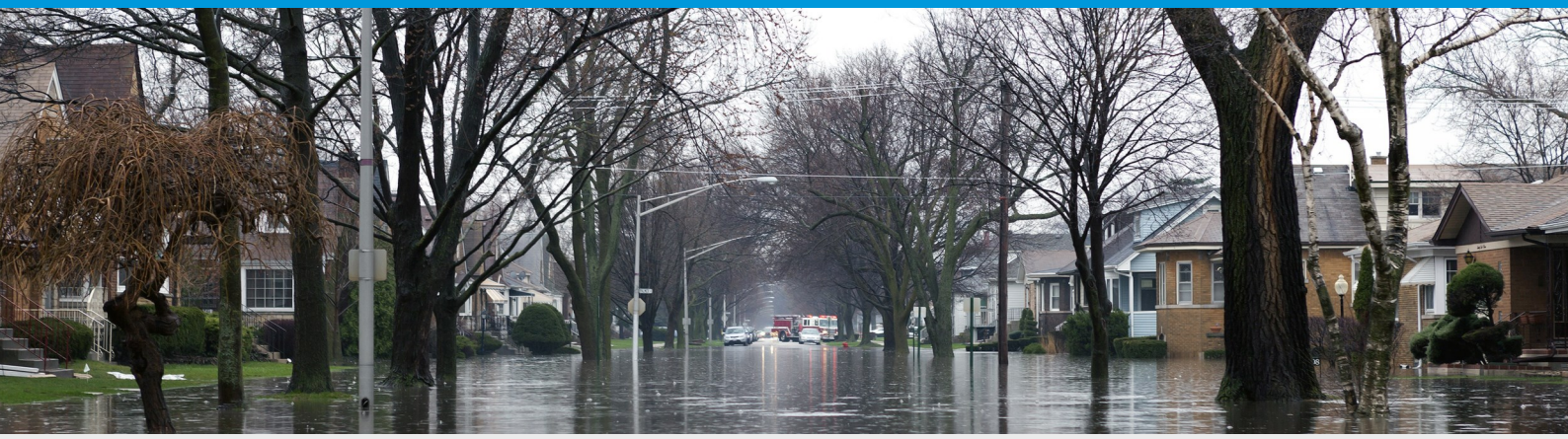


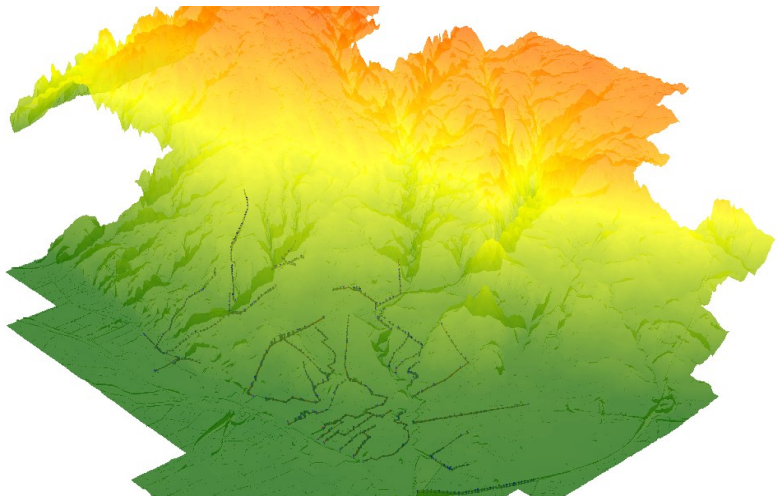
PROTECTING ELBLAG CITY FROM FLOODS

Developing a local monitoring and flood response support system for the municipalities of Elblag

The city of Elblag is located in north-eastern Poland along the Elblag river basin, near the river mouth to the Vistula Lagoon. The city is located in the area with unfavourable hydrological regime and is threatened by floods caused by heavy rainfall and backflow from the Lagoon. To reduce potential losses caused by massive flood events, Elblag city authorities needed to implement a flood forecasting system to enable early warning for the citizens of Elblag. Using MIKE Powered by DHI software, we developed a Local Monitoring and Flood Response Support System (LMFRS) to help them manage flood risks within the city.

A FLOOD MONITORING SYSTEM USING REAL-TIME DATA

Altitudes vary greatly across the Elblag area, ranging from over 100 m in Upland Elblaska to a depression in Żuławy. Such a characteristic results in the occurrence of torrential rain floods, which are particularly acute in urban areas. The Elblag River is characterised by 'backflow', that is, water levels rising upstream due to the return current generated by a strong north-eastern wind. The water level in Elblag is then risen along the entire length of the watercourse, which consequently causes accumulation of the water in Lake Drużno from which the river originates. The aim of the project is to reduce flood risk in the Elblag city through the implementation of the monitoring system based on real-time measured data and forecasts.



Digital Terrain Model used to determine the elementary catchment areas – MIKE URBAN View in 3D. © DHI

CLIENT

Elblag City Authorities

CHALLENGE

- Forecasting floods caused by heavy rainfall and backflow from the lagoon
- Providing an effective warning system for the citizens of Elblag

SOLUTION

Implementing a local monitoring and flood response support system for flood forecasting and early warning based on real-time data.

VALUE

Ability to:

- monitor current water levels in the city
- forecast flood risk and enable early warning, reducing potential damages from extreme flood events
- support operational decisions of the Municipal Emergency Management Team

LOCATION / COUNTRY

Elblag, Poland

SOFTWARE USED

MIKE 11
MIKE 21
MIKE URBAN

© DHI

MEASURING STATIONS' TELEMETRY, FORECASTING MODELS, AUTOMATIC ANALYSIS

The network of measuring stations is a key element of the project. The network consists of 10 stations located within Elblag city, at Lake Drużno and on the Vistula Spit. All stations are used to monitor the current water level. Additionally, two stations along the Elblag River measure the flow speed and direction of water to determine occurrence of the backflow from the Vistula Lagoon. For the same purpose, wind measurements are conducted at stations located north and south of the Vistula Lagoon while precipitation is measured at stations located by Lake Drużno and the Goplenica reservoir.

The LMFRS that we developed is powered by a forecast of water level on the Vistula Lagoon from the High Resolution Operational Model for the Baltic (HIROMB) model, along with precipitation and temperature forecast. The HIROMB model is a high-resolution circulation model originally intended for the Baltic Sea, but is now also used in other regions. Prognostic data are used to simulate the hydraulic models. The data set within the system allows us to perform automated analysis and determine flood risk.

Telemetric station for hydrological and meteorological measurements. © DHI

USING A COMBINATION OF MIKE POWERED BY DHI SOFTWARE FOR FLOOD FORECASTING

Data on water levels from water gauges and uncontrolled sewage and storm water drainage data generated in the MIKE 11 Rainfall-Runoff (RR) module are used as input for the hydraulic modelling.

The MIKE 11 RR model was developed to calculate the probable and forecasted water flow. Within the framework of the LMFRS, the following hydrodynamic models were developed:

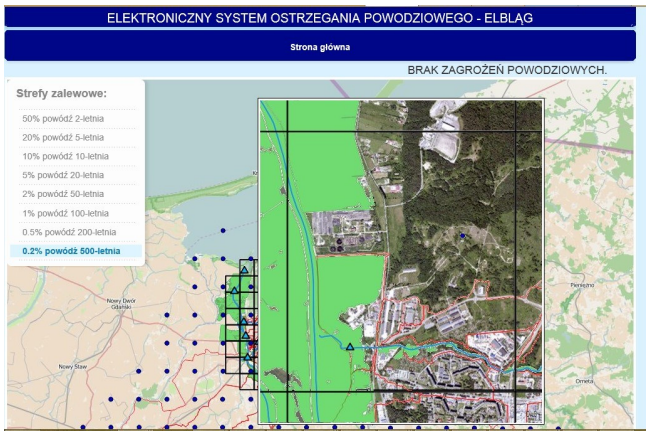
- 1D river hydraulic model in MIKE 11 – for flows with a certain probability of occurrence – used in determining flood risk
- hybrid 1D-2D MIKE FLOOD model combining rainwater drainage system (MIKE URBAN) and 2D surface runoff model (MIKE 21) – used in determining flood risk from rainwater drainage
- 1D hydraulic model in MIKE 11 for rivers and rainwater drainage sections constituting the hydrodynamic module of the LMFRS – used in flood risk forecasting

The Flood Forecasting (FF) module in MIKE 11 combines collected real-time data in MIKE 11 RR and MIKE 11 Hydrodynamics (HD). The FF module compares the data simulation and measurement, which allows automatic adjustment of model parameters to obtain the best fit between simulated and actual situation.

ELECTRONIC FLOOD WARNING SYSTEM

As part of LMFRS, a platform for the presentation of the flood risk was provided. The electronic system has two interfaces: a real-time operator module and the public portal.

The operator can switch between display layers, change the simulation settings, define the limits of the emergency operation and control messages in the public portal. A public user is able to display the area affected by flooding at the end of one of eight flooding scenarios and check the 48 hours precipitation, temperature forecast and the current water levels at 10 measurement stations.



Flood Warning System – public portal view. © DHI

MODERN SOLUTIONS AGAINST GEORISKS

In the time of changing climate, services responsible for the safety of people must have the tools to predict extreme events. Our LMFRS is a solution involving new technologies to protect communities and properties against the threat of floods.

Contact: info@dhigroup.com
For more information, visit: www.dhigroup.com

©DHI / Photo: © Shutterstock / MaxyM