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CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
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SCIENTIFIC PEER REVIEW COMMENTS AND STAFF RESPONSE

The following comments address the scientific review of the Pajaro River Total Maximum Daily Loads (TMDLs) for Sediment including Llagas Creek, Rider Creek, and San Benito River. The reviewer is W. Cully Hession of the University of Vermont who completed the scientific review on June 28, 2005. The reviewer was specifically asked to determine whether the scientific portion of the TMDL is based upon sound scientific knowledge, methods, and practices. The reviewer was requested to make this determination for three issues that constitute the scientific basis of the TMDL. The three issues are presented below, with the reviewer's comments and Staff's response. In addition, the reviewer was asked to comment on any additional "overarching" scientific issues. Comments for these "overarching" scientific issues are also presented below, accompanied by Staff's response.

Issue #1: Because numeric water quality objectives for sediment do not exist, the proposed suspended sediment numeric targets are based on the translation of a narrative sediment water quality objective. Is this approach based upon sound scientific knowledge, methods, and practices?

Reviewer's comment: This is true. Numeric sediment standards do not exist in most states. Mostly, this is due to a lack of long-term sediment monitoring data as well as a lack of research linking sediment and impacts on aquatic biota. The modeling methodology undertaken appears to be sound and is typical of how sediment TMDLs are performed around the country (e.g. SWAT Modeling). The combination of modeling and the SEV scale is something new to me, but I believe it is scientifically sound and based on the best available information currently available.

Staff response: Staff concurs.

Issue #2: Load allocations. Is this approach based upon sound scientific knowledge, methods, and practices?

Reviewer's comment: Generally agree, however it is unclear what year the GIS land use coverage represents. For the 15-year modeling period used to establish the numeric targets (Table 2-7), was the land use changed in the model from year to year to reflect actual changes in land use for the watershed?

Staff response: The GIS land use coverage was derived from a series of satellite images that were obtained from the late 1980's through the early 1990's (approximately 1988 to 1994). Staff

will modify the Project Report to included this information. Land use was not changed in the model on a year-to-year basis to derive the numeric targets reflected in Table 2-7.

Issue #3: The implementation plan proposes that sand and gravel mining operators conduct a cumulative impacts assessment, including fluvial geomorphic impacts, to evaluate effects upon beneficial use and to determine future management measures to minimize effects. Is this approach based upon sound scientific knowledge, methods, and practices?

Reviewer's comment: I'm not sure you need to do a study, we know that sand and gravel mining can have huge impacts on fluvial morphology; including, streambed degradation, streambank erosion, headcut activity, and overall channel adjustments.

Staff response: Staff agrees that sand and gravel mining activities have had an impact on fluvial morphology as the reviewer suggests. However, the specific impacts of these activities upon beneficial uses have not been evaluated. Therefore, the TMDL Implementation Plan proposes additional studies to evaluate impacts to beneficial uses and determine the measures that owners and operators may implement to mitigate these impacts.

The following reviewer comments are directed to any additional "overarching" scientific issues.

Reviewer's comment 1: Calibration was performed for flow and sediment load. However, the main use of the SWAT output is SS, not loads. While I understand that there is a woeful lack of data. I think some attempt should be made to directly compare SWAT simulated SS with measured SS. Not just a general statement that the concentration ranges "overlap" with the limited USGS data (pg. 72, Tetra Tech report).

Staff response: Staff recognizes that few suspended sediment data points are available, however all available data were used to calibrate the SWAT model. A direct comparison of the 24 USGS suspended sediment measurements to the 8,030 simulated suspended sediment data points is unlikely to improve calibration. Tetra Tech, Inc., performed the computer modeling under contract with the U.S. Environmental Protection Agency and Staff has relied upon their expertise for the modeling portion of this TMDL. Tetra Tech used available suspended sediment data and flow data to create regression equations. The regression equations were used to generate "synthetic" suspended sediment data points to represent "observed" concentrations for the SWAT model to be calibrated to. Following model calibration, modeled sediment loads were compared to regression sediment loads on an annual basis (see Figures 7-8, 7-17, and 7-26 of the Tetra Tech report) to determine if these estimates were within reason. Because the total simulated sediment loads from the model are similar to the regression sediment loads (355,184 metric tones and 359,629 metric tones, respectively), Tetra Tech deemed the calibration results were satisfactory and a daily suspended sediment concentration estimate was produced by the SWAT model.

Reviewer's comment 2: Within the TMDL document, it would be good to mention the fact that calibration was not done on SS and that you acknowledge this fact. In addition, when you discuss "uncertainties" you should address this point as well.

Staff response: Comment noted. The method of suspended sediment calibration is described in the Tetra Tech report. Staff will revise appropriate sections of the Project Report to include the fact that suspended sediment calibration was not directly based on observed suspended sediment concentrations. Staff will also edit the Project Report to mention that there are uncertainties related to this method of suspended sediment calibration.

Reviewer's comment 3: The 15-year modeling period was from 1986-2000. Was the land use changed in the model from year to year to reflect actual changes in land use within the watershed over that period?

Staff response: No. See response to **Issue #2** above.

Reviewer's comment 4: The LU/LC data used was the 1992 MLRC (which probably means it represents a late 1980's time period). This fact should be address in the TMDL and included as one of the "uncertainties" inherent in the TMDL analysis.

Staff response: Staff recognizes that the land use type used by the SWAT model is limited to a time period from approximately 1988 to 1994 and will mention this uncertainty in the Project Report.

Reviewer's comment 5: R^2 values are given on pg. 29 to indicate the quality of the calibrations. R^2 values are useless by themselves; we would also need information on the slope and intersect. If the relationship between simulated and measured isn't close to a 45 deg slope, it isn't doing a great job even though the R^2 is 1.0. Also, even if we have a great 45 deg slope and a high R^2, an intersection other than 0 would also be a problem. Please include this information in the report.

Staff response: Staff will provide the slope and y-intercept for each of these calibration values in Section 6.1 of the Project Report. This slope information is contained in data files that Tetra Tech has provided for the Administrative Record.

Reviewer's comment 6: How do you measure the numeric targets for SS? I realize your monitoring plan will be a separate document. However, to evaluate the appropriateness of your TMDL and your implementation tracking plan, we need some idea of how you would monitor SS (temporally and spatially).

Staff response: It is anticipated that suspended sediment numeric targets will be measured using established protocols or test methods (e.g., U.S. Geological Survey or the US Environmental Protection Agency). In addition, an evaluation of other appropriate test methods may be necessary prior to development of the TMDL Implementation Monitoring plan. The monitoring locations (spatial) will likely correspond to the subwatershed "outlet" locations used to develop the SWAT computer model and suspended sediment numeric targets. This will allow for an adequate comparison between modeled and observed suspended sediment concentrations and

durations and provide better in formation in which to evaluate attainment of numeric targets. Staff anticipates that the monitoring will incorporate continuous monitoring over a specified period of time, long enough to adequately capture the inherent variability of stream flow and sediment conditions. Water Board staff will also consider using a monitoring approach that will utilize concurrent turbidity measurements. It is possible that a regression equation for suspended sediment and turbidity may be formulated to so that turbidity may serve as a surrogate for suspended sediment concentration. Turbidity measurements are recognized as being easier to obtain and more cost efficient. Water Board staff will consult with personnel, agencies, or academic advisory groups that have expertise in suspended sediment monitoring and statistical analysis as needed.

Reviewer's comment 7: Also, how do you decide if the target is made or not? On pg. 16 an example is given that "this exposure may occur on 3 occasions within a 15-year period." **THIS IS A HUGE ISSUE** that should be addressed directly in this report. If you were somehow magically able to begin monitoring SS starting today **AND** your sediment reduction measures were also implemented instantly, you would still not know if your targets were met for 15 years, which is not a very useful management tool. You will need to develop some other way to utilize this SEV approach. You need to address how this will be done given 1) the monitoring program won't start right away, 2) the reduction measures will occur over time (while, at the same time, you may have more impacts –e.g. increased development/urbanization). These are not easy and I don't have the answer for you. However, you must acknowledge these realities and set in place a method to deal with them.

Staff response: The suspended sediment numeric targets will be met if the number of exceedences are equal to or less than those represented in Table 4-4, page 16, of the Project Report. Attainment of numeric targets are to be determined, at a minimum, over a 15-year period. As proposed in the Project Report, monitoring data will be evaluated on a periodic basis (every three-years) to determine whether suspended sediment concentrations are on a decreasing or increasing trend (trend analysis). This periodic evaluation should also consider the issues mentioned in the reviewer's comment to account for the time lag between monitoring program implementation and reduction measures, as well as the identification of potentially new sources. Staff has modified the Project Report to include these factors in Section 7.4 Implementation Tracking and Evaluation. Also see Staff's response to Reviewer's comment 6.

Reviewer's comment 8: I suggest you review the following manuscripts for ideas on how to deal with the 3 days in 15 years issue. Perhaps a more statistically-based approach would work (see manuscripts for ideas).

i. Shabman, L and E.P. Smith. 2003. Implications of applying statistically based procedures for water quality assessment. J. Water Res. Planning and Management 129:330-336.
ii. Smith, E., K. Ye, C. Hughes, and L. Shabman. 2001. Statistical assessment of violations of water quality standards under Section 303(d) of the Clean Water Act. Environ. Sci. Technol. 35:606-612.
iii. Smith, E., A. Zahran, M. Mahmoud, and K. Ye. 2003. Evaluation of water quality using acceptance sampling by variables. Environmetrics 14(4):373-386.

Staff response: Staff will assess a variety of statistically based approaches that can be used to evaluate TMDL compliance, including those suggested by the reviewer. This assessment will be performed during development of the TMDL Monitoring Plan so that methods used to evaluate TMDL compliance will be consistent with the monitoring data that is obtained. Also see Staff's response to Reviewer's comment 6.

Reviewer's comment 9: Re: Residual Pool Volume. You might make it clearer for readers unfamiliar with V* that lower is better.

Staff response: The V* numeric target is ≤ 0.21 (mean) and ≤ 0.45 (max), indicating that lower is better.

Reviewer's comment 10: Re: Residual Pool Volume. More information should be given here on how V* is actually measured. Otherwise, it is hard for the reader to evaluate its appropriateness. If I remember from Lyle's manuscript, this is basically measured by poking a stick into the sediments of the pool and estimating the depth of fine sediments. This is a VERY uncertain and qualitative parameter. Be very careful if you plan to use it.

Staff response: This reviewer comment, and in other comments to follow, correctly highlight several of the uncertainties that have been indicated in the Project Report. Staff will consider the reviewer's comments and refer to suggested references when designing the monitoring program and evaluating the numeric target data that will be collected in the future. Staff will also use sediment assessment protocols to tailor streambed numeric targets to central coast streams. Numeric target monitoring and data evaluation for the Pajaro River watershed will be conducted based on these protocols and also in consultation with sediment monitoring and data analysis experts. The final selection of locations where streambed numeric target parameters are to be measured will be made based on their potential or existing habitat function.

Reviewer's comment 11: Re: Residual Pool Volume. What is meant by "unbiased measurement" here? I don't have access to Knopp's report, but I can't believe this parameter doesn't depend on who is measuring it and when (after a storm, various times of year, etc.).

Staff response: Staff agrees that the term "unbiased measurement" may not be appropriate. This term will be changed in Section 4.2.1.1 of the Project Report to "minimizing bias to the maximum extent practicable".

Reviewer's comment 12: Re: Residual Pool Volume. Values of 0.21 and 0.45 are suggested as numeric targets. How can you set these without first having some knowledge of what the current values are in the Pajaro River watershed? You might find that V*'s are already at that level and don't need improvement. You might also find that V*'s don't attain those values due to natural conditions even in your un-impacted waters. Then, you are setting yourselves up to fail no matter what you do in the watersheds. Send someone out to get some V* numbers – then decide if the Knopp-based values make any sense at all.

Staff response: If more appropriate values for the V* parameter or other numeric targets are determined for central coast streams, or for Pajaro River streams specifically, staff will

recommend the numeric target values be changed. Since funding is available for TMDL development, but not available for sediment assessment in watersheds, staff and the Water Board have decided to move forward with TMDLs and defer monitoring program development to a later date. Also see response to comment 10.

Reviewer's comment 13: Re: Residual Pool Volume. On pg. 18, 1st sentence you state that it may "take upwards of 40 years before mitigation of current disturbance is positively reflected." If this is true, and we won't be implementing instantly, this numeric target gives you NO information for 55 years (on the conservative side). Is it of any value?

Staff response: Staff agrees and will make a correction by changing the Implementation Time Frame to 45 years in Section 7.3 of the Project Report. This 45-year period will include the five years necessary to develop and implement a monitoring program as well as the 40-year period that is necessary to observe a positive response in the residual pool volume parameter. Staff is not certain how the reviewer derived the 55-year period that is mentioned in the comment. There is a paucity of streambed numeric target data (including Residual Pool volume) for the Pajaro River watershed; therefore any data will be of value.

Reviewer's comment 14: Re: Residual Pool Volume. Specifically address the uncertainties inherent in this measure and the "time" issue discussed above in the report.

Staff response: See response to comments 10 and 13.

Reviewer's comment 15: Re: Median Diameter (D50) of Sediment Particle in Spawning Grounds. What is a "riffle crest surface?" How big an area are we talking about? How many riffle crests per reach? How many "pebbles" counted per evaluation?

Staff response: See response to comment 10.

Reviewer's comment 16: Re: Median Diameter (D50) of Sediment Particle in Spawning Grounds. Why do you want the samples to have an "approximately normal distribution?" They are almost never normal in nature. That is why we refer to them as D50, D90, etc., which are nonparametric estimates of the distribution. In addition, particle size is often given in Phi sizes (and measured in increments that make sense in a Phi distribution). If we thought they were normally distributed you would be looking at the means. So, given that, I'm not sure where this idea came from, but I don't think it is useful.

Staff response: See response to comment 10.

Reviewer's comment 17: Re: Median Diameter (D50) of Sediment Particle in Spawning Grounds. The expected particle size distribution also depends largely on its position in the watershed. It is common knowledge that as we move from the headwaters to the mainstem of a river, we expect a general fining of the particles on the bed – How will you account for this?

Staff response: See response to comment 10.

Reviewer's comment 18: Re: Median Diameter (D50) of Sediment Particle in Spawning Grounds. As with V*, hasn't anyone done pebble counts in the Pajaro River watershed? Seems unrealistic to select a numeric target (37 mm, 69 mm) when you don't have actually estimates for disturbed and undisturbed sections of the river to base them on.

Staff response: See response to comment 10.

Reviewer's comment 19: Re: Median Diameter (D50) of Sediment Particle in Spawning Grounds. How long do you expect it to take for the management activities to be reflected in the median particle size measurements? 40 years? You should address this issue in the report.

Staff response: The numeric target for Median Diameter (D50) of Sediment Particle in Spawning Grounds is based on the findings of Knopp (1993). Knopp found that combined reference reaches (undisturbed for 40-years) were significantly different from the moderately and highly disturbed reaches. But, the moderately disturbed reaches were not statistically different from the highly disturbed reaches. This indicates that D50 results may take upwards of 40 years before mitigation of current disturbance is positively reflected. The implementation time frame will be changed to 45-years to account for this time period. Also see response to comment number 13.

Reviewer's comment 20: Re: Percent Fines and Coarse Fines. I need more information on how this will be sampled spatially and temporally to really evaluate it. All I know is that you plan to use a McNeil Bulk Sampler. Where will you use it? How many bulk samples per reach? How often? What time of year?

Staff response: See staff's response to reviewer comment number 10.

Reviewer's comment 21: Re: Percent Fines and Coarse Fines. As with the other targets: 1) What are the current values in the Pajaro River watershed?; 2) How long will it take to see the implementation measures reflected in the substrate?; and 3) How will you decide if the target has been achieved – one measurement, an average over the year, etc?

Staff response: See staff's response to reviewer comment number 10

Reviewer's comment 22: Re: Margin of Safety. I would, however, encourage you to include a discussion about the Adaptive Management approach within this section. Adaptive Management is really the only way to deal with sediment TMDLs given our lack of science and data.

Staff response: Staff edited the this section of the Project Report by removing this reference to Adaptive Management approach and adding clarifying language to indicate that the monitoring plan will be designed to address some of the uncertainty issues. The "Adaptive Management" approach that staff will rely upon is described in Section 7.4, Implementation Tracking and TMDL Evaluation.

Reviewer's comment 23: Re: Implementation
Don't forget that erosion and sedimentation are natural processes. Basically, rivers exist to move water and sediment. Many of your statements in this section (e.g. "documentation that there is no

activity that may cause soil, silt, or earthen materials to pass into waters...") are impossible to implement. You'll have to figure out some softer wording to acknowledge that anything we do as humans can cause soil/silt/earth to move into waters. Saying none is allowed is probably unreasonable.

Staff response: The TMDL allocates loads to natural and background sources. Implementation of the TMDL only applies to the portion of the load from controllable, anthropogenic sources.

Reviewer's comment 24: Re: Tracking
"Staff anticipates the development of a monitoring program will take approximately five years." – I would not wait this long. At least set up monitoring stations for flow and SS at the outlets of the main subwatersheds. Also, get out there and get some current numbers for you SBS numeric targets immediately. Remember the comments above, if you need to have 15 years of data to decide if the TMDL is met or not, waiting 5 years means you can't do anything for 20 years.

Staff response: Comment noted.