Contra Costa – AQPI Case Study

Data Implementation Workgroup

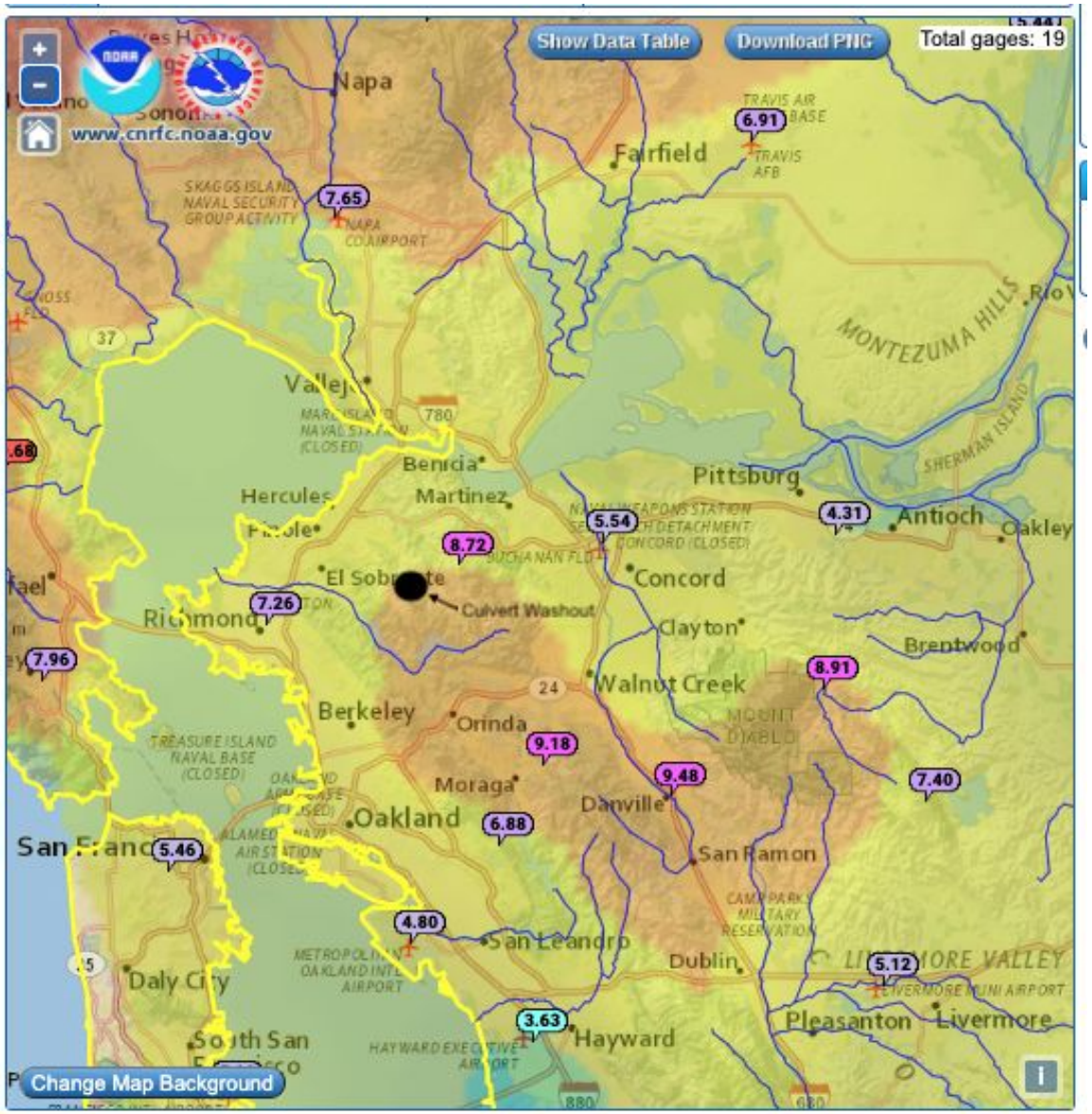
March 2021

What was the Case Study About?

Demonstrate the performance of AQPI products for a past extreme event that occurred in Contra Costa County (CCC).

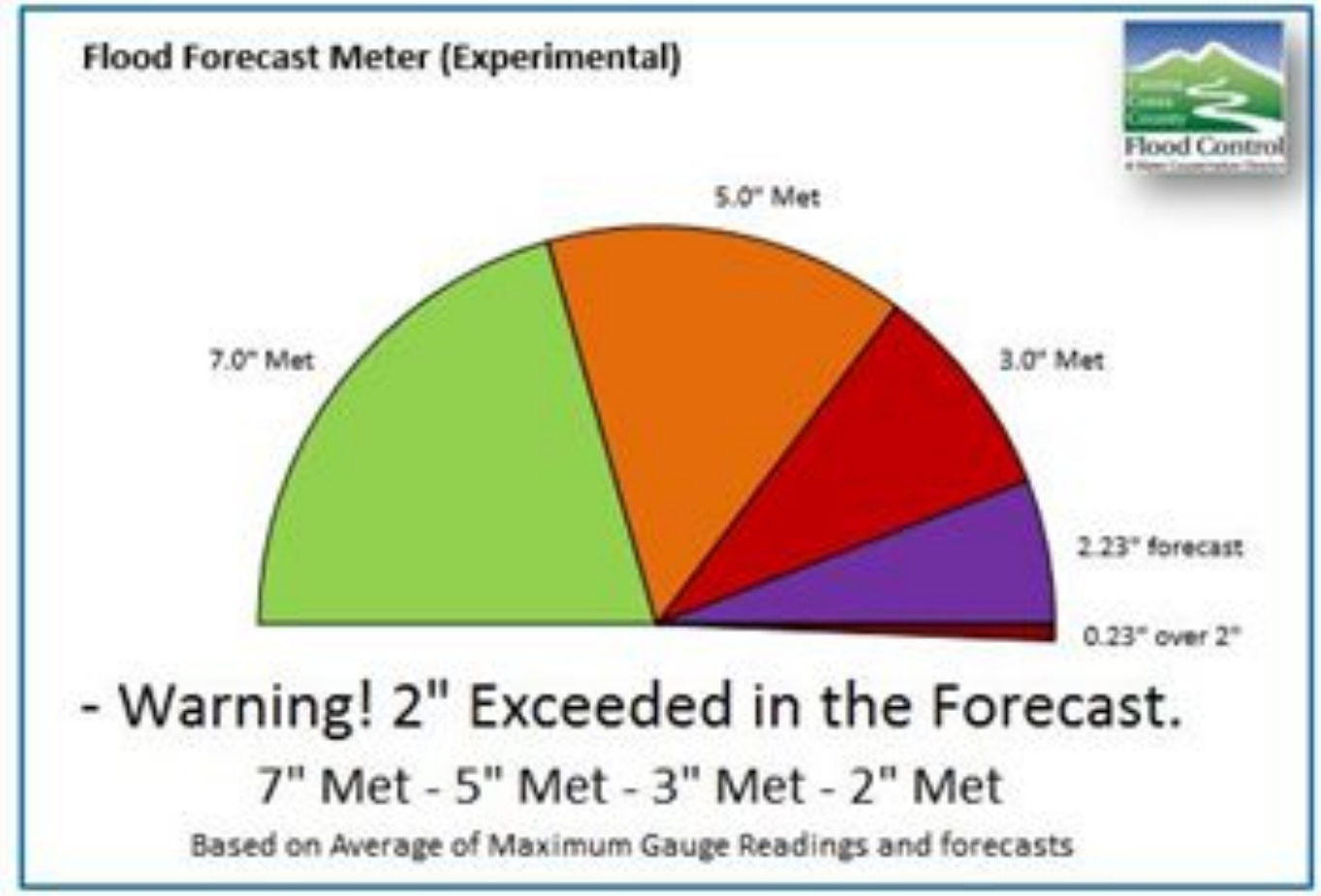
This will provide insight on how AQPI could have informed CCC operations and how AQPI might be used now that AQPI products and services are available

January 2017 Storm, impact on Alhambra Valley Road Culvert

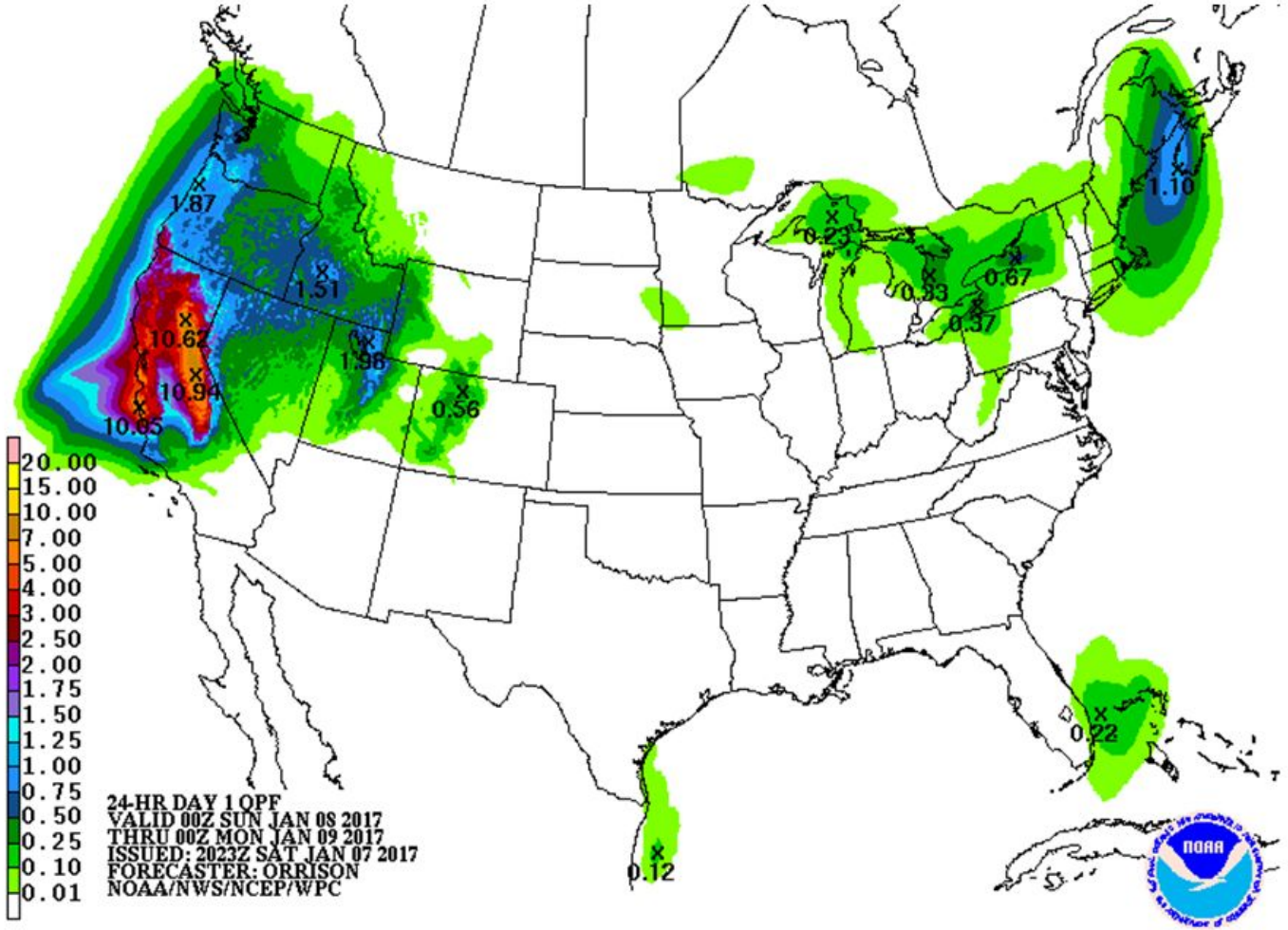



Alhambra Valley Rd.
Castro Ranch Rd.
Earl Combs
Pinole Valley Rd.

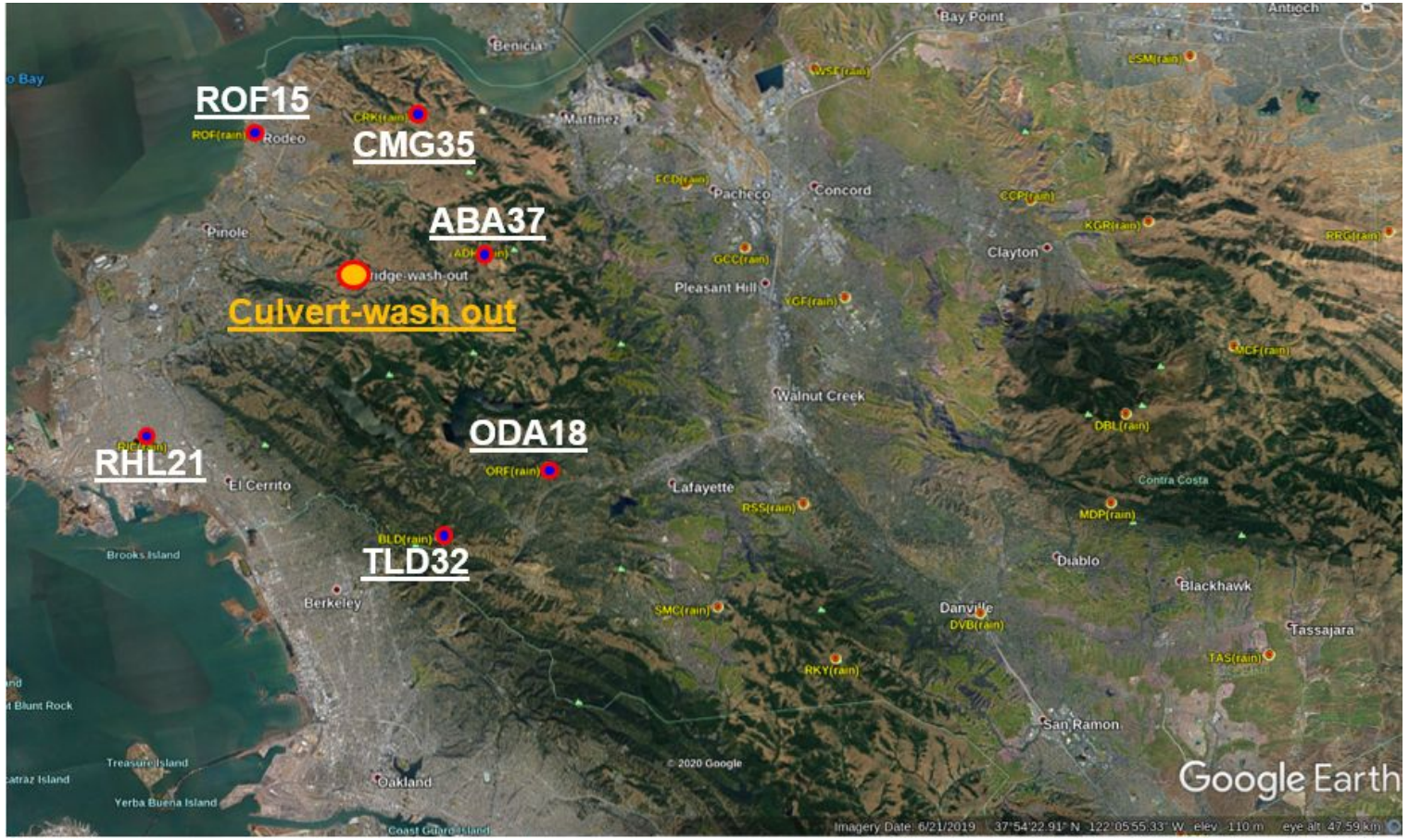
Contra Costa County Flood Alert Protocols



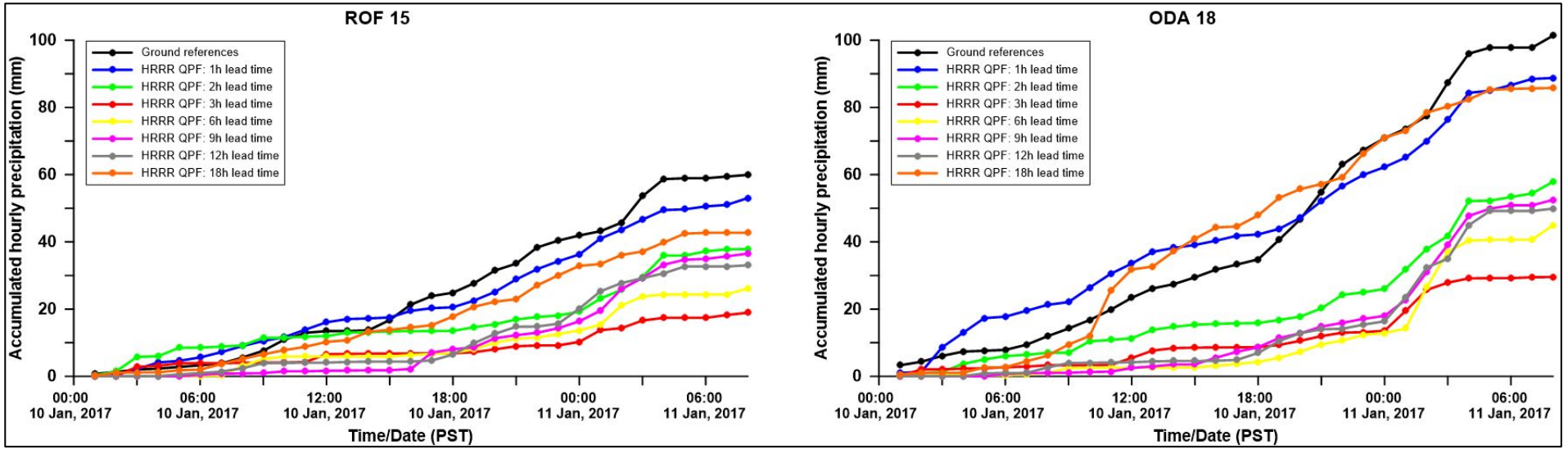
NWS Forecast



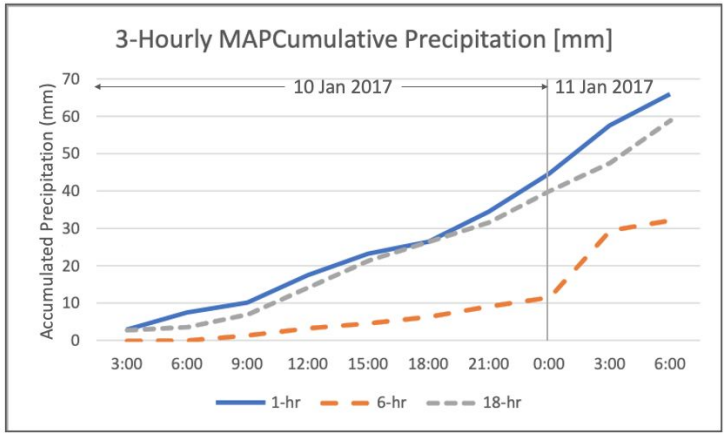
6 rain gauges used for analysis in this study



HRRR Forecasts at Rain Gauges During the Event

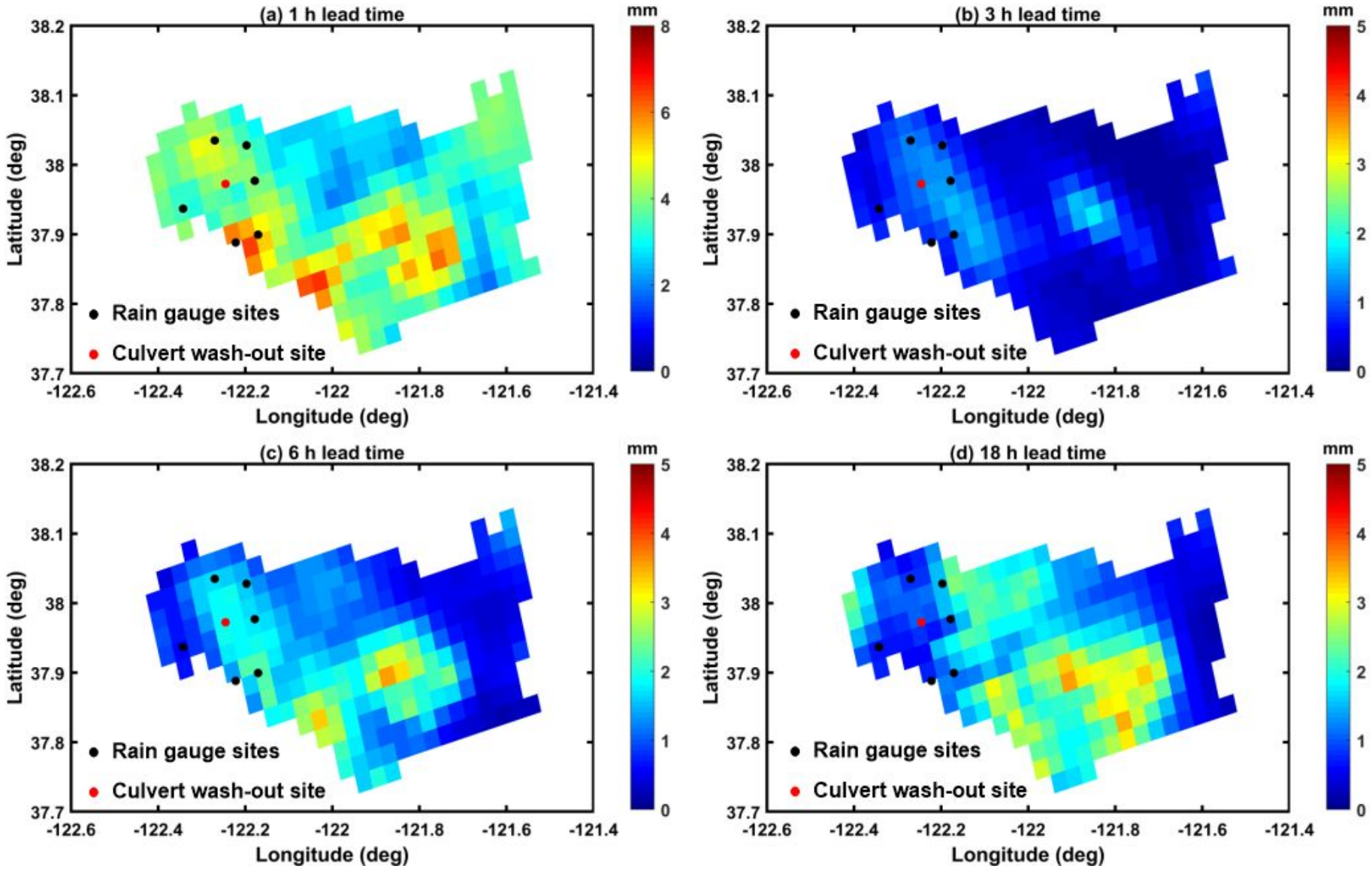


- HRRR tends to underestimate total accumulation
- 3 km grid vs point measurement
- HRRR captures important trends in rainfall patterns



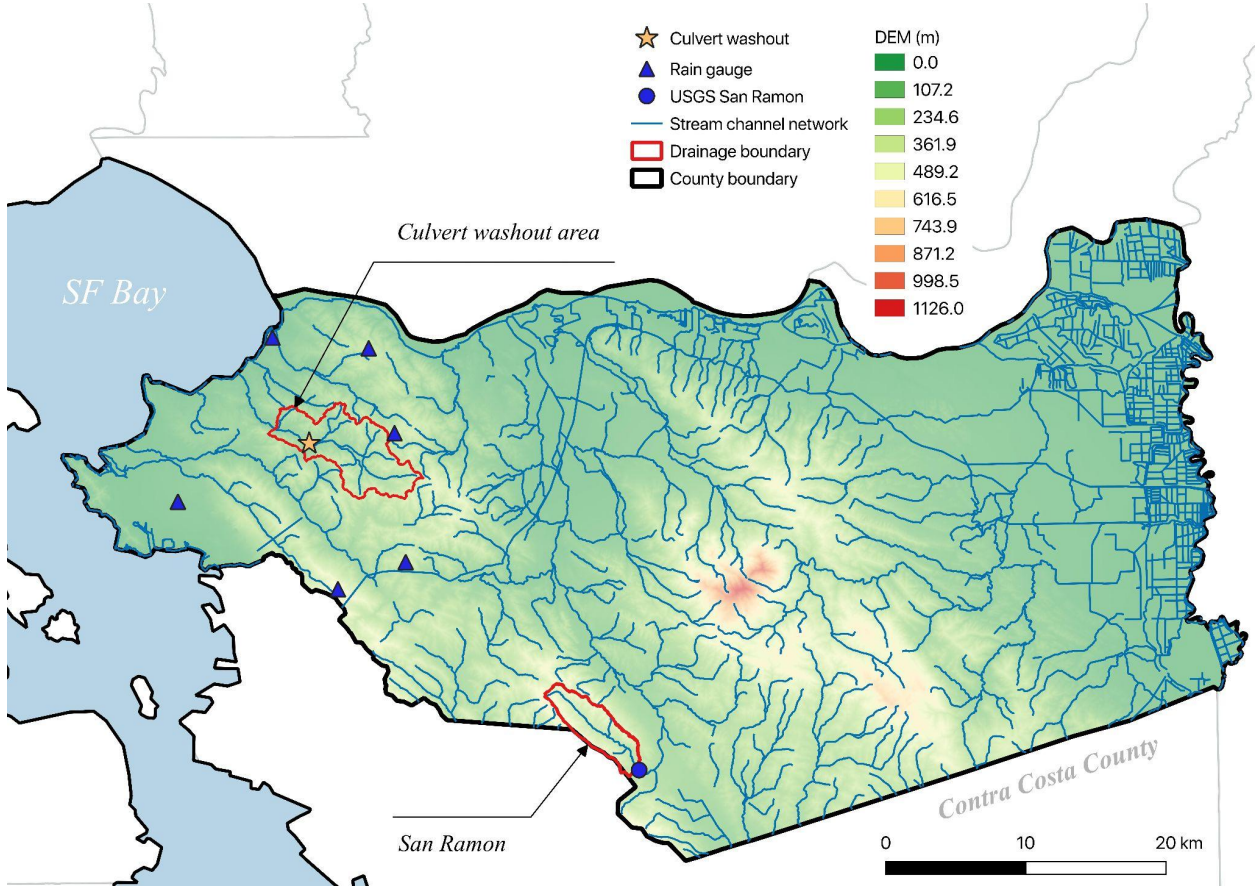
- HRRR forecasts of Mean Aerial Precipitation (MAP) across CCC during the event
- 1 hr and 18 hr are similar

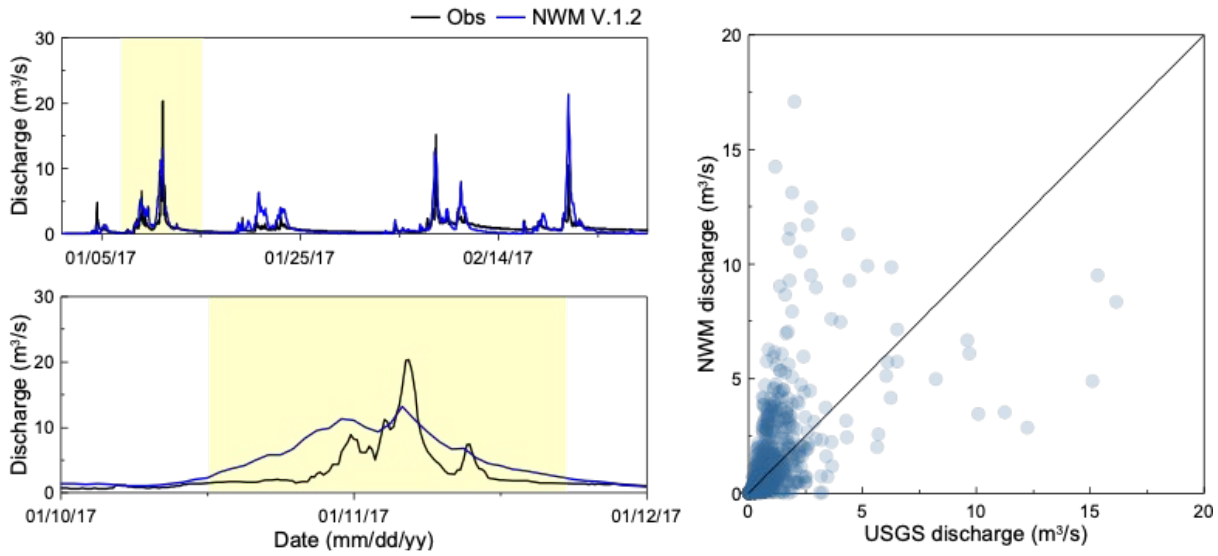
HRRR Spatial Maps of Forecast Hourly Precipitation



- Maps show a lot of spatial variability depending on lead time
- "Hot spots" generally follow terrain across county

Evaluation of NWM Simulations: San Ramon Creek



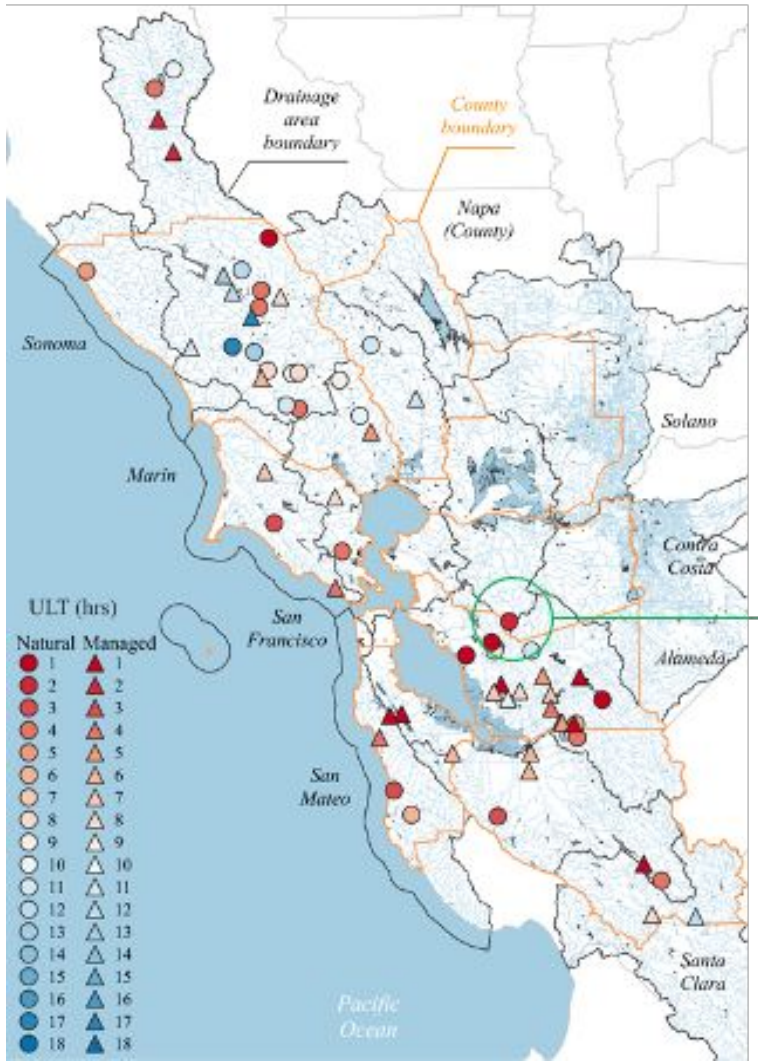


- Overall, a high correlation of the NWM V.1.2 with the observed streamflow
- Good channel routing performance, but **poor** precipitation forcing and soil moisture modeling
- From the scatter plot, overestimated NWM discharge observed in the relatively low USGS discharge

Overall NWM performance on San Ramon Creek ranked as “moderate” in AQPI NWM Assessment Study

Evaluation of Short-Range Forecasts: San Ramon Creek

- Evaluation expressed in terms of useful lead time
- Data from 2018-2019 wet season
- ULT at San Ramon ~ 2 hrs
- Improvement anticipated with better rainfall forecasts



USGS San Ramon gauge location in Contra Costa County

- **Useful Lead Time**

Useful lead time is the longest lead time where metrics satisfy all three conditions as follows:

- Correlation Coefficient (CC) > 0.75
- Relative Bias (RB) <1.25 and >0.75
- NSE > 0

Useful Lead Time (ULT) = 2 hours

- Due to low correlation (CC < 0.75 at 3 hour of lead time)

Forecasting Conclusions

- Rainfall & Creekflow
  - AQPI was not in place during the event, however the AQPI models (National Water Model and HRRR Model) were run in hind-cast mode, to see how the AQPI system will perform in real-time.
  - We learned that the models predicted the event in terms of overall intensity and duration but their forecast performance was variable in time and space.
- Situational Awareness
  - The forecast models provide increased situational awareness about the impacts of the January 2017 event.
  - The AQPI forecasts provided a more comprehensive picture of where rain was falling and the stream impacts that were likely to occur.
  - This suggest AQPI will allow the CCC to be more proactive in terms of their response and where/when to deploy resources.

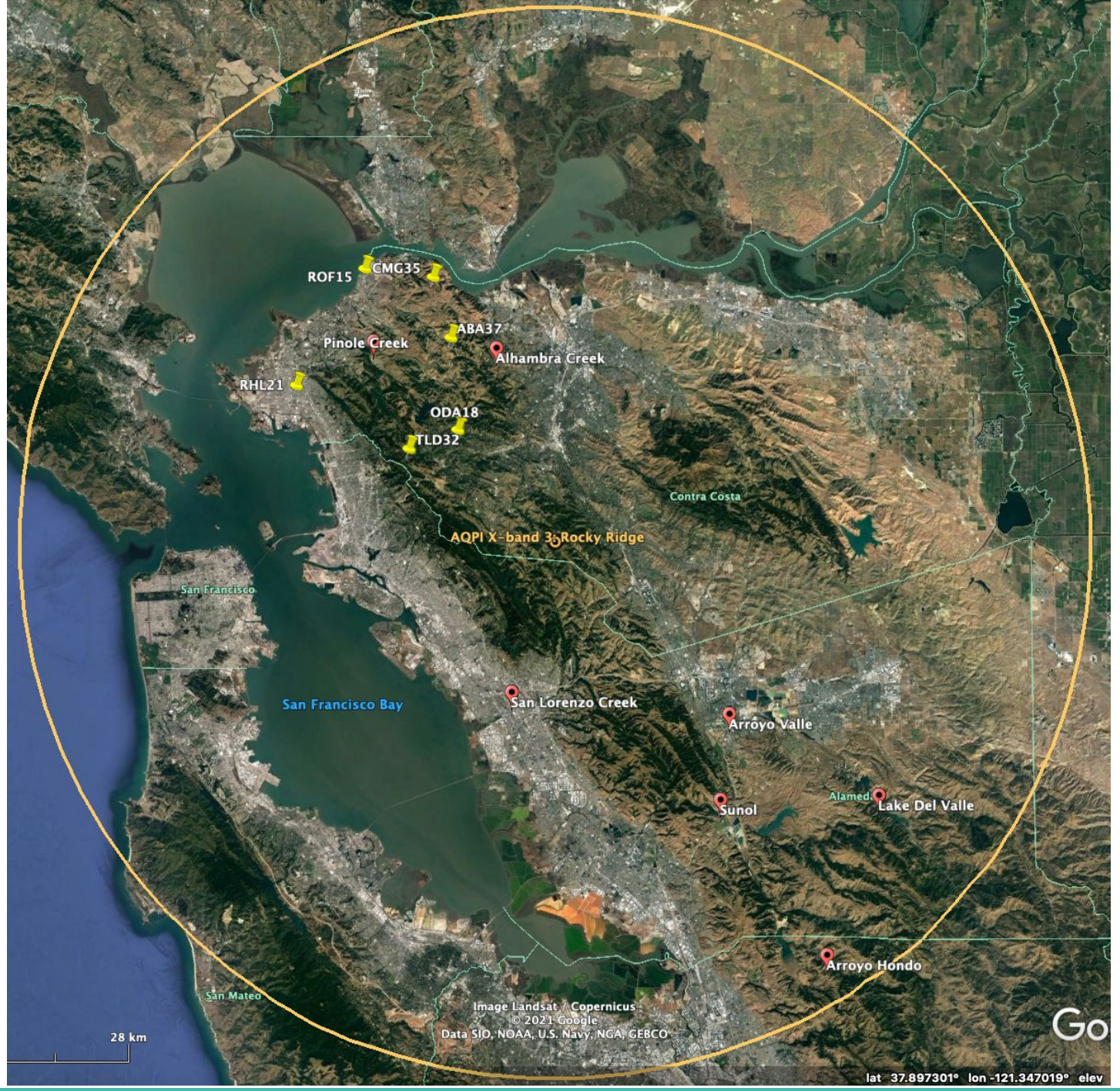
Operational Conclusions

- AQPI model forecasts were shown to provide rainfall and streamflow information at locations and resolutions where CCC officials have not had information before.
  - This will be the same for users throughout the Bay Area.
- Going forward, the AQPI system will support CCC in several ways:
  - the system will update the "7-5-3-2 Flood" protocol automatically and eliminate the time and effort needed to scrape websites and populate the protocol spreadsheet; 2)
  - the system will also begin providing HRRR and NWM forecast information to CCC on a regular basis;
  - the system will share all available rain and stream gauge network information in one place to improve efficiency for decision making; and
  - the upcoming installation of an AQPI gap-fill radar on Rocky Ridge (see Figure 23 above) will augment the current NEXRAD radar coverage in the Bay area and provide improved rainfall information and overall situational awareness for CCC. Recent work has shown that the more accurate rainfall information provided by the AQPI radars can improve streamflow simulations in the Bay area (Ma et al. 2021).
- Local agencies can collaborate with NWM developers to refine the NWM in key locations (such as areas with vulnerable infrastructure).
  - Local agencies can set thresholds for rainfall and streamflow alerts. Since staffing is limited, this can save agencies time and money.
- Models based on accurate forecasts will allow agencies to better provide targeted flood response attention for key infrastructure.

X-band at Rocky Ridge

To be deployed late April-early May 2021

- CCC rain gauges used in the case study
- Areas of concern



Financial Conclusions

- While it is not reasonable to think that better forecast data alone could have saved the culvert and bridge, it is reasonable to conclude that earlier and greater situational awareness of the potential problem could have lead staff to act earlier.
- Acting earlier could potentially have saved the county: overtime costs, public safety officials, and infrastructure repair and/or replacement costs.
- Contra Costa County estimates that the cost to replace the culvert and bridge was about 4.5 million dollars, which includes design, permitting, and construction.
    - The County was able to get Federal, State, and Local financing for the project.

To Ponder

- If your agency, now getting data from AQPI, were to have a similar situation, would you have increased situational awareness?
- What other metrics, or analytical methods, would you be interested in seeing from this case study?
- If you were briefing your county administrator on this study, what would you say?