



An overview of the application of modern methods of hydrodynamic calculations for groundwater control systems of open cast mines in Serbia

Преглед на прилагането на модерни методи за хидродинамични изчисления на системи за контрол на подземни води в открити рудници на Сърбия

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Groundwater control represents a set of technical measures which regulate the groundwater regime in a certain area (levels and inflow) according to assigned criteria. Additionally, it includes the construction of a control system which deals with drainage in a certain area. Groundwater control systems are utilised for the protection of settlements, hydrotechnical facilities, shorelines, a meliorative areas and mineral resource deposits (mines and open cast mines). The most complex issue concerning groundwater control are mineral resource deposits, which is precisely the reason why open cast mines were singled out as being the perfect testing area for assessing the applied methodological process in practice, the so-called hydrodynamic analysis.

The hydrodynamic analysis represents a set of different methods of hydrodynamic calculations, among which the method of three-dimensional hydrodynamic modelling of aquifer regimes is the most complex and the most applicable, being based on the numerical solving of differential equations which describe the flow of groundwater and the processes which occur in a porous media. The main application in hydrogeology is supporting regime analysis and the quantification of groundwater mass balance, flow line analysis, variance calculations of a certain technical solution, as well as for forecasting groundwater flow, pollutants or heat.

The main goals of hydrodynamic models of open cast mines are prognostic calculations for designing groundwater control systems, i.e. lowering the groundwater level under the level of the mining works, followed by an analysis of the effects of groundwater

control system functioning and the choice of optimal variant. Since the end of the 20th century, hydrodynamic models have been used for the aforementioned purposes in Serbia.

There are two coal basins in Serbia where coal is being exploited to supply thermal power plants and the general populace: Kolubara and Kostolac basins. The Kolubara coal basin encompasses a surface area of approximately 600 km² and consists of numerous open cast mines, among which “Polje B”, “Polje D”, “Polje E”, “Tamnava-Zapadno Polje” and “Veliki Crljeni” are active today. These open cast mines produce approximately 75% of lignite in Serbia. The Kostolac coal basin encompasses a surface area of approximately 50 km² and includes open cast mine “Drmno” where 25% of lignite in Serbia is produced. In accordance with the aforementioned purposes of hydrodynamic models in open cast mines, their application is illustrated on the most salient examples from Serbia in the following papers: Polomčić, Bajić (2011); Bajić, Polomčić (2012); Polomčić et al. (2012a, b; 2014; 2016a, b, c; 2017). As one of the research results, chart of the distribution of piezometric levels and balance elements as a result of hydrodynamic model calibration is given in Figure 1. A three-dimensional hydrodynamic model, based on the method of finite differences, was developed using the MODFLOW code with Groundwater Vistas Advanced graphic user interface.

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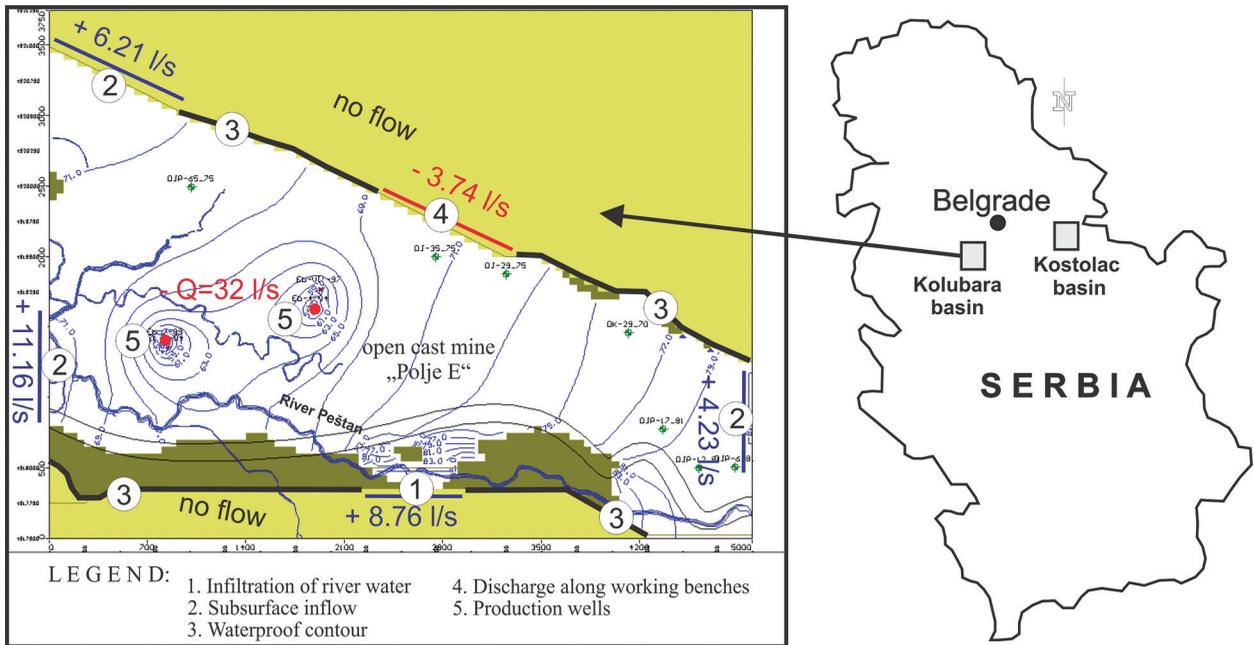


Fig. 1. Map of piezometric level distribution and balance elements at open cast mine “Polje E”

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