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Secretary for
Environmental Protection

California Regional Water Quality Control Board
Colorado River Basin Region

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Arnold Schwarzenegger
Governor

January 20, 2010

Dr. Steven C. Chapra
Department of Civil and Environmental Engineering
Tufts University
Anderson Hall – 200 College Avenue
Medford, MA 02155

Dear Dr. Chapra:

SUBJECT:	**RESPONSE TO PEER REVIEW COMMENTS REGARDING TMDL AND IMPLEMENTATION PLAN FOR DISSOLVED OXYGEN FOR THE FIRST TWELVE MILE SEGMENT OF THE NEW RIVER DOWNSTREAM OF THE INTERNATIONAL BOUNDARY**

Thank you for reviewing and commenting on the draft "Total Maximum Daily Load (TMDL) and Implementation Plan for Dissolved Oxygen (DO) for the First Twelve Mile Segment of the New River Downstream of the International Boundary" Staff Report (hereafter "TMDL Staff Report"). Our responses to the comments you provided in a letter, dated April 29, 2009, are set forth below. The page numbers of your comment letter are noted in parentheses for reference. Sectional headings used in your review, which are based on our peer review request and the TMDL Staff Report, are also provided for clarity.

In addition, Tetra Tech Inc. revised Appendix F in the TMDL Staff Report "New River QUAL2K Water Quality Model for the New River Dissolved Oxygen TMDL" (hereafter "Modeling Report") to address your comments. A copy of the revised Modeling Report is enclosed with this letter for reference. Also enclosed is a copy of a revised draft TMDL Staff Report, which reflects the changes made to the report based on your comments.

1. PROJECT DEFINITION AND WATERSHED DESCRIPTION

Comment 1 (p. 1):
"The section on the Project Definition is clearly written and no technical issues were identified."

Response:
Thank you.

Comment 2 (p. 1):
"The Watershed Description was also well-written. However, it included little description of the river's morphometry and ecology. Thus, I had to rely on the model run files to better understand the river's physics, chemistry and biology."

Response:
We have revised Chapter 2: Watershed Description of the TMDL Staff Report to include more information on the New River's morphometry and ecology to address your comment and better describe the New River's characteristics.

2. DATA AND SOURCE ANALYSIS

Comment 3 (p. 2):
"The source analysis appeared reasonable. However, the water-quality data seemed quite meager. In particular, the lack of sufficiently detailed information for many water-quality variables was striking."

Response:
The TMDL is based on best available data. More data can be viewed at:

http://www.waterboards.ca.gov/coloradoriver/water_issues/programs/new_river/dataindex.shtml

While we acknowledge that the TMDL Staff Report has data gaps, Regional Board staff, USEPA, and USIBWC are continuing monitoring. As stated in the Implementation and Monitoring Plan sections of the Revised TMDL Staff Report, the monitoring will address the data limitations, which will enable the TMDL to be refined. The TMDL will be regularly reviewed and revised as necessary when more information and data become available. The Triennial Review process that the Regional Board conducts ensures that

the TMDL is regularly reviewed to determine its adequacy, as discussed in the Implementation Plan.

3. CRITICAL CONDITIONS AND SEASONAL VARIATIONS

Comment 4 (p. 2):
"This section, which describes the critical condition/seasonality with the strongest impact on organic matter loading, was somewhat vague. This may be due to the meager data available to adequately assess seasonal variations."

Response:
Please see the response to Comment 3.

Comment 5 (p. 2):
"I think that the statement at the end of the section is poorly worded: 'Because the materials that cause low DO may stay in the New River for few months, controlling these materials throughout the year is important.' Because the river has such a short travel time (a few days according to the model run files), I would think that there would not be great carry over of loadings from season to season. However, if the statement is referring to the deposition of organic matter to the sediments, the conclusion is justified. In addition, I agree that the system should be managed on a whole-year basis based on (a) the oxygen data (which does not appear to exhibit strong seasonal variability) and (b) the fact that the cooler winters have lower flows."

Response:
The statement at the end of this section will be revised to read as follows:

"Because the materials that cause low DO may stay in the New River for a few months due to deposition of organic matter to the sediments, controlling these materials throughout the year is important. In addition, the New River flows at IB should be managed on a whole-year basis based on (a) the oxygen data (which does not appear to exhibit strong seasonal variability) and (b) the fact that the warmer months have lower flows."

4. NUMERIC TARGETS

Comment 6 (p. 2):
"The numeric target for dissolved oxygen for this TMDL is the standard 5 mg/L that is routinely used to protect aquatic life in warm-water rivers across the United States."

Response:
Comment acknowledged.

5. TMDL CALCULATION AND ALLOCATIONS AND LINKAGE ANALYSIS

Comment 7 (pp. 2-3):
"This review is intended to address several key model-related issues that bear on the adequacy of the TMDL calculation:
1. Was the model applied in a technically competent and ethical manner?
2. Was the model adequately calibrated and validated?
3. Is the resulting tool adequate to determine the oxygen TMDL?"

1. Technical competence and integrity of model application.

"The application appears to have been implemented in a technically competent and ethical fashion. I could uncover no major flaws in the model application process outlined in the report and exhibited in the data files. In addition, modelers performed the sequence of tasks that I expect to see in a sound modeling exercise:

"1. Specification of boundary conditions and loadings.
2. Calibration and validation of physics (in particular, comparison of model-simulated travel time with measurements).
3. Calibration and validation of biochemistry with particular emphasis on mechanisms closely related to the quality variable of concern (in this case, dissolved oxygen).

"Because of the data-poor nature of this study, these three steps required more professional judgment than is typically necessary for such exercises. I, therefore, checked their choice of kinetic parameters carefully and found none that were beyond the typical range of literature values. Further, there was no indication that the analysts chose parameters in order to bias the outcomes. Therefore, I concluded that the model was applied in a technically, competent and honest manner."

Response:
Comment acknowledged. Thank you for your detailed review of the New River DO TMDL Model.

2. Adequacy of model calibration and validation.

Comment 8 (pp. 3-4):
"Model calibration and validation are usually critical for establishing the credibility of water-quality models. This assertion stems from the fact that biological and chemical mechanisms are typically more uncertain and difficult to quantify than physical processes. Consequently, given an adequate representation of the system's transport, the credibility of most water-quality models hinges on the quantity and quality of system-specific biological and chemical data (Chapra 2003).

"Because the data available for the present application is meager to say the least, I originally suspected that the resulting calibration/validation would be highly uncertain. Further, regardless of the data, the validation itself was also not very convincing because the validation conditions were quite similar to those of the calibration.

"However, as I learned more about the characteristics of this system, I have revised these conclusions. This relates to the fact that the actual level of required data also depends on the (1) nature and complexity of the system being modeled and (2) the type of management questions being addressed. For the present case, because both the system and the management question being addressed are relatively simple and straightforward, the current model application is adequate to develop a TMDL for dissolved oxygen. This conclusion is based on a [sic] two observations:

1. The system's short travel time (<2.5 days) means that there is not sufficient time for reactions to dominate. Therefore, the system's oxygen regime is primarily dictated by the exogenous forcing functions; that is, the upstream boundary condition (U.S./Mexico border) and loadings (U.S. point sources).
2. The system is sufficiently deep and turbid that attached plants do not seem to be important. The absence of high plant activity means that the TMDL is primarily governed by bacterially-driven oxidation processes. If this were not the case, the calculation would have been complicated by the additional consideration of plant-driven photosynthesis and respiration. Thus, much more information (e.g., nutrient and plant biomass concentrations as well as diel data) would have been essential to adequately assess the model's efficacy. [Footnote 1—It should be noted that if control measures significantly reduce the river's turbidity, plant activity could become more dominant in the future. Hence, as suggested below, some monitoring should be directed towards assessing whether this is occurring.]

"These two observations imply that at this juncture the system is primarily physically rather than biochemically driven. Hence, the model predictions will not be as sensitive to kinetic parameter variability as it is to the system's physical regime (travel time and weirs) and forcing functions (boundary condition and loadings). Consequently, model credibility should be more correlated with the adequacy of the characterization of the physics and forcing functions than on the kinetics.

"These points are reinforced by inspecting the model calibration simulations. As in Figure 1 [copy of Fig. 3-3 from Tetra Tech (2007) [Appendix F in TMDL Staff Report] showing oxygen calibration for the New River on July 17, 2006], the boundary condition induces the low oxygen levels in the upper portion until the inflows and weirs start to induce step changes in the oxygen profile as the water flows downstream."

Response:
We agree that based on the modeling results, Regional Board staff's inspections and observations of the New River, and its evaluation of monitoring data, the New River appears to be primarily a physically-driven system rather than a biochemically-driven system for the reasons you stated.

3. Adequacy of model to determine the oxygen TMDL.

Comment 9 (p. 4):
"Because of the aforementioned characteristics, I conclude that despite the small amount of data, the reported Q2K application is an adequate tool to specify the proposed oxygen TMDL for the New River. Put another way, I believe that if the boundary conditions and forcing functions are changed (as in the proposed TMDL), the model provides a sufficiently accurate estimate of the resulting improvements in dissolved oxygen."

Response:
Comment acknowledged. Also, please see the response to Comment 3.

6. IMPLEMENTATION PLAN

Comment 10 (p. 4):
"I think that the implementation plan appears reasonable. I especially liked the cooperation between the U.S. and Mexico which appears essential to achieve the project's objectives."

Response:
Comment acknowledged.

7. MONITORING PLAN

Comment 11 (pp. 4-5):
"Although the proposed monitoring plan is generally adequate for detecting seasonal trends, I would suggest that soluble reactive phosphorus (i.e., inorganic P), total phosphorus and chlorophyll *a* also be measured to provide a more complete representation of the system's future state. I recommend these measurements because I would anticipate that as the river is cleaned up, it might move from autochthonous bacterial-driven system (i.e., organic carbon/nitrification) to a more autochthonous plant-driven system. In particular, if the remedial measures improve light penetration, sections of the river might become dominated by phytoplankton and/or attached plants.

"If such a shift were in fact to occur, it could result in daily variations becoming more critical than seasonal trends of daily averages. Consequently, it would probably be prudent to measure daily variations in several of the water-quality variables. At the minimum, two samples can be collected at dawn and dusk which are typically when extreme values occur for plant-influenced parameters such as oxygen and pH. An even better approach would employ setting out several data sondes to measure key water-quality variables (e.g., temperature, oxygen, pH, conductivity and turbidity) on a diel basis at critical points along the system. These would not have to necessarily be run continuously for the entire year, but could be deployed for several days at critical times during the year."

Response:
We acknowledge that water quality results are influenced by the time of sampling. Sampling of the New River is generally done in the mornings. The timing varies among sampling dates due to constraints in resources. We will revise the Monitoring Plan to include high frequency and more constituents, such as total and inorganic phosphorous, to be monitored as resources allow. The use of continuous monitoring equipment has been considered in the past, but the idea was dropped because of concerns about vandalism since the area in which the monitoring equipment would be located is used by homeless persons and possibly illegal immigrants. Also, please see the response to Comment 3.

CONCLUSIONS

Comment 12 (p. 5):
"Based on my examination of the provided materials, I conclude that the Q2K model was applied to the New River in a technically competent and ethical manner. Although the quantity of data was less than normally required, I believe that the model was adequately calibrated to provide a reasonable estimate of the impact of load reductions on seasonal concentrations of dissolved oxygen. Consequently, I conclude that the resulting tool is adequate to determine the oxygen TMDL."

Response:
Comment acknowledged. Also, please see the response to Comment 3.

Thank you again for reviewing and commenting on the draft New River Dissolved Oxygen TMDL Staff Report. If you have any further comments or concerns, please contact Francisco Costa at (760) 776-8937, or me at (760) 776-8942.

Sincerely,

Nadim Zeywar
TMDL Unit Chief
California Regional Water Quality Control Board
Colorado River Basin

Enclosures:

- Revised Draft "Total Maximum Daily Load (TMDL) and Implementation Plan for Dissolved Oxygen (DO) for the First Twelve Mile Segment of the New River Downstream of the International Boundary" and Appendices.
- Revised Modelling Report in Appendix F: : "New River QUAL2K Water Quality Model for the New River Dissolved Oxygen TMDL"
- Steven C. Chapra's letter dated April 29, 2009.

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Arnold Schwarzenegger
Governor

January 20, 2010

Professor David K. Stevens
Civil and Environmental Engineering
Utah Water Research Laboratory
8200 Old Main Hill
Logan, UT 84322-8200

Dear Professor Stevens:

SUBJECT:	**RESPONSE TO PEER REVIEW COMMENTS REGARDING TMDL AND IMPLEMENTATION PLAN FOR DISSOLVED OXYGEN FOR THE FIRST TWELVE MILE SEGMENT OF THE NEW RIVER DOWNSTREAM OF THE INTERNATIONAL BOUNDARY**

Thank you for reviewing and commenting on the draft "Total Maximum Daily Load (TMDL) and Implementation Plan for Dissolved Oxygen (DO) for the First Twelve Mile Segment of the New River Downstream of the International Boundary" (hereafter "TMDL Staff Report"). Our responses to the comments you provided in a letter, dated December 15, 2008, are set forth below. The page numbers of your comment letter are noted in parentheses for reference. Sectional headings used in your review, which are based on our peer review request and the TMDL Staff Report, are also provided for clarity.

In addition, Tetra Tech Inc. revised Appendix F in the TMDL Staff Report : "New River QUAL2K Water Quality Model for the New River Dissolved Oxygen TMDL" (hereafter "Modeling Report") to address your comments. A copy of the revised Modeling Report is enclosed with this letter for reference. Also enclosed is a copy of a revised draft TMDL Staff Report, which reflects the changes made to the report based on your comments.

EXECUTIVE SUMMARY AND CONCLUSIONS

OVERARCHING QUESTIONS:
Questions presented by Regional Water Board staff in the Peer Review Request Letter, dated November 18, 2007.

Question a. In reading the staff technical reports and proposed implementation language, are there any additional scientific issues that are part of the scientific basis of the proposed rule not described above? If so, please comment with respect to the statute language given above.

Comment 1 regarding overarching question a (p. 2):

"At this stage of the TMDL process for the New River, it appears that the important scientific/engineering issues have been addressed in the draft report. It is clear that the primary issue of the New River TMDL is to obtain an agreement with Mexico to add to and improve wastewater treatment in Mexicali. The degree to which the wastewater is to be treated is a detail that will likely be negotiated with regard to the ability to pay on the part of the City of Mexicali, higher level support from the government of Mexico, and the ability and willingness to cost share on the part of the United States and the state of California.

The level of treatment recommended based on the modeling results is expensive and the negotiation is likely to be delicate. When that stage is reached, the modeling work will likely need to be revisited to recalibrate with more extensive data sets designed specifically for that purpose. It is one thing to calibrate a model with one or two locations along a long river reach - with so many parameters the water quality targets can be predicted more or less exactly with a variety of combinations of model parameters. This, however, does not provide an adequate test for future conditions. For example, if the load at the international border is reduced to levels required by the model, it is likely that the sediment oxygen demand (essentially assumed away in Attachment F) and algal respiration will become much more important factors. Since the model was calibrated to one set of conditions during one year and corroborated against a nearly identical set of conditions, the calibration should be considered as conditional pending a larger effort under more conditions."

Response:
Comment acknowledged.

Question b. Taken as a whole, is the scientific portion of the proposed rule based upon sound scientific knowledge, methods, and practices?

Comment 2. regarding overarching question b. (pp. 2-3):
"In the reviewer's experience the answer to this question is always 'no' because the burden of scientific rigor is never met in the TMDL program…. It reflects the political reality of the TMDL program generally and the consequences of this portion of the Clean Water Act having been neglected for so long after the Act's passage. The databases are inadequate generally because the states' ambient water quality monitoring programs were never designed to support TMDLs directly. This is particularly true in cases in which modeling results are such an important part of the assessment and implementation plan design.

The 'Scientific' portion of the analysis is better terms 'Engineering' because in engineering we are often expected to make judgements [sic] and move forward without sufficient scientific knowledge and information to solve problems. That is the case here – and the conclusions of the sources of the oxygen demanding materials and what needs to be done, in principle, are sound because the dissolved oxygen problem is so critical and the reasons so obvious that engineering judgment is sufficient to identify and take the first steps to solve the problem. Once the major sources of pollutants are controlled the situation in the New River will change dramatically and only then will the modeling be useful for fine tuning the dissolved oxygen levels. As it stands, the model results are equivalent to 'back of the envelope' calculations leading to a conceptual design."

Response:
Regional Board staff agrees with your comments that this first attempt to develop a TMDL for dissolved oxygen, given the limited data available and the many variables and unknowns that currently exist, allowed only for taking more of an engineering analytical approach rather than a more robust and traditional scientific approach. We also agree that this engineering approach is sufficient for this first order analysis, and that the approach will be refined later, using modeling and other scientific methods, once more data and other information have been generated from implementation of Phase 1 of the TMDL (first 3 years of implementation).

SUMMARY:

Comment 3 (p. 3):
"The New River TMDL is scientifically relatively straightforward. The dissolved oxygen is depressed in the upper 20 km north of the U.S./Mexico border to a degree that significantly impairs habitat for warm water fish. The primary reason for the low dissolved oxygen is the load from Mexico due to inadequate wastewater treatment resulting in high

levels of oxygen-demanding materials (organic matter and ammonia) in the river at the Border. The QUAL2K model run under severe conditions reproduced oxygen sag in the first 20 km followed by oxygen recovery downstream to the Salton Sea. The TMDL implementation plan is properly focused on reducing the load at the International Border - the exact means for accomplishing this are less clear."

Response:
Regional Board staff agrees with this comment that the exact means for accomplishing a reduced load at the International Boundary is less clear in the Implementation Plan. As we explained in the TMDL, the Regional Board does not have the authority to regulate sources in Mexico. Accordingly, the TMDL requests that the U.S. Federal Government (USEPA and USIBWC) coordinate with Mexico on properly maintaining existing wastewater facilities in Mexicali, Mexico, and on monitoring and controlling any other sources in Mexico that are or may be causing the impairment. Also, please see the response to Comment 4 below on implementation and monitoring efforts discussed in the TMDL.

CONCLUSIONS:

Comment 4 (p. 3):

"1. The fundamental scientific basis of the TMDL report is sound, though, as with many TMDL reports, some of the key data are lacking and progress is made based on assumptions and scientific judgment."

"4. Monitoring dissolved oxygen at a high frequency would help answer the question of the minimum DO, as required in the State of California water quality objectives."

"5. Additional monitoring should be carried out to better calibrate and test the QUAL2K model."

Response:
The TMDL is based on the best available data. While we acknowledge that there are data gaps, staff at the Regional Board, USEPA, and USIBWC is continuing monitoring. As stated in the Implementation and Monitoring Plan sections of the TMDL Staff Report, the monitoring will address the data limitations, which will enable the TMDL to be refined. We also acknowledge that high frequency monitoring would help answer the question of the minimum DO, and that additional monitoring will help in calibrating and testing the model. In the past, Regional Board staff conducted high frequency monitoring when resources allowed. Tetra Tech had access to this monitoring data. Regional Board staff will revise the Monitoring Plan to include high frequency and more constituents to be monitored as resources allow. The high frequency monitoring data can be viewed at:

<http://www.waterboards.ca.gov/coloradoriver/water_issues/programs/new_river/dataindex.shtml/>

The use of continuous monitoring equipment has been considered in the past, but the idea was dropped because of concerns about vandalism since the area in which the monitoring equipment would be located is used by homeless persons and possibly illegal immigrants. The TMDL will be regularly reviewed and revised as necessary when more information and data become available. The Triennial Review process that the Regional Board conducts ensures that the TMDL is regularly reviewed to determine its adequacy, as discussed in the Implementation Plan.

Comment 5 (p. 3):

"2. The details of the modeling approach, calibration, and results are lacking in the report, making it difficult to review objectively. Though the QUAL2K model is appropriate for this type of analysis and general approach appears sound, more detail concerning the model parameters is needed."

Response:
Details concerning the model parameters were included in the model run spreadsheet files that were not provided to you. Please find attached the input files of the QUAL2K model run for four scenarios used for the TMDL Staff report: 1) Current Critical Conditions; 2) No Flow at the border; 3) Improvements in BOD and NH_3 from Mexico's effluent (Nutrient Removal + Filtration); and 4) Improvements in BOD and NH_3 from Mexico's effluent (Nutrient Removal + Filtration) plus US source reductions. Unfortunately we do not have any of the calibration input files or any other input files that were used for the Q2K model runs in the Appendix F - New River QUAL2K Water Quality Model report.

Also, Tetra Tech added a new Section 3.3 "QUAL2K Water Column Rates" to the Modeling Report in Appendix F. This section describes the approach and calibration, and listed the QUAL2K rates and kinetics in a table. In general, the approach was to calibrate to the limited dissolved oxygen dataset during the critical period at the IB in the summer of 2006. Tetra Tech used July 17, 2006, as the date for calibrating the model and June 2006 as the validation period. They used temperature, BOD, and nitrogen kinetics to calibrate the dissolved oxygen of the model. The best available data for meteorology, hydrography, and point sources were used to characterize the model.

Tetra Tech added the following paragraph to the Section 3.3 of the Modeling Report:

"QUAL2K model was calibrated by adjusting coefficients and rates in order to reproduce time of travel and dissolved oxygen in the longitudinal profile. Literature values were used as a first approximation and their value fine tuned

through the process of calibration. The final value for the water quality rate values are given in Table 3-2. The water quality calibration was done only through dissolved oxygen longitudinal profile because it was the only data available. Nevertheless, dissolved oxygen is affected by carbonaceous and nitrogen oxygen demand sources present in the system and these processes were simulated in the modeling process, and their rates adjusted through the calibration process."

Comment 6 (p. 3):

"3. Uncertainty analysis using the model would be welcome to help in implementation since important and expensive engineering decisions will be made on the basis of the results and important questions revolve around the likelihood of failure to achieve TMDL goals, and the identification of the model inputs that are most important in the implementation design."

Response:
Regional Board staff agrees that the model inputs are important in the implementation design. There needs to be more work in characterizing the boundaries in the model as well as cross-sectional information of the New River. Tetra Tech included a sensitivity analysis in the modeling report, albeit not an uncertainty analysis. The best way Tetra Tech could characterize the uncertainty is by reporting the dissolved oxygen results as a range (e.g., 1-2 mg/L) because of the temporal and spatial ranges in the system. Also, please see the responses to Comments 4 and 5, above.

REVIEW OF DRAFT TOTAL MAXIMUM DAILY LOAD AND IMPLEMENTATION PLAN FOR DISSOLVED OXYGEN FOR THE FIRST TWELVE MILE SEGMENT OF THE NEW RIVER DOWNSTREAM OF THE INTERNATIONAL BOUNDARY

1. PROJECT DEFINITION

Comment 7 (p. 4):
"This section of the TMDL report is clear and unambiguous and reflects a real and long term problems [sic] in a straightforward way."

Response:
Comment acknowledged.

2. DATA AND SOURCE ANALYSIS

Review – Source Analysis.

Comment 8 (p. 4):
"a. On p 23 paragraph 2 discusses urban runoff but then says that it is unlikely to cause problems because of high ET and the lack of urban area. Does this mean that the lack of urban land use limits the generation of urban runoff, or that urban runoff will not reach the New River because of the small urban area? One presumes the former but the statement is ambiguous."

Response:
Comment acknowledged. We have edited the "Urban Runoff" discussion in Section 3.4 of the revised TMDL Staff Report to include the following:

"Urban runoff may possess an oxygen demand, but it is more likely to evaporate or infiltrate in soil rather than drain into the New River, given the arid climate. In addition, lack of urban land use limits the generation of urban runoff. Less than 0.5% of the New River watershed in the Imperial Valley is urbanized. Both of these factors cause urban runoff not to be a potentially significant source of oxygen demand for New River DO resources inside the U.S."

Comment 9 (p. 4):
"b. p. 23 para 3 says the annual average rainfall is 2.5" but on p. 14 the average annual rainfall is < 3". These are consistent but why not one or the other consistently in the report."

Response:
We revised the TMDL Staff Report to include the term "less than three inches," to describe the annual average rainfall throughout. This is the term used for Imperial Valley in our Basin Plan (Colorado River Basin Water Quality Control Board, 2006).

Review – Data Analysis.

Comment 10 (p. 5):
"Flow data - One curious issue concerns the water sources. At 500,000 acres and 2.5"/year rainfall, the steady state watershed yield is about 100,000 ac-ft or 140 cfs. The flow from the Mexico side is slightly more than 150 cfs for 2004-2007, yet only a small portion of the drainage area is physical in Mexico. It would be interesting to read about the water sources - interbasin transfers, groundwater pumping, sea water desalination and about the sustainability of the flows. The comment on p. 28 about the decreasing flows at the border appears to be based on the 2004-2007 dataset and 2008 appears to be headed toward an increase in flow. These short term fluctuations are common even when long term trends are steady. If a longer term record is used for this comment, it should be so stated. Then, what are the implications of the reduced flows?"

Response:
Comment acknowledged. The New River flow from Mexico is mainly influenced by the Colorado River water used in Mexicali Valley and All-American Canal water seepage to Mexico. Precipitation does not have a great impact on New River flow. We revised "Chapter 2: Watershed Description" in the TMDL Staff Report to include more data and information regarding water sources contributing to the New River flows.

Flow has been monitored in the New River at the International Boundary by the United States Geological Survey (USGS) since 1980. We revised Section 4.1 (Flow Data) in the TMDL Staff Report to include flow data for both IB and Outlet to the Salton Sea from 1980 to 2009. We have edited Section 4.1 in the revised TMDL Staff Report to include the following:

"For the past 28 years, the Regional Board has observed flows from Mexico to be decreasing."

The implication of low flow in the New River is mixed. Generally, low flows result in lower DO and higher temperature, especially during the summer months (USEPA: <http://cfpub.epa.gov/caddis/index.cfm/>). For the New River at IB and 19.3 km downstream of IB, however, flow reductions accompanied by removing all remaining untreated municipal wastes from discharging into the New River resulted in increased DO concentrations. (Please see Figures 3.3 and 4.4 in the TMDL Staff Report.) The reduction of flows to the New River at the IB also results in a decrease of the Salton Sea's depth and shoreline exposure. Such a drop in water level may have a substantial change on the amount and quality of wetland habitat at the New River's outlet to the Salton Sea, significantly impacting numerous species there.

Comment 11 (p. 5):
"Water quality data - Figure 4-2 demonstrates that water quality data, especially DO and temperature should come with time support and time metadata. Are these data grab samples, monthly means and if so of how many measurements? The November 2006 observation of > 12 mg/L jumps off of the plot and suggests that the observations were taken on a bright warm sunny day when algae are producing oxygen well in excess of saturation (12.21 mg/L is in Appendix E for 11/06 - the actual date/time are not given. One wonders if this isn't a typo - 2.21 mg/L seems more representative). How does this influence interpretation of the results. Since the time support is not given one wonders about the remaining data and whether the DO data are representative of in-stream conditions. Higher frequency monitoring would be valuable in making that assessment. That the DO is low and appears to jump after 2006 is clear - however the details are not."

Response:
Temperature and DO are measured using YSI equipment, model 600 XLM or 6600 EDS, with a membrane dissolved oxygen probe. Generally, one measurement per sampling site per month is taken, unless specified otherwise. Sampling for the New River is generally done in the morning. We believe that the November 2006 observation of > 12 mg/L is correct. This was the time of the year when the Las Arenitas Wastewater Treatment Plant in Mexicali started operating and experimenting before becoming fully operational in March 2007. In general, higher DO concentrations are observed/reported in November – December.

3. CRITICAL CONDITIONS AND SEASONAL VARIATIONS

Comment 12 (p. 5):
"This section seems to contradict Appendix F in which the TMDL scenarios were run for summer (worst case (IB temperature of 30.5^{o}C, presumably summer), conditions and Table 4.1 and Figure 4.2 where we see that the lowest flows are in the summer at the IB

and in the fall at the Salton Sea outlet. Because the critical condition assessment dictates the model results for the TMDL scenarios, unambiguous identification of these conditions is important. This should be clarified."

Response:
Thank you for pointing out the different flow conditions between the IB and the outlet at the Salton Sea. Because sources of oxygen demanding materials are originating in Mexico, and this TMDL is only for the 12-mile impaired U.S. section of the New River beginning at the International Boundary, Regional Board staff sees no contradiction in setting the critical conditions for the model on lower flow warm months at the IB segment. Table 4.2 (Flow in New River at the Salton Sea Outlet) is just for informational purposes. We revised "Section 4.1: Flow Data" in the TMDL Staff Report to clarify this seeming contradiction.

Specific comments/questions:

Comment 13 (p. 5):
"a. p. 31, para 2 – there the annual rainfall is stated as 3"/year – from 2.5 to <3 to =3. Please clarify."

Response:
Please see response to Comment 9.

Comment 14 (p. 5):
"b. p. 31, para 4 - here it is stated that the highest concentrations are during the winter since the return flows are zero. Does this contradict the use of summer months for the model scenarios? Higher concentrations and lower flows are generally worst case, though higher oxygen solubility through lower temperatures mitigates this. Is the fact that DO is lower at the IB in summer correspond to this?"

Response:
It seems that there is some confusion regarding this paragraph. There is not any sentence stating that agricultural flows are zero during the winter in this section. The sentence regarding an increase of contaminants during the winter may mislead the reader. Therefore, we changed that sentence to read as follows:

"Winter months may see an increase in other contaminant concentrations (e.g., bacteria, oil, chemicals) in the New River downstream of the International Boundary due to the reduction in flow and increase in human activity in Mexicali at this time of the year. In contrast, the concentrations of dissolved oxygen are higher during the winter at the International Boundary."

We used the summer months for the model scenario because this is the period when lower dissolved oxygen concentrations have been observed at the International Boundary for over 10 years. Higher temperatures, higher concentrations of dissolved organic matter, and lower flow during the summer are ideal conditions for low DO. Also, please see the response to Comment 4.

4. NUMERIC TARGETS

Comment 15 (p. 6):
"There are no real concerns with this section. However, there is some ambiguity between the stated WQO in
http://www.waterboards.ca.gov/coloradoriver/publications_forms/publications/docs/basinplan_2006.pdf
(see snippet, right), in which the standard clearly states the 5 mg/L or above is to be maintained at any time. Table 6.1 on p. 34 of the report from U.S. EPA guidelines has a duration basis and includes values at 3 and 4 mg/L for mature fish for a 1 and 7 day minimum. The criteria for early life stages are more protective so the 1 day minimum is the standard apparently adopted by the State of California. Perhaps a statement to that effect would clear things up."

Response:
The Water Quality Objective in the Colorado River Basin Region Basin Plan is independent of diurnal DO fluctuations. And this is the case in most other Regional Boards' Basin Plans in California. The Numeric Target of this TMDL is based on the Water Quality Objective and it is greater than or equal to 5.0 mg/l at any time in this warm water system. We added the following text to "Chapter 6: Numeric Target section" in the TMDL Staff Report:

"Because the criteria for early life stages are more protective, the 5 mg/l DO minimum at any time is the standard adopted by the State of California for the Colorado River Basin Region."

5. TMDL CALCULATION AND ALLOCATIONS AND LINKAGE ANALYSIS

Specific comments.

Comment 16 (p. 6):
"a. p. 36, para 6 - Critical conditions were defined as low flow summer temperatures - this contradicts Table 4.1 where the low flows at the IB are in winter and at the Salton Sea where they are in the fall."

Response:
Please see the responses to Comments 12 and 14.

Comment 17 (p. 6):
"b. p. 40, para 1 - The comment about NH_3 as an indicator for anthropogenic eutrophication is misleading and confusing. In this context, its primary influence is that of an oxygen demanding constituent of waste water. Its influence on eutrophication is dependent on whether nitrogen is the limiting constituent or whether phosphorus, silica, or sunlight are limiting. Whether the nitrogen is in the ammonia form or is present as nitrate (after nitrification to reduce xoygen [sic] demand) is largely irrelevant from the eutrophication prespective [sic]. Ammonia's primary environmental effects are to reduce oxygen and to cause toxicity to fish at higher pH. Eutrophication is secondary. One admits that respiration by algae growth resulting from nutrients reduces DO at night and increases it during the day but the impact of NH_3 above rate limiting values for algae is minor."

Response:
We edited "Section 7.2: Linkage Analysis" in the TMDL Staff Report to read as follows:

"DO is not a pollutant; therefore, the TMDL targets parameters causing low DO. The causative pollutants for the low DO are BOD and NH_3. The Model shows that BOD and NH_3 are the most influential parameters affecting DO levels in the New River and variations in other parameters have a minor influence (Appendix F). BOD represents the decomposition of organic matter to carbon dioxide. NH_3 is an indicator for anthropogenic eutrophication. NH_3 is an oxygen demanding constituent of waste water or waters with dissolved organic matter. The primary environmental effects of NH_3 are to reduce oxygen and to cause toxicity to fish at higher pH. A secondary environmental effect of NH_3 is anthropogenic eutrophication. This arises when excessive amounts of nutrients, mainly from sewage and agricultural runoff, stimulate algal growth. The increase in algal biomass subsequently leads to more organic matter sinking into the benthic water

layers. Bacteria decompose the organic matter at river's bottom, consuming large amounts of oxygen."

Comment 18 (p. 7):
"c. The reviewer has never been a fan of the 'implicit MOS' via compounding conservative assumptions. At the end one doesn't know how large the MOS is - it may be huge, or it may be small. It's better to try to quantify the uncertainty…."

Response:
TMDLs are required to include a MOS to account for uncertainties in a manner that is conservative toward protecting the environment. There are no strict guidelines or methodologies provided by the EPA for selecting a MOS, except to suggest that a MOS may be an explicit value held aside or conservative assumptions built into the analysis. The margin of safety proposed in this TMDL analysis is based on other TMDLs approved by EPA and was adopted in consideration of built-in conservative assumptions of the analysis. The MOS for the TMDL was selected with the understanding that the analysis and the MOS may be revised in the future as better information becomes available.

Comment 19 (p. 7):
"d. Given the past rapid population growth in Mexicali, is the 2.6% annual rate reasonable? The INEGI (2001) reference in the reference list couldn't be found to check their assumptions. If New River flows are reduced at the border, that may just mean a higher BOD and lower border DO levels."

Response:
We revised the statement regarding population growth in the Mexicali Area in Section 7.6 of the TMDL Staff Report to read as follows:

"In the Mexico portion of the New River Watershed, which includes the city of Mexicali, population growth from 2004 to 2005 was about 2.4% (CCBRES, 2007). The population of the city of Mexicali for 2005 is about 900,000."

The new reference is attached to this letter.

Regarding the impacts of reduced flow at the IB, please see the response to Comment 10.

Review of Appendix F: New River QUAL2K Water Quality Model for the New River Dissolved Oxygen TMDL

Comment 20- Model Population (p. 7):
"The Model was populated with data from NHD data set of the USGS (a reference to the data should be provided)."

Response:
Tetra Tech added the reference to the revised model report (Appendix F) of "The National Hydrography Dataset (NHD) by the United States Geological Survey (USGS)." For more information, please visit: <http://nhd.usgs.gov/>.

Comment 21- Reach Segments (p. 7):
"The modeling group used 33 segments stating that this was the minimum required. No basis for this decision was given and should be provided. The reach lengths (assumed the same as segment lengths) ranged from 0.45 to 11 km in Table 2.1 (the report stated the range as 0.33 to 11 km, assumed to be a typographical error), with computational elements ranging from 0.45 to 2.75 km (dividing the reach length by the number of elements for each reach yields a range of 0.45 to 2.75 km, so the 0.33 km minimum reach is also assumed to be a typographical error)."

Response:
Comment noted. Tetratech determined that 33 segments were the minimum number required based on the longitudinal slope data. Also, we agree that stated reach lengths were typographical errors. The reach lengths ranged from 0.45 to 11 km, as stated in Table 2.1, and the range of elements was 0.45 to 2.75 km. The report has been updated to reflect the correct lengths and to provide justification for the use of 33 segments.

Comment 22- Channel Widths (p. 7):
"Channel widths were interpolated between two known cross sections (report said extrapolated) and two additional cross sections at Lack Road and near Brawley (these couldn't be found on the maps provided). The meaning of the statement at the bottom of p.3 ("Additional measurements were obtained from the USGS based on recent flow data ....") is not clear - does this mean cross section data or flow data. One assumes cross section but it's not clear. Similar comments hold for the side slopes. It's claimed that consistent side slopes of 0.24 (assuming this means height/length) were found but never is it said how.

The above two points are probably minor in terms of the results - nonetheless, this sort of detail is important to provide a thorough review and for the results to be defensible through the public process."

Response:
Tetra Tech changed the word "extrapolated" to "interpolated" in Section 2.1 in the Modeling Report. The locations at Lack Road and at Drop 4 near the city of Brawley are stations identified by the USGS. We obtained cross-sectional flow measurements from the USGS to better approximate our cross-sections. The USGS took velocity measurements in addition to width and depth measurements to calculate flow.

Tetra Tech edited the second paragraph in the section 2.1 – QUAL2K Model Geometry in the revised New River DO TMDL Model report (Appendix F) to read as follows:

"Widths were initially determined from USGS cross-section measurements used to develop rating tables at gauging sites (10254970 International Boundary and 10255550 Near Westmoreland). Widths were interpolated between these known cross sections. Additional cross-section measurements were obtained from USGS based on recent flow gauge stations implemented at Lack Road and at Drop 4 near Brawley. Cross-section profiles were analyzed for conversion into model geometry in the form of generalized Manning trapezoids with a bottom width and channel side-slope. Side-slopes for the four cross-sections described above were found to be consistently in the range 0.24 (H/L), a typical angle of repose for a sandy channel."

Comment 23- Critical Conditions (p. 7):

"Questions concerning the critical choice of IB conditions (p.5)
1. Upstream IB BOD is a (the?) critical parameter.
2. How were the BOD data distributed? Was 50 mg/L the best representation, or just a convenient choice?
3. Reference to Setmire - what did Setmire observe. The reference is pointless as it stands and the next statement concerning the fluctuations doesn't follow.
4. Why choose the 3:2 split for slow/fast CBOD? How important is the choice?
5. Source of BOD decay coefficients? Data? Literature citations? Defaults?
6. Sources of other IB parameters, especially NH4/OrgN and phytoplankton?
7. Is the diurnal DO fluctuation important here or is the standard based on the steady state daily average? The standard on p 12 of the Draft TMDL report lists only that the water quality objective is a minimum of 5 mg/L but says nothing about the fact that the DO just before dawn is usually considerably lower than the average daily DO. In some states, the objective is to provide an average daily minimum DO above 5 mg/L. Is this not the case in CA? A quick glance at the Basin Plan can be viewed at:

http://www.waterboards.ca.gov/coloradoriver/publications_forms/publications/docs/basinplan_2006.pdf

and the following snippet was lifted from p. 12 for the water quality objectives for "all surface waters of the Colorado River Basin Region, with the emphasis on '... at any time', presumably referring to the lowest DO time of the day. Given this, unless it's being misinterpreted (no guidance was given in the TMDL report), at the high temperatures and obviously high BOD and nutrient loads, it is very likely that the DO fluctuations in the New River will drive the DO to very low levels at night when there's no photosynthesis even if the daily steady state average is at or above the WQO."

Response:
(1) We agree that the upstream IB BOD is a critical parameter, but it is not the only critical parameter.

(2) The 50 mg/l BOD concentration as a constant for IB was within the observed range of BOD measurements.. The BOD concentration of 50 mg/L was based on the range of 40-70 mg/L measured at all other times, as stated in the report. Since we did not have measurements in June and July 2006, we decided to use the measured range of the data.

(3) Setmire (1984) is referenced to support the inference that the BOD concentration at IB is not constant. Because we were applying the QUAL2K as a steady-state model, however, we were comfortable with the upstream condition (constant of 50 mg/L). We did not have BOD measurements (hourly or daily) during June and July 2006.

(4) Tetra Tech estimated the 3:2 split based on the treatment level for the wastewater loads entering the New River. This was an estimate without any data to substantiate it. The split and subsequent BOD decay match the longitudinal trends in the dissolved oxygen data.

(5) Tetra Tech used BOD decay rates from Surface Water Quality Modeling by Dr. Steven C. Chapra on page 357 that show 0.35/day (range of 0.20 to 0.50) for untreated wastewater and 0.20/day (range of 0.10 to 0.50) for primary treatment. These decay rates are consistent with the 3:2 split and the calibration of the dissolved oxygen in the model, especially in a point source dominated river such as the New River. Tetra Tech believes that these parameters best match the limited data during the calibration and validation periods.

(6) Tetra Tech did not have measurements of nitrogen or algae at IB on the specific day of our calibration.

(7) Please see response to Comment 15. Also, we agree that the diurnal DO fluctuation is important. Therefore, we will edit the following in the Numeric Target Section, page 34, paragraph 3, last sentence, to read as follows:

"The DO just before dawn is usually considerably lower than the average daily DO. It is very likely that the DO fluctuations in the New River will drive the DO to very low levels at night when there's no photosynthesis, even if the daily steady state average is at or above the WQO."

Comment 24 - Tributary and Wastewater Inflows (p. 8):
"It is stated in this section that the inflows and POTW discharges account for 2/3 of the flow at the Salton Sea but no mention is made of the time support for this statement. Presumably the POTW discharges are on the U.S. side of the IB and that the flows given are annual averages but reference is made to the USGS report (Setmire 1984) or 25 years ago. The tacit assumption is that the relative flows have not changed in 25 years. It's a little surprising that, in this day and age with such a high value agricultural area in a desert with almost no natural precipitation and a very large and growing metropolitan area in the headwaters, that the water is not accurately accounted for. In addition, given that low dissolved oxygen is not a new problem for the New River, it's surprising that so little is known about the contribution of the drains to the organic matter inventory in the river.

In Table 2-3, key - what is 'BPJ' used as a reference for estimated flow or water quality? Describe 'unusual or suspect value', the criteria used to flag them, and what was done in those cases."

Response:
The claim is based on the assumption that 1/3 of the New River flow in the Salton Sea comes from Mexico and 2/3 comes from agricultural drains and wastewater in the U.S. This assumption can be verified by a water balance between the flow at IB and Outlet at Salton Sea prior to the operation of Las Arenitas WWTP in 2007. Please see Figures 4.2 and 4.3 in the TMDL Staff Report for more details. This flow has remained relatively constant over the 25 years, as confirmed by USGS data.

"BPJ" means "Best Professional Judgment" and is based on applying water quality models and calibrating with wastewater data that is incomplete. "BPJ" has been removed from Table 2-3, key. This key has been renamed as "estimated value based on data from other treatment plants with similar treatment capabilities". In the QUAL2K model, Tetra Tech had to include a value for the nitrogen and phosphorus series along with BOD, dissolved oxygen, and temperature. Tetra Tech used the measured values in July 2006 as the priority to "load" the model for drains and wastewater discharges. For some drains that were not monitored, Tetra Tech assumed they were similar based on drainage area and land use. For the suspect value of 10.10 mg/L at Seeley County WWTP, Tetra Tech believes this is high, but Tetra Tech used it in the model because it was a measurement reported by the WWTP.

Regional Board staff agrees that little is known about the contribution of the drains to the organic matter inventory in the New River, but does not plan to monitor in the near future due to lack of resources and the fact that the main cause of New River DO impairment is Mexicali's waste discharge.

Model Calibration.

Travel Time.

Comment 25 (p. 8):
"How were the travel times from 1984 scaled to match flow conditions in 2006? The authors state early on that the travel time is the critical physical measure for assessing oxygen behavior and yet the details of the travel time calibration are sketchy. The axes need to be labeled in Figure 3-1 - in fact they all need to be labeled in section 3. "

Response:
We updated the figures in Section 3 of the Modeling Report to include axes labels where they were missing. Table 2-4 shows the calculation based on Setmire's flow analysis. In our analysis we scaled the flows, but did not scale the travel time. For the flows, the Setmire report states: "Total flows were back-calculated from the difference between the two USGS gages at International Boundary and near Westmorland. Known domestic point sources were subtracted from the total. Inflows for the remaining drains were calculated from the difference between Setmire measured flows in 1984, scaled proportionally to the measured USGS streamflow from July 17, 2006." Tetra Tech believes the Setmire report is straightforward on its approach and calculations.

Comment 26 (pp. 8-9):
"Table 3-1 shows that Manning's n and side slopes were assumed the same for all reaches based on condition matching from Chow's classic open channel flow book - this is commonly done when hydraulic measurements aren't available. Channel slopes aren't given in the table. Again, the details of this are critical for understanding and the explanation that widths were obtained from GIS data but looking at the photo in Figure 2-2, because of riparian vegetation along the river banks simply measuring what appears to be open water would likely underestimate the width. Widths from the photos would be more closely related to the bottom width because the top edge of the bank is likely hidden under vegetation. Is this what was done? Or did the authors use GIS polygon layers of the bank locations? It is difficult to see what actually was done to measure widths and no real description is given. "

Response:
Tetra Tech determined the width of the New River based on the photo and used that value as the bottom width of the channel in the model. Since this was scaled off a photo and estimated for the entire reach, we believe this was appropriate. Tetra Tech also used the four cross-sections to interpolate as a best estimate of the river geometry for all 33 reach segments.

Comment 27 (p. 9):
"The choice of a constant Manning's n implies that the channel bottom conditions (substrate materials, presence of debris, flow characteristics, etc.) are constant over the entire reach from the IB to the Salton Sea. The reviewer hasn't visited this river but have [sic] worked on many Western U.S. rivers and this assumption seems to be a stretch. The authors don't mention adjustment of any of these parameters so one presumes that no adjustments were required to match the travel time."

Response:
Tetra Tech used a constant Manning's "n" and adjusted or "fine-tuned" to calibrate to travel time in Figure 3-1.

Comment 28 (p. 9):
"Finally for the flow and other data, the data presented in the various tables have inconsistent units - sometimes cfs, sometimes cms, sometimes mgd. Though one realizes that different entities have difficult 'corporate' cultures when it comes to units, it would be very helpful if units were consistent throughout. It matters little which one, as long as they are the same. The same comment holds for use of SI vs. U.S. customary units (e.g. Figure 2-2 is temperature in ^{0}F but the flow in Manning's equation is in m^3/s). Again, choose one and be consistent."

Response:
Regional Board staff updated the report for consistency. All the data is now in SI units. Some data will have U.S. customary units between parentheses.

Dissolved Oxygen.

Comment 29 (p. 9):
"The first statement in section 3.2 was that once the flow portions of the model were populated, the DO calibration was improved. This implies that calibration was attempted before doing so. Is this true? No mention of it is made previously. Then reference is made to Figure 33 (thirty three) - one presumes the authors mean Figure 3-3 (three dash three) on the next page."

Response:
The reference to "Figure 33" was corrected to "Figure 3-3". Section 3.3 "QUAL2K Water Column Rates" was added to the revised Appendix F to better explain the calibration procedures. Please see response to Comment 9.

Comment 30 (p. 9):
"The DO boundary conditions at the IB boundary were based on a measurement at the border - is this a single measurement (if so, at what time of day), or (more properly) an average over the day? Then authors then state that 'Despite additional drain and WWTP inflows of higher DO', asking the reader to believe that more pollutant loading should in fact improve to DO situation because the effluent is higher in DO than the river, and that 'carbonaceous decay continues to deplete DO...' with no mention of nitrification even though 3-4 mg/L of organic nitrogen plus ammonia are present in the loads from each of those sources (Table 2-3). Assuming that these nitrogen measurements are as N (the table doesn't say) and that nitrification consumes 4-4.5 mg O^2 mg N, these nitrogen loads have an effective NBOD of 12-20 mg/L oxygen. Adding the 2-30 mg/L CBOD (again Table 2-3), the oxygen demand in these loads is 14 - 50 mg/L. One would hardly expect that the DO situation in the river would improve in light of these loads."

Response:
Tetra Tech updated the text to make this section clearer. Tetra Tech edited the following in the section 3.2 "Dissolved Oxygen Calibration" of Appendix F to read as follows:

"Once the model geometry was refined in terms of widths and slopes, and the appropriate time-of-travel was achieved, the calibration process concentrated on water quality model calibration. The adjustments in the hydrodynamic calibration improved the dissolved oxygen results compared to the values obtained in the first runs of the model, requiring only minor adjustments of the water quality rates in order to achieve a satisfactory dissolved oxygen calibration. The final results for dissolved oxygen are shown in Figure 3-3 below.

Headwaters DO input is 0.66 mg/L, as measured on July 17, 2006. Model results show pronounced, extremely-low DO levels below 1 mg/L for the first 30

kilometers downstream of the International Border. The first Regional Board monitoring site is at Evan Hewes Highway at 73.3 km, with measured DO of 0.98 mg/L. Immediately downstream of the highway, there is a rock weir that is described in Setmire (1984) which re-aerates the New River to approximately 2.5 mg/L according to QUAL2K. Despite additional inflows of higher DO, carbonaceous decay and further loads of carbonaceous and nitrogenous matter continues to deplete DO until the weirs at Drop4, Drop3, and Drop2, at 31.6 km, 29.0 km, and 24.1 km, respectively. Measured DO at Drop2 was 5.21 mg/L.

For the initial calibration the headwaters input DO was defined in QUAL2K as 0.66 mg/L, and assumed constant for the entire day of July 17, 2006. Additional continuous DO and temperature data were used to define a diurnal range of fluctuation for model input.

The water quality calibration concentrated on dissolved oxygen because it was the only data available. A specific adjustment of the calibration based on CBODu and ammonia was therefore not possible. Nevertheless, for illustration purposes both profiles are shown in Figures 3-4 and 3-5."

Comment 31 (p. 9):
"Figures 3-3 and 3-4 have legend items DO(mgO_2/L)Min, DO(mgO_2/L)Max, Minimum DO-data, and Maximum DO-data without description of what they are. In addition, my Figures 3-3 and 3-4 show now items on the plot that would be identifiable as Minimum DO-data or Maximum DO-data. Are they there? If not, remove the legend items."

Response:
The figures were updated to remove the minimum and maximum data values. The minimum and maximum lines were the minimum and maximum results during the simulation period.

Comment 32 (p. 9):
"At the end of this section mention was made of continuous DO and temperature data used to define a diurnal range for model input. Then the subject was dropped. What was done with this information? This is a critical issue for assessing compliance with the WQO."

Response:
Tetra Tech used the continuous data, which were data collected over 24 hour periods, to address the diurnal nature of the dissolved oxygen. Tetra Tech did not have this kind of data for June and July 2006.

Comment 33 (p. 9):
"In the DO calibration, as with travel time, no mention is made of any DO-related parameters that were adjusted. One presumes this means that the BOD decay and nitrification coefficients were taken from the literature or were defaults that came with the model. These parameters are critical to the assessment and without their values, the model results cannot be properly reviewed."

Response:
Tetra Tech added Section 3.3 to Appendix F (the Model Report) to describe the calibration approach and better explain to the reader the steps in the calibration.

Comment 34 - Uncertainty Analysis (p. 10):
"In situations where decisions are based on model results that rely on a number of assumptions and highly variable or uncertain inputs, uncertainty analysis is critical for estimating the likelihood that assumed critical conditions will be observed and the likelihood that the proposed management measures will have the desired result. It is especially important when extreme management measures are required to meet objectives. "

"Sensitivity analysis may be helpful, however, sensitivity analysis out of context (e.g. ± 0.5 CBOD in) as was presented here conveys little information about likelihood that either of those limits will be observed. The authors worked hard to find those conditions that would presumably meet the instream water quality objectives under the worst case - however it is impossible to know if those conditions will ever be seen and so, particularly in a delicate political situation such as a transboundary flow, the indicated conditions that would meet the standard, may be impossible to achieve. "

"One realizes that the QUAL2K model has no built-in uncertainty analysis capability. However, a first order uncertainty analysis can be coupled with the sensitivity analysis, and could help answer questions related to uncertainty."

Response:
In addition to Section 3.4 "QUAL2K Sensitivity Analysis," Tetra Tech added an Addendum ("Flow Origins and Sensitivity to U.S. Reductions") to Appendix F to further support the sensitivity analysis. Tetra Tech believes this is sufficient, and we agree.

6. IMPLEMENTATION PLAN

Comment 35 (p. 10):
"This is the most uncertain part of the TMDL in general, made more so by the international nature of the transbasin flows and water quality. Does the Board have any experience to draw upon to know whether the needed cooperation will be forthcoming from USEPA, USIBWC, and the Governments of Mexico and Mexicali? Without such assurances, it's going to be difficult to convince U.S.EPA that the implementation plan is viable. Cannot the Board or local entities carry out monitoring at the IB or is that politically too delicate to address without agreements from the U.S. and Mexico?

"Section 9.4 has a threatening tone to it. Would the U.S. consider some type of sanctions against Mexico if they don't comply? Are there alternatives (e.g. the U.S. building a river water treatment plant for a portion of the flow near the border to eliminate DO demanding materials?) or is Mexican cooperation essential for success of the plan. This seems very risky."

Response:
The Colorado River Basin Water Board has had experience in three previous TMDLs that dealt with the U.S. Federal Government and Mexican agencies: the New River Pathogen TMDL, the New River Silt TMDL, and the New River Trash TMDL. Since the development of these three TMDLs, Regional Board staff and other agencies have been observing significant improvements to water quality, including DO, for the New River at the International Boundary, especially following the commencement of operations of the Las Arenitas Wastewater Treatment Plant (WWTP) in Mexicali in March 2007. Regional Board staff and the USIBWC have been and will be conducting independent sampling at the International Boundary, as stated in the Implementation and Monitoring Plans.

Cooperation from Mexico, regarding maintaining Las Arenitas WWTP and identifying and preventing other waste dischargers from violating the TMDL, is essential to the success of the TMDL Implementation Plan. As we indicated in the TMDL, the Regional Board does not have the authority to require actions by the U.S. Government or the Mexican Government. The Regional Board can only request these actions and increase public awareness and pressure for compliance. If DO water quality objectives are not reached by the end of the first phase (the first three years), several actions will be considered for the second phase (the following three years). A river wastewater treatment plant in the U.S. could be one of these actions, if feasible and appropriate.

7. MONITORING PLAN

Comment 36 (pp. 10-11):
"The monitoring program is essential to assessing the success of compliance with WQOs – the essentially monthly (presumed) grab sampling program should be enough to address this question as long as the monitoring program addresses sampling properly. The concern here is similar to that expressed above in question 2 where the timing during the day of sampling may influence results, especially the temperature and dissolved oxygen, but also nutrients (N and P are taken up by algae, both phytoplankton and periphyton, during the day and released at night. Mid-day grab samples will bias results in terms of the loads. A modest investment in continuous monitoring equipment may help fill the gaps by looking a[t] [sic] diurnal variations in parameters that can be statistically related to BOD, nutrients, and suspended sediment at a high frequency using the grab samples to provide richer load estimates."

Response:
Sampling the New River is generally done in the morning. The timing varies among sampling dates due to constraints in resources. Also, please see the response to Comment 4.

Comment 37 (p. 11):
"A second purpose for monitoring may be to improve the model calibration (see p. 7) for dissolved oxygen and the DO-demand causing constituents. The model is heavily 'lumped' in that all of the mechanisms that influence the DO were apparently assumed based on experience or the literature (it is never stated how) - since there are at least two constituents of interest that influence DO, namely BOD and ammonia, the minimum calibration that would be expected is for those two (with the possible addition of organic N that is converted to ammonia in the water column). Since ammonia oxidation adds significantly to aeration costs at WWTPs, a better understanding of the profiles of these measures would add considerable credence to the loading estimates."

Response:
We agree that there needs to be a better understanding of the measures that affect DO, especially BOD, ammonia, and organic N. It will add considerable credence to the loading estimates. We concentrated on the calibration of DO by focusing on the BOD, ammonia, and organic N kinetics. Thus, even though BOD, ammonia, and organic N data were not available for calibration, they are included in the model, and model results are now shown in Section 3.2. We agree that more monitoring data is necessary to better refine the model and decrease the uncertainty of the TMDL. There should be a better characterization of the instream BOD and nitrogen reactions in the river.

Comment 38 (p. 11):

"It is recommended that the Board consider expanding the purpose of the monitoring program – a lot of money is riding on the results."

Response:
Comment acknowledged.

Comment 39 (p. 11):
"Under the failure scenarios, the comment that the Board may consider more stringent regulatory mechanisms seems moot since it appears that the Board is already recommending that extraordinary measures are being taken on the U.S. side. It would be helpful to see what those alternative mechanisms might be except for treatment of the river water either off-line or in the river itself."

Response:
We revised the "Failure Scenarios" Section in the TMDL Staff Report to read as follows:

"The only failure scenario for TMDL implementation is the failure to achieve the numeric DO WQO of 5 mg/l at any time in the 12 mile (19.3 km) section of the New River downstream from the International Boundary. Cooperation from Mexico, regarding maintaining Las Arenitas WWTP and identifying and preventing other waste dischargers from violating the TMDL, is essential to the success of the TMDL Implementation Plan. As we indicated earlier, the Regional Board doesn't have the authority to require actions by the U.S. Government or the Mexican Government. The Regional Board can only request these actions and increase public awareness and pressure for compliance. If DO water quality objectives are not reached by the end of the first phase (the first three years), several actions will be considered for the second phase (the following three years). A river wastewater treatment plant in the U.S. could be one of these actions, if feasible and appropriate."

Also, please see response to Comment 35.

Thank you again for reviewing and commenting on the "New River Dissolved Oxygen TMDL". If you have any further comments or concerns, please contact Francisco Costa at (760) 776-8937, or me at (760) 776-8942.

Sincerely,

Nadim Zeywar
TMDL Unit Chief
Colorado River Basin
California Regional Water Quality Control Board

Enclosure:

- Revised Draft "Total Maximum Daily Load (TMDL) and Implementation Plan for Dissolved Oxygen (DO) for the First Twelve Mile Segment of the New River Downstream of the International Boundary" and Appendices
- Revised Modelling report in Appendix F: : "New River QUAL2K Water Quality Model for the New River Dissolved Oxygen TMDL"
- David K. Stevens' letter dated December 15, 2008.
- CCBRES (California Center for Border and Regional Economic Studies). 2007. Population Demographics for the Imperial and Mexicali Valleys. CCBRES Bulletin, vol.8, no. 3&4. San Diego State University-Imperial Valley Campus, Calexico, CA.
- Three Excel files regarding the QUAL2K model run for four scenarios in the TMDL staff report: 1)Current Critical Conditions; 2) No Flow at the border; 3) Improvements in BOD and NH_3 from Mexico's effluent (Nutrient Removal + Filtration); and 4) Improvements in BOD and NH_3 from Mexico's effluent (Nutrient Removal + Filtration) plus US source reductions).