Lower Missouri River: Flood Risk Data for the Future

Governors Water Conference 2022

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Why This Project?

2019 Flood Event, Missouri River

Photo courtesy of USACE – Omaha District

Why This Project?

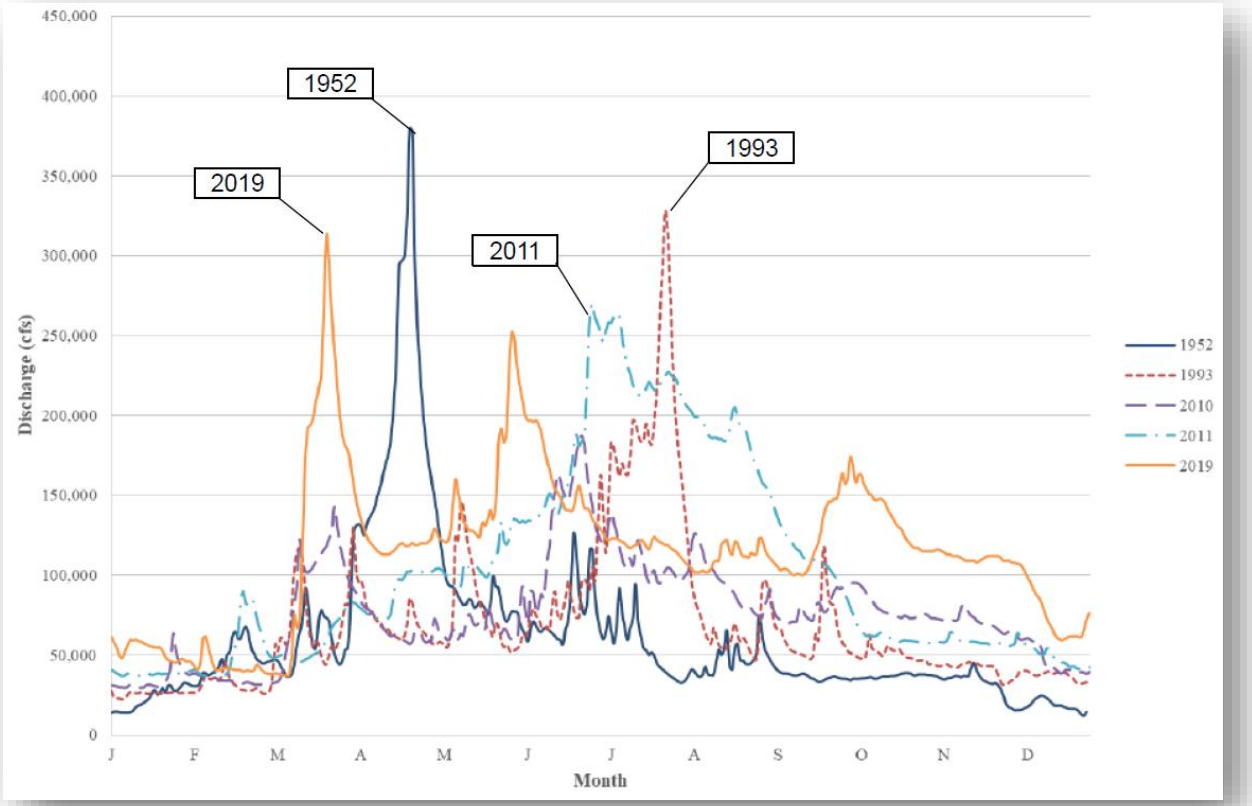
2019 Flood Event, Missouri River

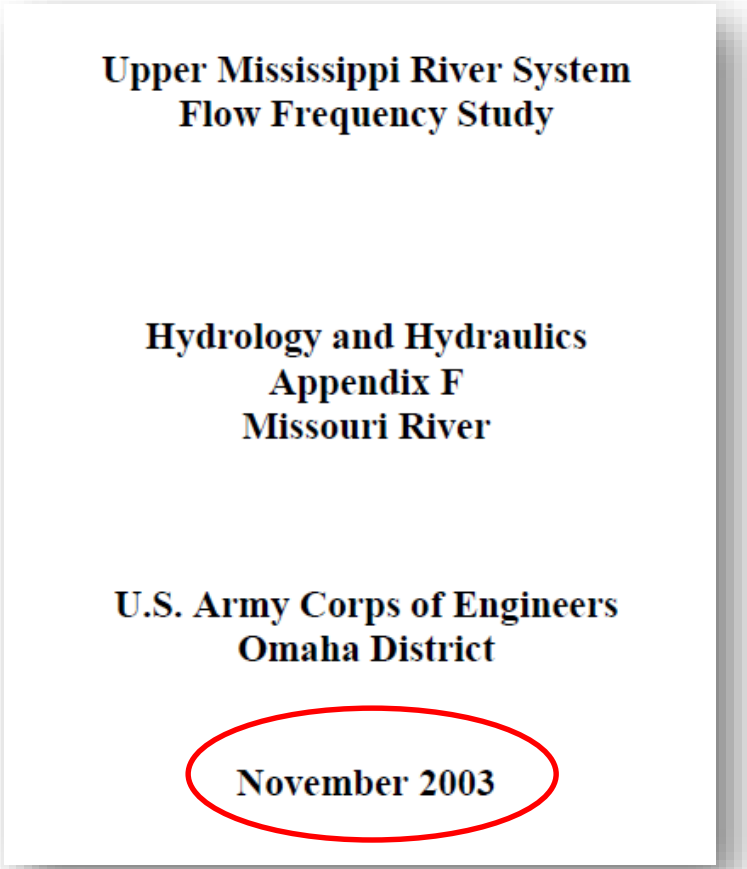
Photos courtesy of USACE – Omaha District

NASA Goddard Photo and Video at https://flickr.com/photos/24662369@N07/40463013783

Why This Project

- Several large flood events in recent years.
- Last study was over 19 years ago.




Upper Mississippi River System
Flow Frequency Study

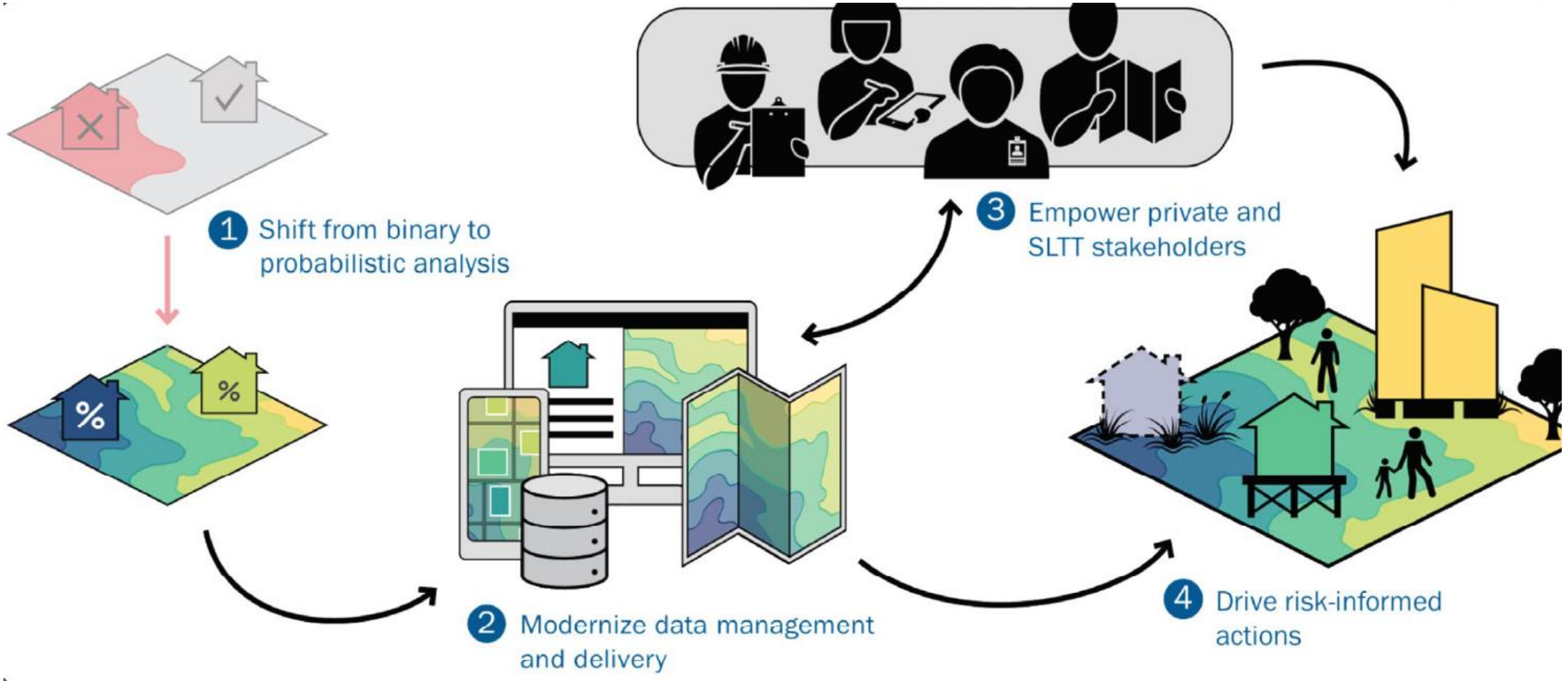
Hydrology and Hydraulics
Appendix F
Missouri River

U.S. Army Corps of Engineers
Omaha District

November 2003

Why This Project?

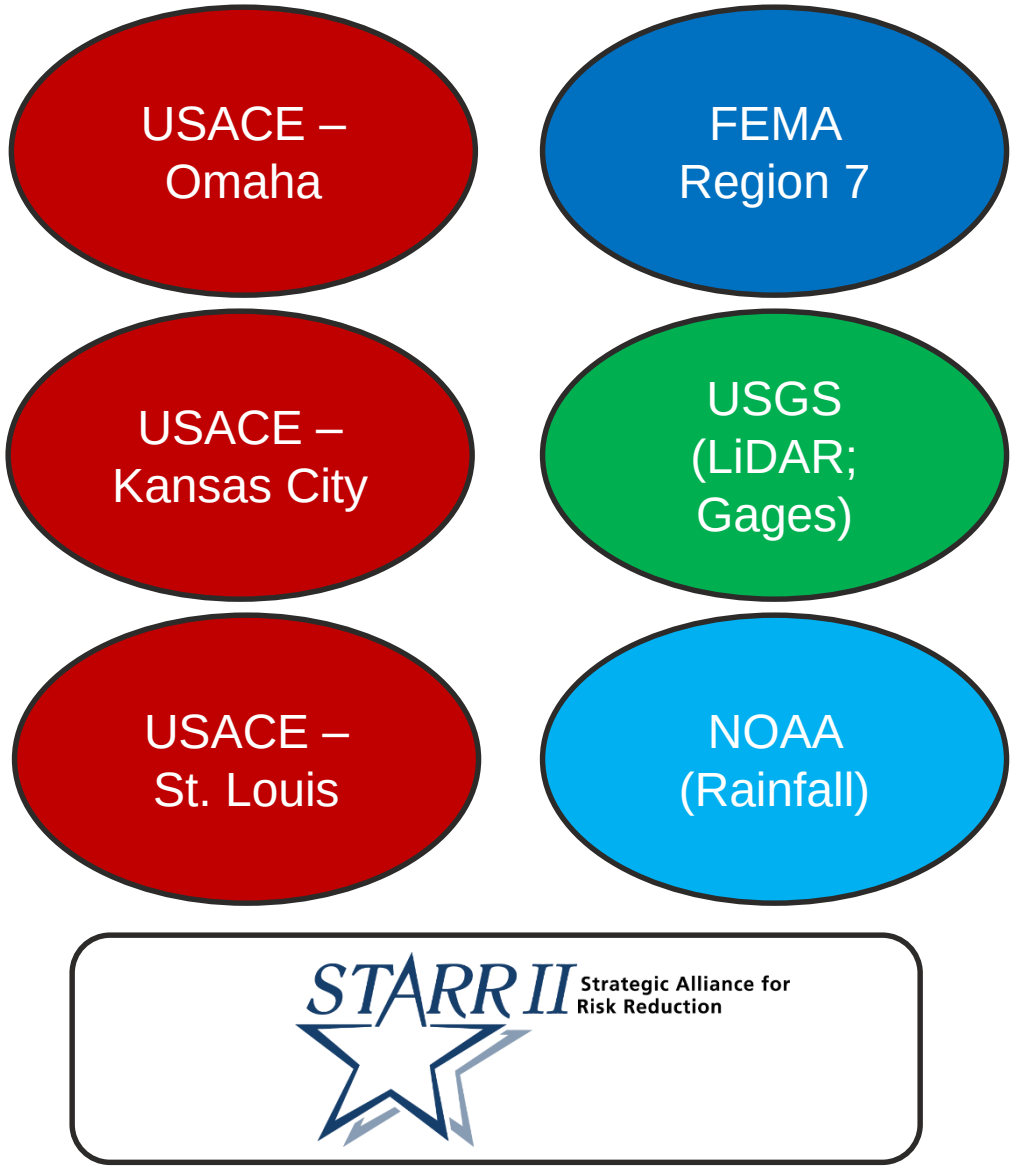
Future Flood Risk Data



Why This Project

Purpose

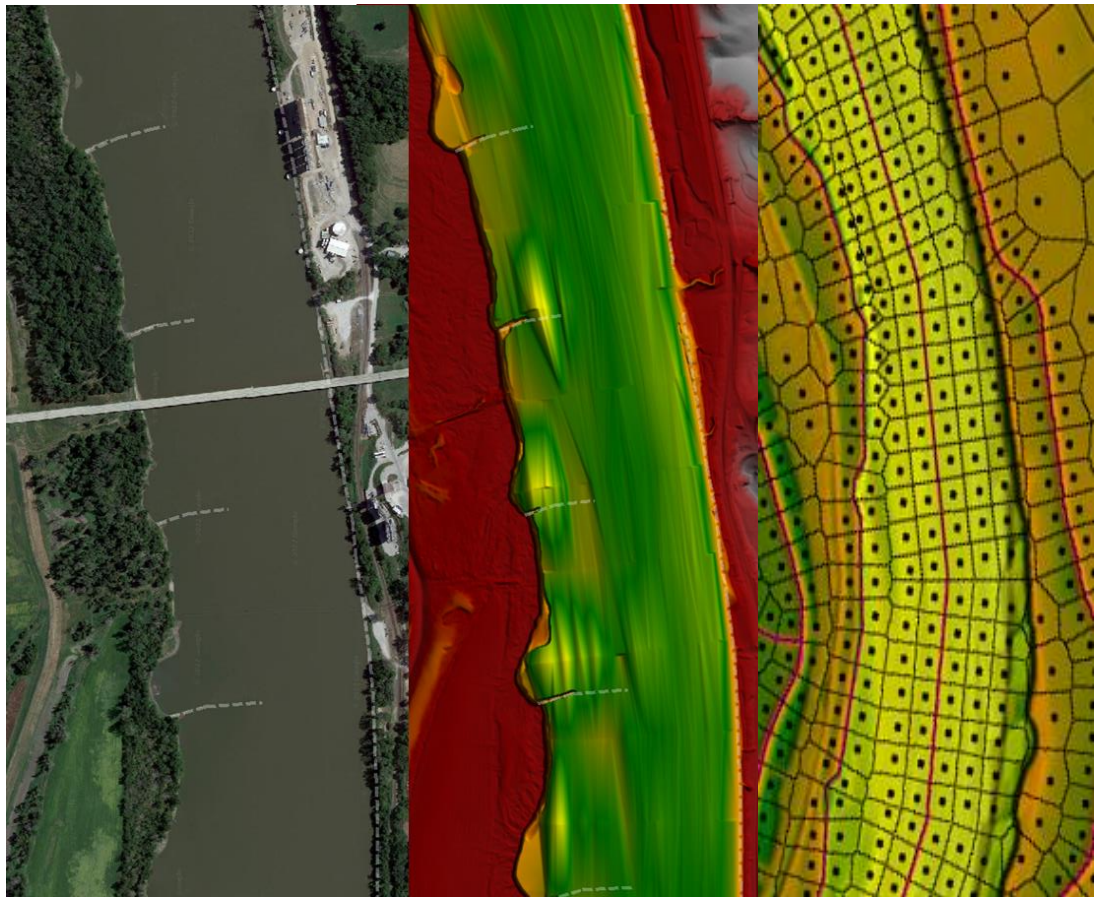
Partnership between FEMA and USACE on creating a technically sound platform for producing future flood risk data of the Missouri River for use in flood risk analysis, communication, mitigation planning, and support the implementation of mitigation actions.



Why This Project?

Goal

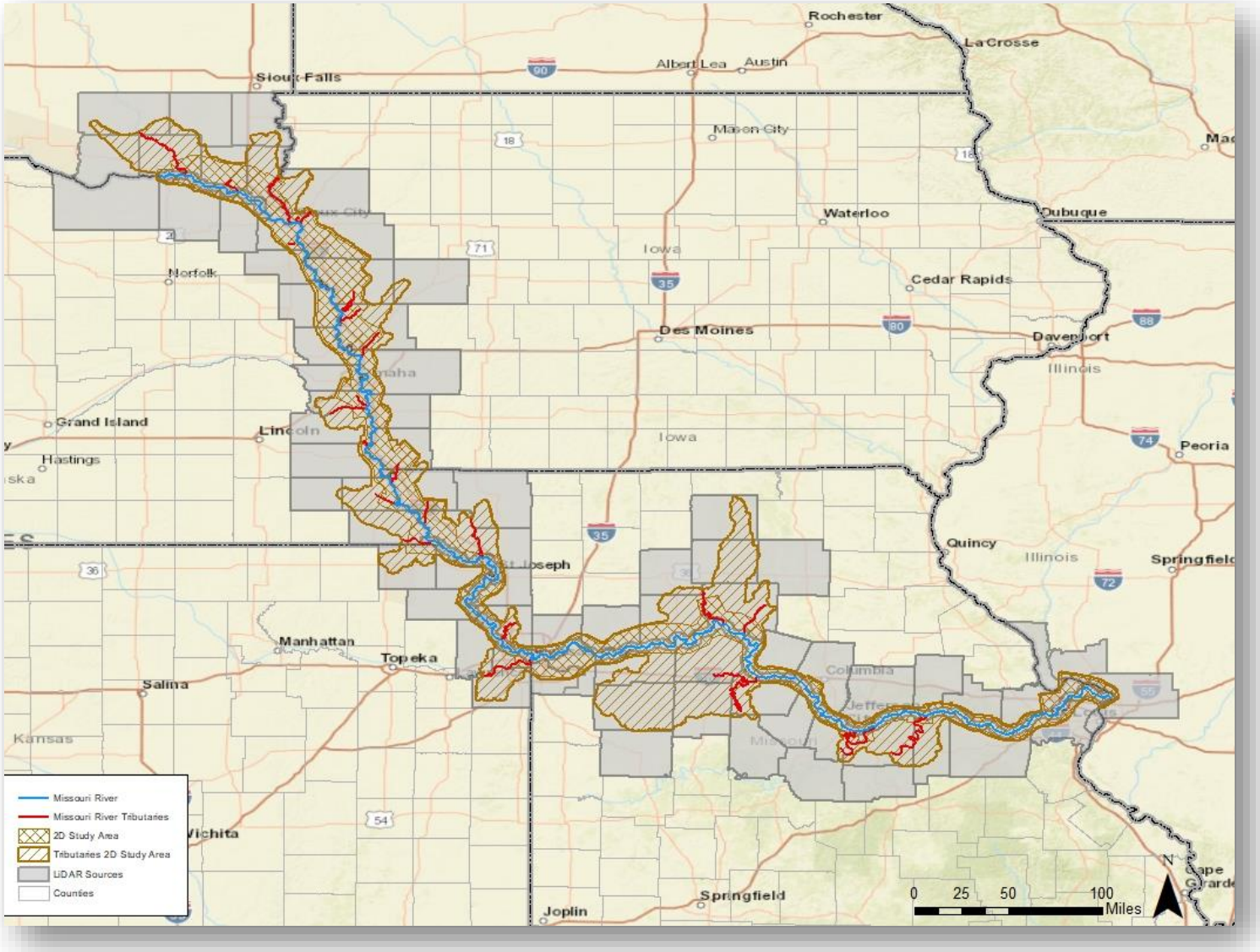
Produce a calibrated 2-D HEC-RAS model that can be leveraged as a baseline hydraulic model for future enhancements by FEMA or the USACE to use in Region-wide flood risk data development supporting flood risk reduction activities.



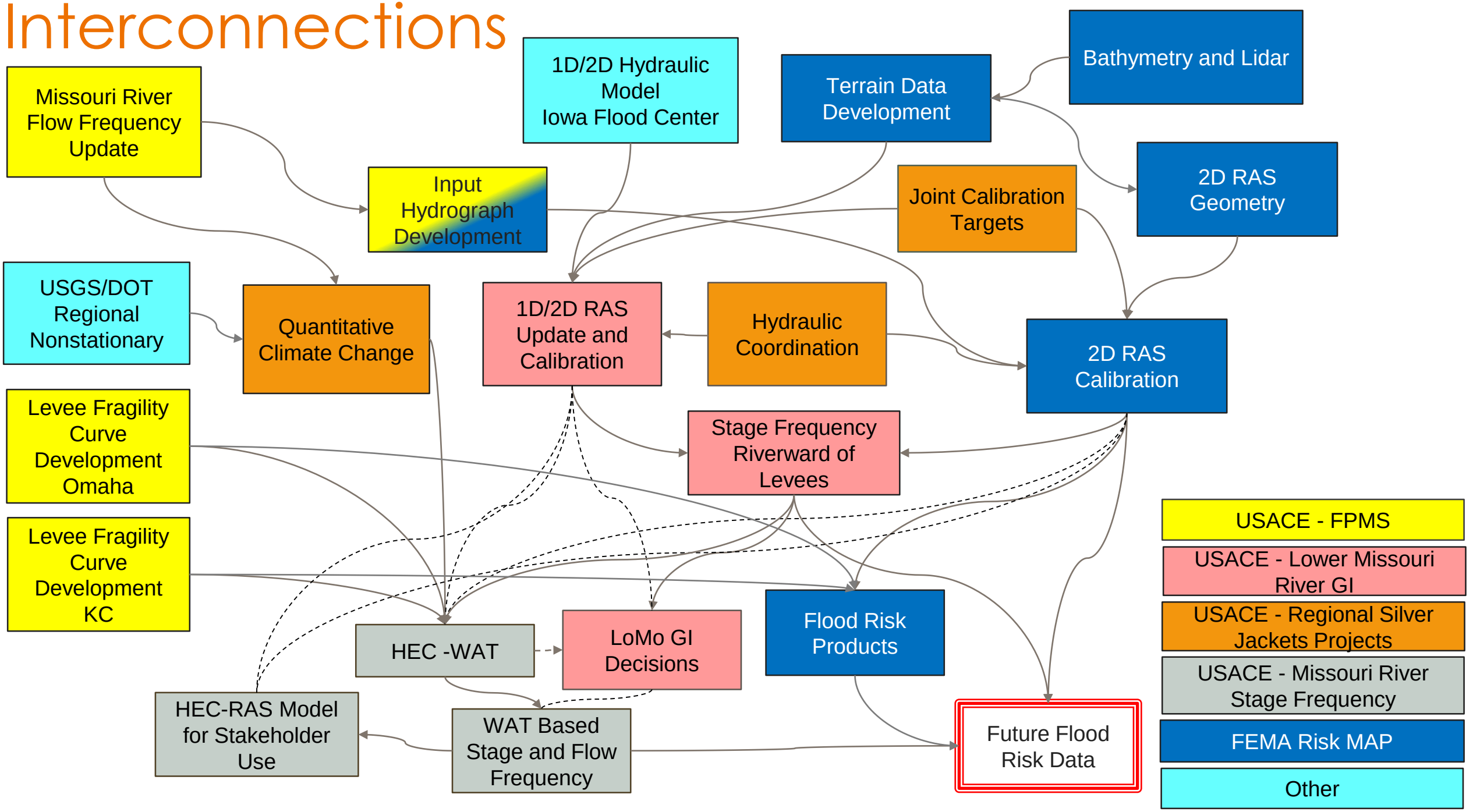
Scope of Work

Study Area

- Missouri River from St. Louis to Gavins Point Dam
- 811 river miles
- 27 major tributaries
- 60 bridges
- 358 levee systems
- 7,600 square miles of floodplain
- 52 counties



Interconnections

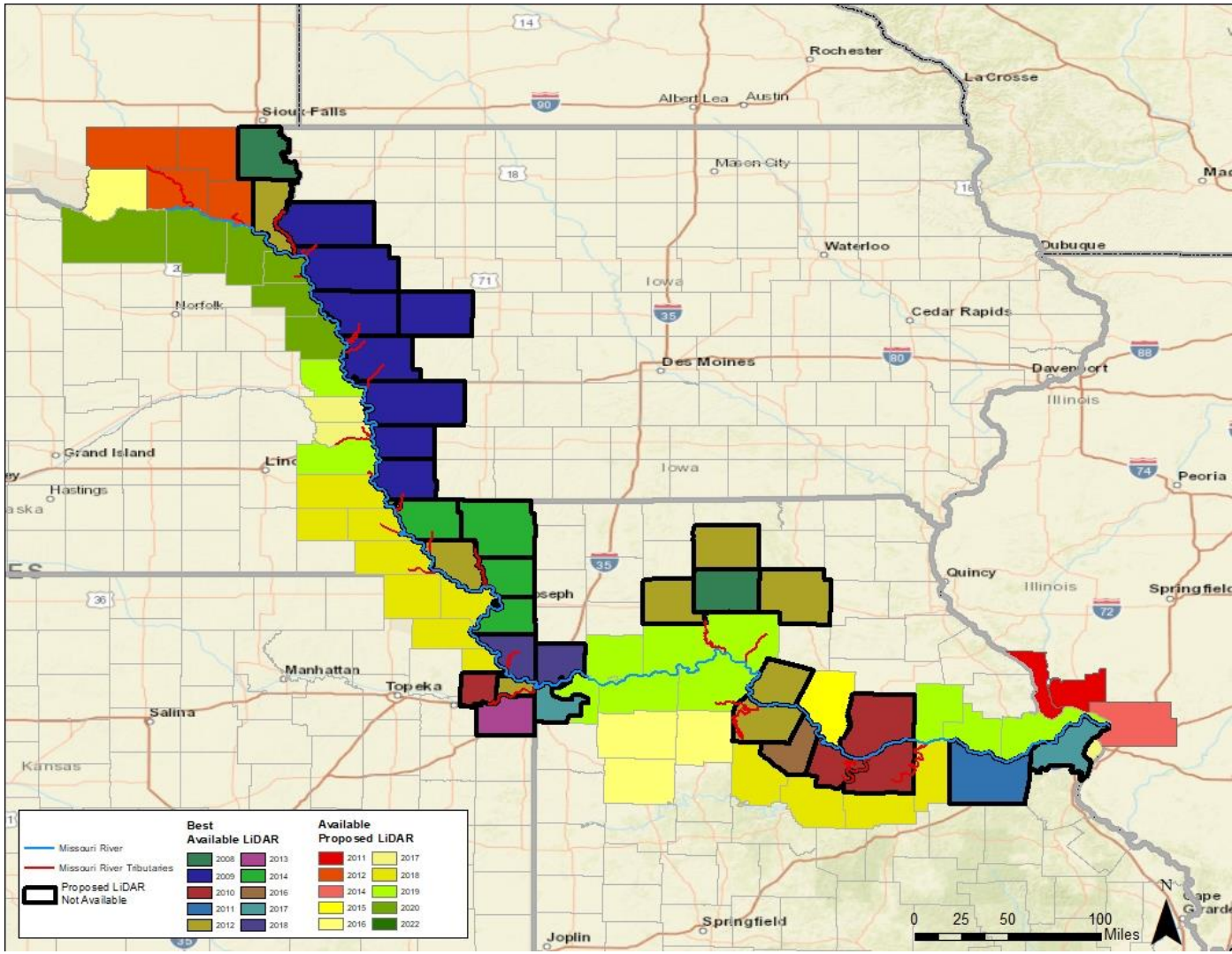


Scope of Work

Terrain Data

Terrain Data

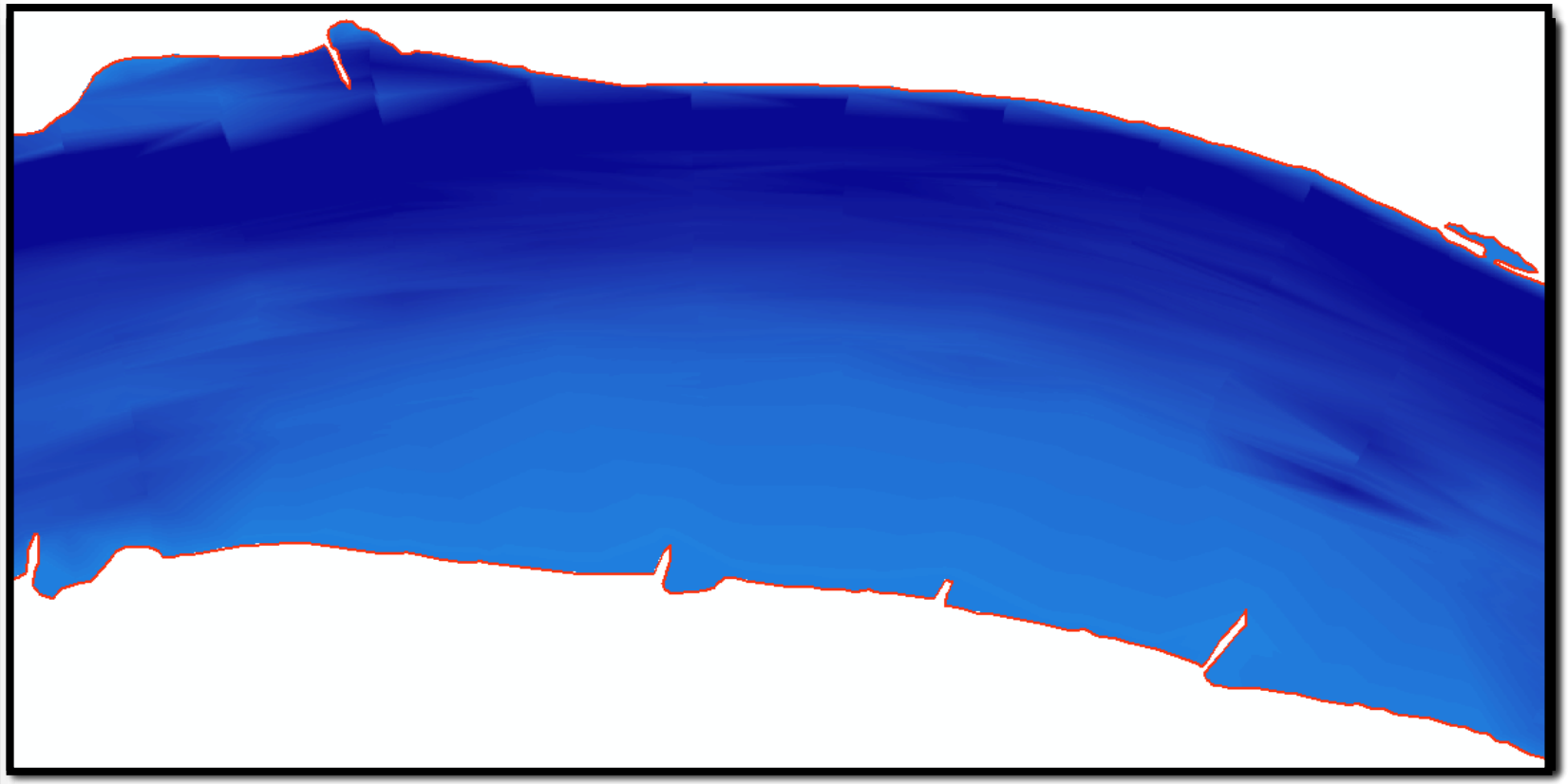
- Gathering existing LiDAR DEMs
  - USGS 3DEP
  - FEMA purchases
  - USACE river corridor
  - State Repositories
- QL2 or better
- Priority to 2019 post flood and newer data



Terrain Data

- Mosaic
  - Bathymetry to Corridor
  - Corridor to Countywide
  - Countywide to Model Areas
- Managing large file size

Terrain Data



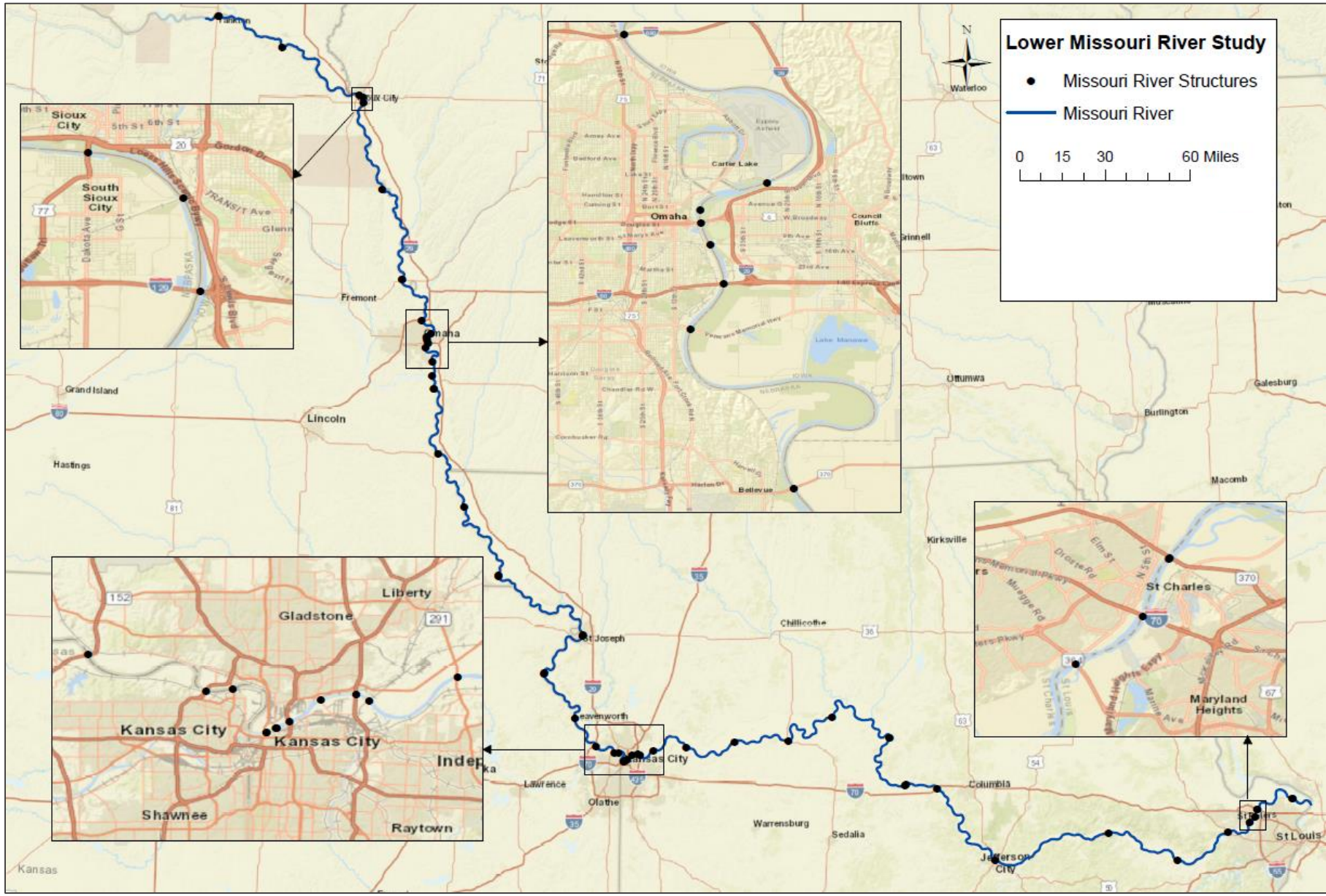
Scope of Work

Survey

Survey

Missouri River Structures

- 60 Bridges
  - 50 Roadway
  - 10 Railroad
- As-built data
- Field Survey



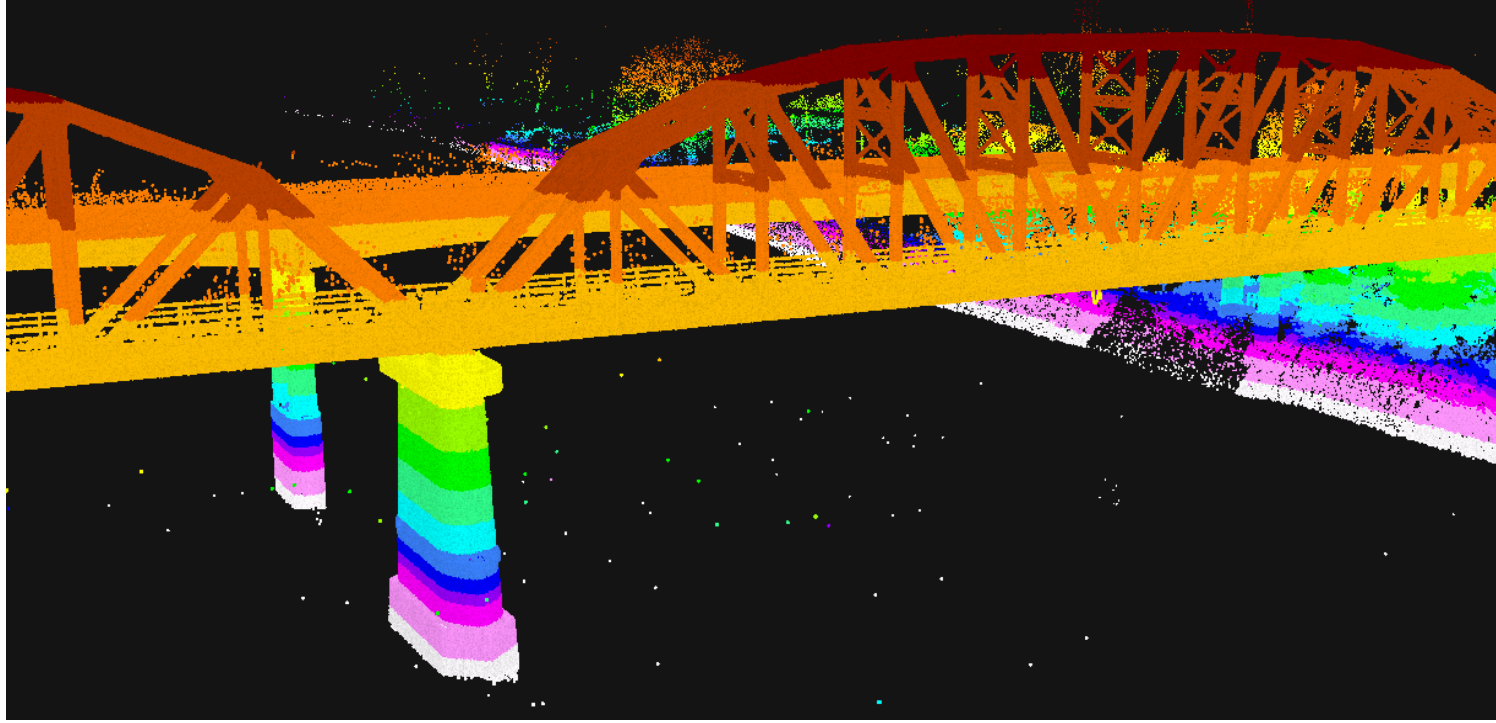
Survey

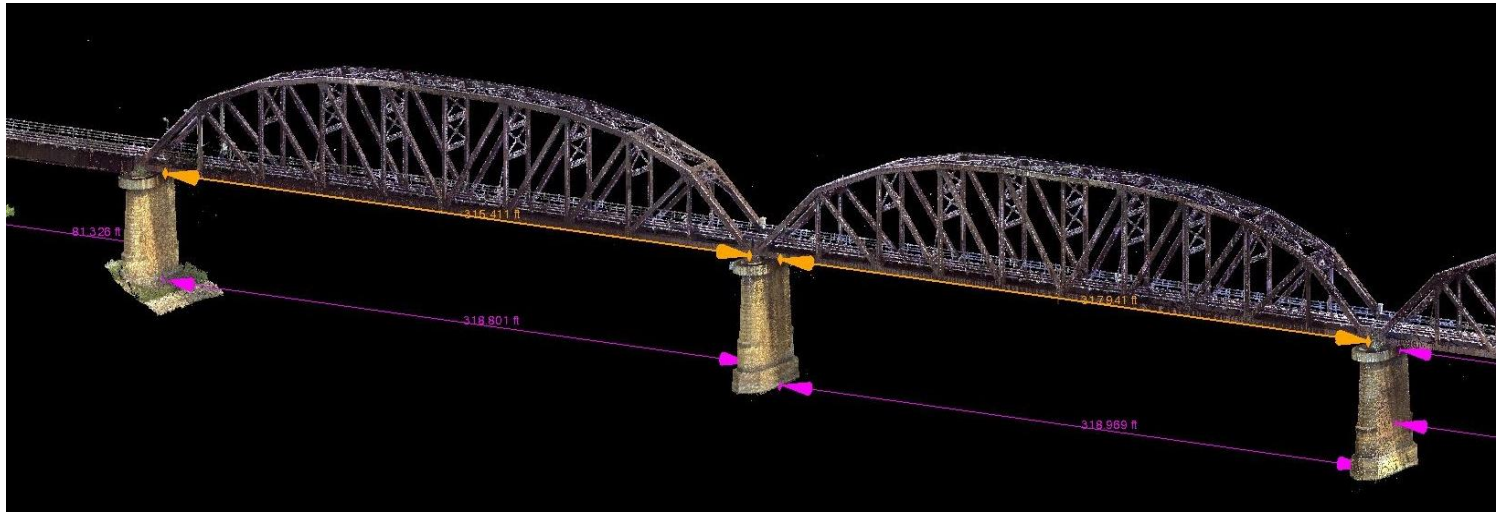
- Roadway bridges
  - As Built data provided by State DOTs
- Railroad Bridges
  - No As Built data provided
  - Accessibility is challenging
  - Solution = Terrestrial LiDAR Survey

Survey

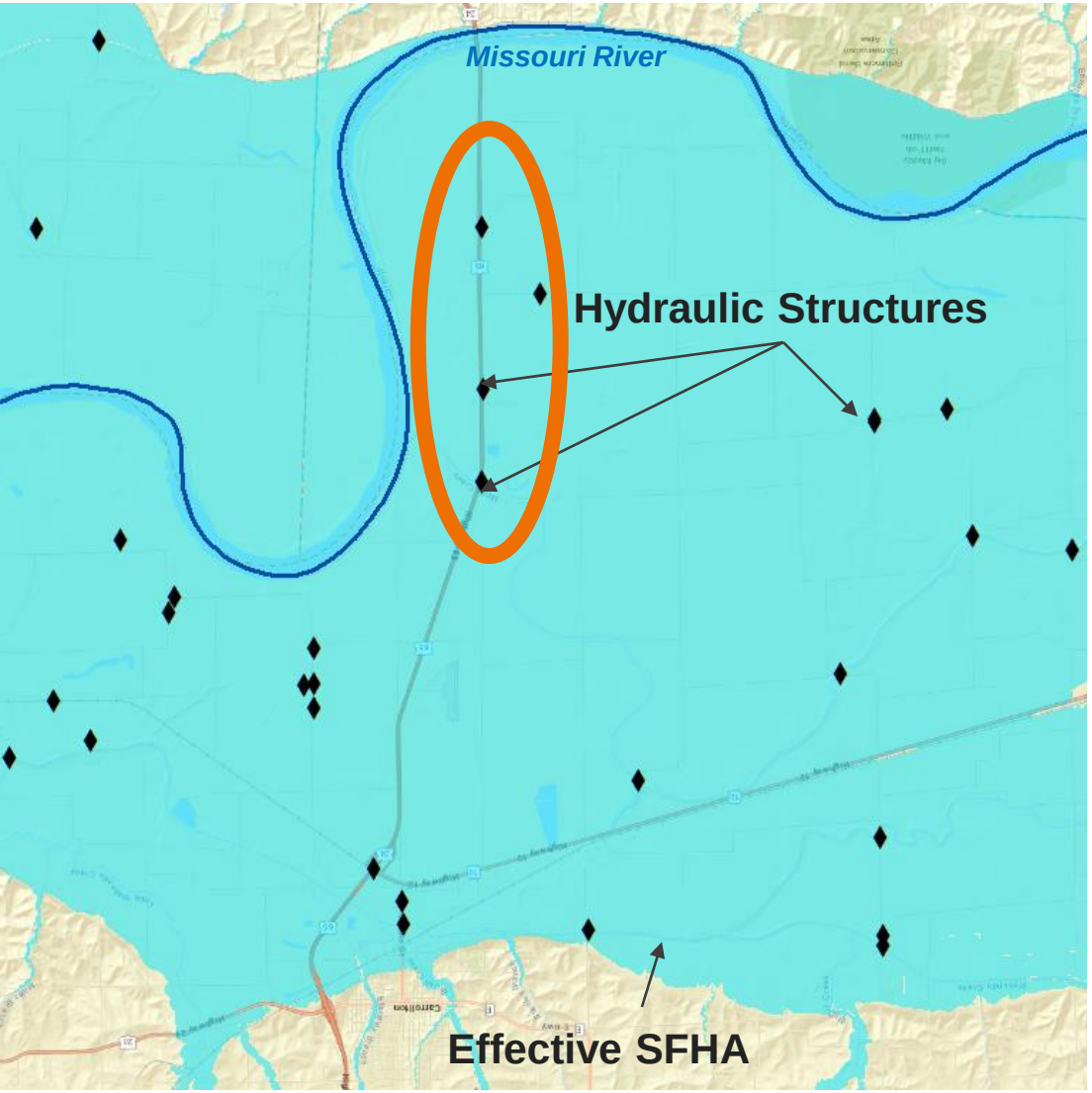
Laser scanning of bridge crossings

- Detailed bridge survey based on overbank laser scans to develop LAS point cloud data
- Does not require access to railroad right-of-way
- Reports more detailed survey information than traditional point survey

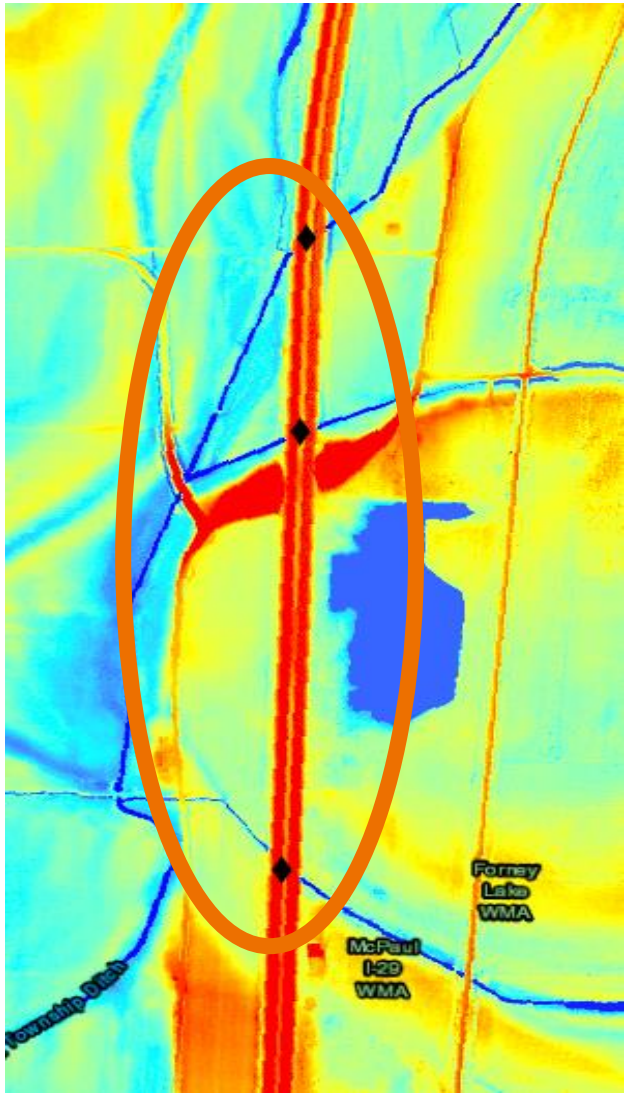




Survey


Missouri River
Hydraulic Structures
Effective SFHA


IOWA
NEBRASKA
Scott
I-29 WMA
McPaul
I-29
WMA


Forney
Lake
WMA
McPaul
I-29
WMA

Scope of Work

Hydrology

Hydrology

Missouri River Flow Frequency

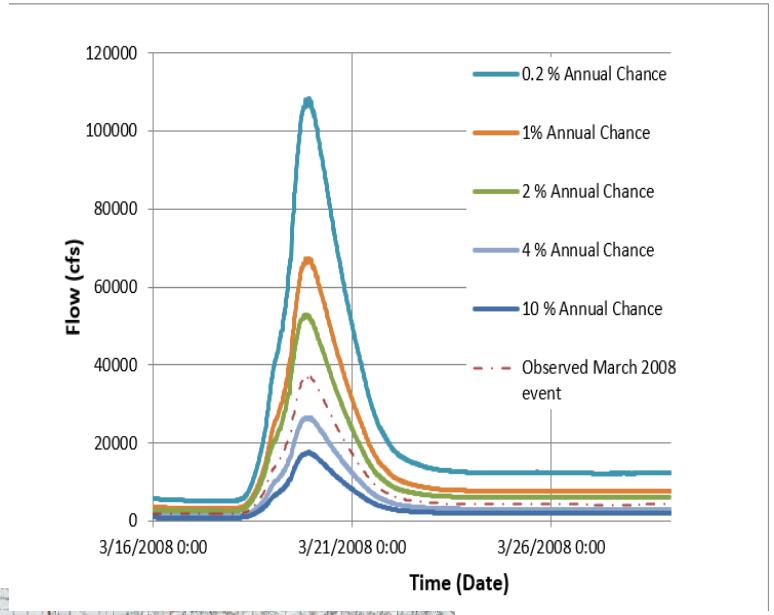
- USACE provide
- 10%, 4%, 2%, 0.2%, 1%, and 1% Plus chance of occurrence within a given year.

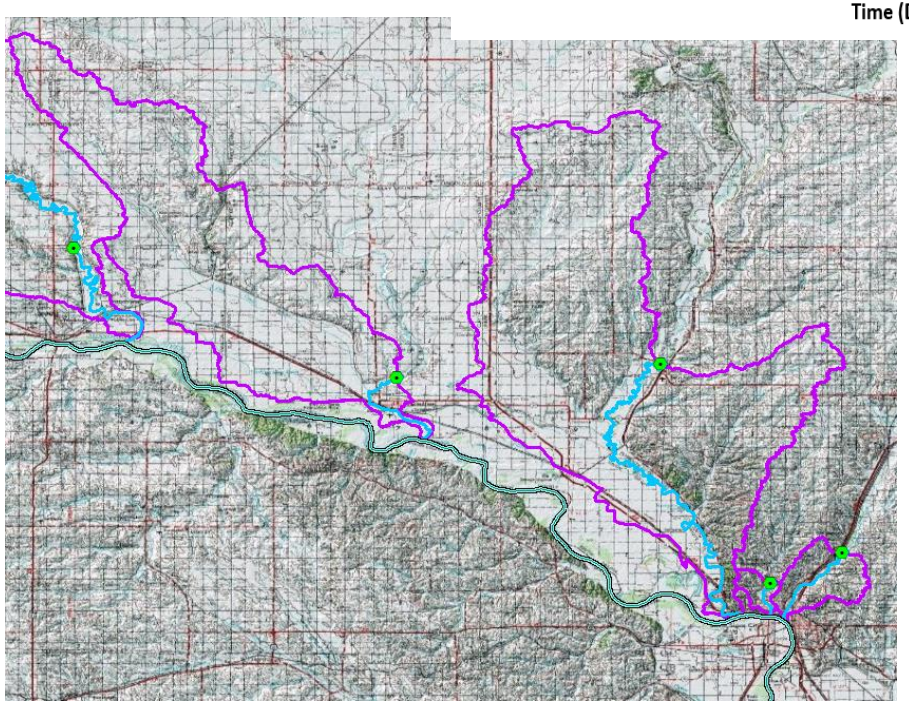
Tributaries

- 27 Major Tributaries
  - Omaha – 16 tributaries
  - Kansas City – 11 tributaries

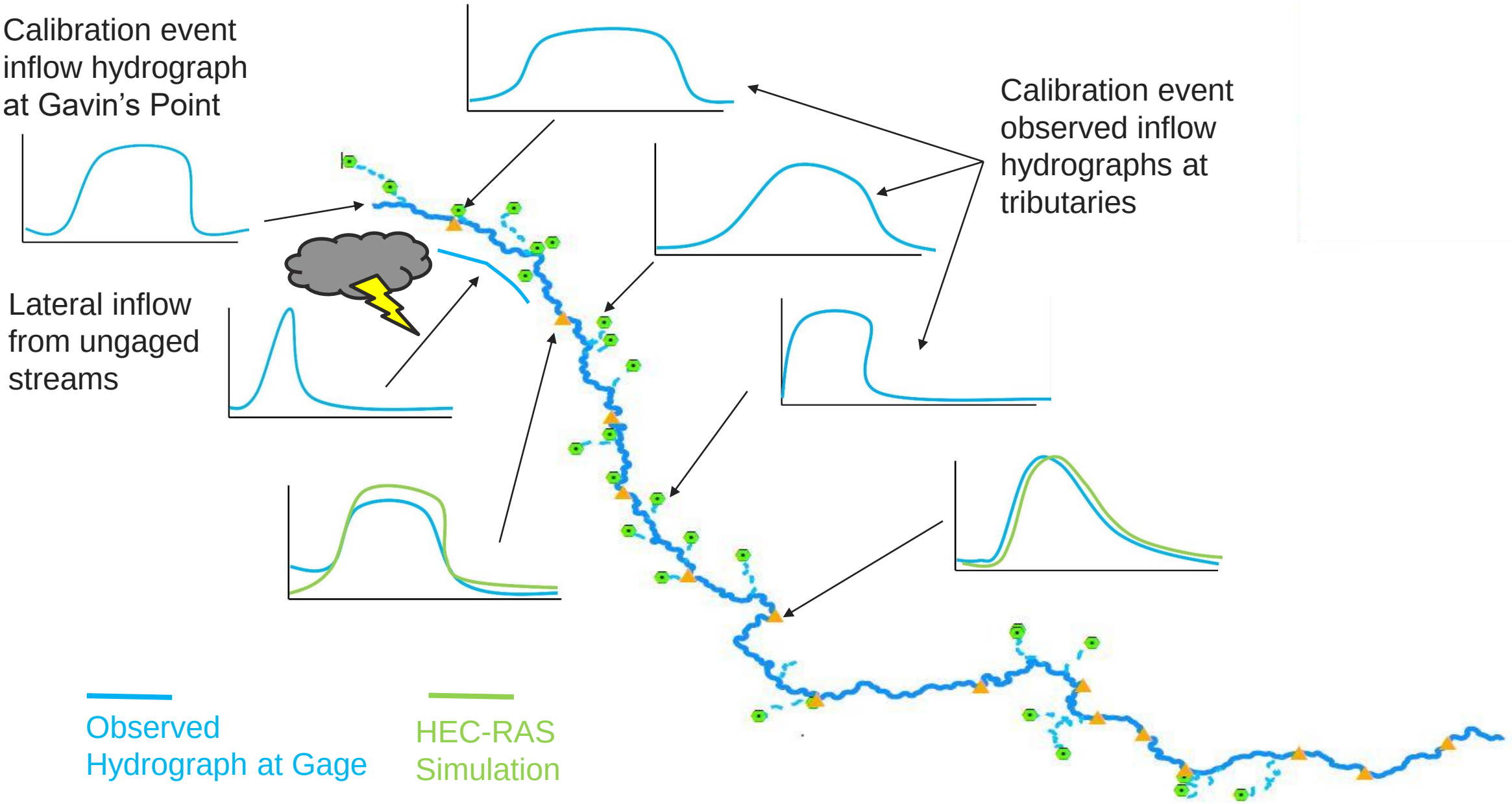
Model Setup

- Hydrograph Scaling
  - Flow frequency
  - Volume-duration frequency
- 2D Hydrodynamic Routing
  - Timing to peak at Missouri River
  - Lateral Inflow



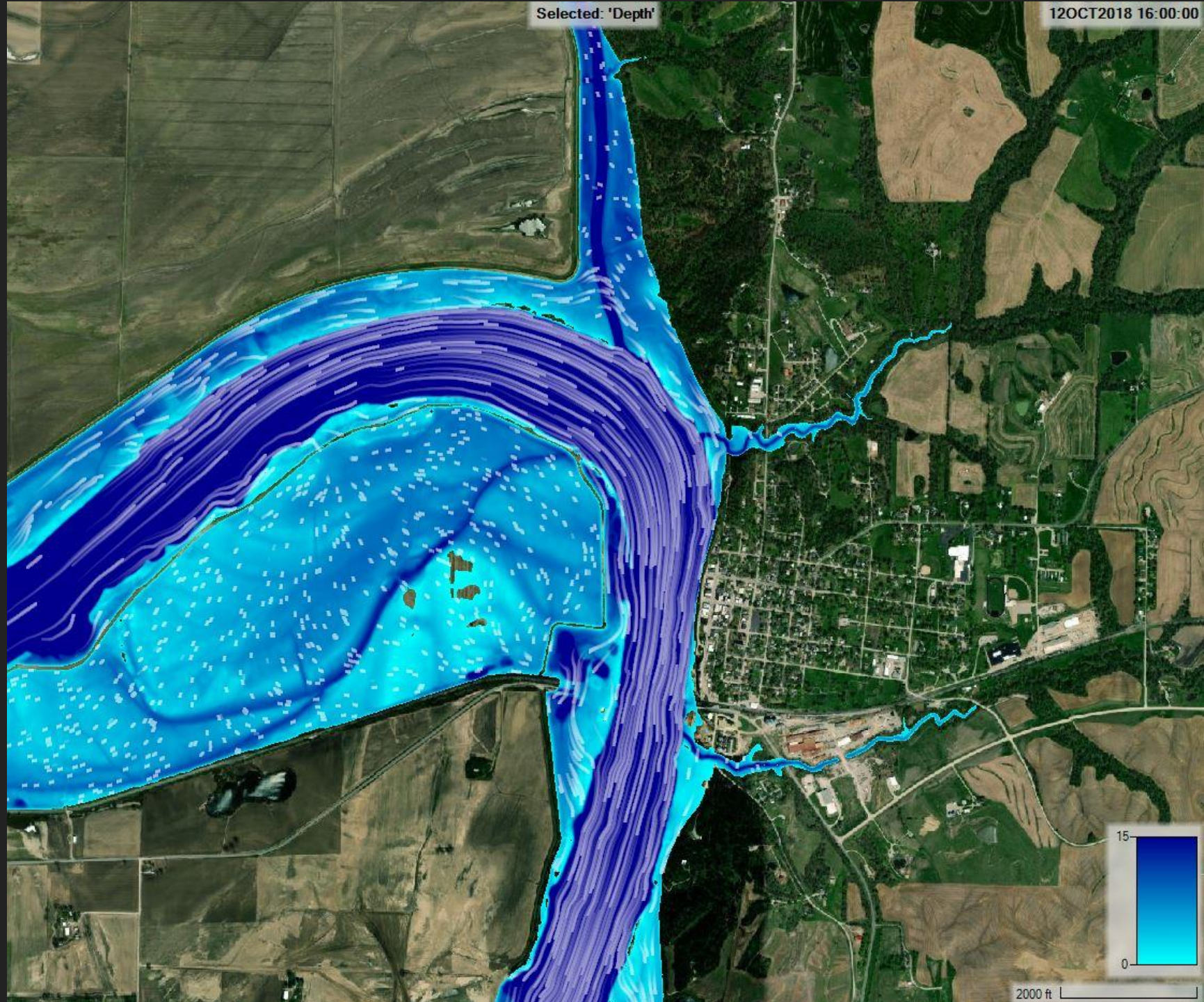


Model Setup – Hydrographs (Peak & Volume)



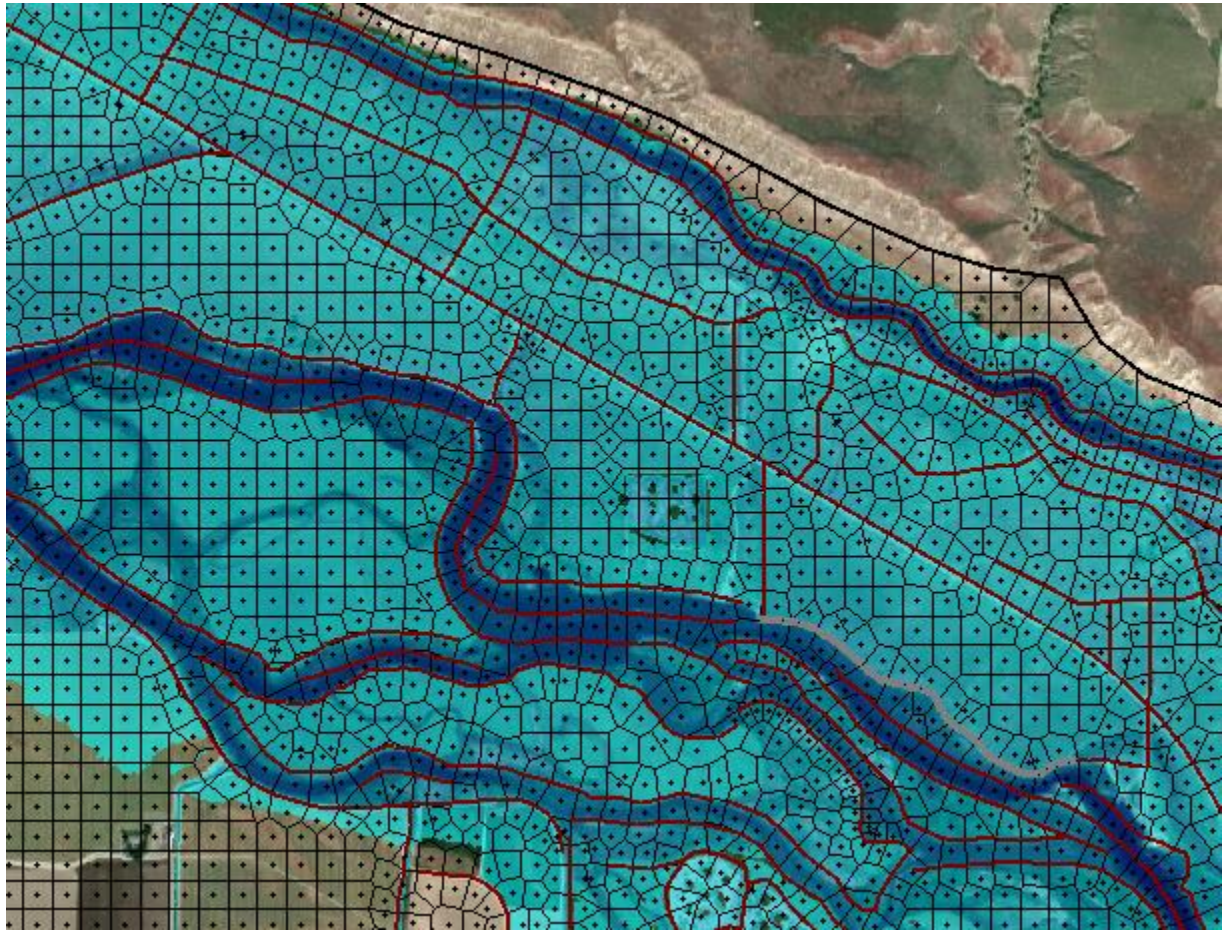
Scope of Work

Hydraulics



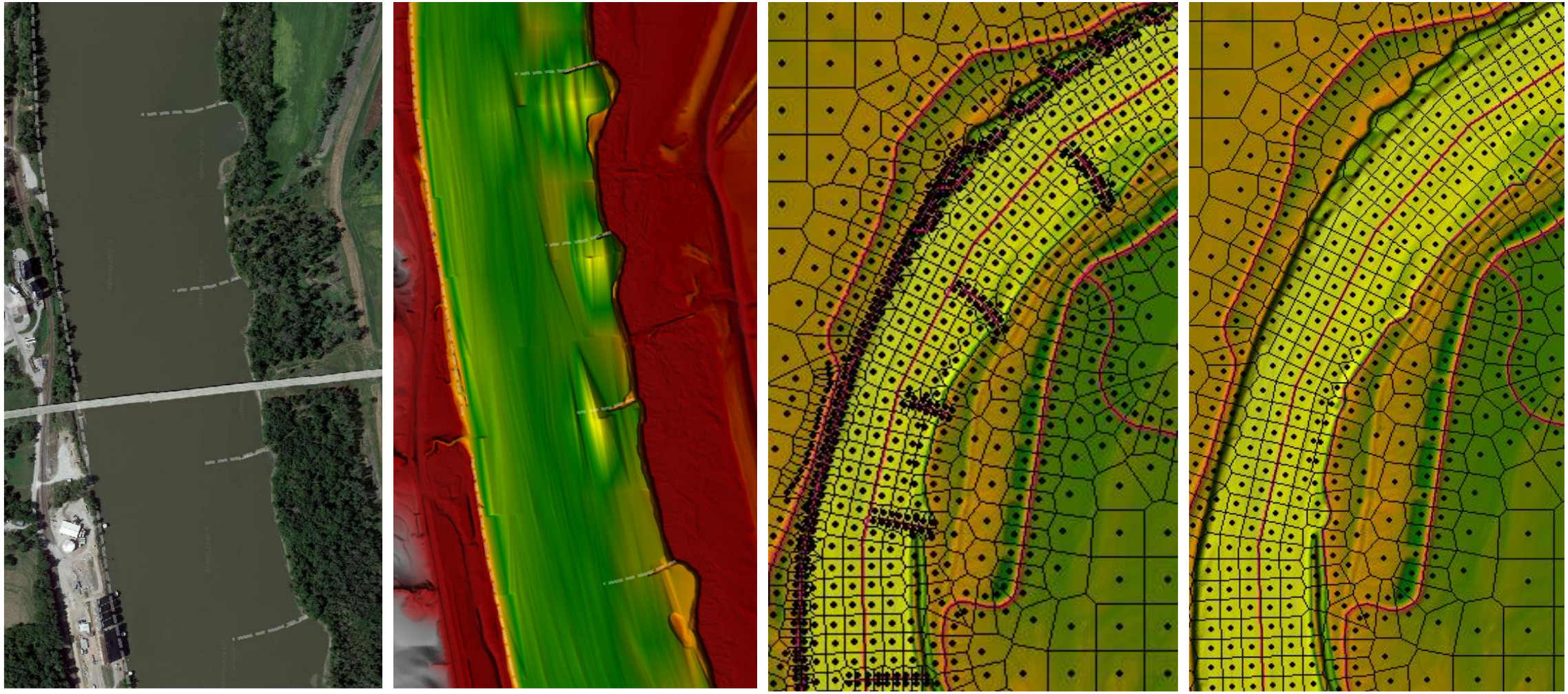
Hydraulics

- HEC-RAS 2D hydrodynamic routing
- Enhanced Geometry
  - All bridges across main channel
  - Hydraulically significant bridges/culverts in overbanks
  - Levee systems
  - Prominent topographic features breaklines
  - Breaklines within stream corridor
  - Refined 2D mesh where necessary
  - Manning’s roughness adjusted to capture stream channels



Hydraulics

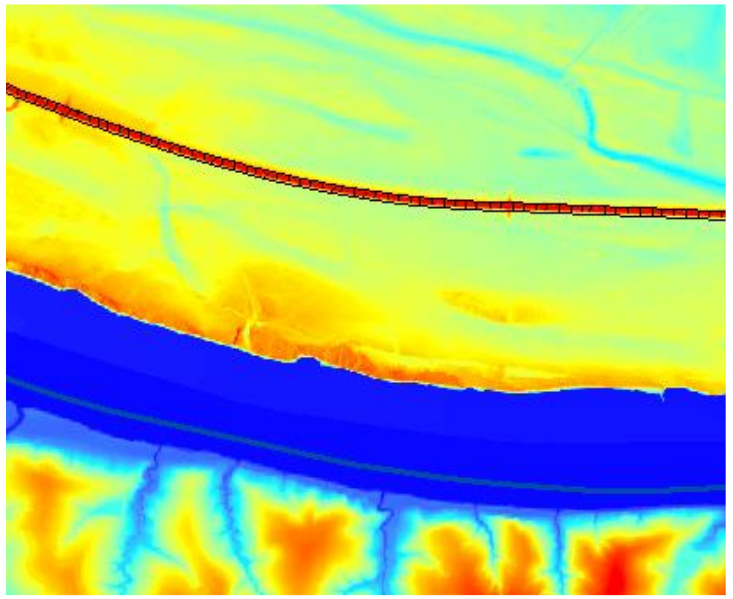
Hydraulic Significance of Dikes and Revetments in Channel

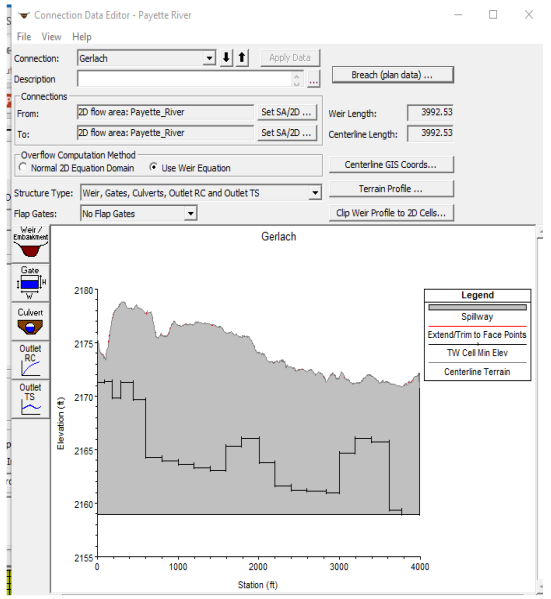


Hydraulics

Levees

- Levee crest elevation profile
  - Elevation from NLD (USACE portfolio)
  - LiDAR extraction (non-USACE)
- Levees modeled using “with levee” approach
- 2D connector allow future modeling of levee failure scenarios without model geometry modification
- Levee overtopping flood frequency determined from model results

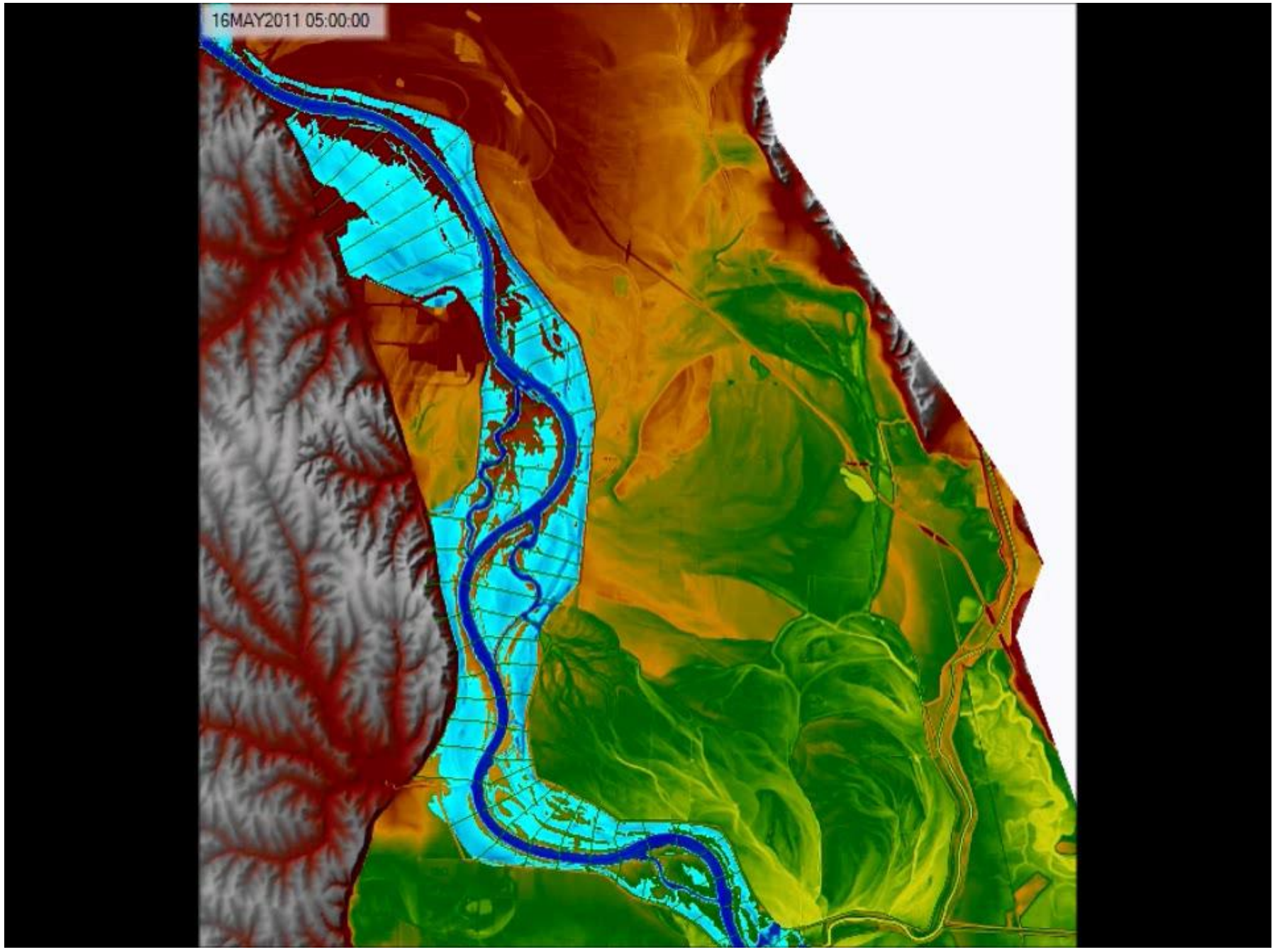




Hydraulics

Example

Simulation of a levee breach near Hamburg, Iowa from the 2011 flood.

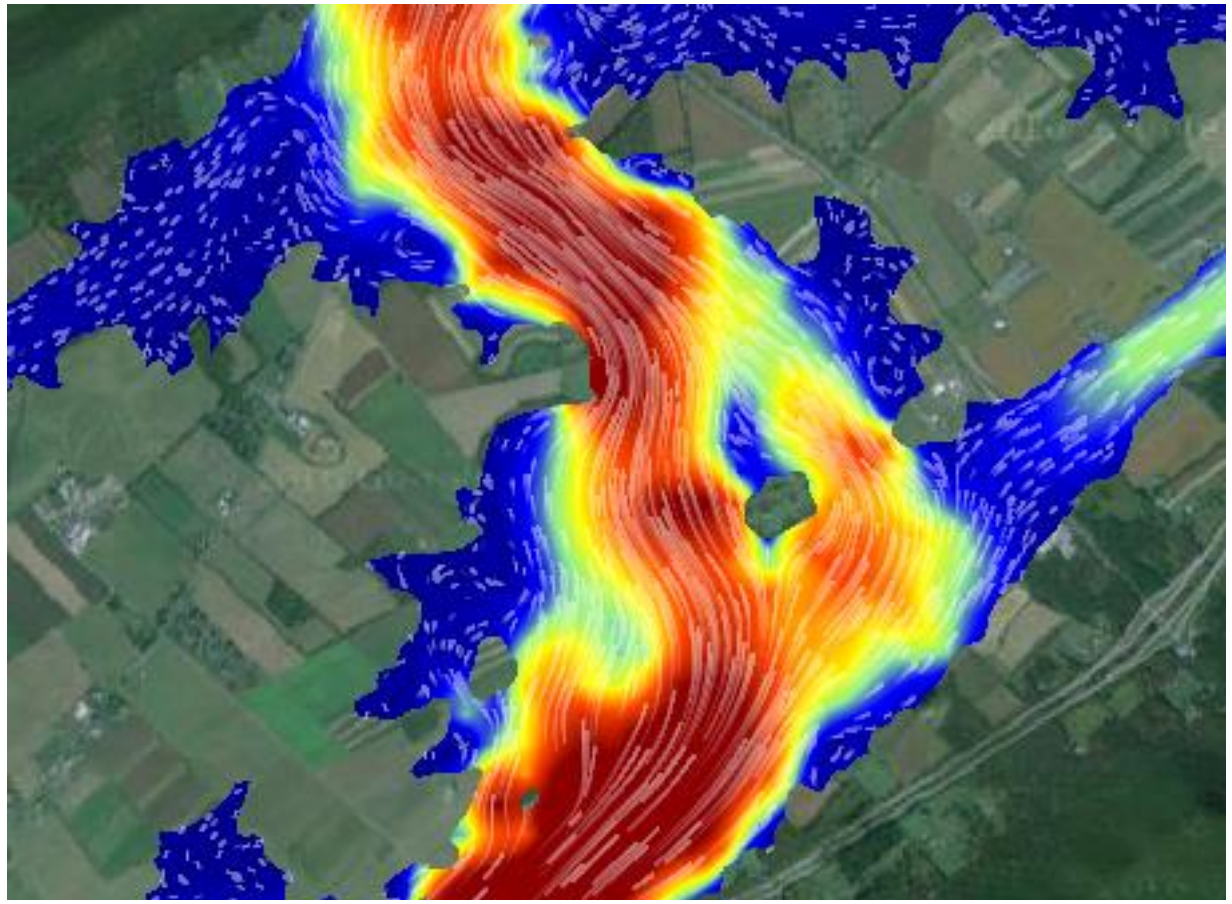


Scope of Work

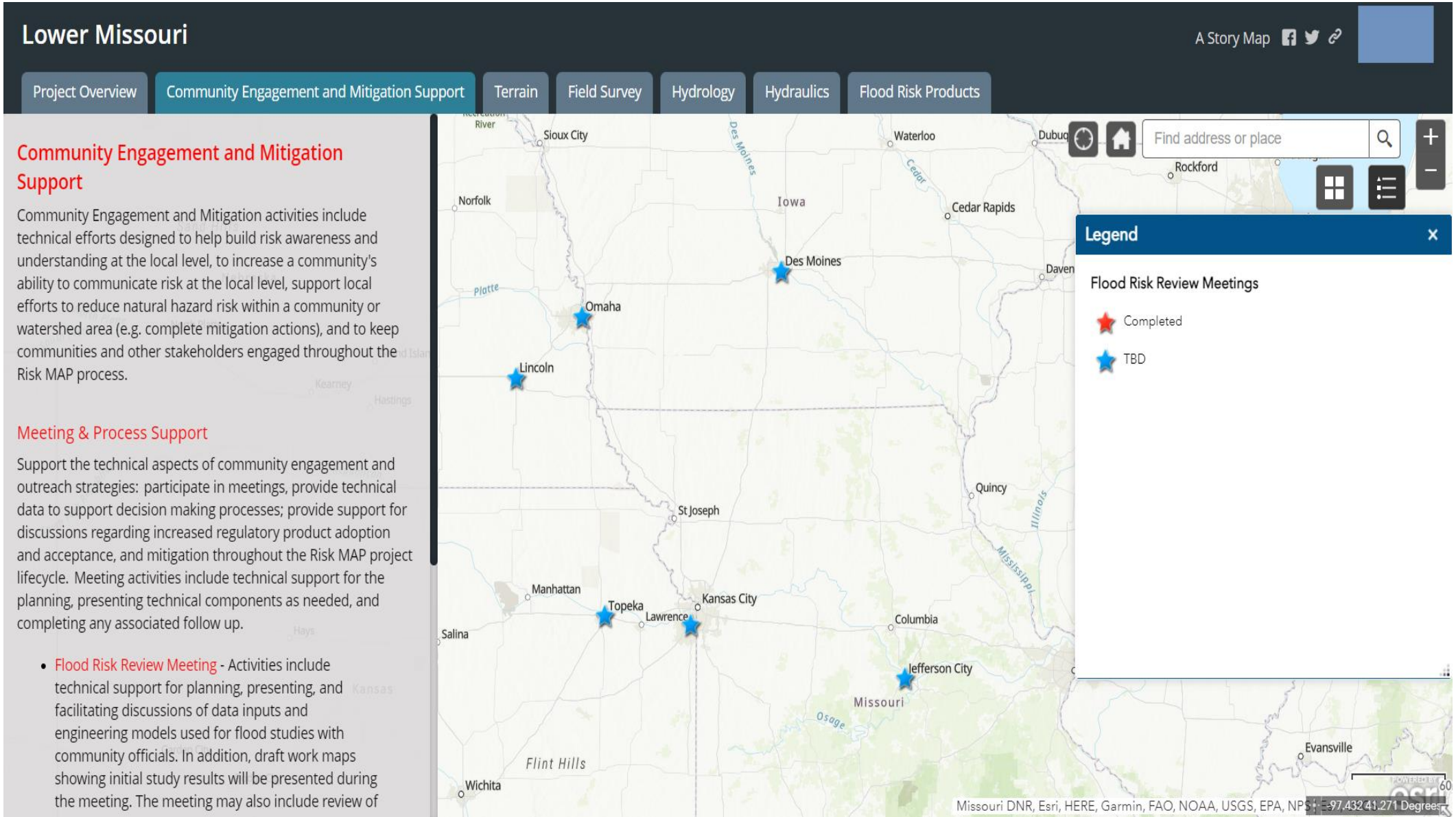
Flood Risk Products and Communication

Flood Risk Products

- Grids for a range of flood events
  - Water surface elevations
  - Depth of Water
  - Velocity
- Changes in floodplain mapping
  - Compared to UMRSFFS
- Levee overtopping flood frequency



Communicate with Partners



We do what is right.

We approach every project as a partnership because our work creates a lasting impact on communities.