Potential impact on the environment and reduction measures in the case of the temporary perimeters for mineral aggregates exploitation. Case study "Temporary perimeter operating in Ribişului Valley", Socol Locality, Caras-Severin County, Romania

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Abstract. In order to achieve the objectives of the exploitation program for the resources of magmatic rocks in the perimeter of Valea Ribişului, Caraş-Severin County, works of opening, preparation and exploitation will be carried out during the validity period of the exploitation permit. The analysis of the geological-mining conditions of the metadolerite deposit leads to the conclusion that the metadolerite reserves can be exploited by mining works in the quarry. In the geological-mining conditions of the deposit for the execution of the quarry, the method of exploitation with descending steps is envisaged, which can be used in deposits of massive industrial and construction rocks. The landscape given by the vegetation will be permanently affected as a result of the exploitation of the aggregates and measures can be taken to reduce the impact. The purpose of the paper is to evaluate the impact on the environment using models and participatory methods, taking into account the situation when there are no concrete data related to the evaluation of the objective, or they are not sufficient or relevant.

1. Introduction
The temporary operating perimeter "Valea Ribişului" is located at approx. 3 km south of the place. Baziaş, on the territory of Socol commune, Caras-Severin County, on the right side of the Ribiş stream and at approx. 300 m from the left bank of the Danube. The perimeter overlaps over the quarry works carried out in the previous years for the extraction of the mineral resource [1].

Administratively, the perimeter belongs to Socol locality, Caraş-Severin County. The access to the area is made on the national road Orşova-Moldova Nouă - Baziaş up to the right of the Ribiş stream, after which we follow the forest road built along the valley, at a distance of approx. 300 m to the perimeter.

The surface of the temporary operating perimeter is 0.016925 km² (16925 s.m.). The temporary operating perimeter "Valea Ribişului" is located on the right side of the Valea Ribişului River. Specifically, the perimeter is delimited by 6 points, presenting the following topogeodetic coordinates in the "Stereographic 70" reference system as shown in Table 1 below.
Table 1. Topogeodetic coordinates in the "Stereographic 70" reference system for temporary perimeter location

| Nr. Punct | X    | Y    |
|-----------|------|------|
| 1         | 371950 | 215060 |
| 2         | 372020 | 215050 |
| 3         | 372110 | 215101 |
| 4         | 372050 | 215153 |
| 5         | 372030 | 215228 |
| 6         | 371965 | 215207 |

Figure 1. Sheet for temporary perimeter location

The temporary perimeter of exploitation Valea Ribișului is superposed over the southwestern extremity of the mountains of Locvei, which forms in the area the left slope of the Danube River. The relief is hilly, with a rugged appearance, with heights in the perimeter area of up to 150 m, with a more important northern dimension of the perimeter of +203.3 m. and the Danube. The perimeter is located on the right (northern) slope of the Valea Ribișului stream as presented in the Figure 1 above.

On the slope that is subject to the exploitation permit, due to the accentuated slope and the partial cover with grassy vegetation, the soil appears skeletal, leaving approx. 30% of the surface to come to light altered limestone. From a pedological point of view, the soils are of the type of calcium yields, with average fertility, due to the permanent washing of the humus from the upper layers [2]. The soil depth is 10-30 cm.
Due to the exploitation activity carried out in the past, the land is affected by the existence of the exploitation stages, on which the soil could not be formed, so that within the perimeter the soil is only present on one third of the surface.

1.1 Geological data
The mineral resource for which it is requested to grant the exploitation permit in the perimeter of "VALEA RIBIȘULUI " is represented by magmatic rocks - metadolerated.

The rocks have a hypidiomorphic-granular structure, massive-compact texture. They are colored in dark gray, greenish-black, black with shades of blue, gray-brown.

The physico-mechanical properties of the chimeridgian limestones are:
- volumetric weight ......................................................3 t / mc
- porosity .................................................................0.01%
- shock resistance .......................................................50-62 daN.cm/cmp.
- Compressive strength ................................................1800-2500DaN / cmp
- wear resistance ........................................................0.5-0.7 g / cmp.

The mineralogical composition is given by the main components represented by plagioclases, olivine, pyroxenes and accessories: chromite, magnetite, apatite, ilmenite, sphincter, sulfides.

The metadolerites from the requested perimeter have been exploited in the past in an old quarry, the field of use of the mineral resource is that of the construction and / or the rehabilitation of some roads and roads.

2. Description of works
The perimeter of Valea Ribișului has, on a part of the surface, a cover made up of vegetation blanket with thicknesses of 0.20 m. Most part of the land area of the perimeter (about 2/3) is affected by older quarry works, so that the soil is present on an area of about 6000 square meters. The vegetal soil will be fully recovered during the period of exploitation and will be used at the end, at the works needed to restore the environment.

The vegetal soil, which will constitute the deposit of the deposit, will be mechanically and separately excavated, before the useful material is used and it will be transported and stored separately in a specially arranged dump.

The amount of vegetal soil to be removed was calculated taking into account the following parameters:
- surface to be discovered quarry 6000 sqm
- average thickness of soil blanket 0.20 m

The result is a volume of 1,200 cubic meters of vegetal soil, which is to be removed and stored in a separate, external dump, in a specially arranged space for storage of 500 square meters, for use in the final rendering of the land.

When performing these works, the working technology will consist mainly of:
- separate dislocation of the soil by separate pickling and pushing with the bulldozer;
- separate loading of the vegetal soil in dump trucks, with the excavator;
- material transport to the landfill specially arranged for the storage and preservation of the vegetal soil.
The geometric elements of the discovery step. will be:

- slope angle = maximum 45º;
- height = the cumulative thickness of the cover (vegetal soil);
- width of safety bar = minimum 4 m.

Preferably, the vegetal soil shall be soldered so that no reserves of useful material can be immobilized. At the same time, the vegetal soil resulting from the discovery will be stored separately, avoiding its mixing with the useful rock, in order to use it for environmental restoration works. The soil slope will be organized on the western side of the perimeter at the base of the older quarry, executed in the western part of the perimeter. The surface of the soil dump will be 500 square meters.

The exploitation method is up to date, in "descending straight steps", the operation is realized in 4 levels located at elevations: + 110m, + 100m, + 90m, + 80m, With the following geometrical characteristics:

- operating height 10 m;
- width of the berm 10 - 25 m; (working berm = 22 m - 7 m, safety berm = 3 m)
- the slope angle of the step 70º;
- operating stage length, max. 145m;
- the slope angle of the quarry 70 °.

The resistance and the massiveness of the rocks allow the stability of the slopes of the quarry at a general angle of the quarry of max 70 °. The quantity of metadolerant resources, which will be exploited during the period of validity of the temporary exploitation permit, was established taking into account the following criteria:

- the amount of resources evaluated;
- the beneficiary's need for raw materials;
- losses incurred in the operation activity.

Inside the requested perimeter, with a computing area of 16900 square meters, a reserve of about 500,000 tonnes is estimated.

The estimation of the exploitable volume of metadolerated from the temporary perimeter of exploitation „Ribişeului Valley was performed by calculating the volume of the exploitation stages. The calculation of the volume of resources was done with four cross-sections. The profiles of the operating section were graphically determined. The step volume was calculated according to the model:

\[ V = S_n \times L \]

The amount of mineral resources exploitable is 160,000 c.m. x 2.5 to / c.m. = 400,000 industrial and construction meladolerites.

The coefficient of transformation resource-reserve is given by the complement of the total losses from the process of exploitation and technological transport. These losses, for the most part, occur during the extraction, when they are disposed of and when the material will be transported from the quarry front to the beneficiary. The value of the loss coefficient is 5%, in which case the coefficient of transformation resource-reserve is 0.95.

The geological extract is estimated at 400,000 tons, which, corrected with a loss factor of 5% (20,000 tons), leads to an industrial extract of 380,000 tons of useful rocks.

The resources evaluated within the limits of the requested operating perimeter are informative.
The exploitation will be realized by executing successive slices of exploitation in the thickness of 10 m, height 10 m and length of 10-25 m, with the sense of advancement towards the mass (from S to N respectively from E to V. Most important of operations in the operating process to date are:

- detachment from the massif, especially for the discovery, in the first phase directly with the excavator, of the sterile rocks (vegetal soil);
- the execution of the boreholes and the firing for the massive detachment of the rocks; excavation and loading;
- land unloading transportation;
- transport and unloading of useful material;

The overthrow of the mining mass will be carried out with the aid of small explosives, after mechanical drilling and blasting operations, in wells. The boreholes will be made inclined, parallel to the slope, at a depth of 10 m and horizontally at the base of the slope at a distance of about 10 m, equal to the width of the slice.

In order to obtain a granulation corresponding to the needs of use and capitalization of the mineral resource, the distances between the boreholes, as well as their number, will be established in the shot monograph, depending on the length of the front required to be shot once and the amount of rock requested by the beneficiary.

The drilling of the boreholes will be carried out by specialized and authorized companies in the use, handling and storage of explosive substances.

The mining mass resulting from the overturning will be loaded into the vehicle by means of the excavator or the tracked front loader and will be transported in the raw state to the work points.

In 2020 four operating stages will be executed as follows:

- Step I, elevation +110 m: length 130 m, average height 12 m.
- Stage II, elevation +100 m: length 137 m, height 10 m.
- Stage III, elevation +90 m: length 140 m, height 10 m.
- Section IV, elevation +80 m length 140 m, height 10 m.

The preparation operation being executed concurrently with the exploitation of the bereavement, no reserves prepared in advance are calculated, the degree of assurance with prepared reserves permanently null.

The technological flow from the quarry, which includes the activity of excavation, transport, and the drilling-firing of rocks, in which only diesel-powered machines are used, involves the consumption of only scrubs, explosives and staples. Operating losses are estimated at 5%, from the material result.

The preparatory works consisted of removing the vegetal soil layer and storing it on the outside dump, arranged on the west side of the perimeter, in order to be used for the restoration and rendering of the land.

As measures of protection of the deposit, it is foreseen the execution of the operating stages with respect to the height of the step, the angle of the slope and the width of the berm. Reserve assets will be avoided on the sides of the quarry, by non-discriminatory exploitation of the whole slice. There will be sloping of the slopes after each shot, in order to avoid collapses and surprises.

The material obtained by exploiting the useful rock will be subjected to processing in a crushing plant, thus resulting in crushed stone to the size that will be requested by the beneficiary. The installation
will be located on a land located on the south side of the perimeter, on an existing platform at the base of the step +80 m elevation.

The processing plant consists of a crusher, with two screens and conveyor belts.

In the process of exploiting the useful rock from the perimeter, it will result in a considerable volume of plant soil, respectively about 1,200 cm.

The planting of the vegetal soil will be carried out in such a way that there is no immobilization of the reserves of useful material, on a surface of 500 s.m. on a land located at the base of the older quarry, executed, in the western part of the perimeter.

The soil deposit will have a geometric shape with the smooth surfaces of the slope angle. The disposal of the material on the dump will be done in successive layers of approx. 30 - 50 cm thick with the crawler bulldozer, compaction by passing the bulldozer is sufficient to give its stability. The basic element in the construction of the plant soil deposit will be the deposit platform, which must meet the following requirements:

- to have a longitudinal and transverse inclination for water drainage;
- have adequate access to the transport routes;

To be elevated to the operating site, to protect against rainwater runoff.

The land chosen for the location of the dump will have to be smooth and its natural inclination will not exceed the slope of 1: 1,000.

The actual exploitation works are scheduled to take place in 2020. The following machines will work in the quarry:

- 2 excavators for the discovery and extraction of grief, with the capacity of the min cup. 1m.c.
- 1 bulldozer at the soil dump and for maintenance of access roads
- 1 front loader
- 2 dump trucks for the transport of the equipment to the preparation plant.

2.1 Transport of the mineral resource

The transport of the mineral resource will be carried out on the existing exploitation road that links the quarry with the national road Socol Moldova Veche, until the investment site.

The transport of the mined mining mass from the quarry is carried out with 10-20 ton dumpers from the endowment of the beneficiary.

The beneficiaries that provide the transport and will use public roads located on the administrative territory of the transit localities will be obliged according to the Ordinance no. 43/1997 to obtain the necessary approvals from the authorized institutions [3].

The effects of the transport activity of the mining products realized in the exploitation perimeter "Valea Ribisului", on the environment, will be minimal due to the following considerations:

- the access road to the perimeter is blocked;
- the opening works have small lengths and are made on a hard, competent rock substrate;
- the transport of useful rock from the quarry is carried out with means of transport of the beneficiary, well maintained and without possibilities of loss of material on the route.

Any inconvenience caused by the carrier will be remedied on its responsibility.
For the cases in which the road transport of the mineral resource affects the road infrastructure and the adjacent buildings from the urban and rural localities crossed, the transport operator will obtain and present a rehabilitation agreement concluded with the local public authorities.

In the event of crossing the Socol commune, the transport operator will obtain from the local authorities (the council and the mayoralty of Socol commune, Caraș Severin county) the necessary authorizations and approvals for carrying out the transport.

The operating roads require consolidation and rehabilitation works to allow the moving trucks of 16 c.m. For the good development of the mining activities, over time, maintenance and repairs of the access road that is already built will be performed periodically.

Apart from the mentioned operating routes, it is no longer necessary to build or change other access routes.

3. Potential impact on the environment and measures to reduce it

The calculation was done for 7 environmental factors presented in Table 2 and the Rojanski diagram [4] was drawn up; the surfaces corresponding to the resulting polygons have been determined according to the quality notes (Figure 2). The quality notes corresponding to the pollution indices and the quality indices calculated above are shown in the following table:

| Environment factor         | Ic  | Ip               | Nb              |
|---------------------------|-----|------------------|-----------------|
| Underground water         | -0.5| -0.5             |                 |
| Surface water             | -0.5|                  |                 |
| Air                       |     | 0.033÷0.245      |                 |
| Vegetation and fauna      |     | -0.14÷-0.14      |                 |
| Population and human settlements | | 0                |                 |
| Soil                      | -0.5|                  |                 |
| Landscape                 | -0.5|                  |                 |
| Subsoil                   |     | -0.33            |                 |

By comparing the ideal surface to the one corresponding to the real state, the global pollution index, IPG, is obtained.

\[ I . P . G . = \frac{S_I}{S_R} = 1.57 \]
Figure 2. The Rojanski diagram for the temporary perimeter operating in Ribișului Valley”, Socol Locality, Caraș-Severin County, Romania

The projected investment will consist mainly of excavation works one meter above the hydrostatic level. The achievement of the objective will not have cumulative effects on other projects that have been executed in the perimeter area. It is appreciated that from the point of view of the cumulative impact of the proposed project with the activities carried out on the studied site, no negative impact elements can be highlighted, the cumulative impact of the project with the existing activities will be insignificant. Therefore, we consider that the cumulative impact of other similar projects is within the limits of sustainability.

During the achievement of the objective, it is necessary to monitor the environmental factors in order to follow the efficiency of the applied measures, and to establish the corrective measures in case of not complying with the specific norms [5, 6]. In this regard, the following measures are proposed:

- identification and monitoring of pollution sources;
- verification of compliance with the operating rules of the machines / means of transport;
- periodic verification of the park of machines for detection of possible defects;
- the proper management of all the resulting waste;
- establishing an intervention program in case the quality indicators specific to the environmental factors air, water, soil do not fall within the limits imposed by the legislation in force;
- preventing and combating accidental pollution;
- taking all protective measures during high water, respectively in case of floods.

5. Conclusions
The impact of the project on the development of the area and on the environmental factors is considered to be beneficial, and if it is realized, it will be reflected on the following plans, respectively: the existence of a public utility for the investment made - consisting of the valorisation of the products for various civil and industrial constructions; will lead to a transformation from an environmental point of view of a non-productive (unused) land, in an area refurbished in terms of efficient and sustainable management of the main environmental factors; beneficial socio-economic consequences - by creating new jobs;

The necessary works for the restoration and restoration within the natural frame of the site, affected by the planned investment, are considered to be the following

- decommissioning of the perimeter of all the machines used in the excavation process of mineral aggregates;
• the transport of the whole amount of gravel and sand excavated for recovery, the transport of the blanket and its complete deposition (in the order of sandy clay in the base and then vegetal soil) - in the resulting pit;
• depositing in successive layers (approx. 20 cm thick) of clay layers and vegetation soil leveling, compacting the deposited material;
• grass sowing on the entire affected and rendered surface;
• sowing of perennial grasses, specific to the area;
• carrying out maintenance work after sowing;
• arranging the access road in the area and maintaining it in good traffic conditions; After the environmental restoration works affected by the excavation activities of the sands and gravels in the temporary exploitation perimeter will be necessary, it will be necessary to carry out a monitoring of the post-closure environmental factors through:
  • regular monitoring of the settlement mode of the lands that have been rendered;
  • periodic monitoring of the methods of drainage and infiltration into the groundwater of surface waters;
  • seasonal monitoring of the way of realizing the vegetation restoration.

During the dry periods of the year, the transport of dump trucks on the dirt roads and arranged, will cause the formation of "clouds of dust" that will then be deposited on the nearby vegetation. For these reasons, it is recommended that, during these periods, all measures to reduce the amount of dust entrained are taken, of which the most efficient would be the circulation of the vehicles at low speeds, the covering of the material transported with tarpaulins and the sprinkling of the roads with water jets, whenever necessary. Upon completion of the mining activities of the mineral aggregates (sands and gravels) within the perimeter, all necessary measures will be taken to close the objective - in accordance with the legislation and regulations.

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