

## Interreg-IPA Cross-border Cooperation Programme Romania-Serbia

# search & rescue - floods -

7 Septembrie 2023

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### Floods- facts

- Are catastrophic natural events on Earth, leading to dangerous fatalities and extensive destruction of buildings and infrastructure worldwide.
- Often coincide with landslides and mudslides.
- People might be compelled to abandon their homes and may find themselves isolated by the rising water levels.
- There are various reasons that contribute to the occurrence of flooding, such as heavy rainfall, insufficient bank capacity, landslides, poor drainage, snowmelt, and glacial outbursts.

## Floods- facts

- The increase in flood frequency globally is a result of both natural factors and human activities, including changes in meteorological conditions and land-use practices. Heavy precipitation is the primary cause of flooding in tributary basins, while tropical cyclones pose a significant threat to coastal regions, affecting hydrology and weather patterns.
- In situations involving floods and cyclone disasters, rescuers must be equipped with swimming and floating aids and possess adequate swimming skills to effectively save drowning victims. It is crucial for rescuers to have both knowledge and experience in swimming to ensure the safety of both themselves and the individuals they are rescuing.

## Flood mitigation

- Flood mitigation strategies are essential for reducing the impact of floods on communities.
- A well-designed flood planning and management approach is crucial, particularly when facing sudden flood disasters.
- Such emergencies demand swift responses and coordinated efforts from government authorities and Search and Rescue (SAR) teams.

## Flood mitigation

- Flood mitigation strategies can be classified into three distinct phases based on when they are implemented during flood events:
- Pre-flood activities
- Inflow activities
- Post-flood activities

## Pre-flood activities

- aim to enhance preparedness for potential flood events.
- a well-planned pre-flood strategy can significantly enhance public safety, reduce social impacts, and minimize economic losses caused by floods.
- preparedness involves implementing effective measures in response to early signs of hazards, such as environmental and weather changes. This includes timely and reliable early warnings, as well as making provisions for temporary shelters and storage spaces for affected individuals and their belongings from vulnerable catchment areas.

## Inlood activities

- In the event of flooding, the prompt and efficient implementation of Search and Rescue (SAR) operations is crucial to mitigating the impact of the flood disaster, particularly in terms of financial losses and the well-being of flood victims.
- This phase involves relocating affected individuals from high-risk areas to safe zones, providing essential necessities like food, water, medicine, and shelter, and closely monitoring the flood situation.
- The goal of SAR operations is to effectively manage the overall risk and adverse consequences of flooding on people, the economy, and the environment.

## Post-flood activities

- After flood events, the primary focus lies on conducting flood relief operations to assist the affected population.
- Effective planning and coordination of relief efforts can significantly alleviate the suffering caused by the floods.
- These relief operations encompass a variety of actions, such as setting up emergency facilities, distributing aid to those in need, transporting injured individuals to safety, and initiating efforts to restore public infrastructure and houses in the affected regions to their pre-flood condition.

## Urban Water Dynamics and Hazards

Urban environments  
present their own  
unique challenges

Fundamental  
moving water  
dynamics are  
still applied



What urban hazards do you see?



# Urban Water Dynamics and Hazards

## • Strainers

- During flooding, numerous obstructions can be found scattered all around.
- These obstructions include trees, fences, guardrails, and various other objects that may be submerged in the water.





## Urban Water Dynamics and Hazards

- **Drop Offs**

- Drainage swales or ditches are frequently located alongside roadways.
- The slopes in these areas can range from gentle to steep and long.
- The water flow in these swales can directly lead into the next hazardous location.

## Urban Water Dynamics and Hazards

- Culvert pipes

- These drainage structures are typically positioned beneath roadways or driveways to facilitate the movement of water from one side to the other.
- The drop-off at these points can sometimes be as high as four feet or more, accompanied by a concrete retaining wall. It is crucial to note that the suction at the inlet side of these pipes can be incredibly strong, posing a risk of pulling a rescuer underwater and into the pipe.

## Urban Water Dynamics and Hazards

### • **Low Head Dam formations**

- These formations are most likely to occur on the downstream side of a roadway where it descends towards the drainage ditch. At these locations, all the hazards associated with a lowhead dam are present, along with the potential dangers from various objects that could be present in the floodwater



## Urban Water Dynamics and Hazards

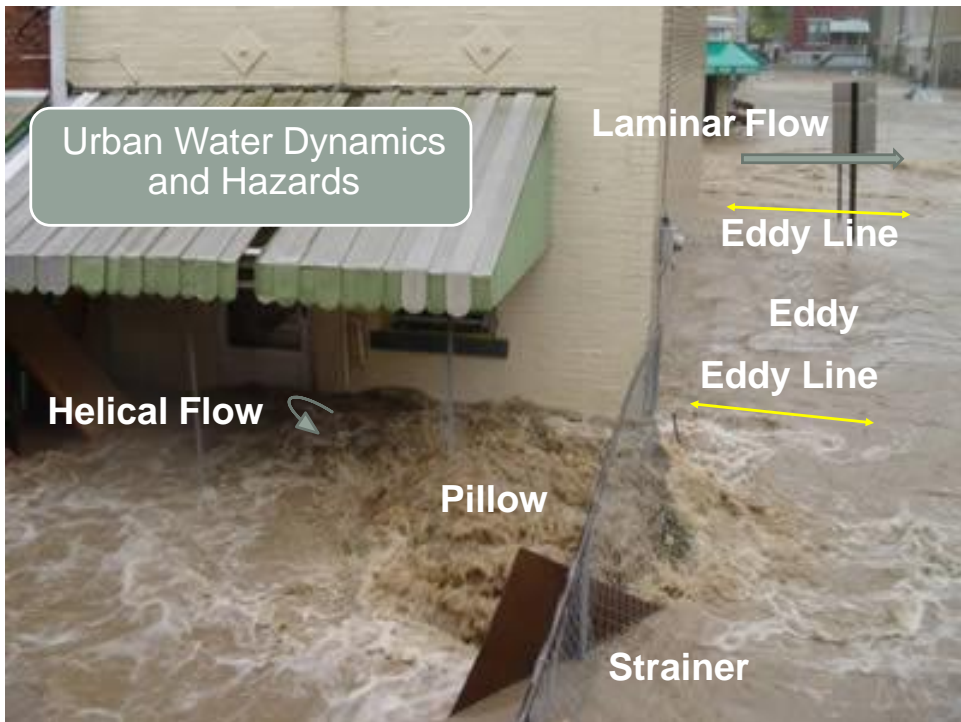
- Vortex(whirlpool)
  - Features in the water can be an indication of very dangerous opening under water
- Can be created by
  - Open manhole covers
  - Drainage grates
  - Water intakes
  - Pipes





# Urban Water Dynamics and Hazards

- Vortex(whirlpool)
  - If water is shallow and rescue personnel are walking their boat
    - Always hold onto the boat!
- Rescuers can walk over grate manhole and

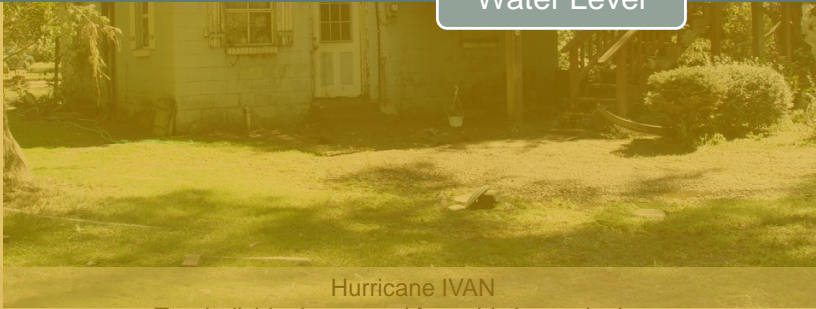


Urban Water Dynamics  
and Hazards

Electric Line



Water Level



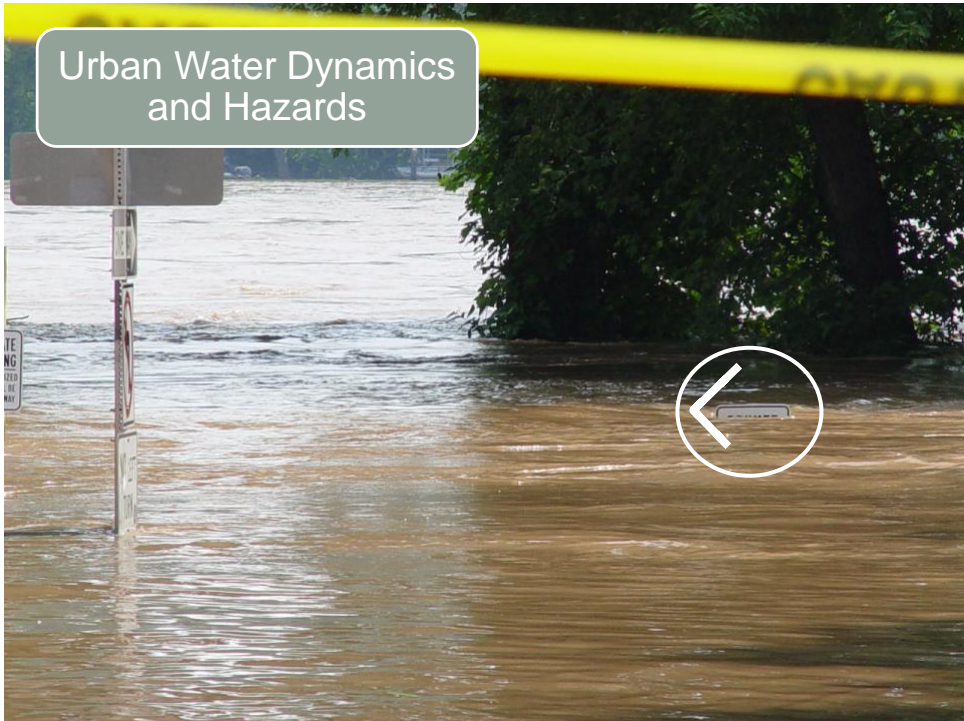
Hurricane IVAN

Two individuals rescued from this house by boat.

Connoquenessing Creek-Butler County PA – Rescue occurred @

Time: 12:00 AM - 9/18/04

Urban Water Dynamics  
and Hazards



## Urban Water Dynamics and Hazards

Constantly scan water horizontal lines

- Take immediate evasive action to avoid the hydraulic!

If unable to avoid, head straight at the hydraulic and power through

Do not slow up until boat has cleared the boil line and into outwash  
Dropping in sideways can flip the boat and trap the team





## Urban Water Dynamics and Hazards

- Floating hazards
  - If it can float rescue personnel can encounter it
    - Propane tanks
    - Sheds and travel trailers
    - Vehicles
    - Containers
    - Docks
  - Always scan water for floating hazards and take actions to avoid
    - Have upstream spotters





## Flood Haz-Mat

- **Contaminants**

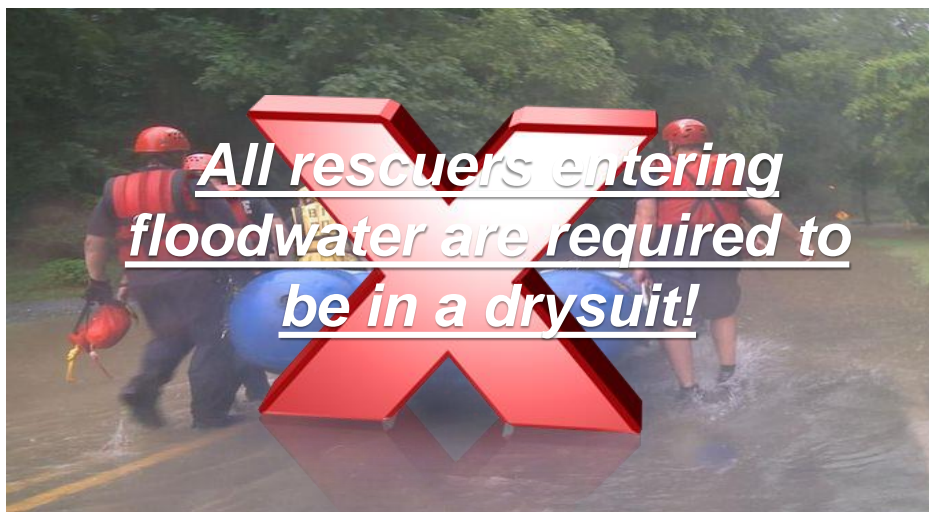
- Things that could be present in the water: Petroleum products, sewage, fertilizers, pesticides, all manner of surface and subsurface objects carried by the current.
- **All rescuers entering floodwater are required to be in a drysuit!**

## Flood Haz-Mat

### Decontamination

- **All rescuers entering floodwater are required to be in a drysuit!**
- Rescuers should perform decontamination (decon) after completing operations at a site, before removing their suits or getting into a vehicle.
- The simplest decon method involves a quick rinse and scrub using a wheel brush. A Bio-friendly cleaner like Simple Green can be used for this purpose.
- To execute decon effectively, access to clean water is essential, which can be provided by an engine company, a brush truck, or a section of hose with a nozzle connected to a hydrant.
- Rescuers can scrub themselves at the water's edge, ensuring that the runoff from decon returns to its original source.

## Flood Haz-Mat



Location designation could include:

- Street names
- House numbers
- Route direction



GPS units can be very useful in urban environments to help pinpoint address locations





# Flood Navigation

## • Identifying Streets

- Make an effort to locate and follow streets as they can help you avoid numerous hazards.
- Avoid cutting through yards, as you might encounter fences or other objects that could impede your path.
- Streets are typically free from such obstacles. Keep in mind that telephone or power poles often run alongside roads, serving as guiding markers.
- Look for clear tree clearings that indicate the presence of a road.
- Additionally, the top of mailboxes can also serve as a clear indication of a roadway.

# Flood Navigation

## • Water Depth indicators

- These are all items that have a standard known height. If you know their normal height then how much of it you can see will give you a gauge of the water depth at the object.

# Flood Navigation

## Water Depth indicators

### Roadway Signs

- Roadway signs are installed at a height above the ground, typically ranging between 150 to 200 cm from the bottom of the sign to the ground. In rural areas, the clearance should be around 150cm, while in urban locations, a clearance of 200 cm is preferred.
- While you may not have a tape measure on hand, you can estimate the depth of the water in a location if it is close to the bottom of a roadway sign. When the water reaches that level, it indicates a significant depth at that particular spot.



# Flood Navigation

## Water Depth indicators

### Water Level

- Keep a constant watch on the water level, especially during flash flood incidents, as it can undergo drastic changes within a few minutes.
- It might be beneficial to designate a member from a supporting FR (Flood Rescue) unit to solely monitor the water level and provide updates every 5 minutes.
- The fluctuating water depth has the potential to significantly impact rescue plans, turning them into more complex operations or, on the other hand, leading to scenarios where individuals can safely walk out within a brief timeframe.

# Rescue from a Vehicle

- General rescue guidelines:

- Consider rescue options:

- Shallow water crossing with boat
    - Shallow water without boat
    - Moveable control point
    - Motor Boat based

- Technique determined by:

- Condition of victim
    - Water dynamics
    - Location of vehicle

- If there are several vehicles in a line with each other in the current, start downstream and work upstream.

- This may prevent a car from breaking loose and hitting another car with persons still inside.

# Rescue from a Vehicle



Water weighs 62.4 lbs. per cubic foot and typically flows downstream at 6 to 12 miles an hour.



When a vehicle stalls in the water, the water's momentum is transferred to the car. For each foot the water rises, 500 lbs. of lateral force are applied to the car.



But the biggest factor is buoyancy. For each foot the water rises up the side of the car, the car displaces 1,500 lbs. of water. In effect, the car weighs 1,500 lbs. less for each foot the water rises.



**Two feet of water will carry away most automobiles.**

# Rescue from a Vehicle

## Susceptibility to Movement

### • How they move

- The engine compartment typically constitutes the heaviest section of a vehicle.
- Due to this weight distribution, the vehicle tends to be anchored in place.
- In static water flow, the lighter end of the vehicle will be spun downstream by the water first.
- However, when a vehicle is being driven in flowing water, it becomes vulnerable to being swept away at any moment.
- The potential for being swept away depends on the speed of the current and the load carried by the vehicle.

# Rescue from a Vehicle

## Susceptibility to Movement

### • Orientation of vehicle to the current

- Among three possible orientations to the current
- a car positioned broadside to the current is the most susceptible to being moved.
  - a vehicle facing the current from the rear end is the next likely to be affected.
  - a vehicle facing into the current is the least likely to be moved.

## Rescue from a Vehicle

Vehicles entering the water can:

- Float for a short time
- Be swept downstream
- Lodge against a fixed object
- Submerge

## Rescue from a Vehicle

- General rescue guidelines:
  - Provide life jacket and helmet to occupants prior to move
    - Properly secure!
  - Large individuals may not fit through window wearing a PFD
    - Use sound judgment
    - Can a door on downstream side be opened?
    - Base decisions upon circumstances

# Rescue from a Vehicle

## General rescue guidelines:

### Shallow Water Crossing with boat

- Attempt if the water is less than waist level
- Boat provides platform for victim, as well as, stability for rescuers
- Minimum equipment for boat:
  - Patient PFDs, Patient Helmets, Throw bags, Walking Poles, Paddles, Window Punch or Rescue Hammer, and Radio
- Have upstream spotters and down stream safety

# Rescue from a Vehicle

## General rescue guidelines: Shallow Water Crossing without boat

- Attempt if the water is less than waist level
  - Follow shallow water crossing guidelines
- Rescuers must carry patient PFDs, helmet, walking poles or paddle, radio, and rescue hammer or window punch
- Rescuer should have the ability to carry victim
  - Victim can walk out if conditions allow
    - Place victim in the center of the shallow water “V”
- Have upstream spotters and down stream safety

# Rescue from a Vehicle

## **General rescue guidelines: Motor Boat based**

- Hold position with boat and rescue occupants
  - Everyone completely set in boat before move
  - Weight shifts effect both boat and vehicle
- Minimum equipment for boat:
  - Patient PFDs, Patient Helmets, Throw bags, Walking Poles, Paddles, Window Punch or Rescue Hammer, and Radio
- Move occupants
  - No hesitation
- Constantly monitor the water level to prevent being stranded by receding water.

# Rescue from a Vehicle

- General rescue guidelines:
  - Access to victims may be through a window
  - Have entry tools available:
    - Window punch device
    - Small sledge hammer
    - Seat belt cutter



# Rescue from a Vehicle

- General rescue guidelines:
  - Gain entry
    - Shatter window if necessary – downstream side
    - Use PPE (gloves, face, eye protection)
    - Inform occupants to cover themselves and look away
  - Cut seat belt if necessary



# Rescue from a Vehicle

- General rescue guidelines:
  - Caution during rescue:
    - Vehicle can move
    - Can pin boat against a fixed object
    - Can sink
  - Rescuers work outside vehicle, not inside
    - If vehicle sinks, it fills with water and potentially pulls rescuer in

## Urban Water Dynamics and Hazards



# Rescue from a Vehicle

## Marking vehicles

- This is done to help avoid repetitive responses for the same vehicle.
- The minimum done should be to record the vehicle type and color and report to ECC.
  - This is even if the car has been moved a great distance from the original location of a previous call.
- If the vehicle is in high moving water then attempt to tag the vehicle.
  - If the car has an antenna then this would be a prime spot. The point is to mark as high as possible.
  - Place marking tags on the windows up high.
- Rescuers should remember to take marking tags when they go to check a vehicle for occupants in the first place. They can then tag the vehicle while they are there.
- Place the tags on both sides at least and preferably the front and back glass also.

# Additional Considerations

## • Incident Scene control

- In the case of a flooded roadway scene, ensure that the entire roadway leading to the scene is blocked.
- Drivers will drive around emergency apparatus if possible and then right into the water at the scene of operations. The road is impassable so you are not doing any harm. Block the entire roadway on both sides of the incident.

# Additional Considerations

- **Night Ops considerations**

- Consider implementing light discipline at the scene so personnel can have their eyes adjust to the dark.
- This means having all FR units turn off lights so the launch or access point is as dark as where personnel will be operating.

**Thank you!**