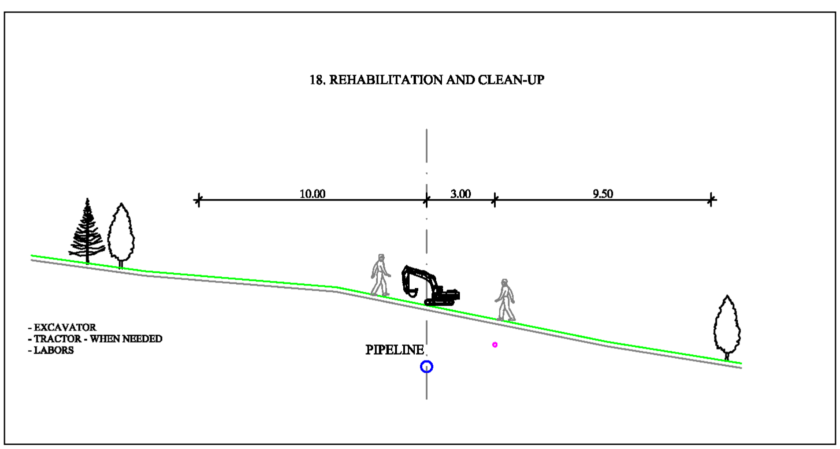

13. LOWERING PIPE INTO TRENCH
12.50
12.50
10.00
3.00
9.50
WORKING AREA
- EQUIPMENT AND TEAM FOR
CONDUCTING PIPES INTO THE TRENCH


14. AS-BUILT SURVEY
10.00
3.00
9.50
- SURVEY TEAM
- INSTRUMENTS
- JEEP


15. BACKFILLING OF PIPES WITH SAND
OR OTHER LOCAL ACCEPTABLE MATERIAL
10.00
3.00
9.50
- TRUCK
- WHEEL LOADER
- LABORS


16. PADDING, BACKFILL, GRADING
12.50
12.50
10.00
3.00
9.50
WORKING AREA
РАБОТНА ОБЛАСТ
- WHEEL LOADER
- MANUAL ROLLER
- LABORS


17. HIDROSTATIC TESTING
LAYING OPTIC CABLE
10.00
3.00
9.50
- EQUIPMENT FOR TESTING
- LABORS
PIPELINE


18. REHABILITATION AND CLEAN-UP
10.00
3.00
9.50
- EXCAVATOR
- TRACTOR - WHEN NEEDED
- LABORS
PIPELINE

APPENDIX 4 - The main intersections of the gas pipeline with watercourses, catchments, roads, railway, oil pipeline and transmission lines

Location (km+m)	Type of infrastructures
km 0+114.46	Irrigation channel
km 0+355.85	Unpaved road
km 0+426.78	Unpaved road
km 0+440.48	Irrigation channel
km 0+801.54	Irrigation channel
km 1+155.26	Canal
km 1+478.65	Unpaved road
km 1+661.87	Canal
km 1+832.44	Unpaved road
km 2+173.42	Unpaved road
km 2+648.56	Unpaved road
km 3+241.89	Unpaved road
km 3+370.57	Unpaved road
km 3+531.70	Unpaved road
km 3+646.49	Unpaved road
km 3+727.47	Earth canal
km 3+844.54	OHL 0.4kV
km 3+848.06	Road Stojakovo - Bogoroditsa
km 3+875.00	Unpaved road
km 4+409.89	Water supply line
km 4+430.95	Unpaved road
km 4+519.64	Unpaved road
km 4+692.03	Water supply
km 4+833.16	OHL 0.4kV
km 5+028.64	Unpaved road
km 5+145.88	OHL 10kV
km 5+169.24	Unpaved road
km 5+273.51	Unpaved road
km 5+589.50	Unpaved road
km 5+692.00	Unpaved road
km 5+828.34	Water supply line Bogdanci

Location (km+m)	Type of infrastructures
km 6+026.92	Unpaved road
km 6+185.62	OHL 110kV
km 6+219.84	OHL 400kV
km 6+298.29	Earth canal
km 6+431.79	Earth canal
km 7+182.04	Foreseen electrical underground cable
km 7+190.44	Regional road Gevgelija - Bogdanci (P1109)
km 8+453.88	River Vardar - start
km 8+560.76	River Vardar - end
km 8+789.00	Unpaved road
km 8+848.42	Unpaved road
km 9+067.27	Unpaved road
km 9+091.85	River Sermeninska - start
km 9+281.15	River Sermeninska - end
km 9+696.00	Unpaved road
km 9+745.78	Unpaved road
km 9+783.90	OHL 110kV
km 10+377.24	Unpaved road
km 10+452.46	OHL 110kV
km 10+786.93	Unpaved road
km 10+922.89	Unpaved road
km 10+929.04	C
km 10+936.07	Unpaved road
km 11+241.47	Unpaved road
km 11+330.09	Sewage line D1500mm
km 11+428.86	Unpaved road
km 12+292.20	Unpaved road
km 12+510.52	Unpaved road
km 12+579.70	Unpaved road
km 12+670.53	Unpaved road
km 12+754.37	Oil pipeline D460mm
km 12+761.99	Unpaved road
km 12+831.37	Railway Skopje - Gevgelija
km 12+844.21	Unpaved road
km 13+531.57	OKL 110kV
km 13+546.99	Unpaved road

Location (km+m)	Type of infrastructures
km 13+549.86	IT infrastructure - cable
km 13+557.30	Highway “Friendship”- start
km 13+584.42	Highway “Friendship”- end
km 13+598.29	IT infrastructure - cable
km 13+604.49	OHL 110kV
km 13+624.36	Highway “Friendship” (ramp)- start
km 13+634.96	Highway “Friendship” (ramp)- end
km 13+654.87	Water supply pipeline D200mm
km 13+729.75	Regional road R103 (Gevgelija – Skopje) - start
km 13+735.79	Regional road R103 (Gevgelija – Skopje) - end
km 13+818.37	Asphalt road to Technological Industrial Development Zone - start
km 13+839.62	Asphalt road to Technological Industrial Development Zone - end
km 13+923.66	Unpaved road
km 13+999.92	Canal
km 14+010.79	Water supply system D140mm
km 14+055.54	Canal
km 14+059.62	Unpaved road
km 14+117.56	Canal
km 14+181.79	OHL 10kV
km 14+198.04	Water supply line D150mm
km 14+202.39	Canal
km 14+223.11	Irrigation system D140mm
km 14+252.44	Unpaved road
km 14+280.87	Irrigation system D140mm
km 14+371.55	Irrigation system D140mm
km 14+603.30	Unpaved road
km 14+619.81	River Kovanska - start
km 14+631.12	River Kovanska - end
km 14+783.24	Unpaved road
km 14+877.20	Unpaved road
km 14+983.46	Unpaved road
km 15+172.98	OHL 10kV
km 15+203.95	Unpaved road
km 15+436.85	Unpaved road
km 15+573.27	Unpaved road
km 15+587.82	OHL 10kV

Location (km+m)	Type of infrastructures
km 15+807.73	Unpaved road
km 17+125.90	Unpaved road
km 17+129.63	Oil pipeline D460mm
km 18+477.90	River Zuica
km 20+375.57	Unpaved road
km 22+801.85	Unpaved road
km 26+030.77	Unpaved road
km 28+608.07	River Petruska
km 28+760.90	Asphalt road
km 28+905.60	River Stara
km 30+000.00	Unpaved road
km 30+200.00	OHL 400 kV
km 33+062.74	Unpaved road
km 33+392.06	Unpaved road
km 35+617.98	Unpaved road
km 35+761.19	Oil pipeline D460mm
km 35+891.21	Unpaved road
km 36+232.09	Unpaved road
km 36+244.80	Oil pipeline D460mm
km 36+770.43	Oil pipeline
km 37+700.00	OHL 400 kV
km 37+896.07	Unpaved road
km 38+751.85	Unpaved road
km 39+607.02	Unpaved road
km 39+784.82	Unpaved road
km 40+349.09	Unpaved road
km 40+407.04	Unpaved road
km 42+356.82	Unpaved road
km 44+675.31	Unpaved road
km 45+200.29	Unpaved road
km 46+402.43	Unpaved road
km 46+751.83	River Maminska
km 47+102.52	Unpaved road
km 47+129.41	Unpaved road
km 47+345.60	Unpaved road
km 46+365.95	River Drenska

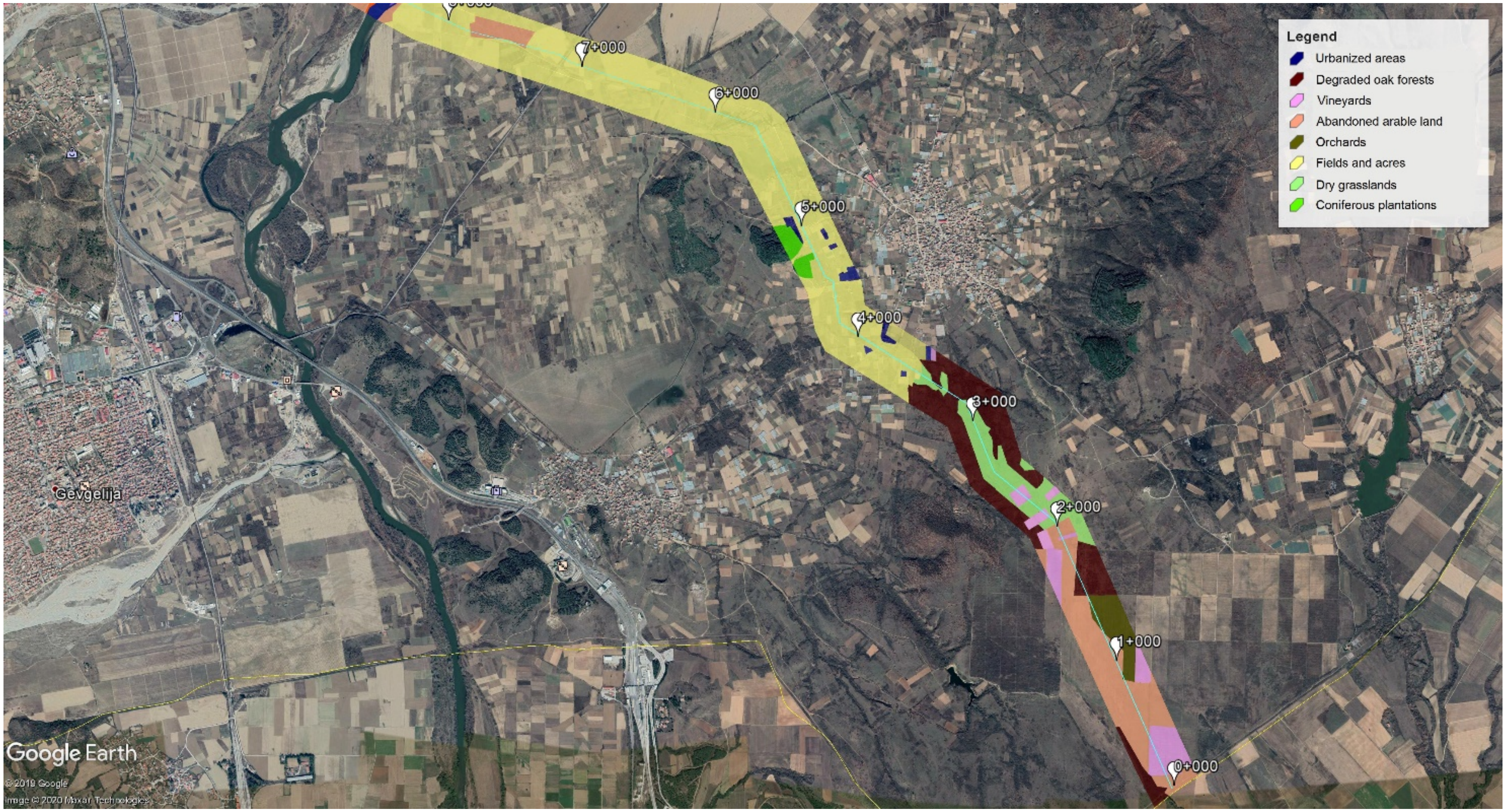
Location (km+m)	Type of infrastructures
km 47+634.29	Unpaved road
km 47+965.00	OHL 400kV
km 48+129.78	Unpaved road
km 48+129.91	IT Cable
km 48+964.06	Unpaved road
km 49+326.03	Unpaved road
km 51+018.11	OHL 35kV
km 51+109.86	Unpaved road
km 51+234.50	Asphalt road (Demir Kapija – v.Chiflik)
km 51+240.86	IT Cable
km 51+279.00	OHL 10kV
km 51+639.16	OHL 10kV
km 51+657.07	Oil pipeline D460mm
km 52+184.59	River Doshnica
km 52+218.13	River Boshava
km 52+290.03	Canal
km 52+293.27	Unpaved road
km 52+307.98	Unpaved road
km 52+309.74	Sewage system D350mm
km 52+387.90	Canal
km 52+530.66	Regional road P109 Demir Kapija -v.Besvica
km 52+539.08	Underground electricity cable 10kV
km 52+614.26	OHL 10kV
km 52+732.59	Unpaved road
km 52+886.38	Earth canal
km 52+896.30	Water supply line D250mm
km 52+901.78	Unpaved road
km 52+903.44	OHL 35kV
km 52+995.77	Unpaved road
km 53+455.22	Unpaved road
km 53+593.62	Unpaved road
km 53+695.68	Unpaved road
km 53+811.53	Unpaved road
km 54+157.44	Unpaved road
km 54+435.99	Unpaved road
km 54+485.90	Unpaved road

Location (km+m)	Type of infrastructures
km 54+528.50	Unpaved road
km 54+834.13	Unpaved road
km 55+285.04	Unpaved road
km 55+297.78	IT cable
km 55+348.84	IT cable
km 55+358.19	Unpaved road
km 55+395.33	Unpaved road
km 55+406.84	IT cable
km 56+391.47	Unpaved road
km 57+100.81	OHL 400kV
km 57+249.05	Unpaved road
km 57+315.52	Unpaved road
km 57+342.62	Canal
km 57+984.01	OHL 10kV
km 58+109.34	Unpaved road
km 58+514.20	Unpaved road
km 58+573.23	Unpaved road
km 58+582.60	River Przdevska
km 58+593.23	Asphalt road v. Przdevo
km 58+596.06	IT cable
km 58+599.37	Water supply line D110mm
km 58+624.00	OHL 10kV
km 58+703.89	Unpaved road
km 58+909.42	Unpaved road
km 59+309.69	Unpaved road
km 59+727.15	Unpaved road
km 60+098.67	Unpaved road
km 60+141.72	Unpaved road
km 60+144.37	Canal
km 60+197.24	River Selo
km 60+252.78	Unpaved road
km 60+480.18	Unpaved road
km 60+640.55	OHL 35kV
km 60+735.77	Unpaved road
km 60+974.15	Unpaved road
km 61+051.10	Unpaved road

Location (km+m)	Type of infrastructures
km 61+166.42	Canal
km 61+235.46	Unpaved road
km 61+303.18	Unpaved road
km 61+471.17	Unpaved road
km 61+672.29	Unpaved road
km 61+705.19	Unpaved road
km 61+776.04	Unpaved road
km 61+789.38	Unpaved road
km 61+934.92	Canal
km 61+938.89	Unpaved road
km 62+530.07	River Gjuleva
km 62+542.61	OHL 35kV
km 62+651.02	Unpaved road
km 62+653.02	IT cable
km 62+762.60	OHL 35kV
km 62+957.74	OHL 110kV
km 63+003.29	Unpaved road
km 63+610.61	River Disanska
km 63+648.15	Unpaved road
km 64+041.53	Unpaved road
km 64+089.29	Unpaved road
km 64+126.65	Unpaved road
km 64+157.16	Irrigation pipeline
km 64+420.49	OHL 400kV
km 64+504.22	OHL 400kV
km 65+861.69	Unpaved road

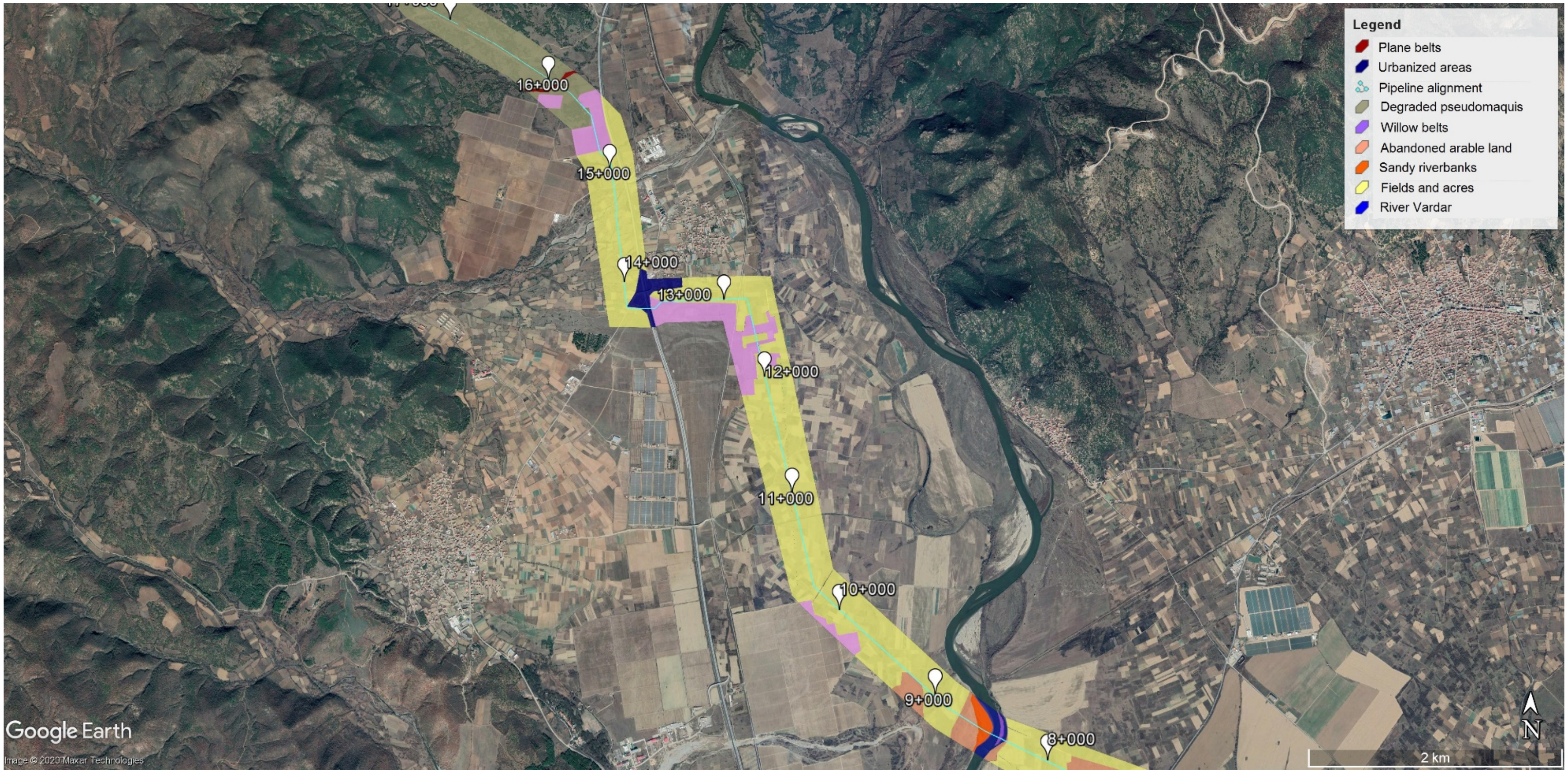
APPENDIX 5 - Photos from measurements on site

APPENDIX 6 - Map of habitats along the route of the pipeline

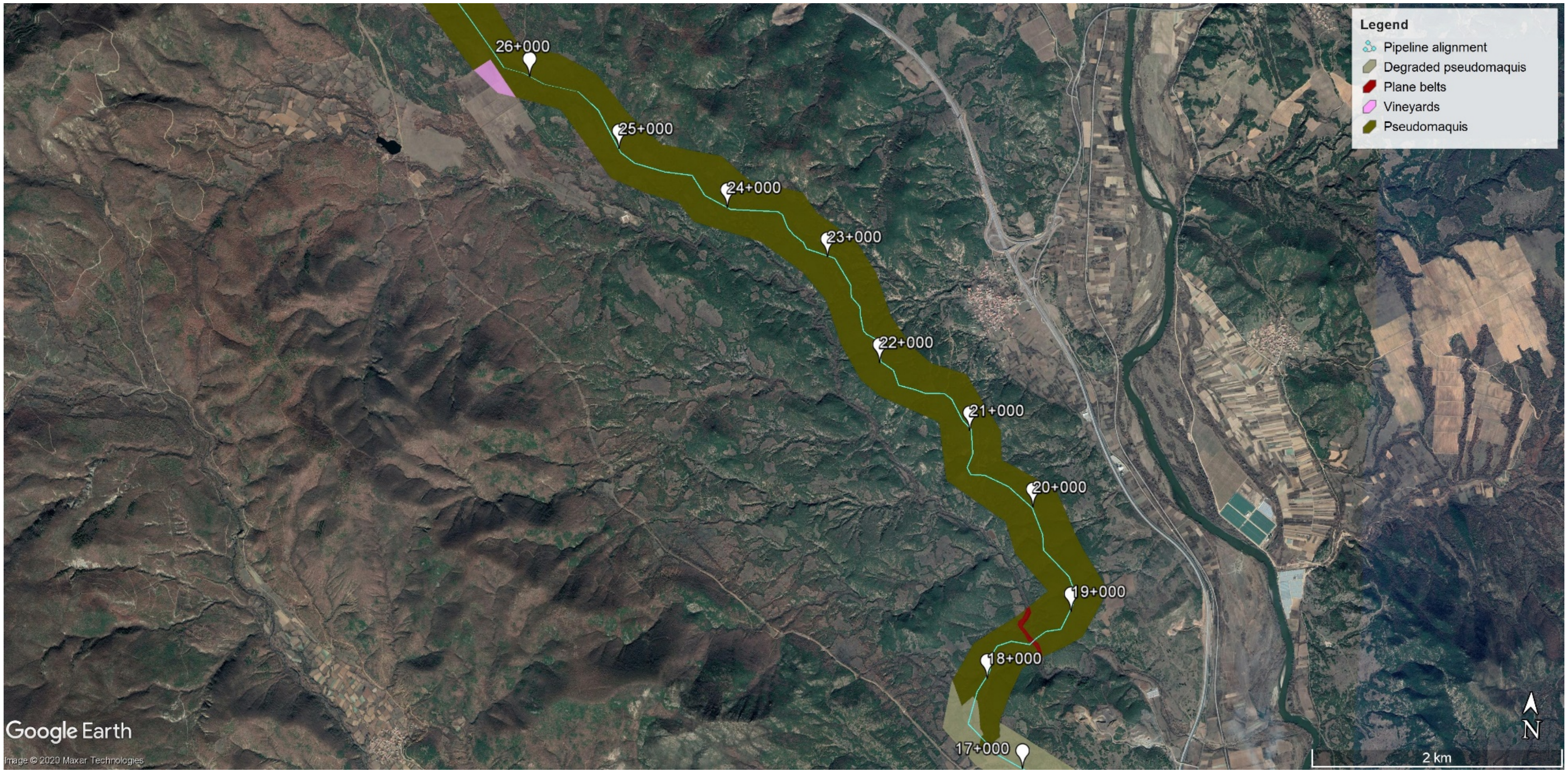


Map of habitats from the pipeline route from 0km to 7km

MOTT MACDONALD CONNECTA CONSORTIUM



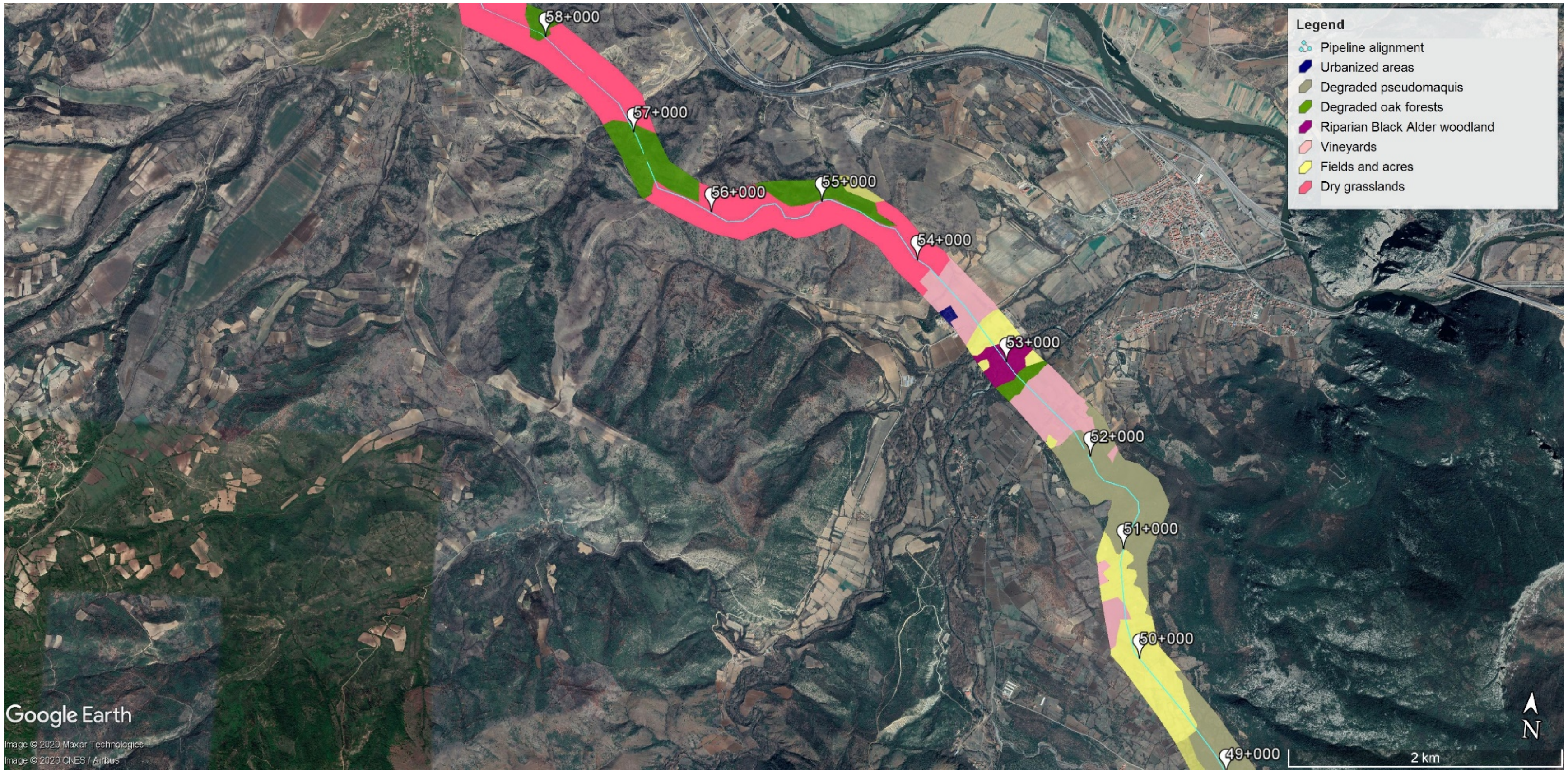
Map of habitats from the 8km to 16km pipeline route



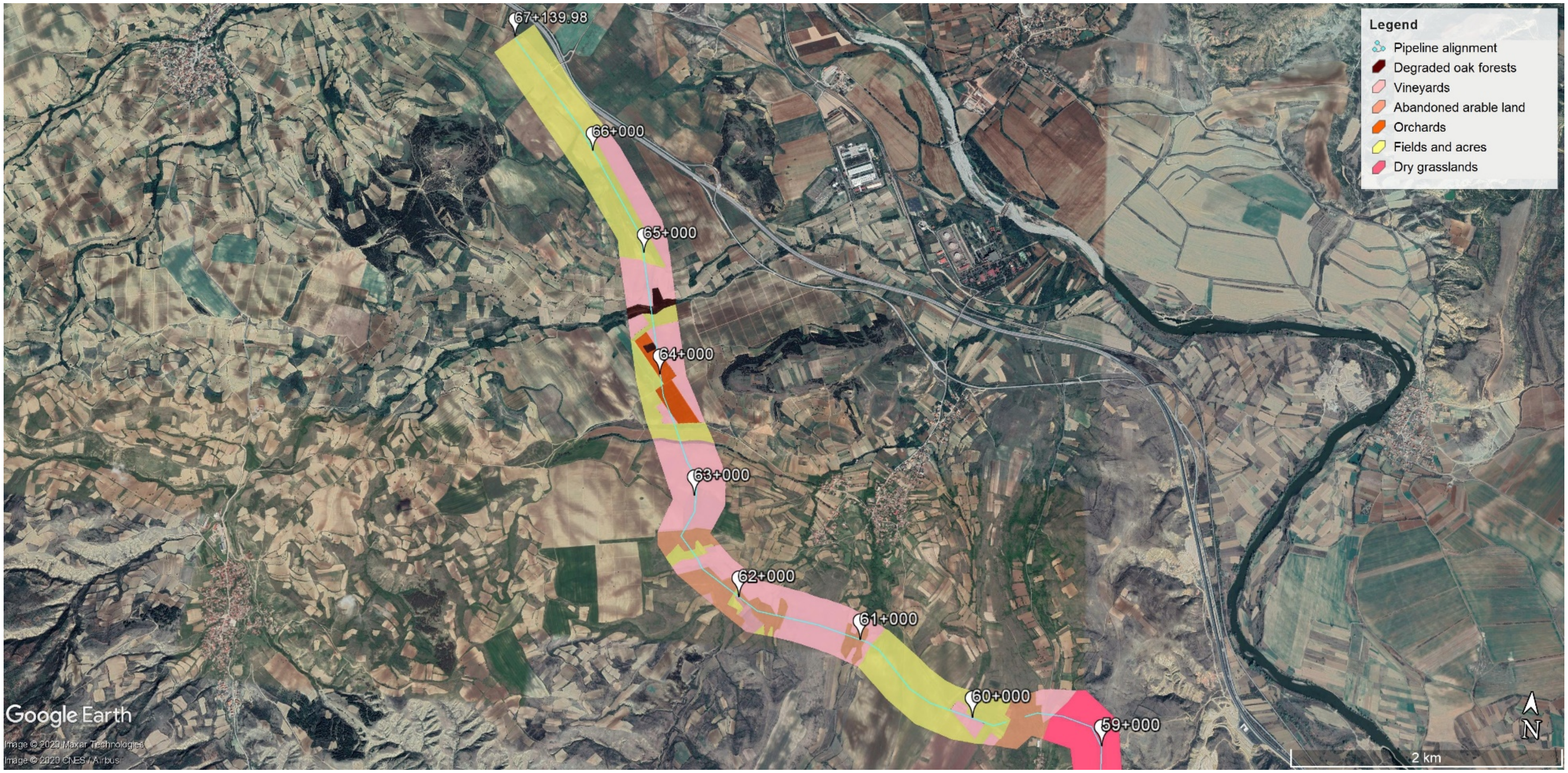
Map of habitats from the 17km to 26km pipeline route

Map of habitats from the pipeline route from 26km to 33km

Map of habitats from the pipeline route from 34km to 49km



Map of habitats from the 49km to 58km pipeline route



Map of habitats from the 58km to 67+139.98km pipeline route