Operations Questions

Slideset3

Real time operations now and if WF was built

Before we can understand how the WaterFix system may operate in the Delta, we have to understand how the Delta flow is being managed now, on a day-to-day basis.

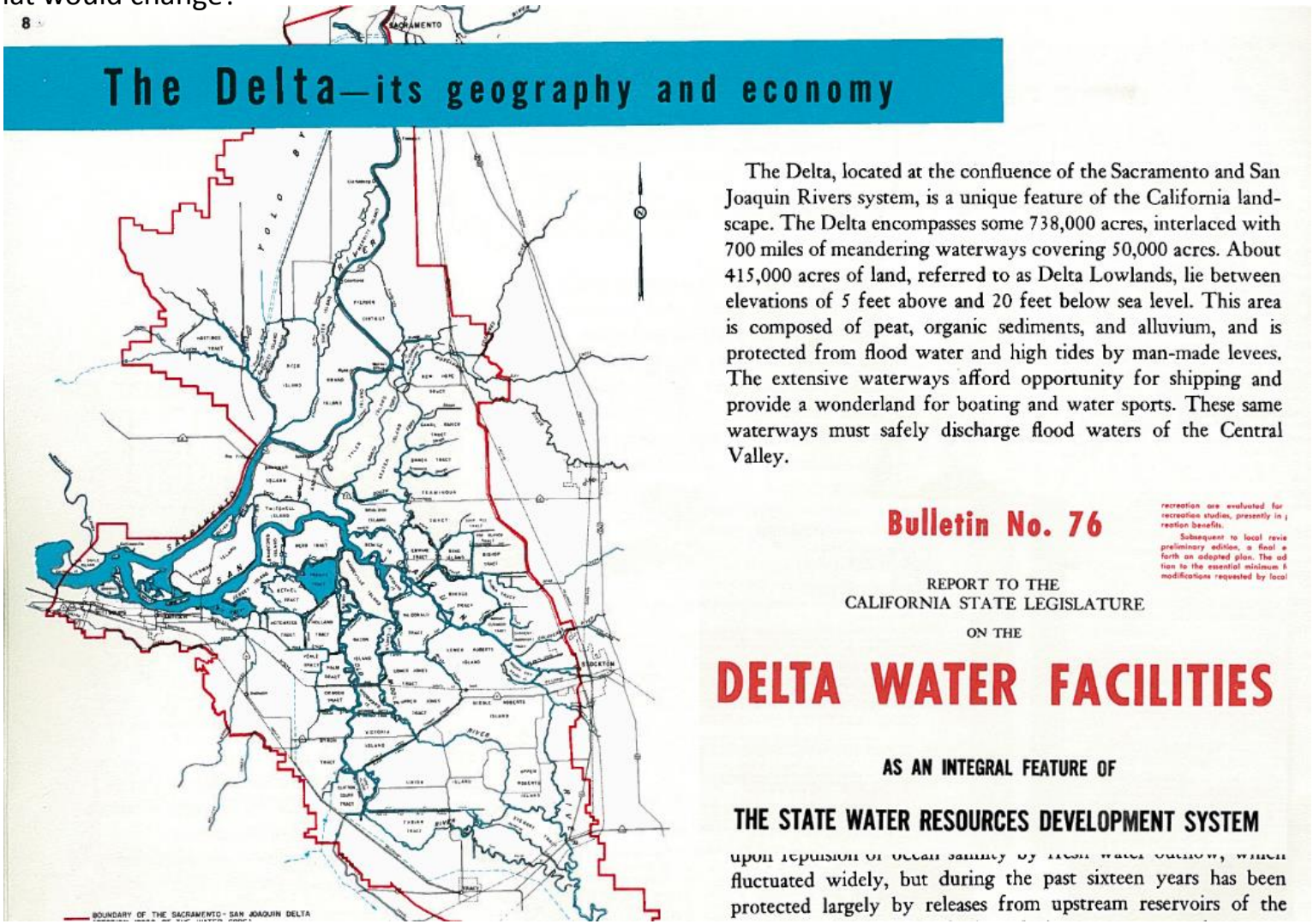
Topic 1: The big picture: How are flow managed above and into the Delta now
And what would change?
Topic 2: North Delta flows: How are flows managed now and what would change?
Topic 3: Steamboat & Sutter Slough: How flows have been managed compared to what would change

Statements by witnesses: Ronald Milligan (DOI) and (DWR)
* operates in real time to manage day to day operations

*Has responsibility to manage flows to meet requirements … to protect water rights

*Operates in real time, which is different than modeling, analyzing or critiquing
Under different operations scenarios or flows

Topic 1: The big picture: How are flow managed above and into the Delta now
And what would change?



8

The Delta—its geography and economy

The Delta, located at the confluence of the Sacramento and San Joaquin Rivers system, is a unique feature of the California landscape. The Delta encompasses some 738,000 acres, interlaced with 700 miles of meandering waterways covering 50,000 acres. About 415,000 acres of land, referred to as Delta Lowlands, lie between elevations of 5 feet above and 20 feet below sea level. This area is composed of peat, organic sediments, and alluvium, and is protected from flood water and high tides by man-made levees. The extensive waterways afford opportunity for shipping and provide a wonderland for boating and water sports. These same waterways must safely discharge flood waters of the Central Valley.

BOUNDARY OF THE SACRAMENTO - SAN JOAQUIN DELTA

Bulletin No. 76

REPORT TO THE
CALIFORNIA STATE LEGISLATURE
ON THE

DELTA WATER FACILITIES

AS AN INTEGRAL FEATURE OF

THE STATE WATER RESOURCES DEVELOPMENT SYSTEM

recreation are evaluated for recreation studies, presently in p reation benefits.

Subsequent to local revie preliminary edition, a final e forth an adopted plan. The ad tion to the essential minimum f modifications requested by local

upon repulsion of ocean salinity by fresh water outflow, which fluctuated widely, but during the past sixteen years has been protected largely by releases from upstream reservoirs of the

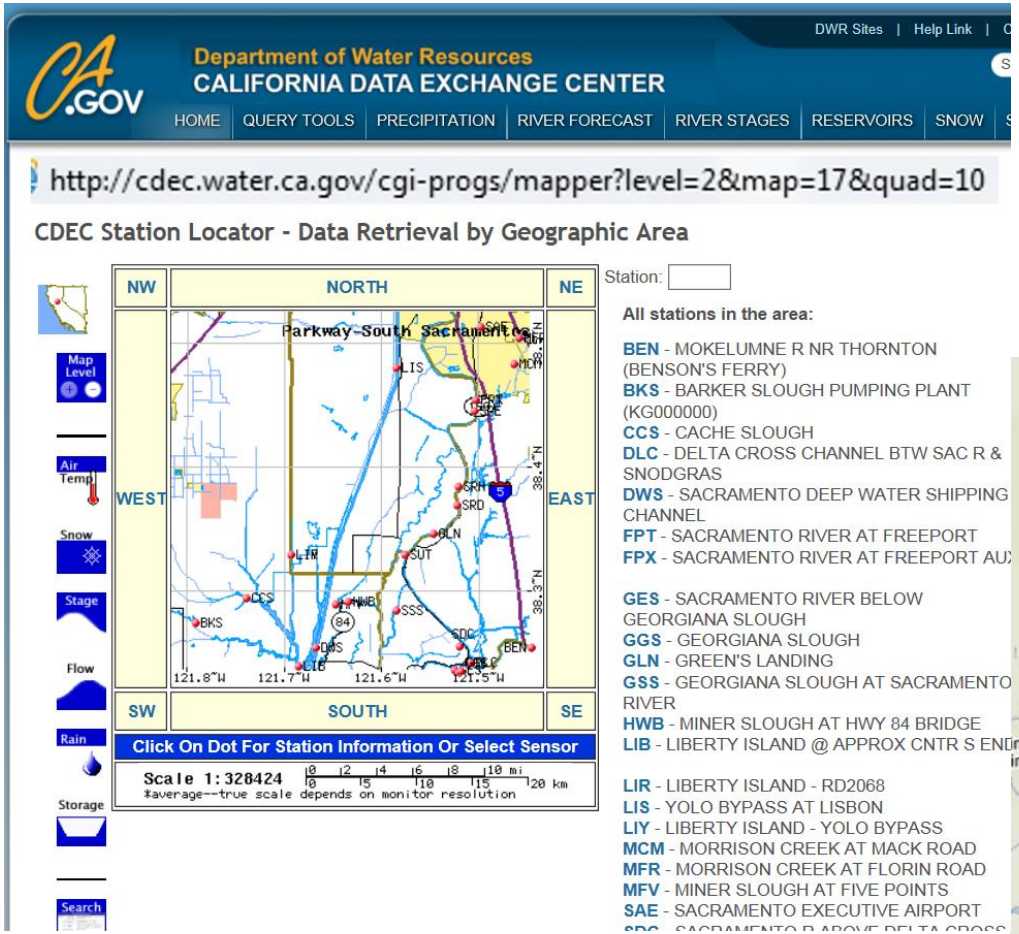
http://snugharbor.net/images-2014/bdcp/flows/1960Bulletin_No._76_Delta_Water_Facilities-Color.pdf

www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/petitioners_exhibit/doi/doi_7.pdf

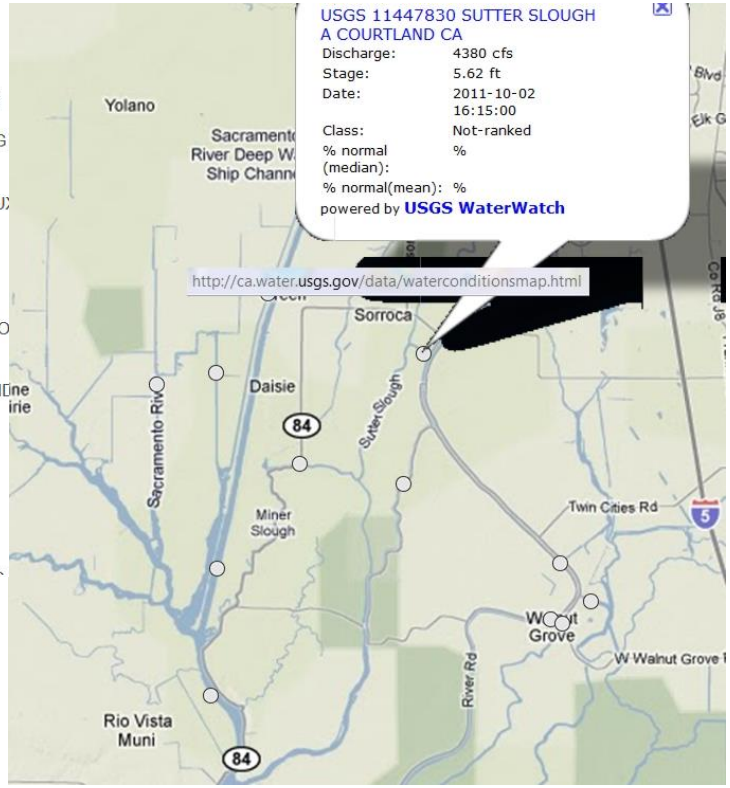
Statement on overall CVP/SWP operations: screen print of part of Ronald Milligan testimony representing DOI

As chief operator of the CVP, it is my responsibility to consider federal and state laws, and other obligations and policies which govern operations. The CVP is the largest Federal Reclamation project and was originally authorized by the Rivers and Harbors Act of 1935. The Central Valley Project was reauthorized by the Rivers and Harbors Act of 1937 for the purposes of "improving navigation, regulating the flow of the San Joaquin River and the Sacramento River, controlling floods, providing for storage and for the delivery of the stored waters thereof, for construction under the provisions of the Federal Reclamation Laws of such distribution systems as the Secretary of the Interior (Secretary) deems necessary in connection with lands for which said stored waters are to be delivered, for the reclamation of arid and semiarid lands and lands of Indian reservations, and other beneficial uses, and for the generation and sale of electric energy as a means of financially aiding and assisting such undertakings and in order to permit the full utilization of the works constructed." This Act provided that the dams and reservoirs of the Central Valley Project "shall be used, first, for river regulation, improvement of navigation and flood control; second, for irrigation and domestic uses; and, third, for power."

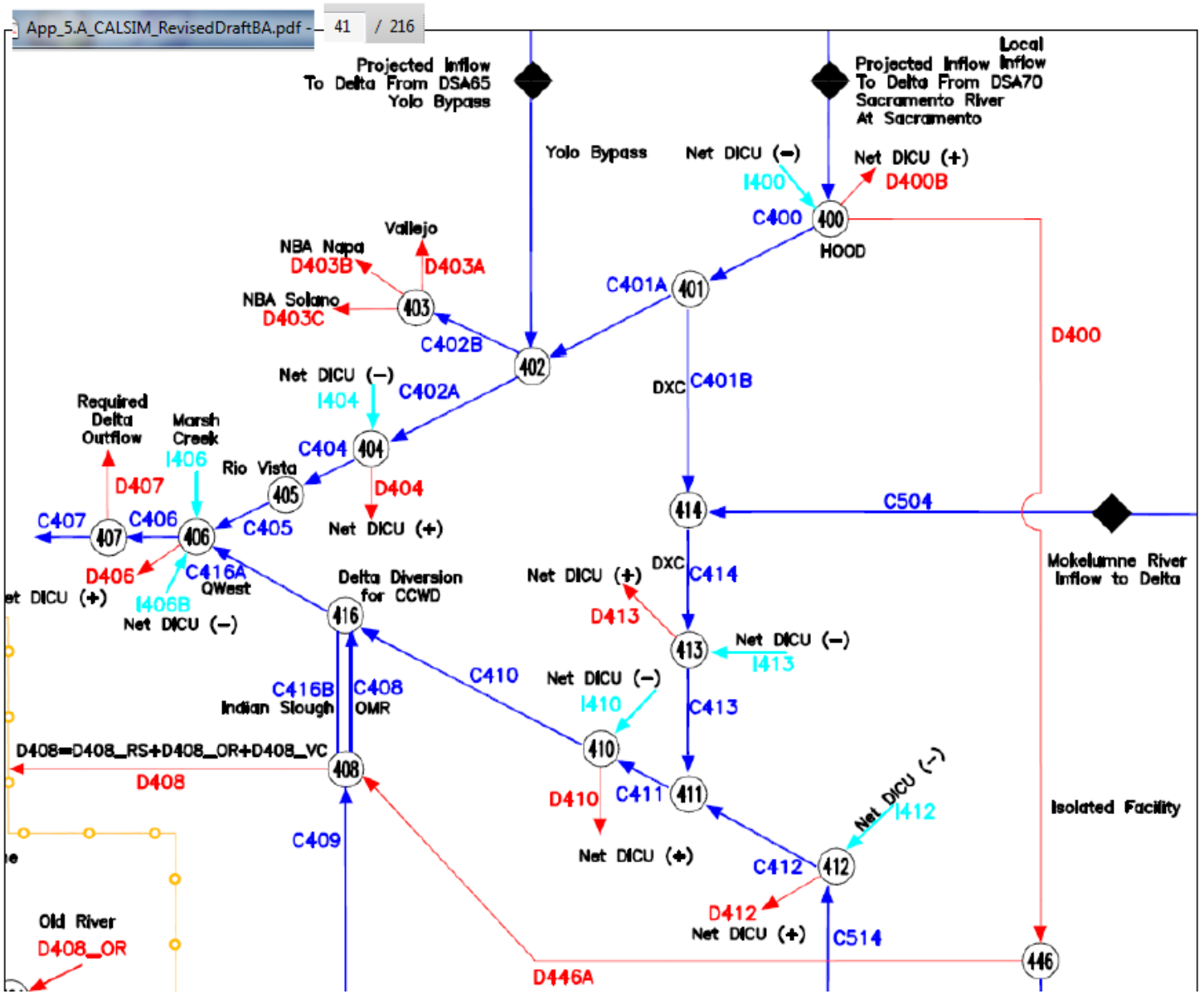
The Central Valley Project was reauthorized in 1992 through the Central Valley Project Improvement Act (CVPIA). The CVPIA modified the 1937 Act and added mitigation, protection, and restoration of fish and wildlife as a project purpose. Further, the CVPIA specified that the dams and reservoirs of the Central Valley Project should now be used "first, for river regulation, improvement of navigation, and flood control; second, for irrigation and domestic uses and fish and wildlife mitigation, protection and restoration purposes; and, third, for power and fish and wildlife enhancement." CVPIA includes authorization for actions to benefit fish and wildlife intended to implement the purposes of that Title.



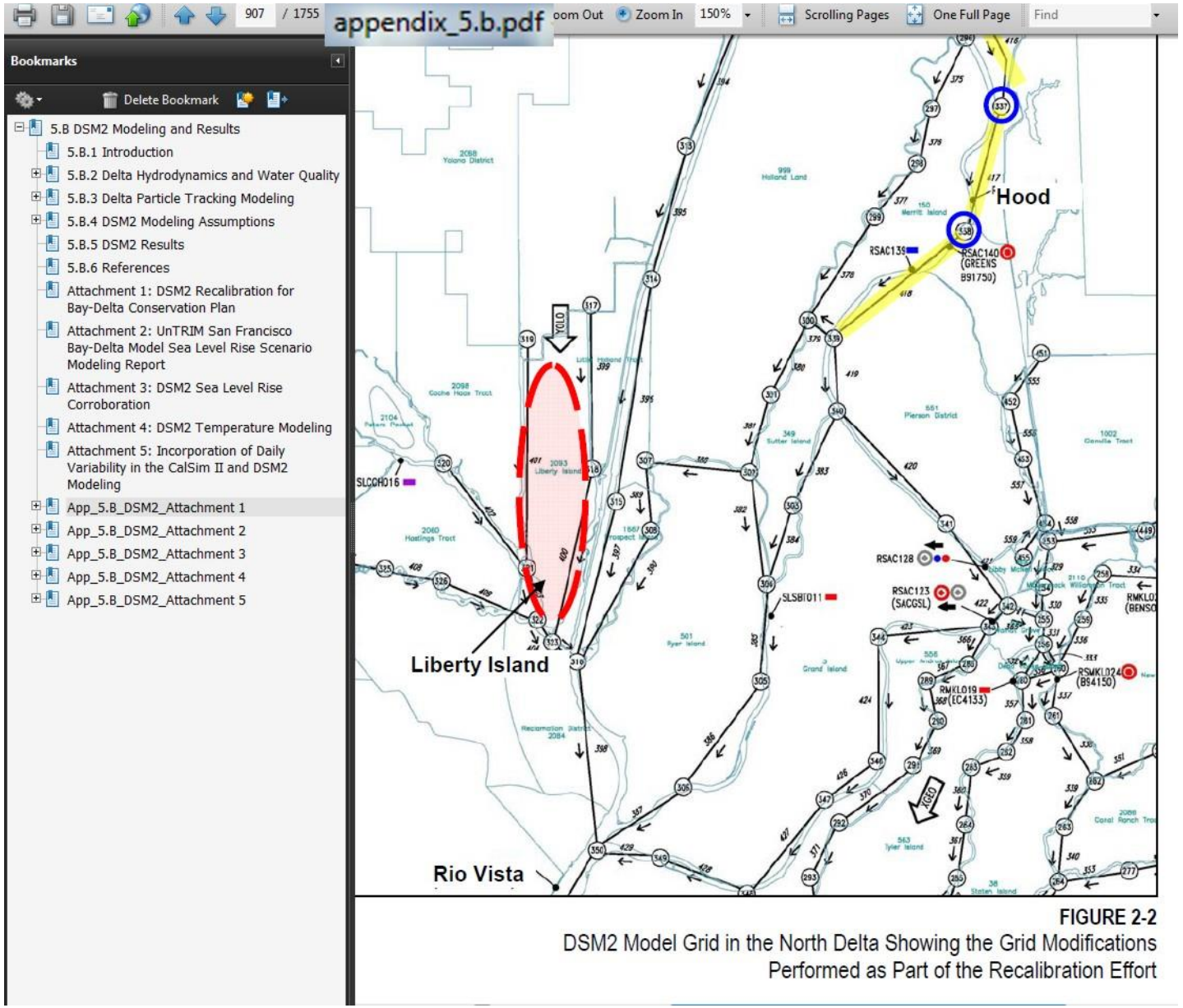
Who is monitoring and reporting the actual flows? Who reports diversions from the Sacramento River? Who determines how much to export? Net Delta Outflow?



Delta monitoring gage stations and online reporting



Which flow models are used to determine "surplus" water exports available? CALSIM II, DSM2 and ???

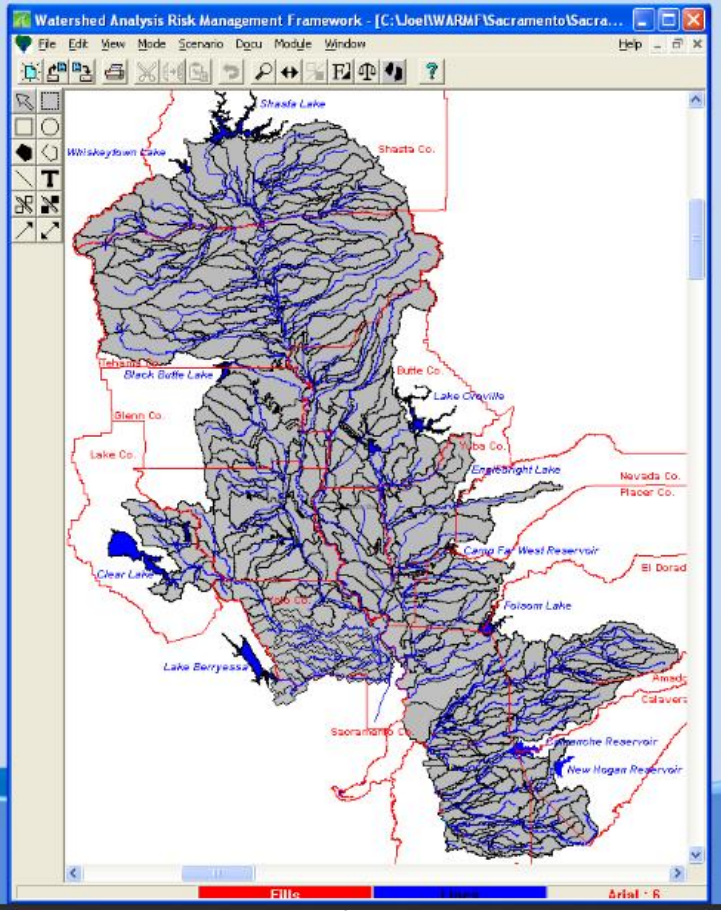


Are there other flow models used to make decisions about quantity to export and/or turning off “knobs”?

Topic 2: North Delta flows: How are flows managed now and what would change?
*Are flows currently managed, and will they be managed, in such a way as to assure that drinking water quality For the Delta area is met? http://www.waterboards.ca.gov/rwqcb5/water_issues/drinking_water_policy/

www.waterboards.ca.gov/rwqcb5/water_issues/drinking_water_policy/2013apr16_wkshop_pres.pdf 12 of 37

Sacramento River / Delta Eastside Watersheds Model Domain



Systech Water Resources, Inc.

SWP to continue to operate within the permit terms.

The unstored flow in the Sacramento-San Joaquin River watersheds including the Delta varies significantly from year to year and season to season. For the purposes of my testimony, "unstored flow" is flow in the system that would occur independent of the storage regulating operations of the Project reservoirs. "Unregulated flow" is unstored flow entering the valley downstream of the major Project reservoirs, independent of flow released from the SWP/CVP reservoirs. Typically, in the winter and early spring period unregulated flows plus SWP/CVP reservoir releases are in excess of all system needs. This condition is referred to as "excess" conditions. In late spring, summer, and fall, unregulated flows plus SWP/CVP reservoir releases are almost always insufficient to meet all system needs and the SWP/CVP are required to actively manage the system. This condition is referred to as "balanced."

A. EXCESS CONDITIONS

During excess conditions unregulated runoff plus SWP/CVP reservoir releases are in excess of that needed to meet In-Basin Requirements. During excess conditions, if unused conservation space exists, the SWP diverts surplus runoff from rain and melting

updated in 1995 and revised in 2006.

[5] Settlement contractors are senior water right holders who have entered into agreements with DWR and Reclamation to manage delivery of water under their water rights.

- What is the difference between “surplus” flows and “excess “ flows?
- Does operations for “in-Basin Requirements” include recharge to drinking water aquifer to protect drinking water rights and is that responsibility being met now?

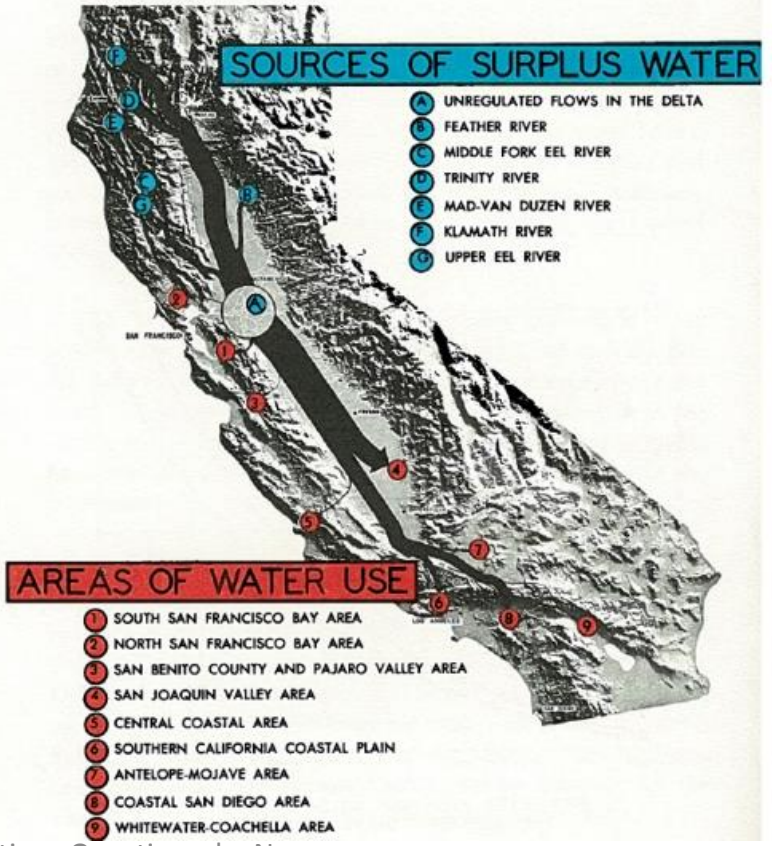
Previous Page Next Page 12 / 63 1960Bulletin_No._76_Delta_Water_Facilities-Color.pdf - olling Pages One Full Page Find

The Delta — its role in California's water development

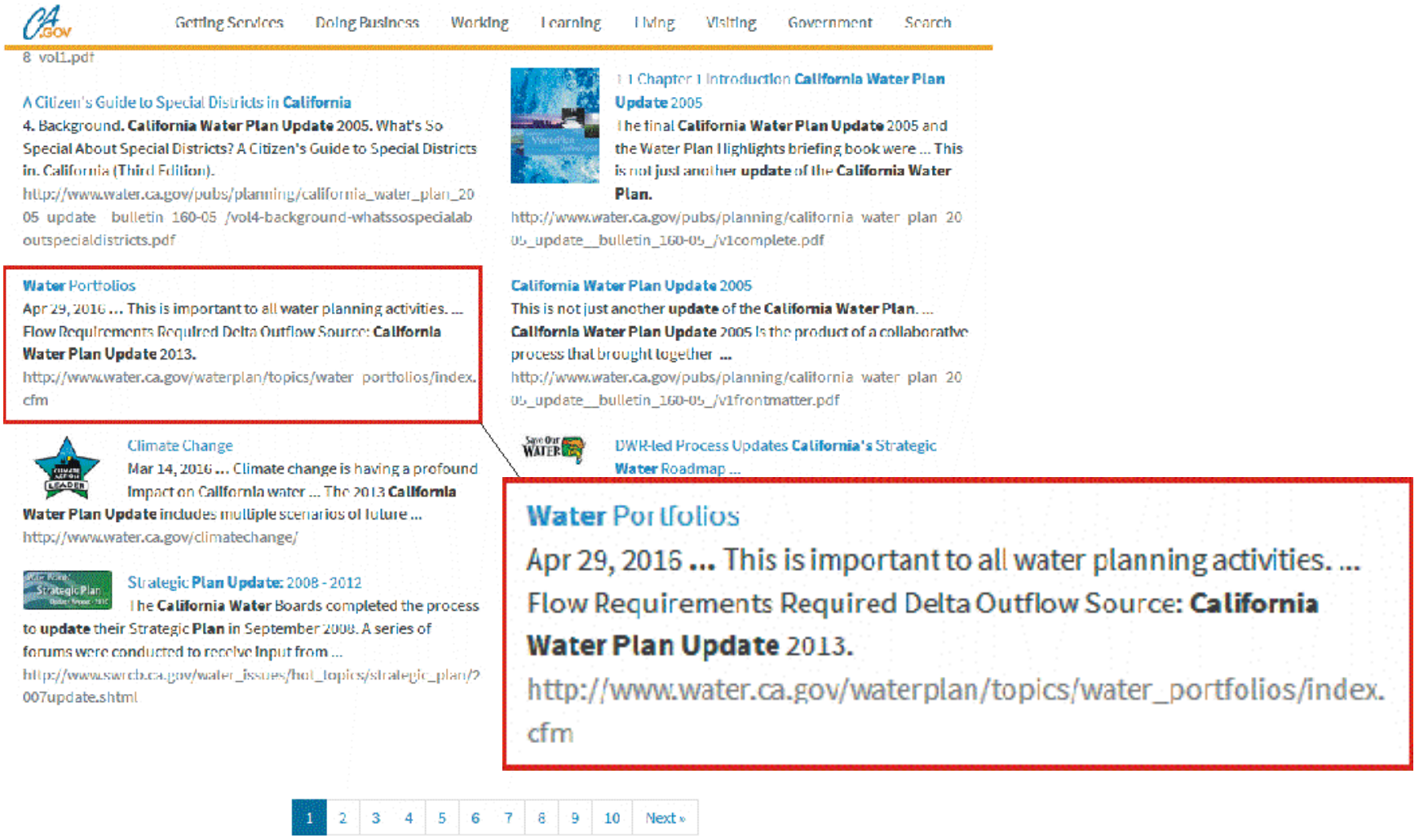
In 1959, the State Legislature enacted the California Water Resources Development Bond Act to finance construction of the State Water Resources Development System. The bond act was approved by the California electorate in November 1960. The State Water Facilities, the initial features of this system, will complement continuing local and federal water development programs and include the very necessary works in the Delta.

One of the principal objectives of the State Water Resources Development System is to conserve water in areas of surplus in the north and to transport water to areas of deficiency to the south and west. The Delta is important in achieving this objective, since it receives all of the surplus flows of Central Valley rivers draining to the ocean during winter and spring months and is the last location where water not needed in the Delta or upstream therefrom can conveniently be controlled and diverted to beneficial use. Surplus water from the northern portion of the Central Valley and north coastal rivers will be conveyed by the natural river system to the Delta, where it must be transferred through Delta channels to export pumping plants without undue loss or deterioration in quality. Aqueducts will convey the water from the Delta to off-stream storage and use in areas of deficiency to the south and west.

In addition to being an important link in the interbasin transfer of water, the Delta is a significant segment of California's economy, and its agricultural, municipal, and industrial water supply problems, and flood control and related problems, must be remedied. A multipurpose system of Delta water facilities, which will comprise one portion of the State Water Resources Development System, is the most economical means of transferring water and solving Delta problems.



Who decides how much "surplus" or "excess" flow is available for export from the Delta? Who provides the actual flow and Export data to modelers and also the persons who report to the legislature, scientists and the public? **For example**, California updates its water plan every few years, based on actual and projected flows and resulting Exports, so who provides the data for the reports? (screen print below from 8-14-16 search at http://ca.gov

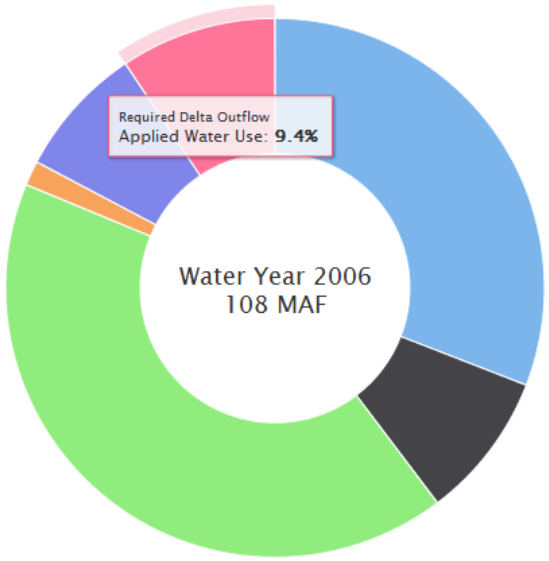


www.water.ca.gov/waterplan/topics/water_portfolios/index.cfm

Wet Year (2006) Average Year (2010) Dry Year (2007) 2002-2010 Average

Water Year 2006

Water Year 2006 was a wet year. A total of 108 million-acre-feet (MAF) of water was used in the state. Hover chart to see the percentage used in each sector.



Agricultural Urban Wild and Scenic Rivers Managed Wetlands
Instream Flow Requirements Required Delta Outflow

Source: California Water Plan Update 2013

Water Use by Hydrologic Region

California has a variety of climates and landforms. The amount and variability of precipitation can change dramatically across California, such that statewide average information does not truly depict regional conditions. Each region has unique challenges in meeting agricultural, urban, and environmental water uses from year to year with available supplies. Water use data for each hydrologic region is included in **Update 2013 Volume 2, Regional Reports**. For detailed groundwater use data, see **California's Groundwater Update 2013**.

Additional Information

For more detailed information about water portfolios, go to **Update 2013 Volume 5, Technical Guide**. You can also email your questions to cwpcom@water.ca.gov.

www.water.ca.gov/waterplan/topics/water_portfolios/index.cfm

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CALIFORNIA DEPARTMENT OF WATER RESOURCES

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California Water Plan

Water Portfolios

Water Plan Water Balances

The primary reason for using water portfolio tables and flow diagrams is to provide an accounting of all water that enters and leaves the state and how it is used and exchanged between the regions. This is important to all water planning activities. Water portfolio data provide information for comparison about how water uses and sources of supply can vary between the wet, average, and dry hydrologic conditions for each of the hydrologic regions. The statewide information has been compiled from the 10 hydrologic regions.

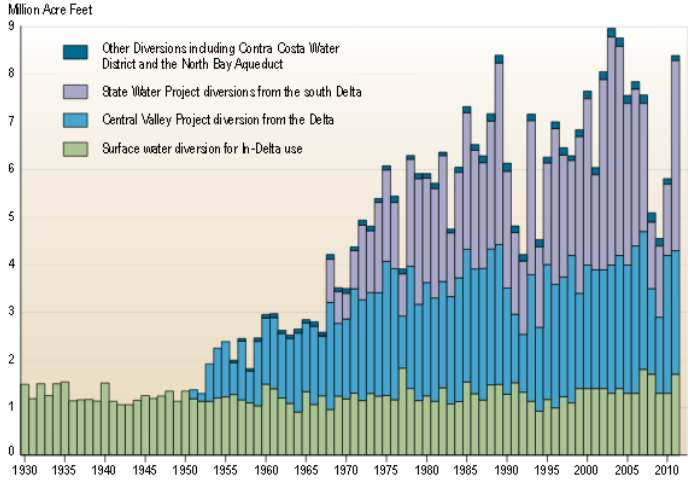
Water Use in California

California Water Plan Home

» California Water Plan Updates
» Update 2018
» Update 2013
» Previous Reports
» About the Water Plan

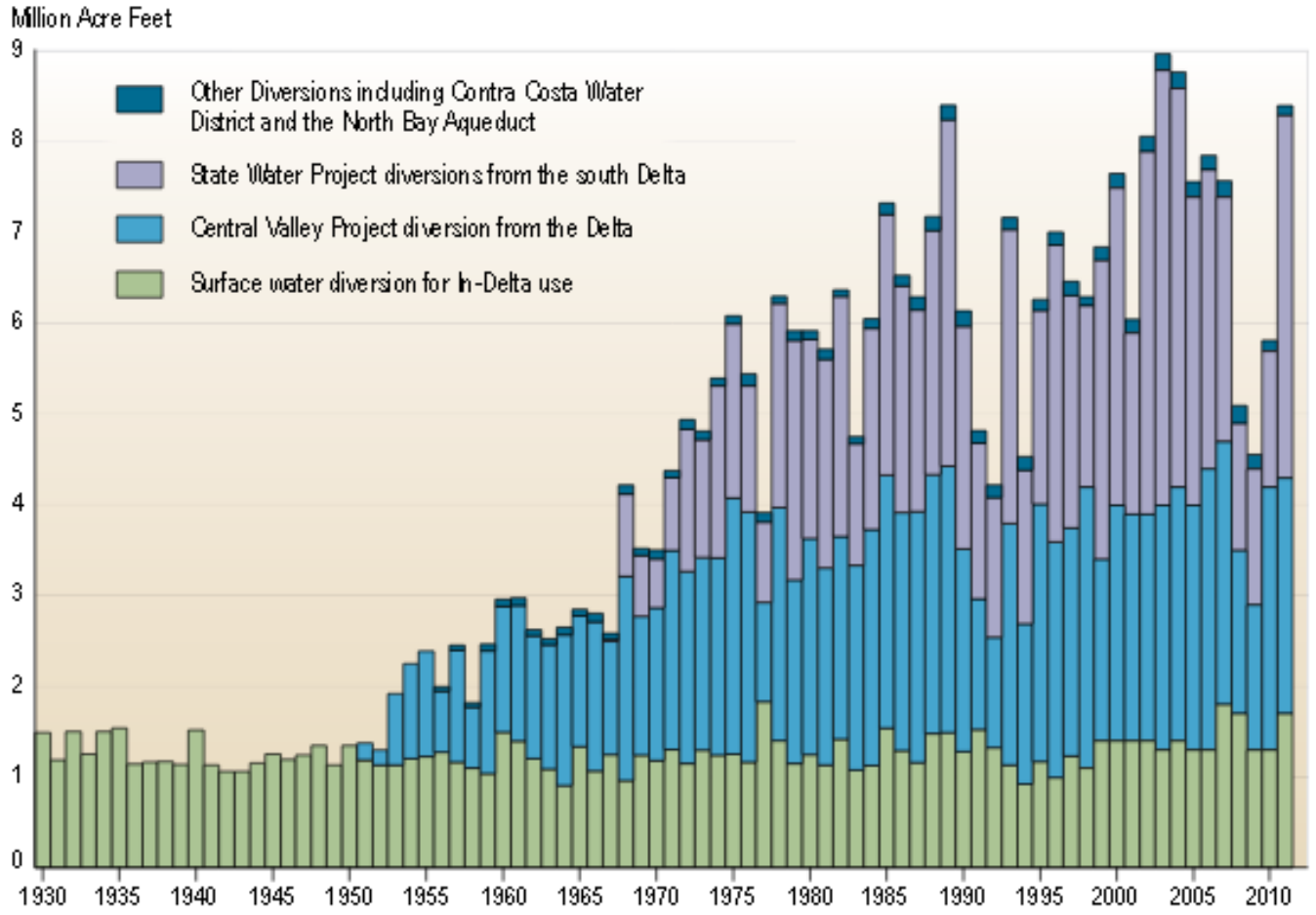
www.water.ca.gov/waterplan/docs/cwpu2013/Final/Vol2_DeltaRR.pdf 37 of 84

Figure D-6 Historical Diversions from within the Delta



Note: Data from 1930-1997 comes from the *Delta Vision Blue Ribbon Task Force 2008 Final Report* and data from 1998-2010 comes from DWR water portfolio and dayflow numbers.

Figure D-6 Historical Diversions from within the Delta



Note: Data from 1930-1997 comes from the *Delta Vision Blue Ribbon Task Force 2008 Final Report* and data from 1998-2010 comes from DWR water portfolio and dayflow numbers.

Below is a screen print* from the “Delta Water Balance Estimate” in thousands of acre feet, from the final version of the California Water Plan Update 2013 showing how much Sacramento River Inflow, outflow and the EXPORTS to State Water Project and Central Valley Project. Are these the flow numbers used to determine “Net Delta Outflow Index”?

Also note CCWD diversions are included in Delta Consumptive use and also listed as a separate category, indicating double-counting of same export #.

http://www.waterplan.water.ca.gov/docs/cwpu2013/ae/water_portfolio-inflow_outflow_delta.pdf

Delta Water Balance Estimates[1] (TAF)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Sacramento River Inflow	29015	21770	18360	10517	13104	18304	17129	16747	28039	11010	9557	9867	12777
Yolo Bypass Inflow	8996	1635	2961	366	708	1122	3121	707	13034	248	417	317	659
Eastside Tributaries Inflow	2096	1399	1078	372	462	534	445	1173	9679	1979	n	1231	2461
San Joaquin River Inflow	8456	3568	2846	1732	1396	1365	1373	3777	7341	1596	1234	865	1829
North Bay Aqueduct Exports	39	37	47	45	47	42	52	48	43	61	55	46	43
Contra Costa Water District Diversions at Rock Slough and Old River	160	133	126	104	121	138	120	119	116	112	135	107	94
State Water Project Exports at Banks Pumping Plant or Clifton Court Intake	2134	2439	3692	2635	2900	3458	3251	3625	3527	2954	1527	1636	2496
Central Valley Project Exports at Tracy	2474	2262	2487	2332	2505	2685	2722	2679	2628	2679	2018	1884	2141
Delta Consumptive Use[2]	1691	1691	1693	1691	1691	1691	1693	1691	1691	1691	1693	1691	1666
Delta Precipitation[2]	1423	734	956	764	758	739	753	1089	1059	477	600	662	789
Delta Outflow	43487	22542	18155	6944	9163	14050	14922	15403	43805	6216	1529	6713	2461

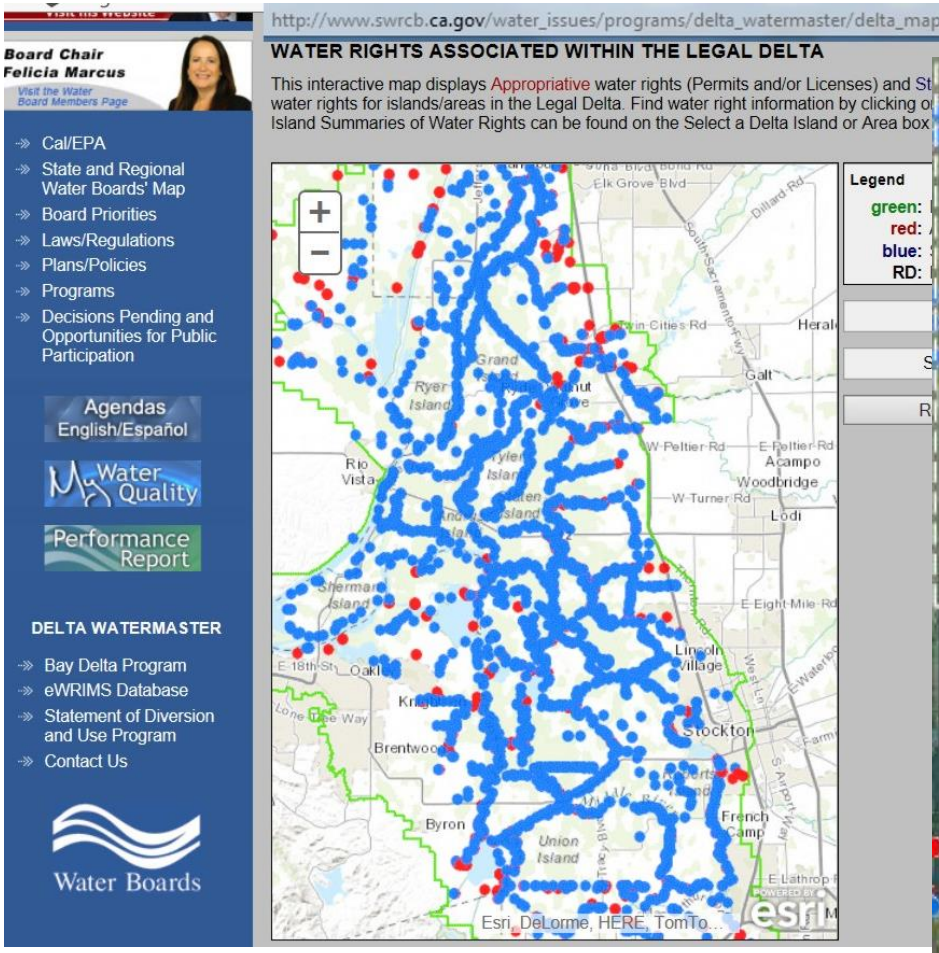
1 Data from DAYFLOW Program; NOTE: includes DAYFLOW corrections through 01-07-2004 (http://iep.water.ca.gov/dayflow)
2 Content Required by Water Code Section 10004.6

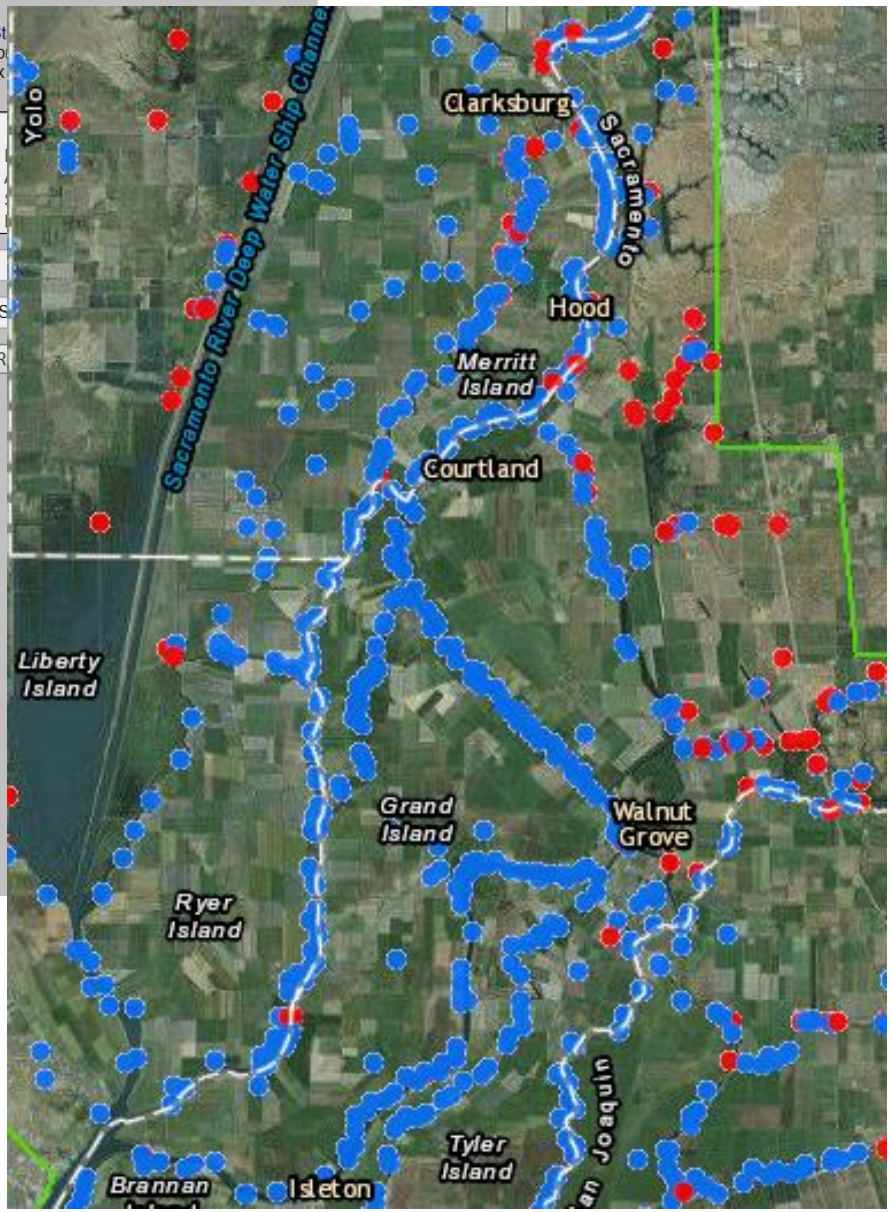
http://snugharbor.net/images-2014/bdcp/flows/unaccounted_diversi

YEAR	total inflows	EXPORTS	DELTA OUTFLOW reported	Unaccounted for flow
2010	18515	6397	2461	9657
2009	12942	5364	6713	865
2008	11808	5428	1529	4851
2007	15310	7497	6216	1597
2006	59152	8005	43805	7342
2005	23493	8102	15403	-72
2004	22821	7838	14922	61
2003	22064	8014	14050	0
2002	16428	7264	9163	1
2001	13706	6807	6944	-45
2000	26201	8045	18156	0
1999	29106	6562	22542	2
1998	49986	6498	43487	1

ita and references compiled by N. Suard, Esq. For use by Delta landowners 2/2014

In none of those years do we see 8.5 million acre feet of export or diversion from the Sacramento River, so how can DWR/USBR claim there is no change to QUANTITY of diversion from the Sacramento River?



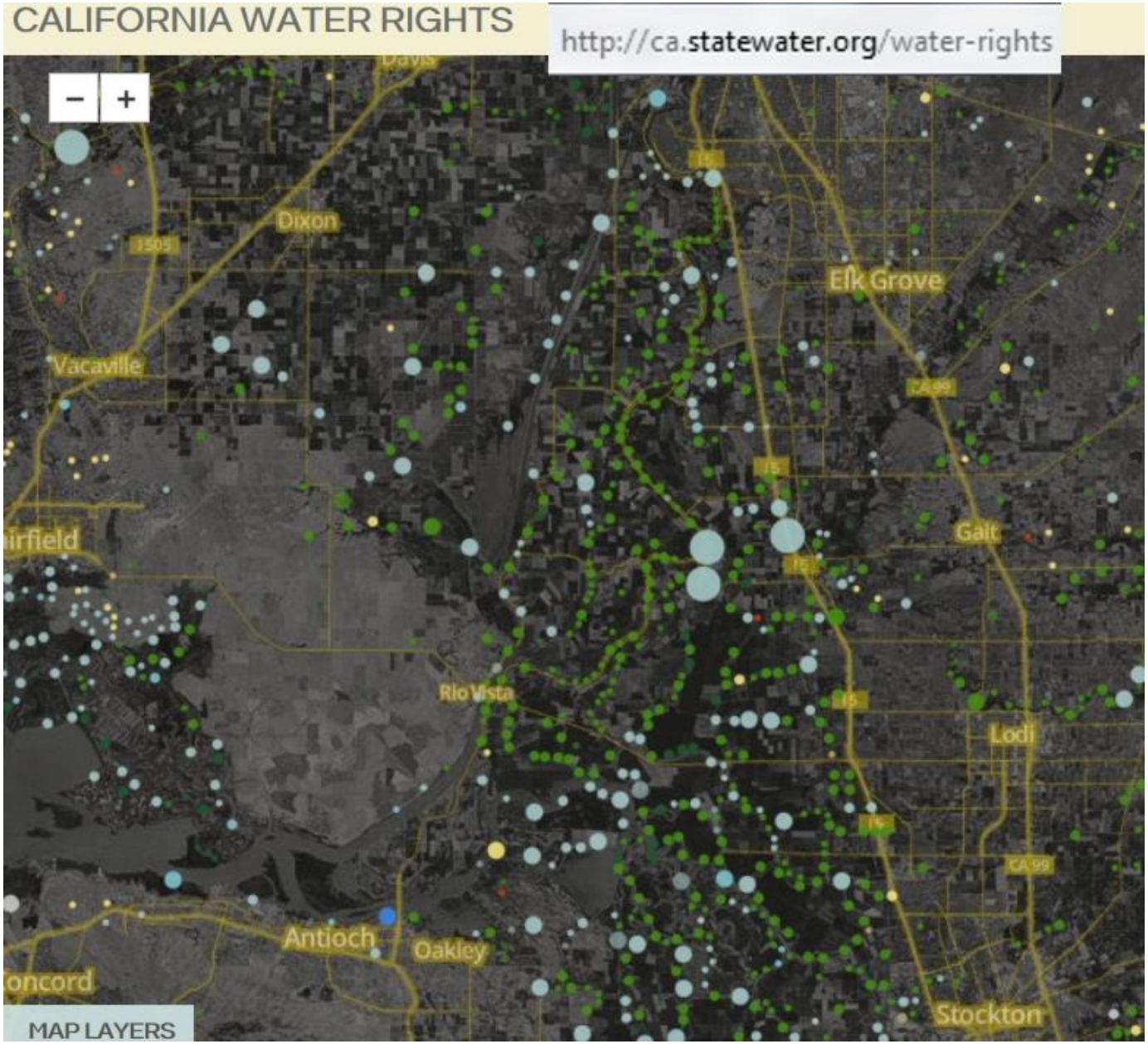


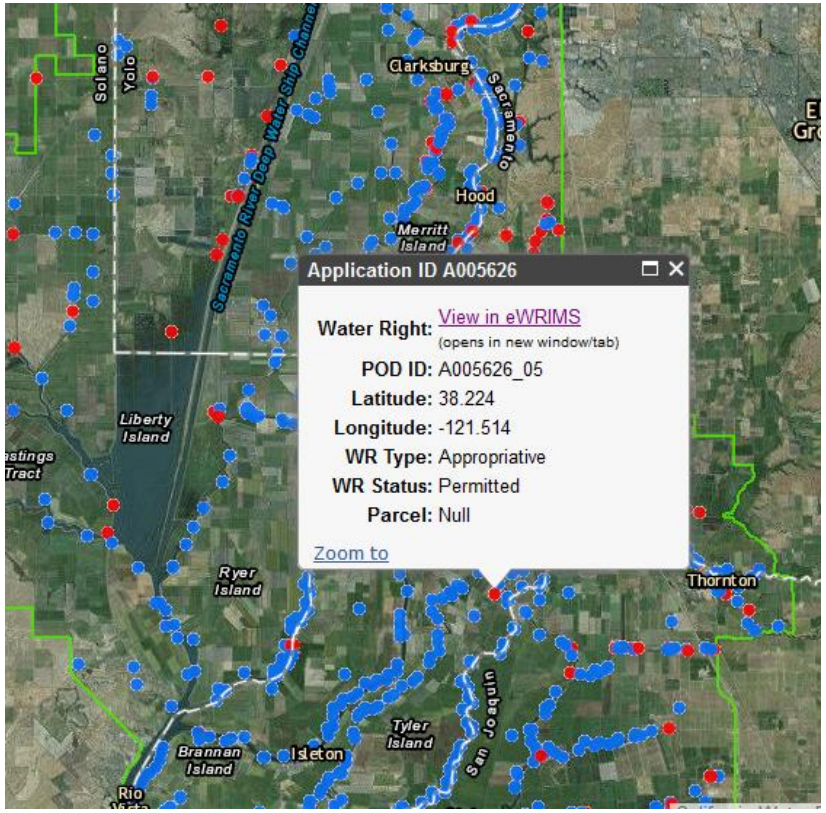
How many acre feet is allowed to be appropriated Or diverted (and from where) from the Delta by

*USBR?

*DWR?

http://www.waterboards.ca.gov/water_issues/programs/delta_watermaster/delta_map/


CALIFORNIA WATER RIGHTS
http://ca.statewater.org/water-rights
Dixon
Vacaville
Elk Grove
Galt
Rio Vista
Lodi
Antioch
Oakley
Stockton
MAP LAYERS



https://ciwqs.waterboards.ca.gov/ciwqs/ewrims_online_reporting/permitPrint.do?form_id=235122

[SUMMARY OF FINAL SUBMITTED VERSION]

PROGRESS REPORT BY PERMITTEE FOR 2015

Primary Owner: U.S. BUREAU OF RECLAMATION
Primary Contact: U.S. BUREAU OF RECLAMATION

Date Submitted: 2016-06-30

Application Number: A005626
Permit Number: 012721

Source(s) of Water	POD Parcel Number	County
OLD RIVER		Contra Costa
SACRAMENTO RIVER		Sacramento
SACRAMENTO RIVER		Glenn
SACRAMENTO RIVER		Tehama
SACRAMENTO RIVER		Shasta
SACRAMENTO RIVER		Shasta
SACRAMENTO RIVER		Contra Costa

MAX Direct Diversion Rate: 8000.0 CFS
MAX Collection to Storage: 3190000.0 AC-FT
Face Value: 7998004.0 AC-FT

Permitted Use(s)	Acres	Direct Diversion Season	Storage Season
Domestic	0.0	09/01 to 06/30	10/01 to 06/30
Fish and Wildlife Protection and/or Enhancement			

8 million acre feet claimed by USBR

Water Boards CIWQS

https://ciwqs.waterboards.ca.gov/ciwqs/ewrims/EWServlet?Redirect_Page=EWWaterRightPublicSearchResults.jsp&Object_Expected=EwrimsSearchResult&

e-WRIMS Water Right Search Results

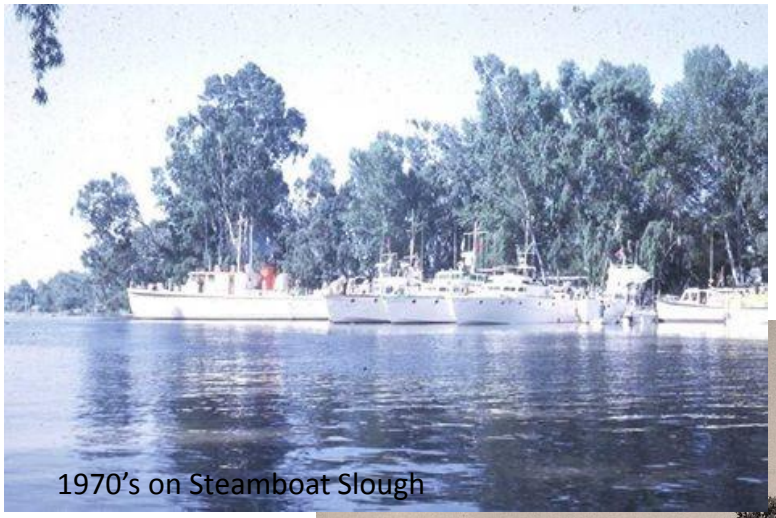
Criteria: Displaying Water Rights where Application Number like '*A005626*'.

Search Results: previous 1-1 of 1 next

Appl ID	Permit ID	License ID	Water Right Type	Status	Holder Name	Date	Face Amt	County	Source	View Reports	Water Right	Open in GIS	Export to Excel
A005626	012721		Appropriative	Permitted	U.S. BUREAU OF RECLAMATION	04/12/1961	7998004 acre-ft/yr	Contra Costa, Glenn, Sacramento, Shasta, Tehama	OLD RIVER, SACRAMENTO RIVER	View Reports	View Permit	Open in GIS	Download to Excel

http://cdec.water.ca.gov/cdecstation/
Department of Water Resources
CALIFORNIA DATA EXCHANGE CENTER
CA.GOV
HOME
QUERY TOOLS
PRECIPITATION
RIVER FORECAST
RIVER STAGES
RESERVOIRS
SNOW
STATIONS
Stations
Base Map
Layers
Filters
MONTEZUMA HILLS

http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/deltaflow/docs/final_rpt080310.pdf
38 / 191
S CONTROL BOARD
ITORING STATIONS
Legend
Baseline Monitoring Stations
Compliance Monitoring Stations
Baseline & Compliance Monitoring Stations
Highway



1970's on Steamboat Slough

http://www.snugharbor.net/timeline.html

http://www.snugharbor.net/images2010/Steamboat_Slough-Sacramento_shipwrecks.pdf
http://www.snugharbor.net/oldriversacramento.html

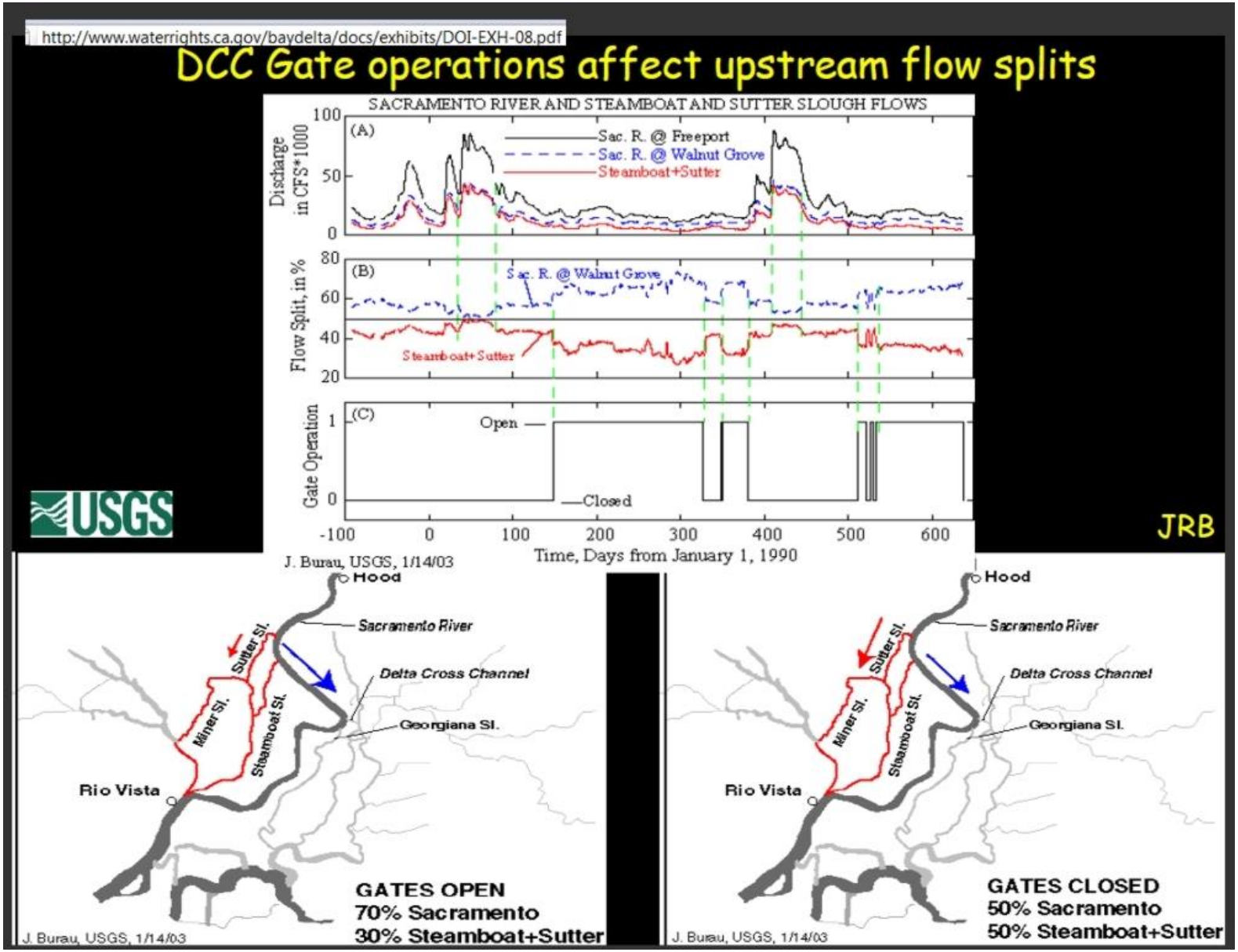
Snug Harbor Resort on Steamboat Slough in th 1950's

Is this a correct understanding
Of river outflows?

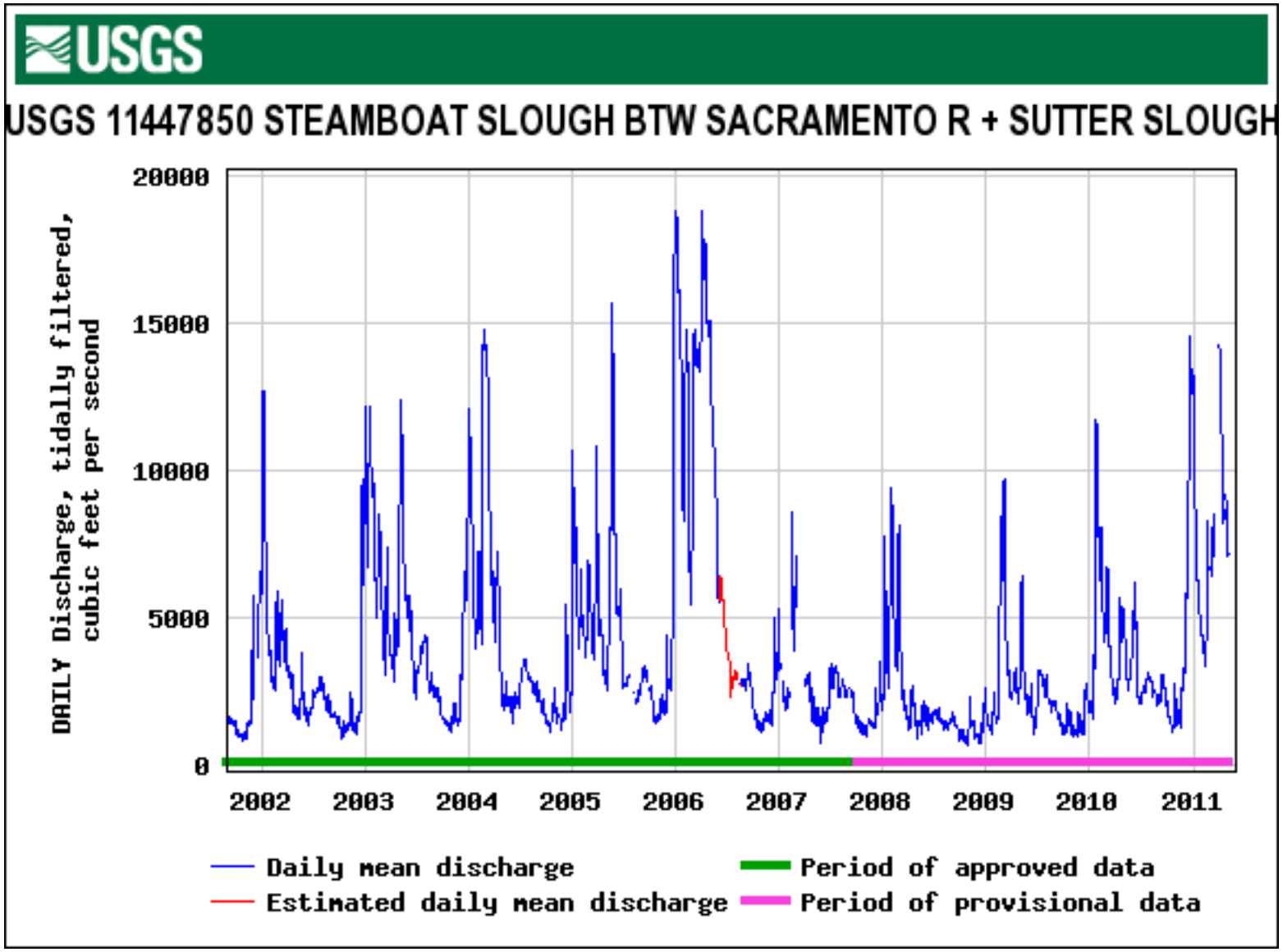
What happens when the
DCC is open or closed?

Describe the “reservoir”
On the map

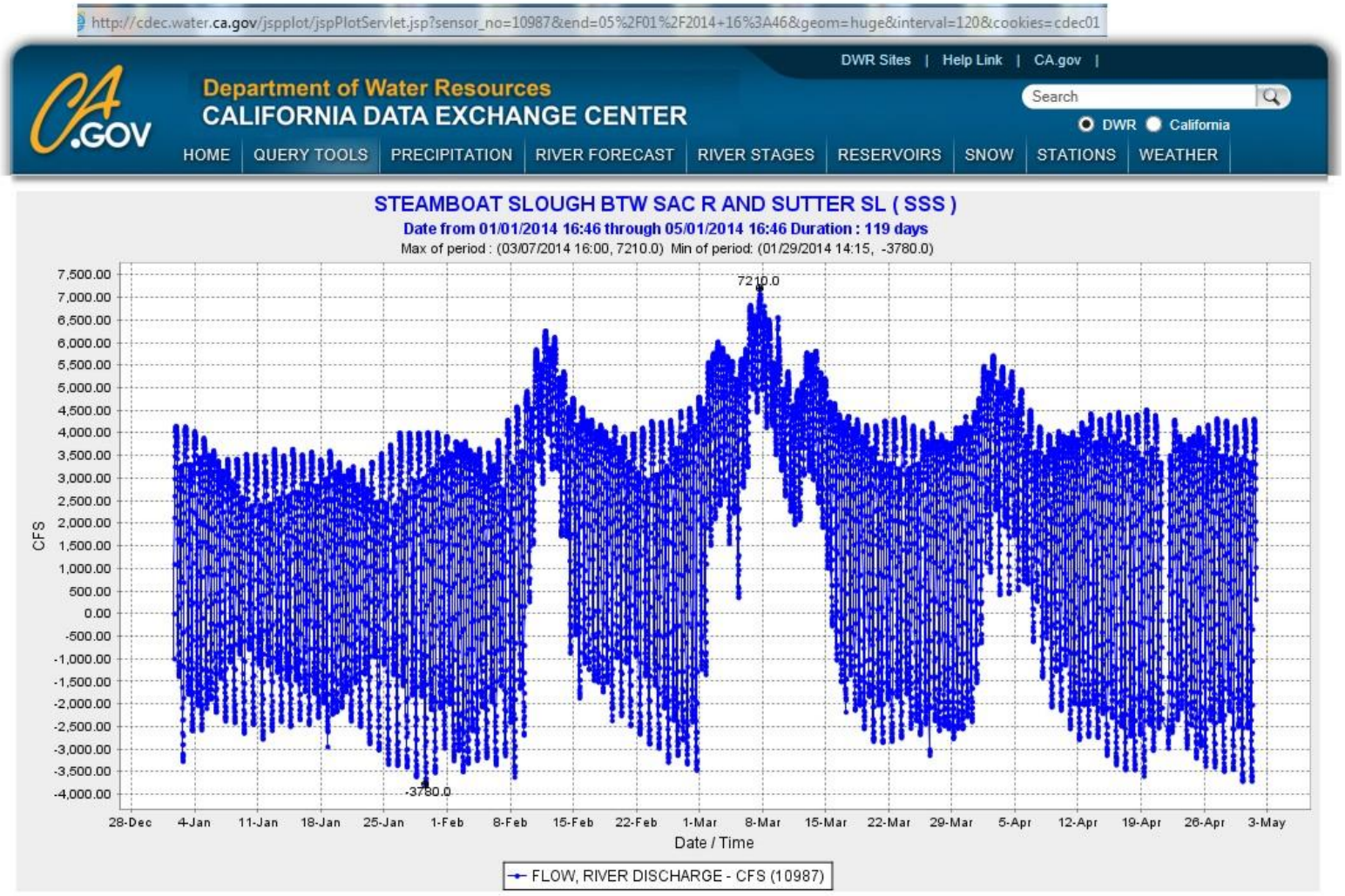
How is the flow on
Steamboat Slough monitored?


http://www.waterrights.ca.gov/baydelta/docs/exhibits/DOI-EXH-08.pdf
DCC Gate operations affect upstream flow splits
SACRAMENTO RIVER AND STEAMBOAT AND SUTTER SLOUGH FLOWS
Discharge in CFS*1000
(A)
Sac. R. @ Freeport
Sac. R. @ Walnut Grove
Steamboat+Sutter
Flow Split, in %
(B)
Sac. R. @ Walnut Grove
Steamboat+Sutter
Gate Operation
(C)
Open
Closed
Time, Days from January 1, 1990
USGS
JRB
J. Burau, USGS, 1/14/03
Hood
Sacramento River
Sutter Sl.
Miner Sl.
Steamboat Sl.
Delta Cross Channel
Georgiana Sl.
Rio Vista
GATES OPEN
70% Sacramento
30% Steamboat+Sutter
GATES CLOSED
50% Sacramento
50% Steamboat+Sutter

Waterfront businesses on Steamboat Slough can be impacted by flows that are too high and/or too low



Turning on the “knobs”: What do the pulse flows accomplish? How much does DWR/USBR rely on the data from the gages? Is flow data from the gates used to determine how much “surplus” or “excess” flow is available for export?



cdec.water.ca.gov/cgi-progs/selectQuery?station_id=FPT&sensor_num=20&dur_code=E&start_date=&end_date=now

03/26/2014 06:00	9440
03/26/2014 06:15	10000
03/26/2014 06:30	9980
03/26/2014 06:45	10500
03/26/2014 07:00	10900
03/26/2014 07:15	11100
03/26/2014 07:30	11600
03/26/2014 07:45	11500
03/26/2014 08:00	11400
03/26/2014 08:15	11300
03/26/2014 08:30	11300
03/26/2014 08:45	11500
03/26/2014 09:00	11600
03/26/2014 09:15	11900
03/26/2014 09:30	11600
03/26/2014 09:45	11300
03/26/2014 10:00	10500
03/26/2014 10:15	10100
03/26/2014 10:30	9260
03/26/2014 10:45	8210
03/26/2014 12:00	2180
03/26/2014 12:15	1140
03/26/2014 12:30	613
03/26/2014 12:45	-188
03/26/2014 14:00	-1760
03/26/2014 14:15	-1950
03/26/2014 14:30	-2240
03/26/2014 14:45	-1880
03/26/2014 15:00	-1320
03/26/2014 15:15	-855
03/26/2014 15:30	271
03/26/2014 15:45	1670
03/26/2014 16:00	2860
03/26/2014 16:15	4590

http://www.snugharbor.net/images-2014/news/notices/cdecdatagaps.pdf

Screen print from above CDEC site for Freeport flows, accessed 4/4/14, 4/8/14 with no changes by DWR.

Can you find the data gap?

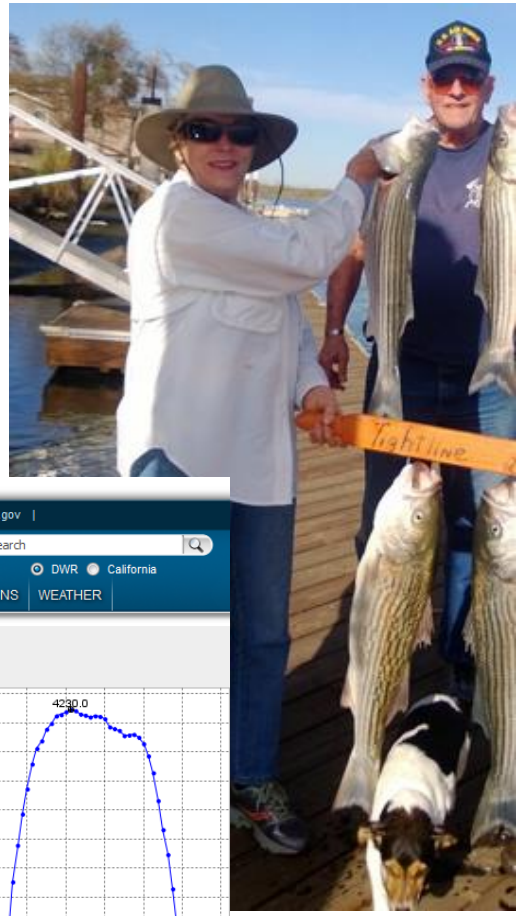
Take a closer look at flows on Steamboat Slough in 2014

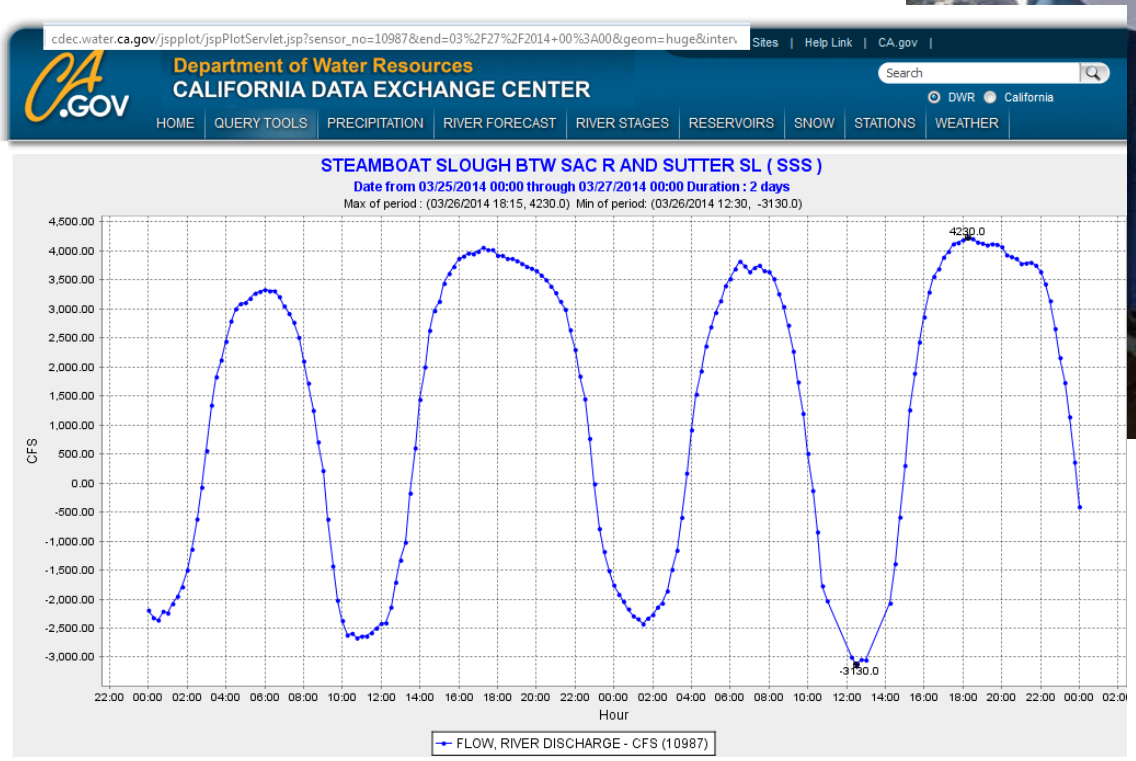
cdec.water.ca.gov/cgi-progs/queryF?SSS&d=26-Mar-2014+18:00

FLOW

Screen print
5/19/15 4:54 am

Date / Time (PDT)	FLOW CFS	
03/26/2014 06:00	3520	
03/26/2014 06:15	3690	
03/26/2014 06:30	3820	
03/26/2014 06:45	3740	
03/26/2014 07:00	3640	
03/26/2014 07:15	3710	
03/26/2014 07:30	3750	
03/26/2014 07:45	3660	
03/26/2014 08:00	3640	
03/26/2014 08:15	3520	
03/26/2014 08:30	3260	
03/26/2014 08:45	3040	
03/26/2014 09:00	2720	
03/26/2014 09:15	2270	
03/26/2014 09:30	1740	
03/26/2014 09:45	1200	
03/26/2014 10:00	510	
03/26/2014 10:15	-129	
03/26/2014 10:30	-842	
03/26/2014 10:45	-1770	
03/26/2014 11:00	-2030	*
03/26/2014 12:15	-3000	
03/26/2014 12:30	-3130	
03/26/2014 12:45	-3040	
03/26/2014 13:00	-3050	
03/26/2014 14:15	-2070	*
03/26/2014 14:30	-1390	
03/26/2014 14:45	-588	
03/26/2014 15:00	302	
03/26/2014 15:15	1260	
03/26/2014 15:30	1890	
03/26/2014 15:45	2430	
03/26/2014 16:00	2860	
03/26/2014 16:15	3290	
03/26/2014 16:30	3560	
03/26/2014 16:45	3690	
03/26/2014 17:00	3890	
03/26/2014 17:15	3990	
03/26/2014 17:30	4120	
03/26/2014 17:45	4140	
03/26/2014 18:00	4190	





Example: Data gap on 3/26/14 for Freeport and Steamboat Slough

http://www.snugharbor.net/images-2014/news/notices/cdecdatagaps.pdf

From 10:45 to 12 noon Sacramento River flow drops over 6000 cfs, from 8210 to 2180. Flows continue to drop to -1760 in just a 3 hour time. This indicates all flow on the Sacramento River at Freeport had been cut off

Impact to Steamboat Slough from flow cut-off is hidden due to gap in data reporting. What does show is that Steamboat Slough was already not receiving freshwater inflow, and the cutoff of flow created a more drastic low tide at this time. Impact to Sutter Slough shows less drastic low water impact.

2014FLOW-updated.xlsx — Section of review of flow data from CDEC which exposed missing data and experimental flow timing:

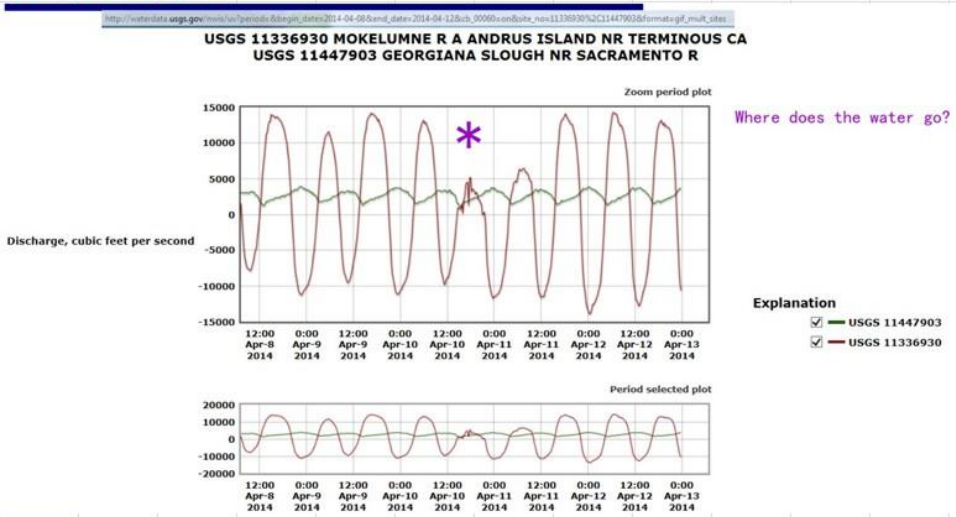
	A	B	C	D FREEPORT		F	G SUTTER	H	I	J STEAMBOAT	K	L	M GEORGIANA		O
1100		3/26/2014 9:45		3/26/2014 9:45	11300		3/26/2014 9:45	2190		3/26/2014 9:45	1200		3/26/2014 9:45	3370	3/
1101		3/26/2014 10:00		3/26/2014 10:00	10500		3/26/2014 10:00	1910		3/26/2014 10:00	510		3/26/2014 10:00	3180	3/2
1102		3/26/2014 10:15		3/26/2014 10:15	10100		3/26/2014 10:15	1610		3/26/2014 10:15	-129		3/26/2014 10:15	2990	3/2
1103		3/26/2014 10:30		3/26/2014 10:30	9260		3/26/2014 10:30	1420		3/26/2014 10:30	-842		3/26/2014 10:30	2830	3/2
1104		3/26/2014 10:45		3/26/2014 10:45	8210		3/26/2014 10:45	1200		3/26/2014 10:45	-1770		3/26/2014 10:45	3050	3/2
1105	11:00 AM	3/26/2014 11:00		MISSING	DATA		3/26/2014 11:00	1190		3/26/2014 11:00	-2030		3/26/2014 11:00	2960	3/2
1106		3/26/2014 11:15		MISSING	DATA		3/26/2014 11:15	966		MISSING	DATA		3/26/2014 11:15	3100	3/2
1107		3/26/2014 11:30		MISSING	DATA		3/26/2014 11:30	714		MISSING	DATA		3/26/2014 11:30	3010	3/2
1108		3/26/2014 11:45		MISSING	DATA		3/26/2014 11:45	240		MISSING	DATA		3/26/2014 11:45	2840	3/2
1109	NOON	3/26/2014 12:00		3/26/2014 12:00	2180		3/26/2014 12:00	-7		MISSING	DATA		3/26/2014 12:00	2750	3/2
1110		3/26/2014 12:15		3/26/2014 12:15	1140		3/26/2014 12:15	-242		3/26/2014 12:15	-3000		3/26/2014 12:15	2620	3/2
1111		3/26/2014 12:30		3/26/2014 12:30	613		3/26/2014 12:30	-408		3/26/2014 12:30	-3130		3/26/2014 12:30	2480	3/2
1112		3/26/2014 12:45		3/26/2014 12:45	-188		3/26/2014 12:45	-658		3/26/2014 12:45	-3040		3/26/2014 12:45	2410	3/2
1113	1:00 PM	3/26/2014 13:00		MISSING	DATA		3/26/2014 13:00	-931		3/26/2014 13:00	-3050		3/26/2014 13:00	2320	3/2
1114		3/26/2014 13:15		MISSING	DATA		3/26/2014 13:15	-1040		MISSING	DATA		3/26/2014 13:15	2220	3/2
1115		3/26/2014 13:30		MISSING	DATA		3/26/2014 13:30	-1230		MISSING	DATA		3/26/2014 13:30	2110	3/2
1116		3/26/2014 13:45		MISSING	DATA		3/26/2014 13:45	-1260		MISSING	DATA		3/26/2014 13:45	1890	3/2
1117	2:00 PM	3/26/2014 14:00		3/26/2014 14:00	-1760		3/26/2014 14:00	-1310		MISSING	DATA		3/26/2014 14:00	1830	3/2
1118		3/26/2014 14:15		3/26/2014 14:15	-1950		3/26/2014 14:15	-1260		3/26/2014 14:15	-2070		3/26/2014 14:15	1620	3/2
1119		3/26/2014 14:30		3/26/2014 14:30	-2240		3/26/2014 14:30	-1120		3/26/2014 14:30	-1390		3/26/2014 14:30	1390	3/2
1120		3/26/2014 14:45		3/26/2014 14:45	-1880		3/26/2014 14:45	-959		3/26/2014 14:45	-588		3/26/2014 14:45	1130	3/2
1121	3:00 PM	3/26/2014 15:00		3/26/2014 15:00	-1320		3/26/2014 15:00	-635		3/26/2014 15:00	302		3/26/2014 15:00	732	3/2
1122		3/26/2014 15:15		3/26/2014 15:15	-855		3/26/2014 15:15	-194		3/26/2014 15:15	1260		3/26/2014 15:15	731	3/2

Sheet1 Sheet2 Sheet3

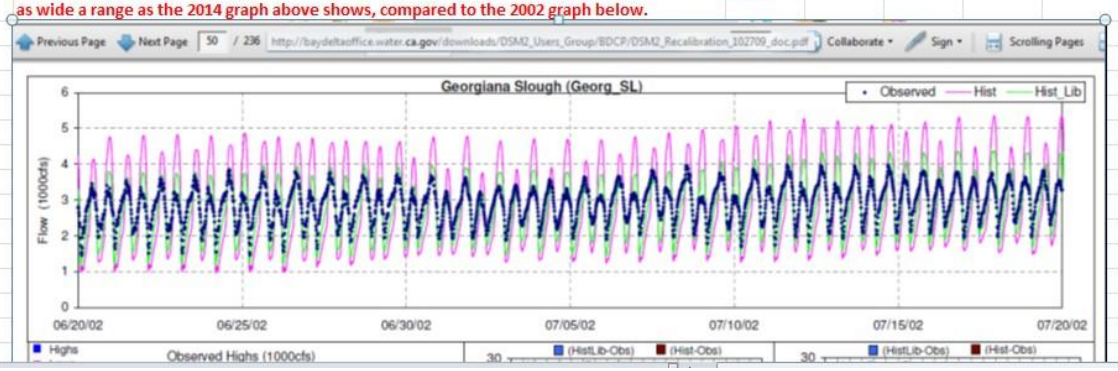
Georgiana flow			Mokelumne Flow	
4/10/2014 9:15	2730		4/10/2014 9:15	9560
4/10/2014 9:30	2760		4/10/2014 9:30	7970
4/10/2014 9:45	2870		4/10/2014 9:45	6380
4/10/2014 10:00	3050		4/10/2014 10:00	4710
4/10/2014 10:15	3190		4/10/2014 10:15	2080
4/10/2014 10:30	3350		4/10/2014 10:30	-378
4/10/2014 10:45	3390		4/10/2014 10:45	-2860
4/10/2014 11:00	3380		4/10/2014 11:00	-4880
4/10/2014 11:15	3270		4/10/2014 11:15	-6630
4/10/2014 11:30	3310		4/10/2014 11:30	-7910
4/10/2014 11:45	3200		4/10/2014 11:45	-8430
4/10/2014 12:00	3260		4/10/2014 12:00	-9140
4/10/2014 12:15	3380		4/10/2014 12:15	-9770
4/10/2014 12:30	3450		4/10/2014 12:30	-9720
4/10/2014 12:45	3180		4/10/2014 12:45	-9070
4/10/2014 13:00	3120		4/10/2014 13:00	-8820
4/10/2014 13:15	3330		4/10/2014 13:15	-8850
4/10/2014 13:30	3220		4/10/2014 13:30	-8390
4/10/2014 13:45	3470		4/10/2014 13:45	-7710
4/10/2014 14:00	2960		4/10/2014 14:00	-6830
4/10/2014 14:15	3110		4/10/2014 14:15	-6240
4/10/2014 14:30	2880		4/10/2014 14:30	-5540
4/10/2014 14:45	2790		4/10/2014 14:45	-4640
4/10/2014 15:00	2770		4/10/2014 15:00	-3330
4/10/2014 15:15	2300		4/10/2014 15:15	-1710
4/10/2014 15:30	1680		4/10/2014 15:30	-199
4/10/2014 15:45	1610		4/10/2014 15:45	1000
4/10/2014 16:00	1380		4/10/2014 16:00	899
4/10/2014 16:15	1090		4/10/2014 16:15	696
4/10/2014 16:30	1130		4/10/2014 16:30	889
4/10/2014 16:45	1220		4/10/2014 16:45	1470
4/10/2014 17:00	1710		4/10/2014 17:00	197
4/10/2014 17:15	1710		4/10/2014 17:15	2040
4/10/2014 17:30	1750		4/10/2014 17:30	2620
4/10/2014 17:45	1790		4/10/2014 17:45	4240
4/10/2014 18:00	1870		4/10/2014 18:00	4510
4/10/2014 18:15	1860		4/10/2014 18:15	4480
4/10/2014 18:30	1970		4/10/2014 18:30	1330
4/10/2014 18:45	2030		4/10/2014 18:45	5190

in April 2014 when substantial amounts of fresh water was diverted from Georgiana Slough, which caused the saltier water of the San Joaquin River to travel up into Georgiana Slough creating the "reverse flows" as indicated from the flow data. Who was diverting that much water and

WHERE DID THE WATER GO?

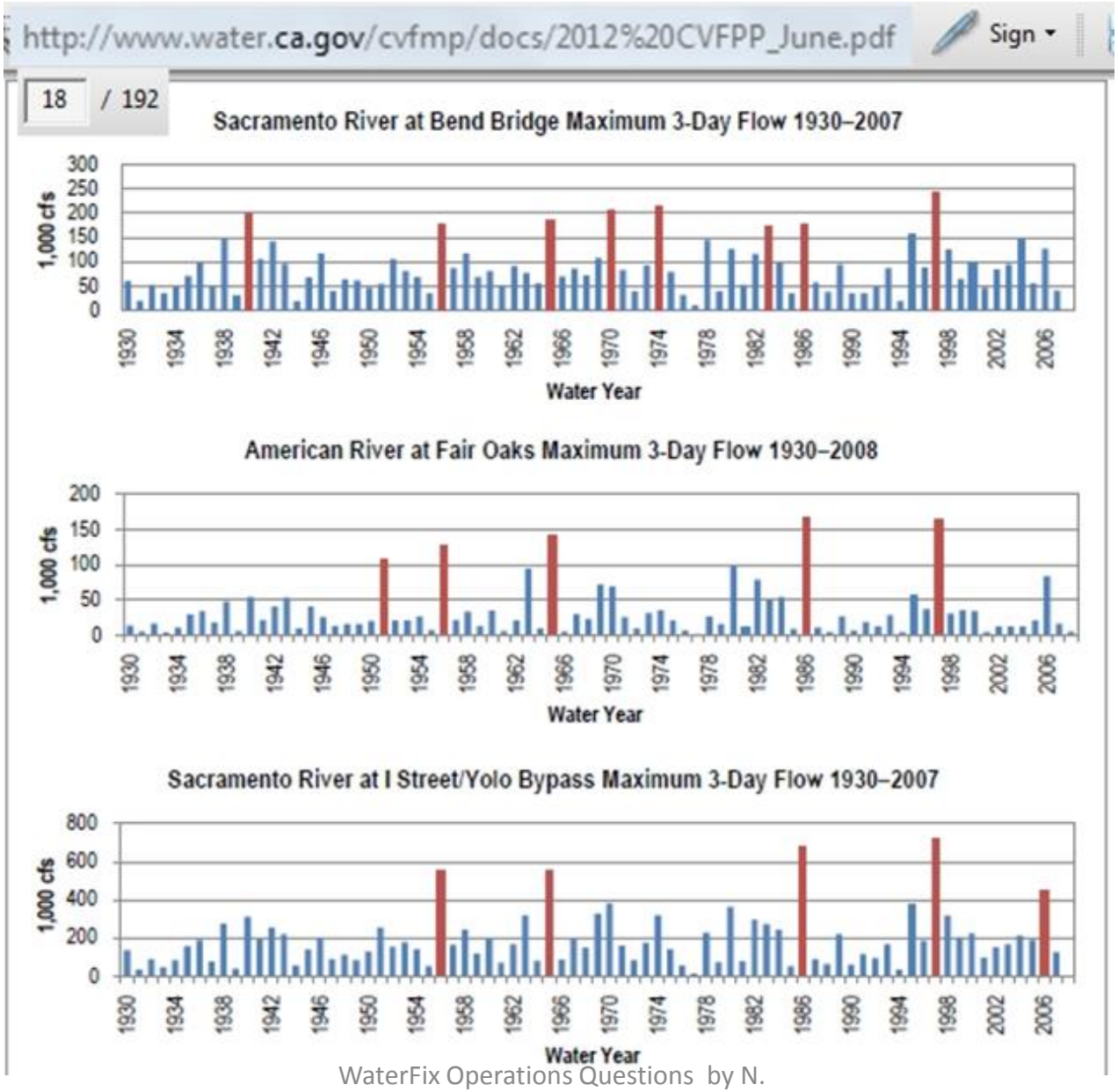


Note that Georgiana Slough used to always have OUTFLOW into the MokeLumne River at the gage, and the tidal fluctuation was not as wide a range as the 2014 graph above shows, compared to the 2002 graph below.



If the flow gages do not report accurate flow data, doesn't that mean the assumptions of flow available for Diversion and export are also inaccurate? Does USBR or DWR operate an intake on Georgiana Slough in April?

How is the system managed when there is TO MUCH water flow coming into the Delta?



www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/petitioners_exhibit/dwr/dwr_61.pdf
6 of 20

B. DELTA HYDRODYNAMICS

Delta hydrodynamics are defined by complex interactions between tributary inflows, tides, in-Delta diversions, and SWP/ CVP operations. Changes in any of the hydrodynamic variables affect water quality in the Delta, particularly with regard to salinity. Each day two high and two low tides of differing magnitudes (flood and ebb tides) cause large fluctuations in flow in the Delta estuary. The positive and negative Delta outflow caused by these tidal forces is the reason that Delta outflow is defined in terms of an average or "net" Delta outflow. The strength of the tides also varies within the month depending on the position of the sun and the moon (spring-neap cycle) and is also greatly influenced by atmospheric conditions such as wind and barometric pressure. Each flood tide has the potential to bring a large volume of high salinity ocean water into the Delta, and can be exacerbated by storm surge conditions. Managing this saltwater intrusion from encroaching too far into the interior Delta is crucial to protecting freshwater supplies for in-Delta and SWP/CVP water users.

Context Memorandum: Agriculture in the Delta

Iteration 2: August 10, 2007

Table 5. Selected Public and Nonprofit Delta Land Acquisitions

Organization	Acquisition	Date	Acreage
CA Department of Water Resources	Sherman Island	1993	8,146
CA Department of Water Resources	Twitchell Island	1993	2,965
CALFED/The Nature Conservancy	McCormick-Williamson Tract	1999	1,654
CALFED/The Nature Conservancy	Staten Island	2002	9,200
U.S. Bureau of Reclamation	Prospect Island	1995	1,600
U.S. Army Corps of Engineers	Little Holland Tract	1999	1,640
Trust for Public Lands/CA Department of Fish and Game	Liberty Island	1999	4,760
CA Department of Fish and Game	Yolo Bypass	1997/2002	16,500

Many of these lands continue in some level of agricultural production, at least as an interim use. Nevertheless, agricultural commissioners, bankers, and agricultural support industry representatives who serve the Delta express concerns over the loss of a critical mass of agricultural land needed to support agricultural infrastructure, including agricultural support industries.

www.water.ca.gov/environmentalservices/docs/frpa/implementation_strategy.pdf 24 of 117

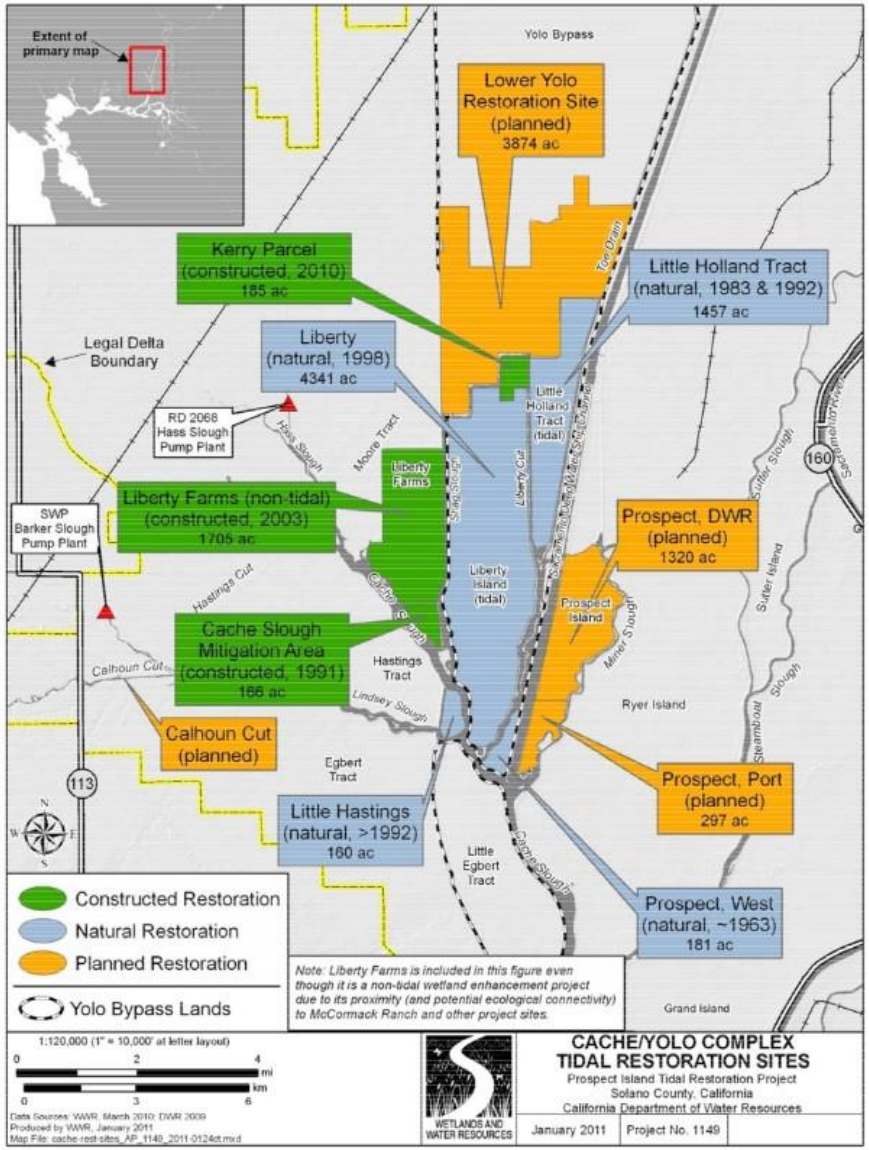
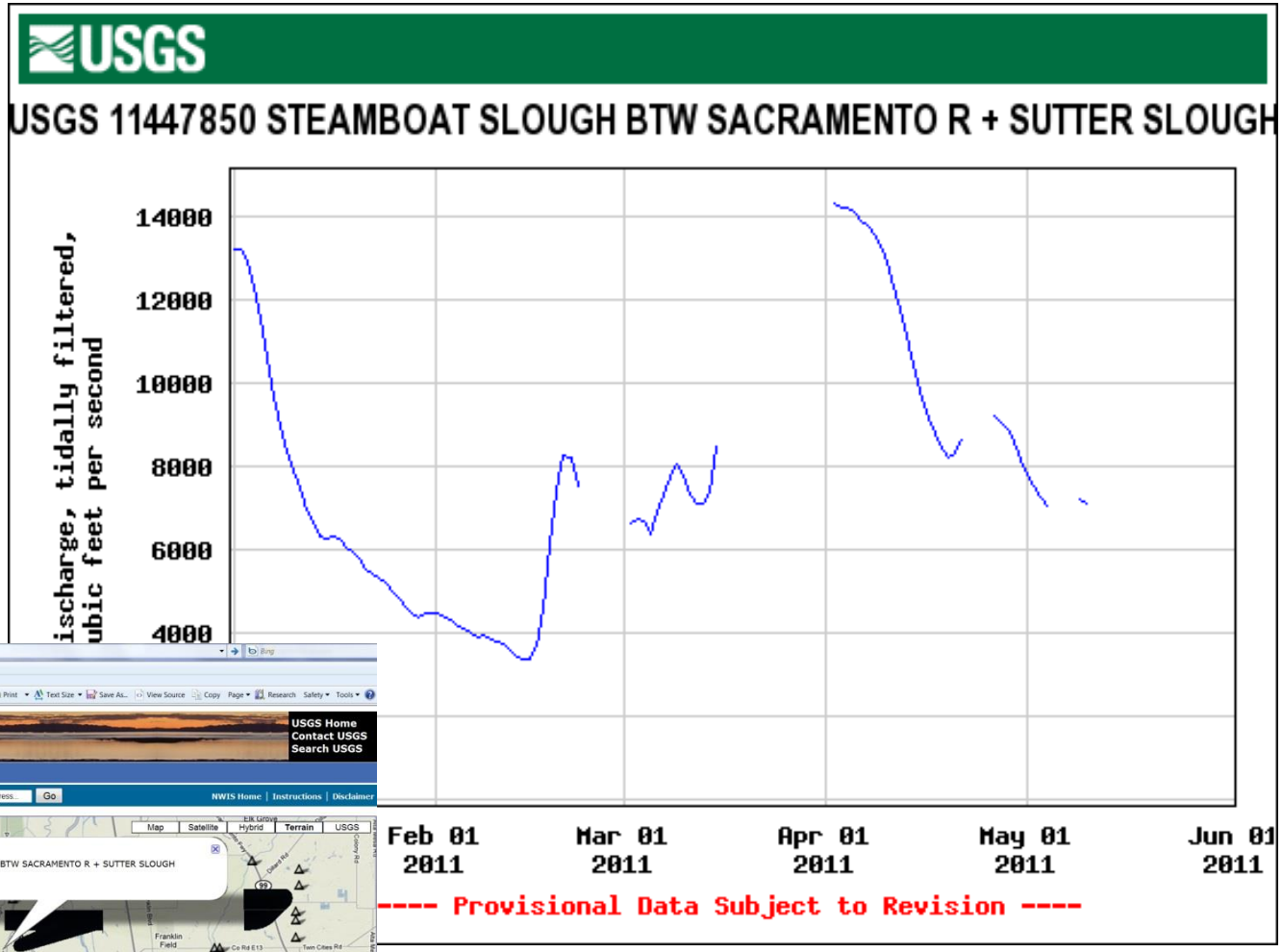
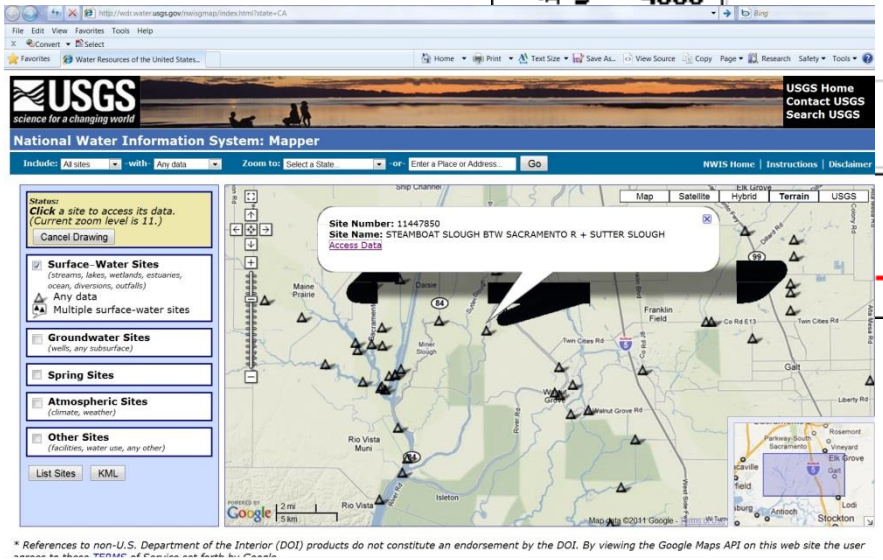


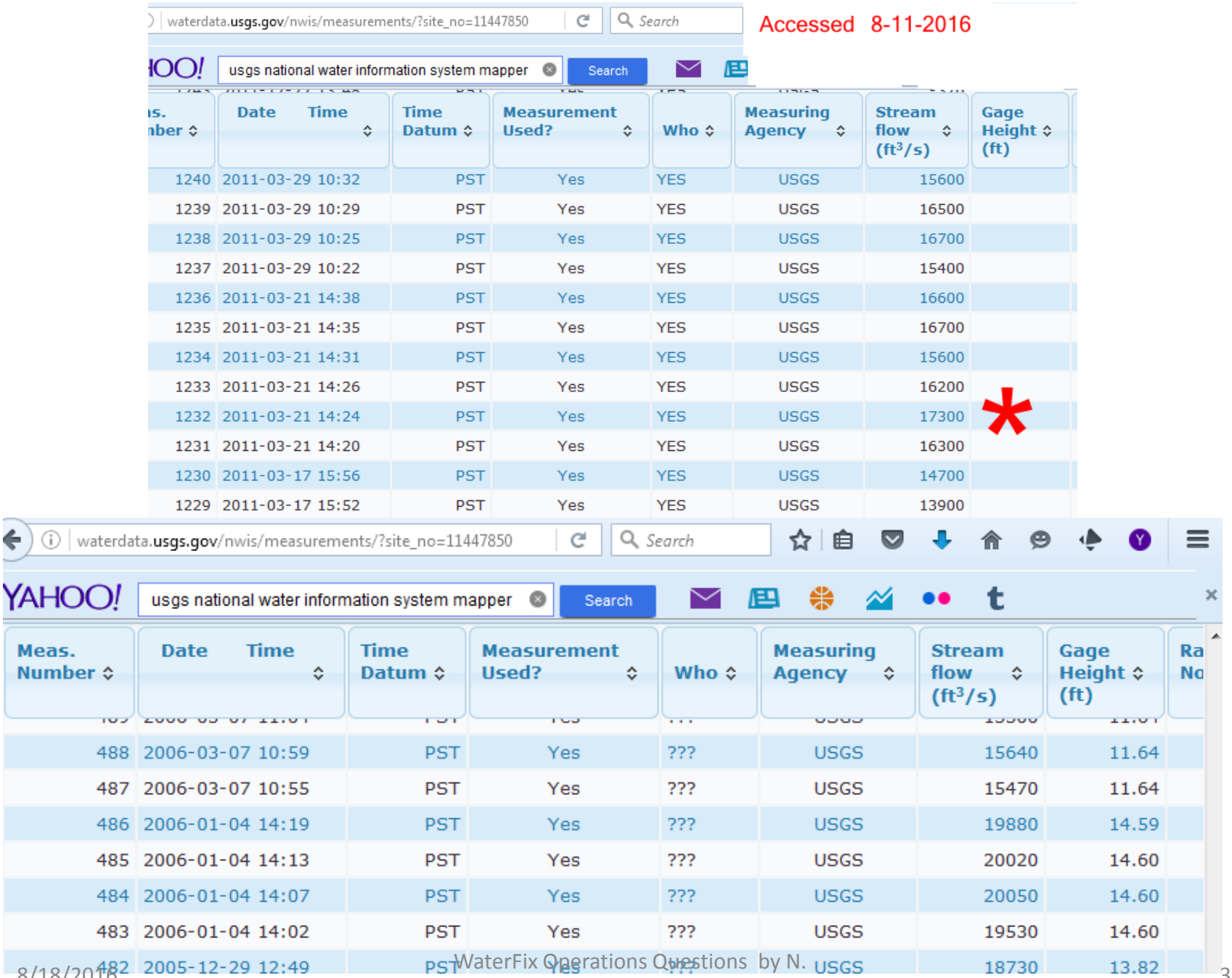
Figure 2. Near-term habitat restoration actions in the Cache Slough Complex





http://waterdata.usgs.gov/nwis/dv?cb_all_=on&format=gif_stats&site_no=11447850&referred_module=sw&period=&begin_date=2005-12-15&end_date=2006-01-14

USGS flow data accessed 12/22/2011


waterdata.usgs.gov/nwis/measurements/?site_no=11447850
Search
Accessed 8-11-2016
usgs national water information system mapper
Search
Date Time
Time Datum
Measurement Used?
Who
Measuring Agency
Stream flow (ft³/s)
Gage Height (ft)
1240 2011-03-29 10:32 PST Yes YES USGS 15600
1239 2011-03-29 10:29 PST Yes YES USGS 16500
1238 2011-03-29 10:25 PST Yes YES USGS 16700
1237 2011-03-29 10:22 PST Yes YES USGS 15400
1236 2011-03-21 14:38 PST Yes YES USGS 16600
1235 2011-03-21 14:35 PST Yes YES USGS 16700
1234 2011-03-21 14:31 PST Yes YES USGS 15600
1233 2011-03-21 14:26 PST Yes YES USGS 16200
1232 2011-03-21 14:24 PST Yes YES USGS 17300
1231 2011-03-21 14:20 PST Yes YES USGS 16300
1230 2011-03-17 15:56 PST Yes YES USGS 14700
1229 2011-03-17 15:52 PST Yes YES USGS 13900
*
waterdata.usgs.gov/nwis/measurements/?site_no=11447850
Search
YAHOO!
usgs national water information system mapper
Search
Meas. Number
Date Time
Time Datum
Measurement Used?
Who
Measuring Agency
Stream flow (ft³/s)
Gage Height (ft)
488 2006-03-07 10:59 PST Yes ??? USGS 15640 11.64
487 2006-03-07 10:55 PST Yes ??? USGS 15470 11.64
486 2006-01-04 14:19 PST Yes ??? USGS 19880 14.59
485 2006-01-04 14:13 PST Yes ??? USGS 20020 14.60
484 2006-01-04 14:07 PST Yes ??? USGS 20050 14.60
483 2006-01-04 14:02 PST Yes ??? USGS 19530 14.60
482 2005-12-29 12:49 PST Yes ??? USGS 18730 13.82

Is USBR or DWR aware of the hindrance to flood flows from “restoration” sites?

the riparian restoration project off Grand Island south of Snug Harbor, combined with the levee toe & restoration project on the opposite side of Steamboat Slough, along Ryer Island, at about river mile 16.5, are creating a “bottle neck” effect that further causes back up of water flow onto Snug Harbor. If you consider flood water exiting Steamboat Slough as an important flood control “structure” then the importance of the continued water flow restriction in this area becomes more clear, as it is a known fact that sedimentation upstream from flood control structures obstructs flow and reduces capacity. The turbidity or particles in the water settle to the

http://snugharbor.net/images2011/deltastuff/centralvalleyfloodmgt-corrected.pdf

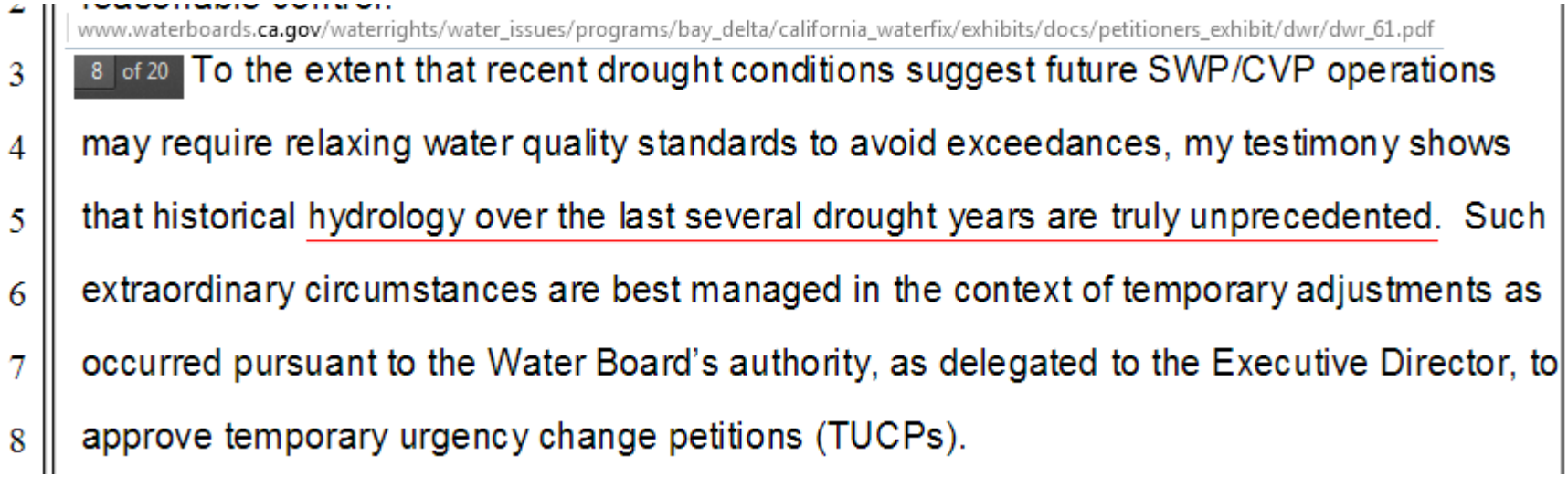
http://snugharbor.net/images2011/deltastuff/centralvalleyfloodmgt-corrected.pdf

The report that goes with the Sacramento River maps shows that historically high tides had little effect on the Delta upstream - contrary to the condition today that Leahigh described in his presentation. Further, historical description Includes a discussion of how the Sacramento River used to overflow into adjacent lands and then slowly drain back I nto the river over the summer - thus providing freshening all summer long.

Mr. Leahigh, your presentation speaks of high tides and salinity - but isn't true that this is not the historic condition but a condition created by the Federal Government and State diverting to much Sacramento River water from the Delta? Also from dredging of the Sacramento Ship Channel and San Joaquin Ship Channel, which draws in more Salt water on incoming tides, at the bottom of those ship channels?

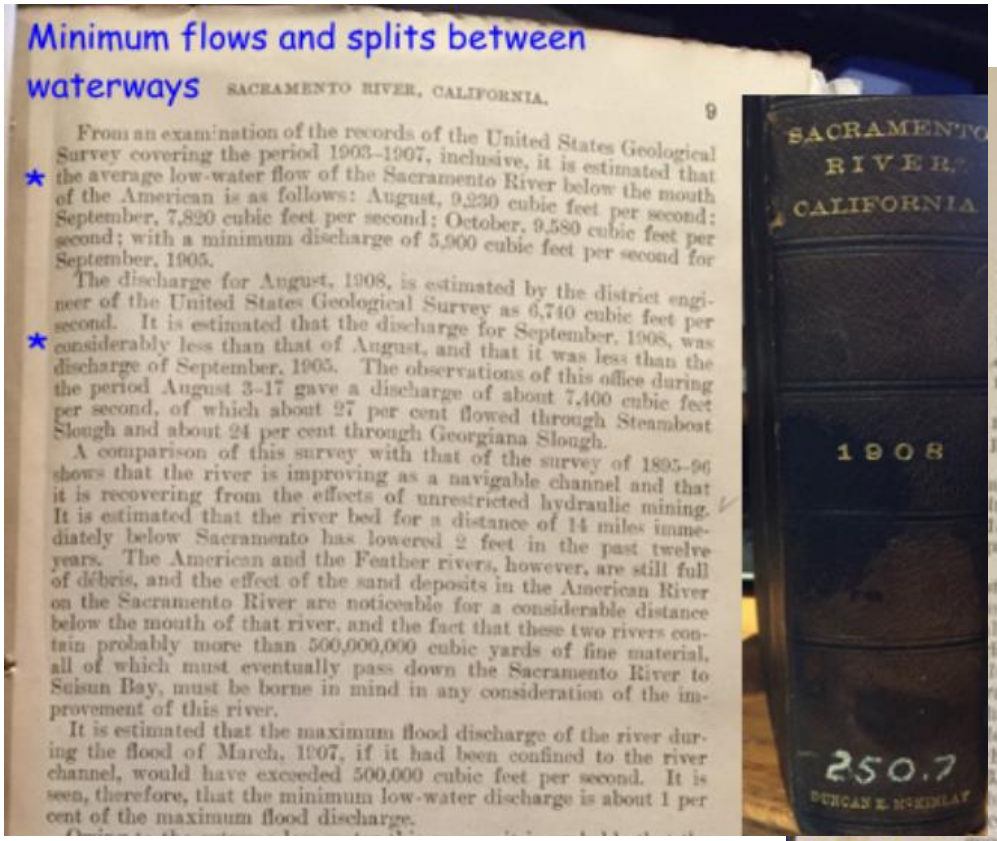
And weren't tides in the North Delta less drastic because there was ALWAYS constant freshwater outflow from The Sacramento River keeping at least the whole North Delta in fresh, drinkable water?

Doesn't the proposed volume of diversion from the Sacramento River in effect suspend the North Delta Waterways in a permanent "drought" condition for flows and negative impacts?


www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/petitioners_exhibit/dwr/dwr_61.pdf

8 of 20 To the extent that recent drought conditions suggest future SWP/CVP operations may require relaxing water quality standards to avoid exceedances, my testimony shows that historical hydrology over the last several drought years are truly unprecedented. Such extraordinary circumstances are best managed in the context of temporary adjustments as occurred pursuant to the Water Board's authority, as delegated to the Executive Director, to approve temporary urgency change petitions (TUCPs).

Minimum flows and splits between waterways



SACRAMENTO RIVER, CALIFORNIA. 9

From an examination of the records of the United States Geological Survey covering the period 1903–1907, inclusive, it is estimated that the average low-water flow of the Sacramento River below the mouth of the American is as follows: August, 9,230 cubic feet per second; September, 7,820 cubic feet per second; October, 9,580 cubic feet per second; with a minimum discharge of 5,900 cubic feet per second for September, 1905.

The discharge for August, 1908, is estimated by the district engineer of the United States Geological Survey as 6,740 cubic feet per second. It is estimated that the discharge for September, 1908, was considerably less than that of August, and that it was less than the discharge of September, 1905. The observations of this office during the period August 3–17 gave a discharge of about 7,400 cubic feet per second, of which about 27 per cent flowed through Steamboat Slough and about 24 per cent through Georgiana Slough.

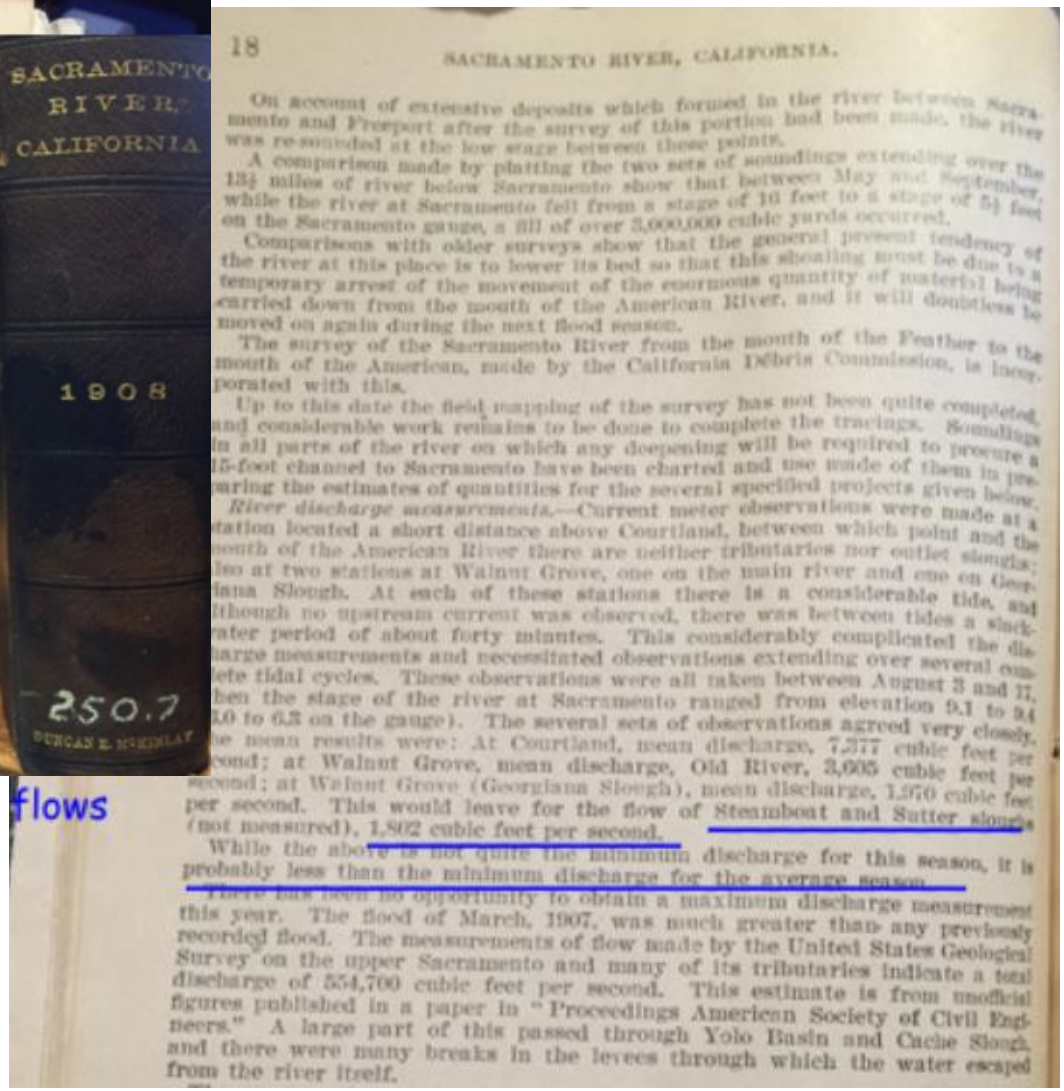
A comparison of this survey with that of the survey of 1895–96 shows that the river is improving as a navigable channel and that it is recovering from the effects of unrestricted hydraulic mining. It is estimated that the river bed for a distance of 14 miles immediately below Sacramento has lowered 2 feet in the past twelve years. The American and the Feather rivers, however, are still full of débris, and the effect of the sand deposits in the American River on the Sacramento River are noticeable for a considerable distance below the mouth of that river, and the fact that these two rivers contain probably more than 500,000,000 cubic yards of fine material, all of which must eventually pass down the Sacramento River to Suisun Bay, must be borne in mind in any consideration of the improvement of this river.

It is estimated that the maximum flood discharge of the river during the flood of March, 1907, if it had been confined to the river channel, would have exceeded 500,000 cubic feet per second. It is seen, therefore, that the minimum low-water discharge is about 1 per cent of the maximum flood discharge.

SACRAMENTO RIVER, CALIFORNIA

1908

250.7



18 SACRAMENTO RIVER, CALIFORNIA.

On account of extensive deposits which formed in the river between Sacramento and Freeport after the survey of this portion had been made, the river was resounded at the low stage between these points.

A comparison made by plotting the two sets of soundings extending over the 13½ miles of river below Sacramento show that between May and September, while the river at Sacramento fell from a stage of 16 feet to a stage of 5½ feet on the Sacramento gauge, a fill of over 3,000,000 cubic yards occurred.

Comparisons with older surveys show that the general present tendency of the river at this place is to lower its bed so that this shoaling must be due to a temporary arrest of the movement of the enormous quantity of material being carried down from the mouth of the American River, and it will doubtless be moved on again during the next flood season.

The survey of the Sacramento River from the mouth of the Feather to the mouth of the American, made by the California Débris Commission, is incorporated with this.

Up to this date the field mapping of the survey has not been quite completed, and considerable work remains to be done to complete the tracings. Soundings in all parts of the river on which any deepening will be required to procure a 15-foot channel to Sacramento have been charted and use made of them in preparing the estimates of quantities for the several specified projects given below.

River discharge measurements.—Current meter observations were made at a station located a short distance above Courtland, between which point and the mouth of the American River there are neither tributaries nor outlet sloughs; also at two stations at Walnut Grove, one on the main river and one on Georgiana Slough. At each of these stations there is a considerable tide, and although no upstream current was observed, there was between tides a slack-water period of about forty minutes. This considerably complicated the discharge measurements and necessitated observations extending over several complete tidal cycles. These observations were all taken between August 3 and 17, when the stage of the river at Sacramento ranged from elevation 9.1 to 9.4 (5.0 to 6.3 on the gauge). The several sets of observations agreed very closely. The mean results were: At Courtland, mean discharge, 7,377 cubic feet per second; at Walnut Grove, mean discharge, Old River, 3,905 cubic feet per second; at Walnut Grove (Georgiana Slough), mean discharge, 1,570 cubic feet per second. This would leave for the flow of Steamboat and Sutter sloughs (not measured), 1,802 cubic feet per second.

While the above is not quite the minimum discharge for this season, it is probably less than the minimum discharge for the average season.

There has been no opportunity to obtain a maximum discharge measurement this year. The flood of March, 1907, was much greater than any previously recorded flood. The measurements of flow made by the United States Geological Survey on the upper Sacramento and many of its tributaries indicate a total discharge of 554,700 cubic feet per second. This estimate is from unofficial figures published in a paper in "Proceedings American Society of Civil Engineers." A large part of this passed through Yolo Basin and Cache Slough, and there were many breaks in the levees through which the water escaped from the river itself.

flows

At the driest time of year of a dry year, the Minimum Sacramento River constant outflow is more than 7,400 cfs, with 27% flow into Steamboat Slough (1,998) and 24% through Georgiana Slough. Or… 7,377 cfs at Courtland, with 1,802 cfs split Between Steamboat and Sutter Sloughs. (fresh water < 1 ppt

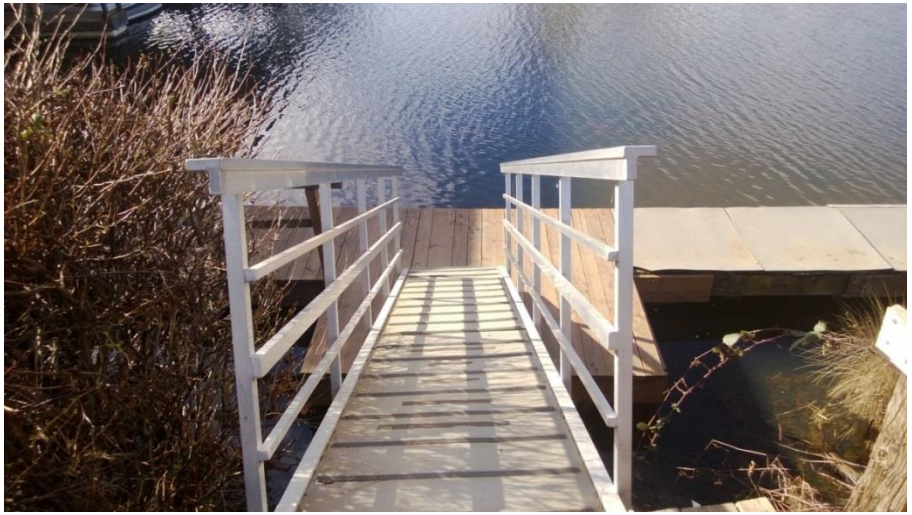
Low flows are also causing problems on Steamboat Slough and operation of WF would suspend us in permanent Drought status for flows, wouldn't it?

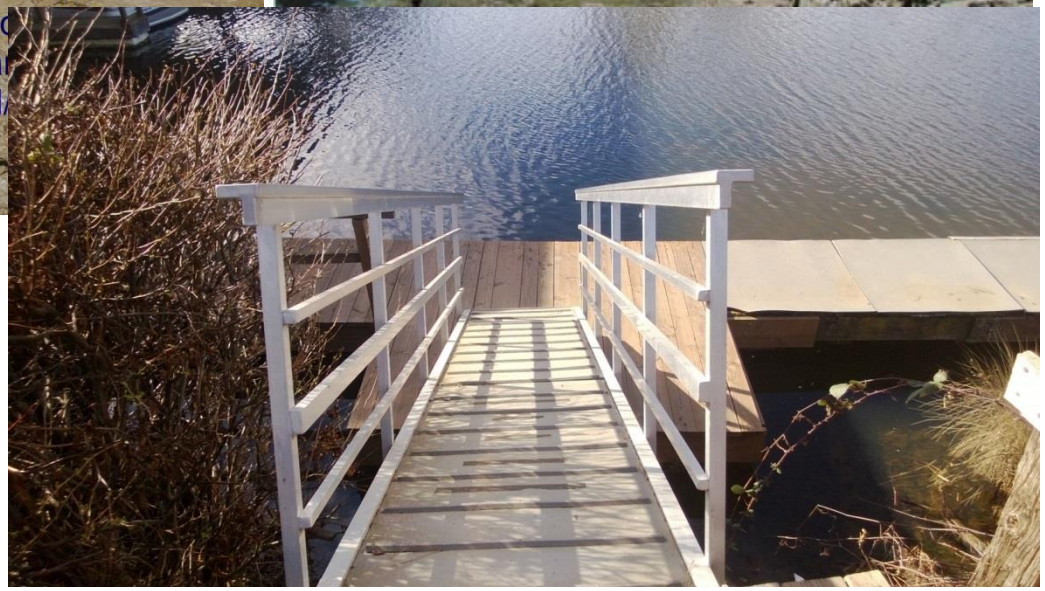
cdec.water.ca.gov/cgi-progs/queryF?SSS&d=26-Mar-2014+18:00

FLOW

Date / Time (PDT)		FLOW CFS
03/26/2014 06:00		3520
03/26/2014 06:15		3690
03/26/2014 06:30		3820
03/26/2014 06:45		3740
03/26/2014 07:00		3640
03/26/2014 07:15		3710
03/26/2014 07:30		3750
03/26/2014 07:45		3660
03/26/2014 08:00		3640
03/26/2014 08:15		3520
03/26/2014 08:30		3260
03/26/2014 08:45		3040
03/26/2014 09:00		2720
03/26/2014 09:15		2270
03/26/2014 09:30		1740
03/26/2014 09:45		1200
03/26/2014 10:00		510
03/26/2014 10:15		-129
03/26/2014 10:30		-842
03/26/2014 10:45		-1770
03/26/2014 11:00	*	-2030
03/26/2014 12:15		-3000
03/26/2014 12:30		-3130
03/26/2014 12:45		-3040
03/26/2014 13:00	*	-3050
03/26/2014 14:15		-2070
03/26/2014 14:30		-1390
03/26/2014 14:45		-588
03/26/2014 15:00		302
03/26/2014 15:15		1260
03/26/2014 15:30		1890
03/26/2014 15:45		2430
03/26/2014 16:00		2860
03/26/2014 16:15		3290
03/26/2014 16:30		3560
03/26/2014 16:45		3690
03/26/2014 17:00		3890
03/26/2014 17:15		3990
03/26/2014 17:30		4120
03/26/2014 17:45		4140
03/26/2014 18:00		4190

Screen print
5/19/15 4:54 am





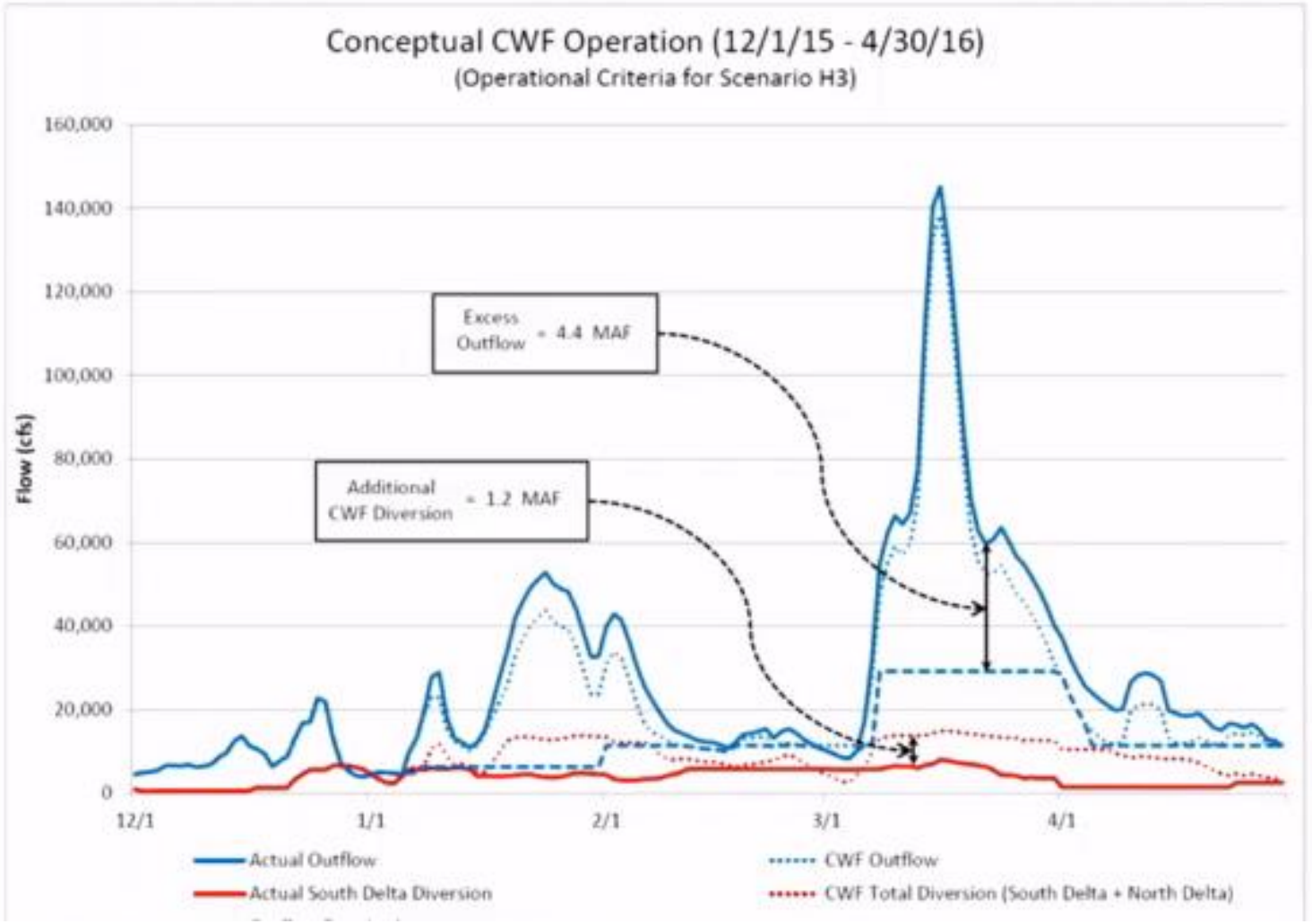
2014 Current Impacts from the low water flows on the Sacramento River into the Delta: dry docking marinas

www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/regulatory_information/stakeholder_advisory_workgroup/2009apr15_advsry_wkgrp_infosession/nitrate_effects_pws_wells.pdf

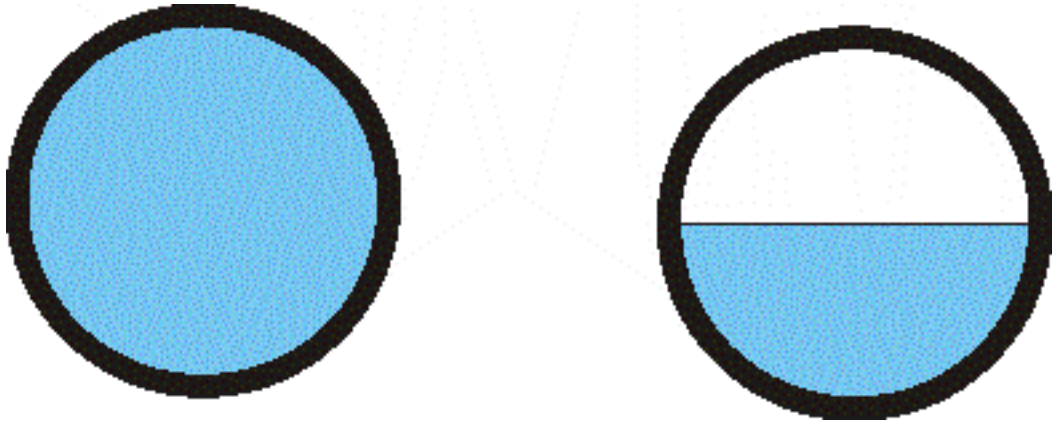
Public Water Systems

- A "public water system" is a system for the provision of piped water to the public (does not refer to ownership of the system)
  - Community water systems serve residential communities with 15 or more service connections
  - Noncommunity water systems serve 25 or more people, 60 or more days per year
    - Nontransient = serves the same population daily (schools, places of business)
    - Transient = serves a changing population (campgrounds, restaurants)
- Public water systems are regulated by CDPH and 35 counties
- "State Small Systems" are communities with 5 to 14 service connections; counties regulate these systems
- Doesn't include agricultural use
- My talk will refer to data from public water system wells

DWR-411



As proposed to be operated, it appears outflow on the Sacramento River below the proposed intakes would be at historic low outflow levels, or basically operating in “drought” conditions permanently. Is that a correct assessment?



Is it your understanding the tunnels are designed to be built side by side, but could instead be installed one on the east side of the Delta and the other on the west side of the Delta?

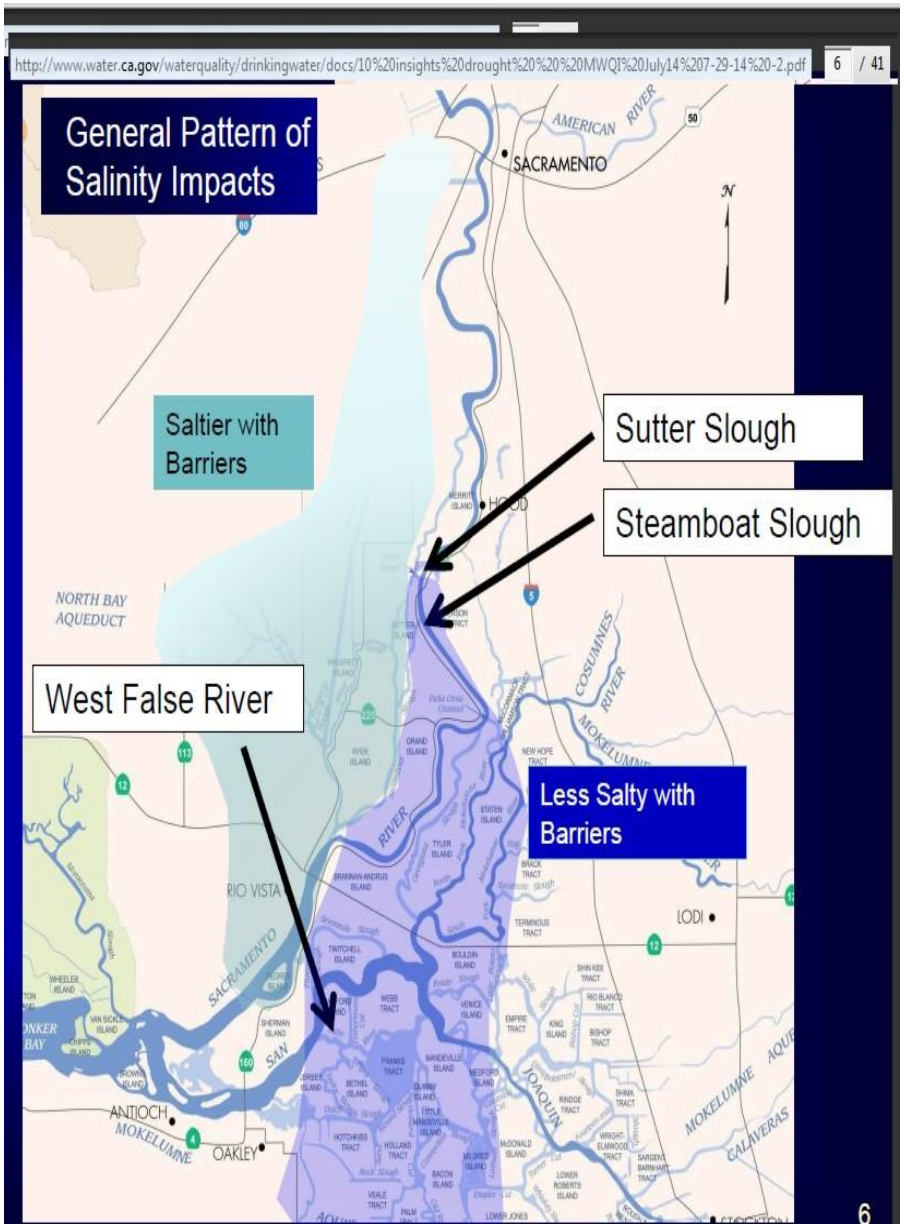
What is the designed volume capacity of each tunnel in cfs and af?
Is the testimony that the goal is to operate to divert 6500 maf during wet season?
Or could tunnels operate at full capacity year round? What are the plans for the extra capacity?

https://www.californiawaterfix.com/docs/dwr_2.pdf

DWR-2

EXISTING WATER DIVERSIONS

- **Total number of effected water rights**
  - Temporarily effected: 10
  - Permanently effected: 5
- **Mitigations for temporarily effected diversions**
  - Provide new groundwater wells
  - Provide alternate water supply from a permitted source



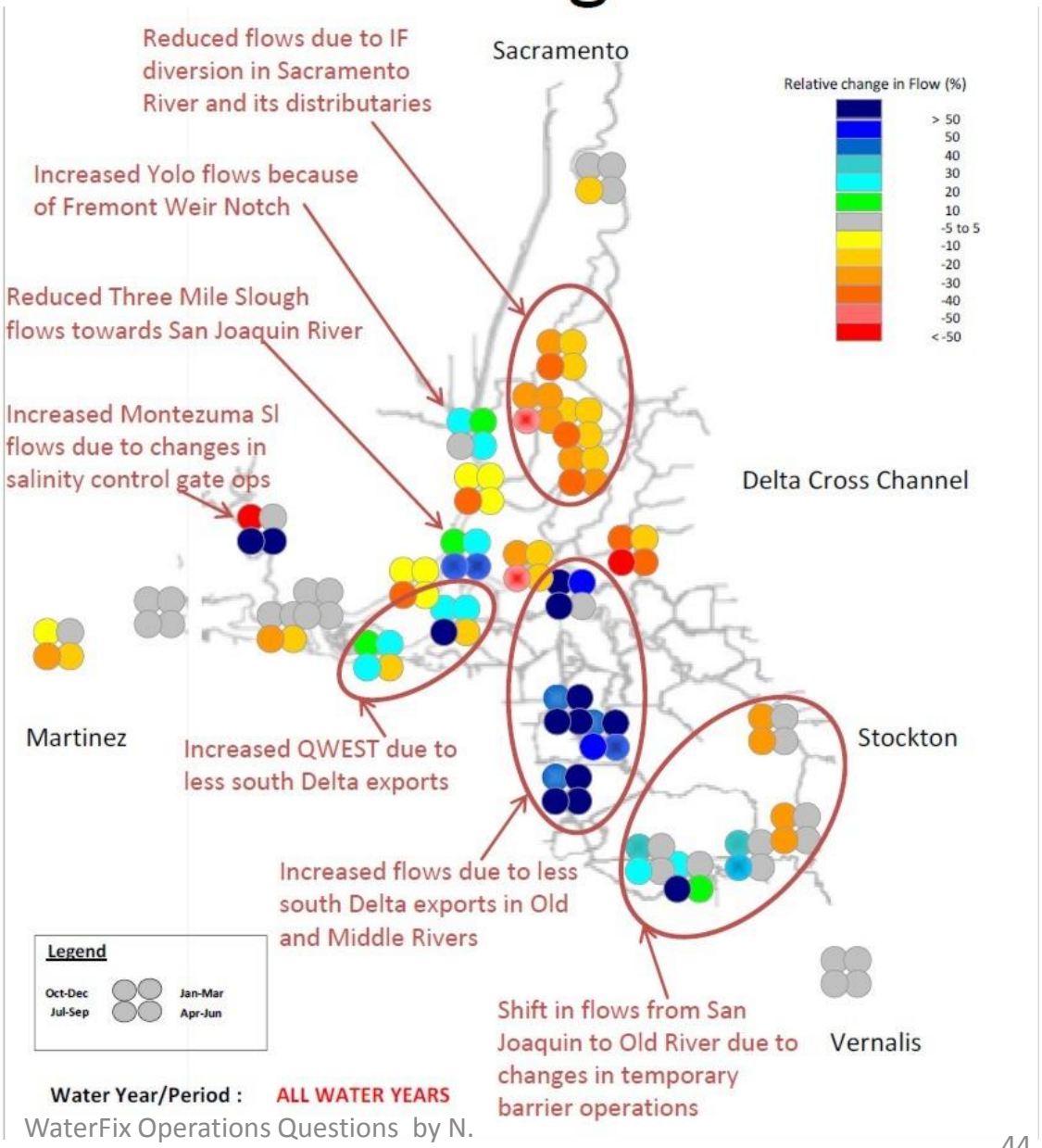
What is the minimum freshwater outflow expected for Steamboat Slough and Sacramento River below the intakes in Dry summer months? Year round? How will project be managed to assure minimum flows to protect freshwater Quality? Adequate flows to maintain water level?

http://baydeltaconservationplan.com/Lists/Calendar/Attachments/112/6.17.10 SC Presentation Modeling Update.pdf

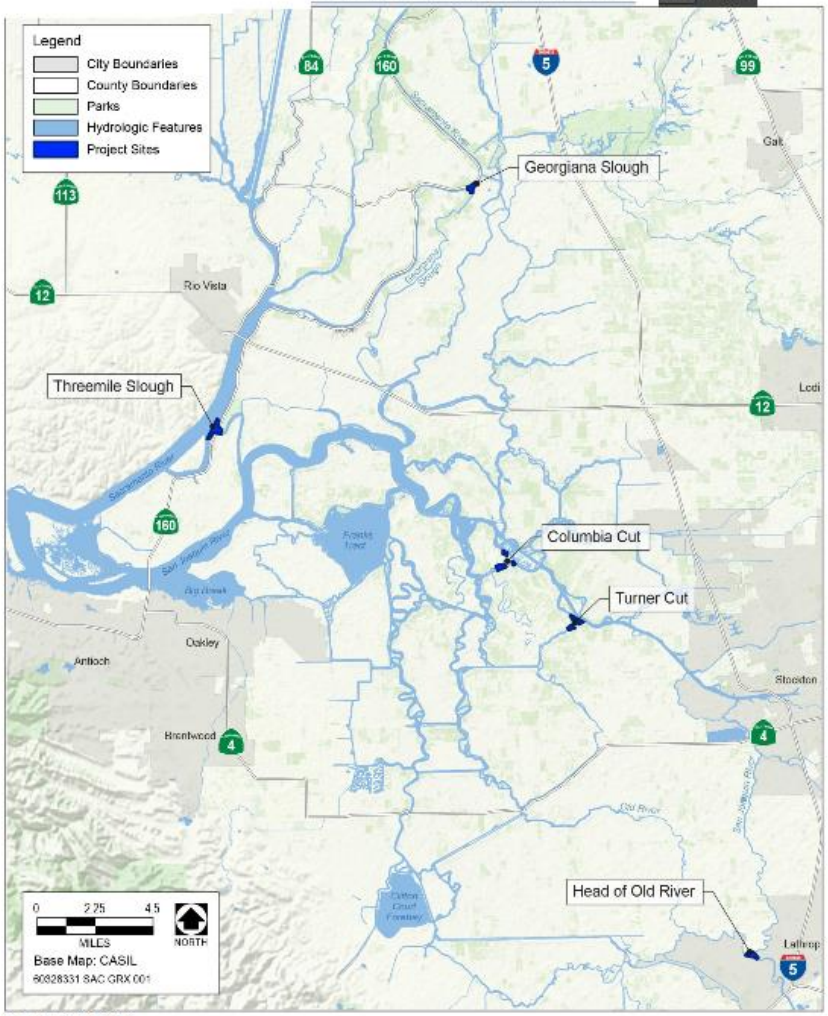
Seasonal Changes in Flow

North Delta waterway impacts: Flows reduced by 20 to 50 percent.
This graphic was used for BDCP Surface conveyance impact estimates.

Since the flow would not go into the central and south but captured into tunnels, it is safe to assume the dark blue dots would be dark red instead, since there would be very little flow left, like 5000 cfs, to split between Sacramento River, Sutter Slough, Steamboat Slough, DCC and Georgiana Slough…unless barriers were installed.



ESS-03 Management Draft_02132015.pdf 24 of 646



Source: AECOM 2014

Figure 1-1. Map of Delta Study Locations

waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/petitioners_exhibit/dwr/dwr_510.pdf

11 of 61

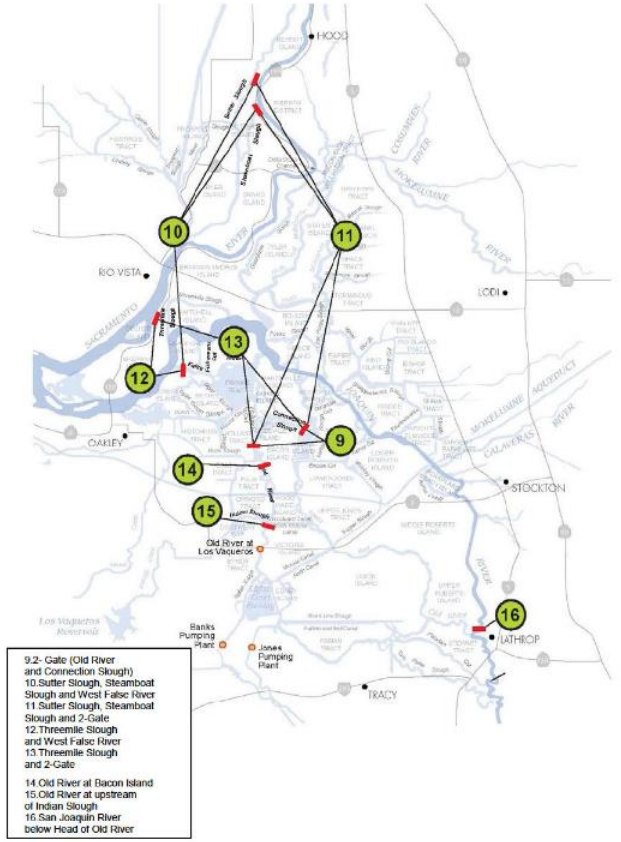
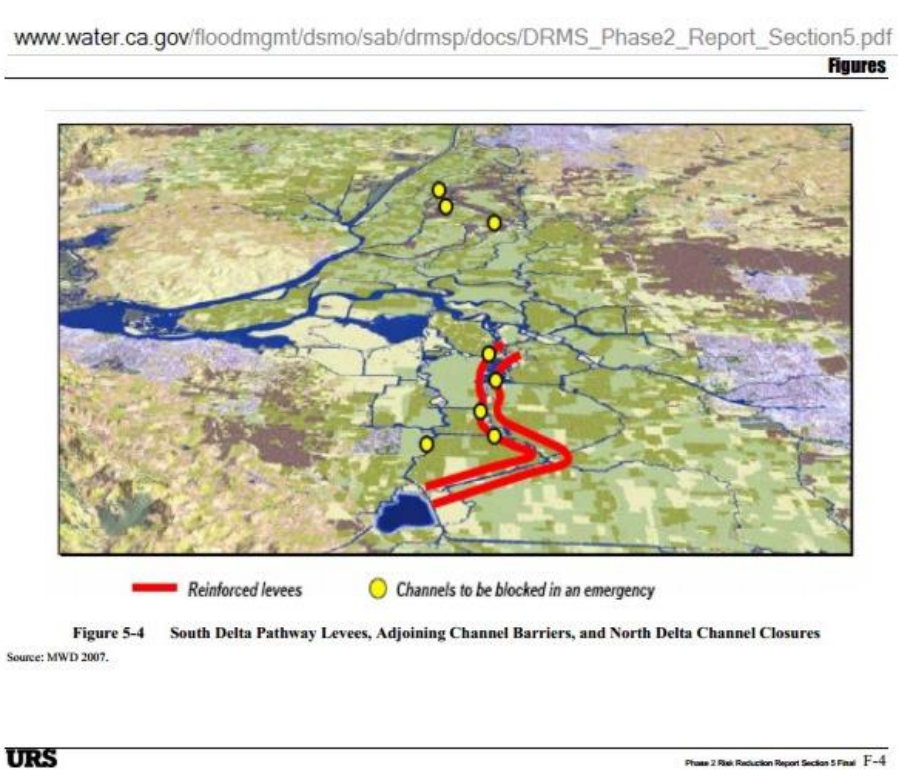


Figure 4-1b Location of Phase 1 Alternatives 9 through 16

http://snugharbor.net/images-2015/barriers/docs/BARRIERStimelinelinks.pdf
http://snugharbor.net/images-2015/barriers/docs/Historical%20review%20of%20proposed%20Barriers.pdf

More engineering questions on the physical construction projects and DWR 510:



* Do you anticipate the need for other barriers in the Delta during construction of the tunnels?
* If construction causes levee failures, what is the contingency plan to halt flooding of affected islands? (flooding impacts quality of drinking water wells)
* If construction causes flooding of areas upriver of the intakes, due to the coffer dams, what is the contingency plan?
* If construction causes flooding of areas downriver of the intakes, due to the coffer dams, what is the contingency plan?

www.water.ca.gov/floodsafe/fessro/levees/drms/docs/DRMS_Phase2_Report_Section21.pdf 6 of 11

Miller, Robin L. 2007. Personal communication from Robin L. Miller to Jeannie Stamberger, URS.

Miller, Robin L., Lauren Hastings, and Roger Fujii. N.d. *Hydrologic treatments affect gaseous carbon loss from organic soils, Twitchell Island, California, October 1995–December 1997*. U.S. Geological Survey Water Resources Investigations Report 00-4042.

Mitsch, W.J., and J.G. Gosselink. 1993. *Wetlands*. (2nd ed.). New York: Van Nostrand Reinhold.

Moffatt & Nichol. 2007. *Levee repair, channel barriers, and transfer facilities concept analyses*. Moffatt & Nichol Memorandum Report. Prepared for the Metropolitan Water District of Southern California. Task Order 4 to Support Emergency Preparation Planning. Draft. August 3.

Moyle, P.B. 2002. *Inland fishes of California*. (revised and expanded). Berkeley: University of California Press. 502 pp.

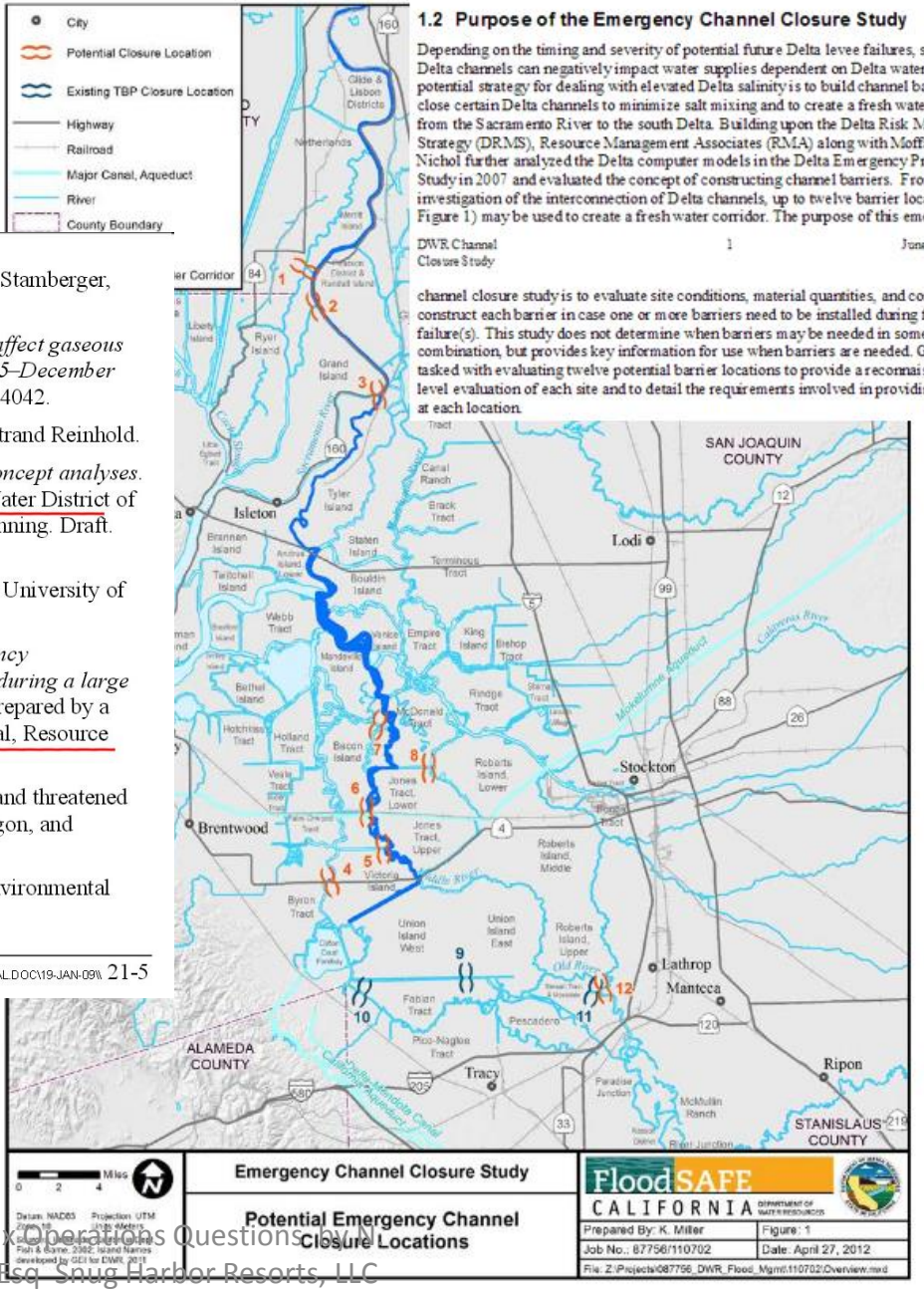
MWD (Metropolitan Water District of Southern California). 2007. *Delta emergency preparedness: A feasibility plan for protecting the State's water supplies during a large earthquake causing the catastrophic collapse of multiple Delta islands*. Prepared by a team including Hultgren-Tillis Engineers, Washington Group International, Resource Management Associates, and Moffat & Nichol. February 2007.

NOAA (National Oceanic and Atmospheric Administration). 1998. Endangered and threatened species: Threatened status for two ESUs of steelhead in Washington, Oregon, and California. *Federal Register* 63(53):13347–13371 (March 19).

Nobriga, M. 2002. Larval delta smelt diet composition and feeding incidence: Environmental and ontogenetic influences. *California Fish and Game* 88:149–164.

Figure 1 Potential Emergency Channel Closure Locations

FINAL-June2012.pdf



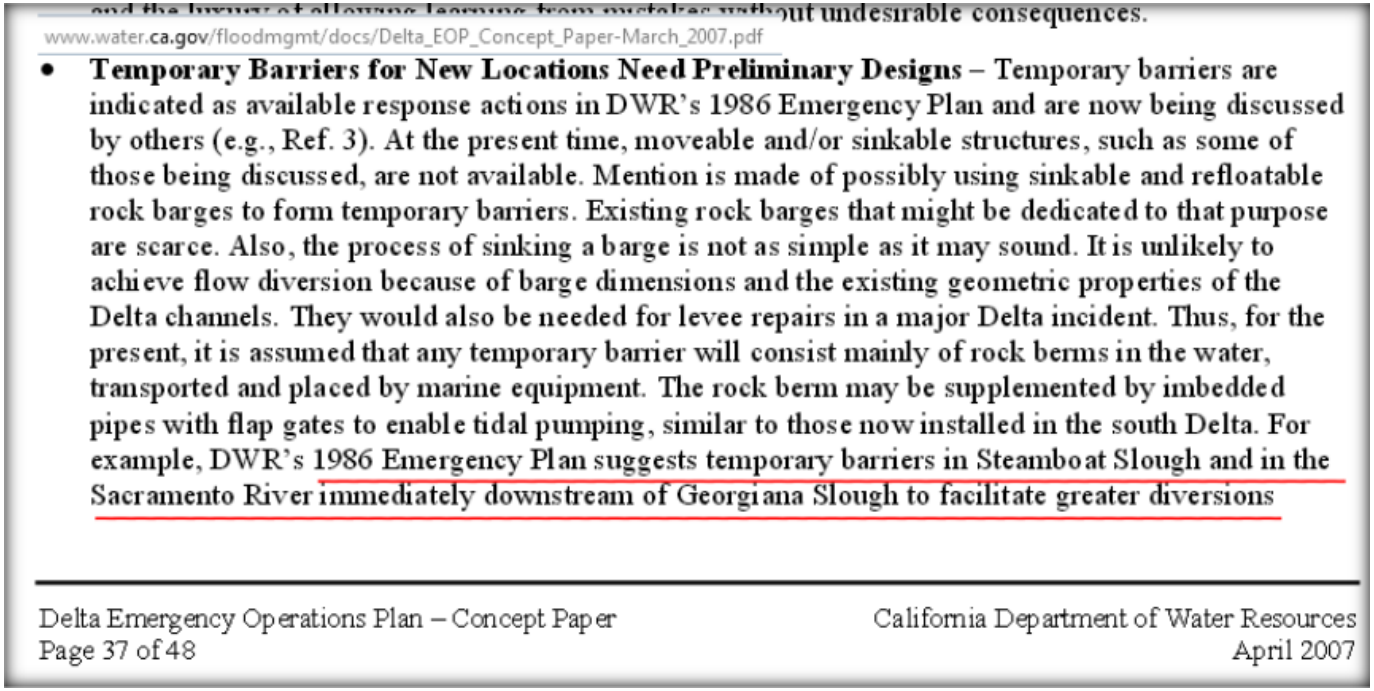
1.2 Purpose of the Emergency Channel Closure Study

Depending on the timing and severity of potential future Delta levee failures, salinity in Delta channels can negatively impact water supplies dependent on Delta water. One potential strategy for dealing with elevated Delta salinity is to build channel barriers to close certain Delta channels to minimize salt mixing and to create a fresh water corridor from the Sacramento River to the south Delta. Building upon the Delta Risk Management Strategy (DRMS), Resource Management Associates (RMA) along with Moffatt and Nichol further analyzed the Delta computer models in the Delta Emergency Preparedness Study in 2007 and evaluated the concept of constructing channel barriers. From investigation of the interconnection of Delta channels, up to twelve barrier locations (see Figure 1) may be used to create a fresh water corridor. The purpose of this emergency

channel closure study is to evaluate site conditions, material quantities, and costs to construct each barrier in case one or more barriers need to be installed during future levee failure(s). This study does not determine when barriers may be needed in some combination, but provides key information for use when barriers are needed. GEI was tasked with evaluating twelve potential barrier locations to provide a reconnaissance-level evaluation of each site and to detail the requirements involved in providing closure at each location.

Emergency Preparedness Plan www.mwdh2o.com/mwdh2o/pages/about/AR/AR11/Chapter-2.pdf

Working in a lead role with the contractors for the State Water Project and Central Valley Project, Metropolitan continued to facilitate and expedite plans for stockpiling material in the Delta region. In the event of a major earthquake in the Delta, these stockpiles would be used to create an emergency freshwater pathway in order to export water supplies.



and the luxury of allowing learning from mistakes without undesirable consequences.

www.water.ca.gov/floodmgmt/docs/Delta_EOP_Concept_Paper-March_2007.pdf

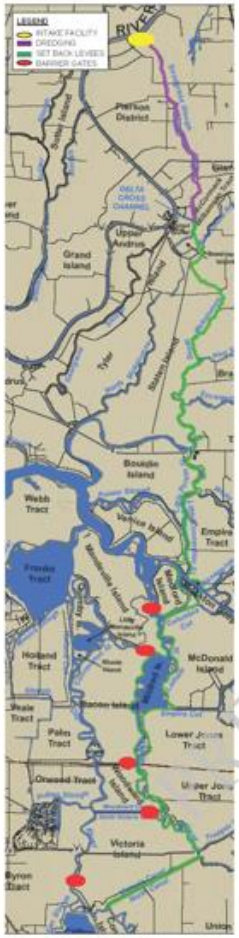
- **Temporary Barriers for New Locations Need Preliminary Designs** – Temporary barriers are indicated as available response actions in DWR's 1986 Emergency Plan and are now being discussed by others (e.g., Ref. 3). At the present time, moveable and/or sinkable structures, such as some of those being discussed, are not available. Mention is made of possibly using sinkable and refloatable rock barges to form temporary barriers. Existing rock barges that might be dedicated to that purpose are scarce. Also, the process of sinking a barge is not as simple as it may sound. It is unlikely to achieve flow diversion because of barge dimensions and the existing geometric properties of the Delta channels. They would also be needed for levee repairs in a major Delta incident. Thus, for the present, it is assumed that any temporary barrier will consist mainly of rock berms in the water, transported and placed by marine equipment. The rock berm may be supplemented by imbedded pipes with flap gates to enable tidal pumping, similar to those now installed in the south Delta. For example, DWR's 1986 Emergency Plan suggests temporary barriers in Steamboat Slough and in the Sacramento River immediately downstream of Georgiana Slough to facilitate greater diversions

Delta Emergency Operations Plan – Concept Paper
Page 37 of 48

California Department of Water Resources
April 2007

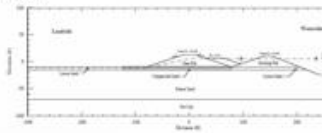
http://snugharbor.net/images-2015/barriers/comments/OpposeBarriersMarch172015.pdf

2006

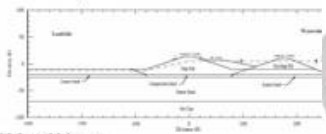


Typical Cross Sections

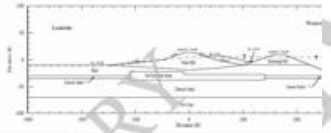
(1) No peat

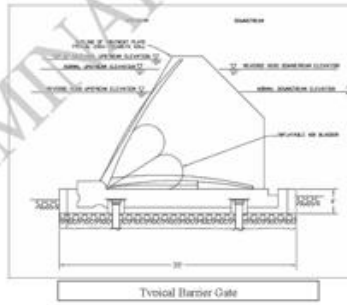


(2) 10-foot-thick peat



(3) 20-foot-thick peat





Typical Barrier Gate

PROJECT INFORMATION
- Capacity = 15,000 cfs
- Corridor Length = 48 miles
- Set Back Levees = 115 miles
- Barrier Gates = 5

PROJECT BENEFITS
- Keeps Salinity Levels Low
- Maintains Water Quality
- Maintains Water Supply Reliability
- Protects Agricultural Areas Adjacent to Improved Levees
- Fish Screens Protect Fish
- Increases Habitat Area in Riparian Zones
- Seismic Resistant Levees

AVOIDED ECONOMIC COSTS DUE TO LOSS OF WATER EXPORTS
- Delta Agriculture Losses Due to Water Quality Degradation $40M
- Losses Due to Water Supply Disruption to Agriculture = $139M
- Losses Due to Water Supply Disruption to Urban Water Users = $16.4B

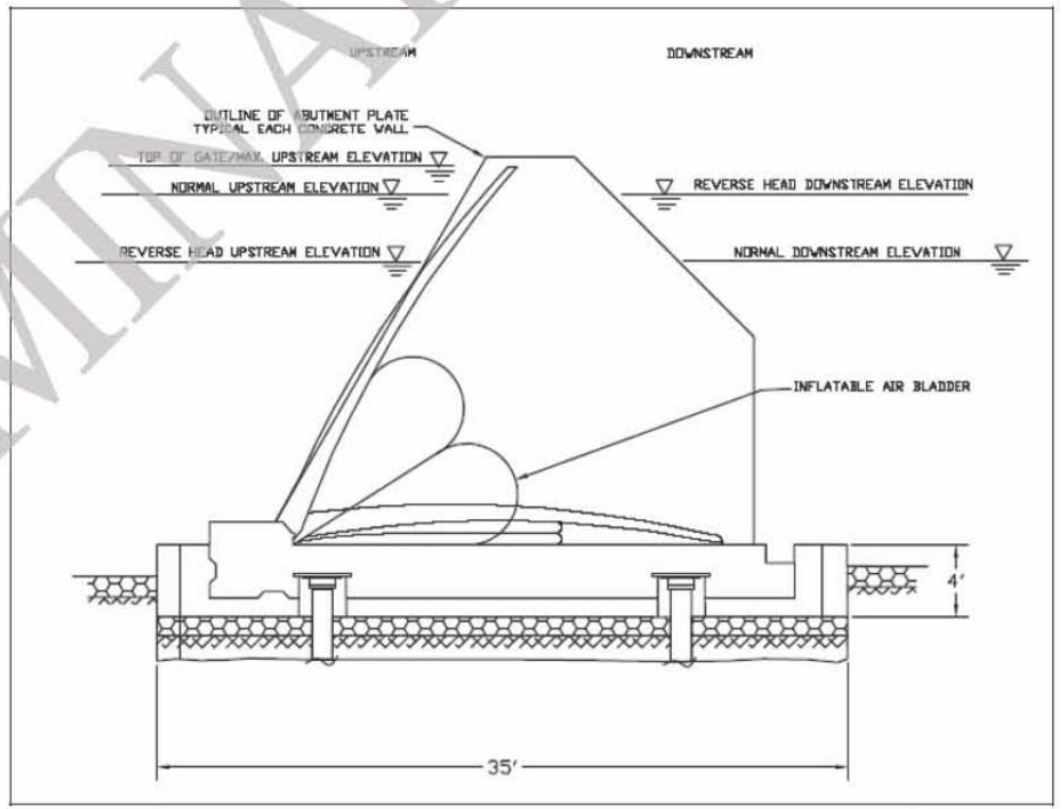
AVOIDED ECONOMIC IMPACTS DUE TO REDUCED WATER SUPPLIES
- Agricultural Water Users Impact = $10.3B
- Urban Water users Impact = $277B

PROJECT COST
(15,000 CFS) = $9.8B

URS

Delta Risk Management Strategy (DRMS) Phase 2

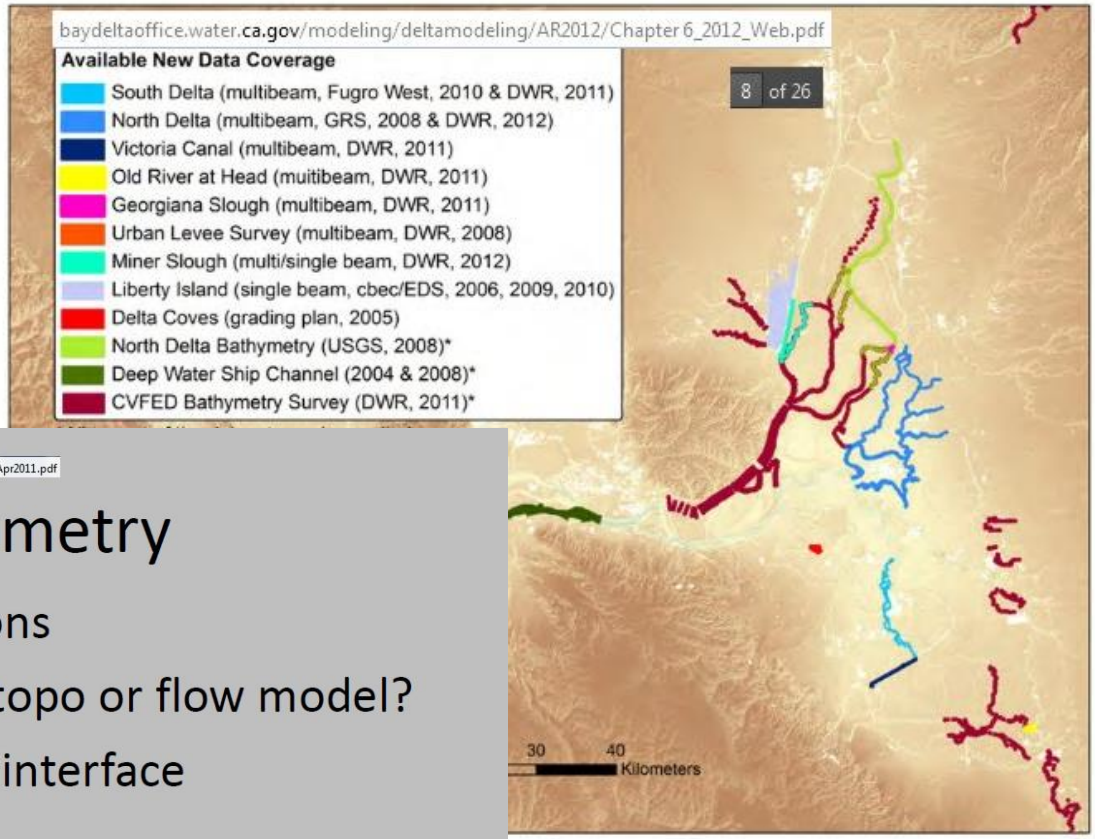
BUILDING BLOCK 1.6: ARMORED PATHWAY THROUGH DELTA CONVEYANCE



Typical Barrier Gate

PRELIMINARY

Delta Simulation Model (DSM2), is assumed by DWR & DOI to simulate hydrodynamic conditions in the Delta.



http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/DSM2UsersGroup/REALM_Bathymetry_27Apr2011.pdf

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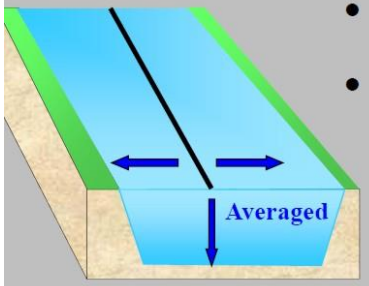
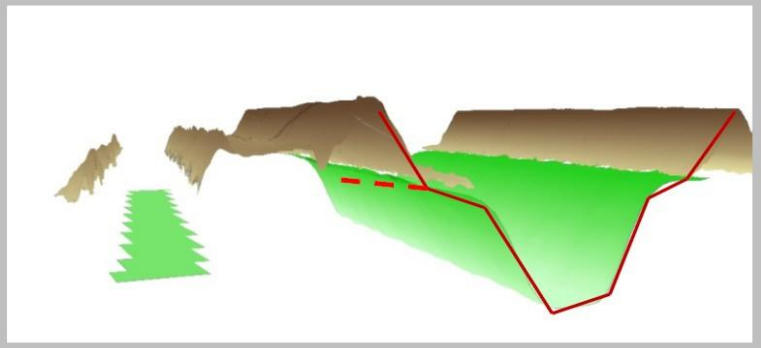
DSM2 geometry

- Cross-sections
- Geometry: topo or flow model?
- Land-water interface

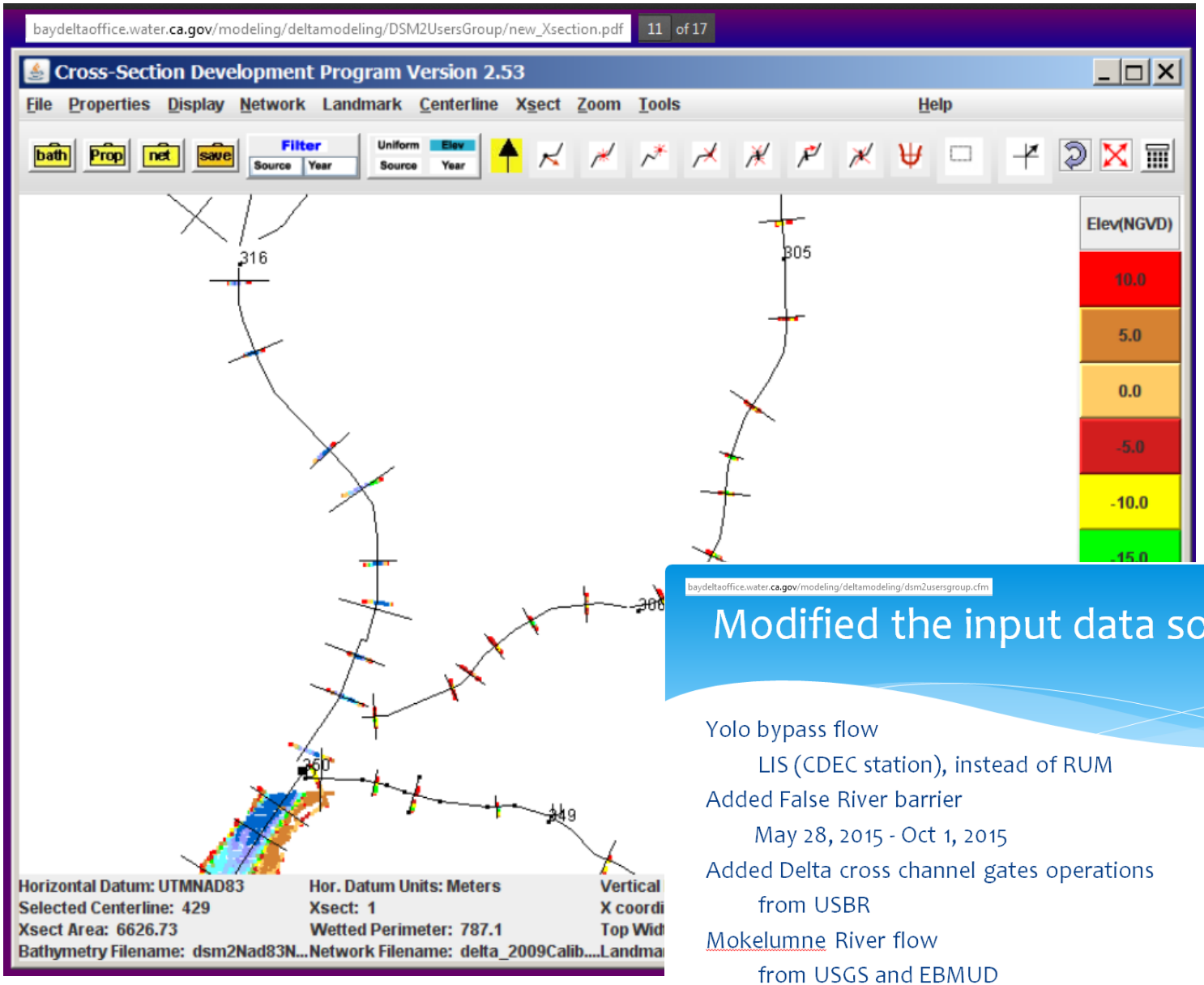




ta:

11)	(Mayr, 2011), (Fugro West, Inc., 2008)
	(GRS, 2008), Mayr, 2011-2010
	(Mayr, 2011)
	Mayr, 2011-2012
	Mayr, 2011-2012
	(Fugro West, Inc., 2008)
	Mayr, 2011-2012
0)	(EDS, 2006), (EDS, 2009), (Campbell, 2012)
	(Ruggeri-Jensen-Azar & Associates, 2005)
	(USGS, 2008)
	(Towill, Inc., 2009)
	(HDR, 2011); (PBS&J, An Atkins Company, 2010)

Figure 6-3 Data Sources Being Added for Version 2.0 of Elevation Model



baydeltaoffice.water.ca.gov/modeling/deltamodeling/dsm2usersgroup.cfm

Modified the input data sources

Yolo bypass flow
- LIS (CDEC station), instead of RUM

Added False River barrier
- May 28, 2015 - Oct 1, 2015

Added Delta cross channel gates operations
- from USBR

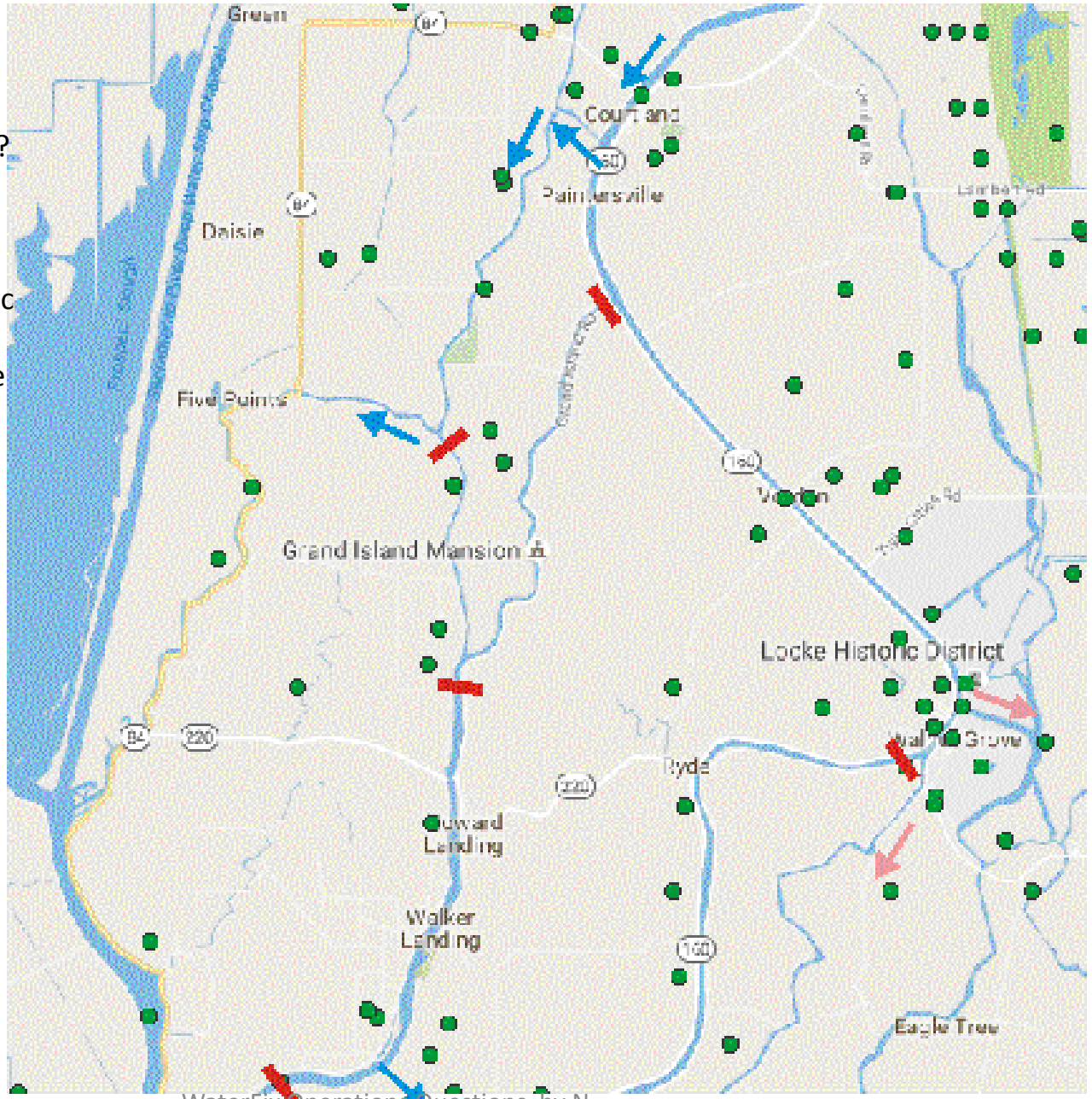
Mokelumne River flow
- from USGS and EBMUD

Precipitation at Lodi
- from NCDC

2016 updates

USBR or DWR aware of:

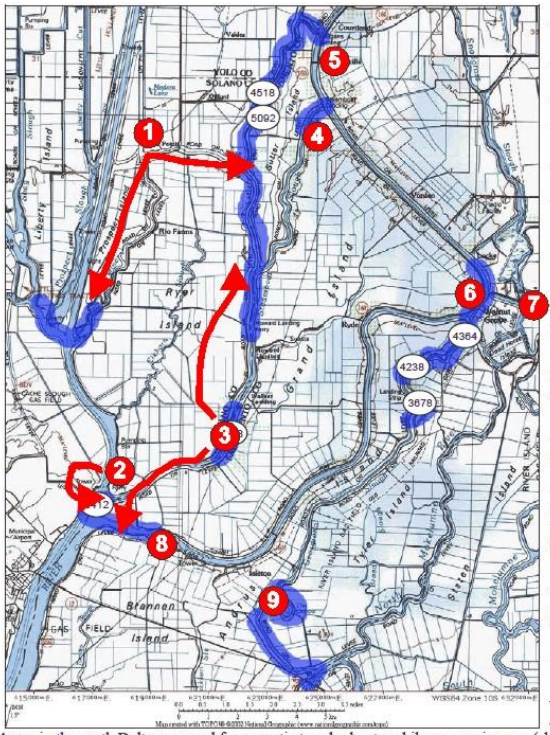
- Physical flow barriers?
- Siphons below surface?
- Flow diversion structures?
- Dredging to facilitate gravity flow in a specific direction?
- Air blowers to facilitate alteration of normal flow direction?
- 6'+ foot diameter twin pipes siphoning water from Cache Slough under Ryer Island, under Steamboat Slough on southeast?



.ca.gov/ndelta/TDF/documents/NorthDeltaSalmonMigration PilotStudy Report.pdf

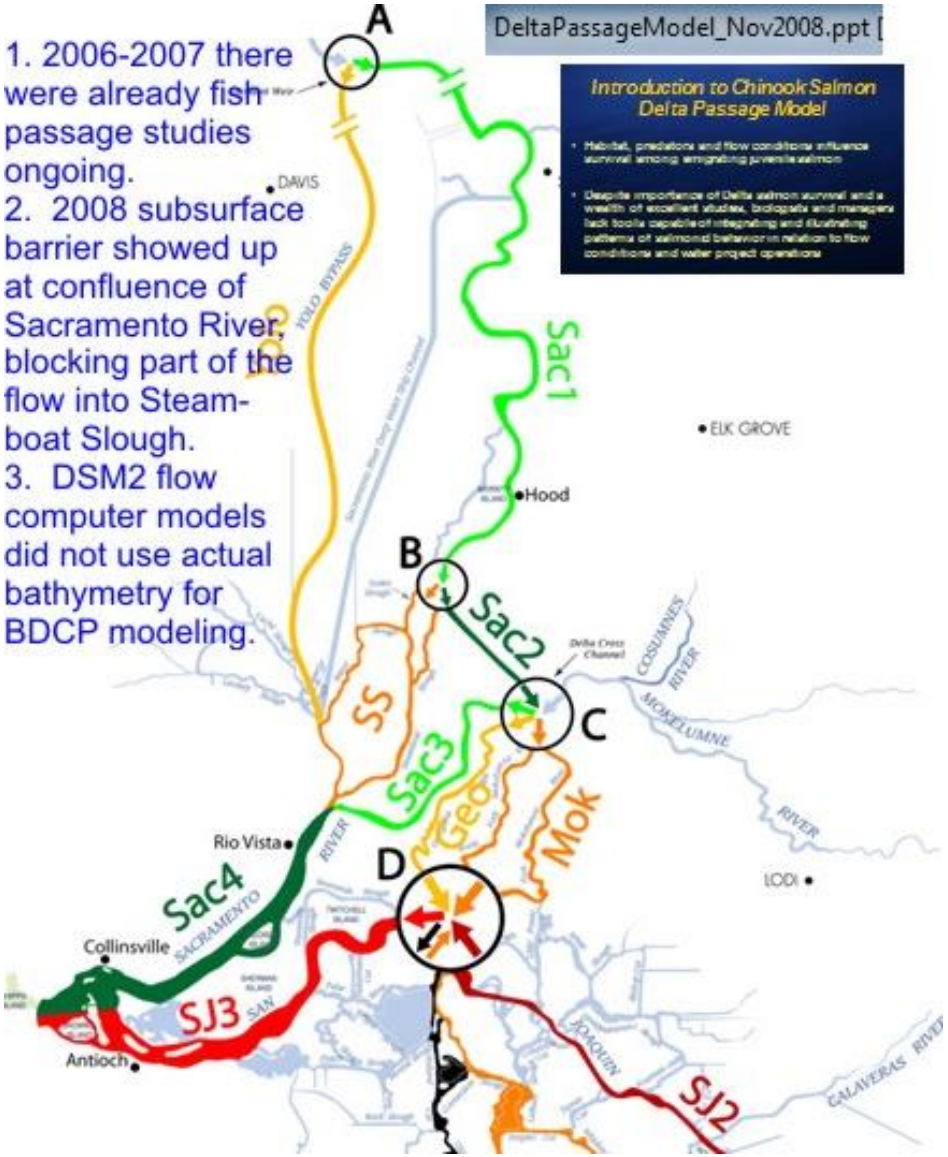
The map below was copied from the 2006-2007 Salmon Migration study. The dark blue areas indicate where tagged salmon smolt that had been released up towards Sacramento were found dead. The scientists assume the salmon died due to preditors, naming stripped bass specifically. We added in the locations of the local marinas which usually have many angler-customers in December and January. Interesting pattern, isn't it?

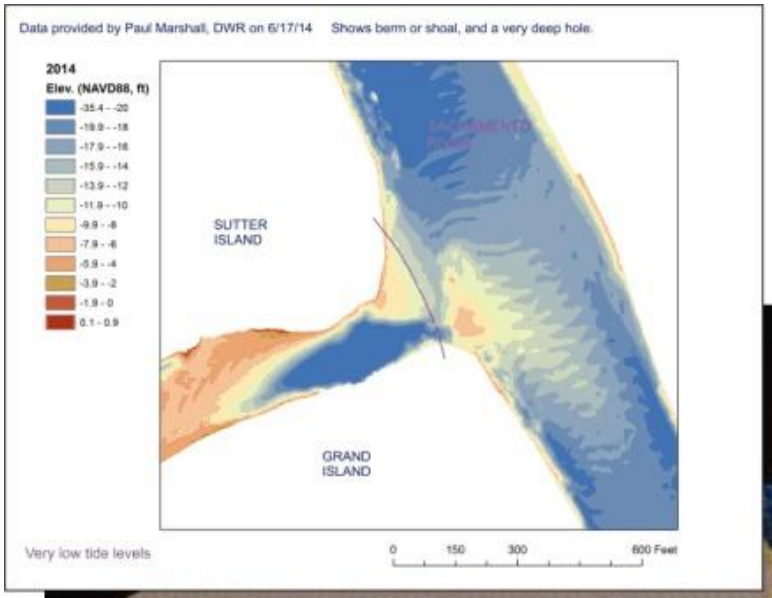
were located at stationary positions which were assumed to be where predatory fish may have defecated acoustic tags after consuming the juvenile salmon. Sites where tagged fish may have been eaten by a predator could not be determined; the data only show where a dead acoustic-tagged salmon or a defecated tag was detected.



1. Arrowhead Marina 2. Hidden Harbor 3. Snug Harbor-many anglers here due to all-weather accomodations and dock access for fishing on Steamboat Slough 4. Steamboat Landing 5. Courtland Docks area 6. Marinas of Walnut Grove on the Sacramento River 7. Walnut Grove Marina on Mukolmne with access to Sacramento River when the DCC gates are open 8. Vierra's is another marina with many anglers year round due to all-weather accomodations and the mobile home community at the location 9. Oxbow Marina-another marina with a mobile home community and year round angler activity

Figure 18. Areas in the north Delta surveyed for acoustic tags by boat mobile reconnaissance (shaded in blue) and locations of acoustic tags and tag codes found during the survey.

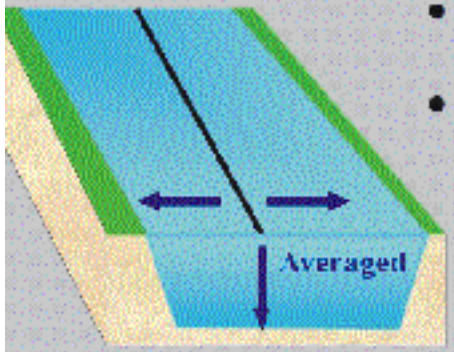


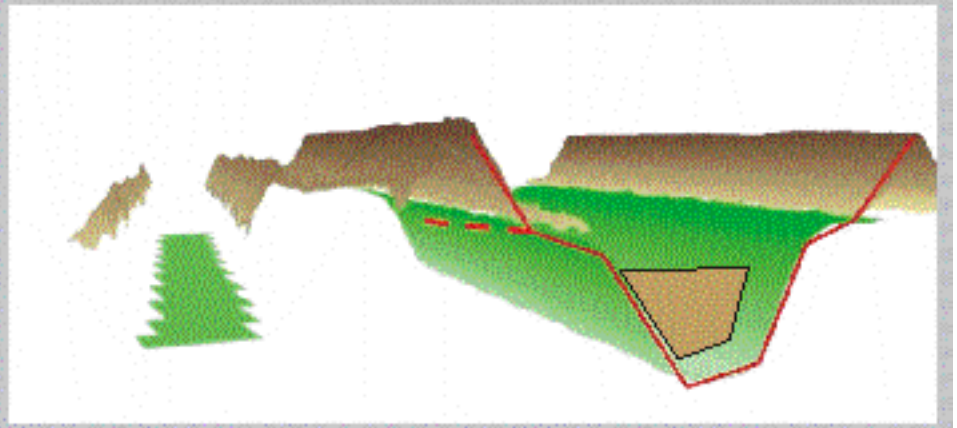


Bathymetery data provided by Paul Marshall from DWR was converted to 3D model to help the viewer understand exactly where and what "the obstruction" is at the head of Steamboat Slough. Despite Mr. Marshall's assertion the shoal is "naturally occuring" the steepness of the underwater walls shown in the sonar views, and the fact an underwater camera showed rock piles indicates this "obstruction" is something other than naturally occuring, at least when the obstruction was first installed.

DSM2 geometry

- Cross-sections
- Geometry: topo or flow model?
- Land-water interface





If conveyance project were built, is it your understanding that the design of the project is based on a plan To leave no more than 4500 cfs Delta outflow on the combined rivers of Sacramento and San Joaquin during The summer months of July, August September?

www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/petitioners_exhibit/dwr/dwr_5_errata.pdf

DELTA OUTFLOW ASSUMPTIONS

NAA and H3 (D-1641 and BiOps)

	W	AN	BN	D	C
Oct	4000/Fall X2	4000/Fall X2	4000	4000	3000
Nov	4500/Fall X2	4500/Fall X2	4500	4500	3500
Dec	4500	4500	4500	4500	3500
Jan	4500	4500	4500	4500	4500
Feb	4000	4000	4000	4000	4000
Mar	4000	4000	4000	4000	4000
Apr	4000	4000	4000	4000	4000
May	4000	4000	4000	4000	4000
Jun	4000	4000	4000	4000	4000
Jul	8000	8000	6500	5000	4000
Aug	4000	4000	4000	3500	3000
Sep	3000/Fall X2	3000/Fall X2	3000	3000	3000

- D-1641 Feb – Jun X2
- USFWS BiOp Fall X2 in W (74 km), AN (81 km) years

Boundary 2

	W	AN	BN	D	C
Oct	11400	11400	7100	7100	7100
Nov	11400	11400	7100	7100	7100
Dec	11400	11400	11400	11400	11400
Jan	35000	35000	35000	35000	35000
Feb	35000	35000	35000	35000	35000
Mar	44500	44500	44500	25000	25000
Apr	44500	44500	44500	25000	25000
May	44500	44500	44500	25000	25000
Jun	11400	11400	7100	7100	7100
Jul	7100	7100	7100	7100	7100
Aug	7100	7100	7100	7100	7100
Sep	11400	11400	7100	7100	7100

- Greater of D-1641/BiOps, or above
- Delta outflow goals above current regulatory requirements achieved through Delta export curtailments
- Upstream releases allowed in Jul – Sep months in all water year types, except Critical.

North Delta Diversion Bypass Flows

These parameters are for modeling purposes. Actual operations will be based on real-time monitoring of hydrologic conditions and fish presence/movement

Low-Level Pumping (Dec-Jun)

Diversions of up to 6% of total Sacramento River flow such that bypass flow never falls below 5,000 cfs. No more than 300 cfs can be diverted at any one intake.

Initial Pulse Protection

Low level pumping will be maintained through the initial pulse period. For modeling, the initiation of the pulse is defined by the following criteria: (1) Sacramento River flow at Wilkins Slough increasing by more than 45% within a five-day period and (2) flow on the fifth day greater than 12,000 cfs.

The pulse (and low-level pumping) continues until either (1) Sacramento River flow at Wilkins Slough returns to pre-pulse flow level (flow on first day of pulse period), or (2) Sacramento River flow at Wilkins Slough decreases for 5 consecutive days, or (3) Sacramento River flow at Wilkins Slough is greater than 20,000 cfs for 10 consecutive days.

After pulse period has ended, operations will return to the bypass flow table (Sub-Table A).

If the initial pulse period begins and ends before Dec 1st in the modeling, then any second pulse that may occur before the end of June will receive the same protection, i.e., low level pumping.

Post-Pulse Operations

After initial pulse(s), allowable diversion will go to Level I Post-Pulse Operations (see Sub-Table A) until 15 total days of bypass flows above 20,000 cfs occur. Then allowable diversion will go to the Level II Post-Pulse Operations until 30 total days of bypass flows above 20,000 cfs occur. Then allowable diversion will go to the Level III Post-Pulse Operations.

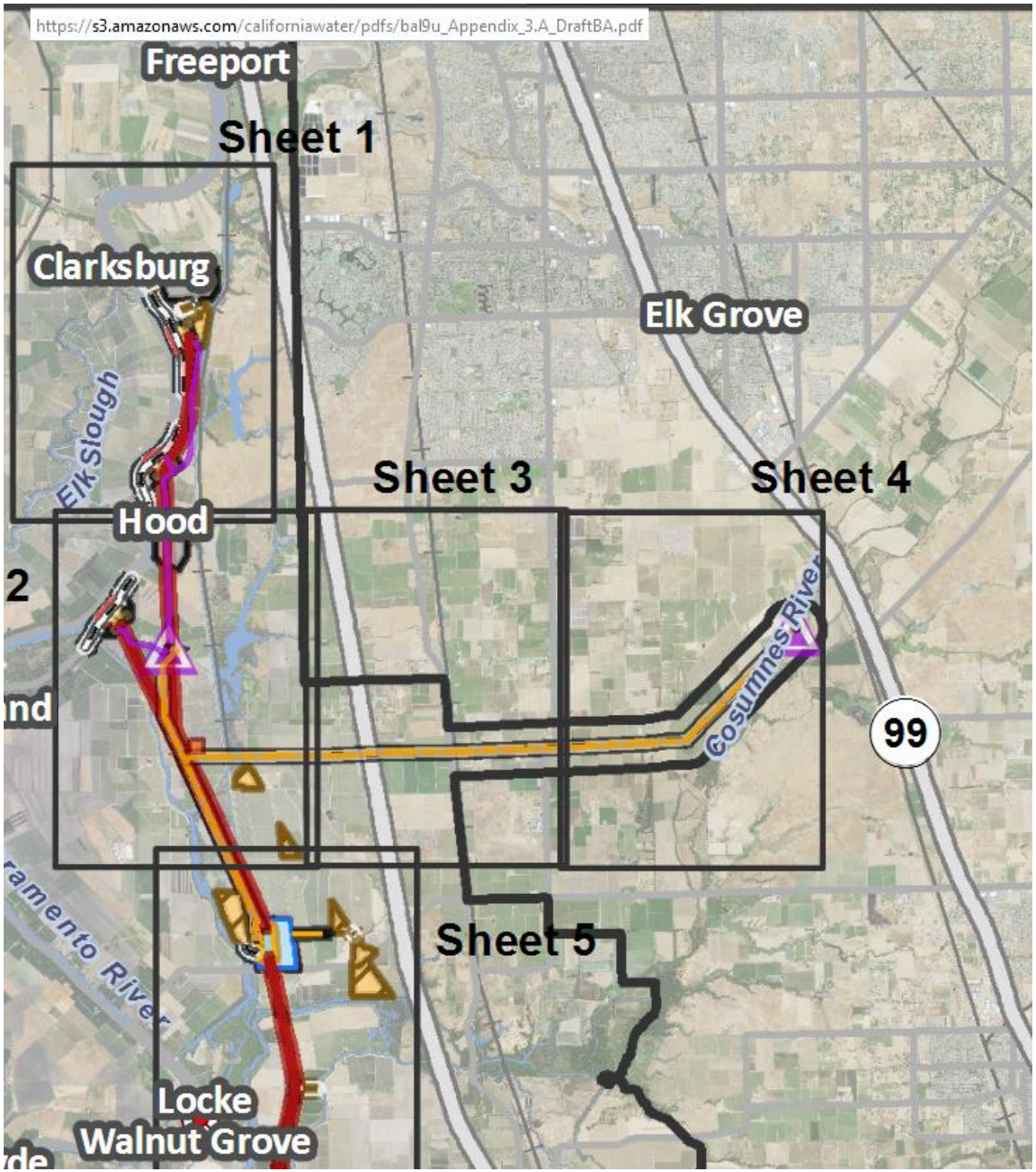
Sub-Table A. Post-Pulse Operations for North Delta Diversion Bypass Flows

Implement following bypass flow requirements sufficient to minimize any increase in the upstream tidal transport at two points of control: (1) Sacramento River upstream of Sutter Slough and (2) Sacramento River downstream of Georgiana Slough. These points are used to minimize any increase in upstream transport toward the proposed intakes or into Georgiana Slough. Allowable diversion will be greater of the low-level pumping or the diversion allowed by the following bypass flow rules.

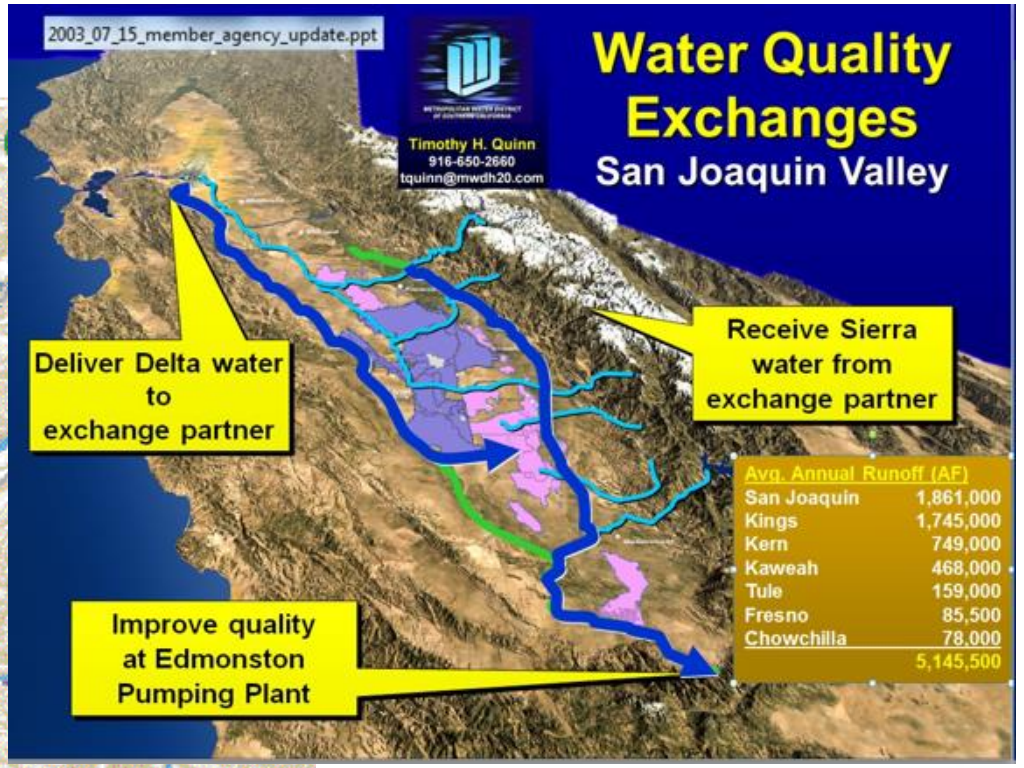
Level I Post-Pulse Operations			Level II Post-Pulse Operations			Level III Post Pulse Operations		
If Sacramento River flow is over...	**But not over...**	**The bypass is...**	**If Sacramento River flow is over...**	**But not over...**	**The bypass is...**	**If Sacramento River flow is over...**	**But not over...**	**The bypass is...**
Dec–Apr								
0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	15,000 cfs	Flows remaining after constant low level pumping	5,000 cfs	11,000 cfs	Flows remaining after constant low level pumping	5,000 cfs	9,000 cfs	Flows remaining after constant low level pumping
15,000 cfs	17,000 cfs	15,000 cfs plus 80% of the amount over 15,000 cfs	11,000 cfs	15,000 cfs	11,000 cfs plus 60% of the amount over 11,000 cfs	9,000 cfs	15,000 cfs	9,000 cfs plus 50% of the amount over 9,000 cfs

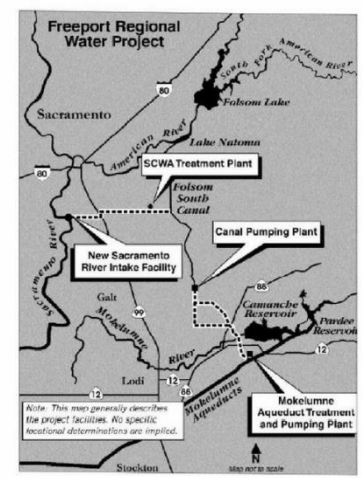
http://cms.capitoltechsolutions.com/ClientData/CaliforniaWaterFix/uploads/FIX_BA_TOC_Rev.pdf

https://s3.amazonaws.com/californiawater/pdfs/vc9f9_Ch_3_Proposed_Action_DraftBA.pdf

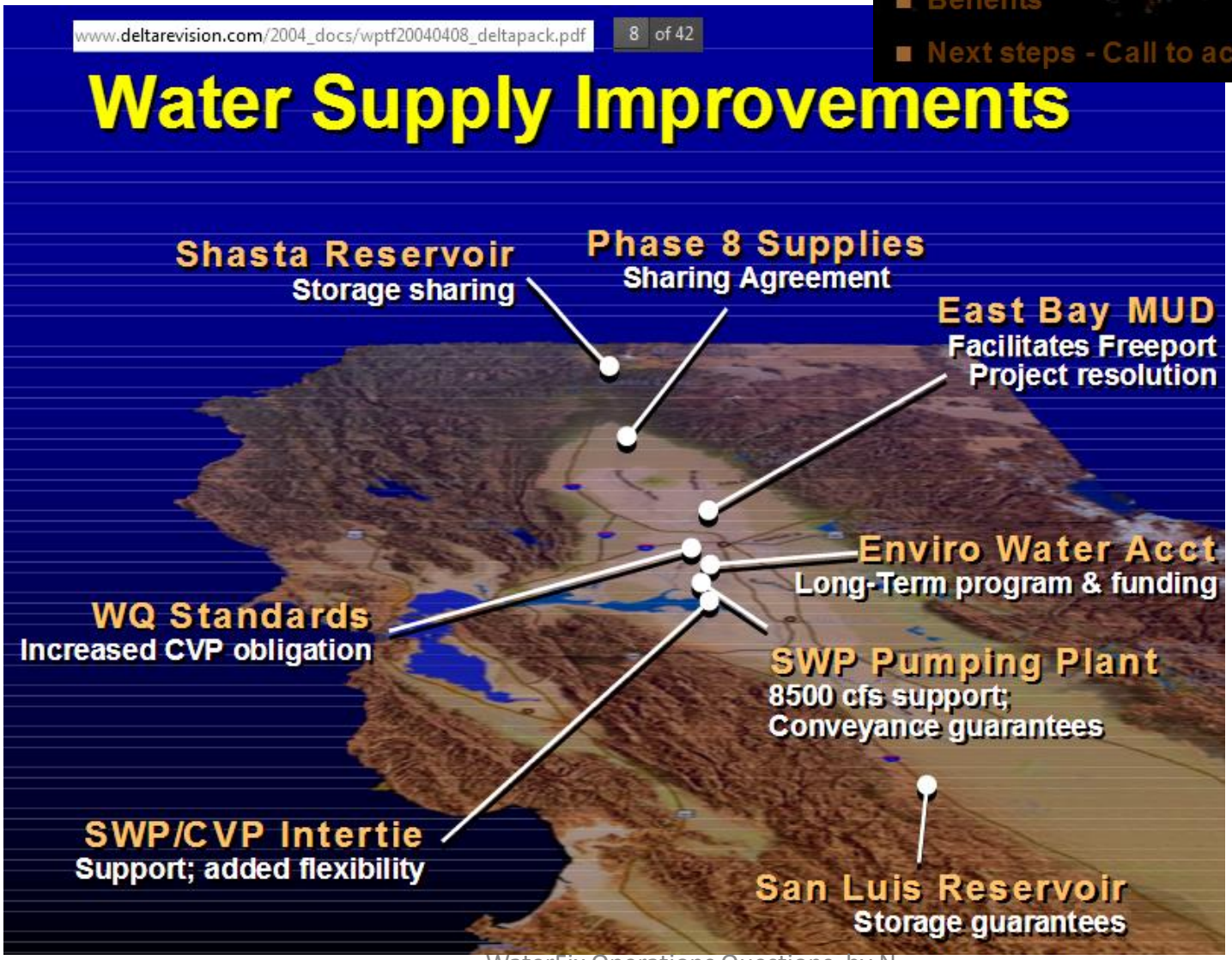

https://s3.amazonaws.com/californiawater/pdfs/bal9u_Appendix_3.A_DraftBA.pdf
Freeport
Sheet 1
Clarksburg
Elk Grove
Elk Slough
Sheet 3
Sheet 4
Hood
Cosumnes River
99
Sheet 5
Locke
Walnut Grove

Folsom Lake
Auburn Folsom South Canal
American R.
Mokelumne Aqueduct
Pardee Reservoir
New Hogan Reservoir
Calaveras R.
Farmington Reservoir
Hetch Hetchy Aqueduct
Modesto Reservoir
Don Pedro Reservoir
Turlock Lake
Lake McClure
Tuolumne River
Merced River
Bear Reservoir
Owens Reservoir
Kaufman Lake
Chowchilla River
Madera Canal
Hensley Lake
Millerton Lake
O'Neill Forebay
Pacheco Conduit
San Luis Reservoir
Los Banos Reservoir
California Aqueduct
Delta Mendota Canal
Clifton Court Forebay
Lake Del Valle
Salt Springs Reservoir
Bear River
Cosumnes
Mokelumne River
Calaveras R.
Stanislaus River
San Joaquin River
Merced River
Chowchilla River
70
80
50
49
99
5
4
108
205
41
152
101
13


2003_07_15_member_agency_update.ppt
Water Quality Exchanges
San Joaquin Valley
Timothy H. Quinn
916-650-2660
tquinn@mwdh20.com
Deliver Delta water to exchange partner
Receive Sierra water from exchange partner
Improve quality at Edmonston Pumping Plant
Avg. Annual Runoff (AF)
San Joaquin 1,861,000
Kings 1,745,000
Kern 749,000
Kaweah 468,000
Tule 159,000
Fresno 85,500
Chowchilla 78,000
5,145,500


Freeport Regional Water Project
Sacramento
Folsom Lake
Lake Natoma
American River
SCWA Treatment Plant
Folsom South Canal
Canal Pumping Plant
New Sacramento River Intake Facility
Galt
Camanche Reservoir
Pardee Reservoir
Lodi
Mokelumne Aqueducts
Mokelumne Aqueduct Treatment and Pumping Plant
Stockton
Note: This map generally describes the project facilities. No specific locational determinations are implied.
Map not to scale
Source: http://www.freeportproject.org

www.deltarevision.com/2004_docs/wptf20040408_deltapack.pdf
Overview
How actions fit into MWD strategies
Benefits
Next steps - Call to action


www.deltarevision.com/2004_docs/wptf20040408_deltapack.pdf
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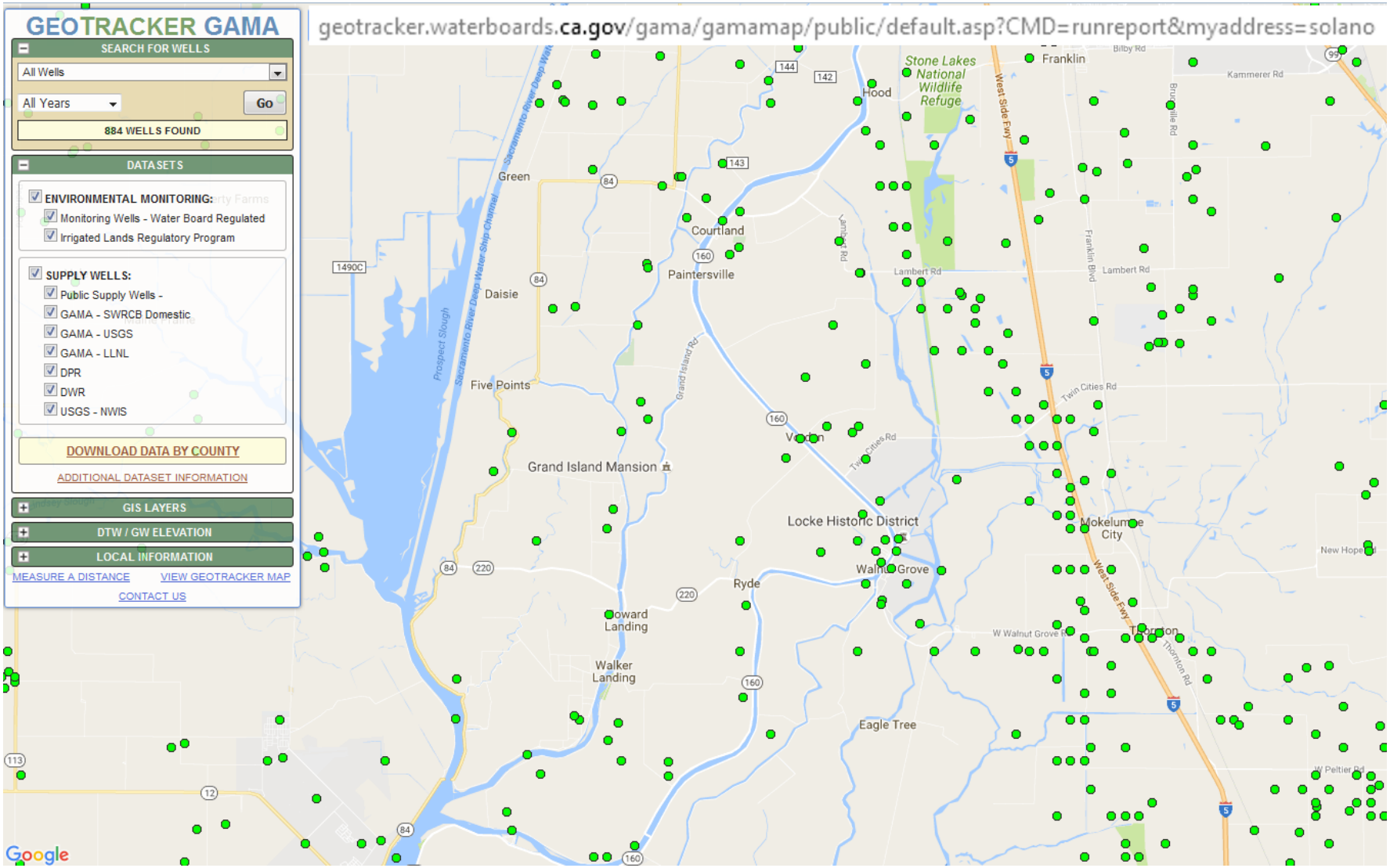
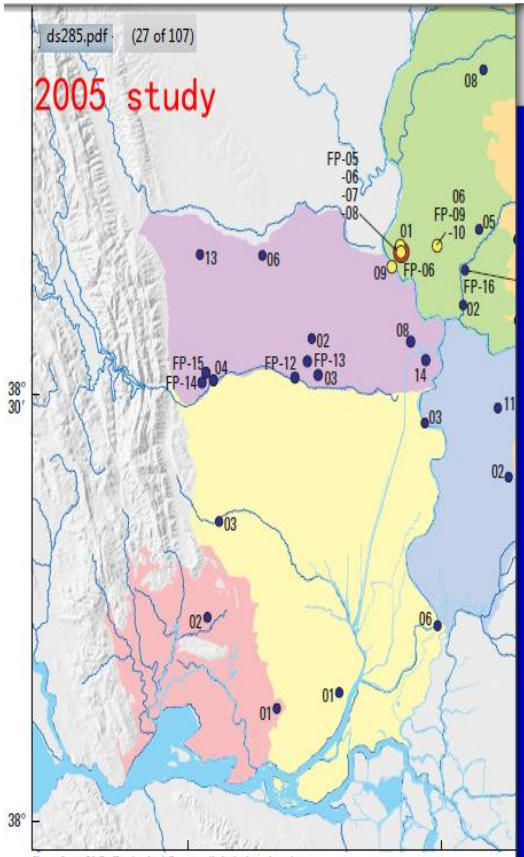
Water Supply Improvements
Shasta Reservoir
Storage sharing
Phase 8 Supplies
Sharing Agreement
East Bay MUD
Facilitates Freeport
Project resolution
Enviro Water Acct
Long-Term program & funding
WQ Standards
Increased CVP obligation
SWP Pumping Plant
8500 cfs support;
Conveyance guarantees
SWP/CVP Intertie
Support; added flexibility
San Luis Reservoir
Storage guarantees

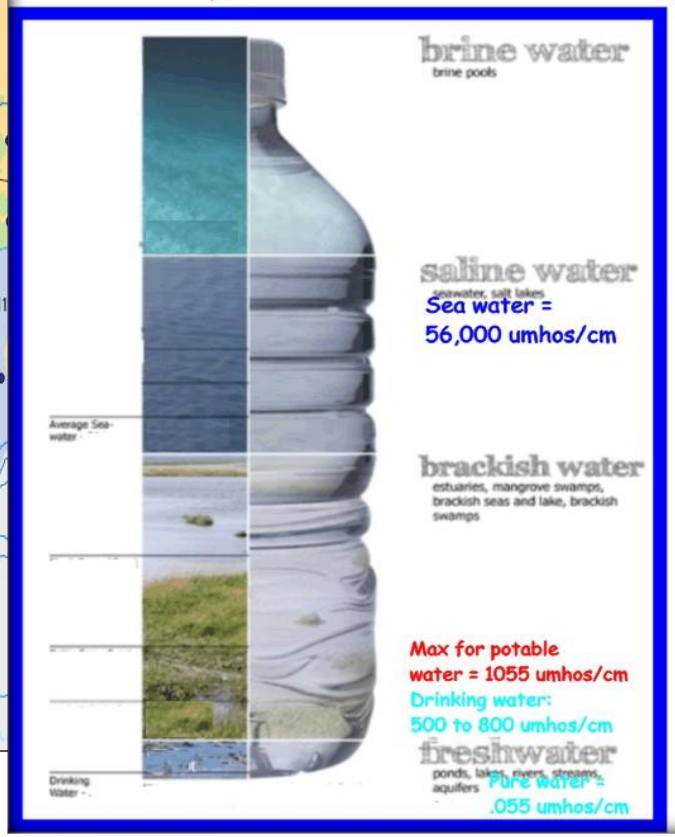
mwdh2o.granicus.com/MediaPlayer.php?view_id=12&clip_id=5547
Draft Schedule California WaterFix
USFWS | NOAA | CDFW – Endangered Species Act Authorizations
USBR | DWR – Environmental Docs
SWRCB – Water Rights | Water Quality
USACE – Permits
2015
2016
2017
2018

http://geotracker.waterboards.ca.gov/gama/gamamap/public/default.asp?CMD=runreport&myaddress=solano
Accessed 8-11-16 at 9:54 am PT

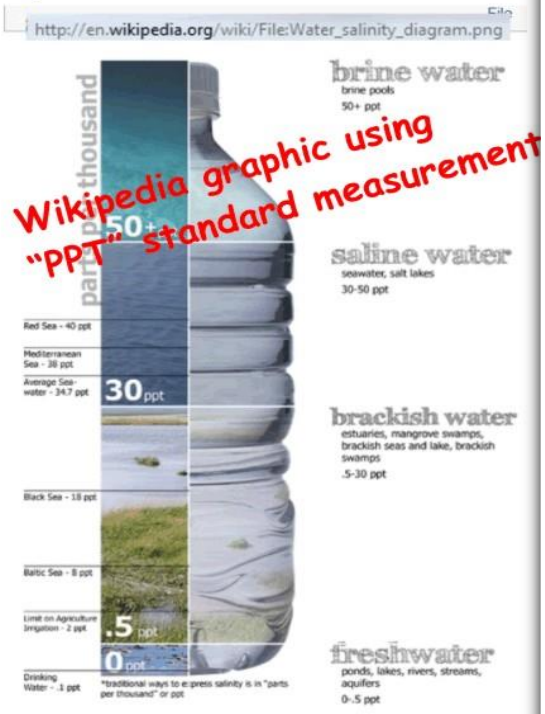




What happens to Delta drinking water wells when there is lower fresh water flow, higher water temperatures and more salinity encroachment?



Delta salinity encroachment maximum historically was 1 ppt, which is double the drinking water standard, but half of the upper limit for irrigation water use. In conductivity terms, maximum "potable" water is reported to be 1055 umhos/cm.



Wikipedia graphic using "PPT" standard measurement

EXPLANATION

Study areas
- North American (NAM)
- Solano (SOL)
- South American (SAM)
- Suisun–Fairfield (SUI)
- Uplands (QPC)
- Yolo (YOL)

Wells sampled, well number, and arsenic concentrations, in micrograms per liter
- 01 < 10
- 01 > 10 – < 50
- 01 > 50

Flowpath (FP)
Depth dependent (DD)