



Probabilistic Flood Mapping

Existing Applications

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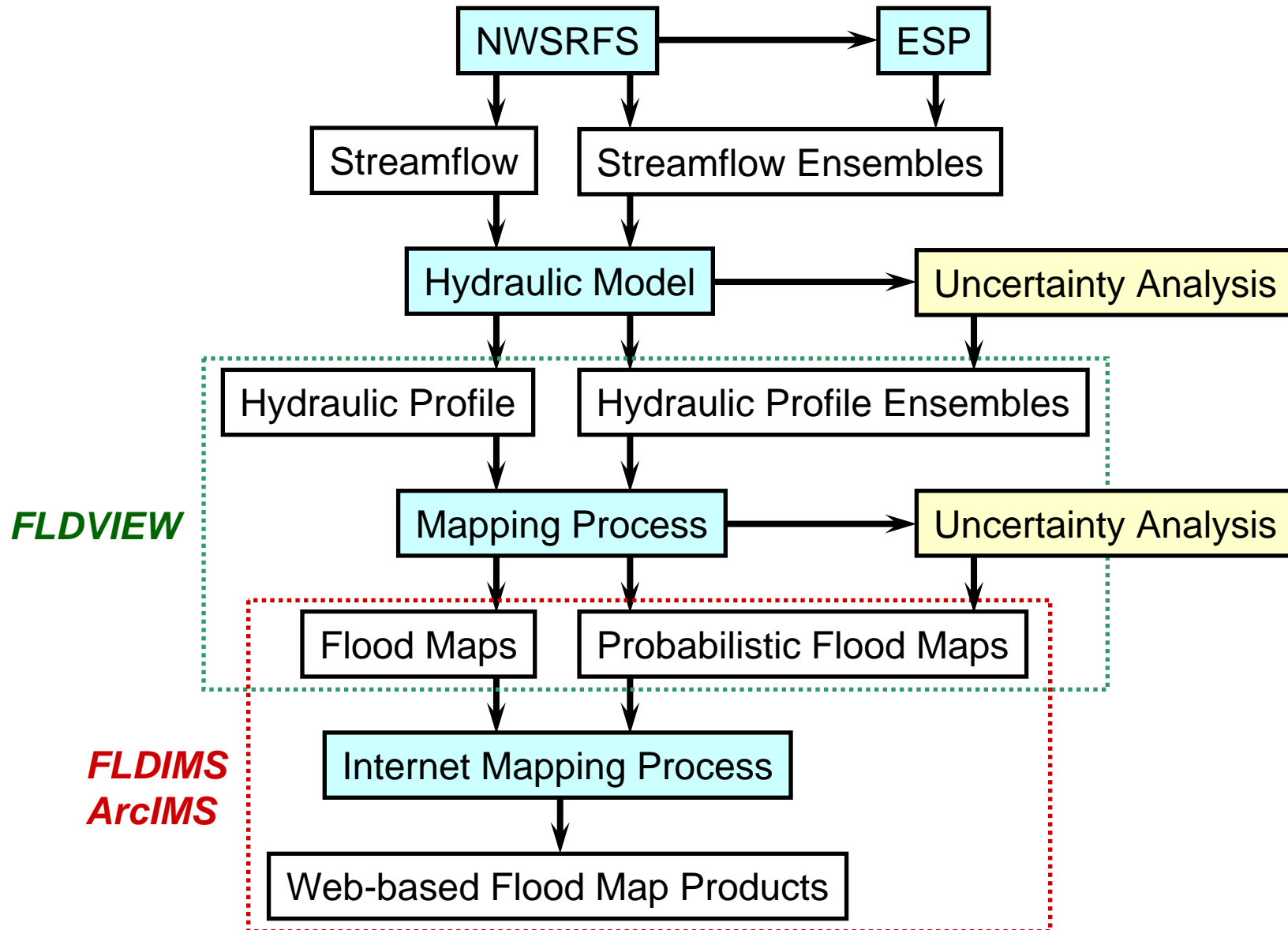
RFC Short-Term Ensemble Workshop, November 28, 2006

Probabilistic Flood Mapping

- Main goal: generate flood forecast maps based on ESP approach to account for uncertainty
- Experimental applications developed by OHD and/or RFCs:
 - Flood mapping tool + interactive mapping tool
 - Under evaluation by NWS Real-Time Inundation Mapping Evaluation (R-TIME) Team
- Required information:
 - hydraulic profiles for desired probability levels
 - + corresponding probabilistic flood maps
- Definitions:
 - probabilistic profiles: profile for which water elevation value of any point has the same probability to be exceeded
 - probabilistic flood map: flood extent for which any point on the limits has the same probability to be flooded

Flood Mapping

Forecasting System to produce deterministic and probabilistic flood maps

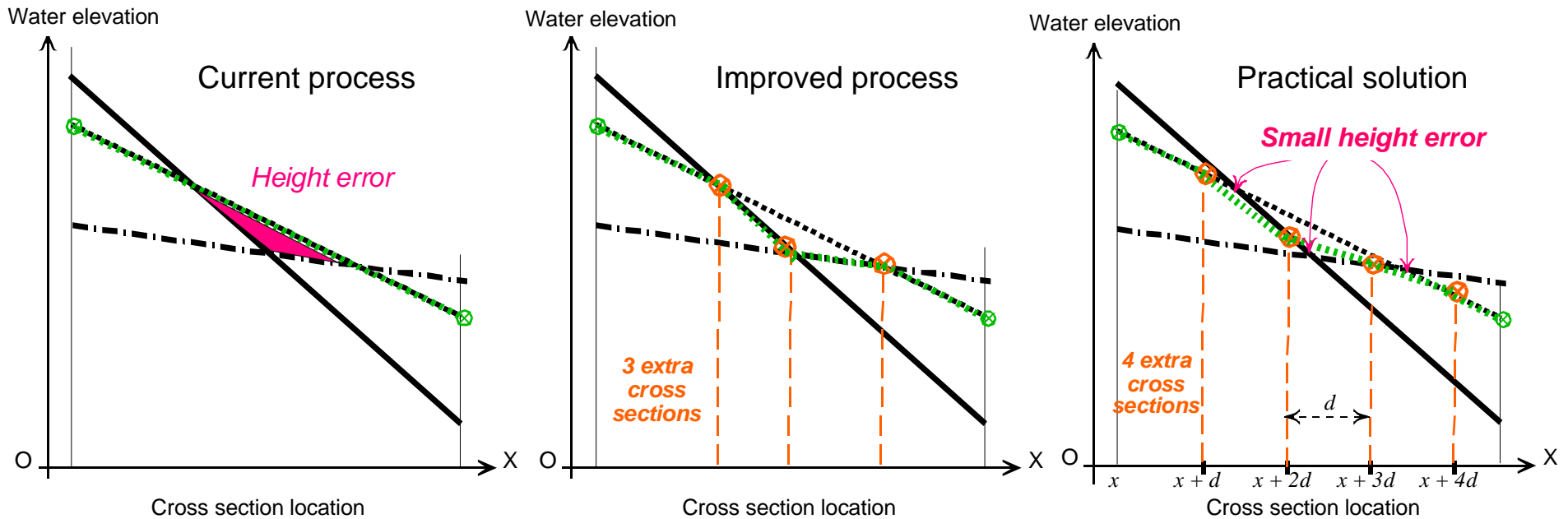


Existing Experimental Applications

- Applications developed by OHD with collaboration of RFCs:
 - GIS tool for flood maps
 - Internet tool for interactive flood maps
 - Analysis of probabilistic flood map generation process using ESP outputs
- **Main goal:** generate real-time flood maps using ESP hydrological outputs and FLDWAV (to produce probabilistic river stages)
- **Existing tools:**
 - FLDVIEW: GIS application to produce flood forecast maps
 - FLDIMS/ArcIMS: internet mapping application to publish forecast maps
- **Limitations:** do not account for uncertainties in hydraulic modeling and geospatial modeling
- **Generation of probabilistic hydraulic profiles:**
 - may require additional cross sections when input hydraulic profiles cross each other
 - for any intermediate probabilistic value, generate fuzzy probabilistic profile (profile envelop) (no interpolation)

Probabilistic Hydraulic Profiles

Generation of probabilistic hydraulic profiles may require additional cross sections when input hydraulic profiles cross each other



- 3 individual hydraulic profiles
- ⋯ (same frequency)
- ⋯ Probabilistic hydraulic profile for $P=0.7$

- ⊗ Original probabilistic water surface elevation
- ⊗ Extra probabilistic water surface elevation

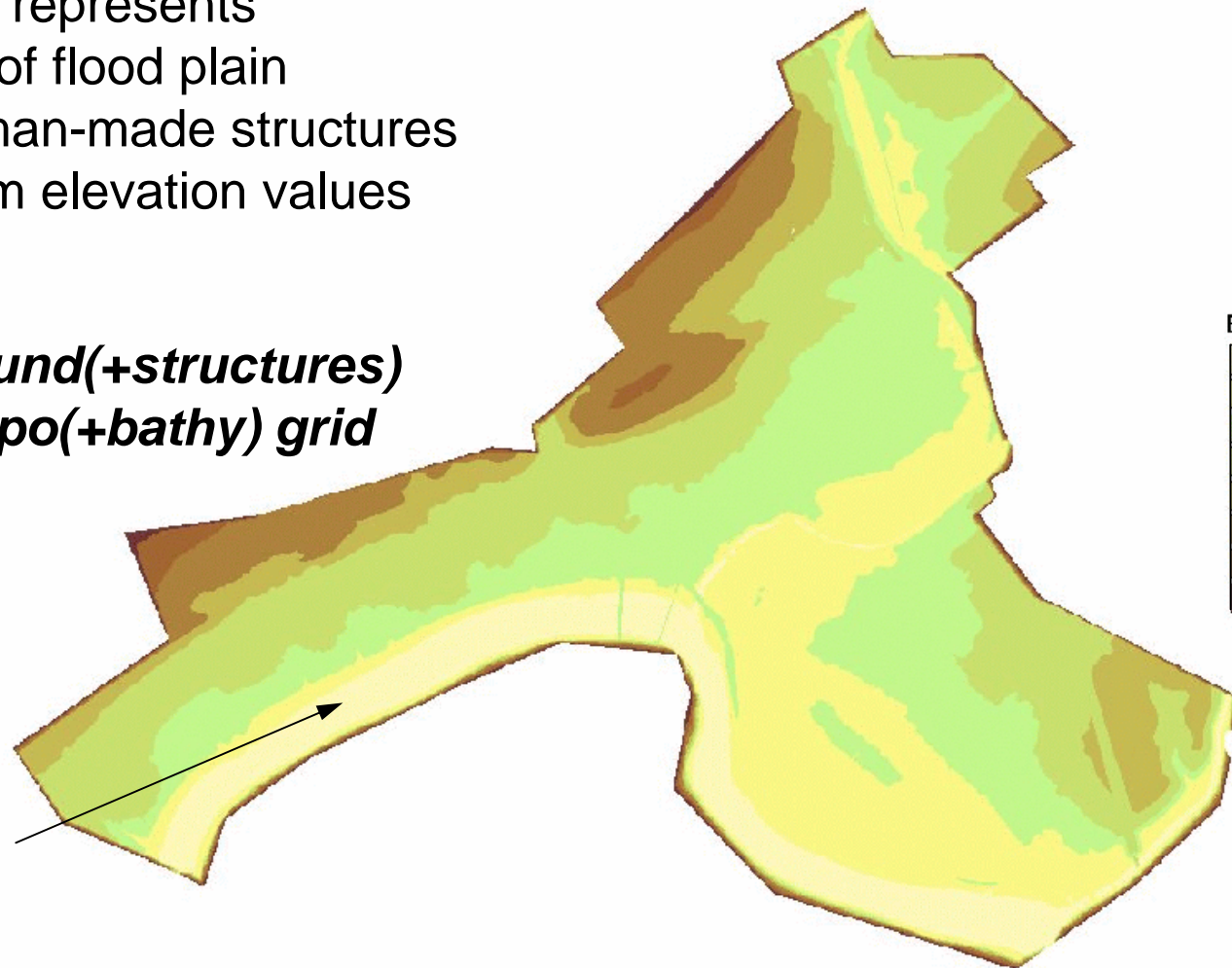
FLDVIEW (1): Ground Grid

Ground Grid represents

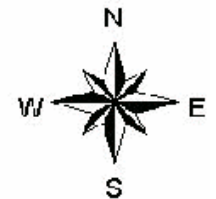
- topography of flood plain
- eventually man-made structures & river bottom elevation values

*ground(+structures)
topo(+bathy) grid*

**Ground
elevation Z**



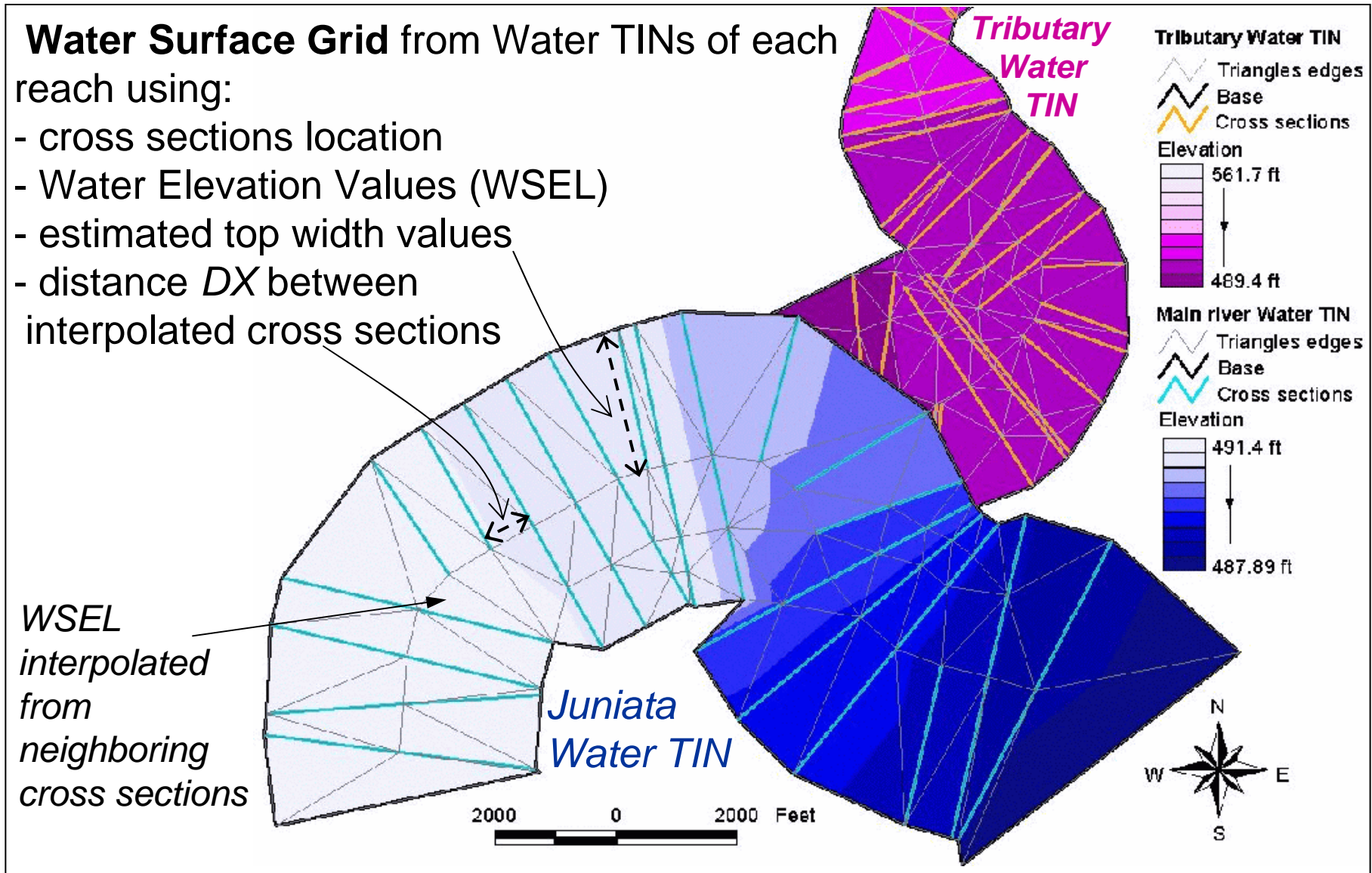
2000 0 2000 Feet



FLDVIEW (2): Water Surface Grid

Water Surface Grid from Water TINs of each reach using:

- cross sections location
- Water Elevation Values (WSEL)
- estimated top width values
- distance DX between interpolated cross sections



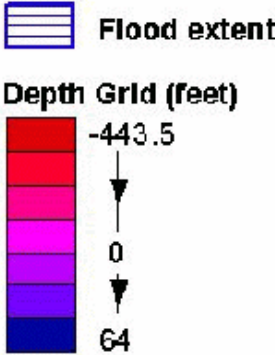
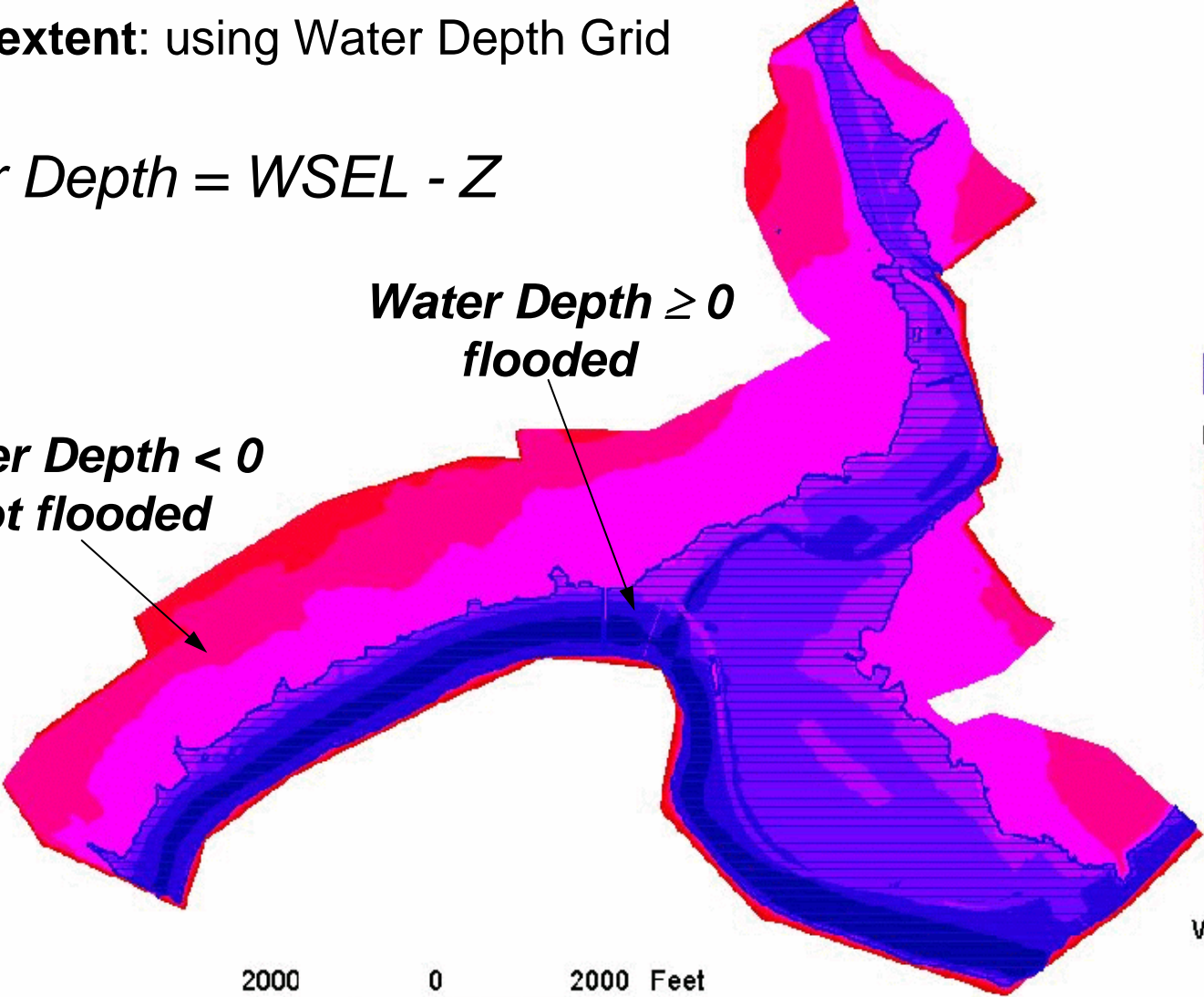
FLDVIEW (3): Flood Extent

Flood extent: using Water Depth Grid

$$\text{Water Depth} = \text{WSEL} - Z$$

*Water Depth ≥ 0
flooded*

*Water Depth < 0
not flooded*



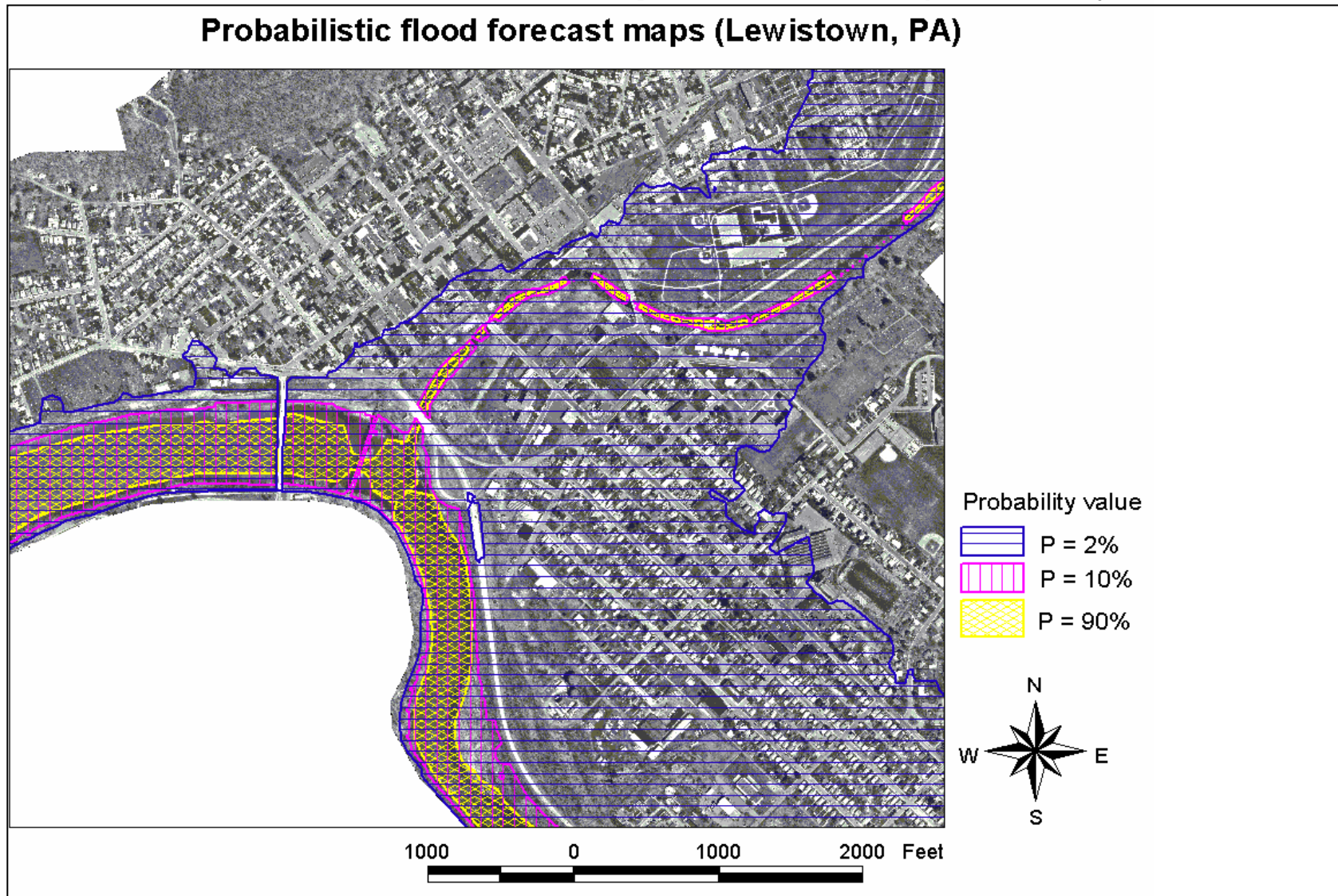
FLDVIEW (4): Deterministic Maps

Deterministic flood map: 1984 flood event



FLDVIEW (4): Probabilistic Maps

Probabilistic flood forecast maps for different probability values



FLDIMS (1): Dynamic Maps on Web

- Probabilistic flood forecast maps
- Deterministic peak flood forecast map
- Display other layers
- Historical flood maps
- Flood animation

The screenshot displays the FLDIMS web application interface within a Netscape browser window. The browser title is "FLD IMS - Lewistown, Pennsylvania - Netscape" and the address bar shows the URL "http://140.90.22.51/lewistown_pa/lewistown.asp". The interface includes a NOAA logo and a sidebar with various controls:

- FLDIMS** section: "Today is September 17, 2002", "Forecast Period June 08 to June 18", "Flood Probability" (ON/OFF), and radio buttons for 10%, 25%, 80%, and 90%.
- Flood Forecast** section: "peak" radio button.
- Layers** section: "ON/OFF" and checkboxes for Rivers, Streams, Roads, Railways, and Aerial Photo.
- Historical Floods** section: Radio buttons for 1984, 1996, 1997, and 1999.
- Animate (beta)** section: Radio buttons for Scenario 1 and Scenario 2.

The main map area shows an aerial view of a city street grid with a blue shaded flood inundation area. The browser window footer includes "Cities : Derry", "1 : 8,134", "7,944 x 5,042 (ft)", and "The following features fall at least partially within the flood inundation area: open frame in a new browser window".

FLDIMS (2): Dynamic Maps on Web

Web-based information provided to NWS partners and customers:

- **Flood forecast extents:** probabilistic floods, deterministic flood (peak conditions), historical floods (1984, 1996, 1997, 1999)

- **Other layers:** rivers, streams, roads, railways, orthophotos

- **Spatial analysis of flood extent:**

identify features

(roads, railways, cities)

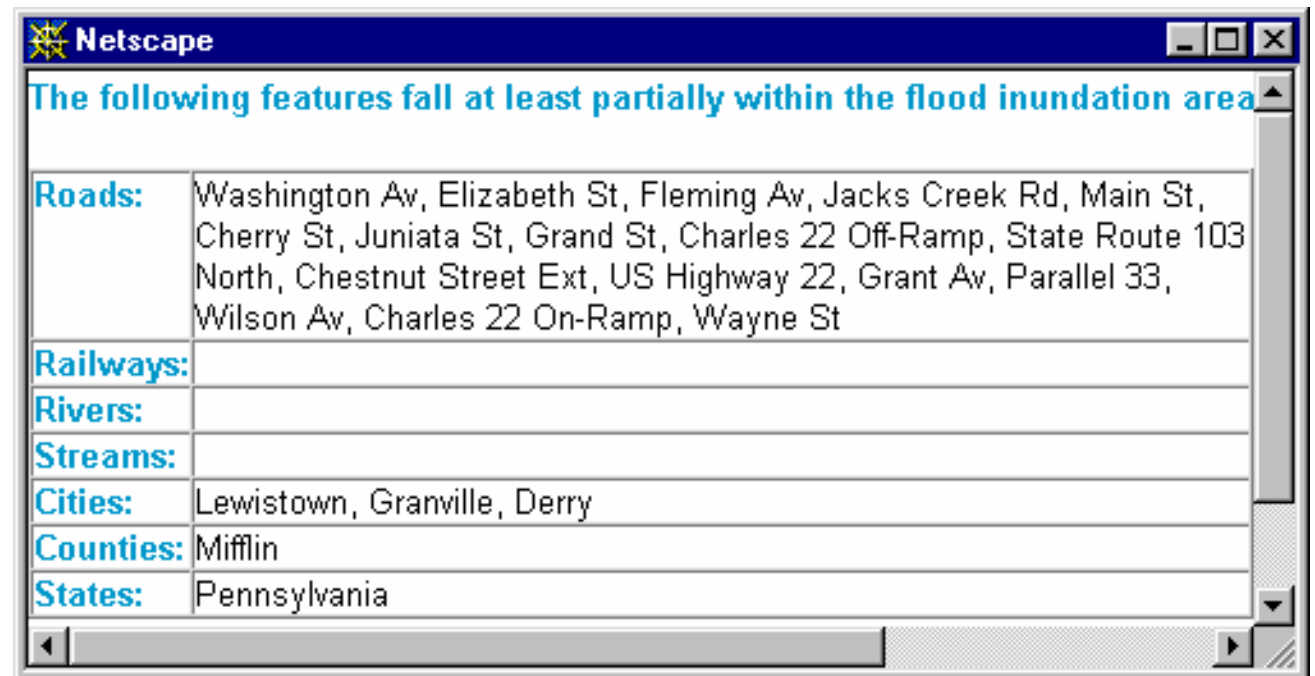
within the flood extent,

give names of

these features and

statistics

- **Animation of scenarios**



Future Flood Mapping Applications