Sacramento Valley Water Users

State Water Resources Control Board
Bay-Delta Water Quality Control Plan Workshop
September 6, 2012

Walter Bourez, P.E.
MBK Engineers

Sacramento Valley Water Users

- Northern California Water Association
- Yuba County Water Agency
- Glenn-Colusa Irrigation District
- Sacramento Municipal Utility District
- Western Canal Water District
- Anderson-Cottonwood Irrigation District
- Biggs-West Gridley Water District
- Browns Valley Irrigation District
- Butte Water District
- Calaveras County Water District
- City of Folsom
- City of Roseville
- Calaveras County Water District
- El Dorado Water & Power Authority
- Meridian Farms Mutual Water Company
- Natomas Central Mutual Water Company
- Pelger Mutual Water Company
- Reclamation District No. 108
- Reclamation District No. 1004
- Richvale Irrigation District
- River Garden Farms
- Sacramento County Water Agency
- San Juan Water District
- Sacramento Suburban Water District
- South Feather Water and Power
- South Sutter Water District
- Sutter Mutual Water Company
- Sutter Extension Water District
- Yolo County Flood Control & Water Conservation District

SWRCB Questions Addressed

The SWRCB's workshop notice asks:

> *What additional scientific and technical information should the State Water Board consider to inform potential changes to the Bay-Delta Plan relating to ecosystem changes and the low salinity zone that was not addressed in the 2009 Staff Report and the 2010 Delta Flow Criteria Report? . . . What is the level of scientific certainty or uncertainty regarding the foregoing information?*

Response:

> *It is highly uncertain whether it is possible to position the low salinity zone to generate specific benefits for the Delta's fish, but it is highly certain that attempting to do so with Sacramento River basin streamflows would adversely and significantly impact many beneficial uses*

Topics Addressed

- Uncertainty regarding positioning the low salinity zone (LSZ) to generate benefits for Delta pelagic fish and regarding the use of Sacramento River flows to attempt to position the LSZ

- Lack of obvious correlation between Sacramento Valley water use and the recent decline in pelagic fish populations in the Delta

- Hydrologic effects in Sacramento Valley of possible Bay-Delta flow requirements based on unimpaired flows

- Managing for multiple beneficial uses

Conclusions

- Daily tidal flows dwarf net Delta outflows and cause the position of LSZ to move considerable distances twice daily. The actual position of LSZ and X2 is not known only estimated. There is considerable uncertainty that attempting to control LSZ or X2 using Sacramento River flow will produce fishery benefits.

- Sacramento Valley consumptive use of water has been essentially stable since the 1970s, while Delta pelagic fish have declined

- Delta flow requirements based on 50% or 40% of unimpaired flow would have significant adverse impacts on Sacramento Valley water resources, including significant reductions in reservoir storage

- California water systems are managed for multiple beneficial uses and these would suffer under new Delta flow requirements based on unimpaired flows

Professional Background

- Registered professional engineer, #54794
- Principal, MBK Engineers
- Development and application of hydrological models in the Bay Delta watershed since 1987
- Representative projects:
  - Evaluation for SWRCB of water-right water availability analysis
  - Co-developer of CalSim II model and hydrology for Sacramento and San Joaquin River systems (DWR, Reclamation)
  - Develop reservoir operations model to simulate CVP/SWP response to Delta levee breaches (DWR)
  - Franks Tract Project (DWR, Reclamation)
  - San Joaquin River Restoration modeling Settlement proposals
  - Conjunctive management projects (numerous agencies)

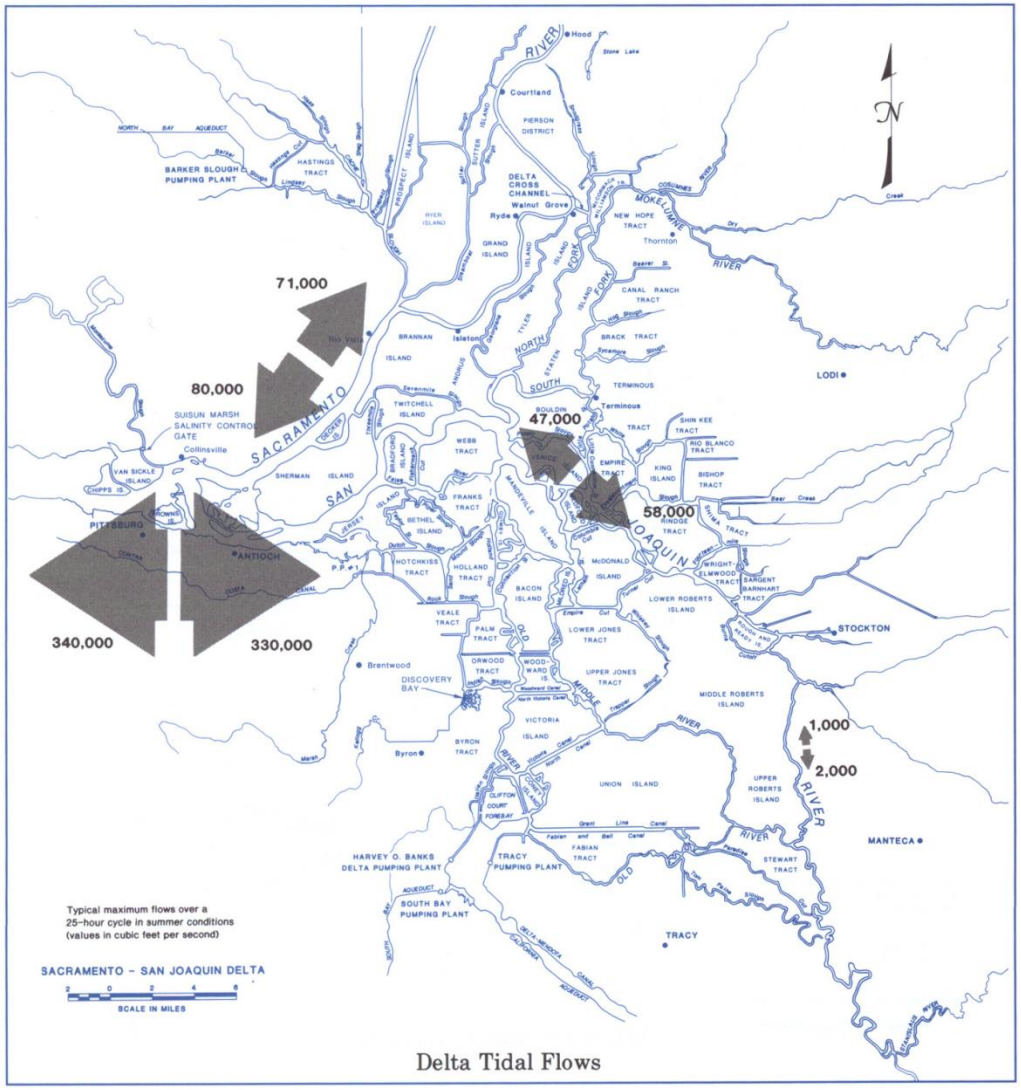
Uncertainty in Positioning Low Salinity Zone

Tidal Effects and Uncertainty in Estimating X2 Location

Tidal Influence in Delta

Sacramento San Joaquin Delta Atlas (DWR 1995):

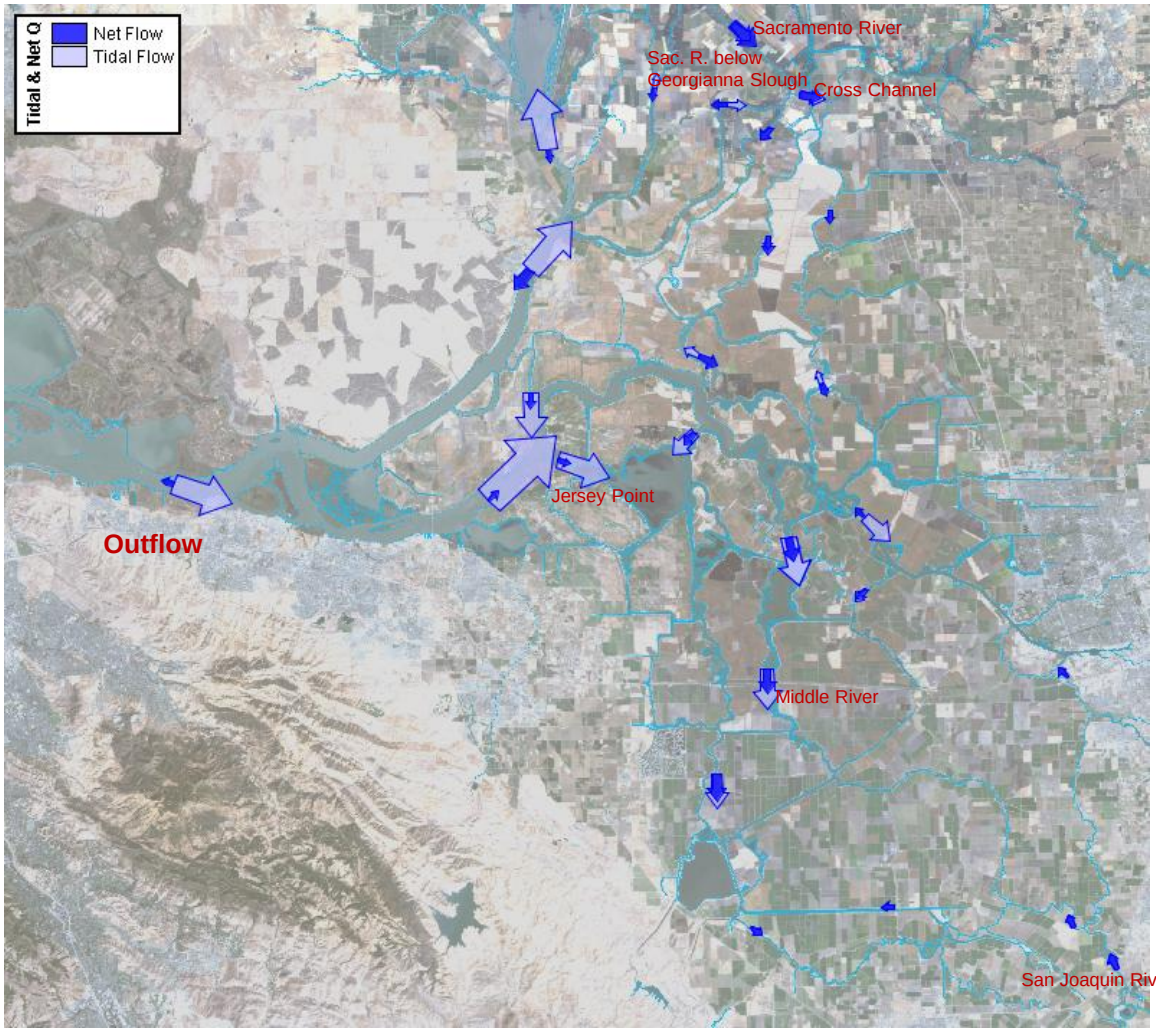
"*During the tidal cycle, flows can . . . vary in direction and amount. For example and as shown on the map below, the flow near Pittsburg during a typical summer tidal cycle can vary from 330,000 cfs upstream to 340,000 cfs downstream. The 'net' summer Delta outflow is a very small amount of the total water movement, generally 5,000 to 10,000 cfs.*"



Tidal and Net Flow

- Delta simulation
- Purpose is to demonstrate tidal influence in the Delta
  - Begin at 2,000 cfs outflow
  - End at 100,000 cfs outflow
  - Export about 10,000 - 12,000 cfs (WY 2002)
  - About 5 minutes long
- Flows scaled to area of arrows

Animation developed by John DeGeorge, RMA

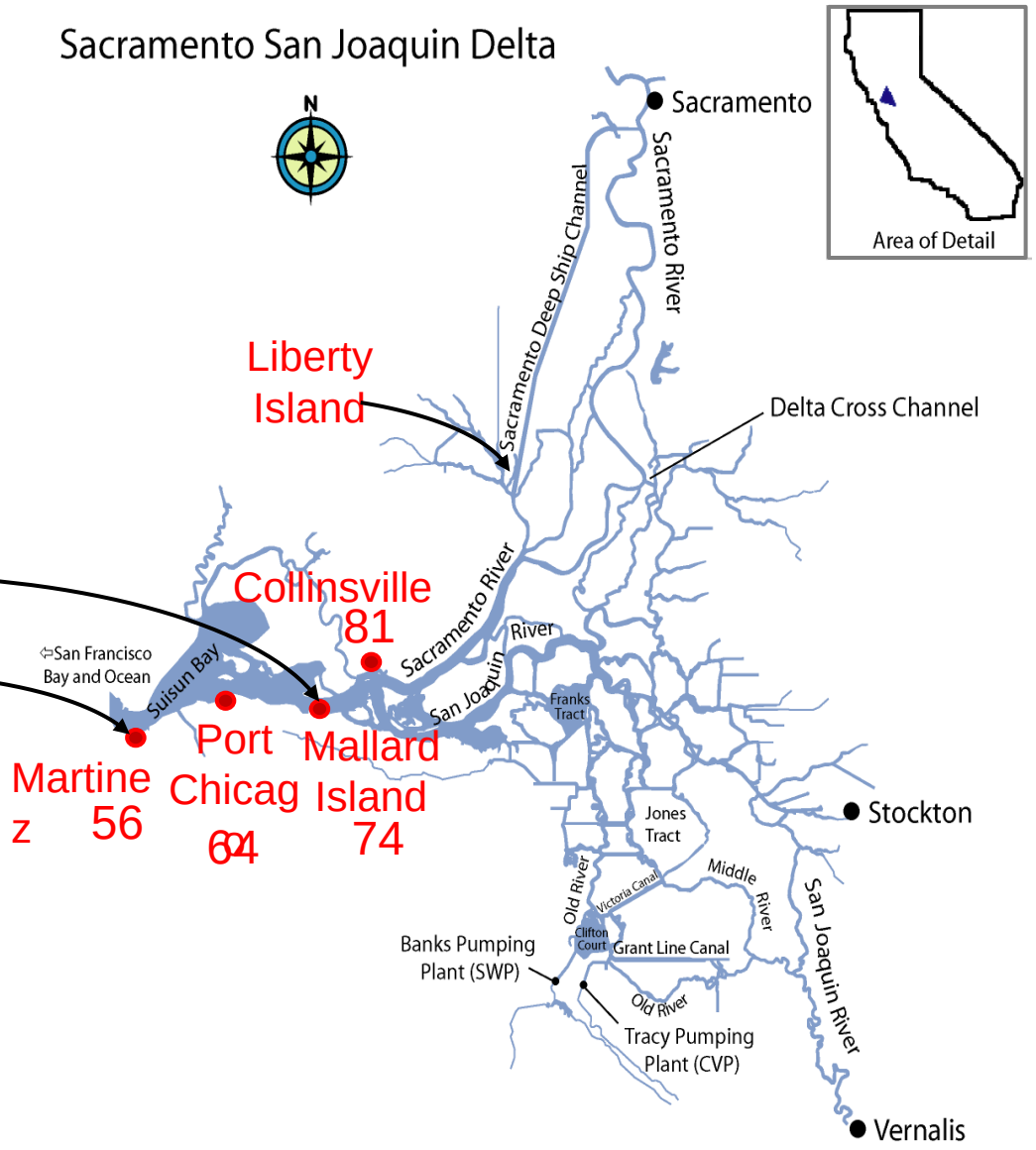


Net Delta Outflow (cfs)

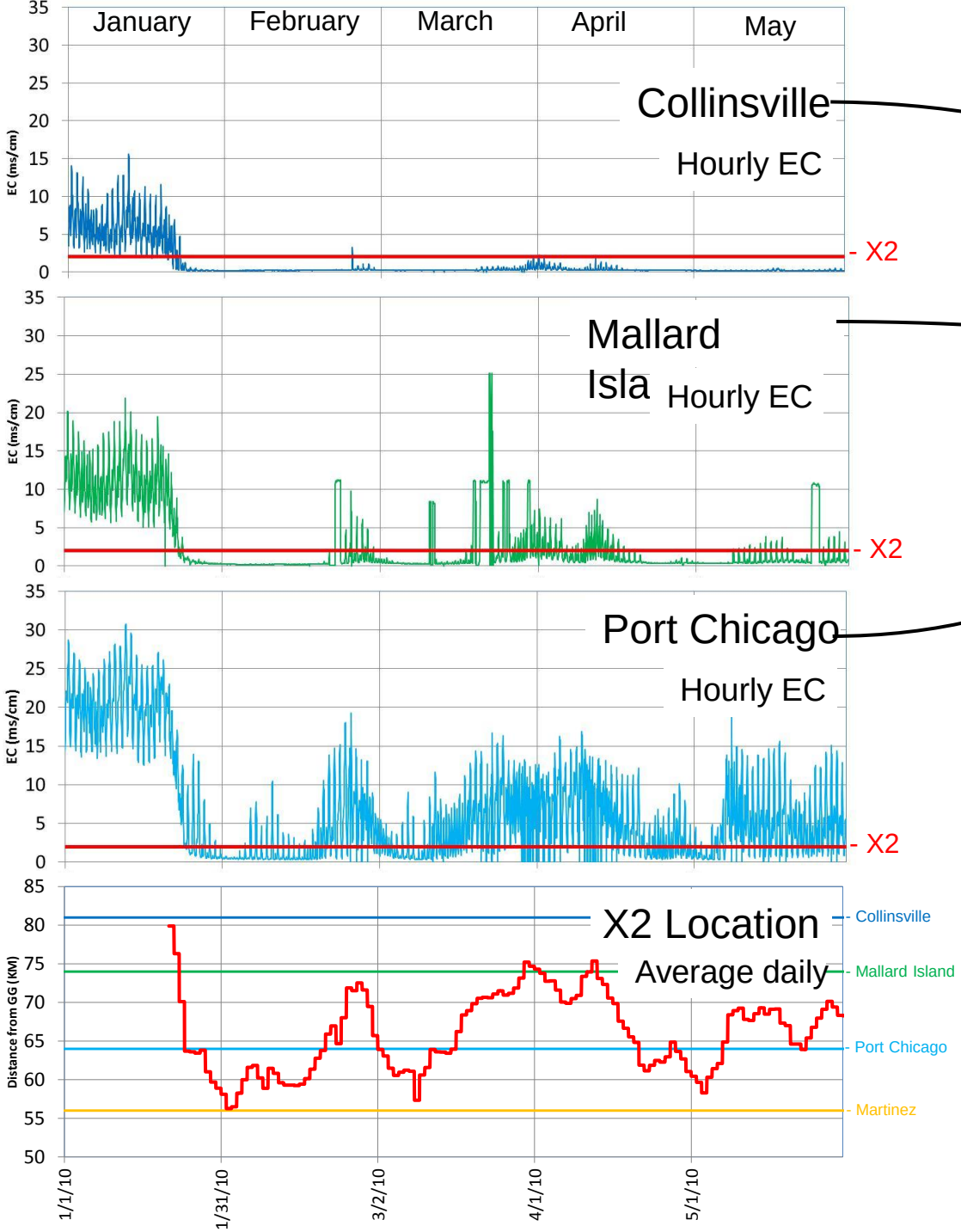
2000 10,000 50,0000 100,000

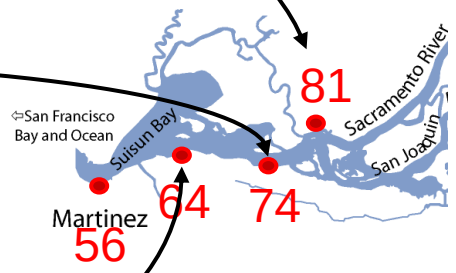
Tidal Excursion

- USGS measured tidal excursion, it can be on the order of 10 to 15 miles
  - Greater than the length of Suisun Bay
- Drifters releases at Mallard Island (74KM) went to Martinez (56KM) in a single ebb tide during low outflow last winter
- Drifters from the Liberty Island breach went to Chain Island, near Collinsville



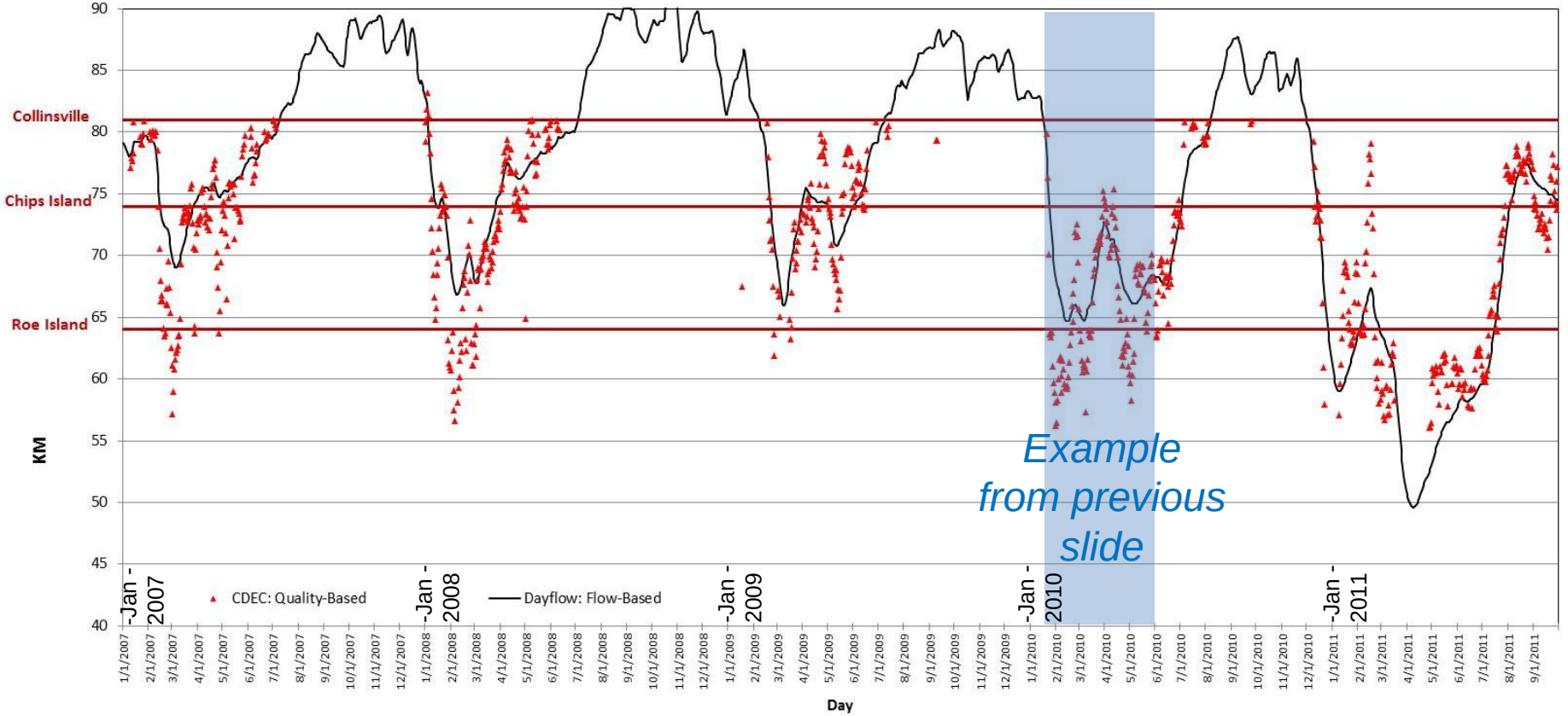
X2 Location
Hourly Sample
2010





- LSZ continuously moves significant distances twice daily
- The LSZ can move between 64 and 74 KM twice daily and as far as 81 KM within a short period

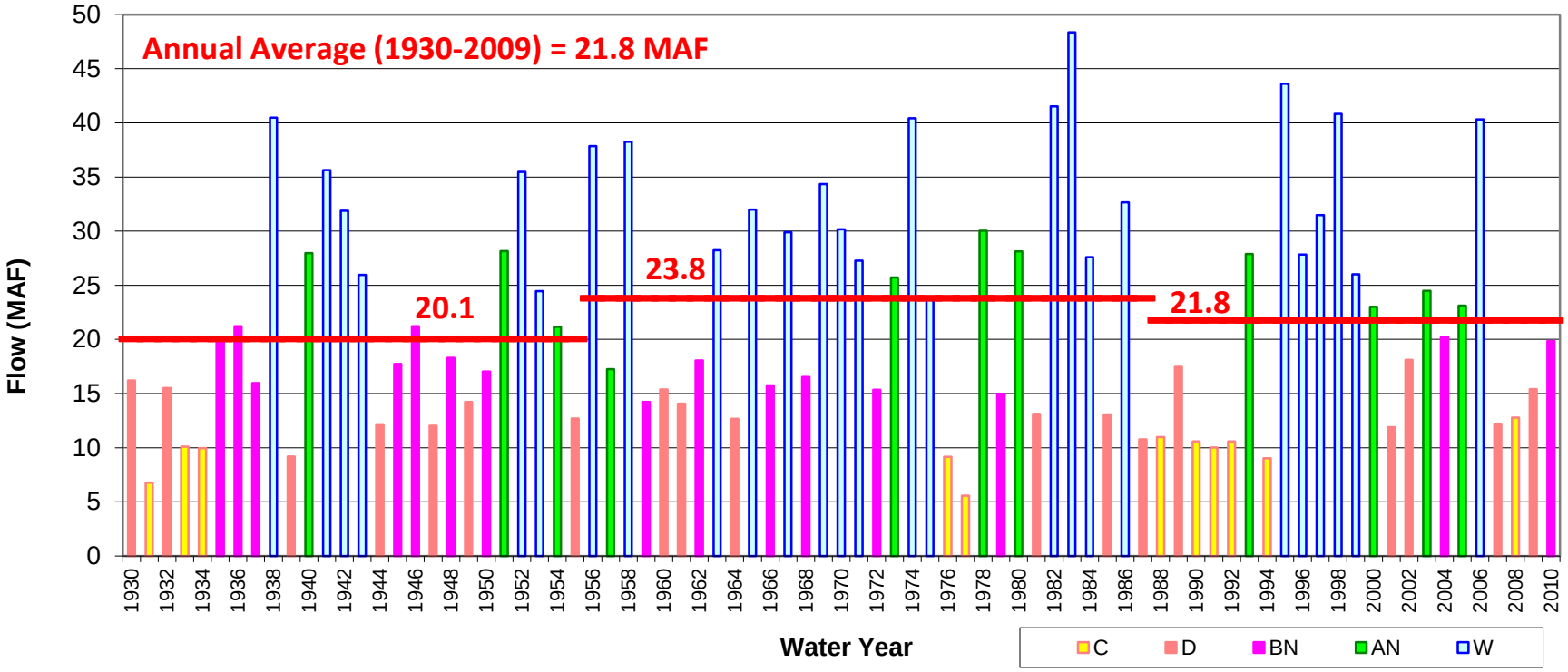
X2 Location – Flow based versus quality based



- The LSZ and X2 position is not measured, but only estimated, and varies significantly based on the estimation method
- There are significant discrepancies between flow-based X2 values (DAYFLOW) and water quality-based X2 values (CDEC)
- Statistical relationships using X2 contain significant uncertainty
- Discrepancy identified as issue by IEP Lead Scientist in February 2012 notes (http://www.epa.gov/sfbay-delta/pdfs/notes-on-estimating-X2-with-DAYFLOW.pdf)

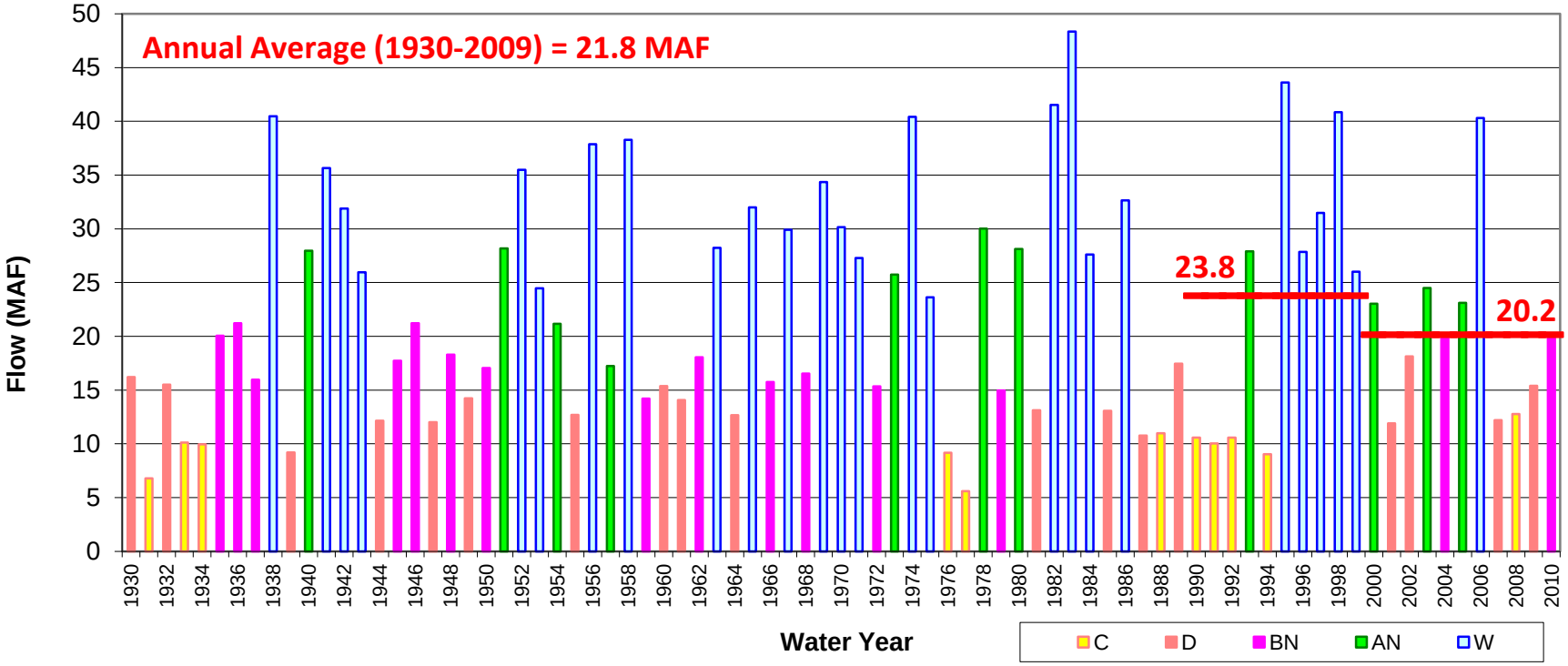
Use of Hydrologic Data

Unimpaired Sacramento Basin Flow to Delta



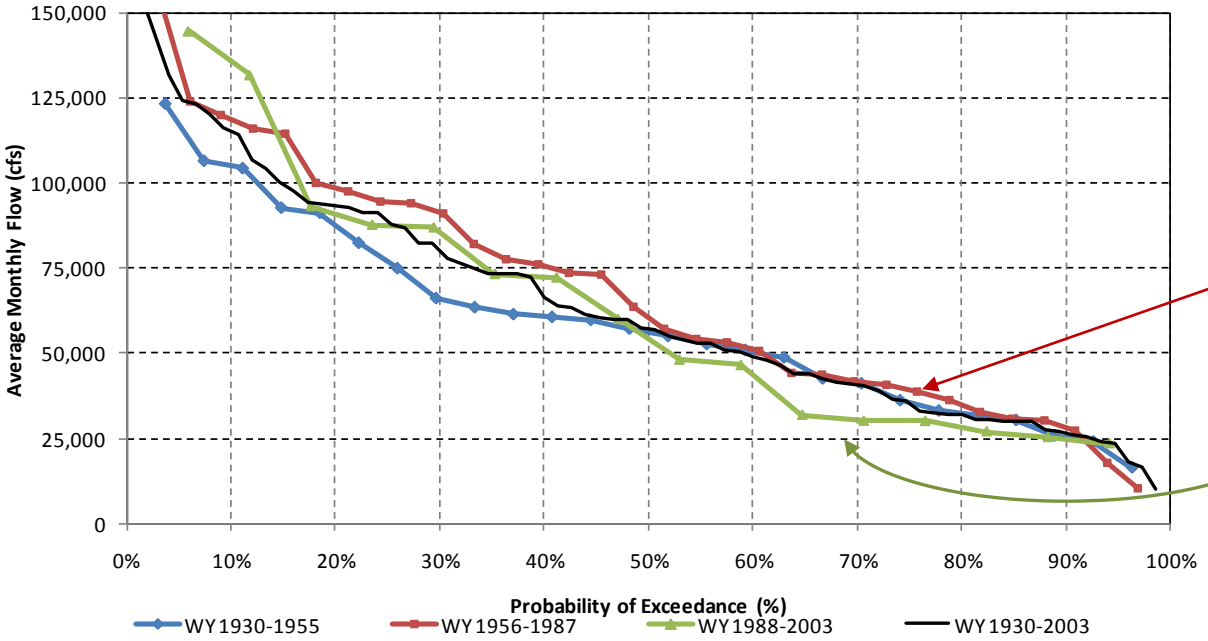
- Comparing various hydrologic periods can lead to incorrect conclusions
- The average unimpaired Sacramento River flow for the 1988-2009 period is about 2.1 MAF lower than the 1956-1987 period
  - 2.1 MAF is about twice the size of Folsom Lake or consumptive use of 700,000 irrigated acres

Unimpaired Sacramento Basin Flow to Delta



- Comparing various hydrologic periods can lead to incorrect conclusions
- The average unimpaired Sacramento River flow for the 2000-2009 period is about 3.6 MAF lower than the 1990-1999 period
  - 3.6 MAF is about 3.5 times the storage in Folsom Lake or consumptive use of 1,200,000 irrigated acres

Unimpaired January - June Delta Outflow



1956-1987 average flow is 4,300 cfs greater than 1988-2003 average flow

Period Average Flow (cfs)	
1930-2003:	64,000
1930-1955:	59,000
1956-1987:	67,600
1988-2003:	63,300

- Differences in hydrology must be considered in comparing environmental conditions in different time periods

- Attempting to recreate past hydrology through regulatory requirements may not produce past environmental conditions
  - Increases in reservoir releases may not replicate wet year environmental conditions
  - In wet years both reservoir storage and Delta flows are higher
  - In wet years water quality, temperature, and many factors are more favorable

Delta Outflow November

SWRCB
Delta Flow Criteria Report

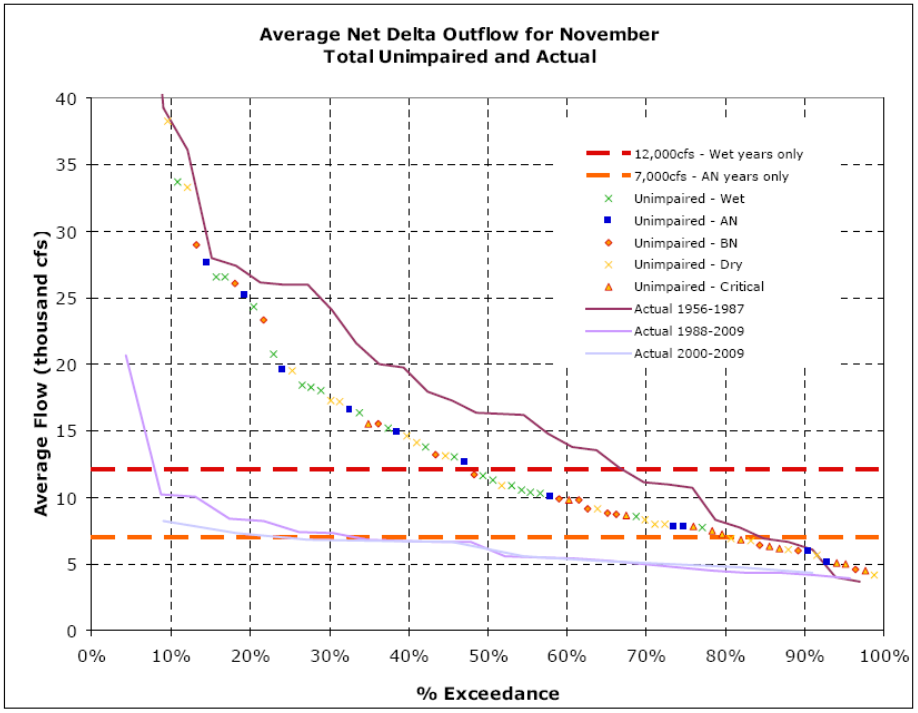
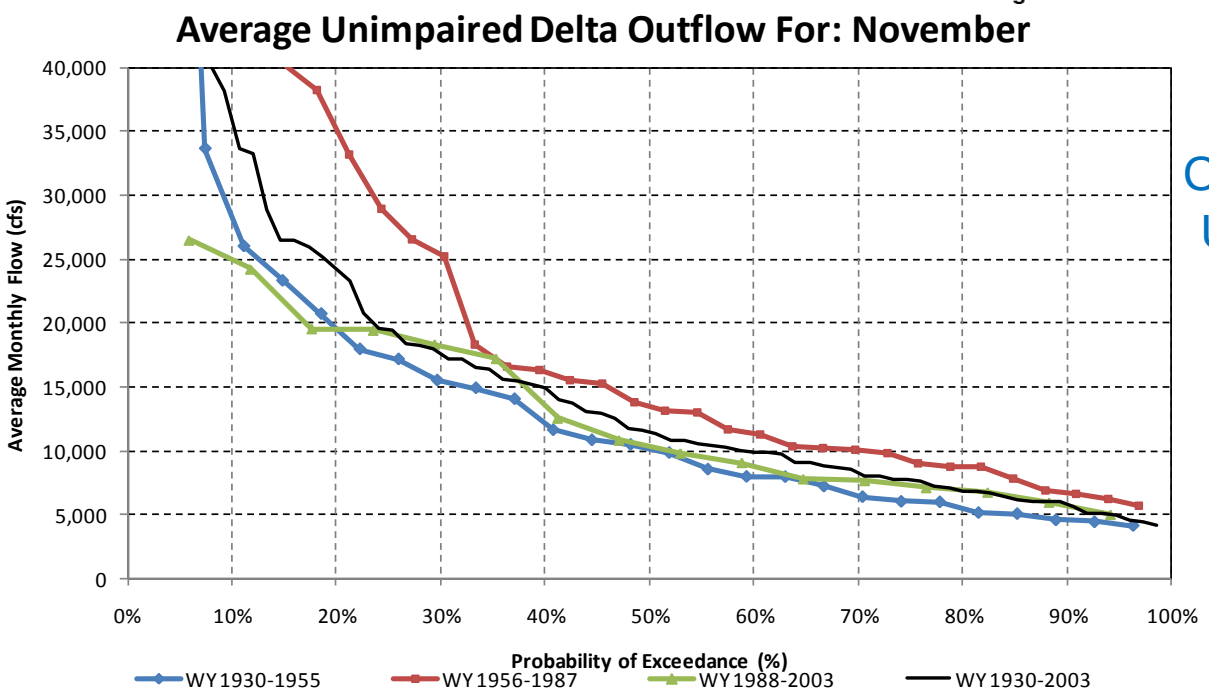


Figure 18. Net Delta Outflow Flow Exceedance Plot - November

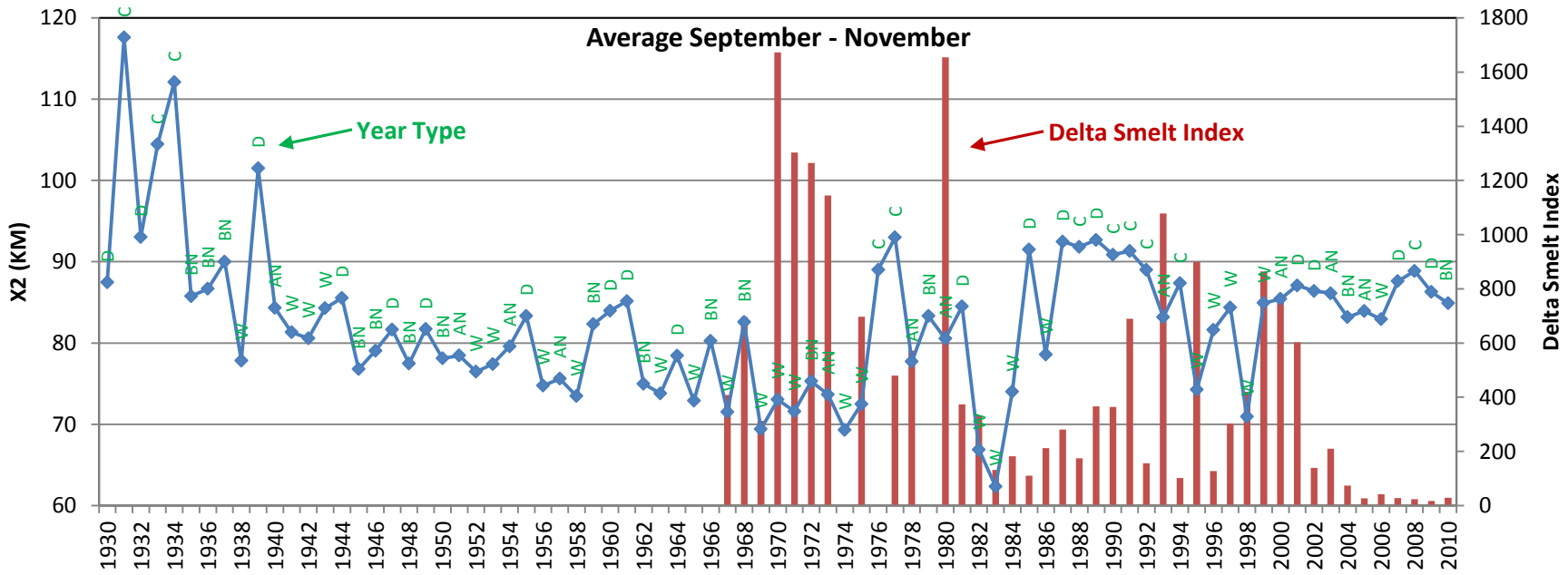


DWR
California Central Valley Unimpaired Flow Data

Period Average Flow (cfs)	
1930-2003:	18,400
1930-1955:	15,450
1956-1987:	23,450
1988-2003:	13,000

> 10,000 cfs difference

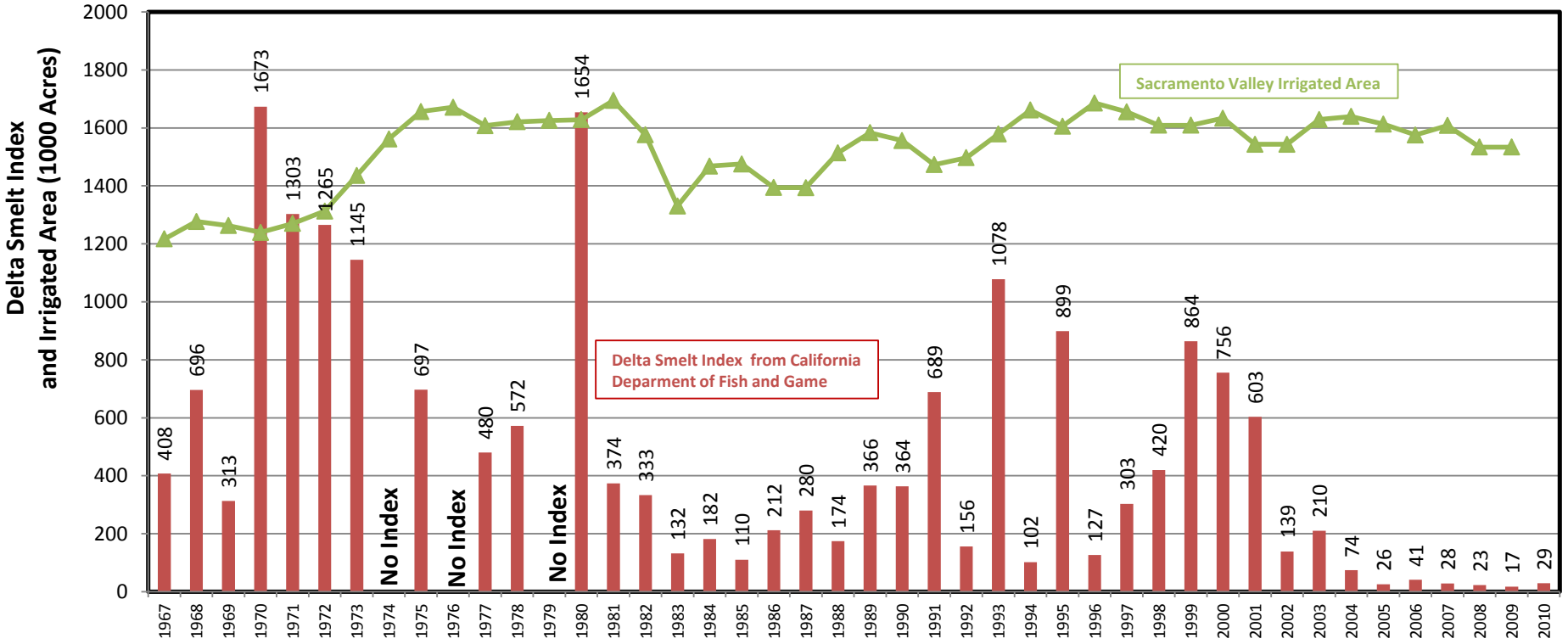
September-November X2 Location & Delta Smelt Index



The Delta outflow - X2 relationship has changed over time, but there are significant variations in the relationship between Delta smelt populations and fall Delta outflow (X2 position) – e.g., low populations with low X2 in 1982-1984, high populations with high X2 in 1993, 1999-2000

Lack of Relationship Between Sacramento Valley Water Use And Pelagic Fish Declines

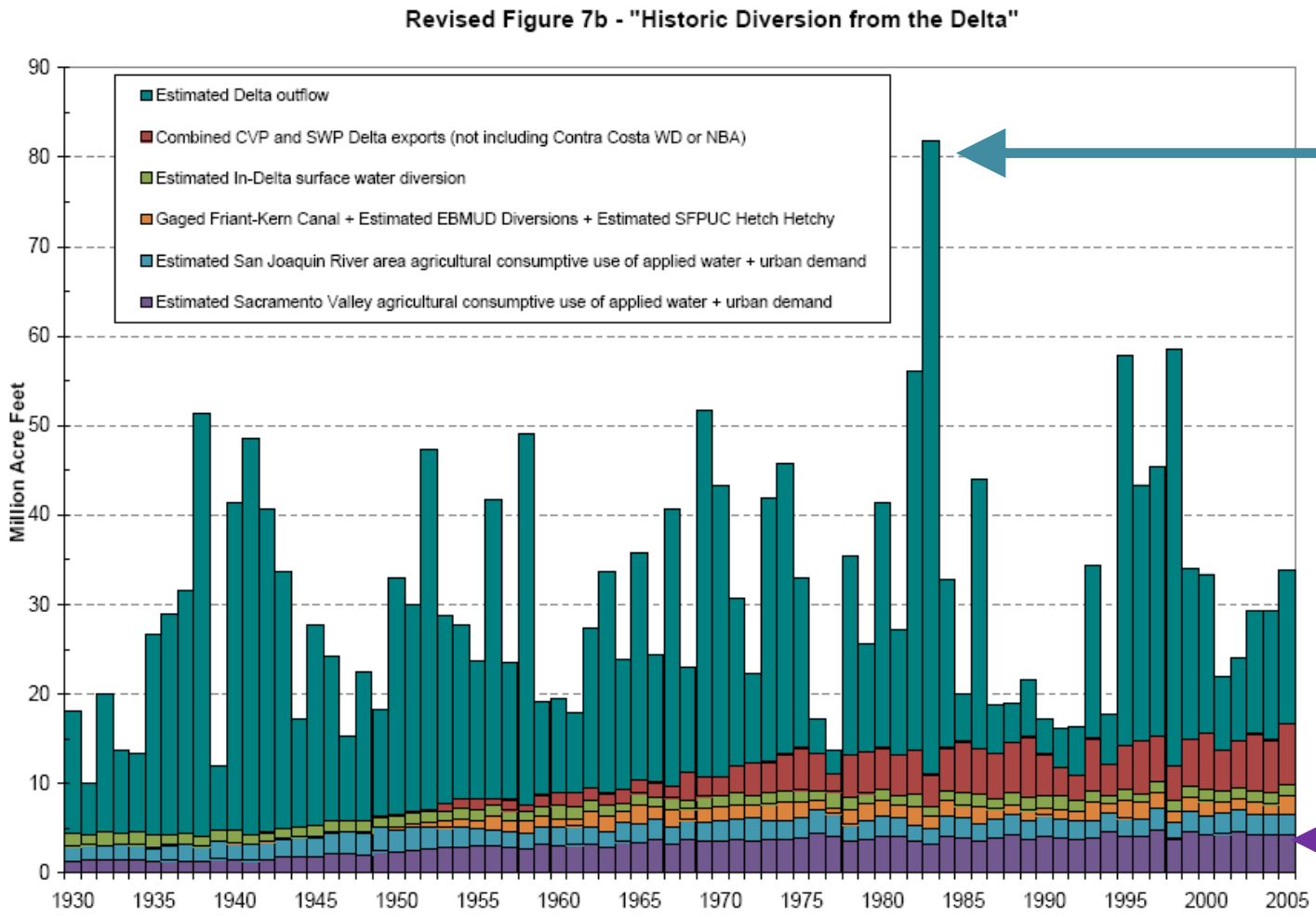
Sacramento Valley Irrigated Area and Delta Smelt Index



- Sacramento Basin irrigated acreage has been essentially constant since the mid-1970's, while fish populations have varied dramatically

Stable Sacramento Basin Water Use

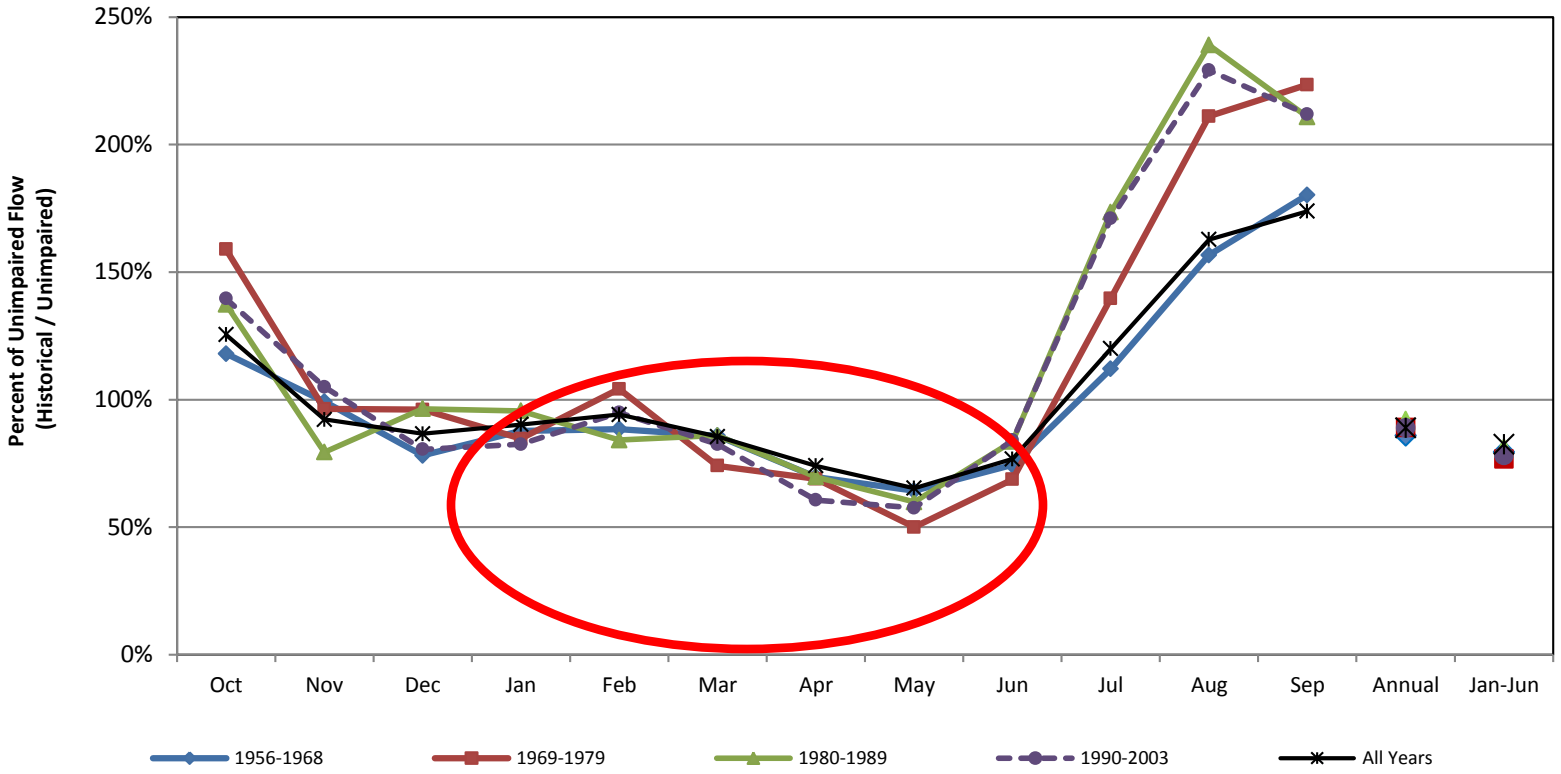
Delta Vision Blue Ribbon Task Force (2007):



Hydrology is the biggest variable

Sacramento Basin use has been essentially constant since the mid-1970's

Historical Average Percent of Unimpaired Sacramento River Basin Outflow (1956–2003)



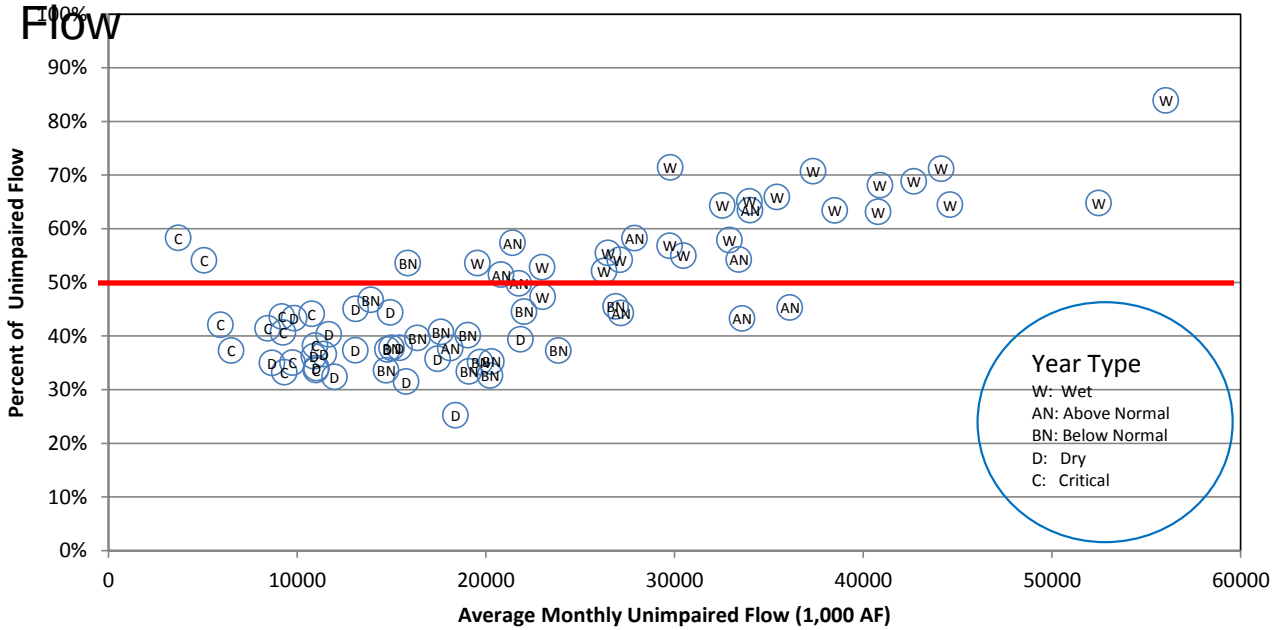
- The 2010 Delta Flow Criteria Report addresses January-June Delta flows
- Hydrology is variable, but the percentage of January-June unimpaired flow that flows from the Sacramento River basin to the Delta has not changed significantly since the late 1950s
- Small changes in percentage requires large changes in flow and large water

Hydrologic Impacts of Delta Flow Requirements Based On Unimpaired Flows

Modeled and Unimpaired Delta Outflow

(model period:1922-2003)

January Through June Outflow – Percentage of Unimpaired Flow



January Through June Average

Wet: 65%

Above Normal: 51%

Below Normal: 40%

Dry: 37%

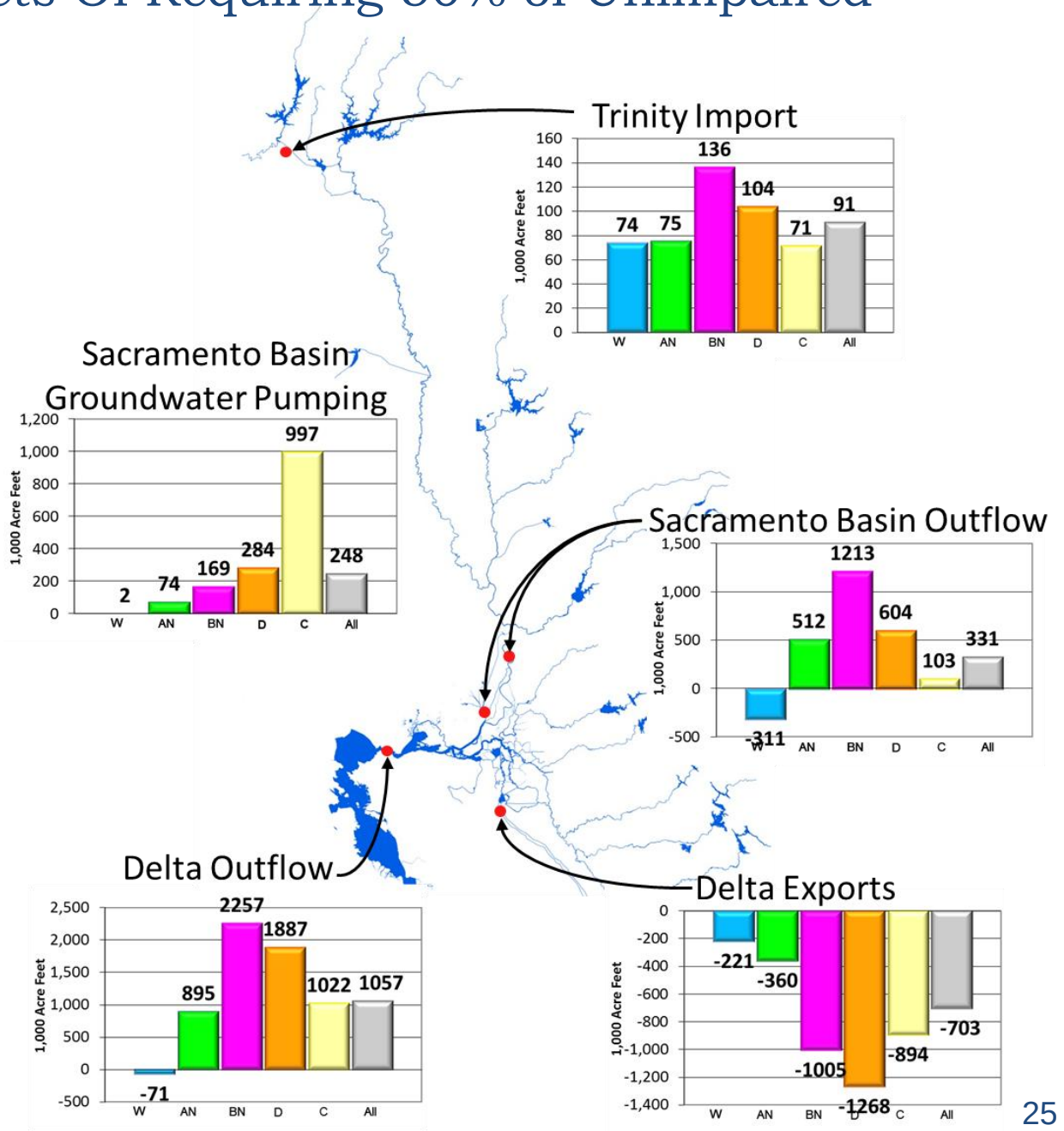
Critical: 40%

All Years: 53%

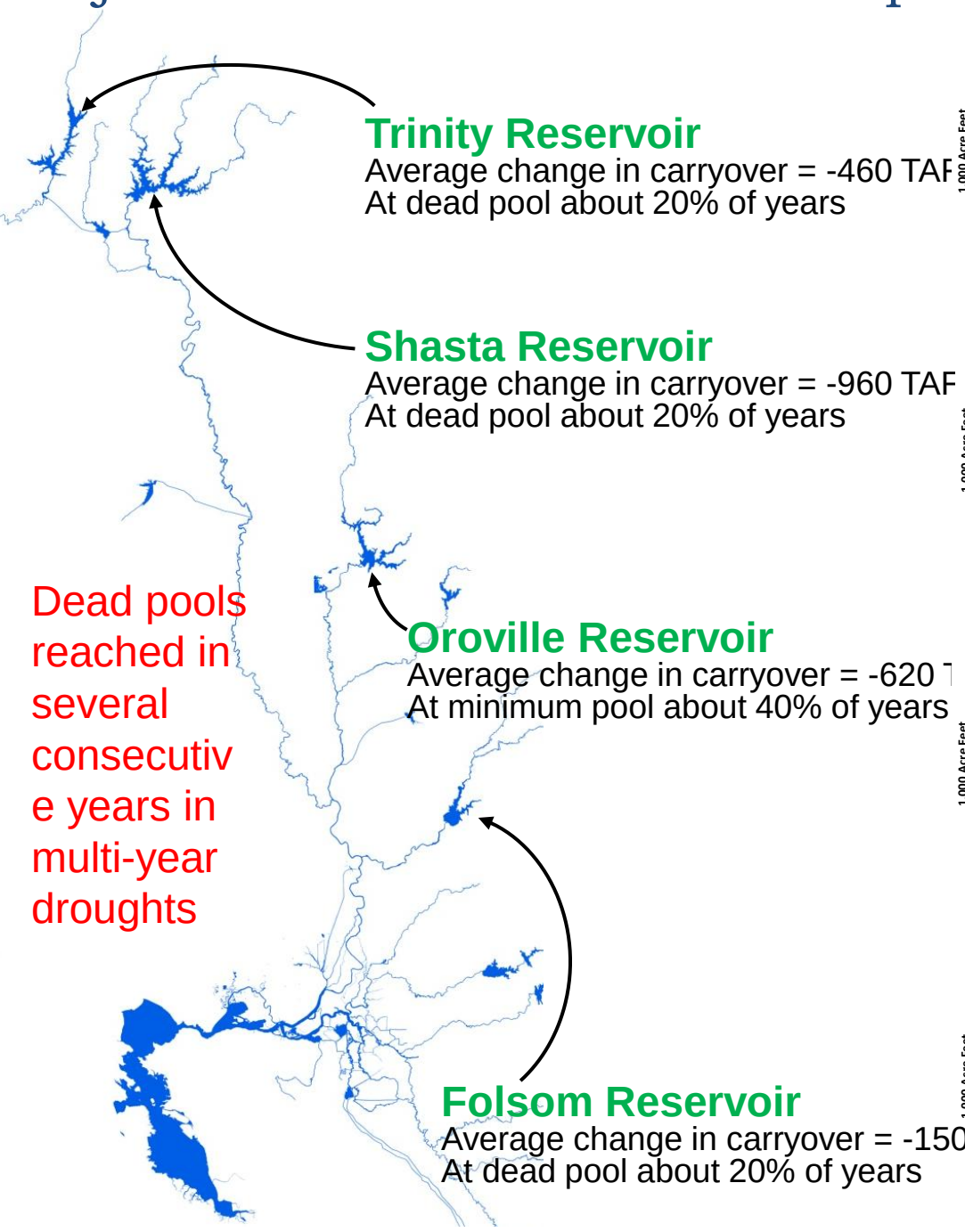
For Bay-Delta scoping comments, Sac. Valley Water Users modeled impacts of average all-year and dry-year percentages of unimpaired flow – 50% and 40% -- if they were adopted as new minimum Delta flow requirements

Average Annual Impacts Of Requiring 50% of Unimpaired January-June Flows

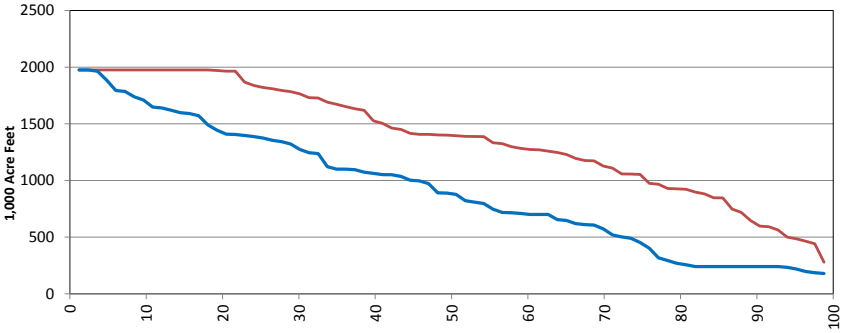
- Delta outflow increase: 1,057,000 AF (acre-feet),
- Sac. Basin groundwater pumping increases 250,000 AF
- Imports from Trinity basin increase 91,000 AF
- Exports to San Joaquin Valley and So. California decrease 703,000 AF



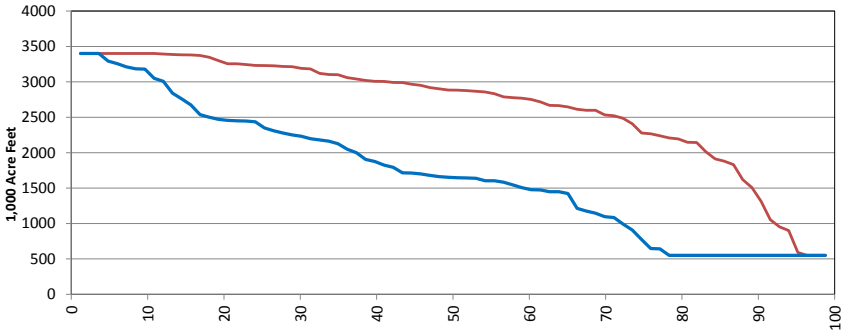
Project Reservoirs-50% of Unimpaired



Trinity Reservoir
Average change in carryover = -460 TAF
At dead pool about 20% of years

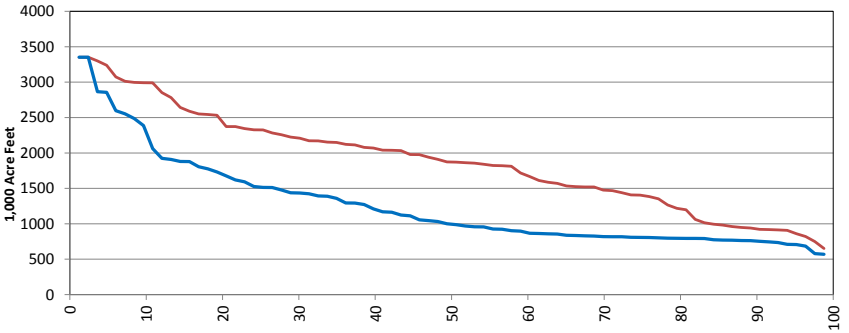


Shasta Reservoir
Average change in carryover = -960 TAF
At dead pool about 20% of years

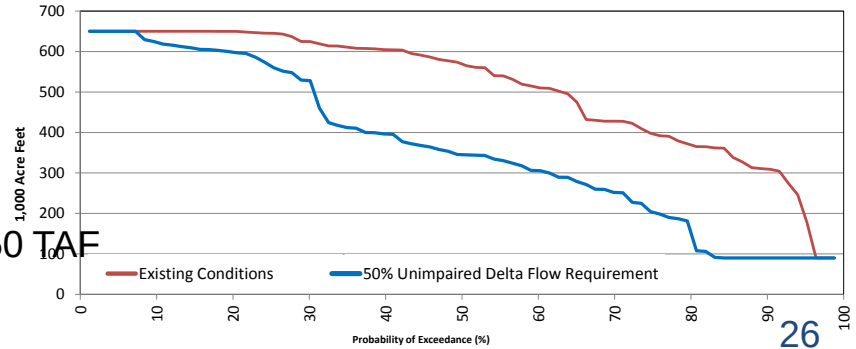


Dead pools reached in several consecutive years in multi-year droughts

Oroville Reservoir
Average change in carryover = -620 T
At minimum pool about 40% of years



Folsom Reservoir
Average change in carryover = -150 TAF
At dead pool about 20% of years



Project Reservoirs – Dead Pools

These pictures reflect water levels higher than these reservoirs' dead pools because they have never been drained to those dead pools

DWR Photographs

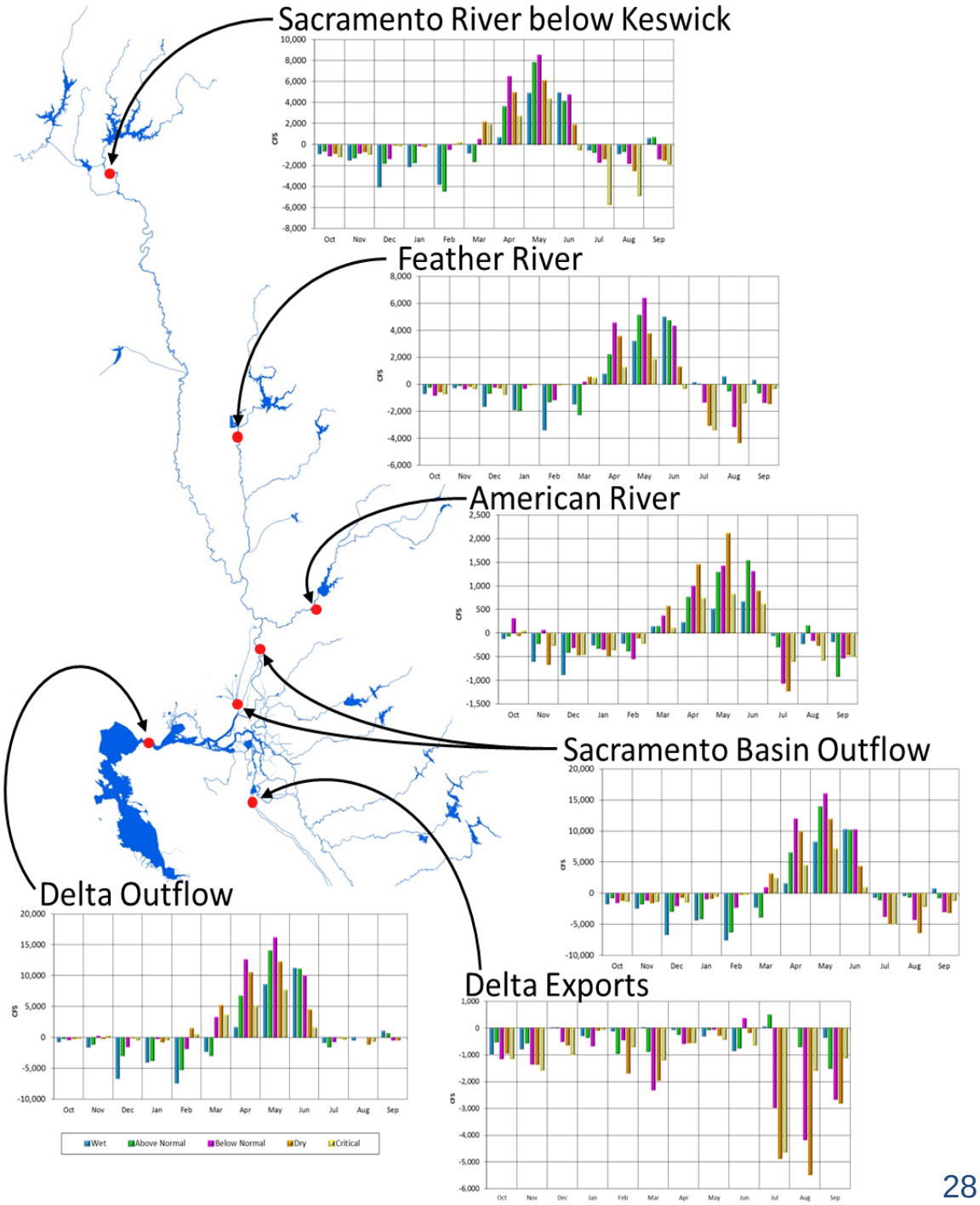
Shasta 1976

Oroville - 1991

Folsom - 1991

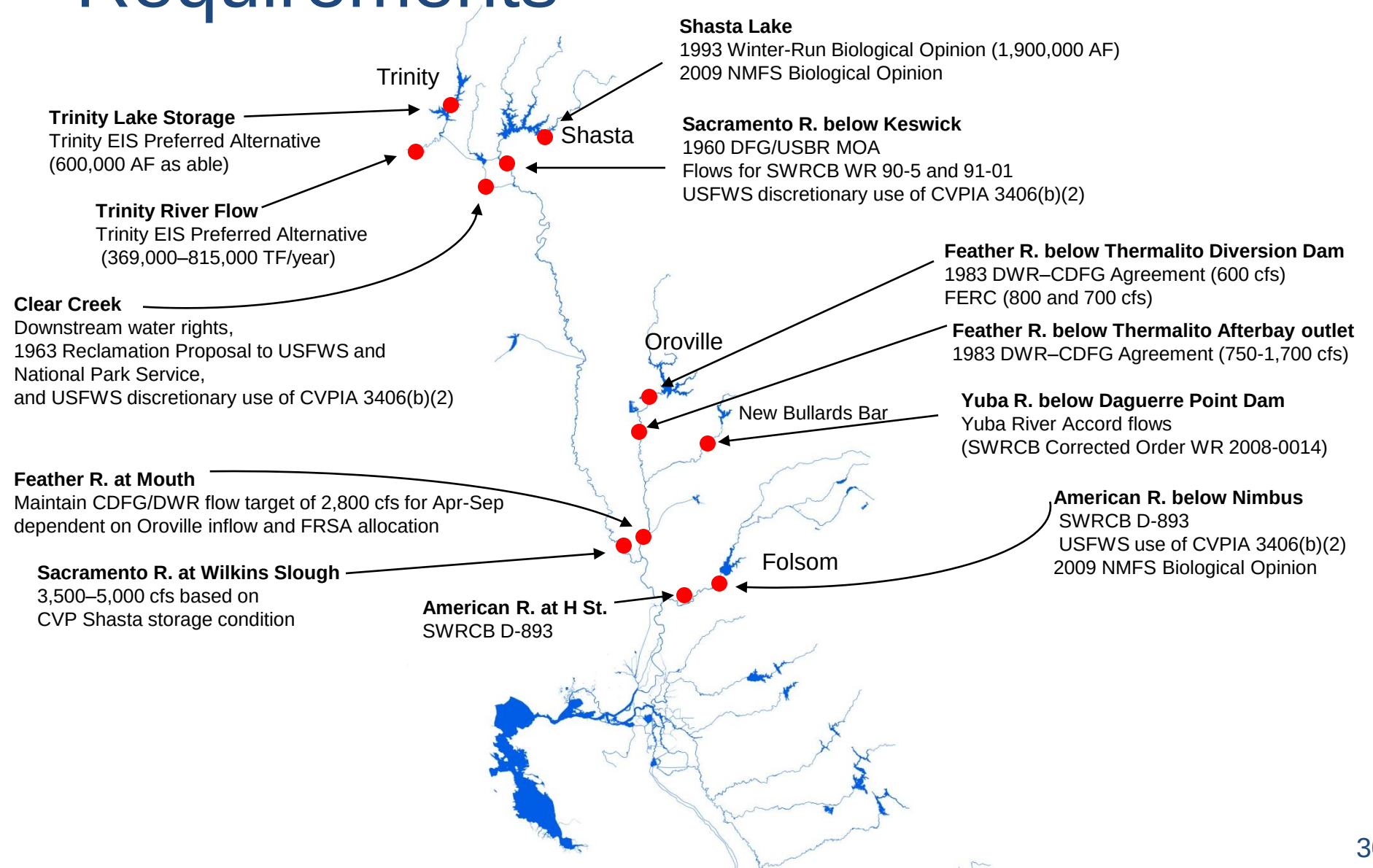
Average Monthly Flow Changes at 50% Unimpaired Flow

- Significant shifts of flow from summer and fall to spring
- Impacts on flows for salmon and steelhead rearing and spawning habitat
- Impacts on hydropower generation during peak-demand periods



Managing for multiple beneficial uses

Existing Sacramento Basin Flow Requirements



Shasta Lake
1993 Winter-Run Biological Opinion (1,900,000 AF)
2009 NMFS Biological Opinion

Trinity Lake Storage
Trinity EIS Preferred Alternative
(600,000 AF as able)

Sacramento R. below Keswick
1960 DFG/USBR MOA
Flows for SWRCB WR 90-5 and 91-01
USFWS discretionary use of CVPIA 3406(b)(2)

Trinity River Flow
Trinity EIS Preferred Alternative
(369,000–815,000 TF/year)

Clear Creek
Downstream water rights,
1963 Reclamation Proposal to USFWS and
National Park Service,
and USFWS discretionary use of CVPIA 3406(b)(2)

Feather R. below Thermalito Diversion Dam
1983 DWR–CDFG Agreement (600 cfs)
FERC (800 and 700 cfs)

Feather R. below Thermalito Afterbay outlet
1983 DWR–CDFG Agreement (750-1,700 cfs)

Yuba R. below Daguerre Point Dam
Yuba River Accord flows
(SWRCB Corrected Order WR 2008-0014)

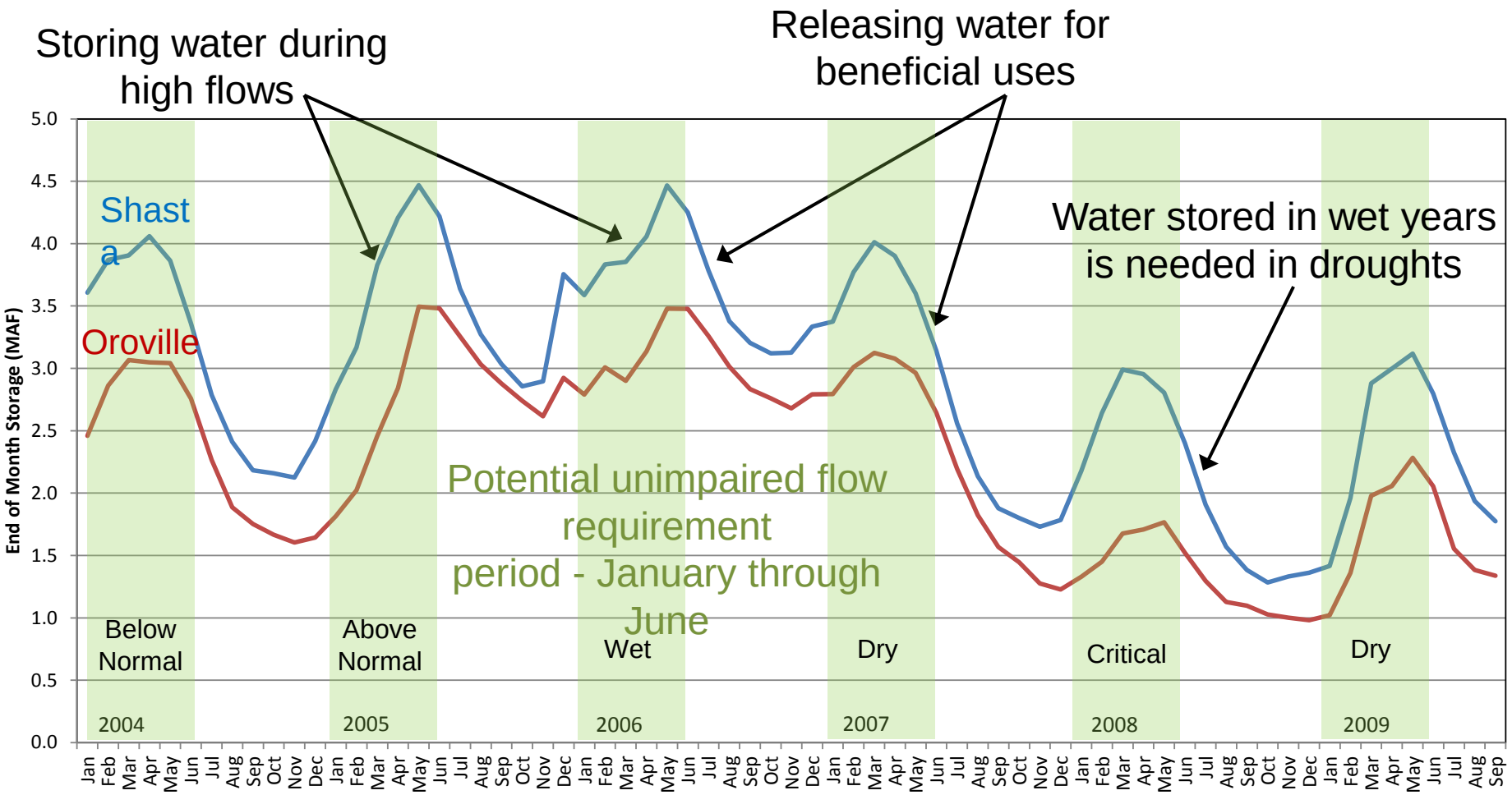
Feather R. at Mouth
Maintain CDFG/DWR flow target of 2,800 cfs for Apr-Sep
dependent on Oroville inflow and FRSA allocation

American R. below Nimbus
SWRCB D-893
USFWS use of CVPIA 3406(b)(2)
2009 NMFS Biological Opinion

Sacramento R. at Wilkins Slough
3,500–5,000 cfs based on
CVP Shasta storage condition

American R. at H St.
SWRCB D-893

Shasta and Oroville Storage 2004 - 2009

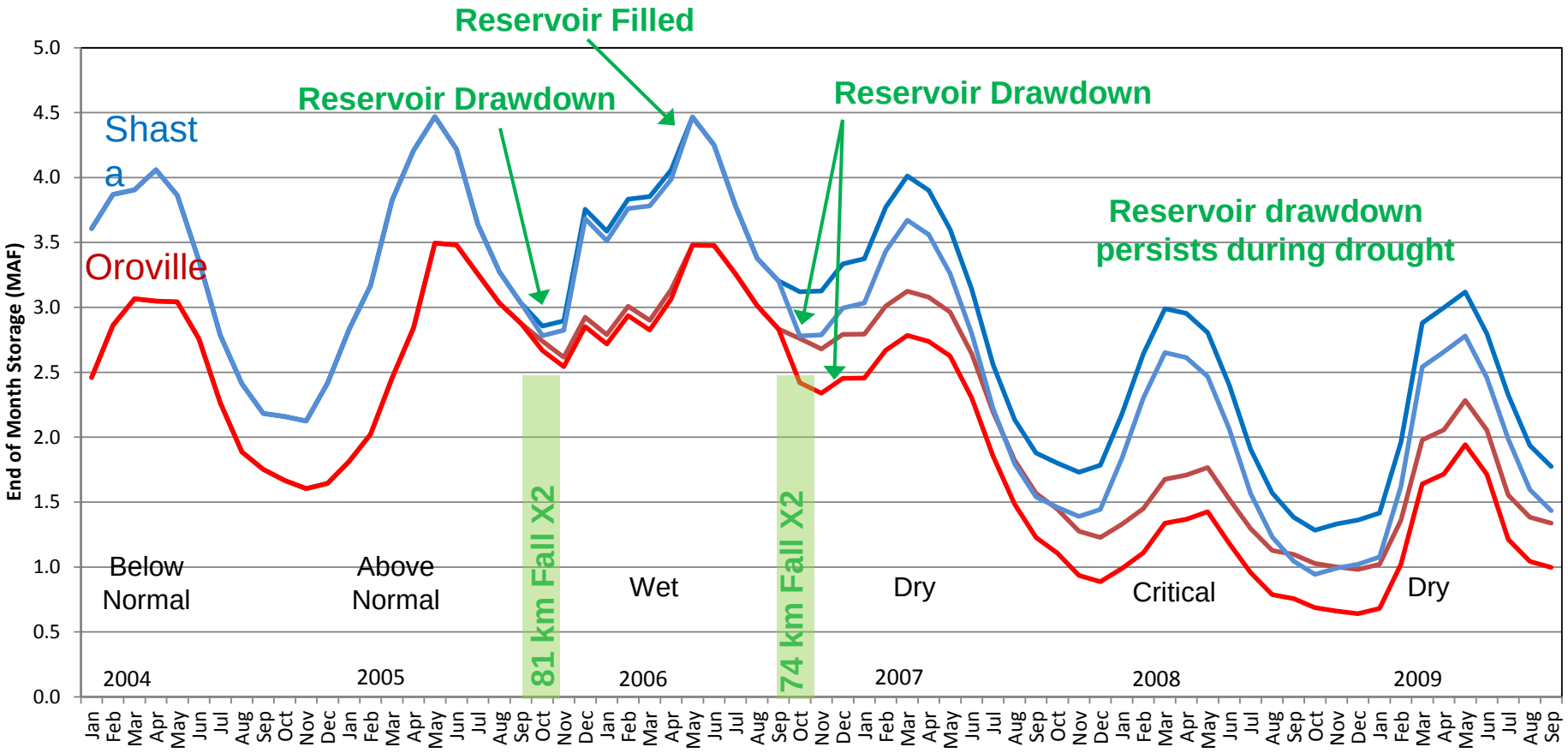


Water stored in reservoirs is essential to meet multiple beneficial uses:

- Salmon habitat
- Stream temperature
- Pacific flyway
- Delta flows
- Recreation
- Urban water supply
- Public health and safety
- Agriculture
- Hydropower

Unimpaired flow requirements inhibits water from being stored and impact beneficial uses

Shasta and Oroville Storage 2004 – 2009
Example of Effects of Fall X2



In 2005 about 150,000 AF of additional outflow would have been needed to meet Fall X2

- X2 in October was located about 83.7 km

In 2006 about 700,000 AF of additional outflow would have been needed to meet Fall X2

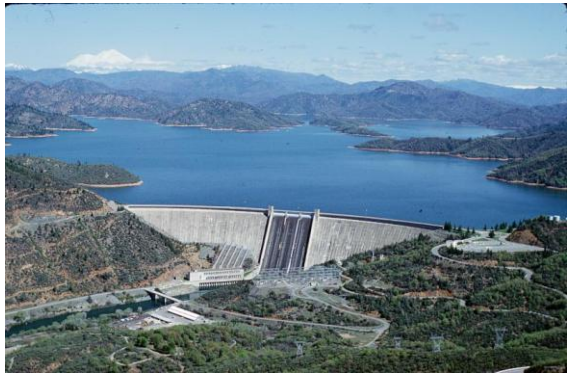
- X2 in October was located about 84.3 km

Estimated based on monthly flow-based X2 equation

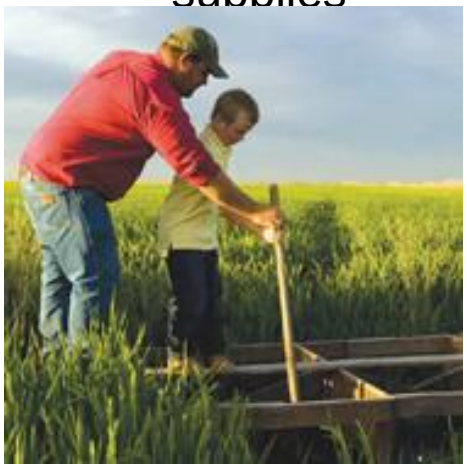
Multiple Beneficial Uses Supported By Summer-Fall Reservoir Storage Releases

Salmon and steelhead rearing and spawning

Peak Hydropower Generation



Agricultural water supplies



Pacific Flyway migratory bird habitat and refuge

Recreation

Source: Anthony Dunn Photography

Conclusions

- Daily tidal flows dwarf net Delta outflows and cause the position of LSZ to move considerable distances twice daily. The actual position of LSZ and X2 is not known only estimated. There is considerable uncertainty that attempting to control LSZ or X2 using Sacramento River flow will produce fishery benefits.

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