

Chemism of the run-off wastewater from urbanized areas based on the Kielce City example

A. Rabajczyk¹, Ł. Bąk² and J. Górski²

¹Department of Environmental Protection and Modelling, The Jan Kochanowski University of Humanities and Sciences in Kielce, ul. Świętokrzyska 15G, 25-406 Kielce, e-mail: chromium@tlen.pl, tel. +48 041 349 64 35, fax +48 041 349 64 18

²The Kielce University of Technology, Chair of Geotechnics and Water Engineering, 25-314 Kielce, Al. Tysiąclecia Państwa Polskiego 7, Building A, l.Bak@tu.kielce.pl

Abstract. The study was conducted at the collector of run-off wastewater (Si9), located in Kielce. Silnica River is a small river cutting through the city of Kielce from the North to the South-West. It has its source in Masłowski Range at a height of 360 m a.s.l. and it flows into Bobrza River. It is ranked among mountain rivers at a 6.4 ‰ gradient. Its river-bed has belonged to Kielecki Protected Landscape Area since 2006. Next to Szydłówek estate the artificial water body was built - Kielecki Bay. Beneath Kielecki Bay, Silnica River flows in regulated river-bed. Because of no separated storm water drainage, the rainwater washes away pollutants among others from industrial plants, houses, pavements, and streets into Silnica River. The wastewater treatment plant is located at the mouth of the Silnica River. It receives rainwater and snowmelt from the central - eastern part of the city with an area of 62 ha. The primary channel has a length of 1569 m and its diameter varies from 600 mm to 1250 mm. It is attached to the side of seventeen channels (with diameters from 300 mm to 1000 mm). The collector wells are 32 inspection and connection, and 24 entries. The side channels are located 119 wells and 82 outlets. The total length of the sewerage system is equal to 5583 m. The decrease of the collector changes to individual sections from 0.04% to 3.9%, and decreases in side channels to reach 2.61%. On average, one groove receives water from the surface of 0.585 ha. Ordinate the highest point in the catchment area is 271.20 m, 260.0 m above sea level the lowest, the average decrease in surface area is equal to 0.71%. Within the basin was isolated six types of surface runoff: roofs (14.3%), walks (8.4%), roads (17.7%), parking (11.2%), green (47.2%) and pitch school (1.3%). Generally, paved areas with a high coefficient of runoff represent 52.83% of the total catchment area, which shows the typical urban character. The run-off wastewater is collected from the roofs by gutters incorporated directly into storm channels (72.5% of all roofs), with roads and streets on a typical street drains with cast iron grate. A qualitative and quantitative study of run-off wastewater was conducted between February 2011 and October 2011. The study covered metals of Fe, Cd, Cr, Al and Mn, ions of Ca²⁺, Mg²⁺, Na⁺, K⁺, NH₄⁺, Cl⁻, F⁻, NO₃⁻, SO₄²⁻ and PO₄³⁻ as well as the distribution of rainfall intensity, the pH and conductivity. The levels of these selected heavy metals were determined using F-AAS and/or ICP-MS-TOF (GBC), but the levels of selected ions were identified by means of ion chromatography (Dionex ICS-3000).

Key words: run-off wastewater, metals, inorganic ions, urban area