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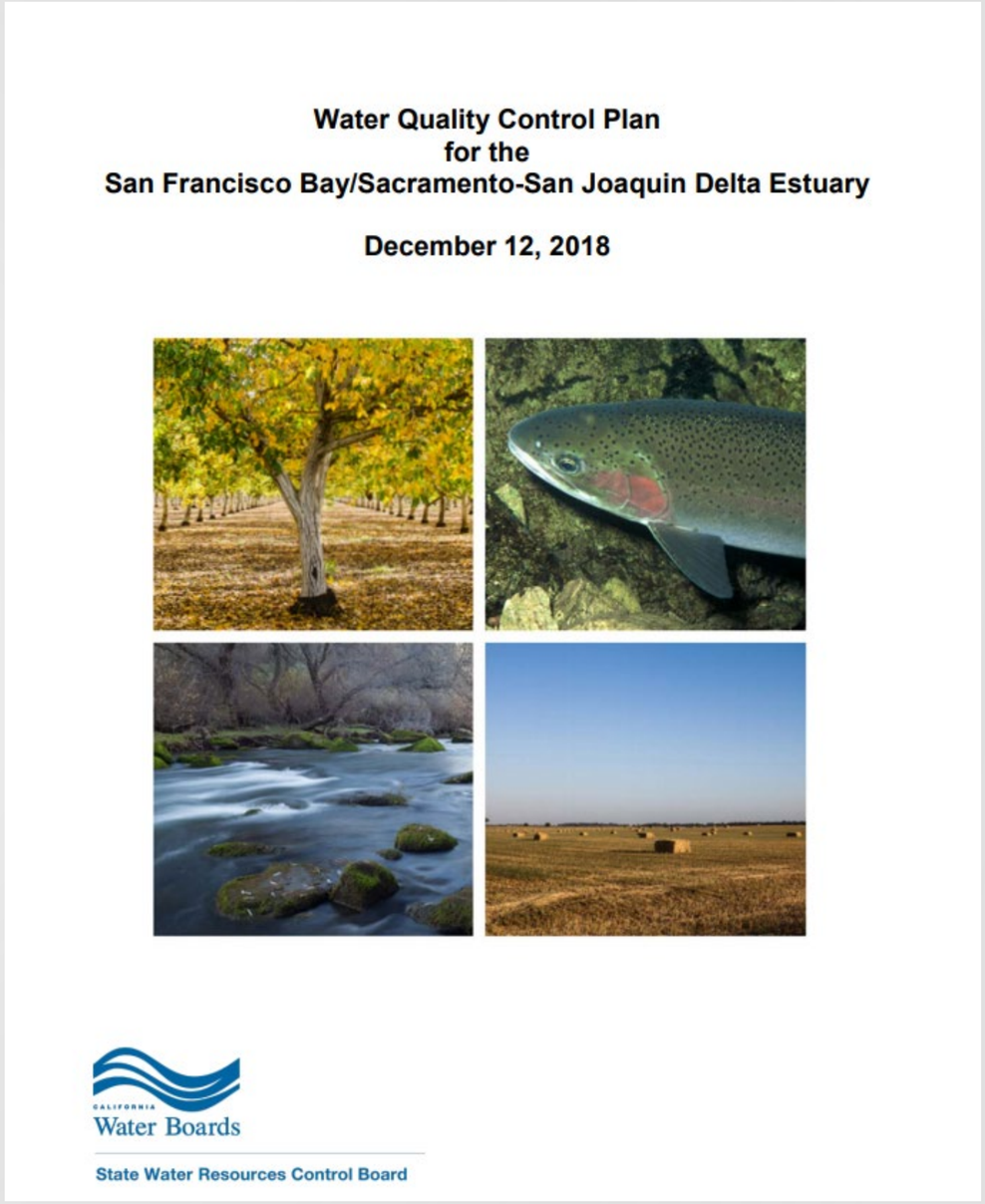
Monitoring Special Study

Technical Studies Overview, May 6, 2021

Jacob McQuirk, P.E., Principal Engineer

MSS Background

- 2018 Bay-Delta Plan amendment requires preparation of a Monitoring Special Study (MSS)
- DWR and USBR planning to conduct 6 technical studies in the MSS
- Stakeholder input needed to develop and implement an MSS that will characterize the spatial and temporal distribution and associated dynamics of water level, flow, and salinity conditions in the southern Delta waterways



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Stakeholder Process Goals

Gather stakeholder input to inform the development of the MSS study plans, including:

1. Identify and discuss the studies that DWR and Reclamation propose to conduct
2. Build consensus about the specific issues and questions the studies should address
3. Gather input on and discuss study design
4. Identify existing data sources and how that data can be shared
5. Provide study status updates and presentations on completed technical work

Stakeholder #1 Meeting Objectives

- ✓ Identify and discuss the studies that DWR and Reclamation propose to conduct
- ✓ Answer questions and gather input on the study tools
- ✓ Chart path forward for development of study designs

Agenda

1. Welcome & Overview
2. Introduction to Technical Presentations
3. Technical Presentations
   - Salinity Point Source Sampling & Increased Ion Sampling AND High-Speed Electrical Conductivity Transects with GPS Mapping
   - Paradise Cut Flushing Study
   - SCHISM 3D
   - Water Quality Data Integration
   - Monitoring Special Studies Informing Future Compliance Monitoring
4. Closing & Next Steps

Logistics

- If you need help with Zoom platform:
  - Use chat feature at bottom of screen
- To call in to the meeting:
  - Phone number: 877-402-9753
  - Conference code: 459931
- Lagging sound?
  - Close all other apps and programs and limit other streaming or downloads
- All participants will be muted upon joining, please stay on mute during presentations
- This meeting is being recorded and will be transcribed
- Meeting notes will be distributed to all participants

If you are on the phone, unmute and mute your phone using ***6**

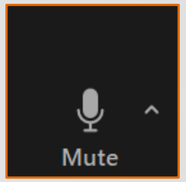
Ground Rules

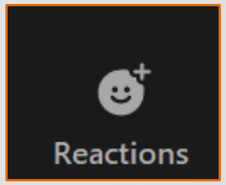
Discussion sessions following each presentation:

- If you have a question or comment, type it in the **Chat** box at the bottom of your screen
- If you would like to comment, you can ‘raise your hand’ to be called on

  If you are on the phone, use ***9** to raise your hand
- Commenters will be called on in the order in which they ‘raise their hands’
- When called upon, you will receive a prompt to unmute

  If you are on the phone, unmute and mute your phone using ***6**
- Commenters will be given 2 minutes to speak. Please be respect everyone’s time and each other





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Key Staff and Technical Team

- Facilitator
  - Erika Britney, Consultant
- South Delta Branch
  - Jacob McQuirk, Principal Engineer
  - Ibraheem Alsufi, Water Resources Engineer
- Water Quality Evaluation Section
  - Jared Frantzich, Senior Environmental Scientist Supervisor
- Bay-Delta Modeling Office
  - Eli Ateljevich, Senior Engineer
  - Zhenlin Zhang, Water Resources Engineer

TECHNICAL PRESENTATIONS

Things to consider:

- What questions/issues could these tools be used to address?
- What existing data/information could be used or applied with these tools?

Reminder:

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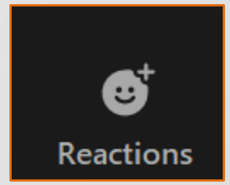

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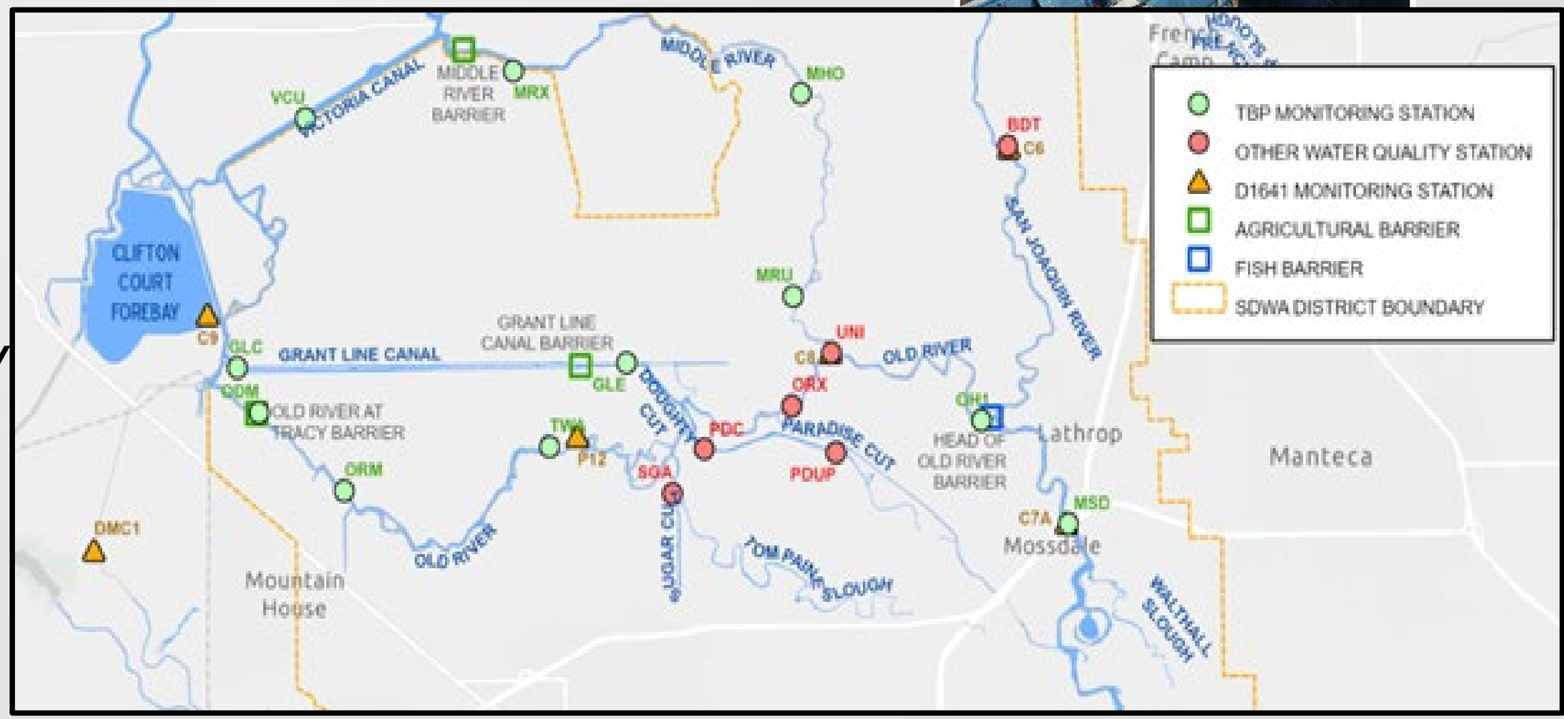
Salinity Point Source Sampling and Increased Ion Sampling

Background:

- *Salinity contributions to South Delta channels are complex*
- *Impacted by complicated hydrodynamics & water demand*
- *DWR operates 18 South Delta Salinity Monitoring Stations*
- *It's difficult to determine salinity origin with stationary points and variable tidal hydrology*



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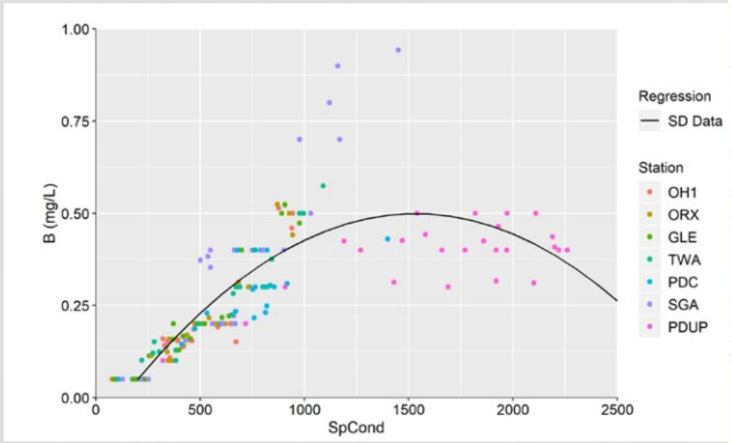
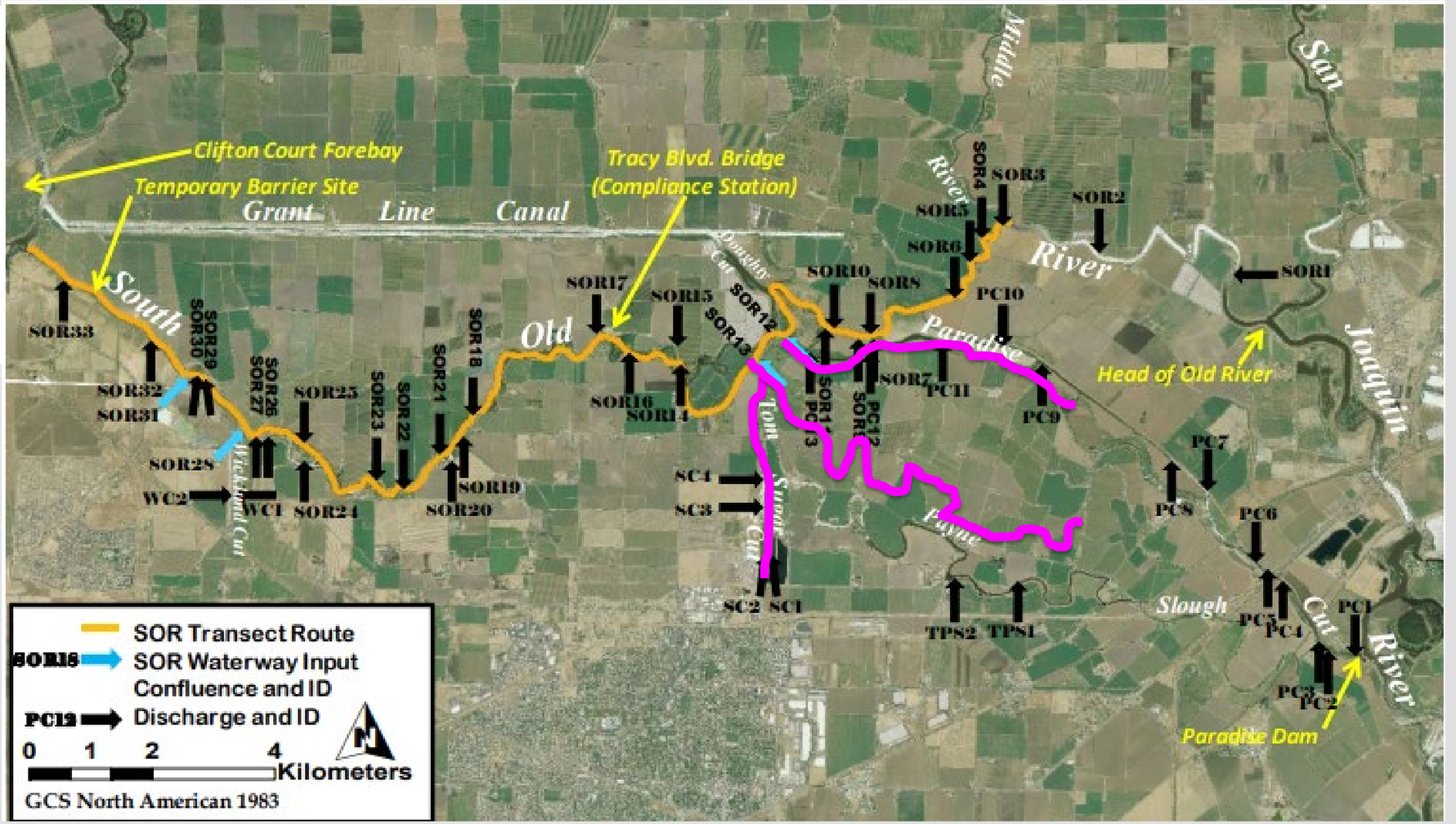
Primary Study Questions:

- *What are the primary salinity point source contributions to Old River?*
- *Can we use water ion fingerprinting to determine specific salinity sources?*





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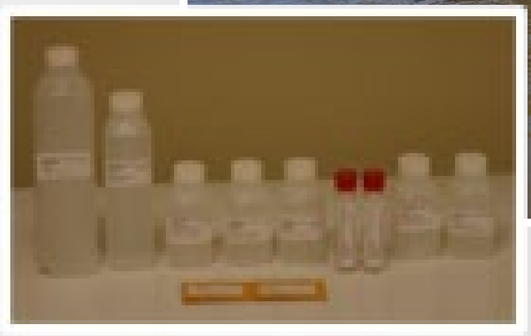
Study Objectives for WY22-23:

- *Increased Continuous South Delta EC Monitoring*
- *Paradise Cut and Sugar Cut Slough Contributions to Old River*
- *Supplement Current Station Network*
- *Inform Model Predictions*



Methods:

- *Deploy Continuous EC sensors*
- *Collect Water Samples for Ion Fingerprinting*
- *High Speed EC and Ion Tidal Dispersion Mapping – Paradise Cut and Sugar Cut*

High-Speed Electrical Conductivity Transects with GPS Mapping

Background:

- *High-speed boat water quality mapping is an emerging method for targeted sampling*
- *USGS has been pioneering this in the Delta*
- *Provides a way to capture entire channel reach water quality conditions*

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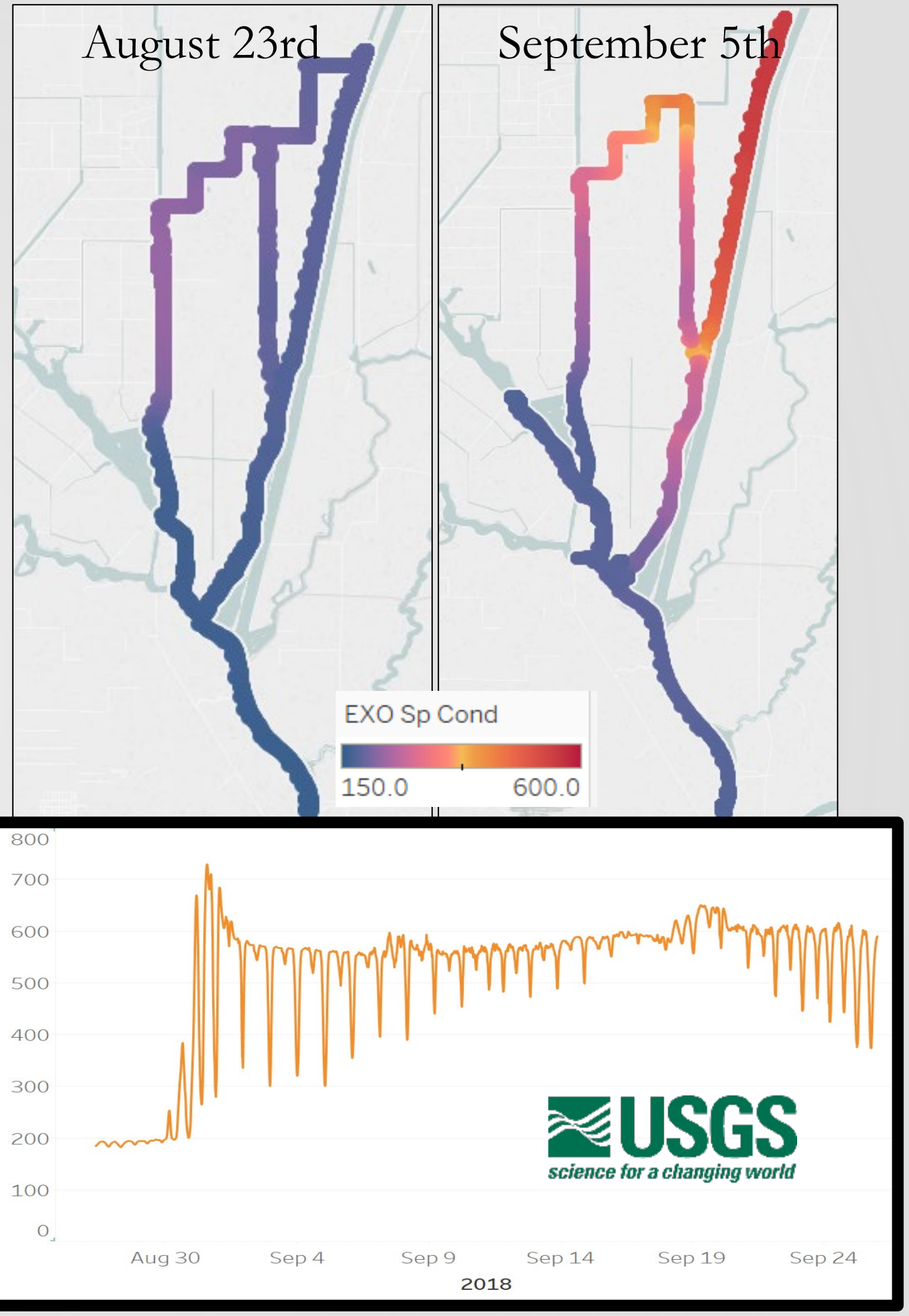
Primary Study Questions:

- *What are the salinity concentrations spatially throughout the entire network of South Delta channels?*
- *How does seasonal conditions and varied tidal flows affect tidal dispersion of salinity from point sources?*

Study Objectives for WY22-23:

- *Spatial Heat Maps of South Delta Channel EC*
- *Supplement DWR Station Data*
- *Inform Model Predictions*
- *Tidal & Flow Effects on EC*
- *River Reach EC Monitoring Feasibility*



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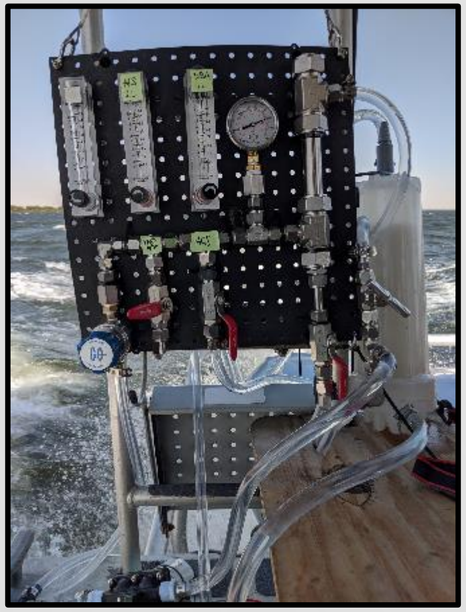
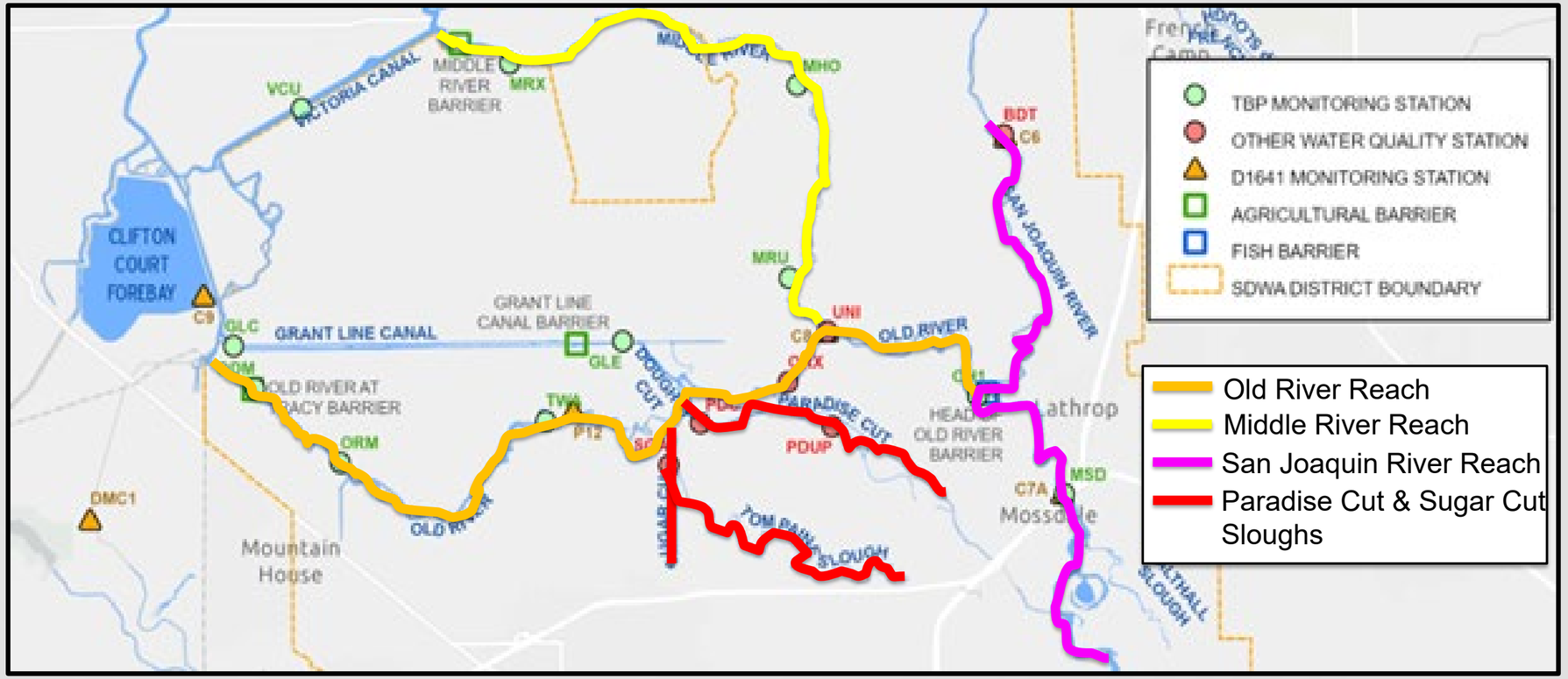
Methods:

- *USGS Modified Design*
- *Outfitted DWR Vessel – 15-20mph data collection*
- *GPS (sub-meter) and Water Sample Intake Option (ion sampling)*
- *Weeklong Seasonal Sampling for Baseline Conditions and Reach Feasibility*
- *Additional Targeted Sampling – Point Sources and Side Channels*





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Stakeholder Involvement:

- *Provide input on the development of study hypothesis and study questions*
- *Participate in the study design*
- *Contribute any known or documented diversion and discharge flows or related water quality datasets from municipal or agricultural water users*

Questions:

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916-376-9823

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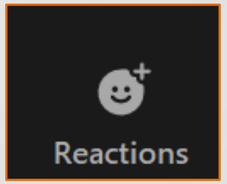

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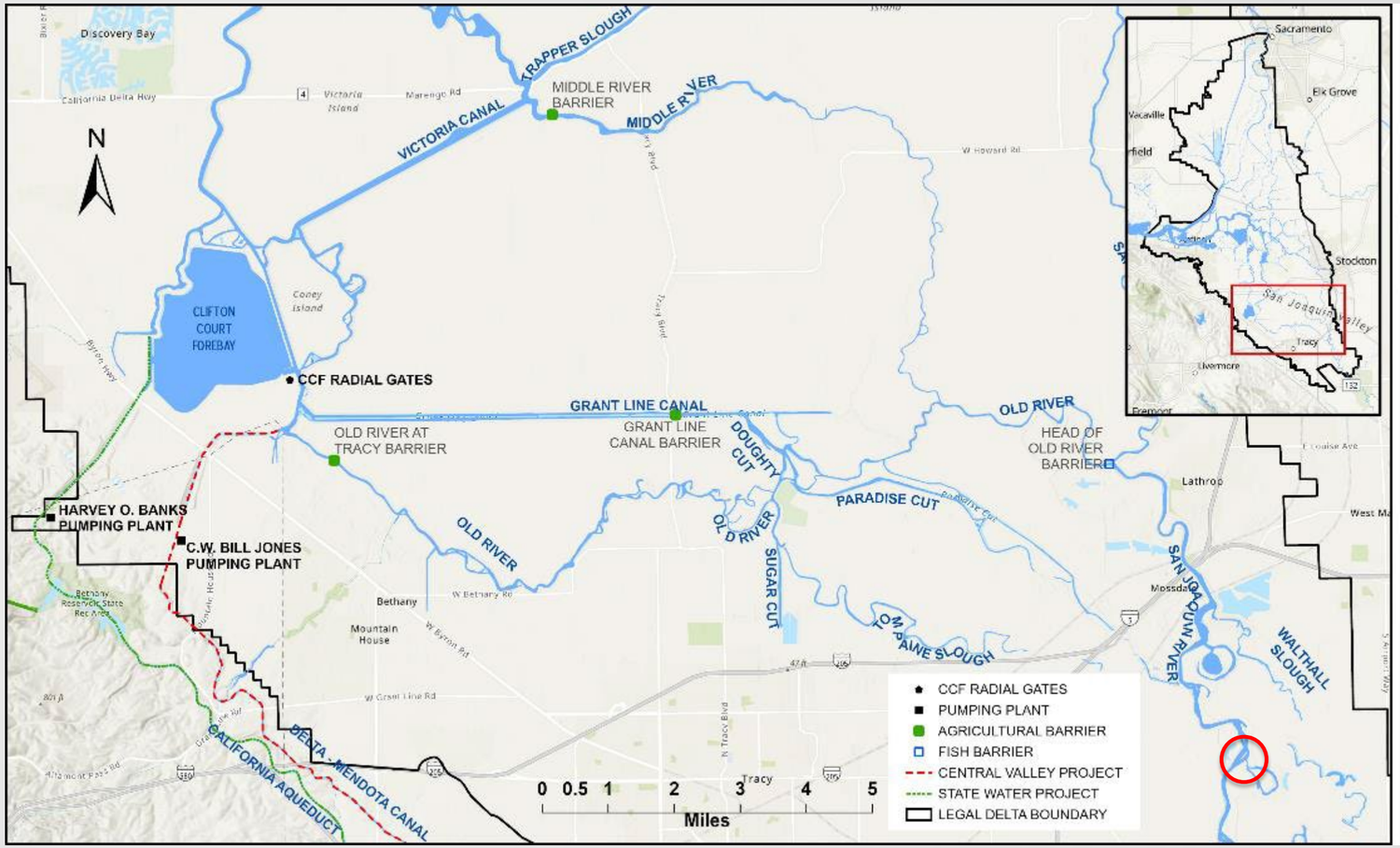
Paradise Cut Flushing Study

Background

- Paradise cut is a Tidal Slough
  - Location
  - Low and null flows
  - Measured high EC, potential for accumulated salts
- May be contributing to high EC levels in neighboring channels
- “Flush out” Paradise Cut and measure response and effects
- Connects to SJR via lateral weir



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Paradise Cut Flushing Study

Methods

- Temporary pump water into Paradise Cut from San Joaquin River
- Measure the flow and EC response
  - Controlled flow using temporary pump over weir
  - Existing WQ monitoring stations in PC & Old River
  - Additional measurement points may be needed
- Utilize hydrodynamic models to validate results
- Incorporate high speed EC and increased ion sampling

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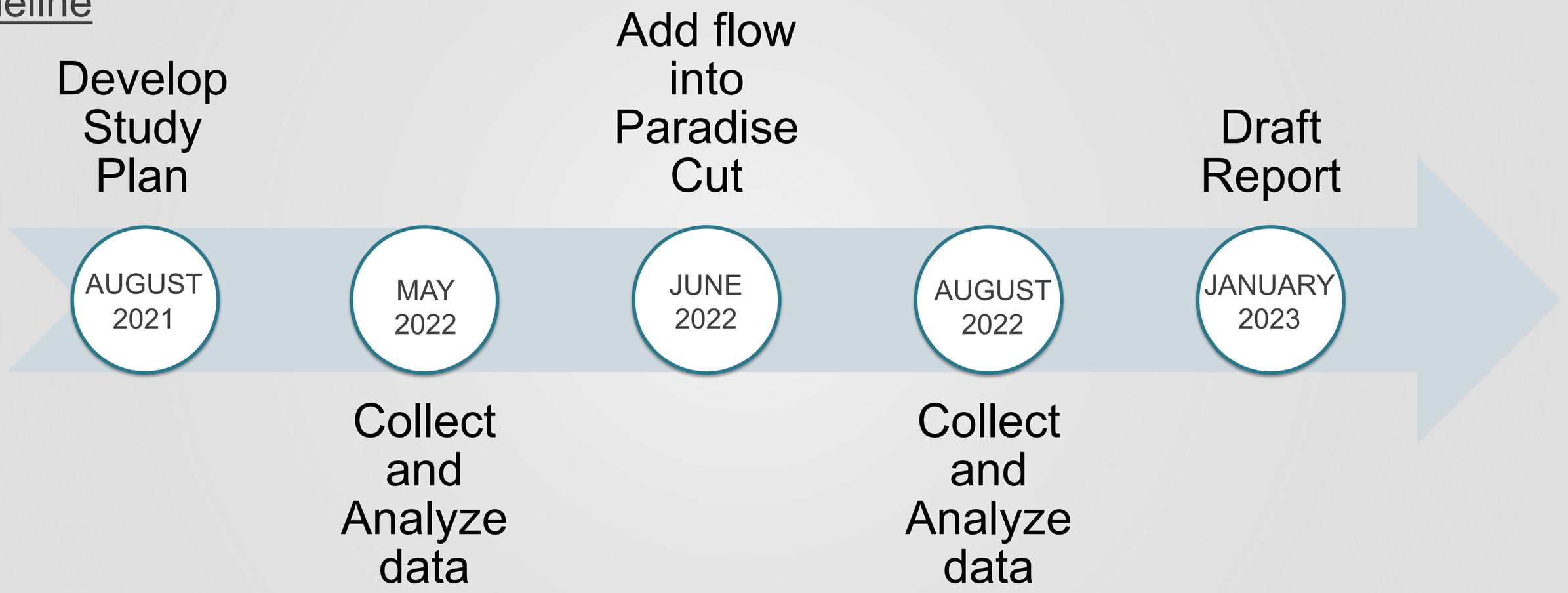
Paradise Cut Flushing Study

Timeline



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Paradise Cut Flushing Study

Discussion

- Locals' knowledge critical to make this experiment a success
- Any input on study design or questions that could be addressed?
- Any existing data or information that could help inform this study?

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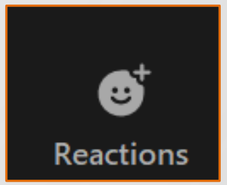

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Bay-Delta SCHISM Intro for South Delta Special Studies

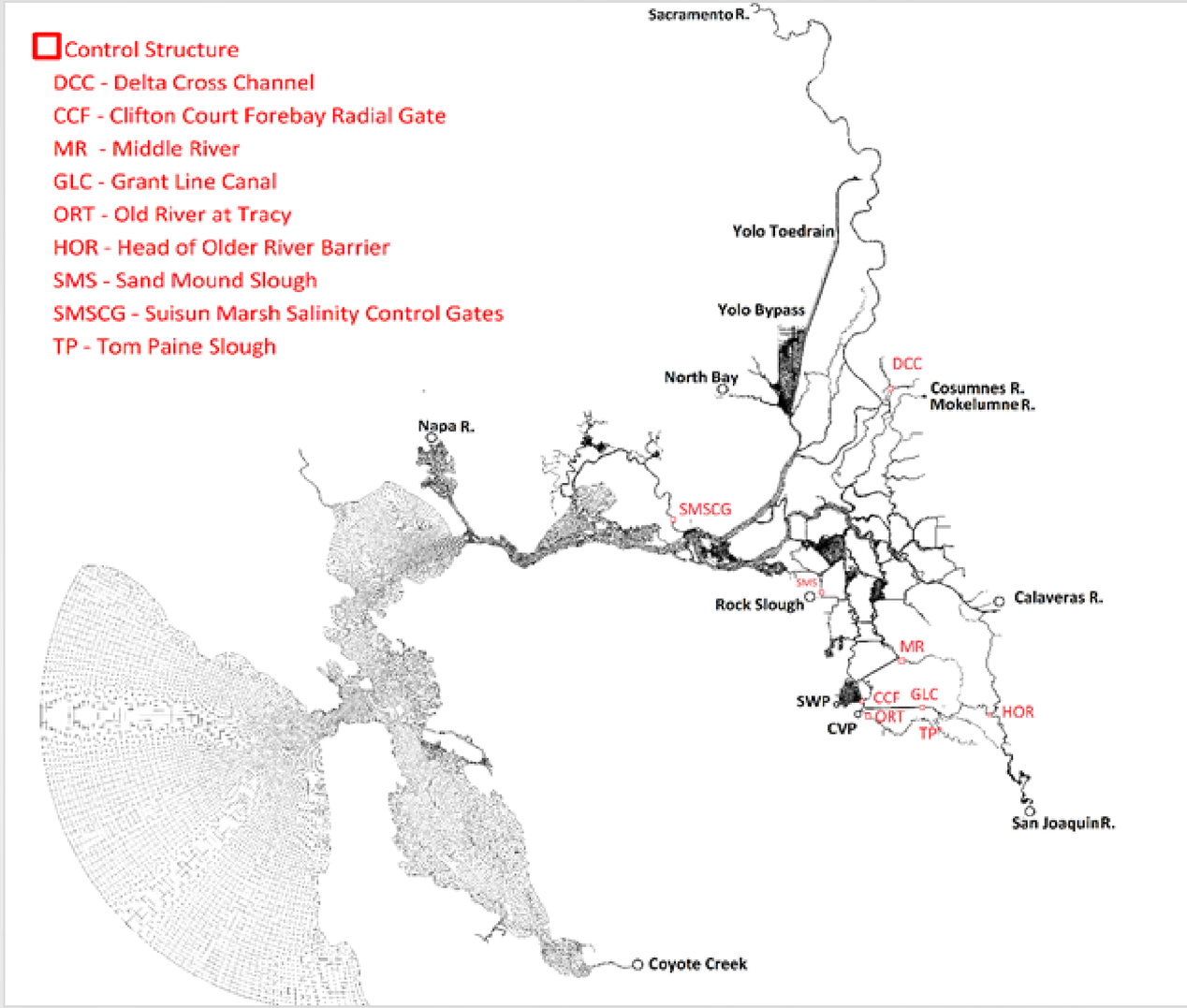
May 2021

Eli Ateljevich, P.E., PhD

Bay-Delta SCHISM

- SCHISM model, 3D
- Farallon to Vernalis/Knights Landing Domain
  - 300,000+ nodes, elements
  - 23 vertical max
- Major flows, exports, structures, channel depletions
- Approximate benchmark:

  ½ year per day on 144-core cluster



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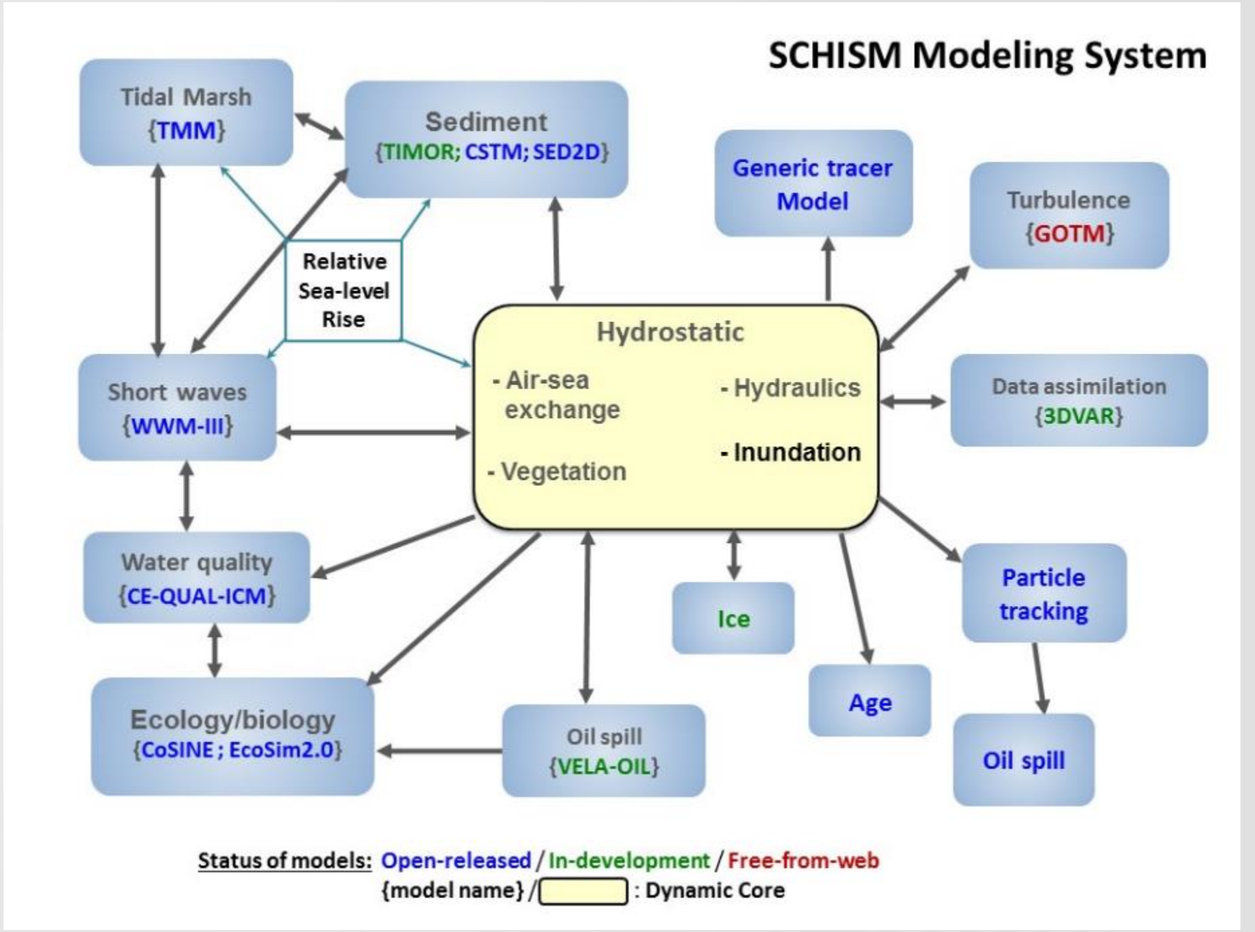
SCHISM Model Suite

- 3D shallow water model
- Free and open source on GitHub
- Primary development at Virginia Institute of Marine Sciences (VIMS)
- Semi-implicit time stepping, mixed FEM and FVM formulation
- Widely used, 150+ publications
- Major funding and contributions
  - DWR
  - NOAA
  - EPA & Chesapeake Bay
- Numerous Bay-Delta Applications
- See http://ccrm.vims.edu/schismweb/



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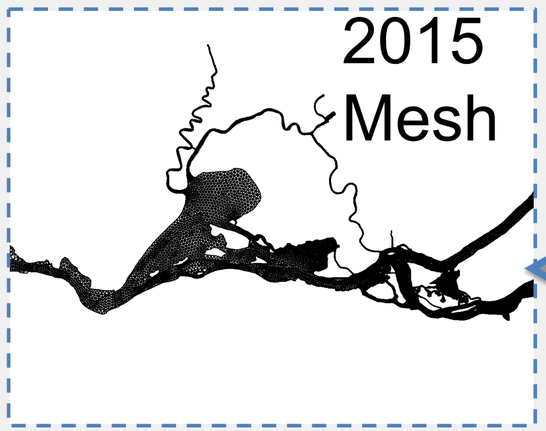

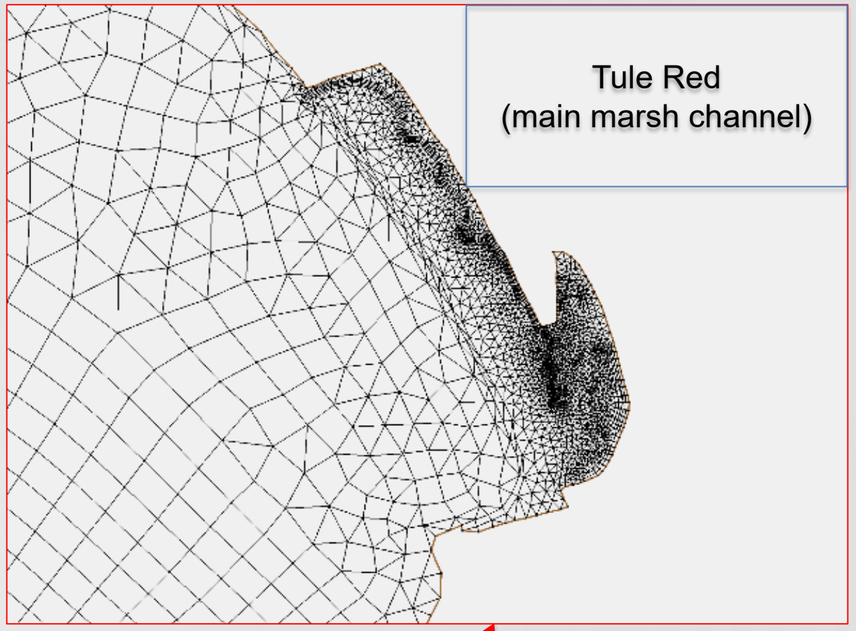

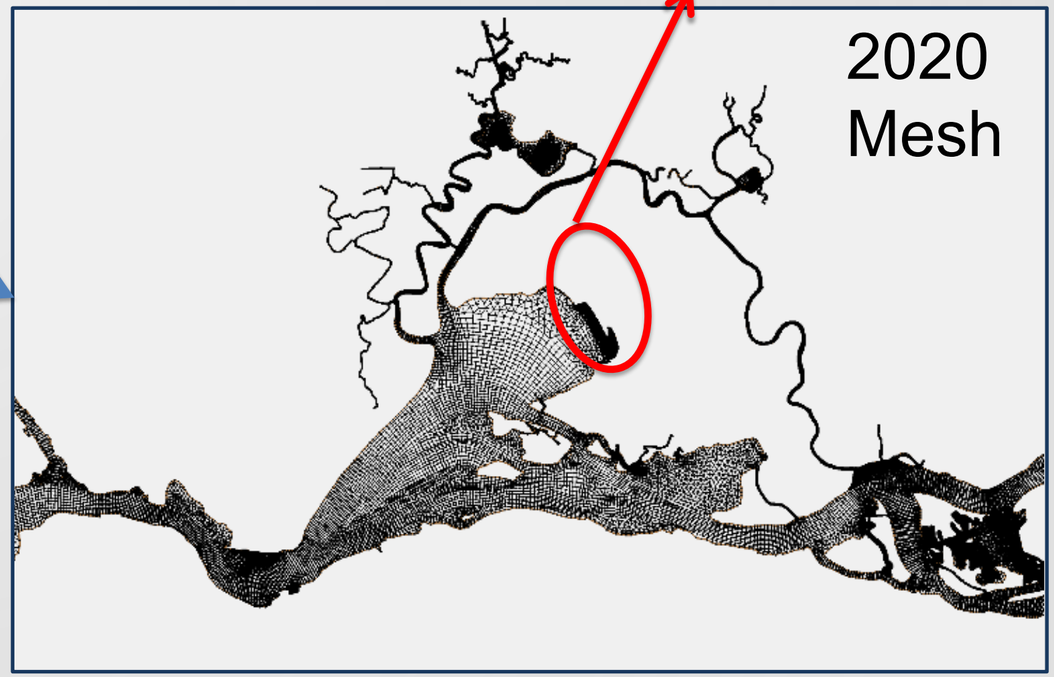

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SCHISM South Delta Proposal

- Higher resolution and refined grid
  - 4-6m widths for channel dispersion studies
  - 5-8m widths for general work in 5 points area
- Recalibrate barriers and structures
- Utilize data assimilation estimates of sources
- Incorporate/commission bathymetry
- Validation in recent years (2019 – 2021)

Expectations

- Gate parameterization and flow/stage tidal range should improve
- SCHISM provides:
  - Better range of processes and vegetation
  - Physical modeling of dispersion
  - Wetting and drying
  - 3D (vertical for light)
    - Vertical circulation is not the limiter in South Delta
    - Better source concentrations/discharges will help all models

References

- Cai, X. (2018) Impact of submerged aquatic vegetation on water quality in Cache Slough Complex, Sacramento-San Joaquin Delta: A Numerical Modeling study. MSc Thesis, Virginia Institute of Marine Science.
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- California Department of Water Resources 2018. Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh, 39th Annual Progress Report to the State Water Resources Control Board. “Chapter 5. A Revised Continuous Surface Elevation Model for Modeling,” by Wang R., and Ateljevich E. Sacramento (CA). California Department of Water Resources. Bay-Delta Office.
- California Department of Water Resources 2019. San Francisco Bay and Sacramento-San Joaquin Delta DEM for Modeling, Version 4.1. https://data.cnra.ca.gov/dataset/san-francisco-bay-and-sacramento-san-joaquin-delta-dem-for-modeling-version-4-1##
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- Zhang, Y.J., Gerdts, N., Ateljevich, E. et al. Simulating vegetation effects on flows in 3D using an unstructured grid model: model development and validation. Ocean Dynamics 70, 213–230 (2020). https://doi.org/10.1007/s10236-019-01333-8
- **Zhang, Y., F. Ye, E. Stanev and S. Grashorn. “Seamless cross-scale modeling with SCHISM.”** Ocean Modelling 102 (2016): 64-81.
- Plus: Technical reports on Franks Tract Restoration, Clifton Court Transit Time Under Bathymetry Interventions and 2015 Drought Barrier Performance

Note: SCHISM previously called SELFE

Questions?

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QUESTIONS, COMMENTS & INPUT

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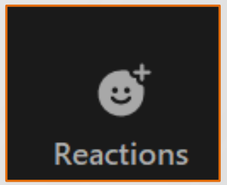

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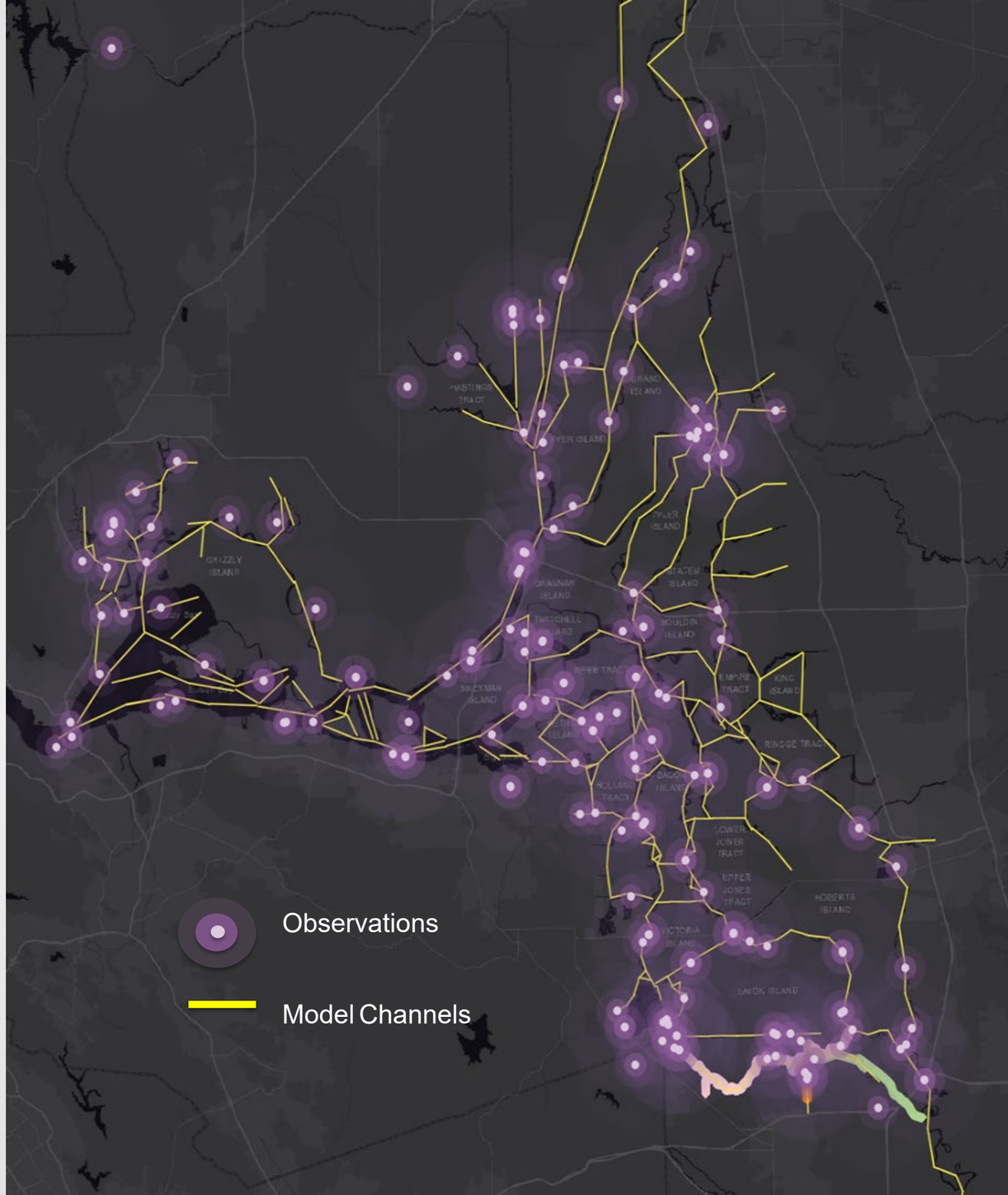
Water Quality Data Integration (Data Assimilation)

- Benefit
  - More realistic modeling of current conditions
  - Making better future predictions
  - Interpreting observations and proposing best solutions

- Stakeholder Engagement
  - Getting feedbacks and suggestions
  - Proposing a range of test cases and future scenarios



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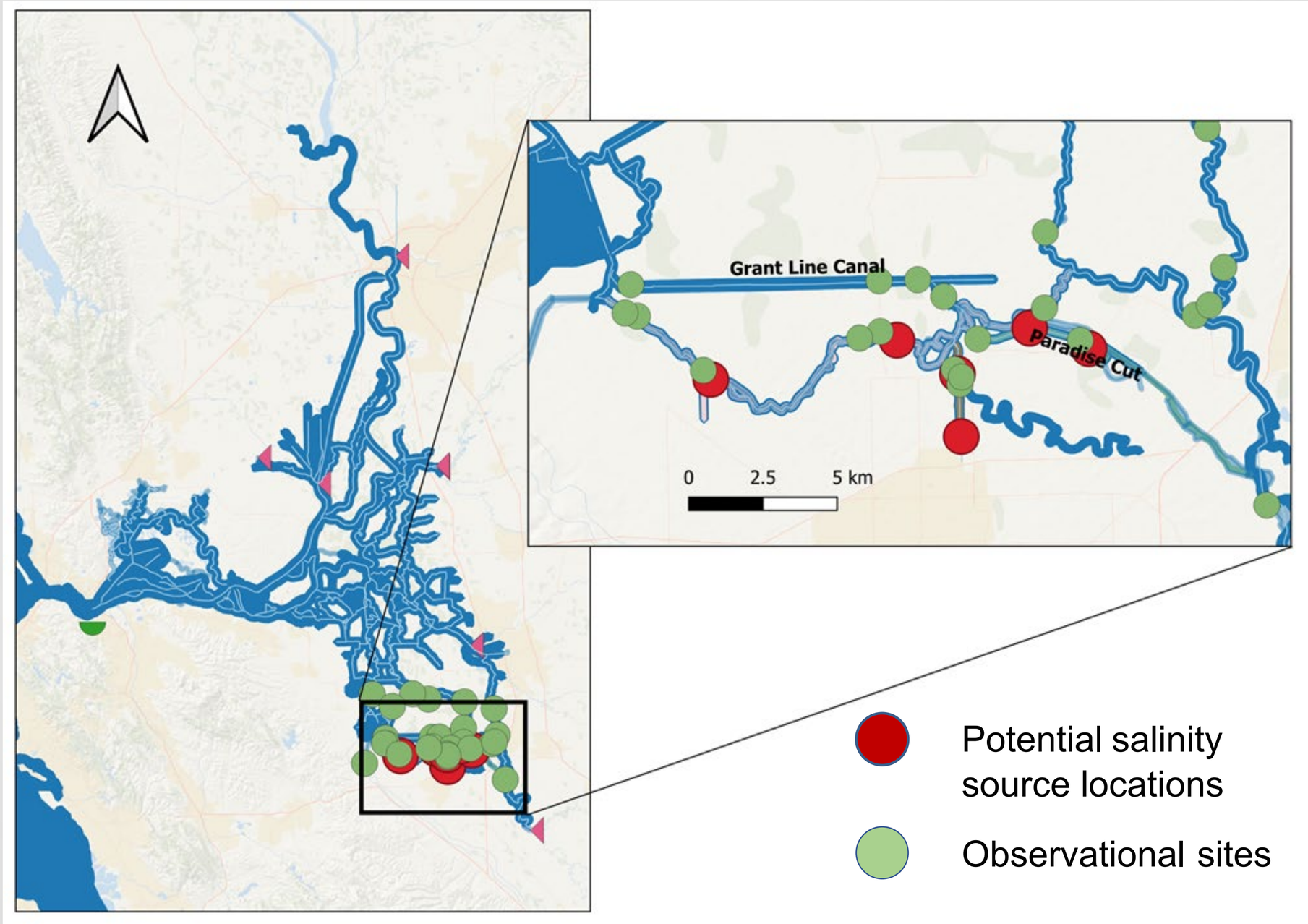
Inferring EC sources



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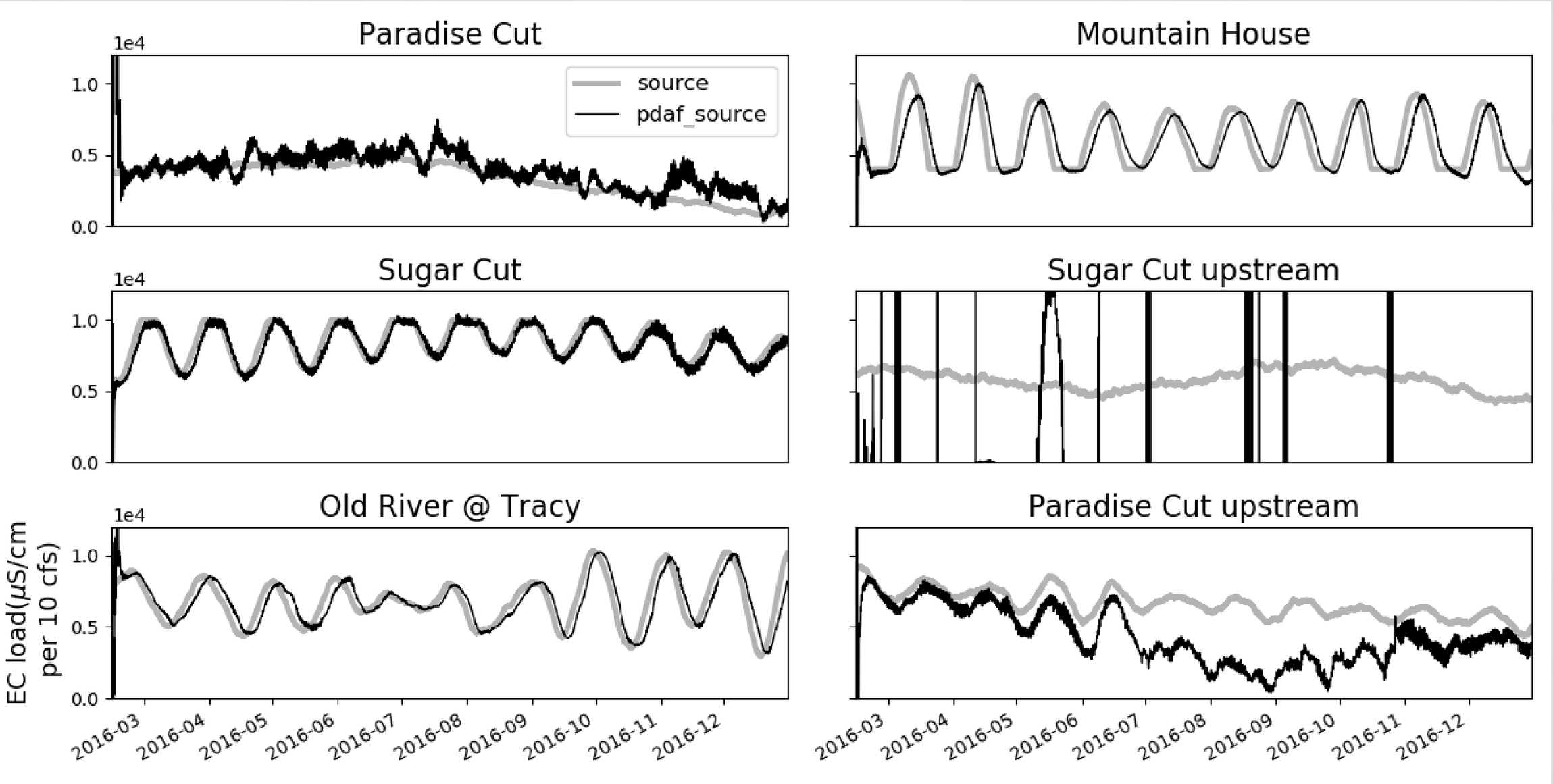

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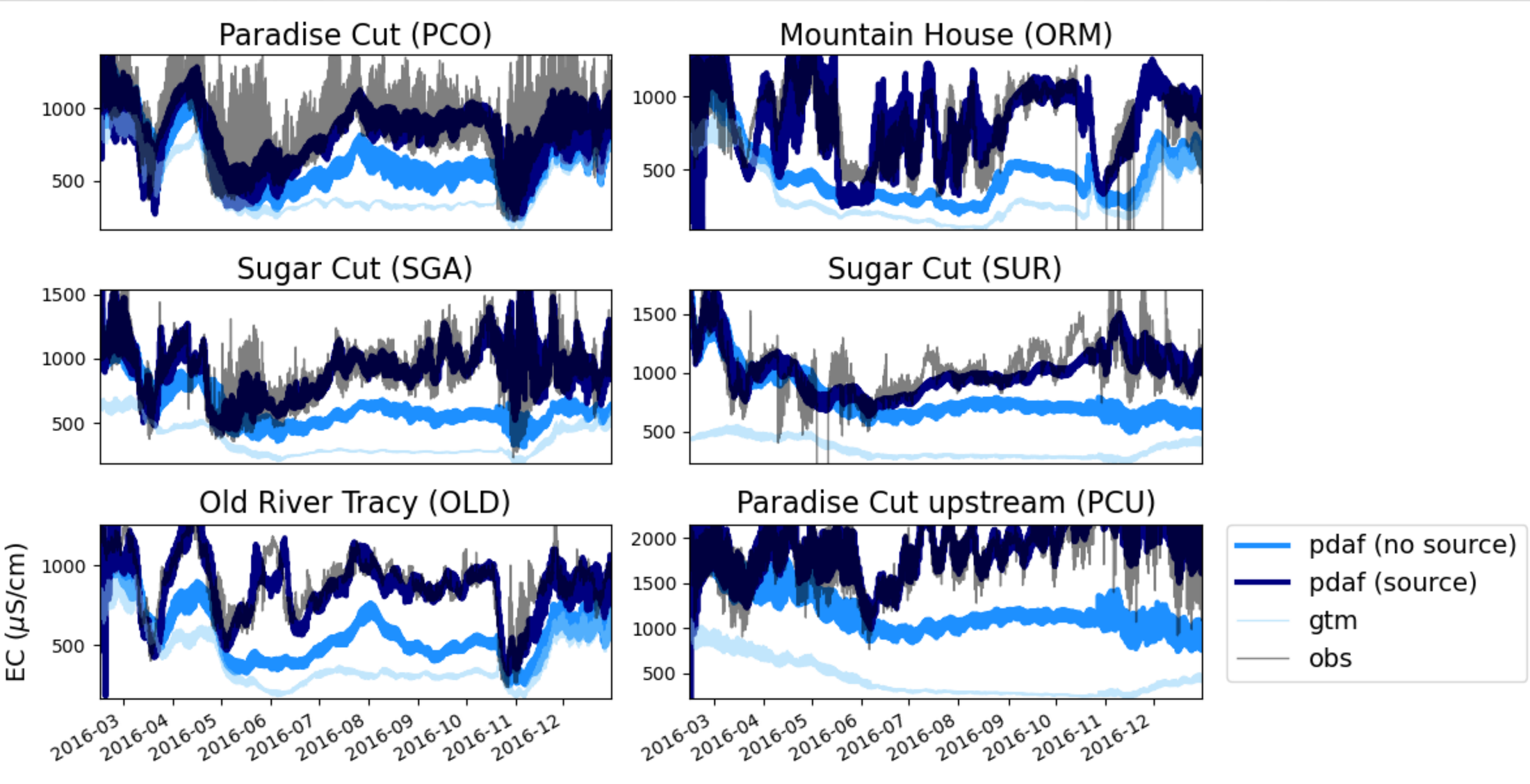
Data assimilation improves EC modeling



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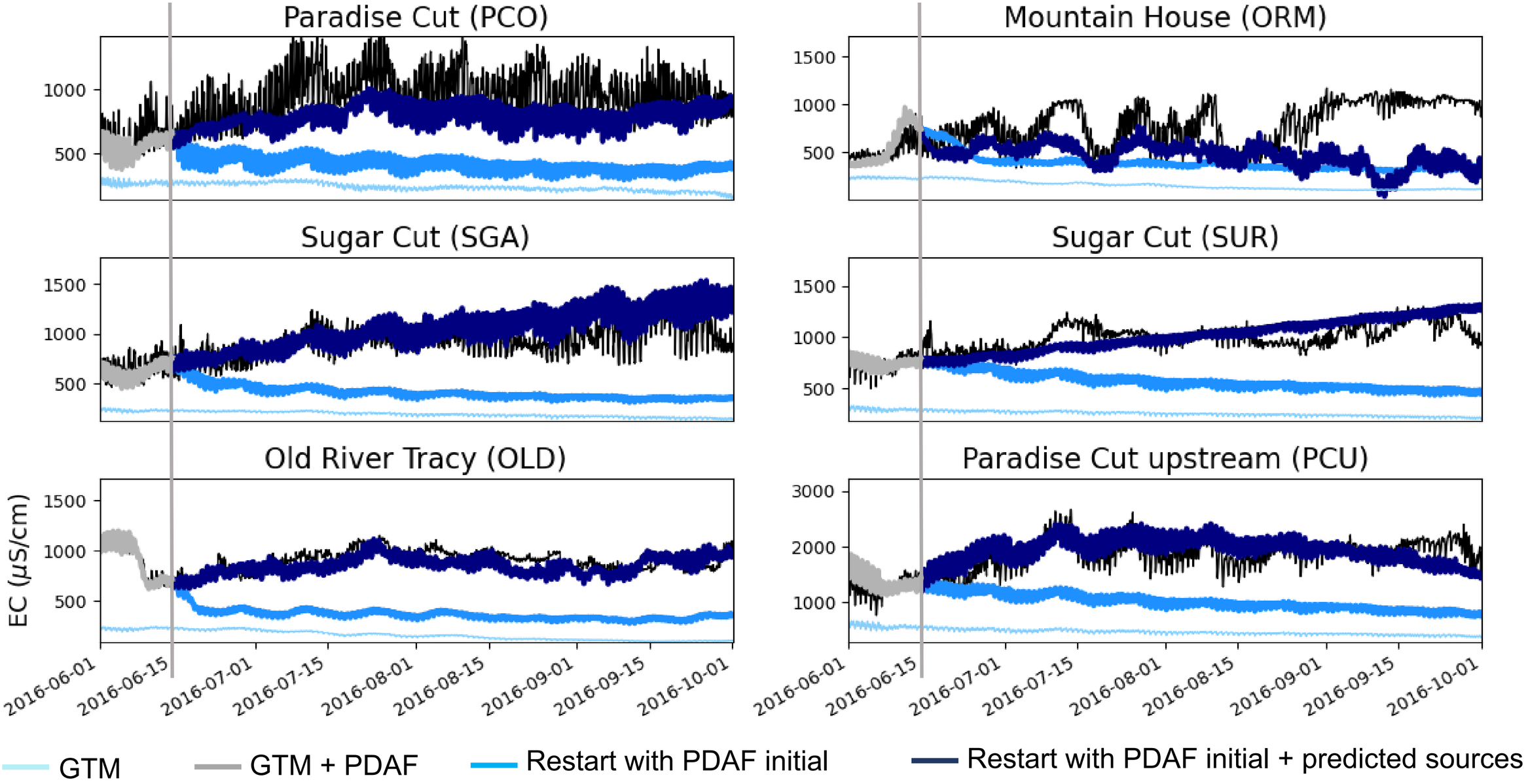
Data assimilation improves future EC prediction



Conclusions

- Data assimilation improves the modeling results of salinity field in South Delta
- Data assimilation can be applied to infer salinity sources and loads into South Delta, however, more data is needed to validate the approach
- Data assimilation improves the predictive power of an operational water quality model
- More data is needed...

QUESTIONS, COMMENTS & INPUT

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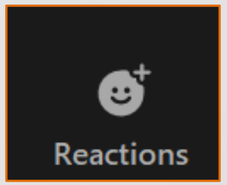

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Monitoring Special Studies Informing Future Compliance Monitoring

- Monitoring Special Study
  - Open stakeholder process
  - Understand complex hydrodynamics and science
  - Understand relationships between monitoring stations and reaches
- Long-term Monitoring and Compliance Plan
  - Science based
  - Assess attainment of the salinity objective in the interior southern Delta
  - Develop monitoring and reporting protocols based on information obtained in the MSS

2021 Objectives

Planned Objectives for 2021

Salinity Point Source Sampling and Increased Ion Sampling

May 2021
Develop Historical South Delta Ion Data Report to support study design.

Paradise Cut Flushing Study

June 2021
Draft Study Plan for stakeholders and Water Board's review.

September 2021
Finalize Study Plan in consideration of feedback.

December 2021
Develop Initial flushing flow schedule.

Water Quality Data Integration

August 2021
Present the current capabilities to stakeholders and then incorporate feedback.

High-Speed Electrical Conductivity Transects with GPS Mapping

December 2021
Develop written and tested Standard Operating Procedures for High-Speed Mapping equipment set up and data collection methods.

SCHISM 3D Hydrodynamic and Water Quality Modeling

December 2021
Prepare special Bay-Delta SCHISM mesh for use in south Delta investigations that resolve major channels in the South Delta, including testing in a WY2020-21 hindcast with field validation.

QUESTIONS, COMMENTS & INPUT

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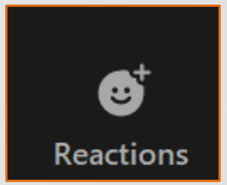

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Continued Involvement

Common goal:

- Develop a better understanding of the South Delta so that it can be better managed for all beneficial uses

We need your input and collaboration to develop and implement these studies

Next steps:

- Meeting Minutes:
  - Circulated to all participants and everyone on the stakeholder list
- Workshop Follow-up:

Send us your comments and input on:

- Study plans
- Study questions, issues to be analyzed, and hypotheses
- Modeling scenarios
- Data sources

- Technical Workgroup work sessions
- Stakeholder Meeting #2 (~early August)

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Questions and Discussion

Contacts

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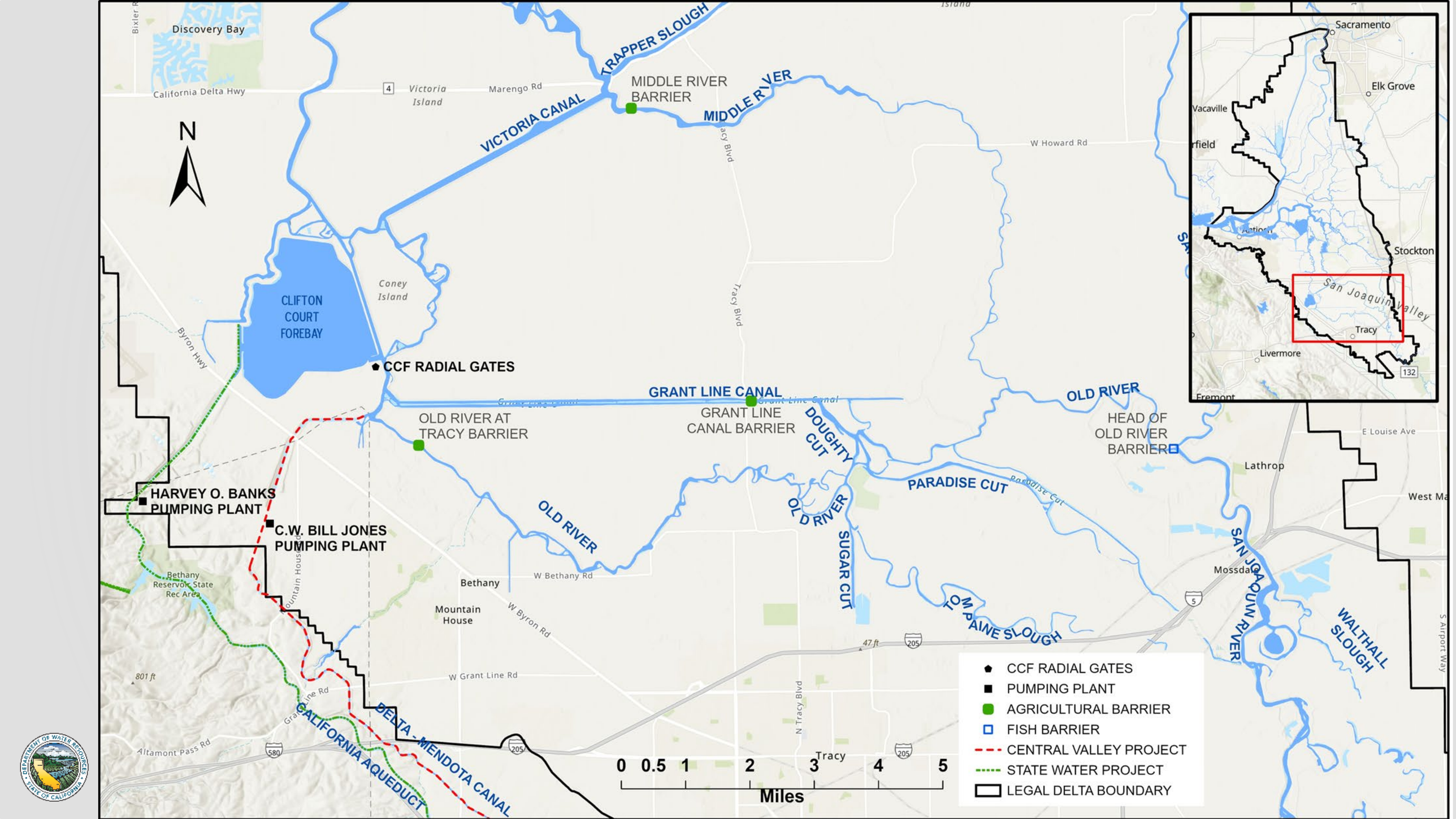
https://water.ca.gov/Programs/State-Water-Project/Water-Quality/Comprehensive-Operations-Plan-and-Monitoring-Special-Study


Discovery Bay
California Delta Hwy
Victoria Island
Marengo Rd
TRAPPER SLOUGH
MIDDLE RIVER BARRIER
MIDDLE RIVER
VICTORIA CANAL
W Howard Rd
Tracy Blvd
N
CLIFTON COURT FOREBAY
Coney Island
Byron Hwy
CCF RADIAL GATES
GRANT LINE CANAL
GRANT LINE CANAL BARRIER
OLD RIVER AT TRACY BARRIER
DOUGHTY CUT
OLD RIVER
HEAD OF OLD RIVER BARRIER
PARADISE CUT
HARVEY O. BANKS PUMPING PLANT
C.W. BILL JONES PUMPING PLANT
Bethany Reservoir State Rec Area
Bethany
W Bethany Rd
Mountain House
W Byron Rd
SUGAR CUT
TOM PAINE SLOUGH
SAN JOAQUIN RIVER
WALTHALL SLOUGH
Lathrop
Mossdale
E Louise Ave
West Ma
47 ft
801 ft
W Grant Line Rd
Grant Line Rd
Altamont Pass Rd
CALIFORNIA AQUEDUCT
DELTA - MENDOTA CANAL
N Tracy Blvd
Tracy
0 0.5 1 2 3 4 5
Miles
CCF RADIAL GATES
PUMPING PLANT
AGRICULTURAL BARRIER
FISH BARRIER
CENTRAL VALLEY PROJECT
STATE WATER PROJECT
LEGAL DELTA BOUNDARY
Sacramento
Elk Grove
Vacaville
Stockton
San Joaquin Valley
Tracy
Livermore
Fremont
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