Danube floods 2014
Consequences for Water Utilities

Vladimir Taušanović, Belgrade Waterworks & Sewerage

- What happened
- What were the consequences
- Lessons learned
- How to prevent and manage water services in flood events
Cyclone (dubbed Tamara) over the Balkans
May 2014

On 13th of May, a low-pressure area formed over the Adriatic Sea moved over the Balkans. Extremely heavy rain fell across the region between 13-16 May.

Route of the center of cyclone on ground level 13th-17th May
Source: Országos Meteorológiai Szolgálat, Hungary
EUROPE – Precipitation 14-16 May 2014
Extreme Meteorological Event

3-day rainfall (14-16 May 2014)

> P_{1000y}
Red Meteorological Alarm on May, 12th

RHMSS issued meteorological alarm – 2 to 3 days of heavy rain
Extreme Hydrological Situation

• Saturated soil due to prolonged rain in April and first week of May
• Rainfall in 3 days
• Torrents – high flow velocities, massive sediment movement, landslides
• Small and medium rivers – sudden and great increases of water levels
• Sava river – extreme water levels due to high flows on all right tributaries in Croatia and Bosnia
• Level of flood water exceeded the level of existing protection
• Flood protection system seriously damaged and failed at many locations
Extreme Water Levels

Several rivers in watersheds of Sava and Morava river rose from 2 to 5 m

Recorded on almost 50 hydrological stations

- +220 cm  Z. Morava (Miločaj)
- +161 cm  Sava (Jamena)
- +133 cm  Skrapež (Požega)
- +110 cm  Kolubara (Valjevo)

Above previously recorded historical maximum levels
99 APSFR identified in Serbia
42 APSFR been affected

- Municipalities where emergency situation was declared
- In the whole country on 15th May
Flood Defense

Extremely rapid development of floods – mostly second flood defense level proclaimed

dike failure

May 15th
14-16 May 2014

- Sudden Natural Disaster – threatened lives, property and the environment
- Rivers rose rapidly (some **overnight**) causing floods in surrounding valleys with devastating consequences
- The rains activated torrents and mud slides
- The first priority was to save peoples lives, properties and provisions of food and water
Torrents and mudslides – APSFR Krupanj

Flood protection structures destroyed or severely damaged
Landslides and massive sediment deposits
Municipality was isolated for 4 days – all bridges collapsed
APSFR Crnica – Paraćin City
City of Valjevo
Tekija – Djerdap gorge
Endangered water supply
APSFR Kolubara

Kolubara river watershed

- The most affected area in the flood event
- ≤ 1 billion m³ of water fell in 3 days

Return period 1000 years
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Average: 239.4 mm - lit/m²
Area: 3,700 km²
Total volume: 885,738,889 m³
Attracted attention of media worldwide

DEVELOPING STORY
BALKANS FLOODING
Region's worst flooding in at least 120 years
Municipality of OBRENOVAC
One of the 16 Municipalities of Belgrade

- City of Obrenovac including 29 settlements (villages)
- Living 70,000 people, 411 sq km area, 73% agriculture
- Main industry - Electric Power Generation, two thermo-power plants (installed capacity 1650 MW - the main electric power supply source of Serbia)

- 80% of territory flooded, 25,000 people evacuated
- Electricity and water supply cut off

- Endangered electric power supply system in the country
Endangered electric power supply system in the country
Crisis management

• First line of defense failed - further measures had to be taken
• Mobilization of all possible man power (Army troops, Police, Firefighters, other specialist groups, Medical staff etc.)
• International response on call for help was great - almost all European countries and some overseas sent emergency aid or special teams to work with us
• A call for voluntaries gave an exceptional response – More people came than could be engaged (especially young generation)
• Rescue operation taking place
Rescue and protection of people
first priority
Evacuation of people
Evacuation of people
Evacuation of people
Evacuation
Animal rescue
Livestock rescue
Boats are more useful!
Rescue mission
City of Obrenovac water source
Riverbank filtration
Ground water abstraction
draw wells

77.57 max water level
Obrenovac water supply system

Installed capacity:
Ground water   320 lit/sec
Surface water   130 lit/sec

Flooded wells
Status of W&S infrastructure
Obrenovac city, May 2014

- Water supply system out of operation
- Water source (wells along the river bank) – flooded
- Sewerage and potable water network under water (1m and above)
- Surface water polluted from sewerage network and septic tanks-
  Potential for infectious diseases and epidemic appearance
- WAITING FOR THE FLOOD WATERS TO RECEDE

Emergency Management:
1. Prompt response – FIRST AID
2. Long term recovery and restoration phase
Emergency supply – FIRST AID
Budapest waterworks
aid to the City of Obrenovac
Mobile water purification unit
Potable water packed in 5 lit plastic bags
Bulk water supply
Aid from Germany
Sewerage pumping station
under water
Pumping out the water from low-lying areas

Diesel engine pump from Czech Republic
Sewerage system repair
Sewerage: bare manholes

All the soil washed away and left the bare manholes exposed.
Repair of potable water mains
donation of Japan
Cleaning the city from the mud deposits and other trash
50,000 tons of trash had to be removed.
Disinfection of whole area
Reconstruction needs assessment process

- Baseline pre-disaster
- **Damages**: current situation minus emergency relief
- **Losses**: in addition to damage
- **Needs**: repair, reconstruction, build better, disaster risk reduction
- Programme and costs
Disruption of water supply

• In most of the affected municipalities the urban water supply was disrupted or not available for about two weeks except in the City of Obrenovac where it took almost two months before the system could be put in operation.

The main damages were to:

• The piped network for both drinking water and sewerage, including blockage of the sewerage system;

• The electrical components of pumping systems, especially at water sources such as well fields.
Losses:

• Most affected municipalities did not collect the normal fees for services for about 1 month, and many of them were not be able to reestablish regular revenues for the next few months.

• Higher costs were incurred for, eg tankering water, additional pumping, disinfection and analyses, cleaning of septic tanks and wells in rural areas, and unblocking sewage pipes.
# Damages and Losses

## Water Supply Sector

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<th>Damages</th>
<th>Losses</th>
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**Total** 1,436 (mil EUR)
### Sectors Affected

**TOTAL DAMAGE** 1,525 mill €

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<td>the most affected Mining and Energy 488 mill €</td>
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<td>– Housing 231</td>
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<td>Cross-Cutting</td>
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<td>– Environment 21</td>
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**24 municipalities**
### Affected People, Casualties and Damage

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<td>Evacuated</td>
<td>32,000 out of which 25,000 from Obrenovac</td>
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<td>Causalities</td>
<td>51 (23 drown)</td>
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<td>Total damage</td>
<td>1.52 billion €</td>
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Disaster Risk Reduction

• Build better and use better materials
• More secure water sources
• Alternative locations for key infrastructure - treatment plants, pumping facilities
• Better design – less leakage; better maintenance
• Better management
• Relocate latrines/septic tanks if flooding likely to result in outflow of sewage water source
• Covers for shallow wells
Lessons learned

• Constructing in areas that are not a vicinity of rivers/streams, whenever possible not in flood plains
• Raising embankments along streams/rivers
• Planning in accordance with requirements for a provision of areas that (at least temporarily) can store sufficient storm water in order to prevent major flooding of settlements and infrastructure
• Constructing new pipelines along the roads in order to allow easier access
Danube floods 2014

Thank you