



STORM WATER MANAGEMENT AND CLIMATE ADAPTATION IN HUNGARY

PROVIDING PLANNING FRAMEWORK TO CITIES OF TÁT AND TOKOD

In 2014, the European Environmental Agency (EEA) together with Norway Grants, have approved a programme that will help solve water concerns of the cities of Tát and Tokod. The programme, Elaborating a Concept for Precipitation Management and Adapting to Climate Change in the Settlements of Tat and Tokod (EEA-C3-8), aims to find the best solution for the two municipalities in the issue of urban storm water. The goal of the project is to increase knowledge about the effects of climate change in the topic of storm water and to take the first steps at climate adaptation in the region. Another aim is to mitigate the damages caused by extreme rainfalls. In recent years, the cities have been under threat of urban flooding and high groundwater levels. DHI has been engaged to provide advanced knowledge of surface water, groundwater and urban water systems through a complex integrated mathematical model using the MIKE Powered by DHI MIKE SHE and MIKE URBAN software.

COMPLEX PROBLEM – INTEGRATED SOLUTION

In the major part of Tát, the means of storm water management is the infiltration trench. Infiltration trenches work well in general weather but are unable to fully function when the water level of the Danube is high and when there is continuous rain, due to the increased ground water level. In Tokod, they faced problems with storm water and the occurrences of wells after the end of mine water removal through pumping. Creeks bring high amount of storm water from the hills through the city into Únyi creek. In addition to this, due to the location of Tokod on the hillside, the culmination of storm water trenches and the stone-bordered roads further drive the water into the Únyi creek.



Storm water outlet and sewer manhole © DHI

CLIENT

Municipalities of Tát and Tokod

CHALLENGE

- Adaptation to climate change—managing increased storm water
- Storm water appearance/ management in separated sewage system
- Solving closed pipe surcharge and manhole flooding issue
- Managing high levels of groundwater

SOLUTION

Conceptual plan based on a coupled MIKE URBAN and MIKE SHE calibrated and validated mathematical model to analyse the current system status and effects of future plans with several climate change scenarios.

VALUE

- Detection of the defects in the existing system
- Suggestions and tasks for the sustainable storm water management and retention
- Developed and tested exemplary methodology

LOCATION / COUNTRY

Tát and Tokod, Hungary

SOFTWARE USED

MIKE URBAN

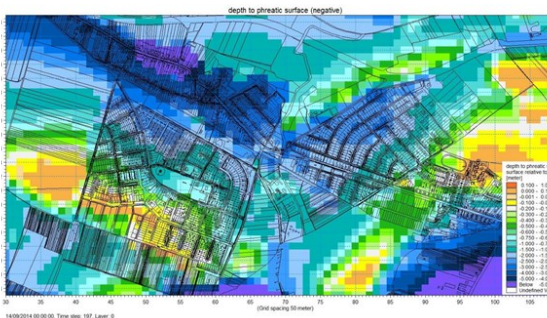
MIKE SHE

This project was carried out by the client using MIKE Powered by DHI software.

DHI has developed mathematical models which simulate water conditions in the two cities in order to evaluate and observe a more integrated process. These models are useful and exemplary for cities and communities with similar terrain and climate.

SOLUTIONS PLANNING GUIDE

Within the project, a storm water conceptual plan and planning guide were developed using our MIKE SHE and MIKE URBAN software. The guide helps the planning process by illustrating the effects on the drainage system after different rain events. Model scenarios based on these events result in the establishment of measurements that function as guidelines for the municipalities. These guidelines help in the management of the urban storm water issue.



Simulated groundwater level © DHI

The use of the MIKE SHE and MIKE URBAN software to create complex modeling was necessary to understand the behavior of the natural runoff system of storm water in Tát-Tokod. The complex modeling also provides an engineering solution to develop and improve the current system. This applied solution gives a good basis in understanding the behavior of the storm water drainage system and also provides an exploration of the processes happening on the hydrological catchment. The simulation model of the storm water system allows us to get a detailed view of the capacity of the system, the location and reasons for the issues that surface. The application of simulation approaches that handle the complex flows, both surface and underground, simultaneously give a base for the conceptual measurements with regards to the optimal drainage and retention system.

OUR SOLUTIONS AT A GLANCE

Calibrated models were prepared, with our MIKE SHE and MIKE URBAN software which communicate with each other.

We have provided the following models:

- Model of sewer system
- Model of storm water collection system
- Integrated model of groundwater and rainfall runoff (catchment)

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We have implemented these project parts:

- Calibration of mathematical model of the Tát-Tokod water system, including sewage, storm water and surface runoff
- Conceptual storm water plan and planning guide for the collection system of Tát and Tokod's catchment
- Execution and documentation of complex monitoring campaign
- Simulation of different scenarios of current and future projections in the calibrated storm water system model

We have provided analyses of the following:

- Evaluation of network capacities — manhole flooding, pressurised pipes, capacity of trenches and pumping stations
- Consultation of actions for the safety of outlets and overflows
- Defining measures for storm water management and retention

MASTER PLAN AS METHODOLOGY

As part of our solution, we used the storm water network of complex Master Plan methodology. The Master Plan methodology is an approach at handling storm water issues, causes and actions in an integrated way. The reason for the use of the digital Master Plan is so that the unique or combined occurrence of different loads and/or measurements can be simulated as individual scenarios. This allows the simulations with the calibrated model, which mimics the real behaviour of the collection system, to give results that help us plan measurements in space and time. In addition, both the effects of the proposed planned measurements and the effects from the lack of necessary measurements can be demonstrated easily. The results gleaned from the Master Plan can also be used in the planning of the storm water management and urban management.

PROJECT VALUE

Flood protection and management of storm water due to the effects of climate change is a worrying problem many cities face. The work that we did for the cities of Tát and Tokod is to provide them with a planning framework for storm water management and a climate adaptation methodology to prepare for future extreme rainfall events. Our models help to establish measurements that serve as guidelines for municipalities to work out the best solution should flooding occur again. In addition, our planning framework for the construction and reconstruction of drainage system ensures the system is at its optimum condition. This will mitigate possible damages caused by floods and bring a reduction of flood risks in a heavy rainfall situation.