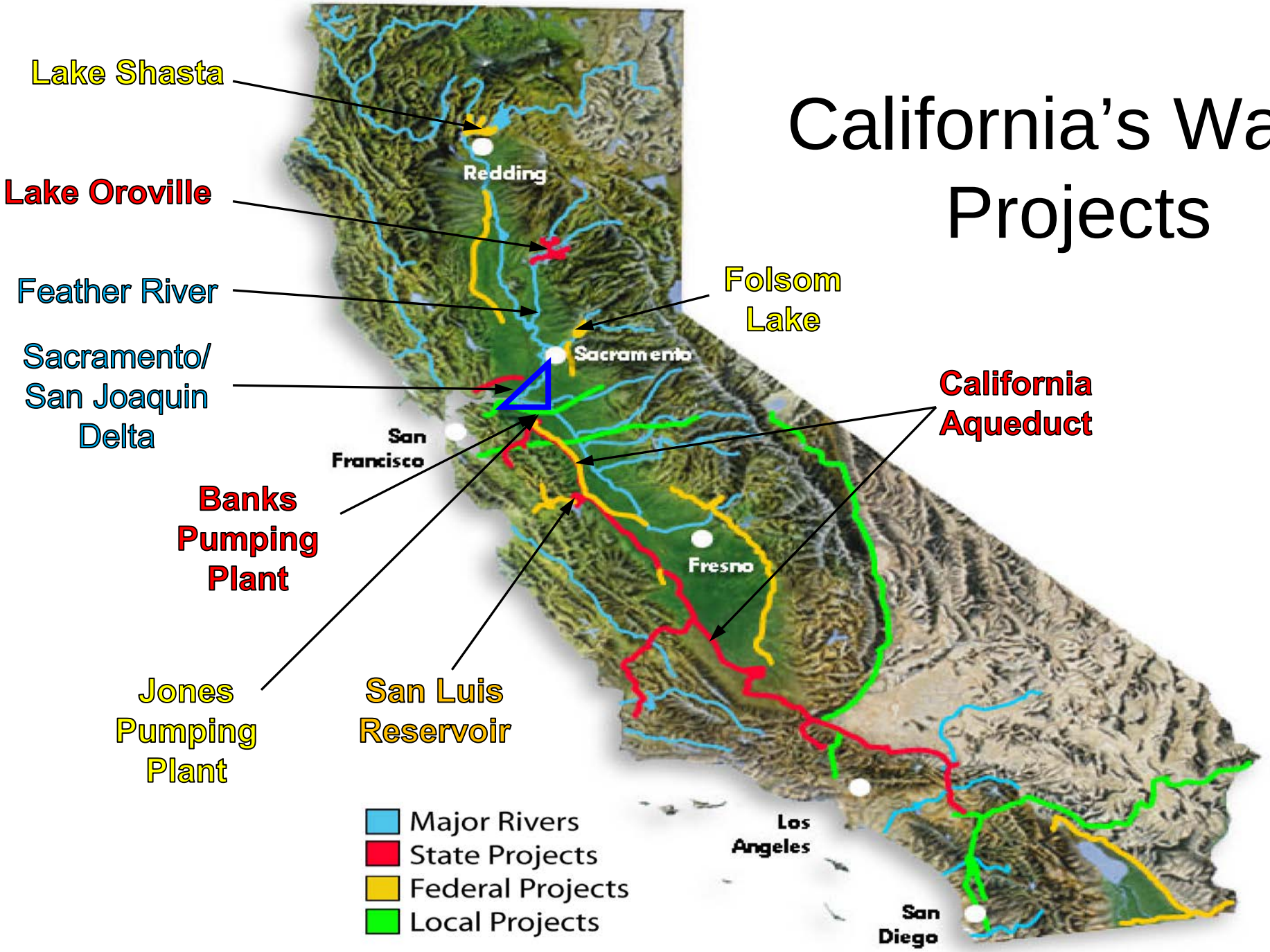
CALIFORNIA WATER FIX
RELIABLE. CLEAN. WATER.

OPERATIONS

OPERATIONS SUMMARY

- **Overview of Water System Operations**
- **Real-Time Operations**
- **Success in meeting WQCP Objectives**
- **Modified Obligations in Recent Drought Years**
- **Increased Flexibility with CWF**
- **Conclusion**

California's Water Projects



OVERVIEW OF WATER SYSTEM OPERATIONS

- **Higher Priority Needs Must be met First**
  - In-Basin Requirements
    - Bay-Delta D-1641 water quality control plan objectives
    - Other legal users of water (including settlement contracts)
  - Other Regulatory Requirements
    - Endangered Species Act Requirements
    - Other State and Federal Permits
- **SWP/CVP developed supply is secondary**

OVERVIEW OF WATER SYSTEM OPERATIONS (CONT'D)

- **Excess Conditions**
  - When SWP/CVP releases plus unregulated flow exceed In Basin Requirements
- **Balanced Conditions**
  - When SWP/CVP releases and unregulated flow are equal to In Basin Requirements
    - Unstored flow may be available for export
    - Supplemental SWP/CVP storage withdrawals may be needed to meet In-Basin requirements
  - SWP/CVP actively manage the system

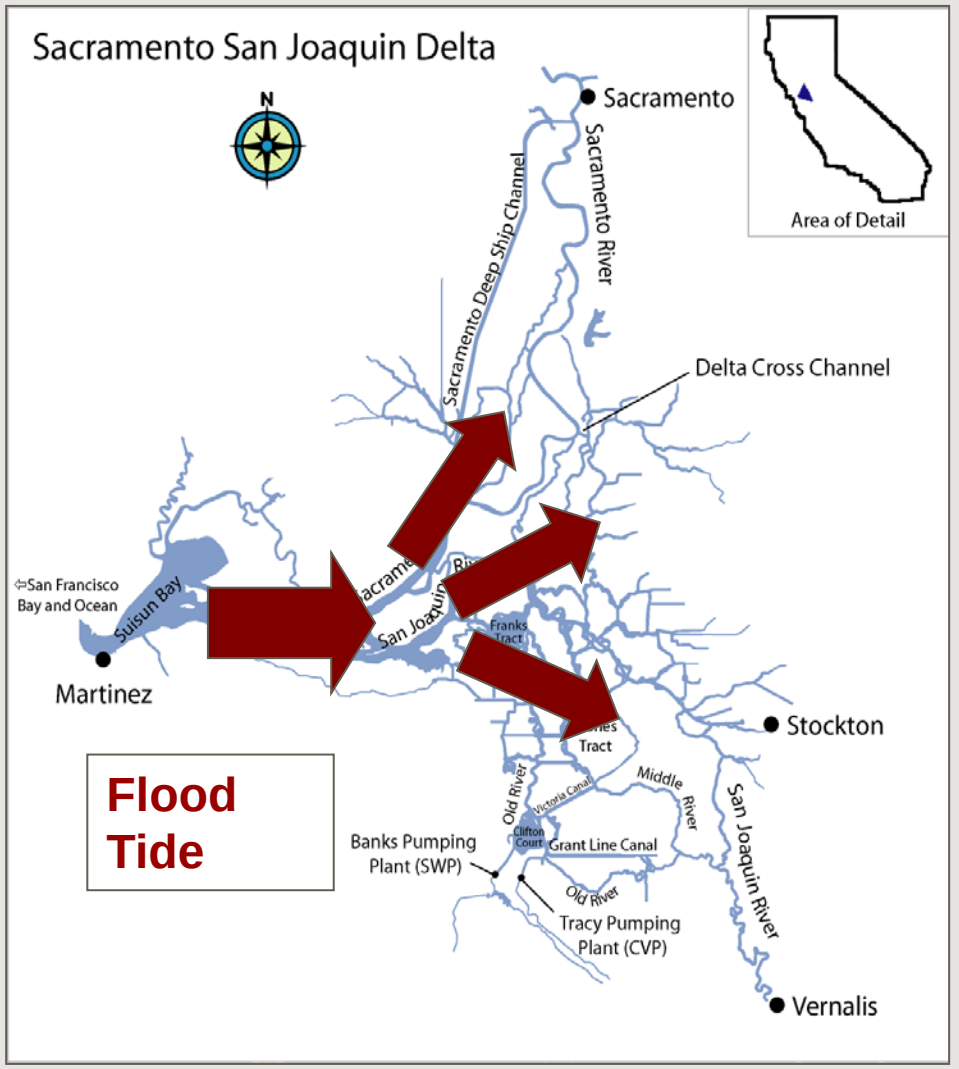
REAL-TIME OPERATIONS

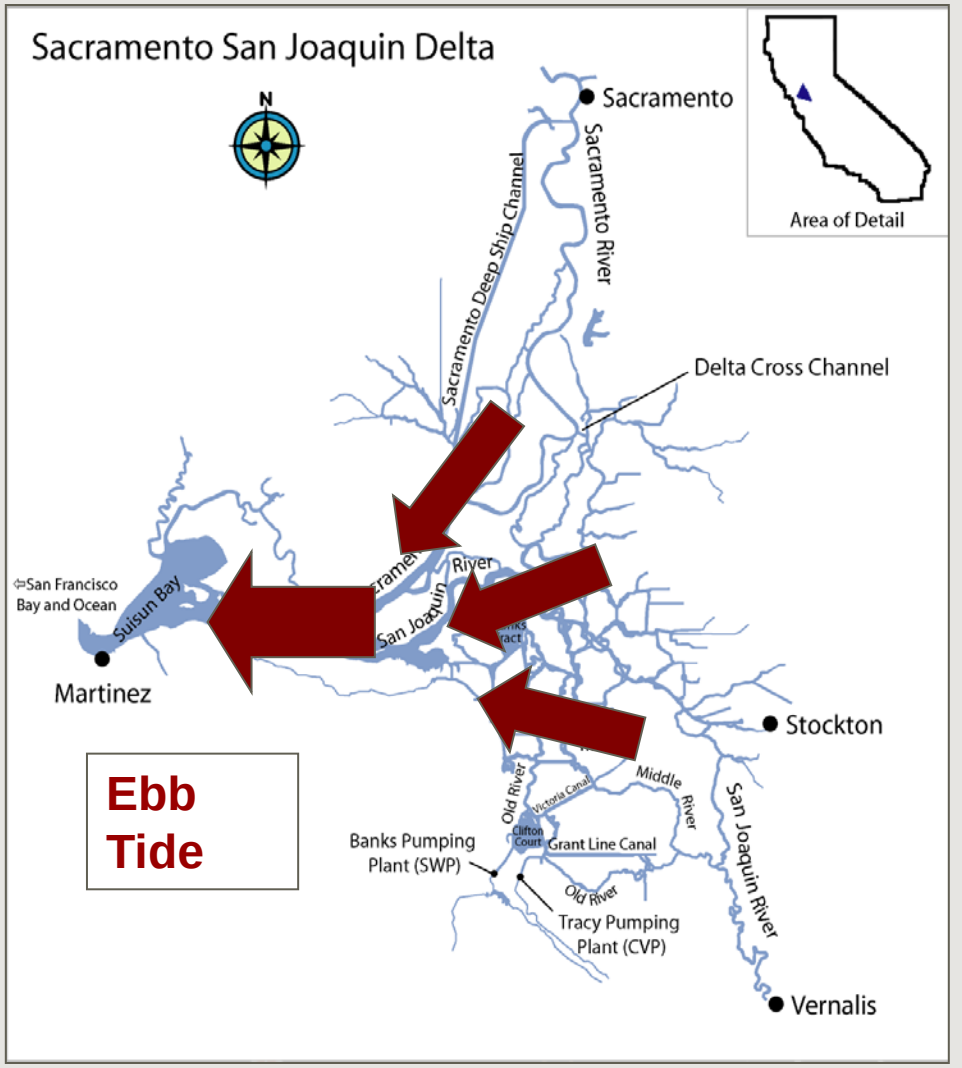
- **Delta Hydrodynamics**
  - Tides
    - Daily ebb and flood
    - Monthly spring and neap
  - Delta Inflow
  - In-Delta Diversions
  - SWP/CVP Exports
  - Net Delta Outflow

- **Real-time Monitoring**

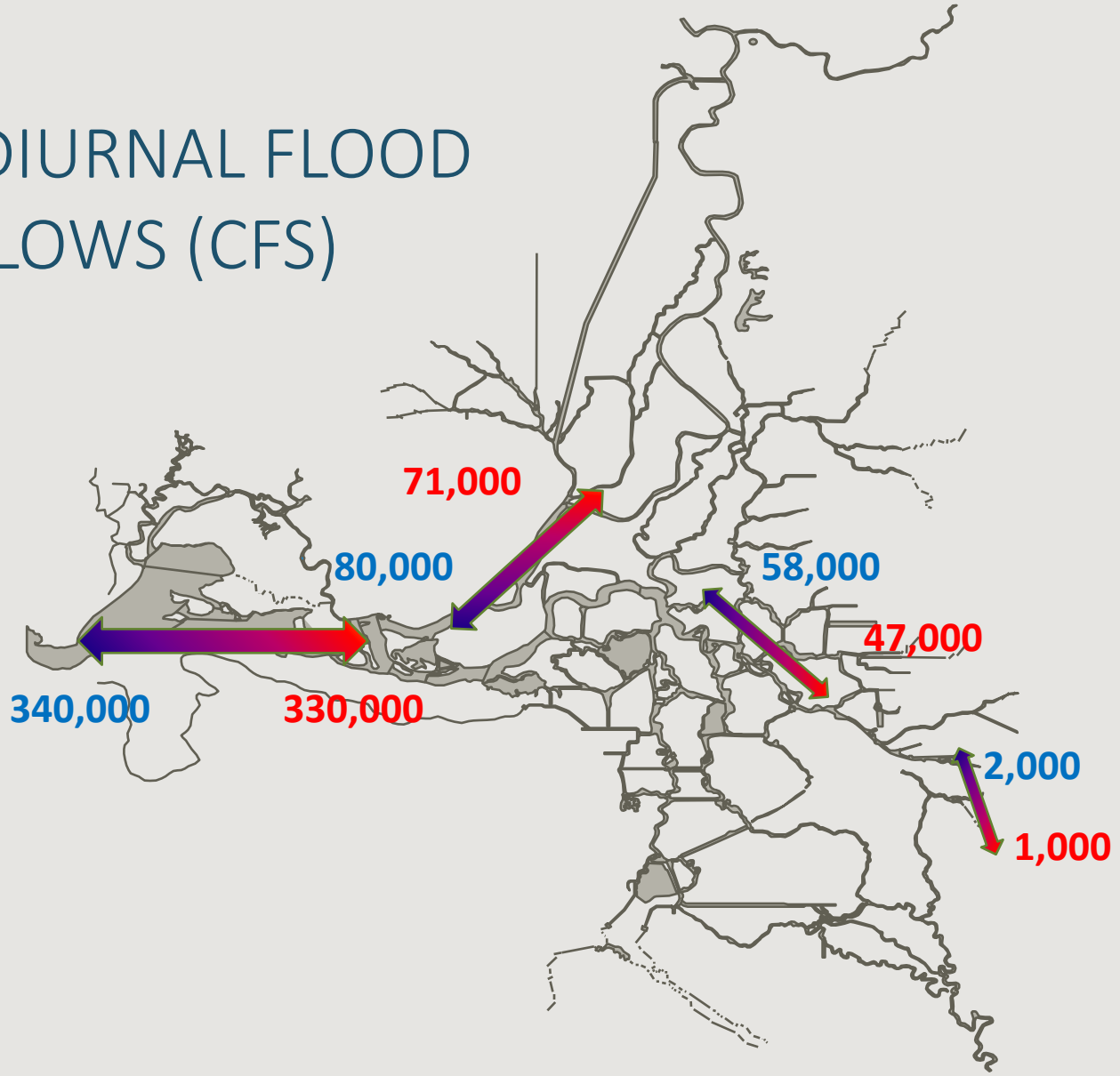
- **SWP/CVP Operations**
  - Upstream Release Changes
  - Export Changes

SALT WATER / FRESH WATER INTERACTION

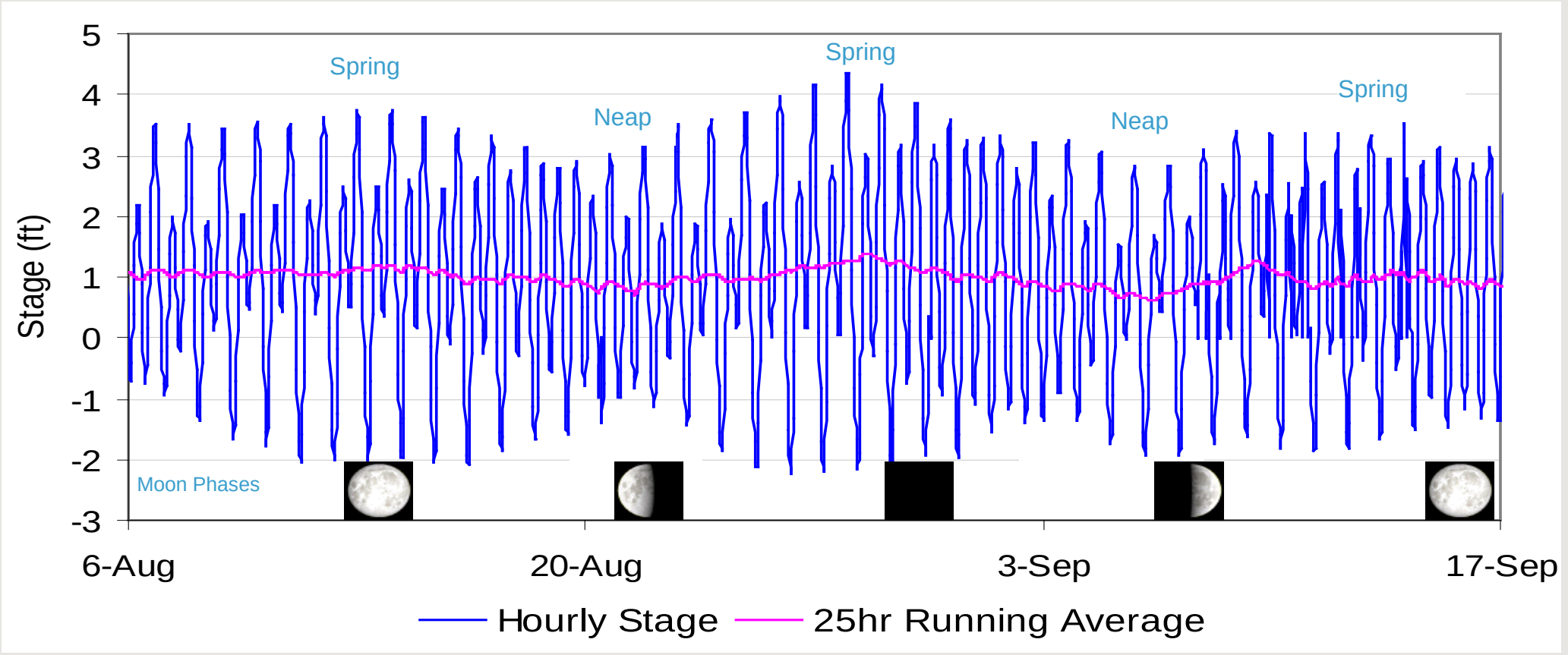




TYPICAL SEMI-DIURNAL FLOOD AND EBB FLOWS (CFS)

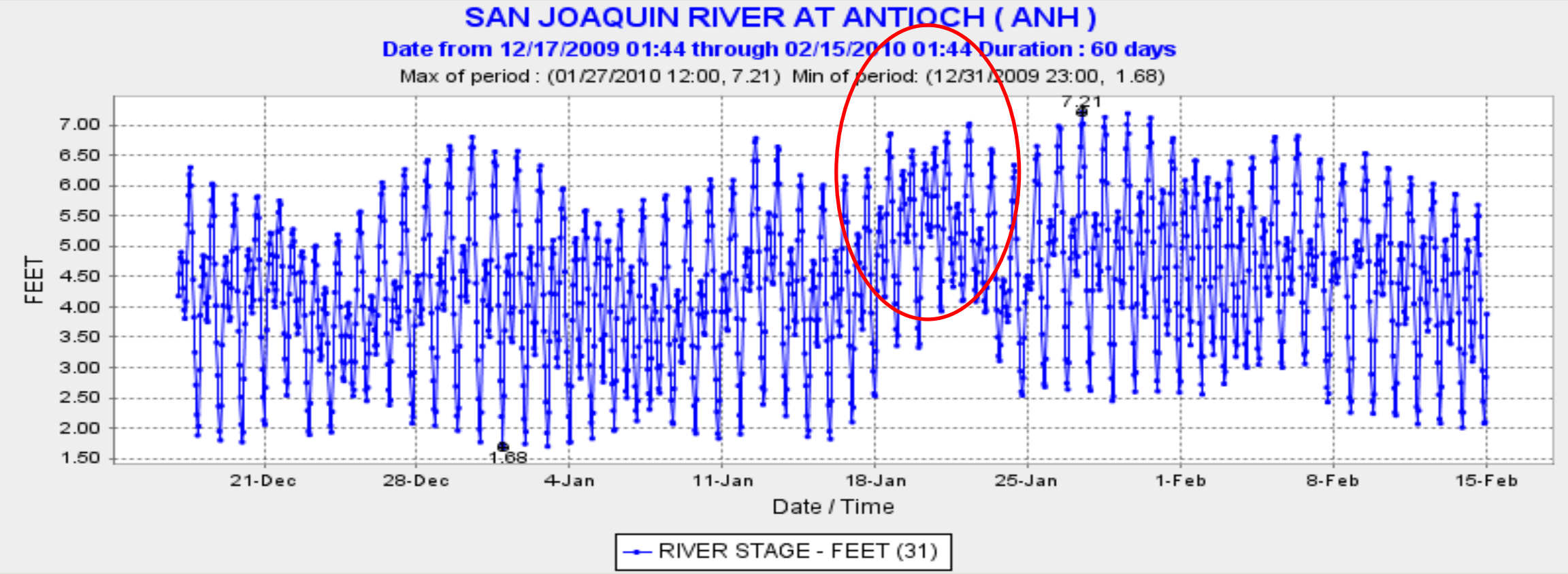


SEMI-MONTHLY
SPRING AND NEAP TIDES (CFS)



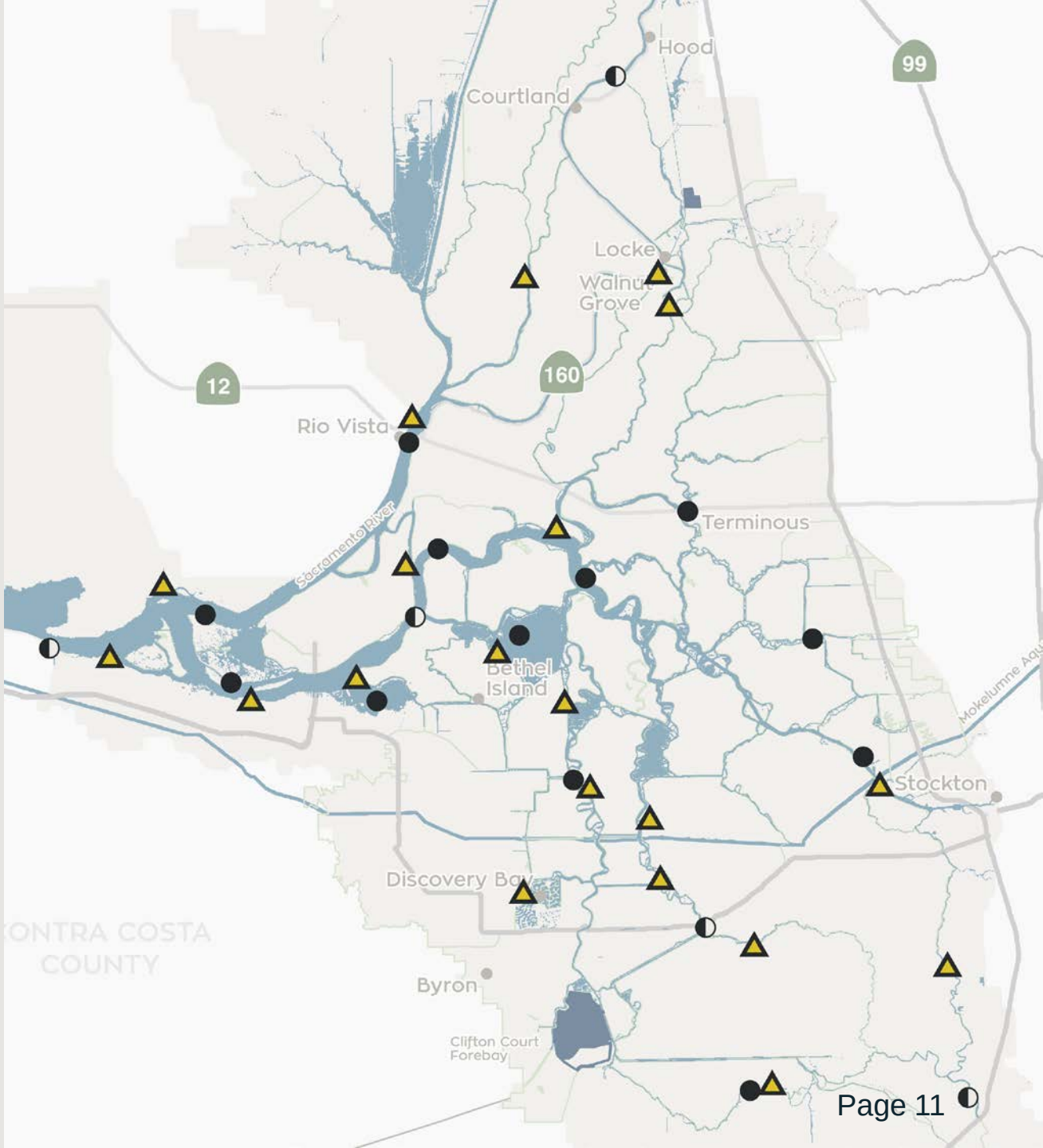
Spring and Neap Tides at Martinez, CA August-September 2000

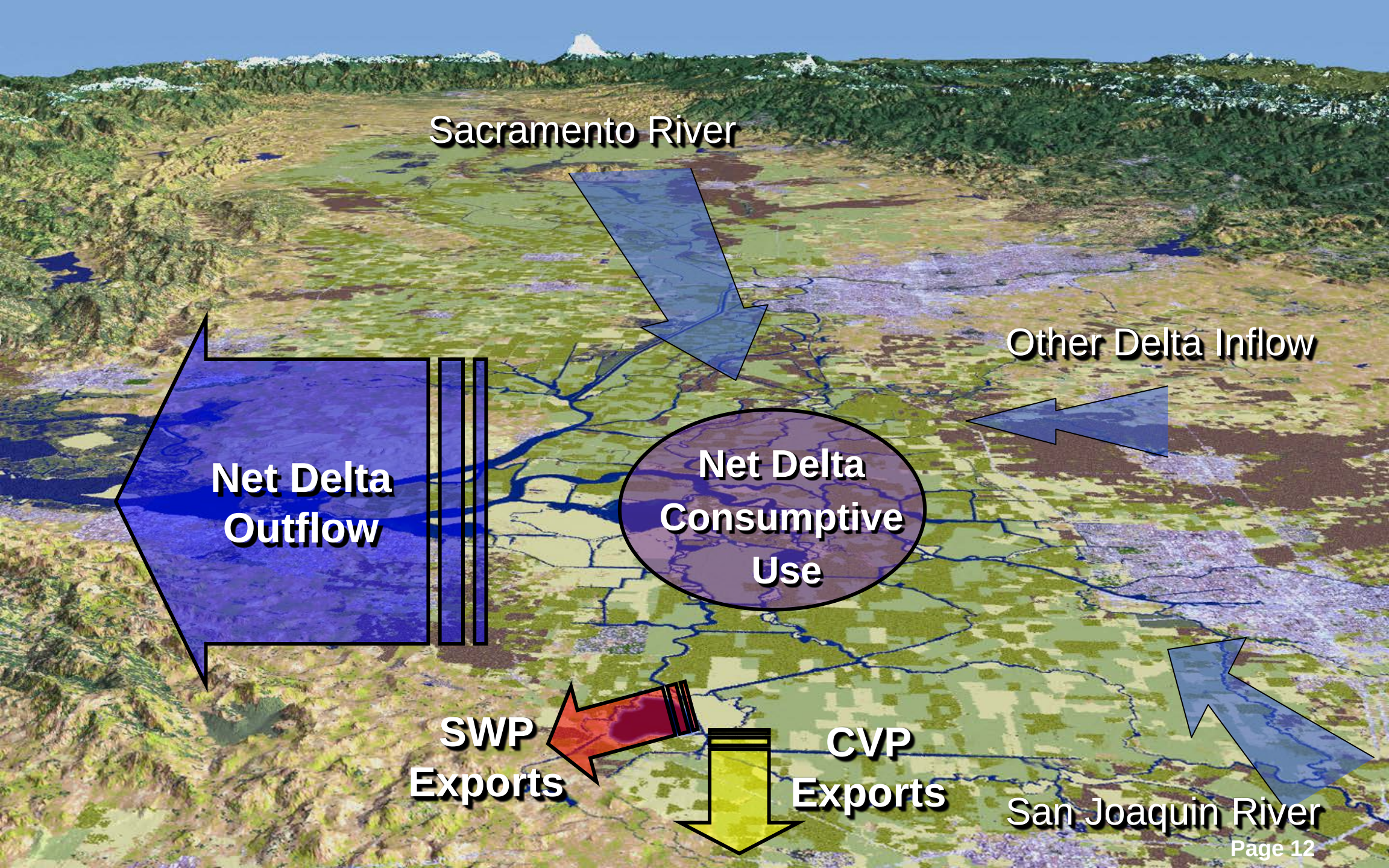
METEOROLOGICAL EVENTS CAN TURN A NEAP TIDE INTO A SPRING TIDE



KEY WATER QUALITY MONITORING STATIONS

- Water Quality Sampling Site
- Salinity Sampling Site
  (Electrical Conductivity Measurement)
- Continuous Salinity Recording Site
  (Electrical Conductivity Measurement)




Sacramento River
Other Delta Inflow
Net Delta Outflow
Net Delta Consumptive Use
SWP Exports
CVP Exports
San Joaquin River

- **Net Delta Outflow Index =**

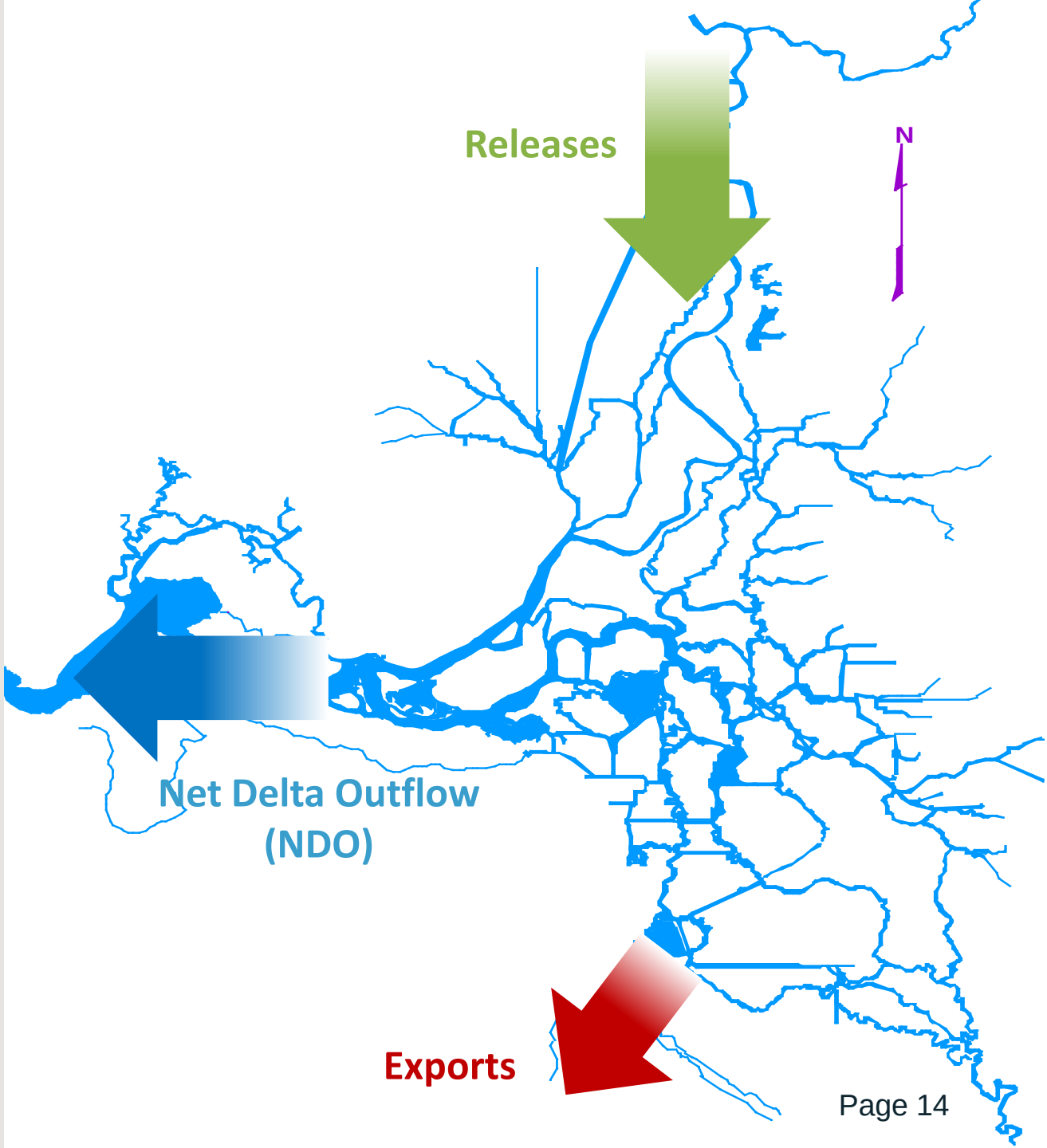
  Delta Inflow – Net Delta Consumptive Use – Delta Exports

- **SWP/CVP Influence Delta Inflow**

- **SWP/CVP Control Delta Export**

EXISTING FACILITIES

- **Two principal "knobs" for Net Delta Outflow Control**
  - Releases
  - Exports

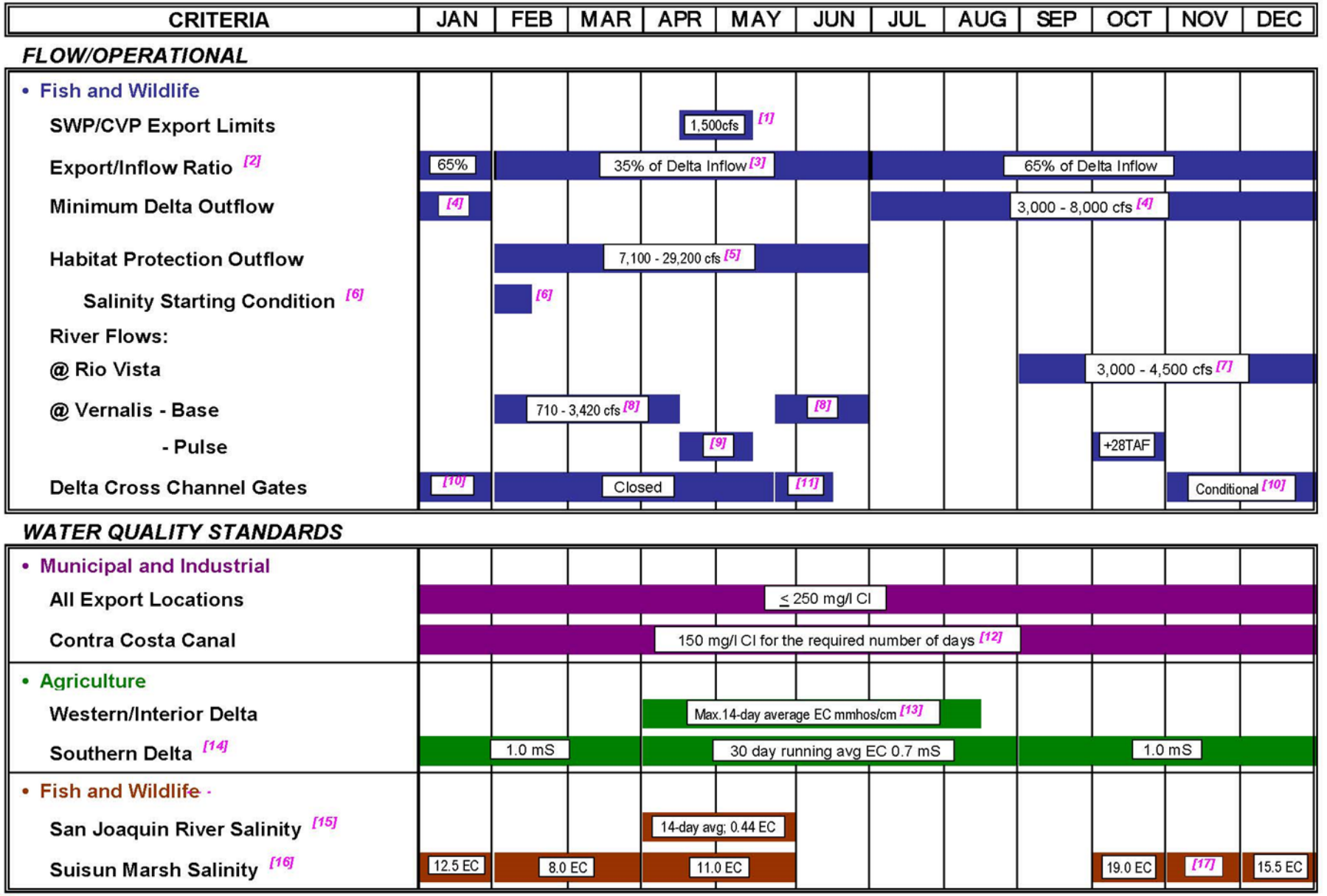


RECORD FOR MEETING BAY-DELTA KEY D-1641 STANDARDS

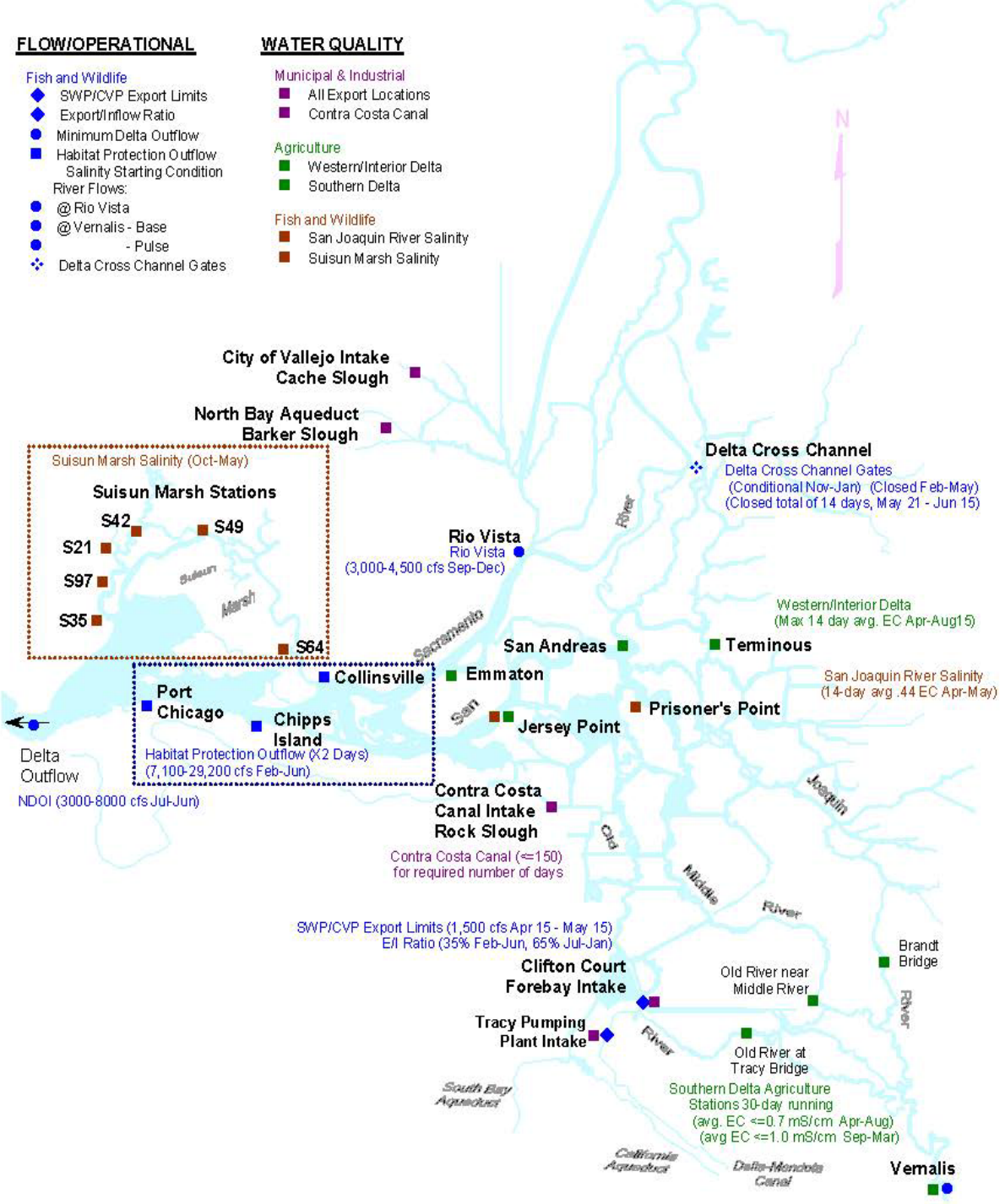
- **What are the Bay-Delta D-1641 standards?**
  - Key compliance stations
- **Historical compliance record**
  - Responsive real-time operations
  - Simulation models simplify and approximate

Bay-Delta Standards

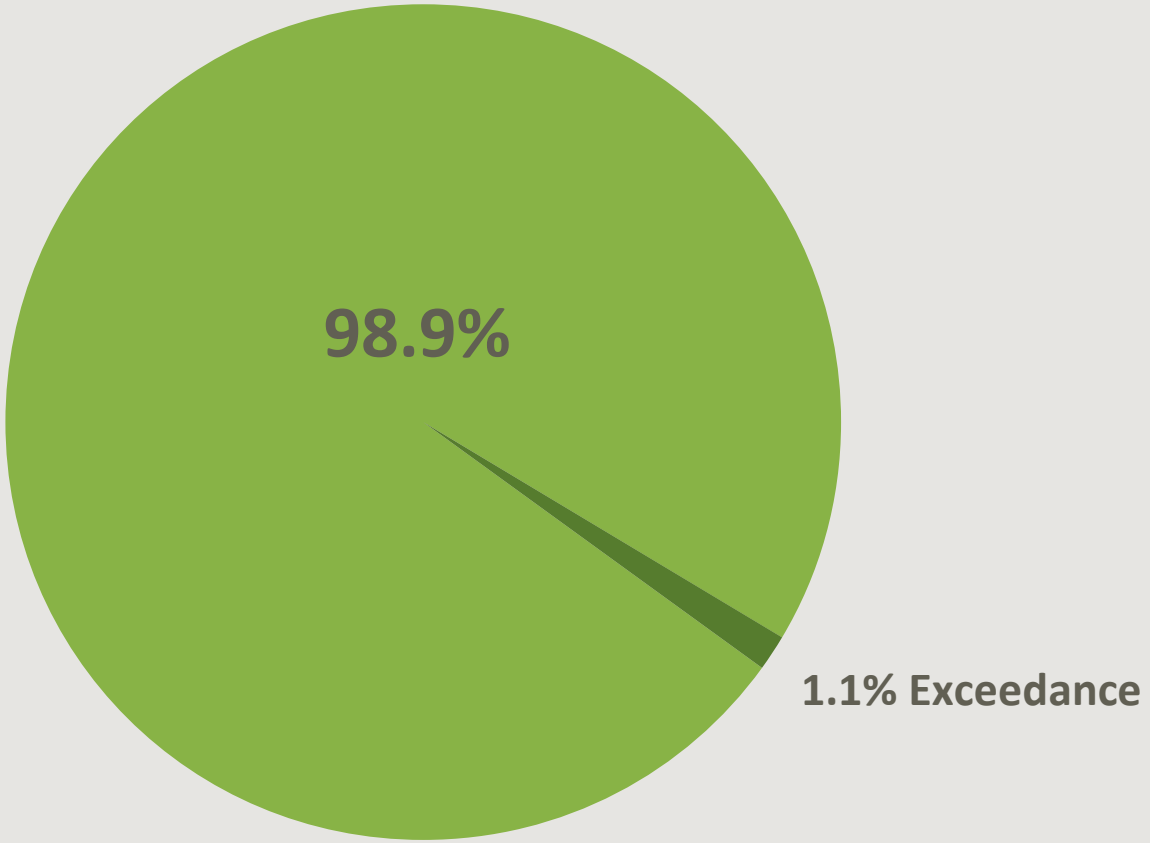
Contained in D-1641



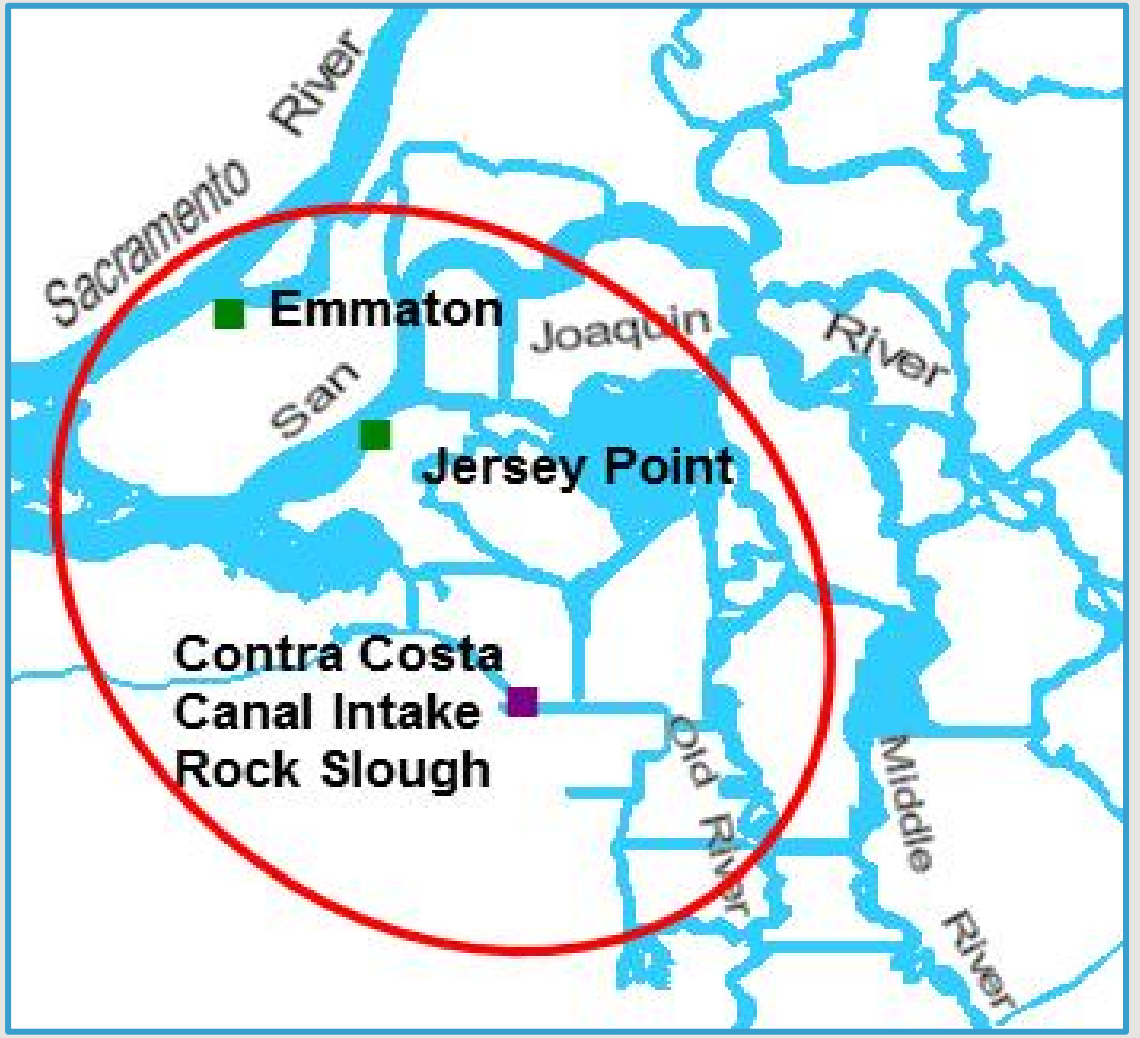
D-1641 BAY-DELTA STANDARDS STATIONS



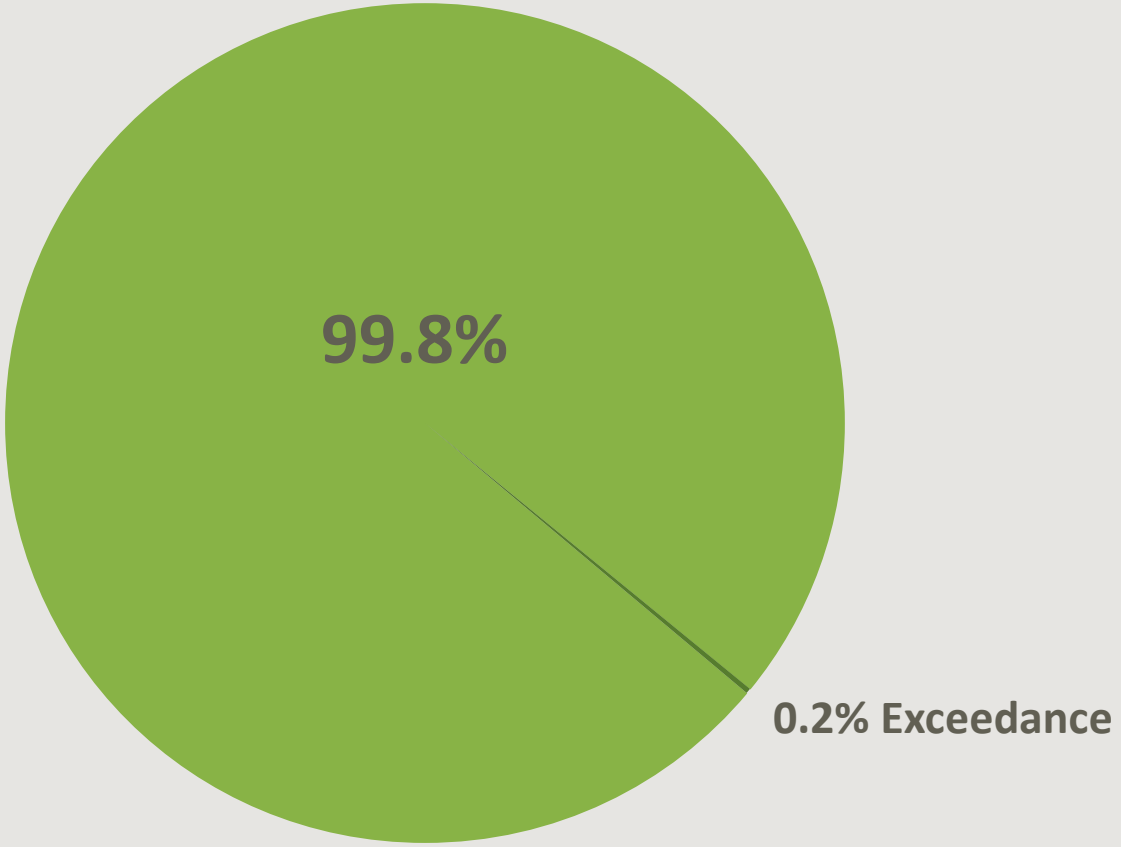
SWP/CVP SUCCESS AT MEETING OPERATIVE BAY-DELTA OBJECTIVES (1978 – 2015)



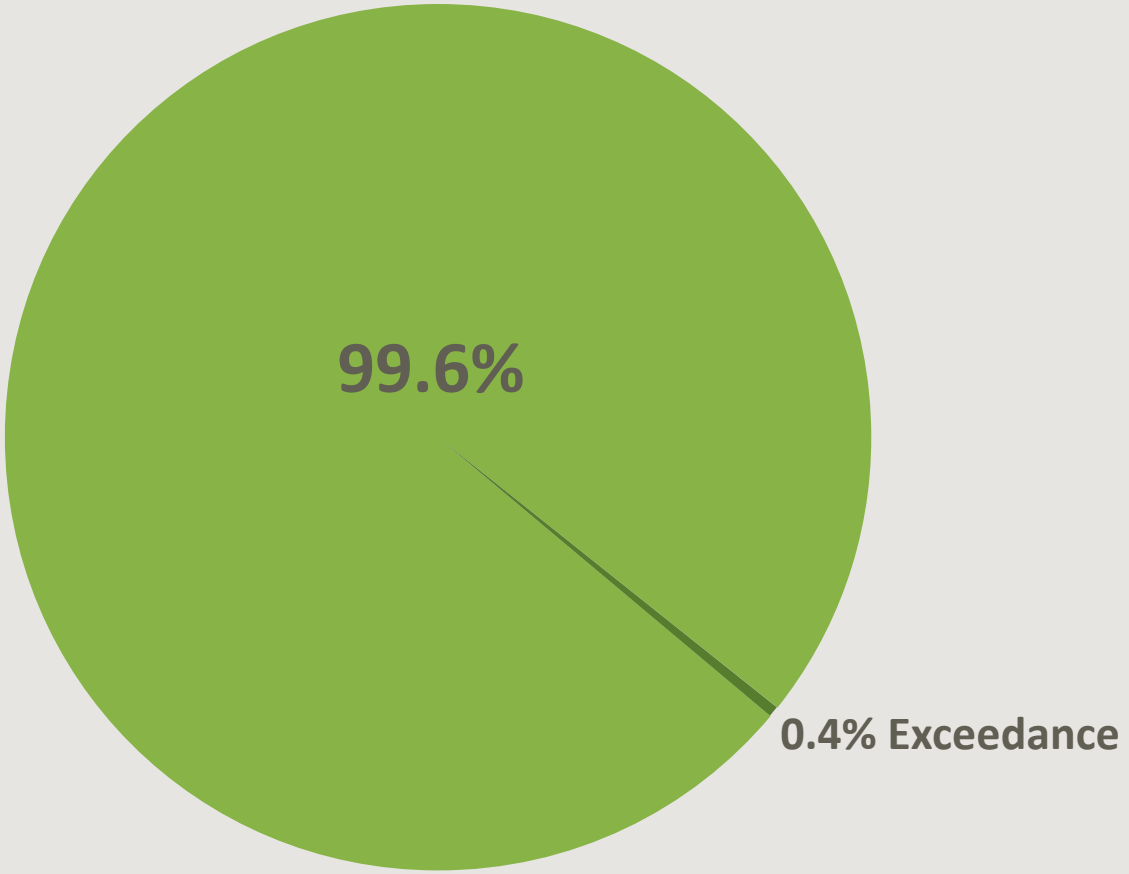
D-1641 BAY-DELTA STANDARDS STATIONS



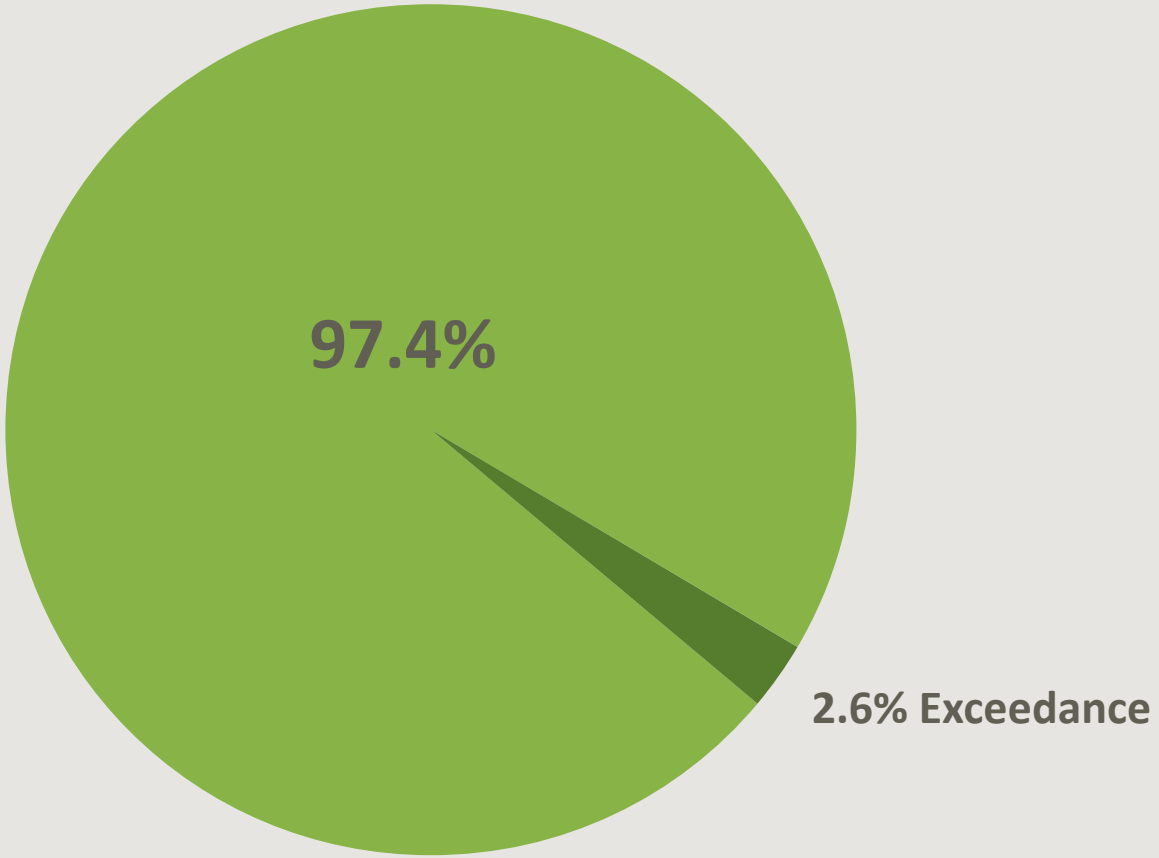
SWP/CVP SUCCESS AT MEETING OBJECTIVES AT CCC ROCK SLOUGH DIVERSION (1978 – 2015)



SWP/CVP SUCCESS AT JERSEY POINT (1978 – 2015)

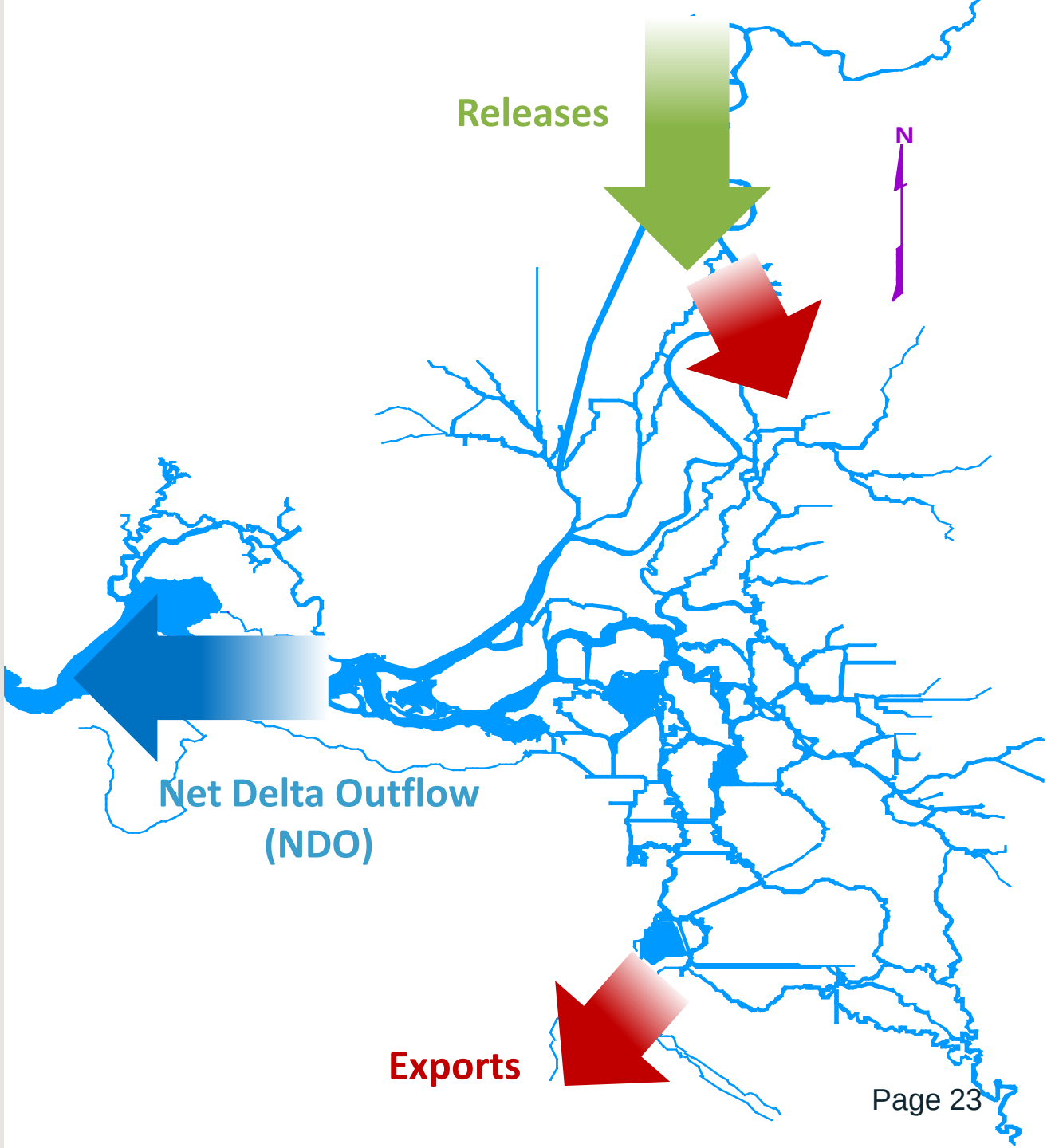


SWP/CVP SUCCESS AT EMMATON (1978 – 2015)

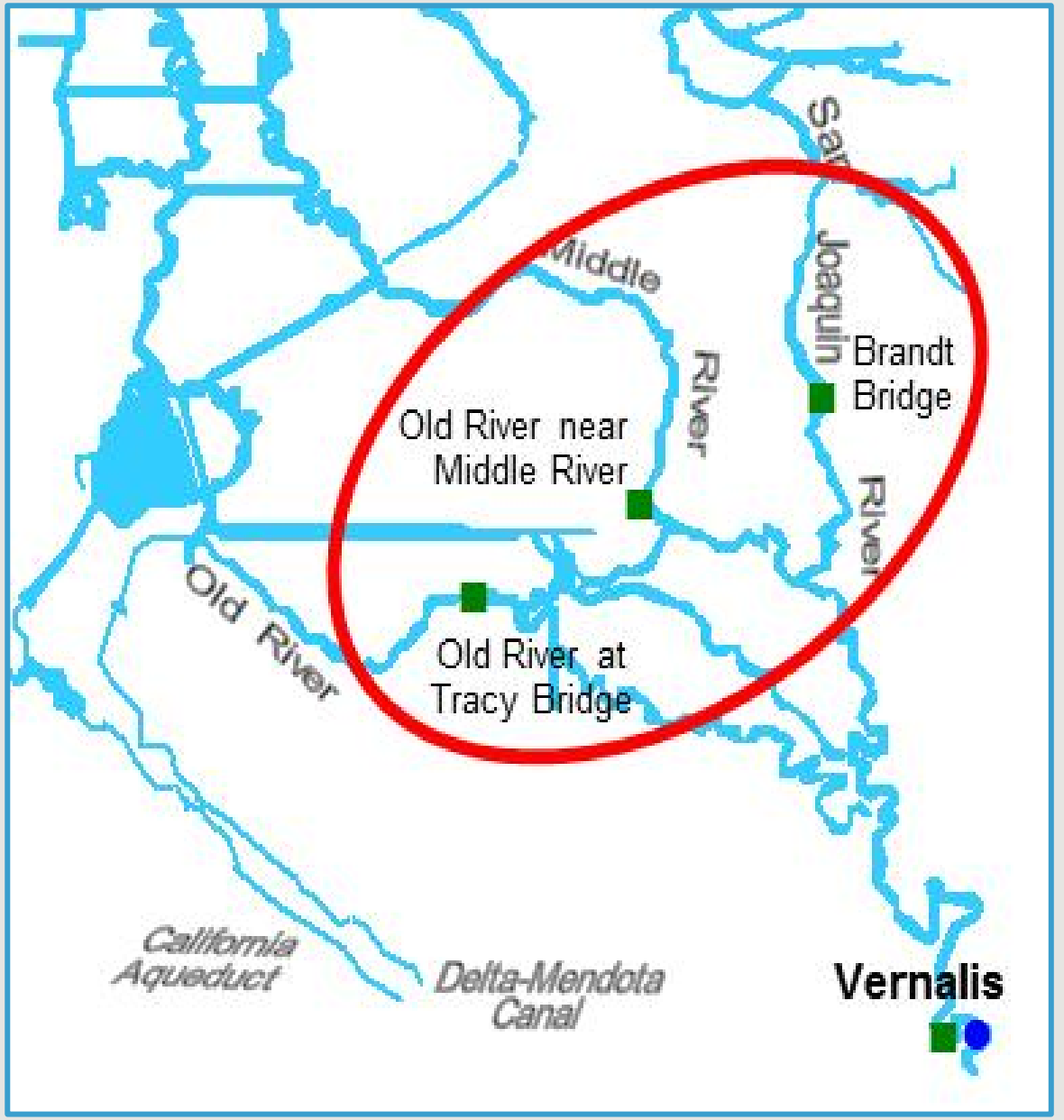


WITH CWF

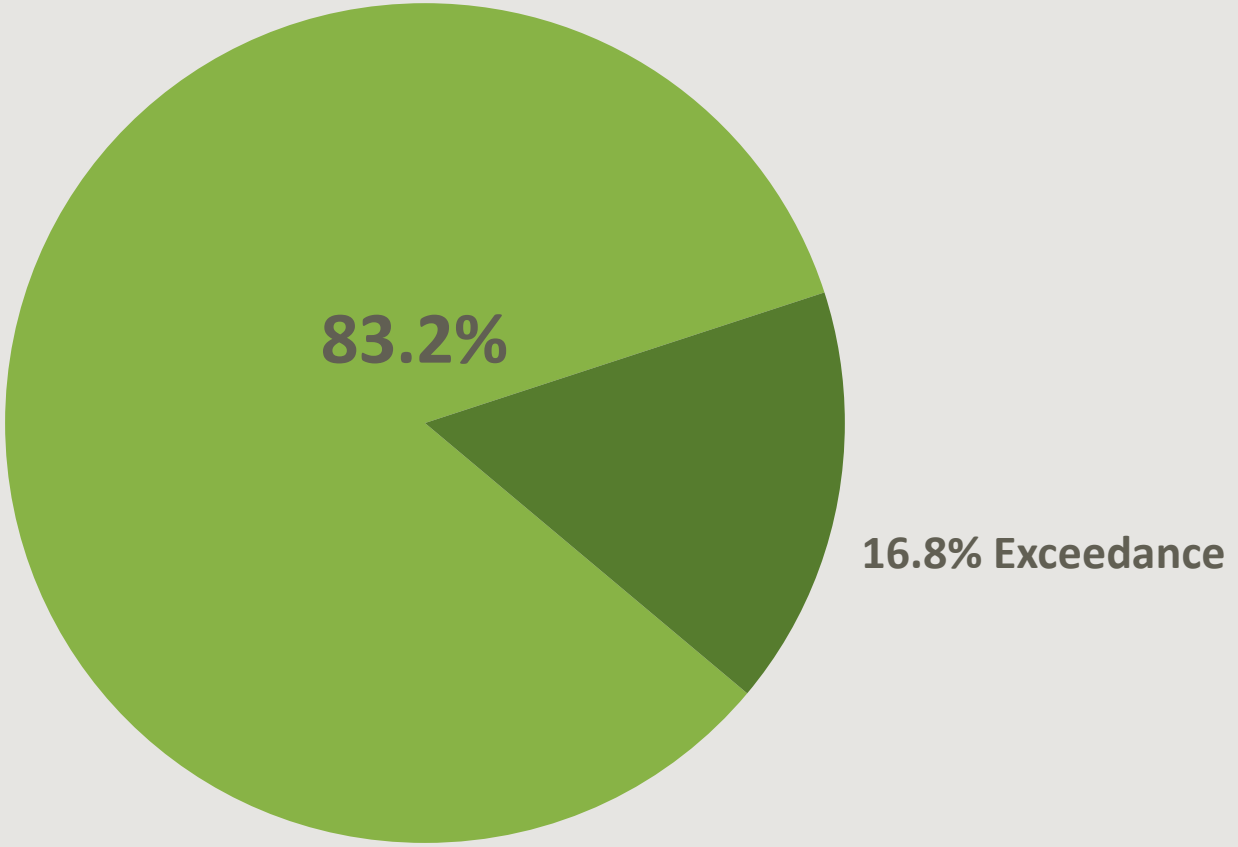
- Same Delta water quality requirements
- No change to SWP/CVP water right permits
- Increased flexibility with two export control ‘knobs’ (North and South locations)



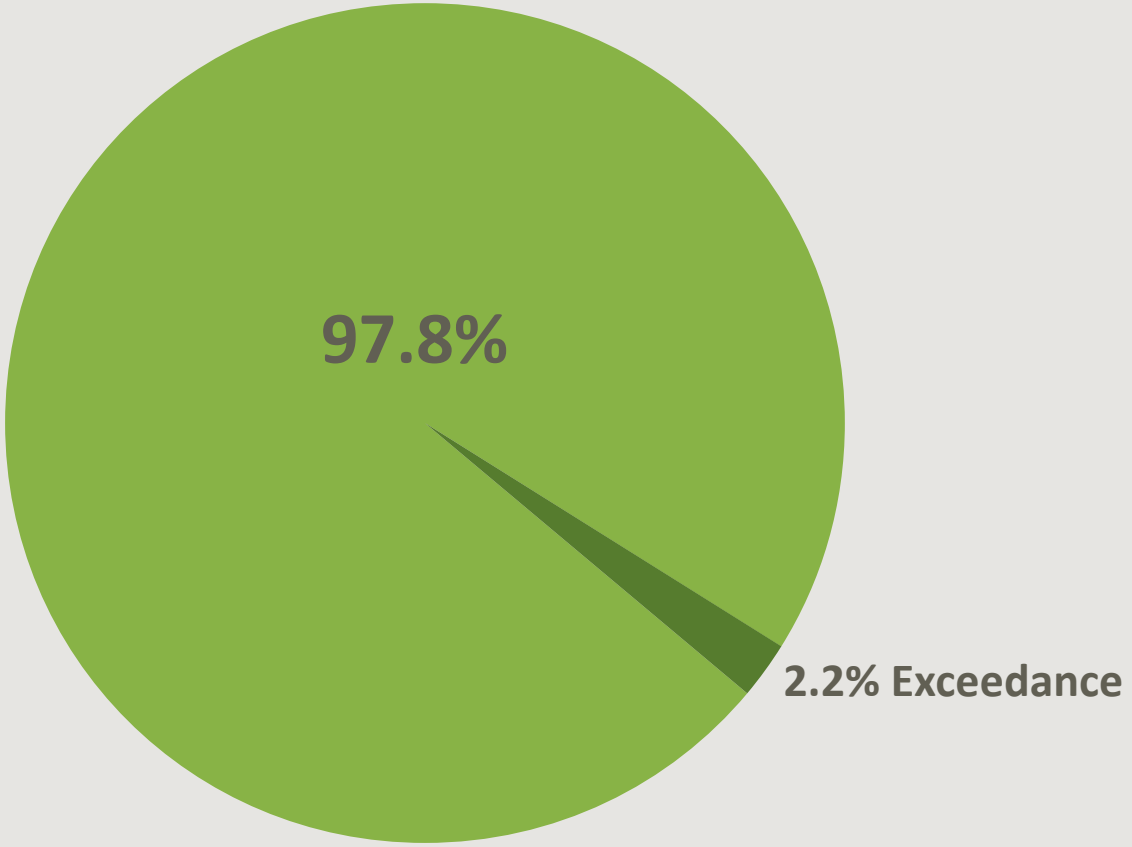
SOUTH DELTA STANDARDS STATIONS



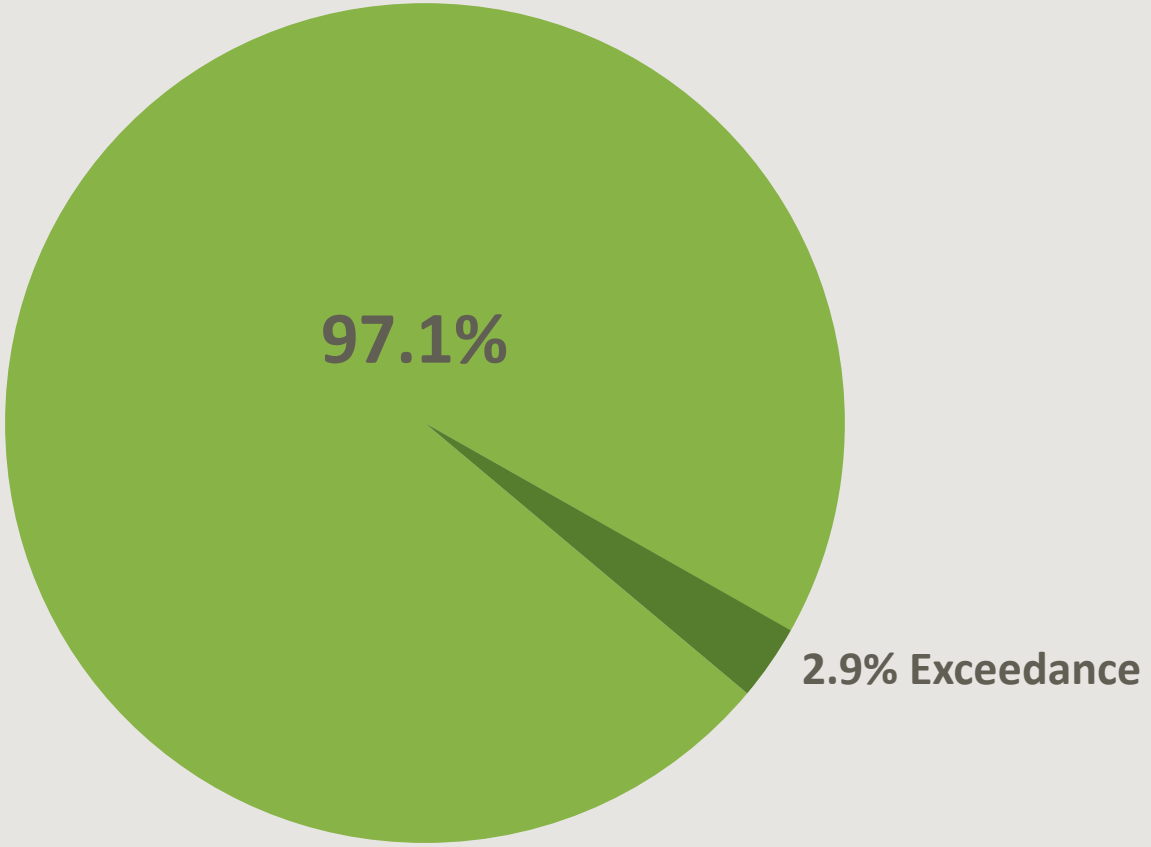
SOUTH DELTA EXCEEDANCE AT OLD RIVER AT TRACY ROAD BRIDGE



SOUTH DELTA EXCEEDANCE AT OLD RIVER AT MIDDLE RIVER



SOUTH DELTA EXCEEDANCE
AT SAN JOAQUIN RIVER AT BRANDT BRIDGE

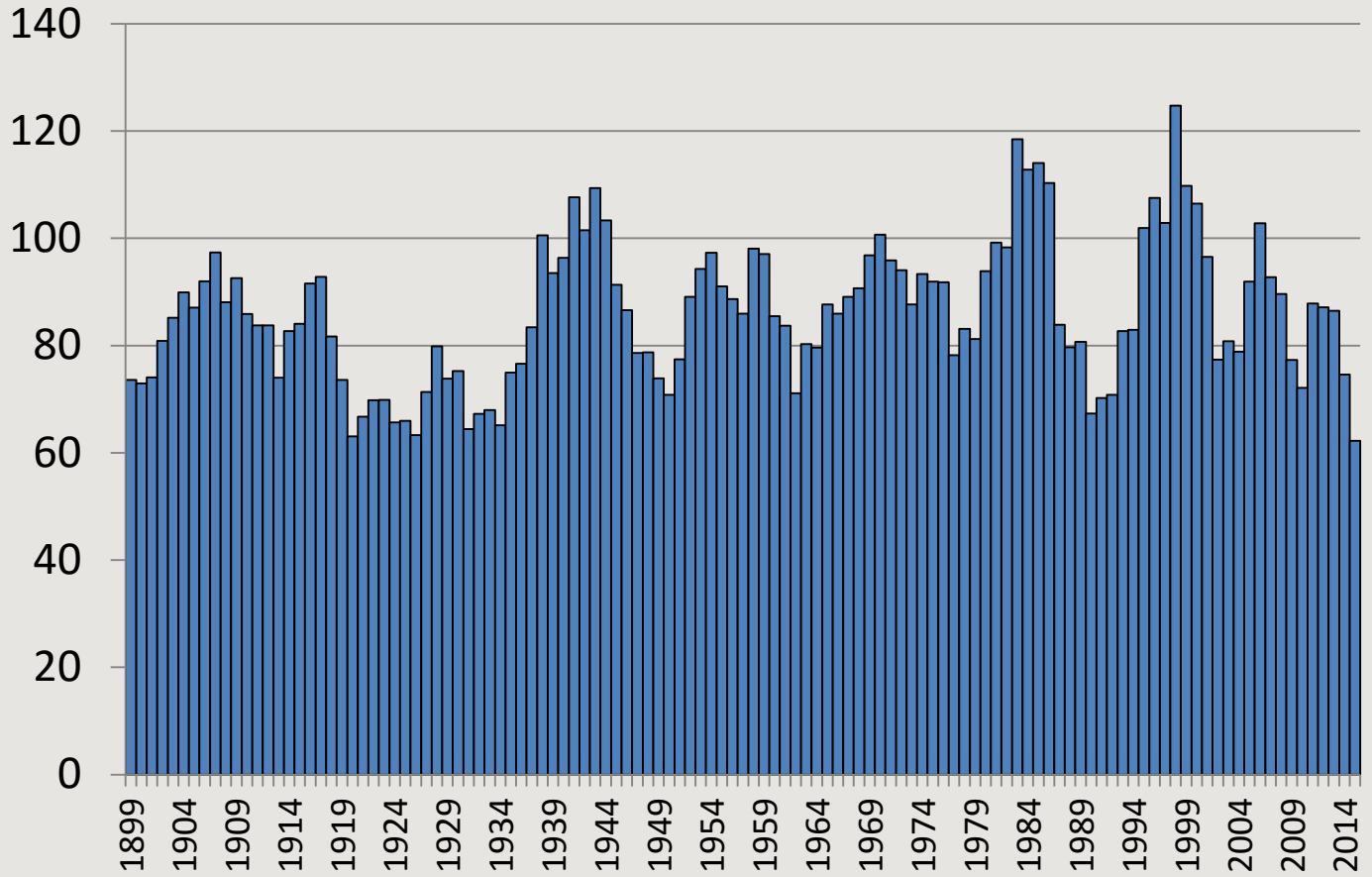


- South Delta water quality exceedances were beyond the reasonable control of the SWP/CVP operations
- South Delta water quality exceedances accounted for 89% of all D-1641 Standard exceedances
- If South Delta objectives are removed from the calculation, comprehensive exceedances drop to 0.2%

TEMPORARY URGENCY CHANGE PETITIONS

- **Past three years of exceptional drought**
  - —Exceptionally warm and dry
- **Insufficient stored water available to meet standards**
  - —SWRCB granted conditional approval

California Statewide 4-year Precipitation Sums

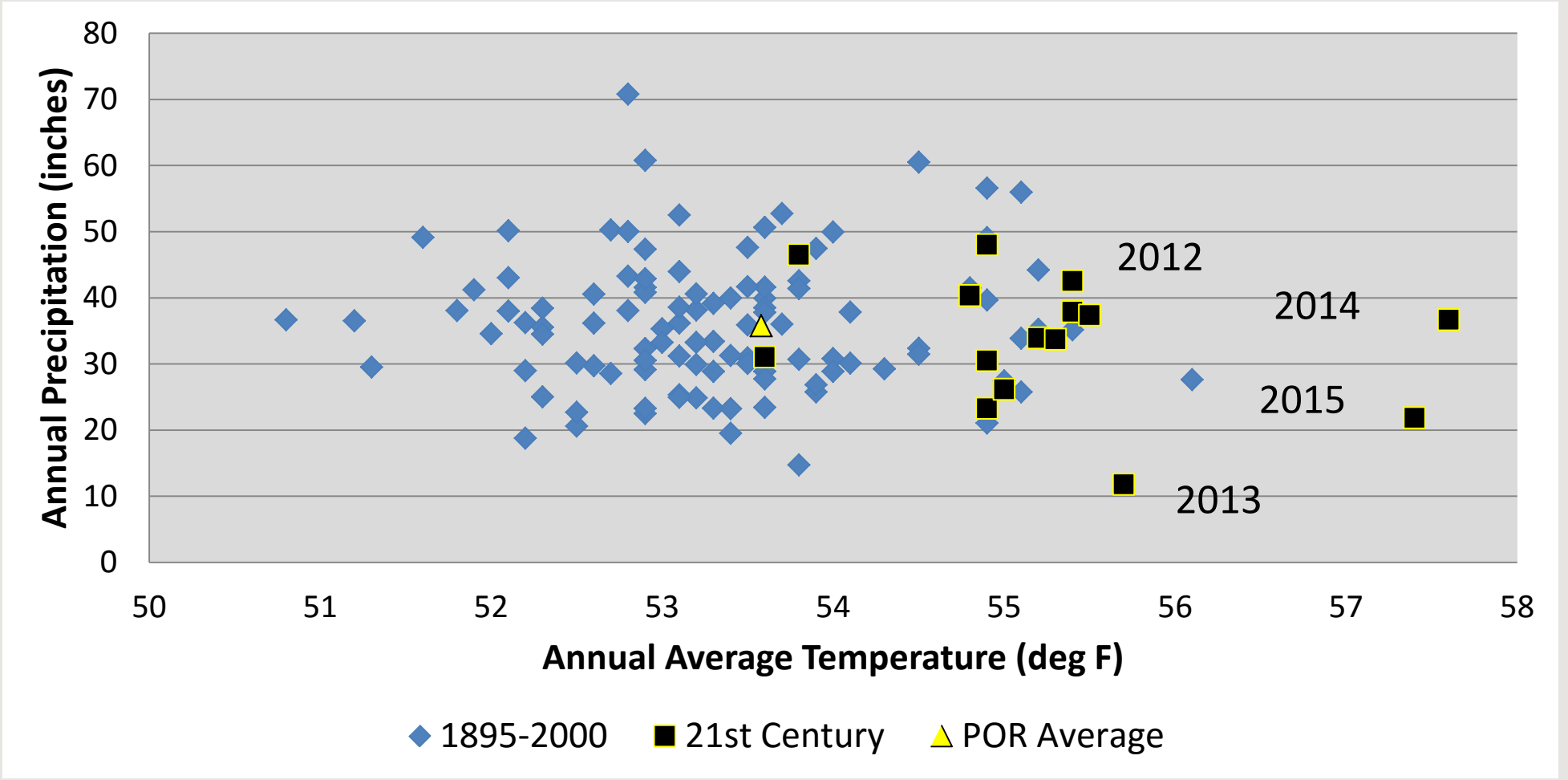


Lowest Totals

Year	4-year Sum
2015	62.2
1920	63.1
1926	63.3
1931	64.5
1934	65.1
1924	65.7
1925	65.9

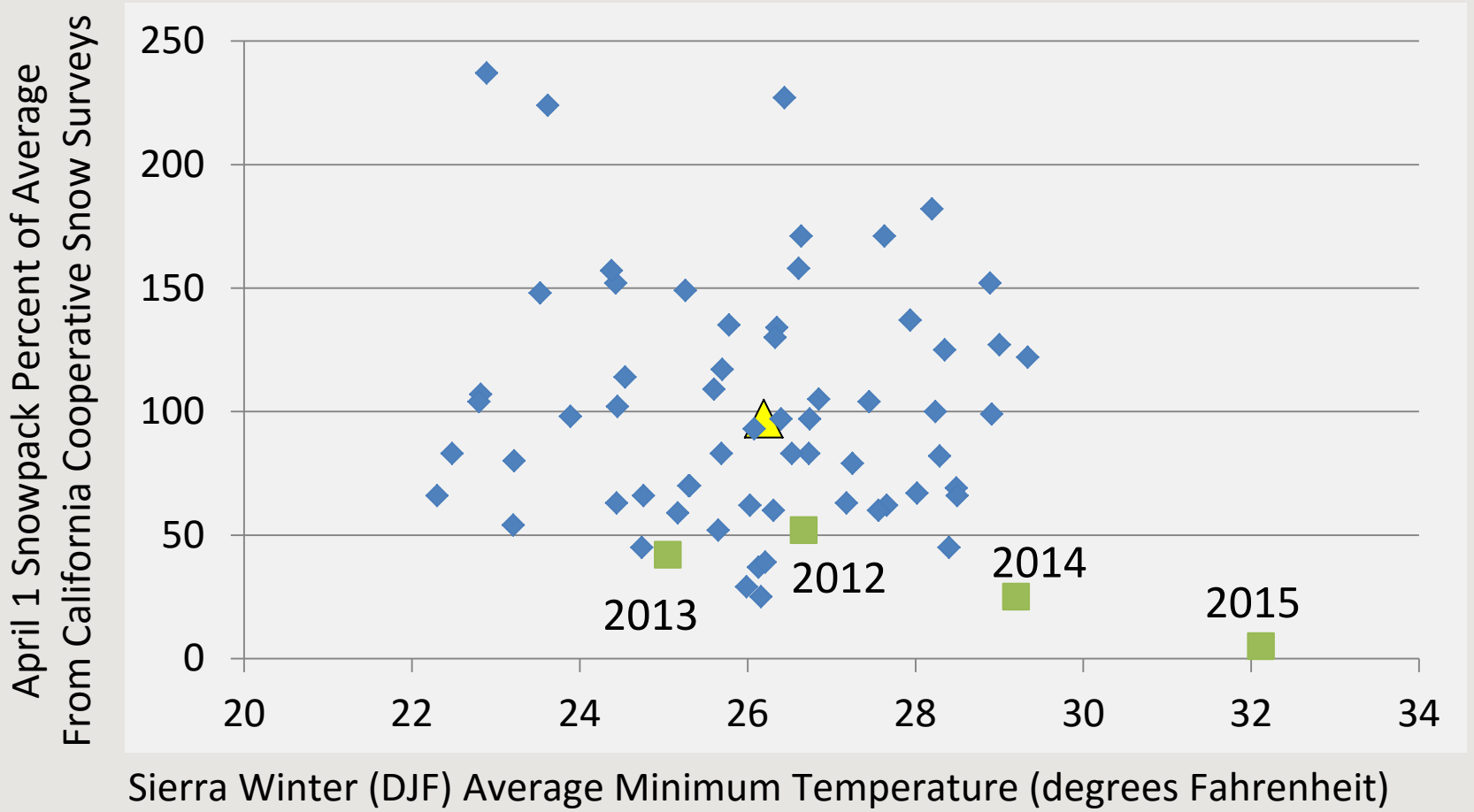
Source: Western Regional Climate Center

SACRAMENTO VALLEY CALENDAR YEAR DATA (1895 – 2015)



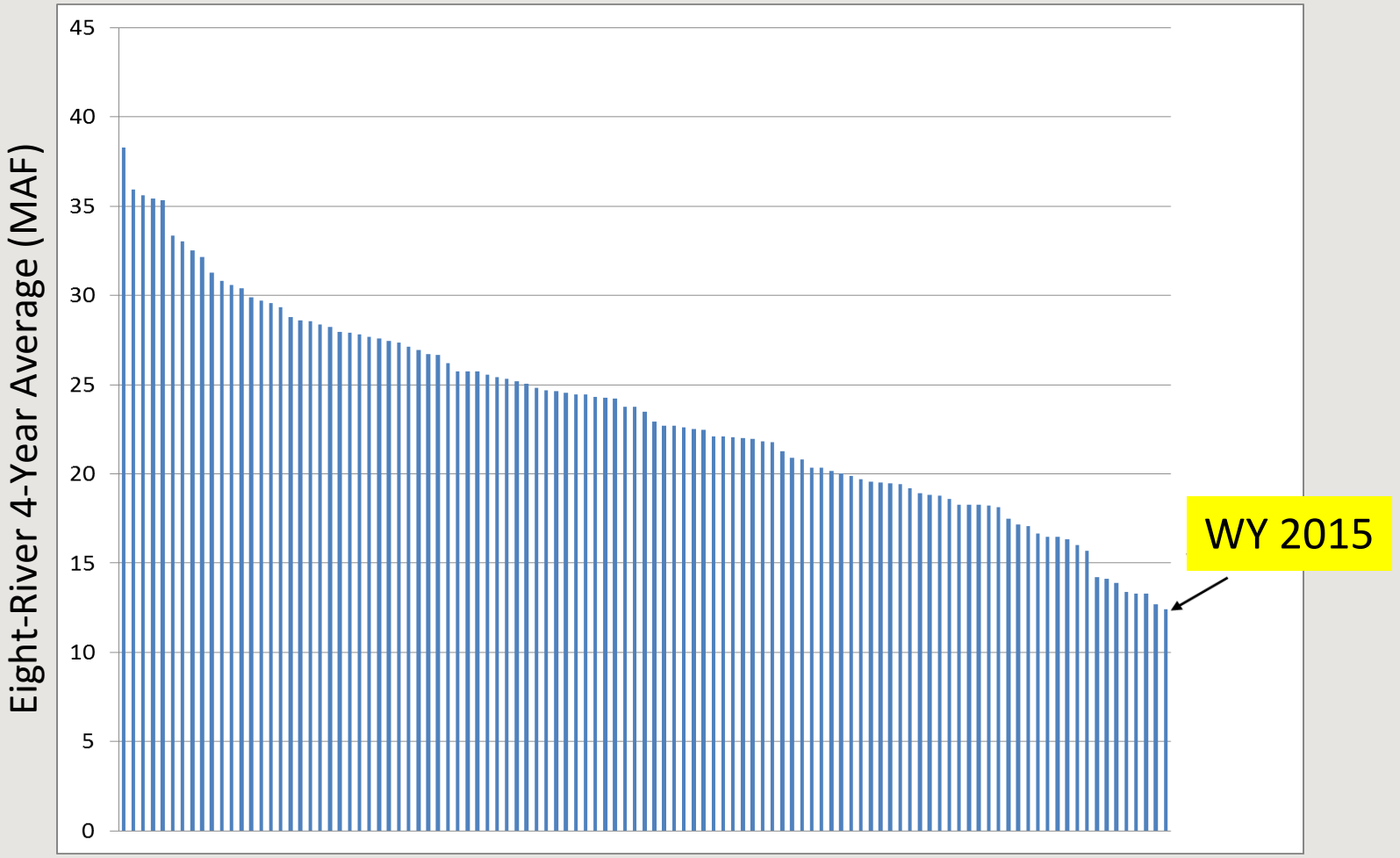
Source: Western Regional Climate Center

SIERRA SNOWPACK VS WINTER TEMPERATURE (1950 – 2015)



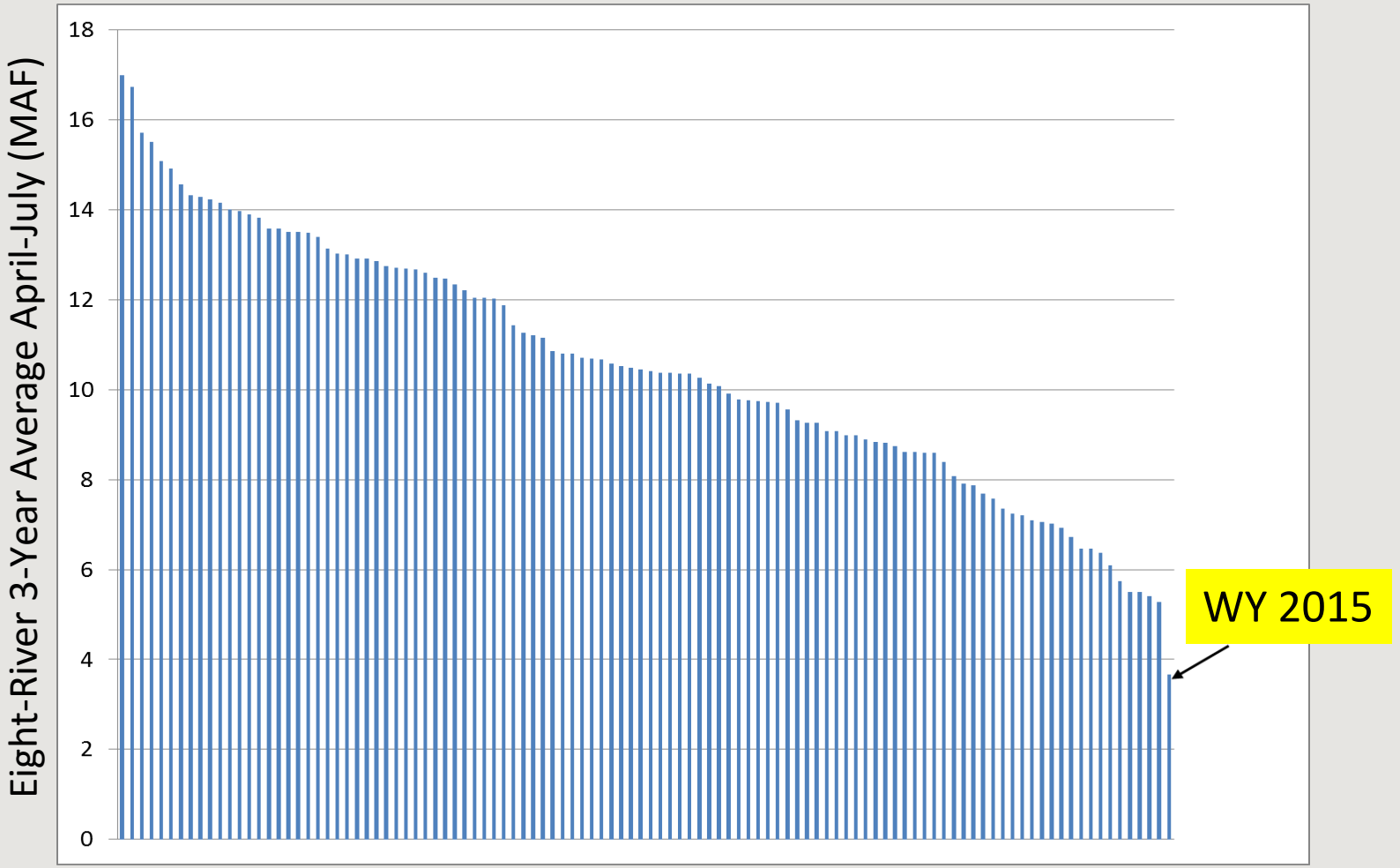
Source: California Climate Tracker

EIGHT-RIVER 4-YEAR AVERAGE WATER YEAR RUNOFF (1909 – 2015)



Source: CDEC

EIGHT-RIVER 3-YEAR AVERAGE APRIL-JULY RUNOFF (1908 – 2015)



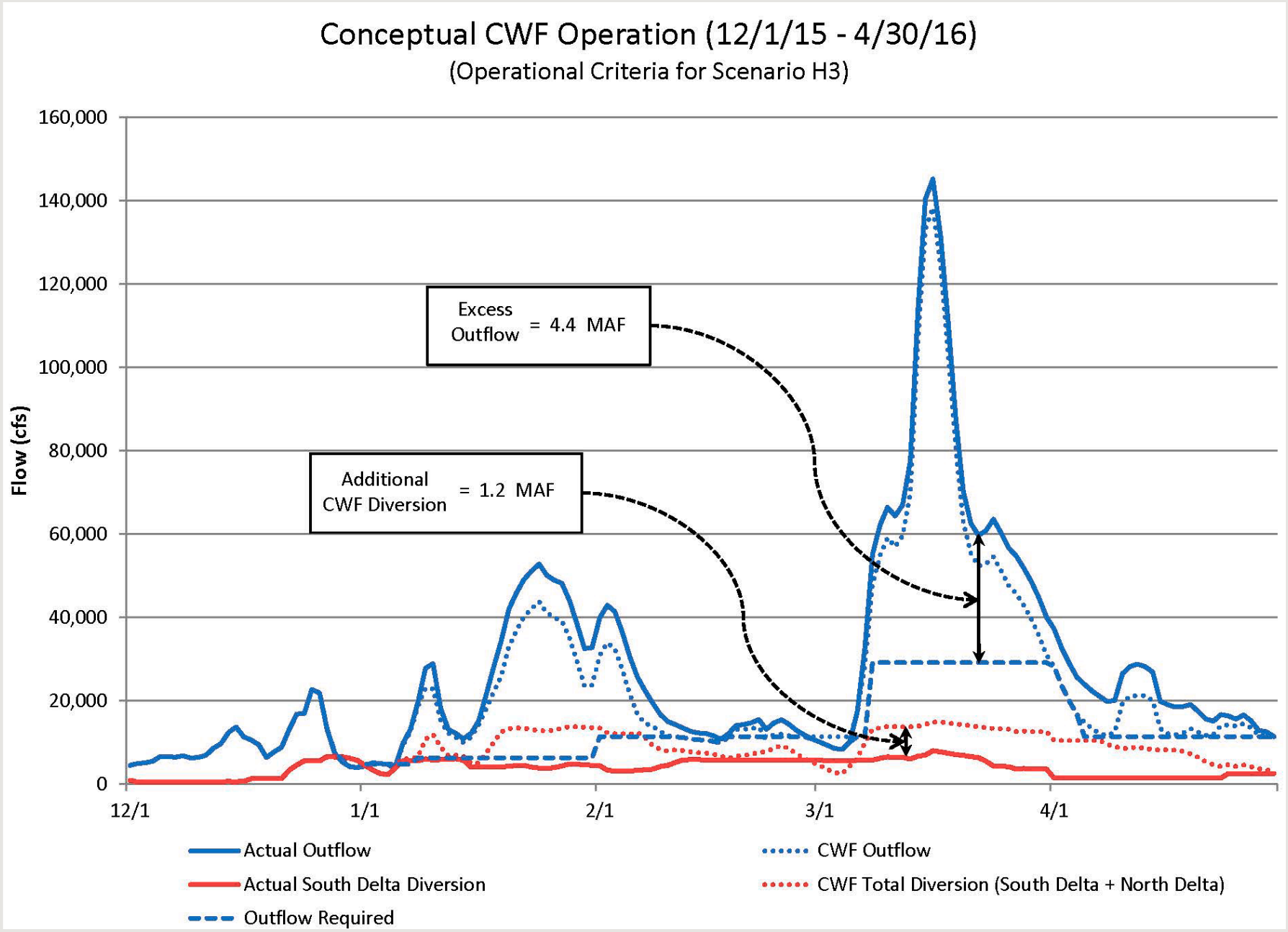
Source: CDEC

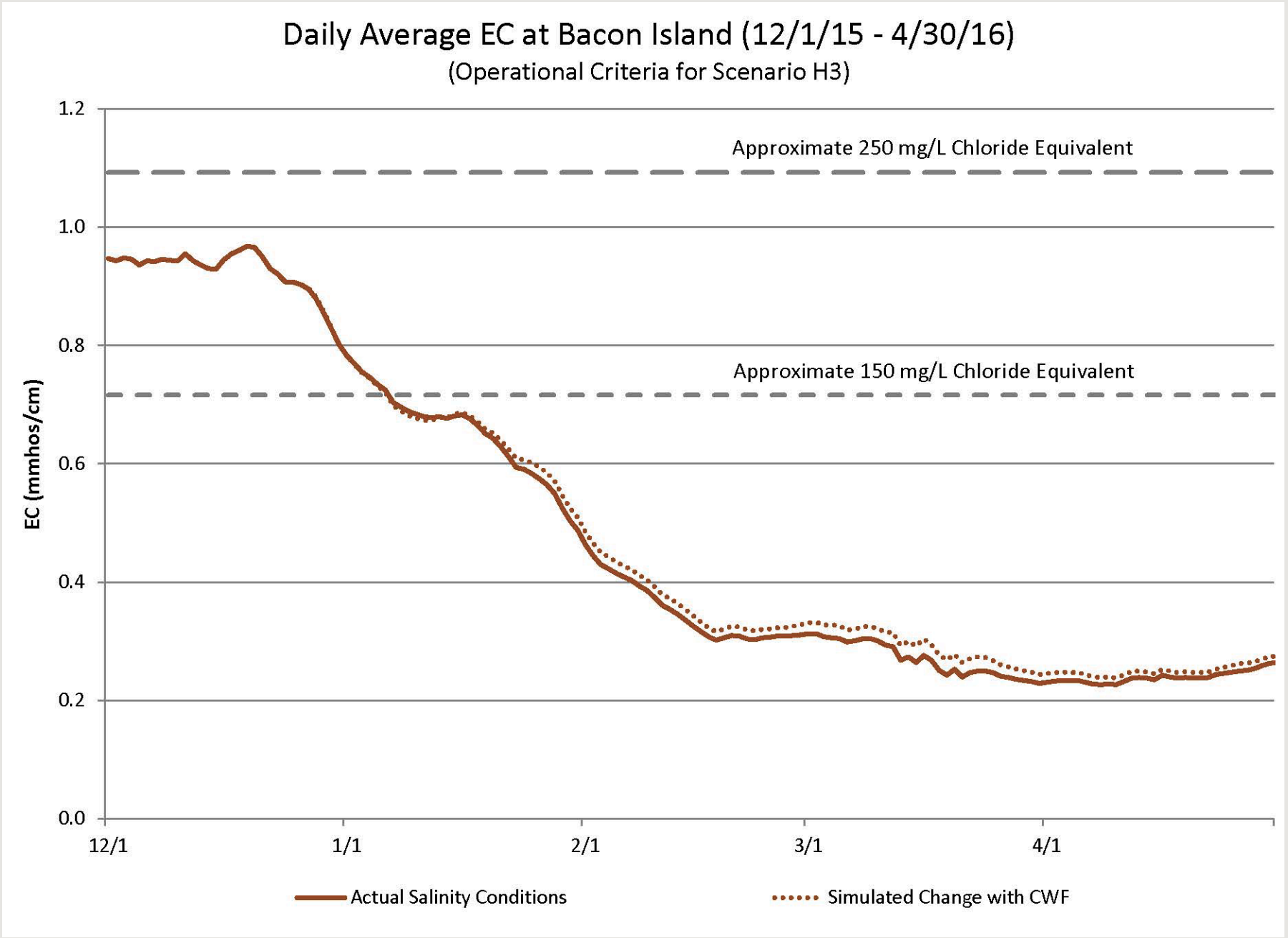
SOUTH DELTA OPERATIONAL CONSTRAINTS

- **Existing south Delta SWP/CVP facilities**
  - Restricted by regulations to protect listed species
    - Restricts diversion of unregulated flow during Excess Conditions
    - Restricts re-diversion of stored water during Balanced Conditions
- **Proposed CWF North Delta Diversions**
  - Shift some of south Delta diversion to North Delta Diversion
  - Increase opportunity to use existing water rights
    - Diversion of unregulated flow during Excess Conditions
    - Re-diversion of stored water during Balanced Conditions

EXAMPLE OF CWF OPERATION

- **Current water year's hydrology assumed**
- **Proposed CWF infrastructure assumed**
  - New North Delta Diversion intakes and tunnels
  - Existing export pumping facilities (Banks and Jones)
- **Assumed CWF Alt 4A H3 Operating Criteria**
  - North Delta Diversion Bypass Flow Criteria
  - New Rio Vista Flow Criteria
  - New South Delta Old and Middle River Flow Criteria
  - New Operable Head of Old River Gate


Conceptual CWF Operation (12/1/15 - 4/30/16)
(Operational Criteria for Scenario H3)
Flow (cfs)
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
12/1
1/1
2/1
3/1
4/1
Excess Outflow = 4.4 MAF
Additional CWF Diversion = 1.2 MAF
Actual Outflow
Actual South Delta Diversion
Outflow Required
CWF Outflow
CWF Total Diversion (South Delta + North Delta)


Daily Average EC at Bacon Island (12/1/15 - 4/30/16)
(Operational Criteria for Scenario H3)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
EC (mmhos/cm)
Approximate 250 mg/L Chloride Equivalent
Approximate 150 mg/L Chloride Equivalent
12/1
1/1
2/1
3/1
4/1
Actual Salinity Conditions
Simulated Change with CWF

CONCLUSION

- **Historical Compliance record**
  - Historically Standards only exceeded 1.1% of the time
  - Real-time adjustments cannot be captured by models
  - Increased operational flexibility supports continued success

- **Operations with proposed North Delta Diversion**
  - Continue to meet in-basin requirements
  - Increased flexibility provided with additional diversion point
  - Increased opportunity to capture water supply without significant impact to other legal users of water