Impact of SJR & South Delta Flow Diversions on Water Quality

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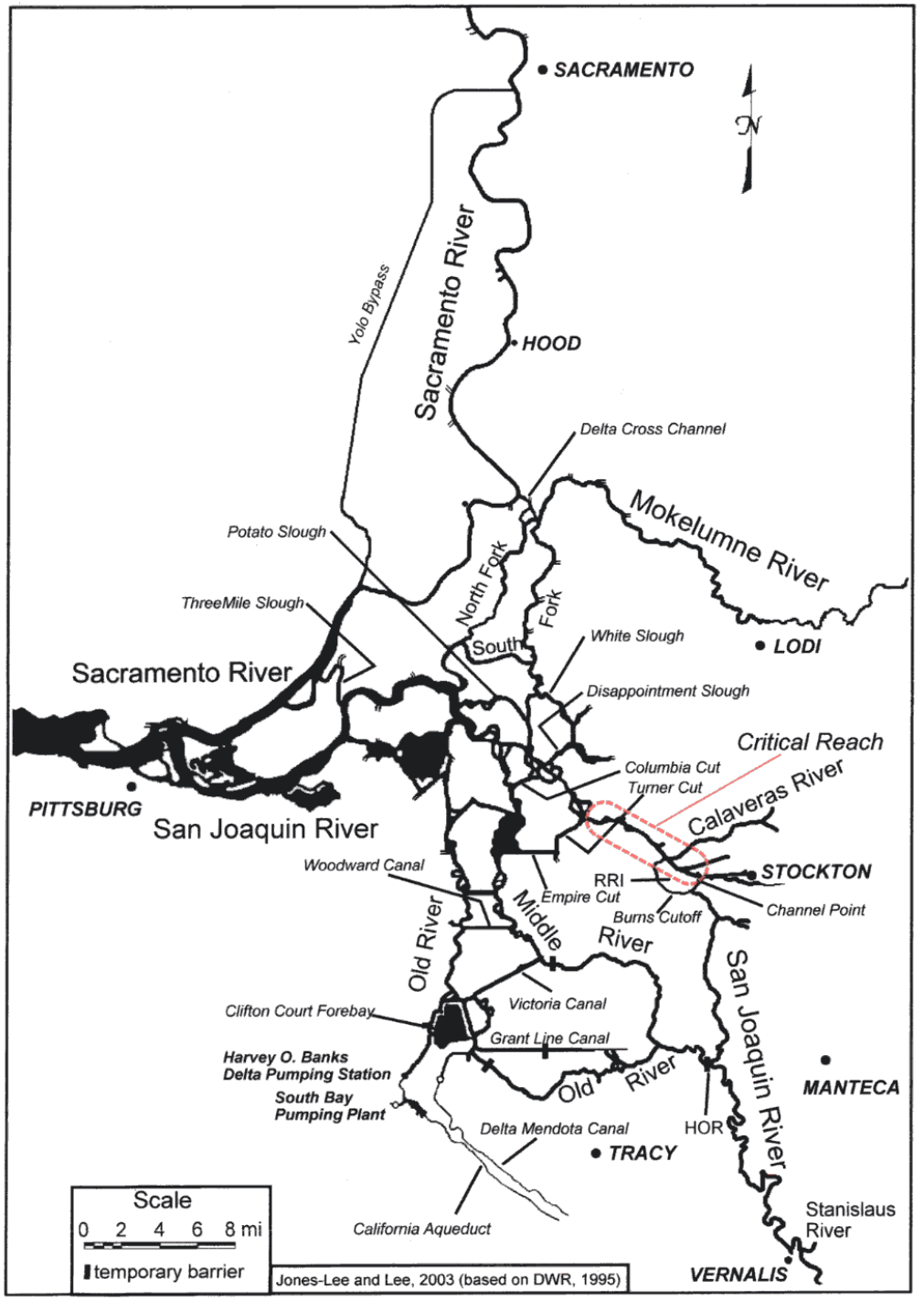
- Began Review SJR Low-DO Problem Spring 1999
  - Supported by CVRWQCB & DeltaKeeper Directed Funds
  - Flow SJR DWSC Available Since 1995 When SJR Garwood Monitoring Station Established
  - DWR Monitoring of DO in SJR DWSC at RRI & Via San Carlos D1641 Cruises in DWSC
- Findings:
  - High SJR DWSC Flow -- No DO WQO Violations
  - Low SJR DWSC Flow -- Frequent DO WQO Violations

[Presentation to CA Water Resources Control Board, D1641 Water Rights Review]

Abbreviations/Definitions

CVP	Central Valley Project (Tracy Pumps) (Federal)
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
DIP	Delta Improvement Package
DO	Dissolved Oxygen
DWR	CA Department of Water Resources
DWSC	Deep Water Ship Channel
HOR	Head of Old River
RRI	Rough & Ready Island Monitoring Station
San Carlos	DWR Cruise Boat Used in Delta for Water Quality Monitoring
SJR	San Joaquin River
SJR DWSC Flow	Net Flow of the SJR in DWSC at Stockton
SWP	State Water Project (Banks Pumps) (State)
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
WQO	Water Quality Objective

Sacramento River San Joaquin River Delta



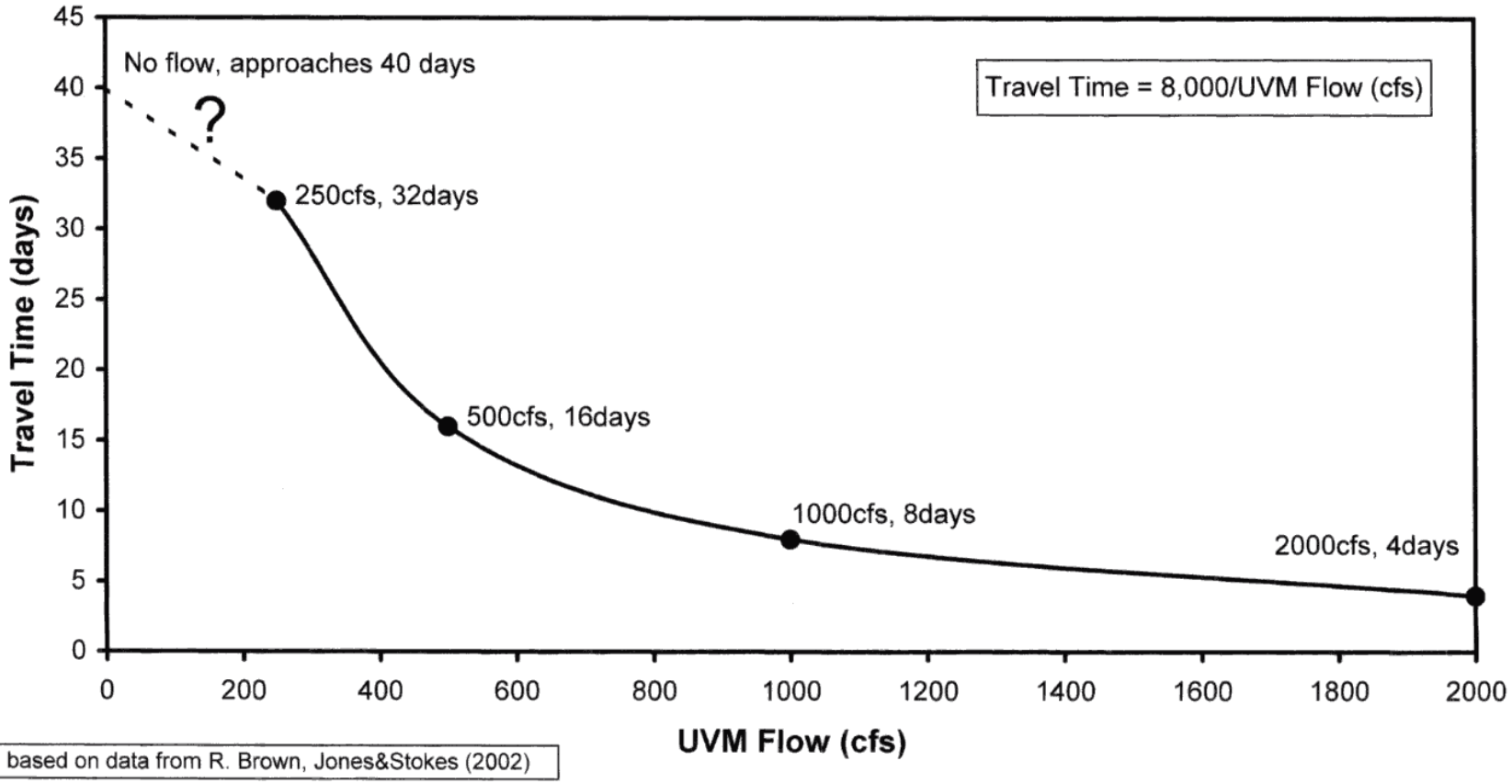
Origin of Low-DO Problem in SJR DWSC

- Oxygen Demand Loads from
  - City of Stockton – Ammonia
  - SJR Watershed Agriculture – Nutrients That Develop into Algae That Die & Decompose in DWSC
- Development of Deep Water Ship Channel / Port of Stockton & Its Continued Maintenance

Impact of Both on DO Aggravated by Diversions of SJR Water That Leads to Low Flow in SJR DWSC

- Long Travel Times in Critical Reach of DWSC
  - Oxygen Demand Loads Exerted in DWSC

Travel Time: DWSC (Channel Point) to Turner Cut as a Function of SJR DWSC Flow



based on data from R. Brown, Jones&Stokes (2002)

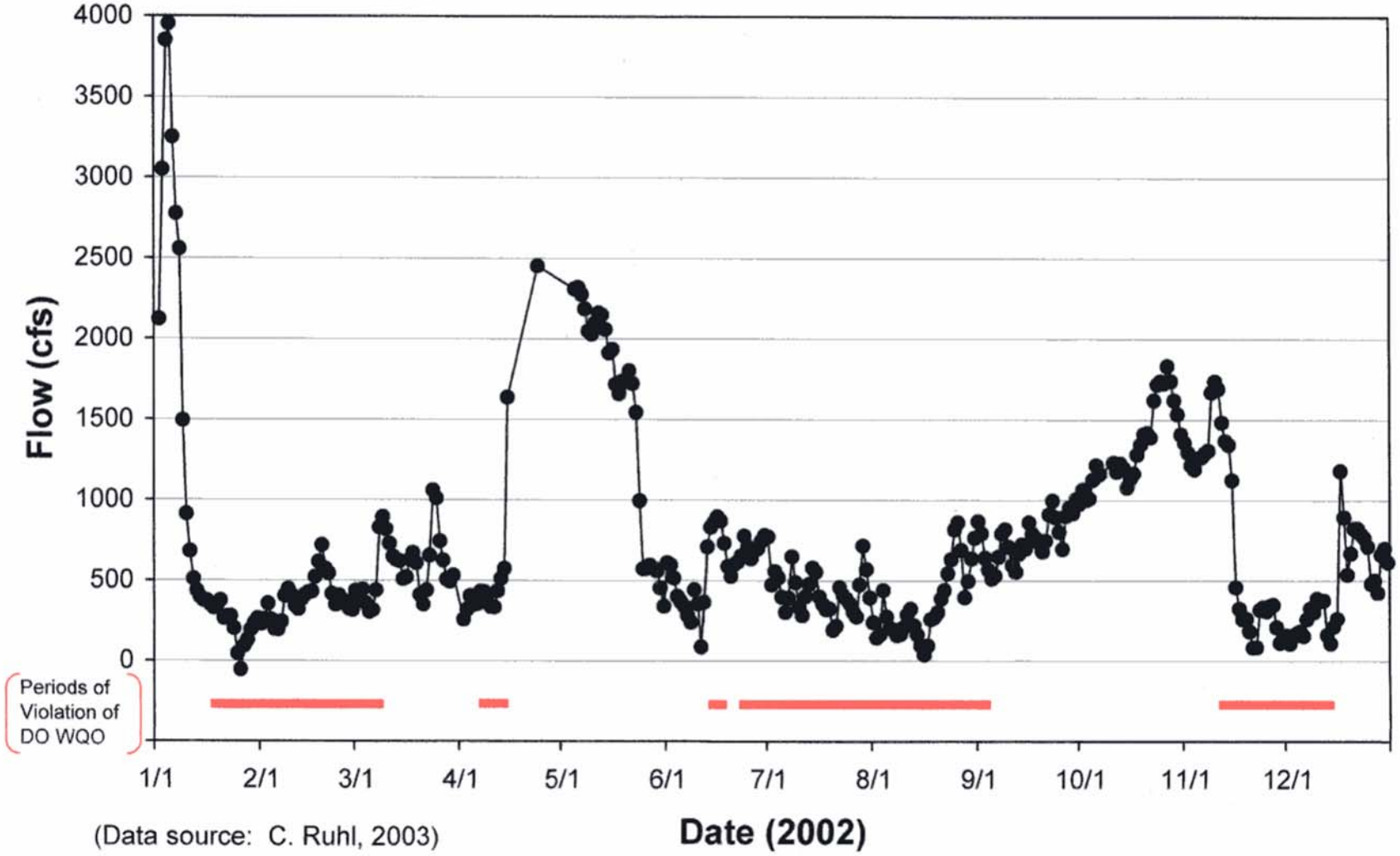
Observations

- SJR DWSC Flow > 1,500 cfs – DO WQO Violations Did Not Occur
- Subsequently, Based on DWR DWSC DO and USGS Flow, 1999-2004 Data

  Low SJR DWSC Flows Associated with Violations of DWSC Water Quality Objectives near RRI
- SJR DWSC Flow Depends on
  - Reservoir Releases & Precipitation in SJR DWSC Watershed
  - Diversions of SJR & Tributary Water
- Key Issue for Violations of DO WQO:

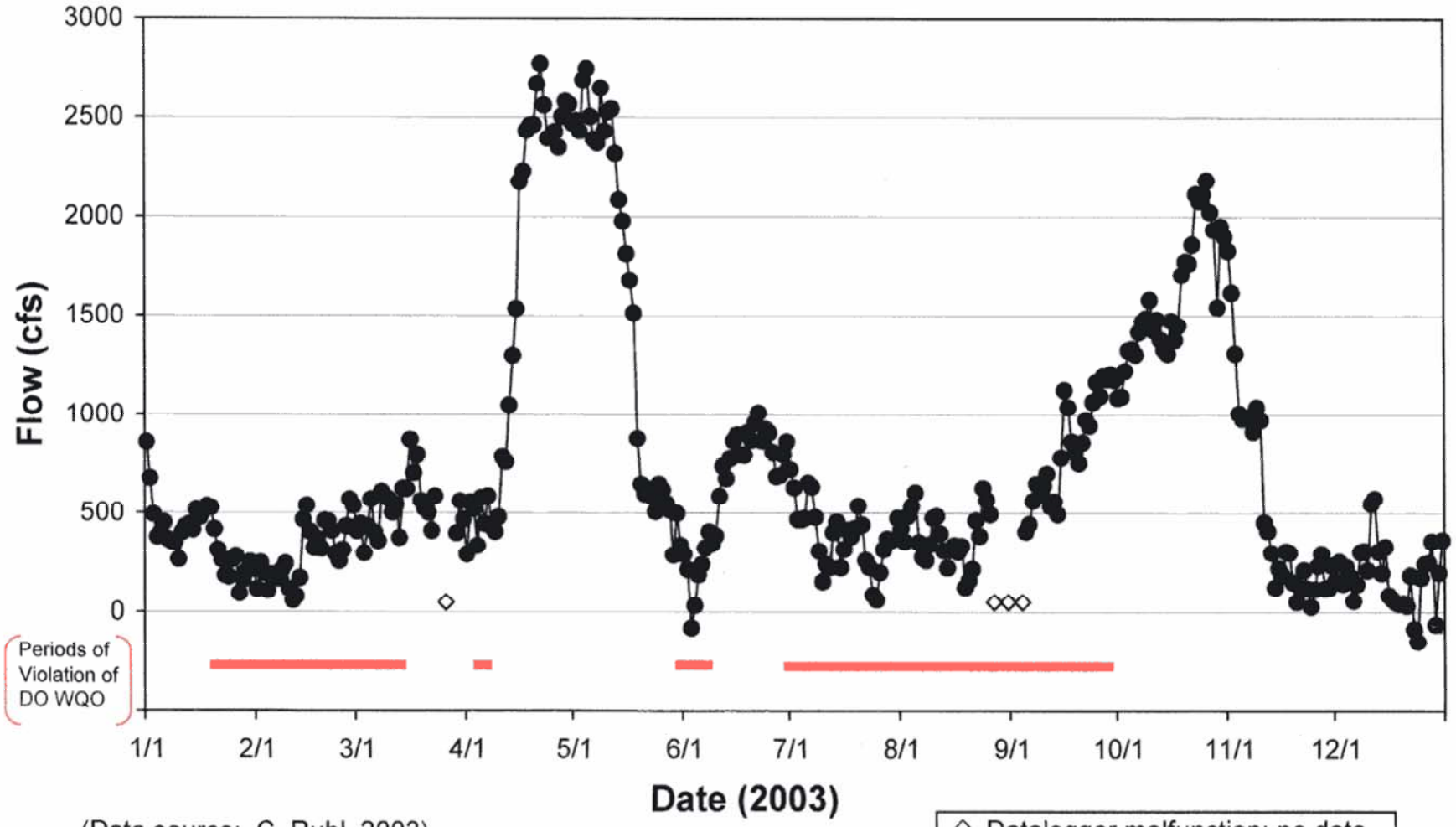
  Amount of SJR Vernalis Water Drawn to Federal CVP (Tracy) & SWP (Banks) South Delta Pumps through HOR

2002 SJR DWSC Flow & DO WQO Violations RRI Monitoring Station



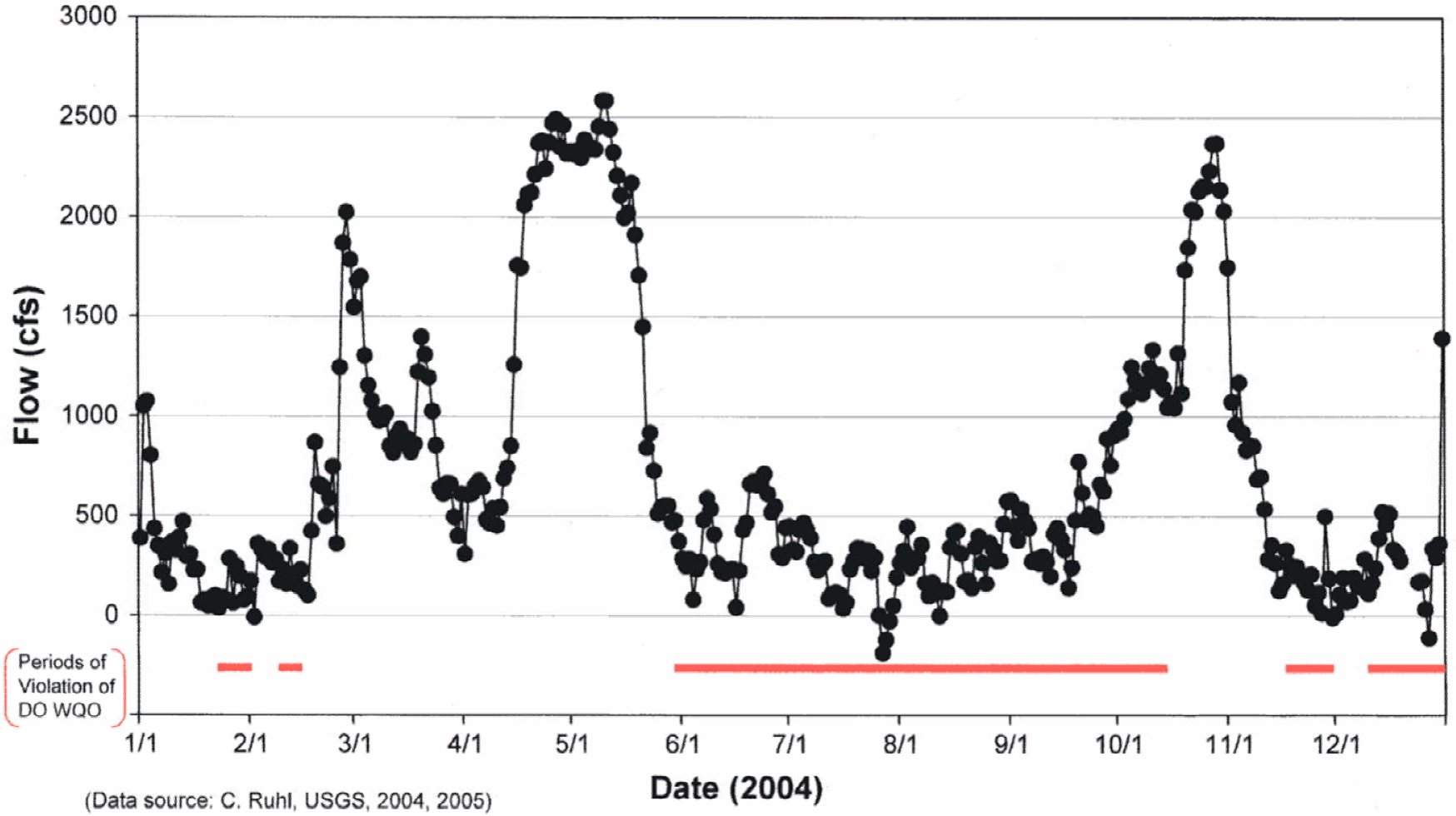
(Data source: C. Ruhl, 2003)

2003 SJR DWSC Flow & DO WQO Violations RRI Monitoring Station



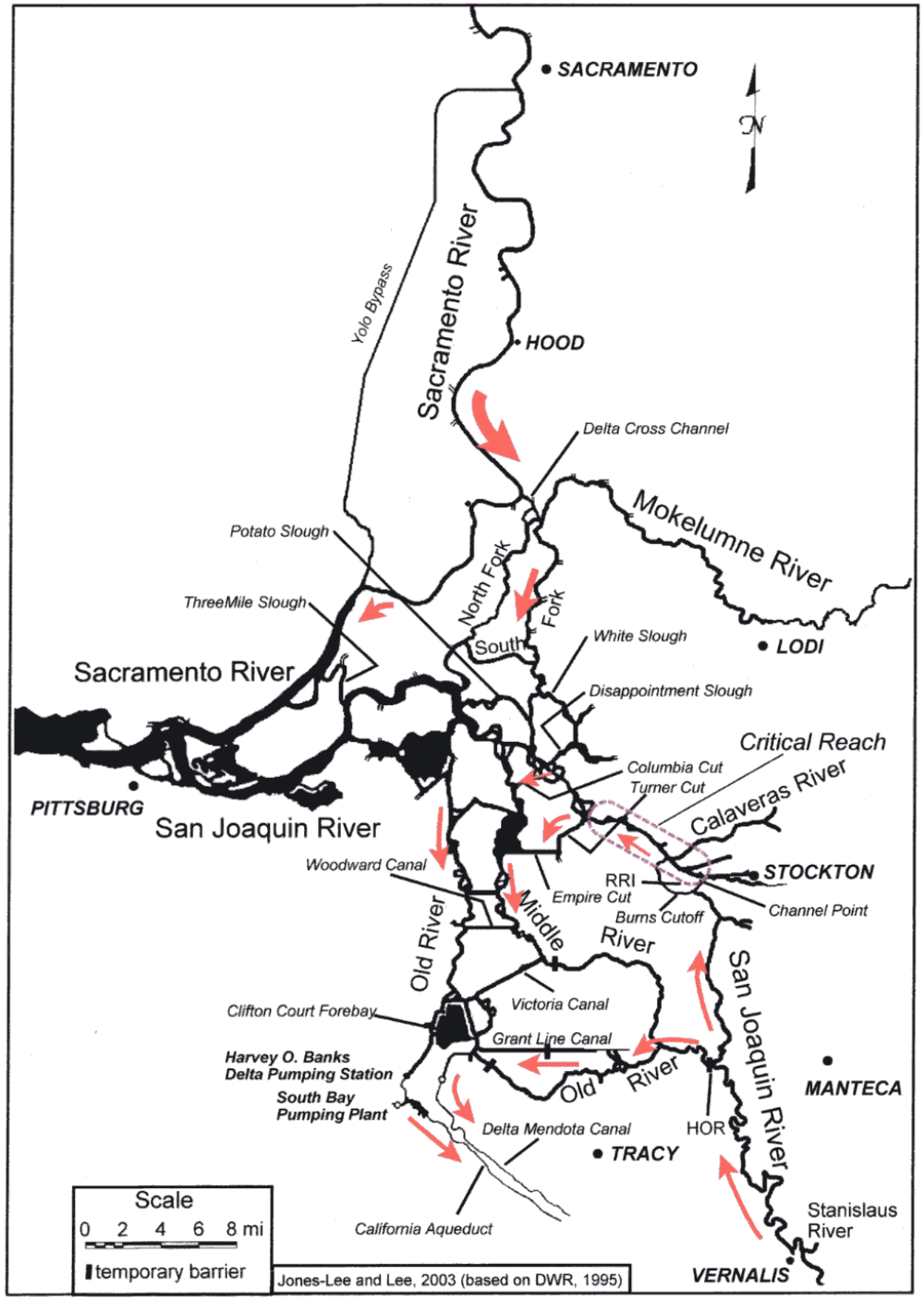
(Data source: C. Ruhl, 2003)

2004 SJR DWSC Flow & DO WQO Violations RRI Monitoring Station



(Data source: C. Ruhl, USGS, 2004, 2005)

Delta Flow Pattern as Influenced by Export Pumping



Current Plumbing of Delta

- CVP & SWP Export Pumps Draw ~ 8,000 – 12,000 cfs of Sacramento River Water to South Delta
  - Transported through Central Delta via Old River & Middle River and
  - Transported through Delta Cross Channel to DWSC at Disappointment Slough to Columbia Cut & Turner Cut
- Since mid-1990s, Flow of SJR at Vernalis Typically 1,000 – 2000 cfs during Summer/Fall
- SJR DWSC Water Mixes with Sacramento River Water by Turner Cut
  - Transported into Central Delta via Turner Cut
  - Mixture Transported to Middle River & to South Delta Export Pumps

Conclusions

- Each Time HOR Barrier Not in Place and closed, SJR Vernalis Water Drawn to CVP & SWP Export Pumps through South Delta
  - Leads to Violations of DO WQO in DWSC
- If Much of SJR Vernalis Water Is Allowed to Pass through DWSC to Turner Cut before Being Drawn South by CVP & SWP Pumps, Violations of DO WQO in DWSC Could Be Greatly Reduced (or Possibly Eliminated)
  - Would Reduce Cost of Oxygen Demand Control & Aeration
  - Would Help Reduce Magnitude of Other Water Quality Problems Arising from City of Stockton Runoff/Discharges
  - Would Not Adversely Affect South Delta Water Exports
    - Most of Water Being Exported Is Sacramento River Water
  - Will Tend to Increase Export of Salt from SJR Watershed
  - Does Not Appear to Cause Low DO Problems in Central Delta Since Oxygen Demand Not Exerted in DWSC Is Diluted by Sacramento River Water at Turner Cut

Other Water Quality Impacts of CVP & SWP

- Presently, Water Quality Impacts of South Delta Exports Largely Focused on Drinking Water Issues
  - Ignoring Other Water Quality Impacts of Export Projects
- South Delta Water Quality Problems Caused by CVP & SWP
  - Low-DO Problems in South Delta Channels
    - Poor Circulation Due to Barriers Needed to Try to Maintain Water Levels
    - Excessive Growth of Algae
      - Fish Kills Caused by Low DO

Other Water Quality Impacts of CVP & SWP

- Impact on Existing Delta WQO Violations/Problems
  - Toxicity to Fish, Zooplankton, Benthic Invertebrates, Algae Due to Currently Used Pesticides in Agricultural & Urban Areas
  - Bioaccumulation of “Legacy” Organochlorine Pesticides (e.g., DDT, Dieldrin, Chlordane, Toxaphene) & Non-Pesticides (e.g., PCBs, Dioxins) That Are Threat to Human Health and Higher Trophic-Level Organisms
  - Potentially Spread the Excessive Bioaccumulation of Mercury in Delta Edible Fish
  - Reduced Primary Production in Central Delta Arising from Drawing Low-Nutrient Sacramento River Water to South Delta by Export Projects

Other Water Quality Impacts of CVP & SWP

- Loss of Chinook Salmon Home-Stream Signal in Upper San Francisco Bay & Western Delta during Fall, in SJR DWSC below Columbia Cut as Result of Export Projects' Drawing All San Joaquin River Watershed Water to Export Pumps.
  - Leads to Straying of Chinook Salmon from Home Stream for Reproduction
- Adverse Impacts of Low DO Problems in SJR DWSC & in South Delta
- Distribution of Heavy Metals (Copper, Lead, Cadmium, Selenium) in Water & Sediments – Impacts Aquatic Life
- Impacts of Excessive Salt/EC on Irrigated Agriculture & Domestic Water Supplies
- Distribution of Excessive TOC/DOC That Impacts Domestic Water Supply Water Quality
- Influences Distribution of Pathogens & Pathogen Indicators That Influences Contact Recreation Safety

303(d)-Impaired Channels in Delta Impacted by CVP & SWP Exports

Overview of Sacramento-San Joaquin River Delta Water Quality Issues

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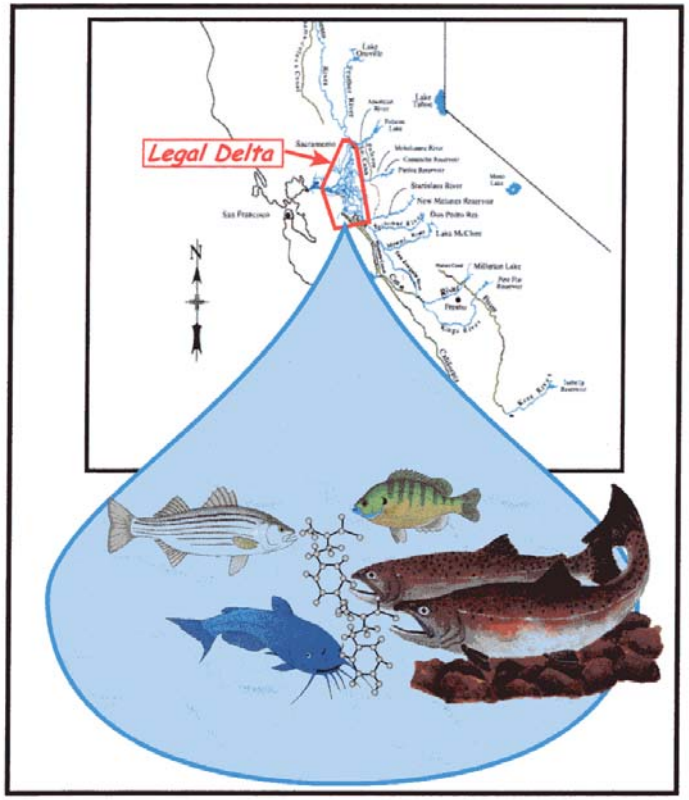

Adapted in part from images in SJRGA (2000)

June 22, 2004

Available on the internet at:
http://www.members.aol.com/apple27298/Delta-WQ-IssuesRpt.pdf

HR 2828 Water Supply, Reliability, and Environmental Improvement Act

HR 2828, states,

"*D) PROGRAM TO MEET STANDARDS-*

(i) IN GENERAL- Prior to increasing export limits from the Delta for the purposes of conveying water to south-of-Delta Central Valley Project contractors or increasing deliveries through an intertie, the Secretary shall, not later than 1 year after the date of enactment of this Act, in consultation with the Governor, develop and initiate implementation of a program to meet all existing water quality standards and objectives for which the Central Valley Project has responsibility."

- How Will This Requirement Be Implemented?
  - Should Address All WQO Violations in Delta Impacted by Exports

San Joaquin River Deep Water Ship Channel Low DO Problem and Its Control

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Characteristics of SJR DWSC Low DO Problem

- Occurrence of Low DO
- Cause of Low DO & Sources of Oxygen Demand
- Factors Influencing Low DO

Management Approaches

- Recommended Approach

(Presented at SETAC World Congress Portland, OR, November 2004, Updated December 2004)

For Review of
SJR DWSC Low-DO Problem

See Lee, G., F., and Jones-Lee, A., "San Joaquin River Deep Water Ship Channel Low DO Problem and its Control," PowerPoint Slides Presented at SETAC World Congress, Portland, OR, November 2004. Updated December (2004)

http://www.members.aol.com/annejlee/LowDOSummaryDec2004.pdf

Further Information

Consult Website of
Drs. G. Fred Lee and Anne Jones-Lee

http://www.gfredlee.com

www.gfredlee.com

Publications on:

- Landfills-Groundwater Quality
- Surface Water Quality
- Hazardous Chemical Sites
- Mine Waste Impacts
- Contaminated Sediment
- Domestic Water Supply
- Excessive Fertilization
- Reclaimed Wastewater
- Watershed Studies San Joaquin River Watershed & Delta
- Stormwater Newsletter