Bay-Delta ERP Selection Panel – Final Review

Proposal Number: #262 DA
Applicant Organization: San Joaquin Valley Drainage Authority
Proposal Title: Monitoring and Investigations of the San Joaquin River and Tributaries Related to Dissolved Oxygen

Recommendation: Fund in Part with Conditions

Amount: $6,807,428

Conditions: The Selection Panel recommends several conditions, listed by task below:

1. Task 3 (Quality Assurance Project Plan): For each project task the Quality Assurance Project Plan (QAPP) should describe sample collection and handling methods and specific data integration and analysis tasks. The specific steps for coordinating data collection tasks for Tasks 4 and 7 should be described in the QAPP. The QAPP should also describe the sampling strategies needed to account for hydrologic variability. ERP staff should review and approve the QAPP.
2. Task 4 (Monitoring Program): Add bi-weekly sampling during the winter months at the 21 year-round sampling stations as described in Task 4.2. In addition, the applicant should add one additional sampling location between Mossdale and Channel Point. The Selection Panel understands the precise location of this sampling station cannot be immediately determined and will depend on flow conditions, navigation requirements, location of nearby outfalls, and right-of-way issues. ERP staff should approve the location of the new sampling station. In addition, ERP staff should ensure that this task provides for evaluation of UCD's and USGS's data and its use in refining the study's monitoring program.
3. Task 5 (Independent Measurement of Constants Used in Algal Growth Models of Importance to the Load Allocation Process). Eliminate this task from this scope of work, but consider submitting a new proposal after significant progress on Task 4 and further study of zooplankton and benthic grazing.
4. Task 6 (River Modeling): The Selection Panel is aware that subtasks within Task 6 overlap somewhat with modeling tasks identified in the Scope of Work for *San Joaquin River Dissolved Oxygen Depletion Modeling(HydroQual, Inc.)*. ERP staff should work with the applicant and HydroQual, Inc. to identify potential overlap and as appropriate, eliminate subtasks and reduce the budget for Task 6.
5. Task 8 (Linking the SJR to the DWSC): ERP staff should work with the applicant to add an assessment of zooplankton and benthic grazing between Vernalis and Channel Point within the scope of Task 8. This study will help determine if grazing is responsible for a significant loss of algae in this area.

Provide a brief explanation of your rating:

The Selection Panel views the monitoring and assessment of upstream sources of oxygen demanding substances in the San Joaquin River (SJR) as critical steps toward understanding and mitigating hypoxia in the Stockton Deep Water Ship Channel (DWSC). The CALFED Record of Decision (ROD) identifies milestones to understand and address this problem which are closely linked to the RWQCB and USEPA regulatory process for the development of the Dissolved Oxygen TMDL.

ERP has awarded approximately $4.1M in Proposition 204 funding for dissolved oxygen projects (1999 and 2001) to determine the sources and causes of low dissolved oxygen in the SJR DWSC. Two additional modeling studies were awarded by ERP and the Science Program to support the 2001 study**.** The results from these studies were reviewed by a panel of distinguished scientists and discussed at the May 2002 SJR Dissolved Oxygen Peer Review Workshop sponsored by the Science Program and ERP. The primary goal of this review was to assess the state of scientific knowledge associated with possible management solutions for the dissolved oxygen problem. The 2002 Peer Review confirmed that the primary variables regulating dissolved oxygen in the lower San Joaquin River are: (i) import of oxygen consuming substances from upstream; (ii) river flows through the channel; and (iii) channel characteristics. The Peer Review concluded that further study and characterization of oxygen-consuming substances upstream of the DWSC is needed. The peer review report (May 2002 Peer Review Workshop) is located at: (http://www.sjrtmdl.org/technical/2001_studies/process/pr_summaryfinal.pdf

The subject proposal was submitted to the ERP as a Directed Action specifically to address recommendations from the 2002 Peer Review regarding further study of the upstream loads in the SJR. This proposal was not part of a prior ERP solicitation due primarily to timing of the peer review recommendations and impending ROD and regulatory milestones. The Selection Panel recognizes the information generated from the proposed project is necessary to identify and implement long-term solutions to address the dissolved oxygen problem.

The proposal has undergone a thorough technical review by an external review panel, and each member of this panel provided their own independent review. The collective recommendation of this external review panel is summarized in a memo to Dan Ray (ERP staff) dated September 23, 2003. Three of the panel members participated in the May 2002 SJR Dissolved Oxygen Peer Review Workshop. Four of the reviewers ranked the proposal as “Good” and two reviewers ranked the proposal as “Excellent”. The Selection Panel believes the project team for this proposal is highly qualified to address some of the most important data gaps for the dissolved oxygen problem.

The Selection Panel considers the proposal a significant step towards resolving the outstanding issues identified in the 2002 peer review recommendations. Deficiencies identified by the external technical panel in their review process are addressed by the conditions recommended by the Selection Panel, which agrees with the external technical panel.

Comments from Delta Keeper, the Natural Resources Defense Council, the Central Delta Water Agency, and others raise several concerns about the proposal. All of these comments identified concerns that the proposal failed to investigate flows in the river. The proposed study focused on understanding the sources and fate of oxygen-consuming materials in the San Joaquin River upstream of the ship channel. Although investigating flows was outside the focus of the proposed study, the Selection Panel notes that the project's water quality monitoring stations will be co-located with flow monitoring stations or at locations where reasonable estimates of flow can be calculated from nearby stations. In this way, flow-dependent loads of various water quality constituents can be analyzed in the modeling efforts of Task 6 and with other concurrent modeling efforts. Furthermore, this study can provide entities responsible for various activities that affect flow and water quality in the San Joaquin River with the information they need to evaluate their effects and develop required mitigation measures. While a fuller discussion of relationships between flows, water quality, and other elements of ecosystem health in the San Joaquin River is desirable, it is beyond the scope of this study.

Other comments raise a variety of technical issues-- most of which were considered early in development of the Bay-Delta Program's strategy for addressing the San Joaquin River's low dissolved oxygen conditions and in this study's design. Independent peer review of the project has found its design adequate. The Selection Panel recognizes the value of ensuring that the study takes full advantage of historical data developed by UC Davis and the US Geological Survey (USGS).The proposal's Task 4 includes obtaining and analyzing historical data, including information from UCD and USGS, which the applicants intend to use to fine tune the monitoring program. The Selection Panel recommends that conditions of the grant ensure that these tasks provide for evaluation of UCD's and USGS's data and its use in refining the study's monitoring program.

* * *

MEMORANDUM

Date: September 23, 2003

To: Dan Ray
Ecosystem Restoration Program
California Bay-Delta Authority

From: Barbara Marcotte
Ecosystem Restoration Program
California Bay-Delta Authority

Mark Gowdy
San Joaquin River TMDL Unit
Central Valley Regional Water Quality Control Board

Subject: **CALFED Directed Action Proposal: Monitoring and Investigations of the San Joaquin River and Tributaries Related to Dissolved Oxygen (March 13, 2003)**

The California Bay-Delta Authority (CBDA) Ecosystem Restoration Program (ERP) received the above proposal from the San Joaquin River Valley Drainage Authority in March 2003. ERP staff received completed reviews from six Technical Review Panel members (Table 1) in July 2003. Three of the panel members participated in the May 2002 SJR Dissolved Oxygen Peer Review. Four of the reviewers ranked the proposal as "Good" and two reviewers ranked the proposal as "Excellent". Barbara Marcotte (ERP) and Mark Gowdy (CVRWQCB) initiated and facilitated a conference call with the panel members on August 26, 2003. The purpose of this call was to seek clarification on selected comments from the reviewers, discuss possible discrepancies between reviews, and facilitate the integration of the reviews for the ERP Selection Panel.

All panel members participated on the conference call. However, due to technical difficulties many of Dr. Mark Roberson's comments were not understood. Dr. Roberson's primary comments were verbally reiterated to Barbara Marcotte following the conference call. To ensure the panel recommendations were accurately characterized the panel members were provided a draft copy of this memorandum for review.

There was general consensus among the reviewers that the proposal addressed many of the primary concerns raised in the May 2002 Dissolved Oxygen Peer Review. There was general consensus among the panel members the proposal would be improved if certain tasks were modified and/or postponed. This memorandum provides a summary of the issues and recommendations for selected proposal tasks within the proposal.

1. Sampling Frequency during Winter Months

Discussion
A few comments questioned the appropriateness of the once monthly sampling proposed in Task 4 (Monitoring Program) during the winter months, citing concern that this was not frequent enough to gain insight during low DO events that can occur during those months. We asked the panel to discuss whether the scope should be modified and costs increased or tasks be reprioritized within the scope to allow for more frequent data collection.

Recommendation
There was general agreement on the need for bi-weekly sampling during the winter months. It was agreed that this should not necessarily be added at the expense of less frequent sampling frequency during other months as already proposed. It was acknowledged that this would lead to an increase in scope and cost for the proposal.

2. Sampling Locations

Discussion
Two reviewers pointed out the need for a sampling station between Mossdale and Channel Point. The review panel was asked to discuss a possible recommendation for how the proposal PI should address this concern.

A reviewer pointed out the importance of being able to account for the input of French Camp Slough relative to this new sampling location(s). If the sampling location #11 in French Camp Slough is not representative of its input to the San Joaquin River, then another sampling location or a relocated sampling location may be appropriate. Concern was expressed about the usefulness of a sampling location at Channel Point because of tidal flows that bring water from the Deep Water Ship Channel past that location. It was not necessarily suggested, however, that this sampling location be eliminated.

Recommendation
It was generally agreed among the peer reviewers that at least one other sampling location between Mossdale and Channel Point is very important and should be added.

3. Algal Growth Dynamics

Discussion:
The timing for algal growth dynamics in Task 5 (Measurement of Algal Growth) and Task 8 (Linking the SJR to the DWSC) prior to performing the data and analysis in Task 4 (Monitoring Program) was questioned by reviewers. A comment was received about the need to integrate and coordinate the activities of Task 5 and Task 8. The panel members were asked to discuss merits, timing and coordination of these tasks.

Questions were raised about the ability of this study to properly evaluate algae growth dynamics without more measurement and understanding of zooplankton and benthos

grazing. Concern was also expressed about the way in which it was proposed that the light extinction coefficient be determined and the need to investigate how mineral particle trends affect algal productivity. Questions were also raised about the way algal species composition was being measured and studied. The panel members were asked to discuss how Task 5 and Task 8 should be modified to address the comments and suggestions.

A reviewer felt that Tasks 5 (particularly Task 5) and 8 might be premature and not going to provide very valuable information. He suggested these tasks be modified and considered in a subsequent year. The same reviewer suggested it would also be valuable and relatively easy to add some carbon isotope techniques to Tasks 5 & 8 for algal carbon source identification, establishing downstream linkages, and degradation experiments. There was considerable discussion among reviewers on the degree of importance and emphasis on algae growth dynamics for Task 5.

Another reviewer questioned the amount of emphasis in Task 5 on studying algal growth dynamics and species composition. He pointed out that there has been a fair amount of study on this already. He believes the system is light limited and maximum yield never can be reached. Also, species composition could be very different in the river. The increasing importance of Microcystis since 1999 and its uniqueness (lack of edibility, ability to float) may be affecting the "mean" behavior of the algal community in the river. At the same time, little attention has been given in past DO TMDL related studies or this proposal on zooplankton and benthic algae grazing (algae removal mechanisms). This was an important shortcoming pointed out in the May 2002 peer-review. He felt that use of past growth studies and textbook growth constants would be adequate for the initial rounds of modeling, and that at least as much emphasis needs to be placed on losses as on growth, especially respiration, grazing and sinking losses. Historical estimates of macro benthic and zooplankton grazing at sampling locations in the Delta could be used to estimate the magnitude of the biomass loads to the Deep Water Ship Channel. Work by Jan Thompson and Jim Orsi (USGS) may be helpful for this effort. Researchers have reported discrepancies of up to 20% between loads and sinks at Mossdale. The reviewer pointed out that it is important to do a mass balance because it is possible zooplankton or benthic grazing could account for a significant portion of this variability. Grazing may also play a role in the diel fluctuation seen in chlorophyll-a data. The reviewer believes that simple "back-of-the-envelope" calculations based on zooplankton and macrobenthic biomass may be enough to dismiss their potential importance, but that the calculation must be done.

Another reviewer felt that more evaluation of the uncertainty of the various parameters and constants was required before further extensive field evaluation of them proceeded. This could be accomplished in part by doing some sensitivity analysis with simple models and could be performed as part of developing the QAPP and factored into the sampling and analysis plan. Based on the results of this analysis, decisions about the appropriateness of more extensive field measurements of certain parameters and constants could be made. It is critical that the QAPP is followed and written to give direction to the project.

Recommendation
Eliminate Task 5 (Measurement of Algal Growth) for now and revise in a subsequent proposal after more of Task 4 (Monitoring Program) has been completed and following further study of zooplankton and benthos. Extensive field study of algae growth dynamics and grazing should be proposed after consideration of more uncertainty and sensitivity analysis.

It was generally agreed that the work in Task 8 (Linking the SJR to the DWSC) was important to better understand all the mechanisms affecting oxygen demanding substances between Mossdale and the Deep Water Ship Channel. It was noted that zooplankton and benthic grazing was not addressed in Task 8 and should be added.

4. River Modeling

Discussion
A reviewer expressed concern for the lack of explicit project coordination between the Task 6 (River Modeling) and the ERP funded HydroQual, Inc. modeling study (San Joaquin River Dissolved Oxygen Depletion Modeling). The reviewer pointed out that the 2002 Peer Review Report frequently referenced the HydroQual modeling study but the proposal made little reference to the HydroQual project. The reviewer stated the proposal was deficient because the proposal did not describe the linkage to or need for integration for the two projects.

ERP staff explained that the HydroQual proposal was awarded in 2002 but had suffered significant delays in contracting. Currently, ERP staff and its contracting agent are working with HydroQual to secure a final scope of work for the project. The final contract should be completed within a month. ERP staff will provide the scope of work to the applicant of the subject proposal. At the time the subject proposal was under development, ERP staff was unable to specify a time to complete a final contract for the HydroQual project.

Recommendation
The scope of work for Task 6 (River Modeling) should be conditionally approved based on the completion of and integration with the HydroQual scope of work and contract. The final HydroQual scope of work should be provided to the applicant for review. The applicant should evaluate the modeling tasks in the HydroQual scope of work, modify Task 6 (River Modeling) as appropriate, and resubmit for consideration. Task 6 should include a description of project integration and coordination tasks for the HydroQual project.

5. Isotope Studies

Discussion:
A reviewer suggested the presentation of the Task 7 (Characterization of BOD Fractions and Sources) could be improved. Despite this concern he felt the approach proposed for nitrogen and carbon would provide useful data. Such methods are well proven and suitable for this type of application. The reviewer stated that isotope studies may be useful for understanding algae growth and removal mechanisms at a later date depending on the uncertainty and sensitivity analysis discussed above. The researchers should be asked if it would be useful for these studies to include isotopes. He also felt that isotope techniques may also be applied to dissolved oxygen production and removal mechanisms in the vicinity of the Deep Water Ship Channel. This could include diel studies addressing PR/respiration. DO isotope studies may be a useful part of future studies in the Deep Water Ship Channel.

The same reviewer expressed concern about the reliance upon sample collection in Task 4 (Monitoring Program) for analysis in Task 7 (Characterization of BOD Fractions and Sources). Requirements for sample collection and handling will need to be coordinated between the two tasks and should be addressed in Task 3 (QAPP).

Recommendation
Proceed with Task 7 (Characterization of BOD Fractions and Sources) as proposed with the caveats as discussed above.

6. Hydrology (temporal variability, groundwater, diversions,etc)

Discussion
Concerns were raised about whether the proposal adequately addressed hydrologic considerations of temporal variability, and groundwater and agricultural drainage inputs/diversions in relation to Task 4 (Sampling Program). A concern was also expressed over the consistency of input data sets for the hydrologic modeling. The panel members were asked to discuss possible recommendations for the modifications to the proposal.

A reviewer expressed the need for flexibility to make changes in the monitoring and sampling program (Task 4, Monitoring Program) based on hydrology or other factors. There was discussion on where and how this flexibility should be addressed in the proposal (Task 3, Task 4 and/or the contract). Depending on the type of hydrologic event sampling cost could increase significantly. Another reviewer had similar concerns with hydrologic variability. A reviewer pointed out that short of doing a mass balance it would be difficult to determine where we have weaknesses.

Recommendation
The QAPP (Task 3) should incorporate and address comments from the reviewers concerning hydrologic variability. The California Bay-Delta Authority should seek external peer review for the QAPP.

7. Data Analysis

Discussion
A reviewer suggested that a more specific description of integration between monitoring, various analyses, and modeling efforts be provided. A lead investigator, description of the specific data analysis efforts, and deliverables for each data analysis effort should be provided.

A reviewer pointed out that integration and synthesis are very important and there should be requirements for this in the proposal, contract or QAPP. Project coordination among researchers is very important. This project is a fairly intense effort and it is important that the team work closely together to integrate results. Project leaders should participate in regular technical meetings to discuss project issues. Need a dedicated small team to guide the overall effort. Periodic external peer review is important. All panel members agreed that despite good intentions, independent efforts warrant a strong oversight committee.

Recommendation
The QAPP should describe specific data integration and analysis tasks for each project task. The contract should specify language for integration as a subtask for each task.

8. Mud and Salt Sough

Discussion
The reviews suggested some disagreement concerning an appropriate level of emphasis on sampling and analysis at Mud and Salt Slough (Task 4, Monitoring Program). One reviewer felt that the data presented at the May 2002 Peer Review strongly pointed towards Mud and Salt Slough as important sources of nutrients and should be further investigated. Another reviewer pointed out that other researchers have looked at water quality in the SJR channel at Vernalis. These long-term records show chlorophyll is closely tied (inversely) to river flow. He questioned the importance of inoculate coming from Mud and Salt Slough because the overwhelming variability is easily explained by river flow; if the amount of inoculate were important, there should be more unexplained variability. Despite this position the reviewer did not feel strongly about this issue because the inoculate could be fairly constant or also correlated with river flow, which would disguise its importance, and there was general agreement not to change the proposal.

Recommendation
No change in sampling protocol for Task 4.

Table 1. Technical Review Panel Members for: *Monitoring and Investigations of the San Joaquin River and Tributaries Related to Dissolved Oxygen*

Reviewer Information	Expertise	Part of 2002 Peer Review	Review Rec'd
David B. Beasley Professor, Biological and Agricultural Engineering Department, North Carolina State University 214 Weaver Laboratories, Box 7625 North Carolina State University Raleigh, NC 27695-7625 (919) 787-1797 (Home) (919) 515-6795 (Office) (919) 515-6772 (FAX) david_beasley@ncsu.edu	Agriculture/Animal Waste Management Issues/Agriculture Control of Nutrients	Yes	Yes
Alan Jassby Research Ecologist University of California, Davis Department of Environmental Science &Policy *Office: 3126 Wickson Hall* *Phone: (530) 752-7865* *Fax: (530) 752-3350* *email: adjassby@.ucdavis.edu* *Mailing Address: Environmental Science & Policy, University of California, One Shields Avenue, Davis CA 95616 USA*	Algal Growth/Oxygen Demand Dynamics	Yes. Provided written comment	Yes
William F. Ritter Professor Bioresources Engineering University of Delaware Newark, DE Ph.D., Iowa State william.ritter@udel.edu	Agriculture/Animal Waste Management Issues/Agriculture Control of Nutrients	Yes	Yes
William (BJ) Miller Consulting Engineer P.O. Box 5995 Berkeley, California 94705 (510) 644-1811 FAX (510) 644-8278 Bjmill@aol.com	Water Management Issues/Engineering planning studies of water resources/water quality problems. Negotiations of agricultural, environmental, and urban water leaders.	No	Yes

Leonard I. Wassenaar National Water Research Institute P.O.Box 296 Environment Canada Osler, Saskatchewan 11 Innovation Blvd, Saskatoon SOK 3AO Saskatchewan, Canada (306) 239-2270 (306) 975-5747 Len.Wassenaar@ec.gc.ca	Stable Isotope Hydrology/Applications of isotope hydrology for DOC, DON, Nitrate, etc.	No	Yes
Mark Roberson Water Quality Consultant Water Use Efficiency Program California Bay-Delta Authority 650 Capitol Mall, 5th Floor Sacramento, CA 95814	Water Supply/Water Quality Issues, Water/Soil Chemistry	No	Yes

CALFED Ecosystem Restoration Program External Review Form for Directed Action Proposals

Proposal Title: Dissolved Oxygen TMDL Directed Action Proposal for the SJR.

Review:

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Not in all cases, for exampleB-1 paragraph three (P3): the purpose of the study is confusing each sentence seems to "grow" what the proposal will do. Perhaps only the final sentence needs to be in the purpose.

   B-2 P1: this proposal will be integrated with studies and modeling projects – what are these other efforts are they critical for using the information generated from this proposal?

   Is the concept timely and important? Yes, a proposal to obtain water quality information to inform the Stockton DO issue is needed. The Stockton DO issue is widely recognized as important.

2. **Justification.** Is the study justified relative to existing knowledge? Yes, there are known data gaps for SJR water quality

   Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Models are presented for each of the tasks however an integrated model that pulls all the tasks together is lacking. Also, B-12 P4: Task 4 Conceptual Model – not clear how the "snap-shot" sampling compares with the 21 key points identified on page B11. Sampling stations are stated to be used adaptively – what is the criteria for this?

   Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified? This is a data collection effort that is required for future projects

   Does the proposal address specific recommendations and data gaps identified in the Dissolved Oxygen TMDL Studies Draft Peer Review Report (July 1, 2002)? It is not clear in the proposal that the peer review recommendations are adequately addresses. Specifically,

   - B-2 P4: this review recommendation states that more integrated data analysis is desirable - it is not obvious in the proposal.
   - B-3 P2: this review recommendation asks for modelers and scientists to work more closely together – it is not obvious in the proposal.
   - B-4: It was not obvious that the stakeholder recommendations 2-5 were addressed by this proposal

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? This is very difficult to answer, each component seems to merit (some need better explanation) however there is no unifying task.

   Are results likely to add to the base of knowledge? yes

   Is the project likely to generate novel information, methodology or approaches? No

Will the information ultimately be useful to decision-makers? Once compiled and analyzed this information should be useful however, in its current form more work needs to be done to integrate the tasks.

Is the approach consistent with the recommendations identified in the Dissolved Oxygen TMDL Studies Draft Peer Review Report (July 1, 2002)? It is not clear in the proposal that the peer review recommendations are adequately addresses. Specifically,

- B-2 P4: this review recommendation states that more integrated data analysis is desirable - it is not obvious in the proposal.
- B-3 P2: this review recommendation asks for modelers and scientists to work more closely together – it is not obvious in the proposal.
- B-4: It was not obvious that the stakeholder recommendations 2-5 were addressed by this proposal

4. Feasibility. Is the approach fully documented and technically feasible? No it is not fully documented partiuculary

- Task 1 – there is no deliverable associated with it
- Task 2 – there is no deliverable associated with it
- Task 3 – there is no deliverable associated with it

What is the likelihood of success? As currently written each task may be a success but it is not clear that the peer review recommendations will be met.

Is the scale of the project consistent with the objectives? yes

4. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? These are not specifically pointed out

   Is there enough detail as to how the performance measures will be quantified? No.

5. **Products.** Are products of value likely from the project? Yes

6. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? All participants are well qualified.

   Do they have available the infrastructure and other aspects of support necessary to accomplish the project? yes

7. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed? Cost of the project as proposed seems reasonable however it is too difficult to make a statement about the benefit of the information collected

Miscellaneous comments:

My main concern with the proposal is that there is no apparent procedure to tie the information collected together. In particular I do not see an analysis that will relate the data collection effort to the hydrology of the San Joaquin River. If this aspect is covered in other efforts then a specific connection to these efforts should be made, if not then I suggest that new tasks be added to address this component.

By task I have the following concerns

Task 4
There is a reference to hydrologic inputs and outputs but there is no discussion of the temporal distribution – this is a critical piece that needs attention. A modeling effort based on a single year will not satisfy stakeholders.

B-12 P4: Task 4 Conceptual Model – not clear how the "snap-shot" sampling compares with the 21 key points identified on page B11.

B-15, P2: Surface in and out flows are accounted for but what about groundwater? This should be part of the hydrologic underpinning of the proposal.

B-16 P1: Sampling during daylight hours. This may eliminate peaks or valleys associated with tailwater returns.

B-21 P2: Are land use or other changes accounted for when eliminating a monitoring site?

B-22 P2: What are the controls for moving the chlorophyll stations? Are there enough sites that you'll be able to isolate the action and make definitive statements or will this just be anecdotal evidence?

B-25 P6: what database – did I miss something? I would assume that any collected flow data would be verified by the collecting agency – this process should be made clear. If this project is collecting data what O&M and calibration procedure will be used and why can't they rely on the collecting agencies abilities.

B-28 P3: is the problem with year round sampling economics or cost? If it was economics then it would be good to understand how this was arrived at – it can then be used as a criteria for adaptive management.

Task 5. Good hypothesis.

B-43 P2: I think that criteria with expected outcomes should be developed before the perturbation is applied.

B-44 P3: how many times will the dye be used? What are the hydrologic criteria that you are shooting for? Also the two hour sampling seems too spread out to see the peak.

B-45 P1: Can't the ag drains contribute a considerable amount of algae and would it be okay to assume that groundwater and drainage are equals?

B-46 P4: Why is a stirred batch reactor being used to study growth rates when the "field" is a flow through? Should the algae species in the reactors be compared to what is in the field?

B-46 P5: Is there any evidence that trace metals are responsible for controlling the growth, none was presented. Are there other factors that may cause the growth to be limited? What about DO, light, temp, EC?

B-47 P2&3: This experiment does not consider hydrology – since water will convey the algae it must be part of the decision.

Task 6: Good hypothesis

B-55 P3: concerns with how hydrology is being handled. Is there a consistent input data set? This is a recurring problem with the model used for basin level work.

B-55 P4: why is the model being calibrated using only four years? The flow variations on the SJR demand that a longer time period be used. Databases not spreadsheets should be used to house the data.

Task 7: Good hypothesis

This task was not described in a manner that led me to believe that it would generate relevant information.

Task 8: are the dye experiments the same that are used in Task 5?

Please provide an overall evaluation summary rating: Excellent: outstanding in all respects; Good: quality but some deficiencies; Poor: serious deficiencies.

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**
- Excellent	As stated in misc above I do not see the integration of this proposal. I do feel that this effort is worthwhile but the proposal should be updated to ensure that the effort is unified.
- Good xx	
- Poor	

CALFED Ecosystem Restoration Program External Review Form for Directed Action Proposals

Proposal Title: San Joaquin River Dissolved Oxygen TMDL Studies

This proposal is submitted by the San Luis and Delta-Mendota Water Authority. As a Consulting Engineer, I have had that Authority as my major client for a number of years, although my work for them does not involve this issue.

Review:

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? **Yes, the goals are clearly stated a logical, given the problem.** Is the concept timely and important? **Yes, there appears to be a critical need for the information that would be developed by carrying out the work described in this proposal.**

2. **Justification.** Is the study justified relative to existing knowledge? **Yes, in fact the purpose of the work is to fill in gaps in existing knowledge.** Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? **Yes.** Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified? **Yes.** Does the proposal address specific recommendations and data gaps identified in the Dissolved Oxygen TMDL Studies Draft Peer Review Report (July 1, 2002)? **Yes, the proposal is closely tied to these recommendations and data gaps.**

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? **Yes. The approach is logical, starting with upstream sources and linking those sources to downstream effects in the Deep Water Ship channel.** Are results likely to add to the base of knowledge? **Yes.** Is the project likely to generate novel information, methodology or approaches? **That is a possibility, especially concerning the relationships between nutrient loads and algal production and with respect to algal growth and decay.** Will the information ultimately be useful to decision-makers? **Yes.** Is the approach consistent with the recommendations identified in the Dissolved Oxygen TMDL Studies Draft Peer Review Report (July 1, 2002)? **Yes.**

4. **Feasibility.** Is the approach fully documented and technically feasible? **Yes.** What is the likelihood of success? **There would appear to be some considerable challenges in accurately linking up upstream discharges and downstream effects, but this is an inevitable result of such TMDL investigations.** Is the scale of the project consistent with the objectives? **Yes.**

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? **Performance in this case means getting the data collected and analyzed and incorporating these data into appropriate models and testing those models. Appropriate measures in this regard are included.** Is there enough detail as to how the performance measures will be quantified? **Yes.** For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed? **Yes.**

6. **Products.** Are products of value likely from the project? **Yes, but linking upstream discharges with downstream effects of non-conservative constituents will be a challenge.** Specifically for restoration projects, are products of value also likely from the monitoring component? **Yes.** Are interpretative outcomes likely from the project? **Yes.**

7. **Capabilities.** What is the track record of applicants in terms of past projects? **For those participants that I have worked with (McGahan, Brown, Foe) I would have no doubts about**

their ability to perform and manage this work. Is the project team qualified to efficiently and effectively implement the proposed project? **Yes.** Do they have available the infrastructure and other aspects of support necessary to accomplish the project? **Yes.**

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed? **I have no relevant expertise in this area.**

Miscellaneous comments: None, other than the one stated above.

Please provide an overall evaluation summary rating: Excellent: outstanding in all respects; Good: quality but some deficiencies; Poor: serious deficiencies.

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**
- Excellent	**The proposal is logical and thorough. The team is competent. The ultimate goal is ambitious.**
- Good	
- Poor	

CALFED Ecosystem Restoration Program External Review Form for Directed Action Proposals

Proposal Title: CALFED Directed Action Proposal for Monitoring and Investigation of the San Joaquin River and Tributaries Related to Dissolved Oxygen

Review:

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

   The proposal is well written, cohesive, and coherent. The goals, objectives, and hypotheses are well constructed, consistent, and focused on the overall needs for better data and understanding of processes in the SJR. The project's conceptual model is solid, the proposed work is timely, and the potential outputs very important to work in the SJR and beyond.

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified? Does the proposal address specific recommendations and data gaps identified in the Dissolved Oxygen TMDL Studies Draft Peer Review Report (July 1, 2002)?

   The proposal's authors have done an excellent job of justifying the various tasks and sub-tasks based both on what is and what isn't known. The conceptual model, which is much more integrated and focused on the "big picture" than earlier work, is both robust and logical. The data collection efforts will integrate well with laboratory and modeling efforts to remove incompatibilities and drastically reduce wasted effort. The data gaps and specific project recommendations are individually and collectively addressed quite well.

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers? Is the approach consistent with the recommendations identified in the Dissolved Oxygen TMDL Studies Draft Peer Review Report (July 1, 2002)?

   The project's design is both novel and very functional. Integrating all of the needed activities under a large "project umbrella" will allow for a level of data sharing and consistency that has escaped SJR researchers heretofore. Providing an overall project QAPP document from the outset is an extremely good idea. The project has been designed to address the data needs and shortcomings voiced in the Draft Review Report and by stakeholders. The results should absolutely add to the base of knowledge and should also go a long way toward resolving issues that have arisen due to conflicting or incomplete data sets. The integration of the data collection, modeling, laboratory studies, and dissemination efforts could very well produce positive outputs (information, methodologies, approaches) that were not initially included or anticipated. I have no doubt that the cohesive data to be generated in this project will be very useful to planners, decision makers, and many others. I believe the authors of this proposal have done an excellent job in crafting a detailed proposal for addressing the recommendations noted in the Dissolved Oxygen TMDL Studies Draft Peer Review Report (July 1, 2002).

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

   The level of detail and explanation for the tasks and sub-tasks is very good. Obviously, some of the details of implementation will be spelled out in the QAPP document to be constructed

after project startup. The project utilizes state of the art technologies that are proven and that are certainly within the capabilities of the experienced staff that will be conducting the work for the various tasks. The likelihood for success is very high. The project's scale is very substantial and is consistent with the objectives. A high degree of management and adaptation will be necessary in order to accomplish all of the objectives that have been set out for this project.

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

   YES to Question 1 and 2. The project participants will meet regularly (TAC) and will provide quarterly reports to document project accomplishments and problems. The overall structure and operational goal of the project is to utilize a structured adaptive management plan to assess performance and move resources to areas requiring more work and away from areas which are adequately understood or which will not provide additional useful information. Since this is primarily a data collection, cataloging, and knowledge building project, the performance measures will basically be detailed within the QAPP and analysis of the various data streams will determine whether the information being collected or developed is meeting a specific quality measure.

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project?

   YES. Models and data developed for the SJR, its tributaries, and upland areas, as well as various physical process components will have applicability in areas outside the boundaries of the SJR-DWSC project. Interpretive outcomes are likely and will be beneficial for other areas within California and potentially nationwide in understanding the complex processes that interact to produce low oxygen problems in natural and manipulated water courses.

7. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

   The team that has been assembled, in terms of the individuals and their agencies, is impressive. There is no doubt that the individuals and the team are qualified to undertake the work described in this proposal. The overall infrastructure that the participants will provide is substantial and will provide excellent capabilities, in many cases with redundancy, for accomplishing all of the proposed activities. The educational aspects (use of students in for collecting and analyzing data) are very positive. Not only will the project benefit from having capable people working in the field and labs, but the students will benefit from being involved with a large, multi disciplinary, multi agency project that is well defined and managed.

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

   The proposal covers a very large amount of work. The proposal attempts to answer a number of important questions concerning a very complex system that contains both natural and highly manipulated components. The budgetary amount is large. However, in order to satisfy the concerns/recommendations of the Review Panel and the stakeholders, all of the work proposed will have to be accomplished. When looking at individual tasks, the budgets appear to be well thought out and reasonable in nature. I believe the budget is within reason and is appropriate for the work proposed.

Miscellaneous comments:

The work proposed and the means of accomplishing it (multi disciplinary, multi agency, adaptive management structure) is probably unique. This effort may very well provide a new model for dealing with complex, large scale environmental management problems. I am impressed with the clarity of the proposal and the apparent collegiality and collaboration among and between very different agencies and organizations.

Please provide an overall evaluation summary rating: Excellent: outstanding in all respects; Good: quality but some deficiencies; Poor: serious deficiencies.

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**
- Excellent	The work proposed is consistent with findings/recommendations by both the Peer Review Panel and the stakeholder group. The various tasks are well integrated and the management structure is logical in design and should be effective in practice. The budget is adequate for the work proposed and is consistent with the science being applied.
- Good	
- Poor	

Proposal Title: CALFED Directed Action Proposal for Monitoring and Investigation of the San Joaquin River and Tributaries Related to Dissolved Oxygen

Review:

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

The goals are clearly stated in that the project will address recommendations of the peer review panel and stakeholders. The objectives are clearly stated and consistent. The hypothesis for each task is clearly defined. The concept is timely and important.

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified? Does the proposal address specific recommendations and data gaps identified in the Dissolved Oxygen TMDL Studies Draft Peer Review Report (July 1, 2002)?

The study is justified relative to existing knowledge. The proposal addresses data gaps and specific recommendations identified in the Dissolved Oxygen TMDL Studies Peer Review Draft Report . A conceptual model is clearly stated for the different tasks and the basis for the proposed work.

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers? Is the approach consistent with the recommendations identified in the Dissolved Oxygen TMDL Studies Draft Peer Review Report (July 1, 2002)?

The approach for some of the objectives is well designed and for others it could be improved. The algae growth constant measurements for modeling appears to be well designed in Task 5. Task 8 linking the SJR to the DWSC and getting a better handle on what is happening between Vernalis and the DWSC is important. The approach proposed for this task appears to be sound.

Task 6 is on developing a simulation model for the river. At the time of the peer review panel, CALFED was going to enter into a contract for a modeling effort with HydroQual. The question is how does the proposed modeling effort in the proposal tie in with ongoing modeling efforts and is another modeling effort needed. If HydroQual is developing a model, the monitoring data to be collected in the proposed effort would be very useful.

Taking grab samples every two weeks from May to November may miss some of the low DO spikes. There have also been low DO levels measured in the winter. Sampling only once a month is not adequate to define these winter low DO events. The May to November sampling should be done once a week to get a better handle on the nutrient and BOD inputs. During the rainy season , there is no mention of sampling runoff events.

Instead of sampling so many stations it may be better to reduce the number of stations and have more intense sampling. Since previous monitoring has shown that Mud Slough and Salt Slough are major contributors of nutrients and algae, more intense sampling should be done in these subwatersheds to determine the source than what is proposed.

The intensive continuous flow measurements are important to get a better hydrologic budget of the watershed.

I do not feel I am qualified to comment on the methodology for the isotope analysis to characterize BOD fractions and determine their sources. The approach has been used in different studies and appears feasible and may complement the monitoring. The question arises would it be more cost effective to do more intensive monitoring than what is proposed in task 7 if funding is limited.

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

The approach is fully documented and technically feasible. There are a large number of investigators involved in the project. How well everybody communicates and works together will determine the success of the project. The scale of the project is consistent with the objectives.

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

The project is weak on appropriate performance measures. There is not enough detail in the project to determine how performance measures will be quantified.

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project?

Valuable products should be produced from the project. The monitoring data will be important in filling data gaps. It will be important in the monitoring program to analyze data in a timely fashion and report it in a timely fashion, so changes may be made to the monitoring program for the next year.

7. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

The team is qualified to implement the proposed project. The infrastructure and other necessary support are available to accomplish the project.

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

The budget is reasonable for the work proposed.

Overall Evaluation Summary Rating:

Please provide an overall evaluation summary rating: Excellent: outstanding in all respects; Good: quality but some deficiencies; Poor: serious deficiencies.

Overall Evaluation Summary Rating	Provide a brief explanation of your summary rating
- Good	The project objectives and justification are clearly defined. The proposal addresses the peer review panel recommendations. There are some deficiencies in the monitoring in task 4 about the intensity of monitoring. The project performance measures are not clearly defined.

CALFED Ecosystem Restoration Program External Review Form for Directed Action Proposals

Proposal Title: CALFED Directed Action Proposal for Monitoring and Investigation to the San Joaquin River and Tributaries Related to Dissolved Oxygen

Review:

This report comprises my assessment of the "CALFED Directed Action Proposal for Monitoring and Investigation to the San Joaquin River and Tributaries Related to Dissolved Oxygen" that was prepared in response to the Peer Review and Stakeholder Recommendations which were submitted from 1999-2001. The initial peer reviews of July 2002 remain an excellent analysis and expert opinion of the scientific questions that need to be answered to address the DO problems in the Stockton Channel. The 2003 CALFED Directed Action Proposal under consideration is a response and proposed action plan to address the 2002 peer review panel questions.

My understanding of the problem is that seasonal and/or intermittent dissolved oxygen (DO) sags occur in the Stockton channel to such low concentrations oxygen levels (<5 mg/L) as to inhibit or disrupt fish migration to and from the upper reaches of the San Joaquin River watershed. The prevailing scientific hypothesis for the cause of these perennial DO sags is that dissolved or particulate organic matter, primarily in form of algal carbon and phytoplankton remains from the upper reaches of the San Joaquin River, and ammonia originating from the Stockton wastewater treatment plant have a longer residence time in the Channel due to slower water velocities and re-suspension from tidal action. Sedimentation and resuspension of organic matter and the ammonia levels in the channel leads to enhanced water column respiration and DO consumption to reach critically low levels . Hence, the Stockton Channel, which comprises the doorway to the upper San Joaquin watershed, at times becomes a low oxygen barrier to aquatic organisms and fish migration.

The proposed solutions to the Stockton Channel DO problem fall into two categories:

1. Reduction of point and non-point sources of nutrients in the San Joaquin River watershed.

   The hypothesis here is that organic biomass and ammonia in the Stockton channel can be reduced or eliminated by addressing point and non-point sources of nutrients sources upstream in the San Joaquin River. The net result would be a lowering the overall flux of organics and ammonia into the Stockton channel which would, presumably, reduce oxygen demand (BOD) and eliminate the DO sags.

2. Mechanical aeration of the Stockton channel to provide immediate engineered relief.

   This 2003 CALFED proposal partially aims towards Solution 1 by proposing a multi-year monitoring program that will result in a current status loading inventory and predictive hydrologic and mass balance model of algal biomass and nutrient loading and cycling in the San Joaquin watershed along a 100 mile section upstream of the Stockton channel (Objectives 1-6, represented by Tasks 4-8). Solution 2 is not considered in this proposal.

The current proposal argues that a thorough scientific understanding of the origin and fate of potentially oxygen consuming substrates (i.e. nutrients, algal biomass, etc) is essential to provide a baseline status for future remediation efforts along the lines of Solution 1. The research will also attempt to quantify the relative importance of several BOD contributors (algal decay, nitrification) in the watershed. Finally, the monitoring program will identify areas of concern in the SJR and tributaries, where nutrient or algal loadings may be high or originating along this final section of the river system.

The sampling and experimental project tasks in the proposal are solely riverine focused, identifying tributaries or main stem sections of concern. There are no attempts to locate, identify, and quantify point and non-point stressors or effluent emitters in the watershed (industry, municipal, agricultural, of which there are likely very many). This proposal therefore lays basic groundwork for future activities required to

fully address and implement Solution 1. Ultimately, the results of this project may be used in a future project whose goal is to make specific recommendations if, where, and how watershed nutrient reductions may be achieved.

Comments on Specific Tasks

Administrative Tasks

Tasks 1-3. Administrative functions as required. Task 3 QA/QC is absolutely critical to ensure integrity of this project data results, as well provide and a template for future monitoring efforts on the SJR.

Recommendation: Approve, as presented

Scientific Tasks

Task 4. Monitoring Program

Task 4 is the centerpiece of the proposal by providing the key and crucial monitoring data required to assess all forms of potentially contributing oxygen consuming constituents in the SJR watershed. The scope, goals and objectives , and sampling program of Task 4 are very well designed, and will characterize the loading of all conceivable BOD contributing components in the SJR and tributaries flowing to the Stockton channel. The logistics and rationale for sampling locations and sampling frequency provide are well justified, and are fully in line with specific recommendations and data gaps identified in the Dissolved Oxygen TMDL Studies Draft Peer Revie w Report. The budget, while costly at first glance, is entirely justified and reasonable to cover an ambitious multi-year field sampling program, to acquire needed specialized field equipment, and to cover the significant analytical parameter costs. Task 4 will provide the much needed baseline information required to design future SJR river nutrient remediation strategies. The project PI has a good track record of grants and refereed scientific publications and therefore the project will likely be successful. They appear to have available the infrastructure and other aspects of support necessary to accomplish the project in a timely manner.

Recommendation: Approve, as presented

Task 5. Independent Measurement of Constants used in algal growth models of importance to the load allocation process

Task 5 proposes to examine various aspects of algal dynamics in the SJR at various strategic locations in the watershed. These aspects include algal growth rates, species composition, effect of light on algal growth, effect of nutrients, and biodegradation rates. The proposal is fairly academic in its scope and goals, and while interesting and useful from a scientific perspective, I have 2 concerns at this stage. First, this project seems premature, and in my opinion should be implemented if and only if Task 4, 6 and 7 collectively identify that upstream algal dynamics are truly an important factor to consider. Finally, this project could be improved through better linkages with Task 7. Algal carbon dynamics are inextricably linked to inorganic water carbon and isotope chemistry cycle. Incorporation of carbon isotope techniques both in algal carbon source identification and downstream linkages (see Task 5.7) and degradation experiments would be a highly valuable and relatively easy addition.

Recommendation: Delay, until Task 4 and 6 have results to justify it. Then, work in stable isotope tracers on the linkages component of Task 5.7. Adjust budget accordingly.

Task 6. River Modeling

Task 6 combines the data generated from Task 4 with ongoing hydrologic logic flow data collections from other agencies, and adding environmental parameters to attempt to model and predict seasonal nutrient and algal flux to the DWSC. Task 6 is therefore inextricably linked to the outputs of Task 4, and is crucial to

providing managers with a graphical, verifiable, conceptual model of algal and nutrient dynamics and fluxes. Fortunately, existing model codes will be modified to accommodate the current modeling requirements. Hence, the budget is reasonable. In the future, this model may be used to predict what might happen if Approach 1 is implemented and a basin management decision is made to reduce point and non-point sources of nutrients in the SJR. I cannot comment of the expertise of the consulting firm staff because I am not familiar with the company – this must be a local decision.

Recommendation: Approve, as requested

Task 7. Characterization of BOD Fractions and their Sources

The main objectives of Task 6 are to employ elemental C/N ratios and naturally occurring stable isotope tracers of ^{13}C and ^{15}N to characterize the DOM and POM (comprising algal biomass and degradation components versus soil carbon) and to fingerprint nutrient processing in the SJR. Nitrate isotopes are proposed to establish the linkages between N-bearing nutrients and algal production. This isotope tracer approach has proven to be a very powerful tool to assess algal and nutrient sources in other watersheds, and the proposal presented here shows intriguing pilot data from the SJR revealing a direct linkage between nitrate sources and algal nitrogen isotopic composition. These pilot data also reveal that groundwater nitrate inputs may be significant nutrient component to the SJR that fosters algal activity, thereby implying that a nutrient reduction strategy for the SJR to alleviate algal carbon fluxes to the DWSC may be more complicated than previously anticipated.

Task 6 has strong linkages and dependencies on Task 4 for sample collections. The project PI has an excellent track record of grants and refereed scientific publications and therefore the project will likely succeed. The USGS has available the needed isotope laboratory infrastructure and specialized sample preparation procedures to accomplish the project in a timely manner.

Recommendation: Approve, as requested. However, I would recommend that Task 7 group re -write the proposal and enhance the budget to incorporate dissolved oxygen isotope systematics as outlined below in Suggestion 2.

Task 8. Linking the SJR to the DWSC

The goal of Task 8 is to determine the cause of the decrease in chlorophyll and other organic matter in the lower sections of the SJR and the Stockton channel. The work proposed also includes algal species determinations and respiration and photosynthesis experiments.

This project appears to have significant duplication with the work proposed in Task 5 and Task 6. I have difficulty rationalizing why Task 8 requires a separate project from Task 5 (can these not be combined?). Further, as with Task 5, I would argue such a level of detailed study is premature prior to assessing the Year 1 outcomes of Task 4 and Task 6 and Task 7. Similarly, I foresee great added value in the group working more closely with Task 7 to incorporate important stable isotope tracers in their experiments.

Recommendation: Delay, until Task 4 and 6 have results to justify it. Then, employ stable isotope tracers on the linkages component of Task 8.3 and 8.4. Adjust budget accordingly.

Task 9. Summary

I feel it is vital that the various Task PI's meet regularly (say, 2x per year) to review their progress and to begin to synthesize their findings as soon as possible. As data is collected and interpreted there may be opportunity to adjust the research priorities, adding or dropping components as required and hypotheses change. It would be a great pity if the various Task Members simply stapled together their individual project results without talking, an altogether too common scenario in such large endeavors.

Miscellaneous Comments

The "2003 CALFED Directed Action Proposal for Monitoring and Investigation to the San Joaquin River and Tributaries Related to Dissolved Oxygen" is a big step in the right direction to try to solve the problem of DO sags in the Stockton channel. With some refinements and adjustments to the scientific program, progress will definitely be made.

However, I have 2 specific suggestions that I would like to see addressed:

Suggestion 1

The entire project is implicitly headed in the direction of Solution 1. However, Solution 1 contains many unverified hypotheses concerning the sources of nutrients, riverine nutrient cycling and the drivers of DO sags, and so will require years of research, future stakeholder input, additional projects, funding, and time to implement. There is the possibility that Solution 1 may not be feasible despite regulatory controls . For example, if groundwater derived nutrients are a key source of the algal problem (as pilot results in Task 7 suggest) then the problem may require decadal scales or longer to fix. Therefore, I cannot see why alternate, low cost, engineered solutions are not concurrently being tested. I was disappointed that the engineered aeration approach (Solution 2) is not part of this project an experimental test. Direct aeration strategies are successfully being used in other jurisdictions, albeit as regulated short-term fixes, to unanticipated DO sags caused by industry (e.g. Pulp and Paper industry in Alberta, Canada). For the $8M proposed to be spent here, I think it would be prudent to reallocate some funds for a direct aeration test project.

Suggestion 2

What is happening to DO in the DWSC?

Missing entirely from this project is any direct research on DO as a chemical species and dissolved gas. While DO concentrations in surface water are governed by temperature dependent solubility constraints , it is ultimately controlled by 4 other key inter-related factors:

1. Gas exchange with the atmosphere – an oxygen input
2. Photosynthesis – an oxygen input
3. Community respiration (e.g. nitrification, algal and organic matter oxidation) – an oxygen sink
4. Dilution by anoxic groundwater. – lowering of DO, an apparent oxygen sink

The assumption in this CALFED proposal is that the DO sag in the DWSC is entirely caused by 3) above. It is entirely possible that community respiration in the SJR and DWSC is relatively constant at any point in time, and that the sag is caused by reduced gas exchange due lower velocity. Or photosynthesis may be a significant contributor of oxygen to the SJR, and reducing the algal load may in fact reduce DO levels even further if ammonium is not removed. All of these and other combinations of possibilities exist, and these cannot be discerned whatsoever by looking at DO concentration trends alone.

Since 1999 DO stable isotope tracers have been employed as a powerful tool to decipher and quantify all 4 factors above. I cannot imagine a study of DO without using DO isotopes as a tracer. I would suggest that Task 7 group (eminently qualified to implement a DO isotope approach) re-write its proposal and budget to include isotope tracers of DO to quantify the processes governing DO in the SJR and DWSC. Further, if engineered aeration is tested, there is another opportunity to examine DO residence time relative to other chemical constituents in the DWSC. The manufacturing process of pure O_2 results in a widely separated O_2 isotope composition from natural levels, thereby providing another unique isotope tracer opportunity to look at DO in the channel.

Please provide an overall evaluation summary rating: Excellent: outstanding in all respects; Good: quality but some deficiencies; Poor: serious deficiencies.

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**
- Excellent	See comments above .
XXX - Good	
- Poor	

CALFED Ecosystem Restoration Program External Review Form for Directed Action Proposals

Proposal Title: CALFED Directed Action Proposal For Monitoring and Investigation of the San Joaquin River and Tributaries Related to Dissolved Oxygen

Review:

1. **Goals.** Are the goals, objectives and hypotheses clearly stated and internally consistent? Is the concept timely and important?

Largely, goals and objectives are clearly stated. Hypotheses are sometimes posed awkwardly, but this is due to the inappropriateness of asking for a hypothesis for every proposal, regardless of its nature. The concept is certainly timely and important, with low DO in the DWSC a long-time and persistent problem.

2. **Justification.** Is the study justified relative to existing knowledge? Is a conceptual model clearly stated in the proposal and does it explain the underlying basis for the proposed work? Is the selection of research, pilot or demonstration project, or a full-scale implementation project justified? Does the proposal address specific recommendations and data gaps identified in the Dissolved Oxygen TMDL Studies Draft Peer Review Report (July 1, 2002)?

The study is mostly well-justified, but there are some conceptual problems outlined in #3 and detailed along with others in the miscellaneous comments.

3. **Approach.** Is the approach well designed and appropriate for meeting the objectives of the project? Are results likely to add to the base of knowledge? Is the project likely to generate novel information, methodology or approaches? Will the information ultimately be useful to decision-makers? Is the approach consistent with the recommendations identified in the Dissolved Oxygen TMDL Studies Draft Peer Review Report (July 1, 2002)?

Although the proposal as a whole has no lethal defects, several deficiencies are present, some of which represent an inadequate response to the peer review. These deficiencies can be corrected within the existing framework and funding of this proposal should therefore not be delayed on this basis. The major deficiencies can be outlined as follows. Please see miscellaneous comments for more details:

(i) Algal productivity is light-limited, primarily by inorganic particles, over large parts of this region. Moreover, there are long-term, declining trends in these particles, with a concomitant increase in clarity. This project could benefit from more emphasis on understanding implications of mineral particle trends and variability on algal productivity. If proposed mitigation measures for flow, aeration, or nutrient control also affect mineral particle concentrations, then the results may be different from expected.

(ii) Channel Point is a poor place for characterizing material inputs to the DWSC. It is affected by tidal dispersion and upstream transport of materials from the DWSC. A site should be chosen above the tidal influence of the DWSC--at least 3 km upstream of Channel Point--to serve this purpose. (An additional site between this proposed site and Lathrop should also be considered.)

(iii) The adequacy of winter sampling should be reconsidered, especially with regard to the ability to understand winter low DO events.

(iv) Some effort should be made to incorporate estimates of zooplankton grazing into the mass balances and models. There is a potential for a large effect that could sabotage interpretation of experiments and monitoring data. The same is true of benthic grazing.

4. **Feasibility.** Is the approach fully documented and technically feasible? What is the likelihood of success? Is the scale of the project consistent with the objectives?

Although the documentation is not universally adequate (see miscellaneous comments), the approaches are feasible and of appropriate scale insofar as one can tell from the proposal.

5. **Project-Specific Performance Measures.** Does the project include appropriate performance measures to measure success relative to the project's goals and objectives? Is there enough detail as to how the performance measures will be quantified? For restoration projects, are monitoring plans explicit and detailed enough to determine if performance measures will be adequately assessed?

The individual tasks provide information on reporting, outreach, and other forms of disseminating results. Certainly what they promise is appropriate.

6. **Products.** Are products of value likely from the project? Specifically for restoration projects, are products of value also likely from the monitoring component? Are interpretative outcomes likely from the project?

There is little doubt that valuable results will be obtained from most of the tasks outlined in this overall project.

7. **Capabilities.** What is the track record of applicants in terms of past projects? Is the project team qualified to efficiently and effectively implement the proposed project? Do they have available the infrastructure and other aspects of support necessary to accomplish the project?

The PIs are all capable, many of them outstandingly so, and a high level of performance and responsibility can be expected. Insofar as can be discerned from this proposal, the necessary support and infrastructure are there as well.

8. **Cost/Benefit Comments.** Is the budget reasonable and adequate for the work proposed?

It is very difficult to evaluate the budget details within the timeframe of this review process. There do not appear to be any obvious or gross problems.

Miscellaneous comments:

(by page number in the proposal)

B-5: The 'objectives' and 'research questions' emphasize the effect of inoculum size and nutrients on loads to the DWSC, but they fail to mention mineral particles and the effect on light availability for phytoplankton. Given that phytoplankton in at least the downstream part of the study area is light-limited, variability in transparency is a more important control than nutrients at present on algal loads to the DWSC. The inclusion of inoculum size is a welcome addition to this project.

B-11: It is unfortunate that the monitoring program contains no stations on the San Joaquin River between Channel Point and Lathrop. This is a substantial distance, within which much turnover of organic materials may be taking place. Moreover, as pointed out in past reviews, Channel Point is a very poor end-member for these studies. It is no doubt susceptible to DWSC water quality through tidal dispersion. A station upstream of DWSC influence will be much more valuable. French Camp poses somewhat of a problem, as it enters around the point where the DWSC effect should be diminishing.

B-13: The integration of monitoring effort represented in this task is indeed a major improvement over previous work in this project and shows great promise in resolving some of the contradictions encountered in past years.

B-14 and Table B-1: Criteria (1) calls for more stations between Lathrop and Channel Point. It may be that cost or site access weighed against the use of additional sites here, but at least one and preferably two more stations should be considered upstream of French Slough. Otherwise, it may not be possible to complete even a proper mass balance of this important section of the river.

B-15 and Table B-2: Depth-integrated phytoplankton productivity depends on the visible light extinction coefficient. Although turbidity is being measured, it is not directly convertible to extinction coefficient. Given the importance of the light field for phytoplankton photosynthesis and organic matter production in this system, a more direct measure of extinction coefficient is also recommended.

B-15: The low DO incident this past February 2003 (less than 1 mg/L in bottom waters) shows that the problem needs to be addressed in winter as well as summer. The continuous monitors for DO and pH will be in operation from May-October at stations upstream of Mossdale, but apparently not in winter. Furthermore, winter discrete sampling will be at a lower frequency than in summer. It is understandable that the highest frequency should be used in the season of most importance, but the PIs really have to ask themselves whether the current winter sampling frequency will be sufficient to understand the problem. There are many possible overall choices in this program about the use of resources and the PIs need to choose stations and sampling frequency that will provide definitive answers.

B-21: The flexible approach to monitoring is commendable; it should help this program achieve efficient use of funding. This applies both to fixed station sampling frequency and to the movable fluorescence and turbidity monitors.

B-23 (also tasks 5, 7 and 8): The monitoring program has no provision for measurement of zooplankton and benthos. The possible and even probable importance of primary consumers in the form of planktonic and benthic organisms has been brought up in past reviews. The only attempt to address this issue is a short statement on B-48 that task 5 will "also generate information on the amount of zooplankton biomass at different locations…needed to estimate the impact of zooplankton grazing on algal biomass loss in the SJR." There is no mention of any details of sampling methods, sampling frequency, or analysis. At least these PIs recognize the issue, which does not appear in any of the other tasks. Benthic organisms are not mentioned at all, despite their known importance in this and many other systems. I cannot understand the omission at this mature stage of the project. The program should have involved specialists in these areas by now. I would recommend transferring funds for at least some exploratory sampling of zooplankton and benthic organisms, in order to estimate biomass and feeding rates or metabolic needs. This could be done as part of the basic monitoring program or in conjunction with one of the other tasks, perhaps also in coordination with some of the existing DWR or USGS programs.

B-31: This task proposes to use the diel DO cycle for estimating algal growth, but this method cannot properly distinguish between algal and non-algal respiration, nor can it correct for community respiration by using nighttime DO declines as phytoplankton respire at different rates in the light and dark. If the estimates are used for model calibration, then the model terms will not represent what they claim to be.

B-36: Some of the methods descriptions are too generic to be informative or reassuring, especially the description of data analysis. At least the need is recognized for a more thorough and coordinated use of the great amount of historical data in conjunction with the studies proposed here. The only information on implementation is that "data compilation and analysis will be a joint effort among Summers Engineering, DWR-IEP, and LBNL". One hopes that the PIs will follow through with a sincere effort in this direction.

B-43: It is not made clear how apparent algal growth rates will be calculated in this task 5.1. Is it simply via a mass balance, i.e., biomass transport at downstream site minus biomass transport at upstream site divided by intervening surface area? In that case, there is a questionable assumption about the lack of losses to consumers. Wouldn't it be more informative to make independent estimates of primary productivity as well and then examine the difference between the two estimates? I **have the same question and concern about 5.3.**

A separate issue is the decision to focus on Salt and Mud Sloughs in Year 1. Given that the importance of these areas has not really been established, wouldn't it make more sense to focus on a reach of the system that we know is important and where there are unexplained changes in algal concentrations, e.g., between Vernalis and the DWSC?

B-45: Once again, the interpretation of experimental results is going to rest on the assumption "that algal herbivory is negligible relative to the standing crop." The PIs need to understand that this is an assumption of convenience for them, not one based on understanding from this system or other similar ones. The failure to deal with this term explicitly is going to cast a shadow over interpretation of this and other related experiments and may prevent a definitive answer from this expensive proposal.

B-46: It is difficult to understand how the results of task 5.4 will be useful. The species composition that develops is probably not going to look anything like the original community, perhaps resulting in generic growth rate data that could be obtained from the literature more easily. Even the maximum yield may be of little value, because the water is so replete in nutrients that the cultures could become light-limited before the limiting nutrient is completely utilized. This would also make it difficult to interpret the results of task 5.5, because all residual nutrients may be plentiful. Simply examining existing ambient water and particle chemistry data may give at least as good an indication of limiting nutrients. In any case, if these experiments are to be useful, the investigators must take steps to avoid premature light limitation, perhaps by using very shallow cultures.

It also needs to be recognized that the actual results of any nutrient control strategy are going to depend in part on the level of light limitation. Algal growth is probably light-limited in at least the downstream part of the region under study. Even if it were possible to decrease nutrient levels to the point where they limit growth rate in the lab, they might not do so in the field. A related issue is the effect of any water treatment practices on transparency. Nutrient control technologies can also affect mineral particle concentrations and therefore transparency. It could be counterproductive to institute practices that removed nutrients but increased transparency. These experiments should address the transparency issue, and in fact, it needs to be an integral part of the entire project.

B-47: This kind of experimental manipulation is to be commended, but I wonder if more could be learned also from the historical data. Wasn't the San Luis Drain discharge closed for a period during DWR's instrumental record? If so, then maybe the signal at Vernalis or Mossdale could tell us if it were important at all, or if it was completely disguised by flow variability.

B-48: I do not recommend following previous DWR procedures for phytoplankton enumeration. There are unresolved questions about these techniques and the existing record suffers from identification only to the genus level; from a lack of reliable information on the smaller taxa; and possibly from imprecision. I also do not understand the statement that "samples of river sediment may be more representative of the SJR's true algal community than water column samples". No doubt, the sediment contains meroplanktonic species, as well as specimens and decomposed remains of truly planktonic species, but how can it be said to be more representative?

B-50: Again, it could be misleading to use the "community fingerprint" at Channel Point as an indication of upstream material transported to the DWSC. Channel Point samples probably also represent material from the DWSC.

B-58: The use of isotope and molecular biomarker techniques is overdue for this problem. The only cautionary note is the potential difficulty of getting adequate source characterization. Cloern and

others (Limnol. Oceanogr. 2002) looked at C-N isotopes as biomarkers for tracing the origins of organic matter in this system and found that the high variability within all organic matter pools impeded the application of this technique. On the other hand, this is only one of several ways of looking at the problem in this project. The potential is there for it to provide useful complementary results that may help resolve ambiguities in other tasks.

B-77: The attention to summary reports and the emphasis on conciseness and clarity are welcome, particularly in reference to past attempts to summarize the progress of the overall TMDL project.

Please provide an overall evaluation summary rating: Excellent: outstanding in all respects; Good: quality but some deficiencies; Poor: serious deficiencies.

Overall Evaluation Summary Rating	**Provide a brief explanation of your summary rating**
Good	The proposal covers almost all important points raised in previous reviews of this project and shows promise of resolving the outstanding issues. A few issues require more attention by the PIs.