POVVIK AD
CONSULTANTS AND ENGINEERS ON ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

ON THE INVESTMENT PROPOSAL

GAS INTERCONNECTOR GREECE-BULGARIA

Sofia, September 2012

C O N T E N T S

ABBREVIATIONS

AMS	Automated Measuring Station
EASRBD	East Aegean Sea River Basin Directorate
BDS	Bulgarian State Standard
GMS	Gas Metering Station
GRS	Gas Regulation Station
SHC	State Health Control
EU	European Union
PS	Protected NATURA 2000 Site
LSP	Law on Spatial Planning
IP	Investment Proposal
IUCN	International Union for Conservation of Nature
BV	Block Valve
CS	Compressor Station
MH	Ministry of Health
MoEW	Ministry of Environment and Water
IGB	Gas Interconnector Greece-Bulgaria
NCPHA	National Center of Public Health and Analyses
NGTS	National Gas Transmission System
IBA	Environment Impact Assessment
OBM	Important Bird Areas
SWB	Surface Water Bodies
MPC	Maximum Permissible Concentration
CPA	Crop Protection Agents
PS	Pigging Station
RBMP	River Basin Management Plan
RIEW	Regional Inspectorate of Environment and Water
RHI/RIPCPH	Regional Health Inspectorate (former Regional Inspectorate for the Preservation and Control of Public Health)
CV	Cut-off Valve
CPS	Cathodic Protection System
CAW	Construction and Assembly Works
HA	Hourly Average
TPP	Thermal Power Plant
FAO	Food and Agriculture Organization
PM_{10}	Particulate Matter
SPZ	Sanitary Protection Zone

INTRODUCTION

Brief presentation of the Investment Proposal and the need for preparation of an EIA

The need for preparation of an Environment Impact Assessment (EIA) Report occurs as a result of implementation of an Investment Proposal for the construction of the Gas Interconnector Greece-Bulgaria.

The development of an EIA Report on the Investment Proposal for the Gas Interconnector Greece-Bulgaria aims to:

1. identify the impacts that the Investment Proposal may have on the environment, population and human health;
2. analyze, clarify and assess the impact on the components and factors of the environment, population and human health during construction, operation and decommissioning of the project;
3. support the consultation process between the Contracting Entity, competent authorities and public with relation to the implementation of the Investment Proposal;
4. provide the necessary data for taking a decision on the EIA by a competent body.

The EIA was developed in accordance with Chapter VI of the Law on Environmental Protection, Ordinance on conditions and procedures for assessing the environmental impact, Decision No 23-PR/2010 by the Ministry of Environment and Water on evaluation of the need for an EIA, letters of ref. No OVOS 1268 No 48-00-831 dd 27.07.2010 and ref. No 26-00-3031 dd 20.10.2010 by the MoEW, and Guidelines of the MoEW for environment impact assessment of investment proposals.

In 2010 notices were prepared and given (to the MoEW, other interested authorities as the Ministry of Culture, Executive Forest Agency, Ministry of Agriculture and Foods, and the concerned municipalities, communes and city/town councils), and also SoS for an EIA for the Investment Proposal under the name Gas Interconnector Greece - Bulgaria and under the name Construction of Gas Pipeline Komotini (Greece) Dimitrovgrad - Stara Zagora (Bulgaria).

In 2012 the Council of Ministers of the Republic of Bulgaria announced by its Decision No 452 of June 7 that the Gas Interconnector Greece - Bulgaria in the section which will be built on the territory of Bulgaria is a national priority project. Therefore, the name of the Investment Proposal was changed in all reports to read as in the Decision of the Council of Ministers, that is, Gas Interconnector Greece - Bulgaria. And the name of the Investment Proposal in the title of the Supplemented Scope of Services for the EIA, the report on the EIA and in this Non-Technical Summary was changed accordingly.

Details of the Contracting Entity of this project

Contracting Entity of the Investment Proposal:

Contracting Entity: ICGB AD

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Details of the company responsible for the EIA Report:

This EIA report has been developed by POVVIK AD under a contract signed between POVVIK AD and PENSPEN Ltd. in accordance with a contract between ICGB AD and Consortium PENSPEN Ltd and C&M Engineering SA.

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Relation to other existing / planned investment proposals

The Investment Proposal is intended to join the existing transmission networks in Greece and Bulgaria. The purpose of the connection between the Investment Proposal and the National Gas Transmission System (NGTS) is to supply the quantity of natural gas for consumption in Bulgaria.

1 ANNOTATION OF THE INVESTMENT PROPOSAL FOR CONSTRUCTION, ACTIVITIES AND TECHNOLOGIES

1.1 General information about the Investment Proposal and its location

The purpose of the Gas Interconnector Greece - Bulgaria investment proposal is to transfer natural gas from Komotini, Greece to Stara Zagora, Bulgaria and connect the gas transmission systems of the two countries. The prepared FEED proposed a pipeline diameter of 28" (711 mm) to allow the transfer of 3.0 bcm/yr without building a compressor station or 5.0 bcm/yr if a compressor station is built. During elaboration of the design it was decided to increase the diameter to 32" (813 mm) to improve the hydraulic characteristics of the pipeline and to increase its capacity.

The pipeline allows for reverse flow from Bulgaria to Greece to ease out any supply problems in the transit line to Greece and has provisions to connect with new sources should the Nabucco transit pipeline be built.

1.1.1 Physical and geographical characteristics of the area and location

The pipeline route is developed in two alternatives – eastern and western route crossing the land of 3 regions (Kardzhali, Haskovo and Stara Zagora) and 10 municipalities

(Kardzhali, Dzhebel, Kirkovo, Krumovgrad, Momchilgrad, Haskovo, Dimitrovgrad, Stambolovo, Stara Zagora and Opan).

The proposed investment proposal does not fall within protected natural territories, but it falls within some Protected NATURA 2000 Sites (PSs) and it is anticipated that such sites will be directly affected. A detailed description of the nearest protected natural territories and PSs is given in sections 3.6.3 and 3.6.4, and the location of the investment proposal with relation to such areas is shown in *Appendix 2*. Distances of the pipeline from the nearest populated settlements are shown in section 3.8, and a general layout of the pipeline route with nearby populated settlements is shown in *Appendix 1*.

1.1.2 Necessary land and property acquisition

The areas required for construction of an eastern and western route, and the facilities required for their operation are considered in the following sections.

The width of the security and protection zone for both alternatives is designed to be 200 m on both sides of the pipeline in accordance with Article 13.(1) of the *ORDINANCE on the construction and safe operation of gas transmission and distribution pipelines and facilities, installations and instrumentation for natural gas, (Letter of the Council of Ministers No 171 of 16.07.2004, published in the State Gazette, No 67, 02.08.2004).*

Easements for construction, maintenance and repair of the pipeline and its facilities will be provided for both alternatives in accordance with Ordinance No 16 of 09.06.2004 on Easements for power sites (State Gazette, No 88, 08.10.2004). The minimum dimensions of the easement zones are a follows: for mains and transit pipelines, and off-takes of ND <1000 mm – 15 m on each side of the pipeline centre line; compressor stations (CSs), gas regulation stations (GRSs and AGRSs) – area of width 10 m around the external limit of the site; cathodic protection systems – area of width 2 m around the external limit of the site; underwater pipeline crossing of water bodies – area of 15 m on both sides of the pipeline centre line.

1.1.2.1 Necessary land and property acquisition at the western route

The construction zone necessary for completion of the investment proposal at the western route is of width 30 m. Such width will be provided almost along the entire length of the route, with the exception of several areas as agreed with the Contracting Entity:

- forest area near the town of Kirkovo where it is reduced down to 20m,
- northern bank of the Maritsa River (the section where the pipe is buried in trench, but additional second pipe is used), where the construction zone is increased up to 60 m.

Easement zones for maintenance and repair of the pipeline and its facilities during the operation are of width 30 m, that is, 15 m on both sides of the centre line of the pipeline in accordance with Ordinance No 16 almost along the entire length of the pipeline route. Exceptions are made in some small areas as agreed with the Contracting Entity where easement is either decreased or increased as follows:

- in the area of the town of Kirkovo easement is reduced to 20m, as the route passes through an old forest with valuable plant and animal species requiring reduction of the easement zone for their conservation.
- in the area around the Maritsa River – from the northern Block Valve BV4A/PS6 up to the southern BV4A/PS5, where in the segment above the Horizontal Directional Drilling (HDD) for the river crossing, the easement is increased up to 90 m, and in the segment where the open cut method is used, but additional second pipe is used, the easement is increased up to 60 m.

To complete construction works given that the length of the western route on Bulgarian territory is 150.57 km, 476.36 ha are required, of which 405.73 ha are farm land

and 51.79 ha are forest land. The area of 10.14 ha required for the construction of 13 permanent sites and their service roads, which will accommodate the above ground installations along the pipeline route such as linear Block Valves, Gas Regulation Stations, Pigging Stations, Gas Metering Stations, etc. will be purchased, while the remaining area will be hired and rental paid. Types of facilities and sizes of sites are as follows:

- 5 sites with BVs, each of area 676 m^2;
- sites with BVs and PSs, each of area 1296 m^2;
- 1 site with gas off-take and AGRS, of area 5751m^2;
- 1 site with BV, AGRS and gas off-take, of area 3111m^2;
- 1 site GMS2/PS2, of area 9025 m^2;
- 1 Dispatching Centre and Operations and Maintenance Base- Operations and Maintenance Centre of the pipeline of area 9540 m^2- both for the Western and Eastern Route;
- depot – intended for storage of pipes and construction materials during construction works and for future process equipment, required spate pipes, etc. during operation, of area 50 000 m^2.

1.1.2.2 Necessary land and property acquisition at the Eastern Route

The construction zone necessary for completion of the investment proposal is of width 30m. Easement zones for maintenance and repair of the pipeline and its facilities during the operation are of width 30m.

To complete construction works given that the length of the Eastern Route on Bulgarian territory is 145.67 km, 455.76 ha are required, of which 331.6 ha are farm land, and 114.44 ha are forest land. The area of 10.15 ha required for the construction of 13 permanent sites and their service roads, which will accommodate the above ground installations along the pipeline route such as linear Block Valves, Gas Regulation Stations, Pigging Stations, etc. will be purchased, while the remaining area will be hired and rental paid. Types of facilities and sizes of sites are as follows:

- 4 sites with BVs, each of area 676 m^2;
- 4 sites with BVs, each of area 1296 m^2;
- 1 site with gas off-take and AGRS, of area 5751 m^2;
- 1 site with AGRS and BV, of area 3111 m^2;
- 1 site GMS2/PS2, of area 9025 m^2;
- 1 Dispatch Centre and Operations and Maintenance Base- Operations and Maintenance Centre of the pipeline of area 9540 m^2- both for the Western and Eastern Route;
- depot – intended for storage of pipes and construction materials during construction works and for future process equipment, required spate pipes, etc. during operation, of area 50 000 m^2.

1.1.3 Physical and legal persons affected by the implementation of the investment proposal

Populated areas located nearby are affected by the investment proposal. A layout which shows the location of the proposed investment proposal and populates settlements in the region is given in *Appendix 1*. All populated settlements and distances from the pipeline to them for the Western Route are shown in Table 4.3.3-1 of section 4.3.3, and for the Eastern Route in Table 4.3.3-2.

1.2 CHARACTERISTIC OF THE INVESTMENT PROPOSAL

1.2.1 Detailed description of the Western Route of the pipeline

A description of the Western Route from Makaza Pass at the Greek border up to the interface point with the existing pipeline near Stara Zagora is provided below.

The border between Greek and Bulgaria follows a high mountain ridge of the Rhodopes. The selected point where the pipeline will cross the border is 905 m above sea level and is located 1.6 km east of the border checkpoint on the international road which is still under construction, 80 m southwest of the border boundary stone marked “E37” and is with coordinates: 41° 16' 33.87"N, 25° 26' 5.21"E. The point of crossing the Bulgarian-Greek border is shown in Fig. 1.2.1-1. The green marker indicates the interface point of the Greek and Bulgarian section of the pipeline. The pipeline on Greek territory is indicated by the light blue line. The Western Route on Bulgarian territory is indicated by the light green line, the Eastern Route by the dark blue line. The orange line indicates the new international road, the yellow line the border, and the red marker border boundary stone E37.

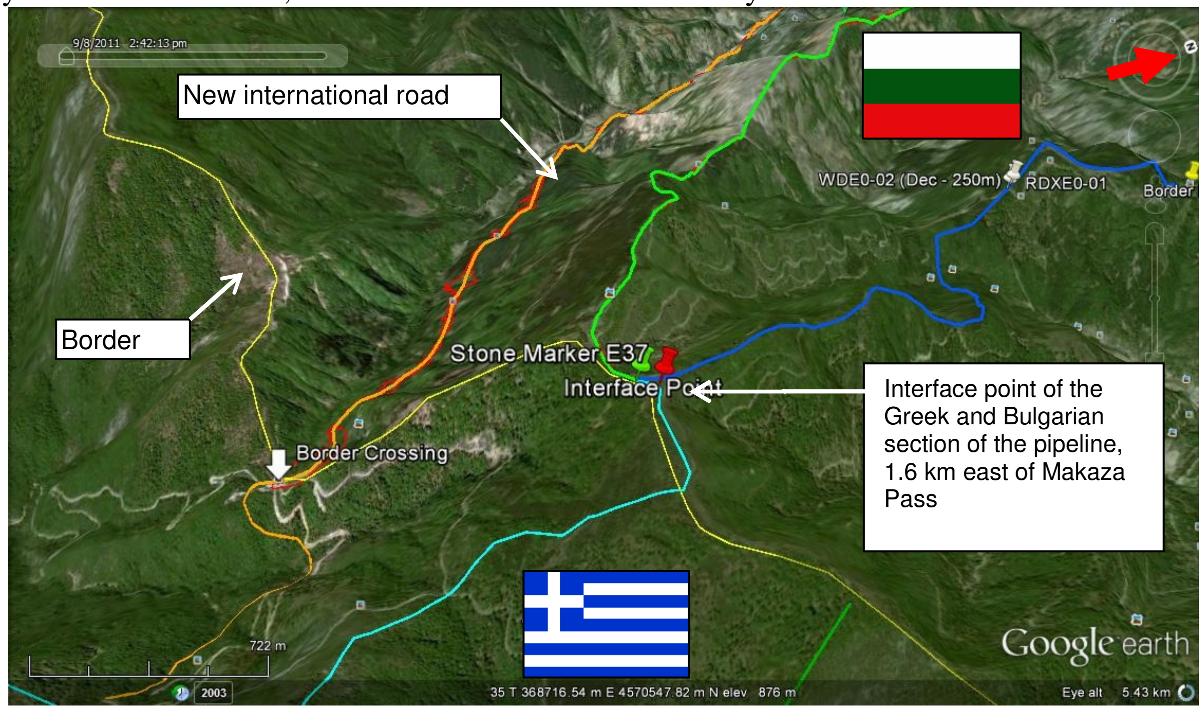


Fig. 1.2.1-1 – Point of Bulgarian-Greek border crossing

The pipeline will be divided into technological sections of lengths up to 30 km by means of Block Valve Stations (BVSs) and other stations which will constructed above ground. The first Block Valve (BV1) is on Greek territory. The sections on Bulgarian territory at the Western Route divided by Block Valves are listed and described below:

1.2.1.1 From the Border to BV2 Velikdenche - Km 0+00 to Km 25+400

The crossing point of the Greek-Bulgarian border is located about 80 m southwest of border boundary stone E37 from where the pipeline follows the same ridge for another 400 m along a forest road and turns northwest over another ridge, and crosses a pine forest and a path. Then it descends from 905 m altitude to 686 m altitude in the first 3 km.

Then the pipeline route goes through a rocky crest and passes 340 m east of the village of Lozengradtsi which is located on a hill with roads which are much rough for light motor vehicles and totally impassable for construction machinery. This area of the route passes through the territory of habitats falling within Natura 2000 BG0001032 Eastern Rhodopes, passing through an area of this PS of length about 6 km.

At Km 6+100 the route descends and elevation 368 m crosses the new international border road (international designation E85, Bulgarian - I-5). This is a 2-lane highway in each directions of length 20 km from Pod ova to the Greek border. It forms part of the European Transport Corridor No 9 from Helsinki in Finland to Alexandroupolis on the Greek Aegean coastline. The road will be crossed by auger boring so that road pavement will not be disturbed. There is a shallow meandering road in the same area which will be crossed by the open cut method.

The route further runs through a narrow strip of farm land locked by hills on the west and wide gravel meanders of the Lozengradska River and the new international road on the east. This fertile land is cultivated to grow tobacco, tomatoes, peppers and cabbage. This is the typical land use for the river valley up to the town of Kirkovo at Km 9+200. Near the town the route passes around a hill rising at 402 m, surrounded by two tributaries of the river. The route will go round a small cemetery and bee hives at the hill. In the forest covering the hill wild orchids, colony of tortoises and a nest of bee-eaters have been found. The route of the pipeline is now relocated to the top of the east side of the hill and the width of the construction zone reduced down to 20 m to avoid these habitats and minimize the impact on them during the works.

Construction works for the pipeline in this area will take about 6 weeks and the timing will take into consideration the bea-eater nesting season, breeding season of the tortoises and other animal species found there as necessary.

There is a level fertile land area beyond the hill and river which is crossed by a potentially active fault at Km 9+750. Typically, the pipeline will cross the fault at right angle and laid in a wider trench filled with material that is able to absorb any eventual tremors and displacement. The pipes for this area will be of walls of much higher thickness than normal.

At Km 10+000 the route will again cross under the new border road, avoiding a water reservoir in the northern part of Kirkovo. Then the route runs through grass lowland and arable land, bounded by forest hills to the east and another water reservoir to the west. The terrain here gradually descends to the river which in summer becomes merely a gravel river bed. At Km 14+400 the route crosses the new road to Makaza Pass for the third time and heads to the river for crossing it at a suitable place. The route will further run to the west to cross, while the new road turns east to cross the river by the newly-built reinforced concrete bridge and continues until joining the existing road at the village of Podkova. The existing railway to the village of Podkova and station facilities can be used for delivery and storage of the gas pipes.

At Km 17+300 the route crosses the Vibrissa River, runs further to the northwest and passes 300 m west of the village of Varben, then rises to hilly scrubland and passes near the villages of Karchovsko and Bregovo, avoiding a woodland area to the east. At Km 22+600 the route crosses another tributary of the Vibrissa River before reaching a crossroad 450 m west of the village of Velikdenche where the BV2 Velikdenche will be located at Km 25+000. More information about this Type 1 facility is provided in section 1.2.3.1.

1.2.1.2 BV2 Velikdenche to BV3 Kardzhali – Km 25+400 to Km 50+000

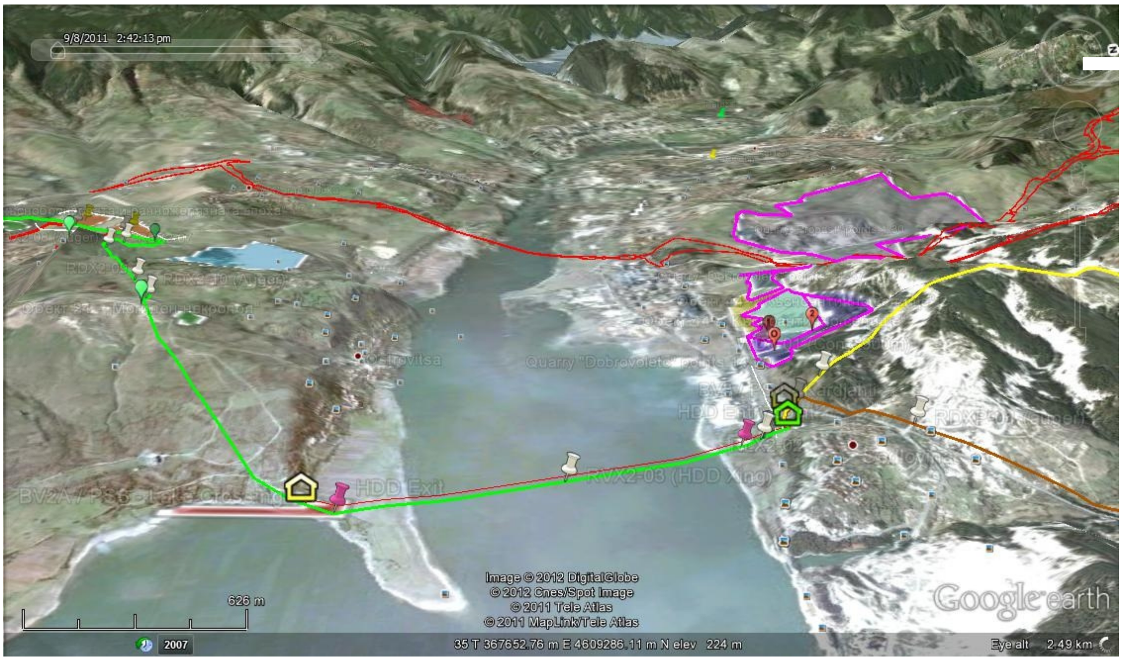
From BV2 the route passes to the east of the village of Rogozari and another three hamlets, two shallow ravines and then ascends to a plateau at elevation 275 m before descending to the dry gravel bed of another tributary and running through a fertile strip of river-side land with poplar tree plantation at the west bank. The pipeline crosses the new road at two points – once at Km 27+900 and again at Km 28+900. The new road is yet under construction in the valley that is occupied by small plots of arable land used mostly for growing of peppers, tomatoes and cabbage. The route reaches one of the few metalled roads in the area near and west of the village of Slanchogled and 105 km east of the village of Zagorsko.

From here all the way to Kardzhali the terrain is less than 400 m above sea level and route crosses a landscape of derelict farms and poor productive stony soil covered with shrubs and unmanaged woodland.

At the town of Momchilgrad the pipeline route is relocated and passes through woodland at 310 m west of the village of Sedlari instead of theVarbitsa River Valley. (This change has occurred after consultation with the local municipality and is consistent with the started construction of the new road, closeness to several archeological sites and a colony of ground squirrels which are a protected species). The route crosses a ravine and runs through woodland area, then descends and passes through another river valley occupied by large orchards and lawns, and then passes 700 m to the west of the village of Varhari. At km 37+800 the route crosses the Chitak Dere River and then the main road to the town of Dzhebel at Km 38+200.

On the northern side of the road the route rises at a hill, runs through a hilly terrain occupied by forest crops and pastures, passes 250 m to the west of the village of Balabanovo and then descends to open terrains and crosses a 2-lane main road and a single railway line at the village of Gluhar located south of Kardzhali. The route runs further through pastures and passes to the south of the village of Gluhar and to the north of the railway line and the village of Gorna Gledka. Most of the slope is occupied by a large landfill located on rocky terrain.

Then the route runs over a narrow strip of shrubs along a metalled road, passes 350 m to the west of the village of Ostrovitsa and reaches the southern shore of Studen Kladenets Reservoir at Kardzhali. The reservoir falls within BG 000213 Studen Kladenets Protected Site under the Birds Directive and Natura 2000 BG0001032 Eastern Rhodopes Protected Site under the Habitats Directive, and the route crosses Studen Kladenets PS and passes along the limits of Eastern Rhodopes PS. Therefore, the timing of the reservoir crossing will take into consideration the nesting season of the birds inhabiting the area adjacent to the water body, as well as the breeding season of other animal species found in the area as may be required for their protection.



Fig, 1.2.1.2-1 – Crossing of Studen Kladenets Reservoir at Kardzhali (of length 1 500 m) indicated by the green line across the reservoir

Crossing of the reservoir at Kardzhali, shown in Fig. 1.2.1.2-1, is very challenging and can be done in two ways – by digging a trench (open cut method) or by the Horizontal Directional Drilling method (HDD).

- Crossing by the open cut method will be relatively easy to complete as the water level in the reservoir is maintained artificially low by sluice gate controlling. It is proposed to weld the pipes at the south shore and then transport them across the reservoir by winch and place them in trench at the bottom of the reservoir. There is not enough space on the southern shore to weld the full pipe length and therefore pipes will be welded in sections of 3 pipes at the shore. It will be best to apply this method of crossing at the height of summer when the water level will be low and wider dry construction strip can be provided by additional control action. Since the reservoir is not suitable for navigation, this method for construction of the pipeline is considered to be the cheapest, but not the best in terms of environmental considerations because of the violation of the shores and bottom during works for laying of the pipes. The crossing of the reservoir by the pipeline can be completed for about 21 weeks.
- Two temporary sites will be constructed for the Horizontal Directional Drilling (HDD) – a site of area 40x60m (0.24ha) with an entry point for the HDD on the northern shore and a site of area 40x40m (0.16ha) with an entry point for the HDD on the southern shore. This method of crossing the reservoir will require the drilling of three bore paths – one for the main pipe, one for the bypass pipeline (at minimum spacing of 30m) and another for the fibre optic cables. This method is much more expensive than the open cut method, but much more environmentally friendly because the pipeline will run under the reservoir, will not affect aquatic life and in fact the bottom and shores will remain unaffected by construction works. The pipeline run beneath the reservoir will be of length 1500 m and will take about 32 week to complete, and the timing of the construction works will take into consideration the nesting season of the birds inhabiting the area adjacent to the water body, as well as the breeding season of other animal species found in the area as may be required for their protection. As the bypass pipeline will need to be tested periodically, it will be also necessary to install pigging stations on both shores of the reservoir. This requires the construction of BV2A on the southern shore of the reservoir located at the border line of the protected site. An old bentonite factory is located along the main road and railway line on the northern shores of the reservoir. A HDD entry point is proposed to be located on a temporary site at Km 49+800 on the northern shore which lies more than 60 m from the railway on a level piece of neglected land. From here three bore paths will be drilled under the railway and the road to accommodate respectively the main pipe, bypass and fibre optic cable to reach the proposed site for construction of BV3. This above ground installation will consist of a block valve, pigging facility for the bypass pipeline and offtake to supply gas to Kardzhali and the surrounding area.

According to information from the MoEW, construction projects within the vicinity of the reservoir should be located at an elevation higher than the highest water level which is about 227.4 m above sea level.

1.2.1.3 BV3 Kardzhali to BV3A Mandra (Km 50+00 to Km 79+00)

This section of the route runs mostly through difficult mountain terrains until reaching Mandra where the terrain levels out. The first part of the area comprises typically of pink and green tinted soft white limestones.

From BV3 the route crosses a road and rises up a pine forest hillside. The southern area of a protected site (500 m) is crossed at that point and then the route runs for 2 km along the boundary of the protected site. The route runs along the top of a hill 200 m from the village of Panchevo and near several small fenced enclosures as the ravine to the east does not allow for any alternative route. For the passing around the hill-top village of Zvezden several alternatives have been considered to avoid the extreme slopes and particularly the severe slope immediately next to several houses as shown in Fig. 1.2.1.3-1.

It is proposed that the route will run around the village from its southern and eastern side. This will make the route longer, but the construction of the pipeline would be safer and the impact on the environment and population of the village of Zvezden reduced.

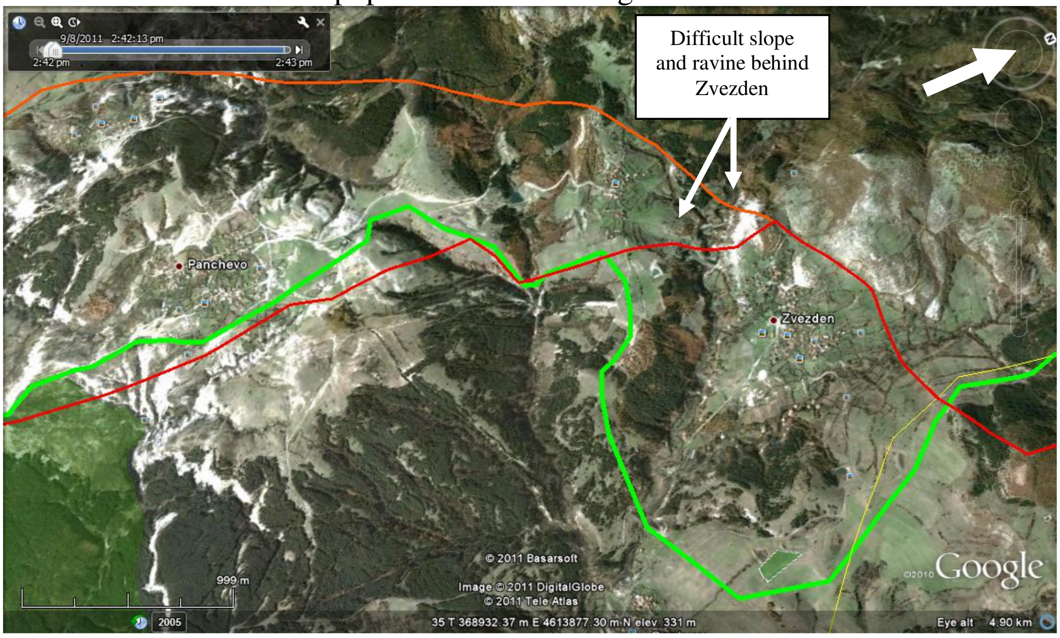


Fig. 1.2.1.3-1 – Routing around the village of Zvezden – selected alternative shown in green

The pipeline route rises up to elevation 513m, runs through pastures and at Km 60+000 passes west of a large mature peach orchard, and then one another orchard of newly planted trees at Km 60+400. Then the route runs in a narrow strip bounded by a reservoir at 300 m to the west, deep gullies to the east, Perperikon 1.5 km to the east, and also by the village of Bolyartsi. North of the reservoir the route crosses a gully and then runs through an open terrain surrounded by hills to the west and east, and at Km 65+000 reaches a road east of the village of Stremtsi, recently rehabilitated funded by European Union money.

Fig. 1.2.1.3-2– Perperikon world heritage site

400 m further on the route crosses the Perperek River. This section runs parallel along the west side of the road making a slight detour to avoid a colony of ground squirrels and

reaches a peak overlooking the village of Beli Plast at elevation 491 m. This is where the route enters its last mountain range which is a particularly difficult area starting from a road junction that splits the village in two at Km 70+000.

Then, 200 m further on, there are two alternatives through this mountainous area. To the left is a cemetery and a narrow strip of land between a stream and woodland, but this route (shown by brown line below) requires ascending a steep hill that rises 90 m over a short distance. The other alternative is to turn right before the cemetery (yellow line) in the field and through the forest along the road. The yellow line is the preferred alternative as the environmental impact is less and construction will be easier.

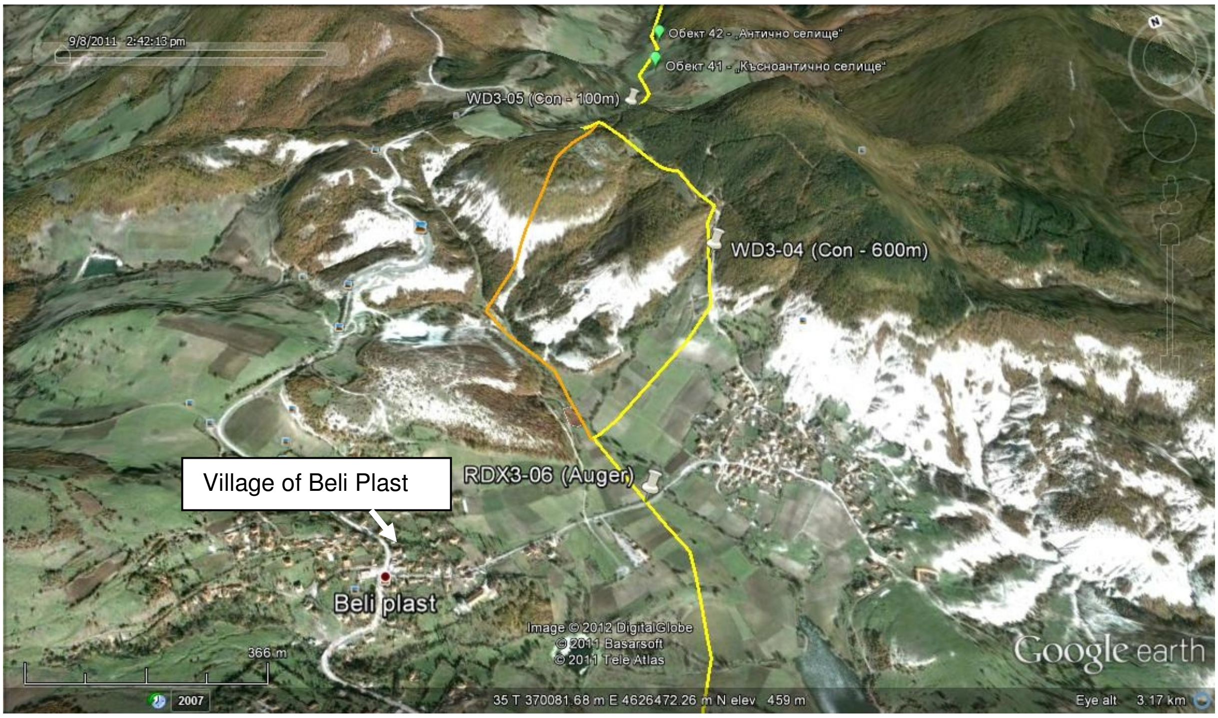


Fig. 1.2.1.3-3 – The preferred route near the village of Beli Plast is shown in yellow. The discarded alternative is in brown

At Km 75+600 the route runs into open arable land, 900 m west of the village of Golemantsi at elevation 344 m. The route then reaches a large forest at Km 76+700 (elevation 315 m), but there a "weak" spot comprising of young fir trees has been specifically selected for the crossing to minimize the impact by avoiding the more mature deciduous and pine trees forming the greater part of this woodland. Beyond the forest the route gradually descends to BV3A which will be located 220 south of the village of Mandra beside a metalled road.

1.2.1.4 BV3A Mandra to BV4 Haskovo – Km 79+00 to Km 96+500

From BV3Athe Western route is free of the mountainous terrain and opens out into a region of intensive arable fields and some small holdings. The route skirts to the south of the village of Mandra and heads to Orlovo. It crosses another metalled road and enters the outskirts of a woodland that hides an abandoned military installation. Then the route crosses a road and woodland close to a barn and some derelict buildings. This route has been selected to minimize its impact on the bulk of the mature woodland and two narrow strips of Natura 2000 (BG0001034 Ostar Kamak PS under the Habitats Directive) at Km 84+500 and Km 85+200, and also to run around the village of Voyvodovo further to the west.

The route then runs through large agricultural fields interspersed with small holdings with vegetables crops, tobacco and vineyards. There are a number of karst springs here and it is important that the route does not interfere with these delicately balanced subterranean water courses.

Then the route will cross the road to the village of Manastir and this will be most likely by horizontal drilling at Km 87+700. From here the route passes through large agricultural fields and at Km 90 +500 turns west to avoid several new peach orchards, which are still in the process of development. A depot (for pipes, etc.) of area of about 5 ha is proposed to be constructed south of Haskovo at Km 92 +300.

Then at Km 94+700 the route crosses a railway that runs a passenger train with two carriages once a day and occasionally some freight trains down to Kardzhali.

The route then runs to the east of Haskovo and at Km 96+500 reaches the preferred location for BV4. At 1500 m west of BV4 is located the proposed site for construction of the IGB Operation and Maintenance Centre (O&M Centre), considered by the designers as the most appropriate because it is near Haskovo, located near a roundabout and main roads of Haskovo, and it is almost in the middle of the pipeline route, and the road network is in comparatively good condition.

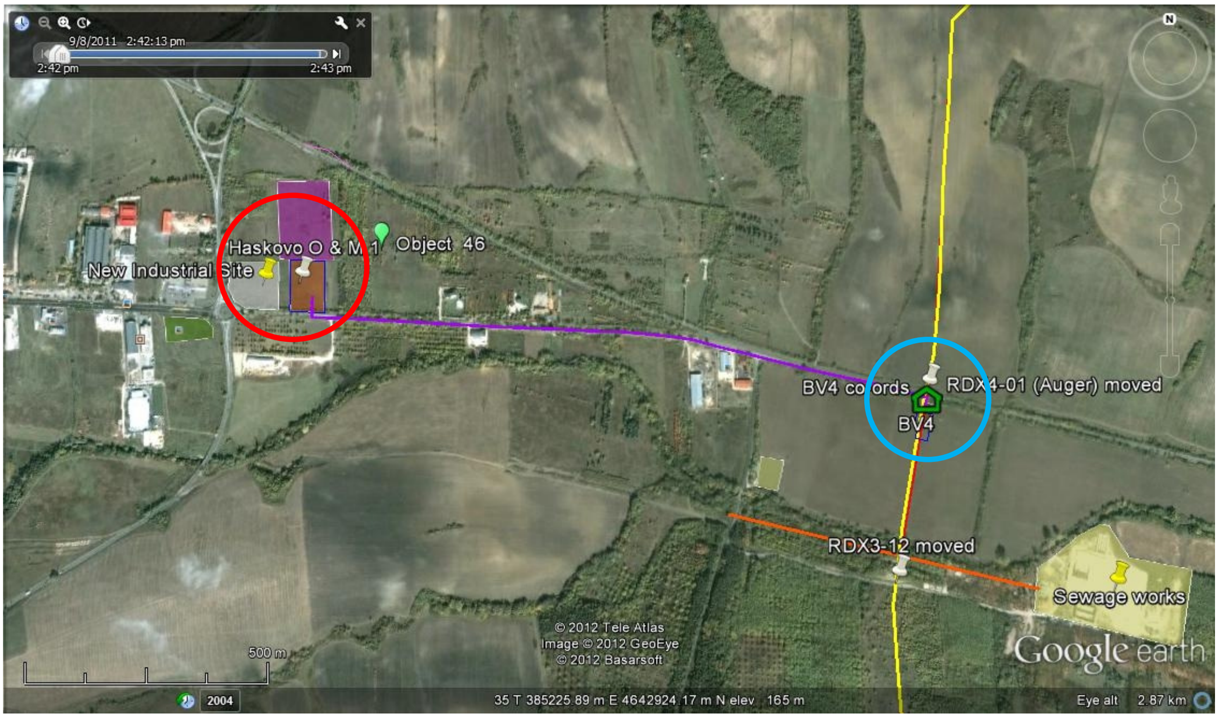


Fig. 1.2.1.4-1 – The route to BV4 is shown in yellow. The proposed location of the O&M Centre is by a red circle, and this of BV4 with a blue circle. Location of the fibre optic cable sending signals between the pipeline and the O&M Centre is shown by a purple line.

1.2.1.5 BV4 Haskovo to Dimitrovgrad station – Km 96+500 to Km 116+900

Upon leaving BV4 the route crosses a main road and heads off in northeast direction across arable land to reach woodland at Km 97+700. At Km 98+600 the route crosses another road, passes through shrubs and open farmland. At Km 100+300 near a turn of the railway and the village of Uzundzhovo the Western Route and Eastern Route converge. Then after 350 m the route is close to the Himmash gas pipeline and both run parallel up to Dimitrovgrad. At Km 105+100 the route runs under the Himmash pipeline for the first time just before reaching the proposed route for the highway extension from Chirpan to Svilengrad at Km 105+600, 800 m west of the village of Voden. At Km 107+100 the route again crosses the Himmash pipeline to avoid another gas pipeline (owned by Citygas), which also connects

Dimitrovgrad and Haskovo. Then the route runs parallel to the Himmash pipeline around the western and northern side of the village of Chernogorovo, crossing the main road to Dimitrovgrad at Km 109+400 and runs parallel to the Himmash pipeline and power line in the field and reaches an existing railway crossing at Km 110+400.

The pipeline is to cross the proposed line of a high speed railway network extension into Turkey that is expected to be built in the coming years. The crossing point is in the eastern end of the industrial zone of Dimitrovgrad, with chemical works, treatment plants and a power plant as shown below in Fig.1.2.1.5-1. The next major obstacle to the route is the Maritsa River of 100 m width, flanked by dense woodland on the south side and willows on the north side. A tributary flows in near the crossing point, and there is a sandy isle in the middle of the river.

Fig. 1.2.1.5-1 – River Maritsa pipeline crossing at Dimitrovgrad shown by a thick green line, bypass pipeline by a thin blue line, and the fibre optic cable by thin purple line. The thick red line in the left is the proposed high speed railway. The blue and brown lines are the Citygas and Himmash pipelines, and the "house" symbols show the two BVs either side of the river (BV4A and BV4B).

The Maritsa River is a Natura 2000 PS under the Habitats Directive 92/43/EEC and it is proposed that the pipeline will cross the river by HDD method to have minimal impact on the environment. Legal provisions require installation of block valves on both sides of the river, a bypass pipeline at 30 m from the main pipeline, fibre optic cable also placed at 30 m distance, and also pigging station for servicing of the pipeline. Both block valves will be located outside the PS (Protected Site), and the Southern Block Valve BV4A/PS5 will be located 60 m from the PS, south of a dual power transmission line and in front of a dyke that protects the field against flooding from the south, while the Northern Block Valve BV4B/PS6 will be constructed on the northern side of the river along a dirt road at Km 112+00. The distance between the two block valves is 830 m and it is proposed to divide it in two parts: the one part will be the crossing of the river by the HDD method at a run of 520 m, for the other part the open cut method at a run of 310 m will be used as described below:

- In the crossing of the river by the HDD method covering a run of 520 m, the pipeline will be installed about 15-20 m under the river bottom. The HDD entry will be on a site of area 40x60m (0.24ha) which falls within a PS, while the exit will be on a site of area 40x40m on the southern shore next to BV4A/PS5 and outside the limits of the PS.

Because of the underground installation at such great depth, there will be no construction zone and only right of way provided for the operation which will be 90 m (as in addition to the main pipeline a bypass pipeline will be installed 30 m from it, and an fibre optic cable at another 30 m for safety). Provision of such right of way of 90 m is included in the design in coordination with the Contracting Entity, but no riparian forests (92A0) on the southern shore will be cut down.

- The pipeline after the HDD entry will be installed by the open cut method for a run of about 310 m through a PS (protected site) up to BV4B/PS6. The same trench will be used to install the bypass pipeline at a distance of 30 m from the main pipeline, however, the fibre optic cable will be between the two pipelines and therefore the construction zone and the right of way will be of width 60 m.

The expected impact on the PS will not be considerable as the following actions will be taken:

- The HDD entry is located 75 m east of a colony of ground squirrels, passes about 15 m below it, and therefore no direct impact on it is expected. Timing of the river crossing will take into consideration the breeding season of the ground squirrels, as well as the nesting season of the birds and breeding season of other animal species found in the area as may be required for their protection.
- The riparian forests (92A0) located near BV4A/PS5 and falling within the limits of a PS, are of high conservation value, and also are not expected to be affected as the HDD path for the pipeline will be drilled about 15 m under the terrain. It is proposed to provide a right of way of with 90 for the operation period (to protect the pipeline route from other investment proposals), however, without cutting down riparian forests (92A0) which will remain unaffected as their root system cannot reach and damage the pipeline.
- The plant species found along the route after the HDD entry where the open cut method will be used and the construction zone of 60 m are not of high conservation value.

The EIA Report gives a detailed assessment of the impact from running through PSs.

From BV4B/PS6 the route heads for the northeast corner of a large woodland where there is a large number of beehives, crosses the road to the village of Brod at Km 112+500, then passes through a belt of shrubs and reaches a large track of arable land at Km 113+200, followed by an active fault in the area at Km 114+200. Then the routes descends smoothly over a small slope across arable land and runs under the existing BEH (Bulgartransgaz) pipeline at Km 116+500 (elevation 114 m) and remains on the west side of a meandering stream (Golyamata Reka), while the existing pipeline crosses it. The proposed site for BV5 Dimitrovgrad is 400 m further to the north, located near a road and overhead power line. A gas offtake will be installed from this site running 416 m back to and joining the BEH pipeline. It should be noted that preliminary indications suggest there is an active fault between the proposed BV5 and the BEH pipeline.

1.2.1.6 BV5 Dimitrovgrad to BV6 Trakia – Km 116+900 to Km 129+400

After crossing the road to the village of Golyamo Asenovo at Km 117+100 the pipeline reaches the existing BEH pipeline and runs parallel to it almost all the way to Stara Zagora. On the way to the north the route passes 900 m west of the village of Golyamo Asenovo, 320 m west of a reservoir and 1.3 km east of a protected site.

The route passes within 1.3 km of the village of Byal Izvor at Km 124+300 through a landscape occupied by vast agricultural fields, with several stream running across the terrain. At a woodland at Km 128+100 the route diverts away from the existing pipeline to run along a 20 m wide open track through the wood before reaching the proposed location of BV6 on the north side of the road from Trakia to Opan 1 km east of the village of Trakia which lies on the main road Stara Zagora - Haskovo.

1.2.1.7 BV6 Trakia to PS2 Stara Zagora – Km 129+400 to Km 150+200

A few hundred meters after BV6 the route skirts a small wetland and archaeological site, and reaches again the existing pipeline, and briefly runs parallel to it, but diverges upon crossing a road at Km 132+200. An active fault has been found in the fields on the north side of the road at Km 132+800 and at that point the route once again runs parallel to the BEH pipeline as far as the village of Yastrebovo, 250 m east of the village of Petrovo, 1200 m east of the village of Pamukchii and 600 m west of the village of Badeshte. Then the route skirts a large wood, crosses a road at Km 142+200, passes near a water tower located 180 mm to the west, and runs through a field with water supply lines and skirts an archaeological site. Then the route runs under the existing pipeline, crosses a Protected NATURA 2000 Site at the river bed of the Sazliyka River at Km 143+000 before reaching again the main road to Stara Zagora at Km 144+100.

From there the route deviates from the existing pipeline because of the new highway under construction, as well as a military facility and two major archaeological sites. For that reason the route heads to the northeast, passes near a water tower at Km 147+100, crosses a road at Km 147+300 and the new section of Trakia highway.

The last obstacle before reaching the proposed site for construction of a Gas Metering Station (GMS2) and Pigging Station (PS2) at Stara Zagora is a fast flowing river (the Azmaka River) at Km 149+100, after which the route runs through a field before reaching the proposed site for construction of PS2/GMS2 at Km 150+200 near the village of Zagore. The populated settlements in the area of PS2 are: Zagore - 1.7 km to the southeast, Madzherito - 3.7 km to the west, Mogila - 2.9 km to the northeast, and Stara Zagora - 3.7 km to the northwest.

The existing block valve station is located in a field without any regulated access road, only a field road along a canal. Access from the road network at the village of Zagore is by a rough dirt road with a length of 3 km, which in its current condition is not suitable for trucks loaded with heavy pipes and equipment. Therefore, it will be necessary to construct a new access road at the village of Malko Kadievo which is located to the north.

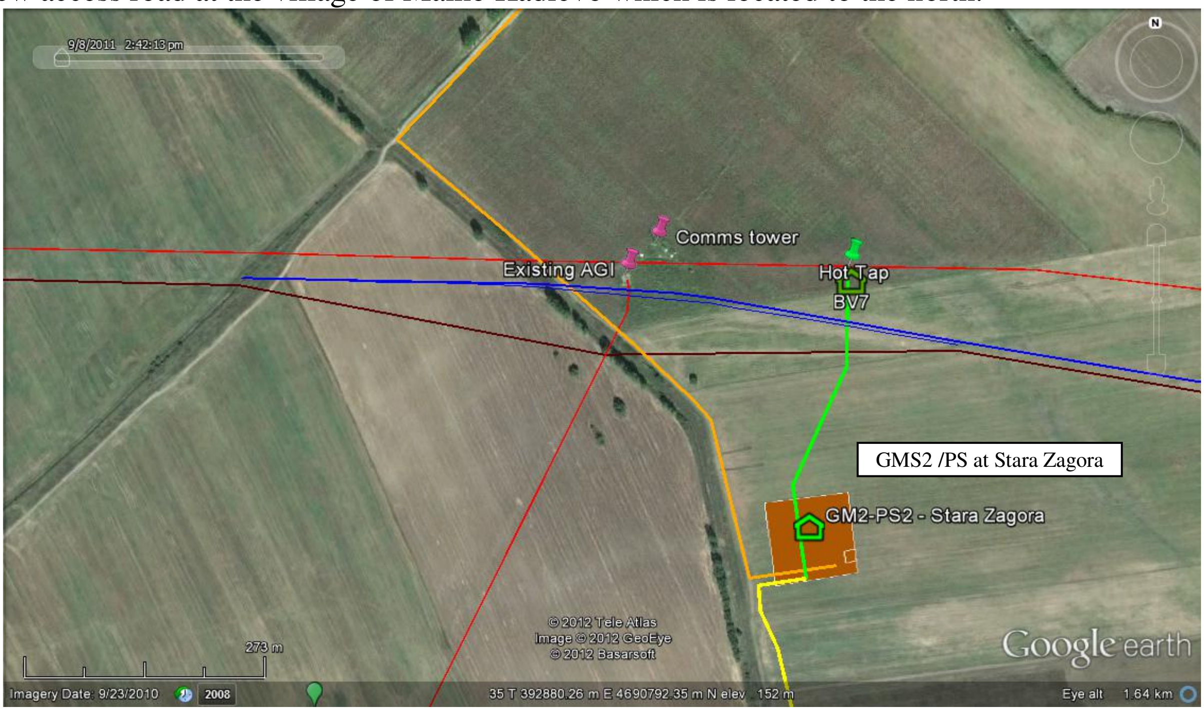


Fig. 1.2.1.7-1 – Stara Zagora GMS2/PS2 site

In Fig. 1.2.1.7-1 the site of GMS2 and PS2 is shown by a brown square. The yellow and green lines show the alternative Western Route at entry and exit from GMS2/PD2 site, the green marker shows the hot tap onto the existing pipeline. BV7 is located near the hot tap and is indicated a "green house" symbol. The red, blue and dark brown lines show existing gas pipelines, while the light brown line shows the proposed new road for access to the site from the village of Malko Kadievo located to the north. Purple markers show the existing a) ventilation and b) existing valve block shown in Fig. 1.2.1.7-2 below. Various facilities are scattered across the area rather than being grouped together and enclosed by a fence, and the newly designed GMS2/PD2 aims to rectify this issue.

Fig. 1.2.1.7-2 – Existing AGI (Block Valve Station) at Stara Zagora

1.2.2 Detailed description of the Eastern Route pipeline

The following sections give a description of the Eastern Route of the pipeline from Makaza Pass at the Greek-Bulgarian border up to the convergence point with the Western Route at the village of Uzundzhovo at Km 95+100.

1.2.2.1 Border crossing to BV2 Mamitia – Km 0+00 to Km 24+70

The interface point on the Greek-Bulgarian border lies on a mountain ridge that is about 80m southwest of border boundary stone E37 from where it joins the routing corridors on Bulgarian territory at elevation 905 m.

From there the Easten Route turns northeast for 80 m and then runs along pine forest-covered mountain ridges. It lowers down to elevation 663 at 100 m west of the border police station, and 350 m north of the station the route crosses a road and then runs parallel to a metalled road after passing the junction to the village of Strizhba at Km 5+000 and a hill-top quarry. The route runs parallel to the road for another 4.6 km to a small unnamed hamlet where the road veers east to the village of Kukuryak located 500 m from the pipeline route. Then the route continues along a ridge and passes 1300 m west of the village of Pashintsi, some 700 m east of the village of Zimornitsa and 700 m west of the village of Sredsko. A mountain stream is crossed at Km 14+100 and elevation 421 m. In this area the route passes through BG0001032 Eastern Rhodopes habitat protected site under Natura 2000.

There is a road junction at Km 16+000 where the route crosses the road and then runs parallel to it and passes near an unnamed hamlet. At Km 16+700 near a well the road continues to the east, then turns at a right angle and heads north to run down an open grass hill into a shallow river valley at km 17+200. It then climbs up to the top of the next hill at

Km 17+700 and level 517 m to reach the next ridge that runs from Km 18+000 to Km 19+200 where it descends into another river valley at Km 19+700 and elevation 386 south of the village of Ribino.

Fig. 1.2.2.1-1 – Typical view of the mountainous region on the Eastern Route at Km 20.6

The route climbs a hill that is topped by the village of Ribino and an expanse of grassland up to Km 20+500, elevation 439 m. Then follows a series of ascending of hilltops and descending into river valleys. In this area is the Ribino Protected Site which the route will skirt by passing 600 m west of it as shown in Fig. 1.2.2.1-1.

1.2.2.2 BV2 Mamitia to BV3 Patnikovo – Km 24+70 to Km 59+85

Through forested mountain ridges the route runs near the village of Konche and enters a wide river valley at Km 27+300, followed by a ravine at Km 28+600, but keeps 200 m east of a landslide area. The route reaches another peak at elevation 584 m and crosses the road to the village of Karamfil at Km 31+000. There are a number of small plateaus in this area where tobacco is grown. The route crosses three ravines at Km 31+ 200, Km 31+ 200 and Km 31+700 and then the terrain becomes more favourable. The route heads east of a mosque and a large cemetery before crossing at Km 32+600 the recently rehabilitated road to Momchilgrad.

The route runs on a plateau which can be considered as a possible depot for pipes, before descending into a river valley. From there the grassland landscape changes to rugged mountain scrubland of little agricultural value near the village of Salzitsa. From Km 38+400 to Km 39+700 the route runs along the boundaries of BG 0001032 Eastern Rhodopes PS under the Habitats Directive. Then follows a series of peaks and troughs to reach a peak at elevation 671 m at Km 41+500. Then the routes runs along a mountain ridge until entering a protected site at Km 43+900 for 1 km and descends to the village of Stare Chal (Km 47+000, elevation 339 m). And 1.6 km further the route skirts to the west of a large bird observation area that sits on a peak at elevation 362 m at Km 48+600. Then at Km 52+750 the route crosses the wide valley of the Arda River which is located within a protected site, and descends to elevation 155 m near the village of Rabovo which remains in the west and the village of Potocharka in the east.

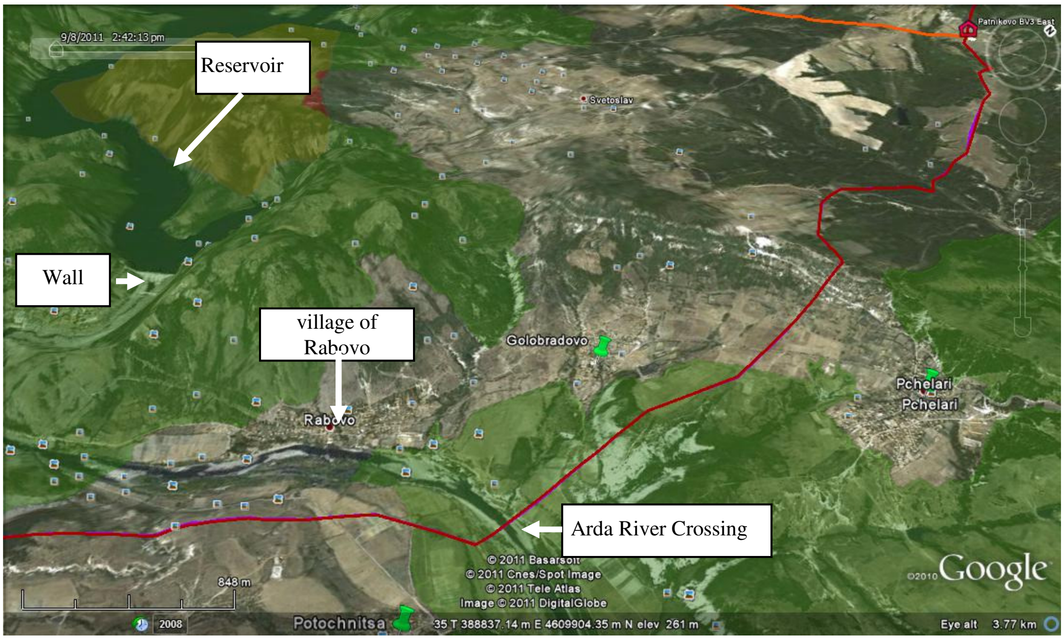


Fig. 1.2.2.2-1 – The Arda River crossing at the village of Rabovo. Protected sites indicated by green

This river is of width greater than 75 m and therefore requires the construction of a bypass pipeline and a block valve/ pigging station installed on either bank to comply with the current legislation. The river crossing point is 4.8 km downstream of the Studen Kladenets Reservoir, and it is a particularly important and sensitive watercourse as shown in Fig. 1.2.2.2-1. The profile of the river crossing at that place is not suitable for HDD. Therefore, regardless of the sensitivity of the area it is advisable to use the open cut method and it is better for the excavation to be completed in summer when water level will be the lowest. The pipeline crossing of the Arda River will take about 10-12 weeks (2.5-3 months), and the timing will take into consideration the nesting season of the birds, as well as the breeding season of other animal species found in the area as may be required for their protection.

Nearby, and to the east of the river crossing, are some remarkable white rock outcrops that harbour two significant archaeological Thracian tombs in the Kara and Hambar Kaya sites. The route continues through these protected areas for 1.5 km to a point between the village of Golobradovo which lies 500 m to the west and the village of Pchelari to the east, and at Km 54+500 crosses the road that connects these two villages.

The route runs along the rough terrain up to a hill at Km 55+300 and enters a forest and follows logging tracks for 1 km up to Km 57+500, then across a rugged terrain and through 400 m of woodland before reaching a clearing where BV3 and an offtake to Kardzhali are proposed to be located. The place lies beside a metalled road 600 m east of the village of Patnikovo and village of Vodentsi 2 km further to the east. A depot of approximately 5 ha is proposed for construction at Km 59+000 south of the BV3.

The offtake required to supply sales gas to Kardzhali will be of length 22.7 km, to be constructed across some difficult rocky terrain, Natura 2000 PS and woodland to the north of the Studen Kladenets Reservoir.

1.2.2.3 BV3 Patnikovo to BV4 Stamboliyski – Km 59+900 to Km 88+100

The field to the north of BV3 is sparsely covered in juniper bushes, a fairly rare species which should be preserved, if possible. Further on the route encounters a 600m wide belt of woodland before reaching open grassland again, and then at Km 62+800 crosses a road and skirts a large area of vineyards close to the village of Popovets 1 km to the west and the village of Zimovina 400 m to the east. The route runs around the western side of Zimovina into an area of wide woodland and grassland, avoiding a reservoir to the northwest at Km 63+900 where it crosses a potentially active fault.

The route runs around the western and northern sides of the village of Kladenets and within 400 m of it to the east, and crosses a road at Km 68+300, mid-way between the village and a reservoir that lies 1 km to the northwest. Then there is little choice but to cut through a wide woodland but exploiting a narrow belt. Ahead of the route is a vast expanse of vineyards and the route runs around their eastern end, and then it crosses the road from Stambolovo to Golyam Izvor at Km 70+900.

Then the route runs parallel to the road for 1 km before crossing it at Km 73+300, 500 m west of the village of Kralevo across shrubs and grassland. At Km 74+000 the route encounters a large woodland and crosses through its western side to minimize the impact on the more dense parts to reappear in open arable land at Km 76+900. From there the mountains are finally left behind. The route crosses a road at Km 78+000, 1.5 km west of the village of Koren. There is a large military training ground of area 10 km^2 north of the village and the route keeps west of this facility and runs east of the village of Malevo, then east of Stamboliyski before reaching the proposed location for BV4 at Km 88+100.

1.2.2.4 BV4 Stamboliyski to convergence with the Western Route – Km 88+100 to Km 95+400

From BV4 the route runs through a patchwork of small holdings and arable fields. The route crosses the busy main road Haskovo – Harmanli at Km 90+5, 4 km east of Haskovo and 2.3 km west of the village of Podkrepa. Further, the route crosses an active fault at Km 92+400 and then enters a 500 wide woodland. The final stretch of the Eastern Route takes a turn to the northwest along the woodland and runs through arable fields to a point where it converges with the Western Route, 1 km southwest of Uzundzhovo.

1.2.3 Above Ground Installations

1.2.3.1 Type 1 – Block Valve (BV)

The pipeline will incorporate 5 Block Valve Stations of Type 1 (BV2, BV3A, BV4, BV6, and BV7), spaced at about 30 km from each other, and accommodated on sites of sizes 26 m x 26 m, or an area of 676 m^2 each. A typical such station will have a buried large ball cut-off valve (CV) and other smaller valves and pipes, a small kiosk with cathodic protection system and instrumentation, and an access road. A vent stack will be constructed 15 m away with its own fenced compound 3 x 3 m. The vent stacks allows for discharging of gas from the pipe when necessary for the proper operation and maintenance of the pipeline, such as when maintenance requirements require blowing off the system.

1.2.3.2 Type 2 – Block Valve and Pigging Station (BV/PS)

These combine block valve and pigging stations of Type 2 will be of an area about 1296 m^2 and located either side of a watercourse that is more than 75 m in width (BV2A/PS3, BV4A/ PS5, BV4B/ PS6). The site of sizes 36 x 36 m will accommodate a buried large ball cut-off valve (CV) and other smaller valves and pipes, a small kiosk with cathodic protection system and instrumentation, and an access road. It will also include a pigging facility which will be used for internal inspection of the bypass pipeline. A vent stack will be constructed 15 m away with its own fenced compound 3 x 3 m.

1.2.3.3 Type 3 – BV, AGRS and Offtake Station at Kardzhali (Western Route only)

The station at BV3 – Kardzhali of Type 3 will be of an area about 3111m^2 (61 x 51m) and surrounded by a security fence. The site will accommodate a block valve (BV) and Automated Gas Regulation Statuin (AGRS) with metering offtake facility. The AGRS system will record the volumes of gas diverted to consumers as sales gas. There will be a small kiosk with cathodic protection system and instrumentation for monitoring of has flows, pressure and temperature. It will also include a pigging facility which will be used for internal inspection of the bypass pipeline.

Heaters will be provided on the site to heat the gas to compensate for the temperature decrease due to pressure reduction. A more detailed description of the system for warming up of the gas is given in section 1.2.6 of the EIA report. A vent stack will be constructed 15 m away with its own fenced compound 3 x 3 m.

1.2.3.4 Type 4 – AGRS and Offtake Station at Dimitrovgrad

The station of Type 4 at Dimitrovgrad will be of an area about 5751m^2 (81 x 71m) and surrounded by a security fence. I will be an AGRS with a metering facility for an offtake of length 400 m connecting the pipeline to the existing pipeline supplying gas to Dimitrovgrad. The AGRS system will record the volumes of gas diverted to consumers as sales gas. There will be a small kiosk with instrumentation for monitoring of has flows, pressure and temperature. Heaters will be provided on the site to heat the gas to compensate for the temperature decrease due to pressure reduction. A vent stack will be constructed 15 m away with its own fenced compound 3 x 3 m.

1.2.3.5 Type 5 – BV, AGRS and Offtake Station at Patnikovo (Eastern Route only)

The station of Type 5 a Patnikovo will be of an area about 3111m^2 (61 x 51m) and surrounded by a security fence. The site will accommodate a block valve (BV), Automated Gas Regulation Statuin (AGRS) and metering facility for the offtake of length 22.7 km supplying gas to Kardzhali. The AGRS system will record the volumes of gas diverted to consumers as sales gas. There will be a small kiosk with cathodic protection system and instrumentation for monitoring of has flows, pressure and temperature. Heaters will be provided on the site to heat the gas to compensate for the temperature decrease due to pressure reduction. A vent stack will be constructed 15 m away with its own fenced compound 3 x 3 m.

1.2.3.6 Gas Metering, Gas Regulating and Pigging Station

A Gas Metering/Regulating Station with a pigging facility will be constructed at the end of the pipeline at Stara Zagora. The Pigging Station allows the insertion of cleaning and monitoring devices called "pigs" into the pipeline through a door at the pig launching station and pushing it down the pipe until reaching the other end of the pipe, or the pig receiving station, at a speed of about 5 km/h. The Metering and Regulating Station alongside the Pigging Station will operate, as the term implies, to meter the volumes of gas entering and exiting the system whilst controlling and regulating the flow and pressure of gas. There will be additional line valves, piping, instrumentation and a kiosk. These facilities will be accommodated on a site of area 9025 m^2 (95 x 95m), surrounded by a security fence. Heaters will be provided on the site to heat the gas to compensate for the temperature decrease due to pressure reduction.

A vent stack will be constructed 15 m away with its own fenced compound 3 x 3 m.

1.2.3.7 Supervision, Operation and Maintenance Centre

The Supervision, Operation and Maintenance Centre will be located at a site of area 9540 m^2 (106 m x 90 m) at Haskovo and will be the main centre for the pipeline. This site accommodate a 24-hour operating control centre using a state-of-the-art SCADA system to monitor and operate the pipeline via fibre optic cables connected to the pipeline and to all the above ground installations. There will be offices, workshops, welfare facilities, maintenance buildings, storage space, security hut, access roads, security fence.

1.2.4 Interface between Greece and Bulgaria

There will be an interface on the border between the Greek spread and the Bulgarian southern spread. There will be no block valves or other accessories.

1.2.5 Temporary construction sites

1.2.5.1 General

Temporary facilities, necessary for the construction of the pipeline and above ground installations, will be deployed on temporary construction sites. It is very likely that the pipeline construction in Bulgaria will be completed in several lots which will result in a corresponding increase in the number of temporary facilities.

The one possible alternative is to split the Western Route (of length 150.57km), if it becomes the preferred route, at BV3A Mandra, Km 79.0. This would make the southern spread 77.50 km long, inclusive of all mountainous areas and four AGIs, while the northern spread would be 71 km long, inclusive of seven AGIs and Operation & Maintenance Centre.

The eastern route is a much more arduous challenge because it comprises of twice as much mountainous construction and four times more woodland. The split in a northern and southern spread could take place at BV3 Patnikovo. Thus, the southern spread will be 60 km long and include four AGIs, and the northern spread will be 85 km long and with seven AGIs and an O & M Centre.

The choice of locations for temporary construction sites will be exercised by the Contracting Entity or his representative. There are no specific requirements for such works near populated settlements since construction sites are also located within their limits. Preferably, the terrain should be flat, outside Protected Sites and Areas, and avoid deployment in areas of protected sanitary zones of water supply sources for populated settlements and mineral water sources. Such terrains, not suitable for construction sites, are indicatively located in the following sections of the pipeline route:

- at the Western Route: from Km 8+000 to Km 9+000 (Kirkovo mineral water spring), from Km 84+000 to Km 85+000 (water intake facilities with pumping station at the village of Voyvodovo), from Km 98+000 to Km 99+840 (Uzundzhovo 2 stage water intake system), about Km 145+500 (two wells with storage tank pumping stations south of the village of Zagore);
- at the Eastern Route: from Km 90+180 to Km 91+600 (Iztochna Zone water intake system).

It is also necessary to comply with the requirements for environmental factors, i.e. standard limits for dust, noise, vibration, radiation, etc., and distances to populated settlements. Pipe and construction materials, for example, factory pipe fittings, etc., will be first stored at storage sites and then transported by heavy-duty trucks to the construction zone. Pipes and construction materials will be also temporarily stored within the construction zone, and environmental concerns of such activities are related mostly to transport noise and loading and unloading operations, pollution from motor vehicle engines, etc.

The location and more detailed description of recommended sites that the Contracting Entity can use as sites of field offices and/or pipe depots are given in section 1.2.5.4 of the EIA report.

It should be noted that if the Eastern Route becomes the preferred alternative, then it will be necessary to construct additionally 22.7 km of pipeline to Kardzhali, probably under a separate contract. Although this additional pipeline is not part of this design, it should be taken in account in the feasibility study conducted for selection of the route, as its cost is a significant factor in determining the total costs. It is also necessary to construct a 400 m distribution sales gas pipeline at Dimitrovgrad, but this facility is part of both alternative routes.

The Greek section of the pipeline will be probably awarded under a third contract and include the construction of a 31.57 km pipeline and two AGIs.

1.2.5.2 Pipe quantities

Upon selection of the Western Route the construction of the whole pipeline from Greece to Bulgaria (from Komotini to Stara Zagora) will require 185,200 m of pipes, inclusive of the bypass pipes for crossing of the Studen Kladenets Reservoir and the Maritsa River, and spare parts for future use. If the pipes are 18 m long at least about 10,290 pipes will have to be transported to various locations along the route, excluding any pipes for emergency purposes. If the pipes are 12.3 m long (what is more likely as not all mills can manufacture the longer pipes), then about 15,060 pipe will be needed for the project.

The Greek section of the pipeline will require to transport for the construction about 1,754 pipes in pipe length of 18 m each, or 2,567 pipes in pipe length 12.3 m each.

The Bulgarian section of the pipeline will require to transport about 8,365 pipes in pipe length of 18 m each for the construction of the Western Route or 8,093 pipes for the Eastern Route (excluding any pipes for emergency purposes), or 12,241 pipes in pipe length 12.3 m each for the construction of the Western Route or 11,843 pipes for the Eastern route.

1.2.5.3 Delivery of pipes to site

Pipes can be supplied from all over the world by sea, road, rail or any combinations thereof. Pipes can be delivered by ship to Thessaloniki or Alexandroupolis, and then transported by truck, or alternatively by rail from Western Europe. Also, there is a good chance for the new international road (I-5 / E-85) through the Makaza Pass to be completed by that time. And the possibility to use the railway Stara Zagora – Dimitrovgrad – Haskovo – Kardzhali – Momchilgrad – Podkova should be considered to save the traffic of hundreds of heavy-duty trucks on the roads of Bulgaria and Greece.

1.2.5.4 Pipe depots

1.2.5.4.1 General

Guarded sites will be constructed for the needs of the project to accommodate the large quantities of pipes necessary for construction of the pipeline. Additional 10 pipes will be kept in stock at the depots for use as spares during operation, if necessary, or in emergency.

Pipes of such length and diametre 813 mm can be stacked in 5 layers (up to a total height of 4 m), the bottom layer being supported on 4 or 5 sand rows of height 50 cm formed on geotextile sheeting laid on the ground. A large area will be also necessary to allow for maneuvering of the heavy-duty trucks and mobile cranes used for the delivery and unloading of the pipes. Given the above considerations, the required area for a pipe depot is 10,800 m^2. A total of 5 pipe depots are proposed for construction in Bulgaria (2 for the southern and 3 for the northern spread of the Western Route; 2 for the southern and 3 for the northern spread of the Eastern Route). The sizes of the four depots (at Momchilgrad, Kardzhali, Haskovo, Dimitrovgrad for the Western Route, and at Momchilgrad, Chaika, Haskovo, Dimitrovgrad for the Eastern Route) are about 180 m x 60 m. The fifth pipe depot is of sizes 200 m x 250m and is located south of Haskovo at Manastir for the Western Route, and at Patnikovo under BV3 for the Eastern Route. It is intended to be a permanent depot for use both during construction and operation. Other construction materials will be also stored in it during construction works and it will be used for future process equipment , necessary spare pipes, etc. during the operation.

Service facilities of the pipe depots will be basic, just a small container type security office/welfare block with a generator and chemical toilet.

1.2.5.4.2 Western Route

For the southern area the most appropriate place for a pipe depot is a site near the old bentonite factory located in the industrial area of Kardzhali next to a road. The second pipe depot can be located just south of Momchilgrad. As mentioned above, plots of sizes 180 m x 60 m for four of the depots for each of the two alternatives for the storage of pipes and pipe elbows, construction materials, etc. during the construction will be required. The proposed depots at Kardzhali and Momchilgrad are located near railway lines which can be used to transport the pipes.

The most suitable sites for pipe depots for the northern spread are Haskovo and Dimitrovgrad due to the good road infrastructure and existing railways.

The coordinates of the pipe unloading railway sidings and pipe depots for the populated settlements where pipes can be delivered to for the construction of the Western Route are shown in the table below. These sites are only provisional as the acquisition of land for temporary or permanent use shall be entirely through the Contracting Entity at a later stage.

WESTERN ROUTE		**UTM Coordinates**					
		Southern spread					
Pipe unloading railway sidings and depots		Pipe unloading railway sidings			Pipe depots		
		°	'	"	°	'	"
Momchilgrad	N	41	30	58.54	41	30	56.47
	E	25	24	4.69	25	24	35.61
Kardzhali	N	41	37	52.23	41	37	55.12
	E	25	23	11.62	25	24	59.29
Haskovo	N	41	55	59.48	41	55	54.45
	E	25	34	53.75	25	36	23.27
Manastir	N	From Haskovo			41	54	18.66
	E				25	35	41.17
Dimitrovgrad (common for Eastern Route and Western Route)	N	42	3	6.48	42	2	58.09
	E	25	36	16.00	25	36	48.56

1.2.5.4.3 Eastern Route

Suitable sites for pipe depots along the eastern route are difficult to find because the terrain is mostly mountainous. Also, railways are too far away to be used in the south, so it is likely that pipes will be unloaded at Haskovo and Momchilgrad railway sidings and then transported by trucks to the mountainous area. It is proposed the above pipe depots at Haskovo and Momchilgrad intended for the Western Route to be used, together with the depot at Dimitrovgrad, also for the Eastern Route. It is also proposed to construct a satellite pipe depot on the road from Karamfil to Chayka near BV2, and another depot south of BV3 at Patnikovo because of the comparatively flat terrains available in these mountains.

The coordinates of the pipe unloading railway sidings and pipe depots for the populated settlements where pipes can be delivered to for the construction of the Eastern Route are shown in the table below.

Eastern Route		UTM coordinates (35T)					
		Northern spread					
		Pipe unloading railway sidings			Pipe depots		
		°	'	"	°	'	"
Momchilgrad	N	41	30	58.54	41	30	56.47
	E	25	24	4.69	25	24	35.61
Chayka (satellite depot)	N	From Momchilgrad			41	29	436
	E				25	33	987
Haskovo	N	41	55	59.48	41	55	54.45
	E	25	34	53.75	25	36	23.27
Patnikovo	N	From Haskovo			41	40	34.06
	E				25	39	55.57
Dimitrovgrad	N	42	3	6.48	42	2	58.09
	E	25	36	16.00	25	36	48.56

1.2.5.5 Site offices

Site offices, welfare facilities and workshops are the hub of any construction area. It is the place where the management, maintenance, catering and cleaning teams will be based. Ideally, site offices will be deployed on level ground and preferably on abandoned industrial sites available for re-use. Unfortunately, these sites are not always easy to find and acquire for use. The area required for each of the two spreads is about 16,000 m^2 (200 m x 80 m).

For the northern spread of the Western Route it will be suitable to deploy the office next to the pipe depot at Dimitrovgrad. For the southern spread Kardzhali would have been the more suitable place, however, the site chosen for the pipe depot may not be sufficiently level which will possibly require considerable grading work. Therefore, it may turn out that the land adjacent to the Momchilgrad pipe depot is the better alternative, but yet there may be difficulties with infrastructure and accommodation.

The Eastern Route is also problematic in terms of the site offices. It would be pointless to deploy such large site offices near small villages and so it may be preferable to construct one such site office at the route near Momchilgrad (the southern spread), and a second one at Dimitrovgrad (the northern spread).

The site offices will be like small populated settlements accommodating offices, a catering block, toilets and showers, meeting rooms, first aid room, drying rooms, separate X-ray developing/dark room, stores, workshops, car and truck parking areas, bunded fuel tanks, generators, sewage system with a septic tank, vehicle maintenance area and fabrication yard. The site will be surrounded by a perimeter fence and floodlights, and will have 24-hour manned security.

It is highly unlikely that the Contractor will require the construction of a temporary accommodation block for the workers since the number of workers who will work on the project for one season does not justify the time and effort necessary to construct such temporary facility. The regional cities of Momchilgrad, Kardzhali, Dimitrovgrad and Stara Zagora are sufficiently large and have the capacity to accommodate the workers. The number of workers will grow more slowly over the first two months, reaching a maximum of about 250 men during the busiest months and after that decrease vary rapidly until the end of the season. This implies that the Contractor will divide the construction of the pipeline in Bulgaria in several separate project lots.

1.2.6 Main technological processes

The investment proposal has its starting point at Komotini in Greece, crosses the territory of Greece and runs generally from south to north in Bulgaria, crossing the international border at the Makaza Pass border point and reaches the exit point at the city of Stara Zagora. The area of the Greece-Bulgaria border crossing is agreed between the partner countries.

The following are the main components of the pipeline:

1. Transmission pipeline – Total length of the Western Route 182.14 km, of which 150.57 km on Bulgarian territory, DN 32" (813 mm), and of the Eastern Route 145.67km on Bulgarian territory, DN 32" (813 mm). The total length of the Eastern Route is 177.24km, of which 145.67km on Bulgarian territory. The pipes are straight seam type, of low alloy steel, of high strength and plastic parameters, installed underground;
2. Gas offtakes from the transmission pipeline to Kardzhali and Dimitrovgrad. They are installed underground, but above ground installations are used at the point of interface with the pipeline;
3. Interface with the national gas transmission infrastructure – The site will be located at Stara Zagora, will be of area 0.9ha and will have a Gas Regulating Station (GRS) and Pigging Station (PS);
4. Two Launcher and Receiver Stations for cleaning and inspection operations (Pigging Stations). Will be constructed above ground;
5. Two Gas Metering Stations at the inlet and outlet of the pipeline (one at Komotini and one at Stara Zagora). Will be constructed above ground;
6. Line Block Valves (BV) – A total of 9 BVs are proposed for each of the two alternative routes of the entire pipeline, of which one will be on Greek territory, the remaining on Bulgarian territory. The pipeline is divided in technological sections of length up to about 30 km by the BVs. BVs are installed underground, but their control is above ground and therefore sites will be required for their construction.
7. Cathodic Protection Stations (CPS)– The Cathodic Protection Stations are intended to protect the pipes of the pipeline against corrosion. The Cathodic Protection Stations are with external power supply LV and are connected by cable to current transformers installed in the booths on the BV sites, i.e. there will be no need for separate (additional) areas for these stations. Records of the BVS can be subject to continuous control.
8. A bypass pipeline will be installed at the Western Route for the crossing of the Studen Kladenets Reservoir at Kardzhali, and also a bypass pipeline under the Maritsa River which will be constructed at the common route of both alternatives. This additional pipeline is required at crossing of rivers of width more than 75 m in accordance with the Bulgarian legislation.
9. Fibre optic cable line for process and telecommunications interfaces of the IGB pipeline – The length of the fibre optic cable line installed underground within the pipeline easement area at a distance of 7 m from the pipeline will match the length of the pipeline both for the Eastern Route and Western Route. The total length of the fibre optic cable will be about 1.5 km longer than the pipeline route because of a deviation to the O & M Centre at Haskovo.
10. External infrastructure interfaces for all site components of the pipeline (roads; electric power supply; water supply and sewerage; telecommunications).

In addition to the main components of the technological process infrastructure listed above, the following components ensuring the pipeline security such as vent candles for discharge of natural gas in the event of overpressure; cut-offs; protective casing for crossing under roads, railways and rivers; electrical equipment; I & C; security and management system; passive and active corrosion protection of steel pipes (cathodic protection) will make part of it. Their purpose is ensure implementation of the main technological process and high reliability through control and maintenance.

The main technological process that will be implemented by the IGB pipeline project is transmission of natural gas from Komotini to Stara Zagora by means of an underground pipeline, inclusive of the following additional processes:

- Pressure regulation and its maintenance (increase or decrease);
- Purification of natural gas from mechanical impurities – The gas purification is by its filtering through filters at both ends of the pipeline - at Komotini and Zagore.
- Measurement of temperature and flow rate of the natural gas;
- Natural gas heating – Heaters will be required to heat the gas to compensate for the lowering of temperature due to its pressure reduction. The gas heating system will consist of highly efficient industrial type condensing boilers running on natural gas. The system will have a standby boiler to ensure high reliability of operation, for example, 2 operating boilers and 1 standby boiler. The size and number of boilers will depend on the flow of gas to the consumers and the calculated capacity. Heaters/boilers on gas will produce warm water which will be pumped by insulated piping into heat exchangers through which the gas flows (Fig. 1.2.6.-1). Such heaters will be installed on the sites at Kardzhali (Type 3), Dimitrovgrad (Type 4), Patnikovoo (Type 5, Eastern Route only), and Stara Zagora (GMS/PS). Until the system capacity is not increased up to 5 Bcm by the additional incorporation in the system of the compressor station, there will be no need to install heaters on the sites at Dimitrovgrad and Stara Zagora. Such heating system which will have CO2 and NO2 emissions will be installed and operated on the site at Kardzhali.

Fig. 1.2.6.-1 An Above Ground Installation site – interface point of the pipeline with the existing pipeline. The pipe is insulated

The proposed process scheme is of the classical type for transmission of natural gas over land. Given the selection of appropriate technical equipment enabling effective management and control in compliance with all requirements for safe operation and environmental protection, it can be classified as the best available technique.

1.2.7 Main raw materials

Natural gas and other energy sources

The natural gas, which will be transported at the rate of 1.0 to 5.0 bNcmy, is produced in the countries of the Caspian region and the Near East.

Mostly diesel fuel will be used for the construction machinery in the construction works. The required electricity for welding works at the pipeline route will be provided by diesel generators, and by the national electricity grid for the main storage sites.

The following types and quantities of raw materials are expected to be used during construction works:

Type	Quantity
Bentonite	100 t
Copper paste	1,000 l
Biopolymer (additive for drilling)	10 t
Nitrogen (needed to fill the pipeline after hydraulic testing)	450,000 m^3
Oxygen	1,000 l
Acetylene	10,000 l
Hydraulic fluid	5,000 l
Diesel - white	150.000 l
Diesel - red	500,000 l
Epoxy primer	18,000 l
Multicomponent liquid epoxy	10,000 l
Iron silicate (for sand blasting, shot blasting)	80 t
River water	100,000 l
Acrylic paint	1,000 l
Developer	100 l
Manganese welding rods	100,000
Propane	50,000 l
Sodium chlorate (herbicides)	10,000 l
Cement	100,000 m^3
Crushed stone	1,000 t

Some raw materials used during construction have hazardous properties. The following table lists the hazardous materials and their hazardous properties:

Type	Hazardous properties
Petrol	combustible
Biopolymer (additive for drilling)	will cause eye irritation
Acetylene	flammable
Hydraulic fluid	will cause irritation
Diesel - white	combustible
Diesel - red	combustible
Epoxy primer	nonflammable, will cause eye irritation
Multicomponent liquid epoxy	nonflammable, will cause eye irritation
Iron silicate (for sand blasting, shot blasting)	will cause eye and throat irritation
Acrylic paint	flammable, will cause eye and throat irritation
Developer	flammable, will cause eye irritation
Manganese welding rods	flammable, harmful to health, eyes and neck
Propane	combustible

Sodium chlorate (herbicide)	will cause eye irritation
Cement	will cause skin, eye and throat irritation

The following types and quantities of raw materials are expected to be used during operation:

Type	Quantity
Copper paste	100 l/y
Oxygen	500 l/y
Acetylene	500 l/y
Diesel - white	20,000 l/y
Acrylic paint	100 l/y

Some raw materials used during construction have hazardous properties. The following table lists the hazardous materials and their hazardous properties:

Type	Quantity
Acetylene	flammable
Diesel - white	combustible
Acrylic paint	flammable, will cause eye and throat irritation

Electricity will be used for operation of valves in BV stations, C & I, and for CPS.

1.2.8 Infrastructure – existing and need of constructing new infrastructure

1.2.8.1 Roads

During construction motor vehicles and machinery will use the existing road network to access the pipeline route. Then the motor vehicles will be driven inside the construction zone. In some cases access roads will be necessary. Existing dirt roads will be used after improvement, and where possible the roads to the sites of the future BVs will be also used as access roads. There will be permanent access roads and temporary roads which will be used to transport materials and equipment to the construction zone and construction sites.

Access roads, which are not necessary during the operation of the pipeline, will be re-claimed appropriately. Agricultural dirt roads, forest roads, etc. used for access during construction works will be rehabilitated by the Contractor to their previous or better condition before the start of works. The reclamation of the temporary access roads will include the return of topsoil, restoring land boundaries as fully as possible and afforestation where appropriate to apply.

The Western Route runs close enough to roads of the main road network from Kirkovo to the south through Momchilgrad, Kardzhali, Haskovo, Dimitrovgrad up to Stara Zagora, while at the Eastern Route suitable access roads are not available. The existing mountain roads are with many turns and in poor condition, with the exception of the section between Momchilgrad and Krumovgrad recently repaved with European money. It will be very difficult for the heavy trucks needed to transport 18 meter pipes to travel on these winding roads and in addition they are likely to break road surfaces during the transportation.

Both the Western Route and Eastern Route require access to the Greek-Bulgarian border, and it has to be noted that the only possible road is with a lot of holes and turns, raises from Podkova to the border checkpoint and then runs through a lockable border gate. The roads after this border gate have to be repaired so that heavy-duty trucks can travel over them.

The access to the southern end of the Western Route where the pipeline crosses the new international road (Km 6+075) also poses a problem. There is only one side road from Podkova for the whole 20 km stretch leading to Kirkovo. To provide better access to this part of the Western Route it will be of great importance to construct temporary access roads starting from the new international road.

Access to the construction area usually takes place at the intersection of roads, but in some places this distance may be too great and then it would be necessary to construct temporary roads. Temporary roads will be constructed of crushed stone laid on geotextile to protect the soil after topsoil is removed and stored away. These roads will have to be strong enough to be able to carry the weight of heavy.

At this stage of the project, it is difficult to determine how many temporary roads will be needed and where they will be located. At an initial estimate 15 temporary roads of total area 1.67 ha will be constructed for the Western Route, 14 temporary roads of total area 1.62 ha for the Eastern Route.

There are zones, both at the Western Route and Eastern Route, and mostly in mountainous areas which are inaccessible for the construction of roads. At the Eastern Route these zones are very long – about 24 km (from the village of Sedefche to the Greek-Bulgarian border), at the Western Route only about 6 km (from Lozengradtsi to the Greek-Bulgarian border).

The Eastern Route runs through much more mountainous terrains than the Western Route, and it has much less suitable places for the construction of temporary roads without causing a serious impact on the environment. In places the terrain is so difficult to access that the only alternative is to blast the mountain slopes, which is expensive, inappropriate and inapplicable when the goal is the construction of temporary roads. Therefore, the temporary roads proposed for the Eastern Route are less by number and length compared to the Western Route, and they run through the few suitable areas where this construction is possible. In the remaining case it will be necessary to travel long distances to reach the permanent roads and the few temporary roads to obtain access to the sites of the above ground installations. This explains the smaller number and length of the temporary roads for the Eastern Route compared to the Western Route, and clearly shows that the Western Route is the better alternative in terms of temporary roads.

Deployment of the temporary roads is shown in Appendix 1.2, the orange strips indicating zones inaccessible for construction of such roads for both routes.

1.2.8.2 Water supply and sewerage

After completion and before start of operation the pipeline will be subjected to a hydrostatic test. The hydrostatic test is intended to check the integrity of the pipe and in particular weld joints by filling sections of the pipeline with pressurized water. The test will be conducted according to the general requirements of BDS EN 12327 and manufacture’s technological instructions. Transmission pipelines are generally hydraulically tested for strength and airtightness according to BDS EN 1594, BDS EN 12186 and BDS EN 12327. For the purposes of the hydrostatic test the pipeline will be divided into sections taking into account various factors (pressure, length of the section, access, location of points of water intake and disposal). At an average distance of about 20.0 km between 2 block valves and diameter of the pipeline 32" (813 mm) the one time volume required per one testing of a section is about 10 000 m^3. The required volume of water to test the pipeline will be supplied from water sources close to the route, mostly surface running water (the Maritsa, Arda, Varbitsa rivers and their tributaries) or from reservoirs (eg, Studen Kladenets). To reduce the number of sources and the amount of water needed, water from one test section will be reused for pressure testing of another section, as far as applicable and possible.

During the hydrostatic test water may change its quality due to the presence of corrosion byproducts from the internal side of the pipes (although pipes will be factory insulated at their inner side), presence of slag, electrodes, scale and accidental dust and various objects inside the pipeline. Waste (used) water can be classified as waste water from a test process.

Upon successful completion of hydraulic test water should be discharged into flowing or stationary water body (after being reused). This is carried out in compliance with the restrictions of Ordinance No 6 of 09.11.2000 on *Emission Standards for Permissible Levels of Harmful and Dangerous Substances in Waste Water*, *Discharged into Water Bodies* (published in the State Gazette, No *97, 28.11.2000, as amended in No 24, 23.03.2004 in effect from 23.03.2004.).*

Waste water shall meet the requirements for category 2 in accordance with Ordinance No 7 on *Parameters and Standards for Flowing Surface Water* (the SG, No 96, 12.12.1986). Under the Water Act (published in the SG, No 67, 27.07.1999, in effect from 28.01.2000, *as amended in No 80, 14.10.2011*) the disposal process is regulated (Article 46). Prior to the disposal of waste water into the water body the place has to be so selected as to prevent the occurrence of conditions for erosion and water has to pass through a settlement pit or tank of an appropriate size for separation of any mechanical impurities.

Water used for hydrostatic testing will be filtered through 50 micron filters before being pumped into the tested pipeline section. Hydrostatic test water shall not contain additives, corrosion inhibitors or other chemicals.

In accordance with the clarification on the potential water sources for testing purposes and disposal of used water made by EASRBD in their letter RD-11-158 of 27.10.2011, the Contracting Entity is required to determine the locations and necessary quantities, and then start a procedure for the issuance of water intake and disposal permits by the local East Aegean Sea River Basin Directorate based in Plovdiv. In this connection and as a next stage the Contractor will develop a complete Hydrostatic Test Plan for approval by the competent authorities on the basis of which the best water intake and disposal will be considered and determined. The source and receiver of hydrostatic test water will be agreed with such authorities and will be in compliance with their requirements. The competent authorities are the East Aegean Sea River Basin Directorate (EASRBD) and the Ministry of Environment and Water (MoEW) (for the Studen Kladenets Reservoir).

During construction works water quantities will be used on the construction sites to prepare concrete mixtures and for drinking, sanitary and production needs in the temporary construction camps. The total estimated amount necessary to meet the need of the workforce is about 100 m^3 daily.

No water is foreseen for process needs during the operation of the transmission pipeline. Water will be used for:

- sanitary/sewage needs of operating staff - the O & M Centre will employ about 32 persons
- firefighting needs – a fire hydrant and fire water tank are proposed both for AGRS and O & M Centre

It is expected that the following waste water will be produced during the construction works:

- waste water from temporary construction camps (industrial water, rain water, sanitary water, sewage) – given that about 250 construction workers will be employed and 300 l waster water average per person per day, the total amount of waste water is estimated at 75 m3 per day. Treatment and disposal of waste water will be in compliance with the Bulgarian legislation and meet the regulatory requirements.
- disposal of water used for hydrostatic test - the amount of disposed water will be controlled and coordinated with the competent authorities in advance (assuming water will be reused, being transferred from one area to another). Disposal will be consistent

with the size and type of water body to prevent flooding and destabilization. Implementation of measures to control soil erosion will be considered. A Detailed Hydrostatic Test Plan will be developed at the next phase of the project. It will indicate the exact locations of disposal, optimal flow rate and dispersion in the water receiver, environmental risk and monitoring programme.

- disposal of water for drainage of a trench (if necessary) – schemes for each particular cases will be developed for such areas, in coordination with the affected owners and users before the start of works.

All waste water from temporary construction camps will be collected in septic tanks and transported from the site by tankers to a operating municipal WWTP. Or, alternatively, waste water will be discharged in the ground or water receiver after treatment in local waste treatment facilities. Determination of the method of disposal of waste water will be done at a later stage in the design process. Whichever alternative is adopted, the receiver of the waste water will be approved by the competent authorities and comply with legal requirements. EASRBD will be the competent authority for the issuance of a permit for disposal of waste water.

It is expected that the following waste water will be produced during the operation:

- waste water from the O & M Centre – given that about 32 will be employed as operation and 300 l waster water average per person per day, the total amount of waste water is estimated at 9.6 m^3 per day. The method of water supply and disposal of waste water will be specified in a water supply and sewerage design approved by the municipality. It is expected that there will be an existing water supply and sewerage system near the O & M Centre which can be joined and used. If there is no such system, a pipe well will be constructed and waste water will be handled by a modular WWTP.

1.2.8.3 Energy source used – type and quantity

The natural gas, which will be transported at the rate of 1.0 to 5.0 bNcmy, is produced in the countries of the Caspian region and the Near East.

Mostly diesel fuel will be used for the construction machinery in the construction works. The required electricity for welding works at the pipeline route will be provided by diesel generators, and by the national electricity grid for the main storage facilities and site offices. The estimated consumption of electrical power during construction of the site offices will be in the range of 10 to 15 kW or about 250 kWh per day. The remaining electricity required for construction works will be provided by diesel generators.

Design, manufacture, construction, installation, testing and commissioning of the electrical grid will be carried out in accordance with the relevant national standards, rules and regulations.

During operation electric power will be needed to run and control the valves in the BVs, C & I, etc., cathodic protection, O & M Centre own lighting needs, computers, UPS, and heating of the apparatus booth. According to estimates about 30 to 50 kW for small above-ground facilities or a total of about 1 MWh per day will be consumed for operation of the pipeline. Larger above ground installations where heating system for gas heating are provided will have higher consumption of electricity – about 75 kW at Dimitrovgrad and Stara Zagora, about 50 kW at Kardzhali.

There will be provisions to switch over to uninterruptible power supply in the event of electric power failure, intended to maintain the operation of the system until the arrival of an emergency team with a generator. UPSs will ensure standby power supply for up to 4 hours after power failure. In the event of power failure a generator will switch on and supply power to the system until restoration of the normal power supply.

1.2.8.4 Risk of accidents and measures to prevent and respond to incidents and unforeseen events

All activities shall be conducted in accordance with the Bulgarian legislation and good business practices to ensure protection of the health of workers and population , and environmental protection.

During construction works the Contractor shall provide the necessary training and equipment to respond to emergencies. Welding teams shall be provided with fire extinguishers. Containers will be provided for activities which involve refilling or reloading of fuel to contain any spills. Also, appropriate materials for cleaning of contamination will be provided. Each team will have a person trained to give first aid. In more serious cases the relevant institutions will be notified and, if necessary, assistance will be asked.

Action plans will be developed for the operation to cope with disasters and emergencies and such plans will be agreed with the appropriate authorities as required under the law.

1.2.8.5 Impact on services of other organizations - need of reconstruction, relocation and deployment of new infrastructure (excluding roads) for the purposes of the project

Construction of the pipeline will involve interference with services of other organizations and therefore reconstruction, relocation and deployment of new infrastructure will be required. There will be crossing of and interference with:

- Roads, construction of new roads
- Railway lines and stations
- Electrical cables
- Water supply and sewerage networks and facilities, Sanitary Protection Zones (SPZ)
- Existing pipelines
- Irrigation canals, etc.

In the process of preparation of the ToR for an EIA and development of the EIA report letters were sent to the concerned public departments to notify the pipeline construction project and request related data and opinions. All obtained data and opinions were submitted to the designers for consideration and all received recommendations were taken into account in the EIA report. Additional field surveys were conducted for the two proposed routes.

After preparation of the detailed site development plan of the pipeline it will be send to all interested public departments for approval. Then all crossing points will be finally determined and the pipeline route accordingly adjusted.

Before starting construction works the underground facilities located near or crossing the pipeline route will be exposed by excavation or detected by underground detectors. Where appropriate, these works will be carried out under the direction and supervision of representatives of institutions responsible for the underground installations. If necessary adequate protection will be installed between the existing infrastructure and new pipeline.

There will be no impact on wireless communication systems and the quality of the wireless communications during the construction and operation of the pipeline.

1.3 Implementation of the Investment Proposal

The main document regulating the design, construction and operation of the Investment Proposal is the *ORDINANCE on the construction and safe operation of gas transmission and gas distribution pipelines, and facilities, installations and instrumentation* *for natural gas, (Letter No 171 dd 16.07.2004 pf the Council of Ministers, published in the State Gazette, No 67, 02.08.2004).*

It is proposed to implement the project in one phase. The pipeline can be divided into a northern spread and a southern spread and the works will be carried for both spreads at the same time.

1.3.1 Construction

The construction of the Gas Interconnector Greece-Bulgaria and the related infrastructure will be completed in accordance with approved designs in compliance with the provisions of the *Spatial Planning Act (the State Gazette, No , year 2001.;as amended by No 41 and No 111, year 2001.; as amended by No 43, 2002; as amended by No. 20, No 65 and No 107, 2003),* and developed in accordance with the construction, engineering, sanitary/hygienic and environmental codes and standards.

The main construction works are: earthworks – removal of topsoil and its temporary storage within the construction zone, excavation for formation of trench for laying of the pipeline and sites for PSs, GMSs, AGRSs and line BVs, backfilling of trench, reinstatement of the construction zone; complex construction works for crossing of water bodies, roads and railways; erection works – mostly weldings on the pipeline to BDS EN 12732, BDS EN 287-1+A1, BDS EN 288-1+A1 and technological instruction; protection of the pipeline against corrosion; erection of the equipment of the pipeline facilities; pipeline airtightness and strength test to BDS EN 12327, BDS EN 1594, BDS EN 12186. Construction works are carried out within a construction strip zone of width 30 m, except for the woodland area at the village of Kirkovo where it will be reduced to 20 m (Km 9+078 up to Km 9+510). Construction works will be carried out also on the sites of the above ground installations and for deployment of the external infrastructure for all site components (road, electric power, water supply and sewerage, telecommunications).

Construction will begin after obtaining the necessary construction permits and their coordination with the relevant public departments.

Construction and construction of buildings and facilities will be completed according to the provisions of the Bulgarian and European legislation. The materials used in these works will comply with the current requirements applied in Bulgaria. As project documentation will be made part works. The design of the construction works will be prepared and added to the design documentation. All proposed works will be completed in accordance with the approved schedules and plans for implementation of the project.

Construction works will be completed in accordance with the approved detailed designs.

According to schedule, construction will start in 2013 and will be completed within about 18 months.

The detailed schedule of the works will be reflected in the organization and completion design: erection of main units and equipment; installation of pipeline; electrical installation; I & C installation; adjustment works; insulations; start up works – certificate form 15 (Complete and Ready for Commissioning Certificate); commissioning and и 72 hour trial tests.

According to the documentation submitted it is proposed to use about 18 heady-duty trucks, 35 light-duty construction machines and 35 heavy-duty construction machines for the construction works. There will be about 40 four-wheel drive automobile cars for the staff and about 20 heavy-duty motor vehicles at the pipeline route during construction works.

It is expected that up to 250 persons will be employed for the construction phase as follows:

- About 30 persons – management and engineers
- About 180 persons – specialized teams directly involved in all construction works for the pipeline
- About 40 persons – subcontractors involved if the pipeline tests

The number of staff employed for the project is large and therefore a large number of automobile cars will be required for peak periods. The largest number of workers will be in the summer months (about 250 in April-July), the smallest in February and November (about 50). In addition, use will be made of materials and services from local suppliers.

Construction will be completed in accordance with the description below.

1.3.1.1 General information and activities during construction

The pipeline will be constructed by applying proven methods developed on the basis of experience gained in the construction of other pipelines. Construction will be carried out within the limits of the work area which will "move" along the pipeline route at an average rate of about 1 km per day. The rate of movement of the work area depends on the nature of the terrain, presence of "special areas" and other factors. Within the work area the activities for construction of the pipeline ranging from survey and setting out of the route to terrain reinstatement / land reclamation will be carried out. The average length of the work area is expected to be about 15 km.

In addition to the works in the main working area, special teams will carry out activities related to crossing of roads, railways, rivers, facilities, etc., requiring implementation of methods other than standard. For example, areas of high ecological sensitivity will require application of more different methods to construct the pipeline, and also construction will be carried out at the most suitable time so that the environmental impact is minimal.

Construction activities are carried out within a temporary fenced off area called a working width. Working width is normally about 30 m and varies depending on specific conditions. It can be greater near roads, rivers and other obstacles that the pipeline has to cross in order to provide adequate area for works and storage of additional specialized equipment and materials. The working width can be smaller in sensitive areas or near existing facilities. Access to the working width will be provided at certain points in agreement with local authorities, owners and land users. Access points will be properly controlled and marked with the appropriate signs.

The EIA report makes assessment of the effects of the construction works for the pipeline listed below which have the potential to impact the environment and population:

1. Temporary use of the land
2. Demobilization
3. Drainage system
4. Site preparation and removal of topsoil. Excavation of trench and laying the pipe
5. Site reinstatement
6. Crossing of obstacles - riverbed, river, stream, road, railway, etc.
7. Delivery, arrangement and storage of pipes
8. Transportation
9. Supply of fuel and other hazardous substances
10. Fuel and oil storage
11. Fuel refilling
12. Operation of motor vehicles and installations, facilities, equipment, machine sets
13. Maintenance (repair) of installations
14. Production and accumulation of waste
15. Storage and removal of waste

16. Waste water treatment
17. Gray water (laundry, kitchen) – water treatment
18. Storage of chemicals
19. Water discharge, sewerage
20. Energy production
21. HDD (horizontal directional drilling) for river crossing
22. Concrete cover/construction of slab
23. Drilling into mud, concrete cover, plastering, lining and painting
24. Welding and coating of joints
25. X-ray testing
26. Hydrostatic test – cleaning, measurement and testing of the pipeline
27. Device known as " cleaning pig" to clean pipes, being driven inside the pipes by pressurized water or air.
28. Emergency actions
29. Pipe failure
30. Smoking
31. Earthquake
32. Temporary roads
33. Construction of above ground installations on sites – including site selection, selection of place for the construction of buildings and necessary facilities, laying of cables, installation of lighting, fiber optic cable laying, construction of temporary roads, fencing off the site.

The construction period will be 3 months for small above ground installations (AGIs)– sites on which *BV2, BV3A, BV4, BV6* and *BV7* will be constructed, and 6 to 9 months for large stations. Duration of the construction works in Bulgaria is expected to be about 9-10 months. For example, sites at Kardzhali (Type 3), Dimitrovgrad (Type 4) will take 6 months to construct, while the GRS/PS at Stara Zagora - 9 months.

Some of these works are described below.

1.3.1.2 Preparation of the working area

The requirements for provision of access and temporary use of the land are agreed with the land owners and users before start of the construction works for the pipeline and after geodetic survey and setting out the route. The specific features of environment and population will be considered and appropriate actions taken. This will include, for example, completion of rooting of trees and shrubs only in due season, public announcement of planned activities before start of construction works, etc.

1.3.1.3 Fencing off the working area

Before start of the construction works the working area will be surrounded by temporary fencing in agreement with land owners and users. On arable land fencing is normally by ropes fixed on wooden posts, while in areas with animals mesh wire and/or barbed wire fence will be installed depending on specific requirements. This fencing will have doors and thresholds at points where access is required, such as walkways, roads to farms, paths of domestic animals.

1.3.1.4 Preparation of terrain and removal of topsoil

Normally, the topsoil is removed along the working width, stored on the one side and is not mixed with the remaining soil, which is stored on the other side of the trench, to avoid its damage due to compaction. In places of highly sensitive environment or infertile soil it will be acceptable not to remove topsoil and instead construct temporary roads by geotextile and/or crushed stone over ground. In such cases, topsoil will be removed only in the area over the trench for pipe laying.

In the event of encountering a hedge, only a small part of it will be cleared so as to provide access to work and then it will be restored. Older trees are retained where possible, and the stones of stone walls are stored for subsequent restoration of fences.

Methods of crossing through obstacles are described in section 1.3.1.10 below.

1.3.1.5 Arrangement of pipes

The pipeline is constructed from single pre-coated pipes of length from 12 to 18 m. The pipes are first delivered to the pipe depot (ideally located near the working area). After that pipes are transported to the working width where are placed on wooden sleepers or special beds in a line parallel to the pipeline trench. Pipes are spaced at distance from each other in these places where passing through the working width is needed. Pipe elbows are fitted where the route changes direction.

1.3.1.6 Welding and coating of joints

The pipes will be supplied pre-coated over their entire length except for the ends. The pipes are welded with each other to get a whole pipeline, and weldings shall be subject to X-ray testing. The defects are removed and then re-testing will be done. After welding and X-ray test, metal surfaces at the ends of the pipes shall be cleaned and coated so that the whole pipeline is coated. Then the coating is electronically tested over the entire length to detect any damages or other defects. Detected defects are removed and the coating is tested again.

1.3.1.7 Excavation of trench and placing of pipe

Trench will be excavated to such depth that after the pipe is buried the minimum cover over will be around 1.1 m. When crossing roads, railways, special areas and other obstacles depth of laying the pipe (and the cover over it) may be greater. Topsoil and the lower layers of soil excavated from the trench, will be stored separately from each other. In some places drainage of trench may be required. For such sites schemes will be developed for each case in agreement with affected owners and users before starting works. The pipeline will be laid in the trench with special equipment, taking care not to disturb the pipe coating. Standard factory finishes are three layers of polyethylene (3LPE) or epoxy coating - Fusion Bonded Epoxy (FBE). They provide the necessary protection for the pipe against corrosion. After laying the pipe, the trench is backfilled with excavated material and is carefully compacted. The expectation is that there will be no surplus material from the excavation, but if such is left, it will be spread across the whole width of the construction site. In the construction of above ground facilities some surplus spoil may be left and it will be temporarily stored on site and subsequently, upon completion of construction activities, will be used for the reclamation of the sites.

1.3.1.8 Cleaning, measurement and testing of the pipeline

It is designed to detect any discrepancies which will be corrected, if needed. Then the pipeline is hydrostatically tested. In such test, stretches of the pipeline are closed and filled with water, then the pressure is increased to a predetermined level higher than that at which the pipeline will be operated. Normally, water volumes required for testing of the pipeline is supplied from sources close to the route, mostly flowing surface water or regulates reservoirs, and then reused for next pipe stretches or discharged in accordance with approved methods and recommendations of the EIA report. Normally, filling one test segment lasts 2-3 days, testing takes 24 hours and the discharge of water takes another 2-3 days (to avoid burst discharge). It will be needed to take appropriate measures so that water intaking and discharge used for the tests will not have any significant adverse impacts. Upon completion of hydrostatic testing the pipeline will be dried before being filled with gas.

1.3.1.9 Reinstatement of terrain

Reinstatement, including the return of removed topsoil and planting of vegetation usually takes place in the year of construction of the pipeline, unless weather conditions are unfavourable. Reinstatement can include deep plowing and loosening the soil if it has been severely compacted, then spreading of the retained topsoil. Banks, walls, fences, etc. located in the working width will be reinstated. Markers to indicate the pipeline and test points for cathodic protection are placed at predetermined places. Most often, they are located at the borders of the land plot so as not to interfere with agricultural activities. Finally, temporary fences around the working width will be removed, unless users choose to retain them until vegetation is fully recovered. In sensitive areas, reinstatement works can be modified according to specific conditions.

1.3.1.10 Crossing of obstacles

Crossing of roads, railways, rivers, etc. is called "special areas". In these areas the standard procedure for pipeline construction will be adapted according to the specific conditions and requirements of the relevant authorities and the land owners and users. Moreover, in the special areas can be applied additional measures to protect the pipeline. These may include deeper burial of the pipe, using pipes with thicker walls, placing concrete slabs above the pipe, anchoring or grouting of the pipe with concrete.

The open cut method is the fastest way to cross through obstacles:

- For small roads where traffic violations are less and there are no sensitive ecological zones crossing is by digging an open trench in the road. Then the pipe is laid inside the trench and the excavation is backfilled. The road pavement is then restored. The road will not be closed completely during construction, and normally a temporary steel bridge is installed for passing of motor vehicles over the trench.
- When crossing small rivers by the open cut method the river will be blocked by a dyke and the water transferred by pumps from upstream to downstream. This method, however, is not applicable for large rivers where horizontal drilling is used for short distances or HDD for distances over 1 km.

Horizontal drilling is often used when crossing busy roads and railways, where digging an open trench will cause unacceptable disruptions. The method is applicable also for crossing under some rivers. In this method two excavations are made on both sides of the obstacle. The one excavation has to be larger enough to accommodate the drilling machine with the rail track on which it moves, and a whole pipe. The working width when crossing the obstacle is greater to enable collection of more excavated soil, additional facilities, equipment and convenience fixtures for workers. The method is not applicable in case of large stones in the soil (boulders).

Horizontal Directional Drilling (HDD) is normally applied for underground crossing of larger distances under wide roads, major rivers, etc. This methods uses a guided drilling head to bore a path under the obstacle to come out on the other side. The working area of this method is greater to enable to accommodate the additional equipment, facilities, excavated soil and topsoil. In this method bentonite (fine natural clay) as a lubricant is generally used during drilling. It is fed by pumps from tanks to the drill head through the hollow drill pipe. Bentonite is mixed with the excavated material and under the action of pressure returns back through the borehole to a recycling system where it is separated from excavated material for reuse.

The depth of laying the pipes depends on the method of crossing through obstacles - under water bodies and rivers the depth of pipe laying is typically 1.8 m, but it can be up to 20 m (with the HDD method) depending on terrain conditions . Typically, the depth in HDD is 3-4m. It is proposed that the Studen Kladenets Reservoir and the Maritsa River at the Western Route will be crossed by HDD, and the smaller rivers by the open cut method. The crossing profile of the Arda River in the Eastern Route is not suitable to use HDD and, therefore, regardless of the sensitivity of the Arda River area, it is propose to use the open cut method.

Below are given several examples of crossing of special areas:

- Forests and hedges - Where possible, the pipeline route avoids these obstacles, but in some places it has to run through them. In these places vegetation has to be uprooted, and if possible, the route will run through younger trees or those in worse condition. In forest areas along the pipeline route of both alternatives the easement area shall be kept clear of trees and shrubs according to design requirements and the provisions of Decree No 16 of 9 June2004 on Easements for Energy Facilities (*the State Gazette, No 88, 8 October 2004, as amended in the State Gazette, No 77, 2 September 2008.*) so that tree roots will not damage the pipe coating. Pursuant to Article 2 of the above Decree: "agricultural land and allocated forest land (forest clearings) in the easement area of gas energy facilities can only be used for planting annual crops with short roots.
- Areas of conservation significance in terms of environment and archeology - The crossing of these areas requires special care. Specific construction methods here depend on the nature and sensitivity of the area. Normally, the working width and area of removal of topsoil is reduced, and a more special scheme for movement of construction machinery may apply. Also, more special methods for restatement of the terrain may be used. The approach to these areas is in agreement with the relevant institutions.
- Faults - Normally, the pipe will run at right angle in crossing and will be laid in a wider trench filled with a material capable of absorbing any shocks and dislocations. Pipes to be used in this area will have much thicker walls than normal.
- Existing pipelines and other services - Before start of construction works, the underground facilities located near or crossing the pipeline route will be exposed by excavation or detected by underground detectors. Where appropriate, these works will be carried out under the direction and supervision of representatives of institutions responsible for the underground installations. Crossing will be completed in accordance with regulatory requirements.

1.3.1.11 General engineering conditions for the pipeline

Pipes

The pipes will be manufactured from high quality stainless steel in accordance with internationally accepted standards. A thicker walled pipes will be used where additional protection is required, e.g. crossing of main roads, rivers and railways, or in areas with high population density, etc. Soil surveys will be conducted before the final determination of the technical details of construction pipes and crossings. Among other things, land and access to the necessary above ground facilities along the pipeline route will have to be provided. In settlement of land issues, it will be necessary to ensure protection of the pipeline structure, i.e., normal agricultural practices in the area shall not exceed a depth of 300 mm. In agricultural land it is normal to provide a minimum 1.1 m land cover over the pipeline. When crossing roads, railways, waterways and pipelines, coverage may be larger as required. For higher levels of protection it may be necessary to use concrete cover or thick-walled pipes in accordance with the appropriate regulations and standards.

<u>Corrosion protection</u>

Protection of the gas transmission system against external corrosion due to chemical and biological processes is of great importance. This is achieved in two ways:

- By highly resistant anticorrosion coating which is factory applied, and after laying of pipes welded areas are re-coated; *The standard factory coatings for the pipes are three-layer polyethylene (3LPE) or epoxy coating - Fusion Bonded Epoxy (FBE).* They ensure protection of the pipe against corrosion.
- By cathodic protection and / or anode system in addition to the anti-corrosion coating in specific circumstances.

Internal corrosion will not be significant since the natural gas used is dry and non-corrosive.

When designing the Cathodic Protection System (CPS) it will be necessary to study resistance on the basis of which the level of corrosion along the route will be determined. Other factors that may affect the design and location of the CPS are:

- availability of conveniently located power supply;
- location of other CPSs near the pipeline;
- diameter of the pipeline wall thickness, pipe coating;
- other considerations and recommendations in this EIA report.

The integrity of the coating of the pipes will be checked and tested electronically before their Installation. The cathodic protection will also be examine prior to commissioning of the pipeline and at regular intervals thereafter. If the protection is not satisfactory as required, remedial works will be carried out to restore it.

<u>Above ground installations</u>

Above round installations will be designed in accordance with the appropriate coordination regimes and has to obtain a construction permit. Also, the will have a security fence with appropriate entries. A recording system for instrumentation signals to the pipeline will be provided.

<u>Impacts from construction and mitigation measures</u>

Revocation of topsoil, digging of trenches, crossing of infrastructure and other structures are the main considerations and where construction works can cause impacts because of damage to soil structure through compaction. The main measure to mitigate the impact on soil compaction is carrying out construction activities when soil is least susceptible to deformation. This is usually the period between April and October. Crossing and / or interruption of drainage systems is also not a minor consideration in terms of environmental protection.

<u>Restrictions on construction</u>

As part of the responsibilities of the Contractor should be included his specific obligations to avoid or minimize environmental damages during construction and prevent public inconvenience. These include as a minimum the following requirements for the Contractor:

- to obtain construction permits from the relevant authorities before start of construction activities on the pipeline;
- to carry out construction works within the agreed work easement and using the approved access roads;
- to notify the land owners / users prior to the start of construction works so that they will have time to prepare in advance;

- to take measures to maintain public roads affected by construction in clean and orderly condition, and measures against traffic offences;
- to provide roads for the passage of the owner/users, as well as farm animals;
- to maintain rights of way in areas affected by the construction and / or construction traffic;
- to restore the drainage system, if affected by the pipeline trench;
- to adhere to restrictions on felling or pruning of trees;
- to maintain the easement in clean and good condition;
- to store and use the material so as to minimize possible contamination;
- to restore the land to its previous condition or as agreed;
- to comply with all conditions imposed by the competent authorities.

Normal working hours for general activities such as removal of topsoil, welding, pipe laying and driving of motorized machinery and equipment between 07.00 and 19.00 hours. Exceptions are possible during non-destructive and hydraulic testing, and at commissioning itself, and in special circumstances, e.g. horizontal drillings. These are continuous activities that generally affect only the end points of the pipeline.

For compliance with all of the above obligations the Contractor of the pipeline is required to have experience in the construction of pipelines under similar conditions and have experienced staff and appropriate equipment and resources.

<u>Construction supervision</u>

There will be construction supervision for the supervision of the construction of the pipeline and related facilities to ensure safe, efficient and professional execution of the works. Also, the supervising engineer shall verify that completed construction works meet the best construction practices and are carried out in compliance with all granted approvals, authorizations or other permits.

1.3.2 Operation

Commissioning of the gas transmission pipeline will be carried out in compliance with the provisions of the *ORDINANCE on the construction and safe operation of gas transmission and distribution pipelines and facilities, installations and instrumentation for natural gas, (Letter of the Council of Ministers No 171 of 16.07.2004, published in the State Gazette, No 67, 02.08.2004*) and BDS EN 12327. Operation of the pipeline and its facilities will be in accordance with Chapter 8 of the above Ordinance. At normal operation of the project the natural gas transported in Bulgaria will be from 1.0 to 5.0 bNcmy.

The projected date for commissioning of the project is 2014.

Operation and servicing of the pipeline will be controlled by an O & M Centre. It is proposed to construct it near Haskovo, but the Contracting Entity may choose another location.

The service staff is expected to be about 32 people and include one manager, contract manager, shift supervisor, maintenance head, cathodic protection engineer, 12 dispatchers, 6 pipeline maintenance technicians who will work in the field, 3 maintenance operators who will work in an office and monitor the maintenance of above ground installations from the O & M Center. For the operation of the O & M Center will be needed also a secretary, who will be responsible for administrative work, 3 security guards and 2 persons responsible for site maintenance and cleaning. There will be technical teams to provide round the clock support, working in shifts. Each shift will consist of 2-3 persons and include one maintenance head and two technicians.

The expected operational lifetime of the pipeline is 40 years.

After commissioning of the pipeline system, it shall be operated and maintained so as to be safe and in good condition. Protective measures incorporated into the design of the pipeline, along with regular monitoring, shall ensure the elimination of uncontrolled actions by third parties, which could cause damages and are a major risk for the pipeline.

The normal monitoring practices are as follows:

- Periodic visual monitoring - performed by a LES team (Line Operational Service). Its duties will include regular inspections to detect any changing conditions along the route and activities of third parties that compromise safety. Inspections may be carried by a motor vehicle or on foot, as well as by air, every few weeks.
- Inspection of the pipeline (by means of "intelligent pigs") – special "intelligent pigs" will be driven inside the pipeline at least once every 10 years to check the technical condition of the pipeline and identify possible signs of corrosion or damage.
- Cathodic Protection System (CPS) – monthly inspections of the energy system of CPSs and/or via the electronic monitoring system, and two measurements of soil potential at CPS centers per year. In order to facilitate access these centers are typically located near road intersections.

Certain procedures will be implemented for the operation and maintenance. An emergency action plan will be drawn up as part of these procedures which will include emergency and recovery measures. These plans will be coordinated with the emergency services and local authorities to which complete information will be provided.

1.3.3 Decommissioning

The above *ORDINANCE on the construction and safe operation of gas transmission and distribution pipelines and facilities, installations and instrumentation for natural gas* and related Bulgarian and European standards do not cover permanent decommissioning of transmission gas pipelines and their facilities. In this regard, after shutdown and emptying of the gas transmission network and facilities, the equipment will be dismantled in accordance with the provisions of BDS EN 12327 and sites closed in compliance with general engineering safety rules.

The pipeline will be decommissioned when it reaches the end of its useful life. Detailed procedures for decommissioning will be prepared for that phase. As recommended in the codes and standards for gas pipelines, pipes buried in the ground will be stabilized by filling with suitable material and left in place because removing them would cause more damage to the environment. Above ground facilities will be dismantled and the site will be restored to its original state.

2 STUDIED ALTERNATIVES FOR LOCATION AND ALTERNATIVES IN TECHNOLOGY AND MOTIVES FOR THE CHOICE MADE FOR THE SURVEY, CONSIDERING ENVIROMENTAL IMPACT, INCLUDING „ZERO ALTERNATIVE”

The EIA report should consider alternatives studied by the Employer for the location (with sketches and coordinates of characteristic points in the coordinate system approved for the country) and technology alternatives and the reasons for the choice of study, taking into account the impact on the environment, including "zero alternative ".

2.1 Zero alternative (current status)

Zero alternative is the current situation, when an investment proposal is not realized

Alternative "zero" corresponds to the current arrangement of natural gas supply from Russia through Romania for consumption in Bulgaria, in transit to Turkey, Greece and Macedonia and related processes and infrastructure without the realization of the investment plan. The system for the transportation of natural gas to Turkey, Greece and Macedonia includes transmission pipelines (branched network), served by six compressor stations and other facilities. National Gas Transmission System includes main transmission pipelines connected in a closed ring, main gas pipelines branches to major industrial consumers, three compressor stations, gas regulating stations to main diversions and other facilities. The two systems are connected in CS "Lozenets" and CS "Ihtiman."

Based on existing National Gas Transmission System in recent years investment proposals have been realized for gasification of settlements.

2.2 Alternative „1”

Alternative “1” is associated with the implementation of the investment proposal. Its advantage is that it connects the National Gas Transmission System with a new source of natural gas and the opportunity for transit of gas to neighboring countries. With this addition to the direct economic benefits associated with the implementation of the proposal, the role of Bulgaria as an energy hub in the Balkans strengthens.

As regards the technological arrangement for the transmission of natural gas, which includes the reviewed processes and infrastructure, the investment proposal has no alternative.

The proposed technological arrangement is classical for the natural gas transfer over land. The selection of appropriate equipment, enabling effective management and control in compliance with all requirements for safe operation and environmental protection, it can be classified as the best available technique.

There are different technical solutions (options) to the route of the transmission pipelines, the number, type and location of service facilities.

In this regard, subject to the terms of route selection under the general concept of the project requirements and the restrictive requirements for arrangement and the safe operation of transferring gas pipelines, facilities and equipment, as well as environmental protection, material and cultural heritage, Alternative "1 " provides two alternatives for the route location – Western route and Eastern route.

For these proposed alternative routes sub-alternatives are also considered in some areas, for example, two options are considered for the Western route passing under the dam Studen Kladenets (where the block valve stations - Block Valve Station 2A of the south coast and Block Valve Station 2B on the north coast are in one and the same place and the affected areas are nearly identical):

- passing under the dam with controlled horizontal drilling (*HDD*);
- passing through the dam with a trench (*open cut*).

2.3 Alternative locations ot the investment proposal – evaluation and comparison

2.3.1 General

This section contains the evaluation and comparison of Western and Eastern route to select a "preferred route", to be submitted for approval by the relevant authorities.

After receiving approval to proceed to Phase 2, where "preferred route" is developed in detail and focus is directed on the axis of the pipeline.

2.3.2 Actual comparison of the Western and the Eastern route

Although the diversions of the main gas supply pipeline along the Eastern route are not a part of the scope of this assignment, they are a significant factor in the overall assessment of one route over the other.

A good example is the comparison of the lengths of the routes. The Western route is 5 km longer than the Eastern, but for the pipeline diversion to Kardzhali from the Eastern route further 22.7 km pipeline will need to be constructed, while the Western route passes close to Kardzhali and it will not be necessary to construct additional pipeline diversion.

2.3.3 Assessment of the factual data

To give a quantitative assessment of the risks, each component is rated on a scale from 1 to 5, where 1 = low risk, 2 and 3 = medium risk, and 4 and 5 = high risk.

The worst case in each column (2 to 5) is colored in orange and columns 6 and 7 present the evaluation from 1 to 5 of 20 components with a total score 100, where 100 is the highest risk, while zero - the lowest.

	Component	Western route (Km)	Estern route (Km)	Estern diversion (Km)	Western route-evaluation	Eastern route-evaluation
1	Length of the pipe line from the border to Zagore	150.57	145.67	inapplicable	3	2
2	Length of the diversion to Kardzhali	inapplicable	inapplicable	22.70	0	4
3	Length / % of the pipeline in mountainous terrain	28.45 (18.9%)	76.4 (52.4%)	7.1 (31.3%)	2	5
4	Length / % of the pipeline in lowland terrain	122.12 (81.1%)	69.27 (47.6%)	15.6 (68.7%)	1	4
5	Length / % of the pipeline through Natura 2000	7.32 (4.9%)	27.4 (18.9%)	1.2 (5.3%)	1	4
6	Length / % of the pipeline in protected areas	4.47 (3.0%)	8.6 (5.9%)	8.9 (39.2%)	2	3
7	Length / % of the pipeline in forest areas	7.44 (4.9%)	26.46 (18.2%)	5.8 (25.6%)	1	4
8	Number of crossings of significant obstacles	78	52	5	3	2
9	Length / % of total route	50.27 (33.4%)	50.27 (33.4%)	inapplicable	2	2
10	Availability of public roads	Good	Bad	Average	2	4
11	Access to rail lines	Good	Bad	Bad	1	4
12	Need of access to temporary roads	Good	Bad	Bad	2	4
13	Conditions for Construction	Average	High	High	3	4

14	Overall impact on the enviroment	Average	High	High	3	4
15	Proximity to cities	Good	Bad	Bad	2	3
16	Risk of interruption due to weather	Average	High	High	3	4
17	Proximity to site facilities	Good	Bad	Bad	1	3
18	Approval of the proposal by the public	Average	Average	Average	3	3
19	Approval of the proposal by the authorities	Average	Average	Average	3	3
20	Impact on geology	Average	Average	Average	2	2
				TOTAL	**40**	**68**

Fig. 2.3.3-1 – Comparative table for evaluation of the two routes

The results of this comparative assessment, though not entirely scientific, are considered to be objective and based on facts. The chart clearly shows that the Western route has medium risk (with a score of 40/100) and the Eastern route - high risk (with a score of 68/100). The evaluation is only in terms of environmental factors and does not include considerations regarding the costs of construction and operation of pipelines.

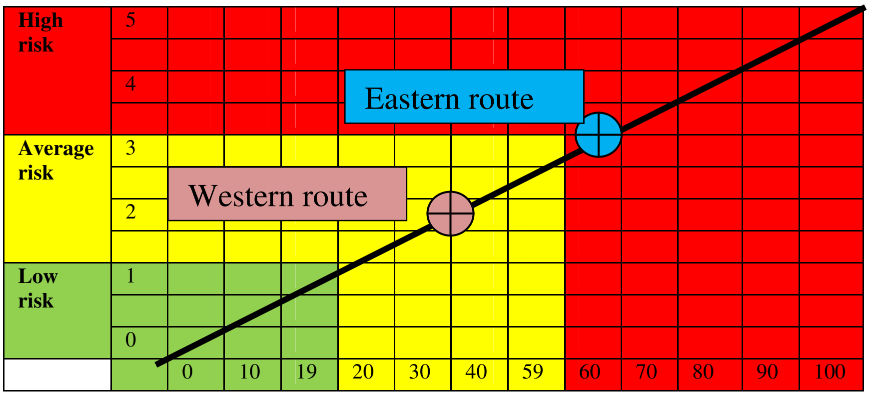


Fig. 2.3.3-2 – Results from the comparative assessment

Construction in mountainous terrain brings about greater risks and requires experience. Construction activities are much slower because of the observation of specific safety measures. Welding speed is about two times slower than that in lowland terrain.

Climatic conditions are a serious problem, since due to clouds or fog works may be ceased. Working with heavy equipment in the mountains can bring to the workers serious safety problems. When cutting trees on the ridge there is a risk of an increase in wind speed in the formed corridors and risk of falling trees including soil erosion due to lack of protection against erosion afforded by the root systems of trees in the shallow soils. That is why construction companies should have relevant experience and know what precautions and measures to implement for erosion prevention.

In this proposal there is no other option than to make the route go through the border mountain chain, but the Western route could descend into lowland terrain after the first 6 km - much faster than the Eastern route, which is remote and has no convenient road network.

In view of the Natura 2000 it should be recognized that the Eastern route, even without considering the pipeline diversion, crosses four times more Natura 2000 areas than the Western route.

It is also ascertained that the Eastern route covers 46 times more forest areas than the Western, and 29.1 percent of the pipeline diversion also passes through forest areas, which is too large percentage to be acceptable.

Besides the Eastern route is 5 km shorter than the Western, its only other advantage is the fact that there are fewer crossings of significant obstacles, but this is understandable as the Eastern route passes through mountainous and remote areas not been developed due to the poor quality of land and steep slopes.

The biggest hurdle which the Western route has to overcome is crossing the dam Studen Kladenets along Arda River near Kardzhali.

This challenge is not facing the Eastern route, although it must also cross the river after the dam Studen Kladenets, the intersection will have a length of 70 m.

The maximum measured slope of the terrain, acress which the pipeline route runs along the Western route is 16.91 ° (30, 4%) at km 5 +930 and along the Eastern route is 19.34 ° (35.1%) at km 6 +140. Thus, the requirements placed on the Employer in the EIA Requirement, which says to avoid sections of the pipeline with downhill slopes or climb higher than 35 ° and lateral earth with great length and with a maximum slope of 45 °.

2.3.4 Conclusions

The results of the comparative assessment are convincing that the western route is of medium **risk** as compared with the **high risk** of the eastern route. Apparently, the environmental impacts of the western route will be much smaller as shown below:

- The eastern route is 5 km shorter than the western, but with the additional 22.7 km pipeline offtake (outside the scope of this Scope of Services) to Kardjahli, the initial advantage is lost;
- A gas offtake of length 400m will be necessary at Dimitrovgrad, but it is required for both alternative routes and therefore it is not a decisive factor in this assessment (outside the scope of this Scope of Services);
- The eastern route crosses over two times more mountainous terrain that the western route - 76.4 km to 28.46 km for the western route;
- The percentage of the Protected NATURA 2000 Sites crossed by the eastern route is 8.6% as compared to 4.47% for the western route, and this value is further increased if the Kardjahli offtake is added, as 6.5% of its total length of 22.7 km also passes through Protected NATURA 2000 Sites;
- In terms of woodland crossed by the routes, the eastern route crosses 26.5 km (18.2%), while the western route involves only 7.44 km (4.9%). The Kardjahli offtake adds another 5.8 km (25.5%) to the figures of the eastern route.
- Access to public roads in the eastern route is very limited and poorly maintained for the southern half of the eastern route from the point of its convergence with the western route. Therefore, it may require temporary haulage roads to be built into mountainous terrains which could take months before the construction of the pipeline can start. Land used for this purpose has to be reinstated later.
- The eastern route offers few level sites sufficiently large enough to set up pipe storages and site offices. The eastern route will probably need to use the same areas proposed for the western route, and then involve a 20 km drive to reach the eastern route “coverage”.
- Equally difficult is the haulage of pipes on the few very winding mountain roads to the eastern route in its southern section. If 18m long pipes are purchased then lorries must have steering wheels on the rear axel to negotiate around the twists and turns on these roads, and even then they can cause damage to the roads.
- The western route is served by a single railway to Dimitrovgrad, Haskovo, Kardzhali, Momchilgrad and Podkova, located only a few kilometres from the proposed pipe unloading and storage places, whereas the eastern route has to make use of the same pipe storage sites, but the pipes have to be hauled at much greater distances to reach the work areas.
- With such a large percentage of the Eastern route in mountain areas exceedance this of the Western route, the Eastern route is at greater risk of adverse weather conditions. The

clouds can descend rapidly down and within just one hour to form fog. This is a very disturbing factor concerning the safety construction works.

- The only advantage that the eastern route has over the western route is that it has 26 fewer major crossings even when the Kardzhali offtake crossings are added. Also there is only one general crossing through the controlled horizontal drilling (HDD) with a length of about 520 m at the Maritsa River near Dimitrovgrad (in a protected area from the Habitats Directive). The Western route is challenged to make such a crossing (HDD) with a length of about 1500 m through dam Studen Kladenets (part of the river system of Arda River and protected area under the Birds Directive). The Eastern route should cross Arda River too, near the village of Rabovo (in a protected area under the Birds Directive), but this is expected to happen by an open trench with a length of 70 m.
- There is a possibility the pipeline construction to happen simultaneously in several individual working areas so that construction can be completed in one season. In this case, there will be several teams, about 250 men each, during the peak months from the beginning of March to end of June.
- The accommodation of so many people will be without problems in Momchilgrad, Kardzhali, Haskovo and Dimitrovgrad, as far as the western route and the northern section of the eastern route are concerned, but the southern part of the eastern route will experience big problems unless workers are transported from Momchilgrad and Kardzhali which will cut down the day working time (normally from 7 to 19 pm Monday through Friday and from 7 to 14 pm on Saturdays). The villages in the mountains just do not have the capacity to accommodate such a large number of workers.

From the data described and the above conclusions it is obvious that the Western route is the preferred option to be considered and approved in the next phase of this proposal with a great significance for ensuring the security of gas supplies to Bulgaria in the shortest possible time.

3 DESCRIPTION AND ANALYSIS OF COMPONENTS AND FACTORS OF THE ENVIRONMENT AND MATERIAL AND CULTURAL HERITAGE THAT WILL BE SIGNIFICANTLY AFFECTED BY THE PROJECT AND INTERACTION THEREOF

3.1 Atmospheric air and atmosphere

3.1.1 Weather and climate

Both alternatives of the route of the Gas Interconnector Greece-Bulgaria fall within two continental climate sub-zones - the Transitional-Continental and Continental-Mediterranean.

The pipeline route passes through a region of the Transitional-Continental climatic subzone-Climatic region of the Middle East Bulgaria. Within the Continental-Mediterranean zone it passes through two regions: Climatic regions of eastern Rhodope river valleys and Brannishko- Dervennski climatic region.

Climatic region of Middle East Bulgaria.

The region is characterized by relatively homogeneous terrain with altitude of 150-200 m. The winter in this region is relatively mild with average January temperatures of about 0 ° and relatively frequent warming. January includes an average of 15-17 days with a positive average day and night temperature. Winter thermal conditions are largely influenced by the position of the Balkan Mountains, which act as a barrier to cold invasions with northern component. For this reason, the snow here is more unstable than in Northern Bulgaria, lasting about 20-30 days.

In the eastern regions the winter is even milder and it lasts only about 15 to 25 days. Winter precipitations are at average of 100 to 150 mm and only about 30-35% of them are snow.

Summer is relatively hot with average July temperatures around 23°, in the eastern regions around 21-22°. The number of days with average day and night temperatures above 25 ° is around or over 20.

Summer rainfalls exceed those during winter with about 10% of the annual precipitation. This is an indicator of the transitory nature of the climate from Temperate-continental to Mediterranean climate.

Climatic region of Eastern Rhodope river valleys

Winter in the Eastern Rhodope river valleys is specific for its softness. The average January temperatures in the region are positive, as over slopes, where is draining cold air, the temperature in January is between 1 and 1, 5°. There are about 17-18 days in January for this region with average temperatures above 0°. Against the background of these soft winter conditions sometimes happen quite strong cold snaps. In such situations, in the lower parts sometimes temperatures could drop down to 24-26 ° below zero, while in the same time on the slopes temperatures haven't gone down more than 16-17 ° below zero.

During the winter the region receives about 150-180 mm precipitation, while its southern part - about 200 mm. The winter time is not only the period with highest precipitations, but in early winter and late autumn the precipitations in this region are most abundant during the year. In the region precipitation is measured during day and night time that exceeds 100 mm. Due to its southern position in the region most of the winter precipitations are rains, which sometimes lead to catastrophic rise in the waters of Arda.

The first snowfall forming the first snow cover as average occur in mid-December. However, this snow cover is short-lived. After it, a snow cover is formed a few more times, but rarely stays for 5-6 days.

Summer is dry, sunny and hot. Average cloudiness in July is between 2-3 ball in 16-17 clear days (cloudiness <0) and not more than one dark day (cloudiness> 8 ball). Average July temperatures are between 23 ° and 25° and there are 7-8 days, when the average daily temperature is above 25°, as in lower parts of the Marichina valley, such temperatures occur in every 14 to 15 days. In terms of hot flushes air temperatures could exceed 42°.

Throughout the summer season only about 110-130 mm precipitation is gained. The annual precipitation in the area around Maritza is 550-600 mm, and in the rest areas - 650 mm.

Branitsa - Dervent climatic region

January temperature is within the range of 0, 5 ° ÷ 1,0 °, the minimum temperatures are higher than those in the lower parts of the neighboring regions. From an altitude 600 m and above, the average January temperature can be assumed approximately about 0, 5° and lower.

First snow cover is generally formed at the end of the first decade of December and disappears at the beginning of the second decade of March. In winter the region is dominated by northern and northeastern winds, in its higher parts being quite strong. Winter precipitations are about 150 mm to about 190 mm and at average 40-50% of them are snow. Precipitation period is mostly in the period from November to December, during this period, as well as in the middle of autumn abundant precipitations are possible, and day and night precipitation may exceed 100 mm.

Summer is sunny, dry and warm. Average cloudiness in July is below 3 ball in 15 to 16 clear days (cloudiness <2) and in only 1-2 cloudy days (cloudiness> 8 ball). The average July temperature is about 23 ° - 24°. During the hot summer days maximum temperatures exceed 38-39°.

In the higher parts of the region the summer temperatures are lower - the average temperature in July is 20-21°.

Summer precipitation is between 120-160 mm. In the late summer and early autumn drought occurs rapidly. The annual precipitation is about 560-680 mm and it is gained within 60-70 days with precipitation.

Detailed analysis of the main meteorological elements, based on the representative weather stations of the pipeline route (Stara Zagora, Dimitrovgrad, Harmanli, Haskovo District) is given in Appendix 3.

Both alternatives of the investment proposal are characterized by a general climate background. However, it should be noted that the eastern alternative goes through a complex and forested terrain, which will lead to some micro-climatic variations, worse than the at western alternative.

The combination of the specific climatic, orographic and anthropogenic factors is leading to enhancement or reduction of their effects on the conditions of distribution of pollutants in the air.

Construction of facilities, which during accidents can lead to explosive discharge of pollutants in the atmosphere in regions with complex geometry, combining mountains, canyons and river valleys, inevitably requires performance in strict compliance with the relevant requirements and standards.

Generally, the climatic conditions for construction and operation of gas pipeline facilities, but any specific weather conditions along the route still need to be taken into account.

For the most of its part, the route passes through areas characterized by strong winds in the sector north- northeast and south-southwest, which in accidents and fires can transfer gas and smoke at large distances in the wind direction.

For the sections passing through mountainous terrain, should bear in mind the following:

- In some sections placed in closed decreases, characterized by high frequency of temperature inversions, in failures explosive atmosphere can be experienced, and although natural gas is lighter and rises, it can still reach dangerous concentrations and possible fire.
- In sections passing through openings in the forest, coinciding with the prevailing wind directions, at explosive environment and possible accidents, transfer of leaking gas can be speeded up.
- The significant revenue of the solar radiation, conditioned by the southern state of these territories, combined with humidity and precipitation (in some road sections and seasons) can be aggressive to the pipeline, which should be taken into account in the maintenance and operation. It applies mainly to the eastern alternative, which passes through more wood lands.

In conclusion it can be said that the Western route, due to its small length, which means less disruption of the crusty surface and relatively less complicated terrain (does not pass through so rugged and mountainous, forested areas) compared to the Eastern route, is the better of the two alternatives.

3.1.2 Ambient air quality

This section describes the status of ambient air quality (AAQ) in the regions through which the pipeline route passes, according to the database of the national system for monitoring of AAQ. This does not apply to the level of air pollution only within cities, where monitoring is conducted and is strongly influenced by the considered territory of industrial sites. All alternatives of the pipeline route are located outside urban areas, so that the level of concentration will be much lower.

The data used for the analysis of air pollution in the vicinity of the pipeline is taken from reports of RIEW - Stara Zagora and RIEW – Haskovo in 2010 and 2011, and the EEA newsletters for the past three months.

Table.3.1.2.1. Number of limit concentration exceedances by major pollutants in the stations for monitoring of AAQ along the pipeline route

Pollutant		Stara Zagora	Haskovo	Kardzhali	Dimitrovgrad
SO_2	Number of exceedances of ML for AHR - [350 µg/m^3	2- 2010 -	- -	26 – 2010 33 – 2011	13 – 2010 17 – 2011
	Number of exceedances of ML for ADR [125 µg/m^3]	-	-	3 -2010 4 – 2011	1 – 2010 5 – 2011
NO_2	Number of exceedances of ML for AHR (200 µg/m^3)	2 – 2010	-	-	-
ФПЧ$_{10}$	Number of exceedances of ML for ADR [50 µg/m^3]	9 – 2010 46 – 2011	331 – 2010 62 – 2011	84 – 2010 85 – 2011	113 - 2010г 70 – 2011

The major pollutant in all of the considered cities is fine particulate matter. The annual number of exceedances everywhere is higher than the allowed by the law 35 days. The highest and the largest number of MAC value exceedances have been recorded during the winter months, resulting from the use of solid fuels in households and the typical for this season - no wind, fog and temperature inversions that create conditions for retention and accumulation of pollutants in the surface layer. In Stara Zagora significant increase of pollution by fine particles has been measured in 2011 compared to 2010. In Kardzhali a high level of dust in the air with fine particles occurs consistently. In Haskovo and Dimitrovgrad there is a notable trend of reduction in number of cases exceedance the ADR for FPM10.

In Kardzhali and Dimitrovgrad high levels of pollution of sulfur dioxide have been observed.There is a tendency in both of the towns for increasing the number of cases exceedance the standards, although in Dimitrovgrad pollution of sulfur dioxide is significantly lower than that in 2009. Stara Zagora has 2 AHR violations that result from the transfer of emissions from Energy Complex "Maritsa Iztok". On 29.01.2010 in Kardzhali the instruction for informing the population in the case of three consecutive levels of sulfur dioxide exceedance the alert threshold of 500µg/m3 is observed. The highest level was recorded in January -1516.63µg/m3, which is 4.33 times the threshold (ML) for average hourly rate (AHR).

Air pollution by nitrogen dioxide is not a problem in the concerned cities. There is a trend for quality and sustainable reduction of air pollution in the region of Stara Zagora by nitrogen dioxide. In 2010 there are two reported exceedances of the threshold level (ML) of the hourly rate (AHR), for comparison, in 2009, the same AIS reported exceedances of 175 CT of LV on this indicator.

In Stara Zagora and Dimitrovgrad there are sporadic exceedances of the threshold by ground-level ozone (180µg/m3). Also 5 cases of exceeding the threshold by ground-level ozone have been observed in the eastern part of Stara Zagora in 2010. In Dimitrovgrad the number of exceedances in 2011 is 8.

For the town of Kardzhali the pollution with lead and cadmium is typical as well. Recorded levels for lead in ambient air of Kardzhali in 2010 exceed 2.05 times the average annual rate (AAR) of 0,5µg/m3, the average annual concentration was 1.0268 µg/m3. Compared to 2009 an increase of the average concentration of lead has been observed. In 2009, the levels exceed 1.66 times the average annual rate of AAR 0,5µg/m3, the average annual concentration was 0.8303 µg/m3. Recorded levels for cadmium in ambient air of Kardzhali in 2010 exceeded 2.27 times the average annual rate of AAR 0,00001 mg/m3, the average annual concentration was 0,00002270 mg/m3. The highest value for cadmium was reported in November - 0,000334 mg/m3. Compared to 2009, decrease I sobserved in the average annual concentration.

In ***Appendix 3*** detailed data of ambient air quality along the routes are shown.

3.2 Water

3.2.1 Surface water

According to the Bulgarian division of river regions, both alternative routes pass through Eastern Aegean region for basin management, which covers the central part of Southern Bulgaria. It has an area of 35,230 km2, which represents about 32% of the country.

On the east it borders with the Black Sea region for basin management (BRBM), on west - with the West Aegean region for basin management (WR BM) to the north -with the Danube region for basin management (DR BM) and on the south – with Republic of Greece and Republic of Turkey.

According to Annex XI of the European Framework Directive of Waters (EFDW) Directive 2000/60/EEA the entire Eastern Aegean region falls within Ecological region № 7 - "Eastern Balkans."

The management plan of the river basin (RBMP) is an essential tool for water management at the basin level and achievement of the objectives of the Directive.

East Aegean region for basin water management, with center Plovdiv, includes the catchment areas of the rivers of Tundzha, Maritsa, Arda and Byala Reka. Tundzha River flows to Turkey, and the rivers Arda and Byala - to Greece. The Maritsa River flows to the border between Turkey and Greece. All rivers merge into a river that flows along the border between Greece and Turkey and runs into the Aegean Sea. For the purposes of analysing the present EIA for the construction of an interconnector pipeline connection Greece - Bulgaria has considered two major basins crossed by the route, basins of Arda and Maritsa Rivers, as the Tunja River is outside the perimeter of the survey area and, therefore, will not be considered.

For the region of BDEAR 307 surface water bodies (SWB) have been identified, 246 of which of category "rivers" and 61 - of category "lakes". 103 of these heavily modified (HMWB) - 45 of category "rivers", which is 32.25% of the total length of the WB "rivers" (3720.83 km) and 58 of category "Lakes". Almost all surface water bodies of category "Lakes" are HMWB.

The internal annual distribution of the flow of the rivers in the EAR is determined by seasonal changes of the relevant outflow forming factors, typical with rains and unstable short-lived snow during the winter in the lower zones and holding relatively stable snow cover during the winter in mountainous areas of the basin, massive rains in spring and dry periods with small precipitation during the summer and autumn, high temperatures too.

The freshet is shifting gradually to the winter months with decreasing altitude of the basins, as in the easternmost and the most southeastern regions its maximum is in February, when up to 20% of the annual runoff is formed, while the higher parts of it is in May-June.

There was serious flooding in Maritza in August 2005, caused by one of the most destructive cyclones "Ihtiman", characterized by relatively stationary front, heavy rains, and in November 2007 before the Turkish border.

The low water-level for the high mountain areas comes after July but continues until the winter, when in February reaches its minimum (up to 1-2% of the annual water volume). For the lower mountain areas, the low water-level begins in July, while for the eastern and southeastern back in May to June, reaching its monthly minimum in September. Typical for the southern tributaries of the low water-level is that during the summer months it is reduced to zero, i.e. they dry up.

The main surface water sources are: dams, water catchments in the upper reaches of rivers, impounded spring waters. Most significant consumers are the industrial plants in cities and agglomerations.

Major point sources of pollution of surface waters (WWTP) are effluents of settlements and industrial emitters discharging wastewater into surface water bodies.

In major cities, the sewage network covers 95-100% of the wastewater, but in many places it is amortized and there are leakages. WWTP of settlements were built mainly during the 70s and 80s of the last century and for many of them the equipment has not been totally replaced yet, sometimes they do not function or provide unadequate purification, therefore, expansion, reconstruction and upgrade is required to remove nitrogen and phosphorus.

Concerning the industrial emitters: priority substances found on the EAR are cadmium, lead, mercury, nickel, zinc, copper, chromium (hexavalent 6), chromium (hexavalent 3) arsenic. They are released by the enterprises – pollitants from the following sectors and industries: Ferrous Metal Industry; Production of medical equipment, precision equipment and instruments; Galvanic coatings; Mining and processing of metal ores, Special Production, Manufacturing and repair of military equipment; Metalworking industry; Production of chemicals, Manufacture of electrical machinery and apparatus; Terminal of oil and oil sub products; Textile, Metal casting; Production of electricity and heat.

Significant pollution is loaded by specific organic and other pollutants discharged by enterprises – pollutants of: Textile production, Pharmaceuticals and medicines, mining and processing of metal ores, Production of chemicals and others.

Pollution from diffuse sources within the area of EAR comes from settlements without sewerage system built or such not well working, from agricultural areas treated with fertilizers and plant protection products (PPP), the cultivation of animals, and use of the resulting organic fertilizer, road and rail transport, deforestation activities around railways and roads when using pesticides, areas affected by mining, unregulated landfills for domestic waste, including within the floodplain terraces, etc., which is expressed in quantities of pollutants, respectively nitrogen, phosphorus and BOD5 in a particular area - a source of diffuse pollution.

Currently quantities and usage of pesticides in agriculture don't have a significant impact on aquatic ecosystems of the territory of BDEAR, because their concentrations in water are minimal or not detectable. However, the use of PPP in agriculture is a potential source of diffuse pollution of surface and underground WB, with significant negative effect on aquatic ecosystems. Treating farmland with pesticides for plant protection is mainly made by herbicides (about 80% of the arable land) and less frequently by insecticides and fungicides (about 15 to 20% of arable land).

It is estimated that transport is the major source of contamination of soil and water by oil products and hydrocarbons, as well as their decomposition products.

Typical for the EAR and especially for the Maritza River Basin is that here are some of the most fertile lands in Bulgaria, so here are built the largest irrigation systems. Rural irrigation dams are old and not maintained elsewhere and need repairs of the walls.

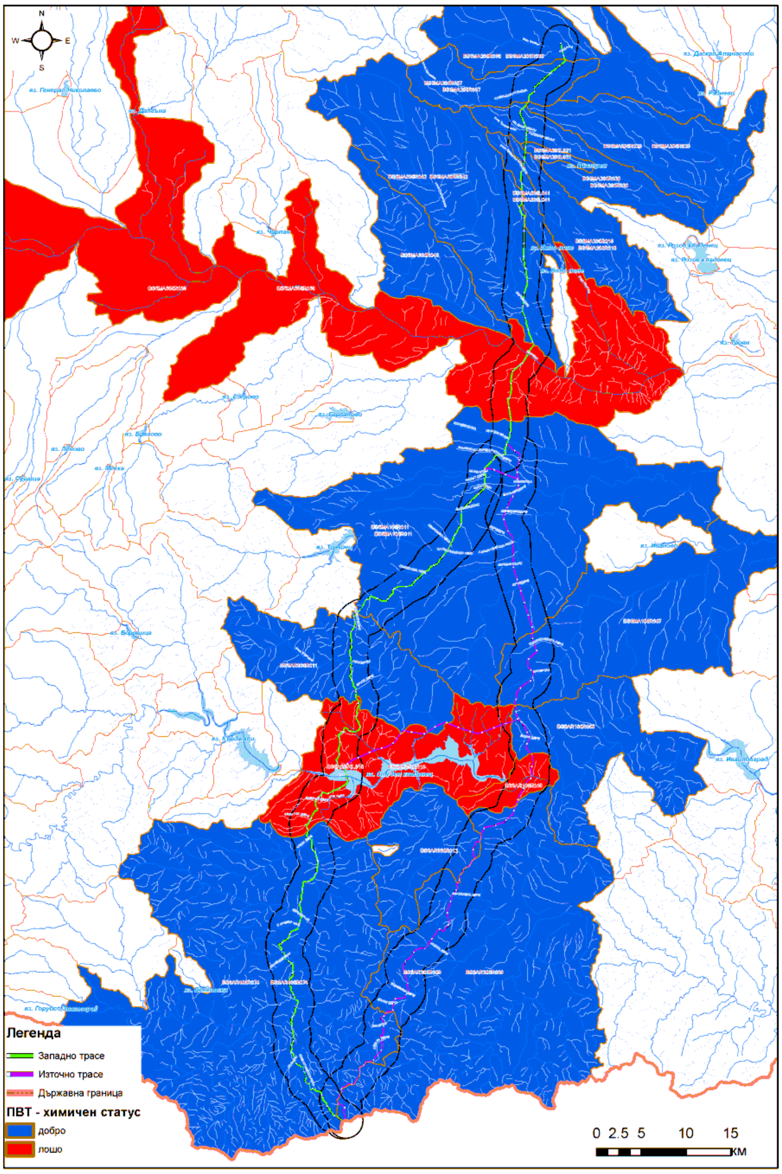
Water bodies, major rivers and their larger or smaller tributaries crossed by both alternatives of the reviewed pipeline route are shown in Appendix 4.1 of the EIA report.

Appendix 4.2 of the report considers the hydrographic and hydrologic conditions in a cross water catchment areas of the river basins of Arda and Maritsa Rivers and other major rivers of their watersheds that intersect the two alternative pipeline routes (based on data of the RBMP BDEAR, 2010 and actual data for 2011 provided by RBD).

In Appendix 4.3, location and number of monitoring stations in the pipeline sections are indicated, based on the analysis of chemical and ecological status of water bodies affected by the investment proposal

Summarized graphical presentation of chemical status of water bodies within the four kilometers range of the two proposed route alternatives is given in Figure 3.2.1-1.

Fig. 3.2.1-1. Chemical status of water bodies within the scope of the route



Chemical status	
Good	Poor

Chemical status of surface water bodies is assessed in two categories - good and poor, which are displayed on the map respectively blue and red. These water bodies that meet the chemical quality standards are in good condition and water bodies, which exceed the designated values are in bad condition. In assessing the chemical status of surface water bodies so-called priority substances are considered. For water bodies that have no sources of pollution by priority substances identified a good condition is defined by the expert judgment.

In the assessment of the chemical status of surface water bodies the qualifying class of parameters for water body status determination are:

- oxygenous/nutritious norm - temperature, dissolved oxygen, BOD5, pH (acidity), pH (alcalinity), NH4 ammonium - N, NO2 nitrite - N, NO3 nitrate - N, PO4 ortho-P, total-P, chlorophyll - A
- ion - sulfate (SO4), chloride (Cl)

- metals (dissolved) - Zinc (Zn), Copper (Cu), chromium (Cr-III + VI), Lead (Pb), Cadmium (Cd), Mercury (Hg), nickel (Ni), Arsenic (As), aluminum (Al)
- Biology – biotic index

For catchment areas of Arda and Maritsa River within the pipeline route area, poor chemical indicators are defined for the bodies as follow:

For the Eastern route 3 water bodies

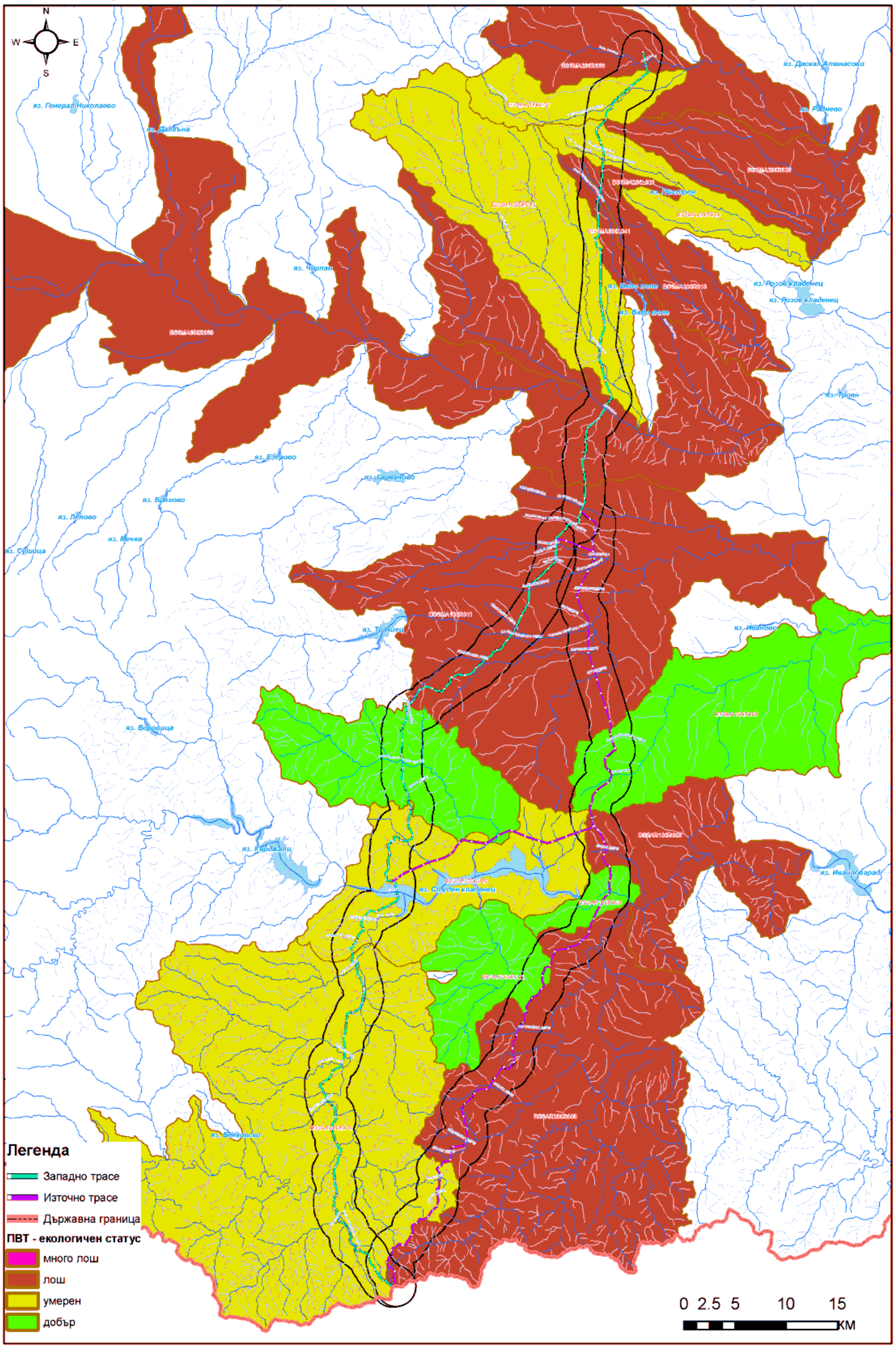
- BG3MA350R039 - Maritsa River from Chepelarska river to Sazliyka River
- BG3AR100R008 – Arda River between the Dam Studen Kladenets and Krumovitsa River
- BG3AR350L010 – Dam Studen Kladenets

For the Western route 2 water bodies

- BG3AR350L010 - Dam Studen Kladenets
- BG3MA350R039 - Maritsa River from Chepelarska river to Sazlyika River

Summarized graphical presentation of water bodies ecological status in the four kilometer range of the two proposed route alternatives is given in Figure 3*.2.1-2*.

Fig. 3.2.1-2. Ecological status of the water bodies within the scope of the route



Ecological status				
Very good	Good	Moderate	Poor	Very poor

Ecological status of surface water bodies is evaluated in five grades: very good, good, moderate, poor or very poor, which is depicted by the colors shown in the table.

To assess the ecological status the following groups of elements should be considered: biological, hydro-morphological and physical and chemical elements. Essential for the state determination are the biological elements: Hydro-morphological indicators, Biological indicators and Physical and Chemical indicators

Hydro-morphological indicators	Hydrological regime
	Morphological conditions
	Continuity of the river
Biological indicators	Phytoplankton
	Phytobenthos
	Macrophytes
	Bottom invertebrates
	Fishes
Physical and chemical indicators	General indicators
	Biogenic substances
	Specific substances

Hydro-morphological indicators

Assessment of hydro-morphological indicators is made based on analysis of the identified loads and expert accepted criteria for their evaluation.

The analysis and evaluation made consider the following:

- Hydrological regime - significant runoff change due to water abstraction or flow control;
- Morphological conditions –at assessing change of morphology the following are considered: extraction of alluvial deposits (aggregates); river corrections, HPP, condition of the riparian vegetation, relation to wet lands, protected areas and Protected NATURA 2000 Sites.
- Continuity of the river – Availability of facilities in the river and opportunity for the fishes to pass upstream and downstream.

Biological indicators

In assessing the ecological status information from various sources is used concerning the condition of the biological elements for quality:

- Data from the National System for Environmental Monitoring from the ongoing monitoring of bottom invertebrates in rivers.
- Data from external projects carried out -
- Information regarding the ecological status assessment by biological elements from the Surveillance Monitoring Program implementation.

Physical and chemical indicators

In assessing the environmental condition of physical and chemical elements for quality data from the National System for Environmental Monitoring is used taking into account the results of the three groups of indicators: general, nutrient and specific substances. Rating scale adapted into 5 grades according to the requirements of the WFD is used to assess the physical and chemical parameters, prepared on the basis of the established categorization of the waters by Ordinance № 7 from 1986 for the indicators and standards for determining the flowing surface water quality.

Within the catchments of Arda and Maritsa Rivers in the area of the pipeline route there are no water bodies with very poor environmental parameters. Bad ecological status is determined for the following water bodies:

For the Eastern route 9 water bodies

- BG3MA100R011 – Harmanliyska River and tributaries to its estuary

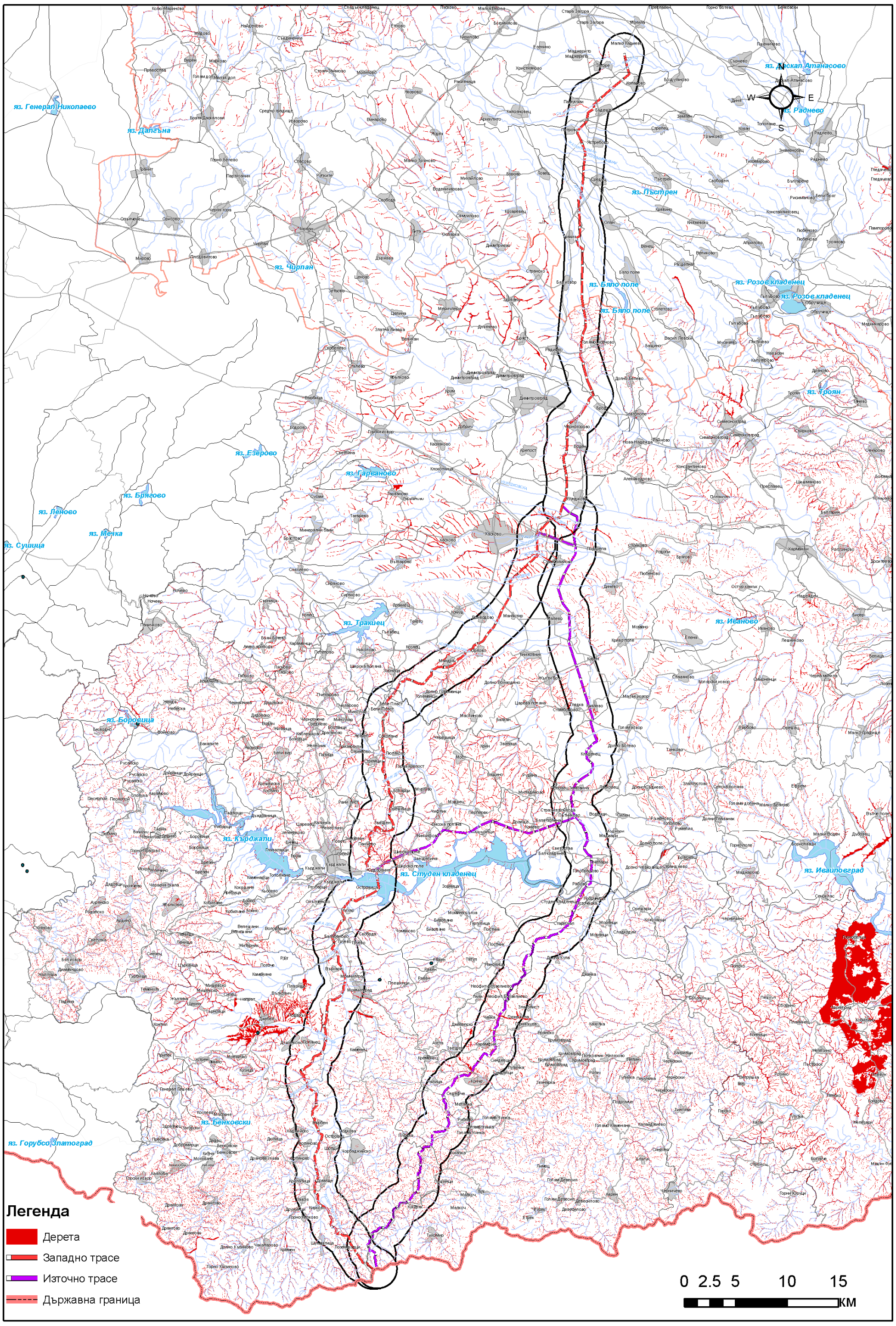
- BG3MA200R016 – Musachka River
- BG3MA200R028 – Sazliyka River and tributaries from Blatnitsa River to Ovcharitsa River
- BG3MA200R030 – Sazliyka River from Azmaka to Blatnitsa and Azmaka River
- BG3MA350R039 – Maritsa River from Chepelarska River to Sazliyka River
- BG3MA200L021 – Dam of Pastren
- BG3MA300L041 – Dam of Byalo Pole1
- BG3AR100R006 – Arda River from the confluence of Krumovitsa River to Dam Ivaylovgrad
- BG3AR200R009 – Krumovitsa River and its tributaries

For the Western route 8 water bodies

- BG3MA100R011 - Harmanliyska River and tributaries to its estuary
- BG3MA200R016 - Musachka River
- BG3MA200R028 - Sazliyka River and tributaries from Blatnitsa River to Ovcharitsa River
- BG3MA200R030 - Sazliyka River from Azmaka to Blatnitsa and Azmaka River
- BG3MA350R039 - Maritsa River from Chepelarska River to Sazliyka River
- BG3MA200L021 - Dam of Pastren
- BG3MA300L041 - Dam of Byalo Pole1
- BG3AR200R009 - Krumovitsa River and its tributaries

The two proposed alternative routes - west and east, also intersect many small streams and gullies. Graphical presentation of the crossed by the route water bodies (gullies) is given in Fig.3.2.1-3.

Fig. 3.2.1-3. Water bodies (gullies) affected by the route



The investment proposal does not include infrastructure designs and the issues concerning the water supply and wastewater disposal from the sites of the facilities, used in the construction and operation of the pipeline, its quantity and composition and the method of discharge. However, the technical design must include reliable measures for disposing and treatment of wastewater of a domestic or production nature, as well as points of discharge amd the water receiver category. The method of water supply and wastewater discharge is defined in the Water Supply and Sewerage Company's proposal, agreed by the municipality.

The alignment of the route with the routes of the main water pipelines and sewerage collectors are not considered in the investment proposal so that it necessarily must be introduced in the next design phase. In Annex 4.4 of the report the intersection points of main water pipelines with gas pipelines are specified according to the information received from WSSC companies of Stara Zagora, Dimitrovgrad, Kardzhali and Haskovo.

As regards the irrigation facilities, according to the letter-ref. № 2007/11.07.2012 received from Irrigation Systems Ltd. Branch Gorna Tundzha, Stara Zagora, upon presentation of the DUP for approval their intersected facilities will be indicated: irrigation canals (open channels and underground pipes), drains, corrected rivers and gullies.

In connection with the construction and operation of the proposal the following permits related to waters are required.

- Permit for use of all rivers, which are going to be crossed by open method or by the method of horizontal drilling
- Permit to take water samples from the water sources for a hydro test.
- Permit for use of water sources, which will be discharging the used waters from the hydro test, from the horizontal directed drilling, and also from the drainage of trenches and sites.

Under the Access to Public Information Act, a letter has been sent to the East Basin Directorate requesting information about location and the SPZs of water sources. In response letter ref. № RD-11-158/27.10.2011 was received, informing that in the scope of the pipeline route there are no sanitary protection zones established around water sources for drinking water supply, as well as such in process. Iinformation was requested from the water supply and sewerage companies acting within the route coverage. According to their data, within the route water towers, wells and pumping stations for drinking water supply of settlements fall. During the detour of the route the availability of pumping stations and tube wells in close proximity to the track was identified, but it was not clear whether these water sources are established under the provisions of Ordinance № 3/2000 for the terms and conditions of research, design, validation and use of SPA around water sources and facilities for domestic water supply and sources of mineral waters used for therapeutic, prophylactic, drinking and hygiene needs. During the detour of the route it was established as follows:

- At the intersection points of the rivers no abstractions of drinking water, agricultural and industrial needs were identified.
- There are water fountains and springs adjacent to the route, used primarily for consumption by animals from the settlements near the route. It is impossible to say at the present moment the exact number of these sources and the extent, to which their watershed will be affected by the construction of the route.
- Near the route water abstraction facilities were identified, but up to this moment, the "Water supply and sewerage companies" have not implemented a procedure for the establishment of SPA under the requirements of Ordinance № 3/16.10.2000, which should have been done by 16.10.2010. Therefore, the Basin Directorate responds, that in the scope of the presented pipeline route there are no established sanitary protection zones around water sources for drinking water supply, as well as such in progress.
- Over the entire area of the Thracian Valley, from the town of Stara Zagora to Voyvodovo village, to the south of the town of Haskovo, the existence of hydromeliorative facilities has been indicated, as well as main channels, open and closed irrigation and drainage networks, reservoirs, etc., which will be affected by the construction works.
- During the detour in October 2011 it was found that low flow rivers were dried up.
- From the border to Vurben village, southwards of Momchilgrad, in some places erosion of the riverbanks is observed.

- Presence of any dykes built on the banks of the main rivers in the points of intersection was not identified.

The rate of the effects is almost the same for both alternatives considering the number of large river crossings, small streams and gullies crossings by the construction of the pipeline. From the hydrological point of view, the better one is the Eastern route, as the number of river crossings is less. When comparing the ecological status of water bodies for both alternatives it can be concluded that water bodies affected by the eastern alternative have a worse environmental potential.

3.2.2 Groundwater

Hydro geological survey within the proposed pipeline routes scope has not been carried out. Therefore, the description of groundwater has been prepared based on a regional information of archival and reference sources, from „Plan for river basin management in the East Aegean Region", terrain visual examination along the Western route of the pipeline and of the existing water intake systems and equipment, as well as on the results from the geological survey performed, included in a report for „Geology, excavation conditions and geological hazards along the proposed corridors of the pipeline „Greece – Bulgaria" on Bulgarian territory", prepared by Dr. V. Zhelev.

The routes of the designed pipeline „Gas Interconnector Greece-Bulgaria" on Bulgarian territory from South to North are situated as follow:

- From km 0+000 (state border with Greece near the Makaza Pass) to km 102+550 along the Western route of the pipeline and km 97+650 along the Eastern route (between the villages Uzundzhovo and Voden) – in the Eastern part of the Rhodopean megablock of the Rila - Rhodope hydrogeological region, overlapping with the East Rhodopean morphographic sub-region within the Rila -Rhodope morphographic area in the Northern periphery of which the Haskovo valley is located;
- From km 102+550 to km 112+000 along the Western route and from km 97+650 to km 107+100 along the Eastern route of the pipeline (at Maritsa river) – in the Maritsa fault zone in the Southern part of the Upper Tracian lowland, a part of the Sredna gora hydrogeological area within the Balkanide hydrogeological region;
- From km 112+000 along the Western route and to km 107+100 along the Eastern route to the endpoint at km 150+600 along the Western route and km 145+700 along the Eastern route – in the southeast part of the Upper Tracian lowland within the Sredna gora hydrogeological area in the Balkanide hydrogeological region.

The hydrogeological conditions in these regions are determined by the fracture and porous groundwater, in which, on the territory of East Aegean Region Basin Directorate there are 48 ground water bodies identified. Of these, the coverage of the pipeline alternative routes includes parts of seven ground water bodies as follow (RBMP of EARBD, 2010):

- Groundwater body „Fissure water in the Central Rhodope massif", code BG3G00000Pt046. It is tied to the hypergenic, cracked and faded near-surface zone of Precambrian metamorphic rocks (gneiss, various gneisses, migmatites, schist), where it forms small area divergent flows of free water level, intense runoff and short circulation route. Feeding is by precipitation and draining is in the river-ravine network through springs with small flow rates up to 0,2 l / s, rarely more. The chemical composition of waters is hydrocarbon-calcium-magnesium-calcium and magnesium, in some places with high sodium content. The mineralization is within the range from 100 mg/l to 600 mg/l. The groundwater body is with good chemical and quantity status.
- Groundwater body „Fissure water in the Krumovgrad-Kirkovo zone", code BG3G00PtPg2023. It is formed in the hypergenic, cracked and faded near-surface zone of

Precambrian metamorphic rocks (marbles, calcite shales) and Paleogene sediments (organogenic limestone, calcareous sandstone, marl). It consists of small area divergent flows of free water level, intense runoff and short circulation route and draining is in the river-ravine network through springs with small flow rates. The chemical composition of waters is hydrocarbon and hydrocarbon-chloride, calcium-sodium and calcium-magnesium, at some places with higher sulphate content. In the limestone water packs the waters are hydrocarbon-calcic and calcic-magnesium. The mineralization is at average about 400 mg/l. The ground water body is in poor chemical condition and with good quantity status.

- Groundwater body „Fissure water in the East Rhodopean massif", code BG3G00000Pg028. It is a laminar aquifer spread on a large area, of significant thickness and anisotropy in the vertical and horizontal direction. The ground water is tied to the weathering zone of Paleogene volcano-sedimentary rocks (rhyolite, latites, andesites, basalts, tuffs, tuffites, conglomerates, breccias, breccia conglomerates, marls, organogenic limestones). Feeding is by precipitation and draining is in the river-ravine network. The chemical composition of waters is hydrocarbon-calcium-sodium-magnesium, at some places with higher sulphate content; the mineralization is at average about 250 mg/l. The ground water body is with good chemical and quantity status.
- Groundwater body „Pore water in Paleogene – Neogene Maritsa East", code BG3G0000PgN019. It is non-pressure collector of clays, sands, coal shales and coals with average thickness of 40 m on the territory of East Maritsa coal basin. Its filtration properties are expressed by a filtration factor, fitting a wide range – from 0,075 to 110 m/d. The chemical composition of waters is hydrocarbon - sulphate - calcium to hydrocarbon – calcium and mineralization of 400÷900 mg/l. The ground water body is in poor chemical condition and with good quantity status.
- Groundwater body „Pore water in Quaternary –Arda river", code BG3G000000Q010. It is formed within the river terraces of Arda river and the rivers Perperek, Varbitsa Krumovitsa and their tributaries (river Dzhebelska, Chitak Dere River, Arabadzhiyska River, river Chukovska, Zeynelere Dere River and others), built of alluvial sandy and gravel formations at the bottom of the profile and sandy – clay formations at the top, lying on a colorful pad of Paleogene and Precambrian rocks. The thickness of the alluvium varies within a wide range – from 1÷2 m in the peripheral parts of the terraces to 10 m in separate sections along Arda River. Feeding of the groundwater is realized by precipitation, partially from fracture and fracture – karst water and from river water at high water levels. The groundwater is drained in the rivers at low water level, in the cup of the dam Studen Kladenets and by the water intake equipment. The filtration properties of the aquifer collectors are characterized by medium conductivity of 370÷390 m2/d in Arda River and 350 m2/d in the terrace of Varbitsa River at the town of Momchilgrad. The ground water body is in good chemical and quantity status.
- Groundwater body „Pore water in Neogene-Quaternary – Haskovo", code BG3G00000NQ009. It is a laminar pressure aquifer in the sediments of the Ahmatovo suite in the Neogene and Quaternary formations. The aquiferous collector includes facial untenable in horizontal and vertical direction aquifier layers and nests of sands and gravels with ranging granularity and clay layer inclusions. Its filtration properties are expressed by conductivity of 100 to 700 m2/d and average filtration factor 7,0 m/d. Groundwater body draining is performed mainly by the constructed water intake systems and equipment. The most significant among them are the pump stations „Haskovo 1", „Haskovo 2", „Eastern zone", „Uzundzhovo 1", etc. The chemical composition of waters is hydrocarbon-calcium-magnesium with dominant mineralization 400÷1600 mg/l and with raised concentrations of: nitrates (in the area of Uzundzhovo village - 160 mg/l, in

the Northern industrial zone of Haskovo – up to 225 mg/l, around the village of Vaglarovo - 73 mg/l), sulphates - 300÷630 mg/l, calcium - 160÷240 mg/l, in some places manganese. The groundwater body is in poor chemical condition and with good quantity status.

- Groundwater body „Pore water in Quaternary – Maritsa East", code BG3G000000Q012. It is formed in the Quaternary deposits. The aquiferous collector includes the alluvial formations (sands and gravels of ranging granularity, stripped by clays) of the rivers Maritsa, Sazliyka, Azmaka, Rakitnitsa, Ovcharitsa and Sokolitsa and the proluvial formations (poorly sorted clast material, larger at the beginning of the alluvial cones and smaller at their periphery) of the Stara Zagora – Nova Zagora alluvial cones. Feeding of the groundwater body is performed by precipitation infiltration, by surface river water and by irrigation water. The draining is in the rivers at low water levels in them and through water intake equipment. The chemical composition of waters is hydrocarbon-sulphate-calcium to hydrocarbon-calcium, with mineralization of 400÷900 mg/l. The ground water body is in poor chemical condition and with good quantity status.

In order to meet the requirements of Directive 2000/60/EC and Directive 91/676/EC of the European Parliament and of the Council, art. 119, par. 3 of the Water Protection Act, designated for the drinking water supply and Ordinance № 2 dated 13 September 2007 for protection of waters against pollution caused by nitrates from agricultural sources sites have been defined for protection of waters (all water bodies that are used for drinking water supply and have average 24-hour flow rate over 10 m^2 or serve to supply water for more than 50 people), including vulnerable areas (those, for which there is an evidence for the presence of nitrate ions over 50 mg/l). All of the eight groundwater bodies mentioned above that the alternative pipeline routes are going through, have been defined as **„Drinking water protected areas".** Three of the groundwater bodies (*BG3G0000PgN019*, *BG3G00000NQ009* и *BG3G000000Q012*) are polluted and threatened by pollution caused by nitrates from agricultural sources.

Within the listed groundwater bodies three types of hydrogeological ground water collectors are conditionally formed:

- I-st collector type for pore water, built up mainly by sand and gravel deposits of the river terraces with relatively high water abundance and shallow level of the nonpressure groundwater contained therein;
- II-nd collector type for pore water predominantly sandy loam layered construction, pressure character, with waterproof jacket from clay and varying water abundance - mostly low to medium water capacity;
- III-rd collector type for sporadic fissure water in the areas of rock weathering, basically of low water abundance.

During the pipeline construction and operation mainly the hydrogeological collectors of the I-st type will be vulnerable to impacts.

The arrangement of the alternative pipeline routes is illustrated by the maps of ground water bodies (***Appendix 5.2.1÷5.2.3***) and it is differentiated by groundwater bodies and collector type in ***Appendix 5.3.1*** for the Western route and ***Appendix 5.3.2*** for the Eastern route. By using the data from these appendixes in Table 3.2.2.1 the location of the collectors type I with high vulnerability (sensibility) is pointed out:

Table 3.2.2-1 Location of the collectors type I with high vulnerability

Western pipeline route					Eastern pipeline route				
№	**Section of the pipeline route**		**Length,m**	**Alluvial sand and gravel formations of flood terrace of river:**	**№**	**Section of the pipeline route /from km to km/**		**Length,m**	**Alluvial sand and gravel formations of flood terrace of river:**
	from km	**to km**				**from km**	**to km**		
1	2		3		4	5			6
1	17+000	18+000	1000	Varbitsa	1	52+900	23+200	200	Arda
2	27+650	28+000	350	Sarayar Dere	2	76+900	78+600	1700	Barzey
3	28+300	29+400	1100	Varbitsa and Dzhebelska	3	79+560	80+460	900	Karaman Dere
4	37+400	38+100	700	Chitak Dere	4	81+700	83+200	1500	Harmanliyska
5	48+000	48+300	300	Right terrace of Arda river	5	90+000	90+530	530	Haskovo
6	48+300	49+650	1350	Studen Kladenets dam	6	93+400	97+700	4300	Chan Dere and Gyol Dere
7	49+650	49+850	200	Left terrace of Arda River	7	104+400	107+200	2800	Maritsa
8	64+850	65+400	550	Perperek	8	109+400	112+700	3300	Goliama
9	84+500	85+850	1350	Harmanliyska	9	138+100	142+100	4000	Sazliyka
10	96+100	96+500	400	Haskovo	10	143+900	144+500	600	Azmaka
11	99+900	102+600	2700	Chan Dere and Gyol Dere					
12	109+300	112+100	2800	Maritsa					
13	114+300	117+600	3300	Goliama					
14	143+000	147+000	4000	Sazliyka					
15	148+800	149+400	600	Azmaka					
		∑	**20700**				∑	**19830**	
1	17+000	18+000	1000	Varbitsa	1	52+900	23+200	200	Arda

● **Water intake systems and equipment for groundwater. Established sanitary – protection areas.**

To specify the location of water intake system and facilities and of the established sanitary – protection areas along the pipeline routes statements were requested from the East Aegean Region Water Management Basin Directorate headquartered in Plovdiv and "Water Supply and Sewerage" companies in Kardzhali, Haskovo, Dimitrovgrad and Stara Zagora.

According to the statement of the East Aegean Sea River Basin Directorate "within the scope of the pipeline route presented to us there are no established sanitary – protection areas around sources for drinking water supply, as well as no areas in procedure" (Letter № РД-11-158/27.10.2011 of EARWMBD).

The statements of "Water Supply and Sewerage" Ltd-Kardzhali (№ 486/02.11.2011), „Water Supply and Sewerage" Ltd -Haskovo (№ 1660/24,10.2011), "Water Supply and Sewerage" Ltd -Dimitrovgrad (№ 930/29.10.2011) and "Water Supply and Sewerage" Ltd - Stara Zagora (№1585/11.10.2011) do not contain any information about water intake facilities for groundwater and their location. Only in the statement of "Water Supply and

Sewerage" PLC - Haskovo it is mentioned that they own networks and facilities within the scope of the pipeline routes, but „the exact determining of their location can be done during the pipeline tracing".

In fact, within the scope of gas pipeline route there are operating water intake systems and facilities for drinking water supply of settlements and mineral water sources, for which no sanitary – protected areas are established in compliance to the requirements of the Ordinance № 3/16.10.2000 for the terms and conditions for research, design, approval, and operation of sanitary protected zones around water sources and facilities for drinking water supply and around the sources of mineral water, used for therapeutic, prophylactic, drinking and sanitary needs. Some of the water sources have fences along the borders of zone A (I) of SPZ, defined according to Ordinance №2/01.08.1989, valid till 19.10.2000, for the sanitary protected zones around water sources and facilities for drinking water supply. This information was extracted from a map in M 1:70 000 for the investment proposal „Maritsa" motorway to Letter № РД-09-250/14.08.2009 from the East Aegean Region Water Management Basin Directorate and from its internet website and from the website of MEW, from topographic maps in scale 1:50000 and 1:25000, from reference sources, from the visual inspection and survey we carried out of existing water intake systems and equipment around the alternative pipeline routes, as well as from additional map material received in May 2012 from Stara Zagora municipality and Haskovo municipality (for water intake system „Uzundzhovo 2 stage." from the study of „Hydrokomp" Ltd. in 1994 „Hydrogeological study for assessment of risk from pollution of Water Intake Pumping Station „Uzundzhovo - 2 stage" and a project for SPZ, Haskovo municipality).

● **Along the Western route of the pipeline**

- Mineral water source „Kirkovo". It is situated about 0.5 km Southwards of the Southeast end of Kirkovo village and 500 m Southwards from the route at km 8+500. The source consisted of several captated springs in river gravels and sands, where the water was received from the Precambrian tectonic zone in karst marble among gneiss and amphibolite. In the period 1975÷1977 five wells were constructed – two of them for water intake (C-1 and C-4) and three for monitoring (C-2, C-3 and C-5). They were registered under № 34 in the register for the mineral water sources – exclusive state property. The water temperature is 21 ^{0}C. The capacity of the source had not been evaluated, there was no sanitary – protected area established. Currently the Ministry of Environment and Water by its Decision № 68/22.02.2011 provides the source to Kirkovo municipality as a grant to manage and use it for a period of 25 years;

- Pump station with water intake facilities and fence of zone I of sanitary – protected area. It is located on the right terrace of Varbitsa River along the North periphery of Krilatitsa village, about 1.75 km far Westwards of the the route at km 12+400.

- A spring Northeast of Domishte village. It is located about 1.1 km to the East of the route at km 12+900;

- A shaft well with diameter of 1.0 m, built of rock blocks masonry. Water level depth is 5.0 m from the surface. It is located at 2.0 km Northeast of the Northeast end of Karchovsko village and 50 m Westwards from the route at km 21+500. Currently the well is abandoned;

- A shaft well with diameter of 3.0/3.5 m, built of reinforced concrete rings. Water level depth is 5.0 m from the surface. It is located on the left terrace of Varbitsa River, 0.6 km to the West of Momchilgrad and 1300 m to the Southeast of the route at km 34+900. Currently the well is abandoned;

- Captated spring. It is located 250 m Southeast of the Southeast end of Mandra village and 100 m to the South of the route at km 79+100;

- A pump station and wells with fencing of zone I of sanitary – protected area. River, at 650 m to the South of Voyvodovo village and 300 m to the Northwest of the route at km 84+700;

- Water intake system with pump station „Uzundzhovo 2 stage". It includes seven tube wells with bunker pump stations (BPS1÷BPS7), five of them currently operate. They reveal the groundwater body „Pore water in Neogene-Quaternary-Haskovo", code BG3G00000NQ009 at depth of 30÷40 m to 122÷134 m. They are located at about 3.2 m Southwest of Uzundzhovo village center. The water intake system is used to supply water for Haskovo. The wells are located at distance of 250 m to 450 m one from another in line directed Northwest – Southeast of total length about 1350 m. In 1994 in a study of „Hydrokomp" Ltd. „Hydrogeological study for assessment of risk from pollution of Water Intake Pump Station „Uzundzhovo - 2 stage" and a project for SPZ, Haskovo municipality" (Penchev P., 1994) a sanitary – protected area has been designed, including:

- zone „C" with dimensions about 4500 m from Northwest to Southeast and 1500÷2500 m from Southwest to Northeast;
- zones „B" around each well approximately round and 140 to 300 m in diameter;
- zones „A" (innermost zone) around each well, square and with sides 30 m long.

As per § 4, art. 1 of the transitional and final provisions of Ordinance № 3/16.10.2000 for the terms and conditions for research, design, approval and operation of sanitary - protected zones around water sources and facilities for drinking water supply and mineral water sources, used for therapeutic, prophylactic, drinking and sanitary needs „Established under Ordinance № 2 from 1989 for SPZ around drinking water supply sources shall be adapted to the requirements of this ordinance in terms of the borders and security regimes in the zones II and III within 10 years from the publication in the „State Gazette". The border of the innermost zone of the SPZ does not change". Therefore, currently the valid borders of zone „A" are these established in 1994 (zone I under Ordinance № 1/10.10.2007) and the borders of zones II and III of SPZ are subject to dimensioning and establishing.

Construction lane along the West route of the pipeline crosses the water intake system „Uzundzhovo – 2 stage" at km 98+200÷98+430, 90 m to the East of zone I border in SPZ of BPS 1 and 140 m to the West of zone I in SPZ of BPS2, as well as the plumbing to the pump station at km 98+285. In respect to the established in 1994 borders of SPZ the route falls out of zone „B" borders (zone II) and crosses zone „B" (zone III) approximately within the section from km 98+000 to km 99+840.

A letter was sent to "Water Supply and Sewerage" Haskovo to approve the route in this section and in reply, by letter № 1178/19.06.2012 the layout is approved, specifying the intersections of the route and the existing plumbing and cable routes with the requirement at the intersections the necessary vertical spacing between electrical cable, gas pipeline and plumbing and between electrical cable and gas pipeline according to Ordinance 8/28.07.1999 (art. 154, par. 3 of Ordinance 2/22.03.2005) to be provided.

- Abandoned and compromised three tube wells with reinforced concrete shafts at the wellheads and small buildings above them. Probably they reveal groundwater body „Pore water in Neogene-Quaternary-Haskovo", code BG3G00000NQ009. They are located 250÷300 m Northwest from Chernogorovo village and 80÷150 m Northwest of the route in the section from km 109+400 to km 109+700;
- Two wells with bunker pump stations, revealing groundwater body „Pore water in Quaternary – Maritsa East", code BG3G000000Q012. They are located at about 600 m to the Northwest of the pipeline route at km 145+500;

- **Along the Eastern route of the pipeline:**

- ***Water intake system „Eastern area".*** It includes 15 shaft wells, revealing groundwater body „Pore water in Neogene-Quaternary-Haskovo", code BG3G00000NQ009 in the alluvial formations on the left terrace of Haskovska river. The wells are located in a line about 1.7 km long in direction West-Northwest – East-Northeast. The water intake system is used to supply water for Haskovo. It is located at about 150 m to the South of the road Dimitrovgrad-Podkrepa. The construction lane of the pipeline route crosses the water intake system at km 90+380 between shaft wells SW 3 and SW 4 and is 25 m away to the East and to the West of their zone I of SPZ borders. Outside zone I apparently the zones II and III intersect in the pipeline route section from km 90+180 to km 91+600.

Analysis of the above described leads to the conclusion that:

- the alternative pipeline routes are equal in terms of the areas of intersecting vulnerable to pollution aquifer collectors type I, indicated above in Tab. 3.2.2.1 and they are not in conflict with operating water intake systems and facilities, as their passage through zones II and III of the sanitary protected areas is admissible at observing the prohibitions, restrictions and limitations upon proven need according to Appendix № 2, to art. 10, par. 1 of Ordinance № 3/16.10.2000 г;
- the Western route of the pipeline seems more acceptable for realization due to the fact that it passes through the sanitary protection area of a **protected** section of groundwater body „Pore water in Neogene-Quaternary-Haskovo", code BG3G00000NQ009, while the Eastern route passes through the sanitary protection area of a **non-protected** section in a terrace of Haskovska River of the same groundwater body. Furthermore, the construction lane of the Eastern route is nearer to the borders of zones I of the shaft wells.

3.3 Subsurface and mineral diversity

The geological and lithological structure within the proposed pipeline routes is described on the basis of information from the report „Geology, conditions for excavations and geological hazards along the proposed pipeline corridors „Greece – Bulgaria" on Bulgarian territory", prepared by D-r V. Zhelev, regional information from archive and reference sources and terrain visual inspection along the Western route of the pipeline by the authors of the EIA Report.

The pipeline routes on Bulgarian territory structurally, consecutively from South to North, fall in the East Rhodopean section of the Rila – Rhodope massif with the Harmanly block in its Northern periphery and the Maritsa fault zone and the Upper Thracian depression of Sredna gora zone, which is morphotectonic structural zone within the composition of the Alpine folded system.

The East Rhodope section of the Rila - Rhodope massif is a morphological depression of fault-block structure, deeply indented by river Arda and its tributaries. Typical formations are the denudation plateau, alluvial formations of river terraces, etc. Against this large structural unit the Kesebir swelling and the East Rhodope Paleogene depression are developed.

The Kesebir swelling is a dome-shaped structure built up of Precambrian metamorphites, belonging to two supergroups: Pre Rhodopean and Rhodopean.

The Pre Rhodopean supergroup is divided in three groups: Strazhets, Boturchenska and Arda. The Strazhets group is represented by its Upper Jurassic suite including double mica and muscovite leptynite, and leptynite gneisses. Boturchenska group includes the Zhulti Chal suite, represented by alternation of gneisses, schist, leptynite and amphibolites. Typical for this group are the large bodies of ultrabasite vulcanites (orto amphibolite). Arda group is represented by similar ultrabasite bodies.

The Rhodope supergroup is represented by its Rupchos group that includes the Chepelare suite, which is alternation of gneisses, schists, marbles and calcium schists, as well as bodies of metamorphosed ultrabasites (metaserpentinite).

. The Kesebir swelling is intersected along the Western route of the pipeline from km 0+000 to km 9+500, and along the Eastern route – from km 0+000 to km 21+600.

The East Rhodopean Paleogene depression is filled by two rock assemblages. For the lower assemblage continental sediments are typical (coal sandstone assembly) and marine sediments (marl-limestone assembly) of Eocene age. The second assemblage is represented by alternation of medium acidic and acidic volcanites, with layers of reef limestone and large bodies of sandstone (Dzhebel suite). Within the full section of this assemblage triple alteration is observed of medium acidic (andesite) and acidic (rhyolite) assemblies. Their products are divided in four types – lava, pyroclasts (tuffs), limestone and mixture of tuffs, tuffites and limestones.

The East Rhodopean Paleogene depression is intersected along the Western route of the pipeline from km 9+500 до km 83+500, and along the Eastern route – from km 21+600 to km 77+000.

The Harmanli block is a shallow graben depression in the Northern part of the East Rhodopean section of the Rila - Rhodope massif. It is filled by Quaternary formations, Neogene sediments of the Ahmatovo suite and Paleogene sediments of the marl-limestone assembly. It is crossed along the Western route of the pipeline from km 83+500 to km 102+550, and along the Eastern route – от km 77+000 до km 97+650.

The Maritsa fault zone is a tectonic structure, between the tectonic zone Sredna gora and the Rila - Rhodope massif. It comprises an area with variable width and approximate orientation West-East from Belovo to Svilengrad. Fault breaks of shift nature and grabens are specific for it that are filled by terrigenous neogene sediments (gravels, sands and clays of the Ahmatovo suite and Quaternary) and protruding horst, made of Precambrian (Zhulti Chal gneiss suite and Konstantinovo meta conglomerate suite), Paleozoic low-grade metamorphites (Klokotnitsa greywacke - shale suite and Chernogorovo meta breccia conglomerate suite) and granites (leuco multiple Aleksandrovo granites) or Paleogene tuffs and limestones. The Western route of the pipeline crosses the Maritsa fault zone from km 102+550 to km 112+000, and along the Eastern route - from km 97+650 to km 107+100.

The Upper Thracian Depression is the largest imposed depression in Sredna gora zone. It is spread between Sredna gora in the North and the Rhodope – in the South, from the gorge of Momina Klisura in the West and to Monastery heights, Sveti Ilia heights and Sakar – in the East. It is filled by sediments of the Quaternary (alluvial and alluvial-proluvial), Neogene Ahmatovo suite (represented by gravels, sands and clays), Oligocene-Miocene Maritsa suite (clay, sands and coal) and Oligocene terrigenous suite Malko Tarnovo (sands and conglomerates). Along the Western route of the pipeline it is crossed from km 112+000 to km 150+150, and along the Eastern route –from km 107 +100 to km 145+250.

Near-surface geological surrounding of the described structural units within the coverage of the proposed pipeline routes including Precambrian, Paleozoic and Paleogene rocks, Paleogene-Neogene and Neogene deposits and Quaternary formations is detailed in ***Appendix 5.4***, within the latter along the Western route in ***Appendix 5.4.1*** and in ***Appendix 5.4.2*** – along the Eastern route and it is illustrated by 10 map sheets – six within the scope of the Western route (***Appendix 5.4.1÷5.1.6***) and four within the scope of the Eastern pipeline route (***Appendix 5.4.7÷5.4.10***) (from the report of Dr. V. Zhelev „Geology, excavation conditions and geological hazards along the proposed corridors of the pipeline „Greece – Bulgaria" on Bulgarian territory).

The geological maps show all the identified faults. They are divided in two groups: old (dead) and contemporary (active). The first ones are not important for the construction and the operation of the pipeline. The second ones are essential for the sustainability of the structure. Many of the faults, covered by the contemporary Quaternary alluvial formations, are marked as suspected and neotectonic.

Active faults, i. e. those that are considered as contemporary active, or it is expected to be such in future, are crossed:

- along the Western route of the pipeline – five times at: km 9+770, km 98+330,km 114+080, 116+620 and km 131+530;
- along the Eastern route of the pipeline – five times at: km 63+940, km 92+920, km 109+180 , 111+720 and km 126+630.

● Engineering – geological conditions

The pipeline implementation emerges in the numerous lithostratigraphic units building up the geological environment within the scope of the upcoming construction works, which physical – mechanical properties outline various and complex engineering – geological conditions, but they will not obstruct the pipeline construction and the adjacent facilities. As regards the excavation work conditions, rock types are distinguished as follow:

- Type I – ununited and not cemented sediments with rock pieces that are possible to excavate by use of an excavator. This group includes all Quaternary deposits (alluvial, alluvial -proluvial, diluvial), Neogene and Paleogene clays, sands, sandstones, etc.;
- Type II – slightly cemented and compacted ununited weathered rocks that is possible to excavate by use of heavy excavators. The group comprises well litificated Paleogene sediments and pyroclasts (tuffs, tuffites, marls, etc.);
- Type III - medium solid and solid rocks, for excavation of which explosives are needed or their comminution by special machines (60-tone excavators with chisel). This group comprises all magmatic (effusive and infusive) rocks, high-grade metamorphic rocks (gneisses, amphibolites, marbles, quartzites, etc.) and low-grade (green schist) metamorphites.

The location of rock types along the proposed pipeline routes and the length of the relevant sections, according to the information from the report „Geology, excavation conditions and geological hazards along the proposed corridors of the pipeline „Gas interconnector Greece – Bulgaria", prepared by Dr. V. Zhelev, are recorded in Table 3.3.1:

Table 3.3.1

The Western route of the pipeline								
Rock type I			Rock type II			Rock type III		
From (m)	To (m)	Length (m)	From (m)	To (m)	Length (m)	From (m)	To (m)	Length (m)
9506	9900	394	9491	9506	15	0	9491	9481
14750	15140	390	9900	14750	4850	18608	20760	2152
15890	17511	1621	15140	15890	750	21260	22440	1180
17660	18040	380	17511	17660	149	22853	23154	301
22440	22853	413	18040	18608	568	23470	24530	1060
27280	27310	30	20760	21260	500	24630	27280	2650
27660	28127	467	23154	23470	316	27310	27660	350
28680	29400	720	24530	24630	100	29400	30150	750
32550	33330	780	28127	28680	553	31100	32550	1450
37410	38080	670	30150	31100	950	33705	37410	3705
48330	48790	460	33330	33705	345	38080	47820	9740
49340	49840	500	47820	48330	510	49840	59722	9882
65000	65480	480	59722	61310	1588	61310	63780	2470

83408	150600	67192	63780	65000	1220	65740	71952	6212
			65480	65740	260			
			71952	83408	11456			
TOTAL:		**74497**			**24130**			**51383**
The Eastern route of the pipeline								
52890	53070	180	15100	16360	1260	0	15100	15100
76920	145700	68780	19043	19600	557	16360	19043	2683
			19790	20230	440	19600	19790	190
			22608	23031	423	20230	22608	2378
						23031	52890	29859
						53070	76920	23850
TOTAL O:		**69960**			**2680**			**74060**

● Physical and geological processes and phenomena

Among the physical and geological processes and phenomena more significant development in the investment proposal area have:

- *the weathering* in near-surface zone predominantly of Precambrian, Paleozoic, Paleogene and Neogene volcanogenic and sediment rocks. The most prominent products of the weathering processes are the protected areas:

1. rock formations mushroom-shaped, sculpted into Paleogene Rhyolite tuffs – natural landmark “Kamennite gabi”/ „The stone mushrooms”. Is is situated at about 1.0 km Northwards of Beli Plast village and at about 200 m Westwards of the Western pipeline route at km 71+250;
2. pyramid rock formations “Belite sipei” / „The white screes” to the East and Northeast of Kardzhali, in the lands of the villages Zimzelen, Povet and Dobrovolets,
3. “Golemiat sipey” / „The great scree” – remarkable rock assemblage, screes, bushes and forests within the lands of Rabovo village, along the wall of “Studen Kladenets” dam and Kachlabuyuk Dere;

- *The erosion processes* include mainly the fluvial erosion, the slope (surface) erosion and the linear (gulch) erosion.
- *The fluvial erosion* is an accumulative – erosion impact on the bottom (deepening and incision of the river bed), the banks (erosion of banks) and flood terraces of the rivers, faulting the sustainability or the normal operation conditions of the facilities. These processes shall be considered in the design solutions for crossing the rivers and the larger gullies; along the Western route of the pipeline such are the Varbitsa River and Chitak Dere; along the Eastern route – Karamandere and along both routes – the rivers Arda, Harmanliyska, Haskovska, Handere, Gyoldere, Maritsa, Goliamata Reka, Sazliyka and Azmaka, etc.;
- *The slope (surface) erosion* is expessed in smoothing of the landscape convex forms and formation of small gulches as a result of washing the ground surface with inclination greater than about 2.5^0 by temporary rain flows. These processes do not pose a serous risk to the engineering facilities, but they can cause linear erosion during periods of intense rainfall;
- *The linear (gulch) erosion* is a process of a concentrated (linear) blur, which causes dismemberment of the ground surface by formation of gulches, growing into gullies. They are negative linear relief shapes with steep bear sides, usually formed of periodically flowing water within easier blurring sediments and slightly cemented Paleogene tuffs. Along the alternative routes of the pipeline numerous products of the linear erosion intersect – gullies and coulees, which are well - documented in the attached topographical and geological maps in scale 1:25000.

- *Karst processes and phenomena,* developed in Paleogene carbonate sediments and in Precambrian marbles and calcium shales in the section of the Chepelare suite. The sections with established karsts along the proposed routes of the pipeline are indicated in Table 3.3.2.

Table 3.3.2 The sections with established karsts along the proposed routes of the pipeline

From (m)	To (m)	Index	Lithostratigraphic description	Structural area
Western route of the pipeline				
6680	6790	Ch_mPCm	Precambrian marbles and calcium shales of Chepelare suite	Kesebir swelling
6878	7120	Ch_mPCm		
7120	7380	Ch_mPCm		
7520	7700	Ch_mPCm		
8154	8245	Ch_mPCm		
47295	47324	2a_lPg3	Paleogene organogenic (reef) limestone and marl	East Rhodopean depression
47820	48330	2a_lPg3		
53770	54286	2a_lPg3		
59722	59810	mlPg2		
64480	65000	mlPg2		
65480	65740	mlPg2		
71952	74540	mlPg2		
Eastern route of the pipeline				
17300	19044	Ch_mPCm	Precambrian marbles and calcium shales of Chepelare suite	Kesebir swelling
19600	19790	Ch_mPCm		
25220	25890	Ch_mPCm		
19044	19600	mlPg2		
19790	20230	mlPg2	Paleogene organogenic (reef) limestone and marl	East Rhodopean depression
22608	23031	2a_lPg3		

Gravitational processes and phenomena are expressed in slope landslides and landslips. The landslides, as well as the sections with the potential for development of gravitational processes, are connected with clay or marl formations revealing on the steep slopes of volcanic structures under the volcanites. The landslips are developed at the foot of projecting hills that are volcanic necks or lava plateaus.

The ascertained landslides and landslips are shown in the geological maps prepared by Dr. V. Zhelev (***Appendix 5.1***). The approximate points of intersection by the proposed pipeline routes are indicated in Table 3.3.3.

Table 3.3.3 The ascertained landslides and landslips

Western route of the pipeline			**Eastern route of the pipeline вода**		
Gravitational phenomenon	**From km**	**To km**	**Gravitational phenomenon**	**From km**	**To km**
Landslide	14+100	14+800	Landslide	5+700	5+800
			Landslide	10+700	10+800
Rock crown with landslip	50+900		Rock crown with landslip (proposed adjustment)	39+900	10+850
Rock crown with landslip	56+900		Rock crown with landslip (proposed adjustment)	47+350	47+400
			Landslide	51+100	51+150

The landslides are mostly small in layout and are developed at shallow depth. More considerable in size on the layout is the landslide along the Western route of the pipeline at km 14+100÷14+800, on the right slope of Varbitsa River, but the proposed route goes near not affecting this landslide.

● Seismicity of the area

As per "Ordinance № 2/23.07.2007 for design of buildings and structures in seismic areas" the proposed routes of the pipeline that are the subject of the investment proposal fall in three seismic areas, as follow (fig.3.4.1):

● *first area of seismic rating VII* – covers the territory between the state border with Greece and Arda River (from km 0+000 to km 48+000 along the Western route and from km 0+000 to km 53+000 along the Eastern route of the pipeline).

● *second area of seismic rating VIII* – Northwards of the first area to the right terrace of Harmanliyska River 84+600 along the Western route and km 83+000 along the Eastern route of the pipeline);

● *third area of seismic rating IX* – Northwards of the second area to the end point of the pipeline (km 150+400 along the Western route and km (144+800) along the Eastern route).

The design of buildings and facilities along the route of the pipeline should be done with the seismic coefficient K_c = 0,10 in the area of seismic rating VII (first area), K_c = 0,15 м in the area of seismic rating VIII (second area) and K_c = 0,27 in the area of seismic rating IX (third area).

For the seismic characteristics of the massif the indicators from table 1 to art. 7, par. 1 of Ordinance № 2/23.07.2007 shall be used for rocks group „A" and for clays, gravel, sands group „F".

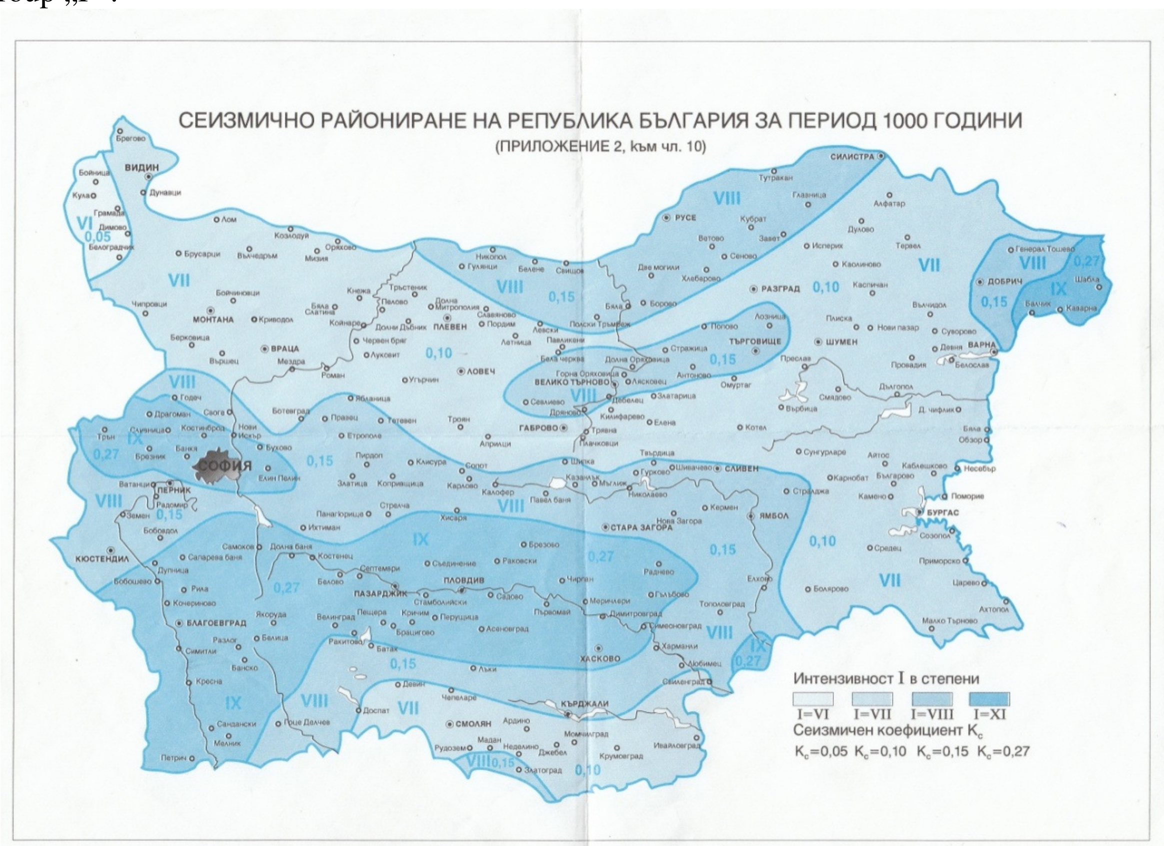


Fig. 3.4.1. Seismic zoning of Bulgaria

The main source of seismic hazard for the reviewed area along the pipeline routes is the Maritsa seismic area within the coverage of the Maritsa fault zone. The biggest disaster for this part of the territory of Bulgaria was provoked by two events – the earthquakes on 14.04.1928 of magnitude M = 6.8 and on 18.04.1928 of magnitude M = 7,0 in Popovitsa and

Chirpan region. The intensity in the epicenter zone was of rating X for the first event and XI for the second. A third event on 25.04.1928 followed in the region of Galabvo village of magnitude 5.7, but its effects were not disastrous. By these earthquakes 74 741 buildings were destroyed, the victims were 114, the wounded - over 1000. On the earth surface fault lines were formed, 143 km in length and displacements up to 1÷2 m.

The most significant event after 1928 were the earthquakes in February and December 1984 of magnitudes accordingly M = 5.3 and M = 5.7 in the vicinity of the town of Strazhitsa. Furthermore, the territory of Bulgaria was considerably affected by the earthquake on 04.03.1977 in the region of Vrancha (Romania). Other catastrophic earthquakes on the territory of Bulgaria were not registered**.**

● Natural resources and mineral diversity

According to the information from „Natural resources and concessions" to MEET within the pipeline coverage 49 deposits of natural resources are situated, described in „List and data for deposits of natural resources within the coverage of investment proposal for gas pipeline Bulgaria - Greece". This information showed that the proposed pipeline routes intersect six deposits along the Western route and five deposits along the Eastern route of the pipeline. Therefore, adjustments were made to bypass the natural resources. Data regarding the adjusted sections near deposits of natural resources were presented in Table 3.4.2. The only exception was the pipeline section along the common route within the borders of the Maritsa West coal basin. Within its coverage there was no need of adjustment of the route and such was not made as it passed to the East of the border of coals with 0.80 m commercial thickness, where no stocks had been approved, no operation was planned or performed in the coal deposit.

Table. 3.4.2 Deposits of natural resources within the coverage of the pipeline „Komotini /Greece/ - Dimitrovgrad – Stara Zagora"

№	Deposit and group of natural resources	Section	A company with mining rights / Decision of the Council of Ministers for granting concession	Section of the pipeline near a deposit of natural resources /from km to km/	Note
1	2	3	4	5	6
	Western route of the pipeline				
1	Sedlovinata – non-metal pi-industrial materials - bentonite clay for foundry	-	-	50+300÷50+500	The route of the pipeline is situated by the deposit that is not operated
2	Beliat Bair – clinoptilolite zeolites	-	**-**	51+000÷52+500	
3	Beli Plast - clinoptilolite zeolites	Beli Plast	„A & B INDUSTRIAL MINERALS" JSC, Kardzhali	70+600÷70+700	The route of the pipeline is situated by the source
4	West Maritsa basin – solid fuels lignite	Zdravets	Minyor „Zdravets" PLC	112+000÷123+000	By 2004 production ceased. The route goes to the East of the commercial borders of the coal basin
5	West Maritsa basin – solid fuels lignite	Maritza-West	Marbas - Dimitrovgrad		
	Eastern route of the pipeline				
1	Makaza – for rock – facing materials – gneiss shales for cladding and paving	Makaza-West Makaza-East	„Memorial" Ltd., Kardzhali	5+400+5+700	Adjustment was made to the route in the indicated section
		Tsarino-West Tsarino-East	"Vitaltrans" Ltd.- Parvomay	6+400+6+600	Adjustment is needed for the route in the indicated section
2	Pcheloyad – lead and zinc ores	Pcheloyad concession	"GORUBSO-KARDZHALI" JSC, Kardzhali	20+700+21+300	Adjustment is needed for the route in the indicated section
3	Zvezdel – lead and zinc ores	Zvezdel galena	**-**	22+800+23+300	Adjustment is needed for the route in the indicated section
4	Sedefche KG – metal and gold ores	-	-	24+800+23+300	No approved stock
5	West Maritsa basin – solid fuels lignite	Zdravets	Minyor „Zdravets" PLC	110+800+121+800	By 2004 production ceased. The route goes to the East of the commercial borders of the coal basin

The alternative routes of the pipeline:

- are equal in terms of geologic hazards: crossed active tectonic disturbances, physical and geological processes and phenomena shown, seismicity, proximity to deposits of natural resources, etc.;

- quite significantly differ in terms of construction work performance conditions. Considerably more favorable are the conditions of the Western route of the pipeline, as the medium solid and the solid rock types that is possible to be excavated by blasting operations or by using heavy excavators, according to data in the table 3.3.1 contained above, represent 34.1 % of the pipeline length, while the length of these rocks along the Eastern route represent 50.8 % of the pipeline length.

3.4 Soils

The route of the pipeline falls entirely within the Mediterranean soil area in the Thracian – Middle Tundzha and the East Rhodope - Sakar provinces.

The Mediterranean area is a part of the subtropical xerophytic - forest soil sector in Europe. Its territory is spread to the South of Stara planina, the Alps, the Pyrenees and it includes the Pyrenean and the Apennine, as well as the Southern part of the Balkan Peninsulas. The composition of the rocks is quite variable. Limestones and the associated with them red colored clayey ferrallite and fersiallite weathering products are widespread; the silicate rocks are extremely much too. The dominant soil type in the planes and in the lower parts of the mountain slopes are the cinnamon soils under the dry forests and bushes, and also the cinnamon-like luvisols and shallow soils.

The Eastern part of the Thrace – Middle Tundzha province is almost entirely covered by vertisols (regular - eutric, VRe, carbonate - calcic, VRc, gleyic, VRg).

There are luvisols too (cinnamon-like -chromic, LVx, light -albic, LVa, red-ferric, LVf). In the non-draining terrains planosols occur (dystric, PLd), solonchaks, solonetz, and alluvial in the subbasins (rich-eutric, FLe, acid-dystric, FLd, dark-mollic, FLm). In the higher parts of the hills and uplands there are shallow soils (rankers-umbric, LPu, lithosols-lithic, LPq) and red soils (nitisols).

The East Rhodope - Sakar province is characterized by the domination of shallow soils (leptosols) – rankers with lithosols, rankers with cinnamon-like luvisols, rendzina soils. Erosion development is also typical. Unique here are the red cinnamon-like luvisols (ferric, LVf), andosols and planosols.

Seven major soil types fall within the coverage of the pipeline route – shallow (Leptosol), vertisols, metamorphic (Cambisols), Luvisols, Fluvisols, Planosols and diluvial (Calluvisols)

Shallow soils (Leptosols)

The shallow soils comprise profiles of very poor development; they have only one horizon lying directly on hard rock. These soils are among the most widespread in our country and are formed on all possible hard rocks, whereat the profile always has the typical signs of immaturity.

Within the coverage of the route considerable areas of this type fall that are divided between two basic subtypes – rankers (Umbric Leptosols, Lpu) and rendzina soils (Rendzic Leptosols, LPk).

As per Bulgarian soil classification the rankers include shallow cinnamon and grey forest and eroded sections of them. These are shallow soils formed on thin eluvium by silicate rocks with profile depth of 10 to 30-40 cm. The rankers are low productivity lands and in the agricultural regions tobacco is grown on them or potatoes after implementation of anti-erosion measures.

Vertisols

The vertisols are typical soils for the poorly drained valleys and lowlands of Central and Southern Bulgaria. Within the coverage of the route two basic soil subtypes fall as per the FAO classification – Eutric, Vertisol, VRe and Calcic Vertisols, VRk. In the Bulgarian soil classification these include – black earth-vertisols, the typical black earth - vertisols, the carbonate black earth - vertisols and the leached black earth - vertisols.

The vertisols are formed under the influence of a hydromorphic early stage of soil formation by meadow and meadow-marsh vegetation mainly on clayey and carbonate soil forming rocks with heavy (in most cases clayey) mechanical composition. The vertisols result from the specific evolution of marsh soils. Contemporary natural vegetation is low in diversity and limited in area. Non-typical characteristic of the vertisols is the seasonal drying of the soil profile and its cracking. In times of drought these soils form wide (over 1 cm) and deep (about and over 50 cm) cracks.

The vertisols are slightly acidic to alkaline with very high sorption capacity and base saturated. They contain 4-5%, and in the fields 2.5-3% humate humus type.

Taxonomy and classification of vertisols in the country is variable - with different numbers of types and subtypes, and according to FAO three taxons are diagnosed on the basis of their base saturation level and the availability of carbonate or gypsum type of horizon in soils, having gleyic properties.

Due to their heavy sandy – clay mechanical composition the vertisols are very sensitive to trampling.

Metamorphic soils (Cambisols)

The cambisols are the largest and the most diverse unit on the soil map of the world. They are formed in regions with various conditions and cover enormous areas. Their genesis is defined by a relatively contemporary soil formation with slight neogenesis of clay at weathering of the primary materials left in their profile and some delayed or masked clay illuviation, whereat a cambic B horizon is formed – their main pecularity.

According to the Bulgarian Classification several types of cinnamon soils fall within the coverage of the route – typical cinnamon with erosion or without, typical cinnamon soils – vertisol like and leached cinnamon soils. According to the contemporary methodological requirements for diagnosis and classification of soils the leached cinnamon fall within another soil order - Luvisols and for this reason they will be considered there.

According to the FAO classification the typical cinnamon soils and their eroded variations belong to the type Chromic Cambisols, CMx, and the cinnamon vertisol like soils belong to the type Vertic Cambisols, CMv. The most characteristic features of these soils are: reddish - brown color, relatively shallow profile (60-70 cm), shallow lying carbonate rich subsoil, poor textural differentiation. The cinnamon soils are saturated by bases (over 80%) and carbonate (to 40%), deposited at different depths within the profile. Cinnamon soil fertility is good – they contain humus from 2 to 5% and by this reason they are widely used for agricultural purposes. The forests growing on them are of low productivity considering their modified composition.

Lessivated soils (Luvisols)

Lessivated soils are characterized by well defined and deeply developed illuvial - clayey horizon B_t, formed in result of clay and alluvion accumulation at their decreasing migration (illimerization) of horizon A. They are characterized by well differentiated profile too, having high sorption capacity of the alluvion and base saturation (over 50%).

Lessivated soils in our country occur within the area of oak forests, which presently are largely destroyed and used for agriculture.

In the absence of erosion the lessivated soils have a fully developed profile of 90 to 200 cm in depth, but having thin surface horizon A (18-35 cm), specific for its gray color with different shades. The mechanical composition varies within wide limits depending on the stage of the illimerization process. In uncultivated soil humus content is high (3-4%), and in the cultivated soil it is considerably reduced, ranging from 1 to 2.5%.

The following representatives of the lessivated soils: Albic Luvisols, LVa, fall within the coverage of the route, represented as per our classification by highly leached to slightly podzolized cinnamon soils; Chromic Luvisols, LVx, represented by medium leached cinnamon soils; Vertic Luvisols, LVv represented by medium leached cinnamon, vertisol soils.

Lessivated soils are spread mostly in the agricultural regions and nearly any crops are grown on them depending on environmental considerations. The varied topography and irrational treatment, however, resulted in a strong and widespread development of erosion - 28.3% of the total area.

Alluvial soils (Fluvisols)

This type of soil is formed on alluvial sedimentts (at some places mixed with diluvial deposits) of rivers, covered more or less with vegetation and periodically enriched with new sedimentary material. They are in the initial phase of soil formation, have only humus A horizon in a different development phase, under which sediment layers of river sand and/or gravel of different thickness and alignment lie.

By their mechanical composition the alluvial soils are from gravel-sandy to slightly clayey, and at small areas they can vary very quickly depending on river sediment granulometry. They are loose, airy, warm and well moisturized by the nearby ground water. These properties make them very suitable for agriculture – vegetables, orchards and meadows.

The alluvial soils within the considered section of the route will be classified as Eutric, FLe (alluvial - diluvial and alluvial - meadow), Dystric, FLd (alluvial).

Alluvial (diluvial) - meadow soils (Eutric, FLe) have well defined and shaped humus horizon of brown – grey color and thickness of 15 to 25 см, containing humus from 2 to 4%. The alluvial soils (Dystric, FLd) are specific for the first flood terrace. They are periodically flooded by the rivers and have a very simple structure – composed by layers of sandy or coarse-mechanical structure. Formed humus horizon is missing, and sometimes fragments are seen in them of buried horizons or other soil profiles.

Planosols

Only one subtype of these soils under the FAO Classification – Eutric Planosols, PLe, that according to the Bulgarian classification comprises cinnamon- podzolized, not eroded soils, gley like, falls within the coverage of the route.

Planosols are soils of eluvial E horizon and water impermeable B_t horizon below it. They are subject to annual periodical surface waterlogging (stagnation of rain water) and strong drought. Waterlogging taking place throughout the most active (surface) horizons causes intense changes in the redox conditions and facilitates the development of micro-biological activity. Iron-manganese hydroxides appear in the form of granular concretions (in the elluvial horizon), grey and rusty spots (in the impermeable horizon B_t).

Planosols are acidic soils with pH 4.5 to 5.5, their mechanical composition varies from sandy - clay to heavy sandy - clay of medium clay content 20-40% and too little alluvion. Base saturation is low (30-40 rarely up to 70%), the humus content in the uncultivated areas does not exceed 2-2.5%, and in the cultivated areas 1-1.5%. These features rate the Planosols as one of the least fertile soils in Bulgaria.

Diluvial soils (Calluvisols)

The name of these soils is defined completely by the origin of the soil forming materials. In the upper part of the sediment cones and the trails, near the base of the slope surfaces, soils of more gravelled and coarse particles are formed. The greater the distance from the place of origin is, where the deluvia turns into material of smaller particle size, better moisturized, the more developed humus horizon the primary diluvial soils have.

The soils occurring along the pipeline route belong to: diluvial, torrent soils (Dystric, CLd) and diluvial – meadow soils (Gleyic Colluvisols, CLg). They cover insignificant part of the route territory.

Dystric, CLd are formed predominantly on diluvial sediments in the lower end of the slope sections and are spread over areas, where the sediments are the youngest and coarse particle type. They are specific with the non-sorted material, not clear and obliquely underrunning lamination and not processed crushed material. Soil forming process is young, not well defined and periodically interrupted by the accumulation of new deposits

Where diluvial materials mix with river sediments (Kirkovo) soils are formed with combined characteristics, determined as subtype alluvial-diluvial and/or proluvial (Gleyic Colluvisols, CLg)

Diluvial soils are the best for growing tobacco, vineyards, cherries and other pyrene species, but they need freeing up from the stones, phosphate mode improvement, watering and protection from erosion. Complete description of the soils along the route is given in ***Appendix* 6.1**

<u>Brief description of the soil types and subtypes location within the coverage of the route</u>

<u>Western alternative</u>

The entry of the pipeline on the territory of Bulgaria is at about 1370 m Northeast from the passage Makaza and the new constructed international road connecting Bulgaria and Greece. It is a mountainous region with average altitude of 900 meters. Typical for this part are the shallow soils. Here not well developed cinnamon soils are encountered, shallow, Lithic Leptosols(Lpq) and cinnamonic, shallow, medium and severely eroded soils, Umbric Leptosols, (Lpu). In depressions and along riverbanks the soils are of subtypes Alluvial-diluvial soils, Dystruc Fulvisols (FLd) and Diluvial soils, Dystruc Colluvisols (CLd).

In lowland areas Northwards of Kirkovo village, at altitude about 340m., deeper and fertile soils occur of subtype medium leached cinnamon, Chromic Luvisols (LVx).

From Kirkovo village to Varben village the abovementioned soils alternate, in lowland areas dominated by the alluvial (FL) and leached cinnamon (LVx), and on the slopes – by shallow soils.

In the vicinity of Varben village rich soils of the type vertisols – medium leached black earth-luvisols, Eutric Vertisols,(Vre) occur. Here they have a very limited distribution.

By Momchilgrad the route crosses mainly alluvial, shallow and leached cinnamon soils. Northwards of the town, in lowland area along Varbitsa River typical cinnamon are found, Chromic Cambisols (CMx).

In the area between Momchilgrad and Kardzhali the sediment soils dominate, but also leached cinnamon and cinnamon luvisols are identified. Soils on steep slopes are again shallow, moderately and heavily eroded. Spots of leached black earth –luvisols occur. The altitude varies between 260 and 310 m. On the banks of the Studen Kladenets dam, in the point of pipeline intersection, the soils are sediment - rich and deep. To the North of Kardzhali, in the lands of Panchevo village, the route intersects an area of not developed cinnamon soils and rocks of shallow location, coming out to the surface at some places.

To the East of Zvezden the route intersects an area of cinnamon soils with erosion and leached cinnamon soils.

At Stremtsi village, due to the influence of Perperek River, cinnamon soils give way to sediment - alluvial soils and diluvial – meadow soils.

In lowland areas to the South of Beli Plast village, the route intersects a section of rich medium leached black earth-vertisols, cinnamon.

In the area between Beli Plast and Orlovo cinnamon soil subtypes dominate, and on the steep slope areas their shallow kinds are identified.

Gradually after Orlovo, the main soil type become the meduim leached black earth-vertisols, cinnamon, but typical black earth-vertisols and leached cinnamon soils are found too.

In the region of the town of Haskovo the soils do not alternate much. Here the main soils types are again leached cinnamon soils and leached black earth-vertisols. Along the valley of Haskovska River sediment soils are also identified. The altitude is between 180 and 220 meters.

In the region of Haskovo – Dimitrovgrad the soil cover stays the same - alternating cinnamon vertisol type soils and leached black earth-vertisols, and to the Northwest of Uzundzhovo village the route crosses a small area of not developed, shallow cinnamon soils.

At Uzundzhovo both routes merge.

To the East of Dimitrovgrad, the route passes through the flood terraces of Maritsa River that are specific for their rich and deep sediment soils located within a wide zone along the river banks.

To the North of Dimitrovgrad the route crosses a wide area, in which the prevailing soils are black earth-vertisols and leached black earth-vertisols, cinnamon type, and along the river beds – sediment soils. To the East of Byal Izvor village a small area is identified covered by medium leached cinnamon, vertisol type soils.

Subtypes of black earth-vertisols cover the entire area Northwards of Badeshte village, where the vertisols give way to a narrow strip of sediment soils along the river bed. From there to the end of the route the soils are cinnamon - podzolated, not eroded, gleyic, Eutric Planosols (PLe).

<u>Estern alternative</u>

From the Bulgaria - Greece border the Eastern alternative of the pipeline goes in Northeast direction following the ridge of the Eastern Rhodope. The prevailing soils within this area are not developed and shallow cinnamon - Lithic Leptosols (Lpq), Umbric Leptosols, (Lpu). These soils cover tightly the section from the border to Sedefche, where spots of medium leached cinnamon are already seen, Chromic Luvisols (LVx).

In the area between Sedefche and Rabovo, on the slope sections, shallow cinnamon soils (Lpu) are spread, the lowlands are covered by leached cinnamon soils (LVx) of different depths, and on the flood terraces of Arda river sediment soils (FL) are formed. To the West of Pchelary village the route crosses an area of black earth-vertisols with limited availability in the region.

Northwards, by the village of Patnikovo, leached cinnamon soils (LVx) and shallow soils (LPu) with different depths prevail, spread on the slopes.

After Zimovina the shallow soils gradually give way to deep soils with structured profile. Typical for the region are the leached cinnamon, vertisol type soils Vertic Luvisols (LVv), black earth-vertisols at different stage of erosion, Vertisols (VR), leached cinnamon Chromic Luvisols (LVx), as well as sediment soils in depressions and on the river terraces (Fulvisols). To the South of Stamboliyski the route crosses an area of typical cinnamon-vertisol type soils Vertic Cambisols (CMv). At Uzundzhovo both pipeline altenatives merge and they are described above.

Complete description of the soils along the route is given in ***Appendix* 6.2**

The alternatives differ in the section from the border with Greece to Uzundzhovo; in this part the Eastern route crosses considerably larger area of shallow soils located in very rugged mountainous terrain. These soils are highly susceptible to secondary erosion process development and restoration there will be of much slower pace, and recultivation activities not very effective.

The Western route passes through more lowland areas of farmland specific for stronger soil types, where the damages caused during construction will be quickly restored, and the secondary impacts could be qualified as minor.

From the above data it can be concluded that the Western alternative is the better one for the pipeline construction.

3.5 Landscape

According to the physiographic zoning of Bulgaria (I. Ivanov, etc. Geography of Bulgaria 2002) the route of the pipeline passes through the regional landscape structure of the Osogovo – Rhodope zone the East Rhodopean area and Kraishte - Tundzha landscape zone with landscape area of Upper Thracian lowland.

Essential part for the formation of the landscape types in the region plays the relief. Characterization of the relief within the coverage of the two pipeline alternatives is given below.

In terms of morphology and hydrography the Osogovo - Rhodope area is a combination of extensive mountain massifs, highly elevated horsts and rounded mountain ridges. These mountain massifs are interrupted by a complex valley net, linked with series of gorges, valley extensions and well-defined valleys.

The East Rhodope area is chracterized mainly by low mountainous and hilly terrain and significant altitude increase from north to south. The centerpiece there is Arda River with the spread in parallel series of valley extensions and short gorges. The morphologic and hydrographic and the physiographic features of this area determine its division into four sub-areas: Haskovo, Ardino, Varbitsa - Krumovitsa and Gyumyurdzhina - Maglenitsa. Both alternatives of the pipeline route pass through these four sub-areas.

Haskovo subarea is situated to the South of the Upper Thracian lowland and the Valley of Maritsa River. The Valley of Arda River is its limit to the South. It is specific for its hilly terrain, the altitude gradually increasing from North to South. In this direction along the parallel the following ridges alternate: Uzundzhovo, Haskovo, Huhlata (353m), Chukata and Gorata (704m). In the Northwest part of this subarea the contours and the steep slopes of the Massif Dragoyna (860m) stand out.

Ardino subarea comprises the Valley of Arda River, which spreads along the parallel and is characterized by alternating valley extensions and gorges. From the West to the East Kardzhali, Gniazdovo-Osmanovo, Rabovo and Borislavovo valley extensions are situated. They are distinguished from the West to the East by the gorges Birmutski, Zhelezni Vrata, Studen Kladenets, Gorno Madzharovo, Dolno Madzharovo and Kamildol.

Varbitsa - Krumovitsa subarea occupies the lower mountain terrain to the South of the Arda River valley. From the West to the East the massifs Zhalti Dial (1241m), Stramni Rid (960m), Iran Tepe (817m) and Sarta (812m) are spread. Along the meridian they are distinguished by the valleys of the rivers Varbitsa, Krumovitsa and their numerous tributaries.

Gyumyurdzhina - Maglenitsa subarea is spread to the South of the valleys of Varbitsa and Byala Rivers in their upper streams. From the West to the East within it the ridges and hills of Gyumyurdzhinski Snezhnik, with its highest peak Orlitsa (1483m) and Maglenik with its highest peak Kodzhaele (1267m) are located, wherethrough our border with Greece passes. The Northern part of these border ridges is situated within the Bulgarian part of the subarea.

The main role in the formation of transitional nature landscape of the Kraishte - Tundzha zone is played by the fault line. The rise of the mountains and hills, sinking of lowland - valley-land and the large contours of valley network result from these faults. The morphological features of the zone are a complex mix of lowland, valleys, low mountainous and mountain relief with different climate, runoff regime, soils and vegetation.

The area of Upper Thracian lowland is characterized by leveled, uniform and low relief, transitional continental climate and it is occupied predominantly by agricultural landscapes and minimized area of natural vegetation. The route of the pipeline passes through the Eastern subarea of the Upper Thracian lowland, which is occupied by the Stara Zagora field. The field is spread Eastwards of the Chirpan heights and the massif Dragoyna and to the West of Sazliyka River. Its numerous right tributaries flood Stara Zagora field and significantly shape the hilly terrain of its Eastern periphery. The altitude of the field is from 150 to 100m, and to the Southeast, between the mouth of Sazliyka and the Harmanli gorge of Maritsa it considerably lowers to less than 100m.

The basic factors for the contemporary landscape formation are the climate, the geological basis and the rivers. The route crosses the catchment of Arda River and intersects the rivers Lozengradska, Kazalach, Varbitsa, Krumovitsa, Arda and their tributaries, as well as the catchment of Maritsa River, and intersects the rivers Biserska, Yurukdere, Balaklidere, Haskovo, Uzundzhovska, Maritsa, Merichlerska, Martinka, Arpadere, Eledzhik, Mustanova, Dundarliya, Rakitnitsa, Bedechka, Azmaka and their tributaries.

At morphological structure analysis of the region landscape it is found out that the contemporary landscape formation processes have greater importance and expression. They model the previous primary morphological structural forms and shape the present landscape.

Slopes The alternatives of the pipeline route pass throughout a section of different in size, inclination and position slopes. The steepest slopes are along the Western route at the intersections near the Makaza pass and at the rocks of Zvezden village. Where there is no vegetation, the slopes are subject to intensive denudation – erosion processes. At some places traces of erosive and landslide processes occur.

Along the Eastern route the steepest slopes are next to the border at kilometer 3+700, and at kilometer 52+400 (near Potochnitsa village)

River valleys The greater part of the river valleys within the coverage of both alternatives is in meridional direction. Depending on the anti erosion stability of the rock base they have steep or wider and gentle slopes. They are covered by alluvial cover of gravels, clays and sands.

Denudation – gravity forms. They are formed in result of active contemporary landslide and landslip processes. The lanslides result from slides of rock - soil masses on surfaces formed on clayey layers. At some places on the slopes landslides of different size are formed. Cases of rock base outcrop are observed that are local and result from increased amount of the surface runoff in the area.

Forms shaped as a result of erosion processes The erosion destroys the surface soils layers and takes away the humus. It is caused by the flowing water on the surface of the slopes, over-felling or pastures overuse in some areas. In some sections of the pipeline routes medium zonal erosion activity is identified, at some places there is gully erosion mainly in the mountain area, wherethrough the pipeline routes will pass along.

Karst landscape shaping processes occur in places with organogenic limestones and their formation is related to the presence of nourishing precipitation and surface water. The route crosses karsting rocks in the area before the town of Kardzhali and Balabanovo village, karst rock landscape within the protected area „Ribino" that covers a very inconsiderable area. The karst relief is very slightly represented.

Rock formations

Near the pipeline (to approximately 600m) there are some rock formations, shaped in result of natural processes, which are unique landscape compositions. Such are for example:

- "Kamennite gabi"("The stone mushrooms") – Natural landmark, which is a rock formation. It is situated near Beli Plast village at a distance of 200 m to the West of the Western pipeline route at km 71+250.
- „Belite sipei" ("The white screes") is a rock formation with a very interesting landscape, situated at a distance of 373m to the left of the Western pipeline route.
- A rock formation and unique relief above Varbitsa River, in the locality „Harmenkaya" at a distance of 550m to the left of the Western pipeline route.
- Protected area „Ribino" – spread near the villages Ribino and Samovil, at a distance of 660m to the right of the Eastern pipeline route. The target of protection are the populations of protected and endangered plant and animal species, including different bat species and the protection of karst relief with cliffs, springs and caves.
- Reservation „Valchi Dol" – spread in the vicinity of „Studen Kladenets" Dam in the lands of Boynik village, Municipality Krumovgrad, 12 km Eastwards of the Western route and at 0,200m to the West of the Eastern route. The area is very picturesque with Mediterranean underbrush, woodland, grassland and rocks. Reservation „Valchi Dol" is situated 12 km Eastwards of the Western route and at 0,200m to the West of the Eastern route.

Anthropogenic landscape The anthropogenic landscape shaping processes cause most often negative changes of the landscape. The anthropogenic impact on the natural environment is the greatest in areas with developed agriculture, settlements and their infrastructure, construction of road and electricity networks.

In respect to the morphology and hydrography both alternatives of the pipeline (Eastern and Western) enter the Bulgarian territory along the ridge of the Rhodope Mountains at elevation of 905m. After that the two alternatives divide and go throughout the Bulgarian territory to the city of Stara Zagora. The landscape of the routes is a colorful mix of planes, low and medium-high mountains and valleys.

The Western route of the considered pipeline and the related items will pass through diversified landscape, including mountain landscapes to the South that turn into plane - hilly and agricultural landscapes to the North, cut through by river valleys and gullies. There are several dams and small lakes, and a vacation home along the route. The gas pipeline will cross the dam „Studen Kladenets", located to the Southeast of Kardzhali.

Near Uzundzhovo the Eastern route of the pipeline passes through typical mountainous landscapes with densely wooded ridges, with less in number depressions between them. The landscapes turn into plane - hilly and agricultural lands within the section after merging of the two alternatives.

The morphological description of the two alternatives of the pipeline route is given in ***Appendix 7.1***

A map and a table of the landscape groups, through which the alternatives of the pipeline route pass, are given in ***Appendix 7.2***

As per the scheme in the Classification Pattern of Landscapes in Bulgaria (Petrov. P., Geography of Bulgaria, 1997), prepared on the basis of the territorial combination of the landscape types, subtypes and groups and according to the altitude zonality, the pipeline route goes trough two landscape regions (fig. 3.5-1).

The route of the pipeline passes through the South Bulgarian mountain – valley area (C) with the East Rhodope subarea (XVIII) and Sredna gora – Zadbalkan subarea (XX) and a zonal area between the mountains of the South Bulgarian lowlands and low mountains (D) with Upper Thracian subarea (XIX). The pipeline alternatives go through three sections of the zonal area between the mountains (Dzhebel-Maglenitsa, Central Arda section and Dragoyna – Garotina section), one section from Sredna gora – Zadbalkan subarea (Svilengrad) and through three sections of the Upper Thracian subarea (Haskovo, Topolnitsa - Maritsa, Syutliyka - Sazliyka)

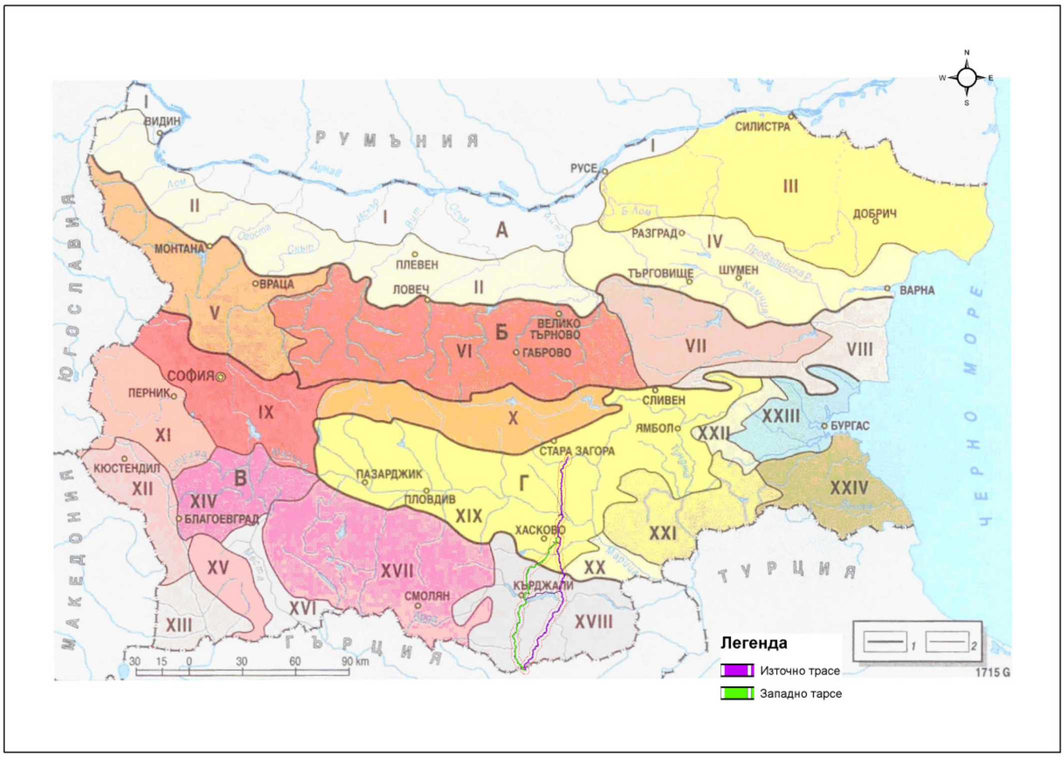


Fig. 3.5-1 Relief subareas intersected by the pipeline (Petrov, 1997)

Within the coverage of the investment proposal there are reliefs of three classes: mountain, inter-mountain valley - lowland and plane reliefs as per the Classification Pattern of Landscapes in Bulgaria (Petrov. P., 1997). Along the route of the pipeline landscapes are represented as follow:

Class	**Mountain landscapes**
Type	*Landscapes of the moderately moist mountain forests*
Subtype	Landscapes of the middle mountanous deciduous forests and secondary meadows
Group	Landscapes of the middle mountainous deciduous forests on massive and metamorphic rocks
Type	*Landscapes of the low mountainous sub-Mediterranean forests*
Subtype	Landscapes of the low mountainous xerophytic shrub forests
Group	Landscapes of the low mountainous xerophytic shrub forests on metamorphic rocks with relatively low rate of agricultural utilization.
Group	Landscapes of the low mountainous xerophytic shrub forests on Mesozoic and Paleogene clay – sand deposits with relatively low rate of agricultural utilization.
Group	Landscapes of the low mountainous xerophytic shrub forests on andesites and

	rhyolites with relatively low rate of agricultural utilization
Class	**Valley – lowland inter - mountain landscapes**
Type	*Landscapes of the sub-Mediterranean meadow-steppe and woodland -meadow-steppe inter-mountain lowlands*
Subtype	Landscapes of the meadow-steppe and woodland -meadow-steppe inter-mountain lowlands
Group	Landscapes of the meadow-steppe and woodland -meadow-steppe inter-mountain lowlands on not cemented Quaternary sediments with high rate of agricultural utilization
Group	Landscapes of the meadow-steppe and woodland -meadow-steppe inter-mountain lowlands with Pliocene sandy-clayey sediments with high rate of agricultural utilization
Subtype	Landscapes of the wooded inter-mountain lowlands
Group	Landscapes of the wooded inter-mountain lowlands on massive and metamorphic rocks with relatively low rate of agricultural utilization
Class	**Plane landscapes**
Type	*Landscapes of the moderate continental meadow-steppe and forested lowlands*
Subtype	Landscapes of the meadow-swampy lowlands
Group	Landscapes of the meadow-swampy alluvial lowlands with relatively low rate of agricultural utilization

The main landscape groups in the Southern parts along both pipeline routes are the mountain landscapes:

- Landscapes of the low mountainous xerophytic shrub forests on andesites and rhyolites with relatively low extent of agricultural utilization;
- Landscapes of the low mountainous xerophytic shrub forests on Mesozoic and Paleogene clay – sand deposits with relatively low extent of agricultural utilization;
- Fewer are found in the Northern parts of both alternatives:
- The landscape group of the marsh meadow alluvial lowlands with relatively low extent of agricultural utilization of the lowland class of landscapes
- The landscape group of the the steppe meadow and woodland -meadow-steppe inter-mountain lowlands on not cemented Quaternary sediments with high extent of agricultural utilization, class inter-mountain landscapes

The least part is taken by the landscape group of the forestry inter-mountain lowlands on massive and metamorphic rocks with relatively low rate of agricultural ustilization, which are identified only in the region around the town of Kardzhali along the Western route and in the region of Kralevo village along the Eastern route as limited areas.

The landscapes within the coverage of the two alternatives can be also divided into types as follow:

<u>Meadow landscapes</u> cover a limited area within the coverage of the future route. Such are common pasture within the land fund with grass vegetation and fully form open landscape structures. These are not valuable landscapes along the route of the investment proposal, as a type they are of quite limited availability too.

<u>Rock landscapes</u> cover the areas with shallow soils and outcrop rock areas, basically in mountainous terrains. These landscapes are in most cases covered by typical vegetation. They are quite widespread, but in terms of the relief the valuable thing are the unique rock formations around the village of Beli Plast, as well as other rock formations.

The forest landscapes are very widespread along the route of the investment proposal. They are the most valuable landscapes, and except the fact that they occupy large areas they are very important for the visual assessment during the pipeline construction for both alternatives.

The water landscapes include the main rivers and their tributaries, and also the lakes and dams along the route of the pipeline. These are valuable landscapes and are of great importance at detemining the visual effect considering their recreational importance.

Agricultural Landscapes of turnover crops include cornfields (mainly cereal crops, corn), orchards, vegetable gardens, tobacco and vineyards. As a whole they form anthropogenic landscape structure, which affects the landscape aesthetic appearance of the area. These are valuable landscapes, which as a landscape type are widespread. In the mountain areas they are represented by relatively rarely identified and small in area territories and in the Northern section of the pipeline, especially after the merger of the two routes they are well represented.

The anthropogenic landscapes include mainly the settlements with highly urbanized settlement network that are incorporated in the environment through their infrastructure. This landscape type is valuable for its landscape and aesthetic importance. The pipeline routes of both alternatives are designed in a way that they go around settlements.

The communication landscapes include the existing road network, railways, newly constructed asphalt roads, as well as the temporary roads that will serve the sites of the pipeline sections construction. This landscape type is valuable for its landscape and aesthetic importance.

The anthropogenic factors that have leading importance during the construction of the proposal will cause changes in the rocks and the relief, taking lands and destruction of the natural meadow vegetation, which has remained in its original state only on lands unfit for cultivation.

The separate elements of the landscape – geological basis, soils, water, plant and animal world, protected areas, are described in details in the relevant sections of the report.

The more favorable alternative for the pipeline construction is the Western alternative as its route will go initially through mountainous landscapes, but later it will go ahead through plane and hilly landscapes, where the route of the pipeline will have less visual participation in the scenery.

The Eastern route will pass for the most part through mountainous landscapes of densely forested ridges and will have larger visual participation in the scenery, due to that it is the less favorable alternative for implementation concerning the landscapes and their elements.

3.6 Flora and fauna, protected territories

3.6.1 Flora

According to the geobotanical zoning (according to Bondew, 1997) Bulgaria is divided into three areas (European deciduous forest area, Eurasian steppe and forest-steppe region and Mediterranean sclerophyllus forest area) and 5 provinces, 28 districts and 80 regions.

Below is a brief description of the current state of vegetation, which occurs in both pipeline routes.

Both alternatives of the pipeline route will cross the Macedonian – Thracian province, Upper Thracian and East Rhodopean districts.

Upper Thracian district covers varied terrain with diverse vegetation cover. In the past the terrains have been covered by forests of pedunculiflora Oak, currently they are occupied by almost only agricultural lands. This species now occurs singly and in groups, with Polish maple and Polish elm, forming mostly mesophytic and hydro mesophytic forests. Where it is dry the forests were xerothermal composed of oaks and cerris oak, and on limestone terrains – mostly of pubescens and Q. virgiliana oak. Some remains of these forests are preserved today on the hilly terrains and slopes of the district. Floral elements within the district are various too. The most numerous are the Balkan endemic from the group of Macedonian – Thracian floral elements (48 floral elements). Of these, 11 species are endemic Bulgarian and 37 species are Balkan endemic. The group of the Illyrian Balkan endemics is represented by 10 species. The group of steppe floral elements is relatively large (13 species). Mediterranean elements are represented by 4 species and 3 species are euxeinos floral elements. This district is divided into six floristic regions, as the pipeline alternatives pass through two of them:

- ***Stara Zagora district*** features one of the driest forests on the southern slopes of the Sarnena gora and Stara Planina Mountain, consisting of the most xerothermic species - mainly pubescent oak and Q. virgiliana. All forests are strongly influenced by human activity and are degraded and turned into bushes hornbeam or completely destroyed. In the Northeast region there are communities of Pistacia turpentine as well *(Pistacia terebinthus).*
- **Rhodope-foothill area** for the most part is built of limestones. On them there are formations of xerothermic vegetation dominated by pubescen and Q. virgiliana oak and secondary communities of hornbeam. Secondary grass phytocenoses of yellow bluestem and other species dominate. The area is characterized by involvement of endemic species Tekirska tekirae *(Gypsophylla tekirae).*

Eastern Rhodope district occupies the Eastern Rhodope and a part of the Thracian lowland – the space between Asenovgrad, Parvomay, Haskovo and Dimitrovgrad. It is specific for its predominantly xerothermic vegetation made up by the formations of Hungarian Oak oak, Pubescent and Q. virgiliana oak. In the end South and Southwest part of the district the Moesian beech formations are spread, common and eastern oak, less of hornbeam. In the Western part of Zhalti Dial there are also birch groves. Many forests are exhausted, and gradually they are penetrated by more sustainable species and form secondary forests of oriental hornbeam and thorn shrub formations, Red juniper and grasslands dominated by beard, yellow bluestem and therophytes. The district is rich with floral elements, the largest number of Macedonian-Thracian (37 species), of which 26 species are Balkan and 9 - Bulgarian endemics. There are relatively numerous Mediterranean species (12 pieces), and less represented are the Illyrian (3 species), steppe (3 species) and Euxine (2 species) floral elements. This district is divided into three floristic regions, as the pipeline alternatives pass through all three of them:

- **Haskovo district** is dominated by farm lands and only a small part is occupied by xerothermal forests dominated by oak, pubescens and Q. virgiliana, mixed forest of oaks and other trees and in many places in the forests hornbeam is seen. In forest degradation xerothermal grass ecosystems are formed of beard, Yellow bluestem, bulbosa and ephemeral plants. In this region, among other elements occur: Barbarea longirostris in the group of Illyrian Balkan endemic, from Macedonian-Thracian Balkan endemic – *Moehringia grisebachii*, degenii sainfoin (*Onobrychis degenii*), Rhodope medick (*Medicago rhodopaea*), black lollipop (*Nonea pallens*), Serbian woundwort (*Stachys serbica*), and from the Mediterranean elements - Bondev alfalfa *(Medicago bondevii),* Merendera attica.

- ***Krumovgrad district*** is characterized by xerothermal oak and Hungarian – Turkey oak forests and xeromesophytic durmast and mixed durmast-hornbeam forests, as a part of the durmast forests consist of eastern oak. In the southern part of the region there are also forests of Moesian beech spread, and in some places there are individual trees and groups of trees of Eastern beech. Somewhere in the beech forests evergreen relict shrub and small tree - common holly (*Ilex aquifolium*) are identified. Only in this region there are rare species like Thracian oak (*Q. thracica*), Yurushka mullein (*Verbascum humile ssp. Juruk*). Only here for now the species *Eriolobus trilobata*, *Arbutus unedo* and *A. andrachnae* were identified.
- **Kardzali district** is dominated by xeromesophytic forest formations of oak, hornbeam and mixed forests, and also mesophytic forests of Moesian beech. Less common the xerothermal forests are spread, mainly oak. In places there are primeval forests of pine, and there are birch forests in Zhulti Dyal.

A detailed list of the vegetation species dominating along the routes of both pipeline alternatives in the Upper Thracian and the East Rhodopean districts according to the geobotanical zoning of Bulgaria (as per Bondev, 1997) is presented in ***Appendix 8.1***

According to the floristic zoning of Bulgaria the route of the pipeline passes through two floristic regions: Rhodope (17) and Thracian lowland (18) as it can be seen on fig. 3.6.1-1.

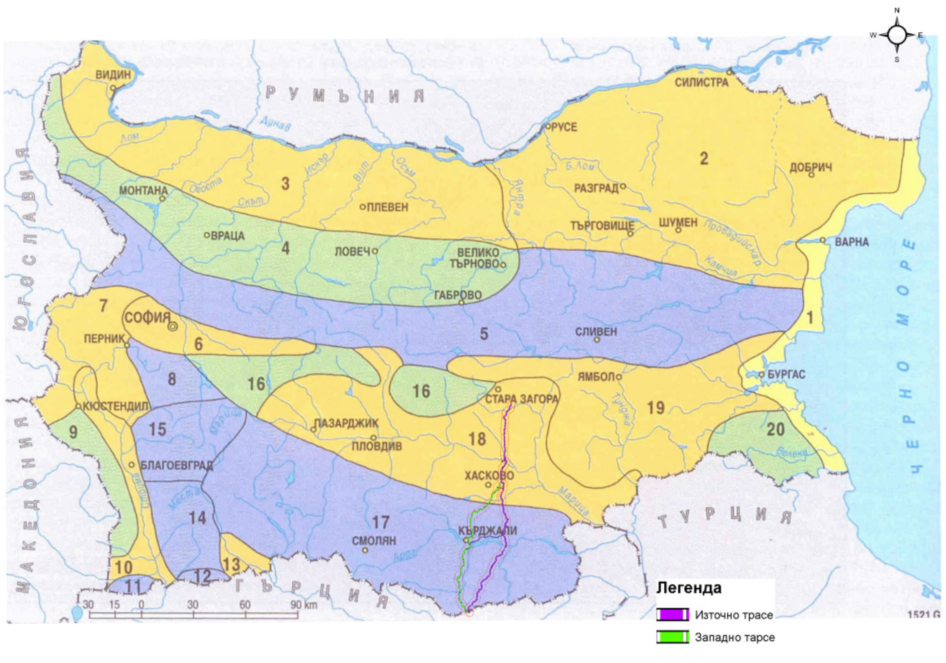


Fig. 3.6.1-1 Floristic regions (*as per Flora of Bulgaria Vol.I 1963*)

During EIA Report preparation surveys were performed on vegetation along the routes of the pipeline. During the inspection some plant communities and habitats were identified, given below **in the Brief characterization of the vegetation along the two alternative routes of the pipeline:**

The Western route

In the areas at border crossing Makaza and Lozengradtsi the route passes mainly through woodland. Coniferous species predominate, but in places there are small groves consisting of Moesian beech, oak - Quercus petraea, etc. To the East of Lozengradtsi it crosses mainly small agricultural lands and meadows.

Between the villages Lozengradtsi and Apriltsi it crosses a large oak forest massif consisting of Hungarian Oak, pubescent oak, etc. Then follows the river Lozengrad and crossing of mainly agricultural lands in very small areas and meadows dominated by *Alopecurus pratensis*. In two points the route goes through riparian forests along the river Lozengrad, dominated by black alder (*Alnus glutinosa*).

Between Apriltsi village and the town of Kirkovo the route goes mainly through agricultural lands and highly anthropogenically influenced areas. Only within the area Northeast of the town of Kirkovo it goes through a hill with natural sparse wood of oak represented by Hungarian Oak (*Quercus frainetto*), Turkey oak (*Quercus cerris*), pubescent oak (*Quercus pubescens*), Oriental Hornbeam (*Carpinus orientalis*) and undergrowth of red juniper (*Juniperus oxycedrus*). Rare and endemic species of conservation significance were identified in the wood like as *Orchis mascula, Fritillaria pontica, Potentilla regis-borissii.*

In the area between the town of Kirkovo and the villages Domishte and Parvitsa the route crosses mainly agricultural lands. At relatively short distances it crosses Ruderal grasslands, forest crops and small degraded groves.

Between the villages Parvitsa and Varben the route passes mainly through agricultural lands and intersects Varbitsa River, which in this area has relatively deforested valley. Between the villages Varben and Karchovsko it steps in areas with silicate chasmophytic vegetation and grasslands dominated by *Chrysopogon gryllus* and *Agrostis castellana*, as well as bushes of common juniper (*Juniperus communis).*

Between the villages Karchovsko and Bregovo along the route agricultural lands prevail, but there is also a relatively large area of dry ruderal grasslands with single bushes and small communities of red juniper *(Juniperus oxycedrus*), Oriental Hornbeam (*Carpinus orientalis*) and Jerusalem Thorn (*Paliurus spina-christii*). The agricultural lands and less dry grasslands prevail within the area between the villages Bregovo, Iliysko and Velikdenche. Such is also the vegetation between the villages Velikdenche, Rogozari and Zagorsko. In the area between Zagorsko and Sadovitsa grasslands prevail with bushes of red juniper (*Juniperus oxycedrus)*, Oriental Hornbeam woods (*Carpinus orientalis*), small areas of agricultural lands. The vegetation between the villages of Sadovitsa and Sedlari is predominantly ruderal grasslands of the dominating species *Taeniatherum caput-medusae, Carthamus lanatus, Lolium perenne*, crops of black pine (*Pinus nigra).* Between Sedlari and Varhari the route goes through white, eroded hills with crops of black pine (*Pinus nigra*) and fragmentary degraded shrubs of Oriental Hornbeam (*Carpinus orientalis*). Between the villages Varhari and Balabanovo the pipeline crosses on its way mainly ruderal shrubs dominated by *Hordeum bulbosum, Bromus arvensis, Agrostis castellana, Carlina corymbosa, Trifolium purpureum*, as well as fragmented and sparse shrubs of Jerusalem Thorn (*Paliurus spina-christi,)* field maple *(Acer campestre),* Turkey oak *(Quercus cerris),* hawthorn *(Crataegus monogyna*). From Balabanovo to residential area Gorna Gledka of the town of Kardzhali and to the village of Vishegrad almost all the pipeline crosses only agricultural lands. Between the village of Vishegrad and the bank of the dam Studen Kladents at Ostrovitsa it crosses a hill of Jerusalem Thorn shrubs (*Paliurus spina-christii*). After crossing the dam Studen Kladents at Sedlovina to Panchevo the pipeline goes through white eroded hills of black pine crops. Locally, in the places with more developed soil there are low shrublands of Balkan endemic *Genista rumelica*. Between the villages Panchevo, Zvezden and Oreshnitsa the route goes basically across agricultural lands or black pine crops (*Pinus nigra*). The vegetation is almost analogical at the villages Stremtsi and Sokoliane, although in places it crosses grasslands dominated by yellow bluestem and *Agrostis castellana*. Between the villages Beli Plast and Golemantsi the route goes across highly dynamic topography with the specific stone mushrooms. The vegetation is predominantly natural or semi natural – degraded woods and shrubs of Oriental Hornbeam (*Carpinus orientalis*), dry grasslands and black pine crops (*Pinus nigra*). From Golemantsi, through Mandra to Orlovo the pipeline crosses basically agricultural lands and ruderal grasslands with shrubs. At the village of Orlovo it intervenes the periphery of an open and light oak forest dominated by Hungarian Oak (*Quercus frainetto*). After that – the villages Voyvodovo, Mandra, to the town of Haskovo – the agricultural lands dominate. An assembly of oak forests and grasslands will be affected slightly between Haskovo and Uzundzhovo. At the village of Uzundzhovo the Eastern and the Western alternatives merge.

The East route.

From Makaza to the village of Strizhba the route goes mostly across forested areas – a lot of black pine crops, oak forests and partially through beech forests. From the village of Strizhba to Kukuryak it basically crosses pine crops. From Kukuryak to the area between the villages Grivka and Delvino the pipeline route goes again across pine crops, degraded shrubs of Oriental Hornbeam (*Carpinus orienalis*), and also through agricultural lands. There are, not large in area, eroded grasslands with shrubs of Common Juniper (*Juniperus communis*). From Delvino, by the village of Ralichevo to Ribino the route goes mostly across agricultural lands, but between the villages of Ralichevo and Ribino the landscape is highly dynamic. The route of the pipeline goes through eroded stony terrains with residual and highly degraded forests of Oriental Hornbeam (*Carpinus orientalis*) and *Acer monspessulanum*. At Ribino, near the route a community falls that is dominated by the evergreen shrub *Phillirea latifolia*. Very similar is the potentially affected vegetation to the North of Ribino, at the villages Sedefche and Konche. Pine crops alternate with degraded mixed forests and agricultural lands. Between the villages Konche and Karamfil agricultural lands prevail and there are less degraded forests and shrubs of Oriental Hornbeam (*Carpinus orientalis*). From Karamfil to Chayka the route crosses mainly agricultural lands.

After the village of Chayka, for tens of kilometers (along the hamlets of the villages Neofit Bozvelievo and Nanovitsa) to Stari Chal village, the route goes along the ridge of the low mountain "Boynik". It affects mainly natural and semi natural grass and shrub communities. The grass communities are mainly Pseudosteppe dominated by *Poa bulbosa*, with the presence of many therophytes growing in spring (April-May). In the shrub communities *Acer monspessulanum* dominates and also the Oriental Hornbeam (*Carpinus orientalis*), the Manna Ash (*Fraxinus ornus*), and in places there are almost monodominant communities of Jerusalem thorn (*Paliurus spina-christii*). After Stari Chal village the route goes by the villages of Potocharka and Studen Kladenets and goes down Boynik Mountain, where the agricultural lands start prevailing. Between the villages of Potochnitsa and Golobradovo Arda River goes, which within the area has specific communities of tamarisk (*Tamarix ramosissima*) on the gravel deposits. Between the villages Golobradovo and Rabovo the route passes mainly across agricultural lands. After Rabovo village to Patnikovo the route passes mainly across forest crops and shrubs of Oriental Hornbeam. Between the villages of Patnikovo and Zimovina, after crossing a forest of Oriental Hornbeam (*Carpinus orientalis*), the route passes across agricultural lands. After Zimovina village towards the village of Kladenets it crosses deciduous forest and agricultural lands. After the village of Kladenets to Kralevo it crosses almost entirely through agricultural lands. Between the villages of Kralevo and Koren it crosses a forest massif. After the village of Koren till the merger with the Western alternative to the South of Uzundzhovo the route goes mainly across fields, and only in two locations at a short distance crosses forests mainly of Oriental Hornbeam.

Common route

Between the villages of Uzundzhovo and Chernogorovo the route crosses basically agricultural lands and a hill with shrubs of Jerusalem Thorn (*Paliurus spina-christii*). To the West of the village of Brod it crosses Maritsa River, on its Southern bank there are riparian white willow galleries (*Salix alba*) and white poplar (*Populus alba*). Between the villages of Brod and Goliamo Asenovo the route goes predominantly across agricultural lands. The vegetation status is similar between the villages of Golyamo Asenovo and Trakiya. To the East of Trakiya village the pipeline passes through mixed forest of Turkey oak (*Quercus cerris*) and Hungarian Oak (*Quercus frainetto*). Between the villages of Trakiya, Sredets and Badeshte it goes mainly in agricultural lands, and at Brod it crosses Sazliyka River with specific strips of riparian woodland. Between the villages of Brod, Kolarovo and Malko Kadievo the route goes only across agricultural lands.

Plant species of conservation significance

Tables with information about the distribution of plant species with areas of distribution in Bulgaria that fall within the coverage of the Eastern and the Western route of the project "Gas Interconnector Greece-Bulgaria" and which have a significant environment protection status, and a table of the natural habitats with conservation significance that are spread along both routes within the area of the project "Gas Interconnector Greece-Bulgaria" are presented in ***Appendix 8.2.***

Table 1 of ***Appendix 8.2***. gives information about the conservation significant and protected plant species that could be potentially affected by the implementation of both alternatives. The information is based on the Red Book of Bulgaria and other reference sources, and on the field surveys in the period October - June 2011/2012. The potential habitats and the species conservation status have been reviewed.

During the field survey of the route or its immediate vicinity the following protected plant species and such of conservation significance were identified:

Floating watermoss (*Salivinia natans*)

The species is assessed as „Vulnerable" in the project "Red Lists" of the Institute of Botany of the Academy of Sciences. There are numerous populations along Danube River and less frequent inside the country. Single individuals were found in a bay of Maritsa River at about 70 m to the Northwest of the merged pipeline route. Considering the dynamics of Maritsa River and the macrophyte communities associated with its subbasin no significant impact could be expected on the species populations during the construction and even less at the site operation.

Fritillaria pontica

It is a protected species, but it is widespread in the natural deciduous (oak and Oriental Hornbeam) forests in the East Rhodopes and Thrace. Because of this it was rated low risk in the project "Red Lists" of the Institute of Botany of the Academy of Sciences. It was identified within the coverage of the Western route in 2 locations.

- In the area of Beli Plast village, in degraded forest of Oriental Hornbeam (GPS N 41 46 59.27; E025 26 01.35), at about 130 m far from the Western alternative of the route. Although it is in the immediate vicinity, this field is not expected to be affected during the construction and the operation of the pipeline
- At the town of Kirkovo (GPS N 41 19 56,82; E 25 22 10,37). A small population of oak forest, to the Northeast of the town falls on the pipeline route itself. At

construction it will be necessary the specimens of this population to be moved in the vicinity in unaffected part of the forest, where the species is found.

Provence orchid (*Orchis provincialis*)

The species is assessed as critically endangered. Its population in Bulgaria is small in number and concentrated mainly in the region of Kirkovo, Lozengradtsi, Chakalovo, Makaza. Its habitats are mapped and they are subject to annual monitoring by RIEW – Haskovo. Under a project funded by the LIFE+ programme "A pilot network of small protected sites for plant species in Bulgaria using the Plant Micro-reserve model" a protected area is proposed for preservation of the species habitats. Most of its known habitats fall near the Western route. (for example, by the village of Apriltsi they are only at about 200 m far). Nevertheles, the pipeline implementation is not expected to impact populations of this species. The forest at Lozengradtsi, where a large population of the species is known, is bypassed by the proposed route.

On the Eastern route at the village of Neofit Bozvelievo a large population was identified of *Verbascum humile*. The species is listed in the first edition of the Red Book of PR Bulgaria. Subsequently, being widespread in the Eastern Rhodopes and due to the numerous populations it has dropped out of the new edition of Appendix 3 of the Biological Diversity Act.

Natural habitats with conservation significance

Table 2 of ***Appendix 8.2.*** gives information regarding potential natural habitats that are found in this part of the country, in which the routes of both alternatives fall. In the table there is information about the location, the conservation significance and the category of these habitats on the grounds of the Red Book of Bulgaria.

It should be emphasized that all affected habitats are presented, regardless of the degree of the negative interference and of their availability or absence within the protected area network.

Affected natural habitats with conservation significance by the Western route

04C1 Natural or semi-natural mesotrophic to eutrophic lakes and marshes with macrophytic vegetation
03E1 Sub-Mediterranean petrophytic steppes
11E1 Xerothermic meadows and pastures of Chrysopogon gryllus, Bothriochloa ischaemum and Festuca valesiaca.
15E2 Lowland hay meadows
24F5 Shrubs of red juniper (*Juniperus oxycedrus*)/ Prickly juniper (Juniperus oxycedrus) scrub
04G1 Riverside woodlands of Alder (*Alnus* spp.) and Common ash (*Fraxinus excelsior*)
06G1 Willow-poplar galleries in South Bulgaria
10G1 Moesian beech forests
13G1 Thracian forests of White oak (Quercus pubescens)
16G1 Thracian mixed thermophilic oak forests
07H3 Silicate rocks with hasmophytic vegetation
08H3 Calcareous rocks with hasmophytic vegetation
09H3 Silicate rocks with pioneer herbaceous vegetation
11H3 Steep siliceous steep rocks with lichens

Affected natural habitats with conservation significance by the Eastern route

01E1 Pioneer thermophilic herbaceous communities in calcareous, rocky and stony places
03E1 Sub-Mediterranean petrophytic steppes
10E1 Sub-Mediterranean pseudo-steppes with annual herbs
11E1 Xerothermic meadows and pastures of Chrysopogon gryllus, Bothriochloa ischaemum and Festuca valesiaca.
15E2 Lowland hay meadows
24F5 Shrubs of red juniper (Juniperus oxycedrus)/ Prickly juniper (Juniperus oxycedrus) scrub
31F9 Tamarisk (Tamarix spp.) riverside stands
06G1 Willow-poplar galleries in South Bulgaria
10G1 Moesian beech forests
13G1 Thracian forests of White oak (Quercus pubescens)
16G1 Thracian mixed thermophilic oak forests
22G1 Montpellier maple (Acer monspessulanum) forests
07H3 Silicate rocks with hasmophytic vegetation
08H3 Calcareous rocks with hasmophytic vegetation
09H3 Silicate rocks with pioneer herbaceous vegetation
11H3 Steep siliceous steep rocks with lichens

Affected natural habitats with conservation significance along the merged route

11E1 Xerothermic meadows and pastures of Chrysopogon gryllus, Bothriochloa ischaemum and Festuca valesiaca.
06G1 Willow-poplar galleries in South Bulgaria
13G1 Thracian forests of White oak (Quercus pubescens)
16G1 Thracian mixed thermophilic oak forests

Forest land

The Western route of the pipeline goes through the territory of the Forest holdings Haskovo, Dzhebel, Kirkovo, Kardzhali, Momchilgrad, Stara Zagora, the Eastern route – through the territory of the Forest holdings Haskovo, Kirkovo, Krumovgrad, Momchilgrad, Stara Zagora.

Agricultural lands

By implementing the Western route 405.73 ha of agricultural lands will be affected, and by implementing the Eastern route – 331.6 ha of agricultural lands. The agricultural lands along the route of the pipeline are occupied mainly by crop species, and the natural vegetation is preserved only in the common lands between the fields. These ecosystems are occupied by manmade biocenoses under strong anthropogenic influence with a high degree of tolerance and lack of unique floristic components. Within these biocenoses that have comparatively low biocenotic value, as dominant communities were formed of species unassuming to direct anthropogenic influence – typical representatives of the ruderal vegetation.

For a more complete characterization of the vegetation along the routes of the pipeline, below a brief review is made of the habitats in the protected areas that will be impaired after the passage of the Western and the Eastern route in them:

Protected area under Natura 2000	The West route (impaired habitats)	The East route (impaired habitats)
BG001032 Eastern Rhodope	91M0, 91W0, 9150, 91E0, 8130, 91AA, 6210, 6220, 5210, 92D0, 5130	91M0, 91W0, 9150, 91E0, 8130, 91AA, 6210, 6220, 5210, 92D0, 5130, 92A0*, 6510
BG001034 Ostar Kamak	91M0, 91AA, 92A0, 6510, 6210	91M0, 91AA, 92A0
BG0000578 Maritsa River	92A0, 91M0	92A0, 91M0
BG000245 Sazliyka River	92A0	92A0

Note: by * habitats are marked, where significant impact is expected

Negative impact could be expected for the following vegetation communities in the protected areas and outside them (both routes):

- Agricultural lands – fields, vineyards, vegetable gardens, etc.
- Grassland dominated by perennial grasses – *Chrysopogon gryllus, Botriochloa ischaemum, Festuca valesiaca*
- Pseudo steppes dominated by annual grasses – *Trachynia distachya, Psilurus aristatus, Poa bulbosa*
- Ruderal grasslands dominated by *Hodreum bulbosum*, *Cynodon dactylon*
- Mesophile meadows dominated by *Alopecurus pratensis*
- Slightly saline meadows dominated by *Elymus elongatus* and *Cynodon dactylon*
- Macrophyte hygrophyte and hydrophyte communities of: *Phragmites australis, Typha latifolia Sparganium erectum, Lemna minor*
- Limestone rocks with chasmophytic vegetation
- Siliceous rock with chasmophytic vegetation
- Shrubs dominated by *Paliurus spina-christii*
- Shrubs dominated by *Juniperus communis* and *Juniperus oxycedrus*
- Mixed degraded forests *Carpinus orientalis, Acer monspessulanum, Fraxinus ornus*
- Mixed thermophilic oak forests *of Quercus cerris, Q. fraintetto, Q. pubescens*
- Xerophilous forests of *Quercus pubescens* and *Carpinus betulus*
- Riverside forests *of Salix alba* и *Populus alba*
- Riverside forests of black alder *Alnus glutionsa*
- Riverside shrubs of wicker *Tamarix ramosissima*
- Beech forests of Moesian beech *Fagus sylvatica* ssp. *moesiaca*

Appendix 8.4 gives information about the area of the impacted habitats (in dka and in %) for all protected areas under the Directive for habitats that the realization of the investment proposal will negatively impact by both alternative routes of the pipeline.

More detailed information about the size and extent of the impact on individual habitats is given in the Appropriate Assessment Report, which is an appendix to the EIA Report.

At the implementation of the Western route 51.79 ha of forest lands will be affected, and of the Eastern route – 114.44 ha of forest lands. An additional gas pipeline diversion to Kardzhali (only for the Eastern route) passes across 9.2 ha of forest lands more. In the forest areas it is necessary to periodically clean the easement area of the pipeline from trees and shrubs, **therefore, the lesser forest lands that the Western route will pass through make it the more favorable alternative to implement.**

3.6.2 Animal world (Fauna)

The investment proposal Natural Gas Interconnector Greece – Bulgaria crosses two physico-geographic regions, distinct to a great extent in the specifics and the variety of the fauna complexes the Upper Thracian (populated predominantly by open plain inhabitants) and the Eastern Rhodopes (inhabited by forest species and such from foothill and mountain zones).

According to the zoo-geographic division of Bulgaria into regions, the layout of both alternatives fall into the Thracian region, characterized by expressed Mediterranean influence (Georgiev, 1997). Due to the monotonous plain relief and the large percent of farming land in the Upper Thracian lowlands the naturally distributed flora and fauna are strongly limited. Greater diversity of species is observed in the foothills and by the rivers and in the plain forests. Most of the fauna is thermophilic – a lot of Mediterranean, Ponte-Mediterranean, Asia Minor and steppe forms are registered. The Euro-Siberian and the European species are also numerous.

In the Eastern Rhodopes 4329 fauna species were registered in 86 orders and 16 classes. 296 species are accepted as rare ones, and the endemic forms are 158. The number of the endangered animals is quite big – 340 species are protected by the Bulgarian legislation, 94 species are included in the Red Book of Bulgaria, 56 species – in IUCN, 25 species – in EUROBATS, 131 species are protected by the Directive on the protection of the wild birds, and 49 species – by the Directive on the habitats (Hubenov, 2004).

The analysis of the fauna diversity takes into consideration the published data for the separate systematic animal groups in the region, registered within the scope of impact, data from investigations performed in the region in the last few years as well as the results from the studies performed for the purposes of this evaluation.

In an article – review on the birds in the Bulgarian part of the Eastern Rhodopes Stoychev et al. (2004) 278 species registered in the region are enumerated. Twelve from the total of 13 orders of the class Birds represented in our country are found here. The Passeriformes are represented by the greatest number of species – 114, the Falconiformes – by 37 and the Anseriformes – by 25. The great diversity of species among the birds of prey is characteristic for the region and all species found in Bulgaria are registered in this region as well. The Eastern Rhodopes are a territory of great conservation significance for the preservation of quite a number of rare and endangered birds. Thus 84 species are included in Supplement I of the Directive on the preservation of the wild birds, 271 species – in the Supplements of the Bern Convention, and from the total of 100 species included in the red Book of Bulgaria, 77 are encountered in the Eastern Rhodopes, 245 species are protected by the Biological Diversity Act (2002). On the grounds of the abundant information 6 places of special importance for the protection of the birds were determined for the region, 3 of which located near the layout of the gas connection between Bulgaria and Greece anticipated for construction:

- Area of ornithological importance Studen Kladenets – it includes the dam lake and the surrounding territory with registered 215 bird species. The area is very important for the preservation of the black vulture (*Aegipius monachus*), the black stork (*Ciconia nigra*), the Egyptian vulture (*Neophron percnopterus*), the blue rock thrush (*Monticola solitarius*) and the masked shrike (*Lanius nubicus*). In the area around the tail of the dam lake Studen Kladenets (where the western alternative of the layout passes through) concentration of water birds is often observed, including such of the world-wide endangered pygmy cormorant and Dalmatian pelican. Nesting or migrating/staying for the winter birds of prey concentrate in the region of the dam-lake including the sea eagle, the osprey, the Griffon vulture, the black vulture. Concentration of birds and intensive migratory flows is encountered mainly in the direction along the valley of the river Arda of both water and rapacious bird species.

- The valley of the river Krumovitsa includes the middle course of the river with its tributary from the right Dyushunn Dere and the adjacent mountain slopes. 139 bird species are found here. The area is of especial significance for the preservation of the black stork (*Ciconia nigra*) and the Egyptian vulture (*Neophron percnopterus*). The eastern alternative of the gas-main layout passes to the west of the protected zone.
- The valley of the river Harmanliyska includes the river and the mountain slopes near the village of Stoykovo; 123 bird species are found here. The place was identified as on of the five areas of exceptional significance for the preservation of the day-time birds of prey in the Eastern Rhodopes and is located near the eastern alternative of the gas-main layout.

The layout of the investment proposal crosses the Maritsa river to the east of Dimitrovgrad, near one of the biggest places of night stay for the world-wide endangered pygmy cormorant (*Phalacrocorax pygmeus*). The river Maritsa is used as a corridor by a great number of waterbirds – herons and wild ducks. The islands and the sand riverside formations and the trees and bushes along the banks are the most important place for the night stay of the world-wide endangered pygmy cormorant. During the winter stay concentration of the river gull (*Larus ridibundus*) is observed here. Near the village of Uzundzhovo high concentration of nesting rapacious birds was registered. These include the hobby, the peregrine falcon, the booted eagle, the long-legged buzzard, the lesser spotted eagle. All these species are legally protected and are included in Supplement II of the Bern Convention with unfavourable preservation statute in Europe.

Spassov & Markov (2004) determine as significant the diversity in species of land big mammals in the Eastern Rhodopes. Of all the 20 species registered in Bulgaria, there are data for 17 found in the region. The more frequently encountered are the grey wolf (*Canis lupus*), the jackal (*Canis aureus*), the fox (*Vulpes vulpes*), the weasel (*Mustela nivalis*), the polecat (*Mustela eversmanni*), the marbled polecat (*Vormela peregusna*), the marten (*Martes martes*, *M. foina*), the badger (*Meles meles*), the wild-boar (*Sus scrofa*), the red deer (*Cervus elaphus*). The conservationally important species – marbled polecat, otter, wolf, jackal, included in the European and the World Red List are presented here by still stable populations.

An investigation in the period 1995-1996 presented data about the identification of 9 families of small mammals (Minkova, 2004). Near the two alternatives of the gas-main layout habitats of *Erinaceus concolor, Talpa europaea*, *Crocidura leucodon*, small water shrew-mole (*Neomys anomalus*), squirrel (*Sciurus vulgaris*), hamster (*Spermophilus citellus*), ordinary dormose (*Glis glis*), forest dormose (*Dryomys nitedula*), ordinary mouse (*Mus musculus domesticus*), water rat (*Arvicola terrestris*) were discovered.

In a summarizing article on the herpetic fauna of the Eastern Rhodopes (Petrov, 2004) data are presented on the occurrence of 27 reptile species and the valley of the river Arda , and this valley between the dam lake Studen Kladenets and Madzharovo is identified as a territory of high herpetological diversity. Current habitats of 16 reptile species are found in the region of the future gas-main layout. The territories around Kirkovo and Momchilgrad accommodate concentrations of rare and endangered species of reptiles – Hermann’s tortoise, Spur-thighed tortoise, Macedonian lizard, Crimean lizard and European glass lizard. For the European glass lizard the region around Kirkovo is the western-most habitat in our country (P. Stoev, B. Petrov, 1996).

Fauna data about the bats in the Eastern Rhodopes are found in episodic or summarizing articles. IVANOVA & GUEORGUIEVA (2004) summarize the literature data and present some new ones on the distribution of 25 bat species from 86 habitats in the Eastern Rhodopes. PANDURSKI AND POPOV (2008) performed a two-year monitoring (direct observation and registration and analysis of the ultra-sounds produced by the bats) on the species composition and the distribution of the bats in model habitats in the Bulgarian part of the Eastern Rhodopes and established 16 species in total. The highest diversity (14 species) was established in the region around the town of Madzharovo – the locations Kovan Kaya, Gaberovoto Dere, etc. Data were collected about a numerous generative colony of the greater horseshoe bat (*Rhinolophus ferrumequinum*) and the Geoffroy’s bat (*Myotis emarginatus*); a new habitat of the exceptionally rare in Bulgaria *Tadarida teniotis*; the high number and the high feeding activity of the *Myotis daubentonii* over the water of the rivers Arda and Byala Reka; the frequently encountered species *Hypsugo savii*, Schreiber’s bat (*Miniopterus schreibersii*), the brown and the little brown bat (*Pipistrellus pipistrellus* and *Pipistrellus pygmaeus*), inhabiting mostly rocky terrains and available underground shelters, and about some species characteristic for forest massifs -*Nyctalus noctula* and *Nyctalus leislerii*.

The Western Upper Thracian Lowlands are among the most poorly studied regions in Bulgaria with respect to the diversity of species and the distribution of bats. Systematic investigations were performed in Plovdiv and Stara Zagora considering that the diversity of species in them was directly influenced by the natural habitat conditions in the Upper Thracian Lowlands (Stoycheva, Georgiev, Pandourski, Tilova, 2009). There are no natural underground shelters of bats in the Western Upper Thracian Lowlands, and the species registered there are forest, synantropic (using various shelters in residential areas) or hunt there flying over significant distances from their rocky or underground shelters in the neighboring mountain regions. In zoo-geographical aspect the species found in the Upper Thracian Lowlands belong to the following complexes:

- Boreal complex, Species, related to the coniferous (taiga) and mixed forests – 15 % (2 species);
- Nemoral complex, Species, reaching maximal abundance in the temperate decidious forests): 50 % (7 species);
- Mediterranean complex, Species, related with thermoxerophile forests and steppes): 35 % (5 species).

In zoo-geographical aspect the bats in the Eastern Rhodopes belong to the following complexes (IVANOVA & GUEORGUIEVA, 2004):

- Boreal complex, Species, related to the coniferous (taiga) and mixed forests – 4 % (1 species);
- Nemoral complex, Species, reaching maximal abundance in the temperate decidious forests): 28 % (7 species);
- Mediterranean complex, Species, related with thermoxerophile forests and steppes): 68 % (17 species).

Despite the comparatively detailed up-to-date studies on bats there are no data about bat shelters in the territory of the two alternatives of the gas-main layout, including the 4 km adjacent land strip. The lack of bat shelters which could be directly affected by the construction of the gas-main along the two alternatives of the layout was confirmed by the thorough investigations in 2011 and 2012.

The terrestrial invertebrates are closely connected to the climatic, soil and vegetation belts. Xerophile and steppe species mostly are found in the lowlands of South Bulgaria (certain species of helix, Orthoptera, termite, etc.) under expressed Mediterranean influence. The richest fauna in the artificial meadows is in the Lucerne and Clover mono-cultures. In the beech-tree belt the Euro-Siberian elements predominate and the fauna is poorer. Greater number of species are registered in the open terrains where many plain species penetrate. In the coniferous belt the thermoxerophile species decrease in number replaced by such of Euro-Siberian origin (Hubenov, 1997).

Except for the zones protected under Nature 2000, the territory of the gas-main layout including the 6 km adjacent strip has never been a subject of investigation with respect to the invertebrates of conservational significance. The terrain anticipated for the construction of the gas-main offers favorable conditions for the existence of rich terrestrial invertebrate fauna. the main prerequisite is the availability of a variety of natural habitats where specific populations of invertebrates have formed – various types of soils, rocky habitats with natural steppe vegetation terrains with xerophylic bushes, deciduous and coniferous massifs at different altitude, alluvial and riverside vegetation in the valleys of the rivers Varbitsa, Maritsa, Harmanliyska, Martinka, Suzliyka and their tributaries, small wet zones with characteristic hydrophytes, etc. Bechev and Stoyanova (2004) announce habitats of 21 species of invertebrates of conservational significance.

By 2000 the data about the ichthyo -fauna of the Eastern Rhodopes in the literature are sporadic and incomplete. There is no information about the overall state of the fish populations with reference to the intensive hydro-construction and the recreation and conservation activities performed in the last few years in that region. Investigations performed after 1995 by Pechlivanov (2000) and Stefanov & Trichkova (2004) present new data about the fish in the tributary system of the river Arda and the large dam-lakes on the river. The following adverse impacts are mentioned: deforestation and erosion, construction of hydro-technical facilities, industrial and household pollution and most of all the uncontrolled fishing and poaching. By data of Pehlivanov (2000) dam lake Studen Kladenets (whose tail is within the reach of the western alternative of the gas-main layout): *Alburnus alburnus*; *Cyprinus carpio*, *Chondrostoma vardarense*, *Leuciscus cephalus*, *Vimba melanops*, *Rutilus rutilus maritza*, *Carassius carassius*, *Carassius gibelio*, *Barbus cyclolepis*, *Silurus glanis*, *Sabanejewia balcanica, Cobitis rhodopensis, Perca fluviatilis, Stizostedion lucioperca, Lepomis gibbosus.*

The invertebrate benthic fauna (macro-zoo- benthos) is one of the main biological qualitative elements for the classification of the ecological state of the surface water: the taxonomic composition, the distribution, the extent of representation of the indicator taxons and the diversity level. The macro-invertebrate including methods are the spine of the determination of the ecological status of the running water (rivers) and they are the best developed part of all biological elements of the monitoring. Less important is the evaluation by macro-invertebrates in lakes and especially in deep dam-lakes, where the significance of the bottom fauna is not so determining for the whole eco-system.

Thorough investigations of the bottom invertebrate fauna in water basins in the territory of the Eastern White Sea Basin were performed in the last decade, with the objective of studying the bio-diversity in them and of following the dependence on the environmental factors. The river Arda (and some of its tributaries) could be considered well examined in this respect and it is the only river at present in Bulgaria with three big dam-lakes constructed along its course (Vidinova et al., 2007, 2008).

Data about the fauna in the region of the investment proposal, results from the terrain investigations performed in October-November 2011 and April – June 2012 along the two alternatives of the gas-main layout and the adjacent territories are presented further below.

3.6.2.1 Birds

During the terrain investigation for the purposes of elaboration of the EIA report in the autumn of 2011 separate sections of the region of the investment proposal were visited (mostly along the eastern alternative of the layout), crossing the territories of the protected zones under the National Ecological Network (NEN) Nature 2000 – protected zone Krumovitsa (BG0002012), protected zone Arda Bridge (BG0002071), protected zone Studen Kladenets (BG0002013), protected zone Zlato Pole (BG0002103). Due to the weather unfavourable for field studies the survey of the other part of the layout was performed in the spring and the summer of 2012 The established bird species with brief data about the habitats, the frequency of occurrence and their conservation statute are presented in ***Attachment 9.2,*** where the Report from the ornithological survey is attached.

During the field studies in 2012 the careful survey of the whole design layout, including both alternatives, 107 bird species were registered along the layout itself or in the immediate vicinity. 103 of the bird species were registered along the layout outside the protected territories for birds of the NEN. The list of the bird species is presented in Table 3.6.2.1-1. Thirty eight bird species were found in the protected zones, with the layout crossing a small part of their territories The bird species subject of protection in the protected zones for birds Krumovitsa, Studen Kladenets, Arda Bridge and Zlato Pole are reviewed in detail in the Compatibility Evaluation Report which is an integral part of the EIA Report. Outside the protected zones for birds from all 103 species registered along the project layout and its immediate vicinity, 2 species have the statute of endangered on a world-wide scale – the imperial eagle and the roller. A young imperial eagle was observed in the section of the eastern alternative of the layout near the village of Zimovitsa (see Attachment 9.2). The European roller was found in three sections of the project layout of the western alternative (in the region of the villages of Brod, Golemantsi and Zimzelen), and in four sections of the eastern alternative of the layout (near the villages of Zhulti Bryag, Koren and Kralevo). Thirty three of the species are included in Supplement 2 of the Biological Diversity Act, 92 species – in Supplement 3 of the Biological Diversity Act, and thirty species – in Supplement I of the Birds Directive. Thirty species are described as endangered in the Red Book of Bulgaria.

Table 3.6.2.1-1 Bird species established along the gas-main project layout during the field studies in 2012 outside the protected territories for birds

Species	Biological Diversity Act				Red Book									Western layout between Stara Zagora and PZ Studen Kladenets	Eastern layout to the north of PZ Arda Bridge	Eastern Rhodopes, western alternative, to the south of PZ Studen Kladenets	Eastern Rhodopes, eastern alternative, to the south of PZ Studen Kladenets
Species	BA				RDB	SPEC	ETS	IUCN	79/409/EEC								
	II	III	IV	VI					I	II 1	II 2	III 1	III 2				
Little Egret *Egretta garzetta*	+	+			NT		S		+					x	x		
Great Egret *Casmerodius albus*	+	+			CR		S		+						x		
Grey Heron *Ardea cinerea*		+			VU		S										x
Black Stork *Ciconia nigra*	+	+			VU	2	R		+					x	x	x	x
White Stork *Ciconia ciconia*	+	+			VU	2	H		+					x	x	x	x
Wild Duck *Anas platyrhynchos*			+	+			(S)			+		+				x	
European Honey Buzzard *Pernis apivorus*	+	+			LC	E	(S)		+					x		x	x
Black Kite *Milvus migrans*	+	+			VU	3	(VU)		+					x	x		
Griffon Vulture *Gyps fulvus*	+	+			EN		S		+							x	
Short-toed Snake Eagle *Circaetus gallicus*	+	+			VU	3	(R		+					x		x	
Western Marsh-harrier *Circus aeruginosus*	+	+			EN		S		+					x	x		
Hen Harrier *Circus cyaneus*	+	+			CR	3	H		+							x	x
Eurasian Goshawk *Accipiter gentilis*		+			EN		S										x
Eurasian (or Northern) Sparrowhawk *Accipiter nisus*		+			EN		S							x			
Levant Sparrowhawk *Accipiter brevipes*	+	+			VU	2	(S)		+					x		x	
Common Buzzard *Buteo buteo*		+					S							x	x	x	x
Long-legged Buzzard *Buteo rufinus*	+	+			NT	3	(VU)		+					x	x	x	x
Eastern Imperial Eagle *Aquila heliaca*	+	+			CR	1	R	VU	+						x		
Booted Eagle *Hieraaetus pennatus*	+	+			VU	3	(R		+					x	x		
Common Kestrel *Falco tinnunculus*		+				3	D							x		x	
Eurasian Hobby *Falco subbuteo*		+			VU		(S)							x		x	

Species	Biological Diversity Act				Red Book										Western layout between Stara Zagora and PZ Studen Kladenets	Eastern layout to the north of PZ Arda Bridge	Eastern Rhodopes, western alternative, to the south of PZ Studen Kladenets	Eastern Rhodopes, eastern alternative, to the south of PZ Studen Kladenets
Species	BA				RDB	SPEC	ETS	IUCN	79/409/EEC									
	II	III	IV	VI					I	II 1	II 2	III 1	III 2				
Rock Partridge *Alectoris graeca*	+		+		EN	2	(D)			+						x	
Grey Partridge *Perdix perdix*			+	+		3	VU			+		+			x		
Common Quail *Coturnix coturnix*			+			3	(H)				+				x	x	
Common Pheasant *Phasianus colchicus*			+	+	RE		(S)			+		+				x	
Northern Lapwing *Vanellus vanellus*		+			LC	2	VU				+			x			
Green Sandpiper *Tringa ochropus*		+			EN		S							x			
Wood Sandpiper *Tringa glareola*	+	+				3	H		+							x	
Common Wood Pigeon *Columba palumbus*			+	+		E	S			+		+				x	
European Turtle Dove *Streptopelia turtur*			+			3	D				+			x	x	x	
Common Cuckoo *Cuculus canorus*		+					S							x	x	x	x
Long-eared Owl *Asio otus*		+					(S)							x			
Common Kingfisher *Alcedo atthis*	+	+				3	H		+					x		x	
European Bee-eater *Merops apiaster*	+					3	(H)							x	x	x	
European Roller *Coracias garrulus*	+	+				2	VU	NT	+					x	x	x	
Eurasian hoopoe *Upupa epops*		+				3	(D)							x	x	x	x
Grey-headed Woodpecker *Picus canus*	+	+			VU	3	(H)		+							x	
European Green Woodpecker *Picus viridis*		+				2	(H)							x	x	x	x
Black Woodpecker *Dryocopus martius*	+	+			VU		S		+							x	
Great Spotted Woodpecker *Dendrocopos major*		+					S							x			x
Syrian Woodpecker *Dendrocopos syriacus*	+	+				E	(S)		+					x		x	
Middle Spotted Woodpecker *Dendrocopos medius*	+	+				E	(S)		+							x	
Lesser Spotted Woodpecker *Dendrocopos minor*		+					(S)								x		
Calandra Lark *Melanocorypha calandra*	+	+			EN	3	(D)		+					x			
Crested Lark *Galerida cristata*		+				3	(H)							x	x	x	x
Woodlark *Lullu la arborea*	+	+				2	H		+					x	x	x	x
Eurasian Skylark *Alauda arvensis*		+				3	(H)				+			x	x	x	x
Sand Martin *Riparia riparia*	+	+				3	(H)									x	
Eurasian Crag Martin *Hirundo rupestris*		+					S									x	

Species	Biological Diversity Act				Red Book	SPEC	ETS	IUCN						Western layout between Stara Zagora and PZ Studen Kladenets	Eastern layout to the north of PZ Arda Bridge	Eastern Rhodopes, western alternative, to the south of PZ Studen Kladenets	Eastern Rhodopes, eastern alternative, to the south of PZ Studen Kladenets
Species	**BA**				**RDB**				**79/409/EEC**								
	II	**III**	**IV**	**VI**					**I**	**II 1**	**II 2**	**III 1**	**III 2**				
Barn Swallow *Hirundo rustica*		+				3	H									x	
Red-rumped Swallow *Hirundo daurica*		+					(S)							x		x	x
Common House Martin *Delichon urbicum*		+				3	(D)							x		x	
Tree Pipit *Anthus trivialis*		+					S							x	x	x	x
Yellow Wagtail *Motacilla flava*		+					(S)							x	x	x	x
Eurasian Wren *Troglodytes troglodytes*		+					S									x	
Alpine Accentor *Prunella collaris*		+			VU		(S)										x
European Robin *Erithacus rubecula*		+				E	S							x		x	x
Common Nightingale *Luscinia megarhynchos*		+				E	(S)							x	x	x	x
African Stonechat *Saxicola torquata*		+					(S)							x	x		
Isabelline Wheatear *Oenanthe isabellina*		+					(S)							x		x	
Northern Wheatear *Oenanthe oenanthe*		+				3	(D)							x		x	
Common Blackbird *Turdus merula*		+				E	S				+			x	x	x	x
Fieldfare *Turdus pilaris*		+				Ew	(S)				+					x	
Song Thrush *Turdus philomelos*		+				E	S				+				x		
Mistle Thrush *Turdus viscivorus*		+				E	S				+						x
Great Reed Warbler *Acrocephalus arundinaceus*		+					(S)							x	x		
Eastern Olivaceous Warbler *Hippolais pallida*		+				3	(H)							x	x	x	
Olive-tree Warbler *Hippolais olivetorum*	+	+			VU	E	(S)		+							x	
Orphean Warbler *Sylvia hortensis*	+	+			VU	3	H								x		
Barred Warbler *Sylvia nisoria*	+	+				E	S		+					x		x	
Lesser Whitethroat *Sylvia curruca*		+					S									x	
Common Whitethroat *Sylvia communis*		+				E	S							x	x	x	x
Eurasian Blackcap *Sylvia atricapilla*		+				E	S							x	x	x	x
Common Chiffchaff *Phylloscopus collybita*		+					S							x	x	x	x
Willow Warbler *Phylloscopus trochilus*		+					S							x		x	x
Long-tailed Bushtit *Aegithalos caudatus*		+					S							x	x	x	x
Marsh Tit *Parus palustris*		+				3	D								x		x
Sombre Tit *Parus lugubris*		+				E	(S)									x	x

Species	Biological Diversity Act				Red Book	SPEC	ETS	IUCN						Western layout between Stara Zagora and PZ Studen Kladenets	Eastern layout to the north of PZ Arda Bridge	Eastern Rhodopes, western alternative, to the south of PZ Studen Kladenets	Eastern Rhodopes, eastern alternative, to the south of PZ Studen Kladenets
Species	BA				RDB				79/409/EEC								
	II	III	IV	VI					I	II 1	II 2	III 1	III 2				
Coal Tit *Parus ater*		+					(S)										x
Blue Tit *Parus caeruleus*		+				E	S								x	x	
Great Tit *Parus major*		+					S							x	x	x	x
Eurasian Nuthatch *Sitta europaea*		+					(D)									x	x
Eurasian Golden Oriole *Oriolus oriolus*		+					S							x	x	x	
Red-backed Shrike *Lanius collurio*	+	+				3	(H)		+					x	x	x	x
Lesser Grey Shrike *Lanius minor*	+	+				2	(D)		+					x	x	x	x
Woodchat Shrike *Lanius senator*		+				2	(D)							x	x	x	
Masked Shrike *Lanius nubicus*	+	+			VU	2	(D)		+					x			
Eurasian Jay *Garrulus glandarius*							S				+			x	x	x	x
Western Jackdaw *Corvus monedula*			+			E	(S)				+					x	
Hooded Crow *Corvus corone cornix*			+				S				+			x	x	x	x
Common Raven *Corvus corax*		+			NT		S							x	x	x	x
Spanish Sparrow *Passer hispaniolensis*		+					(S)							x			
Chaffinch *Fringilla coelebs*		+				E	S							x	x	x	x
European Serin *Serinus serinus*		+				E	S									x	
European Greenfinch *Carduelis chloris*		+				E	S							x	x	x	x
European Goldfinch *Carduelis carduelis*		+					S							x	x	x	x
Common Linnet *Carduelis cannabina*		+				2	D							x		x	x
Hawfinch *Coccothraustes coccothraustes*		+					S							x	x	x	x
Yellowhammer *Emberiza citrinella*		+				E	(S)							x	x	x	x
Cirl Bunting *Emberiza cirlus*		+				E	S							x	x	x	x
Ortolan Bunting *Emberiza hortulana*	+	+				2	(H)		+					x			
Black-headed Bunting *Emberiza melanocephala*		+				2	(H)							x	x	x	
Corn Bunting *Miliaria calandra*		+				2	(D)							x	x	x	x

Twelve species of rapacious bids are observed along the project layout, one of which (the hen-harrier) is a migrating species, and the rest – stay as nesting birds. The rapacious birds generally have a low reproductive performance and a longer period of reaching sexual maturity, that is why their populations are more difficult to be restored after human impact.

The rapacious birds are strongly vulnerable to disturbance or changes in their nesting grounds. In this investment proposal the most vulnerable species are those nesting on trees like the short-toed eagle, the common buzzard, the pern, the black kite, the imperial eagle, the small hawk, the Levant sparrowhawk and the goshawk. The reason is that if the layout crosses an area with a nest of a bird of prey, the tree has to be cut and the nest cannot be later restored to the same location because of the servitude limitations.

As a whole potentially the rapacious birds are the most vulnerable, because they are affected by the loss of nest substrates, by the fragmentation of the forest habitats and from the disturbance, the second is the group of the forest bird species which, besides the disturbance, will be affected by the loss of habitats and the possible demolition of nests in the nesting period, followed by the group of the birds characteristic for open and mosaic habitats, affected by the temporary loss of habitats and disturbance during the nesting period.

The field studies in the nesting period along the western alternative of the layout and along the layout common for the two alternatives established nesting habitats of black stork (1 nest on rocks relatively near the layout), pern (2 nests on the layout itself or in its servitude strip), Kestrel (1 nest relatively near the layout), ordinary buzzard (3 nests in the immediate vicinity of the layout), Levant sparrowhawk (2 nests relatively near the layout), forest long-eared owl (2 nests near the layout), and nesting grounds of Kestrel, long-legged buzzard and short-toed eagle(refer to Report of the Ornithological Investigation for the Natural Gas Interconnector Greece – Bulgaria from March – June 2012, presented in ***Attachment 9.2***). After a consultation with the designers the project layout was moved in the region of the village of Kirkovo because of one of the nests of the pern, so that the nest could be preserved together with a strip of trees between the servitude strip and the nest. The second pern nest is found in one of the alternative layouts near Momchilgrad and its is considered that it could be avoided without additional design. The nest is located on a pine tree in an artificial plantation about 20 years old and besides the active nest, another older one was identified at a distance of 150 m, probably used by the couple the previous year. If that alternative of the layout is selected, it is recommended to perform the construction works beyond the period April – August, that is, in the non-active period, so that if the couple stops using the same nest due to changes in the surroundings, it will still have sufficient alternatives for the building of a new nest.

It was proposed to move the layout in the section north of the village of Malevo along the eastern alternative due to the nest of a buzzard.

Along the eastern alternative nests in rocks relatively near to the project layout were found belonging to Egyptian vulture (1 nest) and black stork (1 nest). It was also established that there is a place of night-stay and rest of Griffon vultures. Nesting grounds of three couples of ravens, one couple of hobbies and one couple of Griffon vultures were found. The section of the layout passing through the Boynik mountain is the main feeding territory of the colony of white-head vultures, nesting in that area, and of at least 3 couples of Egyptian vultures, as well as a hunting territory of two couples of short-toed eagles and one couple of golden eagles. Practically the eastern layout crosses one of the territories in the Eastern Rhodopes where a large number of rapacious birds accumulate almost throughout the whole year.

Accumulation of species of conservational significance was established in the region of crossing the dam lake Studen Kladenets by the western alternative of the layout, including the world-wide endangered Dalmatian pelican outside the winter period which is discussed in detail in the Compatibility Evaluation attached to this Report.

Other similar accumulations were established in the section of the river Maritsa where it is crossed by the layout. The nesting species registered there are the Kingfisher, the roller, the lesser grey shrike, and its is the hunting area of a couple of black Kites and of small egrets.

Small accumulations of migrating white storks in places of rest and night-stay were established in the section of the western alternative of the layout passing near the village of Golemantsi (8 birds), and along the eastern layout – in the section passing by the village of Malevo (12 birds) and near the village Zhulti Bryag (8 and 12 birds).

Most of the bird species with unfavourable protected statute except for the imperial eagle, the white head vulture and the Kingfisher are migratory species, that is, in a certain period of the year (usually between September and March) they are not in their nesting grounds. The winter-staying birds are concentrated mainly in the dam lake Studen Kladenets along the project layout and these are described in detail in the Compatibility Evaluation.

No species depending on large in territory continuous forest massifs were found among the forest – inhabiting species with unfavourable protection status (like for instance the leucotos and the middle spotted woodpecker), which could be significantly adversely affected by the fragmentation of the forest habitats.

On the grounds of the current situation with respect to the birds, the western alternative of the gas-main layout is preferable.

3.6.2.2 Mammals

From the 45 mammal species (excluding bats) established along the layout of the investment proposal, 7 are included in Supplement 2 of Directive 92/43 on the natural habitats o the EU. Thirteen of the found mammals are protected by the Biological Diversity Act, and 9 species are included in the Red Book of Bulgaria.

The established mammal species with brief data about habitats, frequency of occurrence and eventual threats as well as the statute of the species of conservational significance are included in ***Attachment 9.1*** . The variety of the teriofauna along the two alternatives of the layout could be estimated as rich. To the greatest extent this is valid for the region of the Eastern Rhodopes. The western layout passes through a smaller number of mammal habitats of conservational significance in comparison with the eastern layout, and the variety of species along it is poorer (species like red deer, fallow deer , etc. are absent), that is why is should be preferred to the eastern one for the construction of the gas-main. The number of the established species of conservational significance in both alternative is high. For some of them much higher values were registered for the population density along the Eastern layout in comparison with the western alternative, for instance, for the otter and the European wolf.

The final alternative of the western alternative goes round all established colonies of European hamsters, which decreases the extent of the impact on this world wide endangered species to insignificant. These changes made at the stage of the design are important for the lowering of the anticipated adverse impact on other animal species connected to the hamster colonies or with similar habitats – marbled polecat, black polecat, marten, fox, wild cat, ouse-like dormouse, etc.

With respect to mammals, the western alternative of the layout is more favorable because it crosses a smaller number of habitats of mammals of conservational significance in comparison with the eastern alternative, and the variety of species along it is poorer.

3.6.2.3 Reptiles

During the field study for the purpose of this assessment the potential habitats of reptiles along the whole western and eastern layout of the gas-main were mapped. Small natural and artificial static water basins were studied, springs, small rivers, dry stony slopes covered by thorn bushes and juniper, loose oak forests, etc. Special attention was paid to the optimal habitats of tortoises within the scope of the gas-main layout. All available literature sources on the herpeto-fauna of the region were studied.

Twenty five reptile species were identified in the region crossed by both alternatives of the gas-main layout as a result of studying the literature sources and the performed field Five species are included in Supplement 2 of Directive 92/43 of the EU. Twenty four species are protected by the Bulgarian legislation. Seven species are included in the Red Book of Bulgaria. The reptile species which would be eventually affected by the implementation of the project are presented in ***Attachment 9.1.*** As a whole the region of the investment proposal is characterized by a very high variety of reptile species and numerous populations of most of the species. The number of the species of conservational significance could also be assessed as very high both in national and in European scale. These findings are valid mostly for those parts of the two layout alternatives which are in the region of the Eastern Rhodopes (to the south of the river Maritsa). The northern part of the layout in the Upper Thracian Lowlands the variety of the reptile species is from average to low, and the number of the species of conservational significance is much lower than that in the Eastern Rhodopes. The western alternative of the layout passes through regions of poorer herpeto-fauna than the eastern alternative. Species like the turtle, the cat snake, the worm snake, the sand boa, the *Malpolon Insignitus* are encountered only along the eastern layout. Along the western layout these species are never or rarely found. Besides the density of the populations of a number of species of conservational significance along the eastern layout is much higher. This is valid for the two species of tortoises and for the banded adder. Several territories were found for the former in the Eastern Rhodopes, where the density of the populations is high and the habitats are excellent. In the first place this is the region between the villages of Vurben and Kurchovsko, Kirkovo municipality.

On the grounds of the performed analysis of the current state of the reptiles it could be concluded that the western alternative of the gas-main layout is to be preferred because it passes through regions with poorer herpeto-fauna than the eastern alternative.

3.6.2.4 Amphibians

During the field investigations for the purpose of this assessment potential habitats of amphibians were mapped for the whole layout of the anticipated gas-main. Small static natural and artificial water basins were studies, as well as springs, small rivers, moist meadows, gullies, fountains, muddy pools, excavations with water, damp forests, etc. All available literature sources on the amphibians in the region were also studied.

Twelve amphibian species were identified in total in the area crossed by the gas-main layout. Three of them are included in Supplement 2 of Directive 92/43 on the natural habitats of the EU Ten species in total are protected by the Biological Diversity Act. The amphibian species which would be affected in some way by the implementation of the project are presented in

Attachment 9.1. The amphibian fauna in the region could be assessed as abundant and about 2/3 of the species in Bulgaria are registered here. The composition of the amphibian species along the western and the eastern alternatives of the gas-main layout does not differ significantly, nor is the difference in the numbers of the species of conservational importance. Certain species of conservational importance like the yellow-bellied toad and the ordinary triton are quite numerous and widely spread which increases the probability of a more significant impact on those species during the implementation of the investment proposal. This is especially valid for the part of the layout in the Eastern Rhodopes (to the south of the river Maritsa). As a result a conclusion could be made that the construction of the gas-main along the western alternative layout will have a significantly lower impact and is therefore preferable for implementation.

With respect to the amphibians both alternatives of the gas-main layout are equivalent because the species composition and the numbers of those of conservational significance are almost equal.

3.6.2.5 Terrestrial invertebrates

As a result of the field investigation for the purposes of this assessment and from studying the available literature sources about habitats in the close vicinity of the two alternative layouts, the following taxon species from the following systematic groups were identified Odonata (Dragon flies), Orthoptera, Coleoptera , Neuroptera and Lepidoptera (Butterflies): (***Attachment 9.1***):

1. Along the eastern alternative of the layout: 25 species of conservational significance, 15 of which included in Supplements II and IV of Directive 92/43/EEC
2. Along the western alternative of the layoute: 13 species of conservational significance, 9 of which included in Supplements II and IV of Directive 92/43/EEC.

Within the scope of the layout works favorable habitats were mapped for those above mentioned and for several other species of terrestrial invertebrates and the probability of the impact on them was established (***Attachment 9.1***).

The performed investigation established higher variety of habitats and populations of terrestrial invertebrates within the reach of the eastern alternative of the layout.

Although the phases of construction and operation of the gas main are not anticipated to exert significant long-term and irreversible effects on the terrestrial invertebrates with conservational importance, and although these phases do not lead to a high , **it would be preferable to execute the construction of the gas-main along the western alternative of its layout, because habitats of the species mentioned in Attachment 9 are found there more rarely.**

3.6.2.6 Bats

The field investigation for the purpose of this assessment established absence of underground natural and artificial shelters (caves, mining galleries, etc.) within the scope of the implementation of the investment proposal. A study of the literature sources showed for both alternatives of the layout that there are not known underground habitats of bats. Potential shelters and favorable habitats of bats were localized on both alternative layouts. The preliminary analysis of the habitat conditions showed that the species potentially affected to a different extent by the construction and the operation in the region are the forest bat species (the kinds *Nyctalus, Pipistrellus, Vespertilio*, and some species of the kind *Myotis* , etc.) and part of the species considered synantropic (the kinds *Rhinolophus*, species of the kinds

Pipistrellus, Nyctalus , etc.) – in total 17 bat species, all protected by the Bulgarian and the international relevant legislation (***Attachment 9***). In the spring of 2012 the field studies were concentrated onto two underground sites, potential bat shelters, located at a considerable distance from the gas-main layout, which would guarantee the lack of impact from the implementation of the investment proposal:

- The cave Karangil, in the territory of the village Shiroko Pole (41.631728° N 25.457121° E), 2,57 km to the east of the western alternative of the layout. In the past the cave was an important underground habitat of bats, but the frequent visits of people nowadays chased away the underground bat colonies. Not a single bat was found during the investigation.
- Ancient underground mines near the village of Stremtsi (41.711219° N 25.403065° E), 2,68 km to the east of the western layout alternative. Due to the visits of tourists the number of bats in the cave has reduced considerably for the last years. The field investigation in may and June 2012 found only 12 bats from the species horseshoe bat (*Rhinolophus euryale*) and one bat from the species big bat (*Myotis myotis*).

Potential forest and rock shelters of bats exist in limited sections of both layout alternatives (see ***Attachment 9.1***). The rest of the layout provides no possibilities for bat shelters because it passes through open, frequently agricultural plots.

Favorable feeding habitats in the close vicinity of the layout provide the following water basins: micro-dam lake near the village of Domishte (Kirkovo municipality), dam lake Studen Kladenets, the sections of crossing the rivers Krumovitsa, Vurbitsa, Maritsa, Martinka, Harmanliyska, Suzliyka, etc. High activity of the water bat (*Myotis dabentonii*) was registered in these areas.

The analysis of the results from the field study in 2011 and 2012 rand from the available literature sources provides grounds for the conclusion that 20 bat species are found in the territorial scope of the designed natural gas interconnector. Most of them (14 species) use these territory only temporary, as a part of its hunting habitat (*Eptesicus serotinus, Miniopterus schreibersii, Pipistrellus nathusii, Pipistrellus kuhlii, Tadarida teniotis, Myotis daubentonii, Myotis capaccinii, Hypsugo savii, Myotis myotis, Rhinolophus ferrumequinum, Rhinolophus hipposideros, Rhinolophus blasii, Rhinolophus euryale, Myotis emarginatus* and *Pipistrellus pygmaeus*). For 5 species in limited sections there are conditions for the existence of potential habitats (*Barbastella barbastellus, Myotis bechsteini, Nyctalus leisleri, Nyctalus noctula* and *Pipistrellus pipistrellus* from km 0 to km 4, and from km 51 to km 55 - for *Pipistrellus pipistrellus*, where this species was registered with especially high number and activity).

The field investigations of the bat populations within the scope of the gas-main in 2011 and 2012 showed that the territory of the eastern layout alternative crosses several times vast forest territories, larger than those in the scope of the western alternative, which provide shelter and favorable conditions for the populations of the barbastelle bat (Barbastella barbastellus) and the long-eared bat (Myotis bechsteini). Both species are subject of protection in the national network of protected territories of Nature 2000**. it is from this point of view that the implementation of the western alternative of the layout is more acceptable, because it will preserve the current favorable state of the forest habitats in a large area in the section from the border to КВ2 Mamitya – from km 0+00 to km 24+70.**

3.6.2.7 Fish

The layout of the implementation of the investment proposal for the construction of a gas-main between Bulgaria and Greece crosses several big rivers (Maritsa, Arda and Vurbitsa) and smaller rivers and water flows (Azmaka, Suzliyka, Harmanliyska, Haskovska, Perperek, Dzhebelska, Arabadzhiyska, etc.). These all belong to Eco-region 7, the East White Sea river basin, but refer to different river types characterized by specific fauna complex, presented in the table below:

River type	Rivers within the scope of the gas-main works	Characteristic species
R5 – Semi-mountainous type in eco-region 7	Lozengradska, Arabaszhiyska, Dzhebelska	*Alburnoides bipunctatus*; Maritsa barbel (*Barbus cyclolepis*); chub (*Squalius cephalus*); minnow (*Phoxinus phoxinus*)
R12: Big plain rivers in eco-region 7	Maritsa	*Vimba melanops*; nase (*Chondrostoma vardarense*); bleak (*Alburnus* sp.); carp naturally reproducing (*Cyprinus carpio*); Maritsa barbel (*Barbus cyclolepis*); pike (*Esox lucius*); sheat fish (*Silurus glanis*); asp (*Aspius aspius*).
13: Small an middle size plain Aegean rivers	Arkata, Suzliyka, Martinka, Harmanliyska	Maritsa barbel (*Barbus cyclolepis*), *Vimba melanops*; nase (*Chondrostoma vardarens*; river gobies (*Neogobius fluviatilis, Proterorhinus marmoratus*); Balkan loach (*Sabanejewia balcanica*); *Rhodeus amarus*;
R14: Sub-Mediterranean small and middle size rivers	Perperek, Krumovitsa, Vurbitsa	Maritsa barbel (*Barbus cyclolepis*); chub (*Squalius orphaeus*); Balkan loach *(Sabanejewia balcanica*).

The field studies performed for the purpose of this assessment in the period October 2011 – June 2012 showed the presence of the following fish species in the territorial scope of the designed natural gas interconnector: Maritsa barbel (*Barbus cyclolepis*), chub (*Squalius cephalus*), *Rhodeus amarus*, *Lepomis gibossus*, gudgeon (*Gobio gobio*), minnow (*Phoxinus phoxinus*). The draughts of barbell and chub were most abundant and the dimensions were dominated by small-size fish, which is the result of the systematic fishing. In the water basins crossed by the gas connection there are favorable habitats for other fish species, some of which were identified during previous investigations in the region, like *Vimba vimba*, asp (*Aspius aspius*), perchpike (*Sander luciuperca*), perch (*Perca fluviatilis*), European sheat-fish (*Silurus glanis),* carp (*Cyprinus carpio*), crucian carp (*Carassius carassius*), roach (*Rutilus rutilus*), *Proterorhinus semilunaris*, *Sabanejwia aurata* (***Attachment 9.1*****).** Factors like pollution of the water of the rivers Martinka, Suzliyka, Maritsa and the fragmentation of the river beds of Diva and Maritsa exert an adverse impact on the fish populations.

As a conclusion the potentially affected by the project implementation will be mainly the hydro-bionts inhabiting water basins for which the technology *"open cut crossing"*is anticipated. **The comparative analysis of the two alternatives of the gas-main layout unambiguously give priority to the western layout with the alternative of passing under the dam lake Studen Kladenets by the HDD method. Although it crosses a higher**

number of water courses (but low water and running dry in summer) the implementation of the investment proposal along it will have a short term impact on the fish fauna.

3.6.2.8 Aquatic invertebrates

Then field survey for the purposes of the assessment along the western alternative included the cross-points of the layout with water basins which could be classified as four river types (according to the Surface Water Type Classification):

R5: SEMI-MOUNTANOUS TYPE IN THE ECO-REGION 7 – including the rivers Lozengradska, Arabadzhiyska, Dzhebelska;

R12: BIG PLAIN RIVERS IN ECO-REGION 7 – the Maritsa river;

R13: SMALL AND MIDDLE SIZE PLAIN AEGEAN RIVERS – the rivers Sazliyka, Azmaka, Arkata, Martinka, Haskovska, Harmanliyska;

R14: SUB-MEDITERRANEAN SMALL AND MIDDLE SIZE RIVERS (specific river type for the Eastern Rhodopes, including mostly temporarily running dry rivers with strong seasonal amplitudes of the flow) – the rivers Krumovitsa, Perperek and the tributary system of Vurbitsa.

Nine points were visited where the gas-main layout crosses water basins as follows: the river Azmaka at the village of Zagore, the river Lozengradska before the village of Kirkovo, the river Arabadzhiyska at Kirkovo, a river before the village of Samodiva, the river Dzhebelska before the outflow of the river Vurbitsa, a small river at the village of Balabanovo, the river Perperek to the north-east of the village of Stremtsi, the river Karamandere between the villages of Orlovets and Mandra, the river Haskovska after Haskovo. The analysis of the data from the hydro-biological benthos samples provided results close to those for communities of bottom invertebrates characteristics for the river types listed above. Hydrobions were established from 16 systematic groups as follows – Hydrozoa, Turbellaria, Nematoda, Oligochaeta, Gastropoda, Bivalvia, Amphipoda, Decapoda, Hydracaina, Ephemeroptera, Plecoptera, Odonata, Coleoptera, Heteroptera, Trichoptera, Diptera (***Attachment 9.1*)**.

Among the water invertebrates several species have priority and conservational importance, like several species of dragonfly, the pearly mussel and the brook crayfish. These were found only in several of the investigated points. The other hydro-bions established during the field survey, lead to the conclusion that the water basins within the reach of the investment proposal are of comparatively high diversity (according to the relevant river type) and resistant structure which would allow the quick restoration of the communities in event of a negative impact.

The eastern alternative of the layout crosses the river Arda in the section between the dam of the dam-lake Studen Kladenets and the outflow of the river Krumovitsa. By data from previous investigations a trend is established here towards replacement of groups and species due to the dam lake influence and especially as a result of the varying hydrological regime. Changes are observed in the composition and the number of certain benthos groups. The communities of hydro-bions as a whole are less stable.

As a conclusion the potentially affected by the project implementation will be mainly the hydro-bions inhabiting water basins for which the technology *"open cut crossing"*is anticipated.

The comparative analysis of the two alternatives of the gas-main layout unambiguously give priority to the western alternative. Although it crosses higher number (but low water and drying up in summer) water courses, the implementation of the investment proposal along it will have a short-term impact on the hydro-bions and the negative consequences will be quickly restored.

3.6.3 Protected Natural Terriroties

The International Union on the Protection of Nature (IUCN) defines the determined the protected territory as a land and/or sea area territory specially determined for protection of the bio-diversity, of the natural resources and the related to them cultural resources, managed in conformity with the legislation or by other efficient means (IUCN, 1993). For the purposes of comparability on a world-wide scale IUCN developed a generally applicable classification according to the management goals, formulating six categories of protected territories (categories I-V have been approved since 1978, and category VI was added in 1992)
In Bulgaria the network of protected territories is developed and managed as a part of the world network of such territories in conformity with the national ecological policy. The protected territories have a well delimited area and a specific scientific, social, aesthetic and cultural value. The goal of their management is the preservation of the biological diversity in the eco-systems and of the natural processes going in them as well as of the characteristic or remarkable natural and landscape sites. The preservation of nature in the protected territories has priority to any other activities. The Protected Territories Act determined six categories of such territories conforming to the current international requirements and categories (approved by IUCN), differing in state and a degree of preservation of nature, purpose and administration.

1. reserve (category I of IUCN);
2. national park (category II of IUCN);
3. natural landmark (category III of IUCN);
4. maintained reserve (category IV of IUCN);
5. natural park (category IV and/or V of IUCN);
6. protected area (category IV and/or V of IUCN);

It was accepted that for the present Bulgaria has no territories with characteristics corresponding to those of category VI of IUCN.

With regard to the Notification about the Investment Proposal for the construction of the gas-main, developed and sent to MOEW in 2010, Resolution No ПР-23/2010 of MOEW was received on the estimation of the need for performing an Environmental Impact Assessment (EIA) which specifies that the western alternative of the gas-main layout crosses no protected territories in the meaning of the Protected Territories Act, but the eastern alternative affects two protected areas – Ribino, determined as such by Order No РД 583/2.11.2000 and Golemiyat Sipey – by Order No РД 471/2001. On account of this the performed inspection on the admissibility of the layout by MOEW with respect to the determined regimes by the orders for the determination of the protected territories and the protected zones established that the implementation of the eastern alternative of the layout is inadmissible with respect to the established by the relevant orders regimes of the protected areas Ribino and Golemiyat Sipey. The western alternative of the layout of the gas-main is admissible for implementation and does not contradict with the regime of the protected zones of protection of the wild birds, which regulates the type of the activities in them.

The crossing of two protected territories necessitated the updating of the eastern alternative of the gas-main layout by going round the two protected areas at a distance of about 1 km from them, elaborating new Notifications and sending them to MOEW and to the affected municipalities. MOEW performed an inspection of the admissibility of the updated eastern alternative of the layout and by letters with Ref. No OBOC-1268 and No 48-00-831/27.07.2010 of MOEW it specifies that the updated eastern alternative is admissible for implementation and does not contradict with the regime of the protected territories of protection of the wild birds, which regulates the activities performed in them.

The developed in 2010 Terms of Reference on the scope and the contents of the EIA Report the updated eastern alternative is reviewed which affects no protected territories. According to letter Ref. No 26-00-3031/20.10.2010 of MOEW on the EIA Terms of Reference for the Investment Proposal Construction of Gas-main Komotini (Greece) – Dimitrovgrad – Stara Zagora (Bulgaria) it was established that the area of the Investment Proposal dos not cross the borders of any protected territories in the meaning of the Protected Territories Act, but crosses five protected zones for preservation of the natural habitats of the wild flora and fauna and two zones for protection of the wild birds, as a result of which the resolution of the competent authority is a report on the estimation of the degree of the impact to be elaborated as an attachment to the EIA Report.

After the modification of the eastern alternative and the avoiding of the protected areas both alternatives for the gas-main layout at present (the eastern and the western one) pass beyond the borders of the existing protected territories and do not cross any protected territories classified in compliance with the Protected Territories *(promulgated State Gazette No 113 from 11.11.1998, last amended State Gazette No 38 from 18.05.2012.).*

The protected territories located at the nearest vicinity within the 10 km zone around the layout of the gas-main in the direction south – north are the following:

I. Western layout

- Protected area natural habitat of Adiantum capillus-veneris - located at about 3.4 km to the northwest of the gas-main layout.
- Landmark Skalni Gubi (Rock Mushrooms) – located at about 1.230 km to the west of the gas-main layout
- Natural landmark Radzhip Tarla – located at about 5.6 km to the northwest of the gas-main layout.
- Natural landmark natural habitat of blue juniper – located between the two alternatives of the layout at about 5.6 km to the northeast of the western alternative and 4.650km to the west of the eastern alternative.
- Protected area Sredna Arda – located at about 3.4 km to the east of the gas-main layout.
- Natural landmark Kamenni Gabi (Stone Mushrooms) – located at about 0.200 km to the west of the layout.

II. Eastern layout

- Protected area Ribino – located at about 0.670 km to the east of the gas-main layout.
- Natural landmark natural habitat of blue juniper – located between the two alternatives of the layout at about 5.6 km to the northeast of the western alternative and 4.650km to the west of the eastern alternative.
- Natural landmark Dushan – located at about 5.600 km to the east of the layout of the gas-main.

- Natural landmark Vkamenelata Gora (Petrified Forest)- located between the two alternatives of the layout at about 5.200 km to the west of the eastern alternative and about 12.200km from the western alternative.
- Reserve Vulchi Dol (Wolf Ravine)– located at about 0.400 km to the west of the gas-main layout.
- Natural landmark Rodopski Silivryak – located between the two alternatives of the gas-main layout – at about 1.400 km to the west of the eastern alternative and about 17km from the western alternative.
- Protected area Oreshari – located at about 3.550 km to the east of the gas-main layout.
- Natural landmark Kovan Kaya – located at about 3.100 km to the east of the gas-main layout.
- Protected area Golemiyat Sipey (The Big Scree) – located at about 3.050 km to the west of the gas-main layout.

After the merging pf the two alternative layouts the continuation is towards the town of Stara Zagora to the north. The protected territories located near the layout of the gas-main common for both alternatives are the following:
- Natural landmark habitat of summer oak – the area Palamud – located at about 3.200 km to the east of the gas-main layout.
- Protected area Zlato Pole – located at about 4.3 km to the east of the gas-main layout.
- Protected area Propadnaloto Blato (The Sunken Swamp) – located at about 4.3 km to the west of the gas-main layout.
- Protected area Bozduganovska Koriya – located at about 4.3 km to the east of the gas-main layout.

Attachment 2 includes a complete description of the protected territories along the layouts of both alternatives of the gas-main and a map of the layouts for the investment proposal with the protected territories and the protected zones under nature 2000 located nearby

Each alternative is favorable for implementation because none of them crosses a protected territory.

3.6.4 Protected Zones

Protected zones under the Habitats Directive 92/43/EEC

Protected zone Rhodopes - eastern BG0001032

Both alternatives of the gas-main layout, the eastern alternative of the layout mostly, cross a protected zone.

The western alternative of the layout passes along the periphery of the protected zone. The gas-main enters the protected zone at the village of Sedlovina where it crosses the dam-lake Studen Kladenets and then passes between the villages Gluhar, Letovnik and Vishegrad. The landscapes of anthropogenic origin predominate in this section (corn-fields, a dam-lake, etc.). To the south the layout passes for tens of kilometers outside the zone, although not too far from it. It enters the zone again between the villages of Shumnatitsa and Lozengradtsi and the Makaza pass. In this section the layout affects natural habitats, forest predominantly, which are subject to protection in the zone.

The eastern alternative of the layout passes through the protected zone and crosses many more areas. It affects forest massifs at the Makaza pass, it leaves the protected zone at the village of Strizhba and then enters it again between the villages of Ribino, Ralichevo and Malka Chinka. After the village Konche at the dam of Studen Kladenets it passes through the whole protected zone along the valley of the river Krumovitsa. In this large section the layout affects many natural habitats and habitats of species subject to protection in the zone: 6220*, 6210, 5210, tortoises, Elaphe Sauromates, wolf, etc.

This protected zone is one of the largest in our country. The zone includes natural habitats of representatives of the wild flora and fauna and an area of conservation of wild birds. The xerothermal oak forests and bushes are well represented, as well as beech forests, rock and certain grass habitats with the participation of thermophilic species of southern origin. The zone protects riverside habitats not affected by human activity. The valleys of the rivers Byala and Luda Reka and the hills along the border between Bulgaria and Greece have practically not experienced any human intervention.

Protected zone Ostar Kamak BG0001034

Both layout alternatives cross a very small part of the protected zone through the valley of the river Harmanliyska. The eastern alternative crosses it at the village of Malevo for only about 200 m, affecting mainly farming land. The western alternative crosses the zone to the east of the village of Voyvodovo in a section about 200-300 m.

The protected zone BG 0001034 includes the river Harmanliyska to the dam lake Trakiets and the hills to the south of the town of Harmanli. It includes habitats with considerable Mediterranean influence. The zone protects a non-fragmented river system tributary to the river Maritsa with the representative habitats 91E0 and 92A0.

Protected zone Maritsa river BG0000578

After the merging of the two alternatives the gas-main layout crosses the protected zone Maritsa river between the town of Dimitrovgrad and the village of Brod. There is an area in the river valley with cultures from hybrid poplars and the rising northern part indirectly affects the habitat 91M0 (thinned out mixed oak forests). A strip of the river-side forest (92A0) on the southern river bank is not anticipated to be directly affected, since the layout is planned to pass under the river by horizontally driven drilling *(HDD),* which will begin at about 60 m to the south outside the protected zone and will go down to 15 m below the level of the river avoiding any cutting of the river-side forest (92A0).

The zone is an important bio-corridor connecting the zones throughout south Bulgaria as a whole. Its significance is considerable for the winter stay of up to 4000-6000 Pygmy Cormorants. Some upstream sections of the zone include one of the last remaining areas of the river bed unaffected by human activities where riverside vegetation, forest mainly, is preserved. Parts of the zone are artificial damp areas where the water level is of extreme importance for the fauna.

Protected zone Martinka river BG0000442

The layout after the merging of the two alternatives crosses this protection zone between the villages of Radievo and Golyamo Asenovo indirectly affecting the habitats 92A0 and 1530, but in a very small section (about 150-200 m).

The zone includes a part of the riverside of Martinka which is a tributary of the river Maritsa. The location of the zone in the plain among agricultural areas explains the almost complete extermination of the riverside forest vegetation. The river water is slightly polluted and is used for irrigation. The zone is of no significance as a habitat of rare species but possesses a good potential of restoration of exterminated riverside and river habitats and could serve as a bio-corridor between the river Maritsa and the mountain Sredna Gora.

Protected Site Suzliyka river BG0000425

The common layout after the merging of the two alternatives crosses this zone between the villages Budeshte and Pamukchii insignificantly affecting habitat 92A0. The length of the crossing is not more than 140-150 m.

The Protected Site Suzliyka river is located in Southwestern Bulgaria. The river is a left tributary of Maritsa and takes its source from Surnena Sredna Gora. The zone includes part of the riverside of Suzliyka. The river valley upstream is narrow and deforested, and downstream it is widely cut by alluvial deposits. The flooded terrace is covered by a forest in its upper side but is swampy in its lower part. Before the correction the river bed formed a lot of meanders. Near the outflow there are well developed piled and mixed terraces. The river forms the Gulubovo dam lake and its tributaries - 12 small dam-lakes. The river flows mostly through agricultural land on the territory of the zone and is used for irrigation in summer. A small part of it is surrounded by deciduous forests. The zone is an important bio-corridor and a habitat of many species. After the forestation and the restoration (partially in the riverside swamps), the flooded terrace of the river Suzliyka will be proclaimed an eco-corridor connecting the slopes of Sredna Gora and the river Maritsa.

Protected Sites under Directive 79/409/EEC on the protection of the wild birds

Protected Site Krumovitsa BG0002012

The eastern alternative of the gas-main layout passes along the periphery of the western side of the Protected Site affecting in total 3,28 ha of the habitats important for the birds. The western alternative passes away from the Protected Site and does not affect it in any way.

The Protected Site Krumovitsa includes valleys middle reaches of the river Krumovitsa and its tributary Dyushun dere, with the adjacent hills and slopes of the Eastern Rhodopes between the villages of Gorna Kula and Chal. The valley of the river Krumovitsa in this region is wide from 300 to 1000 m, and at some places it is mainly occupied by the sandy river bed. The river banks are covered to a different extent by riverside trees, poplar mostly (*Populus* spp.) willows (*Salix* spp.), black alder (*Alnus glutinosa)* etc. There are bushes in may places in the river bed, mainly tamarisk (*Tamarix* spp.), as well as grassy vegetation. In some places the banks of the river are steep with low rocks. There is faming land where the valley broadens. The valley of the river Dyushun Dere is narrow and deeply cut in volcanic rocks for most of the river course, with many steep rocks next to its bed, with water falls and small caves. 136 bird species were registered in the region of the river Krumovitsa, 26 of which are in the Red Book of Bulgaria (1985). There are habitats suitable for 46 kinds of birds, entered in Supplement 2 of the Biological Diversity Act, requiring special protective measures. Twenty eight of those kinds are also entered in Supplement I of Directive 79/409 of the EC and most of them are found in the region with significant nesting populations.

The region of Krumovitsa is one of the most important places in the country with significance for the EU for the black stork (*Ciconia nigra)*, the small eagle (*Hieraaetus pennatus)*, the Egyptian vulture (*Neophron percnopterus)* and the big olive mocking-bird, as a nesting ground.

Protected Site Arda Bridge BG0002071

The eastern alternative of the gas-main layout passes along the periphery of the western side of the Protected Site, affecting in total 6,60 ha of the habitats, important for the birds. The western alternative passes away from the Protected Site and does not affect it in any way.

The Protected Site is a part of the valley of the river Arda between the dam lakes Studen Kladenets and Ivaylovgrad, surrounded by forest-covered mountain slopes and rock massifs. The greatest part of its surface is occupied by deciduous xerothermic forests and farming land. The percentage of the open grassy territories is significant, the latter covered by xerothermic and alluvial-meadowy (around the river) grass formations and by bush communities, with Mediterranean elements. The farming land is around the valley broadening and down the slopes and the flat watersheds. The river bed is sandy-stony, and its banks are covered by willows (*Salix* spp.) and bushes. In some places the screes are overgrown by mixed deciduous forests of cerris oak /*Quercus cerris*/, Hungarian oak /*Q. frainetto*/ and pubescent oak /*Q. pubescens*/ with Mediterranean elements like red juniper /*Juniperus oxycedrus*/, *Colutea arborescens*, etc.. Certain regions are bushy – covered by thorn /*Paliurus spina-christi*/ and jasmine /*Jasminum fruticans*/ in combination with xerophylic grass formations if Mediterranean type. In the southern parts the forests are mainly durmast /*Q. dalechampii*/ mixed in some places with Hungarian oak

142 kinds of birds are registered in the territory of the Protected Site Arda Bridge, 47 of which are included in the Red Book of Bulgaria. The zone includes suitable habitats for 49 species included in Supplement 2 of the Biological Diversity Act, requiring special protective measures. 43 of them are entered in Supplement I of Directive 79/409/EEC.

The region is one of the most important in the country with significance for the EU for the protection of the imperial eagle, the *Burhinus oedicnemus*, the black stork (*Ciconia nigra*) and the Egyptian vulture (*Neophron percnopterus*).

Protected Site Studen Kladenets BG0002013

Both alternatives of the gas-main layout cross the Protected Site, the eastern one crossing the eastern side through pastures and forests, while the western alternative crosses the western side through pastures, the western shallow part of the dam lake and forests with bushes. Two sub-alternatives were reviewed for the passage of the western alternative through the dam lake – either by an open cut or by horizontally driven drilling *(HDD)*. The implementation of the eastern alternative affects 12,5 ha of birds’ habitats, and of the western one - 15,67 ha, not including the water surface of the dam lake.

The Protected Site includes the dam lake Studen Kladenets. About two thirds of the mountain slopes around the dam lake are covered by secondary mixed deciduous forests of scabby hornbeam /*Carpinus orientalis*/ and manna ash /*Fraxinus ornus*/, Hungarian oak/*Quercus frainetto*/ or durmast /*Quercus dalechampii*/ with Mediterranean elements. Purely durmast forests or such mixed with ordinary hornbeam /*Carpinus betulus*/ are more rare. In some places there are forests and bushes of scabby hornbeam and thorny bush /*Paliurus spina-christi*/, mixed with jasmine /*Jasminum fruticans*/, red juniper /*Juniperus oxycedrus*/ in combination with xerothermic grass formations with Mediterranean elements like *Cistus incanus*, etc. Not a small part of the territory is occupied by rock complexes, single rocks and stone screes. Everywhere in the region there are open spaces occupied by farming land and meadows, covered by xerothermic grass communities with predominating *Dichantium ischaemum*, *Poa bulbosa*, etc.

219 kinds of birds are registered on the territory of the Protected Site, 91 of which are included in the Red Book of Bulgaria. The dam lake Studen Kladenets is significant for the preservation of the habitats of 69 nesting bird species, included in Supplement I of Directive 79/409 of the EU and 21 migrating and staying for the winter waterbirds. This is the only place in Bulgaria where the black vulture (*Aegypius monachus)* nests, and one of the very few places in the country where the lesser kestrel (*Falco naumanni)*still nests. One of the two colonies of the griffon vulture (*Gyps fulvus)* in Bulgaria nests in the rocky banks of the dam lake. The region of Studen Kladenets is one of the most important places in the country with significance for the EU for the species mentioned above and for the nesting here black stork (*Ciconia nigra)*, Egyptian vulture (*Neophron percnopterus)*, *Burhinus oedicnemus*, owl (*Bubo bubo)*, big olive mocking bird and masked shrike. The place maintains a significant on European level nesting population of the blue rock thrush (*Monticola solitarius)*.

Protected Site Zlato Pole BG0002013

None of the alternatives of the gas-main layout crosses this Protected Site.

Attachment 2.2 shows the map of the layouts of the investment proposal with respect to the protected territories and the Protected Sites under Nature 2000 located in the vicinity.

A more detailed description of the protected flora and fauna and a more detailed list of the protected animal species subject to preservation in the Protected Sites are presented in the EIA Report.

With respect to the Protected Sites the western alternative of the gas-main layout is more favorable because it crosses smaller areas and affects a smaller number of Protected Sites than the eastern alternative.

3.7 Cultural Heritage

According to the Cultural Heritage Act (promulgates SG No 19/2012) and the pursuing subordinate legislation documents the cultural - historical heritage includes:

1. surface, underground and under water archeological sites and reserves;
2. historical sites and complexes;
3. architectural sites and complexes;
4. ethnographic sites and complexes;
5. models of park design art and landscape architecture;

6. natural objects of value (models), including anthropological relics, discovered during terrain studies, and remains of pale-zoology and cultivated plants;
7. industrial heritage;
8. works of fine and applied arts;
9. national crafts;
10. documental heritage;
11. audio – visual heritage;
12. folk oral tradition and language;
13. literary heritage;
14. customs, rituals, fests, ceremonies, beliefs;
15. music, songs, dances;
16. folk medicine;
17. culinary and enological traditions
18. folk dances and sports (Art. 6 of the Cultural Heritage Act)

A cultural value is a material or immaterial evidence of human presence and activity, natural fact or phenomenon, which is important for the individual, the community or the society and possesses scientific or cultural value (Art 7, Para 1 of the Cultural Heritage Act), or is of significance to the Bulgarian orthodox church and the other registered religions (Art.7, Para 2 of the Cultural heritage Act). Cultural values are the fragments of archeological and other objects, though demolished and a small part of the authentic completeness of the object, depersonalized to a great extent, with significant cultural, scientific or artistic value and identified as mass material. These are not subject to identification but are included in the scientific – auxiliary funds of museums, when needed (Art. 7, Para 3 of the Cultural Heritage Act).

According to the appurtenance to a specific historical period the immovable cultural values are Pre-historic, Ancient, of the Middle-ages, Renaissance, new and contemporary (Art 46 of the Cultural Heritage Act).

According to their appurtenance to the scientific and cultural sphere, the immovable cultural values are:

1. archeological, material evidence of human activity, inseparable from the environment they were created in, identified by archeological investigations;
2. historical: buildings, facilities, other structural and memorable sites related to remarkable historic events and individuals;
3. architectural - construction: buildings, facilities, structures, parts and combinations with historical, aesthetic, technical, cultural an production-technical, spatial, functional value;
4. artistic: objects of the fine and applied art, integral elements of the space in which or for which they were created;
5. urban: parts of settlement’s territory or settlement formations whose elements are spatially connected and could be differentiated topographically;
6. cultural landscape: the combination of spatially differentiated sustained cultural layers, result of the interaction of man with the environment, characterizing the cultural identity of a certain territory;
7. park and garden art: historical parks and gardens of significance for the development of the art and science of landscape and garden formation;
8. ethnographic material evidence of the way of life, of crafts, skills, customs, religions, related to the environment;

9. cultural route: combination of a historical route of a traditional road with included sites – objects of immovable cultural heritage and landscapes (Art 47 of the Cultural Heritage Act)

The proposed project affects some territories in the Eastern Rhodopes and the Upper Thracian Lowlands. Its layout is located beyond the regulation borders of the settlements. The anticipated construction works in this territory pose a risk for discrediting the completeness of the territories most of all if not only of archeological sites – objects of cultural – historical heritage which could result in their partial or complete destruction. The archeological immovable cultural values are material traces of human activity inseparable from the environment of their historical origin, identified by archeological investigations (Art. 47, item 1 of the Cultural Heritage Act (promulgated State Gazette No 19/2009 with amendments and supplements).

The Eastern Rhodopes and the Upper Thracian Lowlands have provided comparatively good living conditions in all historical ages. The performed archeological investigations established that almost all kinds of archeological sites are presented in these regions in significant concentration.

These studies of the cultural-historical heritage are based on information obtained from:
- The National Scientific – Documentary Archive of the National Institute of Immovable Cultural heritage to the Ministry of Culture;
- Automatic information system Archeological Map of Bulgaria;
- Information from the regional historical museums in the towns of Kurdzhali, Haskovo and Stara Zagora;
- Articles on investigated archeological sites.

It was established as a result of the collection and the processing of the information from these sources that there are a number of immovable archeological sites registered in the territories of the future construction. After the performed field studies in November 2011 the archeological teams of the company POVVIK AD registered new sites, unknown by now. Their characteristics are various (settlements, settlement mounds, single buildings, sanctuaries, sacred locations, fortresses, fortified watch-points, flat and mound necropolises, individual mounds, etc. Their dating refers from pre-historic to late Middle Ages and the Renaissance. They will be included in the Automatic Information System Archeological Map of Bulgaria by the elaboration of registration cards which will be submitted to the chief Administrator of the system – the National Archeological Institute with a museum at the Bulgarian Academy of Sciences. The discovery of archeological immovable cultural values unknown by now is an important contribution to the study of this part of the cultural-historical heritage of Bulgaria.

The archeological immovable cultural values registered along the gas-main layout which could be directly or partially affected by the construction of the gas main or which are located near its layout are 107, 54 of which along the western alternative and 24 along the eastern alternative of the layout, and 29 along the layout common for the two alternatives.

Scheme of the layout with the plotted sites of cultural – historical heritage along it is presented in ***Attachment 10***.

The description of the archeological immovable cultural valuables which may be affected directly or partially by the construction of the gas-main is presented further below

WESTERN LAYOUT

KURDZHALI REGION

Site No 1. Burial mound consisting of 16 + 4 mounds. The 16 mounds are located on a ridge at 0.770 km, 325° NW from the peak Tikla and at 0.563 km, 90° from the center of the village of Lozengradtsi, Kirkovo municipality (N41°17'45.9" E25°24'19.7"). The 4 mounds are located next to the ridge to the west at a distance of 0.990км, 114° from the center of the same village (N41°17'33.1" E25°24'34.5"). The mounds are piled by flat stones and the embankments are of dimensions d=1, 5-3m and h=0,5-1m. The site area (within the polygon) is 3.26dka. Two of the mounds were completely destroyed by treasure-hunters. They are in a mountain pasture and bush area within the territory of the National Forest Fund (NFF)

Site No 2. Burial mound, located at 1.617 km, 345° from the center of the village of Kirkovo (N41°20'42.3" E25°21'37.9"). It is dilled with stones and soil. The embankment has a regular domed shape with diameter 10m and height 1.60m. It is covered by trees and it is inside the territory of the NFF

Site No 3. Ancient settlement, located at 0,965 km, 305° from the center of the village of Domishte, Kirkovo municipality (N41°21'38.6" E25°21'52.8"). It is located on a terrace and its southwestern part is farming land. The open ceramic fragments cover an area of 3,6 decares. Polygon was made. The land include private cornfields and territory of the NFF

Site No 4. Ancient settlement, located at 0.430 km, 335° from the center of the village Malka Purvitsa (N41°23'09.4" E25°21'57.8"). It is inside tobacco plantations, private property, with an area of 3.0 dka.

Site No 5. Thracian rock sacred place, located at 1.300 km, 256° from the center of the village of Ostrovets, Kirkovo municipality (N41°23'33.7" E25°22'07.1"). It is a volcanic tuff with 4 couples, each of 6 holes, cut with orientation west-east. The most western one has dimensions 28x18 cm and consists of 7 holes in 2 rows. It is 2.60 m east of the next complex of 6 holes in two rows. The overall dimensions are 35x20 cm and the diameter of the biggest hole is 9 cm. At 0.5 m to the east of this complex the third complex is located including 6 holes with overall dimensions 25x15 cm. At 2.1 m to the east the fourth complex is located including 6 holes in 2 rows with overall dimensions 20x30 cm. A small reservoirs is made on the western side of this rock with dimensions100x60 cm and a groove for draining to the west. On the north side of the neighboring rock there are 2 small connected reservoirs with dimensions 100x80 cm and 116x100 cm respectively.

Site No 6. Thracian rock sacred place, located at a distance of 1.370 km, 265° from the center of the village of Ostrovets, Kirkovo municipality (N41°23'38.5" E25°22'02.5"). It is a high rock from volcanic tuff on which holes were made (13 holes at 1.50 m from each other and each with diameter of about 5 cm) as well as a small reservoir with diameter about 50 cm with a groove for draining. No ceramics or any other artifacts were discovered under the rocks and in the cornfields around them. An arrow was cut into the rock pointing to Site No 6.

Site No 7. Ancient settlement, located at 0.430 km, 70° from the centre of the village of Kurchovsko, Kirkovo municipality (N41°24'46.5" E25°21'29.1"). It covers an area of about 1.0 dka. Roman and late antiquity ceramics was discovered in this area. At present the terrain is used as privately owned farming land.

Site No 8. Ancient settlement, located at 0,635 km, 31° from the center of the village of Kurchovsko, Kirkovo municipality (N41°24'59.4" E25°21'25.8"). Its area is 4,6 decares. The discovered fragments of household ceramics suggest late antiquity dating (the 4^{th} – 6^{th} century, probably over-settled. Polygon was made.

Site No 9. Medieval cyst flat necropolis, located at 0.975 km, 36° from the center of the village of Kurchovsko, Kirkovo municipality (N41°25'07.5" E25°21'36.1"). Its area is 1.650 dka. The necropolis is on a south slope of a rocky hill, facing north. Scattered limestone flat pieces are found on the terrain which are probably parts of cyst graves, made in rows but probably thrown around by treasure-hunters. A fragment was found of a pitos wall. Polygon was made. The territory is inside the NFF.

Site No 10. Ancient settlement, located at 0.500 km, 307° from the center of the village of Velikdenche, Kirkovo municipality (N41°27'15.2" E25°20'48.1"). Its area is about 3 dka. The discovered fragments of household ceramics suggest late antiquity dating. The terrain is privately owned farming land.

Site No 11. Mound necropolis, located at 1.440 km, 81° from the center of the village of Slunchogled, Dzhebel municipality (N41°29'41.5" E25°22'11.3"). It includes 4 mounds. These are filled with stones. The shape of the embankments is shallow and the biggest one is with dimensions h=1,60m and d=18m. No finds were discovered. The land is NFF

Site No 12. Burial mound, located at 0.960 км, 288° from the center of the village of Sadovitsa, Momchilgrad municipality (N41°30'29.7" E25°22'18.8"). It is filled with stones and its dimensions are h≈5m and d≈22m. There are two openings on the top about 50 cm deep made by treasure-hunters. The land is NFF.

Site No 13. Pre-historic settlement mound, located at 0.900 km, 75° from the centre of the village of Sedlari, Momchilgrad municipality (N41°31'29.6" E25°23'24.1"). Its top was cut off during the construction works on road I-5 Kurdzhali-Dzhebel-Makaza by a chain bulldozer and a great amount of pre-historic ceramics and flints were uncovered of Neolithic and Eneolithic origin. A bone awl was found as well as animal bones. Fragments of pre-historic ceramics and late – antiquity ceramics were found around the mound as well. The site was studied by professor Dr. Ana Raduncheva in connection with the construction of road I – 5. The area is in the NFF – meadows and pastures. The gas-main layout passes to the east of the servitude of the road and just over the still not investigated pre-historic settlement mound. Private farming land area around.

Site No 14. Prehistoric Eneolithic production center, located at 1.340 km, 21° from the center of the village of Vurhari, Momchilgrad municipality (from N41°33'17.3" E25°23'04.5" to N41°33'25.9" E25°23'01.2"). Eneolithic ceramics was found on an area of about 30 dka. The area was studied in connection with the construction of road I-5 Kurdzhali-Dzhebel-Makaza within the road servitude by Assoc. Prof Dr. Yavor Boyadzhiev. The gas-main layout passes to the west of the road servitude and that means over the still not investigated part of the prehistoric production center.

Site No 15. Fortress of the late bronze and the early iron age, found in the so called Harman Kaya location at 0.900 km, 210° from the center of the village of Vishegrad, Kurdzhali municipality (N41°36'07.5" E25°24'09.9") between p. 214 and p. 215 along the gas-main layout. It is on a high rocky hill oriented northwest – southeast, with access from the northeast. The fortress was strengthened from the north and the east by stones dry walling. ceramics from the late bronze and the iron age was found here. Outside the fortress there is a mountain terrace to the north and the northwest. Archeological architectural structures were found there, probably ruined dwelling places. On the plateau тури, in the strengthened part there are walls of premises connected to buildings which could be dated to the same epoch.

Site No 16. Mound necropolis, located at 0.480 km, 117° from the center of the village of Vishegrad, Kurdzhali municipality (N41°36'26.9" E25°24'49.6") at p. 218 of the gas main layout. It consists of three mounds located on a ridge with a slope to the north. They are filled with stones, white felt and white clay. The mound embankments have diameters between 15m and 17m with preserved height up to 1.5m. All mounds were ruined by a bulldozer almost to the middle and next to the one farthermost located there is a constructed military trench. The ceramics found showed that the mounds are probably of Roman origin. To the south in the immediate vicinity there is a dung-hill

Site No 17. Late antiquity settlement, located at 1.100 km, 272° from the center of the village of Sedlovina, Kurdzhali municipality (N41°37'56.4" E25°25'03.6") between p. 226, p. 227, p. 228 and p. 229 along the gas-main layout. It is found on two terraces to the east of the bentonite mine of the town of Kurdzhali with a southern slope to the river Arda with an area of about 20 dka. Late antiquity ceramics was found. The settlement is inside privately owned land, meadows and pastures from the NFF. 17-1: N41°37'57,4" E25°24'56,3" and 17-2: N41°38'03,3" E25°24'58,6"

Site No 18. Ancient settlement, located at 0.630 km, 35° from the center of the village of Panchevo, Kurdzhali municipality (N41°39'26.8" E25°25'07.6") at p. 250 along the gas-main. The settlement is on a slope with a gradient fro the northeast to the southwest. Low concentration findings of ceramics dating late antiquity was established. The land is meadows and pastures from the NFF

Site No 19. Mound necropolis, located at 0.900 km, 20° from the center of the village of Panchevo, Kurdzhali municipality (N41°39'37.9" E25°25'04.4") from 20m to 40m to the south of p. 251 of the gas-main layout. It includes two big (diameter about 7m and preserved height of about 0.50m) and two small (diameter about 2.0m, preserved height 0.30m) mounds, filled with crushed stone and felt. Treasure hunters have dug in the two big moulds, and have probably destroyed the central tombs. The land is meadows and pastures from the NFF

Site No 20. Ancient necropolis, located at 1.100 km, 7° from the village of Panchevo, Kurdzhali municipality (N41°39'46.4" E25°24'57.3") at p. 253 of the gas-main layout. It is on a slight eastern with gradient from the west to the east. Its area is about 10dka. Late antiquity ceramics was found including a jug-cap. The land is a privately owned corn-field.

Site No 21. Mound necropolis, located at 1.560 km, 24° from the center of the village of Panchevo, Kurdzhali municipality (N41°39'57.1" E25°25'19.2") between p. 255 and p. 256 of the gas-main layout. It is on a northeastern slope and includes 15 mounds, three of them big (diameter about 6 m, height from 0.50m to 1m) and 12 small (diameter about 1-1.5m and height 0.30m) mounds. No findings were established. The land is meadows and pastures from the NFF.

Site No 22. Ancient settlement, located at 1.120 km, 102°from the center of the village of Zvezden, Kurdzhali municipality (N41°40'22.1" E25°26'42.3") between p. 268 and p. 269 of the gas-main layout. Treasure-hunters using a metal search device found fragments of a pitos’ mouth and table ceramics from late antiquity. The land is meadows and pastures from the NFF

Site No 23. Mound necropolis, found at 2.230 km, 153° from the center of the village of tremtsi, Kurdzhali municipality at the location Karachaluk Tepe (N41°42'43.1" E25°26'03.5") at p. 289 of the gas-main layout. It is on a hill and consists of at least three mounds, the biggest one with a diameter 14m and preserved height of about 1.0m. Two of the mounds were dug by treasure hunters. No findings were established. The land is in the NFF.

Site No 24. Ancient settlement, found in a saddle at 1.950 km, 149° from the center of the village of Stremtsi, Kurdzhali municipality at the location Karachaluk Tepe (N41°42'53.1" E25°26'04.9") at p. 290 of the gas-main layout. Late antiquity ceramics was found (probably over-settled). The land is meadows and pastures from the NFF

Site No 25. Mound necropolis, located at 1.800 km, 150° from the center of the village of Stremtsi, Kurdzhali municipality (N41°42'56.1" E25°26'01.4") at p. 290 of the gas-main layout. It consists of mounds. They are filled with crushed stone and soil. The embankments have a shallow domed shape with dimensions - diameter 3m-10m, height 0.50m-1m. Treasure hunters’ digging was noticed on two of the mounds. No findings were established. The land is in the NFF

Site No 26. Burial mound, located at 0.950 km, 135° from the center of the village of Stremtsi, Kurdzhali municipality (N41°43'25.2" E25°25'49.8") at p. 295 of the gas-main layout. It was filled with stones and soil. The embankment has a diameter of 16m and preserved height of about 5m. There is a treasure-hunters’ excavation on the mound. No findings were established. The land is meadows and pastures from the NFF.

Site No 27. Late antiquity settlement, found in the location Kuzuldzha Kayryak, at 1,050 km, 34° from the center of the village of Stremtsi, Kurdzhali municipality (N41°44'20.1" E25°25'51.6") at p. 299 of the gas-main layout, on a southern slope. Its area is about 10 decares. Late antiquity ceramics was found. The land is privately owned.

Site No 28. Burial mound, located at 0.630 km, 250° from the center of the village of Sokolyane, Kurdzhali municipality (N41°44'59.4" E25°25'52.3") at p. 202 of the gas-main layout. It was filled with light-brown soil. The embankment has a regular domed shape with dimensions: d=12m and h=2,5m. There are three treasure-hunters’ excavations with rectangular shape on the mound. No findings were established. The land is in the NFF.

Site No 29. Mound necropolis consisting of three mounds at 1.200 km, 329° from the center of the village of Sokolyane, Kurdzhali municipality (N41°45'40.9" E25°25'50.1") between p. 304 and p. 305 of the gas-main layout. The embankments were filled with stones an soil and have regular domed shape with dimensions of the biggest one d =15m and h=2m. The land is a private corn-field and meadows and pastures from the NFF.

Site No 30. Burial mound, located at 1.010 km, 170° from the center of the village of Beli Plast, Kurdzhali municipality (N41°45'56.9" E25°25'51.6") at p. 306 of the gas-main layout. The embankment has a regular oval shape with d=10x6 an average height 1.70m. The land is meadows and pastures from the NFF

Site No 31. Site of indeterminate function (a building probably) from late antiquity, located at 0.630 км, 106° from the center of the village of Beli Plast, Kurdzhali municipality (N41°46'25.3" E25°26'09.9") at p. 313 of the gas-main layout. Single fragments were found – grips and bottoms of vessels and one piece with slanting cuts. Its area is about 1.0dka. The land is meadows and pastures from the NFF.

HASKOVO REGION

Site No 32. Late antiquity settlement, located at 1.650 km, 170° from the center of the village of Zornitsa, Haskovo municipality (N41°47'33" E25°26'44.9") at p. 325 of the gas-main layout. It is on a slope facing northeast. Its area is about 2.0 dka. The land is privately owned cornfields.

Site No 33. Ancient settlement, located at 1.440 km, 163° from the center of the village of Zornitsa, Haskovo municipality (N41°47'40.5" E25°26'50") at p. 326 of the gas-main layout. I is on a terraced slope with gradient to the west. Its area is about 3.0dka (visible). Probably there is a development up the hill to the east. Many treasure-hunters' excavations were established. The findings include a lot of fragmented ceramicspitoses, amphoras, table ceramics. A broken hromel was found. A dry walling in three rows was found with unclear dating. Polygon was made with an area of 2.2dka. It does not cover the whole site. The land is meadows and forests from the NFF

Site No 34. Burial mound and flat necropolis, located at 1.350 km, 131° from the center of the village of Zornitsa, Haskovo municipality (N41°47'57.1" E25°27'15.9") between p. 331 and p. 332 of the gas-main layout. It was filled with crushed stone and soil. The dimensions of the mound are: d=7m and h=1m. The embankment was damaged by two large treasure-hunters' excavations. Fragments of ancient ceramics were found (pitos), scattered processed stones and human bones. There is a tomb built up of ashlar in the central part of the mound with link of while mortar. To the southeast of the mound indefinite number of graves (more than 10) were registered with probable cremation ritual. A connection is possible with Site No 33. The site is on a terrace on a slope with gradient from west to east. Site No 34 is on the other side of that slope. The necropolis extends for 120m to the north-east – 90m to the south of p. 332. HIt is flat and the ritual presumes corpse-laying. there are fragments of Roman ceramics and human bones in treasure-hunters' excavations. An indefinite number of graves are found in the direction east-west. The land is meadows and pastures from the NFF

Site No 35. Site of indeterminate function located at 2.000 km, 316° from the center of the village of Golemantsi, Haskovo municipality (N41°48'02.8" E25°27'52.9") at p. 334 of the gas-main layout. It is on a slight slope facing south in meadows. Fragments were found of household ceramics in an excavation for the laying of a water supply pipeline. Besides there are fragments of sun-dried brick from a house with a frame of tree branches and a fragment of ancient water pipeline. The area cannot be determined because there is no ceramics on the surface. The land is meadows and pastures from the NFF

Site No 36. Burial mound, located at 1.800 km, 326° from the center of the village of Golemantsi, Haskovo municipality (N41°48'02.4" E25°28'10.7") between p. 335 and p. 336 of the gas-main layout. It is on the top of a hill. It was filled with brown soil. The embankment has regular domed shape with dimensions h=2m and d=14m. The land is in the NFF.

Site No 37. Burial mound, located at 1.550 km, 325° from the center of the village of Golemantsi, Haskovo municipality (N41°47'55.3" E25°28'16.6") at p. 336 of the gas-main layout. It is in the highest point of a ridge. It was filled with felt, small-size crushed stone and soil. The embankment has a shallow oval shape in the direction east-west with dimensions d=12/14m and h=1.5m/1.7m. Two excavations made by treasure hunters were found on the eastern and the western side of the mound. On the western side a tomb cut in the rock was registered. No ceramics was found nor any other findings. The land is meadows and pastures from the NFF. 47-1 N41°47'53,3" E25°28'19,2"

Site No 38. Burial mound, located at 1.427 km, 354° from the center of the village of Golemantsi, Haskovo municipality (N41°47'59" E25°28'49.1") at p. 337 of the gas-main layout. It was filled with homogeneous soil. The embankment is of dimensions d=20m and h≈5m. There are two big excavations made by treasure-hunters in the center of the mound – one of them is over 2 m deep. No findings were established. The mound is located in the middle of a private corn-field with a slope from west to east. At about 100 m from the cornfield to the south – southwest, single hand-made ceramic fragments were found and some amphora handles.

Site No 39. Burial mound, located at 1.580 km, 359° from the center of the village of Golemantsi, Haskovo municipality (N41°48'04.3" E25°28'54.9") at p. 338 of the gas-main layout. The dimensions of the embankment are d=20m and h=2m. No backfilling material was found. The site is located in a cornfield neighboring to Site No 48, with a slight slope in the west-east direction. Probably the mound was ploughed. The territory is private farming land.

Site No 40. Burial mound, located at 1.700 km, 1° from the center of the village of Golemantsi, Haskovo municipality (N41°48'08.3" E25°28'57.1"). It is 90 m to the northeast of Site No 39. The dimensions of the embankment are d=14m and h=0.5m. No treasure-hunter excavations were noticed and no backfilling material was found. The mound was destroyed by the ploughing of the private farming land.

Site No 41. Ancient and Medieval settlement, located at 0.660 km, 130° from the center of the village of Mandra, Haskovo municipality (N41°48'55.1" E25°30'39.3") at p. 343 of the gas-main layout. Its area is about 10 dka. The territory is private farming land.
51-1: N41°48'57.5" E25°30'44.7"

Site No 42. Ancient settlement, located at 1.380 km, 262° from the center of the village of Orlovo, Haskovo municipality (N41°49'34.7" E25°31'30.7") between p. 348 and p. 349 of the gas-main layout, to the south of the road Mandra - Orlovo. There is a medium concentration of kitchen and table ceramics from the Roman age and the late antiquity. The settlement is between the gully and the new road. Its area is about 2.0 dka on privately owned land.

Site No 43. Burial mound, found in the location Belenska Mogila (Orlovska Chuka) at 1.770 km, 30° from the center of the village of Orlovo, Haskovo municipality (N41°50'30.5"

E25°33'04.1") at p. 357 of the gas-main layout. The embankment is filled with soil from the pre-historic settlement located at the west-southwest in the immediate vicinity. It has a regular domed shape with dimensions h=9 m and d=70 m. fragments were found from pre-historic ceramica. On the northern and the eastern side there are excavations made by treasure-hunters. According to information from the Regional Historical Museum – Haskovo, an excavation was made by treasure hunters through the whole mound and the central tomb was probably destroyed. The land is in the NFF. (There is an article on this site).

Site No 44. Pre-historic settlement, found in the location Elenska Mogila (Orlovska Chuka) at 1.530 km, 27° from the center of the village of Orlovo, Haskovo municipality (N41°50'26.3" E25°33'00") at p. 357 of the gas-main layout. It is on privately owned land (There is an article on this site).

Site No 45. Burial mound, found in the location Dvete Chuki at 2.250 km, 302° from the center of the village of Orlovo, Haskovo municipality (N41°55'09.8" E25°36'32.6") between p. 367 and p. 368, to the east of the gas-main layout. The embankment was backfilled with soil and has a shallow shape result of long-term machine processing of the terrain. The diameter is about 15m and the height - 0.80m. There are excavations of treasure hunters on the top of the mound which have probably destroyed the central tomb. The mound is on privately owned land.

Site No 46. Ancient settlement, found in the location Razsadnika, at 0.470 km and 133° from the bridge on the road Haskovo - Simeonovgrad (N41°55'56" E25°36'33.6") between p. 370 and p. 373 of the gas-main layout. It occupies an area of about 3.0 dka. According to information from the Regional Historical Museum – Haskovo, Roman and late antiquity ceramics was found here as well as coins from the end of the 3rd – the beginning of the 4th century. The site is located in an orchard whose southern part is built up with storehouses and production buildings, private property.

Site No 47. Ancient settlement, found in the location Gyozovitsa at 1.200 km, 257° from the center of the village of Voden, Dimitrovgrad municipality (N42°00'33.5" E25°38'27.5") at p. 276 of the gas-main layout, at about 500 m to the southwest of the Golyamata Mogila. The site occupies an area of about 2,0 decares. It is on flat terrain open on all sides, on private farming land. medium concentration of hand made ceramics was found and remnants of a wheel (table ceramics, pots, amphora, etc.), dating the Roman age. Polygon was made.

Site No 48. Burial mound, found in the location Gabera at 1.6km and 220° to the southwest of the center of the village of Chernogorovo, Dimitrovgrad municipality (N42°01’03,7” E25°38’22,7”) at altitude of 157 m, at p. 275 of the gas-main layout. The embankment consists of homogeneous brown soil. Its dimensions are d = 40m, h = 7m. More than 10 excavations made by treasure hunters were found on the mound, most of them big-size – depth over 5m and diameter over 2m. probably as a result the central tomb was destroyed. No findings were established of any kind.

Site No 49. Ancient settlement, located at 1.100 km, 233° from the center of the village of Chernogorovo, Dimitrovgrad municipality (N42°01'22" E25°38'29.5") at p. 275 of the gas-main layout. It is on the first not flooded terrace of the local river on a slight slope with gradient from northwest to southeast. There is a visual connection to the mound - Site No 48. its area is about 0.5 decares. The concentration of ancient ceramics is very low. The territory is private farming land.

Site No 50. Late antiquity building, located at 1.500 km, 303° from the center of the village of Brod, Dimitrovgrad municipality (N42°03'15.5" E25°39'59.4") at p. 268 от of the gas-main layout. It is on the second non-flooded terrace of the river Maritsa. very low concentration of late antique table ceramics was found. The concentration gets higher in the north direction. There are fragments of sun-dried bricks with traces of tree branches. The approximate area of the site is about 5.0 dka. It is on flat terrain on private farming land.

Site No 51. Burial mound, located at 1.750 km, 324° from the center of the village of Brod, Dimitrovgrad municipality (N42°03'35.5" E25°40'10.3") at p. 265 of the gas-main layout, on a cart-track. The shape is shallow with dimensions: d=30m and h=3m. On the eastern side there is a single large excavation of treasure hunters. There are no findings of any kind. A power line passes in the east – west direction and one of the concrete poles was founded in the western part of the mound. The land is meadows and pastures.

Site No 52. Burial mound, located at 2.670km, 328° from the center of the village of Brod, Dimitrovgrad municipality (N42°04’03,9” E25°39’52,5”) at p. 264 of the gas-main layout. The shape of the embankment is shallow with dimensions d=20m and h=1.50m. No ceramic findings were established. Old excavations of treasure hunters were noticed, already almost backfilled. The territory is private fallow land.

Site No 53. Ancient settlement, located at 3.260km, 330° from the center of the village of Brod, Dimitrovgrad municipality (N42°04'18.6" E25°39'45.2" – the beginning of Site 63-1: N42°04’21,1" E25°39’43,5" – end of the Site) at p. 264 of the gas-main layout. It is on flat terrain and its area is about 1-1.5dka. There is a medium concentration of ancient ceramics, walls of pitpses, fragments of amphoras, a jug. The concentration decreases to the north. The territory is private farming land.

Site No 54. Roman settlement, located at 1.690 km, 265° from the center of the village Golyamo Asenovo, Dimitrovgrad municipality (N42°06'04" E25°39'20.3") at p. 258 of the gas-main layout.High concentration of table ceramics was found: cups, a bowl, jugs, dish (polished, thin walled) and pitos. A fragment with plastic decoration was found. To the north and to the east single fragments of renaissance ceramics was found, and a piece of blue glass slag. The area is probably about 50 decares. The land is meadows and pastures. Polygon was made. 54-1: N42°06'12.6" E25°39'27.2" and 54-2: N42°06'25.5" E25°39'28.2"

STARA ZAGORA REGION

<u>LAYOUT COMMON FOR BOTH ALTERNATIVES</u>

Site No 55. Roman settlement, located at 1.300 km, 140° from the center of the village of Trakiya, Opan municipality (N42°11'24.7" E25°39'01.4") at p. 252 of the gas-main layout. It is on private farming land on open terrain with a slight slope from west to east on the western side of a micro-dam-lake. medium concentration of Roman ceramics was found: pitoses, amphoras, kitchenware. The approximate area of the site is 4-5 dka. very high concentration of construction ceramics was found – bricks and roof-tiles. The surroundings are private farming land.

Site No 56. Burial mound, located at 0.900 km, 140° from the center of the village of Trakiya. Opan municipality (N42°11'34.8" E25°38'50") between p.251 and p. 252 of the gas-main layout in a functioning graveyard. It is backfilled with light-brown homogeneous soil. The dimensions of the embankment are: d=35m and h=3m. At the foot of the mound single fragments of Roman ceramics were found. The mound is at about 400m to the northwest of Site No 55 and both sites are probably connected. No treasure-hunters’ digging was noticed, nor any findings from the mound. A fire-fighting furrow was made around the mound and high concentration of kitchen and table ceramics was found there as well as amphoras and dolium from the Roman and the late antiquity ages.

Site No 57. Ancient settlement, located at 2.000 km, 320° from the center of the village of Sredets, Opan municipality (N42°15'45.6" E25°39'20.8") at p. 245 of the gas-main layout. Low concentration of construction ceramics, fragments of pitoses, kitchen and table ceramics from the Roman and the late antiquity ages was found. The approximate site area is 1.0 dka. The settlement is located on private farming land on flat terrain.

Site No 58. Ancient settlement, located at 1.150 km, 254° from the center of the village of Nudeshte, Stara Zagora municipality (from N42°18'19.6" E25°39'32.1" to N42°18'27.8" E25°39'29.6") at p. 238 of the gas-main layout. The approximate site area is 35.0 dka. Low concentration of ceramics was found, increasing to the north. Fragments of amphoras, kitchen and table ceramics were found, with thin walls, red polish and dark green glaze, dating to the Roman age and the late antiquity. The site is on private farming land.

Site No 59. Burial mound, located at 1.650 км, 341° from the center of the village of Kolarovo, Stara Zagora municipality (N42°20'56" E25°42'34.5") at p. 233 of the gas-main layout. Its backfilling is brown soil. The dimensions of the embankment are d about 30m and h = 3m. Old treasure-hunters’ excavations were noticed on the mound. No findings were established. The site is on private farming land.

Site No 60. Burial mound, located at 1.680 км, 345° from the center of the village of Kolarovo, Stara Zagora municipality (N42°20'57.2" E25°42'37.7") at p. 233 of the gas-main layout. It is back-filled with homogeneous brown soil. The dimensions of the embankment are d about 20m and h 2m. Old treasure-hunters’ excavations were noticed on the mound. No findings were established. The site is on private farming land.

Site No 61. Burial mound, found in the location Golyamata Mogila at 2.050 km, 350° from the center of the village of Kolarovo, Stara Zagora municipality (N42°21'10.9" E25°42'40.2") at p. 233 of the gas-main layout. Its backfilling is homogeneous brown soil. The dimensions of the embankment are diameter about 80m and height about 12m. many old and new treasure hunters’ excavations were made on the mound and a deep tunnel – shaft was noticed in its center. The soil from those excavations was piled at the northern foot of the mound. Fragments of hand made ceramics and a wheel were found (pots, cups, etc.). The site is on private farming land.

Site No 62. Burial mound, located at 2.040 km, 70° from the center of the village of Zagore, Stara Zagora municipality (N42°21'27" E25°41'41") at p. 232 of the gas-main layout. It was filled with light-brown soil. The dimensions of the embankment are diameter about 32 m and height 1.80 m. No treasure hunters’ excavations were found on the mound, there are no findings of any kind. The site is on private farming land.

Site No 63. Burial mound, located at 2.100 km, 67° from the center of the village of Zagore, Stara Zagora municipality (N42°21'30.6" E25°41'42.2") at p. 232 of the gas-main layout. It is next to Site No 62, on private farming land. The mound was being ploughed. It was filled with light brown soil. The diameter of the embankment is about 40 m and the height - 1.0 m. No treasure hunters' excavations were found on the mound, there are no findings of any kind..

Site No 64. Prehistoric settlement mound, located at about 2 km 84° to the east of the village of Zagore, Stara Zagora municipality (N42°21'10.9" E25°41'43.1"). The site is on the first non-flooded terrace on the left bank of the river Azmak, to the north of the river. The height of the mound on the western side is about 5 m, and on the eastern side – about 3.50 m. Its shape is irregular ellipse with dimensions: N-S = 130 m and E-W = 125 m, at altitude of 149.5 – 154.4m and area of 13.5 dka. It is easily observable on the terrain which is private farming land, corn-fields at present. No treasure hunters' excavations were noticed on the surface. The cultural layer is grey-brownish soil. Ceramic fragments and small pieces of destructed wall plaster were found throughout the whole area of the site.

Site No 65. Late antiquity settlement, located at 1.7 km 87° to the east of the village of Zagore, Stara Zagora municipality (N42°21'06.5" E25°41'30.9"). The settlement covers about 103 decares at altitude 153 m of the highest and 149 m of the lowest elevation.
An ancient spindle element was found as well as fragments of ceramics – construction and household, most of them with destroyed surface. the site is located on the first and second non-flooded terrace to the west of Site No 64. To the south and southeast it borders with the river Azmak. The site is on private farming land.
Hand-made ceramic fragments were found – prehistoric but the late antiquity (IV-V) and early Medieval fragments predominate – from ceramics made by potter's wheel

Site No 66. Late antiquity settlement, located at 850m 245° from the center of the village of Budeshte, Stara Zagora municipality (N42º18'24.7" E25º39'57.5") нat altitude 168 m of the highest and 163 m of the lowest elevation. The site is located on a high non-flooded terrace with dimensions: N - S = 260 m E - W = 433 m and area of 86 dka. It is on private farming land with possible good observation. The displacement of the terrain is 7 m. At 500 m the asphalt road Stara Zagora – Dimitrovgrad passes to the southeast of the settlement, and to the south – a road to the village of Petrovo. probably the settlement continues further to the south after this road, on private cornfields with low possibility of observation. ceramic fragments, pieces of pitoses, construction ceramics were found throughout the whole area of the site, as well as some fragments of hromel stones from the Roman age and the late antiquity.

Site No 67. Iron age settlement, found at 2.160km 112° in the location Otonliyata in the territory of the village of Yastrebovo, Opan municipality (N42º15'57.793" E25º39'23.367"). It is located in the northeastern part of a high non-flooded terrace with terrain displacement of 13 m. The dimensions of the site are: N - S = 208 m, E - W = 234 m with an area of 41 dka at altitude 173m of the highest and 160m of the lowest elevation. The site is on private farming land with good possibility of observation. On the northern side it borders with a gully and on the western side an excavation for a channel was made. Right to the south of the site a late antiquity settlement was registered under No 67. High concentration of ceramic fragments was found throughout the whole area of the site, hand-made or made by potter's wheel, from the early and late iron ages – one with print and a small cup among them – a complete profile. Pieces of wall plaster were also found.

Site No 68. Burial mound, located at 348m 74° to the northeast of the center of the village of Trakiya, Opan municipality (N42°12'00.4" E25°38'38.3") and at altitude of 170 m. The dimensions of the embankment are diameter 17m and height 4.5m. two excavations made by treasure hunters were noticed. The one on the top is with dimensions 3m x 2m and depth 1.5m. The second one is recent, with dimensions 2m x 2m and depth of 1m. The land is territory of the NFF

Site No 69 Burial mound, located at 1.554 km 47,8° to the northeast of the center of the village of Trakiya, Opan municipality (N42°12'31.2“ E25°35'14.5“) and at altitude of 195m. The mound is on the ridge of a hill and a slope facing west. The shape of the embankment is shallow, ellipse at the base, with diameter 35m and height 1.5m. The mound is on private farming land with good possibilities of observation. It is visible on the terrain but its base was destructed and the soil spread by the processing of the field. There is a recent excavation made by treasure hunters at the highest central part of the mound, rectangular with dimensions 2 m x 0.80 m and depth of 0.20m. No ceramic fragments were found on the surface.

Site No 70 Late antiquity building - (Villa rustica), found at 2.08km 49,5° in the location Eski Mezerlik in the territory of the village of Trakiya, Opan municipality (N42°12'44.5“ E25°39'35.3“) at altitude 186 m of the highest and 177m of the lowest elevation. The building is in the middle and the high part of a slope facing east with dimensions: N-S = 297m E-W = 210m and area of 53 dka. The location is private farming land with good possibility for observation. At 230 m to the east there is a micro-dam lake. High concentration of late antiquity ceramics – construction and household, was found throughout the whole area of the site. The highest concentration of archeological material is on the ridge of the slope.

Site No 71. Burial mound, located at 1.730km 47° from the center of the village of Trakiya, Opan municipality (N42°12'35.1“ E25°39'19.0“) and altitude of 188 m. It is found on the ridge of a hill on the slope facing north/northeast. It is a part of a mound necropolis including Sites 81 and 82. The location is private farming land with good possibility of observation. The backfilling is homogeneous light brown soil. The shape is shallow, ellipse at the base, with dimensions diameter 20m and height 1m. The mound is not quite visible and is destructed to some extent by the processing of the land. A low concentration of construction and household ceramics was found. On the surface there were ceramic fragments made by potter's wheel from the Hellenic epoch – fragment of an orifice was found with black firnis decoration. No excavations made by treasure hunters were registered.

Site No 72 Burial mound, located at 1.660km 46° from the center of the village of Trakiya, Opan municipality (N42°12'35.0“ E25°39'16.6“) and at altitude of 189 m. The site is on the ridge of a hill on a slope facing north/northeast. It is a part of a two-mound necropolis, including Sites No 81 and No 82. The location is private farming land with good possibility of observation The distance to Site 81 is 54 to the west (measured from center to center). The dimensions of the embankment are 34m diameter and height of 1.20m. The shape is shallow, ellipse at the base. The periphery was destructed by land processing and the mound is poorly visible. Ceramic fragments made by potter's wheel were found. No excavations made by treasure hunters were registered.

Site No 73 Ancient building, located at 1.23km 111,7° to the east – southeast of the village of Trakiya, Opan municipality (N42º11'43.233" E25º39'11.731") in a woodland. The displacement of the terrain is 2 m. It is covered by grass and forest vegetation with limited visibility. There is a possibility for observation in a section where excavations were made, probably for an old gas-main. The strip is about 50 m wide and crosses the whole forest.

Several fragments of household late antiquity ceramics were found here as well as higher concentration of construction ceramics. The ceramics was made by potter’s wheel. Probably the accessible part is a part of a building with dimensions N-S = 165m E-W = 105m and an area of 13.5dka at altitude 174 m of the highest and 176 m of the lowest elevation. The exact dimensions of the site cannot be determined because of the difficult observation.

Site No 74 Ancient building, located on the ridge of a slope facing north/northeast at 1.5km 120° to the southeast from the center of the village of Trakiya, Opan municipality (N42º11'33.097" E25º39'20.732"). To the nortn and to the west the site is surrounded by a forest. The displacement of the terrain is 3 m at altitude 178 m of the highest and 175 m of the lowest elevation. The territory is farming land with good possibilities for observation. the mound is visible as a spot with high concentration of construction ceramics – bricks mostly and some household from late antiquity. The dimensions of the site are N-S = 82m E-W = 80m and an area of about 5 dka. Most probably the spot is a part of a building. Ancient ceramic fragments were found.

Site 75 Ancient building, located at 1.610km 133° to the southeast of the village of Trakiya, Opan municipality (N42º11'21.404" E25º39'15.317"). It is in the low and middle part of a slope facing northwest. The displacement of the terrain is 3 m.The territory is farming land with good possibilities of observation. The dimensions of the site are N-S = 64m, E-W = 91m. The area is about 4.3 dka at altitude 163m of the highest and 160m of the lowest elevation. Ceramic fragments were found throughout the whole area of the site, dated antique and late antique, most of them small and with damaged surface. The concentration is low. There are also fragments of construction ceramics – bricks mostly.

Site No 76 Burial mound, found in the location of Gabera at 1.800km 224,75° to the southwest of the village of Chernogorovo (N42°01'01.8“ E25°38'10.05“) at altitude of 164m. The site is in the high part of a slope facing west, on farming land with good possibilities for observation. The embankment is light brown soil with dimensions height 0,90 m and diameter 27m. The shape is shallow, irregular ellipse at the base. The periphery was destructed by land processing and the mound is poorly visible. A great amount of crushed stone and construction ceramics were registered. There are separate fragments of household ceramics, a black firnis decorated fragment among them.

Site No 77 Settlement of the late bronze, early iron and ancient era, located at 1.54km 282° from the center of the village of Voden, Dimitrovgrad municipality (N42°00'42.7“ E25°38'12.6“) at 146 m altitude. The site is in the eastern part of the second high non-flooded terrace. The terrain displacement is 7 m. It is on farming land with good possibilities of observation and with dimensions: N-S = 110m, E-W = 172m and area 17 dka. At 170 m to the southeast of the site there is a micro dam-lake and to the east the site is surrounded by a small functioning graveyard. Hand-made ceramic fragments were found throughout the whole area of the site from the late bronze, the early iron and the antique epoch. The concentration of the fragments is medium, most of them are small and with ruined surface. Small pieces of wall plaster were found as well.

Site No 78 Late antiquity settlement, located at 1.56km 267° to the southwest of the village of Voden, Dimitrovgrad municipality (N42°00'38.1“ E25°38'10.0”) and at 144m altitude (157 m is the highest and 142 the lowest elevation). The site is in the northern part of a low non-flooded terrace with dimensions: N-S = 335m E-W = 311m and area of 93 dka. The displacement of the terrain is 15m, the territory is farming land with good possibilities of observation. At 45m to the northeast there is a micro dam-lake. Ceramic fragments from the late antique age were found throughout the whole site area, as well as much less hand-made fragments from the iron age. The cultural layer is brown soil mixed with small-size gravel.

Site No 79 Pre-historic settlement (pit sanctuary), found in the location of Lahumite at 1.900 km 250° from the center of the village of Voden, Dimitrovgrad municipality (N42º00'21.32" E25º37' 59.363") and altitude 165 – 171 m. The site is in the high part of a hill and archeological material was found on the southeastern and the northwestern slopes. The displacement of the terrain is 6 m. It is within the layout of the Maritsa Motorway from km 43+400 to km 43+700. High concentration of hand made ceramic fragments from the late neolithe and the halcolite era was registered. Pieces of sun-dried bricks were found throughout the whole site area. There are some spots of grey ashy soil contusing ceramic and bone fragments.

Site No 80 Mound necropolis, found in the location Gyozkata Chuka at 3.0km 320° from the center of the village of Uzundzhovo, Haskovo municipality (N41º59'02.007" E25º37'56.723") at altitude of 214m. It includes two mounds – Sites No 90 and No 90-1. The embankment of the big mound is orange-brown soil with dimensions: d=33m and h=7m. It is located on the ridge of a natural hill. Its shape is regular domed with approximately round base. The mound is easily visible and its surface is covered by grassy vegetation. Several treasure-hunters’ excavations were registered which could be used for observations. One of them is in the eastern part of the mound with almost ellipse shape and dimensions 6x5 m and depth over 2 m. A tunnel was dug from it to the centre of the mound. There is another excavation in the high central part. It is smaller – with dimensions 1.50x1 m and depth over 1m. Two layers of dark brown soil are visible in the profiles of this excavation. Several older excavations were registered with dimensions about 1x0.70 m and depth 0.50 m. Limestone pieces, probably thrown out from the excavations were noticed on the surface. In the eastern periphery some of those stones could be part of a supporting structure.

Site No 80 – 1 Burial mound, found in the location of Gyozkata Chuka in the territory of the village of Uzunszhovo, Haskovo municipality (N41º59'02.782" E25º38'02.058") at 2.71km 325 from the center of the village and 4126 to the north of Site No 90. The mound is on the ridge of a hill. It is a part of a mound necropolis including sites No 90 and No 90-1. The embankment is light brown comparatively homogeneous soil with shallow shape, ellipse at the base, with dimensions: d=25m and h=1.7m at 220 m altitude. The surface of the mound is covered by grass and bushes and the possibility of observation is poor. Several old excavations made by treasure hunters were registered concentrated in the southern part of the mound. The western periphery of the embankment was destroyed by the intervention of treasure hunters – an excavation over 10 m long in the direction east-west and 0.80 m in the direction north-south.

Site No 81. Burial mound, located at 2.677km 325º from the center of the village of Uzundzhovo, Haskovo municipality (N41º58'59.542" E25º38'13.026") at 205 m altitude. It is 384 m southeast of Site No 90. The mound is in the high part of a slope facing south. The shape of the embankment is regular domed with dimensions: d=20m and h=1.7m. The backfilling is orange-brown soil mixed with small-size gravel. The surface is covered by grass and bushes and the possibility of observation is low. In the high central part of the mound there are two comparatively new excavations made by treasure hunters. One is with irregular tetragon shape with approximate dimensions 2x2.50m and depth of over 1.50m. The dimensions of the other one are 1x1.50m and depth over 1m. Another excavation was found in the southeastern part of the mound with dimensions about 4x2m. A geodetic point was placed on the highest point of the mound.

Site 82 Ancient settlement, found in the location Sveti Ivan at 2.9km 228,2º from the center of the village of Voden, Dimitrovgrad municipality (N41º59'39.576" E25º38'08.768"). Its area is 28 dka and its dimensions are: N-S = 133m and E-W = 220m at altitude 160 – 168 m, displacement of 8 m. The settlement is in the low and medium part of a slope facing south/southwest. The territory is farming land with good possibilities for observation. To the south the site is surrounded by a forest. Ceramic fragments were found throughout the whole area of the site, manufactured by potter's wheel in the Roman era, and several fragments of construction ceramics. The concentration is low and mainly of non-characteristic fragments. In several locations in the southeastern part of the site there are strips of grey loose soil with dimensions EW – 15 m and NS – 2.5 m.

Site 83 Burial mound, found in the location of Gabera at 2.346km 228º from the center of the village of Voden, Dimitrovgrad municipality (N41º59'51.7" E25º38'02.722") at altitude of 186m. The embankment is of a shallow shape, from brown soil with small-size gravel, with dimensions: d=35м and h=1м. The site is on the ridge of a hill facing south. It is at 0.350km to the north- northwest of Site No 92. The territory is farming land with good possibilities of observation. The shape is shallow with approximately round base. The mound is hardly visible. It was damaged by the processing of the land. No excavations of treasure hunters were registered.

EASTERN ALTERNATIVE OF THE LAYOUT

Site No 1(E). Thracian sanctuary on a summit in the location Karaahmed Tepe at 0.640 km, 120º from the village of Grivyak, Kirkovo municipality (N41°23'11.3" E25°28'45"), between p. 67 and p. 69 and 650 m to the west of the gas-main layout. Fragments of ceramic vessels from the iron, the late iron and the Medieval ages were found.

Site No 2(E). Mining developments, found in the location Madan Tepe at 2.0 km, 222º from the village of Sedefche, Momchilgrad municipality (N41°24'47.7" E25°30'57.9"), at 180m to the east of p. 91 of the gas-main layout. Ceramic fragments of the late bronze and the late antique ages were found.

Site No 3(E). Late antiquity settlement, found in the location Kalabak at 0.970 km 38º from the village of Ralitsa, Momchilgrad municipality (N41°26'55.1" E25°30'23.8") and at 1.260 km to the west/northwest of p. 101 of the gas-main layout. Ceramic fragments were found from late antiquity (the 4th -6th centuries).

Site No 4(E). Thracian sanctuary on a summit located at 1.200 km 213º from the village of Karamfil, Momchilgrad municipality (N41°28'16.3" E25°33'04.3") and at 360m to the northwest of p. 111 of the gas-main layout.

Site No 5(E). Thracian rock recesses found in the location Kayryak Kaya at 1,040 km 63º from the village of Chauka, Momchilgrad municipality (N41°30'23.7" E25°34'20") and at 175 m to the northwest of the gas-main layout between p. 123 and p. 124.

Site No 6(E). Settlement from the II Bulgarian Kingdom, found in the location Yuren at 1.400 km, 81º from the village of Stari Chal, Krumovgrad municipality (N41°35'18"

E25°39'53.3") and at 935m to the east of the gas-main layout. Its area is about 40 decares. Household ceramic fragments from the 11th -14th centuries were found.

Site No 7(E). Medieval flat necropolis, found in the location Erenlar at 0,775 km, 75º from the village of Stari Chal, Krumovgrad municipality (N41°35'17.1" E25°39'25") and at 310 m to the east of the gas-main layout. Its area is about 2,0 decares.

Site No 8(E). Burial mound, 0.755 km, 73° from the village of Stari Chal, Krumovgrad municipality (N41°35'17.7" E25°39'23.6") and at 275m to the east of the gas-main layout. The embankment is soil with regular domed shape

Site No 9(E). Site of indeterminate function located at 1.680 km, 285º from the village of Potochnitsa, Krumovgrad municipality (N41°36'45.6" E25°39'45.1") and at 280m to the west of the gas main layout. Fragments of household ceramics from the Roman and the late antique ages were found. The site area is about 5dka.

Site No 10(E). Prehistoric and Roman settlement, found in the location Yuren at 0.540 km, 284º from the village of Pchelari, Stambolovo municipality (N41°38'41" E25°40'50.6") and at 320m to the east between p. 166 and p. 167 of the gas-main layout. Its area is about 20dka.

Site No 11(E). Thracian sanctuary on a summit, in the location of Hambarluk Tepesi at 1.300 km, 27º from the village of Popovets, Stambolovo municipality (N41°42'59.3" E25°38'49.2"), and at 1.0 km to the northwest between p. 196 and p. 197 of the gas-main layout. Ceramics from the early iron epoch was found.

Site No 12(E). Thracian rock crypt, found in the location Hambarluk Tepesi at 1.560 km, 37º from the village of Popovets, Stambolovo municipality (N41°43'02.4" E25°39'04") between p. 196 and p. 197 and at 850m to the northwest of the gas-main layout. It was dug into a volcanic tuff.

Site No 13(E). Prehistoric settlement, located at 1.850 km, 136º from the village of Gledka, Stambolovo municipality (N41°46'00.1" E25°40'24.7") between p. 212 and p. 213of the gas-main layout. At an area of about 10dka fragments of household ceramics were found from the eneolithe. The territory is private farming land.

Site No 14(E). Burial mound, located at 2.500 km, 282º from the village of Koren, Haskovo municipality (N41°49'36.5" E25°39'20.7") and at 370m to the northeast of the gas-main layout between p. 215 and p. 216. The embankment is homogeneous soil with a regular domed shape and dimensions: h = 3.0m and d = 30m.

Site No 15(E). Burial mound, found in the location Kabalar at 2.500 km, 282º from the village of Koren, Haskovo municipality (N41°49'39.7" E25°38'38.") and at 520m to the west of the gas-main layout between p. 215 and p. 216. The embankment is homogeneous soil, with a shallow shape with dimensions h = 2.0m and d = 50m.

Site No 16(E). Mound group, located at about 1.100 km, 320º from the village of Koren, Haskovo municipality (N41°49'50.7" E25°39'54.8") and at 1.250 km to the northeast of the gas-main layout between p. 215 and p. 216. It includes two mounds of homogeneous soil, with a shallow shape with dimensions 1. - h = 2.0m and d = 50m and 2. - h = 2.0m and d = 35m.

Site No 17(E). Burial mound, found in the location Daskalova Chuka at about 2.150 km, 124º from the village of Malevo, Haskovo municipality (N41°50'54.5" E25°39'02") and at 230m to the east of the gas-main layout at p. 217. The embankment is homogeneous soil, with a shallow shape with dimensions: h = 1.50m and d = 25m.

Site No 18(E). Burial mound, found in the location Trinyazova Chuka at 2.160 km, 135º from the village of Malevo, Haskovo municipality (N41°50'43.4" E25°38'51.7") and at 20m to the west of the gas-main layout. The embankment is homogeneous soil, with a shallow shape with dimensions: h = 2.0m and d = 40m.

Site No 19(E). Burial mound, located at 1.860 km, 144º from the village of Malevo, Haskovo municipality (N41°50'44.4" E25°38'33") and at 440m to the west of the gas-main layout at p. 217. The embankment is homogeneous soil, with a shallow shape with dimensions: h = 1.20m and d = 10m.

Site No 20(E). Mound group, found in the location Demireva Chuka at about 2.500 km, 347º from the village of Malevo, Haskovo municipality (N41°52'51.4" E25°37'20"), and at 0.680 km to the west of the gas-main layout. It includes two mounds. The embankments are homogeneous soil with a shallow shape and with dimensions: 1. - h = 3.0m and d = 40m and 2. - h = 1.0m and d = 30m.

Site No 21(E). Burial mound, located at about 1.600km, 79º from the village of Stamboliyski, Haskovo municipality (N41°54'41.2" E25°39'04.8"), and at 130m to the east of p. 223 of the gas-main layout. The embankment is homogeneous soil, with a shallow shape with dimensions h = 1.00m and d = 30m.

Site No 22(E). Mound group, founding the location Boydyovite Chuki at 2.780 km, 96º from the village of Stamboliyski, Haskovo municipality (N41°54'21.8" E25°39'55.4") and at 1.430 km to the east/southeast of p. 223 of the gas-main layout. It includes two mounds. The embankments are homogeneous soil with a shallow shape and with dimensions: 1. - h = 2.0m and d = 30m and 2. - h = 1.5m and d = 20m. Many treasure-hunters' excavations were registered.

Site No 23(E). Mound group, located at about 2.715 km, 295º from the village of Podkrepa, Haskovo municipality (N41°55'45.4" E25°39'00.8") and at 75m to the west of the gas-main layout between p. 224 and p. 225. It includes two mounds. The embankments are homogeneous soil with a shallow shape and with dimensions: h = 1.5m and d = 15m. These were ploughed with the cornfields.

Site No 24(E). Burial mound, located at about 2.715 km, 316º from the village of Podkrepa, Haskovo municipality (N41°55'54.1" E25°39'47.7") and at about 1.070 km to the east of p. 225 of the gas-main layout. The embankment is homogeneous soil with a regular domed shape and dimensions: h = 2.50m and d = 35m.

3.8 Population and Health

This chapter includes information about the demographic, social and economic characteristics of the investigated area – the territory of the three regions Kurdzhali, Haskovo and Stara Zagora and the ten municipalities respectively – Kurdzhali, Dzhebel, Kirkovo, Krumovgrad, Momchilgrad, Haskovo, Dimitrovgrad, Stambolovo, Stara Zagora, Opan, which will be crossed by the gas-main Komotini – Stara Zagora.

The current state is used for assessment of the anticipated social and economic effects of the project and for comparison of the efficiency of the planned measures for mitigation of the adverse impact in future. The chapter includes a review of the main social – economic indicators along the gas-main layout on the Bulgarian territory.

The work of the team of experts was directed to the collection of data from the municipal administrations affected by the passage of the gas-main layout. The data was collected on the grounds of officially published information by the municipalities and the National Statistical Institute, correspondence with the municipal administrations, telephone discussions with their representatives and personal contacts. Contacts were established with other local authorities – police, road traffic office, regional and national institutions. Part of the significant data was requested and obtained from the national Statistical Institute, the national Agencies and Ministries and from statistical surveys and publications, research articles, regional and municipal urban development plans, etc. Part of the information was collected by interviews with representatives of the local communities and with approved local experts with proven knowledge.

3.8.1 Main characteristics and priorities in the development of the Kardzhali, Haskovo and Stara Zagora regions

The population is the main driving force of the economic and the environmental activities. **The number** of the population, **the structure, the level of education** and other characteristics determine the ecological and economic activities and respectively the development process.

The characterization of the demographic situation in the investigated regions engaged in the passage of the gas-main Komotini – Stara Zagora was performed in narrow and broad terms.

- In narrow terms, the demographic situation is the current state of the population in a specific territory. Its number and structure are characterized by the parameters: gender, age, marital status, nationality, education, social status, etc. Statistically it is described by the current aggregate of the population. This is an aggregate of units which co-exist as at a specified moment.
- In broad terms the demographic situation includes the current state of the population and the demographic dynamics, expressed by the dynamics of the main demographic processes – birth-rate and death-rate, natural growth, the health status parameters. These are periodical aggregates of a single event. When studying and analyzing the demographic state the current state of the population is of greater significance because it is a prerequisite for the future development.

Number of population. *Detailed updated data about the number and the distribution of the population by age and by municipalities and settlements concerned with the construction of the gas main layout are presented in* ***Attachment 11***

The gas-main layout is anticipated to cross the territory of three regions (Kurdzhali, Haskovo and Stara Zagora) and 10 municipalities (Kurdzhali, Dzhebel, Kirkovo, Krumovgrad, Momchilgrad, Haskovo, Dimitrovgrad, Stambolovo, Stara Zagora and Opan).

Some of the municipalities are affected by only one of the alternative layouts. In Dzhebel municipality only one settlement is affected by the passage of the gas-main in the western alternative, and the settlements in the municipalities of Opan, Krumovgrad and Stambolovo near the layout are affected only by the eastern alternative.

The comparison shows that in both alternatives the gas-main layout passes **near about 50 settlements**. The difference is that in the western alternative these settlements are bigger, more developed, with greater number of the population while the eastern alternative passes through mountainous regions with a low number of the population in small villages.

The total n umber of the population in the settlements within a 2000 m strip along the layout is 195000 for the western alternative, and about 140000 for the eastern alternative.

Table 3.8.1-1 presents some basic data about the territory and the distribution of the population b y towns and villages in the regions crossed by the investment proposal for a gas-main Komotini – Stara Zagora.

Table 3.8.1-1 Administrative – territorial structure of the regions Kurdzhali, Haskovo and Stara Zagora

Region/Municipality	**Area (Sq.km)**	**Total number of settlements (2011)**	**Density of the population – residents/sq. km**	**Distribution of the population by residence**	
Regions:				**Towns (number, %)**	**Villages (number, %)**
Kurdzhali	3216	152 808	47,5	63 367 (***41,4%)***	89 441 (***58,6%)***
Haskovo	5538	246 238	44,4	177 778 (***72,2%)***	68 460 (***27,8%)***
Stara Zagora	5151	333 265	86	235 027 (***70,6%)***	98 238 (***29,4%)***
Municipalities:					
Kurdzhali	624	67 460	108	43 880 (***65,0%)***	23 580 (***35,0%)***
Dzhebel	229.16	7167	35	3093 (***43,1%)***	5074 (***56,9%)***
Kirkovo	594	21 916	37	-	21 916 (***100%***)
Momchilgrad	306	16 263	21	7831 (***48,1%)***	8432 (***51,9%)***
Krumovgrad (eastern layout)	843,32	17 823	53	5070 (***28,4%)***	12 753 (***71,6%)***
Haskovo	737	94 156	127	76 397 (***81,1%)***	17 759 (***18,9%)***
Dimitrovgrad	564	53 557	94	40 423 (***75,5%)***	13 134 (***24,5%)***
Stambolovo (eastern layout)	277	5934	21	-	5934 (***100%***)
Stara Zagora	1019	160 108	157	138 272 (***86,3%)***	98 238 ***(13,7%)***
Opan (eastern layout)	257	2950	11,4	-	2950 (***100%***)

It could be established from the table that the regions crossed by the gas-main differ in population – ***the density of the population*** is the highest in the region of Stara Zagora, while in Haskovo and Kurdzhali it is almost equal – about 45 residents/sq.km.

The big municipalities are the most densely populated, the regional centers respectively, while the smaller municipalities in the region of Kurdzhali are very thinly populated - 35-53 residents/sq.km. The greatest is the density of the population in the municipality of Stara Zagora (157 residents/sq.km), followed by Haskovo (127 residents/sq.km) and Kurdzhali with 108 residents/sq.km. Among the smaller municipalities along the western layout that of Dimitrovgrad is the most densely populated and the most thinly – the Momchilgrad municipality.

Residence. The percentage of the town population is an important parameter for the distribution of the population by settlements. In the last years this parameter has been rapidly increasing and is already higher than that in some EU countries. In 2008 the average parameter for Bulgaria was 71,1 %. Higher than the average for the country is the parameter for the region of Haskovo - 72,2 %; near to but a bit lower than the average for the country is the percentage for Stara Zagora – 70,6 %, and considerably lower is the parameter for the region of Kurdzhali - 41,4%.

Generally the greater part of the population in the analyzed regions lives in the towns, in the regional centers mostly.

In some municipalities, however, the population lives only in the villages – these are the municipalities of Kirkovo, Stambolovo and Opan.

The village population predominates in the municipalities of Krumovgrad, Momchilgrad and Dzhebel.

It should be noted with respect to the layout of the gas-main Komotini – Stara Zagora on the territory of Bulgaria, that its passage is anticipated to approach about 55-60 settlements, 50 of them villages, that is the impact of the investment proposal will be predominantly on village population.

Distribution of the population by gender (***Attachment 11*** – Structure of the population from the regions and the municipalities crossed by the gas-main layout Komotini – Stara Zagora by residence, gender and age groups by ability to work (NSI, 2011)

The data about the distribution of the population by gender show that more frequently women predominate – they are on the average 52%, and men - 48%, which conforms to the distribution for the whole country – women 51,5%, and men - 48,5%. The reason is the higher death-rate of men and the higher average life expectancy, characteristic for most of the municipalities and for the country in general.

In some of the analyzed municipalities men predominate – in the region of Kurdzhali, the municipalities of Dzhebel, Kirkovo, Krumovfrad and Momchilgrad their majority is not significant – 100 – 200 persons on the average, but the difference with the country and the other municipalities exists. The men are predominantly active which is a prerequisite for the availability of free labour.

Distribution of the population by age (Attachment 11).

Generally the average age of the Bulgarian population increases. In 2000 it was 39.9 and in 2005 - 41.4, in 2007 - 41.5. The ageing process is better expressed in the villages where the average age of the population (45.4 years) is higher than that for the towns (39.9 years). The relative share of the people over the age of 65 in 2007 was 17.32%. Compared to that in the EU countries - 16.47% in 2005), it is higher.

Current data about the distribution of the population by age group (from 0 to over 85 years) in the settlements of the 10 municipalities affected by the project Gas-main Komotini – Stara Zagora – Kurdzhali, Dzhebel, Kirkovo, Krumovgrad, Momchilgrad, Haskovo, Dimitrovgrad, Stambolovo, Stara Zagora and Opan by data from the National statistical Institute (NSI), 2011, are presented in ***Attachment 11***.

The age distribution in the settlements affected by the project differs by regions. The children and the young people predominate in the villages of the region of Kurdzhali – here the age groups below 30 are the most numerous. Many babies and children below 4 are characteristic for these villages – this is the lowest statistically reported age group. The specific data about each of the analyzed villages are presented in ***Attachment 11***, but it could be summarized that the gas-main layout in this region will pass by or through ‘young villages’ with good age potential.

The villages in the region of Haskovo affected by the passage of the gas-main differ by the age indicator. There are villages with a high number of young population (for instance, Voyvodovo, Malevo, Uzundzhovo), as well as such with very few babies and children (most of the villages in this region for instance Manastir, Zornitsa, etc.).

It is characteristic for the region of Stara Zagora and the villages affected by the project that the population is ageing and the number of the new-born and the children is low. This is very strongly expressed in the villages of Opan municipality – the average age of the population there is over 50, and there are many people of age over 70 and very few children.

The demographic and working potential of the population is an important parameter in the analysis of the age distribution of the population – that is, the age groups below, of and over the active age.

Table 3.8.1.-2 presents the dynamics of this distribution by years for the country. The trend of **a reduction of the number of population below active age, the increase of the number of population of active age and the relatively permanent share of the population over the active age** could be noticed. The reasons are determined by the specifics of the demographic processes in Bulgaria – birth-rate, death-rate, emigration, rising the age of retiring on a pension, etc.

Table 3.8.1.-2 – Dynamics of the relative shares of the population below, of and over active age

Year	In total	Age groups		
		below active age - %	of active age - %	over active age - %
1990	100	21.6	55.5	22.9
1995	100	19.1	56.6	24.3
2001	100	16.3	59.2	24.5
2005	100	14.8	62.4	22.8
2006	100	14.6	62.8	22.6
2007	100	14.5	63.0	22.5

The current state of the age structure of the population in Bulgaria and in the analyzed regions is presented in ***Attachment 11*** and table 3.8.1-3.

The data show that the highest percent of young people below 18 years of age is in the region of Kurdzhali, the same is valid for the people of active age and respectively the group over the active age is the smallest one. That is, this region is comparatively young, with high education and labour potential but with a low realization of this potential and therefore characterized by high emigration rate.

In the regions of Haskovo and Stara Zagora the relative shares of the population below, of and over the active age are almost the same and equal to those average for the country.

Table 3.8.1-3 Age structure of the population of the region of Kurdzhali, Haskovo and Stara Zagora (relative share of the population below, of and over active age)

Region /Municipality	Age groups		
	below active age	of active age	over active age
Regions			
Kurdzhali	14,91 %	64,06 %	21,04 %
Haskovo	14,07 %	60,7 %	25,20 %
Stara Zagora	14,49 %	60,5 %	24,92 %
Municipalities			
Kurdzhali	16,10%	64,30 %	19,60 %
Dzhebel	14,63 %	66,34 %	19,03 %
Kirkovo	13,61 %	63,29 %	23,50 %
Momchilgrad	14,02 %	66,15 %	19,93 %
Krumovgrad	16,36 %	61,94 %	21,60 %

Haskovo	15,31 %	63,12 %	21,86 %
Dimitrovgrad	12,14 %	60,45 %	27,51 %
Stambolovo	14,52 %	58,62 %	26,86 %
Stara Zagora	13,94 %	63,75 %	22,21 %
Opan	8,53 %	38,15 %	53,42 %
Generally or the country	***14,12 %***	***62,15 %***	***23,72 %***

The distribution of the population by age in the municipalities to a great extent follows the trends in the regions in which they are located. The data show that the young people predominate (as a percent from the total population) in the municipalities of the region of Kurdzhali, and this percent is the highest in the municipalities of Kurdzhali and Krumovgrad where the young people are over 16 % of the population, quite above the average percent for the country, followed by the municipalities of Dzhebel and Momchilgrad.

The highest percent of young people in the region of Haskovo is concentrated in the Haskovo municipality – over 15%, followed by the municipalities of Stambolovo and Dimitrovgrad, where the percent of the young people is a little below the average for the country.

In the municipalities of the region of Stara Zagora the population is ageing, the population below active age in the municipality of Stara Zagora is 13,94%, and in Opan – only 8,53%, the lowest percent in all analyzed municipalities. In the municipality of Stara Zagora there is a high percent of population of active age – 63,75% and a low percent of population over active age – 22,21%.

Distribution of the population by nationality.

The data about the distribution of the population by nationality are presented and analyzed for the regions crosses by the gas-main Komotini – Stara Zagora on Bulgarian territory.

Detailed data about the nationality of the population by regions, municipalities and settlements are presented in ***Attachment 11*** - Nationality of the population of the affected municipalities and settlements, and in table 3.8.1.-4.

The analysis of these data for the municipalities and settlements concerned with the construction of the gas-main shows that the Bulgarian population predominates in the regions of Haskovo and Stara Zagora, 79,4% and 86,2% respectively. In the region of Kurszhali the population of Turkish nationality predominates – 66,1%. The Gipsy population is the most numerous in the region of Stara Zagora, and the least in number in Kurdzhali – only 0,9%. There are almost no other nationalities in these regions – about 0,5 % of their population describe themselves as Armenian, Greek, Jewish, etc., and a part of these rarer nationalities specify themselves as Bulgarian. There are no exact data about the religion of the different nationalities, but it was accepted in most of the cases that the religion conforms to the nationality. Most of the people from Turkish and Gypsy nationality in the analyzed municipalities speak Bulgarian.

Table 3.8.1.-4 Distribution of the population by nationality according to the self-determination of the interviewed persons (relative shares)

Region / Municipality	*Number of*	*Nationality*

	answers	*Bulgarian*	*Turkish*	*Gypsy*	*Other*	*Not self-determined*
GENERALLY FOR THE COUNTRY	**6680980**	**5664624**	**588318**	**325343**	**49304**	**53391**
Regions						
KURDZHALI	130781	39519 (30,2%)	86527 (66,1%)	1296 (0,9%)	753 (0,5%)	2686 (1,8%)
HASKOVO	227382	180541 (79,4%)	28444 (12,5%)	15889 (6,9%)	891 (0,6%)	1617 (1,3%)
STARA ZAGORA	308106	265618 (86,2%)	15035 (4,8%)	24018 (9,1%)	1715 (0,5%)	1720 (0,5%)
Municipalities						
KURDZHALI	59954	24285 (40,5%)	33276 (55,5%)	1013 (1,6%)	225 (0,3%)	1155 (1,4%)
KIRKOVO	16398	5808 (35,4%)	10138 (61,8%)	39 (0,2%)	253 (1,5%)	160 (0,5%)
KRUMOVGRAD	14485	3968 (27,3%)	10161 (70,1%)	36 (0,2%)	97 (0,6%)	223 (1,3%)
MOMCHILGRAD	14211	1518 (10,6%)	12049 (84,7%)	205 (1,4%)	25 (0,1%)	414 (2,8%)
DZHEBEL	7331	1245 (16,9%)	5432 (74,1%)	3 (0,04%)	82 (1,1%)	569 (7,7%)
HASKOVO	86058	63963 (74,3%)	16890 (19,6%)	3859 (4,5%)	460 (0,5%)	886 (1,0%)
DIMITROVGRAD	49976	45393 (90,8%)	780 (1,5%)	3370 (6,7%)	168 (0,3%)	265 (0,5%)
STAMBOLOVO	5742	1320 (22,9%)	3931 (68,4%)	474 (8,2%)	9 (0,1%)	8 (0,1%)
STARA ZAGORA	146320	133619 (91,3%)	2841 (1,9%)	8531 (5,8%)	624 (0,42%)	705 (0,43%)
OPAN	2527	2443 (96,6%)	7 (0,27%)	72 (2,8%)	-	5 (0,19%)

The distribution of the population by nationality by municipalities shows that in all municipalities from the Kurdzhali region the Turkish population predominates – from 55,5% in the Kurdzhali municipality to 84,7% in the Momchilgrad municipality. The minority groups – Gypsies, etc. are very small – from 0,04% to 1,5%. One of the municipalities in the Haskovo region – Stambolovo, also has a majority of Turkish population – 68,4% self-determined themselves as such. The gypsy groups are not represented in places where there is a concentration of Turkish population.

In the Haskovo and Dimitrovgrad municipalities (the region of Haskovo) the Bulgarian population predominates - 74,3% and 90,8% respectively. The Turkish population in the Haskovo municipality amounts to 19,6 %, the Gypsy – to 4,5% and the other nationalities - to 0,5%. In the Dimitrovgrad municipality the Turkish population amounts to 1,5%, the Gypsy - to 6,7% and the others - to 0,3%. **That is, with the increase of the percentage of the Bulgarian population the number of the Gypsy population increases as well.**

In the Stara Zagora municipality, as well as in that of Opan the relative share of the Bulgarian population is over 90 % – 91, 3% and 96,6% respectively The Turkish population in these municipalities is about 1%, the Gypsy - 5,8% in Stara Zagora and 2,8% in Opan, the other minority groups in Stara Zagora are 0,4%, and in Opan - nil.

The conclusion from these data is that the layout of the gas-main Komotini-Stara Zagora passes **both through territories with prevailing Bulgarian population and through such with prevailing Turkish population.**

The comparison between the two alternatives of the layout shows that for both of them the layout crosses several types of settlements according to the nationality of the population:

- *Settlements with Turkish population only*. For the western alternative these are about 16 villages in the municipalities of Momchilgrad, Kirkovo and Kurdzhali – Sadovitsa, Krilatitsa, Vurben, Kurchovsko, Velikdenche, Sedlari, Vurhari, Sedlovina, Panchevo, Guskovo, Zvezden, Oreshnitsa, Yastreb, Sokolyane, Beli Plast, Zornitsa. For the eastern alternative these are about 20 villages from the same municipalities – Kukuryak, Kran, Zimornitsa, Grivyak, Rabichevo, Malka Chinka, Ribino, Sedefche, Konche, Rabitsa, Pazartsi, Sindeltsi, Karamfil, Chayka, Neofit Bozvelievo, Potochnitsa, Golobradovo, Pchelari, Putnikovo, Strahil Voyvoda.
- *Settlements with prevailing Turkish population*. In the western alternative these are about 9 – Momchilgrad, Balabanovo, Gluhar, Vishegrad, Ostrovitsa, Stremtsi, Lyulyakovo, Golemantsi, Voyvodovo. For the eastern alternative these are 5 villages – Kladenets, Dolno Botevo, Gledka, Kralevo, Stambolovo.
- *Settlements with prevailing or only Bulgarian population*. For both alternatives their number is almost equal, even the settlements are the same. Common for the two alternatives are the villages on the territory of Haskovo and Dimitrovgrad municipalities – Uzundzhovo, Voden, Chernogorovo, Brod, Golyamo Asenovo, Byal Izvor, Trakiya, Sredets, Yastrebovo, Petrovo, Budeshte, Pamukchii, Kolarovo. The villages Lozengradtsi for the western alternative Shumnatitsa, Orlitsa, Apriltsi, Kirkovo, Zagorski have only Bulgarian population.

(*Note*: Probably not all villages through or by which the layout passes are enlisted here, but only the main settlements and those located in the nearest vicinity of the layout are mentioned).

Population and migration. Mechanical growth

There is a general tendency of reduction of the population characteristic for the three analused regions. This tendency is a result not only of the negative natural growth (which has been improving for the last years, but it still has no permanent effect on the demographic processes), but also of the migration to other country regions.

Generally for the whole country a reduction of the population occurs in the last 20 years. There is atendency of ageing of the population, a negative mechanical growth (emigration) from the small to the bigger settlements and abroad. The latter is mostly typical for the people of the age between 20 and 30, with high qualification and spoken foreign languages. This tendency of reduction of the population is observed in all municipalities along the gas-main layout.

The migration processes are an important factor of the demographic changes. For Bulgaria as a whole and for the analyzed regions in particular this process is characteristic, especially for the last years. In order to explain these processes in the regions and settlements crossed by the gas-main layout, the following demographic tendencies were analyzed:

- Mechanical movement of the population by regions and municipalities, between the regions, from and to the towns and villages. Number of emigrants and immigrants, mechanical growth.

- Mechanical movement of the population by age and gender
- Internal and external migration

Table 3.8.1.-5 Mechanical movement of the population in 2010by regions, municipalities and gender

	Immigrants			Emigrants			Mechanical growth		
	in total	**men**	**women**	**in total**	**men**	**women**	**in total**	**men**	**women**
Bulgaria	***155 212***	***74 098***	***81 114***	***179 402***	***84 795***	***94 607***	***- 24 190***	***- 10 697***	***- 13 493***
Kurdzhali region	**2 915**	**1 412**	**1 503**	**3 958**	**1 921**	**2 037**	**-1 043**	**-509**	**-534**
Kurdzhali municipality	1 372	629	743	1 620	748	872	- 248	- 119	- 129
Dzhebel municipality	151	77	74	253	124	129	-102	-47	-55
Kirkovo municipality	306	168	138	486	250	236	-180	-82	-98
Krumovgrad municipality	194	99	95	552	289	263	-358	-190	-168
Momchilgrad municipality	173	81	92	375	180	195	-202	-99	-103
Haskovo region	**4 620**	**2 258**	**2 362**	**6 288**	**3 024**	**3 264**	**-1 668**	**-766**	**-902**
Haskovo municipality	1 736	805	931	2 273	1 078	1 195	-537	-273	-26
Dimitrovgrad municipality	951	483	468	1460	682	778	-509	-199	-310
Stambolovo municipality	124	70	54	144	66	78	-20	4	-24
Stara Zagora region	**7 860**	**3 841**	**4 019**	**9 561**	**4 677**	**4 884**	**- 1 701**	**- 836**	**- 865**
Stara Zagora municipality	3 715	1 829	1 886	4 332	2 176	2 156	- 27	- 347	- 27
Opan municipality	191	96	95	112	63	49	79	33	46

The data show that in 2010 in the three reviewed regions – Kurdzhali, Haskovo and Stara Zagora, the mechanical growth is negative– - 1043, - 1668 and - 1701 respectively. For the separate municipalities in these regions the same tendency is characteristic – the population has decreased in 2010 as a result most of all of the emigration prevailing over immigration in each municipality. Only one – the Opan municipality has positive mechanical growth - 193 immigrants and 63 emigrants, therefore growth of + 79.

For the period 2001 – 2011 the following data are available about the migration of the population in these regions:

- Kurdzhali region – total migration – 8966, from them 3732 in the same region; 1745 to another region, 3489 abroad.
- Haskovo region – total migration - 10 630, from them 4468 in the same region, 6162 to another region, 3762 abroad.
- Stara Zagora region – total migration – 18988, from them 8831 in the same region, 10157 to another region, 5707 abroad.

The analysis of the data about the distribution of the migrating population by gender showed the following:

In the three analyzed regions as a whole in 2010 the women immigrants are more than the men immigrants. The same is valid for the emigrants – men and women. The exception is the Kirkovo municipality and Krumovgrad (region of Kurdzhali) the men immigrants are more than the women immigrants and the men emigrants are more than the women emigrants.

There are municipalities, in which the gender dependence of immigrants and emigrants is inversely proportional – either women or men prevail. For instance, in the municipalities of Dimitrovgrad and Stambolovo the number of the men immigrants is higher than that of the women immigrants, and the number of the men emigrants is lower than that of the women emigrants. For the Dimitrovgrad municipality the negative growth is 509, 199 for the men and 310 for the women.

The structure of the migration processes by age shows that the highest percent of the migrating population is that of the people of the age 20-29, followed by the group of the age 10-19, then follows the group of 30-39 and the migration gradually decreases with the increase of the age. The lowest number of emigrants is for the group 50-69. The increase of the migrating population over 70 is explained by their moving to children and relatives to be taken care of.

The mechanical movement (the migration) of the population by reasons is shown in Table 3.8.1.-6.

Table 3.8.1.-6 mechanical movement of the population in 2010 by reasons, regions and gender

	Immigrants			**Emigrants**			**Mechanical growth**		
	in total	**men**	**women**	**in total**	**men**	**women**	**in total**	**men**	**women**
Kurdzhali region	***2 915***	***1 412***	***1 503***	***3 958***	***1 921***	***2 037***	***-1 043***	***-509***	***-534***
Regular job	252	111	141	358	152	206	-106	-41	-65
Temporary job	7	3	4	63	44	19	-56	-41	-15
Marriage	2	-	2	5	1	4	-3	-1	-2
Education	-	-	-	246	122	124	-246	-122	-124
With (to) parents	554	281	273	537	271	266	17	10	7
To be taken care of	4	1	3	18	4	14	-14	-3	-11
Other	101	53	48	445	221	234	-354	-168	-186
Not shown	1 995	963	1032	2276	1106	1170	-281	-143	-138
Haskovo region	***4 620***	***2 258***	***2 362***	***6 288***	***3 024***	***3 264***	***-1 668***	***-766***	***-902***
Regular job	1 108	512	596	899	419	480	209	93	116
Temporary job	90	45	45	142	85	57	-52	-40	-12
Marriage	6	2	4	9	2	7	-3	-	-3
Education	1	1	-	451	227	224	-450	-226	-224
With (to) parents	878	446	414	914	468	446	-36	-4	-32
To be taken care of	83	38	45	87	35	52	-4	3	-7
Other	1 103	508	595	1 194	498	696	-91	10	-101
Not shown	1 274	647	627	2 193	1 052	1 141	- 919	- 405	-514
Stara Zagora region	***7 860***	***3 841***	***4 019***	***9 561***	***4 677***	***4 884***	***- 1 701***	***- 836***	***- 865***
Regular job	469	277	192	579	308	271	-110	-31	-79
Temporary job	152	100	52	119	62	57	33	38	-5
Marriage	17	2	15	24	5	19	-7	-3	-4
Education	21	8	13	877	476	402	-857	-468	-389
With (to) parents	1 596	838	758	1 470	778	683	126	51	75
To be taken care of	115	42	73	101	37	64	14	5	9
Other	2 829	1 305	1 524	2 539	1 154	1 385	290	151	139
Not shown	2 661	1 269	1 392	3 851	1 848	2 003	- 1 190	-579	-611

There are differences in the hierarchy of the reasons for migration from and to the analyzed regions.

For the region of Kurdzhali the main *reasons for the immigration* are "with/to parents" and "regular job". In the region of Haskovo the immigration is due to "regular job", "with/to parents" and "temporary job". In the region of Stara Zagora the reasons are classified in the following order – "with/to parents", "regular job", "temporary job". The structure of the reasons for immigration t the respective region is connected to the characteristics of the development of the region.

The reasons for emigration of the population from the analyzed regions are of the same structure for the regions of Kurdzhali and Haskovo and differ for the region of Stara Zagora. Most of the emigrants from the regions of Kurdzhali and Haskovo in 2010 have emigrated "with/to parents", "regular job" and "education". For the region of Stara Zagora the structure is: "with/to parents", "education", "regular job", "temporary job".

Definitely the main reason for the emigration from the three analyzed regions is "with/to parents". This could be understood from the characteristics of the psychology of the Bulgarian people, the strong relation to the parents (the family, the kin), the responsibility to the parents. The reason second in significance is the "regular job", especially important for the regions with high unemployment rate like Kurdzhali and Haskovo. For the region of Stara Zagora the "education" is second in importance, which is characteristic for the country as a whole. The Bulgarian people are traditionally studious, the parents encourage and support their children to study and get higher education. In the last 2 – 3 years such a tendency is observed among the Turkish population as well. This is confirmed by the presented data from the sociological study, where "education" is on the third place as a reason for emigration from the regions of Haskovo and Kurdzhali, with traditionally prevailing Turkish population.

Besides the reasons for the migration processes in the regions crossed by the gas-main layout, mentioned by the interviewed people, the negative mechanical growth is related to other social reasons, namely: with he reduction of the number of the children in the villages, schools get closed down and so the children either need to travel to another settlement to get proper education, or their parents leave the villages and look for jobs and schools in the bigger settlements. Medical institutions and healthcare are almost missing in the small villages, the GPs do not visit them and there is no system of rendering first aid, the roads are in a poor state and the bus lines are closed down or their number is very limited, the prices of the bus tickets are high, etc. The supply of medicines is in a very poor state, and so are the cultural, sports and every-day services . These factors to a considerable extent contribute to the negative mechanical growth of the population in the regions of Kurdzhali and Haskovo and to the movement from villages to towns, from smaller to bigger towns and abroad. .

3.8.2 Population and demographic processes in the Kardzhali, Haskovo and Stara Zagora regions

Data is presented and the main dynamic demographic parameters are analyzed - birthrate, death-rate, natural growth.

As for the demographic processes and tendencies, according to the information from the National Statistical Institute, Population and demographic processes in 2009, those for the country as a whole are positive – the rate of reduction of the population decreases, the birth-rate increases, the average life expectancy increases and the effect of the emigration gets limited.

3.8.2.1 Birth-rate

The birth-rate is an important demographic index which characterizes the positive pat of the demographic processes. Its value is determined as the number of the new-born in a year per 1000 people of the population.

The following data are presented in order to characterize the current state and the different aspects of the birth-rate in the analyzed regions:

- Births in 2010 by residence, regions, gender – table 3.8.2.1.-1.
- Born alive in 2010 by regions, municipalities and gender
- Average age of the mothers giving birth in 2010 by residence, regions, provinces
- Birth-rate by regions and residence– table 3.8.2.1-3.
- Total fertility rate by regions and residence – table 3.8.2.1.-3.

Table 3.8.2.1 -1 Births in 2010 by residence, regions and gender

Region	Total			Born alive			Still-born		
	Total	Boys	Girls	Total	Legitimate	Illegitimate	Total	Legitimate	Illegitimate
				By regions					
Kurdzhali	1 616	829	787	1 608	967	641	8	4	4
Haskovo	2 411	1 194	1 217	2 387	974	1 413	24	4	20
Stara Zagora	3 605	1 908	1 697	3 562	1 439	2 123	43	9	34
				In towns					
Total	57 486	29 561	27 925	57 077	28 194	28 883	409	149	260
Kurdzhali	689	358	331	684	380	304	5	2	3
Haskovo	1 852	911	941	1 835	774	1 061	17	3	14
Stara Zagora	2 618	1 380	1 238	2 582	1 226	1 356	36	9	27
				In villages					
Total	18 619	9 606	9 013	18 436	6 469	11 967	183	35	148
Kurdzhali	927	471	456	924	587	337	3	2	1
Haskovo	559	283	276	552	200	352	7	1	6
Stara Zagora	987	528	459	980	213	767	7	-	7

The born alive by municipalities are: Kurdzhali - 810 (396 boys and 414 girls); Dzhebel – 87 (boys 51 and girls 36); Kirkovo – 167 (87 and 80 respectively); Krumovgrad – 189 (96 and 93 respectively); Momchilgrad – 160 (82 and 78); Haskovo – 967 (468 and 499); Dimitrovgrad – 468 (239 boys and 229 girls); Stambolovo– 63 (27 and 36); Stara Zagora – 1765 (931 and 834); Opan – 20 (7 and 13).

The data from Table 3.9.2.-2 show that the births in 2010 as an absolute value are the most numerous in the region of Stara Zagora, but their the women population is the most numerous.

As for the ratio between the number of women and the number of the births (relative share of the births to the total n umber of women), for Kurdzhali it is 2,1%, for the region of Haskovo – 1,9%, and for the region of Stara Zagora – 2,1%. That is, the least number of births in 2010 was in the region of Haskovo.

Data are presented about the born alive – legitimate and illegitimate. The born alive illegitimate children as a percentage of all born alive are respectively: for the region of Kurdzhali – 39,86%, for the region of Haskovo – 59,19%, and for the region of Stara Zagora - 59,60%. These data show the tendency characteristics for the last years of living like a family without official marriage and therefore, illegitimate children.

Since1991–1992 a trend has originated of increase of the absolute and the relative share of the illegitimate births and as it could be seen from the presented results, their number is continuously increasing . In 1992 this share was 18.5% , it amounted to 42.1% in 2001 and 50.2% in 2007. The high rate of illegitimate birth is a result of the considerable increase of young couples living together without wedlock. Comparing the average age of the women at their first birth (25.4 years) and at their first marriage (26.1) the tendency of giving birth to the first child before getting officially married seems strong.

This tendency is expressed to almost the same extent in the regions of Haskovo and Stara Zagora. Considerably less strongly expressed is this tendency in the region of Kurdzhali, where traditional opinion prevails and society does not look favourably at celibacy and illegitimate birth.

The ratio of birth-rates in towns and in villages is bigger than 1, that is due to the larger number of the population in the towns, the birth-rate there is higher. As for the gender of the new-born, boys predominate in the regions of Kurdzhali and Stara Zagora, and girls – in the region of Haskovo.

Birth-rate coefficient. The birth-rate coefficient varies with the years. Table 3.8.2.1-2. shows the dynamics of this parameter.

Table 3.8.2.1.-2 Dynamics of the birth-rate, the natural growth and the total fertility rate for the population in Bulgaria (in retrospect)

Years	Birth-rate (per 1000 people)	Natural growth (per 1000 people)	Total fertility rate
1990	12.1	-0.4	1.81
1995	8.6	-5.0	1.23
2001	8.6	-5.6	1.24
2005	9.2	-5.4	1.31
2006	9.6	-5.1	1.38
2007	9.8	-5.0	1.42

The table shows that the birth-rate decreases from 1990 to 2001 and then a tendency of an increase has occurred. This is mainly due to the increase of the fertility of the maternity contingent measured by the total fertility rate. While in 2002 the average number of born alive per woman was 1.21, in 2006 it was 1.38, and in 2007 - 1.42. This is the highest value after 1993 when this coefficient was 1.45.

Taking into consideration that the number of women in fertile age decreases and the total coefficient of fertility increases, it could be concluded that the increased birth-rate is mainly due to the birth of second (third, etc.) children.

Data from 2010 for the parameters Birth-rate and Coefficient of fertility for the country and for the analyzed regions – Kurdzhali, Haskovo and Stara Zagora, are presented in Table 3.8.2.1-3 .

Table 3.8.2.1-3 Birth rate and total fertility rate by regions and residence in 2010

	Birth-rate			*Total fertility rate*		
	Total	*Town*	*Village*	*Total*	*Town*	*Village*

For the country	***10.0***	***10.6***	***8.6***	***1.49***	***1.43***	***1.64***
Kurdzhali region	10.4	10.6	10.3	1.49	1.38	1.60
Haskovo region	9.4	10.3	7.3	1.53	1.52	1.55
Stara Zagora region	10.2	10.7	9.0	1.64	1.54	1.88

The data show that the birth rate is comparatively high for the country in 2010 – 10.0, higher for the regions of Kurdzhali – 10.4 and Stara Zagora – 10.2 and lower for the region of Haskovo – 9.4. The birth-rate is higher in the towns than in the villages.

Total fertility rate. The total fertility rate expresses the average number of children born by a woman in her whole fertile interval from 15 to4 9 tears and its is also high as seen from the comparison with previous years presented in Table 3.8.2.1-3. The high values of this coefficient show the tendency to having more children than one, irrespectively of the age. This correlates with the higher birth-rate, the higher number of births in 2010 and the more favorable tendencies in the birth-rate general.

In all the three analyzed regions the total fertility coefficient is higher than the average for the country, even for Stara Zagora it is considerably higher than the average for the country.

Average age of mothers at birth in 2010. The data show that on the average for the country the age of mothers when giving birth to their first child was 26,2 in 2010, and when giving birth to a child irrespectively of the number - 27,5.

In the region of Kurdzhali the average age for giving birth to a child is 26,7, and for the first child - 24,7. These are higher in the towns than in the villages, especially the age for the first child. In the region of Haskovo the average age of mothers giving birth to their first child is the same as that in The region of Kurdzhali - 24,7, and is higher in the region of Stara Zagora - 25,4.

The comparison of this parameter for the towns and the villages shows a difference of bout 2 years in favour of earlier age of birth in the villages. For the region of Kurdzhali the average age of birth of the first child is 25,6 in the towns and 23,9 in the villages. For the region respectively 25,2 and 23,1, and for the region of Stara Zagora – 26,3 for the towns and 21,9 for the villages.

3.8.2.2 Death-rate

Death-rate is the number of deceased per 1000 of the population (%).

In order to characterize the death-rate in Bulgaria and in the analyzed regions the following data are presented:

- Deaths by regions, municipalities and gender - Table 3.8.2.2.-1.
- Death-rate in 2010 by residence, region and gender (‰) – Table 3.8.2.2.-2.

Table 3.8.2.2.-1 Deaths by regions, municipalities and gender in 2010

	In total	**Men**	**Women**
For the country	***110165***	***57641***	***52524***
Region of Stara Zagora	*5374*	*2852*	*2522*
Stara Zagora municipality	2200	12043	996
Opan municipality	103	50	52
Region of Haskovo	*4000*	*2076*	*1924*
Haskovo municipality	1200	595	605

Dimitrovgrad municipality	972	526	446
Stambolovo municipality	116	66	50
Region of Kurdzhali	*1713*	*907*	*806*
Kurdzhali municipality	691	368	323
Dzhebel municipality	79	45	34
Kirkovo municipality	287	142	145
Krumovgrad municipality	242	134	108
Momchilgrad municipality	192	88	104

In the light of the economic development of our country special attention should be paid to the **death-rate**, which has increased for the last two decades.

Compared to the European countries, the death-rate level of the population in Bulgaria is considerably higher. One of the main problems resulting from the ageing of the population is the growth of pathology connected to the advance in years.

Death-rate

Table 3.8.2.2.-2 Death rate (general and infant) in 2010 by residence, region and gender (‰)

	Death-rate (per 1000 people)			**Infant mortality (per 1000 born alive)**		
	Total	**Men**	**Women**	**Total**	**Boys**	**Girls**
For the country	***14,6***	***15,8***	***13,5***	***9,4***	***10,6***	***8,1***
Kurdzhali - general	11,1	12,0	10,3	8,7	10,9	6,4
In towns	9,3	10,4	8,3	7,3	5,7	9,1
In villages	12,3	13,1	11,7	9,7	14,9	4,4
Haskovo - general	15,7	16,8	14,7	10,5	8,5	12,4
In towns	12,5	13,5	11,6	8,7	4,4	12,8
In villages	23,2	24,5	22,0	16,3	21,6	10,9
Stara Zagora- general	15,4	16,8	14,0	15,4	16,5	14,3
In towns	12,4	13,9	11,0	15,5	17,7	13,1
In villages	22,1	23,3	20,9	15,3	13,4	17,5

Analyzing the data it should be noted that the lowest death-rate in the three analyzed regions and much lower than the average for the country is the death-rate in the region of Kurdzhali - 11,1 (14,6 for the country). In Haskovo and Stara Zagora the death-rate is higher than the average for the country.

In general the death-rate is higher in the villages than in the towns, which is connected to the higher average age of the population in the villages, the greater percent of people of age there and the poor access to medical assistance.

Infant mortality. (number of dead children below the age of 1 year per 1000 born alive) is one of the most significant indicators of the material, health and cultural level of the population. Despite the decrease of the infant mortality in the last years in Bulgaria, it remains high, higher than that in the European Union.

The main reasons for the mortality of children below the age of 4 are the specific states occurring in the prenatal period due to which are 32.6% of all deaths in this age group. The other reasons are the diseases of the respiratory system – 17.4%, the congenital abnormalities – 15.8%, the diseases of the organs of the blood circulation system – 10.7% and external reasons for morbidity and mortality with relative share of 5.1%.

The **mothers' death-rate** is in close connection with the infant mortality in the light of the reproduction of the population and the economic development**.** A tendency is observed of a decrease of this death-rate due to pregnancy complications, birth and post-natal period. The mothers' death-rate per 100 000 born alive decreases and in 2010 it was 12.0. The relative parameter for the EU countries for 2010 is much lower – 6.01.

Death-rate by reasons

For many years the leading position has been occupied by the diseases of the organs of the blood circulation system - 65.8%. Second come the malignant growths (15.9%), followed by the disease of the respiratory tract (4.0%) an the traumas and poisonings (3.4%). The mortality due to the diseases of the organs of the blood system increases in the last years and Bulgaria is one of the leading countries in Europe by that parameter – much higher in Bulgaria than the standardized death rate parameter for the EU - 685.35 (Bulgaria) vs. 276.3 (EU) per 100 000 people. The death-rate from the second is 234.9 per 100 000 people, which is lower than the average for the EU but with a tendency of increasing. In the structure of the traumas and the poisonings the share of the suicides and the road traffic accidents is the highest, these are the so called external reasons. In 2010 the suicide death-rate in Bulgaria was 11.8 per 100 000 people.

By data from WHO in 2009, according to the parameter for measuring the total load of diseases, expressing the number of years lost as a result of diseases, disability and premature death – DALY, the heart and blood circulation system diseases are on the first place with 34 421 years lost from life, on the second place – the nerve and psychic disorders with 29 370 lost years and on the third place – the oncologic diseases with 17 025 lost years.

3.8.2.3 Natural Growth

Natural growth is a term of the demography, describing the state of the population as the difference between birth-rate and death-rate – positive and negative. It reflects the number of people by which the world or a specific region naturally increases or decreases.

The difference between the numbers of births and deaths forms the natural growth of the population. Since 1990 more people have been dieing than being born, this difference is negative and the population in Bulgaria decreases continuously. Bulgaria is among the countries with negative natural growth.

Table 3.8.2.3. -1 shows the dynamics of the main demographic parameters – birth-rate, death-rate, natural growth for the last five years.

The natural growth for the period 2004 – 2010 exhibits a tendency of improvement, that is, the negative value decreases. This corresponds to the increased birth-rate in the same period and to a certain extent to the decreased death-rate. In general there is an improvement of the analyzed demographic parameters both for the country and for the regions under discussion.

Table 3.8.3.-1 Dynamics of the main demographic parameters – birth-rate, death-rate and natural growth for the regions of Kurdzhali, Haskovo and Stara Zagora for the period 2004-2010

	Birth-rate (‰)				Death-rate (‰)				Natural growth (‰)			
	1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
2010	10,4	9,4	10,2	*10.0*	11,1	15,7	15,4	*14.6*	-0,7	-6,3	-5,2	*- 4.6*

2009	11,1	9,6	10,5	*10.7*	11,3	15,1	15,0	*14.2*	-0,2	-5,5	-4,5	*- 3.5*
2008	11,3	8,8	10,1	*10.2*	11,8	15,5	14,8	*14.5*	-0,5	-6,7	-4,7	*- 4.3*
2007	10,8	9,0	9,9	*9.8*	11,4	15,6	15,4	*14.8*	-0,6	-6,6	-5,5	*- 5.0*
2006	10,8	8,8	9,7	*9.6*	11,0	15,5	15,3	*14.7*	-0,2	-6,7	-5,6	*- 5.1*
2005	10,0	8,5	9,0	*9.2*	11,0	15,7	15,1	*14.6*	-1,0	-7,2	-6,1	*- 5.4*
2004	10,7	8,5	9,2	*8.6*	10,8	15,1	14,9	*14.2*	-0,1	-6,6	5,7	*- 5.6*

Key: **1**- Kurdzhali region; **2**-Haskovo region; **3**-Stara Zagora region; 4 – average for the country

The best tendency of the parameter birth-rate is in the region of Kurdzhali – only -0,7 ‰. In Haskovo and Stara Zagora the natural growth is much lower and worse than the average for the country.

The values of the natural growth differ between the towns and the villages. For the region of Kurdzhali the difference is insignificant (in the towns - +1,3, in the villages – -2,1. In the regions of Haskovo and Stara Zagora the difference is drastic – in the towns of the region of Haskovo the natural growth is -2,2, while in the villages it is -15,9. For the region of Stara Zagora these values are -1,7 and -13,1 respectively.

It could be concluded that the region of Kurdzhali is characterized by demographic parameters significantly better than the average for the country and the best among those for the three analyzed regions.

The demographic tendencies in the region of Stara Zagora follow the processes typical for the country in general, mainly because the largest part of its population is concentrated in the big towns on the territory of the region.

In the region of Haskovo the demographic processes are the most unfavourable compared to the tendencies in the other analyzed regions and worse than the average for the country. .

Prognostication about the population in the analyzed regions.

Attachment 11 includes a prognostication about the number o the population (in total and by gender) up to 2060 in the regions crosses by the layout of the gas-main Komotini – Stara Zagora.

The prognostic data about the number and the distribution of the population in the regions of Kurdzhali, Haskovo and Stara Zagora until 2060 are presented in three alternatives:

- **I alternative** (under the hypothesis of convergence): This alternative is determined as realistic a d conforms to the regulatory requirements of the EU on the demographic and social and economic development of the member states
- **II alternative** (relative acceleration): It is assumed in this alternative that the demographic development will take place under favorable social and economic processes in the country
- **III alternative** (relative deceleration): It is assumed in this alternative that the demographic development will take place under unfavorable hypotheses for the social and economic processes in the country

3.8.3 Health Status and Healthcare services of the Population

3.8.3.1 Health status

Sick-rate – the total number of the registered new diseases by the initial medical attendance for 1 year

Morbidity – the total number of registered new and old cases in a year.

Structure of the sick-rate of the population

Among all the registered diseases in 2010 the highest frequency and the highest relative share belong to the diseases of the respiratory tract (about 38%), followed by the diseases of the nervous system, of the organs of the blood circulation system, the traumas and the poisonings.

The data of the National Health Information centre (for the last 5 years – 2005-2010) show that the **sick-rate** in the analyzed regions differs by its parameters.

The settlements (towns and villages) on the territory where the gas-main layout is anticipated to pass, are quite different by their characteristics which determines the difference in the type of the health characteristics.
The analysis of the available data shows that the region of Kurdzhali is generally characterized by sick-rate lower than the average for the country, the sick-rate in the region of Haskovo is about the average for the country and the sick-rate for the region of Stara Zagora is higher than the average for the country..

The sick-rate and the total number of the diseases, especially the cancer rate, increase. In the period 1990 – 2007 the total number of the diseases reached 3330.7 per 100 000. The sick-rate (the newly registered diseases) has increased from 245.1 to 413.9 per 100 000 in 2007. The highest is the number of the diseases per 100 000 души of the mammary gland in women (1124.8), of the women genitals (981.3) and of melanoma and other malignant skin diseases (716.6), and the sick-rate per 100 000 is the highest for the cancer of the digestive system (105.1), cancer of the mammary gland in women (86.0) and cancer of women genitals (82.3).

Table 3.8.3.1-1 Registered malignant diseases in the region for the period 2005-2009 (per 100 000 people)

Year	Region of Kurdzhali	Region of Haskovo	Region of Stara Zagora	Average for the country
2009	1976,0	3277,0	3380,1	3453,3
2008	1865,9	3212,8	3309,2	3437,6
2007	1698,1	3024,9	3269,3	3330,7
2006	1646,2	2969,5	3260,2	3229,0
2005	1538,2	2941,6	3204,2	3069,9

The highest sick-rate among the three analyzed regions, near to the average for the country, is that in the region of Stara Zagora. This is valid in general and for some specific diseases like the cancer. The sick-rate for the cancer diseases in the region of Kurdzhali is twice lower than the average for the country, which could be due to the lack of diagnostics for different reasons.

The mental disorders also exhibit a tendency of increase. The number of the patients under observation in the psychiatric hospitals increase, irrespectively of the amendments of the regulatory documents. Their frequency has increased from 2656.7 per 100 000 in 1990 to 2892.1 in 2004. A decrease followed and in 2007 this parameter was 2255.0 per 100 000.

Among the contagious diseases due to obligatory announcement the highest number of diseases per 100 000 is for the chickenpox (434.4) and the scarlet fever (50.9).

The ageing of the population leads to a number of health, social and economic problems. The increased demands of health care and social assistance result in an increase of the costs in these spheres and to the need of more resources.

The chronicle non-infectious diseases determine the level of the total death-rate and lead to considerable loss of human and material resources, embarrassing the families and the state.

Generally the sick-rate with some exceptions is the highest in the region of Stara Zagora, and is the lowest in the region of Kurdzhali. The reasons are complex and could be related with the distribution of the population by age, the quality of the environment, the healthcare and the health culture of the population, the quest for medical assistance (general practitioners and/or specialists), the financial capacity for diagnostics and medication, etc.

The Hospitalized morbidity for 2009 was 10,8% or 51 792 cases, which is 467 more than for 2008. The highest is the share of the diseases of the respiratory tract (17,4%), followed by the diseases of the organs of the blood circulation system 16,8% and the pregnancy, childbirth and postnatal period, including the abortions -16,7%. The registered disease in the hospitals for outpatient care in 2009 by classes of diseases are presented in Table 3.8.3.-2.

Table 3.8.3-2 registered diseases in the medical institutions for outpatient care for 2009 by classes of diseases (per 1000 people)

	Classes of diseases	Region of Kurdzhali	Region of Haskovo	Region of Stara Zagora
I	Some infectious and parasitic diseases	16,3	14.9	11,0
II	New growths	15,3	14.1	10,9
III	Diseases of the blood and the blood forming organs	6,8	7.9	10,5
IV	Diseases of the endocrine system, disorders of nutrition and metabolism	18,4	29.5	15,7
V	Mental and behavioral disorders	12,3	20.1	11,3
VI	Diseases of the nervous system	14,5	10.8	17,0
VII	Diseases of the eye and adnexa	33,8	43.5	46,0
VIII	Diseases of the ear and mastoid process	48,2	56.9	33,6
IX	Diseases of the blood circulation organs	41,2	38.7	24,8
X	Respiratory diseases	128,5	363.6	223,3
XI	Diseases of the digestive systems	71,5	57.9	53,7
XII	Diseases of the skin and the subcutaneous tissue	28,4	50.2	53,2
XIII	Diseases of the musculoskeletal system and the connective tissue	66,1	58.4	53,7
XIV	Diseases of the urogenital system	43,8	90.0	95,8
XV	Pregnancy, childbirth and puerperium	3,9	4.6	4,3
XVI	Some states which occur in the perinatal period	2,1	0.1	-
XVII	Congenital abnormalities (developmental defects) deformations and chromosomal abnormalities	2,1	1.7	1,1
XVIII	Symptoms, signs and abnormal changes found in clinical and laboratory studies not classified elsewhere	54,2	65.5	44,2
XIX	Inguries, poisoning and certain other consequences of external causes	55,7	73.6	54,9
XXI.	Factors influencing the health status of the population	4,3	6,2	-

3.8.3.2 Healthcare services of the Population

The healthcare services of the population in the regions crossed by the gas-main layout is provided in the big cities by hospitals, individual medical practices, clinics, etc., and in the small settlements – by general practitioners and in some placed – by centers for emergency medical care. data about the medical facilities and practices in the analyzed regions are presented in Table 3.8.3.2.-1

Table 3.8.3.2.-1 Facilities for outpatient and inpatient care in the regions affected by the project

				Beds in the medical facilities	
Regions	**Outpatient care**	**Medical facilities**	**Specialists physicians**	**For active treatment**	**For rehabilitation**
Kurdzhali	296 medical practices	5 MHAT 1 CEMC	237	495-659	124-245
Haskovo	179 medical practices	2 SHAT 5 MHAT 1 HPTPTR 1 MHC 1 CSVD3 1 CEMC	389	829-973	205-362
Stara Zagora	296 medical practices	3 SHAT 9MHAT 1 RH 1 HPTPTR 1MHC 1 IOC 1 CEMC	428	1158-1430	246-361

Key: **POPT** – Primary Outpatient Treatment; **SHAT** – Specialized Hospital for Active Treatment; **SOC** – Specialized Outpatient Care; **MHAT** – Multifunctional Hospital for Active Treatment; **RH** – Rehabilitation Hospital; **HPTPTR** – Hospital for Post-treatment, Prolonged Treatment and Rehabilitation; **MC** – Medical centre**;** **MHC** – Mental Health Centre; **IOC** – Integrated Oncology Centre; **CSVD** – Center for Skin and Venereal Diseases; **DCC** – Diagnostic and Consulting Centre; **HMSC** – Homes for Medical and Social Care (excluding HMSCC); **CEMC** – Center for Emergency Medical Care

Region of Kurdzhali

Data from a conference of the regional council for cooperation on ethnic and integration issues with the regional governor in Kurdzhali in June 2011 showed that about 41000 people in the region have no health insurance and many people have no access to medical service. In general in the municipalities of Kurdzhali outside the municipal centers there is no appropriate medical service and the population of the outermost settlements is the most affected. The raising of the health culture level and the hygiene of part of the population is also needed.

The remoteness from specialized hospitals and health centers could be compensated by preventive health measures and the organization of health information campaigns raising the standard of living of the population.

Municipality of Kurdzhali The municipality of Kurdzhali is characterized by a well developed health network of private medical practices and a sufficient number of medical specialists. A regional dispensery (clinic) on pneumophtysiatric diseases operates here, as well as a state psychiatric hospital, a center for emergency medical care, a diagnostic – consulting center, a stomatologicla center, etc. For the last five years the number of the medical facilities has not been changes but the bed space has been reduced by 50%.

Kirkovo municipality. The health service in the municipality is mainly performed by general practitioners with individual practices for primary outpatient treatment. There are no medical facilities on the territory of the municipality. Those located at the shortest distance are in Momchilgrad, Kurdzhali and Zlatograd.

In the schools and in the kindergartens there are consulting rooms for prophylactics and promotion of the health of the children and the students.

The emergency medical aid is provided by two branches of the Center for Emergency Medical Care in Kurdzhali in the villages of Kirkovo and Chorbadzhiysko. Two mobile teams with the branch in the village of Kirkovo provide emergency medical aid in the regions Photinovo and Benkovski. There are five pharmacies on the territory of the municipality in the villages of Chakalarovo, Kirkovo, Fotinovo, Benkovski and Chorbadzhiysko and two drug-stores in the villages of Kirkovo and Tihomir, providing the needed medicines.

Dzhebel municipality. The medical service in the municipality is provided by a developed network for outpatient treatment. It is performed by seven medical practices (3 in the town and four in the villages of Mishevsko, Rogozche, Ustren and Pripek – one in each village) and four stomatological practices. The general practitioners send the patients from the municipality to specialists in the regional center – the town of Kurdzhali, because there are no medical specialists on the territory of the municipality. The hospitalization is in the Multifunctional Hospital for Active Treatment "A. Dafovski" in Kurdzhali.

Momchilgrad municipality. The system of health care in the Momchilgrad municipality is comparatively well organized and to a great extent well provided financially, with equipment and personnel. The students' health care is provided by four consulting rooms and 6 medical specialists.

Two municipal and one regional medical institutions operate in the Momchilgrad municipality - the Multifunctional Hospital for Active Treatment – Momchilgrad EOOD with 85 beds and 17 physicians and Medical Center 1 EOOD for outpatient treatment with 17 physicians, as well as general practitioners – 4 in the town and 2 in the villages of Raven and Nanovitsa. The stomatologists in the municipality are 9 and there are 80 medical college graduates .

There are no medical practices and medical institutions in the villages near the layout of the gas-main.

Haskovo region In general the health care in the region is well developed in the larger settlements but in the small villages in the outskirts there are 25 unoccupied medical practices. These are mostly in small villages far from the larger settlements, spread on a large territory, difficult to approach, with limited communications, and the population there continuously decreases in number due to demographic and social factors. These are the reasons for the lack of interest of the general practitioners to registration in these areas. There are, however, unoccupied practices in closer located villages in the Haskovo municipality – Mandra, Nadezhda and Trakiets. By data from the Regional Health Insurance Fund the greatest part of the population in these practices is covered by the practitioners from the neighboring settlements. The appointed medical auxiliaries and the visits of the physician from the neighboring practice according to schedule ensure the medical service according to the Fund.

Haskovo municipality. The total number of the medical personnel in the Haskovo municipality is 1342, 424 (31.59%) from which are physicians and 93 (6.93%) stomatologists. The specialized physicians are 233, and the specialized stomatologists – 37. The general practitioners are 59 or 13.92% of the physicians. The medical specialists are 825 or 61.48% of the personnel. One doctor in the municipality takes care of about 232 people, and one stomatologist - 1058

The regional map of the health service shows 61 practices for GPs in the Haskovo municipality, 48 of which for the town and the neighboring villages. The practices of the stomatologists are 67 in the municipality, 54 of which for the town and the neighboring villages.

There are two unoccupied medical practices in the villages of Mandra and Nikolovo. A great part of these practices are covered by the GPs in the neighboring settlements.

Dimitrovgrad municipality. A foremost task of any health care system is to provide access of the population to basic medical care in the primary medical aid facilities . Despite the declared principles of accessibility and equality of the health-insured, the population in the small settlements encounters serious difficulties in getting medical services. The outpatient medical care in the municipality is provided by 37 general practitioners. The stomatological primary care is provided by 39 individual dental practices. Two medical centers were opened. The hospital treatment is provided by the Multifunctional Hospital for Active Treatment "Sveta Ekaterina".

In the sphere of healthcare the Dimitrovgrad municipality ensures the needed conditions and directly controls the activities in the Kitchen for Children and the crèches, the kindergartens and the schools.

Stara Zagora region The healthcare in the region is provided by a well developed network of outpatient and hospital treatment. The statistics of the bed space (95 per 10000 people) and physicians (in total 703) is a good one.

Stara Zagora municipality. The outpatient treatment is provided by 130 medical practices (112 in the town and 18 in the villages) in medical centers and village treatment and prophylactic institutions. The problem is to provide timely medical aid to the outmost villages and these without medical practices. Besides the access to health care is problematic to a large group of people without health insurance.

Opan municipality.

The medical service in the Opan municipality is provided by general practitioners, there are no medical institutions in the region, those at the shortest distance are the regional.

Table 3.8.3.2.-1 presents the data about the medical service in the settlements directly affected by the layout of the gas-main. It includes the medical practices which serve these settlements, the centers of the practices and the villages covered by them. It shows that there are medical practices in 15 of the settlements affect ted by the gas-main layout with general practitioners, providing prophylactic and current medical examinations, treatment, first aid,

transportation to hospitals and other medical services which could be performed on the spot. In some places, beside the medical practices, there are dental practices and pharmacies. In the village of Kirkovo there is a first aid section with two mobile teams. These practices are insufficient and some of them are unoccupied, some villages are far from the centre of the practice and the access to it is difficult.

Table 3.8.3.2-1 Medical practices and served regions affected by the layout of the gas-main Komotini – Stara Zagora

	Medical practices	
	Centre of the medical practice	**Settlements affected by the project of the gas-main Komotini – Stara Zagora served by the practice.**
Kurdzhali municipality	**Town of Kurdzhali**	town of Kurdzhalli, villages of Panchevo, Zimzelen, Sedlovina, Ostrovitsa and Vishegrad
	village of Beli Plast	villages of Yastreb, Sokolyane and Beli Plast
	village of Stremtsi	villages of Strentsi and Lyulyakovo
	village of Shiroko Pole	villages of Zvezden, Oreshnitsa and Guskovo
	village of Gluhar	villages of Gluhar, Duzhdino and Pepelishte
	village of Rani List	village of Bolyartsi
Dzhebel municipality	**Town of Dzhebel**	town of Dzhebel, village of Slunchogled
	village of Rogozche	villages of Velikdenche and Polyanets
Momchilgrad municipality	**Town of Momchilgrad**	town of Momchilgrad, villages of Balabanovo, Sadovitsa, Sedlari and Vurhari
Kirkovo municipality	**village of Kirkovo**	villages of Kirkovo, Zavoya, Domishte, Shumnatitsa, Lozengradtsi, Apriltsi and Krilatitsa
	village of Fotinovo	villag of Fotinovo
	village of Kurchovsko	village of Kurchovsko, Metlichina and Vurben
	village of Samodiva	villages of Samodiva and Bregovo
	village of Shoptsi	villages of Shoptsi, Ostrovets and Purvitsa
	village of Chorbadzhiysko	village of Orlitsa
	village of Benkovski	village of Zagorski
Opan municipality	**village of Trakiya**	villages of Trakiya, Byal Izvor, Sredets and Yastrebovo
Stara Zagora municipality	**village of Budeshte**	villages of Budeshte, Petrovo and Strelets
	village of Elenino	village of Pamukchii
Haskovo municipality	**village of Golemantsi**	village of Golemantsi
	village of Mandra	villages of Mandra and Orlovo
	village of Uzundzhovo	village of Uzundzhovo
	village of Voivodovo	village of Voyvodovo
	village of Konush	village of Zornitsa
	village of Malevo	village of Manastir
Dimitrovgrad municipality	**Town of Dimitrovgrad**	town of Dimitrovgrad
	village of Chernogorovo	villages of Chernogorovo and Voden
	village of Zlato Pole	village of Brod
	village of Radievo	village of Golyamo Asenovo

The presented data about the health of the population in the analyzed regions cannot determine these regions, where the layout of the gas-main is anticipated to pass, as risky for human health – for most of the settlements the health parameters are better than the average for the country.

The investment proposal for the construction of the gas connection Komotini – Stara Zagora may exert a positive effect on the way of living and the standard of the population and on the environment, which determined the project as compatible with the current state of the *population, the municipal structures and the health risk.*

3.8.4 Education and Educational Institutions in the Affected Regions

The educational level of the population is one of the important characteristics of the population. People with low educational level are in an unfavorable position on the labor market and the possibilities for employment are strongly limited to activities requiring low qualification. The lack of education is a factor which leads to significant problems in finding jobs for the unemployed because of the employers' requirements.

The educational structure of the population affects negatively the development of the local economic potential and limits the possibilities for increasing the competitive power of the local business and therefore the investment potential of the municipalities. This requires the implementation of purposeful policy of development of the human capital with accent on acquiring basic professional skills and liquidation of the illiteracy of the non-educated people. A foremost task of the municipal administrations and the competent authorities is the prevention of children dropping out of the system of education by the implementation of programs for motivation and support of children from underprivileged families.

In comparison with the member states the Bulgarian population has a favorable educational structure. By data from the census of the population in 2011, 14.6% are the people with higher education and their share increases continuously, 37,9% are the people with secondary education and with primary - 27,5%, with elementary– 18,4%, illiterate – 2,1%. That is, about 2027.4% of the Bulgarian population has primary and lower education 39% on the average for the EU countries.

Despite the satisfactory level of the education an increase of illiteracy and the share of children dropping out of school, especially from secondary school, are observed lately. A most alarming fact is the concentration of this tendencies in the groups of population with low income and in some ethnic groups.

The increase of illiteracy and the deteriorating educational structure among the young people (up to the age of 24) exert a most unfavorable effect of the future demographic development. Every 5^{th} of this group has education lower than secondary.

The educational system in Bulgaria undergoes a transition period. The education of the coming generation is based on a number of acts on the pre-school, school, university and post-graduate systems of training. The educational system includes public and private kindergartens, schools and universities.

Kurdzhali municipality

The educational level of the population of the municipality is good in the towns an low in the villages, where there are many illiterate people, or with a very low education, without any qualification. In the last year the number of the enlisted pupils decreases.

In the towns the children study foreign languages (91,8%), about 70% study two foreign languages, there are 8 laboratories in information technologies. In the town of Kurdzhali there is a branch of the Plovdiv University and of the International Slavonic Institute in Moscow which is a possibility to get higher education and qualification.

In the towns the structure of the population by qualification is quite similar to the average for the country. In the villages the illiterate are about 5%, those with elementary education – 15%, with primary – 16%, with secondary – 56%, and with higher – 8%.

The population in the **Kirkovo municipality** is characterized by low level of education and lack of professional qualification. By data from the NSI the share of the *specialists - university and college graduates* is only 3%, and the group with *secondary education* is 19%. People with *primary and elementary* education prevail – 71% of the population in the municipality, including the share of the *illiterate* which is 5%.

The children between 7 and 18 years are enlisted for studying 85.4%. By this parameter the Kirkovo municipality is on the 212th place of all 262 municipalities in Bulgaria. The share of the enlisted pupils is due to the low income of the households, the engagement of the children between 7 and 18 in the family farms and the demotivation due to the lack of perspectives for professional realization.

Dzhebel municipality. By educational level the structure of the population is the following: illiterate - 5.63 %., elementary education– 20.53 %, primary education – 40.44 %, secondary education - 21.28 %, college graduates – 1.90 % university graduates – 2.06 % . This structure changes by increasing the share of the people with secondary and higher education.

Momchilgrad municipality. The data about the educational level of the population show that the share of the specialists – college and university graduates is 6% in the municipality, that of the people with secondary education - 29% or 3 981 people. The group of people with primary and elementary education predominates - 65% of the population.

The low educational level of the population in the municipalities of Kirkovo, Dzhebel and Momchilgrad exerts an unfavorable effect on the local economic potential, by limiting the possibilities for raising the competitive power of the local business and the investment attractiveness of the region.

This situation requires the undertaking of purposeful political measures for the development of the human capital, with accent on the acquiring of basic professional skills, and of the liquidation of the illiteracy, the raising of the level of education of the human resources for the higher competitive power and adaptation on the labor market.

Dimitrovgrad municipality. The development of the educational structure is favorable. An absolute and relative growth of the share of people with higher and secondary education is observed. The predominating part of the people with higher education live in the town of Dimitrovgrad.

The personnel of the administrative and business administration is of the highest qualification, followed by that in healthcare and education. In the secondary sector the people with secondary and vocational secondary education predominate. In the villages the largest share is that of people with primary and elementary education. In general the educational level is quite near to the average for the country (due to the town population).

The relative share of the illiterate people is 3,07 %, that of people with primary education – 26,36%, with secondary – 34,43%, and of college and university graduates - 10,28%.

On the territory of the Dimitrovgrad municipality there are 1084 children of gypsy origin and 79 children of Turkish origin who attend school (according to data of the Department of Education). There total number is 1163 (1084 + 79) which is 15,9% of all students – 7309. A part of the children of Gypsy origin do not go to school so actually this percent is higher.

The problems facing the minority groups, the Gypsies mostly, are the low level of education, the high percent of the unemployed, the low income – the children do not go to school, there is no farming land, etc. The integration to the society is a long process requiring great efforts and on the first place, including the children in kindergartens and schools to all levels, in qualification courses, etc.

Haskovo municipality is characterized with a favorable educational structure:people with higher education – 8%, college graduates - 5%, secondary education – 35%, primary education – 25%, lower than primary education –17,5%, illiterate – 2,7%.

The higher level of education is concentrated in the town of Haskovo where there are possibilities for employment, education and standard higher than those in the other settlements in the municipality.

The tendency in the development of the educational structure of the population is favorable – with an absolute and relative growth of the number of people with higher and secondary education. Most of the people with higher education are concentrated in the town of Stara Zagora.

The share of the people with primary and elementary education predominates in the villages. Parallel to the higher educational level the share of the illiterate increases both absolutely and relatively (from 1,3% to 1,6%). In general the tendencies in the development of the educational structure of the population is near to those for the country as a whole.

Opan municipality. The population of the Opan municipality amounts to 2950 people, Bulgarian nationality, mostly people of the age over 60-70 years. According to the statistics the illiteracy is 15 %, people with secondary education predominate, the people with higher education are about 3%, the rest is people with primary or vocational secondary education, most of them pensioners, who are not employed according to their educational level.

Stara Zagora municipality. About 85% of the children proportionally to the total population, visit schools in the town. The coefficients of enlisting of the children for elementary (100%) and primary education (98%) are very high. There are 9 schools in the villages in the municipality, about 600 children from all the villages receive secondary education in the town. Most of the children from the villages are Gypsies The equipment and the level of teaching in the villages is much worse than those in the town. The objective is to achieve stabilization of secondary basic centers of the education network with guaranteed quality of the process of education.

In general the tendencies in the education in the analyzed regions are not very favorable (except for the town population in the big towns), due to the reduction of the number of schools and the complex difficulties for the access of the children from smaller settlements to the schools, the lack of resources in the families in the smaller settlements for longer training of the children, and to a certain extent, the specific ethnic customs and culture, as well as the amendments of the training plans, the influence of the social and cultural environment, the lack of commitment among the teachers due to the low salaries, the decreasing discipline, etc. The education of the analyzed population in general is secondary.

The number of the schools, classes, teachers and students in the regions affected by the project in the school year 2010-2011 is presented in ***Attachmente 11*** – **Classes, schools, teachers, students and graduates of general education and vocational education schools in the school year 2010/2011 by regions and municipalities.**

Among the settlements affected by the project educational institutions are found in all towns and in the following villages:

- Schools – the villages Kirkovo and Fotinovo (Kirkovo municipality), Gluhar and Stremtsi (Kurdzhali municipality), Voyvodovo and Uzundzhovo (Haskovo municipality).
- Kindergartens and creches –the villages of Shumnatitsa, Kirkovo, Zavoya, Fotinovo, Shoptsi, Ostrovets, Purvitsa, Samodiva (Kirkovo municipality), Gluhar and Stremtsi (Kurdzhali municipality), Mandra, Orlovo, Voyvodovo and Uzundzhovo (Haskovo municipality), Byal Izvor (Opan municipality).
- Community centers – the villages of Shumnatitsa, Orlitsa, Kirkovo, Zavoya, Fotinovo, Ostrovets, Domishte, Vurben, Kurchovsko (Kirkovo municipality); Gluhar, Ostrovitsa, Stremtsi, Beli Plast (Kurdzhali municipality); Orlovo, Voyvodovo, Uzundzhovo (Haskovo municipality), Voden, Chernogorovo, Brod, Golyamo Asenovo (Dimitrovgrad municipality); Byal Izvor, Sredets, Yastrebovo (Opan municipality); Petrovo, Budeshte, Pamukchii (Stara Zagora municipality).

3.8.5 Employment and Unemployment

The latest data about the employment and the unemployment in Bulgaria are the following: in the third quarter of 2011 the unemployment coefficient was 10.2%, and the comparison with the same quarter of 2010 shows an increase of 0.7 points. For the same quarter of 2011 the employment coefficient of the population of the age of 15 - 64 years was 59.9%, which is lower by 0.7 points from the same period of 2010.
The data about the employment of the active population in the analyzed regions of Kurdzhali, Haskovo and Stara Zagora are presented in table 3.8.5-2.

Table 3.8.5.-2. Employed people and employment coefficient for the population of the age of 15-64 years in 2010

	Employed people (thousands)			**Employment coefficient - %**		
	In total	**Men**	**Women**	**In total**	**Men**	**Women**
Kurdzhali region	47.9	22.7	25.2	46.3	44.1	48.5
Haskovo region	100.3	53.2	47.1	60.5	64.1	56.9
Stara Zagora region	143.3	76.5	66.8	63.5	67.4	59.5
For the country	***3010.4***	***1579.2***	***1431.2***	***59.7***	***63.0***	***56.4***

It could be seen from the table that the employment of the population in the regions of Haskovo and Stara Zagora is better than the average for the country. The highest employment in 2010 was in the region of Stara Zagora and the lowest – in the region of Kurdzhali. The number of the employed and the employment coefficient for the region of Kurdzhali is lower than the average for the country and the other two analyzed regions.

The employment dynamics shows that in December 2011 a drastic reduction of the employed was registered in comparison with 2010.

For the region of Kurdzhali in 2010 the number of the employed was about 47 900, and in December 2011 - 27 607, almost twice less.

For the region of Haskovo – the number of the employed in 2010 was 100 300, and in December 2011 - 50 262, also twice less.

In the region of Stara Zagora the reduction is not so big – from 143 300 employed in 20101 to 103 082 in December 2011.

In general the unemployment especially among the village population in the three regions is high, the highest being in the Kurdzhali region. The perspectives for the opening of new working places are connected mainly with investments in small and middle scale business in heavy and light industry and services.

The incomplete use of the human resources is due to the poor employment of the population over 50 years old. For the last three years the share of the unemployed over the age of 50 has increased by 73.26% reaching 26.6% of the active population. The main factors for the increasing unemployment among this share of the population are the improper or the lack of qualification, the lack of computer skills and skills for working with new technologies. The adaptivity of the people decrease with ageing which makes difficult the acquiring of new skills and knowledge. A policy of improving the qualification, the knowledge and the skills of the unemployed from this group should be implemented.

Another important characteristics of the unemployment is its duration. The long-term unemployed are about 64 %, which is an indicator of stagnation on the local labor market and a negative indicator of the state of the employment in the municipality. As a result of the permanent drop out of the labor market a de-socialization is observed among the members of this group, the unemployed lose their working habits and professional skills. The high level of long term unemployment requires special measures and programs for qualification of the labor force and opening of subsidized places of work.

The share of the unemployed women is higher than that of the men (63,53 % of the unemployed are women). 2,32% of all unemployed have higher education. Low education have about 3/4 (80,05%) of all unemployed in the municipality. The high share of the unemployed with primary and lower education to a great extent coincides with that of the unemployed without qualification (68,8%), whose chances of employment are limited. The high unemployment of people with secondary education (17,62% of all unemployed) is mostly explained by the re-structuring of the economic activities.

In general the local labor market is characterized by the incomplete use of the available human resources. permanently affected by the unemployment are the young people, those with primary and lower education, the women and the people over the age of 50.

An inquiry among the population about the unemployment showed that 2/3 of the people are long-term unemployed (for more than 1 year). The reasons for the unemployment mentioned by 48% of the inquired is the restructuring of the enterprise, 20% of them had a fixed data labor contract, 28% left work at their own will. For 48 % of the people the possible way of changing their way of living is to find a job, 16 % think this is the higher qualification, other 16 % see the change in moving to a big city (or abroad– 8%), for 12% this is the start of their own business. The interests in the latter are mostly in the sphere of trade – 28%, industry – 24%, tourism -20% and stock-breeding – 16%. The reason for the inability to start their own business for over 50% of the inquired is the lack of funds, and for 18% - the lack of knowledge and skills.

It could be seen that despite the great potential of the labor force (the number of the active people) the unemployment in the analyzed regions and municipalities is growing, amounting to 50 % in some places. The development of the unemployment is affected by the seasonal activities – gathering, producing and handling of the farming products, in the forest nurseries, the trade, and by the lack of education, the misuse of the labor potential, the economic crisis, etc.

Conclusion. The demographic characteristics of the region are connected to the current and future use of energy sources, natural gas in particular, which is ecologically friendly energy source. The consumption of natural gas follows the population dynamics, not directly, because natural gas is important for the development of the economics, tourism, every-day life, being used in budget, health and educational institutions, etc.

The state of the environment is of significant importance for the social and health status of the population. That is why the sustainable solutions for the supply of natural gas to the region, the reduction of the harmful emissions and the prevention of the irreversible damages of the environment are important elements of the general strategy of improving the demography, the social status and the health of the population.

4 Description, Analysis and Assessment of the Anticipated Significant Impacts on the Population and the Environment as a Result of Harmful Substances emissions during construciton and Operation, Waste Generation (Reviewed by Components and by Environmental Factors)

This chapter includes the unavoidable and lasting impacts on the environment from the construction and the operation of the investment proposal, which may prove to be significant and which should be reviewed in detail in the EIA Report.

The scope of the impact is determined on the grounds of systematization, analysis an assessment of the information about:

- the specific features of the project,
- the territories and the borders of the site,
- the state of the environmental components before the implementation of the investment proposal,
- the proposed construction, activities and technology,
- the proposed system of monitoring of the environment during the operation of the facility,
- the proposed alternatives,

- the characteristics of the components and the factors of the environment,
- the significance of the anticipated impacts,
- the results from the performed consultations with the concerned public and the competent authorities,
- the evaluation of the conformity to the regulatory documents,
- the evaluation of the conformity with the applied best available techniques and the international practices,

The significance of the impacts is determined by the following definitions:

- direct and indirect
- cumulative
- short, medium and long-term
- permanent and temporary
- favorable and adverse

The significance of the impacts in the EIA Report is determined with respect to the environmental components, the material and cultural heritage: atmospheric air, water, mineral diversity, and with respect to the factors exerting impact on the environment – waste, harmful physical factors, etc.

The EIA Report presents generalized data about the scope of the potential impacts (emissions to air, waste water, waste) on the environmental components and the material and cultural heritage, exerted by the investment proposal during the construction and the operation of the project

The scope of the potential impacts is marked as:

- impact along the gas-main layout only – layout of the IP
- local impact in the region around the layout – local L
- regional impact – R
- national impact – N
- trans-border impact – T

The EIA Report includes all activities auxiliary to the implementation of the investment proposal.

Point 4.1. further below reviews all harmful substances and emission and waste sources, and point 4.2 includes a description, analysis and assessment of the anticipated significant impacts on the population and the environment as a result of the identified in point 4.1 emission and waste sources

4.1 Emissions of Harmful Substances during Construction and Operation, Waste Generation;

4.1.1 Emission and waste sources;

4.1.1.1 Emission sources

4.1.1.1.1 During construction

4.1.1.1.1.1 Pollution of the atmosphere and generated exhaust gases

The construction works, according to the supplied data and documents, anticipates the use of about 18 heavy-freight transportation vehicles, 35 light construction machines and 35 heavy construction machines per working day. These machines will operate in a section of about 15 km along the gas-main layout with width of the construction strip of 30 m.

The excavation works during the construction will result in air pollution due to the following activities:

- Transportation – heavy-freight machines will be used for the transportation of pipes, equipment, materials and people.
- Excavation and embankment works – by using heavy machinery for the excavation and for the assembly of the pipes
- Only if needed, in event no connection to the local electric power supply network could be made, diesel generators will be used in the temporary settlements within the limits of the working days.

During the construction, as a result from the excavation works and the transportation of the earth masses and the humus cover, increased dust emissions to the atmosphere will be observed as well as re-emission of aerosols from the temporary roads. This is anticipated to lead to certain short-term changes in the micro-climate in the area of the project implementation and in the air quality in the urban zones or the Protected Sites adjacent to the site. The dust emissions will be the main pollutant during the construction works and relevant measures will be anticipated for the mitigation of their impact on the environment and especially on the quality of the air.

The exhaust gases emitted by the construction technique and the transportation vehicles (according to the Method of calculation by balance approach the emissions of harmful substances to the atmospheric air, approved by MOEW in 2000)are distributed into the following groups:

- The first group includes: sulphur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOC), methane (CH4), carbon oxide (CO), carbon dioxide (CO2), nitric oxide (N2O) and ammonia (NH4).
- The second group includes the heavy metals: cadmium (Cd) and lead (Pb), and stable organic pollutants: polycyclic aroma hydrocarbons, dioxines, and furanes (DIOX), polyvynil chlorinated biphenils (PCBs), etc
- Particles (soot).

The harmful emissions from the used mechanizations and the transportation vehicles will depend mostly on the age and the type of the machines and their maintenance, load capacity as well as on the quality, amount and type of the used fuels. Measures will be taken in this respect according to the relevant Bulgarian legislation and the Industry Best Practices.

According to a letter of MOEW Ref. No OBOC – 249/10.09.2012 these data were supplemented by calculating the emissions from surface sources (which are in practice all sources during the construction) cand the expected concentrations of the fine dust particles (FDP_{10}) and NO_2 from them.

After the calculation a mathematical modeling was performed of the air pollution by the diffuse emissions to the atmosphere from the construction of the gas-main – only for those sections which are problematic from the point of preservation of the air quality (for instance in the immediate vicinity of the towns of Haskovo, Dimitrovgrad and Kurdzhali, whose air quality is lower by the parameter fine dist particles (FDP_{10}). After the determination of the impact of the emissions from the surface sources the resulting concentrations were summed up by pollutants with those from the point and organized emission sources. The modelling is presented in ***Attachment 3.3*** (Mathematical modelling of the pollution of the atmospheric air from the diffuse emissions from the construction of the gas-main), and the results are described in point 4.2.1.2.1.

Anticipated emissions from the transportation and the construction technique

The selected technology for the construction of the gas-main and the technical means to be used in its application imply the emission of harmful substances to the air, posing a potential or real hazard to the air quality and the related ecological and health risks to the environment and to the population near the site. Such factors are the following works:

- preparation and leveling the terrain before the laying of the gas-pipes;
- excavation works for the laying of the gas-pipes in the trenches;
- use of transportation technique for materials, elements of the facility (pipes), workers, etc., including the logistics of the site.
- backfilling and recultivation of the terrain.

Calculations were made of the anticipated emissions of some harmful substances o the air, which, by the opinion of the specialist, pose a real hazard to the environment and to the people. Their calculation was made on the grounds of the used methods, referred to in the text, of the U and of Bulgaria for the balance calculation of the emissions.
The following factors were also taken into consideration:

- The type and the duty of the construction machines according to the nomenclature of MOEW;
- The regime of operation on the site and the factors affecting them, including the organization of the work;
- The type and the amounts of the energy carriers (the fuels) used in the machine park.
- The organization of the work.

Table 4.1.1.1.1.1-1 presents data about the structure of the machine park, including:

- The type of the machines to be used in the construction on the site;
- The duty characteristics of the machines from the nomenclature list of MOEW, using their minimal or mean capacity.
- The number of the machines by types. These data are sufficient for the determination of the emissions of harmful substances from each machine or group of machines.

It should be noted that the summed powers and the work which would be executed by them are the upper (theoretical) limit of the maximal emissions at simultaneous operation of all the machines, which is hardly achievable.

Table 4.1.1.1.1.1-1 Structure of the machine park*

Machines	Average power [kW]	Number	Total power [kW]
Excavators	10	12	120
Bulldozers	30	6	180
Loaders (front)	15	4	60
Electric generator	500	1	500

Machines for laying the pipes (lorry-mounted crane)	100	5	500
Light-duty construction machines	100	1	100
Lorries	160	10	1600
		In total	3060

*According to KORINER (code 0808)

Tables 4.1.1.1.1.1-2 and 4.1.1.1.1.1-3 present the type and the amounts of the emissions from the construction and assembly technique and the emissions from the transportation machines. The data are calculated by the method of MOEW from 2000 under the following conditions and assumptions:

- Specific consumption of diesel fuel per 1 kWH energy – 0,25 кg or 2,9 l.
- The calculations are based on the minimal or the mean power of the construction machines according to the nomenclature list of MOEW;
- The specific emissions of harmful substances per ton of diesel fuel (the KORINER method, 2007, EC);
- The emission coefficients for heavy freight motor vehicle per km , code 0808
- Linear character of the site, double (two-way) run of the lorries and total number of runs per shift;

Table 4.1.1.1.1.1-2. Type and amounts of the emissions from the construction – assembly technique

Emissions	NO_2	Soot (FDP)	Cadmium
moment, g/s	10,1	1,2	0,002 mg/s
shift, g/10 h	366	43	75 mg/10 h

Table 4.1.1.1.1.1-3. Emissions from the transportation technique

Emissions	NO_2	Soot (FDP)	Cadmium
moment, g/s	0,06	0,009	0,000015 mg/s
shift, g/10 h	2180	310	0,54 mg/10 h

Example (from Table 4.1.1.1.1.1-3):

- Emission factor for nitrogen dioxide per run of 1 km: 10,9 g/кm;
- Emission for two-way run of a machine - 21,8 g
- Emission for 10 machines – 218 g.(per hour of operation)
- Momentary emission - 0,06 g. NO2
- Emission per shift of nitrogen dioxide from 10 machines: 2180 g/shift (10 hours of operation)

The emissions of soot are calculated in a similar manner. They are at the base of the high ecological and health risk because of their strongly developed surface reaching 10 – 15 m^2 per gram. This surface has high absorption capacity for the other ingredients (for instance, the sulphur and nitrogen oxides), the concentration of which in it may reach very high values. If they get into the internal organs of man or fall on a plant they cause permanent or irreversible damage.

<u>Emissions from excavation and construction works</u>

Dust including PM_{10} will be emitted into the atmosphere during the following works:

- Bulldozing: this work involves terrain cleaning and leveling by "pushing" the soil and humus by means of construction machinery,

- Excavation: excavation of a trench where the pipes will be laid; trench backfilling

It is foreseen that approximately 5000m^3 of ground will be bulldozed and 2000m^3 excavated per shift. Emissions resulting from these works depend on a number factors such as type of soil, moisture content etc. Open-air mine surveys requested by the US Environmental Protection Agency (EPA) were used for selecting the emission factors during the present assessment. As a rule, the first step shall determine the emission factor for total suspended particles (TSP) and after that a coefficient for assessing the part with particle size less than 10 µg/m^3 - PM_{10} is used. The emission factors used herein are given in Table 4.1.1.1.1.1-4.

Table 4.1.1.1.1.1-4 Emission factors and PM_{10} emissions emitted during construction works.

Work	Emission factor (TSP)		PM_{10} / TSP	PM_{10} emissions per shift		PM_{10} per hour
	kg/t	kg/m^3	-	kg	g	g
Bulldozing	0.1[2]	0.13[1]	0.045[3]	227	227 000	22 700
Excavation	-	0.25[2]	0.2[3]	400	400 000	40 000
				627	627 000	62700

[1] Assumed ground density - 1300kg/ m^3 .
[2] Revisions of Emission Factors for AP-42 Section 11.9
Western Surface Coal Mining, Revised Final Report, EPA Contract 68-D2-0159, MRI Project No. 4604-02, September 1998,
http://www.epa.gov/ttnchie1/ap42/ch11/bgdocs/b11s09.pdf
[3] US EPA. Fugitive Particulate Matter Emissions. US EPA Contract 68-D2-0159, WA No.4-06, Midwest Research Institute, Kansas City, MO, April, 1997.
http://www.nmenv.state.nm.us/aqb/documents/FDHandbook_Rev_06.pdf

4.1.1.1.1.2 Water pollution and waste water generation

The main potential pollutions on surface waters may occur during construction, in result of the following works:

- **Waste water generated from the two temporary construction villages** – sources of pollution are the waste waters generated on site – industrial, sewage and storm waters.
- **Hydraulic test of the gas pipeline for strength and leaks –** discharge of the water used for the hydraulic testing into a surface receiving water - the water may be polluted with corrosion products from the internal pipe walls, scale, slag, electrodes etc.
- **Open-cut crossing of large rivers and small streams and gullies** – rivers alongside the pipeline route, except for Maritsa River, will be crossed in this method. It will be used mainly for drying rivers or these with a weak river flow during pipeline construction. Most of the rivers and feeders to be crossed have low water flow over the most part of the year. The following water pollution is likely to occur upon open-cut crossing:
    - Increased water turbidity in result of flow diversion or carrying out excavation works on the river bed;
    - Pollution from floating alluviums;
    - Machine oil leaks, uncontrolled discharge of solid waste and waste water;
    - Waste water generated from vehicle tires, mud-guards and chassis washing flowing back from site and going to public roads;
    - Increased water turbidity in result of suspending and dispersion of soft alluviums contained in the river bed and eventual pollution substances contained in them.

Crossings of main water flows along the pipeline route are given in item 3.2.1 and *Appendix 4.1* of the present assessment.

- **Water draining from the trench area where the pipeline will be laid** – drained water will contain certain amount of suspended substances, and eventually pollutants contained in the river alluviums;
- **Trench excavation and pipeline laying** – these operations will involve suspending and dispersion of bottom alluviums, and eventually other pollutants contained in them. These substances will be retained within the trench area. Materials excavated from the trench will be used for backfilling which will cause local and temporary increase of river turbidity. Excess ground will be used for filling free spaces behind the riverbank protection facilities.

4.1.1.1.1.3 Hazardous energy pollutants – noise, vibrations, harmful radiations – light, thermal, radiation

The construction of “Gas interconnector Greece-Bulgaria” is not a source of harmful physical factors like light, thermal and electromagnetic radiations. The construction machinery is a source of noise and vibrations within the construction site boundaries as the average noise level in such sites exceeds 85 dBA. The construction site workers shall use personal protection equipment (hearing protection).

Noise impact during construction may occur from the following works:

- Heavy machinery traffic (transportation of pipes, equipment etc.) within the construction zone and adjacent roads;
- Use of heavy machinery for ground excavations and pipeline laying (on the pipeline route).

Construction of such facilities in other countries shows that the noise impact is limited and occurs only during the time of site construction. Duration of construction works during the day will be from 07.00 h to 19.00 h.

The construction machinery is a source of noise and vibrations within the construction site boundaries as the average noise level in such sites exceeds 85 dBA. The construction site workers shall use personal protection equipment (hearing protection).

In Bulgaria, there are no specific norms and requirements related to limit values for the time of construction, operation or other work, for such type of sites. Therefore, there shall be used the limit values (hygiene norms) for work conditions (working environment) and these for settlements for impact on workers or population stated above in the section specifying and describing the relevant components of physical factors.

Working environment

The maximum permissible value of ***noise at work*** is 87 dB (A), with upper and lower noise levels for taking actions on behalf of the employers 85 dB (A) and 80 dB (A) accordingly.

As described in the process part of this investment proposal it is foreseen that there will be about 40 off-road vehicles for the personnel and about 20 heavy vehicles. This number of vehicles will be reached during the active periods of work, mainly in April and May and during the day. The highest noise loading is expected in the period of construction with approximately 500 vehicles passing in the hours between 7.00 h and 19.00 h.

Some measurement data for heavy machinery and construction equipment show the following:

- road construction machinery: 65-105 dBA
- heavy machinery: 73-93 dBA
- electric locomotives: 90-98 dBA

- bulldozers: 97-105 dBA
- excavators: 80-91 dBA.

Therefore, the noise levels on the construction site as stated in Ordinance No 6/2005 will be exceeded.

The main works during which high noise levels are expected are as follows: open-air construction works, drilling and pipeline laying and horizontal drill – a linear method for pipeline laying. These include also: fences and removal of vegetation, construction of barriers, drain works, excavation of soil/archeological monitoring, pipelines supply, excavation works, equipment installation, construction of crossings, pipe welding and testing, connection of pipe sections, trench backfilling, cultivation and planting.

The noise levels measured at work in other similar sites show that at a distance of 100 m from the construction site, regardless of the type of work on the gas pipeline being carried out are between 37 dB (A) and 63 dB (A). Therefore, within settlements situated more than 100 m from site, regardless of their location along the gas pipeline, and even at short pipeline construction works, the requirements of Ordinance № 6/2006 shall be observed.

Vibrations (on the whole body and the hand-shoulder system) refer only to workers within the construction site. For vibrations, the requirements for protection of people working in the conditions of vibration impact as specified in Ordinance №3/05.05.2005 shall be observed.

Measurements of vibro-acceleration at local impact on workers during some construction works show the following:

- in the frequency range from 31.5 to 63 Hz the exceedance of the limit values is from 3.9 to 4.6 times;
- in the range of 425 – 250 Hz it is 3.3 times;
- in the range of 500 – 1000 Hz the exceedance is 2.9 to 3 times

Vibration impact on the population during pipeline construction is not expected because of the remoteness of almost entire part of the gas pipeline and the rapid reduction of the vibrations with distance.

With regard to ***ionizing radiation***, the limit of effective dose in the conditions of ionizing radiation is 100 mSv for 5 years in a row as the maximum effective dose for every year should not exceed 50 mSv. The limit value of annual effective dose per person of the population is 1 mSv.

Non-ionizing radiation – welding works are source of ultraviolet (UV) radiation which has adverse effects on the welders. Welded joints testing will be carried out by using ultrasound as the testing methods do not pose a risk of ultrasound impact on human. The electricity needed for welding works will be provided by diesel generators and for the main warehouse bases – from the national grid. No additional powerful energy systems will be used during the construction stages and no systems which create conditions of radiation to workers and population within the construction area will be used.

Electricity will be used during operation for cranes and crane units control, instrumentation and cathodic protection.

<u>Settlements</u>

The construction method used – with a speed of about 1000 m per day at a strip of 15 km crates the negative impact of the physical factors (mainly ***noise factor***) on the population in the category of an insignificant, short-term impact.

For settlements (residential areas and territories), the above mentioned Ordinance №6 specifies 55 dB (A) for ***equivalent noise level*** during the day, 50 dB (A) in the evening and

45 dB (A) at night (23.00 – 7.00 h), and for rooms and bedrooms in kindergartens and hostels, holiday houses, hotel rooms - 35 dB (A), 35 dB (A) and 30 dB (A) accordingly. These values comply also with the recommendations of the World Health Organization (Guidelines for Community Noise, 1999, Ref. 6-17).

The table below shows hygiene norms stated in Ordinance No 6 with “sensitive” zones such as hospitals and schools, recreation centers etc.

Table of limit values for noise levels in different territories and developments zones in urbanized territories and outside them

Territories and development zones in urbanized territories and outside them		**Equivalent noise level in dB(A)**		
		day	**evening**	**nigh**
1.	Residential zones and territories	55	50	45
2.	Downtown	60	55	50
3.	Territories with intensive road traffic	60	55	50
4.	Territories exposed to the impact of railway and tram transport	65	60	55
5.	Territories exposed to the impact of air noise	65	65	55
6.	Industrial territories and zones	70	70	70
7.	Public and individual recreation zones	45	40	35
8.	Hospital and sanatorium zones	45	35	35

Highest noise loading is expected during the construction period when the estimated road traffic is expected to be 500 vehicles in the hours from 7.00 to 19.00 h. Measurements taken on similar sites by the Investor in Great Britain show the following: at a distance from the construction site of up to 10 m the noise levels vary from 54.4 dBA to 71 dBA during the day; at 50 m – 58.6 dBA; at a distance of about 70 m – 45.4 – 48.9 dBA, which falls within the limits of the hygiene norms according to Ordinance № 6/2006. The limit values are exceeded only for the “sensitive” areas. Therefore, for all settlements situated at distances from site more than 70 m exceedance above the specified limit values is not expected, except for the “sensitive” areas.

As mentioned above, the main noise impact is expected during the day, i.e. in the time when construction works will be carried out. Upon incidental cases, when construction works are to be carried beyond 7.00 – 19.00 h the noise levels will be above the permissible values for evening and night for all settlements situated at a distance less than 100 m, according to the requirements of Ordinance № 6 for noise levels in settlements.

Calculations based on the road traffic noise levels measurement method, Ordinance No 6, State Gazette 58/2006, show that the noise level at a distance more than 100 m from a road (even with worst covering – temporary construction road) is below the limits of the hygiene norms for settlements during the day.

The noise levels measured at work in other similar sites show that at a distance of 100 m from a construction site, regardless of the type of work being carried out, are between 37 dB (A) and 63 dB (A). In rare cases the noise levels may reach 70 dBA. This means that for settlements, even during short-term construction works on the gas pipeline, situated more than 100 m from site, regardless of their location along the pipeline route, the requirements of Ordinance No 6/2006 will be observed.

The table below lists settlements situated at a distance less than 100 m from the route of the West and East alternatives, in the direction from south to north.

Table of settlements situated at a distance less than 100 from the West route

№	**Settlement**	**Population**	**Area of**	**Location and distance of**

		number of inhabitants (NSI, 2011)	**settlement (km^2)**	**the settlement from the gas pipeline route (m)**
28.	Vishegrad	292	1.971	100 m - north
32.	Panchevo	217	4.324	60 m – west
52.	Chernogorovo	945	23.308	At the end of the village

Table of settlement situated at a distance less than 100 m from the East route

№	**Settlement**	**Population** number of inhabitants (NSI, 2011)	**Area of town or village (km^2)**	**Location and distance of the settlement from the gas pipeline route (m)**
11.	Konche	264	6.871	100 m - southeast
25.	Kladenets	59	8.037	At the end of the village
37.	Chernogorovo	945	23.308	At the end of the village

Particular attention shall be paid to the so called “sensitive” areas in the settlements such as hospitals, kindergartens, schools, recreation centers, nursing homes since for such organizations Ordinance No 6 specifies much lesser hygiene norms for noise, namely 45 dBA during the day and 35 dBA for evening and night.

In case of accidental necessity of working outside the working hours specified by the Investor, the expected noise levels for the periods of “evening” and “night” will exceed the hygiene norms during the accidental work.

Vibration impact on the health of the population may not be expected as well as on the buildings in the settlements during construction works due to their remoteness from almost entire part of the gas pipeline and the rapid reduction of the vibrations with distance.

One of the factors which may have adverse effect on the sleep of the people living by the construction sites and their welfare is the ***light radiation*** from searchlight lamps and other optical source lighting the site during work for safety purposes. This factor does not have direct adverse impact on the health of the population as the time of lighting will be during the pipeline construction only.

Ionizing and other non-ionizing radiations are not subject to discussion in any of the planning, construction and operation stages as there are no sources which may create conditions of impact on the population.

The noise impact relates to local impacts only, where the pipeline route passes across a settlement or in close vicinity to it (not less than 100 m from the route).

Exceeding values of physical factors such as: noise, vibrations, ionizing and non-ionizing radiations to the population during site construction are not expected provided that the planned working time and works are observed.

No additional powerful energy systems will be used during the construction stages as well as such exposing the workers and population to radiation at local level in the areas of construction works.

During construction, the gas pipeline route will be lit for protection and safety reasons but the sources of light can be situated so that not to create negative feelings on behalf of the population living nearby.

4.1.1.1.2 During operation

4.1.1.1.2.1 Ambient air pollution and waste gases generated

During pipeline operation, there will be no sources of pollution of the ambient air, provided that the gas pipeline has been constructed correctly. Emissions of substances into the atmosphere may occur only in the following cases:

- During system maintenance a natural gas (methane CH_4 content – up to 95 %) may be released into the atmosphere, which is lighter than the air (volume density of 0,765 kg/m^3), goes up high and is not considered as air pollutant according to the Bulgarian and European legislation.
- In the event of failure, which could be 2 types:
  - Uncontrolled increase of the pressure over 10 % above the maximum without fire – in this case only a natural gas will be discharged and air pollution is not expected due to the characteristics of natural gas;
  - Upon emergency discharge of gas involving fire – in this case the air pollution will depend on the scale of fire and the type of burning materials.

Upon normal gas pipeline operation the natural gas emissions from all operating facilities will be approximately 300 m^3/y from the whole system. The sources of emissions will be:

- Upon filters purging as a regular pipeline maintenance procedure (there will be discharging of a small amount of gas)
- Emissions from condensing boilers – in addition to the emissions discharged from the whole system there will be emissions from the condensing boilers.

An industrial type of a natural gas fired high-performance gas pre-heating system will be used for proper pipeline operation. The system will consist of 2 operating boilers and one standby boiler. The size and number of boilers depend on the gas flow to the consumers. Boiler parameters versus design capacities are shown in Table 4.1.1.1.2.1-1 below.

Table 4.1.1.1.2.1-1 Boiler design parameters

For 75 contracted consumers 6°C upstream & heavy gas			
Station	**Power**	**Emissions**	
		CO_2	**NO_2**
Kardzhali	223 kW	274Kg/y	67Kg/y
Dimitrovgrad	980 kW	1,204 Kg/y	218 Kg/y
Stara Zagora	4 456 kW	5,477 Kg/y	995 Kg/y
At normal conditions , 6°C upstream & Greek Gas (winter operation 5 bNcm/y):			
Kardzhali	89 kW	109 Kg/y	20 Kg/y
Dimitrovgrad	248 kW	304 Kg/y	55 Kg/y
Stara Zagora	668 kW	820 Kg/y	150 Kg/y
At normal conditions 22 °C upstream & Greek Gas (summer operation)			
Kardzhali	3 kW	Emissions are insignificant	
Dimitrovgrad	0	0	0
Stara Zagora	0	0	0

4.1.1.1.2.2 Water pollution and waste waters generated

The main and auxiliary processes at the operation of "Gas interconnector Greece-Bulgaria" are not sources of industrial waste waters. Negligible quantity of household waste waters will be discharged by the personnel of the Control and Maintenance Centre (it is foreseen that the number of operations and maintenance staff be about 32 persons).

Depending on the method of processing, waste waters can be discharged underground or into a water reservoir after purification in local treatment plants. Another option of treating waste waters is to collect them in water-proof pits from where they will be transported from site by road tankers to a public water treatment plant. The method of waste water treatment will be determined at a later stage during designing. No mater which of both options will be chosen, the water reservoir which waste waters will be discharged into will be agreed with the authorities and will comply with their requirements. The authority issuing a waste water discharge permit is the Basin Directorate – East Aegean Region.

No generation of waste waters is expected from the main process during operation.

4.1.1.1.2.3 Hazardous energy pollutants – expected noise, vibrations, harmful radiations – light and thermal, radiation

The operation of the investment proposal is not a source of harmful physical factors such as light and heat radiation or electromagnetic radiation.

The gas transferring technology does not include sources of physical factors. Communication is ensured by fiber connections, pipelines are laid underground, and therefore induction of currents and voltages from surrounding high voltage transmission lines of the national electricity grid is not possible. There are no sources of energy related to any emission of super-low frequency electrical or magnetic fields, including the industrial frequency of 50 Hz as well as related to the power supply of site.

Emissions of noise, vibrations, harmful ionizing or non-ionizing radiations are not expected, according to the description of the investment proposal. Vehicle traffic in the area of the gas pipeline will be very rare, mainly during inspections and repair&maintenance works.

This is clearly demonstrated in the description of the process-related works, as follows:

- General pipeline monitoring – at any time of the day, additional light vehicles using available road network;
- Inspections – at any time of the day, additional light vehicles;
- Pipeline testing – at any time of the day, additional light vehicles using available road network;
- All facilities in operation – increase of noise levels – noise levels will be increased by 86 dB for a few minutes every day, measured at a distance of 1 m from the stations, with release of emissions.

No harmful impacts from physical factors such as noise, vibrations, ionizing and non-ionizing radiations are expected during operation.

4.1.1.2 Sources of waste

4.1.1.2.1 During construction

Household, production, construction and hazardous wastes will be generated during construction. According to Ordinance No 3 dated 01.04.2004 about classification of wastes (Amended, SG, issue 44 dated 25 May 2004) the following types and quantities of wastes, listed in Table 4.1.1.2.1-1 are expected:

Table 4.1.1.2.1-1 Expected types and quantities of waste during construction

Waste code	Description of waste	Quantity, t
	Household waste	

Waste code	Description of waste	Quantity, t
20 01 Separately collected fractions (except 15 01)		
20 01 01	Paper and cardboard	**1**
20 01 02	Glass	**1,5**
20 01 08	Biodegradable kitchen and canteen waste	**30**
20 01 25	Edible oil and fat	**20**
20 03 Other household wastes		
20 03 01	Mixed municipal wastes	**90**
20 03 04	Septic tank sludge	
Production waste		
18 01 wastes from natal care, diagnosis, treatment or prevention of disease in humans		
18 01 04	wastes whose collection and disposal is not subject to special requirements in order to prevent infection (for example dressings, plaster casts, linen, disposable clothing, diapers)	**0,05**
15 01 packaging (including separately collected municipal packaging waste)		
15 01 01	paper and cardboard packaging	**10**
15 01 02	plasticpac kaging	**30**
15 01 03	wooden packaging	**30**
15 01 04	metallicpac kaging	**1**
15 01 06	mixed packaging	**5**
12 01 wastes from shaping and physical and mechanical surface treatment of metals and plastics		
12 01 13	welding wastes	**8**
Construction waste		
17 01 17 01 00 concrete, bricks, tiles and ceramics		
17 01 01	concrete	**26**
17 01 07	mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	**24**
17 02 wood, glass and plastic		
17 02 01	wood	**40**
17 02 03	plastic	**29**
17 04 metals (includingtheir alloys)		
17 04 05	iron and steel	**3**
17 04 07	mixed metals	**2,5**
17 04 11	cables other than those mentioned in 17 04 10	**0,5**
17 05 soil (including excavated soil from contaminated sites), stones and dredging spoil		
17 05 04	soil and stones other than those mentioned in 17 05 03	In detailed design stage, to be clarified
Hazardous waste		
20 01 Separately collected fractions (except 15 01)		
20 01 13*	solvents	**23**
20 01 21*	fluorescent tubes and other mercury-containing waste	**1**
16 01 end-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)		
16 01 07*	oil filters	**4**
16 02 wastes from electrical and electronic equipment		
16 02 10*	discarded equipment containing or contaminated by PCBs other than those mentioned in 16 02 09	**10**
16 02 15*	hazardous components removed from discarded equipment	**3**
16 06 batteries and accumulators		
16 06 01*	lead batteries	**1**
16 06 02*	Ni-Cd batteries	**1**
15 01 packaging (including separately collected municipal packaging waste)		
15 01 10*	packaging containing residues of or contaminated by dangerous substances	**2**
15 02 absorbents, filter materials, wiping cloths and protective clothing		
15 02 02*	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances	**10**
13 01 waste hydraulic oils		

Waste code	Description of waste	Quantity, t
13 01 11*	synthetichydraulic oils	5
13 02 waste engine, gear and lubricating oils		
13 02 06*	syntheticengine, gear and lubricating oils	2
13 05 oil/water separator contents		
13 05 01*	solids from grit chambers and oil/water separators	2
13 05 02*	sludges from oil/water separators	2,5
13 05 07*	oily water from oil/water separators	6
13 05 08*	mixtures of wastes from grit chambers and oil/water separators	4
13 07 wastes of liquid fuels		
13 07 01*	fuel oil and diesel fuel oil and diesel	1

Household waste

Household wastes will be generated from workers involved in construction works. It is foreseen that the employed staff be located in two construction villages. These villages will generate and collect mainly household waste - 20 01 01paper and cardboard, 20 01 02 glass, 20 01 08 biodegradable kitchen and canteen waste, 20 01 25 edible oil and fat and 20 03 01 mixed household waste.

It is foreseen that the household wastes will be collected separately in designated vessels, and handed over and transported by licensed companies for further treatment. Mixed household wastes will be collected in containers and will be handed over to an outside company for disposal.

Water-proof septic tanks will be used during construction. These will be cleaned periodically as the sewage waters will be transported by road tankers to the nearest sewage treatment plants, from which septic tank sludge will be generated (20 03 04).

Production waste

Production wastes will be generated during construction of the pipeline construction and crane stations along the pipeline route.

Wastes whose collection and disposal is not subject of special requirements in order to prevent infection (for example dressings, plaster casts, linen, disposable clothing, diapers) - 18 01 04 will be generated mainly from the medical care centers located along the pipeline route. These will be in small quantities and will be collected and stored in designated vessels, and will be handed over to a licensed outside company for further treatment. Packaging (including separately collected municipal packaging waste) - paper and cardboard packaging (15 01 01), plasticpac caging (15 01 02), wooden packaging (15 01 03), metallicpac caging (15 01 04), mixed packaging (15 01 06), and welding waste (12 01 13) generated during construction will be collected and stored temporarily on site, after which these will be handed over to a licensed outside company for further treatment.

Construction waste

Construction wastes generated during construction – concrete (17 01 01), mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06 (17 01 07), wood (17 02 01), plastic (17 02 03), iron and steel (17 04 05), mixed metals (17 04 07), cables other than those mentioned in 17 04 10 (17 04 11) and soil and stones other than those mentioned in 17 05 03 (17 05 04) will be collected and stored temporarily on designated places and will be handed over to a licensed outside company for further utilization.

Hazardous waste

Hazardous wastes will be generated during machinery operation, upon use of different raw materials and materials and during construction works. It is foreseen that these will be stored in labeled metal containers located on designated concrete and water-proof areas, in covered premises.

Separately collected fractions (except 15 01)

- solvents (20 01 13*) will be collected and temporarily stored on designated areas, in closed metal containers, properly labeled. These will be handed over to a licensed outside company for further treatment.
- fluorescent tubes and other mercury-containing waste (20 01 21*) – spent fluorescent and mercury-containing lamps will be collected in the packaging of the newly installed lamps and will be temporarily stored in labeled metal container. These will be handed over to a licensed company for further treatment.

Oil filters (16 01 07*) will be collected in labeled metal containers and will be temporarily stored on designated areas until handed over to licensed outside companies for further treatment.

Discarded equipment containing or contaminated by PCBs other than those mentioned in 16 02 09 (16 02 10*) and hazardous components removed from discarded equipment (16 02 15*) will be collected in labeled metal containers and upon collection of certain quantities will be handed over to licensed specialized companies for further treatment.

Lead batteries (16 06 01*) and Ni-Cd batteries (16 06 02*) will be generated during construction. These wastes will be collected in designated containers on temporary storage areas and will be handed over to licensed outside companies for further treatment.

Packaging containing residues of or contaminated by dangerous substances (15 01 10*) will be collected in labeled metal containers and will be handed over to outside companies for further treatment.

Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances (15 02 02*) generated during construction will be collected and temporarily stored in labeled metal containers until their handover to licensed outside companies for further treatment.

synthetic hydraulic oils (13 01 11*), synthetic engine, gear and lubricating oils (13 02 06*), solids from grit chambers and oil/water separators (13 05 01*), sludge from oil/water separators (13 05 02*), oily water from oil/water separators (13 05 07*), mixtures of wastes from grit chambers and oil/water separators (13 05 08*), fuel oil and diesel fuel oil and diesel (13 07 01*) will be collected and temporarily stored in separate labeled metal containers until their transportation by licensed company for further treatment.

During construction, impacts from the wastes generated on the site of the investment proposal can be expected. These impacts can be caused by improper waste management – incorrect collection and storage of generated wastes. Impact on the environmental components can be expected also upon discharge of household waste to non-designated places. During construction, impacts would be negative, direct and indirect, temporary, with short-term duration. Cumulative impact from the wastes generated during construction of the Gas interconnector Greece-Bulgaria is not expected.

4.1.1.2.2 During operation

Household and production wastes will be generated during operation. According to Ordinance No 3 dated 01.04.2004 about classification of wastes (Amended, SG, issue 44 dated 25 May 2004) the following types and quantities of wastes, listed in Table 4.1.1.2.2-1 are expected:

Table 4.1.1.2.2-1 Types and quantities of wastes during operation

Waste code	Description of waste	Quantity, t/y

Household waste		
20 01 Separately collected fractions (except 15 01)		
20 01 01	paper and cardboard	**0,1**
20 01 02	glass	**0,05**
20 03 Other household waste		
20 03 01	mixed household waste	**0,4**
Production waste		
05 07 Wastes from natural gas purification and transportation		
05 07 99	wastes not otherwise specified	**0.1**

Household waste

Household wastes will be generated from the personnel involved in the gas pipeline operation. Битови отпадъци ще се генерират от персонала, ангажиран по време на експлоатацията на газопровода. Basically, the following household wastes will be generated and collected- 20 01 01 paper and cardboard, 20 01 02 glass and 20 03 01 mixed household waste.

Household wastes will be separately collected, in designated vessels, and will be handed over and transported by licensed companies for further treatment. Mixed household wastes will be collected in containers and will be handed over to outside company for disposal.

Production waste

Filters that will be replaced at every 7 months will be used during pipeline operation for natural gas gleaning. Filters will be located at both ends of the pipeline – Komotini and Zagore. Each of them weights 0,0005 t and 20 nos. (0,01 t) of that waste (05 07 99 wastes not otherwise specified) will be generated annually for the Bulgarian section of the gas pipeline. This waste will be handed over to licensed company for recycling.

Negligible low quantities of waste is expected to be generated during the operation of Interconnector Greece-Bulgaria, therefore no impact is expected.

4.2 Analysis and assessment of the hypothetical environmental impact, material and cultural heritage (assessed by separate components and environmental factors)

The EIA report makes assessment of the following pipeline construction works which may have an impact on the environmental components and population:

1. Temporary use of area (terrain)
2. Demobilization
3. Drainage system
4. Area preparation and removal of surface soil layer (humus). Trench excavation and pipe laying
5. Area restoration
6. Crossing obstacles – river bed, river, stream, road railway etc.
7. Pipelines supply, arrangement and storage
8. Transportation
9. Supply of fuel and other hazardous substances
10. Fuels and oils storage
11. Re-fuelling
12. Operation of machinery and systems, equipment, devices, aggregate, vehicles
13. Systems maintenance (repair)
14. Waste generation and accumulation

15. Waste storage and removal
16. Waste water treatment
17. Washing machine, car wash, kitchen water – water treatment
18. Chemicals storage
19. Water discharging, sewage
20. Energy production
21. Horizontal directional drill (HDD) for river crossing
22. Concrete covering/slab pouring
23. Putty, cladding and painting
24. Welding and welded joints covering
25. Radiographic testing
26. Hydrostatic testing – pipeline flushing, measuring and testing
27. PIG - Pipeline pigging
28. Emergency response
29. Pipe rupture
30. Smoking
31. Earthquake
32. Temporary roads
33. Construction of above ground facilities on the sites – above ground facilities construction works will include selection of a site, selection of area for construction of buildings and necessary facilities, laying of cables, installation of lighting system, fiber cable laying, construction of temporary roads, site fencing.

4.2.1 Ambient air and atmosphere

4.2.1.1 Weather and climate conditions

4.2.1.1.1 During construction

The construction technology foreseen in the project will result in a sudden increase of dust loading within the area of construction works which will cause some microclimate changes in the construction zone, and upon adverse weather conditions it may spread to about 500 m and more from the route. Therefore, the recommended impact mitigation measures will have to be observed. Machinery operations will result in increased exhaust gas levels but in case the best industrial practices are kept this would not lead to exceedance of the sanitary-hygiene requirements for air quality in adjacent settlements with regard to these pollutants.

As a whole, considering the short duration of impact, the quantities of dust from construction works and exhaust gases from operation of machinery and other equipment will not affect the local climate conditions. Changes in the character of the surface are not of dimensions that may result in climate change within the region.

4.2.1.1.2 During operation

There will be no changes in the character of the surface and air quality during operation, so no changes of the local climate conditions are expected.

4.2.1.1.3 During emergency situations

During emergency situations, in case of explosion, the weather conditions are critical for the spread of fire and pollutants in the atmosphere. The magnitude of impact is dependent on the duration of the emergency situation. Upon short-term emergencies changes in the weather conditions are not expected. Upon long-term accidents the released pollutants would have an impact on the values of weather parameters in the region. The scale of this impact is dependant on the duration of the momentary situation and the quantity of discharged pollutants.

Considering the additional pipeline deviation to Kardzhali and crossing higher percentage of mountain and woodland terrains the construction of the East alternative will cause a higher impact on the surface which will result in a higher level of impact on the local weather conditions, therefore, the East alternative is less favorable as compared to the West alternative. Based on these facts, the West alternative is more favorable for construction.

4.2.1.2 Ambient air quality

4.2.1.2.1 During construction

With regard to the ambient air quality during construction there will be an impact caused by the following works:

I. Exhaust gases from operation of machinery and vehicles, and power generators using liquid fuel during the following works: transportation of equipment and inert and other building materials; staff transportation to and from construction sites.

II. Dusting in result of: construction process – excavation and stacking of ground, disposal and use on inert materials and ground, re-emission of dust on the roads during transportation.

The significance of these impacts will be direct, short, temporary and negative. The scope of impact is dependent on the area where construction works will be carried out and it will be local – along the pipeline route, in the control station area or the sanitary protected area.

This can be seen in detail in the table describing the pipeline works which have a potential of impacting the environment and municipalities.

During area preparation and surface layer removal (humus) – the impact on the air quality and pollution with exhaust gases from machinery operations will be direct, non-cumulative, short, and temporary – for the period of works, and of a local scope.

During area restoration the impact will be analogous to the area preparation and will be direct, non-cumulative, short, and temporary – for the period of works, and of a local scope.

During supply and storage of pipelines– as a result of heavy vehicles operation there will be a cumulative impact on the highways where the trucks will pass through. Provided that the machinery in use comply with the regulatory requirements the impact will be direct, short, negative, temporary and will cover the roads being used. However, to control this impact a recommendation for conducting control measurements of main pollutants and during intensive transportation is made in section “Monitoring” of this EIA. No impact is expected during storage of the pipelines..

During transportation and supply of fuel and other hazardous substances the impact will analogous to that of the supply and storage of pipelines. If the fuel and hazardous substances are stored according to the requirement than their storage will not have an impact on the ambient air quality.

With regard to the vehicles operation the impact will be analogous to that of the supply and storage of pipelines. With regard to the generators using liquid fuel the impact will be direct, cumulative as much as they will operate at certain time intervals together with the other machinery, temporary – for the period of work, and of a local scope.

Upon pipeline/vessel rupture – there will be two scenarios depending on the type and scale of accident: a) upon a leak, depending on the scale of accident and whether it is from a vessel or pipeline there will be a release of different volumes of natural gas which is light and will rise up high, and depending on the duration of accident can spread and cause regional natural gas pollution. However, the natural gas is not classified as a poisonous substance and there will be a risk of fire only if collected in large quantities in closed forms of the landscape. This is unlikely but possible scenario.; b) if the leak involves fire than the magnitude of impact could not be determined. Depending on the size of fire the impact could be of a local or regional nature.

Upon smoking – if there is no fire the impact will be analogous to that of pipeline rupture.

Upon earthquake – the impact will be analogous to that of pipeline rupture.

The expected magnitude of impact during construction is **moderate.** It is expected to be **negative, direct, temporary and short**, within the construction sites along the route of the investment proposal. Cumulativeness may occur on the transportation roads only, however, provided that the vehicles comply with the standards than traffic would not increase to levels that result in exceedance of the sanitary hygiene norms for ambient air quality.

The East alternative of the route is more unfavourable due to the following reasons:

- The pipeline deviation to Kardzhali makes the route longer, which automatically results in longer and heavier spatial impact on the ambient air quality caused by gases exhausted from machinery and vehicles;
- Construction of additional roads results in additional increase of the emissions from the construction process since there are long sections on the East alternative construction of access roads to which is quite difficult;
- Movement of heavy vehicles and machinery on mountainous terrains (these terrains are considerably more for the East alternative) will result in increased exhaust gas emissions.

The West alternative is more favorable in comparison to the East alternative, and therefore it is recommended for construction.

Analysis of the Computational modeling of the ambient air pollution with unorganized emissions discharged during construction (as per MEW letter No EIA - 249/10.09.2012) attached in ***Appendix 3.3*** found the following:

With regard to the expected impact on the ambient air quality during gas pipeline construction

The maximum concentration of PM_{10}, which the gas pipeline construction may cause (daily average limit 50μg/m^3):

- Dimitrovgrad region (Fig4) – the maximum concentration within the construction lane and adjacent to it does not exceed 10μg/m^3, as it may happen at certain times in less than 5 days. This concentration decreases with distance and at a distance of 1 km from site it does not exceed 3μg/m^3 – Fig.4a,
- Haskovo region (Fig.6) – the maximum concentration within the construction site and adjacent to it does not exceed 10μg/m^3, as it may happen at certain times in less than 1 day. At a distance longer than 1.5 km from the pipeline route the concentration does not exceed 3μg/m^3 – Fig.4a,
- Kardzhali region (Fig.8) – the maximum concentration within the construction site and adjacent to it does not exceed 15μg/m^3, as it may happen at certain times in less than 3 days. At a distance longer than 1.5 km from the pipeline route the concentration does not exceed 3μg/m^3 – Fig.8a.

The contribution of the gas pipeline construction to the annual average concentration of PM_{10} (annual average limit 40μg/m^3) is :

- Dimitrovgrad region (Fig.4) – the maximum concentration within the construction site and adjacent to it does not exceed 2.5µg/m^3. At a distance longer than 1 km from the pipeline route the concentration does not exceed 0.25 µg/m^3 – Fig.4б.
- Haskovo region (Fig.6) – the maximum concentration within the construction site and adjacent to it does not exceed 1 µg/m^3. At a distance longer than 1 km from the pipeline route the concentration does not exceed 0.2 µg/m^3 – Fig.6б.
- Kardzhali (Fig.8) – the maximum concentration within the construction site and adjacent to it does not exceed 1.5µg/m^3. At a distance longer than 1 km from the pipeline route the concentration does not exceed 0.25 µg/m^3 – Fig.8б.

The maximum concentration of NO_2 which the gas pipeline construction may cause (limit value per 1 hour - 200µg/m^3):

- Dimitrovgrad region (Fig.5) – the maximum concentration within the construction lane and adjacent to it does not exceed 0.1 µg/m^3, as it may happen at certain times in less than 5 days. At a distance longer than 1 km from the pipeline route the concentration does not exceed 0.025 µg/m^3 – Fig.5a,
- Haskovo region (Fig.7) – the maximum concentration within the construction site and adjacent to it does not exceed 0.18 µg/m^3, as it may happen at certain times in less than 1 day. At a distance longer than 1.5 km from the pipeline route the concentration does not exceed 0.04 µg/m^3 – Fig.7a
- Kardzhali region(Fig.9) — the maximum concentration within the construction site and adjacent to it does not exceed 0.12 µg/m^3, as it may happen at certain times in less than 3 days. At a distance longer than 1.5 km from the pipeline route the concentration does not exceed 0.04 µg/m^3 – Fig.9a

The contribution of the gas pipeline construction to the annual average concentration of NO_2 (annual average limit 40µg/m^3):

- Dimitrovgrad region (Fig.5) – the maximum concentration within the construction site and adjacent to it does not exceed 0.12 µg/m^3. At a distance longer than 1 km from the pipeline route the concentration does not exceed 0.002 µg/m^3 – Fig.5б,
- Haskovo region (Fig.9) – the maximum concentration within the construction site and adjacent to it does not exceed 0.012 µg/m^3. At a distance longer than 1 km from the pipeline route the concentration does not exceed 0.002 µg/m^3 – Fig.7б,
- Kardzhali region (Fig.9) – the maximum concentration within the construction site and adjacent to it does not exceed 0.01 µg/m^3. At a distance longer than 1 km from the pipeline route the concentration does not exceed 0.002 µg/m^3 – Fig.9б,.

Regarding the impact of the pipeline construction on the ambient air quality in adjacent settlements.

The maximum daily average concentration of PM_{10}, which the gas pipeline construction may cause (daily average limit 50µg/m^3) is:

- On the territory of the town of Dimitrovgrad it is lower than 0.5µg/m^3 and it may approach 3µg/m^3 in the most eastern quarters of the town – fig. 4a, as this may happen in less than 5 days

- On the territory of the town of Haskovo it is lower than 0.5µg/m^3 and it may approach 1 µg/m^3 in the most eastern quarters of the town – fig. 6a, as this may happen in less than 1 day
- On the territory of the town of Kardzhali it is lower than 1 µg/m^3 and it may approach 2 µg/m^3 in the most eastern quarters of the town – fig. 6a, as this may happen in less than 3 days

The contribution of the gas pipeline construction to the annual average concentration of PM_{10} (annual average limit 40µg/m^3 is:

- On the territory of the town of Dimitrovgrad it is lower than 0.25µg/m^3 – Fig.4б
- On the territory of the town of Haskovo it is lower than 0.2µg/m^3 – Fig.6б
- On the terittory of the town of Kardzhali it is lower than 0.25µg/m3 – Fig.8б.

Upon comparison of the **annual average concentration of PM_{10}** in these towns measured over the last years with the concentration which the gas pipeline construction is likely to cause it was found that the contribution of the gas pipeline construction is approximately 0.50% (0.47% for Dimitrovgrad, 0.44% for Haskovo and 0.58% for Kardzhali) and only in the easternmost quarters of the towns only.

With regard to the number of exceedances of the **daily average limits for PM_{10}**, worsening of the situation due to the gas pipeline construction is not expected.

Based on the above, it can be concluded that the gas pipeline construction will not result in worsening of the ambient air quality in adjacent settlements, including the towns of Dimitrovgrad, Haskovo and Kardzhali.

4.2.1.2.2 During operation

During operation, impact on the ambient air quality is not expected since upon normal operation mode there will be no sources of pollutants to the atmosphere and the natural gas emissions from all operating facilities (upon filter purging and from condensation boilers) will be minimal.

Furthermore, implementation of the project will result in reduction of the emissions of harmful and greenhouse gases as this will reduce the use of heavy conventional fuels.

During operation there will be no significant difference between the two routes – i.e. both routes do not have a negative impact on the air.

4.2.1.2.3 During emergency situations

The emergency situations can be divided in two types:

- Pipeline leak – leaks are unlikely to occur upon installation of the pipelines according to the specifications, and if such leaks occur than the natural gas is not classified as pollutant; it is light and goes up high. In this case there will be no impact on the ambient air quality.
- Explosions and fires upon failures – in such situations both nitric dioxides and steam and other combustion-related pollutants will be released into the atmosphere which will depend on the scale and type of materials affected by fire. In this case the magnitude of impact will be high, it will be direct, significant, negative, and cumulative, with duration and scale dependant on the duration of the emergency situation.

Upon emergency situations the West alternative is preferable as the East alternative passes through more complicated mountainous and woodland terrains which an unfavourable condition is regarding the spread of pollutants in the atmosphere and in case of fire large woodland areas may be affected. Therefore, the West alternative is recommended for construction.

4.2.2 Waters

4.2.2.1 Surface waters, hydrology

During construction, the impacts on the surface waters will be of the same kind for both alternatives. The impacts, considering the number of crossings of large rivers, small streams and gullies during pipeline construction, are almost the same for both alternatives and will cause almost the same negative impact on the "Waters" component. Upon comparison of the ecological condition of the water bodies for both alternatives it may be concluded that the water bodies affected by the East alternative have a worse ecological potential.

- *Impacts assessment – upon treatment of waste waters from temporary construction villages.*

Waste waters from temporary construction villages – household and sewage, storm and industrial waste waters generated from works carried out on the construction village. During construction water will be necessary for drinking and household needs of the workers and service water will be necessary for vehicles and machinery washing. Before discharging into the earth's subsurface or to a surface water the waste waters will be treated in local water treatment plants. The purified waste waters will comply with the Bulgarian legislations and the regulatory requirements. Another option of waste waters treatment is their collection in water-proof pits and transportation from site to a municipal water treatment plant by road tankers.

Appropriate location for the temporary construction village of the North section of the West route would be next to the pipeline depot in Dimitrovgrad. Kardzhali is more appropriate location for the South section but the ground chosen for a pipeline depot is uneven and may need significant ground leveling works. Therefore, an area in Momchilgrad may be found more appropriate for a temporary construction village but there may be difficulties with the infrastructure and accommodation.

The East route is also problematic in terms of field offices. There is no point of situating such large construction villages close to small villages in the region, therefore it would be better to built such a construction village along the route in the area of Momchilgrad for the South section, and a second one around Dimitrovgrad for the North section.

The impact of the temporary construction villages on the surface waters will be low, controllable, local, direct, temporary and reversible after completion of the construction works.

- *Impacts assessment – upon river crossings and Studen Kladenets reservoir*

The selection of a river crossing method depends on the annual water flow, river width and the engineering-geological conditions. Most of the rivers to be crossed by the pipeline route are shallow during the most part of the year, and some of them dry up temporarily. Therefore, the open cut method for crossing these rivers is recommended. *Appendix 5.2* of this EIA report gives data for river crossings and their classification.

1. Open cut crossing

Description of the open cut method of crossing rivers is given in *1.3.1.10* of this EIA report.

Except Maritsa river, the rivers along the pipeline route will be crossed by using this method. It will be applied mainly to drying rivers or these with a low water flow during the pipeline construction. Most of the rivers and feeders to be crossed have a low water flow over the most part of the year. Two alternative methods of crossing Studen Kladenets reservoir were reviewed: open cut method and horizontal directional drill where the pipeline will go under the reservoir's body. The expedience of the applied method will be additionally studied during the next stage of designing.

From ecological point of view this method of river bed crossing may cause changes in the morphology of the river banks and worsening of the surface waters quality.

Open cut works for river crossing:

1. **River flow diversion** – this will include partitioning of the river above the excavation point. This work is likely to cause increased water turbidity as a result of suspending and dispersion of soft alluviums from the river bed which may contain pollutants. Water will be directed either to a proper receiving water or to the same river after partitioning the section and downstream the excavation area.
2. **Water draining from the excavation area** – water will be directed either to a proper receiving water or bypassed to the same river after partitioning of the section and downstream the excavation area. This water will contain certain amount of suspended substances and eventually pollutants contained in the river alluviums. It may be expected a secondary impact on the quality of water caused by pollutants in the floating alluviums;
3. **Trench excavation and pipeline laying –** during trench excavation fine particles will cause water turbidity. In the small streams with a width of 3-5 m turbidity will last half a day only. Upon large crossings, alluvium barriers may be installed to avoid transportation of the alluvium "tongue" downstream the river. These operations will cause suspending and dispersion of bottom alluviums and eventually other pollutants contained in them. These substances will be held within the excavation area.
4. **Backfilling -** materials excavated from the trench will be used for trench backfilling which will cause a local and temporary increase of water turbidity. The excess ground will be used for filling free areas beyond the constructed river-bank reinforcement facilities. Duration of works will be limited to a few hours for small streams. Clay barriers which seal off the river bank trench will be used for rivers where infiltration of water to groundwater is likely to occur.
5. **River-bank erosion** – possible impacts upon crossing river beds include changes in the river bank morphology – dyke rupture, change of the river bank slope (stability reasons), river bed deformations and erosion of bank slope and river bed. No erosion of the river banks crossed is expected provided that all mitigation measures specified in the project are implemented and the technical specifications during construction are observed. Restoration of the river banks with proper reinforcement of their slopes is expected. Slope reinforcement will consider the expected overflow, with a river bank protection determined in dependence of the height and slope of the water flow. Upon construction of a river bank protection which complies with the environmental requirements, advantage shall be given to natural materials for reinforcement of the river bank. Where stones will be used for reinforcement they shall be covered with a humus layer to facilitate the restoration of the natural vegetation. To prevent erosion and destabilization of the river banks adequate protection measures will be recommended. These will be implemented upstream and downstream from the crossing place and may include combination of measures such as planting, use of geotextile and stones etc., as applicable.

During construction, negative impacts upon crossing of rivers may be expected. The crossings will be implemented in the dry periods of the year and in shortest deadlines possible. The impact will be local, around the location of river crossing for water bodies with a continuous water flow. During construction, the natural water flow upon crossing of water bodies with a continuous flow will be temporarily changed. Increased turbidity of the river water is expected in the section just below the crossing point during excavation and backfilling of the trench and pipeline laying. Considering the time of construction, crossing methods applied and area recultivation measures the impact on the quality of water has been assessed as insignificant, controllable, reversible and short.

2. Horizontal directional drill (crossing Maritsa river and Studen Kladenets reservoir)

The horizontal directional drill is a trenchless method of crossing which starts with a short diameter drilling in horizontal direction (pilot drilling) under the obstacle (i.e. river) by using a continuous steel drill stem. As the drill head and steam appear from the opposite side of the crossing a special cutting device called a back reamer is connected to them which is pulled back through the pilot hole. The back reamer increases the diameter of the pilot hole so that the pipe can be pulled through it. The pipe is pulled from the opposite side of the drilling equipment. Special platforms on both sides of the river shall be constructed for this equipment.

From environmental point of view this expensive method, appropriate for large rivers, prevents modification of the water bodies and reduces the quantity of suspended substances. Disadvantage of this method is the necessity of a large area in the vicinity of the river bank.

The horizontal directional drill method for river crossings is described in item *1.3.1.10* of this EI report.

Horizontal directional drill works for river crossing:

1. **Pipe laying –** the following impacts may be expected upon using this method for pipe laying: necessity of excavating two large entrance pits, damaging the geological base under the river bed, collapses, difficulties upon presence of big rocks on the river bead or the reservoir bottom.
2. **Impacts from drilling fluids and drilling mud** – drilling solutions are usually a mixture of 2 % bentonite clay and 98 % water. Bentonite is a natural clay which contains 85 % montmorillonite, 10 % quartz and feldspar, and 5 % additional material – calcite or gypsum. Betonite is used for stabilization of the walls of the hole and taking the rocks out. Betonite reduces the twisting during drilling, lubricates the pipe, and ensures rotary removal of the cuttings and stability of the bore hole. Betonite is a non-toxic material but measures for its proper storage on the river banks shall be taken thus avoiding contact with water. If discharged into the river it may cause a serious impact on the water species as it contains very fine particles which may spread on a large area. These particles may cause the fish gills and radular of the water invertebrates to plug. The impacts of the drilling fluid will depend on many factors such as type of the drilling fluid, ground base being drilled, supplements etc. In the case of water-base drilling the water can be discharge into a water receiver. The drilling mud shall be disposed in terms of its quality content. Should the trenchless method be used for crossing Maritsa river and Studen Kladenets reservoir and provided that all technical specifications during construction are observed, the sensitivity these water bodies is assessed as low. The impact will be local, around the crossing point, and will not affect the river body and the natural regime of flow. The impact on the ground base will be negative, temporary, and reversible after completion of the construction works and recultivation of the affected area.

Upon applying the horizontal directional drill method water will be necessary for:

- Preparation of a primary drilling fluid;
- Additional drilling fluid necessary for progress in drilling;
- Substituting fluid upon loss of drilling fluid in case of filtration or hydraulic hammer, and

- Pre-test of the pipe section, as needed.

Water may be pumped from adjacent water source or other water body and supplied to a tank on the drilling platform or transported to tanks on site.

Other possible impacts from horizontal directional drill:

- Accelerated pipeline corrosion processes due to undetected damages on its coating;
- Weak control on the surface drainage from the drilling platform causing erosion and entry of materials into the water flow;
- Destruction of groundwater horizons feeding the water flow.

The impacts of the horizontal directional drill on the water quality are expected to be insignificant, local, reversible and short. The horizontal directional drill method will be used upon crossing Maritsa river due to the significant amount of water, high cross sections in the areas of crossing and their significance for the environment along the river valley. For crossing Studen Kladenets reservoir two alternative methods have been reviewed: open cut method and horizontal directional drill as the pipeline will pass under the reservoir's body. The expedience of the applied method will be additionally investigated in the next design stage. Upon crossing Studen Kladenets reservoir by horizontal directional drill the only one impact which may be expected is when discharging drilling fluids and drainage waters and when pumping raw water for drilling works. The impacts upon crossing Studen Kladenets reservoir by open cut method are described in section „*Open cut crossing*" above.

Due to the higher risk of environmental pollution the more appropriate method for crossing Studen Kladenets reservoir would be the horizontal directional drill (HDD). This method is much more expensive as compared to the open cut method but much more environmentally friendly because the pipeline will pass under the reservoir, it will not impact the water species and the bottom and shores will not be affected from construction works.

- *Impacts assessment – upon trench draining and construction sites draining*

Trench draining may be needed in some wet sections of the pipeline route. This work will be carried out and controlled carefully as the pumping will last a few days and only within the specified section.

Storm waters and groundwater being pumped from the trench and construction excavations will be discharged into the nearest water receiver. These waters will pass through clarifiers (temporarily built or mobile). Since the pipeline route does not cross areas with contaminated soil, pollution of these waters is not expected. Therefore, impact on the quality of water receivers is not expected.

- *Impacts assessment – upon hydraulic testing of the gas pipeline*

Conduction of pipe testing – upon construction, hydraulic tests and leak tests shall be conducted on the gas pipeline sections, according to the requirements of БДС EN 1594, БДС EN 12186 и БДС EN 12327. Water does not change its volume during these tests but it may change its quality upon presence of corrosion products from the internal pipe walls, scale, slag, electrodes, ground, water and other occasional items. The water used for testing can be classified as waste water. Its single volume for a pipe section with a length of 20 km is approximately 10 000 m^3. After conduction of the hydraulic testing the water shall be drained to a running water or stationary water object. It shall comply with the requirements to a second category receiving water as per Ordinance No 7 about surface water quality (SG, issue 96/1986). Upon discharging, all drainage lines shall be sufficiently fixed so that they do not move during draining. Discharge into a water body and its crossing shall be carried out in accordance to all issued permits. Discharge into a water body shall be at location where it does not cause shore erosion, wash away and residual deposits.

Water supply for testing purposes – pumping of water from a water source may cause increased turbidity of water in result of suspending and dispersion of bottom alluviums within the pumping area and possible pollutants contained in them. Possible impacts would be reduction of the quantity of water downstream the pumping point, disturbed water flow regime after the pumping point and impact on the quality of river water within the area of pumping.

The source and receiver of test water will be agreed with the authorities and will comply with their requirements. Upon discharging test water into surface water receivers the conditions and individual emission limits set by the authorities – East Aegean Basin Directorate and Ministry of environment and waters (for Studen Kladenets reservoir) will be observed.

Impact on the water quality caused by discharge of test water is not expected since it will not contain chemical substances. Waste water will be treated in accordance with the individual emission limits. These limits will be specified by competent authorities depending on the category of the receiving water. Provided that the specified individual emission limits are adhered to, the impact of discharged water will be low, controllable, local, direct, temporary and reversible after completion of the hydraulic test. The impact on the quality of water in result of pumping from surface water sources is of low importance. It will be short and negative but reversible.

- *Impacts assessment – impact from waters contaminated by workers and machinery upon accidental spills.*

Impact on the water quality caused by machine oil spills, unauthorized disposal of solid waste and waste waters;

Impact on the river water quality caused by waste water used for washing tires, mud-guards and chassis of vehicles coming from construction site and going to public roads;

During construction, oil and fuel spills into the river beds or on river banks are likely to occur in result of accidents or improper maintenance of machinery. These may cause pollution of river and/or groundwater in river terraces. In the event of obvious pollution caused by machinery the water will pass through a separator before being discharged to a water receiver. The expected impact will be low provided that the good construction practices are used.

- *Assessment of impacts on sanitary protection zones*

The use of areas within sanitary protection zones is regulated by Ordinance No 3/16.10.2000 about the conditions and order for survey, design, approval and operation of sanitary protection zones around water sources and facilities for drinking and household water supply and around mineral springs used for medical, prophylactic, drinking and hygienic needs. As per art.8 (2) only works related to the operation of the water source and/or water facilities are allowed within the Ist belt of the sanitary protection zones. As per Appendix I to the same Ordinance, construction of overground and underground facilities within the IInd belt of the sanitary protection zones shall be limited, except for reconstruction and modernization of main water-supply equipment, but no restrictions have been imposed for the IIIrd belt. According to a letter by the Basin Directorate Изх.№РД-11-158/27.10.2011 sanitary protection zones within the scope of pipeline route have not been established.

No impact on the quality of waters of the Ist or IInd belt sanitary protection zones within the scope of pipeline route is expected.

- *Impact assessment – aquatic organisms*

Possible types of pollutants discharged into the water bodies upon construction works

- Suspended substances (bentonite);
- Sewage waters (pollutants from household waste waters)
- Heavy metals (zinc, arsenic, cadmium, lead, barium, mercury, copper, chromium);
- Hydrocarbons
- Petrol products

Excavation works upon crossing rivers along the pipeline route are expected to cause increased turbidity of water basins. This may reduce the quantity of dissolved oxygen and cause breathing problems to fishes, feeding disturbances and mortality of specimen. Due to their mobility fishes will swim away from the affected area but the increased turbidity will have lethal effects on the fertilized eggs and larvae which are highly sensitive to environmental changes. The most affected by construction works will be demersal fishes as these are less mobile.

Upon using the horizontal directional drill for crossing large rivers (such as Maritsa river) impact on the aquatic organisms is unlikely to occur as the river bed and shores will be not affected by excavation works.

Destruction of vegetation and temporary change of the biological diversity upon crossing rivers and water bodies: the impact will be negative, direct, constant, long-lasting , and local (at river crossing points only). A secondary impact is expected but cumulative impact is not expected. Crossing rivers and water bodies is expected to be carried out in the dry periods of the year when the amount of water will be less and the level of impact will be low. The impact will be reversible because after completion of the construction works restoration and recultivation of the affected areas will be carried out.

As a whole, duration of the construction works in water will be for a short period of time. The expected impact will be temporary and varying in level.

Summary of the surface waters impact assessment – during construction the impact on the surface waters will be negative and the magnitude - insignificant and reversible, territorial scope – local, duration – short, frequency – temporary (during construction works).

In terms of impact on waters during construction the West route is more favorable than the East route and is recommended for construction.

4.2.2.1.1 During operation

During gas pipeline operation no impact on the surface waters after completion of construction phase and restoration works is expected.

The main and auxiliary processes during operation of “ Gas interconnector Greece – Bulgaria” are not sources of production waste waters. Household waste water discharged by the operations staff will be in low amounts. Before being discharged into the earth’s subsurface or a water body waste waters will be treated in local treatment plants. Another option of waste waters treatment is their collection in water-proof pits from where they will be transported to a municipal water treatment plant. The waste waters treatment method will be determined at a later stage during the design phase. Whichever of the two options is chosen the waste waters receiver will be agreed with the competent authorities and will meet their requirements.

There is no significant difference between the routes in terms of their operation – i.e. no negative impacts within the river crossing sections are expected.

4.2.2.1.2 During emergency situations

All actions in case of emergency situations along the pipeline route will be taken in accordance with the Emergency response plan which will be produced before the gas pipeline commissioning and updated on a regular basis.

No negative impacts on surface waters are expected in case of emergency situations.

4.2.2.2 Groundwater, hydrogeology

● Impact assessment methods

Hydrogeological surveys on the area of the project pipeline routes have not been conducted. Therefore, the assessment of the potential impact on groundwater is based on the information about the hydrogeological conditions and geological base contained in sections 3.2.2 and 3.3 above, field survey of the existing water facilities and groundwater systems, and instructions by PENSPEN.

The significance of impacts (negligible, low, moderate and high) according to the approved general methodology is assessed based on the combination of two components: vulnerability (sensitivity) of the groundwater as on object of impact and the magnitude of expected impact on it.

Vulnerability (sensitivity) assessment of groundwater according to the expected impact is based on the available regional and local information about the hydrogeological conditions as the most essential ones are:

- depth of groundwater;
- filtration characteristics of the aquifer;
- conditions of groundwater feeding and draining;
- interaction between surface waters and groundwater;
- presence and location of groundwater pumping facilities towards the gas pipeline route and regulated sanitary protection zones around them;
- chemical composition of groundwater;
- presence of other sources having an impact on the chemical and quantitative condition of groundwater.

Combining these indicators the sensitivity of the separate route sections is determined as:

- low – in the cases of lack of non-pressurized groundwater or presence of pressurized groundwater deep under hydrostable or less permeable materials which construction works will be carried out in;
- moderate – upon presence of non-pressurized groundwater in less permeable rocks laying under the facility and presence of water sources whose sanitary protection zones are outside the scope of project works;
- high – when the project facilities are located in close vicinity to a water level in aquifers with high filtration features as well as when the project facilities fall in the scope of sanitary protection zones around drinking and household water sources and deposits of mineral waters.

The magnitude of expected impact is determined based on the existing hydrogeological conditions and the impact of project facilities from the investment proposal on them as well as the measures to mitigating environmental impacts suggested in the project.

One of the essential factors for assessing the magnitude of environmental impact is the location of groundwater level towards the pipeline laying depth and the base of auxiliary gas transmission facilities as well as the filtration characteristics of the water-bearing rocks. It can be:

- low – where there is no direct connection between groundwater and project facilities;
- moderate – where the project facilities are not source of impact upon direct contact with groundwater;
- severe – where the project facilities are source of a significant impact on groundwater or have a direct contact with groundwater.

The impact on groundwater is assessed also according to its intensity, scope and duration both during construction and operation of the project gas pipeline.

● Identification and scope of impact

The expected impacts caused by construction works during gas pipeline construction are:

- temporary lowering of the groundwater level;
- interruption of the groundwater flow;
- exhaustion of the groundwater deposits;
- physical destruction of water withdrawal facilities;
- groundwater pollution from surface spills (oils, fuels, wastes, open-air stored hazardous materials etc.);
- groundwater pollution from untreated household and sewage waters;
- groundwater pollution from storm waters passing through open-air temporary waste storage areas and disposed wastes;
- groundwater pollution from drilling fluids used for river crossing by horizontal directional drill method;
- groundwater pollution from leaks and petrol spills in the event of accidents involving stored petrol products and machinery.

The main construction works foreseen in the investment proposal include excavations with a depth of up to 2,0÷2,5 m for pipeline laying and a depth of up to 3÷4 m upon applying open cut methods, mainly when crossing rivers and river beds. Elements of the piping system and the works on its construction will be in contact with groundwater only within the areas of shallow groundwater described in table 3.2.2.1 above. Basically, these water horizons have high sensitivity both to contamination and changes in the groundwater level.

It is foreseen that the sources of hydro testing water will be surface water bodies with high flow/capacity and therefore the hydro test water pumping will not cause an impact on the groundwater.

4.2.2.2.1 During construction

Currently the quantitative and chemical condition of the groundwater within the area of project pipeline routes is a result of pressure and impact from human activities such as:

- Withdrawal of natural and exploitational resources from groundwater for drinking, household, industrial and other purposes by means of the constructed water withdrawal systems and facilities, including these at and around the gas pipeline described in section 3.2.2 above. Because water withdrawal points are arranged as per the requirements of the

Water Act and the relevant regulations to it and their local exploitational resources are lesser than the available ones, all groundwater bodies are in "good quantitative condition" according to the assessment made by the Basin Directorate – East Aegean Region in "Watershed management plan for East Aegean Region" – Plovdiv;

- Pollution from spot sources such as waste disposal areas, settlements without sewerage, industrial sites, petrol stations etc., and diffuse pollution from agricultural sources, animal farms etc., as a result of which groundwater bodies *BG3G0000PgN019*, *BG3G00000NQ009* and *BG3G000000Q012* are in "bad chemical condition", due to concentrations in groundwater above the quality standard as per Appendix 1 to Ordinance № 1/10.10.2007 mainly for manganese and partially for iron (in GWB BG3G00000NQ009).

The interaction of the gas pipeline with groundwater is expected to include additional impacts on the current quantitative and chemical condition shown and on the chemical composition of the groundwater bodies.

●**Potential impact on the quantitative condition of groundwater –** during construction and only upon draining groundwater from trenches reaching up to and below the water level when crossing rivers and river terraces. It involves withdrawal of insignificant resources from the water body and water level reduction up to 1÷3 m around the construction section of the pipeline route by water pumping of a short duration (up to 10÷15 days). The groundwater bodies being crossed are in direct hydraulic connection to the associated rivers which ensure practically unlimited exploitational resources and rapid restoration of the groundwater level.

This impact will be negative, direct, temporary, short and covering only the area of gas pipeline route. Eventual sections of such impact would be locations where the piping system and construction works will be in contact with high-sensitive groundwater collectors described in table 3.2.2.1 above.

The impact on the quantitative condition of groundwater is assessed as low (low level). It does not generate cumulativeness as practically it does not affect the current quantitative condition of groundwater determined by the natural conditions of feeding and draining, and by the operation of existing water pumping equipment and facilities in service.

●**The impacts on the chemical condition of groundwater** would involve infiltration of contaminated waters, generated upon:

- excavation and backfilling works for construction of the gas pipeline and auxiliary equipments;
- horizontal directional drill
- concrete coverings and slabs, coating and painting
- leaks of stored fuels and oils, and upon re-fuelling
- washing machines, car wash, kitchens
- collected and stored waste

This impact is likely to be negative, indirect, temporary, and short and involving only the areas of project gas pipeline routes and mainly on non-pressurized groundwater and alluvial river terraces described in table 3.2.2.1 above.

The impact on the chemical condition of groundwater is assessed as low, provided that all measures for prevention of accidental spills of lubrication oils, fuels, wastes, hazardous substances etc., within the construction route and construction sites, including proper storage of materials, specified in the project are fulfilled. The impact does not generate cumulativeness and does not cause changes in the current condition of groundwater in result of human impact from spot and diffusal sources of pollution shown above, as well as from the quality of exploitational resources from Maritsa river, Arda river and their feeders going into groundwater bodies.

Impact on the fissure groundwater is not expected since these have low water amounts, occasional distribution within the aeration zones and are typically above the level of the gas pipeline route.

●Impact on sources of drinking and mineral waters

Sources of groundwater and mineral waters, and estimate data of their sanitary hygienic zones are described in section 3.2.2 above. Location of household and drinking water sources as well as natural springs is shown in table 4.1.3.2.1.:

Table 4.1.3.2.1 Location of sources of groundwater, mineral water and captured natural springs

№ by row	Water withdrawal facilities and systems	Location towards pipeline route	Distance to pipeline route	Crossing sanitary protection zones (SPZ)	Notes
1	2	3	4	5	6
West route					
1	Mineral spring “Kirkovo”	km 8+500	500 m southwest	No SPZ	Pressurized fissure waters
2	Abandoned bore hole in the village of Karchovska (water level at 5,0 m from pump)	km 21+500	50 m west	-	Non-pressurized fissure waters
3	Abandoned bore hole in the town of Momchilgrad (water level at 5,0 m from pump)	km 34+900	1300 m southeast	-	Non-pressurized pore waters – terrace of Varbitza river
4	Captured spring in the village of Mandra	km 79+100	100 m south	-	Non-pressurized fissure waters
5	Water supply system of the village of Voivodovo	km 84+700	300 m northwest	Fenced facilities	Non-pressurized pore waters – terrace of Harmanliyska river
6	Water supply system with a pump station “Uzundzhovo” (5 tube wells)	km 98+200÷98+430	Route passes between two tube wells 90 m east of the fence of belt I of SPZ	It crosses belt III of SPZ	Pressurized pore waters
7	Abandoned and damaged tube wells in the village of Chernogorovo – 3 nos.	From km 110+200 to km 110+500	80÷150 southwest	-	Pressurized pore waters
East route					
1	Water supply system with a pumping station „East zone” (15 bore holes)	From km 109+400 to km 109+700	Route passes between bore holes	It crosses belts II and III of SPZ	Non-pressurized pore waters – terrace of Haskovska river

From the information contained in the table above it can be concluded that:

● No impact on water withdrawal systems and facilities along the West route is expected because:

. – the fissure water sources (natural springs) are located above the level of the pipeline routes;

- crossing belts II and III of sanitary protection zones takes place in areas of pressurized groundwater collectors which penetration of pollutants into is impossible due to the fact that their upper level is well below non-permeable clay layers. Furthermore, adherence to prohibitions, restrictions and restrictions until proven necessity shown in Appendix No 2 to art.10, para.1 of Ordinance 3/16.10.2000 about the conditions and order of survey, design, approval and operation of sanitary protection zones around household and drinking water supply systems and facilities, and around mineral springs used for medical, prophylactics, drinking and hygiene needs is a must;

● Impact on the water withdrawal system “East zone” which is part of the water supply system of the town of Haskovo is likely to occur on the East route. This system is located within an unprotected area of a groundwater object having shallow groundwater level in the terrace of Haskovska river as the pipeline route passes through the territory of belts II and II and in close vicinity to the boundary of belt I of the sanitary protection zone. This circumstance is admissible, however, conditions for water pollution at least in the two nearby bore holes do exist.

4.2.2.2.2 During operation

No impact on groundwater is expected during normal pipeline operation. Risk to groundwater is likely to occur upon eventual pipeline failure.

4.2.2.2.3 During emergency situations

Impact on groundwater is likely to occur as a result of:

- natural disasters – earthquake, flood during heavy rains and snow melting etc.;
- eventual failures and catastrophes:
  - upon operation of machinery, installations, equipment, devices, aggregates, including waste water treatment plants, and during system maintenance
  - upon transportation of fuel and other hazardous substances; transportation of pipes
  - on fuel, oil and chemical storage tanks;
  - on pipeline upon hydrostatic testing and other reasons.

These eventual impacts are negative, direct, temporary and short.

4.2.3 Earth’s subsurface and mineral diversity

●Impact assessment methods

According to the approved general methods, the impact assessment significance is a combination of the sensitivity of the environment being impacted and the degree of change upon implementation of the investment proposal. The earth’s subsurface sensitivity is determined by the geological composition – lithologic varieties and their engineering and geological characteristics, and by tectonic condition of the affected area. The degree of change depends on the depth of excavation works for pipeline route construction and foundations of associated facilities. In some cases the excavation method may also cause an impact. For assessing purposes the impact significance is determined as follows:

- Negligible – when only the top layer of the ground base is affected;
- Low – when the impact on the geological base covers a small area and depth;
- Moderate – when the impact on the geological base is limited in size or comparatively shallow –approximately up to 10 m;
- Severe – when the impact on the geological base covers a large area and at a significant depth.

4.2.3.1 During construction

Construction of the gas pipeline and each linear equipment includes removal and temporary disposal of the humus layer, shallow (up to 2,0÷2,5 m and up to 3÷4 m upon applying trenchless methods) and narrow (from 1,3 to 5÷7 m) trench excavations for laying and installation of gas pipelines, temporary disposal of excavated ground, trenches and pipes backfilling, crossing rivers, gullies, roads and railways, permanent disposal of excess ground, temporary usage of terrains, demobilization after completion of construction works on the relevant gas pipeline sections etc. The scope of this impact is limited to the area of pipeline route, the construction area around it, and the temporary road deviations. The industrial impact from unorganized outgoing water not complying with the requirements for stability, undermining etc. in combination with adverse weather conditions may cause activation of:

- Slope (surface) erosion on inclined inter-river sections and linear (gulley) erosion involving formation of gullies and furrows on steep sloped sections;
- Ravine erosion upon crossing river beds due to changes in the river bed morphology, change of the river bank slope (stability considerations), river bed corrections;
- Gravitational processes (landfall, landslip) upon passing along deformed slope areas.

Upon strict implementation of the project solutions regarding the construction methods and storage of materials, stabilizing river banks where necessary, controlled draining of surface waters etc.., the expected impact on the geology and mineral diversity will be insignificant to low, short, negative and mostly reversible due to backfilling of the trench excavations and area restoration works.

Considering the above the expected impact on the earth’s subsurface during construction is practically identical along the alternative routes of the gas pipeline. It will be insignificant to low, short, mostly reversible as the routes have been corrected so that to go round fields of proven underground natural resources.

4.2.3.2 During operation

No impact on the geology is expected during normal pipeline operation. Risk to the geology may occur only upon development of natural erosion processes mainly on the surface of woodless slope sections in periods of heavy rains and snow melting, and eventual pipeline failure.

4.2.3.3 During emergency situations

Impact on the earth’s subsurface and mineral diversity is likely to occur as a result of:

● natural disasters – earthquake, flood during periods of heavy rains and snow melting etc.;

● eventual failures and accidents:

- upon operation of machinery, installations, facilities, devices, aggregates, including waste water treatment plants and during system maintenance;
- upon transportation of fuel and other hazardous substances, transportation of pipelines;
- on fuel, oil and chemical storage tanks;
- on pipelines during hydro testing and other reasons.

These eventual impacts are negative, direct, temporary and short.

The expected impact on the earth’s subsurface 1 during operation is practically identical along the alternative pipeline routes.

4.2.4 Soils

4.2.4.1 Impacts during construction

During the construction of the pipeline facilities, temporary impacts are expected to occur as well as permanent loss of soils. The required areas for the execution of the project are – 476.36 ha for the Western route and 455.76 ha for the Eastern route. The impacts during the construction will be limited within the construction strip of 30 m width. Aiming to protect valuable habitats and species in some forest areas the construction strip width shall be reduced to 20 m.

The areas of 10.14 ha along the Western route and 10.15 ha along the Eastern route, that are required for 13 sites of above ground facilities and service roads shall be permanently destroyed. The impacts on the rest of the areas will be temporary disturbance of the soils properties and productivity.

The full description of each site's area is given in items 1.1.2.2 and 1.1.2.3.
The construction technology for regions with deep enough soils includes:

- Removal of the surface soil layer and its storage in a parallel excavated trench within the construction strip.
- Removal of the sub-humus layers down to the required depth and their storage by the trench in such a way that they will not mix with the humus layer.
- Pipes lying.
- Fill back of the removed soil layer. First the sub-humus layers shall be filled back and then the humus layer shall be spread out above them.

During the above activities the following impacts are expected:

- Violation of the soil profile during trench excavation (after humus layer removal).
- Soil compaction within the construction strip by the construction machines depending on the soil susceptibility to compaction, especially regarding soils with heavy mechanical composition.
- Soil erosion – in regions with sufficient sloping lands characterized by shallow soils and soils susceptible to erosion.
- Impact on soil fertility – due to violation of the soil structure as a result of the trampling down during the construction works and humus horizon displacement by not so rich sub-humus horizons during the recultivation activities.
- Potential local soils contamination during the construction due to casual split of lubricants, fuels and waste.

The above mentioned impacts are going to be negative, temporary (the soils will be recovered after the completion of construction works), short term (only during the construction), local (only for the pipeline route) and direct. Cumulative impacts are not expected, but possibly some secondary impacts may occur due to erosion development. The impact rate is medium.

The foreseen construction works for the errection of the above ground facilities sites include:

1. Foundations concreting.
2. Construction of solid fence facilities.
3. Lying of service roads – access roads to sites for pipes storage and onsite offices. These roads will be temporary and build after the removal of the humus layer, lying of a geotextile coat and breakstone. The roads to the above ground facilities are permanent. However the project foresees these roads to be covered with asphalt or paved with geotextile coat with breakstone depending on the length and location.

During the above works the following impacts are expected:

1. Violation and/or destruction of the soil profile during the construction (after the removal of the humus layer).
2. Soil compaction and congestion by the construction machines at sites and service roads areas.
3. Potential localized pollution of soils during the construction due to casual spill of lubricants, fuel and waste.

The impacts will be negative, permanent (the sites and the facilities will remain during the operation of the pipeline), long term, local (only for the pipeline route) and direct. Cumulative impacts are not expected, but secondary impacts are possible due to erosion development in slope areas. The impact rate is medium.

During the abovementioned works the soil layer within the area of the sites will be permanently destroyed.

During the construction works, not depending on the alternative route selection 4 temporary sites will be constructed with an area of 7.2 ha. The sites location and dimensions are shown in item 1.2.5.4.1. The anticipated impacts on the soils of the sites designated for settlements are due to trampling and pollution with household waste and spill of fuels and lubricants. The impacts on the soils of the pipe storage sites are mainly due to trampling by the heavy machines meant to work there, and due to possible spill of fuels and lubricants.

The impacts described above occur as different disturbances and change of the soil characteristics. The disturbance rate depends mainly on the soil type (mechanical composition, physical and chemical properties etc) as following:

- **Fertility** – The most valuable soils regarding the fertility are chernozem smolnitzi soil (Vertisols - VR), which has the highest susceptibility. Permanent loss of these fertile soils is expected for the valve station sites and the pigging station sites designated for pipeline maintenance and inspection. The soil impact within these areas is direct and permanent. Generally, considering the undertaken mitigations for soil storage and follow up reuse, the soil impact is medium. The impact of the construction sites is short term (only during the construction) therefore it is temporary and recovered. Appropriate storage of the removed soils and their fillback after the construction completion is foreseen in the project. Therefore these sites impact is considered as insufficient. Full recovery of the soil is expected within a year after the soil fillback. It is highlighted that after the construction some limitations, foreseen in the legislation and the best international practices, will be applied for the use of the land within the safety zone.
- **Congestion –** The most vulnerable to congestion (compaction) are the soils with heavier mechanical composition. These are especially Smolnitzi soils (Vertisols). Less susceptible to compaction are lessivated soils (Luvisols), planosols, cambisols and alluvial soils (Fluvisols - FL). The heavy construction machines can easily compact the vulnerable soils. A high impact rate is expected for the pipeline areas consisting of these soil types. However this impact is temporary, with a very short term effect, and in case of strict performance of the foreseen mitigation the impact can be assessed as low one. During the construction and the camps functioning the expected soil compaction rate is medium – no heavy construction machines are expected to work at these sites. The camps impact is expected to be temporary (within two years term) with low to moderate sufficiency. The heavy trucks and construction machines shall work within the area of the construction sites. The impact area will be small one and in case of strict performance of the foreseen mitigation activities the impact is expected to be temporary and low one.

- **Erosion** – The shallow soils (Leptosols, LP) are highly susceptible to erosion and they are located along the pipeline through Eastern Rodopi mountain, excluding the sections located in low lands and in the foot of the hills where alluvial soils (Fulvisols,Colluviosols), predominate. Cambisols, and some other soil types are also susceptible to erosion processes but not so much. The route areas with a high probability of erosion development or badly performed recovery works are given in ***Appendix 6.5***.

Low impact is expected on construction camps sites and the sites for temporary pipes storage considering their location on relatively plane terrain and their recovery after the construction completion.

- **Soil compaction** – Such impact is not expected in case the mitigation activities preventing soil pollution are performed. Nevertheless some casual spills of lubricants and solid waste can result in local soil compaction. The expected impact is secondary and permanent if no measures are undertaken. The impact significance will depend on the impact area and the pollution type and will vary between low impact and no impact at all. Each location of pipeline system elements will suffer of soil profile disturbance as described in item 1.1.2.1. At some places redundant subsoil will result from the pipeline construction which cannot be fillback in the trench. The disposal of the unnecessary subsoil is not required. The latter shall be equally distributed and leveled prior to lying of the humus layer. Part of it shall be used or fill back the excavated pipeline trench in the areas with shallow soils (the majority in the Eastern Rodopi Mountain). The construction strip and the impact sites shall be recovered properly after construction completion.

The impacts are significant in the following cases:

- Permanent loss of valuable soils (highly fertile or with status of highly protected area / natural habitats).
- Temporary removal of vulnerable soils (highly susceptible to erosion/compaction).

During the construction works the Investment Proposal is not expected to make significant negative impacts on the soils. Generally, these impacts could be classified as primary and secondary. The primary impacts occur due to excavation, storage and backfilling of earth masses, and the secondary ones are marked by the progress of erosion on the steep slope areas. However this secondary impact is temporary, until the natural grass vegetation takes roots and grows up. The negative impacts are higher for the Eastern route due to the specific profile and undeveloped infrastructure of the region. These may result in secondary erosion processes, heavy machines hard access, as well as a need of longer service roads which may lead to negative soil impact of larger area. The conclusion on the base of the above is that the Western route is a better alternative.

4.2.4.2 Impacts during operation

During the pipeline operation, soil negative impacts are not expected. An exception is the potential erosion which might occur on the steep slope areas within the construction strip, where the vegetation has been destroyed. This impact is secondary and temporary, and will last during the time required for the recovery of the vegetation cover – approximately in the first 1-2 years of the pipeline operation. The erosion will be local, from low to medium magnitude. Such impact is possible only in case of poor implemented remedial works, or after downpours. In case the erosion mitigation activities foreseen in the project are performed, as well as the regular monitoring of the pipeline is executed, these impacts will be insignificant.

The differences between the impacts of both alternative routes are not sufficient. So that cannot be the reason to appoint the preferable alternative route.

4.2.4.3 Impacts in case of emergency

Incidents are possible to occur in case of natural disasters of calamitous character, or serious pipeline failures. Due to physical and chemical properties of the natural gas, pollution or violation of soil properties could not occur, even in case of considerable leakage. The only exception is the case of inflammation or explosion, but the availability of sufficient number of shut-off valves along the route would make this impact local and short term, until exhausting of the entire gas volume from the failed section.

The difference between the impacts of both alternative routes in emergency cases is not sufficient. So that cannot be the reason to appoint the preferable alternative route.

4.2.5 Landscape

Considering landscape assessment, both, the significance of the Investment Proposal impacts on the landscape, and the visual impact are estimated.

4.2.5.1 During construction

The landscape specific components impacts are studied by the experts in the relevant items of the EIA (Environmental Impact Assessment) Report.

The main landscape impacts during construction will be of visual-aesthetic nature. In general, they will be the same in both alternative routs. The impacts rate will be low, up to medium for the Western alternative, due to the fact that the route crosses fewer types of woodland where the visual impact will be more salient than in lowlands. At the Eastern alternative, the expected impacts rate will be medium, due to larger woodland which are crossed and will be affected. Apart from the physical changes in the landscape, other impacts will occur on the nature of the environmental surroundings as a result of the construction works visibility.

The pipeline construction is related with excavation works that will be sufficient in scope, executed at stages and will have a visual – aesthetic impact along the entire pipeline route due to their visibility, increase of noise and dust pollution of the construction areas in close vicinity of households.

The visual impact is due to the temporary mound of humus and soil layers, availability of construction and transport machines, loss of grown up flora (trees), as well as performance of specific activities during construction (like welding, pipe delivery, hydrotests, as well as commissioning of permanent project details). The impact will be negative, temporary, short term (only during construction), local (within the area of the pipeline route), direct and low rate. Secondary impacts are not expected. Nevertheless cumulative visual impact is expected in the areas where the pipeline route crosses rail ways, high ways, roads and rivers.

The construction works related to local and temporary change of the environment overall condition will not lead to any significant changes in the landscape structures.

After the completion of the construction phase, recovery and recultivation of the terrains will be performed. This will have a positive impact which will be also permanent, long term, local, direct and of medium impact rate.

Crossings of susceptible landscape areas with more specific visual impacts are described below:

In compliance with the design requirements an entire trees cutting within the construction strip of 16 m in mountain regions will be performed. The pipeline route will run zigzag through the mountain forest areas aiming to reduce the visual impact as well as preventing the occurrence of ground moving and erosion processes especially in slope areas. Medium visual impact rate is expected considering the route visibility for the local population and the tourists. The impact will be negative, direct, temporary, medium and local (within the pipeline route area). Secondary impact is not expected. Nevertheless cumulative visual impact is expected for the areas where the pipeline route crosses road, rail ways, reservoirs and woodlands.

The susceptibility of the landscape though which the pipeline passes is low to medium for the Western route and medium for the Eastern route. The conclusion is made on the base of the expected landscape visual impact during the pipeline construction. In areas where the pipeline is located in densely forested landscape the construction works will be seen from a great distance due to cutting of plants. In this case the susceptibility to the proposed change is medium. In areas where the design pipeline passes though visually open agricultural lands, the visual impact will be less susceptible due to its visibility from a shorter distance. The susceptibility assessment considers the construction works temporary term, the landscape impact rate from low to medium and the impact significance that will be from insufficient to medium depending on landscape nature.

The residents of the closed buildings usually are defined as highly sensitive to foreseen changes based on their own long visual interest of the surrounding environment as well as to the existing view quality. In contrary the people traveling through the pipeline area are defined as low sensitive to proposed changes considering their temporary visual contact and interest in the surrounding environment. Considering the temporary nature of the construction works of the pipeline, the impact rate is expected to be low or medium. The impact to the residents of the closed settlements that will witness the construction works is expected to be low to medium and for the travelers – from insufficient to low.

The mountain and woodland landscapes are more valuable and susceptible than the lowlands due to the fact that the visual impact for the first one is greater.

The visual impact on water and waterside landscapes is expected at river and reservoirs crossings. Visual impacts are expected of all river crossings. The expected impact rate will be low to medium due to the foreseen in the Investment proposal schedule of the crossings execution during the dry periods of the year and as quick as possible. The visual impact rate when crossing large reservoirs and rivers (dam Studen Kladenetz, Maritza River, Varbitza River, Arda River etc.) will be medium. The impact will be recovered due to the foreseen rehabilitation of the impaired areas after the completion of the construction works.

At railways and roads crossings the visual impact is expected to be negative, temporary, short term (only during the construction), local (within the area of the pipeline route), direct and low rate. Secondary impact is not expected. Visual cumulative impact is expected.

The visual impact during construction of above ground installations is expected to be negative, temporary, short term, local (within the pipeline route area), direct and up to medium rate for the Western route corridor, and medium rate for the Eastern route. A secondary impact is not expected. Cumulative impact is expected.

During construction the existing landscape will change and new landscape will occur as a result of the new sites construction, the majority of which are polluted to different extent by the human activities including waste that will cause unfavorable visual aesthetic impact. In general, the landscapes will not acquire completely new appearance, part of them will anthropogenize.

During demobilization of the equipment along the pipeline route corridor, a positive impact is expected, which will also be permanent, long term, local, direct and of medium rate. It will occur as a result of the implemented terrains recovery, recultivation and forestation of the terrains.

The landscapes impact will be limited and will not disturb the existing balance of the landscapes. Keeping the relationship between the landscape components and the ecosystems balance will result in no change of the sustainability of the antropogenized landscape.

During the construction of the pipeline and the above ground facilities the Western route of the pipeline is more profitable option due to the expected lower visual impact comparing with the Eastern route. The Western route will pass through woodland and mountains covering smaller areas where the visual impact is greater than in open areas. During the construction of the above ground facilities the pipeline route of the Western alternative will have less landscape impact due to more favorable terms of construction (more lowlands to pass and with better developed infrastructure). During the construction of the above ground facilities along the pipeline route of the Eastern alternative the landscape impact will be higher – the visibility of the construction works will be higher due to mainly forest landscape, difficult access of the machines.

4.2.5.2 During operation

During the pipeline operation the construction works shall be completed, the soil and humus layers backfilled as a part of the construction process. It is assumed that the agricultural lands within the pipeline route corridor will recover with the time and become cultivate areas again and the agricultural activities will start again soon. In that way the direct and indirect landscape impacts and visual impacts related with the designed pipeline will correlate mainly with the operation and maintenance of the facilities and the buildings required for the appropriate functioning of the pipeline. Visually they will be a part of the landscape as above ground structures.
Impacts on landscapes and their components during the operation of the pipeline for both alternative routes will be indirect, long term (for the entire time of operation), permanent, negative. The impact will be local, along the pipeline route and indirect. The impact on landscape and visual perception during operation will be low rate.

The visual impact during operation will be for the people living in close proximity of the pipeline route. The pipeline shall be layed underground so after several years the traces of the construction works shall be visually reduced to certain extend due to agricultural activities.

Planting the sites with local plants will hide the facilities and help them to become a part of the landscapes. The landscape will have a low rate of impact with susceptibility from low to medium. In this way the significance of the pipeline and above ground facilities impact on the nature of the accepting landscape will be within the range of insufficient to low. The expected impact on residents is assessed as low rate due to the foreseen recultivation and follow up forestation of terrains after completion of construction works.

The recultivation of the facilities sites will be in compliance with Ordinance no. 22 regarding recultivation of destroyed terrains, improvement of low productivity lands, removal and utilization of humus layer, approved by the Ministry of Agriculture and Food, Ministry of

Environment and Water, Ministry of Regional Development and Public Works and the Forest Committee at the Council of Ministers, issued DV no.82 dated 22 October 1996, alt. DV no.30 dated 22 March 2002.

Considering the pipeline operation the Western route corridor is more profitable option for execution due to lower visual impact comparing with the Eastern route. Cleaning of wood and bushes plants and maintenance of the pipeline easement is required for both pipeline alternative routes during the operation. Along the Western route the visual cuttings that cause the visual impact will be less. The Western route will pass through larger open areas where the visual impact is less. The above ground facilities visual impact is expected to be the same for both alternatives during the pipeline operation.

4.2.5.3 In cases of emergency

During pipeline construction and operation, emergency cases may arise, which may result in an unforeseen impact on the pipeline, due to natural hazardous factors – floods, earthquakes, fires.

During pipeline operation some incidents may occur, due to fire and explosions, pipe rupture, as well as due to natural disasters (earthquakes, floods etc.). By keeping strictly the safety requirements and implementing appropriate operation of the installations, the risk of failures is reduced to minimum.
The exact impact on the landscape cannot be estimated.

The construction of the Western route of the pipeline is more profitable option based on the expected lower visual impact during the construction as well as during the operation of the pipeline and the above ground facilities.

The construction of the Western route of the pipeline is more profitable option based on the expected lower visual impact during the construction as well as during the operation of the pipeline.

4.2.6 Flora and fauna, protected areas

4.2.6.1 Flora

4.2.6.1.1 During construction

During the construction the impacts on the vegetation will be the same in type for both alternative routes. The impacts rate on vegetation and eco-systems will be lower referring the Western route due to the fact that this route passes through fewer protected areas and the probability for permanent negative impacts on protected and vulnerable species of plants and their habitats is less. Additionally the Western route alternative crosses less natural and semi-natural habitats (woodland, grasslands, meadows, rocks) in comparison with the Eastern route. Within the impact area of the Eastern pipeline route more natural habitats are observed that are important from conservation point of view, especially where the pipeline crosses the region of Ribino village and Boynik starting from Chayka village up to Studen Kladenetz village.

The pipeline construction is associated with excavation works that will be executed at stages and a follow up lay of pipes, construction of buildings and the required infrastructure. The initial construction activities within the construction strip will be vegetation cutting and root up, terrain uncovering followed by removal of the humus layer and the sub-humus earth masses and their temporary storage on the terrain. The impacts on the vegetation during the construction might be direct and indirect.

The direct impacts on vegetation are the following:

- Entire destruction of vegetation within the construction strip of the pipeline route. The construction activities impact for both alternative routes will be negative, direct, permanent, long term, local (along the pipeline route only). Secondary impacts are expected, but cumulative impacts are not expected. The impact rate will be low to medium for Western alternative route, and medium to high for Eastern alternative route. The impact on the agricultural areas will be low due to the fact that notwithstanding the entire vegetation will be cleared within the 30m construction strip the biocoenoses have relatively low conservation value. The meadows and grasslands are also agricultural lands that is why the impact on their biocoenoses might be significant due to biodiversity change. Considering the fact that the area for both pipeline route alternatives is relatively small the overall impact on them can be assessed as low to medium rate. Secondary indirect impacts are possible, such as invasion of non typical, ruderal and invasive vegetation and communities’ type structure changes. The impact rate on woodland can be assessed as medium for the Western alternative route and medium to high for the Eastern alternative route due to cutting of the entire forest plants within the construction strip and wood and brush vegetation cleaning of the pipeline easement for maintenance in compliance with the design and regulation requirements. The impact rate for the Eastern route alternative is higher due to the fact that the route passes through larger areas of woodland. Positive compensation is that the easement to be maintained is narrow and the fragmentation of the woodland coenoses is insufficient. The majority of the afforested areas for both pipeline route alternatives are forest plants (mainly coniferous – black pine) that have low conservation value.

- Vegetation destruction and biodiversity temporary change at river and reservoirs crossings. The impact will be negative, direct, permanent, long term, local (at places of river crossings only) for both pipeline routes. Secondary impact is expected but a cumulative impact is not expected. The impact rate will be of low to medium in case that all the technical requirements are followed during the construction. The execution of river and reservoirs crossings is foreseen during the dry period of the year when water volumes are less and the impact rate will be low. The impact rate for larger reservoirs crossings will be medium. The impact is recoverable due to the rehabilitation and recultivation of the disturbed areas that will be executed after the completion of the construction works.

- Fragmentation of habitats and populations, including typical species for the habitats, by creating artificial barriers (excavations, fences, draining facilities etc.). The habitat is considered to be fragmented in case the habitat territory is unique with linear infrastructures and fences or other kind of construction interrupting the connections between the different parts of the habitat. This is applied also for cases in which the barriers are between two cadastral terrains that preserve one and the same habitat excluding the existing roads, at the time of the studying, within the Republican roads network or other sustainable public infrastructure. This impact will be negative, short term, of low rate for the agricultural land and medium to high for the woodlands along the Eastern route alternative, low degree in the agricultural territories, and medium to high in the afforested areas along the Eastern route. The impact will also be long-term, local (along the pipeline route). A secondary impact is expected due to biodiversity change. Cumulative impact is not expected.

- Fragmentation of habitats of protected, vulnerable and critically endangered flora and fauna species on the territory of Protected Natura 2000 sites, which are crossed by the pipeline route. This impact will be negative, permanent, of low rate, long-term, local (along the pipeline route). The impact rate along the Eastern route will be more significant, due to the fact that the route passes through a lot of protected areas. Secondary impact is expected, due to biodiversity change. Cumulative impact is not expected.

- Dusting of habitats (near the pipeline route and the roads), trampling of the terrain, damaging of the typical species normal population structure and followed up deterioration of ecological structure of the habitats themselves. This impact will be negative, permanent, low rate, long-term, local (along the pipeline route) for both alternative routing corridors. Secondary impact is expected, due to biodiversity change. Cumulative impact is not expected.

- Possible pollution and change of vegetation populations along the pipeline route as a result of produced and accumulated waste, spill of construction machines fuels and lubricants. The impact will be negative, permanent, low rate, long-term, local (along the pipeline route) for both alternative routes. Secondary impact is expected, due to biodiversity change. Cumulative impact is not expected.

Indirect impacts on vegetation are the following:

- Invasion of ruderal and invasive plant species, not typical for the natural habitats. These species change the type structure and habitats and deteriorate the environmental condition and can be rivals to the local and typical species for the habitats. The expected impact will be negative, indirect, permanent, long term, local (along the pipeline route) for both alternative routes. Secondary impact is expected, due to biodiversity change. Cumulative impact is not expected. Considering the relatively small width of the construction strip and the short period of construction, it is expected that the local species will develop rapidly, without giving a chance to invasive species to develop stable populations. The ruderal and invasive species that are atypical for the natural habitats and are likely to invade within the pipeline route during the Investment proposal execution, for both alternative routes are listed in ***Appendix 8.3.***
- Possible negative impacts are related to potential failures, risk of fires, pollution of areas in close proximity of the route, due to availability of people and machines during the facilities construction. The particular impacts on the vegetation cannot be foreseen.

During the equipment demobilization along the pipeline route, a positive impact is expected, which will be permanent, long terms, local, direct and of medium rate. The impact will be a result of implementation of terrain recovery and areas recultivation. More profitable option is the Western route alternative due to the fact that the destroyed woodlands will be less, resulting in less destructed vegetation and habitats of vegetation species along the pipeline route.

4.2.6.1.2 During operation

No impact is expected during pipeline operation on grass vegetation habitats after the completion of the construction and recovery phases.

Fragmentation of habitats and populations is expected for the forest habitats, including fragmentation of typical species for the habitats, within the easement of the pipeline. The impact will be negative, permanent, long term, local (in the woodlands along the pipeline route only), indirect for both alternative routes. The impact rate is expected to be medium for the Western alternative route, and medium to high for the Eastern alternative route, due to the larger area of woodlands that will be disturbed. The impact on the agricultural areas will be temporary and short-term, and on the woodlands it will be permanent and long term.

Secondary impact is expected. Cumulative impact is not expected. The impact rate will be medium and non-recovery for the pipeline easement only. In this secured area growing of any wood and frutex vegetation is not allowed and the fragmentation will be permanent. Beyond this area, the wood vegetation will be restored in a longer period of time.

Regarding the expected impact the execution of the Western alternative route will be a profitable option due to pipeline passing through smaller areas of woodland and mountains and less destruction rate.

4.2.6.1.3 In cases of emergency

Emergency cases may arise during construction and operation phases, which might cause an unforeseen impact on the pipeline, due to natural hazardous factors - floods, earthquakes, fires, which may possibly impact upon the vegetation species and habitats along the pipeline route.

During the operation, emergency cases are possible to occur, due to fire and explosions, pipeline failure or natural disasters (earthquakes, floods etc.). The strict execution of safety requirements and appropriate operation of the facilities will reduce the risk of failures to minimum. The specific impact rate on the vegetation cannot be foreseen, due to non availability of risk assessment project.

4.2.6.2 Fauna

The assessment of the Investment proposal impact on the fauna is preliminary and based on the expert evaluation and the results of the environmental study on current conditions. The assessment also takes in account the technical description of the foreseen project activities. The estimation is based on the principle of cautiousness (considering the worst possible scenario) and the case when all designated suitable habitats are occupied.

During the construction phase the following facilities will be erected: transmission pipeline, offtakes, gas regulation stations, launch and receive traps, upstream and downstream gas metering stations, line valves stations, outside infrastructures of each pipeline elements sites. The main activities associated with the construction are: terrain preparation and removal of the surface humus layer, trench excavation, installation of above ground facilities, draining (dewatering) system, area recovery after the lay of the pipes. In general the activities like transport of the required materials, equipment, staff to the sites and back, disposal of accumulated waste, purifying of water used for household needs, waste water treatment are taken into consideration.

In general, during the Investment proposal execution (construction phase) the following **direct impacts** are expected:

During the construction phase the following **direct impacts** are expected:
Loss of habitats – During the construction the habitats along the routing corridor will be destroyed. The loss of habitats is permanent and non-reversible for woodlands covered with frutex vegetation and rocks, while in the open areas it will be temporary and reversible. Recultivation is possible only in the area of the servitude, where new species inhabiting open territories with shallow root systems will populate these areas. Crossings of water streams and wet zones is associated with their corrections (in the cases of open cut crossings), which can be the cause for local loss of habitats – removal of vegetation and riparian trees. Crossing of overwet areas, swamps, and damp areas (including small river valleys) can result in their dry up. Loss of nutritive habitats of raptors occurs as a result of ground squirrels colonies destruction in the grasslands, located along the route. Cutting of trees with nests of raptors, as well as trees suitable for nesting, also results in habitats destruction.

Fragmentation of habitats – All habitats along the route will be temporary affected during the construction. However the majority of them are expected to be restored. The fragmentation of habitats during the construction will be temporary. Regarding the forest habitats it will be permanent and non-reversible due to keeping the pipeline easement uncovered with forest vegetation during the phase of operation.

Mortality – During the construction works some destruction of birds hatch or nests with offspring is possible. This is the case for route sections where endangered and rare species nidify. At cutting more than 50 years old trees, especially during bats reproduction period, the mortality of species living in hollows and loose roots as their daily shelter is possible. This direct impact might be eliminated to a certain extent during the execution of the preliminary route preparation beyond the reproduction period.

Disturbance – The disturbance of species during the construction works is caused by the intensive motion of construction machines, supporting transport machines and human presence. They are a source of noise, vibrations, light at night etc., which will disturb the fauna in the neighboring area. As a result, the animals will keep away from the territories of construction works, and this might send them away from their nests, feeding places and reproduction. The noise impact rate depends on the construction machines and equipment, the area profile and the flora, the distance from the construction works, the animal species mobility, as well as the sensibility of each species to noise and other disturbance factors. The harmful emissions released in the air (dust from the excavation – backfill works along the pipeline route and from the construction machine engines) and the vibrations also contribute to deteriorate the fauna species habitats quality.

During the phase of operation the impact of the Investment proposal includes the following aspects:

Fragmentation of animal populations in woodlands on both sides of the route (due to maintenance of the pipeline easement). A substitution of neighboring communities will occur, as a result of the population of species inhabiting open areas.

Noise disturbance from the maintenance work on outside infrastructures for all pipeline elements sites – these impacts can be assessed as direct, short term, permanent (repeatable within certain periods of time), occurring only in the areas of the above ground facilities. We can assume that the representatives of vertebrate fauna will adapt to them very quickly, considering the permanent character of the caused disturbances.

During operation the pipeline is not a source of harmful physical factors such as light and heat radiation and electromagnetic radiation. During the pipeline operation individuals' mortality is not expected.

To prevent gas leakage during incidents vents are foreseen to blowing out the gas and depressurize the separate pipeline sections. Nevertheless there is a risk of fires that will cause hard to recover damages on the fauna within the fire region.

To prevent the negative impacts mitigation activities will be applied including appropriate planning of the construction works.

4.2.6.2.1 Birds

4.2.6.2.1.1 During construction

The species inhabiting the grass habitats (mainly grasslands with frutexes), the woodlands and small groups of trees, can be defined as potentially and significantly affected, as a ***loss of their habitats*** is expected. The loss for forest habitats along the construction strip is permanent and temporary for the area beyond due to the possibility of cutting trees with nests or trees suitable for nesting, as well as cutting and clearing a band close to the nests. An example of a strong sensibility to human presence is the black stork which nests are at densely overgrown areas with difficult access. The majority of raptors for many years use one and the same nests located on big and old trees. In a similar way, the susceptible species attached to water sites and water streams are vulnerable due to the risk of losing their habitats or sufficient habitats damage. In this sense the crossings of Studen Kladenetz dam, Maritza River and Arda River that are part of Natura 2000 are potentially vulnerable. The foreseen approach for the execution of the crossings through Studen Kladenetz dam and Maritza River along the Western route is HDD, and for Arda River crossing along the Eastern route is an open way of execution.
For the route open areas the loss of habitats rate during the construction period is defined as medium, and the frequency – temporary.

Mortality of specimens – as a result of the construction strip clearing and other activities during the construction period, death of specimens can be expected – when destroying nests and eggs, if the construction works are executed during the breeding season. Birds nesting on the ground, on trees in woodlands and open habitats along the pipeline route will be affected.

Most of the natatorial birds use the existing water sites during migration and wintering. Mortality of specimens of natatorial birds can be expected, in case the route passes through areas used for breeding and nesting.

Disturbance (noise, visual impact, lights) – The disturbance rate depends on the season. For all kinds of birds, the strongest impact is during their breeding phase. The expected impact is temporary for the construction period.
Highly sensible to light impact are the nocturnal birds, such as owls and some natatorial birds feeding at night. Generally, the expected impact rate for them is significant during the construction period.

Direct and indirect fauna impacts are expected during the pipeline construction. Strong negative impacts are expected especially on rare and conservation sufficient species from different kinds of animals, as well as on the territories of the affected protected areas. Affected areas are expected along the entire pipeline route (for both route alternatives). More serious impacts are expected on the territory of the Eastern Rodopi Mountain, mainly of the Eastern alternative route. Based on the above the preferable route is the Western alternative.

4.2.6.2.1.2 During operation

The pipeline easement will be cleaned from wood and frutexes vegetation and the typical species that live in the forest will be permanently affected by the loss of nesting areas.

A ***permanent fragmentation*** of forest and frutex habitats is expected within the pipeline easement. This will result in negative impact on the typical forest inhabitants with high susceptibility to fragmentation. The impact rate and significance is high.

Disturbance **–** the following activities during the pipeline operation can be the cause for birds' disturbance: cleaning of the pipeline easement in woodlands. If this activity is implemented for a short period of time, within a limited area and only during the day, then the impact rate will be low. Birds are very sensitive to such kind of impact during the breeding period while beyond this period the sensitivity is lower. The significance of the birds' impact during their breeding phase can be defined as medium, and it is low beyond that period.

Generally insufficient direct fauna impacts are expected during the pipeline operation. In some cases the impacts will be residual (from the construction phase) in other cases – long term (during the recultivation processes of the destructed habitats due to construction works).

Generally negative impacts during operation phase are not expected for most of the birds groups or they are going to be insufficient (for example – disturbance caused by transport machines and maintenance activities along the pipeline route). These impacts will be casual and short term.
Regarding the scope of the affected areas the impact is expected to be along the entire pipeline route (for both alternatives). More serious impacts are expected on the territory of the Eastern Rodopi Mountain, mainly for the Eastern alternative route. Based on the above the preferable route is the Western alternative.

4.2.6.2.1.3 In case of emergency

In case of fire resulting from emergency situation the impact on birds is expected to be long-term. The restoration period depends on the number of affected specimens of the populations of different kinds of birds. The impact rate depends on how big and intensive is the fire and what is the access to the place of fire. In general, the impact on birds is expected to be of low to medium significance.

4.2.6.2.2 Mammals

4.2.6.2.2.1 During construction

The pipeline construction phase is associated with the most negative impacts on mammals. The expected impacts on mammals are direct (fatality, destruction of animals, loss of fragmentation of habitats and colonies, disturbance) and/or indirect (limitation / destruction of feeding habitats).

Direct extirpation of specimens – The construction works and the associated activities can cause the death of specimens with low mobility. The excavation works along the route will affect mainly rodents and insectivorous. The souslik and dormice are especially endangered during the hibernation (most often the period between October and April). Cutting trees for the pipeline route when passing through woodlands may lead to fatality of single dormouse specimens (loirs, hazel dormouse, forest dormouse) during the summer period. The hedgehogs as slow mobile animals might become victims of the construction and transport machines. The destruction of lairs with cubs of different mammals is possible including predatory animals as well. So the construction works shall be executed beyond the breeding period for most of the mammals.

Loss of habitats and associated animals movement. As far as it will affect the majority of mammal species, the impact rate will be significant. The impact will be short term and reversible for the species whose habitats are beyond the construction strip, due to the relatively rapid restoration after the construction. Restoration of forest habitats is not expected, which will lead to a negative effect on dormice, squirrels, mountain voles, etc. The removal of the surface soil layer will negatively affect the species with preservation priority such as European souslik, marbled polecat and mouse-like dormouse, as well as mole and mole-rat.

Fragmentation of habitats and populations **–** A temporary and short term fragmentation of mouse-like mammals' colonies is expected during the excavation works, mainly in open habitats – grasslands, meadows and cornfields. Among the endangered species is the European souslik. Building of temporary wire fences, enclosing the construction works area, will be an obstacle for larger mammals (orders – predatory animals, rabbit-like mammals, and cloven-hoofed mammals), as well as for the hedgehogs. The trench fencing (a stripe of 200 m wide) around the water sites crossing points, areas with otters' habitats (the rivers Arda, Varbitza, Chitak dere, Djebelska, Harmanliiska, etc.) will lead to temporary fragmentation of the otters' habitats.

After the completion of the construction works the habitats and populations fragmentation will be terminated. Only the forest habitats fragmentation will have a long term impact. The impact on species like dormice, martens, squirrels, forest mice will be permanently negative but local.

Disturbance is a negative factor of particular significance for mammals. Some of the species are very sensible to human presence especially in low populated, isolated areas (for example the transborder areas for both pipeline route alternatives) or in the areas where these species are chased. The construction works related to the presence of people and machines, and generating significant levels of noise, and will undoubtedly cause disturbance to some species. Medium to significant levels of disturbance are expected for the species – wolf, otter, jackal, fox, badger, marbled polecat, foumart, marten, roe, wild-boar, royal slag. The disturbance for the small mammals will be insignificant. Bears are rare species for the endangered area so the pipeline construction will not cause disturbance of the species.

The impact will be mainly during construction phase. Generally it is reversible and after the construction completion the animals are expected to come back in the route area.

Deterioration of habitats quality – during construction works some pollution of the water sites by oils, fuels, chemicals and waste is possible that might lead to decrease of feeding base and deterioration of life conditions for otter. The strict following of the construction technology will minimize the impact and make it insignificant, local and short-term.

Generally we can conclude that during the construction of the Western route the expected impacts on mammals are insufficient to moderate, direct, short term and negative. The negative impact will be greatest on the small mammals living under ground for longer time within the year. During the construction of the Eastern route the expected impacts on the majority of the species and the endangered habitats are moderate to sufficient, negative ad direct. Based on that the preferable option is the Western route alternative.

4.2.6.2.2.2 During operation

Temporary habitats fragmentation is expected in the open areas at the beginning of the pipeline operation till the full recovery of the habitats. Within the woodlands, the habitats fragmentation along the pipeline easement will be long term. In this case the recovery takes longer time, especially for riparian woodlands. The easement strip will be recovered as herbaceous habitat for some of the affected groups of animals. The anticipated impacts will be insignificant, short term and local. The regular monitoring of the pipeline facilities conditions may lead to override of some specimens of small low mobile mammals along the pipeline route. The walking over and monitoring of the pipeline route may cause disturbance to some mammals having their lairs or feeding areas in close proximity to the routing corridor for example brocks, martens, weasels, marbled polecats, otters, wolfs, foxes and jackals. The Western route is preferable in comparison with the Eastern route that passes through larger woodlands and therefore relatively higher impacts are expected.

4.2.6.2.2.3 In case of emergency

Local, but significant negative impacts on the mammals may occur in case of incidents' gas leakage or explosion and the subsequent fire, which might cause direct mortality of specimens and deterioration of the habitats quality. The significance of such impact on mammals is expected to be high, the duration – long term considering the low reproductive capability and the small number of specimens in the populations. The impact rate depends on fire dimensions and intensity and its prompt restrict.

4.2.6.2.3 Reptiles

4.2.6.2.3.1 During construction

As a result of the project execution, the following potential impacts on the reptiles are possible during the construction phase: direct (loss or fragmentation of habitats, mortality, disturbance) and indirect (deterioration of the habitats quality). For the majority of the cases the impacts will be short term (during the construction only) and are expressed in the following:

Extirpation of specimens during construction – during the excavation works, the lairs and eggs of many species surely will be affected. Among the species that might be affected are the four kinds of turtles. Killing of single specimens is probable for all kinds of lizards and snakes too, especially during the hibernation period. All reptiles are endangered of killing by the moving machines which will be used during the construction. The speed of the moving machines is expected to be low which means that most of the different kinds of snakes and lizards can survive. More susceptible are that kinds of reptiles which are slower such as slow worm, duck-legged lizard. However in cloudy and humid weather the rest of the reptiles' species can easily be endangered even during summer period.

The reconstruction of the secondary roads within the border areas and other places as well as the building of new roads with break stone cover might also lead to killing of various specimens – tortoises, lizards, snakes, especially if the above activities are performed during the reptile's hibernation period, when their lairs are located in areas close to the secondary roads.

Specimens' mortality can be expected when reptiles fall in excavations, channels and rivulets during the construction as well as during the stabilization of the roads for access to the construction sites.

Destruction of habitats and associated displacement of animals **–** this impact affects the greatest number of reptile species. Habitats of all established species will be affected, and the area of the affected habitats will be small. The habitats' changes will be short term and reversible and after the phase completion the reptiles habitats will gradually recovered. The above is not applied to the forest and rock habitats which are essential for particular species like Aesculapian snake, common wall-lizard, Macedonian lizard and duck-legged lezard.

Disturbance and chasing away **–** in general, this factor has a slightly displayed negative impact on reptiles. On the other side all kinds of reptiles with preservation priority are highly susceptible. A temporary light impact, caused by the light resources around the construction and storage sites, is expected. The species with the highest susceptibility to such impact are the nocturnal species. The impact will be temporary till completion of the construction activities and within a limited area. Nevertheless movement to far away regions of every active specimen along the pipeline is expected.

Fragmentation of habitats and populations **–** for some larger reptiles species, the building of temporary fences and excavations might cause problems with their moving around (for example for tortoises and turtles), resulting in a short term negative impact.

Deterioration of habitats quality **–** Pollution of water sites with oils, fuels, chemicals and waste during the construction might lead locally to reduction of the nutritious base of some reptile species like water snakes and turtles. The utilization of surface water located along the pipeline route for hydrotests or other needs might result in local and temporary reduction of water volumes in given small water sites which can be crucial for the turtles.

Generally the conclusion is that during the construction of the Western route alternative the expected impacts on reptiles are insufficient to moderate, direct, short term and negative. The most affected species by the risk of direct mortality will be tortoises in some areas between Matitza River and the border with the Republic of Greece. During the construction of the Eastern route alternative the expected impacts on reptiles are moderate to sufficient, direct, and short term and negative, and the affected number of various species and the level of impact will be greater comparing with the Western route alternative. On the base of that the preferable option is the Western route alternative

4.2.6.2.3.2 During operation

Significant negative impacts are not expected during the pipeline operation. In the open habitats, temporary fragmentations will be available in the beginning of the operation period and with the time they will recover. In the forest habitats permanent fragmentation is expected, due to the slower restoration of wood-species. During repair and maintenance activities, some contiguous habitats of reptiles next to the route itself might be affected in a negative way, or some specimens representing species of animals of poor mobility might be run over. The frequency of such incidents is expected to be very low, so significant negative impacts are not expected. The maintenance of the pipeline easement will provide the possibility for new reptile species to settle, as well as using it as a corridor for most of the endangered groups of animals. During the remedial and rehabilitation activities a negative impact is possible on some reptile habitats close to the route or some slowly movable species to be override. The frequency of such incidents is expected to be very low therefore no sufficient negative impacts are foreseen.

4.2.6.2.3.3 In case of emergency

In case of fire due to failures (explosion of gas) the significance of the impact on reptiles is expected to be high, and the duration – medium or short-term, considering the different reproductive capability of the particular species. For terrestrial reptiles the impact is considered to be deterioration or loss of feeding bases. Depending on the fire strength the expected impact is of medium to high sufficiency.

4.2.6.2.4 Amphibians

4.2.6.2.4.1 During construction

Along the pipeline route a lot of amphibians’ habitats are established which probably are going to be endangered during the construction of the pipeline. (See Appendix 9).
During the construction phase the following amphibians impacts are possible: loss or fragmentation of habitats, mortality, disturbance, light or noise impacts, temporary isolation, (fragmentation) of populations, deterioration of the habitats quality etc.

Specimens’ mortality during construction – all main and auxiliary activities during the pipeline construction might cause death of some specimens representing most of the designated species of amphibians. During the excavation works a lot of the specimens’ eggs and larvae will be affected and for sure the resting places and the wintering areas of the species. The amphibians are slow mobile species and excavation works and machines activities along the water sites coasts will inevitably lead to specimens’ mortality especially of young and slow movable specimens. During the construction there is a risk of mechanical override of specimens’ eggs that is applied both for species that breed in water environment, as well as those that lay their eggs along the coasts. The impacts will be direct, negative and short term, local for most of the species. However for other species larger areas will be affected and specimens may die relatively away from the water site (for example salamander, common toad, and green toad, tree frog and space foot toad).

***Destruction of habitats* –** Very important for amphibians' water sites and associated habitats will be affected. These are the coasts and rivers shallow water sites, puddles, temporary flooded areas, water filled holes etc.
Some of the amphibians' habitats will be lost temporarily or permanently, and the specimens will leave them. During the construction part of these habitats are expected to be permanently modified due to draining of some overwet areas. Digging through water sites will result in muddy water. The above will lead to loss of habitats and feeding base, amphibians' respiration disturbances (*Triturus karelini, Bombina bombina, B. variegata, Pelobates syriacus*). Due to mobility capabilities of the above listed amphibians the expected impact is defined as medium and the impact significance for most of the amphibians - as medium to significant, due to their high sensitivity. The destruction of the grassland along the coast will be short term and recoverable. Amphibians' habitats will also be affected during secondary roads reconstruction and the construction of new ones with breakstone cover.

***Fragmentation of habitats and populations* –** the construction strip will cause temporary fragmentation to amphibians' populations within the route area (*Bombina bombina, Triturus karelinii,* etc.), and part of one species population will be isolated from others. The free specimens movement will be disturbed. However for some species the crossing of the excavation sites will be impossible and their casual presence in these areas may end with their death. Nevertheless for some amphibians the impact will be short term and negative. The building of temporary fences and channels might be a problem for larger species like common toad, salamander etc. The wet meadows draining can possibly lead to permanent fragmentation of certain local amphibians' populations. However such affected areas along the pipeline route are not expected to be a great part.

Detiorioration of habitats quality – pollution of river waters and other water sites by oils, fuels and other chemicals during the construction, might lead locally to reduction of the nutritious base for some amphibian species and/or their larvae, deterioration of the water oxygen regime and other negative impacts of amphibians' living environment. The utilization of water from local shallow water sites for hydrotests or other needs may lead to local and temporary reduction of water volumes of some small reservoirs that might be crucial for the amphibians' species, especially during dewatered summer and autumn months.
***Disturbance and chasing away* –** in general for amphibians, this negative impact is slightly presented and is efficient within small distances only.

Nevertheless all active specimens along the pipeline route will leave the construction area due to the destruction of suitable habitats and also due to the increased disturbance. Generally the conclusion is that for both pipeline route alternatives the impacts on amphibians, that are expected during the construction works, are insufficient to moderate, direct, short term and negative. The most affected species will be slow movable species that often leave the reservoirs and go away from the coasts.

4.2.6.2.4.2 During operation

Temporary fragmentation within the affected by the construction reservoir areas is expected in the beginning of the operation period and with the time being the habitats will recover.

Possible disturbance of species is expected during the walking over and monitoring of the pipeline easement. The impact will be short term and insufficient.
Blowing out of gas during some routine activities will not significantly impact amphibians. During repair and maintenance works, some activities might be implemented that will lead to negative impact on amphibians, for example change of their habitats or run over by vehicles.

4.2.6.2.4.3 In case of emergency

In case of emergency (fire) the significance of the impact on amphibian species is assessed as medium.
At failures associated with gas explosion and/or occurrence of fire, significant local impact is possible resulting in fatality of specimens of all established amphibian species. Stronger negative impacts are more probable for species which spend more time on land, such as salamander, toads and Syrian spade foot.

4.2.6.2.5 Terrestrial invertebrates

The execution of the Investment proposal will have an impact on the terrestrial invertebrates that is expected to be of different levels depending on the various species. The impact depends on the species biology and their presence in the pipeline route area and the areas in close proximity.

4.2.6.2.5.1 During construction

During the construction works the following impacts on invertebrate species are expected:

Destruction of useful entomofauna (*mortality of specimens*) – the typical earth inhabitants using the soil permanently or temporarily as an environment and refuge, and having an essential part for the environmental balance, will be affected directly. The impact will be direct destruction of insects and their larvae, habitats environment and the habitats themselves and therefore it will be a permanent one. Mortality of specimens having high preservation value, including specimens that have fallen into the excavations is anticipated. Due to the relatively narrow strip of the pipeline route and considering the high conservation status of most of the species, the impact is assessed as significant. However due to their breeding potential the invertebrates are flexible to environmental changes.

Loss of habitats – Cleaning of construction strip will affect some of the beetles' (*Bolbelasmus unicornis, Lucanus cervus, Morimus funereus, Osmoderma eremita, Cerambyx cerdo, Rosalia alpina*) habitats and will impact the cankerworms along the pipeline route. Due to the fact that the most suitable habitats for these species are the old deciduous forest, particularly oak trees (*Cerambyx cerdo, Lucanus cervus, Rosalia alpina*); located along the borders of the forest habitats and the river coasts (*Bolbelasmus unicornis, Osmoderma eremita*), the impact on these species will be only during the construction phase when the route is cleaned from wood and frutex vegetations and the transport machines are moving. On the other hand along the construction strip new border habitats will appear, which will be inhabited by new species and this will have a positive effect on the invertebrates inhabiting open spaces.
This impact will be temporary and short-term, as rapid restoration of the natural herbal covering is expected after the construction works completion. The degree of impact is determined as medium. The cleaning from macrophythes prior to rivers purification (in cases of open cut crossing) will affect the dragon flies (*Ophiogomphus cecilia, Coenagrion ornatum*), which use the water vegetation as breeding substrates. This impact will be

temporary and short term due to the expected fast recovery of the natural grass cover after the completion of the construction works. One of the most serious threats for the *Vertigo* species is the cane cutting which will affect the breeding and feeding habitats as well as pupas' substrates. This impact will be permanent within the construction strip. The selection of HDD technology for large rivers crossing (direct horizontal drilling – the pipeline route construction is executed without open excavation works and temporary removal of the river bed or temporary change of the hydrological regime) guarantee the lack of such impact on the species.
The impact rate is defined as medium, considering the small width of the construction strip and the foreseen recultivation (recovery) of greater part of the area after the construction.

Fragmentation – fragmentation of habitats of creeping insects (Osmoderma eremita, Bolbelasmus unicornis, Probaticus subrugosu etc.) and some insects' larvae (Callimorpha quadripunctaria, Dioszeghyana schmidtii, and Eriogaster catax) is expected. Fragmentation is not expected for butterflies and grasshoppers. In general this impact will be temporary and short term and will last till completion of construction works. The fragmentation rate for terrestrial invertebrates will be low; the impact significance is defined as moderate due to the high conservation status of the species. For water invertebrates this impact will be low rate and with small significance.

Disturbance – disturbance of night invertebrate species is expected, caused by the light impact (*Eriogaster catax, Dioszeghyana schmidtii, Morimus funereus etc*.) that may cause their chase out of the construction strip. The impact will be temporary, till completion of construction works, and within a narrow area. That is why the impact rate is estimated as low, and due to the high sensitivity of most of the species, the impact significance is estimated as moderate.

In general the overall impact on the invertebrates is expected to be low, short term and temporary till completion of construction works and within a narrow area. Almost the same impact is expected for both pipeline route alternatives.

4.2.6.2.5.2 During operation

The impact will be low and mostly indirect (residual) caused by the damaged habitats, nutritive base and possible noise during the safety inspections. Permanent fragmentation of forest habitats along the pipeline easement is expected. The easement will be recovered as grass land habitat which can be used as a corridor for most of the affected groups of animals.
For the invertebrate inhabitants of forest habitats, the degree of impact will be medium, and for the species with high conservation status, the significance of the impact will be moderate.

4.2.6.2.5.3 In case of emergency

During failures and/or emergency situations (occurrence of fire for example) a significant local impact on terrestrial invertebrates is possible that may result in specimens' death, destruction of their habitats for a long period of time. The impact rate is estimated as significant, and the duration – medium or short-term, considering the different reproductive capability of particular species.

4.2.6.2.6 Bats

The execution of the Investment proposal will have an impact on bats that is expected to be of different levels depending on the different species – low impact (regarding 14 species that inhabit the territory only temporary as a hunting habitat - *Eptesicus serotinus, Pipistrellus nathusii, Pipistrellus kuhlii, Tadarida teniotis, Myotis daubentonii, Myotis capaccinii, Hypsugo savii, Myotis myotis, Rhinolophus ferrumequinum, Rhinolophus hipposideros, Rhinolophus blasii, Rhinolophus euryale, Nyctalus leisleri and Nyctalus noctula*) up to medium (for two species - *Myotis bechsteini* and *Barbastella barbastellus).* For the rest four species the realization of the Investment proposal in general will not affect them due to the fact that these species are very rare along the pipeline route (*Pipistrellus pygmaeus*, *Rhinolophus mehelyi*, *Myotis emarginatus* and *Miniopterus schreibersii*). The impact depends directly of the species’ biology and their availability along the pipeline route and the areas in close proximity. All of the identified impacts will be mainly during the construction phase.

4.2.6.2.6.1 During construction

Loss of habitats – The loss of some bats’ refuges during terrain preparation and route clearing is probable, especially when more than 50 years trees are cut. Specimens mortality is also possible when cutting trees during the active period of the life cycle of the species. (April – October). Loss of habitats is also expected during the preparation of rocky areas for the excavation works. In cases when cutting of old river coast trees is required there is a high possibility of daily habitats destruction. In any case the described impact will be long term due to the required long recovery time of the affected forest areas.

Fragmentation of habitats – during the project realization, a temporary and permanent fragmentation, due to deforestation of the construction strip, is expected. The impact rate is defined as low up to medium, due to the small width of the affected area (up to 16 m), and the significance of the impact – moderate to high for the species with a high conservation status. The impact rate is defined as medium and together with the high receptors sensitivity the impact significance is defined as high one. Deterioration of feeding bases quality is possible as a result of the construction activities. Considering the duration this kind of impact will be short term (mainly during the construction phase) and as impact rate – low.

Disturbance and chasing away is expected during the construction only, if temporary refuges of species like *Rhinolophus, Myotis, Nyctalus* and *Pipistrellus,* as well as free tailed bat *(Tadarida teniotis)* are located in close proximity (especially within areas with rock formations). Considering the duration this kind of impact will be short term – during the excavation works only, and of low rate.

Light impact – The impact on the bats inhabiting the affected by the construction works areas is indirect. It can occur as concentration of hunting specimens around the light recourses, attracting in the same time a lot of high insects that are bats’ main food. Generally no negative impact is observed.

During the construction phase the species that are affected with the highest rate of impact (medium) and the longest impact duration are two forest bats: ***Myotis bechsteini*** **(Bechstein's bat)** and ***Barbastella barbastellus*** **(barbastelle bat)**. Potentially the impact is expressed as loss of refuges when cutting above 50 years old trees with hollows and probable fatality for specimens if the cutting is during the breeding period. The impact might be sufficiently reduced by applying proper actions and realization of the Western route where the impacts on more favorable species habitats are sufficiently less. The changes in the nature of the favorable habitats for different bats’ species are insufficient and affect a very low percentage of the areas along the pipeline. The recovery of the grass cover with the typical for the area vegetation will result in insects density recovery. Therefore the nutrition potential of the affected areas along the pipeline route will be improved. The cleaned from forest plants route is expected to play the role of bats local migration corridor within км 0 to км 4 of both Eastern and Western route alternatives.

The project execution for both alternatives will impact – directly or indirectly the bat species to different rate. The impact rate difference can easily be seen comparing the affected areas of the favorable bat species habitats within the protected area Eastern Rodopi Mountain considering both pipeline routes alternatives.

As a result of the Investment proposal realization the affected area of the favorable habitats for 8 species, subject to protection within the Protected area Eastern Rodopi Mountain is approximately 3,5 times larger (affected area of 2926 daa) regarding the Eastern route selection comparing with the choice of the Western route (affected area of 818 daa).

Regarding bats impact the choice of the Western route will lead to considerably less impact rate considering the changes of favorable habitats nature as well as the direct impact on specimens in their refuges, especially some forest species (*Barbastella barbastellus* и *Myotis bechsteini).*

Table 3.6.2.6-1. Affected areas of different bat species favorable habitats along the alternative routes. The table includes only bat species whose impact rate as a result of the Investment proposal is different from zero.

Species	**Affected area of species favorable habitat along the Western route**	**Affected area of species favorable habitat along the Eastern route**
Rhinolophus mehelyi	90 daa	660 daa
Rhinolophus hipposideros	150 daa	420 daa
Rhinolophus ferrumequinum	150 daa	420 daa
Rhinolophus blasii	60 daa	360 daa
Barbastella barbastellus	64 daa	128 daa
Myotis capaccinii	90 daa	150 daa
Myotis emarginatus	150 daa	660 daa
Myotis bechsteini	64 daa	128 daa
TOTAL	**818** daa	**2926** daa

4.2.6.2.6.2 During operation

Negative consequences for bats populations during the operation phase are not expected or they will be of insignificant degree (disturbance by transportation machines and maintenance activities along the pipeline route). The probable impacts will be casual and short terms and in general will not affect the population structure and will not lead to fragmentation or a cumulative effect with other activities. The impact of both alternative routes will be equal during pipeline operation.

4.2.6.2.6.3 In case of emergency

A significant local impact on bats is possible in emergency situations (fire), which might result in direct death of specimens, as well as destruction of their habitats (mainly the forest one) for a long period of time. The impact rate is assessed as significant, and the duration – medium or short-term, considering the low reproductive capability and the time required for habitats recovery. The Eastern route impact is expected to be higher one considering the larger woodlands that the route crosses. On that base the Western route alternative is preferable.

4.2.6.2.7 Fish

4.2.6.2.7.1 During construction

Destruction of fishes' habitats will be observed during the construction works. After the construction completion the habitats will recover. The expected results from the execution of the pipeline open cut river crossings are wetlands hydrological regime changes and water basins turbidity. This may lead to dissolved oxygen reduction and harden the breathing of the fishes, destruction of feeding and death of specimens. Due to their mobility the fishes will get away from the affected area but the increased turbidity will lethally impact the fertilized fish eggs and larvae which are highly sensitive to environmental changes. Most affected by the construction works will be the demersal fish (*Barbus* sp., *Cobitis taenia, Sabanejewia balcanica*) which are less movable. This impact will be short-term and with no significant consequences for the local fish populations. During the HDD execution of pipeline large rivers crossings (Maritsa River, Arda River near to Studen Kladenetz dam), generally no impact on the fish fauna is expected as the river bed and banks remain unaffected by the excavation activities.

Fragmentation of habitats – lying of the pipeline river crossings will cause temporary short term fragmentation of fish habitats which can hardly cause significant desturbances of river continuum that will negatively impact the ihthyofauna. The impact rate and significance is assessed as low, and its duration – temporary and brief, until construction completion and the disturbed flow recovery. In case the pipeline river crossing is consolidated, cemented and shoots on both ends of the river crossing are build the fragmentation will be permanent and the hydrological and ecological river passage will be disturbed at the relevant place.

Specimens' death –Death of fishes may occur during the construction works. The cause may be short term dewatering of the river (dam) areas during construction of open cut pipeline crossings that will affect mainly the hydrobiont eggs, larvae and the less movable and unmovable species. The construction works on the territory of the river beds for lying of pipelines will probably increase the water turbinity. The increase content of silt particles may cause their layover structures related with oxygen exchange (gills, skin, etc.) and result in hypoxia and death of eggs and larvae of fishes inhabiting the construction areas and the associated pipeline sections. The mortality of specimens will be caused by the construction machines and potentially the most affected species will be the less movable one and the demersal fishes.

Disturbance and chasing of specimens away – Disturbance is an important negative factor. For most of the fishes the disturbance is not desirous especially during the breeding session which usually is the period between May and July.
The noise and vibrations caused by machines and people's work along the pipeline route will also result in fish fauna disturbance. The impact will be temporary, until construction completion. Generally the duration of the construction works in water areas will be short. The expected impact will be short term and with different rate, depending on the technology applied.

Indirect impact on fish fauna is expected to be expressed in *deterioration of habitats quality* – the impact will be short term and local. The Investment proposal realization does not assume the invasion of atypical hydrobionts in water habitats.

Concerning the impacts on fishes the preferable alternative pipeline route is the Western route due to the fact that HDD pipeline crossings of large rivers (Maritza River, Arda River at Studen Kladenetz dam) no impact is expected on the fish fauna.

4.2.6.2.7.2 During construction

Negative consequences for the fish populations during the operational phase are not expected, or their degree will be insignificant (disturbance caused by transportation machines and maintenance activities along the pipeline route). The probable impacts will be casual and short term and will not lead to fragmentation or cumulative effect with other activities. Both pipeline alternative routes will have equal impact during the pipeline operation.

4.2.6.2.7.3 In case of emergency

In case of incidental fire and/or uncontrolled natural gas leakage an insufficient local impact on fishes is possible. The impact will be a disturbance due to noise and vibrations by the machines and people works along the pipeline route close to reservoirs. The impact will be temporary until remedy of the incident damages. The impact degree is assessed as low, and the duration – short-term – i.e. the time required of the recovery works in the affected area.

4.2.6.2.8 Aquatic invertebrates

4.2.6.2.8.1 During construction

Destruction of habitats and specimens death – the execution of the open cut river crossings along the pipeline route is expected to result in the increase of water turbidity of the reservoirs. This may lead to dissolved oxygen reduction and harden the hydrobiont's breathing, destruction of feeding and death of specimens. Due to the benthos organisms poor mobility, the excavation works and the increased water turbidity will have a lethal impact on aquatic – aerial insects' larvae that are highly sensitive to water quality changes. The expected impact on pearl oysters *Unio crassus*, that inhabits the rivers, through which both pipeline routes pass, is negative, but short term and will not affect the local populations of the species. The impact will be temporary and within limited areas. Benthos fauna recovery within the affected areas is expected so the impact rate is assessed as low, and the impact significant as moderate due to the high susceptibility of most of the species.
During the HDD execution of pipeline large rivers crossings (Maritza River, Arda River near to Studen Kladenetz dam), generally no impact on benthos fauna is expected as the river bed and banks remain unaffected by the excavation activities.

Fragmentation of habitats - lying of the pipeline river crossings will cause temporary fragmentation of habitats of significant conservation status such as aquatic invertebrates (Unio crassus, Austropotamobius torrentium), and all of the rest hydrobionts. The impact rate significance is assessed as low and the duration as temporary and short term till the construction completion and recovery of the disturbed flow.

Negative impact is expected but it will be short term and with insufficient consequences on the species local population, temporary till construction completion and within limited areas. The impact rate is assessed as low and considering the high sensitivity of most of the species, the impact significance is assessed as moderate.

The Western pipeline route is preferred due to HDD large river pipeline crossings (Maritza River, Arda River at Studen Kladenetz dam) which will not affect the benthos fauna.

4.2.6.2.8.2 During pipeline operation

Negative impacts on benthos invertebrate species are not expected during the operation phase or the impact rate will be insufficient. Possible impacts will be casual and short and will not destroy the population structure and lead to fragmentation or cumulative effect with other activities.

4.2.6.2.8.3 In case of emergency

In case of incidental fire and/or uncontrolled natural gas leakage, a temporal, insufficient, local impact on hydrobionts is possible, expressed in disturbance due to the noise and vibrations caused by the machines and people works along the pipeline route close to reservoirs. The impact will be temporary till failure consequences restoration. The impact rate is assessed as low, and the duration – short-term – i.e. the time required for the restoration works within the affected area.

4.2.6.2.9 Protected areas

4.2.6.2.10 During construction

After the revise of the Eastern alternative route and the EIA Terms of Reference for the Investment proposal and the coordination with the competent authority (MEW) both alternative pipeline routes do not pass through protected areas as defined in the Protected Areas Act. Therefore no impact on protected areas is expected during the construction works.

4.2.6.2.11 During operation

No impact on the protected areas is expected during the pipeline operation. The Investment proposal does not pass through protected areas as they are defined in the Protected Areas Act.

4.2.6.2.12 In case of emergency

No impact is expected on the protected areas located in close proximity to the pipeline route in case of emergency (fire, flood, and earthquake).

4.2.6.3 Protected areas

4.2.6.3.1 During construction

The impacts on the protected areas during construction will be the same as a type of impact for both alternative routes. The impact rate will be lower for the Western alternative route due to the fact that the pipeline route passes through fewer protected areas and the probability to occur permanent negative impacts on protected and susceptible vegetation species and their habitats is less.

The protected areas impacts during construction might be direct and indirect.

<u>Direct impacts</u>

- ***Destruction of habitats*** - Direct destruction of habitats is expected as a consequence of the construction works related to excavation of earth mass, cutting and extirpating of natural and semi-natural vegetation, disposal of waste from the construction activity on the natural and semi-natural vegetation, wetlands hydrological regime change, damages during infrastructure creation and maintenance. The destruction of habitats will be along the entire pipeline construction strip with width of 30 m and 20 m (at Kirkovo forest). The impact will be direct and unreversed within the pipeline easement that has to be maintained clean from wood and frutex vegetation. The impact rate will be low to medium for the Western route and low to medium for the Eastern route due to the larger areas of woodlands within the protected areas that will be cut down during the construction works. For the rest of the areas the changes of habitats will be more often short terms and reversible and after the underground laying of the pipeline most of the mammals habitats gradually will recover. Considering that the cultivated lands will fully recover after the construction phase it is assumed that no loss of habitats is expected.

- ***Fragmentation of species populations and habitats –*** The construction of a line with significant length and width is a factor for actual fragmentation of amphibians, reptiles, mammals and birds habitats. Significant rate of habitats fragmentation, although with periodical pattern, is expected to occur mainly during construction due to the execution of long excavations and embankments. During construction temporary and short term fragmentation of some mammals’ colonies is expected especially mammals inhabiting open habitats such as pastures, grasslands, fields due to the built temporary wire fences that are barriers for the animals movement. The habitats fragmentation has a cumulative effect on the existing infrastructure and / or other elements causing fragmentation.
- ***Mortality of specimens*** – The construction works and the associated activities (excavation activities, building of temporary roads, construction and installation works, and passing of construction machines) might cause death of specimens of species with lower mobility, fragmentation of habitats. During dewatering of terrains, some reservoirs shores are possible to be destroyed and/or modified which may cause mortality of adult specimens, eggs, larvae of waterside animals. Fatality for hydrobionts (fish, invertebrates) is also possible. In case the cutting of trees along the pipeline route is performed during the breeding or wintering seasons, death of specimens may occur regarding the group of the forest bats. Every species inhabiting old trees hollows located within the construction area will be potentially affected.
- ***Barriers for normal functioning of habitats –*** Creation of barriers: excavations, fences, dewatering and embankment facilities, which cause fragmentation of habitats and populations, including vegetation and animals which are typical for that habitats, disturb or completely interrupt the genetic and coenotic exchange between them, and lead to deterioration of their protective condition.
- ***Disturbance of animals –*** this impact will mainly affect the mammals, and in a smaller degree amphibians and reptiles, and will be the most salient during the construction. The strongest expression of this impact will be in the border regions crossed by both alternative pipeline routes, located in the protected area “Eastern Rodopi” where animals are not used to human presence, or they are regularly hunted. The impact will be as consequences of human and machines presence and the high noise level within the construction sites. The expected impact on the majority of the species, inhabiting the territories (wolf, marble polecat, and otter) will be moderate and significant at some places, local (along the pipeline route). The impact rate on small mammals will be insufficient (European ground squirrel and mouse-tailed dormouse). The bats disturbance and the probable specimens chasing away is expected due to the occurrence of anthropogenic noise and vibrations during the construction works and the performance of the excavations. The hydrobionts, especially the fishes, inhabiting the areas of the Investment proposal realization will be directly affected during the construction works.

The expected impacts will be negative, direct, short term for the cultivated areas and long term for woodlands, low rate for the Western pipeline route and low to medium rate for the Eastern alternative route, long term and local (along the pipeline route). Secondary impact is expected due to biodiversity changes. A cumulative impact is expected.

<u>Indirect impact</u>

- ***Deterioration of the habitats' quality* –** activities, such as trampling down; cleaning the areas of vegetation; noise, dust and light pollution and increased anthropogenic presence will result in specimens chase away, destruction of the normal habitats population structure, destruction of feeding base for a lot of the species. Cutting of wood plants and permanent loss of forest habitats, pollution of amphibians' and aquatic species water habitats due to fuel and oils wastes during construction will result in the deterioration of the ecological structure of habitats and phytocoenoses. Local quality deterioration of habitats of species inhabiting the protected areas might be expected. Dewatering of wetlands caused during the construction of pipeline rivers and reservoirs crossings or by the displacement of small water sites (connected with their filling up) will additionally cause a negatively affect on the surrounding habitats and sometimes that impact might be on a larger area.
- ***Increased risk of fires* –** the people and machines movement and work increase the risk of fires and may lead to destruction of species and habitats that are to be protected within the area. Most of the fires result in deterioration of the living environment and the feeding base.
- ***Invasion of atypical species into the habitats of the protected areas* –** An invasion of atypical, invasive and synantropic fauna and flora species (weed and ruderal types of vegetations) is possible during the construction of the pipeline and the associated facilities, and the movement of the construction machines. These species will change the type structure of the habitats and the species habitats and will worsen the protected environment. The atypical invasion species might be enemies or competitors to different fauna or flora species – subject of protection within the area, as well as for the species that are typical for the habitats. The construction works do not create any conditions for atypical hydrations invasion in the water habitats.
- ***Impairment of stable environmental development of the protected areas* –** The anthropogenetic activities on the territories permanently injure the unique value of the nature components and rapidly abate the stable tourism which goal is to show the nature outstanding features of the region such as species and habitats – subject of protection within the area.

The expected indirect impacts will be negative, indirect, permanent, long term and local (along the pipeline). Secondary impact is expected due to biodiversity changes. Cumulative impact is also expected.

More detail information regarding the area and the impact rate for the protected area is given in the Conformity Assessment Report, an Appendix to EIA Report.
The Western alternative route is more favorable option considering the fact that less protected areas will be affected during construction.

4.2.6.3.2 During operation

The expected impacts during operation are indirect and due to species disturbance. The impact will be mainly on mammals and to lower extent on amphibians and reptiles. During the regular maintenance activities the impact rate will be low to insignificant. The expected disturbance will be on bats due to the increased noise and vibrations level.

The risk of fires is higher during pipeline failures at the time of pipeline operation. The proper operation, following the regulations requirement does not assume and increase risk of fires.

The impact will be negative, permanent, long term, local (along their pipeline), indirect, low rate for the Western pipeline route and low to medium for the Eastern alternative route. The impact on the cultivated areas will be temporary and short term, and on woodlands permanent and long term. Secondary impact is expected but cumulative impact is not expected.

More detailed description of the actual impact on the protected area, habitats, fauna and flora species is given in the Conformity Assessment Report, an Appendix to EIA Report.

The Western alternative route is more favorable option considering that during operation less protected areas will be affected.

4.2.6.3.3 In case of emergency

Air, water and soils explosions pollution due to incidents of the existing and newly build infrastructure result in species mortality, deterioration of environmental conditions and destruction of habitats and risk of fires.

Incidents associated with gas explosions probably will result in fatality for animals and local deterioration of habitats quality. That is why, maintenance and secure of pipeline safety operation shall be of especially high level within the European ecological network Natura 2000 protected areas.

4.2.7 Cultural heritage

The construction of both pipeline alternative routes affect the safety areas of 107 (hundred and seven) archaeological objects including 54 (fifty four) along the Western alternative route, 24 (twenty four) along the Eastern alternative route and 29 (twenty nine) along the common route. Disturbances are expected during the construction only, as the excavation works might lead to destruction of the archaeological immovable cultural heritage and their protective zones. The expected impacts are only some destruction during the construction such as excavation works that may lead to destruction of immovable cultural heritage and their safety zones.

4.2.7.1 During construction

During construction a negative impact is expected on some of the archaeological immovable cultural sites and their safety zones that are located within 20 m strip on both sides of the pipeline. A negative, direct and temporary impact is expected. During the pipeline construction, the integrity of the archaeological sites structures located within the pipeline easement or in the close proximity will be damaged. The impact will be continuous due to the permanent damage of the archaeological structures integrity. Cumulative and combined environmental impacts are not expected. These archaeological sites shall be investigated - partially or completely, according to their nature and spatial structure.

4.2.7.2 During operation

The operation of the natural gas transmission facilities does not impact the cultural sites located within the area of facilities operation. The pollution of the archeological sites by harmful emissions and waste will not directly affect the condition of the existing within the area of operation cultural and historical heritage sites. The threat is the potential environment pollution. In that case the level of immovable cultural heritage damage will be the same as for the entire environment.

During operation the immovable archeological cultural sites and their safety zones, located in close proximity, will not be affected.

4.2.7.3 In case of emergency

The pollution of the archaeological sites by harmful emissions and waste will not directly impact the condition of the cultural and historical site located close to. The threat is the potential environment pollution. In that case the level of immovable cultural heritage damage will be the same as for the entire environment.

4.3 Sanitary and health aspects of the proposed technology and expected impact on population and workers

4.3.1 Hazardous materials

4.3.1.1 During construction:

Based on the analysis of the technological processes during the construction, the main construction works, the prime and row materials, machinery and equipment used, the following kinds of possible emissions of hazardous materials have been outlined:

- ***Dust emissions*** during the earth works and transportations of materials and construction waste. Dust producing construction works are: mould removal and disposal, excavation works for trench shaping to lay the pipeline and platforms for the cleaning equipment, trench back-filling, remedial work on the construction strip, the complex construction works on reservoirs, roads and railways crossing; construction waste.
- ***Emissions of worked-off gases from the construction machines*** depending on the composition of the mechanization unit. During the construction, fuels for the construction machinary are used, mainly diesel oil. The expected emissions from using of diesel oil by the construction machinery include:

➢ first group of pollutants – SO_2, NO_2, CH_4, CO, CO_2, N_2O, NH_3, Volatile organic compounds (VOC).
➢ second group of pollutants (heavy metals) – Cd
➢ third group of pollutants (stable organic pollutant) – polycyclic aromatic hydrocarbons, dioxins and uraniums, polychlorinated biphenyls
➢ fourth group of pollutants - soots

The amount of the emissions depends on the amount of the fuel used, depending on the composition of the mechanization unit and organization of the construction.

- ***Emissions from the fuels, motor and lubrication oils used* -** it is stipulated that unchlorinated oils on mineral basis will be used. They are produced by earth oil refining. Motor oil is composed of compound hydrocarbonic molecules. Refining results from a complicated process which aims in removing and reducing the harmful materials. Mineral oils are produced from so called base oil on mineral basis to which each manufacturer adds a certain set of additives in order to improve its properties. In this way, for example, from single grade base oils, the multy grade oils are produced. Additives improve the main functions of the oil as well. The oils of good quality have reduced content of metal particles, sulphur, phosphates, which contributes to good combustibility of motors and reduced releasing of harmful emissions. During the work and/or supplying with oils and fuel mixtures, vapours of Volatile organic compounds (VOC) might be released.

- ***Emissions from welding works***. The electrical power needed for welding works on the route (the pipes of the pipeline are made of low-alloyed steel with increased strength properties) is provided by diesel generators, and in the main warehouse bases it is supplied from the state power network. Electrodes used for manual electric arc welding of metals, are ones releasing minimum amounts of detriment, especially aerosols containing manganese and compounds of fluorine. Welding works are related to increased inflammability and explosion hazard.
- ***Waste –*** mixtures of concrete, bricks, roof-tiles, tiles, faience and pottery articles; soil and stones; unchlorinated motor, lubrication oils on mineral basis; smitherings, shavings and cuttings from ferrous metals; waste from welding.

4.3.1.2 During operation

In conformity with realization of the main and additional technological processes during the operation of "Gas Interconnector Greece - Bulgaria", the following kinds of emissions might be released into the atmospheric air:

- Natural gas (main content of methane CH4 – up to 95%);
- Other gases (chemical elements) – mainly chemical substances of combustion processes.

According to the data from the investor, the emissions which will be released by all the devices during the pipeline operation, will be about 300 m^3/y from the whole system. Indicated as sources of emissions are: filters venting during the pipes maintenance (releasing of small amount of gas), emissions from boilers for water heating (gas).

Natural gas. Natural gas is a multi-component mixture of hydrocarbons from the methane homologous series CnH2n+2, minor amounts of non-hydrocarbonic components, carbon dioxide, nitrogen, sulphuretted hydrogen and inert gases: helium, neon and argon. Apart from the elements listed, natural gas contains dust and water vapours as well, which are dissolved in it at its contact with the pore water in the bowels of the earth.

After its extraction, natural gas is refined by eliminating the water, propane, butane, sulphuretted hydrogen, sand and various admixtures. The natural gas supplied to the users contains mainly methane (98,52%), in smaller quantities ethane, propane, butane, carbon dioxide, nitrogen, sulphuretted hydrogen. The simplicity of the metane molecule, due to the low proportion of the carbon toward hydrogen, gives advantages to the natural gas over other fossil fuels. Natural gas burns out without producing waste products which pollute the air or cause acid rains. In contrast to other fossil fuels, during natural gas combustion, considerably fewer greenhouse gases are released. The substitution of traditional energy materials by natural gas leads to reducing of harmful emissions and improving the natural and living environment condition.

In conformity with "Procedure for calculation on balance methods of the emissions of harmful materials (pollutants), released into the atmospheric air", MoEW, 2000., CORNAIR-94 and SNAP-94. Natural gas is lighter than the air (with volume density of 0,765 kg/m^3) and it rises high in the air during its emitting. It is not indicated as a pollutant in the atmospheric air according to Bulgarian and European legislation.

Emissions from combustion processes – during the combustion processes mainly CO_2, CO, SO_2, NOx are released, but at natural gas burning, the materials released are in very low concentrations compared to other fuels. The emissions of CO_2, are 2715 g/kg (for petrol it is 3175 g/kg, for diesel – 3142 g/kg), the emissions of CO – 0,332 compared to 0,565 for petrol and 0,572 for diesel), SO_2, - 0 g/kg (for petrol – 14 g/kg, for diesel – 0,7 g/kg); NOx, – 2,102 g/kg (for petrol 5,363 g/kg, for diesel -2,384 g/kg). Natural gas provides ecologically clean natural and working environment.

Waste – mixed household waste, smitherings, shavings and cuttings from ferrous metals; dust and particles from waste from ferrous metals; waste from welding.

4.3.1.3 In case of emergency

In case of emergency – fire, increasing of preasure over 10 % of the maximum, earthquakes etc.) it is possible to occur uncontrollable increasing of natural gas emissions, arising of highly inflammable and explosion-hazardous situation, gassing of workers and/or population. Other dangerous materials might be released too – methane, sulphur dioxide.

4.3.2 Harmful physical factors

4.3.2.1 During construction

The construction of "Gas Interconnector Greece - Bulgaria" is not a source of light, heat radiation or electromagnetic radiations, that is why they are not considered hazardous for the population and workers.

The most important physical factor of health significance during the pipeline construction is noise. During the construction, ***noise*** can arise from the following activities:

- Traffic of heavy freight machines (carrying the pipes, equipment etc.) within the construction work area and along the closest roads;
- Using of devices for earth excavating and pipe laying (along the pipeline route).

The construction machines are sources of noise and vibrations within the construction site. The average noise level in sites of this type reaches about 85 dB (A). The people working within the construction site shall use personal protective means (silence headphones).

The largest noise impact for the population and workers is expected during the construction period for the Above ground installations. During this period, about 500 vehicles are expected to pass in the time between 7.00 and 19.00 h. The noise produced by a lorry varies from 50-78 dB(A).

The transportation traffic is not expected to be congested. It will depend on the schedule of construction materials, machines and pipes delivery. The pipes will be delivered consecutively for each section stage-by-stage. It is stipulated that the existing roads will be used where possible. Otherwise, temporary roads shall be made both in the woodlands and agricultural lands. The maximum loading of the roads can lead to an insignificant change of the noise, but this will be out of the urbanized territories.

Vibrations (on the whole body and on the arm-shoulder system) refers only to the people working on the construction site. For them it is necessary to meet the requirements for protection of people working in vibration impact conditions, which are considered in Ordinance №3/05.05.2005. A vibration impact on the population cannot be expected during the construction due to the remoteness of almost all the pipeline parts, as well as due to the fast attenuation of vibrations in the distance.

Regarding ionizing radiation, a possibility for harmful impact exists for the workers doing the X-ray quality check. The limit of the effective dose for workers in the conditions of ionizing radiation, is 100 mSv in the course of 5 contiguous years, and the maximum effective dose for each year cannot exceed 50 mSv. The limit of the yearly effective dose for each person from the population is 1 mSv.

Non-ionizing radiation. The welding works are related to emission of **ultraviolet (UV) radiation**, which has an unfavourable impact on the welders.

The welding works control will be done by using **ultrasound**, and the measurement technology does not create risk of ultrasound impact on humans.

During the operation **electric power** is used for control of valves in the Block valves, instruments, as well as for cathode protection.

There are no additional powerful power systems to be used during the construction stages and to create radiation conditions for the workers or the population at local level, in the construction works areas.

During the construction, an impact is expected by the harmful physical factors, and the most important physical factor of health-significance during the construction is noise – caused by heavy-freight vehicles, light vehicles, welding machines and systems etc. The impact is insignificant, local along the pipeline route, brief – during the day only, temporary – during the construction of the pipeline respective section, and it is on the construction workers. An impact on the population is not expected.

4.3.2.2 During the operation

The operation of the investment proposal site is not a source of harmful physical factors such as light, heat radiation or electromagnetic radiation.

During the operation no harmful impacts are expected with regard to the physical factors noise, vibrations, ionizing or non-ionizing radiation.

The gas transportation technology does not include sources of physical factors. The communication is through optical connections, the pipes are laid underground for the most of the route, because of which it is not possible to induce currents and voltages from the available high voltage distribution lines of the national electric distribution network. There are no power sources linked to any emissions of SLF (super-low frequency) electrical or magnetic fields. During general reviews and inspections of the pipeline, light vehicles using the operative transportation network will pass, which is not expected to make an impact.

4.3.2.3 In case of emergency

There are no conditions for emissions of physical factors in any case of emergency. If transportation or construction machinery is necessary to be brought, the impact of noise and vibrations from the transportation or construction machinery is on the workers only. The impact is brief, temporary, local and does not concern the population in the regions.

4.3.3 Defining of the population and territories potentially concerned

The pipeline route passes through 3 regions (Kardjali, Haskovo and Stara Zagora) and 10 municipalities (Kardjali, Djebel, Kirkovo, Krumovgrad, Momchilgrad, Haskovo, Dimitrovgrad, Stambolovo, Stara Zagora, Opan).

The settlements in proximity of the pipeline route are presented in Table 4.3.3-1 and Table 4.3.3-2. The settlements up to 2000 m from the route are presented.

Table 4.3.3. -1 Settlements in proximity of the Western route

№	**Settlement**	**Population** Number of residents (NSI, 2011)	**Area of the settlement (km^2)**	**Location and remoteness of the settlement from the pipeline route (m)**
1.	Lozengradsi	269	14.320	340m - west
2.	Shumnatitsa	530	19.199	1200 m - west

№	Settlement	**Population** Number of residents (NSI, 2011)	**Area of the settlement (km^2)**	**Location and remoteness of the settlement from the pipeline route (m)**
3.	Orlitsa	248	13.842	1400 m - east
4.	Apriltsi	144	1.734	650 m - west
5.	Kirkovo	685	2.964	230 m - west
6.	Zavoya	351	4.282	1200 m - west
7.	Fotinovo	850	7.355	880 m - west
8.	Shoptsi	391	2.816	950 m - east
9.	Ostrovets	342	3.001	840 m - east
10.	Parvitsa	353	5.362	140 m - east
11.	Metlichina	162	3.450	1400 m - west
12.	Samodiva	284	7.040	1150 m - west
13.	Domishte	454	7.877	535 m - east
14.	Krilatitsa	157	17.000	160 m- west
15.	Varben	496	5.854	300 m - east
16.	Karchovsko	201	5.194	202 m – west
17.	Bregovo	101	2.475	700 m – west
18.	Velikdenche	309	4.462	450 m - east
19.	Zagorsko	149	5.624	105 m – east
20.	Polyanets	126	3.034	1350 m - east
21.	Sadovitsa	57	4.710	860 m - east
22.	Slanchogled	211	4.901	400 m - east
23.	Sedlari	190	2.366	310 m - west
24.	Momchilgrad	7827	16.198	1800 m - east
25.	Balabanovo	121	10.628	250 m- east
26.	Varhari	138	4.567	450 m - east
27.	Gluhar	997	2.939	300 m - north
28.	Vishegrad	292	1.971	100 m - north
29.	Ostrovitsa	233	5.149	350 m - east
30.	Kardjali	45482	30.754	1200 m – east
31.	Sedlovina	271	7.019	160 m - east
32.	Panchevo	217	4.324	60 m – west
33.	Zimzelen	110	2.023	1150 m - west
34.	Gaskovo	85	2.583	230 m – south
35.	Zvezden	128	3.832	640 m – west
36.	Oreshnitsa	163	9.242	350 m – east
37.	Bolyartsi	138	6.697	690 m – east
38.	Stremtsi	595	9.815	700 m – west
39.	Lyulyakovo	294	3.688	900 m – east
40.	Yastreb	310	6.711	1400 m - west
41.	Sokolyane	289	4.188	350 m – east
42.	Beli plast	383	17.468	200 m – east/west
43.	Zornitsa	277	8.763	1000 m – west
44.	Golemantsi	547	20.74	900 m – east
45.	Mandra	507	17.098	170 m - north
46.	Orlovo	594	14.934	200 m – east
47.	Voyvodovo	1162	15.835	1000 m - west
48.	Manastir	212	8.696	1032 m -west
49.	Uzundjovo	1816	55.022	450 m – east
50.	Haskovo	78782	95.182	2600 m – west
51.	Voden	418	13.318	800 m - east
52.	Chernogorovo	945	23.308	At the end of the village
53.	Dimitrovgrad	41562	62.436	1400 m - west
54.	Brod	873	20.365	400 m - east
55.	Golyamo Asenovo	1062	16.097	900 m – east

№	Settlement	**Population** Number of residents (NSI, 2011)	**Area of the settlement (km^2)**	**Location and remoteness of the settlement from the pipeline route (m)**
56.	Byal Izvor	1713	19.928	900 m – west
57.	Trakia	386	17.319	750 m - west
58.	Sredets	323	20.467	800 m – east
59.	Yastrebovo	406	19.592	1000 m – east
60.	Petrovo	460	14.502	250 m – west
61.	Badeshte	491	16.441	600 m – east
62.	Pamukchii	314	12.845	1200 m – west
63.	Kolarovo	584	24.939	740 m – east
64.	**Zagore**	924	17.196	1500 m - west
	Total	199 491	-	-

Table 4.2.3. -2 Settlements in proximity of the Eastern route

№	Settlement	**Population** Number of residents (NSI, 2011)	**Area of the settlement (km^2)**	**Location and remoteness of the settlement from the pipeline route (m)**
1.	Lozengradsi	269	14.320	340 m - west
2.	Kukuryak	227	6.360	500 m - east
3	Kran	305	4.247	300 m - east
4.	Zimornitsa	55	5.452	700 m - east
5.	Sredsko	141	4.895	700 m - west
6.	Grivyak	148	2.435	760 m - west
7.	Ralichevo	109	6.421	517 m - east
8.	Malka Chinka	87	3.683	500 m - east
9.	Ribino	78	12.364	160 m - west
10.	Sedefche	201	6.602	1600 m – east
11.	Konche	264	6.871	100 m – south-east
12.	Ralitsa	56	4.694	800 m - west
13.	Pazartsi	183	6.821	1000 m – west
14.	Sindeltsi	381	11.674	450 m - east
15.	Karamfil	287	5.782	300 m - west
16.	Chaika	209	7.665	554 m - west
17.	Neofit Bozvelievo	370	8.705	2000 m - west
18.	Potocharka	163	4.512	500 m - west
19.	Potochnitsa	218	11.319	750 m – west
20.	Rabovo	168	7.725	500 m - east
21.	Golobradovo	65	2.173	300 m - east
22.	Pchelari	180	12.525	500 m - east
23.	Patnikovo	64	5.478	300 m - west
24.	Strahil voyvoda	122	3.406	1300 m - west
25.	Kladenets	59	8.037	At the end of the village
26.	Dolno Botevo	328	12.770	2000 m - east
27.	Gledka	226	5.212	750 m - west
28.	Kralevo	160	9.123	200 m - east
29.	Stambolovo	576	22.585	1700 m - west
30.	Koren	426	8.528	1300 m - east
31.	Malevo	1294	32.503	200 m - west
32.	Stamboliiski	874	17.009	400 m - west
33.	Podkrepa	307	11.188	1800 m - east
34.	Uzundjovo	1816	55.022	450 m – east
35.	Haskovo	78782	95.182	2600 m – west
36.	Voden	418	13.318	800 m - east

№	Settlement	**Population** Number of residents (NSI, 2011)	**Area of the settlement (km^2)**	**Location and remoteness of the settlement from the pipeline route (m)**
37.	Chernogorovo	945	23.308	At the end of the village
38.	Dimitrowgrad	41562	62.436	1400 m - west
39.	Brod	873	20.365	400 m - east
40.	Golyamo Asenovo	1062	16.097	900 m – east
41.	Byal izvor	1713	19.928	900 m – west
42.	Trakiya	386	17.319	750 m - west
43.	Sredets	323	20.467	800 m – east
44.	Yastrebovo	406	19.592	1000 m – east
45.	Petrovo	460	14.502	250 m – west
46.	Badeshte	491	16.441	600 m – east
47.	Pamukchii	314	12.845	1200 m – west
48.	Kolarovo	584	24.939	740 m – east
	Total	138735		

The potentially affected population, which is subject to health protection and object of this analysis in relation with realization of the investment proposal, is defined on the base of the people living and/or sojourning in the settlements near the route and the facilities belonging to it.

The comparison of the two alternatives shows that both alternatives of the route pass in proximity of about 50 settlements, the difference is that in the western alternative the settlements are bigger, more developed and have more residents, while the eastern alternative passes through mountainous areas, less populated, with smaller villages – like hamlets.

The total number of the population in the settlements at a distance up to 2000 m around the route in the western alternative is about 195000, and in the eastern one – about 140000.

In the project considered it must be taken into consideration that the population in proximity of the route will be affected only temporary and with low health risk during the construction. During the operation the population from the areas close to the pipeline will be benefitted by this acquisition and, in fact, this population is impacted in a positive aspect.

4.3.3.1 During construction

The population impacted during the construction comprises the residents of the settlements near which the respective section of the route or some installations belonging to it are being built. Various number of population will be impacted stage-by stage for a short period of time during the construction.

With regards to the physical, as well as chemical detriments related to the pipeline construction, a significant health risk for the settlements near the route does not exist during the construction.

The impact on the affected areas during the construction is temporary, with low degree of intensity, with no cumulative effect, with no considerable health risk.

With regard to noise emissions – it can be said that only the settlements at a distance less than 100 metres away from the route can be considered really affected, bearing in mind the data indicating that above 100-150 metres away from the route, the requirements of Ordinance 6 are met.

With regard to the chemical detriments, the affected population cannot be defined, due to the fact that such ones can be discovered locally, on the working site only, and in fact, they are not a risk for the population, just for the workers, which involves the respective protective measures described under item 6 of the current report.

4.3.3.2 During operation

During the operation, all the population along the route corridor can be defined as impacted. The impact of the project on the population is positive – opening of new job positions, social and economical effect (direct and indirect), keeping (improving) of the ecological situation.

The health risk is minimum, controllable, the project meets the priorities for development of these areas.

That is why the operation of the pipeline stipulated is considered safe for the population if the necessary technological requirements are strictly kept.

4.3.3.3 In case of emergency

In case of emergency, the exact number of the population affected cannot be defined, it depends on the extend of the situation – gas leakage, fire, explosion etc. In the emergency response plan, some measures and resources shall be stipulated to prevent and surmount the consequences of such events for a bigger number of injured (population), in order to save the health and life of the people potentially affected.

The probability of pipe rupture, explosion and gas leakage is bigger at places of the lenear valve connections, as well as during maintenance or preventive works on the route; pipeline pressure increasing etc. In most cases the danger is high for the workers, gassing of the population is slight or there is none at all, but of course it depends on the degree and the extend of the emergency.

4.3.4 Risk factors for human health during construction, operation and in case of emergency

4.3.4.1 During construction

A. Risk factors for population’s health. The following factors can be identified as such:

- *Medical risk factors*: emitting of dust and toxical chemical pollutants into the air, waters and soils from construction and transportation works; changes in acoustic medium; waste generating and accumulating – construction and household; other – accidental and/or episodical emissions; increasing the number of infectious and sexually transmitted deseases.
- *Social risk factors*: direct and indirect employment; disturbance of the local infrastructure, impact on the transport and traffic; on the tourism; on the community interrelations; on the population security and safety;

The main risk factor to emit physical and chemical detriments during the construction is the construction works: excavation works, handling of earth masses, uploading and unloading works, pipe laying etc., described in the investment intention. These works are sources of dust, toxical materials, noise. Depending on the weather conditions, the winds strength and direction, chemical detriments and especially dust might spread around the pipeline route. However, the dust emitted during the construction works usually settles down at a few tens of metres away from the sources, which means it cannot impact population’s health.

Another important risk factor for emissions of harmful materials and noise levels above the standard during the construction is construction machines, especially when they pass near settlements and populated territories – the calculations show that they can emit about 58 kg/km harmful materials per year, and the noise produced by them is up to about 85 dB (A).

The construction and household waste excreted during the construction can also be considered as a kind of risk factor.

B. Risk factors for workers' health.

Construction workers' workplaces and activities are risky regarding toxical chemical materials, noise and vibration levels above the standard, UV radiation, ultrasound, unfavorable weather factors (open-air work), emergencies. The main risk activities are: all the construction works, work of the vehicles, facilities and equipment, as well as their maintenance; welding; roentgenography; storage and work with chemicals, oils, fuels; waste generating and accumulating.

The emissions of harmful chemical materials during the civil work will be mainly unorganized. Mainly emissions of **dust** and **toxical materials** are expected (toxical gases, heavy metals, volatile organic compounds – item 4.2.1.1), caused both by construction machines (excavating machines) and vehicles, as well as by moving of vehicles along terrains without road surface, and uploading – unloading works.

The harmful physical factors – **noise, vibrations, UV radiation, ultrasound, ionizing radiation, unfavourable micro climate** related to the works on the technological process – excavating machines and vehicles, welding, check of weldings, open air work.

Social risk factors – dissemination of infectious deseases; providing of medical assistance; food and drinking water; working in unknown conditions for the foreign workers; different habbits and behaviour of the local people; negative attitude by local communities; restriction of free movement; difficult social contacts in terms of the language barrier; health and safety at work; security for the possessions.

4.3.4.2 During operation

Sources of natural gas emissions along the pipeline are the facilities and works which are done above ground in relation with the main technological process – cleaning of natural gas from mechanical admixtures, pressure controlling and maintaining, measuring of temperature and flow, starting of the valve vents for blowing and draining of particular sections, and at the facilities in precaution and emergency conditions (fire, uncontrollable pressure increasing more than 10% above the maximum). The controlled releasing of natural gas is done through valve vents, with outlets on the borders between passages and facilities.

During the operation, the main risk factor for harmful emissions is the technological process and the works done above ground related to gas releasing:

4. cleaning of natural gas from mechanical admixtures (cleaning devices)
5. pressure control (Gas Regulation Stations)
6. measuring of temperature and flow (Gas Metering Stations)
7. linear block valves
8. repair works

4.3.4.3 In case of emergency

All the break-downs, fires, explosions, earthquakes, which dislocate the layers of the earth and disturb the integrity of the pipes, uncontrollable pressure by more than 10% of the maximum, are emergency situations containing risk of gas emissions increasing, which endangers the workers and/or population.

4.3.5 Prognosis and assessment of the harmful factors anticipated impacts on human health

Pipeline works having the potential of impact on the population and workers are generalized. The receptors population and workers are considered.

Under item 1 – *Using the terrain temporailry* – a temporary difficulty for the normal activities of the population is possible in the area nearby, but with no negative health effect, with no residual and cumulative impacts. The prevention and control comprise preparatory planning, co-ordination with responsible authorities, defining the regime and duration of work.

Under item 4, 32 and 33 *Terrain preparation and removing of the top-soil (mould) Excavating of trenches and laying the pipe Temporary roads and Building of Above Ground installations on the sites* – The impact on the two receptors being analyzed (population and workers) is related to the air dustiness and pollution with gases from the work of the machines used. It will be temporary for the work period, direct, brief, without a cumulative effect, with local range. The measures for prevention and reducing of the impact are related to the way of execution of these activities, spraying the terrains, fencing of the work sites and reducing of citisens' access in proximity to work areas.

Under item 5. *Terrain restoration* - the impact will be identical as per item 4. and will be direct, non-cumulative, brief, temporary for the period of activity, with local range. The measures for prevention (protection) of the population are also identical.

Under item 7. and item 8. *Pipes delivery and storage and Transport* – they have similar negative effects on the population receptor, regarding noise levels above the standard due to the work of the heavy-freight vehicles. A cumulative effect is possible on the highways along which lories will pass. The impact will be direct, brief, negative, temporary, comprising the settlements near the road routes used. For workers, this impact is a factor of the work environment. For control and prevention, control measurements of the main pollutants are recommended during the construction (respectively, during intensive transportation), for the workers, wearing of personal protective means is possible. During pipeline storage, impact will not occur.

Under item 9., item 10 and item 11. *Delivery of fuel and other hazardous substances; Fuels and oils storage; Fuel loading.* The impact here is related to noise levels above the standard caused by transportation vehicles, chemical hazard and inflammability (fire danger). The prevention is, above all, keeping strictly the storage requirements for such substances in closed vessels, trained people working with them. If this is kept, there will not be any danger for the population, for workers it is necessary to use personal protective means – work clothes, gloves, masks.

Under item 12 and item 13 *Work of vehicles and installations, facilities, instruments*; *Installations maintenance and repair*. Regarding the population and workers, the impact will be identical to item 7. – noise exposition. In terms of work of the aggregates using liquid fuel, the impact will be direct, cumulative as far as they will work along with the other machines in some intervals of time, brief, temporary for the period of the activity with local range.

Under item 14 – *Waste producing and accumulating*. The impact on the population is related to the negative visual effect, smells, detriment (in case they contain toxical substances). The effect will be local, temporary, but if they remain – this might lead to residual impacts, decomposition, dispersion and to endanger population's health. Waste management is stipulated and it is a mandatory part of the Environment and population protection plan during the project realization, and its strict keeping can provide security of the population and workers.

Under item 19 – *Chemical storage*. The dangers for people and prevention activities are identical as per items 9, 10 and 11.

Under item 23 – *Drilling in mud, concrete covering, plaster, lining and painting*. These are construction works whose impact on human receptors – workers is temporary, direct negative because of the physical work, outdoors work with machines and tools, noise, vibrations, chemical detriments. As this is the work environment for them, protective means are stipulated – work clothes, helmets, gloves. Wor the welders – welding helmets too. A negative impact on the population from these works is not expected.

Under item 25 – *Roentgenography*. This factor also refers to the workers, mainly those who do this work. The impact might be direct and remote, cumulative, with high health risk. It is necessary to keep the requirements for work with sources of radiation and especially with X-ray devices, and protective means to be worn as well. In proximity of roentgenography execution no persons without protective means shall attend.

Under item 28 – *Reaction in case of emergency*. A factor with great significance for people. It is necessary to provide emergency aid for the workers during the whole period of construction and operation, by a team specially formed for this purpose, or by teams in the settlements near the route. This is very important in case of emergency situations too, when there are people hurt – workers or population.

Under item 29 *Pipe/ vessel rupture*. These are break-down, emergency, sometimes life-threatening situations. Depending on the break down type and dimension, there might be only natural gas leakage, which will raise high, as it is lighter, and depending on the duration of the break down, diffusion of natural gas in the region might occur. However it is not determined as a toxic substance, but there is a danger of its flammability. If the leakage is accompanied by a fire, the impact might be local or regional.

Under item 30. *Smoking* – if there is no fire, the impact will be identical to the one described under item 32 version a).

Under item 31 *Earthquake* – the impact will be identical to the versions under item 32.

At normal operating mode, keeping of the technological and safety requirements, an impact on the population and workers is not expected, regarding the fact that there are no negative physical and chemical factors – increased noise levels, vibrations, air pollutants and toxical materials are not expected. The natural gas itself is not considered as a pollutant, and its using contributes to reducing the harmful emissions from the conventional fuels.

4.3.5.1 During construction

Impact on population

Health effects. The construction works on the project will be in conformity with Bulgarian and European legislation and standards, concerning human health.

A detailed description of hazardous chemical materials related to the construction works is shown under item 4.2.1.

Considered separately, the pipeline construction process could cause uneven air pollution. The construction works and the work traffic related to them is in general unorganized source of emissions of dust into the air, but these emissions are temporary – for the time when excavation and auxiliary works are executed and vehicles pass.

Dust. The construction works are done outdoors and at specific weather conditions (windy weather), the dust is possible to be spread n the vicinity. The dust emissions of this type are unorganized and to a great extend will depend on the weather conditions (wind, moisture, temperature, atmosphere steadiness), earth particles characteristics. The smaller dust fractions, including those with respiratory dimensions below 10 mμ, might be affected by the air masses turbulence in the ground level and might be dispersed in the atmosphere.

Benzpyrene and heavy metals causing a harmful impact on the human receptor might be contained in the dust.

The effect of the dust finds expression in irritation of upper respiratory tract, suffocation etc. The particulate matter might get into lower parts of the respiratory tract, in lungs, and to cause chronic negative impacts. They are well-known for their potential to convey other toxic chemical compounds to the lung cells, and their retention there is one of the possible explanations of the progressing damages of the lung tissue, progress of chronic bronchitis, and are a precondition for progressing of acute bacteriological or virus respiratory infections, especially with sensitive individuals. The dust exposition creates conditions for complicated progress of bronchial asthma, late stages of cronic bronchitis, lung emphysema and existing heart diseases, as well as for occurring of morphological changes in the lung tissue.

Chemical emissions. The expected possible chemical emissions of worked-off gases from the construction and supporting machines and from the works on the work sites are represented under item 4.2.1.1..

It should be noticed that the chemical factors are not hazardous for the population, as they are released on the work site territory, they are not in big quantities and are not spread to the settlements.

Physical factors. Noise. Noise impact on human body is determined by a few factors, among which more important ones are: *noise parameters* – intensity (along with increasing of noise intensity, the risk of professional acoustic injuries increases too, the frequence and degree of hearing loss increases too), frequency characteristics (the impact of high-frequency noise is more unfavourable), noise type (permanent, variable, interrupting, impulsive – the impulsive and variable noise have a more unfavourable impact compared to the permanent type), the exposition on the noise impact in the course of the work shift (permanent or interrupted, with more unfavourable significance of the permanent exposition), the matter of the activity being executed (mainly physical work or work related to nervous and psychic tension), availability of other harmful factors of the work environment – vibrations, unfavourable micro-climate, electromagnetic fields etc., individual sensitiveness, sex, age.

Damaging of the following systems is considered as an extraaural effect:

- ❖ nervous system – attention is disturbed, quick tiredness, irritability occur, absent-mindness, the psychic processes speed slows down, the number of work mistakes increases, the work efficiency decreases;
- ❖ cyrculatory system – it is seen more often increased blood pressure, disturbance of heart work, spasm of the peripheral blood-vessels with a decreasing of the peripherial blood flow and skin temperature, decreasing of pulse amplitude of the fingers;
- ❖ digestive system – a relation has been determined between the noise stress and the increased frequency of occurrence of stomach and intestinal diseases – gastritis and ulcer;
- ❖ changes in metabolism processes and endocrine system (at more intensive noise and noise of impulsive character, increased excretion of catecholamine occurs etc.).

Typical for the noise impact are also subjective complaints such as headache, neuroticism, noise in ears, vertigo, changes in self-confidence and mood, anxiety, sleep disturbance.

Unfavourable impact of noise from the pipeline construction on population will be temporary (not longer than 4 months) and of minimum significance. The noise environment will be completely restored immediately after completing the construction works.

The construction traffic might deteriorate the acoustic environment in the settlements housing areas located in proximity of the route in case the construction machines pass through them. The noise impact on the population's health in these areas is expected to be temporary (during construction works only) and of low significance.

The construction method applied – with speed of about 1000 m per day, puts the impact of the noise factor on the vulnerable receptor – the population in the category of negative, but insignificant, brief impact.

Calculations made on the basis of the Method of reading the noise levels from the motor traffic, Regulation № 6, State Gazette issue 58/2006 shows that the noise level at a distance of above 100 m from the road is between 37 dB (A) and 53 dB (A), even with the worst road surface. Therefore the temporary road for the site construction is below the limits of the sanitary norms for settlements at daytime (the construction works will be done during the day only) and the requirements of Regulation № 6/2006 will be kept.

Generally, the vibrations caused by the transport or technological equipment are within the low frequence zone and are characterized with damage in the locomotor system and vestibularis. The biological effect of vibrations impacts on the circulatory system, the central and peripheral nervous system and might lead to so called vibrational disease, but for the population the vibration impact is a low-risk factor.

Infectious diseases. A significant number of people – workers, gathered together, presents a potential possibility for dissemination of infectious diseases.

Workers will be from various European and non-European countries, which creates a potential risk of availability of infectious diseases carriers, including sexually transmitted diseases.

At the places where a lot of men are concentrated, in this case workers, a risk is available of increasing of prostitution and random sexual relations, which is related to a risk of sexually transmitted diseases, including the especially dangerous HIV/AID virus transmitted through unsafe sex and intravenous use of drugs. As at the moment there is no efficient medicine against HIV/AID, any potential increasing of this disease is considered as highly significant impact. This requires special preventive information for workers and local residents in order to prevent them from these diseases and limiting the possibilities for prostitution.

There is a risk that the presence of foreign construction workers might "import" new or non-typical diseases into the region (even into the country). The appearance of such diseases is quite probable, as the workers come from various places, live at different conditions and above all, are quite mobile (they pass their time with their families and in resort regions), so they create conditions for transmitting of various diseases. In this relation, it is recommended to provide medical services – through medical teams or through establishing of medical centres in the camps, in case such are built, which will first diagnosticate and then protect the healthy workers and local residents from diseases. The risk is of medium significance and depends on the early determination of the disease and quick reaction of the medical staff.

Social effects – impact on the social-economical sphere

Direct employment. The pipeline construction might impact the employment of the local residents in a medium degree and temporarily.

Taking into consideration the significant number of residents and the high levels of unemployment in these areas, the significance of the impact of employing local labour force is assessed as medium, including short employment in the smaller municipalities. This applies in case the construction company employs Bulgarian citizens for the construction phase. Yet, if the contractor for the construction works prefers to employ foreign labour force for some reasons – financial consideration or lack of qualified staff in the region, the impact on the local employment will be insignificant.

Indirect employment – supplying of goods and services. Apart from people directly employed in the construction, workers will be necessary in the following sectors of work:

- Medical staff;
- Kitchen staff;
- Staff for cleaning, washing and other services in the camps (if such are available);
- Watchmen and security guards for the settlements where workers will be accommodated in camps;
- Transport employees for attending the construction workers: drivers of cars, buses and lorries;
- Suppliers of small commercial goods of a vital necessity: water, drinks, cigarettes etc.;
- Suppliers of construction materials;
- Other staff.

If the workers are accommodated at local places such as hotels or houses for guests, this will impact positively, moderately and short-term on the local tourist sector, including food services, entertainment etc.

If they are accommodated in camps or in dwellings specially adjusted for them, the service personnel will be located nearby and will service the workers. This will make a direct impact on the local residents who will be directly benefited from the project investment – accomodation, food supplying etc. The effect will be temporary, but yet – in the small settlements – medium to significant, as the household income might reach or even exceed their usual income. In this regard, the benefits from the project will be distributed among larger groups of the local residents, and this, along with the need of goods and services supply, could increase significantly the local support for the project.

The supply of such services will make an indirect impact on the local employment, as it will increase the necessary quantities of goods and the service network. The personnel listed above will be employed with a short-term labour contract, while the construction work is completed. A significant number of such workers exists in each municipality, as it is seen from the unemployment levels.

The transportation of pipes needs corresponding specialized motor vehicles, significant quantities of construction materials will be transported too. This will increase the necessity of tractors and semi-trailers, cranes, dumpers and other specialized motor vehicles. This, on its hand, will lead to increased necessity of highly-qualified drivers, technician, maintenance workers to service the vehicles etc. Suppliers of construction materials could also be employed from the region, as the construction sector in the region was well developed before the economic crisis, and since then most of the workers in this sector have been unemployed.

Community interrellations: Cultural differences might appear, which are caused by the temporary presence of workers together with local residents, the behavior of construction workers might potentially disturb the local cultural traditions etc. On the other hand, if accommodation camps are built, the local people might be attracted to the camps. Therefore, this might increase the tension between workers and local residents. In terms of the community solidarity, the impact of the workers presence having different life habits or cultural education on the recieving community shall be estimated and controlled, and especially the topics about religious and cultural intolerance, local traditions and social structure etc.

The local business initiatives such as shops, restaurants and bars will probably take advantage of their proximity to the workers' accommodation places. Nevertheless a great number of negative subsequences is possible to arise, which shall be minimized.

Security and safety for the residents. It is of great significance the number of workers accommodated in the settlements to be very well calculated, the rules set to be carefully developed and explained to the workers and additional measures to be taken – such as security, medical services etc.

This is necessary in order to avoid possible conflicts between the workers and local communities – breach of the peace, disturbance of the population's comfort and the accepted behavioural norms, as many of the route areas are inhabited by Turkish (muslim) population having strict moral norms (especially in terms of the place and participation of women in social life), which could cause significant problems to the workers, investors and the pipeline construction.

A danger od accidents exists if workers have access and consume illegal substances and/or increased quantities of alcohol. This could have a negative impact on the local community by increasing the incidents, crime, violence or endangers the work process.

The presence of a great number of men-workers could make a negative impact on corruption, trade with illegal substances – drugs, minor crimes, robberies, violation, hooliganism. The impact is temporary, moderate and unfavourable.

Local infrastructure and resources. During the construction, in rare cases it is possible that municipality or state infrastructural elements might be stopped or cut – roads, railways, distribution lines, communication lines, water-conduit and sewerage systems, watering cannals, cables etc. The pipeline construction might also lead to loss of various small infrastructural elements – animas' paths, wells, shelters, farm roads, water-supplying or watering systems, tanks for water collection etc. After the excavation works and pipe laying, the existing roads will be restored, and the by-pass routes will be closed. Infrastructural cuts, in case they are announced in advance and all the measures are taken, will have moderate, temporary and unfavourable impact until their restoration.

Transport. During the construction, more intensive traffic of heavy vehicles is expected for carrying cargo and passengers from and to the work site. The oversized loads shall be carried at special conditions in order to provide transportation security. Significant traffic of personal and business cars is expected too, which will carry specialists and workers. The impact is temporary, negative, of medium degree.

Safety on roads. Road accidents (RA). The more intensive traffic creates a risk of RA. The risk rises as well in cases when the traffic caused by the workers and construction will pass through the settlements having a social infrastructure such as schools, kindergartens etc. The sensitiveness of the impact recipients is assessed as medium, as the road infrastructure is assessed as comparatively developed for Bulgarian conditions. The extend of the impact could be from small to medium and temporary, depending on the duration of the construction works.

Impacts on workers

Dust is a typical risk factor for construction workers, including in the case considered. The very fine fractions (below 2 mμ) can reach the lungs of the people working on the pipeline site, which imposes a mandatory use of personal protection means, including suitable anti-dust masks for workers.

Harmful chemical factors. Impact of harmful chemical factors is possible in connection with work with and storage of chemicals, fuels and oils; the transport, releasing worked-off gases; welding processes.

The group of expected emited gases comprises of irritating, asphyxiating and system poisons. They have an irritating local and general toxical effect and might damage the respiratory organs, lead to changes in blood composition, increased sensibility to infections and disordered methabolism. Some changes of organism reactions are defined – for example allergic reactions, as well as disturbances of biochemical ballance, accompanied by accumulating of chemical air pollutants and their methabolits in human blood and urine.

The heavy metals are cumulative poisons and have a remote effect. During the pipeline construction, emissions of heavy metals can be expected on the work places – for example cadmium, whose vapours and aerosols can be easily absorbed and have a highly toxic effect, a specific impact on kidneys and liver.

Benzine is highly irritating poison for the respiratory tract, skin after direct contact, affects central nervous system, has a narcotic effect, can lead to changes in blood components.

Volatile organic compounds show negative impact on organism – they go through healthy skin, affect nervous system, vestibularis, have a slight narcotic effect etc., and on the environment, a great number of requirements are stipulated in order to reduce and confine the emissions of VOC in the atmospheric air and in work environment.

***Noise*.** During the construction, noise values above standard can be expected at the workplaces of workers, drivers of heavy vehicles, operating excavators, loaders and other heavy construction machines. The impact of noise is described in the text above, that is why precautions are necessary – above all, personal protective means (silence headphones).

Vibrations. Impact of vibrations is possible on workers only, because their intensity, characteristics and spread do not allow the impact to reach remote places – in the settlements, near the pipeline route. During the pipeline construction, general vibrations might be felt in the work strip, especially around some of the machines at the time of their operation. Most of the machines have vibro-isolating mechanisms in-built with daily exposition value of (0.5 m/s2) for vibrations and will not affect the machines operators. In case personal protective means against vibrations are necessary, the construction company will be responsible to provide them.

UV radiation. UV radiation values above the standard can be expected when welding works are performed, which is related to damaging welders' visual analyser. This is a work environmental factor and precautions are taken – only holders of welding certificate are allowed to work, training is provided, as well as physiological regime of work and rest, using of personal protective means provided by the employer.

Ultrasound. Also a work environmental factor, its impact will be limited for some work places and with levels below the standard, which determines insignificant risk.

Unfavourable microclimate. A factor, active permanently at the work environment, with a risk of overheating or overcooling, depending on the season and weather. The impact of this factor is on human thermoregulation, from which negative effects are resulted – on the skin temperature, sweat secretion, circulatory and respiratory systems, gastrointestinal tract, central nervous system.

Nutrition and providing of drinking water. As it is expected that the workers will be from different countries, their eating habits and preferences will also be different. In Bulgaria there is no problem with supplying with different types of food. What is important is to provide food of good quality and before sell-by date, as well as its proper conservation. The possible negative impacts might be seen in the following: it is possible that Bulgarian food does not correspond to the tastes and perceptions of some of the workers, it is possible spoiled food to be consumed due to incorrect conservation, as well as buying food that is not fit to eat, which might lead to problems with the digestive system or food poisoning. It is important that precautions are stipulated in order to prevent nutrition diseases, and in case such diseases occur – the health authorities shall be immediately informed and measures shall be taken for curing the sick person (people).

Supplying of drinking water of good quality is an important task for the construction work organizers. Drinking water in Bulgaria comply with Regulation 9 which is synchronized with the European requirements, and water in the water-conduit network is of good quality and good to dtink. It is also possible to consume mineral water. A danger might arise when water from local water sources is consumed in the small settlements (villages, near which the pipeline route will be built), which are not always controlled and it is not recommended to workers to consume such water.

Access to medical institutions and medical service. The access to medical institutions is important in order to look after workers’ health, as well as to provide adequate reactions in cases of emergency concerning workers’ health. This is determined by two main factors: most of the personnel will be concentrated in the settlements or in the camps and will work together on the construction sites.

The data about the surveyed areas show that hospitals are available in the big towns only – Kardjali, Haskovo and Stara Zagora. The settlements with concentration of accommodated workers can be serviced by mobile medical teams or, if accommodation camps are built – the two main camps will have medical teams on site, which will look after workers’ health and will exercise the functions of a team for out-hospital service, as well as an emergency team.

Transmission of infectious diseases. This impact is examined in details with regard to the population. It must be noted that transmission of infectious diseases is possible among workers who come from different countries, have different habits, medical culture and health condition. Some of them might be healthy infection-carriers, without knowing it.

Precautions are necessary in order not to allow or avoid dissemination of infectious diseases, and above all, of dangerous and difficult to cure ones. If in the construction team there is a doctor, he/she can provide profilactic examinations and tests, immunizations if necessary, but in case there is not – this work can be assigned to Bulgarian doctors at workers’ arrival and during their stay. In case construction camps are provided, the heads shall inform the health bodies on site in order to take precautions, as well as in case of food poisoning or disease.

It’s essential to be noticed that in Bulgaria there are no dangerous infectious diseases, no transmissive infections such as malaria, Q fever etc., such are found only in individuals infected abroad. To travel to Bulgaria, preliminary vaccines are not required. That is why the risk of infection for workers from the local people is very low.

Education, qualification and trainings – specific education and additional trainings will be necessary during the construction and at the beginning of the operation stage. The training will require teaching in English and specific subjects and skills for the personnel employed in construction, and especially operating levels. This will impose serious changes of curriculum, as well as employing of teachers, including from abroad, translation of materials and specifications, manuals etc.

Purchasing capacity of employees. No matter the amount of the salary, the construction workers will probably spend part of their remuneration in the settlements where they are accommodated, or in the closest settlement if they live in camps. The workers’ location near settlements will have moderate, temporary and positive impact on the business in the close proximity of camps and slight, temporary and positive impact at municipality level. This will lead to increased demand for goods and various services – of light industry, entertainment, restaurants, groceries, car parks and other services.

Social contacts and meetings. The presence on unknown territory and contacts with new people create conditions for meetings and social contacts, but they might be made difficult by the language barrier. The main social and entertainment sites are important for the workers' rest and socialization during their free time. Where the workers are accommodated in a village or town, the existing social and entertainment facilities can be used, as far as this is not an obstacle for the access to entertainments of the members of the local community and creates opportunity for social contacts. The social contacts shall not disturb the customs and manners of the local people.

Discontent to the workers among local communities. During the pipeline construction foreign workers from various countries will be employed. It is possible that the social and cultural differences between foreigners and local people (different cultural herritage, religion, perceptions etc.) might make a negative impact on local communities and create a potential for social tension. In case the presence of foreign workers in settlements causes unacceptable level of discontent among local communities, the workers shall be accommodated in camps complying with European requirements, provide all the necessary conditions for workers, which will reduce the contact with local population.

It is possible some restrictions in workers' moving to be imposed in order to avoid any unnecessary conflict from and/or with the local communities and their sense of vulnerability, and to provide security for both the workers and community, but each restriction shall be clearly founded.

Workers' sensibility to their rights during work, and to their free time is very high, as well as the local people's sensibility to their property and traditions.

Security for workers and their property. It is possible that workers' habitations (or camps) where they are accommodated, might attract some ill-wishers. Violations on machines, fuels, equipment, materials and personal possessions are not excluded, as well as violations on workers' movable possessions and construction sites by the local residents. The guards in the local communities, buildings, garages and stores, and the camp guards if camps are built, will look after the security of the construction sites and construction assets, as well as the workers' security and property. The sensibility of the impact recipients is assessed as moderate, the magnitude of the impact can be from small to medium, depending on the security measures considered. The impact significance is expected to be from small to moderate.

Safety at the workplace during the construction and operation will be organized by the employer in conformity with the requirements of the Law for Healthy and Safe Labour Conditions and other regulations in this field. Safe Labour Conditions will be based on technologies and means of team safety (operations, machines and tools), as well as personal protective means.

4.3.5.2 During operation

Impact on population

As it was indicated under item 4.2.2.2, the main detriments released during the pipeline operation are natural gas and emissions from combustion processes.

Natural gas is lighter than the air (with bulk density 0,765 kg/m^3) and during its emiting it rises high into the atmosphere. As it was said above, natural gas is not standardized as a pollutant in the atmospheric air according to Bulgarian and European legislation.

Natural gas autoignition temperature is 537 °C. The main products at its combustion are water vapours.

Among all natural gas components, sulphuretted hydrogen is especially toxic. Its typical smell is possible to be felt in the air at concentrations of 0,0014-0,0023 mg/l. It causes paralysis of respiratory organs and heart. Sulphuretted hydrogen concentration of 0,006 mg/l causes headache, and at concentration of 1 mg/l or more, acute poisoning and death. Maximum allowable concentration of sulphuretted hydrogen in the working zone is 0,001 mg/l.

Natural gas, in general, causes narcotic effect on human body. High concentration cause fast suffocation from lack of oxigen. Contents of 4-5% in the air cause headache and high blood pressure on human. Inhaling of gas with concentration 20% in the air causes breathing cessation and death.

Methane (CH_4) is colourless combustable gas with no smell, with molecular mass of 16,04, density 0,7166 кg/m^3. Liquid methane has a density of 421,8 kg/m^3 at temperature of -160^{0}C; melting temperature -182,49 ^{0}C; boiling temperature 161,58^{0}C; density of vapours towards air 0,5543; viscosity of the gas 1,09.10^{-5} Pa.s at temperature 20^{0}C; specific heat of combustion 49,9 MJ/kg (11 910 kcal/kg); it is insoluble in water; autoignition point 537^{0}C; ignition range 5-15% vol.; minimum ignition power 0,28 mj; maximum pressure of explosion 0,72 MPa (7,2 kg/cm^2). It burns with light blue flame. Minimum explosion-hazardous contents of oxygen when methane-air mixture is deluted with carbon dioxide is 15,6% vol., with nitrogen -12,8% vol. with helium -12,7% vol., with argon-10,1% vol.

Methane is colourless gas with no smell and is not dissolved in water. It reacts to oxidatively acting materials.

Emissions of combustion processes – have mainly local irritating, allergizing and general toxic effect.

During the operation, increased noise emissions which might have a negative impact on the health of the project area residents are not expected.

Social effects – impact on the social and economic sphere

Direct employment. There will be a permanent unsignificant impact due to the significantly smaller number of personnel needed during this period. The impact of the project on the population and demographic processes will be especially powerful in small municipalities where there is significant human potential. It is possible for some specialists the impact to be significant, as it will be difficult to find and train the necessary number of specialists for such a short time.

Indirect employment. The employment during the operational stage might also include some personnel from the construction stage, after some necessary training and qualification for the corresponding position. Apart from the security staff as an external service, some general supplies and services during work will be needed too. They can be provided by local firms.

- Medical services;
- Fuel supply;
- Water supply;
- Urgent repair works;
- Visits – inspectors from big petrol companies can request a visit permission and after inquiry, can visit the places they want to see;
- Transportation and treatment of waste from the pipeline operating works

Operative traffic. During the project operation, significant impacts from the operative traffic or monitoring works is not expected.

Impact on workers

The main detriments released during the operation are described in details under item 4.2.5.2. – these are natural gas and emissions from combustion processes.

In fact, unfavourable impacts on the working environment are not expected during the normal pipeline operation, provided that all safety requirements stipulated in the project are strictly followed. The pipeline personnel will not have any contact with the raw petrol at normal operational conditions. The pipeline maintenance staff will include specialized employees. All the employees will be provided with the necessary personal protective equipment (PPE in conformity with the requirements). Trainings on safe and healthy labour conditions will be organized at regular intervals with the participation of all the employees.

Social impacts

Employment. A small part of the qualified personnel employed during the construction is expected to continue working during the operational stage. The transition of personnel from the construction stage to the operational stage is a positive factor, allows employing of personnel of proven competence and training of new workers is not necessary.

Education, qualification and trainings **–** Training in specific requirements and emergencies is mandatory, even for the qualified personnel and operators. The training will require teaching in English language and specific subjects and skills for the personnel employed in the construction, and especially for the personnel on the operational levels.

Employees' purchasing capacity and well-being During the pipeline operation, the personnel is expected to get a significant remuneration for their work, as they will be medium and highly qualified specialists. The impact significance in this case is expected to be moderate to low. It is impossible to guess in which sphere the increased purchasing capacity will be used, but it is expected to be displayed first in increased demand of goods and services at the local market in the respective municipalities, and in lower degree out of them.

4.3.5.3 In case of emergency

The impact on people and their health in cases of emergency described above, are related to gas releasing and to the raised danger of gassing of people and explosion-hazardous situations.

Natural gas is comparatively safe, as it is proved that gas-air cloud formed during stream release (leakage) of natural gas into the free open space burns without forming intensive explosive waves which are dangerous for people and neighbouring sites.

With concentration of natural gas from 5 to 15% in the air, the mixture becomes explosion-hazardous (between the lower and upper concentration limit of inflammation). The concentration continues existing some time even after the gas leakage is eliminated. This applies as well to the cases when the higher concentration starts to go down and gets into the range between upper and lower concentration limits of inflammation.

The impact on people (population and workers) does not differ in type from the one described under item 4.3.5.2, but in cases of break-down, fire etc. it is possible to be combined with injuries, traumas, burnings, which endangers in a greater degree human health and life.

The importance of the impact of employing local people as personnel for reacting in emergency situations will be insignificant due to the number of necessary specialists and high requirements of the operator for these activities which require specific knowledge and skills. For this reason the operator will have to invest more time to search, train and employ these specialists.

4.3.6 Assessment of possibilities for combined, complex, cumulative and remote impact

4.3.6.1 During construction

For the population. A possibility of impact of more than one unfavourable factor (combined impact) might be expected during the pipeline construction, which finds expression in noise impact and dusting, but these are temporary impacts and have a limited range of influence. Cumulative impact is possible with other construction activities near the route, such as roads (including motorways, cross-roads etc.), railways, facilities other than the ones envisaged in this investment intention, with accumulation of the described risks – noise and dust pollution, but as it was indicated above, these are detriments of temporary character, insignificant, brief, with a limited range, with low risk for the population, with no permanent consequences. In general, significant negative health impacts on the population are not expected, such as combined, complex, cumulative and/or remote impact on human health in the communities in proximity of the project area during the construction. The existing and described risks have a low degree of intensity, and are manageable and controllable.

For workers. Combined impacts on workers' health can appear at some work places during the pipeline construction. Their receptor is the respective personnel working at that site, while the consequences are caused by simultaneous effects by all or a combination of the following factors: noise, vibrations, toxic or cancerogenous gases released during vehicles and machines work. Apart from the noise levels, the significance of the impact of the others is small.

According to the investor's calculations, the cumulative effect during the construction arising from the effect of the additional heavy and light transportation vehicles, together with the effect of the regular transport on the existing transport network, is not more than 14% if calculations are made for "the worst" case of traffic, weight of transportation vehicles and condition of the road surface.

The assessment of the cumulative effect during the pipeline construction is that the impact is "insignificant" and a cumulative effect from the noise and vibrations impact is not expected.

4.3.6.2 During operation

During the operation of the objects of the investment proposal, the impact on the sensitive receptor – the population, can be assessed as continuous, but insignificant in a negative aspect, direct and indirect, with no cumulative and remote effect.

There are some specific places with hazard of a cumulative effect for the population. These are the places of the pipeline crossings of roads and/or railways in proximity of settlements. BV 2 pipeline route passes east of Rogozari and three other hamlets, two shallow gullies and goes up to a plateau on level 275 m, after which it goes down to a rubble dry bed of a feeder of river Varbitsa and goes across fertile strip of riparian land with poplar plantations. Construction of a new road is stipulated here. The pipeline shall cross the new road twice – kilometer 27+900 and 28+900.

As a cumulative effect for the near settlements – the village of Rogozari and the near hamlets, can be considered the physical detriments – noise and vibrations, as well as chemical detriments. During the operation the pipeline does not make a negative impact on the population, because physical and chemical detriments are not released. The pipeline does not go parallel to the road, just crosses it. For the population there is no risk of cumulative effect, a risk of emergency situations can be noted – falling through of the road and rupture of the pipeline, road accidents with fire, explosion, blast etc. with gassing of surrounding territories. For prevention of these dangers, the necessary measures are taken.

Apart from the land road, the pipeline will cross a railway too – it is necessary the route to cross the high-speed railway to Turkey which is expected to be built in coming years. The place is situated in the eastern end of the industrial area in Dimitrovgrad, including chemical production, treatment plants and power station. The hazards from industrial companies and facilities can combine with those from the pipeline and railway – noise and dust from the railway, and during the operation of the pipeline, as it was shown above, there are no significant detriments for the population, that is why we reckon that a cumulative effect regarding people is not expected. In a further period, when the construction of the mentioned railway starts, a detailed assessment (EIA) will be made, the cumulative effect will be calculated precisely on the basis of the parameters and characteristics of the railway (which are not available at the moment), precautions will be stipulated to preserve population's life and health.

4.3.6.3 In case of emergency

In case of emergency there is a risk of gas leakage, which creates a risk of inflammability and is explosion-hazardous, the impact is acute, but is not combined, complex, cumulative and remote impact. In order to eliminate the arised emergency situations, it is possible to use vehicles, repair teams, additional equipment etc., which means a combined impact on the sensitive receptor – the population and workers, but for a short period of time, with no cumulation.

For the places of pipeline crossing with a road or railway described above, the increased inflammability shall be noticed as a cumulative effect, the existing danger of fires, explosions, gas leakage, incidents related to the pipeline proximity with industrial companies, including businesses of the chemical industry. This can lead to health hazards for the population and people sojourning nearby, releted to the incident – gassing, irritation of the respiratory tract, suffocation, burnings etc.

This imposes especially high attention during design and construction stages, at pipes laying and strengthening and all other technical works and measures for preventing such incidents and the capacity of taking control on them rapidly.

4.3.7 Characteristics of the exposition

4.3.7.1 During construction

<u>*For the population*</u>: During the construction the exposition will be at daytime only and will be impermanent – linked with passing of transportation vehicles, exposition on noise. In terms of its character, it is inderect, brief, negative.

The range of this impact is not for all the population, it has a local impact and is spread only within the area where the construction works are being done.

<u>*For the workers*</u>: During the construction works, exposition of the workers and engineer-technical personnel can be classified as direct – the people working there are subjected to the impact of pollution with chemicals, harmful physical factors – noise, vibrations, unfavourable microclimate (working outdoors). The exposition of workers is related to their professional work environment and is a subject of labour-medical risk assessment for health and work safety of these workers, and undertaking of specific measures to reduce and/or prevent health risk.

4.3.7.2 During operation

During the pipeline operation, permanent exposition of the population to physical and chemical negative factors is not expected. Temporary (accidental) increasing of emissions of physical factors is possible – noise, if passing of heavy vehicles is necessry, implementing of repair works, and gas – in some areas of Gas Regulation and Gas Metering stations and the Above ground installations.

For the population – the exposition can be defined as impermanent, brief at certain conditions. In fact, with keeping the technological requirements, the population is not exposed to harmful factors, related to the pipeline functioning.

For the workers the exposition during the site operation is permanent and direct, and its type depends on the work place.

4.3.7.3 In case of emergency

In this case the exposition is temporary, brief, direct and indirect with negative effect both for the population and workers.

4.3.8 Health risk assessment and impact on social-economical sphere

Health risk is the probability of arising of unfavourable changes in human health conditions at specific impacts of harmful for health factors, and the degree of these changes.

Hazards and health risks: In order to understand the way of percepting the risk by the society, a difference shall be made between health hazard and health risk. The ***hazardous*** situation or object could harm the health of an individual, while ***risk*** is the probability for an individual to become a victim of a hazard.

Percepting the risk: Different factors impact on the decision of an individual to take a risk or not. Usually people define the risks as insignificant, acceptable, bearable or unacceptable regarding the expected benefits, considering that the latter must be significantly bigger than the risk. The differences in perceptions of risk depend on the age, sex, culture and degree of education**.**

The matter of risk can be a reason for its different percepting. Inquiries show that perception of risk is usually influenced by the following factors:

- **Non-accidental, compared to accidental exposition**.
- **Lack of control over the situation, compared to the feeling of availability of such control**.
- **Known risk, compared to unknown risk**.
- **Fear of unfavourable consequences, compared to the lack of such fear.**
- **Feeling of injustice, compared to the opposite feeling**.

The exposition to harmful factors in the environment can cause change in the population's health condition, and these changes start with physiological disturbances, go through patho-physiological changes, which lead to clinical manifestation of the disease. The individual characteristics (age, sex etc.), as well as the life environment quality and socio-cultural differences, related to the lifestyle, are also risk factors.

It is difficult to find exact measurements of the health risk for the population from the environmental factors, including from the investment project.

1. To assess the health risk for people – population and workers, a methodology is used (expert assessment), showing the probability of causing harm, the exposition and the harm burden (impact). .

According to the formula: R = P x E x C, respectively

R – risk

P – probability of causing a harm

E – exposition

C – harm burden (consequences)

Risk (R) =	Probability (P)	Exposition (E)	Consequences/ Harm (C)

Limited, insignificant risk	Practically impossible	Very low (< once a month)	Insignificant
Not big risk	Possible in limited number of cases	Low (up to 1 hour a week)	Small
Moderate risk	Low probability	Middle (up to 1/3 of the day)	Serious
Big risk	High	High (1/2 of the day)	Dangerous
Significant risk/ Inadmissible	Very high	Uninterruptedly	Disastrous

Note. Each of the categories in the chart has a numerical expression too, on the basis of which the risk is assessed *(for health risk assessment Methodology*).

Б. Impact on the socio-economic sphere assessment (impact significance)

Where possible and reasonable, the significance of the potential impacts on the socio-economic sphere is assessed according to the following factors:

- the magnitude of both positive and negative effects, which is defined by the intensity, frequency and range of the effect in time and space;
- the vulnerability/sensibility of the recipient to the change caused by the project realization;
- the recipient’s capability to recover, regarding both their sensibility and strength; and
- the quantitative expression of receptors affected, including residents, workers and visitors.

The survey is focused on the assessment of potential impacts and changes in socio-economic condition and occupation, as a result of project realization.

The impact degree will depend on the criteria which might comprise:

Scale for impact degree	
Low	• Causing of inconvenience, but with no consequences on the long-term occupation, culture, life quality, resources, infrastructure or services; • Events which might lead to health irritations or minor injuries, but not requiring treatment; • Small number of individuals affected, households and/or businesses. It applies to individuals, households, business, agricultural co-operations, family businesses etc.
Medium	• Primary and secondary impacts on the occupation, culture, life quality, resources, infrastructure or services, which might continue during the construction and months after that; • Effects leading to moderate injuries or diseases, which might require medium or long treatment period; • Small number of affected communities or administrative areas. It applies to settlements – villages and towns in the affected areas; • The affected population will be capable to adapt to the changes or to maintain their occupation with a minimum external support.
High	• Consequence which will probably difficultly reversible or will require significant efforts to be compensated; • The impact will be long-term, with duration equal to and exceeding the project operation time • Effects leading to actual risks of loss of human life, serious injuries or diseases; • Regional scale, determined by the administrative borders. In general the regional level of impact affects the districts of Burgas, Yambol and Haskovo. • The affected ones will not be able to adapt to the changes or continue living with their occupation from the time before the project without a significant external support.

The impacts are considered significant or insignificant regarding the residual effect on each receptor, after the mitigation measures have been taken into consideration. For the impacts determined as significant, the following criteria of the impact level assessment have been applied:

Criteria for impact significance assessment			
	Low degree	**Medium degree**	**High degree**
Low value/ sensibility	Insignificant	Slight (low)	Moderate (medium)
Medium value/ sensibility	Slight (low)	Moderate (medium)	Significant (high)
High value/ sensibility	Moderate (medium)	Significant (high)	Significant (high)

This methodology is applied through a combinative approach, covering at the same time the impact degree and strength, as well as sensibility of the receptors. After identifying the activity which might impact the recipients, the following steps are executed: defining of impact intensity, prognosis and planning of its level in the time regarding the impact strength, repetitiveness and duration.

The assessment of the impact on population has various aspects. It comprises different types of casuality, provoked by the change of socio-economic environment. The population attitude is motivated by various factors which might have both positive and negative effect on realization of a specific project, in this case, the pipeline “Komotini – Stara Zagora”.

As it is very difficult to make a quantitative assessment of the project impacts on the population, expert assessments are prepared, which in some degree describe the possible changes in the demographic picture and in the project attractiveness for the population.

4.3.8.1 During construction

A. Health risk for the population

The health risk and the impact of the pipeline construction on the population can be assessed as **insignificant (limited).** The impacts have a temporary effect (within the construction period), direct and indirect, with no cumulative effect.

The magnitude of the negative effect is insignificant, the effect intensity is low, the frequency is only during the construction (brief), the range is only for a part of the population in proximity of the construction site.

The significance of the social impacts can be defined as low to moderate, risks are controllable. It is necessary to prevent and keep the required measures for the impact mitigation.

Б. Health risk for the workers.

For the workers, the pipeline construction is work environment related to some physical and chemical detriments described above.

The health risk assessment for them, regarding criteria Probability, Exposition and Consequences/Harm can be defined as **not big, to medium**. Impact on professional health of the personnel working outdoors is not expected. Even in case of prolonged pollution due to temperature inversions, fog and windlessness, the expected impact on the workplaces will not be significant. In such case , the expected impact on the workplaces caused by the physical and chemical factors of the work environment is within the permissible and possible to prevent, with no permanent injuries of the body.

In a social aspect, the risks for workers have a small to medium degree of impact, can be prevented and controlled.

4.3.8.2 During operation

<u>*A. Health risk for the population*</u>.

During the pipeline operation, the health risk for the population is **low**, the population is not exposed to detriments from the pipeline maintenance activities.

When defining the impact significance, it is important to note the positive social effect which this project has on the economics and social environment of the areas through which it passes – opening of new places of work, providing of cheap and ecologically clean fuel, improving the infrastructure of the area. That is why the project impact significance could be defined as **high and positive.**

<u>*Б. Health risk for workers*</u>.

Unfavourable impacts on work environment are not expected during the pipeline normal operation, provided that all safety requirements stipulated in the project are strictly kept.

The safety requirements will be defined and described in details, and will comply with Bulgarian legislation, European and international norms and requirements and the best standards for the sector. The health risk is not big.

4.3.8.3 In case of emergency

In advance, it is difficult to define precisely the degree of health risk during emergencies because it depends on the type of emergency (break-down, fire, explosion, earthquake etc.), the degree of damage of the installations, the type and quantity of emissions, the remoteness of people from the break-down point etc.

Generally, only in case of insignificant gas leakage the risk for the population is low, the situation can be under control. For workers the risk is higher but controllable and does not lead to significant health injuries.

In case of fire, explosion or serious break-down, the risk increases significantly, gets more difficult to control and a real danger exists for human health and life. In order to prevent or control the risk in these cases suitable manuals shall be developed with plans, programmes, instructions for workers' behaviour, actions of the rescue services.

4.4 Summary assessment of the investment proprsal impacts on the environmental components and factors and population, health risk and Comparison of alternatives

A detailed qualitative characteristics of the potential impact of the investment proposal construction and operation on people and environment is presented in the EIAR.

The data related to the potential impacts during the investment proposal construction and operation, along both alternative routes – western and eastern, are summarized in a chart in the matrix below.

It becomes clear from the matrix that the western route is the route, realization of which is more conserving in terms of the environment. During the westrn route construction, lower impacts are expected than on the eastern route, regarding some environmental components: landscape, plant and animal species and protected sites, while regarding the rest of the components, it is expected to be equal to those on the eastern route.

A comparison of the alternatives with regards to the particular environmental components is shown below.

Air – The pipeline route eastern alternative is more unfavourable regarding air pollution, due to the terrain larger height and complicity, which will lead to bigger atmosphere pollution. It must be taken into consideration as well that most of the route goes through mountain areas and protected sites which are vulnerable in terms of the high degree of dusting and waste gases. For these reasons, it is better to choose the route western alternative.

Water – During the construction the impacts on **surface water** will be almost equal in type at both alternatives. In terms of degree, considering the number of crossings of big rivers, small streams and gullies during the pipeline construction, the two alternatives are almost equal and will make almost the same negative impact on the "water" component. When comparing the ecological condition of water bodies for both alternatives, it can be concluded that the water bodies impacted by the Eastern alternative have worse ecological potential.

During the construction the pipeline alternative routes are equal in terms of **groundwater** of crossing areas with vulnerable to pollution water-bearing collectors of type I, and are not in conflict with operative water-intake systems and facilities, as it is admissible for them to pass through belts II and III of their Sanitary Protection Zones. The western route of the pipeline looks like more acceptable for realization, due to the fact that it passes across the Sanitary Protection Zone of a **protected** area of an subterranean water body "Pore waters in Neogene-Quaternary-Haskovo" with code BG3G00000NQ009, while the eastern route passes across the Sanitary Protection Zone of an **unprotected** area of the same subterranean water body in a terrace of the River Haskovska. Apart from that, the construction band of the eastern route is closer to the boundaries of belts I of the boreholes.

Bowels of the earth – the anticipated impact on the bowels of the earth during the construction is in practice identical along the alternative pipeline routes, as it is likely to be insignificant, to low, brief, direct, reversible to a considerable degree. Corrections are made to the western route which bypasses deposits holding confirmed reserves of underground natural resources, while the same things will need to be specified about the eastern route.

Soils – During the construction, the type of impacts on the soils are identical for both options. Less valuable soils, from agricultural point of view, will be affected along the Eastern route in the area of East Rodopi only, in the part between the border of the Republic of Bulgaria and the Studen Kladenets dam lake. This is determined by the shallow and infertile soils prevailing in the area. However, in contrast to the rest, these shallow soils are strongly susceptible to erosion. Up to the convergence point of the two routes, the soil types and the impacts on them are similar. The necessity of construction of deviations from the main pipeline to the big towns, and the additional disturbance of new areas, as well as the risk of developing of erosion, makes the Eastern route the option with bigger general negative impact on soils.

Landscape – As the relief is one of the main factors contributing to the choice of the pipeline route, a comparison has been made between both alternatives regarding longitudinal profiles of the Western and Eastern route – as a result, it was found that there will be fewer steep slopes and problem mountain ridges, which would make the pipeline construction more difficult, along the Western route, which is the more suitable alternative. In morpho-hydrograpic aspect, the routes of the pipeline both alternatives pass through similar landscapes (mountain, hilly, plane). There will be a difference between the impacts at both alternatives of realization of the project in the areas before the convergence point of the route only, but at the western alternative the degree of the impact on the landscape components will be smaller, because at the eastern alternative the route will go across bigger number of densely afforested mountain ridges with steeper slopes, with typical mountain landscape and much fewer drops.

Flora, Fauna and Protected Natura 2000 sites

For the bigger part of the pipeline the two developed alternatives are elaborated (eastern and western route). In both cases the natural characteristic of habitats are impacted, but their different performance within each of the alternatives, is a precondition for a different degree of the impact on specific groups of animals. From the analysis made in item 2.3.2. and the comparison of the characteristics of both routes, the following conclusions are related to the fauna:

- The Eastern route covers three times bigger territory with mountain relief (76.40 km), and the Western route - 28.45 km;
- Percentage of occupied territory by the Ecological network “Natura 2000” – 18.80% of the Eastern route, compared to 4.9 % of the Western one;
- 26.46 km (18.2%) of the Eastern route length goes across woodland massives, while for the Western route this index has a value of 7.44km (4.9%);

On this basis it can be supposed that in case the Eastern alternative is realized, the impacts (including destroying of refuges during fellings for preparation of the construction works and probable death of specimens, as well as change of the natural characteristics of habitats) will be displayed in a significantly greater degree. This applies especially to the species inhabiting woodlands – birds, mammals and reptiles. The significant and long-term impacts, such as loss and fragmentation of habitats and disturbance, might lead to chasing away of some species. The impact on rapacious birds, nidificating in proximity of the Eastern route and regularly flying to the sites for artificial feeding of vultures in the area in order to eat.

The only advantage of the Eastern route is the fact that it crosses fewer reservoirs. In case of realization of the western alternative, crossing of the tail-end of “Studen kladenets” dam lake using the Horizontal Directional Drill (*HDD*) technology will affect for longer time terrestrial habitats near the shore, which later will be restoring for longer time. But these habitats in practice do not have preservational value because they are part of the technical facility dam lake. By using the technology of “*open cut crossing*” it will be necessary to dry this part, and so temporary loss of habitats for fish, water invertebrates and waterfowl birds will occur. Such a type of impact is temporary and quickly restorable. With both methods the disturbance factor will occur, for minimizing of which it is recommended that the construction works are implemented in minimum time, and the measures recommended in the Environment Impact Assessment Report and Compitability Assessment Report to be fullfilled.

The comparison of the alternative routes regarding the impacts of their realization on the fauna is shown in the chart bellow (the marks are based on the data available, surveys conducted and on the principle of cautiousness):

Supposed impact	**Western route**								**Eastern route**							
	Birds	**Mammals**	**Reptiles**	**Amphibians**	**Terrestrial invertebrates**	**Bats**	**Fish**	**Aquatic invertebrates**	**Birds**	**Mammals**	**Reptiles**	**Amphibians**	**Terrestrial invertebrates**	**Bats**	**Fish**	**Aquatic invertebrates**
Loss of habitats	xx	xx	xx	x	xx	xx	xx	xx	xxx	xxx	xxx	xx	xxx	xxx	x	x
Fragmented habitats	x	x	xx	x	x	x	xx	x	xx	xx	xx	xx	x	xx	x	x
Mortality	x	x	x	x	x		xx	xx	x	xx	xx	xx	xx		xx	x
Disturbance	xxx	xx	xx	xx	x	x	xx	x	xxx	xxx	xxx	xxx	x	xx	xx	x

Legend: **x** – low; **xx** – medium; **xxx** – significant impact.

In terms of the animal species, the choice for realization of the Western route has significantly smaller degree of impact both, regarding changes in the natural characteristics of favourable habitats, and regarding direct and indirect impact on animal species. In view of the reasons above, the comparison made in designers and experts' analyses and conclusions in the Environment Impact Assessment (EIA) Report regarding the expected impact on the environment components, it becomes apparent that the Western alternative is more favourable and preferable.

This attitude is confirmed by the conclusion in the Compitability Assessment Report too, namely that the Western alternative can be realized with regard to the aims of preservation of protected sites and enforcing of the operative Biological diversity Act and Directive 92/43/ЕИО. The preferred option for the western route crossing of Studen kladenets lake and the river Maritsa is according to the Horizontal Directional Drill (*HDD*) technology, and the length under the lake is about 1500 m, and under the river Maritsa – about 500 m.

Population – Regarding hazardous factors for the population, there is no difference between the two routes – the technology and impacts are identical. The impacts of the physical factors on the population and workers (the most important physical factor of significance to health during the construction is the noise), will be equal at realizing of each of the two routes for the pipeline construction. It was found from the comparison made between the two routes regarding some indeces related to the impacts of hazardous energy factors, such as: „availability of public road network", „access to rail ways", „proximity to towns", as well as indeces such as „necessity of temporary access roads", or „number of crossings of significant obstacles", (as part of them are railway lines or transport networks), that the western pipeline route is more preferable to the eastern one, regarding all the indeces, which is why it is recommended with regard to the impact of the physical factors (mainly noise), to accept the western route.

However the western route goes across and near bigger settlements in developed areas, which affords the opportunity for more people to use the natural resource – for household and public activities.

From the comparison made by the designers (shown in item 2), it becomes apparent that the western route is the preferable alternative to be accepted and approved for the next phase.

From the comparison made by the designers and the conclusions from the analysis in the EIA Report regarding the expected impact on the environmental components, it is apparent that the western route has lower impact and is more favourable and preferable.

The conclusion in the Compitability Assessment Report is that the western alternative can be realized with regard to the aims for preservation of Protected sites and applying of the operative Biological diversity Act and Directive 92/43/ЕИО, as well as regarding the aims for preservation of all Protected sites.

Matrix
for potential impacts assessment during realization of the investment proposal, in the particular stages of realization of the investment proposal: during the construction and during the operation – for the Western and Eastern routes

Impact	*Probability of impact occurrence* [1]	*Impact territorial range* [2]	*Impact type*		*Impact degree* [3]	*Impact characteristics*			*Measures for prevention, reduction or compensationof negative impact*
			Positive/ negative	*Direct/ indirect*		*Frequency* [4]	*Duration*[5]	*Cumulativity*	
During construction									
1.1. Atmospheric air and atmosphere									
- Western route	Expected	Local - Investment proposal route and the roads where transportation vehicles pass	Negative	Direct	Low	Temporary	Brief	Not expected	Implementation of the measures under item 6.1 and item 6.2.
- Eastern route	Expected	Local - Investment proposal route and the roads where transportation vehicles pass	Negative	Direct	Low	Temporary	Brief	Not expected	Implementation of the measures under item 6.1 and item 6.2.
1.2. Water									
1.2.1. Surface water									
- Western route	Expected	Local	Negative	Direct	Low	Temporary	Brief	Not expected	Implementation of the measures under item 6.1 and item 6.2.
- Eastern route	Expected	Local	Negative	Direct	Low	Temporary	Brief	Not expected	Implementation of the measures under item 6.1 and item 6.2.
1.2.2. Groundwater									
- Western route	Expected	Investment proposal route	Negative	Indirect	Low	Temporary	Brief	Yes	Implementation of the measures under item 6.1.2.2

Impact	*Probability of impact occurrence* [1]	*Impact territorial range* [2]	*Impact type*		*Impact degree* [3]	*Impact characteristics*			*Measures for prevention, reduction or compensationof negative impact*
			Positive/ negative	*Direct/ indirect*		*Frequency* [4]	*Duration* [5]	*Cumulativity*	
- Eastern route	Expected	Investment proposal route	Negative	Indirect	Low	Temporary	Brief	Yes	Implementation of the measures under item 6.1.2.2
1.3. Bowels of the earth									
- Western route -	Expected	Investment proposal route	Negative	Direct	Low	Permanent	Continuous	Yes	Implementation of the measures under item 6.1.3
- Eastern route	Expected	Investment proposal route	Negative	Direct	Low	Permanent	Continuous	Yes	Implementation of the measures under item 6.1.3
1.4. Soils									
- Western route	**Expected**	**Investment proposal route**	**Negative**	**Direct**	**Medium**	**Temporary**	**Medium**	**No**	***Proper storage and utilizationof mould. Prevention from compaction, pollution and erosion.***
- Eastern route	**Expected**	**Investment proposal route**	**Negative**	**Direct**	**Medium**	**Temporary**	**Medium**	**No**	***Proper storage and utilizationof mould. Prevention from compaction, pollution and erosion.***
1.5. Landscape									
- Western route	Expected	Investment proposal route	Negative	Direct	Low to **Medium**	Temporary	Brief	Yes	Using of machines to minimize the dust, effective transport planning.
- Eastern route	**Expected**	**Investment proposal route**	**Negative**	**Direct**	**Medium**	**Temporary**	**Brief**	**Yes**	**Using of machines to minimize the dust, effective transport planning**.
1.6. Biological diversity									

Impact	*Probability of impact occurrence* [1]	*Impact territorial range* [2]	*Impact type*		*Impact degree* [3]	*Impact characteristics*			*Measures for prevention, reduction or compensationof negative impact*
			Positive/ negative	*Direct/ indirect*		*Frequency* [4]	*Duration*[5]	*Cumulativity*	
1.6.1. Plant species									
- Western route	Expected	Investment proposal route	Negative	Direct and Indirect	Low to **Medium**	Permanent	Long-term	No	Item 6.2.
- Eastern route	**Expected**	**Investment proposal route**	**Negative**	**Direct and Indirect**	**Medium to High**	**Permanent**	**Long-term**	**No**	**Item 6.2.**
1.6.2. Animal species									
- Western route	Expected	Investment proposal route	Negative	Direct	Low to **Medium**	Temporary	Brief	Yes	Route displacement in some sections
- Eastern route	**Expected**	**Investment proposal route**	**Negative**	**Direct**	**Medium to High**	**Temporary**	**Brief**	**Yes**	**Route displacement in some sections. Choosing of the Western route**
1.6.3. Protected natural territories									
- Western route	Not expected								
- Eastern route	Not expected								
1.6.4. Protected zones	Expected	Investment proposal route	Negative	Direct and Indirect	Low	Permanent	Long-term	Yes	Item 6.2.
- Western route	Expected	Investment proposal route	Negative	Direct and Indirect	Low	Permanent	Long-term	Yes	Item 6.2.
- Eastern route	**Expected**	**Investment proposal route**	**Negative**	**Direct and Indirect**	**Low to Medium**	**Permanent**	**Long-term**	**Yes**	**Item 6.2.**
1.7. Waste generating									

Impact	*Probability of impact occurrence* [1]	*Impact territorial range* [2]	*Impact type*		*Impact degree* [3]	*Impact characteristics*			*Measures for prevention, reduction or compensationof negative impact*
			Positive/ negative	*Direct/ indirect*		*Frequency* [4]	*Duration* [5]	*Cumulativity*	
- Western route	Expected	Investment proposal route	Negative	Direct/ Indirect	Low	Temporary	Brief	No	Keeping of operative legislation regarding waste management.
- Eastern route	Expected	Investment proposal route	Negative	Direct/ Indirect	Low	Temporary	Brief	No	Keeping of operative legislation regarding waste management.
1.8. Hazardous power sources									
- Western route	Noise, vibrations, UV (construction workers) Noise (population) Visible light	Regional	Negative	Direct	Insignificant secondary	Once	Short-term	Insignificant	Implementation of the measures under item 6.1 and item 6.2.
- Eastern route	Noise, vibrations, UV (construction workers) Noise (population) Visible light	Regional	Negative	Direct	Insignificant secondary	Once	Short-term	Insignificant	Implementation of the measures under item 6.1 and item 6.2.
1.9. Material and cultural heritage									
- Western route	**Expected**	**Within the servitude of 40m on either side of the pipeline**	**Negative**	**Direct**	**High**	**High**	**Continuous**	**No**	**Complete salvage archaeological excavations of certain sites**

Impact	*Probability of impact occurrence* [1]	*Impact territorial range* [2]	*Impact type*		*Impact degree* [3]	*Impact characteristics*			*Measures for prevention, reduction or compensationof negative impact*
			Positive/ negative	*Direct/ indirect*		*Frequency* [4]	*Duration*[5]	*Cumulativity*	
- Eastern route	**Expected**	**Within the servitude of 40m on either side of the pipeline**	**Negative**	**Direct**	**High**	**High**	**Continuous**	**No**	**Complete salvage archaeological excavations of certain sites**
1.10. Personnel									
- Western route	**Expected**	**Investment proposal route**	**Negative**	**Direct**	**Medium**	**Permanent**	**Medium**	**Possible**	**Items 6.1; 6.2.**
- Eastern route	**Expected**	**Investment proposal route**	**Negative**	**Direct**	**Medium**	**Permanent**	**Medium**	**Possible**	**Items 6.1; 6.2.**
1.11. Population and health risk									
- Western route	Expected	Regional	Negative	Direct	Low	Temporary	Brief	No	Items 6.1 and 6.2
- Eastern route	Expected	Regional	Negative	Direct	Low	Temporary	Brief	No	Items 6.1 and 6.2
During operation									
1.1. Atmospheric air and atmosphere									
- Western route	Not expected								
- Eastern route	Not expected								
1.2. Water									
1.2.1. Surface water									
- Western route	Not expected								
- Eastern route	Not expected								

Impact	*Probability of impact occurrence* [1]	*Impact territorial range* [2]	*Impact type*		*Impact degree* [3]	*Impact characteristics*			*Measures for prevention, reduction or compensationof negative impact*
			Positive/ negative	*Direct/ indirect*		*Frequency* [4]	*Duration* [5]	*Cumulativity*	
1.2.2. Groundwater									
- Western route	Not expected								
- Eastern route	Not expected								
1.3.Bowels of the earth									
- Western route	Not expected								
- Eastern route	Not expected								
1.4. Soils									
- Western route	Not expected								
- Eastern route	Not expected								
1.5. Landscape									
- Western route	Expected	Investment proposal route	Negative	Indirect	Low	Permanent	Continuous	No	Remedy of the terrains diturbed
- Eastern route	Expected	Investment proposal route	Negative	Indirect	Low	Permanent	Continuous	No	Remedy of the terrains diturbed
1.6. Биологично разнообразие									
1.6.1. Растителен свят									

Impact	*Probability of impact occurrence* [1]	*Impact territorial range* [2]	*Impact type*		*Impact degree* [3]	*Impact characteristics*			*Measures for prevention, reduction or compensationof negative impact*
			Positive/ negative	*Direct/ indirect*		*Frequency* [4]	*Duration*[5]	*Cumulativity*	
- Western route	**Expected**	**Investment proposal route**	**Negative**	**Direct and Indirect**	**Medium**	**Temporary for the agricultural terrains, and permanent for the woodlands**	**Short-term for the agricultural territories, and long-term for the woodlands**	**No**	**Item 6.2**
- Eastern route	**Expected**	**Investment proposal route**	**Negative**	**Direct and Indirect**	**Medium to High**	**Temporary for the agricultural lands, grazing grounds, meadows, rock habitats and permanent for the woodlands**	**Short-term for the agricultural lands, grazing grounds, meadows, rock habitats and long-term for the woodlands**	**No**	**Item 6.2**
1.6.2. Animal species									
- Western route	Expected	Investment proposal route	Negative	Direct	Low	Permanent	Continuous	Yes	
- Eastern route	Expected	Investment proposal route	Negative	Direct	Low	Permanent	Continuous	Yes	Item 6.1 and 6.2
1.6.3. Protected natural territories									
- Western route	Not expected								
- Eastern route	Not expected								
1.6.4. Protected zones									
- Western route	Expected	Investment proposal route	Negative	Indirect	Low	Permanent	Long-term	Yes	Item 6.2.

Impact	*Probability of impact occurrence* [1]	*Impact territorial range* [2]	*Impact type*		*Impact degree* [3]	*Impact characteristics*			*Measures for prevention, reduction or compensationof negative impact*
			Positive/ negative	*Direct/ indirect*		*Frequency* [4]	*Duration*[5]	*Cumulativity*	
- Eastern route	Expected	Investment proposal route	Negative	Indirect	Low to **Medium**	Permanent	Long-term	Yes	Item 6.2.
1.7. Waste generating	.								
- Western route	Not expected								
- Eastern route	Not expected								
1.8. Hazardous power sources									
- Western route	Not expected								
- Eastern route	Not expected								
1.9. Cultural heritage									
- Western route	Not expected.								
- Eastern route	Not expected								
1.10. Personnel									
- Western route	Expected	Local	Negative	Direct	Low	Permanent	Continuous	No	
- Eastern route	Expected	Local	Negative	Direct	Low	Permanent	Continuous	No	Items 6.1; 6.2.
1.11. Population and health risk									
- Western route	*Expected*	*Regional*	*Positive*	*Indirect*	*High*	*Permanent*	*Continuous*	*No*	
- Eastern route	*Expected*	*Regional*	*Positive*	*Indirect*	*High*	*Permanent*	*Continuous*	*No*	Items 6.1; 6.2.

`[1] Expected, Not expected
[2] Investment proposal route , around the IP route ИП (can be indicated in metres),local, regional

[3] Low, Medium, High
[4] Permanent, Temporary
[5] Brief, Medium or Continuous
Italics –matrix elements with a positive impacts.
<u>Underlined</u> – matrix elements, from which an impact is not expected or elements from which an insignificant negative impact is expected.
Bold - matrix elements, from which a significant negative impact is expected.

4.5 Transboundary impact

This section has been amended according to a letter by MEW Изх. № ОВОС – 249/10.09.2012

Transboundary impacts may occur upon any pollution (resulting from project-related activities) which has reached a country (countries) neighboring the country where the pollution has taken place. The Investment proposal "Gas interconnector Greece – Bulgaria" will transfer a natural gas from Komotini – Greece to Stara Zagora – Bulgaria and will connect the gas transferring systems of both countries so transboundary impact may be expected only within the border area between Bulgaria and Greece.

In pursuance to its obligations under the ESPOO Convention the Bulgarian Ministry of Environment and Waters (MEW) has established contacts with the competent authority in Republic of Greece. The two Ministries have jointly agreed the EIA procedure regarding the transboundary context of the project. The Bulgarian MEW has sent a letter ref. OBOC-1376/15.12.2011 and an EIA notification about the investment proposal for "Construction of Gas Interconnector Greece-Bulgaria". On 13.02.2012 the Greek Ministry of Environment, Energy and Climate Changes has sent a letter in reply to the MEW letter (Ref. OBOC-1376/15.12.2011) and EIA notification about Construction of Gas Interconnector Greece – Bulgaria – *Reply to the EIA notification concerning "Construction of Gas Interconnector Greece - Bulgaria"*. In this letter the competent authority of Republic of Greece has expressed its intention to participate in the transboundary EIA procedure, in accordance with the provisions of Article 3 of the ESPOO Convention and Article 3 of Directive 85/337/EEC amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC. According to this letter: *The Project, during the phase of construction or operation does not cause significant, long and irreversible impacts on the physical and artificial environment both on Bulgarian and Greek territory, which are considered transboundary effects.*

The length of the preferable gas pipeline alternative is 31 km on Greek territory as there are two alternative gas pipeline routes reviewed on Bulgarian territory – East route and West route which will pass through the land of 3 districts (Kardzhali, Haskovo and Stara Zagora) and 10 municipalities (Kardzhali, Dzhebel, Kirkovo, Krumovgrad, Momchilgrad, Haskovo, Dimitrovgrad, Stambolovo, Stara Zagora and Opan). The length of the preferable West route in Bulgaria is 150.57 km and 145.67 km for the East route with the total length of the gas pipeline in Bulgaria and Greece on the West route amounting to 181.57 km and 176.57 km for the East route.

The border between Greece and Bulgaria runs along a high mountain ridge of Rhodopes mountain. The point where the gas pipeline will cross the border is located at an altitude of 950 m and 1.6 km east of Makaza border checkpoint on the international road which is still under construction. This is the highest part of East Rhodopes mountain in Bulgaria having a highly varied relief and more wooded areas. This part is crossed by small rivers as the closest river to the pipeline route is Lozengradska river. This border area in Bulgaria passes through part of the territory of a Natura 2000 protected areaBG0001032 „Iztochni Rodopi (East Rhodopes)" declared as such in pursuance of Directive 92/43 on the natural habitats, as it crosses a section with a length of approximately 6 km from that protected area. Due to the nature of the project and the geographical location of the border crossing point there are no works which are likely to cause significant effects resulting in transboundary impacts during the phase of pipeline construction and operation. ***Appendix 14*** of this EIA report details and makes assessment of the expected transboundary impacts in terms of individual components and environmental factors.

The proposed "preferable" route of the gas pipeline on Bulgarian and Greek territory is the best from technical and environmental point of view as compared to the other alternatives reviewed. No transboundary impact during pipeline construction and operation is expected because:

- Quantities of pollutants exceeding the limit values, which are likely to have a transboundary impact, will not be emitted into the air, waters and soils during pipeline construction and operation.
- The project does not cause climate changes, it does not cross or impact border rivers or lakes;
- The expected transboundary impact on the biological diversity is insignificant. The scope of impact of the gas pipeline in Greece does not cover important natural complexes or protected areas and sites as the nearest protected sites (under the Birds Directive) – Folliuri and Kompsatou are located more than 20 km away from the gas pipeline and the impact on the habitats of wolf and wild cat is expected to be insignificant. Protected area BG0001032 Rodopi-Iztochni (East Rhodopes) falls within the scope of pipeline impact in Bulgaria as the impact on the habitats and species is assessed as insignificant.

Letter № 1070/12/1119 dated 18.04.2012 by the Greek government summarizes that the project, during the phases of pipeline construction or operation, does not cause significant, long and irreversible impacts on the natural and artificial environment both on Bulgarian and Greek territory, which are considered transboundary effects. Therefore, we think that the project would be implemented without risks of negative transboundary impacts both on Bulgaria and Greek territory.

4.6 Cumulative impact

Cumulative impacts within the area where the project "Gas interconnector Greece – Bulgaria" will be implemented arise as a result of interaction of the project with other existing or future works within the same area.

Environmental impacts as a result of project implementation are related mainly to the construction phase whereas the pipeline operation will not cause significant environmental impacts. The planned duration of pipeline construction is approximately 18 months.

Therefore, cumulative impacts during pipeline construction may occur in combination with existing, already designed or constructed facilities and works, especially linear such as these listed below:

- Roads – **The West route** crosses 37 roads, 2 of them highways (under construction), 14 state roads (I ÷ III class) and 19 municipal roads, it crosses also a new road (constructed) to Makaza in 3 locations and the same road (under construction) in 2 locations, whereas **the East route** crosses 32 roads, 2 of them highways (under construction), 14 state roads (I ÷ III class) and 16 municipal roads.
- Railways: **The West route** crosses railways in 5 locations: 3 locations – Dimitrovgrad-Podkova railway, 1 location – Dimitrovgrad-Harmanli railway and 1 location – the high-speed railway project to Turkey, whereas **the East route** crosses railways in 5 locations: Dimitrovgrad-Podkova railway and the high-speed railway project to Turkey.

The highest cumulative impact is expected upon simultaneous construction of the gas pipeline and other linear facilities which it crosses, for instance: the new section of Trakia highway which is currently under construction, Maritsa highway – designed, first class road Kardzhali-Podkova-Makaza passage-Greece (international marking – E85, Bulgarian I-5) which is currently under construction and others, and the designed high-speed railway to Turkey. Construction of the pipeline crossing facility will be short and cumulative impact is likely to occur only if the construction works for both projects coincide in time. In this case there will be a cumulative impact from increased road traffic resulting in increased exhaust gas emissions, cumulative impact from high dust emissions during excavation works and cumulative impact may also be expected on the population in result of a high nose.

Future Investment Proposals - Referring to the information received from MEW, RIEW and the municipalities about other future projects it was found that series of investment proposals such as wind farms and solar plants, warehouses, silos, trade centers and others have been planed and will be implemented by different investors. There are some uncertainties regarding the potential cumulative impact considering the lack of information about the time schedule which the other investment proposals in the vicinity of the gas pipeline will be implemented within and weather they will be implemented. Considering the scale of these projects and their non-linear character it can be expected that their potential for causing cumulative impacts with the gas pipeline is low. Higher cumulative impact is likely to occur if the implementation periods of these projects coincide with that of the gas pipeline.

Some existing or foreseen facilities and works which would have a cumulative impact together with this investment proposal are described below:

- **Crossing railway and road infrastructure, railway stations** – during pipeline construction the road traffic in the vicinity to or upon crossing railway or road networks will be high which is a source of mortality for many mammals and amphibians listed in this EIA report; it is also a reason for fragmentation of habitats, high rate of fires, waste pollutions, air pollution, noise and other negative impacts. The cumulative impact of noise is temporary and insignificant in level. Visual cumulative impact on the landscape is expected upon crossing roads and railways. Cumulative noise impact on the population may be expected at working nearby railways and upon crossing high-traffic roads (including highways, crossroads etc.). High combustibility, fire hazards, explosion hazards, gas leaks, accidents related to the pipeline proximity to industrial sites, including chemical industry, may also be considered as cumulative effects at locations where the pipeline is to cross a road or railway. This may result in health hazards to the population and residents caused by accidents – gassing, respiratory problems, suffocation, burns etc. Insignificant cumulative impact is also possible with regard to groundwater and geology resulting mainly from mechanical damage on the surface layer of the geological base and eventually from infiltration of contaminated waters into groundwater bodies.
- **Pipeline depots at existing railway stations** – insignificant and short impact on the earth's subsurface and groundwater bodies, noise impact during pipeline loading and unloading and high traffic may be generated during arrangement of pipeline depots at existing railway stations along the pipeline route which will cumulate with the impact from built station communications and facilities, and from the railway traffic.
- **Road traffic** - road traffic on the existing road network will be high during pipeline construction thus causing increased exhaust gas emissions and noise emissions. The increase will be insignificant and cannot be considered as a case of significant cumulative impact. Cumulativeness may occur along the highways only but provided that vehicles comply with the standards the traffic will not increase to a level that exceeds the sanitary hygiene norms for ambient air quality and noise.
- **Presence of** many, intensively **cultivated lands, plowing new pastures and meadows for farming needs**. Farming works involve the use of pesticides, herbicides etc. which may result in **indirect negative impacts** on many species – especially species of open-air habitats and accumulation of impacts together with the pipeline construction. There are

too many cultivated lands within the pipeline section passing Gornotrakiyska nizina (Gornotrakiyska lowland). In the hilly lands of the villages of Kirkovo and Lozengradtsi all river terraces are 100 % cultivated for land farming;

- **Rivers and hydromeliorative activities,** including river corrections done in the past, wet zones draining, derivation facilities, river banks, reservoirs, hydro power plants and others, including those in protected zones. The West route crosses 35 rivers, 6 of them moderate and 29 small, the East route crosses 25 rivers – 6 of them moderate and 19 small as the common route cross 14 rivers, 1 of which very large (Maritsa), 2 moderate and 11 small (according to the river size classification). Most of the rivers which the pipeline route will cross have been made channels. Maritsa river has been diked almost along its whole length in Bulgaria. There is a cascade of 3 large reservoirs downstream Arda river. Hydro power plant permits have been issued for Harmanlyiska river and its feeders. All these activities have a serious negative impact on part of the species (amphibians, terrapins, water snakes and otters as this impact may increase during pipeline construction;
- **Excavation of inert materials from river beds, quarries** – Varbitsa and Dzhebelska rivers are fully excavated along most part of their stream with shoreline vegetation destroyed from unauthorized extraction of inert materials. Same is the state of all rivers in Kardzhali region. There is a quarry for inert materials on Maritsa river located just above the pipeline crossing. Cumulative impact on the landscape, noise and dust accumulation is expected upon pipeline crossing along quarries.
- **Intensive felling in woodlands** – some already done and others planned in the forest management plan of the forestry which the pipeline route will pass through. These works have extremely negative impacts on many mammals such as – wolf, bear, badger, wild cat, squirrel, all dormice and on some amphibians and reptiles – forest frog, salamander, grass snake etc. Felling in woodlands will be carried out during pipeline construction which may result in impact accumulation.
- **Wind farm and photovoltaic plant projects** – such projects exist in the vicinity of the pipeline route in the areas of Momchilgrad and Krumovgrad. Totally 130 wind turbines and 15 investment proposals for photovoltaic plants are under construction in protected area "Rodopi -Iztochni (East Rhodopes) and one investment proposal for protected site "Ostar Kamak (Sharp Stone) (as per data published in CA of SEANRE). Implementation of these projects is related to loss of habitats for many mammals and reptiles, however, such projects are not foreseen in the vicinity of pipeline routes so no cumulative impact is expected.
- A significant cumulative impact on the ichthyo-fauna may result from a **single or chronic pollution** from petrol products and lubricants, concrete and lime solutions, and household waste during construction. An unfavourable cumulative impact on the fish populations will result from the fragmentation of biocorridors caused by the pipeline crossing across rivers, sedimentation, change in hydro-chemical and hydrological regime of the river and impact pollutions of various origin.

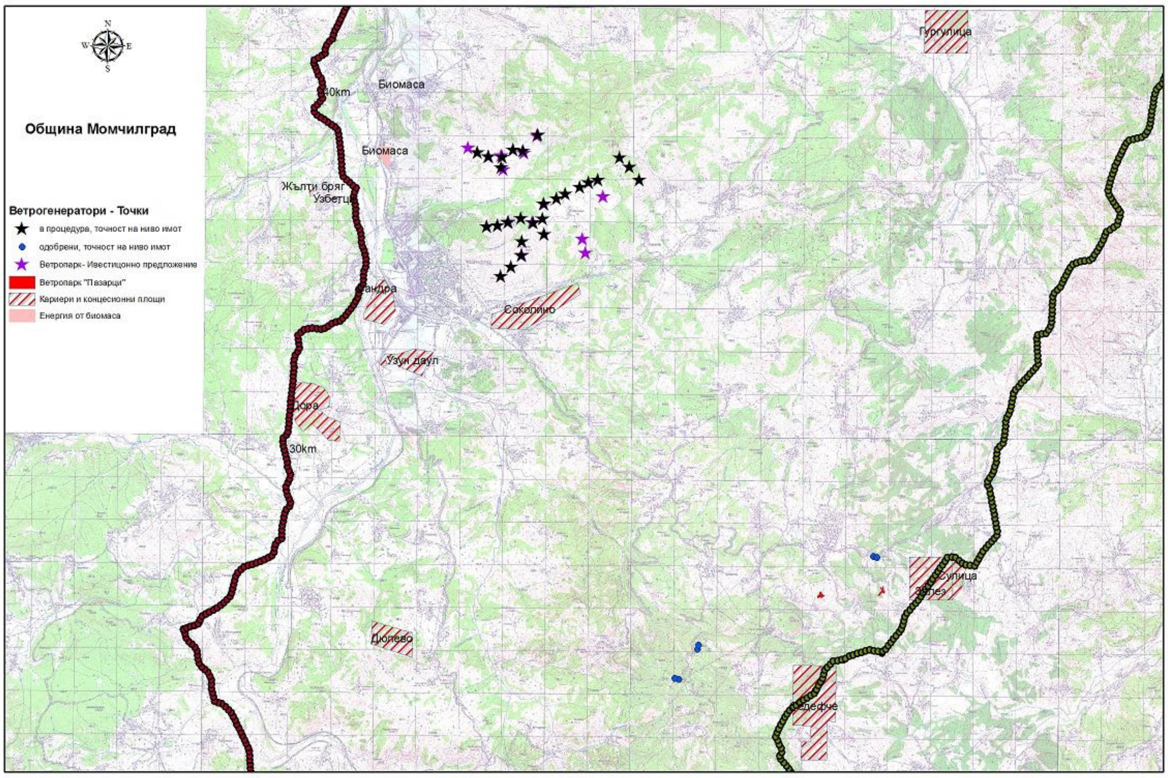
The Compliance assessment details old and new projects within each one of the protected sites which may cause cumulative impacts. This results in worsening of their protected status due to gradual accumulation of impacts caused by various investment proposals in combination with existing old and current impacts. Protected area "Rodopi-Iztochni (East Rhodopes)" is one of the largest protected areas in Bulgaria. However, it is extremely affected by old and new projects and therefore the cumulative effect on it is evaluated as very high.

Limited cumulative environmental impact may be expected only upon combining a few big projects of third parties with this project. Investment proposals outside protected areas but in the vicinity of the pipeline route are listed in the table below:

Municipality	Investment proposal	Purpose
Momchilgrad	Survey area - "Dyulevo"	Building materials
	Concession area - “Uzbetsi"	No data
	Survey area - "Dora"	Building materials
	Survey area - "Sulitsa"	Rock cladding materials
	Survey area - "Zalez"	Rock cladding materials
	Concession area - "Zhalti bryag"	Rock cladding materials
	Investment proposal - "Sedefche" quarry	Extraction of precious metals
	Investment proposal - "Sandra" quarry	Sand and gravel pit
	Survey area - "Uzun Daul"	Rock cladding materials
	Survey area - "Sokolino"	Rock cladding materials
	Investment proposal - "Biomass"	Biomass energy
	Investment proposal - "Biomass 2"	Biomass energy
	Investment proposal - "Wind turbines"	Wind energy
Haskovo	Stamboliyski – Industrial area	No data
	Orlovo	Mobile operator station
	Mandra	Mobile operator station
	Haskovo – Asphalt base	Asphalt base
	Haskovo – Holiday home	Holiday home
	Haskovo – Warehouses and production area	Fruits preservation
	Haskovo - Warehouse	Warehouse base
	Haskovo - Public services	No data
	Haskovo – Holiday home	Holiday home
	Haskovo – Production area	No data
	Haskovo – Production area	No data
	Haskovo – Warehouses and offices	Food warehouse
	Haskovo – Production areaщ	No data
	Haskovo – Holiday homea	Holiday home
	Haskovo- Production area	No data
	Haskovo – Warehouses and offices	Warehouses
	Podkrepa – Holiday home	Holiday home
	Podkrepa – Photovoltaic plant	Photovoltaic plant
Kardzhali	Ivantsi – Wind farm	Wind energy
	Ivantsi - Photovoltaic plant	Photovoltaic plant
Stara Zagora	Badeshte – Trade and logistic center	Trade and logistic centre
	Kolarovo - Greenhouses	Greenhouses
	Kolarovo - Dairy farm	Diary farm
	Yastrebovo	Silos and mill
	Sredets	Fodder factory

The most part of the pipeline route passes through populated areas with many implemented, authorized or planned investment proposals. From the scale of these known projects and their non-linear character it can be concluded that the significance of cumulative impact together with the project is low or insignificant.

The territory of municipality of Momchilgrad has the highest concentration of large and significant investment proposals. Implementation of the gas pipeline project together with implementation of the investment proposals will result in low cumulative impact.



There are no investment proposals on the territory of municipalities of **Kardzhali, Haskovo and Stara Zagora** creating conditions for occurrence of a cumulative impact**.**

5 INFORMATION ON USED ENIRONMENTAL IMPACT PROGNOSTIC AND ASSESSMENT METHODS

Conducting consultations regarding the scope of impacts in Bulgaria for determining the scope of Environmental Impact Assessment (EIA) is a mandatory procedure regulated by the EIA legislative framework (EIA Ordinance). It shall be carried out before the EIA report and involves conduction of consultations aiming at determining possible significant project impacts. As a result of determining the scope of impact an EIA specification was produced and submitted to the competent authority (MEW) for review and comments. In this way the competent authority has exercised intermediate control in the process of producing this EIA report. The EIA specification includes description of the project and its alternatives, and contents of the EIA report but the actual focus in on the detailed description of potential significant impacts which are likely to occur in result of this project. This EIA report has been developed on the grounds of the EIA specification.

Scope of impacts

Essential aspect of finding the scope of impacts is determination of the rate (spatial distribution) of the project components and works. The geographical scope of the EIA takes into consideration the following factors:

- Physical scale of the project components and works carried out within the facility sites and pipeline corridor.
- Condition of the existing environment and the way the impacts can spread beyond the site boundaries and pipeline corridor.

The latter depends on the type of impact: i.e. the archeological impacts are likely to be restricted within the locations physically affected by construction works whereas the noise impacts can spread outside the construction site boundaries, and emissions into the air can affect air quality over long distances. Therefore, the scope of EIA shall cover all areas which can be potentially affected on any topic studied.

Assessment of the impacts on environmental components and factors

The assessment covers impacts during pipeline construction and operation. It reviews the continuous impacts resulting from the progress of the project short-term temporary impacts which will occur during pipeline construction and long-term impacts which will occur during operation of the pipeline and auxiliaries.

The planned duration of pipeline construction phase is approximately 1 year. The construction of the separate pipeline sections partially coincide, but considering their spatial locations no cumulative impacts are expected. The EIA team had difficulties in collecting data about the time schedules for implementation of other projects/investments within the project area. This issue is described in section 7.1 - *Description of difficulties during preparation of the EIA report.* The pipeline's operating lifetime is expected to be at least 30 years as currently there are no concrete plans for pipeline shutdown and decommissioning. Therefore, the impacts related to this phase have not been assessed yet, however, measures for mitigating eventual effects after pipeline decommissioning i.e. soils pollution have been suggested.

General impact assessment approach and principles

Types of impact

The assessment investigates the impacts on social and ecological receptors and resources i.e humans (residents, workers etc.), physical, natural and cultural resources (soils and land, protected habitats and species, historical sites) resulting from the project development. The project development will cause different types of impact, including:

- Positive and negative impacts;
- Direct impacts which are an immediate result from the project works (like emissions), and indirect impacts as a result of the primary impacts (i.e. impacts on the ecosystem caused by changes in the air quality);
- Continuous impacts resulted from the project development (i.e loss of existing land usage), temporary impacts – for the period of construction (i.e noise during excavation works) and long-term impacts – during pipeline operation (i.e impacts on the air quality resulted from discharged emissions);
- Impacts from normal operations and such resulted from emergencies inside and outside the facilities (such as explosions and floods).

The impacts were assessed by comparing the existing conditions (i.e. conditions without the project) with the conditions which will dominate if the gas pipeline was constructed and commissioned. The information used for assessment of the existing environmental and social conditions was collected from different sources such as: Ministry of Environment and Waters, Regional Inspectorate of Environment and Waters, Basin Directorate, Municipal and District departments, Executive Forest Agency, Regional Forest Directorates, Ministry of economics, energy and tourism, Ministry of agriculture and food, National Road Infrastructure Agency, National Statistical Institute, museums etc.

Significance assessment

First,the impact significance is determined as:

- direct or indirect

- positive or negative

A combination of two methods is used for classification of the significance:

- magnitude (scale, size) of impact, and
- significance/value/sensitivity/vulnerability of receptor.

The impact significance assessment can be illustrated as follows:

Estimating the magnitude (scale, size) of impact – a solution regarding the vulnerability/sensitivity of receptor – impact significance assessment

The magnitude of impact is typically expressed by means of quantitative and qualitative values compared with local, national and international standards, norms and good practices; the latter varies according to the nature of impact. The magnitude of some impacts cannot be expressed in values/parameters. In such cases the assessment is subjective but based on the expertise and good practice.

The magnitude (size) of impact is identified as low, moderate or severe.. The significance of receptors depends on their number and vulnerability whereas the significance of ecological resources depends on their value (local, national or international). All protection signs shall also be taken into consideration. This assessment also depends on the professional estimation by the EIA team experts.

Degree of impact – (significance/value/sensitivity/vulnerability) is evaluated as ***– low, moderate or high.***

Than the final assessment of the impact considers the duration of impact:
Frequency of impact – continuous, intermittent
Duration of impact – short term, intermittent or long term

In the event of emergency situations (accidents, natural disasters etc.) both the probability of occurrence and effects shall be reviewed. Details for each case are presented and discussed in the relevant sections of this EIA report.

The methods given in "Reference book for existing environmental impact assessment methods", MEW, 1997 have also been used for environmental impact prognosis and assessment.

Assessment of impacts on protected species in NATURA 2000 protected areas. Methods of assessment and prognosis of impacts on protected species.

Reference books describing the environmental requirements of the relevant species and own observations of similar type of impacts on wet zones and on species and habitats were used during the assessment of impacts on protected species.

The assessment method is based on the requirements of the Ordinance about the conditions and order of carrying out compliance assessment of plans, programs, projects and investment proposals affecting protected zones as the requirements of the guidelines of the European Commission about Assessment of plans and projects affecting NATURA 2000 sites. Preliminary results of the available Manual for ensuring favorable conservation status to natural habitats and species as per Directive 92/43/EC were used for determining the impact assessment parameters. The manual has been produced on the grounds of the EU practice and adjusted to the specifics of Bulgaria, as necessary. The impact magnitude was evaluated on the grounds of the standard impact assessment criteria specified by the

European Directives – duration, reversibility, frequency, cumulativeness, type of impact (primary, secondary), possibility of applying mitigating/compensation measures.

Assessment of the impact magnitude of the alternative routes of gas interconnector Bulgaria-Greece, the influence on each criteria for favorable conversation state (FCS) – population within the area, area of habitats (specific small but important areas shall be reviewed separately), quality of habitats (structural and functional parameters), future perspectives (other essential parameters); other structural and functional parameters such as general functional role of the area for network connectivity – bio-corridor, geographic connectivity etc. shall also be assessed. The level of disturbance to animals was also evaluated. Characteristics of each type of impact is reviewed in section 3. A 10-level scale is used for assessment of the impact magnitude which allows a comparison of the different parameters of significance of an impact towards the standard indicators for assessment of the impact magnitude.

Table 12.1 The 10 magnitudes of impact.

Magnitude	Criterion
0	The work does not cause any impact
1	The work causes very low negative impact
2	The work may cause intermittent negative impacts
3	The work may cause short-term negative impacts
4	The work may cause secondary negative impacts
5	The work may cause cumulative negative impacts
6	The work may cause synergistic impacts
7	The work may cause secondary, cumulative, synergistic negative impacts. The impact may be removed by applying mitigating/compensating measures.
8	The work my cause severe secondary, cumulative, synergistic negative impacts. The impact may be removed by applying mitigating/compensating measures.
9	The work may cause severe, moderate or long-term/continuous negative impacts. The impact may be removed by applying mitigating/compensating measures.
10	The work causes severe and continuous/irreversible negative impact. The impact can not be removed by applying mitigating/compensating measures.

Four grades of impact have been adopted depending on the magnitude:

0 – no impact

from 1 to 3 – low impact which may be avoided without applying special measures other than keeping the best practices during construction and operation;

from 4 to 6 – moderate impact which shall be measured in combination with other factors and measures for its mitigation or removal shall be recommended

from 7 to 10 – severe impact which shall be removed by choosing alternative measures or applying mitigating and compensating measures.

5.1 Ambient air and atmosphere

- Climate guide of Bulgaria – books 1-5
- L. Sabev and Sv. Stanev „Climate regions of Bulgaria and their climate", Works of IMH 1959.
- Clean Air Act /SG 45/ 1996, 49/ 1996, 85/1997, 27/2000, 102/2001, 91/2002, 112/2003 /, amended SG issue 95 dated 29 November 2005, amended SG issue 99 dated 8 December 2006, amended SG issue 102 dated 19 December 2006, amended SG issue 86 dated 26 October 2007, amended SG issue 36 dated 4 April 2008, amended SG issue 52 dated 6 June 2008, amended SG issue 6 dated 23 January 2009, amended SG issue 82 dated 16 October 2009, amended SG issue 93 dated 24 November 2009, amended SG issue 41 dated 1 June 2010, amended SG issue 88 dated 9 November 2010, amended SG issue 35 dated 3 May 2011, amended SG issue 42 dated 3 June 2011.
- Ordinance № 2 dated 19.02.1998 about permissible emission limits for harmful substances discharged into the atmosphere from stationary sources (further amended SG issue 19 dated 08.03.2011).
- Balance methods for calculating emissions of harmful substances discharged into the ambient air, РД-299/2000, MEW
- Ordinance № 6/1999 about the order and method of measuring emissions of hazardous substances discharged into the ambient air from stationary sources /SG 31/1999, 52/ 2000/.
- Ordinance №7/1999 about evaluation and control of the ambient air quality / SG 45/ 1999 /.
- Ordinance № 12 date 15 July 2010 about limit values for sulphuric dioxide, nitrogen dioxide, fine dust particles, lead, benzene, carbon oxide and ozone in the ambient air (SG, issue 58 dated 30 July 2010 , in force as of 30.07.2010)
- Ordinance № 14/1997 about norms and maximum permissible concentrations of harmful substances in the ambient air of settlements / SG 88/1997 amended SG 46/1999 and SG issue 8 from 2002/.
- Ordinance about the requirements to the quality of liquid fuels, conditions and order of control (Adopted by GD № 156 dated 15.07.2003, amended SG issue 66 dated 25.07.2003, in force as of 1.10.2003, amended SG issue 69 dated 23.08.2005, in force as of 23.08.2005, amended SG issue 78 dated 30.09.2005, in force as of 1.10.2005, issue 40 dated 16.05.2006, in force as of 5.05.2006, amended SG issue, issue 76 dated 21.09.2007, in force as of 21.09.2007, amended SG, issue 93 dated 24 November 2009)
- Ordinance №16 for emissions of volatile organic compounds upon storage and transportation of petrol products.
- Ordinance № 3/1996 about the conditions and order of approving import/export certificates, issue of standpoints upon import of machines, devices and equipment containing Freon 11 and 12 and issue of standpoints for duty free import, for which MEW is a competent authority, as per GD № 266/1995 about the export/import regime /SG 29/1996/
- GD № 257/2001 about implementation of Ordinance for conditions and order of reducing pollution from vehicles, amended SG issue 98 dated 16 November 2001, amended issue 110 dated 21 December 2001, in force as of 01.01. 2002.
- Decree № 40 dated 23 February 2007 about implementation of Ordinance for emissions of volatile organic compounds upon usage of organic dissolvent in paints, varnishes and car repair materials, amended SG issue 20 dated 6 March 2007.

- Order № РД-299/2000, Balance methods for calculating emissions of harmful substances (pollutants) discharged into the ambient air /SG 45/1996, amended 49/1996, amended 85/1997, amended 27/2000/.
- Methods of calculating the height of discharging facilities, dispersion and expected concentration of pollutants in the atmosphere / approved by № РД-02-14-211/25.02.1998 of MRDPW, published BCA7,8/1998/.
- Manual for preliminary evaluation of the ambient air quality, a letter by the executive director of EAO dated 13.02.2002.
- Methods of calculating emissions of volatile organic compounds upon storage, loading and unloading of petrol products (approved by Order №РД-1238/01.10.2003 of MEW)
- Methods for determination of dispersion of harmful substance emissions from vehicles and their concentration in the ambient air (approved by Order №РД-994/04.08.2003 of MEW)
- Methods of determination of emissions from combustion processes in the energetics , industry, household heating and from manufacturing processes. Reference book of existing EIA methods, MEW 1997..

5.2 Waters

5.2.1 Surface waters

The ecological analysis was made on the grounds of existing regulatory documents and data:

- Water Act (amended SG issue 67 dated 27 July 1999);
- Ordinance № 9 dated 19.03.2001 about the drinking and household water quality, SG issue 30/2001.
- Ordinance № 1 dated 11.04.2011 about water monitoring (amended issue 34 dated 29.04.2011)
- Ordinance № 1 dated 10.10.2007 about survey, use and protection of groundwater (SG issue 87 dated 30.10.2007 , further amended SG issue 2 dated 8.01.2010);
- Ordinance № 6 dated 9 November 2000 about the emission limits of permissible content of harmful and hazardous substances in waste waters discharged into water objects issued by the Ministry of Environment and Waters, the Ministry of Regional Development and Public Works, the Ministry of Health and Ministry of Economics (amended SG issue 97 from 28 November 2000);
- Ordinance № 3 dated 16.10.2000 about the conditions and order of survey, design, approval and operation of sanitary protection zones around potable and household water sources and facilities and around sources of mineral waters used for medical, prevention, potable and hygienic needs, SG, issue 88/2000 г.
- Ordinance № 2 dated 8 June 2011 about issuance of permits for discharging waste waters into water objects and determination of individual emission limits for spot sources of pollution (SG issue 47 dated 21 June 2011)
- Ordinance №2 about water protection against nitrate pollution from agricultural sources, SG issue 27 ofrom 2000. Ordinance №7 dated 22 December 2003 about rules and standards of planning different types of territories and development zones (amended SG issue 3 date 13.01.2004 ; Resolution №653 by SAC from 2005 - SG issue 11 dated 01.02.2005).
- Ordinance № 7 about indicators and norms for determining the quality of surface running waters (amended SG issue 96 dated 12.12.1986);

- Ordinance № 13 dated 02.04.2007 about characterization of surface waters (SG issue 37 dated 14.10.2007, further amended SG issue 80 dated 14.10.2011);
- Ordinance for conditions and order for carrying out environmental impact assessment SG issue 25 from 2005, amended issue 3 from 2006.
- River management plan of Basin Directorate – East Aegean Region, Plovdiv 2010.
- Ecological assessment of river basins management plant of Basin Directorate, East Aegean Regions, Plovdiv, 2010.

The assessment is based on the project description given in section 1 and the environmental description given in item 3.2.1. The project works during construction and operation of the gas pipeline and associated systems were reviewed. The way the project will interact with water flows and the environmental sensibility towards the expected interactions was also evaluated. The assessment is based on information about the environmental controls and sensibility as well as on the experience gained from other infrastructure projects of similar nature published in various printed and internet materials. The requirements of the Bulgarian and European legislation were also observed. The impacts assessment uses information collected from competent authorities and expert consultations held with them. The norms of the Bulgarian legislation, conventions ratified by Bulgaria, monitoring data for environmental condition of the rivers to be crossed by the gas pipeline, opinions and standpoints of interested parties and other available materials were also considered. Assessment of the impact significance was made for both phases of the project: construction phase and operation phase. The impact magnitude was determined from the expected significance and sensitivity of the receiving environment.

5.2.2 Groundwater

- Antonov Hr., K.Danchev, 1980. Groundwater of Bulgaria.
- „Hydrocomp" OOD from1994 „Hydrogeological survey for pollution risk assessment on PS "Uzundjovo – 2 stage" and a sanitary protection zone project, Municipality of Haskovo
- Penspen instructions
- Basin directorate - East Aegean Region, 2010, Water management plan, book I EAR, book II Arda, book IV Maritsa
- Water Law
- Ordinance for conditions and order for carrying out environmental impact assessment
- Ordinance № 1/10.10.2007 for survey, usage and protection of groundwater
- Ordinance № 3/16.10.2000 for conditions and order of survey, design, approval and operation of sanitary protection zones around potable and household water sources and around sources of mineral waters used for medical, prophylactic, drinking and hygienic needs
- Ordinance № 1/11.04.2011 for water monitoring
- Ordinance for arrangement and safe operation of transmission and distribution gas pipelines and of equipment, installations and devices for natural gas
- Letter № РД-11-158/27.10.2011 by Basin Directorate East Aegean Region – Plovdiv
- Standpoint by „Water supply and sewage" OOD – Kardzhali № 486/02.11.2011
- Standpoint by „Water supply and sewage" OOD - Haskovo № 1660/24,10.2011
- Standpoint by „Water supply and sewage" OOD – Dimitrovgrad № 930/29.10.2011
- Standpoint by „Water supply and sewage" OOD - Stara Zagora №1585/11.10.2011 .

5.3 Earth's subsurface and mineral diversity

- Boyanov Iv. and others, 1989-1991. Geological map of Bulgaria, Map sheets Chirpan, Dimitrovgrad, Haskovo, Iskra, scale 1 : 100 000
- Jelev V., 2011-2012. Geology, conditions for excavations and geological hazards along the project corridors of gas pipeline Greece-Bulgaria on Bulgarian territory
- Kozhuharov D. and others , 1989-92. Geological map of Bulgaria, map sheets, Komotini, Ivailovgrad, Krumovgrad, scale 1 : 100 000
- Tsanko Ts. and others, 1995. Geological map of Bulgaria, map sheet Stara Zagora, scale 1 : 100 000
- Environmental protection Act
- Ordinance for conditions and order of carrying out environmental impact assessment
- Ordinance № 2/23.07.2007 about designing of buildings and facilities on seismic zones
- Mineral resources Act
- Ordinance about the arrangement and safe operation of transmission and distribution gas pipelines and equipment, installations and devices for natural gas
- Letter by "Mineral resources and concessions" department to MRDPW

5.4 Soils

Field surveys for identification and description of the soils to the EIA report of the investment proposal were conducted in the period of October-November 2011 and the available information was analyzed. The following reference materials were used:

- Geography of soils, M.Penkov, Izdatelstvo nauka I izkustvo 1978
- Atlas of soils in Bulgaria, Koynov V., Kabakchiev I., Boneva K., Zemizdat 1998
- Geography of Bulgaria, Institute of geography in BAC, Sofia 2002
- Materials from soil surveys and maps, Institute "N.Pushkarov" 1981, Executive agency of soil resources

The following reference materials were used for assessment of impacts and prognosis of effects on soils upon implementation of the investment proposal:

- Reference book of existing methods for assessment and prognosis of environmental impact, MEW 1997
- Manual for assessment of the type and level of agricultural soils pollution and regime of their usage. MHF, Sofia 1994.
- Soils Act, amended SG issue 89 dated 6 November 2007, amended SG issue 92 dated 22 November 2011
- Ordinance № 3 dated 1 August 2008 about limit values for hazardous substances content in soils
- Ordinance № 26 about re-cultivation of damaged terrains, improvement of infertile lands, taking and utilization of humus layer, amended SG issue 89 dated 22 October 1996, amended SG issue 30 dated 22 March 2002
- Ordinance on soils monitoring dated 12 January 2009, amended SG issue 19 dated 13 March 2009
- Agricultural lands protection Act, amended SG issue 35 dated 24 April 1996, amended SG issue 39 dated 20 May 2011
- Environmental Protection Act, amended SG issue 91 dated 25 September 2002, amended SG issue 42 dated 3 June 2011

5.5 Landscape

For landscape impact assessment field surveys and landscape reviews were conducted on the territory of the investment proposal in October 2011. The presence of protected sites and natural landmarks within the investment proposal area was determined with the purpose of protecting their typical landscapes according to the Protected Areas Act.

The available information was collected and analyzed in order to be assessed the magnitude of potential negative impact on the landscape components and measures for mitigating these negative impacts were determined. A review of the national and international regulatory documents and other data bases, maps and schemes was also made.

Assessment of the significance of impacts on the landscape and the visual impact was conducted according to "Guidelines for landscape and visual impact assessment" (UK) due to lack of issued guidelines for landscape and visual impact assessment in Bulgaria. The methods are applicable for assessing the short-term impacts during construction and all long-term impacts during pipeline operation and decommissioning.

The following methods and regulatory documents for landscape classification and landscape impact assessment during pipeline construction were used:

- Guidelines for landscape and visual impact assessment. Landscape Institute and Environmental Assessors Institute (Second edition) 2002. UK;
- Methods for physical-geographical and landscape zoning, Georgiev M., Landscape, Zemizdat, 1982 г.;
- Methods for physical-geographical and landscape zoning, Georgiev M., Physical geography of Bulgaria, University press "Sv. Kliment Ohridski", 1991;
- Main principles of landscape differentiations, Petrov P., Geography of Bulgaria, BAS, 1997;
- Main principles and methods of landscape zoning, Petrov P. Geography of Bulgaria, BAS, 1997;
- Reference book of existing methods for environmental impact assessment and prognosis, MEW, 1997;
- Physical and social-economical geography of Bulgaria, From, 2002
- Environmental Protection Act, amended SG issue 91 dated 25 September 2002, amended SG issue 42 dated 3 June 2011;
- Forests Act, amended SG issue 19 dated 8 March 2011, amended SG issue 43 dated 7 June 2011;
- Protected Areas Act, amended SG issue 133 dated 11 November 1998, further amended SG issue 19 dated 8 March 2011;
- Ordinance No 26 about re-cultivation of damaged terrains, improvement of infertile lands, taking and utilization of humus layer, adopted by the Ministry of agriculture and foods, Ministry of environment and waters, Ministry of regional development and public works and Committee of forests to the Council of ministers, amended SG issue 89 dated 22 October 1996, amended SG issue 30 dated 22 March 2002.

5.6 Biological diversity

5.6.1 Flora

For flora impact assessment along the pipeline route field surveys and review of habitats and condition of green systems (agricultural lands and forests) were conducted. The presence of Natura 2000 protected areas within the pipeline area according to the Protected Areas Act was also determined.

The available information was reviewed and analyzed in order to be assessed the magnitude of negative impact on the flora and measures for mitigating these negative impacts were determined. A review of the national and international regulatory documents and other data bases, maps and schemes was also made.

Identification of habitats was made by identifying key plant communities or specific plant species within them. Determination of the plant communities was made by using the floristic method (Braun-Blanquet 1964). This method determines the complete floristic composition of typical plant communities and typical species for concrete habitats. Most part of the natural habitats listed in Appendix I to Directive 92/43 EEC and Appendix I to the Biological Diversity Act are characterized by means of syntaxons of various rank (class, order, union, association), described according to the above method.

For identifying the floristic characteristics and all plant species within a particular habitat the presence of rare, endangered and protected plant species according to the Habitats Directive, the Biological Diversity Act, The Red book of Bulgaria and other regulatory documents and reference books was determined.

Furthermore, assessment methods for evaluating the biocenosis condition depending on the biocenosis value of the areas will be used for identifying the plant species on the territory impacted by the investment proposal .

For identification and classification of the plant species and assessment of the impacts during pipeline construction and operation the following methods and reference books were used:

- Geobotanical zoning of Bulgaria, Iv,Bondev (1991), Physical and social-economical geography of Bulgaria, ForKom, Institute of geography to BAS, 2002;
- Red book of Bulgaria, Book I Plants, 1984, BAS;
- Red book of Bulgaria, Book I Plants and Book III Natural habitat, 2011, BAS;
- Reference book of existing methods for environmental impact assessment and prognosis, MEW, 1997;
- Kavrakova V., Dimova D., Dimitrov M., Tsonev R., Belev T., Rakovska K., 2009. Manual for determination of habitats of European importance in Bulgaria, Second revised edition. Sofia, World wildlife fund, Danube-Carpathian programme and "Zeleni Balkani (Green Balkans) federation: 131;
- Environmental Protection Act, amended SG issue 91 dated 25 September 2002, amended SG issue 42 dated 3 June 2011;
- Forests Act, amended SG issue 19 dated 8 March 2011, amended SG issue 43 dated 7 June 2011;
- Manual on the application of the Forests Act, amended SG issue 41 dated 10 April 1998, further amended SG issue 7 dated 21 January 2011;
- Protected Areas Act, amended SG issue 133 dated 11 November 1998, further amended SG issue 19 dated 8 March 2011;
- Biological Diversity Act, amended SG issue 77 dated 9 August 2002, further amended SG issue 33 dated 26 April 2011;
- Ordinance No 26 about re-cultivation of damaged terrains, improvement of infertile lands, taking and utilization of humus layer, adopted by the Ministry of agriculture and foods, Ministry of environment and waters, Ministry of regional development and public works and Committee of forests to the Council of ministers, amended SG issue 89 dated 22 October 1996, amended SG issue 30 dated 22 March 2002.
- Ordinance No 16 dated 9 June 2004 about servitude of energy sites (amended SG issue 88 dated 8 October 2004, amended SG issue 77 dated 2 September 2008).

5.6.2 Fauna

Methods used for collection of information

Reference books describing the environmental requirements of animals and habitats, and results from own monitoring along the two alternatives of Alternative I conducted in the period of October-November 2011 and April-May 2012 were used for animal species impact assessment. A detailed survey of all habitats of animal species along the pipeline route was made and all identified habitats of protected species were marked by GPS and photographed. Stocks of hamsters, holes of polecats (*vormela peregrusna*), habitats of otters and wolf tracks were found and marked in the autumn period, as well as habitats suitable for amphibians and reptiles along the pipeline route. The stocks of hamsters were identified by the occupied holes and the stock boundaries were marked. In the spring of 2012 these areas were visited again and the species of amphibians and reptiles and their number were surveyed. Further search for stocks of hamsters and holes of polecats (*vormela peregrusna*), and for otter tracks, wolf tracks and bear tracks on the mud was also carried out. All areas with habitats suitable for hamsters, polecats, otter and reptiles were surveyed by means of walking transects on the route itself and within a radius of 200 m around it. The ponds were surveyed for amphibians and pond turtles within a radium of 1 km from both sides of the proposed route.

Updated published and non-published data about the habitats and numbers of species within the surveyed area were used. The assessment methods are based on the requirements of the Environmental impact assessment ordinance issued by MEW (SG, issue 3/2006). The Manual on identification and determination of protected status of species and habitats as per Directive 92/43/EEC was used upon specifying the parameters which the impact is assessed towards. The impact magnitude was assessed on the grounds of the standard impact assessment criteria set by the European Directives – duration, reversibility, frequency, cumulativeness, type of impact – main (direct) or secondary (indirect), possibility of applying mitigating (compensating) measures.

Reference books used:

- BIOLOGICAL DIVERSITY ACT, SG issue, 2002.
- ENVIRONMENTAL PROTECTION ACT
- ORDINANCE BY MEW ABOUT ENVIRONMENTAL IMPACT ASSESSMENT (SG, issue 3/2006)
- NATIONAL PLAN ON BIOLOGICAL DIVERSITY PROTECTION.2000. MEW.
- BESHKOV V. 1993. Amphibians and reptiles - B: Sakalyan, M. (rev.). National strategy on biological diversity protection. Main reports. Book 1, C., American Agency of International Development, 567-584.
- BESHKOV V., Amphibians and reptiles – Report on project “Corine Biotopes”, MEW, 12 p.
- BESHKOV V., K.NANEV 2002. Amphibians and reptiles in Bulgaria. Sofia-Moskow, Pensoft. 120 p.
- BECHEV D., A.STOYANOVA. 2004. Habitats of invertebrates of conservation importance in Rhodopes (Bulgaria) – Scientific papers by “Animalia”, 40 (6): 19 – 25.
- BISERKOV V. (REV.), B. NAUMOV, N.TZANKOV, A. STOYANOV, B.PETROV, D.DOBREV, P. STOEV. 2007. Guide to amphibians and reptiles in Bulgaria. Sofia, Green Balkans. 196 p.
- GOLEMANSKI V. (man.editor) 2011. Red book of Bulgaria. Book 2. Animal – BAS.
- DUHALOV D. 1995. Amphibians and reptiles within the area of Davidkovska river and Kardzhali reservoir – Project report, Forests committee, 2 p.
- EC. 2002. Assessment of plans and projects impacting Natura 2000 locations. Guide to regulations under art.6 (3) and (4) of the Habitats Directive 92/43/EEC. Office of official publications of the European Community. ISBN 92-828-1818-7 (Bulgarian translation)

- ZINGSTRA H., KOVACHEV A., KITNEYS K., TZONEV R., DIMOVA D. & TZVETKOV P. (REV.) 2009 - Assessment manual for favorable protected status of types of natural habitats and species under NATURA 2000 in Bulgaria. Wageninge UR, "Balkani" Wildlife Society, Bulgarian Biodiversity Foundation.
- Protection of tortoises in Bulgaria. BBPS-Plovdiv. 2003-2007. http://testudo.bspb.org/bg.php?id=5п
- PETROV B., P.STOEV 1997. Reptiles in East Rhodopes: species, habitats, relative number, protection measures, and areas of high diversity - B: Protection of biological diversity in East Rhodopes, Bulgarian-Swiss program for protection of biological diversity, Book II, 240-263.
- PETROV B., P.STOEV., V. BESHKOV 2001. Review on species and habitats of amphibians and reptiles in East Rhodopes - Hist. Nat. Bulg., 13: 127-153.
- PETROV B., 2002. Condition of Reptiles in East Rhodopes, project GEF-PDF „Assessment of existing information about the biological diversity in East Rhodopes".
- PETROV B., 2008. Bats – methods of environmental impact assessment and compliance assessment. Guidelines for Investors and environmental experts – National museum of natural history – BAS, 88 c.
- PETROV B., V.BESHKOV., G.POPGEORGIEV, D.PLACHYISKI 2003. "National action plan for protection of tortoises in Bulgaria", Revision 1, BNPS, BAS- Sofia.
- PESHEV TZ., D. PESHEV, V.POPOV 2004 - Fauna of Bulgaria. Book 27. Mammalia. – BAS, Sofia.
- POPOV V., A.SEDEFCHEV 2003. Mammals in Bulgaria – field guide", Library "Vitosha", Sofia.
- SAKALYAN M. (REV.) 1993. NATIONAL STRATEGY OF BIODIVERISTY PROTECTION. Main reports. Book 1. The Biodiversity Support Program, 663 c.
- GEORGIEV, D. G. (2005) Habitats of the Otter (*Lutra lutra* L.) in some Regions of Southern Bulgaria. *IUCN Otter Spec. Group Bull*. **18**(1): 6 - 13
- IUCN Red List http://www.iucnredlist.org/.
- GEOGRAPHY OF BULGARIA (Rev. M.Yordanova&D.Donchev). Publisher "Marin Drinov" 1997, C.
- GRUEV B.,.1986. General biogeography – Nauka i izkustvo, Sofia, 396 p.
- PANDURSKI I., V.POPOV. 2008**.** Monitoring study on bats (Mammalia: Chiroptera) in East Rhodopes, Bulgaria. Miscellanea of speleological conference, Sofia: 148-156.
- AHLÉN, I., H. BAAGØE. 1999. Use of ultrasound detectors for bats studies in Europe: experiences from field identification, surveys, and monitoring. – Acta chiropterologica, 1 (2): 137 – 150.
- BATTERSBY J. (comp.). 2010. Guidelines for Surveillance and Monitoring of European Bats.-EUROBATS Publication Series No. 5., UNEP / EUROBATS Secretariat, Bonn, Germany, 95: 133-157.
- FURMANKIEWICZ, J. 2003. The vocal activity of *Pipistrellus nathusii* (Vespertilionidae) in SW Poland. – Acta Chiropterologica, 5(1): 97-105.
- HUBENOV, Z. 2004. Estimation of the faunistic diversity of the East Rhodopes.- In: Beron P., Popov A. (eds.), Biodiversity of Bulgaria. 2. Biodiversity of East Rhodopes (Bulgaria and Greece). – Pensoft & Nat. Mus. Natur. Hist., Sofia, 941-951.
- IVANOVA, T., GUEORGUIEVA, A. 2004. Bats (Mammalia: Chiroptera) of East Rhodopes (Bulgaria and Greece) – species diversity, zoogeography and faunal patterns. – In: Beron P., Popov A. (eds.), Biodiversity of Bulgaria. 2. Biodiversity of East Rhodopes (Bulgaria and Greece). – Pensoft & Nat. Mus. Natur. Hist., Sofia: 907-927.

- KUNZ T., R. HODGKINSON, CH. WEISE. 2009a. Methods of capturing and handling of bat.- In: Kunz T, Parsons S (Eds.) Ecological and behavioral methods for the study of bats, Johns Hopkins University Press, 3-35.
- KUNZ, M. BETKE, N. HRISTOV, M. VONHOF. 2009b. Methods for accessing the colony size, population size and relative abundance of bats. - In: Kunz T, Parsons S (Eds.) Ecological and behavioral methods for the study of bats, Johns Hopkins University Press,
- MINKOVA, T. 2004. Small mammals (Insectivora & Rodentia) of the East Rhodopes (Bulgaria). – In: Beron P., Popov A. (eds.), Biodiversity of Bulgaria. 2. Biodiversity of East Rhodopes (Bulgaria and Greece). – Pensoft & Nat. Mus. Natur. Hist., Sofia: 895–906.
- PETROV B. 2004. The herpetofauna (Amphibia and Reptilia) of the East Rhodopes (Bulgaria and Greece). – In: Beron P., Popov A. (eds.), Biodiversity of Bulgaria. 2. Biodiversity of East Rhodopes (Bulgaria and Greece). – Pensoft & Nat. Mus. Natur. Hist., Sofia: 863-879.
- SPASSOV, N., MARKOV, G. 2004. Biodivesity of large mammals (Macromammalia) in the East Rhodopes (Bulgaria).- In: Beron P., Popov A. (eds.), Biodiversity of Bulgaria. 2. Biodiversity of East Rhodopes (Bulgaria and Greece). – Pensoft & Nat. Mus. Natur. Hist., Sofia, 929-940.
- STEFANOV T., TRICHKOVA T. 2004. Fish species diversity in the East Rhodopes (Bulgaria). – In: Beron P., Popov A. (eds.), Biodiversity of Bulgaria. 2. Biodiversity of East Rhodopes (Bulgaria and Greece). – Pensoft & Nat. Mus. Natur. Hist., Sofia, 849-861.
- STOYCHEV, S., HRISTOV H., IANKOV P., DEMERDZHIEV D. 2004. Birds in the Bulgarian part of the East Rhodopes. – In: Beron P., Popov A. (eds.), Biodiversity of Bulgaria. 2. Biodiversity of East Rhodopes (Bulgaria and Greece). – Pensoft & Nat. Mus. Natur. Hist., Sofia, 881-894.
- **Vidinova, Y.,** I. Yaneva, V. Tyufekchieva, B. Zadneprovski. 2007. Composition and abundance of macroinvertebrate communities in the Arda River (South Bulgaria) in relation to some ecological factors. - Acta zoologica bulgarica, 59(3), 309-324.
- **Vidinova Y.**, V. Tyufekchieva, I. Yaneva, B. Zadneprovski, S. Stoichev, K. Kumanski†. (2008). Species composition and structure of the macroinvertebrate communities in Arda River. – Acta zoological bulgarica, 60 (3), 2008: 317-330, Sofia.
- WILDLIFE ACT, Amendment, 2000, Ireland, № 38: p. 78

5.6.3 Protected areas

Environmental analysis was made on the grounds of existing regulatory documents and reference books:

- Important bird areas in Bulgaria and Natura 2000", 2007, BBPS, Sofia;
- Environmental Protection Act (amended SG 91/ 25.09.2002, further amended SG issue 42/ 03.06.2011);
- Protected Areas Act (amended SG issue 133/ 11.11.1998, further amended SG issue 19/ 08.03.2011);
- Register of protected areas, EEA;

5.6.4 Protected sites

Natural habitats

The alternative routes were visited and surveyed by the compliance assessment team in October 2011. Standard phytosociological surveys including phytosociological descriptions in key areas were conducted.

Data from the standard NATURA 2000 forms were used for the impact assessment zones.

Data from forestry plans of the state forestry whose territories the pipeline alternatives pass through were used (Stara Zagora, Haskovo, Kardzhali, Momchilgrad, Dzhebel, Kirkovo,Krumovgrad).

Information from topographic and forest maps as well as from satellite imagery (Google Earth) was analyzed.

Information from filed visits by experts involved in other projects and surveys was also used.

Reference books describing the environmental requirements of protected species, their habitats and ecology as well as results from own monitoring along the two alternatives of the route conducted in the period of October-November 2011 were used for protected species impact assessment. A detailed field survey of all animal habitats within the pipeline route was also made. All identified stocks of protected species were marked by GPS and photographed. The most updated published and non-published data about habitats and numbers of target species within the surveyed area were used.

An ultrasonic detector type “Pettersson D 240” and a digital recorder “Transcend MP 860” were used during a field survey of species and bat survey conducted in October 2011.

Birds survey methods

Purposeful ornithological surveys for developing the compliance assessment were not conducted. Reference books and non-published data from field surveys conducted in the area of East Rhodopes were used, including mapping of the nesting ornithofauna as well as field surveys of particular species. Available published information about nesting sites of some bird species – mainly vultures and black storks, and personal information collected by experts during field visits non-related to this investment proposal was also used. Data about the wintering and migratory water birds are based mainly on the results of the winter counting of water birds within the area.

A walkdown along the West alternative was carried out in October 2011 aimed at collecting more information about habitats of protected bird species within Studen Kladenets protected site and the area. This assessment has been developed on the grounds of the reference books listed in section 12 and the observations conducted in October 2011.

Environmental analysis was made on the grounds of the following available regulatory documents and reference books:

- Important bird areas in Bulgaria and Natura 2000, 2007 BSPB Sofia;
- Environmental Protection Act (amended SG 91/ 25.09.2002, further amended SG 42/ 03.06.2011);
- Biological Diversity Act (amended SG 77 dated 9 August 2002, further amended SG issue 33 dated 26 April 2011;
- Standard forms of Natura 2000 protected areas;

5.7 Cultural heritage

The archeological survey was conducted according to the requirements and the archeological survey methods specified in the Cultural Heritage Act (SG issue 19/2009 amended), Ordinance № H-00-0001/14.02.2011 on the conduction of field archeological surveys issued by the Minister of Culture (SG issue 18/01.03.2011), and for the rest of the immovable cultural property – Ordinance No 5 by the Ministry of Culture (SG issue

60/1998). The information about the presence of cultural-historical sites was received from the National archive of the National institute of immovable cultural heritage, AIS "Archeological map of Bulgaria, information from RMH-Kardzhali, RMH-Haskovo, RMH-Stara Zagora, publications and other sources, including field observations by other archeologists within the same area.

5.8 Hazardous energy pollutants

The following methods and instructions for assessment of the impact of physical factors on workers and population were used:

- Road traffic noise measurement methods, Ordinance № 6, SG issue 58/2006.
- МФ 07-97. Methods for establishment of sanitary protection zones around sites emitting electromagnetic fields in populated areas, Book of sanitary survey methods, NCHMEF Book IV, 2002.
- МФ 07-97. Methods for establishment of sanitary protection zones around sites emitting electromagnetic fields in populated areas.
- Guidelines for limiting exposure to time-varying electric and magnetic fields (up to 300 GHz), ICNIRP, Health Physics, April 1998, Volume 74, Number 4, p. 494-522.
- Stranks, J. - Handbook of health and safety practice, Pitman Publ., 1994, Метод за оценка на риска от въздействие на физически фактори.

5.9 Population and health hazards

Methods

- Methods for measurement of total sound power emitted into the environment from industrial sites and measuring the noise level within the area of impact. Prepared on the grounds of art.4.5 of Appendix 3 to art.6, para.1 of Ordinance 6 for environmental noise). Order. РД-199/2007, MEW.
- IPCC Guidelines for National GHG Inventories' 1994 (measurement of exhaust gases from vehicles and machinery)
- M. Vlaseva, Z;Dinchev, Methods, computer programs and instructions for determination of environmental protection zones from a spot source of harmful gases – course project on Ecology and environmental protection, UMG "St.Ivan Rilski", Sofia 1996
- Air dispersion modeling guideline for Ontario PIB S#516e, 2005
- Atmospheric dispersion in nuclear power plant citing. Safety Series N 50-SG-S3, IAEA, Vienna, 2008
- Occupational health and safety management systems - Guide: British Standard, BS 8800, BSI 2004; and Managing Safety the Systems Way: Implementing OHSAS 18001 using BS 8800, BSI 2004.
- Council Directive 89/391/EEC with Guidance on Risk Assessment at work
- California Environ. Protection Agency – Health Hazards Assessment
- Presenting Uncertainty in Health Risk Assessment: Initial Studies of Its Effects on Risk Perception and Trust, J. Risk Analysis, Volume 15, Issue 4, p 439–541;
- Health Risk Assessment – National Center of Public Health and Analysis, Sofia, 2005

6 DESCRIPTION OF MEASURES PROVIDED TO PREVENT, REDUCE OR, WHERE POSSIBLE, CEASE THE SIGNIFICANT

HARMFUL IMPACTS ON THE ENVIRONMENT, AS WELL AS A PLAN FOR IMPLEMENTATION OF THESE MEASURES

In this section of the EIA Report suggestions are made for measures to prevent, reduce or, where possible, cease the significant harmful impacts on the components and factors of the environment and for ensuring compliance with the environmental regulations, as well as plan for the implementation of those measures following the sample provided in appendix №2 a of *Ordinance on the conditions and order for carrying out an Environmental Impact Assessment.*

In this section of the report recommendations are also given regarding the self-monitoring plan and the emergency planning.

6.1 Description of the mesures

6.1.1 Atmospheric air and atmosphere

During the construction - it is necessary to take 2 types of measures:

- To reduce the dust in the air and the concentration of exhaust gasses in the area of the construction sites and the transportation routes used, as a result from the work of the heavy-freight and transportation machines.
- To eliminate the danger of air pollution during operation and to reduce the probability of accidents.

Description of the necessary measures:

1. Maintenance of the utilized transportation, mounting and construction equipment according to the requirements no only of the national and European standards but also to the best practices of the industry.

2. Because long droughts are characteristic to the area, especially towards the end of summer and the beginning of autumn, in order to reduce the level of dust from the excavation works and reemissions from the temporary roads, it is necessary to sprinkle the excavated mass of soil and the internal routes used.

3. In the areas with increased sensitivity such as: close to urban territories or individual buildings, as well as parts of protected areas sensitive with regard to the high level of dust, it is necessary to shield the construction site with the appropriate means, such as temporary fences or other similar solutions, on the analogy of the construction of similar sites such as highways, etc.

4. When conveying inert materials, to monitor the measures taken when the trucks are loaded in order to avoid any spillage during transportation, for example to cover the materials with a tarpaulin, etc.

5. When leaving the construction sites, to monitor that the trucks do not pollute the national transportation network. This may be achieved by washing the tires of the trucks when they enter the national road network or the polluted part of the road immediately after the trucks leave the site.

6. To avoid leakage while putting the pipeline in operation and future accidents, a permanent control of the quality of the welding works and the assembly of the pipes to be carried out according to the requirements, as well as to follow strictly that all necessary tests for the proper assembly of the pipes are carried out;

During operation

It is not necessary to take any measures during the time of operation, because if the construction and assembly works are done strictly it is expected that there will be no source of pollution of the atmosphere.

6.1.2 Water

6.1.2.1 Surface water

To protect the surface water during the time of the construction of the pipeline along with the measures resulting from the requirements of "Ordinance on the construction and safe operation of gas transmission and distribution pipelines and facilities, installations and instrumentation for natural gas", it is recommended to:

Measures common for the activities

- When preparing the technical projects to coordinate the route with the availability and the exact location of the main water pipelines and sewers, pumping stations that supply these pipelines, reservoirs - the type and location of the catchment related to the route, the way of moving, the way of overflow, etc.
- At the points where the pipeline crosses the water conduits, to provide for changing the water pipes in the easement area while abiding the normative and technical conditions of the crossing.
- The equipment to be services at least 30 meters away from water bodies.
- To maintain the water conduits at the parts of the intersection with the pipeline.

Measures when hydrotesting the pipeline

- Avoiding the discharge of water from different water basins in order to preserve the local biodiversity from invasive species.
- Use the same water for testing the different sections of the pipeline.
- Regulating the exact location of the water discharges, the optimal flow of water to the receiving water body (in order to minimize the impacts on the water body when discharging the water) and dispersion, the need to use reagents, the environmental risk, and the mandatory monitoring that will monitor the quality of the water before it is taken from the water source and discharged into the corresponding body.
- The wastewater from the hydrotesting passes through precipitators (mobile or built temporary) before being discharged.
- Obtain permission for using water from the water bodies for the hydrotest.
- Obtain permission for using the water bodies into which the water processed from the hydrotest will be discharged.
- When taking water from water bodies to respect the environmental minimum.
- The discharge of water from testing of the individual sections of the pipeline should be done only in water bodies from the same category as the water bodies from which water was taken for the testing. The discharge of these waters may be done in rivers, drainage and irrigation canals in Natura 2000 sites, provided that the composition of the discharge water is unaltered. If this condition is not met, the discharged water should undergo the necessary purification.

Measures for treating the wastewater from the temporary construction camps

- Do not allow any connection between the tanks for storing hazardous substances and the sewers in the area of the sites.
- In case the wastewater is treated in the local treatment facilities, do not allow dilution of the purified water with water from the pipe wells or from the drinking water conduits.
- In case the wastewater is treated in the local treatment facilities, to carry out strict monitoring with regard to the purified water.
- To provide the necessary fire extinguishing system.

- The places for washing the construction machines should be situated at the exit of the site. The water from the places for washing, which is dispatched to the rain drainage, should first go through a mud-oil-filter, including an overflow drain to remove the oil layer.
- In case the wastewater is treated in the local treatment facilities, to follow strictly the technological and technical requirements of operation of the treatment facilities for processing wastewater.
- Permit for using water bodies in which wastewater from the temporary construction camps for the workers building the route will be discharged. (If such authorization is required under the scheme for the treatment of wastewater from the camps).
- A contract with the Water Supply and Sanitation Company for disposal of the wastewater from the septic tank. (If such contract is required under the scheme for the treatment of wastewater from the camps).

Measures at crossing rivers during the time of construction

- The sections where the pipeline crosses under the river beds and the banks to be reliably protected against erosions when high waters come with once per 100 years probability.
- Rehabilitation of the construction line; where necessary – stabilizing and strengthening of the riverbanks.
- The banks of the rivers at the places of intersection should be clear of the perennial vegetation and trees, a status that has to be maintained throughout the entire period of operation and after the operation period depending on the adopted scheme for closing the facility;
- During the time of operation, the condition of the riparian vegetation should be monitored. The lack of the latter leads to erosion of the riverbanks, washing out mud and reduces the self-purification capacity of rivers.
- During the time of operation, to clear out any dead trees, brunches, construction and other waste caught at the point of intersection of the riverbed. Siltation of the riverbed will cause further damage.
- In order to prevent damages caused by erosion of large rivers, the riverbeds can be strengthened with massive boulders. Boulders and stones are used as a barrier to prevent erosion of the riverbed and the washing off soil.
- To provide appropriate constructions of the reinforcing facilities to ensure the natural flow under the river bottom, as well as to maintaining the level of groundwater in the riparian terraces;
- When designing the reinforcement equipment, the presence of small dam barrages located above the points of intersection of small gullies and feeders, must be taken into account, in order to protect the cross sections from emergency situations caused by the micro-dams;
- In places where the pipe crosses rivers and streams, the river slopes should be regularly monitored, especially after natural disasters (e.g. floods, earthquakes, etc.). When instability of the riverbanks is noticed at the intersections, the vegetation must be restored to protect the coastline from erosion or to take other fortifying measures to avoid possible damage to the pipe;
- Preventing the flow from the construction line through sandbags or settling tanks (reservoirs or lagoons);
- Use of drainage ditches that prevent the water from penetrating into the excavation;
- Precipitation of the water pumped from the trench prior to discharging it.
- Surrounding all construction sites, where there is danger of leaks or spillages, with curbs.

- Identifying the appropriate locations for servicing the construction machinery, when needed, in order to prevent spillage of oil and other chemicals on the riverbanks. To provide chemical toilets for the workers during the time of construction.
- Obtaining Permission for the use of all water bodies that will be traversed in an open way;
- Obtaining permission for the use of water bodies, in which processed water from the draining of the trenches and/or sites will be discharged.

Measures when using the method Horizontal Directional Drilling (HDD) during construction

- Bentonite slurry should not be used in drilling through rocks allowing the penetration of bentonite in the water body above the borehole, because this may have serious impact on the aquatic species.
- Using the bentonite slurry on a loop after being recycled in separators.
- Obtaining permission from the competent authorities for crossing Maritsa River using the horizontal drilling method;
- Obtaining permission from the competent authorities for crossing Studen Kladenets Dam, according to the method chosen for crossing (open pit or horizontal directed drilling)
- Obtaining permission for the use of water bodies, in which processed water from the horizontal directed drilling will be discharged
- Preventing spills of the used bentonite from the construction line through sandbags or other suitable facilities.

Post operation measures

- At the end of its life, the pipeline and the relevant facilities are to be decommissioned safely and with due regard for the environment, according to the relevant legislation and best practices available in the industry at the time of decommissioning.

6.1.2.2 Underground water

To protect the underground water during the time of the construction of the pipeline along with the measures resulting from the requirements of "Ordinance on the construction and safe operation of gas transmission and distribution pipelines and facilities, installations and instrumentation for natural gas", it is recommended to:

During the design:

- at the stage of the feasibility study, to carry out hydrogeological studies involving experimental-filtration studies at the most endangered by contamination underground water bodies in the sections along the chosen route of the pipeline where primarily river terraces are crossed;
- the design of the pipeline to be carried based on the results, conclusions and recommendations made in the report from the hydrological studies and research and the regulations;

During construction:

- To not allow improper storage of fuel and oils, waste and chemicals;
- the change, storage and treatment of waste oils and lubricants should be made in the designated areas as specified in the project;
- The construction machinery to be maintained in good condition at all times;
- All vehicles to be equipped with oil traps;.
- To shorten the maximum time available for drainage of the excavations. In cases when that is not possible to seek options for laying the pipes in water environment;

- In areas of steep slopes along the pipeline route drainage ditches are to be constructed to capture and lead away rainwater running down the earth's surface;
- Compliance with the prohibitions laid down in Article. 118a of the Water Act, as well as with the prohibitions and restrictions in zones II and III of the Sanitary Protection Zones in Appendix № 2 of "Regulation № 3/16.10.2000 on the conditions and order for research, design, approval and operation of the Sanitary Protection Zones, around the water sources and the facilities for potable and household water-supply and around the mineral water sources used for treatment, preventive, potable and hygiene needs", i.e.: to prohibit the disposal, including disposal of priority substances that can lead to indirect discharge of pollutants into groundwater, other activities on surface and in the groundwater body which can lead to indirect discharge of priority substances in the groundwater, use of materials containing priority substances in building constructions, civil engineering and other facilities in which contact with groundwater is made or is possible;
- To monitor the quality of the underground water;
- In emergency situations to undertake actions to reduce and eliminate the negative consequances regulated by the existing legal and regulatory documents and to alert the services directly involved in the fight against natural disasters and accidents.

6.1.3 Earth's subsurface and mineral diversity

To protect the geological base and the deposits of mineral resources during the time of the construction of the pipeline along with the measures resulting from the requirements of "Ordinance on the construction and safe operation of gas transmission and distribution pipelines and facilities, installations and instrumentation for natural gas", it is recommended to:

- At the stage of the feasibility study, to conduct geological surveys and studies, including mapping of the exposed geologo-lithological formations on the chosen route of the pipeline and execution of drilling and laboratory physico-mechanical studies of the sites provided for the construction of facilities of importance along the pipeline (mainly along the riverbanks in the sections of intersection using the non-excavation technology);
- The design of the pipeline to be based on the results, conclusions and recommendations of the report from the geological surveys and studies, and the relevant regulations ("Standards for designing a flat foundation", "Rules for acceptance of earthworks and ground facilities", "Ordinance № 2/23.307.2007 for design of buildings and structures in seismic regions ", etc.); regulations;
- During the construction, the generated domestic and production wastes to be collected, transported and treated in an organized manner;
- Identifying, documenting and storing of mineral individuals and units, if any are uncovered during the implementation of the excavation works;
- Quality implementation of the construction works and restoration of the disrupted areas in strict accordance with the design decisions.
- Preparation and implementation of a "Plan for self-monitoring of the geological environment", including monitoring, research and prognosis of the risk of activation and development of dangerous erosion and gravitational processes during the construction period and operation of the pipeline.

6.1.4 Soils

- The excavated humus and soil masses during the construction of the sites and the facilities to be disposed of and stored in accordance with the legal requirements and subsequently to be used for restoration of the disturbed areas.
- To protect the excavated humus layer from compaction, contamination and mechanical demage during construction.
- When it is not possible to determin the exact thickness of the humus layer in shallow soils, to take away the top 10 cm, which contain the seeds of the plants.
- To avoid mixing the removed humus layer with the less fertile sub layers.
- Refuelling and maintenance of the machinery as well as the collection of waste to be carried out in designated areas.
- When the route crosses areas with soils with heavy mechanical composition (mainly vertisols (Vertisols)), to implement measures to reduce the degree of compaction – by laying geotextile with a rubble layer; pads for soft soil; carrying out deep ploughing after the end of the construction activities.
- Planting grass on steep slope areas to reduce erosion risk.

6.1.5 Landscape

To protect the landscapes in while constructing the pipeline it is necessary to design the structures and facilities in according to the existing regulations. The materials designated by the project for construction of buildings and facilities to comply with the applicable laws and regulations regarding security. It is also necessary to observe the measures resulting from the requirements of “Ordinance on the construction and safe operation of gas transmission and distribution pipelines and facilities, installations and instrumentation for natural gas”. Other recommended measures are:

- To prepare a project for restoration, and post operation procedures in accordance with Ordinance 26/22 March 2002 which includes the activities that must be carried out during the technical and biological recultivation, as well as an afforestation scheme of the area with native plant species to incorporate the route of the pipeline and the above ground facilities in the surrounding landscape.
- In the time of construction to use techniques for minimizing the dust as well as to plan effectively the transport activities and the deployment of waste in all phases of the construction of the pipeline, in order to protect the contamination of the landscape and incorporating it into the surrounding landscapes;
- When selecting suitable sites for storing the pipes, the requirements for best practices should be followed. The constructions sites for the pipes and the materials should be away from the settlements and should be agreed with the municipalities. This measure will reduce the visual impact on the inhabitants of the settlements along the pipeline and will reduce the impact of the noise on the environment.
- The excavated humus and soil masses during the construction have to be stored temporary and then to be used for restoration of the disturbed areas and for reforestation of the green areas, according to Ordinance 26/22 March 2002, in order to minimize the visual impact and for more successful biological restoration;
- During construction the outside lighting in the construction camps to be done by halogen lamps in order to incorporate the site the surrounding area and to minimize the visual impact;
- The waste accumulated during the construction and operation is to be collected, stored and processed in compliance with the requirements of the Waste Management Act and

the secondary legislative acts in order to reduce the contamination of the landscapes and to minimize the visual impact;

- The arable farmlands have to be restored after the completion of the construction activities. Upon completion of the construction works, technical recultivation of the land has to be carried out and preparation for the implementation of the biological recultivation through planting the appropriate grass mixtures. This will reduce the visual impact of the pipeline on the surrounding land and will recover and return the land to its previous use, taking into account the constraints that the pipeline poses.
- In forestlands, located on a hill, the route of the pipeline will pass in a "zig-zag" manner to reduce the visual impact. Thus the potential observer of the landscape will not see a clearing but a less obtrusive zigzag stripe, on the periphery of which there are trees that naturally continue in forest areas on both sides of the pipeline
- To carry out anti-erosion activities and fortification of the terrains, especially when the pipeline passes through steep slopes in order to reduce the visual impact and the preservation of the landscape;

6.1.6 Biodiversity

6.1.6.1 Flora

To protect from contamination and to reduce the impact on the vegetation it is necessary to observe the following measures:

- At the time of construction to use techniques for minimizing the dust as well as to plan effectively the transport activities and the deployment of waste in all phases of the construction of the pipeline. It is also necessary to observe the measures resulting from the requirements of “Ordinance on the construction and safe operation of gas transmission and distribution pipelines and facilities, installations and instrumentation for natural gas”.
- To prepare a project for restoration, and post operation procedures in accordance with Ordinance 26/22 March 2002 which includes the activities that must be carried out during the technical and biological recultivation, as well as an afforestation scheme of the area with native plant species for better biological ercultivation.
- Developing a “5-year project for monitoring of conservationally significant species and habitats”. The project has to establish to what extent do these species and habitats recover and what measures should be taken for their protection. For the purpose of the project, conservationally significant habitats are those included in Appendix 1 of the Biological Diversity Act and which are subject and objectives for protection of the protected areas in Natura 2000. Such habitats are 6220, 6210, 91AA, 92A0, 92D0, 5210. Conservationally significant plants are the protected plants, included in Appendix 3 of the Biological Diversity Act.
- During construction, it is necessary to perform replanting of protected and vulnerable species of plants, (*Fritillaria pontica* at the town of Kirkovo), which were found on the ground of the route and would be directly affected by the construction activities (coordinated, following the Project for restoration and reclamation of the land).
- After the completion of the construction activities to restore the arable lands and to use them only for growing crops with shallow root system.
- Upon completion of the construction works, technical recultivation of the land has to be carried out (especially the pasture-ground and the meadows) and preparation for the implementation of the biological recultivation through planting the appropriate grass mixtures. This will recover and return the land to its previous use.

- The agricultural land and the allocated forest lands (openings) in the pipeline easement area to be used for planting annual crops with short root system, as required by regulations.
- The recultivation must be done after the final choice of route is made and depending on the disturbed habitats and the type of vegetation there.
- When recultivating pastures and xerothermal grass communities on hills and on the slopes of the hills along the entire route, the following corn types are recommended for rehabilitation: *Dichanthium ischaemum*, *Chrysopogon gryllus*, *Festuca valesiaca*. When recultivating lands where there used to be damp meadows in valleys, it is recommended to use *Alopecurus pratensis, Dactylis glomerata, Trifolium spp.* At such places natural recultivation is expected from *Elymus repens, Cynodon dactylon, Coronilla varia.* For biological recultivation of forest areas, it is recommended to use some shrubs that dominate in the region. When recultivating forest areas under 500 m altitude and in dry areas along the route, it is recommended to plant *Fraxinus ornus, Quercus pubescens, Quercus frainetto.*Above 500 m altitude (in the region of Makaza), it is recommended to plant *Fagus sylvatica, Quercus daleschampi.* The recovery of riverside forests should be done mainly with *Salix alba.*
- To maintain clear of trees the afforested safety area above the pipeline (access area) in compliance with the project for the construction of the pipeline, in compliance with the requirements of Ordinance 16 from 9 June 2004 about the servitudes of the power facilities (promulgated in the State Gazette, issue 88 from 8 October 2004, amended in State Gazette issue 77 from 2 September 2008) and the Forestry Act and the Regulations for Application of the Forestry Act.
- To carry out anti-erosion activities and fortification of the terrains, especially when the pipeline passes through steep slopes in order to protect the area from erosion and to protect the vegitation;

6.1.6.2 Fauna

The measure for the softening of the impact on the environment should be performed by the construction contractor under the control of experts on the environment.

- The selection of the route of the pipeline – East and West will be of significance for the mitigation of the impact on the animal world, namely – non-affecting or with minimal territorial impact on the existing habitats of the conservationally significant species. The impact on the animal world will be significantly less if the Western route is implemented.
- The construction personnel should be informed about the environmental requirements (laws, regulations and ordinances) that will be applied in the area of construction. The personnel that will maintain the pipeline during its operation has to be trained in the actions that are required in case of potential risks for the environment and problem in compliance with the Emergency Action Plan.
- The provisional roads, the provisional depots for spoils from excavations / for mounds and other construction materials should be concentrated to the maximum on the area of the designated site, and not outside of the construction sites. The waste materials such as insulation covers of pipes, used welding electrodes, used engine oil and other resulting from the normal construction activities, must be collected on daily bases and transferred to the correspondent operators responsible for processing and depositing them according to the Waste Management Plan, developed for the needs of the project. When developing the waste management plan it should explicitly stipulate to avoid depositing

waste and building provisional roads through wetlands, pastures, as well as not to fill or drain wetlands by depositing waste.

- The construction works should be done only during the light part of the day; The same is to be planned outside the period of hibernation (hibernation) of some groups of animals (mammals, reptiles and amphibians), as well as outside the spring season, coinciding with the generative period of most animal species (from April to June), in order to reduce the anxiety and the significant impact on them; To avoid clearing the vegetation in the boundaries of the protected areas under the Birds Directive in the nesting season (April - August), and the recultivation of the areas affected by the construction to be done after it. The table below shows a schedule with the recommended (time) seasonal restrictions during the phase of the construction in order to minimize the negative impacts on the fauna: the crossing of Maritsa River to be done in the period from July to October in order to protect a small colony of ground squirrels 75 m away.

Table with the seasonal restrictions on the construction works related to the impact on the fauna

Months	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
Animal groups												
Birds												
- nesting				**x**	**x**	**x**	**x**	**x**				
- spending the winter	**x**	**x**	**x**								**x**	**x**
- breeding				**x**	**x**	**x**						
Mammals				**x**	**x**	**x**						
Hibernating - reptiles, amphibians, mammals and etc.	**x**	**x**	**x**	**x**							**x**	**x**
Reptiles				**x**	**x**	**x**						
Amphibians				**x**	**x**	**x**						
Terrestrial invertebrates				**x**	**x**	**x**	**x**					
Bats					**x**	**x**	**x**					
Fish			**x**	**x**	**x**	**x**						
Aquatic invertebrates												

- In order to avoid disturbing the process of biolocation in bats, the ultrasonic tests of the pipes should obligatory be done during the day; Due to the expected light impact from the sources of light around the construction camps and the storage sites, they should not be placed near the feeding grounds or the flight corridors of bats.
- To avoid the negative impact on the aquatic animals, the crossing of the rivers should be carried out in periods of low-water levels, for a minimum time and out of the reproduction season. The recovery of the affected sections of the water bodies in a condition as close as possible to the original will result in limited loss and fragmentation of the riverside habitats.
- Checking the excavation works regularly for fallen wildlife animals in order to take measures for their rescue; Developing a plan and conducting regular monitoring about the conditions of the affected groups of animals during the construction; Performing periodical monitoring of the integrity of the pipeline in order to prevent accidents.
- The table below shows water bodies that should not be contaminated with waste water and should not be used for hydrotests. It shows the type of species (amphibians, reptiles, otters) because of which this restriction is imposed. For running waters this restriction applies to their entire length, and for the standing – for their entire volume. The table shows the coordinates of all smaller rivers, standing water bodies and gullies.

Type of basin	The closest settlement (within the range of the IP)	Coordinates		Species with priority for protection
Stream, puddles	Strizhba	41°18'44.68"N	25°26'10.54"E	Bombina variegata
Stream, puddles	Strizhba	41°18'45.22"N	25°26'11.00"E	Bombina variegata
Lozengradska River	Kirkovo	41°19'59.56"N	25°22'16.79"E	Bombina variegata
fountain	Kukuryak	41°19'46.27"N	25°27'15.95"E	Bombina variegata
fountain	Lozengradtsi	41°18'21.89"N	25°23'49.78"E	Bombina variegata
fountain	Orlitsa	41°18'38.09"N	25°23'11.94"E	Bombina variegata
Brook	Domishte	41°21'3.10"N	25°21'38.45"E	Bombina variegata
fountain and small river	Bregovo	41°26'12.84"N	25°21'3.67"E	Bombina variegata
Small lake	Bregovo	41°26'26.99"N	25°20'56.47"E	Triturus vulgaris
Small river	Velikdenche	41°26'55.10"N	25°20'48.55"E	Triturus vulgaris Bombina variegata
Microdam	Pepelishte	41°34'57.97"N	25°22'53.29"E	Triturus karellini
Small river	Balabanovo	41°34'36.88"N	25°22'49.69"E	Triturus vulgaris
Microdam	Varhari	41°32'44.42"N	25°22'18.82"E	Emys orbicularis, Triturus vulgaris
Ditch with water	Varhari	41°32'39.26"N	25°22'19.45"E	Triturus vulgaris
Microdam	Sokolyane	41°45'33.79"N	25°25'51.03"E	Triturus karellini, Emys orbicularis
Microdam	Beli Plast	41°42'7.56"N	25°26'15.40"E	Emys orbicularis,
Small river	Gaskovo	41°39'57.42"N	25°26'20.54"E	Triturus vulgaris, Bombina variegata
Harmanliiska River	Voivodovo, Malevo	The entire river		Emys orbicularis
Martinka River	Golyamo Asenovo	The entire river		Emys orbicularis
Kirkovska River	Kirkovo	41°20'7.76"N	25°22'8.47"E	Lutra lutra
Chitakdere River	Varhari	41 33 22.2 N	25 22 55.3 E	Lutra lutra
Vatbitsa River	Varben	The entire river		Lutra lutra
Dzhelebska River	Polyanets, Zagorsko	41 28 41.0 N	25 22 16.8 E	Lutra lutra

- In the sections of the western route rich of tortoise (look at the table below), before the beginning of the construction and the excavation activities, in the construction 200 m wide area, to perform systematic search for tortoise and to organize their collection and relocation to suitable habitats neighboring the construction site. This activity should be performed in July-August before the beginning of the construction works but while the tortoise are still active. Professional herpetologists should be hired to perform that activity. If possible, other types of reptiles and amphibians should be transferred during the process. That measure will reduce the risk of killing individual specimen during the construction, something that cannot be utterly avoided regardless of the period in which it is conducted.

Sections of the western route rich of tortoise that will require activities to catch and to relocate specimen

Area Beginning Coordinates	Area Ending Coordinates	Territory	Approximate length of the area (m).
41°24'53.24"N 25°21'25.97"E	41°24'0.00"N 25°21'50.28"E	Varben, Karchovsko	1798
41°19'58.27"N 25°22'6.23"E	41°19'51.52"N 25°22'25.08"E	Kirkovo	491
41°17'49.96"N 25°24'18.00"E	41°16'51.69"N 25°25'13.67"E	Lozengradtsi, Strizhba	2331
41°26'23.36"N 25°21'0.97"E	41°25'9.46"N 25°21'33.66"E	Samodiva, Bregovo, Karchovsko	2728

41°27'9.37"N 25°20'41.04"E	41°26'37.35"N 25°20'52.16"E	Velikdenche	1334
41°27'58.41"N 25°21'45.66"E	41°27'30.71"N 25°21'16.07"E	Rogozari	1254
41°44'41.06"N 25°25'48.36"E	41°44'22.69"N 25°25'51.24"E	Lyulyakovo, Sokolyane	598
41°48'7.41"С 25°27'28.88"И	41°47'41.75"С 25°26'49.76"И	Zornitsa	1256

6.1.7 Cultural Heritage

- The following measures are recommended for the identified archaeological sites along the western route:
  - At 13 sites № 1, № 2, № 9, № 12, № 16, № 21, № 25, № 26, № 29, № 30, № 31, № 37, № 52, - to carry out thorough archaeological digs before the beginning of the excavation works following the conditions of Art. 148, para. 2 of the Cultural Heritage Act (CHA, Official Gazette 19/2009, Amended and supplemented.).
  - At 9 sites - № 20, № 27, № 32, № 33, № 41, № 42, № 44, № 50 № 54 the following measure is recommended: first archaeological probing should be done in order to clarify the thickness of the cultural layers, and then proceed to thorough archaeological digs, after proving the existence of archaeological structures and artefacts.
  - At 28 sites № 3, № 4, № 5, № 6, № 7, № 8, № 10, № 11, № 15, №17, № 18, № 19, № 22, № 23, №24, № 28, № 29, № 33, № 34, № 36, № 38, № 39, № 40, № 43, № 48, № 49, № 51, № 53 to implement rigorous archaeological observations, according to Art. 161, para. 2 of the Cultural Heritage Act. In the event that as a result of the observation other archaeological sites, structures and sediments are found it is necessary to carry out rescue excavations under Art. 148, para. 2 of CHA. The remaining 9 sites do not require action.
- The following measures are recommended for the identified archaeological sites along the eastern route:
  - At 14 sites № 2, №3, № 4, № 6, № 7, № 8, № 9, № 10, № 13, № 17, № 18, № 19, № 21, № 24, - to carry out thorough archaeological digs before the beginning of the excavation works following the conditions of Art. 148, para. 2 of the Cultural Heritage Act (CHA, Official Gazette 19/2009, Amended and supplemented.).
  - At 10 sites № 1, № 5, № 11, № 12, № 14, № 15, № 16, № 20, № 22, № 23, to implement rigorous archaeological observations, according to Art. 161, para. 2 of the Cultural Heritage Act. In the event that as a result of the observation other archaeological sites, structures and sediments are found it is necessary to carry out rescue excavations under Art. 148, para. 2 of CHA.
- The following measures are recommended for the identified archaeological sites along the main route:
  - At 3 sites – № 76; № 77; № 78 - to carry out thorough archaeological digs before the beginning of the excavation works following the conditions of Art. 148, para. 2 of the Cultural Heritage Act (CHA, Official Gazette 19/2009, Amended and supplemented.).
  - At 4 sites – № 58; № 66; № 73; № 74 the following measure is recommended: first archaeological probing should be done in order to clarify the thickness of

the cultural layers, and then proceed to thorough archaeological digs, after proving the existence of archaeological structures and artefacts.

- At 13 sites - № 55; № 67; № 69; № 70; № 71; № 72; № 75; № 80; № 80-1; № 81; № 82 и № 83 to implement rigorous archaeological observations, according to Art. 161, para. 2 of the Cultural Heritage Act. In the event that as a result of the observation other archaeological sites, structures and sediments are found it is necessary to carry out rescue excavations under Art. 148, para. 2 of CHA. The remaining 9 sites do not require action.

6.1.8 Hazardous Energy Pollutors

During construction, it is mandatory to take measures to protect the workers on the site with regard to the noise, vibration and the UV radiation.

Considering that it is stipulated during the construction works to abide by the requirements of Presidential Decree 1180/81 of Great Britain (about the boundaries of the emitted noise according to the region), because in Bulgaria there are no specific standards for protection from physical factors when conducting construction works. The abovementioned standards are strict enough and to a great degree respond to Ordinance №6. Moreover, these values refer to the emissions coming from the sources of noise rather than to the impact on the settlements. We have no such standards.

The measures that should be taken to protect the workers from noise and vibration are connected with the requirements of the national legislation on healthy and safe working conditions.

During construction the employer should take the necessary measures to protect the workers from the impact of the noise and the vibrations at the workplace in compliance with Ordinance № 6 from 15.08.2005 about the minimal requirements to ensure the health and safety of the workers when there are risks of being exposed to noise, promulgated in the State Gazette issue 70 from 26.08.2005 active from 15.02.2005, as well as Ordinance № 3 from 5.05.2005 about the minimal requirements to ensure the health and safety of the workers when there is a risk related to being exposed to vibrations, promulgated in State Gazette issue 40 from 12.05.2005, active from 6.07.2005.

The abovementioned documents on noise and vibration in the working environment describe all requirements to ensure the health and safety of the workers. Here we will cite only the most important ones that are connected with the conditions at which the workers will be exposed to noise and vibrations during the construction:

Measures to reduce the impact of the noise:
On the personnel

According to the European and the national legislation, the employer is obliged to eliminate or minimize the risks originating from exposure to noise at the source, by taking into account the technical progress and the availability of measures to control the risk at the source. To give the least examples:

1. Selection of the appropriate working equipment, generating the least noise possible, including the ability to provide working equipment produced according to the requirements of the Law on the technical requirements of the products which purpose or effect is to reduce the exposure to noise;

2. Location of the work stations;

3. Providing the workers with the appropriate information and training about the proper and safe handling of the work equipment in order to minimize the exposure to noise;

4. Applying organizational approach to limiting the noise:

a) Proper organization of the working time with sufficient resting periods.

The workstation, for which the risk assessment shows that the workers are or could be exposed to noise exceeding the upper limit of exposure that requires to take actions, are marked with the appropriate signs. The boundaries of these workstations are set and the access to them is limited when this is technically possible and the risk of exposure is justifiable.

When the type of work gives the worker the opportunity to use premises for rest, designated by the employer, the noise in these premises should be reduced to the levels compatible with their function and the conditions of their use.

The employer provides adequate personal protection equipment to protect one's hearing, which are used by the workers according to Ordinance № 3 on the minimal requirements for the safety and health of the workers when using personal protection equipment at the workplace (State Gazette, issue 46 from 2001).

When taking the necessary measures to ensure the health and safety of the workers working in noisy conditions, no negative impact on the health of the workers is expected.

The detailed project for the protection of the workers should include the following:

- To control the noise levels at the workplace in compliance with the requirements of the national legislation;
- To avoid unnecessary movement of the machines causing high levels of noise;
- Regular maintenance of the equipment;
- To use the excavated earth mass as an acoustic barrier where possible;
- To apply adequate schedule of work and rest for the people working on the heavy load vehicles, the excavators and other construction equipment with high emission of noise.

On the population

With regard to the measures for reducing the noise impact on the population during construction, it is necessary to take the following important more measures:

- Abide the work hours of the construction workers, respectively of the construction machines in the daytime period, which will eliminate the necessity of any protection during the evening and the night;
- Communicate with the population before the beginning of the project including information about the facilities, the expected levels of noise, the schedule of operation during the day and the duration of the processes;
- Give warning of the occasional breaches of the working hours, of the expected extra working hours and of the negative impact.

Measures to reduce the vibration impact:

On the personnel

The employer is obliged to develop and implement technical and/or organizational measures for reducing the levels of exposure to vibrations, when the risk assessment determines exceeding daily values. To give the least examples:

- Selection of adequate working equipment generating the least possible vibrations designed in compliance with the ergonomic requirements, when taking into consideration, the work that has to be done;
- Provision of additional equipment reducing the risk of harm from the vibrations, such as seats that efficiently reduce the vibrations transmitted to the whole body, and handles transmitted to the arm-shoulder system;
- Adequate information and training of the workers for proper and safe use of the working equipment in order to reduce to minimum their exposure to vibrations;

- Limit the duration and intensity of the exposure;
- Proper organization of the working time with sufficient resting periods.;
- Provision of work clothes which protect the exposed from cold and moisture.

On the population

With regard to the measures for reducing the vibration impact on the buildings in the settlements during the construction, it is necessary to take the following important measures:

- Abide the work hours of the construction workers, respectively of the construction machines in the daytime period, which will eliminate the necessity of any protection during the evening and the night;
- Communicate with the population about sites standing less than 50 m from the settlement before the beginning of the construction, including information about the facilities, the expected unfavorable effects, the schedule of operation during the day and the duration of the processes;

Measures to reduce the UV radiation

The protection of the workers from the impact of the UV radiation is performed based on the requirements of Ordinance № 5 from 11 June 2010 on the minimal requirements to ensure the health and safety of the workers, when there are risks related to exposure to artificial optic radiation, promulgated in the State Gazette, issue 49 from 29 June 2010. The Reducing the negative impact (of the UV radiation in welding) is done mainly through using personal protective equipment with the respective filters protecting the cornea from exposure.

Measures to reduce the light impact

With regard to the measures for reducing the possible unfavorable impact of light on the population during construction, it is necessary to take the following important measures:

- Communicate with the population the necessity to light up sites standing less than 50 m away from the settlement before the beginning of the construction.

6.1.9 Population and Health Risk

<u>A. Measures towards the affected population</u>

- To reduce to the minimum the risk for the population, it is necessary to abide the requirements for building and operation of facilities of that kind - ORDINANCE on the construction and safe operation of gas transmission and distribution pipelines and facilities, installations and instrumentation for natural gas (Decree №171/16.07.2004, promulgated in State Gazette, issue 67/02.08.2004).
- Efficient measures are needed to manage the noise exposure of the population from the investment project – urban planning, architectural-planning and building and acoustic. The work will be done only during the daytime, a schedule will be developed for the passing of the trucks near the settlements.
- The machinery and the equipment in the construction should meet the contemporary standards for noise.
- To prevent the emission of excess levels of dust from the site. The quantity of dust from a non-organized source cannot be predicted exactly due to the lack of reliable methods, but the necessary measures have to be taken to reduce it, such as sprinkling the provisional roads and sites, storing dust like substances in closed premises or in containers, coverying them in case they are stored in the open, transportation of earth masses and dust like materials with trucks obligatory equipped with covers.

- To prevent the emission of above the standards levels of toxic substances from the site, including: organizing the traffic away from the settlements, Proper storage and use of lubricants and waste.
- Ensuring the safety of the population in case of accidents or emergencies – developing a plan for prevention of accidents and for actions in case of accidents.

B. Measures towards the workers

In order to provide adequate protection of the health and safety of the workers and to avoid any negative impact on them, it is necessary to:

- To fulfill the requirements of Ordinance №2/22.03.2004 on the minimal requirements for healthy and safe working conditions in construction and assembly.
- To conduct risk assessment of the workstations.
- To develop a Plan for safe labor on the sites, which include instructions on health and safety at work; First aid instructions; An action plan for preventing and acting in case of accidents.
- To perform strictly the necessary instruction sessions – initial and on the spot (when starting work at the site), periodical (each 3 month) and daily (every day at the beginning of the working day).
- To provide and use PPE.
- To develop physiological schedule for work and rest for the workers.
- To perform the obligatory periodic medical exams in order to assess the impact of the working environment over the health of the workers.
- All other measures developed by the Labour Medicine Service (LMS) that has a service contract according to the requirements of the Health and Safety at Work Act (HSWA).
- To obtain permissions for all kinds of potentially dangerous type of work – dangerous equipment.
- To perform periodic training and drills with the participation of all health and safety responcible employees, as well as those on environmental issues, and on specific issues related to the project. These trainings will provide the operative staff with the necessary skills and knowledge on how to manage their work in a safe way and will ensure the health and safety of and will contribute to the protection of the environment and for the protection of the workers.

6.1.10 Waste

The following measures are recommended in order to prevent, reduce and eliminate significant negative impact on the environment in terms of waste:

- Compliance with current regulations regarding waste management – The waste accumulated during the construction and operation is to be collected, stored and processed in compliance with the requirements of the Waste Management Act and the secondary legislative acts in order to reduce the contamination of the vegetation.
- Development of a Program for Waste Management
- Setting shredders to reduce the volume of waste
- Store the waste in closed, specially designated areas

6.2 Plan for Implementation of the Measures

The plan for the implementation of the measures to prevent and reduce the harmful effects on the environment and human health, which is part of the EIA Report was developed in tabular form in the EIA Report, which is shown below. This plan will be divided into the following phases of implementation:

- During construction
- During the operational phase

№	Measures	Period (phase) of implementation	Result
component/ environmental factor			
1.	***Atmospheric air***		
	Controlling the state of the transport, installation and construction equipment used, according to the requirements of the industry's best practices.	During construction	Reduction of the dust in the air at the local on construction sites and transportation routes.
	Besprinkling of the excavated mass and using internal routes.	During construction	Reduction of the dust in the air.
	Controlling the measures taken when loading the trucks to avoid any spillage during transportation.	During construction	Reduction of the dust in the air
	Washing the dirty areas as soon as the trucks leave the site	During construction	Reduction of the dust in the air
	Quality control of the welding works and the installation of pipes to be carried out according to the requirements, and strictly to monitor the implementation of all tests for the proper connection of the pipes;	During construction	Prevention of future accidents.
2.	***Water***		
2.1	***Surface water***		
	When preparing the technical projects to coordinate the route with the availability and the exact location of main water pipelines and sewers, pumping stations that supply these pipelines, reservoirs - the type and location of the catchment related to the track, the way of moving, the way of overflow, etc.	Design	Preventing accidents and deprivation of the population from water
	Obtaining the necessary permits for the use of water bodies affected by the pipeline.	Design	Compliance with the legal requirements in Bulgaria
	Use the same water for testing the different sections of the pipeline whenever possible.	Design and construction	Reduction of the over usage of water
	Using drainage ditches that prevent the penetration of water into the excavation;	Design and construction	Prevention of pollution of surface water
	Rehabilitation of the building site, where necessary - to stabilize / strengthen the riverbanks. Regular monitoring during operation especially after natural disasters.	Design, construction and operation	Prevention of the erosion processes on the shore. Prevention of floods.
	When taking water from water bodies to respect the environmental minimum.	Construction	Avoiding the destruction of ecosystems
	The discharge of water from testing of the individual sections of the pipeline should be done only in water bodies from the same category as the water bodies from which water was taken for the testing. The discharge of these waters may be done in rivers, drainage and irrigation canals in Natura 2000 sites, provided that the composition of the discharge water is unaltered. If this condition is not met, the discharged water should undergo the necessary purification.	Construction	Prevention of the pollution of the surface waters and the negative impact over the ecosystems.

№	Measures	Period (phase) of implementation	Result
	Servicing the machines should be performed at a minimum of 30 meters away from the water body, in compliance with the best practices.	Construction and operation	Prevention of the pollution of the surface waters.
	To perform strict monitoring of the discharged water from various activities.	Construction and operation	Prevention of the pollution of the surface waters.
	Maintenance of the water pipeline in the sections crossing the gas pipeline.	Operation	Prevention of accidents and securing drinking water for the population
	At the end of its life, the pipeline and the accompaning facilities to be decommissioned safely and with due regard for the environment, pursuant to the relevant legislation and best practices available in the industry at the time of decommissioning	post operation	Prevention of the pollution of the surface waters
2.2	***Underground water***		
	Conducting hydrogeological studies involving test-filtration studies at the groundwater bodies which suffer the greatest risk of contamination along the selected pipeline route;	Design	Prevention of the pollution of the underground waters
	Designing the pipeline based on the results, conclusions and recommendations made in the report from the hydrological studies and research, and the existing regulations;	Construction	Prevention of the pollution of the underground waters
	The discharge of the household faecal water and washing liquid to be carried out in accordance with the applicable law;	Construction	Prevention of the pollution of the underground waters
	The construction machinery to be maintained in good condition at all times; the change, storage and treatment of waste oils and lubricants should be made in the designated areas as specified in the project.	Construction	Prevention of the pollution of the underground waters
	To shorten the maximum time available for drainage of the excavations. In cases when that is not possible to seek options for laying in water environment;	Construction	Protection of the underground waters
	To not allow improper storage of fuel and oils (Fuel and Oil Storage), waste (Waste Storage and Disposal) and chemicals (Chemical Storage)	Construction	Prevention of the pollution of the underground waters
	Compliance with the prohibitions laid down in Article. 118a of the Water Act, as well as with the prohibitions and restrictions in zones II and III of the Sanitary Protection Zones in Appendix № 2 of "Regulation № 3/16.10.2000 on the conditions and order for research, design, approval and operation of the Sanitary Protection Zones, around the water sources and the facilities for potable and household water-supply and around the mineral water sources used for treatment, preventive, potable and hygiene needs", i.e.: - Prohibit the disposal, including disposal of priority substances that can lead to indirect discharge of pollutants into groundwater; - Other activities on surface and in the groundwater body which can lead to indirect discharge of priority substances in the groundwater; - Use of materials containing priority substances in building constructions, civil engineering and other facilities in which contact with groundwater is made or is possible;	Construction and operation	Prevention of the pollution of the underground waters

№	Measures	Period (phase) of implementation	Result
	- In areas of steep slopes along the pipeline route to be constructed drainage ditches to capture and lead away rainwater running down the earth's surface;		
3.	***Earth's subsurface***		
	Adjust the location of the pipeline routes in the areas mentioned above in the table. 3.4.2, with the exception of the section on the general track within the area of Zapadnomarishki (Maritsa West) coal basin, where there is no need to adjust the track as it passes east of the border of the coal with a conditional thickness of 0,80 m; stocks are not approbated, nor exploitation of the coil deposits has been planned or carried out;	Design	Protect the earth's subsurface from pollution
	Conducting geological surveys and studies, including mapping of the exposed geologo-lithological formations on the chosen route of the pipeline and execution of drilling and laboratory physico-mechanical studies of the sites provided for the construction of facilities of importance along the pipeline;	Design	Protect the earth's subsurface from pollution
	Designing based on the results of the geological surveys and studies, and the relevant regulations ("Standards for designing a flat foundation", "Rules for acceptance of earthworks and ground facilities", "Ordinance № 2/23.307.2007 for design of buildings and structures in seismic regions ", etc.)	Design	Protect the earth's subsurface from pollution
	During the construction, the generated domestic and production wastes to be collected, transported and treated in an organized manner (Waste Production and Collection), (Waste Storage and Disposal)	Construction	Protect the earth's subsurface from pollution
	Identifying, documenting and storing of mineral individuals and units, if any are uncovered during the implementation of excavation works.	Construction	Protect the earth's subsurface from pollution
	Quality implementation of the construction works and restoration of the disrupted areas (Site Restoration) in strict accordance with the design decisions.	Construction	Protect the earth's subsurface from pollution
4.	***Soils***		
	The excavated humus and soil masses during the construction of the sites and the facilities to be disposed of and stored in accordance with the legal requirements and subsequently to be used for restoration of the disturbed areas.	Construction	Reduction of the loss of valuable soil. Preservation of soil fertility.
	Taking away and retaining the 10 cm top layer in shallow soils, where the thickness of the humus cannot be determined. To avoid mixing the removed humus layer with the less fertile sub layers.	Construction	Reduction of the loss of valuable soil. Preservation of soil fertility.
	Refuelling and maintenance of the machinery as well as the collection of waste to be carried out in designated areas.	Construction	Prevent the contamination of the soil.
	When the route crosses areas with soils with heavy mechanical composition (mainly vertisols (Vertisols)) to implement measures to reduce the degree of compaction – by laying geotextile with a rubble layer; pads for soft soil; carrying out deep ploughing.	Construction	Prevent the contamination and compaction of the soil.
	Planting grass on steep slope areas to reduce erosion risk.	Construction	Reduce the risk of erosion.
	Respect the legislation and the predetermined by the design requirements for operation of equipment of such	Operation	Minimise the impact.

№	Measures	Period (phase) of implementation	Result
	type.		
5.	***Landscape***		
	The design of the structures and facilities to be made according to the existing regulations. The materials specified by the project design for construction of the buildings and the facilities to meet the applicable laws and regulations regarding security.	Project	Prevent the contamination of the landscape and reduce the visual effect.
	The excavated humus and soil masses during the construction have to be stored temporary and then to be used for restoration of the disturbed areas and for reforestation of the green areas. To prepare a project for closure and restoration, and after-care procedures under Ordinance 26/22 March 2002	Design	Prevent the contamination of the landscape and reduce the visual effect.
	To use techniques for minimizing dust as well as to plan effectively the transport activities and the deployment of waste in all phases of the construction of the pipeline	Construction	Reduce the impact and protect the landscape elements from pollution
	The outside lighting in the construction camps to be done by halogen lamps in order to incorporate the site the surrounding area.	Construction	Reduce the impact
	The generated waste should be collected, stored, transported and processed in accordance with the legal requirements	Construction and operation	Reduce the impact and protect the landscape elements from pollution
	Upon completion of the construction works the agricultural lands and meadows should be restored and returned to their previous use.	Construction and operation	Incorporation in the surrounding landscapes
	To carry out anti-erosion activities and fortification of the terrains, especially when the pipeline passes through steep slopes.	Construction and operation	Protecting the landscape and reduction of the visual impact
6.	***Biodiversity***		
6.1	***Flora***		
	To use techniques for minimizing dust as well as to plan effectively the transport activities and the deployment of waste in all phases of the construction of the pipeline	Construction	Reducing the contamination of the vegetation
	To prepare a project for closing down, restoration, and post operation procedures in accordance with Ordinance 26/22 March 2002	Design	Protecting the vegetation from contamination
	Replanting of protected and vulnerable species of plants, which would be directly affected by the construction activities (coordinated, following the Project for restoration and reclamation of the land).	Construction	Reduction of the impact and biodiversity conservation
	The generated waste should be collected, stored, transported and processed in accordance with the legal requirements	Construction	Reduction of the impact and protection of the vegetation from contamination
	After the completion of the construction activities to restore the arable lands and to use them only for growing crops with shallow root system	Construction and operation	Protecting the vegetation from contamination
	The grassland and forest habitats with conservation significance to be restored with species characteristic of	Construction and operation	Biodiversity conservation

№	Measures	Period (phase) of implementation	Result
	the affected habitat in compliance with the Project for restoration.		
	In the forest sections the servitude area should be maintained clear of trees and shrubs in compliance with the project requirements and in compliance with the requirements of Ordinance 16 from 9 June 2004 about the servitudes of power facilities (promulgated in the State Gazette, issue 88 from 8 October 2004, amended in State Gazette issue 77 from 2 September 2008.	Construction and operation	Biodiversity conservation
	To perform anti-erosion activities and fortification of the terrains, especially when the pipeline passes through steep slopes in order to protect the area from erosion and to protect the vegetation	Construction and operation	Biodiversity conservation
6.2	***Fauna***		
	Selecting a route and technology of construction that do not affect or have minimum impact on the existing habitats of species included in Annex 2 of Directive 92/43 EEC.	Design phase	Minimize the impact on the environment
	The construction personnel should be briefed about the environmental requirements (laws, regulations and ordinances) that will be applied in the area of construction. The personnel that will maintain the pipeline during its operation has to be trained in the actions that are required in case of potential risks for the environment and problems in compliance with the Emergency Action Plan.	Construction phase Operation phase	Minimize the impact on the environment
	The provisional roads, the provisional depots for spoils from excavations / for mounds and other construction materials should be concentrated on the area of the designated site, and not outside of the construction sites. The waste materials such as insulation covers of pipes, used welding electrodes, used engine oil and other resulting from the normal construction activities, must be collected on daily bases and transferred to the correspondent operators responsible for processing and depositing them according to the Waste Management Plan, developed for the needs of the project.	Construction phase	Reduction of the anxiety and the significant impacts on the fauna
	Performing construction works only during the light part of the day; The same is to be planned outside the spring season coinciding with the generative period of most animal species (from April to June), as well as to avoid the period of hibernation (hibernation) in some groups of animals; To avoid clearing the vegetation in the boundaries of the protected areas under the Birds Directive in the nesting season (April - August). The crossing of Maritsa River should be done in the period from July to October in order to protect a small colony of ground squirrels 75 m away.	Construction phase Operation phase	Maintaining the side close to the undisturbed habitat appearance at maximum level in order to reduce the anxiety and the significant impact on the animals;
	The ultrasonic tests of the pipes should obligatory be	Construction	Protecting the

№	Measures	Period (phase) of implementation	Result
	done during the day; The sources of light around the construction camps and the storage sites, should not be placed near the feeding grounds or the flight corridors of bats;	phase Operation phase	process of biolocation of the bats; reducing the light impact on the bats
	To prevent using water or discharging waste water in water bodies with populations of species which are priority for conservation (reptiles, amphibians). The habitats are listed in a table in 6.1.6.2.;	Construction phase	Prevention of the negative impact on the quality of the habitats of the amphibians, reptiles and otters.
	Searching, catching and transferring of tortoise in the construction area before the beginning of the construction in the sections of the route identified as being rich in tortoise; Regularly checking the excavation works for fallen wildlife animals;	Before the beginning of construction Construction phase	Minimize the direct mortality of tortoise and other reptiles and amphibians
	The crossing of the rivers should be carried out in periods of low-water levels, for a minimum time and out of the spawning season of the fish and the amphibians. Restoration of the affected sections of the water bodies in a condition as close to the original as possible.	Construction phase	Reduce the negative impact over the benthic organisms, the amphibians and fish, limit the loss and fragmentation of the riverside habitats.
	Develop a plan and monitor the status of the affected animal group during the construction phase; Monitor periodically the integrity of the pipeline.	Operation phase	Prevention of accidents;
6.3	***Protected Areas***		
	Selecting a route and technology of construction that do not affect the existing havens of bats and have minimal territorial impact on the favourable habitats of terrestrial invertebrates included in Annex 2 of Directive 92/43 EEC.	Project phase	Protection of the species in the protected areas
	When designing a project it should include measures to prevent the draining of wetlands or for their restoration.	Project phase	Protection of the species in the protected areas
	The cutting down of trees should not be done during the breeding season of bats (May-July). The limited impact period is October – November.	Construction	Protection of the species and their habitats
	Anxiety is not desirable during the spawning season, which for the vast majority of fish is in the period May-June.	Construction	Protection of the species and their habitats
	To cut down only the vegetation required by the project and if possible to prevent cutting down riverside bushes and trees.	Construction	To prevent fragmentation of the habitats and o preserve the natural characteristics of the riverside habitats.
7.	***Waste and its location***		
	Compliance with the current regulations regarding the	During	Managing the

№	Measures	Period (phase) of implementation	Result
	waste management.	construction and operation	generated waste, reducing the impact and protecting the environment.
	Developing a program for waste management. The program should include minimum the information in article 31, paragraph 1 and 2 from the Waste Management Act, as well as to contain measures for: • Reducing or limiting the formation of waste, as well as its risk level; • Recycling; regenerating or other forms of utilization; • Environmental deactivation;	During construction During operation	Managing the generated waste, reducing the impact and protecting the environment.
	Placing shredders to reduce the volume of waste.	During construction	Reducing the volume of the waste. Reducing the potential impact on the environment. Reducing the financial cost for collection and transportation of waste.
	Storing the waste in closed, specifically designated for the purpose places.	During construction	Limiting the contamination of the environment and reducing the negative impact on the quality of the air, water, souls and the fauna.
8.	***Risky energy sources***		
	Measures for reducing the noise impact on the personnel: - To control the noise levels at the workstations; - To avoid the unnecessary movement of the machinery; - Regular maintenance of the equipment; - To use the excavated earth mass as an acoustic barrier; - To apply adequate schedule of work and rest for those working on machines with high emissions of noise.	During construction	Preserving the health of the personnel, protection of the workers
	Measures for reducing the vibration impact on the population: - Abide the work hours of the construction workers, respectively of the construction machines in the daytime period; - Communicate with the population before the beginning of the project; - Give warning of the occasional breaches of the working hours, of the expected extra working hours;	During construction	Preserving the health of the population
	Measures for reducing the vibration impact on the	During	Preserving the health

№	Measures	Period (phase) of implementation	Result
	personnel: - Selection of the appropriate working equipment - Provision of additional equipment reducing the risk of vibration damage; - Adequate information and training of the workers; - Limiting the duration and intensity of the exposure; - Appropriate organization of the working hours; - Provision of work clothes which protect the exposed from cold and moisture	construction	of the personnel
	Measures for reducing the vibration impact on the buildings in the settlements: - Abide the work hours of the construction workers, respectively of the construction machines in the daytime period, which will eliminate the necessity of any protection during the evening and the night; - Communicate with the population about sites standing less than 50 m from the settlement before the beginning of the construction.	During construction	Preserving the health of the population
	Measures to reduce the possible unfavourable impact of light on the population – to communicate with the public the necessity to light up facilities standing less than 50 m away from the settlement.	Before the beginning of construction	Preserving the health of the population
9.	***Material and cultural heritage***		
	For the identified archaeological sites: - at 13 places on the western, at 14 places on the eastern route and at 3 places along the common route - to carry out thorough archaeological digs before the beginning of the excavation works following the conditions of Art. 148, para. 2 of the Cultural Heritage Act - at 9 places on the western, 10 places on the eastern and 4 places on the common route, to perform archaeological probing.	Before the excavation works	Rescue of archaeological sites
	- At 28 places on the western, 10 places on eastern and 13 places on the common route – to carry out thorough archaeological digs before the beginning of the excavation works following the conditions of Art. 148, para. 2 of the Cultural Heritage Act	During the excavation works	Rescue of archaeological sites
	To avoid the distortion of the contemporary cemeteries of the settlements, that are described in the logbook of the field archaeological studies	During the operation	Avoide the disruption of modern cemeteries
10.	***Population and Health Risk***		
10.1.	***Measures to protect public health***		*Prevent any damage to the health and comfort of the population*
	Efficient measures regarding the management of the applied technological process in the construction of the pipeline.	During the design and construction	Avoid the usage of old technologies generating hazard and dangers to public

№	Measures	Period (phase) of implementation	Result
	Efficient measures to manage the noise exposure of the population from the investment project – urban planning, architectural-planning and building and acoustic	During the construction and operation	Prevent damage from noise on the population and / or people with increased sensitivity
	The machinery and equipment meet the Bulgarian standards for noise	During the construction and operation	Not permitting machinery and equipment generating excessive noise levels
	Rational organization of the activities related to noise generation in the vicinity of settlement – to be performed in specified periods, in coordination with the local authorities.	During the construction	Reducing the negative impact of the noise on populations
	Preventing the release of excessive levels of dust from the site - sprinkling during the performance of ground works - excluding the dispersion of fine dust (sand) during transportation	During the construction	Prevention of the damage to the health of the population from chemical pollutants
	Preventing the release of excessive levels of toxic substances from the site - Organizing the traffic away from the settlements - Proper storage and use of lubricants - Collection and disposal of the industrial waste to the designated areas	During the construction and operation	Prevention of the damage to the health of the population from chemical pollutants
	Ensuring the safety of the population in case of accidents and emergency – development of action plan to prevent accidents and for emergency actions in case of accidents	During the construction and operation	To minimize trauma, burns, exposure to gas and accidents
10.2.	***Measures to protect the health of the workers***		*Ensuring healthy and safe working environment for the workers, which also is a surrounding environment for the population during the time of construction.*
	To conduct risk assessment of the workstations.	During the phase of construction and operation of the facility (from LMS)	Assessing the risk factors – mechanical, physical, chemical during the construction phase
	Measures to comply with the requirements for health and safety at work – plan for safety at work, briefings, work clothes and personal protective equipment.	During the phase of construction and operation of the facility (from LMS)	Protecting the workers and the population from the impact of the hazardous factors related to the pipeline construction process
	Strict briefings.	During construction	Preventing the risk of injury and accidents among the

№	Measures	Period (phase) of implementation	Result
			population which is close to the site
	To develop physiological schedule of work and rest.	During construction	Ensuring of healthy work schedule, preserving the work capacity of the workers
	Developing a plan to prevent accidents, fires, emergency help.	During construction and operation	Ensuring labor safety for the workers, and for the population – protection from chemical hazards, smoke, suffocant gases, etc.
	All other measures developed by the Labour Medicine Service (LMS) that has a service contract according to the requirements of the Health and Safety at Work Act (HSWA).	During construction and operation	Ensuring safe and healthy working conditions, indirect impact on the population for preserving their health and comfort.

6.3 Recommendations to the self-monitoring plan

The monitoring program will include observations, measurement, quantitative and qualitative characteristics of the components of the environment. The objectives of the monitoring program are:

- Timely identification of adverse effects;
- Prognosis for the future development of the adverse effects;
- Prevention of adverse effects;
- Determining the effectiveness of the mitigation measures

6.3.1 Atmospheric air and atmosphere

To avoid disrupting the existing level of air quality in urban areas as a result of the construction, it is recommended:

- To measure the main pollutants (SO2, NO2, NO, PM10, O3 and CO) near the settlements through which the transport stream will pass, before the start of the construction works.
- To make similar measurements during the intense activity in the process of construction.

The purpose of this recommendation is to be able to assess whether the increase in traffic, with trucks and other transport equipment, affects the quality of ambient air in the vicinity of the settlements, alongside which the transportation vehicles will pass.

6.3.2 Waters

6.3.2.1 Surface water

The monitoring ot surface water to be performed in compliance with the requirements of Ordinance № 1 on the monitoring of waters from 11.04.2011 in the following points:

- Studen Kladenets Dam, Maritsa River at the place of interception.

- A 100 m down the stream from the point of interception of the main rivers and feeders (the rivers Maritsa, Varbitsa, Perperek, Harmanliiska, Kazalach, Dzhebelska, Harmanliiska, Kazalach, Dzhebelska, Haskovska and Sazliika)

Indicators for Analysis: pH, suspended substances; dissolved oxygen; Chemically Requisite Oxygen, Biochemical Need of Oxygen; heavy metals (zink, arsenic, cadmium, zink, arsenic, cadmium, barium, mercury, copper, chromium) extractable substances (hydrocarbonates); general organic carbon, barium, mercury, chromium); extractable substances (hydrocarbonates); organic carbon, general organic carbon.

Frequency of the testing:

- Before the construction – once before the beginning of the construction works
- Construction phase – once a week
- Operation phase – once every two years for the main rivers and feeders.
- In case of an accident – weekly in the affected areas.

To perform self-monitoring at all places where waste water is dispatched in a surface water body.

Frequency of sampling: once a month

Indicators for Analysis: pH, suspended substances; Chemically Requisite Oxygen, Biochemical Need of Oxygen; heavy metals; extractable substances (hydrocarbonates); petrochemicals;

During operation, in the places where the pipe crosses rivers and streams, the slopes should be monitored regularly especially after natural disasters (e.g. floods, earthquakes, etc.). When instability of the riverbanks is noticed at the intersections, the vegetation must be restored to protect the coastline from erosion or to take other fortifying measures to avoid possible damage to the pipe;

The monitoring plan should provide for a monthly monitoring of the cathodic protection (CP) of the pipeline.

6.3.2.2 Underground water

The monitoring is performed to obtain enough information about the quality of the underground water in compliance with the requirements of Ordinance № 1/11.04.2011 on the monitoring of water and Ordinance № 1/10.10.2007 on research, use and protection of underground water.

It is recommended during the construction, the monitoring of the chemical condition of the underground water to include taking and testing water samples along the western route at the following points:

- at km 8+500 from the mineral water sources at Kirkovo;
- at km 34+900 from the existing abandoned shaft wells;
- at km 79+100 from the captured spring at Mandra Village;
- from monitoring drills at up to 10÷20 m distance from the pipeline route, with which underground water is to be revealed in the alluvial terraces of the rivers Arda, Harmanliiska, Haskovska, Maritsa, Han Dere, Sazliika, and Azmaka.

Studies of the chemical composition of water should include the indicators: dissolved oxygen, pH, conductivity, presence of nitrates, ammonium, calcium, magnesium, chloride, sodium and potassium, sulphates, hydrocarbons, carbonates, total hardness, permanganate oxidation, temperature, nitrates, phosphates, total iron and manganese, lead, cadmium, arsenic, mercury, copper, zinc, nickel, chromium, hydrocarbons, total β activity and total α activity.

No monitoring of the ground water during the operation of the pipeline is needed.

6.3.3 Earth's subsurface and mineral diversity

Preparation and implementation of a "Plan for self-monitoring of the geological environment", including monitoring, research and prognosis of the risk of activation and development of dangerous erosion and gravitational processes during the construction period and operation of the pipeline.

It is recommended to make periodic visual inspection of the pipeline route in order to identify and predict potential danger of activation and development of erosion and gravitational processes during the construction period and operation of the pipeline.

6.3.4 Soils

There is no needed to monitor the soils during the construction of the gas pipeline.

6.3.5 Landscape

Measures to monitor the landscape should be included in the monitoring plan of the pipeline:

At the time of design and before the construction phase:

- The project for restoration should be made in compliance with the regulations and best practices, before the construction, and it should incorporate the results from the consultations with the interested parties involved. The compliance with the requirements for the restoration, including the landscape, set in the project should be controlled in order to support the recovery of the natural conditions in the disturbed areas and in the incorporation of the site in the surrounding landscapes.

During the operation phase:

- The implementation of the project for restoration ensures timely and complete recultivation of the construction line and the construction sites in compliance with the regulations and best practices. The restoration should be done after the end of the construction works and the activities for recultivation in the agricultural and forest areas should be audited regularly, in coordination with the local authorities if necessary.

6.3.6 Biodiversity

6.3.6.1 Flora

The implementation of the monitoring of the conservationally significant species and habitats should be conducted according to a developed "A 5-year Monitoring of Conservationally Significant Species and Habitats Project."

These species and habitats should be monitored at places that have been selected after the final selection of one of the two alternatives and when found on the spot. The conservationally significant habitats which are included in Appendix 1 of the Biological Diversity Act (BDA) and which are subject and objectives for protection of the protected areas in Natura 2000 should be monitored. Such habitats are 6220, 6210, 91AA, 92A0, 92D0, 5210. Monitoring areas with an area of 100 m2 for grass and shrub communities and an area of 400 m2 for forests (without riparian) should be established at a 50 m strip around the selected option for the pipeline route. In the event of finding conservationally significant types of plants (listed in Appendix 3 of the BDA) the monitoring of the protected plants should be carried out according to the approved methods and forms of the National System for Monitoring of the Biodiversity that can be found on the site of Executive Environmental Agency (ExEA).

6.3.6.2 Fauna

The main purpose of the monitoring survey will be to most fully establish the species composition of the fauna in the area of the route (east and west version), the existence of specific habitats / refuge, affected by the construction of the pipeline, the condition of the affected populations, as well as existence of migration routes (twenty-four-hour or seasonal). It is expected to collect relevant data, as a result of the field study, about:

- Animal species living in different periods of their life cycle along the pipeline route;
- Identify the dominant species;
- Determine the relevant number and activity of the species;
- Identify the places with increased concentration of conservationally significant species;

It is necessary that the self-monitoring covers the specific periods of the life cycle of the animals, included in Annex 2 of Directive 92/43 EEC in the previously identified favorable habitats for them. The purpose of this monitoring study should be to confirm the presence or absence of the species in the sections of the pipeline and the presence of potential impact on them.

Before the construction of the pipeline, it is necessary to monitor the colonies of the European ground squirrel, found near the route (see ***Appendix 9***, which will be supplemented in the spring of 2012) from an expert therologist, who will determine the number of the occupied holes and will monitor the numbers and density of these colonies. Duration – 3 years after the construction of the pipeline.

It is recommended to:

To monitor the mammals (by placing phototraps and using equipment for registration of the ultrasound of bats), especially those with nocturnal activity, living in rocky and different types of damp habitats in selected priority areas (look at ***Appendix 9.1***) That includes annual monitoring of the presence and numbers of otter in the sections of crossing rivers (at a distance of 1 km up and downstream) with established habitats of the species (look at ***Appendix 9.1***); Duration – 3 years after the construction of the pipeline.

- To monitor all groups of mammals, including reptiles and amphibians in selected priority points (look at ***Appendix 9.1*** during the period of fencing the site for the construction of the route;
- To monitor the status of the populations of the amphibians and reptiles in 5, affected by the route, representative habitats for each animal group (look at ***Appendix 9.1***) To perform annually 8 transects to determine the thickness of the population of tortoise in the the 8 sections, defined as areas with high numbers of these animals. Duration – 5 years after the construction of the pipeline. Thus it will be possible to determine to what extent has the population recovered in the affected habitats. The transects for tortoise should be done in the period May-July from a qualified expert herpetologist.
- To perform monitoring of the river sections affected by the pipeline during the phases of construction and operation, in order to monitor the restoration of the hydrozoocoenosis.
- To develop an emergency action plan during the phase of construction and operation.

6.3.6.3 Protected areas

There is no need to develop a plan for self-monitoring with regard to the protected areas.

6.3.6.4 Protected sites

The implementation of the monitoring of the conservationally significant species and habitats should be conducted according to a developed "A 5-year Monitoring of Conservationally Significant Species and Habitats Project." These species and habitats should be monitored at places that have been selected after the final selection of one of the two alternatives and when found on the spot. The conservationally significant habitats which are included in Appendix 1 of the Biological Diversity Act and which are subject and objectives for protection of the protected areas in Natura 2000 should be monitored. Such habitats are 6220, 6210, 91AA, 92A0, 92D0, 5210. Monitoring areas with an area of 100 m2 for grass and shrub communities and an area of 400 m2 for forests (without riparian) should be established at a 50 m strip around the selected option for the pipline route. In the event of finding conservationally significant types of plants (listed in Appendix 3 of the BDA) the monitoring of the protected plants should be carried out according to the approved methods and forms of the National System for Monitoring of the Biodiversity that can be found on the site of ExEA.

6.3.7 Cultural Heritage

Monitoring of the activities during the construction and operation of the pipeline regarding the cultural and historical heritage sites, is necessary with regard to the preservation of the unaffected or unexamined parts of the archaeological sites that fall outside of the pipeline easement, when constructing additional facilities, as well as from looters interventions.

6.3.8 Population and Health Risk

The plan for self-monitoring with regad to the health of the population should be aimed at early detection of the possible significant effects in order to prevent, reduce, or where possible terminate them.

- Organization of activities related to raising the public awareness about the benefits and the potential dangers to their health associated with project implementation.
- Regular measurement of the factors affecting the health of the population - noise level (dB) near the residential and public service facilities during the construction.
- Regular measurement and monitoring of the air pollution (dust, chemical hazards, incl. fumes) in the period of construction.
- Analysis of the monitoring measurements and assessment of the potential risk to the population as correlation to the health indexes of the affected population.
- Development of a plan to prevent accidents and measures to protect workers and the public.

6.4 Recommendations to the Emergency Plan

It is necessary to develop and implement an Emergency Action Plan which includes appropriate controls and indicators for monitoring and tracking trends in the culture of safety in order to avoid mistakes by the personnel in the process of construction, operation and repair of the equipment, observing the instructions and technical specifications, requirements for the environmental protection, for fire and emergency safety, i.e. to take all measures to prevent accidents. The emergency plan is to consider the risk of an accident, including leaks from the pipeline during potential events such as corrosion, sudden ruptures, maintenance or works on expanding the system; contamination of "Sladak Kladenets" Dam and other surface water bodies with waste.

The emergency plan is to include the expected wastes resulting from potential accidents and the manner of their treatment in accordance with the acting procedures in Bulgaria and Europe.

7 VIEWS AND COMMENTS OF THE CONCERNED PUBLIC, COMPETENT AUTHORITIES RESPONSIBLE FOR A DECISION ON THE EIA AND OTHER SPECIALIZED AGENCIES AND INTERESTED PARTIES IN A TRANSBOUNDARY CONTEXT, RESULTING FROM CONSULTATIONS HELD

This section of the EIA report describes how the consultations were conducted, and it contains a compiled Reference Information on views and comments of the competent bodies and specialized agencies, and also views and comments expressed by the public in the region with reference to the consultations on determination of the scope, content and format of the EIA report. In the Table are shown the answer to each question being asked, or opinion and reasoning as to which are accepted and which are rejected and why.

In accordance with Article 95, paragraph 1 of the Environmental Protection Act and Article 4, paragraph 1 and 2 of the *Ordinance on the Conditions and Procedures for Assessing of Environmental Impact*, the Contracting Authority sent notification letters to the Ministry of Environment and Water, the Regional Inspectorate of Environment and Water, and the Municipalities at the most early stage of its project. Copies of the letters and correspondence are enclosed in the Appendix to the Terms of Reference (ToR) for the scope and content of the EIA, and therefore these copies were not enclosed in the EIA report.

The developed ToR for the scope and content of the EIA report on the investment proposal was submitted to the Ministry of health for consultations concerning the scope and content of the assessment on health and hygienic considerations, environment and risks for human health, and as a result a reply was received with the relevant requirements:

- To provide information on location and exact distances from the nearest sites (if any) to the pipeline facilities, subject to health protection within the meaning of § 1, item 3 of the Ordinance on the Conditions and Procedures for Assessing of Environmental Impact (published in the State Gazette, No 25,18 March 2003, as amended in the SG, No 3, 10 January 2006, as amended in the SG, No 80, 9 October 2009, as amended in the SG, No 29, 16 April 2010, as amended by the SG, No 3, 11 January 2011). The ToR indicates that the pipeline route is intended to run through the territory of the regions of Stara Zagora, Haskovo and Kardzhali, and that it is outside the regulation of the populated settlements over its entire length. It is necessary to indicate the closest distances to the regulation boundaries of particular populated settlements.
- To make assessment of the health risk from emergency situations.
- After completion of the health risk assessment measures for health protection and risk management shall be proposed.

A copy of the letter is enclosed in ***Appendix 12*** of the EIA report.

In ***Annex 12*** is shown a **Reference Information on consultations held** and views and suggestions expressed during the consultations, and how they are reflected in the EIA report. Organizations and persons from which answers to the notification letters were obtained and which were consulted on the project are presented therein in tabular form, and these answers are systematized and a reference compilation is made showing reasons for accepted and rejected comments and recommendations. Copies of the correspondence are enclosed in **Annex 12 – Reference Information on consultations held**.

In the course of the consultations letters were sent to the following public departments, agencies, organizations and bodies:

MoEW, Zeleni Balkani, four water supply and sewerage utility companies (Dimitrovgrad, Haskovo, Stara Zagora and Kardzhali), Municipalities (Stara Zagora, Opan, Radnevo, Dimitrovgrad, Haskovo, Kardzhali, Dzhebel, Momchilgrad, Stambolovo, Kirkovo, Krumovgrad), Executive Forest Agency, MEET-Directorate of Natural Resources and Concessions, Museum of Natural History of Sofia, Institute of Biodiversity and Ecosystem

Research at Bulgarian Academy of Sciences, Bulgarian Society for the Protection of Birds (BSPB), East Aegean Sea River Basin Directorate - Plovdiv, RIEW-Haskovo and RIEW – Stara Zagora, Road Infrastructure Agency, Operators of mobile telecommunications networks (Globul, Vivacom and MTel), Regional administration: Kardzhali, Stara Zagora and Haskovo, Ministry of Health, Regional Health Inspectorate: Kardzhali, Stara Zagora and Haskovo, EVN Bulgaria: Electricity distribution companies Kardzhali, Stara Zagora, Haskovo, Zagore, Dimitrovgrad, Momchilgrad, Krumovgrad and Radnevo, National Centre of Radiobiology and Radiation Protection, Ministry of Health, NURTS Bulgaria AD, Regional Forest Directorate of Kardzhali, Stara Zagora, State Forestry of Krumovgrad, Momchilgrad, Stara Zagora, Kardzhali, Kirkovo, Haskovo, Road Infrastructure Agency, Agrolesproekt Napoitelni sistemi EAD, Gorna Tundzha-Stara Zagora Branch.

Replies received from:

MoEW, Municipalities (Stara Zagora, Opan, Radnevo, Dimitrovgrad, Haskovo, Kardzhali, Dzhebel, Momchilgrad, Stambolovo, Kirkovo, Krumovgrad), Regional Administration Kardzhali, Regional Administration Stara Zagora, Water Supply and Sewerage Companies of Stara Zagora, Haskovo, Dimitrovgrad, Kardzhali, East Aegean Sea River Basin Directorate - Plovdiv, MEET-Directorate of Natural Resources and Concessions, RIEW Stara Zagora, RIEW Haskovo, RIEW Stara Zagora, EVN Bulgaria Electrorazpredelenie AD Plovdiv, CEC Stara Zagora, EVN - CEC Haskovo, EVN - CEC Radnevo, RFD Stara Zagora, RFD Kardzhali, RHI Stara Zagora, RHI Haskovo, RHI Kardzhali, Operators of mobile telecommunications networks (Globul, Vivacom), Road Infrastructure Agency, BSPB, National Centre of Radiobiology and Radiation Protection - Sofia, NURTS Bulgaria AD, State Forestry of Momchilgrad, State Forestry of Krumovgrad, State Forestry of Stara Zagora, Napoitelni sistemi EAD, Gorna Tundzha-Stara Zagora Branch.

In addition, meetings were held in all affected municipalities (Stara Zagora, Opan, Radnevo, Dimitrovgrad, Haskovo, Kardzhali, Dzhebel, Momchilgrad, Stambolovo, Kirkovo, Krumovgrad) and Regional Administrations (Kardzhali, Stara Zagora and Haskovo) to which the project and expected impacts from pipeline construction and operations were submitted. Meetings were also held at East Aegean Sea River Basin Directorate - Plovdiv.

Given the territorial scope of the Investment Proposal, a transboundary impact can be expected only in the area of the border lane between Bulgaria and Greece, a due notification was given to the Republic of Greece. As a result, a letter was received from the Greek Ministry of Environment, Energy and Climate Changes, by which this competent Greek authority expressed in writing its intention to participate in the transboundary EIA procedure.

In the EIA report of the project the recommendations were considered and answers were given to the questions that have arisen during the consultations in accordance with the requirements of Article 95, paragraph 2 of the Environmental Protection Act and the Ordinance on the Conditions and Procedure for Assessing of the Environmental Impact.

The EIA report was submitted to MoEW for evaluation by letter ref. No VIII-11 dd 10.08.2012 and as a result a return letter of ref. No OVOC – 249 dd 10.09.2012 was received wherein it is stated that the assessment of the quality of the EIA report **is positive**, with certain deficiencies that would not be essential in the taking of a decision. As a result, the EIA report was supplemented with: mathematical modeling of air pollution from fugitive air emissions generated during construction of the pipeline, as well as additional information with a reasoned conclusion regarding the potential transboundary impacts.

7.1 Description of the difficulties (technical causes, deficiency or lack of data) in gathering information for the development of the EIA Report on the Investment Proposal and how to overcome them.

1. No design

The draft of the EIA report was completed before development of the IGB design, and also:

- Hydrological studies to determine maximum water quantities.
- Hydraulic calculations to determine water levels and velocities corresponding to the maximum water quantities.
- Assessment of the current river bed processes and determination of the profile of the limit leveling (washout).
- Plan of hydrostatic testing of the pipe.
- Lack of clarity about the location of temporary construction camps and the method of treatment of waste water generated in the camps.
- There are no data about catchments near the route and no analysis of the pipeline construction impact on their drainage can be made.

2. Terrain Surveys

The identification of the species in these cases in the autumn of 2011 was not possible, because the fieldwork took place after most species have disappeared or gone to their dens for hibernation Therefore, a detailed study of the flora, vegetation and natural habitats was conducted for both routes during an appropriate vegetation season - March, April, May, June 2012.

Due to insufficient time for field studies in 2011 and because of a partial change in the Western Route, an additional archaeological exploration was conducted across the changed sections of the route in 2012.

3. Collection of Information

The expert team experienced the following major difficulties in collecting information about the environment and social conditions necessary for the EIA in relation to the investment proposal:

- Location of sanitary protection zones of the sources for water for drinking and domestic purposes along the pipeline route. Letters were sent to the EASRBD requesting information about location and the sanitary protection zones of the water sources in compliance with the provisions of the Public Access to Information Act. In its reply the EASRBD provided mostly coordinates of the water sources, while there was nearly no information for the sanitary protection zones. Consequently, coordinates of the sanitary protection zones were requested and supplied from the local water supply and sewerage utility companies. In these replies, however, it was stated that for some of the water sources such zones are not established in accordance with Ordinance No 3 / year 2000 on the Conditions and Procedures for Research, Design, Validation, and Operation of Sanitary Protection Zones around Water Sources and Facilities for Water Supply and Sources of Mineral Waters used for Therapeutic, Preventive, Drinking and Hygienic Needs. Lack of comparability of data provided by the Basin Directorates and local water supply and sewerage utility companies was established.
- Earth's subsurface – The geological engineering report was prepared much later, shortly before completion of the EIA Draft Report

- Cultural historical heritage – there are no available maps in Bulgaria showing archaeological sites and their location coordinates. The records of cultural information are only descriptive.
- Collecting data for other investment proposals in the region. The team experienced also difficulties in preparing the chapter on cumulative impact. Considerable difficulties were encountered especially in collecting information and data for other investment proposals in the vicinity of the pipeline route. They were the result of the lack of a unified register of investment proposals. Each entity maintains its own list of projects available on the website. But the information about the exact location of investment proposals (coordinates) and their time frames were not available. Data were collected from RIEW Stara Zagora and RIEW Haskovo, the affected municipalities, in compliance with the Public Access to Information Act. Additional data were sought from the web sites of the MoEW and MRDPW. Furthermore, in order to determine the locations of other projects, information was also collected from the Ministry of Regional Development and Public Works.

8 CONCLUSION

The EIA report was developed by a team of independent experts to cover the various environmental components and impact factors. The experts have been guided in their preparation of the EIA by the principles for reduction and prevention of risks to human health and ensuring of sustainable development according to current Bulgarian standards for quality environment.

The investment proposal is intended to connect the existing transmission networks in Greece and Bulgaria. The purpose of the connection between the Investment Proposal and the National Gas Transmission System is to supply the quantity of natural gas allocated for consumption in Bulgaria. This project is of great importance for ensuring security of gas supplies to Bulgaria and therefore the Council of Ministers of Bulgaria in its Decision No 452 of June 7, 2012 declared the Gas Interconnector Greece-Bulgaria in the section, which will be constructed on the territory of Bulgaria, as a project of national priority.

The pipeline enters from Greece, crossing the state border near the Makaza Pass and reaches near Stara Zagora. The EIA report has been developed for the project facilities located on the territory of Bulgaria. The EIA report evaluates the project impacts on the environment and social life during construction, operation and emergency, and the decommissioning after the end of the operational lifetime.

The alternative pipeline routes and technological solutions were studied and compared, and the evaluation of the options for the implementation of the project indicates that the two alternative routes - the Western Route and the Eastern Route are feasible and possible solutions for the Project. The Western Route is the preferable choice as the expected environment impact is smaller and less measures will be required to prevent, reduce and, where possible, terminate significant adverse environmental impacts. The selection of the more appropriate Western Route and the implementation of measures to mitigate adverse negative effects would contribute significantly to the limiting and reducing of the expected negative consequences.

The water of the Arda River at the Studen Kladenets Reservoir is classified as a water body of "moderate ecological status" and "poor chemical status". In accordance with the objectives of the Water Framework Directive (WFD), which Bulgaria as a member of the European Community is bound to comply with, the goal is to improve the quality of water from this "poor status" to "good ecological status" in 2021. The project will not endanger the achievement of this goal, as it has no components continuously producing significant quantities of waste water for discharge into rivers. Because of the poor chemical status of water in the reservoir, and in line with the objectives of the Water Framework Directive, it would be more appropriate to use Horizontal Directional Drilling (HDD) as this method will prevent any modification to the water body and reduce the amount of suspended solids. After making a detailed and comprehensive analysis the experts recommend crossing of the Studen Kladenets Reservoir by the Western Route using the HDD method for a stretch of length of about 1500 m.

The water of the Maritsa River is classified as water body of "poor ecological status' due mainly to pollution from sewerage and nutrients introduced by rivers. In terms of environmental protection, crossing of the Maritsa River by the open cut method can cause changes in the morphology and quality of the surface water (mobilization of contaminants from bottom sediments, etc.). Because of the poor chemical status of the water of the Maritsa River, and in line with the objectives of the Water Framework Directive, it would be more appropriate to use Horizontal Directional Drilling (HDD) as this method will prevent any modification to the water body and reduce the amount of suspended solids. Therefore, designers have proposed crossing of the Maritsa River by the Western Route using the HDD method, and the EIA report experts support this solution.

Designers have included a number of measures to reduce environmental impact. Pipeline routes are aligned as far as possible with the recommendations of the experts on the various environmental components based on their field studies and analysis of the expected impacts. The experts responsible for the development of the EIA report have recommended, based on the expected project impacts on the environment and social life, measures to prevent, reduce and, where possible, terminate any significant adverse environmental impacts. These measures are intended for the various environmental components at the phases of the design, construction and operation of the pipeline. The EIA report provides also recommendations for the monitoring plan.

The pipeline routes run though several protected sites under Natura 2000 network and therefore an assessment of compliance of all such potentially affected sites was made in accordance with the Bulgarian and European legislation and enclosed to the EIA report. Based on the collected and analyzed data, field surveys and assessment of the expected impacts, it was found that the Western Route is more acceptable than the Eastern Route in terms of protection of plants and animals within the protected sites. At implementation of the Western route minor to moderate impacts can be expected which, after the application of a set of measures, can be minimized and this option be implemented. That is why, the alternative Western Route can be approved. The Eastern Route will involve minor, moderate and significant impacts on a larger number of different species of amphibians, reptiles and mammals, and over a larger area of their habitats. Therefore, implementation of the project through the Eastern Route is not recommended.

The analysis of data in terms of health risk shows that the project will not create significant health risk for the human population, if implemented in strict compliance with the requirements of the Bulgarian and European legislation, and the best international standards and practices in the construction and operation of the pipeline, and environmental protection, are followed. The health risk is low for the population and moderate for the construction workers, and is acceptable and manageable.

The conclusion of the group of independent experts, which have developed the Environmental Impact Assessment and the Assessment of Compliance, is to approve the Western Route of the Gas Interconnector Greece-Bulgaria Project. Its completion can continue up to the next stage of its development along the Western Route, in strict compliance with the requirements of the Bulgarian and European legislation, and the best international standards and practices in the design, operation, decommissioning and environmental protection, and upon implementation of the additional environmental protection measures recommended in the EIA report and the AS.

9 APPENDICES

9.1 Appendices at the discretion of the EIA Report Contractor

***Appendix 1* – Overview Maps**

Appendix 1.1 – Overview layout showing the location of the intended investment proposal and populated settlements in the area

Appendix 1.2 – Overview layout showing the location of above ground installations, access roads, areas with restricted access

***Appendix 2* – Layout of Protected NATURA 2000 Sites and Protected Areas** – with indicated location of the proposed Investment Proposal and of Protected NATURA 2000 Sites and Protected Areas.

***Appendix 3* – Ambient Air**

Appendix 3.1 – Detailed climatic characteristics of the routes

Appendix 3.2 – Detailed data of quality of the ambient air along the routes

Appendix 3.3 – Mathematical modeling of air pollution from fugitive air emissions generated during the construction of the pipeline

***Appendix 4* – Surface Water**

Appendix 4.1 - Hydrological map of surface water within the range of the route

Appendix 4.2 - Brief description of the drainage basin areas of the river basins of the Arda River and Maritsa River and other major rivers of their drainage basins that are crossed by the two alternative pipeline routes

Appendix 4.3 - Monitoring stations for surface water in the areas along the pipeline

Appendix 4.4 – Map of the pipeline route and of water mains crossed by the route

***Appendix 5* – Underground Water and Geology**

***Appendix 5.1* –** Geological Maps (10 map sheets – six for the Western Route – 5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.5, 5.1.6 and four for the Eastern Route – 5.1.7, 5.1.8, 5.1.9 and 5.1.10) with indicated location of proposed Investment Proposal and description of the geological environment within the range of the pipeline

Appendix 5.2 – Maps of underground water bodies (three map sheets – 5.2.1, 5.5.2 and 5.2.3) with indicated location of proposed Investment Proposal

Appendix 5.3 – Description of underground water bodies (5.3.1 – at the Western Route, 5.3.2 – at the Eastern Route)

Appendix 5.4 – Geological description of pipeline routes (5.4.1 – at the Western Route, 5.4.2 – at the Eastern Route)

***Appendix 6* – Soils**

***Appendix 6.1* –** Detailed description of soils

Appendix 6.2 – Location of soil types by kilometers

Appendix 6.3.– Table of key indicators - fertility, erosion, mechanical structure, risk of compaction and waterlogging.

Appendix 6.4 – Specific Terms

Appendix 6.5 – Zones with increased erosion risk

Appendix 6.6 – Soil Map

Appendix 7 – **Landscape**

Appendix 7.1 Morphological description of the two alternative pipeline routes

Appendix 7.2 Map and Table of landscape groups crossed by the alternative pipeline routes

Appendix 8 - **Flora**

Appendix 8.1 - Detailed list of plant species predominantly found along the routes of the two alternative pipeline routes in the Upper Thracian and Eastern Rhodopes District according to the Geobotanical zoning of Bulgaria (Bondev, 1997)

Appendix 8.2 **-** Table with information about the potential spread of conservation significant plant species whose distribution areas are near the Eastern and Western Route within the zone of the IGB Project, having significant conservation status and a Table of potential habitats which may be common for both routes within the zone of the IGB Project

Appendix 8.3 **-** List of ruderal vegetation and invasive plant species alien to the natural habitats

Appendix 8.4 **-** Area of affected habitats for Protected Sites under the Habitats Directive which will be impacted by the implementation of the Investment Proposal

Appendix 9 – **Fauna**

Appendix 10 – **Layout of cultural historical heritage** – with indicated established sites of cultural historical heritage along the pipeline routes.

Appendix 11 – **Population**

Appendix 12 – **Reference Information about consultations held** and views and suggestions expresses in the process of consultations, and the manner of their presentation in the EIA report, copies of the correspondence and a notice.

Appendix 13 - **List of signatures of the experts** and the head of the team who prepared the EIA report, written declarations under Article 83, paragraph 1 of the EPA and Article 11, paragraph 3 of the Ordinance on the Conditions and Procedures for Assessing of the Environmental Impact.

Appendix 14 – **Transboundary Impact**

9.2 Summary list of regulations on environmental protection to be complied with in the design, construction and operation of the Gas Interconnector Greece – Bulgaria Project

9.2.1 Ambient Air

- Ordinance No 12 of 15 July 2010 on Limit Values for Sulphur Dioxide, Nitrogen Dioxide, Particulate Matter, Lead, Benzene, Carbon Monoxide and Ozone in Ambient Air (SG, No 58, 30 July 2010, in effect from 30.07.2010)
- Ordinance No 14/1997 on Levels of Maximum Permissible Concentrations of Harmful Substances in the Ambient Air of Populated Settlements (SG 88, year 1997, as amended in SG 46, year 1999 and SG 8, year 2002).

- Ordinance on Requirements for the Quality of Liquid Fuels, Conditions and Procedures for their Control (Enacted by Letter No 156 of 15.07.2003 by the Council of Ministers, published in SG, No 66, 25.07.2003, in effect from 1.10.2003, as amended by SG, No 69, 23.08.2005, in effect from 23.08.2005, as amended by SG, No 78, 30.09.2005, in effect from 1.10.2005, SG, No 40, 16.05.2006, in effect from 5.05.2006, as amended by SG, No 76, 21.09.2007, in effect from 21.09.2007, as amended by SG. No 93, 24 November 2009)
- Letter No 257/2001 by the Council of Ministers on the Adoption of Ordinance on the Conditions and Procedures for Reducing of Pollution from Motor Transport Vehicles, published SG, No 98, 16 November 2001

9.2.2 Surface Water

- Water Act (published in the SG, No 67, 27 July 1999);
- Ordinance No 3 of 16.10.2000 on the Conditions and Procedures for Research, Design, Validation, and Operation of Sanitary Protection Zones around Water Sources and Facilities for Water Supply and Sources of Mineral Waters used for Therapeutic, Preventive, Drinking and Hygienic Needs, SG, No 88/2000
- Ordinance No 6 of 9 November 2000 on Emission Levels for Permissible Levels of Harmful and Hazardous Substance in Waste Water Discharged in Water Basins, issued by the Ministry of Environment and Water, Ministry of Regional Development and Public Works, Ministry of Health and Ministry of Economy (published SG, No 97, 28 November 2000);
- Ordinance No 7 on Parameters and Levels for Determination of Quality of Flowing Surface Water (published SG, No 96, 12.12.1986);
- Ordinance No 9 of 19.03.2001 on Quality of Water intended for Drinking and Domestic Needs, SG, No 30/2001.
- Ordinance No 1 of 11.04.2011 on Monitoring of Water (published SG, No 34, 29.04.2011)
- Ordinance No 1 of 10.10.2007 on Research, Use and Protection of Underground Water (SG, No 87, 30.10.2007, as amended by SG, No 2, 8.01.2010);

9.2.3 Underground Water

- Water Act
- Ordinance on Conditions and Procedures for Assessing of Environmental Impact
- Ordinance No 1 of 10.10.2007 on Research, Use and Protection of Underground Water
- Ordinance No 3 of 16.10.2000 on the Conditions and Procedures for Research, Design, Validation, and Operation of Sanitary Protection Zones around Water Sources and Facilities for Water Supply and Sources of Mineral Waters used for Therapeutic, Preventive, Drinking and Hygienic Needs
- Ordinance No 1/11.04.2011 on Monitoring of Water
- Ordinance on the Construction and Safe Operation of Gas Transmission and Distribution Pipelines and Facilities, Installations and Instrumentation for Natural Gas

9.2.4 Earth's Subsurface

- Ordinance No 2/23.07.2007 on Design of Buildings and Structures in Seismic Areas
- Mineral Resources Act

- Ordinance on the Construction and Safe Operation of Gas Transmission and Distribution Pipelines and Facilities, Installations and Instrumentation for Natural Gas

9.2.5 Soils and Landscape

- Soils Act, published SG, No 89, 6 November 2007, as amended by SG, No 92, 22 November 2011
- Ordinance No 26 on Reclamation of Disturbed Land, Melioration of Low Productive Land, Stripping and Use of Topsoil, published SG, No 89, 22 October 1996, as amended by SG, No 30, 22 March 2002
- Farm Land Protection Act, published SG, No 35, 24 April 1996, as amended by SG, No 39, 20 May 2011.

9.2.6 Biodiversity

- Forests Act, published SG, No 19, 8 March 2011, as amended by SG, No 43, 7 June 2011.
- Rules for Enforcement of the Forests Act, published SG, No 41, 10 April 1998, as amended by SG, No 7, 21 January 2011;
- Territories Protection Act, published SG, No 133, 11 November 1998, as amended by SG, No 19, 8 March 2011;
- Ordinance No 16 of 9 June 2004 on Easements for Energy Facilities (published SG, No 88, 8 October 2004, as amended by SG, No 77, 2 September 2008).
- Biodiversity Act, published SG, No 77, 9 August 2002, as amended

9.2.7 Cultural Heritage

- Cultural Heritage Act (SG, No 19/2009, as amended and supplemented)
- Ordinance No H-00-0001 of 14.02.2011 by the Minister of Culture on Conducting of Archeological Excavations (SG, No 18, 01.03.2011),
- Ordinance No 5 by the Ministry of Culture (SG, No 60/1998).

9.2.8 Risk Energy Pollutants

- Ordinance No 6 of 15.08.2005 on Minimum Requirements of Ensuring of Health and Safety at Work against Risks Related to Noise Exposure, published SG, No 70, 26.08.2005, in effect from 15.02.2005,
- Ordinance No 3 of 5.05.2005 on Minimum Requirements of Ensuring of Health and Safety at Work against Risks Related to Vibration Exposure, published SG, No 40, 12.05.2005, in effect from 6.07.2005.
- Ordinance No 2 of 5 April 2006 (published SG, No 37/2006) on the Operation of the National System for Monitoring Environmental Noise and Requirements for Conducting Internal Monitoring and Provision of Information from Industrial Environmental Noise Sources
- БДС ISO 1996-1/2 Acoustics. Description and Measurement of Environmental Noise.
- БДС ISO 1999:2004 Determination of occupational noise exposure and estimation of noise-induced hearing impairment.
- Ordinance No 2 of 5 March 2003 on the Procedures for Assessing the Environmental Impact of National, Regional and District Plans and Programmes for Development, and Development Plans and their Amendments, (published SG, No 24, year 2003)

- Ordinance No 7 on Hygienic Requirements for Health Protection of Populated Environment (published, SG, No 46, year 1992, as amended by SG, No 46, year 1994, amended and supplemented SG, No 89, year 1996, No. 101, year 1997)
- Ordinance on the Essential Requirements and Assessment of Conformity of Electric Equipment Designed for Use Within Specified Range of Voltage (published, SG, No 62 , year 2001)
- Ordinance on Technical Operation of Electric Power Plants and Networks (published SG, No 81, year 2000)
- Ordinance No 7 on Minimum Requirements for Health and Safety at Work and Working Clothes, SG, No 88/1999.
- Ordinance No 6 of 26 June 2006 on Indicators of Environmental Noise, Taking into Account the Degree of Discomfort in Different Parts of the Day, the limit values of indicators of environmental noise, methods for assessing the values of noise indicators and the harmful effects of noise on human health, published SG, No 58, 18 July 2006.
- Ordinance No 9 of 12 February 2010 on Maximum Permissible Levels of Vibrations in Residential Premises, published, SG, No 17, 2 March 2010.
- Ordinance No 9 of 14 March 1991 on Permissible Limit levels of Electromagnetic Fields in Populated Territories and Determination of Hygienic Protective Zone around Radiating Objects, published SG, No 36, year 1991 , Office Bulletin of National Centre of Hygiene, Medical Ecology and Nutrition, 1991, No 2.
- Health Act, SG. No 70, year 2004.
- Ordinance on Basic Requirements for Radiation Protection, SG, No73, 28.08.2004.
- Methods for Examination and Assessment of Electromagnetic Radiation in High Voltage Substations (Indoor and Outdoor Switchgear) and Kiosk Compact Substations, Collections of Methods for Hygienic Studies, National Centre of Hygiene, Medical Ecology and Nutrition, vol. IV, p. 31-39, 2002.
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- Radiofrequency Radiation Hazards, Exposure limits and their implications for broadcasters, European Broadcasting Union, Tech. 3278-E, February, 1995, Geneva.
- Council Recommendation on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz), 1999/519/EC.

9.2.9 Population

- Ambient Air Purity Act (published SG, No 45, 28.05.1996, last amendment SG, No 6/2009)
- Water Act (published SG, No 67, 27.07.1999, last amendment.
- Soils Act
- Environmental Noise Protection Act
- Environmental Protection Act, SG, No 91, year 2002,. last amendment SG, No 47/2009/
- Health Act (published SG, No 70/04, last amendment SG, No 45 / 2011)
- Health and Safety at Work Act (published SG, No 124/97, last amendment and supplement SG, No 76, 20.09.2005)

- Ordinance No 1 on Levels of Permissible Emissions of Noxious Substances (Pollutants) Emitted in the Atmosphere by Facilities and Activities Involving Stationary Sources of Emissions (published SG, No 64, 5.08.2005)
- Ordinance No 1 on Levels of Benzene and Carbon Monoxide in Ambient Air / published SG, No 14/2004/;
- Ordinance No 2 on Permissible Emission Levels of Noxious Substances / published SG, No 51/98г/
- Ordinance No 2 of 22 March 2004 on Minimum Requirements for Health and Safety when Completing Construction and Erection Works, SG 37/2004
- Ordinance No 2 of 19.02.1998 on Permissible Emission Levels (Concentrations in Exhausted Gasses) of Noxious Substances Emitted in the Atmospheric Air from Stationary Sources (published SG, No 51/1998, last amended and supplemented, No 64/2005)
- Ordinance No 6 on Parameters of Environmental Noise (SG, No 58/2006).
- Ordinance No 12 on Limit Levels for Sulfur Dioxide, Nitrogen Dioxide, Particulate Matter, Lead, Benzene, Carbon Monoxide and Ozone in Ambient Air (published SG, No 58/2010)
- Ordinance No 14 on Levels of Permissible Limit Concentrations of Noxious Substances in the Ambient Air of Populated Settlements (published SG, No 88/1997; last amendment SG, No 14, year 2004).
- Ordinance No 13 on Protection of Personnel from Risks Related to Exposure to chemical agents at work (published SG, No 8/2004)
- Ordinance No 3 on Minimum Requirements for Health and Safety of Personnel when Using Personal Protective Equipment at Work, 19.04.2001.
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9.2.10 Waste

- Directive 2006/12/EC
- Directive 2000/532/EC
- Directive 94/62/EC
- Directive 2006/66/EC
- Directive 2002/96/EC
- Directive 2008/98/EC
- Directive 75/439/ECC
- Directive 2008/98/EC
- Waste Management Act, published SG, No 86, 30 September 2003, last amendment SG, No 33, 26 April 2011;
- Ordinance No 3 of 1 April 2004 on Waste Classification, published SG, No 44, 25 May 2004;
- Ordinance on the Launch of Electrical and Electronic Equipment in the Market, and Treatment and Transportation of Electrical and Electronic Equipment Waste, published SG, No 36, 2 May 2006, last amendment SG, No 29, 8 April 2011.
- Ordinance on Treatment and Transportation of Production and Hazardous Waste, published SG, No 29, 30 March 1999.

- Ordinance on Requirements for Treatment and Transportation of Used Oils and Waste Oil Products, published SG, No 90, 11 November 2005, last amendment SG, No 29, 8 April 2011.
- Ordinance on Packings and Packings Waste, published SG, No. 19, 9 March 2004, last amendment SG, No 29, 8 April 2011.
- Ordinance on Requirements for Launch of Batteries and Storage Batteries in the Market and Treatment and Transportation of Waste from Batteries and Storage Batteries, published SG, No 58, 15 July 2005, last amendment SG, No 29, 8 April 2011.