Flood Inundation Mapping Projects

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Kentucky Water Science Center
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Outline

- Flood inundation projects completed in Kentucky
- Overview of general steps involved in flood inundation projects
- Closer look at the Frankfort, Kentucky flood inundation project
- Live demo of USGS Flood Inundation Mapping website

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Flood Inundation Projects Completed in Kentucky

Hopkinsville, Kentucky

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Prepared in cooperation with the City of Hopkinsville, Kentucky, Community Development Services

Flood-Inundation Maps for an 8.9-Mile Reach of the South Fork Little River at Hopkinsville, Kentucky

Pamphlet to accompany
Scientific Investigations Map 3242

U.S. Department of the Interior
U.S. Geological Survey

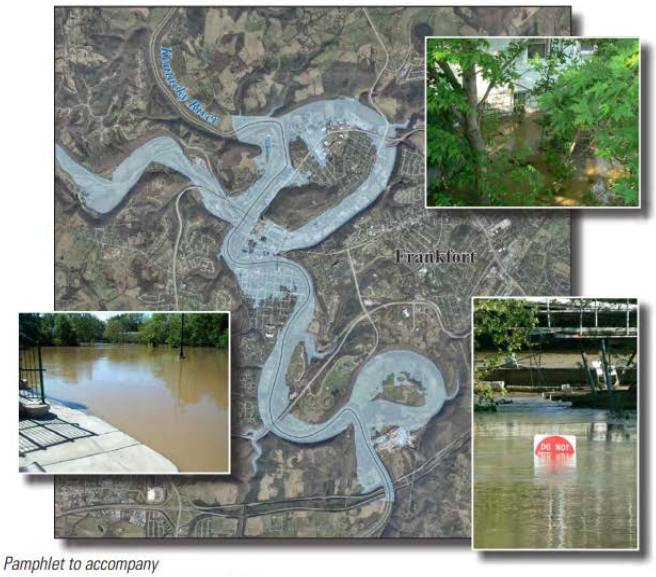
http://pubs.usgs.gov/sim/3242/

Frankfort, Kentucky

USGS
science for a changing world

Prepared in cooperation with City of Frankfort, Kentucky, Office of Emergency Management

Flood-Inundation Maps for a 6.5-Mile Reach of the Kentucky River at Frankfort, Kentucky



Pamphlet to accompany
Scientific Investigations Map 3278

U.S. Department of the Interior
U.S. Geological Survey

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Flood Inundation Project Objectives

- **Develop** detailed libraries of flood inundation maps for a river reach of interest.
- **Use** the flood inundation maps in conjunction with the National Weather Service (NWS) Advanced Hydrologic Prediction Service flood warning system to show predicted areas of flood inundation.
  - **Helps with** preplanning **flood response** and **early flood warning**
- **Provide** online portals for the public to view USGS flood inundation study information and interact with the flood inundation map libraries.
- **The flood inundation maps,** along with online information regarding current stages from USGS streamgage and forecasted stages from the NWS, provide emergency management and local residents with **critical information for flood response activities.**

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Flood Inundation Project Phases

- **Phase 1** – Project Scoping and Planning
  - Site selection, modeling approach, and data collection
- **Phase 2A** – Hydraulic Analyses
  - Build and calibrate hydraulic model
- **Phase 2B** – Mapping
  - Create and submit map products to NWS and USGS Flood Inundation Mapping Program (FIMI)
- **Phase 3** – USGS Flood Inundation Mapping Science (FIMI) and NWS Advanced Hydrologic Prediction Service (AHPS) Web Implementation
  - Make maps public by publishing on the web.

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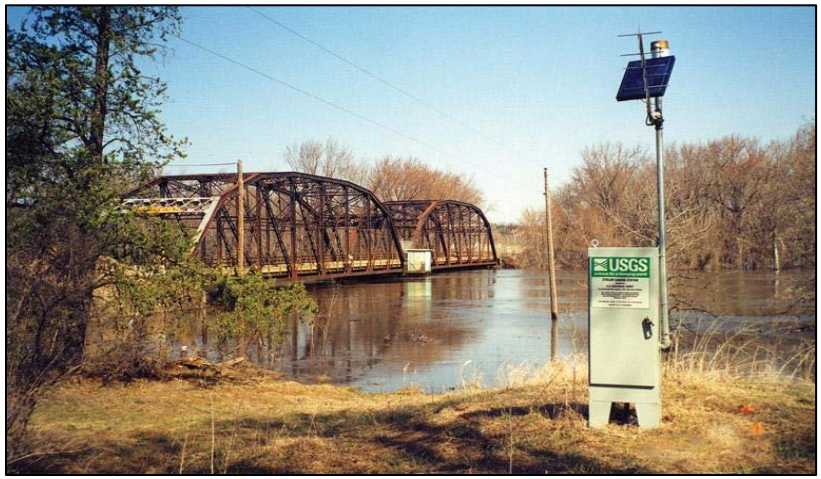
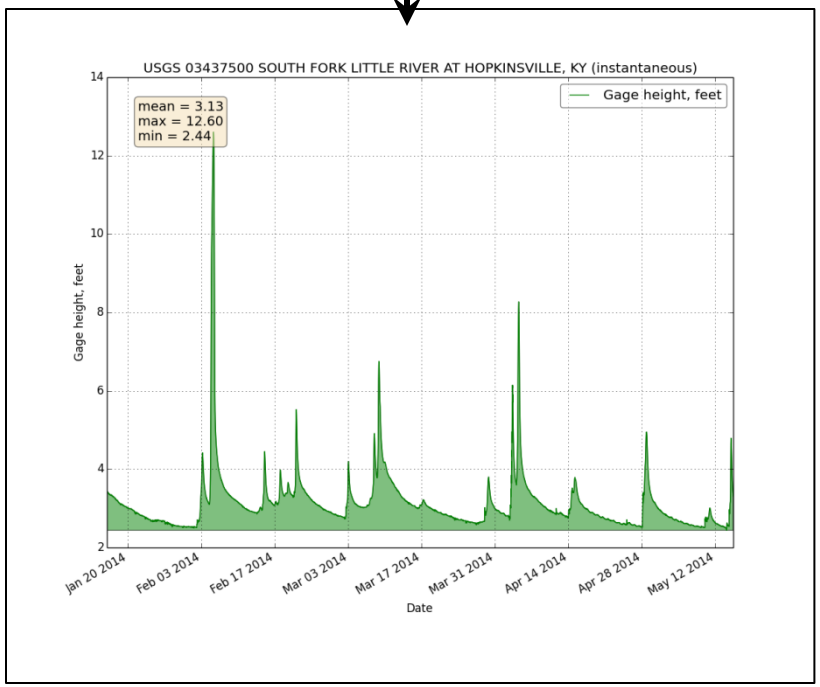
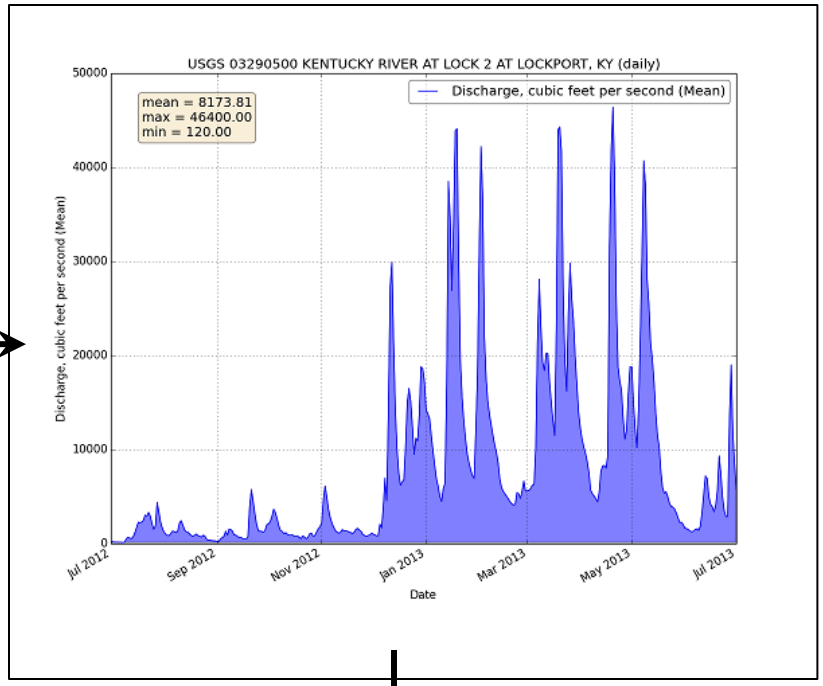
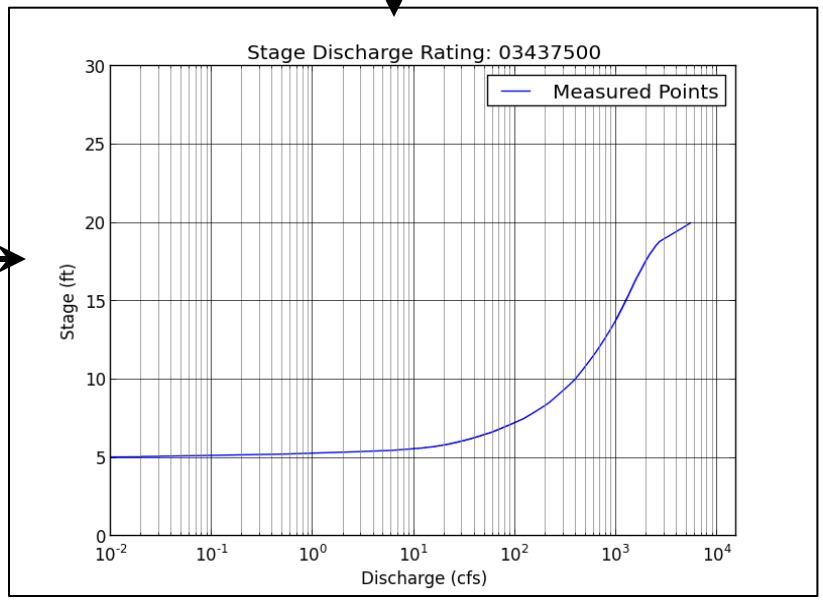
USGS Streamgage

USGS streamgage(s) within study domain



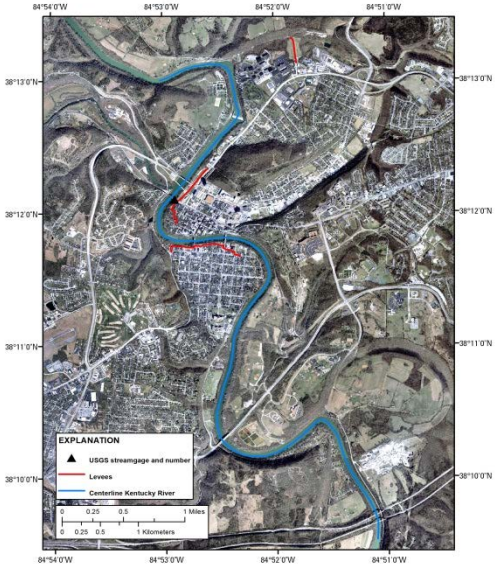






Phase 1 – 2A: Scoping/Approach, Data Collection, Modeling

Study Area



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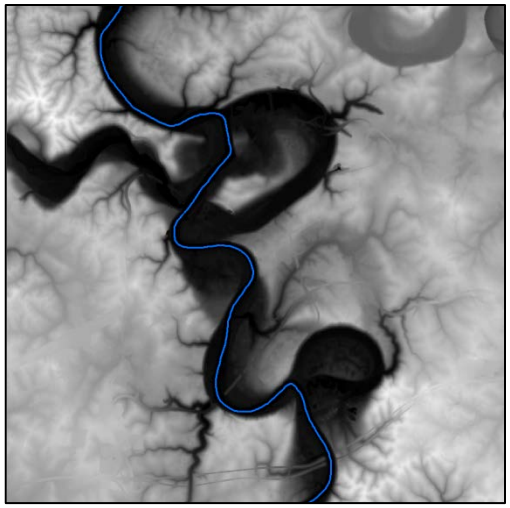
Digital Terrain/Elevation Model



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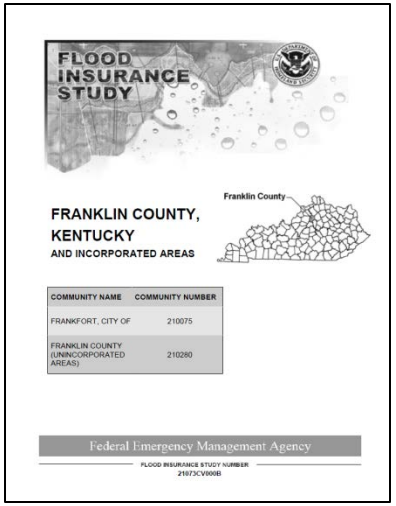
FEMA Flood Insurance Study



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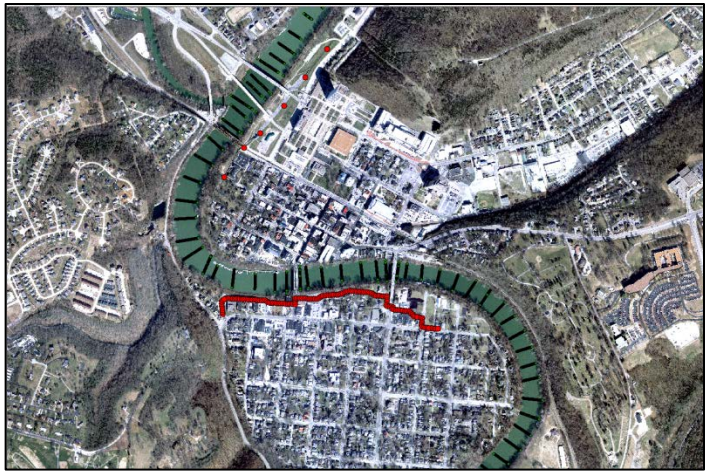
Bathymetry and/or survey data



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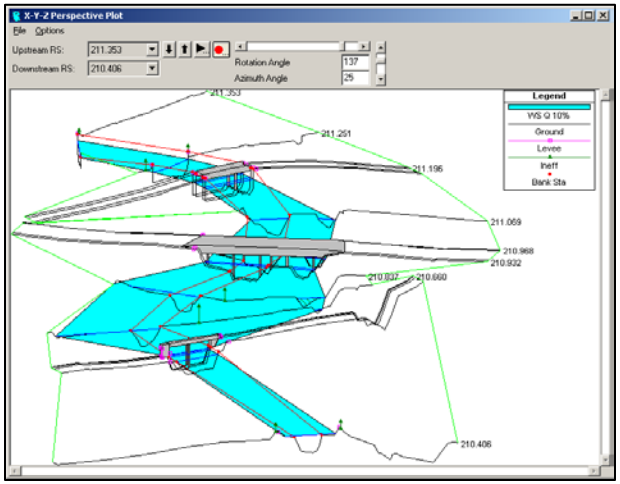
Hydraulic Model and Calibration



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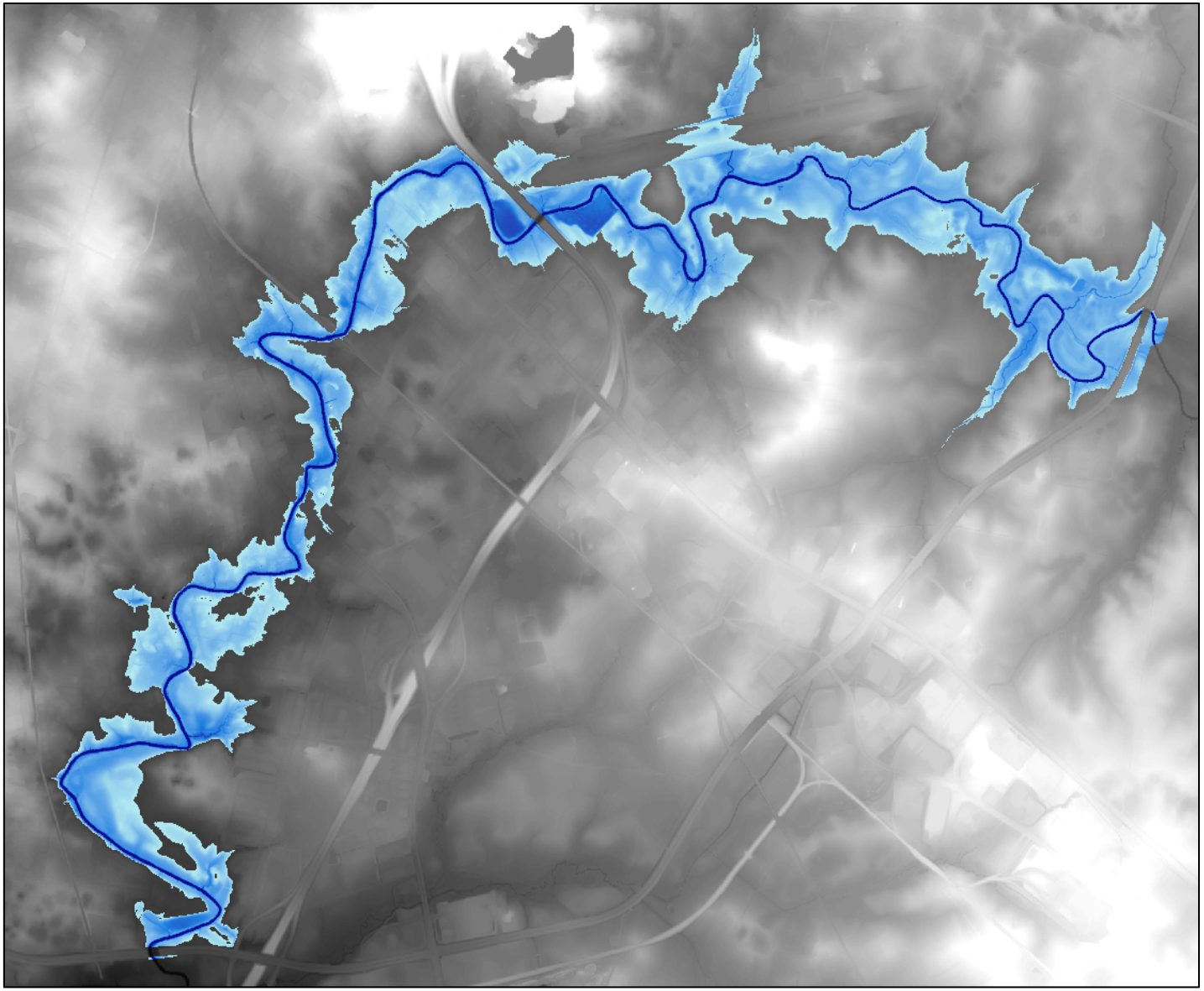
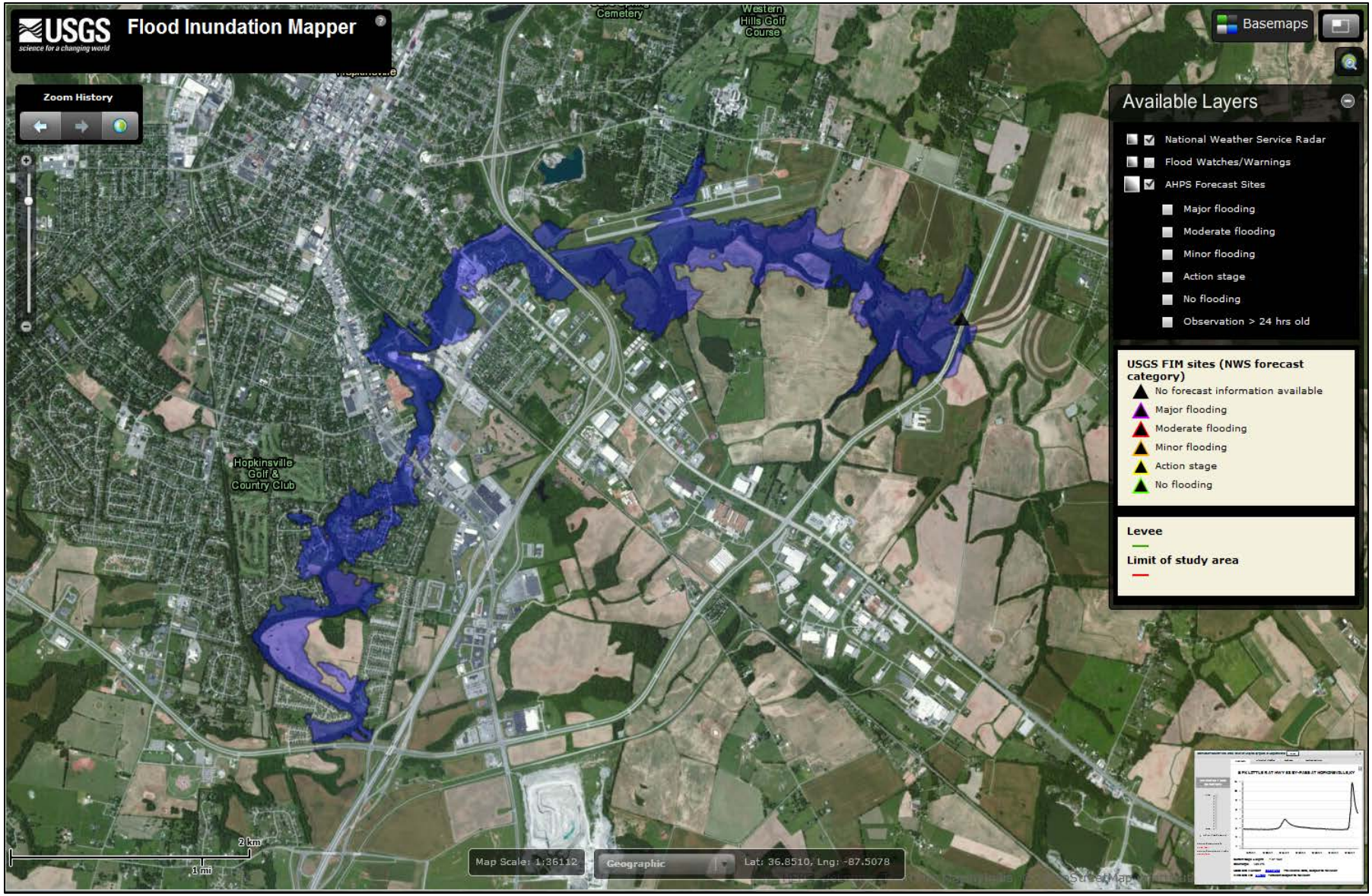
Phase 2B: Flood Inundation Depth Grid



Phase 3: Mapping and Web Implementation

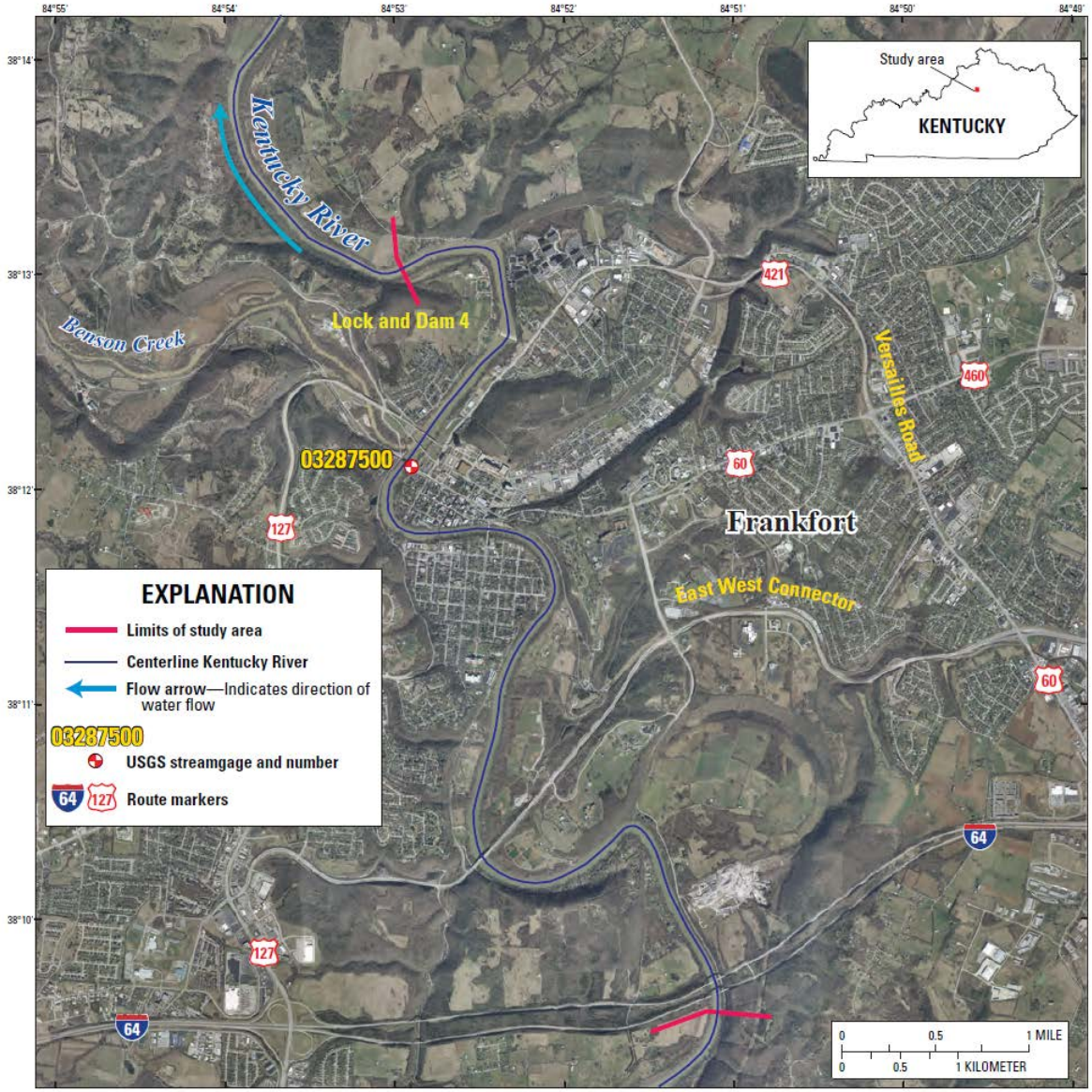


Frankfort, KY – Flood Inundation Project

Project Team

- Local Stakeholder:
  - **Deron Rambo**, Director of Emergency Management & E-911 for City of Frankfort, Kentucky
- Technical Partners:
  - **Mike Griffin**, USGS
    - mgriffin@usgs.gov
    - (502) 493-1913
  - **Jeremiah Lant**, USGS
    - jlant@usgs.gov
    - (502) 493-1949
- National Weather Service Coordinators:
  - **Kris Lander**, NWS
    - kris.lander@noaa.gov
    - (816) 268-3124
  - **Mike Callahan**, NWS
    - mike.callahan@noaa.gov
    - (502) 969-8842 x493

Phase 1: Study Area – Kentucky River



Phase 1: Frankfort, KY **-** Modeling Approach

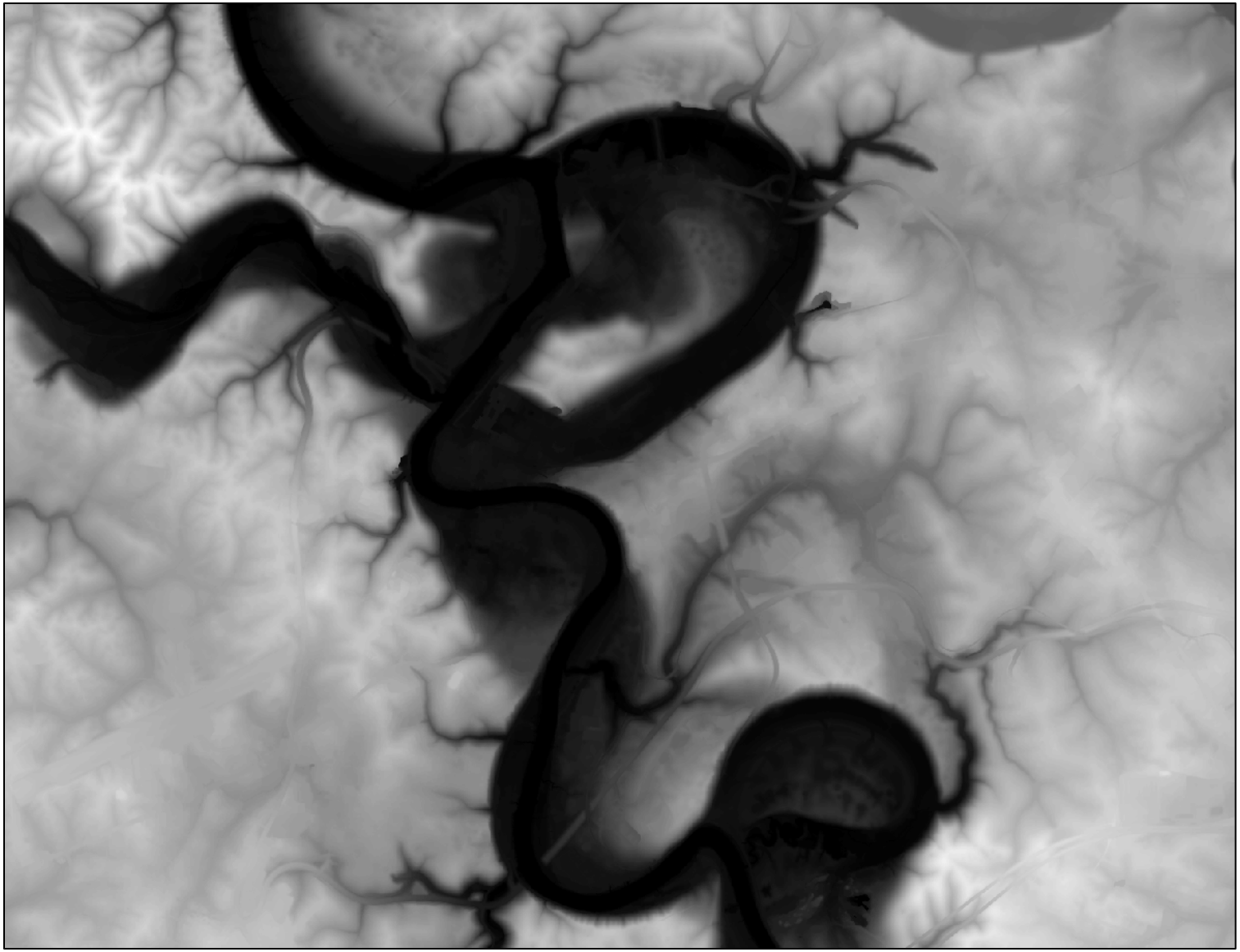
	Stage (ft.)	Elevation (ft.) NAVD88
Highest inundation Stage:	52	513.58
Major Flood Stage:	40	501.58
Moderate Flood Stage:	35	496.58
Flood Stage:	31	492.58
Action Stage:	29	490.58
Lowest inundation Stage:	27	488.58
Gage 0 Datum:	0	461.58

Mapping Interval (ft): 1.0

List of Modeled Stages (ft): 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52

FEMA Elevations for 10, 2, 1, 0.2 % Flood: 10% = 496.0 ft, 2% = 503.0 ft, 1% = 508.0 ft, 0.2% = 510.0 ft

Phase 1: Frankfort, KY – 5 ft LIDAR DEM



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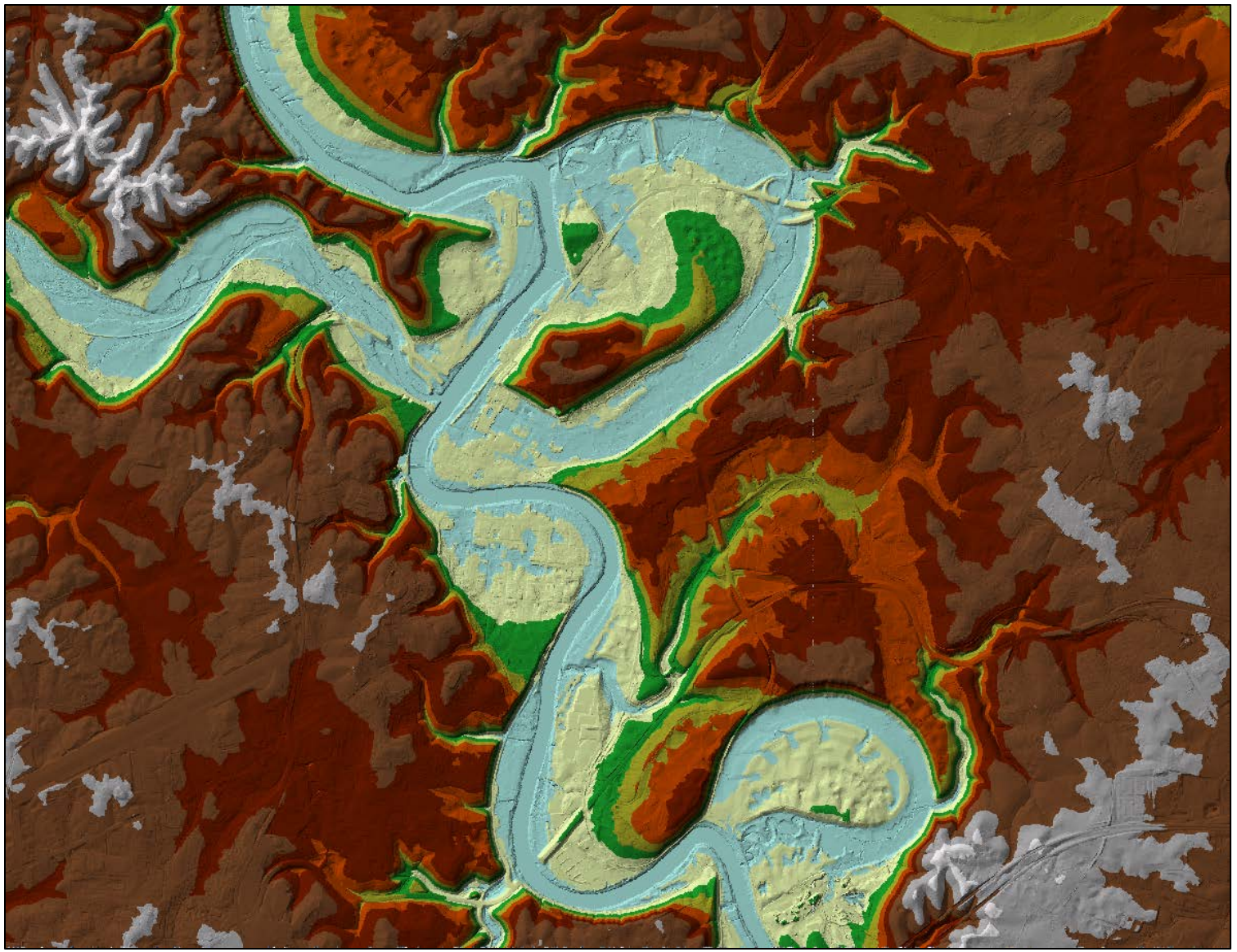

Phase 1: Frankfort, KY – Bathymetry

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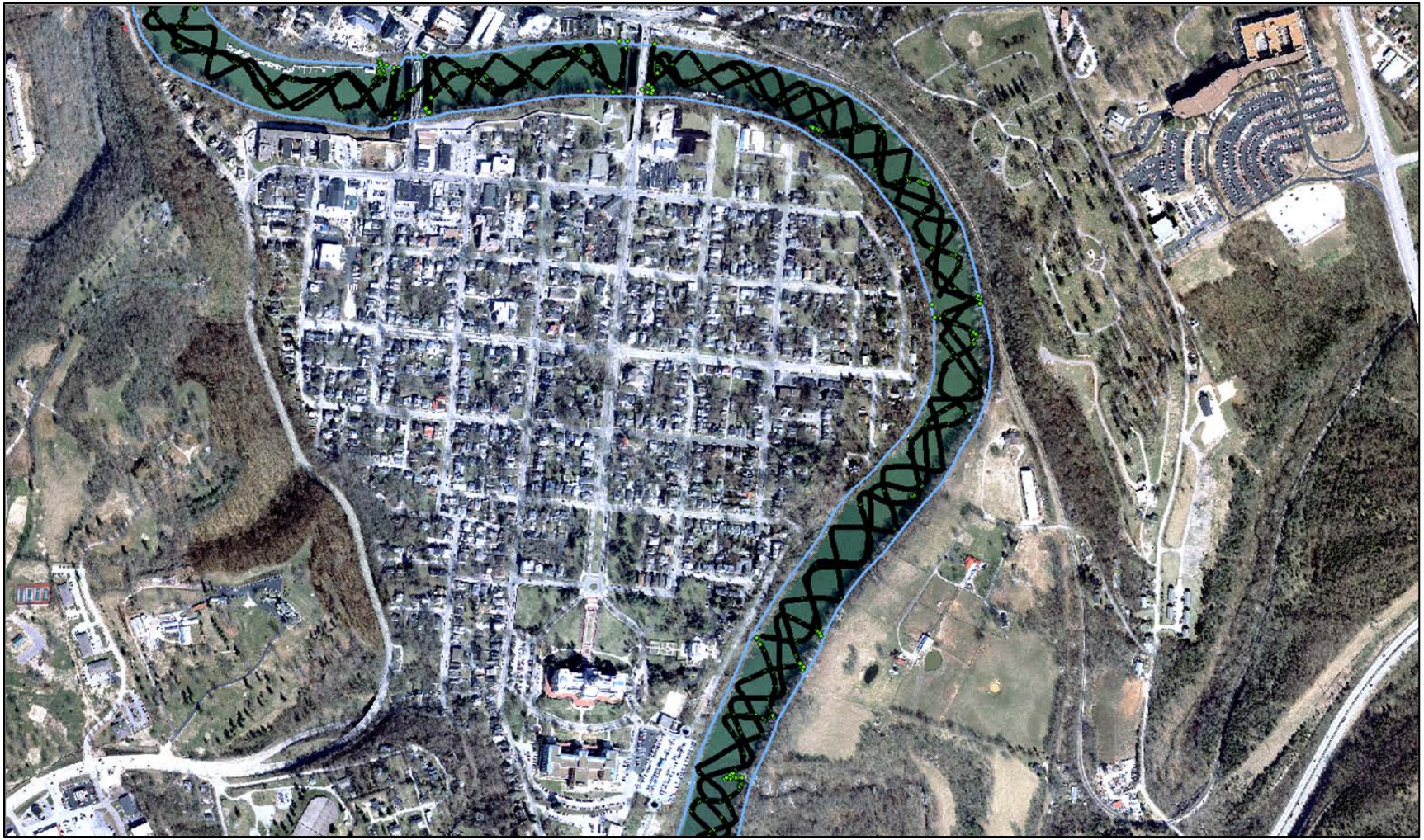
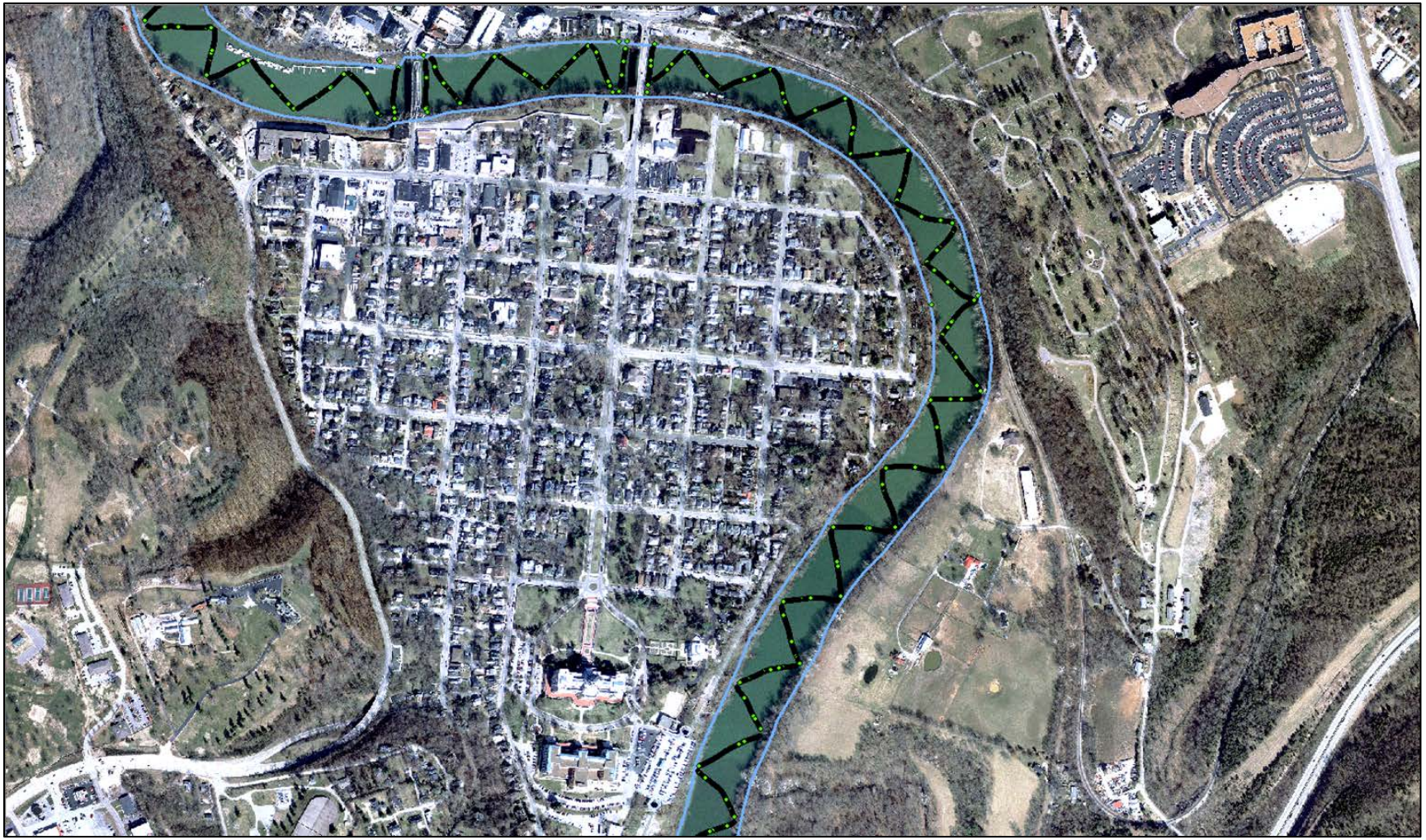
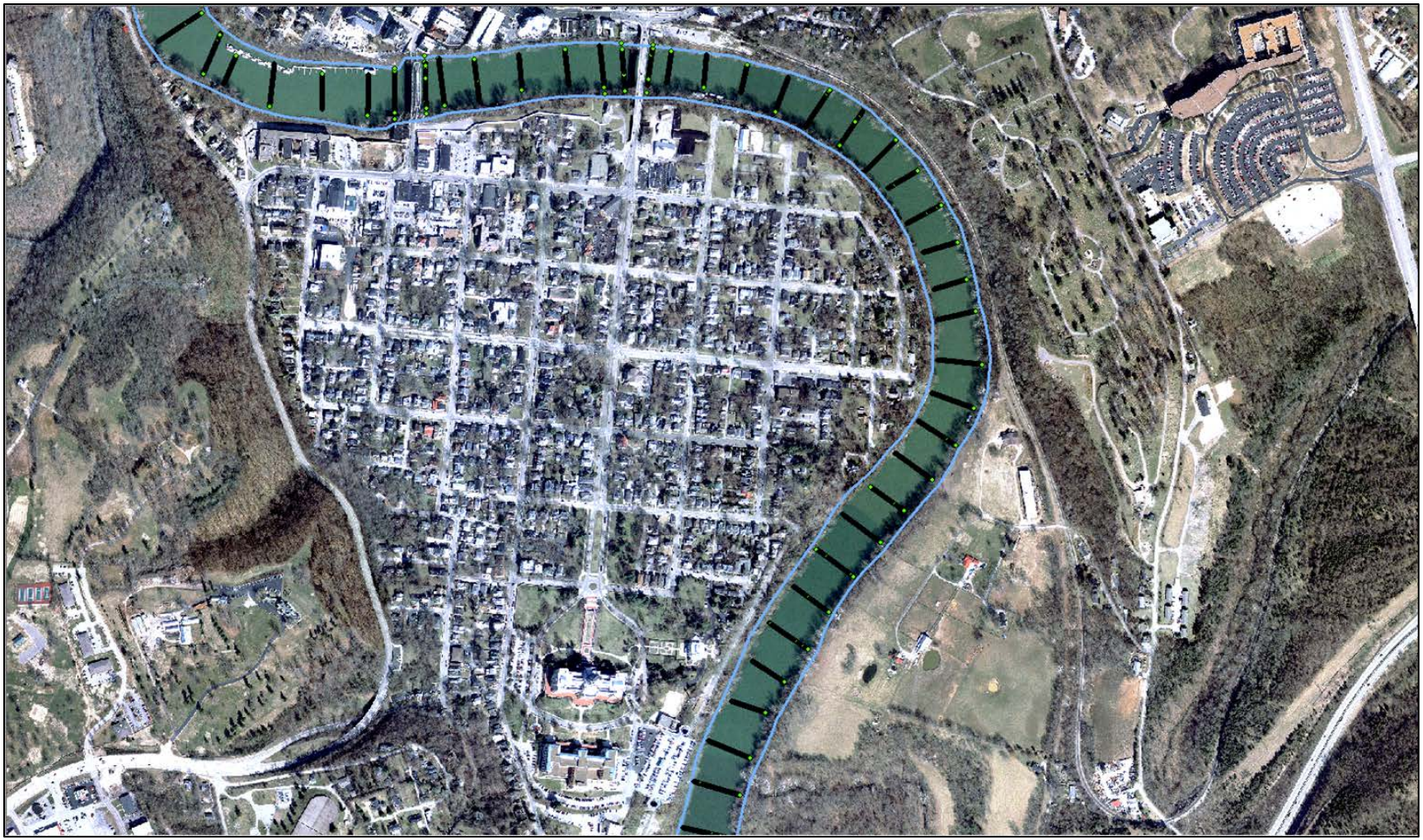
Phase 1: Frankfort, KY – Bathymetry Processing Raw Points



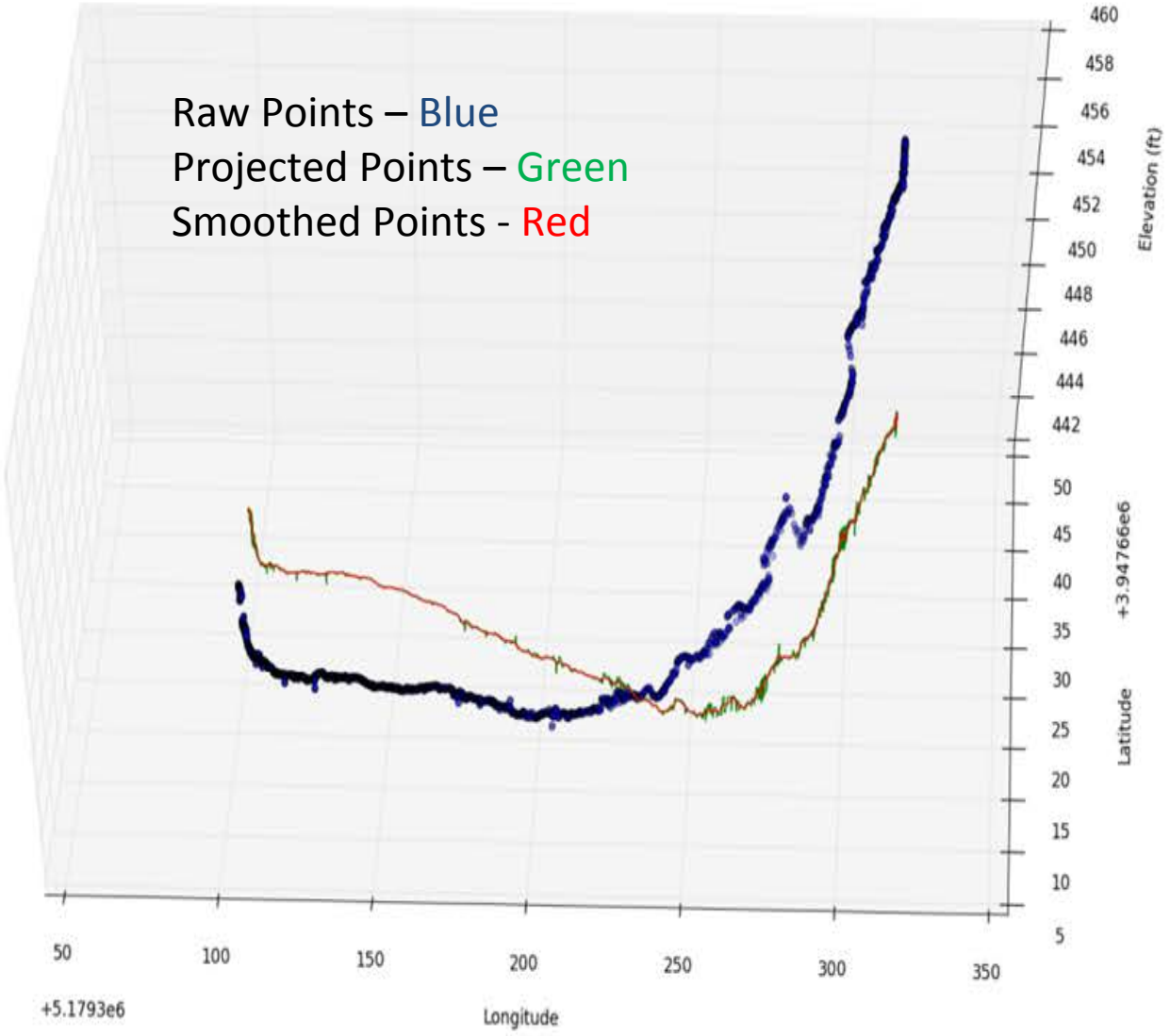
Frankfort, KY – Bathymetry Processing
Cleaned Points



Frankfort, KY – Bathymetry Processing
Projected Points

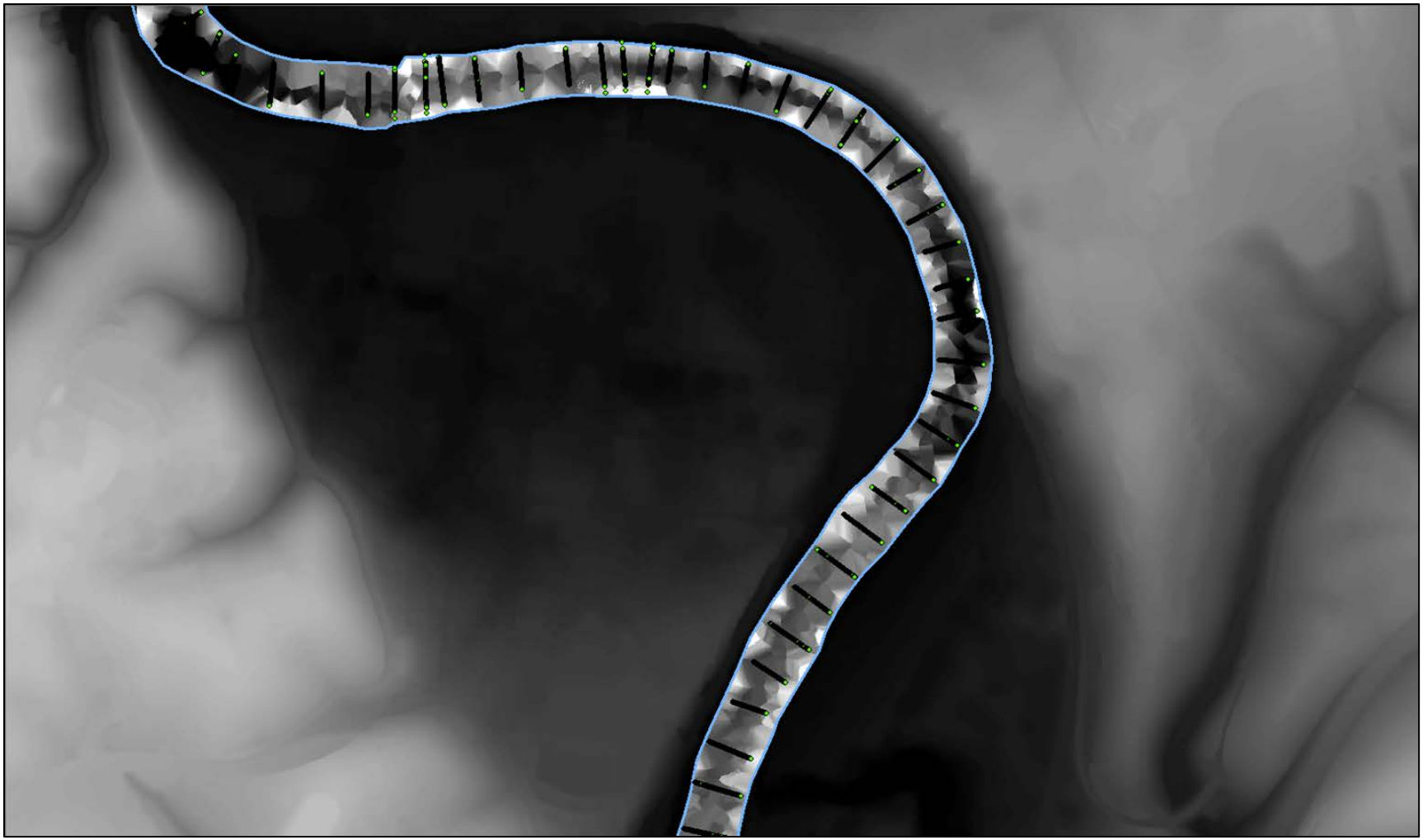


Frankfort, KY – Bathymetry Processing Sample Cross Section

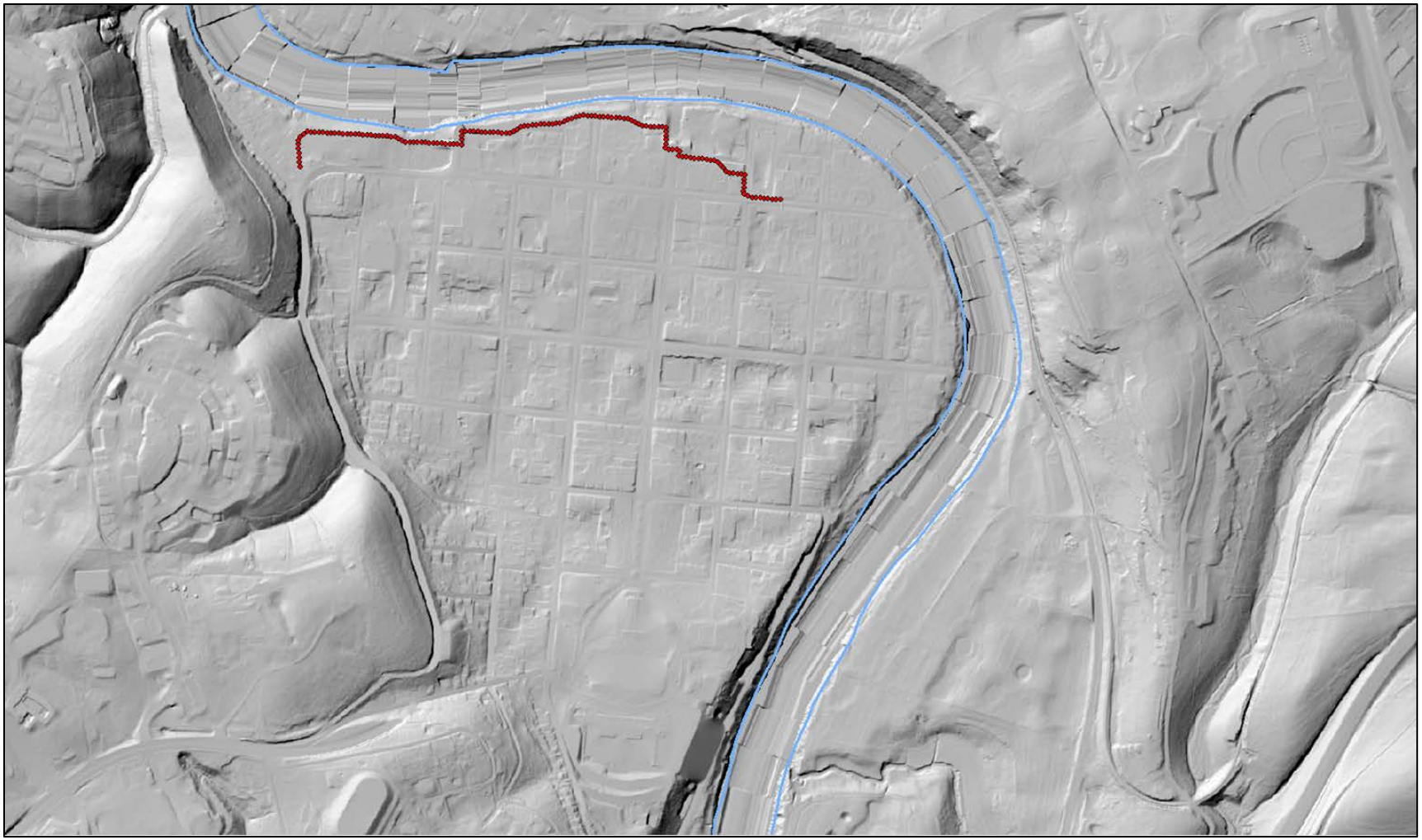


Frankfort, KY – Bathymetry Processing Interpolation

Phase 1: Frankfort, KY – Bathymetry Processing Merge with LIDAR

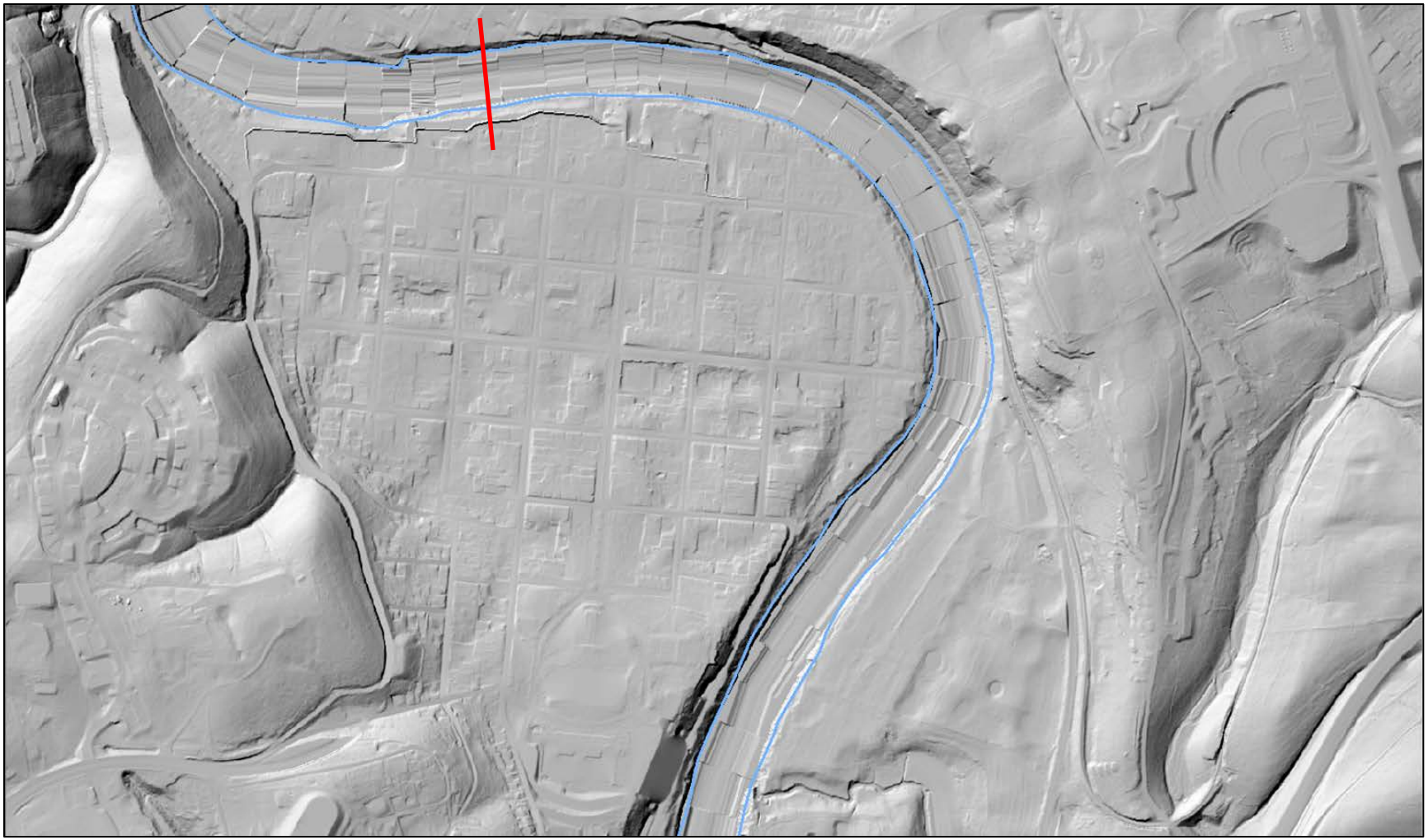


Phase 1: Frankfort, KY – Bathymetry Processing Include Levees



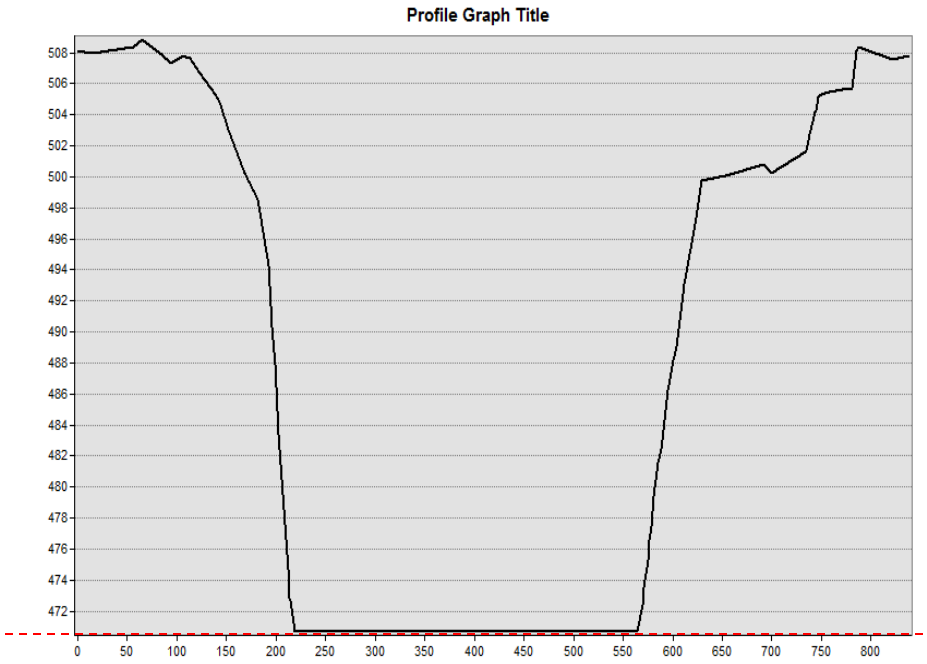
Phase 1: Frankfort, KY – Bathymetry Processing Final DEM

Phase 1: Frankfort, KY – Bathymetry Processing Sample Cross Section

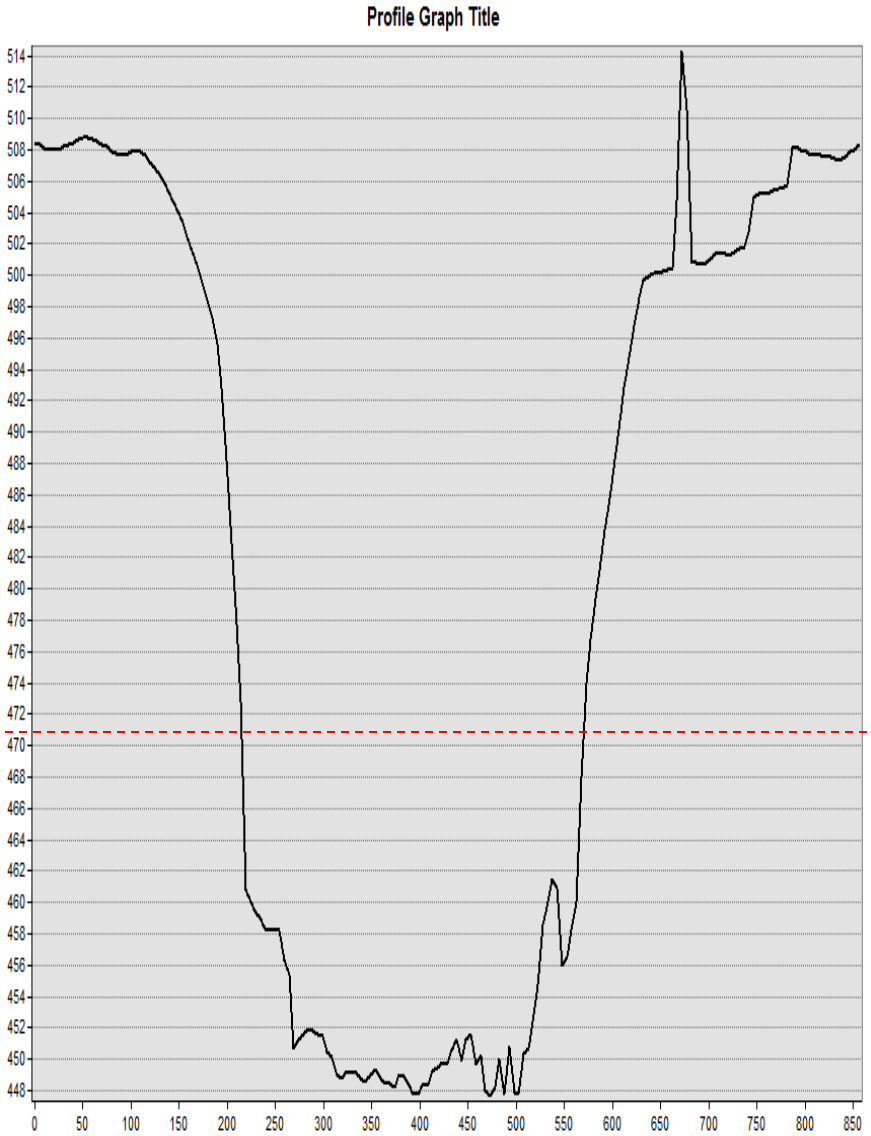


Phase 1: Frankfort, KY – Bathymetry Processing Sample Cross Section

Raw LIDAR

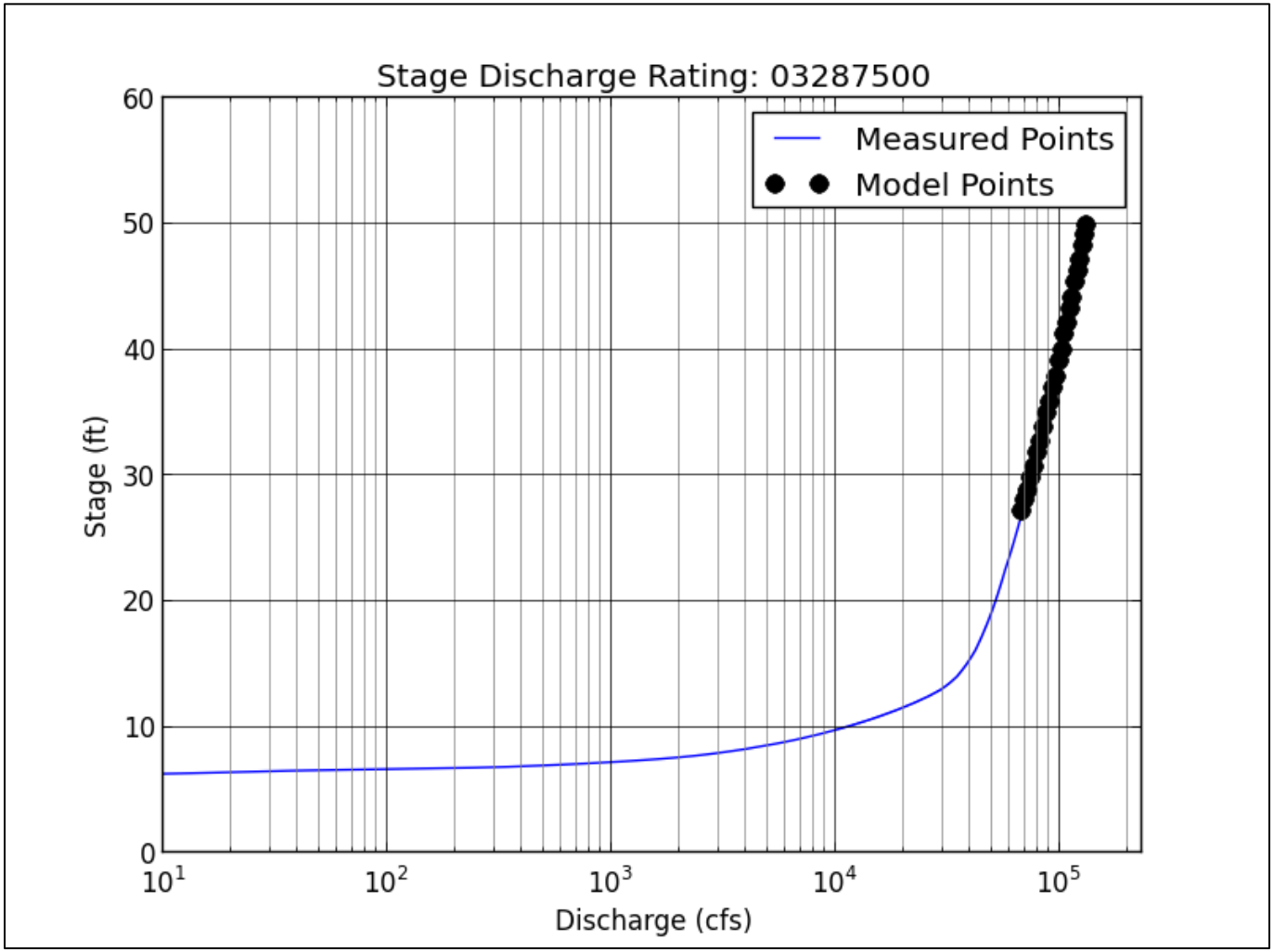


Processed Bathymetry



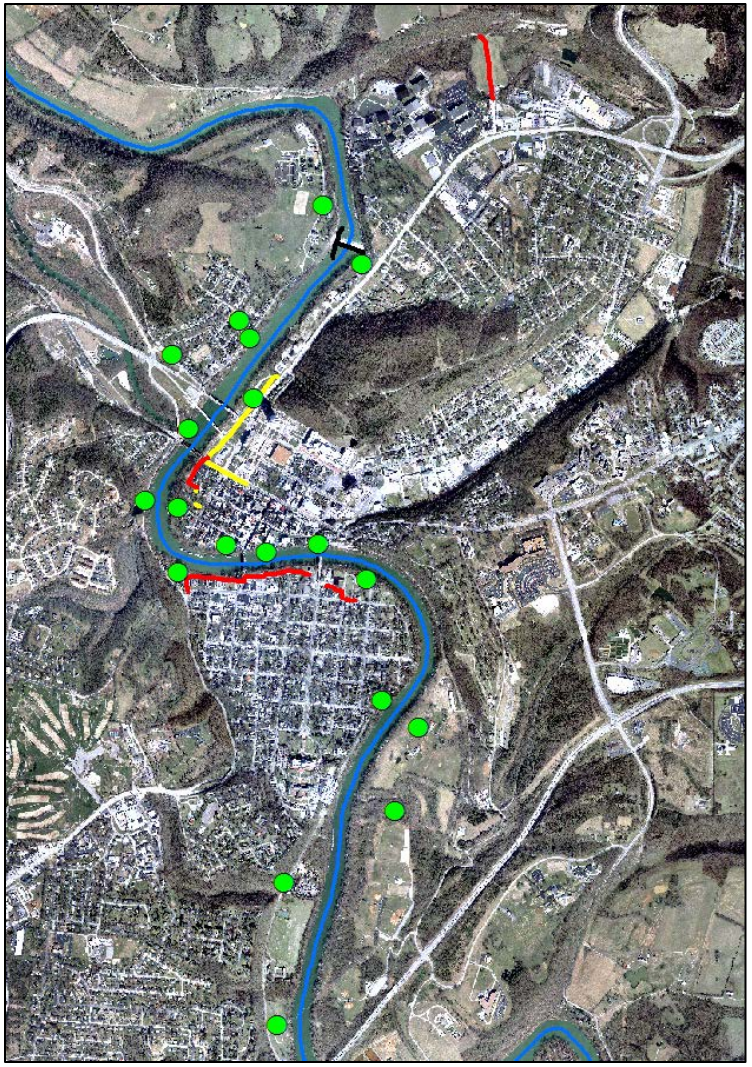
Phase 2A: Frankfort, Kentucky - Model Calibration Stage Discharge Rating

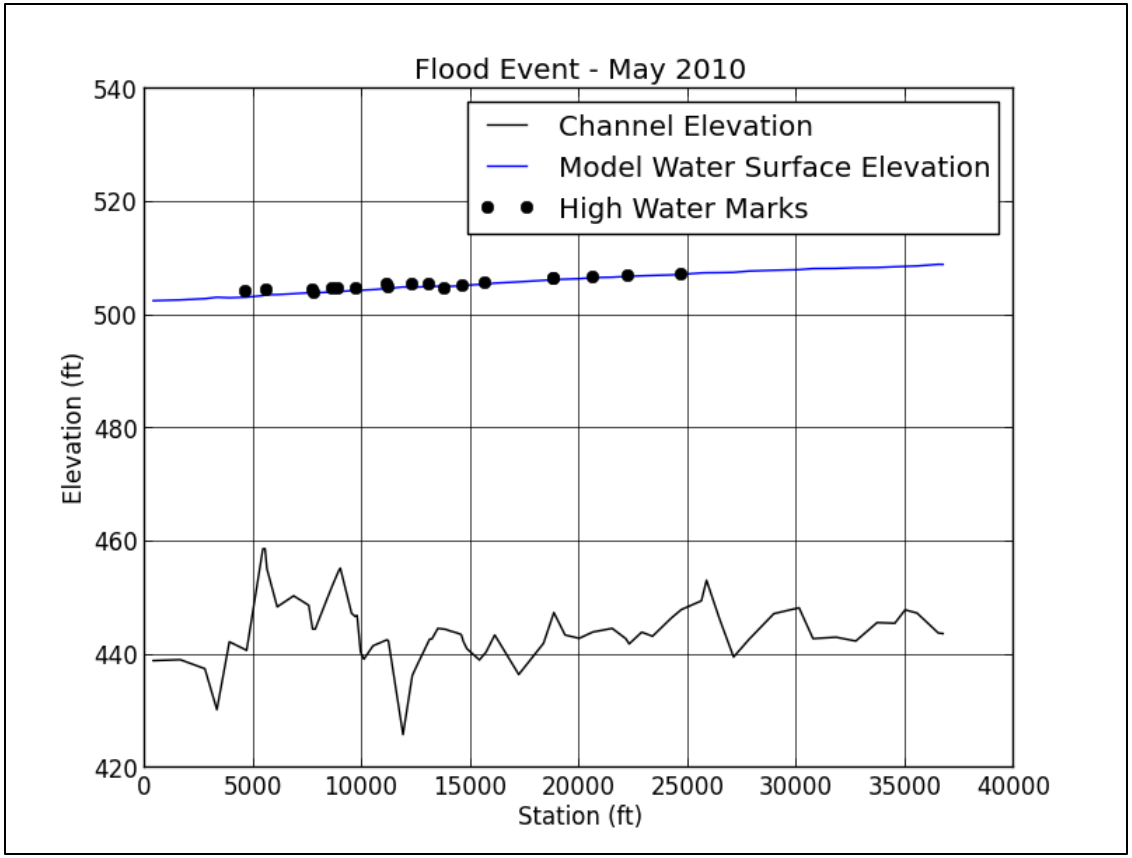
- **Criteria: Water surface profiles are to be within +- 0.5 ft. of the established USGS stage discharge rating.**



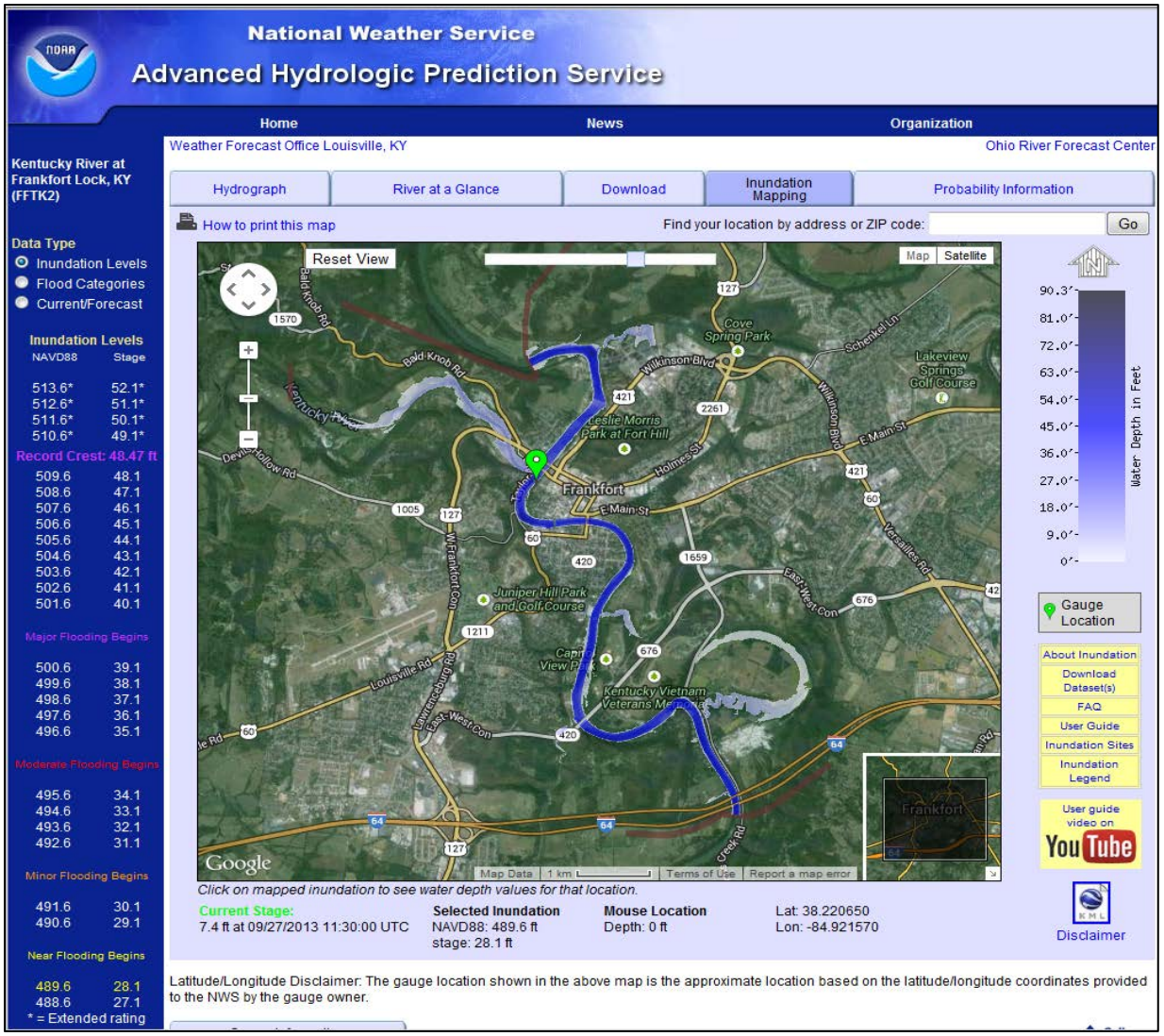
Phase 2A: Frankfort, Kentucky - Model Calibration 2010 Flood Event with High Water Marks

- **Criteria: Water surface profiles are to be within +- 1.0 ft. of the measured high water marks.**



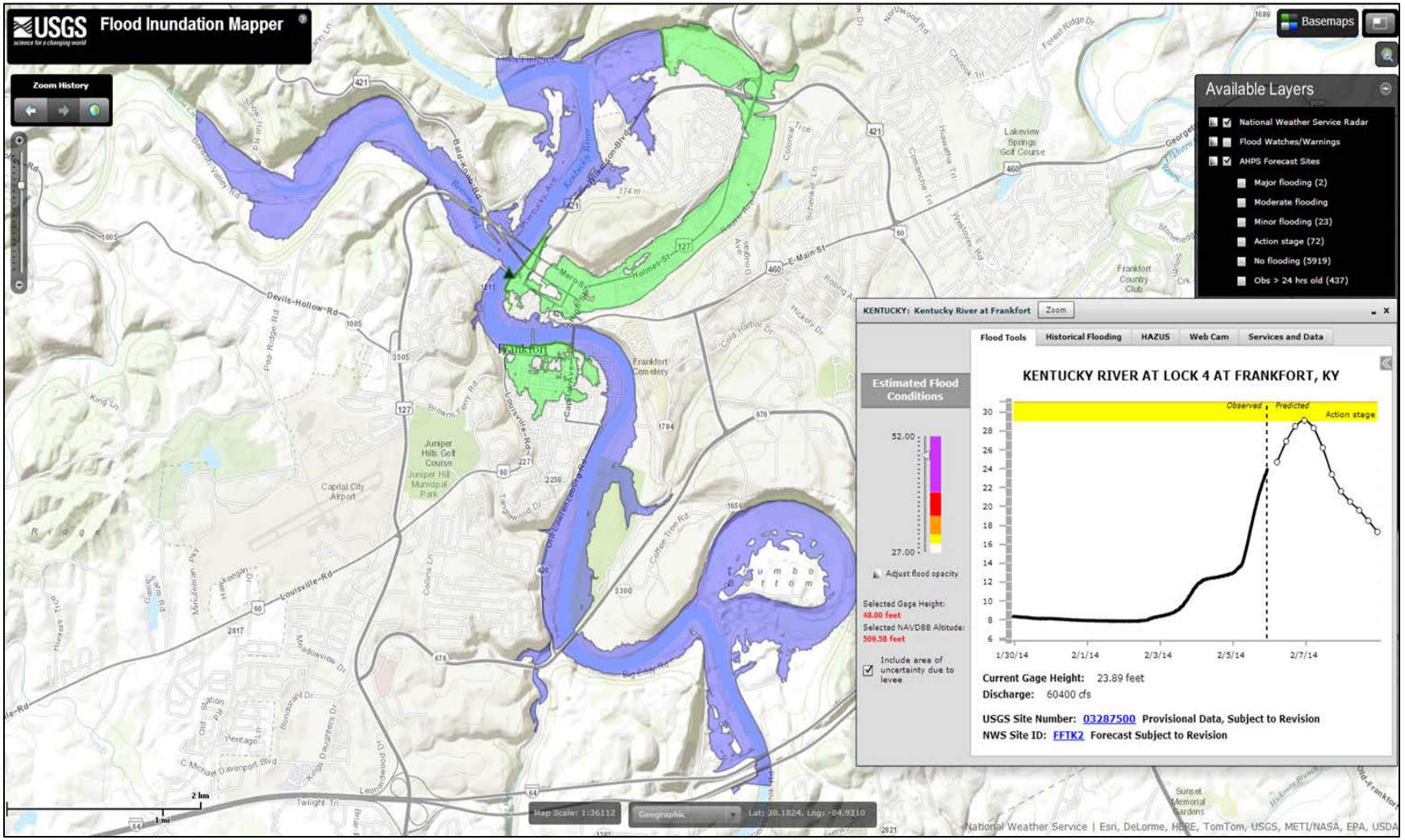


Phases 2B – 3: Frankfort, Kentucky - NWS Flood Inundation Mapper



http://water.weather.gov/ahps2/inundation/inundation_google.php?g_datatype=depth&wfo=lmk&gage=fftk2

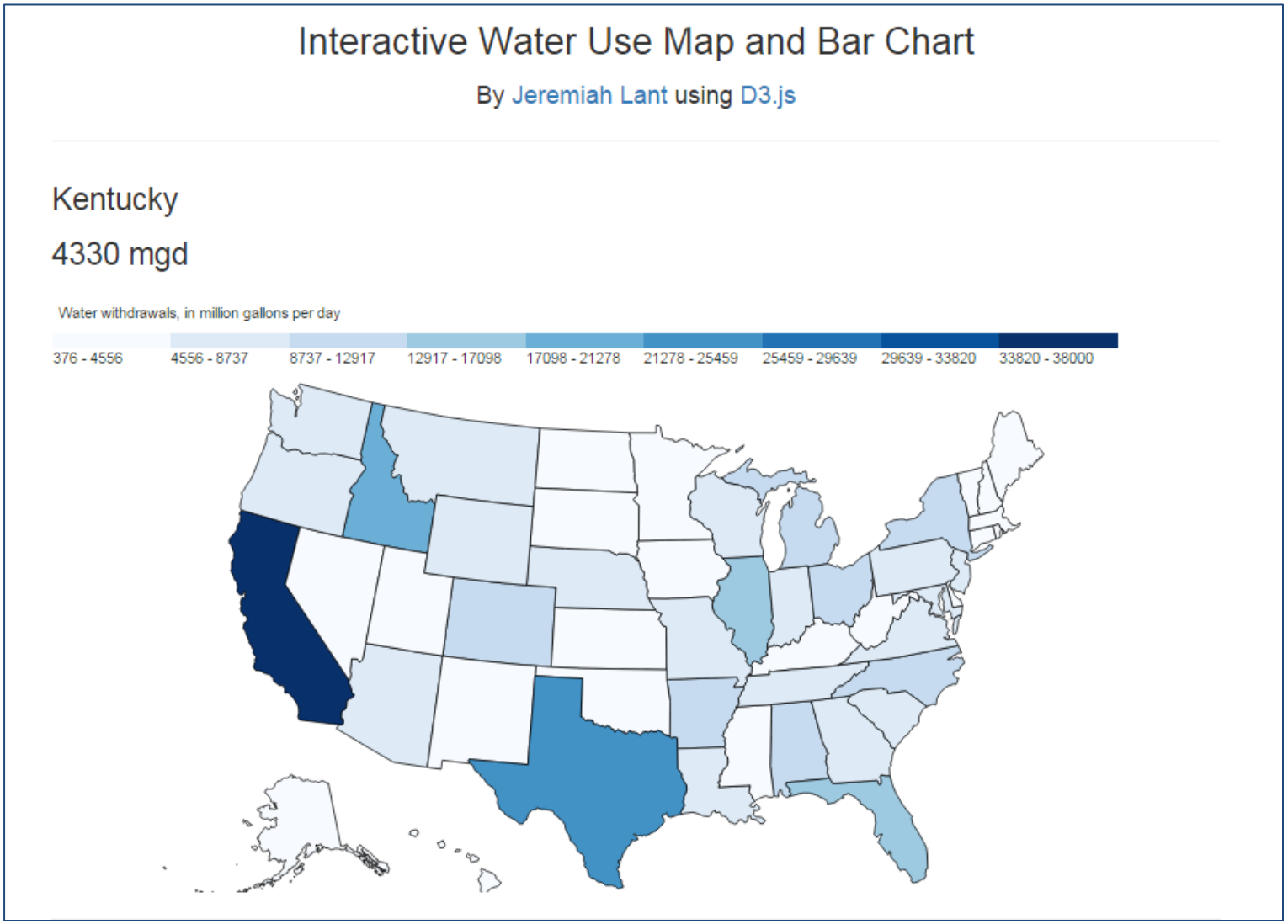
Phases 2B – 3: Frankfort, KY Web Implementation
USGS Flood Inundation Mapper



http://wim.usgs.gov/FIMI/FloodInundationMapper.html

Questions?

Web Development and Data Visualization



http://jlant-usgs.github.io/wateruse-map-d3/