



## DHI CASE STORY

# ALLEVIATING FLOODS IN THE MORAVA RIVER BASIN

## Planning efficient and sustainable flood mitigation

Following a devastating flood in the Morava catchment in 1997, a wide range of mitigation measures were proposed by various stakeholders. We helped to analyse the efficiency of these measures in relation to the required investments. To do this, we used state-of-the-art tools for flood damage assessment, cost-benefit analyses and Environmental Impact Assessments (EIAs). More than 1,000 flood maps were prepared in the process, which included extensive training in the technologies applied. The Czech authorities finally selected a combination of measures for implementation.

### THE FLOOD

In 1997, a flood in the Morava River Catchment caused widespread damage. The rivers breached their embankments at several locations to inundate large rural and urban areas. Houses, bridges and other structures were destroyed and crops were damaged. The total cost of the losses and requisite reconstruction was estimated at approximately USD 1.5-3 billion.

The national project

A national project was launched involving the following entities:

- The Morava River Basin Authority
- The Hydro-Meteorological Institute
- The Water Research Institute
- The Department of Water Management under Ministry of Agriculture
- Basin authorities of other rivers in the country



*The damage was tremendous © MRBA*

Universities and Non-Governmental Organisations (NGOs) were also invited to the project workshops. In the course of these workshops, participating organisations formulated and discussed a wide range of proposals to strengthen the flood control measures along the river.

### SUMMARY

#### CLIENT

DANCEE on behalf of the Morava River Basin Authority and several other Czech organizations

#### CHALLENGE

Cost ineffective and environmentally/socially unacceptable flood mitigation designing

#### SOLUTION

An interactive process of assessing the impacts of potential measures via close cooperation with stakeholder

#### VALUE

- Illustrative and user-driven decision support
- Wide acceptance of the final solution
- Cost-efficient flood damage reduction

#### LOCATION/COUNTRY

Morava River, Czech Republic

Suggestions included:

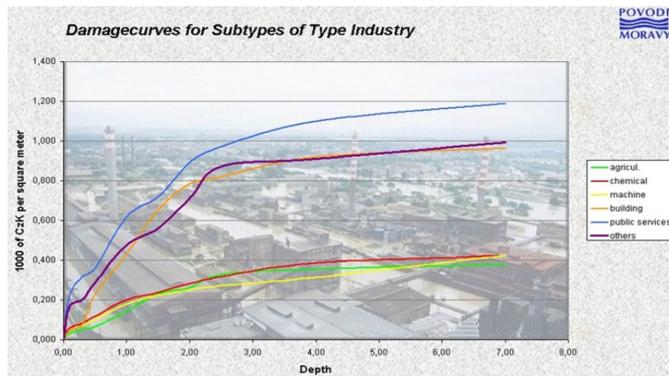
- construction of new reservoirs and polders
- establishment of wetland areas along the river
- improved dike protection of towns and villages
- construction of navigation channels in parallel to the natural rivers

### MODELLING THE PROPOSED FLOOD MITIGATION

We developed models describing the rainfall-runoff process, the river and flood plain flow as well as the erosion and deposition of sediments. The models helped us to analyse and evaluate these options. We mapped floods of different return periods with and without the proposed combinations of flood mitigation measures, to assess and compare their impacts. In parallel to this, workshops and training programmes helped to strengthen the flood modelling capabilities of the participating organisations.

### ASSESSING THE DAMAGE

The most promising measures were analysed further in the second phase of the project. The direct damage of floods was assessed in GIS by combining a detailed property database with damage curves for each property type and flood maps generated for a range of flooding probabilities. To ensure accurate values, a particularly detailed hydraulic model was developed for the town of Olomouc, where significant damage occurred during the flood.



Damage curves, describing the relation between economic loss and water level at the property, were developed for the relevant types of residential and industrial areas © MRBA

The damage assessment enabled a cost-benefit analysis, which was applied to rank the measures and combinations of measures in terms of their cost-efficiency.

### CLIENT TESTIMONIAL

“ The comprehensive modelling and analysis of possible flood mitigation in the Morava River basin provided a solid basis for selecting the best combination of measures and obtaining a consensus among the concerned organizations.  
Dr. Ing. Antonín Tůma - Director of River Basin Management - MRBA

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### PARTICIPATORY APPROACH

The flood damage assessment of direct flood losses is useful in comparing options for flood mitigation. However, it is also important to consider the indirect losses, such as reduced agricultural and industrial production and the intangible losses (such as those at heritage sites). All estimated impacts of the proposed flood mitigation measures were described and discussed at a range of workshops involving the stakeholders. Lively and dedicated debates led to new proposals for measures or combinations of measures to be analysed. This process eventually resulted in a national consensus on a balanced solution.

### IMPLEMENTING THE FLOOD MANAGEMENT PLAN

None of the proposed measures turned out to be sufficient on their own. However, the analyses showed that a combination of measures would provide adequate and economically feasible protection against future flood. The plan formed the basis for negotiations between the Government of the Czech Republic and the European Investment Bank, resulting in considerable loans to finance the implementation.



The resulting flood protection plan included a long range of measures © MRBA

### CONTINUED SUPPORT

We have continued assisting the authorities with detailed planning and additional studies. These included two dimensional (2D) analyses of the erosion/sedimentation around proposed structures, evaluation of the monitoring and warning system in the area and preparation of flood information material.

A total of CZK 3.5 billion (Euro 140 million) has been spent on flood rehabilitation works. Meanwhile, the on-going implementation of planned flood mitigation measures is expected to cost CZK 2.3 billion (Euro 91 million) by the end of 2013.