BALKAN MINERAL AND MINING EAD

ZIP: 2087 Chelopech Village, District OF Sofia

ENVIRONMENTAL IMPACT STATEMENT

for Investment Project
for
Mining and Processing of Auriferous Ores from the Ada Tepe Prospect of Khan Krum Gold Deposit, Krumovgrad

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Sofia
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Introduction

This Environmental Impact Statement (EIS) for the Investment Project Proposal for Mining and Processing of Auriferous Ores from the Ada Tepe Prospect of the Khan Krum Gold Deposit near Krumovgrad ("the Krumovgrad Gold Project") is prepared on the basis of Letter Ref. OBOC-1402/24.06.2010 from the Ministry of Environment and Waters (MOEW) (Appendix 1).

The EIS is compliant with the requirements under art. 96 par. 1 of the Environment Protection Act ("EPA") (SG issue 91/25.09.2002, last amendment in issue 46/2010) and art. 12 par. 1 and art. 14 par. 1 of the Regulation on the Terms and Procedures for Conducting EIAs ("the EIA Regulation") (SG issue 25/2003, last amendment in SG 29/2010).

The decision to conduct an EIA of the Krumovgrad Gold Project was taken after completion of the procedures under art. 4 of the EIA Regulation.

In accordance with the requirements under art. 95 par. 2 and 3 of the EIA, the EIS has bee scoped in compliance with the provisions of art. 10 par. 1 of the EIA Regulation. The EIS scope is compliant with the requirements under art. 10 par. 3 of the EIA Regulation. The EIS and the upgraded EIS scope considers all the directions and recommendations of the MOEW pertaining to the preparation of the EIS, which were provided in writing in Letter Ref. № OBOC-1402/06.10.2010, as well as the recommendations of the appropriate authorities, organisations and affected communities received as part of the consultation process under art. 95 par. 3 of the EPA and art. 9 par. 1 of the EIA Regulation (Appendix 2).

Dango Project Consult EOOD ("Dango") has been commissioned by Balkan Mineral and Mining EAD ("BMM") to prepare this EIS. Sofia The authors of the EIS are independent experts who meet the requirements under art. 83 par. 1 and 2 of the EPA (last amendment in SG issue 61/6.08.2010), which is certified with appropriate declarations. (Appendix 3).

The team appointed by BMM to prepare the EIS consists of:

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	Nikolova, MSc	Forestry Higher Technical Institute Landscape	VII, VIII, IX	
11.	Ivo Dinchev Cholakov, PhD	001354/1999, New Bulgarian University Cultural and Historic Heritage	IV.8, V.10, V.14, VI, VII, VIII, IX	
12.	Alexander Stefanov Spassov, MD	20268/01.03.1973 Medical Academy Kiyv, Ukraine Health assessment	V.11, V.13, VI, VII, VIII, IX	

I. General

1. Information about the Investor

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Information Background of the EIS:

1. Report on the Hydrology of the Krumovitsa River Basin in the Area of Krumovgrad, prepared by the National Institute of Meteorology and Hydrology ("NIHM) for BMM EAD, 2005;
2. Hydrogeological Report for the Impact of the Project on the Abstractions for Public Drinking Water Supply of the Settlements in the Krumovgrad Municipality, prepared by Vodokanalproject AD-Plovdiv for BMM EAD, 2005;
3. Hydrogeological Expert Investigation of Options for Fresh Water Supply to meet the Domestic and Process Requirements of the Krumovgrad Gold Project, Krumovgrad, prepared by Vodokanalproject AD-Plovdiv for BMM EAD, 2010;
4. Results from the Initial TMF Site Investigation undertaken by Jess-E EAD for BMM EAD, 2005;
5. Environmental Background Report - Krumovgrad Municipality, prepared by BSECEE for BMM EAD, 2004;
6. Environmental Impact Statement for the Krumovgrad Gold Project, prepared by BSECEE (2005);
7. Socio-Economic Analysis of Krumovgrad Municipality, prepared by Institute for Market Economy, 2010;
8. Report on the Physical and Chemical Characteristics of the Waste Rock and Tailings Deposited in the Tailings Management Facility, Miguel Diaz, Scott Wilson Mining (UK), for BMM EAD, 2005;
9. Partial Report on the Study of the Flora in the Krumovgrad Prospecting Area 2005-2007, conducted by the Forestry University – Sofia and the Bulgarian Academy of Sciences - Sofia for BMM EAD;
10. Partial Report on the Study of the Fauna in the Krumovgrad Prospecting Area 2005-2007, conducted by the Forestry University – Sofia and the Bulgarian Academy of Sciences - Sofia for BMM EAD;
11. Geological Report, prepared by BMM EAD, 2005;
12. Archaeological Heritage Report, prepared by Rodopica Foundation for BMM EAD, 2005;
13. Krumovgrad Gold Project Traffic Management Plan Krumovgrad.
14. Environmental Monitoring Program for the Ada Tepe Prospect of the Khan Krum Deposit, Krumovgrad.
15. Environmental Management Plan for the Ada Tepe Prospect of the Khan Krum Deposit, Krumovgrad, Bulgaria.
16. Mine Waste Management Plan for the Ada Tepe Prospect of the Khan Krum Deposit, Krumovgrad.
17. Information Disclosure and Stakeholder Engagement Plan of BMM EAD.

18. Results from the Initial IMWF Site Investigation undertaken by Jess-E EAD for BMM EAD, 2010;
19. Social Justification for Granting of a Mining Concession for Gold Ores from the Khan Krum Deposit, Krumovgrad.

2. Justification for the Proposed Development and Main Objectives of the Project

The Environmental Impact Statement (EIS) for the Investment Project Proposal for Mining and Processing of Auriferous Ores from the Ada Tepe Prospect of the Khan Krum Gold Deposit near Krumovgrad ("the Krumovgrad Gold Project") is required under the Environment Protection Act ("EPA") and the Regulation on the Terms and Procedures for Conducting Environment Impact Assessments ("the EIA Regulation").

According to art. 22 par. 3 of the Underground Resources Act ("URA"), promulgated in SG issue 23/12.03.1999, amended in SG SG, issue 61/6.08.2010, the Investor has prepared and provided a Mining Waste Management Plan as an integral part of the proposed development. This plan is prepared under the terms of the Regulation on the Specific Requirements to Mining Waste Management, SG issue 10/06.02.2009, and the Underground Resources Act ("URA").

The EIS also incorporates the Assessment of the Compatibility of the Proposed Development with the Scope and Objectives of Protection Set for Rhodopes-East Protected Site, which is required under the Regulation on the Terms and Procedures for Assessment of the Compatibility of Plans, Programs, Projects and Investment Proposals with the Scope and Objectives of Protected Sites. (Promulgated in SG issue 73/11.09.2007, amendments in SG issue 81/15.04.2010).

The EIS conforms to Bulgaria’s current primary and secondary environmental legislation.

The preparation of the EIS has been assigned to independent EIA experts on the grounds of:

- A contract between BMM EAD, Chelopech Village, District of Sofia, and Dango Project Consult EOOD, Sofia;
- The updated EIS Scoping Study with the results from all consultations incorporated.

The EIA of the Krumovgrad Gold Project aims to define, describe and assess the direct and indirect impacts on the human health and the environmental media including biodiversity and its elements, soil, water, air, climate, landscape, subsurface environment, natural sites, diversity of minerals, and their interactions.

This EIS considers construction, operation and closure stages of the Project. It also considers alternative options with regard to project technology and location as well as the “zero” option, i.e. that the project does not proceed. Recommendations have been made to reduce the impact and to resolve possible environmental issues arising from the implementation of the Project and its closure thus ensuring protection of human health and the environment and providing sustainable municipal development.

3. Location of the Krumovgrad Gold Project - Physical Characterisation. Affected Elements of the National Environmental Network

In terms of Bulgaria's physiographic (geomorphic) division, the project site located within the East Rhodopean sub-region, which is part of the East Rhodopean-Strandzha region. The Krumovgrad District is characterised by a moderate hilly to low-mountainous topography. It is crisscrosseui805(i)-2.1655837(P)5.67535(r)2.805(o)-0.294.235994940.1702(t)-2d72 -0.295585(2.16558

The main site required for the implementation of the Project is located some 3 km south of the town of Krumovgrad in the Municipality of Krumovgrad, which is part of the District of Kardzhali. (Figure I.1-1).

The entire municipality lies within the Eastern Rhodope Mountains. The topography is classified as hilly or low-mountainous.

The Krumovgrad Municipality borders on the Ivailovgrad and Madzharovo Municipalities to the east, the Kirkovo and Momchilgrad Municipalities to the west, the Kardzhali and Stambolovo Municipalities to the north and the Republic of Greece to the south. The total area of the municipality is 843.320 sq. km.

The municipal centre, Krumovgrad, is 360 km from Bulgaria's capital city of Sofia and 48 km from the city of Kardzhali, which is the administrative centre of the district. The closest border check-point is Kapitan Andreevo (to Turkey), which is 130 km north-east of the town. This year has opened a new border checkpoint Slaveevo-Kyprinos near Ivaylovgrad. The nearest railway line is 32 km west of the site in the town of Momchilgrad. Krumovitsa River past the town to drain into the Arda River between the Studen Kladenets and Ivailovgrad water reservoirs.

Some 48.8% of the entire area of the municipality is occupied by forests, 47.8% – by agricultural lands, 2.2% – by towns, villages and hamlets, and 1.2% – by surface water bodies, transport and other infrastructure.

Figure I.1.1. - Krumovgrad Municipality

The sites providing statutory environmental protection in the Krumovgrad municipality are: Vulchi Dol (reservation), Dzhelovo (protected site), Oreshari (protected site), Momina Skala (protected site), Ribino (protected site), Vodopada (natural landmark), Peshteri (natural landmark). Al of these are at distances of over 5 km from the project area. The Dayma sage tea habitat (a natural landmark) is located in the southwest some 3 km away from the open pit.

The entire project area lies within the footprint of Natura 2000 protected site known as **BG 0001032 Rhodopes East** under Council Directive 92/43 on the Conservation of Natural Habitats of Wild Fauna and Flora.

BG 0002012 Krumovitsa, which is a protected site under Council Directive 79/409/EEC on the Conservation of Wild Birds, is in close proximity to the project area. Both protected sites were established with Government Decree 122/02.03.2007.

4. Relation to Other Existing and DDP Approved Activities

BMM EAD has undertaken exploration activities on an area of 130 km^2 known as the Krumovgrad License, whose area has since been gradually reduced, pursuant to License No. 1 dated 09.05.2000 of the Ministry of Economy (ME) and the related Agreement for Prospecting for Metals dated 12.06.2000, and Additional Agreements to it - No 1 dated 11.06.2003, No 2 dated 15.03.2005, No 3 dated 01.06.2005 and No 4 dated 04.07.2007.

Based on the completed exploration work, in 2001 BMM EAD was issued with a Certificate for Geological Discovery No. 0001/25.04.2001 – a low-sulphide epithermal auriferous deposit known as Khan Krum. Based on the registered geological discovery, the Company obtained permission for additional detailed exploration of the Ada Tepe mineralization and completion of the definition work on the adjacent prospects of Surnak, Skalak, Sinap, Kuklitsa and Kupel under additional agreements pursuant to the URA.

The exploration results from the period 2000-2004 were compiled in a Report for the Completed Geological Work for Exploration and Evaluation of the Auriferous Resources of the Khan Krum Deposit Including the Sites of Ada Tepe, Surnak, Skalak, Sinap, Kuklitsa and Kupel in the Krumovgrad Licence, Kardzhali District, Bulgaria, as of 01.09.2004. The gold ore resource/reserve statement has been approved by the MOEW's Reserves Expert Panel at its meeting on 21.04.2005 and the Panel signed Protocol НБ-17/21.04.2005 accepting and approving a commercial discovery provisionally named as Khan Krum within the Krumovgrad License. Consequently, BMM EAD was issued with Certificate 0417/28.08.2009 acknowledging the commercial discovery of a deposit under the terms of the URA. The Certificate enables BMM to apply for direct awarding of a gold mining concession within the footprint of the approved commercial discovery in accordance with the provisions of art. 29 of the URA.

The investment project proposal under consideration in this EIS is the first stage of the concession activities that comprise mining and processing of gold ore from Ada Tepe prospect, Khan Krum deposit.

5. Affected Public and Responsible Authorities

The footprint of the proposed mine project lies entirely in the Krumovgrad Municipality, District of Kardzhali.

The public and other entities that are likely to be affected by the project proposal of BMM are:

- The communities of Krumovgrad and the neighbouring villages;
- The Ministry of Economy, Energy and Tourism;
- The Ministry of Agriculture and Foods;
- The Ministry of Healthcare;
- The Ministry of Culture;
- The Krumovgrad Forestry Department;
- The Kardzhali District;
- The East-Aegean Catchment Directorate - Plovdiv;
- The Regional Public Health Inspection - Kardzhali;
- Water Supply and Sewage EOOD - Kardzhali, Krumovgrad Division;
- The Green Balkans Federation of Environmental Organisations

- The Bulgarian Ornithological Centre at the Bulgarian Academy of Sciences;
- The Bulgarian Society for Protection of Birds (BSPB);
- The Environmental Association for the Earth;
- The Life for Krumovgrad Association;
- The Sofia Environmental Information and Training Centre;
- The Balkans Wildlife Association;
- Bankwatch;
- The National Institute for Protection of Immovable Cultural Assets;
- The Kardzhali Regional Historical Museum;
- EVN Power Distribution EAD, Kardzhali;
- The Regional Police Directorate - Kardzhali;
- The Civil Defense Service - Kardzhali;
- The Regional Fire Department - Kardzhali.

6. Project Permitting Requirements

The implementation of the investment project proposal of the Company requires the issuance of the following permits under the Waters Act:

- Permit for use of fresh water from a surface water body (the Krumovitsa River). This will be a one-off permit that will be used to supply fresh water to the ore processing plant and equipment only for the commissioning of the process. This permit is issued by the Director of the Basin Directorate.
- A permit for use of groundwater - an abstraction well located near the Krumovitsa River or Kessibirdere to supply process make-up and/or drinking/household water via newly constructed pipelines. This permit is issued by the Director of the Basin Directorate.
- A permit for discharge wastewater in a surface water site. The domestic effluent will be treated in a proprietary wastewater treatment plant to meet the water quality requirements to enable discharge in the Krumovitsa. This permit is issued by the Director of the Basin Directorate.

The project will generate hazardous, construction, process and domestic wastes, which requires issuance of a waste handling permit under art. 37 of the Waste Management Act.

Appropriate permits are required to carry out blasting operations, such as a blasting permit issued by the Labour Inspection Directorate; a permit to use explosives and blasting consumables.

7. Connections to the Local Technical Infrastructure. Transport Routes for Delivery of Raw and Ancillary Materials and Shipment of the End Product.

The total length of the municipal road network is 360.6 km including 264.6 km of roads with asphalt concrete surface. The second class road network totals some 27 km and the third class road network - some 75 km. The total length of the municipal roads is 261 km. The road network density in the municipality is 43 km per 100 sq. km., which is higher than the country's average (33 km per 100 sq. km.). The main arterial roads are Route III-509 Hramanli - Dolno Cherkovishte - Dolna Kula - Krumovgrad - Tokachka - Makaza and Route II-59 Momchilgrad - Krumovgrad - Ivaylovgrad, which connect the municipal centre Krumovgrad to the neighbouring municipalities, the district centre and the national road network. They are very important for the socio-economic development of the municipality as a link to Pan-European Transport Corridor 9 and encourage active economic development making the municipality more attractive for the business. A new border checkpoint Slaveevo-Kyprinos has opened near Ivaylovgrad. The importance of these routes will also increase after the opening of the Makaza border crossing point and the start of the actual operation of Corridor 9.

The site supply with materials and consumables will utilise the existing road network. The project implementation will require widening and extension of the existing forest road, which will provide the main access to the future open pit and process plant. Secondary Road II-59 (Momchilgrad-Krumovgrad-Ivaylovgrad) will be used for concentrate shipments for downstream processing. The shipment destination will very much depend on purely economic factors. If an agreement is made with a Bulgarian smelter, the concentrate may be shipped to the smelter using only one type of transport. The concentrate could be transported by rail if it is economically feasible and the nearest place where the concentrate could be transferred is the Momchilgrad railway station located at some 35 km away from the site. Other options for concentrate transportation but now outside the Republic of Bulgaria are the Black Sea ports or Danube River ports.

The transport services during project construction and the shipments of raw materials and end products will comply with the Access Road Map and Letter ref. 378/28.06.2010 by the Kardzhali District Road Service (Appendix 4).

II. Description of the Investment Project Proposal

1. Project Overview

The project proposal considers mining and processing of gold ores from the Ada Tepe prospect in the Khan Krum Deposit, Krumovgrad Municipality, District of Kardzhali.

The main activities considered herein are:

- Open pit mining of auriferous ores;
- Construction of a process plant for processing of the ore to gold/silver concentrate;
- Construction of a mine waste storage facility/facilities;
- Construction of project infrastructure - roads, water and power supply services, materials storage facilities, etc.

The Khan Krum deposit includes several prospects: Ada Tepe, Kuklitsa, Kupel, Sinap, Surnak and Skalak.

The Ada Tepe prospect, which is under consideration, is located approximately 3 km southwest of the town of Krumovgrad and 1 km west of the Krumovitsa River. The Kupel prospect is located 0.5 km south-east of Kupel Village and approximately 1 km south-west of the Buyukdere River, which discharges into the Krumovitsa River. The Sinap prospect is located approximately 0.2 to 0.3 km south of Sinap Village and approximately 0.1 km north of the Kessebir River. the Krumovitsa River. The Kuklitsa prospect is located between the villages of Shturbina, Kokoshar and Lopatar and approximately 1 to 1.2 km south of the Krumovitsa River. The Skalak prospect is located immediately west, approximately 0.2 km, of Skalak Village. The Surnak prospect is located between the villages of Chesun, Belina and Piperitsa.

BMM EAD has carried out extensive and detailed exploration works to identify gold-silver mineralisation of a style and geometry which is amenable to open pit mining. The most intensive resource definition work has been performed on the Ada Tepe portion of the Khan Krum Deposit; therefore, the project proposal considers only this prospect. Should economic resource determinations be made for other prospects that make up the Khan Krum Deposit, these prospects will be subject to and independent EIA and assessment of their compatibility with the the scope of protection of the East Rhodopes Protected Site.

2. Areas Required over Project Construction, Operation and Closure

Appendix 5 (General Site Plan) presents the open pit, the alternative siting options for the ore processing plant, the mine waste storage facilities, project water sources, topsoil stockpiles and associated project infrastructure.

Total project footprint area by alternative options:

Option 1 - about 85 hectares (ha) including:

- An open pit mine (Ada Tepe) – 17 ha;
- A ROM ore pad – 3 ha;
- A facility for the production of gold-silver concentrate (Process Plant) – 6 ha;
- An Integrated Mining Waste Facility including a low-grade ore stockpile – 41 ha;
- A soil and sub-soil material stockpile – 2 ha;
- A retention pond (close to the open pit) and two collecting sumps (at the toe of the Integrated Mine Waste Facility) – 4 ha;
- Roads – 12 ha;
- An abstraction well.

The entire area required for the implementation of the proposed development is state controlled forest fund land. This area is included in the future concession.

Option 2 - about 136 hectares (ha) including:

- An open pit mine (Ada Tepe) – 17 ha;
- A ROM ore pad – 3 ha;
- A process plant for production of dore gold alloy – 2 ha;
- A flotation TMF – 45 ha;
- A waste rock stockpile - 44 ha;
- A soil and sub-soil material stockpile – 2 ha;
- A retention pond and collecting sumps – 1 ha;
- Roads – 15 ha;
- A fresh water storage facility – 7 ha.

The area required for the implementation of the proposed development includes state controlled forest fund land, municipal and private properties. This area is included in the future concession.

No additional land will be required during the construction stage.

The closure and rehabilitation stage will extend to all disturbed lands.

3. Project Implementation Stages

The project design will be based on solutions that minimise negative environmental impacts from emissions of dust and gas, waste water, solid waste, noise and vibrations on the environmental media, and also ensure rational use of land.

3.1. Construction

Construction and engineering works are scheduled to commence in the beginning of 2012 and be completed within 24 months, i.e. by the end of 2013, with approximately 200 to 300 positions being created at various stages over this phase. The construction sequence is planned as follows:

- Construction of the infrastructure (access road from the existing road network, electrical supply and telecommunications) and its integration into the existing infrastructure in the area;
- Clearing of the grass and tree vegetation from the sites designated to accommodate the open-pit, the site roads, the mine waste facility, the ore processing plant;
- Removal and stockpiling of the soil cover for reuse during the closure stage;
- Construction of temporary office and storage facilities for the construction stage;
- Preliminary removal of overburden (containing no economic levels of gold) from Ada Tepe sufficient to provide construction material for the base of the IMWF and to enable commencement of the mining operations;
- Construction of the processing plant, offices, a mechanical workshop and other ancillary buildings;
- Installation of an abstraction well to meet process fresh water requirements;
- Preparation of the ROM ore pad area.

The construction stage will also include construction of site roads to ensure reliable all-weather access for heavy-duty off-road trucks, as follows:

- Roads between the open pit and the ROM ore pad, the gold-silver concentrate production facility (process plant) and the waste rock storage facility (an integrated mine waste facility ("IMWF") or a waste rock stockpile), including connections to the IMWF or the flotation TMF depending on the preferred option;

- Roads connecting the facilities on the process plant site.

The materials that will be used over the construction phase are fuel for motor vehicles and other equipment, pipelines, pumps, construction materials, construction steel, steel sheets, etc.

3.2. Operation

The Ada Tepe mine plan currently being considered is based on an 850,000 tpa operation extending over a 9 year period (excluding the overburden removal), which gives a process plant throughput rate of 106 tph at 8,000 operating hours per annum.

The operational life including production infrastructure, process flowsheets, raw materials and waste products are considered in detail further in this document.

Figure II.3-1 shows the pit contours (its stages of development after the first and second years). It also shows the access road to the orebody (leaving the pit to the southwest).

The depth of the pit on completion of operations will vary according to the location.

- The north end pit bottom is at RL 340 m, which gives final pit depths of 120 m to the east, 100 m to the north, and 40 m to the west. The relatively low pit walls to the west and southwest promote the pit ventilation, which is confirmed by the Krumovgrad windrose pattern.
- The south end haul road exits to the west at RL 380 m, with the southern part of the pit being above the road at RL 400 m. The depths from this point will be 50 meters to the east, 20 meters to the south, and 0 meters (open) to the west. Due to the open end to the west, this portion of the pit will enjoy more favorable ventilation conditions than the northern end.

It is expected that approximately 230 permanent jobs will be maintained during the operation stage. The mine will operate on a continuous (three-shift) basis 330 workdays, or 8,000 work hours, in the year.

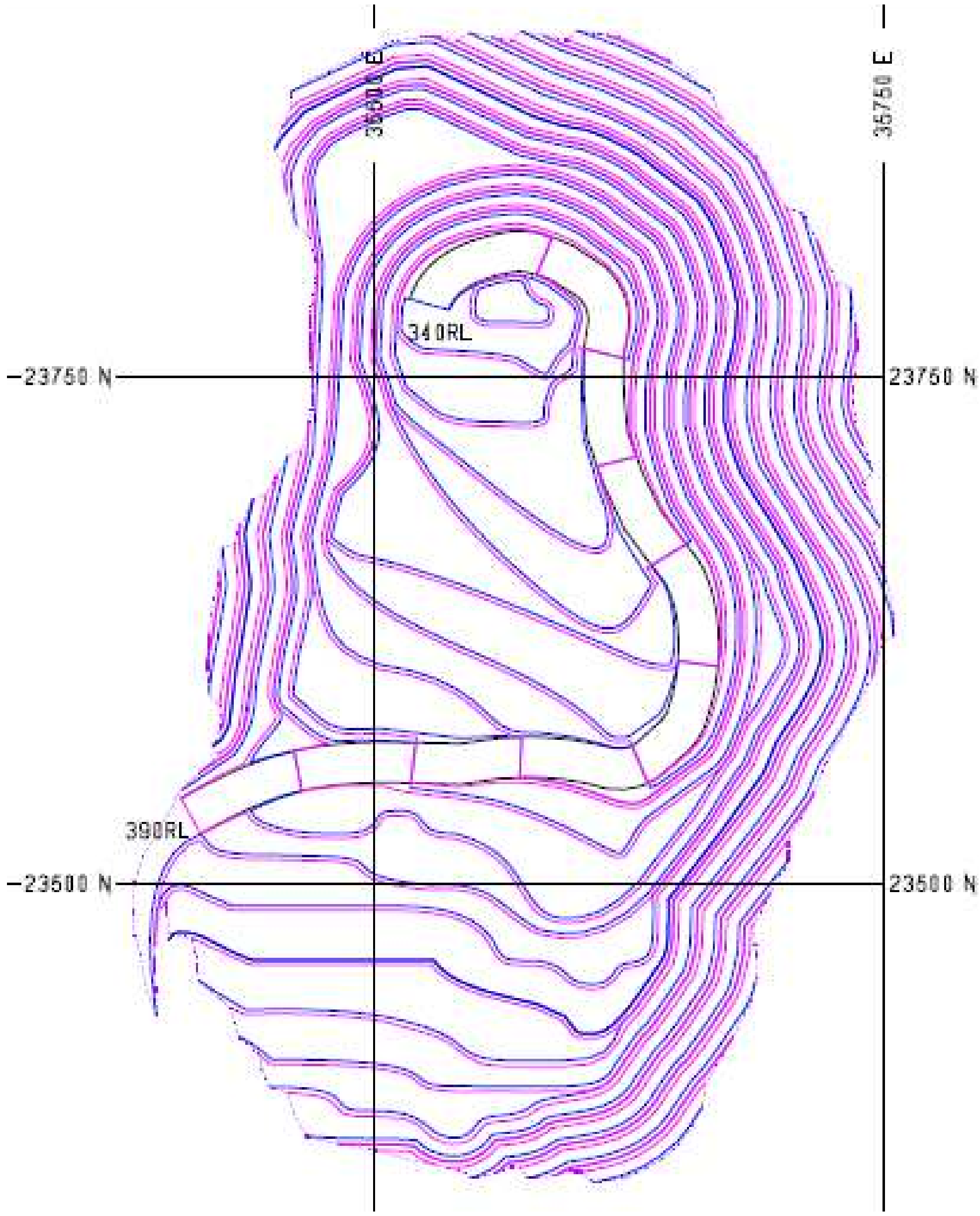


Figure II.3-1 – Ada Tepe Open Pit Development

3.3. Decommissioning and Closure. Rehabilitation

The decommissioning and rehabilitation of the mine operation can be successfully achieved in a manner that satisfies the following objectives:

- Establishment of a beneficial afteruse;
- Protection of public health and safety;
- Mitigation or elimination of environmental damages and provision of sustainable environmental development;
- Minimisation of any adverse social and economic impact.

The long-term objective of the closure strategy is that BMM EAD leaves the site in a condition that meets the following criteria:

- Physical stability – any remaining structures must not be an unacceptable hazard to public health or safety, or to the immediate environment;
- Chemical stability – any remaining materials must not be a hazard to future users of the site, or to the public health, or to the immediate environment; and

- Biological stability that enables establishment of an appropriate land-use that is harmonised with the adjacent areas and with the needs and desires of the community.

A plan for closure of the open pit, the ore processing plant, the IMWF, the ancillary facilities and unnecessary infrastructure will be prepared by BMM EAD together with the construction and operation designs. In order to assess the requirements of stakeholders (principally, the local community), it is envisaged that consultation will be carried out with appropriate community representatives prior to the development of the Closure Plan.

The physical characteristics of the site that influence the selection of an after-use are the final landforms that can be achieved and the quality and quantity of soils (or soil making material) available into which any vegetation cover would be established. Within any particular site these factors may vary, e.g. steep slopes preclude most productive after use whilst more gentle slopes impose no such restriction.

Soils are often a limitation in the closure of such sites. This lack of soils may require the use of soil making materials other than topsoils. The quality of the available materials will therefore have a major influence on the potential use and will limit the types of vegetation that can be established and sustained without excessive maintenance.

The closure stage is expected to require approximately 50 permanent job positions.

a) Open pit

It is proposed that the following should be adopted for the closure of the open pit:

- The final pit walls and slope gradients should ensure safety and stability;
- Technical and biological rehabilitation of the open pit site;
- Continuous monitoring of the quality of surface and groundwater flows to assist in the design of mitigation measures;
- Environmentally sound use ensured by means of all necessary engineering and drainage facilities, and suitable vegetation.

Different options for the open pit closure and its incorporation into the surrounding environment will be considered and discussed during the project operation, consistent with the requirements and wishes of the local community and the scope and objectives of protection set for the East Rhodopes Protected Area.

b) Ore processing plant and infrastructure

Surface installations and foundations will be deconstructed and removed from the site. The surface of the process plant area will be reshaped and revegetated as appropriate to the surroundings and to the proposed end use of the site at that time. Alternatively, buildings, roads and other infrastructure may be retained as required for any further end-use.

c) IMWF (Mining waste disposal method, option 1)

The proposed mining waste disposal method (Option 1) will allow progressive rehabilitation of the facility over the operation stage.

The mine rock mostly comprises quarz and clay minerals, with only insignificant levels of sulphide minerals, which classifies it as non-acid generating. The acid base accounting and net acid generating tests conducted on the ore processing tailings characterise this material as non-acid generating, too.

The outer slopes of the facility will be rehabilitated immediately after their construction. This rehabilitation will allow planting of a vegetation cover that will minimise dust emissions, erosion and visual impacts.

The final closure of the open pit, process plant and associated infrastructure will be carried out over a period of 5 years after shut-down of operations.

The aftercare given to the rehabilitated site will extend over the entire period scheduled in the Mine Closure Plan.

A low-grade ore stockpile with an estimated capacity of 400,400 m^3 will be set up in the upper portion of the Integrated Mine Waste Facility. This ore will be put through the process plant on cessation of mining. Should this ore prove to be uneconomic to process, the stockpile will be decommissioned and rehabilitated as part of the overall IMWF closure design.

d) Mine rock stockpiling and tailings deposition in a TMF (Mining waste disposal method, option 2)

♦ Mine rock stockpile

The mine rock stockpile on Adá Tepe will be rehabilitated in accordance with the type of end use agreed upon shut-down of operations. The soil stripped before the commissioning of the stockpile will be re-placed on the stockpile surface. The stockpile outer surfaces will be prepared for planting of self-sustaining vegetation.

The mine rock stockpile closure design will allow planting of a vegetation cover that will minimise dust emissions, erosion and negative visual impacts.

♦ TMF

On completion of the ore processing, the TMF zone will comprise a rockfill embankment (approximately 40 m in height) containing some 7.5 million tonnes of ore processing tailings. Provisions will be made to allow dry closure of the facility, which will facilitate quick stabilisation of the tailings surface to minimise the potential for wind and water erosion, in line with the objectives of ensuring long-term stability and an appropriate end-use requiring minimal maintenance.

The accepted best closure practice in mining and tailings disposal is to collect data and information consistently throughout the deposition period to ensure that an appropriate closure strategy is adopted. This information will include confirmation of tailings chemical properties, as well as appropriate vegetation types, hydrological and meteorological condition, etc. The data will be incorporated into the closure planning documents. The closure and rehabilitation plan will be prepared at the start of the operations and will be updated on a regular basis during project operation.

Upon cessation of tailings disposal, the tailings management facility will be drained and its surface re-profiled (consistent with the requirements), and will be capped with an insulating layer and then soil using the previously stockpiled soil materials.

The surface cover system will be established upon decommissioning and closure of the TMF. The materials required for the cover system would be taken from the waste rock stockpile and from the topsoil stockpiles established during start-up of the construction work and during processing operations.

The TMF surface cover system should be designed to fulfill three main functions:

- ensure adequate environment for vegetation;
- provide a protective/drainage layer between the tailings and the root zone; and
- limit seepage into the tailings to an acceptable level.

All service roads not required for the tailings pond will be ploughed up and cultivated during the closing work to promote vegetation. A long-term monitoring program will be required after the site is capped and a permanent vegetation cover is established.

In conclusion, the closure and rehabilitation of the mine under both options including the open pit, the ROM ore pad, the ore processing plant, the infrastructure, the IMWF or the rock stockpile and the TMF will be carried out over a period of 5 years after shut-down of operations. The project considers an aftercare period of 20 years or another agreed period according to the final closure plan approved by the competent Bulgarian authority.

4. Production Process. Main Process Stages

The process has the following main stages:

- Ore mining;
- Ore crushing and grinding, flotation;
- Mine waste disposal.

4.1. Mining

The ore at Ada Tepe will be open-pit mined. The mining method will be a conventional open cut drill, blast, load and haul operation. The mined ore will be loaded by two hydraulic back-pull shovels serving up to five 50t off-road dump trucks hauling the ore to the ore stockpile (ROM pad). A front-end loader will deliver ore from the ROM pad to the feed hopper of the jaw crusher and will be used for general clean-up around the plant area. Additional mining equipment will include drill rigs, a bulldozer, a grader, water tank trucks, and auxiliary vehicles and light trucks.

*Mine Mobile Equipment List**

Type	Make/ Manufacturer	Model	Numbers
Drill rig	Sandvik	1100	2
Excavator	Komatsu	1250-7	2
Dump truck	Komatsu	HD465-7	5
Dozer	Komatsu	D155AX	2
Grader	Caterpillar	12H	1
Water tanker truck	KamAz	43118	3
IT utility vehicle	Komatsu	WA250PT-5	1
Total			**15**

*The above makes and models are indicative and will be further specified in the Working Project.

ANFO type explosives will be used (e.g. Dynolite™, a mixture of ammonium nitrate and 6% of diesel by weight) for the mining of the oxidized ore in the Upper Zone and waterproof emulsion for the mining of the ore in the Wall Zone (e.g. Fortis™ Advantage 80). The above materials are indicative and will be further specified in the Working Project. It is possible to select other explosives of the same class, which would not change the blasting process or environmental impact.

An explosives manufacturer will supply the blasting materials. Explosives will be safely delivered from the explosives manufacturing plant to the minesite by a designated MMU vehicle (mobile manufacturing unit). This vehicle will deliver the products to the pit blast area, where they will be mixed to form explosives and immediately poured into the blast holes.

All rock material without economic gold and silver values and therefore classified as waste will be hauled to a newly designed Integrated Mine Waste Facility (IMWF) located approximately 200 m south-southeast of the open pit (Option 1). The IMWF is designed to store both dewatered process tailings and waste rock from mining.

According to Option 2, the mine rock material will be hauled to a waste dump area located approximately 200 m south-southeast of the open pit.

Sprinklers and water trucks will be used to control and reduce dust emissions from the mining activities in the open pit mine and haulage on the roads between the mine and the ROM pad and stockpiles. A wet drilling system, i.e. the reverse circulation (RC) drilling method, will be used, where the drill rigs are equipped with dust collection and suppression systems (two dry filters for larger dust particles and a water mist system to suppress the dust particles smaller than 10µm). Protective vegetation belts will be established and maintained on both sides of the roads and decommissioned roads will be rehabilitated.

The parameters of the forecast side impacts on the environment are defined under the following mining and technical conditions: rock mostly consisting of breccia conglomerates with occasional boulders of metamorphic rocks - amphibolites, gneiss and schists. The rocks in the deposit can be classified in three categories based on the technical parameter estimates: completely weathered, partially weathered or fresh. The energy absorption capacity of these rock types expressed by the estimated relative consumption of explosive is $q=0.2$ kg/m^3, $q=0.5$ kg/m^3 and $q=0.65$ kg/m^3 respectively.

Under the specific mining-technical conditions, the technological parameters of drilling and blasting are:

- Blasthole diameter – d=76/89 mm;
- Bench height – H=5 m;
- Length of blast long holes for the three types of rock – H=5.5 m, H=5.3 m and H=5.3 m respectively.

To ensure maximum possible level of safety, all the buildings in the nearby centres of population are assumed to be "historic structures" in the blasting impact assessment. Based on the Map of Geological Hazards of Bulgaria, Krumovgrad is located within an area defined as a degree VII shakeability area on the MSK scale for a 1,000 year return period. The Bulgarian code for designing structures in seismic regions defines the seismic design coefficient for this area as 0.1 g.

The impacts on the environment that should be controlled as part of the blasting management are:

- Blast vibration impact;
- Airblast impact;
- Backthrow of blasted rock within the pit and flyrock distance;
- Generation of gases from the detonation of explosives.

The estimated minimum safe distance for humans against flyrock under art. 11 (Appendix 7 to art.141) of the Blasting Safety Code (1997) is as follows:

- R=157m for completely weathered rock;
- R=269m for partially weathered rock;
- R=272m for fresh rock.

According to the provisions of art.143 of the Blasting Safety Code (1997), the minimum safe distance for humans is R=300m from the blasted area (for hole diameters less than 110mm). Therefore, R=300m has been accepted as the safe distance for humans. If necessary, the blast vibration parameters of the blasting designs will be updated at the detailed designing stage.

The diesel fuel for the mobile equipment serving the open pit (heavy trucks, hydraulic excavators, etc.) will be stored in two 50m^3 tanks, which will be installed between the tailings thickener and the maintenance workshop, where the lubricants for the mining fleet will be stored.

4.2. Ore Processing

A simplified production process flowchart is presented in Figure II.4-1.

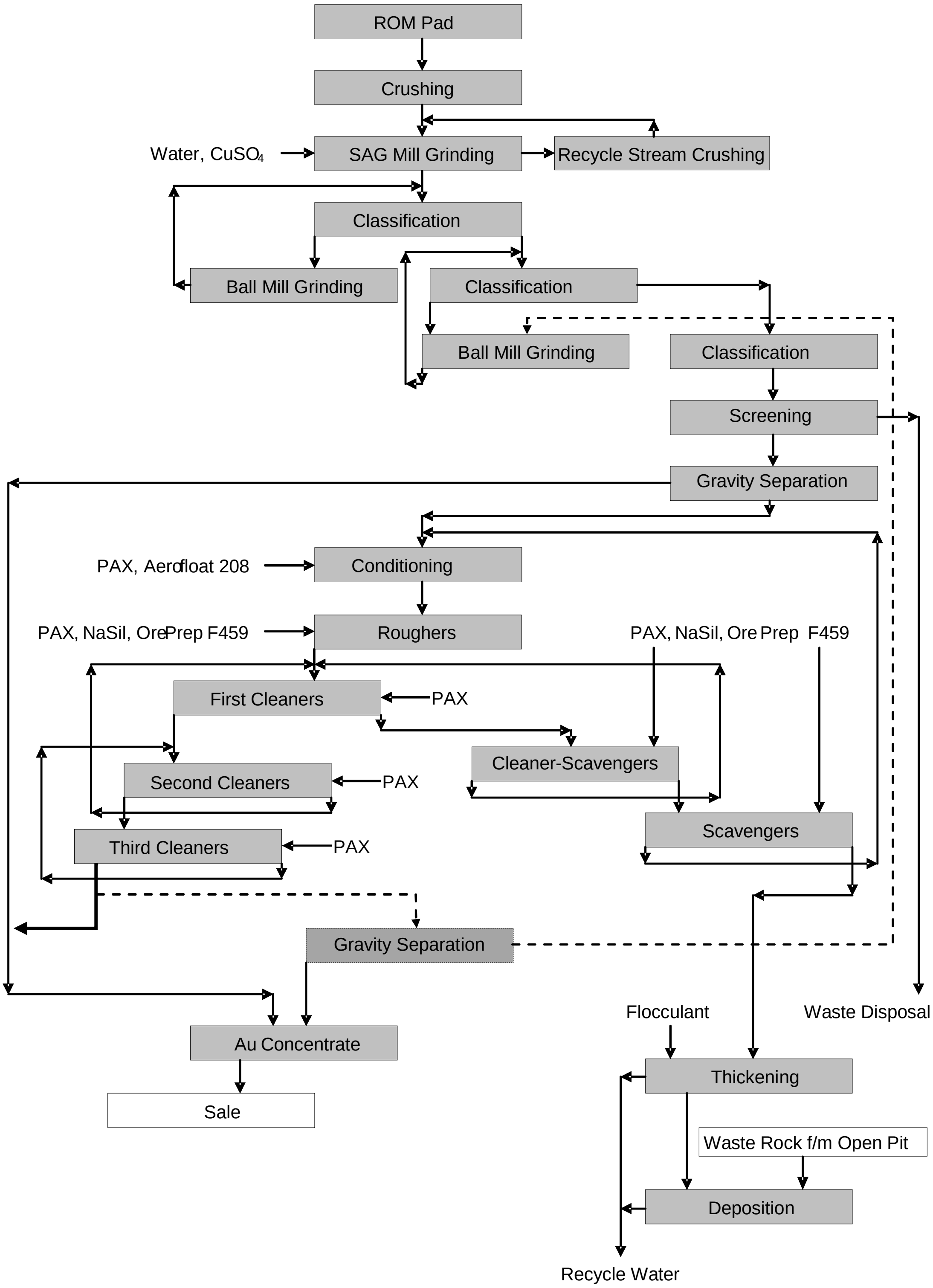


Figure II.4-1. Process Flowchart – Flotation Processing of Ada Tepe Ore

Crushing

A front-end loader will deliver ore from the ore stock pile (ROM pad) to the feed hopper of an outdoor jaw crusher, whose production capacity will be 200-250 tph, discharge end diameter approx. 150mm, which will ensure crushed ore size suitable for SAG Mill grinding. A dust collection system is planned to be installed to ensure dust collection at the ore transfer points and treatment by a bag filter.

The crusher product will be discharged onto a fully enclosed inclined belt conveyor leading to the grinding section. The conveyor will be equipped with sprinklers to minimise the potential for release of dust into the environment.

This circuit will also have a crusher handling the pebbles recycled from the semi-autogenous grinding mill in the grinding section. The pebble crusher product will discharge onto the mill feed conveyor belt.

The downstream process is wet and will not generate dust emissions.

Grinding

The grinding section of the plant will be located inside the main plant building, which will be shared with other plant sections as well as the workshops and other facilities.

The crushed product will be ground using a three-stage wet grinding circuit (no dust emissions are expected) with a primary SAG mill and regrinding in a secondary ball mill and a tertiary vertical stirred mill. The SAG mill pebbles, i.e. the oversize product from the mill trommel, will be discharged onto a rubber-belt conveyor leading back to a pebble cone crusher. The pebble crusher product will discharge onto the mill feed conveyor belt. The project grinding flowsheet includes a grate discharge, steel-lined primary SAG mill. Both the secondary and tertiary grinding stages will incorporate primary and secondary classification in hydrocyclone clusters. A relatively fine grind is required to achieve satisfactory level of exposure, which dictates the selection of this grinding circuit configuration. The grinding circuit product will typically be P_{80} of 40 microns. The grinding circuit will also include a screening section for removal of any trash, mostly wooden and plastic waste, from the ore feed, which would otherwise report to the hydrocyclone overflow stream feeding the flotation section and cause problems in the operation of the flotation banks and thickeners.

After the screening section, the ore feed will be advanced to a gravity separation circuit for recovery of part of the free and exposed gold particles.

The grinding section will be located inside the Process Plant.

Flotation

Flotation will be the main process for recovery of the gold and silver values from the ore. The process will be performed in flotation banks, where the recovery of the payable components from the waste rock is achieved by conditioning the surfaces of mineral grains based on the different surface chemistry of the gold and rock particles. Air is introduced to the bottom of the banks and dispersed by an impeller driven by an electric motor. The air bubbles rise to the surface of the flotation cell colliding with the pulp particles. The hydrophobic particles attach to the rising air bubbles to form froth on the surface, which overflows the flotation cell and advances to the next stage.

A direct selective flotation flowsheet consisting of one rougher stage, three cleaner stages and two scavenger stages is considered. The nature of the floated material requires extended conditioning of the surfaces prior to discharge into to the flotation banks, which is achieved by:

- addition of copper sulphate (a surface sulphidising reagent) into the SAG grinding stage;
- advancing of collector reagents to an agitator for conditioning prior to flotation.

The bulk of the flotation reagents will continuously be metered into the process throughout the circuit.

The following reagents will be used in the flotation process:

- Collector: PAX (potassium amyl xanthate) and a minimum amount of dithiophosphate (Aerofloat 208);
- Frother: Cytec OrePrep F 549;
- Dispersant: Sodium silicate (Na2OxnSiO2, also known as water glass or liquid glass);

- Sulphidiser: Copper sulphate ($CuSO_4 x 5H_2O$).

The Au and Ag recoveries are expected to be circa 85% and 70% respectively.

Gravity Separation

The process involves selective separation of the lighter from the heavier products in the process based on their different densities. It is performed on separation tables using water, which washes the light particles while the heavy ones become attached to the table surface and are advanced to one of its ends by forward/backward motion of the deck. Centrifugal machines are also utilised in gravity separation to enhance the gravitational force experienced by feed particles thus enabling separation of materials within narrow size ranges. The Project Proposal considers the use of centrifugal machines for gravity separation due to the relatively small size of the gold particles in the Ada Tepe ore.

The gravity separation circuit will be located within the grinding area. The coarser gold particles contained in the ore feed will be separated in the centrifugal machines. The recovered gravity concentrate will be combined with the final flotation concentrate to form the final product of ore processing. The discarded slurry from the gravity separation circuit will form the feed to the flotation circuit.

It is possible to include a second gravity separation stage downstream of the flotation circuit to improve final concentrate gold grades if this becomes a requirement from marketing point of view. This stage is edged out in dotted line on the process flowchart. The waste from the gravity separation process will be an interim product, which will be fed back to the regrinding ball mill to further expose the gold particles.

Dewatering

The final tailings will be thickened in a radial thickener to a final pulp density of 56% solids. A diluted flocculant solution will be added to the slurry to facilitate the settling of solids. It is possible to add cement to improve waste consolidation before the waste is fed to the cells of the mining waste facility. The thickener overflow (supernatant water) will be pumped back into the process via a retention pond. The thickener underflow will be pumped into a tailings delivery pipeline for deposition into the IMWF.

The final concentrate will be dewatered and packaged for shipment to a custom smelter.

4.3. Ancillary Plants and Facilities

The process flow-charts for the individual ancillary facilities are presented in Figure **II.4-2**. The reagent preparation facilities will be located within an annex to the main process building. The containers of reagent will be moved from the delivery point into this annex with an overhead crane and a telescopic forklift.

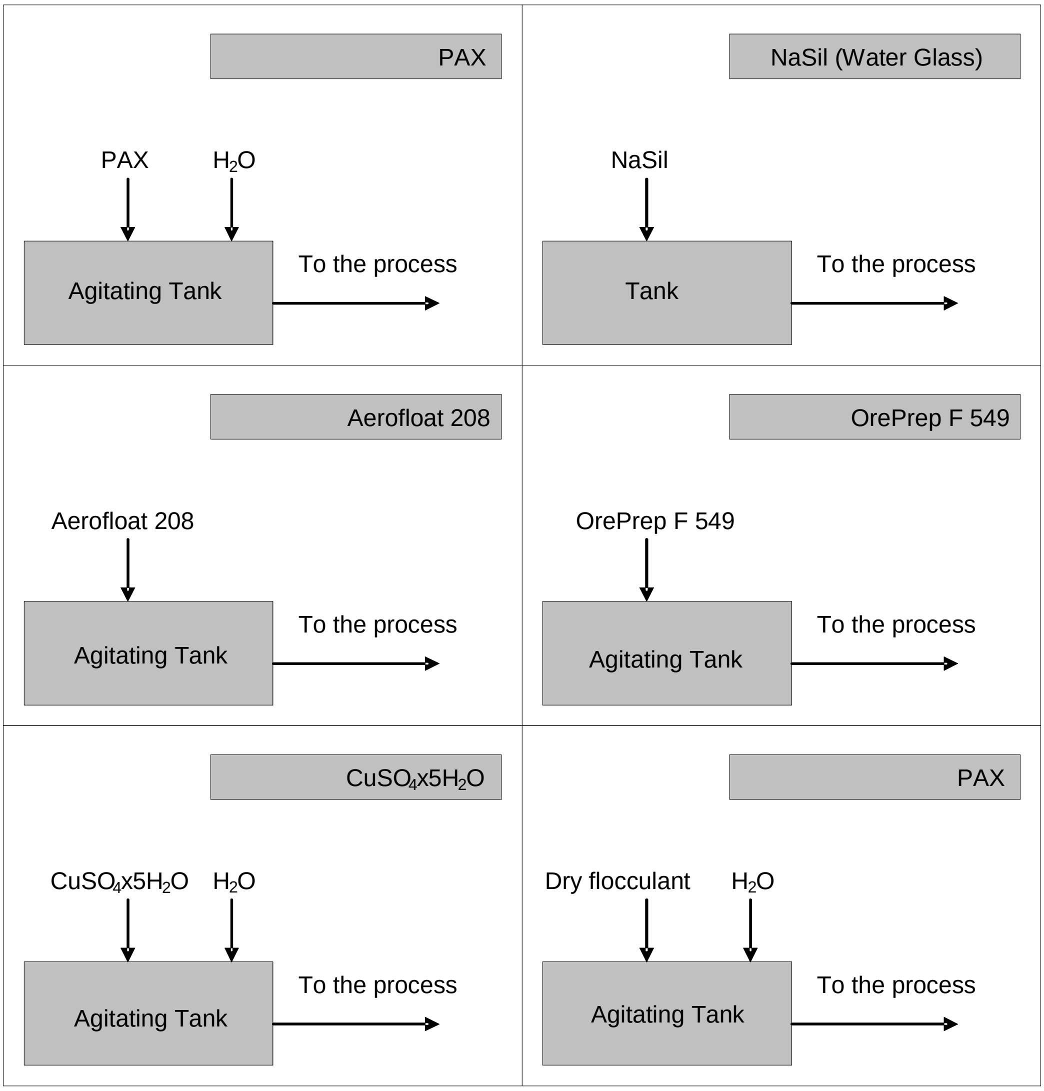


Figure II.4-2. Ancillary Plants and Facilities

The reagents packaging, transportation to and from the site, handling and preparation, and waste packaging handling will conform to the requirements of the Regulation on Packaging and Packaging Wastes (Government Decree 41/2004).

1) Xanthate Mixing Plant

The xanthate will be delivered as pellets in 200 kg lots in PET bags enclosed in steel drums, which will be stored in the reagent storage facility. The drums will be delivered to the reagents mixing annex and lifted by a crane to the regents mixing level.

The drums will be lifted by a trolley hoist to a xanthate solution preparation deck. The ready solution will then be fed by gravity to an agitating tank. The xanthate will be diluted to 5% solution strength. The solution will be pumped into a feed tank in the flotation section, from where it will be dispensed into the flotation cells through dispensing meters.

A dry filter will be installed above the xanthate mixing deck to collect the airborne particulate matter. A general ventilation system will be installed in the facility.

The empty drums and PET bags will be returned to the supplier.

2) *Sodium Silicate (Liquid Glass) Delivery Plant*

The sodium silicate ($Na_2OxnSiO_2$) will be bulk-delivered in 20t tanker trucks. The load will be pumped into a storage tank capable of containing two truck loads.

The solution will be pumped into a feed tank in the flotation section, from where it will be dispensed into the flotation cells through dispensing meters.

3) Copper Sulphate Mixing Plant

The copper sulphate will be delivered as powder packed in 25 kg multi-layer paper bags grouped on polymer shell covered wooden pallets with a lifting eye. It will be stored in the reagent storage facility. The pallets will be delivered to the reagent preparation annex and lifted by a crane to the reagent mixing level. Individual bags will be hand removed from the pallet and loaded into the feed hopper of the appropriate mixing tank, where raw water will be added continuously to produce a 20% by-weight solution. A metering pump will deliver the copper sulphate solution upstream of the SAG mill, where it will be added into the process. The empty bags and polymer packaging will be collected separately as packaging wastes.

4) Dithiophosphate Mixing Plant

Dithiophosphate (such as Aerofloat 208, which is the trade name of a similar product) will be delivered in $1m^3$ packaging (combining a PET container on a wooden pallet). The deliveries will be handled by a crane and stored in the reagent storage facility. A mobile pump will deliver the reagent to a feed tank in the flotation section. The mobile pump handling operations will be performed while the pallet is placed over a secondary containment arrangement having an effective retaining capacity of $1.2m^3$. A dispensing meter will dispense the 20% by-weight solution of dithiophosphate into the flotation process (the conditioning tank upstream of the flotation circuit). The packaging be managed on a rotation basis – the full packages will be delivered in exchange of the empty packaging for re-use.

5) Frother Mixing Plant

The frother (OrePrep F-549, which is the trade name of a similar product) is a liquid delivered in 180kg drums. which will be handled by a crane and stored in the reagent storage facility. The frother storage area will be provided with a concrete secondary containment structure, whose retaining capacity will be 20% greater than the maximum frother stock at any time. A mobile pump will deliver the reagent to a feed tank in the flotation section. A dispensing meter will dispense the reagent into the flotation process. The empty drums will be returned to the supplier.

6) Flocculant Mixing Plant

Flocculant will be delivered to the site in powder form packed in 25kg multi-layer paper bags grouped on wooden forklift pallets covered by shrink wrapped plastic. These will be kept in the reagent store area. The pallets will be delivered to the reagents preparation annex and lifted by a crane to the reagents mixing level.

Individual bags will be hand removed from the pallet and loaded into the feed hopper of the appropriate mixing tank, where raw water will be added continuously to produce flocculant at 0.5% solution strength.

Mixed flocculant will gravity flow from the mixing machine to the storage/surge tank beneath. It will be delivered to the thickener by metering pumps and diluted down to 0.025% strength solution with recycled water immediately before its addition to the pulp stream entering the thickener.

4.4. Final Product. Qualitative and Quantitative Characterisation

The quality of the final product will depend on the efficiency of the recovery of the precious metal values (i.e. gold and silver) as well as on the market demands and the downstream processing (toll treatment) options available in the country and abroad. Therefore, the project will have the option to produce either low-grade gold-silver concentrate (200 g/t Au) or high-grade gold-silver concentrate (500 g/t Au). The concentrate tonnage will vary according to its quality. The process plant will produce more tons of concentrate at low metal grades (about 10,000 tpa) and, respectively, less tons of concentrate at high metal grades (about 4,000 tpa).

4.5. Mine Rock and Tailings Characterisation. Management of Mining Wastes

The mining and processing operations will generate mine rock (waste rock from mining) and flotation process tailings.

The rock material with no economic gold and silver values is classified as waste rock, which is generated in the process of exposure/access to the ore body. It mostly consists of breccia conglomerates with occasional boulders of metamorphic rocks – amphibolites, gneiss and schists. A total of 14,950,000 tons of waste rock are expected to be produced during the life of the Ada Tepe mine.

The process (or flotation) tailings are the waste material rejected from the flotation plant after the recoverable valuable minerals have been extracted from the ore feed. About 7,235,000 tons of tailings are expected to be generated by the end of the project life.

The flotation tailings will be dewatered prior to their disposal in a IMWF (Option 1). That will enable co-disposal of tailings and waste rock.

Co-disposal of mining wastes has the following advantages:

- Reduces the area required for disposal and storage of mining wastes;
- Better utilises the storage capacity of the waste disposal facility;
- The reclaimed water from the tailings will be recycled back to the Process Plant, therefore significantly reducing any losses from evaporation;
- Reduces the risk of spillages during the tailings delivery process;
- Reduces the risk of emergencies resulting in a major uncontrolled discharge during/after a storm event;
- The IMWF drainage will gravity report to two collecting sumps and then pumped to the retention pond;
- Reduces maintenance and closure costs.

The IMWF has a total design footprint area of 41 ha. and an estimated capacity of 14 Mm^3, which is sufficient to accommodate the entire amount of mining wastes generated throughout the mine life of the Ada Tepe portion of the Khan Krum Deposit. The facility features:

- Tailings delivery pipeline – Its total design length is 1,000 starting from the tailings thickener on the process plant site and ending in multiple discharge points in an active tailings cell. It will be composed of HDPE pipes.
- Starter platforms – They will be constructed from waste rock at the start of operations and will form the northern and the southern slopes of the facility. The starting elevation of both platforms will be RL 290m. Their outer face slopes will be constructed at 2.5H:1V, which will ensure the stability of the facility and maximize the storage capacity of the existing ravines.
- Outer berms – They will be constructed from mine rock with horizontal benches at 10 m vertical intervals with the intervening slope constructed at 2.5H:1V and a bench crest width of 5 m. They ensure the containment of the thickened tailings. To prevent tailings being carried through the outer mine rock berm, a filter system will be placed on those berms. The filter system will consist of a drainage layer and/or geotextile. The drainage layer will be constructed from crushed rock;

- IMWF development stages – The facility will be developed by successive over the starter platforms. Mine rock will be placed to create cells, whose outer and internal berms will have a bench crest width of 5 m at every 10m vertical interval. The outer berms will form the downstream face of the facility, whose overall slope will be in the range of 2.5H:1V. Internal berms will create cells for the tailings, accommodate the tailings distribution and discharge pipework and allow mine equipment access. Thus, a structure will be constructed, which has a continuous outer face of mine rock and cells containing the dewatered tailings.
- Underdrain system – It plays an important role and is designed to collect and convey the rainfall that infiltrates into the facility and the water expelled from the tailings during consolidation. A two zone filter system will be placed to prevent tailings being carried through the outer mine rock berm.
- Outer drainage system – Precipitation on the mine waste area will infiltrate through the waste. Surface interception drains will be constructed to divert the runoff from the IMWF upstream catchment and prevent it from entering into the facility.
- Collecting sumps - two sumps will be set up at the toe of the IMWF north and south catchments to collect seepage and tailings water release from the IMWF area. Each collection sump will have a storage capacity of 2000 m^3, with a depth of 3 m. Both sumps will be provided with pumps, which will operate continuously depending on the sump water levels and return the seepage for re-use as process water. Each sump will have two pump units: one in operation and the other one on standby.
- The control and monitoring system will consist of 3 piesometers: 2 of them will be installed downstream of the IMWF toe and the third one will be upstream of the facility. They will be used for groundwater monitoring. The maximum thickness of tailings layers and their consolidation will be controlled by electrical piesometers. Their number and locations will vary depending on the locations of the tailings cells. Approximately 20 electric piesometers will be used. 25 object points on each berm and 3 reference points on the natural ground will be used to monitor the vertical and horizontal displacement.

The IMWF design footprint lies entirely on state-controlled forestry fund land. This land is included in the future concession.

BMM EAD has prepared an Integrated Mining Waste Management Plan, which is attached to this EIS as a separate document. The preparation of this Plan is a requirement under art. 22d par. 2 of the URA.

The detailed characterisation of the mining wastes is presented in the Waste Management Plan (Appendix 6). The waste characterisation and classification complies with the requirements under the Regulation on the Specific Requirements to Mining Waste Management (art. 10 par. 3, Appendix 1) and Directive 2006/21/EC on the Management of Waste from Extractive Industries, and EC Decision dated April 30, 2009.

The mining of the Ada Tepe mineral resource will generate mine rock without economic gold and silver values.

The rock material with no economic gold and silver values is classified as waste rock, which is generated in the process of exposure/access to the ore body. The rocks are sedimentary breccias and breccia-conglomerates comprising various pieces of metamorphic rocks - amphibolites, gneiss, schists. A total of 15 million tonnes of waste rock are expected to be produced during the life of the Ada Tepe mine. The waste rock is classified as fresh (25 %), oxidized (20 %) and strongly oxidized (55 %) depending on the weathering grade.

Mineralogy of Mine Rock (% by weight)

Table II.4-1

Mineral	Molecularformula	Fresh rock sample (wall zone)	Fresh host rock sample	Sample oxidized rock	Sample strongly oxidized rock
Quartz	SiO_2	44.4	22.8	62.1	46.5
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	4.0	6.5	2.0	4.9
Potash feldspar	$KAlSi_3O_8$	28.7	8.4	11.5	33.1
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$		18.5		3.5
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$		21.1		
Pargsite	$NaCa_2(Mg_4Al)Si_6Al_2O_{22}(OH)_2$		1.4		
Kaolinite	$Al_2Si_2O_5(OH)_4$	8.8	5.0	15.3	8.6
Calcite	$CaCO_3$	0.7	14.0		
Ankerite	$Ca(Fe^{2+},Mg,Mn)(CO_3)_2$	11.8	1.6		
Goethite	$\alpha–Fe^{3+}O(OH)$			9.0	3.3
Pyrite	FeS_2	1.7	0.8		
Total		100.0	100.0	100.0	100.0

Quartz, aluminum silicates, carbonates and pyrite prevail in the fresh rock samples (25% of the mine rock). The occurrence of ankerite in the fresh rock from the Wall Zone reduces the neutralization potential due to the presence of iron (II) in the mineral. Despite that, the alkalinity of the whole mineral is sufficient to prevent acid generation. The dominant carbonate mineral in the fresh host rock sample is calcite. The oxidized and strongly oxidized rock (75 % of the mine rock) do not contain pyrite or other sulphides. The available goethite is probably a product of the oxidation of the original sulphide. Like fresh rock, the main phases of the material contain quartz and aluminum silicates.

The mine rock composition has been compared against the average crustal abundance. Except for the fresh host rock samples, all other rock samples contain elevated concentrations of SiO_2 compared to average crustal abundance. The iron oxide concentration is higher than the average in all samples: it is associated with the ankerite, goethite and less with the pyrite. The concentrations in the oxidised rock and fresh host rock samples are lower than the average, while the strongly oxidised rock samples and the fresh rock samples from the Wall Zone contain elevated concentrations compared to average crustal abundance. This is attributed to the varying concentrations of potassium feldspar in the different samples. The concentration of the rest of the oxides is generally below the average crustal abundance. Except for the iron concentrations, the results of the element analysis are similar to the average crustal abundance.

4.6. Soil Stockpile

Prior to construction, all areas planned for construction or mining will be stripped of topsoil, which will be stockpiled for further use at the closure and rehabilitation stage. Topsoil layers are generally low in humus and very shallow (less than 10 cm) over the areas to be affected by the operations; therefore, the subsoil layers will also be stripped to ensure sufficient stock of soil materials to meet closure requirements.

A soil stockpile with an area of 2 ha will be set up in the upper portion of the integrated mining waste facility for convenience during the rehabilitation. It will be used to stockpile the soil material removed from the open pit, process plant and IMWF areas. This soil material contains elevated levels of arsenic and heavy metals above the maximum allowable concentrations (elevated background concentrations) and therefore will be used for forest rehabilitation only.

The total volume of the stockpiled soil will be about 150,000 m^3 with a maximum stockpile height of 10 m according to art. 10 of Regulation 26/02.10.1996 on the Rehabilitation of Disturbed Areas, Improvement of Low-Fertile Lands, Removal and Re-Use of Topsoils. Following topsoil deposition, a deep-root vegetation cover will be established because the soil material will have to be stored for a period of more than three years.

The soil stockpile will be sited in the upstream portion of the IMWF, which will enable both surface runoff and seepage to be collected and conveyed through the IMWF underdrain system.

4.7. Infrastructure

The infrastructure includes construction of the main process plant building, warehouses/storage areas, roads, water/sewage and power services, etc.

The construction projects scheduled for implementation in 2012 and 2013 are:

- Main process plant building;
- Fuel storage area - two (2) tanks for diesel fuel;
- Reagents store;
- Car wash;
- Roads.

The main process plant building, which will also accommodate the reagents plant and associated ancillary equipment, is described in detail in sections 4.2 and 4.3 above.

The car wash will be a steel frame structure with polycarbonate wall and roof panels on a concrete base. It will have three bays – a dry cleaning bay with a powerful vacuum-cleaner to clean the interior of vehicles and two exterior wash bays.

The concrete base surface will be provided with a suitable downward slope to drain the wastewaters containing oils and petroleum products. An underdrainage pipe system will collect and convey the wastewaters to a collecting sump near the car wash The sump will be a conventional mud and oil trap design. Its capacity will be sufficient to ensure collection of wastewaters, oils and petroleum products and efficient solids and oil/water separation. The lighter oil phase will be pumped to a waste oil container. Full containers will be replaced and stored in the area for temporary storage of hazardous wastes. The waste oil will then be handed over to waste management recycling companies that have permits for this type of waste activities. The settled solids (mostly rock material) will be scooped and deposited into the IMWF together with the thickened tailings. The wastewater stream reclaimed from the mud and oil trap at an expected flow rate of 0.2 L/s will be advanced to the reclaimed water tank.

The fuel store will be set up between the workshop and the tailings thickener. It will include two surface steel or reinforced concrete storage tanks. Each of them will have a storage capacity of 50 m^3. A secondary containment system constructed from materials having Class A1 fire rating will ensure safe containment of accidental spills from the fuel tanks. The fuel tanks design and construction will be fully compliant with the requirements under Regulation I-209/22.11.2004 on the Fire Safety Rules at Operational Sites. ДВ, бр.107 / 07.12. 2004г.

The site access road corridors considered in the project proposal are:

- Corridor A starting from the Zvezdel junction on the Momchilgrad-Krumovgrad-Ivaylovgrad main road and running south through and near Tokachka Village, Zvunarka Village and Izgrev Quarters in Krumovgrad, then branching off the main road and passing across Kaldzhikdere near Ovchari Village to the minesite on Ada Tepe. The section of the route between Tokachka Village and Izgrev Quarters in Krumovrgrad is a two-lane asphalt surface road. The road passes near a shoe factory and the town hospital. After the bridge across the Krumovitsa, the road runs parallel to the river. Private agricultural land units are located on both sides of the road. This section of the route passes through belts II and III of the sanitary protection zones around the existing drinking water abstraction supplying Ovchari Village. The distance between the fencing of belt I and the road is approx. 50 m. Just before crossing Kaldzhikdere valley, which discharges into the Krumovitsa River, the road is cut off – the existing bridge is completely destroyed.

- Corridor B starting from the Zvezdel junction on the Momchilgrad-Krumovgrad-Ivaylovgrad main road and running south through and near Tokachka Village and Zvunarka Village, where it branches off to Pobeda Hamlet of Ovchari Village: a dirt road to the Ada Tepe minesite. The section of the route branching off the main road through Tokachka Village to the junction at Pobeda Hamlet is a two-lane asphalt surface road. It passes through a priority habitat of the East Rhodopes Protected Site. The section of the route after the junction to Pobeda Hamlet is a single-lane asphalt surface road. Private land units (agricultural buildings, tobacco plantations, etc.) are located on both sides of the road. The section of the route immediately after Pobeda Hamlet to the Ada Tepe project site is a dirt road. It is in poor condition and part of it is heavily eroded off.

The access to the minesite is based on Corridor B, which is recommended by the Kardzhali District Road Service (see Appendix 4).

5. Project Raw and Other Materials, Natural Resources and Energy Sources

The project will require supply of sufficient quantities of raw materials for the construction, operation and closure of the open pit, the process plant, the IMWF and the associated infrastructure.

5.1. Raw and Other Materials Required for the Construction Stage. Qualitative and Quantitative Characterisation

The main construction materials (bricks, concrete, cement, lime, structural steel and steel sheets, reinforcement bars, window/door framework, glass etc.), and the fuel needed for the construction equipment will be purchased in quantities and with quality as specified in the design.

5.2. Raw and Other Materials Required for the Operation Stage. Qualitative and Quantitative Characterisation

Raw Materials

The main raw material that will be used in the project is the auriferous ore from the Adá Tepe open pit.

Approved reserves and resources at Ada Tepe prospect, Khan Krum deposit

Zone/Prospect	Category	Ore	Grades		Metals	
		t	Au, g/t	Ag, g/t	Au, kg	Ag, kg
Probable Reserves	122	1,493,000	7.29	4.31	10,892.6	6,440.6
Measured Resources	331	7,292,000	2.37	1.03	17,294.0	7,503.0
Total Ada Tepe		8,785,000	3.21	1.59	28,186.6	13,943.6

Table II.5-1 gives the average chemical composition of the mineable ore:

Average Concentration of Major and Trace Elements in the Ada Tepe Ore,
Khan Krum Deposit

Table II.5-1

Prospect	Au	Ag	Co	As	Fe	Cu	Zn	Pb	Ni	Cr	Mn	Cd
	g/t	g/t	g/t	g/t	%	g/t	g/t	g/t	g/t	g/t	g/t	g/t
Ada Tepe	5	2	14	145	3.1	10	34	<5	43	250	509	<5

The results of the whole rock chemical analyses (WRA) of the mineable ore are presented in **Table II.5-2.**

WRA of Ada Tepe Ore

Table II.5-2

Type	Unit	Fresh	Oxidized ores	Average for the deposit
SiO_2	%	69.80	81.00	80.20
Al_2O_3	%	4.70	6.96	5.90
CaO	%	8.63	1.59	2.85
Fe_2O_3	%	2.75	3.51	3.28
K_2O	%	2.19	3.18	2.60
MgO	%	1.53	0.17	0.44
Na_2O	%	0.09	0.11	0.14
TiO_2	%	0.22	0.37	0.30
MnO	%	0.07	0.08	0.08
BaO	%	0.02	0.03	0.03
SO_3	%	1.02	0.10	0.22
P_2O_5	%	0.04	0.07	0.06
Tempering losses	%	8.74	2.75	3.65
Total				**99.75%**

Materials

A licensed explosives manufacturer will supply the blasting materials. Explosives will be safely delivered from the explosives manufacturing plant to the minesite by a designated MMU vehicle (mobile manufacturing unit). This vehicle will deliver the products to the pit blast area, where they will be mixed to form explosives and immediately poured into the blast holes. The blasting works will be fully compliant with the requirements of the Blasting Safety Ordinance issued by the Ministry of Labour and Social Works (SG issue 3/10.02.1997). BMM EAD will not construct and operate an explosives magazine.

The following reagents and consumables will be used in the extraction and processing of the raw material (auriferous ore) to a final product (flotation concentrate): potassium amyl xanthate, copper sulphate, sodium silicate, dithiophosphate, frother, flocculant, grinding balls, explosives and blasting consumables, and water (fresh and returned).

The reagents that will be used in the ore processing must be provided with Material Safety Data Sheets (MSDS) (presented in Appendix 7 of the EIS), which should contain information about:

- chemical composition;
- emergency response;
- emergency phone;
- other information from the manufacturer.

The characterisation of the chemical substances is presented in Table II.5-3. According to the provisions under the Protection against Harmful Impact of Chemical Substances, Preparations and Products Act, the chemical substances are classified on the basis of their principal properties. The classification is done to enable risk assessment of their impact on human health and the environment.

Characterisation of the Chemical Substances That Will Be Used in Ore Processing

Table II.5-3

Code	Classification	Description	Chemical and physical properties	R-phrases	S-phrases	Tonnage kg/h
	Xn– harmful; Xi - irritant	Potassium amyl xanthate	Appearance: powder, flakes or pellets; Colour: pale yellow, grey-yellow, yellow-green; Odour: strong, unpleasant odor;	R22 R36/37/38	S26, S36	14-15
	Not classified as hazardous to humans and the environment	Sodium silicate	Liquid, almost transparent, odorless, soluble in water and other solvents.	Not available	Not available	15
	Xi - , C - Corrosive	Dithiophosphate	Yellow to amber liquid, stable	R41, R34 R3, R35	S26, S45, S50A, S36/37/39	2
	Not classified as hazardous to humans and the environment	Frother	Colour: yellow to brown Appearance: liquid Odour: light ether-like odour	Not available	Not available	0.5-1
	Xn – Harmful	Copper sulfate penthahydrate	Solid, odorless, blue substance Stable under normal conditions of use and storage	R: 22-36/38-50/53	S (1/2-) 22-60-61	11
	Not classified as hazardous to humans and the environment	Flocculant	Organic Colorless and odorless	Not available	Not available	1-2
	Xi -irritant	Cement	fine ground, inorganic material, gray, odorless powder	R37/38 R41 R43	S2, S22 S24/25, S26 S36/37/39 S46	400 – 500

The fuel used on the site must be certified for concentrations of lead, sulphur and other environmentally hazardous substances. The project considers storage facilities and tanks for storage of raw materials, intermediary products and products under normal operating conditions, and secondary containment arrangements for emergencies. The access to the storage areas will be restricted.

The stock of chemical substances and products listed in Table II.5-3 should not exceed the maximum allowable stock levels under the law.

5.3. Natural Resources Qualitative and Quantitative Characterisation

The investment project proposal considers mining of auriferous mineral resources.

Approved reserves and resources at Ada Tepe prospect, Khan Krum deposit

Table II.5-4

Zone/Prospect	Category	Ore	Grades		Metals	
		t	Au, g/t	Ag, g/t	Au, kg	Ag, kg
Probable Reserves	122	1,493,000	7.29	4.31	10,892.6	6,440.6
Measured Resources	331	7,292,000	2.37	1.03	17,294.0	7,503.0
Total Ada Tepe		8,785,000	3.21	1.59	28,186.6	13,943.6

The Ada Tepe deposit can be classified as a high-grade, shallow, low-sulphidation epithermal style gold-silver deposit. Two major styles of gold-silver mineralisation are apparent at Ada Tepe:

Based on the interpretation of the results, i.e. structural and morphological characterization of mineralization, the prospect can be classified as a Class 2 deposit with a complex geological composition, irregular orebody thickness and very uneven gold distribution.

The Ada Tepe reserve and resource estimation has been prepared by RSG Global.

This resource estimate has been determined and reported in accordance with the JORC Code. It has been reconciled by BMM EAD with the Bulgarian Classification of Solid Underground Mineral Resources and Ore Reserves (Resolution 413/1998 of the Council of Ministers) by applying the respective reserve and resource categories accepted in Bulgaria: code 122 (possible reserves) and code 331 (measured resources) based on the level of understanding of the deposit:

- measured resources (code 331), whose estimation in 2004 and 2005 indicated possible economic mining; and

- possible reserves (code 122) - this is the Wall mineralization, which has been subject to more detailed economic mineability evaluation.

Depending on the level of confidence in the resource and the assessment of its technical and economic mineability, the following approach to reserve/resource classification has been adopted (the respective JORC categories are indicated in brackets):

- Wall Zone - Pass 1 (restricted range estimate - based on a 3D wireframe): **Possible Reserves Code 122** (Indicated Resource under the JORC Code)
- Wall Zone - Pass 2 (extended range estimate within the Wall Zone wireframe): **Measured Resources Code 331** (Inferred Resource under the JORC Code)
- Upper Zones: **Measured Resources Code 331** (Inferred Resource under the JORC Code)

The resource categories have been determined using the Selective Mining Unit ('SMU') emulation for the Multiple Indicator Krigging ('MIK') gold estimate at a 0.9 g/t Au cutoff.

The quantitative x-ray analysis of electrum in species from the Upper and Wall Zones indicates that the gold fineness varies with depth. The gold in the Wall Zone is finer (746 to 828) but closer to the surface it becomes electrum (662 to 724 finenenss) and contains more impurity elements (Ag±Cu, Fe, As, Sb, Te, Zn.).

The results of the quantitative x-ray spectrometry indicate different Au/Ag ratios in the Wall Zone and in the Upper Zone.

Quantitative X-Ray Spectrometry of Wall Zone Electrum

Table II.5-5

Elements Minerals	**Composition, Wt%**								**Total**
	Au	**Ag**	**Te**	**Cd**	**Zn**	**Fe**	**Cu**	**S**	
Native gold center	82.2	16.76	0	0	0	0.19	0.44	0	99.56
Native gold periphery	81.7	17.52	0	0	0	0.08	0.2	0	99.47
Native gold in carbonate	82.8	16.72	0	0	0	<0.01	0.49	0	99.95
Hessite	1.98	61.4	36.53	0	0	0	0	0	99.9
Greenockite	0	0	0	51	22.48	0.6	0.38	25.18	99.64

Two site water supply options have been studied:

Option 1. Installation of a proprietary fresh water abstraction well in the Krumovitsa River gravels where sufficient water resources are available and without any negative impact on the requirements of the local community. The option for installation of a proprietary fresh water abstraction well in the alluvial gravels of Krumovitsa River or Kessibirdere would provide up to 5 L/s to the site, which is sufficient to meet the project fresh water requirements for the process and the ablution facilities. This Option will also require a one-off abstraction of 100,000m^3 of fresh water from the Krumovitsa River at the start-up of operations.

Option 2. Collection and storage of water from the Kaldzhik valley watershed into a small storage dam, which will normally be self filling from the catchment areas with occasional abstractions from the Krumovitsa River. A storage dam would have the capacity to supply water to the project for an extended period, 6-12 months, without recharge and minimise the project dependence on water supply.

The economic, social and environmental studies and the data from hydrological and hydrogeological surveys, however, show that the first option (a proprietary fresh water abstraction well) is the most suitable one.

The expert investigation carried out by the Plovdiv-based Vodokanalproekt AD demonstrates that it is possible to abstract 5 L/s without affecting the existing drinking water abstractions supplying Krumovgrad and the nearby settlements. Currently, the Krumovgrad drinking water supply comes from 2 wells and a third one is on standby. The combined resource of the two lower rate wells is 32.4 L/s. The total amount required to meet the drinking water requirements of the town estimated at 20 L/s according to the Guidelines for the Design of Water Supply Systems. These figures clearly demonstrate that the project will not have a noticeable effect on the available resource. The combined project fresh water usage and public drinking water usage would total some 25 L/s leaving a free resource of 7.4 L/s without counting the third abstraction well, which would add further 29 L/s.

The project would require approximately 2,894,000 m^3 of water per annum from internal and external water sources (based on an annual precipitation forecast approximating the mean annual precipitation levels for the average precipitation year). The project considers that more than 98%, or an average of 2,830,000 m^3/year, of the total demand will be met from recycling (internal sources) as follows:

- Internal recycling of tailings thickener overflow – about 2,170,000 m^3/year (248 m^3/h);
- Drainage from the IMWF – about 660,000 m^3/year (75 m^3/h);

External water sources will supply:

- Fresh water – 64,000 m^3 per year (7 m^3/h);

The project drinking water requirements of about 0.8 m^3/h (or about 6,500 m^3/year) will be met from the proprietary abstraction well after obtaining the necessary permits.

5.4. Use of Energy Carriers. Types and Quantities

The main energy carriers that will be used are electric power and diesel fuel.

- **Electric power**

Electric power for the project will be supplied by the NEC-EAD and the power source will be the Krumovgrad substation 110/20kV. The station operates two transformers: a 16MVA unit and a 25 MVA unit. Currently, the nominal load is approximately 30% and the available free capacity will be sufficient to meet the project requirements without affecting the municipal electric power requirements. NEC EAD will supply electric power to the project site via a single overhead line. A backup supply line will also be available. BMM will construct the site substation and the site distribution system.

Most of the electric power will be used for ore crushing and grinding, and the remainder will be used in the other process stages, the offices and other ancillary facilities. The total installed capacity will be 7.5 MW and the maximum rate of consumption is expected to be 5.1 MW. Table II.5-5 presents the quantitative distribution of electric power by types of consumption.

Electric Power Consumption

Table II.5-6

	Electric Power [kW]
Mineral Processing	3,300
Offices	250
Ancillary Plants and Facilities	1,250
Total	**5,100**

The electric power requirement for processing of 850,000 tpa of ore is estimated to be 32 GW/year. The power required for processing of 1 ton of ore is approximately 48 kWh.

- **Diesel fuel**

Diesel fuel will be used by loaders, haul trucks, utility vehicles, mobile mining and ancillary equipment. Liquid fuels will be delivered in tanker trucks. The diesel fuel will be stored in two on-site storage tanks, each with capacity of 50 m^3, located a safe distance from the pit (more than 500 m away) between the tailings thickener and truck shop.

The diesel fuel requirement for processing of 850,000 tpa of ore is estimated to be 5,400 tpa. The fuel requirement per ton of ore processed will be approximately 6.7 litres. The sulphur content in the diesel fuel will be below 0.2%.

5.5. Water Supply Sources. Quantities. Water Management

The site process water supply design should meet two major criteria:

- Ensure normal project operation;
- Minimise fresh water consumption.

One of the more important project directives is to provide the water supply without any negative impact on the requirements of the local community and downstream users, which are particularly important during the dry season of the year.

Two site water supply options have been studied:

a) Option 1

- Installation of a proprietary fresh water abstraction well in the Krumovitsa River gravels where sufficient water resources are available and without any negative impact on the requirements of the local community. The option for installation of a proprietary fresh water abstraction well in the alluvial gravels of the Krumovitsa River would provide up to 5 L/s to the site, which is sufficient to meet the project fresh water requirements for the process and the ablution facilities. The proprietary well installation would not cause inundation of land or disturbance of protected habitats. A fresh water tank will be constructed on the process plant site, which will be fed by the well.

a) Option 2

- Collection and storage of water from the Kaldzhik valley watershed into a small storage dam, which will normally be self filling from the catchment areas with occasional abstractions from the Krumovitsa River. A storage dam would have the capacity to supply water to the project for an extended period, 6-12 months, without recharge and minimise the project dependence on water supply. The only possible option for the siting of the storage dam close to the site is the Kaldzhikdere valley. The valley catchment is big enough to maintain the water balance of the facility. The area required for the construction of the dam amounts to about 7 ha, which will give an effective water storage capacity of about 250,000 m^3. The problem associated with the dam construction is the likely derogation of habitats that are within the scope of protection in the East Rhodopes Protected Area. The dam height will have to be over 16 m because it should be sited in a shallow portion of the valley. This is quite a big height for a dam especially in relation to the impact that an extreme precipitation event would have compared to the low fresh water requirements.

The economic, social and environmental studies and the data from hydrological and hydrogeological surveys, however, show that the first option (a proprietary fresh water abstraction well) is the most suitable one.

The expert investigation carried out by Vodokanalproekt AD Plovdiv demonstrates that an abstraction of up to 10 L/s from the Krumovitsa River gravels will not have a negative impact on the water requirements of Krumovgrad and downstream users.

All local factors for rainfall, evaporation, catchment areas, and topography have been included in the development of the water balance for the project. Historical meterological and river flow records taken on a monthly basis over 30 years between 1974 and 2003 have been included in the model to develop the operating “envelope” for the area, and to ensure that all possible ranges of climate have been taken into consideration. The lake evaporation data has been extrapolated from the Kardzhali station. The runoff coefficients are calculated for the Krumovitsa catchment as part of the water balance calculations. The average annual precipitation is 704 mm while the average annual pan evaporation is 1,052 mm. The average annual runoff coefficient is 0.45 with a very large seasonal variation: 0.91 from January to March and 0.11 from July to September.

Examination of the records has identified three distinct patterns over this time period and has enabled the model to predict the complete balance for “average”, “dry” and “wet” climatic conditions. Figure II.5-1 presents the project water balance flow diagram and Table II.5-6 shows the water balance results (m^3/year) for the average precipitation year. The table also shows that range of possible flows over the mine life for three annual climatic patterns identified.

The project would require approximately 2,894,000 m^3 of water per annum from internal and external water sources (based on an annual precipitation forecast approximating the mean annual precipitation levels for the average precipitation year – see Table II.5-6). The project considers that more than 98%, or an average of 2,830,000 m^3/year, of the total demand will be met from recycling (internal sources) as follows:

- Internal recycling of tailings thickener overflow – about 2,170,000 m^3/year (248 m^3/h);
- Drainage from the IMWF – about 660,000 m^3/year (75 m^3/h);

External water sources will supply:

- Fresh water – 64,000 m^3 per year (7 m^3/h);

The project drinking water requirements of about 0.8 m^3/h (or about 6,500 m^3/year) will be met from the proprietary abstraction well after obtaining the necessary permits.

Table II.5-7. Water Balance (m^3/year)

Area	Flow Number	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Min 100 yr-dry (L/s)[(a)]	Max 100 yr-Wet (L/s)[(b)]	Avg. (L/s)[(c)]
Flows associated with ore processing and tailings production (PR)	PR1	597,312	595,680	595,680	595,680	597,312	595,680	595,680	595,680	597,312	1	18.9	18.9
Pumped Flows (P)	P1	173,426	186,308	185,673	158,262	140,922	170,885	194,832	200,801	202,236	3.4	8.4	5.7
	P2	455,843	449,034	458,188	494,118	522,334	498,554	483,126	485,675	488,495	12.5	19.8	15.3
	P3	68,383	84,231	93,578	103,180	106,842	109,947	115,833	117,352	117,728	1.5	5.7	3.2
	P4	50,640	0	0	0	0	0	0	0	0	0.0	1.2	0.2
	P5	63,245	63,072	63,072	63,072	63,245	63,072	63,072	63,072	63,245	2.0	2.0	2.0
Direct Precipitation (DP)	DP1	145,065	144,591	144,591	144,591	145,065	144,591	144,591	144,591	145,065	2.8	7.5	4.6
	DP2	235	234	234	234	235	234	234	234	235	0.0	0.0	0.0
	DP3	245,062	244,263	244,263	244,263	245,062	244,263	244,263	244,263	245,062	4.8	12.7	7.7
	DP4	235	234	234	234	235	234	234	234	235	0.0	0.0	0.0
	DP5	352	351	351	351	352	351	351	351	352	0.0	0.0	0.0
	DP6	21,458	35,535	37,369	37,869	38,302	38,388	38,558	38,678	38,845	0.4	2.0	1.1
	DP7	10,211	10,178	10,178	10,178	10,211	10,178	10,178	10,178	10,211	0.2	0.5	0.3
Runoff (RO)	RO1	71,317	63,272	55,705	48,138	40,831	32,982	25,415	17,848	13,349	0.3	3.7	1.3
	RO2	120,504	106,981	94,264	81,548	69,273	56,079	43,363	30,646	23,090	0.5	6.2	2.2
	RO3	50,415	66,313	75,661	85,263	88,875	92,030	97,915	99,435	99,760	1.0	5.2	2.7
	RO4	8,169	8,142	8,142	8,142	8,169	8,142	8,142	8,142	8,169	0.2	0.4	0.3

Area	Flow Number	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Min 100 yr-dry (L/s)[(a)]	Max 100 yr-Wet (L/s)[(b)]	Avg. (L/s)[(c)]
Evaporation (E)	E1	281	281	281	281	281	281	281	281	281	0.0	0.0	0.0
	E2	281	281	281	281	281	281	281	281	281	0.0	0.0	0.0
	E3	422	421	421	421	422	421	421	421	422	0.0	0.0	0.0
	E4	27,464	42,967	44,135	44,764	45,268	45,513	45,789	46,008	46,144	0.7	1.5	1.4
Seepage (S)	S1	5,433	16,177	26,923	37,668	48,598	59,188	69,933	80,678	86,332	0.1	4.5	1.5
	S2	9,129	27,186	45,243	63,300	81,668	99,464	117,521	135,578	145,078	0.2	7.5	2.5
	S3	18,037	17,988	17,988	17,988	18,037	17,988	17,988	17,988	18,037	0.6	0.6	0.6
Tailings Water Release (T)	T1	96,724	106,905	103,092	72,503	51,540	78,761	99,530	102,320	102,601	1.6	3.4	2.9
	T2	318,088	306,772	310,585	341,175	363,271	334,916	314,147	311,356	312,209	9.7	11.5	10.3
Environmental Discharge (M)	M1	0	57,436	134,993	152,985	165,821	176,581	190,879	200,818	203,853	0.0	14.8	4.5
Tailings Pore Water[(d)]		254,418	253,722	253,722	253,722	254,418	253,722	253,722	253,722	254,418	8.0	8.0	8.1

(a) Minimum Flow throughout mine life using the 100 yr-Dry Annual Climatic input for each year.

(b) Maximum Flow throughout mine life using the 100 yr-Wet Annual Climatic inputs for each year.

(c) Average Flow throughout mine life using the 100 yr-Wet Annual Climatic inputs for each year.

(d) Water lost permanently to tailings pore space.

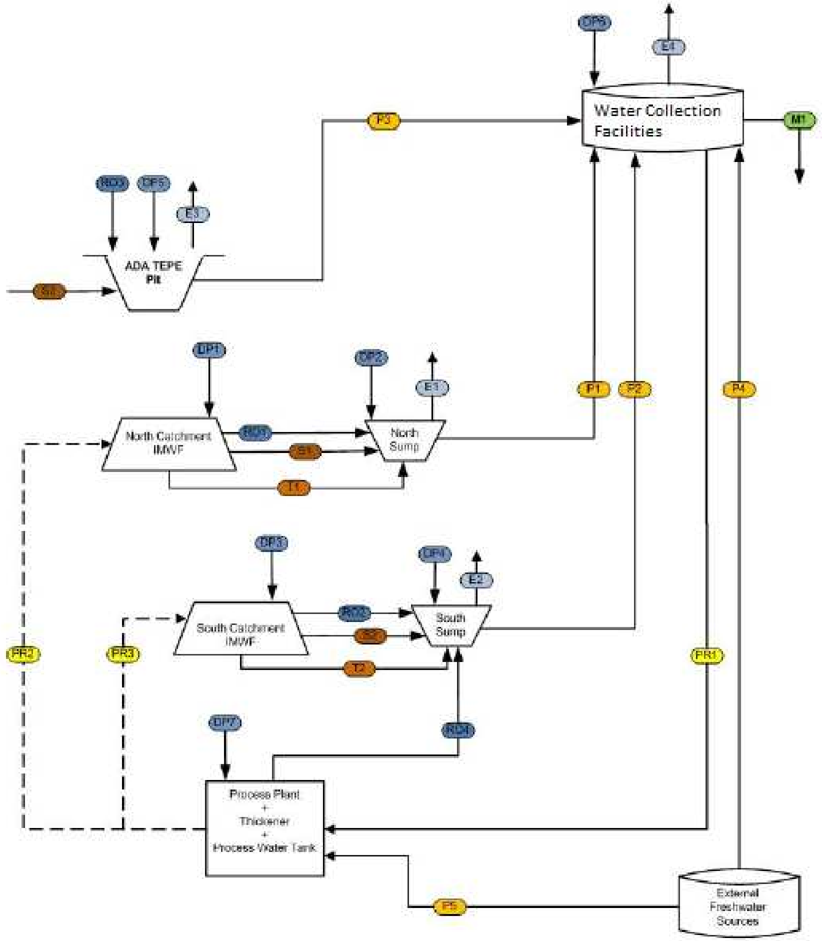


Table 1: List of Water Balance Flow Components

Area	Flow Number	Description	Min 100 yr-dry (L/s)[a]	Max 100yr-Wet (L/s)[b]	Avg. (L/s)[c]
Flows associated with ore processing and tailings production (PR)	PR1	Process Water from Raw and Process Water Reservoir to Process Plant	18.9	18.9	18.9
	PR2	Tailings from Process to North Catchment IMWF	NA	NA	NA
	PR3	Tailings from Process to South Catchment IMWF	NA	NA	NA
Pumped Flows (P)	P1	Water from North Collection Sump to Raw and Process Water Reservoir	3.4	8.4	5.7
	P2	Water from South Collection Sump to Raw and Process Water Reservoir	12.5	19.8	15.3
	P3	Water from Ade Tepe Pit Sump to Raw and Process Water Reservoir	1.5	5.7	3.2
	P4	Water from External Fresh Water Sources to Raw and Process Water Reservoir	0.0	1.2	0.2
	P5	Freshwater to Process Plant	2.0	2.0	2.0
Direct Precipitation (DP)	DP1	Direct Precipitation on North Catchment IMWF	2.8	7.5	4.6
	DP2	Direct Precipitation on North Collection Sump	0.0	0.0	0.0
	DP3	Direct Precipitation on South Catchment IMWF	4.8	12.7	7.7
	DP4	Direct Precipitation on South Collection Sump	0.0	0.0	0.0
	DP5	Direct Precipitation on Ade Tepe Pit Sump	0.0	0.0	0.0
	DP6	Direct Precipitation on Raw and Process Water Reservoir	0.4	2.0	1.1
	DP7	Direct Precipitation on Plant Site Area	0.2	0.5	0.3
Runoff (RO)	RO1	Runoff from North Catchment IMWF to North Collection Sump	0.3	3.7	1.3
	RO2	Runoff from South Catchment IMWF to South Collection Sump	0.5	6.2	2.2
	RO3	Runoff from Ade Tepe Pit Catchment to Pit Sump	1.0	5.2	2.7
	RO4	Runoff from Plant Site Area to South Collection Sump	0.2	0.4	0.3
Evaporation (E)	E1	Evaporation from North Collection Sump Surface	0.0	0.0	0.0
	E2	Evaporation from South Collection Sump Surface	0.0	0.0	0.0
	E3	Evaporation from AdeTepe Pit Sump Surface	0.0	0.0	0.0
	E4	Evaporation from Raw and Process Water Reservoir Surface	0.7	1.5	1.4
Seepage (S)	S1	Seepage from North Catchment IMWF to North Collection Sump	0.1	4.5	1.5
	S2	Seepage from South Catchment IMWF to South Collection Sump	0.2	7.5	2.5
	S3	Seepage from Groundwater to AdeTepe Pit Sump	0.6	0.6	0.6
Tailings Water Release(T)	T1	Tailings Release from North Catchment IMWF to North Collection Sump	1.6	3.4	2.9
	T2	Tailings Release from South Catchment IMWF to South Collection Sump	9.7	11.5	10.3
Environmental Discharge (M)	M1	Discharge	0.0	14.8	4.5

LEGEND:

——— Flow Component

— — — Flows not Directly Modeled

(P#) Flow Number

NOTES:

- Water Balance Flow Components are Described in Table 1.0

PROJECT: DUNDEE PRECIOUS (KRUMOVGRAD) BV
KRUMOVGRAD GOLD PROJECT
BULGARIA

TITLE: WATER BALANCE FLOW DIAGRAM

DRAFT

Golder Associates

PROJECT No. 09-1221-3019			PHASE No. 5000
DESIGN	MLP	8APR10	SCALE NTS / REV.1
CADD			FIGURE 1
CHECK			
REVIEW			

Figure II.5-1 Project Water Balance Flow Diagram

Site Water Management

General Principles

The water management principles and associated activities adopted for the project are:

- Minimise impacts on natural water courses
- Minimise impact on existing water resources and the requirements of other downstream users.

These principles will be promoted by adherence to the following objectives:

- Thickening of the tailings and recycling of the supernatant water under Option 1, which will reduce evaporation losses (compared to deposition of tailings in a TMF under Option 2);
- Recycling of the mine and IMWF drainage waters back into the process.

Following is a summary of the water management activities considered for the construction, operation, closing and rehabilitation stages.

Construction

No mining or processing operations will be carried out during the construction stage and the project will have the typical features of a large construction project. This stage will include removal of the soil from the sites of the future Process Plant, IMWF and open pit, construction of the foundations of the buildings and the infrastructure required for the normal operation of the open pit and the ore processing plant.

The impact on surface water quality during the project construction means increased content of particulate matter (increased sediment flows). Elevated suspended solids sediment loadings in rivers and streams are generally detrimental to aquatic ecologies because they can blanket stream beds and vegetation and reduce light reception.

The strongly seasonal flow regime of the Krumovitsa River catchment is a naturally restricting factor for sediment impacts. During dry months there is little tributary flow to carry sediment. and in wet months the rivers are naturally high in sediment loads during periods of higher energy and flows but these loads are largely diluted by the large flow quantities.

Nevertheless, the potential sediment loads will be reduced as much as possible to minimise the impact of the project on the environment.

The following provisions have been made to minimise the risk from pollution of the surface run-off:

- Construct temporary surface interception drains to divert surface run-off from the construction sites;
- Construction of settling ponds to collect the waters containing high sediment level (soil and subsoil material) for clarifying and precipitation of suspended solids prior to discharge into the receiving water.

Operation

Most of the surface runoff will be diverted from the project area by way of a drainage system which will prevent its contact with process related products, raw materials and waste.

The Ada Tepe Pit will collect seepage and runoff from the surrounding area and pump the water to an open process water reservoir.

Two collection (drainage) sumps will collect surface runoff, seepage, and tailings water release from the IMWF area (Option 1). The seepage from the IMWF and Ada Tepe sumps will report to a Runoff Storage Pond with a capacity of 100,000 m^3, which is shown in Figure II.5-1. Figure II.5-2 shows the project water collection and treatment facilities.

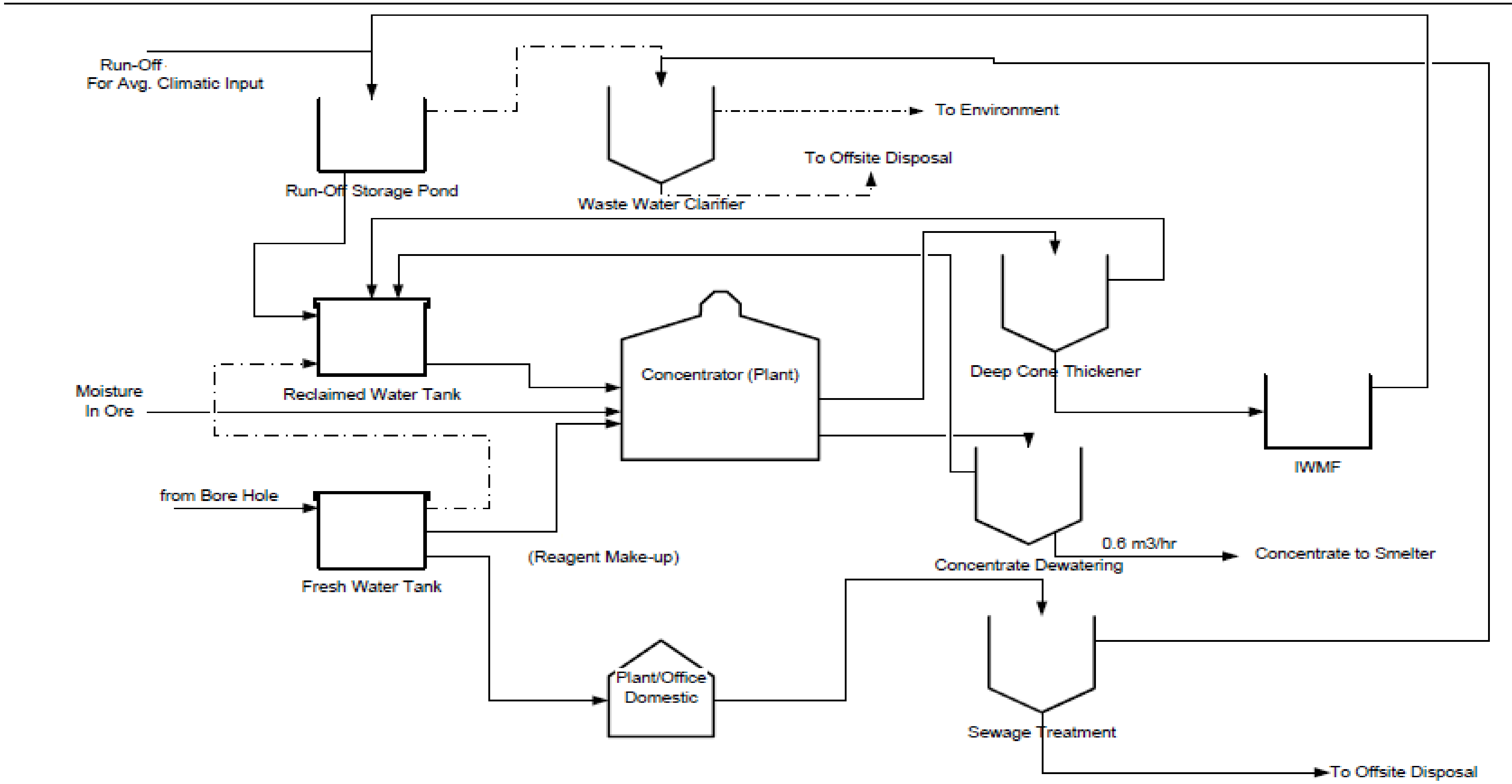

Run-Off
For Avg. Climatic Input
Run-Off Storage Pond
To Environment
To Offsite Disposal
Waste Water Clarifier
Deep Cone Thickener
Concentrator (Plant)
Reclaimed Water Tank
Moisture
In Ore
IWMF
from Bore Hole
Fresh Water Tank
(Reagent Make-up)
0.6 m3/hr
Concentrate to Smelter
Concentrate Dewatering
Plant/Office
Domestic
Sewage Treatment
To Offsite Disposal

Figure II.5-2

The main facilities are:

- Runoff Storage Pond with a capacity of 100,000 m^3, which will collect seepage from Ada Tepe pit, IMWF and site runoff;
- Reclaimed Water Tank with a capacity of 380 m^3, which will collect the tailings thickener overflow;
- Fresh Water Tank with a capacity of 380 $m^{3,}$ which will collect the fresh water supplied from the proprietary abstraction well.

Make-up water will be added to the Runoff Storage Pond from the Fresh Water Tank, which will be fed by the proprietary abstraction well to meet household and process demands. Water will be pumped from the Runoff Storage Pond to the Reclaimed Water Tank to provide the process water requirements.

The excess water from the Runoff Storage Pond will report to a Wastewater Clarifier, where it will be treated for discharge into the Krumovitsa River. The estimated discharge rate is 4.5 L/s. It may increase to 15 L/s under extreme weather conditions (a 1 in 100 years storm event). The quality of the discharge from the Wastewater Clarifier will meet the allowable emission levels and will not derogate the river water quality. The discharged quantities of water will not change the river flow regime significantly as they are negligible compared to the river flows in both normal and extremely wet years. No discharges will occur in the first year of operation and in dry years.

The water from the Fresh Water Tank will be used:

- as make-up water, which will be added to the Reclaimed Water Tank;
- for reagents preparation;
- for household purposes.

The project considers that more than 98 % of the total demand will be met from recycling. According to the water balance model, the process feshwater makeup requirement is 2 L/s.

Effluents from restrooms and bathrooms will be collected using a separate collection sewage system and delivered to a domestic wastewater treatment plant. The treatment process will include passive, chemical and biological treatment stages. The treated effluent will report to the Wastewater Clarifier prior to discharge into the Krumovitsa River.

Closure

In accordance with the closure objectives, the water management will further assist in ensuring the physical and chemical stability of the site and its successful rehabilitation taking into account any land use designations. It is important to complete the following tasks as part of the water management process:

- Consider an option for a wet closure of the open pit provided that the waters have adequate quality;
- The IMWF drainage system established during the construction stage is retained as a permanent system at closure to provide efficient post-closure water management.
- Monitor IMWF drainage flows. The preliminary investigations indicate that the drainage waters will not be polluted and can be discharged into the Krumovitsa River.

The water monitoring over the closure stage is expected to confirm that the rehabilitated areas will not be sources of environmental pollution.

III. Description of Siting and/or Process Alternatives Together with Justification for the Selection Made Taking into Account the Impact on the Environment Including the "Zero" Alternative.

Worldwide, mining techniques can be divided into two common excavation types: surface (open pit) mining and sub-surface (underground) mining.

The entire mineral resource of the Khan Krum deposit is found near the surface. Hence, underground mining would not be a practical and safe option for its extraction. Therefore, the project proposal considers open pit mining and the use of modern environmentally sound methods for mine waste management. The proposed options are limited to the alternative for open-pit mining of the Adá Tepe prospect of the Khan Krum deposit and the "zero" alternative, i.e. that the project will not proceed.

Pit location, size and layout are dictated by geology of the ore body and the determined for mining reserves as topographic and geographic constraints combine to reduce opportunity for locating the plant for production of gold concentrate and mining waste facility. When considering the project design and siting options, the EIS takes account of the following:

- the ore mining method and the siting of the project facilities;
- water supply options;
- the requirements to the environmentally friendly mine waste management (flotation tailings and waste rock).

The different options are analysed on the basis of the above considerations and the related environmental impacts. The preferred alternatives and locations of the facilities for the investment proposal were selected from the reference document on Best Available Techniques for Management of Tailings and Waste Rock in Mining Activities (*Best Available Techniques Reference Document on Management of Tailings and Waste-Rock in Mining Activities, BREF Code MTWR, 2004* - see next section 1.2). The reference document puts particular emphasis on waste minimization and improved physical and chemical stability. The investment proposal for the construction of the Ada Tepe project infrastructure, its operation and closure is made following the guidelines in the BREF document.

1. Evaluation of Alternative Solutions for the Implementation of the Project Proposal

1.1. Alternatives for the Selection of Mining and Processing Methods

1.1.1. Mining Method Alternatives

According to BAT, there are two common methods that can be used to mine the deposit - open pit mining and underground mining *(BREF Code MTWR, section 2.1*)

Open pit mining (*BREF Code MTWR, section 2.1 and figures 2.1 and 2.2*) is used when deposits of commercially useful minerals or rock are found near the surface and the grades of the payable components (Au and Ag in this instance) are relatively low. The main disadvantage of this mining method is the formation of a new, relatively large negative form in the landscape (open pit or borrow), which is a challenge to the rehabilitation of the environment after shut-down of operations. Additionally, another large landscape form may be created – a waste rock stockpile.

Open pit mining of mineral resources is applied in the development of mineral deposits that are close to the surface. Besides how deep the mineral occurrence is located underground, the following factors play a role in the selection of the mining method: surface topography, opportunities for stockpiling the overburden (waste rock or low/poor grade ores lying above), feasible and cost-effective transport arrangements, relevant techniques, technology and mining plant and equipment. All this will be specified in the Life of Mine Plan (mine construction and production, as well as closure and rehabilitation).

Underground mining *(BREF Code MTWR, section 2.1.2*) is used to mine higher grade deposits located at greater depths in the earth's crust. In some cases it is imperative to backfill the mining voids. Underground backfilling is required for the more efficient extraction of the reserves and for prevention of surface caving above the ore bodies. The underground mining option facilitates the management of mine wastes (flotation tailings and waste rock) as it involves partial reclaim and reuse of waste products as fill materials in the underground backfilling process. In the case of close-to-surface low-grade deposits (such as the placer deposits), this option is economically infeasible because it involves higher mine construction and operational costs.

The operation of Ada Tepe open pit is compliant with the BAT requirements. The deposit will be developed by open pit mining, given the relatively shallow mineral occurrence. The ore production will be carried out using drilling and blasting, followed by extraction and haulage of the blasted tonnage (ore and overburden). At present the material will be drilled and blasted on 5 m benches. The blasted tonnage will be loaded by a 120t hydraulic back-pull shovel serving up to five 50t off-road dump trucks. The dump trucks will haul the ore to the ore stock pile in the south end of the deposit. A front-end loader will deliver ore from the ore stock pile to the feed hopper of the jaw crusher. A belt conveyor will deliver the crushed ore to the feed bins in the Process Plant section. The additional necessary mining equipment will include drill rigs, a bulldozer, a grader, water tank trucks and other auxiliary vehicles. *ANFO* type explosives will be used, e.g. Dynolite™, a mixture of ammonium nitrate and 6 % of diesel by weight) for the mining of the oxidized ore in the Upper Zone and waterproof emulsion for the mining of the ore in the Wall Zone Fortis™ Advantage 80). Waste rock will be hauled to the integrated mining waste facility.

1.1.2. Processing Alternatives

There are two possible alternatives for ore processing:

- *Option 1:* Processing of the ore to gold-silver concentrate as the end product based on a combined flowsheet of flotation and gravity separation;

- *Option 2:* Processing of the ore to end metals (so-called dore bullion) based on a cyanide leaching process for extraction of Au and Ag.

- ***Production of gold-silver concentrate (Option 1)***

It is considered that the processing of ore will deploy a combined flotation and gravity separation flowsheet (see section II, item 4.2. above). The methods to be applied are in conformity with the BAT requirements.

Flotation will be the main process for recovery of the gold and silver from the ore *(BREF Code MTWR, section 2.3.1.5, section 3.3.2.2.2)* The process will be performed in flotation banks, where the recovery of the payable components from the waste rock is achieved by conditioning the surfaces of mineral grains based on the different surface chemistry of the gold and silver particles on the one hand and the rock particles on the other. A direct selective flotation flowsheet consisting of one rougher stage, three cleaner stages and two scavenger stages is considered. The following reagents will be used in the flotation process: Collector: PAX (potassium amyl xanthate) and a minimum amount of dithiophosphate; Frother: Cytec OrePrep F 549; Dispersant: Sodium silicate (Na2OxnSiO2, also known as water glass); Sulphidiser: Copper sulphate (CuSO4x5H2O).

The flotation process will be combined with gravity separation to increase recovery efficiencies and maximize precious metals values in the final concentrate (*BREF Code MTWR, section 2.3.1.4*). The process involves selective separation of lighter particles from the heavier particles based on their different densities. It is performed on separation tables

(BREF Code MTWR, Section 2.3.1.4.3) using water, which separates the heavy particles (rich in gold and silver) from the light particles in the rock.

The Au and Ag recoveries are expected to be 85 % and 70 % respectively. The final gold-silver concentrate will be dewatered and packaged for shipment to a custom smelter.

The tailings flow will be thickened in a radial thickener. The thickener overflow will be recycled back into the process after being pumped through the Reclaimed Water Tank. The thickener underflow at 56% solids on average will be pumped into a tailings delivery pipeline for deposition into the Integrated Mine Waste Facility.

- ***Cyanide Extraction of Gold and Production of Dore Bullion (Option 2)***

This option comprises a conventional cyanide process for gold and silver extraction (*BREF Code MTWR, sections 4.3.11.8, 4.3.15, and 5.3*), which includes consecutive process stages of leaching in a sodium cyanide solution and carbon adsorption, elution of loaded carbon and electrowinning of dissolved gold followed by filtration, drying and smelting of the cathode sludge to produce doré bullion. The available silver will be recovered together with the gold.

- ***Leaching and carbon adsorption.*** The leaching and carbon adsorption processes take place in several open topped tanks (with estimated capacities between 250 and 720 m^3) arranged in series – a CIL process (*Carbon in leach* – the carbon adsorbs the gold from the solution as cyanidation of the ore proceeds), or a CIP process (*Carbon in pulp* – the carbon adsorbs the dissolved gold after leaching). Each tank will be equipped with an agitator to ensure optimal mixing and good contact between the ore solids and the cyanide leach solution and, consequently, between the carbon and the cyanide-gold solution. The dissolved gold and silver are adsorbed from the solution onto the surface of activated barren carbon granules introduced into the circuit at the discharge end of the CIL tank series. The rice-sized carbon granules are advanced counter-current to the leached slurry towards the head of the CIL tank series by a combination of airlifts and intertank screens in each CIL tank. The airlifts allow the carbon to be moved through the tanks in the counter-current or opposite direction to the flow of slurry, while the intertank screens retain the carbon in the tank against the flow of the slurry. The carbon granules loaded with gold and silver are removed from the pulp on a screen in the first tank in the CIL tank series.
- ***Elution (carbon desorption)*** The loaded carbon will first be washed with diluted hydrochloric acid and then the adsorbed gold and silver will be eluted. The washed carbon will be processed in a elution column with 2% w/w strength sodium hydroxide and 2% w/w strength sodium cyanide soak solution. The resulting pregnant eluate (gold and silver rich solution) is cooled and advanced to the electrowinning plant.
- ***Electrowinning and Production of Doré Gold*** Gold and silver will be recovered from the pregnant eluate by electrowinning. The depleted (barren) eluate will then be returned to the feed end of the leach and CIL tanks so that remnant gold and silver values can be recovered on to activated carbon and not lost to tailings.

The electrowinning cell cathodes are wrapped with knitted stainless steel mesh onto which the gold and silver will be electro-deposited as sludge. This sludge will periodically be washed into the bottom of the cell and drained through settling and filtration units to produce a damp cake. The cake will be dried in a low-temperature electric oven and will be melted with added fluxes in a smelting furnace to produce a doré alloy.

Carbon granules regeneration and cyanide destruction will take place in the waste solutions.

- ***Carbon regeneration*** The carbon stream will need to be reactivated to maintain efficient adsorption/desorption process. This will be achieved by heating the carbon granules in a rotary kiln at 650°C in steam atmosphere for a period of approximately 15 minutes. The discharge from the kiln will be quenched with fresh water and then re-introduced into the last CIL tank.

- ***Cyanide Destruction*** There are various options for treatment of cyanides (cyanide destruction). The method that is most widely used is known as the INCO process. Sodium metabisulphite ($Na_2S_2O_5$ providing the necessary SO_2) and copper sulphate ($CuSO_4$ - acting as a catalyst) are metered into the open topped cyanide destruction tanks and mixed under intensive agitation and aeration. This destroys the free and weak acid dissociable cyanides transforming them into cyanates, thiocyanates, and other significantly less toxic compounds.
- Tailings Management Facility. The cyanide process option will require construction of a tailings management facility (TMF) for storage of the flotation tailings from the process plant. The TMF is considered to be located in the Kaldzhikdere valley immediately west of the plant site and Ada tepe open pit. The TMF design capacity is 7.235 Mt of tailings for the life of the Ada Tepe operation.

The assessment of the process alternatives recommends Option 1 – the non-cyanide method. The cyanide process option ensures slightly higher gold recovery (approx 95%) but in terms of the site and area specific conditions and public attitudes it is considered environmentally more inappropriate. It is not acceptable for the local community.

1.2. Alternatives for Mine Waste Management - Flotation Tailings and Waste Rock

Two options for disposal of mine waste (flotation tailings and waste rock) from the operation of the Ada Tepe open pit are considered and they both meet the BAT requirements (*BREF Code MTWR, sections 2.4.2 and 2.4.4*). These options are:

- *Option 1:* Co-disposal of waste rock and tailings within a single footprint (IMWF – an Integrated Mine Waste Facility);

- *Option 2:* Separate disposal of mine waste - subaqueous (below a pond surface) deposition of the flotation tailings in a TMF and waste rock stockpiling.

The proposed options are compliant with the BAT requirements for the management of these particular types of wastes, namely:

- Ensure protection of groundwaters against pollution by suitable water management and construction of runoff interceptor trenches *(BREF Code MTWR, section 4.3.10.2);*
- Ensure the stability, a suitable outer face gradient and permeability of the base (bottom) of the mine waste facilities lower than 10^{-8}m/s*(BREF Code MTWR, section 4.3.10.1)*.

Option 1 also allows reduction of the tailings volume and, respectively, of the footprint required for tailings storage – (BREF Code MTWR, sections 4.1 and 4.5);

- ***Integrated Mine Waste Facility (Option 1)***

The rock material with no economic gold and silver values is classified as waste rock, which is generated in the process of exposure of/access to the ore body. It mostly consists of breccia conglomerates with occasional boulders of metamorphic rocks – amphibolites, gneiss and schists. A total of 15 million tonnes of waste rock are expected to be produced during the life of the Ada Tepe mine.

The process (or flotation) tailings are the waste material rejected from the flotation plant after the recoverable valuable minerals have been extracted from the ore feed. About 7.235 Mt of tailings are expected to be generated by the end of the project life. The flotation tailings will be dewatered and thickened (to a final pulp density at 56% solids) prior to disposal into the IMWF. That will enable co-disposal of tailings and waste rock.

The project proposal takes an integrated approach to the management of mine waste in order to minimize the affected area and, respectively, the impact on the environment. The proposed option considers co-disposal of waste rock and flotation tailings in an Integrated Mine Waste Facility (IMWF). The IMWF location and size are shown on the General Site Plan (Appendix 5) The IMWF site is confined by The Krumovitsa River to the east, the open pit to the north, land properties to the north-east and south-west, and the gullies and hills that are part of the local topography.

The concept for the IMWF is that dewatered tailings are placed within cells constructed from mine rock. The outer face of the facility will have a continuous face of mine rock. Mine rock not needed for construction of the outer face will be placed as internal berms to allow mine equipment access. The facility will be developed from the bottom up for stability, starting near the river and building up-hill. The lowest areas of the facility will be stripped of all soils and soft materials to provide a high quality foundation for the facility. An underdrain system will be installed along the base of the ravines and natural drainage channels to collect and convey the rainfall that infiltrates into the facility and the water expelled from the tailings during consolidation to a sump at the toe of the facility. Drainage water will report to collecting sumps at the toe of the facility. Water collected in the sumps will be pumped to the 100,000 m^3 Runoff Storage Pond for re-use in the process.

To prevent tailings being carried through the outer mine rock berm, a two zone filter system will be placed. This will consist of a layer of heavy, non-woven geotextile directly against the mine rock and covered by a layer of sand. The sand will contain the tailings and the geotextile will prevent movement of the sand into the mine rock. During the last year of operation, the tailings and the waste rock will be placed in the pit using the same method of construction.

The tailings will be thickened to approximately 56% solids. For this option, mine rock will initially be placed within the outer berms to create cells to contain tailings.

The tailings will be conveyed via pipeline for discharge into the mine rock cells. When a layer of tailings is completed, the tailings discharge will be moved to another area and the tailings allowed to drain. If the tailings are to be covered in a short period of time, a high strength, non-woven geotextile will be placed over the tailings or mine rock will be pushed onto the tailings. The geotextile will act as a drainage layer for the tailings, will prevent the mine rock from completely displacing the tailings as it is placed, and will provide reinforcement within the IMWF to increase stability. The load of the new tailings or mine rock on the older tailings will consolidate the tailings. The mine rock will be placed to create nearly continuous ribs within the facility and on the outer face to provide strength. It is expected that a portion of the tailings will move into the void space of the mine rock placed internal to the IMWF. As an alternate method of placement, tailings and mine rock may be placed in alternating lifts, called “layered co-mingling.” A layer of mine rock would be placed to provide a level surface behind the outer mine rock berm and filters. Next, a layer of tailings would be discharged over the rock and then covered with a high strength filter cloth and drainage layer, then with another lift of mine rock or a lift of tailings. As the facility is built in successive lifts, the lower tailings are loaded progressively and therefore have time to drain, consolidate, and gain strength.

Drainage and consolidation of the tailings is required for stability.

Consolidation testing indicates that tailings deposited at 56% solids will change in volume by approximately 40% due to release of pore water under a load of approximately 15 m of additional mine rock and tailings. Based on the results of the consolidation analyses presented below, the thickness of individual layers of tailings should be limited to approximately 2 m to reduce the time for tailings consolidation.

The tailings pipeline will require multiple discharge points and pipeline moves. Multiple work areas are required to allow continuous operation of the facility including one area with active tailings discharge, several areas with tailings draining, and one or more areas of cell construction with mine rock. The remaining mine rock would be used to build internal berms and tailings would then be placed within the berms.

The IMWF has a total design footprint area of 41 ha. Its design capacity is 14 million m^3, which is sufficient to accommodate the entire amount of mining wastes generated throughout the mine life of the Ada Tepe portion of the Khan Krum Deposit.

The co-disposal of waste rock and tailings into IMWF as a waste management method has the following important advantages:

- Reduces the area required for disposal and storage of mining wastes;
- Better utilises the storage capacity of the waste disposal facility;
- Enables direct recycling of the process waters on the plant site, where the tailings are dewatered;
- Reduces the risk of spillages during the tailings delivery process;
- Reduces the risk of emergencies resulting in a major uncontrolled discharge during/after a storm event.

The proposed option for disposal of mine waste (Option 1) enables the progressive rehabilitation that will minimise the potential for erosion and dust generation from waste rock disposal. The IMWF will be constructed from the bottom up with horizontal benches up to10 m vertical intervals with the intervening slope constructed at 2.5H: 1V. The outer faces of the backfilled cells can progressively be rehabilitated during project operation. The deposition of the mine wastes into an IMWF and the elimination of the conventional TMF design will reduce the risk of emergencies.

♦ ***Waste Rock Stockpile and Flotation TMF (Option 2)***

The option for separate disposal of mine wastes requires construction of a stockpile for the waste rock and a flotation tailings management facility, which must meet the BAT requirements (*BREF Code MTWR, section 2.4*).

Waste rock stockpile

The proposed analysis and assessment according to Alternative 2 - option for the disposal of waste rock stockpile enabling the progressive rehabilitation of affected stockpile areas, meets the requirements for BAT (*BREF Code MTWR, section 2.4.4*).

The waste rock stockpile under Option 2 can be sited south of Ada Tepe open pit on an area of 44 ha.

The sulphide sulphur content in the oxidised waste rock is below the detection limit, which allows the conclusion that this material is non-acid generating. However, seepage should be collected and recycled back into the process. Overall, the rock is fresh and can be used as construction material for the construction of the TMF embankments. The waste rock is not expected to pollute the environment (the material is considered non-acid generating) and its proximity to the open pit enables progressive rehabilitation of the stockpile outer faces.

Tailings Management Facility.

The TMF option is applicable in both cyanide ore processing and flotation concentration (*BREF Code MTWR, section 2.4.2*).

Under Option 2, a CIL TMF will consist of a rockfill confining embankment (approximately 40 m high) containing some 7.5 million tonnes of cyanide processing wastes at the end operation with total area of about 45 ha. A flotation TMF will have a similar design and operational parameters. The tailings will be delivered as slurry for deposition into the TMF. The TMF is a conventional upstream design including an impoundment with a main confining embankment, upstream embankments, a tailings delivery pipeline and a drainage system.

The BAT reference document for management of tailings (*BREF Code MTWR, section 4.3.11.1*) requires recycling of supernatant water and placing of a lining system depending on the waste characterisation, the design of the facility and the inherent risks. When designing the lining system, the factors that define the *source – pathway – target* model of risk analysis and assessment should be considered:

- The tailings solids are environmentally benign but the liquid phase contains residual levels of reagents, most notably cyanides (including the WAD CN species below 1 ppm);
- Groundwater flows under the TMF bottom;
- Requirements for protective distances to the nearest settlements.

It is necessary to to take preventive measures against instant release of dust emissions from dry beaches in strong wind conditions (*BREF Code MTWR, section 4.3.4*).

The analysis of the project mine waste disposal options gives preference to Option 1 based on the obvious advantages of IMWF as an environmentally sound method for co-management of mine waste (flotation tailings from the process plant and waste rock from pit overburden removal).

1.3. Siting Options for the Project Facilities

The factors dictating the location and geological composition of Adá tepe deposit have no alternative and further consideration is beyond the scope of the analysis. Siting options for the open pit mine cannot be considered because of the unique location of the mineralisation, which can be mined and processed only from the deposit on the hill known as Adá Tepe In this particular case, the Khan Krum gold deposit is close to the surface and underground mining would not be an efficient method for extraction of the mineral resource. The pit siting is dictated by the location of the orebody and only alternative siting options for the associated facilities for flotation and gravity separation for recovery of the gold values to a gold concentrate, and mine waste disposal can be considered.

In accordance with the alternatives for methods and sites for disposal of mine waste (see section 1.2. above) and methods for ore concentration, two alternatives for the location of the main sub-areas of the investment proposal can be considered.

- *Option 1* with separate sites for a process plant, an IMWF and an abstraction well for raw water supply to meet process (and possibly household) demands;
- *Option 2* with separate sites for a dore gold production facility, a waste rock stockpile, a flotation TMF and a water storage dam for raw water supply.

The project sub-sites locations under the two siting options are shown on the General Site Plan (Appendix 5). The total area plus the areas of the included sub-sites according to the alternatives shall be as follows:

Option 1 - about 85 ha including:

- The open pit (Adá tepe) – 17 ha and ore stockpile - 3 ha;
- A facility for the production of gold-silver concentrate (Process Plant) – 6 ha, located south-southwest of the open pit;
- Integrated Mine Waste Facility (IMWF), incl. a low grade ore stockpile - 41 ha, located south-southwest of the open pit, adjacent to the Process Plant;
- A soil material stockpile – 2 ha;

A retention pond (close to the open pit) and two collecting sumps (at the toe of the Integrated Mine Waste Facility) – 4 ha;

- Roads - approx. 12 ha;
- A fresh water abstraction well - located west of the open pit in the Krumovitsa River.

Option 2 - a total area of about 136 ha including:
- The open pit (Adá tepe) – 17 ha and ore stockpile - 3 ha;
- A dore gold production facility – 2 ha;
- A flotation tailings management facility – 45 ha;
- Waste rock stockpile - 44 ha;
- A soil material stockpile – 2 ha;
- A retention pond and collecting sumps – 1 ha;
- Roads - approx. 15 ha;
- A water storage dam - 7 ha - located east of the open pit

According to the analysis (see sections 1.1., 1.2. and 1.4. in this chapter), Option 1 is the most suitable alternative. The entire area required for the implementation of the proposed development is state controlled forest fund land. This land is included in the future concession. No additional land will be required during the construction stage. The closure and rehabilitation stage will extend to all disturbed lands.

1.4. Options for Water Supply and Reduction of Water Use

One of the more important project directives is to provide the water supply without any negative impact on the requirements of the local community and downstream users, which are particularly important during the dry season of the year. The site process water supply design should meet two major criteria:

Ensure normal project operation;

Minimise fresh water consumption.

Two options for water supply have been studied.

- *Option 1* - a fresh water abstraction well in the Krumovitsa gravels, which will also require a one-off abstraction of water from the Krumovitsa River at the start-up of operations;

- *Option 2:* water supply from a storage dam constructed in the Kaldzhikdere valley watershed.

- ***Water supply from a fresh water abstraction well (Option 1)***

Option 1 considers installation of a proprietary fresh water abstraction well in the Krumovitsa River gravels, located east of the open pit. According to the hydrological survey carried out by the Plovdiv-based Vodokanalproject AD, an abstraction of up to 10 L/s from the Krumovitsa River gravels will not derogate existing abstractions for drinking water supply to Krumovgrad and downstream users. The alluvial gravels of Krumovitsa River have sufficient water resources available and the construction of an additional abstraction well is not expected to affect the drinking water supply requirements of the local community. The one-off abstraction of about 100,000 m^3 of water from the Krumovitsa River required at the start-up of operations will take place during a period of high river flow.

The option for installation of a proprietary fresh water abstraction well in the alluvial gravels of Krumovitsa River would ensure 5 L/s (up to18 m^3/h) to the site, which is sufficient to meet the project fresh water requirements. The proprietary well installation would not cause inundation of land or disturbance of the protected area - Eastern Rhodopes.

The economic, social and environmental assessment and the data from hydrological and hydrogeological studies show that the abstraction well option is more suitable and has been given priority for detailed designing.

- ***Water supply from a water storage dam (Option 2)***

According to Option 2, the raw water supply to the site will come from collection and storage of runoff from the Kaldzhikdere watershed into a small storage dam, which will normally be self-filling from the catchment areas with occasional abstractions from the Krumovitsa River. The only possible siting option for the storage dam that is close to the site is the Kaldzhikdere valley (see General Site Plan - Appendix 5) The valley catchment is big enough to maintain the water balance of the facility and the storage dam would have the capacity to ensure supply of approx. 250,000 m^3 of water for a period of 6-12 months. The area required for the construction of the dam is about 7 ha. The problem associated with the dam construction is the likely derogation of habitats that are within the scope of protection in the East Rhodopes Protected Area. The dam height will have to be over 16 m because it should be sited in a shallow portion of the valley. This is quite a big height for a dam especially in relation to the impact that an extreme precipitation event would have compared to the low fresh water requirements.

Options for reduction of water use

The operation of the open pit, the process plant and the IMWF will use the water in a closed cycle, where the reclaimed water will be recycled back into the process at the rougher flotation stage, which meets the BAT requirements (*BREF Code MTWR, section 4.3.11.1*).

A water balance for the project has been developed (see section 2.1.2 in Chapter V), which covers all project areas (open pit, process plant and IMWF) and takes into account all local factors (rainfall, evaporation, catchment areas and topography). The water balance model is developed using the GoldSim simulation environment; a graphical, object oriented software platform. The model simulates the water management processes at the mine from start of operations through to the end of mine life. The water balance has been modeled for three distinct periods - dry, wet and average, with specified water use from an outer source under the conditions of the accepted Option 1. The water balance model provides a good basis for possible minimisation of the industrial water use over the 9-year operational period based on a water recycling system. Based on the water balance model results, it is estimated that 98% of the annual process water requirement of 2,900,000 m^3 will be met from recycling. Fresh water make-up of 64,000 m^3/year (average 7.2 m^3/h) will be supplied from an external source.

Water consumption in ore processing is minimised through systems and facilities that are capable of achieving a high level of recycling. The excess water from the Runoff Storage Pond and the treated domestic effluent, which are assumed to be chemically unpolluted, will report to a Wastewater Clarifier for discharge into the environment without affecting the flow regime or the water quality of the Krumovitsa River.

2. Comparison of the Proposed Technology with the Conclusions of the BAT Reference Documents (according to Article 18 of CoM Decree No. 302/30.12.2005)

The process has the following main stages:

- Open pit mining of ores;
- Ore processing - flotation and gravity separation;
- Disposal of mine waste.

As early as this stage of EIA procedure, a comparison between the proposed technology and the conclusions of the BREF documents has been made in accordance with the requirements. The BREF notes specific for the mining sector are covered by the following reference document (the so-called ”vertical” BREF notes – http://eippcb.jrc.es; Sevilla - Spain): *Best Available Techniques Reference Document on Management of Tailings and Waste-Rock in Mining Activities (BREF Code MTWR, 2004).*

There is no formalised BAT document for mining and processing of gold ores. The EIS considers various alternative options within the context of proven processes, whose environmental, technical and economic advantages are proven worldwide. The preferred alternatives and locations of the facilities for the investment proposal for the construction of infrastructure and operation of the deposit therefore makes comparison with the BAT reference document *(BREF Code MTWR, 2004).* This document mainly considers options for TMF and waste rock management since they are the most significant factor in mining and processing activities.

The reference document puts particular emphasis on waste minimization and improved physical and chemical stability. The investment proposal for the construction of the Ada Tepe project infrastructure, its operation and closure is made following the guidelines in the BREF document.

2.1. BAT in Mining

The ore at Ada Tepe will be open-pit mined. The mining method will be a conventional open-cut, drill, blast, load and haul operation followed by flotation and gravity concentration for recovery of the metal values from the mined ore. The mine rock from overburden removal will be used for construction of the outer face and the internal berms of the IMWF. The mining operations will be carried out in compliance with the BAT requirements.

The proposed option for open pit mining of gold-silver ore meets the BAT requirements (*BREF Code MTWR, section 2.1 and figures 2.1 и 2.2*). The open pit mining method includes separation of mined rock for further processing:

- Waste rock (overburden) - rock material with no economic gold and silver values and no acid-generating potential, which will be placed on a stockpile or heap (*BREF Code MTWR, sections 2.4.5 and 3 - Table 3.2*);
- Gold-silver ore, which will be processed using a combined flotation (*BREF Code MTWR, sections 2.3.1.5 and 3.3.2.2.2*) and gravity separation (*BREF Code MTWR, sections 2.3.1.4*) flowsheet to produce gold-silver concentrate as the end saleable product.

The open pit mining method requires post-operation rehabilitation of the pit and the adjacent areas in order to mitigate the negative impact to the local topography and landscape *(BREF Code MTWR, section 2.6).*

2.2. BAT in Ore Processing

Gold-silver ore processing includes ore crushing in jaw crusher, two-staged grinding in ball mills and a vertical stirred mill with pulp screening, flotation (one rougher stage, three cleaner stages and two scavenger stages), combined with following gravity separation of the product from the cleaner flotation stage to produce gold-silver concentrate as an end product. The tailings from ore processing will be disposed in an Integrated Mine Waste Facility (IMWF). The proposed process flowsheet is in conformity with BAT with regard to all main stages of ore processing, namely:

- *Ore comminution* (*BREF Code MTWR, section 2.3.1.1*) composed of *crushing* (*BREF Code MTWR, section 2.3.1.1.1* – two or more crushing stages in cone, jaw and other types of crushers), *grinding* (*BREF Code MTWR, section 2.3.1.1.2 and figures 2.4 and 2.5* – multistage dry and wet grinding in ball mills, rod mills and autogenous mills), *pulp classification* (*BREF Code MTWR, section 2.3.1.3* – wet classification in hydrocyclones or spiral classifiers).

Ore flotation The proposed flotation flowsheet includes one rougher stage, three cleaner stages and two scavenger stages, which is in conformity with BAT requirements (*BREF Code MTWR, section 2.3.1.5, section 3.1.7.2.2 plus figure 3.45* – multistage flotation in mechanical and pneumatic banks *section 3.3.2.2.2).*

Gravity Separation. The gravity separation method on shaking separation tables has been adopted after review of the various methods used in mineral processing (*BREF Code MTWR, section 2.3.1.4.3).* The light particles from the gravity separation process will form an interim product, which will be recycled back to the regrinding ball mill to further expose the intergrowths.

2.3. BAT in Mine Waste (Waste Rock and Flotation Tailings) Management

The investment proposal includes effective and environmentally sound method for mine waste storage, which is more protective to environment and excels the traditional co-disposal methods – waste rock on stockpiles (*BREF Code MTWR*, *section 2.4.4*) and flotation tailings in various types of tailings management facilities. (BREF Code MTWR, section 2.4.2).

The proposed method is disposal in an Integrated Mine Waste Facility (IMWF) (see section 4.5 in Chapter II and section 1.2 in Chapter III above), where the flotation tailings (thickened to 56% solids) will be placed together with the waste rock from the open pit development. The IMWF design is based on the "*thickened tailings*" method *BREF Code MTWR, section 2.4.3 and figure 2.47)* and further developed to achieve accelerated dewatering and consolidation of tailings by placement of waste rock over it. The requirements of the *BREF* document for deposition of tailings (at 50 to 70 % solids) and arrangement of drainage systems have been implemented. Drainage water will be recycled back into the main process. The important advantages of IMWF as a method and facility for mine waste management are presented in section 1.2. above.

3. „Zero"" (No Action) Alternative

The Project Proposal for Mining and Processing of Auriferous Ores from the Ada Tepe Prospect of Khan Krum Deposit provides an acceptable solution in terms of feasibility and requirements to environmental protection during the operation. The open pit will be sited on a relatively small area, the ore will only be primary processed on the site at an acceptable recovery of the precious metals values to the gold-silver concentrate, which is the end product for toll treatment. The investment proposal includes effective and environmentally sound method for mine waste storage, which includes co-disposal of the waste rock and the flotation tailings in an Integrated Mine Waste Facility (IMWF). The proposed solutions and measures will reduce the emission levels that have an impact on the environment and the local communities considerably below the respective regulated limits.

The "zero" ("no-action") alternative is associated with the following principal potential socio-economic impacts:

- Loss of significant macroeconomic benefits to the Municipality and the state.
- Loss of revenues to the state and municipal budgets
- Deterioration of living standards of the population and supply of social services
- Continued migration undermining the sustainable development and the outlook for the local economy

Loss of significant macroeconomic benefits for the Municipality and state due to:

- Decrease in foreign direct investment capital into Bulgaria with attendant impacts on Bulgaria's balance of payments;
- Decrease in national revenues from the payment of production royalties, custom duties and profit taxes;
- Decrease in municipal revenues through payment of property and asset taxes on project infrastructure, and revenue derived through the sale of municipal property;

- Loss of revenues from taxes and social security contributions from direct and indirect employment generated by the implementation of the investment project proposal.

Loss of revenues to the state and municipal budgets due to:

The delayed start of the project has its socio-economic dimension in terms of lost benefits. If the project had been launched back in 2006 the project construction would have been completed by now (2010) and more than 154 million BGN invested in the national economy and in the regional economy of Krumovgrad Municipality and Kardzhali District. Both the state and municipal budget would have received about 11.4 million BGN, and another 30 million BGN would have been paid for salaries over the 5-year project construction period.

Both the state and municipal budget would have received about 11 million BGN, and another 30 million BGN would have been paid for salaries over the project designing and construction stages.

By 2010, ore mining and processing would have commenced and royalties, VAT, corporate and local taxes, social security contributions, etc. would have been paid.

Estimated Potential Average Annual Benefits	**Value in BGN**
VAT paid (expense)	6,724,569
Customs duties and excise	399,171
Local taxes	479,005
Health and social security contributions	1,785,063
Personal income tax	389,407
Royalty payment	3,734,228
Profit tax under the Corporate Income Tax Act	3,759,707
Salaries paid	4,299,360
Total effect	**21,570,509**

The average annual loss of revenue to both the state and municipal budget is estimated in excess of 21 million BGN.

Deterioration of living standards of the population and supply of social services due to:

- Loss of investment in the municipal infrastructure and provision of additional services (education, health, communications, etc.) due to the low potential for investment by the Municipality and local businesses in times of economic crisis;
- Loss of employment opportunities - Approximately 300 jobs at the peak of the 3-month construction stage, approximately 230 full-time jobs for the 8-9 years of operation and approximately 50 jobs for at least 2 years of closure and rehabilitation.
- Limited employment opportunities especially considering the high official and hidden unemployment rates. Maximum priority will be given to local residents for employment at the mine. They will receive adequate training and qualifications;
- The cumulative negative effect from the non-implementation of the project proposal would be that the living standards of the population would continue to be low with all the associated negative consequences - declining purchasing power,

even stronger decline of the already restricted local economy, deteriorating social services, with a final result - migration of local population.

Continued migration undermining the sustainable development and the outlook for the local economy

Now, the migration rate in the municipality, which is four times higher than that in Kardjali District and mainly covering groups under 39 years of age, continues to be one of the most serious problems the local authorities are faced with.

The "zero" alternative would not only be incapable of stopping that most negative trend in the sustainable municipal development, but would also intensify it. Practice shows that a negative spiral is formed in such cases. The more people, especially young people in active age, depart from an area, the more downward the trend of economic outlook, quality of services and living standards. As a result, a new wave of emigration is encouraged, which leads to greater economic stagnation, etc. A powerful 'engine' is required to break out of this vicious circle and boost the municipal economy, encourage groups to remain in the area and those that have left to consider returning and thus create conditions for sustainable development in the coming years.

Environmental balance - the project proposal of the Company considers a relatively small mine footprint and promotes modern methods and strict measures to control any adverse impacts on the environment and local community. Any risk from a human activities would be minimised by achieving compliance with the relevant standards and meeting the closure and rehabilitation commitments.

Limited opportunities for development of alternative tourism and agriculture - essentially, the project proposal will not cause limitations because the available data strongly suggests that the current development of these sectors is more than limited. The number of registered farmers engaged in alternative farming or agriculture is extremely low and the poor road/hotel infrastructure and declining human resource practically neutralise any potential for expansion of these sectors in the coming years under the existing economic and demographic conditions. The financial analysis clearly indicates that these sectors have not been developed even during times of relative economic prosperity. Now, such development is even more problematic. Just the other way round, the investment in infrastructure, services, more skilled labour, higher consumption and living standards, and return of people as a result of the implementation of the project proposal would create realistic conditions for further development of these sectors. Here, we have to mention that the local communities are highly dependent on tobacco growing for their living, and this business is going to be further restricted by the EU regulations. The need to improve the employment structure becomes more pressing. The above sectors cannot ensure sufficient employment because they require substantial municipal and private investment (such investment is not currently considered in the Municipal and District Development Plan).

Provisions are made for the majority of the project work force to be from the local communities (90% of the workers are expected to be from the Kardzhali District).

The Company intends to use a classical functional unit structure of organisational relations for the project implementation. The operations will be managed by a Managing Director based in Krumovgrad. The main activities are organized in 5 linear functional units (departments) headed by managers:

Personnel Numbers			
Department	Workforce/Staff	Supervisors/	Total

		Managers	
General Manager		1	1
Mining	99		99
- Manager		1	1
Engineering	59		59
- Manager		1	1
Processing	19		19
- Manager		1	1
Administration	38		38
- Manager		1	1
Health, Safety and Environment (HSE)		9	9
- Manager		1	1
Total operations personnel	**177**	**3**	**180**
Total administration	**38**	**12**	**50**
Total employment including management	**215**	**15**	**230**

After completion of the operations under the concession, the local personnel will ensure a highly qualified labour potential that can be employed in the mining business throughout the country.

The expectations for positive effects of the project are related mainly with the areas of greatest concern in the municipality. The realistic views of the people in the municipality consider the circumstance that there aren't any serious prospects to overcome the economic backwardness and the dependence of the region on tobacco production in the near future. A substantial investment such as that of BMM EAD would not only have a direct positive economic effect, but could also create conditions and help accumulate resources for subsequent development of other businesses.

The "zero" alternative is not only an unrealistic option for the development of the region, but it would also cause significant losses and limitations on the economic development, fiscal revenues, direct and indirect employment, living standards and income, development of local economy and continued migration. Provided that all environmental, economic and social commitments are met, the Company's project will become the "engine" driving the development of the region and its future sustainability.

Based on the analysis and assessment of the impacts on the environmental media and human health, the compliance of the proposed mining and processing methods with the BAT, and the social justification of the benefits from the project implementation, there is sufficient reason not to recommend selection of the "zero" alternative.

IV. Description and Analysis of the Environmental Media and Factors, Material and Cultural Assets that are Expected to be Affected Significantly by the Investment Project Proposal and the Interaction between Them.

1. Air

1.1. Brief Characterisation and Analysis of the Climatic and Meteorological Factors Related to the Particular Impact and the Air Quality.

The Ada Tepe prospect of the Khan Krum deposit is located approximately 3 km southwest of the town of Krumovgrad (including residential district Izgrev) Krumovgrad and 100 m west of the Krumovitsa River.

The settlements within the 1,000 m zone from the open pit and the IMWF are: - to the east: Chobanka 1- 380 m (636 m), Chobanka 2 - 330 m (360 m), Kupel - 990 m (500 m); to the north-east: Soyka - 600 m; - to the west: Pobeda - 740 m (980 m). An old tourist lodge, which is half-destroyed (a two-storey building and a couple of bungalows) is located some 700 m north of the IMWF. All other hamlets of the villages of Ovchari, Surnak, Dajdovnik, Edrino, Malko Kamenare, Kuklitsa, and Skalak are at a distance greater than 1,000 m. The settlements that are farther than 1 km from the project site are: - to the east: Dazhdovnik - 1,740 m (1,300 m); to the north: Vurhushka - 1,160 m, Bitovo - 1,090 m, - to the west: Taynik - 1,510 m, Koprivnik - 1,500 m, Skalak - 1,530 m, Belagush - 1,500 m; - to the south: Sinap - 1,470 m (970 m).

According to Bulgaria's climatic division, the project area belongs to the Continental-Mediterranean climatic type, Southern Bulgarian climate sub-area, Eastern Rhodopean river valleys climatic zone. The low-mountainous topography of the Eastern Rhodope Mountains cut by the Krumovitsa River flowing south to the north allows free flow of both Mediterranean and cold continental air during winters.

The The nearest NIHM-BAS gauging station is in the town of Krumovgrad and its hydrological and weather data is used in the document. The winters in the area are mild and the average January temperatures are between 1 and -1.5°C. Cold spells with temperatures below -12°C are rare. Winter precipitation is one of the highest in the country – 250-260 mm, and even higher in the higher parts of the region due to their orography. Springs are warm and come earlier than usual. The average air temperature rises steadily above 5°C at the end of March and above 8°C in April. Spring precipitation remains high – between 140 and 190 mm on average. The summer is quite hot and dry, as the average temperature in July reaches 22 - 24°C, and the maximum temperature in the higher parts are usually between 30 and 32°C. The summer precipitation is one of the lowest - between 32 and 160 mm on average. The fall is warm and the average temperature in October is about 1.5 to 2°C higher than the temperature in April. An increase of the autumn precipitation is observed, especially in late autumn. Precipitation peaks in November, which is related to the higher frequency of the Mediterranean cyclones. The average annual precipitation is about 760 - 770 mm.

Climate characteristics according to meteorological data

1. Sunshine

The amount of sunshine in the region averages 2,249 hours per annum, one of the highest for Bulgaria. Most of it is combined with air temperatures above 10◦C.

Sunshine Duration in Hours (Kardzhali) *Table IV.1.1-1*

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
79	109	146	191	225	261	322	318	250	167	103	78	2249

2. Cloud Cover

The cloud cover directly affects the solar radiation absorbed by the earth. The cloud cover is reported on a ten-point scale (0 - clear sky, 10 - overcast).

Average Monthly Total Cloud Cover (Krumovgrad) *Table IV.1.1-2*

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
6.7	6.0	6.1	5.0	4.7	4.0	2.4	2.2	2.7	4.7	6.4	6.6	4.8

3. Thermal Conditions

Winters are mild, the average monthly temperatures in the winter months being above zero. Springs are cool and summers are hot with average monthly temperatures of above 23°C in the hottest period between July and August. Autumns are warm and the average temperatures remain steadily about 13 - 15°C until October due to the Mediterranean influence.

Average Monthly Air Temperature (Krumovgrad) *Table IV.1.1-3*

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
1.3	3.6	6.5	12.2	17.0	20.8	23.7	23.4	19.1	13.4	8.7	4.2	12.8

4. Air Humidity, Fog

The average air humidity in the area is 59 -81%, the maximum occurring in the winter and autumn months, but with a low fog occurrence.

Average Monthly Relative Humidity (Krumovgard) *Table IV.1.1-4*

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
80	76	74	69	69	65	59	58	65	75	80	81	71

The amount of fog in the region is low, 19 to 20 days per annum. The maximum fog amount is in the winter (about 16.9 days from November to March), dropping to 0.1-0.2 days per month in the summer.

Number of Fog Days by Months (Krumovgrad) *Table IV.1.1-5*

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
2.8	1.7	1.3	0.7	0.6	0.4	0.2	0.1	0.3	3.1	4.2	3.8	19.2

5. Precipitation

Annual precipitation in the region is 760-770 mm. It varies from a maximum of 250 mm in the winter to a minimum of 125 mm in the summer, with the spring and autumn averaging 190-200 mm.

Average monthly precipitation in mm (Krumovgard) *Table IV.1.1-6*

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
83	67	64	60	66	64	37	24	38	73	84	101	761

6. Wind

The data about the windrose patterns and the respective wind speeds and directions are from the Krumovgrad hydro meteorological gauge station and presented in the tables below. The monthly average wind speed is 1.5-2.2 m/sec against an annual speed of 1.8 m/sec.

Average wind speed (Krumovgrad) *Table IV.I.I-3*

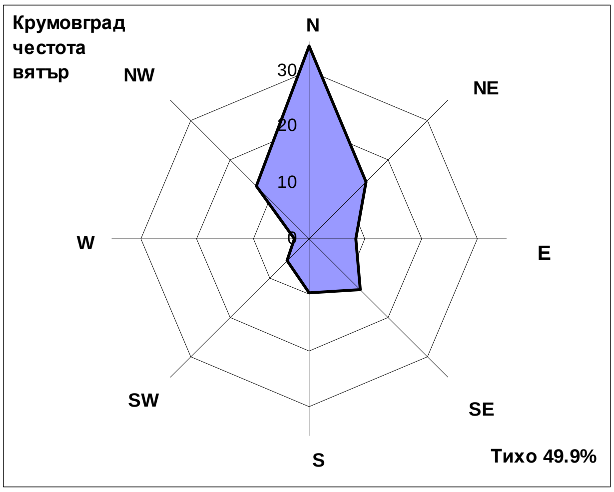
I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
2.1	2.2	2.1	2.0	1.7	1.5	1.9	1.7	1.6	1.6	1.8	1.8	1.8

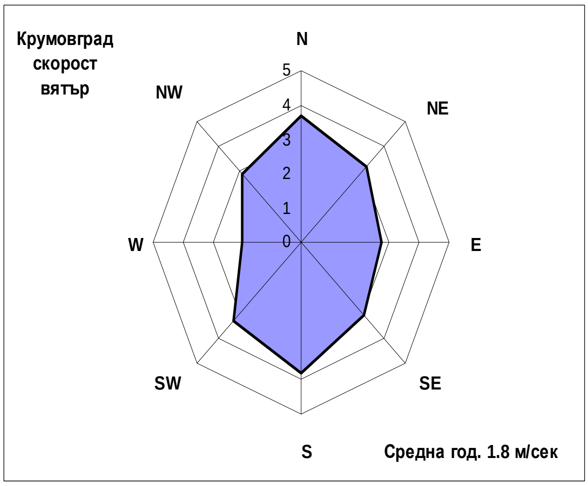
Average wind speed in m/sec by months and direction (Krumovgrad) *Table IV.1.1-8*

Directions	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
N	4	3.8	3.6	3.4	3.3	3.3	3.6	3.5	3.4	3.6	3.5	3.8
NE	3.4	3	3.4	3.1	3.1	2.7	3	3.2	2.9	3	3.1	3
E	3.1	2.9	2.7	2.6	2.6	2.5	2.6	2.6	2.8	2.5	2.8	2.7
SE	3.0	3.3	3.1	3.0	2.9	2.9	2.7	2.6	3	3.1	3.2	3.1
S	3.3	4.9	4.3	4.4	3.3	3.2	3.2	3.2	3.2	4	4.3	4.7
SW	2.7	4.2	3.2	3.7	3.3	3.1	2.8	2.6	2.8	3.2	2.8	4.2
W	1.6	2	2.2	2.6	1.9	2.1	2.0	2.1	2.0	1.6	1.9	1.6
NW	3.0	2.6	2.7	2.7	3.5	2.6	3.1	2.8	2.8	2.5	2.6	2.7

Percentage Frequency of Wind Direction and Calm Weather (Krumovgrad) Table IV.1.1-9

Directions	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
N	**43.5**	**32.6**	**35.9**	**25.3**	**29**	**31.7**	**39.3**	**33.3**	**36.3**	**40.3**	**25.0**	**36.6**
NE	8.5	10.3	12.7	15.2	13.9	15	22.4	21.9	18.7	13.9	8.9	8.7
E	4.5	5.3	10.2	12.4	11.7	10.1	8.5	9.2	10.3	4.3	9.4	3.9
SE	10.3	12.9	12.5	17.8	17.6	12.6	7.5	9.1	7.2	10.1	21.6	13.3
S	11.0	14.9	9.7	10.9	9.0	9.2	3.3	4.3	4.9	9.0	13.5	14.3
SW	5.1	7.8	4.3	7.7	6.1	5.0	4.5	4.7	4.4	5.3	5.0	6.7
W	2.2	3.0	1.7	2.4	2.7	2.7	1.6	4.3	2.2	2.9	2.1	2.9
NW	14.9	13.1	12.8	8.3	10.2	13.7	12.9	13.2	16	14.3	14.4	13.6
Calm	51.3	44.6	41.3	41.9	50	53.7	47.3	49.9	54.3	54.5	54.5	54.3





Graphical model of the windrose in Krumovgrad

The wind direction in Krumovgrad is N-NW/S-SE and the percentage distribution is N (36.6 %), NW (13.6%), S (14.3%), SE (13.3%), with wind speeds ranging from 2.7 to 3.8 m/sec in the respective directions. The percentage of "calm" weather in the region is relatively low for the country (49.9%).

The following meteorological factors have a considerable impact on the dispersion of pollutants:

- *Air temperature* – The annual average air temperature is 12.8°C, the average minimum temperature is 1.3°C, and the average maximum temperature is 23.7°C.
- *Air humidity*. The average annual humidity is 71%, with a maximum during the winter months. The high relative humidity contributes to the entrainment of the finely dispersed particulate matter in the atmospheric surface layer.

- *Fogs*. The maximum relative humidity and cloud cover during the winter period correlates with the fog maximum. The number of fog days for the region is low – about 19-20 days per annum. The maximum fog amount is in the winter (about 16.9 days from November to March), dropping to nearly zero in the summer. Fogs contribute to the elevation of pollutant concentrations in the air but they also contribute to the pollutant dilution by wetting and suspending the particulate matter.

- *Precipitation regime.* Precipitation has a distinctive air cleaning effect. According to Krumovgrad gauge station data, the annual precipitation is 761 mm. The seasonal distribution is as follows: a winter maximum of 250-260 mm, a spring and autumn average of 140-190 mm, and a summer minimum of 120-160 mm. The precipitation effectively reduces the dust level in the air.

- *The wind and the calm weather* influence the degree of horizontal dispersion of the air pollutants. The prevailing wind direction in the region is north/northwest to south/southeast. The percentage of calm weather in the region is very close to the national average – 49.9%.

The analysis of the climatic and meteorological factors in the region shows that most of them are favorable for the air's self-cleaning mechanisms.

1.2. Available Air Pollution Data for the Region. Sensitive Zones

The area is located south of the polluted air basins controlled by the Ministry of Environment and Water (MOEW): VI. Dimitrovgrad (controlled air pollutants: dust, sulphur dioxide, notrogen oxides, hydrogen sulphide, fluoric compounds, lead aerosols) and VII. Kardzhali (controlled air pollutants: dust, sulphur dioxide, notrogen oxides, sulphuric acid, lead aerosols). Due to the remoteness from these basins and the prevalent wind direction (NNW to SSE) the project area is not polluted by industrial activities.

According to the Environmental Atlas of Republic of Bulgaria, the annual emissions of the main pollutants for the Krumovgrad region are:

Table IV.I.2.-1

Item	Pollutant	Krumovgrad (annual emission), $t/km^2/year$
1	Dust	< 0.1
2	Sulphur dioxide	< 0.1
3	Nitrogen dioxide	< 0.1

The area is located in the SE region for air quality management and assessment, with the closest monitoring stations being: Haskovo, RIEW manual sampling - (TSP, PM_{10} (Cadmium and PAH), sulphides and nitrogen dioxides); and - Studen Kardzhali AGS (PM_{10} , AS, Cd, Pb and PAH), sulphur dioxides and SSMP - a standard set of meteorological parameters). The transfer of pollutants from the above atmospheric basins (Kardzhali and Haskovo) can be considered as insignificant due to their relatively big distance from the area.

Background air measurements were undertaken at several locations: Krumovgrad, Pobeda, Vurhushka, Chobanka and Kupel. The monitoring results are presented in the assay certificates issued by the Plovdiv Regional Raboratory of EEA-Sofia.

Air quality measurements at Krumovgrad were performed by the Plovdiv Regional Laboratory of EEA-Sofia on 27 and 28 September 2010 (Certificates 1297/08.10.2010 and 1298/08.10.2010). The results of the air sampling are presented as average hourly values for each sampled pollutant:

Background Air Quality, Krumovgrad *Table IV.1.2-2*

Times	**CO** mg/m^3	**O_3** $\mu g/m^3$	**SO_2** $\mu g/m^3$	**NO** $\mu g/m^3$	**NO_2** $\mu g/m^3$	**PM_{10},** $\mu g/m^3$
Standards	*10 (float. 8-hr. ave.)*	*120 (float. 8-hr. ave.)*	*350 / 125 ave. hourly/ ave. daily*	-	*200 ave. hourly*	*50 ave. hourly*
Regulation 12/15.07.2010						
16-19	0.7 – 3.5	85 - 101	<9* - 11	<9*	<9*	
20-24	3.6 – 5.9	27 - 76	<9*	<9*	<9*	
01-04	6.9 – 9.4	13 - 19	<9*	<9*	<9*	16±1
05-10	0.4 – 0.8	<7* - 19	<9*	<9*	<9* - 9	
11-15	0.4 – 0.8	44 - 104	<9*	<9*	<9*	

* *the measured value is below the detection limit of the method.*
*** float. 8-hr. ave. – maximum 8-hour average limit value per day (24 hours)*

The air sampling at Pobeda was performed on 28 and 29 September 2010 (Certificates 1299/08.10.2010 and 1300/08.10.2010) by the Plovdiv Regional Raboratory of EEA-Sofia. The results of the air sampling are presented as average hourly values for each sampled pollutant:

Background Air Quality, Pobeda *Table IV.1.2-3*

Times	**CO** mg/m^3	**O_3** $\mu g/m^3$	**SO_2** $\mu g/m^3$	**NO** $\mu g/m^3$	**NO_2** $\mu g/m^3$	**PM_{10},** $\mu g/m^3$
Standards	*10 (float. 8-hr. ave.)*	*120 (float. 8-hr. ave.)*	*350 / 125 ave. hourly/ ave. daily*	-	*200 ave. hourly*	*50 ave. hourly*
Regulation 12/15.07.2010						
17-19	<0.3* - 0.5	93 - 105	<9*	<9*	<9*	
20-24	0.3 - 0.5	55 - 85	<9*	<9*	<9*	
01-04	0.4 - 0.5	66 - 73	<9*	<9*	<9*	10±1
05-10	0.3 – 0.4	51 - 67	<9*	<9*	<9*	
11-16	<0.3* - 0.8	75 - 87	<9*	<9*	<9*	

* *the measured value is below the detection limit of the method.*
*** float. 8-hr. ave. – maximum 8-hour average limit value per day (24 hours)*

The air sampling at Vurhushka was performed on 29 and 30 September 2010 (Certificates 1301/08.10.2010 and 1302/08.10.2010) by the Plovdiv Regional Raboratory of EEA-Sofia. The results of the air sampling are presented as average hourly values for each sampled pollutant:

Background Air Quality, Vurhushka *Table IV.1.2-4*

Times	**CO** mg/m^3	**O_3** $\mu g/m^3$	**SO_2** $\mu g/m^3$	**NO** $\mu g/m^3$	**NO_2** $\mu g/m^3$	**PM_{10},** $\mu g/m^3$
Standards	*10 (float. 8-hr. ave.)*	*120 (float. 8-hr. ave.)*	*350 / 125 ave. hourly/ ave. daily*	-	*200 ave. hourly*	*50 ave. hourly*
Regulation 12/15.07.2010						
18-20	<0.3* - 0.5	61 - 69	<9* - 11	<9*	<9*	
21-24	0.3 - 0.4	62 - 69	<9* - 10	<9*	<9*	
01-04	<0.3* - 0.3	50 - 65	<9*	<9*	<9*	10±1
05-08	0.3 – 0.4	36 - 49	<9*	<9*	<9*	
09-12	<0.3*	46 - 78	<9*	<9*	<9*-14	
13-17	<0.3* - 0.4	84 - 96	<9*	<9*	<9*	

* *the measured value is below the detection limit of the method.*
*** float. 8-hr. ave. – maximum 8-hour average limit value per day (24 hours)*

The air sampling at Chobanka was performed on 30 September and 1 October 2010 (Certificates 1303/08.10.2010 and 1304/08.10.2010) by the Plovdiv Regional Raboratory of EEA-Sofia. The results of the air sampling are presented as average hourly values for each sampled pollutant:

Background Air Quality, Chobanka *Table IV.1.2-5*

Times	**CO** **mg/m³**	**O_3** µg/m³	**SO_2** µg/m³	**NO** µg/m³	**NO_2** µg/m³	**PM_{10},** µg/m³
Standards	*10 (float. 8-hr. ave.)*	*120 (float. 8-hr. ave.)*	*350 / 125 ave. hourly/ ave. daily*	-	*200 ave. hourly*	*50 ave. hourly*
Regulation 12/15.07.2010						
19-22	<0.3*	57 - 79	<9*	<9*	<9*	
23-04	<0.3*	51 - 74	<9* - 12	<9*	<9*	
05-10	<0.3*	17 - 38	<9*	<9*	<9*	9±1
11-14	<0.3*	72 - 92	<9* - 9	<9*	<9*	
15-18	<0.3*	87 - 92	<9*	<9*	<9*	

* *the measured value is below the detection limit of the method.*
*** float. 8-hr. ave. – maximum 8-hour average limit value per day (24 hours)*

The air sampling at Kupel was performed on 1 and 2 October 2010 (Certificates 1305/08.10.2010 and 1306/08.10.2010) by the Plovdiv Regional Raboratory of EEA-Sofia. The results of the air sampling are presented as average hourly values for each sampled pollutant:

Background Air Quality, Kupel *Table IV.1.2-6*

Times	**CO** **mg/m³**	**O_3** µg/m³	**SO_2** µg/m³	**NO** µg/m³	**NO_2** µg/m³	**PM_{10},** µg/m³
Standards	*10 (float. 8-hr. ave.)*	*120 (float. 8-hr. ave.)*	*350 / 125 ave. hourly/ ave. daily*	-	*200 ave. hourly*	*50 ave. hourly*
Regulation 12/15.07.2010						
20-22	<0.3*	50 - 52	<9*	<9*	<9*	
23-04	<0.3*	23 - 48	28 - 52	<9*	<9*	
05-10	<0.3*	18 - 26	62 - 69	<9*	<9*	15±1
11-14	<0.3* - 0.5	35 - 76	<9*	<9*	<9*	
15-19	<0.3* - 0.7	72 - 79	<9*	<9*	<9* - 9	

* *the measured value is below the detection limit of the method.*
*** float. 8-hr. ave. – maximum 8-hour average limit value per day (24 hours)*

The air sampling at the above locations around Ada Tepe showed that the background levels of fine particulate matter below 10 µm (PM_{10}) are between 9 and 15 µg/m³ or about 20-30% of the average annual limit for protection of human health, while the nitrogen oxide levels were below the detection limit of the method, i.e. they are negligible. The carbon monoxide levels were also about or slightly above the detection limit of the method.

The ozone background levels were 40-85% of the maximum daily average 8-hour standard. The sulphur dioxide levels are below the detection limit of the method except for Kupel, where at certain times they reached up to 20% of the average hourly limit for protection of human health.

2. Surface and Ground Waters

The project site is within the area of responsibility of the East Aegean Catchment Directorate based in the city of Plovdiv.

The water management must be compliant with the current national laws and legal requirements and any specific short or long-term activities must be consistent with the applicable River Basin Management Plan. This plan is intended to summarise the national requirements and the international commitments the country has as a EU member state. This means achieving full compliance with the requirements and concepts under Directive 2000/60/EC (commonly known as the Water Framework Directive), which aim at achieving and maintaining a certain water status in a consistent and staged manner.

In terms of the project area, **Order No РД-292 /22.03.2010** by the Minister of Environment and Waters approves the ***River Basin Management Plan (RBMP) for the East-Aegean Region,*** which is the main water management tool.

Therefore, the characterisation of both surface water and groundwater bodies that may be affected by the project development or are located in the project area takes into account the data and requirements set out in Volume 1 "General" and Vol. 2 "Arda River" of the RBMP. It also takes into account the baseline studies commissioned by the Investor to investigate the status and characterise the waters in the project area, as well as third-party studies that are considered important for improving the understanding of the water status and impacts, e.g. Technical Assistance for Water Quality Management of Arda River - PROJECT PHARE BG 2003/005-630.05.

2.1. An Overview of the Hydrological and Hydrogeological Conditions and Factors of the Water Resources in the Project Area

- Surface Water Characterisation

The project area is located in the west watershed of the mid-stream portion of Krumovitsa River, a right-hand tributary of Arda River between the Studen Kladenets and Ivailovgrad water reservoirs.

According to Annex VII to the Water Framework Directive, the entire East-Aegean Region lies within Ecoregion 7 - Eastern Balkans. The basin of transboundary watershed system flowing into Greece and is part of the international watershed system of the Maritsa River.

Figure IV.2.1.-1 shows a flow diagram of the Arda River watershed system including the location of the project area.

Arda is the largest Rhodopean river and one of the major tributaries of Maritsa. The watershed area of the Arda River is 5,273 km^2. The river issues from the Ardin Summit at RL 1730 m and discharges into the Maritsa River near the city of Edirne in Turkey. The length of the river to the border is 241 km. The Arda has an average gradient of 5.8‰ and a sinuosity of 1.9. The river network density is 1.32 km/km^2. The main tributaries of Arda has 25 major tributaries including the Krumovitsa River. The average multiannual flow of Arda for the period 1961-1998 is $2{,}289*10^6$ m^3 and the minimum flow is $851.8*10^6$ m^3.

Figure IV.2.1.-1: Flow Diagram of the Arda River Watershed System with the Location of the Project Area (RBMP, Vol. 2)

The basin of the Arda River lies entirely in the Rila-Rhodopean morphographic zone, Rhodopean region, and its watershed is almost entirely in the East-Rhodopean sub-region. The Arda watershed is subject to strong Mediterranean influence and its climate is typical of a Continental-Mediterranean climate,

featuring mild winters and hot summers, small annual temperature variance, maximum precipitation in the autumn and winter and minimum precipitation in the summer, and impermanent snow-cover in the low land areas.

This creates a very good correlation of the annual river flow patterns with the annual precipitation distribution, snow cover and air temperature. The Mediterranean influence is most notable in the easternmost and south-easternmost parts, where the maximum outflow levels occur as early as February and the low flows are typical of the summer. This pattern is typical for the southern tributaries of the Arda River.

The river typology of the Arda River basin indicates that the entire watershed of Krumovitsa River - the main watercourse and its tributaries, belongs to a uniform water body. Table IV.2.1-1 presents river typology data about the project area and the area of confluence of the Krumovitsa River. Figure IV.2.1-2 presents a map of the water bodies.

Table IV.2.1-1

Water body description	Code	Type Code	Type
Main water body available to the project			
Krumovitsa and tributaries	BG3AR200R009	TP 011011	Intermittent rivers
Main receiving stream of the water body			
the Arda downstream of confluence of Krumovitsa to Ivaylovgrad Reservoir	BG3AR100R006	TP 011111	Gravely, semi-mountainous

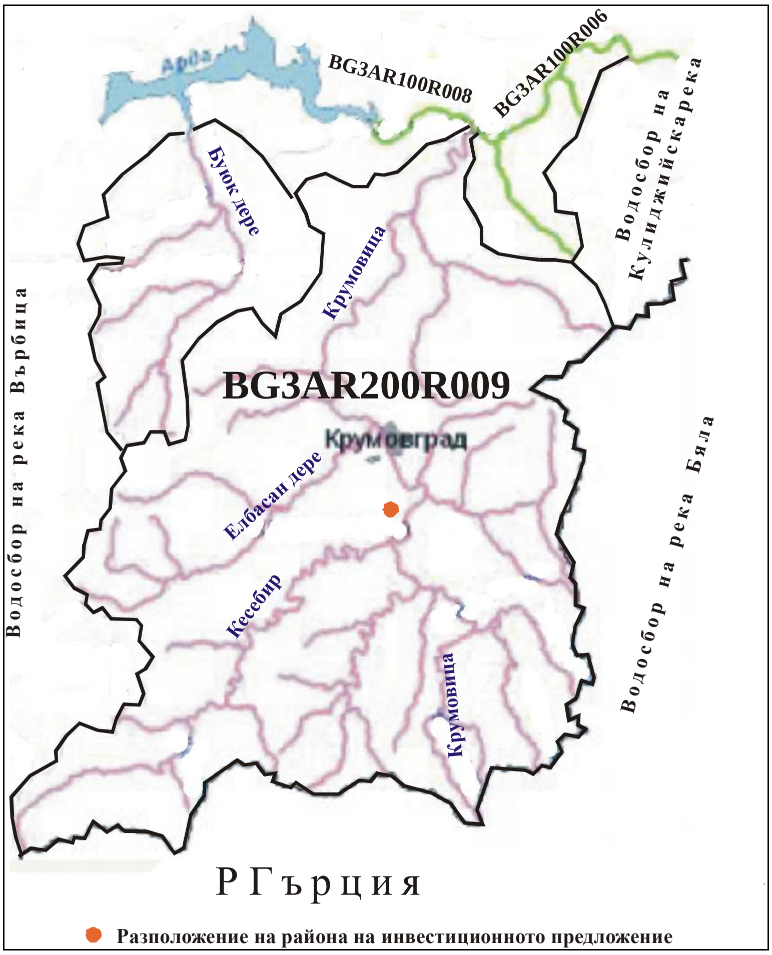


Figure IV.2.1-1:

The Krumovitsa watershed borders on the Varbitsa and Buyuk Dere rivers watershed to the west, the Bulgarian-Greek border -Greek border to the south, the Biala and Kulidzhiiska rivers watershed to the east, and the Arda River.

These boundaries overlap with the positive landscape forms, whose top parts play the role of watershed separating ridges - Figure IV.2.1-3.

Such ridges are the St. Ilia paleovolcano (RL 879 m) to the west and Stramni Rid further south, which separate the Krumovitsa watershed from the Varbitsa and Buyuk Dere rivers watershed. The Maglenik Ridge, which is on the border with Greece, is the main watershed separating structure to the south. The Irantepe heights, which are also paleovolcanic remnants, separate the Krumovitsa watershed from the Biala and Kulidzhiiska rivers watershed to the east.

The more important tributaries are the Virovitsa (Kessebir) River, the Vetritsa (Elbassan) River and the Kaldzhikdere River.

Table IV.2.1.-2 presents the typical Krumovitsa water quantities and Table IV.2.1.-3 and Figure IV.2.1.-4 present the average monthly percentage flow distribution.

Разположение на района на инвестиционното предложение

Figure IV.2.1.-3:

General Characterization of the River Flows of Krumovitsa (under the RBMP)

Table IV.2.1-2

River, station	Watershed area (F), km^2	Typical values			
		Q_{61-98}, m^3/s	$M=Q_{61-98}/F$ $l/s.km^2$	Q_{min}, m^3/s	Q_{max}, m^3/s
the Krumovitsa, at Krumovgrad	497.6	7.320	14.712	2.827	15.100

Average Monthly Percentage Distribution of the Flow of Krumovitsa (under the RBMP)

Table IV.2.1-3

River, station	Month											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
the Krumovitsa River, at Krumovgrad	15.2	22.0	15.3	9.9	6.4	3.3	1.1	0.4	0.7	2.4	6.9	17.1

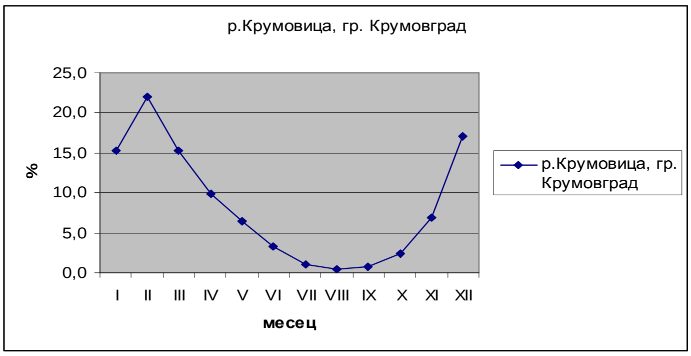


Figure IV.2.1-4:

The main surface water body that may be affected by the project development is the Krumovitsa River, which is the nearest one and the main receiving stream of project wastewater after treatment.

The Investor has commissioned a hydrological investigation and assessment of the project area. The assessment provides the expected most likely condition of the surface waters in the project area during the project life based on the available factual information. The more important conclusions and data are presented below.

The Krumovitsa River issues from the southern border ridge (Maglenik) of the Eastern Rhodopes and flows northwards and north. Its total length is 58.5 km, and its watershed area is 670.8 km^2. At the Krumovgrad gauge station (HMS 61550, which is the only one in the river watershed), the river has:

– length of 37.3 km;
– watershed area of 497.6 km^2;
– average gradient of 19‰;
– average altitude above sea level - 494 m;
– river network density of 1÷1.5 km/km^2;
– average vegetation cover in the watershed of 35% reaching up to 90-100% in the upper parts and down to zero around Krumovgrad.

The soils, which are mainly cinnamon low saline and sandy and clayey-sandy, stony in composition, have eroded severely in the conditions of deforestation, and their water regulation capacity is very poor. This causes rapid runoff from precipitation, which is predominantly rain in this climatic area of Southern Bulgaria.

The poor soil retention also contribute to the formation of many short-period surface water flow events that follow the precipitation intensities very closely. This creates a very good correlation of river flows with seasonal and monthly extreme precipitation values: maximum levels during November-March and minimum levels in July, August and September.

The river flow extreme values are exacerbated by seasonal weather factors such as temperature and humidity of air. Lower temperatures and higher air humidity in winter are not conducive to evaporation which also increases the maximum outflow levels. High temperatures and low air humidity in summer reduce the river flows and can render surface flow manifestations non-existent along the middle and lower stretches of the catchment.

The river flow fluctuation amplitude is very high. Regarding the average monthly values, the maximum monthly average value (in February) exceeds the minimum monthly average value (in August) by a factor of more than 50 while the same factor for the monthly precipitation values is far lower, at 3.5 to 3.7.

Concerning the absolute average monthly extreme values of river flows, the above factor is higher than 1300. This is evidence of the extremely torrential nature of river flows in the region – very high maximal and almost zero minimal water quantities.

The most general characterisation of the river flows expressed using the so-called average flow modulus is:

- winter flow - 15÷45 L/s.km^2;
- spring flow - 8÷25 L/s.km^2;
- summer flow - 2÷10 L/s.km^2;
- autumn flow - 7÷20 L/s.km^2;

The average multiannual level of the runoff coefficient, which is the ratio of the average flow expressed as depth of water and the the average precipitation depth, varies between 0.36 and 0.72.

The minimum flow modulus averages between 0.3 and 0.5 L/s.km^2.

The main hydrographic and flow characteristics of the surface waters in the project area are presented in Tables IV.2.1-4 and 5.

The same assessment presents a conceptual surface water balance for the alternative for construction of artificial lakes - for water supply or tailings management. The most important conclusion is that the results indicate moisture deficiency, i.e. the evaporation from open pond surfaces will exceed the recharge from precipitation.

For example, the two scenarios under the alternative for construction of a TMF in the Kaldzhikdere valley are:

RL 320 m and open pond surface of 1,088x10^3 m^2:

– Recharge from precipitation 692 mm 752.9 x10^3 m^3/year
– Evaporation losses 1,031 mm 1,121.7 x10^3 m^3/year
– Deficit 368.8 x10^3 m^3/year or 42.1 m^3/h

RL 300 m and open pond surface of 512.5x10^3 m^2:

– Recharge from precipitation 685 mm 752.9 x10^3 m^3/year
– Evaporation losses 1,049 mm 537.6 x10^3 m^3/year
– Deficit 186.5 x10^3 m^3/year or 21.3 m^3/h

The status of surface water is assessed by the magnitude of the anthropogenic pressures and impacts.

For the basin of the Arda River these are grouped as follows:

- point sources - urban wastewater;
- water flow regulation and morphological alterations;
- point sources - industry;
- diffuse sources - agriculture;
- other diffuse sources - diffuse pollution by wastes;
- water abstraction;
- other pressures - watershed erosion, pollution from old mines, dry spells and deficiency of water or unknown pressures.

The major impact on the water body including Krumovitsa and its tributaries is from the direct discharge of untreated municipal effluents (Figure IV.2.1-5) and extraction of gravels from the riverbed (Figure IV.2.1-6). There are no sources of industrial wastewaters nor areas that are identified as potentially impacted by agricultural sources.

There are no surveillance and operating monitoring stations in the Krumovitsa watershed. Currently, only one station is maintained as part of the investigative monitoring network - this is Station BG3AR00021MS0050 located downstream of confluence of Krumovitsa with its right tributary Dyushundere Rivier.

Investigative monitoring is undertaken when the surface water bodies are found to be in a poor condition.

In this case, bilogical elements are monitored - macrozoobenthos and fish, and major physical and chemical indicators.

Hydrographic Characteristics, Water Balance Elements and Average Annual Flows Table IV.2.1-4

#	River, station	Watershed area, km^2	Average elevation above sea level, m	Watercourse length, km	Average river gradient, ‰	Multiannual values derived from empirically determined relations						
						Modulus, $L/s.km^2$	Flow rate, m^3/s	Flow volume, $x10^6\ m^3$	Annual precipitation, mm	Total flow depth, mm	Total evaporation loss, mm	Runoff coefficient K**11**/K**10**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1	Krumovitsa, Gauging Station 61550	497.60	494	56.3	11.9	12.5	6.22	196.2	757	394	363	0.520
2	Krumovitsa, upstream of Krumovgrad and downstream of confluence with Iskachdere	348.90	553	47.8	13.8	13.7	4.78	150.7	779	432	347	0.555
3	Krumovitsa, downstream of confluence with Kessebir	291.00	508	41.3	15.6	12.8	3.72	117.3	762	404	358	0.530
4	Krumovitsa, upstream of confluence with Kessebir	167.40	487	23.0	29.7	12.3	2.06	65.0	755	389	367	0.514
5	Kessebir, at confluence point	123.60	536	41.3	15.6	13.4	1.66	52.3	773	423	350	0.547
6	Kaldzhikdere, at confluence point	5.54	337	5.0	36.0	9.09	0.0504	1.589	699	287	412	0.411
7	Elbassandere, at confluence point	121.50	366	22.0	24.8	9.73	1.182	37.3	710	307	403	0.432
8	Kaldzikdere, downstream of Ada Tepe	3.99	356	3.2	39.1	9.51	0.0379	1.195	706	300	406	0.425
9	A gully close to Kuklitsa Village	3.51	447	2.5	56.0	11.5	0.0404	1.274	740	363	377	0.491
10	A gully east of Surnak Village, an ephemeral course south of Gyunuktepe	2.30	409	1.7	73.0	10.7	0.0246	0.776	726	337	389	0.464
11	A gully close to Kupel Village	1.91	325	2.2	85.0	8.82	0.0168	0.530	694	278	416	0.401

Typical Annual Water Quantities for Various Probabilities

Table IV.2.1-5

#	River, station	Flow quantity m^3/s	Flow quantities in m^3/s and their probability, %						
			1	5	25	50	75	95	99
1	Krumovitsa, at the Gauging Station	6.22	14.94	11.51	7.75	5.78	4.26	2.68	1.90
2	Krumovitsa, upstream of Krumovgrad and downstream of confluence with Iskachdere	4.78	11.48	8.85	5.96	4.45	3.27	2.06	1.46
3	Krumovitsa, downstream of confluence with Kessebir	3.72	8.94	6.89	4.64	3.46	2.55	1.60	1.14
4	Krumovitsa, upstream of confluence with Kessebir	2.06	4.95	3.81	2.57	1.92	1.41	0.888	0.630
5	Kessebir, at confluence point	1.66	3.99	3.07	2.07	1.54	1.14	0.715	0.508
6	Kaldzhikdere, at confluence point	0.0504	0.1211	0.0933	0.0628	0.0469	0.0345	0.0217	0.0154
7	Elbassandere, at confluence point	1.182	2.84	2.19	1.47	1.10	0.810	0.509	0.362
8	Kaldzikdere, downstream of Ada Tepe	0.0379	0.0910	0.0702	0.0472	0.0352	0.0260	0.0163	0.0116
9	A gully close to Kuklitsa Village	0.0404	0.0970	0.0748	0.0503	0.0376	0.0247	0.0174	0.0124
10	A gully east of Surnak Village, an ephemeral course south of Gyunuktepe	0.0246	0.0591	0.0455	0.0307	0.0229	0.0169	0.0106	0.0075
11	A gully close to Kupel Village	0.0168	0.0404	0.0311	0.0209	0.0156	0.0115	0.0072	0.0051

Figure IV.2.1-5: Discharge of household wastewater

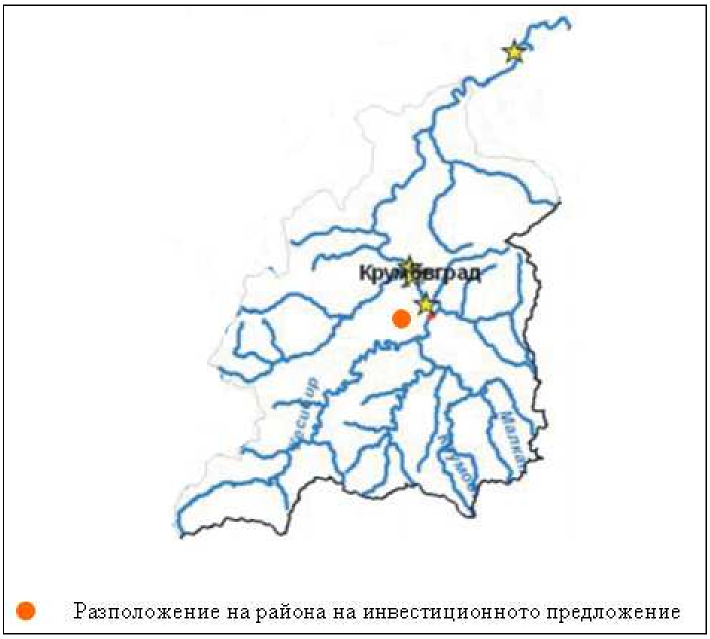


Figure IV.2.1-6: Locations of quarrying operations

Table IV.2.1-6 presents the evaluation of the water status of the Krumovitsa watershed.

Table IV.2.1-6

Code	Water Body	Type	Environmental status/ potential 2009	Chemical status	General status	Note
BG3AR200R009	the Krumovitsa and its tributaries	TR24	3	good	poor	moderate
BG3AR100R006	Topolnitsa River Arda downstream of confluence of Krumovitsa to Ivaylovgrad Reservoir	TR27	4	poor	poor	

Table IV.2.1-7 presents the evaluation of the water status of the Arda and Krumovitsa Watershed (Based on the Results of the Phare Project /4/).

Table IV.2.1-7

River	Point	BI 2000	BI 2001	BI 2002	BI 2003	BI 2004	BI 2005	BI 2006	River Type
Arda River	Potochnitsa-Rabovo			2	2	2	2		Medium size rivers
Arda River	downstream of confluence with Krumovitsa, Oreshari Village bridge	2.5	1	3	3		3		Medium size rivers
Krumovitsa River	a bridge between Avren and Devisilivo Villages		3	3.5	3.5	3.5	3.5	3	intermittent
Krumovitsa River	upstream of Krumovgrad	3	i	1	i	i		2	intermittent
Krumovitsa River	downstream of Krumovgrad	3	2	1	3	3	3		intermittent
Krumovitsa River	Gorna (Dolna) Kula Village	2.5	2.5	1.5	3		3		intermittent
Krumovitsa River	prior to confluence, bridge of Moriantsi Village	2.5	i	1	2.5	2.5	3	3	intermittent
Kessebir	at Buk Village		i	3	3	3	3		intermittent
Kessebir	at Tihomir Village							3	intermittent
Kessebir	at Kandilka Village							3	intermittent
Malkata	prior to confluence		i	3	3			3	intermittent
Kodzhadere	at Malko Kamenyane	4				3	i		intermittent
Goliamata	a bridge to Egrek Village		1.5	3	3	3	3		intermittent
Golemi Dol	confluence		i	1	i	i	i	i	intermittent

Colour code and symbols

Water Status	
	high
	good
	moderate
	poor
	bad
1- 5 Biotic Index (BI) values	
i - intermittent (low waters)	

Biotic Index Values

Biotic Index	Categories under Regulation 7	Water Quality.
5 ; 4-5	I	clean, unpolluted waters of high quality
4	I	clean, unpolluted waters of good quality
3-4	II	slightly polluted waters
3	II; III	slightly to moderately polluted waters
2-3	III	moderately polluted waters
2	III; outside categories	seriously polluted waters
1-2 ; 1	outside categories	extremely polluted waters; environmentally damaged section of the river

The biological quality assessment of the surface stream waters is undertaken in accordance with the Methodology for Biological Quality Assessment of Surface Stream Waters (04/1998) approved by the Minister of Environment and Waters. This method enables an integral assessment of the overall pollution level by analysis of communities of indicator benthic macroorganisms (macrozoobenthos). The hydrobiological studies indicate the cumulative effect of the pollutants on the environment using appropriately selected bioindicators.

Krumovgrad has a sewer system (except for the Izgrev Quarters) and the majority of wastewater discharge directly reports to the Krumovitsa River, while the remainder reports to cesspits.

The Kessebir, Kaldzhikdere, Elbassan and Krumovitsa rivers are Category II receiving streams according to the Categories of Surface Waters in Water Bodies approved by the Minister of Environment and Waters (Order RD-272/03.05.2001).

The impact from the project development on the surface waters will affect an area equal to the project footprint of the main production facilities. Practically, the water courses and flow regime in that zone will be modified. This mostly applies to the diversion of waters to sumps and their use in the process. Their subsequent re-use (recycling) into the process would create conditions that reduce the runoff flows from the project area to the Krumovitsa River. Another type of impact is the discharge of treated wastewaters into. the Krumovitsa River.

- Groundwater Characterisation

The project area is located in the East-Rhodopean sub-region, which is part of the Rila-Rhodopean region. Groundwater availability and resources depend on the physiographic conditions - climate, landscape, hydrology, soil cover, vegetation, etc., and on the geological setting of the area - geology, lithology and structures. These are the natural factors. On the other hand, groundwater quality and quantitative status are highly dependent on non-natural factors defined by anthropogenic activity - abstractions for various uses, discharge of wastewaters from various activities, developments on groundwater recharge areas, e.g. agriculture.

Interstitial and fissure-flow groundwaters are the dominant types that occur in the project area. The interstitial groundwaters occur in the valley of Krumovitsa and some of its tributaries, while fissure-flows are practically found across the rest of the area.

Table IV.2.1-8 below presents the characteristics of the groundwater bodies (aquifers) that are identified in the project area:

Table IV.2.1-8

Aquifer name	Aquifer code	Aquifer area, km^2	Primary aquifer characteristics					
			Type	Overlying strata in the recharge zone	Aquifer lithology	**Average aquifer depth, m**	**Average transmissivity, m^2/d**	**Average permeability, m/d**
Interstitial groundwaters in the Quaternary deposits - Arda River	BG3G000000Q010	101	unconfined	clayey sands	**sands, gravels, clays, boulders**	5		90
Fissure-flow groundwaters, Krumovgrad-Kirkovo zone	BG3G00PtPg2023	217	unconfined	Soil	**Organogenic limestones - calcareous sandstones, marls, marbles, calcoschists**			0.016 -0.08
Interstitial groundwaters - Central Rhodopean complex	BG3G00000Pt046	4367	unconfined		**gneissic schists, granitised biotite and two-mica gneiss, migmatites, schists**			

Table IV.2.1-8 (contd.)

Aquifer name	Aquifer code	Aquifer area, km^2	Secondary aquifer characteristics				
			Aquifer recharge area, km^2	**Average groundwater flow modulus, L/s.km^2**	**Natural resources, L/s**	**Identified aquatic or terrestrial ecosystems, or surface water bodies that are linked to the aquifer**	**Direction and level of exchange with surface waters**
Interstitial groundwaters in the Quaternary deposits - Arda River	BG3G000000Q010	101	101	2	**202**	-	
Fissure-flow groundwaters, Krumovgrad-Kirkovo zone	BG3G00PtPg2023	217	217	0.5	**110**	-	
Interstitial groundwaters - Central Rhodopean complex	BG3G00000Pt046	4367	4367	1	**4370**	**Hambar Dere (protected site), Kazak Village**	

Figure IV.2.1-7 shows the aquifer configuration and the location of the project site.

The project footprint partly overlaps the aquifer identified as BG3G00PtPg2023 - Fissure-flow groundwaters, Krumovgrad-Kirkovo zone.

It is evident from data presented in Table IV.2.1-8 that this aquifer has the lowest water potential - its modulus is 0.5 L/s.km^2. Water abstractions from this aquifer primarily meet local requirements.

Of particular interest in the project area are the waters accumulated in the Quaternary deposits (aquifer code BG3G000000Q010) of the Arda River.

Continuous alluvial deposits are formed along the middle and lower stretches of Arda, where the landscape flattens. This aquifer includes the alluvial deposits of both Arda and its major tributaries: Perperek, Varbitsa and Krumovitsa.

Continuous alluvial deposits are formed along several river stretches in the Krumovitsa catchment, which are presented in Table IV.2.1-9.

Table IV.2.1-9

River	Stretch
the Krumovitsa River	from Ovchari Village to Arda River
the Elbassan Dere	from Dilyana Village to Krumovitsa River
the Buyuk Dere	from Podrumche Village to Krumovitsa River

Water in the alluvial aquifers is recharged by precipitation, by inflowing tributary or fissure flow water along the river valleys, by river water penetrating into the floodplains and by high water along the rivers. An unconfined groundwater flow has been formed in the alluvials, which generally flows in the direction of the hydraulic gradient of the river watershed.

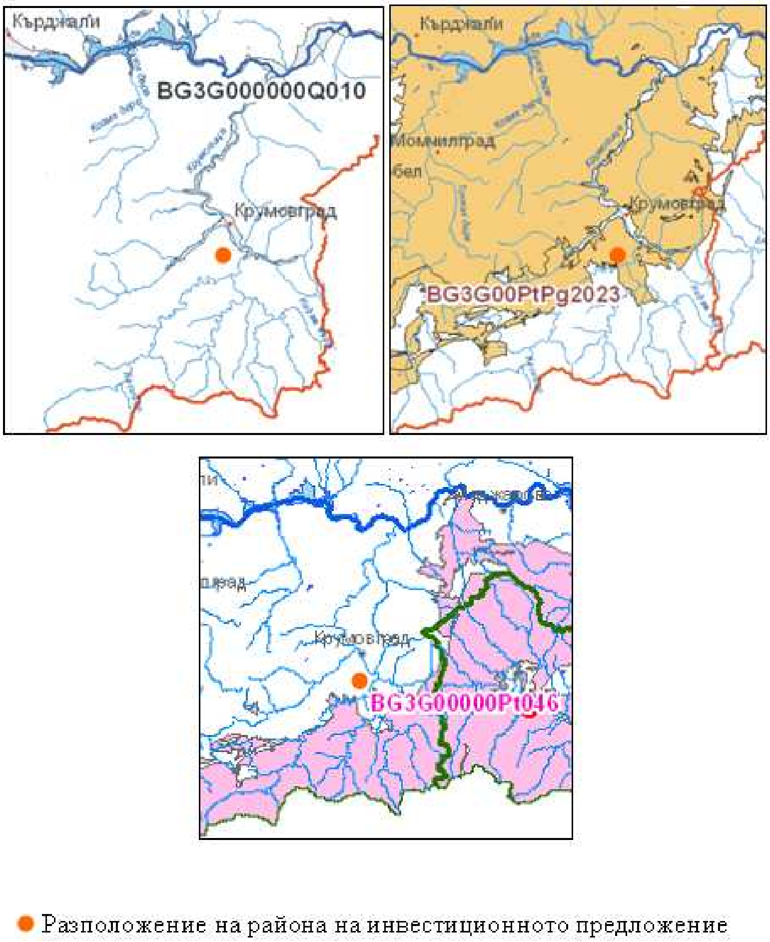


Figure IV.2.1-7:

The alluvial aquifer is drained by the rivers and artificially by the existing water abstractions.

It has relatively good permeability.

The interstitial groundwaters in the Quaternary deposits are mostly calcium-sodium-bicarbonate type of water with average mineralisation of about 0.5 to 0.6 g/L.

The fissure-flow groundwaters in the Paleogene sediments are associated with the weathering zone of the overlaying volcanic rocks, which comprise rhiolites, andesites, dacites, their laval breccias, as well as with the consolidated sedimentary rocks. Their abundance is mainly controlled by the regional weathering patterns and tectonic structures in the rocks. Higher abundance is associated with the tectonic structures. These rocks form a common aquifer with the overlaying alluvial, deluvial and colluvial deposits. A common unconfined aquifer is formed where the water level depends on the landscape and is several scores of centimeters to 7-10 m below surface. The seasonal fluctuation of the water level is 0.3-0.4 m. The groundwater is recharged by precipitation and drained by springs in the lower parts of the land surface, whose flow rates vary between 0.06 and 0.2 L/s, and rarely higher. Due to the shallow circulation of groundwater, the flow of these springs is intermittent and some even dry up in the summer.

The groundwaters in the the Oligocene volcanic sediments are relatively fresher - their mineralisation averages 0.4 g/L. They are mostly bicarbonate and bicarbonate chloride type, calcium-sodium and calcium-magnesium type, with some combination of sulphate.

The fissure-flow groundwaters in the Late Paleogene acidic effusions are calcium-sodium-magnesium-bicarbonate type, with some combination of chloride, and with average mineralisation of 0.25 g/L.

The fissure-flow groundwaters in the Proterozoic rocks are associated with the zone of weathering and tectonic jointing of metamorphic rocks.

The water circulation takes place close to the land surface. The groundwaters are recharged by precipitation and drained by a multitude of springs, whose flow rates vary between 0.02 and 0.2 L/s, and rarely higher. The rocks of the Pre-Rhodopean Supergroup and more specifically those of the Arda Group are significantly less abundant in water, where the spring flows do not exceed 0.02-0.05 L/s. The Eastern Rhodopes have been subject to extensive exploration drilling. The majority of the completed drillholes are either slightly wet or completely dry.

The water in the metamorphosed crystalline complex are calcium-magnesium-bicarbonate and magnesium-calcium type, with some combination of sodium. The mineralisation values vary from below 0.1 g/L to 0.6 g/L.

In general terms, the project area is relatively less abundant in groundwater resources due to the specific conditions that control the water exchange balance.

The Investor commissioned geotechnical and hydrogeological investigations of the concession area and the region.

The objective of the first investigation was to identify the preferred site for construction of the IMWF under Option 1.

The objective of the second investigation was to identify the preferred site for construction of a TMF (Option 2) as an alternative process waste management option considered as part of the selection of the preferred ore processing alternative. The specific objectives of the investigations were:

- To characterise the ground conditions on each of the potential sites for construction of the IMWF (Option 1) and the main embankment of the proposed TMF (Option 2);
- To study the foundation conditions for each IMWF or TMF (main confining embankment) siting option and prepare a flowchart of the groundwaters in the area;
- To install piesometers enabling ongoing monitoring of the groundwater table;
- To install monitoring wells in the area of the selected waste management facility to enable groundwater monitoring over the construction and operation of the facility.

Whether a TMF or an IMWF is a viable option or not, the investigation results are very useful to improve the understanding of the area, especially of the Paleogene rocks, and will be summarised here for the sake of evaluating the ground permeability properties.

2.1.1 IMWF Site Investigation (Option 1):

The scope of work included drilling of 8 boreholes (abstraction wells) with a total length of 220 m and installation of piesometers in them, collection and analysis of 28 samples from the exposed lithological types, completion of 39 pumping tests to establish the permeability of the basement rocks, collection and analysis of 6 groundwater samples.

The permeability of the exposed lithological types was determined by alternating inflow and outflow across the abstraction well screen. The abstraction wells were subsequently converted into piesometers. Table IV.2.1-11 presents the borehole data.

Table IV.2.1-11

Borehole #	BMM code	Borehole design		Water level m	
		L, m	∅, mm	relative to ground level	relative to mean sea level
BH-Plant-001	ATDDGT 036	35.00	88.9	33.55	359.95
BH-IMWF-003	ATDDGT 037	25.00	88.9	13.63	370.66
BH-IMWF-007	ATDDGT 038	40.00	88.9	25.39	379.45
BH-MWP-001	ATDDGT 039	25.00	88.9	15.55	413.25
BH-IMWF-008	ATDDGT 040	30.00	88.9	17.45	394.17
BH-IMWF-006	ATDDGT 041	20.00	88.9	12.08	382.03
BH-GWM-001	ATDDGT 042	25.00	88.9	5.64	371.63
BH-GWM-002	ATDDGT 043	15.00	88.9	2.09	226.79

Note: Boreholes BH-GWM-001 and BH-GWM-002 were drilled outside the IMWF footprint for the purposes of the future groundwater monitoring.

The investigation concludes:

Of the exposed lithological types, 23% are impermeable (q < 0.001 L/s.m), 41 % are low permeable (q = 0.001 ÷ 0.01 L/s.m), 26 % are permeable (q = 0.01 ÷ 0.1 L/s.m), and 10% are medium-permeable (q = 0.1 ÷ 1.0 L/s.m). Water permeable are mostly the first 0.5 m of the Quaternary sediments, which will be manipulated during the construction, and some deep fracture zones in the metamorphic rocks.

The permeability of the lithological types identified as part of the investigation completed in the IMWMF area varies from 0.00 to 0.48 m/d. The metamorphic rocks, which will be the base of the IMWF cells, show permeability values in the range of $n.10^{-7}$ m/sec to $n.10^{-9}$ m/sec, and 0.00 in the most impermeable zones. The data from the investigations completed back in 2009 show that the Quaternary sandy-clayey deposits on the surface have permeability in the range of $n.10^{-7}$ m/sec to $n.10^{-8}$ m/sec.

A total of 6 samples were collected after the installation of all the piesometers and monitoring wells for groundwater chemical characterisation. The groundwater sampling points were ATDDGT 037, ATDDGT 038, ATDDGT 039 and ATDDGT 040. The results are shown in Table IV.2.1-12 and indicate good condition of the groundwater as compared to the standard set out in the Regulation 1/2010. Borehole ATDDGT-040 (located north-northwest on the perimeter of the facility) indicates elevated concentrations of antimony, which is associated with the frequently occurring quartz veins in the gneiss rocks in this area. The initial sampling in this area had the objective to establish the background characteristics of groundwater to provide the basis for the future monitoring during project construction and operation.

Table IV.2.1-12

Parameter	ATDDGT-037	ATDDGT-038	ATDDGT-039	ATDDGT-040	Standard, Reg. 1/2010
pH	6.9	7.51	7.34	7.29	6.5
Conductivity	662	438	517	514	<2000
Total hardness	6.41	3.92	4.25	4.49	<12
Permanganate oxidisable C	0.97	1.43	2.02	0.75	<5
NH_4^+	0.058	0.226	0.175	0.227	<0.5
NO_2^-	<0.05	0.064	<0.05	0.15	<0.5
NO_3^-	0.37	0.77	<0.10	5.6	<50
F^-	0.27	0.29	0.2	0.25	<1.5
PO_4^{3-}	<0.10	<0.10	<0.10	0.28	<0.5
SO_4^{2-}	47.9	12.4	25.4	21.7	<250
Cl^-	21.5	8.5	8.6	12.7	<250
Na	20.4	14	19.2	20.8	<200
CN^-	<2	<2	<2	<2	<50
Hg	<1.0	<1.0	<1.0	<1.0	<1.0
Cd	<1.0	<1.0	<1.0	<1.0	<5.0
Cu	0.004	0.007	0.0068	0.0066	<0.2

Ni	10.9	5.4	<2.0	2.6	<20
Pb	<10	<10	<10	<10	<10
Se	<10	<10	<10	<10	<10
Cr	<1.0	<1.0	<1.0	<1.0	<50
Al	51.3	107.9	131.2	50.2	<200
Fe	100.6	188.3	9.7	40.3	<200
Zn	0.0141	0.0117	0.0115	0.0042	<1.0
B	0.0108	0.0092	0.0094	0.0051	<1.0
Sb	<5.0	<5.0	<5.0	22.4	<5.0
As	<10	<10	<10	<10	<10
Mg	28.85	15.82	13.41	11.98	<80
Ca	80.7	52.3	63	70	150
Uranium (natural)	<0.001	<0.001	<0.008	<0.001	<0.06

2.1.2 TMF Site Investigation (Option 2):

The scope of work included drilling of 14 boreholes with a total length of 730.10 m, vertical electrical sounding at 10 locations, excavation of 6 trial pits with a total depth of 8.90 m, collection and analysis of 28 samples from the exposed lithological types, completion of 108 pumping tests to establish the permeability of the basement rocks.

The permeability of the exposed lithological types was determined by alternating inflow and outflow across the well screen. The abstraction wells were subsequently converted into piesometers or monitoring wells. Table IV.2.1-10 presents information about the boreholes.

Table IV.2.1-10

Borehole #	BMM code	Borehole design		Water level m	
		L, m	∅, mm	relative to ground level	relative to mean sea level
BH 09-01	ATDDGT 028	61.3	122.8	12.93	345.86
BH 09-02	ATDDEX 034	182.5	75.8	6.30	329.43
*BH 09-03	ATDDGT 033	60.7	75.8	1.76	299.28
BH 09-04	ATDDGT 032	40.8	122.8	11.48	401.06
*BH 09-05	ATDDGT 031	60.7	75.8	8.10	300.86
BH 09-06	ATDDGT 34	40.5	122.8	1.82	288.54
BH 09-06A	ATDDGT 35	15.8	122.8	1.90	288.40
BH 09-07	ATDDGT 029	50.5	75.8	+ 0.73	295.58
BH 09-08	ATDDGT 025	60.0	75.8	0.28	296.29

BH 09-08A	ATDDGT 027	15.6	75.8	0.41	295.89
BH 09-09	ATDDGT 030	20.2	75.8	9.18	338.05
BH 09-10	ATDDGT 024	61.3	122.8	21.45	410.06
BH 09-11	ATDDGT 026	60.2	122.8	53.2	393.51
BH 09-12	ATDDEX 033	79.2	75.8	0.90	363.93

Note: ** Sealed borehole*
+ self-discharging borehole

The hydraulic gradient in the steep slopes, where groundwater flow entirely occurs in Paleogene sediments, is 0.15-0.34. In the flattened areas around Kaldzhikdere, where interstitial and fracture flows are mixed, the hydraulic gradient varies between 0.025 and 0.094.

The investigation concludes:

A) The Quaternary sediments of bed 1 and upper intervals of bed 2 (alternating sandstones, siltstones and marls) comprise moderately permeable (specific capacity of 0.1 to 1.0 L/s.m) and permeable lithological types occurring at depths of up to 10-12 m from the land surface.

B) The Paleogene complex rocks below that depth, bed 2 and bed 3, are mostly low permeable and impermeable. The transition intervals of jointed sandstones and siltstones are permeable – q = 0.01 to 0.1 L/s.m. Such intervals are intersected by boreholes BH 09-03 between 39 and 45 m, BH 09-05 between 29 and 56 m and BH 09-07 between 36 and 42 m.

The permeability of the lithological types identified as part of the TMF site investigation varies as follows:

Bed 1 - Quaternary sandy-clayey deposits and the weathering zone below them to a depth of 3.0 m below the land surface - from 0.0036 to 0.037 m/d.

Bed 2 - Alternating Paleogene sandstones, siltstones, marls and clays termed as a 'sandstone coal-bearing formation' - from 0.000 to 0.036 m/d.

Bed 3 - Coarse conglomerates and breccia-conglomerates - from 0.000 to 0.7 m/d.

A total of eight samples were collected after the installation of all the piesometers and monitoring wells for groundwater chemical characterisation. The sampled monitoring stations were: BH 09-01, BH 09-04, BH 09-06, BH 09-06A, BH 09-07, BH 09-10, BH 09-11 and BH 09-12.

The assays of the water samples taken from boreholes BH 09-06, BH 09-06A and BH 09–10 characterise the water as fresh with total mineralisation <1 g/L and pH = 7.1 to 8.3. The water samples from boreholes BH 09-01, BH 09-04, BH 09-07, BH 09-11 and BH 09-12 are characterised by higher mineralisation – from 1.2 to 1.8 g/L and pH = 7.9 - 9, and elevated sulphate concentrations. The waters are richer in minerals, occur and flow at greater depth and, respectively, are recharged and drained at a slower pace. Elevated antimony concentration is typical of all the groundwater flows in the TMF siting area.

Another conclusion made is that a 12m thick zone is identified, where the rocks have low geotechnical properties on one hand and transmissivity varying from moderate to high on the other.

The investigation carried out by Vodokanalproekt AD studied the abstractions of water in the watershed of the Krumovitsa River.

Figure IV.2.1.-8 presents the location of the water abstractions and the protective distances from them. With a Letter ref. ЗДОИ-19/25.06.2010, the EA Catchment Directorate based in Plovdiv provided information about the drinking water supply abstractions in the Krumovgrad Municipality. All the abstractions specified in the letter are outside the footprint of the project (Appendix 8).

The construction of abstraction wells in the Krumovitsa gravels began as early as 1950, when the first Krumovgrad drinking water supply facility was set up.

A new abstraction well was constructed in 1964 for public drinking water supply of Gorna Kula Village. A "perfect" abstraction well (in Bulgarian technical terms that is a well reaching through to the aquifer base) was completed in 1981 to augment the water supply capacity and extend it to the Zvezdel Water Supply Group (WSG).

The second well for drinking water supply to Krumovgrad was constructed in 1973. Two springs were cased in 1975 for drinking water supply to Zvunarka Village. Two additional abstraction wells were developed in the Krumovitsa gravels in 1981 and 1984 respectively to meet the water requirements of Moriantsi and Potochnitsa villages.

Additional hydrological investigations were carried out in the Krumovgrad water supply field. Based on their results, four more "perfect" abstraction wells were completed in 1982/83 to augment the Krumovgrad drinking water supply and feed the Ovchari WSG.

New potential abstraction fields were studied in 1985/86 to feed the Zlatolist and Gurgulitsa WSGs, which were intended to supply the villages in the Momchilgrad and Krumovgrad municipalities that did not have access to the existing water supply system. Consequently, three abstraction wells were completed in 1985 and a drain in 1987.

In 1966, the Guliika WSG was designed and, consequently, two abstraction wells were completed.

The typical rapid flows and response of rainfall in the Krumovitsa catchment eroded off the first well, which forced the construction of the second one.

A third well had to be constructed in 1997 to replace the old one, which had been washed off by the river thus cutting the supply to the Guliika WSG.

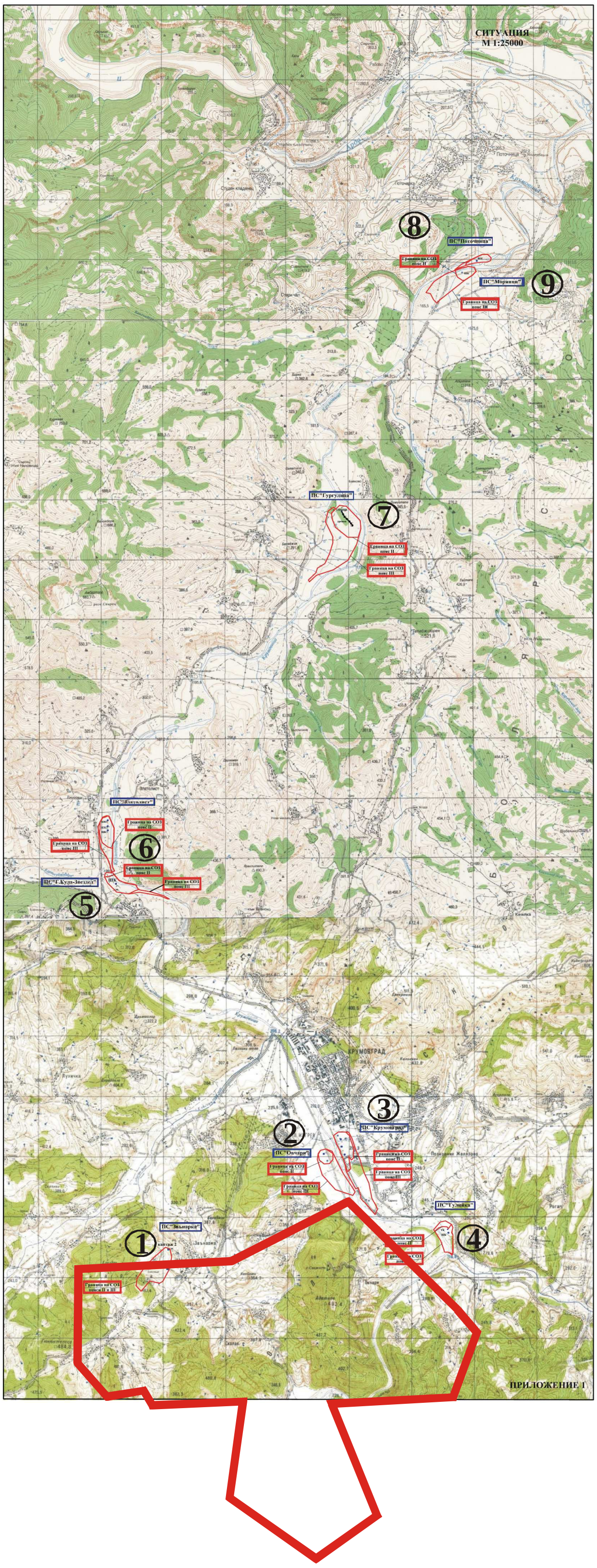
The investigation explored the option of utilising the Guliika system as a water supply alternative to the Krumovgrad, Ovchari and Gorna Kula-Zvezdel systems. The estimations demonstrated that the option was absolutely feasible.

All hydrogeological investigations including the construction of the above abstraction facilities was carried out by Vodokanalproekt - Plovdiv.

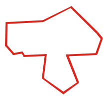
The alluvial deposits occuring in the Krumovitsa/ Elbassandere/Kessebir catchment comprise gravels with sand infill, which are rarely laminated by thin clayey lenses. The thickness of the Krumovitsa alluvium is 10 m at the Guliika Pump Station (PS), 8.5 m at the Krumovgrad and the Ovchari PS, and 6 m between the Gorna Kula-Zvezdel PS and the Moriantsi PS, i.e. the thickest deposits occur just upstream of Krumovgrad.

An unconfined groundwater flow has been formed in the Krumovitsa gravels, which generally flows in the direction of the river hydraulic gradient and is recharged and rarely drained by the river. The average hydraulic gradient is 0.0018. In dry periods apparent surface flows can be very low even zero in some parts whilst there is some underground flow and water resource storage in the gravels. The alluvial deposits overlay a bed of Paleogene marls, clays and andesites, which is the confining unit of the aquifer.

Permeability is quoted at 60-150 m/d, averaging 100 m/d. Transmissivity is in the range 500-2,000 m^2/d, averaging 800-1500 m^2/d. The prevalent specific yield (storage) value is 0.25.



1 – Zvunarka abstraction
2 – Ovchari abstraction
3 – Krumovgrad abstraction
4 – Guliika abstraction
5 – Zvezdel abstraction
6 – Zlatolist abstraction
7 – Gurgulitsa abstraction
8 – Potochnitsa abstraction
9 – Moriantsi abstraction



Concession edged out in red

Figure IV.2.1-8: Location of the water abstractions and the protective distances from them

Table IV.2.1-11 presents the capacities of the existing water abstractions: Zvanarka, Ovchari, Krumovgrad and Guliika, which are closest to the project area.

Table IV.2.1-11

Parameter	Krumovgrad Abstraction			Ovchari Abstraction		Guliika Abstraction		Zvunarka Abstraction	
	Right bank floodplain			Left bank floodplain		Right bank floodplain		High	Low
Abstraction facility code	ШК 2	ШК 3	ШК 4	ШК 1	ШК 2	ШК	ТК	К1	К2
Year of construction	1982 - 1983			1983		1986	1997	1975	
RL, masl	209.5			209.5		217.5		353.0	317.0
Depth, m	7.0	8.0	8.5	8.5	8,5	8.5	10.0		
Diameter, m	3.0	3.0	3.0	3.0	3,0	3.0			
Flow rate, l/s	15.0	15.4	13.1	11.7	standby				
Qmax, l/s								0.29	0.69
Qmin, l/s								0.1	0.2
SWL, m	2.10	1.73	2.05	2.20		3-4			
Drawdown, m	0.80	0.72	1.30	2.10					
Relative flow, l/s/m	18.8	21.4	10.08	5.57					
Distance to the river, m	110.0	35.0	40.0	110.0					
Transmissivity, m^2/d	1284.0	1129.0	550	382		915	204		
Aquifer thickness, m	4.9	6,3	6.43	6.3		6.1	7		
Permeability, m/d	262.0	180.0	85	60		150	29		
Transmissivity coef., m^2/d	1000.0	1000.0	1000.0	1000.0		1000.0			
Allowable drawdown, m	2.9	3.7	3.8	3.84		3.36	4.2		
Q_{EP1}, l/s	19.20	43.68	29.40	8.96		23.76	3.96		
Q_{EP2}, l/s	12.80	29.12	19.60	5.94		15.84	2.64		
Annual yield, l/s	20.0			1.5		34.5	2.8		

The quality of the abstracted water (from the Krumovitsa gravels and the springs at Zvunarka Village) in terms of physical, chemical and radiological properties meets the requirements under Regulation 9/16.03.2001 on the Drinking and Household Water Quality (SG issue 30/2001), amended in SG issue 87/2007).

Table IV.2.1-12 also presents the water chemical assays for the same abstractions.

Table IV.2.1-12

Parameter	Unit	Zvunarka abstr.	Krumovgrad abstr.	Ovchari abstr.	Guliika abstr.	Regulation 9	Appendix 1 to art. 3, item 2
pH		7.55	6.3		6.8	6.5 – 9.5	Table B
Susp. solids	mg/l	395.5	361		445		
Total hardness	mgeqv/l	6.6	5.8		7.6	12	Table B
Ammonia	mg/l	<0.05	н.о.		н.о.	0.5	Table B
Nitrites	mg/l	<0.02	<0.02		<0.02	0.5	Table Б
Nitrates	mg/l	14.9	6		3	50	Table Б
Permanganate oxidisable C	mgO_2/l	3.04	0.32		2.48	5	Table B
Manganese	mg/l	<0.04	<0.04		<0.02	0.05	Table B
Iron	mg/l	0.1	<0.02		<0.02	0.2	Table B
Phosphates	mg/l	0.4	0.04		0.4	0.5	Table B
Calcium	mg/l	116.2	100,2		124.25	150	Table B
Magnesium	mg/l	9.73	9.7		17.02	80	Table B
Sulphates	mg/l	38.2	60		101.6	250	Table B
Chlorides	mg/l	17.73	19.5		17.73	250	Table B

Note: „Regulation 9" means *REGULATION 9/16.03.2001 on the Drinking and Household Water Quality (SG issue 30/2001).*

The natural (dynamic) resources in the alluvial deposits in the Krumovitsa watershed are relatively low. Given an average transmissivity of 1500 m^2/d, average hydraulic gradient of 0.002 and average floodplain width of 750 m, **the dynamic groundwater draw is 26 L/s**. Therefore, the groundwater abstraction is dependent on the recharge from the Krumovitsa river flow. Крумовица. Between 60 and 80% of the local abstraction resource comes from the river recharge. Крумовица. На територията на всички вододайни зони, както и по целия водосбор в горното течение на р. Крумовица, до вливането й в р. Very strict control over industrial and agricultural activities should be exercised in all water abstraction fields and in the entire Krumovitsa valley downstream to confluence with the Arda River.

2.2. Sources of Fresh Water Supply

The site water supply design should meet two major criteria:

Ensure normal project operation;

- Minimise supply from external water sources.

One of the more important project directives is to provide the water supply without any negative impact on the requirements of the local community and downstream users, which are particularly important during the dry season of the year.

Two site water supply options have been studied:

Option 1. Installation of a proprietary fresh water abstraction well in the Krumovitsa (or Kessebirdere) gravels, where sufficient water resources are available and without any negative impact on the requirements of the town and the surrounding areas. This option would ensure 5 L/s to the site, which is sufficient to meet the project fresh water requirements. The abstracted water will report to the Fresh Water Tank on the process plant site.

Option 2. Collection and storage of water from the Kaldzhik valley watershed into a small storage dam, which will normally be self filling from the catchment areas with occasional abstractions from Krumovitsa if needed. A storage dam would have the capacity to supply water to the project for an extended period without recharge and minimise the project dependence on water supply. The only possible option for the siting of the storage dam close to the site is the Kaldzhikdere valley. The valley catchment is big enough to maintain the water balance of the facility. The area required for the construction of the dam amounts to about 7 ha, which will give an effective water storage capacity of about 250,000 m^3. The problem associated with the dam construction is the likely derogation of habitats that are within the scope of protection in the East Rhodopes Protected Area. The dam height will have to be over 16 m because it should be sited in a shallow portion of the valley. This is quite a big height for a dam especially in relation to the impact that an extreme precipitation event would have compared to the low fresh water requirements.

It is obvious that Option 1 should be the preferred option for the project implementation. First, it can realistically meet the requirements; and second, it saves the expenditure on a water storage dam.

The development of the proprietary fresh water abstraction system, whether tapping into surface or groundwater resources, should be preceded by a permit for exploration and construction of an abstraction well. The competent permitting authority is the East-Aegean Catchment Directorate based in Plovdiv.

3. Geological Setting

3.1. Brief Geological Characterisation

A brief characterisation of the local geology will follow. Figure IV.3.1-1 shows a geological map of the Krumovgrad region.

Regional Geology

The Ada Tepe prospect occurs in the centre of the Eastern part of the Rhodopes Massif. The latter is a metamorphic complex that covers a significant part of the Balkan Peninsula in the frontier area between Bulgaria, Greece and Turkey (Fig. 1). The Rhodope Massif has been regarded as a Precambrian or Variscan stable continental block (Bonchev, 1971, 1988), but recent works have demonstrated that it was actively involved in Alpine convergent tectonic processes (Burchfiel, 1980; Ivanov, 1989; Burg et al., 1990, 1995). The Rhodope Massif is bounded to the east by the Circum Rhodope Belt and to the north by the Maritsa fault which separates the massif from the Srednogorie Zone. To the west the Rhodope Massif is separated from the Serbo-Macedonian Massif by a tectonic contact interpreted as a middle Miocene-late Pliocene Strymon detachment fault (Dinter and Royden, 1993). In many recent tectonic works, the two massifs have been combined and broadly termed the “Rhodope Massif” (Burg et al., 1995; 1996; Ricou et al., 1998; Jones et al., 1992; Lips et al., 2000).

Pre-Upper-Cretaceous deformation/metamorphism

Several authors have suggested that the Rhodope Massif suffered Variscan and even Precambrian metamorphism (Kozhoukharov et al., 1988; Zagortchev, 1993), whereas others deny the pre-Alpine metamorphic evolution of the massif (Burg et al., 1990, Dinter, 1998; Barr et al., 1999). However, all workers agree that in Alpine times the Rhodope Massif was characterized by a complicated tectono-metamorphic evolution. Ivanov (1989) and Burg et al. (1990) distinguish two phases in the evolution of the Rhodopes. The first compressional phase caused large-scale, south-vergent thrusting and amphibolite facies metamorphism. The following extensional phase involved tectonic erosion of the thrust complex and formation of detachment and synthetic faults.

Two major tectonostratigraphic units (complexes) have been recognised on the basis of composition and tectonic setting of the metamorphic rocks: a Gneiss-migmatite complex and Variegated Complex (Haydoutov et al., 2001), which correspond to the Continental and Mixed units of Ricou et al. (1998), respectively (Fig. 2). Several age data demonstrate the existence of Lower Cretaceous or older high-pressure metamorphism in the Eastern Rhodopes. Migmatites from the Variegated complex have been dated at 159 ± 19 Ma, using Rb-Sr whole-rock methods (Peytcheva et al., 1998). A Sm-Nd isochron age of 119 ± 3.5 Ma on a spinel-garnet pyroxenite of the Kimi complex in Greece, the analogous of the Kesebir dome, has been interpreted to reflect an Early Cretaceous high-pressure (16 kbar and 750-8000C) subduction-related metamorphic event (Wawrzenits and Mposkos, 1997; Mposkos and Krohe, 2000). Recent findings of diamonds and coesite relicts in garnet from eclogites and metapelites indicate UHP metamorphism in the Kimi complex (Mposkos and Kostopoulos, 2001). These authors argued that the complex had been subducted to ca. 220 km (70 kbar). A Rb-Sr isochron age of 65.4 ± 0.7 Ma from an undeformed metamorphic pegmatite was interpreted by Mposkos and Wawrenitz (1995) as a minimum age of migmatisation. Similar ages but a different metamorphic evolution in the same area was presented by Liati et al. (2002) on the basis of U-Pb SHRIMP studies. These authors interpreted an age of 117.4 ± 1.9 Ma on a garnet-rich mafic rock to reflect the age of magmatic crystallization of the protolith, which was later metamorphosed at 73.5 ± 3.4 Ma. According to these authors, the last retrograde stage of this metamorphism (ca. 5000C, 5 kb) occurred at 61.9 ± 1.9 Ma.

Upper Cretaceous-Tertiary extension and associated faults

The onset of the extensional stage seems to have occurred in the Upper Cretaceous times (ca. 70 Ma). Metamorphism in the Kimi complex (73.5 ± 3.4 Ma) closely coincides with the age (69 Ma) of granitoids intruded in the Variegated complex in Bulgaria (Marchev et al., unpubl.). Extension led to the formation of the Biala Reka and Kesebir metamorphic core complexes (Burg et al., 1996; Bonev, 2002), low-angle detachment faulting (Mposkos and Krohe, 2000; Krohe and Mposkos, 2002; Bonev, 2002) and sedimentary basins (Boyanov and Goranov, 2001). Formation of Maastrichtian-Paleocene colluvial-proluvial sediments in the area north of the two dome structures, passing gradually into marine sediments, and the presence of several unconformities in the Paleocene and overlying Upper Eocene strata (Goranov and Atanassov, 1992; Boyanov and Goranov, 1994, 2001) suggest a supradetachment evolution of these basins as the result of surface uplift and exhumation of the metamorphic rocks. The inferred timing of the unroofing of Biala Reka and Kesebir core complexes, 65-42 Ma for the Upper (Variegated) complex and 42-30 Ma for the lower (Gneiss-migmatite) unit (Krohe and Mposkos, 2002), is consistent with the timing of sedimentary deposition, although slightly older ages for the beginning (e.g. 70 Ma) and slightly younger ones (e.g. 25 Ma) for the end of the exhumation process can be suggested on the basis of the new data. Several ages between 42 and 35 Ma, obtained from Rb-Sr isochrons (Peytcheva, 1997) and 40Ar/39Ar dating of mica and biotite (Lips et al., 2000; Marchev et al., 2002c; Mukasa et al., 2003), suggest that unroofing of the Variegated and Gneiss-migmatite complexes in Biala Reka and Kesebir was accompanied by cooling below 3500C. A similar Rb-Sr age (37 ± 1.0 Ma) of white mica from a milonitic orthogneiss from Biala Reka (Kechros) has been interpreted by Wawrenitz and Mposkos (1997) as a minimum age of high-pressure metamorphism.

In the Upper Eocene times, another major episode of extension started with block faulting and formation of sedimentary E-W to NNW-SSE depression, thus differing from the previous stage of predominantly low-angle detachment faults. The older units in the depressions are non-volcanic sediments (Harkovska et al., 1989; Boyanov and Goranov, 2001) replaced upwards by a large volume of dyke-fed intermediate-silicic volcanism with rare basalts (Harkovska et al., 1989; Marchev, 1985; Marchev et al., accepted). This volcanism yields ages between 39 and 30 Ma and paroxysmal activity at 33-31 Ma (Yanev et al., 1998; Lilov et al., 1987) with younger activity in Greece (Pecskay et al., 2003). The extension spread over a much larger area that spanned nearly the entire width of the Rhodopes, including the Biala Reka and Kesebir core complexes. Here, it partly coincides with 42-35 Ma thermal event and exhumation of the lower Gneiss-migmatite complex. The process of extension, exhumation of the core complexes and magmatism in the Bulgarian part of the Eastern Rhodopes seems to have finished with emplacement of OIB-like basalts at 28-26 Ma (Marchev et al. accepted).

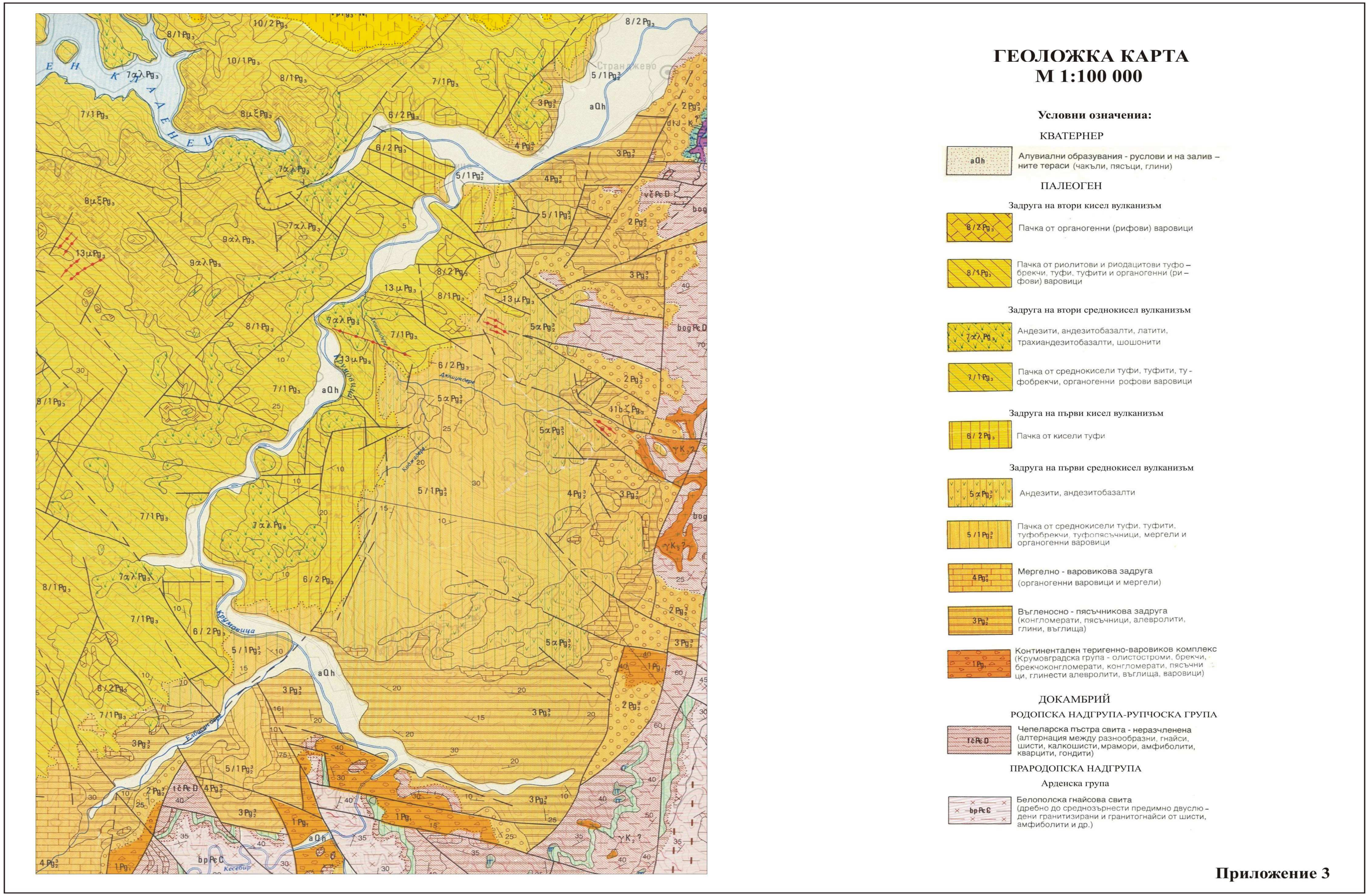


Figure IV.3.1-1

District geology

Rocks in the Krumovgrad area (Fig. 2, 4) consist of Precambrian and Palaeozoic high-grade metamorphic rocks, Maastrichtian-Palaeocene sedimentary rocks, and Eocene-Oligocene sedimentary and volcanic rocks and dykes.

Precambrian and Palaeozoic metamorphic rocks

Basement metamorphic rocks in the Krumovgrad area build up the elongated in N-NE direction Kesebir dome (Kozhoukharov, 1971; Bonev, 2002) (Fig. 4). The structurally lowest rocks, cropping out in the core of the Kesebir metamorphic dome complexes, belong to the Gneiss-migmatite complex. It is dominated by orthomagmatic rocks including metagranites, migmatites and migmatized gneisses overlain by a series of pelitic gneisses, marbles and amphibolites. Eclogites and eclogite amphibolites have been described in the Kechros complex in Greece (Mposkos and Krohe, 2000). Rb-Sr ages from the metapegmatites in Greece (334±3 Ma, Mposkos and Wawrzentz, 1995) and from metagranites in Kesebir dome, Bulgaria (328±25Ma, Peytcheva et al., 1998) indicate that the Gneiss-migmatite complex is formed of Variscan or even older continental basement.

The overlaying Variegated Complex consists of a heterogeneous assemblage of metasedimentary rocks and ophiolite bodies (Kozhoukharova, 1984; Kolcheva and Eskenazi, 1998). Metamorphosed ophiolitic peridotites and amphibolitised eclogites are intruded by metamorphosed gabbros, gabbronorites, plagiogranites and diorites of boninite and arc-tholeiitic affinities. The Variegated complex probably originated in an island-arc setting (Kolcheva and Eskenazi, 1998, Haydoutov et al., 2001). U-Pb zircon dating of a gabbro from Biala Reka yields a Late Neoproterozoic age (572 ± 5 Ma) for the core and Hercynian age (~300-350 Ma) for the outer zone (Carrigan et al., 2003).

Maastrichtian (69 Ma) two-mica granitoids (Chuchuliga type)

These are a series of volumetrically minor plutonic bodies, intruded in the rocks of the Variegared complex (Belmustakova et al., 1995). In the Krumovgrad area (Perunika) several small bodies are mapped. However, the largest plutons, Chuchuliga (12 km2) and Rozino (3 km2), outcrop to the east of Perunika in the Biala reka metamorphic dome (Belmustakova et al., 1995; Stoykov and Mavroudchiev, 1997). The rocks are medium to fine-grained light grey two-mica granites of massive or slightly foliated structure. They are composed of acid plagioclase, perthitic microcline, biotite and white mica and accessory minerals opaques, apatite, zircon, monazite, allanite and garnet. Earlier K-Ar ages of several of these granites yielded Middle Eocene (45-39 Ma) ages, which have been interpreted to reflect a regional tectono-thermal event (Belmustakova et al., 1995). New U-Pb dates on zircon, indicate that these rocks are Upper Cretaceous (Maastrichtian, 69 Ma, Marchev et al., unpubl. data).

Tocachka detachment and Maastrichtian-Paleocene sedimentary rocks

The contact between poorly consolidated sedimentary strata and underlying metamorphic rocks is a regionally developed low-angle normal fault, named by Bonev (1996) the Tockachka detachment (Fig. 4). The dip of the fault is approximately 10-150 to the north-north-east. It can be traced for more than 40 km from Krumovgrad to the Bulgarian-Greek frontier and is beautifully exposed in the area west of the village Sinap (Fig. 5A). In the latter area and the whole northeastern part of the dome, the Tocachka detachment fault is overlain by strongly fragmented metamorphic blocks, breccia, sandsones and limestones (Fig. 5B). This unit was first recognised by Atansov and Goranov (1984) in the Krumovgrad area and described as Shavarovo formation of the Krumovgrad group in a later paper (Goranov and

Atanasov, 1992). The wider distribution of these sediments in the other areas (Ivailovgrad area, NW part of Borovitsa) of Eastern Rhodopes was confirmed by later detailed works (Boyanov and Goranov, 1994; 2001). The type section of the Shavarovo formation is described along Kaldjic river near the village Shavar. The total thickness of the unit is ~350m. It consists of strongly fragmented metamorphic blocks, breccia, sandsones, marls and clayey limestones (Fig. 6 A, B, C). Clasts of breccia and conglomerates are mixtures of gneisses, amphibolites, marbles, derived primarily from the Variegated complex. The only unknown lithology is the red quartzites, described by Goranov and Atanasov (1992) at the base of the Paleocene section (Fig. 6D).

Eo-Oligocene sedimentary and volcanic rocks

Priabonian sedimentary rocks

Upper Eocene-Oligocene sedimentary rocks overly the Maastrichtian-Paleocene sedimentary rocks with angular unconformity or directly overly metamorphic basement rocks. Several superimposed formations are described in the area by Goranov (1995): (1) breccia-conglomerate, (2) coal-bearing-sandstone and (3) marl-limestone. In the Krumovgrad area only the last two formations are described. Coal-bearing sandstone formation occupies large areas east of Krumovgrad and Ludetino graben, where it overlies the rocks of Krumovgrad group or metamorphic basement. The major lithologies are sandstones alternating with subordinate conglomerates, marls, clay and rare coals. Numerous angular unconformities in the conglomerate layers suggest that the major source of sedimentary material was located south of Krumovgrad, probably from the Kesebir dome. Total thickness is in the range 2-500 m. A general tendency of sedimentation is the increase of the limestone component towards upper part of the section.

Marl-limestone formation in the Krumovgrad area outcrops southwest of Krumovgrad and west of Ada Tepe. It consists of alternating sandstones, sandy limestones and limestones.

Iran Tepe paleovolcano

Iran Tepe volcano is located 7-8 km northeast of Ada Tepe (Fig. 2). It is built up of suite of lava flows, breccias, domes and volcanoclastic rocks overlying the marl-limestone formation. K/Ar age determinations indicate that the Iran tepe volcano was active ~ 35 Ma (Lilov et al., 1987) and is among the oldest volcanoes in the Rhodopes. Recently, these ages were confirmed by new K-Ar age determination (Pecskay and Harkovska, personal communication). Lavas of the Iran tepe volcano are high-K calc-alkaline plagioclase-pyroxene and plagioclase-hornblende-biotite andesites ranging from 56% to 62% SiO2. Representative analyses of the volcanic rocks are given in Table 1 (an.1, 2, 3).

The Kesebir latite-rhyolite

Scarce magmatic activity is spatially associated to the Kesebir dome. Two dykes (one of latitic and one of rhyolitic compositions, Table1, an. 4, 5) have been established in the western and northeastern part of the dome. The latitic dyke strikes east west, having similar orientation to the nearby large east-west oriented Ardino-Zvezdel dyke swarm. A rhyolite dyke, documented recently by E. Chelebiev, intrude the Gneiss-migmatite complex along the axes (~200NE) of the Kesebir dome (Fig. 7A). The rhyolite is yellowish to pale green containing large sanidine and smaller plagioclase, biotite, ilmenite, magnetite and quartz. The rock is extremely hard and has been used in the past for production of grain-grinding stones (Fig. 7B). K-Ar age determinations of 3 dykes from the Zvezdel area places the magmatic activity in the Zvezdel area of the dyke swarm between 32.20±1.24 and 31.23±1.19 Ma

(Harkovska et al., 1998). A new 40Ar/39Ar data of the Kesebir rhyolite (31.82□20 Ma, see below) is in agreement with the Harkovska et al’s data, suggesting that it is a part of the Ardino-Zvezdel dyke swarm activity.

Several other rhyolitic dykes crop in the southern part of the Kesebir dome, close to the Bulgarian-Greek frontier. Mavroudchiev (1964) points out that these rhyolites crosscut the 28-26 Ma basalts (see below) in the area of the village Chernichino. However, we observed the opposite relationship in the area between villages Avren and Egrek. Thus, it appears that Kesebir and Biala reka domes were a site of protracted contrasting magmatism (see also Marchev et al., accepted).

28-26 Ma intraplate basalts

Several mafic dykes of intraplate basaltic composition have been described in the southwestern part of the dome, between villages Egrek and Devesilovo (Mavroudchiev, 1964; Marchev et al. 1997; 1998) (Fig. 8). They are of Middle Oligocene age (28-26 Ma, Marchev et al., 1997) and are the most primitive Paleogene magmatic rocks found in the Rhodope region (Table 1. an. 6-10). Basalts contain phenocrysts of olivine, Mg-rich and Fe-Na rich clinopyroxenes, biotite, and microphenocrysts of plagioclase. Megacrysts of sanidine, olivine, clinopyroxene and kaersutite are also present. They carry small xenoliths of spinel lherzolites and xenocrysts of high-Mg olivine and a large number of cumulus clinopyroxenites, olivine, hornblende-bearing clinopyroxenites and hornblendites. Crustally derived xenoliths are also present.

Project Geology

The Khan Krum deposit includes the following ore deposits (prospects): Ada Tepe, Kuklitsa, Kupel, Sinap, Surnak and Skalak.

The Ada Tepe prospect, which is under consideration, is located approximately 3 km southwest of the town of Krumovgrad and 1 km west of the Krumovitsa River.

The deposit was explored in full compliance with the Bulgarian laws. The exploration project followed the standard formal procedure including licensing and permitting, exploration, interim and final geological reporting, and issuance of a Commercial Discovery Certificate. A more detailed overview of those project stages is presented in the Introduction. Therefore this section will present an overview of the Ada Tepe deposit itself.

Stratigraphy

The geology at Ada Tepe deposit is dominated by the Tocachka detachment fault (TDF) (Figure IV.3.1-2), which separates the rocks of the deposit into two distinct structural packages.

The Pre-Paleogene metamorphic complex builds up the basement and crops out in the areas west and south of Ada Tepe. It is represented by metasedimentary (amphibolites and gneisses) and Hercynean metagranites of the Gneiss-migmatite complex. Metamorphites are intersected by all the deep holes completed in the area to the north. They are unconformably overlain by thin bands of amphibolites, orthoamphibolites and irregular marble bodies. Surface exposures and drillcore samples show that at least 10-20 m under the detachment surface the rocks are strongly deformed and altered. These are intersected by many drillholes. The tectonic contact with the lower Gneiss-migmatite is defined by a 0.5 to 0.8 m thick mylonitisation zone. The drillholes to the west and south of Ada Tepe often intersect metagranites of haplitic texture. They are often cross-cut by small gray quartz veins marked by pyrite mineralization. These veins have a predominant east-west strike and steep north dipping. They often form wide (up to several meters) stockwork zones. The thickness of the haplitic body varies from 5 to 20 m. The contact with the lower gneiss is a narrow mylonite zone with a clear angle discordance. It is clearly exposed in the area west of the Ada Tepe, in Kaldzhikdere.

The metamorphites frame a NE-extended small half graben (Ludetinski) filled up by older paleogene sediments.

The Paleogene sediment complex in the deposit area is represented by tertiary (Paleocene-Eocene) conglomerates, sandstones, siltstones and limestones of the Krumovgrad Group. Gold and silver mineralization in the Krumovgrad License area is predominantly hosted within the Shavarovo Breccia Formation. It consists of polygenic breccia boulders and blocks including large marble and amphibole olistoliths. The most typical feature of this unit is its coarse terrigenous colluvial-proluvial-alluvial facies. Breccia and conglomerate fragments show large variety of metamorphic lithologies: gneisses, metabasites, amphibolites, ultramafics, migmatites, schists and marbles. Clasts are angular to subrounded. The breccia matrix is composed of crushed material of the same composition as the clasts. Occasional occurrence of biogenic textures probably consisting of phytofossils is also observed. Coarse bedding is observed in the Shavarovo Breccia Formation, where the beds are dipping at 10 to 30 degrees to the N-NE. In the southern part of Ada Tepe, probably for tectonic reasons, the coarse-grained sandstone seams are SW-NE oriented and dipping at 30 to 45 degrees to the SW or strongly sheared by later faults.

The contact between the Krumovgrad Group and the lower metamorphites is a NW-SE-oriented fault. The dip of the fault is approximately 10-15^{o} to the north-north-east. In the northern part of the Ada Tepe, outside the footprint of the deposit, the Maastrichtian-Paleocene sedimentary rocks of the Shavarovo formation is overlain by the Upper-Eocene conglomerates and sandstones of the coal-bearing-sandstone formation.

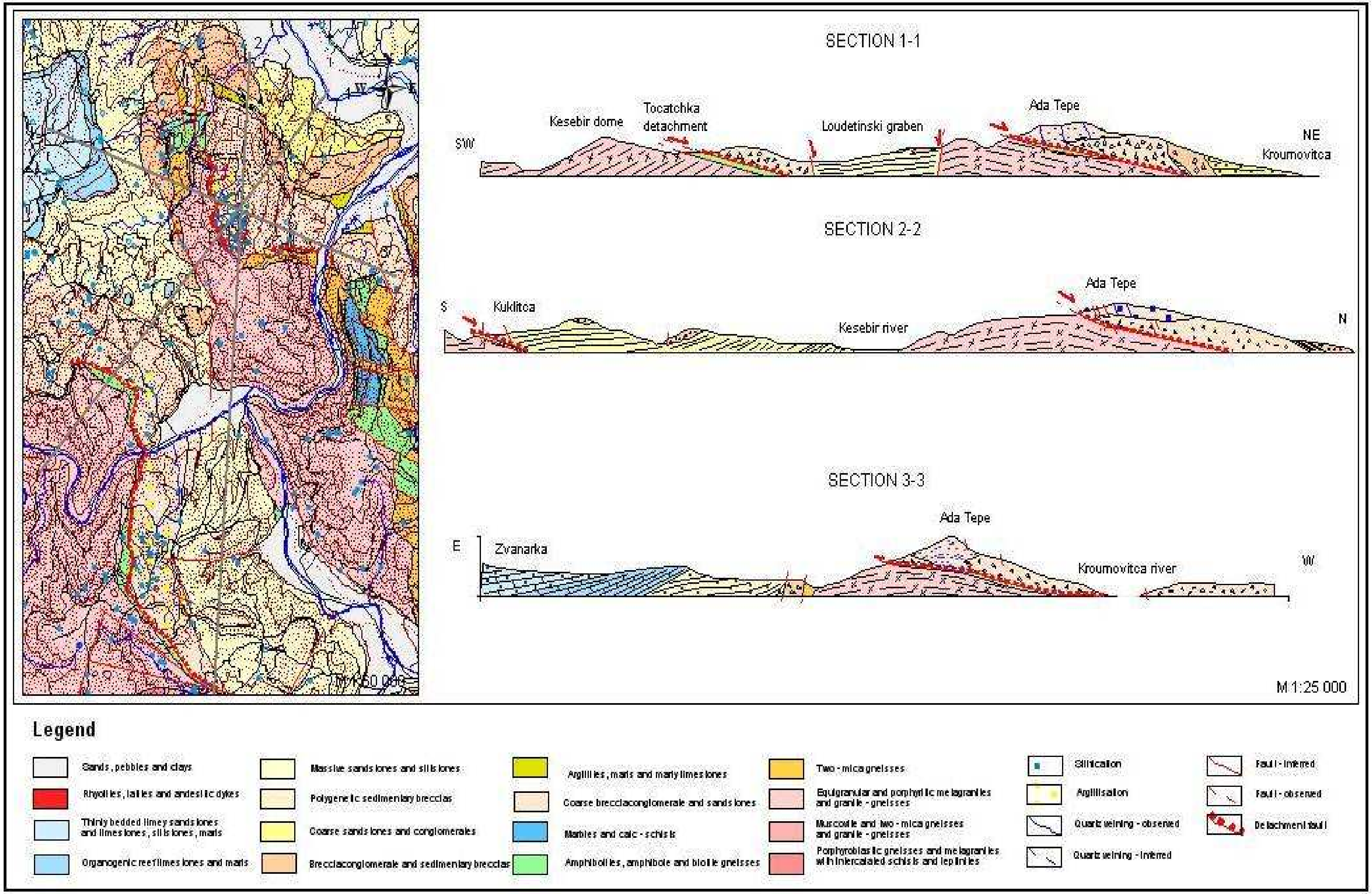


Figure IV.3.1-2 – Adá Tepe geological map

Deposit Structures

In structural terms, the deposit is hosted within the eastern periphery of the Momchilgrad Depression. It is strongly sheared by faults, which is further complicated by the Lidetinski graben, which deeply extends in SE direction. The deposit is located on the north-south elongated Ada Tepe ridge, which rises about 100 m above the basal contact with basement rocks (Figure IV.3.1-2). It is a fragment of the Kessebir block structure of the para-autochtone in the NE periphery of the graben and consists of metagranites of the Gneiss-migmatite complex. They are unconformably overlain by rocks of the allochtone represented by amphibolites and and irregular marble bodies. This big package is in turn overlain by the neo-autochtone Paleocene sedimentary rocks of the Krumovgrad group. The sedimentary rocks have a complex coarse-grained mosaic texture resulting from a continuous and multi-stage process of tectonic shearing as part of the evolution of the East-Rhodopean Paleogene Depression.

The dominant structure in the Ada Tepe prospect is is a regionally developed low-angle detachment fault and the associated steep extensional faults.

The steep-dipping faults can be grouped in two systems according to their direction: E-NE and N-NE (primary system), and N-NW and N-S (secondary system). They most frequently comprise low amplitude down-throw and slip faults. In most cases, these structures can be interpreted as feeder structures for the mineralized fluids. Geological field work and exploration drilling undoubtedly confirm that the dominant structure is the ‘detachment’ structure and all the remaining structures, whether flat or steep, are subordinate to the dominant structure. The hydrothermal activity is controlled by these structures and as a result low-temperature fault-proximal stratified gold-bearing metasomatites are formed.

Quartz veins are also observed within this system but they are rare and very limited. A jointing zone is formed with smooth joint surfaces 80 to 100 m wide. Another important control on the localisation of mineralisation is exhibited by the sedimentary rocks overlying the detachment.

Morphology of the Orebodies

The morphology of the tectonic structures is complex and they can be interpreted as both feeder structures for the mineralizing fluids and ore bearing structures. The intersections with suitable lithological strata form complex stockwork orebodies and zones of hydrothermal alteration with strictly controlled gold-bearing mineralisation.

One major orebody has been identified, which is morphologically very well hosted within the base of the sedimentary rocks.

Reserves and Resources

The Ada Tepe deposit can be classified as a high-grade, shallow, low-sulphidation epithermal style gold-silver deposit.

Two major styles of gold-silver mineralisation are apparent at Ada Tepe:

Wall Zone - a shallow-dipping (15 degrees north) tabular (9 metres average thickness) zone developed directly above the basement-sediment contact;

Upper Zone - a series of east-west trending steep-dipping vein sets with ancillary vein sets in other orientations, occurring as complimentary structures;

Texturally, the high grades are related to open-space filling textures, which is in bonanza-type epithermal gold deposits

Based on the interpretation of the results, i.e. structural and morphological characterisation of mineralisations, the prospect can be classified as a Class 2 deposit with a complex geological composition, irregular orebody thickness and very uneven gold distribution.

Table IV.3.1-1 below presents the Mineral Resource and Reserve Estimate for the Ada Tepe prospect of the Khan Krum deposit, 01.09.2004.

Table IV.3.1-1

Prospect	Code	Cut-off grade	Tonnage (t)	Table of Contents		Metals	
				Au (g/t)	Ag (g/t)	Au (kg)	Ag (kg)
Ada Tepe	Probable Reserves 122	0.9	1,493,000	7.3	4.3	10,892.6	6,440.6
	Measured Resources 331	0.9	7,292,000	2.4	1	17,294	7,503

Mining and Processing of the Mineral Resource

The mineable reserve of Ada Tepe will be mined within a single footprint and processed (concentrated) via a combined flotation and gravity separation flowsheet to a final gold-silver concentrate. This approach will minimise the areas that will be affected by the project implementation and, respectively, substantially minimise the risk of affecting the rest of the environmental media – air, waters, soils, flora and fauna, etc.

Two alternative options for the development of the deposit, which are discussed in the beginning of the EIS, have been examined and the main difference between them is whether a conventional TMF will be operated (Option 2) or not (Option 1) together with the associated road, piping and drainage infrastructure.

The main problem can be defined as how to control and manage the mining and processing wastes. The remaining project activities, i.e. initial development, mining and processing, are practically identical under both options.

The Ada Tepe mine plan currently being considered is based on 850,000 Mtpa production.

The deposit type and genesis, the orebody configuration and the detailed geological characterisation of the area strongly suggest that minimum additional exploration and test work would be required to convert the current resources into reserves; moreover, the project cut-off grade is only 0.9 g/t.

The siting options for the main project facilities are shown on the General Site Map (Appendix 5).

Mining

The ore at Ada Tepe will be open-pit mined. The mining method will be a conventional open cut drill, blast, load and haul operation. The mined ore will be truck-hauled to the ore stockpile (ROM pad). A front-end loader will deliver ore from the ore stock pile (ROM pad) to the feed hopper of the jaw crusher The following explosives will be used: Dynolite for the mining of the oxidized ore in the Upper Zone and waterproof emulsion for the mining of the ore in the Wall Zone.

Crushing

The ore from the ROM pad will be delivered by a front-end loader to a feeding hopper, which will feed the ore into a jaw crusher. The crusher product will be discharged onto a fully enclosed inclined belt conveyor leading to the grinding section.

This circuit will also have a small cone crusher handling the pebbles recycled from the semi-autogenous grinding mill in the grinding section. The pebble crusher product will discharge onto the mill feed conveyor belt.

Grinding

The grinding section of the plant will be located inside the main plant building, which will be shared with other plant sections as well as the workshops and other facilities.

The crushed product will be ground using a three-stage wet grinding circuit with a primary SAG mill and secondary and tertiary (regrinding) ball mills. The grinding circuit product will typically be P_{80} = 40 microns.

It will report to a screening section for removal of any trash, mostly wooden and plastic waste, from the ore feed.

Flotation

Flotation will be the main process for recovery of the gold and silver values from the ore. The process is performed in flotation banks, where the recovery of the payable components from the waste rock is achieved by conditioning the surfaces of mineral grains based on the different surface chemistry of the gold and rock particles.

A direct selective flotation flowsheet consisting of one rougher stage, three cleaner stages and two scavenger stages is considered.

Gravity Separation

The gravity separation circuit is required to achieve a final concentrate quality that matches the requirements of toll treatment facilities.

Gravity separation is based on the different densities of the products in the process.

The discarded slurry from the gravity separation circuit will form the feed to the flotation circuit.

Process Reagents

The ore processing is an essentially wet process. Limited amounts of reagents are added to facilitate the recovery of the precious metal values.

The following reagents will be used in the flotation process:

- Collector: PAX (potassium amyl xanthate) and a minimum amount of dithiophosphate (Aerofloat 208);
- Frother: Cytec OrePrep F 549;
- Dispersant: Sodium silicate (Na2OxnSiO2, also known as water glass or liquid glass);
- Sulphidiser: Copper sulphate (CuSO4x5H2O).

These substances are traditionally used not only in mineral processing but also in other applications - for example, the dithiosulphate is a main component of machine oils and lubricants; the water glass is used to improve soil stability (e.g. loess soils) or waterproofing; the copper sulphate is also known as "bluestone" and is widely used to combat pests. Frothers, flocculants are not defined as harmful while the xanthate concentrations in use will be los and therefore not harmful. The project raw and other materials and reagents are described in detail in Section II.5.

Dewatering

The final concentrate will be dewatered and packaged for shipment to a custom smelter.

Final Pit Design Parameters

The depth of the pit on completion of operations will vary according to the location.

- The north end pit bottom is at RL 340 m, which gives final pit depths of 120 m to the east, 100 m to the north, and 40 m to the west.

- The south end haul road would exit to the west at RL 380 m, with the southern part of the pit being above the road at RL 400 m. The depths from this point will be 50 meters to the east, 20 meters to the south, and 0 meters (open) to the west.

Mine Wastes

The gold mining and processing operations at Ada Tepe will generate waste mine rock and process (flotation) tailings. These wastes will be subject to co-disposal in an Integrated Mine Waste Facility, which will be designed and operated in compliance with the *Regulation on the Specific Requirements to Mining Waste Management (2009).*

According to testwork results, tining waste is classified as **non-hazardous non-inert waste** in terms of the risk to the environment and human health based on their composition and properties. That allows their co-disposal within a single footprint.

Based on the completed mining waste classification, the geotechnical properties of the facility, the site wide ground conditions, specific environmental conditions and proposed preventive measures and management of the facility, it is classified as a Category B facility.

The above category is based on the acid-base accounting and net acid generating testwork on mine rock samples.

The As, Cd, Pb and Ba leaching tests (EPA Method 1312 - SPLP, 2004), which were undertaken by VISON SciTec Inc., indicate that the mine rock is not dangerous to the environment. Table IV.3.1.-2 shows the test results.

Mobility (Leaching) of Certain Elements Present in the Mine Rock

Table IV.3.1.-2:

Element	Sample oxidized rock	Fresh host rock sample	Strongly oxidised rock	Fresh rock sample (wall zone)	USEPA limit	Quality standard Regulation 1	Regulation 6 Emission standard
Arsenic	0.002	<0.001	0.003	0.013	5	0.010	0.1
Cadmium	<0.0002	<0.0002	<0.0002	<0.0002	1	0.005	0.1
Lead	<0.001	<0.001	<0.001	<0.001	5	0.010	0.2
Barium	0.026	0.001	0.002	0.002	100	n.a.	n.a.

Description and Parameters of the Facility

The IMWF has a total design footprint area of 41 ha. Its design capacity is about 14 Mm^3, which is sufficient to accommodate the entire amount of mining wastes generated throughout the mine life of the Ada Tepe portion of the Khan Krum Deposit.

Its main components will include:

- A HDPE tailings delivery pipeline, via which the tailings thickened to approximately 56% solids will be transported for discharge into the mine rock cells.
- Starter platforms – They will be constructed from waste rock at the start of operations They will form the base of the facility in both catchment areas (north and south). The platforms will be constructed from mine rock at the toe of the existing two ravines. The starting elevation of both platforms is RL 290 m. Their outer face slopes will be constructed at 2.5H:1V.
- Outer berms – They will be constructed from mine rock with horizontal benches at 10 m vertical intervals with the intervening slope constructed at 2.5H:1V and a bench crest width of 5 m. They ensure the containment of the thickened tailings. To prevent tailings being carried through the outer mine

rock berm, a filter system will be placed on those berms. The filter system normally consists of a drainage layer and/or geotextile. The drainage layer will be constructed from crushed rock;

- Internal berms - constructed from mine rock at 10 m vertical intervals and different patterns to create cells for the tailings. These berms will not require a filter system as they will be used only for internal confinement and distribution of the tailings thus maximizing the storage efficiency of the facility. The internal berms will also allow mine equipment access for placement of the mine rock. The tailings pipeline and discharge ends will also run on the internal berms.
- Drainage water will report to collecting sumps at the toe of the facility;
- External drainage system - outer berms will ensure the drainage of runoff from direct precipitation. Runoff water will report to the collecting sumps at the toe of the facility;
- Collecting sumps - two sumps will be set up at the toe of the IMWF north and south catchments to collect seepage and tailings water release from the IMWF area. Each sump will have 2,000m^3 capacity. Both sumps will be provided with pumps, which will operate continuously. Each sump will have two pump units: one in operation and the other one on standby.
- The control and monitoring system will consist of 3 piesometers: 2 of them will be installed downstream of the IMWF toe and the third one will be upstream of the facility. They will be used for groundwater monitoring. The maximum thickness of tailings layers and their consolidation will be controlled by electrical piesometers. Their number and locations will vary depending on the locations of the tailings cells. Approximately 20 electric piesometers will be used. 25 object points on each berm and 3 reference points on the natural ground will be used to monitor the vertical and horizontal displacement.

Closure

The site closure will be achieved in a manner that satisfies the objectives of the closure process and the developed and approved closure projects. The Closure Strategy developed and presented by BMM EAD ensures that the decommissioning and rehabilitation of the mine operation can be successfully achieved in a manner that satisfies the following objectives:

- Establishment of a beneficial afteruse;
- Protection of public health and safety;
- Mitigation or elimination of environmental damages and provision of sustainable environmental development;
- Minimisation of any adverse social and economic impact.

The long-term objective of the closure strategy is that BMM EAD leaves the site in a condition that meets the following criteria:

- Physical stability – any remaining structures must not be an unacceptable hazard to public health or safety, or to the immediate environment;
- Chemical stability – any remaining materials must not be a hazard to future users of the site, or to the public health, or to the immediate environment; and
- Biological stability that enables establishment of an appropriate land-use that is harmonised with the adjacent areas and with the needs and desires of the community.

Together with the construction and operation designs, BMM EAD will prepare a Closure Plan for the open pit, the ore processing plant, the WMF, the water dams, the ancillary facilities and the unnecessary infrastructure. In order to assess the requirements of stakeholders (principally, the local community), it is envisaged that consultation will be carried out with appropriate community representatives prior to the development of the Closure Plan.

4. Lands and Soils

4.1. Soil Characterisation. Disturbed Lands. Polluted Lands. Degradation Processes

According to Bulgaria's soil division, this region belongs to the Mediterranean soil district, Balkan-Mediterranean soil sub-area, East-Rhodopean-Sakar province. This province is dominated by shallow soils (Leptosols, LP) – umbric leptosols with lithosols, umbric liptosols with cinnamon luvisols (chromicq LVx) soils and development of erosion. The soils in the province belong mainly to Class IV of soil capability – poor.

Three soil types are identified in the project area: shallow soils - rendzinas, leached cinnamon and sedimentary – alluvial, alluvial-meadow, alluvial-talus soils. According to the new soil classification system (FAO classification) in Bulgaria, the soils belong to:

• **Order A –** soils not related to area climate;
* **Type –** Fluvisols, FL
* **Sub-type -** Eutric Fluvisols
* **Type –** Distric Colluvisols
* **Sub-type -** Eutric Colluvio/Proluviosols

The fluvisols are formed by Late Quaternary river sediments developing various vegetation covers and periodically recharged with new sediments.

The distric colluvisols occur in areas where the sediments are youngest, coarse and poorly processed. The soil formation process is young, poorly manifested and periodically interrupted by aggregations of new material.

• **Order A –** soils not related to area climate;
* **Type –** thin soils (Leptosols, LP)
* **Sub-type -** Rendzinas (Rendzic Leptosols, LPk)

The soils that are confined in depth by a continuous bed of solid rock are defined as thin, according to the FAO classification. In Bulgaria, these soils are classified as independent units: lithosols – shallow soils over hard rocks, umbric leptosols – poorly developed humus-silicate soils; and rendzinas – over carbonaceous rocks.

• **Order F** - soils with accumulations of clay or sesquioxides and organic matter in the sub-surface horizons
*** Type** - Luvisols – leached cinnamon forest soils (Luvisols, LV)
*** Sub-type.** Cinnamonic chromium or luvisols (Chromic Luvisols, LVx) leached cinnamon, gray forest soils.

The leached forest cinnamon soil is the prevalent soil type in the project area. The intrazonal soils – rendzinas are rare and the alluvial soils are even much rarer.

• ***Leached cinnamon forest soils (Chromic luvisol)***

The soils in the area of the Krumovgrad orefield are mostly eroded leached cinnamon forest soils. The soils on the flatter and wider part of the slopes are slightly to moderately eroded. There is a set of various soils in the area: average to highly eroded forest cinnamon and stony forest cinnamon soil on the steeper slopes and towards rivers/creeks. The first type are arable soils while the second type support grazing with scattered tree and brush vegetation. Most of the Ada Tepe prospect includes state controlled forest fund land. Cinnamon soils were formed under the dominant influence of oak vegetation. According to referenced data, the humus layer in the arable lands is approximately 25 - 28 cm thick, the soil profile is approximately 60 - 90 cm thick. Erosion and deep ploughing have damaged the humus horizon which has been altered and includes part of the transitional illuvial B horizon. The upper (arable) layer has a sugary texture while the sub-arable layer has a lumpy texture.

The undulating ground surface in the steeper sections (many micro-subsidences and micro-rises) and the evident surface erosion have contributed to the development of various soil profiles. Their thickness varies between 8 and 25 cm for thin profiles and up to 30 - 45 cm for moderately to heavily eroded cinnamon forest soils.

Their prevailing texture is medium to heavily sandy-clayey (approx. 30% genuine clay). The nutrient reserves of the one-meter soil layer in arable soils is higher due to the thicker humus horizons and soil profile.

The B horizon contains more clay than the A horizon. They absorb a lot of water in during heavy rain falls and retain it longer, which worsens their air circulation rate and nitrogen supply to vegetation. The bulk density is 1.20 – 1.35 g/cm^3 , while the relevant density is – 2.60 – 2.45.

The levels of humus (below 2.5%), total nitrogen (below 0.25%) and total phosphorus (0.35%) are low, while that of available potassium is moderate – 14 mg/100g. In virgin lands, humus reaches 3-4%, while nitrogen increases insignificantly. Those soils have low level of available nitrogen. The soil pH is 5.8 (acidic).

The leached cinnamon forest soils used for agriculture in the valleys of Krumovgrad municipality are relatively deep and fertile but the diversity of crops grown on them is low.

The soil in the central part of the orefield – the Adá Tepe hill – is also cinnamon forest soil. The destruction of the natural vegetation in the past caused intensive erosion processes. Afforestation carried out in the 60s gradually limited the erosion process. The soil surface was stabilised. The soil formation process is now resumed through the formation of organic forest matter. At this stage, the thickness of the soil varies depending on the location and slope gradient, and on the intensity of the historic erosion processes. The humus and illuvium horizons have eroded on steeper sections. Fragments of the soil parent rocks outcrop at the surface. The flatter sections at the foot of the hill include locations where the soil layer is relatively well preserved.

- ***Rendzinas (Humus-Carbonaceous Soils)***

These soils are developed over carbonaceous rocks and have continuous or intermittent irrigation. Rendzinas have high humus content. The large quantities of calcium carbonate have formed slightly alkaline or neutral reaction of the soil solution.

These soils are relatively thin and confined by the basement rocks. The thickness of the soil cover is irregular - not exceeding 10 cm and the soil profile is occasionally discontinued by outcropping boulders. They are developed over slowly weathering rocks on slopes exhibiting denudation and erosion. Their topsoil accumulation (organic) horizon is thin and often discontinued by the outcropping basement rocks.

The rendzinas are diverse in texture and properties. Their texture depends on the soil parent rock and they vary from heavy sandy-clayey to light clayey soils. A typical feature of these soils is the irregular thickness of their profile. Consistent with the irregular weathering of the limestone, thick soil spots frequently occur next to very thin soil. The pH is neutral in the surface horizon and slightly alkaline in depth. The humus content is moderate: 2 to 3%.

- ***Alluvial (Deluvial-) Meadow (Fluvisol) Soils (Cumulicsols)***

The southern part of the site is dominated by fluvisols, which consist of the following units: Deluvial soils (Deluviumsols), stony - of clayey-sandy mechanical composition and lightly sandy and clayey; deluvial-meadow soils (Deluviumsols) – medium sandy-clayey and heavily sandy-clayey; alluvial-deluvial-meadow soils (Fluvisols) - clayey sandy and sandy clayey.

Deluvial soils have formed on the fallen earth material in the foothills of near-by mountains (as a transition to alluvial soils) These soils are of light mechanical composition (the physical clay is between 10 and 20%), and stony which makes them poorly retentive of water and susceptible to erosion These soils are young, with low humus content(<1%). The most frequent soil pH, (in water) is 5.0 - 6.0 units which makes the soils acidic, but also neutral soils or soils of weak alkaline reaction occur which are made of rendzina or carbonaceous rock materials. The deluvial soils in the region are therefore categorized as 6 - 8 by productivity and most often 5 (lowest) by resistance to chemical pollution.

Deluvial-meadow soils have formed in the middle of the deluvial apron. Alluvial-deluvial-meadow soils have formed in the lowest parts of this territory, in the periphery of the deluvial-prolusion apron under the influence of alluvium from small streams and the richer grass-meadow vegetation. In most cases these are of medium depth with good crumbly-grainy structure, of light clayey sandy mechanical composition, good porosity and aeration. The organic horizon is well-expressed and its thickness reaches 20 – 40 cm. A well-expressed gley horizon occurs in certain more humid locations. Their reaction is lightly acidic to neutral

With respect to fertility, the alluvial-deluvial-meadow soils in the area are included in categories two through four.

Alluvial-meadow soils (Fluvisols) occupy the flood plain and upper river terraces. They are formed by alluvial deposits alongside rivers and by the constant and sufficient humidity in river sediments covered by meadow vegetation They belong to the saturated (Eutric) type, have a pale organic horizon and pH ≥ 5.2 or V ≥ 50% in all horizons at depths of up to 75 cm from the surface. The profile of these soils is incomplete. The average thickness of the humus accumulation layer is 20 cm.

These soils occur around Krumovitsa river and its tributaries (Kesebir, Elbasan etc.), which enter this river in Krumovgrad region, together with the sediments deposits on them. They contain much rubble, large sand and stones carried by these torrential rivers. However, these soils are subject to the most diverse use such as tobacco growing, vegetables, corn and other crops.

The diversity of land and soil in this relatively limited area under study is the direct result of morphological processes occurring in the floodplains of Krumovitsa River and its tributaries, the existing terrain and the co-existence of plateau-shaped, abrasion, and accumulative landforms.

The cinnamon soils will be the most affected soil type by the project implementation while the alluvial-talus soils and rendzinas will be affected to a lesser extent. Most of the cinnamon soils are gravelly, shallow and erosional, and do not react with hydrochloric acid. Despite that, the soil floor beneath the forest canopy is well covered with decaying forest litter, while the flat surfaces without tree vegetation are covered with turf. The average topsoil thickness at Adá Tepe is 20 - 25 cm. The forests in the project area are established on soils having the same characteristics.

The soil properties are derived from the forest development plan of the Krumovgrad State Forestry Board (1999) and presented in Table IV.4.1-1.

Humus, Total Nitrogen and Genuine Clay Content in the Soils

Table IV.4.1-1

Soil type ans sub-type	Humus, %		Total nitrogen, %		Natural clay, %	
	Horizons					
	A	B	A	B	A	B
1. Leached cinnamon forest soil	1.97	0.98	0.167	0.054	15.02	22.44
2. Humus-carbonaceous soil	3.97	3.22	0.117	0.207	8.77	36.63

The soils and lands in the region have been characterised by analysing samples of soils that will be directly affected by the project implementation. Eight soil samples have been analyzed as follows:

PP-001 (south of the ore stockpile);
PP-002 (IMWF);
PP-003 (south of the IMWF);
PP-004 (IMWF);
PP-005 (IMWF);
PP-006 (south of the open pit);
PP-007 (open pit);
PP-008 (open pit).

Texture is one of the key soil properties, which determines their resistance to pollution and buffering capacity. The soil texture under consideration conforms to the genetic features of the described soil types. A trend of increasing clay fractions in depth is observed, which is one of the typical parameters for diagnostics of leached cinnamonic forest soils and deeper rendzinas.

The morphological description of the soil samples gives a visual indication of the condition of the environment, land and soil in the area under consideration. The morphological data is presented in Table IV.4.1-2.

Relative Density Determinations

Table IV.4.1.-2:

Lab No	Sample No	Unit	Method of testing	Test results
1238	PP-001; 387118/4587817	g/cm^3	BNS 646	2.66
1239	PP-002; 387704/4587372	g/cm^3	BNS 646	2.65
1240	PP-003; 388007/4586920	g/cm^3	BNS 646	2.69
1241	PP-004; 388016/4587272	g/cm^3	BNS 646	2.60
1242	PP-005; 387758/4587301	g/cm^3	BNS 646	2.55
1243	PP-006; 387533/4587913	g/cm^3	BNS 646	2.72
1244	PP-007; 387552/4588153	g/cm^3	BNS 646	2.57
1245	PP-008; 387551/4588452	g/cm^3	БДС 646	2.49

The relative density of the tested soil samples was between 2.49 and 2.72 g/cm^3. This means that the soils had low organic and high silicate content. The soils with higher losses from HCI had the lowest density – 2.58 to 2.63 g/cm^3, and only one sample showed 2.71 g/cm^3. These samples contained more limestone and marl.

Soils with sandy-clayey texture are the dominant type in the local forests. The texture differentiation of cinnamonic soil and the intensity of the erosion processes on the soil surface have created layers of various texture. The changes are mainly in the categories of slightly to moderately sandy-clayey soils. The moderately sandy-clayey soils prove to be more resistant than the clayey-sandy soils.

The texture analysis of the soils allows the general conclusion that the forest lands are dominated by soils of average resistance to pollution with heavy metals, while the agricultural lands are dominated by less resistant soils.

The pH is low to medium acidic with values between 6.01 and 5.0. The content of **humus** is between 0.50 and 4.17%, which means that the forest soils in PP-001, PP-002, PP-003, PP-006 have low humus and those in PP-004, PP-005, PP-007, PP-008 have medium humus. Humus acts as heavy metal adsorbent in the soil. It demonstrates significant reactivity with metals to form complex organic-mineral complex compounds in which the elements remain strongly bound and cannot migrate to other media. The ***total nitrogen*** content in soils is closely related to the humus content. According to the classification system, the soils in the ore mining region are slightly to moderately rich in humus.

The background concentration of ***heavy metals and arsenic*** is the most important indicator that is studied prior to commencement of mining and excavation works. It is important to know their background levels in the soils near the future development areas, which may potentially be subjected to a cumulative impact if some or all of these elements are found in them. All this is necessary to determine the extent to which the biological products from the soils and the future rehabilitated land contains and could contain toxic elements that could migrate to the higher trophic levels when the soils are polluted and after the rehabilitation of the disturbed lands.

The testwork on the studied soils to determine the concentrations of heavy metals, metalloids, and sulphur was completed using the comparative ecosystem approach, i.e. the testwork results are compared against the maximum allowable levels of these elements under our regulations and against data and analyses by scientists from other countries who study the mobility and assimilation of these substances by plants under normal soil metabolic conditions. That is practically the start of the soil monitoring to control the condition of the soils during the project implementation. The monitoring data will allow forecasting of future impacts from the gold mining and processing operations until and after the closure of the project. An Environmental Monitoring Program is developed and the collected monitoring data will be processed and regularly supplied to the appropriate authorities and stakeholders. The draft Program is attached to this EIS (Appendix 10).

The data from the soil testwork to determine the levels of heavy metals silver, gold, sulphur and arsenic in their total and mobile forms in the forest lands in the project area are presented in Tables IV.4.1-3, IV.4.1-4, IV.4.1-5.

Determination of Sulphur Content

Table IV.4.1-3

Lab No	Sample No	Unit	Method of testing	Test results
1238	PP-001; 387118/4587817	%	ETC V3I1/7.3-7/87	<0.005
1239	PP-002; 387704/4587372	%	ETC V3I1/7.3-787	<0.005
1240	PP-003; 388007/4586920	%	ETC V3I1/7.3-7/87	<0.005
1241	PP-004; 388016/4587272	%	ETC V3I1/7.3-7/87	<0.005
1242	PP-005; 387758/4587301	%	ETC V3I1/7.3-7/87	0.01
1243	PP-006; 387533/4587913	%	ETC V3I1/7.3-7/87	<0.005
1244	PP-007; 387552/4588153	%	ETC V3I1/7.3-7/87	0.01
1245	PP-008; 387551/4588452	%	ETC V3I1/7.3-7/87	0.01

Determination of Water Soluble (Mobile) Species

Table IV.4.1-4

Lab No	**Sample No**	**V mg/kg**	**Cr mg/kg**	**Co mg/kg**	**Ni mg/kg**	**Cu mg/kg**	**Zn mg/kg**	**As mg/kg**	**Se mg/kg**	**Mo mg/kg**	**Cd mg/kg**	**Sb mg/kg**	**Ba mg/kg**	**Pb mg/kg**	**Hg mg/kg**
1238	PP-001; 387118/4587817	0.067	0.053	0.122	0.138	0.159	0.979	<0.10	<0.10	0.067	0.232	<0.050	0.852	0.14	<0.10
1239	PP-002; 387704/4587372	0.025	0.022	0.050	0.024	0.127	0.762	<0.10	<0.10	<0.050	0.248	<0.050	0.675	0.12	<0.10
1240	PP-003; 388007/4586920	0.044	0.045	0.025	0.057	0.257	0.613	<0.10	<0.10	<0.050	0.238	<0.050	2.589	0.11	<0.10
1241	PP-004; 388016/4587272	0.213	0.133	0.317	0.231	0.222	1.006	<0.10	<0.10	<0.050	0.015	<0.050	2.600	0.19	<0.10
1242	PP-005; 387758/4587301	0.234	0.164	0.280	0.114	0.298	0.843	<0.10	<0.10	<0.050	<0.010	<0.050	3.639	0.36	<0.10
1243	PP-006; 387533/4587913	0.165	0.043	0.206	0.182	0.246	0.837	<0.10	<0.10	<0.050	0.020	<0.050	10.04	0.34	<0.10
1244	PP-007; 387552/4588153	0.192	0.076	0.260	0.152	0.174	0.694	<0.10	<0.10	<0.050	<0.010	<0.050	2.158	0.25	<0.10
1245	PP-008; 387551/4588452	0.123	0.104	0.480	0.480	0.123	0.828	<0.10	<0.10	<0.050	0.019	<0.050	2.729	0.26	<0.10

Heavy Metal Concentrations

Table IV.4.1-5

#	Parameter	Unit	Standards/validated methods	Sample no. according to Sample Logbook	Test results (value, below detection)	Parameter value and tolerance	Test conditions
1	2	3	4	5	6	7	8
1	Determinations in water extract:						
1.1	pH	pH units	BNS ISO 10390/02	Soil sample PP-001 387118/ 4587817 lab # 1238 from the Ada Tepe area , Krumovgrad	6.73 ± 0.10	-	Standard
2	Chemical composition						
2.1	Chromium (Cr)	mg/kg	BNS ISO 14869-1/02		50 ± 5	-	Standard
2.2	Manganese (Mn)	mg/kg	BNS ISO 14869-1/02		330 ± 33	-	Standard
2.3	Iron (Fe)	mg/kg	BNS ISO 14869-1/02		20530 ± 410	-	Standard
2.4	Cobalt (Co)	mg/kg	BNS ISO 14869-1/02		10 ± 1	-	Standard
2.5	Nickel (Ni)	mg/kg	BNS ISO 14869-1/02		13 ± 1	-	Standard
2.6	Copper (Cu)	mg/kg	BNS ISO 14869-1/02		18 ± 2	-	Standard
2.7	Zinc (Zn)	mg/kg	BNS ISO 14869-1/02		56 ± 6	-	Standard
2.8	Arsenic (As)	mg/kg	BNS ISO 14869-1/02		44 ± 4	-	Standard
2.9	Silver (Ag)	mg/kg	BNS ISO 14869-1/02		<1	-	Standard
2.10	Cadmium (Cd)	mg/kg	BNS ISO 14869-1/02		1 ± 1	-	Standard
2.11	Lead (Pb)	mg/kg	BNS ISO 14869-1/02		24 ± 2	-	Standard
2.12	Gold (Au)	mg/kg	ETC V3I1/7.1-4/85		<0.05	-	Standard
3	Humus	%	ETC V3I1/7.2.3-11/02		0.54 ± 0.05	-	Standard
4	Kjeldahl nitrogen	mg/g	BNS ISO 11261/02		<0.50	-	Standard

Table IV.4.1-5 (contd.)

1	2	3	4	5	6	7	8
1	Determinations in water extract:						
1.1	pH	pH units	BNS ISO 10390/02	Soil sample PP-002 387704/ 4587372 lab # 1239 from the Ada Tepe area, Krumovgrad	6.64 ± 0.10	-	Standard
2	Chemical composition						
2.1	Chromium (Cr)	mg/kg	BNS ISO 14869-1/02		61 ± 6	-	Standard
2.2	Manganese (Mn)	mg/kg	BNS ISO 14869-1/02		650 ± 65	-	Standard
2.3	Iron (Fe)	mg/kg	BNS ISO 14869-1/02		17931 ± 359	-	Standard
2.4	Cobalt (Co)	mg/kg	BNS ISO 14869-1/02		8 ± 1	-	Standard
2.5	Nickel (Ni)	mg/kg	BNS ISO 14869-1/02		12 ± 1	-	Standard
2.6	Copper (Cu)	mg/kg	BNS ISO 14869-1/02		12 ± 1	-	Standard
2.7	Zinc (Zn)	mg/kg	BNS ISO 14869-1/02		57 ± 6	-	Standard
2.8	Arsenic (As)	mg/kg	BNS ISO 14869-1/02		8 ± 1	-	Standard
2.9	Silver (Ag)	mg/kg	BNS ISO 14869-1/02		<1	-	Standard
2.10	Cadmium (Cd)	mg/kg	BNS ISO 14869-1/02		1 ± 1	-	Standard
2.11	Lead (Pb)	mg/kg	BNS ISO 14869-1/02		34 ± 3	-	Standard
2.12	Gold (Au)	mg/kg	ETC V3I1/7.1-4/85		<0.05	-	Standard
3	Humus	%	ETC V3I1/7.2.3-11/02		1.16 ± 0.12	-	Standard
4	Kjeldahl nitrogen	mg/g	BNS ISO 11261/02		0.76 ± 0.08	-	Standard

Table IV.4.1-5 (contd.)

1	2	3	4	5	6	7	8
1	Determinations in water extract:			Soil sample PP-003 388007/ 4586920 lab # 1240 from the Ada Tepe area, Krumovgrad			
1.1	pH	pH units	BNS ISO 10390/02		6.66 ± 0.10	-	Standard
2	Chemical composition						
2.1	Chromium (Cr)	mg/kg	BNS ISO 14869-1/02		121 ± 12	-	Standard
2.2	Manganese (Mn)	mg/kg	BNS ISO 14869-1/02		809 ± 81	-	Standard
2.3	Iron (Fe)	mg/kg	BNS ISO 14869-1/02		35235 ± 705	-	Standard
2.4	Cobalt (Co)	mg/kg	BNS ISO 14869-1/02		20 ± 2	-	Standard
2.5	Nickel (Ni)	mg/kg	BNS ISO 14869-1/02		32 ± 3	-	Standard
2.6	Copper (Cu)	mg/kg	BNS ISO 14869-1/02		32 ± 3	-	Standard
2.7	Zinc (Zn)	mg/kg	BNS ISO 14869-1/02		86 ± 9	-	Standard
2.8	Arsenic (As)	mg/kg	BNS ISO 14869-1/02		7 ± 1	-	Standard
2.9	Silver (Ag)	mg/kg	BNS ISO 14869-1/02		<1	-	Standard
2.10	Cadmium (Cd)	mg/kg	BNS ISO 14869-1/02		1 ± 1	-	Standard
2.11	Lead (Pb)	mg/kg	BNS ISO 14869-1/02		29 ± 3	-	Standard
2.12	Gold (Au)	mg/kg	ETC V3I1/7.1-4/85		<0.05	-	Standard
3	Humus	%	ETC V3I1/7.2.3-11/02		1.66 ± 0.17	-	Standard
4	Kjeldahl nitrogen	mg/g	BNS ISO 11261/02		1.20 ± 0.12	-	Standard

Table IV.4.1-5 (contd.)

1	2	3	4	5	6	7	8
1	Determinations in water extract:			Soil sample PP-004 388016/ 45887272 lab # 1241 from the Ada Tepe area, Krumovgrad			
1.1	pH	pH units	BNS ISO 10390/02		6.33 ± 0.10	-	Standard
2	Chemical composition						
2.1	Chromium (Cr)	mg/kg	BNS ISO 14869-1/02		94 ± 9	-	Standard
2.2	Manganese (Mn)	mg/kg	BNS ISO 14869-1/02		665 ± 66	-	Standard
2.3	Iron (Fe)	mg/kg	BNS ISO 14869-1/02		34134 ± 683	-	Standard
2.4	Cobalt (Co)	mg/kg	BNS ISO 14869-1/02		20 ± 2	-	Standard
2.5	Nickel (Ni)	mg/kg	BNS ISO 14869-1/02		33 ± 3	-	Standard
2.6	Copper (Cu)	mg/kg	BNS ISO 14869-1/02		37 ± 4	-	Standard
2.7	Zinc (Zn)	mg/kg	BNS ISO 14869-1/02		79 ± 8	-	Standard
2.8	Arsenic (As)	mg/kg	BNS ISO 14869-1/02		9 ± 1	-	Standard
2.9	Silver (Ag)	mg/kg	BNS ISO 14869-1/02		<1	-	Standard
2.10	Cadmium (Cd)	mg/kg	BNS ISO 14869-1/02		1 ± 1	-	Standard
2.11	Lead (Pb)	mg/kg	BNS ISO 14869-1/02		23 ± 2	-	Standard
2.12	Gold (Au)	mg/kg	ETC V3I1/7.1-4/85		<0.05	-	Standard
3	Humus	%	ETC V3I1/7.2.3-11/02		4.42 ± 0.44	-	Standard
4	Kjeldahl nitrogen	mg/g	BNS ISO 11261/02		2.38 ± 0.24	-	Standard

Table IV.4.1-5 (contd.)

1	2	3	4	5	6	7	8
1	Determinations in water extract:			Soil sample PP-005 387758/ 4587301 lab # 1242 from the Ada Tepe area , Krumovgrad			
1.1	pH	pH units	BNS ISO 10390/02		5.85 ± 0.10	-	Standard
2	Chemical composition						
2.1	Chromium (Cr)	mg/kg	BNS ISO 14869-1/02		97 ± 10	-	Standard
2.2	Manganese (Mn)	mg/kg	BNS ISO 14869-1/02		685 ± 68	-	Standard
2.3	Iron (Fe)	mg/kg	BNS ISO 14869-1/02		40699 ± 814	-	Standard
2.4	Cobalt (Co)	mg/kg	BNS ISO 14869-1/02		23 ± 2	-	Standard
2.5	Nickel (Ni)	mg/kg	BNS ISO 14869-1/02		28 ± 3	-	Standard
2.6	Copper (Cu)	mg/kg	BNS ISO 14869-1/02		25 ± 2	-	Standard
2.7	Zinc (Zn)	mg/kg	BNS ISO 14869-1/02		74 ± 7	-	Standard
2.8	Arsenic (As)	mg/kg	BNS ISO 14869-1/02		10 ± 1	-	Standard
2.9	Silver (Ag)	mg/kg	BNS ISO 14869-1/02		<1	-	Standard
2.10	Cadmium (Cd)	mg/kg	BNS ISO 14869-1/02		1 ± 1	-	Standard
2.11	Lead (Pb)	mg/kg	BNS ISO 14869-1/02		22 ± 2	-	Standard
2.12	Gold (Au)	mg/kg	ETC V3I1/7.1-4/85		<0.05	-	Standard
3	Humus	%	ETC V3I1/7.2.3-11/02		4.17 ± 0.42	-	Standard
4	Kjeldahl nitrogen	mg/g	BNS ISO 11261/02		1.41 ± 0.14	-	Standard

Table IV.4.1-5 (contd.)

1	2	3	4	5	6	7	8
1	Determinations in water extract:			Soil sample PP-006 387533/ 4587913 lab # 1243 from the Ada Tepe area, Krumovgrad			
1.1	pH	pH units	BNS ISO 10390/02		5.00 ± 0.10	-	Standard
2	Chemical composition						
2.1	Chromium (Cr)	mg/kg	BNS ISO 14869-1/02		33 ± 3	-	Standard
2.2	Manganese (Mn)	mg/kg	BNS ISO 14869-1/02		383 ± 38	-	Standard
2.3	Iron (Fe)	mg/kg	BNS ISO 14869-1/02		47847 ± 957	-	Standard
2.4	Cobalt (Co)	mg/kg	BNS ISO 14869-1/02		16 ± 2	-	Standard
2.5	Nickel (Ni)	mg/kg	BNS ISO 14869-1/02		21 ± 2	-	Standard
2.6	Copper (Cu)	mg/kg	BNS ISO 14869-1/02		32 ± 3	-	Standard
2.7	Zinc (Zn)	mg/kg	BNS ISO 14869-1/02		104 ± 10	-	Standard
2.8	Arsenic (As)	mg/kg	BNS ISO 14869-1/02		42 ± 4	-	Standard
2.9	Silver (Ag)	mg/kg	BNS ISO 14869-1/02		<1	-	Standard
2.10	Cadmium (Cd)	mg/kg	BNS ISO 14869-1/02		1 ± 1	-	Standard
2.11	Lead (Pb)	mg/kg	BNS ISO 14869-1/02		30 ± 3	-	Standard
2.12	Gold (Au)	mg/kg	ETC V3I1/7.1-4/85		<0.05	-	Standard
3	Humus	%	ETC V3I1/7.2.3-11/02		0.76 ± 0.08	-	Standard
4	Kjeldahl nitrogen	mg/g	BNS ISO 11261/02		<0.50	-	Standard

Table IV.4.1-5 (contd.)

#	Parameter	Unit	Standards/validated methods	Sample no. according to Sample Logbook	Test results (value, below detection)	Parameter value and tolerance	Test conditions
1	2	3	4	5	6	7	8
1	Determinations in water extract:			Soil sample PP-007 387552/ 4588153 lab # 1244 from the Ada Tepe area, Krumovgrad			
1.1	pH	pH units	BNS ISO 10390/02		6.01 ± 0.10	-	Standard
2	Chemical composition						
2.1	Chromium (Cr)	mg/kg	BNS ISO 14869-1/02		179 ± 18	-	Standard
2.2	Manganese (Mn)	mg/kg	BNS ISO 14869-1/02		2199 ± 109	-	Standard
2.3	Iron (Fe)	mg/kg	BNS ISO 14869-1/02		29320 ± 586	-	Standard
2.4	Cobalt (Co)	mg/kg	BNS ISO 14869-1/02		28 ± 3	-	Standard
2.5	Nickel (Ni)	mg/kg	BNS ISO 14869-1/02		82 ± 8	-	Standard
2.6	Copper (Cu)	mg/kg	BNS ISO 14869-1/02		48 ± 5	-	Standard
2.7	Zinc (Zn)	mg/kg	BNS ISO 14869-1/02		87 ± 9	-	Standard
2.8	Arsenic (As)	mg/kg	BNS ISO 14869-1/02		122 ± 12	-	Standard
2.9	Silver (Ag)	mg/kg	BNS ISO 14869-1/02		1 ± 1	-	Standard
2.10	Cadmium (Cd)	mg/kg	BNS ISO 14869-1/02		1 ± 1	-	Standard
2.11	Lead (Pb)	mg/kg	BNS ISO 14869-1/02		24 ± 2	-	Standard
2.12	Gold (Au)	mg/kg	ETC V3I1/7.1-4/85		0.16 ± 0.02	-	Standard
3	Humus	%	ETC V3I1/7.2.3-11/02		2.77 ± 0.28	-	Standard
4	Kjeldahl nitrogen	mg/g	BNS ISO 11261/02		2.40 ± 0.24	-	Standard

Table IV.4.1-5 (contd.)

1	2	3	4	5	6	7	8
1	Determinations in water extract:			Soil sample PP-008 387551/ 4588455 lab # 1245 from the Ada Tepe area, Krumovgrad			
1.1	pH	pH units	BNS ISO 10390/02		5.43 ± 0.10	-	Standard
2	Chemical composition						
2.1	Chromium (Cr)	mg/kg	BNS ISO 14869-1/02		224 ± 22	-	Standard
2.2	Manganese (Mn)	mg/kg	BNS ISO 14869-1/02		3345 ± 167	-	Standard
2.3	Iron (Fe)	mg/kg	BNS ISO 14869-1/02		26822 ± 536	-	Standard
2.4	Cobalt (Co)	mg/kg	BNS ISO 14869-1/02		45 ± 4	-	Standard
2.5	Nickel (Ni)	mg/kg	BNS ISO 14869-1/02		96 ± 10	-	Standard
2.6	Copper (Cu)	mg/kg	BNS ISO 14869-1/02		30 ± 3	-	Standard
2.7	Zinc (Zn)	mg/kg	BNS ISO 14869-1/02		70 ± 7	-	Standard
2.8	Arsenic (As)	mg/kg	BNS ISO 14869-1/02		109 ± 11	-	Standard
2.9	Silver (Ag)	mg/kg	BNS ISO 14869-1/02		1 ± 1	-	Standard
2.10	Cadmium (Cd)	mg/kg	BNS ISO 14869-1/02		1 ± 1	-	Standard
2.11	Lead (Pb)	mg/kg	BNS ISO 14869-1/02		24 ± 2	-	Standard
2.12	Gold (Au)	mg/kg	ETC V3I1/7.1-4/85		0.08 ± 0.01	-	Standard
3	Humus	%	ETC V3I1/7.2.3-11/02		3.08 ± 0.31	-	Standard
4	Kjeldahl nitrogen	mg/g	BNS ISO 11261/02		2.98 ± 0.30	-	Standard

Copper, **lead** and **zinc** levels are within the permitted limits applicable in Bulgaria – below the maximum allowable levels and below the preventive levels (under Regulation 3 - SG issue 71/2008). In forestry fund land, ***lead*** exceeds the background levels but is below the preventive levels.

Cadmium is below the allowable limit but higher than the preventive and background levels.

Nickel in samples PP-007 and PP-008, however, exceeds not only the background and preventive levels but also the maximum allowable levels.

Chromium in most samples is above the background levels but below the preventive and maximum allowable levels.

Cobalt is below the preventive level and above the nation-wide background levels in samples PP-005, PP-007 and PP-008.

Arsenic levels, however, raises the greatest concern. Except for soil samples PP-002, PP-003, PP-004 and PP-005, its concentrations in forest soils exceeds the background and preventive levels. The concentrations in samples PP-007 and PP-008 are higher than the maximum allowable concentrations.

Silver in the soil is below 1 mg/kg except for samples PP-007 and PP-008. The soils in the ore mineralisation areas are rich in silver but its concentration dose not exceed 1 mg/kg.

Gold is a rare element and does not occur in the rocks in concentrations above $n.10^{-3}$ mg/kg. The gold levels in the sampled soils are circa <0,05 to <0,16 mg/kg.

The total quantity of ***sulphur*** in the soil varies considerably from 20 mg/kg to 5 g/kg and depends on the chemical composition of the soil parent materials and the organic feed. According to reference sources, the world-wide soil average is approximately 0.085%. The levels in the samples vary between 0.01 and <0.005 mg/kg.

Conclusions

1. - The values of analysed parameters at the individual forest sampling locations vary significantly depending on the specific combination of soil formation factors. The climate, topography, soil parent materials and anthropogenic activities have dictated the formation of vegetation habitats of varying fertility. The factors that limit the fertility of the soils most are the soil depth, moisture and erosion. Despite the low fertility of the steeper areas, the soil conditions may be suitable for certain non-demanding tree species.

2. - No pollution or acidification, salinisation, or other anthropogenic impacts on the Ada Tepe soils have been identified.

3. Certain forest soils in the Ada Tepe area contain elevated concentrations of arsenic, chromium and nickel due to the soil natural chemistry.

4. Despite the prevalence of favourable conditions for high soil resistance to anthropogenic impacts such as soil solution pH and content of clay and organic matter, the soils are considered sensitive to impacts. The elevated concentrations of heavy metals and metalloids has raised the sensitivity of these soils to acidification, which could increase the mobility of metals to other media.

5. The forest soils at Adá Tepe are a potential source of pollution to other media due to the elevated levels of certain heavy metals in them. The soils removed and stockpiled during the open pit mining may only be selectively re-used for rehabilitation. It should be noted that their use for agricultural rehabilitation will cause pollution of the agricultural crops. Soils that are rich in heavy metals are suitable only for forestry rehabilitation, where they are not expected to have any negative environmental impacts.

Land Use

Land use in the region is based on the climate, topography, soils and the economic development of the area. The land is used in four main businesses – agriculture (tobacco, vegetables, and orchards growing and live stock breeding), forestry business and commercial hunting, recreation and construction.

The set of environmental factors, social status and difficult access to the area are to a great extent the reason why the local agriculture is very much specialised with a focus on tobacco growing. Most of the population makes a living by tobacco farming, and therefore tobacco determines the business profile of the municipality. Agriculture is based on small pieces of land scattered throughout the area, insufficiently equipped with machines and lagging behind other businesses.

Disturbed Lands.

Disturbed land in the area includes:

- dirt roads and forest tracks;
- asphalt-capped road to Krumovrad Forest Farm – 2 da;
- developed land including existing buildings on 1.2 da area, and demolished buildings.

Polluted Lands. Degradation Processes

There are no marshlands and wet soil areas in the project site area. All arable land is exposed to surface water erosion. The highest soil erosion impact is on slopes of gradient higher than 6 - 12° and on land located by the Krumovitsa River and Kesebir River. Meadows and pastures are less affected. Large part of the land is not cultivated.

No landslide processes are observed in the project site area. No polluted land is identified in the site area.

5. Flora and Fauna

5.1. Characterisation of the Vegetation in the Project Area

The project area is within the Macedonian-Thracian province of the European broadleaved forest district. The province includes the Eastern Rhodopes and part of the Thracian lowland. The project site belongs to the Krumovgrad region of the Eastern Rhodopes. The Eastern Rhodopes are generally dominated by xerothermal vegetation represented by formations of Italian oak (*Querceta frainetto*), pubescent oak (*Querceta pubescentis*) and common oak (*Querceta virgiliana*). Moesian beech formations (*Fageta moesiaca*) occur in the S-SW end of the Eastern Rhodopes. The Krumovgrad region typically hosts xerothermal Italian oak and Italian oak-Cerris oak forests, as well as xeromesophytic durmast oak and mixed durmast oak and hornbeam forests. Habitats of the rare species *Quercus thracica*, *Verbascum humile ssp. Juruk*, *Eriolobus trilobata*, strawberry madrone (*Arbutus unedo*) and *Arbutus andrachne* are found in this region alone.

The number of species of high conservation value in the project area is:

- protected by the Biodiversity Act – 83 species;
- globally rare – 2 species;
- listed in Annex I to Directive 92/43 – 2 habitat types;
- listed in Annex 1 to the Bern Convention – 5 species;
- listed in the Red Data Book of Bulgaria – 13 endangered and 101 rare species.

The plant communities in the Ada Tepe area are represented by a relatively small number of taxa and syntaxa. The forest vegetation in Adá tepe consists of secondary Austrian pine communities and mixed coniferous species dominated by Austrian pine (*Pinus nigra*) and Scots pine (*Pinus sylvestris*), which are characterised by dense canopies and good vitality. The forest canopies typically have one-storey and rarely two-storey structure with individual grass species on the ground-level phytocenotic horizon. Also, mixes Italian oak and coniferous communities have formed with manifest mosaic arrangement of mictrogroups of Italian oak, Austrian pine and other tree and brush species.

Secondary vegetation consisting of individuals or groups of certain tree, brush and ruderal grass species occurs alongside the forest roads and in esoteric areas. The most frequently occurring tree and brush species are: Italian oak (Quercus frainetto), common durmast oak (Quercus dalechampii), gumarabic acacia (Robinia pseudoacacia), pear (Pyrus elaeagrifolia), whitethorn (Crataegus monogyna), cornel tree (Cornus mas), dog rose (Rosa canina), traveller's joy (Clematis vitalba), dewberry (Rubus caesius) etc. The following species participate in the grass micro-groups, although in varying numbers sea barley (Hordeum murinum), St. John's wort (Hypericum perforatum), yellow toadflax (Linaria vulgaris), chamomile (Chamonilla recutita), Bupleurum comutatum, pepperwort (Lepidium ruderale), hypericum (Hypericum rumeliacum), field milkweed (Sonchus arvensis), field bindweed (Convolvulus arvensis), hare's foot trefoil (Trifolium arvense), T. angustifolium, T. retusum, T. repens, sheep's sorrel (Rumex acetosella), fat hen (Chenopodium album), knotgrass (Polygonum aviculare), plumeless thistle (Carduus acanthoides), common mallow (Malva sylvestris), Verbascum orientale, lop grass (Bromus mollis), brome (B. sterillis), Orlaya grandiflora, chickweed (Stellaria media), yarrow (Achilea millefolium), goosegrass (Galium verum), Galium apparine, immortelle (Xeranthemum annuum), lesser burdock (Arctium minos), germander (Teucrium chamaedrys), wild basil (Clinopodium vulgare), Grecian foxglove (Digitalis lanata), cinquefoil (Potentilla argentea), Solanum schultesii, prickly lettuce (Lactuca seriola) etc.

Hygromesophyllous groups consisting of black poplar (Populus nigra), white willow (Salix alba), purple willow (Salix purpurea), dewberry (Rubus caesius), hop trefoil (Trifolium campestre), strawberry clover (Trifolium fragiferum) sun spurge (Euphorbia helioscopa), common tormentil (Potentilla erecta) etc. are formed in ravines at the foothills of Ada Tepe.

Moving away from the valley sections to areas where moisture levels are low, the hygromesophytic groups are replaced by xerophytic microgroups with participation of Italian oak (Quercus frainetto), cerris oak (Quercus cerris), Pyrus pyraster, red juniper (Juniperus oxycedrus), restharrow (Ononis hircina), white melilot (Melilotus alba) etc.

The vegetation in the project area is strongly affected by human activity. The native vegetation is preserved in limited small areas. Most of the area is occupied by primary and secondary succession vegetation, and by lands that have eroded after deforestation. The tree vegetation at Adá Tepe is strongly affected. The afforestation of large areas with Austrian pine (Pinus nigra) mixed with acacia (Robinia pseudoacacia) has changed its natural appearance. The species that naturally occur in the region are represented by flowering ash (Fraxinus ornus), Italian oak (Querceta frainetto), common Durmast oak (Qurrcus delechampii), hawthorn (Crataegus monogina), cornel tree (Cornus mas) and dogrose (Rosa canina). The natural mezo-hydrophilic tree vegetation has remained in the ravines around the hill but its distribution is extremely limited. In general, the vegetation in the area is extremely altered by extensive historic human activity. Secondary succession grass and brush vegetation or introduced tree species now replace the former xerophilic forests in some areas. Tree cutting in other areas has been fatal causing complete erosion and washing away of the soil profile.

The analysis of the current status of the flora in Krumovgrad Municipality has shown a number of negative changes related to the economic use of vegetation resources, agricultural assimilation of various historical forest areas, construction and urbanization. The specific climate combined with irrational use of plant resources over the last centuries has stimulated plant xerophytisation and desertification of certain areas. Environmentally sound forest conservation and successful afforestation of denudated areas and rehabilitation of degraded forest communities during the recent decades are positive plant conservation and development activities.

The analysis of the current status of the vegetation in Krumovgrad Municipality has shown a number of negative changes related to the economic use of vegetation resources, agricultural use of various formerly forested areas, construction and urbanization. The vegetation is represented mainly by forest crops with prevalent Austrian pine and Scots pine, mixed coniferous-broad-leaved forests dominated by Italian oak, derivative brush and grass communities.

According to the forest development plan of the Krumovgrad State Forestry Board (2008), the project area includes the following sections:

- section 600 with a total area of 62,3 ha and a resource of 7,660 m^3;
- section 601 with a total area of 70.9 ha and a resource of 11,320 m^3;

- section 629 with a total area of 79.6 ha and a resource of 8,360 m^3;
- section 630 with a total area of 59.7 ha and a resource of 7,805 m^3.

Depending on their origin, the **forest ecosystems** affected by the Ada Tepe project are divided into:

- Derivative forest ecosystems formed through anthropogenic impacts;
- Secondary forest ecosystems formed by afforestation and creation of various forest plants.

Depending on their origin, the **brush and grass ecosystems** are divided into:

Derivative grass ecosystems formed through secondary succession and anthropogenic impacts;

Brief continuity grass ecosystems formed through secondary succession following landscape degradation.

The following typical ecosystems can be differentiated on the hill of Ada tepe and its adjacent territories within the footprint of the project:

- Secondary Austrian pine forest ecosystems on slopes exposed to south-west, north-west and east on cinnamon forest soils over basement rock comprising breccia-conglomerates, sandstones and granite-gneiss. The community has a two-storey canopy structure, where the first storey has 70% coverage and consists of Austrian pine (Pinus nigra), while the second storey has 20% coverage and consists of Italian oak (Quercus frainetto);

- Secondary Scots pine-Austrian pine-Italian oak forest ecosystems basement rock comprising breccia-conglomerates and sandstones. These are one-storey communities with up to 80 % coverage;

- Secondary pure Austrian pine and mixed forest ecosystems with prevalence of Austrian pine of varying exposure on cinnamon forest soils over basement rock comprising breccia-conglomerates, sandstones and granite-gneiss.

- Derivative and secondary Italian oak-Durmast oak-Austrian pine forest ecosystems of varying exposure on cinnamon forest soils over basement rock comprising breccia-conglomerates, sandstones and granite-gneiss

- **Derivative and secondary Italian oak-Acacia-Austrian pine forest ecosystems** of varying exposure on cinnamon forest soils over a geological base of breccia-conglomerates, sandstones and granite-gneiss.

- **Derivative xeromesophytic grass ecosystems** of varying exposure on cinnamon forest soils over a geological base of breccia-conglomerates, sandstones and granite-gneiss.

Conclusions:

The flora in the Krumovgrad phytogeographic area is characterized by specific Mediterranean floral elements, and plant species listed in the Red Data Book of Bulgaria are found in the municipality.

The vegetation in Krumovgrad municipality comprises native and derivative secondary communities. The native vegetation is represented by forest communities with prevalent European beech, common durmast oak, Eastern durmast oak, Italian oak, cerris oak, pubescent oak, Quercus virgiliana, Acer monspessulanum, flowering ash etc.

During the degradation of forest communities and secondary succession occurring in many places, derivative plant communities have formed with prevalence of oriental hornbeam, red juniper, brush and grass communities with prevalent Christ's thorn and xeromesophillous grass communities with prevalent beard grass, Dichantieta ischaemui, poa bulbosa, wild thyme etc. The secondary vegetation is represented by forest crops dominated by Scots pine and Austrian pine and by agricultural crops, mainly tobacco.

The analysis of the current status of the flora and fauna in Krumovgrad Municipality has shown a number of negative changes related to the economic use of vegetation resources, agricultural assimilation of various historical forest areas, construction and urbanization. The specific climate combined with irrational use of plant resources over the last centuries has stimulated plant xerophytisation and desertification of certain areas. Environmentally sound forest conservation and successful afforestation of denudated areas and rehabilitation of degraded forest communities during the recent decades are positive plant conservation and development activities.

The analysis of the current status of the vegetation in Krumovgrad Municipality has shown that secondary and mobile floral elements prevail and no habitats of rare, near-extinct or protected plant species have been found. The vegetation is represented mainly by forest plants with prevalent Austrian pine and Scots pine, mixed coniferous-broad-leaved forests dominated by Italian oak, derivative brush and grass communities and agrophytocenoses dominated by tobacco.

The elevated levels of macro and microelements identified in most of the vegetation samples lead to the conclusion that the nutritional balance of the plants is disturbed.

The analyses of samples of plant biomass (tree and grass species) within the Ada Tepe project area (according to the Krumovgrad EIS, 2005) allow the following conclusions:

- Regarding Ca, all levels in Pinus nigra are above those accepted as optimum both for 1-year and 2-year old coniferous tree needles.
- Regarding K, all levels in Pinus nigra are above those accepted as optimum, except for one sample where 1 year old coniferous tree needles show levels closer to the "normal" ones.
- Mg content is also high, but does not exceed the normal levels by far. P content is better, with only one sample area showing levels higher than the optimum.
- The content of Fe in P. nigra needles in some samples is present in quantities twice higher than those accepted as optimum. The content of Cu is similar, with most samples exhibiting values higher than the optimum.
- Only two samples of 2-year old Pinus nigra needles have exhibited elevated Zn levels. All other samples show values within the normal limits.
- The level of Ca in 2-year old P. sylvestris needles is higher, while K is above the optimum for both one-year and 2-year needles. The other macroelements are tested within the accepted normal levels. Regarding the microelements, the 2-year old needles exhibit higher accumulation of Zn and Cu.
- The content of Ca in Quercus frainetto is excessive in all samples. K is excessive in only one sample, and is within the normal levels in the remaining samples. The established Mg quantity is normal, and three samples show higher-than-optimal phosphorous quantities. Most samples contain excessive Fe and Cu. Zn is higher than the optimum in 2 samples, and Mn is higher than the optimum in 1 sample.
- Tobacco leaf samples exhibit the largest quantities of Ca, K and Mg. Large quantities of As, Cr and Cd are identified in leaf samples from gramineous plants in derivative grass communities.

5.2. Characterisation of the Animal Life in the Project Area

The Krumovgrad municipality and the prohject area in particular are in the East-Rhodopean sub-region of the South-Bulgarian fauna region. The fauna in the region belongs to the nemoral fauna complex and is part of the Thracian zoogeographic region including the Eastern Rhodopes. From the zoogeographic perspective, the East-Rhodopean sub-region is characterized by a high percentage of Mediterranean, sub-Mediterranean and Middle-Asian fauna elements and a lower percentage of European and Euro-Siberian elements.

The climate combined with the geographic location, the landscape and the vegetation have dictated the composition of the invertebrate fauna. The area is located in the central part of the Eastern Rhodopes, which is one of the southernmost parts of Bulgaria. The proximity of the Eastern Rhodopes to the Aegean sea and to Southwest Asia has had its effect on the formation of the present fauna. Another important fact for the formation of the current fauna is the proximity of the region to the rivers Arda and Byala River. These rivers are part of the Aegean watershed of the Mediterranean. Their valleys are corridors and refugia allowing access for xerothermophyllous fauna. The landscape in the area has also had a profound effect on the current composition of fauna species. It comprises a series of rounded hills separated by deep river and pan valleys, which do not have the typical mountainous appearance. The area can then be classified as low-mountanous based on its average altitude and altitude differential. Two of the high ridges (Gyumyudzhiski Snezhnik and Maglenik) trend west to east. They stop the air flows from the Mediterranean and affect the climate and the fauna. This fact explains the reduced relative share of the Mediterranean component, typical of areas in similar geographic location, such as the valleys of the rivers Struma and Mesta. The proximity of the region to Eastern Thrace and to Southwest Asia respectively explains the increased presence of Asian fauna.

The climate in the area is typical of a Continental-Mediterranean climate with well-expressed Submediterranean features. The relative warm and humid winter and hot summer have also had a profound effect on the fauna structure. This climate is typical of Subtropic Europe and Southwest Asia. The warm air masses coming from the Mediterranean in a northern direction are one of the main reasons for extension of the active vegetation period, which has also played a crucial role in the formation of the contemporary fauna. The proximity of the area to Krumovitsa and Arda rivers allows humidity of air that is crucial for the fauna, especially in the hot summer season.

Vegetation is one of the main biotic environmental factors with a determinant role in the formation and distribution of animal complexes. The flora in Krumovgrad municipality and, in particular, in the envisioned area, is characterised by the presence of a number of Mediterranean and transitive-Mediterranean species, which have had their effect on the fauna.

Invertebrates

From zoogeographic perspective, the invertebrate taxa in Krumovgrad municipality are unique. This uniqueness is due to the geographic location, the climatic and edaphic features of the area.

Today, the beech and coniferous belt of the Rhodopes are dimeinated by species belonging to the Euro-Siberian complex, while the oak belt is dominated by Mediterranean forms and complexes. The Eastern Rhodopes lie almost entirely in the oak belt and, consequently, are dominated by the Mediterranean complex, while the occurrence of the Euro-Siberian complex is very rare. In time, the areas of distribution of many of these species have fragmented and broken into individual isolated sections.

The habitat distribution of the complexes of invertebrates includes two main groups: terrestrial and aquatic habitats. The terrestrial habitats can be subdivided into open land and forest habitats. The open land habitats are subdivided into the following series: primary natural, secondary successive (derivative), and agricultural arable lands. The subgroup of forest habitats includes the following series: natural autochthonous forests, secondary successive tree plantations (species).

- there are several types of primary natural open land habitats in Krumovgrad municipality: the banks of Krumovitsa River, forest meadows in preserved forest communities, solid rock masses and debris.

- secondary successive open land habitats resulting from severe degradation of forest communities. Forest cutting and the transformation of large areas into pastures or arable areas is a process known in the region for hundreds of years. These habitats are normally dominated by red juniper, Christ's thorn and oriental hornbeam.

- Agricultural arable lands. Tobacco is the dominant crop in the region.

The following types represent the series in the second subgroup:

- autochthonous forests – forests with prevalence of beech with underbrush of European hornbeam. These habitats are dominated by Euro-Siberian fauna species, which prefer mesophyllic microclimate. Forests dominated by common durmast oak, Italian oak and Turkey oak. Meso-xerophilous microclimate is typical of these habitats They exhibit a trend toward an increased share of xerophilous elements. The tree associations with main species such as Italian oak, Italian oak and oriental hornbeam, pubescent oak and Quercus virgiliana include also xerophilic and xero-mesophillous complexes with increasing share of Mediterranean species.

- Secondary successive forests – these are communities with prevalent oriental hornbeam. These have occurred as a result of degradation of the typical forest communities of pubescent oak, Quercus virgiliana, and Italian oak. A xerophilous trend is observed in these habitats and, therefore, the complexes of invertebrates also have changed in this direction. At an advanced stage of degradation, the Oriental hornbeam is replaced by red juniper, which has formed xerothermal habitats with xerothermal grass sinusia. These habitats are populated by bot Mediterranean and Southwest-Asian/steppe species. They also include the community of Christ's thorn and xerotherm grass.

- tree plantations (crops) – these are crops of Austrian pine, and crops of Austrian pine, Scots pine, and acacia.

The aquatic habitats include both above-ground and superficial groundwater inhabited by various biotic groups. The aboveground aquatic habitats are concentrated mainly around Krumovitsa River and its watershed. This river has uneven flow throughout the year. It dries almost completely during the hot summer months, and causes floods very often during the spring. The communities of groundwater hydrobionthic species have not been studied, but they are one of the main groups that will react quickly, even to insignificant changes of water chemistry.

Vertebrates

According to the forest territory zoning, the municipality lies in the lower plain-hilly and hilly-submontane belt of oak forests (RL= 0-900 masl.).

According to reference data, no less than 304 vertebrate species have been identified in the municipality (type Chordata, sub-type Vertebrata), of which 22 fish, 10 amphibians, 23 reptiles, 191 birds and 58 mammals. The vertebrate species represent 27 orders and 86 families.

The species composition in the Krumovgrad municipality can be defined as abundant. The highest contribution to this abundance is that of the birds with no less than 191 species, or 46,02% of the total bird species in Bulgaria (415 species according to the most recent official data), i.e. almost half of all local species. The area is home to more than half of the reptile (23 of a total of 36), amphibian (10 of a total of 16) and mammal (58 of a total of 114) species occurring in Bulgaria. Fish species (all of which are fresh-water species) are also abundant here.

From quantity and quality perspective, the vertebrate fauna in Krumovgrad Municipality reflects the geographic location of the area in Bulgaria and in Europe, and the other geographic features of the area, such as altitude and topography. Also, the historical development of this area is of importance since it determines the magnitude of anthropogenic pressure on the environment.

The diversity of Bulgaria's bird fauna, and of the vertebrate fauna, is due both to the diverse phyciso-geographic and natural conditions in the country, and to its geographic location – it is central not only on the Balkan Peninsula, but also in the Palearctic zone, or the northern part of the Old World which comprises Europe, Asia and Africa and covers zones of the cool, moderate and sub-tropic climatic belts of the Northern hemisphere. According to Simeonov, Michev (1990), our ornithofauna exhibits easily discernible features mostly related to the terrain or, more accurately, altitude. The following 5 terrestrial faunal complexes are distinguished in Bulgaria:

- Oak belt fauna;
- Beech belt fauna;
- Coniferous belt fauna;

- Sub-Alpine belt fauna;
- Alpine belt fauna;

The authors of this publication indicate that the fauna and, in particular, the ornithofauna of the oak belt is the richest in number of species as well as numbers and density of individuals. Most of the Krumovgrad Municipality lies in the oak belt and this is one of the main reasons for its vertebrate fauna diversity.

The 5 classes of vertebrates and their habitats can be classified as follows:

Fish (Pisces)

The Carps are represented by the largest number of species – 13 species, flollowed by the Loaches - 4 species, and the Perches – 2 species. The remaining families are represented by 1 species each. Of those, 11 species are typical of running waters and further 11 of still or slow-flowing waters. The 5 most typical running water species are common minnow, Maritsa barbel, undermouth, golden spiny loach, Rhodopean loach. Chub, vimba, gudgeon, and spiny loach also inhabit running waters but these species frequently occur in slow-flowing or still waters. Only one species is the typical inhabitant of the upper flows of high-mountain rivers - the common minnow, but two other species also occur there - the Maritsa barbel and the golden spiny loach. The prevalent species in Krumovitsa and Arda rivers are the chub (*Leuciscus cephalus*) and the barbell (*Barbus cyclolepis*). The carp (Cyprinus carpio), silver carp (Hipophthalmichthis molitrix), golden carp (Carassius auratus), rudd (Scardinius erythrophthalmus), chub (Leuciscus cephalus), bleak (Alburnus alburnus) are the most abundant and significant resources for industrial and sports fishing in the Studen Kladenets Reservoir. Some small artificial water bodies in the municipality are dominated by the golden carp.

The most frequently occurring ichtiofauna in the river in the project area – in Krumovitsa River:

Family: Carps (Cyprinidae)

»Chub (*Leuciscus cephalus*)
»Barbel (*Barbus cyclolepis*)
»Lesser vimba *(Vimba melanops);*
»Common roach *(Rutilus rutilus);*
»Bleak *(Alburnus alburnus);*
»Gudgeon *(Gobio gobio)*

Loaches (Cobitidae)

»Spined loach *(Cobitis taenia)*
»Spined loach *Cobitis strumicae**

Two of those fish species are listed in Annex II of Council Directive 92/43.

***Barbus cyclolepis* (*Barbus plebejus*) - barbel**
***Sabanejewia balcanica* (*Sabanejewia aurata*)**

The barbel (*Barbus cyclolepis*) is subject to a conservation regime and regular use (Article 41, paragraph 1 of the Biodiversity Act) and is listed in Annex 5 to Directive 92/43.

Herpetofauna (Amfibia and Reptilia). The warm Mediterranean climate promotes rich herpetofauna in the Eastern Rhodopes due to the mosaic occurrence of natural habitats. 11 amphibian species and 30 reptile species have been identified there. Rare and very rare species also occur. Overall, the project area is not characterised by significant herpetological diversity and species of conservation value. The following amphibians and reptilies have been identified in the Ada tepe project footprint:

Amphibians (Amfibia)

All the amphibians - except for two species living most of their life in water: the grass water frog (Rana ridibunda) and the yellow-bellied toad (Bombina variegata), and a tree-brush species, the European tree frog (Hyla arborea) - live on land outside their mating periods. The dominant species are the green toad (Bufo viridis) and the big water frog (Rana ridibunda).

The yellow-bellied toad (*Bombina variegata)* is a protected species in the East Rhodopes Protected Area. That species occurs at the project site. It is almost exclusively found in troughs of fountains and spill puddles around them. The species proliferates and dominates the area of impact.

Nature Protection Status

Species	Annex 2 to the Biodiversity Act	Annex 3 to the Biodiversity Act	Directive 92/43
Yellow-bellied toad (Bombina variegata)	+	+	+
Green toad (Bufo viridis)	-	+	-
European tree frog (Hyla arborea)	+	+	-
Marsh frog (Rana ridibunda)	-	-	-

Reptiles (Reptilia).

Of all reptiles, four species - two turtle species *(Emys orbicularis, Mauremys caspica)* and two water snake species *(Natrix natrix, Natrix tessellata)* - are native to water. Three species may be defined as forest species – the Aesculapian snake *(Elaphe longisima),* the smooth snake *(Coronella austriaca)* and the slow worm (*Anguis fragillis).* Species that are terrestrial and arboreal looking for food not only on the ground but also on trees, or species that climb well and inhabit mostly forest or brush habitats are the Aesculapian snake and the light-green whip snake (*Coluber najadum*) but the green whip snake (*Coluber jugularis*) and even the Dione's snake are good climbers of trees and bushes (*Elaphe quatuorlineata sauromates*). Typical petrophyllic species are the Macedonian (*Podarcis erhardii*) and the wall lizards (*Podarcis muralis*) but other species also inhabit rocky and stony areas. The European blind snake (*Typhlops vermicularis*) practically lives its entire life underground. The Balkan gecko (*Cyrtodactylus kotschyi*) lives mainly in buildings. The dominant lizard species (order Sauria) are the Macedonian lizard (*Podarcis (Lacerta) erhardii*) and the green lizard (*Lacerta viridis*), and the dominant snake species (order Serpentes) is the green whip snake (*Coluber jugularis*). Of the land tortoises (order Testudinata, family Testudinidae), the dominant species are the Iberian tortoise and the Herman's tortoise with prevalence of the Herman’s tortoise (*Testudo hermanni*). Of the pond tortoises (order Testudinata, family Emydidae), the dominant species is the European pond tortoise (*Emys orbicularis*). The viper species (Viperidae) are represented by the western sand viper (Vipera ammodytes).

Among all species that are subject to protection in the East Rhodopes BG0001032 Protected Site, two species of tortoises will be directly affected - the Hermann's tortoise (Testudo hermanni) and the Mediterranean Spur Thigh Tortoise (Testudo graeca). Tortoises inhabit the whole area of the project site.

Nature Protection Status

Species	Annex 2 to the Biodiversity Act	Annex 3 to the Biodiversity Act	Directive 92/43
Hermann's tortoise (Testudo hermanni)	+	+	+
Iberian tortoise (Testudo graeca)	+	+	+
European pond tortoise (Emys orbicularis).	+	+	+
Caspian terrapin (Mauremys caspica)	+	+	+
Kotchy’s gecko (Cyrtodactylus kotschyi)	-	+	-

Species	Annex 2 to the Biodiversity Act	Annex 3 to the Biodiversity Act	Directive 92/43
Green lizard (Lacerta viridis)	-	-	+
Wall lizard (Podarcis muralis)	-	-	-
Macedonian lizard (Podarcis erhardii)	-	-	-
Grass snake (Natrix natrix)	-	-	-
Dice snake (Natrix tesselata)	-	-	-
Slow worm (Anguis fragilis)	-	+	-
European blind snake (Typhlops vermicularis)	-	+	-
Aesculapian snake (Elaphe longissima)	-	+	-
Dione's snake (Elaphe quatorlineata sauromates)	+	+	+
Green whip snake (Coluber jugularis).	-	+	-
Light-green whip snake (Coluber najadum)	-	+	-
Smooth snake (Coronella austriaca)	-	+	-
Western sand viper (Vipera ammodytes)	-	-	-

Birds (Aves)

The bird fauna of the Eastern Rhodopes includes 278 species, of which 171 nesting, 82 wintering, 154 migrating, and 15 appearing during their roaming. One characteristic feature is the high diversity of diurnal raptors (Falconiformes). The diversity of southern species is another characteristic feature.

Of the species identified in the region, 11 are listed in the IUCN World Red List, 12 are endangered, 46 are vulnerable, 13 are rare and 32 are species decreasing in Europe.

6 sites have been defined as particularly important for the protection of the ornithofauna:

- Studen Kladenets Reservoir
- Byala River valley
- Krumovitsa River valley
- Madzharovo
- Gorata ridge Harvanliiska River valley

The Krumovitsa River valley was designated in 1997 as an important bird area by BirdLife International and was given protected area status under Natura 2000.

According to data published by the Bulgarian Society for Protection of Birds, there are 136 bird species identified in the Krumovitsa River area, 31 of which are listed in the Bulgaria's Red Data Book. Of all bird species, 64 species are of European conservation concern (SPEC), two species are classified as SPEC 1 or European species of global conservation concern, 18 species are classified as SPEC 2 and 44 are classified as SPEC 3. The site is globally significant as being representative of the Mediterranean biome with 7 biome-limited species occurring here of a total of 9 established in Bulgaria: black-eared wheateater (*Oenanthe hispanica*), olive-tree warbler (*Hippolais olivetorum*), sub-Alpine warbler (*Sylvia cantillans*), Sardinian warbler (*Sylvia melanocephala*), rock nuthatch (*Sitta neumayer*), masked shrike (*Lanius nubicus*), black-headed bunting (*Emberiza melanocephala*). The black vulture (*Aegypius monachus*) and the lesser kestrel (*Falco naumanni*) are species that are threatened with global extinction. Suitable habitats for 46 species listed in Annex 2 of the Biodiversity Act with 28 species listed in Annex I of Directive 79/409 are identified in the protected area. Krumovgrad is one of the most important areas in Bulgaria and in Europe for the black stork (*Ciconia nigra*), the booted eagle *(Hieraaetus pennatus*) and the Egyptian vulture (*Neophron percnopterus*), which nest there.

From the ecological perspective, the nesting bird fauna of the region may be divided into the following habitat complexes:

» xerophyte vegetation in the oak-hornbeam belt;
» provincial area complex;
» anthropogenic complex.

The project area is the home of representatives of all six ecological groups of birds - tree-brush, terrestrial-arboreal, terrestrial, aquatic, riparian, hunting in or from the air. The number of petrophyllous species (those that inhabit rocky and stony areas) is significant. The same applies to the species typical of forest and brush habitats and the species bound to water impoundments.

Regarding the relation of species to tree vegetation and to its spatial formations in this part of Bulgaria, there are species both related or lightly related to the tree vegetation and species related to it in varying degrees including typical forest species and inhabitants of vast and dense forests. Since forest-type plant communities occupy most of the area of the municipality, the number of forest species, or those, linked to forest vegetation, is significantly larger that those that are not or are lightly related to tree vegetation.

With regard to their presence in the area, both permanent and nesting migratory species occur, as well as passing and wintering species.

The dominant species in the open land areas with scattered tree vegetation are the red-backed shrike (*Emberiza calandra*) and the bunting (*Lanius collurio*), and the species dominating the forest habitats including the Ada Tepe hill are the chaffinch (*Fringilla coelebs*), great tit (*Parus major*), crested tit (*Parus cristatus*), coal tit (*Parus ater*), blue tit (*Parus caeruleus*), oriole (*Oriolus oriolus*), mountain chaffinch (*Fringilla coelebs*), goldfinch (*Carduelis carduelis*), siskin (*Carduelis spinus*), cirl bunting (*Emberiza cirlus*), jay (*Garrulus glandarius*), mistle thrush (*Turdus viscivorus*), dipper (*Turdus merula*), robin (*Erithacus rubecula*), turtle dove (*Streptopelia turtur*), green woodpecker (*Picus viridis*), Syrian woodpecker (*Dendrocopos syriacus*), lesser spotted woodpecker (*Dendrocopos medius*), goshawk (*Accipiter gentilis*). The most frequently occurring scrub community inhabitants (in dense groups of patches of low tree vegetation trees and brush) are the chaffinch (*Fringilla coelebs*), oriole (*Oriolus oriolus*), blackbird (*Turdus merula*), red-backed shrike (*Lanius collurio*), cirl bunting (*Emberiza cirlus*), and, in some locations, rock bunting (*Emberiza cia*), turtle dove (*Streptopelia turtur*), and rarely other species. The dominant species in the rocky and cliff areas is the wheatear (*Oenanthe oenanthe*). The house sparrow (*Passer domesticus*) and the house martin (*Delichon urbica*) are best established and with numerous individuals in the town of Krumovgrad and the nearby villages, where large numbers of swallows (Hirundo rustica) are also typical. The following species were identified in the project site area:

#	**Species**		**Nature Protection Status**							
	Latin name	Bulgarian name	BDA	RDB	Bern	Bonn	SPEC	ETS	DIR 79/409	CITES
	Falconiformes									
1	*Accipiter gentilis*	голям ястреб	+	Thr	II	II		S		II
2	*Buteo buteo*	обикновен мишелов	+		II	II		S	II	II
3	*Pernis apivorus*	осояд	+	Thr	II	II	4	S	I	II
	Galliformes									
4	*Perdix perdix*	яребица	-			III	3	V		
	Columbiformes									
5	*Streptopelia turtur*	гургулица	-		III		3	D		III
	Cuculiformes									
6	*Cuculus canorus*	кукувица	+		III			S		
	Strigiformes									
7	*Otus scops*	чухъл	+		II		2	D	II	II
	Apodiformes									
8	*Apus apus*	черен бързолет	+		III			S		
	Coraciiformes									
9	*Merops apiaster*	пчелояд	+		II	II	3	D	II	
	Piciformes									

#	**Species**		**Nature Protection Status**							
	Latin name	Bulgarian name	BDA	RDB	Bern	Bonn	SPEC	ETS	DIR 79/409	CITES
10	*Dryocopus martius*	черен кълвач	+	R	II			S		
11	*Dendrocopos syriacus*	сирийски пъстър кълвач	+	R	II			S		
12	*Dendrocopos major*	голям пъстър кълвач	+		II			S		
13	*Dendrocopos medius*	среден пъстър кълвач	+		II			S		
14	*Picus canus*	сив кълвач	+		II		3	D	I	
15	*Picus viridis*	зелен кълвач	+		II		2	D		
	Passeriformes									
16	*Alauda arvensis*	полска чучулига	+		III		3	V		
17	*Lullula arborea*	горска чучулига	+		III		2	V	I	
18	*Melanocorypha calandra*	дебелоклюна чучулига	+		II		3	(D)	I	
19	*Galerida cristata*	качулата чучулига	+		III		3	D		
20	*Hirundo rustica*	селска лястовица	+		II		3	D		
21	*Delichon urbica*	градска лястовица	+		II			S		
22	*Luscinia megarhynchos*	южен славей	+		II	II	4	(S)		
23	*Oenanthe oenanthe*	сиво каменарче	+		II	II		S		
24	*Turdus merula*	кос	+		III	II	4	S		
25	*Turdus philomelos*	поен дрозд	+		III	II	4	S		
26	*Turdus viscivorus*	имелов дрозд	+		III	II	4	S		
27	*Erithacus rubecula*	червеногръдка	+		II	II	4	S		
28	*Sylvia atricapilla*	черноглаво коприварче	+		II	II	4	S		
29	*Sylvia communis*	голямо белогушо коприварче	+		II	II	4	S		
30	*Sylvia curruca*	малко белогушо коприварче	+		II	II		S		
31	*Phylloscopus collybita*	елов певец	+		II	II		(S)		
32	*Muscicapa striata*	сива мухоловка	+		II	II	3	D		
33	*Parus major*	голям синигер	+		II			S		
34	*Parus cristatus*	качулат синигер	+		II		4	S		
35	*Parus ater*	боров синигер	+		II		4			
36	*Parus caeruleus*	син синигер	+		II		4	S		
38	*Sturnus vulgaris*	обикновен скорец	-					S		
39	*Oriolus oriolus*	авлига	+		II			S		
40	*Carduelis spinus*	елшова скатия	+		II		4	S		
41	*Garrulus glandarius*	сойка	-					(S)		
42	*Pica pica*	сврака	-					S		
43	*Corvus corone cornix*	сива врана	-					S		
44	*Corvus corax*	гарван	+					(S)		
45	*Fringilla coelebs*	чинка	+		III		4	S		
46	*Carduelis carduelis*	щиглец	+		II			(S)		
47	*Miliaria calandra*	сива овесарка	+		III		4	(S)		
48	*Emberiza cirlus*	зеленогуша овесарка	+		II		4	(S)		
49	*Emberiza hortulana*	градинска овесарка	+		III		2	(V)	I	
50	*Lanius collurio*	полска овесарка	+		III		2	(V)	I	

The following species listed in Appendix I to Directive 79/409/EC (Appendix 2 to the BDA) are identified:

Short-toed Eagle /*Circaetus galicus*/. The species was found to nest at the project site during the 2005-2006 monitoring. The SE hillside of Ada Tepe was the nesting territory of one pair in 2005. However, that species was not observed to nest there in 2006. The SW hillside of Ada Tepe is a suitable nesting habitat despite the fact that the species did not nest there back in 2006, 2007 and 2008, and the open areas are the feeding ground of that species. The project does not consider construction of stockpiles on the southern hillside of Ada Tepe, which would otherwise destroy the nesting habitat of the species.

Black Kite /*Milvus migrans*/. The species was not identified in the project area during the 2005-2006 monitoring campaign; however, a black kite individual was observed flying high above the eastern hillside of Ada Tepe during field observations in 2008. The project is not expected to have a direct negative impact on that species due to the small number and sporadic occurrence of black kites in the area where gold mining will take place.

European Roller /*Coracias garrulus*/. It was found nesting in the project area. As the only nesting pair found in the project site area is outside the project infrastructure footprint, the expected impact on that species is negligible.

European Nightjar /*Caprimulgus europaeus*/. It was found nesting in the project area. One nest was found on the eastern hillside of Ada Tepe during the 2005-2006 monitoring campaign. It was not observed during the field studies in 2008. Considering the small number of individuals occurring in the project area, the project development is expected to have a minimal negative impact on that species.

Barred Warbler /Sylvia nisoria/. It inhabits shrub and brush communities, scattered groups of trees with many shrubs in open areas and grazing lands around the Ada Tepe hill. No significant impact on that species is expected.

Red-backed Shrike /*Lanius collurio*/. It inhabits shrub and brush communities and scattered groups of trees with many shrubs in open areas around the Ada Tepe hill and in the Krumovitsa valley. No significant impact on that species is expected.

Mammals (Mammalia)

The mammals are the second most abundant class with 58 species, which represent 50,88% of all mammal species in Bulgaria (114 species). Similar to reptiles, mammals also have a group of species that live their lives above and under the ground, and two species, the common mole (*Talpa europaea*) and the lesser mole rat (*Nannospalax leucodon*) that practically live their entire life underground. The Bats are represented by the largest number of species (19 in total), followed by Rodents (18 species), Predators (11 species), Cloven-footed (5 species), Insectivores (4 species) and Lagomorpha (1 species). The most frequently registered insectivorous animal was the common mole (Talpa europaea). The most abundant rodents were the common shrew (*Microtus arvalis*), especially in open areas, the forest mice (*Sylvaemus sp.*) and the squirrel (*Sciurus vulgaris*) in the forests, and the forest dormouse (*Dryomys nitedula*) at some other locations.

No constant wildlife migration corridors that can be affected by the project have been established in the region.

The field investigations identified the following species:

Family: Hedgehog *(Erinaceidae)*

»Hedgehog *(Erinaceus concolor)*

Family: Moles (*Talpidae*)

»European common mole (*Talpa europaea*)

Family: Mice (*Muridae*)

»Yellow-necked field mouse (*Sylvaemus flavicollis*)

»Common field mouse (*Sylvaemus sylvaemus*)

Family: Dormice (*Myoxidae*)
»Forest dormouse (*Dryomys nitedula*)
Family: Voles (Arvicolidae)
»Common vole (Microtus arvalis)
»European pine vole (Microtus subterraneus)
Family: Otters (Mustelidae)
»Badger (Meles meles)
»Weasel (Mustela nivalis)
»Beech marten (Martes foina)
Family: Hares (Leporiae)
»European hare (Lepus capensis)
Family: Squirrels (Sciuriddae)
»Red squirrel (Sciurus vulgaris)
Family: »Canids (Canidae)
»Jackal (Canis aureus)
Family: Boars (Suridae)
»Wild boar (Sus scrofa)

Nature Protection Status

Species	Annex 2 to the Biodiversity Act	Annex 3 to the Biodiversity Act	Directive 92/43
Hedgehog (Erinaceus concolor)	-	+	-
Weasel (Mustela nivalis)	-	+	-

Protected species in the the East Rhodopes Protected Area include:

Otter ***(****Lutra lutra****)*** **-** not identified but there are traces of its existence.

Marbled polecat (*Vormela peregusna*) This species was not identified and there are no records or evidence of its presence.

Mouse-tailed dormouse *(Myomimus roachi).* No habitats that may be suitable or typical of the mouse-tailed dormouse were found in the project area. There are no records or observations of live or dead individuals.

European ground squirrel (Spermophilus citellus): No presence of that species has been detected in the project area or in proximity to it.

Wolf (*Canis lupus* L.) The Ada Tepe area is not a very suitable habitat for the species. Austrian pine monocultures have low productivity rate and do not provide the required variety of plant species to ensure sufficient feeding base for the wolf's potential pray.

Brown bear *(Ursus arctos L.*). The Ada Tepe area does not provide sufficient feeding base for the bear and could only be used as a temporary shelter as bears go from place to place. No traces of brown bear life have been identified and thete have been no eye witness reports of any bear presence over the last ten years.

Bats (Chiroptera)

Five bat species listed in Annex II of Directive 92/43/EEC have been identified in the project area.

Greater horse-shoe bat (Rhinolophus ferrumequinum). A small group of approximately 8-10 individuals was seen to inhabit the ancient Thracian mine working consisting of short adits. The field observations and studies using recording ultrasound equipment have shown that this species has a significantly broader feeding area within the project area, and most likely individuals from neighbouring areas and colonies fly in and out. Hunting individuals of the species have been registered regularly above the Krumovitsa River near the culvert downstream of Skalak Village. Since this species also feeds above open grass spaces, brush and rock formations in the Ada tepe area, then the areas intended for the construction of a soil stockpile, IMWF, roads and facilities are an integral part of its feeding habitat. The small summer colony identified in the Thracian mine uses the entire open pit footprint as a feeding area. The mine development will irreversibly destroy the daily shelter of the colony and it is most likely that the animals will not die but will simply be driven away. The area used by the colony as its feeding habitat – the footprint of the open pit, the above-mentioned stockpiles and facilities – will be reduced significantly.

• Large mouse-eared bat (*Myotis myotis*) and lesser mouse-eared bat (*Myotis blythii*). The specifics of the field observation method used – detection of echo-location ultrasounds – and the extremely low occurrence of both species in the project area means that it is impossible to distinguish between the two species. Both species are listed in Annex II to Directive 92/43/EEC. Their biology is very similar and they frequently form mixed colonies. For this reason, the analysis of the impact of the project on these two species will not be different. No day-time shelters of the two species have been identified in the project area and their presence is simply to meet their feeding needs. The brush, the open small grass-covered spaces and the waters of Krumovitsa provide good feeding conditions with abundance of insects, but the distance from their potential day shelters explains the rare occurrence of the species in the investigated area.

• Schreiber's bat (*Miniopterus schreibersii*). Individuals of this species have been observed at the Ada Tepe foothills, near the open spaces and above the water surface of the Krumovitsa River near the village of Skalak. It is most likely that this species has no day-time shelters in the project area and uses the open spaces and flies above water to hunt and feed. Its presence is extremely rare and the areas mentioned above are part of its feeding habitat. Since this species uses mainly underground karst hollow spaces as day-time shelters and frequently lives together with the large and lesser mouse-eared bats (Myotis myotis and Myotis blythi), we believe that the project implementation will have similar and, in most cases, identical effect on this species.

• Geoffroy’s bat (Myotis emarginatus). So far, this species has been observed once in immediate proximity to the project area: in the abandoned Ada Tepe hut. A numerous migrating colony was observed in this abandoned building during previous studies (Petrov, B. personal communication). Several subsequent visits did not confirm the presence of this species. No echolocation ultrasounds from the species were registered during the investigation. Perhaps the Ada tepe area and the Krumovitsa River together with its tributaries are a part of a local migration corridor. From this perspective the change in flow regime of the Kaldzhikdere, which is a local migration corridor for bats, and its partial conversion into a tailings management facility (under Option 2) will affect the Geoffrey’s bat species in the Eastern Rhodopes. Considering the incidental occurrence of this species there, we assess the severity of this impact as insignificant and also incidental. In this regard, we recommend Option 1 – construction of an IMWF, which will not be sited in Kaldzhikdere.

Presently, i.e. prior to the implementation of the project, we believe that the numbers and diversity of bats correspond to the natural characteristics, namely: diversity of microhabitats and feeding areas.

In our opinion, the lack of suitable day-time shelters in the area, i.e. the coniferous vegetation dominates the area, rock formations are practically unavailable, etc., is the main factor for the low diversity of local bat species within the project footprint. The project area, whose total footprint is 81 ha., is the feeding area of species that mainly inhabit other parts of the Eastern Rhodopes Protected Site.

In addition to the species mentioned above, six other bat species not listed in Annex II to Directive 92/43/EEC were identified: serotine (*Eptesicus serotinus*), common noctule (*Nyctalus noctula*), Daubenton’s bat (*Myotis daubentonii*), common pipistrele (*Pipistrellus pygmaeus*), Savi’s pipistrelle (*Hypsugo savii*) and long-eared bat (*Plecotus sp.*).

The conservation value of the observed bat species listed in Annex II to Directive 92/43/EEC is presented in the table below.

Conservation Value of the Bats Identified in the Project Area

Identified species	IUCN	EUROBATS	DIR 92/43	BONN	BERN	BDA	RDB
Family Horseshoe Bats (Rhinolophidae)							
Greater horseshoe bat Rhinolophus ferrumequinum	LR/nt	+	II, IV	+	II	2.3	-
Family Vespertilionid bats (Vespertilionidae)							
Lesser mouse-eared bat Myotis blythii	-	+	II, IV	+	II	2.3	-
Large mouse-eared bat (Myotis myotis)	LR/nt	+	II, IV	+	II	2.3	-
Geoffroy’s bat (Myotis emarginatus).	VU	+	II, IV	Annex II	II	2, 3	+ cat. "rare"
Schreiber's bat (Miniopterus schreibersii)	LR/nt	+	II, IV	+	II	2.3	-

List of abbreviations in the table:
IUCN: the IUCN 2000 Red List of Threatened Species
EUROBATS: the Agreement on the Conservation of Populations of European Bats
DIR 92/43: Council Directive 92/43 on the Conservation of Natural Habitats of Wild Fauna and Flora (Annex II, Annex IV)
BONN: the Convention on the Conservation of Migratory Species of Wild Animals (also known as CMS or Bonn Convention)
BERN: the Convention on the Conservation of European Wildlife and Natural Habitats (also known as the Bern Convention) (Annex II)
BDA: the Biodiversity Act (Bulgaria)
RDB: The Red Data Book of Bulgaria (1985)

Species of Conservation Value

Five of the vertebrate species identified at Ada Tepe, including the regeneration period, are listed in Appendix 2 to the BDA. These include 1 amphibian, 2 reptile and 2 bird species:

- European tree frog (Hyla arborea);
- Iberian tortoise (Testudo graeca);

Herman’s tortoise (Testudo hermanni)

- Syrian woodpecker (Dendrocopos syriacus);
- Middle spotted woodpecker (Dendrocopos medius).

Two vertebrate species of the birds family (Aves) of those identified in the open areas with scattered tree vegetation (also during their mating periods) are listed in Annex 2 to the BDA:

- Syrian woodpecker (Dendrocopos syriacus);
- Red-backed shrike (Lanius collurio).

It is evident that the areas that will potentially be affected by the project are inhabited by a total of 5 species listed in Annex II to the BDA – a rather small number. Furthermore, two of the bird species – the Syrian woodpecker and the red-backed shrike – are rather frequent in this region and in Bulgaria. The Syrian spotted woodpecker occurs more than frequently in the low lands in Bulgaria and at the same time is the most abundant woodpecker species (family Picidae) in the towns and villages in Bulgaria (Yankov, 1986) including the Krumovgrad municipality. The other species - the red-backed shrike - is an abundant nesting species occurring most frequently in open areas with scattered tree vegetation and in thinned forests at elevations from sea level to above 1,000 m, and, in some cases, during the nesting period, at 1,300-1,400 and even higher than 1,500 m, and even above the upper forest line after the end of the mating period, including above 2,000 m, and, therefore, is not at risk of becoming extinct.

The European tree frog and the tortoises are also frequently observed in various parts of Bulgaria including the Krumovgrad municipality and its neighbouring municipalities.

So, only one of those five species is really rare but not at risk of becoming extinct in Bulgaria, and that is the middle spotted woodpecker. This species nests in forest habitats, which are sufficient in this municipality, and also, according to the project design, a small part of Ada Tepe will be affected, which will have a rather small (negligible) effect on the typical habitats of this species in the area. Also, the disturbed areas will be rehabilitated after the mining ceases. The biological rehabilitation will include afforestation, i.e. after a period following the completion of the rehabilitation activities, the size of the area occupied by forest habitats will increase and will have a favourable effect on this species since it belongs to the group of typically forest species.

5.3. Protected Sites. Sensitive Zones. Elements of the National Environmental Network

The project area does not affect nor is in close proximity to protected sites within the meaning of the Protected Areas Act.

The following protected sites are located within the Krumovgrad Municipality (Figure IV.5.3-1): 1 reservation – Vulchi dol (13-14 km north of Krumovgrad), 8 natural landmarks, of which 4 waterfalls (Vodopada natural landmark - 6 km north of Krumovgrad, Dushan natural landmark – 8 km north of Krumovgrad, Bureshe natural landmark – 12 km northeast of Krumovgrad, Mandrata natural landmark – 6 km northeast of Krumovgrad), Dzhelovo natural landmark – 6 km east of Krumovgrad, Pesheri natural landmark in Mosta area – 14 km northeast of Krumovgrad, sage habitat (natural landmark) – Kese dere river – 6 km northwest of Krumovgrad and 3 protected sites – Momina skala protected site – 20 km northeast of Krumovgrad, Oreshari protected site – 14 km northeast of Krumovgrad and Ribino protected site– 12 km southwest of Krumovgrad. There are 3 key ornithological territories (KOT): Krumovitsa KOT – 3 to 5 km north of Krumovgrad, Studen kladenets KOT – 14 km north of Krumovgrad and Byala reka KOT – 20 km southeast of Krumovgrad.

Reservations

Vulchi Dol reservation – It is located on the lands of Studen Kladenets Village and Boynik Village and protects typical East Rhodopean natural ecosystems and interesting rock complexes; it is the habitat of the griffin vulture (Gyps fulvus) and other birds at risk of becoming extinct. Its area is 774.7 hectares.

Natural Landmarks

Vodopada – a waterfall on the Dushandere River with a height of 25 m. It is located near Dzhanka Village and has an area of 0.2 hectares.

Dushan – a waterfall on the Dushandere River with a height of 20 m. It is located near Krassino Village and has an area of 0.1 hectares.

Bureshte – a waterfall on the Dushandere River with a height of 10 m. It is located near Padalo Village and has an area of 0.2 hectares.

Mandrata - a waterfall on the Tashbunar River with a height of 3 m. It is located near Chal Village and has an area of 0.2 hectares.

Dzhelovo - a natural habitat of Turkish Hazel (Corylus colurna) on the lands of Perunika Village with an area of 4.9 hectares.

Peshteri (Caves) - a complex of 6 caves on the lands of Oreshari Village with an area of 0.1 hectares.

Sage Habitat on the Kesedere River - it protects a habitat of sage (Salvia officinalis) on the lands of Dolna Kula Village an has an area of 5 hectares.

Sage habitat in the Daima area - it protects a habitat of sage (Salvia officinalis) on the lands of Krumovgrad an has an area of 15 hectares.

Protected Sites

Momina Skala - it protects habitats and populations of animal and plant species that are at risk of becoming extinct on the lands of Bryagovets Village with an area of 782 hectares. Part of the site is on the lands of Madjarovo Municipality.

Oreshari - it preserves habitats and populations of protected plant and animal species. It is located on the lands of Oreshari Village and has an area of 55 hectares.

Ribino - it protects populations of animal and plant species that are under protection or at risk of becoming extinct, including some bat species, as well as karst landscape, rock massifs and caves. It is located on the lands of Ribino and Samovila villages and has an area of 66.3 hectares.

Sensitive Zones. Key Ornithological Territories (KOT)

Krumovitsa KOT - it includes valleys in the mid-stream portion of the Krumovitsa and its tributary the Dyushundere River and the adjacent East Rhodopean ridges. The ornithological resources of Krumovitsa KOT include about 140 bird species, of which nearly 20% are listed in the Red Data Book of Bulgaria. Over half of them are species of European conservation concern. The territory has a world importance as a representative biome of the Mediterranean zone.

Studen Kladenets KOT - the territory is part of the CORINE site known as 'The Valley of the Arda River' and comprises the Studen Kladenets Reservoir and the adjacent hills including the Vulchi Dol Reservation. The ornithological resources this KOT include about 200 bird species, nearly half of which are species of European conservation concern. The territory has a world importance as a representative biome of the Mediterranean zone.

Byala Reka KOT - It is a CORINE site and includes the watershed of the Byala Reka River in the southeasternmost part of the East Rhodopes. The ornithological resources of this site include over 150 bird species, 20% of which are listed in the Red Data Book of Bulgaria. Over 90 of them are species of European conservation concern. The territory has a world importance as a representative biome of the Mediterranean zone.

Venerable and remarkable trees are also subject to protection under the Biodiversity Act. The area under consideration hosts a 200-year-old Thracian oak (*Quercus thracica*) individual, which grows between Surnak and Kandilka villages about 6 km southwest of Krumovgrad. Its health status is deteriorating. The protection of venerable trees against destruction or damage is a requirement under the law.

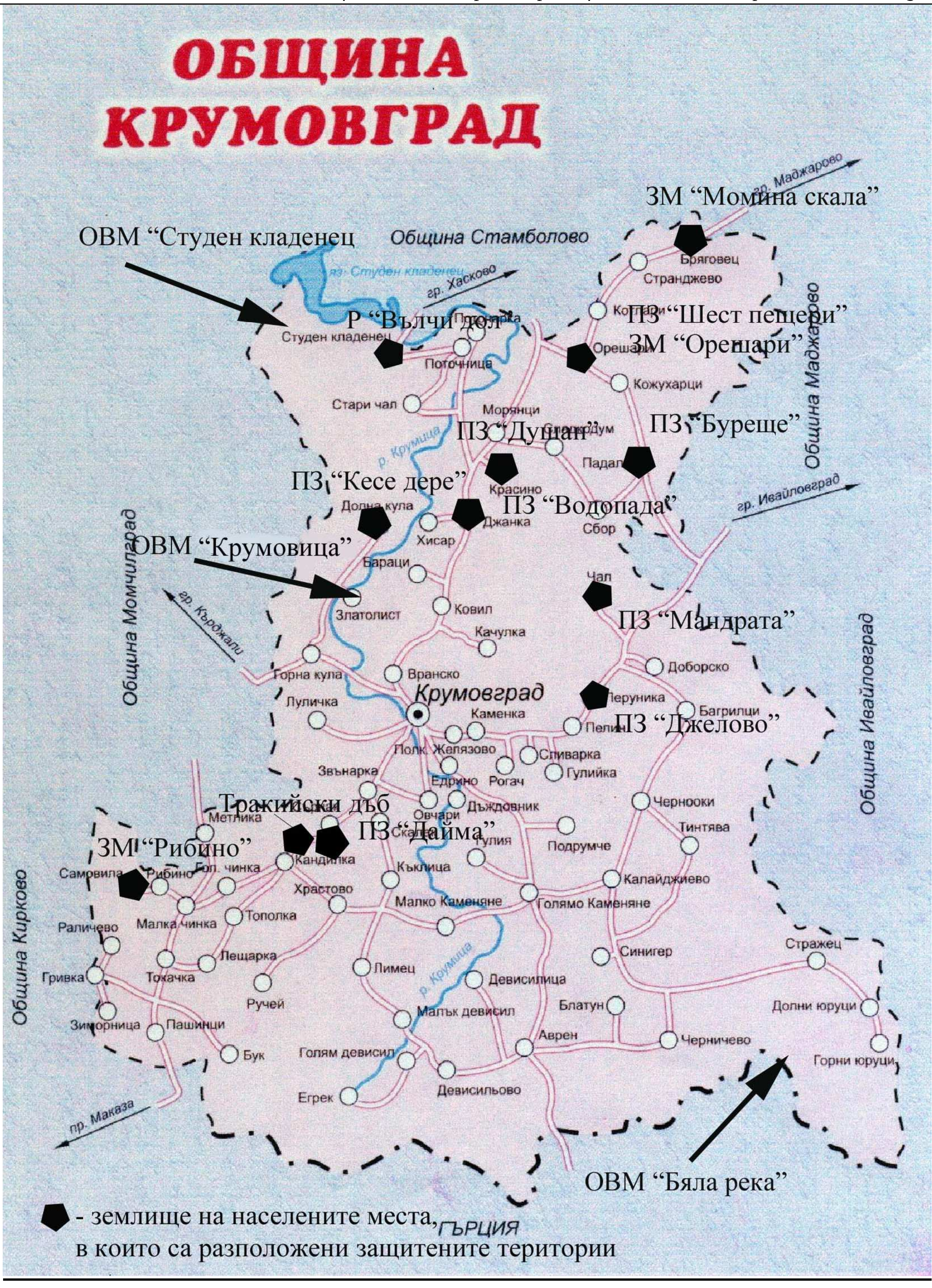


Figure IV.5.3-1. Map of the location of the protected sites and the key ornithological territories (KOT)

According to the provisions of art. 8 par. 1 of the BDA, the entire project area lies within the footprint of Natura 2000 protected site known as **BG 0001032** Rhodopes East under Council Directive 92/43 on the Conservation of Natural Habitats of Wild Fauna and Flora. **BG 0002012** Krumovitsa, which is a protected site under Council Directive 79/409/EEC on the Conservation of Wild Birds, is in close proximity to the project area. Both protected sites were established with Government Decree 122/02.03.2007.

- **BG 0001032 Rhodopes East**

The objectives of protection set for the area include:

» Conservation of natural habitats and habitats of species and their populations subject to protection in the protected area.

» Conservation of the original condition of natural habitats and habitats of species subject to protection in the protected area, including the species composition, representative species and environmental conditions typical of those habitats.

» Whenever required, restoration of the area and natural condition of priority natural habitats and habitats of species, as well as populations of species subject to protection in the protected area.

Total area under protection **–** 2,173,529.50 ha.

The protected area covers the larger part of the East Rhodopes. The Gorata Ridge occupies the northeastern part (704 masl) and it has an oak tree cover. The valley of the Arda River and the downstream portion of the Krumovitsa river lie to the south of the ridge and feature interesting rock and grass habitats. The southeastern part of the zone is occupied by the river valleys of Byala Reka and Luda Reka, and the high ridges of Gyumyurdzhinski Snejnik (1,463 masl) and Muglenik (1,266 masl) dominate the border with Greece. Old beech forest habitats are typical there. The zone preserves habitats unaffected by human activities - types 91 EO, 92 CO and 92 AO. The zone is one of few places in Bulgaria where habitat types 91 MO, 91 AA and 91 GO are preserved. It is also one of the four zones that is home to habitat type 9270.

Subject of Protection
Habitat Types under Annex I to Directive 92/43EEC

Code	***Habitat Type***	***Cover, %***
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation	***0.5***
5130	Juniperus communis formations on heaths or calcareous grass lands	***0.1***
6110*	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi	***0.01***
6210*	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (*important orchid sites)	***2***
6220*	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea;	***3***
62A0	Eastern sub-Mediterranean dry grasslands	***8***
62D0	Oro-Moesian acidophilous grasslands	***0.01***
6510	Lowland hay meadows	***1***
6520	Mountain hay meadows	***1***
8210	Chasmophytic vegetation on calcareous rocky slopes	***0.1***
8220	Chasmophytic vegetation on siliceous rocky slopes	***0.5***

8230	Siliceous rock with pioneer vegetation of the Sedo-Scleranthion or of the Sedo albi-Veronicion dillenii	***0.6***
8310	Caves not open to the public	***0.01***
9110	Luzulo-Fagetum beech forests	***0.356***
9130	Asperulo-Fagetum beech forests	***6***
9150	Medio-European limestone beech forests of the Cephalanthero-Fagion	***0.01***
9170	Galio-Carpinetum oak-hornbeam forests	***3***
9180	Tilio-Acerion forests of slopes, screes and ravines	***0.0107***
91AA	Eastern white oak woods	***4***
91EO	Alluvial forests with Alnus glutinosa and Fraxinus excelsior	***0.35***
91M0	Pannonian-Balkanic turkey oak –sessile oak forests	***45***
91Z0	Dacian oak & hornbeam forests	***0.2***
9270	Hellenic beech forests with Abies borisii-regis	***0.1***
92A0	Salix alba and Populus alba galleries	***1***
92C0	Platanus orientalis woods	***2***
92DO	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)	***0.023***
9530*	Sub-mediterranean pine forests with endemic black pines	***0.1***

Fish Species under Annex II to Directive 92/43EEC
Asp (*Aspius aspius)*
Barbel (*Barbus cyclolepis)*
European bitterling (*Rhodeus sericeus amarus)*
Ray-finned fish (*Sabanejewia aurata)*

Amphibian and Reptile Species under Annex II of Directive 92/43/EEC
Bombina variegata
Elaphe quatorlineata
European pond tortoise (Emys orbicularis).
Caspian terrapin (Mauremys caspica)
Hermann's tortoise (Testudo hermanni)
Iberian tortoise (Testudo graeca)
Triturus karelinii

Mammal Species under Annex II to Directive 92/43EEC
Rhinolophus mehelyi
Rhinolophus hipposideros
Greater horse-shoe bat (Rhinolophus ferrumequinum).
Rhinolophus euryale
Rhinolophus blasii
Myotis blythii
Barbastella barbastellus
Miniopterus schreibersi
Myotis capaccinii
Geoffroy’s bat (Myotis emarginatus).
Myotis bechsteinii
Myotis myotis

Myomimus roachi
Spermophilus citellus
Canis lupus
Ursus arctos
Lutra lutra
Vormela peregusna

Other Significant Plant and Animal Species
European tree frog (Hyla arborea)
Brown toad (Bufo bufo)
Green toad (Bufo viridis)
Rana dalmatita
Pelobates siriacus

Plants
Himantoglossum caprinum

Invertebrates
Austropotamobius torrentium
Unio crassus
Paracaloptenus caloptenoides
Coenagrion ornatum
Dioszeghyana schmidtii
Eriganster catax
Euphydryas aurinia
Callimorpha quadripunctaria
Lycaena dispar
Cerambyx cerdo
Lacanus cervus
Morimus funereus
Rosalia alpina
Probaticus subrugosus

The **East Rhodopes Protected Area** corresponds with three sites under the **CORINE Biotopes**: The Valley of Arda – F00005200, Byala Reka – F00005300 and Veykata – F000-13800. The project area does not include areas within the footprint of CORINE biotopes.

- **BG 0001032 Krumovitsa**

It includes valleys in the mid-stream portion of the Krumovitsa and its tributary the Dyushundere River and the adjacent East Rhodopean ridges. Its total area is 11,196.420 ha.

The area includes valleys in the midstream section of Krumovitsa River and its its tributary the Dyushundere River with the adjacent ridges of the Easter Rhodopes. The area includes the portion of the Krumovitsa between Gorna Kula Village and the estuary of Dyushundere and reaches the lands of Chal Village to the southeast. The width of Krumovitsa river valley in this area is from 300 to 1,000 m and a considerable part of it at certain locations is occupied by the sandy riverbed. The river banks are forested with river wood vegetation mainly represented by poplars (Populus spp.), willows (Salix spp.), black alders (Alnus glutinosa), etc. There is abundant shrub vegetation, mainly brambles (Rubus spp.), dog rose (Rosa canina), etc. Shrubs are frequent at many places in the riverbed itself mainly represented by saltcedar (Tamarix spp.), as well as grass vegetation. Certain parts of Krumovitsa banks are steep and rocky. The wider valley sections include arable land. The valley of Dyushundere is mostly narrow and deeply cut into volcanic rock with many steep rocks reaching to its bed, waterfalls and small caves. The wood vegetation on its banks is scattered and mostly dominated by shrub species. Both rivers demonstrate large seasonal variation – from very high in February – March to almost completely dry in July-August (except for separate pools). A considerable part of the area is occupied by low mountain ridges and slopes. Most of their surface is deforested but the southeasternmost parts are covered with old deciduous forests consisting of Hungarian oak (Quercus frainetto), sessile oak (Quercus dalechampii) with Mediterranean features and occasional oriental hornbeam (Carpinus orientalis), as well as secondary forests substituting the old woods cut down over tha past few decades. The slopes and crests of both valleys comprise various rocks and rock complexes, and a considerable portion of their area is occupied by shrub formations dominated by prickly juniper (Juniperus oxycedrus), etc. Also, there are frequent high rocky sections covered by grass vegetation.

There are 136 bird species identified in the Krumovitsa River area, 31 of which are listed in the Bulgaria's Red Data Book (1985). 64 of them are species of European conservation concern (SPEC) (BirdLife International, 2004). Two species are classified as SPEC 1 or European species of global conservation concern, 18 species are classified as SPEC 2 or unfavorable conservation status in Europe, and the remaining 44 species are classified as SPEC 3. The territory has a world importance as a representative area of the Mediterranean biome. The following 7 biome-limited species out of the total 9 typical Mediterranean biome species identified in Bulgaria are typical representatives of the ornitofauna in the protected area: black-eared wheatear (Oenanthe hispanica), olive-tree warbler (Hippolais olivetorum), subalpine warbler (Sylvia cantillans), Sardinian warbler (Sylvia melanocephala), sitta neumayer (Sitta neumayer), masked shrike (Lanius nubicus) and black-headed bunting (Emberizia melanocephala). Five of them inhabit biotopes that are similar to those typically developed on ridges and are likely to occur in the project area: the black-eared wheatear, the black-eared wheatear, the Sardinian warbler, the masked shrike and the black-headed bunting.

The Krumovitsa site is one of few places in Bulgaria that is the home of two endangered species: the cinereous vulture (Aegypius monachus) and the lesser kestrel (Falco naumanni). Also, for the black stork (Cionia nigra), the booted eagle (Hieraaetus pennatus) and the Egyptian vulture (Neophron percnopterus), the site is one of the most important places in the country with EU importance as they nest there.

Krumovitsa provides suitable habitats for 46 bird species listed in Appendix 2 to the Biodiversity Act, which require special environmental protection measures. Twenty-eight of those species are also listed in Annex I to Council Directive 79/409. More than half of them have significant nesting populations in the area. Also, for the black stork (Cionia nigra), the booted eagle (Hieraaetus pennatus), Egyptian vulture (Neophron percnopterus) and the olive-tree warbler, the site is one of the most important places in the country with EU importance as they nest there.

In 1997 the territory was declared a key ornithological territory (KOT) by BirdLife International. About 10% of the territory of Krumovitsa overlaps a CORINE site: the Valley of the Arda River, which was declared in 1998 due to its European importance for the conservation of rare and threatened habitats, plants and animals, including birds.

6. Physical factors

6.1. Noise Characterisation of the Project Area

The project proposal considers mining and processing of gold ores from the Ada Tepe prospect of the Khan Krum Deposit, which is located about 3 km southwest of Krumovgrad.

The project site area and adjacent lands are forest fund lands, for which no noise standards are established. Currently, no noise sources exist on the hill and the noise background is the natural environmental noise. The project operational sites are located on the hill top. Settlements are located at different distances from them - Chobanka 1, Chobanka 2, Kupel, Sinap, Belagush, Pobeda, Soika and Vurhushka. A solid two-storey building - a tourist lodge - is located at about 150 m northeast of the future open pit. The lodge has been abandoned since 2000 and is no longer used for recreation. A one-storey building owned by Krumovgrad Municipality is located near the lodge. It continues to be used together with several bungalows by one of the Krumovgrad schools.

7. Landscape

7.1. Brief Characterisation of the Main Landscape Features of the Project Area

According to Bulgaria’s regional landscape zoning, the project site is in:

- The South Bulgarian mountainous-valley landscape area;
- The Eastern Rhodopes landscape sub-area;
- The Dzhebel-Maglenitsa landscape area.

The Eastern Rhodopes sub-area is formed by the polycyclic development of the terrain during the Neogene and Pleistocene, and is a combination of rolling and low-mountainous topography. It consists of two broad fold structures – the Eastern Rhodopes megaanticline and the Eastern Rhodopes syncline. In morphohydrographic terms, the landscape patterns combine rolling and low-mountainous topography. The landscapes are formed by the polycyclic development of the terrain during the Neogene and Pleistocene.

The formation of the Dzhebel-Maglenitsa landscape area was dictated by the nonuniform stability of the bedrock on one hand and by the significant instability of the Tertiary sediments, which had a differentiated effect on the landscape formation in the Krumovgrad Municipality. The horizontal and vertical landscape features are not uniform across the landscape types and their resource potential, which are grouped in two typological landscape groups according to Bulgaria’s horizontal structure of landscapes, namely: 3.9.20.46 and 3.9.20.47.

According to the Landscape Classification System of Bulgaria, the site belongs to the following landscape hierarchical structure:

Class - Mountain landscapes.

Type - Landscapes of the sub-Mediterranean low-mountainous forests.

Sub-type - Landscapes of the low-mountainous xerophytic-bush forests.

Group - Landscapes of the low-mountainous xerophytic-bush forests over sedimentary rocks with relatively limited agricultural use.

Being the largest taxonomic unit to which the entire territory of Krumovgrad Municipality belongs, the Mountain Landscapes class is identified by the macromorpholithogenic parameters of the Eastern Rhodopes, which is one of the old-fold mountain ranges in Bulgaria. They reflect the zonal and azonal character and the relative ratio of environmental indicators that determine the mountain landscape types. From the geo-environmental perspective, the landscape classification of the project site must consider the anthropogenic impacts.

The Sub-Mediterranean low-mountainous forest landscapes make up the second largest taxonomic unit, which includes the entire territory of the Krumovgrad Municipality and is identified on the basis of typical zonal environmental indicators. The quality indicator for vegetation type, which defines the visual (external) appearance of existing landscapes, is used to identify this landscape taxon.

This landscape sub-type is used as an intermediary taxon for classification of landscapes and is based on the differentiation of the same zonal landscape parameters used for the landscape types but of different order of magnitude as indicated above.. In this case, the diagnostic criterion for both the entire Krumovgrad Municipality and the open-pit minesite is the vegetation sub-type.

The landscape groups by diagnostics include mezomorpholithogenic parameters such as rock substrata type and properties, nature of the young deposits, plant associations, level of arability and deforestation.

The landscape type is the smallest taxonomic rank in the classification structure. It is defined on the basis of its morphological features and vertical (internal) structure.

The following landscape types are identified in the Krumovgrad Municipality:

Forest landscapes - the part of the state-controlled forest fund managed by the Krumovgrad State Forestry Board and occupying 100% of the project footprint. The vegetation cover consists of tree species mostly represented by low-growing anthropogenic forest vegetation as follows:

- Forest low-growing ridge poor xeromorhpic.
- Forest low-growing ridge medium-rich mesomorhpic.
- Forest low-growing slope poor xeromorhpic.
- Forest low-growing slope poor mesomorhpic.
- Forest low-growing slope medium-rich mesomorhpic.
- Forest low-growing slope rich mesomorhpic.

The deciduous high-growing forest landscapes have relatively limited occurrence but give quality to the forest landscapes.

They are represented by the following sub-types:

- Forest deciduous, high-growing slope poor xeromorhpic.
- Forest deciduous, high-growing slope medium-rich xeromorhpic.

The coniferous forest landscapes, which are also of anthropogenic origin and created as forest crops, have more limited occurrence.

They are represented by the following sub-types:

- Forest coniferous ridge poor xeromorhpic.
- Forest coniferous slope poor xeromorhpic.
- Forest coniferous, slope medium-rich mesomorhpic.

The landscape outside forest land is represented by:

Meadow landscapes mainly occurring as grasslands and pastures located on municipal lands:

- Meadow ridge xeromorhpic.
- Meadow slope xeromorhpic.
- Meadow plain mesomorhpic.

The territories occupied by those landscapes cover meadows, grazing lands and barren lands occupied by grass ecosystems.

The agricultural landscapes comprise farmland mostly used for agriculture:

Agrarian crop-rotation planar medium-rich mesomorhpic.

The aquatic landscapes occupy the existing aquatic areas in the municipality represented mainly by a river and streams.

Rock landscapes are represented by outcrops of basement rock, which are shaped mainly by weathering processes.

One of the main anthropogenic impacts the implementation of the mining project will have will be on the landscape component.

8. Cultural Heritage - Cultural and Architectural Monuments within the Project Area

Characterization and analysis of cultural assets

The study of the cultural heritage was carried out in connection with the Project Proposal for Mining and Processing of Auriferous Ores from the Ada Tepe prospect, Khan Krum deposit, Krumovgrad. It is based entirely on the results of the archaeological studies carried out in the period 1989 - 2009.

A Thracian shrine was registered back in 1989 during field works at the crest of Ada Tepe (reg. № 2510002 on the Archaeological Map of Bulgaria). The shrine was declared in 1994 an archaeological monument of culture of local importance (SG, issue # 65/1994 г.). The shrine was studied through rescue archaeological surveys carried out in 2001, 2002, 2005 and 2006, funded by Balkan Mineral and Mining EAD. The surveys have found that the shrine was active for 1,500 years - from the middle of the Second Millennium to the end of the First Millennium BC. Various archaeological structures related to religious practices have been explored and documented - clay mortars, fireplaces, stone structures and pottery clusters. Probably after the middle of the First Millennium BC a solid stone wall was constructed to enclose an oval area of 161 sq. m. at the top of the hill. It is 2.20 m wide and 1.5 m of its height is preserved - it must have been higher judging by its destruction. The wall was constructed from large stones cemented with mud, which formed the outer faces, while its inside was backfilled with soil and rubbles/gravels. The shrine was a very active place during the late Iron Age (V-I century BC). Ritual activities were conducted inside the stonewall structure.

The field excavations uncovered numerous artifacts considered to be of high scientific and exhibition value and dating back to all the chronological periods identified at the site. These artifacts are now stored in the Kardzhali Regional Historical Museum and the National Archaeological Museum in Sofia.

The Thracian shrine at Ada Tepe is considered the most important of any of the known sites in the Eastern Rhodopes because it provides the opportunity to re-create the Thracian religious practices, customs, economic activities and relations.

All the cultural layers across the site were fully surveyed during the seven-month rescue archaeological surveys carried out at Ada Tepe. The archaeological structures discovered there were carefully recorded and deconstructed in the course of the survey. Therefore, the shrine was excluded from the register of cultural monuments by recommendation of the National Institute for Cultural Monuments (NICM), cf. Order № RD09-184/12.05.2006 issued by the Minister of Culture.

The initial round of rescue excavations found evidence of ancient mining activity at Ada Tepe. Consequently, archaeological surveys of an adit in the southwestern periphery of the hill and structures associated with extraction of auriferous ores on the western slope began in 2005. The adit was fully surveyed. (protocol of the commission appointed by the Director of the NICM, Order P-84/11.08.2005)

Consequently, a Bulgarian-German archaeological team conducted a field investigation of remains from ancient ore mining and metallurgy in 2008 followed by excavations in September 2009. Based on the investigation and excavation results, the site was interpreted as an ancient gold mine dating back to the Late Bronze/Early Iron Age (c. 15-8 century BC).

The traces of mining works found on the surface are represented by cone-shaped heaps (dumps) sloping down the hillsides. These contain varigrained mined waste rock material. Some of them contained fragmented stone or flint tools and ceramic material. Other specific structures exposed by excavation could be interpreted as ore processing areas. These archaeological structures have the status of immovable cultural assets of national significance within the meaning of art. 146, par. 3 of the Cultural Heritage Act (CHA).

In general, it could be summarized that the traces of ancient mining are found high on the hill between RL 380-400 m and the hill top (RL492 m). According to Letter ref. 92-00-0549/03.11.2010 from the Ministry of Culture, a procedure has been initiated to verify the cultural and scientific value of the archaeological structures and BMM will be advised in due course of the administrative actions taken in this regard.

According to the archaeologists engaged in the rescue surveys, the remains exposed on Ada Tepe indicate that currently this is the earliest known gold minesite in SE Europe.

In order to enable the archaeological surveys to continue, BMM and NAIM-BAS concluded a framework agreement on 09.08.2010. The Agreement governs the funding and the progress of the surveys in the future. BMM commits to funding the rescue archaeological surveys at Ada Tepe, which are due to be completed by 31.12.2012. The surveys will continue according to a schedule prepared by the leaders of the archaeological team. After completion of each survey stage, the Ministry of Culture will accept the surveyed area in compliance with the applicable laws and bylaws. In addition, BMM will promote the survey results through scientific publications, museum and/or open exhibitions at a location that is accessible to the local communities. The agreement provides that the project implementation may go parallel with the archaeological survey and the surveyed areas will progressively be released to enable the project to continue.

V. Description, Analysis and Evaluation of the Potential Impacts on the Population and the Environment from the Implementation of the Investment Project, the Use of Natural Resources, Emissions of Harmful Substances during Normal Operation and in Emergency Situations, Generation of Waste and Nuisance

1. Air

1.1. Air Pollution Sources Associated with the Implementation of the Investment Project – Construction and Operation

Project Construction - Open Pit

The construction sequence is planned as follows: - Construction of infrastructure (local road for access to the national roads, power supply and telecommunications) and integration with any existing local infrastructure; - Land to be cleared of any trees and other vegetation within the footprint of the the open pit, roads, the integrated mine waste facility and the the concentrate production facility; - Soil removal and disposal to a designated area where it is to be stored and re-used at the closure phase; - Construction of temporary offices and storage areas for the construction phase; - Preliminary overburden (without any commercially significant gold level) of Ada Tepe, sufficient to provide the material required for construction of a platform for the launch of the mining operations; - Construction of a process plant, offices, service and repair shop and other buildings; - Construction of a well which is to provide the required volume of fresh water for the production process; - Preparation of ore stockpile. The construction stage will also include construction of site roads to ensure reliable all-weather access for heavy-duty off-road trucks, as follows: Roads between the open pit and the ROM ore pad and the Integrated Mine Waste Facility ("IMWF") including connections to the a waste rock stockpile); and the process plant and the flotation TMF (under Option 2);

During project construction, the site will generate only fugitive emissions from the following operations: - Excavation works; - Earthfill works; - Development of temporary haul roads situated at the side of the pit and forming ramps up to the ROM ore pad, the low-grade ore stockpile and the mine rock disposal facility, whose surfaces are graded, cleared and topped with gravel and crushed rock; - Loading, haulage, unloading and disposal of solid waste from the construction process; - Construction of soil and overburden stockpiles, ROM ore pad and the respective facilities for mine waste disposal; - Construction of a concentrator plant and a crushing plant. The following equipment will be used to complete the above activities, which may generate harmful emissions: - Flat-blade bulldozer; - front loader and grader; heavy trucks.

The sources of fugitive emissions during preparation of the pit operational areas include: - construction works, which will emit dust from the inert material of various particle size; and internal combustion engines of the project equipment, which will emit exhaust gases and soot during the construction phase. Moving the heavy construction and excavation equipment to the project site will be a one-off exercise, which will have a short impact on the centres of population along the selected access route.

The harmful substances that will be generated by the mining operations will include: - dust emissions of various particle size (including PM_{10}) from earthworks (manual and mechanised). Depending on the chemical composition of the ore and the waste rock that will be mined, the particulate matter may contain different levels of: SiO_2; Al_2O_3; Fe_2O_3; K_2O; CaO; MgO; TiO_2 and MnO. At the same time, the equipment operation will generate typical exhaust gases such as: nitrogen oxides, carbon oxide, sulfur dioxide, non-methane volatile organic compounds (NMVOC), soot, heavy metals, polycyclic aromatic hydrocarbons (PAH), persistent organic pollutants (POP), polychlorinated biphenyls (PCB), etc.

The main air pollution sources will be: dump trucks, an excavator, a front-end loader, a dozer. About 370 t of diesel fuel are expected to be used over a two-year period. This amount is estimated on the basis of the following assumptions: daily average truck mileage of 25-30 km at 25 L per 100 km and average consumption of 15 L per engine hour of a construction equipment unit. According to the CORINAIR method, the substances that will be emitted into the atmosphere over the construction stage based on the above fuel consumption will include 2,120 kg of soot, 2,220 kg of sulphur oxides, 18,056 kg of nitrogen oxides, 5,846 kg of carbon monoxide and 1,762 kg of volatile organic compounds (VOC).

At this stage, it is hard to quantify the dust emissions that would be generated during project construction. In this case (Option 1), the areas that would be affected are the open pit, the ROM ore pad, The IMWF and the haulage links between them. The dust that would be generated from excavation, loading, dumping, etc. will be precipitated within several tens of meters from the sources. The finer dust particles including respirable dust (below 10 microns) will be influenced by the turbulence of air masses in the atmospheric surface layer (ASL) so they will dissipate in the air. The ultra fine dust particles (below 2 microns) could enter the lungs of site employees. Compulsory wearing of PPE including suitable respiratory protection (dust protection masks) by the personnel.

<u>Project Operation</u>

The ore in Ada Tepe will be open-pit mined. The mining method will be a conventional open cut drill, blast, load and haul operation. The mined ore will be loaded into dump trucks hauling the ore to the ore stockpile (ROM pad). ROM ore will be fed to the jaw crusher feed bin by a front-end loader (FEL). Ore processing will include: crushing, grinding, gravity separation, flotation and dewatering.

All rock material without economic gold and silver values and therefore classified as waste will be Option 1 considers co-disposal of waste rock and dewatered flotation waste, while Option 2 considers construction of a conventional tailings management facility and a separate waste rock dump. The ore material with low economic gold and silver values will be hauled to a separate low-grade ore stockpile under Option 2 and within the IMWF footprint under Option 1.

Emission of Exhaust Gas Pollutants from Mining Equipment

Construction and engineering equipment is a mobile source of emissions. The following mine production and ancillary equipment is scheduled in the Project: - Drilling equipment (Sandvik 1100) – 2 units, 200 kW, fuel consumption 40 L/h (diesel), 3-shift operation (24 – 4hrs break) – 20 hrs; - Excavator (Komatsu 1250-7) - 2 units – 500 kW, fuel consumption 50 L/h (diesel), 3-shift operation (24 – 4hrs break) – 20 hrs; - Heavy trucks (Komatsu HD 12-7) – 5 units – 250 kW (50t capacity), fuel consumption 100 L/h (diesel), 3-shift operation – 24hrs; - Bulldozer (Komatsu) - 1 unit – 200 kW, fuel consumption 50 L/h (diesel), 3-shift operation – 24 hrs; - Grader (Caterpillar TCA 250 PT) – 1 unit. – 200 kW, fuel consumption 50 L/h (diesel), 3-shift operation – 24hrs; - Water truck (KamAz 43118) – 3 units. – 100 kW, fuel consumption 15 L/h (diesel), 3-shift operation (24 – 4hrs break) – 20 hrs; - IT utility vehicle (Komatsu WA250 PT-5) – 250 kW (50t capacity), fuel consumption 100 L/h (diesel), 3-shift operation (24 – 4hrs break) - 20hrs; - Front loader (L-35.5) - 1 unit – 200 kW, fuel consumption 50 L/h (diesel), 3-shift operation – 24hrs.

The mined ore and rock material will be hauled by 50t off-road dump trucks to the respective storage areas: the waste rock dump (Option 2) or the IMWF (Option 1) – approx. 410 rounds per day, which will deliver the mined ore at a distance of approx. 200 to 1,000m from the open pit to the ROM pad and at a distance of approx. 500 to 1,500m from the open pit to the IMWF. About 1,100 trips per annum of various types of vehicles, whose payload capacity will vary from 3.5 to 10 t, will be required to ship the final gold-silver concentrate batches and deliver process consumables and materials. The traffic on the off-site roads (to the cargo railway station at Momchilgrad some 35 km west of the minesite) will increase by 10 to 12 heavy trucks per day or 60 to 80 vehicles per month. Regardless of the selected process option, the road traffic will increase but it will not cause substantial ASL (ground-level) pollution at the centres of population along the selected route.

According to project estimates, a total of 5,675t of diesel fuel will be used per annum for mining and rock material handling (ore and waste rock) at the assumed production rate. According to the CORINAIR method, based on one year operation period, the substances that will be emitted into the atmosphere over the construction stage based on the above fuel consumption will include 32.5t of soot, 34t of sulphur oxides, 276.9t of nitrogen oxides, 89.6t of carbon monoxide and 40.2t of volatile organic compounds (VOC).

Based on the CORINAIR 94 method, the emission factors and the volume of harmful emissions from the motor vehicles, production and haulage equipment, as well as the total emissions per one year of operation of the Adat Tepe open pit, the ROM ore pad and the waste rock stockpile are shown in the table below. Over the concession period of 9 years, this equipment will not be available at all times and will have to be serviced and repaired at the on-site workshop from time to time as required.

Emission of Pollutants from Drilling, Material Handling, Breaking and Haulage Operations in the Pit Operational Areas and At the ROM Pad

The Ada Tepe mine plan currently being considered is based on 850,000 Mtpa production over a 9-year period (excluding the overburden removal), which gives a process plant throughput rate of 106 tph at 8,000 operating hours per annum. The project will be a 3-shift based, 24/7 operation, 12 months or 330 days per year (8,000 operating hours per year). A total of 230 employees is planned to support the production process.

Drilling equipment for drill holes of 102mm size and approx. 5m space between drill holes for blasting purposes will operate under the reverse circulation (RC) method and will be equipped with three dust collection and suppression systems (two dry filters for larger dust particles and a water mist system to suppress the dust particles smaller than 10 μm).

The mined ore will be loaded by a 120t hydraulic back-pull shovel serving 50t off-road dump trucks hauling the ore to the temporary storage area. A front-end loader will deliver ore from the ROM pad to the feed hopper of the jaw crusher and will be used for general clean-up around the plant area. Additional mining equipment will include drill rigs, bulldozers (2 units), a grader, water tank trucks, other vehicles and auxiliary vehicles and light trucks.

The harmful substances that will be emitted by those pollution sources during the operation of the Ada Tepe prospect of the Khan Krum deposit are: - dust from excavation, loading and unloading operations in the open pit after blasting; - dust generated by the heavy truck traffic across the minesite; nitrogen oxides, carbon monoxide; - dust generated by the drill rigs during blasthole drilling.

All rock material without economic gold and silver values and therefore classified as waste will be hauled to a waste dump area located approximately 200 m south-southeast of the open pit. Option 1 considers co-disposal of waste rock and dewatered flotation waste, while Option 2 considers construction of an additional waste rock dump. The ROM pad will ensure continuous ore feed to the grinding circuit, which is necessary to maintain a constant grind quality, which is generally not possible to achieve by direct feed from the open pit due to the specifics of mining. A front-end loader will deliver ore from the ore stock pile (ROM pad) to the feed hopper of the jaw crusher. The ore material with low economic gold and silver values will be hauled to a separate low-grade ore stockpile (within the IMWF footprint under Option 1), where the material will only be unloaded and the stockpile will be re-profiled from time to time. The harmful substances that may be generated by the ROM pad operations include: - dust – from ore handling and feeding to the crusher. Sprinklers and water trucks will be used to control and reduce dust emissions from the mining activities in the open pit mine and haulage on the roads between the mine and the ROM pad and stockpiles.

The total suspended dust emissions will have a local-scale impact on the air. Those dust emissions disperse within small distance range from the source, as their temperature is the same as the temperature of the ambient air, have high gravity velocity of deposition and their sources are positioned very close to the ground. To characterise the dust emission impact on the air quality within the minesite and the adjacent residential areas from the mining operations, the emissions of fine particulates (PM_{10}) are determined as they normally disperse over larger distances. It is assumed that the PM_{10} fraction is included in the total dust emissions.

The dispersion of the emitted substances will primarily depend on the project production rate and the annual mining rate, as well as on the the mining schedule for the entire concession period.

The estimated annual emissions from mining, handling and haulage activities, which have been estimated using CEPMAIR 2002 emission factors applicable to open dust sources in mines and quarries, including the operation of the Ada Tepe open pit, the ROM pad, and the waste rock stockpile are shown in the table below.

Crushing section. Treatment facilities

Ore crushing is an intensive source of fugitive dust emissions. A front-end loader will deliver ore from the ore stock pile (ROM pad) to the feed hopper of an outdoor jaw crusher, whose production capacity will be 200-250 tph, discharge end diameter approx. 150mm, which will ensure crushed ore size suitable for SAG Mill grinding. The crusher product will be discharged onto a fully enclosed inclined belt conveyor leading to the grinding section. This circuit will also have a small cone crusher handling the pebbles recycled from the semi-autogenous grinding mill in the grinding section. The pebble crusher product will discharge onto the mill feed conveyor belt.

The crusher will be an open facility but the ore transfer points will be enclosed and provided with dust collecting equipment. A dust collection system is planned to be installed to ensure dust collection at the ore transfer points and treatment by a bag filter. The dust emission at the crusher and gas emitted at the point after the bag filters comprise non-fugitive point source. The air volume required for efficient dust collection is estimated to be about 8,000 - 10,000 Nm^3. Air will be discharged in the environment by a discharging device, as the anticipated dist emissions in the output air flow must comply with the standards under Regulations 1/2005 on Normally Allowable Air Emission Levels for Harmful Substances (Pollutants) Emitted from Sites and Operations with Emission Point Sources (art. 11, par. 1) – 20 mg/m^3 at a total mass flow rate for the source above 0.20kg/h.

The inclined belt conveyor leading to the grinding section will be fully enclosed and the ore transfer point in the Grinding Section will be equipped with sprinklers to minimise the potential for release of dust into the environment. The conveyor belt will feed to a crushed ore hopper, as the entry pint will be equipped with a sprinkler to suppress any potential; dust generation. With the planned water-based dust suppression system, the wet particles will add to the output material and will not be separated as waste (water or precipitation), since the water content in the output is relatively low and only causes moisture level increase in the output. Such type of "wet" dust suppression provides a high capture rate (80-90%) and is effective down to 10 µm particle size.

The emissions profile has been prepared by a standard method, which has been developed by adapting the Emission Inventory Guide CORINAIR-94, SNAP-94 to the conditions that are typical of Bulgaria. Since the updated method for determination of harmful air emissions does not provide any data about SNAP CODE 040616, the forecasting of PM_{10} generated by mining operations uses the emission factors under CEPMAIR, 2002. PM_{10} emission factors are applied as the $PM_{2.5}$ emission factors are an order of magnitude lower.

Grinding and Gravity Separation

Grinding. The grinding section of the plant will be located inside the main plant building and will use a three-stage wet grinding circuit with a primary SAG mill and secondary and tertiary (regrinding) ball mills. The SAG mill will operate in an open circuit, where the oversize from the mill will be discharged onto a rubber-belt conveyor leading back to a cone crusher in the

The project grinding flowsheet includes a grate discharge, steel-lined primary SAG mill and a grate discharge, rubber-lined secondary and tertiary ball mills. Both ball mill grinding stages will incorporate primary and secondary classification in hydrocyclone clusters. A relatively fine grind is required to achieve satisfactory level of exposure, which dictates the selection of this grinding circuit configuration. It will report to a screening section for removal of any trash, mostly wooden and plastic waste, from the ore feed.

Gravity Separation. After the screening section, the ore feed will be advanced to a gravity separation circuit for recovery of part of the free and exposed gold particles. The process involves selective separation of the lighter from the heavier products in the process based on their different densities. It is performed on separation tables using water, which washes the light particles while the heavy ones become attached to the table surface and are advanced to one of its ends by forward/backward motion of the deck. Centrifugal machines will also be utilised where possible in gravity separation to enhance the gravitational force experienced by feed particles. The waste from the gravity separation process will be an interim product, which will be fed back to the regrinding ball mill to further expose the gold particles.

The circuit will be adjacent to the flotation circuit in the process plant. The recovered gravity concentrate will be combined with the final flotation concentrate to form the final product of ore processing. The discarded slurry from the gravity separation circuit will form the feed to the flotation circuit.

Grinding of crushed ore, crushing and gravity separation will be based on a wet process and therefore no potential dust emissions are expected. A dust collection system is not considered for the Grinding and Flotation sections of the process plant. Those processes involve material with high moisture content and do not generate dust. Additional sprinkler will be installed at the feed point of the SAG mill to ensure suppression of any potential dust release.

Flotation. Reagents Facility

Flotation Flotation will be the main process for recovery of the gold and silver values from the ore. The process is performed in flotation banks, where the recovery of the payable components from the waste rock is achieved by conditioning the surfaces of mineral grains based on the different surface chemistry of the gold and rock particles. Air is introduced to the bottom of the banks and dispersed by an impeller driven by an electric motor. The air bubbles rise to the surface of the flotation cell colliding with the pulp particles. The hydrophobic particles attach to the rising air bubbles to form froth on the surface, which overflows the flotation cell and advances to the next stage.

A direct selective flotation flowsheet consisting of one rougher stage, three cleaner stages and two scavenger stages is considered.

A general ventilation system will be installed in the facility, which will enable triple air exchange within the facility to ensure normal work conditions. Suction and blowing fans will be installed on the walls and rooftop of the facility.

Reagents Facility The nature of the floated material requires extended conditioning of the surfaces prior to discharge into to the flotation banks, which is achieved by: - Addition of reagent for sulfidizing the particles' surface (Copper Sulphate) at the preceding stage - SAG mill grinding; - advancing of collector reagents to an agitator for conditioning prior to flotation. The following reagents will be used in the flotation process:

- Collector: PAX (potassium amyl xanthate) and a minimum amount of dithiophosphate (Aerofloat 208);
- Frother: Cytec OrePrep F 549;
- Dispersant: Sodium silicate ($Na_2OxnSiO_2$, also known as water glass or liquid glass);
- Sulphidiser: Copper sulphate ($CuSO_4x5H_2O$).

The hazardous materials in the reagents facility include: - potassium amyl xanthate (PAX), CAS No. 220-329-5, concentration 90 – 100%, symbols Xn- Harmful, R-phrases: 22, 36/37/38, with a maximum allowable concentration of PAX aerosols in the ambient air at the workplace – 1 mg/m^3 (section 198 of Appendix 1 to Regulation 13/30.12.2003 on the Protection of Personnel against Exposure to Chemical Agents at the Workplace); - dithiophosphate with a $MAC_{av.24h}$ of 0.05 mg/m^3 and $MAC_{max.short}$ of 0.15 mg/m^3 (section 114 of Regulation 14/23.09.1997, last amendment in SG issue 42/29.05.2007, effective date 01.01.2008, on the Maximum Allowable Concentrations of Harmful Substances in the Ambient Air of Populated Areas), which is also similar to the aerosol forms of s-s-dibutyl trithiophosphate with a MAC in the ambient air of the operational area of 0.5 mg/m^3 (section 102 of Appendix 1 to Regulation 13/30.12.2003 on the Protection of Personnel against Exposure to Chemical Agents at the Workplace – maximum allowable concentrations of harmful substances in the air at the workplace).

A dust collecting system having a rated capacity of 4,000 Nm^3 will be installed above the xanthate mixing deck. To minimise dust emissions, the xanthate will be delivered as pellets in 200 kg lots in PET bags enclosed in steel drums. An exhaust roof top fan will provide about 4,000 Nm^3 of suction capacity to the dust collecting system. Separation of dust particles will take place in a filter cartridge. The filter will be cleaned by washing at regular intervals recommended by the designer. A general ventilation system will be installed in the facility.

The hazardous components in the reagents facility may be classified as Class I organic substances according to Appendix 3 to Regulation 1/2005. The anticipated emissions from potassium amyl xanthate and dithiophosphate in the exhaust air must comply with the limits set in Regulation 1/2005 on Normally Allowable Air Emission Levels for Harmful Substances (Pollutants) Emitted from Sites and Operations with Emission Point Sources (art. 16, par.3 and art.14.par. 1) – 20mg/m^3 or 0.20kg/h.

Waste Rock and Flotation Waste (Tailings) Integrated Mine Waste Facility

The rock material with no economic gold and silver values is classified as waste rock, which is generated in the process of exposure/access to the ore body. It mostly consists of breccia conglomerates with occasional boulders of metamorphic rocks - amphibolites, gneiss and schists. A total of 15 Mt are expected to be generated over the life of Ada Tepe mine.

The process (or flotation) tailings are the waste material rejected from the flotation plant after the recoverable valuable minerals have been extracted from the ore feed. About 7 to 8 Mt of tailings are expected to be generated by the end of the project life. The flotation tailings will be dewatered by thickening prior to their disposal in a waste storage facility

(Option 1). The tailings will be thickened in a deep-bed thickener (DBT), which is capable of delivering a thickened product with the required paste consistency. That will enable co-disposal of tailings and waste rock.

The IMWF capacity will be sufficient to accommodate the entire amount of mining wastes generated throughout the mine life of the Ada Tepe portion of the Khan Krum Deposit (about 14 Mt). The facility features: - tailings pipeline – it will be composed of polyethylene pipes to transport the thickened flotation tailings at 56% solids; - Starter platforms – they will be constructed from waste rock at the start of operations; - outer berms – constructed from mine rock with horizontal benches at 10 m vertical intervals with the intervening slope constructed at 2.5H: 1V and a bench crest width of 5 m; - internal berms constructed from waste rock with horizontal benches at 10 m vertical intervals and different patterns to create cells for the tailings; - drainage system.

Under Option 2, the waste rock will be stockpiled separately while the flotation tailings will be deposited into a conventional TMF.

The harmful substances that are expected to be emitted from the IMWF are: - dust generated by the construction of the outer and internal berms of the cells; - dust - excavation and handling as part of the waste rock disposal operations; - dust generated by heavy equipment traffic to the respective active cell; nitrogen oxides, carbon monoxide;

Dust emissions from mining operations (without blasting) at the Ada Tepe open pit
(based on the mining reserves inventory by years)

Table V.1.1-1

Year	Total mine rock tonnage	Flotation tailings	Waste rock tonnage	Blasthole drilling, t			Excavation after fragmentation (pushing), t			Handling of bulk material, t			Dust from mobile equipment t		
				TSP	PM_{10}	$PM_{2.5}$	Dust	PM_{10}	$PM_{2.5}$	Dust	PM_{10}	$PM_{2.5}$	Dust	PM_{10}	$PM_{2.5}$
1	1820	850	970	0.876	0.741	7.415	84.26	33.70	13.481	26.963	12.807	4.044	67.41	14.156	2.022
2	2400	850	1550	1.156	0.978	9.778	111.11	44.44	17.778	35.556	16.889	5.333	88.89	18.667	2.667
3	2590	850	1740	1.247	1.055	10.552	119.91	47.96	19.185	38.370	18.226	5.756	95.93	20.144	2.878
4	2640	850	1790	1.271	1.076	10.756	122.22	48.89	19.556	39.111	18.578	5.867	97.78	20.533	2.933
5	2590	850	1740	1.247	1.055	10.552	119.91	47.96	19.185	38.370	18.226	5.756	95.93	20.144	2.878
6	3040	850	2190	1.464	1.239	12.385	140.74	56.30	22.519	45.037	21.393	6.756	112.59	23.644	3.378
7	3180	850	2330	1.531	1.296	12.956	147.22	58.89	23.556	47.111	22.378	7.067	117.78	24.733	3.533
8	3170	850	2320	1.526	1.291	12.915	146.76	58.70	23.481	46.963	22.307	7.044	117.41	24.656	3.522
9	760	440	320	0.366	0.310	3.096	35.19	14.07	5.630	11.259	5.348	1.689	28.15	5.911	0.844
Total	**22190**	**7240**	**14950**	**10.684**	**9.040**	**90.404**	**1027.31**	**410.93**	**164.370**	**328.741**	**156.152**	**49.311**	**821.85**	**172.589**	**24.656**

Total dust emissions by mining and material handling operations
(based on the mining reserves inventory by years)

Table V.1.1-2

Year	Total mine rock tonnage	Flotation tailings	Waste rock tonnage	Dust emissions from mining operations (drilling, loading and handling, internal haulage) without blasting, ton			Dust emissions from handling of the mined rock in the crushing area (transfer, crushing and screening), ton			Total dust emissions from mining and rock handling (without blasting), ton		
				TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
1	1820	850	970	179.506	61.408	26.963	40.040	13.104	5.373	219.546	74.512	32.336
2	2400	850	1550	236.711	80.978	35.556	52.800	17.280	7.085	289.511	98.258	42.640
3	2590	850	1740	255.451	87.389	38.370	56.980	18.648	7.646	312.431	106.037	46.016
4	2640	850	1790	260.382	89.076	39.111	58.080	19.008	7.793	318.462	108.084	46.904
5	2590	850	1740	255.451	87.389	38.370	56.980	18.648	7.646	312.431	106.037	46.016
6	3040	850	2190	299.834	102.572	45.037	66.880	21.888	8.974	366.714	124.460	54.011
7	3180	850	2330	313.642	107.296	47.111	69.960	22.896	9.387	383.602	130.192	56.498
8	3170	850	2320	312.656	106.958	46.963	69.740	22.824	9.358	382.396	129.782	56.321
9	760	440	320	74.959	25.643	11.259	16.720	5.472	2.244	91.679	31.115	13.503
Total	**22190**	**7240**	**14950**	**2188.591**	**748.707**	**328.741**	**488.180**	**159.768**	**65.505**	**2676.771**	**908.475**	**394.246**

Dust emissions by type of operation and waste rock handling at the IMWF
(based on the mining reserves inventory by years)

Table V.1.1-3

Year	Total mine rock tonnage	Flotation tailings	Waste rock tonnage	Waste rock handling (off-loading and distribution) at the mining waste facility, ton			Dust from transport equipment at the mine waste facility, ton			Total dust emissions from waste rock at the TMF, ton		
				TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
1	1820	850	970	44.91	17.96	7.185	35.93	7.544	2.022	80.833	25.507	9.207
2	2400	850	1550	71.76	28.70	11.481	57.41	12.056	2.667	129.167	40.759	14.148
3	2590	850	1740	80.56	32.22	12.889	64.44	13.533	2.878	145.000	45.756	15.767
4	2640	850	1790	82.87	33.15	13.259	66.30	13.922	2.933	149.167	47.070	16.193
5	2590	850	1740	80.56	32.22	12.889	64.44	13.533	2.878	145.000	45.756	15.767
6	3040	850	2190	101.39	40.56	16.222	81.11	17.033	3.378	182.500	57.589	19.600
7	3180	850	2330	107.87	43.15	17.259	86.30	18.122	3.533	194.167	61.270	20.793
8	3170	850	2320	107.41	42.96	17.185	85.93	18.044	3.522	193.333	61.007	20.707
9	760	440	320	14.81	5.93	2.370	11.85	2.489	0.844	26.667	8.415	3.215
Total	**22190**	**7240**	**14950**	**1027.31**	**410.93**	**164.370**	**541.85**	**113.789**	**24.656**	**1569.167**	**524.715**	**189.026**

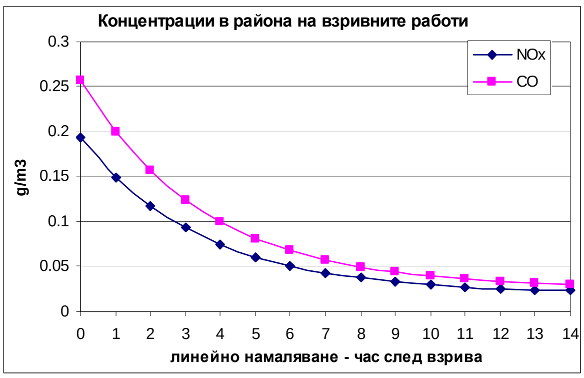
Emissions from Blasting in Open Cut Mining

The drilling and blasting operations will be undertaken at high intensity rate in view of the rock classification as "hard", which is a requirement for initial rock fragmentation. Multiple ring blasting or mass blasting will be the dominant method of blasting, which requires the use of large amounts of explosives. The explosives that will be used include ANFO (Dynolite^{TM}, a mixture of ammonium nitrate and 6% of diesel by weight) for the mining of the oxidized ore in the Upper Zone and waterproof emulsion (e.g. Fortis™ Advantage 80 – a mix of 80% matrix and 20% AN prills) for the mining of the ore in the Wall Zone. The blasting of such an explosive generates nitrogen and carbon oxides. The project schedules 100 blasts per year, or two blasts per week. The total charge per blast is 7,000kg, or a total of about 700t per year.

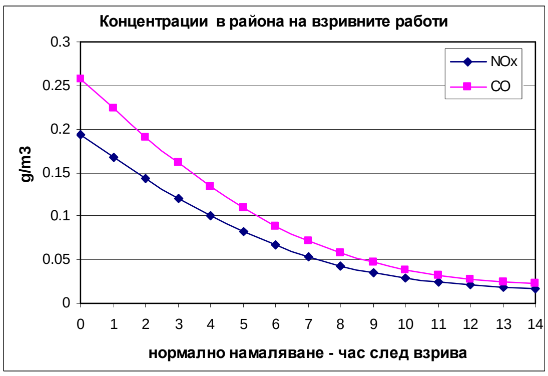
Chemical explosion is, by definition, a very rapid transformation of matter into energy by combustion. The chemical explosion liberates from 600 to 1000dm^3 gas per kg of explosive at a temperature of 2,500 to 4,500°C and pressure of 200–300 MPa. Given those parameters of the generated detonation wave, part of the carbon is converted into carbon oxide (CO), while part of the nitrogen is converted into $NO_{x.}$ It is a convention in blasting science to use equivalent CO, i.e. nitrogen oxides are converted into equivalent CO units. Quarrying operations typically use coarse dispersed ammonite. The most recent studies show it releases between 103 and 201 dm3/kg equivalent CO. According to the mining plan, the estimated consumption of explosives per ton of rock is between 0.20 kg/m^3 for completely weathered rock and 0.65 kg/m^3 for undisturbed rock. The estimations assume the maximum value.

It is anticipated that the mining operations will be highly intensive with smooth operational cycles over the year. With regard to the mining operations, the Investor has provided the estimated explosive consumption – 7,000 kg per blast, two blasts per week. Each blast will therefore release the following gas amounts: - about 600 m^3 of CO_2, - about 160 m^3 of CO, - about 120 m^3 of NOx, - about 400 m^3 of hydrocarbons.

The gases will be released as a plume with the following gas and dust composition: - blasting fumes released at the moment of the explosion – nitrogen oxides, carbon oxides and hydrocarbons; - dust from the blasted rock with different dispersion composition including respiratory dust below PM_{10}.



Linear reduction of CO and NOx levels



Normal reduction of CO and NOx levels

The experimentally determined toxic gas levels in the plume (per 2,500kg explosive) 30 seconds after the blast at 30-50m distance are as follows: - CO 0.0025 vol.% equivalent to 2 g/m^3; - NO_2 0.005 vol.% equivalent to 2.4 g/m^3; total dust 200-1,200 mg/m^3 equivalent to 0.2-1.2 g/m^3. Concentration levels within the blasting area (with release of approx. 377kg CO_2, 50 kg CO, 58 kg NOx (mostly NO_2 converting to NOx) within a relatively limited volume remains high even hours after the blast and the visual inspection of the blasted rock should take place once the atmosphere in the area proves to be safe but not until 30 minutes have elapsed after the blast.

Given a charge weight per blast of 7,000kg, the anticipated volume of the plume is approx. 6,000 m^3, which may rise to more than 160m in the air. Assuming a secondary volume in normal conditions (temperature and pressure) of 400,000m^3 and footprint corresponding to the footprint of the assumed area source 140 x 40m (with even distribution of the blasting fumes), the concentrations within that volume will change as a result of diffusion processes or dispersion of materials.

Deposition of particulate matter will depend on the weather conditions. Deposited particulates, however, may become airborne again in windy conditions and be transported at various distances. Precipitation, which is relatively abundant in the region, play a positive role in cleaning the air from fine particulates.

The annual emissions of harmful substances from the blasting operations in the Ada Tepe open pit, Khan Krum Deposit, are provided in the table below.

Emissions from blasting based on the mining reserves inventory by years.

Table V.1.1-4

Year	Total mine rock tonnage	Flotation tailings	Waste rock tonnage	Gas emissions from blasting t			Dust emission from blasting		
				CO	NO_2	CO_2	Dust	PM_{10}	$PM_{2.5}$
1	1820	850	970	10.077	7.449	81.496	12.133	6.404	6.404
2	2400	850	1550	13.289	9.822	107.467	16.000	8.444	8.444
3	2590	850	1740	14.341	10.600	115.974	17.267	9.113	9.113
4	2640	850	1790	14.618	10.804	118.213	17.600	9.289	9.289
5	2590	850	1740	14.341	10.600	115.974	17.267	9.113	9.113
6	3040	850	2190	16.833	12.441	136.124	20.267	10.696	10.696
7	3180	850	2330	17.608	13.014	142.393	21.200	11.189	11.189
8	3170	850	2320	17.552	12.974	141.946	21.133	11.154	11.154
9	760	440	320	4.208	3.110	34.031	5.067	2.674	2.674
Total	**22190**	**7240**	**14950**	**122.867**	**90.815**	**993.619**	**147.933**	**78.076**	**78.076**

Annual emissions of harmful substances from the deposit operation

The total annual emissions of harmful substances for one year of deposit operation are broken down by groups and shown in the table below. The only emissions which are summed up are those of group 1 and dust.

Inventory of forecast annual air emissions of harmful substances by main sources

Annual emissions of group 1 pollutants and dust from Ada Tepe operations (excluding transport)

Table V.1.1-5

Mining operations	**Harmful emissions from rock blasting, mining, and handling, and total (in tpa)**							
	SO_X	**NO_X**	**Xanthate**	**CH_4**	**CO**	**NH_3**	**CO_2**	**PM_{10}**
Mining operations in the open pit without blasting – area source								97.484
ROM ore pad operations – area source								19.628
Low grade ore stockpile operations – area source								4.580
Waste rock disposal operations – area source								56.783
Ore crushing (after crusher filter) – point source								1.744
Process Plant (after filter) – point source			0.871					-
Transport operations: haulage of mined ore and disposal of waste rock - line source								18.520
Gas and dust from blasting (twice per week) – area source.	-	9.701		-	13.184	-	106.709	8.378
Total	**-**	**9.701**	**0.871**	**-**	**13.184**	**-**	**106.709**	**207.116**

Annual emissions - group 1 pollutants and dust from transport (exhaust gas)

Table V.1.1-6

Transport operations	**Harmful emissions from transport equipment in g/kg of fuel consumed and total (in tpa)**							
	$*SO_X$	**NO_X**	**NMVOC**	**CH_4**	**CO**	**NH_3**	**N_2O**	**PM_{10}**
Emission factors for diesel engines, g/kg sulphur * 0.2 %/ 0.3 %	4.0/6.0	48.8	7.08	0.17	15.8	0.007	1.30	5.73
Mining operations in the open pit without blasting – area source	9.257	75.290	10.923	0.262	24.377	0.011	2.006	8.840
ROM ore pad operations – area source, tons per year	1.864	15.159	2.199	0.053	4.908	0.002	0.404	1.780
Low grade ore stockpile operations – area source	0.435	3.537	0.513	0.012	1.145	0.001	0.094	0.415
Waste rock disposal operations – area source	3.728	30.318	4.399	0.106	9.816	0.004	0.808	3.560
Transport operations: haulage of mined ore and disposal of waste rock - line source	18.763	152.602	22.140	0.532	49.408	0.022	4.065	17.918
Total	**34.046**	**276.907**	**40.174**	**0.965**	**89.654**	**0.040**	**7.377**	**32.514**

Emissions of group 2 pollutants (heavy metals)

Table V.1.1-7

Fuel	Harmful emissions from construction and engineering equipment in mg/kg of fuel consumed and total in kg per annum					
	Cd	**Cu**	**Cr**	**Ni**	**Se**	**Zn**
Equipment emission factors, mg/kg	0.01	1.7	0.05	0.07	0.01	1.0
Mining operations in the open pit without blasting – area source, tons per year	0.015	2.623	0.077	0.108	0.015	1.543
ROM ore pad operations – area source, tons per year	0.003	0.528	0.016	0.022	0.003	0.311
Low grade ore stockpile operations – area source, tons per year	0.001	0.123	0.004	0.005	0.001	0.072
Waste rock disposal – area source, tons per year	0.006	1.056	0.031	0.043	0.006	0.621
Transport operations: haulage of mined ore and disposal of waste rock - line source, tons per year	0.031	5.316	0.156	0.219	0.031	3.127
Общо	**0.057**	**9.646**	**0.284**	**0.397**	**0.057**	**5.674**

Emissions of group 3 pollutants *Table V.1.1-8*

Fuel	Harmful emissions from construction and engineering equipment in µg/kg of fuel consumed and total in g per annum						
	Benz(a) anthracene	Benzo(b) fluoranthene	Dibenzo(a,h) anthracene	Benzo(a) pyrene	Chrysene	Fluor anthene	Phen anthene
Equipment emission factors, µg/kg	80	50	10	30	200	450	2500
Mining operations in the open pit without blasting – area source, tons per year	123.4	77.1	15.4	46.3	308.6	694.3	3857.1
ROM ore pad operations – area source, tons per year	24.9	15.5	3.1	9.3	62.1	139.8	776.6
Low grade ore stockpile operations – area source, tons per year	5.8	3.6	0.7	2.2	14.5	32.6	181.2
Waste rock disposal – area source, tons per year	49.7	31.1	6.2	18.6	124.3	279.6	1553.2
Transport operations: haulage of mined ore and disposal of waste rock - line source, tons per year	250.2	156.4	31.3	93.8	625.4	1407.2	7817.7
Total	**453.9**	**283.7**	**56.7**	**170.2**	**1134.9**	**2553.4**	**14185.8**

The percentage distribution shows that: - The everyday mining operations in the open pit will contribute most (about 49-50%) to the emissions of particulate matter (PM_{10}) (drilling, crushing, material handling) as a fugitive emission area source. - The next largest source are the emissions from the waste rock disposal – approx. 25% (the co-disposal under Option 1, which will add moisture, will reduce them by half), while the annual emissions from blasting will have a relatively low contribution to total emissions – approx. 5-6%.

Dust emissions from fugitive sources have the following typical features: - dust emissions from excavation of topsoil, its handling and stockpiling in a designated open area come from the release of small amounts of dust depending on the soil structure and the vegetation cover that binds the particles; - uneven seasonal distribution - dust emissions may increase in dry weather and strong wind conditions; - dust emissions generated by overburden removal, handling and stockpiling on the soil stockpile are also associated with the release of small amounts of dust due to the presence of clay and other mineral components in the material, which have substantial adhesion properties and retain the small particles which would otherwise be carried away by the air flow - dust may become airborne in dry weather and strong wind conditions.

As a result of the operation of internal combustion engines on heavy trucks and mobile mining equipment in the open pit area, exhaust gas will be emitted in the air including: nitrogen oxides, carbon oxide, sulfur dioxide, non-methane volatile organic compounds (NMVOCs), soot, heavy metals, polycyclic aromatic hydrocarbons (PAHs), resistant organic pollutants, polychlorinated biphenyls (PCBs), etc. The blasting fumes contribute 10% of the nitrogen oxides, 30% of the carbon oxide emissions and approx. 30% of the dust emissions from transport equipment, as their impact is primarily due to their rapid release and dispersion in the wind direction.

1.2. Air Impact Assessment According to the National Standards and Legal Requirements

The project operations over the construction and operation stages will generate emissions of inventory pollutants in the air. The following air pollution sources have been identified: Blasting operations – instant emission of pollutants in the air, twice per week (12 months per year); - area sources – the open pit area is a source of: fugitive dust emissions from the mining equipment and exhaust gas from engines of the mobile equipment; - point sources – the crusher and the reagents facility in the process plant; - line sources - off-site and site roads connecting the project areas.

1.2.1. Instant emissions of gas and dust from blasting immediately after the blast

The instant emissions of dust from the mined rock will depend on the rock condition and especially its moisture content. The process of particulate precipitation will depend on the weather conditions, especially the air humidity. Dust and coarser particulates will deposit quickly, very close to the location of the blast, while any gas generated by the blast and the fine particulates will disperse over larger distance and higher above the ground.

In view of those specifics, the assessment considers only the impact on the ASL from the blasting fumes and dust (PM_{10}), which will be emitted under mass blasting conditions associated with consumption of large amounts of explosives. ANFO (Dynolite™ and Exan™) and emulsion (Emulite™ and Fortis™) explosives generally release: - nitrogen oxides (80% NO and 20% NO_2) – 17 g/kg, and carbon monoxide – 23 g/kg. The project schedules 100 blasts per year or two blasts per week. The total charge weight per blast will be 7,000kg of explosives or an average of 700 tons per year.

The safe distance **for toxic fumes** is estimated in accordance with the requirements under:

I. Open Pit Mining Safety Code (1996, pp. 26÷28; art.60÷65).

II. Blasting Safety Code (1997),

Appendix 7; Instructions for Estimation of Safe Distances in Blasting

Chapter IV: Estimation of **Safe Distances for Toxic Fumes,** p. 178, art. 24 and 25

Weather conditions: Calm:
$R_T = 160 \times \sqrt[3]{Q}$
$R_T = 160 \times \sqrt[3]{7}$ = **307 m**

Windy, wind speed V = 3.6 m/s:
$R_T = 160 \times \sqrt[3]{Q} \times (1 + 0.5 \times V)$
R_T = **860 m**

The ASL nitrogen oxide concentrations for downwind (north to south) dispersion of 0.04 mg/m^3 meet the the average annual limit for protection of human health, and up to 0.2 mg/m^3 meet the the average annual limit for protection of human health.

The ASL particulate matter (PM_{10}) concentrations for downwind (north to south) dispersion of up to 0.04 mg/m^3 meet the average annual limit for protection of human health, and up to 0.05 mg/m^3 meet the average daily limit for protection of human health (Regulation 12/15.07.2010 on the Emission Limits for Sulphur Dioxide, Nitrogen Dioxide, Fine Particulates, Lead, Benzene, Carbon Monoxide and Ozone in the Air).

The isolines of ASL downwind (north to south) dispersion of carbon monoxide are way below the CO emission limit of 10 mg/m^3 (maximum 8-hour limit) (Regulation 12/15.07.2010 on the Emission Limits for Sulphur Dioxide, Nitrogen Dioxide, Fine Particulates, Lead, Benzene, Carbon Monoxide and Ozone in the Air).

1.2.2. Dust and gas emissions generated by mining operations (drilling, mining, handling and haulage)

The air pollution that may be caused by the mining operations will depend on the weather conditions in the region and the location of respective active production area in the open pit. The mining operations will extend the pit in N-S direction. Due to the relatively large footprint of the deposit (17 hectares) and the locations of the nearby populated areas, the pollution effect has been modelled by assuming two different operational scenarios (active north pit area and active south pit area). The emitted amounts of pollutants in the forecast model are associated with four operational areas: active operational open pit area, ROM ore pad, IMWF and low-grade ore stockpile within the IMWF footprint (Option 1) or, alternatively, waste rock stockpile (Option 2).

The major air emissions from the mining and processing of the Ada Tepe portion of the Khan Krum deposit will include: - Instant emissions of gas and dust from solid rock blasting (twice per week); and - dust and gas emissions from the rock mining, handling and haulage operations in the particular operational area of the open pit; - exhaust from the loading and haulage equipment, which delivers ore to the stockpile and the waste rock to the designated disposal area; - dust and gas emissions from the loading, storage at the ROM ore pad, low-grade ore stockpile and the IMWF; - rock processing by crushing, screening and conveying in the crushing area.

The forecast includes only the ASL impact of particulate matter and nitrogen oxide emissions from the open pit, the ROM ore pad and the IMWF as the rest of the inventory pollutants are in relatively low amounts and their ASL concentrations will be below the respective emission limits. The emission profiles has been prepared by a standard Method, which has been developed by adapting the Emission Inventory Guide CORINAIR-94, SNAP-94 to the conditions that are typical of Bulgaria. CEPMAIR, 2002 emission factors have been used to forecast the

PM_{10} and $PM_{2.5}$ emissions from the mining operations. PM_{10} emission factors are used in the modelling as the $PM_{2.5}$ emission factors are an order of magnitude lower.

Operations associated with dust and fine particulate emissions will include:

- blasthole drilling and charging;
- excavation of the broken rock from the blast pile;
- loading with a hydraulic back-pull shovel into dump trucks;
- truck haulage of ore to the ROM pad near the crushing section or direct haulage of waste rock for disposal;
- crushing of the mined rock to obtain a crushed product of the desired rock particle size.

The anticipated daily production of 2,500 m^3/day at Ada Tepe would generate the following emissions:

- between 1.9 and 3.8 g/s of particulate matter (PM_{10}) from rock drilling, blasting and handling in the open pit (the highest value of the emission factor of 0.05 kg/t can be selected because it includes mining, blasthole drilling, pushing, truck loading with a shovel, pit haulage operations, etc.; however, it may be reduced to 0.025 kg/t due to the use of dust control measures in drilling (sprinkling and wet scrubbing);
- 0.3 g/s of PM_{10} at the ROM ore pad;
- 0.3 g/s of PM_{10} at the low-grade ore stockpile;
- 1.3 g/s of PM_{10} at the IMWF (Option1) or, alternatively, 2.6 g/s of PM_{10} at the waste rock stockpile (Option2, no mixing of mine rock with tailings).

The rated throughput of the crusher is approx. 250-300 t/h (with the respective treatment facilities) The project considers installation of sprinkler and dust collection systems (bag filters) in the crushing section. Therefore, the estimated emission values there are comparatively low – 0.06 g/s.

The service road is split in two sections: - from the open-pit operational area through the ore stockpile to the crusher, or approx. 1,200m long section – 0.22 g/km of dust for about 130 trips per day; - from the stockpile to the mining waste facility, or approx. 1,800m long section – 0.15 g/km of dust for appox. additional 90 trips per day.

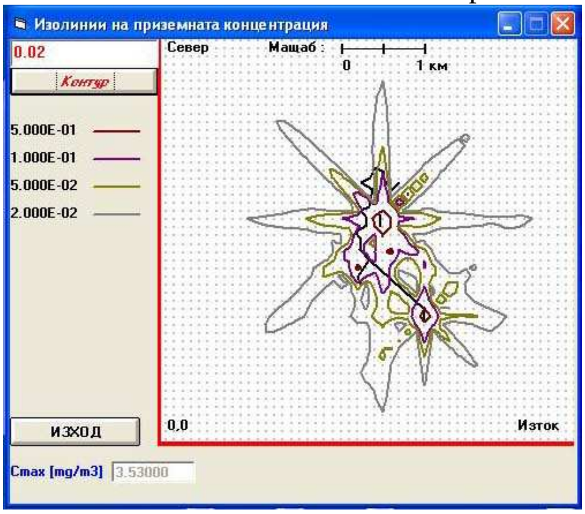
The model assumes four area sources with the following dimensions:

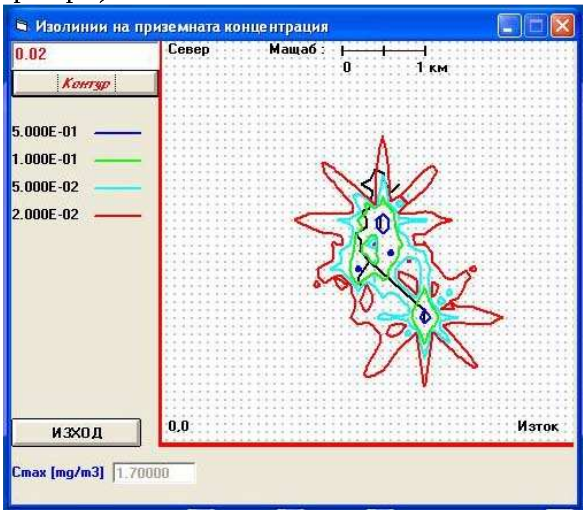
- open pit operational area – 140m long and 40 wide;
- ROM pad – 50m long and 20m wide;
- low-grade ore stockpile operational area (within the IMWF footprint) – 50m long and 20m wide;
- IMWF – 140m long and 40m wide.

The pit haulage roads, which are 6.0 m wide and have a total length of 3,000 m, are assumed as line sources.

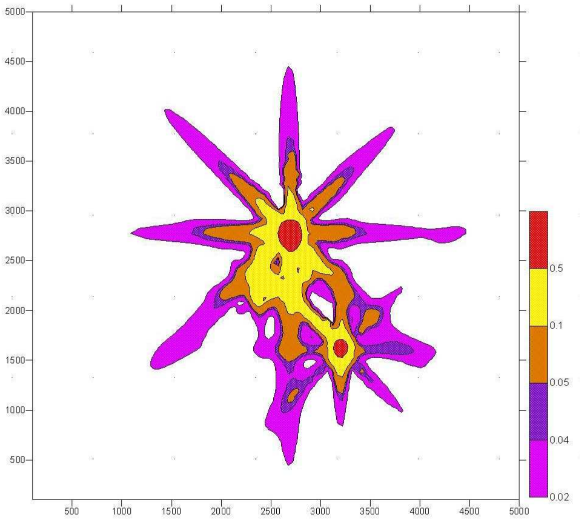
The respective isolines of the superpositioned ASL dispersion concentrations of **particulate matter** (PM_{10} with a gravity deposition rate of 0.07 m/sec) and **nitrogen oxides** (with a gravity deposition rate of 0.001m/sec) for the so-identified emission sources associated with the respective mining and transport operations (point sources are ignored) under the typical weather conditions in the region are provided in the figures below.

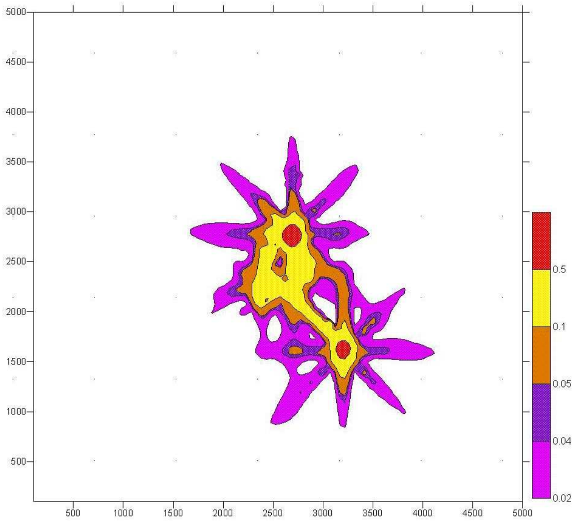
Dispersion of PM_{10} from mining operations, ROM pad, low grade ore stockpile and the IMWF **(Option 1),** together with the site and access roads (assuming active operations in the north part of the open pit).



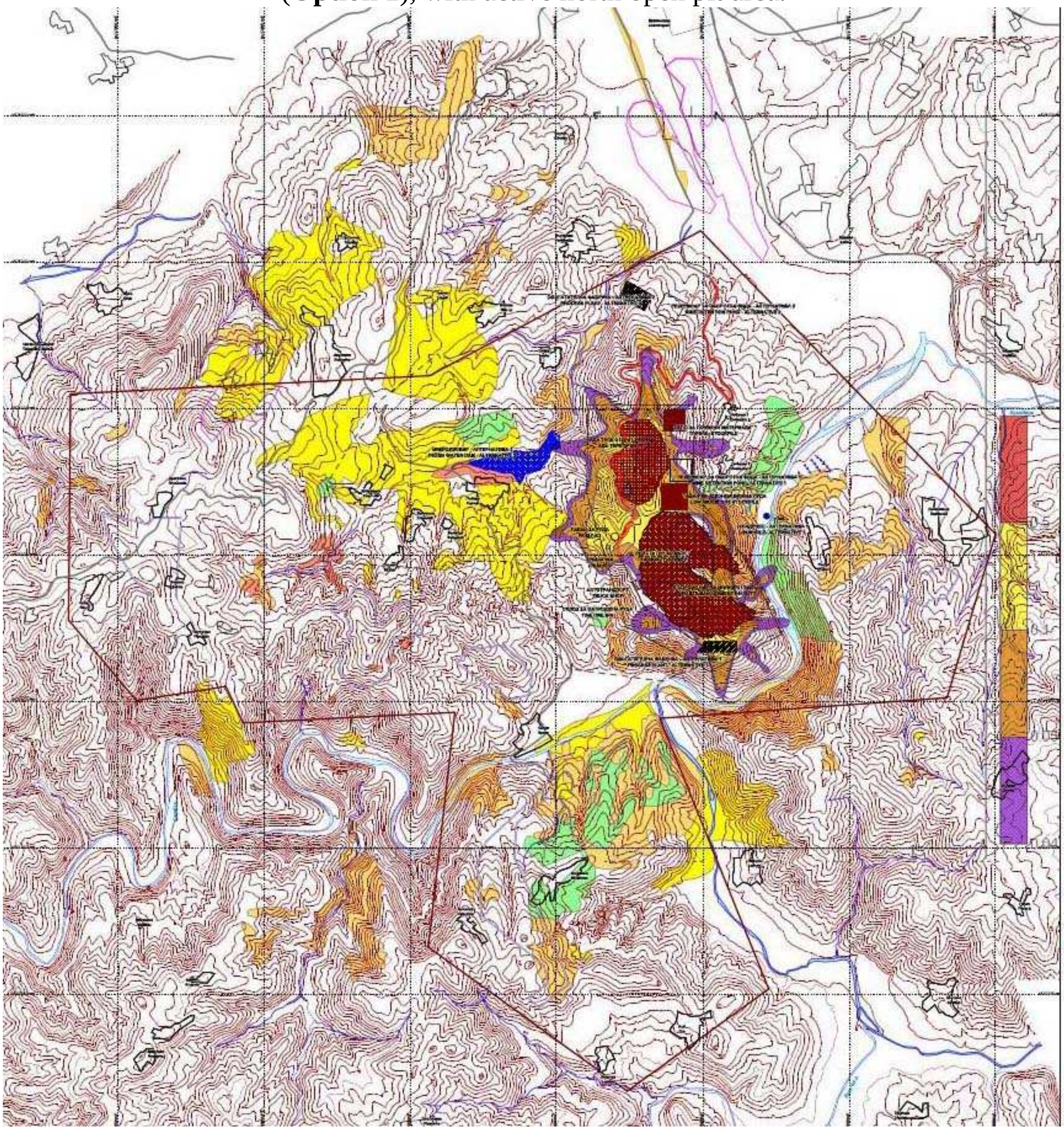


at maximum emission factor values at minimum emission factor values

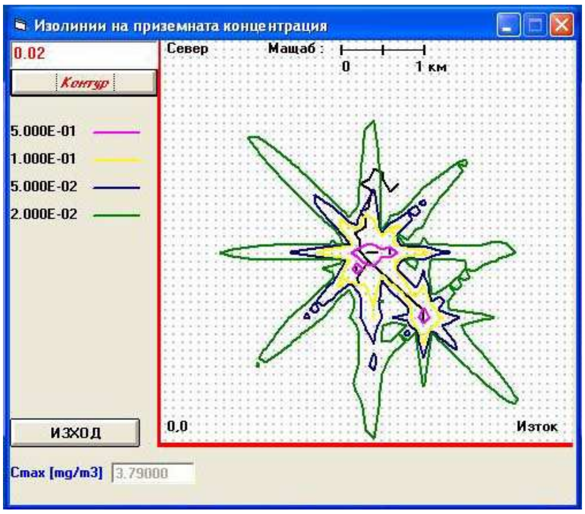


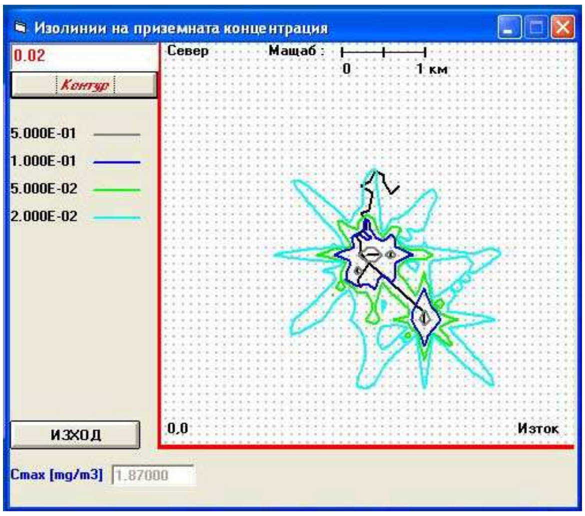


Total dispersion of particulate matter (PM_{10}) in the vicinity of the deposit shown on a map (**Option 1**), with active north open pit area.



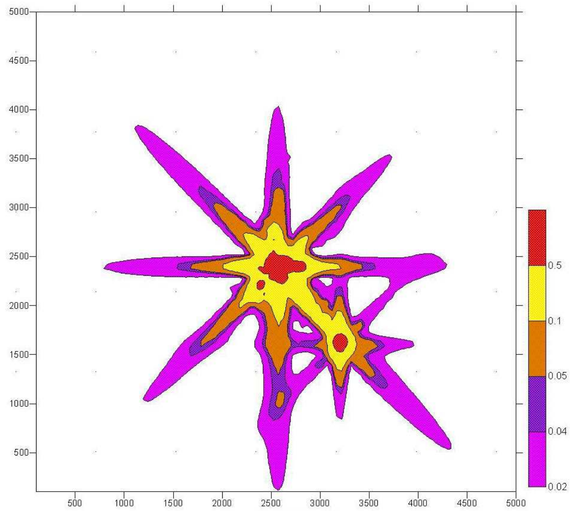
Dispersion of PM_{10} from mining operations, ore stockpile and the IMWF (**Option 1**) including site roads (assuming active operations in the south open pit area)

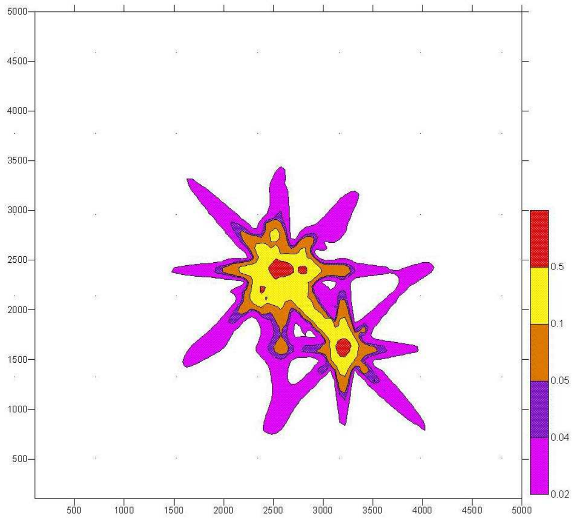




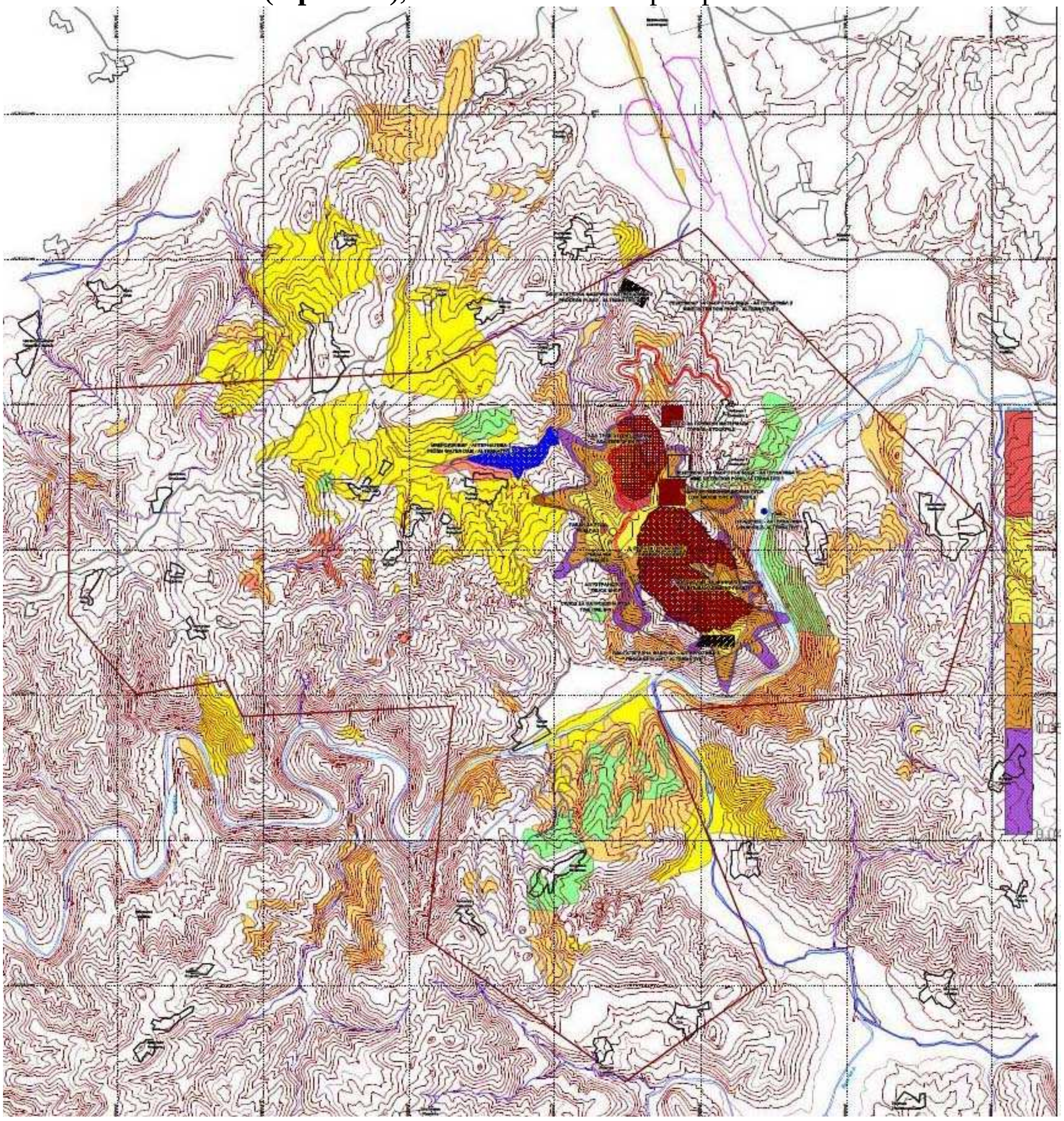
at maximum emission factor values

at minimum emission factor values

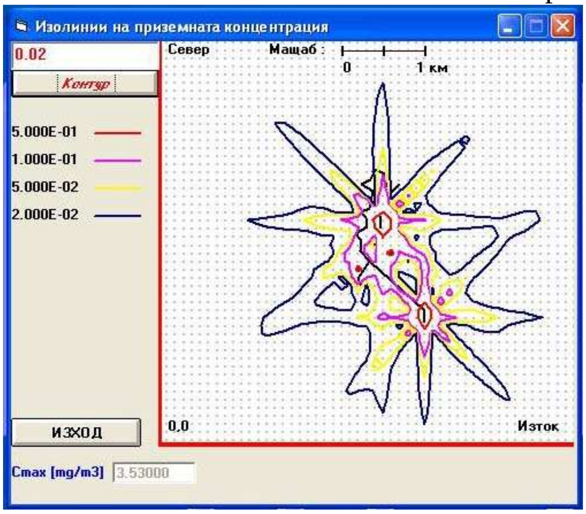


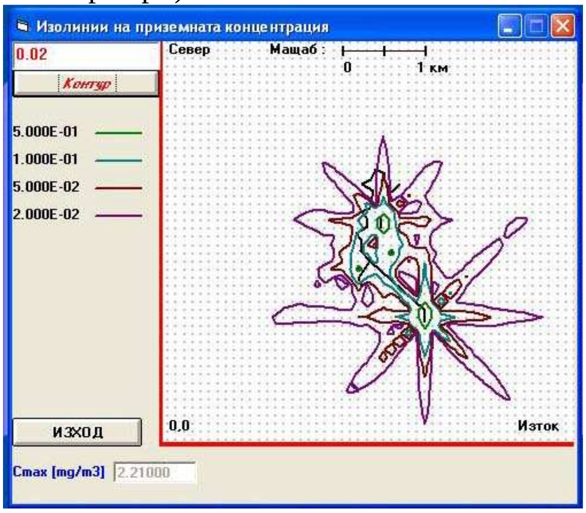


Total dispersion of particulate matter (PM_{10}) in the vicinity of the deposit shown on a map (**Option 1**), with active south open pit area.



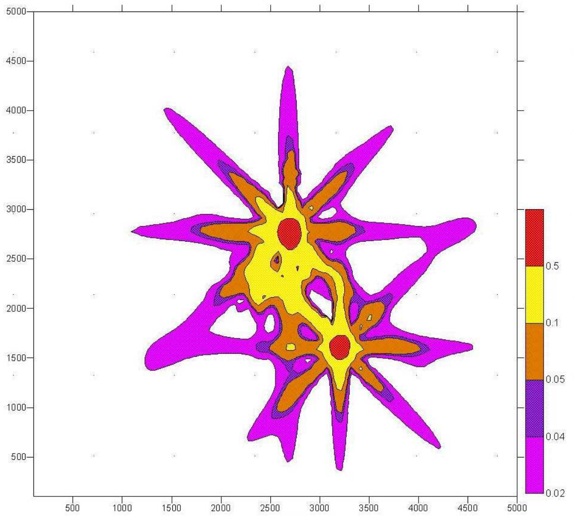
Dispersion of PM_{10} from mining operations, ROM pad, low grade ore stockpile and the waste rock stockpile **(Option 2),** together with the site and access roads (assuming active operations in the north part of the open pit).

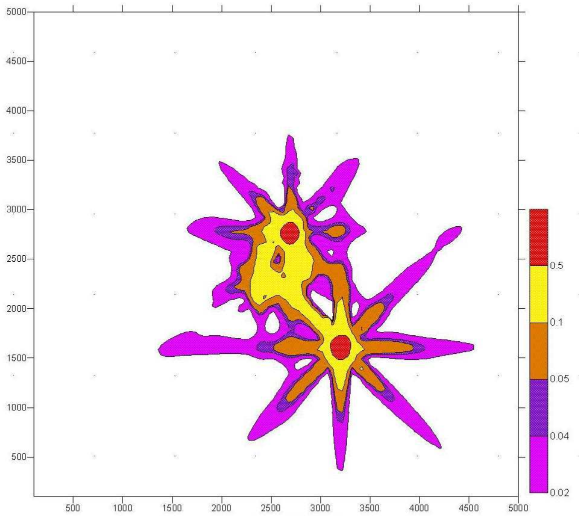




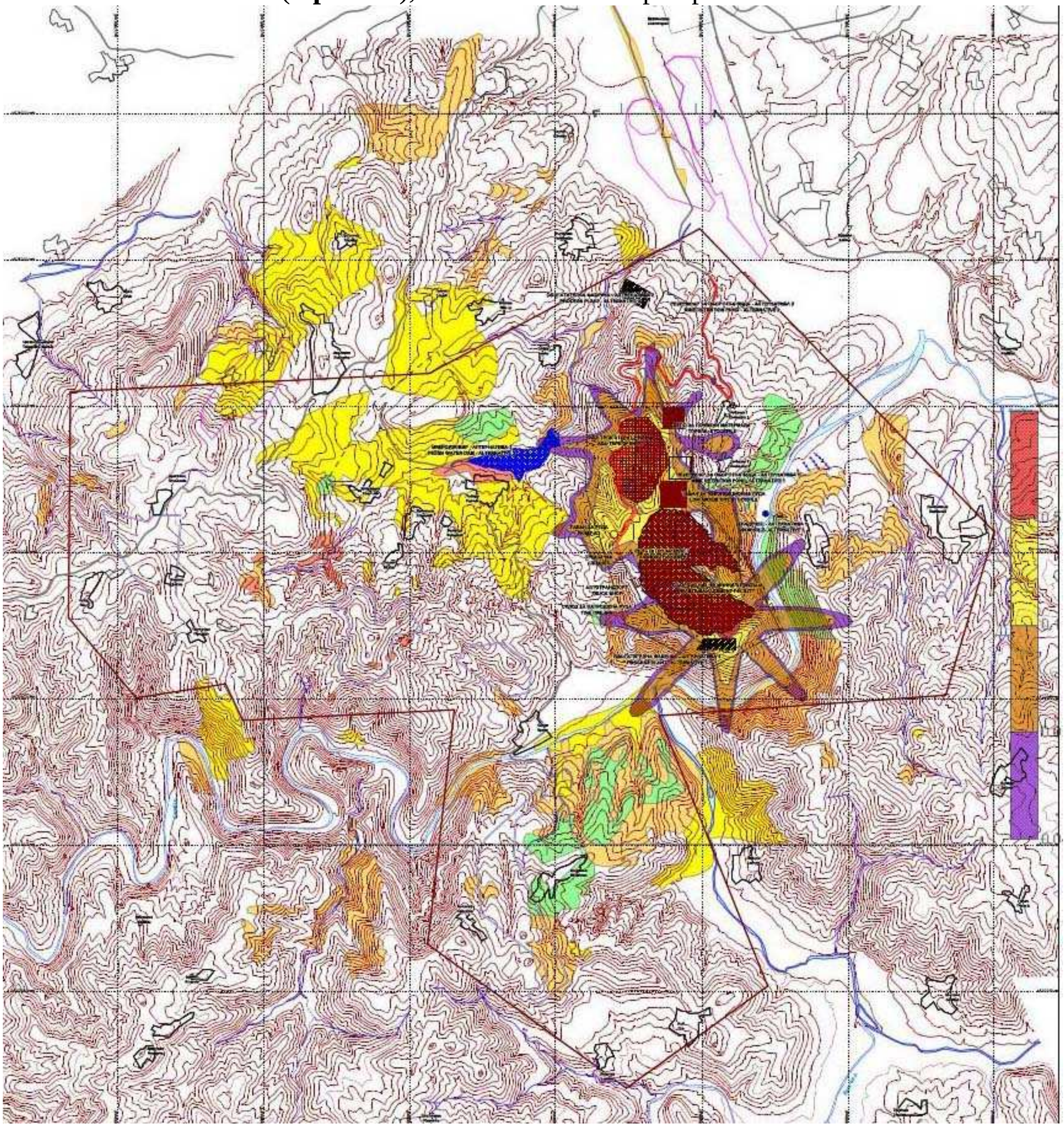
at maximum emission factor values

at minimum emission factor values

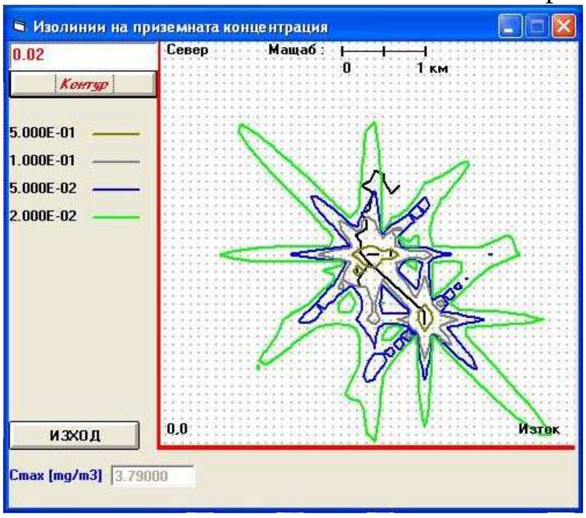


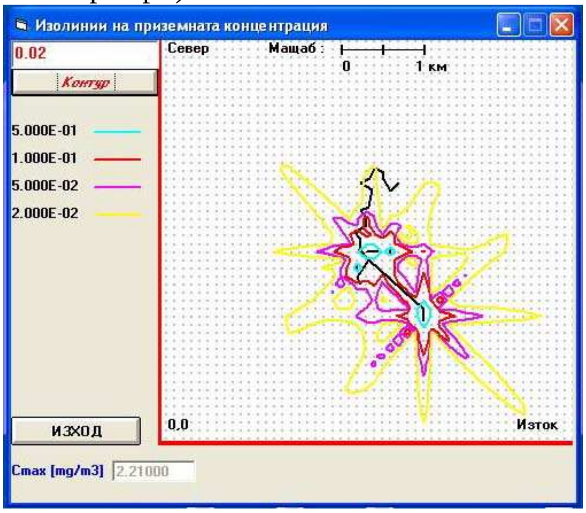


Total dispersion of particulate matter (PM_{10}) in the vicinity of the deposit shown on a map (**Option 2**), with active north open pit area.



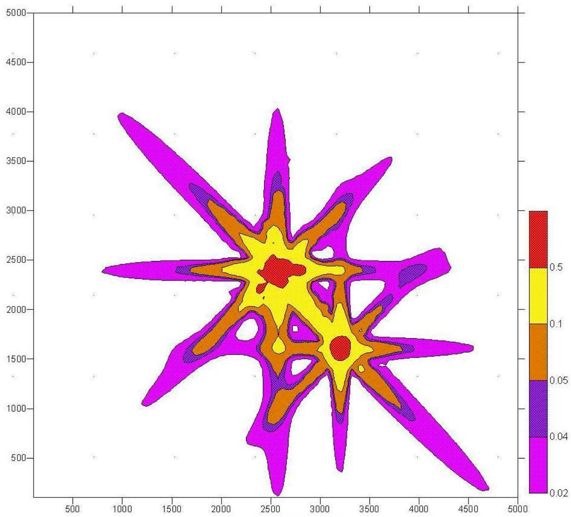
Dispersion of PM_{10} from mining operations, ROM pad, low grade ore stockpile and the waste rock stockpile **(Option 2),** together with the site and access roads (assuming active operations in the south part of the open pit).

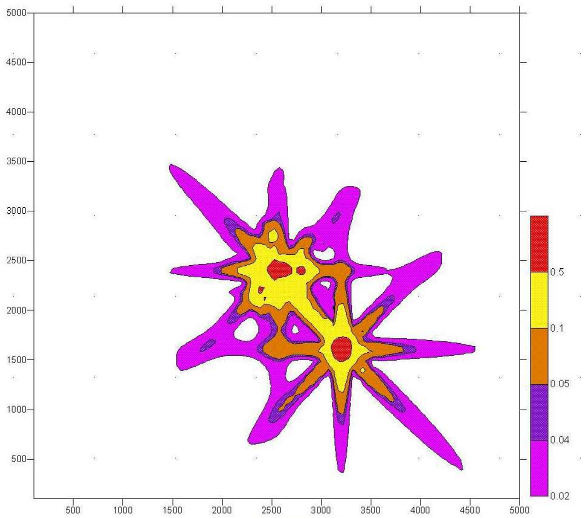




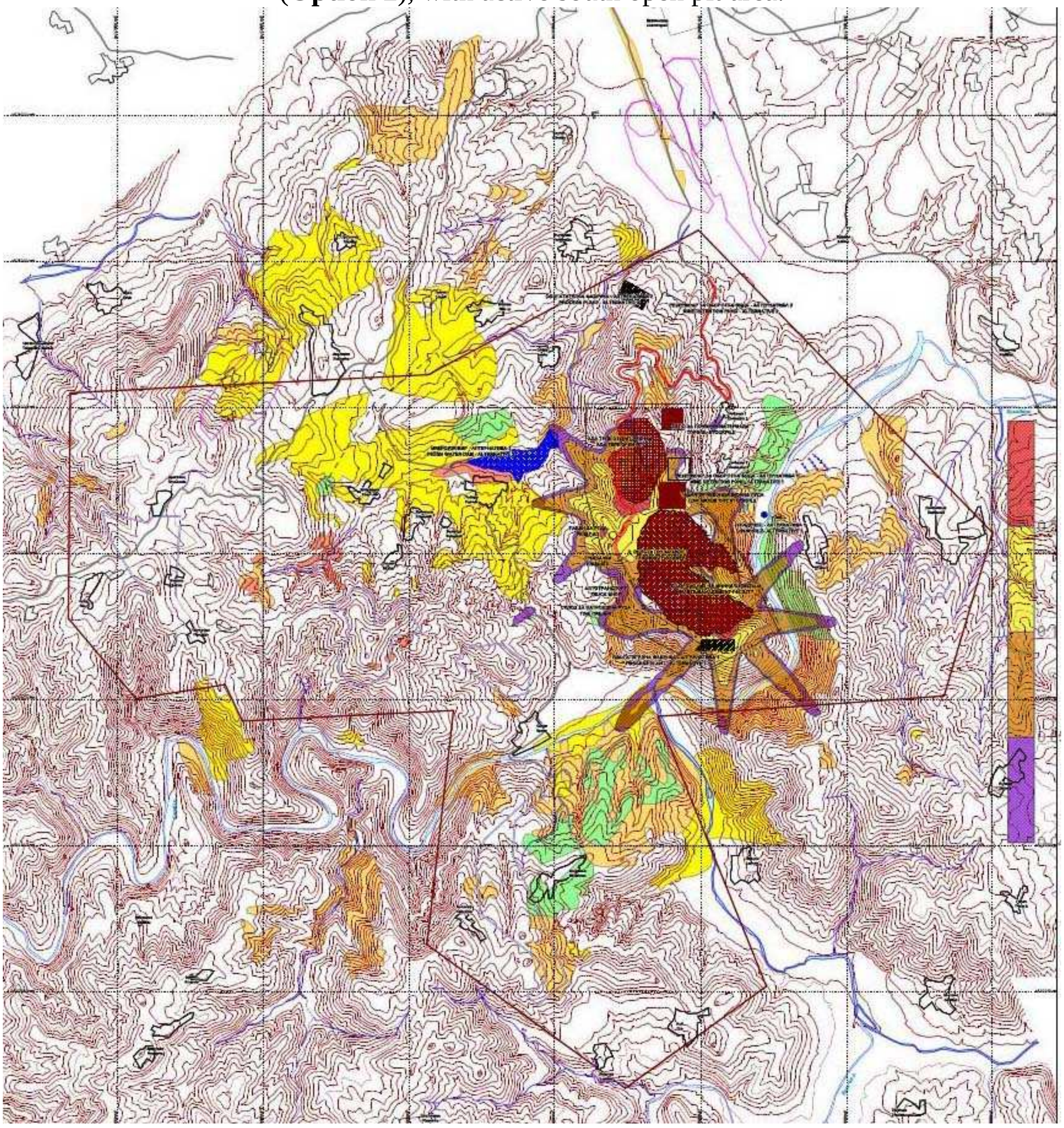
at maximum emission factor values

at minimum emission factor values





Total dispersion of particulate matter (PM_{10}) in the vicinity of the deposit shown on a map (**Option 2**), with active south open pit area.



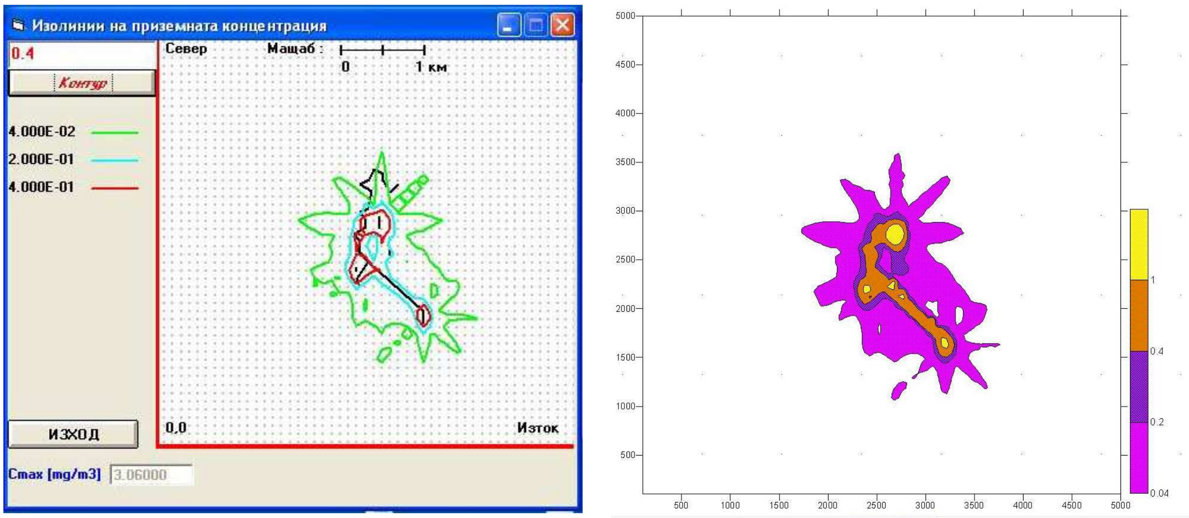
The main isolines of ASL dispersion of particulate matter (PM_{10}) concentrations are estimated as follows: - up to 0.04 mg/m^3 in purple (compliant with the average annual limit for protection of human health); and – up to 0.05 mg/m^3 in brown (compliant with the average daily limit for protection of human health) (Regulation 12/15.07.2010 on the Emission Limits for Sulphur Dioxide, Nitrogen Dioxide, Fine Particulates, Lead, Benzene, Carbon Monoxide and Ozone in the Air).

The crusher exhaust facility is assumed as a separate point source, 4m high, 0.4m in diameter, whose capacity will match the capacity of the dust collection system and will emit the exhaust air downstream of the bag filters - 0.20kg/h of dust (art. 11, par. 1 of Regulation 1/2005 on Normally Allowable Air Emission Levels for Harmful Substances (Pollutants) Emitted from Sites and Operations with Emission Point Sources). The ASL concentrations under these conditions will be as follows: - under typical windrose conditions in the region - maximum ASL concentrations of 0.00114 mg/m^3 at 100m south and north of the source; - under prevalent wind conditions in the region (north to south) - maximum ASL concentrations of 0.00334 mg/m^3 at 100m south of the source. The maximum ASL concentrations will be far below the respective average annual limit for protection of human health (0.02 mg/m^3) and average daily limit for protection of human health (0.05 mg/m^3) under Regulation 12/15.07.2010 on the Emission Limits for Sulphur Dioxide, Nitrogen Dioxide, Fine Dust Particulates, Lead, Benzene and Carbon Monoxide in the Air, and also below the anticipated total dust level in the active operational area in the open pit, at the ROM pad and at the IMWF.

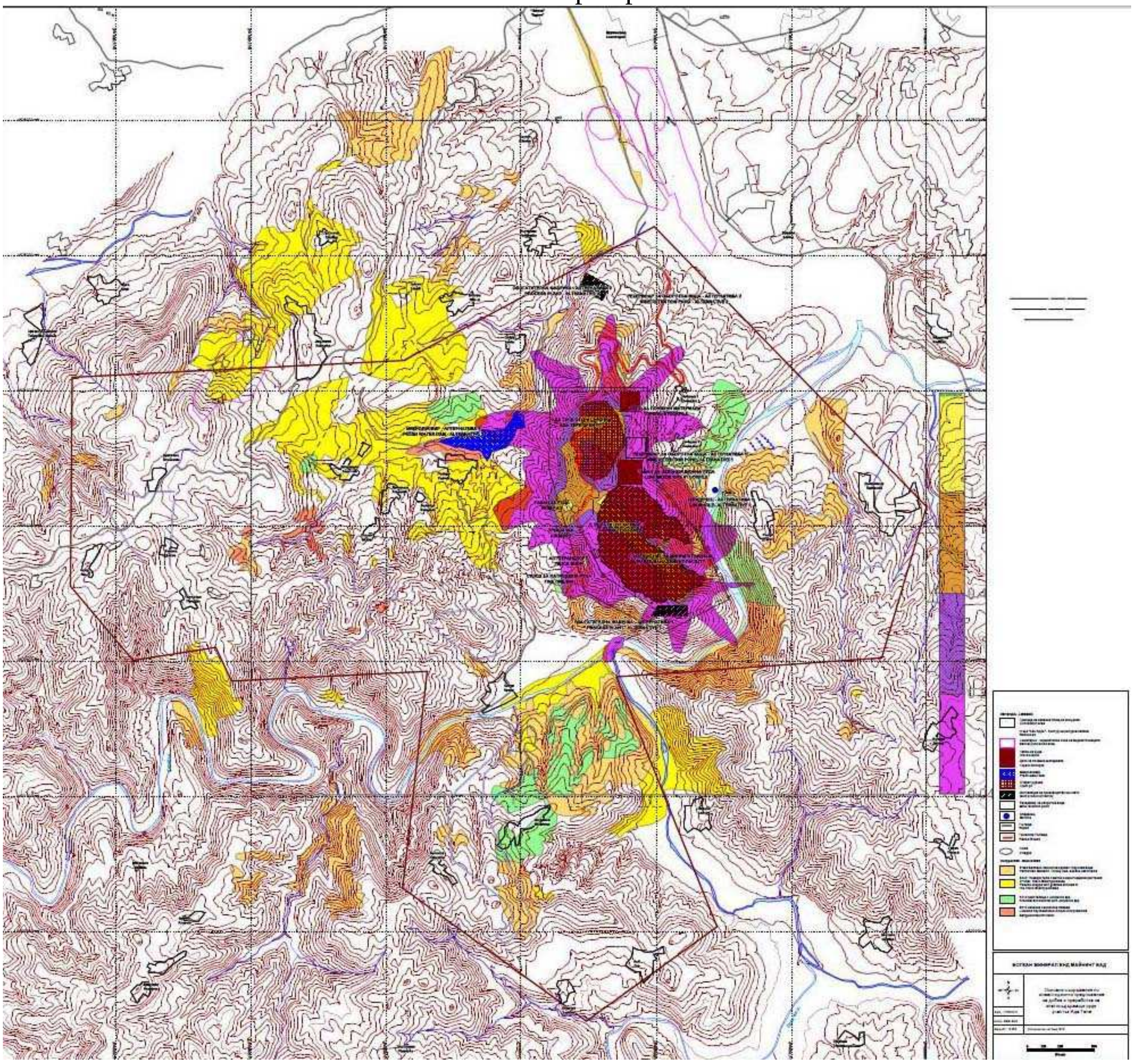
The two options do not substantially differ in terms of nitrogen oxide pollution since the IMWF (Option 1) and the waste rock stockpile (Option 2), where the number of active equipment units is assumed to be the same, are more or less similar in terms of location and area. Site and access roads will be a major source of nitrogen oxide pollution but they are also the same under both options.

The selection of an active operational area in the Ada Tepe open pit is of minor importance for the pollution in the vicinity and for the ASL concentrations of nitrogen oxide in the nearby populated areas.

Dispersion of NOx from mining operations, ore stockpile and waste rock stockpile, including the IMWF and the site and access roads



Total distribution of nitrogen oxides (NOx) in the vicinity of the deposit shown on a map, with active north open pit area.



The main isolines of ASL dispersion of nitrogen oxide concentrations are as follows: - up to 0.04 mg/m^3 in purple yellow (compliant with the average annual limit for protection of human health); and – up to 0.2 mg/m^3 in dark blue (compliant with the average hourly limit for protection of human health).

1.2.3. Dust and Gas Emissions from Processing (Flotation and Reagents Facilities) at the Process Plant

The pre-treatment of the flotation feed requires: - Addition of reagent for sulfidizing the particles' surface (Copper Sulphate) at the preceding stage - SAG mill grinding; - advancing of collector reagents to an agitator for conditioning prior to flotation. The following reagents will be used in the flotation process: Collector: PAX (potassium amyl xanthate) and a minimum amount of dithiophosphate (Aerofloat 208); Frother: Cytec OrePrep F 549; Dispersant: Sodium silicate ($Na_2OxnSiO_2$, also known as water glass or liquid glass); Sulphidiser: Copper sulphate ($CuSO_2x5H_2O$).

The hazardous components in the reagents facility can be classified as Class I organic compounds according to Appendix 3 to Regulation 13/30.12.2003 on the Protection of Personnel against Exposure to Chemical Agents at the Workplace. The emissions from potassium amyl xanthate and dithiophosphate in the air may not exceed 20mg/m^3 or 10 kg/h (art.16, par.3 and art. 14, par. 1 of of Regulation 1/2005 on Normally Allowable Air Emission Levels for Harmful Substances (Pollutants) Emitted from Sites and Operations with Emission Point Sources). A dust collecting system having a rated capacity of 4,000 Nm^3 will be installed above the xanthate mixing deck.

The process plant exhaust facility is assumed as a separate point source located within the process plant footprint, 12m high (art. 4, par. 4 of Regulation 1/27.06.2005) and 0.4m diameter, whose capacity will match the capacity of the dust collecting system and will emit the exhaust air downstream of the bag filters - 0.10kg/h of potassium amyl xanthate and/or dithiophosphate. The ASL concentrations under these conditions will be as follows: - under typical windrose conditions in the region - maximum ASL concentrations of 0.00049 mg/m^3 at 140m south and north of the source; - under prevalent wind conditions in the region (north to south) - maximum ASL concentrations of 0.00188 mg/m^3 at 140m south of the source. The maximum ASL concentrations will be far below the respective $MAC_{av.24h}$ = 0.05 mg/m^3 and $MAC_{max.short}$ = 0.15 mg/m^3 for dithiophosphate (section 114 of Regulation 14/23.09.1997, last amendment in SG issue 42/29.05.2007, effective date 01.01.2008, on the Maximum Allowable Concentrations of Harmful Substances in the Ambient Air of Populated Areas).

The identified air pollution sources from **production operations** include:

- area sources - the operational area in the open pit, the ROM pad, the low-grade ore stockpile and the IMWF (mining, processing and disposal operations, 24 hours a day);

- line sources (site and access roads with 24-hour traffic); and blasting (instant release twice per week);

- point sources – crusher and process plant emission facilities (24 hours a day).

Area sources – the active operational areas in the open pit, the ROM pad, the low-grade ore stockpile and the IMWF will be sources of: - fugitive dust emissions from the mining equipment and exhaust gas from engines of the mobile equipment, which are adjusted to area sources; and line sources (site roads adjusted to area sources): the road for shipment of the final product, which is a source of dust and engine exhaust from the trucks.

Point sources - gas exhaust from the crusher dust collecting system downstream of the filter set; - gas exhaust from the process plant dust collecting system (after filtration).

Line sources – heavy truck traffic on the site roads between the active operational areas in the open pit, ore stockpile and the IMWF.

Blasting operations – instant release of pollutants in the air, which include blasting fumes and dust from the blasts, twice per week (12 months per year).

The type and quantitative profile of the pollutants that will be emitted is provided in numerical format in the previous tables, while the dispersion area of the individual pollution sources is provided in the respective figures. The ASL isolines generated by the model with the respective ASL concentrations are used as a basis to identify the critical receptors during operation - the nearby populated areas: - to the east: Chobanka 1- 380 m, Chobanka 2 - 330 m (360 m), Kupel - 990 m (500 m); to the north-east: Soyka - 600 m; - to the west: Pobeda - 740 m (1,300 m). In order to determine the compliance of the emission concentrations with the applicable maximum allowable concentrations for populated areas, the model estimates the potential annual average and maximum ASL concentrations in the respective recipient areas. The estimated **24-hour average and annual average concentrations** of pollutants in the air reflect the typical operating conditions for such a mining operation and are calculated in terms of the typical windrose conditions in the Krumovgrad region (data from Krumovgrad gauging station). The estimated **maximum hourly average concentrations** of pollutants reflect the maximum possible pollution that may occur as a result of an instant release (blasting operations) assuming the prevalent north-to-south wind direction.

1.2.4. Assessment of the Impact from Air Pollution on the Environmental Media and Factors Significance of the Impact

The estimated concentrations of nitrogen and sulphur oxides in the vicinity under normal operating conditions are: - commensurable with the limit for safe vegetation exposure to nitrogen oxide (30 $\mu g/m^3$) based on 1-year average estimates and - below the limit for safe natural ecosystems exposure to sulfur dioxide (20 $\mu g/m^3$) for one calendar year and subsequent winter period. Total deposited dust emissions will have a localised impact on the air as they disperse at short distances from the source at a high gravity deposition rate and small release height. Those sources may impact vegetation that is within a certain distance. Dust emissions do not differ in chemical composition from the soil parent materials in the region and therefore they do not create any risk of altering the local soil properties and/or fertility.

Mining: The estimates demonstrate that air pollution levels in particular critical zones (Chobanka 1, Chobanka 2, Kupel, Soyka and Pobeda) during the project operation, including the associated ancillary infrastructure, will heavily depend on the selected option for management of the mine rock. The re-location of the active operational area in the open pit (within 600m north to south) substantially changes the respective ASL concentration lines.

The 24-hour average **PM_{10}** concentrations in the model of the critical zone are as follows:

- under Option 1: – at Chobanka 1 and Chobanka 2 – approximating and below the average daily limit for protection of human health (depending on the location of the active operational area in the open pit); - at Kupel, Soyka and Pobeda - approximating and below the average daily limit for protection of human health; - Taynik, Bitovo, Belagush, Koprivnik and Dazhdovnik - below the background level;

- under Option 2: – at Chobanka 1 and Chobanka 2 – approximating and exceeding the average daily limit for protection of human health (exceeding when the active operational area is in the north part of the open pit); - at Kupel, Soyka and Pobeda - approximating and below the average daily limit for protection of human health; - Taynik, Bitovo, Belagush, Koprivnik and Dazhdovnik - below the background level;

The existing mathematical models used to predict dust emissions from surface mineral workings do not provide reliable data (UK Department of Environment report, 1996). Generally, the models cannot handle the complex interaction of surface conditions, changing meteorology, the range of activities and the topography. The model does not include the ground surface type (open pit and rugged landscape) nor the influence of perennial vegetation, although those factors will mitigate the dispersion of particulate matter. In this case, the natural shielding topography (a hill between the pit and Chobanka 1, Chobanka 2 and Kupel villages) will act as a physical barrier to the dispersion of particulates in the direction of these villages.

Data from monitoring of active opencast mining operations suggests that large dust particles (greater than 30μm) make up the greatest proportion of dust emitted from mineral workings and will largely deposit within 100m of sources. Medium size particles (10-30μm) are likely to travel up to 250-500m. Particulates below 10 μm comprise a relatively small proportion of the total suspended particulate. Dust emissions essentially consist of particles, whose composition is similar to that of the local soils and rocks and therefore should not necessarily be regarded as polluting matter.

With regard to the impact on the nearby residential areas, the potential for the generation of fugitive dust emissions may be perceived at up to 500-600 m of the dust source. The PM_{10} background levels measured in the nearby villages are up to 20-30% of the average annual limit for protection of human health.

The IMWF, where waste rock and tailings will be co-disposed under Option 1, will progressively be rehabilitated, which will minimise the effect of wind erosion. Experience suggests that such facilities tend to be "self-sustaining" as the finer fractions move into the void space of the rock material. A TMF under Option 2 (separate storage of mining and processing wastes) will store wet tailings with comparatively high water content and therefore its surface will not be a source of significant dust emissions. Upon termination of tailings disposal, the tailings management facility will be drained and its surface will be capped with an insulating layer and then soil.

The dust emitted from the opencast mining activities will largely be contained within the open pit. The pit walls will act as natural shielding elements.

The strategy developed to mitigate the impacts has the objective to improve controls and minimise the adverse effects on the surrounding centres of population and the environment. The Company considers the following controls: - Maintain the haulage road surfaces wet in dry conditions; - All site drilling equipment will operate under the reverse circulation (RC) method and will be equipped with three dust collection and suppression systems (two dry filters for larger dust particles and a water mist system to suppress the dust particles smaller than 10 μm); - Progressively rehabilitate the roads that have been made redundant; - Establish and maintain a protective green belt around roads and operational areas. Considering this project strategy, the minimum PM_{10} emission factors have been used in the enmission forecasts.

In terms of **nitrogen oxides (NOx)**, the selection of either option will not make a difference on the ASL concentrations: – at Chobanka 1 and Chobanka 2 – approximating and below the average daily NOx limit for protection of human health (depending on the location of the active operational area in the open pit); - at Kupel, Soyka and Pobeda (also in the critical zone) - approximating and below the average daily limit for protection of human health; The measured background concentrations of nitrogen oxides are below the detection limit of the method, i.e. negligible.

The other emitted pollutants do not demonstrate any values above the allowable limits: - the 24-hour average concentrations of SO_2 are below the average daily limit for protection of human health; - the 24-hour average concentrations of NH_3 are way below the MAC for a 24-hour period. The sprinkling-based dust suppression in the active operational area of the open pit will mitigate the dust pollution in the deposit area, while site roads must be wetted regularly, especially in windy and dry/warm weather conditions.

Area of impact: The impact on the ASL quality will be direct at Ada Tepe and in the areas within 500-600m distance from the deposit (around operational areas) but on a local scale; the anticipated levels that may potentially exceed the respective average annual limits for protection of human health are: - aproximating or below the limits for Chobanka 1 and Chobanka 2 under Option 1; and - aproximating or above the limits for Chobanka 1 and Chobanka 2 under Option 2. The impact on the soils and vegetation will be indirect within 10-30m from the active operational area in the open pit, the ore stockpile and the waste rock strockpile. *Severity of impact*: moderate to significant (medium to high); *Duration of impact*: over the 9-year concession period;

Occurrence of impact: continuous throughout the day, 330 workdays per annum; *Cumulative impacts* – none expected. *Transboundary impacts* – none expected.

Blasting: The model demonstrates that air pollution from blasting in the identified zones (Sinap, Shturbina and Labovo, north to south direction) will be below the maximum allowable (not-to-exceed) concentrations of harmful substances in the ambient air of populated areas.

Area of impact: Direct air impact on the minesite and the adjacent areas in downwind direction, which is north to south for the site. At prevalent wind direction from the north, the nearest populated areas, namely Chobanka 1, Chobanka 2, Kupel, Soyka and Pobeda, will remain outside the zones of concentration levels exceeding the emission limits (1-hour average limits for protection of human health). Indirect impact on soils and vegetation on a local scale – occasionally, along the path of the blasting plume. *Severity of impact:* moderate (medium); *Duration of impact*: Over the life of the operation, during blasting operations; *Occurrence of impact*: Occasional Instant release of pollutants, twice per week, 12 months per year; *Cumulative impacts* – none expected; *Transboundary impacts* – none expected.

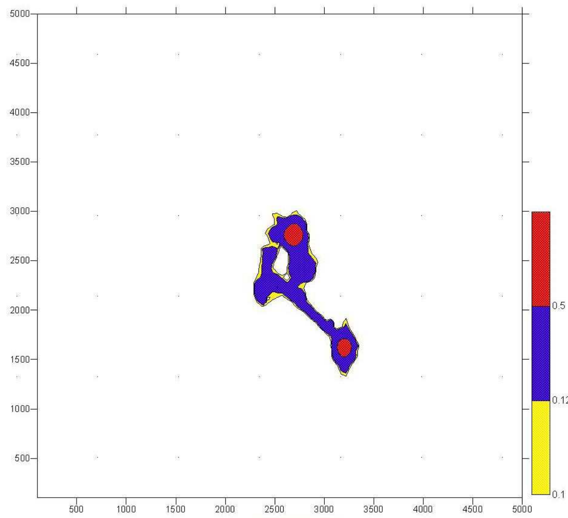
Realistically, the blasting operations in the open pit are likely to impact the air quality in the nearest populated areas only when the wind blows from the east or from the west. The likely change of the prevalent wind direction will reduce the effect of the potential air transport of pollutants to those areas. Coarser particulates may have a negative impact as they deposit on the vegetation along the path of the blasting plume.

1.2.5. Assessment of the Impact from Air Pollution on the Lands Adjacent to the Minesite

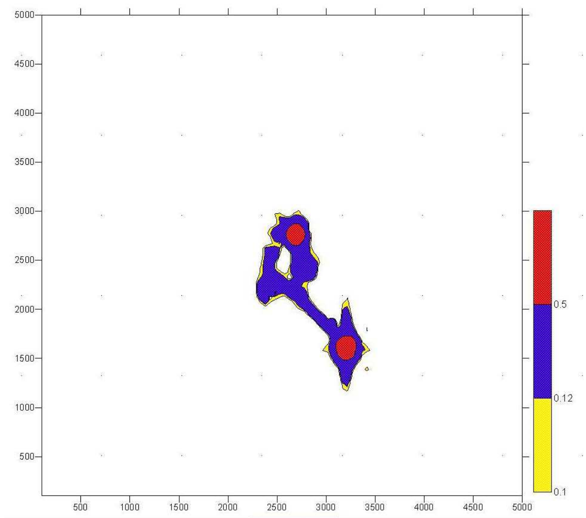
The Ada Tepe operations will have an indirect impact on the soils from dust emissions in the ASL and subsequent dust deposition, as well as on the vegetation – the nitrogen oxides emissions are likely to exceed the limits for exposure of vegetation. The limits for exposure of natural ecosystems to sulphur oxides are not expected to be exceeded.

Mining: The forecast results demonstrate that air pollution levels within the populated areas as a result of open pit operations will be: - comparable with the allowable limits for MAC of PM_{10} in centres of population depending on the selected option: – Option 1, Chobanka 1 and Chobanka 2 – approximating and below the average daily limit for protection of human health (depending on the active operational area in the open pit); Option 2: Chobanka 1 and Chobanka 2 – approximating and exceeding the average daily limit for protection of human health (exceeding when the active operational area is in the north part of the open pit). The average daily nitrogen oxide (NOx) levels at Chobanka 1 and Chobanka 2 will be aproximating or below the average annual limit for protection of human health regardless of the selected option.

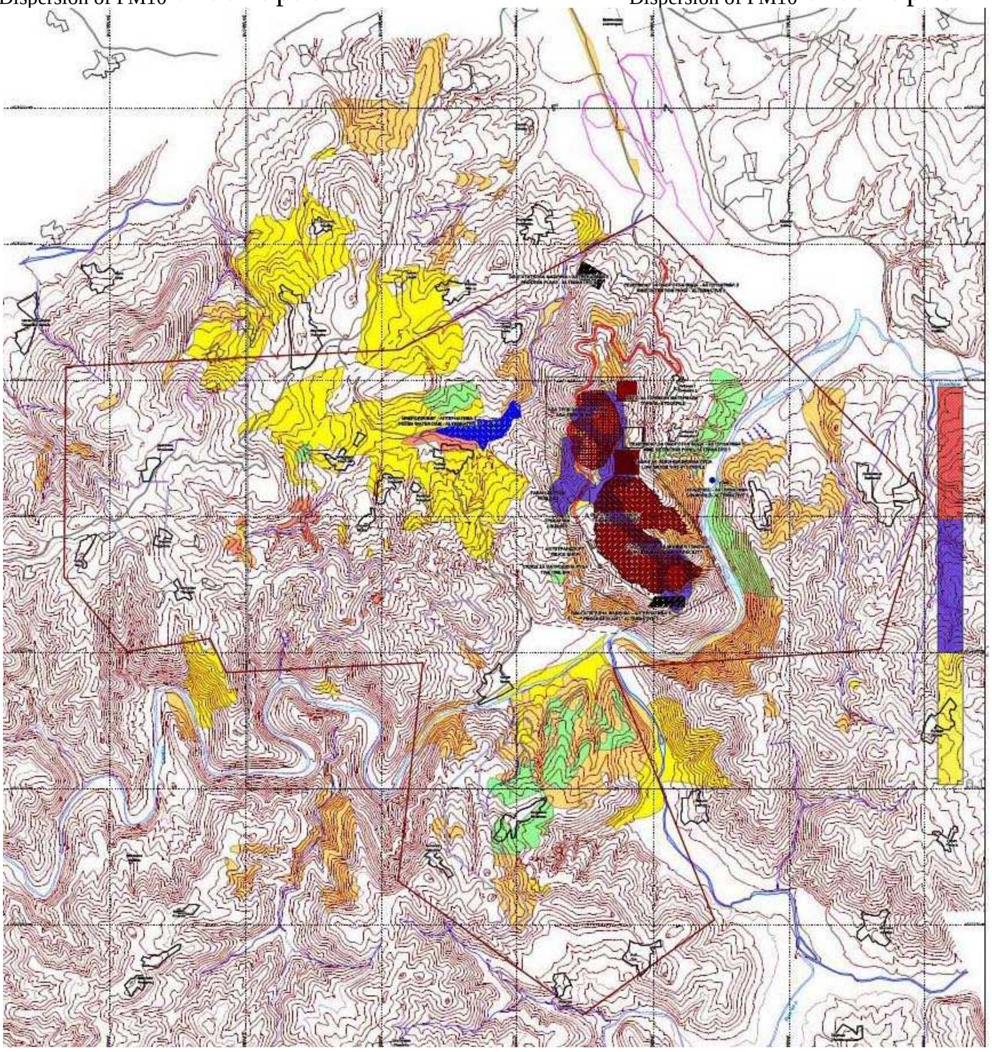
The obtained results and forecast models demonstrate that the zones where the deposition of particulate matter from the mining operations will exceed the limits for surface pollution of open areas will be confined to the operational areas. The graphic presentation of the estimated dispersion of the ASL concentrations of particulate matter (PM_{10}) in the open pit area is provided in the figure below.



Dispersion of PM10 under Option 1



Dispersion of PM10 under Option 2



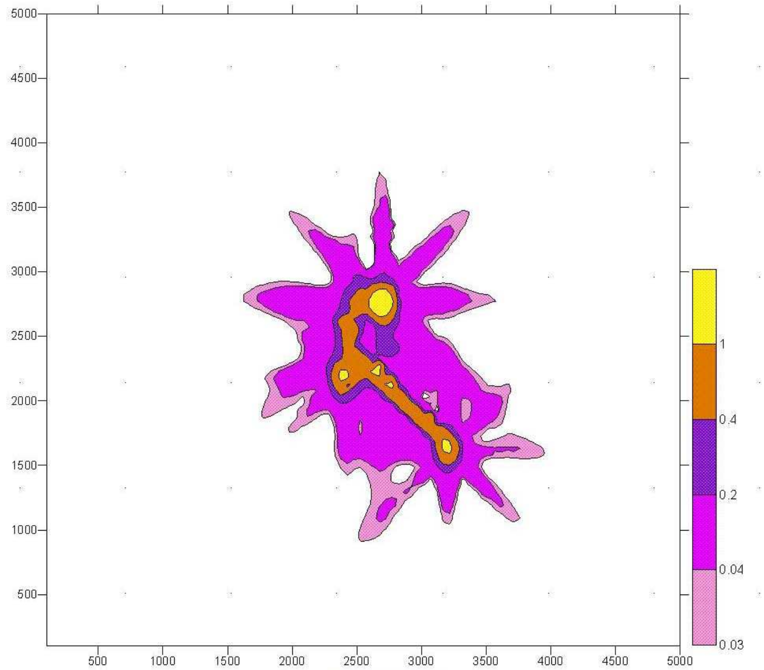
Dispersion of particulate matter (PM10) in the vicinity of the Ada Tepe minesite (Option 1)

Isolines of ASL windrose dispersion of particulate matter (PM_{10}) concentrations for a 24-hour workday (continuous operation): – up to 0.12 mg/m^3 in dark blue (corresponding to 350

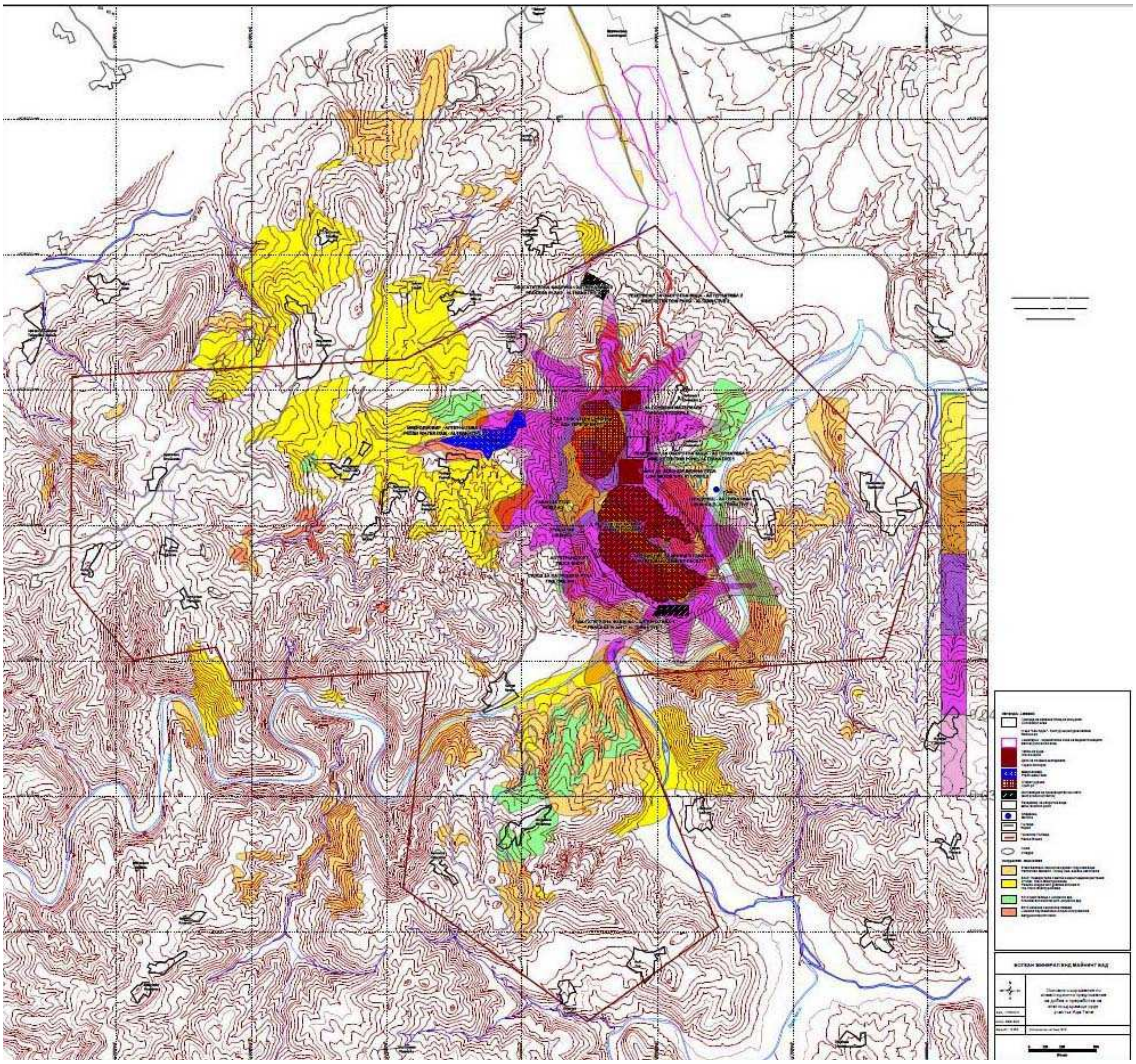
mg/m^2 of total dust per 24 hours - maximum allowable surface pollution of open areas under art.16 of Regulation 2/1998 on Maximum Allowable Air Emissions (Concentrations in Waste Gases) of Harmful Substances Emitted from Static Sources). The duration of impact is 24 hours per day although the zone is comparatively small and will include operational areas only.

The obtained results and forecast models demonstrate that the zones where the average annual nitrogen oxides emissions from the mining operations will exceed the limits for exposure of vegetation will be commensurable with the emissions forecasts for the vicinity of the operational areas. Isolines of ASL windrose dispersion of nitrogen oxides concentrations for a 24-hour workday (continuous operation): - up to 0.03 mg/m^3 in cream colour (vegetation exposure limit based on 1-year average estimates) (not applicable to the areas in immediate proximity to the sources).

The graphic presentation of the estimated dispersion of the ASL concentrations of NOx in the open pit area is provided in the figure below. It is not dependent on the option selection.



Distribution of NOx levels under the two Options



Distribution of nitrogen oxide (NOx) levels in the vicinity of Ada Tepe

The impact on the ASL quality will be direct within the Ada Tepe areas, especially those that are adjacent to the operational areas, but on a local scale; no significant changes in the air quality are expected. Impact forecasts include: - an indirect impact on the soils from the deposition of particulate matter around and between operational areas (for PM_{10}), which will exceed the total dust emission standards for open areas; and - a direct impact (NOx) on the vegetation around the operational areas and the roads connecting them, which will exceed the limit for exposure of vegetation based on 1-year average estimates; this limit is not applicable to the areas adjacent to the sources.

Blasting: The obtained results and the forecast models demonstrate that the blasting-related air pollution at the nearest recipient in downwind direction (Sinap Village) will be below the MAC for centres of population. It is very unlikely that the blasting operations in the mine will have any impact on the air quality in other neighboring villages downwind of the minesite (Labovo and Sturbina).

2. Surface and Ground Waters

2.1. Project Sources of Surface Water and Groundwater Pollution

2.1.1. Sources of Surface Water and Groundwater Pollution over the Project Construction Phase

Construction and engineering works are scheduled to commence in the beginning of 2012 and be completed within 24 months, with approximately 300 positions being created at various stages over this phase.

The impact on surface water quality during the project construction means increased content of particulate matter (increased sediment flows). Elevated suspended solids sediment loadings in rivers and streams are generally detrimental to aquatic ecologies because they can blanket stream beds and vegetation and reduce light reception.

The strongly seasonal flow regime characteristic of the Krumovitsa catchment is probably naturally conducive to minimising any impact from sediment loading During dry months there is little tributary flow to carry sediment. and in wet months the rivers are naturally high in sediment loads during periods of higher energy and flows but these loads are largely diluted by the large flow quantities.

Nevertheless, the potential sediment loads will be reduced as much as possible to minimise the impact of the project on the environment.

The following provisions have been made to minimise the risk from pollution of the surface run-off:

- Construct temporary surface interception drains to divert surface run-off from the construction sites;
- Construction of settling ponds to collect the waters containing high sediment level (soil and subsoil particulate matter) for precipitation of suspended solids prior to discharge into the receiving water.

2.1.2. Sources of Surface Water and Groundwater Pollution over the Project Operation Phase - Water Balance

Most of the surface runoff over the operation stage will be diverted from the project area by way of a drainage system, which will prevent its contact with process related products, raw materials and waste.

The Ada Tepe Pit will collect seepage and runoff from the surrounding area and pump the water to an open pond (the Runoff Storage Pond), which will provide the process plant water requirements. Two collection (drainage) sumps will collect surface runoff, seepage, and tailings water release from the IMWF area. Water collected in the collection ponds will be pumped to the Runoff Storage Pond specified above. This tank will also collect pit runoff from direct precipitation and other mining operations.

The Runoff Storage Pond will be the main source of water for the mining and processing operation. A discharge facility will be installed to enable discharge of water from the tank into the Krumovitsa river system. Water will be discharged into the environment mostly in case of storm events, i.e. extreme precipitation. The water will report to a Wastewater Clarifier for additional clarification prior to discharge. The discharge quality will meet the allowable emission levels and will not derogate the river water quality. The discharged water volume will not cause a significant change in the river flow rate as that volume will be small compared to the river outflow. The project considers that more than 98 % of the total demand will be met from recycling.

Eluate determinations according to BNS EN 12506/03 were conducted on mine rock and flotation tailings samples in order to identify their behavior. The method is used for the purpose of determination of waste leaching as a function of the liquids/solids ratio. The low ratios reflect the standard conditions in similar waste facilities while higher ratios reflect the processes that could take place in stored mine waste in case of runoff infiltration and circulation. The results of the eluate testwork are substantially below the allowable limit values specified in Table 4 of Regulation 8 on the Terms, Conditions and Requirements for Construction and Operation of Landfills and Other Facilities and Installations for Waste Recovery and Treatment (Threshold leaching values for non-hazardous granular materials that may be deposited in non-hazardous waste facilities).

The quality of the water released from the tailings during consolidation was assessed through water tests conducted in the SGS assay laboratory during testwork on flotation tailings samples from the flotation concentrate tests on ore samples from both zones of the deposit - the Upper Zone and the Wall Zone. The water assays indicate that the clarified water meets the discharge quality requirements for categories I and II of receiving streams.

The mine drainage from the open pit is expected to contain mostly high sediment levels. The results of the Acid Base Accounting (ABA) static geochemical testing conducted by Eurotest Control on 81 mine rock samples from the deposit clearly demonstrate that the mine rock is non-acid generating and therefore the mine drainage is not expected to be acidic, nor contain elevated levels of arsenic and heavy metals.

The assay certificates from the testwork on water and mine waste samples are presented in Appendix 9.

Effluents from restrooms and bathrooms will be collected using a separate collection sewage system and delivered to a domestic wastewater treatment plant. The treatment process will include passive, chemical and biological treatment stages. The treated effluent (at a rate of 0.8 L/s or 6,500 m^3 per annum) will report to the Wastewater Clarifier prior to discharge into the Krumovitsa River.

Site Wide Water Balance

A site wide water balance model has been developed for the proposed gold mining project, which includes the open pit, the process plant and the mine waste disposal facility (the Integrated Mine Waste Management Facility) shown on the General Site Plan, Appendix 1. The water balance features have been grouped into three main categories:

- Water collection facilities including the open pit;
- Integrated Mine Waste Management Facility (IMWF); and
- Process Plant.

Figure V.2.1-1 shows the conceptual water balance flow diagram and Table V.2.1-1 describes the individual flow components. The assumptions made in the site wide water balance development are:

- Precipitation distributions for all types of years are distributed based on the average year distribution;
- Precipitation on the integrated mine waste area will infiltrate through the waste and contribute to collection sumps as IMWF seepage inflows;
- The collection sumps are assumed to be operated in an empty condition; The sumps and the water collection facilities are also assumed to be empty at the start of the simulation;
- The sumps and the water collecting facilities were modeled assuming no seepage losses from the model;
- Seepage and runoff from the IMWF is assumed to have adequate water quality for use as process water at the process plant;

- The Runoff Storage Pond is modeled as a fully liner impoundment with only evaporation and makeup water extraction for the process plant. Any water excess to the process requirements is assumed to be a surplus (so-called ”overflow”) that can be treated for discharge into a surface receiving stream after additional clarification in a clarifier;

- Process water requirements are satisfied entirely from the Runoff Storage Pond; - A one-off abstraction of water from the Krumovitsa River at the start-up of operations;

- Freshwater makeup is pumped from the Fresh Water Tank, which is recharged from the proprietary abstraction well;

- The water released from the consolidation of deposited tailings is based on an annual production rate of 850,000 tons per year and a tailings solids contents of 56%.

- Runoff from the plant site area is assumed to report to the South Collection Sump.

Water Balance Flow Components

Table V.2.1-1.

Area	Flow Number	Description
Flows associated with ore processing and tailings production (PR)	PR1	Process Water from Runoff Storage Pond to Process Plant
	PR2	Tailings from Process to North Catchment IMWF
	PR3	Tailings from Process to South Catchment IMWF
Pumped Flows (P)	P1	Water from North Collection Sump to Runoff Storage Pond
	P2	Water from South Collection Sump to Runoff Storage Pond
	P3	Water from Ade Tepe Pit Sump to Runoff Storage Pond
	P4	Water from External Fresh Water Sources to Runoff Storage Pond
	P5	Water from External Fresh Water Sources to Raw and Process Plant
Direct Precipitation (DP)	DP1	Direct Precipitation on North Catchment IMWF
	DP2	Direct Precipitation on North Collection Sump
	DP3	Direct Precipitation on South Catchment IMWF
	DP4	Direct Precipitation on South Collection Sump
	DP5	Direct Precipitation on Ade Tepe Pit Sump
	DP6	Direct Precipitation on Runoff Storage Pond
	DP7	Direct Precipitation on Plant Site Area
Runoff (RO)	RO1	Runoff from North Catchment IMWF to North Collection Sump
	RO2	Runoff from South Catchment IMWF to South Collection Sump
	RO3	Runoff from Ade Tepe Pit Catchment to Pit Sump
	RO4	Runoff from Plant Site Area to South Collection Sump
Evaporation (E)	E1	Evaporation from North Collection Sump Surface
	E2	Evaporation from South Collection Sump Surface
	E3	Evaporation from AdeTepe Pit Sump Surface
	E4	Evaporation from Runoff Storage Pond Surface
Seepage (S)	S1	Seepage from North Catchment IMWF to North Collection Sump
	S2	Seepage from South Catchment IMWF to South Collection Sump
	S3	Seepage from Groundwater to AdeTepe Pit Sump
Tailings Water Release	T1	Tailings Release from North Catchment IMWF to North Collection Sump
	T2	Tailings Release from South Catchment IMWF to South Collection Sump
Discharge (M)	M1	Discharge

***/** IMWF - Integrated Mine Waste Management Facility.

The project water collection facilities and the assicated flows will be:

- Runoff Storage Pond – Its design capacity is 100,000 m^3 and is designed to collect runoff from the process plant site, runoff from direct precipitation on the open pit and IMWF areas and IMWF drainage (tailings release, seepage). The Runoff Storage Pond will provide the process plant water requirements while the excess water will report to a Wastewater Clarifier for additional clarification prior to discharge into the Krumovitsa River;
- Reclaimed Water Tank – It will collect the water reclaimed from the tailings thickening and concentrate dewatering. This tank will also receive waters from the Runoff Storage Pond and makeup water from the Fresh Water Tank according to process requirements;
- Fresh Water Tank – Its design capacity is 380 m3 and it is designed to collect fresh water supplied from the proprietary abstraction well in the Krumovitsa (or Kessibirdere) gravels. It will supply fresh water to all site ablution facilities, the reagents preparation facility and the Reclaimed Water Tank. It will also be connected to the Runoff Storage Pond to enable recharging of the pond during the dry period of the year should this be necessary.

The water balance model is developed using the GoldSim simulation environment; a graphical, object oriented software platform. The model simulates the water management processes at the mine from start of operations through to the end of mine life. The mine construction, closure and post closure states are not included at this stage.

The model has been run with daily timesteps for a nine year mine operating period. Table V.2.1-2 presents the general modeling parameters and assumptions.

Water Balance Model Input Parameters and Assumptions – General Table

Table V.2.1-2

Variable/Parameter	Value	Comment/Assumptions
Simulation Duration	Year 0 to Year 9	Selected from start to end of mine processing operations.
Number of Timesteps	3288	Based on daily time-steps. Results, however, will be shown on a monthly basis and summarized on an annual basis.

Climate Parameters

The climate on the project site is typical of a Continental-Mediterranean climate with mild winters and hot summers. The monthly average temperatures vary between +1.3 °C in January to +23.7 °C in July. The average daily maximum between December and February is between +6 °C to 8.6 °C, however, during cold periods the temperatures can fall to -13 °C. During summer warm periods, the temperatures can exceed 36 °C. Local daily rainfall data was recorded at the Krumovgrad meteorological station over a 30-year period between 1974 and 2003.

The water balance model will be developed using average climate conditions, as outlined in Table V.2.1-3 below which presents the average monthly rainfall, lake evaporation, and runoff coefficients (Golder, 2009). Table V.2.1-4 presents the precipitation frequency analysis results for the annual wet and dry years (Golder, 2009). Lake evaporation was estimated from the pan evaporation data presented in Golder (2009) using a coefficient of 0.8 (Ausenco, 2005). Table V.2.1-5 presents the estimated 24-hour rainfall events for different return periods (Golder, 2009). These values are considered to be conservative (Golder, 2009). Table V.2.1-6 presents the water balance model input parameters and assumptions for climate and runoff generation in the model.

Monthly Average Precipitation, Lake Evaporation and Runoff Coefficients (Golder, 2009)

Table V.2.1-3

Month	Precipitation (mm)	Lake Evaporation (mm)	Natural Ground Runoff Coefficient
January	63.4	26	0.89
February	69.9	30	1.01
March	65.9	42	0.84
April	63.4	62	0.62
May	59.1	81	0.38
June	46.4	103	0.24
July	38.4	140	0.13
August	24.1	132	0.08
September	41.6	95	0.12
October	51.1	60	0.14
November	83.3	40	0.30
December	96.9	29	0.64
Total	**703.5**	**841**	*N/A*
Average	*N/A*	*N/A*	**0.45**

N/A - not available

Annual Precipitation (mm)

Table V.2.1-4

Return Period	Annual Precipitation (mm)	
	Wet Years	Dry Years
1:2 years	687.9	
1:5 years	829.6	570.7
1:10 years	914.0	519.6
1:25 years	1012.8	474.1
1:50 years	1081.8	450.2
1:100 years	1147.5	432.8

Frequency Analysis Summary for the 24-hour Rainfall Event

Table V.2.1-5

Return Period (years)	24-Hour Rainfall Event (mm)
2	56.6
5	73.0
10	84.6
20	96.4
50	112.6
100	125.6

Water Balance Model Input Parameters and Assumptions - Climate/Runoff Generation

Table V.2.1-6

Variable/Parameter	Value	Source	Comment/Assumptions
Daily Precipitation	Lookup Table	Golder, 2009	Deterministic daily precipitation is based on an average monthly precipitation distribution and yearly total precipitations (see Table 3).
R_c Undisturbed Area	Lookup Table	Golder, 2009	Monthly runoff coefficients applied to the natural ground and undisturbed areas. Accounts for losses due to evaporation, storage, infiltration, etc (see Table 3).
Rc Integrated Mine Waste Facility	0.6 to 0.8		Assumed: The ratio of precipitation infiltrating through the IMWF that contributes to IMWF seepage is assumed to vary seasonally between 0.6 (May to October) and 0.8 (November to April) to account for losses due to evaporation, storage, infiltration, etc.
R_c Water surface	1.0		Assumed: Average annual runoff coefficient applied to the pond surface (Direct precipitation).
R_c Pits	0.9		Assumed: Average annual runoff coefficient applied to the open pit areas. Accounts for losses due to evaporation, storage, infiltration, etc.
R_c Plant Site	0.8		Assumed: Average annual runoff coefficient applied to the plant site areas. Accounts for losses due to evaporation, storage, infiltration, etc.

Runoff in the water balance model is estimated according to catchment types. The following catchment types have been assumed and summarised in Table V.2.1-7:

- Undisturbed areas – represent areas of undisturbed natural growth;
- Waste areas – represent areas where tailings and waste rock have been placed, or the areas that have been prepared for placement;
- Water surface areas of surface water bodies or facilities;
- Pit areas – represent the open pit footprint areas (Ade Tepe pit); and,
- Plant Site area- represents a combination of gravel surfaces and infrastructure.

Catchment Areas (in m^2 or ha) Per Catchment Type

Table V.2.1-7

Area	Undisturbed Area	Waste area	Pond Surface	Pits	Plant Site Area
Ade Tepe Pit	0.0	0.0	334 m^2	81,668 m^2 to 157,905$m^{2(a)}$	0.0
Runoff Storage Pond	0.0	0.0	Varies with water level	0.0	0.0
North Collection Sump's Watershed	Varies with Mine Life (20.6 ha to 3.7 ha)	Varies with Mine Life (0 to 16.9 ha)	334 m^2	0.0	0.0
South Collection Sump's Watershed	Varies with Mine Life (34.8 ha to 6.4 ha)	Varies with Mine Life (0 to 28.4 ha)	334 m^2	0.0	0.0

Area	Undisturbed Area	Waste area	Pond Surface	Pits	Plant Site Area
Plant Site Area	0.0	0.0	0.0	0.0	1.45 ha

(a) Pit Areas by Year are as follows: Year 1 – 60,000 m², Year 2 – 100,000 m², Year 3 – 115,000 m², Year 4 – 130,000 m², Year 5 – 145,000 m², Year 6 – 145,000 m², Year 7 – 155,000 m², Year 8 – 158,000 m², Year 9 – 158,000 m²,

Water Collection Facilities and Sources

The water supply facilities consist of the Runoff Storage Pond, the Reclaimed Water Tank, the Fresh Water Tank and external freshwater supply.

The Runoff Storage Pond will collect:

- The surface runoff, seepage, and tailings water release from the IMWF area. The water is collected in two collection ponds at the toe of the IMWF and then pumped to the Runoff Storage Pond.
- Mine waters and runoff from the Ada Tepe pit area. The mine waters are collected in the pit sump and pumped to the Runoff Storage Pond.

The Runoff Storage Pond will provide the process plant water requirements. The excess water from the pond will report to a Wastewater Clarifier for additional clarification prior to discharge into the Krumovitsa River.

The Reclaimed Water Tank will collect the water reclaimed from the tailings thickening and concentrate dewatering. It will be recharged with water from the Runoff Storage Pond and with fresh water from the Fresh Water Tank.

The Fresh Water Tank is designed to collect fresh water supplied from the proprietary abstraction well in the Krumovitsa or Kessibirdere gravels. The fresh water will be used as process makeup water and to supply the project ablution facilities.

Open pit

Table V.2.1-8 presents the water balance input parameters and modeling assumptions for the Ade Tepe pit, the water collection facilities and external water sources.

Water Balance Model Input Parameters and Assumptions – Ade Tepe Pit and Water Collection Facilities

Table V.2.1-8

Variable/Parameter	Value	Source	Comment/Assumptions
Pit Seepage	18,000 m^3/yr	Ausenco, 2005	Seepage assumed to be constant throughout the year and starts at the beginning of mine life.
Pit Sump Pump Capacity	30 m^3/hr		Ade Tepe sump pump capacities assumed to pump four weeks of the maximum monthly runoff volume from the average annual year plus groundwater over a three week period
Mine Pit Sump Capacity	2000 m^3		Collection sump is assumed to have a storage capacity of 2000 m^3, with a depth of 6 m, and a rectangular shape with a water surface area of 334 m^2.

Variable/Parameter	Value	Source	Comment/Assumptions
Runoff Storage Pond Storage-Elevation Curves	Lookup	Golder 2010	Storage-Elevation-Curves based on Option 2 Water Pond Location
Water Volume to start pumping freshwater	91,081m^3	Email communication from Dundee	Assumed to be the minimum volume for storage capacity required for 3 months of process plant operation
Freshwater pump to Runoff Storage Pond	42.2 m^3/day		Assumed to be the minimum required size to meet all process plants demands

Process Plant The process plant water requirements are satisfied from the Reclaimed Water Tank. The tailings output is directed to the Integrated Mine Waste Facility. Table V.2.1-9 presents the water balance input parameters and modeling assumptions for the process plant.

Water Balance Model Input Parameters and Assumptions – Process Plant

Table V.2.1-9

Variable/Parameter	Value	Source	Comment/Assumptions
Production Rate	850,000 tpy	Ausenco, 2005	Production rate
Tailings % Solids (by Weight)	56%	Golder, 2010	The Tailings output is directed to IMWF
Total Process Water Requirements	68 m^3/hr	Email communication from Dundee	Water required from the Runoff Storage Pond to meet the Process Plants Requirements
Process Freshwater Requirements	7.2 m^3/hr	Email communication from Dundee	Freshwater required from External Freshwater Sources to meet the Process Plants Requirements
Water in Ore	68,000 m^3/year	Ausenco, 2005	Water in ore feed to the Processing Mill at a production rate of 850,000 tpy

Integrated Mine Waste Management Facility (IMWF). The IMWF comprises the North and South Catchments that will store both Tailings and Waste Rock from mining operations. Two collection sumps will collect surface runoff, seepage, and Tailings Water Release from the waste area. Water collected in the ponds is pumped to the Runoff Storage Pond, where it is either recycled back to the process plant to meet process demands or advanced to the Wastewater Clarifier for subsequent discharge to the environment. Table V.2.1-10 presents the water balance input parameters and modeling assumptions for the process plant.

Water Balance Model Input Parameters and Assumptions – IMWF

Table V.2.1-10.

Variable/Parameter	Value	Source	Comment/Assumptions
North/South South Sump Pump Capacity	Varies		The North and South sump pump capacities are equal to the MWF underdrain design flow, sized to pass the peak flow from the 24-hour, 100-year precipitation event. This is Depended on the Tailings percentage solids
North/South Sump Capacity	2000 m^3		Each collection sump (North and South) is assumed to have a storage capacity of 2000 m^3, with a depth of 6 m, and a rectangular shape with a water surface area of 334 m^2

Variable/Parameter	Value	Source	Comment/Assumptions
Tailings Release to Collection Ponds	Lookup Table		The water released from the consolidation of deposited tailings is based on an annual production rate of 850,000 tons per year assuming tailings water content 56%. Ratio of water released from North and South Catchments based on ratio of volumes of Waste Deposited in each Catchment
Maximum Tailings and Waste Rock Volume North	4104200 m^3		Total North Tailings Volume. Assumed to grow from 0 to full size throughout mine life
Maximum Tailings and Waste Rock Volume South	9577500 m^3		Total South Tailings Volume. Assumed to grow from 0 to full size throughout mine life
Total Tailings Water Release to Collection Ponds	414,000 m^3/year		The estimated annual volume of water released from consolidation of the deposited tailings for a tailings solids content of 56%

Water Balance Results

The water balance scenarios that have been modelled are described in Table V.2.1-11. The scenarios provide a range of required external freshwater flows and discharges to the environment.

Water Balance Scenarios Modelled

Table V.2.1-11

Scenario	Tailing Solids Content	Precipitation Year
Scenario 1	56%	Mean annual year
Scenario 2	56%	100-year wet year
Scenario 3	56%	100-year dry year

The water balance is positive on an annual basis for Scenario 1 and Scenario 2 after the Runoff Storage Pond, the Reclaimed Water Tank and the Fresh Water Tank are filled. However, there is a shortage of water throughout Scenario 3. The maximum freshwater requirement occurs at the beginning of operations while the maximum discharge to the environment occurs at the end of opertaions due to the increasing watershed of the Ade Tepe pit, and the volume and area of waste in the IMWF. Table V.2.1-12 below estimates a maximum discharges to the environment of 465,008 m^3/year maximum freshwater intake of 184,781 m^3/year in Scenario 1 and Scenario 3 respectively.

Table V.2.1-13 shows the model results of the full water balance flow diagram for Scenario 1 the average precipitation year and also the range of possible flows over the mine life for three annual climatic scenarios modeled. Additionally, Figure V.2.1-1 shows the inflows, overflows, and volumes of the Runoff Storage Pond, the IMWF north and south collection sumps, and the pit collection sump.

Water Use – Amounts and Sources

Two site water supply options have been studied (see section 1.4 in Chapter III above):

- Installation of a proprietary fresh water abstraction well in the Krumovitsa or Kessebirdere gravels, where sufficient water resources are available and without any negative impact on the requirements of the town and the surrounding areas.

- Collection and storage of water from the Kaldzhikdere watershed into a small storage dam, which will normally be self-filling from the catchment areas with occasional abstractions from Krumovitsa if needed.

Option 1 (a proprietary well in the Krumovitsa gravels) has been selected as the most appropriate project water supply option. The site would need water supplies at approximately 2,894,000 m^3/year from internal and external water sources. The water balance results indicate that more than 98%, or an average of 2,830,000 m^3/year, of the total demand will be met from recycling. Freshwater makeup of 64,000 m^3/year (average 7.2 m3/h) will be supplied from an external source.

The project drinking water requirements of about 0.8 m^3/h (or about 6,500 m^3/year) will be met from the proprietary abstraction well after obtaining the necessary permits.

The economic, social and environmental studies and the data from hydrological and hydrogeological surveys completed by Vodokanalproekt-Plovdiv show that the first option (a proprietary fresh water abstraction well) is the most suitable one. The project fresh water requirements are minimal and therefore will not derogate existing abstractions used for drinking water supplies for the town of Krumovgrad and other villages along the Krumovitsa River.

Reference List:

1. *Ausenco Ltd (Ausenco), 2005*. Krumovgrad Gold Project Definitive Feasibility Study (June 2005).
2. *Golder Associates Ltd (Golder), 2009*. Draft Technical Report on Krumovgrad Filtered Tailings (April 2009).

Freshwater Makeup and Discharge to the Environment for 56% Tailings Solids Content (m^3 /year)

Table V.2.1-12

Year Scenario	Flow	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Scenario 1 Average	Total Freshwater Requirements [(a)]	113,885	63,072	63,072	63,072	63,245	63,072	63,072	63,072	63,245
	Discharge to Environment (M1)	0	57,436	134,993	152,985	165,821	176,581	190,879	200,818	203,853
Scenario 2 Wet	Total Freshwater Requirements[(a)]	99,706	63,072	63,072	63,072	63,245	63,072	63,072	63,072	63,245
	Discharge to Environment (M1)	111,823	323,342	352,408	381,859	403,318	419,380	443,362	460,450	465,809
Scenario 3 Dry	Total Freshwater Requirements[(a)]	184,781	67,123	63,072	63,072	63,245	63,072	63,072	63,072	63,245
	Discharge to Environment (M1)	0	0	0	0	0	818	30,322	39,370	45,291

(a) Minimum Freshwater Requirements for the Process Plant and Potable water are 63,072 m^3 / year (7.2 m^3/h.)

Water Balance Results - Scenario 1 (m^3/y)

Table V.2.1-13

Area	Flow Number	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Min 100 yr-dry (L/s)[(a)]	Max 100 yr-Wet (L/s)[(b)]	Avg. (L/s)[(c)]
Flows associated with ore processing and tailings production (PR)	PR1	597,312	595,680	595,680	595,680	597,312	595,680	595,680	595,680	597,312	1	18.9	18.9
Pumped Flows (P)	P1	173,426	186,308	185,673	158,262	140,922	170,885	194,832	200,801	202,236	3.4	8.4	5.7
	P2	455,843	449,034	458,188	494,118	522,334	498,554	483,126	485,675	488,495	12.5	19.8	15.3
	P3	68,383	84,231	93,578	103,180	106,842	109,947	115,833	117,352	117,728	1.5	5.7	3.2
	P4	50,640	0	0	0	0	0	0	0	0	0.0	1.2	0.2
	P5	63,245	63,072	63,072	63,072	63,245	63,072	63,072	63,072	63,245	2.0	2.0	2.0
Direct Precipitation (DP)	DP1	145,065	144,591	144,591	144,591	145,065	144,591	144,591	144,591	145,065	2.8	7.5	4.6
	DP2	235	234	234	234	235	234	234	234	235	0.0	0.0	0.0
	DP3	245,062	244,263	244,263	244,263	245,062	244,263	244,263	244,263	245,062	4.8	12.7	7.7
	DP4	235	234	234	234	235	234	234	234	235	0.0	0.0	0.0
	DP5	352	351	351	351	352	351	351	351	352	0.0	0.0	0.0
	DP6	21,458	35,535	37,369	37,869	38,302	38,388	38,558	38,678	38,845	0.4	2.0	1.1
	DP7	10,211	10,178	10,178	10,178	10,211	10,178	10,178	10,178	10,211	0.2	0.5	0.3
Runoff (RO)	RO1	71,317	63,272	55,705	48,138	40,831	32,982	25,415	17,848	13,349	0.3	3.7	1.3
	RO2	120,504	106,981	94,264	81,548	69,273	56,079	43,363	30,646	23,090	0.5	6.2	2.2
	RO3	50,415	66,313	75,661	85,263	88,875	92,030	97,915	99,435	99,760	1.0	5.2	2.7
	RO4	8,169	8,142	8,142	8,142	8,169	8,142	8,142	8,142	8,169	0.2	0.4	0.3

Area	Flow Number	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Min 100 yr-dry (L/s)[(a)]	Max 100 yr-Wet (L/s)[(b)]	Avg. (L/s)[(c)]
Evaporation (E)	E1	281	281	281	281	281	281	281	281	281	0.0	0.0	0.0
	E2	281	281	281	281	281	281	281	281	281	0.0	0.0	0.0
	E3	422	421	421	421	422	421	421	421	422	0.0	0.0	0.0
	E4	27,464	42,967	44,135	44,764	45,268	45,513	45,789	46,008	46,144	0.7	1.5	1.4
Seepage (S)	S1	5,433	16,177	26,923	37,668	48,598	59,188	69,933	80,678	86,332	0.1	4.5	1.5
	S2	9,129	27,186	45,243	63,300	81,668	99,464	117,521	135,578	145,078	0.2	7.5	2.5
	S3	18,037	17,988	17,988	17,988	18,037	17,988	17,988	17,988	18,037	0.6	0.6	0.6
Tailings Water Release (T)	T1	96,724	106,905	103,092	72,503	51,540	78,761	99,530	102,320	102,601	1.6	3.4	2.9
	T2	318,088	306,772	310,585	341,175	363,271	334,916	314,147	311,356	312,209	9.7	11.5	10.3
Environmental Discharge (M)	M1	0	57,436	134,993	152,985	165,821	176,581	190,879	200,818	203,853	0.0	14.8	4.5
Tailings Pore Water[(d)]		254,418	253,722	253,722	253,722	254,418	253,722	253,722	253,722	254,418	8.0	8.0	8.1

(e) Minimum Flow throughout mine life using the 100 yr-Dry Annual Climatic input for each year.

(f) Maximum Flow throughout mine life using the 100 yr-Wet Annual Climatic inputs for each year.

(g) Average Flow throughout mine life using the 100 yr-Wet Annual Climatic inputs for each year.

(h) Water lost permanently to tailings pore space.

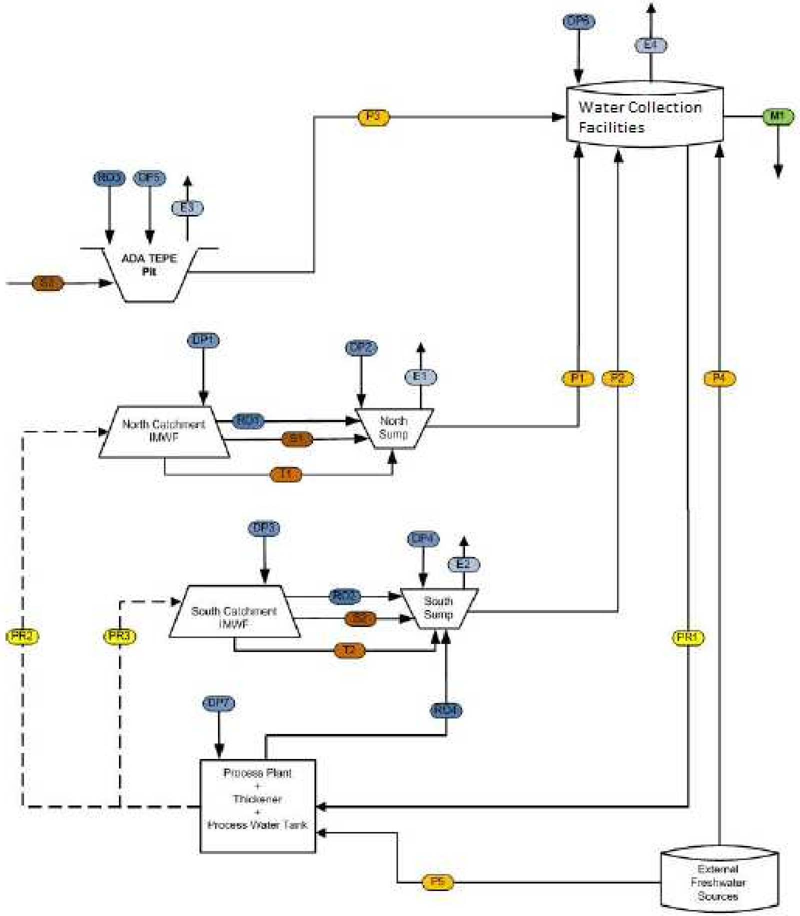


Table 1: List of Water Balance Flow Components

Area	Flow Number	Description	Min 100 yr-dry (L/s)[a]	Max 100yr-Wet (L/s)[b]	Avg. (L/s)[c]
Flows associated with ore processing and tailings production (PR)	PR1	Process Water from Raw and Process Water Reservoir to Process Plant	18.9	18.9	18.9
	PR2	Tailings from Process to North Catchment IMWF	NA	NA	NA
	PR3	Tailings from Process to South Catchment IMWF	NA	NA	NA
Pumped Flows (P)	P1	Water from North Collection Sump to Raw and Process Water Reservoir	3.4	8.4	5.7
	P2	Water from South Collection Sump to Raw and Process Water Reservoir	12.5	19.8	15.3
	P3	Water from Ade Tepe Pit Sump to Raw and Process Water Reservoir	1.5	5.7	3.2
	P4	Water from External Fresh Water Sources to Raw and Process Water Reservoir	0.0	1.2	0.2
	P5	Freshwater to Process Plant	2.0	2.0	2.0
Direct Precipitation (DP)	DP1	Direct Precipitation on North Catchment IMWF	2.8	7.5	4.6
	DP2	Direct Precipitation on North Collection Sump	0.0	0.0	0.0
	DP3	Direct Precipitation on South Catchment IMWF	4.8	12.7	7.7
	DP4	Direct Precipitation on South Collection Sump	0.0	0.0	0.0
	DP5	Direct Precipitation on Ade Tepe Pit Sump	0.0	0.0	0.0
	DP6	Direct Precipitation on Raw and Process Water Reservoir	0.4	2.0	1.1
	DP7	Direct Precipitation on Plant Site Area	0.2	0.5	0.3
Runoff (RO)	RO1	Runoff from North Catchment IMWF to North Collection Sump	0.3	3.7	1.3
	RO2	Runoff from South Catchment IMWF to South Collection Sump	0.5	6.2	2.2
	RO3	Runoff from Ade Tepe Pit Catchment to Pit Sump	1.0	5.2	2.7
	RO4	Runoff from Plant Site Area to South Collection Sump	0.2	0.4	0.3
Evaporation (E)	E1	Evaporation from North Collection Sump Surface	0.0	0.0	0.0
	E2	Evaporation from South Collection Sump Surface	0.0	0.0	0.0
	E3	Evaporation from AdeTepe Pit Sump Surface	0.0	0.0	0.0
	E4	Evaporation from Raw and Process Water Reservoir Surface	0.7	1.5	1.4
Seepage (S)	S1	Seepage from North Catchment IMWF to North Collection Sump	0.1	4.5	1.5
	S2	Seepage from South Catchment IMWF to South Collection Sump	0.2	7.5	2.5
	S3	Seepage from Groundwater to AdeTepe Pit Sump	0.6	0.6	0.6
Tailings Water Release(T)	T1	Tailings Release from North Catchment IMWF to North Collection Sump	1.6	3.4	2.9
	T2	Tailings Release from South Catchment IMWF to South Collection Sump	9.7	11.5	10.3
Environmental Discharge (M)	M1	Discharge	0.0	14.8	4.5

LEGEND:

Flow Component

Flows not Directly Modeled

P# Flow Number

NOTES:

- Water Balance Flow Components are Described in Table 1.0

DRAFT

PROJECT DUNDEE PRECIOUS (KRUMOVGRAD) BV
KRUMOVGRAD GOLD PROJECT
BULGARIA

TITLE WATER BALANCE FLOW DIAGRAM

Golder Associates

PROJECT No. 09-1221-3019 | PHASE No. 5000
DESIGN MLP 8APR10 | SCALE NTS | REV. 1
CADD
CHECK
REVIEW

FIGURE 1

Figure V.2.1-1

2.1.3. Sources of Surface Water and Groundwater Pollution over the Project Construction Phase

A plan for closure of the open pit, the ore processing plant, the IMWF, the ancillary facilities and unnecessary infrastructure will be prepared by BMM EAD together with the construction and operation designs. In order to assess the requirements of stakeholders (principally, the local community), it is envisaged that consultation will be carried out with appropriate community representatives prior to the development of the Closure Plan. The closure stage is expected to require approximately 50 permanent job positions.

In accordance with the closure objectives, the water management will further assist in ensuring the physical and chemical stability of the site and its successful rehabilitation taking into account any land use designations. It is important to complete the following tasks as part of the water management process:

- Consider an option for a wet closure of the open pit provided that the waters have adequate quality;
- The IMWF drainage system established during the construction stage is retained as a permanent system at closure to provide efficient post-closure water management.
- Monitor IMWF drainage flows; The preliminary investigations indicate that the drainage waters will not be polluted and can be discharged into the Krumovitsa River.

The water monitoring over the closure stage is expected to confirm that the rehabilitated areas will not be sources of environmental pollution.

Domestic effluents will continue to be generated over the closure stage, which may, following appropriate treatment, be discharged into a surface receiving stream. Upon completion of the closure stage the domestic wastewater treatment plant will be decommissioned and the plant site will be rehabilitated. Chemical toilets must be provided for that post-closure period.

No pollution sources will remain active after the closure stage, which waives the requirement to construct water treatment facilities.

2.1.4. Requirement for Construction of Water Treatment Facilities

The requirement for construction of water treatment facilities is normally determined on the basis of the water quality assessment of the wastewater flows to the water collection facilities as shown on the water balance flow diagrams in Figures V.2-1 and V.2-2 above. These are the water flows from the Ada Tepe pit sump (mine drainage) and the IMWF North and South sumps.

Mine Drainage

The mine drainage flow components include groundwater seepage and runoff from direct precipitation on the pit drainage area. According to the water balance model, their amount will vary from 68 383 m^3/y to 117 728 m^3/y (Table V.2-13). These waters are expected to contain high sediment levels, which will settle in the Ada Tepe pit sump. The water collected in the sump will be pumped to the Runoff Storage Pond. The mine drainage is not expected to be acidic as the Ada Tepe ore and host rocks are classified as non-acid generating.

A small shallow groundwater flow occurs in the overburden and the orebody at the Ada Tepe open pit at an elevation (RL) of around 380-390 m. This groundwater is recharged by direct precipitation and is manifested by the presence of small springs on the steeper slopes (emerging at the outcrop of perching impermeable layers) or flows via structures to deeper formations. The available data indicates that the water is relatively clear, of generally high quality and low in dissolved metal concentrations compared to the water quality standards for Category II receiving stream, which is the category of the Krumovitsa River. A map showing the water and soil sampling points is included in Appendix 8. So, it should be possible to discharge it direct to the Krumovitsa without derogating its quality. The comparative analysis of the data in the assay certificates from Eurotest Control EAD (Appendix 9) in Table V.2.1-14 confirm this conclusion.

Background Concentrations in the Groundwaters in the Project Area

Table V.2.1-13

Components	Regulation 1/2007	Groundwater in Ada Tepe Area [1/]	Allowable Limits - Regulation 1/2007 [2/]	Regulations 7/1986 and 6/2000	Allowable Limits - Regulation 7/1986 [3/]	Allowable Limits - Regulation 6/2000 [4/]
pH	-	6.80-7.57	6.50 - 9.50	-	6.0-8.50	6-9
Conductivity	µS/cm	353-1028	2000	µS/cm	1300	-
Total hardness	mgeqv/l	2.67-7.49	12.0	mgeqv/l	10.0	-
Permanganate oxidisable C	mgO_2/l	0.99-1.91	5.0	mgO_2/l	30.0	-
Ammonium	mg/l	0.013-0.074	0.5	mg/l	2.0	-
Nitrites	mg/l	< 0.05	0.5	mg/l	0.04	-
Nitrates	mg/l	0.1 - 4.3	50.0	mg/l	10.0	-
Fluorides	mg/l	0.17-0.53	1.5	mg/l	1.5	-
Phosphates	mg/l	< 0.1	0.5	mg/l	1.0	-
Sulphates (as SO_4^{2-})	mg/l	30.6-66.0	250.0	mg/l	300.0	-
Chlorides (as Cl^-)	mg/l	6.0-108.7	250.0	mg/l	300.0	-
Sodium	mg/l	7.0-140.0	200.0	-	-	-
Cyanide (total)	µg/l	< 2.0	50.0	mg/l	0.5	1.0
Mercury	µg/l	< 1.0	1.0	mg/l	0.001	0.01
Cadmium	µg/l	< 1.0	5.0	mg/l	0.01	0.1
Cu	mg/l	0.003-0.0057	0.2	mg/l	0.1	0.5
Nickel	µg/l	< 2.0	20.0	mg/l	0.2	0.5
Lead	µg/l	< 10.0	10.0	mg/l	0.05	0.2
Selenium	µg/l	< 10.0	10.0	mg/l	0.01	-
Chromium	µg/l	1.0-4.0	50.0	mg/l	0.05	0.1
Aluminum	µg/l	10.0-50.0	200.0	-	-	-
Iron	µg/l	20.0-180.0*	200.0	mg/l	1.5	3.5
Zinc	mg/l	0.001-0.07	1.0	mg/l	5.0	2.0
Boron	mg/l	0.01-0.12	1.0	Not allowed		-
Antimony	µg/l	< 5.0	5.0	-	-	-
Arsenic	µg/l	< 10.0	10.0	mg/l	0.05	0.1
Magnesium	mg/l	5.2-35.3	80.0	-	-	-
Calcium	mg/l	26.9-141.5	150.0	-	-	-
Natural uranium	mg/l	< 0.001	0.06	mg/l	0.6	2.0
Petroleum products	µg/l	20.0-100.0 (in one of the boreholes)	50.0	mg/l	0.3	10.0

1/Groundwater samples from the Ada Tepe area (Protocols 4145/29.04.2020 - Eurotest Control AD);
2/ Appendix 1 to art. 10, par. 2, item 1 of Regulation 1/10.10.2007 on Groundwater Exploration, Use and Protection; last amendment SG issue 2/08.01.2010 (The presence of iron in ATDDEX 025 is attributed to the corroded casing, which did not allow taking a non-contaminated sample.)
3/ According to Regulation 7/1986 on Surface Waters (Category II Receiving Water)
4/ Regulation 6/09.10.2000 on Emission Limits for Allowable Concentration of Harmful and Hazardous Substances in Wastewater Discharged in Water Bodies. (SG issue 97/2000).

Flotation Process Water and IMWF Seepage

Most of the flotation process water is recycled back into the process from the tailings thickening and concentrate dewatering stages. The balance reports with the tailings flow to the IMWF. The quality of the water released from the tailings during consolidation was assessed through water tests conducted in the SGS assay laboratory during testwork on flotation tailings samples from the flotation concentrate tests on ore samples from both zones of the deposit - the Upper Zone and the Wall Zone. The water assays indicate that the clarified water meets the discharge quality requirements for categories I and II of receiving streams. The water pH is 8.06-8.16. The suspended solids concentration is 6 to 21 mg/L, the dissolved solids are 183 to 257 mg/L, dissolved arsenic is 0.0004 to 0.0006 mg/L, and the concentrations of heavy metals are also very low. The COD is 36 mg/L, i.e. the organic load in the clarified waters is low and it may be accepted that the residual PAX levels are negligible. The extremely low concentrations of copper, sulphates and phosphates confirm the fact that the reagents metering in the flotation process is optimal and will not increase the organic loading of the clarified water.

Process Wastewater

Almost the entire amount (nearly 98%) of the water in the Runoff Storage Pond will be recycled back into the process. The water excess that will have to be discharged is the pond overflow accumulated mostly from abundant precipitation. The quality of these waters must meet the specific emission limits. The above analysis shows that the quality of the site wastewaters that are going to be discharged in Krumovitsa as pond overflow is mostly affected by the IMWF seepage quality. Discharges will occur in 5 or 6 months over the year, when precipitation is more abundant. These waters will report to the Wastewater Clarifier for additional clarification prior to discharge into the Krumovitsa River. No discharges will occur during the rest of the year.

Table V.2.1-15 shows the results of the assays of the water samples collected on 13.04.2010 by sampling points.

A map showing the water and soil sampling points is included in Appendix 8.

Table V.2.1-15

Assays of Surface Water Samples Taken on 13.04.2010 by Sampling Points

Parameter	Unit	Regulation Regulation 7/12.12.1986 on Parameters and Reference Values for Assessment of the Quality of Running Surface Waters.	Regulation 6/2000	PV – 003 Krumovitsa downstream of confluence with Kaldzhikdere	PV – 004 Buyukdere - prior to confluence with the Krumovitsa	PV – 005 Krumovitsa downstream of confluence with Elbassandere	PV – 002 Kaldzhikdere - prior to confluence with the Krumovitsa	PV – 001 Krumovitsa - beginning (confluence of the Egrechka River and the Kessebirdere River)
pH	pH units	6.0-8.5	6 – 9	8.57 ± 0.10	8.36 ± 0.10	8.56 ± 0.10	8.29 ± 0.10	8.31 ± 0.10
Conductivity	µS/cm	1300	-	284 ± 9	555 ± 17	333 ± 10	603 ± 18	206 ± 6
Total hardness	$mgeqv/dm^3$	10	-	2.50 ± 0.25	5.58 ± 0.56	3.04 ± 0.30	6.17 ± 0.62	1.46 ± 0.15
Suspended solids	mg/dm^3	50	50	<6	<6	<6	6 ± 1	6
Dissolved solids	mg/dm^3	1000		171 ± 5	333 ± 10	200 ± 6	362 ± 11	124 ± 4
COD (bichromatic)	mgO_2/dm^3	70	150	7.0 ± 0.7	8.1 ± 0.8	8.3 ± 0.8	8.4 ± 0.8	11.0 ± 1.1
Ammonium (NH_4^+)	mg/dm^3	2.0	-	<0.013	<0.013	<0.013	0.117 ± 0.012	0.025 ± 0.003
Nitrites (NO_2^-)	mg/dm^3	0.04	-	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrates (NO_3^-)	mg/dm^3	10	-	0.62 ± 0.06	1.1 ± 0.1	0.91 ± 0.09	<0.10	<0.10
Phosphates (PO_4^{3-})	mg/dm^3	1.0	-	.	<0.10	<0.10	<0.10	<0.10
Sulfates (SO_4^{2-})	mg/dm^3	300	-	23.7 ± 2.4	75.3 ± 7.5	36.3 ± 3.6	78.2 ± 7.8	15.5 ± 1.6
Chlorides /Cl^-/	mg/dm^3	300	-	8.2 ± 0.8	12.5 ± 1.3	8.5 ± 0.9	12.5 ± 1.3	7.8 ± 0.8
Sodium (Na)	mg/dm^3	-	-	9.4 ± 0.9	17.2 ± 1.7	11.0 ± 1.1	16.0 ± 1.6	8.9 ± 0.9
Potassium (K)	mg/dm^3	-	-	1.6 ± 0.2	2.4 ± 0.2	1.6 ± 0.2	1.9 ± 0.2	1.4 ± 0.1
Chromium (as Cr^{6+})	mg/dm^3	0.05	0.1	<0.010	<0.010	<0.010	<0.010	<0.010
Mercury (Hg)	mg/dm^3	0.001	0.01	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cadmium (Cd)	mg/dm^3	0.01	0.1	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Copper (Cu)	mg/dm^3	0.1	0.5	0.0034 ± 0.0003	0.0033 ± 0.0003	0.0031 ± 0.0003	0.0040 ± 0.0004	<0.0030
Cobalt (Co)	mg/dm^3	0.1	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lead (Pb)	mg/dm^3	0.05	0.2	<0.010	<0.010	<0.010	<0.010	<0.010
Aluminum (Al)	mg/dm^3	-	-	0.0182 ± 0.0018	0.0106 ± 0.0011	0.0115 ± 0.0012	0.0537 ± 0.0054	0.0503 ± 0.0050
Iron (Fe)	mg/dm^3	1.5	3.5	0.0168 ± 0.0017	0.0213 ± 0.0021	0.0193 ± 0.0019	0.0747 ± 0.0075	0.1344 ± 0.0134
Zinc (Zn)	mg/dm^3	5	2	<0.0010	0.0425 ± 0.0043	0.0522 ± 0.0052	<0.0010	0.0020 ± 0.0002
Manganese (Mn)	mg/dm^3	0.3	-	0.0015 ± 0.0002	0.0032 ± 0.0003	0.0070 ± 0.0007	0.0057 ± 0.0006	0.0067 ± 0.0007
Arsenic (As)	mg/dm^3	0.05	0.1	<0.010	<0.010	<0.010	<0.010	<0.010
Magnesium (Mg)	mg/dm^3	-	-	9.75 ± 0.98	20.92 ± 2.09	10.66 ± 1.07	22.09 ± 2.21	5.24 ± 0.52
Calcium (Ca)	mg/dm^3	-	-	34.10 ± 3.41	77.2 ± 7.7	43.26 ± 4.33	87.1 ± 8.7	20.58 ± 2.06
Temperature	°C	-	-	15.3	16	16.3	15.5	18

Domestic sewage

Domestic sewage will be generated at a rate of up to 18 m^3/day. It will be treated in a site modular treatment plant and then advanced to the Runoff Storage Pond.

2.1.5. Impact Assessment According to the National Standards and Legal Requirements

2.1.5.1. Impacts on surface waters

The potential impacts on surface waters are assessed in terms of the surface water resource quantity and quality.

Impacts over the construction stage

No derogation of the water resources and their quality is expected over the construction stage because there will be no major water abstractions or discharges. The strongly seasonal flow regime characteristic of the Krumovitsa catchment is probably naturally conducive to minimising any impact from sediment loading During dry months there is little tributary flow to carry sediment.

Construction activities by their nature cause ground disturbance and the clearance of trees and vegetation can also result in increased soil erosion and runoff carrying sediment. This will be minimised by appropriate control and management of construction activities, and sediment-carrying runoff to the natural surface water environment will be minimised by appropriate drainage diversion (temporary or permanent) and settlement ponds.

Suitable portable chemical toilets will be provided for ready sanitation at the construction sites.

Impacts over the operation stage

The project operation, which requires external freshwater supply from a groundwater abstraction well in the Krumovitsa aquifer, is not expected to have a negative impact on the local community in terms of derogation of the surface water resource for two reasons:

- Insignificant modification of the surface water resources;
- Limited water abstraction for the process and ablution facilities from the well at relatively low rates (up to 5 m^3/h), which will not derogate existing abstractions used for drinking water supplies for the town of Krumovgrad and other villages in the Krumovitsa valley.

Part of the project fresh water requirements will be met from surface runoff from the open pit and IMWF watersheds, which will be collected in the Runoff Storage Pond, thus minimising the external fresh water demands. 98% of the annual process water requirement of the project will be met from recycling. So, the impact of the project operation on the natural water flow regime and other water users will be insignificant.

Geochemical testing and modelling studies indicate that the drainage from the IMWF will be suitable for direct discharge following solids settlement and ensuring that their chemistry meets the specific emission limits for discharges into the environment.

During operation, domestic wastewater from the offices, showers, toilets and the canteen will be treated on-site in an wastewater treatment plant. So, there will be no impact on the natural water environment from such waste effluents.

The proposed technical solutions ensure minimal discharge of process wastewaters. Thus their current status will practically be sustained.

Impacts over the closure stage

The closure and rehabilitation plan will include measures that ensure the long-term physical and chemical stability of the areas thus preventing any significant negative impacts on surface water resources and quality after cessation of operations. The closure planning for the mine will include long-term monitoring of surface water quality and flows as part of the aftercare activities with a view to assessment of any required additional measures.

The Ada Tepe pit will fill with groundwater forming a lake-type of surface water body, whose water is expected to be of good quality. The rehabilitation of the rest of the operational areas/sites will be achieved in a manner that ensures establishment of a sustainable vegetation cover and surface drainage system to prevent further erosion.

After the project closure, the proprietary abstraction well may be used for augmentation of community water supply to Krumovgrad and nearby villages.

2.1.5.2. Impacts on groundwaters

Impacts over the construction stage

There are no significant aquifer resources developed within the footprint of the project and therefore project site groundwater is not subject to abstraction. The most significant local aquifer is the alluvial gravels of the Krumovitsa valley, which is used for water supply. This aquifer is at a significant distance from the project operational areas and will not be affected by the project construction and operation. The karst limestone aquifer in the Paleogene rocks is the other aquifer of greater significance. It will not be impacted by the project implementation either, because it occurs at a lower elevation and the project construction and operation will not affect it.

The groundwater resources and quality will not be derogated by the construction of the individual operational facilities considered in the project. The diversion of the surface flows away from the project construction sites may slightly alter the recharge of groundwater from precipitation but the impact will be on a minor-local scale and will not derogate groundwater resources and flows.

Impacts over the operation stage

Development of significant aquifers is typical for alluvial gravels in the Krumovitsa River. No fissure karst (limestone) structures occur within the project footprint. The limestone outcrops occurring to the north-west of the project minesite are at a higher elevation and will not be affected by facilities of activities. All groundwater flows in the mine project area, whether in fracture systems or alluvial aquifers, are ultimately controlled by the topography of the Krumovitsa, which provides the basal discharge level.

Pit development is expected to intersect some minor low-yield aquifers. Preliminary investigations indicate that the water is of generally high quality and meets the emission requirements for direct discharge to the Krumovitsa (after clarification in the Ada Tepe pit sump). So, there will be no impact on the natural water environment from the dewatering of the Ada Tepe open pit.

According to project estimates, domestic wastewater is expected to be generated at a rate of up to 18 m^3/day. Following appropriate treatment in an on-site site treatment plant to meet legal discharge standards, the effluent will be advanced to a clarifier and then discharged to the Krumovitsa River.

It is necessary to ensure high-quality coupling of the sewer pipes to minimise the risk of breakdowns and leaks that may affect the local groundwaters.

The conclusion is that the implementation of the project proposal will not have a significant impact on the groundwater quality. Nevertheless, the site monitoring plan will incorporate a long-term groundwater monitoring program covering the operation and post-operation stages.

Impacts over the closure stage

The proposed activities and methods for closure of the project areas and rehabilitation of their footprints are not expected to result in a significant impact to the groundwater quality.

The groundwater monitoring plan will ensure continued evaluation of the groundwater quality to enable adequate assessment of their status over the project closure stage.

Conclusions and impact forecasts

It is expected that the project construction will have no significant impact on the local groundwater status. The significant aquifers are either at a greater distance from the project site or at a lower elevation. It is therefore concluded that the impacts over the construction stage will be insignificant, of short duration and without a cumulative effect.

The project implementation is not expected to result in a significant impact on the existing surface water resources as the fresh water requirements will be met from site runoff and makeup from an abstraction well. There are no project interactions with groundwater that present any specific significant impact to the groundwater resources and quality over the 9-year operation period.

The basement rock is expected to act as a confining bed thus eliminating the risk of having the soil and groundwaters contaminated. Site investigations have been commissioned to confirm that.

The IMWF base and outer faces (slopes) must ensure protection of the soil and surface and ground waters that is equivalent to the protection of a confining bed with a permeability of $1*10^{-9}$ m/s or lower (for non-hazardous wastes). If the permeability of the basement rock is higher than the required level, a min. 1m thick layer of clay material must be established. The same recommendation is made in the EU reference document on BATs for management of tailings and waste rock in mining activities.

The site monitoring plan, which includes groundwater monitoring as well, will ensure continued evaluation of the groundwater status over the project operation stage.

The proposed closure activities and methods are not expected to result in a significant impact to the groundwater status. The closure planning for the mine will include long-term monitoring of surface water quality and flows as part of the aftercare activities with a view to assessment of any required additional measures.

Surface water impact forecast

Impact influence – local;
Type and significance of impact – direct, insignificant;
Duration of impact – over the entire operation period;
Occurrence of impact – every day;
Cumulative impacts on the environment – none expected;
Transboundary impacts – none expected.

Groundwater impact forecast

Impact influence – local;
Type and significance of impact – direct and indirect, insignificant;
Duration of impact – over the entire operation period;
Occurrence of impact – every day;
Cumulative impacts on the environment – none expected;
Transboundary impacts – none expected.

3. Geological Setting

3.1. Assessment of the Changes to the Geological Setting Brought by the Implementation of the Project Proposal

The project will have a visual impact on the geological setting by changing the local topography with the removal and relocation of some 7.5 million m^3 of rock material. A negative form, which is the open pit, and a positive form, which is the IMWF, will be created.

The rational recovery of the mineral inventory is a key factor that influences the assessment of the impact on the local geology. This will be ensured by strict compliance with the Life of Mine Plan and the annual mining projects. These plans and projects must be implemented only with the prior approval of the competent authorities.

It is therefore concluded that the proposed methods of mining and processing of Ada Tepe mineral resource to concentrate will not have a significant impact on the environment.

The negative impacts will be limited only to the project site within the concession area, which is something that is important and not easy to achieve by a mining operation.

Therefore, the selection of Option 1 as the preferred option is obvious.

4. Lands and Soils

4.1. Land Use

The diversity of land and soil in this relatively limited area under study is the direct result of morphological processes occurring in the floodplains of Krumovitsa River and its tributaries, the existing terrain and the co-existence of plateau-shaped, abrasion, and accumulative landforms.

Soil stability depends on the soil solution reaction, on the content of clay and humus, which determine the mobility of materials, their ability to move from the soil into other environments, and the capacity of the soil to absorb and retain the pollutants deposited on its surface. According to these criteria, the soils are characterized by a variable stability depending on the specific characteristics.

Apart from these characteristics, the evaluation of soil stability within the potential area of influence of the project should be based also on the relatively elevated background levels of the naturally occurring heavy metals and metalloids in the soils in the area including some parts of the project site. This requires the soils to be classified as sensitive to anthropogenic impacts.

The soils at Adá Tepe have elevated background levels of heavy metals, which should be kept in mind when earth material is excavated, moved and stockpiled in the designated areas during project operation. It is of practical importance to ensure that the soil is re-used for rehabilitation. Its use for agricultural rehabilitation will cause pollution of the agricultural crops due to the elevated levels of heavy metals in it. Soils with high levels of heavy metals and arsenic are primarily appropriate for forest land rehabilitation, which is proposed in the project.

4.2. Land and Soil Derogation Impact Assessment

The entire area required for the implementation of the proposed development under Option 1 is state controlled forest fund land represented by leached cinnamon forest soils and shallow soils (rendzinas).

The project also considers Option 2, which in addition to the forestry fund lands requires another 52 ha of municipal and private lands (for the construction of a TMF and a water storage dam).

The land requirements under each option are shown in the Table V.4.2-1 below:

Table V.4.2-1

Item	Elements of the Investment Project Proposal	Land Requirement (ha)	
		Option 1	**Option 2**
1	Open pit (Ada Tepe)	17	17
2	ROM ore pad	3	3
3	Process Plant	6	
	A gold processing facility – 2 ha;		2
4	Integrated Mine Waste Facility	41	-
5	Flotation TMF	-	45
6	Waste rock stockpile	-	44
7	Soil Stockpile	2	2
8	Raw and process water reservoir and collecting sumps	4	1
9	Roads	12	15
10	Water storage dam	-	7
	Total	85	136

The data suggests what physical damage will be caused to the soils in the area after the start of project implementation. The negative impacts will be continuous and cannot specifically be time-bound. The overburden removal will go in parallel with the construction of the stage-1 roads and facilities: offices, a workshop, etc., i.e. the entire area will become a big construction site. The commencement of ore production will also mark the beginning of the construction of the low-grade ore stockpile, the waste rock stockpile (under Option 2) and the soil stockpile.

Until mine closure, the impact on the soils in the project area will continue to be direct and irreversible, while the impact on the surrounding lands will be indirect.

The selected mineral resource mining method involves extraction of ore for subsequent downstream processing. The mining operation will result in complete anthropogenisation of the site. The development and extraction of the mineral resource will strongly transform the landscape and seriously affect the soil resources within the project footprint. The mining operation will have a negative impact on the soil cover, which is mechanical disturbance of the soil profile across an area of 17 ha (the open pit footprint). A mined void will be created, where the most extensive damage will occur. The excavation will be deep, permanent and irreversible. The soil profile, the overburden and the reserves will be extracted and the soils will be stockpiled for re-use during project closure.

The construction of the remaining facilities: the process plant, the IMWF and the roads, will additionally damage the soils across an area of 64 ha (which will be rehabilitated after cessation of operations).

The direct impacts over the project preparation and operation stages will involve:

Removal: Physical disturbance of the soil genetic profile as a result of the topsoil removal and the related losses in terms of quality and quantity. Topsoil layers are generally low in humus and very shallow (less than 10 cm) over the areas to be affected by the operations; therefore, the subsoil layers will also be stripped to ensure sufficient stock of soil materials to meet closure requirements. The total amount of soil materials is about 150,000 m^3.

Stockpiling and Disposal: Related to the construction of the IMWF. Mine rock will be co-disposed with the dewatered process waste (tailings) under Option 1.

A soil stockpile with an area of 2 ha will be set up near the Ada Tepe open pit. It will be used to stockpile the soil material removed from the open pit, process plant and IMWF areas. This soil material contains elevated levels of arsenic and heavy metals above the maximum allowable concentrations ("MAC") and therefore will be used for forest rehabilitation only. Following topsoil deposition, a deep-root vegetation cover will be established because the soil material will have to be stored for a period of more than three years.

Assessment of Impacts during Project Construction

- ***Area of impact:*** Direct impact of the project causing destruction of the original soil cover across 85 ha of forest lands (on Ada Tepe). Construction works will continue during project operation. Therefore, the impacts cannot clearly be defined as construction-related and operation-related impacts. The impact on soils at the beginning of construction will comprise mainly direct damage of agricultural soils and lands and dust emitted from earthworks, transport and construction. The soil materials will be stockpiled for subsequent re-use for rehabilitation purposes in accordance with the requirements under the EPA.
- ***Severity of impact:*** Significant in terms of impacted area.
- ***Duration of impact:*** The direct impacts will be clearly visible during the first stage of project construction and operation as a result of soil removal and stockpiling, while subsequent pit development will have an indirect impact caused by dust and gas emissions.
- ***Occurrence of impact:*** During construction, the impact will occur within the shift work hours based on a 2-shift schedule (16 work hours a day).
- ***Cumulative and synergistic impacts on the environment:***

Cumulative impacts may be expected from the dust emissions during deep earthworks. No high heavy metal or arsenic concentrations have been established in the rock material; however, the concentrations are elevated in the the soil particulate matter and in the adjacent lands and soils. Synergistic impacts on the environment are not expected.

4.3. Sources of Soil Pollution Impact Assessment

The mine operations will affect the soils through ground-level (ASL) pollution with and subsequent deposition of dust and harmful substances.

Deposition of Dust:

- From mining (dust emissions of short duration and small impact radius);

- During stockpiling (the geologic materials normally have sufficient moisture content and such an impact could be expected only in the dry months – small impact radius);

- Soil pollution from open line sources (pit haulage roads) - small impact radius, mostly on both sides of the roads;

- Dust emissions from mining and stockpiling operations do not differ in chemical composition from the soil parent materials in the region and therefore they do not create any risk of altering the local soil properties.

Sources of Air Pollution and Deposition of Pollutants on Vegetation

During project construction, the site will generate only fugitive emissions from the following operations:

- excavation;

- earth backfilling;

- development of temporary haul roads situated at the side of the pit and forming ramps up to the ROM ore pad and the mine rock disposal facility, whose surfaces are graded, cleared and topped with gravel and crushed rock;

- loading, haulage, unloading and disposal of solid waste from the construction process;

- construction of a soil stockpile, ROM ore pad and the IMWF;

- construction of a concentrator plant and a crushing plant. The sources of fugitive emissions at the phase of preparation of operational work areas include: construction works, which emit dust of various particle size from the inert material; and internal combustion engines of the project equipment, which will emit exhaust gas and soot during the construction phase.

The harmful substances that will be generated by the mining operations will include: - dust emissions of various particle size (including PM_{10}) from earthworks (manual and mechanised). Depending on the chemical composition of the mineable rock, the particulate matter may contain different levels of silica, aluminum dioxide, magnesium oxide, calcium oxide and iron oxide. At the same time, the equipment operation will generate typical exhaust gases such as: nitrogen oxides, carbon oxide, sulfur dioxide, non-methane volatile organic compounds (NMVOC), soot, heavy metals, polycyclic aromatic hydrocarbons (PAH), persistent organic pollutants (POP), polychlorinated biphenyls (PCB), etc.

Assessment of the impact of air pollution on vegetation. Significance of the Impact

The estimated ambient concentrations of nitrogen and sulphur oxides during mining are comparable with the range of the regulated limit of vegetation exposure to nitrogen oxide (30 $\mu g/m^3$) based on a 1 year average, and below the regulated limit for natural ecosystems exposure to sulphur dioxide (20 $\mu g/m^3$) for one calendar year and the next winter period. Total deposited dust emissions will have a localised impact on the air as they disperse at short distances from the source at a high gravity deposition rate and small release height. Those sources may impact vegetation that is within a certain distance. Dust emissions do not differ in chemical composition from the soil parent materials in the region and therefore they do not create any risk of altering the local soil properties and fertility.

Mining:

Area of impact: The impact on the ASL quality will be direct at Ada Tepe (around operational areas) but on a local scale;

Severity of impact: moderate (medium); *Duration of impact*: over project life;

Occurrence of impact: continuous, within the day, 330 work days per annum;

Cumulative impact – none expected.

Blasting:

Area of impact: Direct air impact on the minesite and the adjacent areas in the wind direction. Indirect impact on soils on a local scale – occasionally, along the path of the blasting plume.

Severity of impact: Moderate.

Duration of impact: Over the term of the concession, during blasting operations;

Occurrence of impact: Occasional Instant release of pollutants, twice per week, 12 months per year.

Cumulative impact – none expected.

Assessment of the Impact from Air Pollution on the Lands Adjacent to the Minesite

The Ada Tepe operations will have an indirect impact on the soils from dust emissions in the ASL and subsequent dust deposition, and from nitrogen oxides emissions in the air. The limits for exposure of natural ecosystems to sulphur oxides are not expected to be exceeded.

Mining:

The obtained results and forecast models demonstrate that the zones where the deposition of particulate matter from the mining operations will exceed the limits for surface pollution of open areas will be confined to the operational areas.

The impact on the ASL quality will be direct within the Ada Tepe area, especially in immediate proximity to the operational areas, but on a local scale. An indirect impact is expected on the soils from the deposition of particulate matter around and between operational areas (for PM_{10}), which will exceed the total dust emission standards for open areas.

Blasting:

Coarser particulates may have a negative impact as they deposit on the vegetation along the path of the blasting plume. During blasting (twice per week), the isolines of ASL downwind (north to south) dispersion of particulate matter (PM_{10}) concentrations twice per week are up to 0.12 mg/m³ (corresponding to 350 mg/m² of total dust per 24 hours - maximum allowable surface pollution of open areas under art.16 of Regulation 2/1998 on Maximum Allowable Air Emissions (Concentrations in Waste Gases) of Harmful Substances Emitted from Static Sources).

Impact Assessment

- ***Area of impact:*** A total of 85 ha of soils will be directly affected by earthworks, dust and gas emissions and change of land use designation as part of the project implementation (lands disturbed by mining and processing operations). The area of potential indirect impact (e.g. from dust and gas emissions) around the operational sites can also be added.
- ***Severity of impact:*** significant - the open pit development will alter the surface profile by converting a positive landscape form into a negative one over the mine life period of 9 years. The low-grade ore and waste rock stockpiles will create new positive landforms. After the mine closure, these changes in the landscape, soil and basement rocks will be utilised as forest land.
- ***Duration of the impact:*** over the mining and processing stage.
- ***Occurrence of impact****:* During operation, the impact will occur within the shift work hours based on a 3-shift schedule.
- ***Cumulative and synergistic impacts on the environment:*** Reduction of the ground level, pollution of surrounding lands with non-toxic particulate matter, alteration of the water regime and increased erosion until the beginning of biological rehabilitation, changing of the existing land use. A successful and viable biological rehabilitation may convert the disturbed lands into an environmentally more valuable landscape.

Synergistic impacts on the environment are not expected.

4.4. Assessment of the planned closure activities

The decommissioning and rehabilitation of the mine operation can be successfully achieved in a manner that satisfies the following objectives:

- Establishment of a beneficial land afteruse,
- Mitigation or elimination of environmental damages and promotion of sustainable environmental development;
- Minimization of any adverse social and economic impact.

The long-term objective of the closure strategy is that BMM EAD leaves the site in a condition that meets the following criteria:

- Physical stability – any remaining structures must not be an unacceptable hazard to public health or safety, or to the immediate environment;
- Chemical stability – any remaining materials must not be a hazard to future users of the site, or to the public health, or to the immediate environment; and
- Biological stability that enables establishment of an appropriate land-use that is harmonised with the adjacent areas and with the needs and desires of the community.

A plan for closure of the open pit, the ore processing plant, the IMWF, the ancillary facilities and unnecessary infrastructure will be prepared by BMM EAD together with the construction and operation designs. In order to assess the requirements of stakeholders (principally, the local community), it is envisaged that consultation will be carried out with appropriate community representatives prior to the development of the Closure Plan.

The physical characteristics of the site that influence the selection of an after-use are the final landforms that can be achieved and the quality and quantity of soils (or soil making material) available into which any vegetation cover would be established. Within any particular site these factors may vary, e.g. steep slopes preclude most productive after use whilst more gentle slopes impose no such restriction.

Soils are often a limitation in the closure of such sites. This lack of soils may require the use of soil making materials other than topsoils. The quality of the available materials will therefore have a major influence on the potential use and will limit the types of vegetation that can be established and sustained without excessive maintenance.

Mining - open pit

It is proposed that the following should be adopted for the closure of the open pit:

- The final pit walls and slope gradients should ensure safety and stability;
- Technical and biological rehabilitation of the open pit site;
- Continuous monitoring of the quality of surface and groundwater flows to assist in the design of mitigation measures;
- Environmentally sound use ensured by means of all necessary engineering and drainage facilities, and suitable vegetation.

Different options for the open pit closure and its incorporation into the surrounding environment will be considered and discussed during the project operation, consistent with the requirements and wishes of the local community and the scope and objectives of protection set for the East Rhodopes Protected Area.

Ore processing plant and infrastructure

Surface installations and foundations will be deconstructed where necessary and removed from the site. The surface of the process plant area will be reshaped and revegetated as appropriate to the surroundings and to the proposed end use of the site at that time. Alternatively, buildings, roads and other infrastructure may be retained as required for any further end-use.

Integrated Mine Waste Facility

The proposed mining waste disposal method will allow for phased out closure and rehabilitation of the facility during the operation stage.

The mine rock mostly comprises quarz and clay, with only insignificant levels of sulphide minerals, which classifies it as non-acid generating. The acid base accounting and net acid generating tests conducted on the ore processing tailings characterise this material as non-acid generating, too.

The outer slopes of the facility will be rehabilitated immediately after their construction. This rehabilitation will allow planting of a vegetation cover that will minimise dust emissions, erosion and visual impacts.

The closure and rehabilitation of the open pit, the ROM ore pad, the ore processing plant, the infrastructure, the IMWF or the rock stockpile and the TMF will be completed within 5 years after shut-down of operations. The project considers an aftercare period of 20 years or another agreed period according to the final closure plan approved by the competent Bulgarian authority.

Area of impact: The area of impact at the project closure stage will depend on the Final Closure Plan, which will require deconstruction of all plant and depreciated buildings and facilities, and rehabilitation of some of the on-site and site access roads. Other road links that can be incorporated in the local road network may be upgraded to good condition suitable for use by the local communities.

Severity of impact: The impacts will gradually be mitigated and the lands and soils in the region will be rehabilitated within a five year period.

Duration of impact: Five to ten years after shutdown of operations.

Occurrence of impact*:* Continuous during site closure and land rehabilitation.

Cumulative and synergistic impacts on the environment: Progressive rehabilitation of soil cover and affected land in the area.

Conclusions:

➢ ***Project construction***

Construction works among all other factors under consideration will have the greatest negative impact on the soils due to the long-term land occupation and use. This impact is typical for any construction project. The land cannot be used as a forestry fund while the mining and processing facilities exist. The impact, however, will be reversed after their closure. The implementation of an appropriate rehabilitation program can advance project rehabilitation.

➢ ***Project Operation***

Removal of forest soils will continue during pit development and operation. The removed soil material will be stockpiled on a dedicated soil stockpile for subsequent re-use. Dust and gas emissions from blasting and haulage operations may also have an impact. If the proposed process designs, which ensure minimum negative impact on the environment, are observed, the dust and gas emissions, wastewater and solid waste are expected to have minimum impact on the soils.

➢ ***Project Closure and Rehabilitation***

The lands occupied by mine and construction operations will be rehabilitated after shutdown of operations and therefore no negative impact on the soils is anticipated. Technical and biological rehabilitation will be implemented. The soil material stockpiled over the life of the mine should be re-used selectively due to the elevated levels of heavy metals in it. These soils are suitable only for reforestation. Suitable and resilient tree species should be planted to ensure continuous restoration of the soil forming process and play important soil protection, anti-erosion, and social functions.

All site closure activities specified in the project have the objective to ensure successful rehabilitation of the environment including soils.

5. Flora and Fauna

5.1. Assessment of the Project Impacts on the Vegetation

Construction

The implementation of the project, which includes development of an open pit and construction of a processing plant and other project facilities, will have an impact on the flora resulting in reduction of the floral diversity across an area of some 85 ha under Option 1 and approximately 136 ha under Option 2.

Item	Elements of the Investment Project Proposal	Land Requirement (ha)	
		Option 1	Option 2
1	Open pit (Ada Tepe)	17	17
2	ROM ore pad	3	3
3	Flotation plant/Dore gold processing facility	6	2
4	Integrated Mine Waste Facility	41	-
5	Flotation TMF	-	45
6	Waste rock stockpile	-	44
7	Soil Stockpile	2	2
8	Raw and process water reservoir and collecting sumps	4	1
9	Roads	12	15
10	Water storage dam	-	7
	Total	**85**	**136**

The impact on the vegetation during project construction will be from the clearing of planted forest communities and mixed derivative deciduous communities. Derivative and secondary brush and grass micro formations consisting mostly of widespread mobile and secondary ruderal species will be destroyed. The affected vegetation is renewable.

According to the forest development plan of the Krumovgrad State Forestry Board (2008), the project area includes the following sections:

- section 600 with a total area of 62,3 ha and a resource of 7,660 m^3;
- section 601 with a total area of 70.9 ha and a resource of 11,320 m^3;
- section 629 with a total area of 79.6 ha and a resource of 8,360 m^3;
- section 630 with a total area of 59.7 ha and a resource of 7,805 m^3.

The construction of the project facilities will affect the following sections and sub-sections:

Item	**Elements of the Investment Project Proposal**	**Affected sections and sub-sections vegetation composition**	
		Option 1	**Option 2**
1	Open pit (Ada Tepe)	Section 600 Sub-sections: г, д, е, ж, з, и, к Austrian pine, Italian oak, oriental hornbeam, acacia, Sessile oak, Scots pine, pubescent oak	Section 600 Subsections: г, д, е, ж, з, и, к Austrian pine, Italian oak, oriental hornbeam, acacia, Sessile oak, Scots pine, pubescent oak
2	ROM ore pad	Section 629 Sub-section - л Austrian pine, Italian oak, acacia	Section 629 Sub-section - м Austrian pine, Italian oak
3	Process Plant	Section 629 Sub-section - н Austrian pine, Italian oak, oriental hornbeam, gumarabic acacia	Section 601 Subsections: б, в Austrian pine, Italian oak, oriental hornbeam, Sessile oak, acacia
4	Integrated Mine Waste Facility	Section 629 Subsections: к, л, м, н, п, с, т, у, ф Austrian pine, Italian oak, oriental hornbeam, gumarabic acacia, acacia	
5	Flotation TMF		Outside forest lands
6	Waste rock stockpile		Section 629 Subsections: к, л, м, н, п, с, т, у, ф Austrian pine, Italian oak, oriental hornbeam, gumarabic acacia, acacia
7	Soil Stockpile	Section 600 Sub-section - е, ж Austrian pine, Italian oak, acacia	Section 600 Sub-section - е, ж Austrian pine, Italian oak, acacia
8	Raw and process water reservoir and collecting sumps	Section 600 Sub-section - ж Austrian pine, Italian oak, acacia	Section 600 Sub-section - н Italian oak, pubescent oak, oriental hornbeam
9	Water storage dam		Section 630 Subsections: б Italian oak, Austrian pine, oriental hornbeam

Secondary forest ecosystems formed through reforestation are mainly affected. Derivative forest ecosystems formed during anthropogenic impact are affected to a lesser extent. The vegetation composition of the affected forest lands is dominated by secondary forest ecosystems of Austrian pine and secondary derivative forest ecosystems of Italian oak, Austrian pine and acacia.

The impact will be caused by the clearing of vegetation at the designated construction sites. The impact is assessed as significant.

The natural habitat types that are subject to protection in the East Rhodopes Protected Area and occur in the project area are:

91MO Pannonian-Balkanic Turkey Oak and Sessile Oak Forests. These are sprouting type habitats formed as a result of natural regeneration of oak species within the Austrian pine communities. They mainly occur in the lower parts of Ada Tepe, where the IMWF under Option 1 will be sited. Another small portion of the habitat is observed within the project footprint of the water storage dam (Option 2). Given the small areas affected by those sites, the impact is defined as negligible.

5110 Bushes of Juniperus spp. A red juniper community occupies a small area within the project footprint of the water storage dam (Option 2). The community is not a typical one in terms of species composition and structure. The impact will be negligible if the water storage dam is constructed.

6220 Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea. The habitat occupies a small abandoned agricultural area within the project footprint of the water storage dam (Option 2). The community has formed a common cover with the red juniper.

6510 Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis). The habitat is identified within the project footprint of the water storage dam (Option 2).

The Eastern European Orchid (*Himantoglossum caprinum*) has not been found within the project footprint.

Possible negative impacts on species and habitats:

Anticipated impacts on habitats:

- Direct destruction of habitat 91MO during the construction of the IMWF (Option 1). Negligible impact;
- Direct destruction of habitats 91MO and 6220 during project construction (Option 2). Negligible impact;
- Direct destruction of habitat 6510 (Option 2). Significant impact;
- Entry of invasive plant species and alteration of the species composition of habitats mainly due to an higher level of urbanization of this part of the area.

Impact Assessment:

Area of impact: Direct impact on plant habitats on a limited scale.
Severity of impact: Moderate.
Duration of impact: During project construction.
Occurrence of impact: A one-off impact during project construction.
Cumulative impact – none expected.

The potential impact on the vegetation in the surrounding areas will mainly be caused by the emission of air pollutants, which will include dust from construction works, open pit mining and site road transport. The content of some heavy metals in the soils that will be removed and stockpiled for re-use are above the background levels. These levels are a significant factor in relation to their future re-use but not in relation to soil dust as a potential pollutant.

Sources of Air Pollution and Deposition of Pollutants on Vegetation

During project construction, the site will generate only fugitive emissions from the following operations:

- excavation;
- earth backfilling;
- development of temporary haul roads situated at the side of the pit and forming ramps up to the ROM ore pad and the mine rock disposal facility, whose surfaces are graded, cleared and topped with gravel and crushed rock;

- loading, haulage, unloading and disposal of solid waste from the construction process;
- construction of soil stockpiles, ROM ore pad and the respective facilities for mine waste disposal;
- construction of a concentrator plant and a crushing plant. The sources of fugitive emissions at the phase of preparation of operational work areas include: construction works, which emit dust of various particle size from the inert material; and internal combustion engines of the project equipment, which will emit exhaust gas and soot during the construction phase.

The harmful substances that will be generated by the mining operations will include: dust emissions of various particle size (including PM_{10}) from earthworks (manual and mechanised). Depending on the chemical composition of the mineable rock, the particulate matter may contain different levels of silica, aluminum dioxide, magnesium oxide, calcium oxide and iron oxide. At the same time, the equipment operation will generate typical exhaust gases such as: nitrogen oxides, carbon oxide, sulfur dioxide, non-methane volatile organic compounds (NMVOC), soot, heavy metals, polycyclic aromatic hydrocarbons (PAH), persistent organic pollutants (POP), polychlorinated biphenyls (PCB), etc.

Assessment of the impact of air pollution on vegetation. Significance of the Impact

The estimated ambient concentrations of nitrogen and sulphur oxides during mining are comparable with the range of the regulated limit of vegetation exposure to nitrogen oxide (30 $\mu g/m^3$) based on a 1 year average, and below the regulated limit for natural ecosystems exposure to sulphur dioxide (20 $\mu g/m^3$) for one calendar year and the next winter period. Total deposited dust emissions will have a localised impact on the air as they disperse at short distances from the source at a high gravity deposition rate and small release height. Those sources may impact vegetation that is within a certain distance. Dust emissions do not differ in chemical composition from the soil parent materials in the region and therefore they do not create any risk of modifying the local vegetation at the single organism level.

<u>Mining:</u>

Area of impact: The impact on the ASL quality will be direct at Ada Tepe and surrounding areas (around operational areas) but on a local scale;

Severity of impact: moderate (medium); *Duration of impact*: over project life;

Occurrence of impact: continuous, within the day, 360 work days per annum;

Cumulative impact – none expected.

<u>Blasting:</u>

Area of impact: Direct air impact on the minesite and the adjacent areas immediately downwind of the operational areas. Indirect impact on vegetation on a local scale – occasionally, along the path of the blasting plume.

Severity of impact: Moderate.

Duration of impact: Over the project life, during blasting operations;

Occurrence of impact: Occasional Instant release of pollutants, twice per week, 12 months per year.

Cumulative impact – none expected.

Conclusions:

The analysis of the current state of ecosystems shows that most of them have been subject to processes of degradation from agricultural use of forests, uprooting of forests for agricultural use of lands, soil erosion, urbanization of areas, etc.

Depending on the degree of deviation from the climax condition, the present ecosystems that form parts of various succession rows are of varying resilience to additional negative impacts.

Secondary derivative and artificial forest ecosystems as well as derivative grass and brush ecosystems prevail in the exploration area in the Ada tepe site.

Some natural habitat types that are within the scope of protection in the East Rhodopes Protected Area will be affected to a minor extent. These impacts will be minimized by implementing Option 1, which will only affect the priority 91MO habitat.

No plant species protected by the law or in protected areas will be affected.

During the construction of the sites under the project and the development of the auriferous ore deposit, the vegetation resources in the project areas will be used and partially affected. The vegetation can be restored after cessation of operations and decommissioning of project facilities. This requires preparation of a detailed Closure Plan implemented in stages during the construction, operation and closure of the project.

Operation

The immediate direct impact on the remaining elements of vegetation will continue during the operation of the open pit and the IMWF. The potential impact on the vegetation in the surrounding areas will mainly be from the emission of airborne particulate matter and gases. If the process designs considered in the project are strictly observed, where the content of harmful substances in air and water will be within the applicable standards, no negative impact on the flora and vegetation in the areas adjacent to the project is expected.

Conclusions

If the process designs considered in the project are strictly observed, where the content of harmful substances in air and water will be within the applicable standards, no negative impact on the flora and vegetation in the areas adjacent to the project is expected during project operation.

Closure

The timely technical and biological rehabilitation of the area during the closure stage of the project is a condition for the successful revegetation of the project footprint. There is a potential risk for direct and indirect impacts on the vegetation and the surrounding areas during site closure. In this regard, a potential risk is the re-use of soils removed during the construction phase that have elevated background levels of heavy metals. Therefore, controlled use of soil materials for bilogical rehabilitation will be required. This requires strict observance of the detailed Closure Plan, which will be implemented in stages during the construction, operation and closure of the project.

Conclusions:

At the project closure stage, the soils recovered from operational areas should be used only for rehabilitation of forest fund land.

5.2. Assessment of the Project Impacts on the Animal Life

Construction

Invertebrates

The changes to the vegetation will cause abrupt changes to the invertebrate fauna. These changes will result from dramatic habitat modifications caused by the clearing of tree and grass vegetation, and replacement of the edificatory species after the rehabilitation.

The changes in the soil composition will affect the edaphic conditions of the environment and the geobiont, stratobiont and epigeal invertebrate faunas. This stage will include the soil removal and the initial pit development. The habitats within these footprints will be destroyed. The rehabilitation of these areas is a difficult and slow process requiring continuous monitoring and consultations with experts on the affected groups of the animals.

Changes in the invertebrate fauna in the soil stockpile footprint will also occur.

Vertebrates

Since the construction phase will impact the land surface and strata, as well as the vegetation, including forests, the habitats of the species inhabiting the ground surface, the strata underneath and the vegetation will change. Some individuals of small-size and slow-moving species such as small rodents, lizards and ground nesting bird species may also be affected.

Parallel to destruction of plant and animal systems, the initial development of the open pit and any sites associated with its operation will destroy the soil systems and the basement rock in some parts of the ecosystems. The damage of these ecosystems will be permanent but on a small territory and without a cumulative effect. New ecosystems may form after the closure of the operational sites.

Pisces

There are no potentially threatened river sections because the vehicles will not drive across the Krumovitsa River system according to the Traffic Plan of the company.

Amphibians and reptiles

Among all species that are subject to protection in the East Rhodopes BG0001032 Protected Site, two species of tortoises will be directly affected - the Hermann's tortoise (Testudo hermanni) and the Mediterranean Spur Thigh Tortoise (Testudo graeca). Tortoises inhabit the whole area of the project site.

Yellow-bellied toad (Bombina variegata) - that species occurs at the project site. It is almost exclusively found in troughs of fountains and spill puddles around them. Rapidly multiplying species widespread in the region and throughout the country.

Birds

The protected species whose habitats are likely to be affected are:

Short-toed Eagle /*Circaetus galicus*/. The species was found to nest at the project site during the 2005-2006 monitoring. The SE hillside of Ada Tepe was the nesting territory of one pair in 2005. However, that species was not observed to nest there in 2006. The SW hillside of Ada Tepe is a suitable nesting habitat despite the fact that the species did not nest there back in 2006, 2007 and 2008, and the open areas are the feeding ground of that species. Construction of stockpiles on the southern hillside of Ada Tepe would destroy the nesting habitat of the species.

Black Kite /*Milvus migrans*/. The species has been found to breed within BG0002012 Krumovitsa Protected Area - one pair. The species was not identified in the project area during the 2005-2006 monitoring campaign; however, a black kite individual was observed flying high above the eastern hillside of Ada Tepe during field observations in 2008. The project is not expected to have a direct negative impact on that species due to the small number and sporadic occurrence of black kites in the area where gold mining will take place.

European Roller /*Coracias garrulus*/. The European Roller is a protected nesting species within BG0002012 Krumovitsa Protected Area and it is observed to nest in the project site area. As the only nesting pair found in the project site area is outside the project infrastructure footprint, the expected impact on that species is negligible.

European Nightjar /*Caprimulgus europaeus*/. It is a protected species within BG0002012 Krumovitsa Protected Area and is observed to nest in the project site area. One nest was found on the eastern hillside of Ada Tepe during the 2005-2006 monitoring campaign. Not found during the field studies back in 2008. Considering the small number of individuals occurring in the project area, the project development is expected to have a minimal negative impact on that species.

Barred Warbler /*Sylvia nisoria*/. It inhabits shrub and brush communities, scattered groups of trees with many shrubs in open areas and grazing lands around the Ada Tepe hill. No significant impact on that species is expected.

Red-backed Shrike /*Lanius collurio*/. Similar to the above species, it also inhabits shrub and brush communities and scattered groups of trees with many shrubs in open areas around the Ada Tepe hill and in the Krumovitsa valley. No significant impact on that species is expected.

The anticipated impact at national level is negligible for the above species.

Mammals

No habitats of protected species will be affected (excluding bats).

Bats - the following impacts are anticipated during the project implementation:

- Direct destruction of habitats and shelters: This will mainly affect the Greater Horseshoe Bat *(Rhinolophus ferrumequinum).* The pit development will destroy the summer underground shelter of that species.

- Interruption of migratory corridors - not anticipated.

- The construction of stockpiles will derogate the habitats (including deterioration during the initial closure period after project decommissioning) in terms of their food potential for bats because that will affect the diversity and abundance of insects they feed on. Currently, these areas represent a minor portion of the feeding areas of the observed bats.

- The fragmentation of bats habitats will be negligible considering the small project footprint and the abundance of favorable bat habitats and shelters in the protected site.

- - The overall impact will be insignificant since four out of the five bat species found in the project area have been observed very rarely.

Conclusions:

The implementation of the project involves partial or complete transformation of a number of ecosystems, which will cause reduction of the ecosystem diversity in the project area.

The overburden removal work in the open pit will destroy the soil systems and the rock base of the existing ecosystems. Ecosystem degradation in these areas will be permanent but on a small territory and without a cumulative effect. New ecosystems may form after the closure of the operational sites.

The biotic components of the ecosystems within the footprints of the waste rock stockpile, the TMF, the soil stockpiles and the construction sites will be disturbed to a lesser or greater extent. The disturbance of these ecosystems will be permanent and new ecosystems may form after the closure of the operational sites.

Operation

Invertebrates

Changes in the local fauna within the IMWF footprint will occur. The areas where soil material will be removed and stockpiled will be most affected.

Emergencies or natural disasters may also cause changes in the fauna and the aquatic zoocenoses.

Vertebrates

The forest type habitat in the Ada Tepe area will be affected. It will be altered strongly and will be transformed into a rocky type habitat although a relatively small one.

As noted above, the elevated background levels of heavy metals in the soils removed prior to construction and operation will be an important factor for their future re-use but not a risk of pollution of ecosustems. The practices considered in the project (soil removal on stockpiles that will be vegetated) and the low pollution potential of the soils and the mine wastes will minimise the potential for significant negative impacts.

Closure

Invertebrates

The edificatory plant species will be replaced after the rehabilitation. This is not a typical succession, which will not promote restoration of the habitats.

The areas where soil material will be removed and stockpiled will be most affected. The initial pit development will require removal of not only soil but also rock material, which will also be stockpiled.

Such changes are usually followed by occurrence of pioneer invertebrate species and communities that are typical of the initial stages of succession.

Vertebrates

The closure stage will include technical and biological rehabilitation of the minesite. The waste rock stockpile site and the disturbed portion of Ada Tepe should be subject to forest-type rehabilitation. A well-developed cover of introduced tree vegetation will gradually transform the rehabilitated operational areas into typical forest habitats, which will have a positive effect on the animal species inhabiting such habitats, and at a certain stage these restored habitats will be re-colonized by typical local species.

Generally, the total project footprint area is not large. Compared to the area surrounding the town of Krumovgrad, the affected site area is a very small percentage. The shape, size and location of the sites demonstrate that they will not obstruct the migrations of the different non-flying animal species and will just impede the movement of some of the smaller species to some extent.

The project operational sites are potentially reproductive habitats of 5 species listed in Annex II to the Biodiversity Act but only one of them, the Middle Spotted Woodpecker, is really rare but not at risk of becoming extinct in Bulgaria.

5.3. Assessment of the Project Impacts on Elements of the National Environmetal Network. Protected Areas.

Construction

The project minesite is located some 3 km south of the town of Krumovgrad. The closest protected sites are: a sage habitat in the Daima area - some 6 km southwest of Krumovgrad, and a venerable Thracian oak - some 6.5-7 km also southwest of Krumovgrad.

Given the remoteness of the production facilities from the existing protected sites and key ornithological territories, no direct impacts are possible during the stage of construction.

Operation

The only potential indirect effects are of accidental nature since the emissions in the air will be within the approved national and European standards and water pollution will not be allowed. The prevalent winds have a north component and transfer of harmful substances is possible only in a southern direction which is a beneficial factor with regard to the sites included in the network of the protected sites and key ornithological territories.

Closure

No actual impact is expected on the existing protected areas and key ornithological territories.

No direct impact is expected from the site on the existing network of protected territories both during the stage of construction and during its operation and closure.

No protected natural landmarks are located in proximity to the facilities. The Vulchi Dol Reservation, which hosts nesting habitats of two rare vulture species in the country (the Egyptian vulture (Neophron percnopterus) and the griffin vulture (Gips fulvus)), is located far north of the operational areas.

Indirect impacts on the protected areas and key ornithological territories are not likely (i.e. these would be accidental, if any) since the emissions in the air will be within the approved standards and water pollution will not be allowed.

The project area is located 6-7 km away from Gorna Kula Village, whose land is the southern border of the closest Krumovitsa KOT (key ornithological territory) that is declared by the Bulgarian Society for the Protection of Birds. The other two KOTs – Studen Kladenets and Byala Reka are located even farther from the site.

The project will be implemented outside the border of the proposed nature park.

National Environmetal Network

The site of the Krumovgrad Gold Project operated by Balkan Mineral and Mining EAD (BMM) is part of the East Rhodopes Protected Site, code: BG 0001032 under the Habitats Directive 92/43/EEC (Sites of Community Importance – SCIs). The BG0002012 Krumovitsa Protected Area under the Birds Directive 79/409/EEC (Special protected areas – SPAs) is in immediate proximity to the site.

An assessment of the compatibility of the proposed development with the conservation objectives of the protected sites has been completed in compliance with the provisions of art. 6 (3) and art. 6 (4) of the Directive 92/43/EEC, art. 31-34 of the Biodiversity Act and the Regulations on the Terms and Procedures for Assessment of the Compatibility of Plans, Programs, Projects and Investment Proposals with the Scope and Objectives of Protected Sites. The assessment results are presented in a separate report, which is an integral part of this Statement.

6. Wastes

The project proposal considers mining and processing of gold ores from the Ada Tepe prospect in the Khan Krum Deposit, Krumovgrad Municipality, District of Kardzhali

The project considers construction and operation of an open pit mine and a process plant for mining and processing of auriferous ores to gold-silver concentrate, an Integrated Mine Waste Facility (IMWF) and associated project infrastructure - roads, water and electrical supply services, storage facilities.

The wastes that will be generated over the construction and operation stages are described and classified with a code and name according to Appendix 1 to art. 5 par. 1 of

Regulation 3/01.04.2004 on Waste Classification jointly issued by the MOEW and MoH. (SG (2004).

6.1. Types and Amounts of Wastes that are Expected to be Generated during Project Construction and Operation Waste Classification

6.1.1. Wastes Generated during Project Construction

The construction of the project will involve different activities, which will generate different types of waste (hazardous, operational, construction and domestic wastes).

The main waste-generating activities to be involved in the construction works are:

- Construction of the infrastructure (access road from the existing road network, electrical supply and telecommunications) and its integration into the existing infrastructure in the area;
- Clearing of the grass and tree vegetation from the sites designated to accommodate the open-pit, the site roads, the mine waste facility, the ore processing plant;
- Removal and stockpiling of the soil cover for reuse during the closure stage;
- Construction of temporary office and storage facilities for the construction stage;
- Preliminary removal of overburden (containing no economic levels of gold) from Ada Tepe sufficient to provide construction material for the base of the IMWF and to enable commencement of the mining operations;
- Construction of the processing plant, offices, a mechanical workshop and other ancillary buildings;
- Installation of an abstraction well to meet process fresh water requirements;
- Preparation of the ROM ore pad area (ore stock pile).
- Roads between the open pit and the ROM ore pad, the gold-silver concentrate production facility (process plant) and the waste rock storage facility (an integrated mine waste facility ("IMWF") or a waste rock stockpile), including connections to the IMWF or the flotation TMF;
- Roads connecting the facilities on the process plant site.

A/ HAZARDOUS WASTES

Waste hydraulic oils

Waste hydraulic oils will be generated from routine or breakdown change of the oils of vehicles, mobile and construction equipment. Waste composition – petroleum products, high-molecular-weight hydrocarbons.

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

13 01 10* - Mineral-based non-chlorinated hydraulic oils

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification H 3-Б, H 6 and H 14

Estimated waste quantity – 2.5tpa

Mineral-based non-chlorinated engine, gear and lubricating oils

Waste engine and gear oils will be generated from routine or breakdown change of the oils of vehicles, mobile and construction equipment. Waste composition – petroleum products, high-molecular-weight hydrocarbons.

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

13 02 05* mineral-based non-chlorinated engine, gear and lubricating oils

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification Н 3-Б, Н 6 и Н 14

Estimated waste quantity – 1.6tpa

Oil filters

Waste oil filters will be generated from routine or breakdown changes of the oils of vehicles, mobile and construction equipment. Waste composition – petroleum products, high-molecular-weight hydrrocarbons and impregnated cellulose.

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

16 01 07* – Oil filters

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification Н 3-Б, Н 6 and Н 14

Estimated waste quantity – 0.045tpa

Brake fluids

Waste brake fluids will be generated from breakdown changes of brake fluids of vehicles and construction equipment.

Waste composition – petroleum products, high-molecular-weight hydrocarbons.

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

16 01 13* – Break fluids

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification Н 3-Б, Н 6 and Н 14

Estimated waste quantity – 0.065tpa

Antifreeze fluids

Waste antifreeze fluids will be generated from breakdown change of engine-cooling fluids of vehicles, mobile and construction equipment. Waste composition – ethylene glycol, additives

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

16 01 14* – Antifreeze fluids containing dangerous substances

16 01 15 – Antifreeze fluids other than those mentioned in 16 01 14*

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification Н 3-Б, Н 6 and Н 4

Estimated waste quantity – 0.25tpa

Batteries

The waste will be generated from replacement of discarded batteries of vehicles, mobile and construction equipment.

Waste composition – lead, sulphuric acid

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification Н 4-Б, Н 6 and Н 14

16 06 01* – Lead batteries

Estimated waste quantity – the number of those batteries is impossible to forecast.

Wiping cloths and protective clothing contaminated by dangerous substances

The waste will be generated from cleaning of vehicles, mobile and construction equipment and contamination of workwear of employees. Waste wiping cloths and clothing will be generated in the respective operational area of the pit. The wastes will be stored in steel drums in the area they are generated and kept there until sufficient amount is accumulated for removal and subsequent treatment.

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification H 14

15 02 02* - Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths,protective clothing contaminated by dangerous substances

Estimated waste quantity – 0.040tpa

B/ OPERATIONAL WASTE

Excess earth and rock material

Excess earth and rock material (rockfill, soil and stones) from the excavation of foundation pits for project buildings and process facilities will be stockpiled in a designated area and part of it will be re-used for backfilling of foundations. Non-reusable earth material will be stockpiled in a designated area and removed from the minesite by the owner of the wastes for disposal onto a landfill using the construction waste haulage route approved by the mayor of the municipality in accordance with art. 18 of the Waste Management Act.

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

17 05 04 – Soil and stones other than those mentioned in 17 05 03

Estimated waste quantity – 60m^3/total

Mixed construction waste

The construction of buildings and installation of equipment will generate concrete, bricks, tiles, ceramics, etc. Waste composition – bricks, concrete, tiles, mortar, etc.

Mixed construction wastes will be collected and removed from the minesite by the owner of the wastes (the project construction contractor) in accordance with the provisions of art. 18 par. 1 of the WMA and disposed of onto a landfill as directed by the local authorities in accordance with the provisions of art. 16 par. 3 item 4 and art. 19 of the WMA.

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

17 01 07 – Mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06

Estimated waste quantity – 20m^3/total

Iron and steel

Metal wastes – angle steel, pipes, construction steel etc. will be generated from project construction and process equipment installation.

The metal wastes generated during the constriction stage will be subject to separate collection and temporary storage in a designated area, and contract delivery to recycling companies certified under art. 37 of the WMA, registered under art. 12 of the WMA or licensed under art. 54 of the WMA as scrap metal traders, or holders of an IPPC Permit.

Waste composition - steel

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

17 04 05 – Iron and steel

Estimated waste quantity – 1.5t/total

Wood

Wood wastes will comprise discarded formwork from the construction of the foundations of the facilities and wood packaging of delivered equipment units and components for the new plant.

Waste composition - wood

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

17 02 01* – Wood

Estimated waste quantity – 2.2t/total

C/ Mining wastes from the open pit development

The development of the open pit and the construction of the mine waste storage facilities will generate typical mining wastes: topsoil and soil materials and mine rock from the overburden removal to access the orebody.

According to the provisions of the URA (art. 22 d, par. 3): Whenever a waste-generating activity is subject to an EIA under the Environment Protection Act, the waste management plan under art. 22c, par. 2 becomes an integral part of the Investment Project. In compliance with this requirement, BMM EAD has developed a Mining Waste Management Plan (Appendix 5).

The rock generated from the open-pit construction will be used for the construction of platforms/foundations of the mining waste facilities.

Dredging spoil

Topsoil will be removed during the initial stage of development of the open pit and the excavation works across the site for construction of buildings, infrastructure and process facilities.

Prior to construction, all areas for construction or mining will be stripped of topsoil, which will be stockpiled for further use over the closure and rehabilitation stage. Topsoil layers are generally low in humus and very shallow (less than 10 cm) over the areas to be affected by the operations; therefore, the subsoil layers will also be stripped to ensure sufficient stock of soil materials to meet closure requirements.

The estimated total volume of the stockpiled soil will be about 150,000 m^3 with a maximum stockpile height of 10 m according to the Bulgarian legal requirements. Following topsoil deposition, a deep-root vegetation cover will be established because the soil material will have to be stored for a period of more than three years.

Waste composition – topsoil, soil.

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

17 05 06 – Dredging spoil other than those mentioned 17 05 05

Estimated waste quantity – 150,000m^3, total for the open pit, process plant and associated infrastructure.

Waste Rock

Mine rock will be generated from the overburden removal to access the orebody. Overburden will be removed in a manner that ensures the stability of the open pit slopes and maximum compliance with the requirements for protection of the subsurface and surface environment. The mine rock will be utilized to construct the IMWF.

This material is classified as waste rock, which is removed to expose/access the ore body/reserves. It mostly consists of breccia conglomerates with occasional boulders of metamorphic rocks – amphibolites, gneiss and schists. The estimated tonnage that will be generated to fully access the ore body/reserves is 320,000t.

The waste classification is based on tits mineral composition, data from the Geological Report and laboratory tests. The mine rock is therefore classified as as a **non-hazardous, non-inert waste.**

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

01 01 01 - Waste from mineral metalliferous excavation (mine rock)

Estimated waste quantity– 320,000t, from open pit development to access the orebody.

D/ Solid municipal wastes

Municipal wastes will be generated over the construction stage of the project from the use of everyday items by the site construction and engineering workers. Municipal wastes will comprise waste packaging, Code 15.01, including:

- Paper and cardboard packaging, Code 15 01 01;
- Glass packaging, Code 15 01 07;
- Metallic packaging, Code 15 01 04;
- Plastic packaging, Code 15 01 02;

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

20 03 01 – Mixed municipal waste.

Estimated waste quantity – 0.35kg per worker per day

6.1.2. Wastes Generated during Project Operation Mine Wastes

6.1.2.1. Mine Wastes Generated during Project Operation

The project operation will generate typical mine wastes: mine rock from the open pit development and ore processing tailings from the process plant.

In compliance with the provisions of the URA (art. 22d par. 3), BMM EAD has developed a Mine Waste Management Plan (Appendix 5).

The mine rock from the Ada Tepe open pit and the flotation tailings from the process plant for production of gold-silver concentrate can, in compliance with the URA and the provisions of the *Regulation on the Specific Requirements to Mining Waste Management* (SG issue 10/2009), be classified as *non-hazardous, non-inert mining wastes""*.

Waste Rock

Waste rock will be generated from the overburden removal to access the mineable reserves for each year of open-pit operation. Overburden will be removed in a manner that ensures the stability of the open pit slopes and maximum compliance with the requirements for protection of the subsurface and surface environment. The mine rock from the development of the open pit will be utilized to construct the IMWF.

The rock material with no economic gold and silver values is classified as waste rock, which is generated in the process of exposure/access to the ore body. It mostly consists of breccia conglomerates with occasional boulders of metamorphic rocks – amphibolites, gneiss and schists. A total of 14,630,000 tons of waste rock are expected to be produced during the life of the Ada Tepe mine.

The waste classification is based on tits mineral composition, data from the Geological Report and laboratory tests.

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

01 01 01 - Waste from mineral metalliferous excavation (mine rock)

Estimated waste quantity – 14,630,000 tons

3. Flotation Waste (Tailings)

The final tailings will be thickened in a radial thickener to a final pulp density of 56% solids. A diluted flocculant solution will be added to the slurry to facilitate the settling of solids. The thickener overflow (supernatant water) will be pumped back into the process via a retention pond. The thickener underflow will be pumped into a tailings delivery pipeline for deposition either into an IMWF (Option 1) or into a TMF (Option 2).

The process (or flotation) tailings are the waste material rejected from the flotation plant after the recoverable valuable minerals have been extracted from the ore feed. About 7,235,000 tons of tailings are expected to be generated by the end of the project life.

The waste classification is based on tits mineral composition, data from the Geological Report and laboratory tests.

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

01 03 06 - Tailings other than those mentioned in 01 03 04 and 01 03 05

Estimated waste quantity: – 849,500 tpa

The detailed characterisation of the mining wastes is presented in the Waste Management Plan (Appendix 5). The waste characterisation and classification complies with the requirements under the Regulation on the Specific Requirements to Mining Waste Management (art. 10 par. 3, Appendix 1) and Directive 2006/21/EC on the Management of Waste from Extractive Industries, and EC Decision dated April 30, 2009, Tables V.6.1-1 and V.6.1-2..

Mineralogy of Mine Rock (% by weight)

Table V.6.1-1

Mineral	**Molecularformula**	**Fresh rock sample (wall zone)**	**Fresh host rock sample**	**Sample oxidized rock**	**Sample strongly oxidized rock**
Quartz	SiO_2	44.4	22.8	62.1	46.5
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	4.0	6.5	2.0	4.9
Potash feldspar	$KAlSi_3O_8$	28.7	8.4	11.5	33.1
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$		18.5		3.5
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$		21.1		
Pargsite	$NaCa_2(Mg_4Al)Si_6Al_2O_{22}(OH)_2$		1.4		
Kaolinite	$Al_2Si_2O_5(OH)_4$	8.8	5.0	15.3	8.6
Calcite	$CaCO_3$	0.7	14.0		
Ankerite	$Ca(Fe^{2+},Mg,Mn)(CO_3)_2$	11.8	1.6		
Goethite	$\alpha–Fe^{3+}O(OH)$			9.0	3.3
Pyrite	FeS_2	1.7	0.8		
Total		100.0	100.0	100.0	100.0

Mineralogy of Tailings

Table V.6.1-2

Mineral	Molecular formula	Flotation tailings from ore processing
Quartz	SiO_2	56
Phlogopite (rombic mica)	$KMg_3\,(Si_3A)lO_{10}(F,OH)_2$	23
Plagioclase	$(Na, Ca)(Si, Al)_4O_8$	17
Chlorite	$(Mg,Fe)_3\,(SiAl)_4O_{10}(OH)_{2.}$ $(Mg,Fe)_3(OH)_6$	3
Amphibole	$(Mg,Fe)_7\,Si_8O_{22}(OH)_2$	1
Total		100.0

Mining waste is classified as non-hazardous non-inert waste in terms of the risk to the environment and human health based on their composition and properties. That allows their co-disposal within a single footprint.

Based on the completed mining waste classification, the geotechnical properties of the facility, the site wide ground conditions, specific environmental conditions and proposed preventive measures and management of the facility, it is classified as a category B facility.

6.1.2.2. *Wastes from Gold-Silver Concentrate Production*

A/ HAZARDOUS WASTES

Waste engine, gear and lubricating oils

Waste engine, gear and lubricating oils will be generated from changes of the oils of process and mobile equipment. Composition – high-molecular-weight hydrocarbons.

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification H 3-Б and H 14

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

13 02 05* Mineral-based non-chlorinated engine, gear and lubricating oils

Estimated waste quantity – 3.5tpa

Waste hydraulic oils

Waste hydraulic oils will be generated from changes of the oils of hydraulic components of process and lifting equipment. Composition – high-molecular-weight hydrocarbons.

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification H 3-Б and H 14

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

13 01 10* - Mineral-based non-chlorinated hydraulic oils

Estimated waste quantity – 1.95tpa

Waste insulating and heat transmission oils

Waste mineral-based insulating and transformer oils will be generated from changes of insulating and heat transmission oils of transformers. Waste composition – petroleum products, high-molecular-weight hydrocarbons.

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification H 3-B, H 6 and H 14

Code under the waste categorization, Regulation 3/01.04.2004 of the MoEW and the MoH.

13 03 07* Mineral-based non-chlorinated insulating and heat transmission oils

Estimated waste quantity - 2 tons/once in 9 years

Lead batteries

The waste will be generated from replacement of discarded batteries of mobile and lifting equipment. Solid waste.

Waste composition – lead, sulphuric acid

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification H 5 and H 14

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

16 06 01* – Lead batteries

Estimated waste quantity – 1.75tpa

Fluorescent tubes and other mercury-containing waste

The waste will be generated from discarded mercury and luminescent lights used in the lighting systems across the site. Solid waste.

Composition – mercury.

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification H 6 and H 14

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

20 01 21* - Fluorescent tubes and other mercury-containing waste;

Estimated waste quantity – 0.025tpa

Packaging containing residues of dangerous substances

Multi-layer paper bag packaging of copper sulphate, plastic and metallic packaging contaminated by dangerous substances will be generated from the consumption of delivered ancillary materials (reagents)

Waste composition – hydrocarbons, plastic, cellulose, steel, etc.

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification H 3-B

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

15 01 10* – Packaging containing residual hazardous wastes or contaminated with hazardous waste;

Estimated waste quantity – 0.120tpa

Wiping cloths and protective clothing contaminated by dangerous substances

The waste will be generated from cleaning of process and ancillary equipment and contamination of workwear of employees during work. The wastes will be stored in steel drums in the area they are generated and kept there until sufficient amount is accumulated for removal and subsequent treatment.

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification H 14

15 02 02* - Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths,protective clothing contaminated by dangerous substances

Estimated waste quantity – 0.065tpa

Oil from oil/water separators

Oil from oil/water separators will be generated from the mud and oil trap in the car wash area.

Waste composition – petroleum products, високомолекулни въглеводороди.

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification H 3-B, H 6, H 14

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

13 05 06* – oil from oil/water separators

Estimated waste quantity – 1 ton

Interceptor sludges

Interceptor sludges will be generated from the mud and oil trap in the car wash area.

Waste composition – solid waste, suspended solids corresponding to tailings composition.

Properties under Appendix 2 to art. 6, par. 2, item. 1 of Regulation 3/01.04.2004 on Waste Classification H 14

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

13 05 03* – interceptor sludges

Estimated waste quantity – 5 tons

B/ OPERATIONAL WASTES

Dust from treatment of the exhaust from ore crushing

The operation of the jaw crusher dust collection system, which will be installed to ensure dust collection at the ore transfer points and treatment by a bag filter, will generate dust from the treatment of the crusher exhaust.

Composition – same as the gold ore composition

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

01 03 08 – dusty and powdery wastes other than those mentioned in 01 03 07

Estimated waste quantity – 150tpa

Dust bags

Worn filter fabrics will be generated from the replacement of the bag filters in the xanthate solution preparation area and the jaw crusher area.

Composition – fabrics.

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

15 02 03 - Adsorbents, filter materials, wiping cloths and protective clothing, other than those included under 15 02 02*

Estimated waste quantity – 0.150tpa

Scrap

Mixed metal wastes will be generated from replacement of discarded grinding steel and from the repairs and replacement of operational equipment, units and components or decommissioning of equipment and plant. The generated wastes will be subject to collection and temporary storage until sufficient amount is accumulated for contract delivery to recycling companies certified under art. 37 of the WMA, registered under art. 12 of the WMA or licensed under art. 54 of the WMA as scrap metal traders, or holders of IPPC Permit.

Waste composition – mixed ferrous and non-ferrous metals

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

19 12 02 - Ferrous metals

19 12 03 –Non-ferrous metals

Estimated waste quantity – 25tpa

Metal filings and turnings

These will be generated from repairs of equipment in the mechanical workshop. The generated wastes will be subject to collection in metallic containers and contract delivery to recycling companies certified under art. 37 of the WMA, registered under art. 12 of the WMA or licensed under art. 54 of the WMA as scrap metal traders.

Waste composition – steel, non-ferrous metals

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

12 01 01 - Ferrous metal filings and turnings

12 01 03 - Non-ferrous metal filings and turnings

Estimated waste quantity – 0.5 tpa of ferrous metals; 0.2 tpa of non-ferrous metals

Waste rubber belts

They will be generated from replacement of worn rubber belts of conveyors.

Composition – elastomer, fabrics.

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

19 12 04 – Plastic and rubber (waste rubber belts)

Estimated waste quantity – 2.8tpa

Discarded electronic and electrical equipment

The project operation will generate waste sodium-vapor lamps, sensors, office equipment etc. The wastes will be collected in metallic containers in compliance with the Regulation on the Release of Electrical and Electronic Equipment on the Market and Treatment and Transport of Electrical and Electronic Waste, (promulgated in SG, issue 36/02.05.2006).

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

16 02 14 - Discarded electrical and electronic equipment other than those mentioned in 16 02 09 through 16 02 13

Estimated waste quantity – 0.27tpa

Sludges from treatment of household wastewater

The waste will be generated from the household wastewater treatment in the site treatment plant. The deposited sludges will be recovered and removed from the site for disposal on a community landfill.

Waste composition - organics

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

19 08 05 - Sludges from treatment of urban waste water

Estimated waste quantity – 24m^3/total

C/ Generation of construction wastes

Mixed construction wastes will be generated from renovation/rehabilitation of buildings across the minesite. Solid waste.

Composition – concrete, bricks, tiles and ceramics, etc.

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

17 01 07 – Mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06

Estimated waste quantity – 4m^3/year

D/ Solid municipal wastes

Municipal wastes will be generated over the operation stage of the project from the use of everyday items by the mine and process plant employees.

Waste composition - organics, plastic, cellulose

Code under the waste classification, Regulation 3/01.04.2004 of the MoEW and the MoH.

20 03 01 – Mixed municipal waste.

Estimated waste quantity – 25tpa

6.1.3. Wastes Generated during Project Closure

The closure of the open pit, ROM pad, process plant, associated infrastructure, IMWF, or the waste rock stockpile and TMF (Option 2), will be carried out over a period of 5 years after shut-down of operations. The project considers an aftercare period of 20 years or another agreed period according to the final closure plan approved by the competent Bulgarian authority.

The Company will prepare a Mine Closure Project for the Decommissioning and Rehabilitation of the Minesite and Disturbed Lands (Open Pit, Process Plant and IMWF) and submit it to the responsible authorities (the MEET and the RIEW (MOEW)) for approval and will, in compliance with the provisions of the URA, provide a reclamation bond to the Concessionor.

The preparation of a Mine Closure and Rehabilitation Project is an integral part of all activities associated with the final closure and rehabilitation.

The essential purpose of the Closure Plan is to identify the potential environmental impacts that the decommissioned mine, processing facilities and mine waste facilities (together with any financial and legal commitments made) may have at an earlier stage, as well as mitigation of such impact through actions consistently taken over the project design and operation stages.

Over the entire lifetime of the mine, the Closure and Rehabilitation Plan will be regularly updated in view of the projects implementation, in order to ensure that a final Closure and Rehabilitation Plan is in place prior to decommissioning. The Plan will include a detailed strategy of closure according to the arrangements agreed with the Bulgarian authorities and consultations held with the local communities and NGOs on the land use methods, and the objectives and definitions of after care.

In that sense, the development of a Closure and Rehabilitation Plan is a process which starts with the Environmental Impact Assessment for the Project and continues on the subsequent stages of detailed designs preparation and operation. The process will comply with the requirements under the Underground Resources Act and with the applicable practices and guidelines specified in the following documents:

Regulation 26 on the Rehabilitation of Disturbed Areas, SG 89/22.10.1996

Reference document on the Management of Tailings and Waste Rock from Mining Activities, EU BREF (July, 2004);

According to the MIRO Manual (referenced in the EU BREF document), the main objective of the minesite closure planning is ensure the successful decommissioning and rehabilitation of lands while meeting the following objectives:

Opportunity for productive and sustainable use of land acceptable for the mine operator and regulators;

Protection of public health and safety;

Mitigation or elimination of environmental damages and promotion of sustainable environmental development;

Preservation of valuable features;

Minimization of any adverse social and economic impact.

The long-term objective of the closure strategy is to leave the site in such a condition that requires minimum care and monitoring. Usually, there are three interim stages in the process of achieving such condition:

Closure stage, where decommissioning and dismantling takes place in accordance with the Final Closure and Rehabilitation Plan;

Proactive maintenance stage, where ongoing operation and maintenance activities take place for the reclamation areas;

Aftercare stage, where minimum activities take place to ensure that the maintenance and monitoring efforts meet the desired level of accomplishment.

The closure and proactive maintenance stages are limited in time and are normally completed within the last years of the operation. The aftercate stage is not limited in time and may be ongoing, as the purpose of the activities within this stage is to ensure that the results of the closure stage are preserved and maintained. The activities under the aftercare stage are performed according to the arrangements agreed between the operator and the competent government authorities responsible for the environment, which are listed in the Final Closure and Rehabilitation Plan.

The following three criteria need to be satisfied to ensure the timely progress to the aftercare stage following operations closure:

- physical stability – the remaining sites should be safe for both humans and the environment in the adjacent area;
- chemical stability – any remaining materials must not be a hazard to future users of the site, or to the public health, or to the immediate environment;
- biological stability, which allows suitable land use consistent with the surrounding regions.

The Closure and Rehabilitation Plan of the Krumovgard operation for the minesite and disturbed land will follow those principles and approach/ It is based on individual key components of the Overall Project:

- Open pit and relevant surface-based mining facilities.
- Ore processing facility (process plant);
- Mining waste facility;
- Infrastructure;

The works on the closure of the IMWF will commence at the operation stage. The outer face of the facility will progressively be rehabilitated. The proposed mining waste disposal method (Option 1) will allow progressive rehabilitation of the facility over the operation stage. That would enable a relatively long-term monitoring of the rehabilitated areas and possible implementation of additional measures to ensure the long-term stability of facility. The last closure stage considers deconstruction of the associated facilities and infrastructure including access roads, pipelines and pump stations.

6.2. Waste Collection, Transport, Re-Use and Disposal

6.2.1. Waste Collection and Transport during Project Construction

A/ HAZARDOUS WASTES

Hydraulic, engine and gear oils, brake and antifreeze liquids and oil filters.

The generated hazardous wastes will be subject to collection in sealed steel drums/containers, removal by the project construction contractor, and contract delivery for treatment to companies holding permits under art. 37 of the WMA or relevant IPPC permits.

Lead batteries, which will be generated from the replacement of discarded batteries of vehicles, mobile and construction equipment and will be collected in a designated container in the temporary storage area pursuant to the Regulation on the Release of Lead Batteries on the Market and Treatment and Transport of Discarded Lead Batteries (Council of Ministers Decree 144/ 2005, promulgated in the SG issue 58/2005), and then subject to contract delivery to recycling companies certified under art. 37 of the WMA, or holders of IPPC Permit.

Wiping cloths and protective clothing contaminated by dangerous substances

The generated waste - Wiping cloths, and protective clothing contaminated by dangerous substances by the site equipment and construction personnel will be disposed in a metal container and temporarily stored at a designated area before haulage to the main base of the construction contractor for subsequent collection and treatment under written contract with entities licensed under art. 37 of the WMA.

B/ OPERATIONAL WASTE

Top soil and other soil material

Top soil will be generated as part o the overburden removal, as well as by earth works for the construction of buildings, facilities and infrastructure of the new plant (the process plant). Prior to construction, all areas for construction or mining will be stripped of topsoil, which will be stockpiled for further use at the closure and rehabilitation stage. Topsoil layers are generally low in humus and very shallow (less than 10 cm) over the areas to be affected by the operations; therefore, the subsoil layers will also be stripped to ensure sufficient stock of soil materials to meet closure requirements.

Both Options involve topsoil and other soil material to be stored in a designated area of 2 hectares.

Excess earth and rock material (rockfill, soil and stones) from the excavation of foundation pits for project buildings and process facilities will be stockpiled in a designated area and part of it will be re-used for backfilling of foundations. Non-reusable earth material will be stockpiled in a designated area and removed from the minesite by the owner of the wastes for disposal onto a landfill using the construction waste haulage route approved by the mayor of the municipality in accordance with art. 18 of the Waste Management Act.

Mixed construction wastes will be collected and removed from the minesite by the owner of the wastes (the project construction contractor) in accordance with the provisions of art. 18 par. 1 of the WMA and disposed of onto a landfill as directed by the local authorities in accordance with the provisions of art. 16 par. 3 item 4 and art. 19 of the WMA.

Waste metal - structural steel, angle steel, construction steel etc., will be generated over the construction of the plant; The waste metal will be subject to separate collection and temporary storage in a designated area, and contract delivery to recycling companies certified under art. 37 of the WMA, registered under art. 12 of the WMA or licensed under art. 54 of the WMA as scrap metal traders, or holders of IPPC Permit.

Wood

Wood wastes will comprise discarded formwork from construction and wood packaging of delivered equipment units and components for the new plant. They will be subject to separate collection and temporary storage until sufficient amount is accumulated for contract delivery to recycling companies.

Solid municipal wastes will be generated from the use of everyday items by the site construction and engineering workers and will be collected in mobile waste containers (dumpsters) for subsequent disposal onto a landfill designated by the Krumovgard authorities or for approved recycling.

6.2.2. Waste Collection and Transport during Project Operation Mine Wastes

6.2.2.1. Mine Wastes

The project considers two mine waste disposal options.

6.2.2.1.1. Mine rock

Option 1.

Under this option, the waste rock will be disposed in an integrated mine waste facility (IMWF). The IMWF will also accommodate the final tailings (slurry), which will be thickened in a radial thickener to a final pulp density of 56% solids. The thickener underflow will be pumped into a tailings delivery pipeline for deposition into the IMWF.

The proposed mining waste disposal method (Option 1) will allow progressive rehabilitation of the facility over the operation stage.

The outer slopes of the facility will be rehabilitated immediately after their construction. This rehabilitation will allow planting of a vegetation cover that will minimise dust emissions, erosion and visual impacts. The footprint of the IMWF will be 41 hectares.

Option 2.

Under Option 2, the mine rock will be stockpiled on a waste rock stockpile. The waste rock stockpile siting is the same as that of the IMWF.

The mine rock stockpile on Adá Tepe will be rehabilitated in accordance with the type of end use agreed upon shut-down of operations. The soil stripped before the commissioning of the stockpile will be re-placed on the stockpile surface. The stockpile outer surfaces will be prepared for planting of self-sustaining vegetation.

The mine rock stockpile closure design will allow planting of vegetation which will minimize the potential for dust emissions, erosion and visual impact. Footprint of the waste rock stock pile - 44 hectares;

6.2.2.1.2. Flotation Waste (Tailings)

Option 1.

Under Option 1, the tailings will be deposited in the IMWF. The facility will also accommodate the mine rock within the same footprint.

The final tailings will be thickened in a radial thickener to a final pulp density of 56% solids. The thickener underflow will be pumped into a tailings delivery pipeline for deposition into the IMWF.

The proposed mining waste disposal method (Option 1) will allow progressive rehabilitation of the facility over the operation stage.

The outer slopes of the facility will be rehabilitated immediately after their construction. This rehabilitation will allow planting of a vegetation cover that will minimise dust emissions, erosion and visual impacts. The footprint of the IMWF will be 41 hectares.

Option 2.

Under Option 2, the tailings will be deposited in a TMF.

On completion of the ore processing, the TMF will comprise a rockfill embankment (approximately 40 m in height) containing some 7.235 million tons of ore processing tailings. Provisions will be made to allow dry closure of the facility, which will facilitate quick stabilisation of the tailings surface to minimise the potential for wind and water erosion, in line with the objectives of ensuring long-term stability and an appropriate end-use requiring minimal maintenance.

The accepted best closure practice in mining and tailings disposal is to collect data and information consistently throughout the deposition period to ensure that an appropriate closure strategy is adopted. This information will include confirmation of tailings chemical properties, as well as appropriate vegetation types, hydrological and meteorological condition, etc. The data will be incorporated into the closure planning documents. The closure and rehabilitation documents will be prepared within 5 years of start-up and updated on a regular basis throughout the operations.

Upon cessation of tailings disposal, the tailings management facility will be drained and its surface re-profiled (consistent with the requirements), and will be capped with an insulating layer and then soil using the previously stockpiled soil materials.

The surface cover system will be established upon decommissioning and closure of the TMF. The materials required for the cover system would be taken from the waste rock stockpile and from the topsoil stockpiles established during start-up of the construction work and during processing operations.

The TMF surface cover system should be designed to fulfill three main functions:

- ensure adequate environment for vegetation;
- provide a protective/drainage layer between the tailings and the root zone; and
- limit seepage into the tailings to an acceptable level.

All service roads not required for the tailings pond will be ploughed up and cultivated during the closing work to promote vegetation. A long-term monitoring program will be required after the site is capped and a permanent vegetation cover is established.

The TMF will require an area of 45 hectares.

6.2.2.2. Wastes from Gold-Silver Concentrate Production

A/ HAZARDOUS WASTES

Waste engine, gear and lubricating oils will be subject to separate collection in steel drums until sufficient amount is accumulated for contract delivery to recycling companies certified under art. 37 of the WMA, or holders of IPPC Permits.

Waste insulating and heat transmission oils

Waste mineral-based non-chlorinated insulating and heat transmission oils will be subject to separate collection in steel drums until sufficient amount is accumulated for contract delivery to recycling companies certified under art. 37 of the WMA, or holders of IPPC Permits.

Lead batteries will be collected in a designated container in the temporary storage area pursuant to the Regulation on the Release of Lead Batteries on the Market and Treatment and Transport of Discarded Lead Batteries (Council of Ministers Decree 144/ 2005, promulgated in the SG issue 58/2005), and then subject to contract delivery to recycling companies certified under art. 37 of the WMA, or holders of IPPC Permit.

Fluorescent tubes and other mercury-containing waste

Unusable fluorescent and mercury lamps will be replaced with new ones. The discarded lamps will be re-placed in the packaging of the new ones and stored temporarily in a metal container . The container will be kept in an enclosed storage area the access to which will be restricted to authorized personnel only.

The container will be labelled in compliance with the Regulation on the Release of Electrical and Electronic Equipment on the Market and Treatment and Transport of Electrical and Electronic Waste, (promulgated in SG 36/02.05.2006), and the lamps will be subject to contract delivery to recycling companies that hold an IPPC Permit for waste handling activities. A sulphur package will be kept in the respective storage area for treatment in case of emergency.

Packaging containing residues of dangerous substances

Multi-layer paper bag packaging of copper sulphate, plastic and metallic packaging contaminated with dangerous substances will be collected in a metal container and then subject to contract delivery to recycling companies certified under art. 37 of the WMA.

Oil from oil/water separators

The oil from oli/water separators generated from the mud and oil trap in the car wash area will be collected in steel drums and then subject to contract delivery to recycling companies certified under art. 37 of the WMA or holding an IPPC Permit for this activity.

Interceptor sludges

The interceptor sludges generated from the mud and oil trap in the car wash area will be scooped and deposited in the IMWF.

B/ OPERATIONAL WASTES

Dust from treatment of the exhaust from ore crushing

The dust from the bag filter will be collected in large bags and then recycled into the mill ore feed.

Dust bags

The discarded filter bags will be collected in a metal container and then subject to contract delivery to recycling companies certified under art. 37 of the WMA.

Mixed metal wastes will be collected and temporarily stored and kept there before shipment for contract treatment and recycling by recycling companies certified under art. 37 of the WMA, registered under art. 12 of the WMA or licensed under art. 54 of the WMA as scrap metal traders.

Metal filings and turnings

The waste will be disposed in a metal container and kept there before shipment for contract treatment and recycling by recycling companies certified under art. 37 of the WMA, registered under art. 12 of the WMA or licensed under art. 54 of the WMA as scrap metal traders.

Waste rubber belts

The waste will be disposed and temporarily kept at a designated area before shipment for treatment by entities licensed under art. 37 of the WMA.

Discarded electronic and electrical equipment

These will be collected in a metal container in compliance with the requirements of the Regulation on the Release of Electrical and Electronic Equipment on the Market and Treatment and Transport of Electrical and Electronic Waste, (promulgated in SG 36/ 02.05.2006), and then subject to contract delivery to recycling companies certified under art. 37 of the WMA or hold an IPPC Permit.

Sludges from treatment of household wastewater

The sludges generated from the household wastewater treatment in the site treatment plant will be recovered and removed from the site for disposal on a community landfill.

Generation of construction wastes

The construction wastes generated from renovation/rehabilitation of buildings across the minesite will be collected and stockpiled in a temporary storage area before being removed for disposal onto a landfill using the construction waste haulage route approved by the mayor of the municipality in accordance with art. 18 of the Waste Management Act.

Generation of solid municipal wastes

The solid municipal wastes will be collected in metal containers for subsequent disposal onto the appropriate municipal landfill.

6.2.3. Re-use and Disposal of Wastes

The project does not consider re-use of wastes generated over the project construction and operation stages.

The Investor will only contract recycling companies certified under art. 37 of the WMA or licensed under art. 54 of the WMA as scrap metal traders to handle the wastes generated by the project.

Waste Detoxification

The project does not consider on-site processing or detoxification of waste generated at the construction and operation stage of the site. Recycling of site-generated waste will be contracted out.

Wastes will be subject to contract delivery to recycling companies certified under art. 37 of the WMA or holders of an IPPC permit.

Other Waste Handling Methods

- solid municipal wastes should be collected separately in containers:

⇒ glass packaging;
⇒ paper packaging;
⇒ plastic packaging
⇒ aluminum packaging from non-alcoholic beverages.

Waste Disposal

The project proposal does not consider construction of a landfill (for storage of wastes other than mining wastes) on the minesite.

Under Option 1, all waste rock material is hauled to the IMWF, which is designed to store both dewatered process tailings and waste rock from mining.

Under Option 2, the mine rock is stockpiled on a waste rock stockpile while the flotation tailings are conveyed via pipeline to a TMF.

Areas for temporary storage are foreseen for hazardous, industrial and household waste to be kept prior to collection for subsequent treatment by contracted individuals or corporate entities licensed under art. 37 of the WMA for such operations.

The wastes will be stored in containers as follows:

- waste oils - in designated spill-proof containers made from oil-resistant materials, which will be kept closed and labeled with: "Waste Oils”
- sealed containers;
- heavy-duty and resistant to the substances contained in this type of waste, and the material they are made of does not react with these substances;

- storage containers or in transport packaging that ensure safe storage of the discarded hazardous wastes, pallets and other gear suitable for mechanical handling;
- the waste containers will be stored on waterproof surfaces.

Record Keeping and Reporting of Waste Management Activities

Reports are to be prepared for the type and quantity of the waste, which will be generated at the minesite(mine waste, industrial and hazardous waste), in the same manner as currently reported by the Company. The report is to be prepared on an annual basis for the total waste quantity .

Pursuant to Appendix 4 to Regulation 9/21.10.2004 on the Procedures and Formats for Submission of Information about Waste Related Activities, and the Procedures for the Public Register of Issued Permits, Registration Documents and Closed Facilities and Activities (SG issue 95/2004) the information to be filled out is as follows:

- Identification cards;

-Annual report.

Identification cards will be submitted to the Haskovo Regional Environment and Water and to the municipal authorities of Krumovgrad.

Expected Impacts

The impact of the wastes that will be generated over the construction and operation stages of the project on the environmental components may be classified as **negligible**, **of short duration** (during project construction), **continuous** (during project operation), **reversible**, **on a small local scale**.

Assessment of Impact on the Environment and Human Health

Project construction and operation

Separate waste collection over the construction and operation stages of the project, and waste haulage, temporary storage and removal by contractors that are licensed under art. 37 of the WMA or holders of IPPC permit for waste handling, re-use and/or treatment does not entail negative impact on the environment and human health.

Project decommissioning and closure

At the closure and decommissioning stage, the waste impact on the environmental components and human health will be limited to negligible impacts of various types of construction waste generated by demolition works and household waste from the use of everyday items by the site workers. The Closure Plan will detail the activities and the responsibilities over this stage.

7. Hazardous Substances

7.1. Types of Hazardous Substances Used during Project Construction and Operation. Classification and Toxicological Characterisation

The classification of the hazardous substances follows the Regulation on the Terms and Conditions for Classification, Packaging and Signage of Chemical Substances and Mixtures (Decree No. 182/20.08.2010, SG issue 68/2010).

7.1.1. Types of Hazardous Substances That Will Be Used during Project Construction

During the mine construction, earth and construction works for construction of the new plant for production of gold-silver concentrate and the site infrastructure, the hazardous substances that will be used primarily include fuel – diesel fuel and LPG for metal cutting.

Diesel fuel
CAS No. – 68334-30-5
Symbol – F+;Xn
Phrases – R – 40; S: (2-)36/37

Propane
CAS No. – 74-98-6
Symbol – F+
Phrases – R – 12; S:(2-)9-16

Butane
CAS No. – 106-97-8
Symbol –F+
Phrases – R – 12; S:(2-)9-16

Butadiene-containing Butane (0.1 %)
CAS number – 106-97-8
Symbol –F+
Phrases – R – 45-46-12; S:53-45

Toxicological profile of the hazardous substances that will be used during project construction

Petroleum products – high concentrations of hydrogen carbonates can be lethal. Lower concentrations - headaches, nausea and over excitement. Chronic poisoning may can cause functional disorders.

Higher concentrations of hydrocarbon vapors may cause instant poisoning. Caused loss of consciousness and quick death if the victim remains in the poisoned environment.

Alkaline substances (propane and butane) are very strong drugs, but their effect on the human body weakens due to their low blood solubility. They are practically harmless under normal conditions.

LPG (propane-butane) – physical and chemical profile of liquefied petroleum gas according to Bulgarian National Standard (BNS) 5670-83

Name			**LPG**	
1.	Molecular formula		C_3H_8	C_4H_{10}
2.	Density of liquefied gas	kg/m^3	520	580
3.	Vapour density	kg/Nm^3	1.97	2.6
4.	Vapour density relative to air	kg/Nm^3	1.56	2.06
5.	Explosion limit – lower – upper	% vol.	 2.1 9.5	 1.9 9.1
6.	Ignition temperature	°°C	466	405

7.1.2. Types of Hazardous Substances That Will Be Used During Project Operation

The purpose of the Investment is production and processing of gold ore at the Ada Tepe area of Chan Krum Deposit, Krumovgrad.

The ore at Ada Tepe will be open-pit mined. The mining method will be a conventional open cut drill, blast, load and haul operation. The mined ore will be loaded by two hydraulic back-pull shovels serving up to five 50t off-road dump trucks hauling the ore to the ore stockpile (ROM pad) near the jaw crusher area.

The explosives that will be used include ANFO (Dynolite™, a mixture of ammonium nitrate and 6% of diesel by weight) for the mining of the oxidized ore in the Upper Zone and waterproof emulsion (Fortis™ Advantage 80 – a mix of 80% matrix and 20% AN prills) for the mining of the ore in the Wall Zone.

Explosives Classification:

Properties	***Dynolite***	***Fortis Advantage 80***
1. Appearance	Granules with light yellow color and diesel fuel odor	Homogeneous paste with gray-beige color containing white granules
2. Bulk mass, *kg/m*^{3}	800 ± 50	1200 ± 100
3. Composition, % w/w	95 % ammonium nitrate 5% diesel fuel	75 - 85 % ammonium nitrate > 1.0 % Sodium nitrite
3. Volume of blasting fumes released, *l/kg*	980	940
4. Heat of explosion, *J/kg*	3,650	3,200
5. Detonating velocity, *m/sec*	> 3,200	> 5,000
5. Initiation	NONEL^R system	NONEL^R system

*/ Contains two non-explosive components – emulsion matrix and gasifying agent, which are mixed when charging the drill hole.

The Dynolite (ANFO) explosive is a registered trade mark of DynoNitroMed AD - Panagyurishte for an industrial type of ANFO explosive used for open-cut and underground blasting of dry faces at ambient temperatures from -30 to +50 ^{o}C. Dynolite is a substance that is physically and chemically stable, with a fire and explosion hazard. It is classified as an explosive of Group II in terms of transport and handling hazard. It is transported in compliance with the provisions of the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), Regulation 40/14.01.2004 on the Terms and Conditions for Carriage of Dangerous Goods by Road and the Explosives, Guns and Ammunitions Control Act. According to ADR, the classification of Dynolite *ANFO* is: Class 1, Division 1.1D, UN No. 0082. The following R-phrases and S-phrases apply to Dynolite ANFO:

CAS No TSC 48.2;
Hazard symbol - bomb label (E);
R-phrases: R3/5 - high risk of explosion;
S-phrases: S35: This material and its container must be disposed of in a safe way

The Fortis Advantage 80 explosive is an emulsion-type of explosive for open-cut blasting including wet faces/ under running water at ambient temperatures from -20 to +50°C. According to BNS 14363-90, the Fortis Advantage 80 explosive is classified as an industrial explosive. In terms of hazard, it is classified as an explosive of Group II under the Blasting Safety Code (Bulgaria) and as an explosive of Class 5.1 under the ADR. Fortis Advantage 80 is highly water-resistant, has excellent gas properties and chemical composition, which ensures high efficiency rate.

The the estimated monthly requirement for pit blasting during project operation is 56 tons.

The mining and processing of the raw material (gold ore) to an end product (flotation concentrate) in the process plant for production of gold-silver concentrate will require the use of the following hazardous reagents and consumables: potassium amyl xanthate, copper sulphate, sodium silicate, dithiophosphate, frother and flocculant.

CAS No
ammonium nitrate 6484-52-2
sodium nitrite 7632-00-0
Hazard symbol - bomb label (E);
R8 - Contact with combustible material may cause fire
R9 - Explosive when mixed with combustible material
S-phrases: S35: This material and its container must be disposed of in a safe way

Potassium amyl xanthate ($C_2H_5OCS_2K$):
CAS No – 2720-73-2; EC No (EINECS): 220-329-5
Symbol – Xn
Phrases – R – 22; S: 36/37/39.

Copper sulphate ($CuSO_4.5H_2O$)
CAS No – 7758-99-8; EC – 231-847-6
Symbol – Xn; N
Phrases – R 22-36/38-50/53; S: (1/2-)22-60-61

Dithiophosphate
CAS No – 33619-92-0
Symbol – Xi; C
Phrases – R 32, 34, 35, 41; S: 26, 45, 50A, 36/37/39

The mining and processing of the raw material (gold ore) to an end product (flotation concentrate) in the process plant for production of gold-silver concentrate will require the use of the following hazardous ancillary materials: motor oil, grease and diesel fuel.

Diesel fuel
CAS No – 68334-30-5 EC No 270-675-6
Symbol – F+;Xn
Phrases – R – 40; S: (2-)36/37

Motor oils
CAS No 64742-19-4
Symbol – F; N;
Phrases – R – 45; S: 26

Grease
CAS No 74869 – 21 - 9
Symbol – T
Phrases – R – 45; S: 53-45

Toxicological profile of the hazardous substances that will be used during project operation

Dynolite

It contains approx. 95% nitrates; therefore, contact with the eyes may cause irritation. Prolonged contact may cause itching and redness, possibly nausea, vomiting and diarrhea. If swallowed, it may cause nausea, vomiting and diarrhea. If inhaled, remove victim to fresh air and keep at rest. In case of eye contact, flush eyes with plenty of water. If symptoms persist, seek medical attention. In case of skin contact, remove contaminated clothing and wash skin with water. If swallowed, rinse mouth first and then drink a couple of glassfuls of water. If larger quantity is swallowed, seek medical attention.

Fortis Advantage 80

Repeated substance contact, especially after drying-in of the substance, can lead to skin- and eye-irritation.

Medical help necessary in case of symptoms, e. g. irritation of the respiration tract, which might have been caused by inhalation of dust, vapours or combustion gases. Victims must be removed from the danger area as quickly as possible. Symptoms do not necessarily appear immediately with persons who have inhaled combustion gases. Therefore, patients should be kept under medical observation for at least 48 h.

If inhaled, remove the victim to fresh air, consult with a doctor. If possible, administer Dexamethason spray (or other suitable respiration stimulant spray) by oral inhalation. Give oxygen if necessary. If unconscious, hold and transport victim in stable side position. If breathing stops, provide rescue breathing. In case of dust inhalation, remove victim to fresh air. If symptoms persist, e.g. coughing, consult with a doctor.

After skin contact, rinse with water, consult with a doctor if necessary. After eye contact, rinse with water, consult with an ophthalmologist if necessary. After swallowing, flush mouth with plenty of water, consult with a doctor.

Avoid skin and eye contact with unpackaged explosives.

Potassium amyl xanthate ($C_2H_5OCS_2K$):

It is dangerous if inhaled. Inhalation of dust can cause irritation of the nose, throat and respiratory tract. Inhalation of decomposition fumes (carbon disulphide) can cause severe behavioral disorder, incl. anxiety, anger, hallucinations. Irritates the mucous membranes and upper respiratory tract. Causes skin irritation. Dust and fumes may be irritating. Xanthate solutions cause severe skin irritation. Harmful when absorbed through the skin. Causes eye irritation and inflammation. Dust and fumes cause irritation. Xanthate solutions cause severe eye irritation. Exposure symptoms: nausea, headache, vomiting.

Chronic exposure can cause irritability, manic behavior, hallucinations, fever, hearing and visual disorders and liver nuisance. Carbon disulphide has severe acute effects on the central nervous system. Xanthate salts may cause respiratory irritation.

Copper sulphate ($CuSO_4.5H_2O$)

Reagent for analysis; chemical production; mineral dyes manufacturing; wood impregnation; pest control; leather industry; medicine; galvanisation: etc.

Harmful if swallowed. Causes skin and eye irritation. Very toxic to aquatic life with long lasting effects. If inhaled, remove victim to fresh air. In case of skin contact, remove contaminated clothes and wash the affected skin with plenty of water and soap. In case of eye contact, flush eyes with plenty of running water for at least 10 min. keeping the eyelids open. Seek medical attention (ophthalmologist). Ingestion may cause stomach ache, nausea, vomiting, diarrhea, blood pressure to drop, tachycardia, and unconsciousness. Immediately make victim drink plenty of water (several litres). Do not induce vomiting. Seek immediate medical attention.

Dithiophosphate

The substance is not classified as hazardous to the environment. It is not readily biodegradable.

May cause burns. Risk of severe eye damage. Contact with acids produces highly toxic gas. If swallowed, immediately call a doctor.

In case of eye contact, immediately flush with plenty of water and seek medical attention. In case of an accident or sickness, immediately seek medical attention (if possible, show the label to the doctor). Do not mix with acids and acid/water solutions as there is a risk of producing toxic and flammable hydrogen sulphide gas. Wear appropriate protective clothing, gloves and eye/face protection.

Diesel fuel

Avoid inhalation of fumes. May cause dizziness and drowsiness. May cause moderate eye irritation and skin rash. Affects the central nervous system. Ingestion may cause gastrointestinal disorders including irritation, nausea, vomiting and intoxication-like effects on the central nervous system. May cause respiratory arrest and death in severe cases.

Motor oils

Composition – high-molecular-weight hydrocarbons. Complex combination of hydrocarbons, obtained by processing of light vacuum gas oil, heavy vacuum gas oil, and by dissolving of de-asphalted residues with hydrogen with added catalyst in two stages, with an interim process of wax removal between the two stages.

Harmful in case of skin contact and if inhaled. Allergens. Affect the nervous system and liver. Mutagens and carcinogens. Contain polycyclic aromatic hydrocarbons. Inhalation of large amount of fumes, gas, or stream may cause throat irritation. Inhalation of small amounts should not cause sickness. Ingestion of large amounts may cause serious stomach damage, diarrhea and severe sickness. No risk is involved under normal conditions.

Grease

Grease (a complex combination of hydrocarbons with long carbon chains (12 to 50 carbon atoms); may contain organic salts of alkaline metals, alkaline earth metals and/or aluminum compounds).

Inhalation of oil mist or fumes when heated irritates the respiratory system and induces coughing.

Product which has penetrated the skin under high pressure may cause serious cell damage or mortification of subcutaneous tissues. Continuous or frequent skin exposure may cause redness, irritation, dermatitis, ichthyosis. Percutaneous absorption during skin contact is not sufficient to produce severe toxic reactions.

Eye contact may cause temporary eye irritation.

Inhalation causes mild toxic effects. However, inhalation after swallowing and vomiting may cause severe and potentially fatal damage to the lungs.

7.2. Safe Storage of Hazardous Substances

The hazardous substances which will be used in the ore mining and processing operations will be stored as follows:

Table V.7.2-1

Hazardous Substances	Storage method
Dynolite	A local manufacturer (e.g. Dyno-Nitro Med) will supply the blasting materials for the mining operation. Explosives will be safely delivered from the explosives manufacturing plant to the minesite by a designated MMU vehicle (mobile manufacturing unit). MMUs will deliver the products to the pit blast area, where they will be mixed to form explosives and immediately poured into the blast holes.
Fortis Advantage 80	
Potassium amyl xanthate	Steel drums, 200kg capacity.
Copper sulphate	Tanker trucks, 20t capacity
Dithiophosphate	1 m^3 polymer bags placed on wooden pallets.
Diesel fuel	Tank
Motor oils	Steel drums
Grease	Steel boxes

Substitution of Hazardous Substances

The proposed mining and processing methods will use the above hazardous substances or other materials of the same class, which will not alter the process flowsheet and, respectively, the impact on the environment.

The Ada Tepe operations will not use methyl bromide (CH_3B) or substances listed in Appendix 1 to CoM Decree 254/30.12.1999 (amended with CoM Decree 224/01.10.2002) on the Control and Management of Ozone Depleting Substances.

The project does not consider any use of raw materials, products or materials that are within the scope of the Regulation on the Hazardous Chemical Substances, Preparations and Products That Are Banned for Use and Trade. Furthermore, the project does not consider use of any organic solvents within the scope of Council Directive 1999/13/EC on the Limitation of Volatile Compound Emissions.

The Investor will also comply with the ban on the use of fixed fire suppression systems within the scope of Appendices 2 and 3 to the above-mentioned Decree, portable halon fire extinguishers and specified surfactants and lubricants.

Based on the types and amounts of hazardous substances scheduled in the project design, the mining and processing operations are classified as a project that does not require permitting under art. 104 of the EPA.

8. Physical Factors

8.1. Forecasting and Assessment of the Noise, Vibration and Radiation Levels in the Environment during Project Construction and Operation

The noise emissions in the environment during the project implementation are associated with three stages - construction, operation and closure.

Project construction

This stage will include:

- construction of the necessary infrastructure (roads, power and water supply, and telecommunications);
- clearing and preparation of the sites for the open pit, the mine waste storage facility and the process plant;
- construction of facilities (process plant, mechanical workshop, offices, etc.);

- construction of the ROM pad;
- construction of a mine waste storage facility (sumps, berms);
- installation of a conveyor belt, etc.

The construction equipment used for excavation, backfilling, concreting, formwork, assembly, transportation, etc. will be the main source of environmental noise.

The main plant and equipment and associated noise emissions are presented in the Table V.8.1-1 below:

Noise emissions from the main plant and equipment during project construction

Table V.8.1-1.

Plant/Equipment	Noise level, dBA	Plant/Equipment	Noise level, dBA
Excavator	80-91	Concrete placing equipment	87-94
Dozer	97-105	Wood cutting machines	94-99
Front-end loader	86	Trucks (including concrete mixers)	80-92
Truck-mounted crane	92-98	Road-construction equipment	65-105

The construction equipment will be concentrated mainly in the operating areas (open pit, stockpile, crushing plant, concentrator, mine waste storage facility) depending on the work required to be done.

An equivalent noise level of 90-95 dBA can be expected near operating equipment. The transport services such as waste trucking and disposal, and delivery of materials and components required for the production facilities will utilise the local road network. The Traffic Plan (Option B) sets out two road corridors for transport services and shipments of raw materials and end products depending on the shipment destination:

- , Krumovgrad – Zvunarka – Pobeda – Ada Tepe.
- , Momchilgrad – Tokachka – Zvunarka – Pobeda – Ada Tepe.

The equivalent noise levels from vehicle operation will depend on the number of trips and speed. According to Traffic Plan data, the expected number of trips is 10 to 12 per day, which would give an equivalent nose level of about 53 dBA.

<u>Project Operation</u>

The main project operations are:

- Ore mining;
- Ore processing (crushing, grinding and flotation);
- Mine waste disposal.

The mining method will be a conventional open cut drill and blast operation. The sources of environmental noise will include:

- Mining equipment;
- Blasting operations.

All mining equipment will be purchased new and supplied complying with the EU requirements to harmful noise emissions applicable to equipment for outdoor use[1]. The noise emissions from the main plant and equipment are presented in the Table V.8.1-2 below:

[1] Directive 2000/14/EC on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors;

Noise emissions from the main plant and equipment during project operation

Table V.8.1-2.

Plant/Equipment	**Noise level, dBA**	**Plant/Equipment**	**Noise level, dBA**
Drill rig	90-110	Hydraulic excavator	80-91
Dozer	97-105	Grader	88
Dump truck (50 t)	86-93	Tank truck	80-85

An equivalent noise level of 93-95 dBA can be expected near operating equipment.

Blasting operations will generate specific noise – instant, high-intensity pulse-like noise, whose level will depend on the blasting method. The pulse noise will have short duration (of the order of seconds) depending on the size of the blasting area. For comparison - at the GUSV quarry, Studena deposit, city of Pernik - 61 blastholes - an equivalent noise level of 53.8 dBA and a maximum noise level of 80.1 dBA were measured at a distance of about 650 m from the source (the blast area) at unobstructed noise propagation (direct line of sight between the measurement point and blast area) . The project schedules two blasts per week.

The ore mined will be hauled to the ROM ore pad using dump trucks (50 t). Based on the design throughput rate of 106 t/h, the estimated equivalent noise levels from heavy trucks will be about 62 dBA at 7.5 m from the roadway centerline.

A front-end loader will deliver ore from the ROM pad to the feed hopper of a jaw crusher. The noise emissions from the main plant and equipment in that area are presented in the Table V.8.1-3 below:

Noise emissions from the main plant and equipment in the crushing area

Table V.8.1-3.

Plant/Equipment	**Noise level, dBA**
Jaw crusher (at 1 m away, crushing, data submitted by the Company)	102-108
Jaw crusher (idling, data submitted by the Company)	87
Cone crusher (data taken from actual measurements)	91-95
Conveyor belt (data taken from actual measurements at similar sites)	68

Downstream ore processing (grinding, gravity separation, flotation) will be performed in the respective sections of the process plant. Main noise sources:

- Mills;
- Separation tables;
- Centrifuges;
- Flotation banks;
- Pumps.

The environmental noise levels from the process plant will depend on the noise emitted by the process equipment and the sound attenuation capacity of the outer confining walls. However, no such noise data is available at this stage. According to in-situ measurements at Chelopech, the noise levels near the process plant are within 60-67 dBA.

The mine wastes (waste rock and tailings) will be deposited in the IMWF. A dozer and dump trucks will be the noise sources at the IMWF site. An equivalent noise level of 85-90 dBA can be expected near operating equipment. Waste rock will be hauled using 50 t dump trucks. An equivalent noise level of 67 dBA will be generated by the dump trucks based on the design throughput rate. Tailings will be delivered via a 1000 m long tailings pipeline.

Concentrate shipments and deliveries of process materials and consumables will be made using heavy trucks, which will travel on the site roads and the local roadwork to Momchilgrad. Based on the estimated end product annual output rate, the number of truck trips (20t trucks) is about two per day according to the Traffic Plan of the Company. The plan considers two alternative road corridors under Option B:

- Momchilgrad – Tokachka – Zvunarka – Izgrev – Kaldzhikdere – Ada Tepe minesite; and
- Momchilgrad – Tokachka – Zvunarka – Pobeda – Ada Tepe.

The noise level associated with these transport services is expected to be about 48 dBA.

Project Closure and Rehabilitation

The closure will include: Closure of the open pit, process plant, crushing area and any redundant infrastructure. The rehabilitation will take 5 years based on a project approved in advance for each area of the project site. The noise emissions in the environment during closure and rehabilitation will be similar to those during construction.

8.2. Impact Assessment According to the National Standards and Legal Requirements

The noise level standards applicable to various sites and urbanized areas are regulated by Regulation 6 on the Environmental Noise Indicators of Time-Dependent Levels of Discomfort, Environmental Noise Limits, Methods for Assessment of Noise Levels and Negative Effects of Noise on Human Health (MH, MOEW, SG issue # 58/2006).

The maximum allowable noise levels in urban environment under this Regulation are:

- Day – 55 dBA;
- Evening – 50 dBA;
- Night – 45 dBA;

For any production or storage areas - 70 dBA during the day, evening and night.

For recreation areas:

- Day – 45 dBA;
- Evening – 40 dBA;
- Night – 35 dBA;

The process circuits (ore mining, processing and disposal of mining waste) will take place at four main operating areas - sources of noise emissions in the environment. These are:

- Open pit;
- Crushing section and ROM ore pad;
- Concentrator;
- IMWF.

The site is hilly.

The areas with set-out acceptable noise levels in the vicinity of the project are the villages at the foot of Ada Tepe hill, which are at various distances from the individual operational areas. Only populated areas located at up to1,500m straight line distance from the site and affected by unobstructed noise propagation (direct line of sight) have been considered as follows (Table V.8.2-1):

Distance from operational areas to recipients

Table V.8.2-1

Area	Recipient	Distance, m
Open pit	Belagush	1,155
	Kremenik	1,311
	Soyka	600
	Pobeda	740
	Tourist lodge	150
Crushing section	Pobeda	880
	Belagush	1,070
	Kremenik	1,300
	Skalak	1,460
	Kupel	1,350
	Sinap	1,100
Process Plant	Sinap	954
	Kupel	912
IMWF	Pobeda	981
	Sinap	980
	Kupel	509

The distance from the noise source at which the noise standard for the particular site/period of the day is achieved on the basis of unobstructed noise propagation over a flat surface will determine the size of the noise-protection zone. The day period with the most stringent noise standard is the baseline for noise protection depending on the schedule of operation of the noise source.

Project construction

Construction and installation works will be carried out at the operating areas during the day time. The width of the noise-protection zone around the operating plant and equipment on the site is about 300 m with regard to the noise standard of 55 dBA for urban environment. The local centres of population are at greater distances. The nearest villages Chobanka 1 & 2 are protected by landforms, which act as natural screening structures.

Estimated equivalent noise levels at recipient locations (populated areas) during project construction

Table V.8.2-2

Recipient	Expected equivalent noise level, dBA
Chobanka 1	No impact; the village is located behind a hill that acts as a natural screen
Chobanka 2	
Soyka Village	About 33 dBA
Taynik	About 28 dBA
Pobeda Village	About 35 dBA
Belagush	About 31 dBA
Skalak	About 30 dBA
Kremenik	About 31 dBA
Kupel	About 36 dBA at the start of deposition
Sinap	About 33 dBA

The estimated noise levels meet the daytime noise standard and approximate but not exceed the background noise levels.

Construction works are not expected to cause noise nuisance to the centres of population surrounding the project site.

Noise will be a significant factor in the working environment during construction.

The heavy trucks servicing the site during project construction will travel through populated areas using either road corridor (the Izgrev quarter in Krumovgrad and Pobeda, and past the hospital in Krumovgrad – a medical care facility where stringent noise standards apply). Trucks will travel very close past housing areas (1 to 2 m) in Pobeda). The acceptable daytime noise level of 55 dBA for populated areas is not expected to be exceeded. The noise impact from the truck transport will be negative but it will be experienced over short periods during daytime only.

Project Operation

The noise-protection zones (protective distances) around the main noise sources at the site and the recipients (towns and villages) within them are presented in the Table V.8.2-3 below.

Noise-protection zones (protective distances) around the main noise sources at the site and recipients within them.

Table V.8.2-3

Noise source	Noise emissions, dBA	Noise standard, dBA	Noise-protection zone, m	Affected recipient
Open pit	95	50	500	-
Crusher	105	45	1500	Pobeda, Belagush, Kremenik, Sinap, Skalak
Process Plant	67	45	60	-
IMWF	90	45	500	Kupel (at the boundary)

Affected recipients (five villages) are identified only within the zone of the noisiest source - the crushing plant.

In addition to distance, other factors also contribute to the attenuation of sound during propagation outdoors – absorption in the atmosphere, landscape and landforms (difference in elevation between the noise source and the recipient). (EN ISO 9613-1 Acoustics – Attenuation of Sound During Propagation Outdoors).

The estimated noise level at Pobeda Village, which is nearest to the crushing plant, is expected to be, after adjustment using the above factors, about 42 dBA, which meets the nighttime noise standard. The noise levels from the site will not exceed the noise standard for the other settlements located farther from the crushing plant.

Estimated equivalent noise levels at recipient locations (populated areas) during project operation

Table V.8.2-4

Recipient	Expected equivalent noise level, dBA
Chobanka 1	No impact; the village is located behind a hill that acts as a natural screen
Chobanka 2	
Soyka Village	About 30 dBA at the start of operation

Recipient	Expected equivalent noise level, dBA
Taynik	About 23 dBA
Pobeda Village	About 42 dBA
Belagush	About 40 dBA
Skalak	About 38 dBA
Kremenik	About 37 dBA
Kupel	Within 26 - 32 dBA
Sinap	About 38 dBA

All noise levels are lower than the nighttime noise standard of 45 dBA. The noise levels are within the natural environmental noise (<32 dBA) for some villages.

The pit will be mined in a top down sequence. The height of pit slopes will increase with the progress of mining operations. Noise propagation in the environment will be limited by the strong screening effects of the pit slopes. The operational staff will be directly affected by the noise emissions. Noise is an important factor in the working environment.

The high-energy impulse noise generated by blasting operations has not been rated in Bulgaria. Two blasting operations per week are envisaged at the site. The impulse noise has short duration (of the order of seconds). There will be no negative impacts on the local urban environment.

The allowable limit of 70 dBA is expected to be exceeded near operating plant and equipment in the operational areas.

The heavy trucks shipping gold-silver concentrate and delivering raw materials and consumables to the site will travel through populated areas using either road corridor (the Izgrev quarter in Krumovgrad and Pobeda). The expected noise levels from that traffic will meet both the daytime and the nighttime standards for populated areas.

The road corridor through the Izgrev quarter goes past the Krumovgrad hospital. The expected equivalent noise levels from the traffic will exceed the noise limits for medical care centres (45 dBA daytime limit and 35 dBA nighttime limit) by 3 dBA and 13 dBA respectively. This gives preference to the other road corridor: Momchilgrad – Tokachka – Pobeda).

A tourist lodge is located some 150 m NE of the open pit. It used to be a recreation site before the year 2000. Currently, the building is not used or maintained. A one-storey building owned by Krumovgrad Municipality is located near the lodge. It continues to be used together with several bungalows by one of the Krumovgrad schools.

Being a recreation site where stringent noise limits apply, its proximity to the future open pit is unfavorable.

The Company should take steps to re-locate the recreation site to a suitable alternative location, which is agreed with the Krumovgrad authorities.

Project Closure and Rehabilitation

The closure and rehabilitation activities are not expected to generate any excessive noise levels that would impact the nearby residential areas.

8.3. Vibrations and Radiation

Vibrations

Vibrations attenuate very quickly with distance and therefore cannot be regarded as a hazardous factor in the working environment.

Vibrations will be a factor in the working environment when performing some specific construction and engineering works during project construction. Construction works will not be a source of vibrations in the environment.

The project activities (ore mining and processing) will not be a source of vibration into the environment.

Radiation

The project activities (ore mining and processing) will not be a source of radiation into the environment.

9. Landscape

9.1. Assessment of the Expected Landscape Alteration

Construction and Operation

The main anthropogenic impact from the implementation of the project will be on the landscape component. A two-stage process of landscape change will occur during project implementation.

The first stage will occur during the construction (operation) of the open pit and the key contributing process will be ore mining, which will change the existing landforms. Another process that is linked with landscape alteration is the construction of site and access roads, stockpiles, waste facilities, production facilities, etc. A pit with stepped walls will progressively be developed, i.e. the existing physical environment will be affected by changing the surface profile and visual perception and aesthetics. The landscape will be modified to some extent in terms of its functions resulting in limited accessibility due to the relatively steep slopes that will remain after shutdown of operations.

The changes in the landscape will be direct but on a local scale involving significant modification of all landscape components. The natural landscape types will be transformed into technogenic landscapes as the project continues. The changes will essentially be irreversible because the landscape within the project footprint will remain as changed after the mine closure.

The formation of a deep pit may encourage some erosion and landslide but these processes will be confined to the pit only. Neither the ore nor the overburden material contain or generate pollutants. The mining method, rock material handling, ore processing and the mining plant and equipment will not be conducive to pollutant generation either.

The irreversible changes that will occur during project operation will alter the structure of the existing local landscapes. The degraded technogenenic landscape consisting of the open pit, the soil stockpiles and the IMWF will have a modified structure and will temporarily be not able to perform its resource and environment regeneration functions. This will be caused mainly by the alteration of the socio-economic functions of the landscape within the project footprint. It should be said that the alteration of landscape functions is linked to the higher public significance of the site due to its potential – the gold deposit. The implementation of the project will not cause critical deterioration of the physical environment despite that the landscape structure on the site will be modified. The neighboring lands will sustain indirect negligible or minor changes, mainly in the bio-component of the physical environment, but the landscape will retain its functional sustainability.

The main impact on the landscape will be on a local scale affecting visual perception and aesthetics.

Closure

The second stage will involve a permanent change in the topography through the creation of a negative landform – an open pit.

The following alterations linked with the project development are expected to have occurred by the end of project operation:

The depth of the pit on completion of operations will vary according to the location.

- The north end pit bottom is at RL 340 m, which gives final pit depths of 120 m to the east, 100 m to the north, and 40 m to the west.
- The south end haul road exits to the west at RL 380 m, with the southern part of the pit being above the road at RL 400 m. The depths from this point will be 50 meters to the east, 20 meters to the south, and 0 meters (open) to the west.

This stage will cause a direct and lasting change in the environment and significant alteration of the visual aesthetics of the landscape and the dominant landscape features. The new negative landforms will stand out as technogenic disturbances against the natural physical environment with significant changes in the existing spatial structures and resembling urbanised environment to some extent.

The anthropogenic changes occurring in the relatively open landscape after shutdown of operations will primarily have a negative aesthetic impact on landscape appearance.

Appropriate designing and planning of mining and processing operations will limit and mitigate the negative impact of the open pit on the local landscape, and a closure plan will further be developed.

The proposed closure process will involve a set of activities whose objective will be to improve the environmental and aesthetic value of the affected landscapes – the open pit, the IMWF and other production and ancillary structures.

The successful rehabilitation of the technogenic landscapes will be achieved as a two-stage process. The technical rehabilitation stage will include planning (a landscape design plan), re-profiling of artificial slopes, trucking and placement of soil, construction of hydrotechnical and amelioration facilities.

The biological rehabilitation stage will include application of soil fertility restoration techniques and a set of phyto-amelioration activities whose objective will be to rehabilitate the biological components of the landscape. The mine closure practices across the world indicate that such sites may become extremely attractive habitats for certain animal and plant species and a valuable nature conservation resource.

Assessment of the Changes in the Landscape Structure and Functions

The deposit will be open-pit mined, which will inevitably involve rock blasting and excavation, and operation of heavy-duty plant and equipment. The project development will substantially modify the physical appearance of the project site by creating a devegetated landform with clearly expressed elevation. Landscape structure and functions will change - the structure will change from horizontal to vertical and will affect the bedrock, topography, soil and vegetation components. The designation of about 8.5 ha of forest land will be changed to a technogenic landscape for a period of 9 years.

The site rehabilitation will modify the visual perception and aesthetics of the landscape and restore some of its functions.

The negative impacts from the project development will include:

- physical occupation of land;
- devegetation;
- short-term derogation of the quality of environmental media.

The open pit mining will undoubtedly have an irreversible impact on the existing landscape. The footprint of technogenic landscapes will be expanded at the expense of other landscapes during the project operation. The open pit mining will change the topographic forms and land use, and contribute to elevated rates of erosion, pollution of the local environment with non-toxic dust and aerosols, changes in the feeding base of wild fauna and its disturbance. Noise, dust and aerosol pollution of the surrounding areas will disturb the normal life of local populations and may be instrumental for the death of few individuals but not entire populations.

Conclusion:

The implementation of the project will not cause critical deterioration of the physical environment despite that the landscape structure on the site will be modified. The neighboring lands will sustain indirect changes, mainly in the bio-component of the physical environment, but the landscape will retain its functional sustainability.

The main impact on the landscape will be on a local scale affecting visual perception and aesthetics.

Impact forecast:

» *Area of impact* - direct, confined to the pit footprint;
» *Severity of impact* - significant on the surface topography and the overall appearance of the site. The overall impact will be mitigated after the site rehabilitation;
» *Duration* - in the long-term;
» *Reversibility* - limited, through rehabilitation and introduction of suitable vegetation in compliance with the landscape zoning;
» *Cumulative impacts: None.*

10. Cultural Heritage - Expected Impact on Immovable Cultural Assets within the Project Area

The site required for the development of the Krumovgrad Gold Project near the town of Krumovgrad contains evidence of archaeological structures - an adit (fully surveyed) and two bunds, which are interpreted as an ancient gold mine dating back to the Late Bronze/Early Iron Age. The project implementation may jeopardize some of these structures. Therefore, on the grounds of art. 161 par. 1 of the Cultural Heritage Act, BMM and NAIM-BAS have concluded a Framework Agreement for Funding Research Activities, whose objective is to carry out rescue archaeological survey on the Ada Tepe hill with progressive release of surveyed sites to enable the project to proceed. The second stage of implementation of the Agreement includes activities to popularise survey results with the general public.

11. Health and Hygiene Aspects

11.1. Assessment of the Health Risk during Project Construction and Operation and Measures for Health Protection. Distances to the Nearest Housings

11.1.1. Identification of Potentially Affected Population and Areas, Zones or Sites with Specific Health Protection Status or Subject to Health Protection Based on the Environmental Impact Forecast.

An essential element of the project implementation is to ensure the safety of both the on-site personnel and the nearby communities during the 9 year period of operation.

The people living in the neighboring settlements can be assumed as potentially affected.

The Investor proposes two alternative options for development of the deposit, which are summarised below:

Option 1:

- An open pit mine (Ada Tepe) – 17 ha;
- A ROM ore pad – 3 ha;
- A facility for the production of gold-silver concentrate (Process Plant) – 6 ha;
- An Integrated Mine Waste Facility – 41 ha;
- A soil and sub-soil material stockpile – 2 ha;
- A retention pond (close to the open pit) and two collecting sumps (at the toe of the Integrated Mine Waste Facility) – 4 ha;
- Roads – 12 ha;
- An abstraction well.

Option 2:

- An open pit mine (Ada Tepe) – 17 ha;
- A ROM ore pad – 3 ha;
- A process plant for production of dore gold alloy – 2 ha;
- A flotation TMF – 45 ha;
- A waste rock stockpile - 44 ha;
- A soil stockpile – 2 ha;
- A retention pond and collecting sumps – 1 ha;
- Roads – 15 ha;
- A water storage dam.

The types of facilities under each option and their siting clearly shows that Option 1 has significant advantages over Option 2 in terms of health and hygiene, which strongly support the selection of Option 1 as the preferred one and can be summarised as follows:

- Option 1 would require considerably less land to operate the mine, which will reduce the anthropogenic impact, the pollutant emissions in the environment and the health risk;
- Under Option 1, the operational areas are sited to the south-southwest of Ada Tepe thus using the hill as a natural barrier to negative noise and air impacts in the direction of the most densely populated area - the town of Krumovgrad located to the north-northeast of Ada Tepe.
- Under Option 2, the operational areas will be sited closer to the hamlets west of Ada Tepe and the residential areas of the town of Krumovgrad.
- Option 2 considers operation of a TMF, which will raise the health risk if incorrectly operated or in an emergency. The TMF is sited adjacent to residential areas, which is not acceptable.
- There are four main project operational facilities: an open pit, a crushing plant, a concentrator and an IMWF (Option 1) or a TMF (Option 2). Option 1 does not meet the required hygiene protective distances from the open pit and the IMWF, while Option 2 does not comply with the required hygiene protective distances from three of the four operational facilities: the open pit, the dore gold processing facility and the TMF.

- Option 2 considers construction of a water storage dam, which will create additional operational and hygiene risks during normal operation or in an emergency.

Based on the above reasons, Option 2 may be considered as firmly rejected in terms of the hygiene aspects of project operation. The health and hygiene aspects of Option 1 and the "zero" ("no action") alternative are considered below.

Regulation 7 of the MoH on the Hygienic Requirements for Health Protection of Urban Environment (SG issue # 46 /1992, last amendment in SG issue # 46/1994, issue # 89 and issue 101/1996, issue # 101/1997, issue # 20/1999) sets out the minimum protective distances between production sites and settlements. According to art. 4 (1) of the Regulation, any reduction or extension of the hygiene protective distances from/to the operations listed in Appendix 1 & 2 must be sanctioned by the Ministry of Healthcare.

The nearest settlements around the project site are subject to sanitary protection. These are: Soyka (hamlet), Chobanka 1 (hamlet), Chobanka 2 (hamlet), Kupel (hamlet), Sinap (hamlet), Skalak (village), Koprivnik (hamlet), Kremenik (hamlet), Belagush (hamlet) and Pobeda (hamlet).

The effect of the potential negative health impact will also depend on the number of local residents presented in Table V.11.1-1 according to Investor data:

Number of local residents in the settlements around Ada Tepe, Khan Krum deposit.

Table V.11.1-1

Town/ Village	**Hamlet**	**Number of registered residents**	**Number of actual residents**
Krumovgrad		6183	4,662
Izgrev quarter		1,174	1,174
Ovchari	Trastika	18	
	Taynik*	31	27
	Bitovo*	120	44
	Soika*	30	18
	Vurhushka*	150	62
	Konevo*	8	0
	Chobanka 1*	50	0
	Chobanka 2*		
	Sinap*	40	18
Zvanarka	Zvanarka center*	211	75
	Lozino 1	20	10
	Lozino 2	110	50
	Lozino 3	30	15
Surnak	Dryanovets	120	25
	Slez	75	45
	Belina	35	10
	Luka	10	5
	Senoklas	40	23
	Piperitsa	30	5
	Lukovitsa	35	22
	Kiselitsa	40	15
	Tranak	15	0
Dazhdovnik	Dazhdovnik*	89	
	Kupel*	10	1
Edrino*		342	380
Malko Kamenyane	Ladovo	50	25
Kuklitsa	Shturbina	50	20
Skalak	Kremenik*		12
	Pobeda*		15
	Belagush*		0
	Skalak*		9
	Koprivnik*		0

Note: *The settlements whose protective distances are not met are marked with with an asterix sign (*).*

In this regard, the locations of the four operational facilities under the project are important for the hygiene protective distances: 1. Open pit, 2. Crushing plant, 3. Concentrator, and 4. IMWF.

In terms of operational facilities 2. Crushing plant (matched to section 211 - "Crushing, washing and screening plants") and 3. Process plant (section 194 - "Process plants using wet processes"), the required protective distance of 500 m is met.

The pit design contour at the end of the concession period, i.e. the final pit contour, will be at a distance of 330 m from the development limits of the nearest settlement - Chobanka 2. Although the hamlet does not have any registered or permanent residents, it is subject to sanitary protection pursuant to art. 2 of Regulation 7 and the Spatial Development Act (SDA).

According to Appendix 1 to Regulation 7, Section 185 "Open-cut mining of ore and non-ore resources" provides that a protective distance of 2,000 m should be maintained.

This requirement is not met with respect to the following neighbouring settlements, which are subject to health protection and located at the following distances from the open pit:

- Soyka (hamlet) – 600 m.
- Chobanka 1 (hamlet) – 383 m.
- Chobanka 2 (hamlet) – 330 m.
- Kupel (hamlet) – 991 m.
- Pobeda (hamlet) – 738 m.
- Taynik (hamlet) – 1516 m.
- Bitovo (hamlet) – 1093 m.
- Vurhushka (hamlet) – 1164 m.
- Konevo (hamlet) – 1935 m.
- Sinap (hamlet) – 1471 m.
- Zvunarka (village) – 1905 m.
- Dazhdovnik (village) – 1743 m.
- Edrino (village) – 1700 m.
- Kremenik (hamlet) – 1311 m.
- Belagush (hamlet) – 1155 m.
- Skalak (hamlet) – 1530 m.
- Koprivnik (hamlet) – 1597 m.

In addition, the project does not comply with the protective distance requirement applicable to the ***Integrated Mine Waste Facility***. Although it is not a conventional TMF design, it practically belongs to that group of facilities (manges "thickened tailings") and in terms of its potential health impact it should be governed by Section 188 of Appendix 1 to Regulation 7 pertaining to the disposal of non-hazardous process wastes in waste storage facilities whose operational life does not exceed 10 years. The settlements within the 1000 m protective distance from the facility are:

- Chobanka 1 at 636 m;
- Chobanka 2 at 356 m;
- Sinap at 972 m;
- Kupel at 417 m;
- Pobeda at 757 m;

All other hamlets of the villages of Ovchari, Surnak, Dazhdovnik, Edrino, Malko Kamenare, Kuklitsa, and Skalak are at a distance greater than 1000 m. The town of Krumovgrad, including Izgrev quarter, is at about 3000 m from the mining waste facility.

In addition, the provisions of art. 7 of Regulation 7 require that the blast concussion and flyrock safety distance from drill&blast operations should not be greater than 50% of the distance to the nearest property subject to sanitary protection. Therefore, account should be taken of this requirement when designing the mining operation at Ada Tepe. The design safe distance from drill&blast operations (set out in the "Blasting" section of the engineering design) should not exceed **165 m** since the nearest settlement, Chobanka 1, is at a distance of 330 m according to the Krumovgrad Municipal Development Plan. Although the hamlet does not have any registered or permanent residents, it still enjoys the status of a residential area. The estimation of the blast concussion and flyrock safety distances should include a tangential adjustment to take account of the lower elevation of Chobanka 2 relative to the deposit site.

As Chobanka 1 and Chobanka 2 have not been populated for years (according to information provided by the Investor), the closest settlement where people actually live is Soyka, which is at 600m from the open pit. In view of the above, we believe that it is possible to increase the blast concussion and flyrock safety distance. However, this requires that the Investor together with the appropriate state and local authorities should first take the necessary steps under the law to revoke the settlement status of Chobanka 1 and Chobanka 2. Then the safe distance requirement could be extended to **300 m** according to the provisions of art. 7 of Regulation 7.

The project development could proceed at reduced hygiene protective distances only after receiving prior approval from the Ministry of Healthcare.

The concentrate will be shipped on a new road from Ada Tepe, which will connect to an existing road passing close by Pobeda and bypassing the town of Krumovgrad. The concentrate shipment outside the project site is not an issue in terms of hygiene protective distances because the traffic intensity is expected to be low, in covered trucks, about 90 truckloads/trips per month.

The project specifics enable us to conclude that significant health precautions should be taken to ensure protection of public health. The occupational health impacts will be on a strictly local scale.

11.1.2. Identification of the Risks to Human Health Taking Account of Environmental Media, Type of Risk Factors and Conditions (Preconditions for Negative Impacts).

The physical risks to the health of workers involved in the project implementation are dust, noise, common and local vibrations, adverse micro-climate, physical strain.

Chemical risk factors in the working environment are primarily the components of blast fumes and exhaust gases: polycyclic aromatic hydrocarbons (PAHs), carbon and nitrogen oxides, sulfur dioxide, tar, potassium amyl xanthate, sodium silicate, dithiophosphate, copper sulphate, frothers, flocculants.

The risks to the public health during the mine operation will primarily include air pollutants (dust and vehicle exhaust); excessive noise levels, pollution of local surface water and groundwater.

11.1.3. Characterisation of Individual Risk Factors in Terms of Their Impact on Human Health and Comparison against the Applicable Hygiene Standards and Requirements.

Harmful Physical Factors.

Heavy-duty machines (bulldozers, excavators, dump trucks, grader, tank trucks) drill rigs, etc, will be used during project construction, operation, and closure although the fleet will be relatively limited. The above suggests elevated emissions of certain pollutants and particulate matter. Workers will be exposed to the following harmful physical factors:

Dust - A major harmful factor affecting the health of the workers and local population that is associated with the future activities on the site.

The project is a conventional open-cut drill&blast operation. In the most adverse weather conditions (dry and calm weather when blasts are fired) the dust levels may exceed the Maximum Allowable Concentration (MAC), which would be exacerbated by the dust from ore trucking to the crushing section, ore crushing and waste handling at the IMWF in dry and windy conditions. These particulate emissions will be fugitive depending largely on the weather conditions (wind, humidity, temperature, atmospheric stability), properties of ground particles, etc. Ore trucking up the pit ramps and to the crushing section will generate the highest ASL (ground level) dust concentrations near the haulage roads.

Acute health effects

Generally, the acute health symptoms caused by dust are mucosal irritation (eyes, nose and throat) and shortness of breath; however, exposure to "clean" (free of toxic substances) particulate matter is very rare. It is common that dust exposure is combined with exposure to toxic substances. Acute toxic effects caused by toxic chemical substances can dominate over the effects caused by dust. The role of particulate matter in the transport of toxic chemical substances to the lung cells and retention there is one of the possible explanations for the progressive damage of lung tissue following acute exposure.

Chronic health effects

Fine particulates can impair the functioning of the lungs temporarily (reversible) or permanently (irreversible). They are instrumental for the development of chronic bronchitis and are a prerequisite for acute bacterial or viral respiratory infections, especially in susceptible individuals. Dust exposure contributes to complicated bronchial asthma, late stages of chronic bronchitis, pulmonary emphysema, any existing cardiovascular disease, and also morphological changes in the lung tissue.

Unfavorable micro-climate - the activities at the site will be carried out mostly outdoors, which in the best case puts the activities into the 'Working outdoors all year round' category. The micro-climate in the cabs of heavy-duty machines during the summer increases the risk of overheating.

Excessive noise levels - the adverse health effects of noise are mainly on the central nervous system and primarily cause sleep disorders and neurosis-like conditions. This will affect a very limited number of workers.

Heavy construction equipment - excavators, bulldozers, trucks - generate high sound pressure levels in the working environment, which often exceeds the standard of 85 dB/A inside the cab and has adverse health effects on the auditory and nervous systems.

Modern and technically sound equipment should be used on the site to ensure mitigation of the adverse noise impacts to both workers and the nearest communities. The preliminary estimations of the noise levels at the nearest recipients (settlements) indicate that the noise standards applicable to different times during the day and night would be met, which is favourable from the hygiene perspective. The above forecast can unconditionally be confirmed or rejected only on the basis of direct in-situ measurements and regular noise monitoring after commencement of operations.

Excessive levels of common vibrations. Reference literature and expert studies indicate that heavy equipment generates excessive levels of common vibrations. Older equipment generates stronger vibrations. Operators of trucks, excavators and bulldozers will be exposed to common vibrations. Common vibrations damage primarily the muscolo-skeletal and vascular systems. The resonance effect can also cause damage to many internal organs.

Local vibrations - Operators of utility vehicles will be exposed to local vibrations. Their adverse impact on human health results in impairment of the sensory and micro-vascular system of the upper limbs. Those effects are exacerbated when working in an overcooling microclimate.

Harmful toxic chemicals.

No mining or processing operations will be carried out during the construction stage and the project will have the typical features of a large construction project. The main chemical pollutant will be the exhaust from the construction equipment, which is not expected to be a hygiene issue for the local communities.

Air pollution with toxic substances during operation will also come from the exhaust from the internal combustion engines of the mining and haulage equipment. The main pollutants released in the environment are CO, NOx, SO_2, hydrocarbons, exhaust fumes. These emissions are fugitive emissions and will depend on the number and type of operating units, the mode of operation and the road traffic intensity during operation:

Carbon monoxide - When inhaled, it forms carboxyhemoglobin, which reduces the oxygen binding capacity of hemoglobin. Has general toxic effects.

Nitrogen and sulphur oxides - They form acids when interacting with the body, irritating and corrosive.

Gasoline is a mixture of light-weight hydrocarbons and includes paraffins, cycloparaffins, aromatic hydrocarbons - colourless, with a specific odor, volatile under normal conditions. Gasoline toxicity - fume concentrations of 40 mg/m^3 are life-threatening if inhaled for 5-10 minutes. Exposure to lower concentrations for one or several hours causes irritation of the mucous membrane of the upper respiratory tract and the eye conjunctiva, headaches, dizziness, and stomach pains.

Potassium amyl xanthate (Figure V.11.1-1) - is an ester with a molecular weight of 164.288880 [g/mol]. Classified as 'harmful' (H5) if in a concentration greater than 25 % (R35) or 'irritating' (H4) if in a concentration greater than 20 % (R36, R36, R38). Xanthate will be fed to the flotation circuit as a 5% solution. The tailings will be thickened in the process plant and the thickener overflow will be recycled back into the process. Therefore, xanthate will not only have no harmful or irritating effects but it will also be absent from the final thickened tailings or will be present in negligible amounts, i.e. it will be contained in the process circuit and will not report to the IMWF. In addition, xanthate has a half-life of 7 days and therefore even traces of it cannot remain in the tailings in the long term.

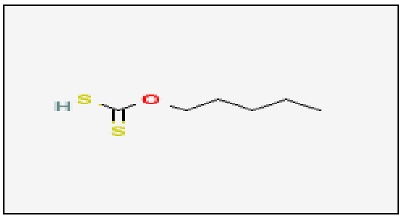


Fig. V.11.1-1. Potassium amyl xanthate $C_6H_{12}OS_2$ (O-pentyl ester).

Appendix 1 to Regulation 13 on Employee Protection against Risks of Exposure to Chemical Reagents at Work specifies a maximum allowable concentration in the ambient air at the workplace when using potassium amyl xanthate - 1.0 mg/m^3, and the Regulation also specifies requirements that the employer should comply with when working with chemical reagents - xanthates in our case.

Sodium silicate (Fig. V.11.1-2) - An alkaline solution, which irritates the mucous membranes and the skin. Practically safe if appropriately handled in a professional environment.

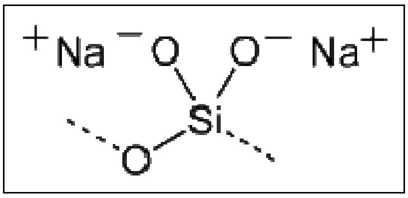


Fig. V.11.1-2. Sodium silicate (liquid glass).

Degrades quickly in the environment and does not accumulate. Only large amounts of the substance would create a risk in case of accidental spillage in surface water because of its strong alkalinity. Its former use in the food industry as a preservative for eggs is evidence that it is relatively safe.

Zinc dialkyl dithiophosphate (Fig. V.11.1-3) - a compound with limited reactivity, low biological activity and very limited water solubility. Irritates the mucous membranes and the skin in case of direct contact. In addition to mining, it is also used as an additive to motor oils to reduce friction. Emits specific unpleasant sulphur odor when in contact with aqueous solutions.

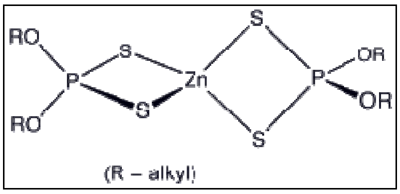


Fig. V.11.1-3. Zinc dialkyl dithiophosphate.

Copper sulphate pentahydrate $CuSO_4.5H_2O$ (bluestone) - Harmful if swallowed, can cause irritation to eyes and skin. Ingestion may cause stomach ache, nausea, vomiting, diarrhea, blood pressure to drop, tachycardia, and unconsciousness. Very toxic to aquatic life with long lasting effects. Has a fungicidal effect. Copper ions are toxic to fish, algae, protozoa and bacteria. If present in waste in concentrations greater than 20%, it makes the waste exhibit a hazardous property – irritant (4). It will be fed into the process upstream of the grinding stage in the semi autogenous mill as a 20% solution. Due to the minimum amounts of copper sulphate that will be added to the process and the absence of any copper minerals in the ore, the final copper sulphate concentration in the waste will be extremely low.

The **OrePrep F-549 frother** by Cytec is a liquid mixture of polyglycols. The oral LD50 (tested on rats) and the dermal LD50 (tested on rabbits) are > 2000 mg/kg and > 2000 mg/kg respectively. A direct contact with the frother may cause mild irritation to eyes and skin. It has an ether-like odour and is completely soluble in water.

Flocculant - It is a chemical agent used to decant water in the flotation pond. It causes small particles to aggregate (flocculate).

***Physical strain*.**

The mining and processing operations will largely be mechanised. Notwithstanding, manual labour requiring significant physical efforts will also be done as required. In terms of physical strain, the work load can be classified as "moderately heavy" to "heavy".

11.1.4. Assessment of the Potential for Combined, Complex, Cumulative and Remote Effects of the Identified Factors.

The long-term combined effects of dust and toxic gaseous chemicals are irritating to the mucous membrane and may cause respiratory diseases - chronic inflammation of the upper respiratory tract (rhinitis, bronchitis) and lung diseases (pneumosclerosis, bronchiectasia).

There are no indications of cumulative effects of toxic noxae. No negative cumulative health effects in terms of dust and noise pollution from the project are expected in the absence of other major industrial activities and unfavourable environmental background conditions in the area.

Another favourable factor is the absence of other sources of industrial noise in the local environment.

Regarding the cumulative effect of the potentially harmful ***physical factors*** form the activities on the site, dust and noise are the most important workplace hazards in terms of industrial hygiene.

Dust will be generated in large amounts by almost every major operation – rock blasting and handling, crushing and grinding, and waste deposition in the IMWF (airborne dust from the open surfaces). Dust generation will be directly proportional to the scale and intensity of operations. If all practical dust control measures are implemented and given the design scale of the operations and the proximity to the surrounding settlements, the dust levels may occasionally exceed the allowable limits in unfavourable weather conditions. The local communities primarily use hard fuels for heating during the cold season and the particulate matter from heating and traffic should also be taken account of.

In terms of **noise**, there is a cumulative effect because noise is generated by pit blasting, material handling, crushing and grinding, and co-disposal of waste rock and tailings in the IMWF.

Regarding the ***chemical factors***, the main issue are the elevated background levels of arsenic and heavy metals in the local soils. The Investor's modelling of the behaviour of arsenic and heavy metals in a water leaching medium in an industrial environment does not indicate a risk of migration. Despite that, to avoid a cumulative risk of liberating mobile forms of arsenic and other heavy metals, especially in the Krumovitsa River system (the Krumovitsa gravels are the main drinking water source available to the local communities), strict monitoring of the groundwaters downstream of the IMWF and of the excess water discharges to the environment should be performed.

The ancillary transport is not expected to generate negative cumulative noise, dust and fume effects to human health because the traffic intensity outside the project site will be low and the transport corridor will bypass the most densely populated town of Krumovgrad without crossing the Krumovitsa River.

11.1.5. Exposure Characterisation.

The exposure of workers and population is expected to be direct, through the air, regular in terms of duration or intensity.

To estimate the path of air exposure, it should be noted that mainly fugitive emissions are expected to be generated by the site operations:

- Exhaust from the engines of the mine production and haulage equipment;
- Dust;
- Noise from blasting and from the operation of the mobile fleet and the crushing section.

The risk of chemical pollution of local surface waters and groundwaters involves direct exposure in case of pollution of drinking water sources in the Krumovitsa valley, and indirect exposure in case of supply of polluted water for irrigation or drinking by animals.

The direct risk is minimal because the main project facilities are away from the drinking water abstractions. In addition, the water supply sources are subject to special sanitary protection. It is a triple protection system that ensures physical protection of the source and protection against contamination with pollutants. The land falling within the relevant protective distance is referred to as 'protected zone', which circumscribes the water source. The outermost protected zone (Zone III) ensures protection of the source against pollution with chemical, slowly degrading, low-sorbing and non-sorbing cubstances. The outer edge of Zone III is determined as the vertical projection of the curve on the ground surface which connects all the points in the aquifer from which the water could reach the source (abstraction) for 25 years. The project wastewater discharges will occur 5 to 6 km upstream of Zone III around drinking water abstractions. The site discharges will be subject to a more restrictive control that is normally required for direct discharges into protected zones.

The emissions under consideration will occur in the long term but on a local scale and will depend on the mitigation measures that will be taken.

11.1.6. Health Status of the Potentially Affected Population.

The health status of the population is dependent on many factors of the natural and work environment, social welfare, hereditary factors and demographic status. Of particular importance are some specific criteria that can relate the environmental pollutants to the changes in the health status, like for example the respiratory and cardio-vascular diseases and the structure of oncological morbidity.

The objective of this survey is to examine the health status of the population from Krumovgrad municipality including the residential areas situated in the vicinity of the investment site and Kardzhali District for a retrospective period in order to identify whether there are determinant environmental factors (patterns) or not.

The tasks required to achieve this objective are:

1. Survey of the health status of the population of Krumovgrad Municipality by demographic indicators for a three-year retrospective period and comparison of the results against the nation-wide indicators.
2. Survey of the health status of the population of Kardzhali District by reported morbidity rates, number of hospitalized children and students and oncological morbidity indicators (level and structure) for a three-year retrospective period.
3. General Characterisation of the Health Status of the Population of Krumovgrad Municipality.

The subject of the survey is the population of Krumovgrad Municipality and the population of the country.

Scope of survey:

Comprehensive for the population of Krumovgrad municipality by the indicators specified above and the necessary comparison against the nation-wide indicators.

Monitoring units:

Logic monitoring unit - the residents of Krumovgrad Municipality.

Technical monitoring unit - the environment, including the factors and parameters of Krumovgrad municipality.

Survey of the health status of the population of Krumovgrad Municipality by demographic indicators and comparison of the results against the nation-wide indicators.

Statistical data for the number of the population and its distribution according to sex and age for Krumovgrad municipality indicate that the age structure is of "static to ageing" type as the greater percentage of the population is either in active working age or over state pension age.

Distribution of the population in the Krumovgrad municipality

Table V.11.1-2

Categories	**Numbers**
Population of Krumovgrad Municipality on 31.12.2005	18,374
Including men women	9,238 (50.3%) 9,136 (49.7%)
Below 18 years of age 18-64 years of age Over 65 years of age	3,154 (17.2%) 11,388 (62.0%) 3,832 (21.8%)

The main demographic indicators for a three-year period are examined for the Krumovgrad Municipality only and for the country as a whole (Table V.11.1-3).

Data on childhood mortality rate, general mortality rate, birth rate, and natural growth are summarised for Krumovgrad Municipality and for the country as a whole.

The birth rate data shows fairly equal values, it is stable for the period 2005-2007 and basically higher for Krumovgrad Municipality. The mortality rate is considerably lower than that for the country. The natural growth rate, which is a resultant indicator derived from the two main demographic indicators birth rate and general mortality rate, is markedly higher for the Krumovgrad Municipality compared to the rate for the country as a whole.

The surveyed period indicates a relatively high childhood mortality rate for the region, which in 2007 was close to the average for the country.

Demographic indicators for Krumovgrad Municipality and the country as a whole

Table V.11.1-3

Year	**Indicators per 1,000 people**	**Krumovgrad Municipality**	**Republic of Bulgaria**
2005	Birth rate	10.8	9.2
	Mortality rate	11.8	14.6
	Natural growth	-1.0	-5.4
	Mortality of infants under 1 year of age	19.5	11.1
2006	Birth rate	11.7	9.6
	Mortality rate	12.3	14.7
	Natural growth	-0.6	-5.1
	Mortality of infants under 1 year of age	22.8	9.4
2007	Birth rate	11.3	9.8
	Mortality rate	13.4	14.8
	Natural growth	-2.1	-5.0
	Mortality of infants under 1 year of age	9.6	9.2

As a whole, the current negative demographic characteristics for the Krumovgrad municipality population are considerably more favorable than those for the country, which does not indicate any significant hazardous impact from environmental factors. A major problem is the continuing migration including immigration, the economic issues, the problems of marriage and family life, the bad habits and the related socially significant diseases.

The data about deaths caused by diseases under some of the chapters of the International Statistical Classification of Disease and Related Health Problems (10th revision), or ICD-10, provides interesting demographic and health information because it is one of the indirect indicators for the health status of the population. Data is available for the Kardzhali district as a whole, which includes Krumovgrad Municipality.

The disease clusters that are most related to the environmental factors are:

Chapter II: Neoplasms;
Chapter IV: Endocrine, nutritional and metabolic diseases;
Chapter IX: Diseases of the circulatory system;
Chapter X: Diseases of the respiratory system;
Chapter XI: Diseases of the digestive system;
Chapter XII: Diseases of the skin and subcutaneous tissue;
Chapter XIV: Diseases of the genitourinary system;
Chapter XVII: Congenital malformations;

The data for Kardzhali District in Table V.11.1-4 below are more favourable than those for the country including the disease clusters that are most influenced by environmental factors - the oncological, respiratory and cardio-vascular diseases, and the mortality associated with them (Chapters II, IX, and X). Kardzhali District reports considerably lower mortality rates for oncological and cardio-vascular diseases than the country as a whole.

The summarised data for the district indicate a mortality rate that is lower than the the national average.

One of the typical negative impacts observed in communities living close to polluting businesses is on the functions of the respiratory and the cardio-vascular systems, and, respectively, on the mortality rates for these diseases. Kardzhali District does not report a significant increase of oncological, respiratory and cardio-vascular diseases over the surveyed period, which is a favorable factor and proves the limited effect of aggressively influencing factors, including environmental ones.

Death registrations by cause in Kardzhali District and the country as a whole (per 100,000 persons)

Table V.11.1-4

Disease chapter; Year	Region	*General mortality rate*	II	IV	IX	X	XI	XII	XIV	XVII
2005	Kardzhali	*1097.9*	181.5	11.9	690.9	40.8	25.1	-	14.4	7.5
	Bulgaria	*1464.8*	231.7	25.6	968.1	57.7	42.8	0.7	15.4	3.2
2006	Kardzhali	*1104.4*	188.0	4.4	704.4	39.9	21.5	-	20.3	-
	Bulgaria	*1473.4*	230.0	29.1	978.5	54.3	41.5	0.5	15.4	2.4
2007	Kardzhali	*1143.5*	178.3	8.9	732.9	55.4	22.9	-	24.8	3.2
	Bulgaria	*1475.3*	234.9	28.3	971.0	59.3	45.6	0.5	17.2	2.2

A detailed survey of the structure of morbidity by cause in Krumovgrad Municipality for 2007 and 2008 was completed and the results were compared against the summarised data for Kardzhali District. The survey covered 19 disease chapters of ICD-10 and the results are presented in Tables No. V.11.1-5 and V.11.1-6:

Structure of Morbidity by Cause in the Krumovgrad Municipality and Kardzhali District, 2007.

Table V.11.1-5

Chapter No.	*Disease name according to ICD-10*	*New disease registrations*	
		Krumovgrad Municipality %	*Kardzhali District %*
	Total	***100***	***100***
I	Certain infectious and parasitic diseases	3.2	3.5
II	Neoplasms	0.7	0.9
III	Diseases of the blood and blood-forming organs	0.4	0.6
IV	Endocrine, nutritional and metabolic diseases	1.3	1.4
V	Mental disorders	0.4	1.5
VI	Diseases of the nervous system	3.6	4.2 VI+VII+VIII
VII	Diseases of the eye and adnexa	9.3	
VIII	Diseases of the ear	1.6	
IX	Diseases of the circulatory system	17.0	7.3
X	Diseases of the respiratory system	28.0	48.4
XI	Diseases of the digestive system	4.3	4.5
XII	Diseases of the skin	5.5	5.8
XIII	Diseases of the musculoskeletal system and connective tissue	5.0	3.5
XIV	Diseases of the genitourinary system	5.0	8.0
XV & XVI	Pregnancy, childbirth and the puerperium	0.4	0.1
XVII	Congenital malformations	0.1	0.2
XVIII	Symptoms not elsewhere classified	3.2	4.1
XIX	Injury and poisoning	11.0	6.0

Structure of Morbidity by Cause in the Krumovgrad Municipality and Kardzhali District, 2008.

Table V.11.1-6

Chapter No.	*Disease name according to ICD-10*	*New disease registrations*	
		Krumovgrad Municipality, %	*Kardzhali District, %*
	Total	***100***	***100***
I	Certain infectious and parasitic diseases	6.8	5.2
II	Neoplasms	1.5	1.0
III	Diseases of the blood and blood-forming organs	0.6	1.6
IV	Endocrine, nutritional and metabolic diseases	2.2	0.5
V	Mental disorders	1.0	1.1
VI	Diseases of the nervous system	1.7	2.4 VI+VII+VIII
VII	Diseases of the eye and adnexa	6.1	
VIII	Diseases of the ear	4.4	
IX	Diseases of the circulatory system	9.7	7.4
X	Diseases of the respiratory system	30.6	52.3
XI	Diseases of the digestive system	3.8	4.0
XII	Diseases of the skin	4.4	6.8
XIII	Diseases of the musculoskeletal system and connective tissue	4.8	0.1
XIV	Diseases of the genitourinary system	9.0	5.0
XV & XVI	Pregnancy, childbirth and the puerperium	0.7	3.8
XVII	Congenital malformations	0.5	0.2
XVIII	Symptoms not elsewhere classified	3.1	3.1
XIX	Injury and poisoning	9.1	5.5

Especially interesting are the disease rates for the 4 disease chapters that are socially important for the population of Bulgaria. They can change under the influence of environmental factors including ecological risk factors, namely: oncological diseases, diseases of the blood and blood-forming organs; diseases of the circulatory system; diseases of the respiratory system.

The rates in Tables 5 and 6 are fairly equal for the two-year survey period. They are more favorable for the population of Krumovgrad Municipality including for the most important disease chapter influenced by environmental risk factors - the diseases of the respiratory system.

The data of hospitalized supervision of children and students have also been surveyed (Tables No. V.11.1-7, V.11.1-8, V.11.1-9 and V.11.1-10):

Disease Monitoring of Pre-School Children in the Kardzhali District in % for 2004/2008

Table V.11.1-7

Diseases that are subject to monitoring	**Kardzhali District**				
	2004	**2005**	**2006**	**2007**	**2008**
Epilepsy	0.17	0.00	0.27	0.27	0.32
Tuberculosis	0.17	0.00	0.00	0.00	0.00
Oligophrenia	0.14	0.00	0.00	0.00	0.06
Congenital malformations of the cardio-vascular system	0.08	0.00	0.17	0.13	0.08
Hypertonia	0.03	0.02	0.02	0.04	0.00
Asthma	0.45	1.08	0.27	0.97	0.67
Chronic bronchitis	1.64	0.59	2.99	1.27	0.73
Cerebral palsy	0.03	0.00	0.04	0.06	0.14
Diseases of the endocrine gland	0.03	0.00	0.00	0.02	0.02
Diseases of the blood and blood-forming organs	0.45	0.02	1.13	0.13	0.18
Gastric and duodenal ulcer	0.00	0.02	0.00	0	0
Gastritis and duodenitis	0.00	0.00	0.02	0.15	0.02
Obesity	1.10	0.41	1.32	0.80	1.42
Diabetes	0.03	0.00	0.04	0.10	0.00
Acute and chronic glomerulonephritis	0.03	0.00	0.00	0	0
Acute and chronic pyelonephritis	0.22	0.02	0.02	0.04	0.04
Spine deformities	0.03	0.02	0.00	0.00	0.00
Congenital malformations	0.14	0.08	0.04	0.04	0.08

Disease Monitoring of Pre-School Children in the Krumovgrad Municipality, in % for 2004/2008

Table V.11.1-8

Diseases that are subject to monitoring	**Krumovgrad Municipality**				
	2004	**2005**	**2006**	**2007**	**2008**
Epilepsy	0.00	0.00	0.00	0.00	0.00
Tuberculosis	0.00	0.00	0.00	0.00	0.00
Oligophrenia	0.00	0.00	0.00	0.00	0.00

Diseases that are subject to monitoring	**Krumovgrad Municipality**				
	2004	**2005**	**2006**	**2007**	**2008**
Congenital malformations of the cardio-vascular system	0.00	0.00	0.00	0.00	0.00
Hypertonia	0.00	0.00	0.00	0.00	0.00
Asthma	0.00	0.00	0.00	0.00	0.00
Chronic bronchitis	0.00	0.00	0.00	0.00	0.00
Cerebral palsy	0.00	0.00	0.20	0.20	0.20
Diseases of the endocrine gland	0.00	0.00	0.00	0.00	0.00
Diseases of the blood and blood-forming organs	0.00	0.00	0.00	0.00	0.00
Gastric and duodenal ulcer	0.00	0.00	0.00	0.00	0.00
Gastritis and duodenitis	0.00	0.00	0.00	0.00	0.00
Obesity	0.39	0.61	0.40	0.65	0.65
Diabetes	0.00	0.00	0.00	0.00	0.00
Acute and chronic glomerulonephritis	0.00	0.00	0.00	0.00	0.00
Acute and chronic pyelonephritis	0.00	0.00	0.00	0.00	0.00
Spine deformities	0.00	0.00	0.00	0.00	0.00
Congenital malformations	0.00	0.00	0.00	0.00	0.00

Disease Monitoring of School Children in the Kardzhali District in % for 2004/2008

Table V.11.1-9

Diseases that are subject to monitoring	**Kardzhali District**				
	2004	**2005**	**2006**	**2007**	**2008**
Epilepsy	0.22	0.20	0.20	0.25	0.38
Tuberculosis	0.04	0.00	0.07	0.00	0.00
Oligophrenia	0.66	0.54	0.53	0.55	0.71
Congenital malformations of the cardio-vascular system	0.19	0.06	0.15	0.15	0.20
Hypertonia	0.17	0.11	0.08	0.11	0.10
Asthma	0.37	0.40	0.37	0.42	0.47
Chronic bronchitis	0.51	0.68	0.51	0.57	0.62
Cerebral palsy	0.02	0.00	0.02	0.04	0.05
Diseases of the endocrine gland	0.02	0.01	0.06	0.03	0.01
Diseases of the blood and blood-forming organs	0.07	0.01	0.10	0.11	0.01
Gastric and duodenal ulcer	0.02	0.05	0.05	0.06	0.08
Gastritis and duodenitis	0.08	0.06	0.07	0.13	0.07
Obesity	1.58	1.58	2.58	2.19	3.10
Diabetes	0.06	0.06	0.14	0.05	0.07
Acute and chronic glomerulonephritis	0.02	0.06	0.02	0.01	0.02
Acute and chronic pyelonephritis	0.05	0.04	0.05	0.03	0.05
Spine deformities	0.37	0.32	0.33	0.36	0.20
Congenital malformations	0.10	0.07	0.06	0.08	0.08

Disease Monitoring of School Children in the Krumovgrad Municipality, in % for 2004/2008

Table V.11.1-10

Diseases that are subject to monitoring	**Krumovgrad Municipality**				
	2004	**2005**	**2006**	**2007**	**2008**
Epilepsy	0.12	0.09	0.12	0.08	0.20
Tuberculosis	0.00	0.00	0.00	0.00	0.00
Oligophrenia	0.04	0.04	0.08	0.08	0.10
Congenital malformations of the cardio-vascular system	0.00	0.00	0.00	0.04	0.05
Hypertonia	0.12	0.16	0.08	0.04	0.05
Asthma	0.08	0.12	0.21	0.21	0.05
Chronic bronchitis	0.46	0.40	0.54	0.12	0.10
Cerebral palsy	0.00	0.00	0.00	0.00	0.00
Diseases of the endocrine gland	0.00	0.00	0.00	0.00	0.00
Diseases of the blood and blood-forming organs	0.00	0.00	0.00	0.00	0.00
Gastric and duodenal ulcer	0.08	0.09	0.04	0.04	0.10
Gastritis and duodenitis	0.00	0.04	0.00	0.04	0.05
Obesity	1.05	0.92	1.68	0.47	1.01
Diabetes	0.00	0.00	0.00	0.00	0.00
Acute and chronic glomerulonephritis	0.00	0.00	0.04	0.04	0.05
Acute and chronic pyelonephritis	0.00	0.00	0.00	0.08	0.10
Spine deformities	0.08	0.08	0.08	0.04	0.05
Congenital malformations	0.00	0.00	0.00	0.00	0.04

The results show steady to lowering number of hospitalized children and students for the five-year period, which once again indicates that there is no negative trend in the health characteristics of the Krumovgrad Municipality.

Survey of the ealth status of the population by oncological morbidity indicators according to level and structure for the retrospective period.

The data for the oncological morbidity have been analysed according to localization for a three-year period 2005-2007. Table V.11.1-11 presents 7 oncological disease clusters according to localization that are socially important and at the same time most influenced by the environmental factors.

Malignancy registrations according to their localisation for 2005-2007 (per 100,000 persons)

Table V.11.1-11

Name and localisation of the neoplasm	**2005**		**2006**		**2007**	
	District Kardzhali	**Bulgaria**	**District Kardzhali**	**Bulgaria**	**District Kardzhali**	**Bulgaria**
Total	*1538.2*	*3069.9*	*1646.2*	*3229.0*	*1698.1*	*3330.7*
1. Mouth, mouth cavity and pharynx	106.8	120.4	107.6	121.6	111.4	118.6
2. Digestive organs and peritoneum	245.0	441.9	215.2	472.7	217.8	498.7

Name and localisation of the neoplasm	**2005**		**2006**		**2007**	
	District Kardzhali	**Bulgaria**	**District Kardzhali**	**Bulgaria**	**District Kardzhali**	**Bulgaria**
3. Respiratory system and thoracic organs	152.0	201.3	175.9	209.1	169.4	217.6
4. Breast (females)	347.9	1038.3	395.9	1093.1	408.8	1124.8
5. Other or unspecified localisation	31.4	46.8	35.4	46.7	38.8	47.4
6. Lymph and blood-forming organs	59.7	117.1	75.3	123.8	72.6	131.1

The nosologic structure of the reported oncological morbidity for the Kardzhali district and the country during the 3 year period has not changed substantially.

For all disease clusters, the numbers for Kardzhali District are considerably lower than those for the country as a whole, and the rates for breast neoplasms are almost three times lower. The general oncological morbidity rate is considerably lower than the average for the country and the rates for all the other 27 districts. These numbers are well known and indirectly prove that the environment is clean and the life conditions are favourable in most parts of the district.

General Characterisation of the Health Status of the Population.

The population of Krumovgrad Municipality enjoys relatively stable levels of demographic indicators that are more favorable than the national average.

The dynamics of the reported morbidity rate in Kardzhali district and Krumovgrad municipality is steady for 2007-2008.

The socially important oncological morbidity rate according to localisation reflects female breast diseases and diseases of the digestive and respiratory systems. The general oncological morbidity rate is considerably lower than the national average.

11.1.7. Health risk assessment, measurement for health protection and risk management.

Preventive Measures for Protection of Personnel Health

The following key requirements to occupational health and safety may be listed:

- All excavator operators and bulldozer operators should wear ear protection.
- Workers should use anti-vibration safety gloves and mats.
- Appropriate protection should be provided to keep hands dry and warm during cold periods.
- Fans should be installed in the cabins of excavators and bulldozers during the warm summer days.
- Workers should be provided with workwear that is appropriate for the season.
- Personnel should undergo regular medical checkups for early identification of work-related diseases.

Table V.11.1-12 summarises the risk factors that have a negative impact on the health of the workers engaged in the project construction, operation and closure, and the measures for mitigation of the professional risk.

Table V.11.1-12

Type of risk factor	**Conditions for negative impact**	**Measures for mitigation of the health risk at the work place**
Soil dust. Dust from ore and mine waste activities. Dust from transport activities.	Pit operations in dry and calm weather. Crusher breakdowns	Use personal protective equipment. Ensure water sprinkling. Maintain dust protective systems in good condition.
Exhaust emissions.	Operation of vehicles that are old or in poor condition.	Use high-quality fuel, ensure emissions control, install efficient catalysts on vehicles.
Contamination with engine, gear and lubricating oils.	Vehicles in poor operating condition and incorrect oil change.	Do oil change according to requirements.
Blasting materials. Blasting fumes.	Lack of safety information. Non-compliance with technical requirements.	Use personal protective equipment. Ensure strict control on the use of explosives.
Excessive noise/ vibration levels.	Operation of heavy equipment and dump trucks. Operation of the crusher.	Operate well-maintained equipment and dump trucks. Wear hearing protection. Use noise-protection and anti-vibration equipment.
Overheating or overcooling micro-climate.	Work outdoors.	Ensure suitable work clothing, boots, hats, food and drinking diet.
Physical strain. Uncomfortable working position.	Lifting of heavy objects. Manual work.	Ensure convenient breaks. Personnel to undergo preliminary and regular medical checkups.
Psychological and sensory strain. High level of responsibility.	Complicated operational stages in the process design.	Work under the supervision of qualified specialists.
Possible labor accidents.	Falls, light injuries and traumas, burns, chemical poisoning.	Ensure personnel induction and toolbox meetings. Use personal protective equipment.
Compliance with the OHS requirements pertaining to acceptable levels of the dust and prevention/ protection against physical and chemical hazards at the work place in accordance withe standards for health and safety at work.	No dust control in the open pit. No dust collection system in the crushing area.	Implement measures for mitigation of the health risk at the work place Ensure prevention of occupational diseases.
Strict compliance with the OHS rules.	Inefficient organisation of the working process.	Design a set of measures to reduce occupational morbidity rates. Reduce the risk of work-related traumas.

All preventive care requirements must be complied with in relation to potential health risks, namely:

- Excessive dust levels involve a risk factor for the development of lung diseases due to the irritating effect of dust, e.g. rhinitis, chronic bronchitis and similar complications, and also for the development of occupational dust-related pathology. Implementation of all technical and medical preventive measures will be of utmost importance for employee health protection.
- Compliance with all technical requirements for general vibrations in bulldozers and heavy trucks must be achieved;

- An ergonomic work/rest schedule must be implemented (Regulation 15/1999 of the Ministry of Healthcare);
- A shift-based work cycle demands promotion of certain healthcare measures and ergonomic work/rest schedule for the workers on site including the crusher section (Regulation 16/1999 of the Ministry of Healthcare);
- All preventive measures need to be implemented to ensure employee health and safety by delivery of equipment operating safety instructions;
- Ensure compliance with Regulation 13 on Employee Protection against Risks of Exposure to Chemical Reagents at Work, especially when working with flotation reagents.

Preventive Measures for Protection of Public Health

Based on industrial hygiene experience, the major factors that are potential health risks for the population in areas of open pit ore mining, hauling, crushing, flotation, and tailings disposal, are related to:

- *Noise and vibrations;*
- *Air emissions of dust and exhaust from vehicles;*
- *Chemical pollution of soils, surface and ground water*

From hygiene point of view, the proximity of the investment project site to the surrounding residential areas is the main risk to the public health.

No new open pits, flotation plants and mine waste disposal facilities have been constructed in Bulgaria over the last few decades. However, much larger similar facilities are operated in the country. In strict compliance with the requirements for public health protection, the Ministry of Healthcare has approved a number of quarrying projects to proceed.

The current project is very similar to the existing operational mining and quarrying projects because it involves open-cut mining and primary (flotation) processing of the mineral resource. This type of operation has a typically intensive operational cycle of mining and processing of large resource tonnages to produce concentrate of sufficient quantity that ensures cost-efficiency of the project. That involves extraction of large volumes of rock material, blasting, consumption of relatively large amounts of explosives, continuous site operation (24/7), generation of large quantities of mine wastes, etc. The project proposal considers a relatively small-scale open pit operation with not more than two blasts per week. This substantially minimises the risk to the health of the workers and the local public.

1. The main sources of ***noise and vibration emissions*** are the open pit operations including ore handling and the crushing operations. The hilly topography of the region is not conducive to free propagation of high equivalent noise and vibration levels. The Investor (using the measures from the table below) must invest maximum efforts to limit the negative noise impact on human health.

The existing favourable factors and measures for noise mitigation are:

- the hill acting as a natural barrier to negative noise impacts;
- the mining sequence leaving a shielding wall;
- a wet drilling system, where the drill rigs are equipped with dust collection and suppression systems (dry filters for larger dust particles and a water mist system to suppress the dust particles smaller than 10μm);
- maintaining a protective green belt around roads and operational areas; and
- progressive rehabilitation of the roads that have been made redundant.

The results obtained from the noise modelling and presented under Section 6. Noise above do not demonstrate any excessive noise above the acceptable levels.

As already mentioned above, the explosive charges will be calculated and designed to ensure compliance with the requirements under art. 7 of Regulation 7/1992 for flyrock safety distance from the blast. That would not only limit the noise generation within the region as a result of the reduction in the mining and throughput tonnage, but also have a positive health effect from the reduction of the dust and exhaust emissions to the adjacent villages.

The noise protection of every area potentially affected by high noise levels should be considered and planned separately taking account of the applicable noise limits, the local topography, the type of the site/area subject to protection, its location relative to the noise source, and other factors. Regulation 6/2006 on the Environmental Noise Indicators (MH and MOEW) sets out the limits for "existing residential areas", which are: 55 dBA daytime limit, 50 dBA evening limit and 45 dBA nighttime limit (see Table V.11.1-2).

2. In terms of ***dust and exhaust gas emissions***, the risk will vary depending on the process stage, wind direction, and air humidity.

The hilly topography of the region is a favorable factor that has a shielding effect acting as a natural dust screening and attenuation barrier. The open-pit is at a higher elevation than the adjacent villages, which is not very favourable in terms of dust emission dispersion. It is expected that the pit walls will have a shielding effect, which will additionally minimise the dust emissions in the direction of the nearest settlements.

According to the Section 1. Air above, everyday mining operations in the open pit (drilling, crushing, material handling) will contribute most to the emissions of particulate matter (PM_{10}) as a fugitive emission area source. The next largest source of dust emissions will be the waste rock disposal, while the annual emissions from blasting will have a relatively low contribution to total dust emissions.

The prevalent north to south wind direction is a favorable factor, which will carry potential excessive dust levels towards unpopulated areas.

The most accurate data on the health impact potential of blasting and mining can be derived from the modelling of the air pollutant composition, volume and dispersion.

<u>Mining:</u> The forecast results demonstrate that air pollution levels within the populated areas as a result of open pit operations will be: - comparable with the allowable limits for MAC of PM_{10} in centres of population depending on the selected option: – Option 1, Chobanka 1 and Chobanka 2 – approximating and below the average daily limit for protection of human health (depending on the active operational area in the open pit); Option 2: Chobanka 1 and Chobanka 2 – approximating and exceeding the average daily limit for protection of human health (exceeding when the active operational area is in the north part of the open pit). The average daily nitrogen oxide (NOx) levels at Chobanka 1 and Chobanka 2 will be aproximating or below the average annual limit for protection of human health regardless of the selected option.

The obtained results and forecast models demonstrate that the zones where the deposition of particulate matter from the mining operations will exceed the limits for surface pollution of open areas will be confined to the operational areas.

The impact on the ASL quality will be direct within the Ada Tepe areas, especially those that are adjacent to the operational areas, but on a local scale; no significant changes in the air quality are expected.

<u>Blasting:</u> The obtained results and the forecast models demonstrate that the blasting-related air pollution at the nearest recipient in downwind direction (Sinap Village) will be below the MAC for centres of population. It is very unlikely that the blasting operations in the

mine will have any impact on the air quality in other neighboring villages downwind of the minesite (Labovo and Sturbina).

It is recommended that the Investor should perform monitoring of dust ($PM_{2.5}$; PM_{10} and total dust) and gas (sulphur and nitrogen oxides) levels in the air prior to commissioning and during project operation. The monitoring should cover nearby settlements including the town of Krumovgrad .

Regular cleaning and maintenance of the on-site and off-site roadways will considerably lower the concentration of dust including fine particulates in the ambient air.

Sprinkling of the operational areas and site roadways must be scheduled in dry and windy conditions.

In terms of the health risk of soil, surface water and groundwater pollution:

The review of the mine design under Option 1 identifies the Runoff Storage Pond as the only possible non-fugitive source of soil and water pollution. This facility will practically receive all process water flows – from the two IMWF sumps and the pit sump. The water collected in the pond is assumed to have adequate water quality. The Runoff Storage Pond is designed to provide the process plant water requirements. The excess water from the pond will be advanced to the Wastewater Clarifier prior to discharge into the Krumovitsa River. Discharges into the environment will mostly occur in case of storm events, i.e. extreme precipitation. The project water balance model demonstrates that such discharges will occur only during the wet months of the year, which are 5 or 6. No water will be discharged to the environment during the remaining part of the year, i.e. the dry months when the Krumovitsa flow is also minimal. Therefore, the project water balance can be regarded as environmentally friendly.

From hygiene point of view, it is especially important to control the quality of water in the reservoir in order to meet the individual emission limits, which will prevent the deterioration of the river water quality. The discharged quantities of water will not change the river flow regime significantly as they are negligible compared to the river outflow in wet periods.

A favourable fact is that the project considers that more than 98 % of the total demand will be met from recycling.

The acid base accounting and net acid generating tests conducted on mine rock samples (including ground ore and process tailings) characterise this material as non-acid generating. The arsenic content in the tailings is expected to be lower than the background levels in the soils in the region. The presented data are favorable from hygiene point of view.

Particular attention should be paid to the IMWF and the prevention of potential uncontrolled seepage from the facility. Strict control and monitoring are required despite the sound design, the essentially inert waste materials stored in the facility and the absence of groundwater flows within the IMWF footprint.

A good practice would be to perform regular monitoring of the groundwaters downstream of the facility using the piesometers and inspections of the filter system.

The project operation should get to a stage when supposed pollution of adjacent soils or water would immediately be identified and prompt mitigation and health protection measures taken.

12. Cumulative Effects

This section is only a theoretical discussion of the possible cumulative effect of the proposed mine development.

It should be pointed out at the very beginning that the cumulative effect assessment would not be accurate due to the fairly low level of understanding of the mineral resources of Kuklitsa, Kupel, Surnak and Skalak, whose exploration will continue during the development of the Ada Tepe prospect.

The prospects are located close to one another but not in a compact group. The total area of the deposit based on the prospect footprints is 120 ha, which is broken down by prospects as follows: Ada Tepe – 16.1 ha, Surnak - 20.6 ha, Skalak – 21.3 ha, Sinap – 11.5 ha, Kuklitsa – 31.6 ha, and Kupel - 19.1 ha.

Additional EIA procedures will be initiated prior to commencement of operations on any of the remaining prospects if and only if they should prove to contain economic mineral resources that can be mined and processed in an environmentally acceptable way.

The the currently defined Ada Tepe mineral resource of 8.785 Mt will be mined over a 9-year period. The remaining prospect are with a combined mineral resource estimate of 3.6 Mt. It is expected that this additional resource would be mined over a 3 to 4 year period (no definitive resource estimation work has been don and therefore this estimate is rather hypothetical).

The project mining construction and operation in the individual prospects is scheduled by concession years as follows:

Prospect	Overburden removal by concession years	Mining by concession years
Ada Tepe	years 4 and 5	from year 5 to year 15
Kupel	years 15 and 16	years 16 and 17
Kuklitsa	years 17 and 18	years 18 and 20
Sinap	year 20	year 21
Surnak	year 21	years 22 and 24
Skalak	year 24	years 25 and 26

The following comments can be made in terms of the cumulative effect of the project:

1. There are no other operating quarries or open pits around Ada Tepe now, so no increase in the background levels of dust or other pollutants that are typical of quarrying operations is expected in the base level of the atmosphere in the region.
2. Extension of operations to the remaining prospects:

2.1. Infrastructure:

- The ore from these prospects would be processed through the Ada Tepe process plant, which would require reconstruction of existing roads or construction of new roads linking the respective prospect with the plant. The Ada Tepe operations will require 12 ha of roads. The road requirements of the remaining prospects have not been studied but they would probably require some 12-12 ha of roads.
- The development of these prospects would intensify traffic and increase the load on the local road system several times.
- It is very likely that they would require construction of new power supply system and possibly other services.

2.2. Proximity to local settlements:

Their proximity to settlements where people actually live is obvious. In addition, the footprints of some prospects come into conflict with the hygiene protective distances to the settlements:

- Kuklitsa – The footprint of the prospect goes beyond the development limits of Shturbina Village;
- Surnak – Part of its footprint is within the development limits of Belina Village, in close proximity to Dragovets Village and Slez Village;
- Kupel – It is in close proximity to Kupel Village and Dazhdovnik Village;

2.3. Natural resources – water in particular:

The mining operations would require water supply. The abstraction of additional resources, e.g. via boreholes, would require additional surveys for each prospect to identify the potential resource that would be available for use without derogating the outflow balance of the local river system and the existing drinking water abstractions.

2.4. Additional dust and gas emissions:

More area and line emission sources are expected (pits, mining and haulage equipment), including additional noise loads, which may have undesirable effect on the local communities and protected areas/sites. Each prospect will have to operate its own mobile crusher.

2.5. Advance into or proximity to protected areas and sites:

That would affect the protection regime of the areas, habitats or species populations. To support this, a simmarised description of the location of each prospect (except for Ada Tepe) is provided below:

- Kuklitsa – Part of its footprint overlaps with Natura 2000 habitats: 91MO Pannonian-Balkanic Turkey Oak and Sessile Oak Forests, and 5110 Bushes of Juniperus spp.;
- Surnak – Does not overlap nor is in close proximity to Natura 2000 sites but it would surely contribute to the overall cumulative effect should the remaining prospects be developed.
- Sinap – Part of the prospect borders on a Natura 2000 habitat: 91MO Pannonian-Balkanic Turkey Oak and Sessile Oak Forests;
- Skalak – Partly overlaps or borders on a Natura 2000 site: 6510 Lowland hay meadows;
- Kupel – Partly overlaps a Natura 2000 site: 91MO Pannonian-Balkanic Turkey Oak and Sessile Oak Forests;

Moreover, additional limitations may be imposed on the prospects if their development threatens to destroy important archaeological sites. In conclusion, although at a very early stage of resource definition on the remaining prospects, it is expected that their operation will have a significant cumulative effect and therefore it is recommended that they should be developed one at a time to prevent significant negative impacts on the environment and human health.

13. Risk of Emergencies

Table V.13-1 describes the possible potentially adverse impacts during operation and accidents involving chemical substances, which may impact people and the environment, and the required measures to prevent that impact.

Potential adverse impacts from the use of hazardous chemical substances and measures for their mitigation

Table V.13-1

Humans or Environmental media	Possible impact	Impact mitigation measures
Humans	Inhalation, ingestion	Observe operating safety instructions and the requirements for safety at work for each hazardous substance. Require suppliers to provide safety data sheets for the chemical substances. Provide preventive training to personnel to raise their safety awareness of activities and operations that are not part of their job profile. Ensure strict management control and make no compromise on safety.
Groundwater, basement rock	Pollution caused by uncontrolled spillages and accidents	The mixing tanks in the reagents preparation areas will have secondary containment arrangements. Any spillage of reagent solutions will be collected in sumps and pumped back into the process.
Surface waters	Pollution	Since 98% of the process water will be recycled, the the risk of surface waters pollution with chemical substances and suspended solids will be reduced significantly.
Lands and soils	Pollution	Ensure maximum safety during transportation of chemical substances including proper signage and labelling. Select suppliers carefully. Secure proper packaging of materials to ensure minimum risk of accidental spills.
Flora and Fauna	Damage to plant and animal species resulting from transport accidents	Ensure maximum safety during transportation of chemical substances including proper signage and labelling. Select suppliers carefully. Secure proper packaging of materials to ensure minimum risk of accidental spills.

The objective of emergency response planning is to establish efficient system for forecasting natural disasters, major accidents and incidents and their consequences, and successful implementation of measures for protection of human life and health and the environment through:

- Planning, approval and implementation of measures for prevention, mitigation and control of the consequences of major emergencies which may impact human life and health, the environment and property;
- Supply of information from the operator to the competent authorities and affected population in the area adjacent to the company site in an emergency;
- Coordinated response to any emergency from the Site Emergency Centre and the local (municipal or district) Coordination Centre.
- Planning and provision of funds and resources to combat major emergencies and rehabilitate the environment.

The Site Emergency Response Plan should take account of:

- availability of suitable materials, gear and equipment required to combat emergencies and their consequences;
- site arrangements for training personnel in emergency response;
- ways in which an emergency is declared and personnel is alerted;
- management of personnel response and action;
- a procedure for activating the ERP and notifying the competent authorities;

- means, ways and procedures for warning/alerting the neighbouring communities that are potentially at risk;
- procedures for performing rescue operations and carrying out urgent remedial works on the site;
- procedures for resuming normal operation.

14. Monitoring

The Environmental Monitoring Program (The Program) of Balkan Mineral and Mining EAD (BMM EAD or the Company) has been prepared for the Investment Project Proposal for Mining and Processing of Gold Ores from the Ada Tepe Prospect of Khan Krum Deposit in connection with the current EIA procedure, in compliance with the national and EU environmental legislation.

The Program is prepared at the project proposal stage and therefore it should be revised and updated three months prior to the commissioning of the mine. The revision of the Program will enable a more accurate definition and confirmation of the proposed monitoring stations in accordance with the final project design.

The monitoring of the Integrated Mine Waste Facility (IMWF) is included in the Mine Waste Management Plan in compliance with the requirements under Chapter VIII of the URA and the Regulation on the Specific Requirements to the Management of Wastes from Underground Resource Exploration, Mining and Processing. A Mine Waste Monitoring and Sampling Plan is prepared in compliance with EN 14899 and included as an appendix to the Site Monitoring Plan.

The main objectives of the Monitoring Program are:

- To provide reliable measurements of environmental parameters in the area of the mine;
- To collect, report and analyse environmental data;
- To ensure preemptive control for prevention of environment pollutions;
- To test the performance of the Environmental Management System (EMS);
- To assess the efficiency of the Environmental Management Plan;
- To supply information to the state authorities and the stakeholders on environmental matters.

The scope of the Environmental Monitoring Program of BMM EAD includes:

- Weather Monitoring;
- Air monitoring including air quality and non-fugitive emissions from point sources;
- Noise and vibrations from blasting;
- Waters – surface water, groundwaters and wastewaters;
- Wastes – mining, processing, hazardous, construction and household (municipal) wastes;
- Soils;
- Biodiversity.

The Program is available in full detail in Appendix 10.

15. Summarised Conclusions

The analysis and the assessment made in this EIS allow the following general conclusions:

1. The proposed mining and processing methods do not involve generation of excessive air emissions, wastewaters and solid wastes that may have a negative impact on the environment and human health. The project ensures continuous process control and environmental monitoring of the generated air emissions, wastewaters and solid wastes.
2. The levels of harmful pollutants in dust and gas emissions generated from all project operational areas will achieve compliance with the emission standards set out in the national and European legislation.
3. Water consumption in ore processing is minimised through systems and facilities that are capable of achieving a high level of recycling. The waters in the Runoff Storage Pond, which are chemically unpolluted, and the treated domestic effluent are assumed to have adequate water quality and will be discharged into the environment after additional clarification without affecting the flow regime or the water quality of the Krumovitsa River.
4. The project meets the requirements under Chapter VIII of the Underground Resources Act.
5. The generated mine wastes comprising waste rock and flotation tailings will be co-disposed in an Integrated Mine Waste Facility. The flotation tailings will be thickened (dewatered) to 56% solids prior to disposal.
6. Disposal in negative landforms is recommended in the BAT reference (BREF) documents. Option 1 eliminates the conventional TMF design, which will reduce the risk of emergencies and substantially reduce the footprint required for waste management operations.
7. The soil removed from the project footprint will be stockpiled for re-use for rehabilitation of affected areas both during project operation and after shutdown of operations.
8. The project considers progressive rehabilitation of the IMWF under Option 1, which will minimise the risk of erosion of and dust generation from the exposed waste rock surfaces.

VI. Information about the Methods Used to Forecast and Assess Environmetal Impacts Project Documentation, Legal Provisions and Other Sources

♦ **Air**

The mine emissions profile has been prepared by a standard method, which has been developed by adapting the Emission Inventory Guide CORINAIR-94, SNAP-94 to the conditions that are typical of Bulgaria. Since the updated method for determination of harmful air emissions does not provide any data about SNAP CODE 040616, the forecasting of PM_{10} generated by mining operations uses the emission factors under CEPMAIR, 2002.

The ASL concentrations from blasting are based on data from surveys conducted by G. Kamburova, Toxic Blasting Fumes from Industrial Blasts. Legal requirements and new results, Mining University Yearbook, vol. 44-45, Part II, Mining and Mineral Processing, Sofia, 2002, pp. 169-171. For ASL concentration of toxic blasting fumes: Method for estimation of the transport distance for a toxic plume from a chemical source of contamination, A. Simeonov and T. Dechevsky, Civil Defense, textbook, 1978.

Modelling of pollution and ASL dispersion of pollutants emitted from the mining operations: Regulatory Model for Calculating of the Vehicles Emissions and Pollutants Concentration in the Surface Layer (Traffic Oracle) - Diffusion Module; ASL concentration estimation: Method for estimation of the source height, dispersion and expected ground-level concentrations of harmful substances (MOEW) and the Plume modelling software of the Institute of Geophysics (estimation of ground-level concentrations (glc) of pollution), which were kindly provided by the AIr Quality Protection Dept. of the MOEW.

♦ **Biodiversity**

Basic methods and approaches and fieldwork have been used to assess the fauna. These include the Line Transects Method and the Point Counts Method (Bibby et al., 1992). Each has it advantages and depends on the survey objectives and the type of the area.

The methods of survey of the flora include the Line Transects Method and the Belt Transects Method. The species identification is based on the Bulgarian Flora, vol. 1-10 and the Higer Plant Identificator (Kozhuharov, 1992). The habitats are identified on the basis of the Identification Guide to the Habitats of European Conservation Significance in Bulgaria (Kavrakova, Dimova, Dimitrov, Tsonev and Belev, 2005).

The basic method for surveying bat species in open areas is detection and software processing of ultrasonic sounds emitted by bats. Two types of detectors have been used: a Pettersson D240 and a Tranquility Detector. Point observations have been undertaken in BG 0001023 Rupite-Strumeshnitsa (protected site), mostly in food habitat areas. BatSound 3.1 software for Windows has been used to process bat sound data.

♦ **Health and Hygiene Aspects**

- Healthcare Reference Book, NSI, 2005, 2006, 2007.
- Population and Demographic Processes, NSI, 2005, 2006, 2007.
- Krumovgrad Municipality Development Plan 2007-2013.
- Hygiene, vol. II - Occupational Medicine. D. Tsvetkov, 2006.
- Statistical Data - Demography and Health, RHC Kardzhali, 2007-2008.

♦ **Cultural Heritage**

Administrative documents:

Protocol of commission appointed by the Director of the National Institute for Protection of Immovable Cultural Heritage

Reference list:

Jockenhövel et. al., 2009: A. Jockenhövel , H. Popov, S. Iliev, K. Groor.

Observation Tours in the lands of Krumovgrad, Krumovgrad Municipality, and Zvezdel and Sedefche, Momchilgrad Municipality - Archaeological Finds and Excavations in 2008, Sofia, 2009, pp. 777-780.

Nehrizov, Mikov, 2002: G. Hehrizov, R. Mikov. Rescue Archaeological Survey of Ada Tepe near Krumovgrad in 2001 - Archaeological Finds and Excavations in 2001, Sofia, 2002, pp. 42-44.

Nehrizov, 2003: G. Hehrizov. Rescue Archaeological Survey of Ada Tepe near Krumovgrad in 2002 - Archaeological Finds and Excavations in 2001, Sofia, 2002, pp. 67-68.

Nehrizov, 2005: G. Hehrizov. Field Observation Tours in Krumovgrad Municipality in 2004 - Archaeological Finds and Excavations in 2004, Sofia, 2005, pp. 70-72.

Nehrizov, 2006: G. Hehrizov. Rescue Archaeological Survey of the Thracian Shrine at Ada Tepe in 2005 - Archaeological Finds and Excavations in 2005, Sofia, 2006, pp. 140-142.

Nehrizov, 2007: G. Hehrizov. Rescue Archaeological Survey on the Western Slopes of Ada Tepe in 2006 - Archaeological Finds and Excavations in 2006, Sofia, 2007, pp. 173-176.

Popov, Iliev, 2006: H. Popov, S. Iliev. Ancient Mining Development on the Western Slope of Ada Tepe. - Archaeological Finds and Excavations in 2005, Sofia, 2006, pp. 156-156.

Popov, Jockenhövel , 2010 (now printing): H. Popov, A. Jockenhövel. Archaeological Section Excavations of an Ancient Gold Mine of the LBA and IA on the Ada Tepe Hill near Krumovgrad - Archaeological Finds and Excavations in 2009, Sofia, 2010 (now printing).

Legal Framework

I. Laws and Bylaws

1. Environment Protection Act (2002), last amendment: 2010;
2. Underground Resources Act (1999), last amendment: 2008;
3. Clean Air Act (1996), last amendment: 2006;
4. Waters Act (1999), last amendment: 2010;
5. Soils Act (2007);
6. Agricultural Land Protection Act (1996), last amendment: 2003;
7. Protected Areas Act (1998), last amendment: 2006;
8. Biodiversity Act (2002), last amendment: 2010;
9. Waste Management Act (2003), last amendment: 2010;
10. Protection against Harmful Impact of Chemical Substances and Products Act (2000), last amendment: 2010;
11. Spatial Planning Act (2001), last amendment: 2010;
12. Health Act (2004), last amendment: 2008;
13. Environmental Noise Protection Act (2005), last amendment: 2006;
14. Cultural Heritage Act (2009), last amendment: 2009;
15. Regulation on the Terms and Procedures for Conducting Environmental Impact Assessments (2003), last amendment: 2010.

♦ **Air Quality and Air Emissions**

1. MH, MOEW; Regulation 14/23.09.1997 on the Maximum Allowable Concentrations of Air Pollutants in Populated Areas;
2. Regulation 12/15.07.2010 on the Air Emission Limits for Sulphur Dioxide, Nitrogen Dioxide, Fine Particulate Matter, Lead, Benzene, Carbon Monoxide and Ozone;
3. MOEW, MJ, MRDPW, MH; Regulation 2/19.02.1998 on Maximum Allowable Air Emissions (Concentrations in Waste Gases) of Harmful Substances Emitted from Static Sources;
4. MOEW; Regulation 6/26.03.1999 on the Terms and Procedures for Measuring Air Pollutant Emissions from Sites with Point Sources;
5. Regulation 1/27.07.2005 on Normally Allowable Air Emissions for Harmful Substances (Pollutants) Emitted from Sites and Operations with Point Sources;
6. Regulation 11/14.05.2007 on the Air Emission Limits for Arsenic, Cadmium, Nickel and PAHs;
7. Regulation 7/03.05.1999 on Air Quality Assessment and Management;
8. A Guide to the Climate in Bulgaria (1982);
9. A Guide to the Climate in Bulgaria – Precipitation (1990);
10. EMEP/CORINAIR Atmospheric Emission Inventory Guidebook, Third Edition, B810 (Other mobile Sources and machinery), 2003;
11. Regulatory Model for Estimation of Emissions from Combustion Processes in the Power Industry, Household Heating and Manufacturing, MOEW (1992), last amendment: 1994.

♦ **Waters**

1. Regulation 1/10.10.2007 on Groundwater Exploration, Use and Protection;
2. Regulation 5/2000 on the Terms and Procedures for Setting up Networks and on the Work of the National Water Monitoring System;
3. Regulation 9/16.03.2001 on the Drinking and Household Water Quality;
4. Regulation 7/12.12.1986 on Parameters and Reference Values for Assessment of the Quality of Running Surface Waters;
5. Regulation 3/16.10.2000 on the Terms and Conditions for Surveying, Designing, Approval and Operation of Sanitary Protection Zones around Water Sources and Drinking Water Supply Facilities and around Mineral Water Sources Used for Medical, Preventive, Drinking and Hygiene Purposes.

♦ **Lands and Soils**

1. General Rules of Application of the Agricultural Land Protection Act (1996);
2. Regulation 5/1979 on the Maximum Allowable Concentrations of Pollutants in the Soil;
3. Regulation 3/2008 on the Maximum Allowable Concentrations of Harmful Substances in the Soil;
4. Regulation 26/1996 on the Rehabilitation of Disturbed Areas, Improvement of Low-Productive Lands and Topsoil Utilisation;
5. Instruction on the Assessment of the Type and Severity of Pollution of Agricultural Lands and Land Use Designations (1994).

♦ **Flora, Fauna and Protected Areas**

1. Biodiversity Act (2002);
2. Protected Areas Act (1998), last amendment: 2009;

3. Regulation on the Terms and Procedures for Conducting Environmental Impact Assessments (2003), last amendment: 2010.
4. Regulation on the Terms and Procedures for Assessment of the Compatibility of Plans, Programs, Projects and Investment Proposals with the Conservation Objectives of Protected Sites (2007), last amendment: 2010;
5. International Conventions - A Guide to Biodiversity Protection. Published by the Green Balkans Association, 1996.

♦ **Wastes**

1. Regulation 3/2004 on the Classification of Wastes; MOEW and MH; 44 от 2004 г.
2. Regulation on the Specific Requirements to Mine Waste Management (2009);
3. Government Decree 53/19.03.1999 on the Treatment and Transport of Operational and Hazardous Wastes;
4. Regulation on the Release of Lead Batteries on the Market and Treatment and Transport of Discarded Lead Batteries (2005);
5. Regulation on the Requirements for Treatment and Transport of Oil Wastes and Wastes of Petroleum Products (2005);
6. Regulation on the Release of Electrical and Electronic Equipment on the Market and Treatment and Transport of Electrical and Electronic Waste (2006);
7. Blasting Safety Code, issued by the Ministry of Labour and Social Works (1997);
8. Open-Pit Mining Safety Code, approved by the Minister of Labor and Social Policy in 1996 (not promulgated).

♦ **Hazardous Substances**

1. Regulation on the Terms and Conditions for Classification, Packaging and Signage of Chemical Substances (Government Decree 182/2002, effective date 01.01.2004, last amendment 2008).

♦ **Harmful Physical Factors.**

Regulation 6/26.06.2006 on the Environmental Noise Indicators of Time-Dependent Levels of Discomfort, Environmental Noise Limits, Methods for Assessment of Noise Levels and Negative Effects of Noise on Human Health.

♦ **Environmental and Occupational Health Aspects Health and Safety at Work**

- Regulation 7/1992 on the Hygiene Requirements for Health Protection of Urban Environment, last amendment: 1999;
- Regulation 6/2006 on the Environmental Noise Indicators;
- Regulation 13/2003 on Employee Protection against Risks of Exposure to Chemical Reagents at Work, last amendment: 2007.

Reference List

- BSPB Standard Form for Collection of Data about Special Protection Areas, Proposed Sites of Community Importance and Special Areas of Conservation, East Rhodopes (BG0001032), Natura 2000. MOEW;
- Natura Form for the East Rhodopes Protected Area;
- Identification Guide to the Habitats of European Conservation Significance in Bulgaria, 2005, WWF, Danube-Carpathian Project, Green Balkans Federation;
- Identification Guide to the Habitats of European Conservation Significance, 2005, WWF, Green Balkans Federation, MOEW;
- Botev, B., Ts. Peshev (editor), 1985. The Red Book of Bulgaria (1985).

- Council Directive 92/43 on the Conservation of Natural Habitats of Wild Fauna and Flora;
- Council Directive 79/409/EEC on the Conservation of Wild Birds;
- Bondev, I., 1999. Bulgarian Flora;
- Physiography of Bulgaria, 2002;
- Michev, T., P. Yankov. 1993. Ornithofauna. B: A National Strategy for Protection of Biodiversity. Key Reports, Sofia, vol. 1, pp. 585-613;
- Nankinov, D., S. Simeonov, T. Michev, B. Ivanov, 1997. Bulgarian Fauna, Aves, Part II, Sofia, 427 C;
- Nankinov, D. et al. 2004. Bird Census: the National Populations of Birds Nesting in Bulgaria. Green Balkans, Plovdiv;
- Yankov, P., An Atalas of Birds Nesting in Bulgraria, BSPB, 2007;
- A National Strategy for Protection of Biodiversity. Key Reports, Section 2. Biodiversity Sustainability Program, 1993;
- Beshkov, V., 1990. Protection of Large Bat Colonies in Bulgaria. A Report
- Internet information from the sites of NATURA 2000; the Biodiversity Foundation; BSPB; MOEW; (*BirdLife International*, 2004) etc.;
- Bibby, I., N. Burgess, D. Hill. 1992. Bird census techniques. London, Academic Press, 257 p;
- Birds in Europe: Population estimates, trends and conservation status. Cambridge, UK: Birdlife International (Birdlife Conservation Series No. 12). 2004. 373pp.;
- Tucker, G. M., M.F. Heath 1994. Birds in Europe: Their Conservation Status. BirdLife Conservation Series no. 3. Cambridge, 600 p.

VII. Description of the Measures Planned to Prevent, Mitigate or, Where Possible, Eliminate Significant Negative Impacts on the Environment, and a Plan for Implementation of These Measures

- **Air**

The measures that will minimise the emissions from pit operations and the dust and fume emissions from blasting include:

- ✓ Use a suitable and efficient blasting method, and explosives that generate smaller quantities of toxic fumes;
- ✓ Ensure personnel health and safety at work when exposed to a potential risk of explosive environment, in compliance with Regulation 11/27.12.2004 (SG issue 6/18.01.2005). Focus on provision of personal protective equipment to employees - dust and gas masks, hearing protection, helmets, work clothing and footwear, gloves.
- ✓ Ensure monitoring of emissions of fumes and dust after blasting to enable assessment of the health risk to employees and residents of Chobanka 1, Chobanka 2, Kupel, Soyka and Pobeda located in the vicinity of the open pit;
- ✓ Apply regular sprinkling-based dust suppression to minimise dust levels in the air in the active areas where mining operations take place – pit operational areas, ROM pad and and the haulage links between them. Roads must be sprinkled consistently at regular intervals;
- ✓ Maintain a protective green belt around roads and operational areas, and rehabilitate redundant roadways.
- ✓ Ensure supervision of dust control in the crusher and process plant, including control over the operating condition and functioning of the sprinkler and/or dust collection systems;
- ✓ Factor the local meteorological features into the blasting schedules in view of limiting the impact on the nearby villages;
- ✓ Ensure that haulage vehicles are not overloaded with bulk material and/or final product, and that they have a cover securely fastened over top;

Plan for Implementation of the Measures to Prevent, Mitigate or Eliminate Environmental Impacts

This plan covers the project operation only – ore mining and processing, and waste rock disposal. Its primary focus is on:

✓ Everyday inspections of operating equipment and vehicles to prevent contamination of the project area with petroleum products;

✓ Sprinkler-based dust suppression on site roadways in warm and dry weather conditions to minimise dust emissions in the area;

✓ Continuous supervision of the blasting operations that are performed by contractors;

- ✓ Use wet drilling systems in the open pit to suppress dust, including particulates smaller than 10µm;

✓ Continuous supervision of the trucks loaded with ore and waste rock, and prevention of spills during on-site haulage;

✓ Compliance with the procedures for handling and treatment of the waste generated on the minesite and measures to prevent on-site disposal of wastes from other operations or companies.

This plan will be updated on a regular basis over the life of the mine to take account of any specific new conditions that may arise on the minsite.

The plan for implementation of the proposed key measures for prevention of negative impacts on the environment and human health is presented in Table VII-1 below.

♦ **Waters**

1. Any project involving use of water bodies and/or abstraction of water may proceed only after issuance of the relevant permit(s).

2. A water monitoring network must be established to cover both surface and ground water, and the water abstraction systems adjacent to the project site.

3. Due to the high public interest, the monitoring project should be discussed with the local community to clarify any and all issues before its submission and also during its preparation.

4. It is recommended that the existing abstractions of Guliika, Krumovgrad and Ovchari should be included in scope of the Environmental Monitoring Program.

5. All components of the recycling water system such as collecting sumps, pipework and pumps should be maintained in good operating condition.

6. It is recommended to undertake an additional site water supply survey focusing on the siting of the proprietary abstraction well to ensure the facility is adequately protected against the torrential flows of the Krumovitsa River.

7. An intensive monitoring of the quality of the water in the Runoff Storage Pond should be undertaken during the first year of project operation, when no discharges into the Krumovitsa River. The monitoring results should be put together in a report and submitted to the competent authorities, the Plovdiv-based Catchment Directorate and the Haskovo Regional Environment and Waters Inspection, after the first six months of project operation.

8. If the water quality does not meet the allowable limits under the discharge permit the Company should design and implement suitable mitigation measures including an additional treatment stage prior to discharge of water from the pond into the Krumovitsa River.

♦ **Project Geology**

1. Strict compliance with the legal requirements pertaining to protection of the geological environment and primarily:

- the Underground Resources Act (URA) (1999); SG issue 23/12.03.1999)
- Regulation on the Technical Records of Exploration and Mining Projects (1999); SG issue 108/10.12.1999).
- Regulation 18 / 07.01.2000 on the Terms and Procedures for Approval of: Annual Prospecting and/or Exploration Projects; Annual Project for Mining and Processing of Underground Resources; Projects for Closure of Exploration and Mining Operations; Projects for Placing Exploration and Mining Operations under Care and Maintenance; Amendments of and Addendums to Such Projects (2000); SG issue 6/21.01.2000)

2. Strict compliance with the Life of Mine Plan and the annual mining and processing projects and the mine closure and rehabilitation projects.

3. Additional ABA testwork and metal leaching tests on tailings samples to confirm the tailings properties.

♦ **Soils**

Removal of topsoil where possible and placement of the soil material on a dedicate stockpile to enable its re-use for rehabilitation purposes.

♦ **Biodiversity**

Project construction

• Keep construction works within the respective design footprints. Do not disturb areas outside the approved construction site footprints;

• Vehicles must drive only on approved roads that have clear and permanent signage. Traffic is not allowed off the approved roads and courses to the construction sites;

• Supervise implementation of construction and engineering works to ensure maximum protection of natural vegetation and habitats.

• Ensure that the following impacts are minimised as much as practically possible during project construction: soil stripping and removal, removal of ecotonic communities (transition areas between forest and grassland, plane and hill), grass and brush clearing;

No cutting of the oak woodlands on Ada Tepe north of the open pit and near the low-grade ore stockpile. Reduction of the footprint of this stockpile in SE direction, where it borders on a protected habitat (91M0 Pannonian-Balkanic Turkey Oak and Sessile Oak Forests)

• Employ efficient dust control measures across the project site, especially on the new courses (not having hard surfaces), and prevent pollution on the roads from oils, fuel and hazardous chemicals;

• Prevent spillage of fuels and oils from the construction equipment during project construction and operation;

• Avoid unnecessary clearing of old hollow trees to preserve the existing day-shelters of bats;

• Avoid unnecessary clearing of grass and brush vegetation to preserve the existing feeding habitats of bats;

• Provide training to the personnel engaged in project construction and subsequently in project operation and maintenance of equipment and infrastructure to raise their awareness of the impact mitigation measures;

• Ensure that no aggregate materials are extracted from the Krumovitsa gravels for project construction purposes. Krumovitsa River

Project Operation

• Ensure no blasting occurs outside the approved schedules as part of the Mine Life Plan and the annual mining and processing projects.

• Restrict all traffic of vehicles, mobile equipment and people to the roadways designated for the respective project activities;

• Fire blasts during the daytime hours only;

• Do not dispose of any household waste that could attract animals;

• Observe fire safety rules and regulations, and do not use fire for vegetation clearing.

Project closure

• Implement the rehabilitation measures as set out in the Closure Plan after shutdown of operations;

• The selection of plant species for biological rehabilitation must be harmonised with the native vegetation. No invasion of alien plant and vegetation species in the protected areas. Use of native species for rehabilitation always when possible;

• Technical rehabilitation of disturbed areas for revegetation (planting of grass and tree vegetation, fertilizer application and watering) and active aftercare over the first 3 years to ensure a full vegetation cover develops.

• Ensure suitable agricultural rehabilitation (ploughing, harrowing, seed-sowing, rolling, mineral fertilizer application and watering) of disturbed areas designated for agricultural use (mostly roads) and active aftercare over a 5-year period to restore land productivity.

♦ **Wastes**

<u>Project construction</u>

- The contracted construction company must arrange contract delivery of the generated hazardous wastes to persons or companies that hold a permit for transport, temporary storage, re-use and/or treatment (detoxification) of wastes under art. 37 of the WMA or a registration document under art. 12 of the WMA, or an IPPC Permit;
- In case of accidental (uncontrolled) spillage of oil or other pollutants, any contaminated soil and rock must immediately be removed and hauled to a suitable waste disposal site that is permitted to accept such wastes;
- The soil material removed from the pit and the other sites must be placed on a designated soil stockpile;
- The waste rock from overburden removal (during initial development of the pit) must be stockpiled within the IMWF footprint;
- The wastes generated from the construction and engineering works must collected separately and kept in temporary storage areas until removal from the site for subsequent treatment;
- Mineral-based non-chlorinated hydraulic oils and mineral-based non-chlorinated engine, gear and lubricating oils must be collected in a manner that enables their recycling – in closed, chemically resistant and spill-proof containers that are properly labeled and stored indoors.
- Only vehicles and mobile equipment in good operating condition must be used to transport hazardous and process wastes on and out of the construction site;
- Solid household waste must be hauled and disposed of on a landfill that is permitted to accept such wastes;

Project Operation

- The mine waste from the open pit and the process plant must be transported directly to the designated disposal facility;
- The generated wastes must be collected separately and placed in a temporary storage facility in compliance with requirements under Chapter II, Section I of the Regulation on the Requirements for Treatment and Transport of Industrial and Hazardous Waste, adopted with CoM Decree 53/19.03.1999;
- Waste oil must be collected in a manner that enables their recycling – in closed, chemically resistant and spill-proof containers that are properly labeled and stored;
- Wastes must be collected in a structured manner in compliance with the environmental regulations;
- Access to drums/containers for hazardous wastes must be restricted to authorised personnel only;
- Only vehicles and mobile equipment in good operating condition must be used to transport hazardous and process wastes on and out of the site;
- Transport of hazardous wastes - only in closed steel drums/containers;
- Waste shipment for treatment/detoxification must be contracted out only to companies that are certified under art. 37 of the WMA or holders of an IPPC permit for waste handling for treatment.

- Fluorescent tubes and other mercury-containing waste must be stored separately from other waste types, on a temporary storage site where sulfur must be available at all times.

♦ **Hazardous Substances**

The oil of the mining equipment (excavators and drill rigs) must be changed using a service vehicle equipped with an oil-changing unit. The oil-changing unit is be connected to the excavator/drill rig oil/lube system via Euro connectors. The oil is recharged/replaced by extracting the waste oil and pumping fresh oil in via the Euro connectors. Filters must be encapsulated in steel casings. The waste oils must be stored in compliance with the legal requirements until shipment by a contracted company that is certified under art. 37 of the WMA or a holder of an IPPC permit for waste oil treatment.

Heavy equipment must be provided with an oil pressure relief system to prevent spillage of oil in case of a hose failure. The excavator (shovel) must be provided with a centralized lubrication system that is completely sealed to prevent any grease spills.

Only suitable fuel pumping equipment must be used for equipment refueling to minimise the risk of spills and pollution.

♦ **Noise during Project Construction and Operation**

- Carry out construction works during the daytime hours only. Ensure good organisation on the site to reduce the duration of environmental noise impacts (especially when construction works are carried out in close proximity to Pobeda)

- Set a vehicle speed limit of 30 km/h when driving through or past residential areas;

- Ensure mobile fleet and process plant and equipment comply with the *Regulation on the Substantial Requirements and Environmental Noise Compliance Assessment of Equipment and Plant for Use Outdoors* (SG issue 11/2004). The Regulation is compliant with *Directive 2000/14/EC on the Approximation of the Laws of the Member States Relating to the Noise emission in the Environment by Equipment for Use Outdoors*;

- Surveillance monitoring of the noise levels from the crusher that reach Pobeda Village at nighttime. If the noise limits are reported to be exceeded, a noise screening structure should be set up west of the crusher in the direction of the village. A suitable approach is to construct a bund from unused rockfill and earthfill materials. Such a structure is easy to rehabilitate at the closure stage and blends well in the landscape.

♦ **Cultural Heritage**

Preliminary archaeological investigations must be carried out in compliance with art. 161 par. 1 of the Cultural heritage Act because a cultural heritage site has been discovered within the project footprint. Those investigations need to be extended to the footprint of the minesite infrastructure as well.

Rescue archaeological surveys of identified structures related to ancient mining must be carried out. High priority will be given to structures that the leaders of the archaeological team consider to be most important and at high risk of destruction. The team leaders should also have the freedom to select the survey and inter-disciplinary methods that are most suitable to use on the site. Pursuant to art. 148, par. 5 of the Cultural Heritage Act, the rescue field surveys must be funded by the investor engaged in the development on the site.

According to the decisions of the committee appointed by Order R-89/13.10.2009 of the Director of the National Institute for Protection of Immovable Cultural Heritage (NIPICH), once the archaeological survey is completed in 2010, a new committee should be appointed to „evaluate the results of the archaeological surveys and determine the cultural heritage value, and specify measures for preservation of newly uncovered archaeological structures".

If the committee decides that the archaeological surveys should continue, it is recommended that the schedule of these surveys proposed by the archaeological team leaders should be coordinated with the schedule for initial development of the project. In case the archaeological surveys need to be extended further, their schedule may be coordinated with the construction and mining plans for Ada Tepe.

The nature of the archaeological finds at Ada Tepe requires compliance with art. 161 par. 2 of the Cultural Heritage Act for archaeological supervision of project construction after completion of the archaeological survey works. If new archaeological sites are identified, the provisions of art. 148 and 160 of the same act shall apply.

♦ **Health and Hygiene Aspects**

Preventive Measures for Protection of Personnel Health

The following key requirements to occupational health and safety may be listed:

- All excavator and bulldozer operators should wear ear protection;
- Workers should use anti-vibration safety gloves and mats;
- Appropriate protection should be provided to keep hands dry and warm during cold periods;
- Fans should be installed in the cabins of excavators and bulldozers during the warm summer days;
- Workers should be provided with workwear that is appropriate for the season;
- Personnel should undergo regular medical checkups for early identification of work-related diseases.

All preventive care requirements must be complied with in relation to potential health risks, namely:

- Excessive dust levels involve a risk factor for the development of lung diseases due to the irritating effect of dust, e.g. rhinitis, chronic bronchitis and similar complications, and also for the development of occupational dust-related pathology. Implementation of all technical and medical preventive measures will be of utmost importance for employee health protection;
- Compliance with all technical requirements for general vibrations in bulldozers and heavy trucks must be achieved;
- An ergonomic work/rest schedule must be implemented (Regulation 15/1999 of the Ministry of Healthcare);
- A shift-based work cycle demands promotion of certain healthcare measures and ergonomic work/rest schedule for the workers on site including the crusher section (Regulation 16/1999 of the Ministry of Healthcare);
- All preventive measures need to be implemented to ensure employee health and safety by delivery of equipment operating safety instructions;
- Ensure compliance with Regulation 13 on Employee Protection against Risks of Exposure to Chemical Reagents at Work, especially when working with flotation reagents.

Preventive Measures for Protection of Public Health

Based on industrial hygiene experience, the major factors that are potential health risks for the population in areas of open pit ore mining, hauling, crushing, flotation, and tailings disposal, are related to:

- *Noise and vibrations;*
- *Air emissions of dust and exhaust from vehicles;*
- *Potential pollution of soils, surface and ground water.*

The current project is very similar to the existing operational mining and quarrying projects because it involves open-cut mining and primary (flotation) processing of the mineral resource. This type of operation has a typically intensive operational cycle of mining and processing of large resource tonnages to produce concentrate of sufficient quantity that ensures cost-efficiency of the project. That involves extraction of large volumes of rock material, frequent blasting, consumption of relatively large amounts of explosives, continuous site operation (24/7), generation of large quantities of mine wastes, etc. The project proposal considers a relatively small-scale open pit operation with not more than two blasts per week. This substantially minimises the risk to the health of the workers and the local public.

1. The main sources of ***noise and vibration emissions*** are the open pit operations including ore handling and the crushing operations. The hilly topography of the region is not conducive to free propagation of high equivalent noise and vibration levels. The Investor must implement noise mitigation measures to reduce impact on human health:

- The explosive charges must be calculated and designed to ensure compliance with the requirements under art. 7 of Regulation 7/1992 for flyrock safety distance from the blast. That would not only limit the noise generation within the region as a result of the reduction in the mining and throughput tonnage, but also have a positive health effect from the reduction of the dust and exhaust emissions to the adjacent villages.
- The noise protection should be considered and planned separately taking account of the applicable noise limits, the local topography, the type of the site/area subject to protection, its location relative to the noise source, and other factors. Regulation 6/2006 on the Environmental Noise Indicators (MH and MOEW) sets out the limits for "existing residential areas", which are: 55 dBA daytime limit, 50 dBA evening limit and 45 dBA nighttime limit (see Table V.11.1-2).

2. In terms of ***dust and exhaust/fume pollution***

Recommendations:

- The Investor should perform monitoring of dust ($PM_{2.5}$; PM_{10} and total dust) and gas (sulphur and nitrogen oxides) levels in the air prior to commissioning and during project operation. The monitoring should cover nearby settlements including the town of Krumovgrad .
- Regular cleaning and maintenance of the on-site and off-site roadways will considerably lower the concentration of dust including fine particulates in the ambient air.
- Sprinkling of the operational areas and site roadways must be scheduled in dry and windy conditions.
- The existing woodlands must be preserved as much as practically possible. Green belt protection should be considered around project roadways and operational areas.

In terms of the health risk of soil, surface water and groundwater pollution:

From hygiene point of view, it is especially important to control:

- The quality of water in the Runoff Storage Pond in order to meet the individual emission limits, which will prevent the deterioration of the river water quality.

- An intensive monitoring of the quality of the water in the Runoff Storage Pond should be undertaken during the first year of project operation, when no discharges into the Krumovitsa river system will occur. The monitoring results from the first six months of operation should be put together in a report and submitted to the competent authorities. If additional treatment is necessary the Company should design and construct a suitable treatment facility prior to commencement of discharging;
- Monthly monitoring of the groundwaters upstream and downstream of the IMWF, and of the Krumovitsa water quality.

Plan for Implementation of the Measures under Art. 96 Par. 1 Item 6 of the EPA

Item #	Measures	Period	Objective
1	**Air**		
1.1	Control on the operation of heavy equipment: excavators, trucks, dozers, graders, front loaders, etc.	Project construction and operation	Reduce emissions of harmful substances in engine exhaust.
1.2	Dust control in dry weather conditions by sprinkling the operational areas of the open pit, waste rock stockpile and roadways between them, where the roadways must be sprinkled on a regular basis.	Project operation	Reduce dust pollution to adjacent villages.
1.3	Regular monitoring of nitrogen oxide and dust levels after blasts near the open pit and in the adjacent villages – Chobanka 1, Chobanka 2, Kupel, Soyka and Pobeda	Project operation	Identify the composition and optimal amount of explosives per charge.
1.4	Regular monitoring of emissions after the source: - crusher - dust; - process plant – dust and aerosols.	Project operation	Reduce gas and dust pollution in the pit area.
2	**Waters**		
2.1	Issuance and renewal of the required permits for use and abstraction of surface water and groundwater resources.	Continuous over the project life until post-closure monitoring.	Protect surface waters and groundwaters, and mitigate any potential impact in an emergency.
2.2	Monitoring of surface waters and groundwaters	Continuous from site commissioning until after closure as required.	Protect waters, collect raw data and implement adequate measures in case of undesired events
2.3	Strict compliance with the process design requirements for extracting reagents	continuous over the project life	Maintain process flow parameters and facilitate water management
2.4	Availability of sufficient containment capacity to ensure containment of accidental spills from the plant	continuous over the project life	Prevent uncontrolled release of process solutions to the hydrosphere
2.5	Regular inspection and appropriate maintenance of the runoff diversion system that intercepts and diverts surface runoff away from the site.	continuous over the project life	Minimise runoff through the minesite and thus reduce the potential for water pollution.
2.6	Personnel preparation and training to improve their understanding of solution flows and their circulation across the site and the measures that must be implemented in unforeseen situations	continuous over the project life	Enhance site water management controls.

Item #	Measures	Period	Objective
2.7	Water consumption control	continuous over the project life	Ensure efficient water consumption this minimising the amounts potentially subject to pollution
2.8	Continuous communication with representatives of the Krumovgrad local authorities and the Kardzhali Water and Sewage Company, discussion and implementation of measures to prevent pollution of public drinking water abstractions.	continuous from site commissioning until after closure as required.	Ensure normal water supply to the local population at the level before commencement of the mining operations.
3	**Geological Setting**		
3.1	Development of a Life of Mine plan and a Mine Closure Plan	Within 6 months from the date of obtaining concession rights	Ensure efficient extraction of the resource and rehabilitation of the concession area to a condition similar to that before commencement of operations.
3.2	Development of annual mining and processing projects and annual site rehabilitation projects	On an annual basis, over the project life	Ensure efficient extraction of the resource and rehabilitation of the concession area to a condition similar to that before commencement of operations.
4	**Soils**		
4.1	Removal of topsoil where possible and placement of the soil material on a dedicate stockpile to enable its re-use for rehabilitation purposes.	Project operation	Re-use the material for rehabilitation purposes
5	**Flora and Fauna**		
5.1	Construction works are limited to the respective design footprints.	Project construction	Ensure areas outside the approved construction site footprints are not disturbed;
5.2	Vehicles drive only on approved roads that have clear and permanent signage. Traffic is not allowed off the approved roads and courses to the construction sites;	Project construction	Prevent unnecessary devegetation in vehicle operational areas. Minimise nuisance from vehicle operation.
5.3	Supervision of project construction and engineering works.	Project construction	Ensure maximum protection of the native vegetation and habitats
5.4	The following impacts are minimised as much as practically possible: soil stripping and removal, removal of ecotonic communities (transition areas between forest and grassland, plane and hill), grass and brush clearing	Project construction	Protect and not fragment the feeding habitats and shelters of invertebrates.

Item #	Measures	Period	Objective
5.5	No cutting of the oak woodlands on Ada Tepe north of the open pit and near the low-grade ore stockpile. Reduction of the footprint of this stockpile in SE direction, where it borders on a protected habitat (91M0 Pannonian-Balkanic Turkey Oak and Sessile Oak Forests)	Project construction	Avoid the direct impact on a protected habitat (91M0 Pannonian-Balkanic Turkey Oak and Sessile Oak Forests) and, consequently, the impact on the feeding base of the larvas of *Cerambyx cerdo* and *Lucanus cervus*.
5.6	No removal of old or hollow trees unless required	Project construction	Preserve the existing day-shelters of bats.
5.7	Employment of efficient dust control measures across the project site, especially on the new courses (not having hard surfaces), and prevention of pollution on the roads from oils, fuel and hazardous chemicals	Project construction	Protect the trophic base of herbivorous insects (larvae and imagoes).
5.8	Prevention of spillages of fuels and oils from the construction equipment during project construction and operation	Project construction Project operation	Prevent pollution of local soils and waters within the site and the protected area, which may potentially derogate the feeding base and habitats of species under protection.
5.9	No removal of old or hollow trees unless required	Project construction	Preserve the existing day-shelters of bats.
5.10	No unnecessary clearing of grass and brush vegetation	Project construction	Preserve the integrity of the feeding habitats of bats
5.11	Observance of the fire safety rules and regulations, no use of fire for vegetation clearing.	Project construction Project operation	Prevent temporary loss of habitats including the substrate and trophic base of insect species under protection.
5.12	No aggregate materials are extracted from the Krumovitsa gravels for project construction purposes. Krumovitsa River		Protect an important feeding habitat of bats and an abundant source of water insects.
5.13	Training to the personnel engaged in project construction and subsequently in project operation and maintenance of equipment and infrastructure to raise their awareness of the impact mitigation measures	Upon commencement of project construction	Ensure correct and complete implementation of mitigation measures and commitment to environmental protection.
5.14	Rock blasting during the daytime hours only;	Project Operation	Minimise nuisance to birds
5.15	All traffic of vehicles, mobile equipment	Project Operation	Prevent devegetation of

Item #	Measures	Period	Objective
	and people is restricted to the roadways designated for the respective project activities		adjacent lands.
5.16	No disposal of any household waste that could attract animals	Project Operation	Prevent attraction of animal species.
5.17	Implementation of the rehabilitation measures as set out in the Closure Plan after shutdown of operations	Project closure	Partially rehabilitate the soil and vegetation covers.
5.18	The selection of plant species for biological rehabilitation must be harmonised with the native vegetation No invasion of alien plant and vegetation species in the protected areas. Use of native species for rehabilitation always when possible;	Project closure	Mitigate the risk of invasion of alien species in the habitats in the protected area. Prevent possible damage on the feeding base and structure of habitats of species under protection.
5.19	Technical rehabilitation of disturbed areas for revegetation (planting of grass and tree vegetation, fertilizer application and watering) and active aftercare over the first 3 years to ensure a full vegetation cover develops.	Project closure	Rehabilitate disturbed lands designated for revegetation
5.20	Suitable agricultural rehabilitation (ploughing, harrowing, seed-sowing, rolling, mineral fertilizer application and watering) of disturbed areas designated for agricultural use (site areas and roads) and active aftercare over a 5-year period to restore land productivity.	Project closure	Rehabilitate disturbed lands designated for agricultural use.
6	**Noise**		
6.1	Construction works during the daytime hours only. Good organisation on the site to reduce the duration of environmental noise impacts (especially when construction works are carried out in close proximity to Pobeda)	Project construction	Minimise noise impact.
6.2	Vehicle speed limit of 30 km/h when driving through or past residential areas	Project construction and operation	Minimise noise impact.
6.3	Compliance of mobile fleet and process plant and equipment with the Regulation on the Substantial Requirements and Environmental Noise Compliance Assessment of Equipment and Plant for Use Outdoors (SG issue 11/2004). The Regulation is compliant with *Directive 2000/14/EC on the Approximation of the Laws of the Member States Relating to the Noise emission in the Environment by Equipment for Use Outdoors*;	Project designing	Minimise the environmental noise emissions from the operating plant and equipment.
6.4	Surveillance monitoring of the noise levels from the crusher that reach Pobeda Village	Project Operation	Control noise imission levels at the recipient.

Item #	Measures	Period	Objective
	at nighttime. If the noise limits are reported to be exceeded, a noise screening structure should be set up west of the crusher in the direction of the village. A suitable approach is to construct a bund from unused rockfill and earthfill materials. Such a structure is easy to rehabilitate at the closure stage and blends well in the landscape.		Construct a noise screening structure if the noise levels do exceed the allowable limits.
7	**Wastes**		
7.1	The generated wastes must be collected separately and placed in a temporary storage facility in compliance with requirements under Chapter II, Section I of the Regulation on the Requirements for Treatment and Transport of Industrial and Hazardous Waste, adopted with CoM Decree 53/19.03.1999. Wastes must be collected in a structured manner in compliance with the environmental regulations.	Project Operation	Eliminate spills and pollution of soil and water. Manage wastes in compliance with the WMA.
7.2	The generated mine wastes must be transported directly to the IMWF and deposited there.	Initial pit development and project operation	Manage wastes in accordance with Mine Waste Management Plan
7.3	Only vehicles and mobile equipment in good operating condition must be used to transport hazardous and process wastes on and out of the site.	Project Operation	Prevent waste spills.
7.4	Access to drums/containers for hazardous wastes must be restricted to authorised personnel only. Transport of hazardous wastes - only in closed steel drums/containers.	Project operation	Reduce risks associated with hazardous wastes. Manage waste in compliance with the WMA.
7.5	Waste shipment for treatment/detoxification must be contracted out only to companies that are certified under art. 37 of the WMA or holders of an IPPC permit for waste handling for treatment.	Project operation	Manage waste in compliance with the WMA.
8	**Health and Hygiene Aspects: *Measures for Protection of Public Health***		
8.1	*General measures*		
8.1.1	The Investor together with the appropriate state and local authorities should take the necessary steps under the law to revoke the settlement status of Chobanka 1 and Chobanka 2, and change the status of the tourist lodge and the school camp at Ada Tepe.	Prior to commencement of operations	Mitigation and future prevention of public health risk.
8.1.2	Implement a system to ensure good organisation of work, proper operating condition of all construction machines and vehicles, and regular monitoring of the	Prior to commissioning and during project operation – Investor's	Prevention of occupational and public health risk.

Item #	Measures	Period	Objective
	environment and workplace conditions.	responsibility.	
8.1.3	Regular comparison of the health status indicators for the residents in the area of the IMWF against the municipal and district average to ensure early detection of any status changes - within the competence of the Kardzhali Regional Healthcare Centre and Regional Public Health Inspection.	Project Operation	Prevention of public health risk
8.2	*Noise and vibrations*		
8.2.1	Technical measures: Fire maximum two blast per week.	Project Operation	Mitigation of the health impact on residential areas caused by pulse noise
8.2.2	Technical measures: Blasting operations should be performed according to approved design layouts using smaller explosive charges and divided/deck charge (hole-by-hole firing), and ensure that flyrock safe distances are compliant with art. 7 of Regulation 7/1992 of the Ministry of Healthcare.	Project Operation	Prevention of public health risk
8.2.3	Monitoring of daytime, evening and nighttime noise levels at Soyka and Pobeda hamlets prior to commissioning and during project operation. The reported levels should be compared, analysed and interpreted.	Before and after project commissioning.	Prevention of public health risk by reducing noise levels.
8.3	*Dust and exhaust gases*		
8.3.1	Technical measures: Before the start of any drilling and blasting cycle in the open pit, measures should be implemented as required to reduce dust and fumes after blasting (minimum explosives per charge, subsequent dust suppression by sprinkling in dry conditions, scheduling of blasts on a calm day or when the wind is favourable);	Project Operation	Prevention of public health risk
8.3.2	Monitoring of dust ($PM_{2.5}$; PM_{10} and total dust) and gas (sulphur and nitrogen oxides) levels in the air prior to commissioning and during project operation, at the recipient (nearby settlements). The reported levels should be compared, analysed and interpreted.	Before and after project commissioning.	Prevention of public health risk by minimising exposure to physical and toxic chemical pollutants.
8.3.3	Regular cleaning and maintenance of the on-site and off-site roadways as this will considerably lower the concentration of dust including fine particulates in the air.	Project operation	Prevention of public health risk
8.3.4	Sprinkling of the operational sites and site roadways in dry and windy conditions.	Project operation	Minimise dust emission generation
8.4	*Pollution of soils, surface and ground water*		
8.4.1	To avoid a cumulative risk of liberating mobile forms of arsenic and other heavy metals, especially in the Krumovitsa River	Project operation	Prevent uncontrolled seepage (infiltration) of polluted water from the

Item #	Measures	Period	Objective
	system (the Krumovitsa gravels are the main drinking water source available to the local communities), the following is recommended: • regular monitoring of the groundwaters in the river gravels downstream of the IMWF by increasing the piesometers from two to four and • regular monitoring of the quality of the excess water discharged from the Runoff Storage Pond (it must meet the allowable emission limits).		site.
8.4.2	Monthly monitoring of Krumovitsa waters upstream and downstream of the discharge point of the Runoff Storage Pond; upstream and downstream of the gravity gradient of the IMWF.	Project operation	Prevent release of polluted water from the site.
8.4.3	Establishment of permanent soil monitoring stations at the toe of the IMWF as part of the environmental monitoring program.	Project operation	Prevent soil pollution.
8.4.4	The Kardzhali District Public Health Inspection should prepare annual reports with historic analysis of the quality of the drinking water supply of the settlements in the Krumovitsa valley (downstream starting from the abstraction of Guliika) to identify the probable cause of potential pollution of the gravels and river waters with heavy metals.	After project commissioning	Prevention of public health risk of drinking water that does not meet the drinking water standards under Regulation 9/16.03.2001 on the Drinking and Household Water Quality.

VIII. Statements and Opinions of the Affected Public, the Authorities Responsible for the EIA Decision-Making and Other Key Government Actors, and Stakeholder States in a Transboundary Context Obtained through Consultations.

The project documentation required under art. 4, par. 1 of the EIA Regulation has been submitted to the MOEW. Notices have been sent to the Krumovgrad Municipality and the Mayor's Offices in Zvanarka, Ovchari and Dazhdovnik. Announcements notifying the local community of the Investment Project have been posted in the Municipality and the Mayor's Offices.

Pursuant to the requirements of art. 95, par. 1 of the EPA, the Company has identified the stakeholders that should be involved in the consultations process on the scope and content of the Environment Impact Statement:

- Ministry of Environment and Waters - a Letter Ref. OBOC-1402/10.08.2010 sent by MOEW to the Government of Greece;
- Ministry of Agriculture and Foods;
- Ministry of Economy, Energy and Tourism;

Ministry of Healthcare;
- Ministry of Culture;
- Krumovgrad Municipality;
- Zvanarka Mayor's Office;
- Dazhdovnik Mayor's Office;
- Ovchari Mayor's Office;
- Kardzhali District Governor;
- RIEW Haskovo;
- East Aegean Catchment Directorate based in the city of Plovdiv;
- Regional Inspectorate for Protection and Control of Public Health, Kardzhali;
- Regional Forestry Directorate, Kardzhali;
- Executive Forestry Agency - Sofia;
- Krumovgrad State Forestry;
- Green Balkans Federation of Environmental Organisations - Plovdiv;

Bulgarian Society for Protection of Birds;
- Balkans Wildlife Association - Sofia;
- Environmental Association for the Earth - Sofia;
- Sofia Environmental Information and Training Centre;
- Harmony Civic Association;

The EIA Terms of Reference and the Mine Waste Management Plan are available to the general public in Bulgarian and English on the Company website www.dundeeprecious.com. Hard copies of the documents are available at the BMM's Information Centre in Krumovgrad .

Statements on the EIA Scoping Report and the Mine Waste Management Plan have been received from government agencies, public organisations and experts as follows (Appendix 12):

Organisation	*Statement*	*Reasons for Acceptance/ Non-Acceptance*
RIEW Haskovo	RIEW Haskovo has the following opinion: The Scoping Report for the EIA for the Krumovgrad Gold Project has all the requisites required under the EIA Regulation, and the Environment Impact Statement (EIS) should comply with the provisions of art. 12 of the EIA Regulation considering the following recommendations	

	for the content of the EIS with reference to art. 11, par.1:	
	1. Air – The EIS should identify: the sources of air pollution: point, area and line sources during project construction and operation; the air pollutants emitted from every source during all project stages.	Accepted.
	2. Waste:	
	- Since the total land requirement for the project implementation is 98ha, of which 57 ha is the total footprint of the project facilities, what would the balance of 41habe used for?	Further project design revisions have reduces the land requirement to 85 ha. The intended use of the individual footprints is presented in the EIA Scoping Report.
	- Present the flow of both streams from classification prior to screening and gravity separation. Figure 1. Process Flowchart – Flotation Processing of Ada Tepe Ore shows only one process stream from the classification stage to the screen (screening stage);	Accepted.
	- Amounts of reagents used in flotation - potassium amyl xanthate (PAX), dithiophosphate, frother, sodium silicate (Na_2O x SiO_2), sulphidiser ($CuSO_4$ x 5 H_2O), etc.	Accepted.
	- Description of the properties of the substances and reagents in compliance with EU Regulations (EC) No.1272/2008, (EC) No.1907/2006.	Accepted.
	- The estimated land requirement for soil stockpiling is 0.5 ha. On the other hand, the total volume of material for stockpiling is 120,000 m^3, which at a stockpiling height of 10 m gives a max. footprint of 0.12 ha, which takes us back to the question about the remaining 3.8 ha;	Accepted. The Project considers a soil stockpile footprint of 2 ha.
	Does the amount of 14,630,000 tons of waste rock include the 320,000 tons that will be removed during initial pit development (project construction)?	No.
	The classification of the flotation waste (tailings) needs to factor in not only the mineral composition but also the chemical substances and products added to the process.	Yes, they are factored in.
	The waste classification needs to be prepared by the contracted construction company or operator (if different companies) and must meet the provisions of Regulation 3/ 2004 on Waste Classification.	Accepted - for common wastes. They will be classified according to the requirements under Regulation 3/2004. As to the mine wastes, the classification must follow the guidance under the Regulation on the Specific Requirements to Mine Waste Management (2009) and Commission Decision of 30 April 2009 completing the technical requirements for waste characterisation under Directive 2006/21/EC of the European Parliament and of the Council on the Management of Waste from Extractive Industries

		(notified under document number C(2009) 3013) (2009/360/EC) 2009/337/EC: Commission Decision of 20 April 2009 on the definition of the criteria for the classification of waste facilities in accordance with Annex III to Directive 2006/21/EC of the European Parliament and of the Council on the Management of Waste from Extractive Industries (notified under document number C(2009) 2856)
	Please clarify the inconsistency between these two paragraphs: "The tailings will be conveyed via pipeline to the constructed cells" (in the IMWF), page 26 and - The co-disposal of waste rock and tailings into IMWF as a waste management method has the following important advantages: - Enables direct recycling of the process waters on the plant site, where the tailings are dewatered; - Reduces the risk of spillages during the tailings delivery process; - Reduces the risk of emergencies resulting in a major uncontrolled discharge during/after a storm event.	There is no inconsistency. Option 1 - Tailings are dewatered at the Process Plant. Reduction of the risk of spillages during the tailings delivery process – after dewatering, the tailings are conveyed via pipeline to the IMWF according to Option 1.
	With regard to the requirements under art. 31 of the Biological Diversity Act the assessment should be conducted by experts on flora and natural habitats, invertebrates, fish, amphibians, reptiles, birds and mammals. The Biodiversity and Ecosystem Research Institute, which was recently established as part of the Bulgarian Academy of Sciences, should also be involved in the consultation process on the the Compatibility Assessment Scoping Report.	Accepted. The scoping report has been supplied to the Biodiversity and Ecosystem Research Institute (Cover Letter ref. БММ/BMM-изх/out-0080/19.08.2010)
Kardzhali District Governor	The Kardzhali District Governor expresses the opinion that the EIA Scoping Report and the Mine Waste Management Plan submitted by Balkan Mineral and Mining EAD for the revised Krumovgrad Gold Project are compliant with the Environmental Protection Act (art. 95, par. 2), the Underground Resources Act (art. 22d, par. 3) and the Regulation on the Terms and Procedures for Conducting Environmental Impact Assessments (the EIA Regulation). It is advisable to select and approve Option 1, which considers: A conventional open cut drill, blast, load and haul operation. The ore will be crushed in an outdoor crusher and then fed to a wet grinding circuit, which will be located in the Mill Section of the Process Plant. The ore will be processed to gold/silver concentrate only through	Accepted.

	flotation and gravity concentration using various reagents. The chemical reagents (collectors, frothers, dispersant, sulphidiser) that will be used in the process are relatively safe. The final concentrate will be dewatered and packaged for shipment to a custom smelter. Supply and use of explosives will not require a local explosives magazine. At this stage, there is no information about the planned construction of the main process facility, the fuel store, the reagents store, the fire resistance class of the buildings, the clearances between buildings and facilities, the electrical systems and equipment, the roads, and the fire water supply. Environmentally sound co-disposal of mining waste (non-inert material - waste rock from overburden removal and discarded slurry (tailings) from ore processing) in the IMWF to reduce the storage footprint, progressive rehabilitation as operation continues, elimination of the conventional TMF design, and less impact on the flora and fauna. This option would of course make the mine waste difficult to process in the future to recover any residual precious metal values. However, this is primarily a concern of the Company. It is also noted that the geochemical background at the concession site features naturally elevated concentrations of arsenic, chromium and nickel. There is no data about the chemical composition of the ore and what is the average concentration of the above elements in the ore. The EIA Scoping will involve several critical points of **discussion and clarification that should be emphasized** in the EIS:	
	1. Commission studies and provide the findings about the impact of the forecasted **amounts** of surface and/or ground water abstracted for process and drinking/household supply to the project site on the existing water resources in the Krumovitsa valley downstream of the project site to confluence with the Arda River. The existing drinking water abstractions include the Guliika group of villages, Krumovgrad, the Ovchari group, the Gorna Kula-Zvezdel group, and the Potochnitsa-Moryantsi group.	Accepted.
	2. Evaluate the site impact on the surface water **quality** during project operation and after project closure and site rehabilitation.	Accepted.
	3. Considering the impact of the project under the above items 1 and 2, assess whether restrictions or bans have been imposed.	Accepted.
	4. Assess whether sufficient resources are provided for continuous monitoring of the surface water quality of the Krumovitsa River by indicators, which could be affected by the use and storage (stores) of reagents and chemical substances for gold recovery.	Accepted.
	5. Assess whether adequate emergency warning systems are in place in case of accidental release of hazardous or	Accepted.

	toxic emissions in order to prevent contaminated water from reporting into the systems for public drinking water supply from the abstractions in the Krumovitsa gravels, which could affect human health and lives.	
	6. The Investor should obtain a water use permit under the Waters Act .	The permit is issued under the Waters Act and after EIA Resolution
	7. Concentrations of **dust** in the atmospheric surface layer (ASL) (from blasting and material handling - haulage, loading/unloading, transfer and disposal) at the nearby settlements after dust control (bag filters, sprinkling systems).	Accepted.
	8. The **noise** levels at the settlements (ranked by number of permanent residents) and measures to meet the permitted noise levels in terms of mining and haulage equipment (396 trips per day by 50t trucks, a 120t hydraulic excavator, and a jaw crusher). It is especially important to assess the need to implement measures to limit the noise propagation towards adjacent populated areas. It is specified that the project will use new and modern equipment compliant with the EU and wold standards of operation.	Accepted.
	9. Blast vibrations impact on the nearby housings (distances, impact, stability, etc.).	Accepted.
	10. The overhead crane specified in the documents must comply with the requirements under Regulation on Safe Operation and Technical Supervision of Lifting Equipment (effective date: 26.08.2006, last amendment: 2009).	Accepted.
	11. All other equipment specified in the documents must comply with the requirements under the Regulation on the Substantial Requirements and Environmental Noise Compliance Assessment of Equipment and Plant for Use Outdoors (effective date: 29.12.2009).	Accepted.
	12. Develop procedures for handling and use of reagents **and** explosives within the meaning of art. 7 of the Technical Requirements to Products Act (1999, last amendment: 2009).	Yes, the procedures will be prepared prior to commencement of site operations.
	13. At this stage, the Report structure, particularly the section discussing the health and hygiene aspects, should additionally include approval/acceptance statements from the Ministry of Health regarding the hygiene protection distances (zones) set out for the following project sites: - Open pit; - Crushing Section; - Process Plant; - IMWF.	The footprint of the project is subject to approval by the Ministry of Health after completion of the EIS for the project.
	14. The project so proposed could be implemented after preparation of the required project/design documents that ensure compliance with the fire safety rules and requirements in Bulgaria and approval under the Spatial Planning Act.	Accepted.

Education Center of Ecology and Environment - Sofia Letter ref. 29/07.06.2010	The Education Center of Ecology and Environment has the following proposals with regard to the EIA Scoping Report and the Compatibility Assessment Scoping Report:	
	The implementation of an investment project of such scale would significantly affect the Krumovgrad Municipality, which currently has no polluting industries and enjoys highly-developed agriculture. The employment structure and any economic activities in the vicinity of the open pit will be changed. The Investment Project is likely to adversely affect the potential for sustainable development through organic farming and ecotourism. Given these arguments, we believe that careful and detailed consideration must be given to: • the "zero" (no action) alternative; • the economic and social constraints that the Investment Project will impose; • the area affected by these constraints.	Accepted for the "zero" alternative. The economic and social constraints that the project may have are not an objective nor part of the EIA process The social and financial justifications of the project are elements of the project concession analysis.
	The EIS should considered the compliance or failure to achieve compliance with the existing strategic documents - the Krumovgrad Municipal Development Plan (2009-2013) and the Regional Development Strategy (2005-2015).	Accepted.
	This project proposal considers only the Ada Tepe prospect. Potentially, the satellite deposits will also be developed. It is specified that the satellite deposits will be subject to an independent EIA process and compatibility assessment. We believe this approach creates a risk of assessing the impacts in a "piecemeal" fashion, therefore we insist on having a theoretical assessment, at this stage and in this EIS, of the **cumulative impact** from the development of the deposit in its entirety. More details about the satellite deposits are required - distance from settlements and location relative to protected sites.	Accepted. A theoretical assessment will be made.
	The EIS should include (as an attacment) a Traffic Plan, which specifies he transport corridor (course) for concentrate shipments and the shipped tonnages.	Accepted.
	We suggest the EIA Statement should consider in detail the water-related issues: • Impact of the proposed proprietary abstraction well in the river gravels and, consequently, the impact of its design flow rate on the existing abstractions; • Impact on the Kessebirdere (a gully) located on the southwest side of Ada Tepe.	Accepted.
	We strongly hope that this Investment Project will avoid the bad practice for non-compliance with the sanitary protection distances to settlements set out in the Regulation 7 of the MH.	Yes, the project site footprint is subject to approval by the Ministry of Health after completion of the EIS for the project.
	One of the main issues arising from the project implementation is the environmental noise. We propose	Not accepted for the Ada Tepe prospect. The EIS will discuss

	commissioning, if possible, of blast testwork in various conditions and including the data from the testwork in the EIS. Expected noise levels from the normal operation of the open pit during the day and night periods as well.	actual data obtained from similar blasting operations at quarries across the country.
	Information about the world practice in mine waste disposal must be provided. Identification of the risks and advantages associated with the new IMWF design. Justification of the dewatering of flotation tailings prior to their disposal in the IMWF. Will tailings dewatering enable co-disposal of tailings and waste rock?	Accepted.
	We propose that the EIS should include details about the archaeological sites located on the project site or near it.	Accepted.
	Regarding the **economic aspects** of the project, we propose:	
	9. Justification of the annual throughput rate and, consequently, the mine life of the deposit and, possibly, of the satellite deposits.	Accepted.
	10. Justification of the approaches to the "extensive and detailed resource definition work to identify gold-silver mineralization of a style and geometry which is amenable to open pit mining".	Not accepted. The mineral resource definition methods, their review and approval of the resource/reserve statements are outside the scope of the EIS and EIA procedure. - The justification of the "extensive and detailed resource definition work" is the objective of a different procedure under the URA. BMM EAD has submitted its reserve/resource statement to the Reserves Expert Panel of the MOEW in accordance with the requirements under the URA and related bylaws, The resource/reserve statement was reviewed and approved by the Reserves Expert Panel at its meeting on 21.04.2005 and the Panel signed Protocol НБ-17/21.04.2005 accepting and approving the reported mineral resources and reserves. Resource estimation was completed using the GSLIB geostatistical package within the Vulcan software.
	11. Comparison of options for various gold/silver reserve and resource tonnages at Ada Tepe and at various gold cut-offs with forecasts of the gold price trend.	Not accepted. A comparison of options for various gold/silver reserve and resource tonnages at Ada Tepe

		at various gold cut-offs was made as part of the procedure for approval of reserve/resource estimates under the URA. Agagin, this is not part of the EIA procedure. The resource and reserve tonnages were analysed for different cut-off grades: 0.5, 0.9, 1.0 and 1.5 g/t, and approved at 0.9 g/t. The mine rock tonnage that is used in the air modelling will remain unchanged no matter whether it is classified as waste rock or ore. In this regard, a higher or lower cut-off grade would cause proportionate increase/decrease of ore and waste rock tonnage, which is only relevant to the project economics but not to the environmental impact.
Executive Forestry Agency - Sofia	Executive Forestry Agency - Sofia expresses the opinion that the EIA Scoping Report does not comply with the provisions of art. 10, par. 3, item 1, sub-item "a" of the EIA Regulation. The Report should contain a characterization of the project including a description of the physical characteristics of the project and land requirements (occupied land, farmland, woodland, etc.) during both the construction and operation stage. The documents does not present this information in the required detail (section, sub-section, area, type of sub-section, vegetation cover).	Accepted. The information will be presented in the required detail in the EIS.
Krumovgrad Municipality	The Krumovgrad Municipality expresses the opinion that the scope of EIA should be extended to achieve a complete and comprehensive assessment based on the following arguments:	
	1. The EIS should guarantee implementation of Option 1 (on page 24 of the EIA Scoping Report) for development of the project without the use of cyanides. The joint motion for a resolution on a general ban on the use of cyanide mining technologies in the European Union (B7 0238/2010) calls on the Commission and the Member States not to support, either directly or indirectly, any mining projects in the EU that involve cyanide technology until the general ban is applicable before the end of 2011.	The EIS will consider both process alternatives. There is no ban on the use of cyanides in the mining industry. The draft resolution on a general ban on the use of cyanide mining technologies IS REFUSED by the EU Commission because the Commission considers that a general ban of cyanide in mining activities is not justified from environmental and health point of views. A

		general ban on cyanide use would imply higher unemployment and closure of existing mines, which is not beneficial for any Member State.
	2. Take into account the cumulative impact that may be caused by adding together the impact of the current project proposal and the impact from the development of the satellite deposits as stated in the Application for a Concession for Mining of Metalliferous Natural Resources – Gold Orese from the Khan Krum Deposit. The cumulative impact assessment should be based on the concession footprint as defined in the Concession Application for the Khan Krum Deposit submitted to the Ministry of Economy, Energy and Tourism.	Accepted. A theoretical assessment of the cumulative impact from the development of all the prospects will be made
	3. Recognise the impact of blasting operations, blast concussion, noise and dust on the housings, the ground layers and water flows. Define more accurately the estimated blast power on page 5 of the EIA Scoping Report.	Accepted.
	4. Analyse in the greatest possible detail the ABL dust emissions (from blasting and material handling) after dust control (bag filters, sprinkling systems).	Accepted.
	5. Define the transport infrastructure - transport corridor (course), concentrate shipment tonnages, number of trips per day or month, type of motor vehicles; assess the impact on the local population and environment, and develop measures to prevent any accidents.	Accepted.
	6. The EIS should put more focus on the analysis of the noise levels from the mining and haulage equipment reaching the local settlements, including the anticipated daytime and nighttime noise levels during normal operation of the open pit. The noise mitigation measures should address all the settlements located close to the site.	Accepted.
	7. The EIS should include detailed and clear information about the Krumovitsa River waters: • Impact of the proposed fresh water abstraction well on the existing public drinking water abstractions; • About the one-off abstraction fresh water from the Krumovitsa River at the start-up of operations; • Develop a water balance model, where account should be taken of precipitation, evaporation, catchments, topography, etc, which should be confirmed by the East Aegean Catchment Directorate based in Plovdiv. • Ensure that the project site/footprint complies with the sanitary protective distances that define the respective protection zones - I, II and III; • The measures developed to prevent pollution of the Krumovitsa River from the Raw and Process Water Reservoir or the IMWF. Assessment of the risk of a possible overflow of the Reservoir; • Reagents concentration in the waste and reagents long-term behavior in the IMWF; detailed assessment of the	Accepted.

	biological and physical characteristics of the reagents, toxicity, environmental behavior (degradation, mobilisation, accumulation in food chains).	
	8. Provide information about the measures for health protection of the following communities: Soyka, Chobanka 1, Chobanka 2, Kupel, and Pobeda, which will fall short of the sanitary protection distances despite the statutory distances set out in Regulation 7/1992 on the Hygiene Requirements for Health Protection of Urban Environment.	Accepted.
	9. Make a detailed analysis of the jobs that will be created and indicate the percentage of these positions that is expected to be filled by people from the local community if the project proceeds.	Accepted.
	10. Plan measures for response to possible accidents during project construction and operation that may affect the environment and public health.	Accepted.
	11. Would a gold price fall below the desired rate of profit result in low-quality environmental protection or abandonment of the mine due to non-profitability of operations?	Such a risk does not exist. According to the recent amendments made to the Underground Resources Act - art. 64a & art. 22з, the Company must ensure funding for environmental activities and closure of the IMWF, i.e. even if the site is abandoned by the Concessionee the state should have the funds required for a safe closure.
	12. A joint Bulgarian-German research project has registered an archaeological site "A Gold Mine Dating to the Late Bronze/Early Iron Age" on the Ada Tepe. The archaeological site has the status of an immovable cultural heritage of national significance within the meaning of art. 146, par. 3 of the Cultural Heritage Act (CHA). The EIS should provide guarantees for the preservation of the archaeological sites within the requested concession footprint of Khan Krum deposit.	We don't have information and we are not aware of such a registration of an ancient mine. Regarding the above-mentioned research project, on the grounds of art. 161 par. 1 of the CHA, BMM and NAIM-BAS have concluded a Framework Agreement for Funding Rescue Archaeological Surveys.
	13. We insist on the careful consideration of the "zero" option because the implementation of the project will have a negative impact on the Krumovgrad Municipality which has so far not been affected by anthropogenic activity and is free of industrial polluters.	Accepted.
	14. The EIS should take into account that the project will be on a possible collision course with the Krumovgrad Municipal Development, the Regional Economic Development Strategy (2007-2015) and traditional lifestyle of the local communities.	Accepted.
	15. The EIA Statement should specify the risk created by the implementation of the project, which affects the ability of Krumovgrad Municipality to develop organic farming and alternative tourism.	Accepted.

Ministry of Healthcare	The Ministry of Healthcare expresses the opinion that the EIA Terms of Reference incorporates different sections in its structure in accordance with the legal requirements including sections that will analyse and assess the health and hygiene aspects of the environment and the risk to human health (both site personnel and the population of the nearest towns and villages). Whilst discussing these matters, detailed and comprehensive information must be provided about:	
	1. Locations and precise distances (shown on suitable maps) to the nearest residential areas and other sites and zones that are subject to health protection against potential project sources of pollutants: the open pit, the stockpiles and the Integrated Mine Waste Facility, the concentrator, the crushing plant, process and domestic wastewater treatment plants. The distances so measured/estimated should be compared to the statutory protective distances for the respective sites and operations under Regulations 7/1992 on the Hygienic Requirements for Health Protection of Urban Environment. The most recent census data about each city/town, village and/or hamlet must also be provided.	Accepted.
	2. Background assessment of the local environment (air, surface and ground waters, soils).	Accepted.
	3. Identification of the environmental and work-related risks to human health associated with the project construction and operation.	Accepted.
	4. The severity of the expected negative impacts on the environmental media and factors based on mathematical modelling, analysis and forecasting including: - modelling of the dispersion of the expected pollutants from non-fugitive (point) sources and fugitive (area) sources as part of the assessment of the potential impact on **air quality**; - forecasting of not only the emission concentrations but also the **imission** concentrations of air pollutants at the nearest housings; - paying special attention to the potential negative impacts on the water quality of the drinking water abstractions and ensuring site drinking water supply whose quality meets the standards under Regulation 9/16.03.2001 on the Drinking and Household Water Quality as part of the assessment of the potential impacts on the surface and ground waters; - estimation of the expected noise levels from the operation of the open pit and other project facilities and the impulse noise from blasting at the nearest recipients as part of the assessment of the expected **environmental noise**; - estimation of the distances at which flyrock is thrown based on the type of explosives and the blasting method as part of the assessment of the mining method. Flyrock must not travel more than one half the distance to the closest residential area or other facilities and sites that are subject	Accepted. Accepted. Accepted. Accepted.

	to health protection.	Accepted.
	5. The transport courses to the project site specifying the towns/villages/hamlets they pass through or the smallest distance to them.	Accepted.
	Identification of the potentially affected population and areas, zones or sites with specific health protection status or subject to health protection based on the analysis and assessment of the impacts on the environmental media and human health. Characterisation and ranking of the risk factors according to their impact on the human health and comparison to the applicable hygiene standards and requirements pertaining to both workplaces and affected *residential areas.*	Accepted.
	Assessment of the potential for combined, compound, cumulative and remote effects of the identified factors on both the personnel and the affected local population. Scheduling of the mining operations on the remaining prospects of the Khan Krum deposit and what cumulative effects are possible when two or more prospects are mined on the same day.	Accepted. A theoretical assessment of the cumulative impact from the development of all the prospects. will be made
	The EIS should analyse the health and demographic status of the population of the nearest towns, villages and hamlets based on the most recent demographic data (birth rate, death rate, natural growth, infant mortality, etc.) and morbidity data (level and structure). The data must be compared to the district and national average. A forecast of the potential health and demographic impact from the project implementation must be made.	Accepted.
	Based on the information on the matters discussed above, an assessment of the health risk should be undertaken, which should propose measures for health protection and risk management.	Accepted.
East Aegean Catchment Directorate based in the city of Plovdiv.	Statement from the Plovdiv-based East Aegean Catchment Directorate with comments and proposals: According to the presented description of the project a spillway or a pipeline will be constructed to enable water discharge from the project site into the Krumovitsa River. The discharged water must be compliant with the relevant allowable emission limits set out in the Wastewater Discharge Permit. We find the EIA should include an assessment of the requirement for construction of a wastewater treatment plant to treat any wastewater discharges to surface water bodies, which combine flows from the pit, site runoff, process and seepage water, to ensure compliance with the relevant allowable emission limits taking into account the risk of pollution of the receiving stream and to prevent any major instant release(s) in extreme precipitation events.	Accepted.
Education Center of	Further to Letter ref. № 29/07.06.2010. The Education	

Ecology and Environment - Sofia Letter ref. 41/11.08.2010	Center of Ecology and Environment has the following additional recommendations:	
	The conclusion on page 19 stating that the well will not derogate the public drinking water supply is not sufficient. The fresh water abstraction for the project will affect the available resource and the purpose of the EIS is to provide the most detailed and clear information about that. The hydrological survey carried out by the Plovdiv-based Vodokanalproject AD should be attached to the EIS.	Accepted.
	It is noted on page 20 that waste water "... will meet the allowable emission levels and will not derogate the water quality of Krumovitsa". Experience shows that almost every mining and processing company in the country consistently breaches the allowable emission limits set out in the permits, while the sanction is a minor fine. The EIA Statement must assess how these emission limits may be breached and what will be the effect on the receiving stream.	Accepted.
	We welcome the idea of extending the consultations to Greece. We recommend that information should also be provided to the Prefectures of Evros and Rodopi in addition to the competent Greek authorities. The Greek competent authority declined participation in the consultations on the previous EIS. However, representatives of the prefectures arrived at the public hearing and protested against the failure to inform them.	The procedure under the UN EIA Convention on Environmental Impact Assessment in a Transboundary Context is in progress. The government of Greece decides who should receive information.
Education Center of Ecology and Environment - Sofia Letter ref. 30/08.06.2010	A statement on the Compatibility Assessment Scoping Report.	The statement is accepted for reference. The scope and content are specified in art. 23 of the Compatibility Assessment Regulation taking into account the criteria set out in art. 24, par. 3 for assessment of impacts on the conservation objectives of protected sites.
	1. Project impacts A. Assess the direct destruction of or damage to populations and habitats within the project site.	Accepted.
	B. Assess the direct destruction of or damage to habitats or damage to populations within the local road network – access road to the minesite together with the perimeter of the road (the perimeter of impact on animal species directly associated with the size of the individual territory).	Accepted.
	C. Deaths of individual animals by the minesite or by the road – reasons for traffic within an individual territory, seasonal migrations or traffic between various key habitats (winter shelters, reproduction areas, feeding areas), and migrations to new territories: C1. Project components: all site activities such as operating and travelling equipment, local fires, site preparation, high-risk facilities etc. that may result in death of individuals should be identified and shown on a	Not accepted. Fencing will be installed to restrict the access of individuals to the project components.

	map. The vehicle trip frequency on the road should be estimated and a forecast of animal deaths and impact on populations should be made.	
	C2. Assessment of the magnitude (severity) of impact – size of habitats and size of populations within the perimeter around the minesite and the road according to the characteristic of the affected species, percentage of impacted populations of national, regional and local conservation status.	Accepted but only for the species for which this assessment can be made.
	C.3. Scope of impact within the minesite, the road and the perimeter around them (the perimeter of impact on animal species directly associated with the size of the individual territory).	Accepted but it can be done for tortoises only.
	C.4. Impact duration – project construction and operation.	Accepted.
	C.5. Possible impact mitigation measures: perimeter fencing of the site and the road, if required, prior to commencement of construction works; removal of all individuals outside the fence (that cannot be a legitimate measure for mitigation of the impact in terms of the percentage of directly damaged population), reduce and optimise (convoy travel) the number of vehicle trips per day, train drivers to remove animals from the road and make sure they do it.	Accepted.
	D. Fragmentation of animal habitats – blocking of seasonal migrations or traffic between various key habitats (winter shelters, reproduction areas, feeding areas), blocking of courses/bio-corridors for migration to new territories OR formation of small, isolated and unviable sections of suitable habitats/populations.	Not accepted. The Investment Project does not fragment any habitats nor affects bio-corridors.
	E. Chemical impact outside the site footprint as a result of reagents transport and storage. Project components: biological and physical properties of reagents, toxicity, chemical reactions, behavior in the environment (degradation, immobilisation, mobilisation, accumulation in food chains), transfer routes, hehicle loads and trip frequency, storage, environmental risks in case of accident(s) and Risk Mitigation and Emergency Response Plan for transport accidents.	Accepted.
	E. Chemical impact outside the site footprint as a result of reagents transport and storage. Project components: biological and physical properties of reagents, toxicity, chemical reactions, behavior in the environment (degradation, immobilisation, mobilisation, accumulation in food chains), transfer routes, hehicle loads and trip frequency, storage, environmental risks in case of accident(s) and Risk Mitigation and Emergency Response Plan for transport accidents.	Accepted.
	F. Other types of chemical pollution	Accepted.
	G. Chemical pollution by waste products.	Partially accepted. The TMF-related comments are irrelevant.
	2. Chasing animal species away – human presence, noise pollution. - Project components – all processes, blasting, noise	Accepted.

	etc. It is considered in the document. - Assessment of the magnitude (severity) of impact – area of potentially affected habitats and size of the affected population, and percentage from total populations and habitats. • Area of impact: according to the impact intensity and behavioral profile of species. • Impact duration – project construction and operation. Possible impact mitigation measures: keep operations away from habitats, reduce noise levels.	
	2.1. Impact assessment, severity and significance Asses all types of impact in terms of their negative effect on the conservation status of species and habitats. For that purpose, apply the definitions in the Habitats Directive as well as the Manual of Identifying Favorable Conservation Status (FCS) published on http://www.natura2000.biodiversity.bg/. Assess all impact factors in view of protecting the integrity of protected areas and the NATURA 2000 network: assess against the following conservation levels (in connection with Appendix 1 of the Directive on Environmental Liability): National level - percentage of impacted habitats (area size) if data is available – populations within the country and the biogeographical region. Regional level - percentage of impacted habitats (area size) and percentage of impacted populations within the Eastern Rhodopes Protected Area. Local level - percentage of impacted habitats (area size) and percentage of impacted populations within the Krumovgrad portion (as part of the constituency land of the municipality) of the Eastern Rhodopes Protected Area. The Investor may choose to apply a more restrictive and biological approach by defining local landscape units (which is the approach in Germany).	Accepted except for the last item. The EIA Regulation does no contain a requirement for local impact. Furthermore, local impacts can be identified only for individual species that have a distinct local population, e.g. Euplagia quadripunctaria.
	2.2. Habitats and species	Partially accepted. The inclusion of typical species is not acceptable in relation to comments concerning the habitats
	D: Lucanus cervus, Rosalia alpina, Morimus asper funereus, Cerambyx cerdo - Relevant impacts: A. Direct destruction of or damage to populations and habitats within the project site; B. Direct destruction of or damage to habitats within the local transport; C. Fragmentation of animal habitats; D. Other types	Accepted.

	of chemical pollution (dust pollution); - Parameters of favorable conservation status to be assessed: Parameter 1.1. – Number of identified colonies; Parameter 2.1. – Total size of potential habitats; Parameter 2.2. Size of high-quality habitats – forests in the old-age phase; Parameter 4.3. Construction development in known colony habitats or another change of forest purpose - Reference areas: for known colonies, use the maps prepared on the basis of KORINE Land Cover and used in the process of database entries for NATURA 2000 and or Compatibility Assessment Report; collect new and/or additional information and process with the mapping methods provided in the FCS Manual. For the size of suitable habitats, use the Model of Suitable Forest Habitats (we can provide upon request) which was used in the process of filling out the NATURA 2000 template form. Condition of populations and habitats of species within the project site: identify by field studies, prepare maps, min. 1:5 000 scale and descriptions within the active season. Clearly indicate and describe identification and reporting method and collected field data.	
	E.: Dioszeghyana schmidtii, Eriogaster catax, Euphydryas aurinia, Callimorpha quadripunctaria - Relevant impacts: A. Direct destruction of or damage to populations and habitats within the project site; B. Direct destruction of or damage to habitats within the local transport; C. Fragmentation of animal habitats (typical habitat species); D. Other types of chemical pollution (dust pollution); - Parameters of favorable conservation status to be assessed: Parameter 1.1. – Number of identified colonies; Parameter 2.1. Size of suitable habitats of the identified colonies, Parameter 4.6. Conservation of the nature of grass areas - Reference areas: for known colonies, use the maps prepared on the basis of KORINE Land Cover and used in the process of database entries for NATURA 2000 and or Compatibility Assessment Report; collect new and/or additional information and process with the mapping methods provided	Accepted.

	in the FCS Manual. - Condition of populations and habitats of species within the project site: identify by field studies, prepare maps, min. 1:5 000 scale and descriptions within the active season. Clearly indicate and describe identification and reporting method and collected field data.	
	F.: Unio crassus and Austropotamobius torrentium - Relevant impacts: E. Chemical impact beyond the site footprint as a result of reagents haulage and storage; G. Chemical pollution by waste products (only for Unio crassus). - Parameters of favorable conservation status to be assessed: Parameter 1.1. – Number of identified colonies; Parameter: condition of typical species. Parameter 2.1. Length of suitable habitats in the identified colonies, Parameter 2.2. – Total length of potential habitats; Parameter 4.3. Pollution – instant/chronic - Reference areas: for known colonies, use the maps used in the process of database entries for NATURA 2000 and or Compatibility Assessment Report, collect new and/or additional information and process with the mapping methods provided in the the Manual of Identifying Favorable Conservation Status. For the size of suitable habitats, use the Model of Suitable Forest Habitats (we can provide upon request) which was used in the process of filling out the NATURA 2000 template form. - Define the scope of potential impact – include the entire length of Krumovitsa River and Arda River to the water reservoir at Kumovitsa River (only for Unio crassus), as well as all rivers where pollution could be expected as a result of haulage, according to the likelihood of toxic chemical substances contaminate the river and spread down the river. Condition of populations and habitats of species within the project impact area: identify by field studies, prepare maps, min. 1:5 000 scale and descriptions within the active season. Clearly indicate and describe identification and reporting method and collected field data.	Accepted.

	G: Testudo hermanni and Testudo graeca - Relevant impacts: A. Direct destruction or damage to habitats within the minesite; B. Direct destruction of or damage to habitats and population within the local transport [routes]; C. Death of individual animals by the minesite or by the roadways; D. Fragmentation of animal habitats; E.Other types of chemical pollution (dust pollution); - Parameters of favorable conservation status to be assessed: Parameter 1.1. – Population; Parameter 2.1. Total size of suitable habitats in the area, Parameter 2.2. –Area size of sparse forests and bushes, meadows and abandoned agricultural land with trees and bushes. - Reference areas: For the size of suitable habitats and the size of populations, use the Model of Suitable Habitats (we can provide upon request) which was used in the process of filling out the NATURA 2000 template form. For the size of key habitats (par. 2.2.), and additionally for the size of all habitats, use the algorithm for those habitats provided in the Manual of Identifying Favorable Conservation Status and data about the earth cover in the Protected Area (Corine, or Cadastre information). - Define the scope of potential impact – include areas around the project site and access roadways in terms of direct destruction and damage; in terms of deaths and impact perimeter, take in mind the most recent unpublished data about seasonal migration of Testudo hermanni within more than 1km in the Rhodope Mountain; in terms of dust emissions - according to the impact area forecast. Condition of populations and habitats of species within the project impact area: identify by field studies, prepare maps, min. 1:5 000 scale and descriptions within the active season. Clearly indicate and describe identification and reporting method and collected field data.	Accepted.

	H.: Vormela peregusna - Relevant impact: A. Direct destruction or damage to habitats within the minesite; B. Direct destruction of or damage to habitats and population within the local transport [routes]; C. Death of individual animals by the minesite or by the roadways; D. Fragmentation of animal habitats; E.Other types of chemical pollution (dust pollution); 3. Chasing animal species away - Parameters of favorable conservation status to be assessed: Parameter 1.1. Number of colonies; Parameter 2.1. Total area size of suitable habitats in the area. - Reference areas: For the size of suitable habitats and the size of populations, use the Model of Suitable Habitats (we can provide upon request) which was used in the process of filling out the NATURA 2000 template form. - Define the scope of potential impact – include areas around the project site and access roadways in terms of direct destruction and damage; in terms of eviction, use either available literature or best available experts; in terms of dust emissions - according to the impact area forecast. - Condition of populations and habitats of species within the project site area: The density of this species is often low and therefore difficult to identify. As a minimum, prepare a map of suitable habitats, min. 1:5 000 scale, with the mapping methods provided in the the Manual of Identifying Favorable Conservation Status.	Not accepted. The species is not present at the Project site

	I.: Lutra lutra - Relevant impacts: A. Direct destruction or damage to habitats within the minesite; B. Direct destruction of or damage to habitats within the local transport [routes]; C. Death of individual animals (typical species) by the minesite or by the roadways; D. Fragmentation of animal habitats (typical species in the particular habitat); E. Chemical impact beyond the site footprint as a result of reagents haulage and storage; F. Chemical pollution by waste products; H. Chasing animal species away - Parameters of favorable conservation status to be assessed: Parameter 1.1. Relative number; Parameter 2.3. Length of river sections, man-made canals and size of bank areas suitable for otters; Parameter 3.1. Places suitable for shelters and dens. - Reference areas: For the size of suitable habitats under Parameter 2.3 and the size of populations, use the Model of Suitable Habitats (we can provide upon request) which was used in the process of filling out the NATURA 2000 template form. - Define the scope of potential impact – include areas around the project site and access roadways in terms direct destruction and damage; in terms of eviction, use a 200m perimeter, as detailed in the FCS Manual; in terms of chemical pollution, include the entire watershed of Krumovitsa Arda to the water reservoir at Krumovitsa River, as well as all rivers where pollution could be expected as a result of haulage, according to the likelihood of toxic chemical substances contaminate the river and spread down the river. - Condition of populations and habitats of species within the project impact area: Define the population in the Krumovitsa valley within the identified impact area either by designated studies or by using the density forecast assumed in the Model. Prepare a map of habitats, min. on 1:5 000 scale, with the mapping methods provided in the the FCS Manual.	Not accepted. The species is not identified in the Project site area.

	J. Canis lupus - Relevant impacts: A. Direct destruction or damage to habitats within the minesite; B. Direct destruction of or damage to habitats and population within the local transport [routes]; C. Death of individual animals by the minesite or by the roadways; D. Fragmentation of animal habitats; H. Chasing animal species away - Parameters of favorable conservation status to be assessed: Parameter 1.1. Number of individuals; Parameter 2.1. Total size of suitable non-fragmented habitats. Parameter 2.2. Habitats suitable for dens; Parameter 2.3. Size of unaccessible forest basins - Reference areas: For the size of suitable habitats, including key habitats, use the Model of Suitable Habitats (we can provide upon request) which was used in the process of filling out the NATURA 2000 template form. To assess the population, use extrapolated values from the models. - Define the scope of potential impact – include areas around the project site and access roadways in terms direct destruction and damage; in terms of eviction apply min.1,000m analogically to the boundaries of populated areas of 100 to 1,000 residents. Condition of populations and habitats of species within the project site area: This species has large individual territories compared to the project footprint area, and therefore it may be irrelevant to determine a directly impacted population. Map potential habitats in the impact area, according to FCS Manual. Assess impact population based on the habitats' capacity.	Not accepted. The species is not present at the Project site
Harmony Civic Association and Citizen Participation and Sustainable Development Coalition	Expressed willingness for participation in the consultations for the EIS and in the public hearing.	The EIA Scoping Report has been sent to the Harmony Civic Association.
Harmony Civic Association and Citizen Participation and Sustainable Development Coalition	Request to arrange participation of experts and NGO activists in continuous monitoring of people and the results of the archaeological surveys on the concession site - from the start of the EIS to its review by the SEEC.	Not accepted. Only the Ministry of Culture may, through its divisions specified in the CHA, perform monitoring and supervision of archaeological survey works.
Dr. Zlati Dimitrov Zlatev, SRA Academician in the International Academy	Geological profile of the deposit:	

of Environmental Sciences and Safety of Human Activities; Leader of the expert team who collaborated on the statement.		
	- there is no data in the project about the chemical composition of the ore and the low-grade ore material. What is the concentration of the key elements occurring in the deposit area such as arsenic, chromium, nickel, iron, manganese, zinc, cobalt, copper, cadmium, and lead?	Not accepted. This data is not within the scope of the EIS Terms of Reference and is presented in the EIS. The Mine Waste Management Plan includes certificates of assays of mine rock and tailings. Testing was performed on two bulk tailings samples representing ore from the Upper and Wall zones. The chemistry of the tailings samples is representative of the composition of the rock material from which the payable components, i.e. gold and silver, are recovered. It genetically inherits the elemental composition of the ore minus the payable components.
	It is untrue that arsenic and heavy metals occur in the ore, low-grade ore and mine waste as water insoluble species. Hydrogeochemical, biochemical and electrochemical processes causing decomposition of minerals and transition of arsenic and heavy metals into the water occur in the mine pit and in the low-grade ore and mine waste stockpiles during the development of the deposits. The velocity of the mineral decomposition in the triple system of mineral-water—oxygen is low, but increases with time. Autochthonous microflora of diverse microorganism groups occurs in all of the developed deposits containing sulphide minerals, and oxidises the reduced sulphuric compounds and acidic iron ions of acidic manganese. The representatives of such micro organisms established in the mine and stockpile drainage are bacteria of the species Thiobacillus ferooxidans and Tiobacillius thiooxidans. These bacteria cause abrupt catalyzing of many chemical and biochemical reactions causing mineral decomposition and releasing of arsenic and heavy metals into water. Where the ratio between sulphide and alkaline components in some deposits ensure a neutralizing potential much higher than the acidity potential, the acid released during mineral decomposition is neutralised and the drainage is non-acidic, the pH of the water is neutral, but arsenic and heavy metals remain in the water.	Not accepted. The statement that arsenic and heavy metals are in a water insoluble form has been proven by testswork and chemical analyses. The testwork on the mine wastes, which have the potential for the largest environmental impact, and their classification are consistent with the requirements of the Regulation on Specific Requirements to Mine Waste Management, Regulation 3 on the Waste Classification, and the Regulation on the Terms and Conditions for Classification, Packaging and Signage of Chemical Substances. The mine waste from the Ada Tepe section is non-inert non-hazardous waste because it does not contain any very toxic elements in concentrations above 0.1%, toxic elements above 3%, their sulphur content is low and has

		no acid generation potential! The tailings and waste rock analyses show no acid generation potential, mainly because of the low content of sulphur at <0.01%. The acid-neutralization capacity of these materials is >1 due to which the materials are not acid generating. The evidence that the Management Plan conforms to Bulgaria's regulatory requirments is a letter by the competent authority MOEW with outgoing No. OBOC-1402/06.10.2010. Regarding the Thiobacillus ferooxidans and Thiobacillus thiooxidans, the opinion presented in the statement is correct in theory, but the absence of acidic environment (pH < 4) means that the listed bacteria could not develop.
	The soils in the deposit area:	
	The stockpile for soils polluted with arsenic and heavy metals may become a source of pollution for other media in the case of increased arsenic and heavy metal mobility through the soil in the stockpile. The elevated content of heavy metals and metalloids in the soils has increased the sensitivity of these soils to acidification which in turn increases the mobility of metals making them accessible to other media. The pH of the soil solution (in water) is equal, most often, to 5.0-6.0 units, describing it as acidic.	Not accepted. Yes, some of the forest soils contain heavy metals and arsenic, as is natural in the region. Such soils will be placed in a soil stockpile located in the upper section of the mine waste management facility. In this way the atmospheric precipitation falling on these soils will be collected by the IMWF drainage system. The soils will be used for rehabilitation solely and only of the forest-area terrains (from which they will be extracted). The groundwater and the water in the Krumovitsa River are also lacking in the above elements which is proof that there is no impact, or that the soils containing such elements are good absorbents.
	Surface and ground water:	
	Why have the samples been taken only from the area of the future Mine Waste Management Facility?	The groundwater analyses presented were taken from 7 water points. These are not

		placed only around the Mine Waste Management Facility, although it is the focus of the presented plan. The Company's monitoring program will involve 17 boreholes, most of which have already been constructed, and will be used to assess the impact of all mine facilities. The EIS will present also water and alluvial deposits from the Krumovitsa River, which are hydraulically connected to the ground water.
	There are no comments concerning the composition of the ground water. The submitted protocols show that pollution is present even within the future IMWF? The iron content is as high as 9.2 times above the admissible level, and 1.06 times for antimony, which confirms the fact that minerals decompose leaving heavy metals in the water. This confirms the above statement regarding mineral decomposition and releasing of heavy metals into the water.	The EIS considers the groundwater in detail and presents an analysis and forecast about the expected impact on that water during the project implementation. There is no groundwater pollution – the content of iron, heavy metals and arsenic is within the admissible limit values. The presence of iron in the uncontained borehole (ATDDEX 025) was caused by the heavily corroded pipe and pollution with iron could not have been avoided during the sample taking. As can be seen from the chemical analysis, all other parameters of this water are within the admissible limit values. No iron has been established in the studied Krumovitsa River water samples. Its absence both in the groundwater and in the surface water is indicative of the incorrectness and fallacy of the conclusion that iron is present in the groundwater. The conclusion about higher antimony content is absolutely improper because the submitted protocol shows clearly that the quoted higher content is within the margin of error of the analyssi. The conclusions about presence of heavy metals and arsenic are also discrepant and

		in fact they refute some statements made previously by this expert: • on the one hand, the heavy metals and the arsenic in the water are said to be soluble, and on the other, the water of the Krumovitsa River is Category I, which means that it is very clean (as is also proven by the protocols). • The fact that the town of Krumovgrad and the village of Ovchari are supplied with water from wells built within the alluvial floodplain of the Krumovitsa River and that no heavy metals and arsenic are present in the water also refutes this expert's statement about expected pollution.
	Samples taken from the Krumovitsa River and its tributaries show that the water meets the requirements for category one receiving water bodies with regard to the contents of heavy metals and arsenic. The drain water will be collected in a return water pond, which will receive also mine water. The water from this pond will be discharged into the Krumovitsa River and will be treated only for suspended solids. The discharge is expected to meet the individual emission standards for category two receiving water bodies. This is inadmissible. With regard to the arsenic and heavy metal contents, the discharged water should meet the category one requirements.	Not accepted. The Krumovitsa River is a Category II receiving water body. For this reason the emission standards will be consistent with the standards for the receiving water body. The analyses of clarified water and of process-tailings eluate show arsenic at <0.01 mg/l which is consistent with a Category I receiving water body.
	ROM Pad and low-grade ore stockpile Soil Stockpile	
	The ROM Pad drainage will not be collected and treated. This drainage, as has already been seen, will contain arsenic and heavy metals.	Not accepted. The ROM Pad, the low-grade ore stockpile and the soil stockpile will be located in the upper area of the Integrated Mine Waste Facility. This will allow use of the drainage systems of the Integrated Mine Waste Facility to collect all water entering this facility. An absolutely incorrect

		statement is made once again without any evidence of the presence of heavy metals and arsenic in the water draining from the low-grade ore stockpile and from the ROM pad. The Mine Waste Management Plan presents protocols of analyses of water, soil, waste rock and tailings. None of the pollutants are in excess of the limit values. Analyses of ore and low-grade ore have been made. These are presented in the EIS.
	Integrated Mine Waste Facility:	
	No consideration has been made of the expected arsenic and heavy metal pollution in the drainage. No chemical treatment of the water for heavy metals and arsenic is provided for before the periodic discharging of water into the return water pond, and only removal of suspended solids is provided for.	Not accepted. There is no pollution with heavy metals and arsenic. Protocols of analyses of mine waste, clarified water, and tailings eluate (1:10) are provided as proof. The water balance shows that no water will be discharged from the return water pond into the Krumovitsa River during the first year of mine operation. This will allow the Company to provide a sufficient number of analyses of this water during operation as proof that chemical treatment of the water during production would also be unnecessary.
	Extraction of low-sulphide auriferous ores. Mine water	
	The problems presented by open pit mining are considered separately.	
	The expectation that the mine water will be polluted only with suspended solids is unacceptable because processes (hydrogeochemial, biogeochemical and electrochemical) will cause decomposition of minerals and pollution of the mine water with arsenic, heavy metals and sulphate ions. Pollution of the mine water will occur also from explosives and motor vehicles. Discharging of the return water pond following only removal of suspended solids would be unacceptable.	All ore elements typical of ore-formation processes occurring in low-sulphide epithermal auriferous mineralisations are as low as the Earth's crust average (the average grade of the remaining ore elements is similar to the typical grades that occur in the earth's crust worldwide). Silver is an exception, but its content is also very low. This is certainly no reason to believe that the mineralisation is a native quarts-auriferous one.

		The analyses show no presence of heavy metals and arsenic in the water.
	Processing of low-sulphide auriferous ore. Return Water Supply:	
	The problems concerning the potential technological and technical solutions for processing of ore from the Khan Krum deposit are considered separately.	The project and the EIA Scoping Report consider the Ada Tepe prospect only, where extensive resource definition work has been done. The remaining prospects will be explored further during the first 9 years of operation of Ada Tepe and a separate project for their development will be prepared should they prove to contain economically viable resources.
	The processes concurrent with the process of flotation using return water have not been taken into consideration. When using acidic reactants, the return water will become gradually acidic. The acidification and constant contact of the return water with new batches of ground sulphidic auriferous ore will cause decomposition of the minerals and accumulation of arsenic, heavy metals and sulphate ions in the liquid phase. It is inadmissible to discharge water treated only for suspended solids, as is the current provision.	Not accepted. The conducted tests do not show any pH reduction resulting from the use of reagents. The Ada Tepe ore is not a sulphide-style auriferous mineralisation. Pyrite is a typical mineral occurring in almost all hydrothermal deposits, including not only Fe and S, but also the remaining element, which is normal. Marcazite, its dimorphous variety is, as indicted, a very rare mineral established at depth, below the ore mineralisation in the metamorphous foundation. Galenite and sphalerite, as well as other sulphide minerals are exotic for this deposit and have been established as singular occurrences during microscopic studies. This is evidenced by the ore tests. The process flows during the concentration process are monitored very strictly, including for the pH of solutions. A mandatory requirement for the use of xanthate as coagulant (as is consistent with the project) that the pH of the slurry be maintained between 7 and 9.

		As required, the slurry pH may be adjusted using medium regulators such as lime.
	Concentrator Plant Return Water Pond:	
	It is inadmissible to discharge water from the pond into the Krumovitsa River following only the envisaged treatment.	Not accepted. The wastewater discharged into the Krumovitsa River will conform to the standard for the river as category II receiving water body. The tests and analyses conducted so far do not require any further treatment, except for the removal of suspended solids. As can be seen by the water balance, there will be no water discharging during the first year of operation. This will allow for a monitoring of the pond water quality with sufficient frequency and for presentation of the results to the competent authorities and to the concerned public.
	Opinions, remarks and recommendations regarding the IMWF	
	The joint function of the drainage material (crushed waste rock, geotextile) and the tailings will cause clogging with drainage material causing the drainage system to become plugged and stop its function.	Not accepted. Geotextile and waste rock clogging will be controlled by precise selection of geotextile and laying of accurately sized layers of rubble depending on the tailings grain size. The geotextile will also be selected for pore size. Despite the described preventive measures, clogging may occur in certain places. The IMWF drainage system area is rather large and the conductivity of the system could not be affected by individual clogged surfaces.
	The diversity of waste rock shows that it is not one of the most reliable materials that can be used in the construction of the IMWF and of the drainage system.	Not accepted. The waste rock which will be used to construct the drainage system will be selected and, if necessary, processed further. Diversity of the waste rock used to construct the IMWF will be required in order to ensure the most reliable result.
	No IMWF liner is provided for.	The geological base is defined by the geological and

		hydrogeological conditions below and in the IMWF area and must ensure sufficient retaining capability to prevent the risk of pollution to the soil and water. Engineering-geology and hydro-geology studies of the geological base have been carried out for the purpose. The base and slopes (batters) of the IMWF should comprise mineral layers where the combined effects of thickness and seepage (determined using a seepage ratio k) ensure protection of the soil and groundwater at least equivalent to the protection provided by a layer with the following parameters: seepage ratio – for non-hazardous waste – k < 1.0 x 10 raised to the power of (-9) m/sec and with a thickness of >1 m; The BATs for TMF and stockpiles used for waste rock also recommend a factor of 1.10-9 m/s.
	The quantity of mined waste rock will be twice the quantity of Concentrator Plant tailings. It is not clear how joint drainage will be implemented.	Joint discharging will be carried out gradually in an upward manner, the waste rock being used to build “cells” in which the partially dewatered tailings will be disposed of. It is important to point out that the proposed IMWF embankment construction phases are completely consistent with the development of the pit mine. That is, the waste rock and tailings will be deposited in the facility as designed, and the tailings will be laid in up to 2 m deep layers.
	The IMWF stability models were carried for two conditions: all the material was modelled as tailings; no water aquifer is formed within the waste body.	Not accepted. The waste rock will be used to construct a water permeable facility and no collection and retaining of a substantial masses of water are expected. The IMWF outer face slopes will be constructed at 2.5H:1V, which is considered

		to ensure stability in the long-term. The angle of friction of the deposited materials is 40° for waste rock, 30° for the thickened tailings (at 56% solids) and 33° for the IMWF foundation. The IMWF is sited in a negative landform – a ravine, and is further secured by a starter platform. Internal 5 m wide (at the crest) berms form tailings deposition cells.
	The seismic stability of the slopes was evaluated not considering liquefaction.	Not accepted. The tailings will enter the IMWF partially dewatered, i.e. no separation of the fine and coarse phases is expected. The tailings will be further compacted when covered by waste rock. The tailings is not expected to liquefy under the combined effect of these two measures.
	An expert assessment is required of this facility by a Bulgarian institution.	Such an assessment will be carried out at the University of Architecture, Construction and Geodesy.
	With its height of 170 m the IMWF poses the danger of sliding of material in some areas caused by storm water.	Not accepted. The analyses show that even if such ingress should be possible, the water will circulate in the waste rock layers and will not endanger the IMWF stability.
	No sediment-flow retention pool is envisaged at the toe of the facility.	Two sumps will be set up downstream of the northern and southern catchments of the IMWF. Each has a capacity of 2,000 m³. The water from those sumps will pumped into a 100,000 m³ retention pond (Raw and Process Water Reservoir).
	The drainage from return water is expected to contain arsenic, heavy metals and sulphate ions.	Not accepted. The tests and analyses do not show any presence of arsenic, heavy metals or sulphates in the eluate (1:10L) or in the decant water from the tailings thickener.
	The IMWF should be classified as a Category A facility	Not accepted. This statement requires proving. The IMWF was categorised in accordance with the URA and

		the Regulation on the Specific Requirements to Mine Waste Management. The competent authority (MOEW) has by letter No. OBOC-1402/06.10.2010 determined that the Mine Waste Management Plan is consistent with the regulatory provisions and the categorisation of the IMWF as a Category B facility was considered proper.
	The IMWF does not guarantee protection of the Krumovitsa River bed and the safety of the settlements surrounding it.	Not accepted. The facility will be designed and constructed in accordance with the safety and security requirements and will be made consistent with the mine waste BATs.
	Disposal in the IMWF as proposed would be impossible.	Not accepted. No reasons are presented in defence of this statement. The competent authority (MOEW) approves with letter No OBOC-1402/06.10.2010 of the mine waste classification and of the proposed category of the facility.
	The quantity of gold extracted during the flotation of low-sulphide auriferous ore is low. The remaining significant amount of gold in the tailings cannot be extracted in the future following joint discharging of the tailings and the waste rock.	Not accepted. The gold content in the sterile rock (the so-called waste rock) is below 0.6 g/t. The gold content in the process tailings will be 0.5 g/t. The waste mined material and the tailings will be disposed of separately into the facility. The waste rock will be used to build berms (similar to walls built in TMFs) and for covering of drained tailings (such covering will be carried out during TMF closure and rehabilitation and prior to the placement of soil).
	Impact of the project on the drinking water sources used to supply the urban centres in the Krumovgrad Municipality.	
	The project does not specify the structural dimensions of the well and its type (pipe, shaft)	The water supply well will be of the shaft type and its technical details will be specified and coordinated with the East Aegean Basin Department at the time of applying for water use in accordance with the Water

		Act.
	There are no aquifer conductivity calculations.	Not accepted. There are many pumping stations and boreholes along the river, and their parameters have been established. The aquifer data are specified in the EIS. According to an expert study by Vodokanalproject – Plovdiv (2010), the alluvial aquifer is established in the contemporary deposits of the Krumovitsa River and its larger tributaries.
	Any pollution of the Krumovitsa River water (or any of its tributaries) will, irrespective of its duration or intensity, cause deterioration of the quality of abstracted potable groundwater.	Not accepted. No pollution of the Krumovitsa River from the process will be allowed. The sanitary protection belts around the water supply wells will be located 5-6 km downstream of the point of discharge of water from BMM EAD and will be constructed so that: • The boundary for belt I for water sources in non-protected underground water bodies is defined as a vertical projection over the earth's surface of the curve described by all points of the underground water body, whose water could reach the water source in 50 days. • The boundary for belt II is defined as a vertical projection over the earth's surface of the curve described by all points of the underground water body, whose water could reach the water source in 400 days. • The boundary for belt III is defined as a vertical projection over the earth's

		surface of the curve described by all points of the underground water body, whose water could reach the water source in 25 years. Although the water from the BMM process will be discharged far from belt area III, the water will conform to the category of the receiving water body – the Krumovitsa River – as is the requirement for direct discharging into belt area III.
	The schematic map attached to the project shows the road connecting the town of Krumovgrad and the site, crossing sanitary protection belt areas 2 and 3 of the Ovchari Pumping Station.	Alternative access roads are considered in the EIS. There are no prohibitions for roads passing through sanitary protection belt areas 2 and 3.
	Very strict monitoring of all industrial processes and farming operations is required on the territory of all water-supply areas and along the entire watershed area along the upper flow of the Krumovitsa River.	This is within the competencies of RIEW-Haskovo and RIPHPC (Regional Inspectorates for Public Health Protection and Control) – Kardjali, and the Plovdiv Basin Directorate.
	The project does not consider the protection of the main source of potable groundwater for the villages in the Krumovitsa Municipality – the Krumovitsa River. The potential pollutants are the open pit-mine – mine water, the soil stockpile – drain water, the ore stockpile – drain water, the low-grade ore stockpile – drain water, the IMWF – drain water. It would be inadmissible to discharge untreated water from the water pond into the Krumovitsa River.	Not accepted. The protection of the groundwater used for water supply of the town and of other urban areas has been considered. The water which will be discharged from the tank will conform to the standard of the receiving water body, which is stricter than the emission standards. This water will be discharged approximately 5 km upstream of the third sanitary belt area around the town's potable-water sources and will still conform to the standards for the receiving water body. This provision of Regulation 3 on the Sanitary Protection Belt Areas applies only if the wastewater is discharged directly into belt areas three or two!
	Requirements of the Convention on Environmental Impact Assessment in a Transboundary Context:	
	BMM EAD have not prepared information about all	Not accepted.

	envisaged activities for submission to the MOEW and the Republic of Greece. The opinion of Greece should be taken into account in the preparation of the final ToR for the EIA statement.	The MOEW has notified Greece and has sent the EIA Scoping Report and the Mine Waste Management Plan for consultancy in the transboundary context. The EIS and its attachments (in English) will be sent to the Republic of Greece following a positive evaluation of the quality of the report conducted in accordance with the criteria under the EIA Regulation.
	Aspects of health and hygiene	
	It is unclear how the problem of the affected population will be resolved.	Article 3 of Regulation 7 of 25.05.1992 on the hygiene requirements for health protection of the urban environment defines the minimum distances and hygiene-protection areas (separated in 7 different groups depending on the nature of production and economic activity). Hygiene protection belt areas may be reduced or enlarged with the permission of the Ministry of Healthcare on the basis of a statement by the relevant Regional Inspectorate of Hygiene and Epidemiology and an EIA clarifying the health and hygiene aspects of the site location.
	Compatibility assessment report	
	The project is likely to have a significant negative impact on the natural habitats, the populations and habitats of species under protection in the Eastern Rhodopes and Krumovitsa protected areas.	A compatibility assessment report was prepared as an integral part of the EIS.
	BMM EAD have not prepared a ToR for the scope and content of the Compatibility Assessment.	Not accepted. The scope and content of the report on the assessment of the compatibility with the scope and objectives of the protected areas is specified under Article 23 of the Regulation on the Conditions and Procedures for Assessment of the Compatibility of Plans, Programmes, Projects and Investment Proposals with the Scope and Objectives of Conservation of the Protected Areas, and in letter No.

		OBOC-1402/24.06.2010 of the Minister of Environment and Water. The structure and the proposed content of the compatibility assessment are included in item 9 of the EIA Statement ToR, since both the EIA and CA procedures will be combined.
	Cultural Heritage:	
	The project implementation will endanger some of the structures of cultural and historical value. No solution for their conservation is provided.	Not accepted. At the present moment the Ada Tepe continues to be of archaeological interest. On 09.08.2010 BMM EAD and National Institute of Archaeology and Museum under the Bulgarian Academy of Sciences concluded a framework agreement for the financing and conducting of scientific research, according to which the Company will provide up to BGN 2 million for rescue archaeological surveys in the Ada Tepe area. According to the Framework Agreement, the operations in the Ada Tepe section are expected to concur with the rescue research in the Ada Tepe area, and the studied areas to be gradually released for implementation of the Company's project.
	CONCLUSION:	
	Environmental aspects	
	It is mandatory to set up prohibitions and restrictions as required for sanitary protection belt areas 3.	There is no information about any approved sanitary protection belt areas and, therefore, the restrictions are unclear. The information from the Plovdiv Basin Directorate refers only to the public drinking water sources. The water effluent from the Company's operations will not be discharged in any of the sanitary protection belt areas (determined in a report by Vodokanalproject – Plovdiv).
	The concept of BMM EAD for EIA during the prospecting, mining and processing of ore, mine-waste and water management and the solutions to mitigate the	Not accepted. This conclusion requires justification.

	impacts do not guarantee the required degree of environmental protection.	The EIS and the Compatibility Assessment present, following an analysis, a forecast of the impact and recommend the measures to mitigate this impact.
	Mining of low-sulphate auriferous ores – open pit, auxiliary sites, technology proposals.	
	BMM EAD should elaborate a project for overall development of the Khan Krum deposit.	Not accepted. The project concerns the Ada Tepe section only. When the remaining sections are developed at a later stage, they will be subjected to EIA immediately preceding operations in these sections.
	Processing of low-sulphide auriferous ore.	
	The cyanide process has indisputable advantages over the proposed process.	Accepted. Yes, the cyanide technology has definite advantages. The valuable component – gold – will be extracted in a substantially higher degree. At the same time, the community in the region and certain NGOs are against the use of this technology in the Eastern Rhodopes protected area.
	EIA in the transboundary context	
	No complete information about all envisaged activities is prepared	Not accepted. The necessary information for the population, including population in the transboundary context, has been prepared. The MOEW has notified the Republic of Greece using the proper channels.
	Aspects of health and hygiene	
	The issue of concerned population has not been resolved.	Not accepted. Article 3 of Regulation 7 of 25.05.1992 on the hygiene requirements for health protection of the urban environment defines the minimum distances and hygiene-protection areas (separated in 7 different groups depending on the nature of production and economic activity). Hygiene protection belt areas may be reduced or enlarged with the permission of the Ministry of

		Healthcare on the basis of a statement by the relevant Regional Inspectorate of Hygiene and Epidemiology and an EIA clarifying the health and hygiene aspects of the site location.
	Compatibility assessment report	
	There is no Terms of Reference for the scope and content.	The scope and content of the report on the assessment of the compatibility with the scope and objectives of the Eastern Rhodopes protected area is indicated under Article 23 of the Regulation on the Terms and Procedures for Assessment of the Compatibility of Plans, Programmes, Projects and Investment Proposals with the Scope and Objectives of Conservation of Protected Areas, and in letter No. OBOC-1402/24.06.2010 of the Minister of Environment and Water. The structure and the proposed content of the compatibility assessment are included in item 9 of the EIA Scoping Reprot, since both the EIA and CA procedures will be combined.
	Cultural Heritage	
	No solution for the conservation of cultural heritage is provided.	At the present moment the Ada Tepe continues to be of archaeological interest. On 09.08.2010 BMM EAD and National Institute of Archaeology and Museum under the Bulgarian Academy of Sciences concluded a framework agreement for the financing and conducting of scientific research, according to which the Company will provide funding for archaeological rescue surveys in the Ada Tepe area. According to the Framework Agreement, the operations in the Ada Tepe section are expected to concur with the rescue research in the Ada Tepe area, and the studied areas to be gradually released

		for implementation of the Company's project.
	PROPOSAL	
	We propose that BMM EAD should prepare a project utilizing the cyanide process.	In 2004 BMM EAD submitted a project for production of Dore gold by extraction in cyanide solutions and carbon leaching, and a suitable cyanide cleaning process. The EIS was never scheduled for review by the Supreme Environmental Expert Council and was not accepted by the Krumovgrad community and municipality.
Krum Mikhailov – mining engineer, specializing in open pit mining of ores and minerals.	Raw materials	
	It is unclear how the cut-off grade of 0.9 g/t is estimated.	Not part of the EIS scope. The cut-off grades have been estimated by the Investor and coordinated with the MOEW during the exploration of the deposit. Section 2.3 under Chapter III "Geological and Economic Evaluation of the Ada Tepe Portion of the Khan Krum Gold Deposit" in the Final Exploration Report specifies the summarised Whittle Four-X input parameters used to calculate the cut-off grade of 0.9 g/t for gold (except for the silver resources, which are calculated using their actual grades)
	What are the current ore tonnages and grades by categories?	The Expert Panel has accepted and approved the reported gold ore reserves and resources with Protocol НБ-17/21.04.2005.
	Are there any changes in the tonnage and grades of the measured resources (code 331)?	Not part of the EIS scope. Having filed the commercial discovery application, BMM EAD stopped the prospecting and valuation works in the deposit area. There is no change of reserves (122) and resources (331). Following the granting of a concession, the

		geological exploration will continue for further studying of the deposit sections and annual reports concerning any changes in the balance of resources and reserves in the Khan Krum deposit will be prepared as required by the Mineral Resources Act.
	How was the low-grade ore defined? What is the lower boundary for the cut-off grade for low-grade ores?	Not part of the EIS scope. The cut-off grades were used to define this ore. According to the Methodological guidelines which conform to the UN International Framework Classification for Reserves / Resources – Solid Fuels and Mineral Commodities, the low-grade ore belongs to the category of “potentially economic / economic to potentially economic”. These are the quantities of mineral resources in tons / volume, the industrial value / quality, evaluated at the stage of the geological and economic study based on the geological parameters of economic interest. The geological and economic study based on those geological parameters does not allow for accurate definition of the categories of “economical” and “potentially economical”. Mining those minerals would be inexpedient considering the current technological, environmental and other conditions of the evaluation, but might become economical in the near future as a result of changed process-related, technical, economic, environmental and/or other conditions. This ore was determined at a lower boundary for the cut-off grade of 0.5 g/t. The ore quantity is approximately 488,671 t and it will be stored in a separate stockpile at the upstream part of the IMWF during overburden removal. Constant monitoring of the

		quality of mined ore and of its subsequent storage or processing will be carried out during the exploration.
	Based on the above questions, how much is the overburden?	2,7
	What are the ore quantities in the other sections?	The Expert Panel has accepted and approved the reported gold ore reserves and resources with Protocol НБ-17/21.04.2005. The ore tonnages are indicated there.
	Productivity of the mine	
	What was the basis used in determining the annual throughput rate of the process plant with only 8 years of operation life?	The process-plant throughput rate is based on the mining rate. The mining rate is based on the rsource-specific geological, mining and technical conditions, the available equipment and processes, legal restrictions etc., and an annual rate of 850 Kt. is been proposed over approximately 9 years of operation in the Ada Tepe section.
	How were the mining and technical conditions during the mining operations evaluated using the parameters of the mining method?	The mining method was selected according to the specific technical conditions in the mine, and various forms of the same development system may be used in the different sections in order to achieve efficient mining and improve the financial and economic parameters of the mining process in general.
	Is this period sufficient for creating a livelihood for the local population?	A social justification has been developed as part of the concession analysis. At the same time the EIS will consider the no-action alternative and will evaluate the benefits and losses from the project. Most generally speaking, approximately 3 years will be required for designing and construction, approximately 9 years for operation, and approximately 3 years for closing of the mine.
	Mining Method	

	The old project design considered a bench height of 2.5 m. What is the situation on the horizontal plane (by area)?	In view of the improved blasting efficiency and reduced impacts, the use of a bench height of 5 m is considered in the design.
	What areas will be cleared of overburden to access the auriferous ore reserves (blocks)?	The areas of all sites are specified in the EIS, and the phases of overburden removal are subject to scheduling in the Mine Life Plan and the annual production projects. The EIS indicates the expected volumes of soil, ore, low-grade ore, and waste rock.
	What is the minimal area from which the blasted ore will be delivered to the process plant?	The sentence “minimum ore area which will be fed to the plant following blasting” bears no sense because a volume of material (expressed in cubic meters or tons) is fed for processing. The annual quantity of mined material is presented in the mining plan in the EIS.
	Will there be any losses during mining?	Of course there will be. A practical balance of losses and dilution will be sought for.
	What is the optimistic dilution expected during mining?	The optimistic dilution is 2-5%.
	What will be the content of gold in ore fed to the plant for processing?	At the periphery, in the contact zone, the content of gold in the ore will vary in each mining block (field, section). In the sections inside the ore field where no significant gravel inclusions are present, this content will be approximately equal to the content of payable components of the clean ore. In the sections with rock inclusions the gold content will depend on the size of the particular inclusion. The content will be managed by the geologists and process specialists.
	Technology of mining operations in the pit	
	The machinery envisaged for mining of 3,000 t of ore per year is insufficient.	The machinery was updated and the use of various arrangements and optimisations makes achieving the targeted results entirely possible.
	Drilling - The TAMROC 1100 drill would not be suitable	The bench height will be 5 m.

	for operation on 2.5 m high steps because it bores 89-140 mm wide holes. A 1 linear meter long hole accommodates large quantities of explosives generating high blasting energy and large amounts of flyrock. The following calculations show that BMM EAD will need at least 5 drills.	
	Blasting – I believe that this volume of work will be difficult to organise in view of the mining and technical conditions. Raising the bench height to 5 m is proposed. It is unclear whether the cut-off grade report discusses the design bench height.	The design bench height will be 5 m. It is bears no relevance to the cut-off grade.
	- Excavator works – for technical reasons, mining in the pit should not be carried out using only one excavator, for the following reasons: The excavators will be used for only 55%-60% of the 8,000 hours per year envisioned for the operation, or the excavator operations in the mine will be shorter by almost a half. The jaw crusher was sized for the hourly output rating and not in consideration of the size of the largest piece. The percentage of oversize pieces that cannot fit into the crusher will be high. It is believed, therefore, that 4 excavators with 3-4 m3 buckets will be required.	The equipment requirements have been updated and the use of various arrangements and optimisations makes achieving the targeted results entirely possible. The overall deposit development project will consider these questions in detail.
	The annual output of ore should be reduced to approximately 500 th.t., and 1,000 t of overburden, and the step height should be increased to 5 m. while the output capacity of the process plant should be approximately 500 th.t./year.	The step height will be 5 m. The annual output capacity cannot be reduced to more than 800 th.t./year.
	It would be advisable if the Ada Tepe is developed in 2 independent sections – a northern and a southern section.	This is a matter that will be considered as an option during the elaboration of the overall deposit development design.
	Automotive transport – In the case of one-excavator operation in the mine the required number of haul trucks should be recalculated for the hourly output rate of the excavator because it will operate approximately 4,500-5,000 hours/year.	The machinery was updated and the use of various arrangements and optimisations makes achieving the targeted results entirely possible.
	Stockpile Works – Disposal of Mine Waste	
	Option 1	
	The process is experimental.	
	In fact, it is unclear how the overburden stripping and tailings related operations will be accommodated with their different volumes.	Not accepted. It is important to point out that the proposed IMWF embankment construction phases are completely consistent with the development of the pit mine. That is, the waste rock and tailings will be deposited in the facility as designed, and the tailings will be laid in up to 2 m deep layers.
	It is unclear how much time will be required for consolidation.	The consolidation time will depend on the layer depth and

		pressure. According to the calculations, full consolidation of a 2 m deep layer is reached in 8 under a pressure of 300 kPa.
	The Mine Waste Management Plan (page 52) states that the facility will be raise at an approximate rate of 10 m per month at the beginning of the operations. This refers to the 1st year of operation when the ore will be processed at a rate of 1,110 th.t/year. Operations during this time will be carried out at the base of the facility where the disposal area is the smallest. It is unclear how much time would be needed for a 10 m layer to consolidate and ensure stability of the facility. The horizontal area in the facility during the first years of operation will be insufficient for disposal of the tailings from as low as 2 m.	Not accepted. As was pointed out above, the proposed IMWF embankment construction phases were developed in full consideration of the pit mine development phases and of disposal in up to 2 m deep layers. The productivity of the mine will be 850,000 t/year.
	It is unclear whether any cement would be used to solidify the tailings. The required amount of cement would be 8,500 t/year (1% of 850,000 t/year). If things do not work out, operations may have to be discontinued.	Cement will be added only where the facility is not raised for any unforeseen reason, and not otherwise.
	How will the tailings consolidation cells be covered to prevent entry of sudden storm events?	The cells are made using waste rock and the water will circulate mainly through the waste rock. The active cells will be open until filled up. The water that would enter those cells will be drained in the same manner as the water from the tailings.
	The tailings will be disposed of into the pit bowl during the final year of operation. Where will the additional return water required for the process plant be sourced from during this time?	This option is under discussion, however a final decision will be made during the detailed engineering design and if proven necessary. The return water will be sourced from the return water tank, as will be the case during the entire period of operation.
	An expert assessment of the IMWF should be carried out by the Higher Institute of Architecture and Construction or another institute.	Accepted. The company envisages the commissioning of such an expert assessment.
	The level of the Richter scale to which the seismic stability calculations (pseudostatic stability K = 1.01) correspond is unclear. Do they cover the 8 and 9 degree requirements?	This remark is acceptable. A technical error has been made in the Mine Waste Management Plan. The ratio used for the calculations is 0.07g (50 % of 0.13g (and not 0.013g as is stated in the document)). In this case the calculations were made using a ratio higher than the required (0.06g).

	No isolating liner is envisaged under the facility.	Not accepted. There is no such requirement. A seepage ratio of the base of 10-9 m/s should be ensured If the natural geological base cannot ensure this seepage ratio, it can be strengthened using other means ensuring equivalent protection.
	No sediment-flow retention pool is envisaged at the toe of the facility.	There is no such term as “sediment flow”. Perhaps what is meant is suspended solids. Two drain water sumps are envisioned for the IMWF, with a volume of 2,000 m3 each. The water will be pumped into the return water tank which will ensure sufficient additional settling.
	There is no evidence that the facility will be established over an area devoid of ore.	A Report on the results of the geological survey in the south eastern part of Ada Tepe has been prepared and shows that the IMWF lies outside the contoured reserves and resources.
	Only the overburden and tailings from the Ada Tepe section will be disposed of into the Facility. No spare volume will be available.	Operations only in the Ada Tepe are considered in the project.
	Option 2	
	The TMF in the Kaldhik valley will have a capacity of 8.5 million tons and will have no spare volume available. No stability calculations are available. No information about the presence of ore in the base is available.	Similarly, there is a report for the absence of ore underneath the IMWF. The IMWF lies outside the contoured reserves and resources.
	Mine works schedule	
	It is illogical that the output capacities of the plant will be maximised (1,100 th.t./year) during the initial years with subsequent reduction down to 850 th.t./year, or by 23%.	The project is for 850,000 t/year.
	Site Arrangement – Location of the Sites (General Layout)	
	Considering the danger of pollution of the Krumovitsa River floodplain, the location of the IMWF is unsuitable.	Not accepted. The IMWF location is consistent with the terrain features and uses a minimum area for storage of mine waste. The IMWF will be constructed in accordance with the current regulations and with the BATs.
	Locating and building a high stockpile is also unsuitable and even dangerous, considering the functions of the facility and its role as a filter providing additional return water for the plant.	Not accepted. The IMWF location is consistent with the terrain features and uses a minimum

		area for storage of mine waste. The IMWF will be constructed in accordance with the current regulations and with the BATs. Provisions are made for two sumps, each with a volume of 2,000 m3. The water will be pumped into the return water tank which will ensure sufficient additional settling.
	A step-down substation (installed capacity of 7.5 MW), a medical point, and amenities have been omitted from the site.	Not accepted. A plan with the layout of the facilities, including offices, sanitary and social rooms etc. was prepared
	Social impact of the operations	
	The 8 year period of operation is insufficient to ensure the livelihood of the local population.	The deadline is based on a technical and economic analysis. See above – the implementation period – construction, operation, closure and rehabilitation – is 12-14 years.
	Considerations regarding certain factors with environmental impacts	
	What software was used in air modeling?	The methods used were approved by the Minister of Environment and Water.
	The fuel has not been properly calculated	Accepted. The quantity of fuel has been adjusted in the EIA Statement.
	Geological conditions for overburden removal and development of the mine	The arguments in this section are not accepted because they relate to other administrative procedures. The EIS is based on the reserves and resources approved with the protocol of the Specialised Committee of Experts at the MOEW and is not concerned with justifying them, or with the methods used to calculate or prove them. The issues raised in this section are subject to the commercial discovery or will be considered in the future detailed design fro mining and processing in the Ada Tepe section of the Khan Krum deposit. Our answers are intended as

		clarification for the experts and for the Krumovgrad Municipality and are not within the scope of this procedure.
	Why have the ore quantity and quality in two sub-sections of different texture been estimated using the same cut-off grade of Кб = 0.9 g/t?	The fact that a section of the deposit has ore bodies with higher content is a natural phenomenon and is not grounds for separation and setting of different cut-off grade. A geological and economic assessment (GEA) and the respective modelling have been made. Even the block with high gold content contains bodies with lower and higher contents. The reserves and resources in these general blocks were contoured involving, and in agreement with, the experts of the Specialised Committee of Experts who recommended acceptance of the summarised parameters at this stage – the GEA. The reserves and resources were calculated in accordance with the justified quantities in the deposit approved by the Executive Director of BMM EAD in Sofia, in coordination with the Ministry of Environment and Water.
	Why are the ores in the haigh-grade area, i.e. the “Wall” zone, defined as “reserves”, and “resources” in the “Upper” zone?	Based on the better gold mineralization, the different ratio of variation in the two zones, and on the different morphology, two bodies of differing authenticity have been designated – reserves in the embankment and resources in the Upper zone.
	Based on the gold content in other sections, what is the price of gold at which the costs for ore mining, overburden removal, transporting and processing in these areas would be justified?	Most generally, the other sections (satellite ore mineralisations in the Khan Krum deposit) have not been studied completely and this is why their resources are in a low category. Following further studies expected during the operation of the Ada Tepe section, the qualitative and

		quantitative parameters and the potential for processing will be specified. The reserve-balance table shows that the current gold prices make these resources economical at this stage.
	From the mining and technical perspectives, the ore reserves in the "Wall" zone of the Ada Tepe section should not be mined separately. When mined, they should be mixed with the ore from satellite sections and from the "Upper" zone.	The methods for mining and processing will be explained in detail in the overall design for the development of Ada Tepe section, and in the annual designs. A detailed engineering project will be prepared following a positive EIA resolution approving of the proposed project. The remaining sections of the Khan Krum deposit will be studied further and their potential mining and processing will begin after completion of the Ada Tepe section and following the procedure required under the Environment Protection Act.
	Conclusions:	
	The project is inconsistent with the report on the results from the geological survey for prospecting and assessment of the auriferous ores and reserves in the Khan Krum deposit was submitted to the Ministry of Economy at the end of 2004 describing the following sections – Ada Tepe, and with the Protocol by the Specialised Committee of Experts at the MOEW.	Not accepted. The project is fully compliant with the protocol by the Specialised Committee of Experts at the MOEW concerning the approved reserves and resources in the Ada Tepe section of the Khan Krum Deposit.
	The quantities and quality of ore in the Ada Tepe as of this moment or at a recent date are unknown.	Not accepted. The quantities are clearly known and shown in the EIS. They are clearly defined in the protocol by the Specialised Committee of Experts of the MOEW.
	No comment is made about ores from other sections such as expected reserves, resources, quantities and quality.	Not accepted. Not in the scope of this project. When development of some or all remaining sections of the deposit is undertaken, a separate procedure required by the Environment Protection Act will be conducted and will involve the necessary analyses of reserves, resources and processes. This EIA Statement presents information about the

		cumulative effect of simultaneous development of all sections in the deposit due to interest shown during the consultancy, although this is outside the project scope.
	Development of ore from the remaining sections will not be possible with the presented project since Option 2 has no provision for available volume in the IMWF or in the TMF.	Not accepted. At present, the remaining sections will not be developed, as can be seen by the EIA descriptions. When developing some or all other sections, the mine waste will be used as backfill for the open pit whose operation will be discontinued prior to the commencement of operations in those sections.
	The envisaged mining equipment is insufficient.	Not accepted. The machinery was updated and the use of various arrangements and optimisations makes achieving the targeted results entirely possible.
	The expected annual throughput rate will be difficult to achieve.	Not accepted. The annual throughput rate of 850,000 t will not be difficult to achieve.
	No priority development of the rich ores in the Ada Tepe section should be allowed.	This will not be allowed. This will be controlled during the implementation of the overall and annual detailed designs for mining and processing.
	The Facility and the process of its construction are unpopular and dangerous.	Not accepted. The process is used in many countries (Ireland, Canada, Tanzania) and is described as the most suitable for mitigation of water-management risks.
	It is unclear how the underdrain will be ensured against emergencies both with a view to the stability of the facility itself and against compromising the return water supply to the plant.	The underdrainage system will be constructed using specially selected materials. Return water supply shall will be provided by pumps all of which will be backed up.
	No stability (Kc) and seismicity (Kseismicity) studies of the Facility have been made as is required by the Bulgarian legislation.	The seismic acceleration used in the project is 50% of 0.13 g = 0.07 g and is higher than the seismic acceleration calculated using the Bulgarian standards. According to Regulation 07/2 on the design of facilities in

		seismic areas, the design seismic acceleration as of 2007 is: a5 = c.R.Kc.g = 1.50 . 0.40 . 0.10 = 0.060 g.
	No evidence that the Facility is not laying over a potential source of ore is provided. The same applies to the TMF.	A Report on the results of the geological survey in the south eastern part of Ada Tepe has been prepared and shows that the IMWF lies outside the contoured reserves and resources.
	It is unclear how the Facility will be secured against local slides and pollution of the Krumovitsa River.	The construction of the IMWF forming a non-steep stepped batter is not a problem as regards stability. Pollution is also not expected since neither the tailings nor the waste rock or water will reach the Krumovitsa River.
	The IMWF and the TMF are not sized for development of all the prospects.	At present, the remaining deposits will not be developed, which is clearly indicated in the current EIA procedure.
	It is unclear what method was used to determine the environment protection parameters – software (Bulgarian or foreign)	Each of the experts will describe in the EIS the applicable legislation and the methods used in the EIA.
	The period of operation is short – 8 years. It will not create a livelihood for the population.	See above – the implementation period – construction, operation, closure and rehabilitation – is 12-14 years.
	The presented paper does not clarify the possibilities for complete processing of the ore in the Khan Krum deposit in accordance with the Commercial Discovery. There is no concept about the processing of the remaining sections.	At present, the remaining sections will not be developed, as can be seen by the EIA descriptions. A plan for the development lf all sections of the deposit has been presented, but the EIA procedures for those sections should be carried in 9 years' time, after conclusion of the operations in the Ada Tepe section. The EIS will consider those sections from the theoretical perspective to provide a preliminary idea of their environmental impact.
	Recommendations	
	The raw material quantities should be updated and clarified as of the present time or the most recent date for the Ada Tepe section and for the remaining sections of the	Having filed the commercial discovery application, BMM EAD stopped the prospecting

	deposit (according to Article 22 of the Ores and Minerals Act)	and valuation works in the deposit area. There is no change of reserves (122) and resources (331). Following the granting of a concession, the geological exploration will continue for further studying of the deposit sections and annual reports concerning any changes in the balance of resources and reserves in the Khan Krum deposit will be prepared as required by the Mineral Resources Act.
	As regards the Ada Tepe section, the quantity and quality of low-grade ore must be clarified.	The quantitative and qualitative parameters of the low-grade ore are made clear in the EIS.
	To synchronize mining during the development of individual sections, to reduce the dynamics of mining operations and increase the period of operation in order to create a livelihood for the population the annual output capacity of the process plant should be reduced to around 500 th.t./year, or to a level close to it.	Not accepted. The annual output capacity will be 850 thousand tons. A detailed rationale of the financial, legal, environmental and social aspects was made in the concession analysis. At present, the remaining sections will not be developed, as can be seen by the EIA descriptions.
	The IMWF should not be built, being a hazardous facility.	Not accepted. The IMWF is not a hazardous facility, on the contrary, it has a number of advantages over the well known TMFs. These advantages are related to the smaller area required for discharging of mine waste, reduced risk of emergencies, recycling of water in the process plant following tailings dewatering, reduction of evaporation losses (as compared to the TMF) and less use of fresh water.
	Alternative solutions and possibilities to implement the project should be considered and assessed for technology, spatial placement of the project facilities such as TMFs, stockpiles, landfills and roads. A proposal– develop an alternative option or options reflecting the concept for an overall development of the Khan Krum deposit with positioning of the waste storage facility (TMF) in a new location.	An analysis for compliance with the BATs is made in the EIS. The TMF, known very well in Bulgaria as a hydro engineering facility, and the subject of vast experience in management is not a facility that is received well by the public. From the perspective of experts, TMFs require significant areas which is not

		recommended in protected areas.
	No stockpiles, TMF or other sources of pollution should be placed in the Krumovitsa River valley.	Accepted. No provisions are made for such a layout. The mine waste is classified as non—hazardous and non-inert. The proposed structure of the facility will guarantee its security. The facility will not cause pollution of the Krumovitsa River.
	The stability calculations (Kc and Kseismicity) for the stockpiles and TMFs should involve expert studies by a specialized Bulgarian institution.	Accepted. An expert assessment by Bulgarian institutions is forthcoming. In Bulgaria, the detailed engineering design will be carried out by duly qualified Bulgarian designers only. The designs will be subject to special supervision and will be approved by committees of experts from the respective municipality, so we don't think they will allow construction of facilities that do not meet the Bulgarian standards!
	Two new sections should be added to item 9 of the project, concerning the structure and content of the EIA, as follows: - Condition of the raw materials in the Khan Krum deposit; - Social effectiveness of the operations.	Not accepted. The data about natural resources required by the project are presented in the EIA Statement. The socio-economic justification is not within the scope of the EIS. The EIA considers only the Ada Tepe portion of the deposit, since the remaining prospects will not be developed during the next 10 years. Therefore, an issued EIA decision will lose its validity in 6 years and a new procedure will be required for any of the remaining prospects. The social justification for the development of the deposit is the subject of the concession analysis. The EIS will consider the no-action alternative, or the option of non-implementation of the project.
	The text "the options" under item 9 of the Project should	Accepted.

	be as in the letter by the MOEW – "options".	The compatibility assessment report will consider alternative solutions and possibilities for implementation of the project.
	The development of all sections should be considered in the EIA Statement.	Not accepted. The remaining sections will not be developed in the near 10 years and will, therefore, be presented in the EIS only theoretically.
Prof. Dr. Ilia Baltov, PhD SRA Processing Enginer	Combined gravity separation and flotation flowsheet	
	A separate gravity separation sheet is not provided but it is expected that the gravity concentrate would provisionally contain 3000 to 5,000 g/t Au and 1,000-2,000 g/t Ag.	The process flowsheet includes two gravity separation stages. The first one is downstream of the grinding circuit and its objective is to recover larger size grains (if any) and thus improve overall recoveries. The second gravity stage is downstream of the flotation circuit and its objective is to improve the concentrate grades to the levels specified by the custom smelter. The circuits are not shown in detail because their design will be different depending on the agreed final concentrate grades. This second gravity stage is very likely to drop out of the overall flowsheet provided that the smelter agrees to treat low grade concentrate. This will have a significant positive impact on the overall recovery levels.
	The type of flotation banks that is suitable for concentration of low-sulphide ores is not specified.	The equipment will be selected during the detailed engineering project design phase.
	Concentrate dewatering - the proposal does not specify the type of equipment intended to be used.	The equipment will be selected during the detailed engineering project design phase. The use of a 'deep cone' thickener is considered.
	Analysis of the Testwork Completed To-Date	Two reports presenting the testwork results were provided.
	First and foremost, it should be noted that there is a difference in the Ada Tepe resource estimates, which give the benchmark for assessment of the proposed process alternatives.	It is unclear what difference is meant. If this is about grade continuity and confidence, separate estimations for

		reserves and resources are reported. In terms of composition, the ore is sub-divided in oxidised, non-oxidised and mixed types. These types reflect the different amounts of quarts or argilised rock material in the ore. An account of these differences is taken in the designing of the process flowsheet.
	The testwork for the development of a combined flotation-gravity separation flowsheet was carried out in Lakefield, Canada, on two main composites called "representative" composites but the significant variance in Au and Ag grades and between the two resource estimates does not confirm their "representativeness".	Not accepted. "Ideal" sampling is not possible. The reserve and resource estimations are updated every year based on the infill drilling results.
	According to the regulations that are accepted in Bulgaria, one cannot estimate cut-offs, do resource/reserve reporting, design and commission mining and processing facilities without having results from detailed laboratory testwork that are backed up by pilot plant testwork. This requirement is justified because such data provides the process plant design criteria for the detailed design, the end operating and economic results and the compliance with the environment protection requirements.	Not accepted. The classification of reserves is consistent with the Classification of reserves and resources of solid ores and minerals (adopted with Decree of the Council of Ministers 413 dated 1998). Detailed laboratory tests were conducted in the laboratories of the SGS research centre in Lakefield. A pilot plant test is scheduled.
	There are no results for the proposed final flowsheet with three cleaner stages.	Locked-cycle testwork results are presented. The selected flowsheet based on the final concentrate quality will be tested in a pilot plant operation.
	Conclusions	
	The data in the report by SGS Canada Inc indicate that the flotation feed is slightly alkaline to almost neutral (pH = 7.5-7.8). Under these conditions, the re-use of process water will reduce the pH level of the medium, which will cause elevation of the concentrations of the harmful heavy metals, some of which will exceed the maximum allowable levels. The only way out would be additional construction of a return water treatment plant. Under these conditions, any emergency release of wastewaters would potentially cause pollution.	Not accepted. There is no evidence suggesting a change in the pH level after recycling the water back into the process. The test results do not indicate any pH reduction resulting from the addition of acidic reagents to the water. The flotation process is very strictly monitored. The use of xanthate as a collector (according to the project design) requires that the pH of the slurry should be maintained between 7 and 9. The slurry pH may be

		controlled using medium regulators such as lime to meet the process operating parameters.
	All gravity concentration testwork results indicate that inclusion of a gravity separation stage in the flowsheet is not recommendable.	The second stage of gravity separation will depend on the final concentrate grade requirements. If a high-grade product is required this second gravity separation circuit should be added to the process flowsheet.
	The main problem in accepting the suitability of a combined gravity+flotation flowsheet is the considerably lower recoveries of gold and silver that can be achieved.	The objective is to achieve the recoveries achieved during the testwork.
	The proposed flowsheet including a rougher, two scavenger and three cleaner stages was not subjected to locked-cycle tests at a primary grind size of 40 microns.	The selected flowsheet will be tested in a pilot plant operation.
	No pilot plant testing of the floatability of the Ada Tepe ore was undertaken.	A pilot plant test will be conducted.
	The future exploration and development of the satellite deposits is unclear.	The mine development plan presented in the concession analysis provides information about the expected development of the satellite prospects. As it has been mentioned many times already, this will happen only after project year 10 should economic resource determinations be made for them.
	The financial efficiency of the proposed flowsheet is inadequate and does not meet the national interests of Bulgaria as the owner of the underground resource.	The MEET, which is the competent authority to decide on the project financial efficiency and to protect the state interests, has no objections against the EIA at this stage, or against the proposed gold concentrate production process.
	The inclusion of a redundant gravity stage and a three-stage grinding circuit will increase the operating costs associated with power consumption and labour.	The objective of such a flowsheet is maximum possible recovery of the payable component from the ore.
	It is evident from the arguments above that a direct cyanidation/carbon adsorbtion/electrowinning flowsheet is preferable from both economic and environmental point of view.	That was the original proposal made by the Company but the Krumovgrad Municipality, the local community and the NGOs interested in the protected areas in the region rejected it as unacceptable.

	Conclusions	
	It is recommended that BMM EAD should accept the direct cyanidation/carbon adsorbtion/electrowinning flowsheet for detailed plant design and full scale operation.	See the comment above!
	The Ministry of Environment and Waters should conclude a concession agreement with BMM EAD for Khan Krum deposit after the proposed flowsheet is subjected to pilot plant scale testwork.	There is no such a legal requirement but BMM will conduct pilot plan testwork.
Ministry of Culture	The EIS should consider the following aspects:	
	The current status of the project site under the Cultural Heritage Act ("CHA") is "cultural asset of national importance and a national treasure". The site is in a procedure under the CHA.	Accepted.
	Description, characterisation and structure of the archaeological cultural asset.	Accepted.
	Measures to facilitate the survey, conservation and promotion of the cultural asset and secure its protective zone.	Accepted. The Ministry, however, did not provide information about the designated protective zone by the completion of the EIS.
	Description, analysis and evaluation of potential significant impacts on the cultural asset, which may result from emissions of harmful substances during project construction or operation.	Accepted.
	A summary of the potential impacts during project construction and operation on the components of the cultural asset is provided in a table format hereto.	The archaeological surveys will continue according to a schedule prepared by the leaders of the archaeological team in compliance with the provisions of the Framework Agreement between the NAIM-BAS and BMM EAD. After completion of each survey stage, the Ministry of Culture will accept the surveyed area in compliance with the applicable laws and bylaws.
	Comparison between the proposed options by environmental components and factors: based on analysis and forecast of any potential impact following a fair review of all proposed solutions.	The archaeological surveys are concentrated within the project footprint of the open pit, which has no alternative.

A brochure has been prepared to make a greater number of Krumovgrad residents familiar with the Investment Project.

IX. Transboundary Context

The site of the project proposal for mining and processing of gold ores from the Ada Tepe prospect of the Khan Krum Deposit is some 3 km south of the town of Krumovgrad in the Krumovgrad Municipality. The Krumovgrad Municipality borders on the Ivailovgrad and Madzharovo Municipalities to the east, the Kirkovo and Momchilgrad Municipalities to the west, the Kardzhali and Stambolovo Municipalities to the north and the Republic of Greece to the south.

The straight line distance from the project site to Greece is about 30 km.

The Krumovgrad District is characterised by a moderate hilly to low-mountainous topography. It is crisscrossed by many valleys and ravines, most of which are completely or nearly dry during the dry months of the year.

In view of the proximity of the project site to Greece and in compliance with the Bulgarian law, the EIS considers the potential transboundary impact of the project on the environment and public health in Northern Greece, which borders on the Krumovgrad Municipality.

With regard to the requirements under the UN Convention on Environmental Impact Assessment in a Transboundary Context and the obligations of Republic of Bulgaria, the necessary information has been compiled and and presented to the MOEW in English in the format approved with Decision I/1 of the First Meeting of the Parties to the Convention. The information package has been sent to Republic of Greece as the nearest state to the project site.

Project Construction

Construction and engineering works are scheduled to commence in the beginning of 2012 and be completed within 24 months, i.e. at the end of 2013.

Project construction will include the following works:

- Construction of the infrastructure (access road from the existing road network, electrical supply and telecommunications) and its integration into the existing infrastructure in the area;
- Clearing of the grass and tree vegetation from the sites designated to accommodate the open-pit, the site roads, the mine waste facility, the ore processing plant;
- Removal and stockpiling of the soil cover for reuse during the closure stage;
- Construction of temporary office and storage facilities for the construction stage;
- Preliminary removal of overburden (containing no economic levels of gold) from Ada Tepe sufficient to provide construction material for the base of the IMWF and to enable commencement of the mining operations;
- Construction of the processing plant, offices, a mechanical workshop and other ancillary buildings;
- Installation of an abstraction well to meet process fresh water requirements;
- Preparation of the ROM ore pad area;
- Roads between the open pit and the ROM ore pad, the gold-silver concentrate production facility (process plant) and the waste rock storage facility (an integrated mine waste facility ("IMWF") or a waste rock stockpile), including connections to the IMWF or the flotation TMF depending on the preferred option;
- Roads connecting the facilities on the process plant site.

Project Operation

The Ada Tepe mine plan currently being considered is based on an 850,000 tpa operation extending over a 9 year period (excluding the overburden removal), which gives a process plant throughput rate of 106 tph at 8,000 operating hours per annum.

The depth of the pit on completion of operations will vary according to the location.

- The north end pit bottom is at RL 340 m, which gives final pit depths of 120 m to the east, 100 m to the north, and 40 m to the west. The relatively low pit walls to the west and southwest promote the pit ventilation, which is confirmed by the Krumovgrad windrose pattern.
- The south end haul road exits to the west at RL 380 m, with the southern part of the pit being above the road at RL 400 m. The depths from this point will be 50 meters to the east, 20 meters to the south, and 0 meters (open) to the west. Due to the open end to the west, this portion of the pit will enjoy more favorable ventilation conditions than the northern end.

The ore at Ada Tepe will be open-pit mined. The mining method will be a conventional open cut drill, blast, load and haul operation. The mined ore will be loaded by two hydraulic back-pull shovels serving up to five 50t off-road dump trucks hauling the ore to the ore stockpile (ROM pad). A front-end loader will deliver ore from the ROM pad to the feed hopper of the jaw crusher and will be used for general clean-up around the plant area.

All rock material without economic gold and silver values and therefore classified as waste will be hauled to a newly designed Integrated Mine Waste Facility (IMWF) located approximately 200 m south-southeast of the open pit (Option 1). The IMWF is designed to store both dewatered process tailings and waste rock from mining.

A front-end loader will deliver ore from the ore stock pile (ROM pad) to the feed hopper of an outdoor jaw crusher, whose production capacity will be 200-250 tph, discharge end diameter approx. 150mm, which will ensure crushed ore size suitable for SAG Mill grinding. A dust collection system is planned to be installed to ensure dust collection at the ore transfer points and treatment by a bag filter.

The crusher product will be discharged onto a fully enclosed inclined belt conveyor leading to the grinding section. The conveyor will be equipped with sprinklers to minimise the potential for release of dust into the environment.

The grinding section of the plant will be located inside the main plant building, which will be shared with other plant sections as well as the workshops and other facilities.

The crushed product will be ground using a three-stage wet grinding circuit (no dust emissions are expected) with a primary SAG mill and regrinding in a secondary ball mill and a tertiary vertical stirred mill. The SAG mill pebbles, i.e. the oversize product from the mill trommel, will be discharged onto a rubber-belt conveyor leading back to a pebble cone crusher. The pebble crusher product will discharge onto the mill feed conveyor belt. The project grinding flowsheet includes a grate discharge, steel-lined primary SAG mill. Both the secondary and tertiary grinding stages will incorporate primary and secondary classification in hydrocyclone clusters.

After the screening section, the ore feed will be advanced to a gravity separation circuit for recovery of part of the free and exposed gold particles.

The grinding section will be located inside the Process Plant.

Flotation will be the main process for recovery of the gold and silver values from the ore. The process will be performed in flotation banks, where the recovery of the payable components from the waste rock is achieved by conditioning the surfaces of mineral grains based on the different surface chemistry of the gold and rock particles.

A direct selective flotation flowsheet consisting of one rougher stage, three cleaner stages and two scavenger stages is considered.

The following reagents will be used in the flotation process:

- Collector: PAX (potassium amyl xanthate) and a minimum amount of dithiophosphate (Aerofloat 208);
- Frother: Cytec OrePrep F 549;
- Dispersant: Sodium silicate ($Na_2O \times nSiO_2$, also known as water glass or liquid glass);
- Sulphidiser: Copper sulphate ($CuSO_4 \times 5H_2O$).

The Au and Ag recoveries are expected to be circa 85% and 70% respectively.

The gravity separation process involves selective separation of the lighter from the heavier products in the process based on their different densities. It is performed on separation tables using water, which washes the light particles while the heavy ones become attached to the table surface and are advanced to one of its ends by forward/backward motion of the deck. Centrifugal machines are also utilised in gravity separation to enhance the gravitational force experienced by feed particles thus enabling separation of materials within narrow size ranges. The Project Proposal considers the use of centrifugal machines for gravity separation due to the relatively small size of the gold particles in the Ada Tepe ore.

The final tailings will be thickened in a radial thickener to a final pulp density of 56% solids. A diluted flocculant solution will be added to the slurry to facilitate the settling of solids. It is possible to add cement to improve waste consolidation before the waste is fed to the cells of the mining waste facility. The thickener overflow (supernatant water) will be pumped back into the process via a retention pond. The thickener underflow will be pumped into a tailings delivery pipeline for deposition into the IMWF.

The final concentrate will be dewatered and packaged for shipment to a custom smelter.

Project Decommissioning and Closure. Rehabilitation

The decommissioning and rehabilitation of the mine operation can be successfully achieved in a manner that satisfies the following objectives:

- Establishment of a beneficial afteruse;
- Protection of public health and safety;
- Mitigation or elimination of environmental damages and provision of sustainable environmental development;
- Minimisation of any adverse social and economic impact.

The long-term objective of the closure strategy is that BMM EAD leaves the site in a condition that meets the following criteria:

- Physical stability – any remaining structures must not be an unacceptable hazard to public health or safety, or to the immediate environment;
- Chemical stability – any remaining materials must not be a hazard to future users of the site, or to the public health, or to the immediate environment; and
- Biological stability that enables establishment of an appropriate land-use that is harmonised with the adjacent areas and with the needs and desires of the community.

A plan for closure of the open pit, the ore processing plant, the IMWF, the ancillary facilities and unnecessary infrastructure will be prepared by BMM EAD together with the construction and operation designs. In order to assess the requirements of stakeholders (principally, the local community), it is envisaged that consultation will be carried out with appropriate community representatives prior to the development of the Closure Plan.

There are two possible alternatives for ore processing:

- *Option 1:* Processing of the ore to gold-silver concentrate as the end product based on a combined flowsheet of flotation and gravity separation;

- *Option 2:* Processing of the ore to end metals (so-called dore bullion) based on a cyanide leaching process for extraction of Au and Ag.

Two options for disposal of mine waste (flotation tailings and waste rock) from the operation of the Ada Tepe open pit are considered and they both meet the BAT requirements (*BREF Code MTWR, sections 2.4.2 and 2.4.4*). These options are:

- *Option 1:* Co-disposal of waste rock and tailings within a single footprint (IMWF – an Integrated Mine Waste Facility);

- *Option 2:* Separate disposal of mine waste - subaqueous (below a pond surface) deposition of the flotation tailings in a TMF and waste rock stockpiling.

Option 1 also allows reduction of the tailings volume and, respectively, of the footprint required for tailings storage – (BREF Code MTWR, sections 4.1 and 4.5);

The analyses and assessments in the EIS allow the conclusion that the proposed project will not have significant negative impacts on the environment and it is advised that the project may proceed.

The assessment of a potential transboundary impact of the project on the environment and population of Greece requires analysis of:

- generated waste gases (dust and gas emissions), potential for their transport to Republic of Greece and associated impacts;
- generated wastewaters, potential for their transport via surface water and groundwater streams to Republic of Greece and associated impacts;
- generated solid wastes, potential for their transport to Republic of Greece and associated impacts.

Waste gas and dust emissions

- Based on the chemical composition of the ore and the waste rock that will be mined, the particulate matter may contain different levels of SiO_2; Al_2O_3; Fe_2O_3; K_2O; CaO; MgO; TiO_2 and MnO. At the same time, the equipment operation will generate typical exhaust gases such as: nitrogen oxides, carbon oxide, sulfur dioxide, non-methane volatile organic compounds (NMVOC), soot, heavy metals, polycyclic aromatic hydrocarbons (PAH), persistent organic pollutants (POP), polychlorinated biphenyls (PCB). These emissions will be generated by:
  - the operating mining equipment;
  - the blasting works;
  - the heavy trucks transporting the mined rock material;
  - the ore processing, which includes crushing, grinding, gravity separation, flotation and dewatering;
  - the Integrated Mine Waste Facility.

The amounts and concentrations of gas pollutants will be below the maximum allowable limits ("MAC") for the working environment, the natural environment and the neighboring territories of Republic of Greece.

The project ensures continuous process control and environmental monitoring of the generated air emissions and mitigation measures in the event that the applicable air quality standards are not met.

- Dust will be generated by:
  - mining operations in the open pit (excluding blasting);
  - operations at the ROM pad;
  - operations at the low-grade ore stockpile;
  - waste rock disposal operations;
  - ore crushing (downstream of the filter);
  - processing (downstream of the filter);
  - haulage of ore and waste rock;
  - blasting – fumes and dust from mine blasts (two per week).

The EIS takes into account all these sources of dust and prescribes the necessary technical, process and operational measures that would prevent excessive dust and gas pollution on the project site and adjacent lands. The project ensures continuous control and monitoring of dust emissions, whose objective is to minimise and, where possible, eliminate these emissions.

Conclusions:

The above arguments allow the conclusion that there is no potential for transport of gas and dust emissions over long distances that may cause transboundary pollution of the environment of Republic of Greece.

Wastewater

Most of the surface runoff over the operation stage will be diverted from the project area by way of a drainage system, which will prevent its contact with process related products, raw materials and waste.

The Ada Tepe Pit will collect seepage and runoff from the surrounding area and pump the water to an open pond (the Runoff Storage Pond) with a design capacity of 100,000 m^3, which will provide the process plant water requirements. Two collection (drainage) sumps will collect surface runoff, seepage, and tailings water release from the IMWF area. Water collected in the collection ponds will be pumped to the Runoff Storage Pond specified above. This pond will also collect pit runoff from direct precipitation and other mining operations.

A discharge facility will be installed to enable discharge of water from the pond into the Krumovitsa river system. Water will be discharged into the environment mostly in case of storm events, i.e. extreme precipitation. The water will report to a Wastewater Clarifier for additional clarification prior to discharge. The discharge quality will meet the allowable emission levels and will not derogate the river water quality. The discharged water volume will not cause a significant change in the river flow rate as that volume will be small compared to the river outflow.

Eluate determinations according to BNS EN 12506/03 were conducted on mine rock and flotation tailings samples in order to identify their behavior. The results of the eluate testwork are substantially below the allowable limit values specified in Table 4 of Regulation 8 on the Terms, Conditions and Requirements for Construction and Operation of Landfills and Other Facilities and Installations for Waste Recovery and Treatment (Threshold leaching values for non-hazardous granular materials that may be deposited in waste facilities for non-hazardous wastes).

The quality of the water released from the tailings during consolidation was assessed through water tests conducted in the SGS assay laboratory during testwork on flotation tailings samples from the flotation concentrate tests on ore samples from both zones of the deposit - the Upper Zone and the Wall Zone. The water assays indicate that the clarified water meets the discharge quality requirements for categories I and II of receiving streams.

The mine drainage from the open pit is expected to contain mostly high sediment levels. The results of the Acid Base Accounting (ABA) static geochemical testing conducted by Eurotest Control on 81 mine rock samples from the deposit clearly demonstrate that the mine rock is non-acid generating and therefore the mine drainage is not expected to be acidic, nor contain elevated levels of arsenic and heavy metals.

Conclusions:

According to Annex VII to the Water Framework Directive, the entire East-Aegean Region lies within Ecoregion 7 - Eastern Balkans. The Arda River is a transboundary watershed system flowing into Greece and is part of the international watershed system of the Maritsa River.

The Krumovitsa River flows in a northern direction past the Ada Tepe hill and the town of Krumovgrad, and discharges into the Arda River some 20 km downstream of the town.

The point of confluence of the Krumovitsa River with the Arda River is upstream of the Ivaylograd Reservoir, which is one of the largest fresh water reservoir in Bulgaria with a capacity of 180 Mm^3. Downstream of the reservoir, the Arda continues to flow for another 25 km on Bulgarian territory, then crosses the border with Greece and discharges into the Maritsa River.

The above arguments allow the conclusion that there is no potential for water transport of pollutants over long distances that may cause transboundary pollution of the environment of Republic of Greece.

Wastes

The project mining and processing operations would generate construction, household (municipal), hazardous and operational wastes. These wastes will be subject to separate collection and temporary storage on the project site before contract delivery to companies that have permits for waste management and/or recycling.

The wastes generated during project construction, operation and closure are not conducive to transboundary impacts.

Mine Wastes

The mining and processing operations will generate mine rock (waste rock from mining) and flotation process tailings. The flotation tailings will be dewatered and co-disposed with the waste rock within a single footprint, i.e in an Integrate Mine Waste Facility.

Mining waste is classified as non-hazardous non-inert waste in terms of the risk to the environment and human health based on their composition and properties.

Based on the completed mining waste classification, the geotechnical properties of the facility, the site wide ground conditions, specific environmental conditions and proposed preventive measures and management of the facility, it is classified as a category B facility.

The mine wastes and the IMWF are not conducive to transboundary impacts.

Hazardous Substances

The proposed mining (blasting) and processing methods will use hazardous substances or other materials of the same class, which will not have a negative impact on the environment.

The Ada Tepe operations will not use methyl bromide (CH_3B) or substances listed in Appendix 1 to CoM Decree 254/30.12.1999 (amended with CoM Decree 224/01.10.2002) on the Control and Management of Ozone Depleting Substances.

The project does not consider any use of raw materials, products or materials that are within the scope of the Regulation on the Hazardous Chemical Substances, Preparations and Products That Are Banned for Use and Trade. Furthermore, the project does not consider use of any organic solvents within the scope of Council Directive 1999/13/EC on the Limitation of Volatile Compound Emissions.

The Investor will also comply with the ban on the use of fixed fire suppression systems within the scope of Appendices 2 and 3 to the above-mentioned Decree, portable halon fire extinguishers and specified surfactants and lubricants.

The hazardous substances that will be used in the process are not conducive to transboundary impacts.

Conclusion:

The qualitative and quantitative assessment of the material pollutants (waste gases, waters and other waste products) and the noise and vibration levels that will be generated during project construction, operation and closure confirms the conclusion that the project does not have potential for transboundary impact on the environment and public health in neighbouring Greece.

The proposed development is not expected to cause any transboundary impacts on the flora, fauna, soils, air, waters, climate, landscape, cultural and other material assets, as well as interactions between these factors affecting the cultural heritage, social and economic conditions as a result of the implementation of the project.

The assessment of the impacts on the environmental media does not indicate any transboundary impacts. The air and water impacts are on a local scale.

X. Comparative Table for Selection of the Preferred Option

The EIS for the project undertakes a review and selection of the preferred alternative option based on the environmental media and factors.

The experts' rationale for the selection of the preferred option is summarised in the table below.

Table X-1

Environmental Medium	Preferred Option	Rationale
Air	Option 1.	The air pollution in the nearby populated areas will be different under each option. ABL concentrations that are expected to exceed the allowable limits (PM_{10} average annual limit for protection of human health): Chobanka 1 and Chobanka 2 under Option 1 and Chobanka 1, Chobanka 2 and Kupel under Option 2.
Physical factors, Noise	Option 1.	The project facilities are sited only in the upper portion of the Ada Tepe hill compared to Option 2. Under Option 1, the populated areas (i.e. areas with limited environmental noise levels) are located at greater distances from the project site and it is therefore not expected that the day/evening/night time noise limits will be exceeded over the construction and operation stages.
Wastes	Option 1.	Substantially smaller areas required for disposal and storage of mining wastes;
		The IMWF drainage will gravity report to two collecting sumps and then pumped to the retention pond, which reduces the risk of emergencies resulting in a major uncontrolled discharge during a storm event.
		The thickening plant will be located above the IMWF and the tailings pipelines will run within the footprint of the IMWF. Any spills from the thickening plant or from the pipelines will flow into the IMWF and be contained on the upper most active platform.
		Tailings are placed wet in the IMWF and are buried with mine rock to promote consolidation. The surface area of tailings exposed to wind is also minimized by placing the tailings in cells. The progressive rehabilitation of the facility will minimise the possibility of dust generation.
Lands and Soils	Option 1.	Substantially lower land and soil derogation.
Health and Hygiene Aspects	Option 1.	Option 1 would require considerably less land to operate the mine, which will reduce the anthropogenic impact, the pollutant emissions in the environment and the health risk;
		Under Option 1, the operational areas are sited to the south-southwest of Ada Tepe thus using the hill as a natural barrier to negative noise and air impacts in the direction of the most densely populated area - the town of Krumovgrad, which is located to the north-northeast of Ada Tepe.
		Under Option 2, the operational areas will be sited unacceptably close to the hamlets west of Ada Tepe and

		the residential areas of the town of Krumovgrad
		Option 2 considers operation of a TMF, which will raise the health risk if incorrectly operated or in an emergency. The TMF is sited adjacent to residential areas, which is not acceptable.
		There are four main project operational facilities: an open pit, a crushing plant, a concentrator and an IMWF (Option 1)/TMF (Option 2). Option 1 does not meet the required hygiene protective distances from the open pit and the IMWF, while Option 2 does not comply with the required hygiene protective distances from three of the four operational facilities: the open pit, the concentrator and the TMF.
		Option 2 considers construction of a water storage dam, which will create additional operational and hygiene risks during normal operation or in an emergency.
Waters	Option 1.	Reduced project footprint, which in turn reduces the potentially affected catchment area.
		Minimisation of open pond areas and reduction of evaporation loss thus maximising the efficiency of water consumption.
		No derogation of the natural flow of Kaldzhikdere.
		Reduced water monitoring area.
		The reduced project footprint improves the site water management.
Flora and Fauna	Option 1.	The clearing of forest vegetation and derogation of priority vegetation and animal habitats is considerably lower.
Geological Setting	Option 1.	Reduces project footprint, which in turn reduces the potentially affected ground area.
		Reduces the area required for disposal and storage of mining wastes;
		Allows better mine waste management.
		Reduces mine waste volumes.

XI. Conclusion

This Environmental Impact Statement (EIS) for the Investment Project Proposal for Mining and Processing of Auriferous Ores from the Ada Tepe Prospect of the Khan Krum Gold Deposit near Krumovgrad presents a thorough and detailed review and assessment of the possible impacts that the above project may have on the environment and human health.

The EIS has been prepared in accordance with the provisions of the EPA, art. 96 of the EIA Regulation and all other applicable laws and bylaws. The EIS takes into account the feedback from the responsible authorities and the affected public.

The expected impacts that the project may have on the environmental media and factors and human health have been analysed. The risk factors have been identified.

The impact of the pollutants emitted over the project operation stage on the environmental media can be classified as continuous, reversible, on a local scale, without cumulative effects, below the accepted national and EU standards, which does not indicate any significant negative impacts on human health and environment media and factors.

Based on the analysis, measures are proposed to prevent or mitigate any potential significant negative impacts on the environment, which are included in a mitigation plan.

Based on the environment impact assessment and analysis and the current environmental provisions, the EIS authors are of the opinion that the Supreme Expert Environmental Council should approve **Option 1** of the Investment Project Proposal for Mining and Processing of Auriferous Ores from the Ada Tepe Prospect of the Khan Krum Gold Deposit near .

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