



WEB SERVICES • GIS • VISUALIZATION



Open and Collaborative  
Natural Resource Management



**OpenNRM**  
ENTERPRISE

OpenNRM unites each module  
for a powerful management and  
collaboration tool:



Map Maker and Map Manager



Document Library



Project Collaborator



RSS Engine



Real Time Monitoring



Geo-Spatial and Science Application



Simulation Engine

...or combine as many modules as  
you want for a custom application.

Collaborative  
resource  
management  
workspace and  
project management  
application for data  
collection, analysis,  
reporting and  
visualization

Collaborative  
Science Projects

Regional  
Monitoring

Ecosystem  
Restoration

Estuary  
Management



Data  
Visualization

Publication  
Management

Species  
Observation

Operations  
Management

**OPENNRM Workspaces are used to build data stories** using Spatial Data, Observations Data, and Site Content at various scales.  
(Site Level, Regional Level and System Wide)

# A COLLABORATIVE EFFORT

[BAYDELTA.LIVE.COM](http://BAYDELTA.LIVE.COM)

[CAESTUARIES.OPENNRM.ORG](http://CAESTUARIES.OPENNRM.ORG)

MY WATER QUALITY PORTALS

SAN JOAQUIN WATER QUALITY

SAN JOAQUIN REAL TIME MANAGEMENT

DWR 1641 INTERACTIVE

SACRAMENTO RIVER WATERSHED



**SAN JOAQUIN RIVER**  
Regional Water Quality Monitoring



# BUILDING ON EACH OTHER'S PROGRAMS

Each region's needs are different:

Various Stakeholder Requirements

Regional Data

Region Specific Data Analysis

Local Mapping and GIS

Regional Document Libraries

Stakeholder Specific Data Dashboards

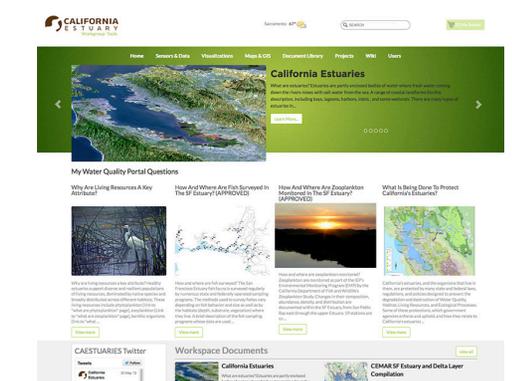
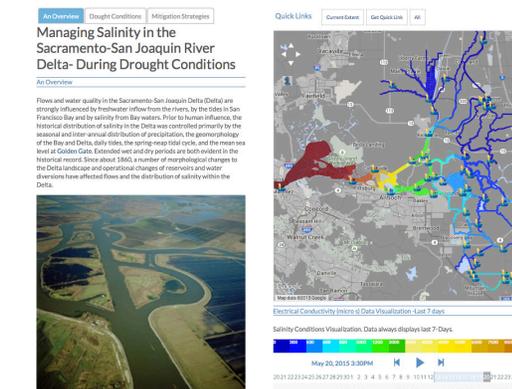
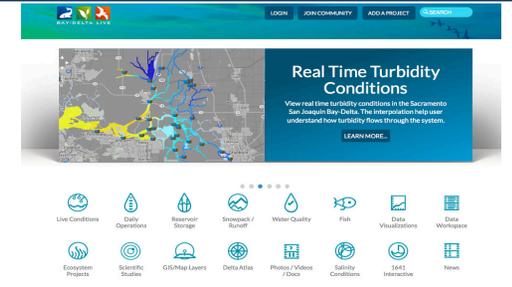
Tool for Local Ecosystem Projects

Special Studies

Regulatory Reporting

Web Service Development

...Share data and products with other portal's for system wide view



# BUILDING ON EACH OTHER'S PROGRAMS

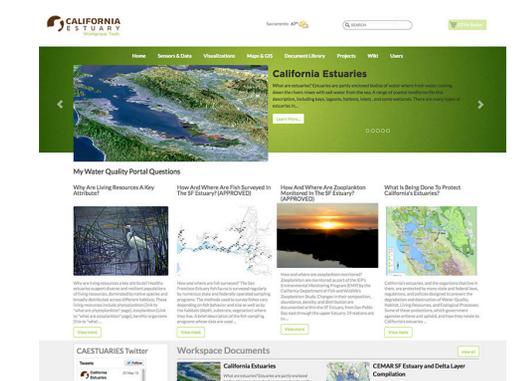
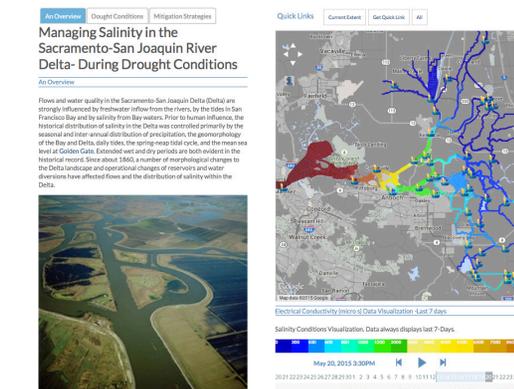
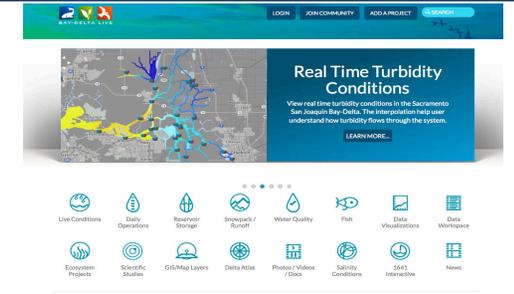
- Benefit and learn from each other's regional monitoring programs and assessment efforts
- All investments are contributed back to the community: Content, GIS, data sets, mapping tools
- Data is managed at the regional level and shared with all stakeholders for larger watershed assessment and analysis

The screenshot displays the California Estuaries website interface. At the top, there are navigation links for 'HOME', 'SENSORS & DATA', 'VISUALIZATIONS', 'MAPS & GIS', 'DOCUMENT LIBRARY', 'PROJECTS', 'WEB', and 'USERS'. The main content area features a large map of the Sacramento-San Joaquin River Delta with a color-coded overlay representing salinity conditions. Below the map, there are several sections:

- Real Time Turbidity Conditions:** A section with a map and text explaining that users can view real-time turbidity conditions in the Sacramento-San Joaquin Bay Delta. It includes a 'LEARN MORE...' link.
- Navigation Menu:** A grid of icons for various features: Live Conditions, Daily Operations, Reservoir Storage, Snowpack / Runoff, Water Quality, Fish, Data Visualizations, Data Workshop, Ecosystem Projects, Scientific Studies, GIS/Map Layers, Delta Atlas, Photos / Videos / Docs, Salinity Conditions, 3645 Interactive, and News.
- HIGHLIGHTS:** A section with four columns:
  - OPERATIONS:** Salinity Conditions Dashboard. Text: 'Salinity is the central management challenge facing a drought. Fresh water released from farms...'
  - RESEARCH:** Real Time Acoustic Telemetry Data. Text: 'In support of various fish tracking studies by the Army Corps (USCG, MWD, DWR) and participating agencies for management of the regional network...'
  - PROJECTS:** Creating new, self-healing wetlands will... Text: 'This \$100mm project will apply various design and modeling tools...'
  - SPOTLIGHT:** NOAA Satellite. Text: 'A new weather satellite was launched on Thursday February 25th from Japan...'
- Managing Salinity in the Sacramento-San Joaquin River Delta- During Drought Conditions:** An overview section with an aerial photo of the delta and a map showing salinity visualization. It includes a 'Quick Links' section and a 'Salinity Conditions Visualization' section with a color scale and a time slider for May 20, 2015.
- California Estuaries:** A section with a large image of an estuary and text describing the program's mission to protect and restore California's estuaries.
- My Water Quality Portal Questions:** A section with four questions and answers:
  - Why Are Living Resources At Risk?**
  - How And Where Are Fish Scurved In The SF Estuary?**
  - How And Where Are Zooplankton Scurved In The SF Estuary?**
  - What Is Being Done To Protect California's Estuaries?**
- CAESTUARIES Twitter:** A section showing social media updates.
- Workspace Documents:** A section with links to 'California Estuaries' and 'CMAA SF Estuary and Delta Layer Completion'.

# BENEFITS OF A COLLABORATIVE PROGRAM

- Benefit and learn from each other's regional monitoring programs and assessment efforts
- All investments are contributed back to the community: Content, GIS, data sets, mapping tools
- Data is managed at the regional level and shared with all stakeholders for larger watershed assessment and analysis
- Application updates



# SJR REGIONAL MONITORING AND REAL TIME MANAGEMENT

- 50+ Datasets contributed for multi-stakeholder use and evaluation
- Real Time WQ Assessments for Temperature, Salinity, Nutrients, etc. available to the public
- Current phase SJR Real Time WQ Management
- View model results and data dashboards

**SAN JOAQUIN RIVER**  
Regional Water Quality Monitoring

STOCKTON 73°

SEARCH

My Basket

Home Explore Data Library Explore the SJR Login

## Does Water Temperature in the San Joaquin River and its Tributaries Support...

Monitoring temperature in the San Joaquin River and its tributaries will help us better understand if conditions support migration and other life stages of the Chinook Salmon. Two San Joaquin River runs (spring and fall) of the Chinook salmon are currently struggling for survival. There are...

Learn More...

### Water Quality Conditions in the San Joaquin River Basin

- Is Salt Affecting Beneficial Uses in the San Joaquin River Basin?**  
Water quality in the San Joaquin River has degraded significantly since the late 1940s. During this period, salt concentrations in the River, near Vernalis, have doubled. Concentrations of boron, selenium, molybdenum and other trace elements have also increased. These increases are primarily due to reservoir development on the east side tributaries and upper basin for agri...  
[View more](#)
- Does Water Temperature in the San Joaquin River and its Tributaries Support Chinook ...**  
Monitoring temperature in the San Joaquin River and its tributaries will help us better understand if conditions support migration and other life stages of the Chinook Salmon. Two San Joaquin River runs (spring and fall) of the Chinook salmon are currently struggling for survival. There are varying reasons for their decline and temperature is one factor.  
[View more](#)
- Is it Safe to Swim in the San Joaquin River and its Tributaries**  
The San Joaquin River boasts 330 miles of beauty, wildlife habitat, and superb recreational opportunities. The incredibly scenic San Joaquin River Gorge near the town of Aubrey boasts excellent hiking, mountain biking and horseback riding trails as well as guided nature walks, camping, swimming, and more. Keeping our water safe for recreational uses is a national priority...  
[View more](#)
- Are excess nutrients a problem in the San Joaquin River?**  
Nutrients in rivers serve the same basic function as nutrients in a garden. They are essential for growth, in a garden growth and productivity are considered beneficial, but this is not necessarily so in a river. The additional algae and other plant growth allowed by the nutrients may be beneficial up to a point, but may easily become a nuisance.  
[View more](#)

### SJRWQ Twitter

Follow

- SJR Water Quality** @SJRWQ 3 Dec  
Does water temperature support Chinook salmon migration in the San Joaquin River?  
[sanjoaquinriverwaterquality.com/ques](#)
- SJR Water Quality** @SJRWQ 3 Dec  
Is excess salt a problem in the San Joaquin River? 23 stations monitor salinity in the San Joaquin River Basin.  
[sanjoaquinriverwaterquality.com/ques](#)
- SJR Water Quality** @SJRWQ 3 Dec

Tweet to @SJRWQ

### Management Activities

view all

#### Management Activities

The San Joaquin River Restoration Program is a comprehensive long-term effort to restore flows to approximately 92 miles of the San Joaquin River in California's Central Valley from Friant Dam to the confluence of the Merced River. Its goal is to restore and maintain fish populations in "good condition", including naturally reproducing and self-sustaining populations of...

[view more](#)

#### News

Access the latest news and information for the San Joaquin River Basin.  
[view more](#)

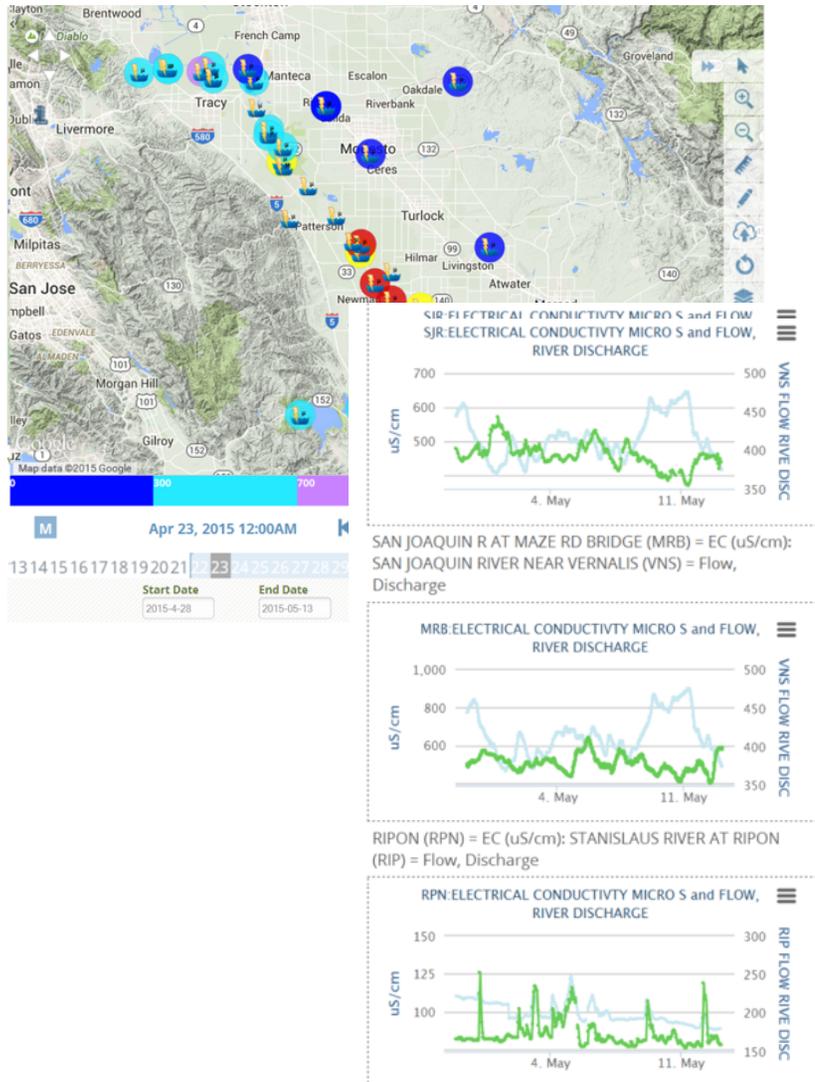
#### About the San Joaquin River Basin

The San Joaquin River basin surrounds the San Joaquin River from Friant Dam to Vernalis. The main tributaries to the San Joaquin River basin include the Stanislaus River, Tuolumne River, and Merced River. The San Joaquin River is the second largest river in California and includes wetlands and marshes.  
[view more](#)

#### Regional Assessment: What we measure?

There are many tools used for regional assessment in the San Joaquin River Basin. Each tool provides the user with specific information about their questions. Below is a list of regional tools for the public to explore.  
[view more](#)

# SAN JOAQUIN RMP COLLABORATORS



US Bureau of Reclamation  
CURES  
CV Salts

California Environmental Protection Agency  
CA Department of Water Resources  
State and Federal Water Contractors  
CVRWQCB  
AG Industry  
Central Valley Irrigation Districts

Major Multi-Agency Effort  
Regular Workgroup Meetings for  
Enhancements

Real Time Salinity Management

WARMF Model Online

Question Driven

Stakeholder Specific Data Dashboards

Feed Libraries

# CA ESTUARIES PORTAL

- Multi-Agency Workspace
- Source project for critical estuary data: EMP, Estuary GIS, 1641 and Trawl Data
- 50+ GIS files
- 85+ question driven WQ pages on [mywaterquality.ca.gov](http://mywaterquality.ca.gov)
- Assessment
- TMDL Report Cards

**CALIFORNIA ESTUARY**  
Workgroup Tools

Sacramento 47°F

SEARCH

My Basket

Home Sensors & Data Visualizations Maps & GIS Document Library Projects Wild Users

## California Estuaries

What are estuaries? Estuaries are partly enclosed bodies of water where fresh water coming down the rivers mixes with salt water from the sea. A range of coastal landforms fits this description, including bays, lagoons, harbors, inlets, and some wetlands. There are many types of estuaries in...

Learn More

### My Water Quality Portal Questions

- Why Are Living Resources A Key Attribute?**  
Why are living resources a key attribute? Healthy estuaries support diverse and resilient populations of living resources, dominated by native species and broadly distributed across different habitats. These living resources include phytoplankton [link to "what are phytoplankton" page], zooplankton [link to "what are zooplankton" page], benthic organisms [link to "what ..."]  
[View more](#)
- How And Where Are Fish Surveyed In The SF Estuary? (APPROVED)**  
How and where are fish surveyed? The San Francisco Estuary fish fauna is surveyed regularly by numerous state and federally operated sampling programs. The methods used to survey fishes vary depending on fish behavior and size as well as by the habitats (depth, substrate, vegetation) where they live. A brief description of the fish sampling programs whose data are used ...  
[View more](#)
- How And Where Are Zooplankton Monitored In The SF Estuary? (APPROVED)**  
How and where are zooplankton monitored? Zooplankton are monitored as part of the IEP's Environmental Monitoring Program (EMP) by the California Department of Fish and Wildlife's Zooplankton Study. Changes in their composition, abundance, density, and distribution are documented within the SF Estuary, from San Pablo Bay east through the upper Estuary. 19 stations are GI ...  
[View more](#)
- What Is Being Done To Protect California's Estuaries?**  
California's estuaries, and the organisms that live in them, are protected by many state and federal laws, regulations, and policies designed to prevent the degradation and destruction of Water Quality, Habitat, Living Resources, and Ecological Processes. Some of these protections, which government agencies enforce and uphold, and how they relate to California's estuaries ...  
[View more](#)

### CAESTUARIES Twitter

Tweets

- California Estuaries @caestuaries 20 May 13  
Estuary workgroup meeting tomorrow May 21st from 9am to noon at the Delta Conservancy office.
- California Estuaries @caestuaries 24 Jan 13  
TMDL Report Cards

### Workspace Documents

- California Estuaries**  
What are estuaries? Estuaries are partly enclosed bodies of water where fresh water coming down the rivers mixes with salt water from the sea. A range of coastal landforms fits this description, including bays, lagoons, harbors, inlets, and some wetlands. There are many types of estuaries in California including bar-built, open river mouths, and perennially tidal estua ...  
[view more](#)
- CEMAR SF Estuary and Delta Layer Compilation**  
[view all](#)
- Shifts in Zooplankton Community Structure: Implications for Food Web Processes in t**  
[view more](#)
- Sacramento**

# CA ESTUARIES COLLABORATORS



US Bureau of Reclamation  
US Department of Fish and Wildlife  
NOAA  
NMFS

US Geological Survey  
CA Department of Water Resources  
IEP

State and Federal Contractor  
Water Education Foundation  
SFEI  
SWRCB  
AG Industry

---

Major Multi-Agency Effort  
Regular Workgroup Meetings for Enhancements  
150+ Registered Agency Users  
1000 + Images, Documents, Research Articles  
Host for 85+ State Question Pages  
50+ Downloadable Datasets  
1641 Interactive  
Home to All California Estuaries  
Feed Libraries  
Home to Trawl Data 2016

- Data central to the Delta
- Extensive libraries for Delta data, photos, reports
- Real time reporting dashboards: salinity, WQ
- Weekly survey results, fish tracking
- Relevant news
- Collaborator workspace
- Ecosystem projects
- Delta Community
- Post and view model results

**Real Time Turbidity Conditions**  
View real time turbidity conditions in the Sacramento San Joaquin Bay-Delta. The interpolation help user understand how turbidity flows through the system.  
[LEARN MORE...](#)

**HIGHLIGHTS**

- OPERATIONS**  
Salinity Conditions Dashboard  
Salinity is the central management challenge during a drought. Fresh water released from Sierra reservoirs to repel saltwater intrusion from ocean tides into areas of the delta tapped by ...  
[Learn more](#)
- RESEARCH**  
Real-Time Acoustic Telemetry Data  
In support of various fish tracking studies by the Army Corp, USCS, MWD, DWR and participating agencies for management of the receiver network ops and visualization of raw and processed...  
[Learn more](#)
- PROJECTS**  
Creating new, self sustaining  
This 1,100acre project will apply various designs and monitor their...  
[Learn more](#)
- SPOTLIGHT**  
NASA Update  
A new weather satellite was launched on Thursday (February 27) from Japan aimed at providing high-tech, three dimensional snowfall around the earth. The Global Precipitation Measurement...  
[Learn more](#)

**WATER NEWS**

- Monday's Top of the Scroll: California water cut...
- New state rule could impact how Marin would build...
- Northern California water-bottling plant's crisis...
- Sacramento wants to grow; will drought say no?
- Walnut Creek faces competing mandates: OKs afford...

# BDL WORKGROUP COLLABORATORS



*Directing  
development and  
new data  
investments*

US Bureau of Reclamation

NOAA

NMFS

US Geological Survey

CA Department of Water Resources

Metropolitan Water District

State and Federal Contractor

US Fish and Wildlife

SWRCB

AG Industry

---

25,000 Unique Visits (Annual)

400+ Registered Users

1500 + Images, Documents, Research Articles

100+ Ecosystem Projects

250+ Downloadable Datasets

Feed Libraries



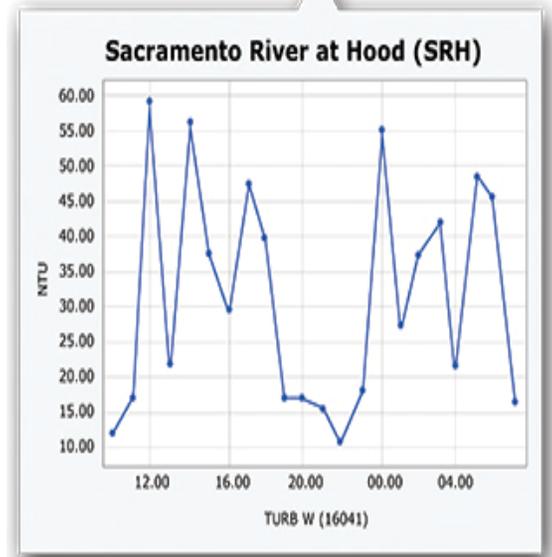
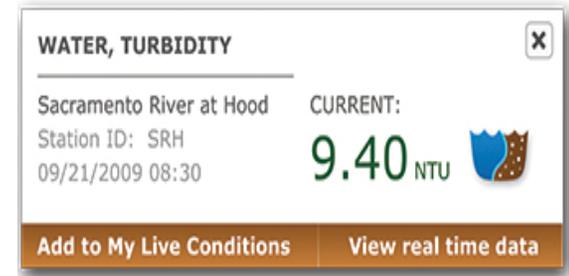
# SWRP KEY FEATURES AND TOOLS

- Data Management Tools
    - Interactive GIS
    - Access to 120+ GIS Layers
  - Document Management (400+ Records)
    - Projects Management
      - Data Dashboards
    - Regulatory Reporting Templates
      - Question Templates
      - Data Story Templates
    - Real Time Management Tools
-



# EXPLORE DATA & CATALOG

- California Data Exchange Center (CDEC)
- National Water Information System (NWIS)
- National Oceanic & Atmospheric Agency (NOAA)
- California Irrigation Management System (CIMIS)
- California Environmental Data Exchange Network (CEDEN)
- SWRP Data Catalog
- ...See Data Spreadsheet



Data Sets

Layers

Tools

Search Tools



Data Source

USGS (National Water Information S

EXPLORE!

Start Date

End Date

2015-06-08

2015-06-15

Duration

7 Days

By Region

Current Map Extent

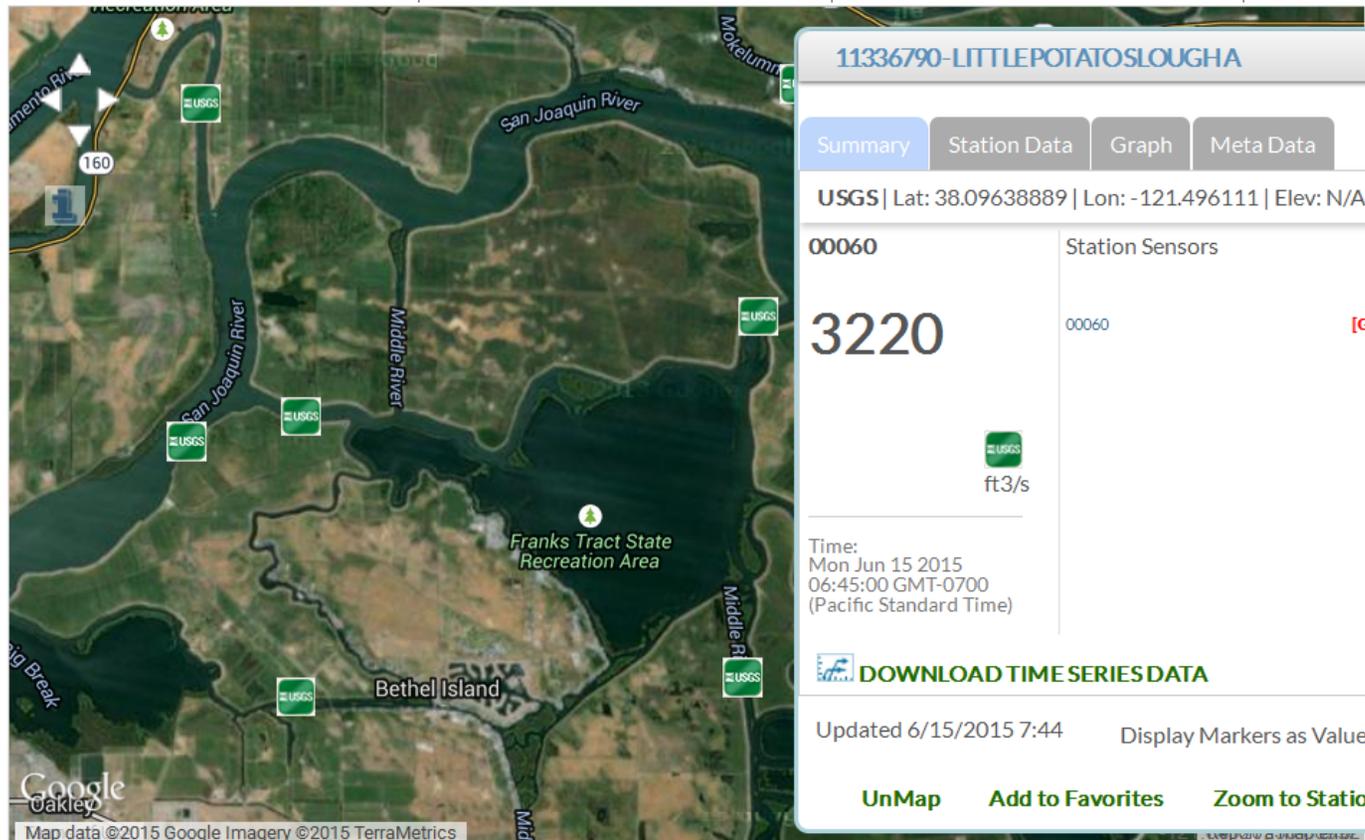
Sensor

- Depth to water level, feet below land
- Difference between observed and predicted
- Direction of stream flow, magnetic azimuth
- Discharge duration, minutes
- Discharge velocity, meters per second
- Discharge, cubic feet per day
- Discharge, cubic feet per second**
- Discharge, cubic meters per second
- Discharge, cubic meters per second
- Discharge, gallons per minute
- Discharge, instantaneous, cubic feet per

Maps

Graphing

Results



11336790-LITTLEPOTATOSLOUGHA

Summary Station Data Graph Meta Data

USGS | Lat: 38.09638889 | Lon: -121.496111 | Elev: N/A

00060

Station Sensors

3220

00060

[Gr] [Add]

ft3/s

Time:  
Mon Jun 15 2015  
06:45:00 GMT-0700  
(Pacific Standard Time)

DOWNLOAD TIME SERIES DATA

Updated 6/15/2015 7:44

Display Markers as Values:

UnMap

Add to Favorites

Zoom to Station

M

Jun 15, 2015 6:45AM



Timestep

Show Timeline



1 hour

24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29



Department of Water Resources  
CALIFORNIA DATA EXCHANGE CENTER

Data

Discharge

Location 11313452

Graph

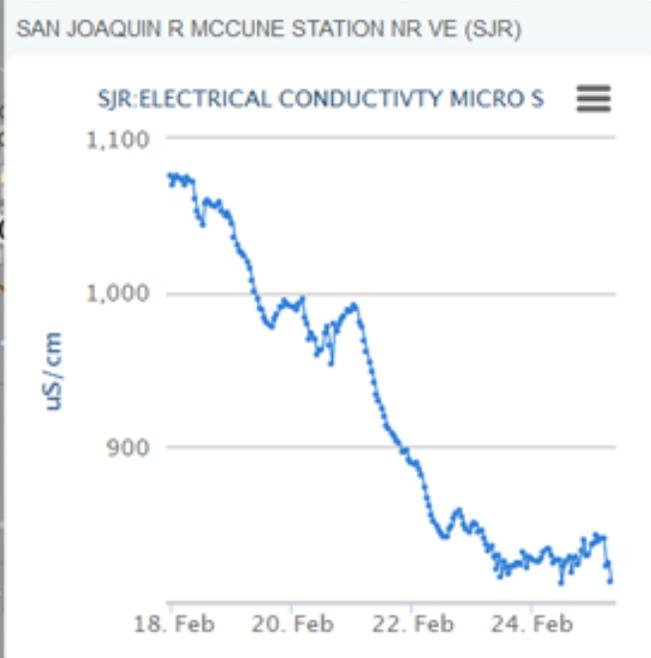
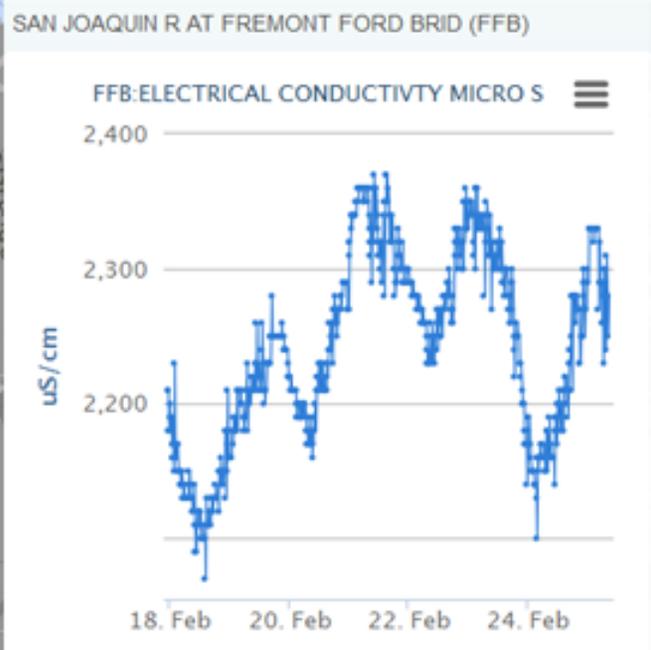
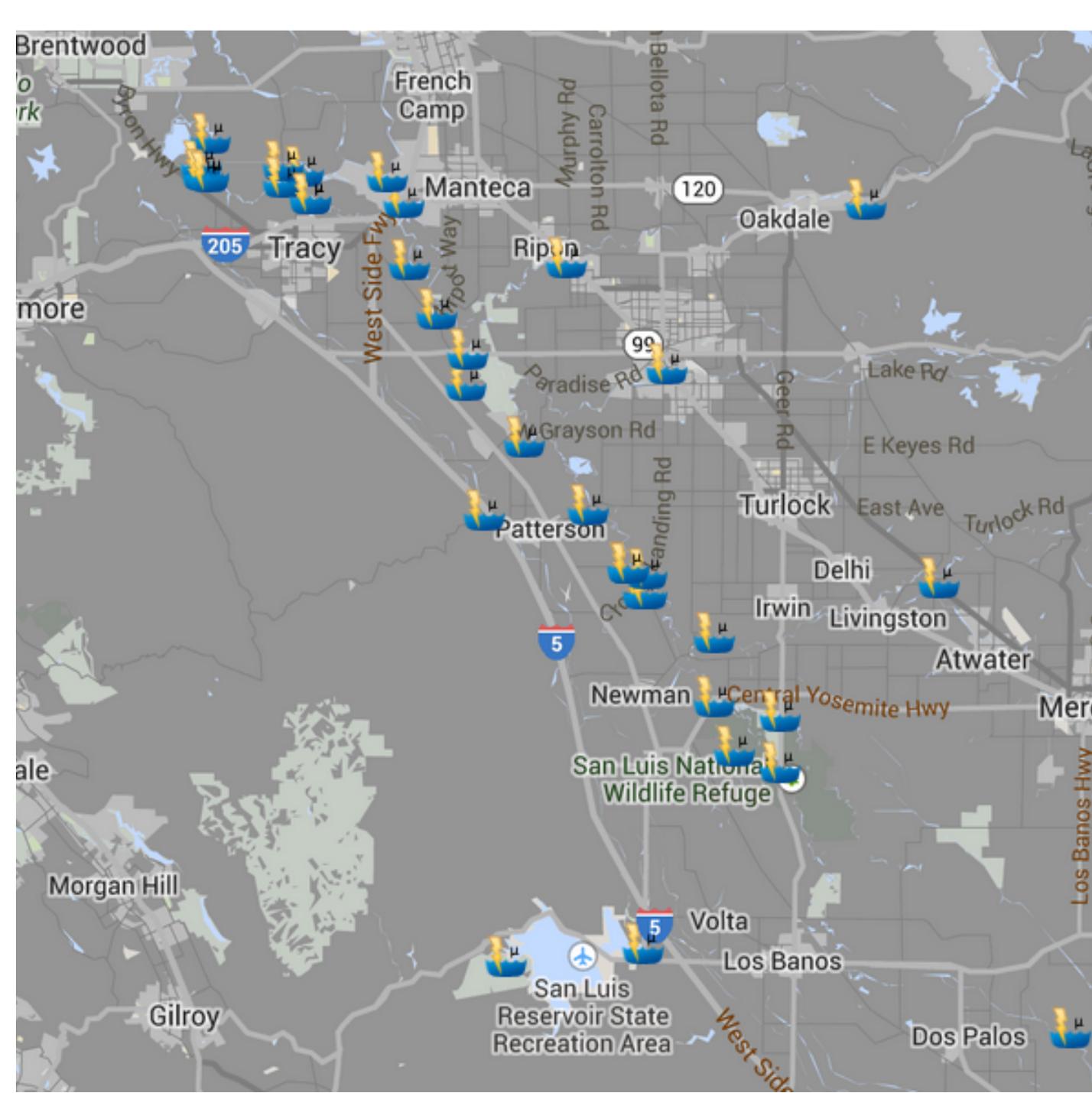
Line

Overlay



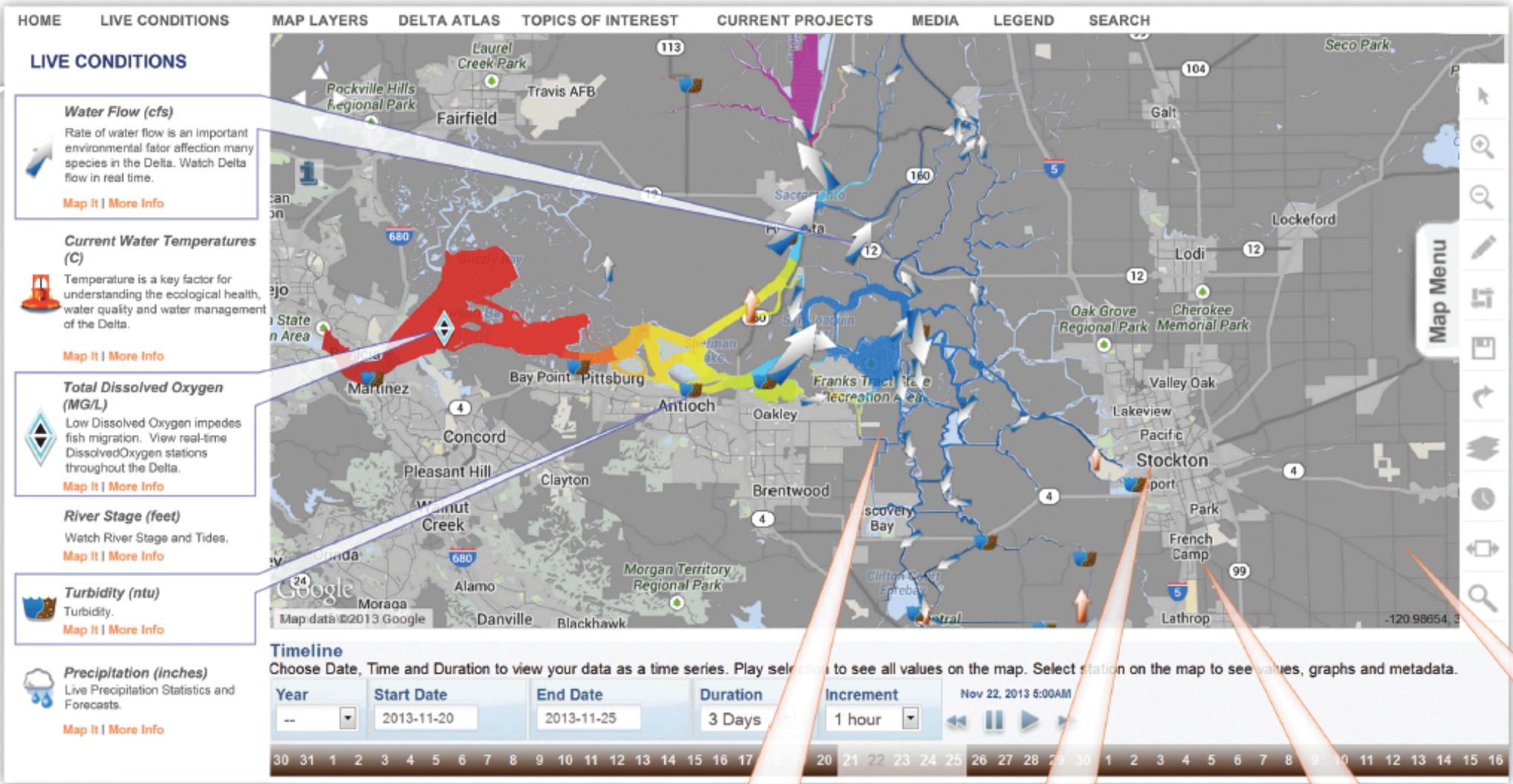
Discharge, cubic feet per second

SENSOR NETWORKS



Ave 14 Madera -121

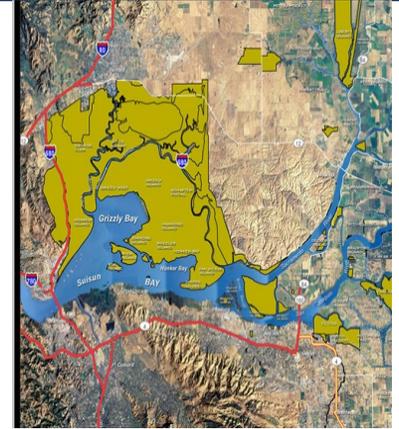
SENSOR NETWORKS



MULTI PARAMETER VISUALIZATIONS

# MAPPING AND GIS

- Explore and analyze 120+ GIS
- Species
- Water Bodies
- Infrastructure
- Land Designation
- Transportation & Infrastructure
- Geopolitical
- Projects
- Live Conditions





Explore Data

Operations

Projects

Maps & GIS

Photos, Videos, Docs

Data Catalog

Community



DAVE OSTI



(0) MY BASKET

JOIN COMMUNITY

MY PROJECTS

SEARCH



New

Maps

View Layers

Delta Atlas

Add New

### Map Layers (Refresh Legend)

All Layers

Active

#### Legal Delta and Suisun Boundary

Manage

Query

<< 0.5

>> Opacity Order

Metadata Zoom to Extent

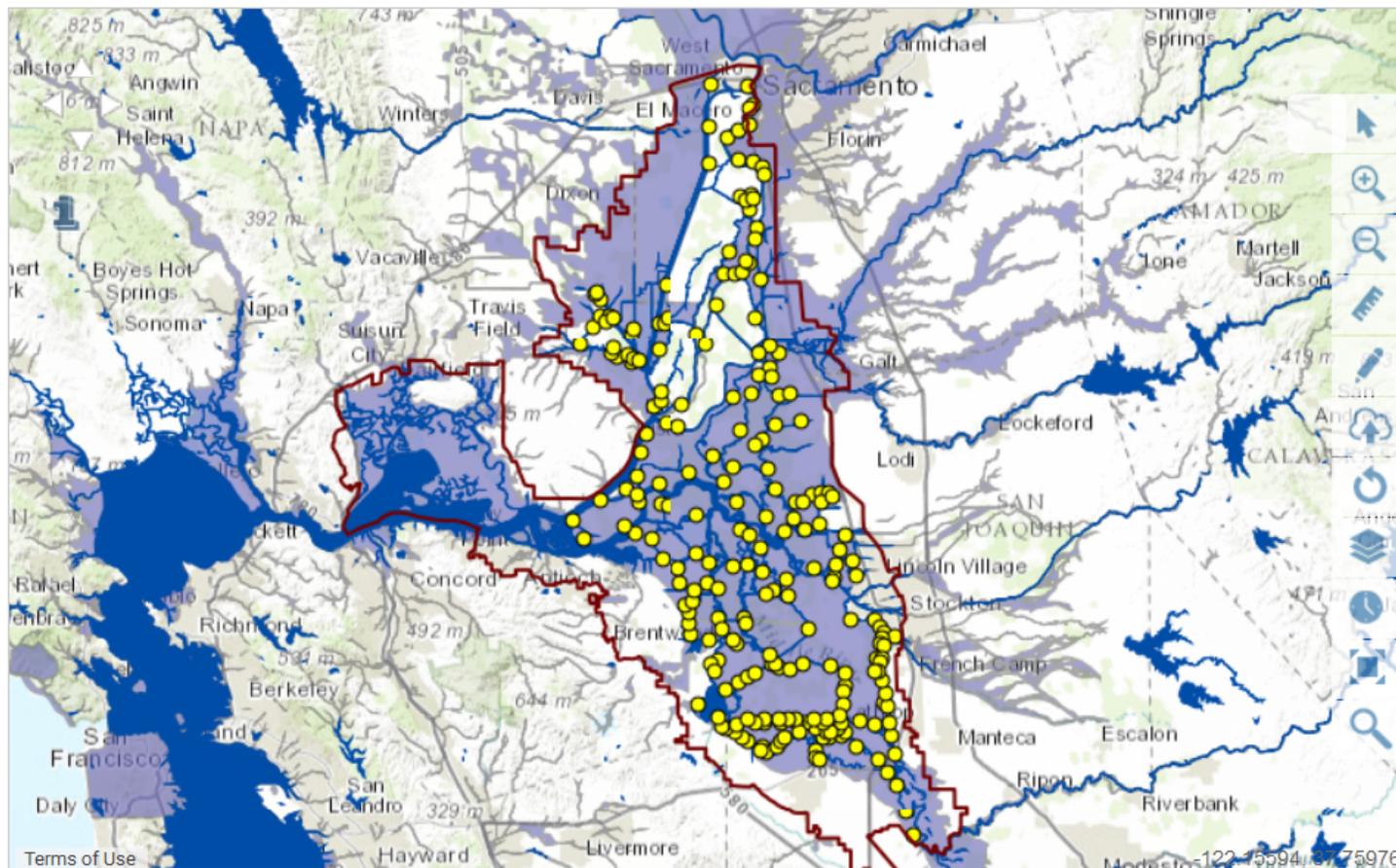
Layer URL Layer Properties

Remove Layer

Ag Drain Returns

Rivers & Bodies of Water (Polygon)

FEMA Flood Data



Jun 15, 2015 6:30AM



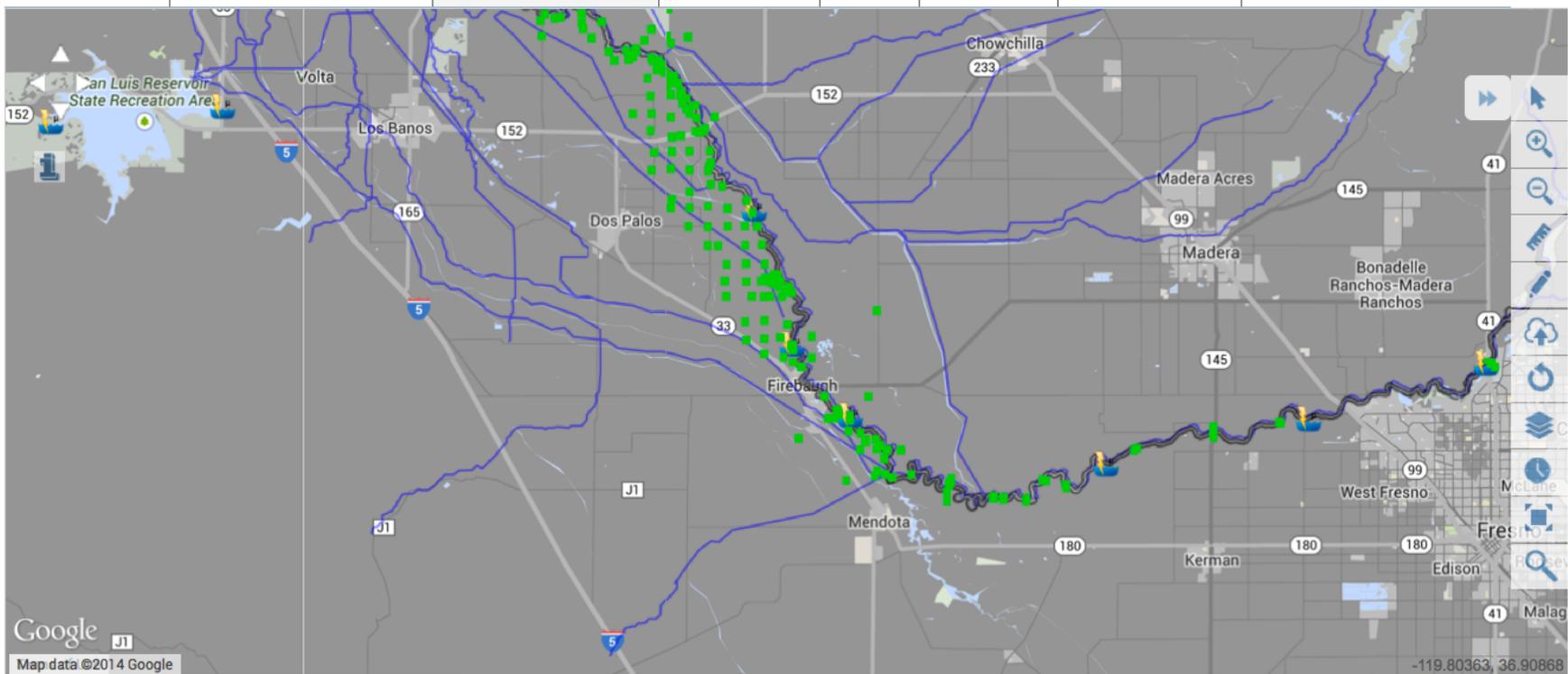
Timestep

4:00:00

Show Timeline



Maps



Data Sets Layers Tools

Map Layers (Refresh Legend)

All Layers Active

- SJR\_Groundwater\_Monitoring\_Sites
- CDEC Stations
- SJR\_NHD\_WM\_Poly1
- SJ\_WARMF\_Rivers\_012513\_Web
- San Joaquin River
- SJR Canals
- Mist Styled

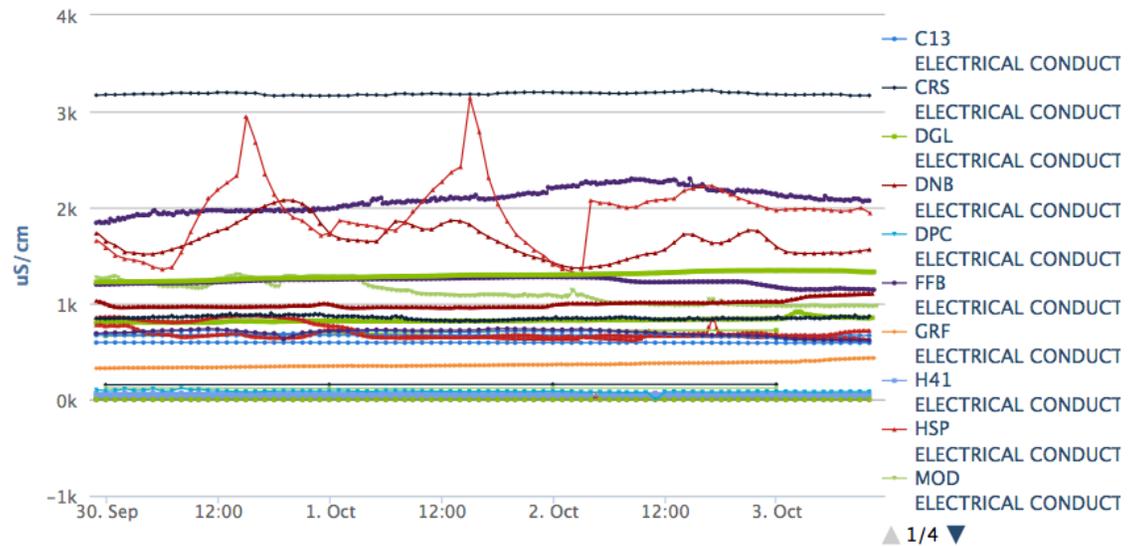
Maps

Graphing

Results

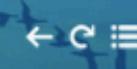
Data ELECTRICA Location all Graph Line Overlay

ELECTRICAL CONDUCTIVITY MICRO S



# DOCUMENT MANAGEMENT

- Access to 394 SWIM Records
  - Geo-locate for Data Synthesis
  - Customizable Metadata
  - Add Images, Videos, Reports, Data
  - Easy portability for Use in Site
  - Support for Dashboards
  - Keep Private or Make Public
  - HTML Templates for Supporting Descriptions and Documentation
-



# Understanding Juvenile Salmon Entrainment and Survival in the South Sacramento/San Joaquin Delta Through the Use of Acoustic Telemetry and Hydrodynamic Measurements

[TOOLS](#)[RECENT ACTIVITY](#)[ARTICLE](#)[DOCUMENTS](#)[IMAGES/VIDEO](#)[FISH TRACKING DASHBOARD](#)

## DESCRIPTION

[SHARE](#) [INVITE](#)

(16 members, 0 Following)

### DESCRIPTION

The intent of the web application is to support USFWS, USBR, Army Corp, USGS, MWD, DWR and participating agencies with the management of the receiver network ops and visualization of raw and processed data from the receivers in order to support the goal of rigorous statistical management-decision telemetry data. The resulting web component will customize existing OpenNRM software components and reside on baydeltalive.com for management and public consumption of information. 34 North will also develop a receiver management dashboard for regular monitoring and maintenance of receiver instrumentation. The web based application features will provide decision support for the following: 1. Graphical representation of fish behavior in reaches. 2. Fish Tracks 3. Operations dashboard for viewing and understanding study results. 4. Support management decisions with relevant and rigor statistical data. 5. Begin phase 1 implementation of basic survival model for statistical analysis. 6. Ability to view and analyze antecedent and real time study conditions. 7. Present an operation dashboard to better understand entrainment probabilities. 8. Present an operation dashboard for instrumentation/receiver management.

## COMMENTS

[Add comment +](#)

## RECENT UPDATES

**BDL ADMIN**

Current project participants: Josh Israel, Barbara Byrne, Arnold Amman, Maria Rea, Jeff McLain, Sean Hayes, Ryan Reeves, Jacob McQuirk

[Apr 03, 2015 11:07 AM](#)

**BDL ADMIN**

Fish Tracking Dashboard is now available. Use the Dashboard tab above to for a quick link you can use the gear icon in the header. Link is called USBR Fish Tracking.

[Apr 03, 2015 11:04 AM](#)

[+MORE](#)

## NEW UPLOADS



**FISH RECEIVER DATA: DAILY SUM, 30 MIN. FILTER: 14 DAY DURATION TEMP/FLOW**

[JUN 14, 2015](#)



**USBR Fish Tracking Receiver Station Map**



## Understanding Juvenile Salmon Entrainment and Survival in the South Sacramento/San Joaquin Delta Through the Use of Acoustic Telemetry and Hydrodynamic Measurements

[TOOLS](#)[RECENT ACTIVITY](#)[ARTICLE](#)[DOCUMENTS](#)[IMAGES/VIDEO](#)[FISH TRACKING DASHBOARD](#)[EDIT ARTICLE](#)

### TELEMETRY STUDY BACKGROUND

The Sacramento-San Joaquin Delta (delta) is the hub of the California's water delivery system. Surface water supplies are in the north, demand in the south. Thus, water supply reliability in California critically depends on the amount of water that can be transferred from the north to the southern part of the state through the delta. For the past four decades, environmental regulations designed to protect endangered species, including salmon, and downstream estuarine habitats have constrained water supplies south of the delta.

The central conservation objective for salmon, the subject of this proposal, is to improve outmigrant survival through the delta. Salmon emigrate through the delta from three watersheds: (1) The Sacramento, (2) the San Joaquin and (3) the Mokelumne River systems. The outmigrants from each of these regions are in jeopardy and thus each controls water project operations to varying degrees by location, time of year and water year type. The major exporters of water from the delta – the US Bureau of Reclamation (USBR), California Department of Water Resources (DWR), and East Bay Municipal Water District (EBMUD) - are required, as a condition of their permits to remove water from the delta and various biological opinions, to conduct salmon outmigration studies to quantify the impacts of their operations and to develop management strategies that mitigate those impacts.

San Joaquin River outmigrants, the focus of this study, have a particularly challenging migratory pathway involving channels in the delta that are functionally canals and they must traverse a series of junctions whose channels lead directly to the export facilities. Salmonids in the San Joaquin River basin were once abundant and widely distributed, but currently face numerous limiting factors. The National Marine Fisheries Service (NMFS) Public Draft Central Valley Recovery Plan identified 'Very High' stressors for juvenile steelhead outmigration on the San Joaquin River including habitat availability, changes in hydrology, water temperature, reverse flow conditions, contaminants, habitat degradation, and entrainment. Many of these stressors can be studied using acoustic telemetry. For example, recent advances in acoustic technology have allowed investigators to evaluate the influence of behavior, species interactions, and physiology on reach-specific survival of salmonids in the Sacramento-San Joaquin river basins (Perry et al. 2010, Vogel et al. 2010).

This study will use the release-recapture information derived from the 2012 receiver array to populate a mark-recapture model based on a Cormack-Jolly-Seber model in combination with a route-specific survival model of Skalski et al. (2002) to derive maximum likelihood estimates and standard errors of reach specific survival and entrainment rates at important junctions, similar to what was used in the 2011 steelhead survival study and 2010 VAMP study (SJRGA 2011).

In addition to the purely scientific objectives, we are experimenting with a variety of new field techniques and technologies. The overall goal of these hardware specific investigations is to expand the acoustic telemetry network in 2012, which is mostly focused on the South Delta, and is mostly autonomous, and will be deployed for a short duration (2 months), to a network that covers the entire delta, is run year-round and the data is telemetered in real-time. The implementation of past studies and our proposed 2012 study plan is incredibly man-power intensive, and, thus unduly expensive. The goal of the equipment development aspect of this investigation is develop the technologies that will allow us to reduce the manpower associated with these experiments by telemetering all of the acoustic receiver data from a delta-wide network in real-time. Telemetry of the data will save on manpower, increase the data return rate and quality of the data and will, most importantly, allow us to use acoustic telemetry data as a real-time management tool. Moreover, year-round, delta-wide operations will allow for the study of predators and other large fish, such as sturgeon, etc. with large tags that last multiple years. Finally, a delta-wide network will allow us to study all of the outmigrant groups – San Joaquin, Sacramento and Mokelumne river fish.



# Understanding Juvenile Salmon Entrainment and Survival in the South Sacramento/San Joaquin Delta Through the Use of Acoustic Telemetry and Hydrodynamic Measurements

TOOLS

RECENT ACTIVITY

ARTICLE

DOCUMENTS

IMAGES/VIDEO

FISH TRACKING DASHBOARD

## CHINOOK SALMON



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### Caption

Chinook salmon (*Oncorhynchus tshawytscha*)

### Description

Chinook Salmon

### Subtype

Image

### Keywords

species

Added By: BDL Admin

Last Edited: Aug 06, 2011 04:26 PM

Public Syndicated



## CHINOOK SALMON

Author: Description: Chinook Salmon

Select a picture here:





# PROJECTS

- Customizable Metadata
  - Add Images, Videos, Reports, Data, Interactive maps
  - Community Features: Comments, Groups, Follow
  - Project Data Dashboards
  - Invite Members
  - Keep private or make public
  - Work in the Field: Sync with Mobile App
  - HTML Templates for project presentation
-

## PROJECT DATA

### DESCRIPTION

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Creating new, self-sustaining wetlands will require excavating new channels at various depths, sizes and configurations. This 1,000-acre project will apply various designs and monitor their effectiveness in relation to tidal and storm pulses and the establishment of plants in the created wetlands. Ecologically, the goal is to provide important new sources of food and shelter for a variety of native fish species at the appropriate scale in strategic locations. Locally, the goal is a process with stakeholder input and ensuring continued or enhanced flood protection.

**MORE INFO URL:** <http://www.baydeltalive.com/site/loweryolo>

### CONTACT

The Lower Yolo Restoration Project is a cooperative effort with water districts receiving supplies via the Delta's State Water Project (SWP), Central Valley Project (CVP) and the Department of Water Resources (DWR). The WWD owns a portion of the project site. Additional financial support is provided by the State and Federal Contractors Water Agency (SFCWA) a joint powers authority representing members of the SWP and CVP. This agency will be the lead in developing the restoration project.

## RECENT UPDATES

BDL Admin



Jun 20, 2015 10:44 AM

BDL Admin



Jun 20, 2015 10:44 AM

BDL Admin



Jun 20, 2015 10:44 AM

BDL Admin

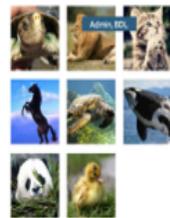


Jun 20, 2015 10:44 AM

## NEW UPLOADS

- [Salinity Conditions](#)  
MAR 13, 2014  
↓ DOWNLOAD
- [Electrical Conductivity Real Time Visualization](#)  
MAR 13, 2014  
↓ DOWNLOAD
- [Public Water Agencies Flow Workshop](#)  
MAR 13, 2014  
↓ DOWNLOAD
- [Restored Ecosystem Function](#)  
MAR 13, 2014  
↓ DOWNLOAD

## MEMBERS AND FOLLOWERS



## COMMENTS

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- Add your comments here
- [POST COMMENT](#)
- Lorem Ipsum is simply dummy text of the printing and typesetting industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. It has survived not only five centuries, but also the leap into electronic typesetting, remaining essentially unchanged. It was popularized in the 1960s with the release of Letraset sheets containing Lorem Ipsum passages, and more recently with desktop publishing software like

Apr 01, 2014 12:03 PM
  - industry. Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book. It has survived not only five centuries, but also the leap into electronic typesetting, remaining essentially unchanged. It was popularized in the 1960s with the release of Letraset sheets containing Lorem Ipsum passages, and more recently with desktop publishing software like

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Apr 01, 2014 12:03 PM

## About Us

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## LOWER YOLO RESTORATION PROJECT

[Edit Article](#)

The Lower Yolo Restoration Project represents an ideal location to restore tidal wetlands in the Sacramento-San Joaquin Delta. The project is an early action consistent with the Bay Delta Conservation Plan and will meet a portion of the state and federal requirement to restore 8,000 acres of wetland habitat in the Delta.

## GOAL: DIVERSE HABITAT

Creating new, self-sustaining wetlands will require excavating new channels at various depths, sizes and configurations. This 1,000-acre project will apply various designs and monitor their effectiveness in relation to tidal and storm pulses and the establishment of plants in the created wetlands. Ecologically, the goal is to provide important new sources of food and shelter for a variety of native fish species at the appropriate scale in strategic locations. Locally, the goal is a process with stakeholder input and ensuring continued or enhanced flood protection.

## PROJECT SITE: YOLO RANCH

The project site includes the Yolo Ranch, also known as McCormack Ranch, which was purchased in 2007 by the Westlands Water District (WWD). The 3,400-acre ranch has historically been used for cattle grazing.

## SMELT: A SPECIAL NEED

The two inch delta smelt are an endangered species that live year round in the estuary. A resident population has taken hold in the adjacent Liberty Island region, making the project site an ideal place to expand habitat as part of a broader smelt restoration strategy.



## NEEDED: A MORE NATURAL TIDAL LANDSCAPE

The Bay Delta region, prior to levees, was a vast area of tidal marshland spanning about 700 square miles. The construction of more than 1,100 miles of levees has eliminated an estimated 95 percent of the region's original wetlands. Restoring wetlands in strategic locations, to provide important new sources of food and shelter for a variety of fish species, is part of a comprehensive approach to reversing the ecological decline of the Delta. The Lower Yolo wetlands restoration project is part of an adaptive management approach in the Delta to learn the relative benefits of different fish habitats, quantify the production and transport of food and understand how fish species take advantage of new habitat.



## BAY DELTA CONSERVATION PLAN

The Bay Delta Conservation Plan (BDCCP) is an effort by state and federal agencies, water districts, non profit organizations and other stakeholder groups to promote the recovery of Delta fish species in ways that protect and restore water supplies consistent with endangered species laws. A draft plan is scheduled for release in late 2010. While BDCCP is envisioned to be a 50-year plan of water system and ecosystem improvements, it is already taking into account existing mandates by state and federal wildlife agencies to restore 8,000 acres of tidal wetlands in order to maintain the operations of Delta water projects. BDCCP has identified as a priority to maximize restoration on existing public lands including the Lower Yolo Restoration Project.

## PROJECT PARTICIPANTS

The Lower Yolo Restoration Project is a cooperative effort with water districts receiving supplies via the Delta's State Water Project (SWP), Central Valley Project (CVP) and the Department of Water Resources (DWR). The WWD owns a portion of the project site. Additional financial support is provided by the State and Federal Contractors Water Agency (SFCWA) a joint powers authority representing members of the SWP and CVP. This agency will be the lead in developing the restoration project.

[Edit Article](#)

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# Understanding Juvenile Salmon Entrainment and Survival in the South Sacramento/San Joaquin Delta Through the Use of Acoustic Telemetry and Hydrodynamic Measurements

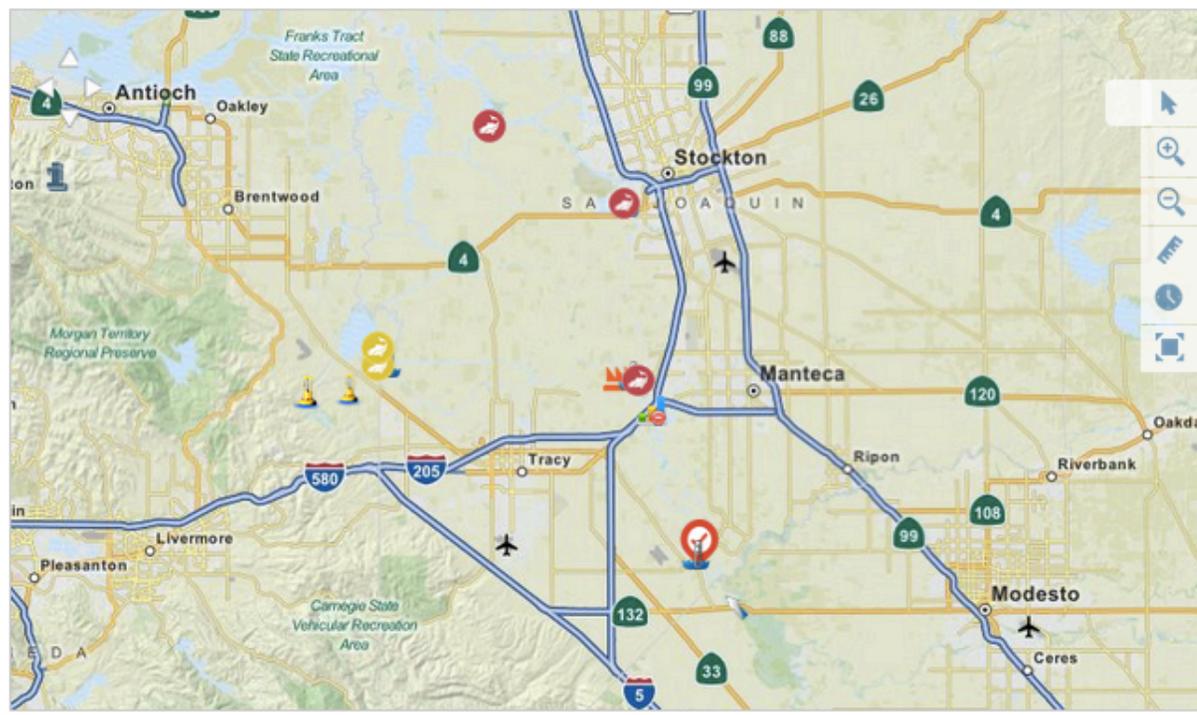
- TOOLS
- RECENT ACTIVITY
- ARTICLE
- DOCUMENTS
- IMAGES/VIDEO
- FISH TRACKING DASHBOARD

## USFWS/USBR/USGS/DWR ACOUSTIC TELEMETRY STUDY

(This study is an interdisciplinary, interagency endeavor involving USBR, California Water Resources (DWR), US Fish and Wildlife Service (FWS) and the USGS. USBR is providing funding, the linkage to regulatory requirements, assistance on study design and coordination. DWR is adding receivers to the overall network and the FWS is participating in the fish handling and tagging efforts.)

### Quick Links

- All Stations
- Release Site
- Head of Old River
- Garwood Bridge
- Turner Cut
- Facilities
- Current Extent

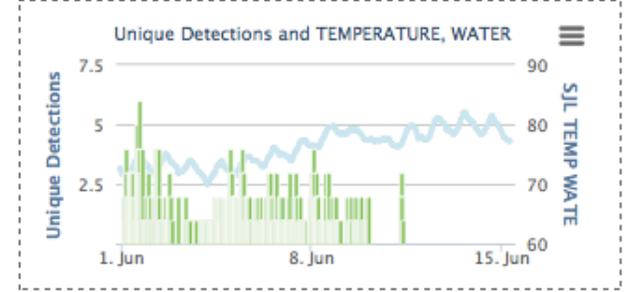


FISH RECEIVER DATA: 30 MIN. FILTER: 14 DAY DURATION TEMP/FLOW

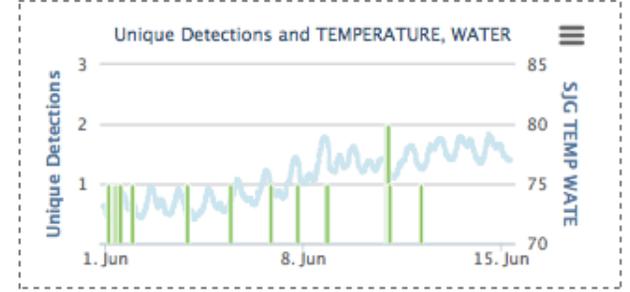
Roll over each icon on the map to see time series data and station description. Click on the Quick Links for area detail. Scroll down to build your own graphs with the aggregated data.

### Tag Detection Data/Current Conditions

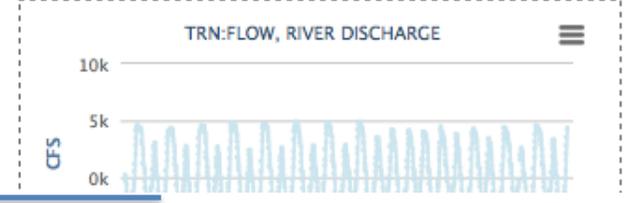
HORU - 14.5 Miles from Release Point



SJGU - 26.5 Miles from Release Point



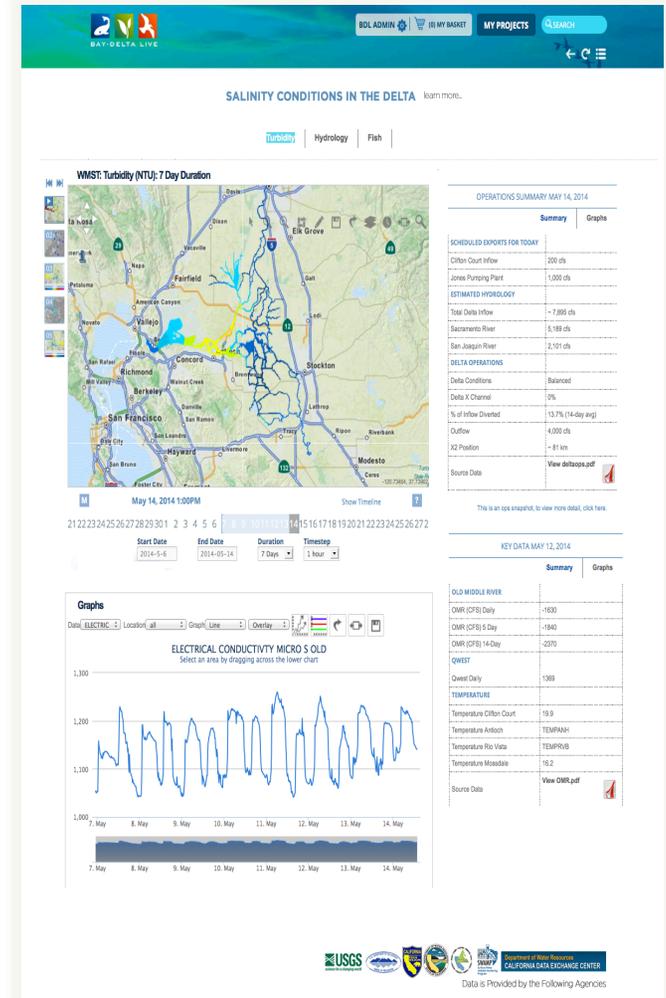
TCW - 36.4 Miles from Release Point



# DATA DASHBOARDS

## ONE VIEW DATA (Visualize, Map, Graph)

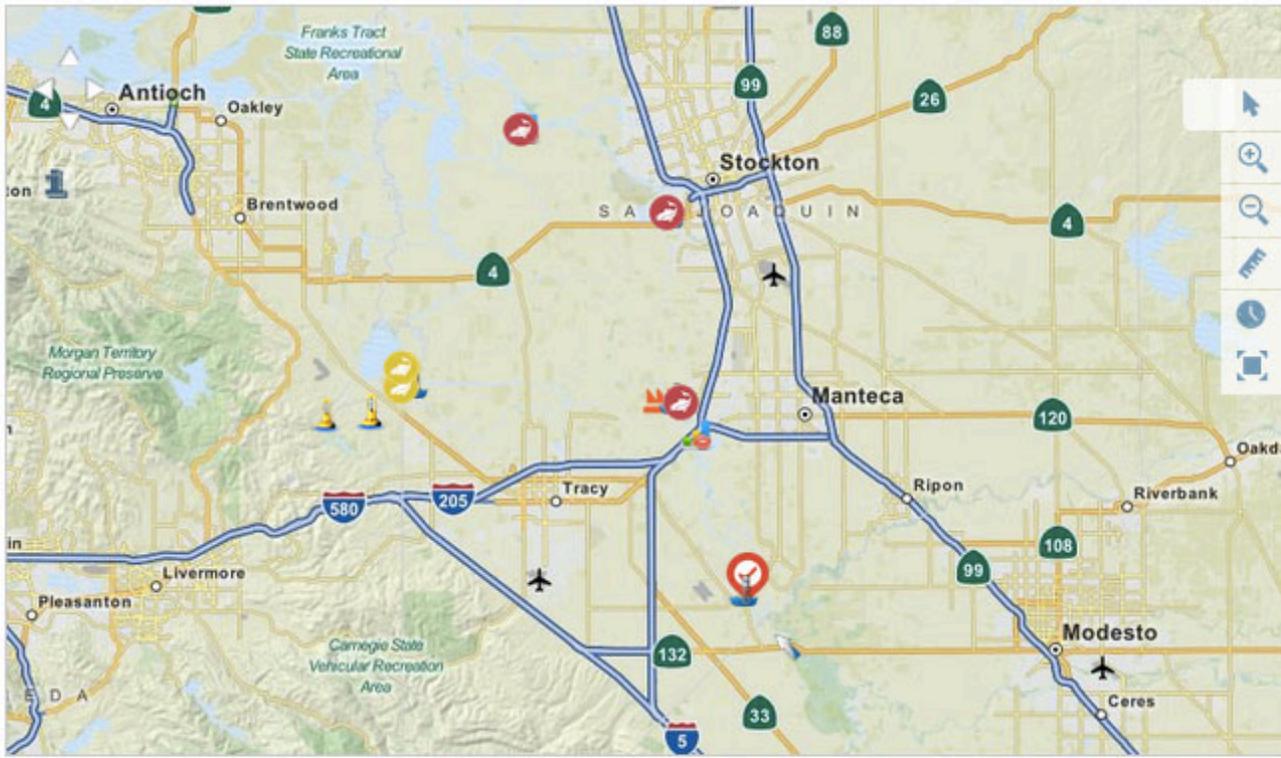
Custom view of data  
compilations  
Project management  
dashboards



# USBR/USGS FISH RELEASE 2015

## Quick Links

- All Stations
- Release Site
- Head of Old River
- Garwood Bridge
- Turner Cut
- Facilities
- Current Extent



FISH RECEIVER DATA: DAILY SUM, 30 MIN. FILTER: 14 DAY DURATION TEMP/FLOW

Roll over each icon on the map to see time series data and station description. Click on the Quick Links for area detail. Scroll down to build your own graphs with the aggregated data.

MORE

M
May 13, 2015 6:45AM
⏪
▶
⏩
Show Timeline
?

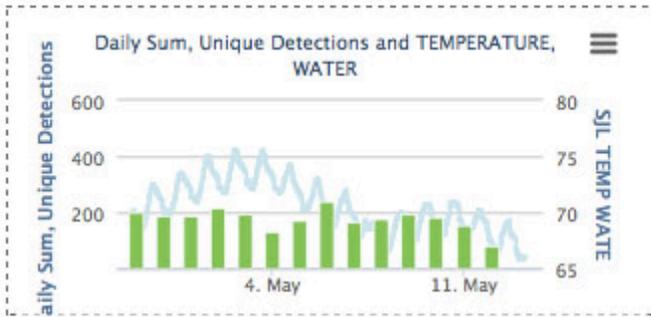
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Start Date: 2015-4-28    End Date: 2015-05-13    Duration: 14 Day    Timestep: 1 day

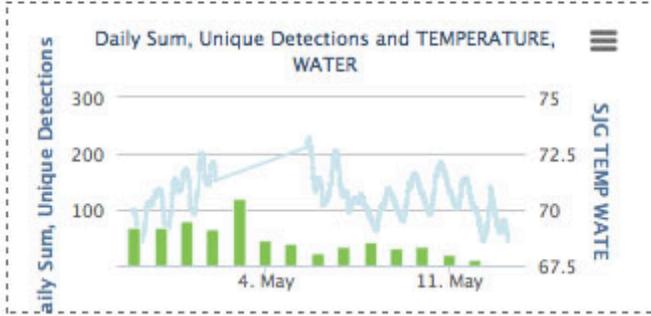


## Tag Detection Data/Current Conditions

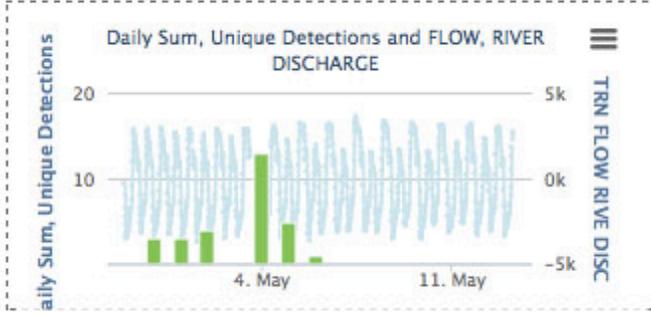
HORU - 14.5 Miles from Release Point



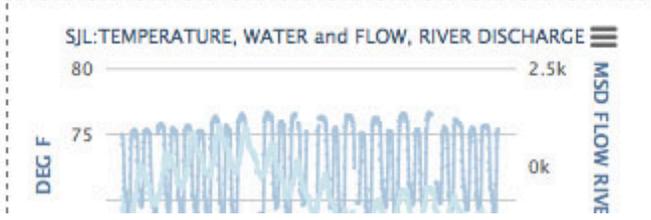
SJGU - 26.5 Miles from Release Point



TCW - 36.4 Miles from Release Point

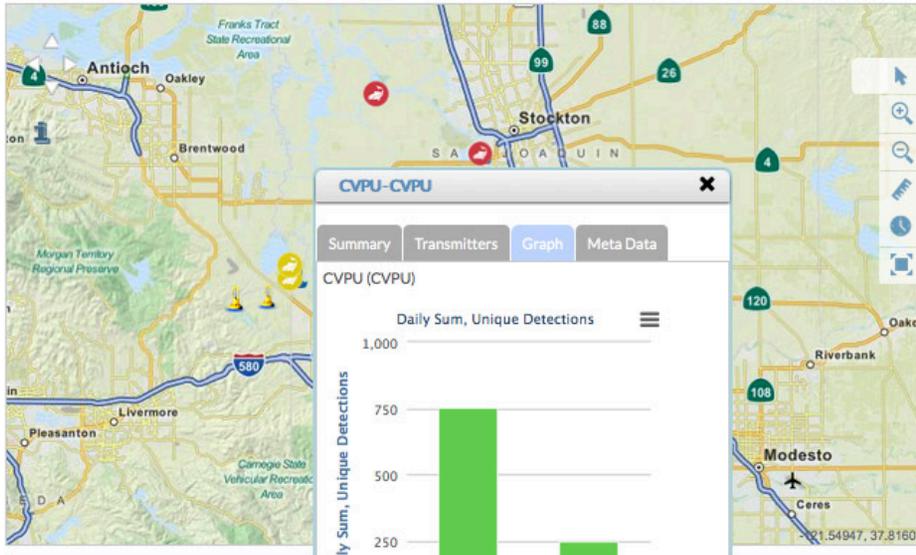


SJL Temp.&MSD Flow



Quick Links

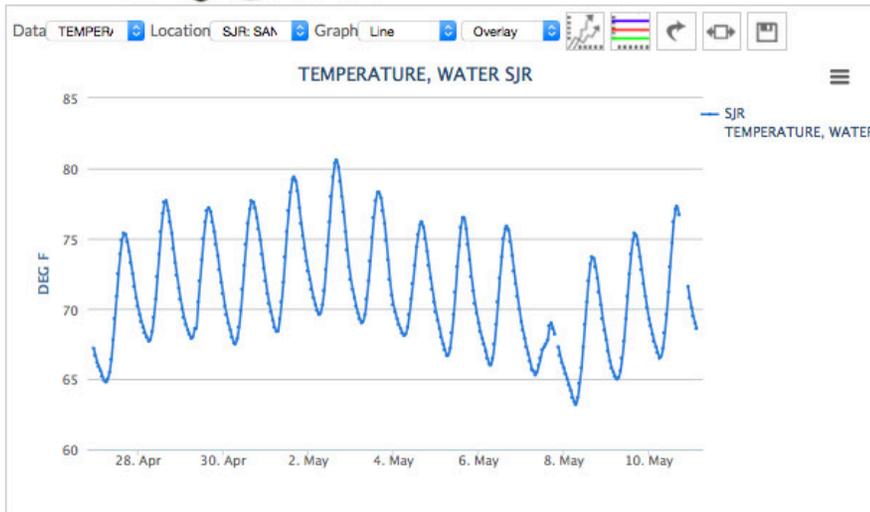
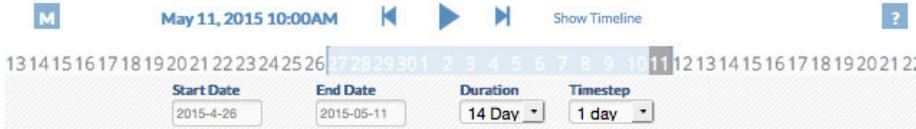
- All Stations
- Release Site
- Head of Old River
- Garwood Bridge
- Turner Cut
- Facilities
- Current Extent



FISH RECEIVER DATA: DAILY SUM, 30 MIN

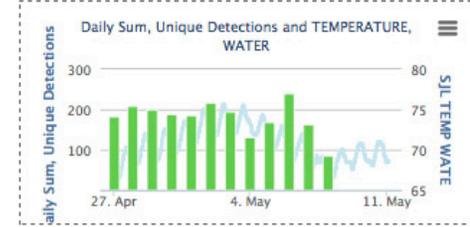
Roll over each icon on the map to see time series data. You can also build your own graphs with the aggregated data.

**MORE**

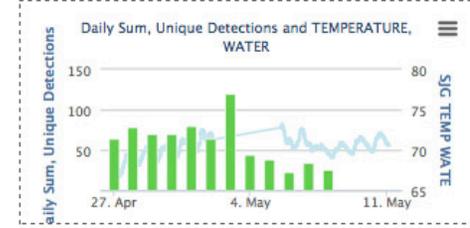


Tag Detection Data/Current Conditions

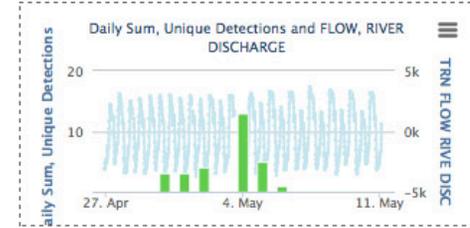
HORU - 14.5 Miles from Release Point



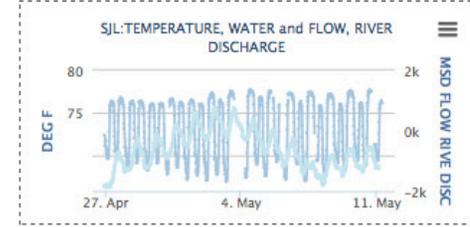
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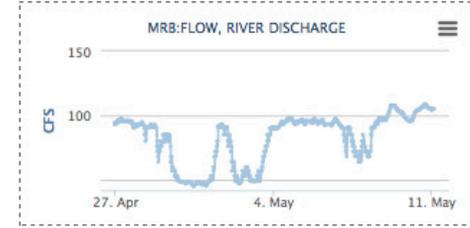
TCW - 36.4 Miles from Release Point



SJL Temp.&MSD Flow



MRB Flow





## Salinity Conditions in the Delta [read more](#)

### Electrical Conductivity(micros) Data Visualization-Last 7 days



### OPERATIONS SUMMARY JUN 14, 2015

	Summary	Graphs
<b>SCHEDULED EXPORTS for Today</b>		
Clifton Court Inflow	500 cfs	
Jones Pumping Plant	230 cfs	
<b>ESTIMATED HYDROLOGY</b>		
Total Delta Inflow	~ 8,526 cfs	
Sacramento River	6,510 cfs	
San Joaquin River	180 cfs	
<b>DELTA OPERATIONS</b>		
Delta Conditions	Balanced	
Delta X Channel	0%	
% of Inflow Diverted	7.7% (3-day avg)	
Outflow	5,100 cfs	
X2 Position	> 81 km	
Source Data	<a href="#">View deltaops.pdf</a>	

**Turbidity Conditions in the Delta** [read more](#)

Turbidity | Hydrology | Fish

WMST: Turbidity (NTU): 7 Day Duration

**OPERATIONS SUMMARY MAY 21, 2014**

Summary	Graphs
<b>SCHEDULED EXPORTS FOR TODAY</b>	
Clifton Court Inflow	300 cfs
Jones Pumping Plant	800 cfs
<b>ESTIMATED HYDROLOGY</b>	
Total Delta Inflow	~ 8,004 cfs
Sacramento River	6,573 cfs
San Joaquin River	888 cfs
<b>DELTA OPERATIONS</b>	
Delta Conditions	Balanced
Delta X Channel	0%
% of Inflow Diverted	12.1% (14-day avg)
Outflow	4,100 cfs
XZ Position	~ 61 km
Source Data	<a href="#">View deltaops.pdf</a>

**KEY DATA MAY 20, 2014**

Summary	Graphs
<b>OLD MIDDLE RIVER</b>	
OMR (CFS) Daily	-1630
OMR (CFS) 5 Day	-1840
OMR (CFS) 14-Day	-2370
<b>QWEST</b>	
Qwest Daily	452
<b>TEMPERATURE</b>	
Temperature Clifton Court	21.2
Temperature Antioch	67.4
Temperature Rio Vista	68.5
Temperature Mossdale	66.0
Source Data	<a href="#">View OMR.pdf</a>

**RESERVOIR CONDITIONS MAY 20, 2014**

Reservoir Name	Capacity (AF)	Storage (AF)	Outflow (CFS)
Castaic	325000	223414	---
Dive Park	2030000	1686015	1573

**FLOW, RIVER DISCHARGE OMR**  
Select an area by dragging across the lower chart

**FLOW, RIVER DISCHARGE OMR**  
Select an area by dragging across the lower chart

OLD & MIDDLE RIVERS - FLOW | CLIFTON COURT - TEMPERATURE

**Turbidity Conditions in the Delta** [read more](#)

Turbidity | Hydrology | Fish

WMST: Turbidity (NTU): 7 Day Duration

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**RESERVOIR CONDITIONS MAY 20, 2014**

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Dive Park	2030000	1686015	1573

**FLOW, RIVER DISCHARGE OMR**  
Select an area by dragging across the lower chart

**FLOW, RIVER DISCHARGE OMR**  
Select an area by dragging across the lower chart

**SCHEDULED EXPORTS FOR TODAY**

- Clifton Court Inflow
- Jones Pumping Plant

**ESTIMATED HYDROLOGY**

- Total Delta Inflow
- Sacramento River
- San Joaquin River

**DELTA OPERATIONS**

- Delta Conditions

# REGULATORY REPORTING

Environmental Monitoring Program (EMP) water quality monitoring and special studies for:

- Hydrologic Conditions
- Water Quality
- Phytoplankton and Chlorophyll a
- Zooplankton
- Benthic
- Nutrients
- Special Studies

The screenshot shows the 'Water Quality Conditions' report page on the Bay-Delta Live website. The page title is 'Water Quality Conditions in the Sacramento-San Joaquin Delta and Suisun and San Pablo Bays.' Below the title is a grid of eight interactive tiles: Introduction, Hydrological Conditions, Water Quality, Phytoplankton & Chlorophyll a, Zooplankton, Benthic Monitoring, Explore Data, and Continuous Monitoring. The main content area features a section titled 'Report to the State Water Resources Control Board in Accordance with Water Right Decision 1641'. The text summarizes the results of water quality monitoring and special studies conducted by the Environmental Monitoring Program (EMP) within the Sacramento-San Joaquin Delta and Suisun and San Pablo Bays (the estuary) during calendar year 2010. It states that this monitoring is mandated by Water Right Decision 1641 (D-1641) and this report is being submitted to fulfill the reporting requirements of that decision. The text further details the monitoring protocol, including 13 sampling sites, 15 physical and chemical water quality parameters, and the results of biological sampling, including phytoplankton, zooplankton, and benthic communities. The report concludes that the EMP monitors water quality using a protocol implemented in 1996. Under this monitoring protocol, 13 sampling sites—2 of which were added after 1996—representing 8 regions of the estuary were monitored for 15 physical and chemical water quality parameters. The results gathered from the sampling of these 15 parameters are described herein. Parameters such as water temperature, Secchi disk depth, dissolved oxygen (DO) concentration, specific conductance, dissolved inorganic nitrogen, orthophosphate, and volatile suspended solids were within their historical range. Measured parameters exhibited seasonal variation as well as changes in response to significant rainfall events and in flow rates. In addition to monitoring physical and chemical water quality parameters, biological sampling was conducted to monitor the productivity and composition of phytoplankton, zooplankton, and benthic communities. Chlorophyll a samples were collected at 24 monitoring sites in the estuary. Chlorophyll a is the principal photosynthetic pigment, is common to all phytoplankton, and is thus used as a measure of phytoplankton biomass. Samples for chlorophyll a and phytoplankton were taken at 15 sampling sites in the estuary. Chlorophyll a concentrations for 2010 showed seasonal patterns and were generally below 10 µg/L, and ranged between 0.38 µg/L and 59.20 µg/L throughout the estuary. Of the 156 samples taken in 2010, 94.2% (147 samples) had chlorophyll a levels below 10 µg/L. Phytoplankton samples were collected using a submersible pump from 1 m below the water's surface. All organisms collected in 2010 fell into 13 categories: centric diatoms, pennate diatoms, green algae, cryptomonad flagellates, cyanobacteria, haptophyte flagellates, dinoflagellates, euglenoid flagellates, ciliates, chrysophytes, little green algal balls, katablepharid flagellates, and silico-flagellates. Of the thirteen groups identified, centric diatoms, pennate diatoms, green algae, cryptomonad flagellates, and cyanobacteria constituted 99.2% of the organisms collected.

ABOUT THIS REPORT CONTRIBUTORS ACRONYMS & METRICS WRD1641

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# DATA STORIES

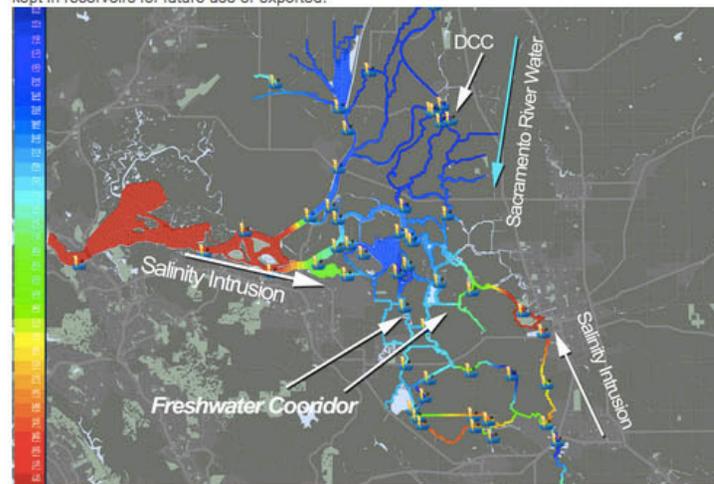
## Managing Salinity in the Sacramento-San Joaquin River Delta- During Drought Conditions

### An Overview

Flows and water quality in the Sacramento-San Joaquin Delta (Delta) are strongly influenced by freshwater inflow from the rivers, by the tides in San Francisco Bay and by salinity from Bay waters. Prior to human influence, the historical distribution of salinity in the Delta was controlled primarily by the seasonal and inter-annual distribution of precipitation, the geomorphology of the Bay and Delta, daily tides, the spring-neap tidal cycle, and the mean sea level at Golden Gate. Extended wet and dry periods are both evident in the historical record. Since about 1860, a number of morphological changes to the Delta landscape and operational changes of reservoirs and water diversions have affected flows and the distribution of salinity within the Delta.

### Drought Conditions

Salinity controls exports during droughts. As river flows entering the delta decrease, the water in the south delta will become so salty it will be unusable and exports from the delta will stop. This document outlines a number of alternatives for "controlling" the salt field in the central delta. These alternatives principally rely on strategically placed "temporary" barriers. In the absence of these barriers, a great deal of water will be used to repel salinity intrusion in the delta, rather than being kept in reservoirs for future use or exported.

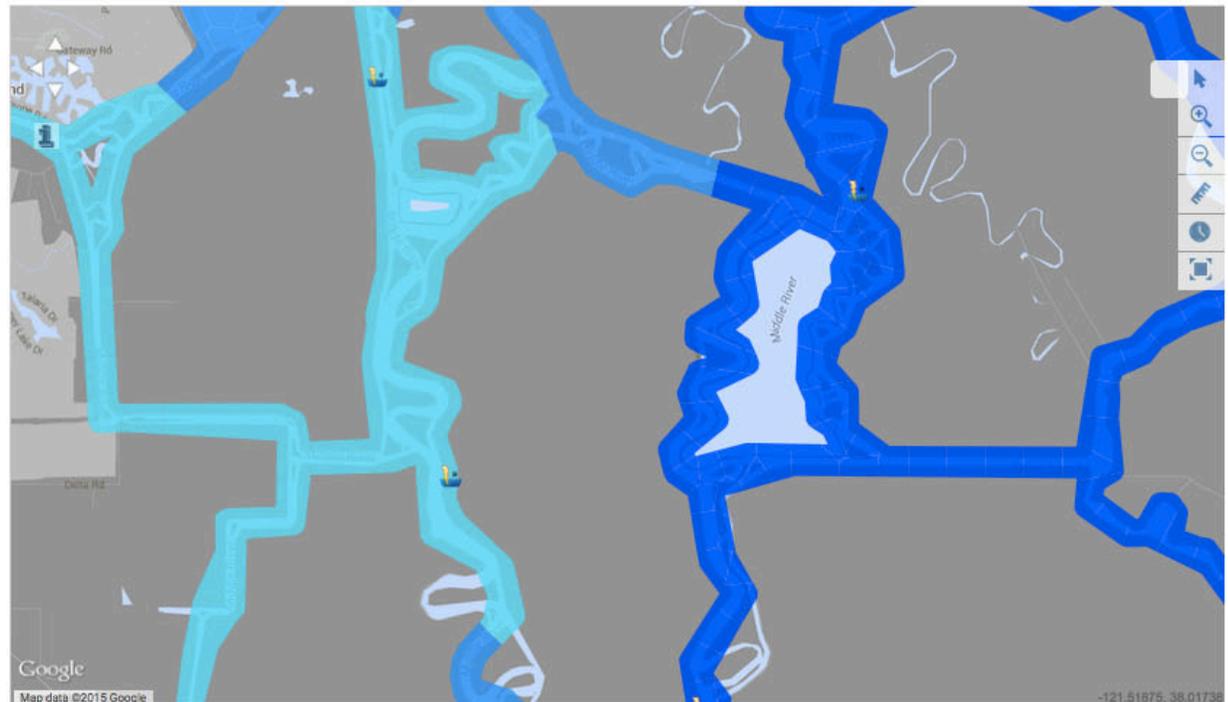


Caption: Salinity Intrusion and the Fresh Water Corridor Illustrated

There number of drought mitigation strategies that will allow the water projects to reduce reservoir releases, minimize the impacts on the ecosystem of very low river flows and continue to deliver water to the greatest extent possible as water supplies dwindle. A variety of numerical models are being used to evaluate the response of the salt field to a sequence of mitigation measures, which involve export curtailments, reservoir releases, gate operations and temporary barriers. All of these strategies could help us minimize the amount of water needed to keep the "fresh water

### Quick Links

Current Extent Get Quick Link All



### Electrical Conductivity (micro s) Data Visualization - Last 7 days

Salinity Conditions Visualization. Data always displays last 7-Days.



May 13, 2015 7:30AM

13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Start Date

2015-5-5

End Date

2015-05-13

Duration

7 Days

Timestep

1 hour

# QUESTION TEMPLATES

Does water temperature support Chinook salmon migration in the San Joaquin River?

Next Question

Chinook Salmon and the SJR Basin

Current Conditions for Salmon

Fun Facts

Water Quality Objectives and Beneficial Uses

Monitoring temperature in the San Joaquin River and its tributaries will help us better understand if conditions support migration and other life stages of Chinook salmon (*Oncorhynchus tshawytscha*). Two San Joaquin River runs (spring and fall) of Chinook salmon are currently struggling for survival. There are varying reasons for their decline and temperature is one important factor.



## About the Chinook salmon life-cycle

Chinook salmon are anadromous, which means they spawn in freshwater, but migrate to the ocean where they remain for their adult lives. After years of living in the open ocean, they return to their natal freshwater streams to reproduce. Females dig nests in gravel-bedded streams called redds where they deposit their eggs. After the male fertilizes the eggs, the female covers the redd with gravel. The embryos hatch into larval fish called alevin that remain in the gravel redd nourished by the yolk sac of the egg from which they were born. The alevin absorbs the yolk sac and grows, emerging from the gravel as fry (see life stage illustration below). The fry begin their migration downstream toward the ocean. As they grow, they develop scales and dark vertical bars on their sides called parr markings. At this stage they are called parr. Smoltification is a physiological change that enables the fish to adapt from living in freshwater to living in saltwater. At the completion of this process they are called smolt. Smolt typically remain in brackish water estuaries as juveniles before they move into the open ocean. Adults migrate throughout the North-east Pacific until returning to the freshwater streams to reproduce.



Does water temperature support Chinook salmon migration in the San Joaquin River?

Next Question

[Chinook Salmon and the SJR Basin](#)

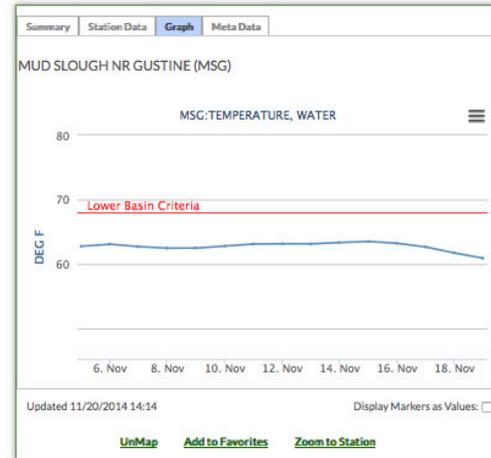
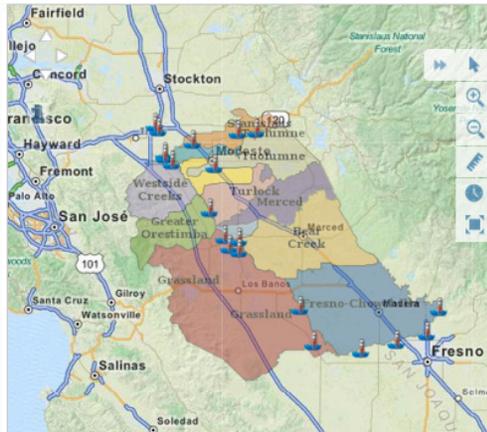
[Current Conditions for Salmon](#)

[Fun Facts](#)

[Water Quality Objectives and Beneficial Uses](#)

Currently, temperature is measured in many locations in the San Joaquin River watershed. Most stations are located on the main stem of the San Joaquin River (see interactive map with conditions below).

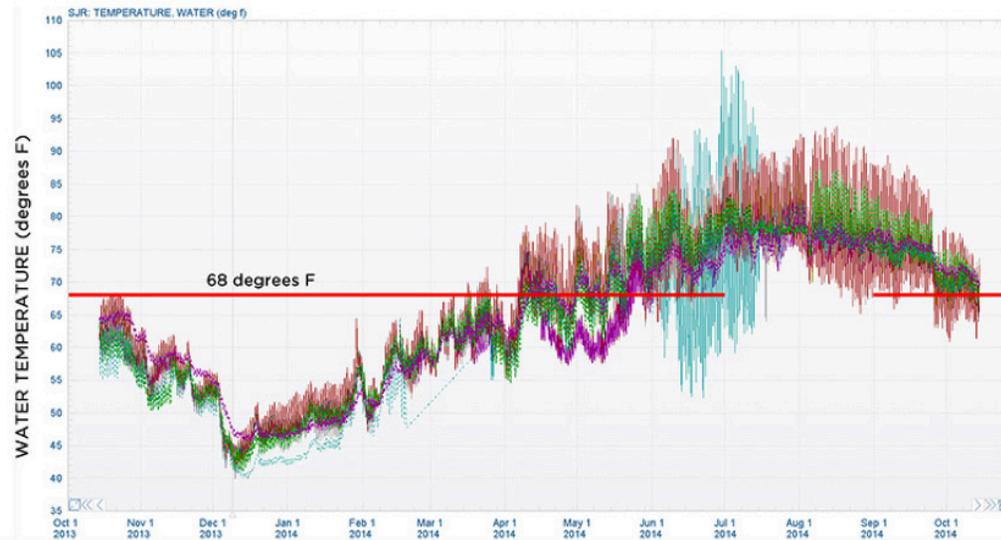
### Current Temperature Conditions in the San Joaquin River and its Tributaries



Graph Mode (Toggles between graph and current value)

Click on the stations above to see real time temperature conditions. The graphs illustrate the temperature conditions over the last two weeks. The peak temperature experienced in any given day is averaged across 7 days to produce the 7-day average daily maximum value which is being displayed. For the Lower Basin stations the red line shows the 68 F (7-day average daily maximum) threshold to support migration. In the Upper Basin, the red line shows the 64 F (7-day average daily maximum) threshold to support migration. To allow for migration of both Spring and Fall-run Chinook the thresholds must be met September thru June.

### San Joaquin River lower basin temperatures over the last year



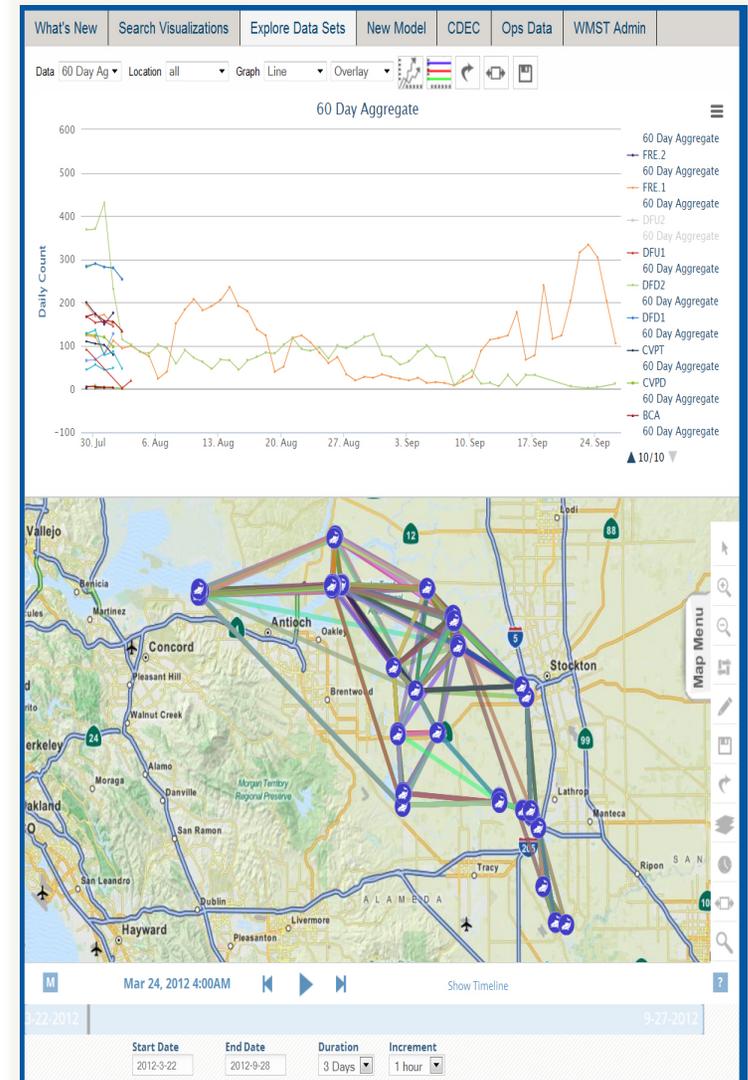
October 2013 to October 2014



# SPECIAL STUDIES

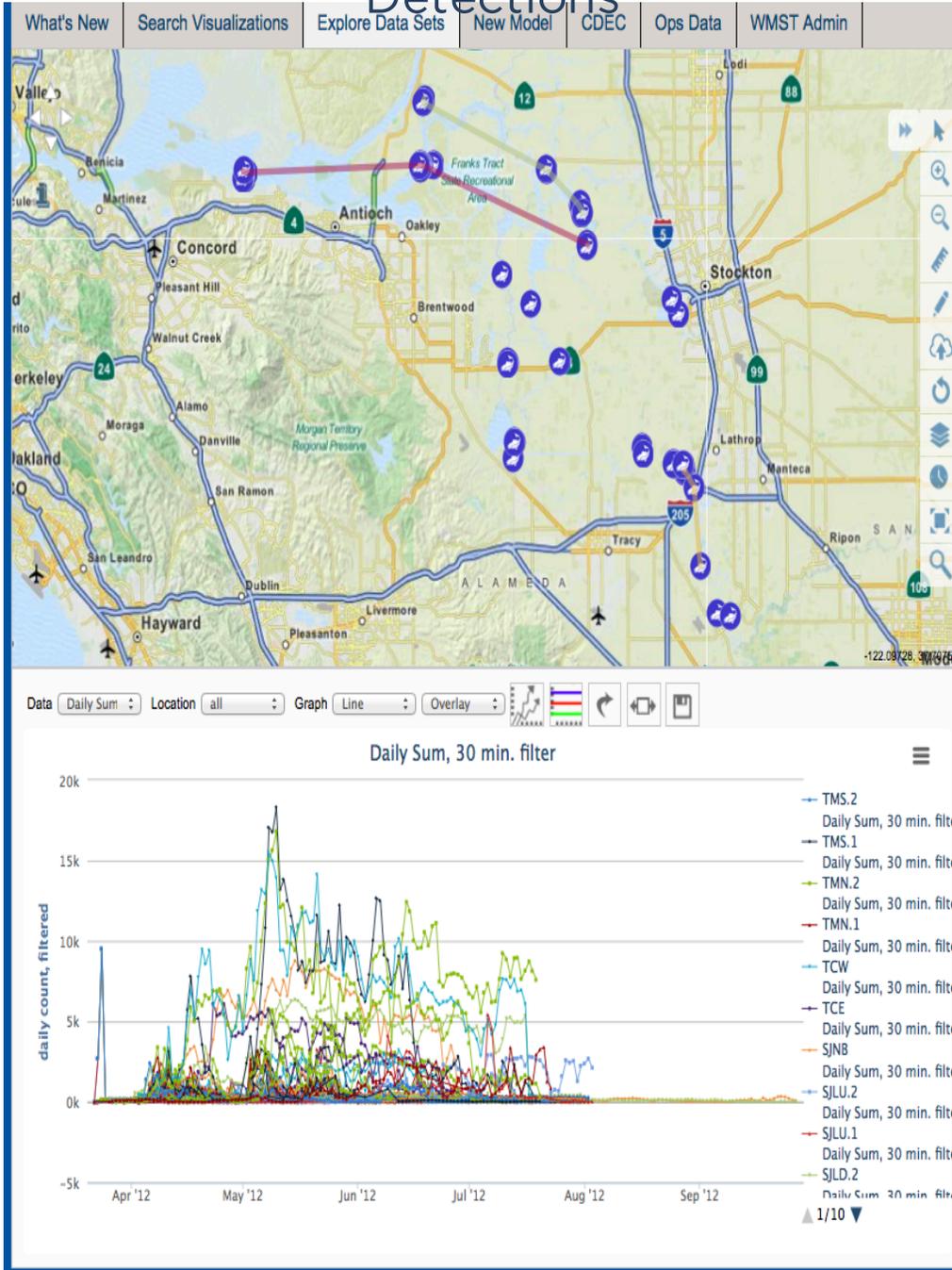
## Tracking Fish

- 🌊 Analyze Fish Tracks
- 🌊 Integrate Real Time Conditions
- Survival Rates
- 🕒 Tides
- 🕒 Flow
- 🕒 X2

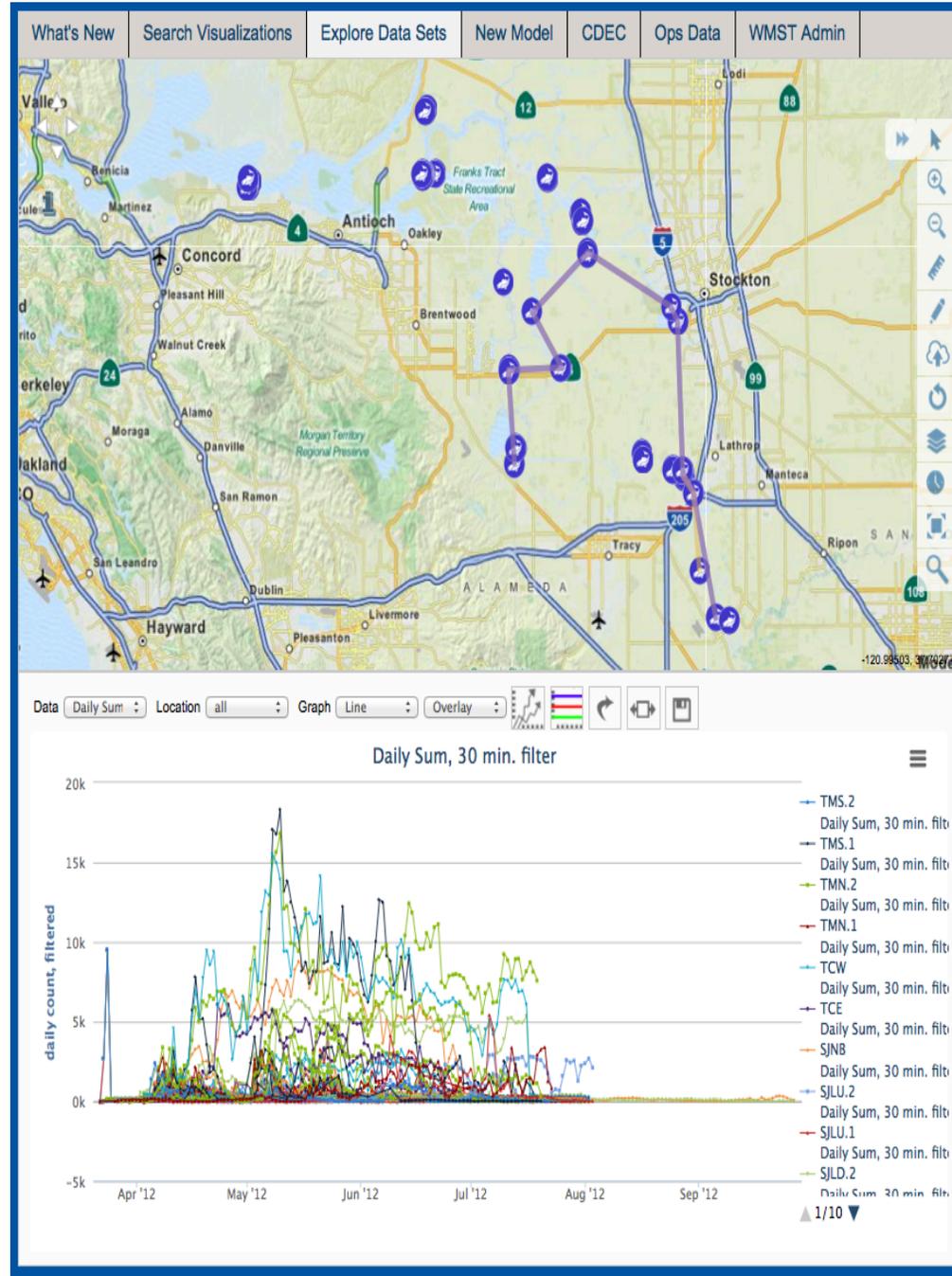


Department of Water Resources  
CALIFORNIA DATA EXCHANGE CENTER

# No Prior Detections



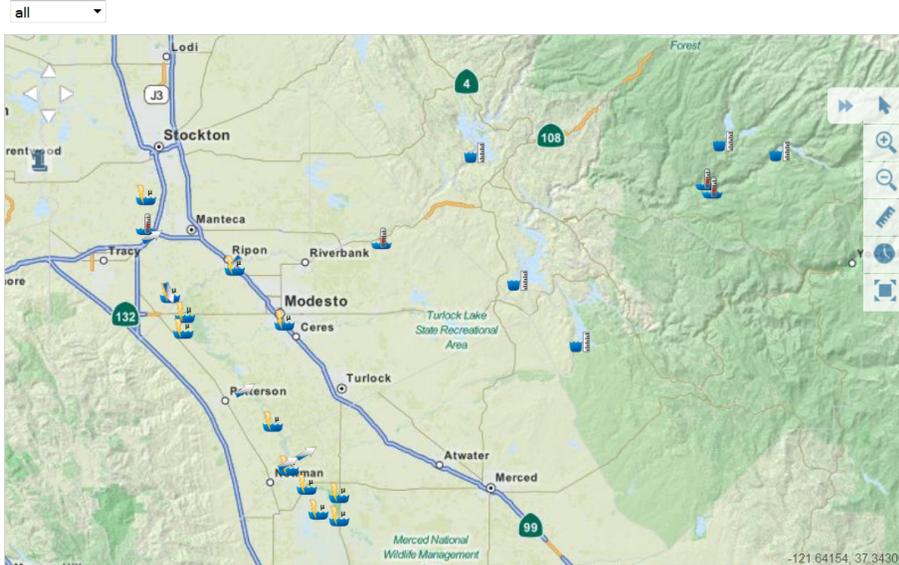
# Fastest Way Out



# REAL TIME TMDL MANAGEMENT: SJRRTM

Quick Region Links

- Vernalis
- Crows Landing
- Lower SJR
- Modesto
- Turlock
- Salt Slough
- Mud Slough
- Reservoirs
- Current Extent
- Station Finder

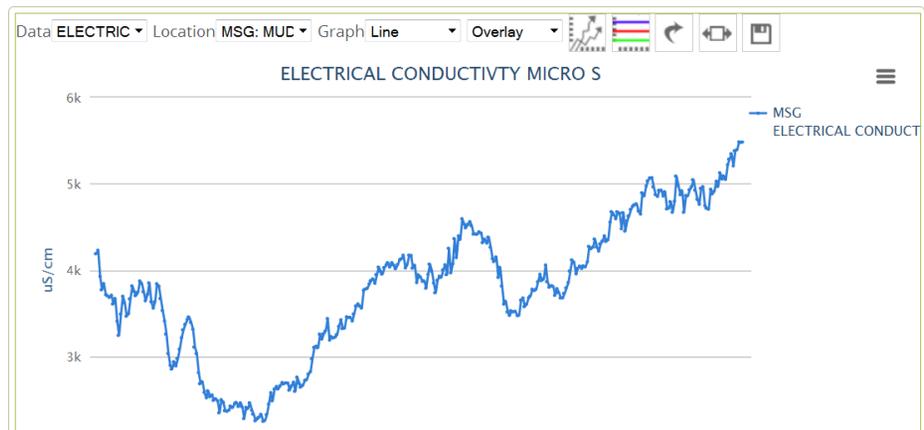


V5: Real Time Conditions View: EC, Flow, Reservoir Storage

M May 13, 2015 5:15AM Show Timeline ?

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Start Date: 2015-4-28 | End Date: 2015-05-13 | Duration: 14 Days | Timestep: 1 hour

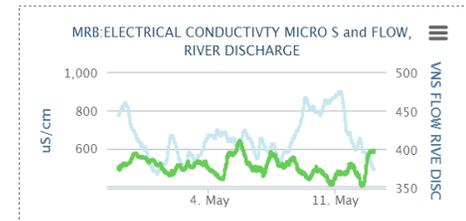


EC/FLOW

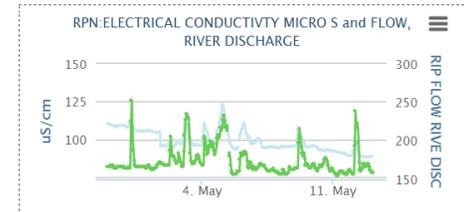
SAN JOAQUIN R MCCUNE STATION NR VE (SJR) = EC (uS/cm)  
 SAN JOAQUIN RIVER NEAR VERNALIS (VNS) = Flow, Discharge



SAN JOAQUIN R AT MAZE RD BRIDGE (MRB) = EC (uS/cm):  
 SAN JOAQUIN RIVER NEAR VERNALIS (VNS) = Flow, Discharge



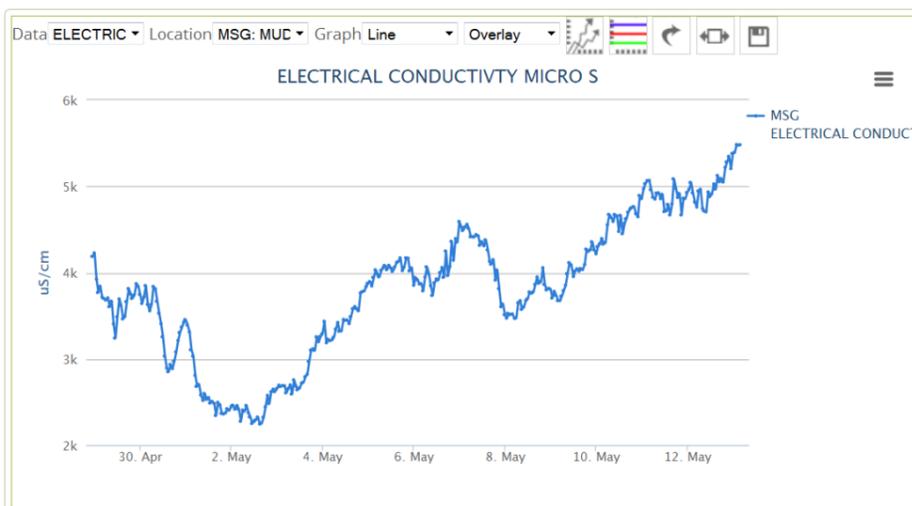
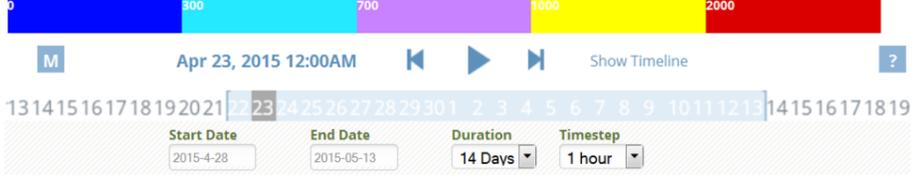
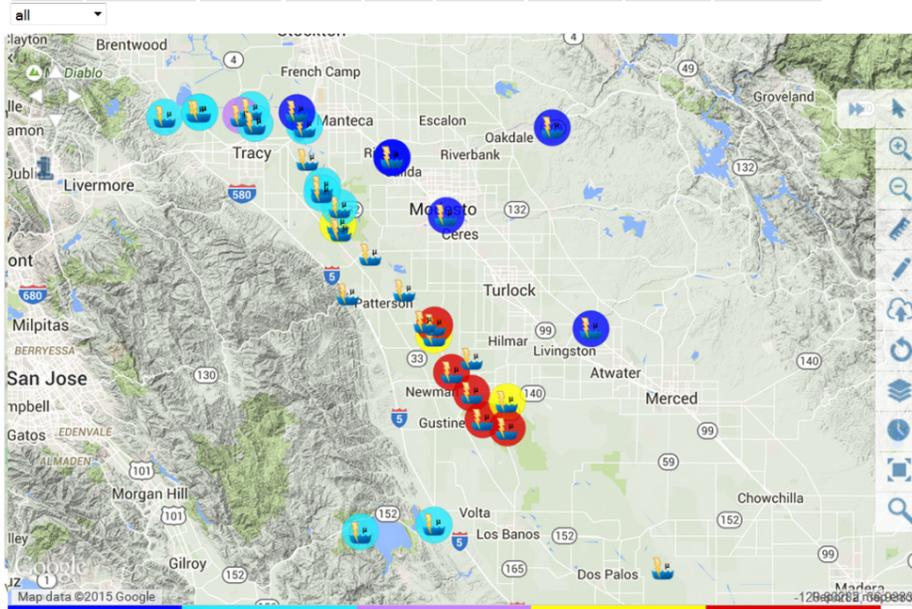
RIPON (RPN) = EC (uS/cm): STANISLAUS RIVER AT RIPON (RIP) = Flow, Discharge



### USBR Realtime Monitoring

#### Quick Region Links

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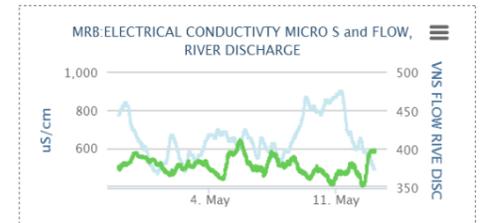


#### EC/FLOW

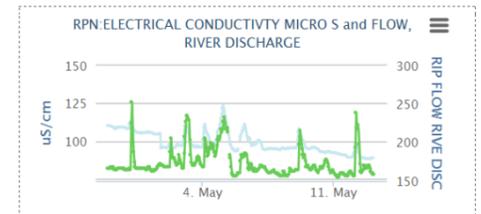
SAN JOAQUIN R MCCUNE STATION NR VE (SJR) = EC (uS/cm);  
 SAN JOAQUIN RIVER NEAR VERNALIS (VNS) = Flow,  
 Discharge



SAN JOAQUIN R AT MAZE RD BRIDGE (MRB) = EC (uS/cm);  
 SAN JOAQUIN RIVER NEAR VERNALIS (VNS) = Flow,  
 Discharge



RIPON (RPN) = EC (uS/cm); STANISLAUS RIVER AT RIPON  
 (RIP) = Flow, Discharge



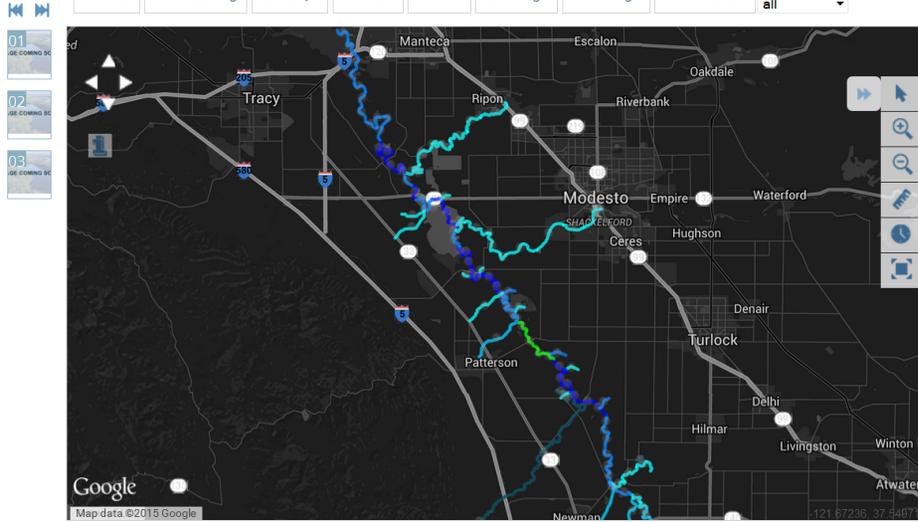
### WARMF Visualization Overview: Visualize WARMF

A quick model load for visualizing the WARMF forecast on your desktop. The interactive map defaults the first visualization to the WARMF forecast\* for Salt Load. Using the image carousel on the left side of the map, you can choose additional visualizations including Electrical Conductivity and Flow. Data graphs displayed on the right are filtered by region using the graph quick view buttons below. For a complete list of stations graph available, see the Station Finder.

\*The time interval for the forecast is currently set at 14-day duration, the last 7 day archive forecast with current 7 day forecast.

#### Quick Region Links

Vernalis | Crows Landing | Lower SJR | Modesto | Turlock | Salt Slough | Mud Slough | Current Extent | Station Finder



#### WARMF FORECAST (Reduced): Salt Load (TDS)- 14 Day Duration

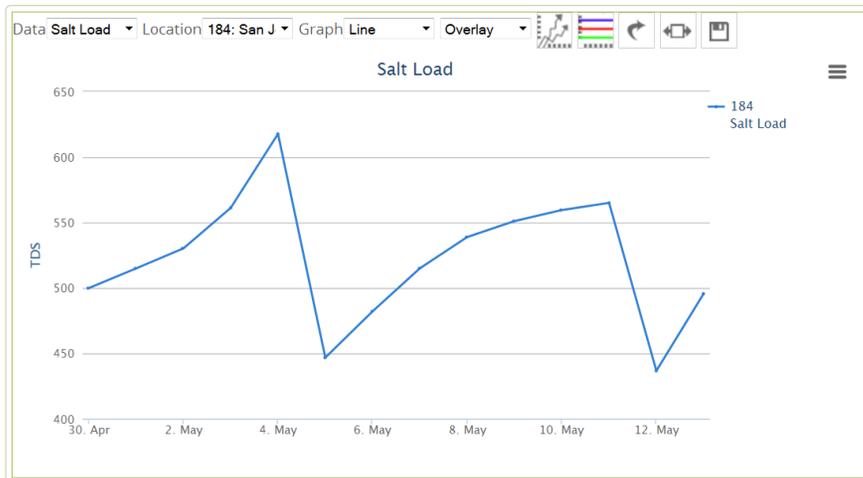
Salt Load Forecast Visualization using a custom GIS grid with reference to the WARMF model station output. This model has been optimized using a reduce station count.



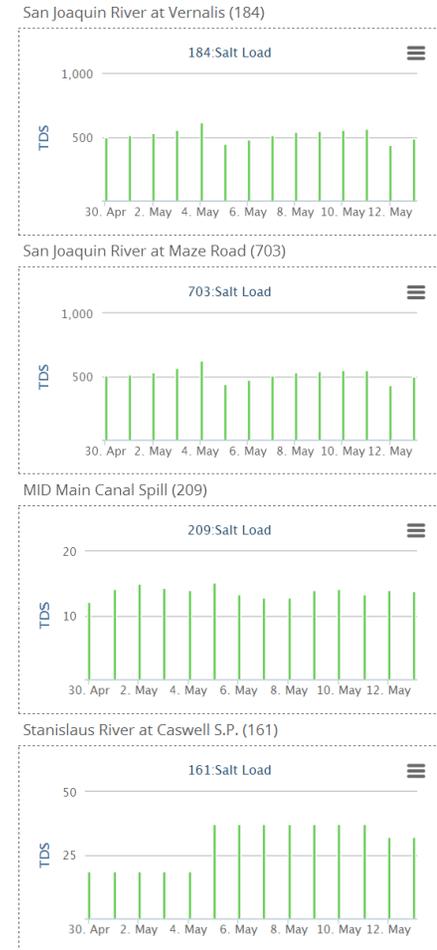
May 2, 2015 12:00AM

16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

Start Date: 2015-04-29 | End Date: 2015-05-13 | Duration: 14 Days | Timestep: 6 hour



#### Salt Load



Graph Mode (Toggles between graph and current value)



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