# Interactive approach for the sustainable stormwater management in medium-sized cities in Serbia – case study Pancevo

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## Introduction and Background

In the Republic of Serbia, **urban drainage systems**, along with the waste water and water supply systems, are under jurisdiction of the local government and managed by the **municipal public utility companies** (PUC). Due to the political, economic and sociological situation in the last 25 years, **development was not continuous**, resulting in the numerous issues that need to be addressed. Most of them are related to the socio-economic aspects, capacity building and data. Example problems, common for a number of cities in Serbia, and some viable solutions, for achieving sustainable management by public or private utility companies, are presented through the case study of city of Pancevo.

## Case study

The municipality of Pancevo is located on the southwestern rim of Banat region in Serbia. According to the 2011 census, **municipality population is 123 414**, while in the city itself has a population of 76 203. Stormwater system is **separated** from the waste water sewer. The system consists of the combination of the underground sewer network, open and closed channels, with some of them dating from the mid 18$^{th}$ century. Five main subcatchment areas are present, three of them are discharging in the Tamis River, while remaining two in the Nadel River through the open channel network. In the recent history, **two extreme storm events in 2011. and 2014.** have caused notable flooding in the urban and suburban areas. Similarly, as by Defra (2008), increase in the intensity of the storm events has been identified in some places in Serbia (Plavšić *et al*., 2016).

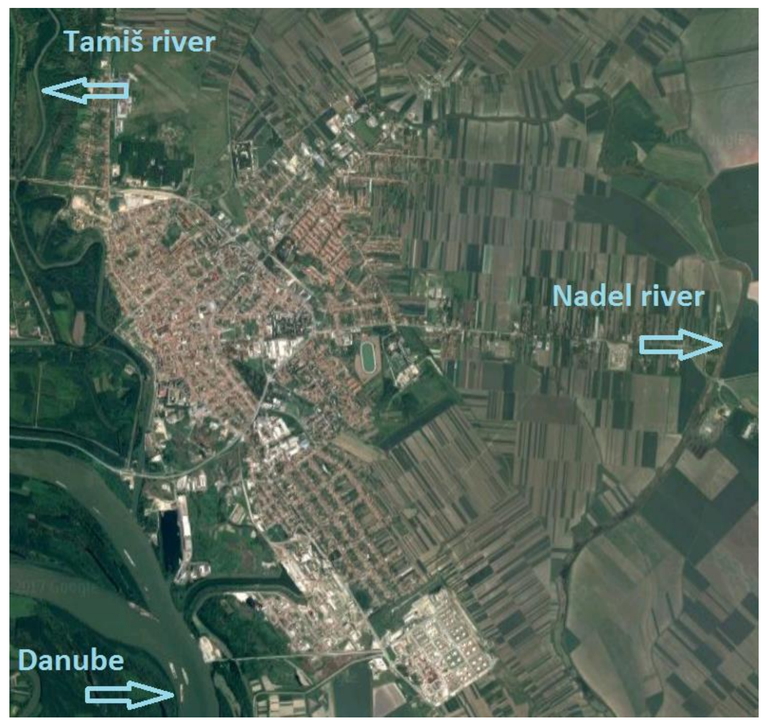


**Figure 1.** Google map image of Municipality of Pančevo and recieving water bodies

**Figure 2.** Private properties along the channel bank

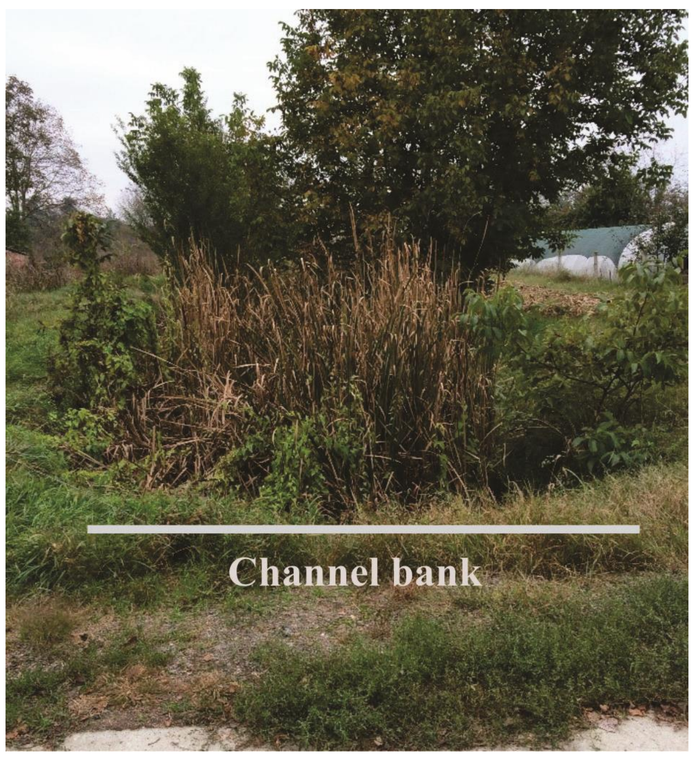


**Figure 3.** Vegetation inside the channel

## Socio-economic aspect 1: PUC funding

Recognized as a key issue for the storm water management, socio-economic aspect is reflected upon the managing PUC as well as upon the users. Until recently **water tariffs were kept low**, bellow the economic price, which reflected on the utilities. Due to the lack of funds, PUC-s efforts are limited in most cases to the maintenance of the system while seldom there is major development activity. This period was accompanied by intensive **unplanned urbanization**, resulting in new undrained suburbs and increased inflow to existing system. On the other hand, without the notable service improvement, population and the social movements **resist the further price rising**.

**Viable solution: Where to break the vicious circle?**

## Socio-economic aspect 2: "Recklessness"

Additional problem, in the case of the city of Pancevo, is that large parts of the **open-channel network is off-limits** for the employees of the PUC. Reason is that in some places, properties that are on the channel banks had been sold to the private owners in the past (Fig 2). To make things worse certain households and companies positioned along the banks, are using the channels as **sanitary sewer outfalls**, which led to the **vegetation excessive growth** (Fig 3). Maintenance of these vital parts of the system is difficult, and in some cases impossible, because of the limited and/or restricted access. Result is a channel **hydraulic capacity reduction**, leading to the **frequent flooding**, as well as the **water quality degradation**.

**Viable solution: Should the Public Interest Regulations be imposed?**

## Knowledge transfer and capacity building

Although the engineering staff of the managing PUC, is experienced and capable of resolving the system related problems, they are often discouraged to look for alternative, innovative, yet available novel approaches, like Nature-Based Solutions etc. Currently, **austerity measures**, like restricted-employment in public sector, has an impact on the PUC-s, as well. This prevents an inflow of young engineers and to train them for future challenges.

**Viable solution: By LLL to improve the expertise in these topics**

1. Sustainable Urban Drainage Systems
2. Green Infrastructure and Nature Based Solutions
3. Numerical modelling with EPA-SWMM,
4. Measurements and Data collection
5. Asset Management.

## Data issues

In order to allow for the sustainable management of the system, measured data is needed (Schutze *et al*., 2002). Mutual problem for the water utilities in the CEE region is the **lack of valid data**. Specific for the city of Pancevo was that the in terms of the hydraulic parameters (water levels and flow rates), are very limited, while the data on soil types and characteristics, needed for the assessment of GI and NBS potential, are not available. Water quality measurements are periodically performed at the river also, but open channel network with combined sewer flow still needs to be investigated.

**Viable solution:**

- **State-level initiative regarding the urban water systems monitoring and data management and integration with other urban infrastructure systems.**
- **Possible sources of funding:**

  1) PPP
  2) Central Republic funds
  3) IPA funds

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