Flood Prevention and Control in the Elbe Region

Czech Republic

Vaclav Jirasek - Elbe River Authority

Krakow, September 2004, EURO-INBO
Flood Risk Areas

1977  Upa, Labe; $Q_{20} - Q_{100}$; 0,5 bill. CZK
1978  Jizera; $Q_{50} - Q_{100}$; 2 bill. CZK
1979  Stenava; $Q_{100} - Q_{500}$; 2,5 bill. CZK
1983  Labe; $Q_{100}$; 0,7 bill. CZK
1997  Orlice, Labe, Stenava; $Q_{50} - Q_{100}$; 3,3 bill. CZK (total 62,6 bill. CZK)
1998  Dedina, Orlice; $Q_{50} - Q_{100}$; 1,8 bill. CZK
2000  Jizera, Labe, Orlice; $Q_{20} - Q_{100}$; 3,8 bill. CZK
2001  Labe, Stenava, Doubrava; $Q_{10} - Q_{50}$; 1,0 bill. CZK
2002  August => Vltava, Labe $Q_{250} - Q_{500}$; 10,0 bill. CZK (total 75,1 bill. CZK)
Prague
Outflow from continents

Figure 13.3: A comparison of fluctuations in streamflow divided among various continents and the world. Variations are represented as the difference between annual values and the long-term mean, relative to the long-term mean. From Pickard and Corley, 1997.
Flood Forecasting & Warning - CHMI

Picture from the NOAA polar satellite

Radar information

Input data
Flood Forecasting & Warning - CHMI + RA

Directly measured data

Rain gauging station in the Giant Mountains

Water level gauge on the river Jizera
Flood Forecasting & Warning - RA

SURFLOW 4000 - Instromet, Belgium
Discharge data
Authomatical measurement stations

Flood Forecasting & Warning - RA

Water system control - Operation Room
Data Available to Other Clients

www.pla.cz
Regulation of Flow Regime

- Inflow
- Time
- Volume
- Discharge
- 12.8. 2002
  - water level - 730,29 m
  - 171 cm below the full supply level
- total pre-prepared storage
  - 2,5 mil.m³
- inflow (>Q₂₀) 66 m³/s
- outflow (<Q₂) 25 m³/s
- 14.8. 2002
  - water level - 732,11 m
Delineation of Flood Prone Areas
Delineation of Flood Prone Areas

- Basic data for site planning
- Active/passive zones
  - building restriction in flood prone areas
- Risk evaluation
  - velocity, depth, time
- Mathematical modelling
  - LaserScan, DMT, ortofoto, MIKE 11, MIKE 21C, HEC
Flooding in Litomerice Region

Flooded area
• Q 100 (theoretical flood 4400 m³/s) - blue
• Prognosis Q = 5500 m³/s - pink
• August 2002 reality - brown
## Flood Risk Assessment

(Criteria x Weight Method)

<table>
<thead>
<tr>
<th>Criterium</th>
<th>Rank</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>I - Flooded Area</td>
<td></td>
<td>Downtown</td>
<td>Concentrated Development</td>
<td>Low Development</td>
<td>Scarse Development</td>
</tr>
<tr>
<td>W = 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II - River Bed Capacity</td>
<td></td>
<td>&lt; $Q_1$</td>
<td>$Q_1 - Q_5$</td>
<td>$Q_5 - Q_{20}$</td>
<td>$Q_{20} - Q_{100}$</td>
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<tr>
<td>W = 0.4</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>III - Erosion</td>
<td></td>
<td>Extreme</td>
<td>Very High</td>
<td>Strong</td>
<td>Medium</td>
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<tr>
<td>W = 0.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>IV - Number of Flood Days in Area</td>
<td></td>
<td>&gt; 20</td>
<td>11 - 20</td>
<td>5 - 10</td>
<td>0.4</td>
</tr>
<tr>
<td>W = 0.2</td>
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<td></td>
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</tbody>
</table>

1\textsuperscript{st} Category - Till 4.5 Points

2\textsuperscript{nd} Category - 4.6 - 5 Points
# Flood Risk Assessment of Communities

<table>
<thead>
<tr>
<th>Place</th>
<th>River</th>
<th>District</th>
<th>Population</th>
<th>Bed Capacity</th>
<th>Flooded area specification</th>
<th>Risk Score</th>
<th>No. of measures</th>
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<tbody>
<tr>
<td>Liberec</td>
<td>Lužická Nisa</td>
<td>Liberec</td>
<td>101018</td>
<td>Q5 - Q20</td>
<td>concentrated development</td>
<td>4.3</td>
<td>15</td>
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<tr>
<td>Hradec Králové</td>
<td>Labe</td>
<td>Hradec Králové</td>
<td>100854</td>
<td>Q20 - Q100</td>
<td>concentrated development</td>
<td>4.9</td>
<td>6,13,17</td>
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<tr>
<td>Ústí n.L.</td>
<td>Labe</td>
<td>Ústí n.L.</td>
<td>97290</td>
<td>Q1</td>
<td>concentrated development</td>
<td>4.7</td>
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<tr>
<td>Pardubice</td>
<td>Labe</td>
<td>Pardubice</td>
<td>94820</td>
<td>Q5 - Q20</td>
<td>historical downtown</td>
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<tr>
<td>Děčín</td>
<td>Labe</td>
<td>Děčín</td>
<td>54205</td>
<td>Q1 - Q5</td>
<td>concentrated development</td>
<td>5.1</td>
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<tr>
<td>Jablonec n. N.</td>
<td>Lužická Nisa</td>
<td>Jablonec n. N.</td>
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<td>Mladá Boleslav</td>
<td>Jizera</td>
<td>Mladá Boleslav</td>
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<td>concentrated development</td>
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<td>7,16</td>
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<tr>
<td>Trutnov - Hor. St. Město</td>
<td>Úpa</td>
<td>Trutnov</td>
<td>32694</td>
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<td>Kolin</td>
<td>Labe</td>
<td>Kolin</td>
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<td>Hronov -Náchod</td>
<td>Metuje</td>
<td>Náchod</td>
<td>30329</td>
<td>Q1 - Q5</td>
<td>concentrated development</td>
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<td>Litoměřice</td>
<td>Labe</td>
<td>Litoměřice</td>
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<tr>
<td>Chrudim - Štětín</td>
<td>Chrudimka</td>
<td>Chrudim</td>
<td>24397</td>
<td>Q5 - Q20</td>
<td>concentrated development</td>
<td>5</td>
<td>9</td>
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<tr>
<td>agglomeration Třebovka</td>
<td>Třebovka</td>
<td>Ústí n.O., Svitavy</td>
<td>22100</td>
<td>Q1 - Q5</td>
<td>concentrated development</td>
<td>4.1</td>
<td>3,4,5</td>
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<td>Mělník</td>
<td>Labe</td>
<td>Mělník</td>
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<td>low development</td>
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<tr>
<td>Dvůr Králové n. L.</td>
<td>Labe</td>
<td>Trutnov</td>
<td>17098</td>
<td>Q1 - Q5</td>
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<td>18</td>
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<td>Jičín</td>
<td>Čidline</td>
<td>Jičín</td>
<td>16994</td>
<td>Q5 - Q20</td>
<td>low development</td>
<td>5.4</td>
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<td>Neratovice</td>
<td>Labe</td>
<td>Mělník</td>
<td>16071</td>
<td>Q1 - Q5</td>
<td>concentrated development</td>
<td>4.5</td>
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<tr>
<td>Ústí n. Orlický</td>
<td>Tichá Orlický</td>
<td>Ústí n.O.</td>
<td>15323</td>
<td>Q1 - Q5</td>
<td>concentrated development</td>
<td>4.6</td>
<td>2,3,4,5</td>
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</table>
### Flood Risk Perception
*(Public & Council)*

<table>
<thead>
<tr>
<th>Occurrence of Flood</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
<th>Extremely Low</th>
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</thead>
<tbody>
<tr>
<td>Extremely High</td>
<td></td>
<td>4</td>
<td>11</td>
<td></td>
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<tr>
<td>High</td>
<td>1</td>
<td>7</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Medium</td>
<td>2</td>
<td>8</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>Low</td>
<td>9</td>
<td>16</td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

- Unacceptable Risk  - Maximum Protection Demands
- Perceived Risk     - Economically Based Demands
- Underestimated Risk - Exceptional Demands
- Unperceived Risk   - No Protection Demands

*Seminar WMA, Berlin 1999*
Risk and Feasibility Assessment

GIS Layers:

0 - Basic map ZABAGED
1 - Flood prone areas
2 - Regional development plans
3 - NATURA 2000
4 - Flood protection measures
5 - Communities

Priorities -> 2008 (Program of Measures) -> 2015 (evaluation)
Complex Flood Measures in the Trebovka Rivier Catchment Area

Polder Nr. 2
Complex Flood Measures in the Trebovka River Catchment Area
Flood barriers
Proposals

- **Improvement of early warning**
  (European Weather Forecast centre, satellite and radar inputs => rain intensity)

- **In time run-off modelling**
  (flood wave prediction models)

- **Specification of flood risk areas**
  (area zoning => active flow zones)

- **Reasonable countryside management**
  (water retention capacity; biological & technical provisions)

- **Flood Protection Measures**
  (retention capacity; river improvement; biological & technical provisions)

- **WFD 2000/60/EC - Art. 4 -7.**
  ((deterioration only from High to Good Status of W.B.)