The Development of a Flood Warning and Response System

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Purpose

- Provide a Flood Warning and Response System to communities along river systems
  - Maximize response time (County Emergency Management Agency and Floodplain Residents)
  - Use stage/elevation-based flood inundation mapping
  - Damage estimates (expedite disaster assistance)
  - Evacuation & flood warning plan formulation tool
  - Educate the public on flood hazard

Software Development Goals

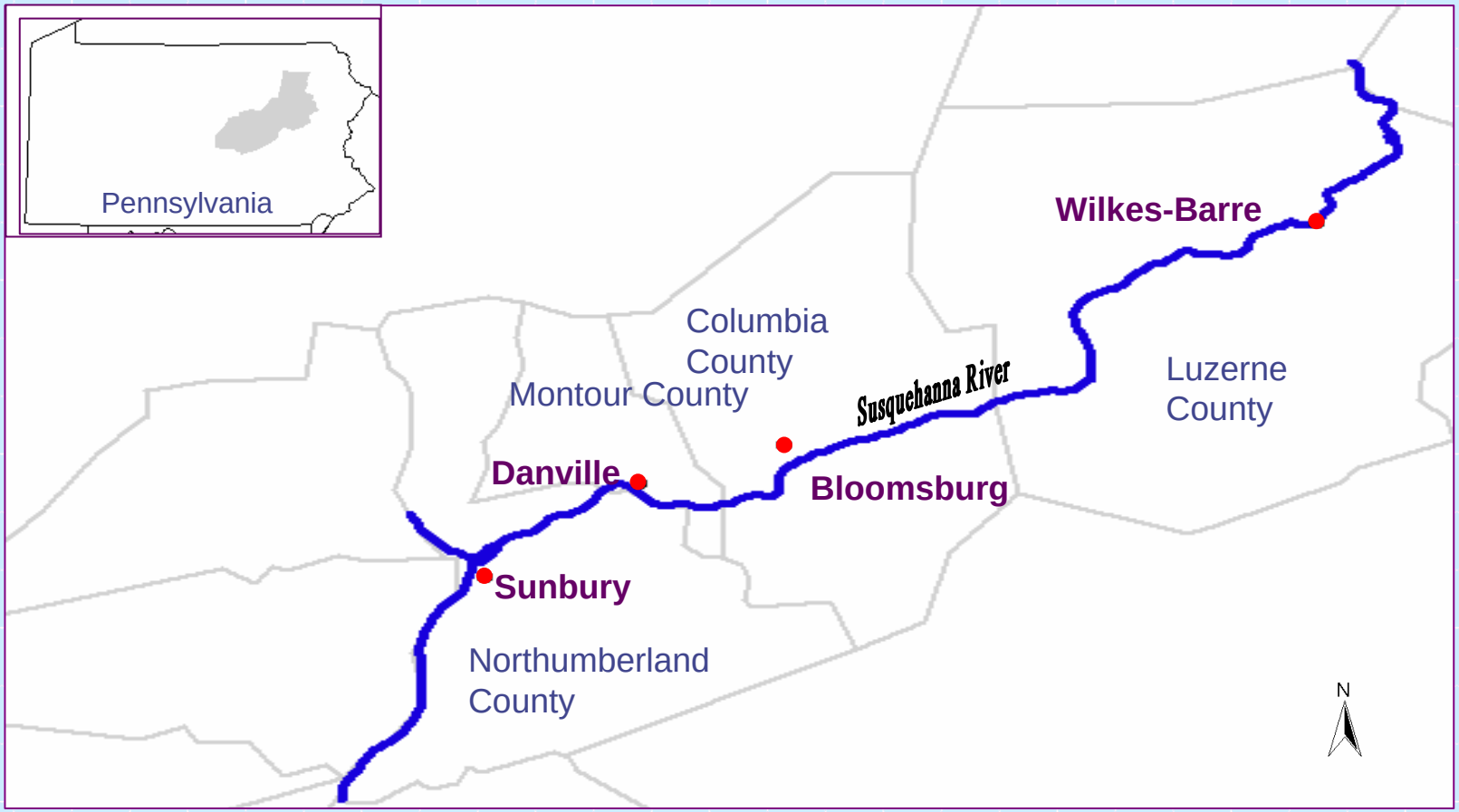
- Use existing technologies as much as possible to develop the FWRS
- Develop new tools and interfaces only where necessary
- Maximize the use of geospatial displays
- Keep the interface simple and customizable
- Easily update data

Process Components

- Forecast Information
  - National Weather Service Forecasts
- River Hydraulics Model
  - River Analysis System (HEC-RAS), HEC-GeoRAS
- Data Visualization
  - ArcGIS – Customized Interface, Excel
- Flood Damage Computations
  - Structure Inventory
- Flood Impact Response Tables

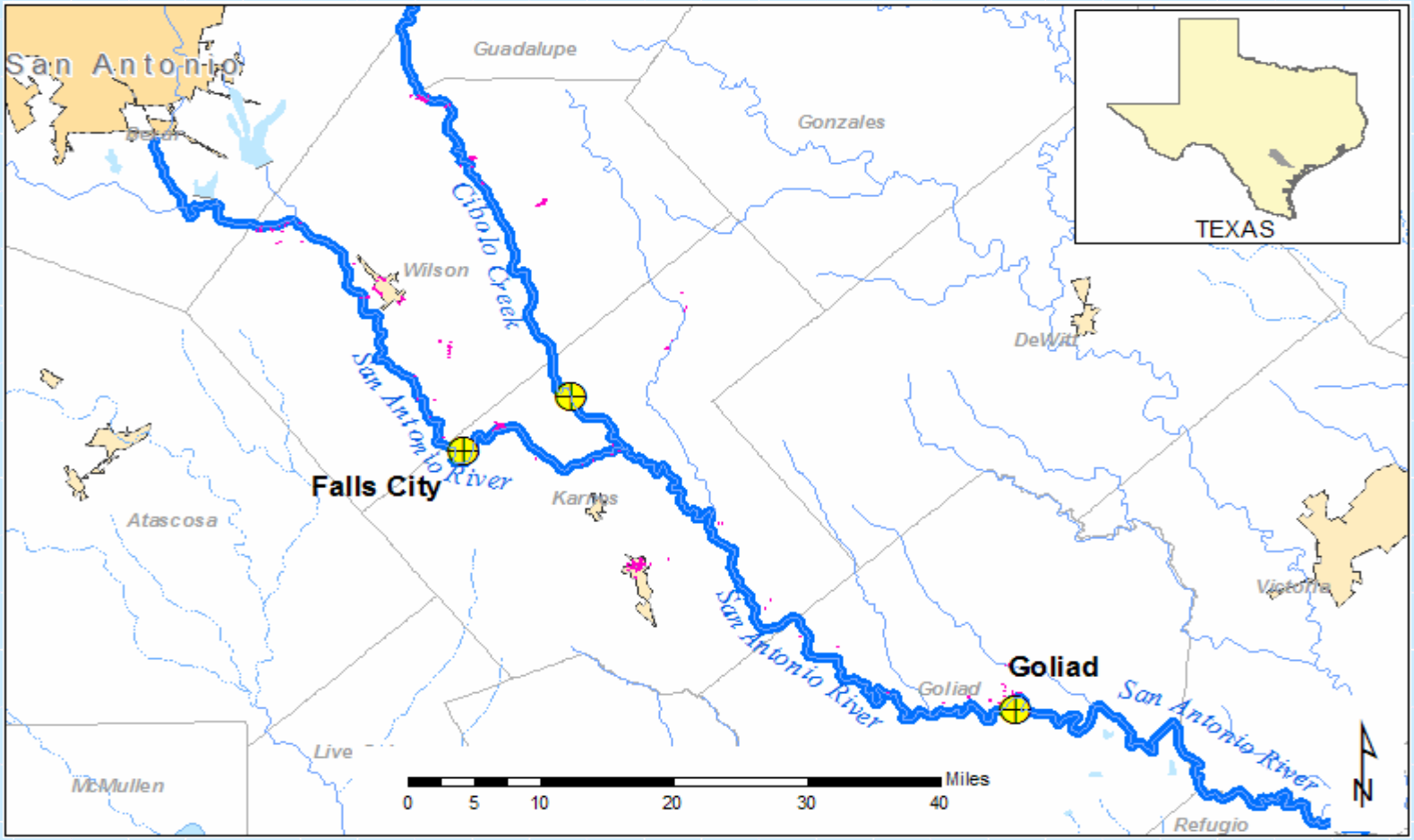
Study Area – Susquehanna River

- 4 NWS Forecast Locations

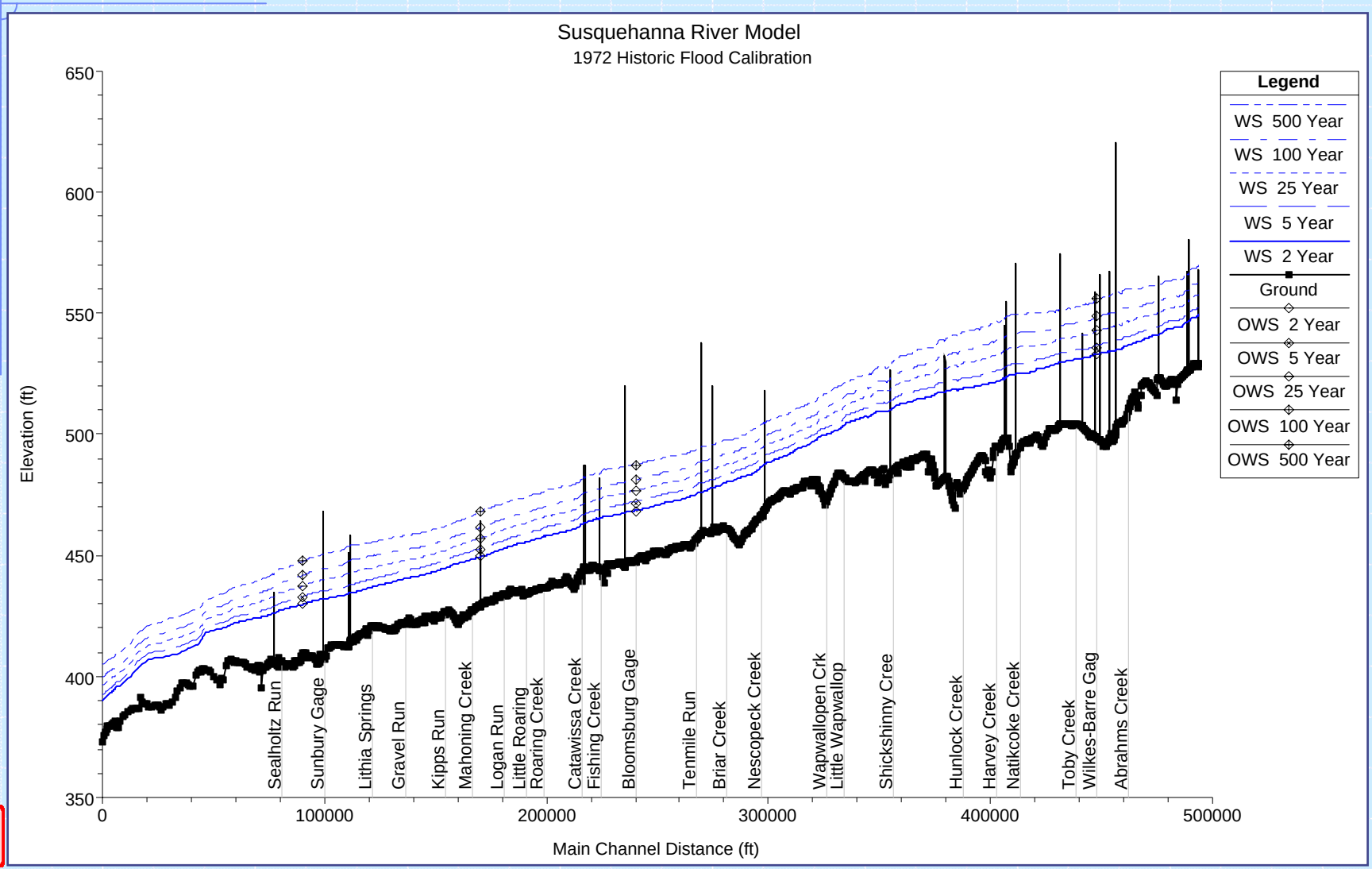


Study Area - San Antonio River

- 3 NWS Forecast Locations

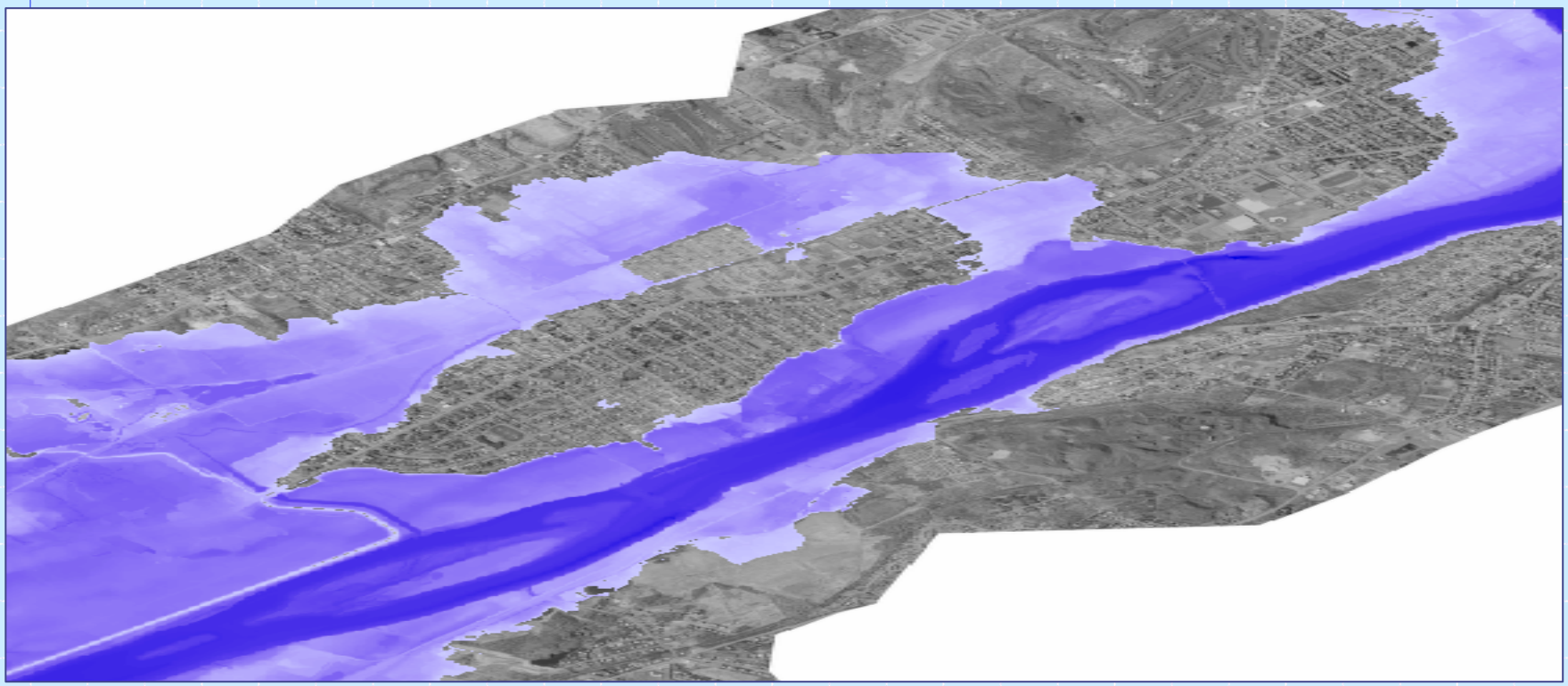


HEC-RAS Model Creation and Calibration



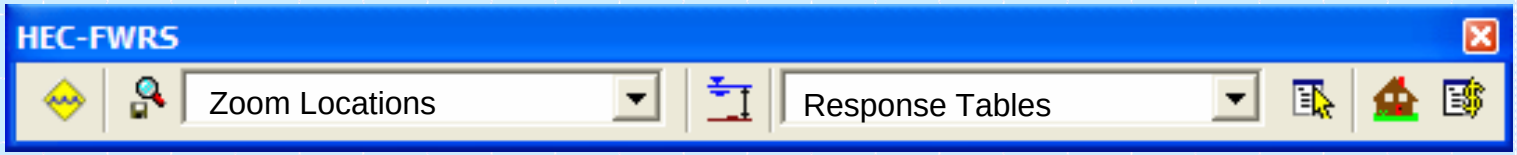
Inundation Mapping using HEC-GeoRAS

- Atlas of water surface profiles/inundation maps run to cover the range of expected events



Flood Warning and Response System

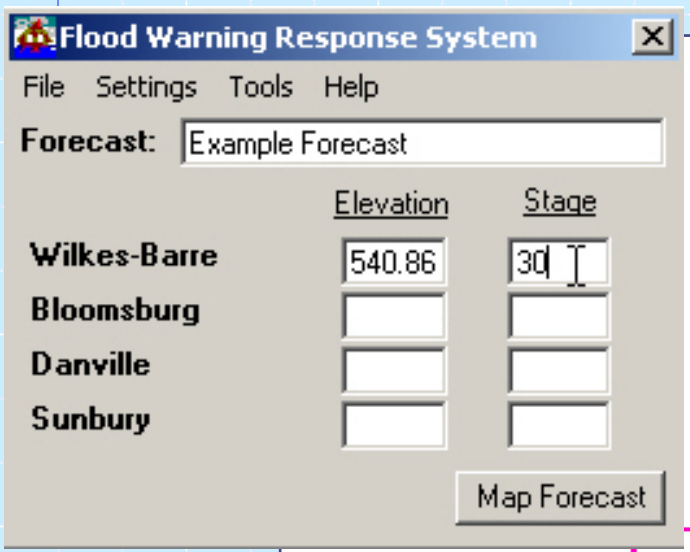
- Customized interface to ArcGIS



- Entry of forecast information
- Query of inundation depths
- Access impact response tables
- Calculate structure damages

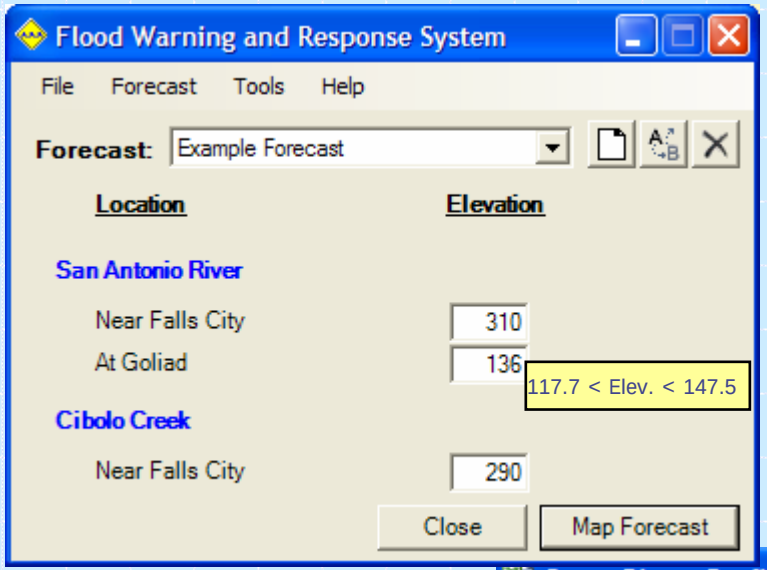
Forecast Entry – Susquehanna River

- Predefined Locations for entry of Elevation or Stage



Forecast Entry – San Antonio River

- Flexible “selection” of input locations



- FWRS input form is built based on Excel sheet

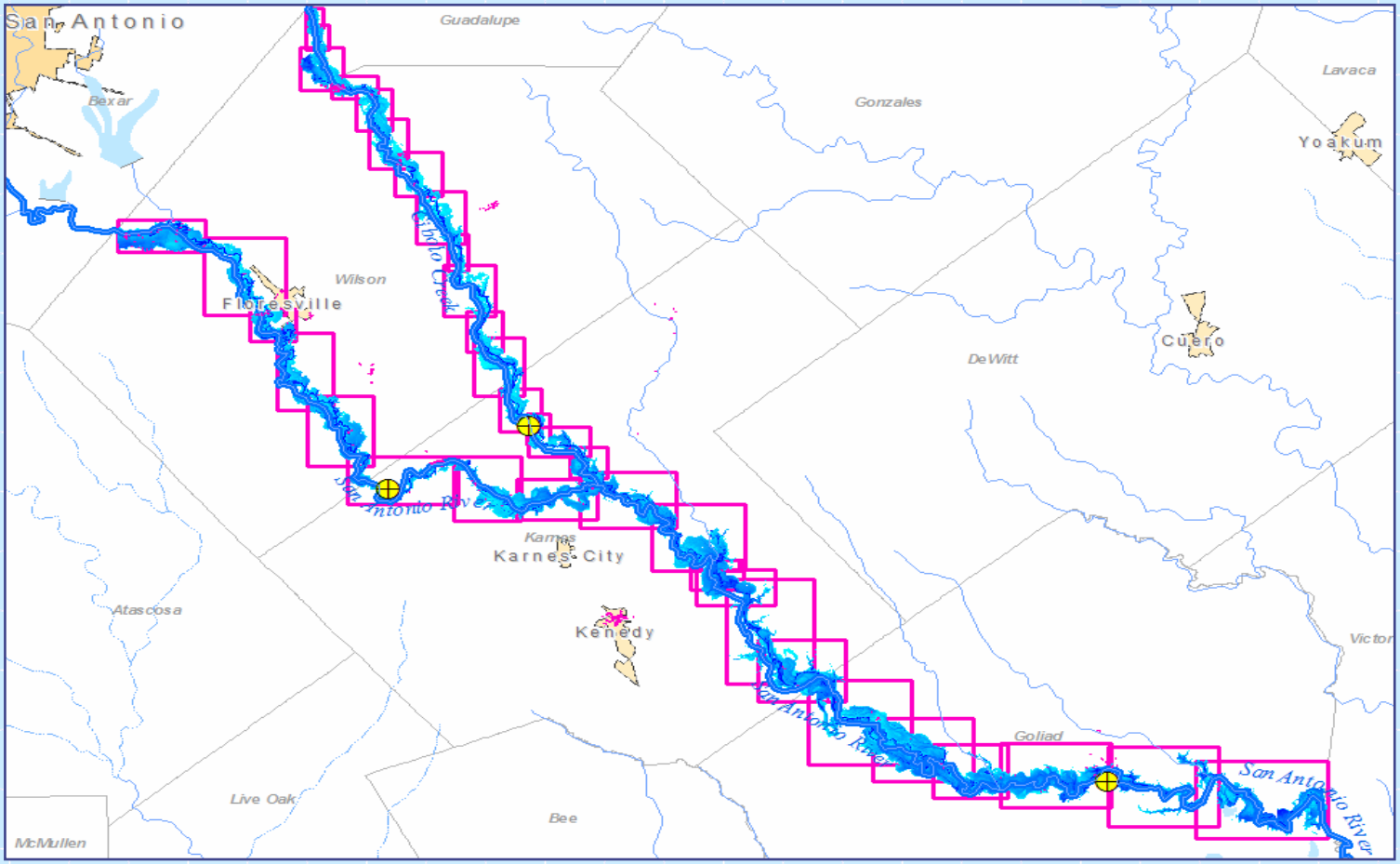
Gages Rivers Profiles.xls

	A	B	C	D	E
1	River Name	River Station	Location Name	MinWSE	MaxWSE
2	San Antonio River	824797.2	Near Falls City	302.3	326
3	San Antonio River	368786.3	At Goliad	117.7	147.5
4	Cibolo Creek	56391	Near Falls City	286.4	300.2
5					

Gages | Rivers | San Antonio River | Cibolo

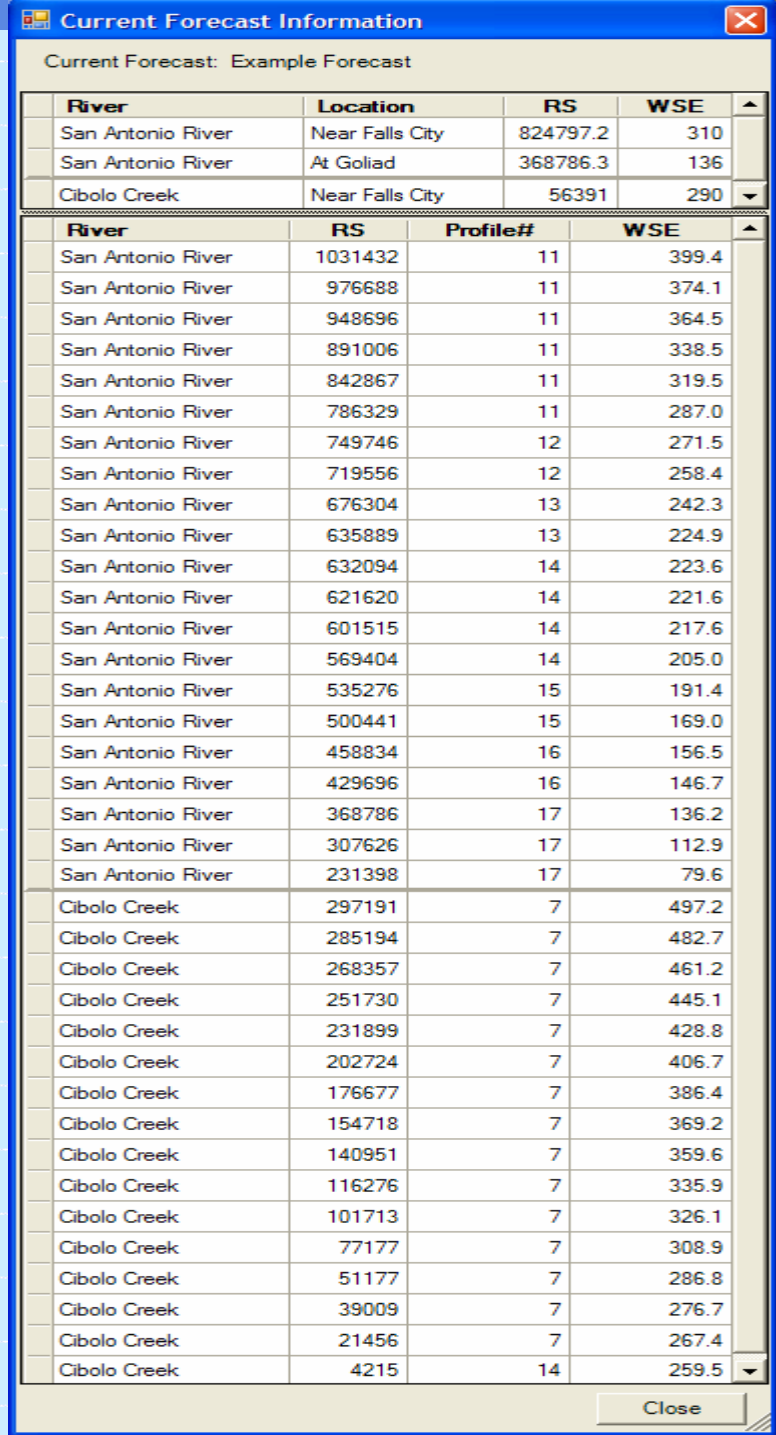
Tiled Mapping

- 20 Tiles San Antonio River, 16 Tiles Cibolo Creek

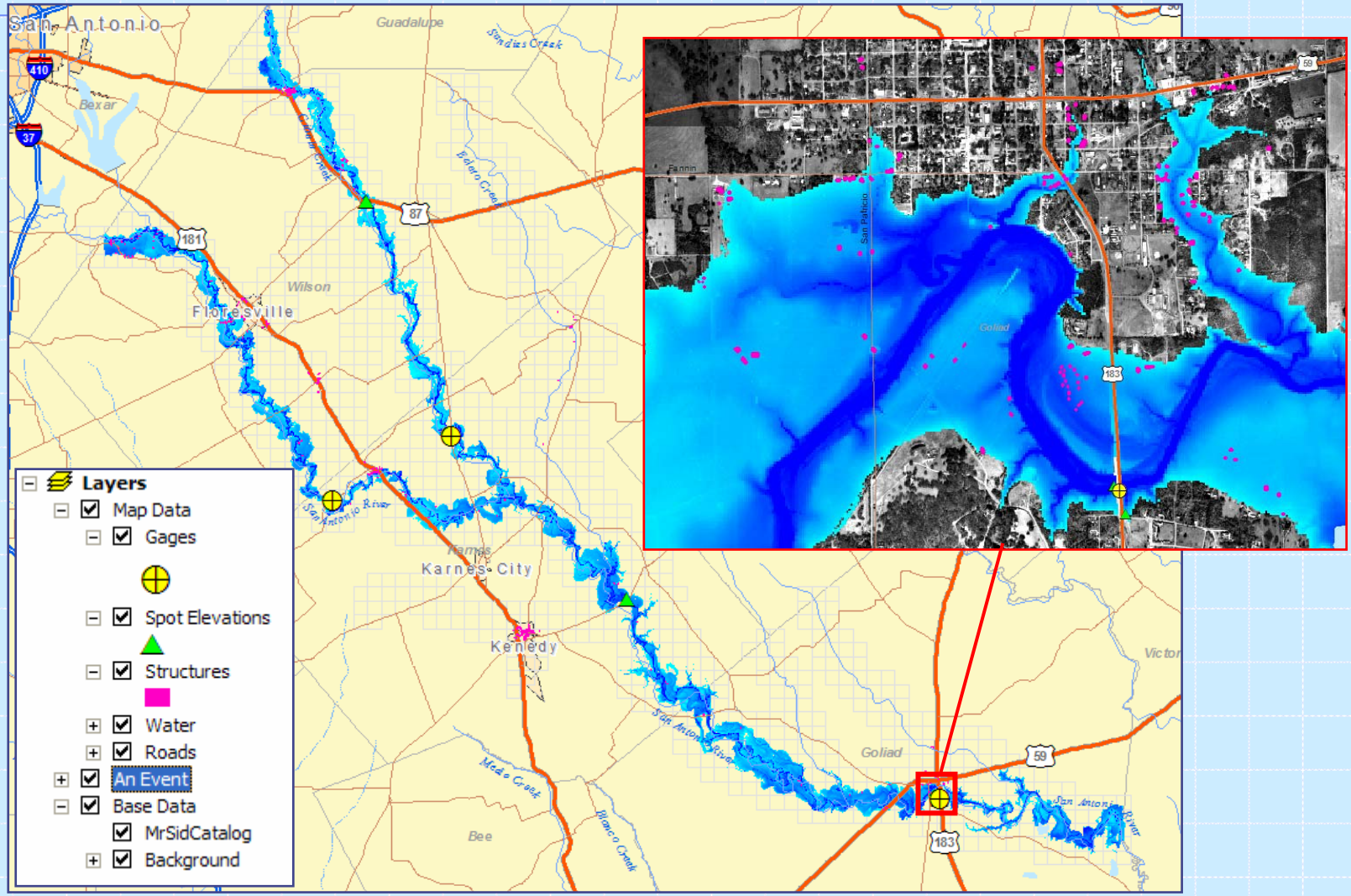


Tiled Mapping

- Interpolation by profile number
- Backwater by water surface elevation at confluences to handle tributaries
- Data stored by profile



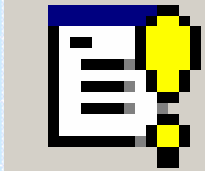
Mapping Layers



Flood Impact Response Tables

- Given a forecasted elevation:
  - What is the expected impact?
  - What response action should be taken?
- Developed by individual local Emergency Management Agencies
  - Excel spreadsheet
  - May be formatted (font, color, size)

Flood Impact Response Tables



Flood Impact Response Table

Print ... Copy ...

	Elevation	Stage	Impact	Response
Wilkes-Barre City	528	19		W-B Market St, & Union St. Pumping Stations Activated
	529	20	WARNING STAGE Inundation: Nesbitt Park	Vine St. Shickshinny, Farm Area Plainsville, EMA Control Center Activates.
	530	21		
	531	22	FLOOD STAGE Inundation: Plymouth Flats, W. Nanticoke, Shickshinny	
	532	23	Farm Area Plains Inundated	
	533	24	Inundation: Lowlands, Pittston City, Canal St., Shickshinny	
	534	25	Inundation: W Pittston, Harding	Levee Patrol Begins, Lowlands of Plainsville.
	535	26		
	536	27	Inundation: RT.11 W. Nanticoke & River Rd. Palinsville	
	537	28	Inundation: Canal St. W. Nanticoke	Close RT. 11 W. Nanticoke
	538	29	Inundation: PP&L Riverlands, River Rd, Por Balanchard, Ws Pittston	Close RT. 11 Shickshinny
	539	30	Inundation: RT.11 Avondale Flooding C.H. Subbasement, Main St. Shickshinny from sewers.	Activate W-B Brookside Flood Protection System
	540	31	Duryea & W. Pittston affected	Hanover Twp. Installs Stop Logs Canadian Pacific RR Tracks Hollenback PK. W-B Mark Plaza EDW.
	541	32	Main St. Shickshinny Inundated	County Installs Barrier Erie-Lackawanna RR Tracks, Swoyersville
	542	33	Inundation: Mocanaqua	Kingston Installs Stop Logs, Pocono-NE RR Tracks. W-B Installs Barrier at rear of C.H.
	543	34		Kingston Installs Sandbag Closure, RT. 11 Edwardsville. W-B Installs Enclosure at Market St Bridge
	544	35	Inundation: RT.11 Edwardsville, Dundee Area, Hanover Twp.	
	545	36	Inundation: Nescopeck B.	County Installs Sill, Lehigh Valley RR Tracks, Swoyersville.
	546	37	Levee topped - Inundation W-B	County Installs Sandbag Closure, Wilkern St. Exeter.
	547	38	Inundation: Hanover Twp. & West Side (Plymouth, Edwardsville, Kingston, Forty-Fort, Wyoming)	
	548	39	Swoyersville, Luzerne begin Inundation.	

Flood Damage Analysis

- Structure inventory
- Depth-%Damage curves
  - Damage Category (Susquehanna River)
    - Residential, commercial, …
  - Occupancy type (San Antonio River)
    - Single Story Residential, 2 Story Residential, Mobile Home, Single Story Apartment, ...

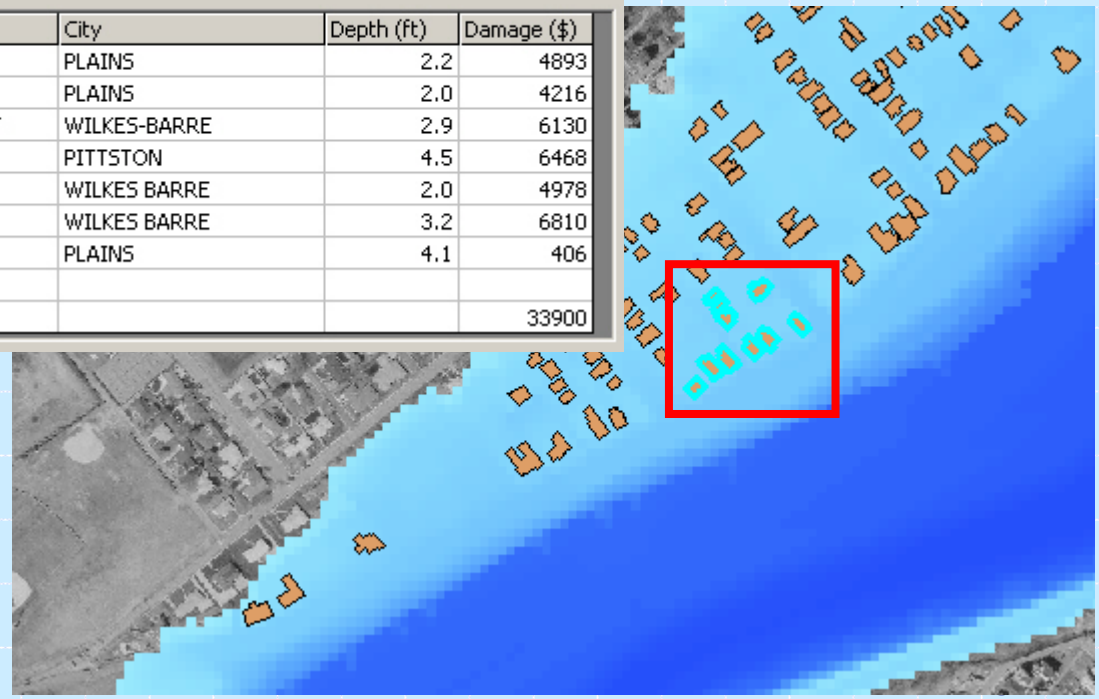
Structure Damage

- Query inundation depth
- Compute individual structure damage

Flood Damage by Structure

Print ... Copy ...

Name	Address	City	Depth (ft)	Damage ($)
OWENS WILLIAM & LORETTA	2 ROBERTS ST	PLAINS	2.2	4893
OWEN GEORGE R & SADIE J	10-12 ROBERT ST	PLAINS	2.0	4216
BELSKY DAVID & DIANE	163 COURTRIGHT ST	WILKES-BARRE	2.9	6130
POHODA JOHANNA THERESA	16 MITCHELL ST	PITTSTON	4.5	6468
LINSKI MARY H & BENJAMIN	15 MITCHELL ST	WILKES BARRE	2.0	4978
GRAY MARGARET A	6 MITCHELL ST	WILKES BARRE	3.2	6810
CHOPKA ANDREW & JEAN	2 MITCHELL ST	PLAINS	4.1	406
Total =				33900



System-wide Damage

- Working estimate for FEMA disaster relief

Flood Damage by Structure

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	# Res.	Res. Damage($)	# Comm.	Comm. Damage($)	# Total	Total Damage($)	# Impacted
Columbia County							
Berwick Borough	1	11038	0		1	11038	18
Bloomsburg Town	127	2089524	26	1554798	153	3644320	589
Briar Creek Borough	0		0		0		18
Catawissa Borough	15	183563	3	55213	18	238776	90
Franklin Township	0		0		0		15
Mifflin Township	0		0		0		25
Montour Township	16	257353	0		16	257353	68
Scott Township	93	1504762	4	52773	97	1557536	357
South Centre Township	7	80559	10	6362070	17	6442628	70
Total	259	4126798	43	8024855	302	12151650	1250
Lackawanna County							
Ransom Township	0		0		0		14
Total	0		0		0		14
Luzerne County							
Conyngham Township	28	120324	0		28	120324	131
Duryea Borough	0		0		0		31
Edwardsville Borough	0		0		0		19
Exeter Borough	1	7697	0		1	7697	42

Contact Information

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