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SOLUTION OF WATER TRANSPORTATION FROM WELLS LINE LC-14 TO THE RIVERBED OF DUNAVAC ON THE WEST SIDE OF OPEN PIT DRMNO

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Abstract:
Transport is an integral part of mining activities. In addition to driving, mining, processing and dispatching, transport presents the most important service process in deep and open-cast mines. This paper presents the solution of the water transport from the wells line LC-14 by pipeline. It is envisaged that the pipeline be placed on the surface of the terrain, and partly the transport of water will take place under pressure, and the other part gravitational.

Key words:
Water transport, open pit, lignite, Drmno

INTRODUCTION

Transport and transportation process present one of the key element of mining. There are several ways of transport and transport devices for mining processes. For example transport by conveyors (with winding element – belt conveyors, chain conveyors, etc.), transport tracks, transport by self-weight, transport by pipes.

Pipelines presents a very important part for transport energy utilities (for example for oil, gas, water transport). By Efzan and Kesahvanveraragu pipelines are the only medium installed at offshore region to convey oil, gas, chemicals and water [1].

Water can be conveyed through pipelines by the help of gravity flow or pumping. The pumping system is significanlty more expensive to operate, construct and maintain. Pipelines with large-diameter can be used for conveying of water over large distance [2]. It is needed to emphasize that the transportation sector use large amounts of energy. The same situation is in the area of pipeline and water transportation [3] and also in mining sector.

The lignite deposits of Drmno (area of about 60 km^2) belongs to the Kostolac basin and is located about 100 km from Belgrade or 18 km from Požarevac (Figure 1). Its border is: the Danube River in the north, the Boževačka beam in the east, the line Bradarac-Sirakovac valley in the south and the river Mlava in the west. Within the deposit there is a open pit Drmno, whose annual capacity is 9 * 106 tons of lignite. Of the total annual production, 8.5 * 106 tonnes of lignite is for the supply of thermal power plants. The hydrographic network is very diverse [4]. The Danube with the Dunavac (fork) and the tributaries of Velika Morava and Mlava gives specific features to the hydrographic network of the area.

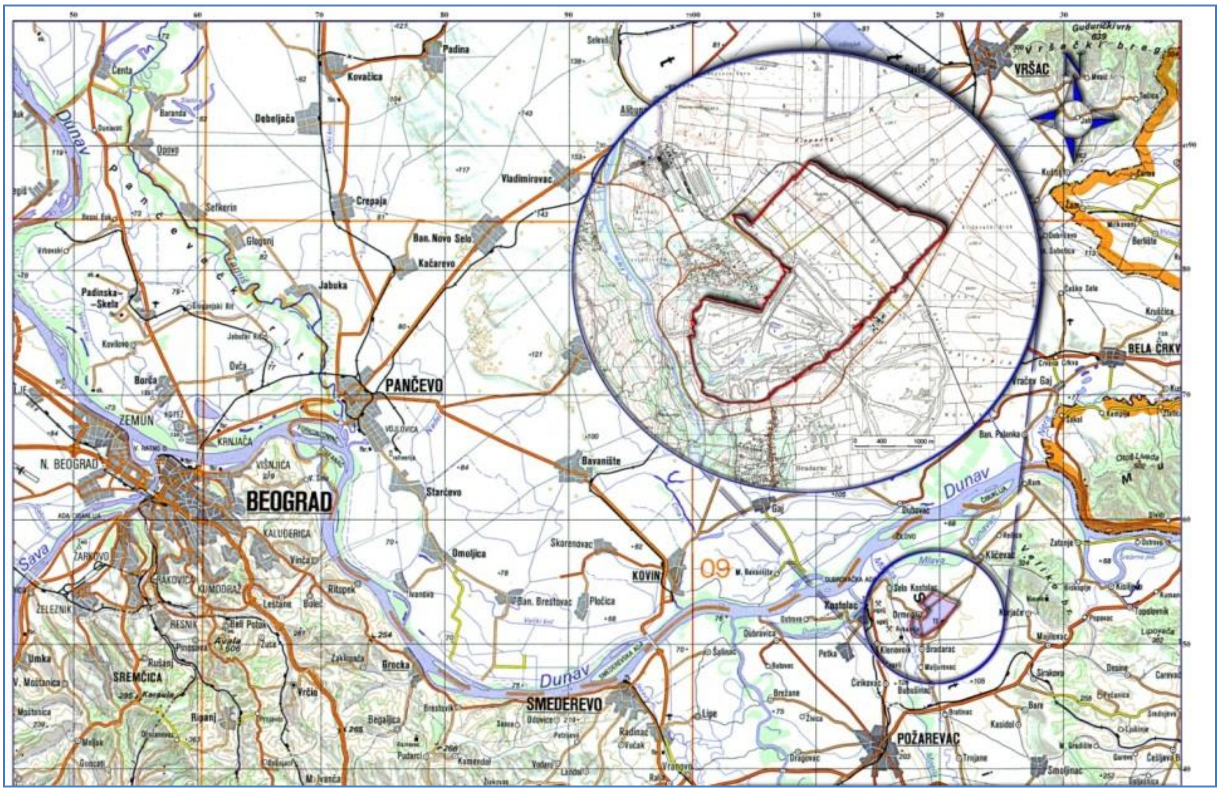

***Fig. 1** Geographic position of open pit Drmno*

The dynamics of mining operations foreseen that the open pit Drmno at the end of 2018 on the eastern side intersection the riverbed of Dunavac. Currently, there is a line LC-14 well, as well as parts of the wells lines LC-12 and LC-13, between the open pit and the trough of Dunavac. The water from these wells is pumped into the trough of Dunavac in front of the front of the works.

Due to the planned intersection of the trough of Dunavac, a new Connect Channel 4 has been constructed on the west side of the tray, which connects to Channel 4-1 (Figure 2).

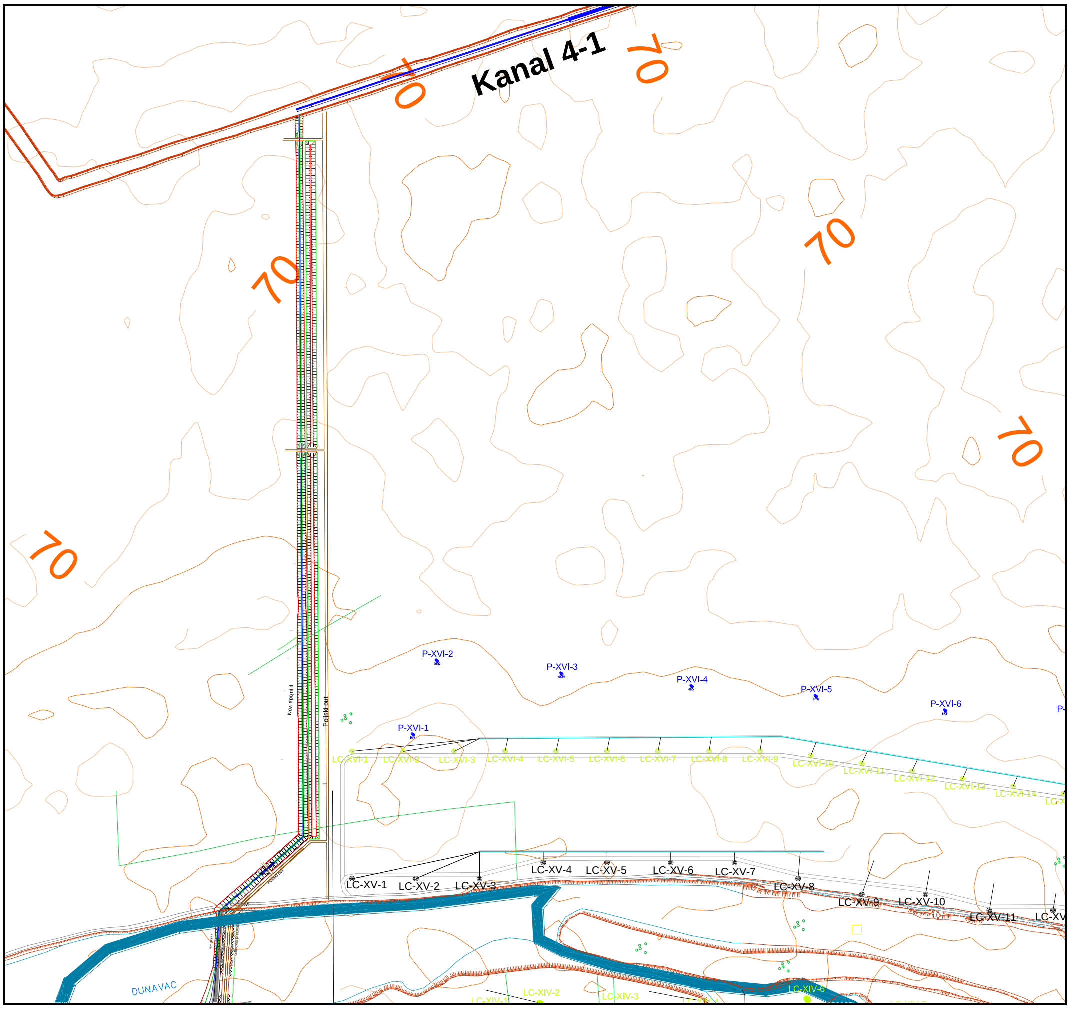

Fig. 2 *Location of new Connecting Channel 4*

In order to approach the mine closure of the old Dunavac riverbed and allow intersection for the mining works, it is necessary to transport the underground water from the well LC-14 to the Dunavac riverbank, where it connects to the Connection Channel 4 on the west side of the open pit.

1 SOLUTION OF WATER TRANSPORT FROM WELLS LINE LC-14

As at the end of 2018. year, mining works are planned to intersect the Dunavac riverbeds in the eastern part, it is necessary to redirect and transport water from the wells to the section of the Danube riverbank, on the west side of the open pit (Figure 3). For the transport of the mentioned water, a CT-14 pipeline will be constructed, which will transport water from the wells to the ZGC's western gravity pipeline, ie the ZŠ-5 manhole. From the manhole the water will flow gravity into the Dunavac riverbed [5].

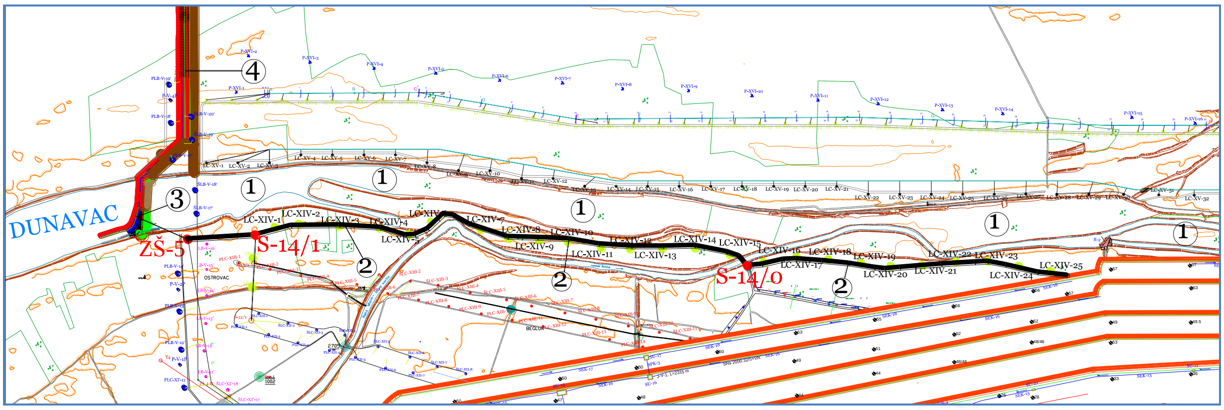

Fig. 3 *Location of the CT-14 pipeline for the gravity water transport from the well LC-14*
1 - Danube riverbed, 2 - Pipeline CT-14, 3 - Water drainage point in Dunavac riverbed, 4 - Connecting channel 4

The water from the wells LC-XIV-1 to LC-XIV-25 will be pumped to the CT-14 pipeline, which will be installed in the field and the water will be transported under pressure. Investor disposes of a certain amount of water pipes of different diameters (Table 1), which need to be fitted into the designated pipeline.

Tab. 1 *Existing water pipes*

Pipe diameter (mm)	Pipe length (m)	Material
200	235,0	
350	705,0	
400	310,0	Epoxy resin with glass fibers
500	730,0	
700	400,0	
800	420,0	

The pipeline for water transporting from the well LC-14 will consist of 7 sections. The water under pressure will be transported by pipeline in the length of 2,540 m to the Š-14/1 manhole, from which, in the length of 215 m, it will go gravitational to the ZŠ-5 manhole (Table 2).

Tab. 2 *Characteristics of sections of the pipeline CT-14*

Section	L (m)	R (mm)	Note	Water inflow (l/s)	Real permeability (l/s)
1	235	200	Under pressure	31,5	94,24
2	705	350	Under pressure	81,1	288,63
Manhole Š/14/0				141,1	
3	310	400	Under pressure	162,0	376,99
4	730	500	Under pressure	234,3	589,04
5	400	700	Under pressure	263,7	1150,00
6	160	800	Under pressure	286,7	1510,00
Manhole Š/14/1				501,7	
7	215	800	Gravitational	501,7	601,70

The water transport will start with 200 mm diameter pipes in the length of 235 m, and will continue with pipes of 350 mm diameter in the length of 705 m, up to Š-14/0 (Figure 4).

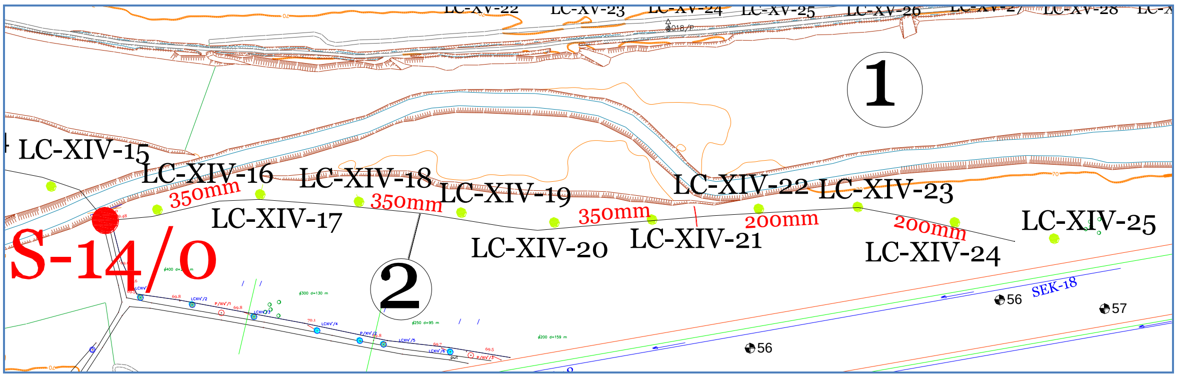

Fig. 4 *Manholes 1 and 2 of the pipeline CT-14*
(1-Dunavac, 2-Pipeline CT-14)

From the manhole Š-14/0 where water is collected from the pipeline OC-14, the transport is continued with pipes 400 mm in diameter, 310 m in length, and continues with a diameter of 500 mm in the length of 730 m (Fig. 5) and a diameter of 700 mm at a length of 400 m and a diameter of 800 mm in the length of 160 m to the Š-14/1 manhole (Figure 6).

From the manhole Š-14/1 where it accepts water from the pipelines OC-12 and OC-13, the transport of water is continued with gravity tubes of 800 mm diameter in the length of 210 m to the ZŠ-5 manhole (Figure 6). As the ZŠ-5 manhole is buried, the transported water from the CT pipeline will flow from the terrain to it [6].

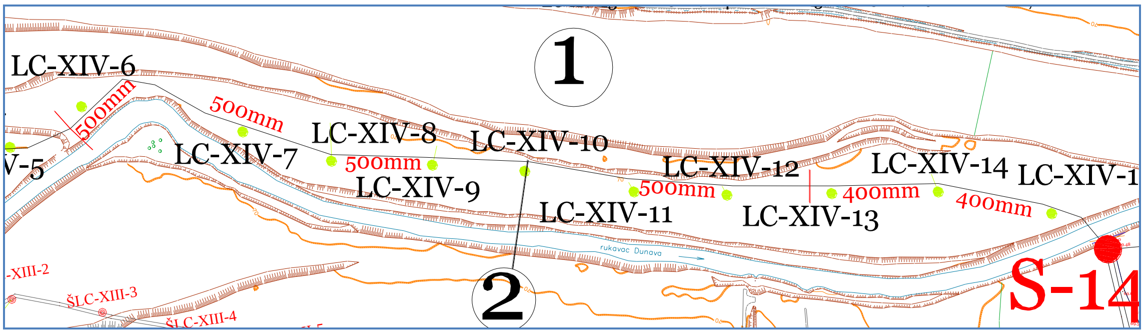

Fig. 5 *Sections 3 and 4 of the CT-14 pipeline*
(1-Dunavac, 2-Pipeline CT-14)

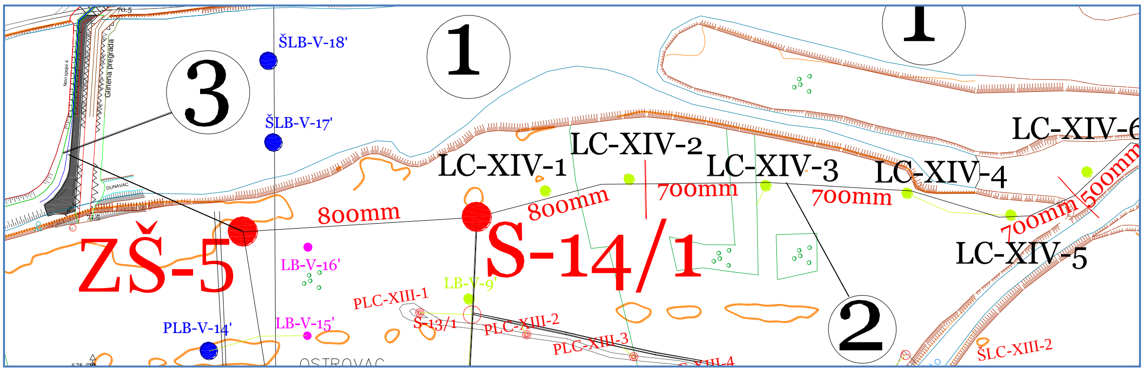

Fig. 6 *Sections 5, 6 and 7 of the CT-14 pipeline*
(1-Dunavac, 2-Pipeline CT-14, 3- Flow of pipeline in the Dunavac riverbed)

As the exit from the manhole Š-14/1 on the corridor is 70.27, and the leak in the ZŠ-5 on the angle 70.0, it is a drop in the share of 0.125%. With tubes of epoxy resin with a glass fiber diameter of 800 mm, where the resistance coefficient of water movement is 145, and with this fall, it is possible to transport a water quantity of 601.7 l / s for a full cross-section of the pipe.

2 CONCLUSIONS

The proposal for the solution of the water transport from the wells LC-14 to the ZŠ-5 on the western gravity pipeline required the use of the pipes available to the Investor, its quick realization and as little cost as possible.

The given solution is reflected in the construction of the CT-14 pipeline on the surface of the terrain in the total length of 2755,0 m, with the use of existing pipes. Thanks to the quality of the pipe, very easy and quick installation on the surface of the terrain is possible, as well as the transport of water under pressure in the length of 2540 m, and the transport of water gravity in the length of 215 m. By placing this pipeline, minimal earthworks (burial of 2 manholes) occurred, which will contribute to the minimal costs of implementing this solution.

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