
# Predicting Atmospheric Rivers:
## *Applications for Wastewater Agencies*

**BACWA Webinar**

**November 5, 2025**

# AGENDA

- Introduction and Purpose
- AQPI Background, Program,  and Future Plans
- Dublin-San Ramon Services District Case Study
- Union Sanitary District Case Study
- Q&A
- Wrap-up and Next Steps

Sonoma Water

SERVING THE COMMUNITY SINCE 1949

# Advanced Quantitative Precipitation Information Project Update

Dale Roberts, Principal Engineer

05 November 2025

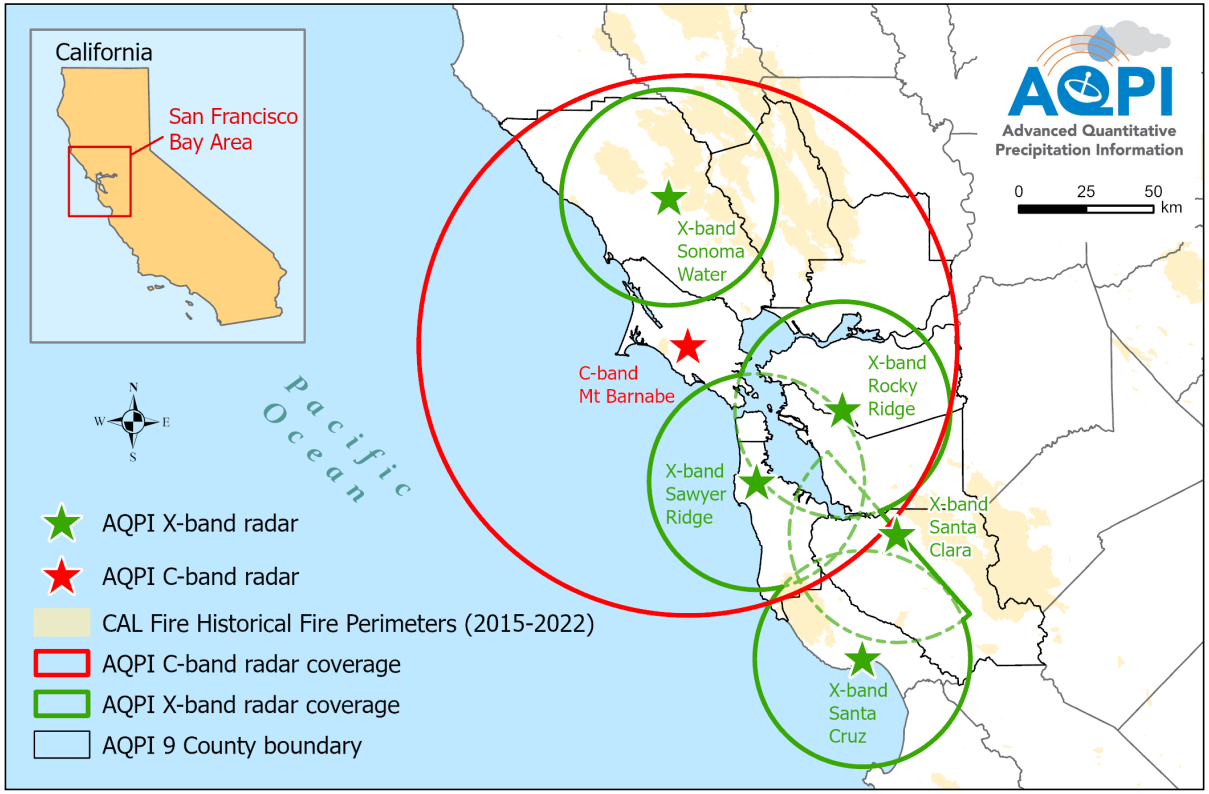
Bay Area Clean Water Agencies

sonomawater.org

## Advanced Quantitative Precipitation Information (AQPI)

- $19.8M DWR grant, 25% match
- Sonoma Water Local Sponsor
- 4 X-band radars (N-S-E-W)
- 1 C-band radar (Ocean facing)
- 20 ground mounted stations
- Data transmission of radar observations to Colorado State and CW3E for processing, forecasting, and distribution to local water agencies
- Users can integrate AQPI forecasts to better inform operations and resource allocation, increase efficiency, and save money
- Grant requires operation for 20 years
- Contributions from Feds, State, & Locals

*A regional weather prediction system using enhanced weather radars to track and forecast precipitation from atmospheric rivers for use by water/flood/wastewater/emergency entities.*



# AQPI Agreements History

| Date | Action |
|---|---|
| Early 2010's | Individual agency agreements with NOAA and others |
| June 2015 | Sonoma Water, SFPUC, and Valley Water executed San Francisco Estuary Partnership to prepare of a grant application for the SF Bay AQPI Project to be submitted under Round 4 of Proposition 84 |
| August 2016 | DWR/Sonoma Water Agreement executed, $19.8M |
| Summer 2016 | Sonoma Water sub-agreements with NOAA, CSU/CIRA, USGS, Morrison, Krebs, CW3E, and BPC |
| January 2020 | Local Partner Agencies Committee (LPAC) Planning Agreement |
| TBD | LPAC Implementation Agreement – C-band cost share and Ongoing operational cost share |
| April 2021 | Cooperative Agreement for East Bay X-band EBMUD, EBDA, CCCFCWCD, ACFCD, ACWD, and Zone 7. Replaced in 2022 |
| October 2024 | DWR No Cost Time Extension 3 to Grant Agreement |
| March 31 2026 | All eligible work under DWR grant completed |
| June 2026 | Final paperwork and invoices submitted, grant expiration |
| 2025 / 2026 | Agreements for Operational Transition to CW3E & subs |

# AQPI Radar Timelines

| Date | Action |
|---|---|
| 2016-2022 | Site Selection, Access, Rent, Power, Network, Permits, etc. |
| Summer 2016 | X-band operational in south bay at Valley Water |
| Summer 2018 | X-band operational in north bay at Sonoma Water |
| Summer 2022 | X-band operational in further south at Santa Cruz |
| Summer 2023 | X-band operational in east bay at Rocky Ridge |
| Spring/Summer 2025 | X-band to be operational in west bay at SFPUC Sawyer Ridge |
| January 2025 | C-band at Mt Barnabe Building Permit Issued |
| March 2025 | C-band installation contract to be advertised for bid |
| April 2025 | C-band installation contract bids received |
| June 2025 | C-band installation contract to be awarded |
| July 2025 | C-band installation contract Notice To Proceed |
| December 2025 | C-band radar operational |
| March 31 2026 | All eligible work under DWR grant completed |
| June 2026 | Final paperwork and invoices submitted, grant expiration |
| 2025 / 2026 | Operational Transition to CW3E |

**Advanced Quantitative Precipitation Information (AQPI) C-band**

- Lease Agreement with County of Marin
- Construction Cost $550k
- Design, Project Management, Construction Management, Permitting, etc. $650k
- Sonoma Water fronting $1.2M
- Need multiparty reimbursement agreement
- Propose $300k split from each ordinate/quadrant of bay
- Lead from N-S-E-W


# Sonoma Water

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# AQPI

## Advanced Quantitative Precipitation Information

*Current and Future Capabilities*

**Jon Rutz (CW3E)**

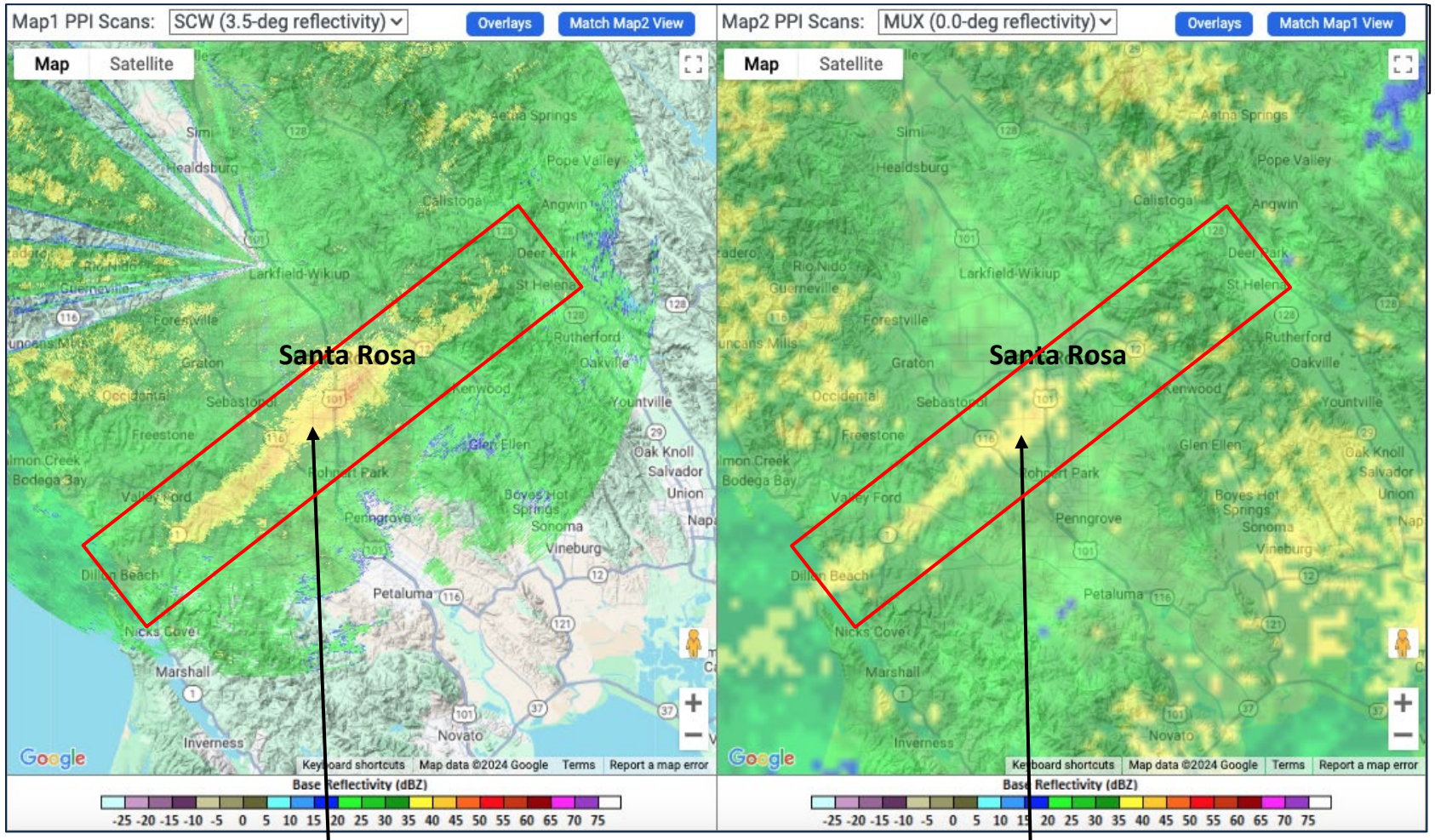
BACWA Webinar
5 November 2025

AQPI X-Band Radar at Santa Rosa, CA with wildfire smoke in the background

Center for Western Weather and Water Extremes
SCRIPPS INSTITUTION OF OCEANOGRAPHY AT UC SAN DIEGO
UC San Diego
SCRIPPS INSTITUTION OF OCEANOGRAPHY
NOAA
DEPARTMENT OF WATER RESOURCES · STATE OF CALIFORNIA ·
CIRA Connecting Models and Observations
Sonoma Water

# AQPI Detection of Intense Rainfall

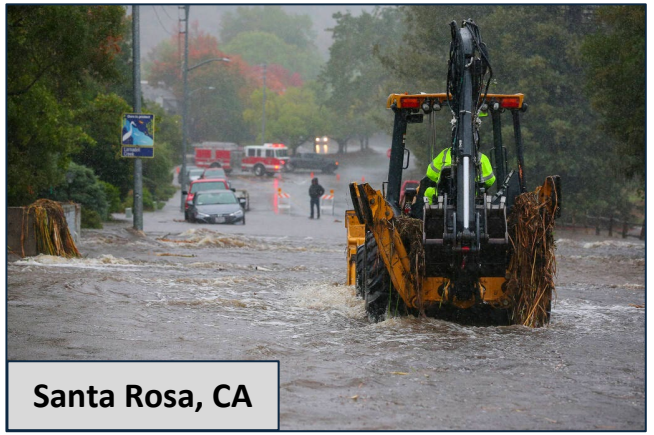
Center for Western Weather and Water Extremes




**NCFR:** Narrow Cold-Frontal Rainband

**NCFR:** Linear indication, but weaker

Guerneville, CA



Santa Rosa, CA

Source: https://www.pressdemocrat.com/article/news/atmospheric-river-lashes-the-north-bay-bringing-flooding-power-outages/

# Representative Timeseries of Precipitation

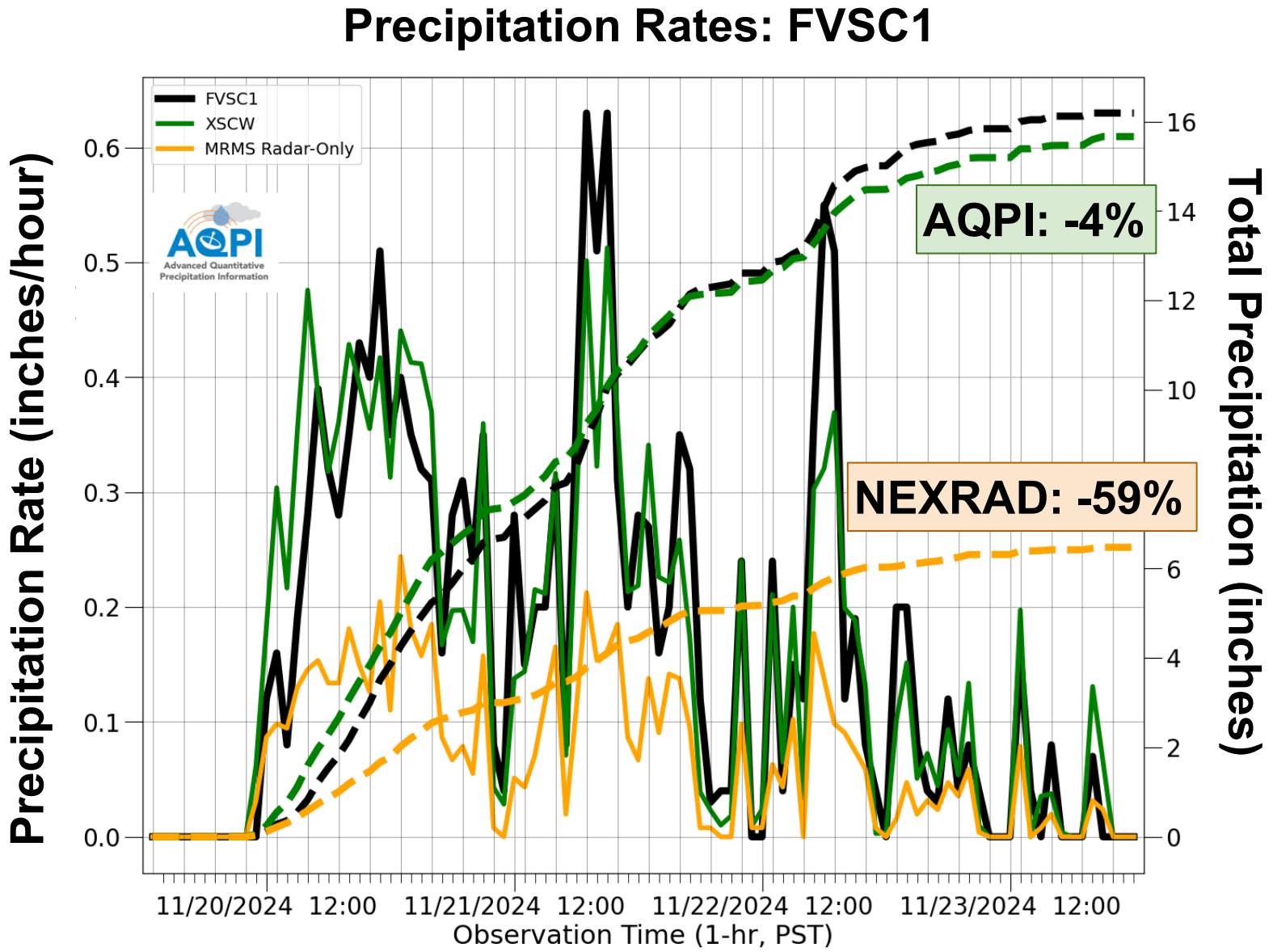
Center for Western Weather and Water Extremes

Rain gauge observations show three peaks in precipitation rate during the event

The NEXRAD radar product does not identify these peaks… not even close

AQPI radar identifies these peaks much more accurately

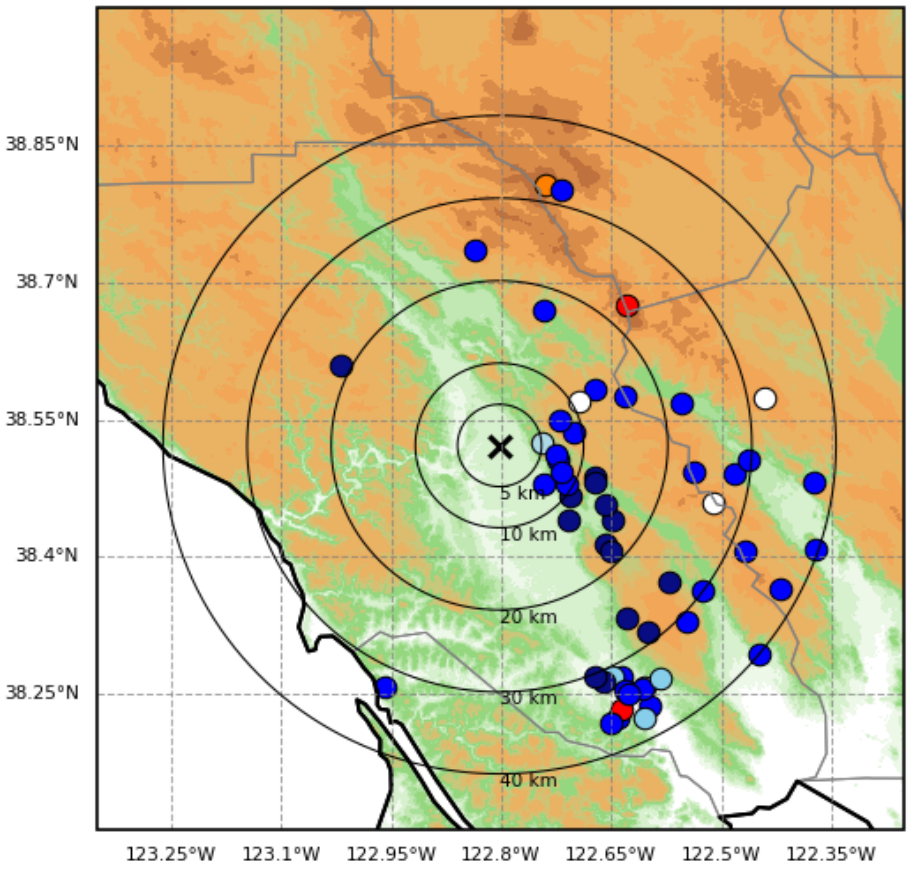
AQPI also outperforms cumulatively during the storm

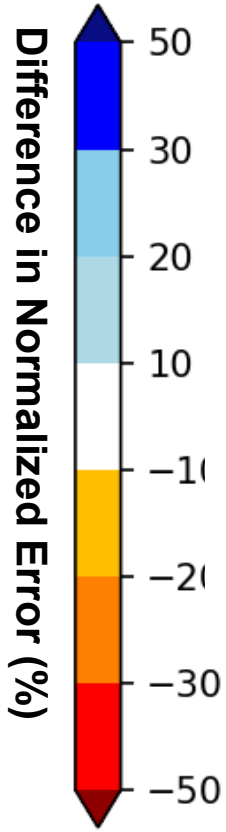


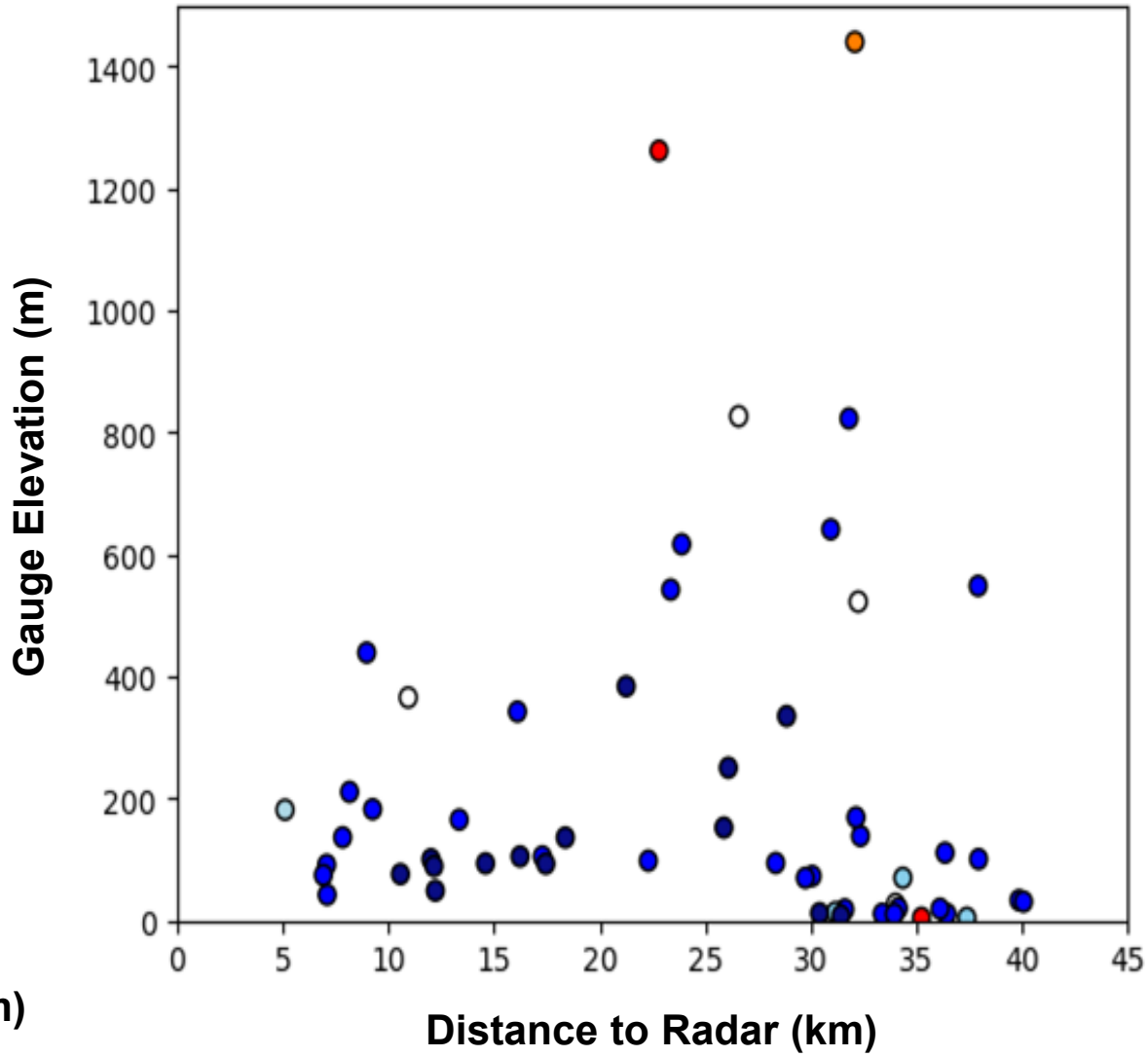
# Case Study: Sonoma County (24 -25 Oct 2021)

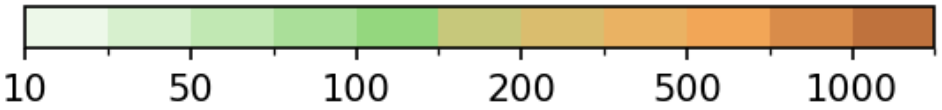
Center for Western Weather and Water Extremes

**Difference in Norm Error (AQPI – NEXRAD)**




Elevation (m)

# Case Study: Sonoma County (24 -25 Oct 2021)

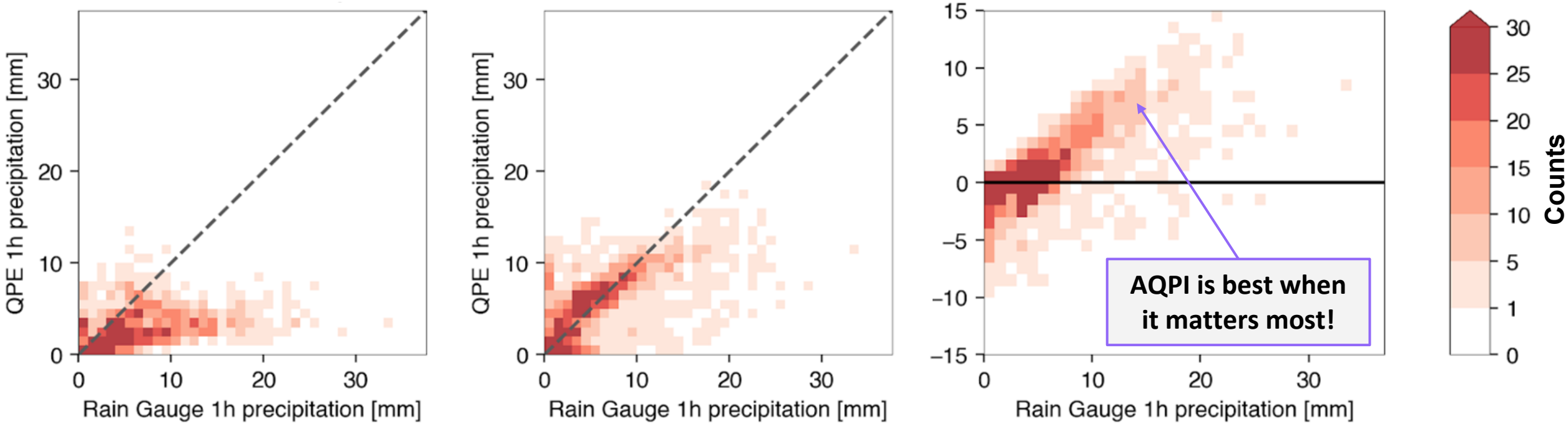
Center for Western Weather and Water Extremes

**Comparing 1-h rain rates between the AQPI and NEXRAD (S-band, MRMS) radar**

**NEXRAD**
MAE (obs>10mm): 10.86

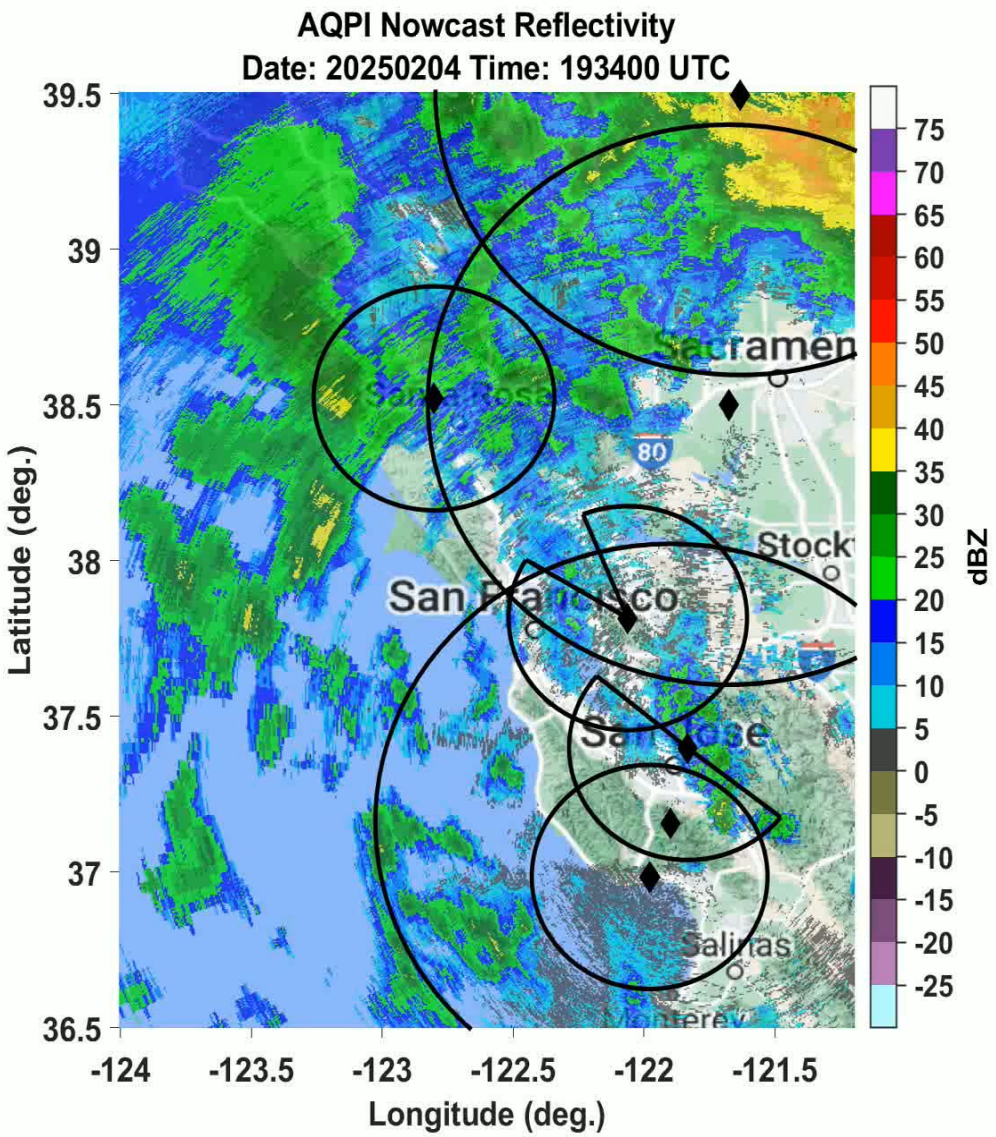
**AQPI**
MAE (obs>10mm): 5.45

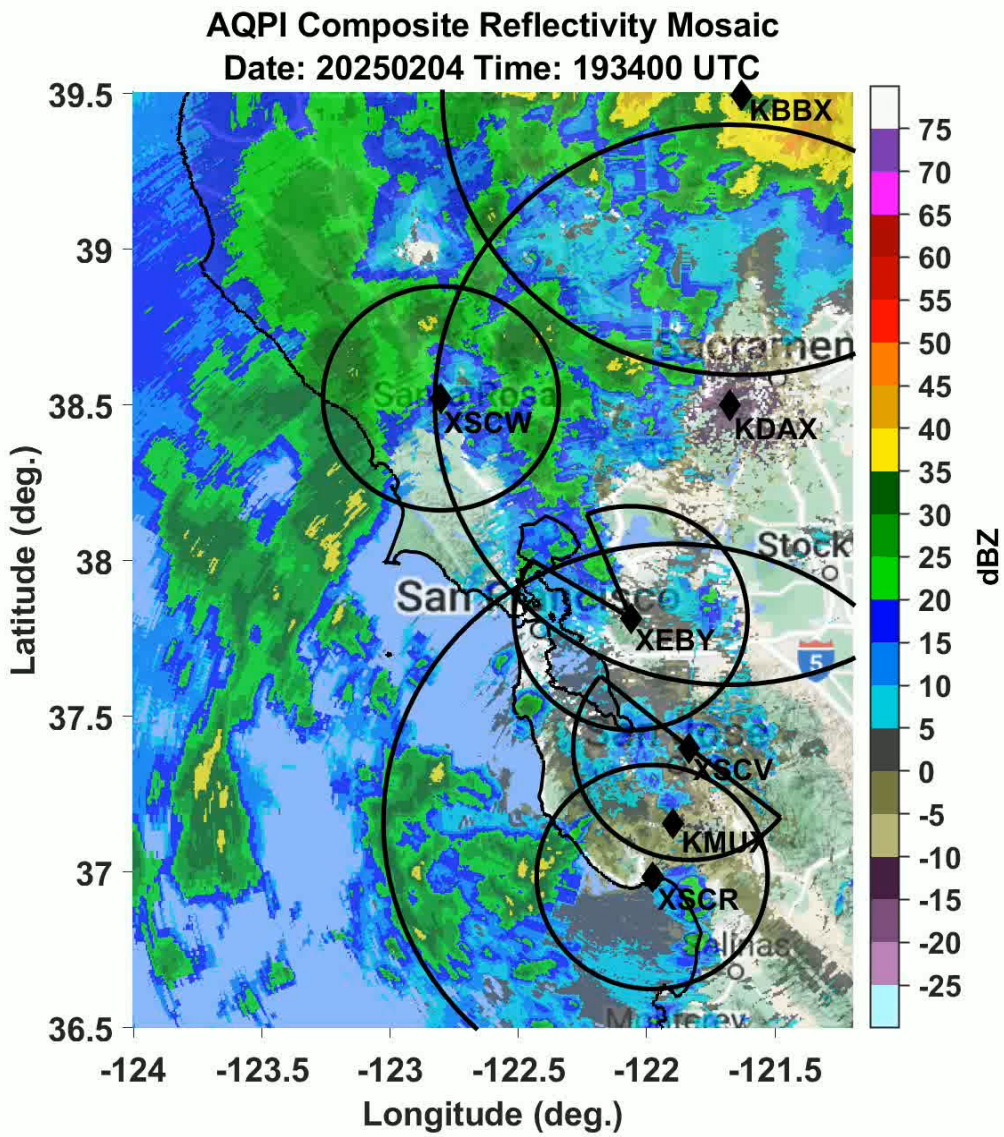
**NEXRAD – AQPI**
(difference between errors)



# AQPI Mosaic – Nowcast

Center for Western Weather and Water Extremes



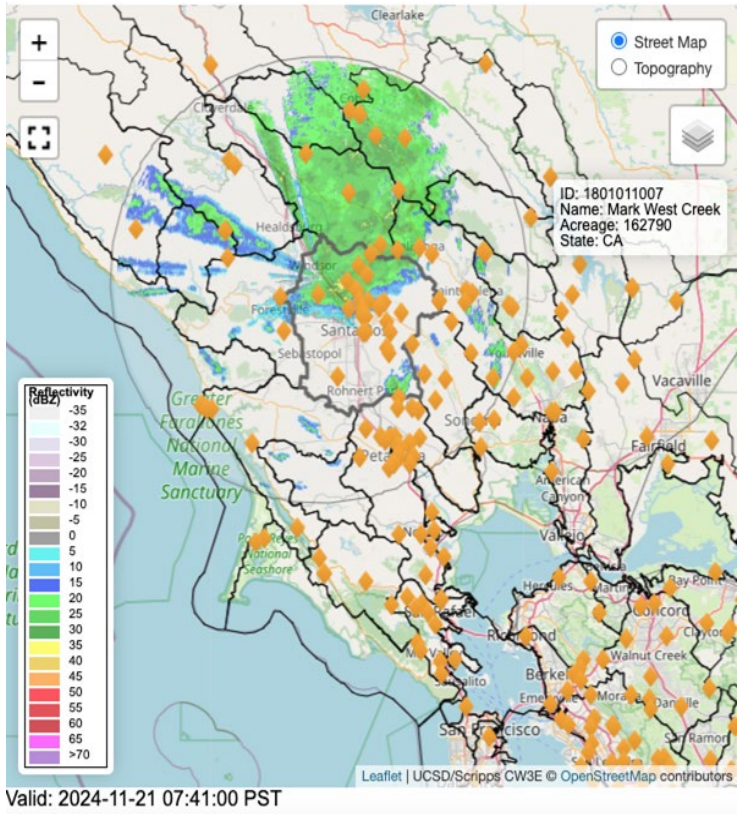



# User Interface - Live Demo?

Center for Western Weather and Water Extremes

A newly developed user interface integrates data visualization for radars and other observations, radar-derived products such as a mosaic and nowcast, and a suite of additional forecast and decision support tools.

**https://cw3e.ucsd.edu/Projects/AQPI/main.html**



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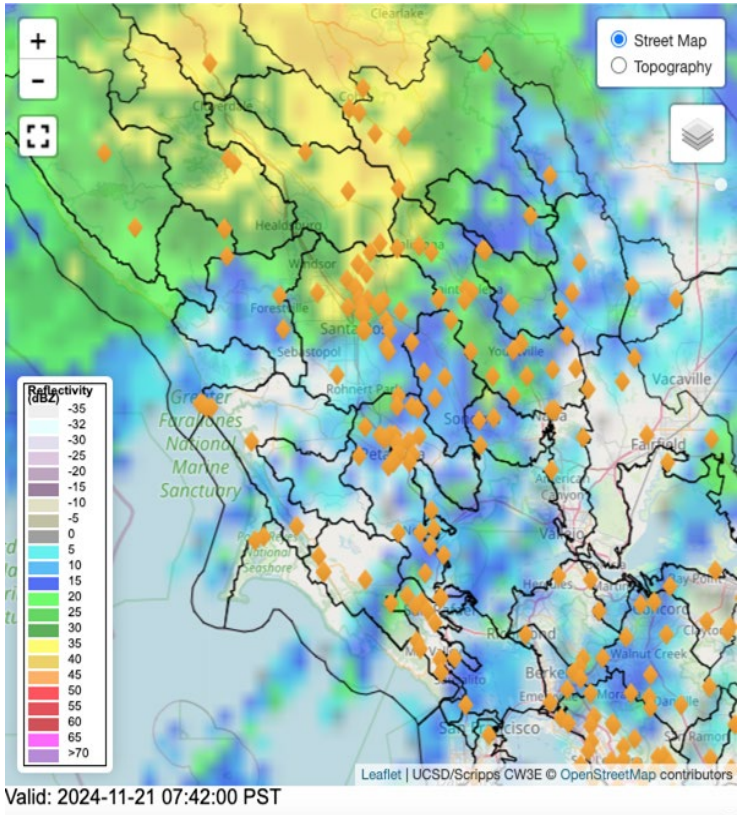

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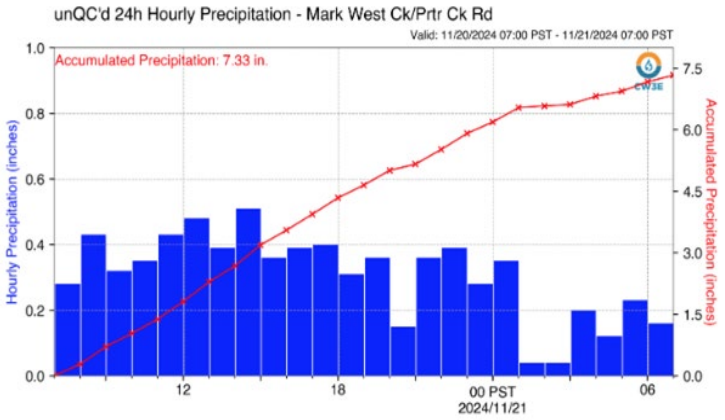
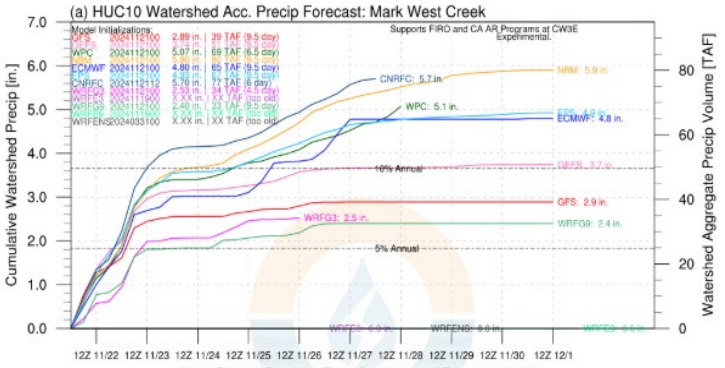
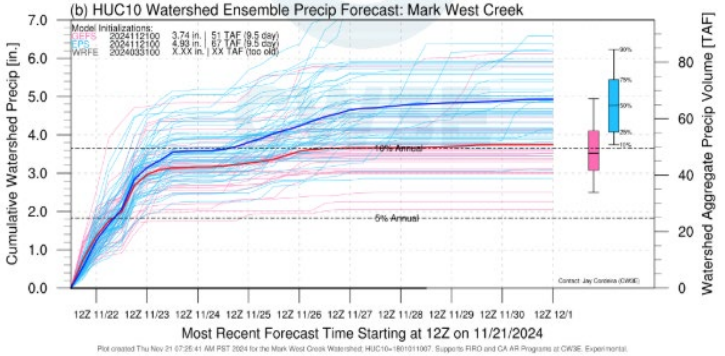


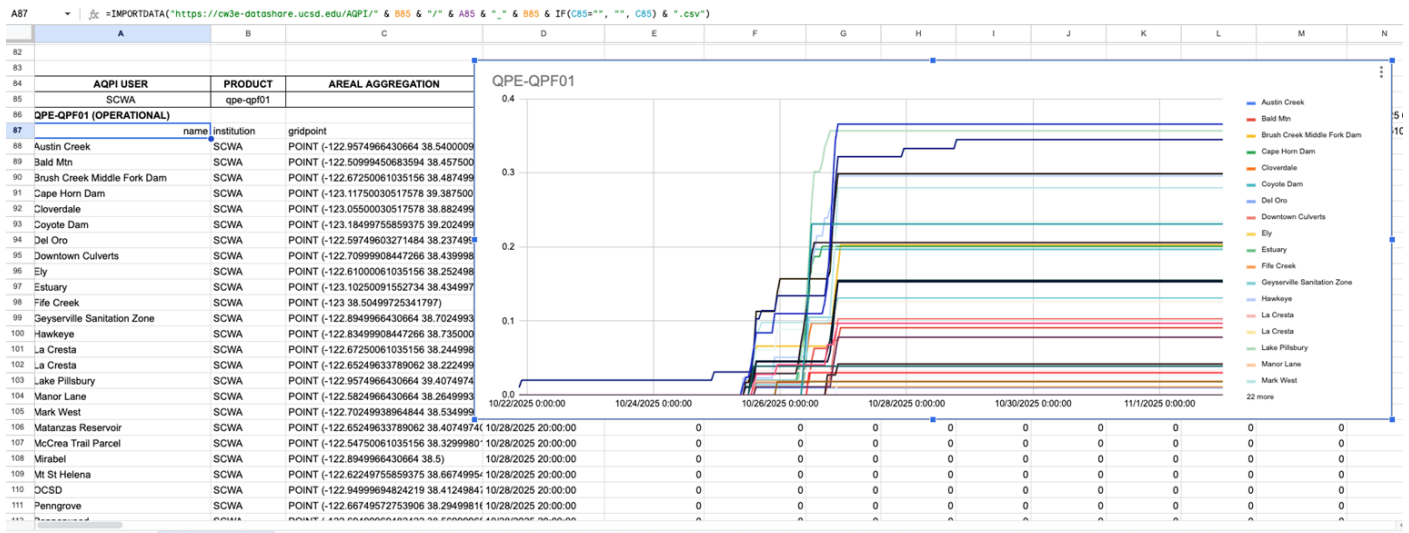



# AQPI Data Delivery

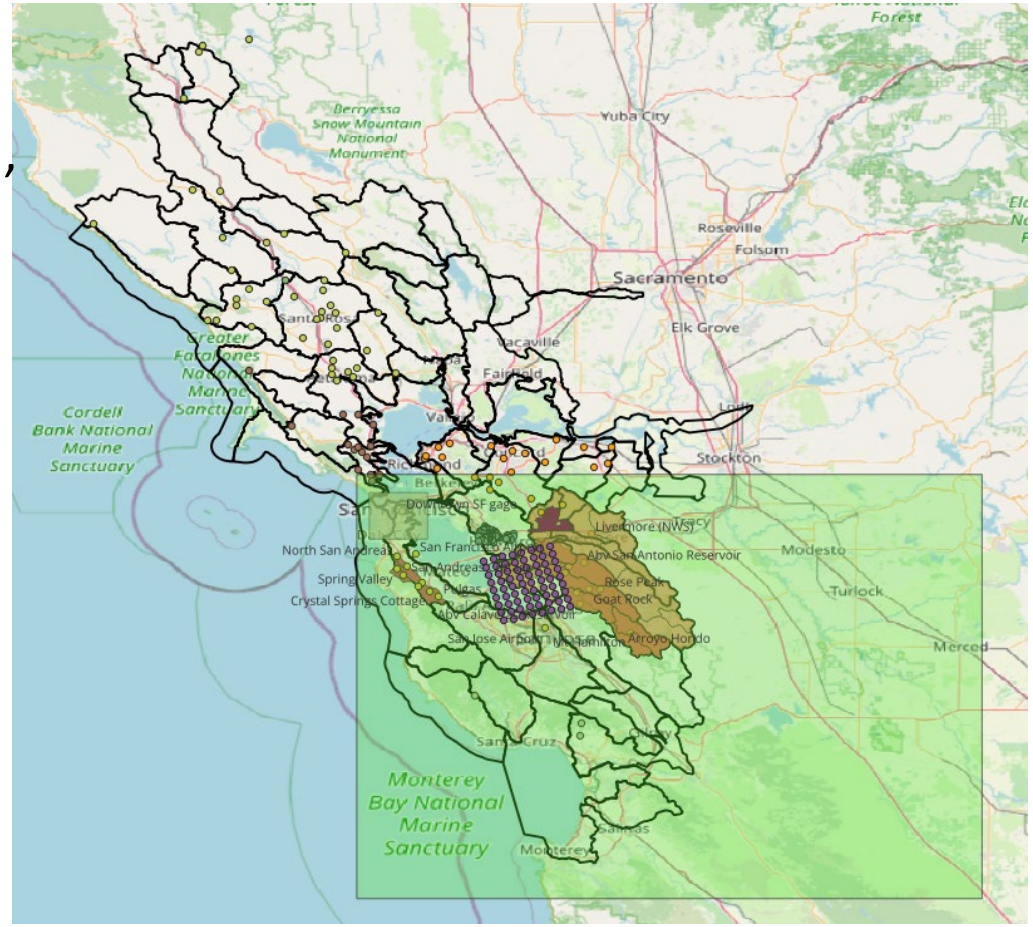
Center for Western Weather and Water Extremes

AQPI provides observed and forecast precipitation data via an online data share: https://cw3e-datashare.ucsd.edu/AQPI/

The data is available in a variety of temporal resolutions (1-h, 6-h, 24-h) and percentiles (10th, 50th, 90th). A quick guide provides more information: https://cw3e-datashare.ucsd.edu/AQPI/CW3E-AQPI_data-feed_quick-guide.pdf



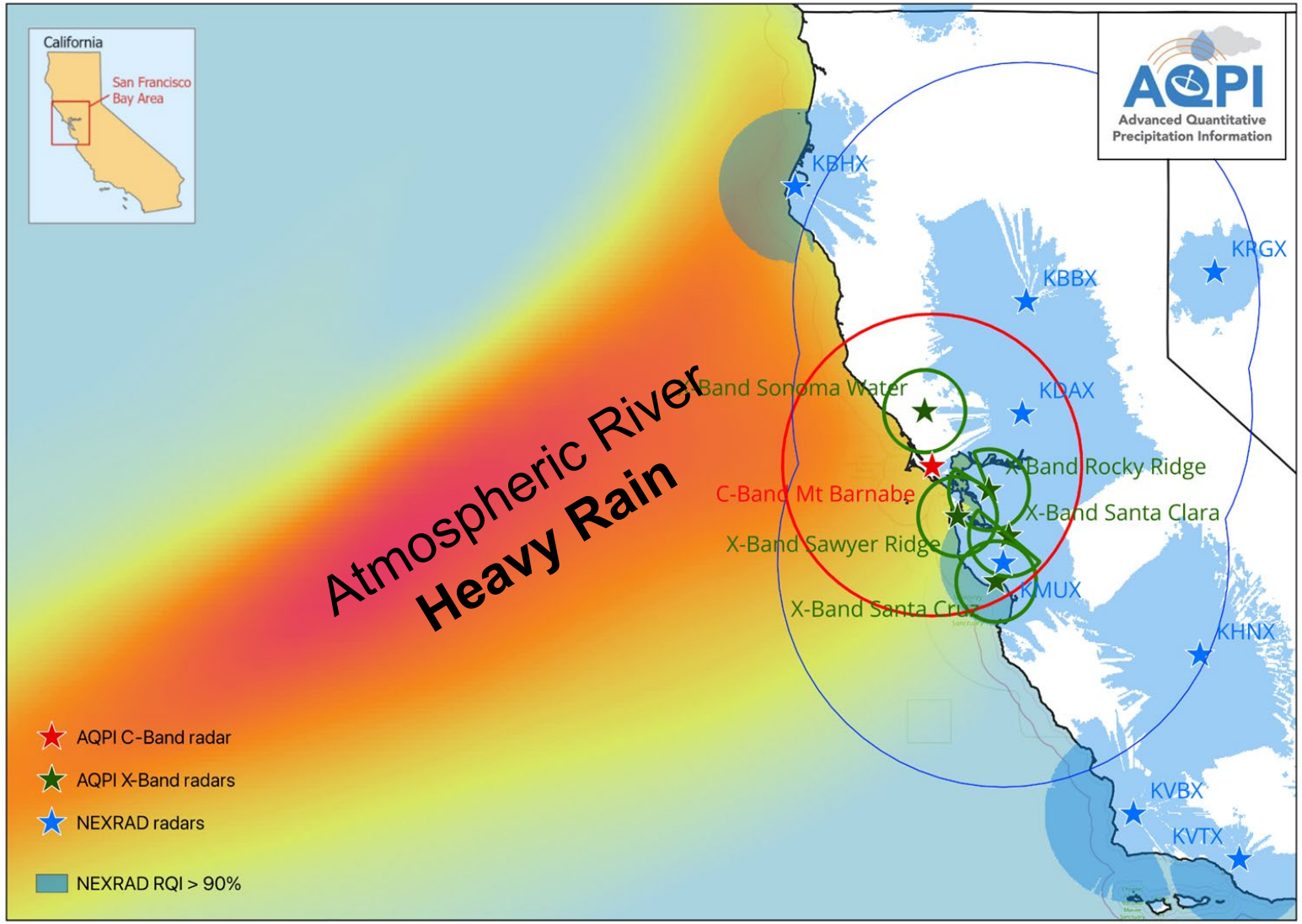

Example of qpe-qpf01 extraction for SCWA locations.




Map of AQPI users' data extraction regions.

# C-Band Benefit to Rainfall Forecasting

Center for Western Weather and Water Extremes

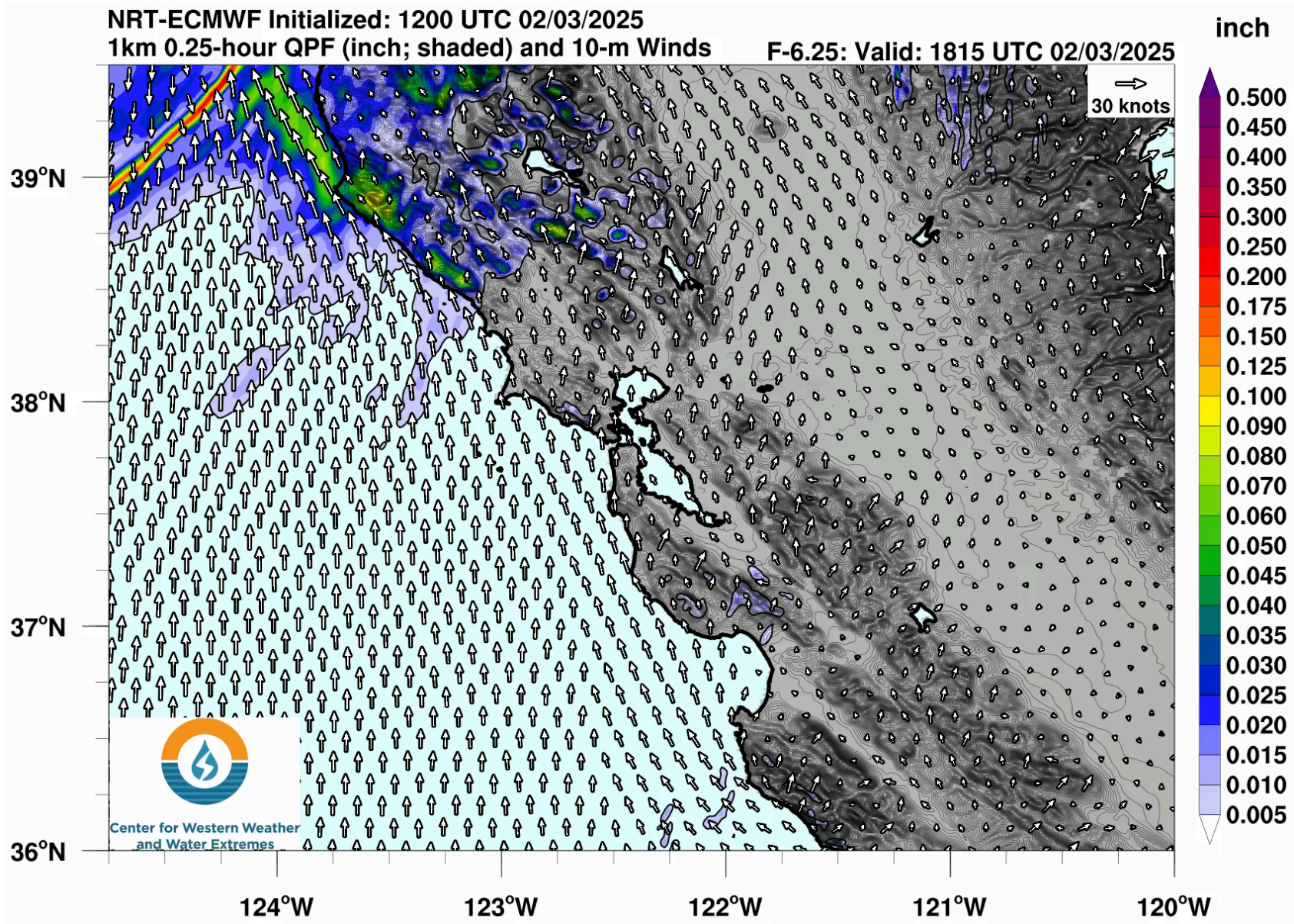



**The C-band will provide several benefits to the AQPI network:**

- greater offshore "sight" for approaching rain bands: 2-8 hours lead time
- filled gaps between X-band radars
- redundancy for most of the Bay Area

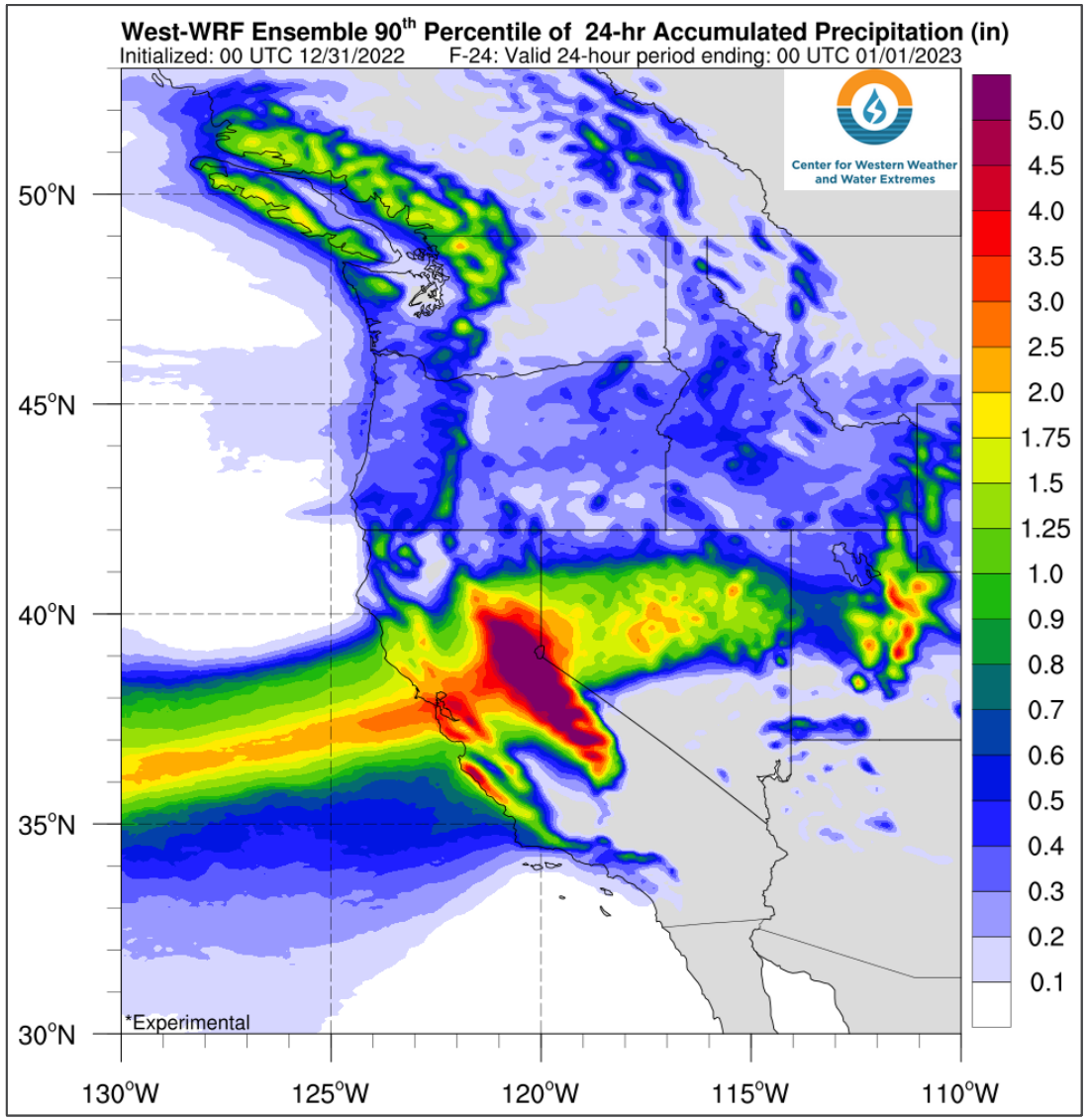
# CW3E 1-km West -WRF: 15-Min Precipitation

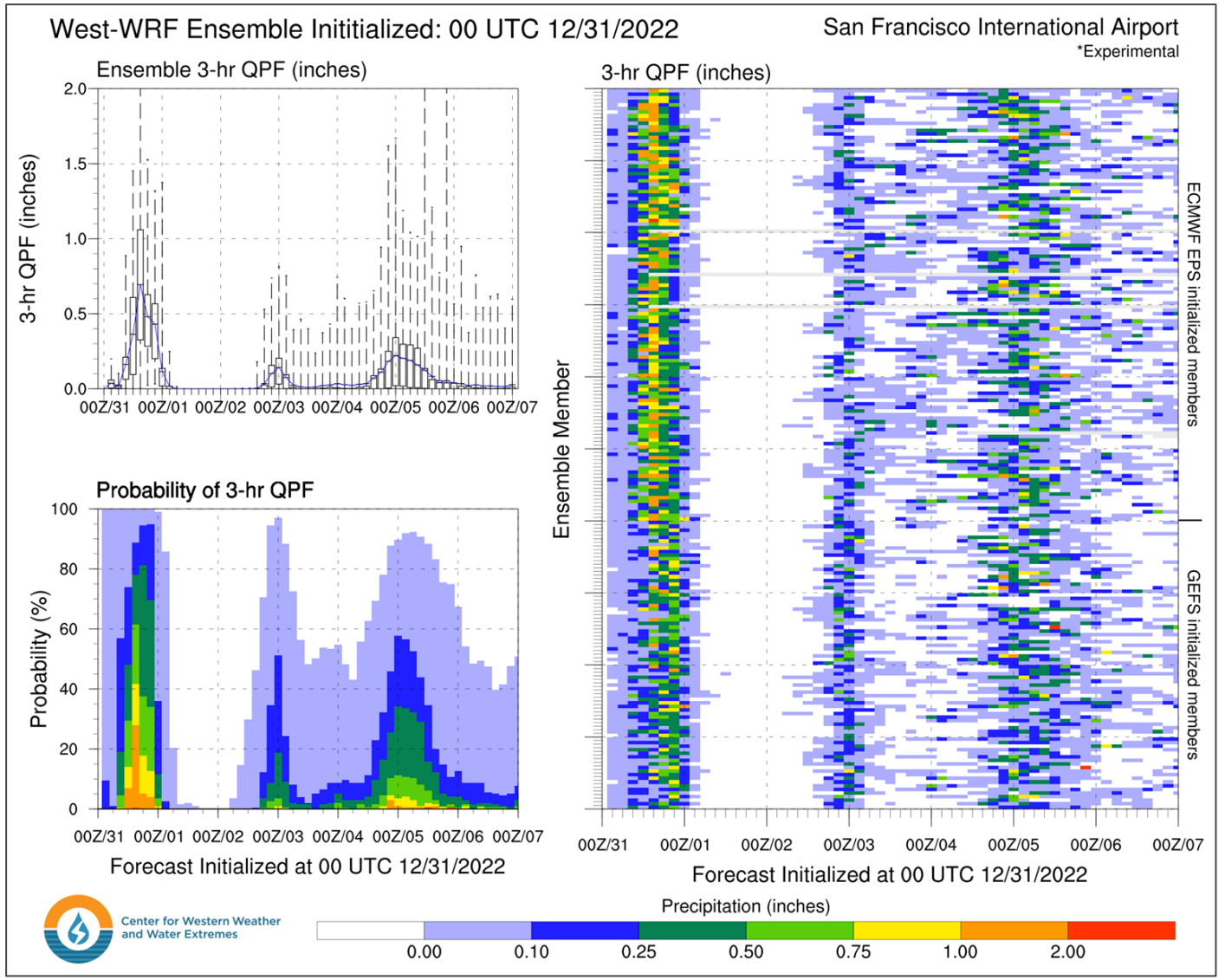
Center for Western Weather and Water Extremes



# West-WRF Ensemble: Dec 31, 2022

Center for Western Weather and Water Extremes

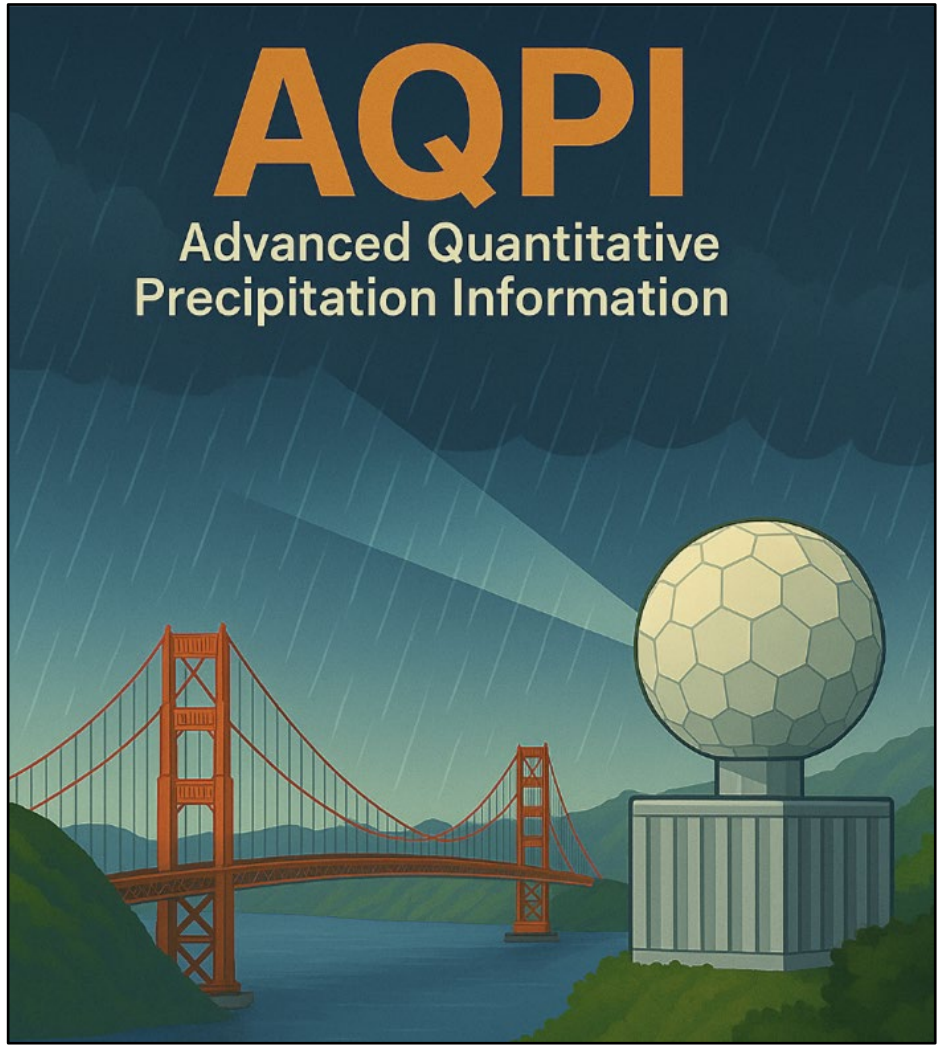


# Questions / Comments

Center for Western Weather and Water Extremes

AQPI is building a state-of-the-art observation and forecast system for the San Francisco Bay Area **– local contribution under consideration is needed to perform O&M beyond Mar 2026.**



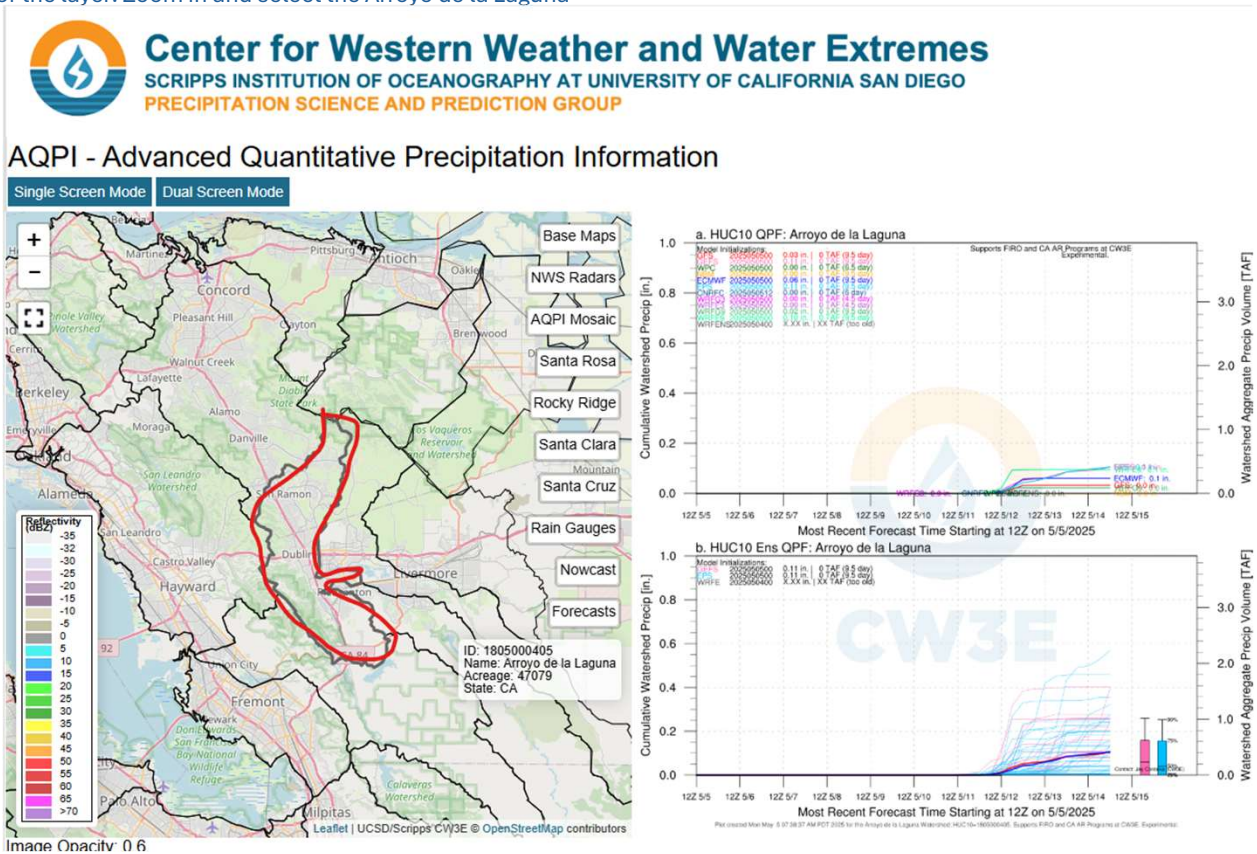

| Contact |
| --- |
| **Jon Rutz** (jrutz@ucsd.edu)<br>*AQPI Program Management, CW3E* |

| Information / Data Access |
| --- |
| CW3E AQPI Webpage: Access Here<br><br>NOAA Radar Archive: Access Here<br>*NEXRAD and AQPI Radar Side-by-Sides* |


Dublin San Ramon
Services District
Water, wastewater, recycled water
DSRSD
AQPI USE

**AQPI Weather Information**

- AQPI (Advanced Quantitative Precipitation Information) AQPI Radar Viewer
  - Select Rocky Ridge for the layer. Zoom in and select the Arroyo de la Laguna



CW3E Watershed QPF Portal
AQPI Radar Viewer

**AQPI Weather Information**

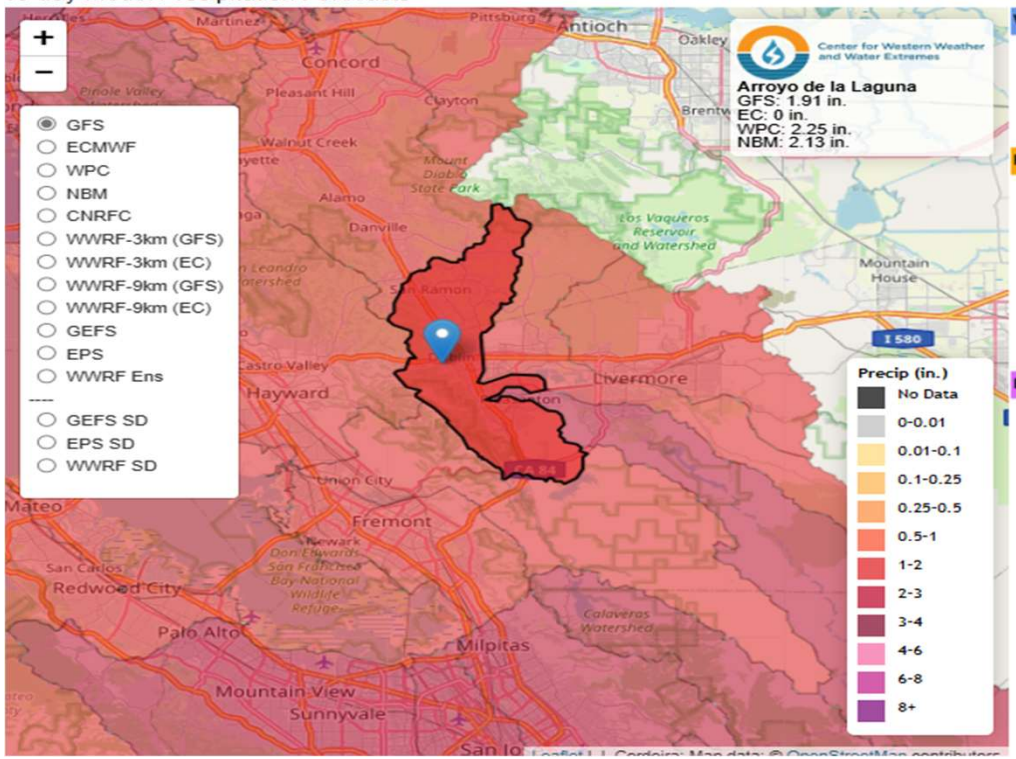
- AQPI (Advanced Quantitative Precipitation Information) AQPI Radar Viewer
- Select Rocky Ridge for the layer. Zoom in and select the Arroyo de la Laguna

# CW3E Precipitation Forecasts

Primary support by the California Atmospheric Rivers Program and U.S. Army Corps of Engineers FIRO Program
Return to CW3E Homepage.

Western US Basins | Select California Sub-Basins | AQPI Sub-Basins | Select Reservoir Catchments | CONUS ASOS | Refresh Entire Page

10-day Model Precipitation Forecasts




**Watershed and Update Information:**

| | |
|---|---|
| Watershed Name: | Arroyo de la Laguna |
| Watershed ID: | 1805000405 (HUC10) |
| Watershed Area: | 47079 Acres (47TAF) |
| Model data last updated: | Wed Feb 12 07:39:49 AM PST 2025 |

**Forecast Summary of Mean Areal Precipitation and Volume**

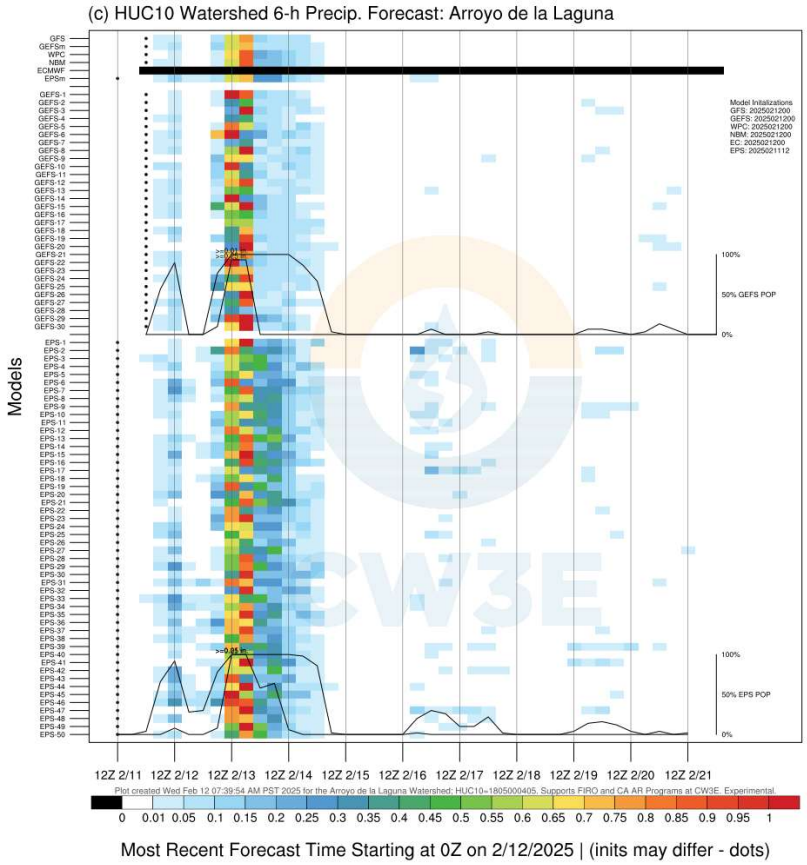
| Model | Initialization | Total QPF | Total Volume | Duration |
|---|---|---|---|---|
| GFS Op. | 2025021200 | 1.91 in. | 7 TAF | 10 days |
| ECMWF Op. | 2025021200 | 0.00 in. | 0 TAF | 10 days |
| NOAA WPC | 2025021200 | 2.25 in. | 8 TAF | 7 days |
| National Blend | 2025021200 | 2.13 in. | 8 TAF | 10 days |
| GEFS Ens Mean | 2025021200 | 1.83 in. ±0.51 | 7 TAF ±1 | 10 days |
| ECMWF Ens Mean | 2025021112 | 2.48 in. ±0.37 | 9 TAF ±1 | 10 days |
| CNRFC | 2025021112 | 2.45 in. | 9 TAF | 6 days |
| WWRF GFS3km | 2025021200 | 2.58 in. | 10 TAF | 5 days |
| WWRF EC3km | 2025021200 | 2.82 in. | 11 TAF | 5 days |
| WWRF GFS9km | 2025021200 | 2.51 in. | 9 TAF | 10 days |
| WWRF EC9km | 2025021200 | 2.49 in. | 9 TAF | 10 days |
| WWRF Ensemble | 2025021200 | 2.30 in. ±0.46 | 9 TAF ±1 | 7 days |

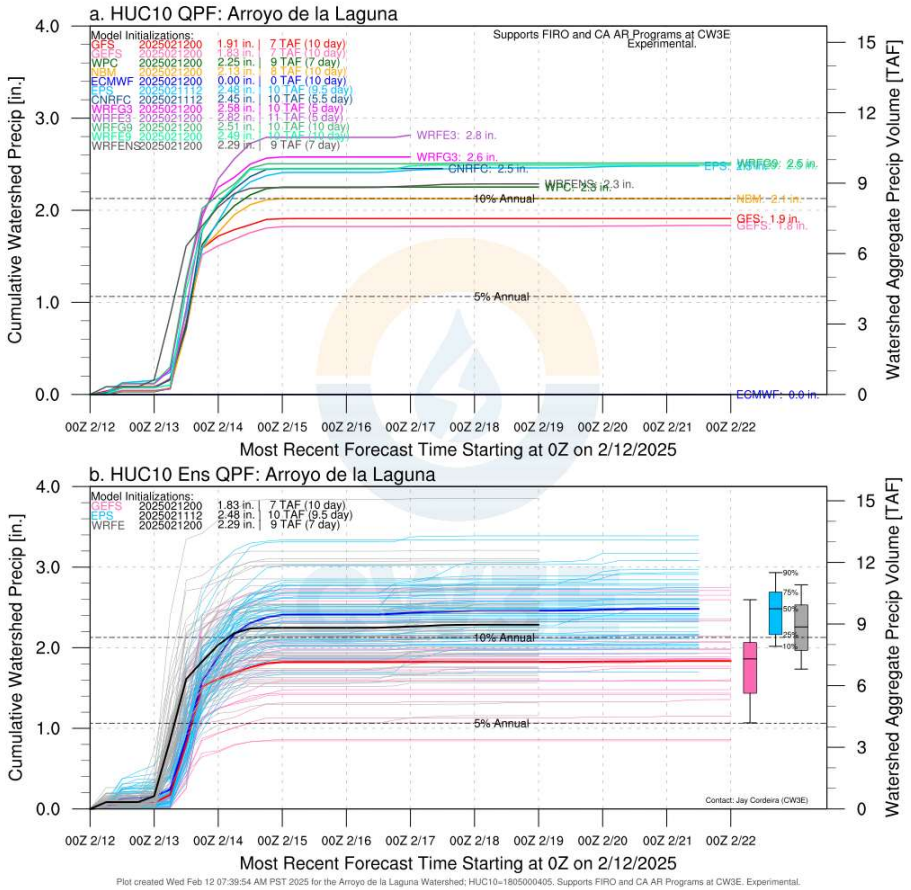
**Daily and Multi-Day Precipitation Forecast Totals**

| Model | Day-1 | Day-2 | Day-3 | Day-4 | Day-5 | Day-6 | Day-7 | Days-8-10 |
|---|---|---|---|---|---|---|---|---|
| GFS Op. | 0.08 | 1.63 | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ECMWF Op. | [illegible] | | | | | | | |
| NOAA WPC | 0.03 | 1.84 | 0.38 | 0.00 | 0.00 | 0.00 | 0.00 | X |
| National Blend | 0.04 | 1.72 | 0.37 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| GEFS Ens Mean | 0.07 | 1.54 | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| ECMWF Ens Mean | 0.13 | 0.75 | 1.43 | 0.10 | 0.00 | 0.04 | 0.01 | 0.02 |
| CNRFC | 0.07 | 0.65 | 1.64 | 0.09 | 0.00 | 0.00 | X | X |
| WWRF GFS3km | 0.12 | 2.13 | 0.33 | 0.00 | 0.00 | X | X | X |
| WWRF EC3km | 0.04 | 2.30 | 0.45 | 0.00 | 0.02 | X | X | X |
| WWRF GFS9km | 0.12 | 2.04 | 0.34 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| WWRF EC9km | 0.07 | 2.01 | 0.37 | 0.00 | 0.03 | 0.01 | 0.00 | 0.00 |
| WWRF Ensemble | 0.16 | 1.88 | 0.21 | 0.00 | 0.02 | 0.02 | 0.00 | X |

Daily totals are relative to each respective model's initialization time. The "--" symbole indicates that the model initializaion is >1.5 days old

Table created Wed Feb 12 07:39:54 AM PST 2025 for the Arroyo de la Laguna Watershed, HUC10=1805000405. Supports FIRO and CA AR Programs at CW3E. Experimental.


(c) HUC10 Watershed 6-h Precip. Forecast: Arroyo de la Laguna
Models
GFS
GEFSm
WPC
NBM
ECMWF
EPSm
Model Initializations
GFS: 2025021200
GEFS: 2025021200
WPC: 2025021200
NBM: 2025021200
EC: 2025021200
EPS: 2025021112
100%
50% GEFS POP
0%
50% EPS POP
12Z 2/11 12Z 2/12 12Z 2/13 12Z 2/14 12Z 2/15 12Z 2/16 12Z 2/17 12Z 2/18 12Z 2/19 12Z 2/20 12Z 2/21
Plot created Wed Feb 12 07:39:54 AM PST 2025 for the Arroyo de la Laguna Watershed: HUC10=1805000405. Supports FIRO and CA AR Programs at CW3E. Experimental.
0 0.01 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8 0.85 0.9 0.95 1
Most Recent Forecast Time Starting at 0Z on 2/12/2025 | (inits may differ - dots)


a. HUC10 QPF: Arroyo de la Laguna
Model Initializations:
GFS 2025021200 1.91 in. | 7 TAF (10 day)
GEFS 2025021200 1.83 in. | 7 TAF (10 day)
WPC 2025021200 2.25 in. | 9 TAF (7 day)
NBM 2025021200 2.13 in. | 8 TAF (10 day)
ECMWF 2025021200 0.00 in. | 0 TAF (10 day)
EPS 2025021112 2.48 in. | 10 TAF (9.5 day)
CNRFC 2025021112 2.45 in. | 10 TAF (5.5 day)
WRFG3 2025021200 2.58 in. | 10 TAF (5 day)
WRFE3 2025021200 2.82 in. | 11 TAF (5 day)
WRFG9 2025021200 2.51 in. | 10 TAF (10 day)
WRFE9 2025021200 2.49 in. | 10 TAF (10 day)
WRFENS 2025021200 2.29 in. | 9 TAF (7 day)
Supports FIRO and CA AR Programs at CW3E
Experimental.
WRFE3: 2.8 in.
WRFG3: 2.6 in.
CNRFC: 2.5 in.
EPS: 2.5 in.
WRFG9: 2.5 in.
WRFENS: 2.3 in.
WPC: 2.3 in.
10% Annual
NBM: 2.1 in.
GFS: 1.9 in.
GEFS: 1.8 in.
5% Annual
ECMWF: 0.0 in.
Cumulative Watershed Precip [in.]
Watershed Aggregate Precip Volume [TAF]
4.0
3.0
2.0
1.0
0.0
15
12
9
6
3
0
00Z 2/12 00Z 2/13 00Z 2/14 00Z 2/15 00Z 2/16 00Z 2/17 00Z 2/18 00Z 2/19 00Z 2/20 00Z 2/21 00Z 2/22
Most Recent Forecast Time Starting at 0Z on 2/12/2025
b. HUC10 Ens QPF: Arroyo de la Laguna
Model Initializations:
GEFS 2025021200 1.83 in. | 7 TAF (10 day)
EPS 2025021112 2.48 in. | 10 TAF (9.5 day)
WRFE 2025021200 2.29 in. | 9 TAF (7 day)
10% Annual
5% Annual
90%
75%
50%
25%
10%
Contact: Jay Cordeira (CW3E)
Cumulative Watershed Precip [in.]
Watershed Aggregate Precip Volume [TAF]
4.0
3.0
2.0
1.0
0.0
15
12
9
6
3
0
00Z 2/12 00Z 2/13 00Z 2/14 00Z 2/15 00Z 2/16 00Z 2/17 00Z 2/18 00Z 2/19 00Z 2/20 00Z 2/21 00Z 2/22
Most Recent Forecast Time Starting at 0Z on 2/12/2025
Plot created Wed Feb 12 07:39:54 AM PST 2025 for the Arroyo de la Laguna Watershed; HUC10=1805000405. Supports FIRO and CA AR Programs at CW3E. Experimental.

•Weather models created for DSRSD service area. NOTE: “Run_time” for the reports is in UTC (similar to Zulu or GMT) so you will need to subtract 8 (7 during DST) hours to get local time in PST. These are being updated regularly. These contain various models so you can see where various predictions are similar. The more the models line up the higher the confidence level.

- •The CW3E AQPI team is providing precipitation forecasts for your provided polygon.

Your files are being updated on these URL's:

- •36 Hour in 1 hr. increments: https://cw3e.ucsd.edu/Projects/AQPI/datashare/DSRSD_nbm.csv
- •18 Hour in 15 min increments: https://cw3e.ucsd.edu/Projects/AQPI/datashare/DSRSD_hrrr.csv
- •10 Day in 6 hr. increments: https://cw3e.ucsd.edu/Projects/AQPI/datashare/DSRSD_gfs.csv

| name | institution | model_grid | run_time | precipitation_1.0h | precipitation_2.0h | precipitation_3.0h | precipitation_4.0h | precipitation_5.0h | precipitation_6.0h | precipitation_7.0h | precipitation_8.0h | precipitation_9.0h | precipitation_10.0h | precipitation_11.0h | precipitation_12.0h | precipitation_13.0h | precipitation_14.0h | precipitation_15.0h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DSRSD | DSRSD | POINT (-121.98424757056186 37.681708445235145 | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.84082079032406 37.68183483352267) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.84635445743474 37.70366015434035) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.81876907000537 37.708036936353786 | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.85189037680473 37.725483310991805 | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.82429960125474 37.729860585072274 | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.8574285497909 37.747304300027366) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.91261411422029 37.73853520433367) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.88502246049731 37.74292201279893) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.91816532238433 37.76035303832117) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.89056827923947 37.76474033907551) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.86296897775111 37.769123117998156) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.92371879090156 37.782168698765126 | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.8961163563253 37.7865564913237) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.86851166204436 37.79093976145618) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.90166669311597 37.808370466096505 | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.92909709813941 37.690502687369616 | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.90151847350866 37.694893029519754 | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.87393759260499 37.69927885195291) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.93464917372616 37.71232436424585) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.90706516504846 37.71671520025033) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.87947889873882 37.72110151594182) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.9402035089513 37.73414387495984) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.95667346449187 37.686107825831556 | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.98981041016138 37.703529132613845 | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.96223092276554 37.70792900825723) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.9953755134089 37.72534765480167) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.96779064268298 37.729748025006145 | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.97335262560627 37.751564872630006 | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DSRSD | DSRSD | POINT (-121.94576010517608 37.75596121606317) | 5/5/2025 16:00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Sent:** Wednesday, February 12, 2025 9:49 AM
**Subject:** RE: AQPI District Forecast for atmospheric river

All,

Below are the rainfall predictions based on the most recent models.

**DSRSD AQPI 6-hour precipitation model was updated this morning at 4 AM. Total predicted rainfall for the below period is 1.88 inches.**

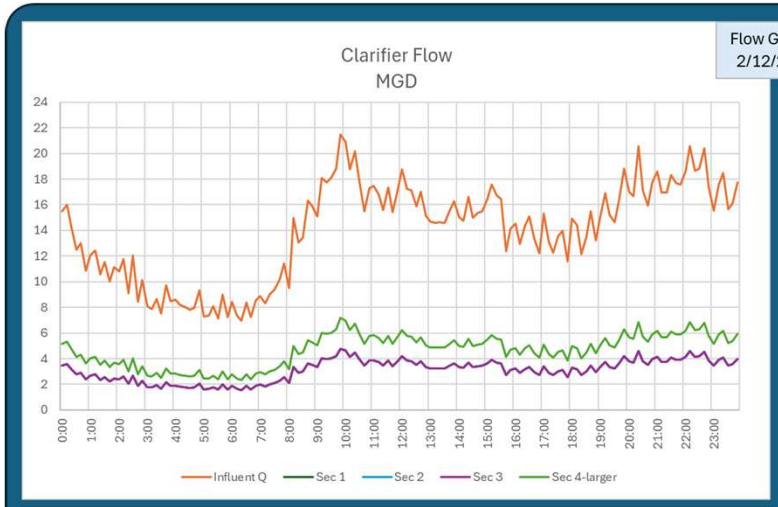
| Model Run Time | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2/12/2025 4:00 | **Date** | Wed 2/12 | Wed 2/12 | Wed 2/12 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Fri 2/14 | Fri 2/14 | Fri 2/14 | Fri 2/14 | Sat 2/15 | Sat 2/15 | Sat 2/15 |
| | **Time** | 10:00 AM | 4:00 PM | 10:00 PM | 4:00 AM | 10:00 AM | 4:00 PM | 10:00 PM | 4:00 AM | 10:00 AM | 4:00 PM | 10:00 PM | 4:00 AM | 10:00 AM | 4:00 PM |
| | 6-hour total | 0.00 | 0.00 | 0.18 | 0.90 | 0.49 | 0.20 | 0.14 | 0.06 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| | 6-hour total | 0.00 | 0.00 | 0.14 | 0.72 | 0.59 | 0.18 | 0.06 | 0.04 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| | **Average 6-hour totals** | 0.00 | 0.00 | 0.16 | 0.81 | 0.54 | 0.19 | 0.10 | 0.05 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |

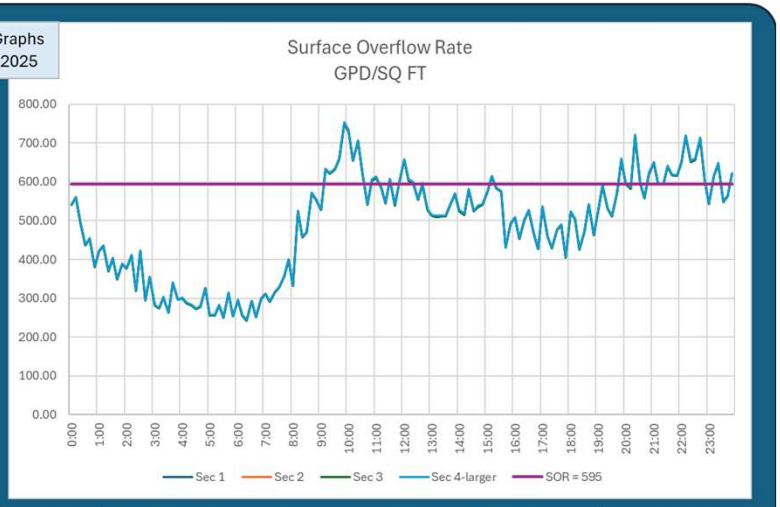
**DSRSD AQPI hourly precipitation model was updated today at 5 AM. Total predicted rainfall through Thursday at 5 PM is 1.8 inches.**

| 2/12/25 5:00 AM | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Date | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 | Wed 2/12 |
| | Time | 6:00 AM | 7:00 AM | 8:00 AM | 9:00 AM | 10:00 AM | 11:00 AM | 12:00 PM | 1:00 PM | 2:00 PM | 3:00 PM | 4:00 PM | 5:00 PM | 6:00 PM | 7:00 PM | 8:00 PM | 9:00 PM | 10:00 PM | 11:00 PM |
| | 1-hour avgs | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.06 | 0.06 |

| 2/12/25 5:00 AM | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Date | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 | Thu 2/13 |
| | Time | 12:00 AM | 1:00 AM | 2:00 AM | 3:00 AM | 4:00 AM | 5:00 AM | 6:00 AM | 7:00 AM | 8:00 AM | 9:00 AM | 10:00 AM | 11:00 AM | 12:00 PM | 1:00 PM | 2:00 PM | 3:00 PM | 4:00 PM | 5:00 PM |
| | 1-hour avgs | 0.08 | 0.12 | 0.14 | 0.17 | 0.20 | 0.19 | 0.15 | 0.12 | 0.15 | 0.07 | 0.03 | 0.03 | 0.00 | 0.01 | 0.04 | 0.04 | 0.02 | 0.05 |

Flow Graphs
2/12/2025



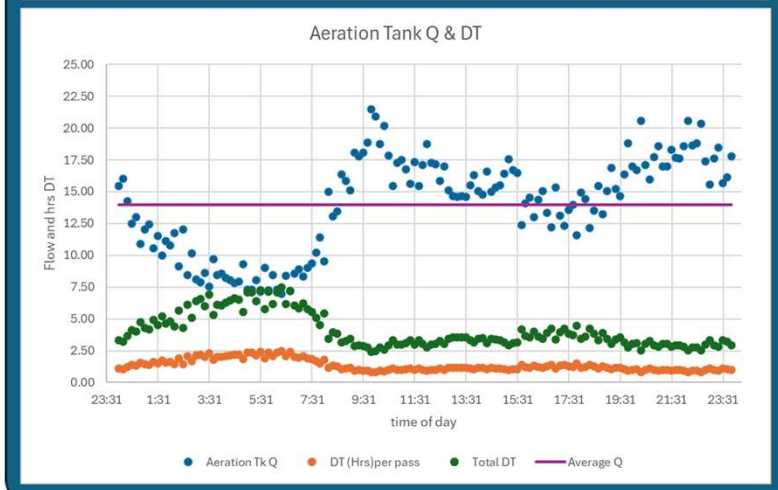



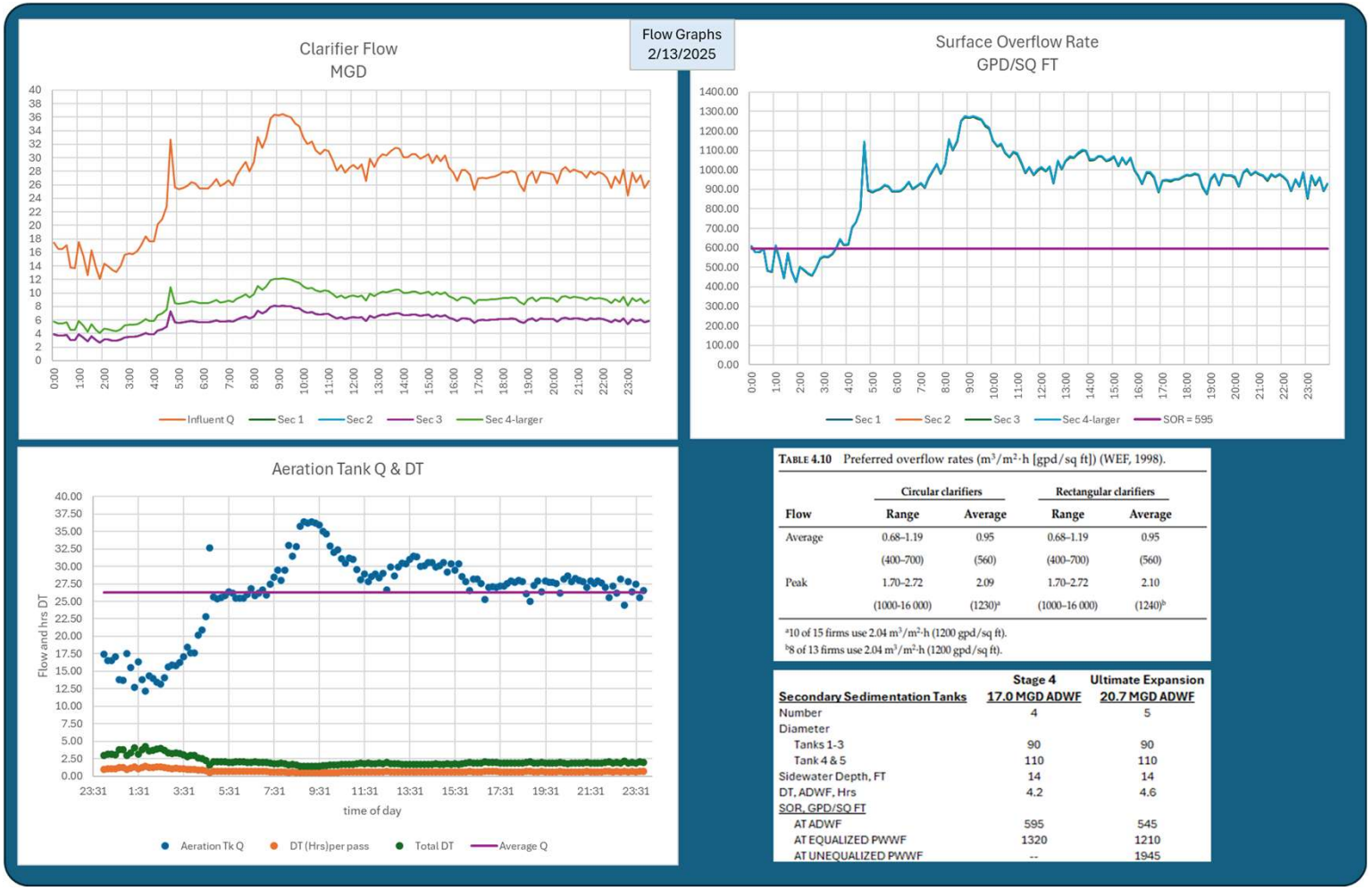

**TABLE 4.10** Preferred overflow rates ($m^3/m^2 \cdot h$ [gpd/sq ft]) (WEF, 1998).

| | Circular clarifiers | | Rectangular clarifiers | |
|---|---|---|---|---|
| **Flow** | **Range** | **Average** | **Range** | **Average** |
| Average | 0.68–1.19 | 0.95 | 0.68–1.19 | 0.95 |
| | (400–700) | (560) | (400–700) | (560) |
| Peak | 1.70–2.72 | 2.09 | 1.70–2.72 | 2.10 |
| | (1000–16 000) | (1230)[a] | (1000–16 000) | (1240)[b] |

[a]10 of 15 firms use 2.04 $m^3/m^2 \cdot h$ (1200 gpd/sq ft).
[b]8 of 13 firms use 2.04 $m^3/m^2 \cdot h$ (1200 gpd/sq ft).

| Secondary Sedimentation Tanks | Stage 4 17.0 MGD ADWF | Ultimate Expansion 20.7 MGD ADWF |
|---|---|---|
| Number | 4 | 5 |
| Diameter | | |
| Tanks 1-3 | 90 | 90 |
| Tank 4 & 5 | 110 | 110 |
| Sidewater Depth, FT | 14 | 14 |
| DT, ADWF, Hrs | 4.2 | 4.6 |
| SOR, GPD/SQ FT | | |
| AT ADWF | 595 | 545 |
| AT EQUALIZED PWWF | 1320 | 1210 |
| AT UNEQUALIZED PWWF | -- | 1945 |

**Flows 2/12/2025:**
**Avg – 13.98**
**Min – 6.95**
**Max – 21.50**

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|---|---|---|---|---|
| Flow | Range | Average | Range | Average |
| Average | 0.68–1.19 | 0.95 | 0.68–1.19 | 0.95 |
| | (400–700) | (560) | (400–700) | (560) |
| Peak | 1.70–2.72 | 2.09 | 1.70–2.72 | 2.10 |
| | (1000–16 000) | (1230)[a] | (1000–16 000) | (1240)[b] |

[a]10 of 15 firms use 2.04 $m^3/m^2 \cdot h$ (1200 gpd/sq ft).
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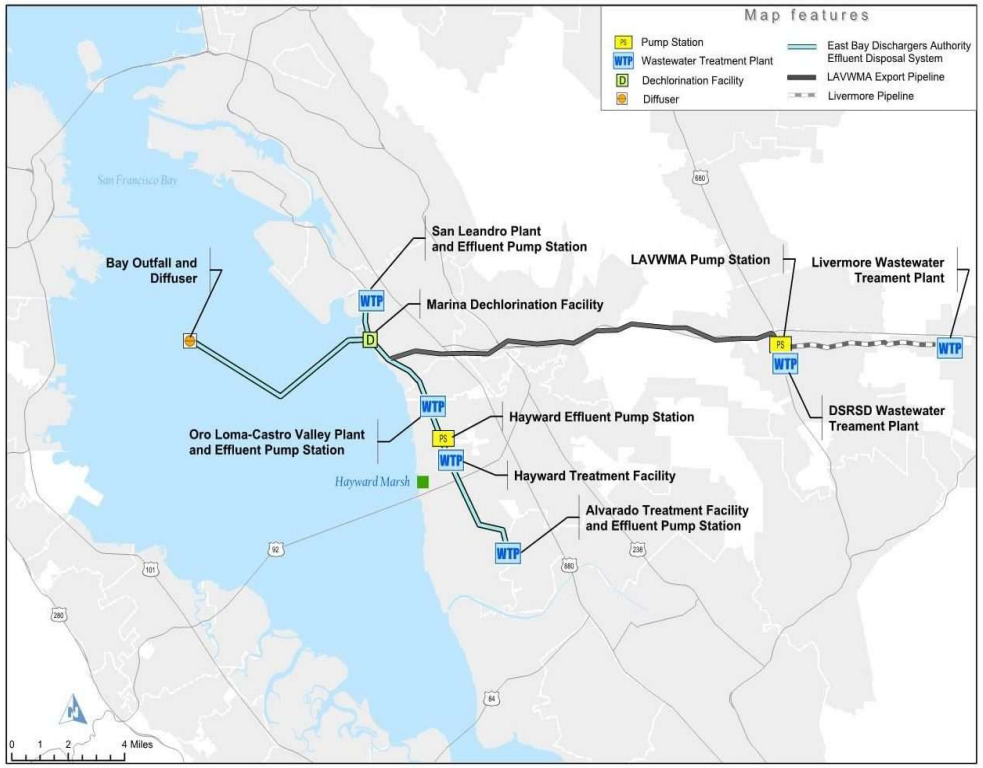
| Secondary Sedimentation Tanks | Stage 4 17.0 MGD ADWF | Ultimate Expansion 20.7 MGD ADWF |
|---|---|---|
| Number | 4 | 5 |
| Diameter | | |
| Tanks 1-3 | 90 | 90 |
| Tank 4 & 5 | 110 | 110 |
| Sidewater Depth, FT | 14 | 14 |
| DT, ADWF, Hrs | 4.2 | 4.6 |
| SOR, GPD/SQ FT | | |
| AT ADWF | 595 | 545 |
| AT EQUALIZED PWWF | 1320 | 1210 |
| AT UNEQUALIZED PWWF | -- | 1945 |

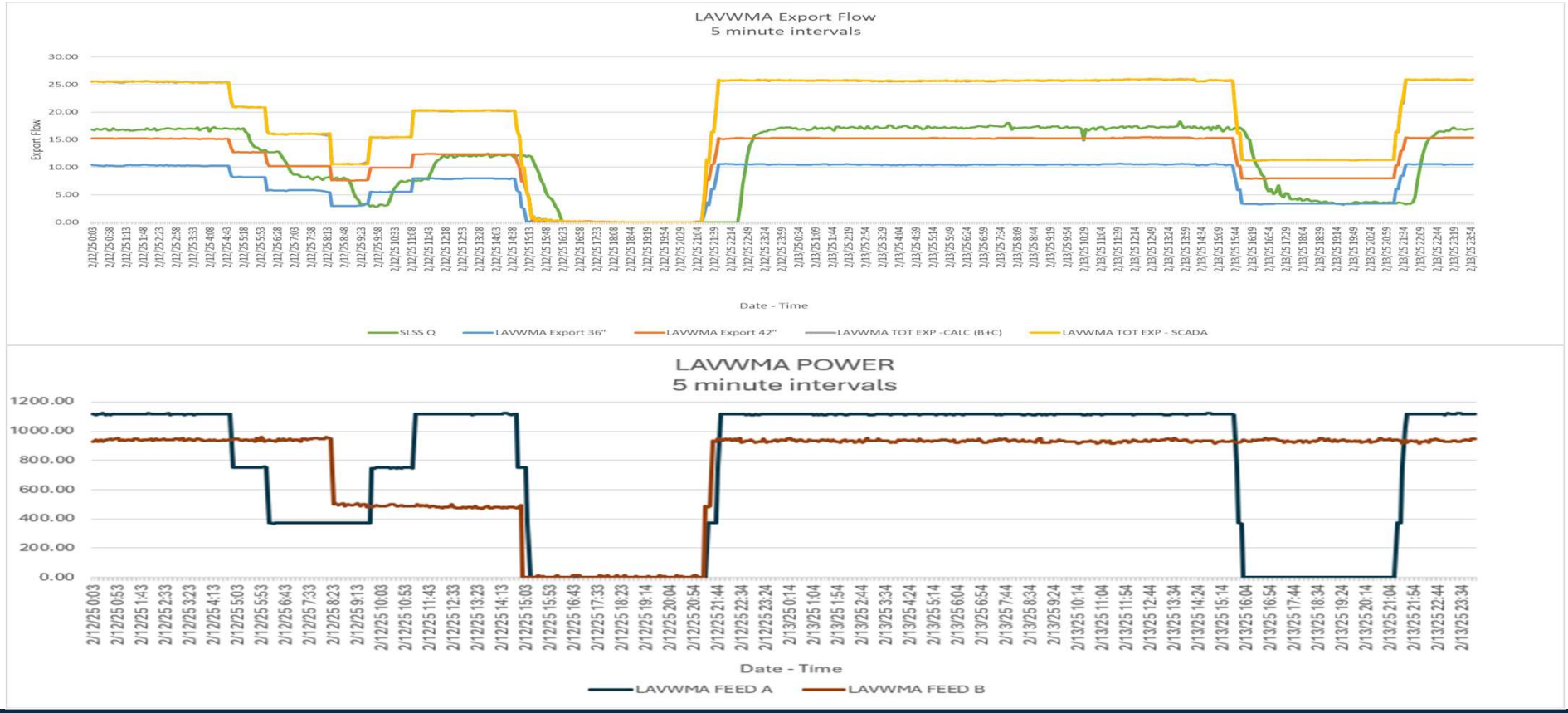
**Flows 2/13/2025:**
**Avg – 26.28**
**Min – 12.13**
**Max – 36.43**

# Use of AQPI for pumping decisions.




- Demand Charge for pumps
  - Small Pump $15.5K
  - Large Pump $19.8K
- LAVWMA Storage
  - 3 Basins totaling 18 MG

LAVWMA storm flows with 3 small and 2 large Pumps. No impact to the usual demand charges as a result of utilizing AQPI hourly data to develop a pumping plan during and after the storm.




Dublin San Ramon
Services District
Water, wastewater, recycled water
Questions?

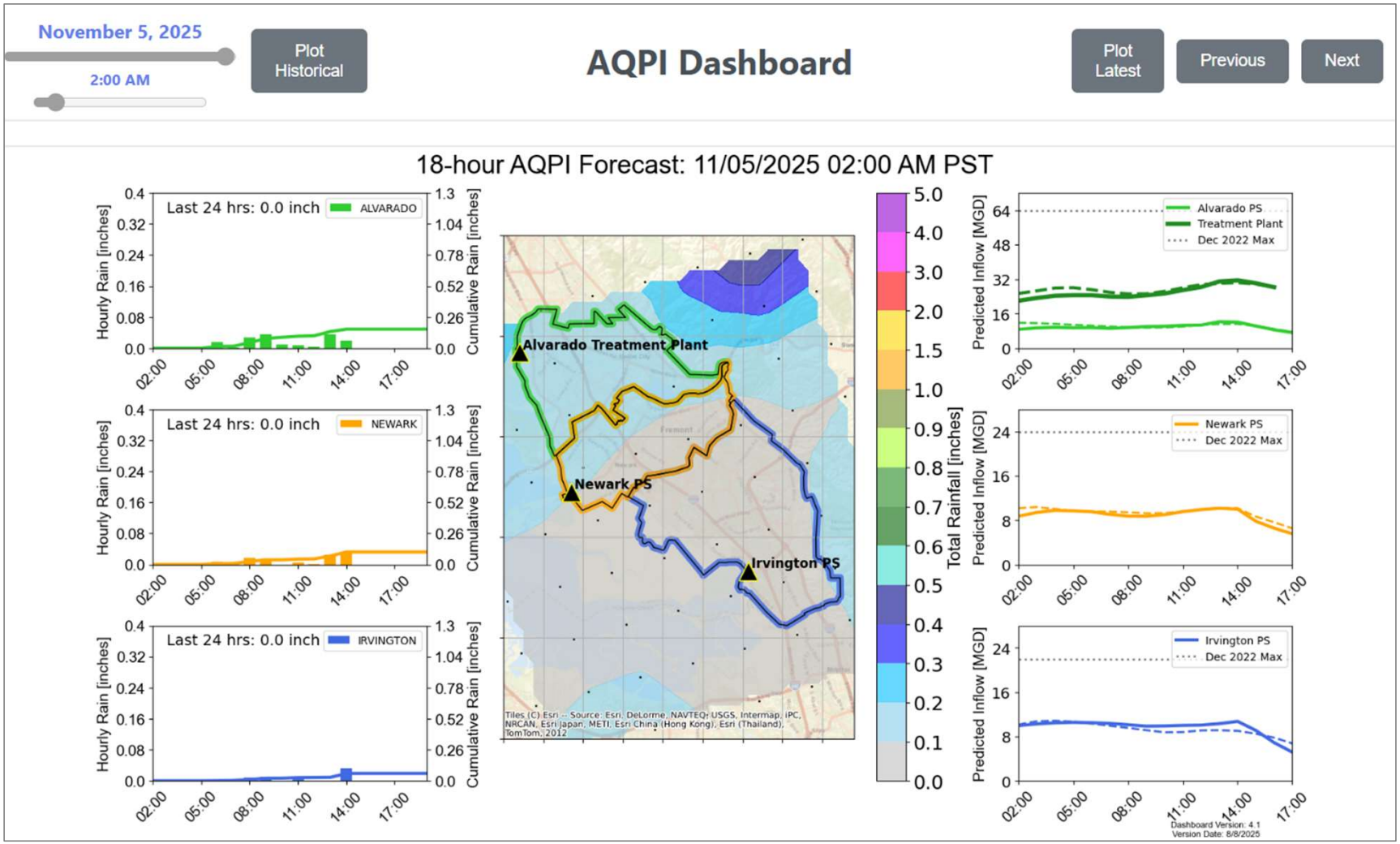
# UNION SANITARY DISTRICT

## BACWA - Predictive Rainfall Model Update

## 11/5/25

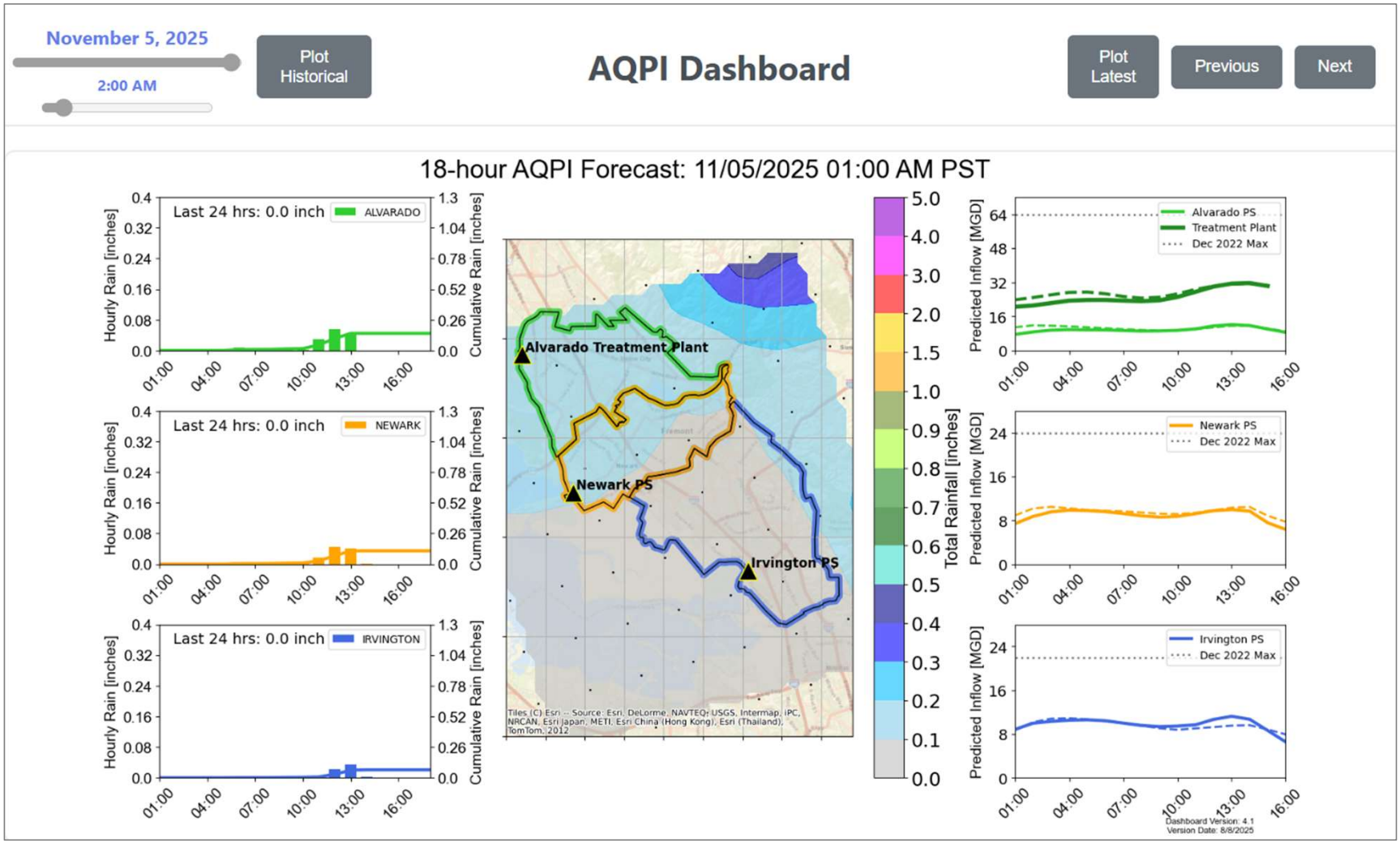
# November 5, 2025, Storm Event: forecast at 2:00 am

## USD uses AQPI Rainfall Rates and Forecasts with Machine Learning to Predict Flows to Pumps & Plant



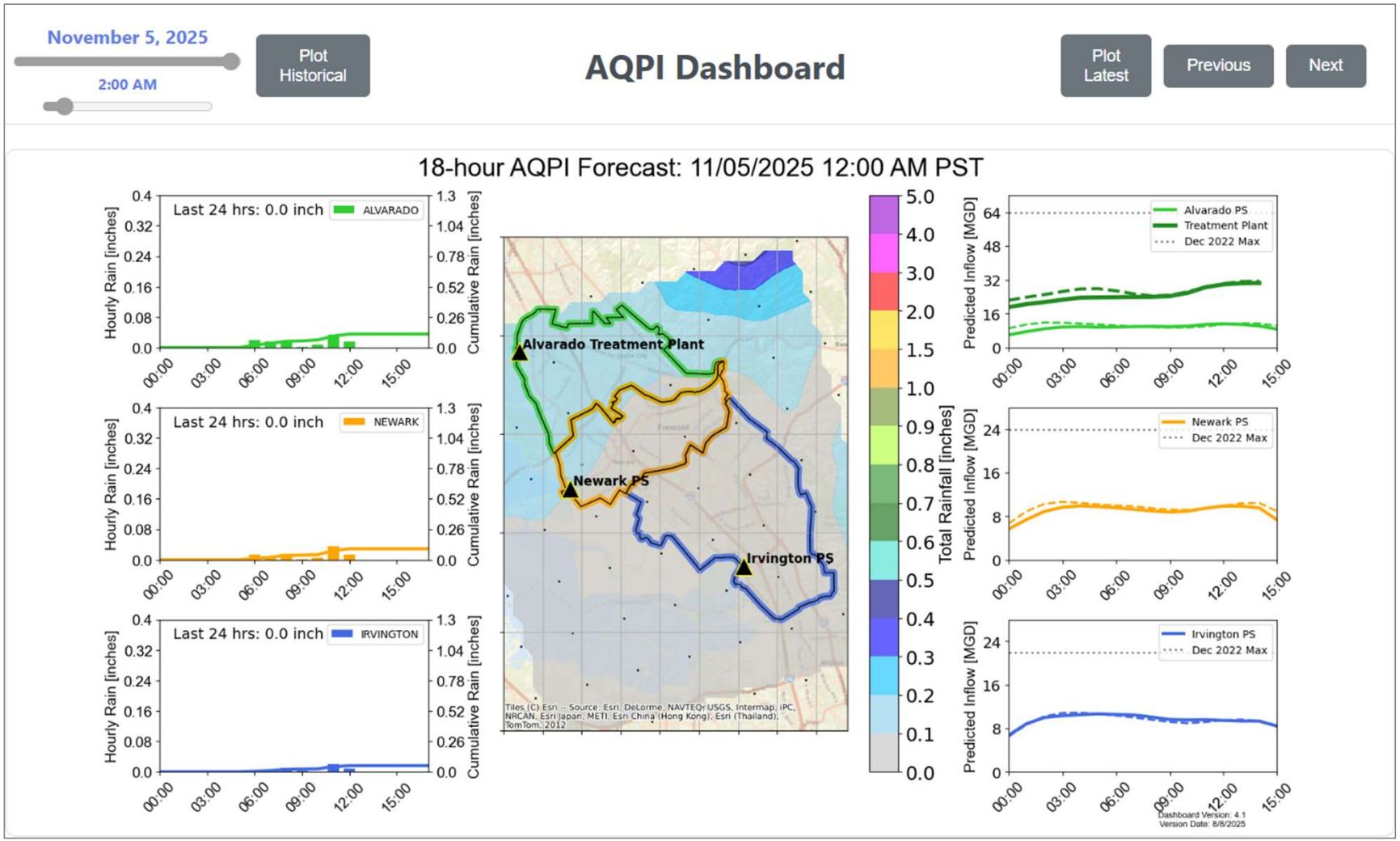
# November 5, 2025, Storm Event: forecast at 1:00 am

**Dashboard includes navigation tools to look back at prior forecasts**



# November 5, 2025, Storm Event: forecast at 12:00 am

**Dashboard includes navigation tools to look back at prior forecasts**



# Data Flow Diagram

**Dashboard is deployed on AWS Cloud to reduce cyber security and data storage concerns**