The 55th International October Conference on Mining and Metallurgy
15 - 17 October 2024, Kladovo, Serbia
https://ioc.irmbor.co.rs

DOI: 10.5937/IOC24037M Original Scientific Paper-Mining

IMPACT ON THE ENVIRONMENT AND RECLAMATION OF THE LANDFILL SARAKA, VELIKI KRIVELJ

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Abstract

The consequence of increase in the exploitation capacity of copper ore at the open pit "Veliki Krivelj" is the expansion of the Saraka landfill. The result of landfill expansion is a degradation of the surrounding land. The impact on the quality of the environment as a result of these works is greatly impaired. In order to protect it, it is necessary to intervene in such a way that the neglected areas of the Saraka landfill are recultivated as soon as possible.

***Keywords**: degradation, environmental, reclamation*

1. INTRODUCTION

The Veliki Krivelj copper deposit is located, about 3 km northeast (azimuth about 10) from the town of Bor, and 0.5 km northeast (azimuth about 125) from the nearest village of Veliki Krivelj, in the Krivelj river basin. Within the Veliki Krivelj copper deposit, there is the "Veliki Krivelj" open pit, where exploitation began in 1982. The regional road 393 passes in the immediate vicinity of this open pit, and connects it with Bor and the village of Veliki Krivelj.

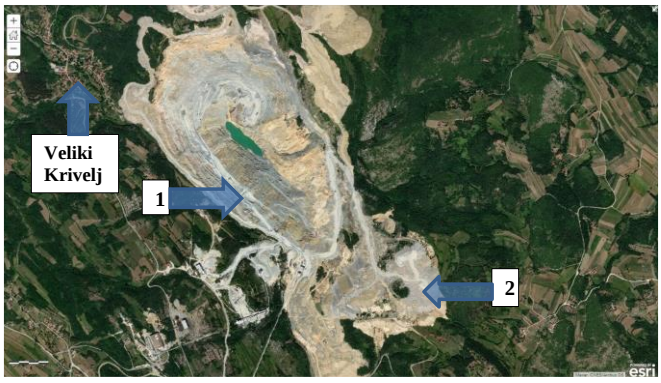

Figure 1. *Spatial layout of facilities: open pit (1), waste landfill Saraka (2)*

The new development plan of the company Serbia Zijin Copper DOO Bor foresees an increase in the annual ore processing capacity from the existing capacity to 23.1 million tons of dry ore per year. For the planned increase in the mine capacity, it is necessary to expand the Veliki Krivelj open pit, as well as a significant increase in the capacity to reveal the deposits. For the required quantities of overburden in the next

twenty years, the additional space for waste disposal must be provided, this will be provided by expanding the existing Saraka landfill.

In order to protect the environment, the newly formed degraded areas of the Saraka landfill are brought to a useful purpose through the application of optimal reclamation with the phases of technical and biological reclamation

2. DEGRADED SURFACES

Exploitation of copper ore at the "Veliki Krivelj" open pit means the degradation of the surrounding land during the formation of designed contours of the open pit, as well as the formation of the landfill Saraka (Figure 1). In this case, in addition to the already formed landfills East landfill and Todor Potok, the Saraka landfill will be expanded (Figure 2). In doing so, an area of 903,875 m^2 will be degraded.

Figure 2. *Designed final contour of the Saraka landfill*

Flat and sloping surfaces are formed by disposal of waste at the external Saraka landfill of the Veliki Krivelj open pit. The final level (plateau) at the Saraka landfill is at level +580 and has an area of 93,100 m^2.

3. CHOICE OF RECLAMATION METHOD

The goal of reclamation is to, through a series of activities foreseen by the reclamation project, in some form "return" what was previously borrowed from the nature through exploitation.

The analysis of the landscape state after formation the final contour of the Saraka landfill indicates that the conditions created at the end of exploitation period will be such that the concept of biological reclamation should be adapted to the function of achieving visual harmony of the disturbed environment with the surrounding undisturbed environment, using the species adapted to the prevailing ecological conditions on the newly formed degraded surfaces.

In accordance with the set functional requirements, the goals of reclamation are: creation of the new, anthropogenic meadow-pasture and forest ecosystems, revitalization of degraded areas and return to the cycle of natural biological flows, provision of a healthy environment, protection and improvement of biodiversity, assurance of terrain

stability, prevention of erosion processes, regulation runoff of surface water as well as improvement of the soil quality.

4. TECHNICAL PHASE OF RECLAMATION

The technical phase of reclamation includes several works. First of all, the subsequent planning or leveling the final plane-plateau is done with a bulldozer before the start of reclamation.

The next stage is the formation of terrace planes along the slopes of landfill. Terrace planes are formed at 10 m.

The next stage involves the application of soil material. The soil material will be used for:

- formation a layer on a flat surface - a landfill plateau of 0.5 m height;
- formation a layer on the floor levels - 0.5 m high;
- filling pits when planting seedlings.

The technical phase of reclamation includes the planning of soil material provided by the investor for execution the works on the designed areas of the Saraka landfill. After that, the preparation of these areas for grass sowing is carried out in order.

5. BIOLOGICAL PHASE OF RECLAMATION

The biological phase of reclamation includes the following works:

- Grassing and afforestation on the waste landfill plateau according to a mosaic arrangement of cultures;
- Afforestation on the slopes of landfill;
- Grassing and afforestation on the floors of waste disposal site according to a triangular scheme.

A biological method of reclamation will be applied for the greening of degraded areas at the site in question, and the following crops will be used:

- Weeding - Sowing a mixture of grasses 49 kg/ha: White clover (24.5%), Yellow star (24.5%), Cat's tail (20.5%), True meadowsweet (30.5%);
- Afforestation - Woody plants: Robinia pseudoacacia L. (acacia), Betula alba L. (birch), Acer campestre L. (clump).

Afforestation with acacia will be carried out on the slope of the landfill. The created terrace planes on the slopes of landfill will also be afforested with clump. Grass will be planted on the flat surface of landfill - level planes, followed by the afforestation with birch and clump.

The planting of trees on the slopes of waste disposal site will be carried out according to a triangular scheme at a distance of 2.24 m between the seedlings. This means that about 2000 seedlings can be planted on one hectare.

The planting of trees on a plateau (E560 and E580) of the landfill will be carried out according to a mosaic arrangement at a distance of 3 m between the seedlings. The mosaic arrangement will be used on the floors E580 and E560, which will alternate between shrubs and trees. In this way, about 70% of the area will be forested, while the rest will be a space reserved for the road for passage of machinery

Works on formation, i.e. raising green areas on a plateau of the Saraka landfill consist of formation the individual mosaics that will consist of shrubby and woody plants.

Woody plants (birch) will be used within one mosaic, which is approximately square in a shape. Planting will be done two meters from the edge at a distance of 3 m between seedlings (square scheme). In this way, about 1100 seedlings will be planted per hectare. Seedlings aged 2+1 will be used for planting.

Shrubby vegetation (clump) will be used for roundabouts. Planting will be done 1 meter from the edge at a distance of 3 m between seedlings (square scheme). In this way, about 1100 seedlings will be planted per hectare. Seedlings aged 2+1 will be used for planting.

The planting of trees on the floor levels of the waste disposal site will be carried out according to a square scheme at a distance of 3 m from each other. This means that about 1,100 seedlings can be planted on one hectare.

6. CONCLUSION

The goal of reclamation the open pits and landfills is to restore the ecological integrity of disturbed areas [1]. Revegetation is the most widely accepted and useful way of reclamation the degraded areas to reduce erosion and protect the soil from degradation. Revegetation must be done with plants selected on the basis of their ability to survive and regenerate in the local environment, and their ability to stabilize the soil structure.

The reclamation of degraded areas at the Saraka landfill is aimed at preserving the environment, and with the application the foreseen technical and biological measures, the good results can be expected despite the unfavorable underlying substrate. In this case, no economic profit is expected from the plantations, but only the protection of damaged soil from erosion and improvement the microclimate. In addition, the root system of seedlings and leaves that fall and rot on degraded surfaces will initiate the pedological processes in a direction of humus creation.

The effects of reclamation the degraded areas are reflected in the fact that:

- Forest plantings enable better binding of soil, stimulate the development of ground flora, activate the pedological processes in substrate with the root system, prevent the soil insolation and drying, blowing of strong winds and raising of dust.
- The application of grass cover on the final planes is aimed to prevent the erosion of soil, applied in a layer of 50 cm height, and enable the creation of grassy areas.
- Afforestation of degraded areas contributes to the environmental protection, improving the microclimate and aesthetic appearance of the environment.

ACKNOWLEDGEMENT

The authors are grateful to the Ministry of Science, Technological Development and Innovation of the Republic of Serbia for financial support according to the Contract with the registration number 451-03-66/2024-03/ 200052.

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