

**Comments on Draft  
Demonstration Monitoring Plan for the Stockton  
Deep Water Ship Channel Oxygenation Device**

Comments Submitted by  
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In response to a request for comments, I wish to provide the following comments on Jones & Stokes' proposed Demonstration Monitoring Plan for the Stockton Deep Water Ship Channel Oxygenation Device.

**Overall**

Overall, I find that this proposed monitoring plan is significantly deficient in developing a monitoring/evaluation program that will reliably evaluate the efficacy of the proposed U-tube aeration device.

Much of this report is derived from old Jones & Stokes reports and ignores a substantial amount of literature that exists, much of which is available on our website, [www.gfredlee.com](http://www.gfredlee.com), providing more recent data on issues that should have been considered in developing this monitoring plan.

This draft report appears to have been hastily put together without adequate proofreading and review by Jones & Stokes staff. It is noted that the draft pages carry an October 2005 date, with the exception of the first page, which says June 2004. Why has it taken until February 2006 to get this document out for review? The delay in this review may have created a situation where the final monitoring program that should be used to evaluate U-tube aeration efficacy will not have been developed by the time that the U-tube aeration device is supposed to become operational in summer 2006.

One of the issues that needs to be addressed in the evaluation program for the oxygenation device is a comprehensive evaluation of the cost of aeration, as a function of various parameters that can influence the need for aeration. Ultimately there will be need to balance aeration costs and effectiveness in preventing DO excursions below the water quality objective (WQO), versus the effectiveness and costs of oxygen demand source control from upstream sources within the SJR watershed. One of the costs that has to be evaluated is the cost of the monitoring program that will need to be implemented to guide the operation of the aeration device based on the characteristics of the SJR DWSC flow and other conditions, as well as the oxygen demand loads to the DWSC. This should be an important part of the report presenting an evaluation of the efficacy of the U-tube aeration device. Of particular concern is what measurements will be used to establish how to operate the aerator to eliminate WQO violations at any time and location within the DWSC. This could require a highly sophisticated monitoring program that is

proactive in detecting potential WQO violations before they occur, and adjusting the aeration operation to prevent their occurrence.

### **Recommendation**

It is recommended that the CVRWQCB and CALFED develop an independent expert panel of individuals knowledgeable in DWSC characteristics to work with the agencies to develop a credible monitoring program that has the potential of developing the information needed to properly evaluate whether the current proposed U-tube aeration device is a viable approach for providing DO to the DWSC to eliminate DO water quality objective violations at any time and location, in accordance with current regulatory requirements.

Specific issues of concern on the deficiencies in the proposed monitoring plan are discussed below.

### **Specific Comments**

Page 2, first paragraph makes mention of Columbia Cut in Figure 1. Examination of Figure 1 shows that Columbia Cut is not mentioned on the figure.

Page 2, third paragraph, SJR net flow should be added to the factors that control residence time in the DWSC.

Page 3, second paragraph, reference to the USGS Stockton tidal flow station should mention "(SJR Garwood)," since this is the USGS designation for this site.

Page 5, first paragraph, third line, "extend" should be "extent."

Page 7 presents a discussion of some of the factors influencing DO depletion in the DWSC. A more comprehensive discussion of these issues is presented in our synthesis report,

Lee, G. F. and Jones-Lee, A., "Synthesis and Discussion of Findings on the Causes and Factors Influencing Low DO in the San Joaquin River Deep Water Ship Channel Near Stockton, CA: Including 2002 Data," Report Submitted to SJR DO TMDL Steering Committee and CALFED Bay-Delta Program, G. Fred Lee & Associates, El Macero, CA, March (2003). <http://www.gfredlee.com/SynthesisRpt3-21-03.pdf>

and in the supplement to the synthesis report,

Lee, G. F. and Jones-Lee, A., "Supplement to Synthesis Report on the Low-DO Problem in the SJR DWSC," Report of G. Fred Lee & Associates, El Macero, CA, June (2004). <http://www.members.aol.com/duklee2307/SynthRptSupp.pdf>

as well as other reports on our website, [www.gfredlee.com](http://www.gfredlee.com).

On the bottom of page 7 to the top of page 8 is a discussion of the DWR San Carlos boat surveys. The complete database since the mid-1990s for these surveys has been presented in our

synthesis report mentioned above. Reference should have been made to the information in this database.

Top of page 9 discusses the DO deficit situation during 2001. This discussion is significantly deficient compared to the readily available information that exists in non-Jones & Stokes reports, which shows, for example, that during several winters since 2001 the greatest DO depletion occurred in the DWSC in February. Failure to mention and specifically address this situation is another example of the inadequacy of this report.

Page 9, under “Basic Monitoring Approach,” states in the first bulleted paragraph,

*“The existing R&RI water quality monitoring station, operated by DWR, will continue to be the main station for judging the effectiveness of the DWSC oxygenation device.”*

As discussed in our reports, the Rough and Ready Island station (R&RI) is not a good station under all SJR DWSC flow conditions to evaluate DO depletion issues. Under elevated SJR DWSC flows, the minimum DO occurs near Turner Cut. The DO depletion at Rough and Ready Island does not reliably reflect this situation.

The last sentence in this paragraph states,

*“The daily minimum DO, which usually occurs in the early morning hours, will continue to be used to indicate the average daily DO in the DWSC.”*

This is an inappropriate approach for assessing the potential efficacy of the aeration device.

Throughout this report, discussions focus on “average” concentrations. Under the current regulatory requirements, meeting the water quality objectives by the average concentration is not adequate. A credible monitoring program for evaluation of the aeration device must focus on obtaining measurements that comply with the regulatory requirements of the minimum DO that occurs at any time and location in the DWSC. As discussed in our reports, the Rough and Ready Island monitoring station is not reliable for this purpose, since it does not reflect the greatest DO depletion near the surface and near the bottom waters that can occur in the DWSC between the Port of Stockton and Turner Cut.

Page 9 states,

*“Five new stations with continuous (15-minute) DO monitoring will be installed along the DWSC. Three stations will be located upstream of the oxygen device diffuser (at Stockton R2a and navigation lights 48 and 43), and two will be located downstream (at lights 41 and 40). These five stations will provide a complete record of the position and extent of the longitudinal DO sag within the DWSC, and the DO of the SJR as it flows into the DWSC (R2a) during ebb tide.”*

If the Jones & Stokes staff had reviewed and reported on the data presented in the synthesis report and in the supplement to it, they would have found that navigation lights 40 and 41 are not

sufficiently downstream to address minimum DO conditions that occur under some SJR DWSC flow conditions.

Page 10, first paragraph states that, *“Measurements will be obtained from mid-depth to eliminate the high DO measured during surface stratification.”* As discussed above, mid-depth measurements are not adequate to assess compliance with regulatory requirements. The low DO that can occur in the surface waters during early morning can readily be the minimum of the day. This minimum DO is not reflected in the med-depth samples.

Page 10, first full bulleted paragraph states,

*“Longitudinal boat surveys in the DWSC for mid-depth and surface measurements of temperature, DO, pH, EC, turbidity and algae florescence will be obtained at the end of each ‘on’ and ‘off’ period within the operational cycle (see Operations Section below) to provide a more complete record of the longitudinal gradients for high-tide and low-tide conditions.”*

This approach represents another significant deficiency with the proposed monitoring, in that, if the aeration device is to be effective, it must address the low DO that occurs in the near-bottom waters. As discussed in our synthesis report, the San Carlos data show that frequently the DO near the bottom is 1 to 2 mg/L below the mid-depth and near-surface waters in mid-day. The proposed monitoring approach must be significantly changed to reliably evaluate how effectively the aeration device provides oxygen to the near-bottom waters throughout the critical reach of the DWSC – i.e., Channel Point to Turner Cut.

On page 10, under “Monitoring Parameters and Locations,” mention is made of monitoring BOD<sub>5</sub>. The CVRWQCB studies show that BOD<sub>10</sub> is a more reliable assessment of oxygen demand load. Pheophytin and organic nitrogen should be added to the list of parameters monitored.

Page 10, second paragraph under “Monitoring Parameters and Locations,” the title “Grad” should be “Grab.”

Page 10, under “Continuous Monitoring” again has the problem of mid-depth monitoring rather than surface and near-bottom monitoring where the critical values can be found.

Page 11, second paragraph states that monitoring of the DWSC near station R7 is not necessary, based on “historical data.” It is not clear what historical data were examined. There are situations where low DO occurs below R6 and near R7.

Page 11, last paragraph states,

*“Therefore, it will not be possible with these DO monitoring stations to determine the amount of injected DO that actually becomes mixed into the DWSC. Therefore, an operational strategy that turns the U-tube device on for several days and then turns the device off for several days will be used to observe the increases in the DWSC DO*

*concentrations and determine the amount of injected DO that increases the average DO within the DWSC.”*

From the information provided in this draft report it appears that Jones & Stokes has not approached the development of the monitoring strategy based on a critical analysis of the variability of DO and factors influencing DO at various locations along the critical reach of the DWSC. Based on this type of analysis it should be possible to determine the number and location of samples needed to determine the efficacy of the aeration device. The day-to-day variability during an on-off cycle at times can potentially be sufficiently great to make reliable assessments of the addition of oxygen by the aeration device questionable.

Page 12, “Baseline Monitoring” states that the baseline data will be collected from May 1 through November 30. As discussed in the synthesis report and supplement, there are times in the winter when the DO in the DWSC has been zero at the Rough and Ready Island monitoring station. The winter conditions also need to be monitored, especially during the time when the USBR and DWR export pumps suck all the SJR Vernalis water into Old River, leaving very low flow through the DWSC. These conditions also need to be watched for and monitored.

On page 12, under “Long-term Monitoring,” it is stated that the weekly vertical profiles and boat surveys will no longer be conducted after the first year. As discussed herein, the vertical profiles and boat surveys need to be significantly expanded during the first year, and continued for several years, in order to address year-to-year variability that occurs in the SJR DWSC.

The top of page 13 states that after the first year the long-term effectiveness of the aeration device will be determined at monitoring stations R4, R&RI and R6. This approach will almost certainly prove to be inadequate to evaluate the ability of the U-tube aeration device to provide DO at all locations in the critical reach of the DWSC where violations of the DO WQO can occur. There will be need for intensive, focused monitoring that can only be accomplished from a boat that examines DO conditions as influenced by the U-tube aeration device along the channel and across the channel, especially along the opposite shore shallow water areas on the east side of the channel. Thus far, to my knowledge, there has been no work done to determine if there are critical conditions in DO depletion in the shallow water areas of each side of the channel. This needs to be investigated.

Another factor which apparently is being ignored by Jones & Stokes in establishing this monitoring program is the potential influence of the Turning Basin on DO conditions in the upper part of the DWSC. It was well established in the studies that were done during 1999 through 2001 that the Port of Stockton Turning Basin has significantly different DO and temperature characteristics than the main channel. The previous studies have shown that the water in the Turning Basin can affect DWSC DO conditions; however, the relationship between the waters in each area and DO depletion is not adequately understood. There almost certainly will be conditions where Turning Basin water will influence the magnitude of the DO depletion in the upper parts of the DWSC. These issues need to be investigated and understood, since they could lead to greater DO depletions below the WQO than are normally experienced.

Page 13, third paragraph discusses the proposed operation of the oxygenation device. It appears from the discussion at this location and in other parts of this draft report that Jones & Stokes proposes to ignore the low-DO conditions that occur near the sediment water interface. Clearly, this is a significant deficiency in the proposed monitoring approach. The trigger points that will often drive the need for aeration to avoid WQO violations will be near the sediment water interface, yet Jones & Stokes does not propose to monitor in this area. This issue needs to be re-examined and the monitoring program adjusted to properly reflect the known conditions that exist in the DWSC, based on the complete database available – not just during the limited period that Jones & Stokes has used to establish their proposed monitoring program.

Page 14, second paragraph discusses potential three-day off and four-day on cycles and specifically mentions starting on Monday. As discussed in the synthesis report, the past and presumably current city of Stockton wastewater discharges to the SJR just upstream of the DWSC are such that the city does not discharge over the weekend, but starts up again on Monday. It was not clear whether the Monday discharges were typical of what occurs over the rest of the week, or whether they might reflect the fact that the treatment plant had not been operating over the weekend. Since at times the city's oxygen demand load can represent a significant part of the total load to the DWSC, there is need to consider when the city discharges occur and their characteristics, as part of properly determining the potential operation of the aerator.

Page 16, under "Effects of High DO on Fish," has a number of significant problems with respect to addressing the effects on fish physiology of the release of water from the U-tube aeration device with DO at 40 to 50 mg/L. It appears that Jones & Stokes staff do not understand the Basin Plan requirements of no discharge of toxics in toxic amounts. As discussed in my previous comments on the problems with the proposed U-tube aeration device using pure oxygen,

Lee, G. F., "Comments on the Draft San Joaquin River Deep Water Ship Channel Demonstration Dissolved Oxygen Aeration Facility Initial Study/Mitigated Negative Declaration," Submitted to CA Department of Water Resources Sacramento, CA, March (2005). <http://www.members.aol.com/annejlee/ComDraftDemoAeration.pdf>

the US EPA has established a water quality criterion of 110 percent saturation for total dissolved gases as the limit that can occur without adverse effects on fish. As part of preparing the above comments, I contacted the US EPA headquarters to determine if there was any reason to change this criterion and learned that the Agency still finds that this is an appropriate criterion for protection of fish. At 40 mg/L DO, the oxygen concentration in the aeration device discharge waters would be about six to eight times saturation. This means that there could readily be gross over-saturation of dissolved oxygen in the region of the aeration device discharge. This in itself is a violation of the Basin Plan that cannot be allowed unless the Basin Plan is amended.

A negative result from the proposed studies involving caged fish in this region will not mean that the Basin Plan requirements of not violating US EPA water quality criteria can be ignored. The failure of the CVRWQCB staff to utilize the Basin Plan requirements and the US EPA criterion in evaluating the potential for the proposed aeration device to cause violations of the Basin Plan

requirements will not likely be allowed to stand under further review by those concerned with protecting fish from the adverse impacts of supersaturated water.

The bottom of page 16 and top of page 17 discuss the problems with the dye tracer used in the previous studies showing a lack of complete vertical mixing due to “stratified surface conditions.” These stratified surface conditions will continue to occur in the DWSC, which will certainly impact the ability of the current design of the U-tube aeration device to provide DO to the near-bottom waters of the DWSC where often the greatest DO depletion occurs. Jones & Stokes has not adequately addressed this issue.

### **References Cited**

The Jones & Stokes authors chose to list only a few Jones & Stokes reports as references. There is a substantial literature that provides greater insight into issues that need to be considered in developing a credible monitoring program to evaluate the U-tube aeration approach.