Mining Waste Management Plan, Balkan Mineral and Mining EAD

БОЛКАН МИНЕРАЛ ЕНД МАЙНИНГ ЕАД

December 2010

PREPARED BY:

(Irena Stambolieva

Environmental and Sustainable Development Manager

APPROVED BY:

Adrian Goldstone

Executive Director

TABLE OF CONTENTS

LIST OF APPENDICES

I. Documentary proof of information referenced in Item III, incl. confirmation about the location of the facility and other siting options; as well as geotechnical, hydrogeological, geotechnical and hydrogeological, hydrochemical, seismic and morphological data about the area where the facility is to be built;

1. ***Appendix 1*** A figure showing the planned method of construction of the facility;
2. ***Appendix 2*** Laboratory test results of physical and chemical properties of the waste;
3. ***Appendix 3*** Protocols of chemical analyses of surface and ground water and soil
4. ***Appendix 4*** Layout of sampling points a static test results of mine waste samples
5. ***Appendix 5*** Tailings consolidation tests
6. ***Appendix 6*** Water balance;
7. ***Appendix 7*** Material Safety Data Sheets of chemical substances and reagents to be used;
8. ***Appendix 8*** Hydrological profile of surface water in the Krumovgrad region;
9. ***Appendix 9*** Sampling Plan developed in compliance with Standard EN 14899, pursuant to EC Resolution of April 30, 2009 (2009/360/EO) and Monitoring Plan;
10. ***Appendix 10*** Commercial Discovery Certificate.

I. INTRODUCTION

The Mining waste management plan of Balkan Mineral and Mining EAD (BMM) was developed in connection with the *Underground Resources Act (URA)*, SG 23/12.03.1999, last amendment and elaboration in SG 70/8.08.2008 and the *Regulation on the Specific Requirements to Mining Waste Management*, SG 10/6.02.2009.

This Plan was prepared by BMM EAD and pursuant to art.22d, par.3 of the URA, comprises an integral part of the Investment Project for mining and processing of gold ores from the Ada Tepe prospect, Khan Krum Deposit, Krumovgrad, which is subject to environmental impact assessment.

The Mining waste management plan was prepared with the objective to:

- reduce the harmful impact of mining waste by implementing technological solutions for primary processing of underground resources which will enable the stabilization of their harmful and hazardous components;
- ensure the safe storage of mining waste via:
  - ensuring the long-term geotechnical stability of the facility;
  - monitoring, control and management of the mining waste facility at the operation stage and after the closure and rehabilitation stage;
  - preventing or minimizing the long-term impact on the human health and the environment;

II. RESPONSIBILITIES

II.1 Executive Director

The Executive Director is the person who approves the Mining Waste Management Plan and each revision before its submission to the respective competent authorities. The Executive Director is also responsible for the provision of resources required for the implementation of the Plan, maintenance of the mining waste facility and any improvements to its management. Resources need to include any special skills, technologies, human and financial resources.

II.2 Process Plant Manager/ Mine Manager

The Process Plant Manager/ Mine Manager is responsible for the safe operation and environmental safety of the mining waste facility and for implementation of the measures set in the Mining Waste Management Plan

II.3 Environmental Manager

The Environmental Manager is responsible for the preparation and updates of the Mining Waste Management Plan compliance with the regulatory requirement. They are responsible for the implementation of any planned monitoring, database maintenance and reporting of the obtained results in compliance with the applicable regulations. They are responsible for the management of all documents which need to be approved by the competent authorities.

III. MINING WASTE MANAGEMENT PLAN

III.1 Type and suggested category of the facility under art. 22b, par. 4 with accompanying rationale

The gold mining and processing operations at Ada Tepe will generate waste mine rock and process (flotation) tailings. That waste will be disposed in one facility, namely Integrated Mine Waste Facility (the Facility).

Mining waste is classified as **non-hazardous non-inert waste** in terms of risk for the environment and human health based on their composition and properties, which allows for co-disposal.

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**.

III.1.1 Description and Parameters of the Facility

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. Its main components will include:

- 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 tailings cells. It will be composed of HDPE pipes.
- Starter platforms located in the two gullies and built by constructing an embankment of waste rock material will form the northern and the southern slopes of the facility. The starting elevation of both embankment walls is RL 290 m. Their outer face slopes will be constructed at 2.5H:1V.
- IMWF development stages – The facility will be developed by successive upgrade over the embankment. 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 complex structure will be constructed, which has a continuous outer face of mine rock and cells containing the dewatered tailings.
- Underdrain system – It plays a very important role and is designed to collect and convey the rainfall that infiltrates into the facility and the water expelled from the tailings during loading and 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.
- Collection (drainage) sumps (one for each gully and located at the toe of both slopes) will collect seepage and tailings water release from the IMWF area, each sump with a storage capacity of 2000 m3. Two pumps (one operating and one stand-by pump) will be installed in each collection

sump and operated in automated mode (in direct relation to the water level in the sumps) to recycle the water.

- Measuring and control system - three (3) standpipe piezometers for groundwater monitoring are envisaged, two of which located downstream and one located upstream of the facility, and about twenty (20) electrical piezometers to monitor the piezometric levels in the tailings. 25 object points on each berm and 3 reference points on the natural ground will be used to monitor the vertical and horizontal displacements.

The IMWF will be built on land which is currently sate-owned, part of the State Forestry Fund. This land is included in the future concession.

Waste mine rock will be used to build cells within the IMWF to retain dewatered tailings. Appendix 1 provides a Figure, which shows the project construction method for the IMWF. Waste mine rock will be used to build the continuous face of the facility . Mine rock not needed for construction of the outer face will be placed as internal berms to support 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 be collected and conveyed to sumps built at the toe of the facility, at the north and south end. Drainage water streams will be pumped back to a Process Water Reservoir situated close to the mine.

To prevent tailings being carried through the outer mine rock berm, a two zone filter system will be placed. The filter 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 method proposed for dewatering of tailings includes thickener, which is to produce paste and paste to be subsequently delivered to the IMWF via pipeline. The tailings will be consolidated to 56% solids and transported 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, and that will prevent the mine rock from completely displacing the tailings as it is placed. 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 and drainage of the facility.

Drainage and consolidation of the tailings is required for the IMWF stability. Consolidation tests show that tailings containing 56% solids, will lose about 40% of their volume as a result of fissure-flow water drainage under the pressure of the 15m thick upper layer of waste rock and tailings. The test result analysis proves that the layers of tailings should not be thicker than 2m in order to shorten the time required for consolidation. Cement may be added whenever shorter consolidation time is required. The cement will be about 1% of the tons of processed ore. The maximum raise height of each layer will be controlled with piezomters installed in the tailings to monitor the pore water pressure and the consolidation rate.

The structure of the tailings pipeline which will deliver dewatered tailings will need to include multiple discharge points and pipeline moves. To ensure continuous work schedule, several cells will be concurrently operating at a time (one in tailings disposal and several ones in drainage mode) and one or more in a raise mode of operation. The remaining mine rock would be used to build internal berms and tailings would then be placed within the berms.

III.1.2 Quantitative and qualitative parameters of the waste to be disposed at the IMWF, including physical and chemical properties;

A. Waste rock profile

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 million tonnes of waste rock are expected to be produced during the life of the Ada Tepe mine.

Waste rock varies from "weathered" to "fresh" rock conglomerate. Different types weathering processes have produced different degrees of rock weathering and alteration (solicified, propylitised and clay-rich rock) as a result of hydrothermal processes.

Based on the evaluation of the *average weathering depth* of the rock at Ada Tepe, the rock above RL 400m is expected to be highly weathered (oxidized). The rock below that RL is expected to be prevalently fresh (although with various degrees of propylitization).

The strength of the undisturbed rock is expected to vary from "very low" (uniaxial compressive strength up to 1 MPa) (in case of highly weathered non-silicified rock) to "high" (uniaxial compressive strength up to 100 MPa) of silicified of various weathering degrees.

The variable and random nature of weathering depths and rock alteration which is observed within the open-pit area entails that both hard rock and soft rock should be in place.

Waste rock is expected to be highly permeable to air and water.

Laboratory tests (Proctor compaction) were performed in order to determine the maximum and minimum density (with one modified mold), specific gravity, as well as shear strength at one confining stress (250 kPa) in a large shear box shown in Appendix 2. Minimum density was determined by loosely placing material in the mould, while maximum was determined by placing the rock in the mould in lifts with light tamping and light vibration by tapping the mould.

Properties of that mine rock included:

- Minimum dry density 1.794 t/m3;
- Maximum dry density 2.016 t/m3;
- Specific gravity 2.72 t/m^3;
- Friction angle 40 degrees for 250 kPa confining stress, assuming zero cohesion.

Major mineral components of waste rock are presented in Table 1.

Table 1 Mineralogical description of waste rock

Mineral oxides	**Unit**	**Waste rock**
SiO_2	%	64.98
Al_2O_3	%	12.55
CaO	%	2.23
Fe_2O_3	%	7.07
K_2O	%	3.61
MgO	%	1.40
Na_2O	%	0.76
TiO_2	%	0.79
MnO	%	0.13
Tempering losses	%	5.83

Laboratory test results are included in Appendix 2.

B. Mineralogy of Tailings

Tailings comprise finely ground solids. The tailings are non-plastic, with low clay content and low shear strength when unconsolidated, but gain shear strength with consolidation As density values of tailings increase, shear strength values increase as well.

Tailings were tested for grain size, specific gravity, shrinkage limit, soil water characteristic curve, consolidation and hydraulic conductivity and for shear strength by drained direct shear test . Tailings properties were as follows:

- Fine grained, with a d80 value (80% of particles have smaller grain size than d80) of near 30 microns
- Non-plastic
- Shrinkage limit 25%.
- Specific gravity 2.74 t/m3;
- Friction angle of dewatered tailings 30 degrees;
- Tailings at 64% solids content had a slump of 241 mm

Values of hydraulic conductivity k were measured near 3 x 10-8 m/s at low confining stress (14 kPa) and near 5 x 10-9 m/s at higher confining stress (655 kPa).

Values of coefficient of consolidation c_v were $9x10^{-4}$ cm^2/s at low stress (14 kPa) and 3.5 x 10^{-2} cm2/s at high stress (655 kPa).

Pressure plate test results for soil water characteristic curve showed an air entry value greater than 100 kPa, indicating that the tailings will not readily desaturate under gravity drainage.

Tailings prepared to approximately 77% solids content had peak and residual friction angles near 30 degrees, with peak cohesion near 25 kPa, and residual cohesion near 14 kPa Pre-shearing of the specimen tested at 500 kPa to determine residual strength resulted in loss of material (a limitation of the direct shear test method), and higher than peak strength, possibly due to material build up between the shear box halves The 500 kPa residual point was therefore ignored for calculation of residual friction angle.

Laboratory test results are included in Appendix 2.

III.1.3 TMF site topography

The Ada Tepe site is located approximately 3 km south from Krumovgrad. Krumovitsa River runs approx. 150 m east from the toe of the southern embankment of the IMWF. The area is rugged, with slightly steep slopes. Morphologically, the rock is highly weathered, with a thin top soil layer dried by the local coniferous vegetation.

The Facility will be situated in two ravines south from the open pit. The two ravines are more or less parallel along the north-west, south east axis, with slight south-east slopes to Krumovitsa River. The IMWF will reach RL 450 at the north end, approx. 15m above the highest RL of the terrain.

The existing natural green belt (vegetation) and the proposed construction method for the IMWF which will allow for progressive rehabilitation of the embankments will provide dust and noise protection of the nearby towns. In addition, there will be regular monitoring of the soils and air, including noise and vibrations.

III.1.4 Estimate time of probable maximum precipitation to reach populated areas;

The proposed co-disposal method of mining waste is meant to provide quick and effecting drainage of tailings. An underdrain system will be installed along the base of the facility to facilitate collection and conveyance of the rainfall that infiltrates into the facility and the water expelled from the tailings. The IMWF cells will not collect and retain water.

The location of the site was selected in a manner which will ensure that the water catchment area will practically match the IMWF footprint area. That approach will ensure that no extra runoff water is collected from areas around the IMWF.

III.1.5 Flow speed of probable maximum precipitation/overflow

Maximum precipitation flow will not be formed as there is no water body to allow for that. The purpose of the proposed disposal method is to eliminate the requirement to collect and retain runoff water and water from the tailings.

III.1.6 Forecast water and tailings levels

Under the proposed disposal method, as detailed in III.1.4 and III.1.5, no free water body will form, which will ease drainage to a maximum.

The proposed facility will be built as follows:

- The RL of the starter platforms of waste mine rock will be 290m.
- The facility will be developed in 17 stages to its final elevation at 450 masl. ;
- The approx. area of the facility at the final stage of construction will be 41 hectares, 14,000,000 m^3design capacity.

This project foresees phase out construction of outer and internal berms of 10m height and and bench crest width 5m. The proposed phased out construction will ensure the stability of the IMWF and will provide the required capacity for disposal of waste rock and tailings.

The RL of the facility will rise concurrently with the mining and processing advancement rate.

III.1.7 Water and tailings raise rate

The rate of rise of the IMWF will depend entirely on the volume of the mined and processed ore from the open pit. It is important to note that under the proposed construction method, no temporary storage of waste rock is foreseen beyond the IMWF boundaries.

III.1.8 Other site-specific factors which could contribute to a potential fatality of hazards to human health.

The IMWF site is to be located entirely on forestry fund land. There are no villages south-east from the site, towards the slope of the terrain, and therefore there IMWF could be no impact on residents.

The results from the performed geotechnical and hydrogeological investigations of the conditions in the area show the following lithological variations:

41 % of the exposed rocks are less permeable (q - 0,001 – 0,01 l/s.m),

26 % of them are water permeable (q - 0,01 – 0,1 l/s.m),

10% of them are medium-permeable rocks (q - 0, 1 – 1,0 l/s.m), and

23% of them are watertight (q - 0,1 – 1,0 l/s.m).

The water permeable surface is mostly the first 0.5 meters of the Quaternary sediments, which will be treated during the construction, and some deep fracture zones in the metamorphic rocks.

The permeability of the lithological types identified as part of the investigation performed in the IMWMF area varies within 0.00 to 0.48 m/d. The metamorphic rocks will be the bedrock of the tailings cells, showing permeability values in the range of n.10-7 m/sec to n.10-9 m/sec, and 0.00 in the most watertight zones. The data from the investigations performed 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.

The good condition of the groundwater is evident from the analyzed samples collected after the installation of all the piesometers and monitoring wells for groundwater chemical characterization, as compared to the standard set out in the Regulation 1/2010. One of the boreholes (located north-northwest on the border of the facility) has registered elevated concentrations of antimony, which is associated with the frequent quartz veins in the gneiss rocks in this area. The initial sampling in this area is intended to clarify the background characteristics of groundwater and will be the basis for future monitoring during construction and operation of the deposit.

Following the performed geotechnical and hydrogeological investigations we have concluded that the IMWMF area does not entail any landslide, rockslide or mudslide potential.

III.2 Mining waste description and volume estimates

III.2.1 Waste properties

Section A. Mining Waste Characteristics

III.2.1.1 Basic information of the region including:

III.2.1.1.1 Natural topography and developed areas;

The land to be used for the IMWF is entirely property of the forestry fund. There has been no construction development on the land. At approx. 700 m west from the facility, there are: an old chalet building (nearly ruined), one two-storey building and several shacks.

The villages adjacent to the IMWF, which are located within the hygiene protection areas of less than 1,000m and are subject to coordination with the Ministry of Health Care pursuant to Regulation 7 of the MoH on the hygiene protection requirements to residential environment, SG 46/1992 are as follows:

- to the north – 636m from Chobanka 1, 359m from Chobanka 2;
- south-west – 979m from Sinap;
- east – 455m from Kupel;
- north-east – 757m from Pobeda;

All other hamlets of the villages Ovchari, Zvanarka, Surnak, Dazhdovnik, Edrino, Malko Kamenare, Kuklitsa, and Skalak are at a distance greater than 1,000 m.

Krumovgrad, including Izgrev quarter, is at about 3,000m away from the mining waste facility.

III.2.1.1.2 Protected areas;

The Integrated Mine Waste facility is almost entirely within the boundaries of BG0001032 East Rhodopes Protected Area under the Habitats Directive 92/43/EEC (Sites of Community importance – pSCIs) and is situated at approx. 4-5km distance from BG0002012 Krumovitsa Protected Area under the Birds Directive 79/409/EEC (Special protected areas – SPAs).

III.2.1.1.3 Surface and Ground Waters

Surface waters

The main water body close to the IMWF is Krumovitsa River. Virovitsa River (Kessibir) flows above the IMWF while Kaldzhikdere and Vetritsa Rivers (Elbassan) flow into Krumovitsa River below the IMWF. The river network density in the region in question is 1.0 - 1.5km/km^2. The average vegetation cover in the watershed is 35% reaching up to 100% in the upper parts and down to nearly zero around Krumovgrad. The snow cover is unstable due to the major impact of the Mediterranean climate and low altitude of the water catchment area. The low tree cover and the land erosion contribute to the rapid response and correlation of runoff and surface flows in the Krumovitsa catchment. The extreme high/low river flows are during the winter (humid period) and during the summer (dry period). The winter flow is high (approx. 45% of the annual flow) while the summer flow is relatively low (approx. 10%). The river flow modulus in the Eastern Rhodope Mountains rapidly decreases downhill reaching only 2-3 l/sec/km^2 at the foot of the mountain. The multi-annual average flow of Krumovitsa River in the investigated areas is 0.85m^3/sec.

Krumovitsa River has a very low gradient. The Krumovitsa recharge is winder/snowfall based. It is highly aquifying, it is one of the highest aquifyiers in Bulgaria. Regardless of the low-mountain and hilly topography, the area features high water abundance due to high annual precipitation volumes of 850mm and high runoff rate.

This region is typical of high waters of extreme peaks and high values. The Krumovitsa watershed generates some of the most torrential flows that discharge into the Arda River. This is dictated by its location and the relatively low watershed ridges, which channel the precipitation runoff. High flows are caused by area-wide and often highly intensive rainfalls primarily in the winter period from November through March. Rainfalls outside this period are less frequent and abundant.

The minimum outflow levels are observed during the summer and autumn periods of the hydrological year with the lowest values occurring in August and September.

The low water phase occurs as a result of the sudden reduction of the surface runoff volumes reporting to river system and the Krumovitsa River valley as a result of the specific climatic features and the use of water for various purposes.

The Krumovitsa river together with its mountain tributaries in the water abstraction areas (the pump stations) could be assumed to have adequate water quality. That assumption is conditional and dynamic in time as it depends on technogenic factors.

The Krumovitsa water quality in the Krumovgrad area is dictated by natural and anthropogenic factors. The anthropogenic factors could be grouped as two types:

- Krumovgrad impact;
- agricultural impact;

The impact of Krumovgrad waste water is both direct and indirect. Krumovgrad has a sewer system (except for the Izgrev area) and the majority of wastewater discharge directly reports to the Krumovitsa River, while the remainder reports to cesspits.

The quick response of slope run-off carries fertilizers and preparations used in agriculture. That is one of the reasons for the presence of biogenic elements. Their concentration cannot be high because of the significant water dilution.

The mountainous topography of the region causes rapid response of slope runoff, which minimizes its contact with soils and rocks. At the same time, the sediment loading in high water periods is substantial and to a large extent follows the water flow pattern.

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).

Appendix 3 provides test results from the chemical analyses of water samples collected from Krumovitsa River and Kaldzhik Gully.

Groundwater

The geological setting of the area - geology, lithology and structures, the Continental-Mediterranean climate, deep erosion-generating ridges, sparse vegetation and other natural prerequisites make this region in Bulgaria one of the poorest in ground water sources. The modulus of natural resources is 0.1 - 0.5 $l/s/km^2$.

There are three types of ground water in the Krumovgrad region. interstitial, fissure-flow and karst water. Interstitial water is primarily observed in the Krimovitsa River terrace and its tributaries. Fissure-flow is observed primarily in Paleogene sediments, while the karst-fissure flow water is primarily found in the marl-limestone formation of the Priabon age. They all comprise fresh ground water.

Fissure-flow water:

Interstitial water is well represented and is associated with gravel-sand Quaternary material.

Quaternary is the most aquifying formation in the Krumovgrad region. It is represented by alluvial deposits. Alluvial deposits are in place along Krumovitsa, Elbasan and Kesibir rivers. Their catchment areas comprise gravels with sand infill, which are rarely laminated by thin clayey lenses. The Krumovitsa alluvial layer varies between 6.0 m and 10.0m, as the thickest section is south from 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 their own sediments. 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 m2/d. The prevalent specific yield (storage) value is 0.25.
Proluvial cones accommodate some of the small tributaries of Krumovitsa River. Proluvial sediments comprise gravels of various grain size with high clay content. Clayey lenses are embedded in gravels, especially in the periphery of the cones. They hydrogeological values are substantially lower.

Fissure-flow ground water

This water is accommodated by the tectonic fault structure where rocks are very much cracked and crushed. Tectonic faults and mineralization areas are good conductors of ground water. That water circulates deeper and has a longer circulation track. In the area in question, such water is accumulated in the sandstones of the Paleogene sediments. Storm water/precipitations are the water recharge source (surface watershed). Water drains on the surface in the form of low-volume springs of 0.1 l/s flow rate.

The permeability of the jointed zones in the sediments ranges between 0.01 and 2-3 m/d.

Fissure-flow and karst water

Karst water is associated with the marl-limestone formation of the Palaeogene age situated north from the studied area.

Large part of the mountain south-west from Krumovgrad comprises Priabon carbonate rock, by Golyama Chinka and Tokachka villages. There are multiple faults and cracks in this area where ground water forms low-pressure streams which come out as surface springs. Those streams flow downwards and in some areas upwards, with highly oscillating flow rate. There could be 10 times difference between minimum and maximum flow rate values, because of the sparse vegetation, quick melting snow, high evaporation rate in the summer and short infiltration tracks. That water comprises the source of several springs of over 10 l/s floe rate. The biggest spring is Golyama Chinka, 5-30 l/s floe rate, while the others are with 2.0 to 10 l/s flow rate. Their water temperature is 13-140C.

The major recharge source is storm water. The water drains in multiple springs as the main drainage receiver is Krumovitsa River with its tributaries.

A large number of geotechnical and hydrogeological investigations at the future IMWMF site have been performed, as well as at the TMF site in Kaldzhik Gully (an alternative option for tailings disposal), and samples have been collected from the piezometers for groundwater chemical characterization. The test results are included in Appendix 3 enclosed to this Plan and show the good condition of the groundwater, as compared to the standard set out in the Regulation 1/2010. One of the boreholes (located north-northwest on the border of the facility) has registered elevated concentrations of antimony, which is associated with the frequent quartz veins in the gneiss rocks in this area. The initial sampling is intended to clarify the background characteristics of groundwater and will be the basis for future monitoring during construction and operation of the deposit.

Appendix 3 provides protocols of chemical analyses of groundwater samples collected from the IMWMF area.

III.2.1.1.4 Soils

Soils in the Krumovgrad area include the following types and sub-types: alluvial, alluvial-meadow, alluvial-diluvial, leached forest cinnamon soil and rendzina. Large part of the soils are highly eroded, with distinct gully erosion. Agricultural land in areas of higher gradient are subject to surface area erosion.

The prevalent soil type within the local municipality is leach forest cinnamon soil, or 94.2%. The areas of highest elevation within the municipality (at RL 800 and 800+) have brown forest soil - 4.3% and limited embedded distribution of rendzina soil - 1.5%. Alluvial soil is extremely rare, mostly along the Krumovitsa River.

There is prevalently eroded leached forest cinnamon soil in the Ada Tepe area, as the soil erosion in the flatter and wider sections of the slopes is slight to average. 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. Cinnamon soils were formed under the dominant influence of oak vegetation. Their prevailing texture is medium to heavily sandy-clayey (approx. 30% genuine clay). 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 volume density is 1.20 - 1.35 g/cm^{3}p while the relative density is - 2.60 - 2.45. The humus reserve in place (below 2.5%), total nitrogen (below 0.25%) and total phosphorus (0.35%) are very poor [in nutrients], while soil with absorbable potassium is average, 14 mg/100g. In virgin lands, humus reaches 3-4%, while nitrogen increases insignificantly. Those soils have low level of absorbable nitrogen. The soil pH is 5.8 (acidic).

The soil in the central section of the ore field – Adá tepe hill – is also cinnamon forest 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 floor was stabilised. The soil formation process is now resumed through the formation of organic forest matter. At this stage, the depth of the soil varies depending on the location and slope inclination, and on the intensity of the former erosion. 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.

- Certain forest soils in the Ada Tepe area contain elevated concentrations of arsenic, chromium and nickel due to the soil natural chemistry. ***Copper, lead ans zinc*** levels are within the permitted limits applicable in Bulgaria – below the maximum allowable levels and below the preventive levels (under Regulation 3 - SG 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. 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.

Alluvial (deluvial-) meadow (sediment) soils (Cumulicsols) are prevalent in the area south from Ada Tepe. Soils include the following variety: 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 (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 toward 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. 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 type (Eutric) - with a light humus strata and pH ≥5.2 or V ≥50% in all strata at depths of 75 cm from the surface. The profile of these soils is incomplete. The average depth of the humus accumulation layer is 20 cm.

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

Appendix 3 provides protocols of chemical analyses of soil samples from the IMWF area.

III.2.1.1.5 Vegetation

The Ada Tepe hill is 492.4m high and dominates the landscape. The vegetation in the past comprised xerothermic oak forests whose remanats could still be observed as stray trees or groups of trees. That vegetation was destroyed in the past, the vegetation on the hill was almost completely cleared. About 40-50 years ago black pine (Pinus nigra) and white locust (Robinia pseudoacacia) were planted on the hill which develop pretty well and currently cover major part of the area. The original tree and bush vegetation is naturally restoring in some areas. Those processes cannot substantially accelerate in the future due to the altered soil reaction as a result of the decomposed pine tree needles which therefore makes the full restoration of the autochtone vegetation of Ada Tepe. The southern and eastern slopes of the hill are steeper and were used as pastures in the past. Those slopes host better developed grass vegetation. The southern slopes of Ada Tepe are lower and comprise highly ruderalized grazing land with sparse coenoses of Oriental hornbeam (Carpinus orientalis), which grow on limited-size areas.

III.2.1.1.6 Potential natural disasters

The engineering and geological conditions in the the site area do not entail any landslide, rockslide or mudslide potential.

The design preparation and the construction of the mine will involve the measures required under the Bulgarian legislation. The sites will have the required strength to resist seismic loads in compliance with the applicable standards.

III.2.1.1.7 Climate

The Krumovgrad region is part of the southern Bulgarian climate region, i.e. Continental-Mediterranean area. The low mountain topography of the Eastern Rhodope Mountains cut by the Krumovitsa River to the north allows the free flow of both Mediterranean and cold continental air. Continental air flow is typical of winter periods. The climate is too diverse as a result of that influence.

The average annual temperature typical of this region is 12.6ºC.

The minimum temperatures are in January, as the lowest reported values reach –26.4ºC. Winters are mild as the average January temperature is about 2ºC, varies between 1.7ºC and 2.1ºC. The average July temperature varies between 23.2ºC and 23.6ºC, which makes the region one of the warmest in the country. Summers are sunny and hot. The absolute maximum temperature reaches 42.6ºC in August. The average monthly and average annual temperatures are provided in Table 2.

Table 2 Average monthly and average annual temperatures

Temperature gauge station	H, m	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	year	t_{max}	t_{min}

Krumovgrad	220	8.1	3.8	1.7	3.5	6.4	12.1	17.2	20.6	23.2	22.7	18.7	12.7	12.6	42.6 Aug	-26.4 Jan

Average annual wind velocity is 1.8 m/sec. Winters are windier, with max. monthly average wind velocity in February 2.2 m/sec. The lowest average monthly wind velocity values are reported in the fall – 1.6-1.7m/sec. North winds prevail in the region year round while local winds in all directions appear in the warm season.

Precipitations (rain and snowfalls) in the area are of distinct transitional Mediterranean nature. the average annual precipitations in the region vary between 676mm and 912mm, i.e.much higher than the country average values. The distribution of precipitations shows a major peak in December and a second one in May (Table 3) and minimum level in August. Precipitations are short and heavy. They generate outflows in the gullies and ravines.

The first snowfall in the region typically occurs in the second decade of December although the high temperatures do melt it quickly. The snow cover does not stay longer than 5-6 days in the winter. The longest stay of the snow cover is in January and may be up to 10 days. The maximum snow cover is 54cm, which is typical of the second half of January.

The average annual precipitation is 704 mm while the average annual pan evaporation is 1,052 mm (Table 3). The potential pan evaporation was calculated by extrapolation of the data obtained from the weather station in Kardzhaly. The average annual outflow coefficient is 0.45 with major seasonal oscillations: - 0.91 between January and march, up to 0.11 in July-September.

Table 3 Average monthly data of precipitation volumes and potential pan evaporation

Month	Average Annual Precipitation (mm)	Average potential pan evaporation	Average outflow coefficient
January	63.4	33.0	0.89
Feb	69.9	38.0	1.01
Mar	65.9	53.0	0.84
Apr	63.4	78.0	0.62
May	59.1	101.0	0.38
Jun	46.4	129.0	0.24
Jul	38.4	175.0	0.13
Aug	24.1	165.0	0.08
Sep	41.6	119.0	0.12
Oct	51.1	75.0	0.14
Nov	83.3	50.0	0.30
Dec	96.9	36.0	0.64
Total	**703.5**	**1052.0**	**0.45**

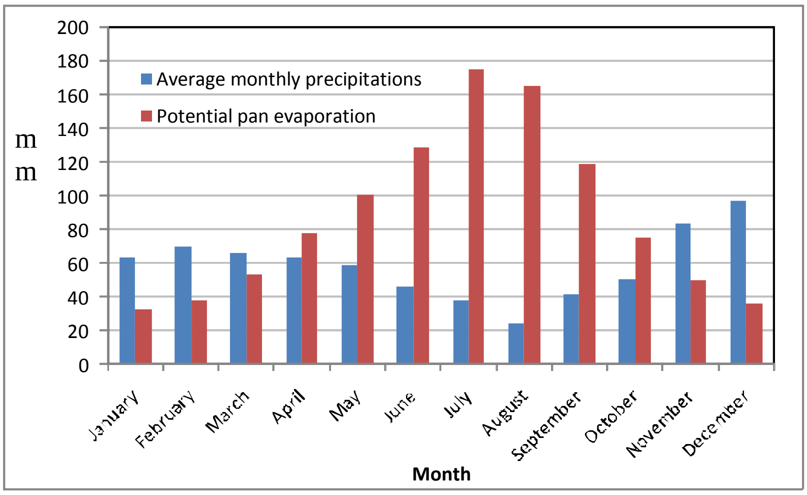


Figure 1. Average monthly precipitations and potential pan evaporation

Average precipitations of the 1974-2003 period varied between 468mm and 1,060mm. The calculations of the annual precipitations in wet and dry periods of various frequency were based on the Pearson frequency distribution method (Table 4).

Table 4 Annual precipitation - frequency distribution

Frequency	Annual Precipitation (mm)	
	Wet periods	Dry periods
1:2 yrs	687.9	687.9
1:5 yrs	829.6	570.7
1:10 yrs	914.0	519.6
1:25 AM yrs	1012.8	474.1
1:50 AM yrs	1081.8	450.2
1:100 yrs	1147.5	432.8

III.2.1.1.8 Social and economic data of the region

Demographic data

At 2004 year end, the population of Krumovgrad municipality was 22,424, including 11,269 male and 11,155 female residents. As of March 2010, the population of the municipality was 20,121, or density 23.9 persons per km^2. That indicator shows three and a half times lower value than the country average, which is 70 persons per km^2. The low density value is primarily a result of the specific geography of the region, which hampers business development, especially small and medium enterprises. High percentage of rural population is a typical feature of Krumovgrad and Kardzhaly . The rural population comprises 60% of the District while, the value in Krumovgrad municipality is 62.6%. That peculiarity is indicative of the type of employment, i.e major part of the residents are involved in the farming business and small family farms.

The population if the work force group is slightly above 50 per cent of the population in this municipality. Most of the employed persons, or approx. 55% are in the agricultural and forestry business. At year end of 2009, the number of registered unemployed persons in the municipality was 1,307 or 13.15% of the work force age group. That figure was nearly 5% higher than the country average unemployment rate.

As a comparison, in 2005 the unemployment rate in the municipality was 18.4% (1,833 persons), which was twice higher than the country average. What is interesting is that during the 2005-2008 period, the employment rate decreased by 1/7, as the decline rate was higher in the private business. At the end of 2009, according to the National Institute of Statistics (NIS), the unemployment rate in the District reached 9.4%, whereas the country average was 7.9%.

Local business is to a large degree limited to tobacco growing. The local geographic conditions such as specific climate conditions, low-mountain topography and highly eroded and permeable soil also add to the favorable conditions of tobacco farming. The Krumovgrad area is renowned for its production of high quality Oriental tobacco (Bashibali sort).

Live stock breeding is another key component in the farming business of Krumovgrad municipality. Large part of the work force is involved in that business, no matter the produce is mainly for the household consumption.

Industrial operations in the municipalities provide a small number of jobs, primarily shoe and garments production.

III.2.1.2 Description of the Chelopech Deposit

III.2.1.2.1 Shape and Size

The Khan Krum deposit includes the following ore deposits (prospects): Ada Tepe, Kuklitsa, Kupel, Sinap, Surnak and Skalak. This Plan discusses only and solely the Ada Tepe prospect and the mine waste generated by its operation.

The mining waste facility was sized only for containment of waste generated by mining and processing of gold ore from the Ada tepe prospect, which is located 3km southwest from Krumovgrad and 1 km west of the Krumovitsa River.

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

- Wall Zone - a shallow-dipping (15 degrees north) tabular (9 meters 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;

III.2.1.2.2 Mining Depth

The Ada Tepe mine plan currently being considered is based on an 850,000 tpa operation extending over a 8 year period, 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 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.

III.2.1.2.3 Completed Exploration

BMM EAD has undertaken exploration activities on an area of 113 km^2 known as the Krumovgrad License pursuant to License No. 1 dated 09.05.2000 of the Ministry of Economy (ME), Agreement for Prospecting for Metals dated 12.06.2000, and Additional Agreements to it - No 1 dated 13.06.2003, No 2 dated 15.03.2005, No 3 dated 01.06.2005 and No 4 dated 04.07.2007.

As a result of the exploration operation over the 2000 - 2001 period, in 2001 BMM EAD obtained certificate No 0001/25.04.2001 of geological discovery, namely low sulfide epithermal gold deposit of Khan Krum. Based on the registered geological discovery, the company received permission for additional detailed exploration of the Ada Tepe mineralisation and completion of the definition work on the adjacent prospects of Surnak, Skalak, Kuklitsa and Kupel.

The MOEW's Reserves Expert Panel issued Protocol НБ-17/21.04.2005 accepting and approving a commercial discovery provisionally named as Khan Krum within the Krumovgrad License. Based on the above grounds, BMM EAD obtained Certificate 0417/28.08.2009 acknowledging the commercial discovery of a deposit under the terms of the URA (Appendix 10).

III.2.1.2.4 Information about old mine workings in the region

No such information is in place. There are traces of underground mining dating back in Thracian ages.

III.2.1.2.5 Mining Methods - Description

Ada Tepe will be an open-pit operation involving drilling and blasting with subsequent mucking and haulage of the mined up ore. 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, a bulldozer, a grader, water tank trucks, and auxiliary vehicles and light trucks.

The following explosives will be used: The explosives planned for use is ANFO type (say DynoliteTM, 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 (say Fortis™ Advantage 80) for the mining of the ore in the Wall Zone.

An explosives manufacturer will supply the blasting materials. Explosives will be safely delivered from the explosives manufacturing plant 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 waste dump area located approximately 200 m south-southeast of the open pit. Waste rock will be disposed together with the dewatered process waste (tailings).

III.2.1.2.6 Processing Methods - Description

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 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 (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 will operate in an open circuit, where the oversize from the mill will be discharged onto a rubber-belt conveyor leading back to a pebble cone crusher in the crushing section The project grinding flowsheet includes a grate discharge, steel-lined primary SAG mill. 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 that is fed into the flotation circuit 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.

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 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.

Gravity Separation

The overall ore processing flowchart includes a gravity separation process. The process involves selective separation of the lighter from the heavier products in the process based on their different densities. It will be 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 precious metal grades in the final product of the gravity separation circuit are expected to be circa 3,000 to 5,000 g/t for Au and 1,000 to 2,000 g/t for Ag.

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.

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 (e.g. Aerofloat 208);
- Frother: e.g. 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 Au and Ag recoveries are expected to be circa 85% and 80% respectively.

<u>Dewatering</u>

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

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 into the IMWF.

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 at a rate of about 10,000 tpa or high-grade gold-silver concentrate at a rate of 500 tpa. The metal values in the concentrate will vary between 300 to 500 g/t gold and 80 to 300 g/t silver in the low-grade concentrate, or 4,000 to 5,000 g/t gold and 1,500 to 2,000 g/t silver in the high-grade concentrate.

III.2.1.2.7 Reagents Used in the Flotation Process

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 involve the following hazardous substances - reagents and consumables: potassium amyl xanthate, copper sulfate, sodium silicate, dithiophosphate, frother, flocculant, and explosives.

Table 5 Chemical substances to be used in the ore processing

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; Color: Color: pale yellow, grey-yellow, yellow-green; Odor: strong, unpleasant	R22 R36/37/38	S26, S36	14-15
	Not specified	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	Color: yellow to brown Appearance: liquid Odor: light ether-like	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 Xi -irritant	Flocculant Cement	Organic Colorless and odorless fine ground, inorganic material, gray, odorless powder	Not available R37/38 R41 R43	Not available S2, S22 S24/25, S26 S36/37/39 S46	1-2 400 – 500

III.2.1.2.8 Water circulation requirements

Drainage water generated by the consolidation of the disposed thickened tailings, together with any storm water drained through the tailings will be collected in drainage sumps. That water will be pumped to Process Water Reservoir and used in the production process.

III.2.1.2.9 Other pollution sources in the waste management facility;

The soils at Adá Tepe are a potential source of pollution of other media due to the naturally high level of arsenic and heavy metals in them. That 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. Arsenic and heavy metals are not in the mobile form, which explains why there is no local water contamination regardless of the identified concentration in soils. Laboratory test results are included in Appendix 3.

III.2.1.2.10 Transport Routes; Vehicle Transport, Belt Conveyors, Pipelines and Pipe Couplings;

Waste rock will be trucked to the facility on roads built of crushed rock. Roads will be 10m wide, 1-2km length and located entirely within the IMWF site.

Thickened tailings will be delivered to the IMWF by a tailings pipeline. Its total design length will be1,000, made of HDPE pipes, starting from the tailings thickener on the process plant site and ending in multiple discharge points in an active tailings cell The HD polyethylene pipes will be plastic and highly resistant.

III.2.1.3 Project Geology

III.2.1.3.1 Characterization of the Mineral Resource, Host Rock and Waste Rock

Stratigraphy

The geology at Ada Tepe deposit is dominated by the Tocachka detachment fault (TDF) 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 (so called Strazhitsa-Belorechka unit acc. to Sarov et al. 1995). 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. They should be associated with the Krumovitsa lithotectonic unit cc. to Sarov et al. 1995. 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 detachment 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.

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 1). It is a fragment of the Kessebir block structure of the para-autochtone (Kozhuharov, 1987, 1991) 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 a regionally developed low-angle detachment fault and the associated steep extensional faults.

The detachment structures occur in both the metamorphites (a mylonitisation zone between the two metamorphic units) and the Paleogene sediments. The tectonic zone that is recognized as the contact between the metamorphic rocks and the sedimentary rocks is best expressed. It is a NNW-SSE-oriented undulating planar contact dipping 10 to 15 degrees northeast to east. Data from some drill holes indicate some post-mineral movement, which is probably the result of later low amplitude down-throw and slip faulting. The fault zone is marked by 0.2-5.0 m gray tectonic clay. That tectonic surface was formed during the Palaeocene and may be related to updoming to the south, in the vicinity of the Kessebir core complex, and the onset of the East Rhodopean depression to the north. The tectonic movements continued after the Maastrichtian-Paleocene age. As a result of the mechanical impact of the overlying sediments, the metamorphites beneath the detachment surface are cataclazed, mylonitized and transformed into monogenic tectonic breccias. The overlying sediments also exhibit similar slip surfaces. It is a key feature of those slip surfaces that they are overlain on the hydrothermally altered and silicified breccias. That fact may be explained with later, post-mineralization down-throw and slip faulting or the continuing post-mineralization updoming of the Ada Tepe basement complex. This is well observed in the geological cross-section (Figure 1).

The steep faults could be grouped in two main systems based on their orientation: a dominant E-NE and N-NE oriented system and a secondary N-NW and N-S oriented system. They most frequently comprise low amplitude down-throw and slip faults. Some of them probably extend into the basement rock but those are later, post-mineralization structures. The prospecting drill holes did not intersect such extensions into the basement rock. The normal down-throw and slip faults are steep dipping at 80º – 90º and trending in different directions. They could be grouped in two main systems based on their orientation: The area north from Ada Tepe peak is dominated by structures with dip direction of 60º – 80º while the southern part of the deposit is dominated by structures with dip direction of 90º – 140º. The nature and the direction of the movements along these structures are relatively well expressed. The sedimentary rocks very often exhibit zones of more intensive breaking, argillitisation and limonitisation thus forming wide cataclase zones, whose fabric and morphology are difficult to interpret. 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 localization of mineralization is exhibited by thesedimentary rocks overlying the detachment. The alteration of their petrophysical properties such as primary porosity (determined by the granulometry of the sediments) or secondary porosity (determined by the tectonic processes) has a clear impact on the physiochemical parameters of the fluid flows such as velocity, pressure and temperature. The abrupt changes in the environment create conditions for emplacement of high-grade mineralization.

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. As indicated above, the faulting is probably caused by gravity shearing along the detachment fault and rotation of individual blocks of Paleogene sedimentary rocks. The intersections with suitable lithological strata form complex stockwork orebodies and zones of hydrothermal alteration with strictly controlled gold-bearing mineralization.

Another important factor in localizingfluid flow is the lithological control. The selective metasomatic alteration and the formation of the orebodies is expressed in the Paleogene package at intersections of sedimentary rock strata with different petrophysical properties. The coarse breccias of the Shavarovo Formation are interpreted as an environment that does not facilitate hydtrothermal alteration and vein emplacement. The sandy-clayey component in them is not conducive of hydrothermal fluid flows and the mineralization is mostly structurally controlled or forms irregular lenses in the interstitial spaces.

In contrast, the gravely breccia conglomerate is a very suitable lithological environment that facilitates hydrothermal alteration. Intensely silicified tabular bodies are formed in the areas where the conglomerate is cross-cut by structures and consists of finer breccias. These bodies are probably wedged horizontally or intersected by similar bodies at various depths.

The exploration work confirms the significant morphological diversity of the orebodies. At the current level of understanding of the deposit, however, it would be incorrect to attempt to delineate other gold-bearing orebodies in addition to the main orebody, which is morphologically well localized within the base of the sedimentary rocks. These orebodies have complex contours and the best criterion for their delineation would be the gold assays.

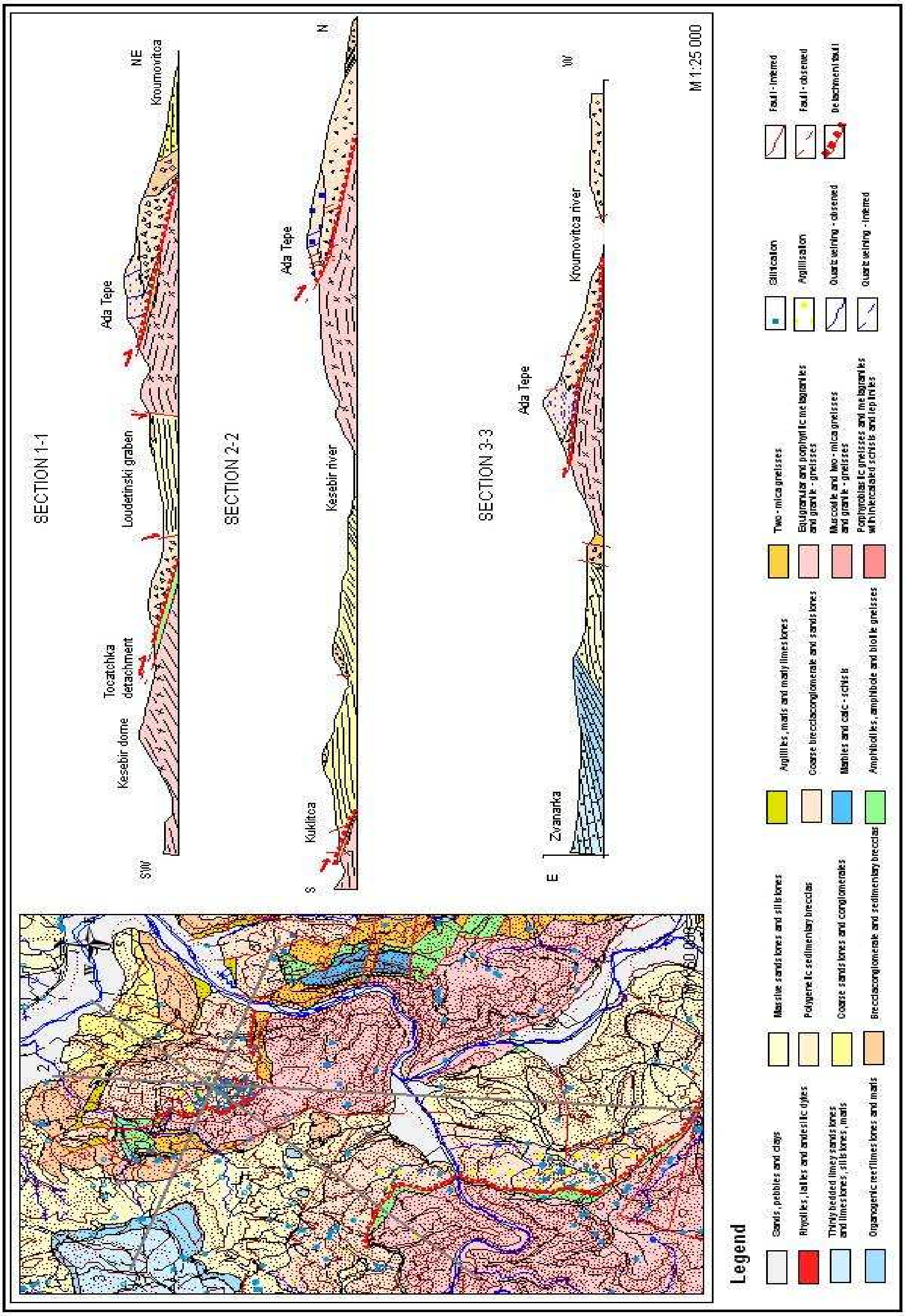


Figure 1 – Adá Tepe geological maps

III.2.1.3.1.1Reserve and Resource Volumes (Tonnage)

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

Mineralization

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

- Wall Zone - a shallow-dipping (15 degrees north) tabular (9 meters 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

The textural style and grade of mineralization at Ada Tepe, high grades in association withopen-space fill textures, such as bladed silica replacement after carbonate (i.e. evidence ofboiling), hydrothermal breccias and also the presence of sinter material, suggests proximityto the paleosurface and a low-sulphidation nature of mineralization.

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.

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 indicated possible economic mining; and
- possible reserves (code 122) - this is the Wall mineralisation, 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. Table 6 provides the calculated resources and reserves of the Ada Tepe prospect, Khan Krum Deposit

Mineral Resource and Reserve Estimate for the Ada Tepe Prospect of the Khan Krum Deposit, 01.09.2004.

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

III.2.1.3.1.2Mineralogical Description:

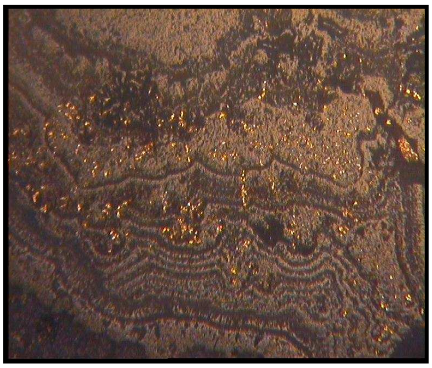
The past mineralogical studies and assay results confirm that the mineral composition of the ore is rather simple and not abundant in mineral species (Munkov, S. 2001; Marchev, P. 2003; Ilieva, A. 2004). All ore elements typical of the formation of low-sulphide gold-bearing mineralization occur in background concentrations. The only exception is silver but its concentrations are extremely low. This undoubtedly defines the mineralization as native quartz-gold-bearing. The following ore and gangue minerals are deposited as part of the primary hydrothermal (hypogene) stage and the hypergene (infiltration) stage of the mineralization process.

ORE MINERALS

Gold The polished sections prepared and studied at the early stage of exploration indicated gold grains ranging from 5-7 μm to 40 μm in the form of oval-shaped gold dust or dendrite flakes with yellow to pale yellow color. The native state of the gold has been confirmed by the testwork undertaken in the Genalysis Laboratories, Perth, Australia. The testwork results indicate that the gold occurs mostly as electrum, where about 90% of the gold grains range from 3-12 μm to 65-75 μm. Microscopically visible gold is found in high-grade core intervals (Appendix II, Fig. 13-16, 21). It occurs as pockets, gold veinlets or corrosively intergrown with quartz aggregates.

The gold in the deposit is contained in electrum. The native gold occurs as fine impregnations that are corrosively intergrown with quartz or as relics within limonite. Its size ranges from 1-2 μm to 6-8 μm and is observed as micro-agglomerations and gold emulsion within quartz or developed as framing aggregates around clayey sections within the quartz (Munkov, 2001).

The electrum tends to occur in the margins of gray or black bands of opaline silica (plates 1 to 6).



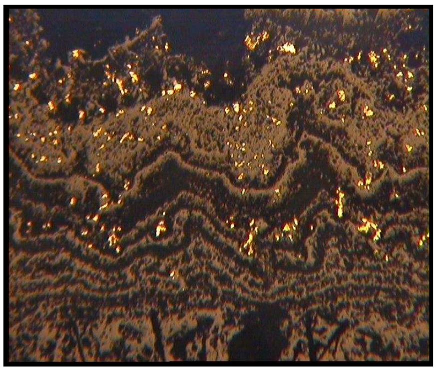


Plate 1 Photomicrograph of injected gold (electrum) in an opaline-chalcedony band (visual field size 1900 µm)

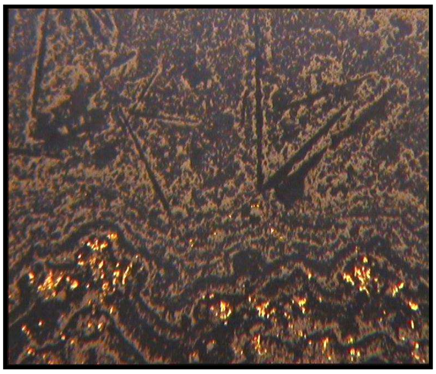


Plate 2 Photomicrograph of injected gold in an opaline-chalcedony band (visual field size 1225 µm)

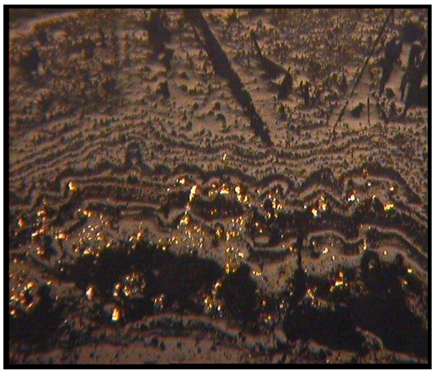


Plate 3 Photomicrograph of gold (visual field size 1225 µm) Pockets of gold in the hinge of an opaline quartz streak.

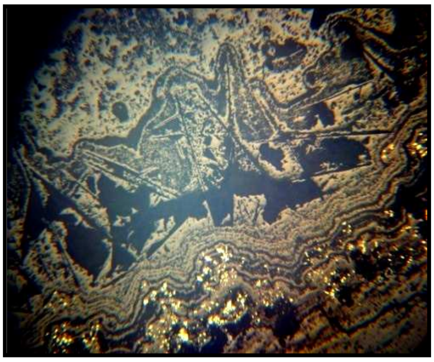


Plate 4 Photomicrograph of en-echelon gold grains in chalcedony quartz (visual field size 1225 µm)

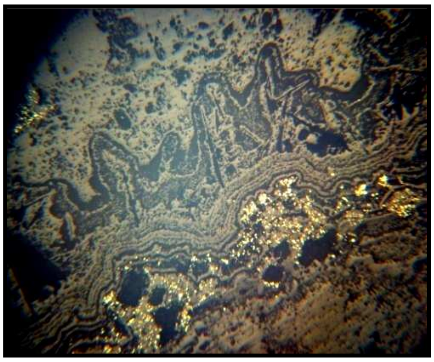


Plate 5 Photomicrograph of various quartz parageneses (chalcedony with gold (electrum) and later "paper-spar" (visual field size 1225 µm)

Plate 6 Photomicrograph of gold (visual field size 1225 µm). Concentration of gold in a colomorphic quartz-chalcedony streak with growing calcite pseudomorphoses

Greenockite – associates with native gold forming small grains and crystals with hypidimorphic-granular textures.

The major silicification, the intensive pyritisatioin with gersdorphite and deposition of native gold is associated with the hydrothermal stage (Munkov, 2001).

The gersdorphite occurs on the periphery of single pyrite grains in the form of 4-5 micron thick frames.

Pyrite. Pyrite is the most common iron sulphide in Ada Tepe. Several generations of pyrite can be identified. The early disseminated pyrite comprises 1-2% up to 5% of altered rocks at the early stage silicification. Its occurrence in the hydrothermally altered metamorphites is largely as alotriomorphic-granular and hypidimorphic-granular aggregates within quartz or feldspar. The size of single metacrystals is up to 0.5 mm (Munkov, 2001). The second generation pyrite occurs in the bonanza opaline-microcrystalline quartz-electrum stage. The genetic association between this pyrite and gold is evident under backscattered electron images, revealing zonal arranged bright spots within the pyrite. This pyrite type comprises less than 5% of the composition of opaline-fine-grained quartz-electrum bands. The quantitative EDS analyses show that it contains small amounts of As, Te and Ni. The third generation of pyrite is widespread in the beginning of the late dolomite-ankerite-siderite stage. Sometimes it forms large masses. (Marchev, 2003).

Under a microscope, the pyrite is observed to have idiomorphous to hypidomorphous texture, which is occasionally corroded by later quartz and magnetite. Well-shaped pentagon-dodecahedral pyrite crystals are also observed, which may be indicative of low-temperature deposition conditions, i.e. the temperature of the hydrothermal solutions is below 200ºC (Ilieva, A. 2004).

Marcasite. Marcasite is another sulphide, which is dimorphous with pyrite. It is macroscopically observed in drillhole ATDDEX 004 (96.0 m). It infills primary voids in cross-cutting quarts veins and brecciation zones with silicification in the metamorphites.

Galena and sphalerite are formed during a post-quartz stage and are represented by up to 1mm thick quartz-galena-sphalerite veinlets. They occur sporadically. The boundaries between the galena and sphalerite grains in reflected light are mostly inductive and the minerals are optically and mechanically homogeneous.

GANGUE MINERALS (vein and alteration minerals)

Quartz. Quartz is a major hydrothermal mineral that occurs at all stages of mineral deposition. It is white, gray to black, fine to medium-coarse grained. Allotriomorphic (anhedral) quartz is most frequently occurring and observed in specimen. It exhibits massive, crystalline, colloform, banded and other textures, which are typical of low-temperature epithermal style deposits such as the Ada Tepe deposit.

Quartz (silica) polymorphs. Following Saunders (1994), silica textures in the Ada Tepe can be divided into: finely banded opaline silica, microcrystalline quartz (chalcedony), jig-saw quartz and sugary (saccharoidal) quartz.

Opaline silica forms thin (< 1 mm) crustiform and colloform bands. It is virtually isotropic under crossed polars. According to Saunders (1994), it is probably deposited as amorphous silica (opal A). Microcrystalline quartz is composed of quartz crystals 100 μm in diameter. According to Saunders, it appears to represent a more advanced stage of opal recrystallization than the opaline silica. Jigsaw quartz consists of interlocking, anhedral, fine-grained quartz. It likely represents recrystallization of silica gel (Lovering, 1972). Sugary quartz consists of massive granular aggregates of nearly uniform size. It is usually associated with calcite.

Adularia. Adularia occurs as three textural types: replaced detrital K-feldspar, replacement of the matrix or directly deposited with the silica in the veins and veinlets. Fine-grained adularia is present locally in the electrum bands. Adularia replacing the former K-feldspar show a cloudiness caused by minor alteration to clay. Vein and matrix replacement adularia forms fine-grained rhombic crystals up to 200 microns across. The electron microprobe analyses show that the vein and the matrix adularia is very pure K-feldspar (Or97-99); K2O>15 wt. %) and very low Na2O (0.1-0.28 wt. %), whereas adularia replacing the detrital K-feldspar has ~1 wt. % Na2O, possibly retained from its original composition. X-ray diffraction analyses indicate that the feldspar is monoclinic and structurally similar to orthoclase.

Plagioclase. Plagioclase is present in the gneiss and granite clasts. The x-ray diffraction shows that it is of albite composition.

Calcite. Carbonate minerals are present as patches in the matrix and replacement of detrital minerals (K-feldspar). They also occur as veins in the host sedimentary rocks. Carbonates form massive and bladed crystals in the strongly mineralized zones. The following types of bladed carbonates have been observed: lattice type, parallel type, curved parallel type and radial type. The microscopic observations and the microprobe analyses of the carbonate veinlets allow distinguishing of two stages of carbonate mineralization. Early carbonate is calcite crystallizing after the early gray silica. It also forms the inner part of the quartz-adularia-pyrite veinlets. The microprobe analyses of vein and replacement calcite are very similar. They show very low content of MnO, SrO (below 0.6%) and FeO (less than 0.2 except one analysis ~1.0%). The late carbonate minerals are dolomite, ankerite and very similar ferroan magnesite and magnesian siderites. Mn contents are low (<0.75% MnO) and comparable to those of Sr (<0.45% SrO). Following Buckley and Wooley (1990), the boundary between dolomite and ankerite is taken at an Fe:Mg ratio of 1:4.

Chlorite. Chlorite occurs in the host rocks as both a metamorphic mineral and a hydrothermal alteration replacement of maphic minerals (biotite, muscovite and amphibole). It also occurs in the margins of the veinlets in amphibolites.

Sericite. Sericite occurs in the host metamorphic fragments as alteration replacement of plagioclase and other minerals forming fine-grained aggregates.

Muscovite. Detrital muscovite is a common mineral in metamorphic fragments. It is stable under the influence of the mineralising fluids.

Biotite is of dominantly detrital origin from gneiss clasts, where it was partially or fully replaced by chlorite. However, a newly formed biotite is observed in a specimen from AT 1076.

Illite and Kaolinite Illite and kaolinite are the most abundant clay minerals in the altered rocks Their abundances progressively increase toward the upper part of the system. Most of the kaolinite is probably of supergene origin, however, some samples with kaolinite contain unoxidized pyrite suggesting hypogene origin for this assemblage, at least for deeper kaolinite. Inter-layered illite-montmorillonite is established in the surface sample.

Table 7. Bulk Mineralogy of the Master Composite Samples

Mineral oxides	Unit	Fresh	Oxidised	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

In addition to the master composite samples, individual samples have been subject to ICP-OES analysis to determine impurity elements, mostly heavy metals. Most of these individual samples are obtained from drill cores recovered from various depths across the deposit

III.2.1.3.1.3 Chemical Properties;

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 fineneness) 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. The ratio is ≈2.9 - 3.2 in the Wall Zone (Marchev, 2001) and 2.5 in the Upper Zone according to recent studies.

Table 8. Quantitative X-Ray Spectrometry of Wall Zone Electrum

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

III.2.1.3.1.4Hydrothermal Alteration of the Mineralisations and the Host Rocks;

The hydrothermal alteration is the strongest in the sediments at the base of the Paleogene complex. Alteration consists of intensive silicification, silica, quartz-adularia and quartz-carbonate veinlets, argillisation, oxidation. Hydrothermal alteration of the basement metamorphic rocks is weaker - they are argillised and intensely cataclised in immediate proximity to the contact with the sediments. The overlying coal-bearing sandstone formation to the north is not hydrothermally altered

The field observations allow the following horizontal division of the metasomatic alterations.

The alteration of the outer zone is irregular and very weak - argillic, affecting mostly the clayey-sandy matrix of the coarse polygene breccia in the Shavarovo Formation. Most of the detrital minerals remain unaltered. The fragments are nearly unaltered but the matrix alteration consists of chlorite, calcite, kaolinite and subordinate albite, pyrite and ankerite-dolomite. Hydrothermal alteration of the inner zone, despite that the fragments retain their textural characteristics, is more pronounced. The alteration assemblage includes quartz, adularia, illite or sericite, pyrite, kaolinite, and late stage ankerite-dolomite-siderite.

Fault-proximal quartz-adularia zones are formed over the argillic alteration of the central and southern part of the deposit. The fragments and the matrix in these zones are almost entirely replaced by quartz, adularia, sericite, pyrite, kaolinite, some clay minerals, etc. These quartz metasomatites are of the greatest metallogenic importance.

III.2.1.3.1.5 Weathering and Supergene Alteration Processes;

Both the metamorphites and the sediments have been subject to supergene hydrothermal alteration. The oxidation zone is well expressed in depth and contains many clay minerals, Fe and Mn oxides, carbonates, etc. Drilling data shows that its maximum depth reaches 80 m and tends to decrease to 15-20 m to the north. This alteration overlies the original hydrothermal alteration. Often the alteration decolours the rocks or colours them in yellowish-brown colours. Most of the pyrite in the oxidized zones has been converted into limonite (goethite). Kaolinite is largely distributed in this zone, forming sometimes small veinlets.

III.2.1.3.1.6 Physical and geotechical properties (specific gravity, density, porosity, strength, elasticity, plasticity, jointing, abrasiveness, transmissivity, permeability, water content, gas content, spontaneous ignition, dust formation, etc.)

<u>Specific gravity</u>

A review of specific gravity data was undertaken as part of the exploration program. The specific gravity had been measured by water immersion with paraffin sealing. A total of 2,086 measurements were completed and the average specific gravity value obtained was 2.4 t/m^3.

Table 9 summarizes the results of the statistical analysis of the specific gravity data.

- Breccias and mixed sandstones (supergenic alteration – SOX) – 2.3t/m^3;
- Breccias and mixed sandstones (fresh – REST) – 2.5t/m^3;
- Basement rocks and tectonic clay (supergenic alteration – SOX) – 2.5t/m^3;
- Basement rocks and tectonic clay (fresh – REST) – 2.6t/m^3;

Table 9 Specific Gravity - Summarized Statistical Data

Lithology	Oxidation	Numbers	Average	Median	Standard deviation
Unprocessed data					
Breccia	SOX	750	2.26	2.26	0.168

	MOX	127	2.52	2.53	0.167
	WOX	140	2.5	2.54	0.152
	FRS	712	2.52	2.53	0.108
Sandstones	SOX	78	2.22	2.23	0.083
	MOX	2	2.43	2.17	0.151
	WOX	2	2.08	1.93	0.102
	FRS	2	2.44	2.32	0.07
Tectonic clay	SOX	7	2.43	2.39	0.053
	MOX	0			
	WOX	1	2.13	2.13	
	FRS	29	2.54	2.54	0.055
Basement	SOX	13	2.45	2.47	0.069
	MOX	0			
	WOX	7	2.33	2.65	0.046
	FRS	216	2.61	2.94	0.05
Summary					
Breccia/Sandstones	SOX	828	2.3	2.3	
	REST	985	2.5	2.5	
Basement/Tectonic clay	SOX	20	2.5	2.5	
	REST	253	2.6	2.9	
Note: SOX – strongly oxidized, MOX – moderately oxidized, WOX – weakly oxidized, FRS – fresh; REST = MOX + WOX + FRS					

III.2.1.3.1.7 Acid Generating Potential

The acid base accounting and net acid generating tests conducted on mine rock samples (including ground ore) and flotation tailings characterize this material as non-acid generating.

Acid Base Accounting (ABA) static geochemical testing was conducted on 81 mine rock samples. Appendix 4 contains a sample plan and a table summarizing the laboratory results of ABA testing performed by Eurotest Control. ABA tests on the samples were performed on the basis of a static test prEN 15875 and included: acid generating potential (AP) through sulfur species analysis for total sulfur (STotal) and sulphide sulfur (SS-2); neutralization potential (NP); and total inorganic carbon (C inorganic). These data were used to calculate the net neutralizing potential (Net NP = NP – AP) and the neutralizing potential ratio (NPR = NP/AP).

All results of the ABA testing are summarized in Table 10. The table includes the EU Criteria for Inert Material (2009) included in Appendix B, and also reference standards for ARD potential from the International Network for Acid Prevention (INAP) Global Acid Rock Drainage (GARD) Guide (2009) and Price (2009). Of note, samples with sulphide sulfur <0.1 % were considered non-acid generating.

The results of the acid base accounting tests conducted on the mine rock samples indicate that roughly 90% of the samples are not classified as "inert" based upon the EU criteria. Six out of 81 samples (No 292104, 292118, 292120, 292125, 292151 and 292168) have sulfide sulfur concentration more than 1%, as three of them have NPR>3, while the other three have NPR between 2 and 3. The remaining 73 of 81 samples had either sulphide sulfur below 0.1% or between 0.1% and 1% and NPRs higher than 3.

According to both the INAP (2009) and Price (2009) criteria for potential acid generation, all of the samples are classified as non-acid generating with the exception of two samples (sample numbers 292117 and 292142) which are considered “possibly” acid generating.

The analysis shows that rock material may not be categorized as **inert**, instead it can be considered **non-hazardous, non-inert** waste.

Table 10 Test Results for acid generating potential

			Parameter			
			S (total)	AP	NP	NPR
			%	H+ mol/kg	H+ mol/kg	
INAP (2009) and Price (2009) Criteria for Non-Acid Generating						**>2**
EU Criteria for Inert Material (2009)			<0.1%(A)			>3
Sample Number	**Name**					
292101	ATDD009	10.0 - 13.0	<0.10	-	-	
292102	ATDD009	79 - 82	0.58	0.363	4.009	11.04
292103	ATDD010	15 - 18	<0.10	-	-	
292104	ATDD010	72 - 75	1.26	0.788	2.161	2.74
292105	ATDD071	38 - 41	0.65	0.406	2.843	7
292106	ATDD050	11 - 12.4	0.1	-	-	
292107	ATDD050	76 - 78.5	0.79	0.494	2.029	4.11
292108	ATDD042	71.5 - 74	0.44	0.275	1.777	6.46
292109	ATDD047	31 - 33.4	0.87	0.544	3.002	5.51
292110	ATDD047	107 - 111	0.77	0.481	2.93	6.09
292111	ATDD006	111 - 113	0.5	0.313	2.016	6.44
292112	ATDD037	16 - 18.8	<0.10	-	-	
292113	ATDD037	133 - 135	0.64	0.4	2.601	6.5
292114	ATDD041	31 - 33.5	<0.10	-	-	
292115	ATDD041	131 - 134	0.75	0.469	5.04	10.75
292116	ATDD005	36 - 39	0.26	0.163	1.401	8.6
292117	ATDD061	13.2 - 14.2	0.78	0.488	0.775	1.59
292118	ATDD061	52 - 53	1.34	0.838	3.12	3.72
292119	ATDD087	4 - 5.5	<0.10	-	-	
292120	ATDD087	80 - 82.2	1.54	0.963	3.753	3.9
292121	ATDD033	6.0 - 9.0	<0.10	-	-	
292122	ATDD033	107.4 - 110	0.67	0.419	2.471	5.9
292123	AT1060	8.7 - 11.7	<0.10	-	-	
292124	AT1060	127.9 - 131.3	0.77	0.481	6.187	12.86
292125	ATDD001	86 - 88.2	1.34	0.838	2.333	2.78
292126	ATDT203	113 - 118	0.82	0.513	2.898	5.65

			Parameter			
			S (total)	AP	NP	NPR
292127	ATDD039	29 - 33	<0.10	-	-	
292128	ATDD039	129 - 133	0.29	0.181	7.099	39.22
292129	ATDD040	10.0 - 13.0	<0.10	-	-	
292130	ATDD040	130 - 134	0.54	0.338	5.389	15.94
292131	ATDD038	33 - 36	<0.10	-	-	
292132	ATDD038	132 - 137	0.96	0.6	3.071	5.12
292133	AT1038	4.7 - 7.7	<0.10	-	-	
292134	AT1038	86.9 - 90.9	<0.10	-	-	
292135	ATDT176	83 - 85	0.56	0.35	4.647	13.28
292136	ATDD101	15 - 16.5	<0.10	-	-	
292137	ATDD002	40 - 42	<0.10	-	-	
292138	ATDD002	62 - 64.5	0.89	0.556	2.004	3.6
292139	ATDD021	5 - 7.5	<0.10	-	-	
292140	ATDD021	48 - 50.5	0.79	0.494	2.442	4.94
292141	ATDD080	5.0 - 8.0	<0.10	-	-	
292142	ATDD079	70.2 - 73	0.29	0.181	0.355	1.96
292143	ATDD079	133 - 137	0.57	0.356	4.174	11.72
292144	AT1023	6.1 - 10.6	<0.10	-	-	
292145	ATDD086	64 - 66.5	0.81	0.506	1.699	3.36
292146	AT1070	59.4 - 63.4	<0.10	-	-	
292147	AT1070	123.8 - 125.6	0.2	0.125	4.564	36.51
292148	ATDD043	40.4 - 43	<0.10	-	-	
292149	ATDD028	11.0 - 14.0	<0.10	-	-	
292150	ATDD028	102 - 104	0.48	0.3	5.935	19.78
292151	AT1030	60.7 - 63	1.17	0.731	1.935	2.65
292152	AT1067	8.8 - 11.5	<0.10	-	-	
292153	AT1067	74.4 - 76.9	0.3	0.188	3.908	20.79
292154	ATDD069	10.0 - 13.0	<0.10	-	-	
292155	ATDD069	92 - 95	0.69	0.431	2.686	6.23
292156	ATDD051	28 - 29.5	<0.10	-	-	
292157	ATDD024	5.0 - 10.0	<0.10	-	-	
292158	ATDD024	58.5 - 61	<0.10	-	-	
292159	ATDD083	2.0 - 3.5	<0.10	-	-	
292160	ATDD058	11 - 14.5	<0.10	-	-	
292161	ATDD026	73 - 75.3	0.77	0.481	2.916	6.06
292162	ATDD077	8 - 10.2	<0.10	-	-	
292163	ATDD077	64 - 67	0.2	0.125	1.043	8.34
292164	ATDD092	64 - 67	<0.10	-	-	

			Parameter			
			S (total)	AP	NP	NPR
292165	AT1018	4.8 - 7.7	<0.10	-	-	
292166	AT1080	12.8 - 15.8	<0.10	-	-	
292167	ATDD016	10.0 - 13.0	<0.10	-	-	
292168	ATDD016	3.0 - 6.0	1.12	0.7	6.595	9.42
292169	AT1033	9.9 - 12.7	<0.10	-	-	
292170	AT1033	64.3 - 67.7	<0.10	-	-	
292171	AT1020	20.8 - 24.2	<0.10	-	-	
292172	ATDD085	17 - 18.8	<0.10	-	-	
292173	ATDD011	3 - 5.8	<0.10	-	-	
292174	ATDD088	22 - 25	<0.10	-	-	
292175	ATDD013	6.0 - 9.0	<0.10	-	-	
292176	ATDD013	53 - 56.4	<0.10	-	-	
292177	ATDD018	3.0 - 6.0	<0.10	-	-	
292178	ATDD060	6 - 7.6	<0.10	-	-	
292179	ATDD060	41 - 42.9	0.33	0.206	2.704	13.13
292180	AT1037	6.7 - 10.4	<0.10	-	-	
292181	AT1037	61 - 63.2	0.43	0.269	4.391	16.32

Notes: (A) - The EU criteria for Inert Material includes the provision that if S(S-2) is >0.1% but <1% with an NPR of >3, all other criteria being satisfied, the material can be considered Inert.
(B) – Indicated samples that were considered to not have potential to generate acid based on the sulphide sulfur content and NP was not analyzed.

III.2.1.3.1.8 Seepage:

The selected mining method does not promote seepage generation.

III.2.1.3.1.9 Change in the level of confidence in the mineral resource as the mining progresses;

The level of confidence in the mineral resource is not expected to change significantly as the mining progresses, which allows the conclusion that there will be no changes in the mineral composition of the ore.

III.2.1.3.1.10 Marginal and low grade mineralized inventory;

Temporary storage of grade ore is planned to be within approx. 10ha area. That low grade ore stockpile is planned to be located in the upper end of the IMWF.

III.2.1.3.1.11 Kinetic testwork:

The applied processing method does not require kinetic testing.

III.2.1.3.1.12 Particle size distribution

The Ada Tepe prospect can be classified as a low-sulphide epithermal deposit, which does not require granulometry testing of the payable components.

III.2.1.3.1.13 Surface water properties.

The major water body in the Ada Tepe area is Krimovitsa River – Category II receiving water. Completed testwork of water samples from the river show that the tested indicators are within the regulated limits (Appendix 3).

Storm water and potentially ground water to be generated within the minesite area will be collected in a sump situated in the open pit. Following decantation, the water collected in the sump will be pumped to the Raw and Process Water Reservoir. This water will be compliant with the regulated limits for Category II receiving water. Waste water discharge with the planned flow rate of up to 3 L/sec. is not expected to impact surface and ground water in the area.

III.2.1.3.2 Mining Waste Characterization

III.2.1.3.2.1 Daily/Annual Mining Rates and Total Tonnage

The mine rock and tailings tonnages that will be generated will depend on:

- tonnage put through the process plant;
- gold headgrades;

The mine plan currently being considered is presented in Table 11. The plan is based on varying annual production over a 8 year period.

Table 11 Production добив plan by year

1. Year	2. Total Rock Mined from Open Pit (kt)	3. Mineral Processing (kt)	4. Mine Rock to Waste Facility (kt)	5. Strip Ratio =(2)/(1) (t/t)
1	1820	850	970	1.14
2	2400	850	1550	1.82
3	2590	850	1740	2.05
4	2640	850	1790	2.10
5	2600	850	1740	2.05
6	3040	850	2190	2.58
7	3180	850	2330	2.74
8	3170	850	2320	2.73
9	760	440	320	0.73
TOTAL	22,200	7,240	14,950	2.07

III.2.1.3.2.2 Particle size distribution of solids; solid waste and suspended solids, pulp density (% of solids), solids density; stability/plasticity:

Flotation Waste (Tailings)

The tailings are composed of rock particles ground to an ultra-fine particle size distribution. The tailings are non-plastic, with low clay content and low shear strength when unconsolidated, but gain shear strength with consolidation.

Tailings were tested for grain size, specific gravity, shrinkage limit, soil water characteristic curve, consolidation and hydraulic conductivity and for shear strength by drained direct shear test . Tailings properties were as follows:

- Fine grained, with a d80 value (80% of particles have smaller grain size than d80) of near 30 microns.
- Non-plastic
- Shrinkage limit 25%.
- Specific gravity 2.74 t/m3;

III.2.1.3.2.3Liquid phase chemistry:

The planned construction method does not entail a supernatant pond at any construction stage. Drainage water to be generated at the Facility could be grouped as follows::

- o Drainage water generated by the tailings consolidation process. Part of that drainage water will be generated as tailings are settling as a result of their own weight and during consolidation under surcharge load conditions. Another, much smaller part will be retained in the tailings as interstitial non-saturated water.
- o Storm water infiltrated and drained through the drainage layers of the Facility and the waste rock.

The composition of that water will not impact the surface and ground water as it will be collected in the two sumps via a drainage system. Those sumps will be set up at the at the toe of the IMWF catchments (North and South). Water collected in the collection ponds is pumped to the Raw and Process Water Reservoir.

Eluate determinations according to BDS EN 12506 (Bulgarian State Standard) were conducted for mine rock and flotation tailings 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 are comparable to the usual conditions in place in similar waste facilities while higher ratios are comparable in processes which could take place in stored mine waste in case of storm water seepage and circulation. The analyzed eluate testwork parameters are substantially below the threshold 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 of non-hazardous grain material, which may be deemed non-hazardous waste).

Protocols of laboratory test results are included in Appendix 3.

III.2.1.3.2.4 Acid Generating Potential

Sulfur content analysis of process tailings was carried out by Eurotest Control. A protocol of the laboratory test results is included in Appendix 3.

Tailings samples were obtained by testing ore from both ore zones - Upper Zone and Wall Zone. Sulfide sulfur in both samples is below 0.1%, i.e. according to the Draft EU Regulation, this material has no acid generating potential. it is worth noting that sulfide sulfur content in the tailings is lower than the content in the ore and the waste rock. It is so because during the processing of ore, sulfide sulfur remains there and is extracted in the concentrate together with the gold. Arsenic and some of the metals associated with pyrite have similar behavior.

III.2.1.3.2.5Geochemical characterization (metal concentrations, seepage behavior):

The analysis of the NAG test and leaching test results (Eluate determinations 10l/kg) indicate that the pH of the waste rock and tailings sample is neutral to alkaline, pH values 6.68 and 8.15 respectively. Appendix 3 presents protocols with test results of waste rock and tailings samples.

As required by the local and EU legislation, waste mine rock and tailing samples were subjected to leaching testwork (eluate determinations according to BDS EN 12506 (Bulgarian State Standard) and applying the requirements of Order RD 988/29.12.06 of the Minister of Environment and Water. Conditions for determination of waste behavior when leaching, with high values of the liquids/solids ratio (L/S = 10L/kg). Test results are provided below and are compared against the requirements specified in Table 4 of Appendix 1 to Regulation 8 /24.08.2004 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 of non-hazardous grain material, which may be deemed non-hazardous waste). Leaching testwork (Eluate determinations - solution obtained at 10 l/kg) of mine waste proves that harmful substance levels in the eluate are below leaching threshold values of non-hazardous grain-type waste, which may be deemed non-hazardous waste according to Table 4, Appendix 1 to Regulation 8 /24.08.2004).

Leaching test results show that elements leach to insubstantial concentrations, i.e. their mobility is ate the minimum level, especially As, Sb, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ba. That confirms the exploration results, namely that most elements are present in the mineral composition of the waste (and ore respectively) and have inert properties. The data show that the concentration of microelements is very low compared to the threshold values of hazardous waste concentrations (Appendix 3 of Regulation 3/2004)

III.2.1.3.2.6 Interstitial water

Interstitial water content in the disposed tailings will be pressure-free. No permanent aquifer is expected to form, as the mine waste facility is designed in a manner allowing for improved water drainage.

III.2.1.3.2.7 Tailings Consolidation

Tailings consolidation process is shown in Appendix 5. Sensitivity analyses were also run to assess the the maximum thickness of tailings that can be placed in an undrained condition. Test results indicate that the outer berms constructed of waste rock may be deposed on undrained tailings layer, not more than 20m thick. The maximum lift intensity will occur during the initial period (first year)of the operation and will be about 10m per month. After the first year, the intensity rate of the raise will drop to approx. 2.5m per month, while at the end of the operations period it will be 1m per month. Cement may be added to speed up the consolidation process in the thickener before disposal to the IMWF.

The maximum lift height in the IMWF cells can be controlled by piezometers installed in the tailings to monitor pore water pressure and the progress of tailings consolidation. The deposition sequencing and sections where tailings and waste rock will be deposed may be controlled on the basis of the pore pressure monitoring in order to maintain the stability. Tailings consolidation rate may be increased by placement of extra drainage layers between the layers of tailings.

III.2.1.3.2.8 Mineralogical description;

The waste rock is classified as fresh (25%), oxidized (20%) and strongly oxidized (55%) depending on the weathering grade. Representative samples of waste rock were characterized by mineralogical studies as the results are presented in Table 12.

Table №12 Mineralogy of Mine Rock (% by weight)

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.

III.2.1.3.2.9 Surface water properties.

Krumovitsa River is the major River in the Ada Tepe prospect, Khan Krum Deposit. The water of Krumovitsa, at the three sampled points, is compliant with the regulated concentration limits applicable to Category II surface water. The water chemical assays for Kaldzhik Gully and Buyuk Gully are presented.

Appendix 3 provides protocols of chemical analyses of water samples.

III.2.1.4 Geotechnical characterization of waste rock and process tailings

III.2.1.4.1 Geotechnical stability parameters:

Waste mine rock will provide the overall stability of the IMWF. Tailings will be placed within cells constructed from mine rock. The external face of the facility will be mine rock that will improve overall stability of the structure and enable upslope deposition. As deposition advances, some of the confining cells are expected to be founded on tailings. In that respect, stability analysis was required to assess overall stability of the structure and to identify potential failure mechanisms.

Analysis Assumptions and Limitations

The IMWF will be constructed within the base of two small valleys, being operated as two footprints for four years, then as a single footprint until the end of operations. These small valleys will provide good confinement for the tailings and mine rock and the three-dimensional configuration will improve stability. In order to provide an understanding of the general stability of the structure the stability analyses considered a critical single cross section from the south deposition area. This section for nearly the maximum height of material on an area of near maximum foundation steepness. Due to the complexity of local topography and spatial distribution of the confining cells, only two-dimensional analyses have been carried out These analyses provide in-depth understanding of the factors that will control stability of the IMWF, but do not take into account the three-dimensional stabilizing effect of the local topography

The tailings have lower strength properties than the mine rock. Continuous layers of tailings within the outer berms of mine rock will be the critical case for stability and as such all material behind the external berm was modeled as tailings.. This neglects the stabilizing effect of the internal mine rock berms and is a conservative assumption for stability analysis.

A drain will be constructed along the valley bottom to collect infiltrating runoff and water expelled from the tailing during consolidation. The stability analyses assume that a phreatic surface will not develop in the IMWF.

Model Description

Stability analyses were performed using the commercially available limit equilibrium slope stability program SLOPE/W, applying the Morgenstern-Price Method of analysis. Information available for the stability assessment of the IMWF included laboratory testing results for consolidation and shear strength properties of the tailings carried out as part of this study. The section includes a typical slope angle for the outer berms of 2.5 horizontal: 1 vertical. Two scenarios were prepared as part of the analysis, with draied and undraine tailings:

- Scenario 1: All the tailings are fully drained and consolidated, representing the long-term condition of the IMWF after closure.
- Scenario 2: Uppermost tailings are undrained and lower portions of the tailings are drained and consolidated representing the condition near the end of the operating life of the IMWF.

Table 13 presents summarized strength data on the basement rock, mine rock and tailings which were used in the stability analysis.

Table 13 Material Properties for Stability Analysis

Material	Specific weight (kN/m^3)	Friction Angle (degrees)	Cohesion (kPa)
Basement (conglomerate)	18.2	33	8
Waste rock	19.5	40	0

Material	Specific weight (kN/m^3)	Friction Angle (degrees)	Cohesion (kPa)
Undrained tailings	19.1	Strength of (f) $Su=0,2\sigma_1$	0
Drained tailings	19.1	30	0

The undrained strength of the tailings was estimated from published information. The drained strength of the tailings was based on the results of the laboratory strength testing carried out as part of this study and on published information.

Earthquake induced seismic loads were incorporated in the pseudo-static analysis, which consists of conventional limit equilibrium static analysis completed with pseudo-static acceleration coefficients that act upon the critical failure mass. In common practice, a horizontal pseudo-static coefficient of one-half of the PGA, and a vertical coefficient equal to zero are used when seismic stability of slopes is evaluated not considering liquefaction. The peak ground acceleration was determined to be 0.013 g for the project area for a 1000-year return period. Therefore, a kh of 0.07 g was used as a horizontal seismic coefficient in the pseudo-static analysis.

Test

The results of the stability analysis run for the three scenarios described above under static and pseudo-static conditions are presented in Table 14.

Table 14 Factors of Safety obtained for the different scenarios modeled.

Scenario	FoS (Static)	FoS (Pseudo-Static)	Failure criteria
1	2.01	1.62	Complete
2	1.75	1.40	Top layer - trained and undrained tailings
2	1.35	1.01	Upper slope – undrained tailings only

Results of the stability analyses show that to construct a stable IMWF, the tailings must be allowed to drain and consolidate. A friction angle of approximately 20o is required to meet the requirement of a Factor of Safety of 1.3 for static conditions. Strength testing indicates that the tailings have a friction angle of 30o, so the facility will have stability exceeding the criteria.

Test results indicate that the outer rockfill berms should not be constructed over more than 20 meters of undrained tailings. The maximum rate of rise of the IMWF occurs at start-up of operations and will be about 10 meters in 1 month. After about 1 year of operation, the rate of rise is about 2.5 meters per month, and towards the end of the operating period, the rate of rise will 1 meter per month. After about 1 year of operation, the rate of rise is about 2.5 meters per month, and towards the end of the operating period, the rate of rise will 1 meter per month.

III.2.1.5 Geochemical characterization of the process tailings:

III.2.1.5.1 Evaluation of the mineralogical and chemical properties of the mining waste and the residuals remaining in the waste from the primary processing:

<u>Mineralogical Description:</u>

Quartz and aluminum silicates (which are inert) dominate in tailings. Major part of the sulphide minerals remain in the concentrate during the flotation process. All microelements associated with sulphide minerals as As, Pb, Zn, Cu, Cd also remain in the concentrate together with the Au AND Ag.

Table №15 Mineralogy of Tailings

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

A number of studies were carried out with ground ore samples from different sections in the deposit area. Table 16 presents microelements and their presence in the representative average sample and in the sample from the unoxidized zone.

Table 16 Analysis of microelements in tailings (slurry)

Element	**Unit**	***Average sample**	****Unoxidized sample**	**Earth crust**	**Soils**
Mo	**mg/kg**	82.26	94.36	1.5	2
Cu	**mg/kg**	69.7	61.83	55	2-100
Pb	**mg/kg**	5.75	4.13	12.5	2-200
Zn	**mg/kg**	45	24	70	10-300
Ag	**mg/kg**	0.6	0.828	0.07	0.1
Ni	**mg/kg**	478.2	572.2	75	5-500
Co	**mg/kg**	18.7	16.1	25	1-40
Mn	**mg/kg**	554	530	950	850
As	**mg/kg**	151.3	123.1	1.8	1-50
U	**mg/kg**	0.6	0.9	2.7	1
Au	**mg/kg**	0.156	0.216	0.004	-
Th	**mg/kg**	1.6	1	10	13
Sr	**mg/kg**	31.7	78.4	375	50-1000
Cd	**mg/kg**	0.04	0.03	0.2	1
Sb	**mg/kg**	4.45	2	0.2	5
Bi	**mg/kg**	0.11	0.06	0.17	-
V	**mg/kg**	41	38	135	20-500
La	**mg/kg**	7.3	5.2	30	-
Cr	**mg/kg**	967	1201	100	5-1000

Element	Unit	*Average sample	**Unoxidized sample	Earth crust	Soils
Ba	**mg/kg**	117.3	14.8	425	100-3000
Ti	**mg/kg**	40	20	5700	5000
B	**mg/kg**	1	1	10	2-100
W	**mg/kg**	1.9	1.4	1.5	-
Sc	**mg/kg**	3.6	3.2	16	-
Tl	**mg/kg**	0.25	0.11	0.45	0.1
Hg	**mg/kg**	0.01	0.045	0.08	0.03
Se	**mg/kg**	0.5	0.5	0.05	0.2
Te	**mg/kg**	0.26	0.38	0.001	-
Ga	**mg/kg**	0.7	0.7	15	15
Cs	**mg/kg**	0.77	0.54	3	6
Ge	**mg/kg**	<0.1	<0.1	1.5	1
Hf	**mg/kg**	<0.02	<0.02	3	-
Nb	**mg/kg**	0.16	0.21	20	-
Rb	**mg/kg**	5.7	2.5	90	20-500
Sn	**mg/kg**	0.7	0.8	2	10
Ta	**mg/kg**	<0.05	<0.05	2	-
Zr	**mg/kg**	0.3	0.2	165	300
Y	**mg/kg**	9.24	6.82	30	-
Ce	**mg/kg**	12.8	10.2	60	-
In	**mg/kg**	0.03	0.02	0.1	-
Re	**mg/kg**	0.005	0.009	0.0005	-
Be	**mg/kg**	1.8	1.2	2.8	6
Li	**mg/kg**	0.7	0.7	20	5-200
Pd	**mg/kg**	<0.01	<0.01	0.004	-
Pt	**mg/kg**	<0.002	0.002	0.002	-

Note:

*- tailings generated by processing of ore from all sections in the ore body;

*- tailings generated by processing of ore from unoxidized ore in the Wall Zone;

The mine rock composition has been compared against the average crustal abundance and it indicates that quartz content is above average while all other components are below average values.

The results of whole rock trace element analysis were compared against the average crustal abundance. Elevated values above the crustal average are: Mo, Ag, Au, Ni, As, Sb, Se, Te and Re, but their levels are not harmful to the environment.

Chemical properties

Summarized chemical composition of process tailings and mine rock is presented in Tables 17 and 18.

Table 17 Chemical composition of process tailings (flotation waste from pilot facility) – Eurotest Control EAD, 2010.

Parameter	**Unit**	**Wall zone sample**	**Wall zone sample**
Vanadium (V)	mg/kg	65	44
Chromium (Cr)	mg/kg	107	111
Cobalt (Co)	mg/kg	15	8
Nickel (Ni)	mg/kg	51	38
Copper (Cu)	mg/kg	35	23
Zinc (Zn)	mg/kg	46	30
Arsenic (As)	mg/kg	91	68
Molybdenum (Mo)	mg/kg	<3	<3
Cadmium (Cd)	mg/kg	1	1
Antimony (Sb)	mg/kg	22	12
Barium (Ba)	mg/kg	393	125
Lead (Pb)	mg/kg	7	11
Total organic carbon C (TOC)	%	0.18	0.42
Sulphur (as total S)	%	<0.005	<0.005
Sulphide sulphur (S^{2-})	%	<0.1	<0.1
Sulfates SO (SO_4^{2-})	%	-	
Tempering losses	%	2.55	6.77

Table 18 Chemical composition of mine rock – Eurotest Control, 2010.

Element	**Unit**	**Measured value (minimum and maximum, of 81 tested samples)**
Vanadium (V)	mg/kg	67 - 118
Chromium (Cr)	mg/kg	166 - 545
Cobalt (Co)	mg/kg	7 - 27
Nickel (Ni)	mg/kg	42 - 172
Copper (Cu)	mg/kg	20 - 42
Zinc (Zn)	mg/kg	40 - 81
Arsenic (As)	mg/kg	53 - 506
Molybdenum (Mo)	mg/kg	3 - 7

Cadmium (Cd)	mg/kg	1
Antimony (Sb)	mg/kg	<0.1
Barium (Ba)	mg/kg	28 - 453
Lead (Pb)	mg/kg	11 - 17
Total organic carbon (TOC)_	%	0.05 – 0.27
Sulphur (as total S)	%	<0.005 – 1.46
Sulphide sulphur (S^{2-})	%	<0.10 – 1.34
Sulfates SO (SO_4^{2-})	%	0 – 0.43
tempering losses	%	2.95 – 9.46

Mine Rock

The waste mine rock is categorized under art.12 of the Regulation on the Specific Requirements to Mining Waste Management (CoM Decree 17/ 27.01.2009, SG 10/6.02.2009), effective 6.02.2009) as follows:

- Pursuant to art -12, par.1: mining waste type is classified with a code and name, according to Resolution 2001/118/EC dated January 16, 2001, which replaces Resolution 94/3/EC and defines a list of waste types in compliance with art. 1, "a" of Directive 75/442/EEC by the Waste Issues Council and Resolution 94/904/EC which determines a list of hazardous waste types in compliance with art. 1, par. 4 of Directive 91/689/EEC on hazardous waste: ***waste generated by excavation of metalliferous minerals, Code 01 01 01;***
- Pursuant to art -12, par.2 - Mining waste may not be classified as unpolluted soils in case they meet [the criteria set in] § 1, Item 1 of the Additional Provisions of the Act on Soils and Noxious Content in Soils and the limits set by Regulation 3 of 2008 on the regulated limits for noxious substances in soils (SG 71/2008).
- Pursuant to art 12, par.3 - Mining waste may not be classified as inert waste as it does not meet the following criteria :
  - Item 2 - contains sulfide sulfur whose concentration exceeds 0.1 per cent;
  - Item 3 - the coefficient calculated as a ratio between the neutralizing potential and the acid potential, determined as a result of static tests under prEN 15875 is lower than 1 (NPR <1), i.e. there is no neutralization capacity in place for the released acidity and therefore the waste is acid generating);

Waste rock does not contain any elements which are harmful to the human health and the environment, especially As, Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb, V and Zn, including such content as part of the fine waste particles, whose volume exceeds the limits set in the Regulation on the Terms and Conditions for Classification, Packaging and Labeling of Chemical Substances and Preparations approved by CoM Decree No 316 of 2002 (promulgated in SG 5 /2003, amended in SG 66/2004), 50 and 57/2000, issue 20/2007, and 4 and 51 of 2008, (Appendix 3);

Waste rock does not contain any substances which are potentially hazardous for the human health and the environment, in particular As, Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb, V and Zn, including such content as part of the fine waste particles, whose volume exceeds the threshold values set in Appendix 3 to

Regulation 3 of 2004 on Waste Types Classification (SG 44/2004), namely Toxic (T) elements chrome, nickel, zinc, cadmium, lead, arsenic are of 0.13% total concentration, i.e. < 3% (concentration, which could make it hazardous); highly toxic (T+) – mercury 0.0001% - < 0.1%; harmful (Xn) – cobalt, nickel, copper, zinc, molybdenum, antimony, barium and lead of 0.13% - <25% total concentration; and hazardous/noxious to the environment (N) – lead and chrome of 0.052% total concentration. ***(Appendix 3);***

Waste rock does not contain any substances or products which are involved in the ore mining or primary processing, which may impact the community health and safety and the environment.

Pursuant to art.12, par.4 - Mining waste is classified as **non-hazardous, non-inert** of Regulation 3, 2004 on the waste classification - classified as 01.01.01. Waste from mining and excavation of metalliferous minerals (mine rock);

Flotation Waste (Tailings)

Waste mine rock is classified pursuant to art.12 of the Regulation on the Specific Requirements to Mining Waste Management (CoM Decree 17/ 27.01.2009, SG 10/6.02.2009), effective 6.02.2009) as follows:

Pursuant to art -12, par.1: mining waste type shall be classified with a code and name, according to Resolution 2001/118/EC dated January 16, 2001 which is a revision of Resolution 2000/532/EC of May 2000 and defines a list of waste types in compliance with art. 1, "a" of Directive 75/442/EEC by the Waste Issues Council and Resolution 94/904/EC which determines a list of hazardous waste types in compliance with art. 1, par. 4 of Directive 91/689/EEC on hazardous waste: ***Waste other than that specified in 01 03 04 and 01 03 05, Code 01 01 06;***

- Pursuant to art -12, par.2 - Mining waste may not be classified as unpolluted soil in case it does not meet [the criteria set in] § 1, Item 1 of the Additional Provisions of the Act on Soils and Noxious Content in Soils and the limits set by Regulation 3 of 2008 on the regulated limits for noxious substances in soils (SG 71/2008).

Tailings do not contain any elements which are hazardous to the human health and the environment, especially As, Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb, V and Zn, including such content as part of the fine waste particles, whose volume exceeds the limits set in the Regulation on the Terms and Conditions for Classification, Packaging and Labeling of Chemical Substances and Preparations approved by CoM Decree No 316 of 2002 (promulgated in SG 5 /2003, amended in SG 66/2004), 50 and 57/2000, issue 20/2007, and 4 and 51 of 2008, (Appendix 3);

Tailings do not contain any substances which are potentially hazardous for the human health and the environment, in particular As, Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb, V and Zn, including such content as part of the fine waste particles, whose volume exceeds the threshold values set in Appendix 3 to Regulation 3 of 2004 on Waste Types Classification (SG 44/2004), namely Toxic (T) elements - chrome, nickel, zinc, cadmium, lead, arsenic are of 03% total concentration, i.e. < 3% (concentration, which could make it hazardous); highly toxic (T+) – mercury 0.0001% - < 0.1%; harmful (Xn) – cobalt, nickel, copper, zinc, molybdenum, antimony, barium and lead of 059% - <25% total concentration; and hazardous/noxious to the environment (N) – lead and chrome of 012 % total concentration. ***(Appendix 3);***

Tailings do not contain any substances or products which are involved in the ore mining or primary processing, which may impact the community health and safety and the environment. The requirements of Regulation 3/2004 were applied to calculate the summed up concentration of substances in the waste, which demonstrate the same hazardous properties and that value was compared against the one specified in **Appendix 3** - Threshold concentration values of hazardous substances. The worst scenario was assumed for assessment purposes, i.e. that they have or bring about hazardous properties. The sum of residual concentrations of reagents was calculated with the worst scenario assumption namely that all reagents will remain in the waste – xanthate (irritant – 0.004%), copper sulphate (irritant -0.003%) and dithiophosphate (irritant – 0.0006%). The total amount of reagents which are to be disposed in the IMWF is 0.0076%, at threshold value of H4-20% and of H5 – 25%.

Pursuant to art.12, par.4 - Mining waste is classified as **non-hazardous, non-inert** of Regulation 3, 2004 on the waste classification - classified as 01.01.03.

III.2.1.5.2 Estimation of the potential for drainage and seepage of substances and chemicals which have a negative impact on the environment and the public health and safety on the basis of:

III.2.1.5.2.1 Evaluation of metals, oxyanion and salt leachability over time by pH dependence leaching test, and/or percolation test and/or other suitable testing;

Due to the specifics of the geological composition of the ore and the ore processing method and use of reagents, the ARD potential of the rock is of a key importance for the chemical/geochemical and mine waste stability. The ARD potential is discussed in detail in Items III.2.1.3.1.7, III.2.1.3.2.4 and III.2.1.3.2.5

Tailings and mine rock leaching test

Leaching testwork (Eluate determinations - solution obtained at 10 l/kg) of tailings samples proves that samples meet the requirements specified in Table 4 in Appendix 1 to Regulation 8 /24.08.2004 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 of granular non-hazardous wastes that may be disposed of in non-hazardous waste facilities) Appendix 7.

Leaching test results show that elements leach to insubstantial concentrations, i.e. their mobility is ate the minimum level, especially As, Sb, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ba. That confirms the exploration results, namely that most elements are present in the mineral composition of the waste (and ore respectively) and have inert properties. The data show that the concentration of microelements is very low compared to the threshold values of hazardous waste concentrations (Appendix 3 of Regulation 3/2004).
Protocols of laboratory test results are included in Appendix 2.

III.2.1.5.2.2 Anticipated changes during mining waste delivery and storage from any external influence and evaluation of their impact on the environment and public the health and safety, and the stability of the facility.

Waste haulage will be supported by:

- Heavy trucks (for mine rock);
- Tailings delivery pipeline (for thickened tailings);

No changes are anticipated in the mine waste haulage and disposal method. That waste is inert and no impact on human health and the environment is expected.

Section B. Information required for characterization of the waste under Section A is obtained from:

1. Exploration reports covering the deposit or individual areas of the deposit;

2. Existing geological and technical documentation prepared by prospecting and exploration permit holders and or by the concessionaires as part of the exploration and mining activities;

3. Existing local and EU standards applicable to mine waste characterization and testing;

4. Existing rock classification;

5. Issued permits which contain information under par. 1.

In case of insufficient or unavailable information, the operator shall arrange for mining waste testing in compliance with the standards applicable to sampling and testing as specified in Order No 988 of the Minister of Environment and Water dated December 29, 2006.

III.3 Description of operations which generate mine waste

III.3.1 Waste Rock

Mine rock will be generated from the overburden removal to access the orebody. That rock contains precious metals of negligible economic value. That rock must be removed in a manner which would ensure 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 anticipated volume of mine rock to be generated over the life of the Ada Tepe operation, is approx. 15 Mt. The mine rock will be disposed in IMWF.

- **Under Regulation 3/2004 on Waste Classification;**

Main waste to be generated by mining operations is mine rock (010102). The waste classification is based on tits mineral composition, data from the Geological Report and laboratory tests.

Table 19 Mine rock classification

Name	**Code under Regulation 3/2004**
Waste from mining and excavation of metalliferous minerals (mine rock);	01 01 01

- **Under Resolution 2001/118/EC**

Table 20 Mine rock classification under the EC Resolution

Name	**Under Resolution 2001/118/EC**
Waste from excavation of metalliferous minerals	01 01 01

- **Regulation on the Specific Requirements to Mining Waste Management**

Mine rock is classified under art.12 of the Regulation on the Specific Requirements to Mining Waste Management. The mine rock from Ada Tepe will comprise waste rock generated by gold ore mining.

The mine rock does not contain harmful or potentially harmful elements which may impact human health or the environment and cannot be classified as *hazardous* under art. 6 of Regulation 3 / 2004 on the waste classification.

10% of mine rock sampled contain sulphide sulfur of more than 1% and do not meet the requirements of art.12, par. 2 and par. 3 of the Regulation on the Specific Requirements to Mining Waste Management. Therefore they are classified as **"non-hazardous non-inert waste".**

III.3.2 Flotation Waste (Tailings)

Tailings generation is discussed in detail in Item III.2.1.2.6. Table 5 provides the cost range of all reagents to be used in the gold concentrate processing and production. Appendix 7 provides Material Safety Data Sheets of chemical substances and reagents to be used.

Ore processing (flotation), as part of gold concentrate production, does not change the chemical composition of the ore, which is evident from the mineralogical profile of the waste slurry (tailings) Presented in Table 15.

Quartz, aluminum silicates are approx. 80 - 95% of tailings and are completely inert, and therefore very stable. Carbonate minerals are approx. 5%. Results of whole rock trace element analysis were compared against the average crustal abundance and are presented in Table 16. The identified elevated values above the crustal average are: Mo, Ag, Au, Ni, As, Sb, Se, Te and Re, but their levels are not harmful to the environment.

As required by the local and EU legislation, tailing samples were subjected to leaching testwork (eluate determinations according to BDS EN 12506 (Bulgarian State Standard) and applying the requirements of Order RD 988/29.12.06 of the Minister of Environment and Water. According to that Order, conditions have been selected to determine the leaching behavior of tailings. Leaching testwork was carried out for the purpose of identifying the mobility of different metals when leaching agent is applied on the waste. Those tests were carried out by an accredited laboratories, Eurotest Control AD and SGS Canada, and test results are presented in Appendix 2 and Appendix 4.

Using Regulation 3/2004, the MSDS data and physical and chemical transformations as part of the technological flow of the chemical substances to be used, it was established that:

- **Potassium amyl xanthate** (Potassium O-pentyl dithiocarbonate) is 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 process as a 5% solution. The tailings will be thickened in the process plant and the thickener overflow will be recycled back into the process. The reagent will be added at the flotation stage in a concentration of 0.004%. Therefore the xanthate will not be present in the thickened tailings or if present, the concentration will be insubstantial.
- ***Copper sulphate*** ($CuSO_4.5H_2O$, bluestone, R36, R38), if present in waste in concentrations greater than 20%, it makes the waste exhibit a hazardous property – irritant (H4). The solution of this reagent is envisaged to be 20% and it will be fed into the process upstream of

the grinding stage in the semi autogenous mill It will be present in the ground material in 0.003% concentration, as the copper sulphate decomposes in water environment). 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. Experimental data and chemical analyses of tailings confirmed that its concentration in the tailings is low. (See Appendix 2 and Appendix 4 of Eurotest Control EAD);

- ***Dithiophosphate*** - Tailings could have hazardous properties - "irritant"- (H4), if the concentration is higher than 20%, which is impossible as that is the initial concentration of the solution. At the flotation stage where the dithiophosphate level should be highest, the value is 0.0006%.

The requirements of Regulation 3/2004 were applied to calculate the summed up concentration of substances in the waste, which demonstrate the same hazardous properties and that value was compared against the one specified in **Appendix 3 -** Threshold concentration values of hazardous substances. The worst scenario was assumed for assessment purposes, i.e. that they have or bring about hazardous properties. The sum of residual concentrations of reagents was calculated with the worst scenario assumption namely that all reagents will remain in the waste – xanthate (irritant – 0.004%), copper sulphate (irritant -0.003%) and dithiophosphate (irritant – 0.0006%), as they will be disposed to the IMWF at 0.0076% while the marginal value for H4 is 20% and for H5 is 25%.

In terms of other microelements in the mineral compounds, i.e. they are inert and have no hazardous properties.

In the worst case, is we assume that the present As, Ni, Cd are in forms which coild be deemed "highly toxic", then their concentration is 0,068%, at threshold value higher or equalt ot 0.1% ((the level which could make it hazardous).

- **<u>Under Regulation 3/2004 on Waste Classification;</u>**

Table 21

Name	**Code under Regulation 3/2004**
Tailings other than those mentioned in 01 03 04 and 01 03 05	01 03 06

- **<u>Under Resolution 2001/118/EC</u>**

Table 22

Name	**Under Resolution 2001/118/EC**
Residues other than those mentioned in 01 03 04 and 01 03 05	01 03 06

- **<u>Regulation on the Specific Requirements to Mining Waste Management</u>**

Mine rock is classified under art.12 of the Regulation on the Specific Requirements to Mining Waste Management. Tailings comprise waste from gold ore processing.

Tailings do not contain harmful or potentially harmful elements which may impact human health or the environment and cannot be classified as *hazardous* under art. 6 of Regulation 3 / 2004 on the waste classification.

(2) Tailings do not meet the requirements of § 1, Item 1 of the Additional Provisions of the Act on Soils and Noxious Content in Soils and the limits set by Regulation 3 of 2008 on the regulated limits for noxious substances in soils (SG 71 /2008) and cannot be classified as "unpolluted soils" due to the high concentrations of As and Ni.

Therefore, process waste (tailings) generated by processing of gold from the Ada Tepe prospect, Khan Krum deposit is classified according to art.12, par.5 of the Regulation on the Specific Requirements to Mining Waste Management as "**non-hazardous, non-inert**" waste.

III.4 Potential environmental risks and preventive measures, including water, air and soil pollution prevention

There is a limited number of potential environmental risks and they could be generally presented as:

- Soil impact risk – the humus layer in the bottom of the IMWF is insubstantial and planed for complete removal before the start of the construction. Soils will be stored for later use as part of the rehabilitation but they contain arsenic and heavy metals in elevated concentrations. Soils will be disposed in a designated stockpile which will be grassed. The vegetation in place preserves the soil quality and protects it against wind erosion and dust pollution.. Soils will be used only for forest land rehabilitation after closure.
- Seepage water – the risk of impact on seepage water in the terrain is evaluated as insignificant. Interstitial water is not evaluated as hazardous as that water is not expected to contain any harmful substances. The design includes a drainage system for the IMWF which will entirely collect the drainage water convey it to water collecting sumps. The system is sized for the maximum expected flow rate and allows for sufficient drainage water control. The ground water and drainage water quality will be monitored after closure as well. Monitoring results will allow for evaluation of the system's condition.
- Stability problems with the IMWF during the operation stage and after closure – the gradual rise of the IMWF will be carried out with constant monitoring of stress values via piesometers installed at each rise stage. In case increased stress values are observed or insufficient drainage of tailings layers, deposition in a given area of the IMWF will be suspended and allow tailings to drain. The IMWF is designed with a capacity allowing for disposal of tailings generated within several weeks. That will completely rule out the stability hazard. No stability issues are anticipated after closure, as the facility is sized according to the requirements under static and pseudo-static conditions.
- Extended periods of wet weather may cause issues as a result of wetter than expected tailings in the active cell.. The following actions are planned: placing non-woven geotextiles over thinner layers of tailings to provide additional drainage and reinforcement and improve traffic ability for the operating equipment, potentially mixing cement into the tailings, either in a mixer at the dewatering plant or in the active cell using soil-cement technology, installing

synthetic horizontal drains within the tailings to improve drainage and consolidation, and using geotubes to contain the tailings.

- Dust emissions to ambient air - tailings are fine grained and will be prone to dusting if allowed to dry and exposed to wind or agitation. Control of dusting is accomplished by maintaining tailings in a saturated or partly saturated condition, and by covering with mine rock 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. Phased out vegetation of the IMWF walls is included in the plan.
- Issues which may arise as a result of seasonal fluctuations of Krumovitsa water level - Such issues are evaluated as insubstantial, as the lowest level of the IMWF which corresponds to the level of the drainage sumps in the toe of the facility is 10m above the highest registered level. Sumps are designed with reinforcement and safeguards.

III.5 Proposed monitoring and control procedures

The production and disposal processes inevitably involve interruptions due to breakdowns or planned preventive maintenance (PPM). the Company will develop operating instructions to maintain the technological processes of the IMWF, process plant, open pit and their supporting facilities which will contain a separate section to describe the staff actions in case of short and longer shutdown periods. Those instructions will place special focus on personnel actions associated with IMWF safety measures to be undertaken during emergency shutdowns, primarily measures for the tailings pipeline. An Emergency Response Plan will be developed for the IMWF and will be updated every year.

Table 23 defines monitoring types for each environmental component close to the site. The exact number and location of monitoring pints will be determined prior to commissioning of the site and following consultations with the competent authorities.

Table 23 Environmental Media Monitoring System

Components	Methods	Location of points	Sampling frequency
Surface water quality	Manual sampling and analysis	Stations on surface watercourses	Monthly/continuous
Groundwater	Manual sampling and analysis	Piezometer network	4 times per annum
Air quality (dust)	Dust meters (sediment dust)	Dust monitoring network (ambient air)	daily
Emissions	Manual sampling and analysis	Dust and gas monitoring network	annual
Soils	Mechanical sampling	Monitoring stations within and out of the site	annual
Biological monitoring	Monitoring of habitats and protected species /reporting of any changes which may have occurred in the	Habitats in the East Rhodopes Protected Area	Biyearly

Components	Methods	Location of points	Sampling frequency
	monitored flora and fauna.		
Archeology	Maintenance of liaison with archaeological authorities concerning any finds, for recording and preservation	Areas of direct impact	Continuous
Noise and vibrations	Noise and vibration monitoring	Selected stations between source and receptors	Continuous for vibrations/ scheduled for noise

III.5.1 Preventive program against any worsening of the water and soil condition beyond the regulated limits including:

III.5.1.1 Evaluation of the seepage potential, including pollutants in the seepage which are generated by the stored waste, both during the operation phase and the post-closure phase of the facility;

Drainage system Seepage to ground water

Seepage of drainage water to ground water is evaluated as insubstantial. Water will naturally drain towards the two walls and will be collected in the IMWF drainage system. The underdrain design flow is the combination of water released from the tailings placed in the IMWF and flow resulting from precipitation events

The estimated flow of water released from the tailings was based on the annual average deposition rate assuming tailings deposition at solid contents of 56% The watershed flow is estimated based on watershed area.

The estimated flow from precipitation events was based on the 24 hour precipitation events. The total water flow of each was assumed to report to the underdrain system at a constant rate over the 24 hours with no losses (the most conservative scenario). The total design flow including the water released from tailing and the flow from the precipitation event is summarized for each watershed in Table 24.

Table 24 Design flow rate of the watershed

ReturnPeriod(years)	Watershed Areas - Underdrain Design Flow (L/s)	
	North Catchment	South Catchment
	Tailings Solids Content 56%	Tailings Solids Content 56%
10	205	330
20	233	375
50	272	437
100	303	487

The underdrain system will be composed of a combined perforated HDPE pipe and rock drain system. The pipe and rock drain components of the underdrain system are both sized to convey the 10 year return period design flow and the complete underdrain system is sized to convey the 100 year return period design flow.

The underdrain system is sized for the IMWF when fully developed at the end of mine life (the last year of operation). The capacity of the pipes was estimated under gravity flow conditions using Manning's equation with a ratio of flow depth to pipe diameter of 0.8 and a Manning's roughness coefficient of 0.013. The required pipe sizes are summarized in Table 5-5. The minimum design pipe size is assumed to be 200 mm in diameter.

The rock drain component of the underdrain system is sized to convey the 10 year return period design flow. The rock drains along the centerline of the existing drainage courses are sized to convey the complete watershed area design flow and the branches are sized to convey the portion of the total watershed area design that would report to each branch.

The required cross sectional area of the rock drain is based on the Wilkins (1956) method assuming a median rock diameter of 300 mm, 200 mm, and 150 mm.

III.5.1.2 Water Balance Model

The operation of the IMWF and the activities associated with it do not require water use as a resource or as a raw material.
In terms of water flows, the discussed IMWF will collect three flows:

- Water released from thickened tailings, 56% solids content delivered as slurry for deposition into the IMWF;
- Water from precipitation events (storm water) reporting to the IMWF and its water retention pond. It is important to note that the water retention pond of the IMWF is very limited and practically identical with the surface area of the IMWF;
- Water from precipitation events (storm water) which runs off at the process plant site. That flow runs naturally to the south wall of the IMWF.

Water flow which reports to the IMWF as part of the thickened tailings is negligible compared to precipitations during extreme storm events.

Underdrain water is generated by tailings consolidation. Underdrain and precipitation water is conveyed to collection sumps through the underdrain system built along the toe of each slope. The water is relatively clear, without pollutants, and is pumped to the Process Water Reservoir. The Process Water Reservoir also retains mine water and runoff water from the different sites.

The return water is sent back to production or discharged in the environment. Appendix 6 presents the IMWF Water Balance and water management.

III.5.1.3 Development of plans and implementation of measures to prevent or minimize any seepage formation and water and soils pollution;

Seepage of drainage water to ground water is evaluated as negligible.

III.5.1.4 Development of and implementation of measures to ensure containment of any seepage and treatment of polluted water;

Seepage of drainage water to ground water is evaluated as negligible.

III.5.1.5 Monitoring

Water monitoring

The monitoring network of the IMWF-associated water flows will consist of:

- ongoing monitoring of underdrain water volume which will return back to production – 2 points (water meters) and weekly monitoring of water quality;
- measurement of the ground water level – by designated monitoring boreholes located downstream and upstream the IMWF (minimum 3 boreholes);
- monitoring of ground water quality at 3 points;
- monitoring of Kumovitsa water quality – minimum 2 points (before and after the IMWF) – monthly;

Both by a contracted (accredited) laboratory and in-house.

Monitoring indicators and sampling frequency are detailed in a Sampling Plan developed in compliance with Standard EN 14899, pursuant to EC Resolution of April 30, 2009 (2009/360/EO) and Monitoring Plan (Appendix 9); The Monitoring Plan will be developed before IMWF commissioning and submitted to the respective authorities for approval.

Soil monitoring

Permanent soil monitoring points will be determined once the detailed designs are completed and the IMWF and sites' and boundaries are defined. In any case, at least 2 monitoring points will be situated within the minesite areas, as well as points close to the IMWF. The exact number of those points will be determined in the Monitoring Program document. Heavy metals will be imperatively analyzed before the IMWF commissioning as there is background pollution in place.

III.5.2 Air Pollution Prevention Program including:

III.5.2.1 assessment of potential dust and gas emissions

Considering the nature of the IMWF which is to retain flotation tailings, the impact on the ambient air in the considered area will comprise primarily fugitive dust and gas emissions. There will be no sources of non-fugitive dust and gas emissions.
The IMWF may be a source of dust emissions generated by the haulage and disposal of mine rock. Thickened tailings are sufficiently wet, which is going to prevent dust generation from the cells where they will be disposed.

III.5.2.2 Development of plans and implementation of measures to ensure prevention or minimization of any of dust and gas emissions;

As a preventive measure against dust pollution of the minesite area, technical and biological rehabilitation is planned of the IMWF walls. The rehabilitation will be phased out as the IMWF operation advances and that will limit the dust emissions and potential erosion of the berms.

The IMWF is situated in ravines which are fully occupied by trees. It is a positive factor that the lower end of the ravines (close to Krumovitsa River) is vegetated with deciduous trees (oak). A green belt will be kept to the maximum extent possible, to act a buffer area and a natural protective screen of potential dust emissions.

Monitoring will be carried out during the IMWF construction and operation stages, including:

Weather monitoring - according to the regulatory requirements, industrial operations must have a system in place to monitor the impact on environmental components. The weather monitoring is an integral component of that system, as the ambient air is the media where gas and dust emissions disperse. The conditions for that dispersion depend on the specific weather parameters which requires awareness of those parameters at all times. A weather monitoring module will be purchased to monitor the local parameters as temperature, wind speed and direction, precipitations and barometric pressure.

Ambient air monitoring – will monitored in the adjacent villages – Kupel, Sinap, Chobanka 1 and 2, and Pobeda. The monitoring will include fine dust particles (PM10) at those villages and around the IMWF with the support of dust meters. Sediment dust meters will be installed to measure sediment dust.

In addition to the in-house monitoring, ambient air will be monitored by an independent contractor (accredited laboratory) at leas twice per year.

III.6 TMF Closure Plan

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. This approach to the planning of mining operations highlights the fact that mining involves temporary use of land, and also that appropriate closure is congruent with the sustainable development of mineral resources.

The essential purpose of the Closure Plan is to ensure that potential environmental impact is identified in terms of the closed mine and processing facilities (together with any financial and legal commitments made) at an earlier stage, as well as minimization of such impact through actions during the design preparation process and for the lifetime of the mine.

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 applicable practices and requirements set in the following documents:

- *Regulation No 26 on the Reclamation of Disturbed Areas*, SG 89/22.10.1996
- *Comparative document on Management of Tailings Storage Facilities and Rock Dumps* , 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 lands, acceptable for the mine operator and the controlling authorities;
- Protection of public health and safety;
- Mitigation or elimination of environmental damages and provision 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 aftercare 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 Krumovgrad operation for the minesite and disturbed land will follow these principles and approaches. It is based on individual key components of the Overall Project:

- Open pit and relevant surface-based mining facilities.
- Ore processing facility (process plant);
- IMWMF.
- 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. That would allow for a relatively long-term monitoring of rehabilitated areas and potentially, 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.

IV. REGULATORY REQUIREMENTS

- Underground Resources Act (prom. in SG, issue 23/1999).
- Regulation on the Specific Requirements to Mine Waste Management (SG 10/6.02.2009, effective 6.02.2009).
- Order 988 of the Minister of Environment and Water dated December 29, 2006;
- Open-Pit Mining Safety Code, approved by the Minister of Labor and Social Policy in 1996 (not promulgated).

V. REPORTING

Pursuant to art. 22 c of the URA, the Concessionee shall, on an annual basis and by 31st March, report the performance of the mining waste management plan to the Minister of the Environment and Waters including tonnage and composition of the deposited mining wastes, and the results and findings from the ongoing in-house monitoring.

In connection with the implementation of the Monitoring Program, the Company will prepare annual reports of the local water monitoring for the Khan Krum area and will submit them to the Haskovo Regional Environmental Inspection, and reports on compliance with the requirements of the effective water use and water body use permits to the Basin department in Plovdiv.

VI. RECORDS

Pursuant to art. 26, par. 1,2,3 and 4 of the Regulation on the Specific Requirements to Mining Waste Management, the Company will keep all documentation on the mine waste management and will make it available for inspection to the competent authorities upon their request and shall hand over that documentation in case the operator is replaced and will archive that documentation about the IMWF at the respective local departments of the state archives in compliance with the Act on the National Archive.

All data (including reports) will be archived with the respective Company departments, in a soft and hard copy.