Response to July 2002 Peer Review comments on CALFED 2001 Directed Action Study

Prepared by G.M. Litton
January 5, 2003

2001 Directed Action Report:
Sediment Deposition Rates, Associated Oxygen Demands and Sediment Oxygen Demands in the Deep Water Ship Channel for the San Joaquin River, Stockton, CA.

Study Element:
Sediment deposition rates and associated oxygen demands

A peer review panel consisting of

Dr. Jim Cloern, US Geological Survey,
Dr. Steve Chapra, Tufts University,
Dr. Bill Ritter, University of Delaware,
Dr. David Beasley, North Carolina State University,
Dr. Alex Horne, University of California, Berkeley; and
Dr. Alan Jassby, University of California, Davis

reviewed the above referenced report and provided final comments in a written report made available on July 22, 2002.

General response to comments
General and specific comments did not contain controversial statements or raise significant questions of concern about the work performed.

Response to specific comments

Appendix B, prepared by Dr. Steven C. Chapra
Page 12.
"*The impact of SOD is not insignificant. However, the investigators (Litton, 2002) have determined that it is not a dominating mechanism. This is partially due to the impact of tidal motion and scour on delivery of organic matter to the sediments*."

Agreed. The significance of resuspension during neap and spring tides was an important finding of this study. Deposition and resuspension of suspended matter effectively retards the movement of particulate matter and its associated oxygen demand in the DWSC. If decaying algae and other particulate organic matter stay in the critical reach of the DWSC longer, they will exert a greater oxygen demand. Therefore, water quality models need to incorporate the cycle of deposition and resuspension mechanistically to accurately simulate oxygen depletion associated with particulate material.

The importance of resuspension was further discussed in Dr. Chapra's comments:
Page 13
"*The phytoplankton impact is more subtle. First, sedimentation of phytoplankton cells is diminished by the effect of the tidally-induced resuspension*."

Page 13
"*Within the channel, the problem [reduced clarity, light-limiting conditions] is exacerbated by tidal scour, which tends to diminish the net sedimentation of particles within the DWSC*."

Agreed. Dr. Chapra's comments emphasize that deposition and resuspension mechanisms also impact algal productivity. Resuspension contributes to the light-limiting conditions in the DWSC. However, the clarity of the San Joaquin River generally increases upon entering the DWSC due to sedimentation and diminished algal biomass in the water column. It is the depth of the euphotic zone relative to the greater channel depth of the DWSC that contributes to the decay of algae in the DWSC. This ratio is greater in the upper San Joaquin River where high algal productivity drives elevated dissolved oxygen concentrations.

Page 16.
"*Because of the small importance of SOD, it would be expected that the system should adjust quickly to loading or flow changes*."

Agreed. Although evidence is not provided here, a historical review of the water quality data for the San Joaquin River would probably support this statement.

Appendix E, prepared by Dr. Alan Jassby
Page 37.
"*This research has provided two important conclusions: first, the SOD is small compared to other sources of oxygen demand; second, particles that make it out of the DWSC have a much longer residence time (2-3x) than suggested by water residence times because of sedimentation and resuspension. The latter process has been incorporated into the current model (section 9). It would be useful to know how sensitive the model is to this process, in order to decide whether the further studies recommended here are warranted.*"

The additional work recommended in this investigation involved 1) study of the aggregation mechanisms that increase particle settling rates in the DWSC compared with the San Joaquin River above the DWSC, 2) installation of a continuous turbidity sensor near the bottom of the DWSC and at mid depth to better assess resuspension with episodic events (e.g., tide reversals, ship traffic, high winds), and 3) fate of particulates (algae and organic debris) from Mossdale to the DWSC.

It is agreed that a comprehensive study on the mechanisms of aggregation should be studied if required by model simulations. However, some simple measurements should be performed to assist with model calibration, such as, undisturbed settling velocity

measurements in the DWSC. The turbidity measurements would help to independently verify the conclusions contained in this report about the importance of tidal scour and provide a more complete data set for which a two-dimensional model could be better calibrated. Lastly, the investigation on the fate of algae and particulate matter entering the DWSC from Mossdale is required regardless of model simulations in the DWSC.

Appendix F, prepared by Dr. William Ritter
Page 48.
"In a detailed study by Litton (2002) it is well documented that the oxygen demand from the bottom sediments in the DWSC is low compared to other sources".

No comment is necessary.

Page 51.
"*There is some question how the geometry of the DWSC affects the settling and resuspension of sediments and oxygen demanding particulate matter."*

Dredging and widening of the DWSC slows water velocities considerably and permits greater settling and some permanent deposition of particulate matter. Sediments in the DWSC are generally soft, unconsolidated sands, silts and clays. Above the DWSC, in the San Joaquin River, the bed is often comprised of stiff silts and clays where higher water velocities have generated a dense, scoured surface.

Regarding spatial variability within the DWSC, this study investigated the longitudinal and vertical variations of particle settling. Lateral variability was not specifically evaluated. However, lateral water turbidity measurements were fairly constant for a given depth. On two occasions the sediment traps were placed on the opposite side of the channel at Navigation Light 38. Deposition rates were similar for each side of the channel. Perhaps the deposition and resuspension rates could vary significantly within some of the shallow shelves along the DWSC. However, due to dredging, much of the DWSC possesses a channelized cross-sectional profile with steep side slopes.