

Monitoring DO in the DWSC
with the O₂ Injection Device:
How will we know if its really
working?

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Jones & Stokes

SJR DO-TMDL TWG Meeting

March 21, 2006

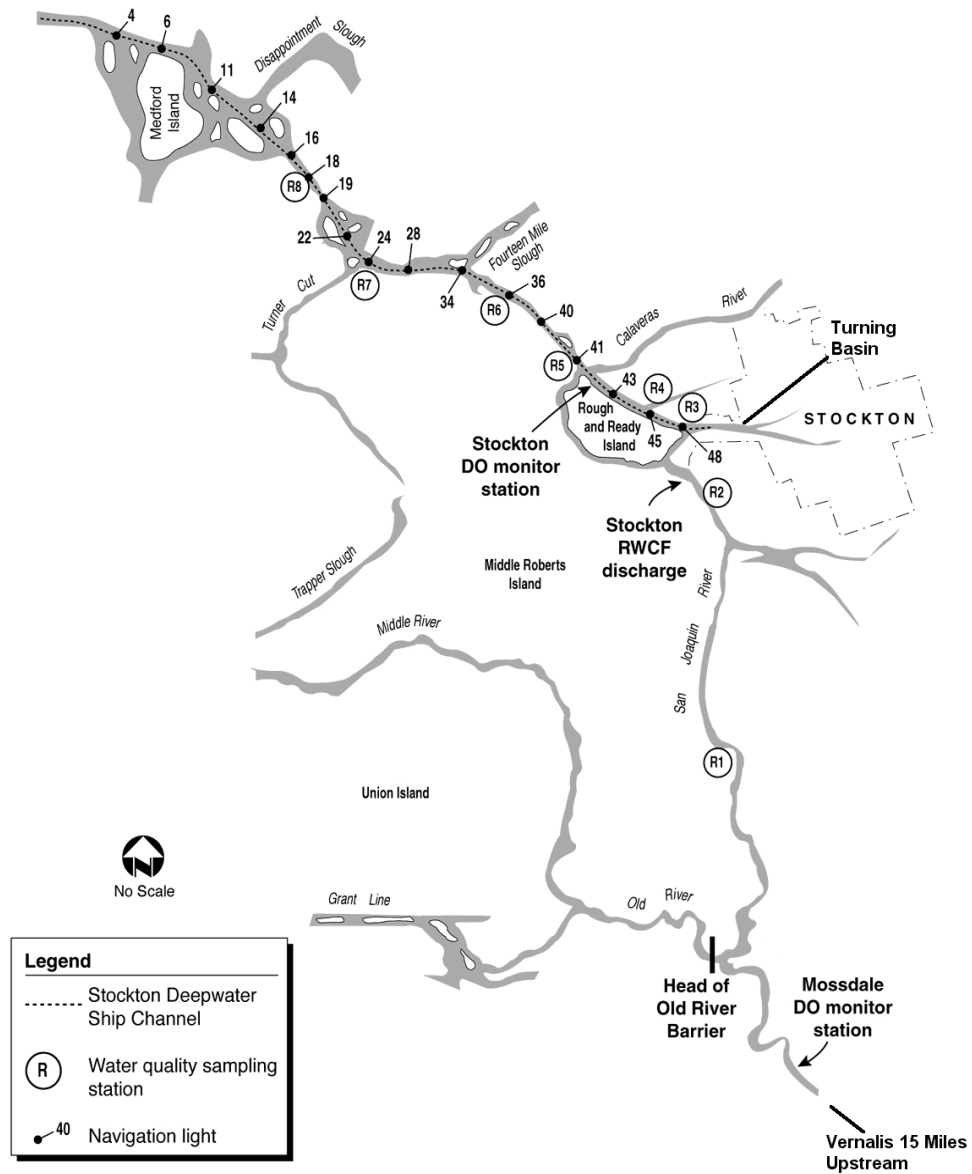
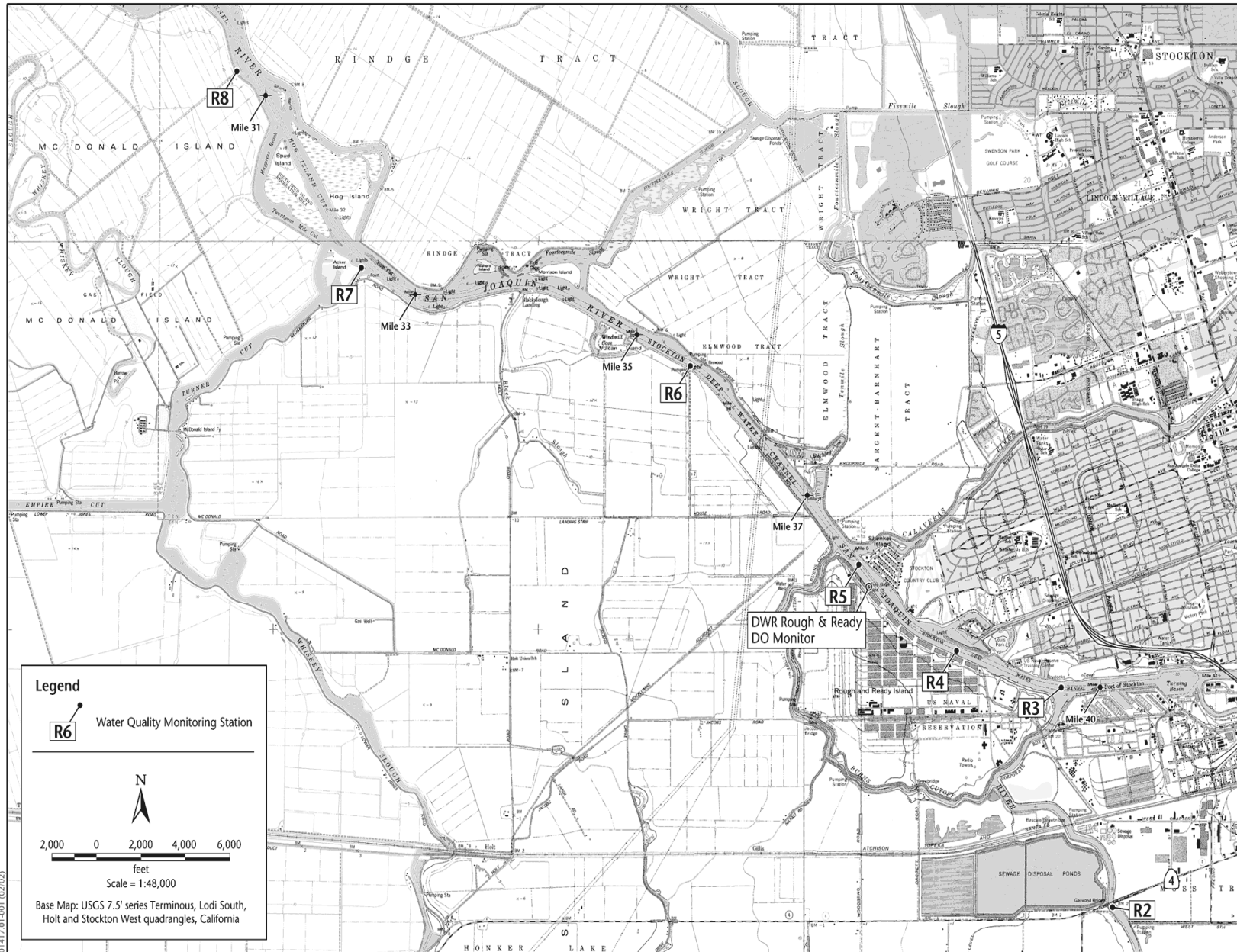


Figure 1
 Location of Water Quality Stations and Navigation Lights
 on the San Joaquin River in the Vicinity of Stockton

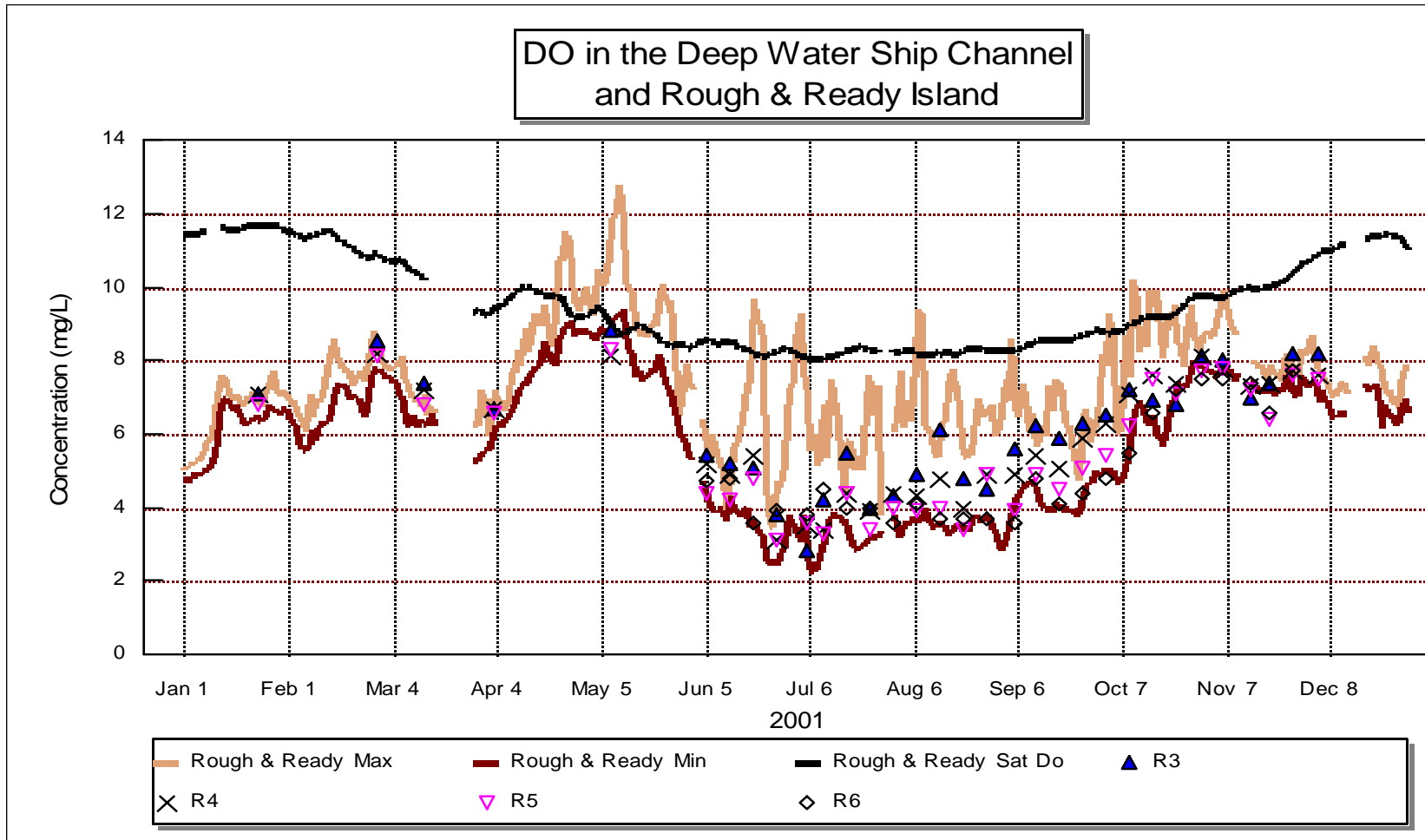


The DWSC DO Monitoring Plan

Table 1. Stations for Proposed Water Quality Monitoring

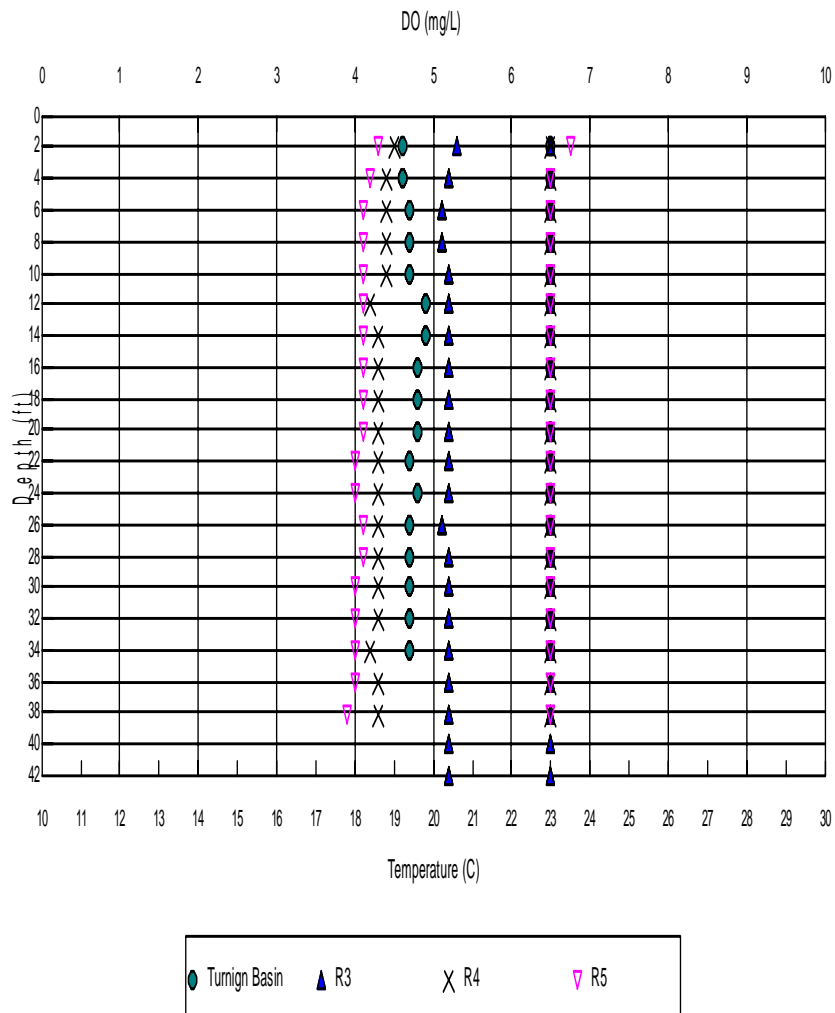
Station Name	Station Location	A. Continuous 15-Minute Monitoring*	B. Vertical Profiles (Weekly; Daily if Device Operating)*	C. Grab Samples (Weekly)*
R2a	On San Joaquin River, upstream of Channel Point at railroad bridge; SJR mile 40	X	–	X
Turning Basin (TB)		–	X	X
R3	River Mile 39.4 (light 48)	X	X	X
R4	River Mile 38.5 (light 43)	X	X	X
DWR Rough & Ready Island Station	River Mile 37.8	Existing	X	X
R5	River Mile 37.3 (light 41)	X	X	X
R6	River Mile 35.5 (light 40)	X	X	X

Existing DO Measurements -2001

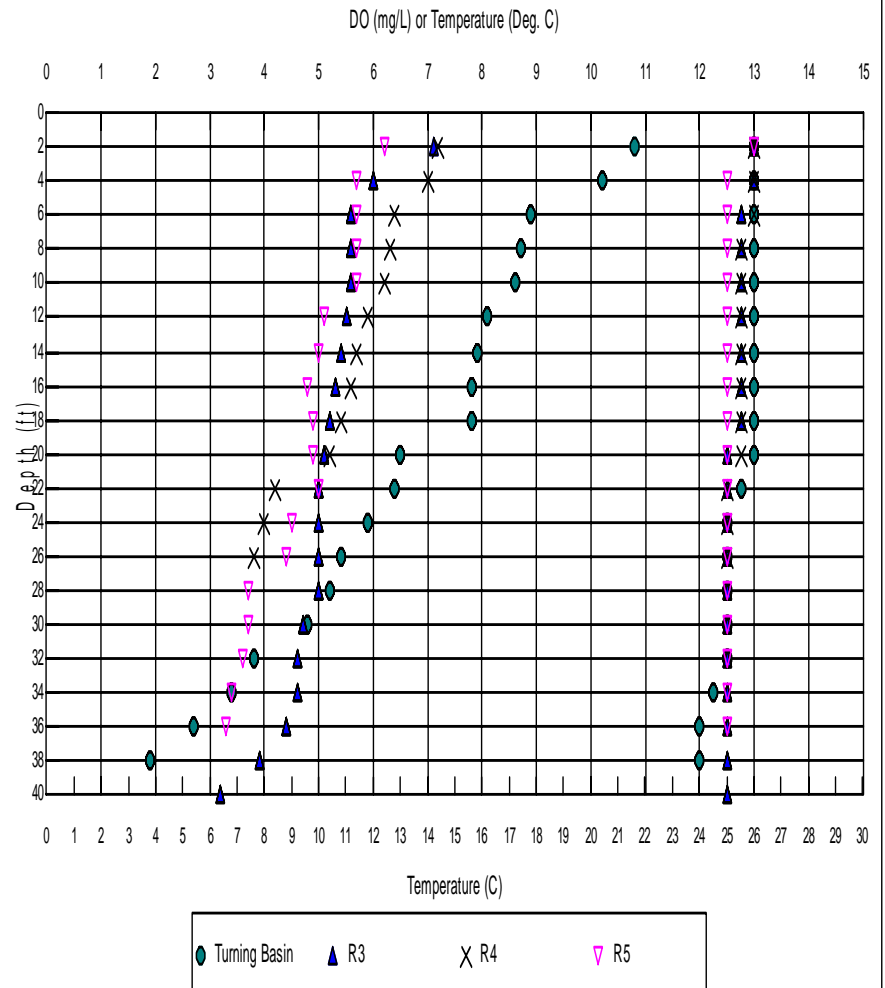


Vertical Temp & DO Profiles

Vertical Profile of the San Joaquin River - 6/12/01

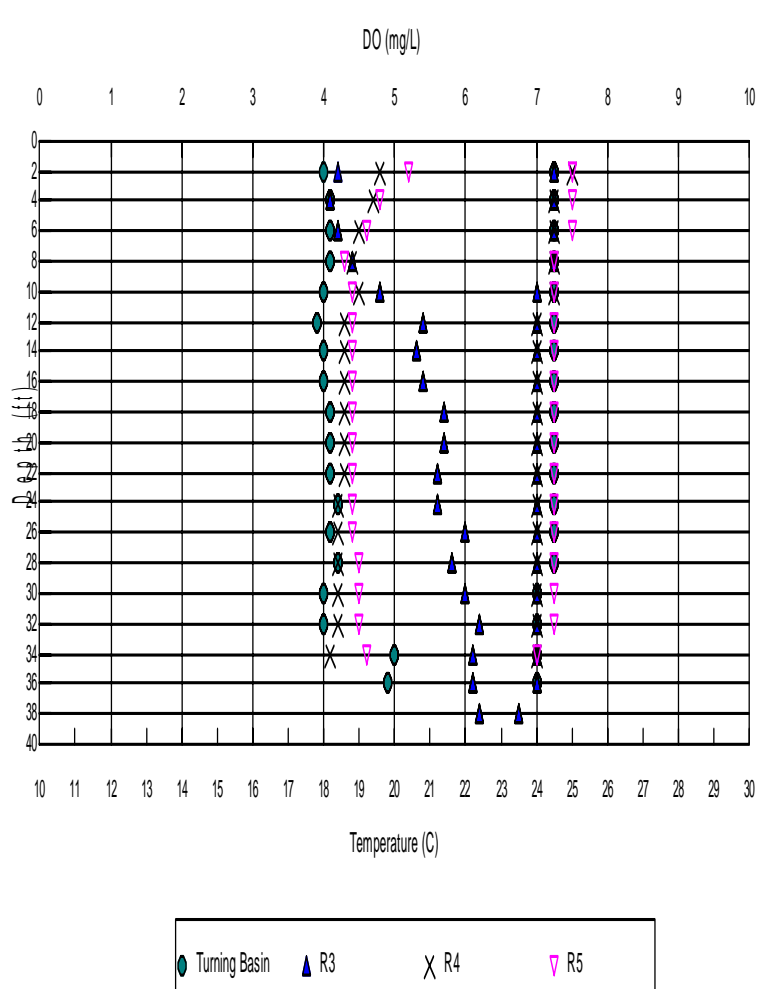


Vertical Profile of the San Joaquin River - 6/19/01

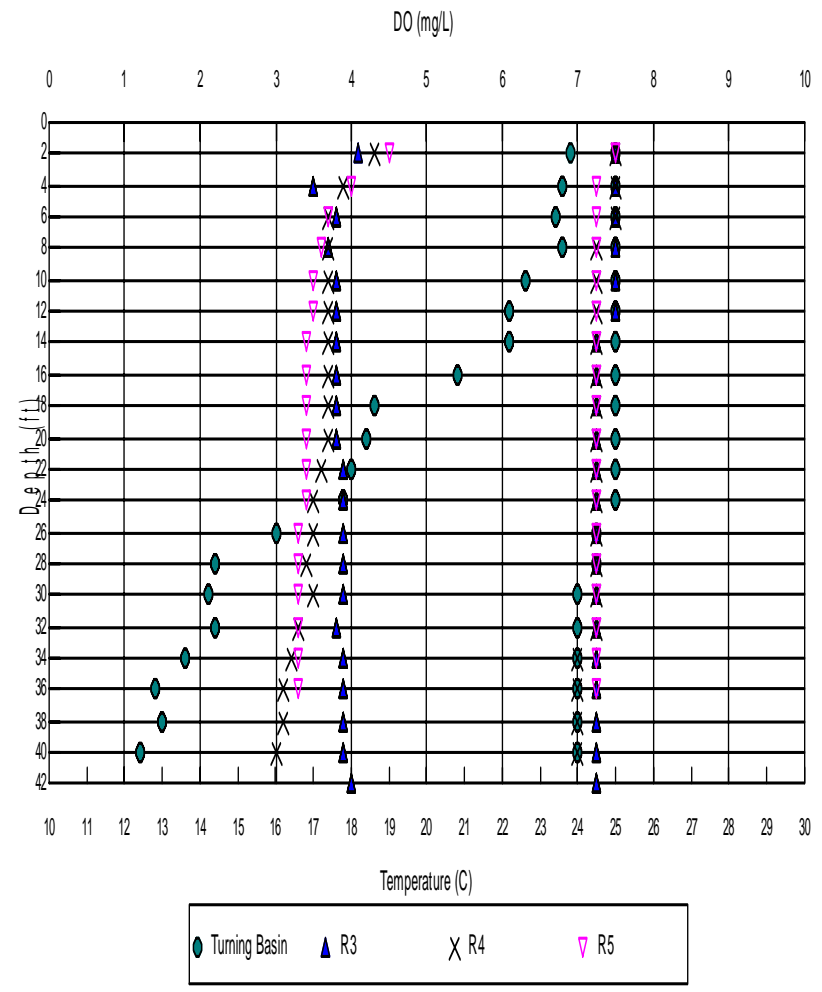


Generally uniform, but not always; what are the causes of gradients?

Vertical Profile of the San Joaquin River - 7/17/01

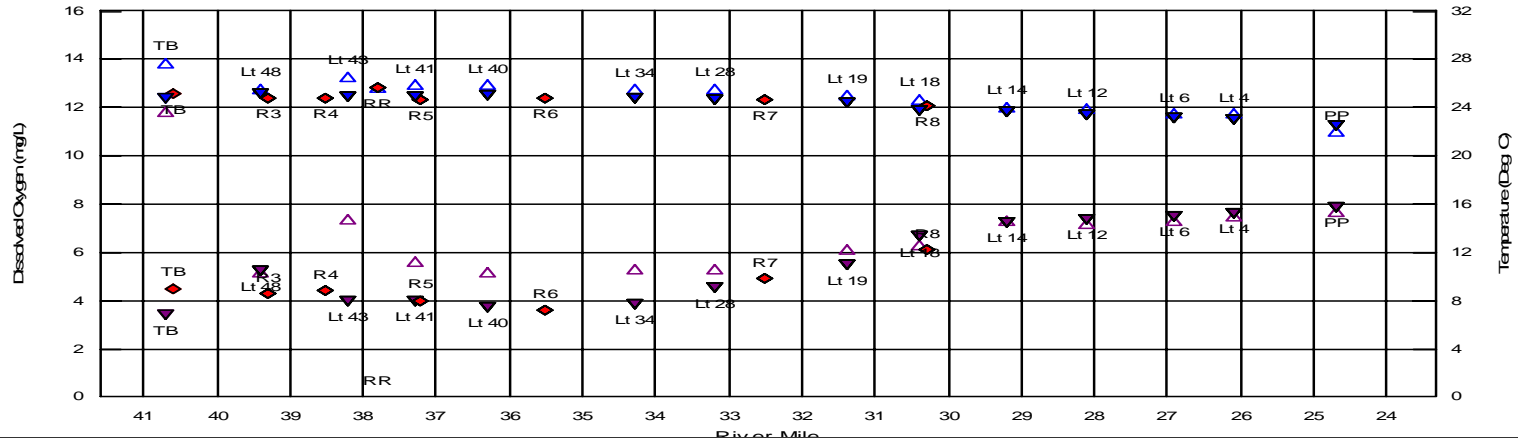


Vertical Profile of the San Joaquin River - 7/24/01

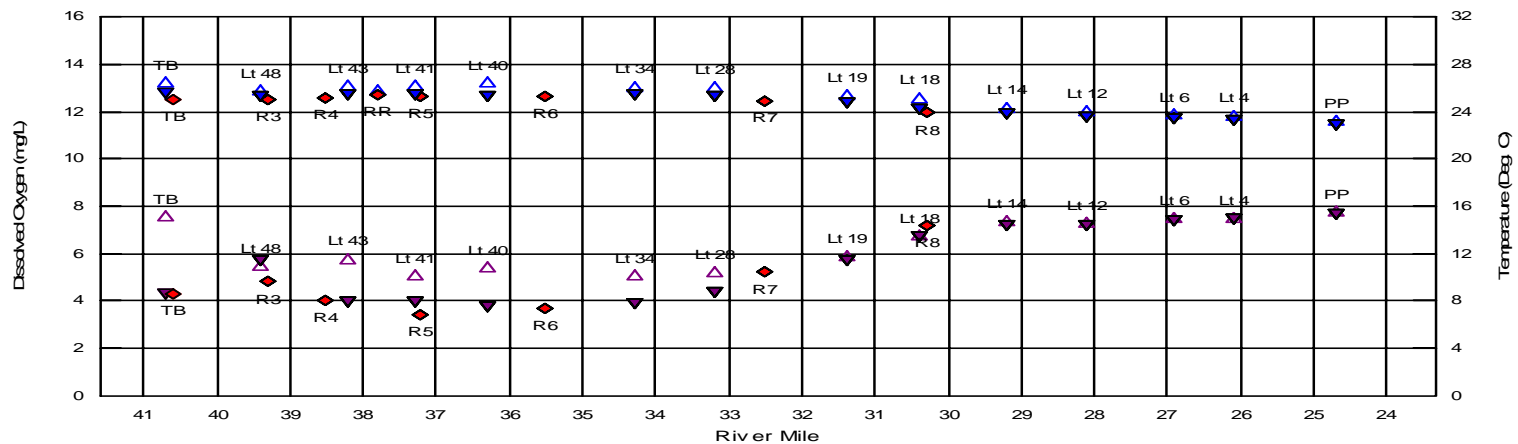


DWSC Longitudinal Profiles

Water Temperatures and Dissolved Oxygen in the San Joaquin River
8/1/01 7-Day Flow = 612 cfs



Water Temperatures and Dissolved Oxygen in the San Joaquin River
8/20/01, 7-Day Flow = 607 cfs



- ▲ Surface Temp
- ▲ Bottom Temp
- ▲ Surface DO
- ▲ Bottom DO
- ◆ Stockton Data

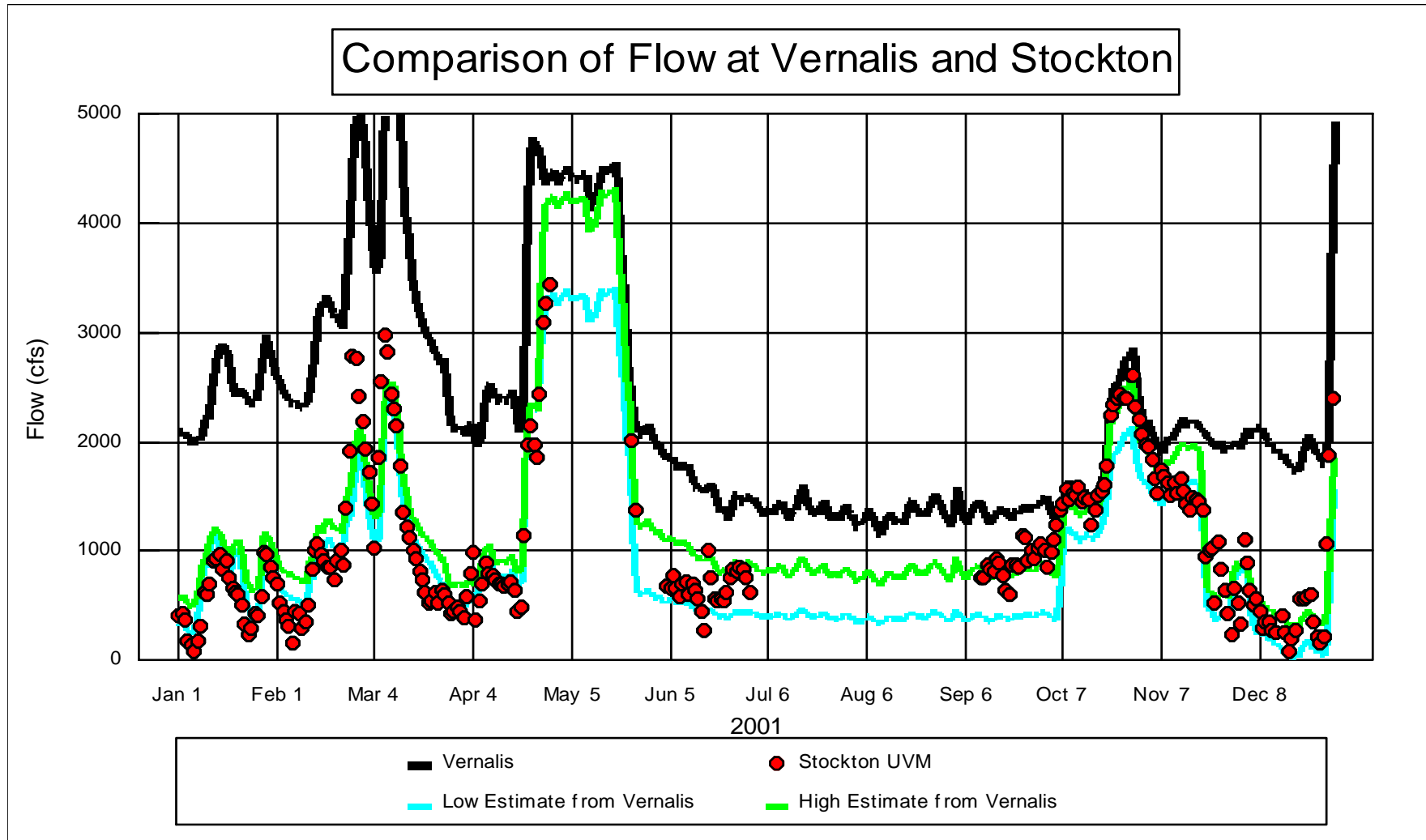
Net Flow and Tidal Movement in the DWSC

- Net Flow = $[0.5 - 0.05 * \text{Pumping}] * \text{Vernalis}$
- Net Flow = measured USGS tidal flow at Garwood

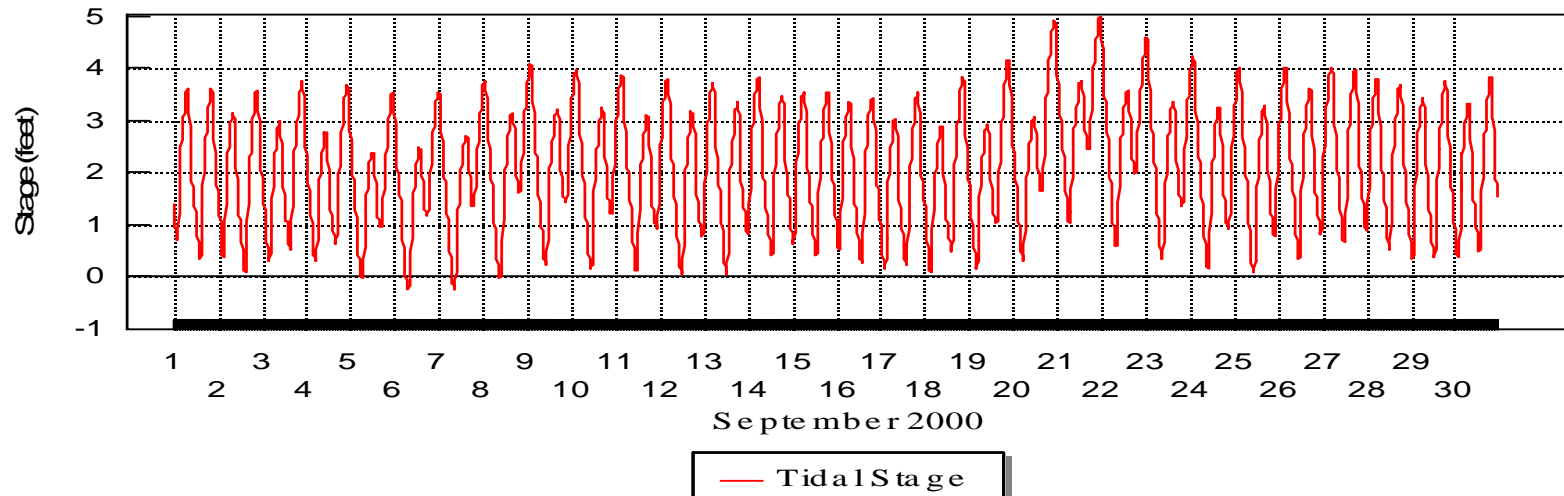
- Tidal volume = $850 \text{ (ac)} * \text{stage change (ft)}$
- Tidal movement = tidal volume / cross-section

- Tidal volume = 2,500 acre-feet (for 3-ft tide)
- Tidal movement = 1.5 miles (for 3-ft tide)

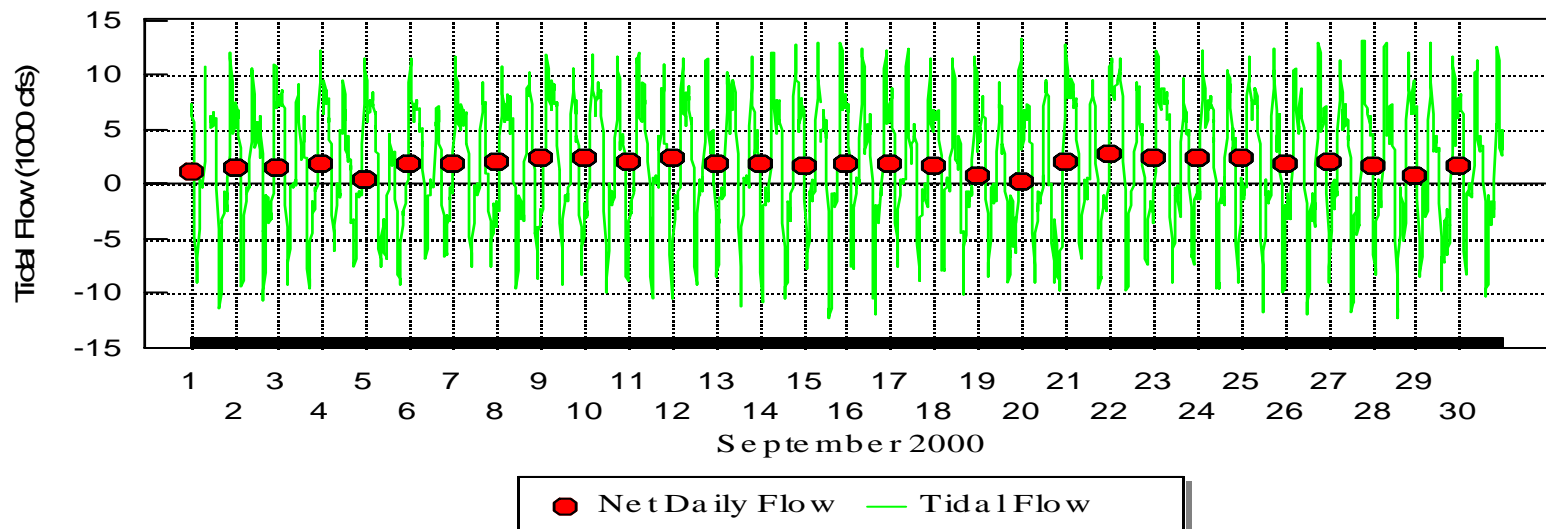
DWSC Tidal and Net Flow



Tidal Stage at Rough and Ready Island

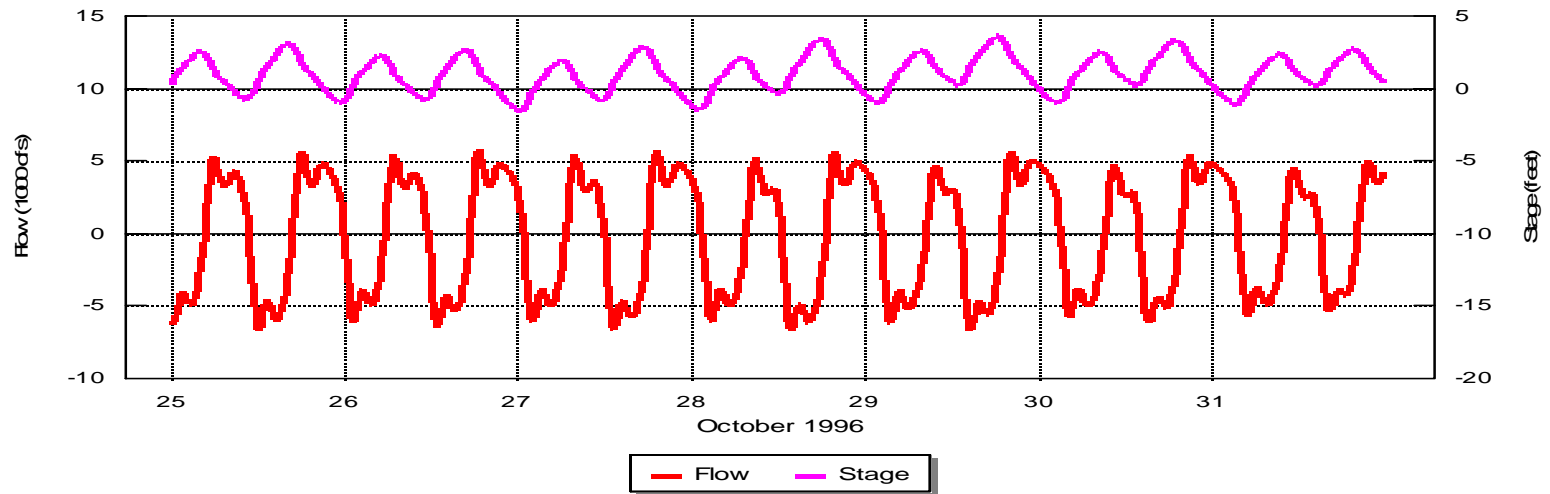


Tidal Flows at Rough and Ready Island



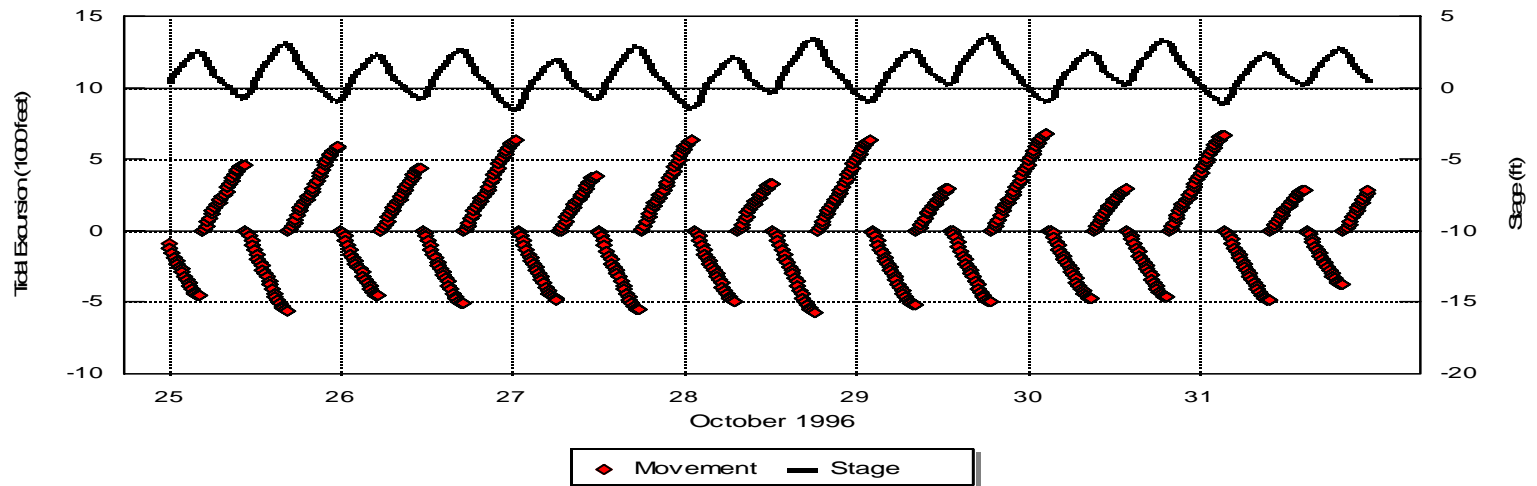
DSM2 Simulated Tidal Flow at Rough & Ready Island

Exports=10000 cfs, HOR Barrier is out and SJR flow =1000 cfs



DSM2 Simulated Tidal Movement at Rough & Ready Island

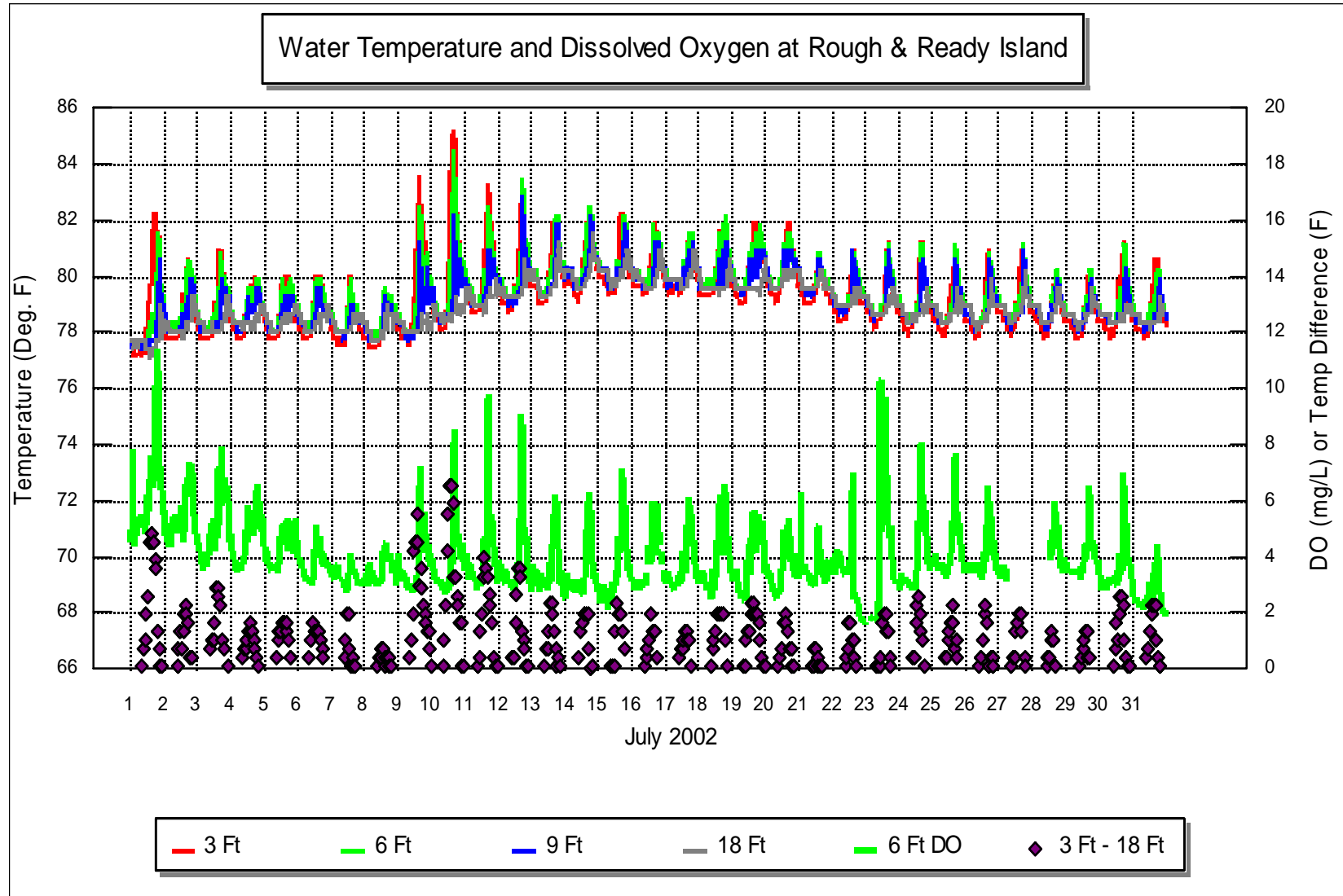
Exports=10000 cfs, HOR Barrier is out and SJR flow =1000 cfs



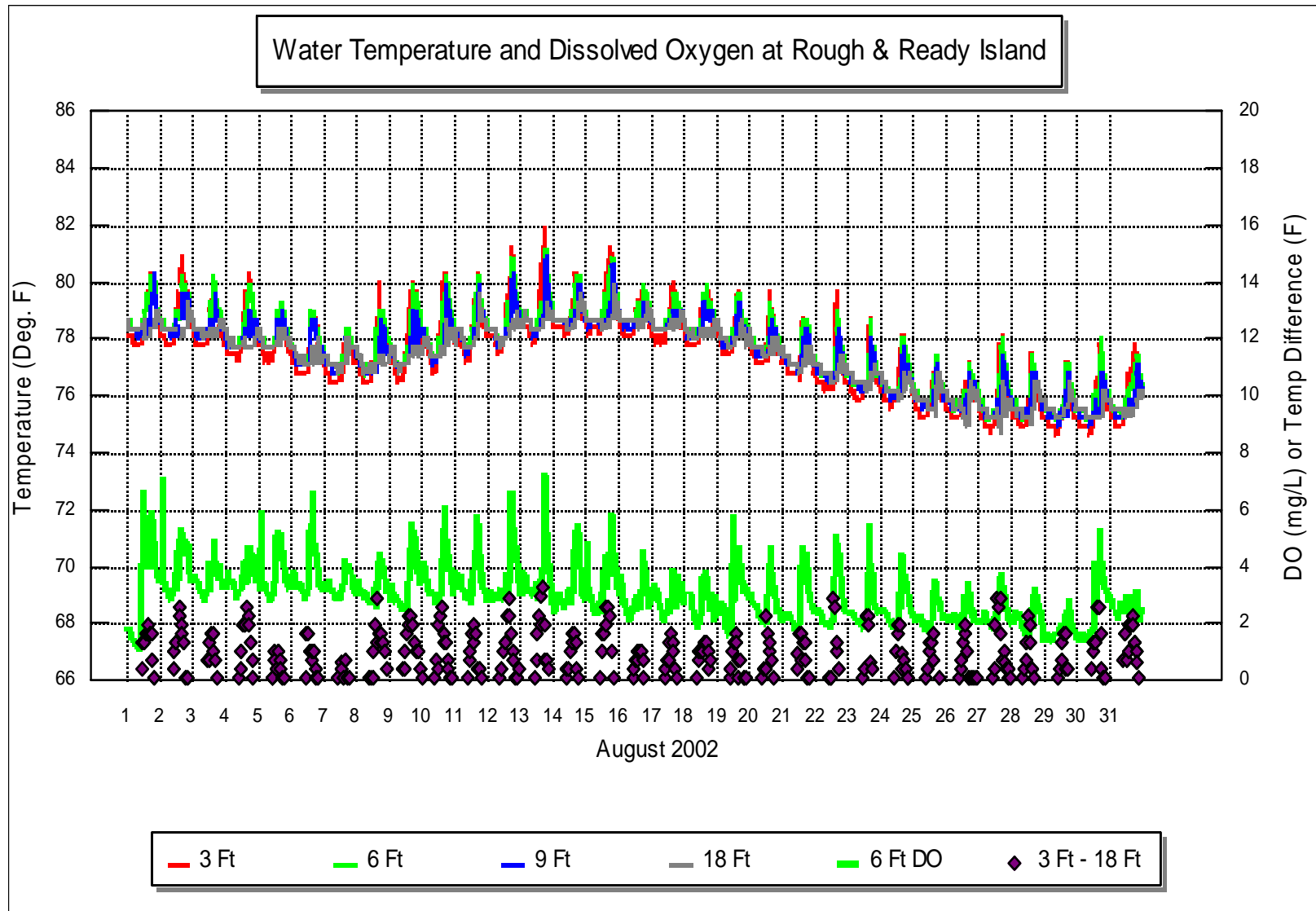
Vertical Velocity Gradients and Stratification of Temperature and DO in the DWSC

- Temperature stratification and vertical DO gradients are measured during most days
- Stratification isolates the surface layer from mixing and allows more algal growth (light) in the surface layer, but prevents algal growth (no light) and limits re-aeration below the surface layer

Diurnal Stratification & DO in the DWSC



Diurnal Stratification & DO in the DWSC

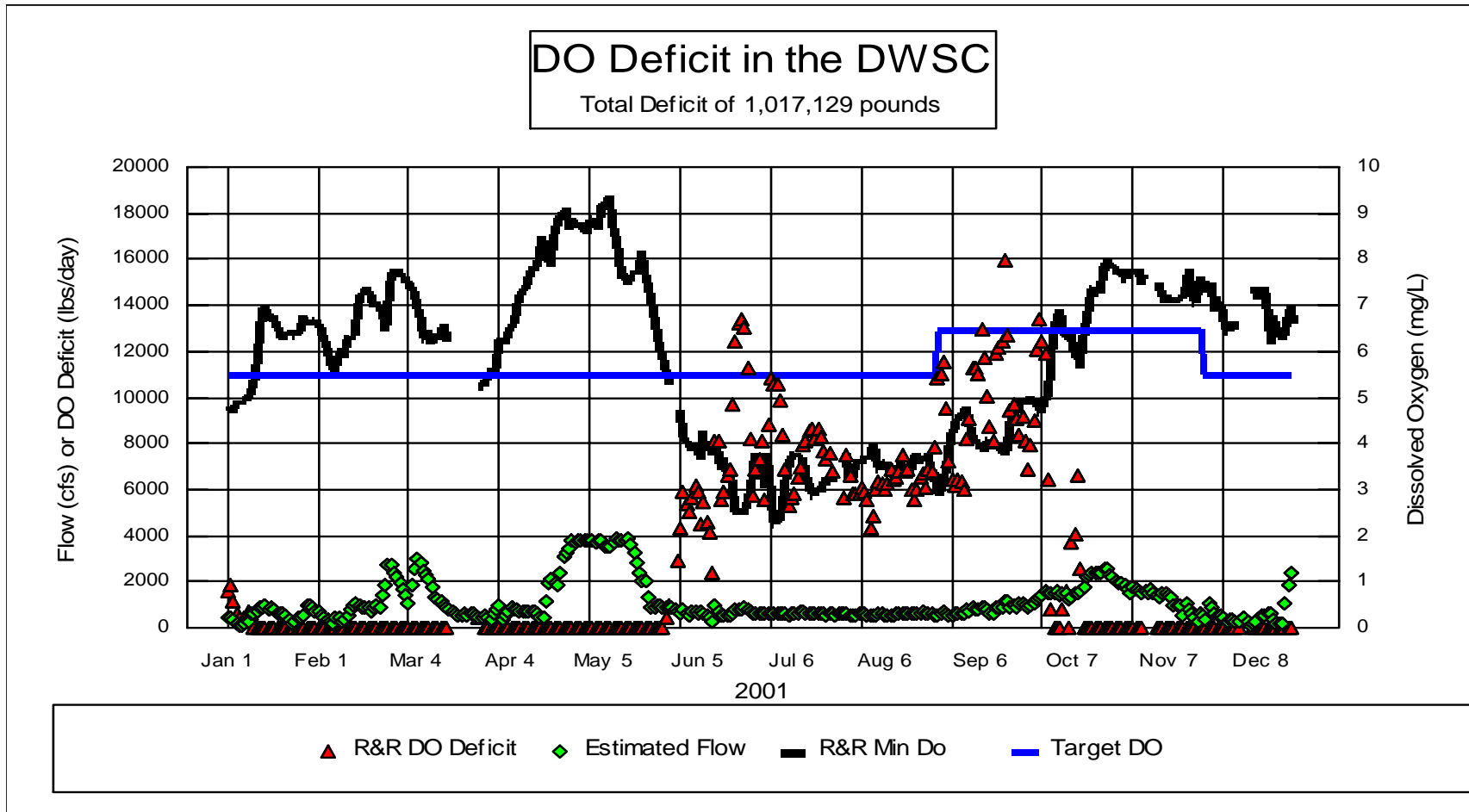


Expected DO Change in the DWSC from the O2 Device

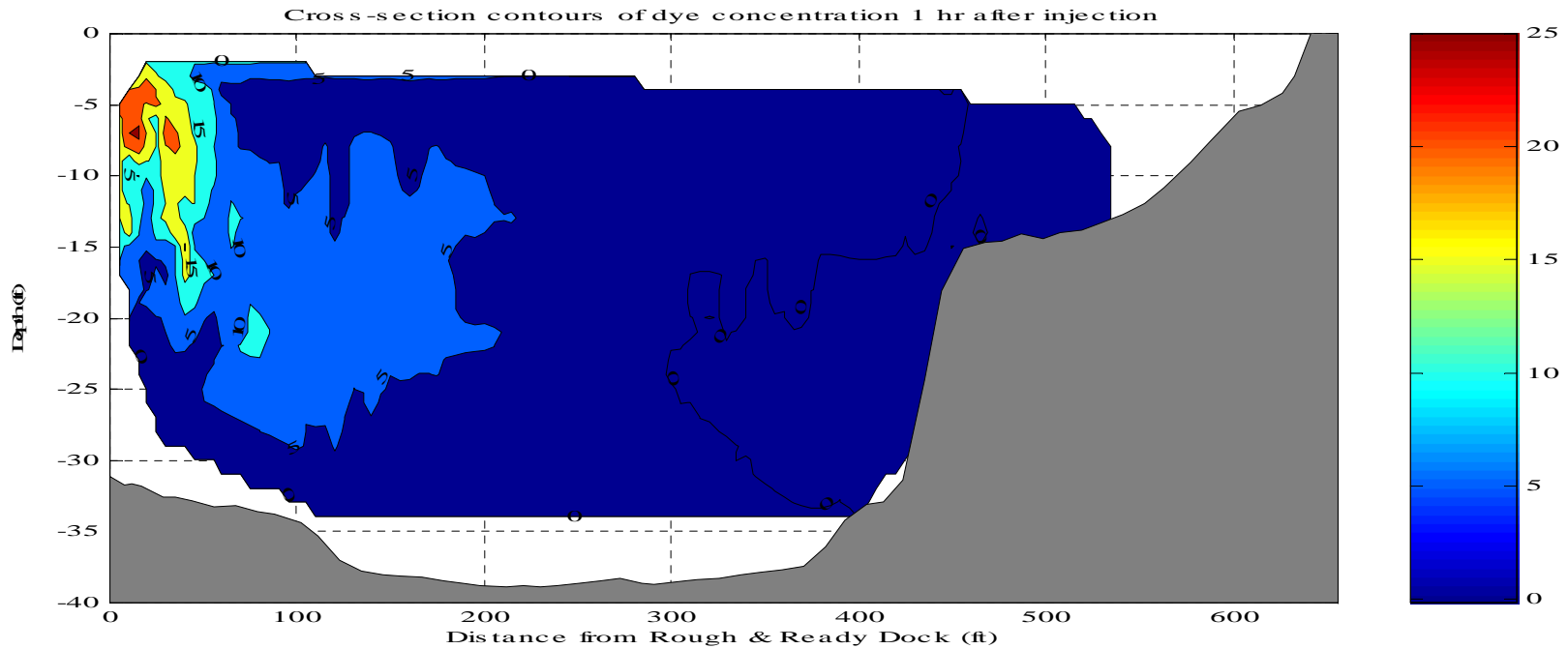
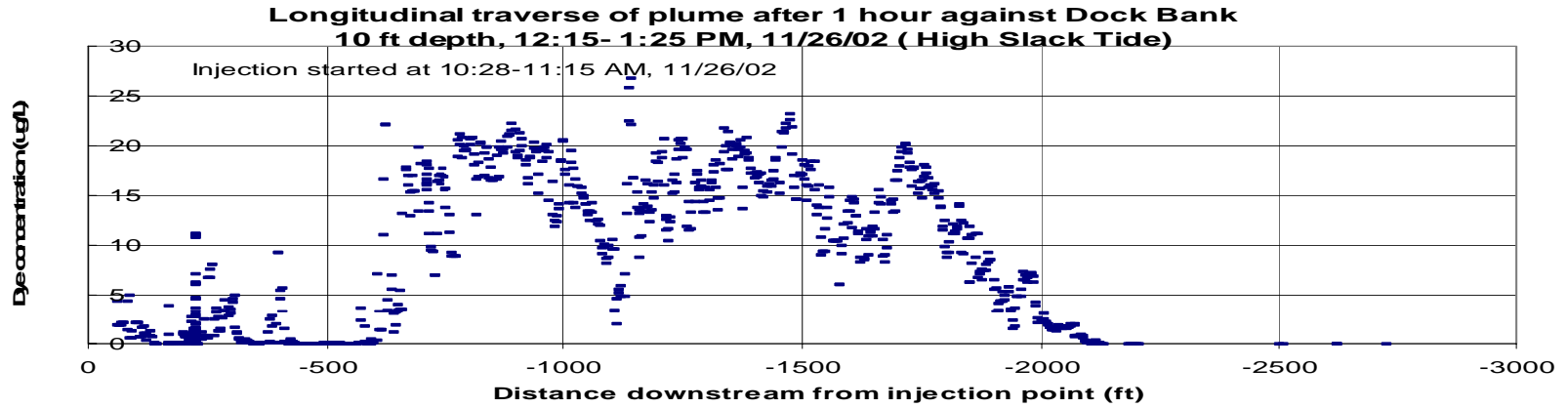
$$\begin{aligned}\text{DO increment (mg/l)} &= 10,000 \text{ pounds} / \\ &\quad [2.7 * 2,500 \text{ af}] \\ &= 1.5 \text{ mg/l per day}\end{aligned}$$

-But some oxygen may spread out beyond the
2,500 acre-feet tidal mixing zone

Operating the O₂ Device

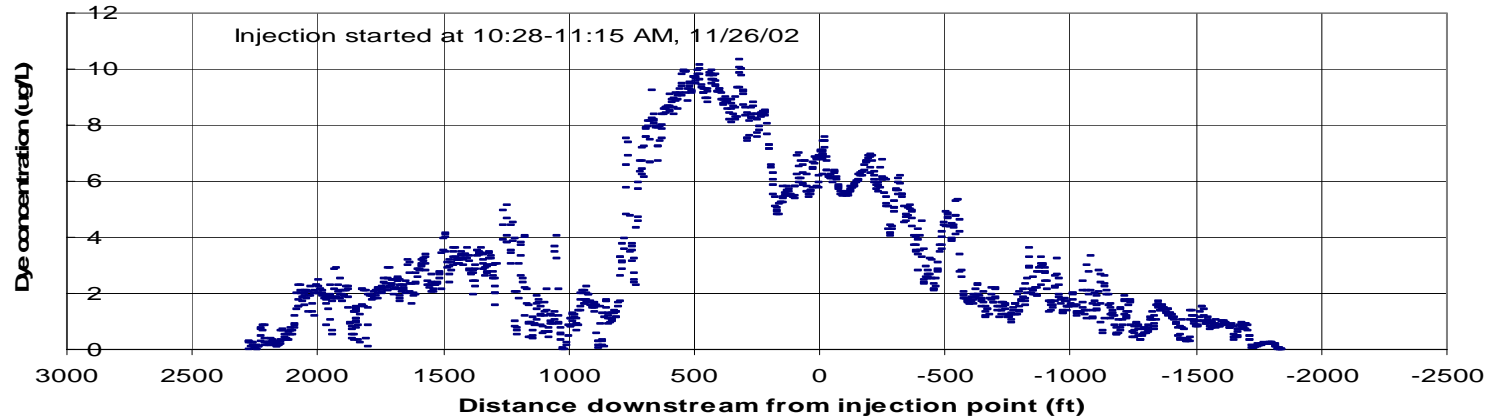


Vertical and Lateral Mixing in the DWSC

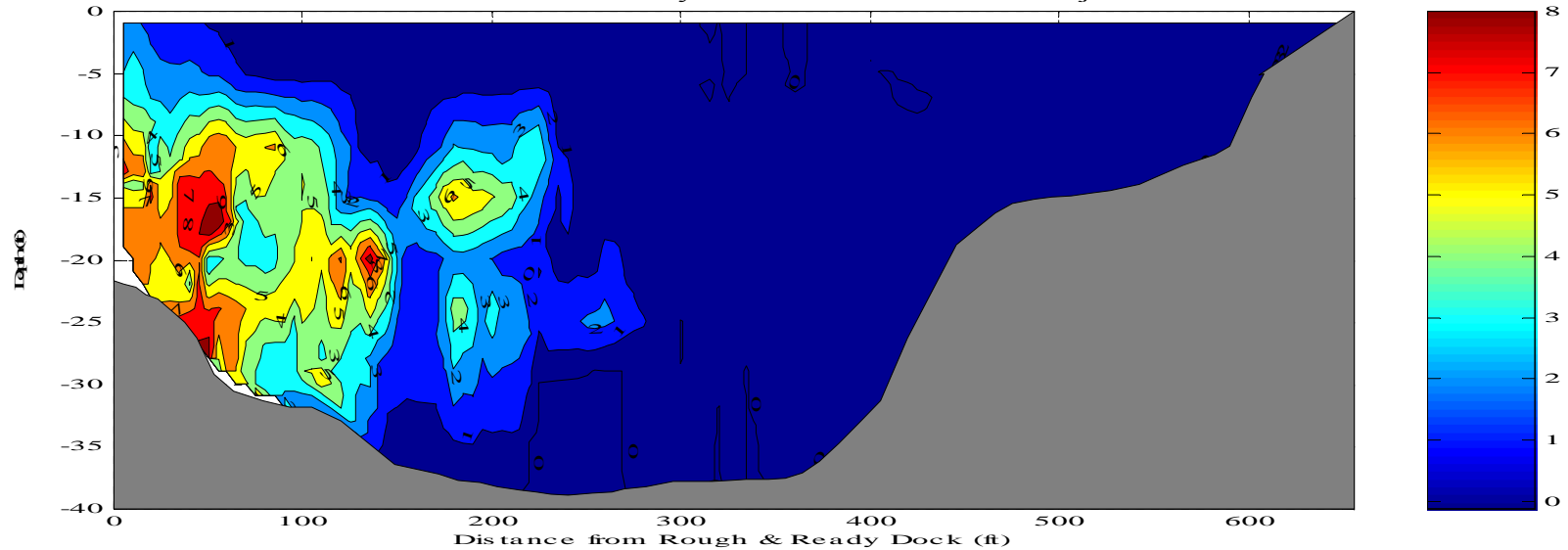


Vertical and Lateral Mixing in the DWSC

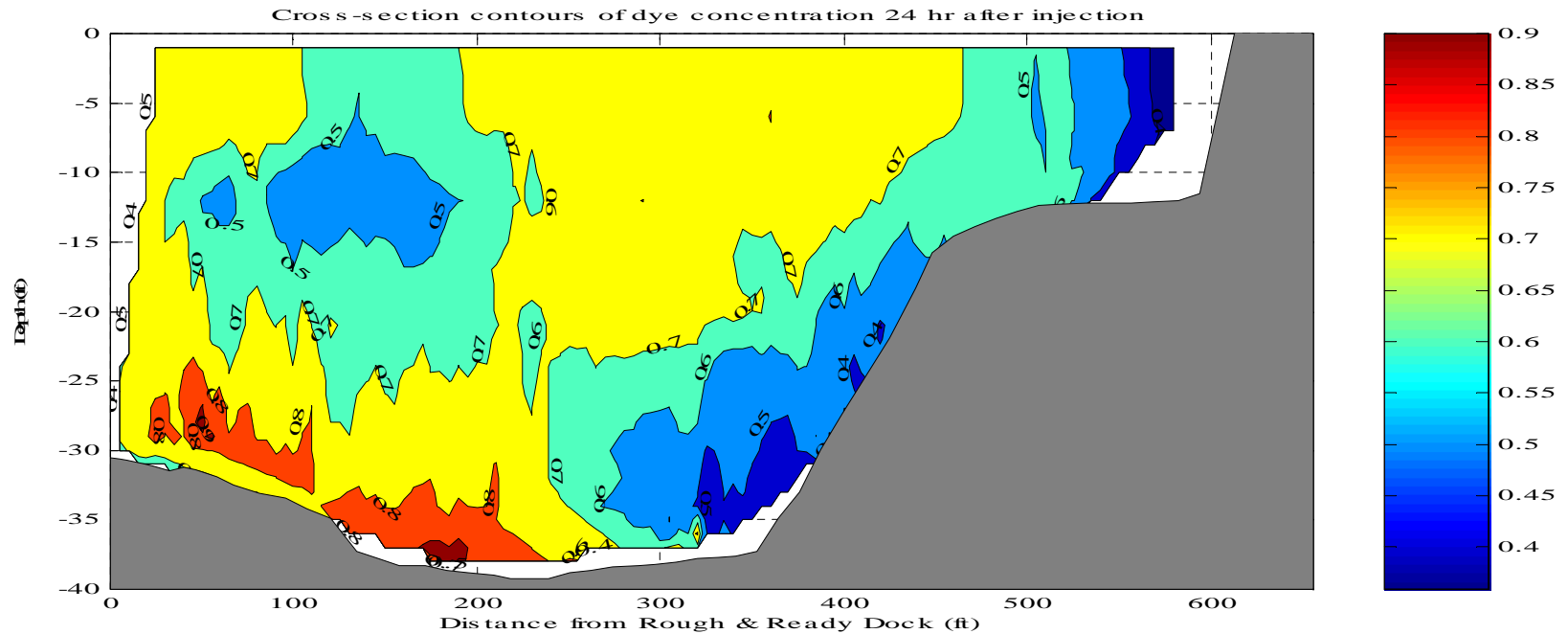
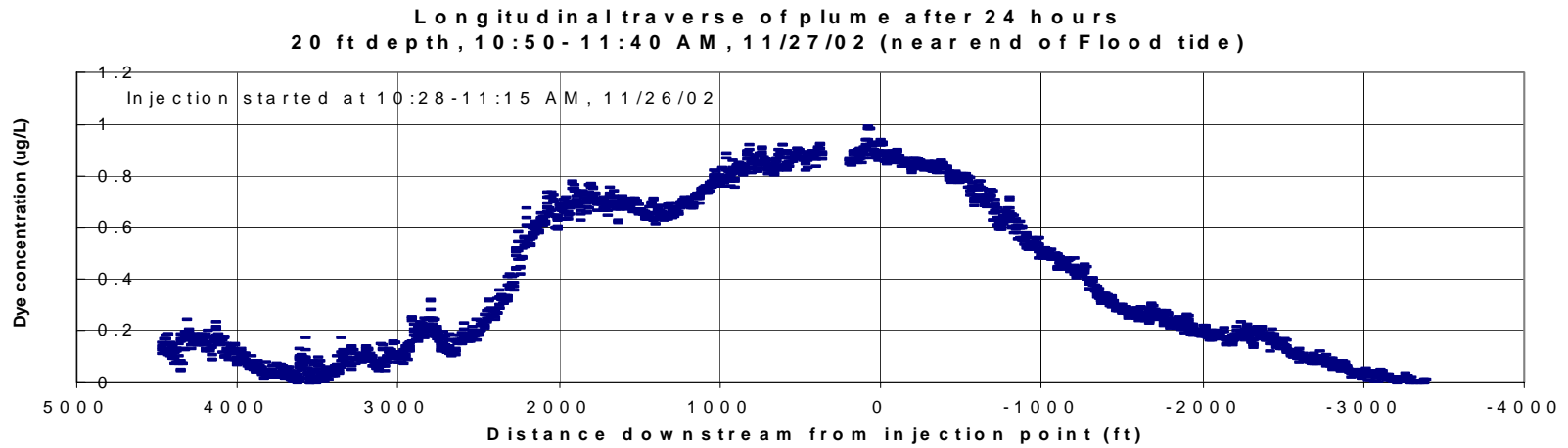
Longitudinal traverse of plume after 5 hours against Dock bank
11 ft depth, 4:15- 4:45 PM, 11/26/02 (Ebb tide)



Cross-section contours of dye concentration 6 hr after injection



Vertical and Lateral Mixing in the DWSC



DWSC DO Monitoring Strategy

- Grab samples for WQ- City of Stockton
- Continuous DO Monitoring at mid-depth
- Boat Surveys of longitudinal DO profiles
- Vertical Temperature and DO profiles
- Special studies of near-field DO & ORP
- Special diffuser dye-spreading studies
- Special measurements of R&RI interference

Operations for Performance Testing

- Use “on-off” cycle to detect the effects of the O₂ device in the DO monitoring records
- The DO should increase by 1.5 mg/l within the 2,500 acre-feet tidal mixing volume for each day of O₂ device operations
- The on-off cycle should dominate the natural DO variations within the DWSC
- Do you think this will work?

Existing DO Measurements -2001

