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# Untypical Draining Barriers Efficiency as a Method of Pollutants Limiting in the Groundwater Reservoir

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**ABSTRACT**

The main aim of the paper was to formulate a proposal of using the draining barriers as a method of limiting pollutants in the groundwater reservoir. Primary processes of pollutants migration and examples of functioning the draining barriers work against the spread of various pollutants in the groundwater were indicated. An untypical kind of draining barrier, i.e. wells which were designed as a hydrogeological borehole to exhaust water intended for consumption, was selected as the research object. For analytical purposes, the available archival results of the physicochemical analysis of groundwater exhausted from the wells, located in the water intake so-called "belt D" in Kraków-Nowa Huta were used. The database was analysed by specialist programs, and the dispersion migration of pollutants from the existing metallurgical waste dump "Ruszcza" in time was presented. Temporary and spatial variability of the physicochemical parameters of groundwater was done during the analysis. The analysis was performed both in the draining barriers wells and in the intake boreholes. A geostatistical analysis of the variability of pollutant spread in the groundwater medium was a vital factor in the appraisal efficiency of the draining barriers operation. It was shown that the highest contents of the researched substances were present in the wells, which are located the nearest of metallurgical waste dump "Ruszcza" and are thereby the wells co-forming draining barriers. The efficiency of draining barriers was found after a thorough analysis.

**Keywords:** groundwater, pollution, draining barrier, pumping

## INTRODUCTION

Groundwaters offer the best physicochemical and bacteriological properties and thus they should be provided with the highest form of protection. About 40% of the drinking water comes from groundwater, about 97% of the rural population drinks groundwater, and about 30–40% of the water used for agriculture comes from groundwater [Sharma and Reddy 2004]. A steadily growing anthropogenic pressure on groundwater resources creates a conflict situation between nature and man which are competing for clean and safe sources of water [Żurek et al. 2015]. This is caused by the increasing inputs of contaminants to our global water resources, posing a serious risk to human health and ecosystem functions [Balderacchi et al. 2013; Schwarzenbach et al. 2010]. A growing interest is now observed in the methods of stopping or reversing the progressing degradation of the soil and water environment, mainly caused by anthropogenic pressure. Since the end of the 20th century, a rapid development of effective remediation has been observed, although optimization is still necessary. Treating the soil and groundwater environment, unlike surface water treatment (where technology is largely recognized), is a challenge for environmental engineering. High consciousness of groundwater contamination is reflected in the environmental legislation of the European Union [Kløve et al. 2011a and 2011 b; EC 2000 and 2006]. A systematic approach for the assessment and remediation of contaminated sites is necessary in order to facilitate the remediation process and avoid undue delays. The most important aspects of the approach include site characterization, risk assessment, and selection of an effective remedial action [Sharma and Reddy