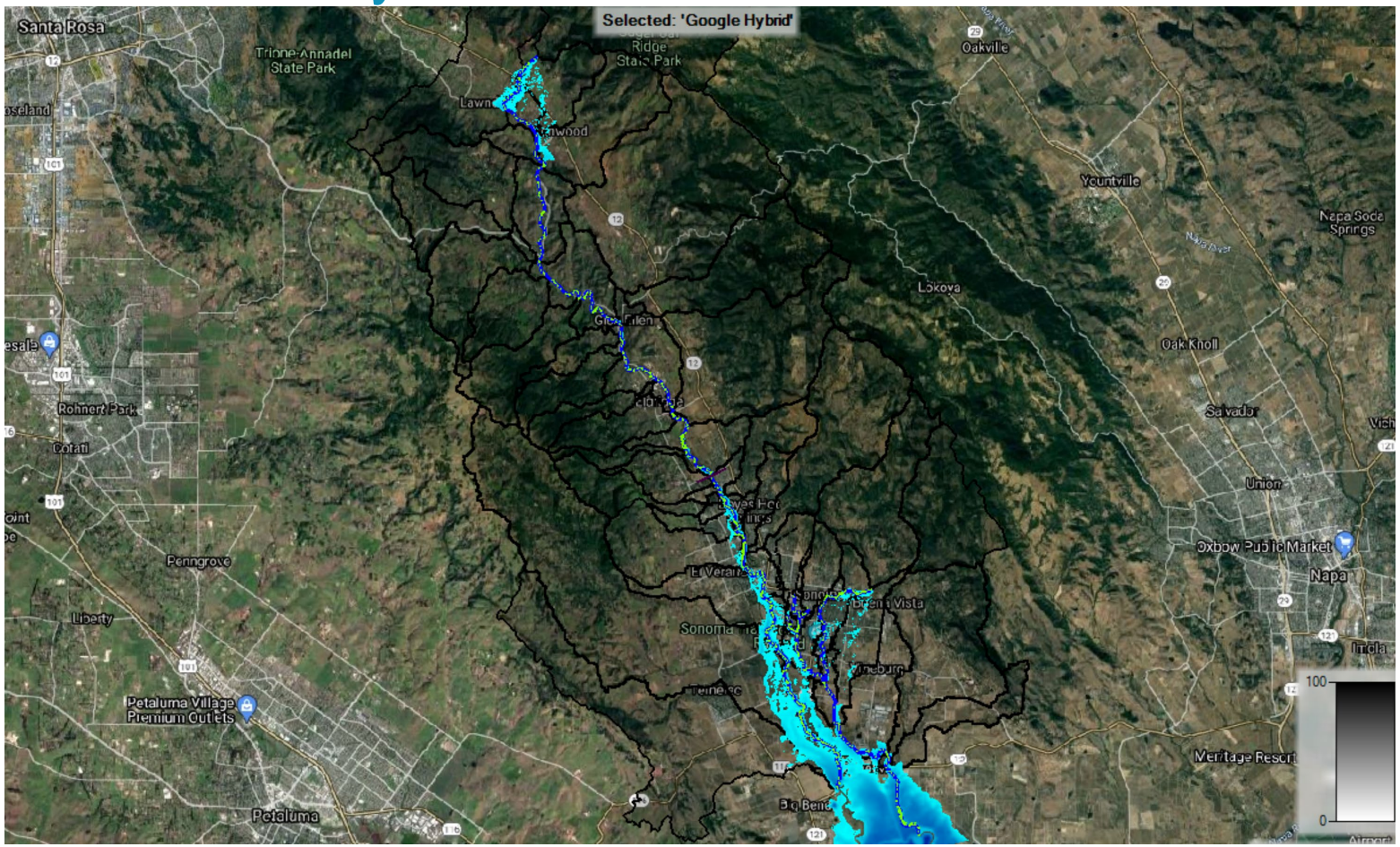
Sonoma Creek – Preliminary HMS/RAS results



October 26, 2021

Sonoma Valley Hydrology and Hydraulics – Project Overview

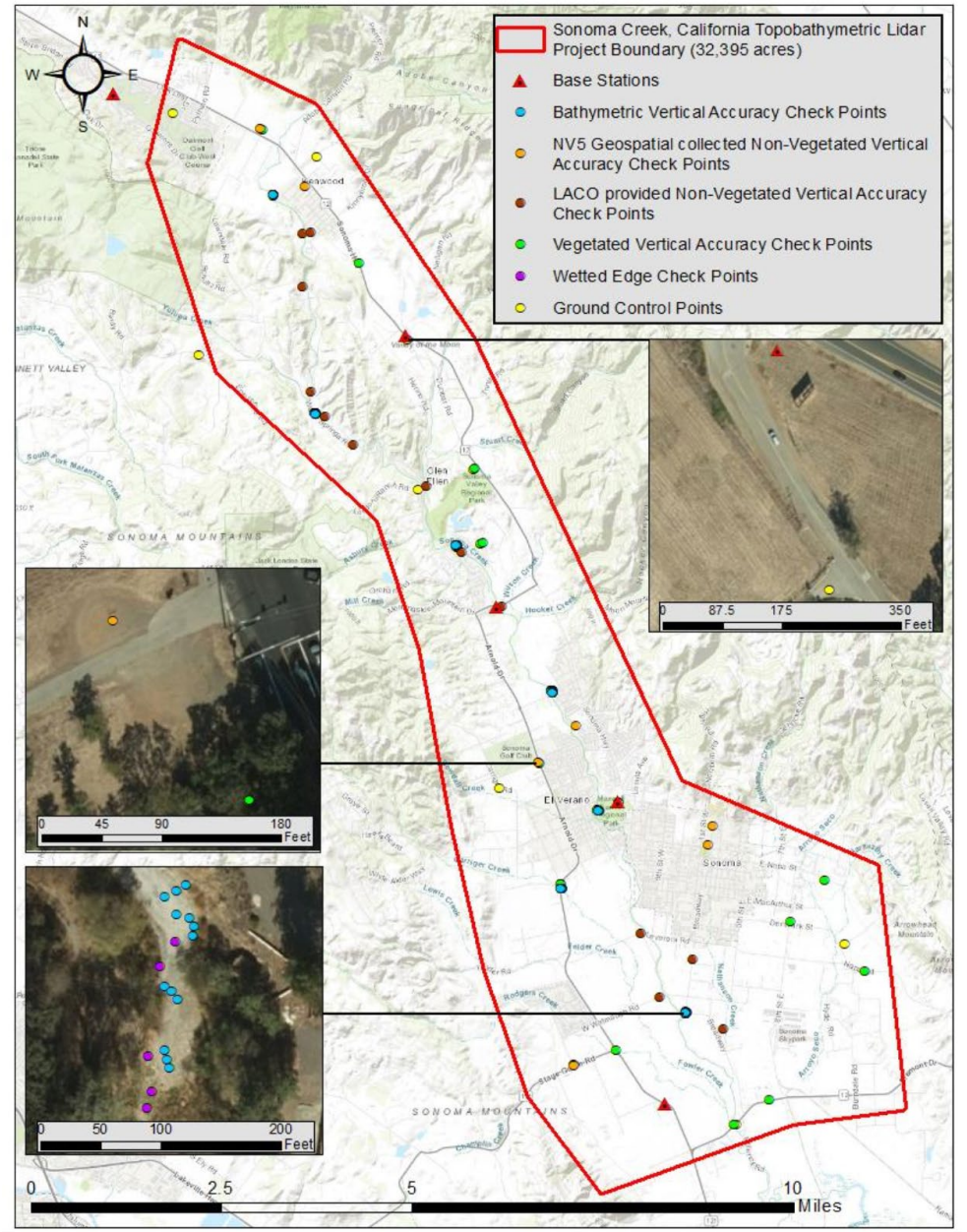
- An integrated regional hydrologic and 1D/2D hydraulic model is under development
- The model domain includes hydrology for the full Sonoma Creek watershed
- The hydraulic model domain includes for the channel (1D) and floodplain (2D) includes
  - **Sonoma Creek** from Watmaugh Road to upstream of Highway 12 in Kenwood
  - **Nathanson Creek** Watmaugh Road to Lovall Valley Road
  - **Fryer Creek** from Nathanson Creek to W Napa Street
- The models are being completed with the latest tools and methods including
  - A green LiDAR topobathymetric terrain surface covering the full hydraulic model domain
  - Ground surveys for bridges, culverts and weirs
  - New rainfall and streamflow gages for February 2019 calibration event
  - Updated flow frequency curves for long-recording USGS streamflow gage at Agua Caliente Road
  - Compliance with the 2020 Sonoma County Flood Management Design Manual

Sonoma Water

ESA

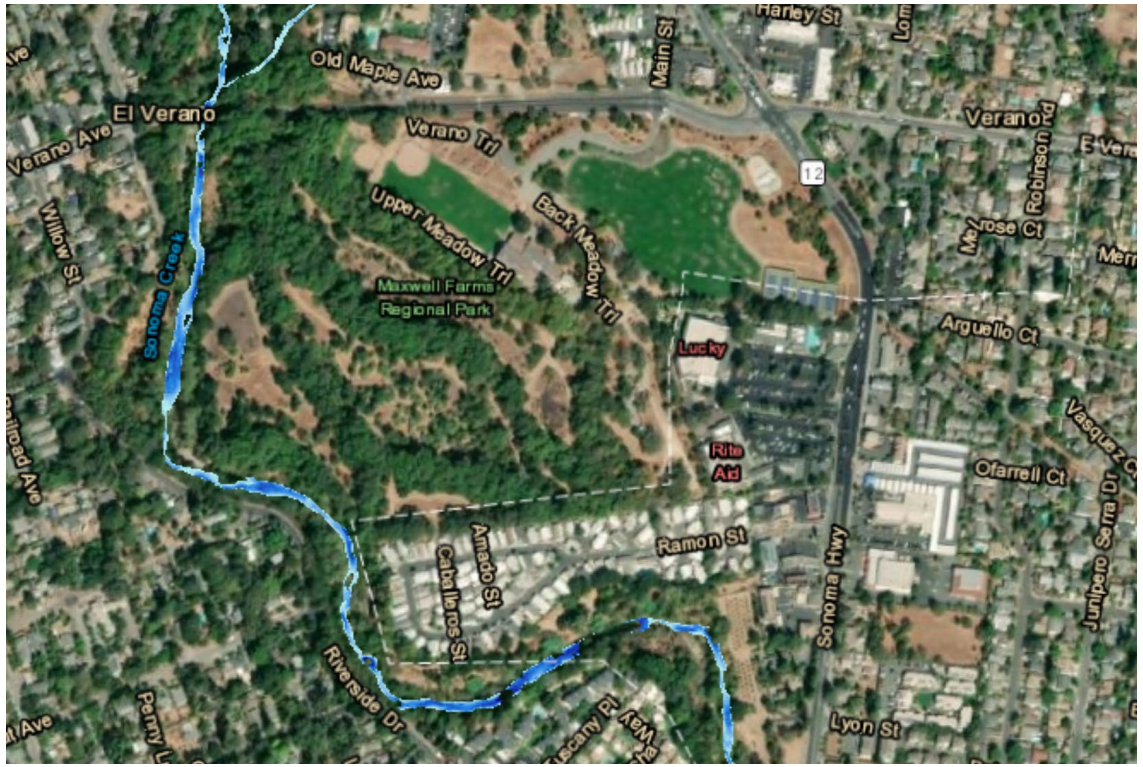
Topobathymetric data collection

- Green LiDAR topobathymetric data collected by Quantum Spatial Incorporated (QSI)
- 02/04/2021-02/06/2021
- High degree of vertical and horizontal accuracy across study area
- **Deliverables**
  - 3 ft Topobathymetric ESRI Grids and GeoTiFFs
  - 3 ft depth raster
  - 1.5 ft green and NIR sensor intensity images
  - Water's edge breaklines
  - LAS v1.4 points (all returns)

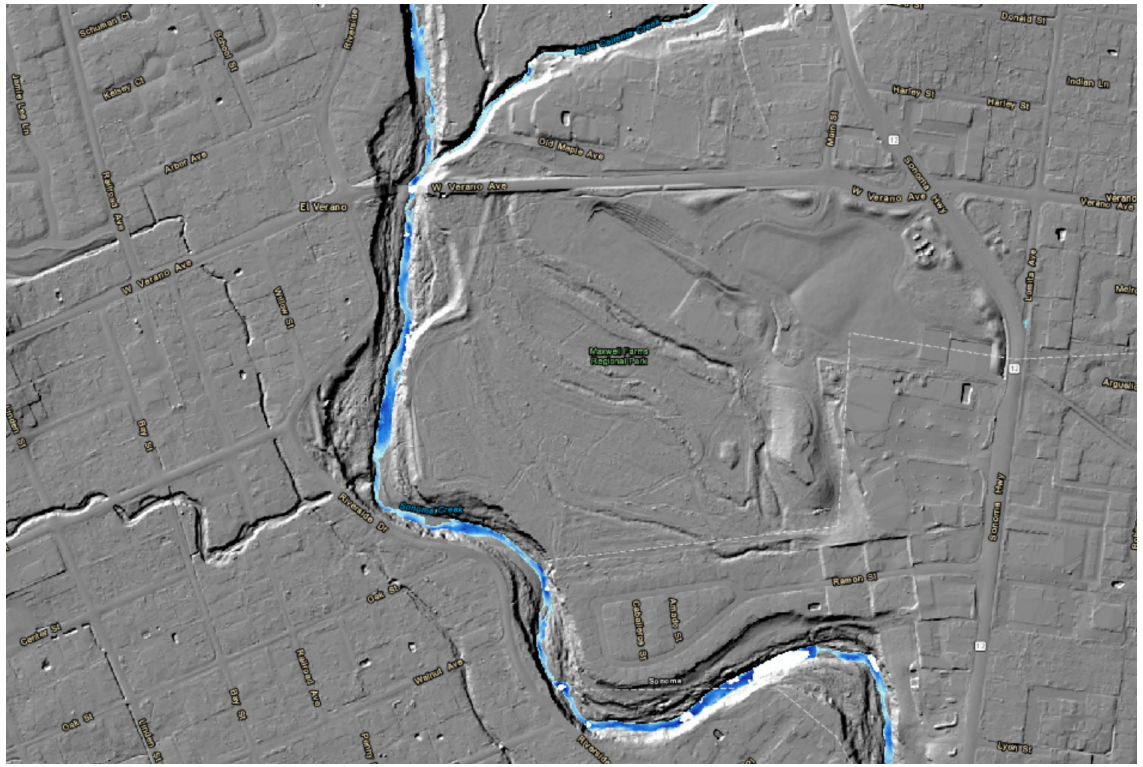


Topobathymetric deliverables

Depth raster for flight period (02/04/2021-02/06/2021)



3ft Topobathymetry (with depth raster)



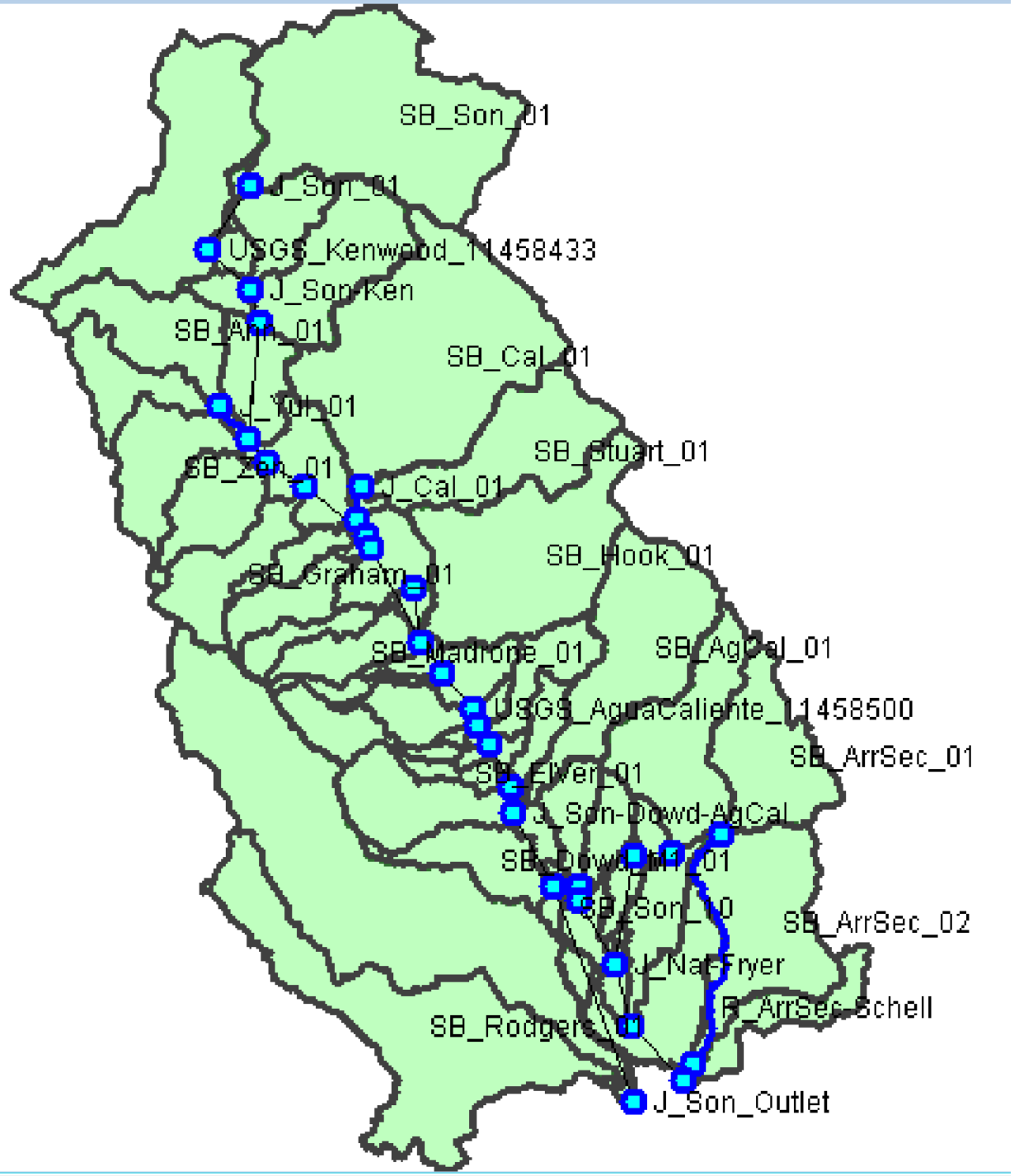
Ground surveys

- Ground survey data collected for bridge geometry and cross-sections at 30 structures
- **Deliverables:**
  - Raw survey point data
  - Bridge workups in CAD and PDF
  - Georeferenced database of photos at each structure
- Collected by LACO associates

SHEET INDEX

Hydrologic model

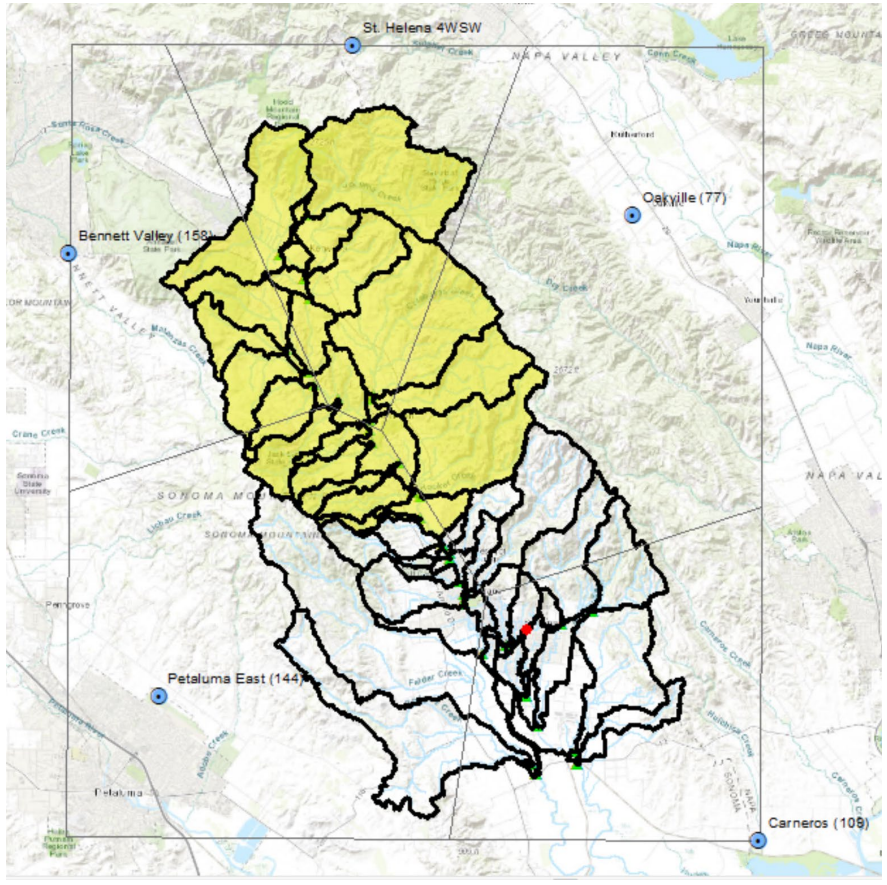
- A fully new hydrologic model developed in the latest version of HEC-HMS (v4.8) has been completed by ESA
- Model scenarios developed for 2 observed events (1) New Years Eve 2005, and (2) February 26-27, 2019
- Model scenarios developed for 6 design events
  - 2-year, 5-year ,10-year, 50-year, 100-year, 500-year
- Parameterization follows Sonoma Water 2020 FMDM
- **Deliverables**
  - Finalized HEC-HMS model



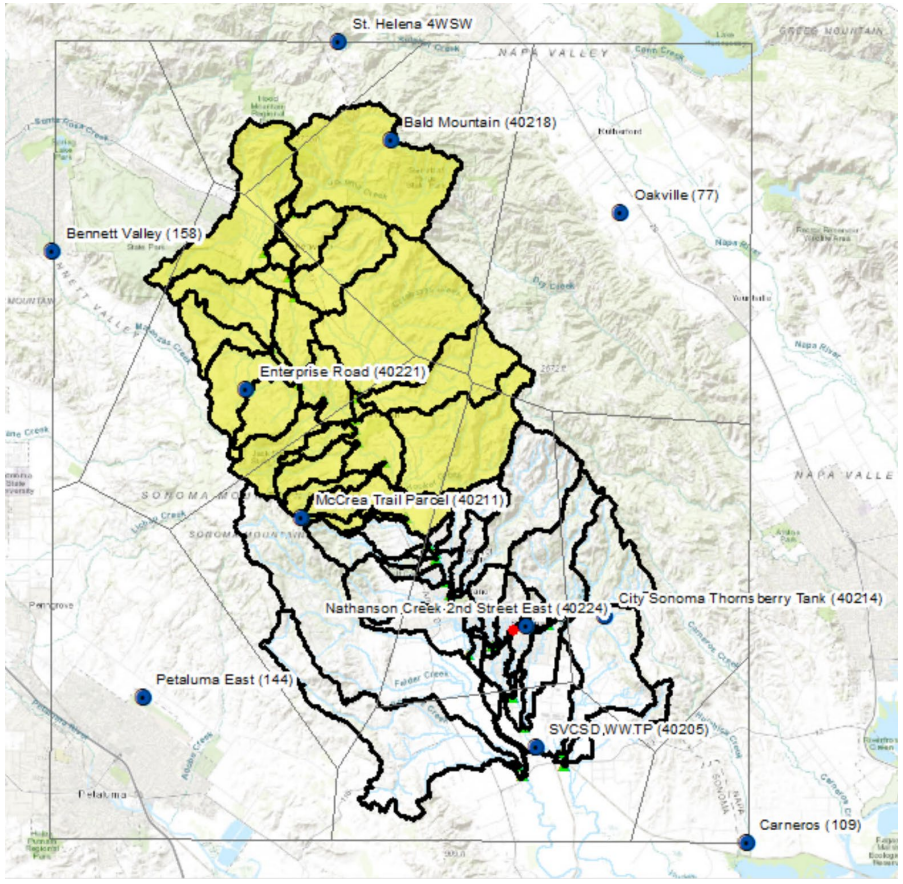
Hydrologic model – New Year's Eve 2005 event

- Preliminary findings suggest incomplete spatial rainfall
- New One Rain gage network used fill in rainfall for 2005 event substantially improving model results

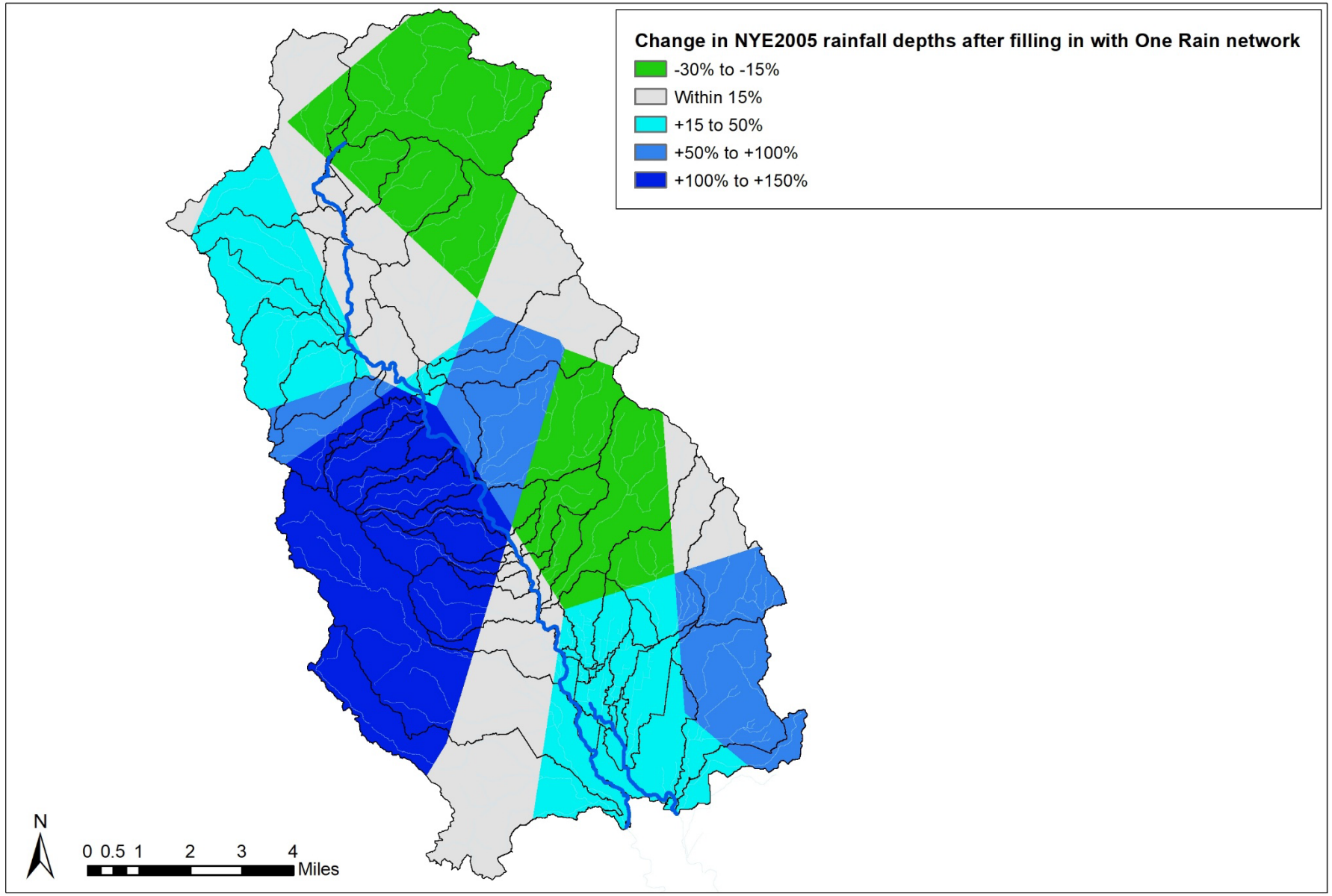
NYE05 Gages, Theissen Polygons



Feb2019 Gages, Theissen Polygons



Change in NYE2005 rainfall depths after filling in with One Rain network



New Year's Eve 2005 event results comparisons

- Model results, even at very high antecedent moisture conditions (AMCIII), show missing volume (Figure 1)

- After filling in rainfall data with One Rain network, volume accuracy improves significantly (Figure 2)

Figure 1. Results with preliminary rainfall

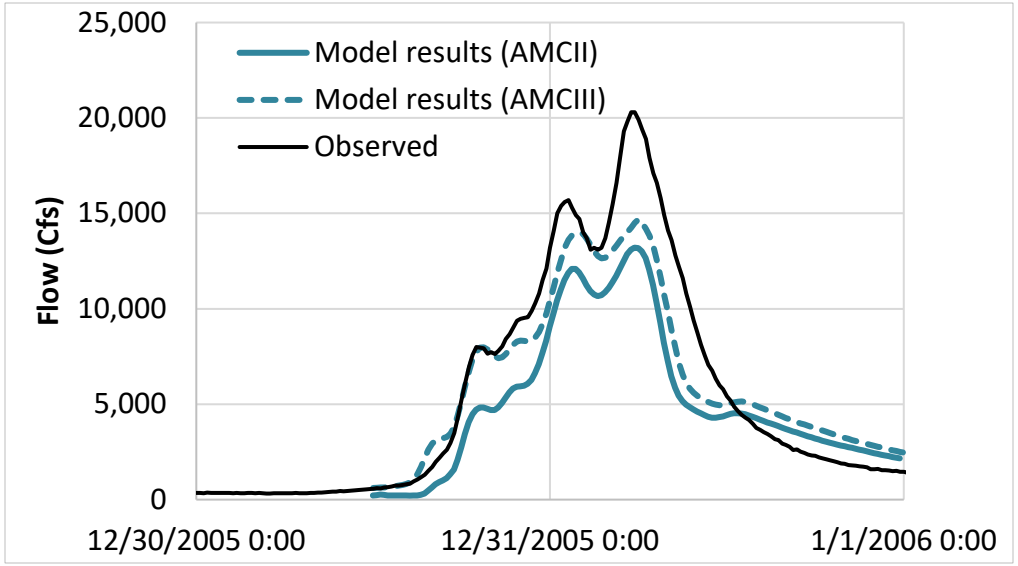
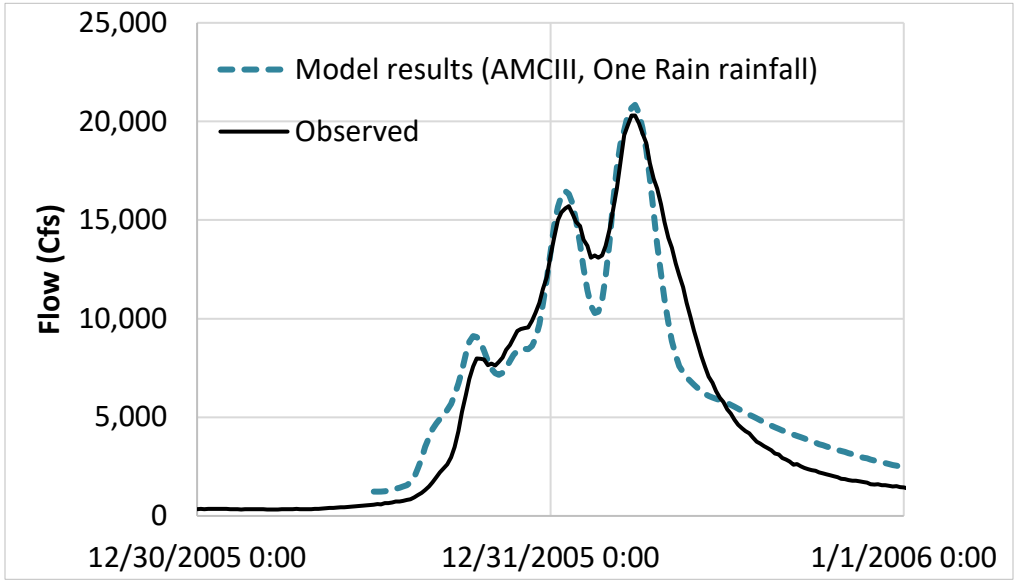


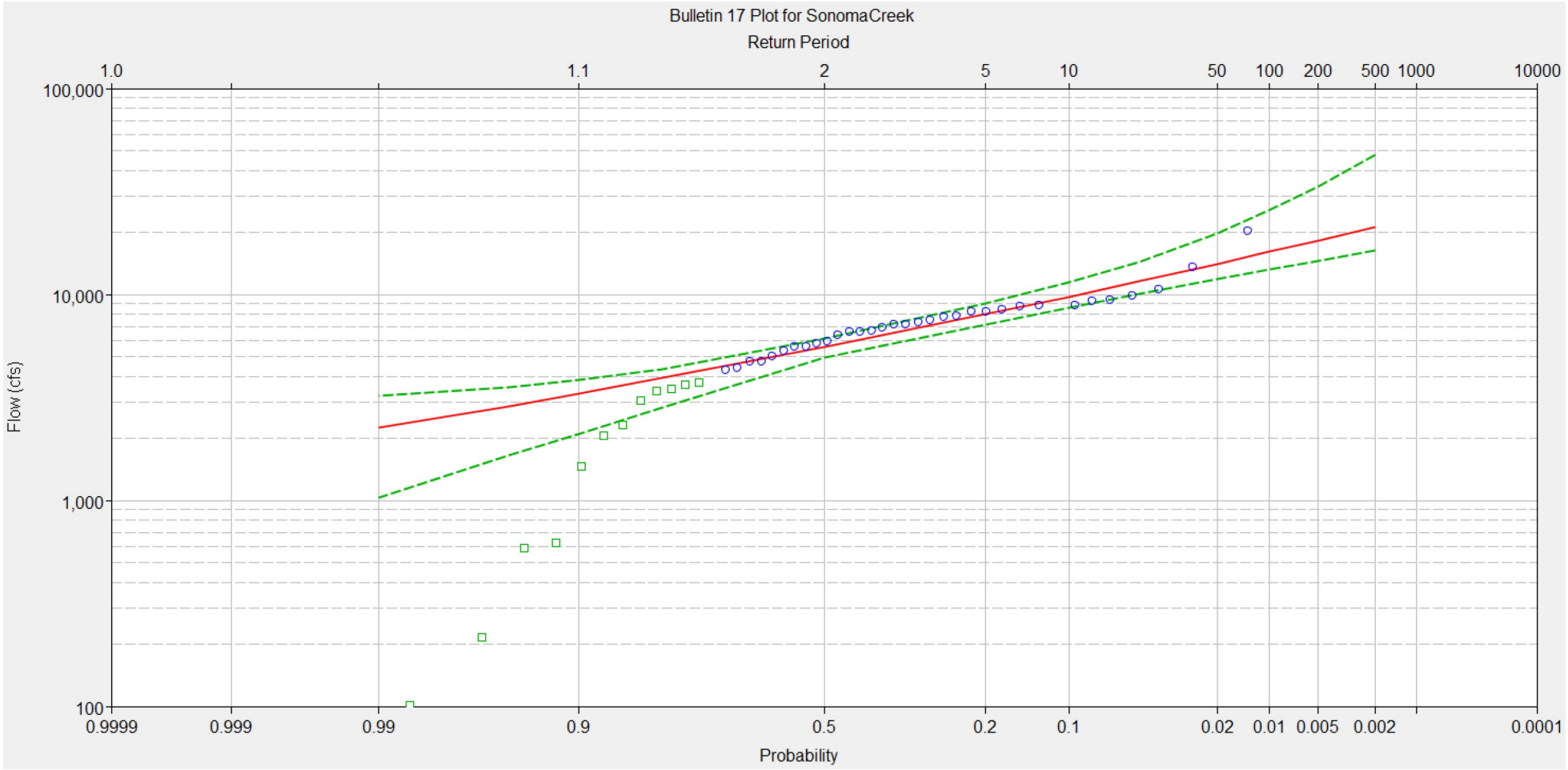
Figure 2. Results with filled in rainfall



Note: Results reflect RAS output

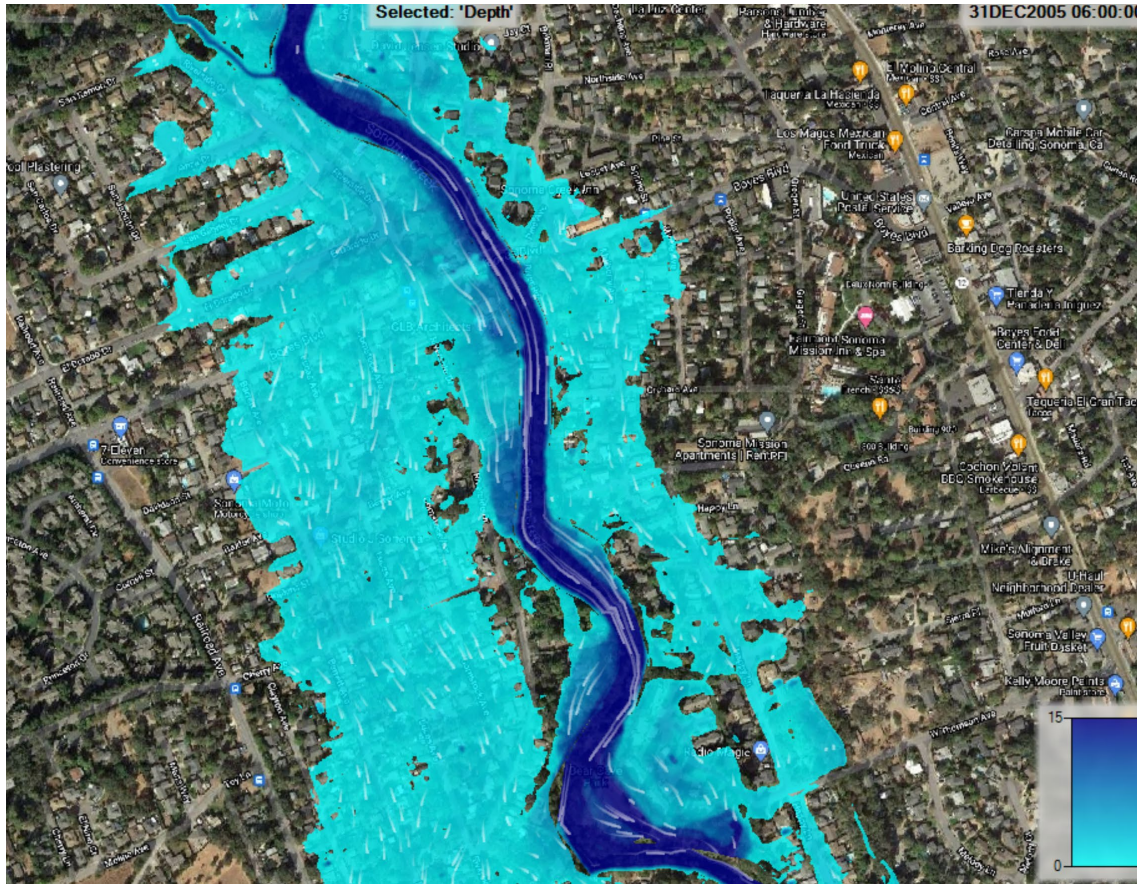
New flow frequency – USGS Agua Caliente gage

- Reflects latest standard of practice including USGS updates to California specific data (USGS 2010, 2012) and general flow frequency methods documented in Bulletin 17C (USGS, 2019)



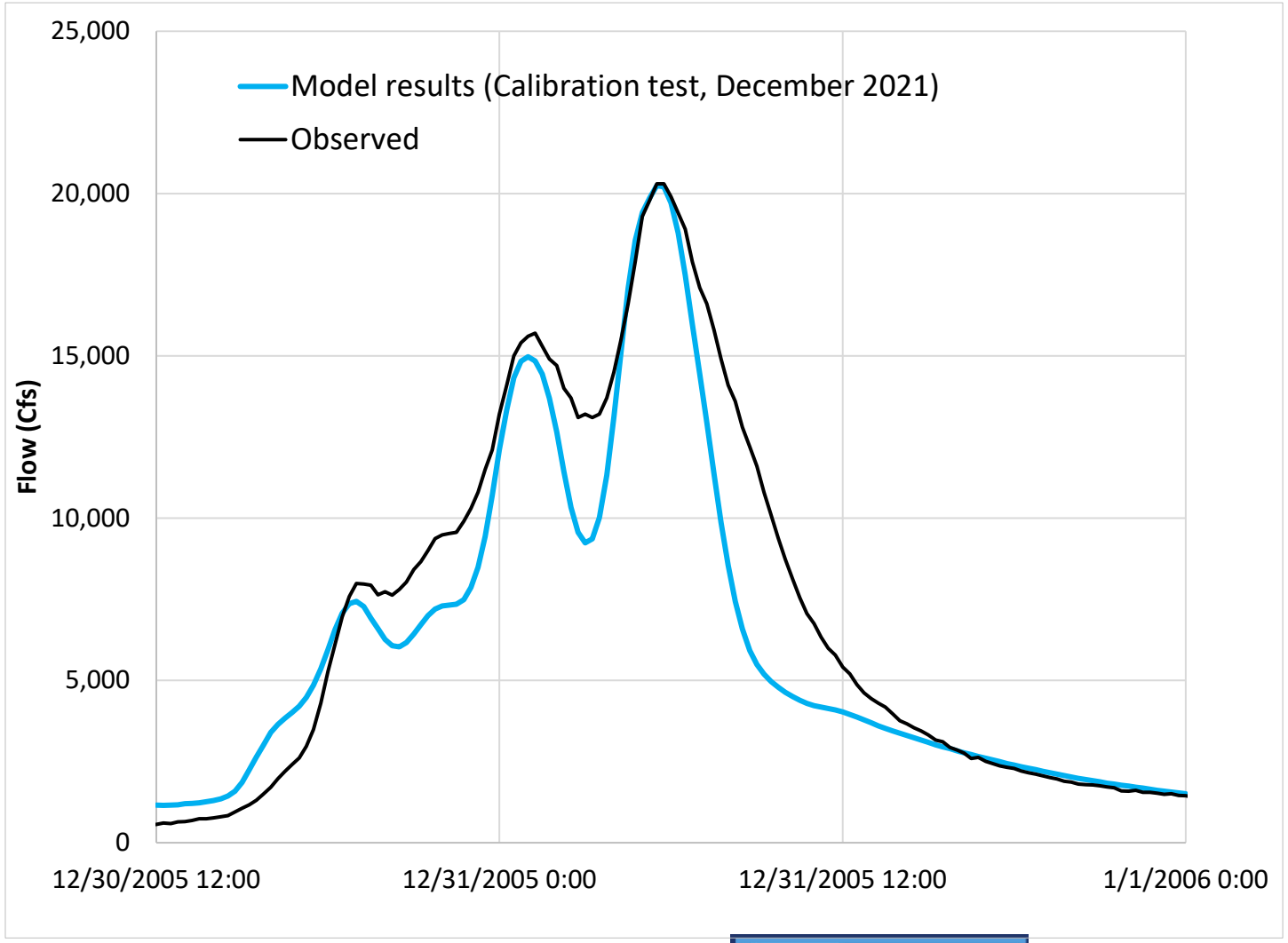
Hydraulic model

- New regional hydraulic model developed in latest version of HEC-RAS (v6.1)
- Channel and structures in 1D
- Floodplain and overbank areas in 2D
- 2D modeling significantly enhances understanding of flood processes as it preserves storage and routing aspects for flows overtopping the main channel area
- **Deliverables**
  - Regional 1D/2D HEC-RAS model calibrated to 2 observed and 6 design events



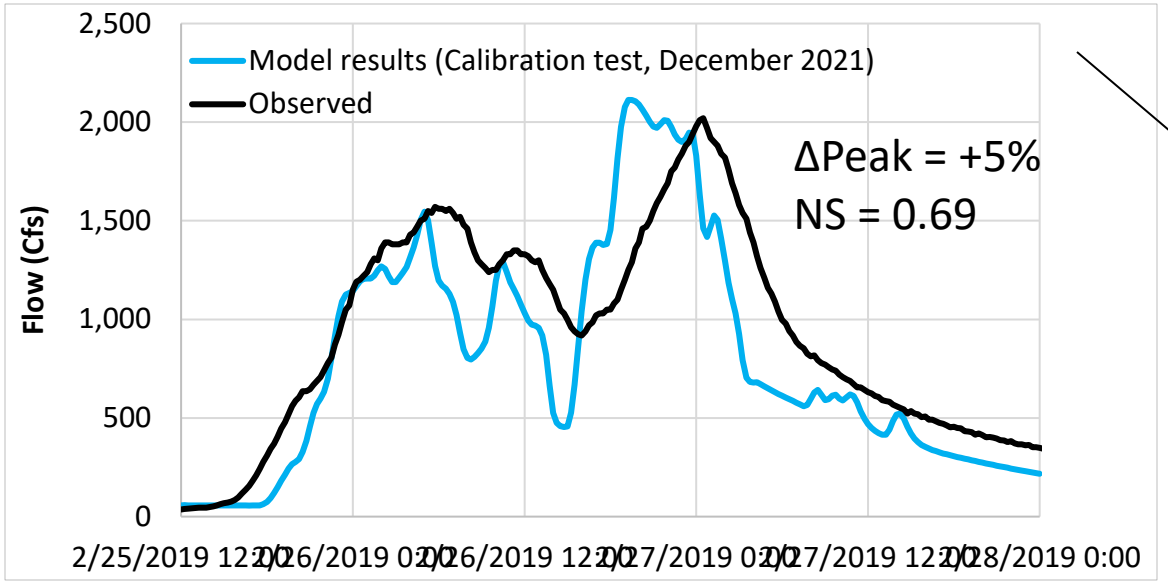
Preliminary Hydraulic Model Results – New Year's Eve 2005

- Peak flow with 0.5%
- Total volume ~13% low
- Model accuracy (Nash-Sutcliffe efficiency) = 0.88 (very good)

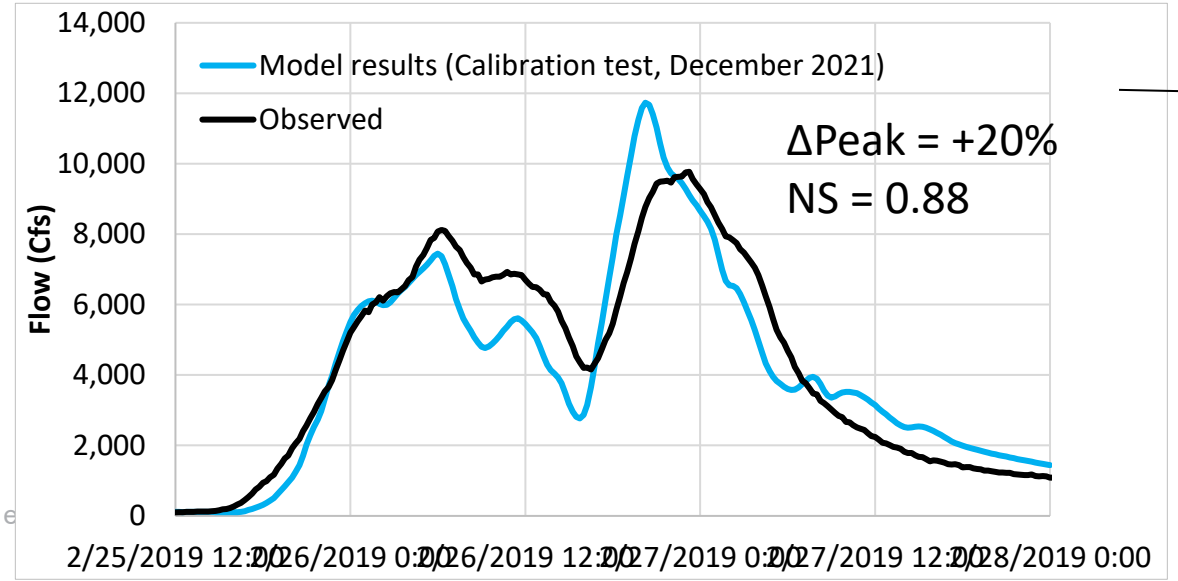


Preliminary Hydraulic Model Results – February 2019

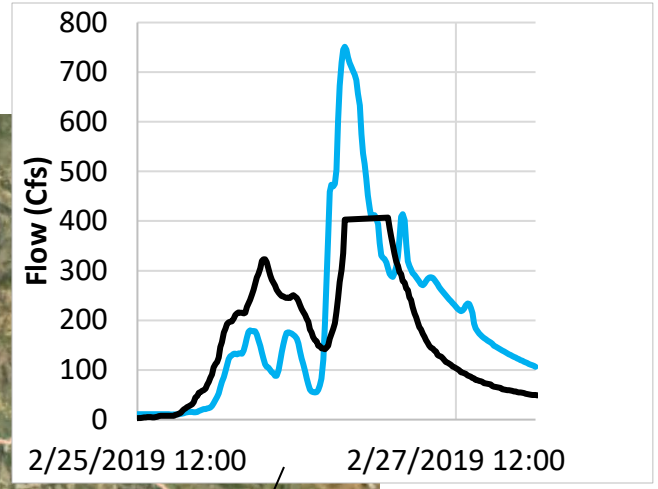
Sonoma Creek @ Kenwood

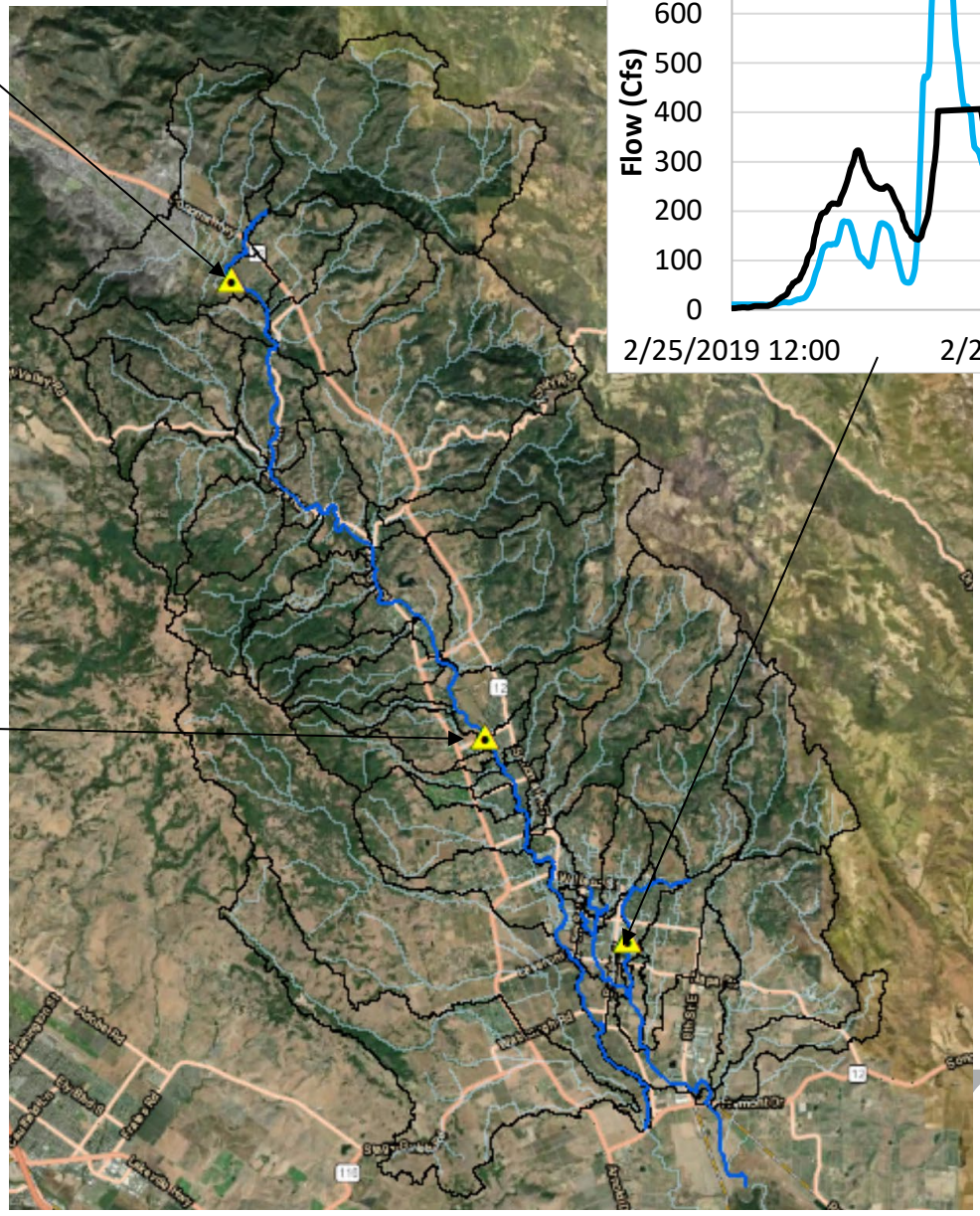


Sonoma Creek @ Agua Caliente



Nathanson Creek @ Denmark





ESA

Preliminary hydraulic model results – Design Hydrographs (uncalibrated)