



Open and Collaborative  
Natural Resource Management

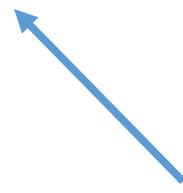
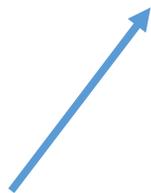
Developed by 34 North



SAAS Model for Natural Resource Management



*GeoServer*



*OpenLayers*

PostGIS



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



Data Dashboards



Real Time Monitoring



GIS and Map Manager



Document Library



Project Collaborator



Geo-Spatial and Science Application



Model Simulation Engine

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

Project Management application for data aggregation, analysis, reporting and visualization

Admin application for Data Dashboard Development

NASA Earth Observation Workspace

HTML Articles

**San Francisco Bay-Delta Water Resources**

Subtitle: Utilizing NASA and ESA Earth Observations to Monitor Turbidity Conditions in the San Francisco Bay-Delta

VPS Title: The Delta Smeltdown: Monitoring Turbidity to Aid Delta Smelt Conservation

NASA DEVELOP National Program, NASA Jet Propulsion Laboratory (Summer 2017)

**Project Overview**

Water quality is a critical element of freshwater supply, particularly in times and areas of drought. Limited water resources can be further strained if water quality concerns are not effectively and efficiently addressed. While there are measures in place to protect human and environmental health from poor and risky water quality conditions, implementation of these measures is frequently reliant on physical water samples and fixed station data, both of which have gaps in spatial and temporal coverage of water quality conditions. This consideration is especially important in environments that are highly complex and heterogeneous, such as the San Francisco Bay-Delta, as well as in budget-constrained areas or sites that are remote and are challenging to access. Remotely sensed information can help supplement existing data, supporting more informed water management practices and representing a wealth of information that has yet to be fully leveraged. In this project, we evaluated the application of remote sensing-derived turbidity from three Earth observing satellites in the San Francisco Bay-Delta and conducted comparisons with in situ turbidity data from USGS and CDEC water quality stations. The Semi-Empirical Single Band Turbidity Algorithms yielded a 1:1 relationship with in situ turbidity when calculated values were less than 15 to 20 FNU. This relationship did not extend to higher turbidity values, which yielded significantly lower slopes. Incorporating site-specific constants into the algorithms to correct for this deviation must be explored further. Sentinel-2 was the only satellite able to pick up turbidity values in the smaller tributaries of the Bay-Delta.

**Keywords:**  
Turbidity, smelt, San Francisco Bay-Delta, water quality, Landsat 8, Sentinel-2, Sentinel-3

**Partner Organizations:**

Organization	POC (Name, Position/Title)	Partner Type	Boundary Org?
Metropolitan Water District of Southern California (MWD)	Dr. David Fullerton, Principal Resource Specialist, Dr. Shawn Acuna, Environmental Scientist, Russell Ryan, Senior Engineer	End User	Yes

**Community Concerns:**

- Prolonged drought conditions in California have necessitated an increased use of water resources from the Bay-Delta for both agricultural and municipal usage.
- Diverting water from this region must be done in consideration of the Delta smelt, an endemic and federally protected endangered fish species that spawns within the Bay.
- There is a need for remotely-sensed tools to monitor turbidity in areas not covered by in situ monitoring stations and to assist with turbidity model calibrations.

**Current Decision-Making Practices & Policies:**

Currently, Bay-Delta water quality assessments and management policies are primarily informed via field observations from in situ monitoring stations and sediment transport models to interpolate turbidity values between these fixed station sites. While Bay-Delta variations in salinity are well understood, turbidity is less so. Data from these snapshots and models is currently necessary to balance water resource needs with proper ecosystem functioning. Turbidity distributions are a vital part in the MWD's decision-making process—determining the timing of pumping station operations and avoiding accidental entrainment of endangered species like the Delta smelt at pumping facilities. In addition, the MWD supports research efforts into the link between turbidity values and preferred smelt habitat, utilizing GPS tagging, drones, and other technologies to ensure compliance with local and federal wildlife protections.

**Decision Support Tools & Benefits:**

End Product	Earth Observations Used	Partner Benefit & Use	Software Release
Turbidity Maps	Landsat 8 OLI, Sentinel-2, Sentinel-3A	This product will be used for improved monitoring and management strategies for pumping facilities, such as pumping restrictions, periodic closure, or Delta smelt salvage at pumping facilities in the southern Bay-Delta.	N/A

**Images**

Landsat 8 ACOLITE Turbidity Output Imagery (Captured April 27, 2017)

Landsat 8 ACOLITE Turbidity Output Imagery (Captured April 27, 2017; Landsat 8 Satellite, OLI/TIRS Combined Sensor, Processing correction level: Precision Terrain, WRS path 044 and WRS row 034, Acquired April 27, 2017, Collection number 01, Collection category Tier 1.

Adjust Timeline

1 hour

Title: Turbidity Snapshot



Login Register

Home Data and Dashboards Explore Data Operations Projects Maps & GIS Doc Library Fisheries More



### Turbidity Current Conditions (past 30 days)

California Department of Water Resources Sacramento San Joaquin Bay Delta real time monitoring stations for Turbidity. Data analysis displays last 30 day time series graphs.

[Learn More](#)

## CALIFORNIA CURRENT ENVIRONMENTAL CONDITIONS

### FALL MIDWATER TRAWL

STANDARDIZED FISH SURVEY

Year Initiated: 1995  
Sampling Season: March through July  
Survey Length: Each survey takes 4 days to complete  
Survey Frequency: Once a fortnight

Number of Stations: 55  
Gear Type: Egg and Larva Net  
Tow Information: Three 10-minute tows at each location



### Fisheries

There are many fish monitoring programs led by State and Federal agencies in the Delta. View fish monitoring results and dig deep into the programs.

[VIEW ALL DATA DASHBOARDS](#)

● Precipitation Data ● Water Quality ● Fisheries ● Delta Operations  
● Water Quality and Flow Conditions

### WHAT'S NEW ON BDL



**Fisheries**  
Aggregating more than 40 disparate data sets, these Fisheries dashboards support water managers to make real time decisions...



**Salinity Management in The Delta**  
The BDL Salinity Dashboard and Data Story conditions data visualization and...



**Water Quality Conditions in the Sacramento-Pablo Bays**  
This web enabled interactive report summarizes and provides a platform to explore water...



**Ecosystem Restoration Projects**  
Explore more than 200 projects to restore and improve Delta habitat and infrastructure...

[VIEW DIRECTORY](#)

### SIGN UP FOR UPDATES & LIVE CONDITIONS NOTIFICATIONS

First Name and Last Name

Email Address

● Daily Operations ● Projects ● Delta Turbidity Conditions ● Delta Salinity Conditions ● Fisheries Data ● Historical BDL Updates

[Sign Up](#) [Learn more about BDL notifications](#)

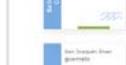


## RESTORE THE DELTA

BDL is home to hundreds of restoration projects throughout the Delta. Explore projects by location, awarded project date.

## CALIFORNIA CURRENT ENVIRONMENTAL CONDITIONS

### WATER QUALITY



### WATER SUPPLY



● Precipitation Data ● Delta Operations ● Water Quality ● Water Quality and Flow Conditions ● Fisheries



**Water Supply**  
Surface water is stored in reservoirs throughout the year to be used as needed in the dry summer months for a variety of beneficial uses. View reservoir data.

[VIEW ALL DATA DASHBOARDS](#)

# Redesign of Baydeltalive.com website and iPhone / Android app Release coming soon – Next couple months



Login Register

Home Data and Dashboards Explore Data Operations Projects Maps & GIS Doc Library Fisheries More

### Browse Data Stories



#### Yolo Bypass Restoration Data Dashboard

Aggregation of data from the Yolo Bypass region  
The Yolo Region Data Hub aggregates all data and information for the restoration of the Yolo Bypass and surrounding areas. This restoration hub includes project information, documents, data sets, PDF descriptions, GIS data and real-time local conditions.

[Read More](#)



#### EDSM Key Species Weekly Views (07/01/17 to 12/15/17)

Each map story shows the weekly catch summaries for key species from the Enhanced Delta Smelt Monitoring (EDSM) program by the US Fish and Wildlife Service. To view each week, click through the week links above the map. Or, scroll...

[Read More](#)



#### Turbidity Current Conditions (past 30 days)

California Department of Water Resources Sacramento San Joaquin Bay Delta real time monitoring stations for Turbidity. Data analysis displays last 30 day time series graphs.

[Read More](#)



#### Salinity in the Sacramento San Joaquin Bay Delta

In an unaltered environment there is natural variation...  
Salinity is simply a measure of the amount of salts dissolved in water. Salinity is usually expressed in parts per thousand (ppt) or PPT. Fresh water in rivers has a salinity of 0.5 ppt or less. Within...

[Read More](#)



#### Lake Oroville Flood Zones and Conditions

This data story overviews current conditions, past conditions and flood zones around Lake Oroville and its watershed.

[Read More](#)



#### Ca DWR: Delta Atlas Map Compilation

The images and interactive maps associated with this project here are from individual sections of the Delta Atlas published in 1995. Now out of print (no printed copies available), the Delta Atlas contains information that is included in appears here...

[Read More](#)



#### NASA Remote Sensing Imagery Workspace

IQ workspace for project team members to explore and download project files, data visualization and member profiles.

[Read More](#)



#### California Sierra Nevada Snowpack and Station Data Dashboard

The California Department of Water Resources Snow Survey Program provides mountain snow pack data and precipitation data for the western United States.

[Read More](#)



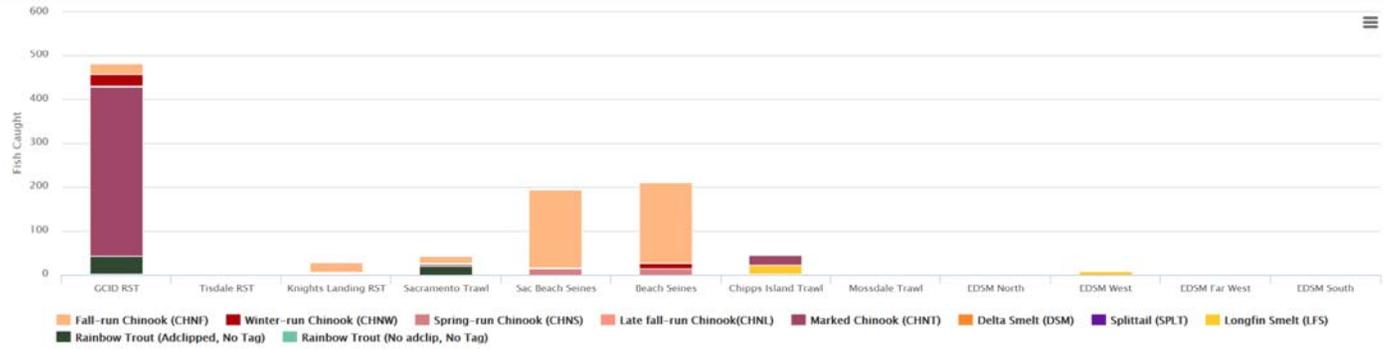
# The BDL Fisheries Data Dashboard: A Collaborative effort with SFCWA, NOAA, USFWS and the Delta Operations WG

## Catch Summaries, Indices, and Key Stations

Preliminary data, subject to change.

Fish Caught by Region (Click legend to turn species on and off)

12 Fish Surveys: Monitoring Data for Species of Management Concern  
Species of management concern caught at key survey monitoring locations (last 7 days).



Catch Indices for DCC Gate Operations per NMFS BiOps Action IV.1.2

Catch indices indicate Chinook salmon movement upstream of the Delta and inform water operations of migration timing for real-time management decisions.

Sacramento Trawl Catch Index (Trawl SCI)



Knights Landing Catch Index (KLCI)



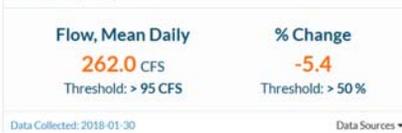
Sacramento Beach Seine Catch Index (Seine SCI)



Environmental Indicators of Fish Migration

Key river flow and water temperature station data help managers better understand salmon migration.

Mill Creek (MLM)



Deer Creek (DCV)



Wilkins Slough (WLK)



Knights Landing



# The BDL Turbidity Model + Daily Operations Summary

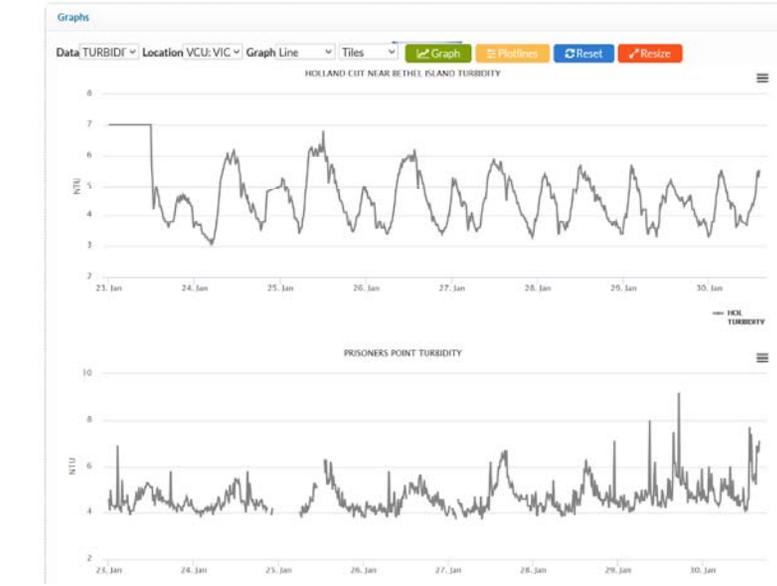
- 40 + Stations loaded via web services
- Summary scrapped from email & Url's

Ending at midnight - 01/29/2018

For selected reservoirs in Northern and Southern California

Report generated: 01/30/2018 09:04

Reservoir Name	StalID	Capacity (AF)	Elevation (FT)	Storage (AF)	Storage Change	% of Capacity	Average Storage	% of Average	Outflow (CFS)	Inflow (CFS)	Storage - Inflow Year Ago This Date	
<b>TRINITY RIVER</b>												
TRINITY LAKE	CLE	2,447,650	2,324.75	<u>1,774,394</u>	1,339	72	1,724,452	103	142	825	1,455,104	
WHISKEYTOWN	WHI	241,100	1,198.41	<u>205,417</u>	-471	85	205,287	100	298	64	222,516	
LEWISTON	LEW	14,660	1,900.80	<u>13,764</u>	-371	94	13,808	100	338	151	14,278	
<b>RUSSIAN RIVER</b>												
SONOMA(WARM SPRINGS)	WRS	381,000	435.79	<u>206,941</u>	142	54	220,093	94	80	155	285,037	
MENDOCINO(COYOTE)	COY	122,400	734.79	<u>63,942</u>	163	52	67,983	94	38	123	76,124	
<b>SACRAMENTO RIVER</b>												
SHASTA	SHA	4,552,000	1,022.10	<u>3,337,685</u>	6,068	73	3,056,296	109	3,550	6,645	3,589,145	
KESWICK	KES	23,772	581.78	<u>20,557</u>	82	86	21,626	95	3,846	3,888	21,386	
<b>FEATHER RIVER</b>												
OROVILLE	ORO	3,537,577	717.80	<u>1,395,550</u>	5,899	39	2,308,167	60	1,866	4,900	2,867,669	
ANTELOPE	ANT	22,566	4,996.08	<u>17,437</u>	9	77	16,977	103	----	----	23,580	
FRENCHMAN	FRD	55,477	5,580.21	<u>44,002</u>	41	79	34,722	127	----	----	26,879	
LAKE DAVIS	DAV	83,000	5,771.28	<u>70,105</u>	-38	84	58,800	119	----	----	59,502	
<b>YUBA RIVER</b>												
BULLARDS BAR	BUL	966,000	1,908.82	<u>756,658</u>	1,816	78	581,408	130	263	1,190	791,374	



Delta Operations Summary

Summary | Graphs

Scheduled Exports

Clifton Court Inflow  
**2600 CFS**

Jones Pumping Plant  
**3500 CFS**

Data Collected: 2018-01-28 16:44:16-07

Estimated Hydrology

Total Delta Inflow  
**24049 CFS**

Sacramento River  
**21294 CFS**

San Joaquin River  
**1813 CFS**

Data Collected: 2018-01-28 16:44:16-07

Delta Operations

Delta Conditions  
**Excess**

Delta X Channel  
**0**

% of Inflow Diverted  
**28.8 %**

Outflow  
**18900 CFS**

X2 Position  
**74**

Controlling Factors  
**OMR (-5000)**

Data Collected: 2018-01-28 16:44:16-07

Reservoir Storages

Shasta Reservoir  
**3332 TAF**

Folsom Reservoir  
**584 TAF**

Oroville Reservoir  
**1390 TAF**

San Luis Res. Total  
**1733 TAF**

SWP Share  
**766 TAF**

Data Collected: 2018-01-28 16:44:16-07



Bouldin Island GIS Dashboard

LEARN MORE →



Bouldin Island Information Hub

LEARN MORE →



Bouldin Island Real Time Conditions

LEARN MORE →



Island Information Documents and GIS

LEARN MORE →



Delta Islands Documents

LEARN MORE →



Delta Wide Real Time Conditions

LEARN MORE →

# Delta Islands Data & Information Portal

- Diversion Data
- Real Time Data
- Time Series Visualizations
- GIS Data
- Document Management
- Island Descriptions
- Levee Data

Password protected  
Email [david@34north.com](mailto:david@34north.com)  
For a username and password

Bouldin Island is an island in the Sacramento-San Joaquin River Delta in San Joaquin County, California, 20 kilometers (12 mi) northwest of Stockton. The 2,400 ha (5,900-acre) island is bounded to the north by South Mokelumne River which separates the island from Staten Island. To the east, the island is bounded by Little Potato Slough, to the south by Potato Slough, and to the west by the Mokelumne River.



# Delta Islands Portal: GIS Data Dashboard – Siphon Location Data



## BOULDIN ISLAND GIS DASHBOARD

Tools

Bouldin Island GIS Dashboard

Delta And California Saved Maps

**SELECT A GIS LAYER**

Bouldin Island Siphons Data

[Download](#) [Attribute Table](#)

RD756 Bouldin Island Water Diversion Points

- 1.5in Diversion
- 2in Diversion
- 12in Diversion
- 12.75in Diversion
- 13in Diversion
- 14in Diversion
- 16in Diversion
- 18in Diversion
- 24in Diversion
- 24.5in Siphon

[Download](#) [Attribute Table](#)

Siphon Locations Bouldin Island

- 12in Siphon
- 12.75in Siphon
- 13in Siphon
- 14in Siphon
- 16in Siphon
- 18in Siphon
- 24in Discharge Pipe
- 24in Siphon
- 24.5in Siphon
- 30in Discharge Pipe
- 31in Discharge Pipe

[Download](#) [Attribute Table](#)

District Pumping Station

- Rural Drainage Pump Stations
- Pump Station Emergency

[Download](#) [Attribute Table](#)

Logistics Base

[Download](#) [Attribute Table](#)

100 Year Flood Elevation

[Download](#) [Attribute Table](#)

1 2 3 4 >



**Bouldin Island GIS Layers**

**SELECT A GIS TO VIEW ATTRIBUTE TABLE**

Latitude	Longitude	SiphonNo	Statement	StationNo	MeterBrand	MeterMake	MeterModel	MeterType	MeterTech	MeterCost	MetLeadTim	DataBrand	DataMake	DataRetriv	Data
38.1063697097	-121.4992273699	2	21068	32+33	Seametrics	AG 3000	AG3000-1200	Flange	Electromagnetic with Mounted Totalizer and Internal Data Logger	2820	3-5 weeks	Seametrics	Internal	Manual w/ cable/software /computer	Inclu with mete
38.0865952347	-121.5421283939	14	21096	359+61	McCrometer	SPI	SPI Model 282L	Insertion	Electromagnetic with External Totalizer and Data Logger	4165	3-5 weeks	Mesotech	MT-SB88	Manual with flashdrive	846
38.1151411062	-121.5056235844	39	21117	922+75	Seametrics	EX100/200-SERIES	EX253B-126	Insertion	Electromagnetic with Mounted Totalizer	1850	3-5 weeks	Mesotech	MT-SB88	Manual with flashdrive	846
38.115113195	-121.5055823243	40	21113	922+79	Mace	Velocity sensor	No Model#	Insertion	Doppler Ultrasonic	2400	3-5 weeks	Mace	AgriFio XCI	Manual w/ cable/software /computer	3055

10 Entries Per Page

Displaying Page 1 of 1

**DETAILS**

**Details** **Geometry** **Options**

**Latitude:** 38.1063697097  
**Longitude:** -121.4992273699  
**SiphonNo:** 2  
**Statement:** 21068  
**StationNo:** 32+33  
**MeterBrand:** Seametrics  
**MeterMake:** AG 3000  
**MeterModel:** AG3000-1200  
**MeterType:** Flange  
**MeterTech:** Electromagnetic with Mounted Totalizer and Internal Data Logger  
**MeterCost:** 2820  
**MetLeadTim:** 3-5 weeks  
**DataBrand:** Seametrics  
**DataMake:** Internal  
**DataRetriv:** Manual w/ cable/software/computer  
**DataCost:** Included with meter  
**DataTurn:** Data logger does not have telemetry capability

[Zoom](#)

# Delta Islands Portal: Real Time Data: NWIS Tidally Filtered Discharge



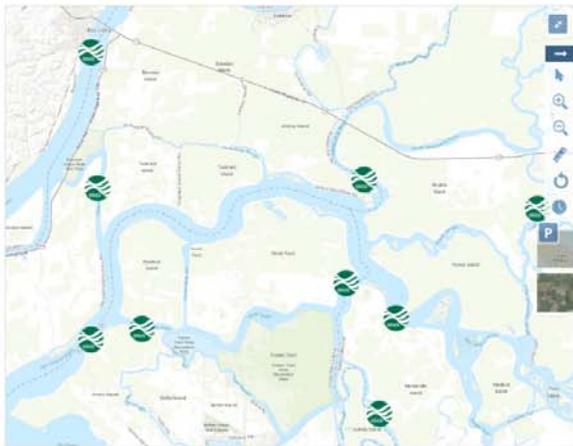
BOULDIN ISLAND REAL TIME CONDITIONS

Tools

Boulding Island/Central Delta Real Time Data

SELECT A DATA SET

Central Delta: NWIS Tidally Filtered Discharge



Central Delta: NWIS Tidally Filtered Discharge

Jan 31, 2018 10:15AM

Timestep

1 hour

Adjust Timeline

1011121314151617181920212223 24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13

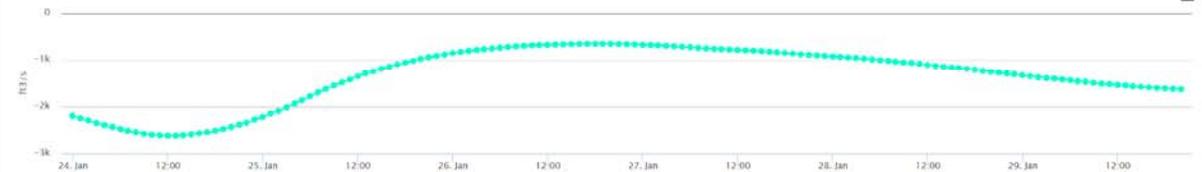
TIME SERIES GRAPHING

Data: NWIS: Dis Location: all Graph: Spline Tiles Graph Plotlines Reset Resize Save

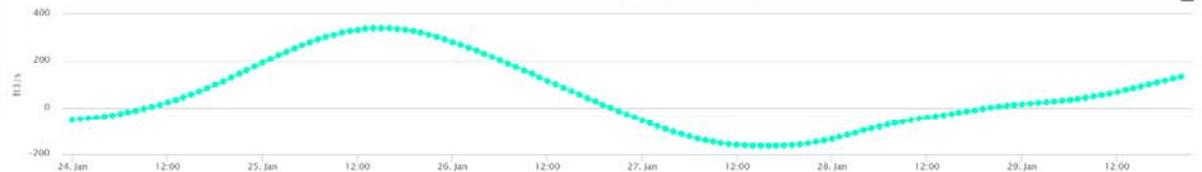
OLD R A QUIMBY ISLAND NR BETHEL ISLAND CA Discharge, tidally filtered, cubic feet per second



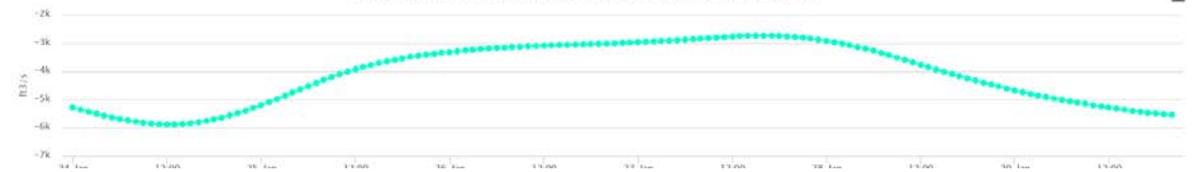
FALSE R NR OAKLEY CA Discharge, tidally filtered, cubic feet per second



OLD R A FRANKS TRACT NR TERMINOUS CA Discharge, tidally filtered, cubic feet per second



SAN JOAQUIN R A PRISONERS PT NR TERMINOUS CA Discharge, tidally filtered, cubic feet per second



# Delta Islands Portal: Real Time Data: Wind Speed + River Stage



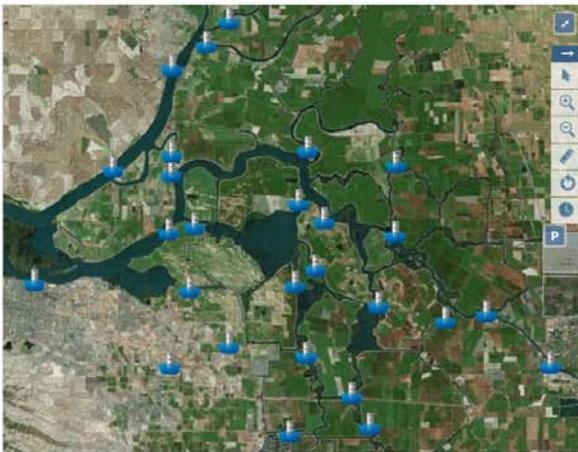
BOULDIN ISLAND REAL TIME CONDITIONS

Tools

Boulding Island/Central Delta Real Time Data

SELECT A DATA SET

Delta: CDEC River Stage (7 Days)



Delta: CDEC River Stage (7 Days)

Jan 31, 2018 10:15AM



Timestep

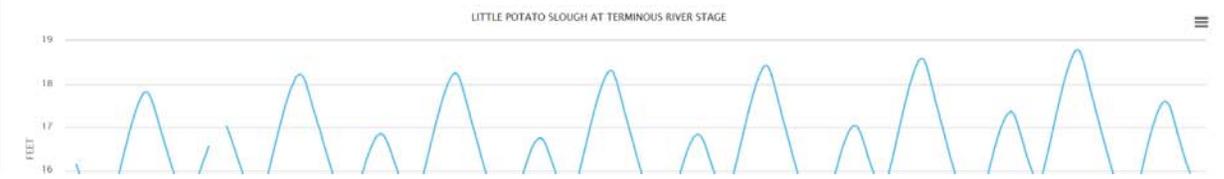
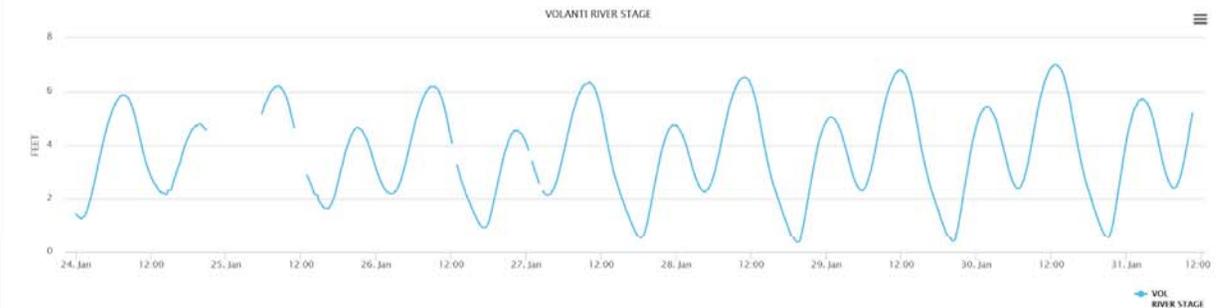
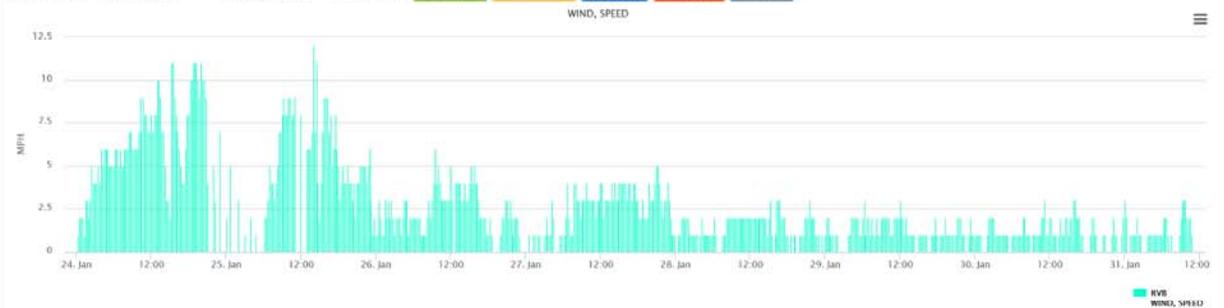
1 hour

Adjust Timeline

1011121314151617181920212223 24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10111213

TIME SERIES GRAPHING

Data: CDEC: WIP Location: all Graph: Column New Graph Graph Plotlines Reset Resize Save



# Delta Islands Portal: GIS Data Dashboard – Saved Maps



BOULDIN ISLAND GIS DASHBOARD

Tools

Bouldin Island GIS Dashboard

Delta And California Saved Maps

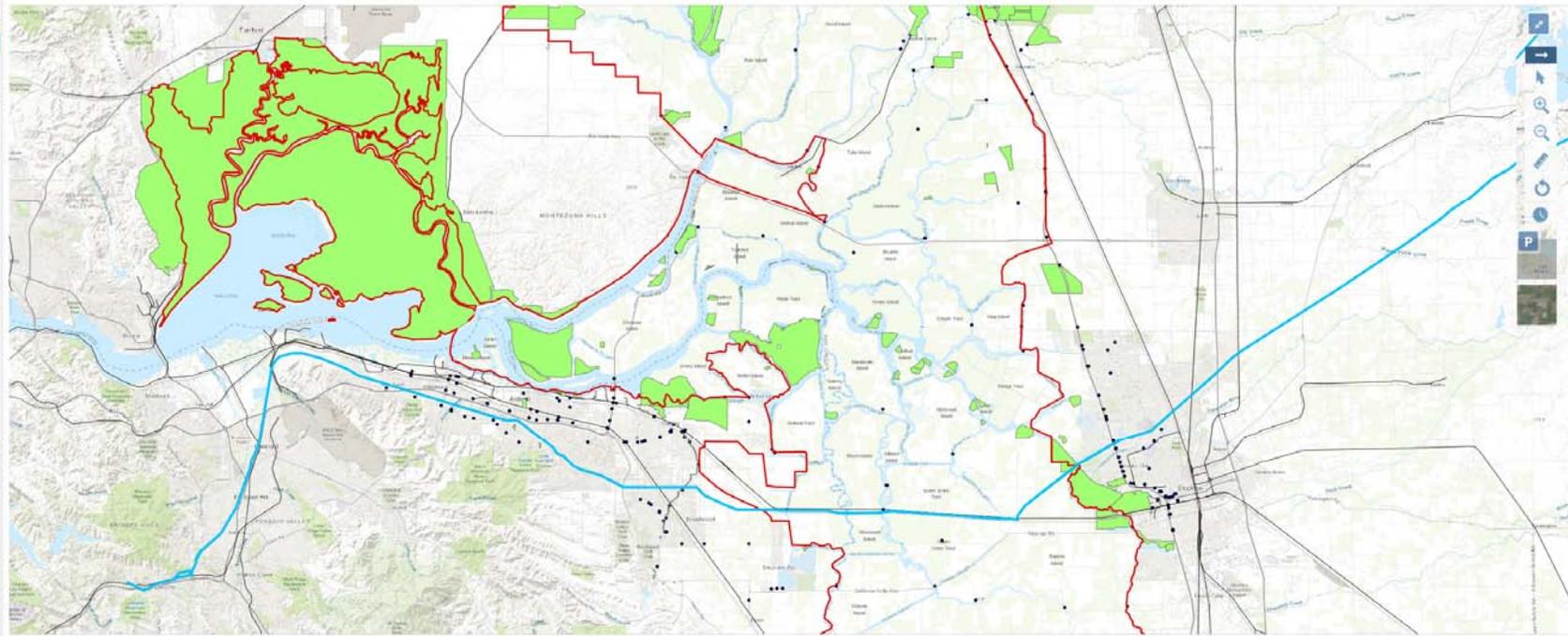
SELECT A SAVED MAP

Delta Atlas

MAP LAYERS

All Layers Active Maps SEARCH

- Mokelumne Aqueduct Pipe  Mokelumne Aqueduct Pipe
- Delta and Suisun Primary Zone  Delta and Suisun Primary Zone
- Conservation Lands  Conservation Lands
- Railroads  Railroads
- Bridges  Bridges
- Ferry Routes  Ferry Routes
- EsriWorldTopo



Delta Atlas

# Delta Islands Portal: Island Information Hub



## BOULDIN ISLAND INFORMATION HUB

Tools

Bouldin Island

Photo Tour Of The Island

The Mokelumne River

### BOULDIN ISLAND



Bouldin Island is an island in the Sacramento-San Joaquin River Delta in San Joaquin County, California, 20 kilometers (12 mi) northwest of Stockton.

The 2,400 ha (5,900-acre) island is bounded to the north by South Mokelumne River which separates the island from Staten Island. To the east, the island is bounded by Little Potato Slough, to the south by Potato Slough, and to the west by the Mokelumne River.

State Route 12 crosses the northern section of Bouldin Island, which is also called Kettleman Lane on the island. A swing bridge over the Mokelumne River on SR 12 connects the northwestern part of the island to Andrus Island. Near the northeastern tip of Bouldin Island, a high-level bridge on SR 12 spans Little Potato Slough connecting the island to Stockton, California.

Source: Wikipedia, the free encyclopedia

#### BOULDIN ISLAND AT-A- GLANCE

Location:	20 kilometers (12 mi) northwest of Stockton
County:	San Joaquin
Area:	2,400 ha (5,900-acre)
Reclamation District:	756, #5-22.10, San Joaquin Valley
Groundwater Basin Priority:	High
Surrounding Hydrology:	Bouldin Island is bordered by the Mokelumne River to the northwest and the San Joaquin river to the southwest, the rivers converge at the southwest tip of the island. To the north is the South Mokelumne River, east is Little Potato Slough, and the southern edge is bordered by Potato Slough.
Land Use Types	Grain and Hay Crops; Field Crops - Corn (field & sweet); Riparian Vegetation - Marsh lands, tules and sedges; Native Vegetation; Water Surface; Semiagricultural and Incidental to Agriculture; Residential
Notable Features	Delta Tunnels proposed route crosses over Bacon Island.



Title: Delta Farm Land



#### DOCUMENTS



**RD 756 - Bouldin Island - Diversion Map...**

Author: MBK Engineers/MWD  
2017-12-07

Download



**2017 Bouldin-Bacon Experiment Siphon Selection Map**

Author:  
2017-12-07

Download



**2016 Bouldin Island Crop Maps Mar21**

Author:  
2017-12-07

Download

# Delta Islands Portal: Island Information Hub



## BOULDIN ISLAND INFORMATION HUB

Tools

Bouldin Island

Photo Tour Of The Island

The Mokelumne River

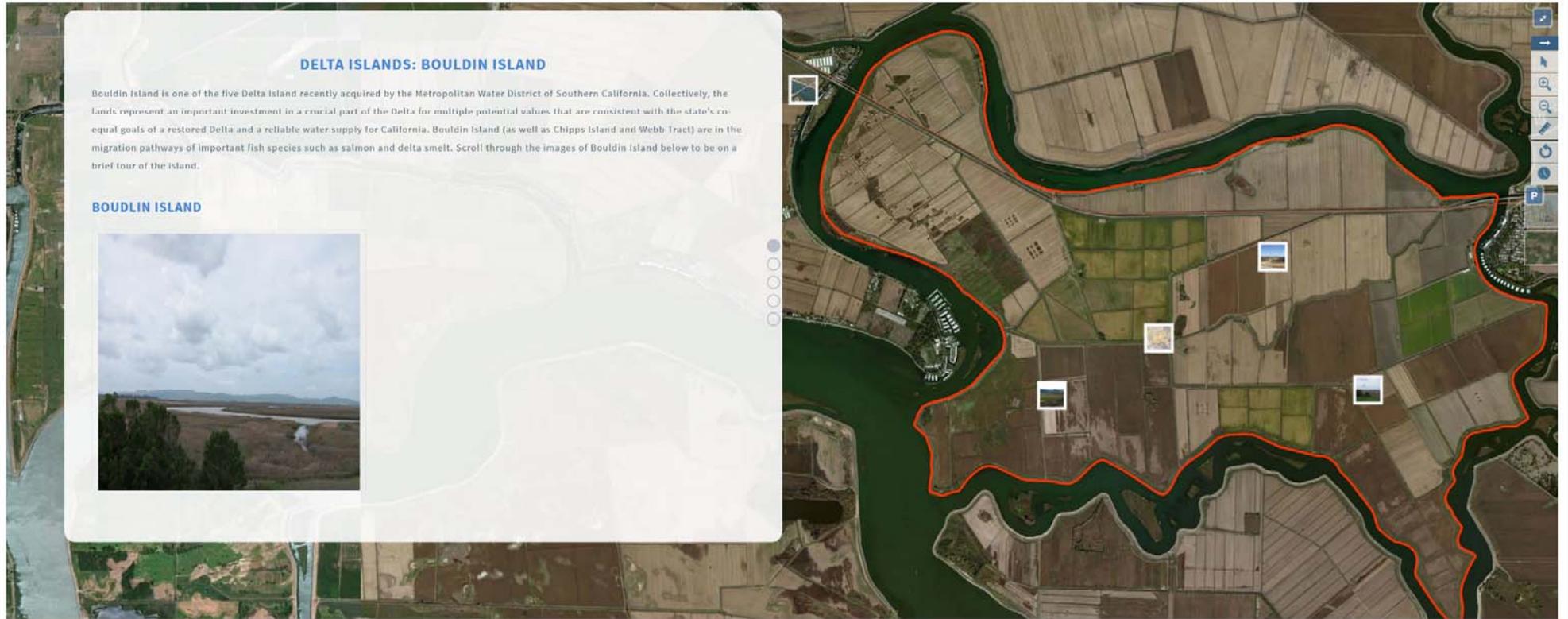
### DELTA ISLANDS: BOULDIN ISLAND

Bouldin Island is one of the five Delta Islands recently acquired by the Metropolitan Water District of Southern California. Collectively, the lands represent an important investment in a crucial part of the Delta for multiple potential values that are consistent with the state's equal goals of a restored Delta and a reliable water supply for California. Bouldin Island (as well as Chipps Island and Webb Tract) are in the migration pathways of important fish species such as salmon and delta smelt. Scroll through the images of Bouldin Island below to be on a brief tour of the island.

#### BOULDIN ISLAND



Bouldin Island Tour



# Questions?



Contact: Dave Osti, 34 North

Email [david@34north.com](mailto:david@34north.com)

For a username and password

Extra Slides

# Data Stories



## YOLO BYPASS RESTORATION DATA DASHBOARD

Benthic Monitoring

Tools

- Restoration Projects
- Current Conditions
- Yolo Region Monitoring Stations
- Data And Documents
- GIS Resources
- Project Importance & RPA Actions
- Extending The Arc (UC Davis)
- Zooplankton Dynamics (USGS And SFSU)

### THE YOLO BYPASS REGION

The Sacramento and San Joaquin Valleys historically flooded during major rain events and with seasonal runoff. The occasionally large amounts of rain that fall in the surrounding Coastal and Sierra Nevada mountain ranges produce rapid surface water runoff to the Sacramento River. This fast water flowing from the mountains is blunted by the relatively shallow grade of the Sacramento River south of the city of Red Bluff, and would often overtop the river banks. In addition, The Sacramento River would begin depositing sediment in the shallower grades that would often alter its direction of flow. In order to control these storm flows that would otherwise flood farmland and cities, a system of bypasses, weirs and other flood-relief structures were created.

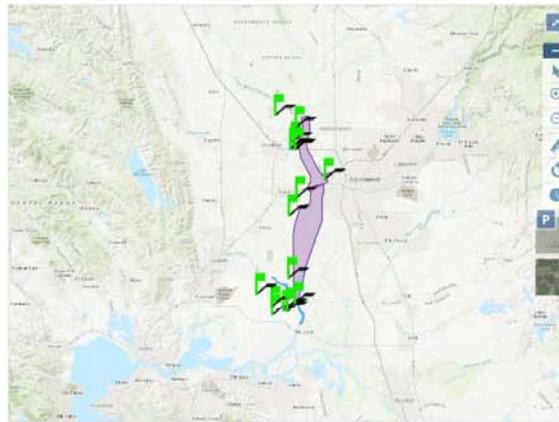
The Yolo Bypass was created in 1917 to divert excess flow from the Sacramento River and protect Sacramento and West Sacramento from flooding. Water overtops at Fremont Weir and inundates the Bypass; the amount of wetted areas depends on the duration of the overtopping event. Water also flows into Yolo Bypass from other sources, including the Knights Landing Ridge Cut, the Cache and Putah Creeks on the west and occasionally from the American River at the Sacramento Weir.



Caption: The Yolo Bypass, Photo Credit: Chris Austin, Mavens Notebook  
Source

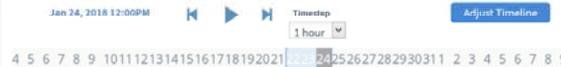
The Yolo Bypass is 3 miles wide and 40 miles long which allows the bypass to hold four times the flow of the Sacramento River's main channel. This is allowable through a system of weirs that pass floodwaters by gravity once the river reaches the overflow water surface elevation. There are six weirs within the flood-relief project, with the Fremont Weir marking the beginning of the Yolo Bypass.

An additional benefit of the Yolo Bypass acting as a flood zone is that winter floods wash juveniles Chinook salmon into the flood plains of the Yolo Bypass. This flooded habitat is a very productive habitat for winter run juvenile Chinook salmon, as demonstrated by [The Nigiri Project](#) which shows the ability of juveniles to grow much faster in this flood plain.



### Monitoring, Restoration, and Scientific Studies in the Yolo Bypass Region

Each green flag represents a different restoration and/or monitoring project within the Yolo Bypass region. Click on a flag to see the project title and a quick description. The purple area indicates the Yolo Bypass.



- Fish Friendly Farming Certification Program for the Sacramento-San...**  
 Author: Delta Conservancy  
 2016-06-27  
[More](#)
- Wildlife Corridors for Flood Escape on the Yolo...**  
 Author: Delta Conservancy  
 2016-06-18  
[More](#)
- Yolo Bypass Wildlife Area Habitat and Drainage Improvement...**  
 Author: Delta Conservancy  
 2016-06-27  
[More](#)

1 2 3 4 5 6 7 +



Title: Nigiri Project in the Yolo Bypass  
Author: Carson Jeffres/UC Davis

# San Joaquin River Real Time Management: Funding by USBR

- Automated data packages for WARMF model input
- Visualize Real Time and Forecast Data

**SAN JOAQUIN RIVER**  
Real Time Management

Search [ ] [ ] LOGIN REGISTER

HOME EXPLORE DATA SJRB CONDITIONS COMPLIANCE DASHBOARDS FOR MODELERS REPORTING DASHBOARDS

## San Joaquin River Real-Time Management

### Real Time Basin Conditions

Explore data. Search, find, view and download real time conditions as reported by the SJR sensor network.

The SJRRTM Data Portal offers map based access to CDEC, NWIS, NOAA and CIMIS data services. Using the map and data filter, set your time extents and location.

[VIEW MORE](#)

### Compliance Reporting

Reporting dashboards displaying summary data for watershed conditions and forecast results.

Reporting dashboards provide stakeholders with data compilations to view conditions throughout the watershed, model results and compliance with the Vernalis objective.

[VIEW MORE](#)

### For Modelers

This section provides model data, detailed model results and data visualizations related to the WARMF model.

Modelers and stakeholders can access data used to run the WARMF model, visualizations, detailed model output and collaborate with modelers.

[VIEW MORE](#)

### Download Observation Data for Model

To run the WARMF model user will need to access more than 200 stations data.

The WARMF input data package is aggregated using an automated script that collects and formats data for use or analysis. Choose the download button below to access the WARMF model input data package. To set a custom time frame choose view more.

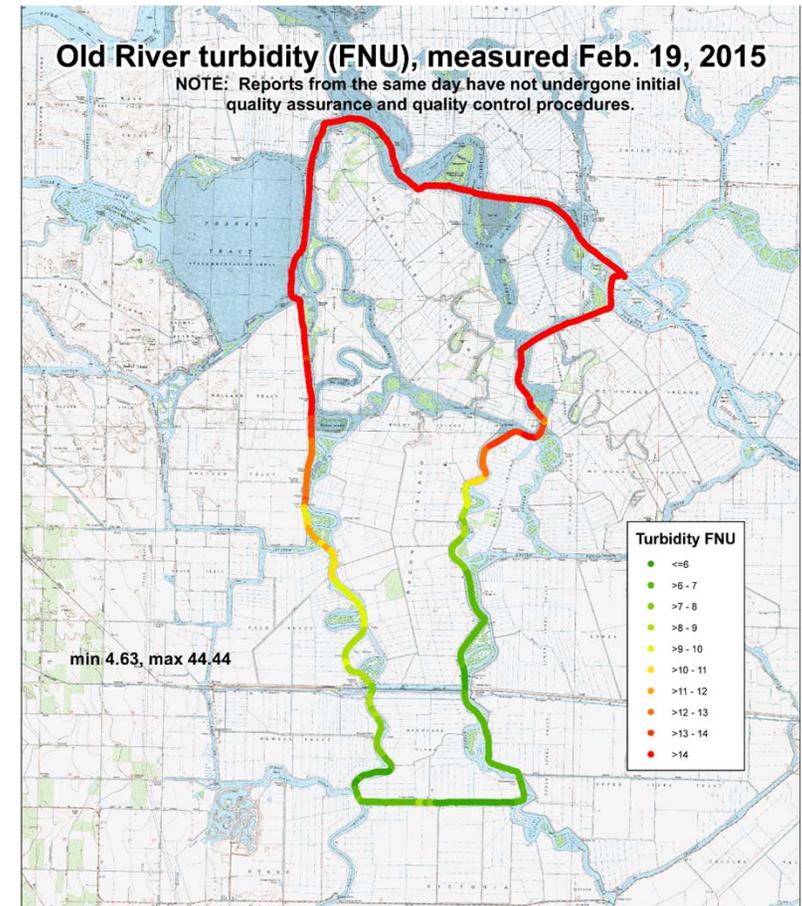
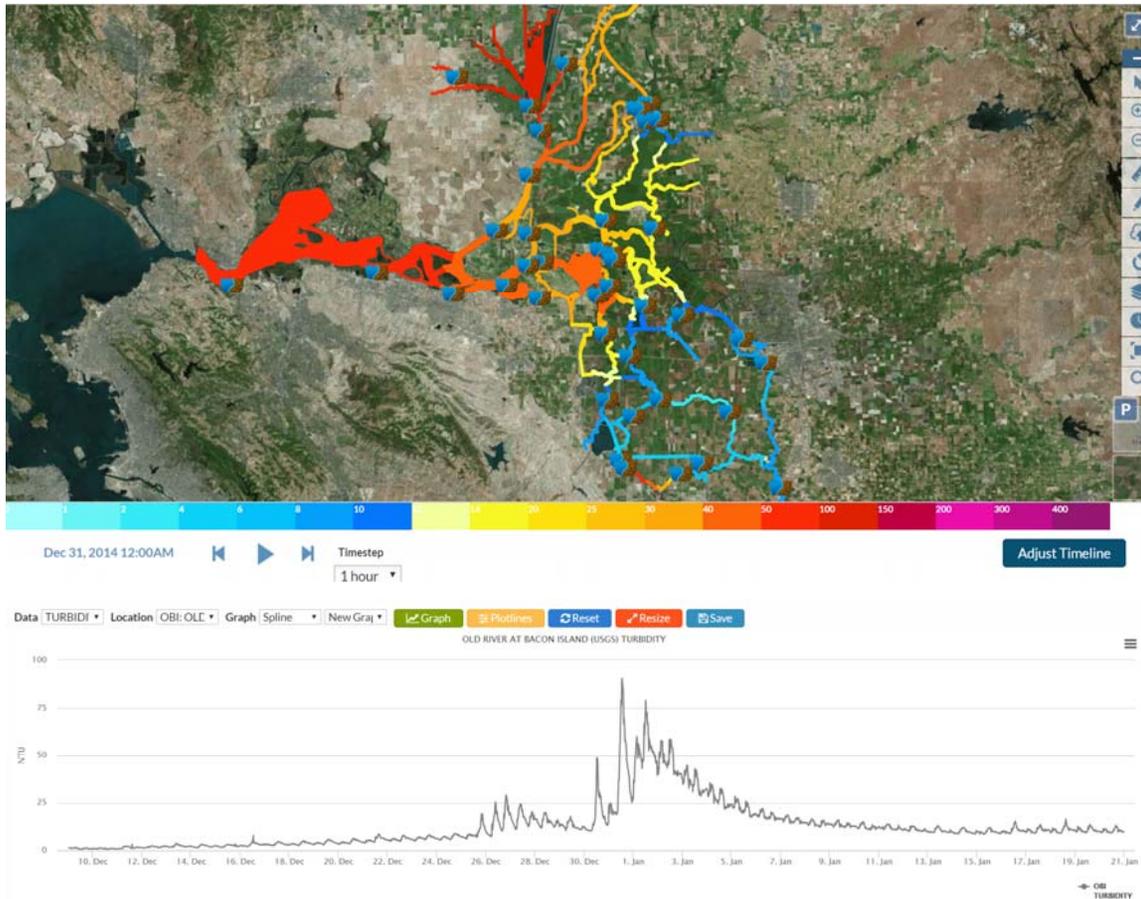
[DOWNLOAD TODAY'S DATA](#) [DOWNLOAD WEEKLY DATA \(EVERY TUESDAY AT 1 AM\)](#)

## SJR Real Time Management Program Stakeholders



## Constituent Tracker: Collaboration with USGS, DWR, SFCWA

- Two steps: Find (a) common point in tide (b) use advection equation using web services from CDEC.
- Identifying common point in using velocity. Once we find the slacks. Associated with the max flood/ebb sets
- We affiliate a given WQ reading with the distance from the station at each time step



# DWR Environmental Monitoring Program: D1641 online reports



Login Register

Home Hydrology Graphs EMP pages Explore Data Maps & GIS Doc Library Projects Wiki Help



### Where Are California's Estuaries?

Hundreds of estuaries are found in California, including the San Francisco Estuary (SF Estuary), Santa Monica Bay, and Morro Bay.

[LEARN MORE →](#)



### Hydrology in the San Francisco Estuary

Hydrologic data are collected in the field and synthesized into information about real-time hydrologic conditions. Data is used to make water management decisions.

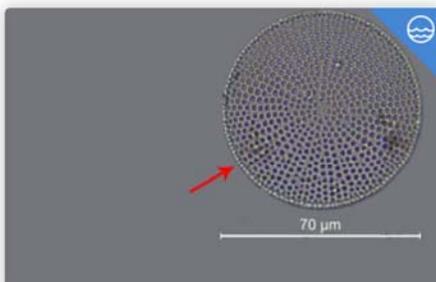
[LEARN MORE →](#)



### Water Quality in the San Francisco Estuary

Sacramento-San Joaquin Delta water quality monitoring involves collecting a large quantity of water samples on a monthly basis to be analyzed for numerous water quality tests.

[LEARN MORE →](#)



### Phytoplankton in the San Francisco Estuary

Phytoplankton are the foundation of the aquatic food web. The Environmental Monitoring Program performs monthly surveys to collect phytoplankton for analysis.

[LEARN MORE →](#)



### Zooplankton in the San Francisco Estuary

The California Department of Fish and Wildlife's Zooplankton Study determines the composition, abundance, and distribution of zooplankton in the upper San Francisco Estuary.

[LEARN MORE →](#)



### Benthic Organisms in the San Francisco Estuary

Benthic monitoring by the Environmental Monitoring Program is conducted monthly at 10 sampling sites from San Pablo Bay upstream through the Sacramento-San Joaquin Delta.

[LEARN MORE →](#)



# DWR Environmental Monitoring Program: D1641 online reports



Login Register

## HYDROLOGY IN THE SAN FRANCISCO ESTUARY

Hydrology in the San Francisco Estuary >

Tools

### HYDROLOGY REPORTING SUMMARIES

#### Introduction

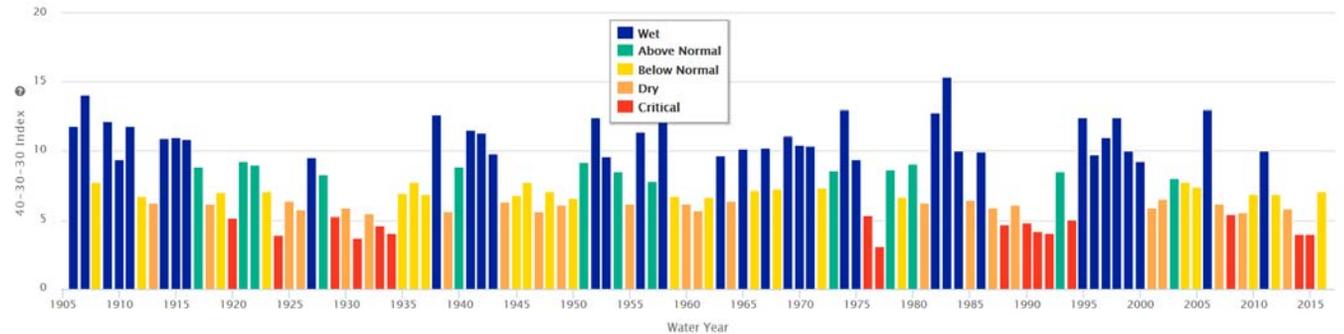
The California State Water Resources Control Board (SWRCB) establishes water quality objectives and monitoring plans to protect the variety of beneficial uses of the water within the upper San Francisco Estuary (Estuary). The SWRCB ensures that these objectives are met, in part, by inclusion of water quality monitoring requirements into water rights decisions issued to the California Department of Water Resources (DWR) and the United States Bureau of Reclamation (USBR) as conditions for operating the California State Water Project (SWP) and the Federal Central Valley Project (CVP), respectively. These requirements include minimum outflows, limits to water diversions by the SWP and CVP, and maximum allowable salinity levels. In addition, DWR and USBR are required to conduct a comprehensive monitoring program to determine compliance with the water quality objectives and report the findings to the SWRCB.

#### Hydrologic Conditions

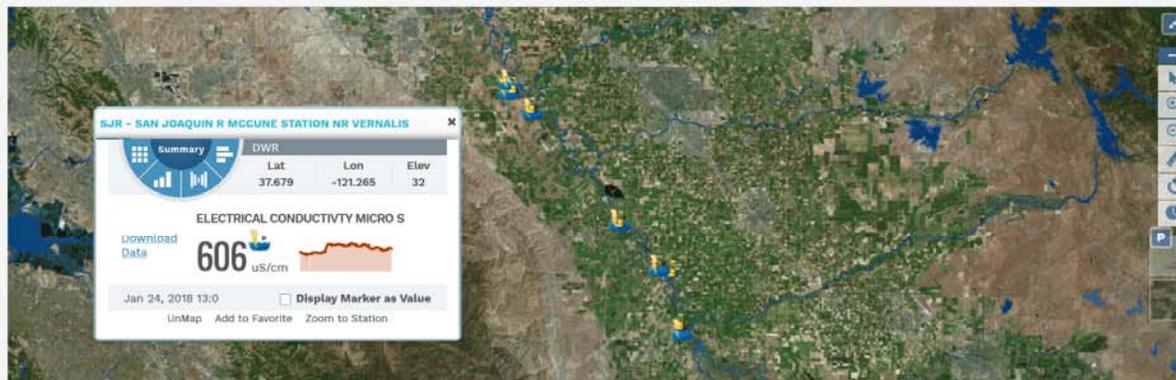
Hydrologic conditions are typically discussed using water years (October through September). Water years 2012, 2013, 2014 and 2015 are the primary focus of this hydrology summary. Water years are classified for the Sacramento Valley using the Sacramento Valley 40-30-30 Water Year Hydrological Classification Index. Water years are classified for the San Joaquin Valley using the San Joaquin Valley 60-20-20 Water Year Hydrological Classification Index.

Expand Graph

Sacramento Valley Water Year Hydrological Classification 1906-2016

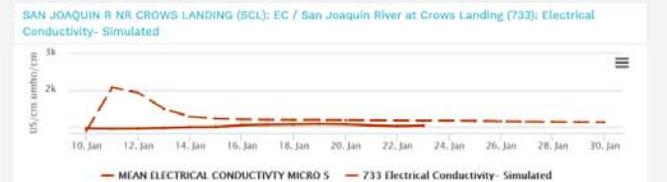
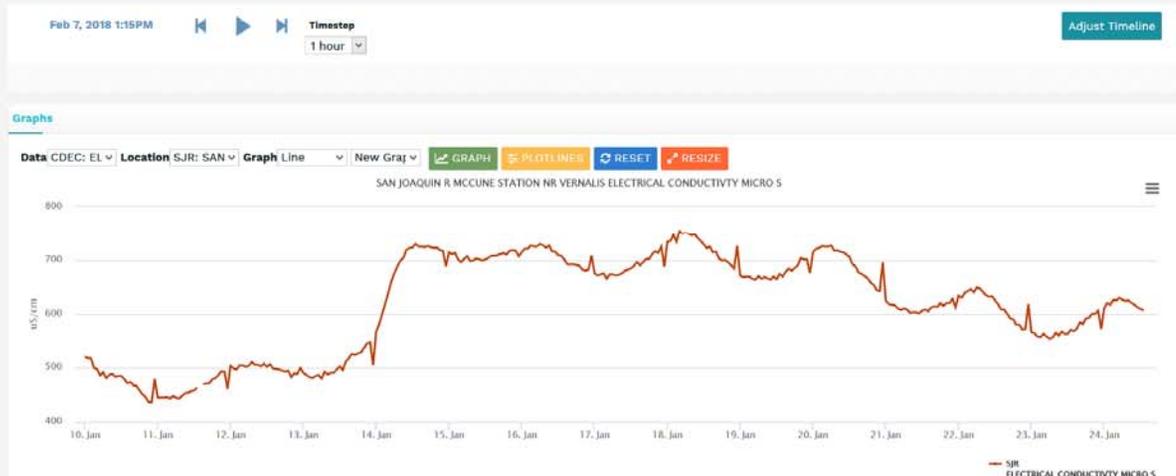


# SJR Real Time Management: Compliance Dashboard

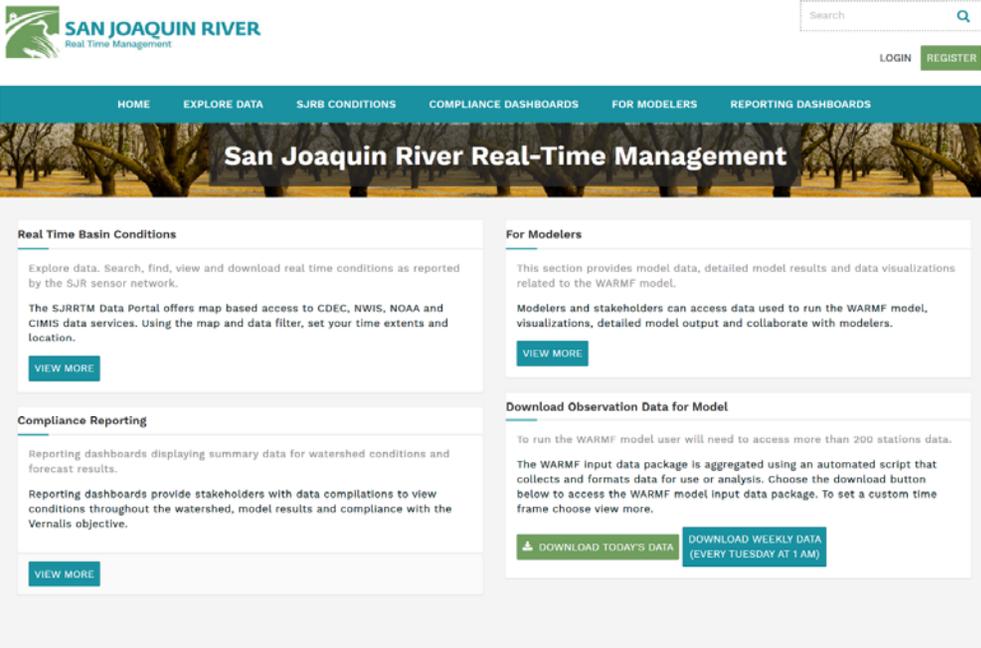


## Key Stations to Determine Salinity Status of San Joaquin River (Real Time and Forecast Data)

The above map displays the key salinity and flow stations used to monitor salinity in the San Joaquin River. Stations: Vernalis, Maze Road, Patterson, Crows Landing, San Joaquin above Merced River Near Newman



# Sacramento River & San Joaquin River Watershed Portals



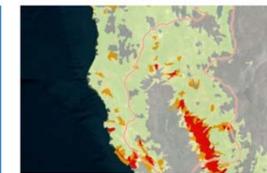
## SJR Real Time Management Program Stakeholders



### What Can You Do on the SRWP Data Portal?

- Using data dashboards, view current monitoring conditions from hundreds of data sensors throughout the watershed.
- Explore SRWP historical data.

[Read More](#)



### Forest Health and Fire in the Sacramento River Watershed

**Management Objectives:** To assess the health of our forests, identify areas of tree mortality, healthy forests, and areas at risk for fire.

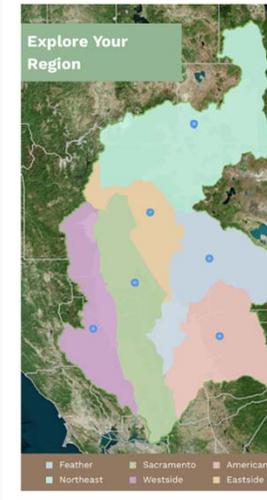
**Measurable Objectives:** Changes in fire intensity, return interval, and size as well as identification...

[Read More](#)

### What's new

View latest projects, documents, and data sets

- Feather River Watershed Data Dashboard**  
The Feather River Watershed includes all...  
Author: 2017-10-11  
[More](#)
- Shasta Dam Operations and Chinook salmon**  
Author: 2016-10-21  
[More](#)
- Mercury and the Sacramento Watershed**  
Author: Sacramento River Watershed Program 2016-10-02  
[More](#)
- Battle Creek Restoration Data Dashboard**  
Author: 2017-10-12  
[More](#)
- Sierra Meadows Partnership**  
Author: 2017-10-12  
[More](#)
- The Sierra Fund: Reclaiming the Sierra Initiative**  
The initiative works to bring solutions...  
Author: The Sierra Fund 2016-06-29  
[More](#)

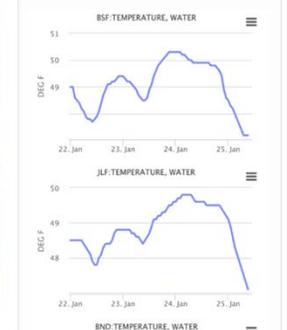


### Current Conditions



#### Temperature Compliance Stations

Key temperature stations in the upper Sacramento River. These stations are used to help control water temperature for spawning and rearing of Chinook salmon. Temperature is controlled to aid the survival of salmon egg and fry during summer months.



# Data Stories



## Managing Salinity in the Sacramento-San Joaquin River Delta

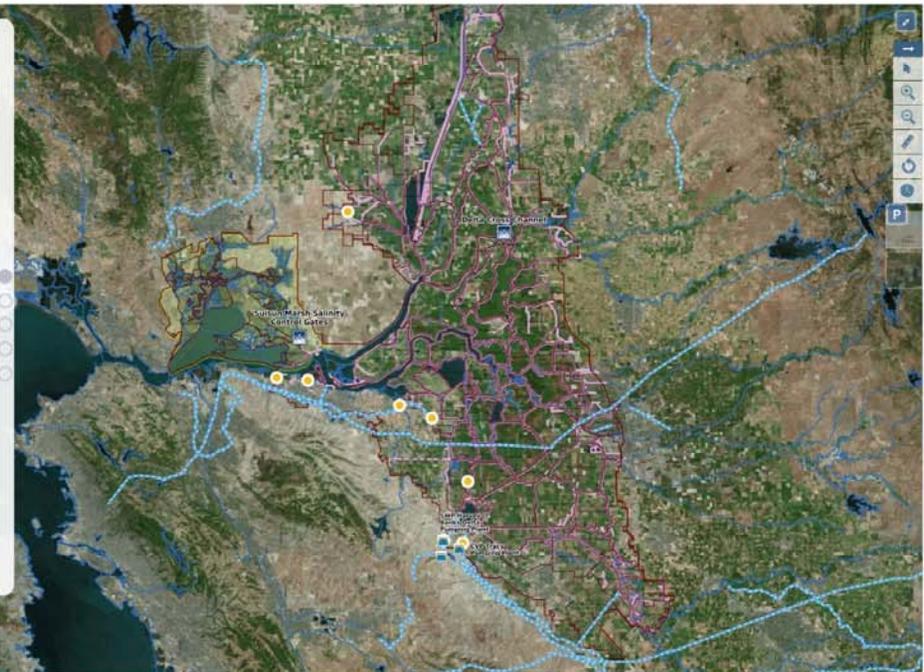
Salinity in the Sacramento-San Joaquin River Delta (The Delta) is largely influenced by daily and seasonal tides from San Francisco Bay along with upstream freshwater flows. Delta salinity is managed by the amount of Delta outflow which keeps saltwater from San Francisco Bay from pushing too far inland. Delta salinity is regulated to protect three broad classes of water use:

- 1) Municipal and industrial
- 2) Agricultural
- 3) Fish and wildlife uses

Through the construction of channels, barriers and levees, the movement of water through the Delta can be influenced to some extent. The California Department of Water Resources and U.S. Bureau of Reclamation manage most of the water stored upstream of the Delta, flow control structures within the Delta, and Delta pumps. The management of these features move the line that connects all points of equal salinity in an estuary, called an isohaline. The abundance and survival of most of the species of concern in the Bay Delta are related with the locations of the 2 parts per thousand salinity isohaline. In the early 1990s, scientists designated this parameter as X2. Since then, scientists have sought to understand the mechanisms behind the relationships of X2 with aquatic resources, how to predict the location of the X2 based on the isohaline and preceding location of the isohaline with the present value of delta outflow.

### About X2

In 1995, the State Water Resources Control Board adopted X2 as a water quality standard to help restore the relationship between springtime precipitation and the geographic location and extent of estuarine habitat. The regulatory requirements for this springtime (February through June) standards are indexed to monthly flows into reservoirs on the eight largest rivers draining into the Bay Delta. This requires water managers to position X2 further downstream in wet months than in dry months either by increasing reservoir releases or, more commonly, decreasing exports from the Delta. Compliance is achieved by positioning X2 downstream of one of three locations: Roe Island (65km), Chipps Island (74 km), or the confluence of the Sacramento and San Joaquin rivers (81km). The State Boards did not set standards for managing the



### Operations in the Delta For Salinity Control

The main management tools for salinity control in the Sacramento-San Joaquin Bay Delta.

# Data Stories



Salinity in the Sacramento-San Joaquin Bay Delta
Back To List Next In List

Tools

What Is Salinity?

Salinity In The Bay Delta

Salinity Operations In The Delta

Ops Salinity Dashboard

Salinity Objectives To Protect Beneficial Uses

Comparison Of EC To Flow And Turbidity

Shasta Current Conditions

Oroville Current Conditions

Folsom Current Conditions

30 Day Turbidity Graphs

30 Day Flow Graphs

### Salinity in the Sacramento-San Joaquin Bay Delta

The map to the right is an interactive map with stations that measure the electrical conductivity of the water, which is a way to measure the amount of salt dissolved in water. The ability of water containing dissolved salts to conduct electricity gives rise to this simple method for measuring the concentration of salt. Electrical conductivity (EC) is a measure of the ability of water to conduct an electric current and thus is a measure of the amount of dissolved salts. EC is often measured in units of microsiemens per centimeter ( $\mu\text{S}/\text{cm}$ ), also called micromhos per centimeter, which is the inverse of the resistance of a sample of water between two electrodes that are one centimeter apart. It is far simpler to measure this property of water than doing the required laboratory method to measure Total Dissolved Salts directly. EC is therefore a quick, cost effective, and widely used surrogate measure of salinity.

Salinity in the Delta is a function of freshwater inflow, wastestreams, tides, reservoir operations, Delta exports, diversions, and the configuration of Delta channels. Delta flows can be divided into three categories:

- (1) River and floodplain flows
- (2) In-Delta net channel flows
- (3) Net Delta outflows

The timing and distribution of salinity is primarily affected by flow, which is largely determined by water management in the Delta and its watersheds as determined by applicable flow objectives. Water operations, reservoir releases, channel barrier operations and diversion pumping rates are our primary means of controlling flow in the system, and thereby salinity. These operations are complicated by the uncontrollable natural influences on salinity, mainly hydrology factors (precipitation, runoff and evaporation), climate change and tidal cycles. These factors are unpredictable elements as each varies seasonally and year to year out of our control.

Hydrodynamics, the movement of water, in the Delta is another important driver of salinity. We have been able to influence movement of water through the Delta to some extent through construction of

**FCT - FISHERMANS CUT**

Summary | DWR-NCRO

Lat 38.068 Lon -121.649 Elev

**ELECTRICAL CONDUCTIVITY MICROS**

Download Data **381**  $\mu\text{S}/\text{cm}$

Jan 23, 2018 14:15  Display Marker as Value

UnMap Add to Favorite Zoom to Station

Data CDEC: EL Location all Graph Spine Tiles Graph Plotlines

Reset Restore Save

**PRISONERS POINT ELECTRICAL CONDUCTIVITY MICRO S**

**FISHERMANS CUT ELECTRICAL CONDUCTIVITY MICRO S**

**LITTLE POTATO SLOUGH AT TERMINOUS ELECTRICAL CONDUCTIVITY MICRO S**

**SAN JOAQUIN RIVER AT TWITCHELL ISLAND ELECTRICAL CONDUCTIVITY MICRO S**

### Electrical Conductivity in the Sacramento-San Joaquin Bay Delta

Real-time electrical conductivity stations throughout the Sacramento-San Joaquin Bay Delta.