Basin Plan Amendment to Establish New Salinity and Boron Objectives and a TMDL in the Lower San Joaquin River

Public Workshop

Stanislaus County Ag Center

8 February 2006

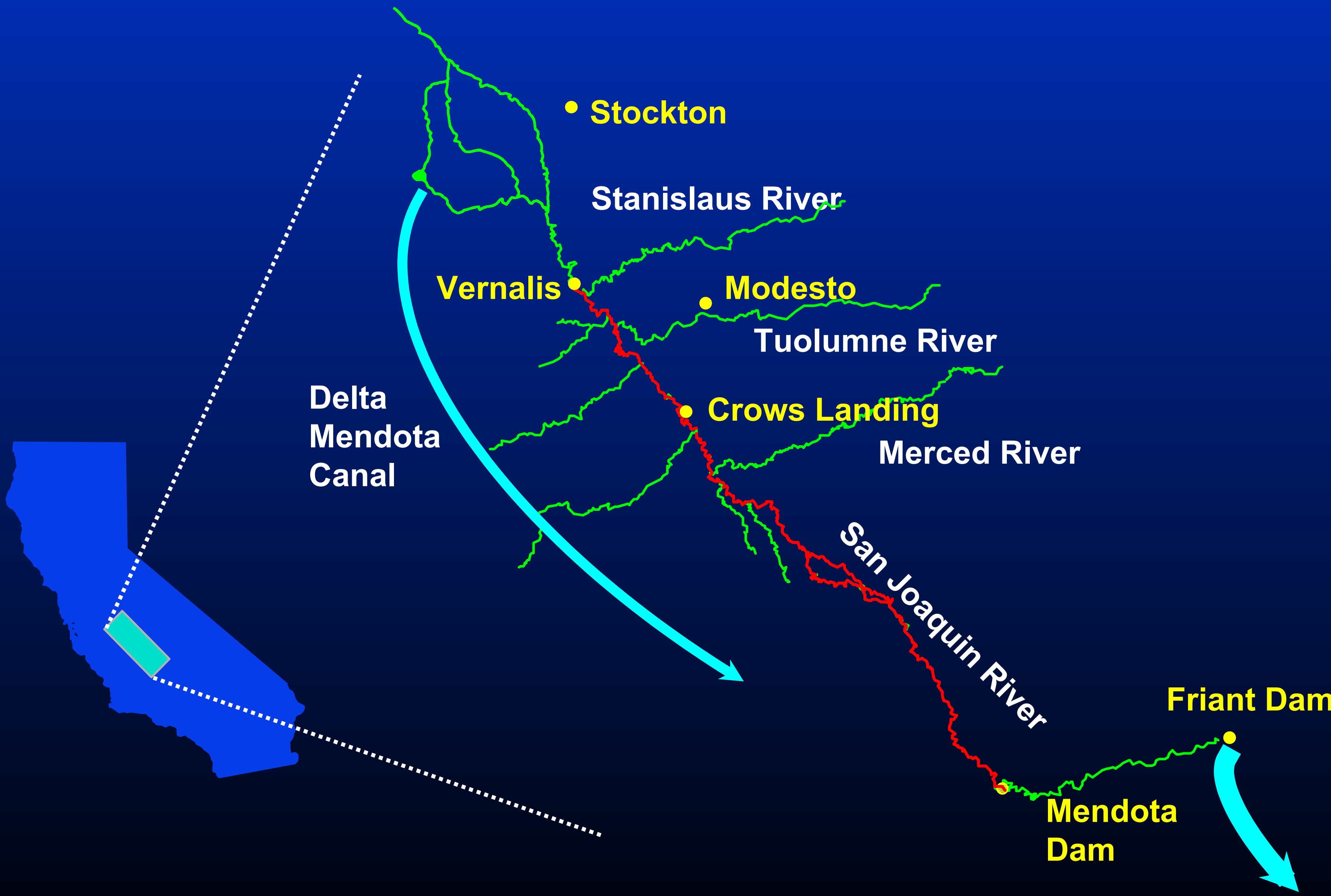
Why are we here today?

- Status of Salt and Boron TMDLs
  - First Phase – Vernalis
  - Second Phase – Upstream Objectives
- Solicit feedback

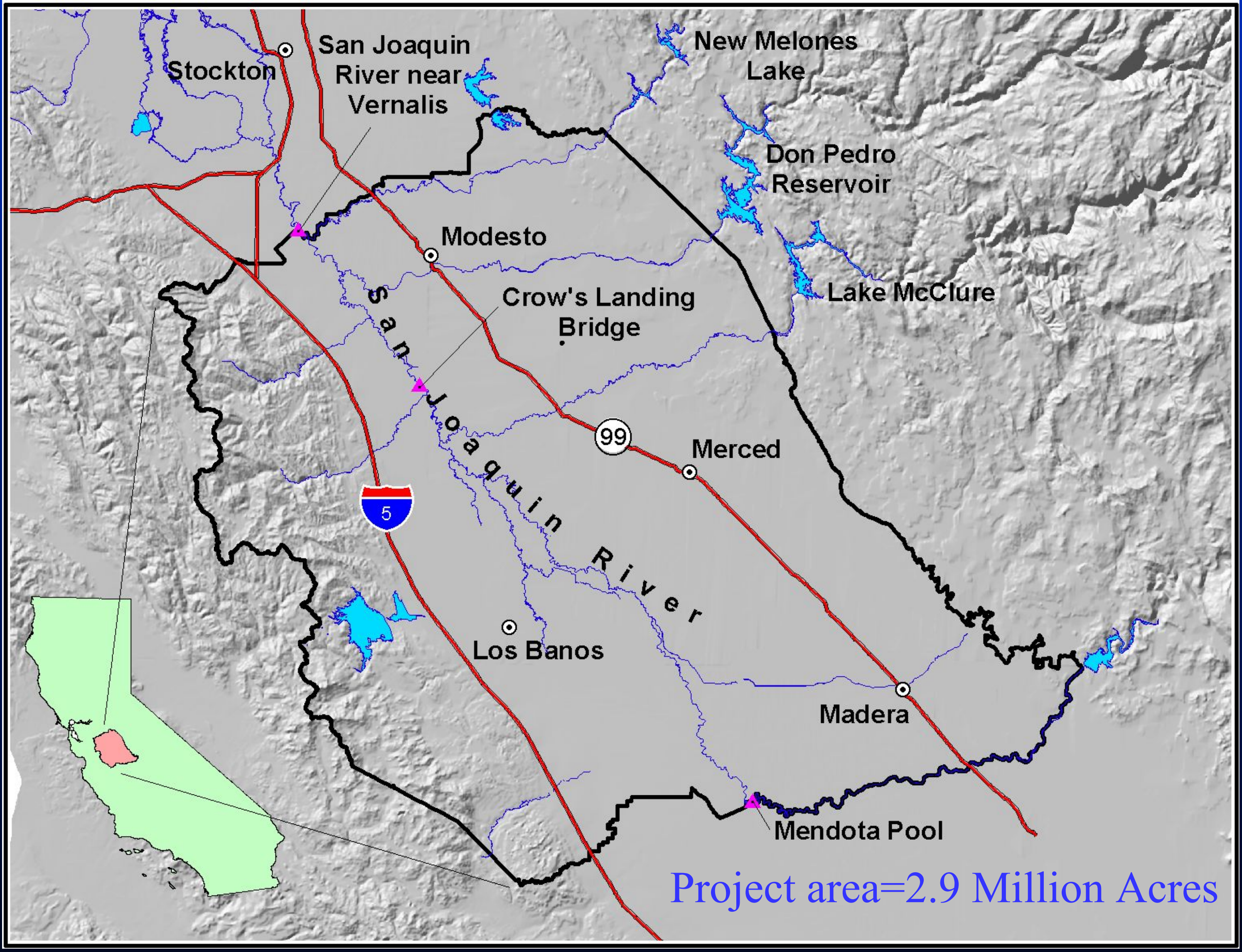
Agenda

- Background
- First Phase TMDL
- Second Phase: Objectives
  - Technical basis
  - Policy considerations
- Second Phase: Load Allocations
  - Technical basis
  - Policy considerations

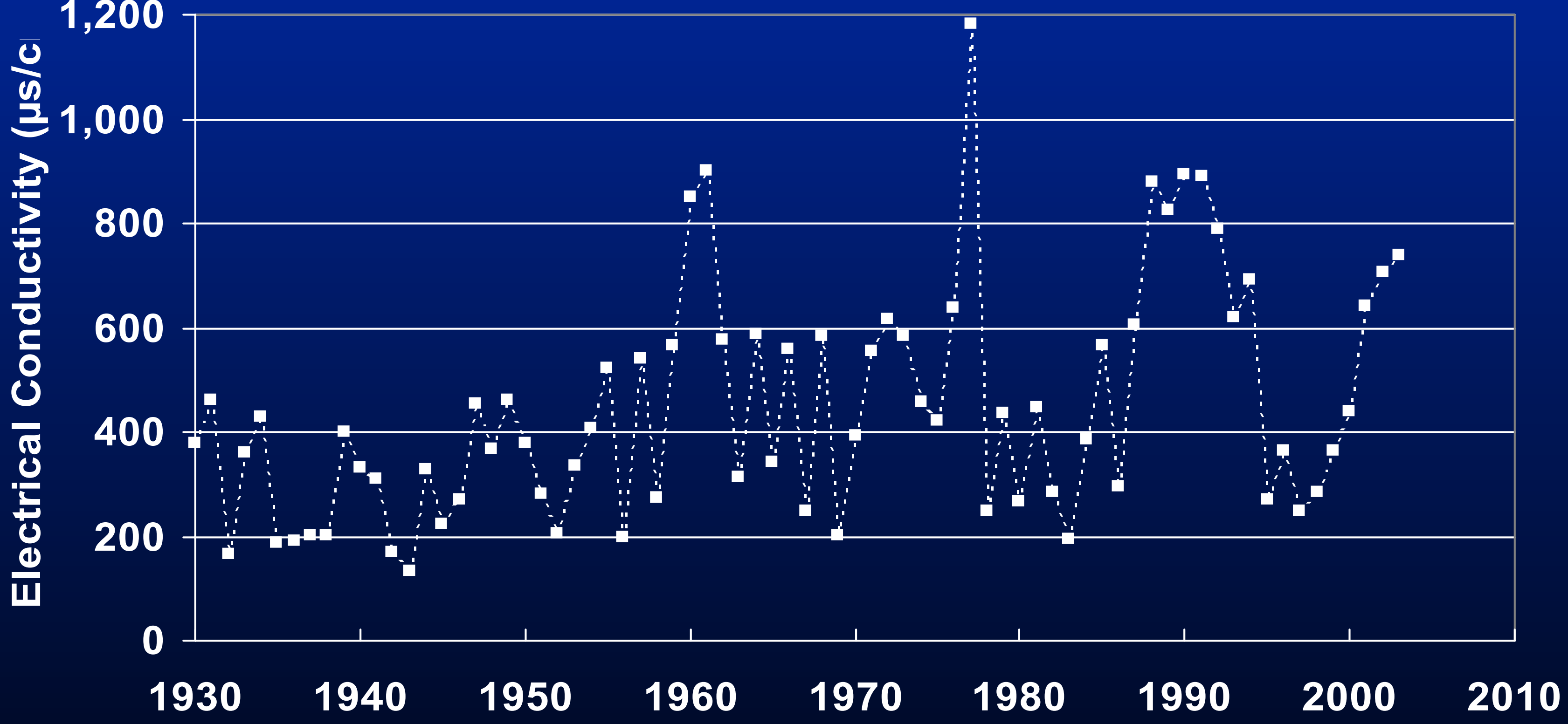
Lower San Joaquin River Basin



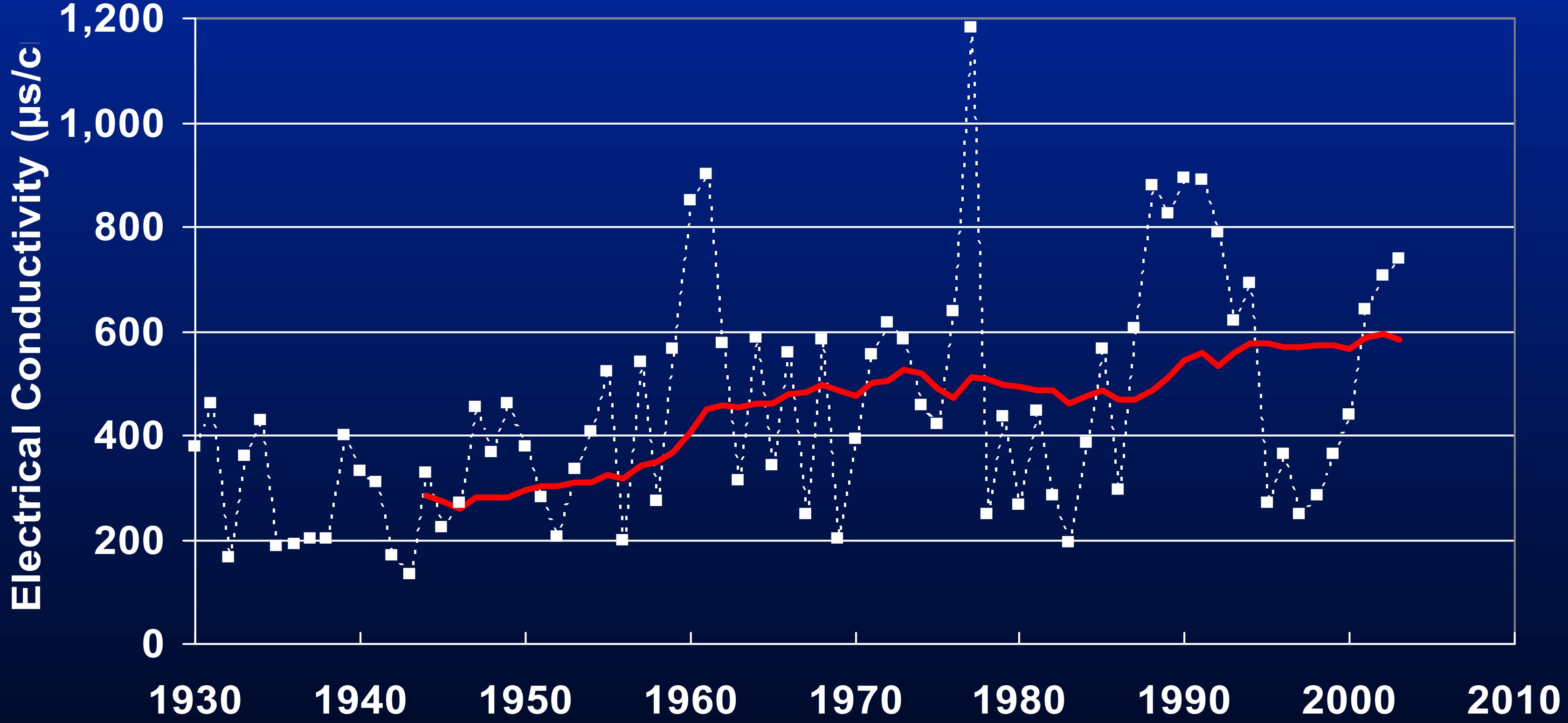
Project Area for the Lower San Joaquin River



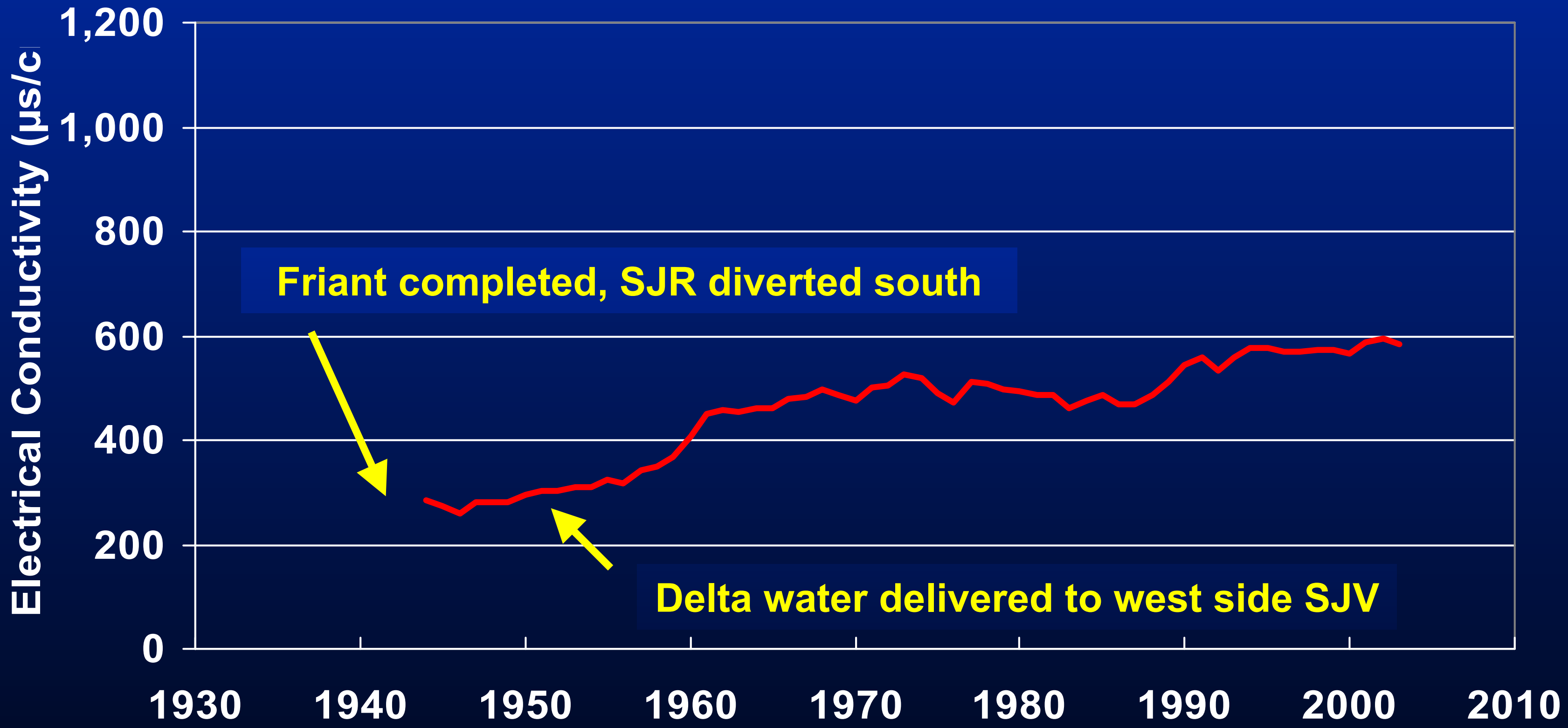
Average Electrical Conductivity SJR Near Vernalis



Average Electrical Conductivity SJR Near Vernalis

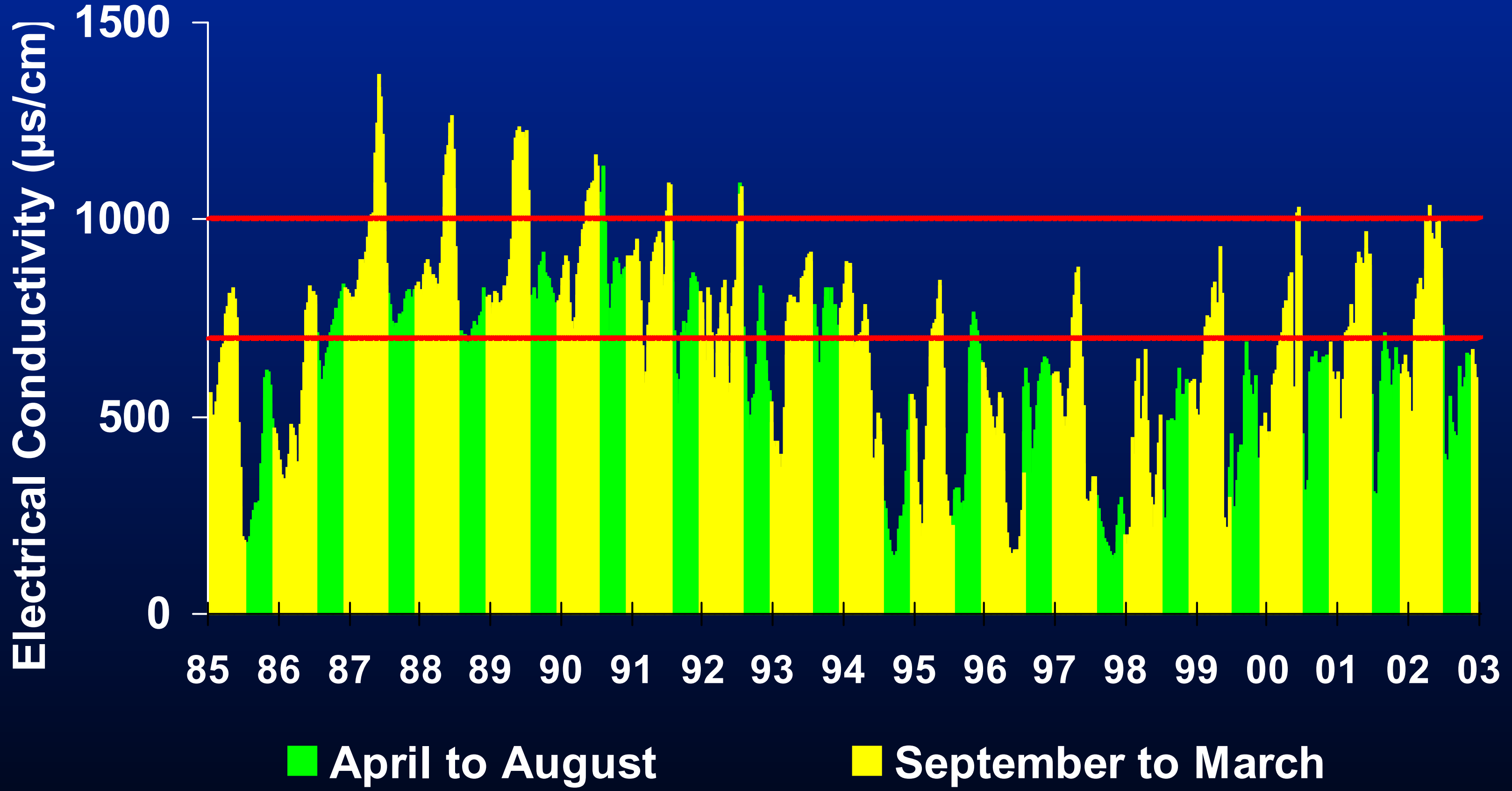


15-year Running Average Electrical Conductivity SJR Near Vernalis



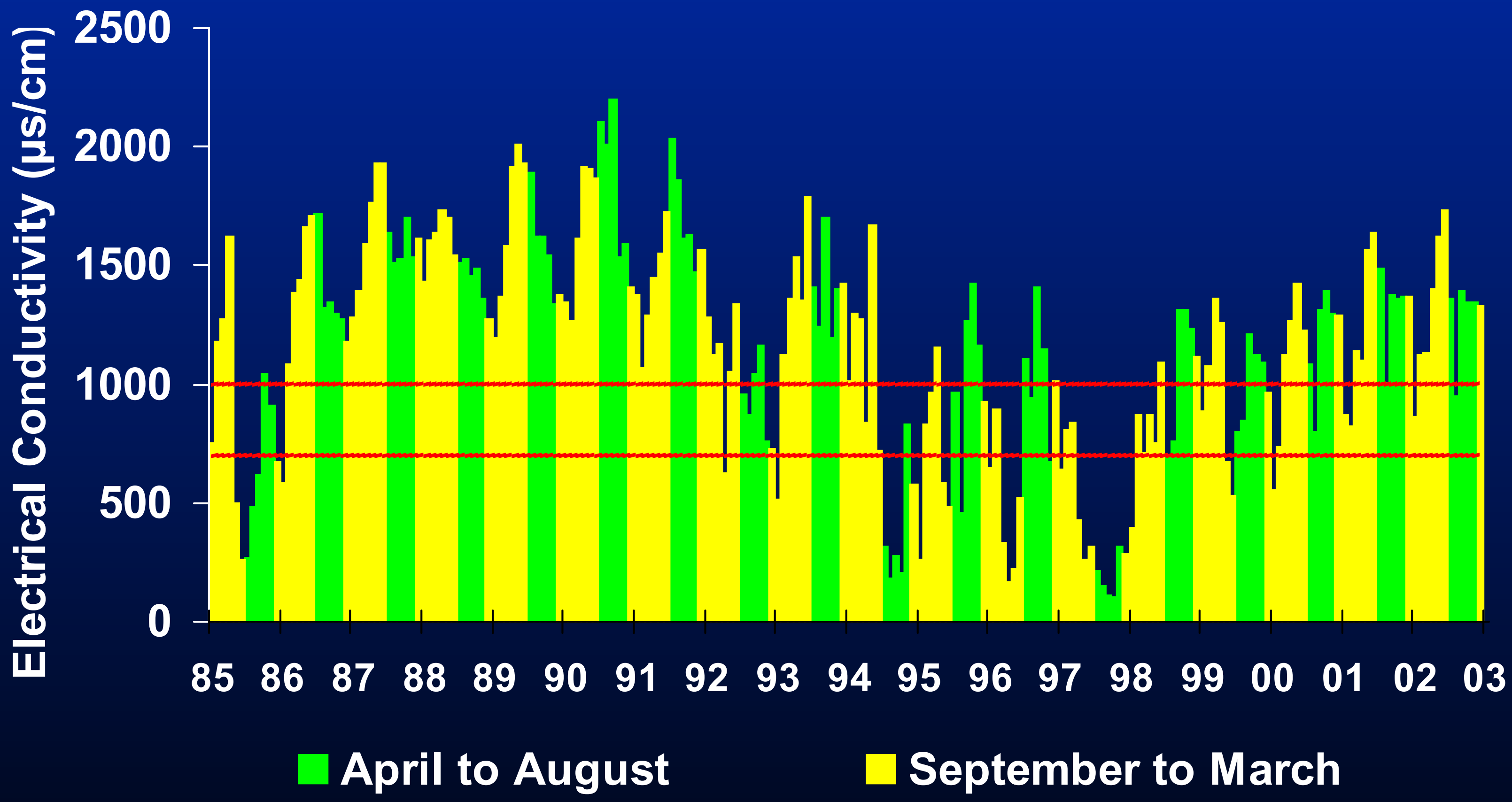
San Joaquin River near Vernalis

30-Day Running Average Electrical Conductivity

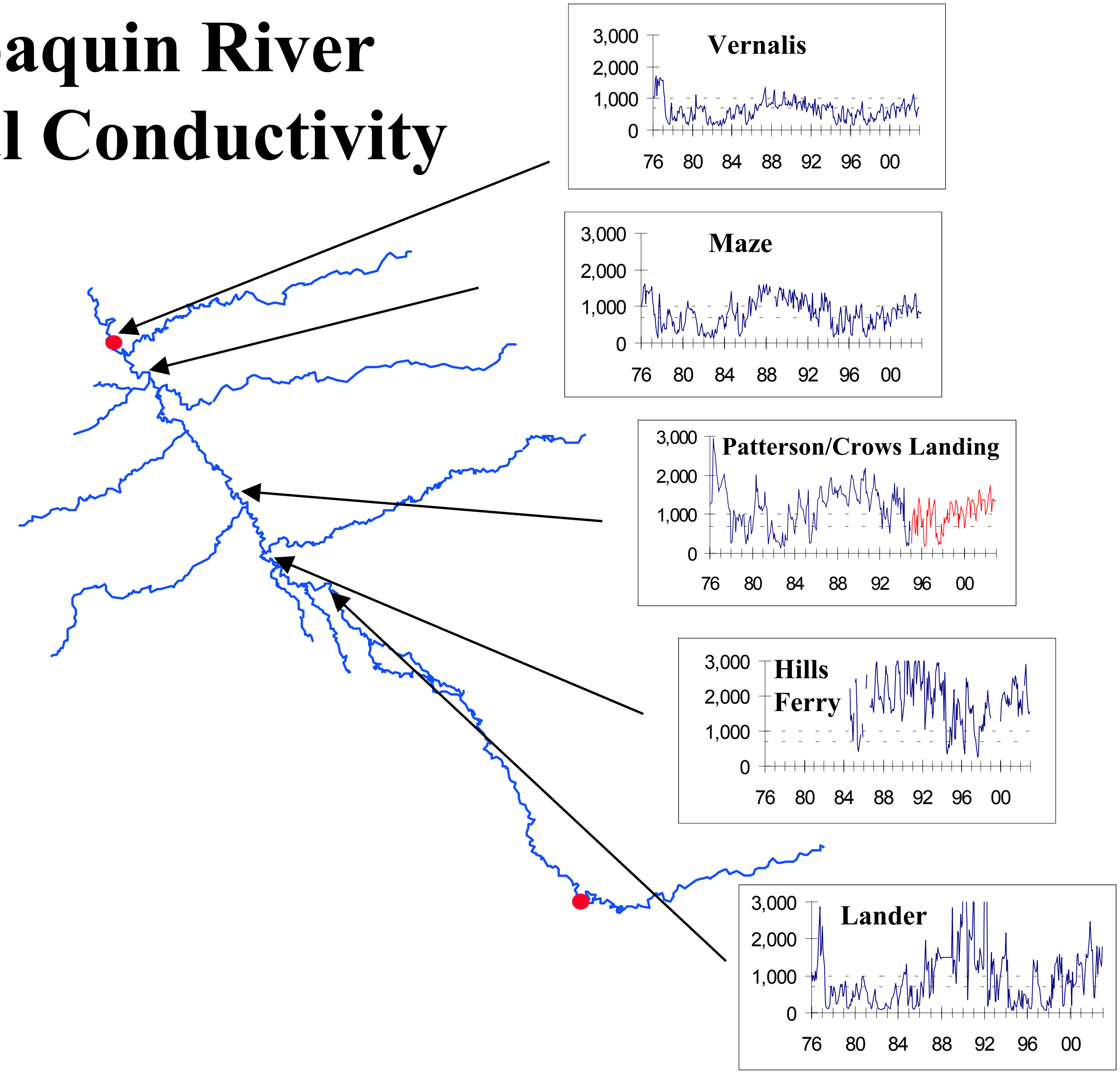


San Joaquin River at Crows Landing

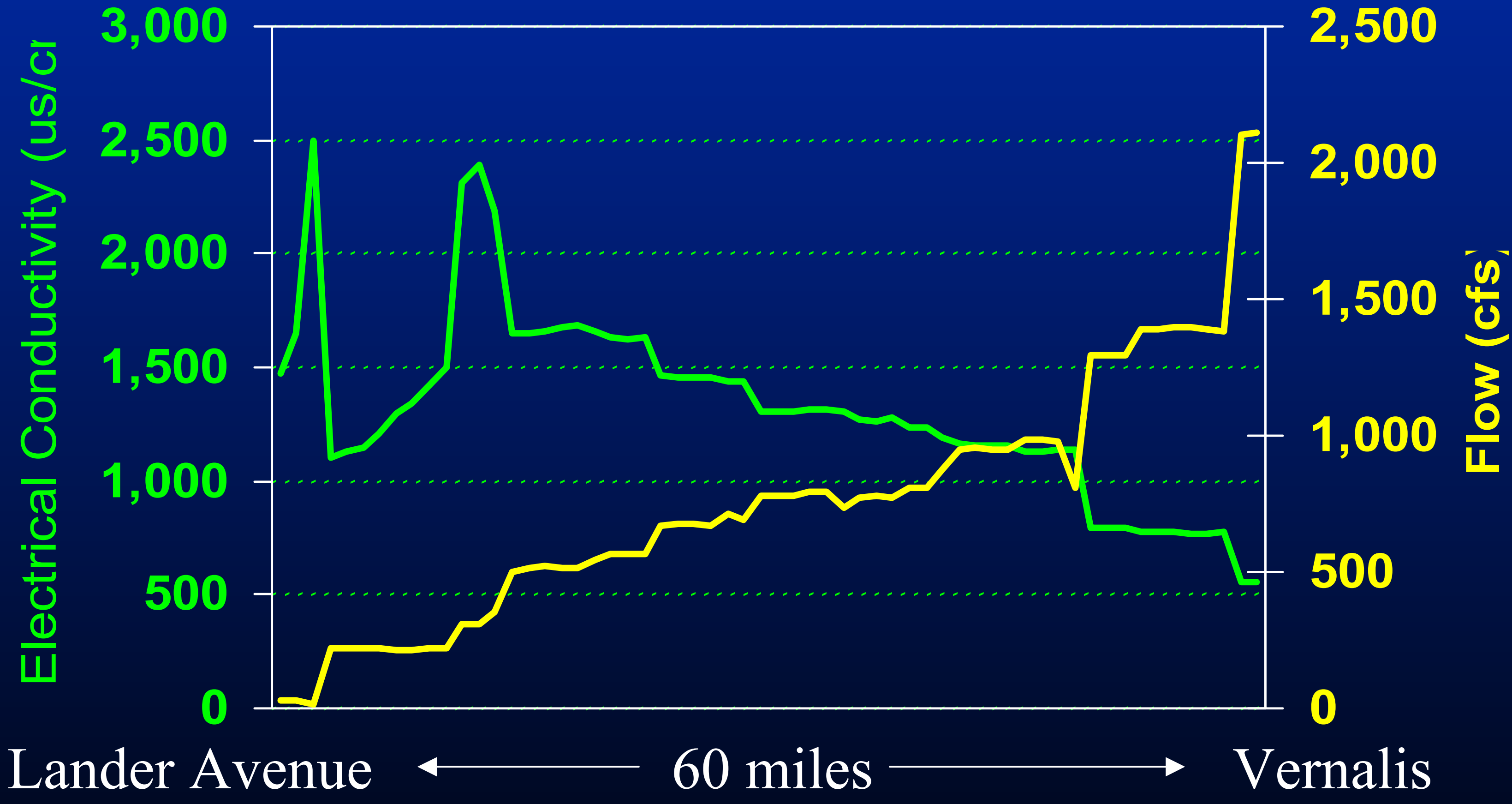
Monthly Average Electrical Conductivity



San Joaquin River Electrical Conductivity



Flow and Salinity, July 1999



Impetus for Second Phase TMDL

- Federal Clean Water Act- TMDL Required for impaired waters
- State Board Direction- Water Rights Decision 1641
- Timeline in First Phase TMDL- Basin Plan Amendment adopted in November 2005
- State Board Direction- adopt upstream objectives by September 2006

First Phase SJR Salt TMDL

- Adopted by State Board November 2005
- Based on attaining Vernalis water quality objectives
- Established salt load limits:
  - fixed base load and real time
- Established load allocation ‘framework’

First Phase SJR Salt TMDL

Regulatory Tools

- Non-point Sources:
  - Waste Discharge Requirements
  - Waivers of Waste Discharge Requirements
- Point Sources
  - NPDES Permits

Waste Discharge Requirements

- Conservative and static effluent limits
- Provides assurances
- Regulatory backstop

First Phase SJR Salt TMDL

Waiver of WDRs

- Modify Irrigated Lands Waiver or create new (salt specific) waiver
- Relies on stakeholder driven solutions and tools to:
  - Meet water quality objectives
  - Meet real-time load allocations

Preferred Implementation

- Waiver of WDRs (Real-time Management):
  - Achieves standards
  - Allows for export of salts
  - Provides flexibility

U.S. Bureau of Reclamation

- Responsible for salt in supply water
- Management Agency Agreement
- Report of Waste Discharge

Waste Load Allocations

- Relatively small contribution
- Implemented through NPDES permits: concentration based effluent limits for salt set equal to existing water quality objectives

Recommendations to State Water Board

- Prohibit water transfers that contribute to salinity impairment
- Condition water rights permits on meeting water quality objectives

Second Phase TMDL

- Objectives
  - Technical basis
  - Policy considerations

Water Quality Objectives

- Technical Basis:
  - Beneficial uses
  - Existing objectives
    - Drinking water
    - Agricultural (Vernalis standard)
  - New information
    - Bay Delta Periodic Review

Beneficial Uses

Lower San Joaquin River Reach	MUN	AGR		PROC	REC-1		REC-2	WARM	COLD	MIGR		SPWN		WILD
	Municipal and Domestic Supply	Irrigation	Stock Watering	Industrial Process Supply	Contact	Canoeing and Rafting	Other Noncontact	Freshwater Habitat-Warm	Freshwater Habitat-Cold	Warm	Cold	Warm	Cold	Wildlife Habitat
Mendota Dam to Sack Dam	P	E	E	E	E	E	E	E		E	E	E	P	E
Sack Dam to Merced River	P	E	E	E	E	E	E	E		E	E	E	P	E
Merced River to Vernalis	P	E	E	E	E	E	E	E		E	E	E		E

P = potential E = existing

Beneficial Uses

Reach	Drinking Water	Irrigation Supply
Mendota Dam to Sack Dam	potential	existing
Sack Dam to Merced River	potential	existing
Merced River to Vernalis	potential	existing

Basin Plan Drinking Water Requirements

"At a minimum, water designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs) specified in the following provisions of Title 22 of the California Code of Regulations…"

Title 22 California Code of Regulations*

Secondary Maximum Contaminant Level [a] Electrical Conductivity (us/cm)	
Recommended [b]	900
Upper [c]	1,600
Short Term [d]	2,200

a. For the constituents shown, no fixed consumer acceptance contaminant level has been established.

b. Constituent concentrations lower than the Recommended contaminant level are desirable for a higher degree of consumer acceptance.

c. Constituent concentrations ranging to the Upper contaminant level are acceptable if it is neither reasonable nor feasible to provide more suitable waters.

d. Constituent concentrations ranging to the Short Term contaminant level are acceptable only for existing systems on a temporary basis pending construction of treatment facilities or development of acceptable new water sources.

* Section 64449, table 64449-B

Irrigation Supply

- Protect Salt Sensitive Crops
- Review of peer-reviewed literature
  - Ayers and Westcot: foundational citation
  - Maas and Grattan: University of California Publication 8066, Irrigation Water Salinity and Crop Production

Irrigation Supply

- Assumptions:
  - 15 to 20 percent leaching fraction
  - All other factors (fertility, irrigation scheduling, pest control) are *optimized*
- 700 µs/cm for beans, carrots
- 1,000 µs/cm for numerous tree, vine, vegetable, and row crops…

…notably almonds and grapes

Project Area Crop Acreage

Crop	County Acreage*		
	San Joaquin	Merced	Stanislaus
Beans	7,800	2,200	8,200
Almonds	34,157	83,449	77,657
Grapes	68,651	12,561	9,848
Total	110,608	98,210	95,705

* Source : USDA Crop Acreage Reports for 2004 and 2005

New Information

- Bay Delta Periodic Review:
  - Dr. Charles Burt
  - Dr. John Letey
- Provide “reasonable protection”
- Evaluations assume higher salinity can be mitigated through application of additional water

Salinity Option 1
“Existing” Narrative Drinking Water

- Year-round objective of 1,600 µS/cm
- 1,600 µS/cm is upper level MCL* for domestic drinking water supplies per Title 22 of the California Environmental Health Code of Regulations

* Maximum Contaminant Level

Salinity Option 2
"Full Protection"

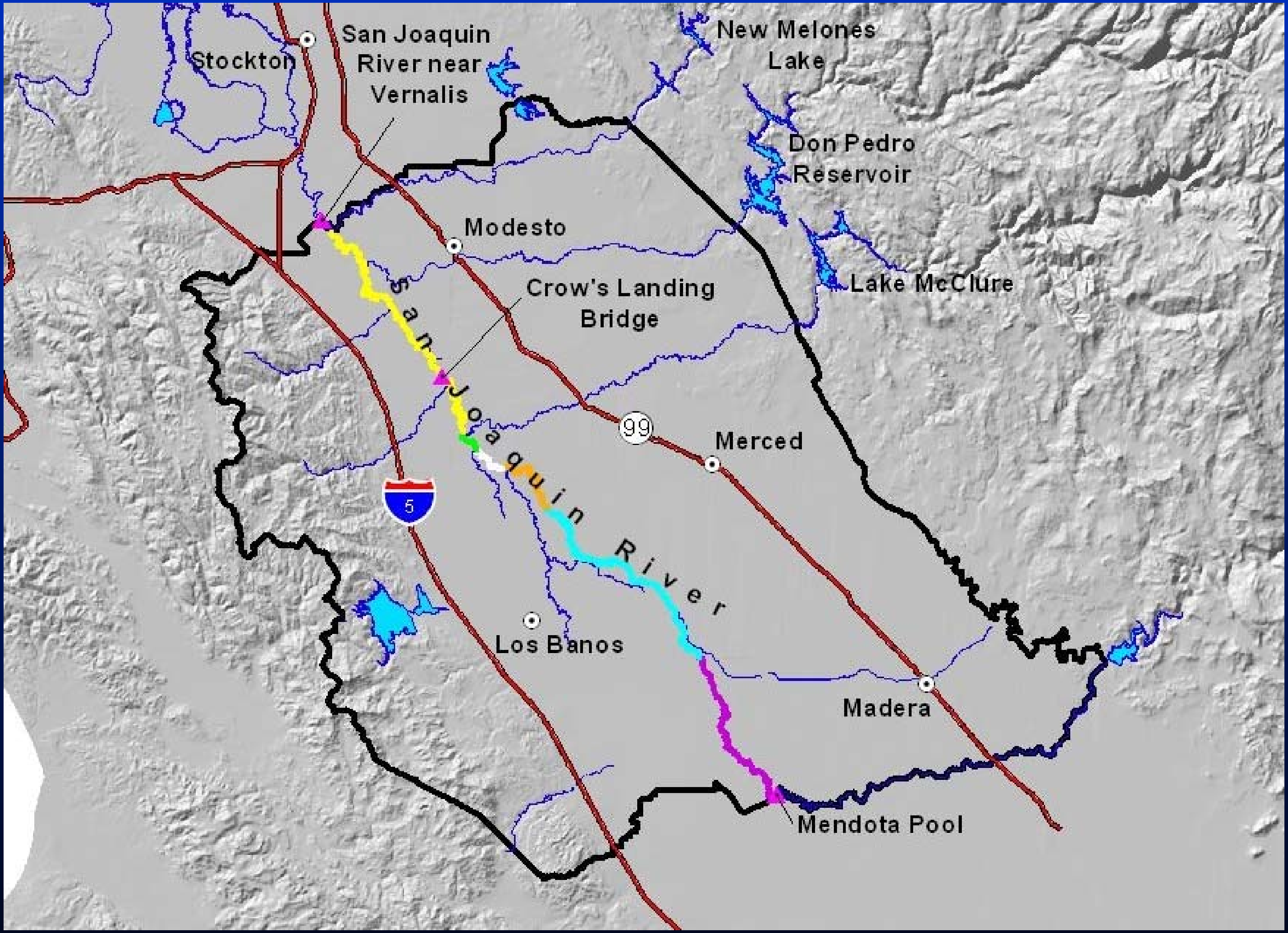
- 700 µS/cm from 1 April to 31 August when agriculture is most sensitive beneficial use
- 900 µS/cm from 1 September to 31 March when municipal water supply is most sensitive beneficial use

Salinity Option 3
"Export Limit"

- Year-round objective of 1,000 μS/cm
- 1,000 μS/cm is numeric standard for Delta waters at intakes to California Aqueduct and Delta-Mendota Canal

Factors to Consider

- Beneficial uses
- Characteristics of the hydrographic unit
- What can reasonably be achieved
- Economics
- Need to develop housing
- Need to develop & use recycled water


San Joaquin River near Vernalis
Stockton
New Melones Lake
Don Pedro Reservoir
Modesto
Lake McClure
Crow's Landing Bridge
San Joaquin River
99
Merced
5
Los Banos
Madera
Mendota Pool

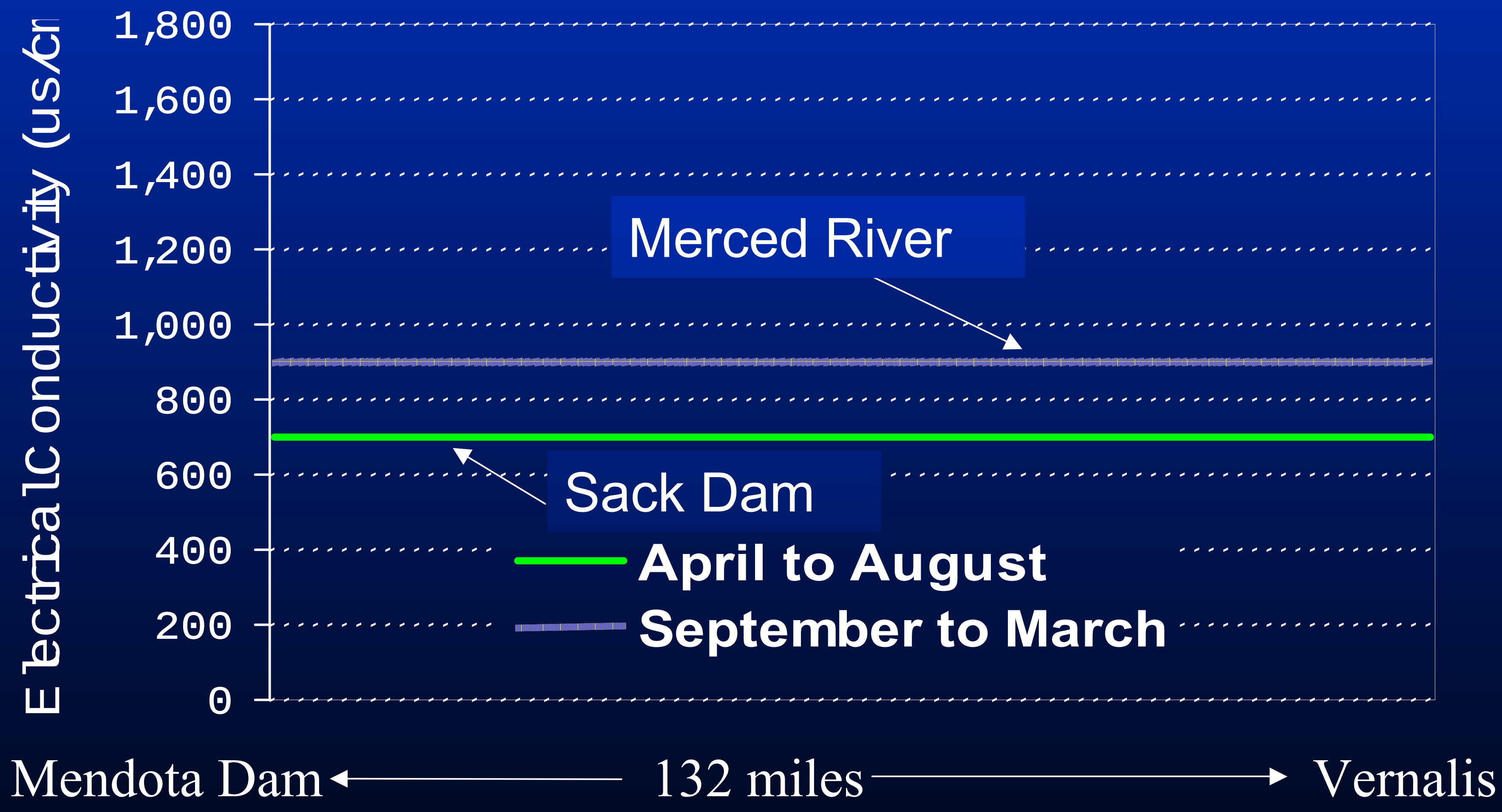
SJR Reach Characteristics

Reach	Length (miles)	Characteristics
Mendota Pool to Sack Dam	23	DMC deliveries and upper SJR
Sack Dam to Bear Creek	46	Flood flows and groundwater
Bear Creek to Salt Slough	6	Wetland, ag returns, and Bear Ck
Salt Slough to Mud Slough	9	Wetland and ag returns
Mud Slough to Merced	3	Grassland tile drainage
Merced to Stanislaus	43	East side tributary
Total	130	

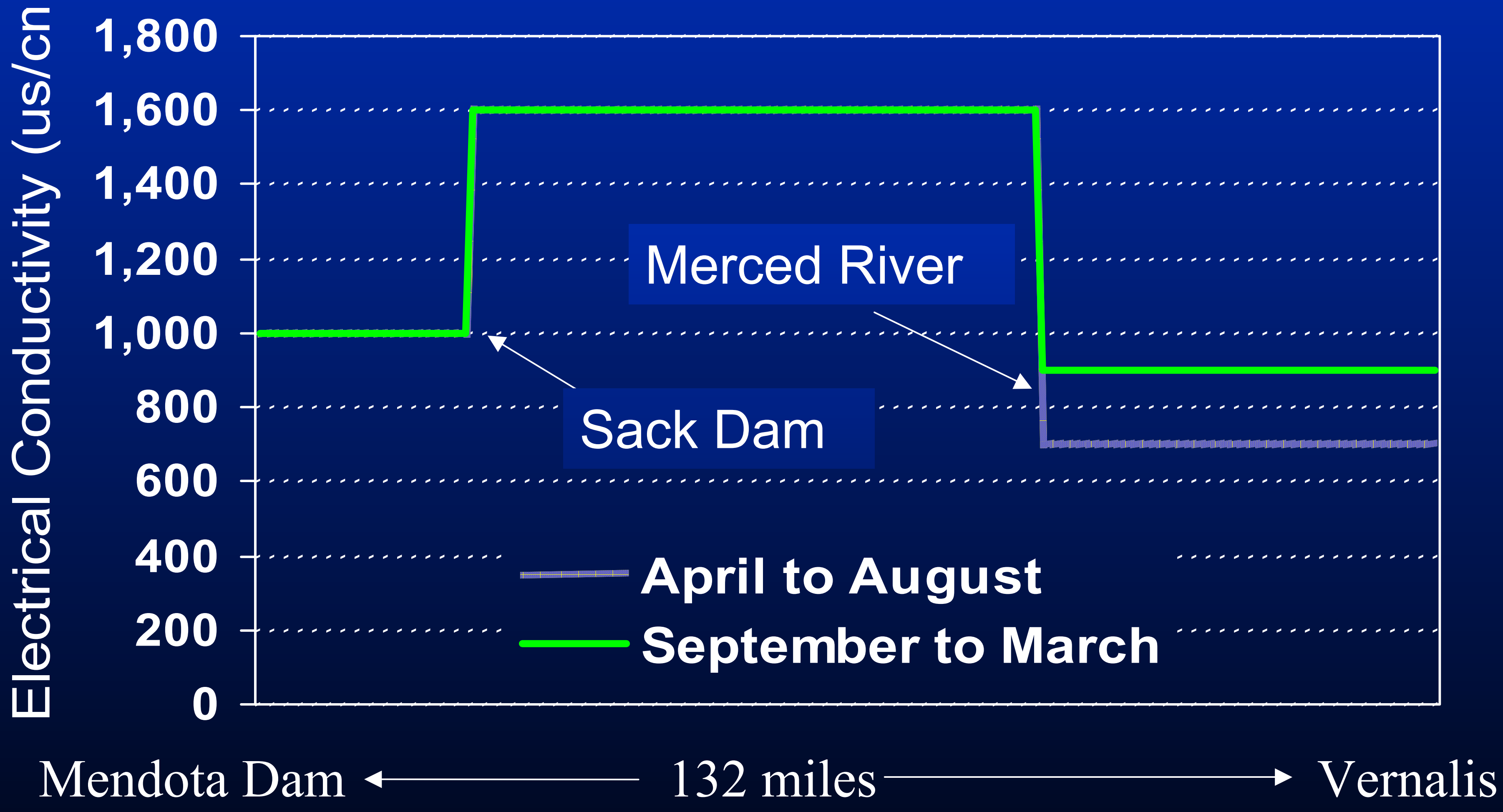
Salinity Alternatives

- Various combinations of options
- Are they reasonable?
  - Do they protect the use?
  - Are they consistent with established policies?
  - Are they achievable?
- Performance goal versus objective

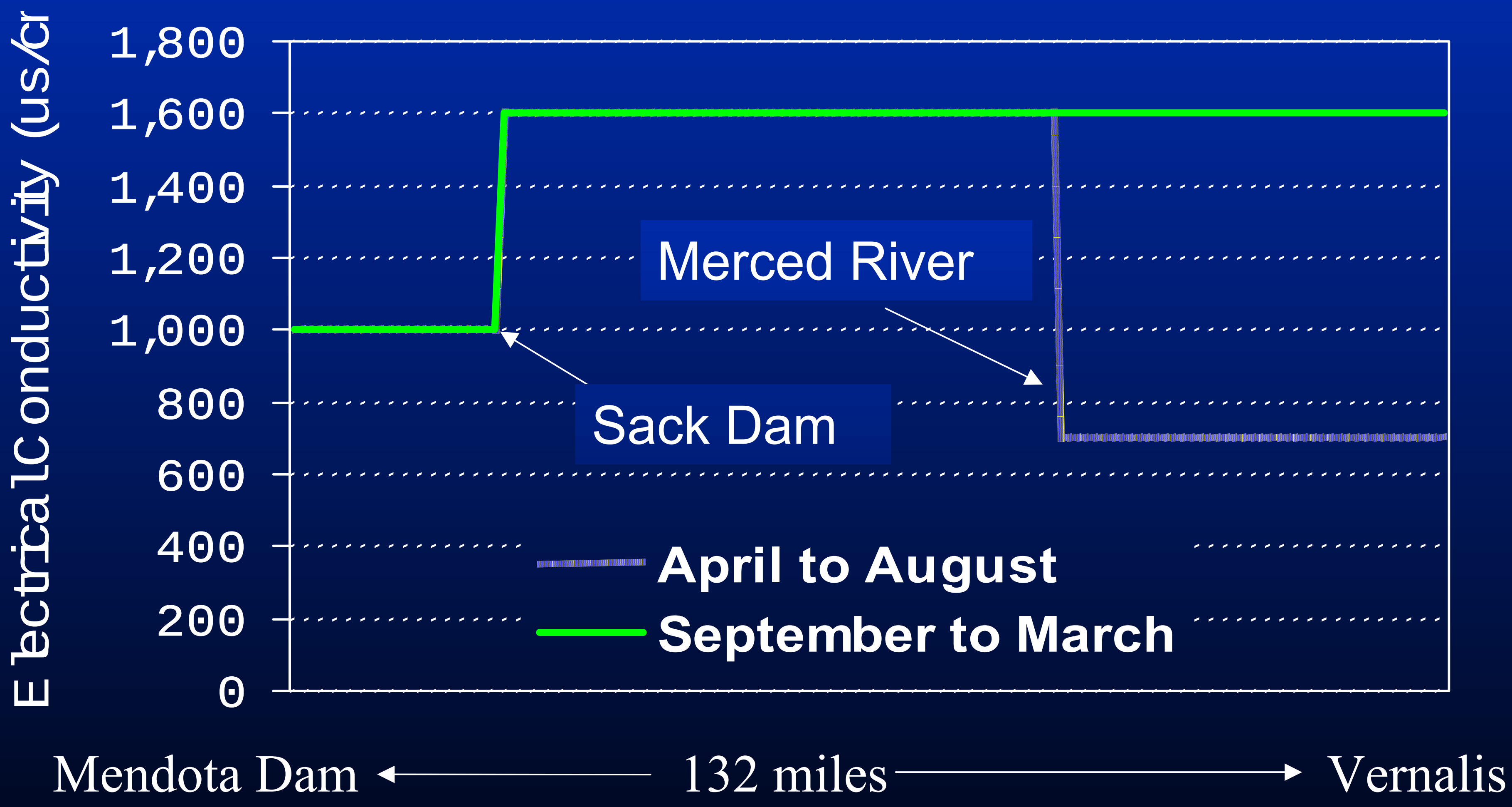
Salinity Alternative 1



Salinity Alternative 2



Salinity Alternative 3



Loading Capacity

Developing Design Loads:

- Determine design flows for each water year type (DWRSIM & CALSIM)
- TMML (Loading Capacity) = WQ objective * design flow

Loading Capacity

The TMML must consider ambient loading and a Margin of Safety

$$TMML = \Sigma LA + \Sigma WLA + BG\ loads + GW\ Loads + MOS$$

Load Allocations are dependant on background loads and groundwater loads

$$\Sigma LA + \Sigma WLA = TMML-(BG\ loads + GW\ Loads + MOS)$$

Loading Capacity
SJR Compliance Stations (thousand tons)

Year Type	Jan	Feb	Mar	Apr	VAMP	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet													
Above Normal													
Below Normal													
Dry													
Critically Dry													

SJR Compliance Stations

Reach	Compliance Station
Mendota Pool to Sack Dam	Sack Dam
Sack Dam to Bear Creek	SJR at Lander Avenue
Bear Creek to Salt Slough	SJR at Lander Avenue
Salt Slough to Mud Slough	SJR at Fremont Ford
Mud Slough to Merced	SJR at Hills Ferry
Merced to Stanislaus	SJR near Patterson /Crows Landing SJR at Maze Road
Stanislaus to Vernalis	SJR near Vernalis

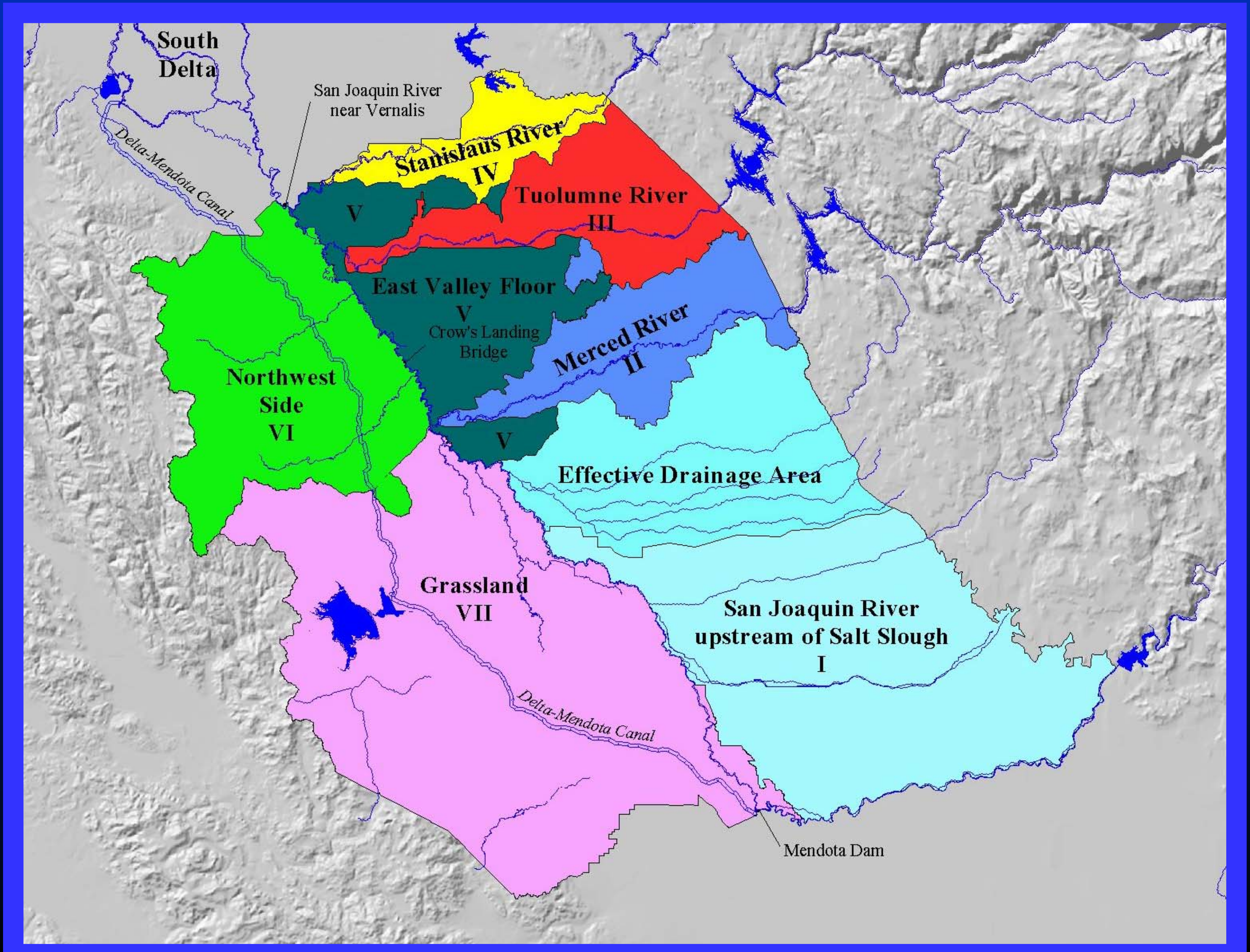
Loading Capacity - Phase I TMDL SJR at Vernalis (thousand tons)

Year Type	Jan	Feb	Mar	Apr	VAMP	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	84	148	211	164	180	86	57	54	88	162	85	75	84
Above Normal	88	148	136	166	150	52	44	42	87	103	72	70	88
Below Normal	56	58	88	124	108	42	37	35	78	79	70	67	56
Dry	66	82	79	86	82	23	20	26	59	65	61	64	66
Critically Dry	51	46	59	49	42	17	16	22	50	63	58	57	51

Load Allocations - Phase I TMDL SJR at Vernalis (thousand tons)

Year Type	Jan	Feb	Mar	Apr	VAMP	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	41	84	116	23	72	31	0	0	5	45	98	44	36
Above Normal	44	84	64	26	71	14	0	0	0	44	58	35	32
Below Normal	22	23	31	11	45	8	0	0	0	38	41	34	30
Dry	28	39	25	5	25	1	0	0	0	25	31	27	28
Critically Dry	18	15	11	0	0	0	0	0	0	19	30	26	23

Lower San Joaquin River Subareas



Loading Capacity
SJR Subareas (pounds / acre)

Year Type	Jan	Feb	Mar	Apr	VAMP	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet													
Above Normal													
Below Normal													
Dry													
Critically Dry													

Loading Capacity - Phase I TMDL SJR Subareas (pounds / acre)

Year Type	Jan	Feb	Mar	Apr	VAMP	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wet	68	140	191	37	120	52	0	0	8	74	161	72	59
Above Normal	73	140	106	43	117	23	0	0	0	74	94	58	54
Below Normal	37	39	52	19	75	13	0	0	0	63	67	56	50
Dry	47	66	41	8	41	1	0	0	0	42	51	45	46
Critically Dry	31	25	19	0	0	0	0	0	0	31	49	42	39

Loading Capacity

- Loading capacity for each subarea is the lowest loading capacity applicable
  - For example loading capacity per acre for Grasslands subarea could be controlled by loading capacity at Vernalis or Crows Landing

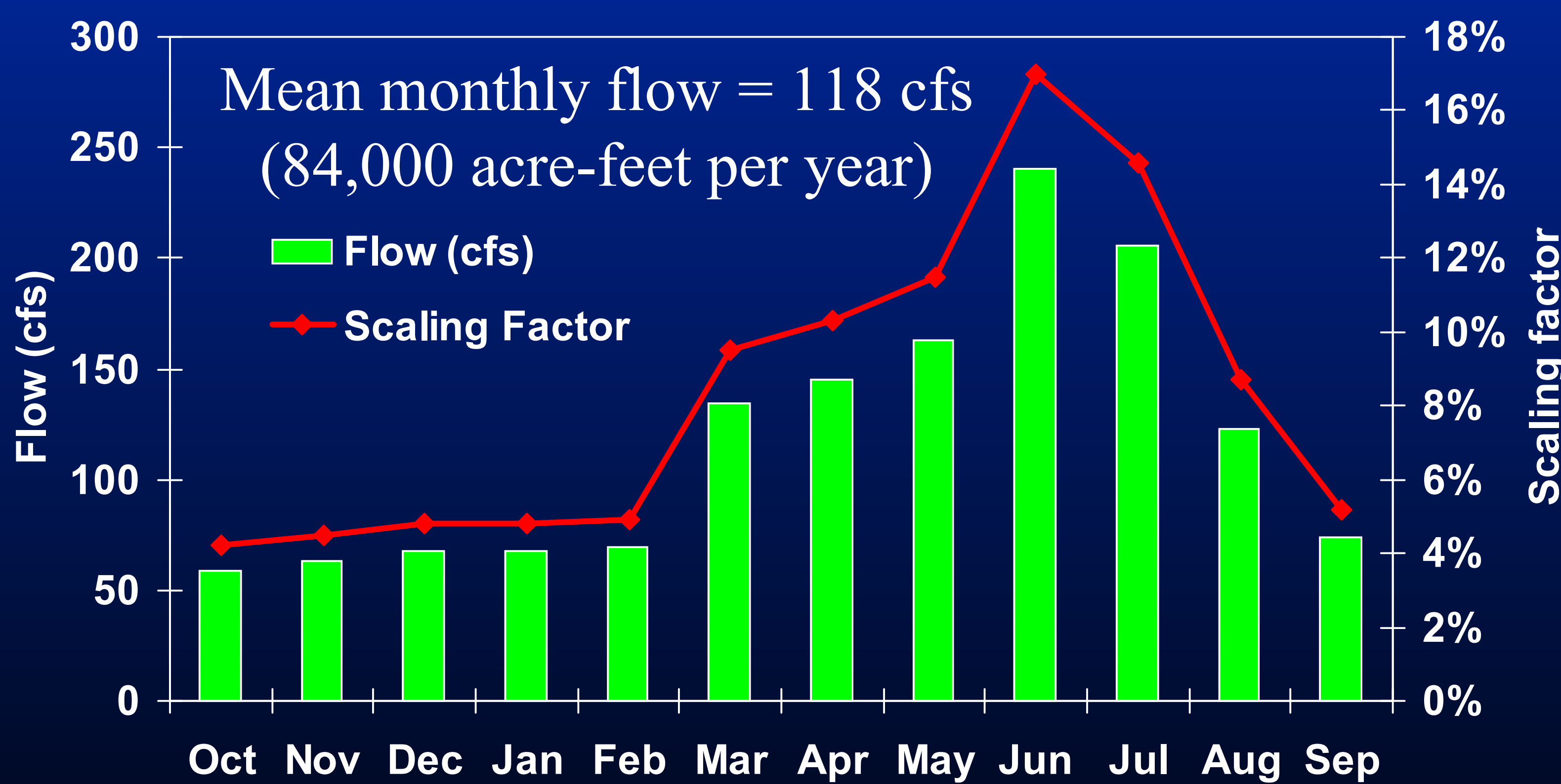
SJR EC Objectives

- Are they reasonable given high poor quality groundwater base flow?
- Three options:
  - Groundwater control program
  - Flow augmentation
  - Use attainability analysis (UAA)

Groundwater Loads

- Three methods used to calculate groundwater accretions:
  - USGS studies
  - Mass balance
  - Low flow at Lander Avenue
- Water quality based on
  - USGS estimate
  - Mass balance

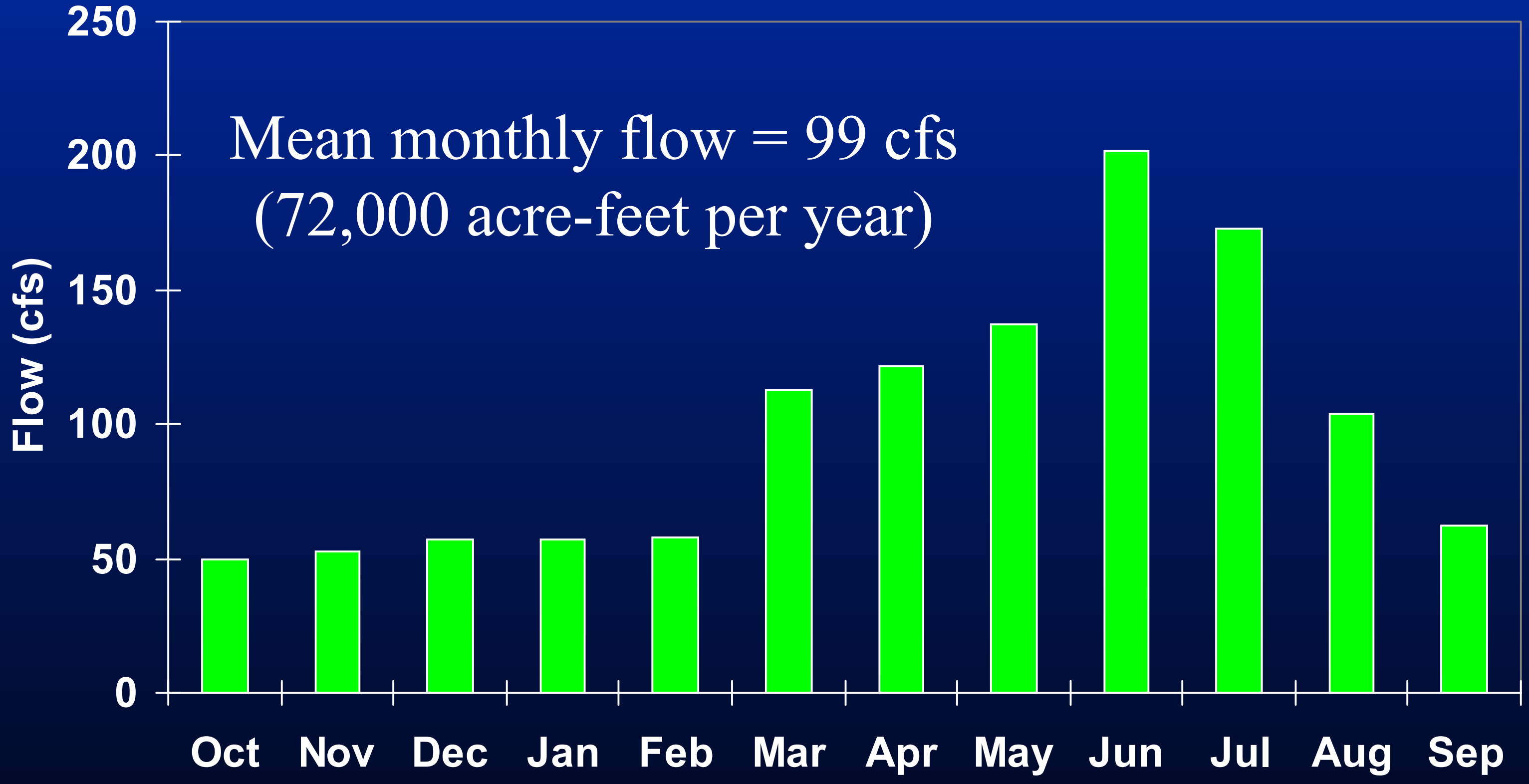
Groundwater Accretions Upstream of Merced River



How to Account for Groundwater Salt Load?

- Assumptions:
  - WQO: 1,600 µs/cm
  - Groundwater salinity: 2,800 µs/cm
  - Dilution flow salinity: 200 µs/cm

Dilution Flows
Upstream of Merced River



Dilution Flow Versus Increased Leaching Requirement?

- Dilution flow of 99 cfs (72,000 acre-feet per year)
- What is impact of higher salinity water?
  - Additional leaching requirement…

    … how much?

Effect of Increased Salinity Irrigation Water

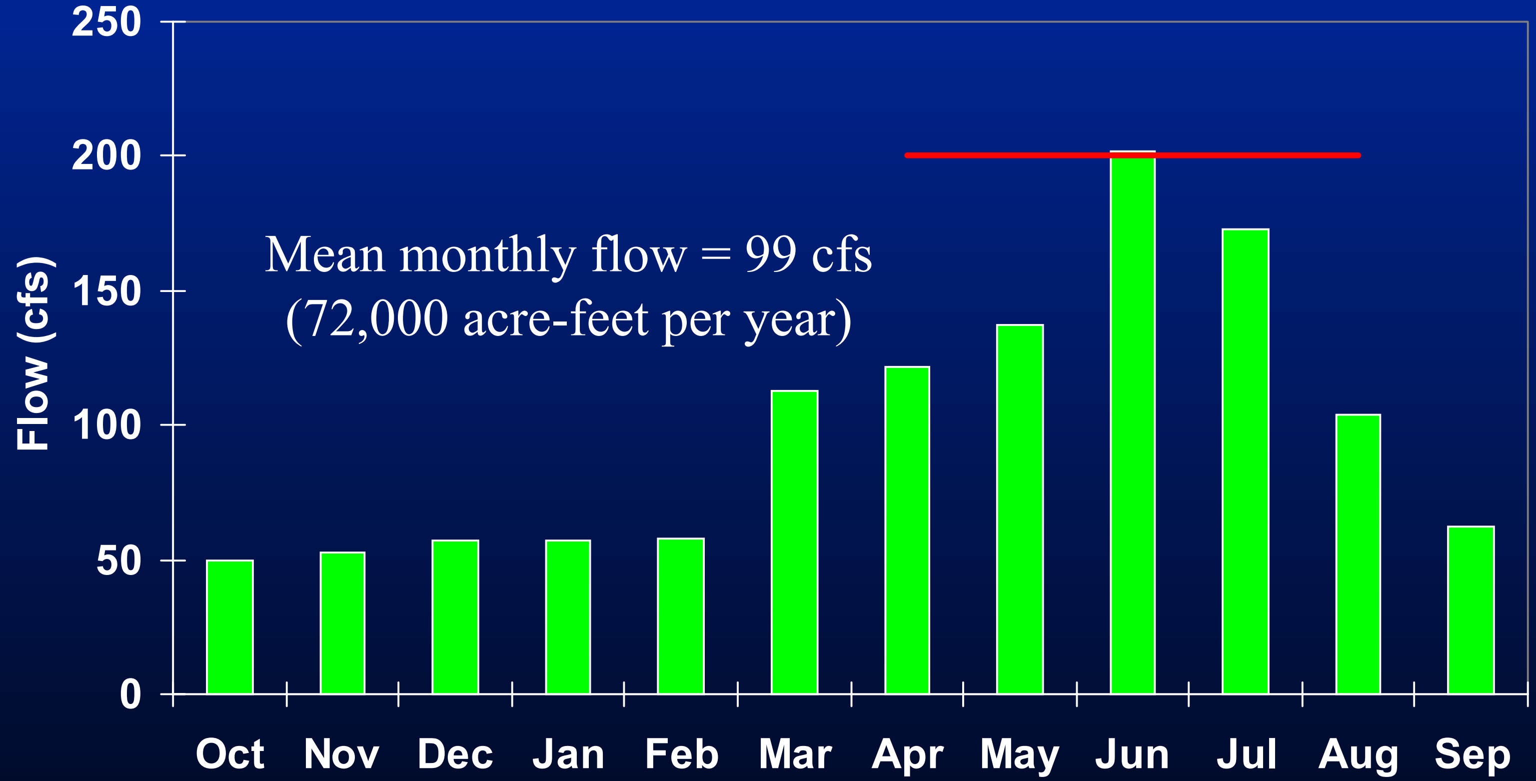
- Assume for beans* :
  - EC_e = 1,000 µs/cm (no yield decline)
  - Increase leaching ratio from 0.25 to 0.57
  - Crop evapotranspiration (ET) for beans of 1.8 feet
- Applied water increases from 2.4 to 5.4 feet to satisfy leaching requirement and no yield decline

•Example provided by Dr Burt in exhibit SJEC-EXH–01 prepared for Bay-Delta periodic review

Effect of Increased Salinity Irrigation Water

- Assume:
  - Increased need for water: 3.0 acre-feet/acre
  - 60,000 acres irrigated by SJR water from Sack Dam to Vernalis
  - One-third acres planted with salt-sensitive crops
- Requires 60,000 acre-feet of additional water to assure no loss in productivity
- Equivalent to 200 cfs in each month, April to August

Dilution Flows
Upstream of Merced River



Tradeoff

- Improved water quality (lower salinity) results (in general) in lower water use due to decreased leaching requirement

Other Considerations

- Central Valley Project Impacts
- Need for salt balance

Central Valley Project Impacts

- Decreased SJR flows: diversion of SJR flows to outside SJR Basin
- Increased CVP salt load imports with replacement water supply
- Consistent with Phase I TMDL and Water Right Decision 1641: USBR is *principle cause* of the salinity impairment

Central Valley Project Impacts

SWRCB D-1641

- The SWRCB Order in Decision 1641, adopted 29 December 1999, amended the CVP permits under which the USBR delivers water to the San Joaquin Basin to require that the USBR meet the 1995 Bay Delta Plan Salinity objectives at Vernalis
- The USBR has wide latitude in developing a program to achieve this result

Need for Salt Balance

- Salt and boron are naturally occurring elements that are mobilized whenever water is applied to soils (precipitation and applied irrigation water)
- Concentrations of salt and boron also increase as a result of evapotranspiration
- Historically more salt has been imported to basin that has been exported

Need for Salt Balance
TMDL Implementation

- Typically, fixed TMDL load limits are established to meet water quality objectives during low flow conditions
- Recognizing need to maintain a salt balance in the basin, there is a need in the salt and boron TMDL to maximize salt exports while still meeting water quality objectives

Challenge:

How can these considerations be incorporated in the TMDL?

Load Allocation Methodology

- Base Load Allocation Method
- Import Water Relaxation
- CVP Load Allocation
- Real-time Relaxation

Base Load Allocation

- Low flow conditions
- Background loads are subtracted from total loading capacity
- Consumptive use allowance loads subtracted from total loading capacity
- Waste load allocation: current limits
- Remaining assimilative capacity evenly distributed to non-point sources

Import Water Relaxation
(For SJR & Central Valley Project Imports)

- Subareas with high salt supply receive additional allocation
- “Supply water relaxation” is 50 percent of mean salt load imported to the subarea during low flow conditions
- Problem: additional load allocation results in violation of water quality objectives

Import Water Relaxation
(For SJR & Central Valley Project Imports)

- Problem: additional load allocation results in violation of water quality objectives
- Solution: impose load limits on supply water

CVP Load Allocation

- USBR responsible for salt load in Central Valley Project (CVP) water delivered to the TMDL project area that is in excess of a base load for equivalent volume of Sierra Nevada quality water
- This load responsibility offsets additional allocation provided to subareas that receive CVP water supply credit

CVP Load Allocation

- Consistent with Phase I TMDL, USBR will have wide latitude to address salt imports:
  - Reduce salt in supply
  - Drainage treatment / disposal
  - Dilution flows

Real-time Load allocations

- Base loads plus import water relaxation may still be too restrictive
- TMDL includes opportunities to utilize real-time load allocations in lieu of the base load allocations

Real-time Load allocations

- Real time relaxation may only be employed if physical and organizational infrastructure is put in place to manage discharges

Other Basin Plan Amendment Elements

Other Basin Plan Amendment Elements

- Surveillance and Monitoring
- Time Schedule
- Economic Analysis

Surveillance and Monitoring

- Determine Success of Amendment
- Discharger Ultimately Responsible
- Program Goals
  - Compliance with Objectives
  - Compliance with Load Allocations
  - Effective Management

Time Schedule for Compliance

- Schedule will be determined based on factors including relative contribution to the problem and achievability
- Performance goals versus full compliance with water quality objectives

Economic Analysis

- Nonpoint source discharger costs
- Point source (NPDES Permittee) costs
- Program costs
- Potential sources of financing

Salt and Boron Project Timeline

Public Workshop on Draft BPA and TMDL	February 2006
Draft BPA and TMDL released	April 2006
Regional Board Workshop	June 2006
Regional Board Hearing	September 2006
State Board review	December 2006
OAL & U.S. EPA	February 2007

Next steps

Submit Comments:

Les Grober

Central Valley Regional Water Quality Control Board

11020 Sun Center Drive, #200

Rancho Cordova, CA 95670-6114

lgrober@waterboards.ca.gov

Website:

http://www.waterboards.ca.gov/centralvalley/programs/tmdl/upstream-salt-boron/

Listserve:

http://www.waterboards.ca.gov/lyrisforms/reg5_subscribe.html