

REQUEST FOR EXPRESSIONS OF INTEREST (REOI)

CONSULTANT’S QUALIFICATIONS BASED SELECTION (CQS)

Name of Project	Just Transition in Select Coal Regions of Bosnia and Herzegovina
Loan No.	IBRD-98010
Assignment Title	Consultancy service for design of Comprehensive mine closure plan by international standard
Procurement Plan Ref Number	BA-FBIH-JCT-CS-CQS-26-2.2.4
Country of Delivery	Bosnia and Herzegovina

The Federal Ministry of Energy, Mining and Industry (FMERI) has received financing from the World Bank toward the cost of the Just Transition in Select Coal Regions of Bosnia and Herzegovina Project and intends to apply part of the proceeds for the following consulting services.

Federal Ministry of Energy, Mining and Industry (FMERI) is seeking to appoint a consultancy company to support the Federal Ministry of Energy, Mining and Industry (FMERI), Zenica coal mine (RMU Zenica) and the utility company Elektroprivreda BiH (EPBiH) in closing the underground mine Raspotočje. This consultancy supports the preparation and implementation of priority mine closure measures, including removal of the underground mining equipment and ground stabilization, mine water management, the environmental remediation of surface facilities, and strengthening institutional capacity for safe and environmentally sound closure, in support of a responsible and orderly mine closure process. The services are expected to start at December 2026 and to be finalized until the end of March 2027.

The detailed Terms of Reference (TOR) for the assignment can be found at the following website: <https://fmeri.gov.ba/project-implementation-unit/>

The Federal Ministry of Energy, Mining and Industry (FMERI) now invites eligible consulting firms (“Consultants”) to indicate their interest in providing the Services. Interested Consultants should provide information demonstrating that they have the required qualifications and relevant experience to perform the Services.

The attention of interested Consultants is drawn to paragraph 3.14, 3.16 and 3.17 of the World Bank’s Procurement Regulations for IPF Borrowers [dated September 2023] (“the Regulations”), setting forth the World Bank’s policy on conflict of interest.

The best qualified firm to carry out the services will be selected in accordance with the Consultant's Qualifications Based Selection (CQS) method set out in the Regulations and based on the following criteria:

1. Core business and years in business 30%;
2. Qualifications in the field of the assignment 60%;
3. Technical and managerial organization of the firm and availability of key staff within the firm 10%;

CVs of Key Experts will not be evaluated in evaluation of expressions of interest.

Further information can be obtained at the address below during office hours 09:00 to 14:00 hours.

Expressions of interest must be delivered in a written form to the address below (in person, or by mail, or by e-mail) by 29/10/2026

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Terms of Reference: Mine Closure Consultancy Services

Project: Technical Support for the Closure of the Raspotočje Underground Coal Mine

Location: Zenica, Federation of Bosnia and Herzegovina (BiH)

Client: The World Bank Group (WBG)

1. Introduction.....	4
2. Background information.....	4
2.1 Geology	5
2.2 Deposit tectonics.....	8
2.3 Hydrogeological characteristics of the deposit	10
2.4 Methods of excavation used in the mine.....	12
2.5 Existing drainage conditions	13
3. Objectives of the assignment.....	13
4. Implementing Body	13
5. Initial Assessment and available information	13
6. Scope of work	16
6.1 Integrated Technical Assessment and Numerical Model	16
6.2 Methane monitoring, capture and management	18
6.3 Four-Dimensional longterm monitoring and maintenance plan	19
6.4 Scope exclusions	19
6.5 Deliverables	20
6.6 Guiding principles.....	20
7. Consultant qualifications	20
7.1 Consultant team.....	21
7.2 Consultant support team	21
8. Project duration	21

1. Introduction

The government of Bosnia and Herzegovina (BiH) is undertaking a phased approach to coal sector transition through the planning and closure of several open and underground mines in the Federation of BiH. The World Bank Group (WBG) is supporting some of the government's mine closure plans through an investment lending operation (IPF), focused on managing the environmental, social and economic impacts of mine closure and supporting a just transition in the affected regions.

One mine supported under the IPF project is Raspotočje mine in Zenica, an underground brown coal mine at the end of its life cycle, which ceased production in 2024 and remains under care and maintenance since then. The mine consists of multiple underground workings and surface facilities and is associated with ongoing environmental, safety, and water management liabilities typical of underground coal operations, including mine water pumping, ground stability risks, and the management of legacy infrastructure.

The IPF project will specifically support the preparation and implementation of priority mine closure measures, including removal of the underground mining equipment and ground stabilization, mine water management, the environmental remediation of surface facilities, and strengthening institutional capacity for safe and environmentally sound closure, in support of a responsible and orderly mine closure process.

Closing an underground coal mine requires careful study. From a technical mine perspective, there are a range of environmental considerations to be made with respect to water, soil and air quality in addition to geotechnical stability. In addition, WBG's Environmental and Social Framework (ESF) further sets out a range of obligations to meet specific safeguard standards¹.

2. Background information

The Raspotočje Coal Mine is a brown coal mine located in Zenica, Zenica-Doboj Canton (Raspotočje, Federation of Bosnia and Herzegovina, Bosnia and Herzegovina).

In Zenica area there are three small underground mines: Stara jama, Raspotočje and Stranjani. RMU Zenica which is owned by Elektroprivreda BiH (EPBiH) operates these mines. Coal from the mines was used to supply the Kakanj Thermal Power Plant.

The mining company had coal reserves amounting to 179 million tonnes of lignite in 2008 and a production capacity of 0.25 million tonnes of coal in 2023.

The company's website states that, from 1983 onwards, the chamber mining method is used as no significant investments were made in the company to regain the wide-faced method. Coal production in the last five years amounted to 0.32 million tonnes per year on average.

¹ <https://www.worldbank.org/en/projects-operations/environmental-and-social-framework>

Production at the Stranjani pit was suspended in 2019 and in June 2020, the Stranjani pit was officially closed. In 2023, Stara jama pit closed and in 2024 Raspotočje pit.

The deposit is bordered on the north by the Bosna River, the Šamac–Sarajevo railway line, and the Sarajevo–Zenica section of the Corridor Vc highway, while in the southern part of the exploitation field hills rise (Janjički Vrh, Zvečaj, etc.).

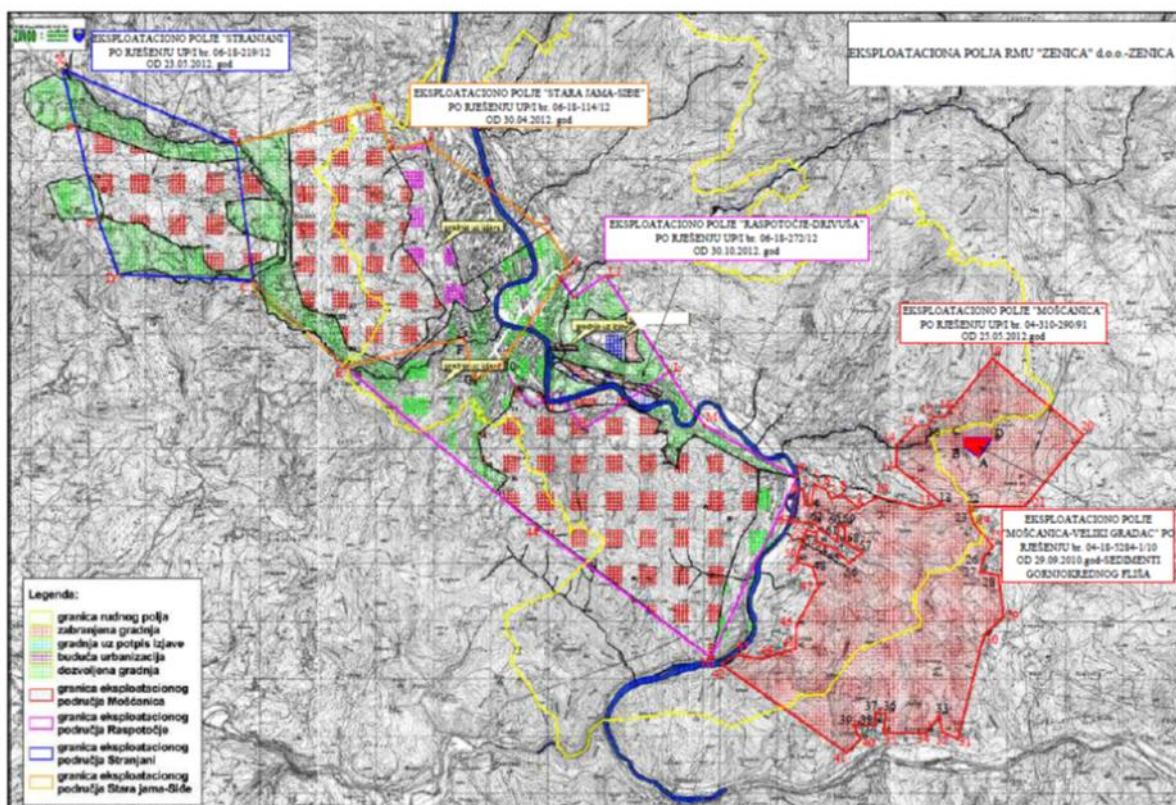


Figure 1: Exploitation areas of RMU Zenica

2.1 Geology

Figure 2 shows the lithostratigraphy of the “Raspotočje” exploitation field

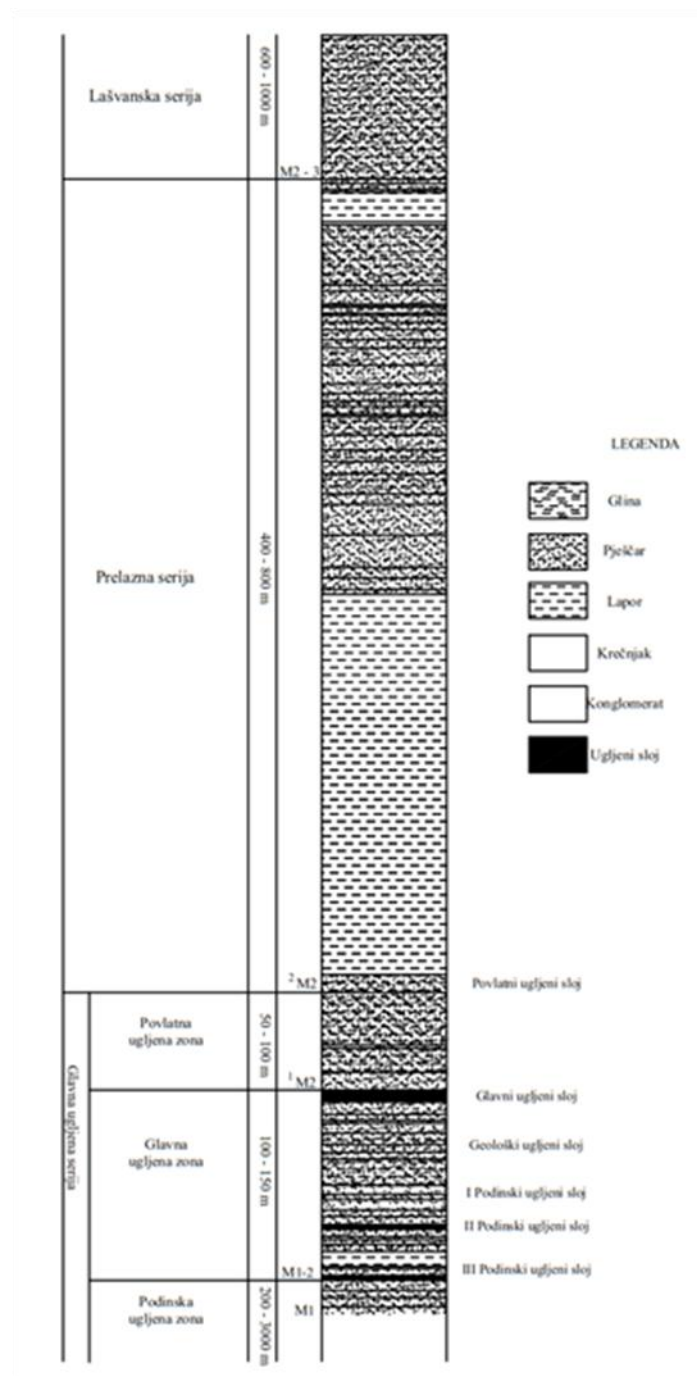


Figure 2: Lithostratigraphy of the "Raspotočje" exploitation field

The following exploitable coal seams have been identified and developed: the main, second, third, and sixth floor seams, of which the main and second floor seams have been exploited. Along the "Raspotočja" coal seam, the main coal zone (M₁₋₂) has been continuously developed, which begins with the third underlying coal seam and ends with the main coal seam.

This zone is approximately 130 m thick and is divided into a lower limestone section with the III, II, and I sub-bed coal seams, and an upper clayey and clayey-sandy section with the II pre-bed and main coal seams. The thickness of the lower part of the main coal zone is 90 m, and it is composed of yellow-gray and gray limestones and gray limy marls with three underlying coal seams (III, II, and I).

The upper part of the sediments of this zone, about 40 m thick, begins with the II sub-base layer, followed by clays, clayey limestones, and clayey sandstones, and finally the main coal seam.

The main coal zone is significantly different from the lower-lying Podinska coal zone (M_1), because the sediments of the Podinska zone are greenish and greenish-red in color, which is one of the correlatives and identifying characteristics for the entire basin.

In the main coal zone (M_{1-2}), coal seams of economic and exploitable significance for the Raspotočje mine have been deposited. The preferential coal zone of the sediments ($^1M_2$) begins with yellowish limestones, immediately above the main coal seam, followed by grayish-yellow limestones, and subordinate marly limestones, all the way to the transition of these limestones into marls and clayey marls of the transitional zone ($^2M_2$). The thickness of the sediments of the seventh ($^1M_2$) horizon is 70 meters, and near the top of this horizon, several coal beds are encountered, representing the overlying (cap) coal seam.

The following transitional zone ($^2M_2$) is about 200 m thick and is composed of gray claystones and gray argillaceous claystones with interbeds of gray fine-grained sandstone throughout its entire thickness.

Exploration drilling has proven that the coarse-grained Lašvanska Series (M_{2-3}) in the "Raspotočje" mine area, is about 1000 m thick and is composed of conglomerates and sandstones, which throughout the entire profile are interbedded with sandy clays, sandy and clayey limestones, and sandy clays.

It is considered that the deposition of this series completes the filling of the depositional environment of the "Raspotočje" mine's exploitation field. To date, it has been determined that in this exploitation field, only the sediments of the main coal zone (M_{1-2}) can be considered to contain coal-bearing strata.

No investigations have been conducted in the subsoil coal zone (M_1), where a lower group of subsoil coal seams (IV, V, VI, and VII) should be expected. A few boreholes have penetrated part of this zone as well, and only about one hundred meters below the third underlying coal seam, where a carbonaceous layer was drilled that, in a superimposed relationship, should correspond to the fourth underlying coal seam of the Old Pit, but there is little data for its more precise identification.

This coal seam (IV floor) is about 7.0 m thick, and is composed of coal-bearing clays, coal-bearing shale, and minor beds of matte coal.

The third floor coal seam in the Raspotočje area is 4.0 meters thick, of which more than half is liptak and clayey coal, and the remainder is matte coal. Waste liptak and clayey strata are associated with the upper part of the seam.

The distance from the III to the II underlying coal layer is about 50.0 m, and it is mainly composed of yellowish sandy limestones.

The roof and floor of the Second Sub-Bed are composed of yellowish and gray sandy limestone. Within the coal seam itself, there are multiple barren interbeds of yellowish sandy limestone. The average thickness of this layer with barren interbeds is 11.4 m.

The first subsoil layer in the “Raspotočja” exploitation field has not been determined.

The interval from the second bed to the second sub-bed, with a thickness of 30 meters, is composed of yellowish and grayish-yellow sandy limestones, and subordinate gray limestone marl.

On the aforementioned limestones, the Second Pre-Pennsylvanian Coal Seam, 1.2 m thick, is exposed. It is composed of lenticular coal.

The distance from the top of the Second Pre-Basal Coal Layer to the base of the Main Coal Layer is 45 m, and it is composed of red and green-colored clays and sandstones, gray sandstones, gray clays, and gray clayey limestones.

The main coal seam in the “Raspotočja” exploitation field has an average thickness of 7.5 m. The base of the seam is clayey, and the overburden is limestone. In the upper part of the seam, there are numerous barren layers of gray and yellowish sandy limestone. Sterile layers are also present in the middle and lower parts of the seam. The coal seam itself is composed of bands of matte and lustrous coal, and this seam represents the highest quality coal in the Zenica-Sarajevo Basin.

At the top of the so-called overlying coal zone ($^1M_2$), in the form of several thinner coal seams, an overlying (roof) coal seam occurs, which has only a parallelizing significance.

2.2 Deposit tectonics

The Zenica-Sarajevo Basin, and by extension all the mining fields of the ZD Zenica Brown Coal Mines, according to the tectonic regionalization of Bosnia and Herzegovina, belong to the Central Dinarides. This geotectonic unit is characterized by the presence of paleodepressions filled with Oligocene and Neogene lacustrine deposits.

After the deposition of Upper Cretaceous sediments, tectonic movements occurred during the Pyrenean phase of the Alpine orogeny, causing the erosion, faulting, and uplift of Mesozoic formations and the cessation of sedimentation.

In the Oligocene, faulting and the formation of an isolated paleodepression occurred as the initial stage in the formation of the Zenica-Sarajevo Basin, and thus the sedimentation of fresh-water lacustrine deposits.

After the formation of the initial paleodepression, a period of relative quiescence occurs, during which the sediments of the lower part of the Oligomiocene polyfacial complex, within which the Koščanski coal layer is located, are deposited.

A renewed tectonic activity occurs during the deposition of the coarse-clastic sediments of the Red Series (^3Ol , M). After that, another period of relative tectonic quiescence ensued, and in

the basin, there was deposition of calcareous bituminous limestones (^4Ol , M) and sediments of the Podin Coal Zone (M_1) containing large amounts of coal substance, namely multiple coal seams. After the deposition of the Podine Coal Zone (M_1) sediments, when coarse-clastic rocks are deposited beneath the third podine coal seam, more intense tectonic activity occurs.

After the deposition of the Main ($\text{M}_{1,2}$) and the Lower Carbon Zone ($^1\text{M}_2$), as well as the sediments of the Transitional Zone ($^2\text{M}_2$), i.e., periods of longer quiescence, more pronounced tectonic movements affect the paleodeposit, resulting in the deposition of coarse-clastic sediments of the so-called series. “Lašvanski Conglomerates.” These tectonic movements caused the lacustrine environment to shift southwestward and led to the appearance of numerous radial deformations. (VII, VI, V, and IV Podin).

The greatest tectonic activity in the basin occurred after the deposition of the extremely coarse-grained “Orlač Conglomerates” ($^2\text{M}_3$), at the Miocene–Pliocene transition. At that time, the basin was completely filled, and it acquired approximately its present tectonic structure. This tectonic activity led to the formation of numerous fold structures in the basin, creating several synclines and anticlines with gently inclined limbs and axes that dip to the west.

In the basin, there are well-known gentle synclinal structures: the Zenica, Kakanj, Brezana, and Sarajevo synclines, which are associated with gentle anticlines. Between Zenica and Kakanj, the Lašva anticline is known, which is deeply eroded, while the youngest sediments (Orlački Conglomerates) are preserved in the Orlačka syncline near Zenica. Previous exploration work has proven that the frequency and size of faults decrease from bottom to top, i.e., from the oldest Oligomyoceanic to the younger Miocene and Pliocene sediments.

As for the present-day structural-tectonic relationships in the Raspotočje exploitation field, they are the result of predominantly vertical movements, and to a much lesser extent, tangential thrusting of the underlying mountain range, i.e., the Mesozoic sediments. All of these movements are also linked to the Alpine orogeny.

As in other exploitation fields, the faults in the Raspotočje area are longitudinal, transverse, and less frequently diagonal, and this classification is relative to the strike of the carboniferous sediments.

The formed fault blocks most often have prismatic or parallelepiped shapes, and the fault surfaces are at angles between 40° and 70° . When faults occur in limestone sediments, they are invariably accompanied by fault breccias, and when they are in clayey or argillaceous rocks, schistosity parallel to the fault surfaces develops.

In the Raspotočje pit, the identified faults are of the gravitational type with varying displacements of the fault wings. As in other fields, here too the older strike faults are roughly aligned with the strike of the coal seams.

The younger faults are north-south oriented and are approximately parallel to each other. The most significant is the fault that separates the eastern part of the Raspotočje pit from the area of the former Drivuša pit, with a scarp that decreases from north to south. Additionally, a

significant transverse fault that separates the central from the eastern part of the Raspotočje pit is also notable.

The aforementioned older strike-slip faults have divided the Raspotočje mine's exploitation area into nine tectonic terraces, which are labelled such that the first terrace is the shallowest and lies to the north, while the ninth terrace is the deepest and lies on the southern side of the exploitation area.

The relationships between the tectonic terraces are such that those with higher sequential numbers are higher (more elevated) than those with lower sequential numbers. The only exception to this rule is the final IX tectonic terrace, which is lower than the eighth. It is also characteristic that the throw of these faults decreases from north to south, or from the shallower to the deeper parts of the exploitation field.

The carboniferous sediments are approximately ENE-WSW with a dip to the SW, and the stratigraphic dip ranges from 12° to 40°.

2.3 Hydrogeological characteristics of the deposit

As part of the comprehensive geological investigations of the eastern section of the Raspotočje pit, hydrogeological investigations were also carried out.

The investigations were aimed at defining the filtration characteristics of the immediate overburden of the main coal seam, which consists of limestones, and at determining the filtration characteristics of the lithological members of the overburden of the main coal seam. In addition to the filtration characteristics, the investigation should provide an answer to the question of the origin of the groundwater and the way it is replenished.

The classification of water permeability was carried out based on measurements and calculations of the filtration coefficient. In the area of the Raspotočje pit, the following aquifer horizons were identified:

- The first aquifer horizon is located immediately adjacent to the Bosna River and is composed of clays, clayey sands, and gravel. The thickness of this horizon ranges from 1.50 to 5.00 meters.
- The second aquifer horizon is located above the limestone zone. It is composed of marl.
- The third aquifer horizon is associated with the overlying coal zone, i.e., the limestones above the main coal seam up to the shaly zone. The lower boundary of this horizon is formed by the main coal seam and the clay in its immediate subsurface. The limestones that largely make up this horizon are secondary aquitard rocks whose permeability depends on fractures and faults. The thickness of this horizon is about 70 m.
- The fourth water-permeable horizon is located between the basal clays (lower boundary) and the main coal seam (upper boundary). This aquifer horizon is

composed of clays, clayey loams, sandstones, argillaceous limestone, and coal (main basal seams I, II, and III). The thickness of this horizon is up to 150 m.

Based on hydrogeological classification, the lithological members are classified as aquifers and aquitards.

Hydrogeological aquitards primarily include the shales that are present in the overlying sequence of the main coal seam, the bedded clays, as well as the coal seam itself. The aforementioned lithological members belong to permeable rocks with a filtration coefficient of $k = 2.06 \times 10^{-8}$ to $k = 9.10 \times 10^{-8}$ m/s. A very significant thick series of limes in the top of the main coal seam is present, as they hydrologically separate multiple aquifer horizons and surface flows from the aquiferous limestones in the immediate overlying layer.

In the category of hydrogeological collectors are the limestones of the immediate overlying layer of the main coal seam. The limestones feature pronounced secondary fractures and good filtration properties with $k = 2.13 \times 10^{-8}$ m/s. The most significant water-bearing formation (the limestones) in the northern parts of the deposit is hydraulically connected to the Bosna River alluvium, with which it is locally in direct contact.

In the Raspotočje pit, water appears in two forms: as stagnant and dynamic waters. Stagnant waters pose a danger to crews at the work sites and cause material damage, as their sudden breakthrough can occur when new mining areas were opened. After the breakthrough, the level of stationary water tends to decrease and it transitions into dynamic water. Dynamic water is characterized by a continuous influx into the mine chambers in smaller quantities:

Inflow: in older works, dynamic waters create accumulations that partially drain away through migration through the fissure system of the karstic limestones. The current inflow of water into the "Raspotočje" pit is about 4,300 m³ per day = appr. 180 m³/h.

During mining operations to develop the opening and preparation chambers for the "Raspotočje" pit, a sudden influx of groundwater may occur. Given the deposit's tectonics, it is realistic to expect the inflow of accumulated water from older, higher-lying workings as well as infiltration through fault zones.

For the above reason, all measures to prevent water ingress must be taken, first and foremost pre-draining as mining progresses.

Multi-year hydrogeological research in the pit Raspotočje has established a very low water permeability of roof marls (from 0 to 6.5 l/min), while the water permeability of marly limestones is much higher and amounts to 45 l/min. The main coal seam and the bottom of the main coal seam are impermeable. According to previous tests of self-ignition of the coal layer, it was concluded that the main coal layer is extremely prone to self-ignition, and the pit "Raspotočje" is classified in the III category of self-ignition of coal.

2.4 Methods of excavation used in the mine

During the current exploitation of the mine, the main and II floor coal seams were excavated using the following excavation methods:

- chamber excavation method (Mostar method),
- chamber excavation method using a fan of deep mine boreholes,
- wide-face excavation method of the roof part of the main coal seam, with a working height of up to 3.4 m, using SHP (Becorit and Hemscheid),
- wide-face - sublevel excavation method of the entire thickness of the main coal seam, with a working height of up to 6.5 m, using SHP (reconstructed Becorit and DAWTY 4L - 4000 kN),
- wide-face excavation method using MHP type BW 22/41 POZ with accompanying equipment

The Raspotočje mine employed the wide-face excavation method with a face length of 95 m using MHP type BW 22/41 POZ with accompanying equipment, and as an alternative method, for parts of the deposit where wide-face excavation is impossible due to mining and geological conditions, the Chamber excavation method was applied using a fan of deep mining boreholes.

The chamber excavation method using a fan of deep mine boreholes was an alternative excavation method in the Raspotočje mine for mining fields where the application of SHP and wide-face mining was not possible due to geological conditions. The geometry and dimensions of the chamber method are shown in Figure 3.

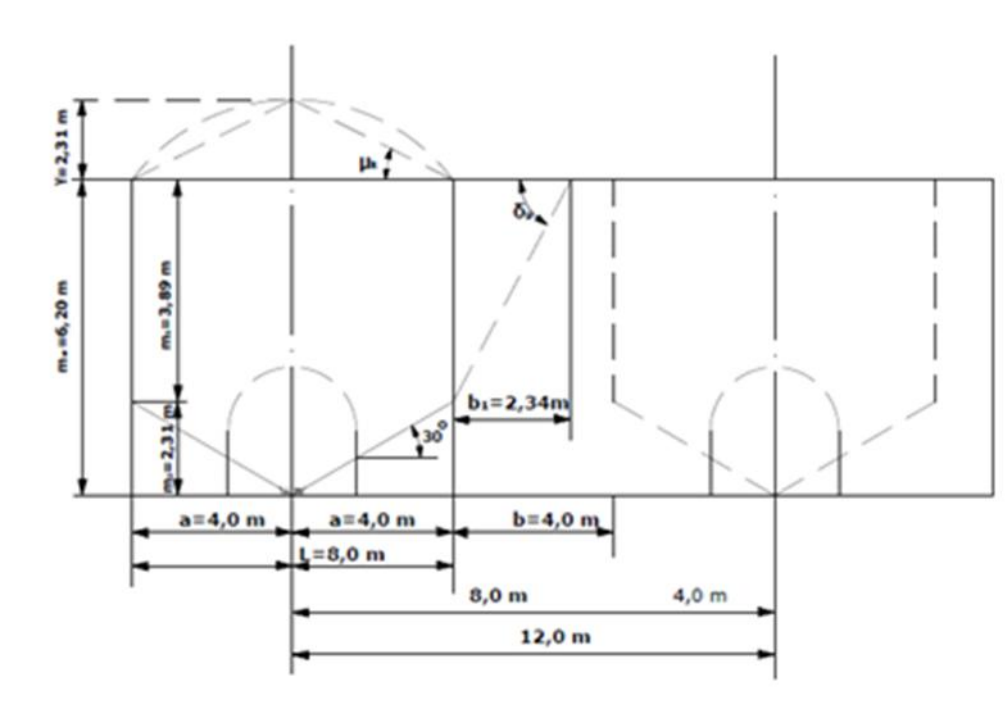


Figure 3: Geometry of heading a gallery working in the II sub-coal seam in the eastern part of the "Raspotočje" mine

2.5 Existing drainage conditions

All water inflows above the catchment at elevation K+176.90 m, as well as water from the free depth of the shaft, are collected in this catchment and from that point are directly pumped out of the mine into the Bosna River. This pumping station is called PS K+180 m.

All other water inflows below elevation K+176.90 m, inflows from the productive part of the mine and preparatory workplaces of new excavation fields, inflows from old workings, whether by gravity or via centrifugal pumps, are collected in the main water collector of the Main Pump Station (MPS), which is located next to the main transport gallery (GOP) at elevation K+1.6 m, and from there they are discharged outside the mine directly through a pipeline via the gallery and the hoist shaft.

3. Objectives of the assignment

- a. The World Bank Group (the “Client”) is seeking to appoint a mining consultancy company (the “Consultant”) to support the Federal Ministry of Energy, Mining and Industry (FMERI), the mining company Zenica and the utility company Elektroprivreda BiH (EP-BiH) in closing the underground mine Raspotočje (the “Project”).
- b. The Consultant will develop an **Integrated Technical Assessment and a Numerical Model** and to develop a **four-dimensional post-closure monitoring program** for Raspotočje mine.
- c. The model should be able to assess the potential influence of the mine water rebound process on hydrogeological conditions, mine water quality, and relevant geotechnical and methane migration processes at Raspotočje mine. Depending on the outcomes of this model, technical suggestions and cost estimates are required for the implementation of the different solutions.
- d. A spatio-temporal post-closure monitoring program for Raspotočje mine over a specific time period must be developed to monitor mine water, mine flooding, methane and methane blowers, other gas emissions and geotechnical stability/ground movements.
- e. Throughout the assignment, the Consultant will work closely with the mine staff, the mining company Zenica and with the Federal Ministry of Energy, Mining and Industry.

4. Implementing Body

The implementing body will be the Federal Ministry of Energy, Mining and Industry (FMERI) supported by the World Bank Group.

5. Initial Assessment and available information

A first assessment of technical and environmental risks of the mine closure has been carried out. Coal mining at the Raspotočje pit has created long-term effects on the environment. The most relevant ones are:

- a. Ground movements: From the perspective of post-mining residual ground movement risks, two main types of mining methods have been applied in Raspotočje mine: wide-face method = longwall mining, chamber and pillar mining. In particular the chamber and pillar mining method has left large residual empty spaces. The stability of the remaining pillars in the old works may be affected by the alteration or aging of the material or by modifications in the environment of the underground structures, probably due to the mine flooding. In particular, the limestone might be highly sensitive to water circulation.
- b. Mining induced hydrological and hydrogeological disturbance: Pumping stops at Raspotočje mine will lead to a gradual flooding of the mine voids and a rise in the hydrostatic level. This flooding can result in the hazard that natural draining toward the surface occurs at topographical low points (valleys, depressions), maybe through mine galleries that are connected to the surface. New discharge outflows can also appear. Whatever the scenario, it can be assumed that the hydrostatic level in the area of a former mining operation is not in its original position.
- c. Methane and other gas emissions: Raspotočje mine is classified as a gassy mine i.e. the coal seams contain methane which was released during extraction. Once production has ceased and the coal mine is closed, it continues to release methane. Such methane emissions typically occur at well-defined source points, such as ventilation shafts or pressure-relief vents.

Available information

The following information is available about the mine, in Bosnian language and will be made available to the successfully appointed consultant:

Title	Translation	Type of document
O KATEGORIZACIJI I RAZVRSTAVANJU RUDARSKIH PROSTORIJA POSTEPENU OPASNOSTI OD METANA U JAMI „RASPOTOČJE“, JP ELEKTROPRIVREDA BIH D.D.-SARAJEVO, ZD RMU „ZENICA“ D.O.O.-ZENICA + prilog 1 -8	On the categorization and classification of mining premises by degree of methane hazard in the Raspotočje mine, JP Elektroprivreda BiH D.D.-Sarajevo, ZD RMU “Zenica” D.O.O.-Zenica	Report (284 pages) and 8 attachments (maps of ventilation, water drainage, mine exploitation and galleries, digital terrain models)
PROJEKAT OTPADNIH VODA	Wastewater project	Drawings, photos etc. (31 documents)
PROJEKAT SISTEMA ZA ODVODNJU I TRETMAN	Project of the system for drainage and treatment of	Report (76 pages)

TEHNOLOŠKIH, SANITARNO – FEKALNIH I OBORINSKIH OTPADNIH VODA POGONA „RASPOTOČJE	technological, sanitary-faecal and storm waste waters of the Raspotocje plant	
GEOLOGIJA I HIDROGEOLOGIJA RASPOTOCJE	Geology and hydrogeology Raspotocje	Geological report, hydrogeological information, geological and hydrological profiles
BILANS METANA U VAZDUŠNIM STRUJAMA VENTI-LACIONOG SISTEMA JAME „RASPOTOČJE”	Methane balance in the air flows of the ventilation system of the 'Raspotocje' pit	Reports and drawings (in dwg)
GEOMEHANICKA ISPITIVANJA UGLJA I STIJENA PRATECIH NASLAGA IZ JAME „RASPOTOCJE"	Geomechanical testing of coal and rocks of the accompanying layers from the “Raspotocje” mine	Report (52 pages)
IZVJESTAJ O REZULTATIMA ISPITIVANJA TERETA ZAGADENJA OTPADNIH VODA RMU ZENICA D.O.O. ZENICA, POGON RASPOTOCJE, IZRAZENOG PREKOEBS-	Report on the results of waste water pollution testing RMU Zenica D.O.O. Zenica, Raspotocje plant, expressed through EBS	Report (58 pages) Dec. 2024
IZVJESTAJ O MONITORINGU KVALITETA I KVANTITETA OTPADNIH VODA ZD RMU «ZEN/CA» D.O.O. ZENICA, POGON «RASPOTOCJE»	Report on the monitoring of quality and quantity of waste water ZD RMU “Zenica” D.O.O. Zenica, plant “Raspotocje”	Report (17 pages) March 2024
KNJIGA PROTIVEKSPLOZIVNIH – BRANA POGONA "RASPOTOCJE" ZAPOCETA: 02.08.2017 GOD	Book of anti-explosive dams of the 'Raspotocje' plant started: 02.08.2017	Hand-written documentation with drawings
EVIDENCIJA IZRADE ZIDOVA U JAMI “RASPOTOCJE”, ZAPO-CETA 18.03.2013	Record of wall construction in the pits 'Raspotocje', started on 18.03.2013	Hand-written documentation with drawings
ELABORAT ZA SVJETSKU BANKU	Report for the World Bank	Summary report (32 pages) containing information on geology hydrogeology,

		methane, description of mine void closure methods, water quality monitoring
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6. Scope of work

The Consultant will deliver the following part of this assignment:

6.1 Integrated Technical Assessment and Numerical Model

The Consultant will develop an Integrated Technical Assessment and Numerical Model. It is open to him whether the Consultant develops individual more detailed models or a comprehensive model. In any case the following components must be included:

6.1.1 Geotechnical study

The geotechnical study must include the following aspects:

- a. post-closure stabilisation of underground workings—including geotechnical assessments of the stability of the underground openings, assessment of groundwater conditions and groundwater impacts on the design of stabilisation methods
- b. the requirements for sealing off surface openings to underground workings—including geotechnical assessments of bulkhead materials, competency and stability of the ground containing the bulkhead, the need if any for additional ground support and reinforcement including grouting, and assessment of groundwater conditions and groundwater impacts on the design of bulkheads
- c. the magnitude and spatial extent of post-closure residual subsidence of underground workings—this would include but not be limited to geotechnical assessments of the stability of the underground openings and overburden, assessment of adverse surface effects and any critical scenarios like failure of pillars – in collaboration with Bosnian partners, and assessment of surface water and groundwater conditions and groundwater impacts on subsidence.
- d. identification of post-closure stabilisation of underground workings in order to manage the potential for unplanned surface subsidence and unplanned ground collapse such as pillar failures.

6.1.2 Hydrogeological Conceptual Model

A hydrogeological conceptual model shall be developed as the basis for the numerical modelling and closure water management assessments. The Consultant shall clearly document all key assumptions, uncertainties, limitations and confidence levels associated with the conceptual understanding and predictive modelling.

The conceptual model shall include:

- a. geological and hydrogeological conditions,

- b. hydrogeological units and structural controls,
- c. mine workings and hydraulic connections,
- d. groundwater flow systems,
- e. groundwater recharge and discharge mechanisms,
- f. groundwater and surface water interaction,
- g. historical mine water management and dewatering activities.

The conceptual model shall furthermore include a high-level assessment of:

- h. potential post-closure groundwater rebound processes,
- i. possible new hydraulic flow paths,
- j. potential interactions between mine flooding and methane migration pathways,
- k. and key hydrogeological uncertainties relevant to mine closure.

6.1.3 Numerical Mine Water and Hydrogeological Model

A dedicated numerical mine water and hydrogeological model shall be developed to assess the post-closure flooding behaviour of the underground workings and the associated impacts on the surrounding groundwater and surface water systems. The modelling approach shall be consistent with the available data and shall clearly document assumptions, uncertainties and model limitations.

The scope shall include:

- a. Simulation of post-closure mine flooding and groundwater rebound, including:
 - flooding of underground workings,
 - long-term mine water levels,
 - potential uncontrolled discharges to surface,
 - groundwater and surface water interaction.
- b. Assessment of potential impacts on:
 - surrounding groundwater systems,
 - aquifers and surface water bodies,
 - mine water quality,
 - geotechnical stability where directly linked to groundwater rebound.
- c. Assessment of potential mine water quality impacts using a source–pathway–receptor approach, including consideration of potential acid mine drainage (AMD) risks and possible mitigation measures.
- d. Identification of key uncertainties, data gaps and recommendations for additional monitoring or investigations where required.
- e. Evaluation of potential closure water management measures, including sealing concepts and passive versus active long-term water management approaches.

6.1.4 Subsidence modelling

Subsidence modelling must be carried out to predict potential subsidence, surface strain and tilt resulting from the underground mining operations and be used to inform implications for the rehabilitation strategies.

The subsidence analysis and modelling which will inform rehabilitation strategies must address potential management and monitoring issues including:

- a. consideration of how potential entries to underground workings will be sealed (i.e. through some form of capping or back filling)
- b. how surface ponding and cracking will be mitigated and mitigation strategies suggested
- c. identification of post-closure stabilisation of underground workings in order to manage the potential for unplanned surface subsidence and unplanned ground collapse such as sinkholes and pot holing.
- d. impacts associated with changed hydrogeological characteristics and changes to hydrological regimes
- e. potential impacts to surface infrastructure including houses, roads, and power lines, etc.
- f. changes to pre-existing surface water characteristics due to cracks in the bed and banks of waterways
- g. changes to the hydrogeological regime as a result of new cracks in the rock mass which can provide new flow paths in what could have previously been impermeable rock
- h. potential for vertical connections between previously separated aquifers
- i. changes in surface topography and local drainage characteristics—this may result in some areas becoming more free-draining while runoff may be reduced in other areas, resulting in the ponding of water in areas where previously no ponding occurred
- j. changes in surface drainage, leading to changes in the composition of vegetation communities and distribution of flora and fauna species as well as wildlife and livestock safety.

6.2 Methane monitoring, capture and management

Methane is a powerful GHG with GWP that exceeds that of CO₂, albeit comparatively short-lived. The management of methane that is released from the mine is therefore a crucial aspect of the closure planning.

- a. The consultant is expected to determine potential methane pathways and point sources, address this issue by suggesting appropriate technologies for the capture, monitoring and controlled release or other technologies to manage methane and prevent its release to the atmosphere.
- b. Included in this will be a review of existing technologies, their levels of effectiveness and maturity, and comparative costs.

6.3 Four-Dimensional longterm monitoring and maintenance plan

Monitoring and maintenance to ensure that completed closure work has achieved (and continues to achieve) closure objectives, and future risks that were unknown at the time of closure and are identified through post-closure monitoring or through an unexpected event is an important part of mine closure. Therefore, a monitoring and maintenance program that identifies and describes the monitoring systems that will be carried out in order to demonstrate a milestone and milestone criteria have been achieved.

An ongoing process of spatio-temporal monitoring of the Rasptocje pit over a specific time period is needed to monitor mine water, mine flooding, methane and methane blowers, other gas emissions and geotechnical stability.

To facilitate future monitoring of the site, the consultant is expected to support future monitoring of the site, its closure and future post-closure conditions by providing:

- a. description of methodologies and standards, which could include field-based assessments and the application of new remote sensing (satellite data), GIS and other relevant emerging technologies
- b. key monitoring parameters that enable the collection of relevant and statistically valid data
- c. post-closure monitoring to ensure milestone criteria
- d. monitoring parameters that support appropriate quality assurance and data management processes and systems
- e. a schedule of monitoring, reporting and review for each key environmental parameter
- f. a monitoring schedule that supports regular analysis of site data including multi-year comparison trends and benchmarking against analogue/reference sites
- g. suggested future key structure and content of monitoring reports and long-term documentation
- h. cost estimates for CAPEX, OPEX and required staff

6.4 Scope exclusions

The work described herein forms part of a larger mine closure plan for the three coal pits at Zenica. This work only addresses the current closure plan of the Raspotočje coal mine.

- a. The consultant will only deliver the items in the Scope of work in support of the full mine closure plan. The development of the full mine closure plan is not within the project scope.
- b. The consultant will only provide the information, data and supporting materials as described. The interpretation and use of that data in the eventual development of the mine closure plan and decisions about the monitoring plan that will be adopted, are not part of the scope.
- c. The development and costing of options for post-closure alternative land uses of the mine and surrounding landscape is not part of this project scope.
- d. The closure plan of the other mines in the area is also excluded from the scope.

- e. Training of officials in the deployment, use and interpretation of monitoring data for future site management is excluded from the scope.

6.5 Deliverables

The consultant is expected to deliver the following:

Phase	Deliverable
Inception report	Following review of the available information, an inception report that includes a plan to fill those gaps
Study report phase 1	Report on full project scope, providing overview of the full project and specialist studies to be completed, including a timeline for each specialist study
Study report Phase 2	Full project report, with all specialist studies included. This is the full closure plan, covering the scope as explained herein. Also prepared as technical and non-technical presentations
Study report 3 – monitoring plan	Based on Study report 2, a plan for monitoring the works after closure is completed. This plan must include options for active and passive monitoring and a cost estimate for each alternative
Close-out report	A final report on the project, providing an overview, a record of all work completed, all technical supporting reports, annexures and measurement data, cost estimates, and records of all meetings

6.6 Guiding principles

The mine closure plan and deliverables that are expected are to be fully compliant with the Word Bank General EHS Guidelines², the IFC Guidelines for EHS in mining³, and the GRI 12 guideline on coal mine closure⁴, as well as all the applicable laws of the BiH relating to mining, water, and the environment.

7 Consultant qualifications

To be considered for this assignment, the consultant must adequately show the following attributes:

- a. Over 20 years' corporate experience in managing coal mine closures
- b. Experience in managing coal mine closures in fiery mines
- c. Experience in managing mine water recharge and discharge
- d. Experience in conducting geotechnical investigations for coal mines
- e. Experience in monitoring of mine sites post closure.
- f. Experience in managing methane release from fiery mines.

² <https://www.worldbank.org/en/projects-operations/environmental-and-social-framework>

³ <https://www.ifc.org/content/dam/ifc/doc/2000/2007-mining-ehs-guidelines-en.pdf>

⁴ <https://www.globalreporting.org/how-to-use-the-gri-standards/gri-standards-english-language/>

7.1 Consultant team

The core team employed by the consultant must include the following key roles and qualifications:

Key role	Experience level
Geotechnical engineers	At least 15 years of experience
Mining engineers	At least 15 years of experience, of which 10 must be in UG coal mines
Hydrologists	At least 15 years of experience, of which 10 must be in coal mining
Geohydrologists	At least 10 years of experience
Mine ventilation specialists	At least 10 years of experience.

7.2 Consultant support team

The support team employed by the consultant must include, as a minimum, the following members:

GIS specialists
Bosnian speaking core and support team members will be a bonus

8 Project duration

The project is expected to be completed in **4 months** from contract signature to final delivery.