

**Comments on
Total Maximum Daily Load for Low Dissolved Oxygen in the
San Joaquin River
Developed by the CVRWQCB Staff
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Mark Gowdy and Leslie Grober of the CVRWQCB staff, San Joaquin River TMDL Unit, released a report, "Total Maximum Daily Load for Low Dissolved Oxygen in the San Joaquin River," on July 1, 2003. Presented herein are my initial comments on this report.

The title of this report is incorrect. It is not a TMDL for DO. It is a TMDL for oxygen-demanding substances and factors leading to low DO.

On page 1, under "Pollutants Addressed," this item needs to be modified to read "Biodegradable Organic and Ammonia Enrichment." "Low Dissolved Oxygen" is not a pollutant, but is the result of pollution by oxygen-demanding materials.

On page 1, under "Numeric Target," the words "dissolved oxygen" should be in that sentence.

On page 1, under "Watershed Characteristics," I do not understand the phrase, "*Substantial water importation from Delta for irrigation and wetland supply.*" As worded, this indicates that there is export of Delta water for irrigation and wetland supply. Is this connected to the Federal Project? This sentence needs to be reworded to make it clearer as to what is meant.

Page 1, last paragraph, line 2 indicates, "...*impairment of the Stockton Deep Water Ship Channel (DWSC) between the City of Stockton and Disappointment Slough.*" It would be more appropriate to say "... between the Port of Stockton and Disappointment Slough/Columbia Cut." Whenever Disappointment Slough is mentioned, Columbia Cut should also be mentioned, since that is the break point for the DO problem. It is important to mention Columbia Cut because this is an area that needs to receive additional attention because of the potential for low DO to occur there, as a result of diverting SJR oxygen demand loads into the Central Delta via Columbia Cut.

Page 1, last paragraph, mid-paragraph, after "*The impaired reach,*" I would add, "(the Port of Stockton to Disappointment Slough/Columbia Cut)".

Page 2, in the third bulleted item (and elsewhere), the concept has been introduced of reduced flow reducing the input of oxygen to the DWSC. This concept is incorrect in terms of affecting the DO in the DWSC. If the DWSC reach in question were a completely mixed system, then the amount of oxygen in the flow entering the DWSC would be a factor influenced by flow. However, since the critical reach of the DWSC behaves as a “plug-flow” system, there is need to consider what happens within each liter of water as it passes through the DWSC. Each liter has about the same DO coming in during a particular season – i.e., it is at or near saturation. It is my recommendation that this notion of flow affecting the amount of oxygen added to the DWSC being a significant factor in the DO depletion problem, be deleted from this report. It is not technically correct as a factor that is of importance.

Page 2, paragraph 4 states in the first sentence,

“DWSC geometry and reduced DWSC flow share equal responsibility for the impairment because of the interdependent nature of the three main contributing factors.”

That statement should be modified to indicate that the Regional Board has initially assumed that the three factors – load, flow and geometry – are equal.

On page 2, next to last paragraph, the statement is made that,

“The ability to allocate loading capacity to specific sources of oxygen demanding substances is limited by the need for further technical studies ...”

This is one of the disappointing aspects of this TMDL, in that the Regional Board staff could and should have assigned load responsibilities to the stakeholders in the Mud and Salt Slough and SJR upstream of Lander Avenue watersheds. There is adequate evidence from the past studies to assign a tentative load responsibility to each of these watersheds. This should be done so that work on their control can begin, and not have to be delayed three years or so while additional studies provide confirming evidence of what is already fairly well known.

Page 3, first paragraph, last sentence states,

“More information is also needed on performance and cost information for possible mitigation alternatives ...”

The issue is not the need for “more” information. There is need for information. This issue has not been addressed thus far.

Page 3, under the Load Allocation Summary, there is need to understand why 40 percent of the total theoretical loading capacity was chosen as the Margin of Safety. That value seems high.

In this same table, the Waste Load Allocation assigned to the Stockton RWCF of 30 percent is not a valid approach. This wastewater discharge of ammonia can have a significant adverse impact well above 30 percent of their load. As documented in the Synthesis Report, at

times, especially under low SJR DWSC flow conditions and high city of Stockton ammonia concentrations in the wastewaters, the city of Stockton's wastewaters represent on the order of 90 percent of the load of oxygen-demanding materials to the DWSC. The city of Stockton's allocation should be a function of the SJR DWSC flow, and not fixed arbitrarily at 30 percent.

Page 3, under Load Allocation Summary, the Load Allocations should specify that a significant percentage of the load allocation is assigned to the Mud and Salt Slough and SJR upstream of Lander Avenue watersheds.

Page 4, last paragraph, first sentence, should include the phrase "at times" – i.e., "*The impaired reach of the SJR addressed by this TMDL at times does not meet the applicable water quality objectives for DO.*" There are many times when water quality objectives in the critical reach are met.

Page 7, under Land Use, or possibly in another location, mention needs to be made of the large amount of recreational use (boating, fishing, swimming) that is made of the Central Valley waterbodies.

The Sack Dam is mentioned on page 8, first paragraph. A reader should be made aware of its location – i.e., it should be on the map. Similarly, the Merced River needs to be labeled on the map. Anything that is mentioned in the text of the report should be identified on a map of the area. The same applies to Mud and Salt Slough watersheds and where Highway 65 (Lander Avenue) crosses the SJR.

Page 8, last paragraph, first sentence states that tides influence the flow in the SJR at Vernalis. It is my understanding that there is no tidal influence at Vernalis. It starts to occur somewhere between Vernalis and Mossdale.

The reference listing is not adequate to enable reviewers to locate the sources of the material. A properly listed reference should contain sufficient information so that a reviewer of the report can find the referenced material from the information provided.

There is a problem with the reference to DWR (1994) in section 3.4.1 Reduced Flow at Vernalis. If one looks for that reference in the back of the report, the reference is not in the reference list. When material is cited in the text, it should be cited the same way it is listed in the reference list. Otherwise, individuals not familiar with the details may be confused when they try to locate the reference. It should be listed not as "California DWR," but simply "DWR" in the reference list, with an indication further down in the reference that it is the California Department of Water Resources.

In section 4.3.1 Impact of Non-Load-Related Factors, the third line has a reference to ACOE (1990). I assume that this is the US Army Corps of Engineers. The proper abbreviation should be used in the text so there is no confusion as to what the reference is.

Page 9, first paragraph, third line, I am unsure what is meant by “semi-regular cruises.” What should be said is “semi-regular biweekly cruises” – i.e., about once every two weeks during late summer and fall.

The statement is made in the next sentence that, “*These data provide excellent characterization of the spatial extent and temporal variability of the DO impairment.*” As discussed in the Synthesis Report (Lee and Jones-Lee, 2003) for the 2002 data where we were able to compare on a day-by-day basis the San Carlos cruises with the DWR Rough and Ready Island monitor, the cruises do not indicate the magnitude of the DO depletion, because of the time of day at which the measurements are made compared to when the low DO occurs at various locations in the Deep Water Ship Channel. I would delete the word “excellent,” and say instead that the data provide “some” characterization.

Page 9, second paragraph, mid-paragraph, the statement is made that, “*This configuration has been determined to produce a somewhat depth-integrated measurement.*” This statement is not true. It is a depth-integrated measurement over the top about one-third of the water column. It does not reflect the low DO in the bottom half of the water column.

Page 9, third paragraph, I would add that this sampling approach did not necessarily measure the low DO of the day for the critical reach.

Page 10, section 1.3.3, first paragraph, Table 1-1 presents the data only through 2001. Data for 2002 were presented in the Synthesis Report and should have been included in the table, since data from 2002 through mid-February 2003 provided key information on winter conditions.

Page 10, last paragraph, reference should have been made to the Synthesis Report for the 2002 data, where there is a detailed presentation of the diel variations in DO throughout the year.

Page 11, Table 1-1 should have included data for 2002 through February 2003, since these data were readily available in the Synthesis Report and they provide important information on current conditions.

Page 12, first paragraph, first line, delete the word “simply.”

Page 13, section 3.1, third bullet, as discussed above, I would delete the statement about adding oxygen to the DWSC. That is not a relevant issue in a plug-flow system when the water comes into the DWSC at DO saturation.

Page 14, first line, the word “mechanisms” is not appropriate. We understand the mechanisms of DO depletion. We do not have a quantitative understanding of the factors influencing these mechanisms.

Page 14, under section 3.2.2 Algal Loads, first paragraph, last sentence states, “*As a result, a portion of the algae begins to respire, consuming rather than generating oxygen*” That statement is technically incorrect. Algae are respiring at all times. Sometimes, in the presence of light, they can photosynthesize.

Page 15, second paragraph, third line, after “Lander Avenue” I would put in parentheses, “Highway 165.”

Page 15, I would add another paragraph just above 3.2.3 Other Potential Sources, to discuss the presentation in the Synthesis Report that during 2000 and 2001 oxygen demand loads in the SJR from the Mud and Salt Slough watersheds and the SJR upstream of Lander Avenue watershed increased on the average eight-fold by the time they reached the SJR at Mossdale.

Page 16, second paragraph, next to last line, we understand the oxidation “mechanism.” It is biochemical. What we do not know are the rates and factors influencing rates of oxidation.

Page 16, last paragraph, third from last line, the concept of algae “beginning to respire” is incorrect. Algae are respiring at all times. They are simply not photosynthesizing in the dark.

Page 17, first paragraph, sixth line states, “*Using flow and organic loading data....*” The word “organic” is incorrect. It should be “biochemical oxygen demand loading data.” There are a lot of organics that are not biodegradable.

Page 17, the first paragraph should be expanded to indicate what the natural depth is – say, 8 to 12 feet.

Page 17, second paragraph, next to last line, delete the statement about “... *appears to both reduce the oxygen inputs to the DWSC*” That is an inappropriate concept.

Page 19, first paragraph, mid-paragraph, I would delete the reference to “oxygen input rate.” This is an inappropriate concept for this system.

Page 20, in section 4.1, third line, delete the word “organic,” in “organic enrichment.” It is “oxygen demand enrichment.”

Page 21, section 4.2.1, the statement that, “*The solubility of oxygen in water, at relatively constant atmospheric pressure and salinity, is a function of temperature.*” It is a function of temperature even if the atmospheric pressure and salinity are variable.

Page 21, section 4.2.1, second paragraph, reaeration is used to include photosynthesis. That is an inappropriate use. Reaeration is restricted to transfer from the atmosphere, so it should be “reaeration and photosynthesis.”

Page 23, Figures 4-1(a) and (b) are not accurate above about 1500 to 2000 cfs. Under those conditions much higher loads can occur due to the fact that they are diluted out by the cross-SJR DWSC flow of the Sacramento River that occurs at Disappointment Slough/Columbia Cut.

Page 25, first paragraph, section 4.3.1, line 5, I believe “ACOE” should be “USACOE,” in order to match the listing in the references.

Page 25, under 4.3.1, first paragraph, the last line in the paragraph states, “... *the impairment could be eliminated if the flow through the DWSC were increased.*” There is need to add “above about 2000 cfs.”

Page 25, under section 4.3.2 Assumptions, I would add in line 3, “e.g., ammonia and dead algae.”

Page 26, first paragraph, I would add to this paragraph a discussion that the Port of Stockton’s responsibility should be based on those who benefit from the continued existence of the Port.

Page 29, mid-page, states, “*It has also been observed that the magnitude of BODu load from the RWCF is seasonally variable with lower loads during the summer and early fall and higher loads during the remainder of the year.*” There is need to qualify this statement with the word “typically.” In 2001 that pattern did not hold true. There were high summer ammonia loads, as well. Further, it appears that summer 2003 may have, at least initially, high ammonia loads.

Page 29, three lines from the bottom of the page, again the word “mechanisms” is inappropriate. We know the mechanisms. We simply do not understand well the relative contribution of the mechanisms.

Page 29, third paragraph, I do not agree with the approach of allowing the city of Stockton to be responsible for only 30 percent of the loading capacity for oxygen demand loads. The percentage of the City’s load should be based on the flow of the SJR, since (as discussed in the Synthesis Report) under low SJR DWSC flow conditions, essentially all of the oxygen demand load to the DWSC is city of Stockton ammonia.

Page 30, section 4.4.2 Waste Load Allocations, first paragraph states, “*Other RWCF effluent constituents may, however, exert minor additional oxygen demand.*” There are no other constituents that could exert an oxygen demand which are not accounted for already, except for the possibility of algae in the effluent. Even there, if the algal load in the effluent is not filtered, which will not be applicable to the future situations, it will be a small part of the total load. In addition, the algal load is incorporated into the BOD measurements.

Page 30, last paragraph, and the first paragraph on page 31, mention the possibility of load trading. The likelihood of this is extremely remote. The US EPA has never approved a load trading situation based on a complicated approach. It usually bases it on total concentrations of phosphorus, without regard to availability, etc. I would not spend a lot of time on load trading issues, since they are not likely to be approved. If approved, they will be extremely difficult to implement to keep all parties happy.

Page 31, section 4.4.3 Load Allocations, in the next to last sentence, the concept should be “... *are linked to DO concentrations ...*” below the water quality objective. The phrase “below the water quality objective” should be added.

Page 31, under the bulleted items, there is need to include the amount of diversion of algae between Mud and Salt Sloughs and Mossdale due to irrigation diversions. This should be another bullet. As discussed in the Synthesis Report, this can be a significant part of the total load.

Page 31, the next to last paragraph states that, “*Specific load allocations for algae and substances that contribute to algal growth will be assigned to upstream sources through the agricultural discharge regulatory program.*” Is this meant to indicate that the allocation of loads upstream is going to be controlled by the agricultural waiver program? If so, this is years away. The TMDL should be implemented more rapidly than that.

Page 31, last paragraph, I do not understand what is being said here. An example is needed.

Page 33, last paragraph, fifth line, the word “mechanisms” is incorrectly used here again. We understand the mechanisms. What we do not understand is the relative significance of the factors that influence how oxygen demand is exerted.

Page 34, second paragraph, first line, “mechanisms” is again used inappropriately.

Page 34, second paragraph mentions aeration for the first time. A paragraph or so should be added ahead of this to indicate that aeration is being considered.

Page 34, in the bulleted items, the diversion of water and algae needs to be included in the bullets.

Page 35, under section 5.3.1, first paragraph, the first sentence needs to be expanded to include “... that lead to DO concentrations in the DWSC below the WQO.” There is no interest in nutrients, algae or other oxygen-demanding materials in general, unless they are part of the low-DO problem.

Page 35, second paragraph, “mechanisms” is again used inappropriately.

Page 35, third paragraph states in the next to last sentence that, “*Upstream stakeholders ... have demonstrated interest and willingness to organize and perform these upstream studies.*” That is only partially true. They are not willing to perform the studies that are needed to specifically define sources of oxygen demand or constituents that lead to oxygen demand. Unless the upstream studies include specific source studies, they will be of limited utility in several key areas that need to be addressed in the Phase I TMDL.

Page 37, under section 5.4.1 Consideration of Alternative Mitigation Measures, states in the second sentence, “*As an example, the DWSC geometry is a factor that cannot be directly mitigated.*” That statement is not true. The DWSC could be allowed to fill in – i.e., no further maintenance dredging. This would accomplish what is ultimately needed with respect to

reducing the volume of the DWSC, and therefore the residence time of oxygen demand loads to it.

Page 37, section 5.4.2 Load Trading Program, as discussed above, the likelihood of being able to develop oxygen demand load trading programs is small because of the complexity of the situation and the difficulty of trying to implement a complex load trading program.

Page 38, next to last paragraph puts far too much emphasis on what will be accomplished with the currently planned upstream studies. These studies will not provide some of the information that has been identified as necessary.

Pages 39, 40 and 41 provide references. There are significant problems with many of the references. The references need to be presented in a standard style, where there is sufficient information so that someone else could find the reference from the information provided. The Hallock, *et al.*, reference has several errors, which indicates that it was not proofread after it was typed.