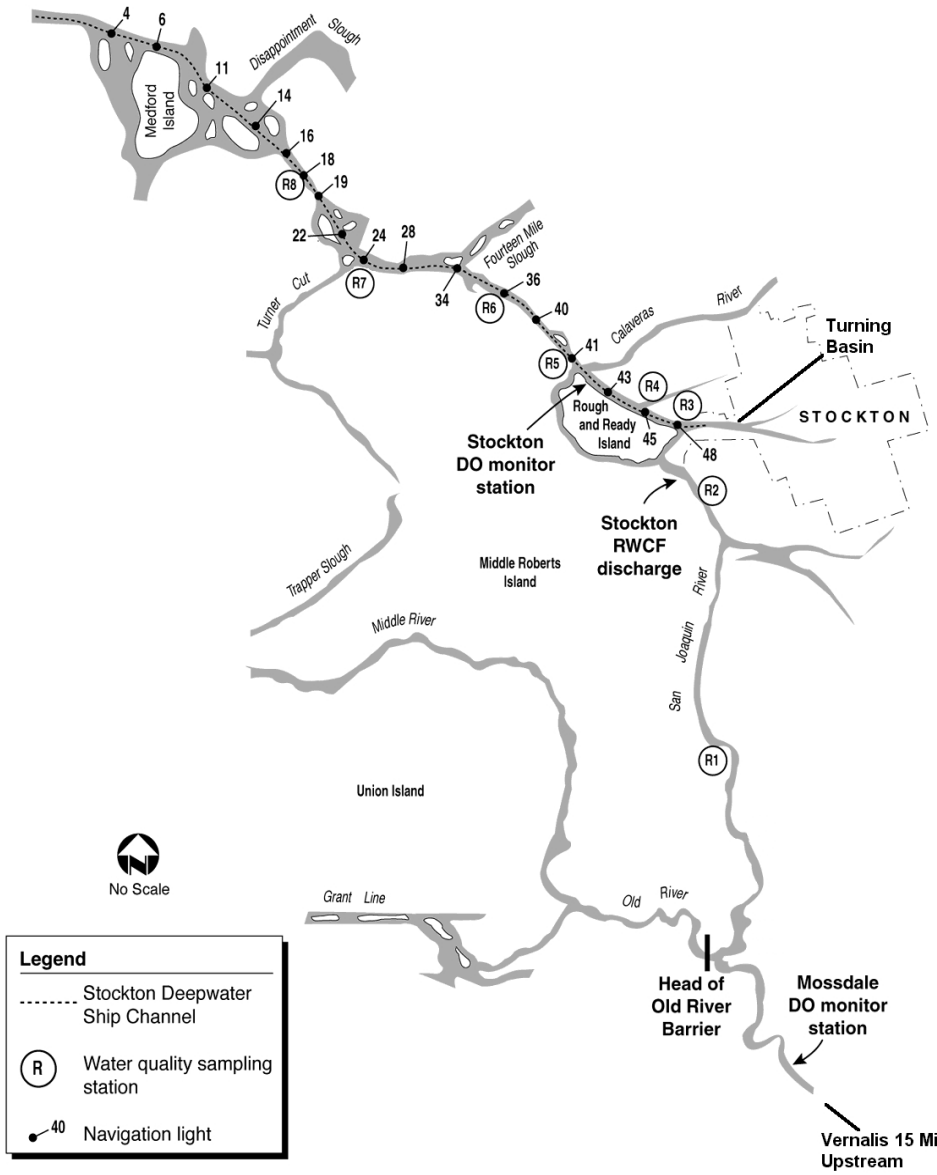
Monitoring DO in the DWSC with the O_2 Injection Device: How will we know if its really working?

Russ Grimes & Russ Brown

Jones & Stokes

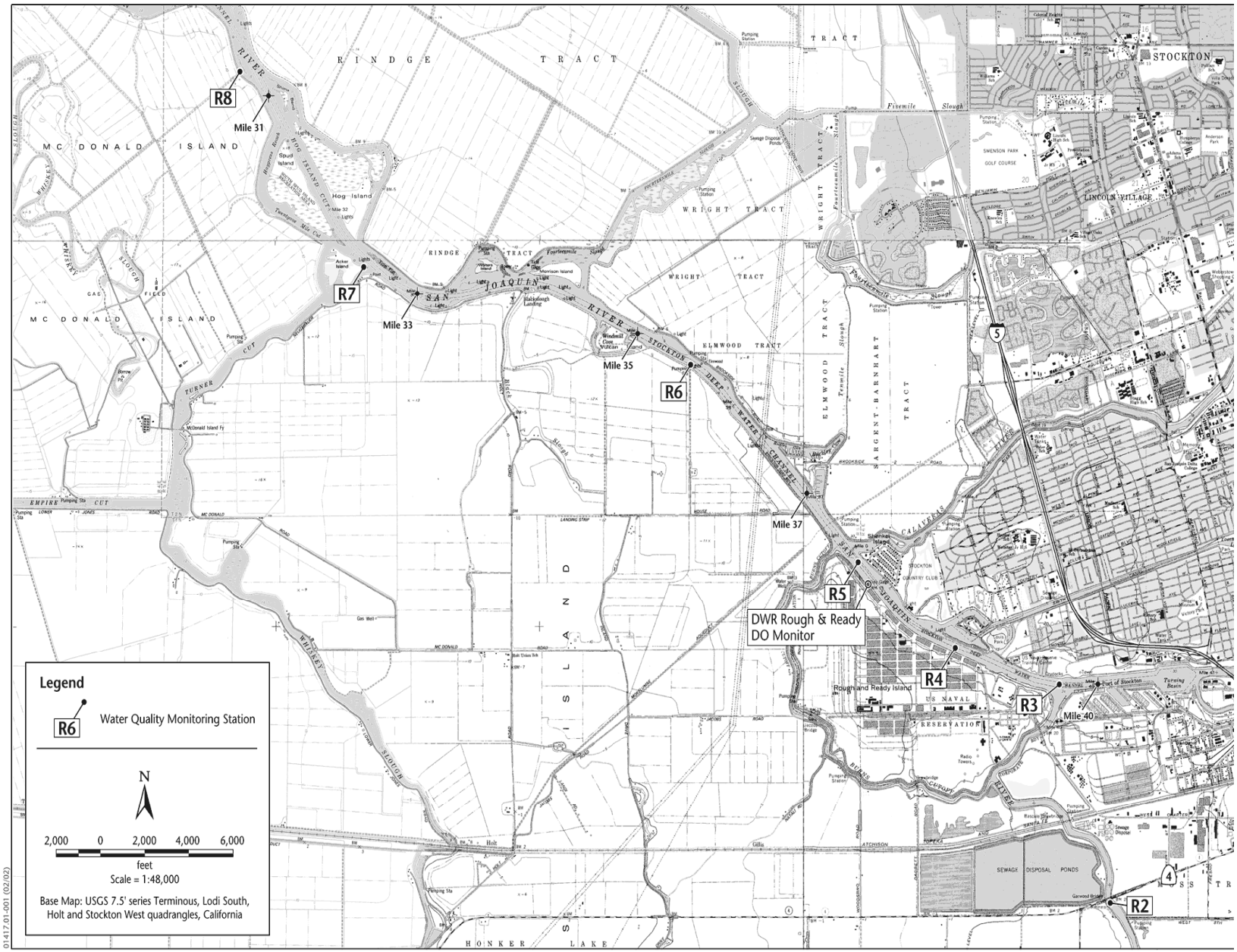
SJR DO-TMDL TWG Meeting

March 21, 2006



Jones & Stokes

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



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Jones & Stokes

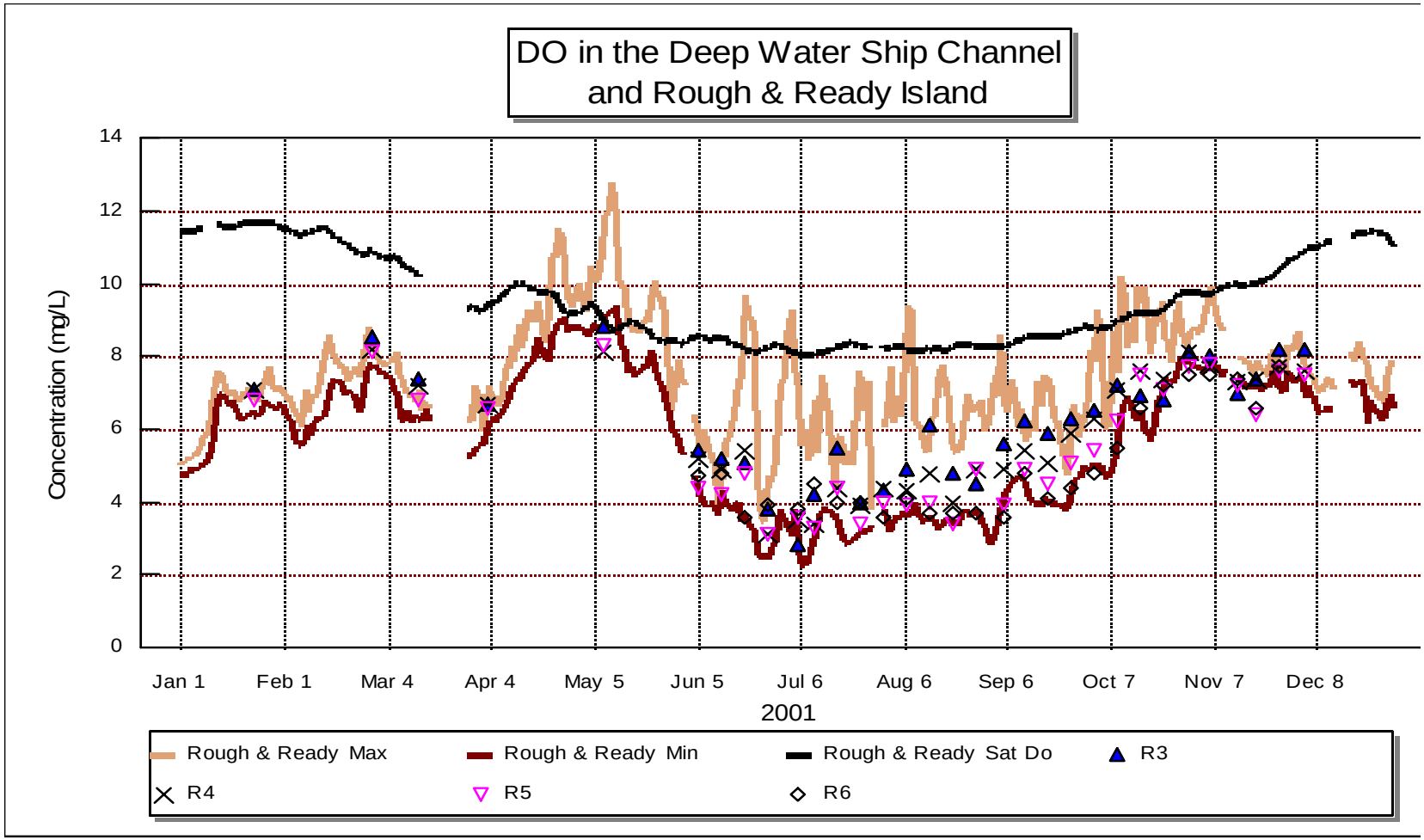
Stockton Deep Water Ship Channel Wat

The DWSC DO Monitoring Plan

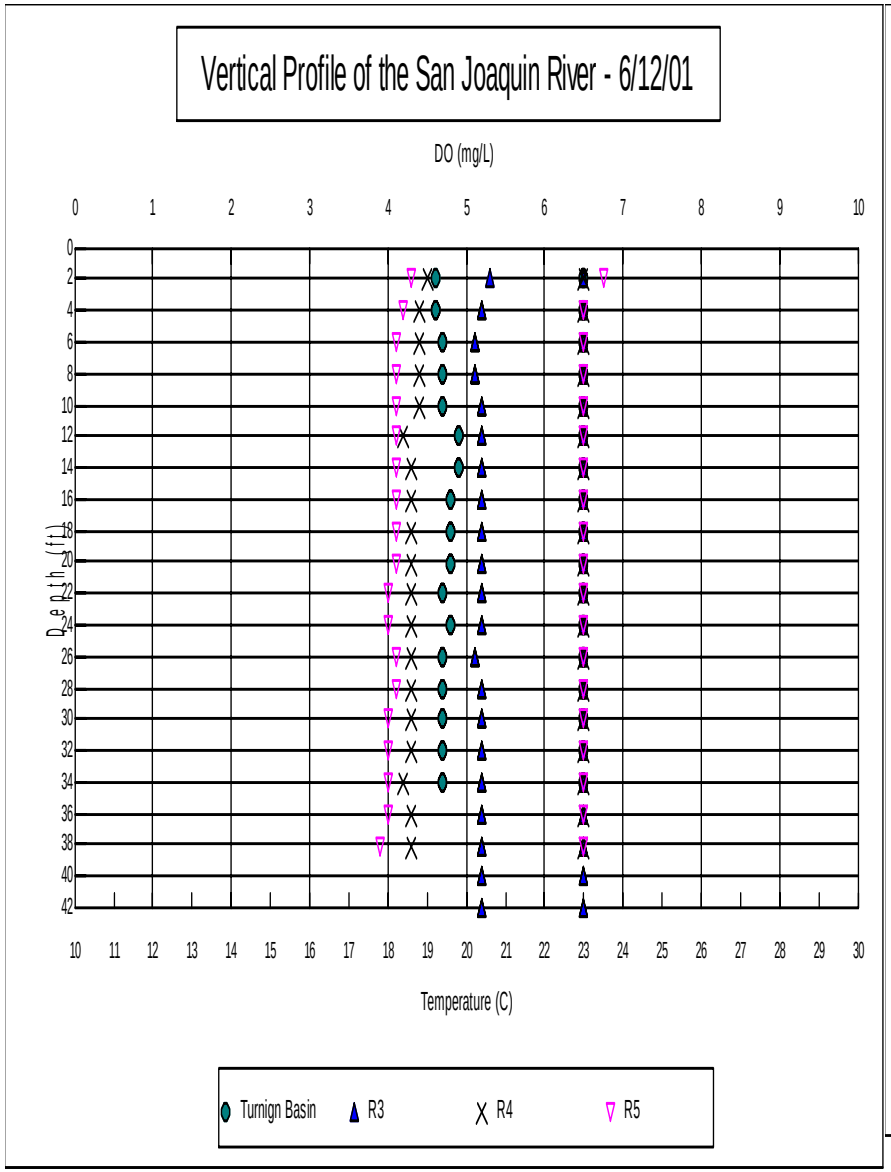
Table 1. Stations for Proposed Water Quality Monitoring

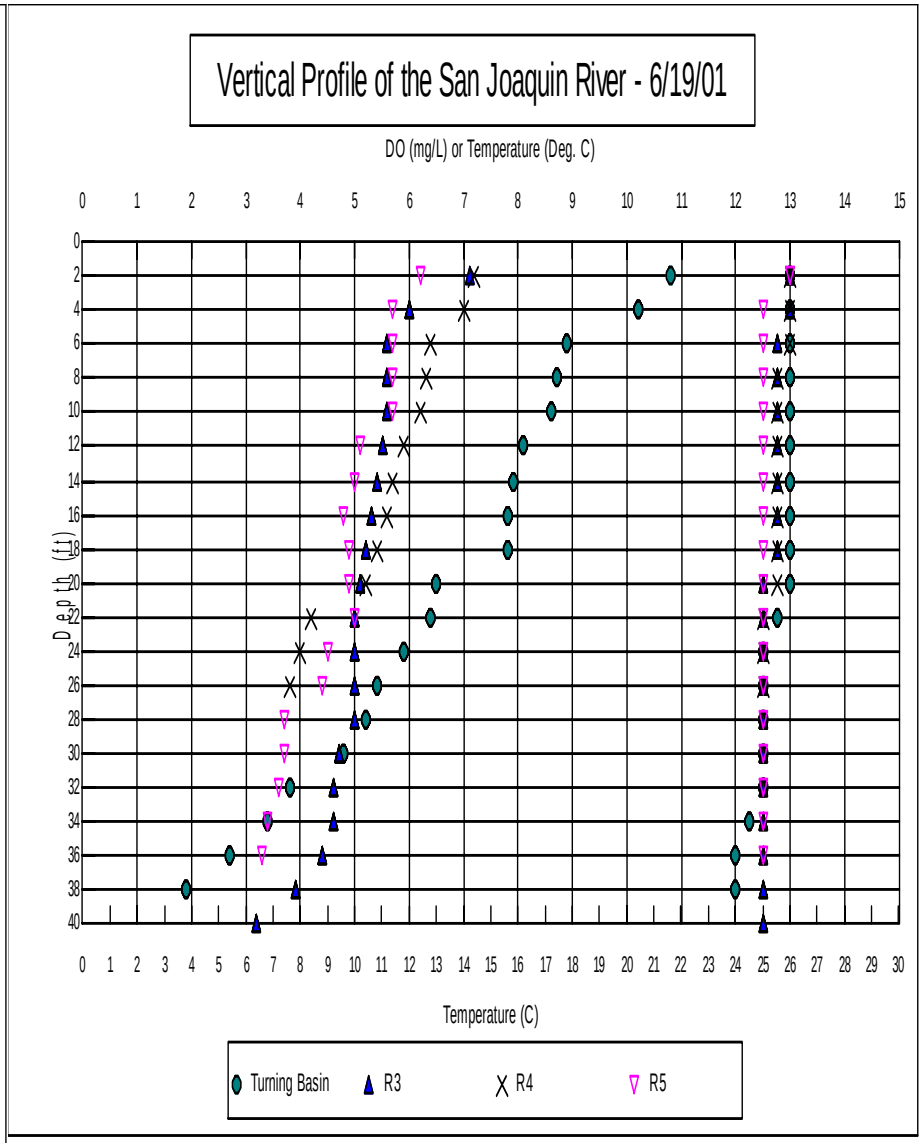
Station Name	Station Location	A. Continuous 15-Minute Monitoring*	B. Vertical Profiles (Weekly; Daily if Device Operating)*	C. Grab Samples (Weekly)*
R2a	On San Joaquin River, upstream of Channel Point at railroad bridge; SJR mile 40	X	–	X
Turning Basin (TB)		–	X	X
R3	River Mile 39.4 (light 48)	X	X	X
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

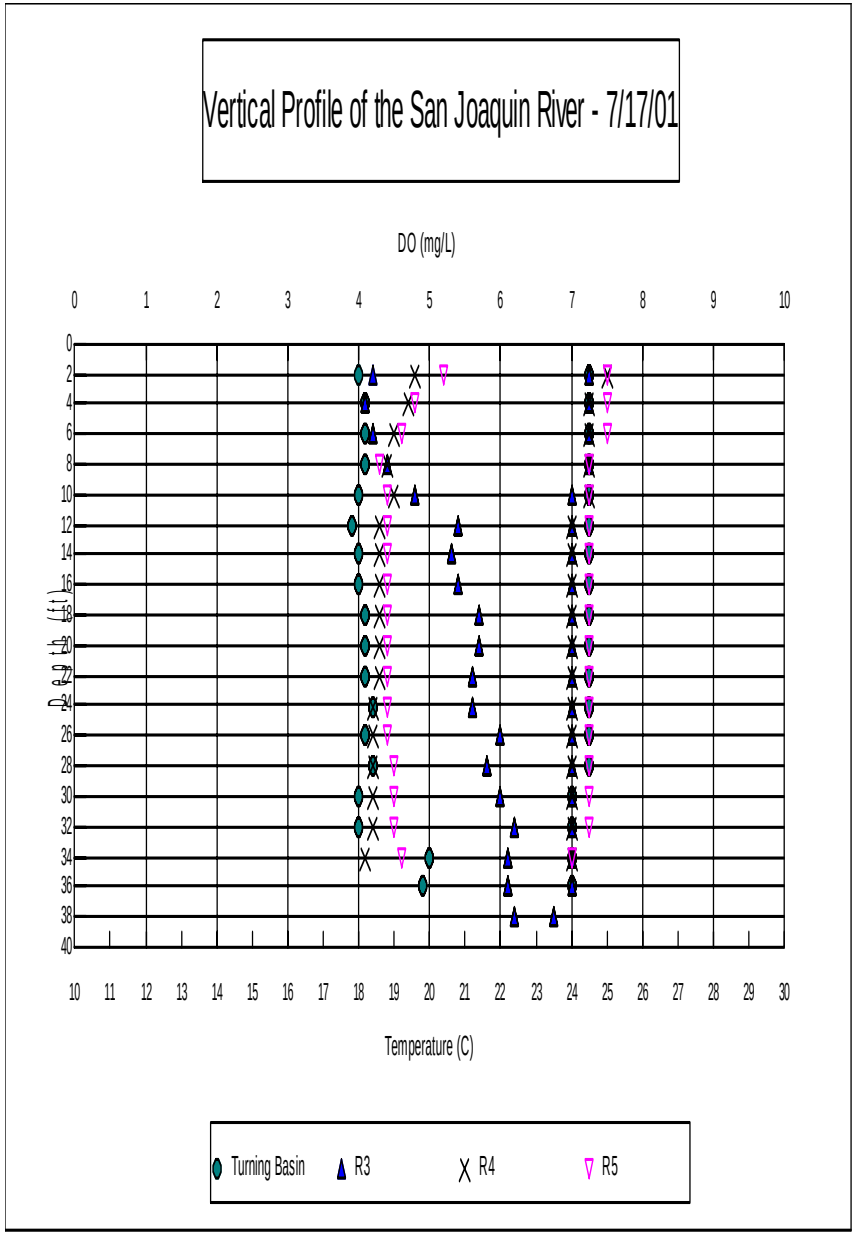


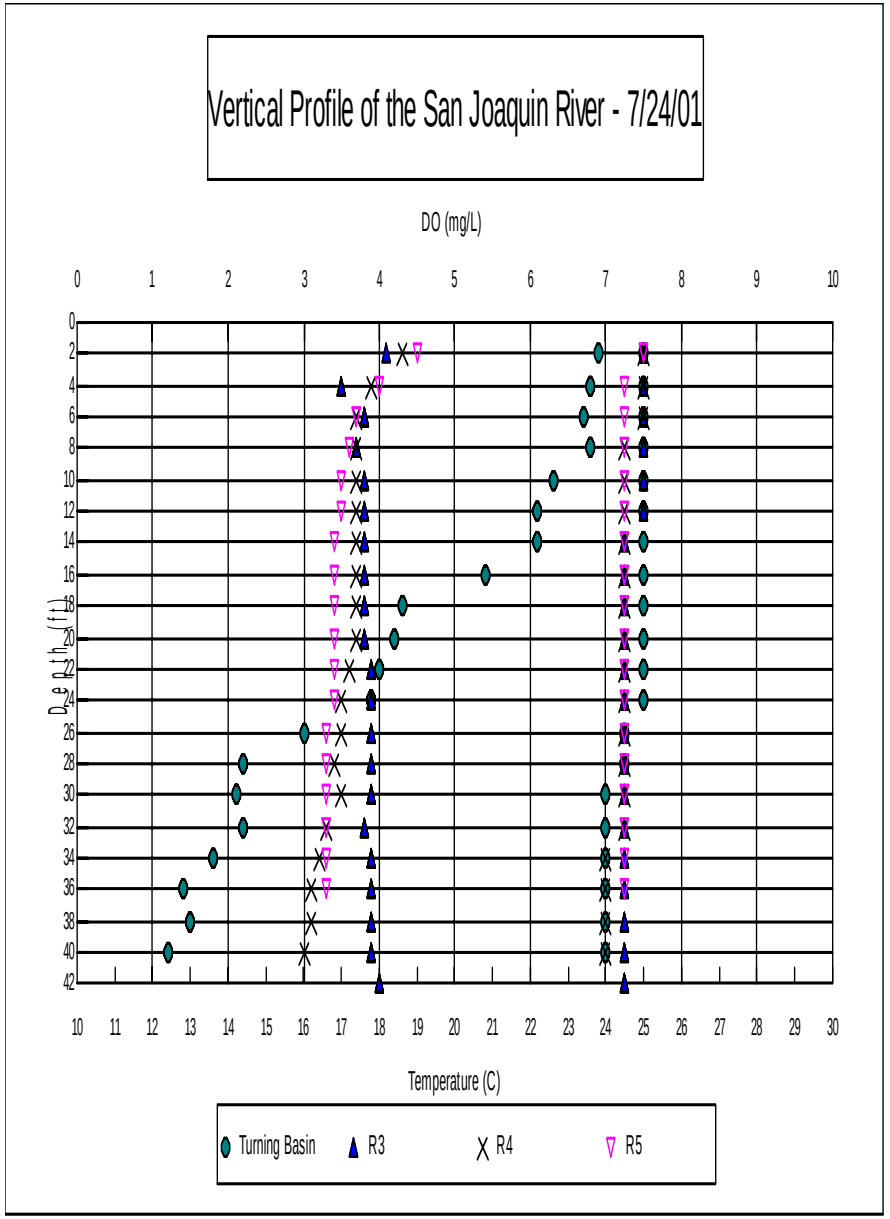
Vertical Temp & DO Profiles



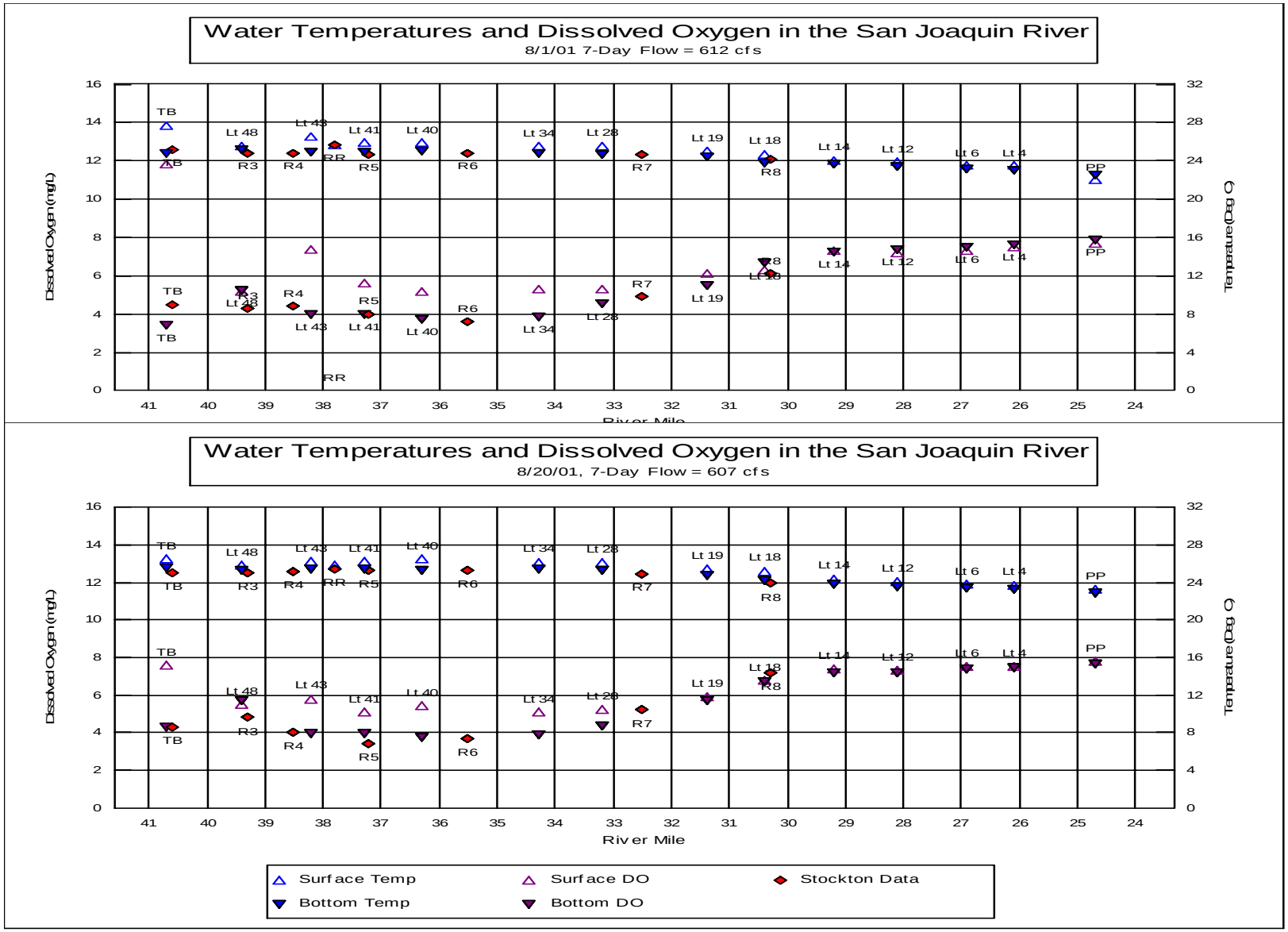


Generally uniform, but not always; what are the causes of gradients?





DWSC Longitudinal Profiles



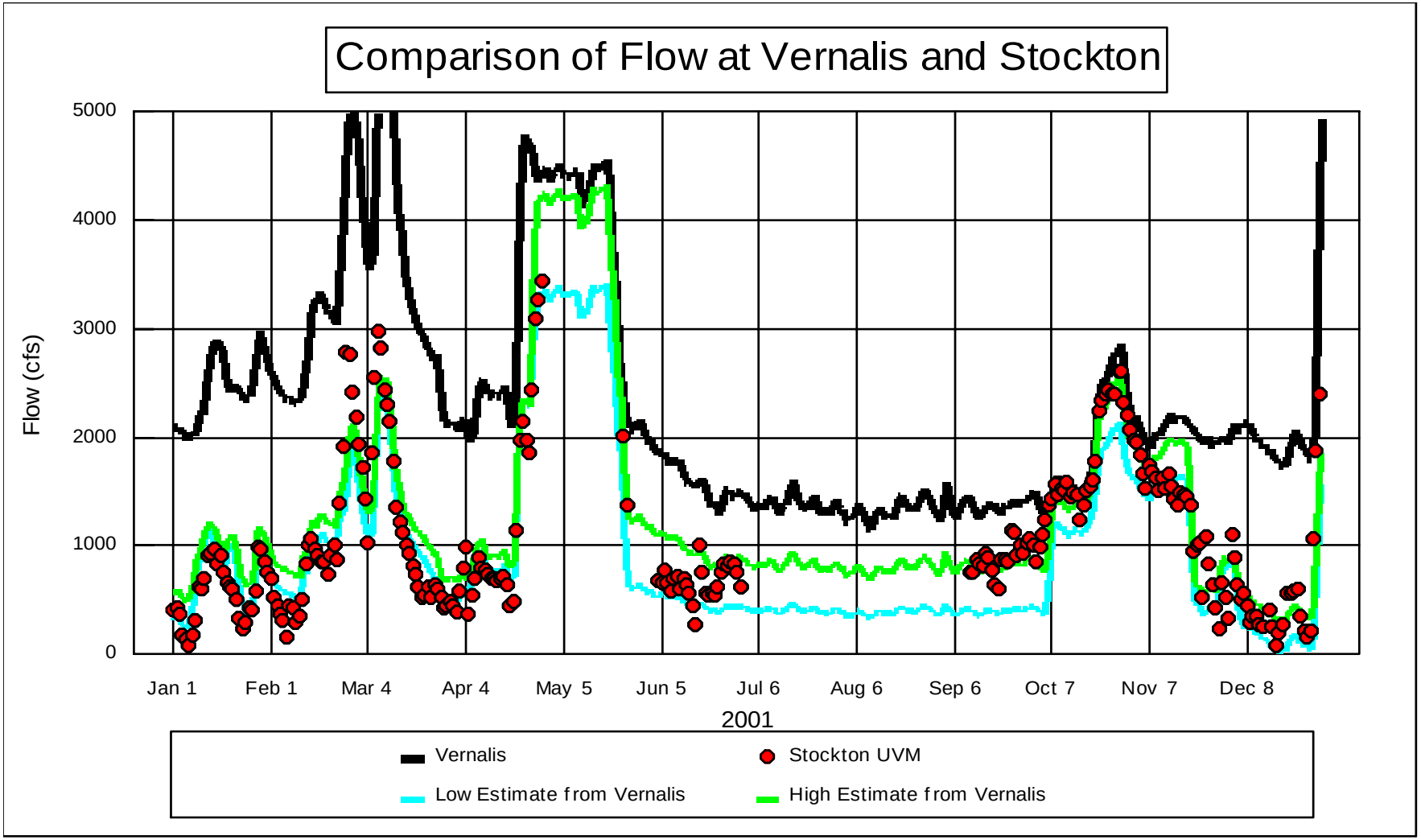
Net Flow and Tidal Movement in the DWSC

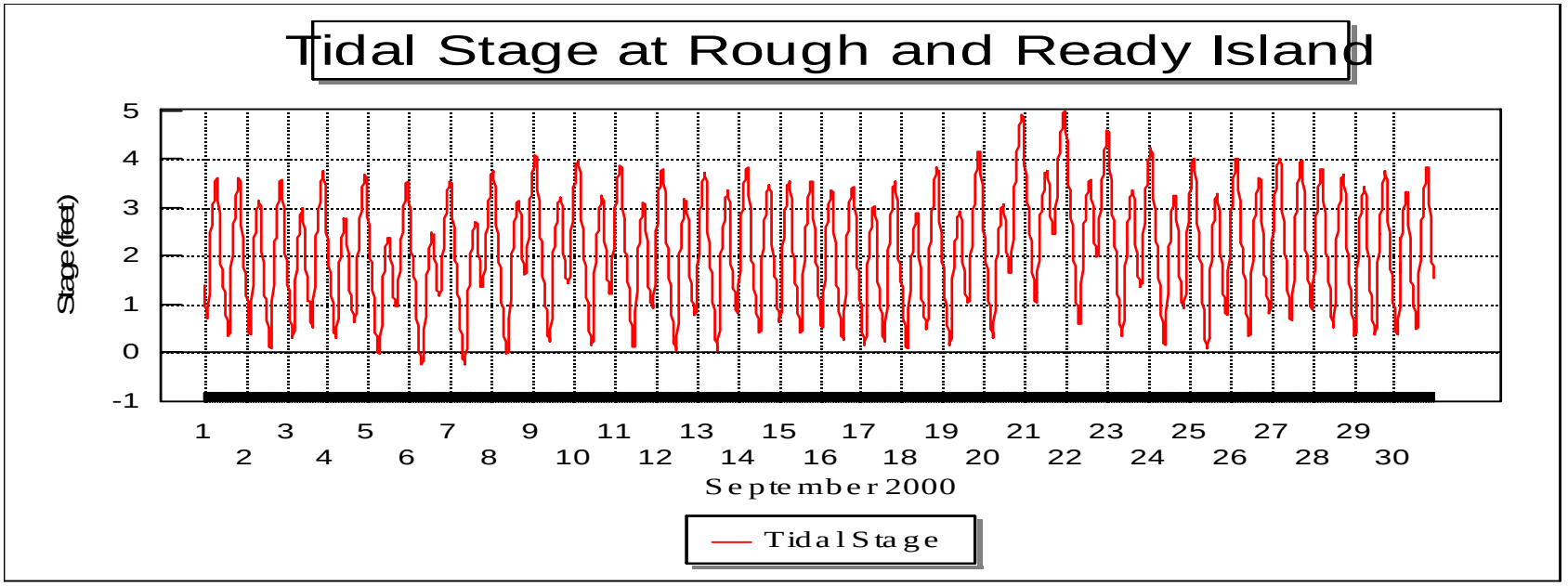
- Net Flow = [0.5 – 0.05 * Pumping] * Vernalis
- Net Flow = measured USGS tidal flow at Garwood

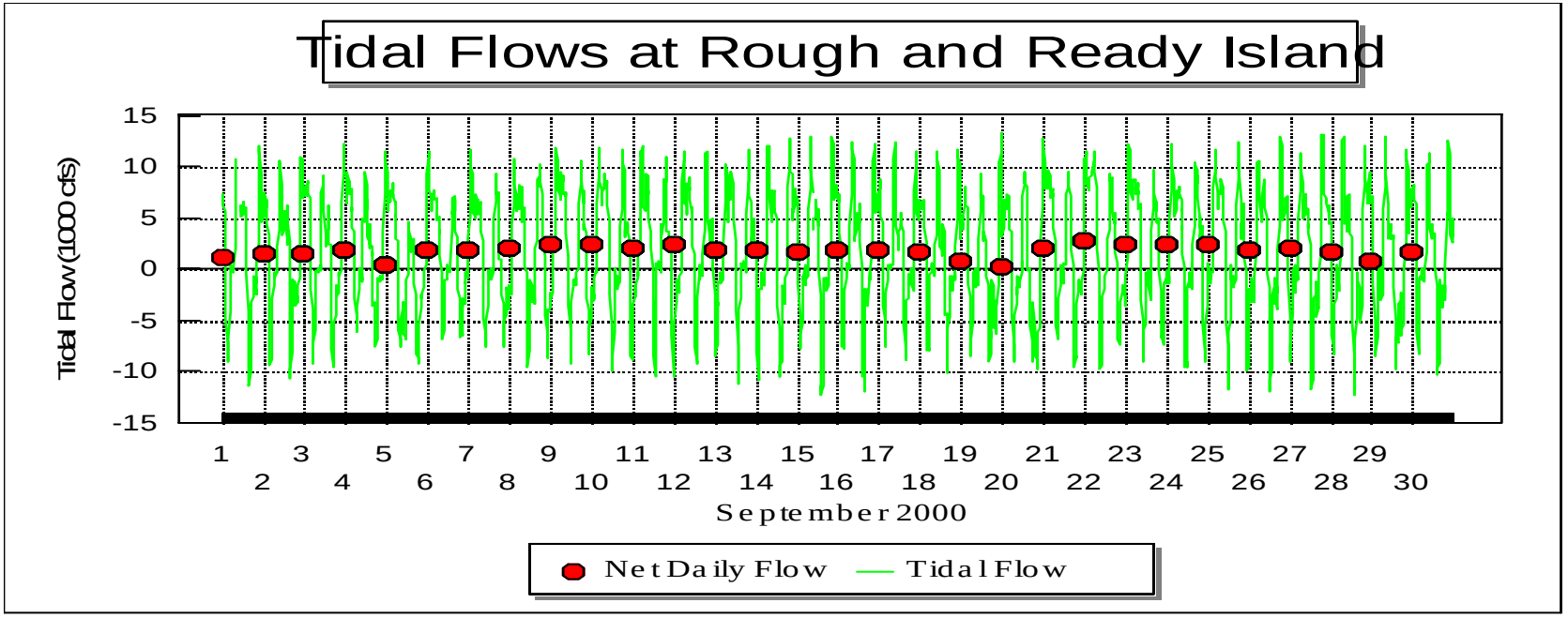
- Tidal volume = 850 (ac) * stage change (ft)
- Tidal movement = tidal volume / cross-section

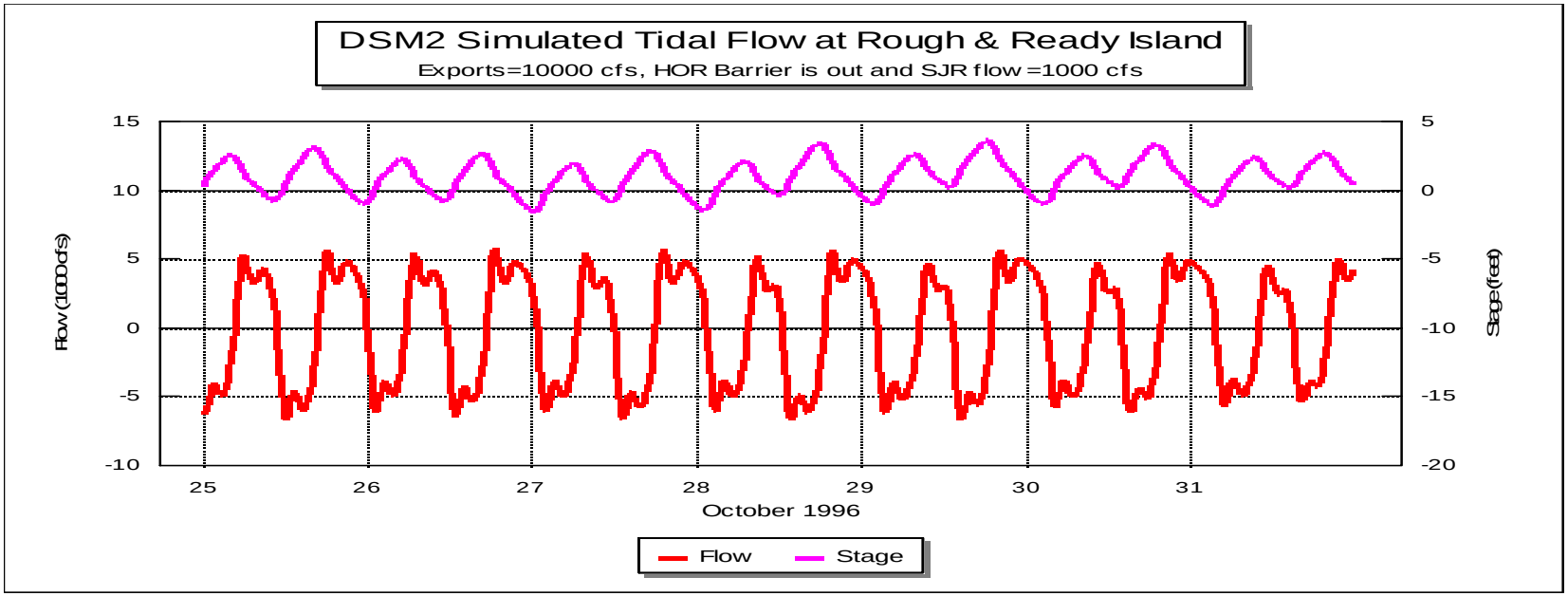
- Tidal volume = 2,500 acre-feet (for 3-ft tide)
- Tidal movement = 1.5 miles (for 3-ft tide)

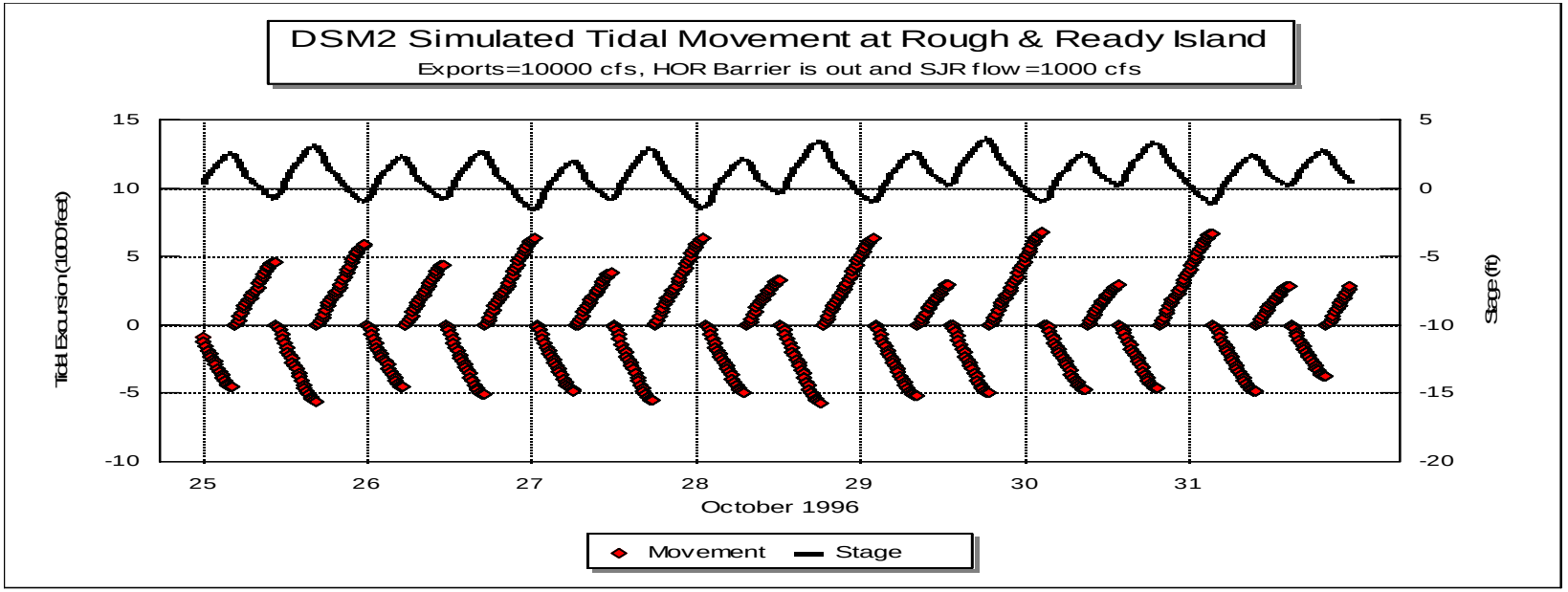
DWSC Tidal and Net Flow




Tidal Stage at Rough and Ready Island
Stage (feet)
5
4
3
2
1
0
-1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
September 2000
Tidal Stage


Tidal Flows at Rough and Ready Island
Tidal Flow (1000 cfs)
15
10
5
0
-5
-10
-15
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
September 2000
Net Daily Flow
Tidal Flow


DSM2 Simulated Tidal Flow at Rough & Ready Island
Exports=10000 cfs, HOR Barrier is out and SJR flow =1000 cfs
Flow (1000 cfs)
Stage (feet)
15
10
5
0
-5
-10
5
0
-5
-10
-15
-20
25
26
27
28
29
30
31
October 1996
Flow
Stage

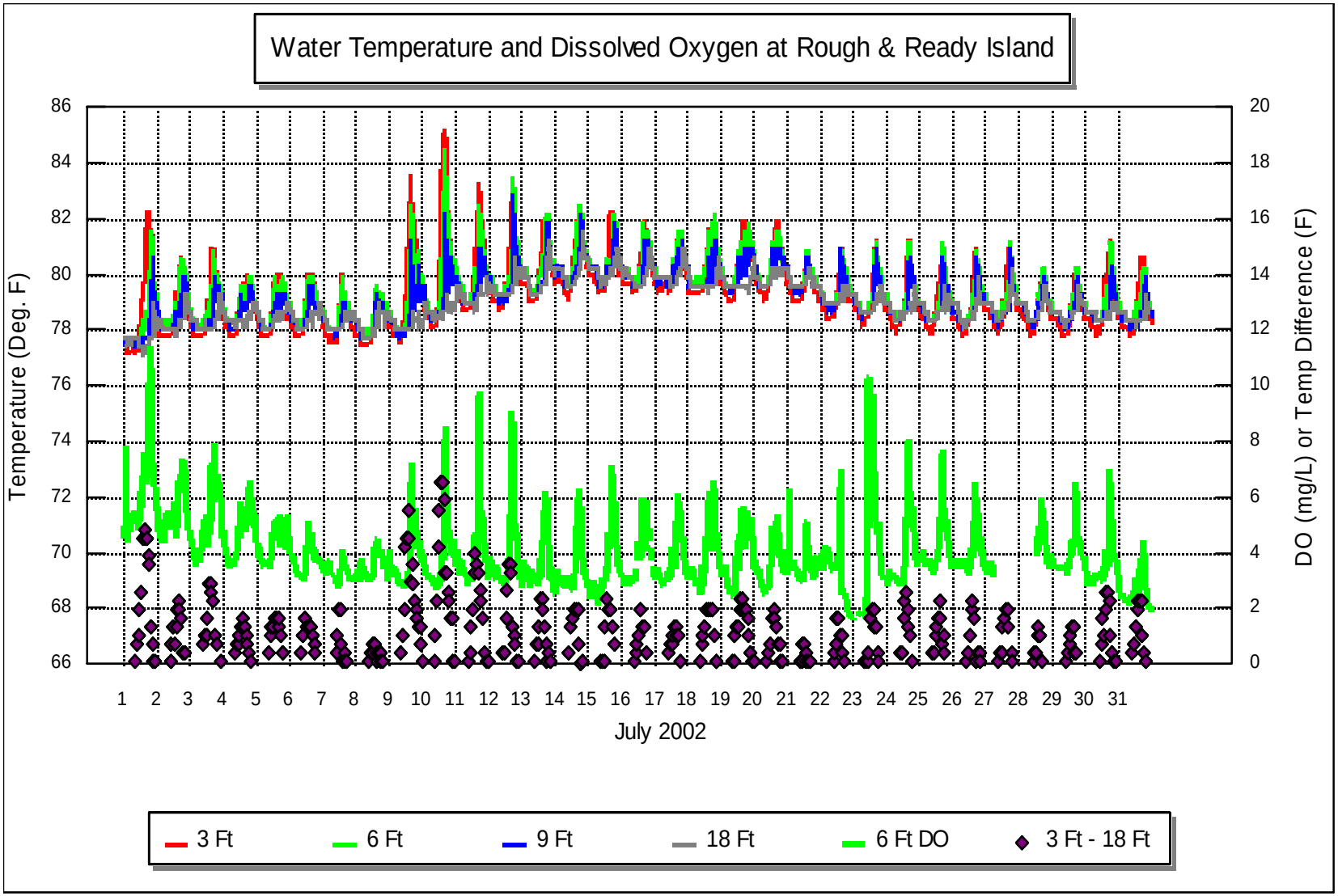

DSM2 Simulated Tidal Movement at Rough & Ready Island
Exports=10000 cfs, HOR Barrier is out and SJR flow =1000 cfs
Tidal Excursion (1000 feet)
Stage (ft)
15
10
5
0
-5
-10
5
0
-5
-10
-15
-20
25
26
27
28
29
30
31
October 1996
Movement
Stage

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

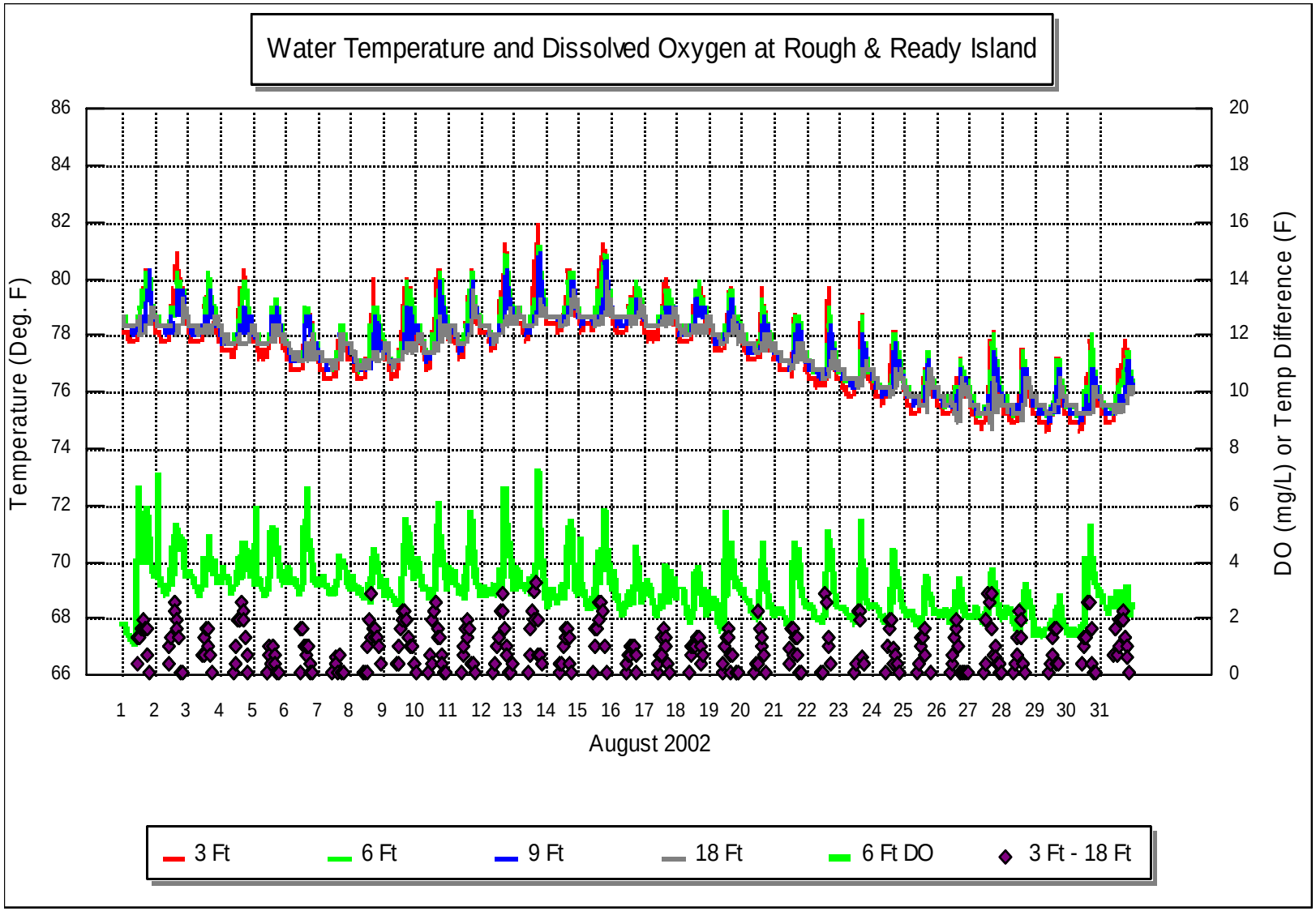
- Temperature stratification and vertical DO gradients are measured during most days

- 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



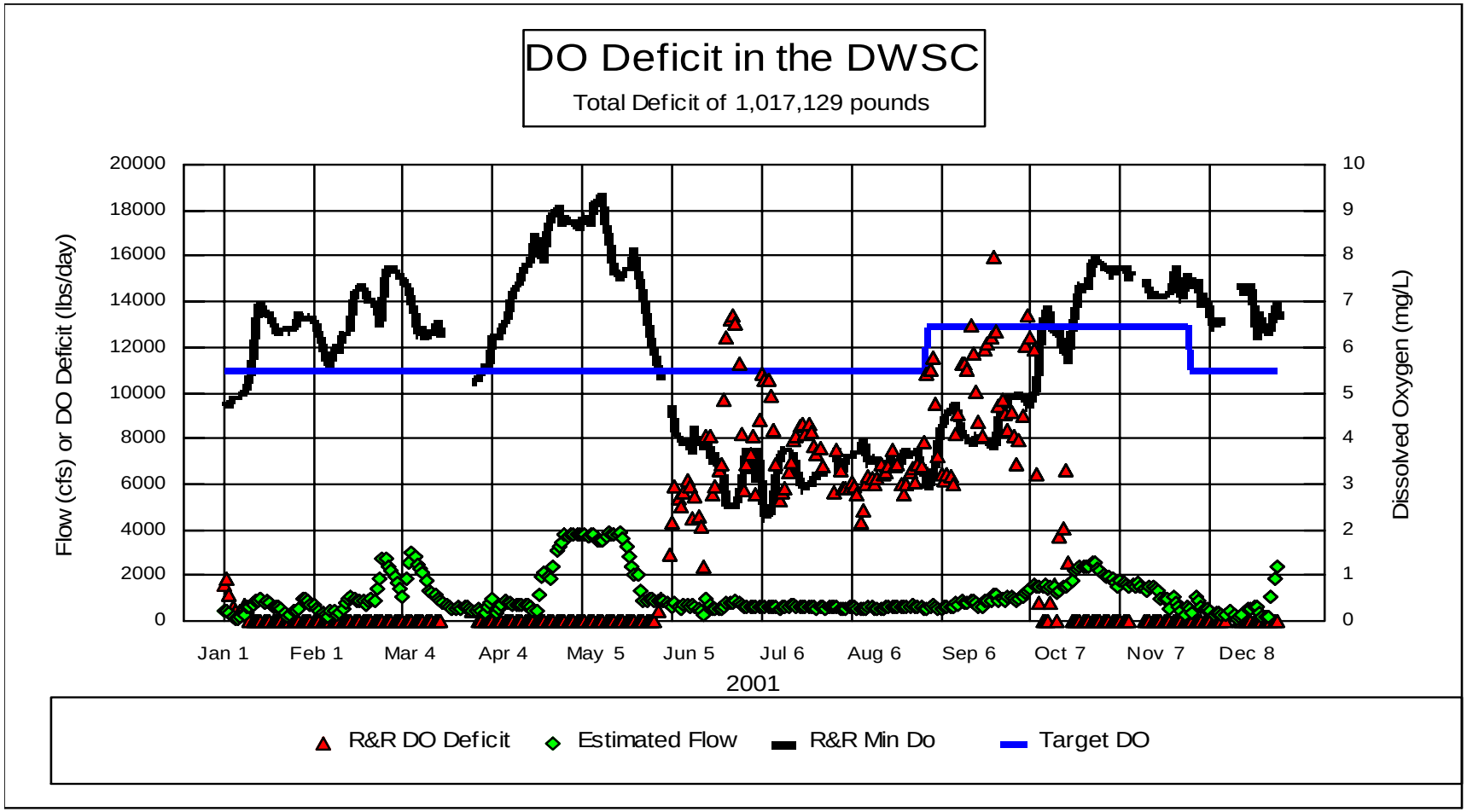
Expected DO Change in the DWSC from the O2 Device

DO increment (mg/l) = 10,000 pounds /
[2.7 * 2,500 af]

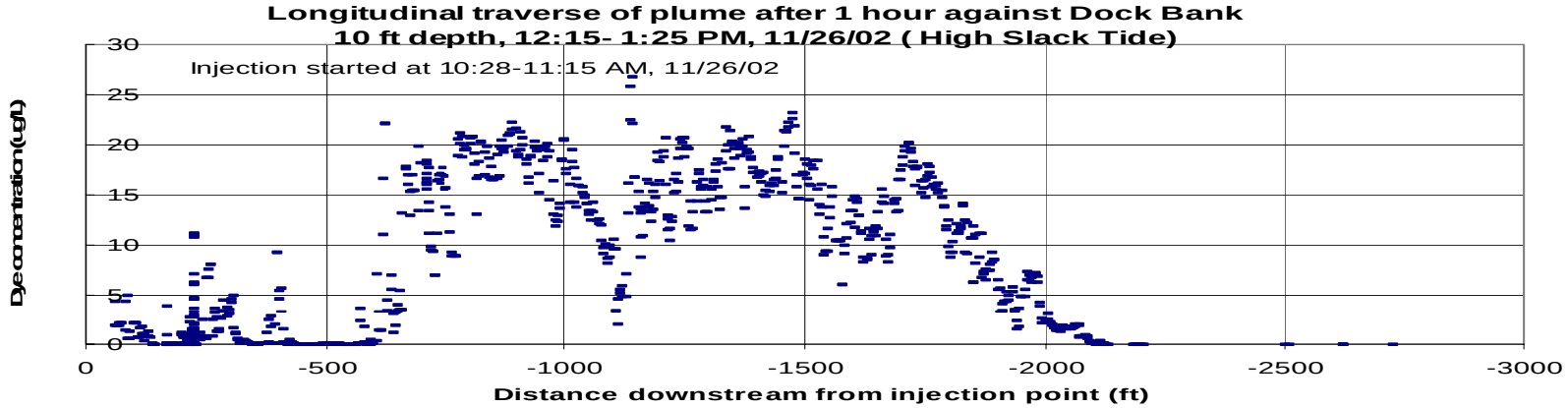
= 1.5 mg/l per day

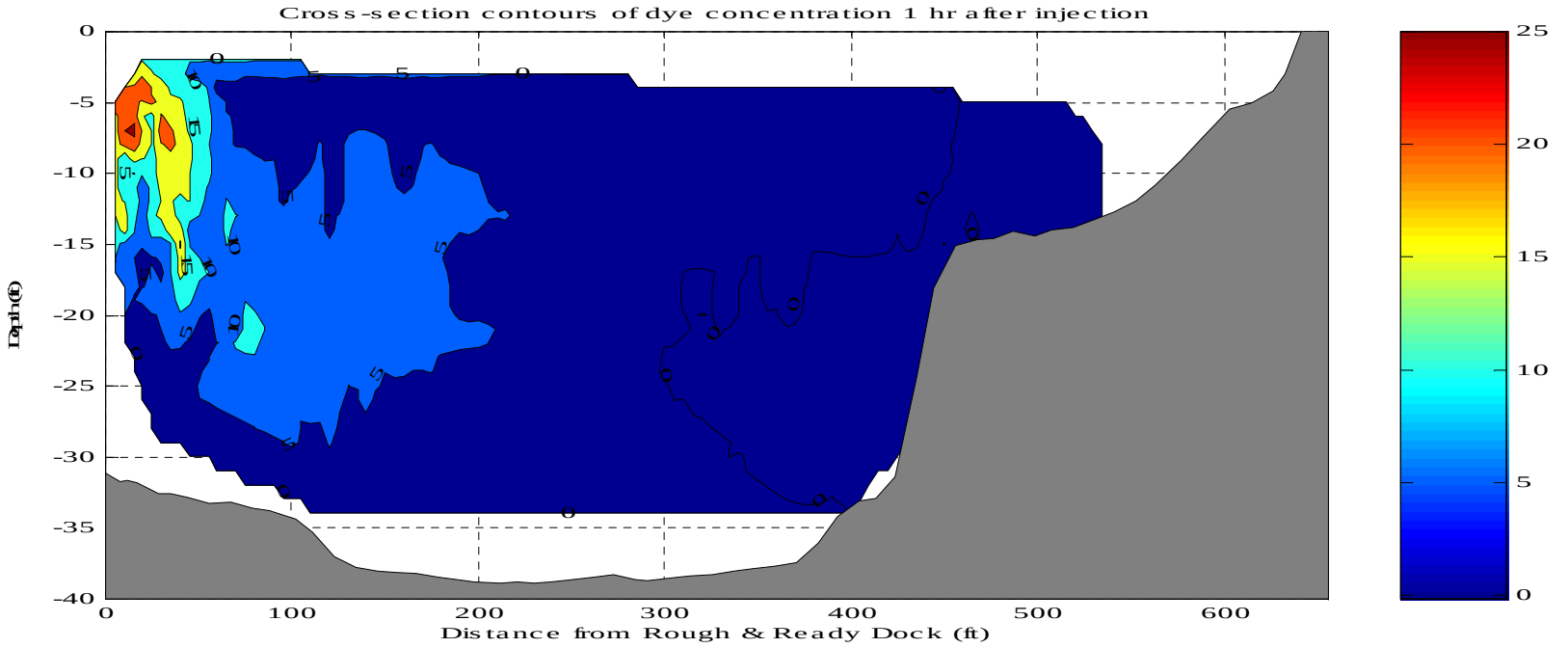
-But some oxygen may spread out beyond the 2,500 acre-feet tidal mixing zone

Operating the O_2 Device

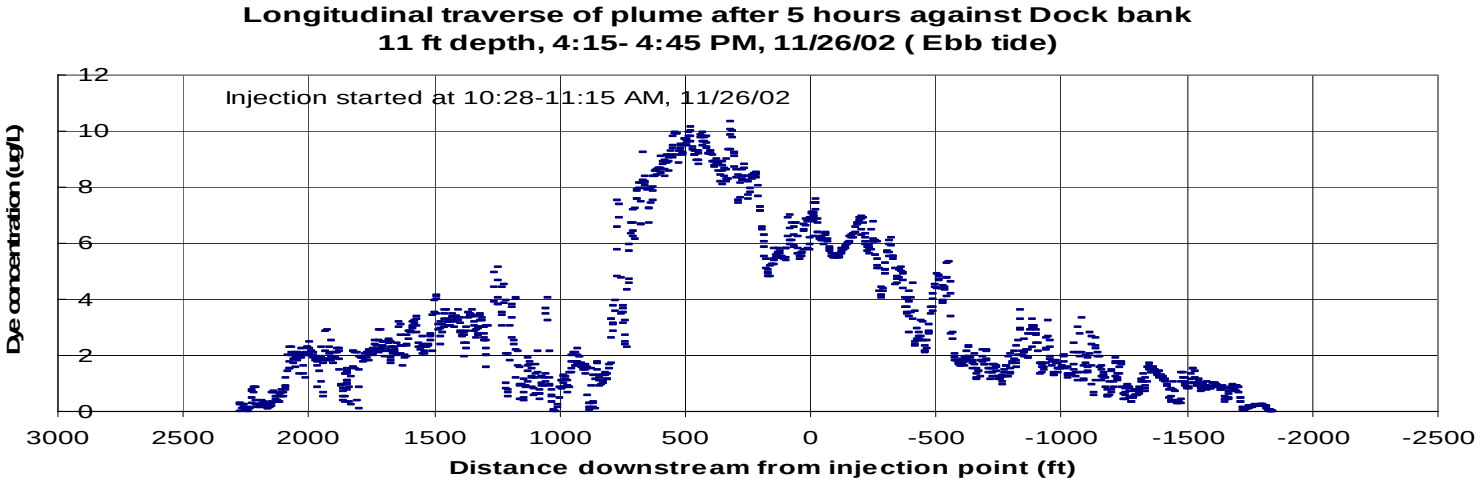


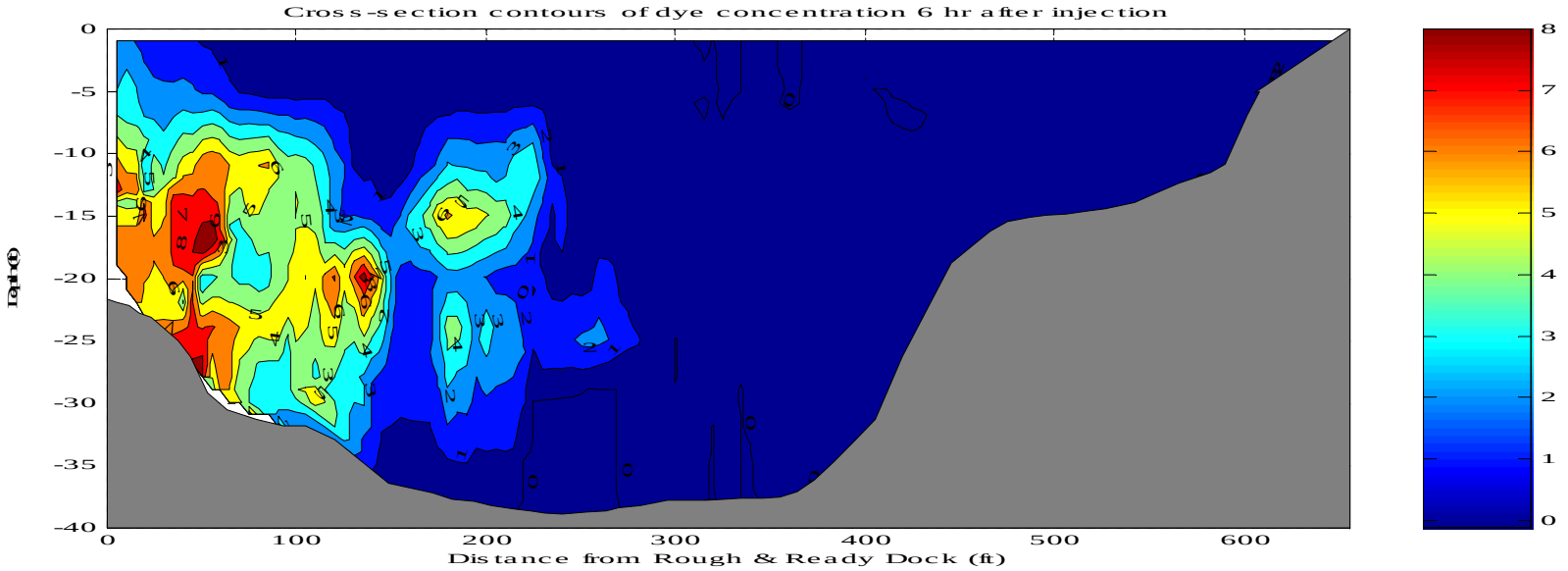
Vertical and Lateral Mixing in the DWSC



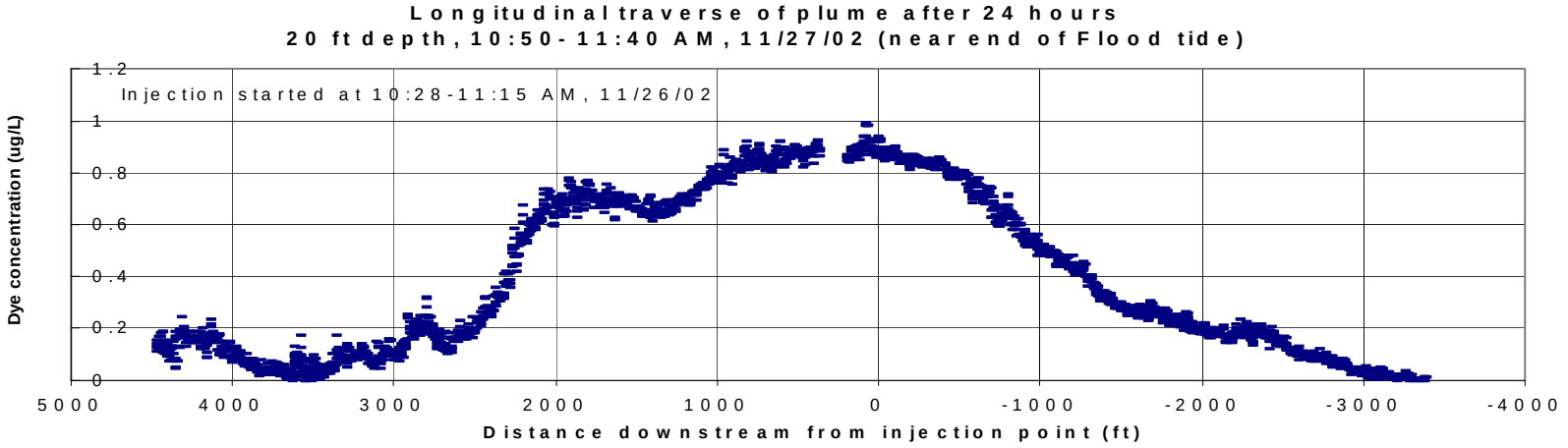


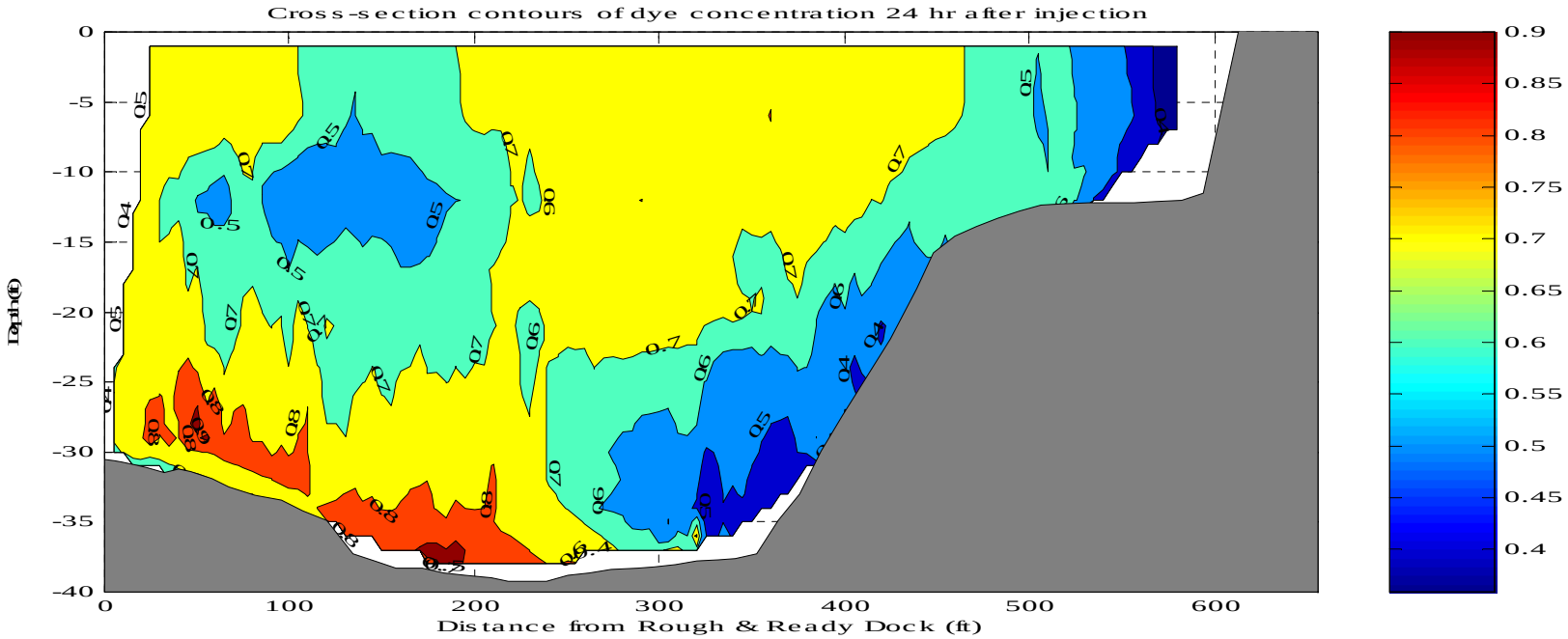
Vertical and Lateral Mixing in the DWSC





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 O_2 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 O_2 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