COMPARISON OF COSTS OF REHABILITATION WORKS ON CENTRAL MINE WASTE BANK OF JAN ŠVERMA MINE IN ŽACLÉŘ

SROVNÁNÍ NÁKLADŮ VYNALOŽENÝCH NA DOKONČENÍ REKULTIVAČNÍCH PRACÍ CENTRÁLNÍHO ODVALU DOLU JAN ŠVERMA V ŽACLÉŘI V JEDNOTLIVÝCH LETECH

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Abstract

This article pays particular attention to the evaluation of costs associated with the rehabilitation of the Central Mine Waste Bank of the Jan Šverma Mine in individual years. It mentions briefly the present state of the Central Mine Waste Bank and describes in short the works performed so far on the mine waste bank. Furthermore, the article describes specific types of rehabilitation; the description of partial operations is provided as well. The above-mentioned costs are quantified in a tabular summary for the years 2008 – 2011. These works were ordered by the Ministry of Industry and Trade through the state enterprise Fuel Combine Ústí nad Labem, which had absorbed the former state enterprise East Bohemian Coal Mines in Trutnov [1].

Abstrakt

V tomto článku se autoři zaměřují na náklady spojené s rekultivací Centrálního odvalu hlušin Dolu Jan Šverma v jednotlivých letech. Krátká zmínka je tu o současném stavu Centrálního odvalu a jsou zde stručně vylíčeny dosud provedené práce na odvale hlušin. Dále jsou zde popsány a rozděleny jednotlivé druhy rekultivací a u každé popis dílčích úkonů. V přehledné tabulce jsou vyčísleny již zmiňované náklady v letech 2008 - 2011.

Key words: rehabilitation, intermediate stockpile, hydro seeding, overall rehabilitation, technical rehabilitation, biological rehabilitation, specific costs.

1 INTRODUCTION

The underground mining of coal in the mining claim of the Jan Šverma Mine – Žacléř led to a ground subsidence and waste bank construction, which caused landscape devastation. For this reason, the necessity of remediation and rehabilitation appeared together with the closing down of mining operations.

In August 1992, the company Báňské projekty Ostrava worked out "Jan Šverma Mine Closure Plan – remedying the consequences of mining operations on land resources". This closure plan divides the area of interest into several localities and proposes a specific method of remediation and rehabilitation for each locality. It is a case of the Central Mine Waste Bank, Small Mine Waste Bank, Old Mine Waste Bank Eliška, Large Settling Basin and Small Settling Basin.

The most significant and most money consuming locality intended for remediation and rehabilitation is the Central Mine Waste Bank. This is situated at the altitude raging from about 530 to 630 m above sea level and occupies about18 ha. It dominates the landscape; along one side the mine waste bank is adjacent to the premises of the Jan Šverma Mine (GEMEC-UNION, JSC), along the opposite side it neighbours the municipality of Lampertice.

2 PRESENT CONDITION OF CENTRAL MINE WASTE BANK

At present, 11 of 18 hectares are rehabilitated. The cone of the Central Mine Waste Bank has been merely partially lowered to a half the height and re-graded, which resulted in a stable angle of the slope in the lower part of the waste bank. Rehabilitation works themselves began in the year 2004. In the period of 2004 – 2006, according to the current project, the Central Mine Waste Bank was reshaped to satisfy safe slope conditions, a small east protection barrier was constructed and the top part of the cone was lowered. Two transport inclined roads, three benches, drainage ditches, dams at the toe (east and south), irrigation pipes and a plateau were constructed, and the south ditch with retention basins and an overflow weir to the Egidi basin were modified. Altogether, about 93 000 m^3 of mine waste was excavated and moved away. Hydro seeding was applied to the area of about 118 000 m^2. In the years 2006 – 2009, the problems of water management conditions in this locality were solved comprehensively. It was the case of construction of the following three basins:

- Egidi basin – 1 370 m^3 of precipitation
- North basin – 2 000 m^3
- Setting basin – 5 000 m^3

Since the year 2008, works under the project "Subsequent care and maintenance of Central Mine Waste Bank" have been carried out. The goal is to green the whole surface of the mine waste bank – by grassing with scattered shrubbery and trees. The surfaces of benches, the top and the intermediate plateau and the toe of the mine waste bank were planted locally with woody species. The maintenance of slopes, inclined roads and benches – by so-called stabilization thresholds was performed. Over flat areas, soil was spread in the thickness of 10 cm and subsequently the areas were grassed over. On sloped areas, soil was spread in the thickness of 15 cm and the areas were grassed and rolled over. After that, coconut mats were put on the ground to prevent the soil already sown from being washed away. Before that, hydro seeding had been carried out in these areas.

Since the year 2010 works on the Central Mine Waste Bank under the project "Completion of Restoration and Rehabilitation Works on the Central Mine Waste Bank" have been done. The works are scheduled for five years. This year and next year, rehabilitation works will be performed in the west part of the mine waste bank; the toe of the mine waste bank will be stabilized by means of geogrids, the mine waste bank will be graded, drainage ditches will be excavated, etc. The goal of these improvements is the stabilization of the mine waste bank, planting with greenery and return of the mine waste bank to the landscape in the given area. The completion of these phases is planned to take place in the year 2012 [2,3].

Fig. 1 View of Central Mine Waste Bank before rehabilitation in 2004

2 TECHNICAL REHABILITATION OF JAN ŠVERMA MINE

2.1 Slope Maintenance

It includes the purchase of a gravelly material, transport of the material to an intermediate stockpile (10 km) and loading of the material from the stockpile. The transport distance between the intermediate stockpile and the locality is about 1km. The deposition into individual ditches (by means of chutes) and surface re-compaction (by means of rope securing) follow.

Fig. 2 Slope maintenance

2.2 Maintenance of Inclined Roads and Benches

The purchase of a gravelly material, transport of the material to an intermediate stockpile (about 10 km), loading of the material from the stockpile, transport from the intermediate stockpile to the locality (about 1km), deposition into individual ditches (without chutes), surface re-compaction (without rope securing), and construction of stone thresholds.

Fig. 3 Maintenance of inclined roads and benches

3 BIOLOGICAL REHABILITATION OF JAN ŠVERMA MINE

3.1 Greening Flat Areas

Lawn establishment by seeding (including the purchase of a grass mixture), covering the seed lightly by working into the soil with a rake, basic fertilisation.

3.2 Greening Inclined Roads

The purchase of soil, transport of the soil to an intermediate stockpile (50km), loading it from the stockpile, transport from the stockpile to the locality within 1km. Soil spreading, lawn establishment, including the purchase of a grass mixture. The transport and handling of coconut mats and oak wood pegs, purchase of stone, transport of the stone to an intermediate stockpile (about 10 km), loading it from the stockpile, transport from the stockpile to a locality within 1km, construction of stone thresholds.

3.3 Subsequent Maintenance of Seed-Sown Area

The preparation of a mixture for hydro seeding (seeds and admixtures, including fertilisers), establishing a lawn by the hydro seeding technique, establishing a lawn by sowing seed, including the purchase of a grass mixture, covering the seed lightly by working into the soil with a rake, and basic fertilising. The transport and handling of coconut mats, including oak wood pegs.

3.4 Subsequent Maintenance of Seed-Sown Areas and Irrigation

With reference to specific local conditions of the re-formed mine waste bank, grasslands will not be mowed and maintenance will be limited to the additional fertilising of grass plots and to the local manual additional sowing of grass mixture seeds. All greened areas are to be irrigated during the whole vegetation period.

Fig. 4 An example of hydro seeding and coconut mats

4 CALCULATION OF COSTS OF REHABILITATION IN YEARS 2008 - 2011

A formula for the calculation of specific costs of rehabilitation is as follows

$$N_m = \frac{\sum_{i=1}^{j} \Delta n_i}{S} \qquad \textbf{[CZK/ha]}$$

S – total area of rehabilitation action

Δn – partial cost

2008

Costs per1 ha- overall rehabilitation $\frac{2738000}{3.235} = 846368$

Costs per 1 ha- technical rehabilitation $\frac{434000}{0.195} = 2225642$

Costs per 1 ha - biological rehabilitation $\frac{2304000}{3.040} = 757895$

2009

Costs per 1 ha - overall rehabilitation $\frac{5152000}{6.250} = 824320$

Costs per 1 ha - technical rehabilitation $\frac{546000}{0.142} = 3845071$

Costs per 1 ha - biological rehabilitation $\frac{4606000}{6.108} = 754093$

2010

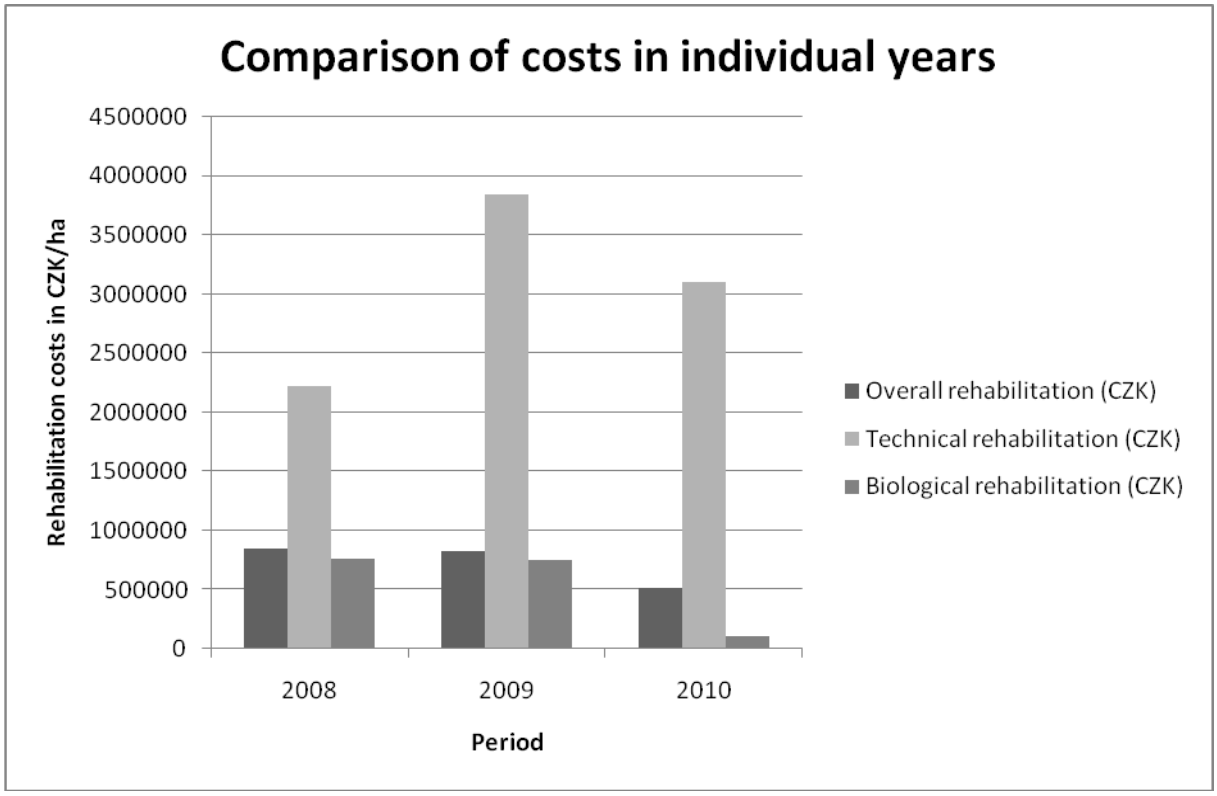
Costs per 1 ha - overall rehabilitation $\frac{5788000}{11.157} = 518778$

Costs per 1 ha - technical rehabilitation $\frac{4727000}{1.524} = 3101707$

Costs per 1 ha - biological rehabilitation $\frac{1061000}{9.633} = 110143$

Tab. 1 Comparison of costs in individual years

		Period		
		2008	**2009**	**2010**
Costs in CZK/ha	Overall rehabilitation (CZK)	846368	824320	518778
	Overall rehabilitation–area (ha)	3.235	6.250	11.152
	Technical rehabilitation (CZK)	2225642	3845071	3101707
	Technical rehabilitation - area (ha)	0.195	0.142	1.524
	Biological rehabilitation (CZK)	757895	754093	110143
	Biological rehabilitation - area (ha)	3.040	6.108	9.633



Graph 1 Comparison of costs in individual years

5 CONCLUSION

The goal of this contribution was to state and compare the costs related to the rehabilitation of the Central Mine Waste Bank at the Jan Šverma Mine and to determine proportions of the given types of rehabilitation, i.e. technical and biological ones. As can be seen in Table 1 and Graph 1, costs per 1 hectare of technically rehabilitated area exceed the costs per 1 hectare in the case of biological and overall rehabilitation. From Table 1 it is clear that from the point of view of surface area, this technical rehabilitation was less extensive than the biological and overall rehabilitation. The high costs of technical rehabilitation are caused by works connected with the water management of the mine waste bank, i.e. the formation of the above-mentioned basins, namely the Egidi basin, north basin and setting basin. In the year 2008, the ratio of costs per hectare of biological rehabilitation to those of technical rehabilitation is 34%, in the year 2009 it is 19.6% and in the year 2010 the ratio is 3.6%. For the year 2011, the costs of biological rehabilitation and technical rehabilitation are planned to be CZK 54 830 and CZK 675 924, respectively. The costs of technical rehabilitation will incur for e.g. the stabilization of the toe of the mine waste bank by means of geogrids. The costs of biological rehabilitation will be used for the maintenance and irrigation of greened areas.

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Fig. 5 View of Central Mine Waste Bank after rehabilitation in 2010

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RESUMÉ

Článek se zabývá problematikou rekultivace Centrálního odvalu hlušin Dolu Jan Šverma v letech 2008-2011. Vlivem hlubinné těžby vznikla potřeba provést asanaci i rekultivaci v uvedené oblasti na ploše 18 hektarů.

Pro konkrétnější představu řešeného problému autoři článku popsali stručně i historii hlubinné těžby uhlí v dobývacím prostoru Dolu Jan Šverma – Žacléř a současný stav Centrálního odvalu. Hlavní náplní článku je posouzení nákladů souvisejících s technickou a biologickou rekultivací v uvedené oblasti.

Pro zjištění nákladů ve sledovaném období se použil vztah pro výpočet měrných nákladů jednotlivých rekultivací. Náklady byly propočteny na jeden hektar rekultivované plochy. Z vypočtených výsledků vyplývá, že náklady na jeden hektar technické rekultivace zdánlivě převyšují náklady na jeden hektar biologické i celkové rekultivace. Z prezentovaných výsledků je zřejmé, že provedení technické rekultivace je nákladnější než rekultivace biologické.