

# CONSEQUENCES OF NON PLANNED URBAN DEVELOPMENT DURING TURBULENT TIMES IN SERBIA – CASE STUDY OF SUBURB KUMODRAZ WATERSHED IN BELGRADE

JOVAN DESPOTOVIĆ\*, JASNA PLAVŠIĆ, ALEKSANDAR  
DJUKIĆ AND NENAD JAĆIMOVIĆ

*Institute for Hydraulic and Environmental Engineering, Faculty  
of Civil Engineering, University of Belgrade, P.O. Box 42, 11120  
Belgrade, Serbia*

**Abstract.** Development is usually based on numerous analyses accounting for planning, economy and population assessments as well as urbanism, architectural and civil engineering infrastructure planning and project design. The modern city planning begun during Napoleon in Paris, while modern urban planning in Belgrade started in mid nineteenth century. At the end of twentieth century turbulent times occurred in the area of ex Yugoslavia so that numerous plans of development started being misused or never completely respected. Actually, during 1990s urban development in cities of Serbia became rather uncontrolled. In addition, during 1990s many people moved from rural places to, to their opinion, more promising places, most frequently to the Capital city. This paper presents a series of consequences of non planned urban development on sewer infrastructure operation. Those includes high construction rate including increase of number of inhabitants at suburban part, namely watershed of the brook Kumodraz at the southern part of the city of Belgrade. Those changes were noticed during preparation of preliminary design for the reconstruction and upgrading of the combined waste water system at this part of the city. The design preparation included measurements of wastewater and rainfall runoff at the downstream outlet. During measurement period, which started in 1997, significant differences occurred in the both base flow, i.e. dry weather flow, as well as in peak flows during moderate and severe rainfall events.

**Keywords:** urban planning, sewerage, rainfall, runoff, infiltration, flooding

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\* To whom correspondence should be addressed. Jovan Despotović, Institute for Hydraulic and Environmental Engineering, Faculty of Civil Engineering, University of Belgrade, P.O. Box 42, 11120 Belgrade, Serbia; e-mail: edespoto@hikom.grf.bg.ac.yu

## 1. Introduction

Kumodraz catchment covers 8 km<sup>2</sup> and is located in southern part of the city of Belgrade (Serbia). Urban development of the area was most intense during 1960s and 1970s when Kumodraz trunk sewer was constructed for conveying waters of Kumodraz brook as well as wastewaters and surface runoff from the catchment area. Construction of the trunk sewer was a part of realization of the Belgrade sewerage master plan in southern part of the city which foresaw development of mixed sewer system in the area: separate sewer systems in newly developed areas on upstream parts of the watershed and combined sewer system in downstream part of the catchment where combined sewerage already partly existed. Urban planning foresaw development of housing, industrial zone, while significant portion of the watershed in its upstream part should remained non-urbanized. Maximal capacity of the main trunk sewer was 8 m<sup>3</sup>/s, which corresponded to hydrological and hydraulic analyses at that time. The master plan also foresaw that further urbanization of the area in the future would require construction of retention basin(s) for lowering peak storm water flows, however these has not been constructed.

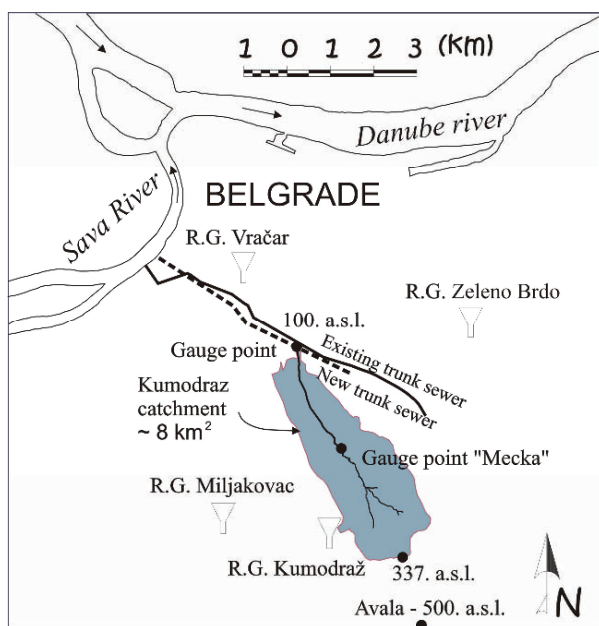


Figure 1. Kumodraz catchment and rain gauges (RG) in the area