



Drainage Area Study of the city of Hradec Kralove, Czech Republic, and its utilization for urban planning

Suchanek M., Vitek J., Finfrlova P., Stransky D.
and Kabelkova I.

The 1st Danube Region Workshop, 28-29 January 2014, Szentendre, Hungary

Contents



Stormwater management in the Czech Republic

Project introduction

Goals of the study

Methods and results

Conclusions

Stormwater management in CZ



Till 2009

- no sustainable urban drainage systems (exceptions: rare individual projects and EU financed projects)

Since 2009

- revision of Water Act and regulations to the Building Act - change towards sustainability

2013

- development and application of standards for SWM

Priority 1	Infiltration ; in the case of polluted runoff, pre-treatment is needed.
Priority 2	Retention and regulated discharge to the receiving waters (directly or by a separate sewer system), pre-treatment if needed.
Priority 3	Retention and regulated discharge to the combined sewer system

Drainage Area Study of Hradec Kralove



Project execution:

- 03/2009 – 03/2011

Client:

- Municipality of Hradec Kralove

Processed by:

- DHI
- JVPVH

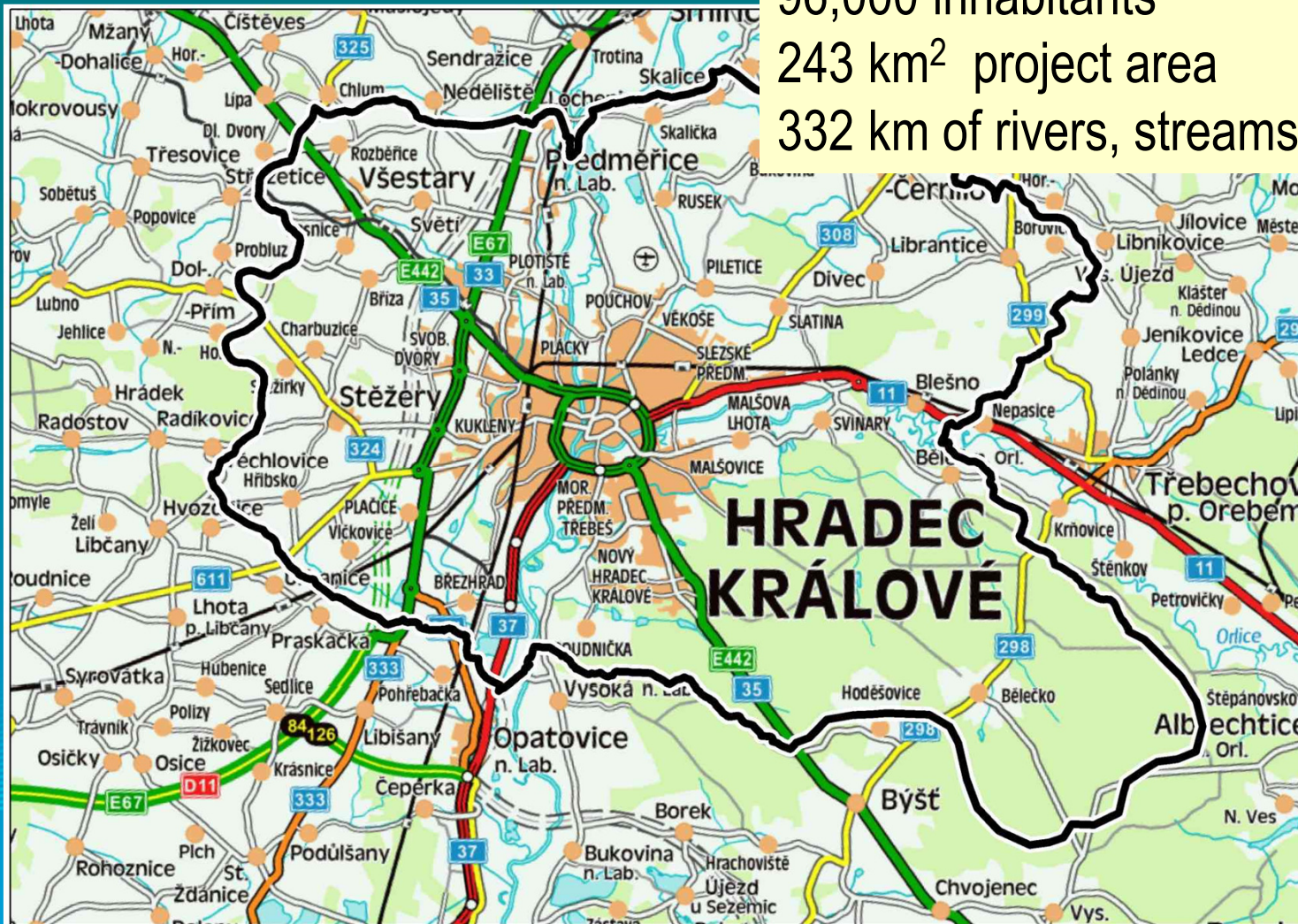


+

10 further
organizations
involved

Scope of the study

96,000 inhabitants
243 km² project area
332 km of rivers, streams and channels



Goals of the study



Main goals of the study were:

- set a long-term conception of the city stormwater drainage respecting sustainability principles
- link stormwater management within the region with the new City Development Plan
- provide decision support for city authorities

Tasks

1. Assessment of current status of the stormwater management in the area and identification of regions of high flood risk both at open channels and in the sewer system,
2. Analysis of the potential of the existing development to approach pre-urbanization runoff behavior,
3. Definition of rules and criteria of sustainable stormwater management in the planned development,
4. Design of measures in the in the catchment, sewer system and open channels

1. Current status of stormwater management



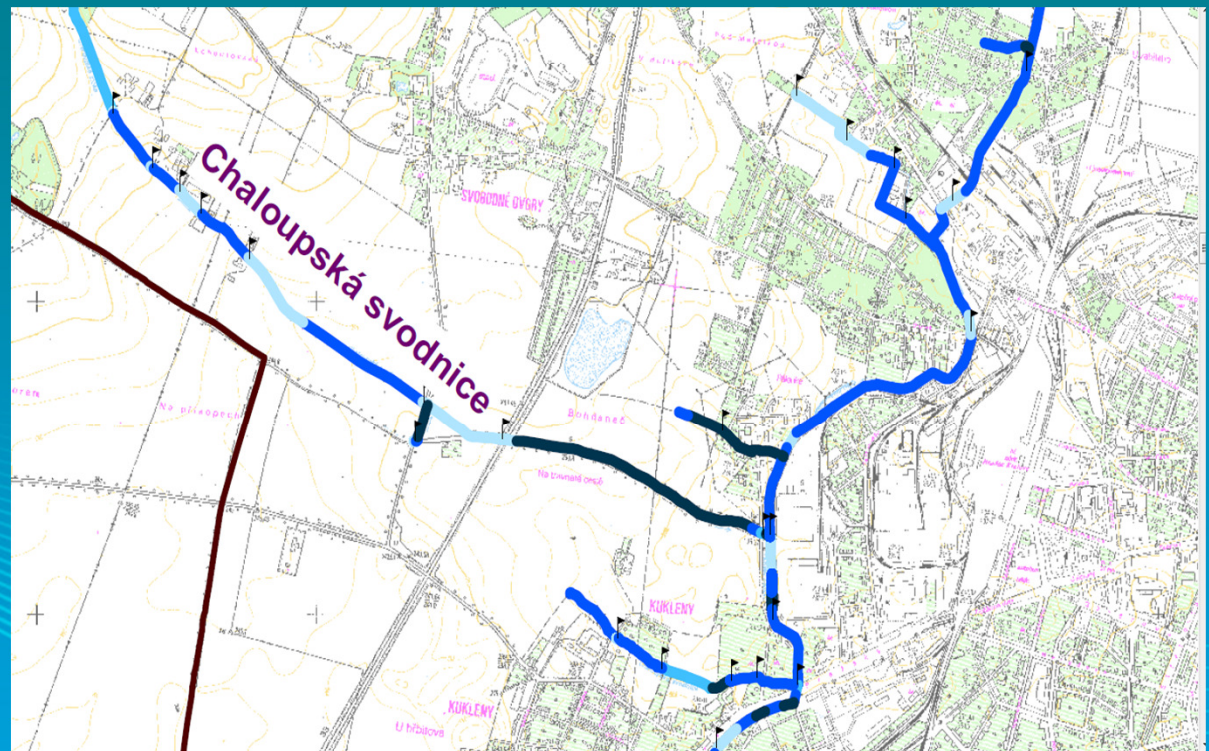
Methods:

- Monitoring and surveys
- Hydrodynamic modeling of the
 - sewer system,
 - water bodies, artificial open channels,
 - underground waters and
 - elements of stormwater management

1. Current status of stormwater management

Results:

- Ranking pipes and channels according to the frequency and level of overloading
- Identification of areas of flood risk



2. BMPs potential of the existing development


Methods:

- Analysis of the City Development Plan from the point of view of BMPs application,
- Field survey of the potential of the area to infiltrate or to delay stormwater runoff
 - e.g. sufficient green areas,
- Evaluation of the technical and available BMPs potential in different areas
 - based on the enhancement of the field survey for hydrogeology, slopes, ecological burdens, character of the development, ownership of the buildings and grounds,
- Determination of the total BMPs potential of the existing development.

2. BMPs potential of the existing development

Results:

- 92 evaluation sheets
- ranking availability of BMPs potential

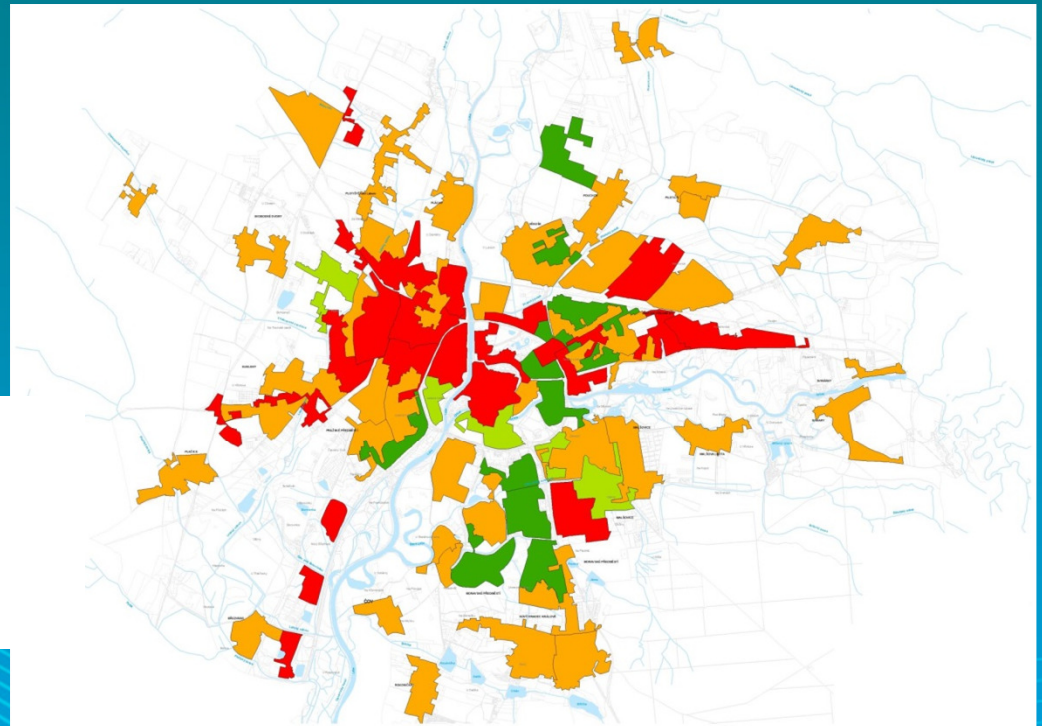
Streets	POD ZAMECKEM, MILADY HORAKOVE, PROSTEJOVSKA, FRICOVA, URKOVA	Local part	Trebes
		Acreage	35 ha
		Hydrological catchment No.	1-03-01-002
		Trunk sewer	C
Borders of area			
Criteria		Classification	
Information on the development	Prevailing development	city centre	5 %
		multi-storey dwellings	95 %
		low-storey dwellings	
		industrial area	
		traffic infrastructure	
	Ecological burdens	Yes	
		No	•
	Stormwater infiltration	no limitations	10%
		conditionally suitable	
		difficult	90 %
impossible			
Technical potential of infiltration	Presence of areas suitable for stormwater infiltration	Yes	•
		No	
	Prevailing slope of surface	< 3%	•
		≥ 3%	
Available potential of infiltration	Owner of buildings	City	•
		other	
	Owner of adjacent areas suitable for stormwater infiltration	City	•
		other	

2. BMPs potential of the existing development

Results:

- 43 ha of impervious surfaces can be disconnected (decrease of connected impervious area by 15%)

available – dark green,
conditionally available – light green,
not available - orange,
none – red



3. Water management rules and criteria for the planned development

Methods:

- Analysis of the water regime, setting water management criteria distinguishing areas suitable and unsuitable for the future urbanization,
- Evaluation of possibilities of stormwater management in areas suitable for urbanization,
- Specification of requirements regarding maximum specific regulated discharge from individual building plots.

3. Water management rules and criteria for the planned development

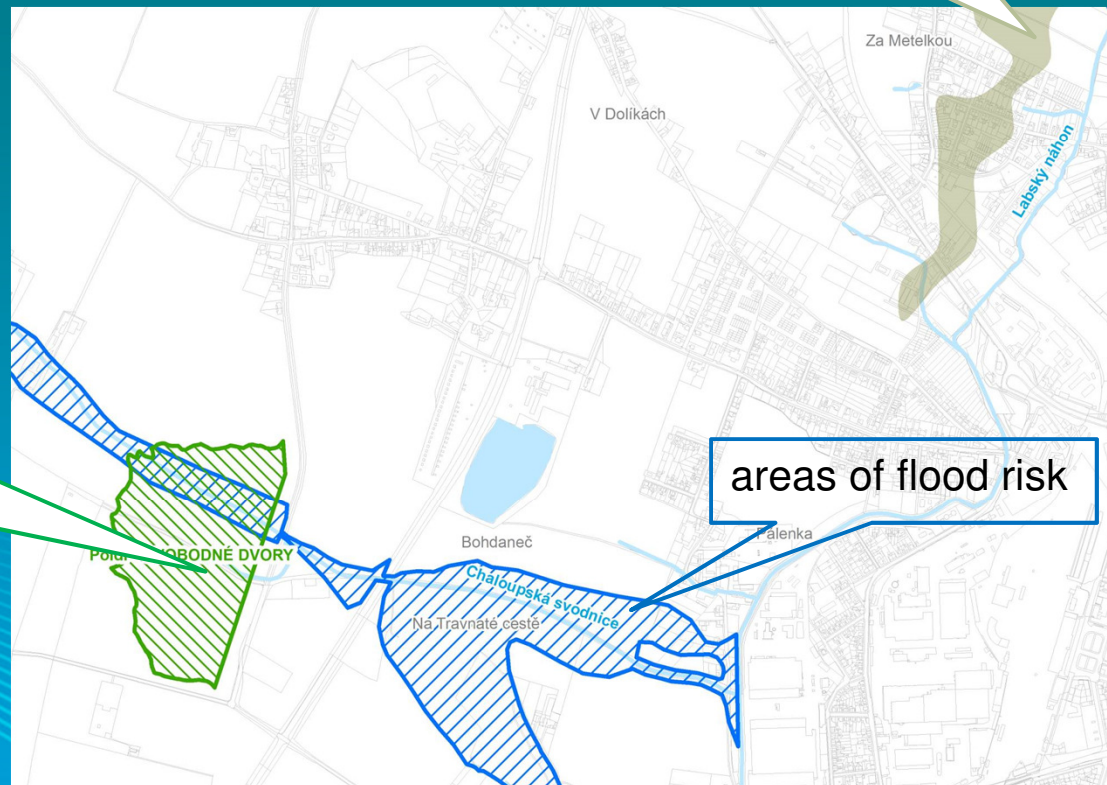
Results:

- Definition of areas with limited urbanization:

areas for surface water accumulation (flood protection)

areas of natural water retention


areas of flood risk



3. Water management rules and criteria for the planned development

Results:

- Evaluation of local possibilities of stormwater management in 24 areas (10-60 ha) - 80 sheets.

Development area	No. 3	ZA METELKOU, DRTINOVA STREET	
Borders of area			
Identification of areas		Acreage of areas	Functional type
6-9/6, 7-9/14, 7-9/30, 6-9/4		18 013 m ²	suburban low-storey development
6-9/7		5 487 m ²	multi-storey dwellings
Studies and regulation plans		No	
Areas of special water regime			
Natural water retention area		No	
Flood risk area		No	
Inundation area		No	
Adjacent recipients			
Groundwater	groundwater level	2 to 5 m below surface	
	hydraulic conductivity	≥ 1 x 10 ⁻⁶ m/s	
	ecological burden	No	
Available surface receiving waters / storm sewers		Melounka Brook (Identification No.10101505, Hydrological catchment No. 1-03-01-005)	
Available combined sewers / foul sewers		combined sewer B (DN 500) – Petra Jilemnického Street combined sewer B 18 (DN 300) – U Drevony Street combined sewer B 19 (DN 300) – Predmericka Street	
Drainage concept for stormwaters			
Groundwater		Decentralized infiltration devices recommended (detailed hydrogeological survey necessary)	
Surface receiving water / storm sewer		Melounka Brook recommended for overflows from infiltration devices	
Combined sewer		-	
Drainage concept for foul waters			
combined sewer system, sewers B, B18 or B19			
Comments			
-			

3. Water management rules and criteria for the planned development

Results:

- Specification of design criteria and rules :
 - Individual (scattered) developments:
 - the maximum specific regulated discharge from the ground plot 3 l/(s.ha) , return period for the design of retention volume 5 years,
 - Extensive individual developments or large development projects:
 - additionally obligation to recalculate effects on the water regime - hydraulic capacity of the sewer system, water bodies and artificial channels, groundwater level changes.

4. Design of measures

Technical measures to fulfill planned disconnection % in existing development:

- Removal or sinking of existing curbs,
- Lowering or adjustment of the surface,
- Transfer of stormwater from the area of street inlets to decentralized devices,
- Taking apart gutters and street inlets within green areas,

Technical measures in the planned development:

- Four functional types of stormwater management structures recommended in dependence on the bedrock and ground water level.

CONCLUSIONS

Storm water management must be integrated into urban planning to guarantee sustainable development of the city.

Transparent step-by-step guidelines specifying activities and responsibilities at each level of urban planning from the stormwater management point of view must be prepared.

The project presented went beyond the current Czech legislation and serves as a good example for similar studies.