Lake Springfield's Spaulding Dam

How does it work? What if it doesn't?

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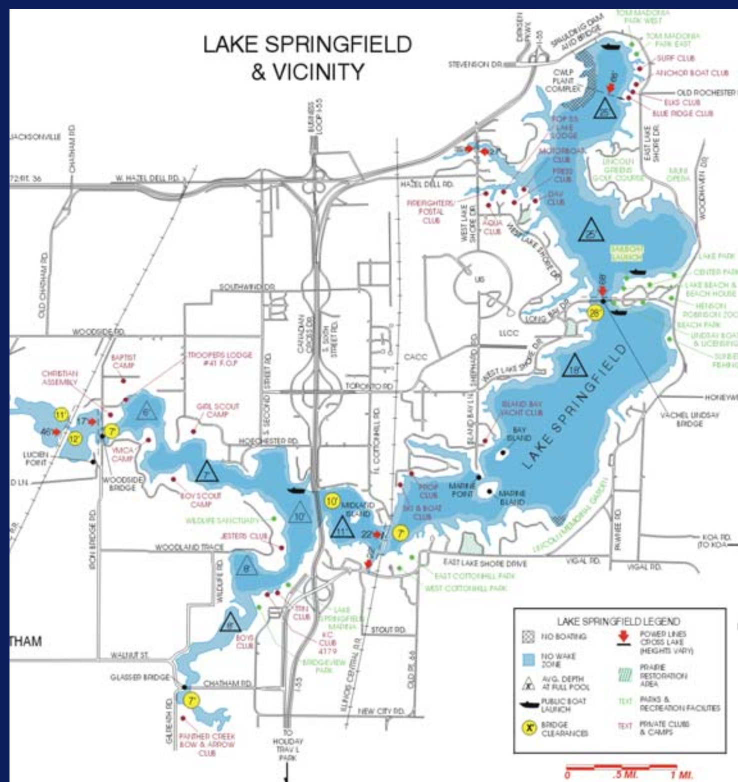
IAFSM 2017 Annual Conference

How does it work?

Introduction and Background



Lake Springfield

- Location: Springfield, IL
- Owned by City of Springfield
- Built in early 1930’s
- 4,200 acres at normal pool
- Purpose
  - Cooling water for power generation station
  - Community water supply
  - Recreation

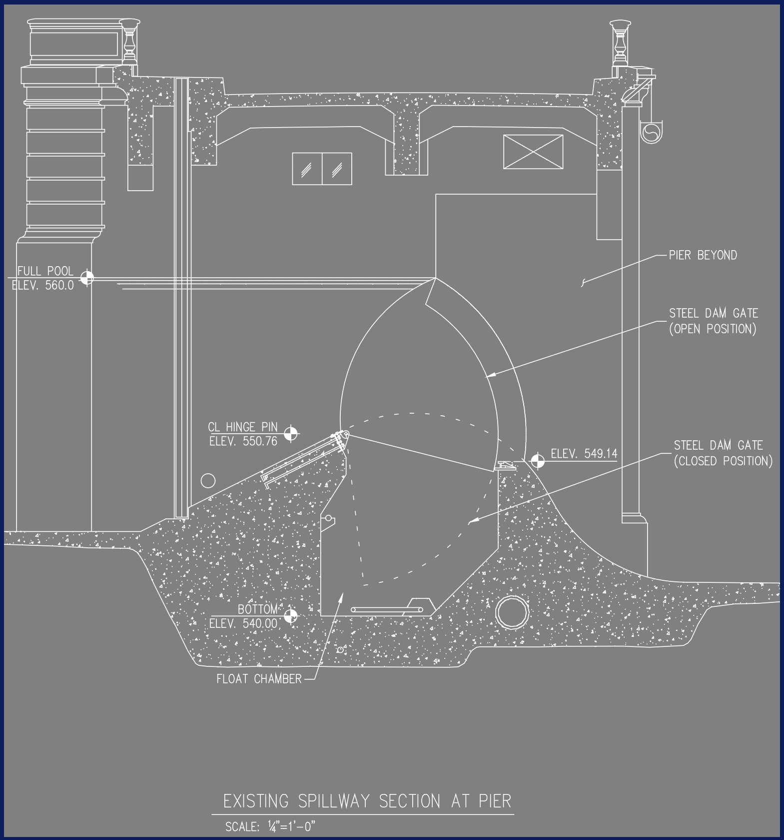
Introduction and Background

Spaulding Dam

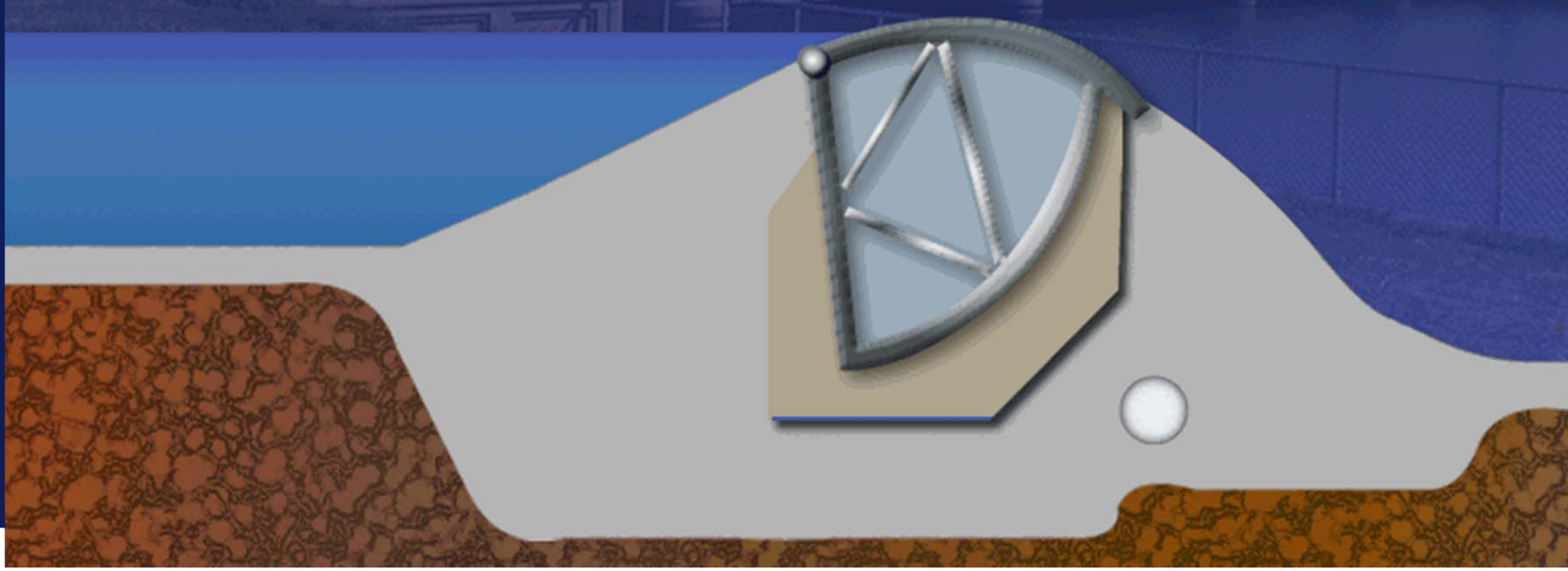
- Earth Filled Dam 1,600 ft long
- Gated Spillway (5 gates) 265 ft long
- Public Roadway on dam
- Historic Bridge over spillway
- Roadway Bridge over downstream spillway slab
- Class I high-hazard potential

Previous Gates – Floating Drum Gates

- Five spillway gates
- Circa 1932 construction
- 45 ft long by 8 ft high
- Sealed steel drum gates
- Floats on water within float chamber in gate bay
- Inlet/Outlet piping control water level in float chamber
- No mechanical gate lifting equipment



Floating Drum Gate



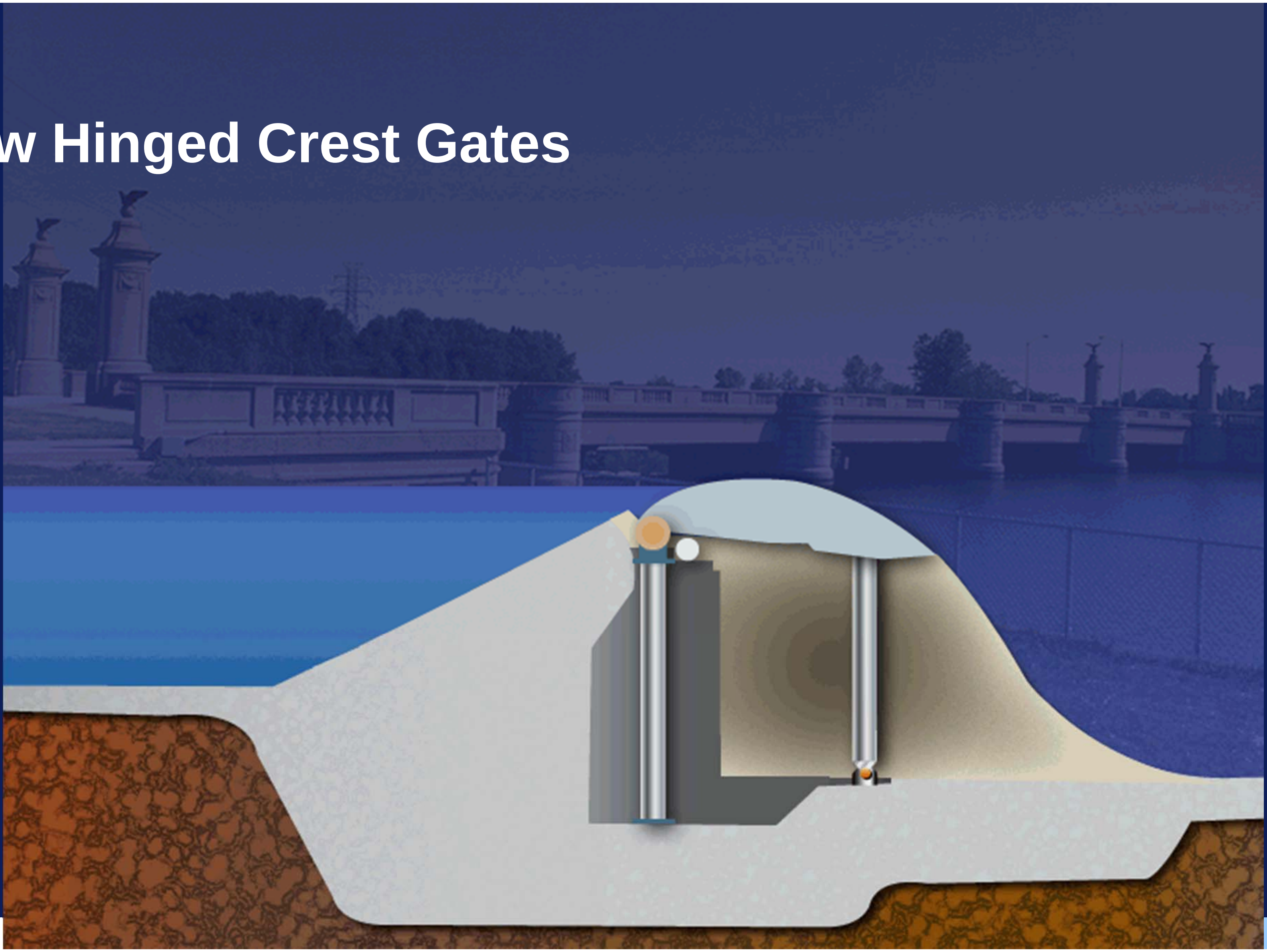
Replacement Gate Alternatives

- Alt 1a – Hinged Crest Gate – Operators Below
- Alt 1b – Hinged Crest Gate – Operators Above (Two locations Alt 1b1 and Alt 1b2)
- Alt 1c – Hinged Crest Gate – Bascule Type
- Alt 2 – Vertical Lift Gate
- Alt 3 – Pneumatically-Operated, Hinged-Leaf Gate
- Alt 4 – Rehabilitate Existing Gates

Scoring Matrix

Criteria	Weighting Factor	Alternative 1A Conventional Hinged Crest Gate Operators Below		Alternative 1B Conventional Hinged Crest Gate Operators Above		Alternative 1C Bascule-Type Hinged Crest Gate		Alternative 2 Vertical Lift Gate		Alternative 3 Obermeyer Steel-Faced Rubber Dam		Alternative 4 Rehabilitate & Modify Existing Drum Gate	
		Gate Type											
		Raw	Wt'd	Raw	Wt'd	Raw	Wt'd	Raw	Wt'd	Raw	Wt'd	Raw	Wt'd
1. First Cost	2.5	3	**7.5**	3	**7.5**	2.5	**6.25**	2	**5**	4	**10**	4	**10**
2. Fail safe, If they fail, loss of lake level will not be an immediate issue	2.5	4	**10**	4	**10**	4	**10**	4	**10**	4	**10**	3.5	**8.75**
3. Independent of existing drain piping for operation	1	5	**5**	5	**5**	5	**5**	3.5	**3.5**	5	**5**	3.5	**3.5**
4. Ability to be remotely controlled and operated	1	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**	5	**5**
5. Future maintenance	1.5	3	**4.5**	4	**6**	4	**3**	4	**6**	2	**3**	3	**4.5**
6. Hydraulic efficiency and fine water control	2	4	**8**	4	**8**	4	**8**	4	**8**	2	**4**	5	**10**
7. Sediment/debris accumulation	1.5	4	**6**	4.5	**6.75**	5	**7.5**	2	**3**	4	**6**	3	**4.5**
8. Aesthetics and Historic Preservation Concerns	1	3	**3**	2.5	**2.5**	3	**3**	2	**2**	3	**3**	5	**5**
9. Constructability	3	3	**9**	2	**6**	2	**6**	2	**6**	4	**12**	2	**6**
10. Reliability	2.5	3	**7.5**	3	**7.5**	3	**7.5**	3	**7.5**	3	**7.5**	3	**7.5**
TOTAL WITH FIRST COST			**65.5**		**64.25**		**61.25**		**56**		**65.5**		**64.75**
TOTAL WITHOUT FIRST COST			**58**		**56.75**		**55**		**51**		**55.5**		**54.75**

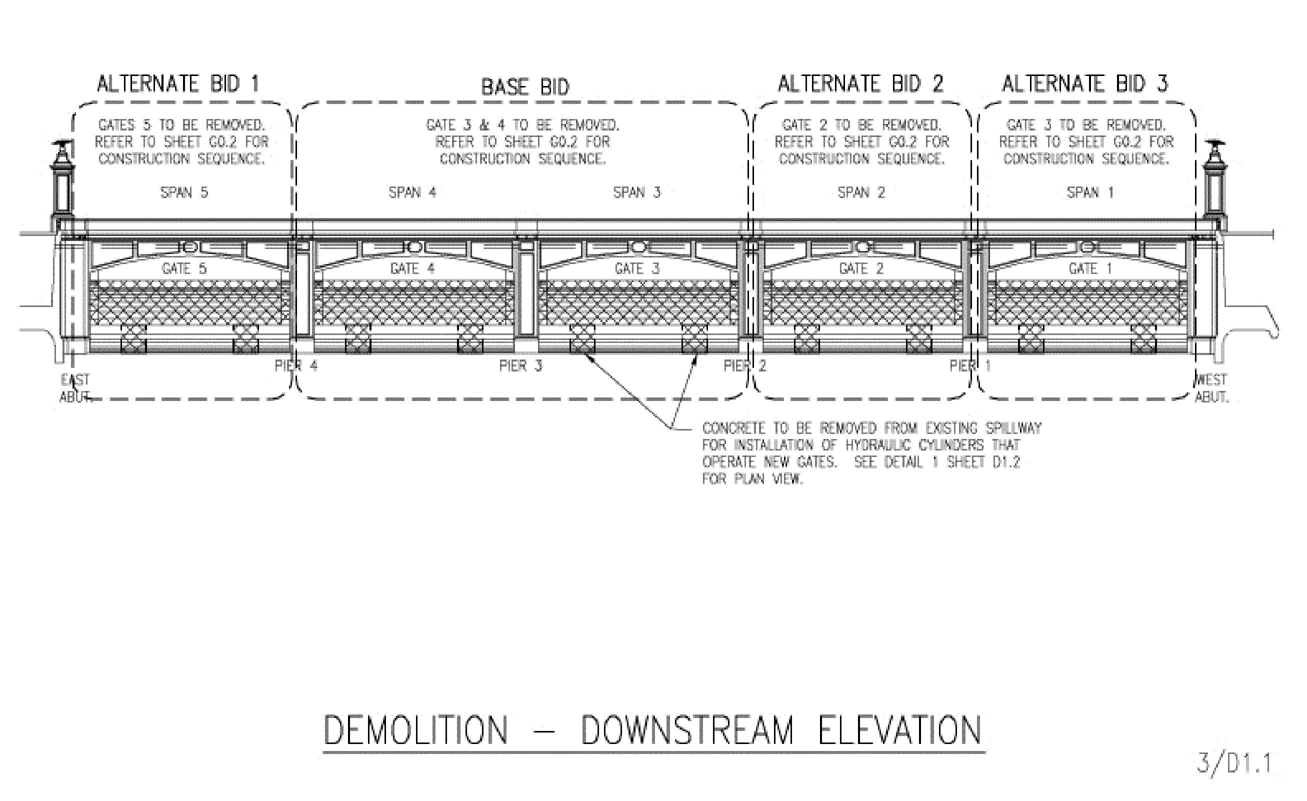
New Hinged Crest Gates



Design Development

- Limit concrete demolition and replace one gate at a time
- Permitting authorities
  - IHPA, USACE, IEPA, IDNR
- Limit visual changes to structure and maintain a "historic time capsule“
- Update Emergency Action Plan

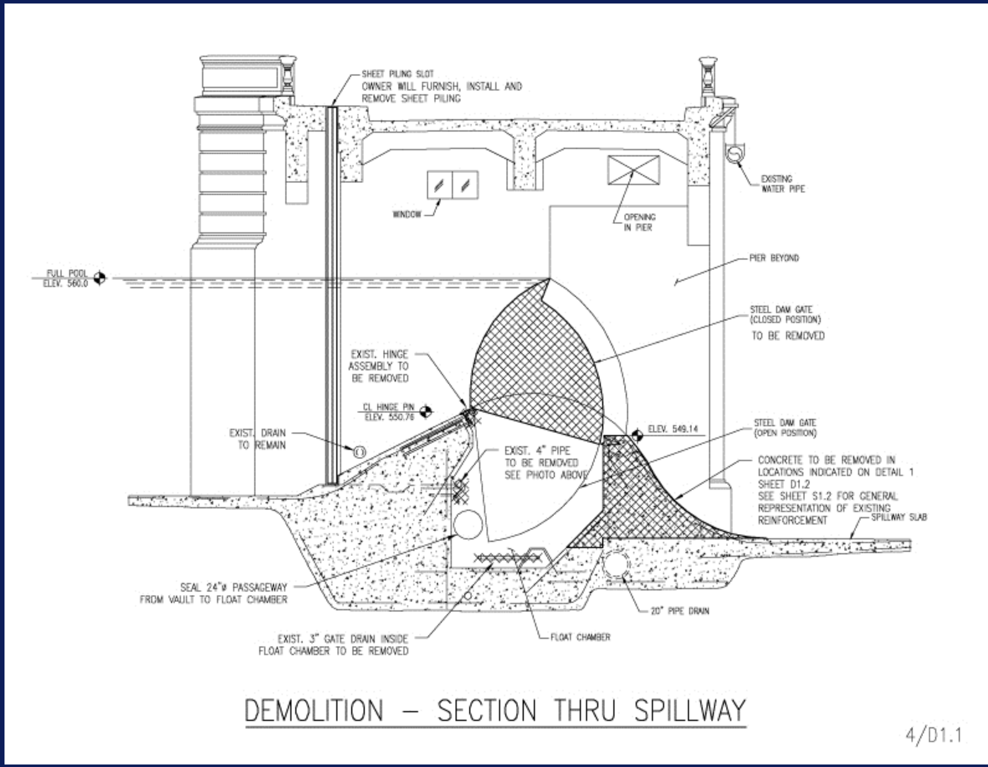
Base and Alternate Bids



Awarded Contract

- **Base Bid + Alternate Bids 1 through 3 - $5.4M**
- **General Contractor: J.F. Brennan Marine Professionals, LaCrosse, Wisconsin**
- **Subcontractors:**
  - Gate Supplier: Rodney Hunt Company, Orange, Massachusetts
  - Sitework: Vancil Contracting, Springfield, Illinois
  - Electrical: Anderson Electric, Springfield, Illinois
  - Hydraulic Piping and Setup: Sarco Hydraulics, Litchfield, Illinois
  - Concrete Cutting and Coring: Minneapolis Concrete Sawing, Minneapolis, Minnesota
  - Asbestos Abatement: Midwest Asbestos Abatement, Chicago, Illinois

Bulkhead, Dewatering, and Demolition




AUG 20 2008


AUG 27 2008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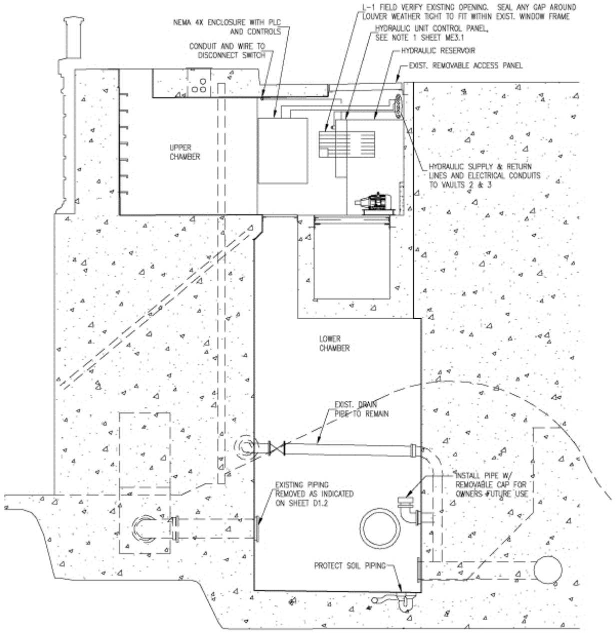
4802
AUG 28 2008

"What's the big deal? We've picked up chains heavier than this!"


AUG 28 2008


AUG 28 2006

Mechanical Systems



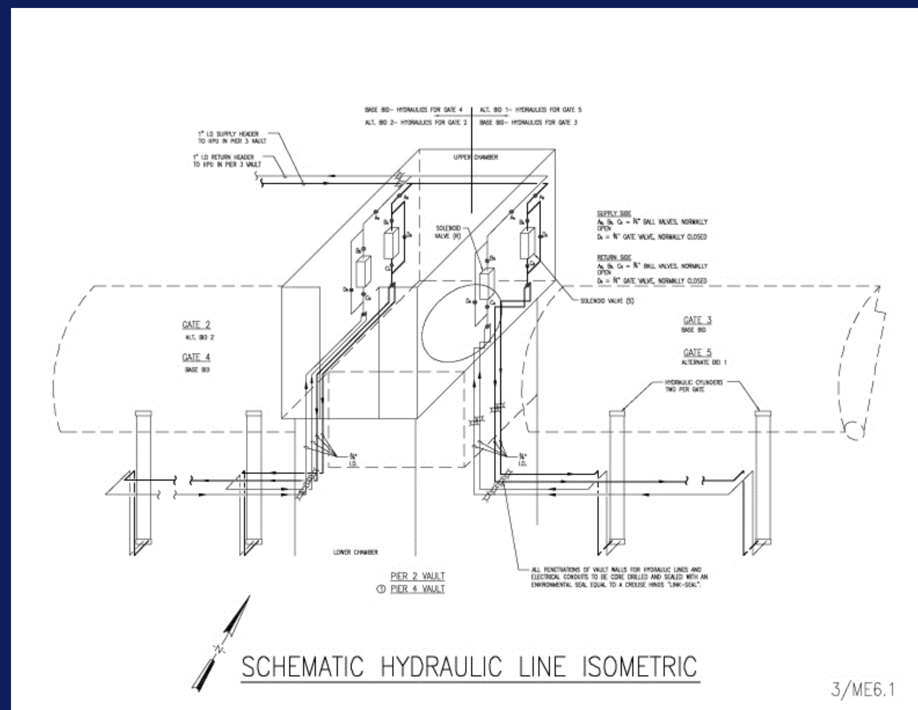
PIER 3 VAULT – WEST WALL ELEVATION

2/ME2.2


HOLS
LOLS
DANGER
CAUTION
WARNING

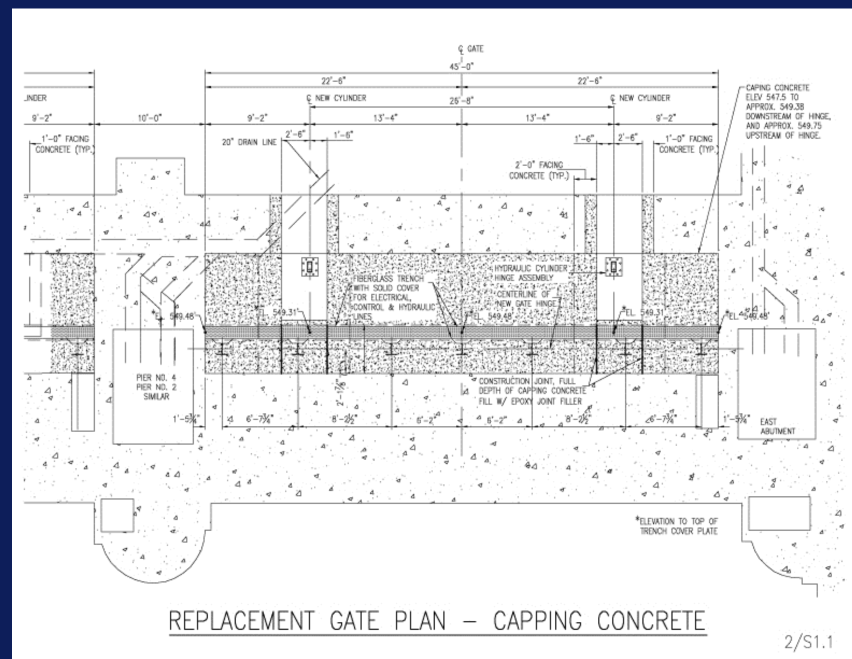

TOR/PUMP 1
MOTOR/PUMP 2
PIT
PS-H
DANGER
HIGH PRESSURE
SEP 3 2008

Schematic Routing of Hydraulic Supply and Return Lines

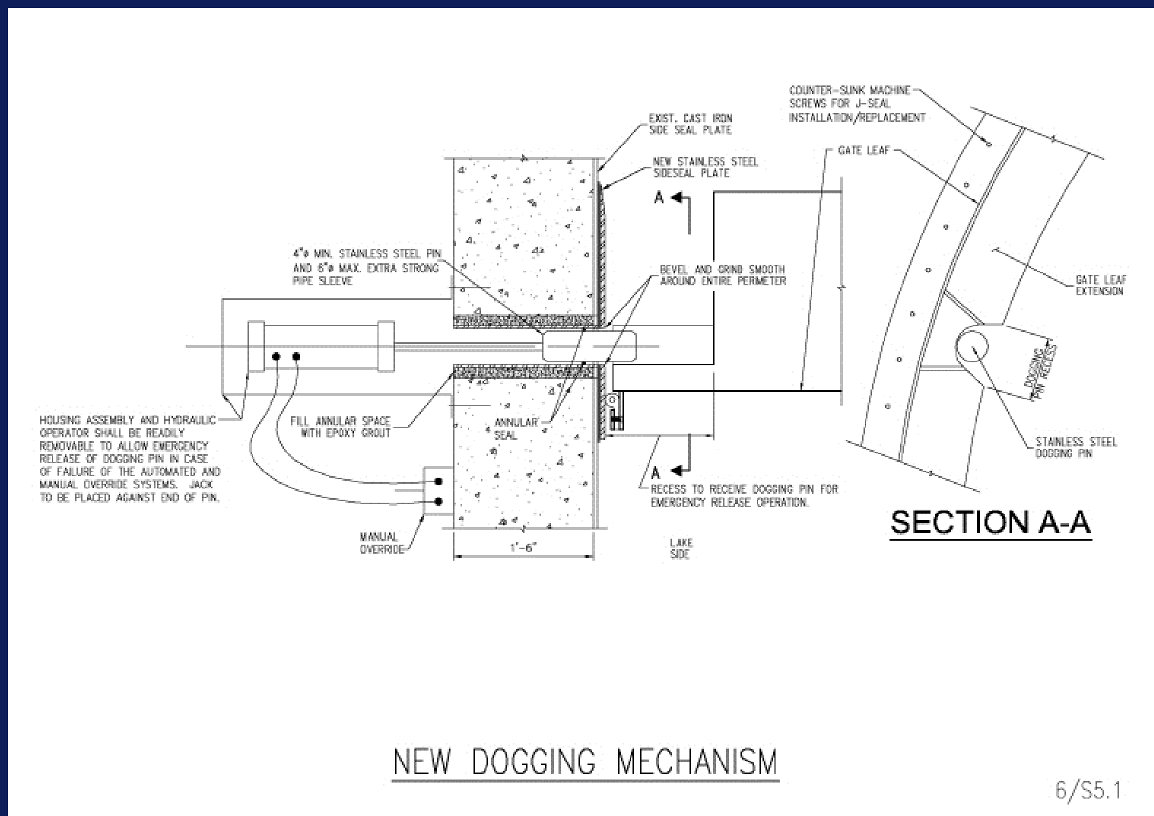



115 VOLTS
DANGER
HIGH PRESSURE
DOGGING CYL. CONTROL STACK
DOGGING CYL. PSI
DOGGING CYL. EXTEND PSI
DOGGING CYL. RETRACT PSI
TANK
BW / BE

Concrete Placement

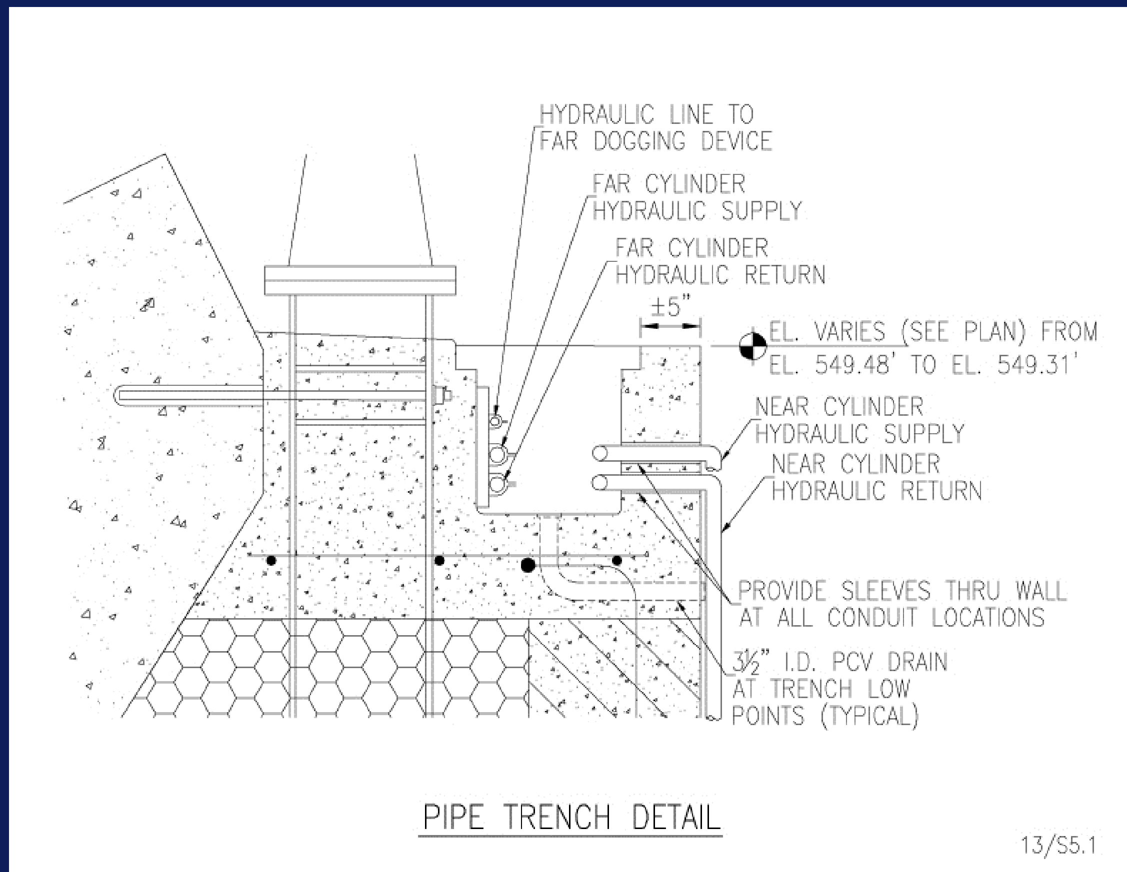


Redundant Gate Support




TEAM
WORK

Routing Hydraulic Lines

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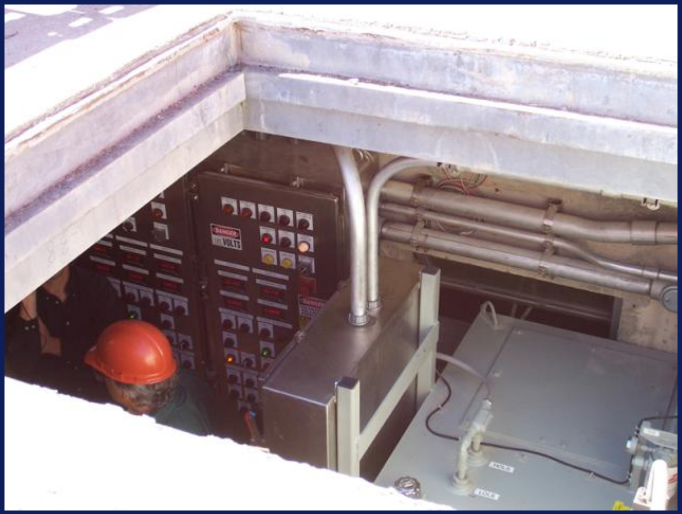
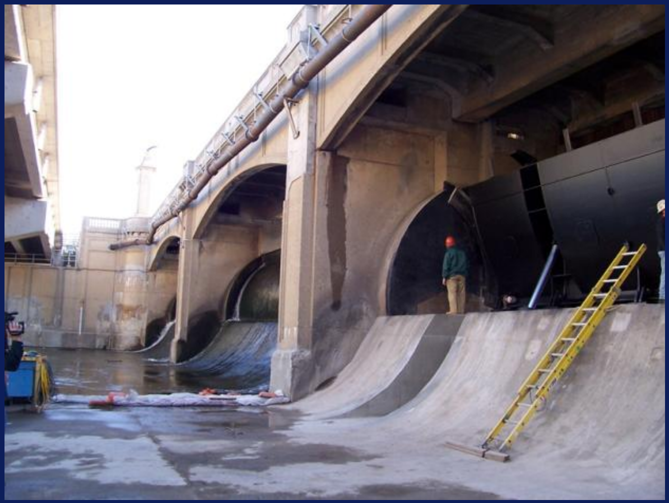
Commissioning and Training





What if it doesn't work?

- Do Dams Fail?
- What is an EAP & why is one needed?
- How do we alert the public?
- How do we quantify the risks?
- How can modern technology help?

Dams Do Fail

Hartwick Dam - Lake Delhi, Iowa

Orlan Love/The Gazette

Maquoketa River

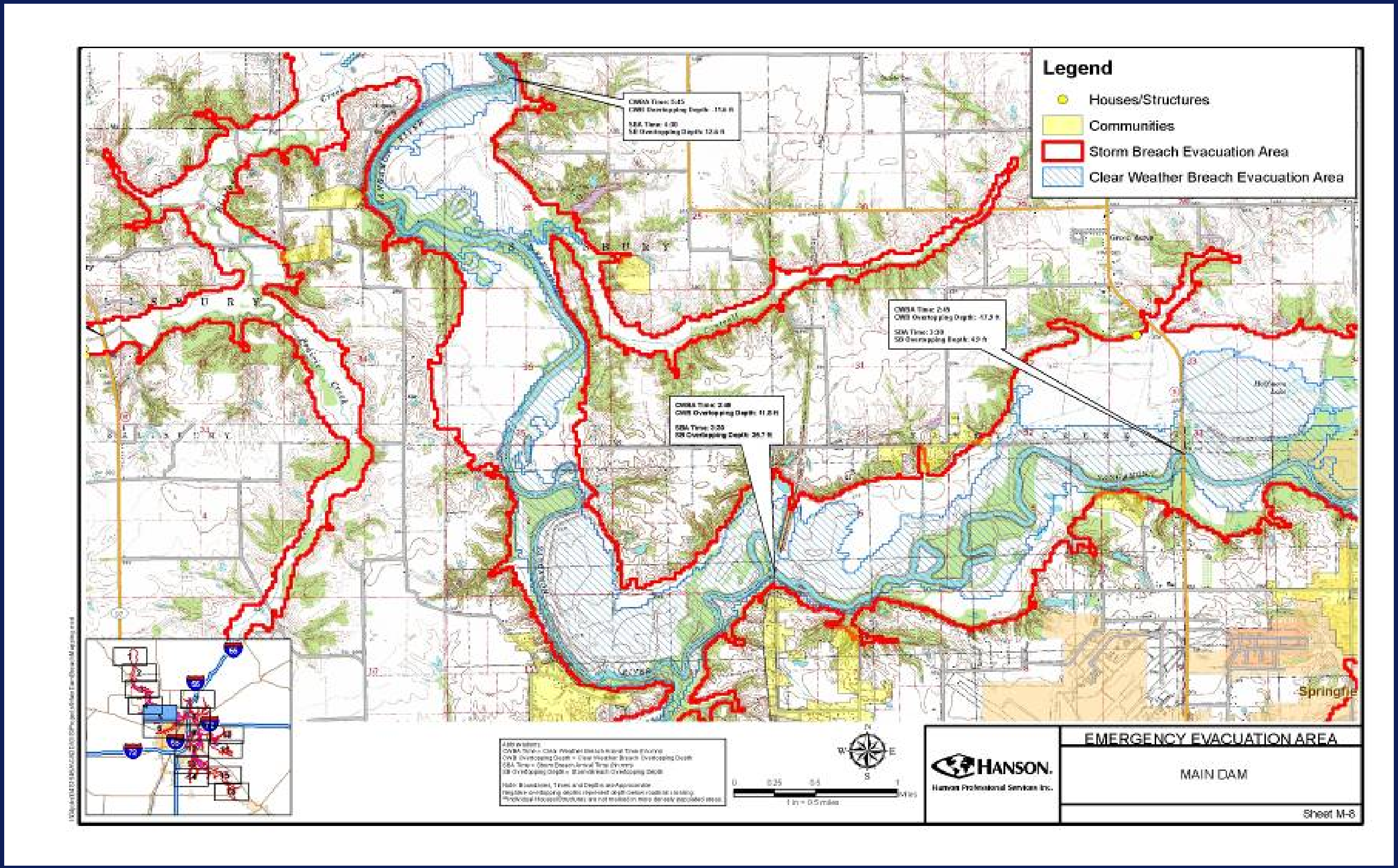
Hartwick Dam failed on July 24, 2010, due to a period of about 10 in. of rainfall in 12-hours. River levels upstream of the dam had reached 10 ft above flood stage prior to the failure.

Mark Benischek/SourceMedia Group News

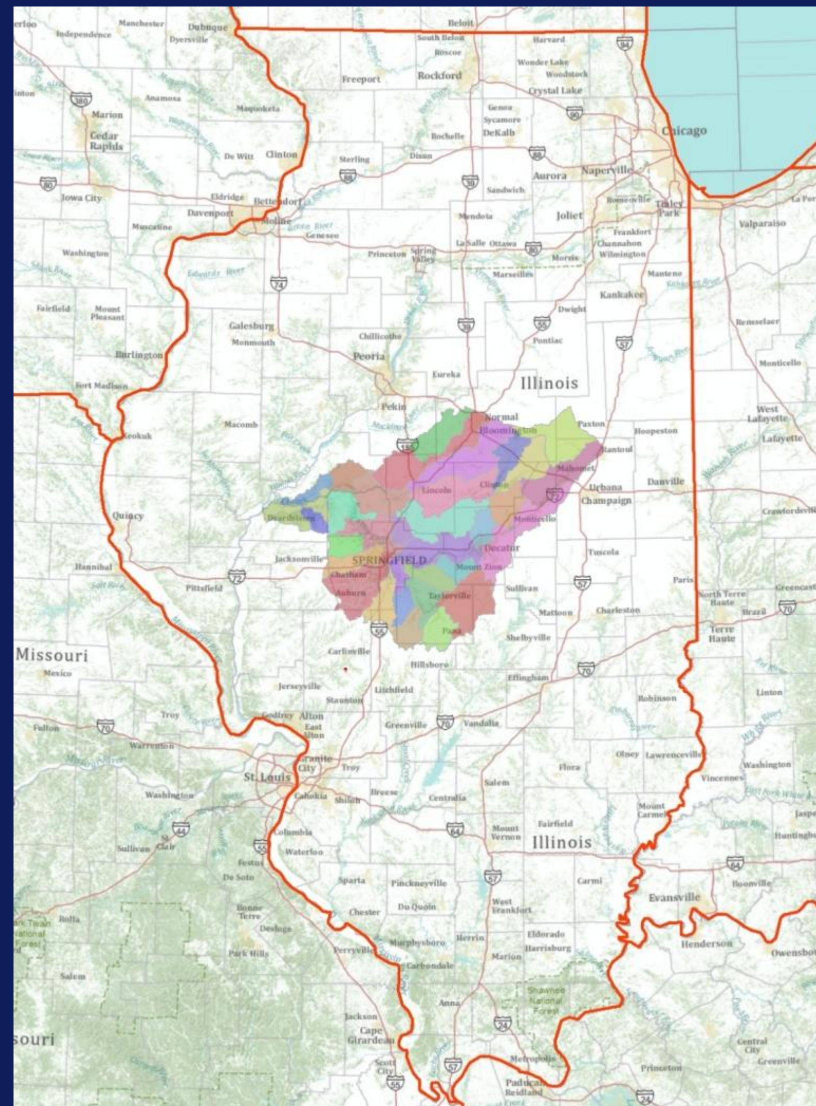
Why do you need an EAP?

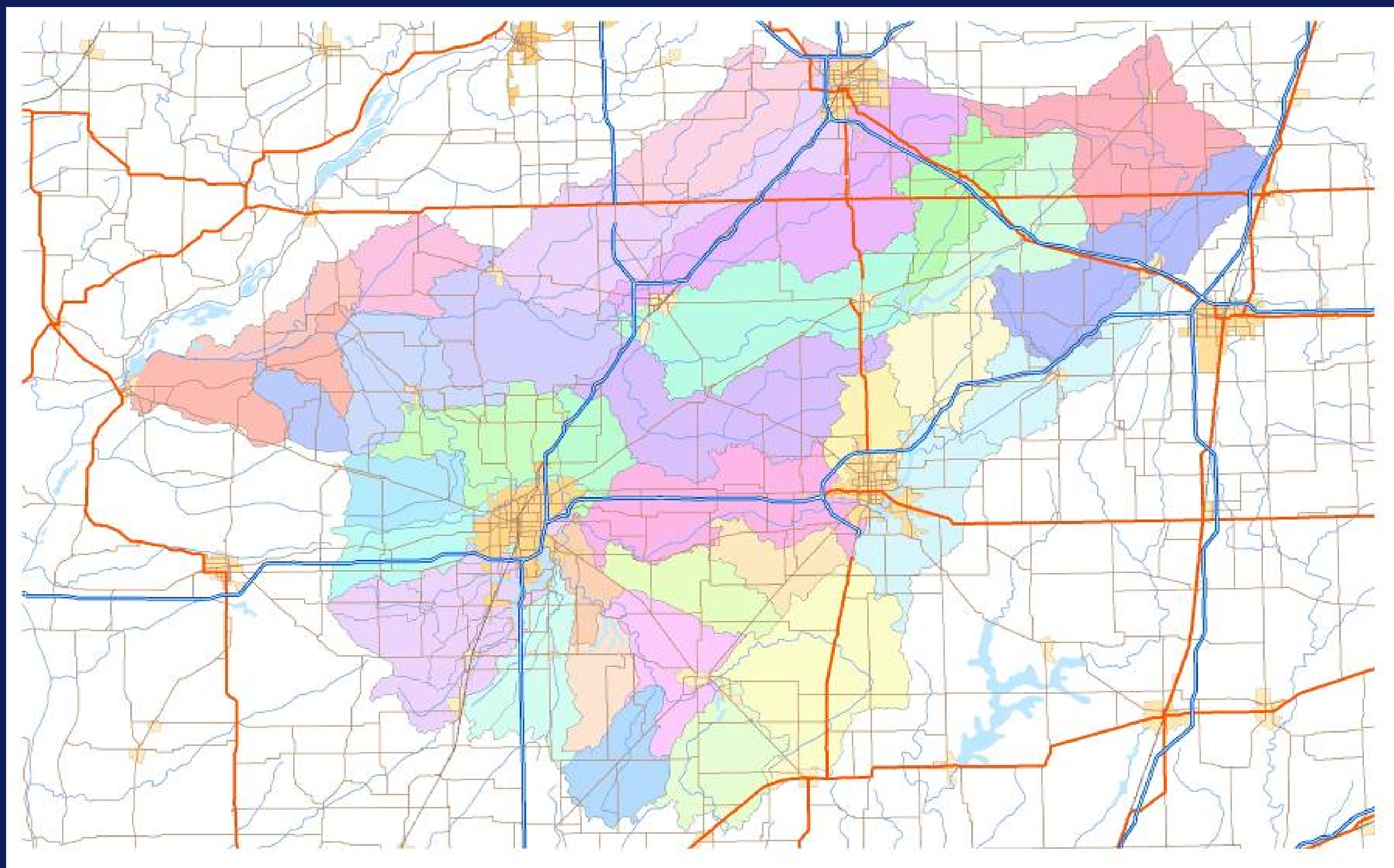
- Emergency Planning
- Resource Allocation
- Evacuation

Inundation Mapping

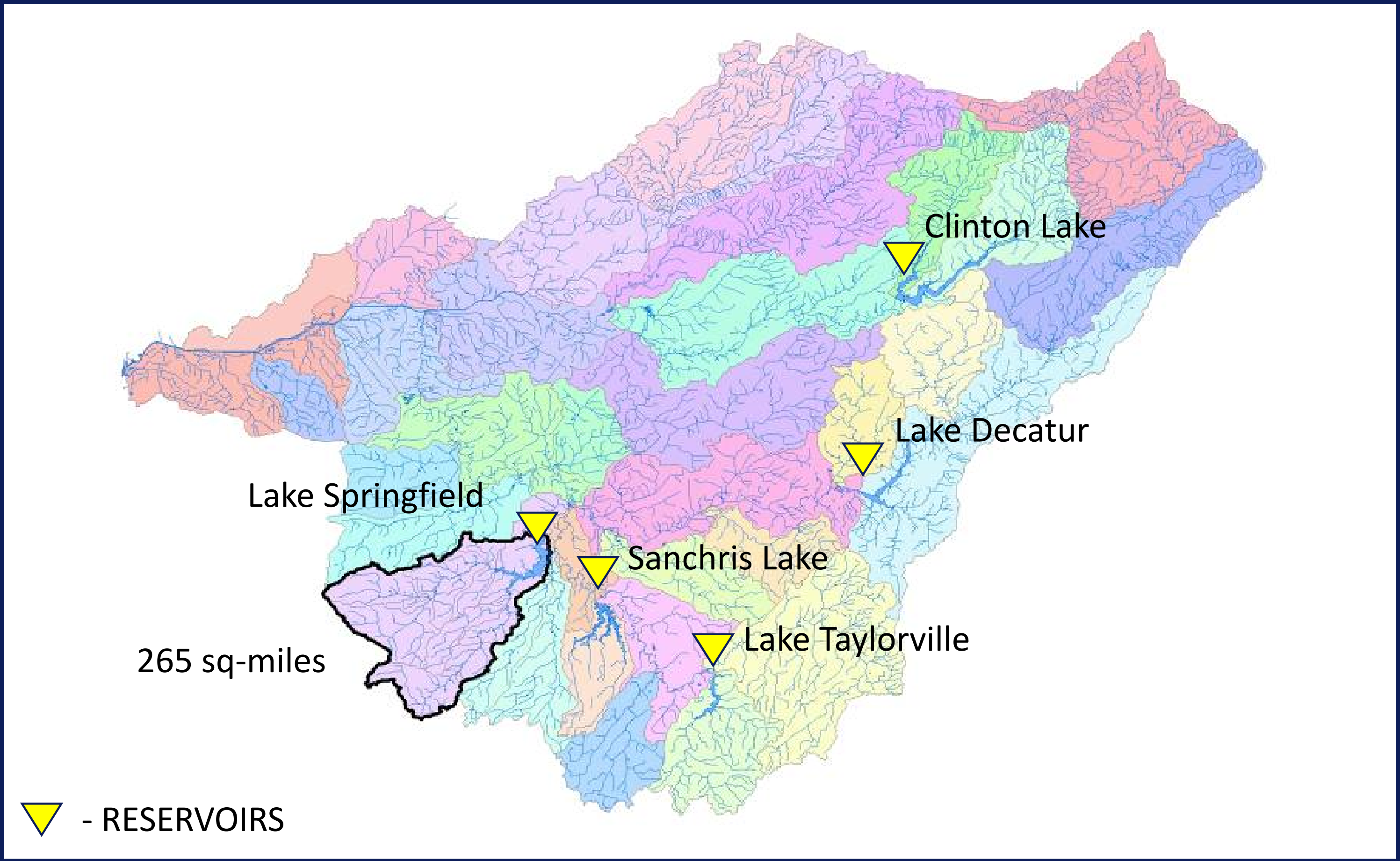


Study Watershed
> 5,000 sq. miles

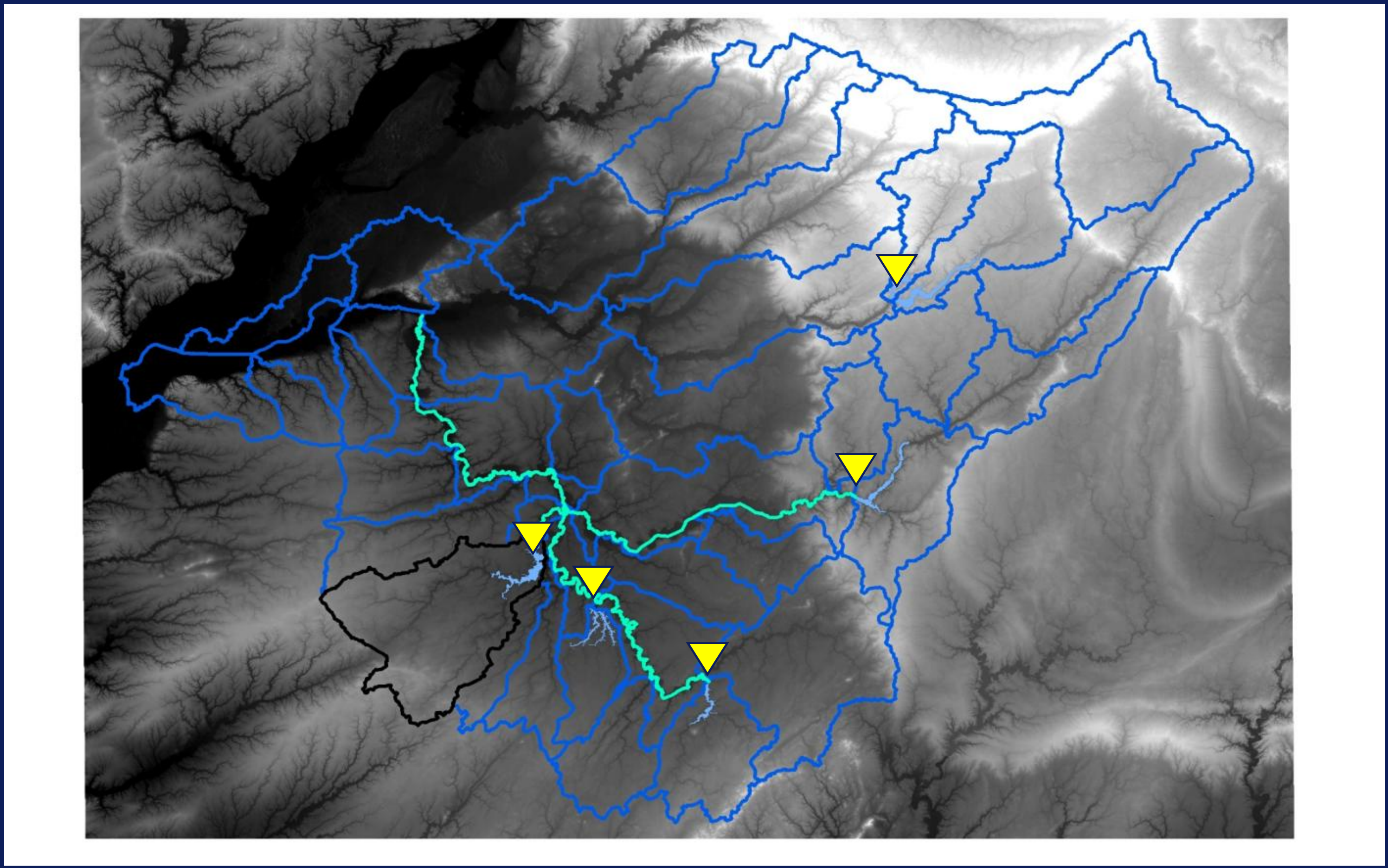




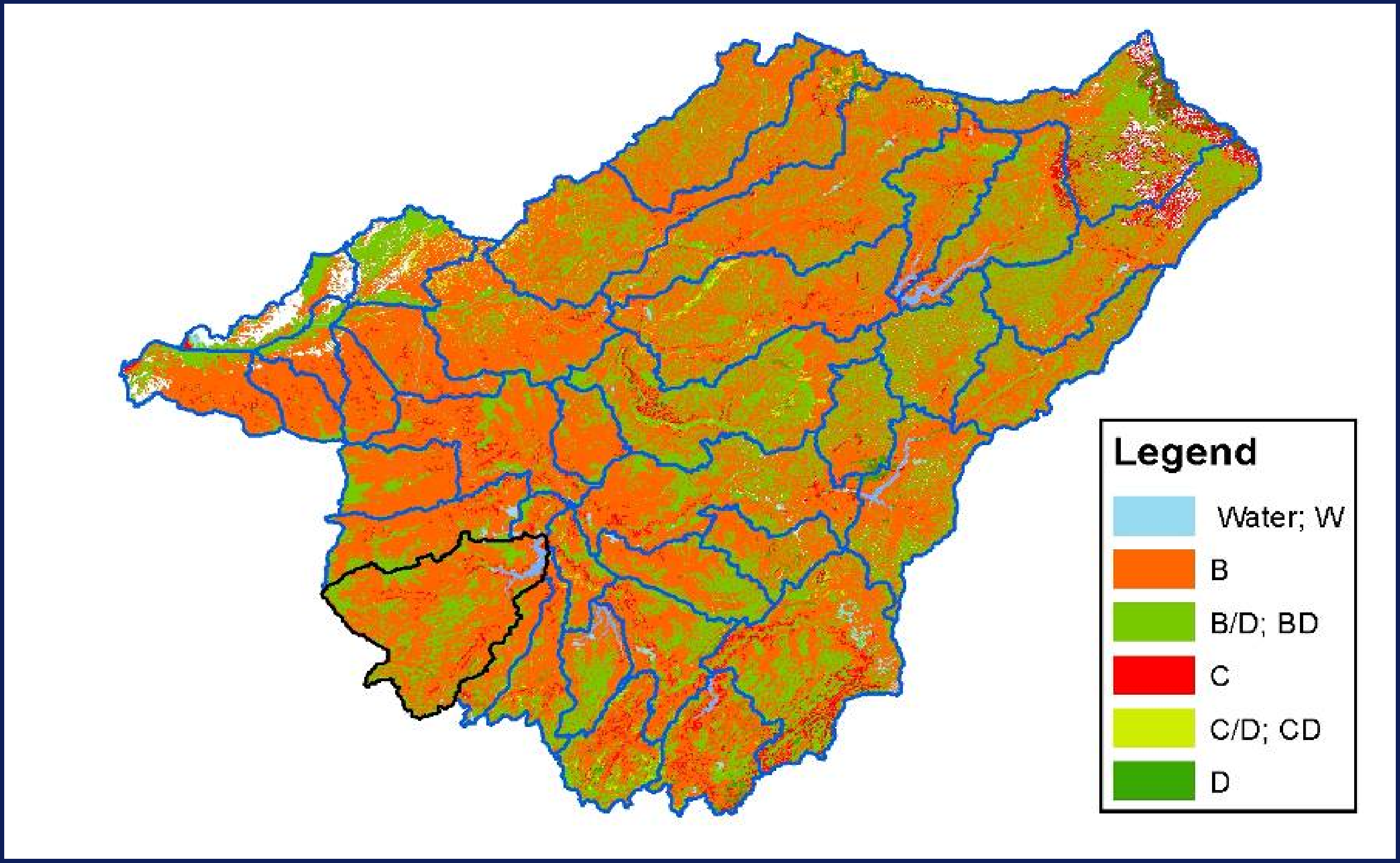
Hydrography – stream network



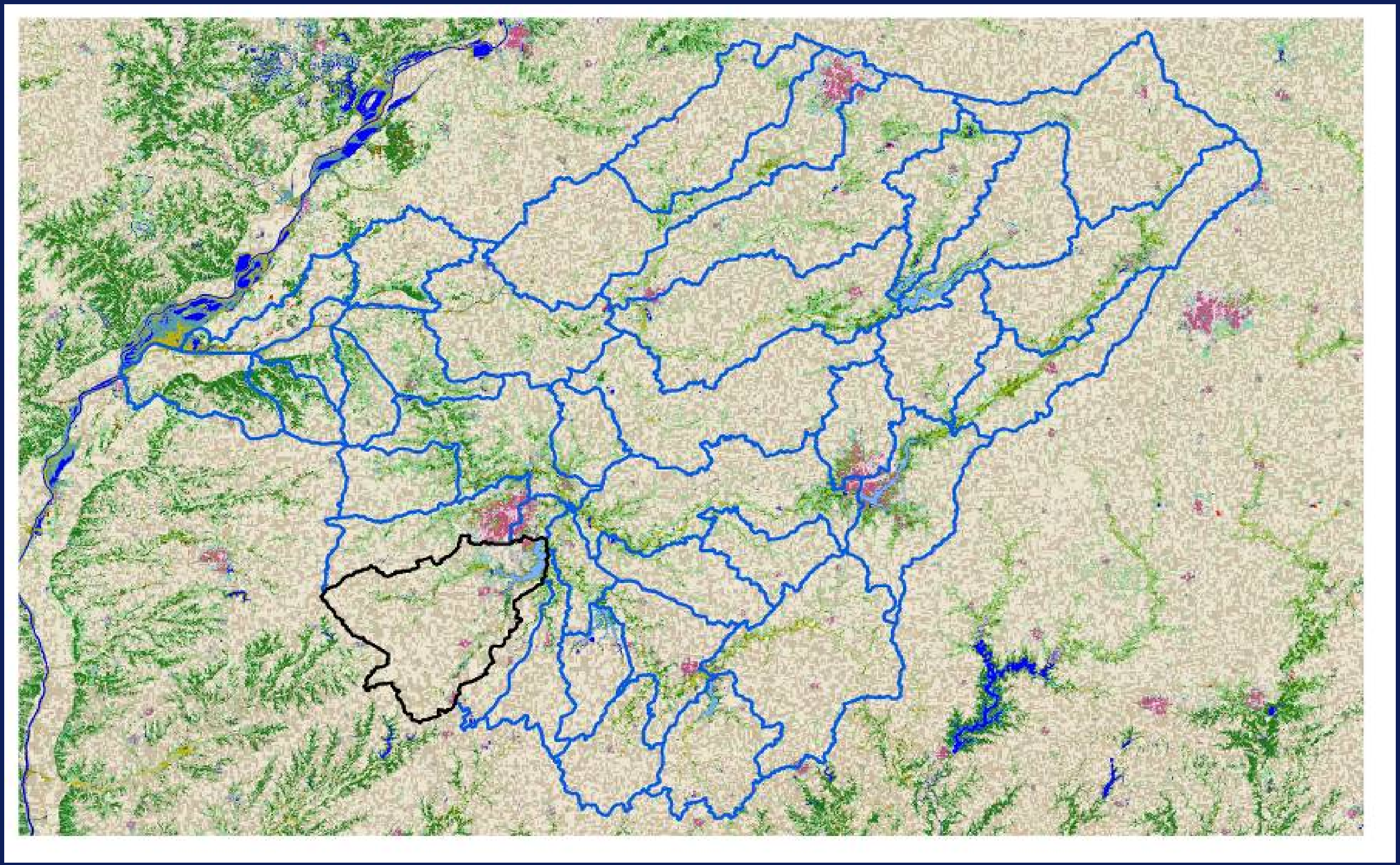
Reach to be modeled extracted from Hydrography



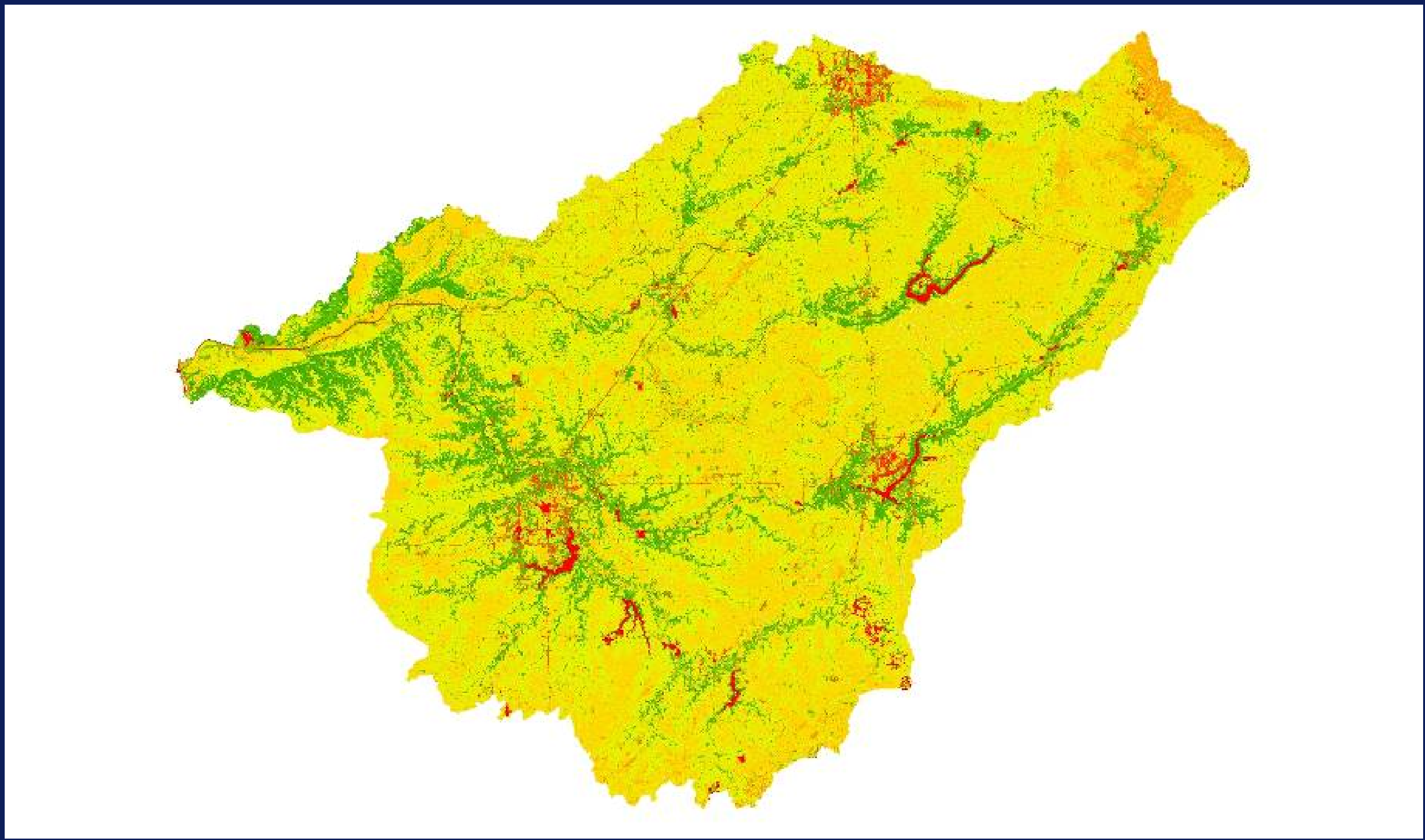
Digital Soils Data – Hydrologic Soils Group



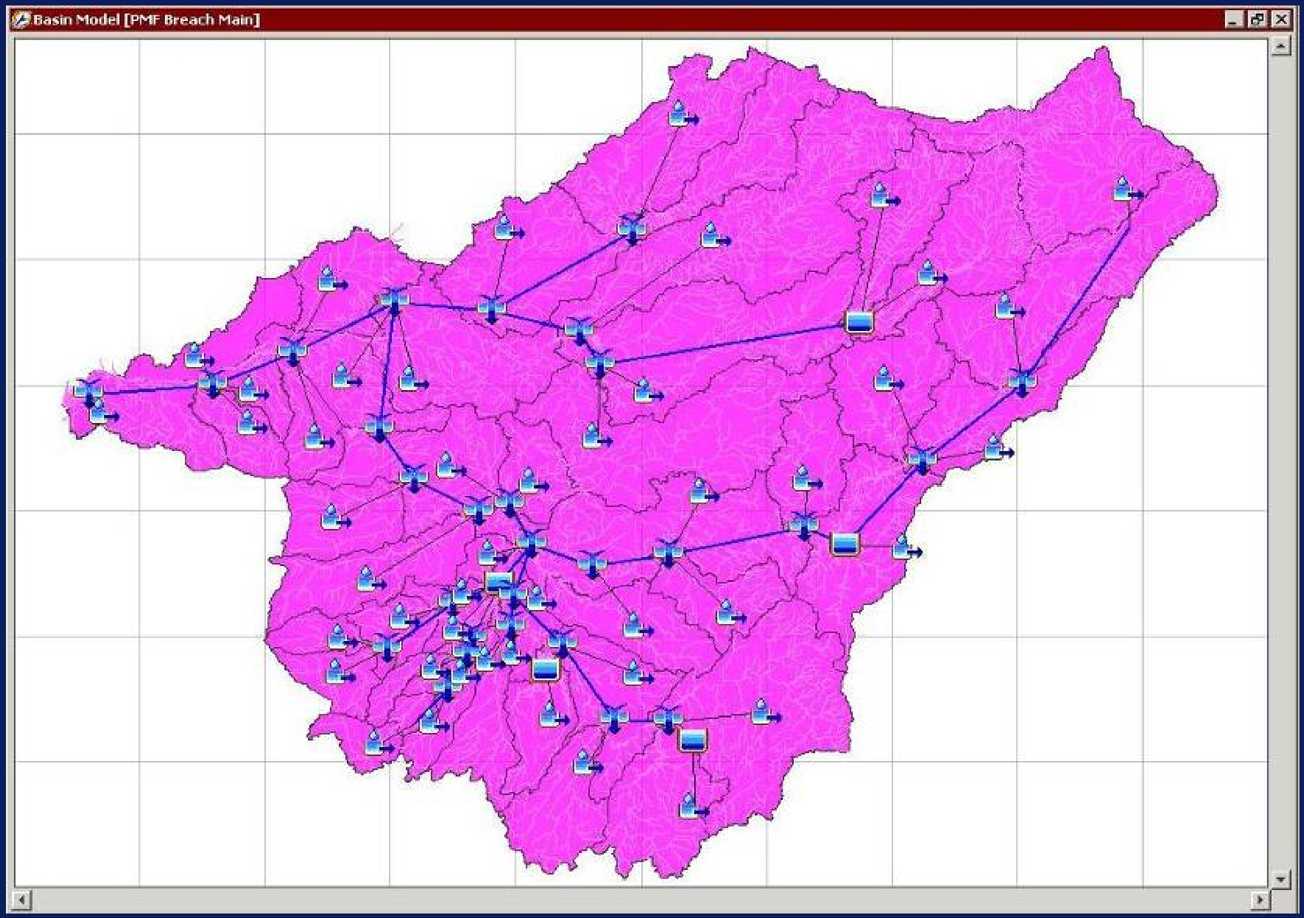
Digital Land Cover/Land Use Data



Digital Soils/Land Data to Composite SCS Curve Numbers



Build HEC-HMS Hydrology model

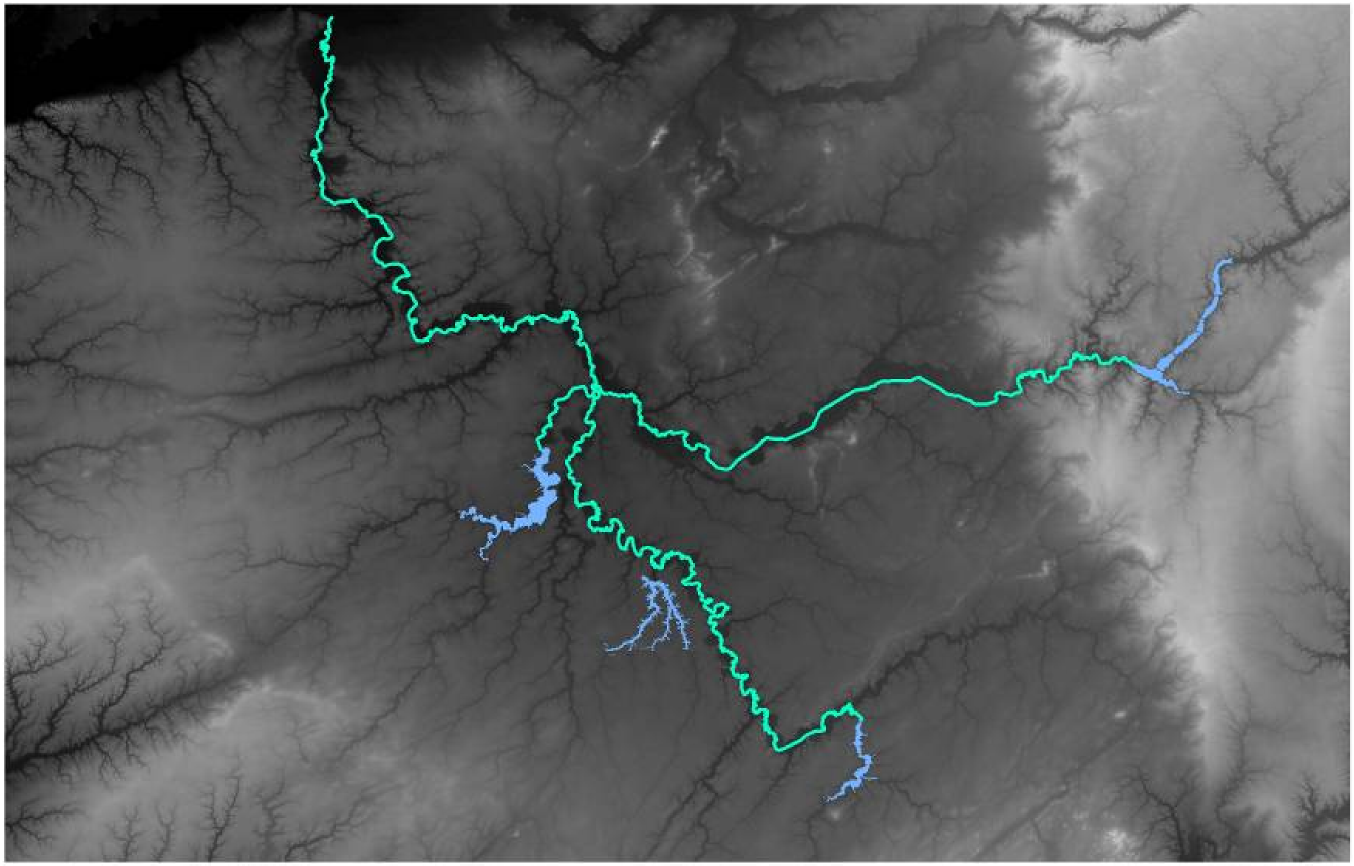


Building a Dam Breach Model using HEC-RAS

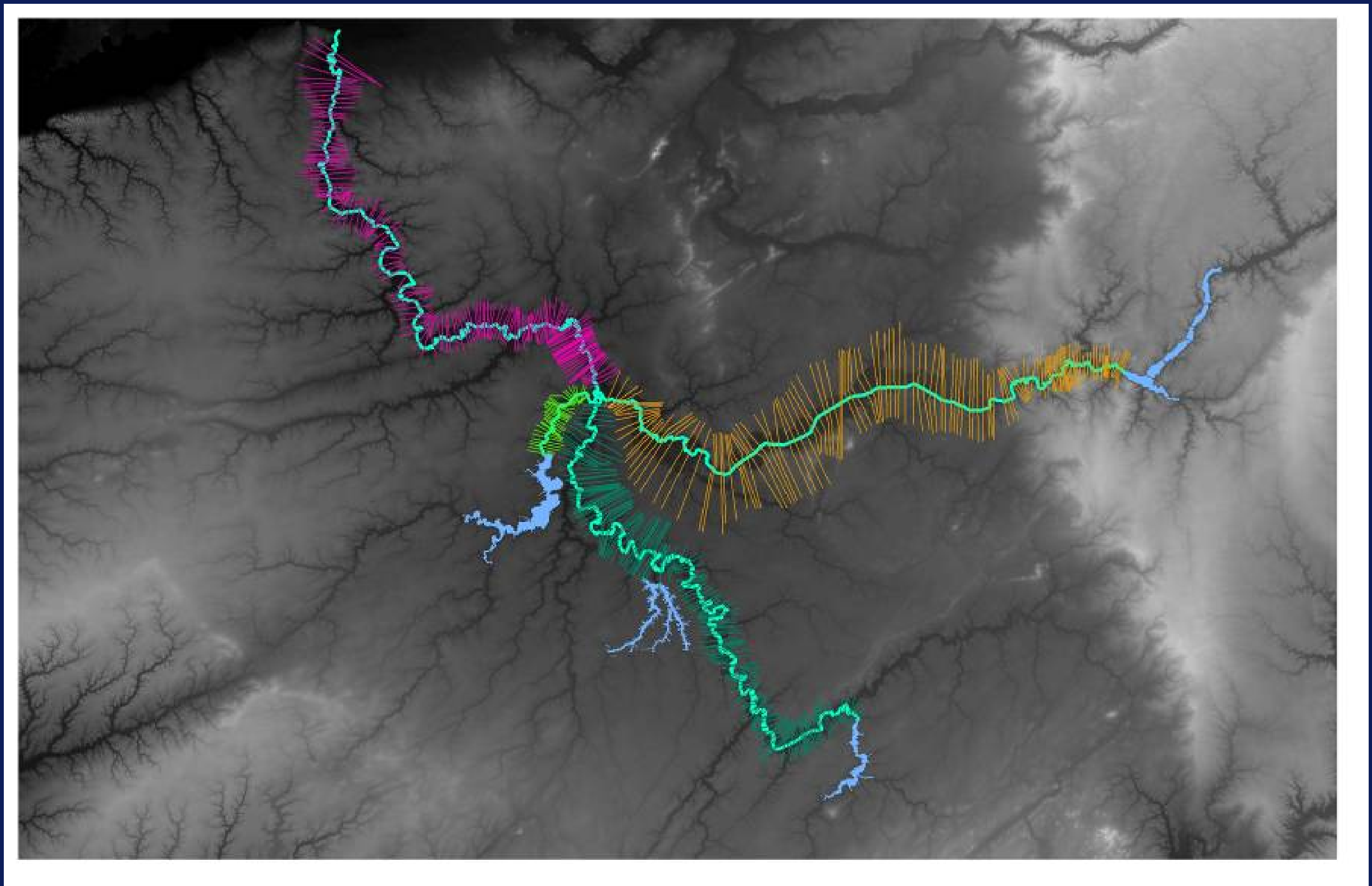
Lake Springfield's Dams

- Lake area 4200 acres.
- Watershed 265- sq miles.
- 57 Miles of Shoreline.
- 735 Residences.
- Service territory is more than 160,000 people.

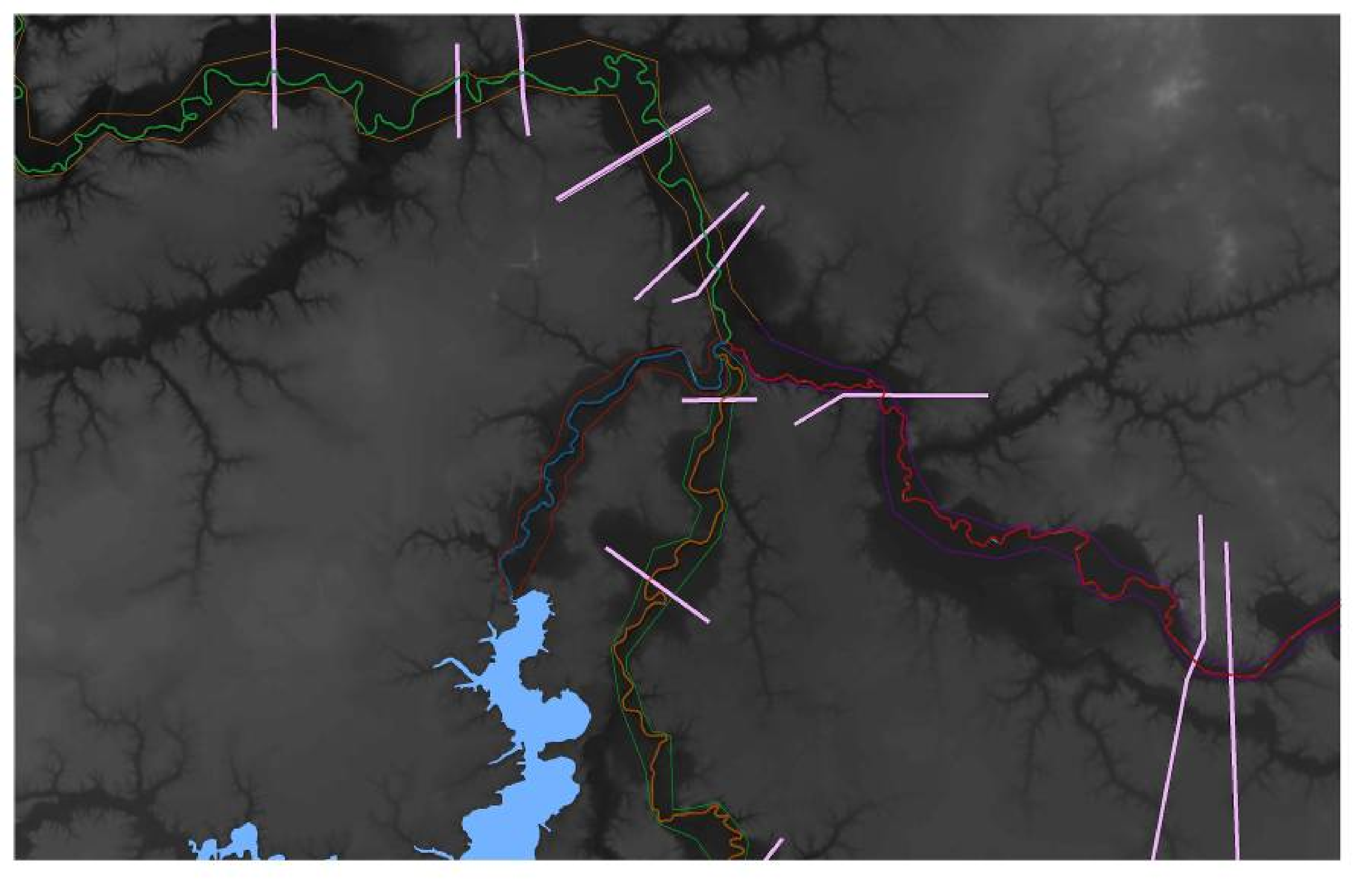
Reaches (Rivers to be modeled)



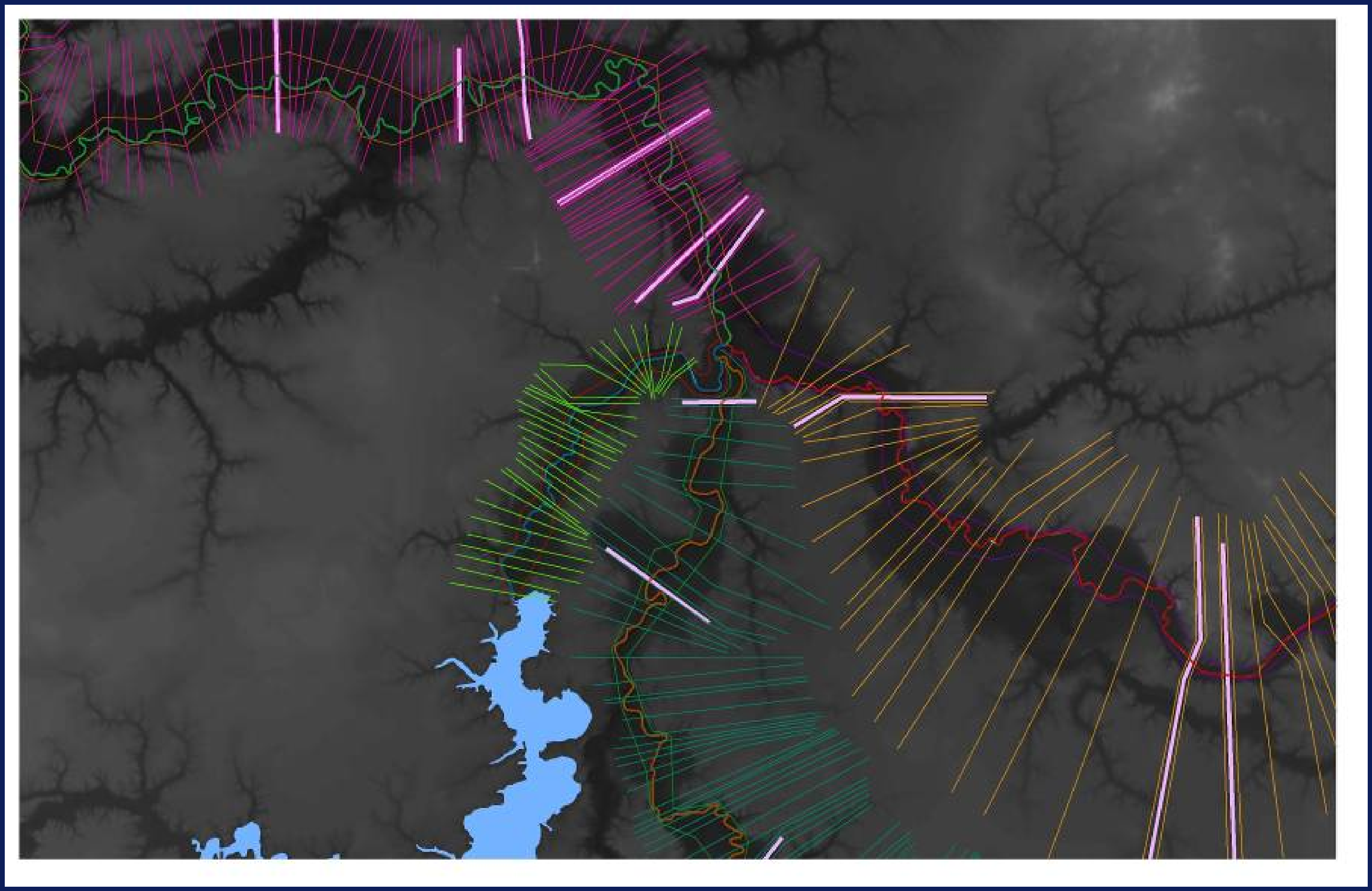
Cross-Sections



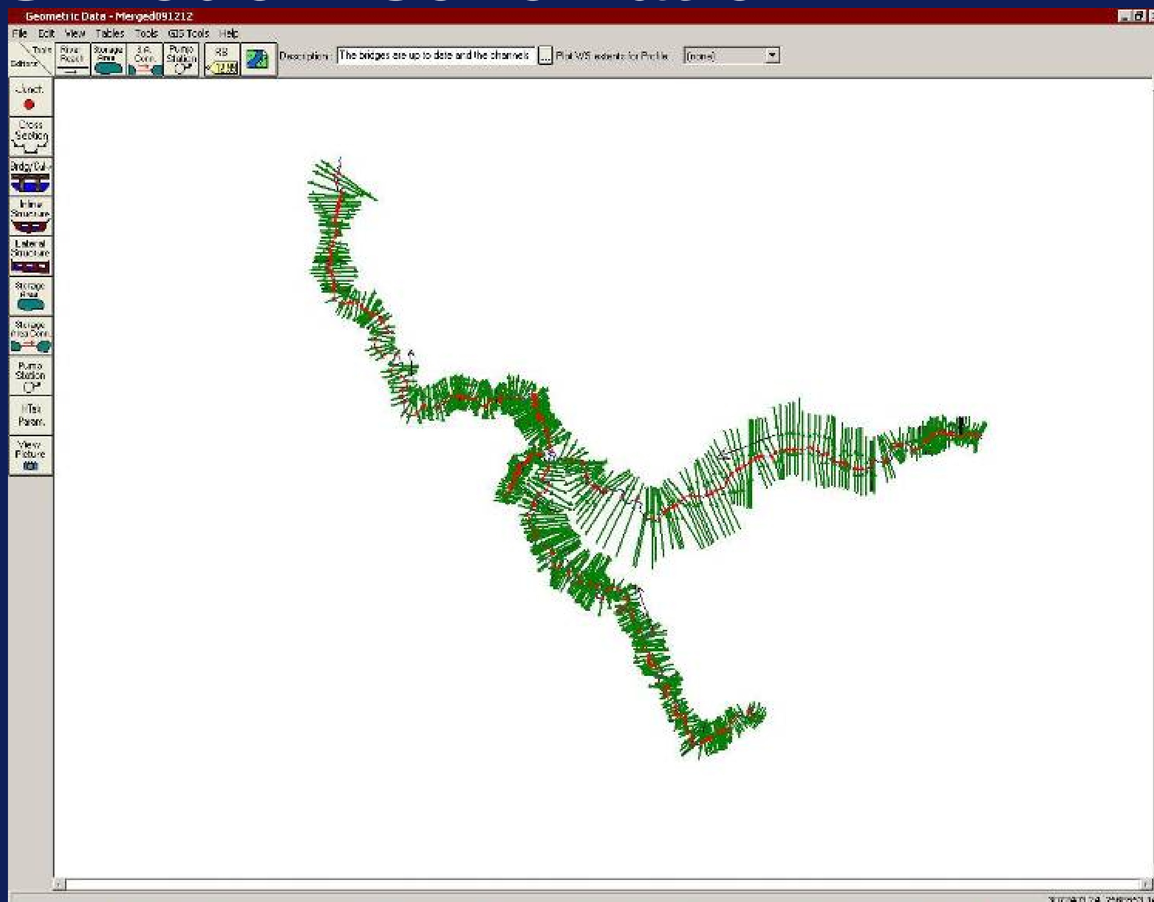
Stream Crossings



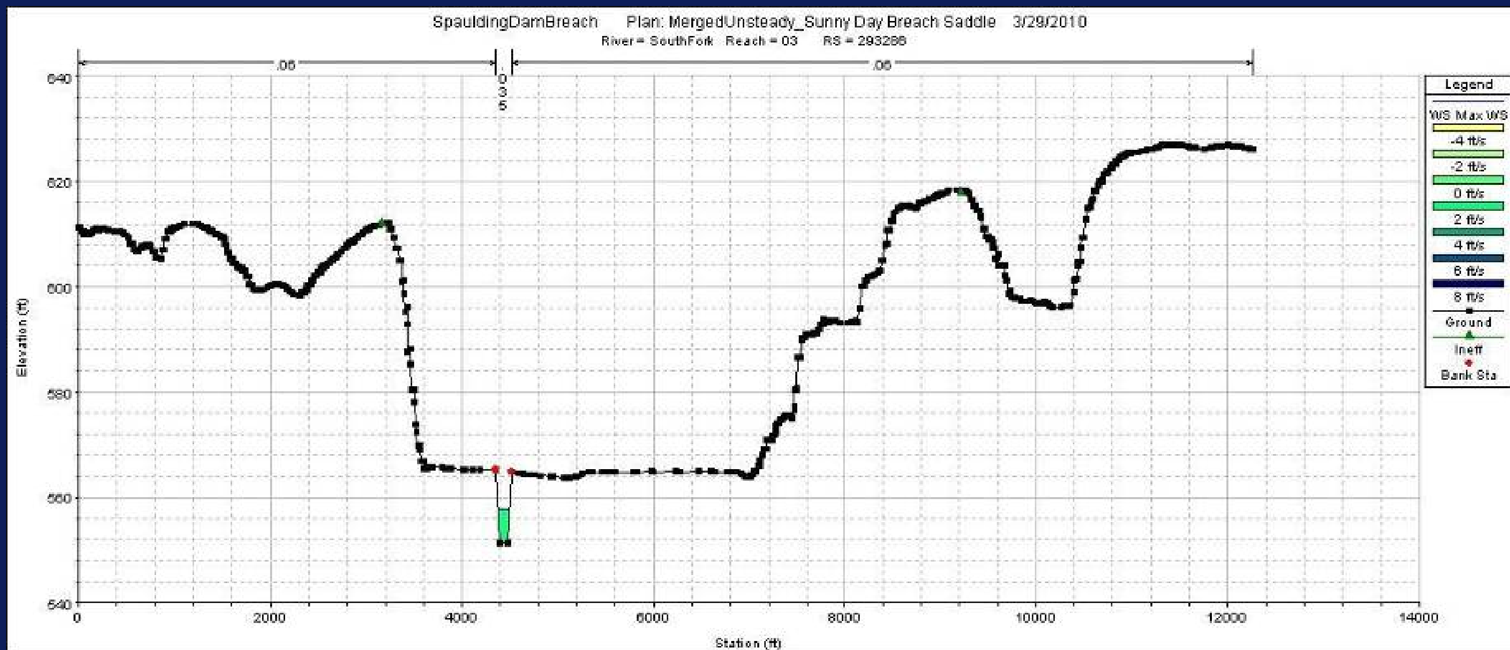
All Layers are Complete – Ready to Export to HEC-RAS



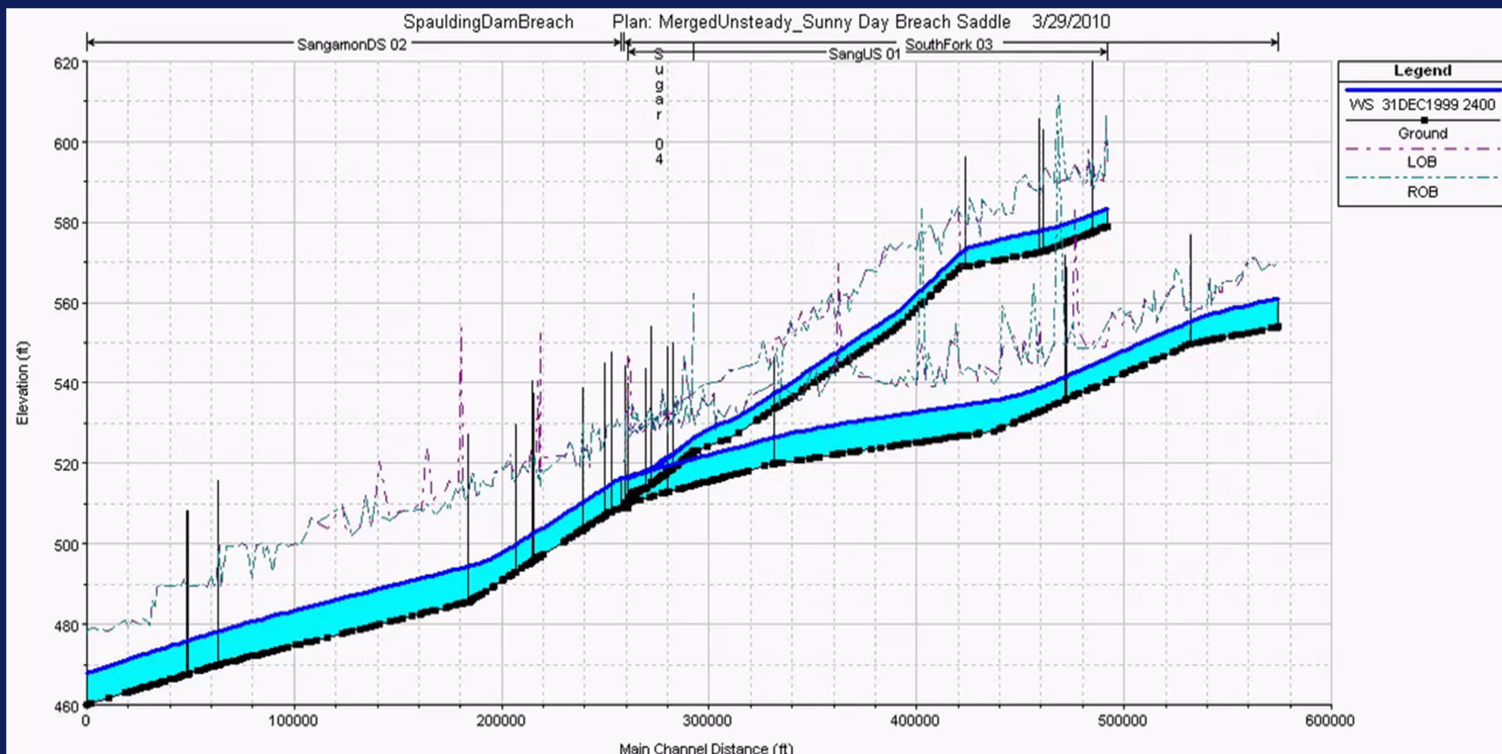
HEC-RAS Model - schematic



Cross-Sections based on LiDAR (<u>Li</u>ght <u>D</u>etection <u>A</u>nd <u>R</u>anging)

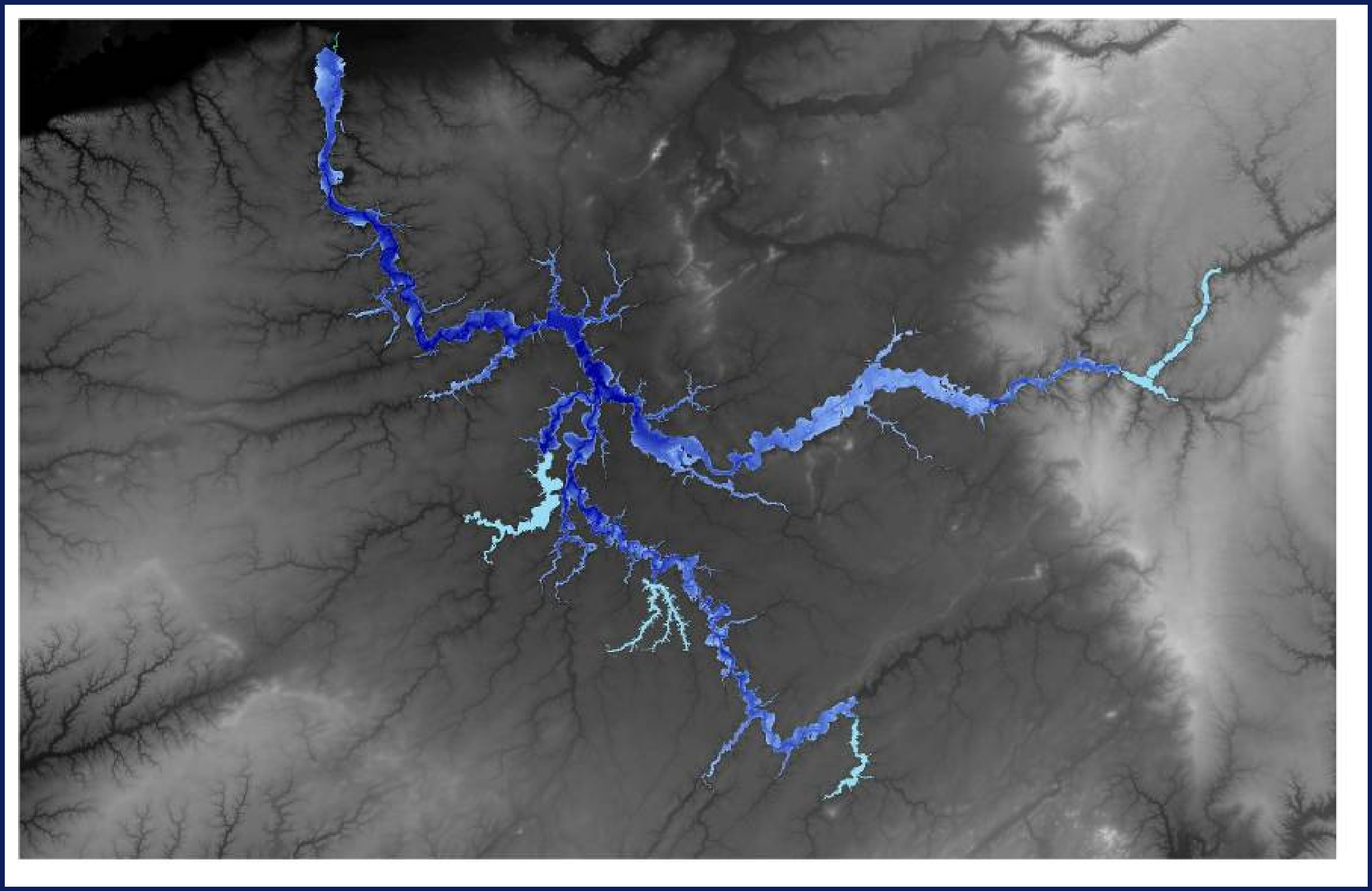


Dam Breach Model Results

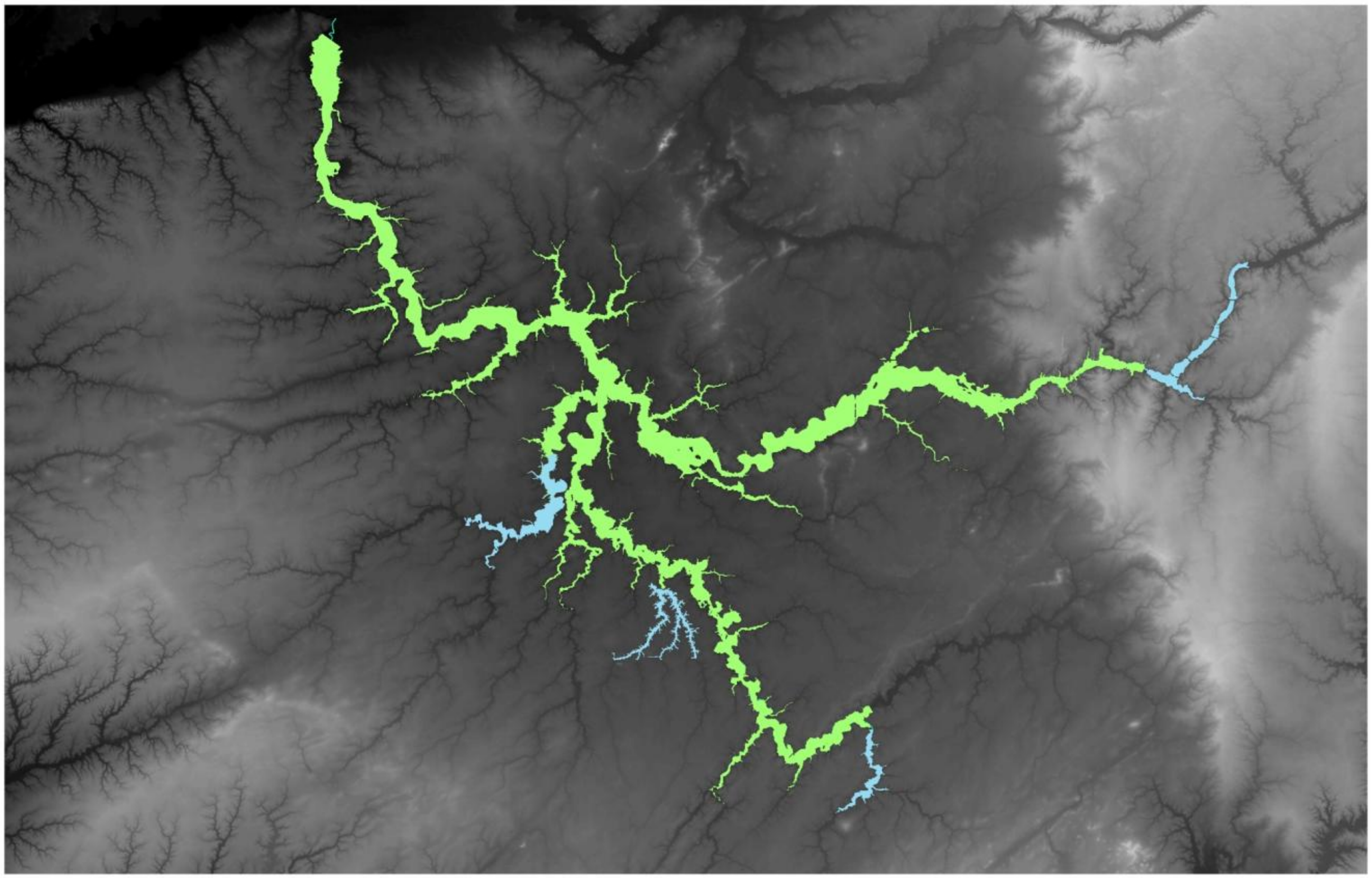


Need Inundation Maps to Identify Hazard Areas

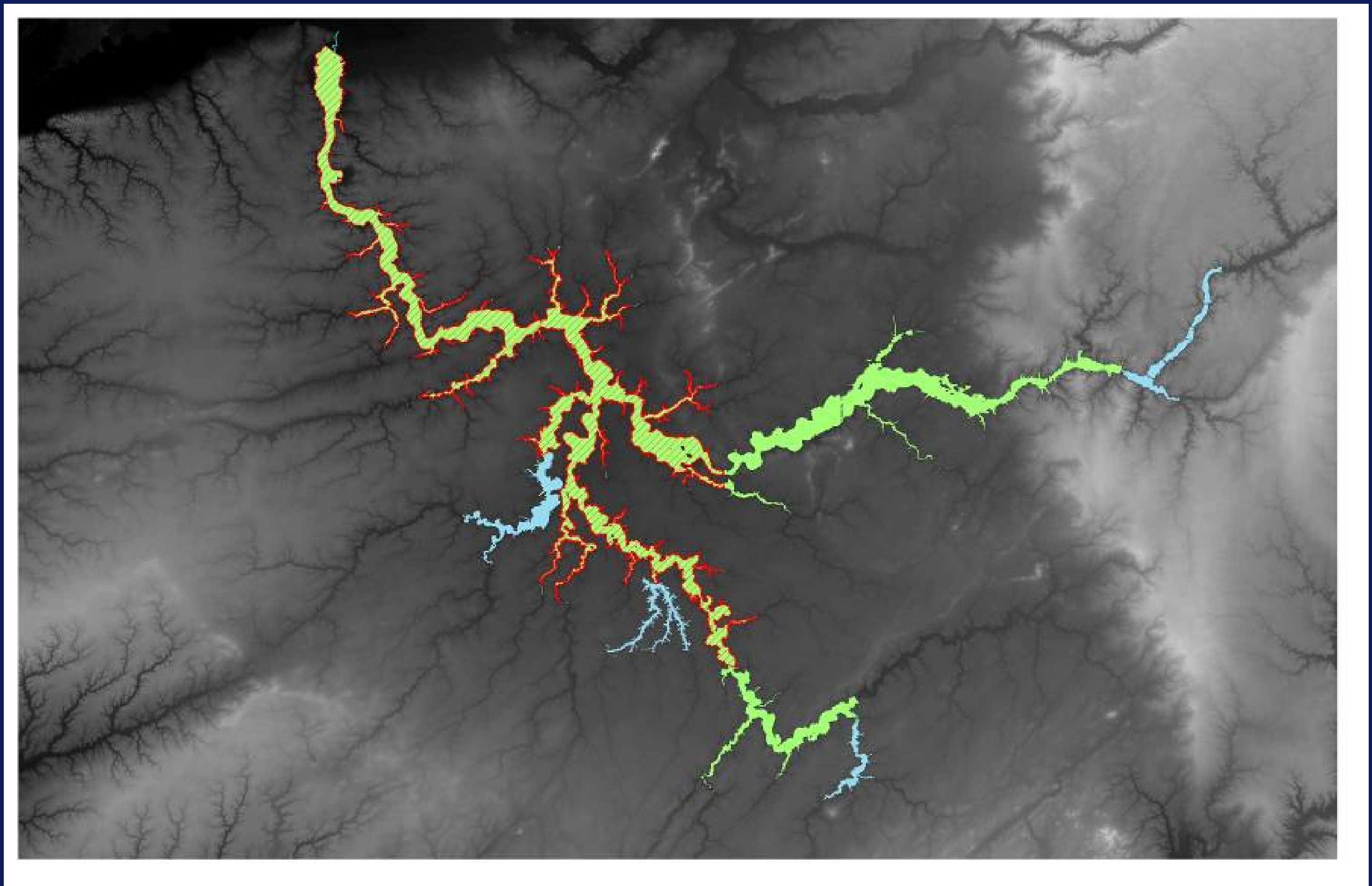
Flood Depth



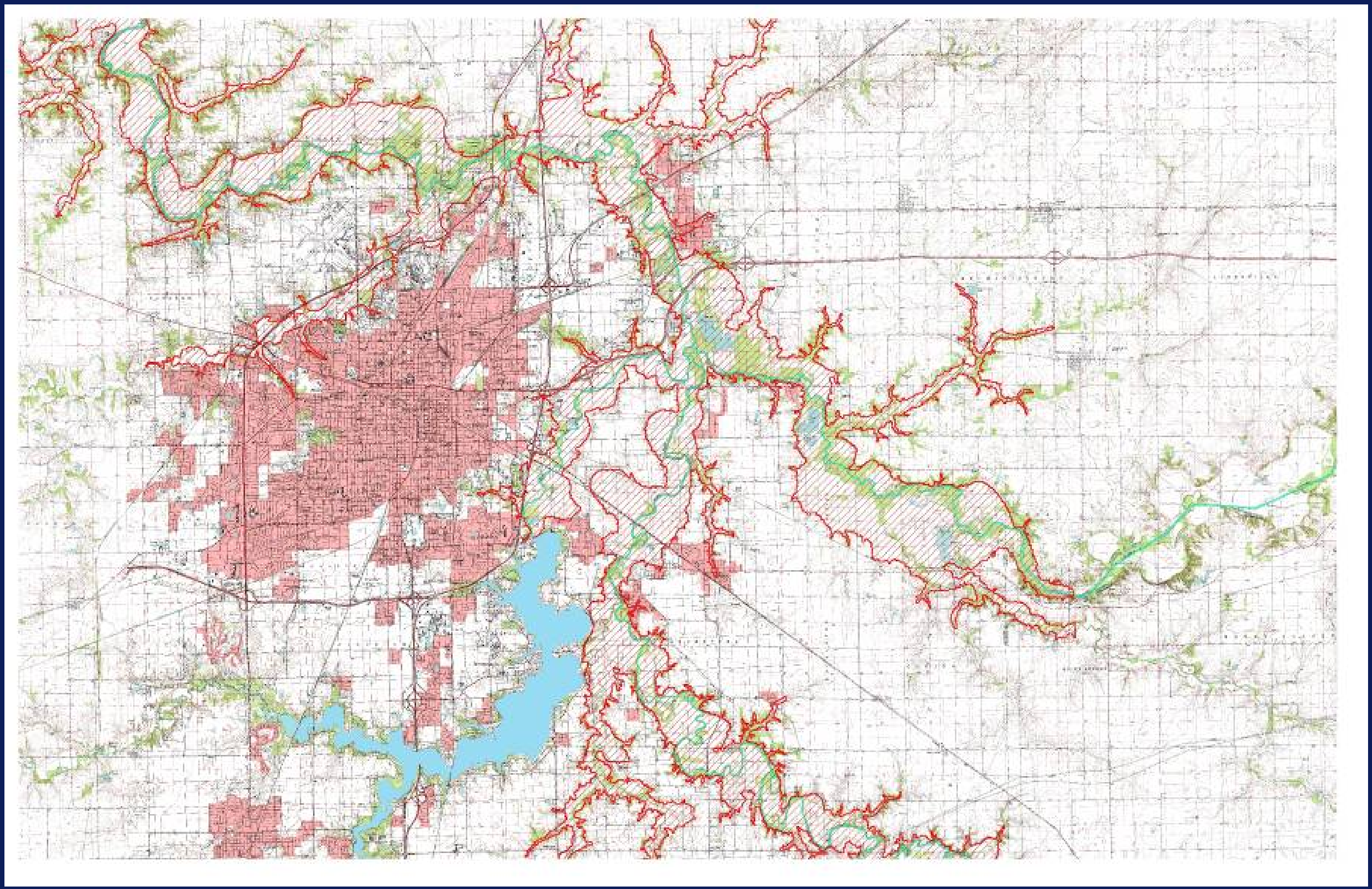
Inundation Area



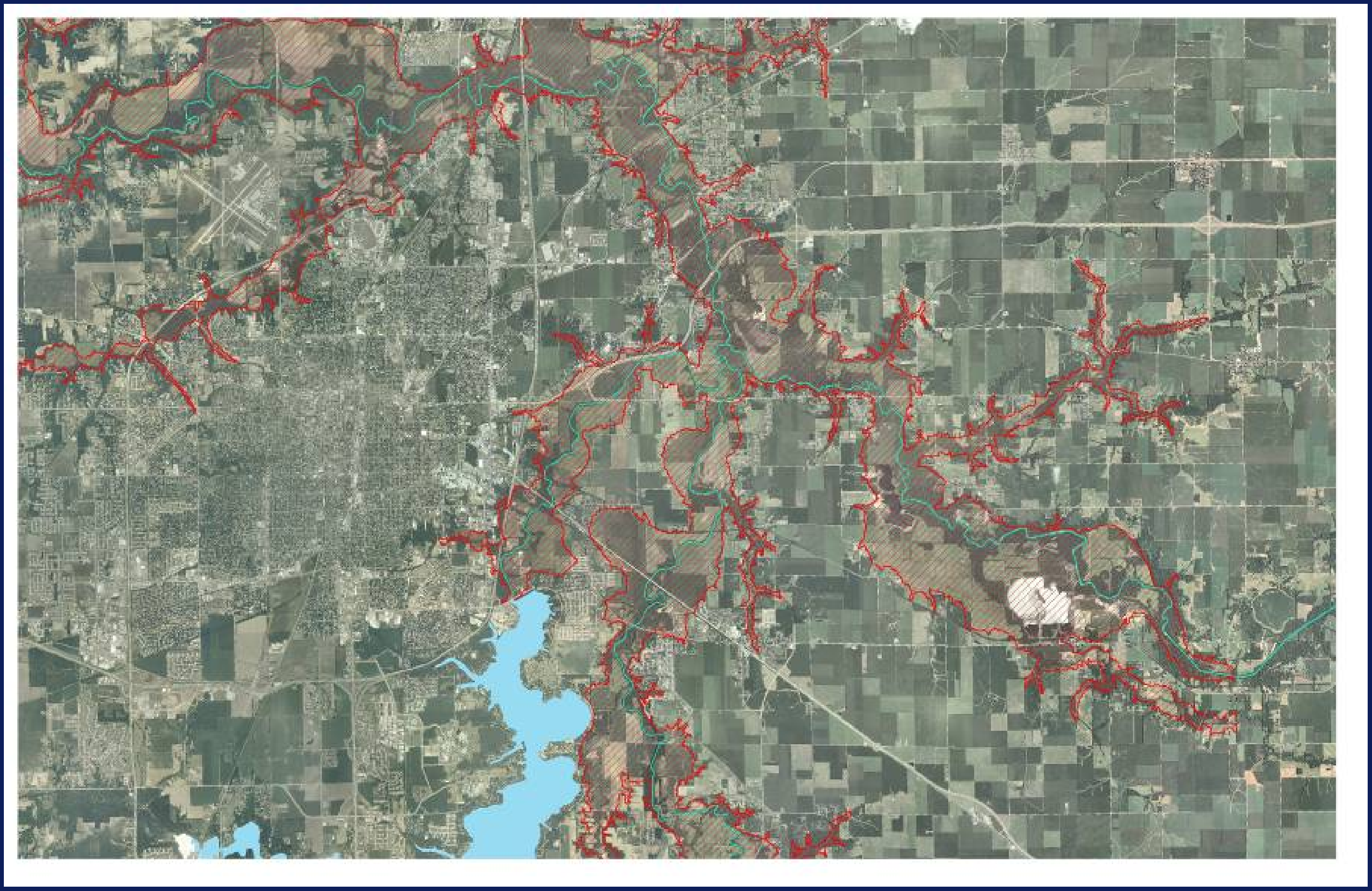
Dam Breach Impact Area



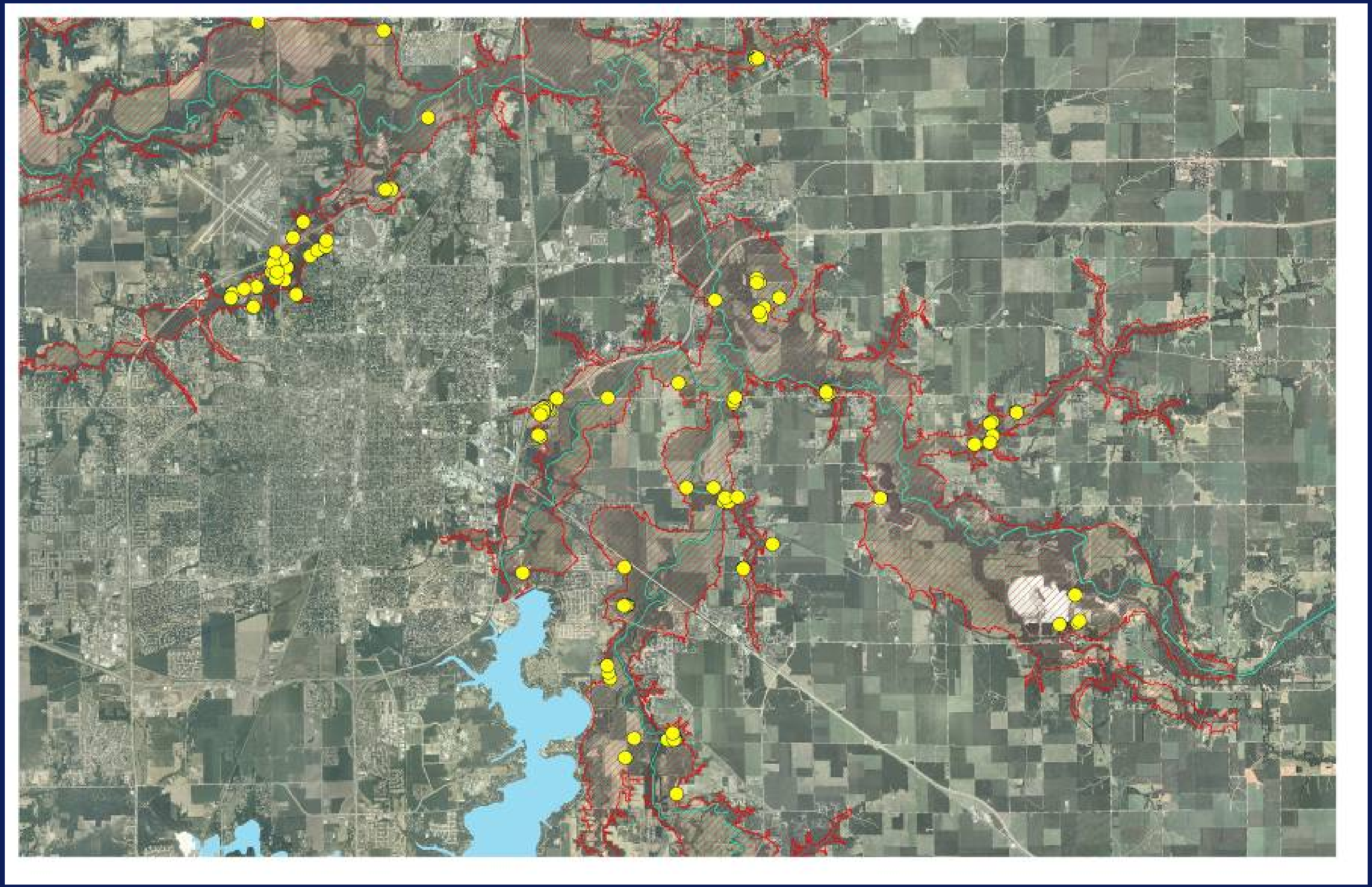
Inundation Area on USGS Topographic Map



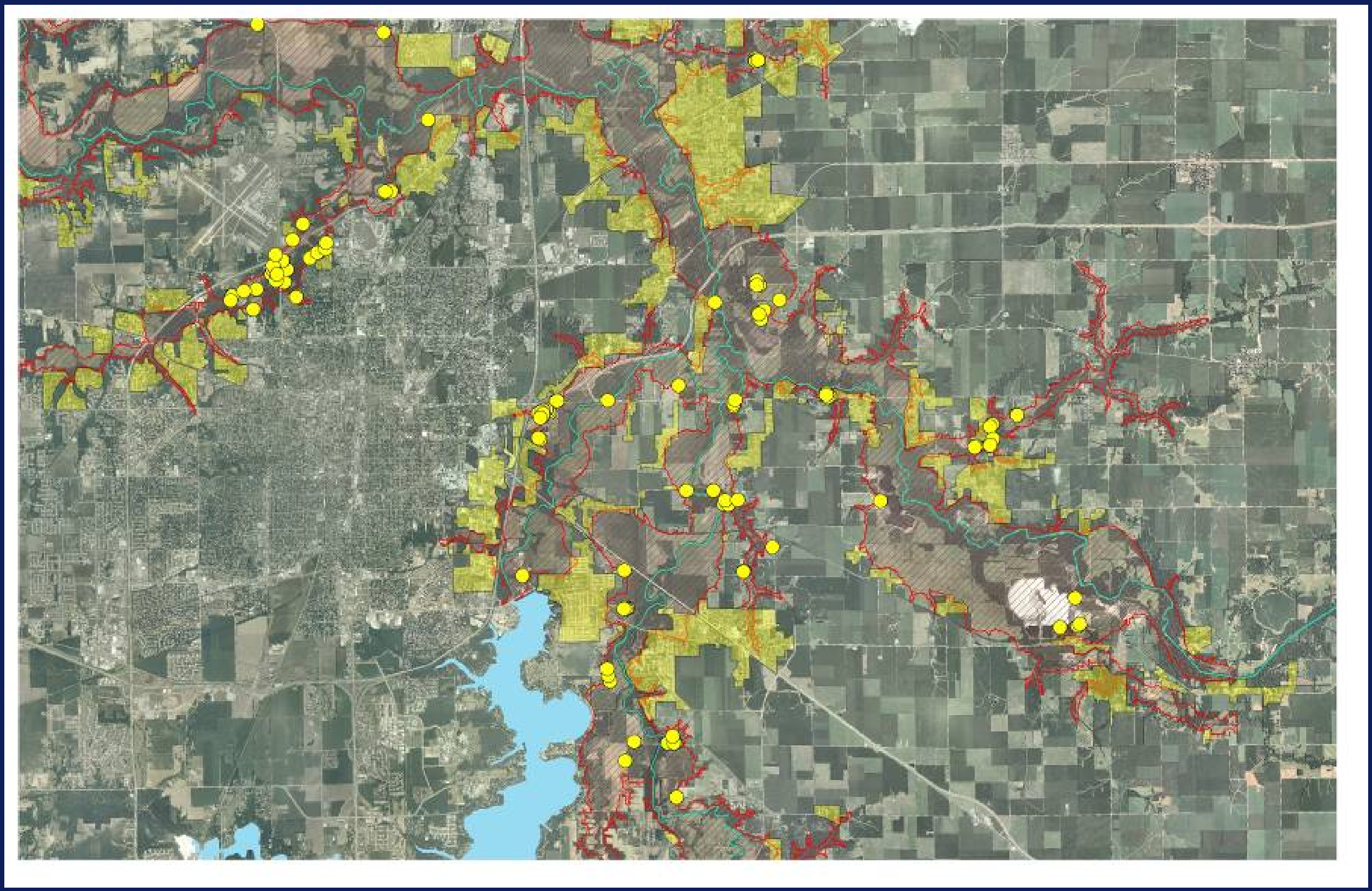
Inundation Area on Orthophoto



Identify Structures at Risk



Communities at Risk



Add User Valued Information