Board Workshop
Bio Objectives
Deadline: 2/25/13 by 12 noon

Las Virgenes – Triunfo Joint Powers Authority
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818.251.2100

February 21, 2013

Jeanine Townsend, Clerk to the Board
State Water Resources Control Board
1001 I Street, 24th Floor
Sacramento, CA 95814

Sent via e-mail to commentletters@waterboards.ca.gov

Subject: **Comment Letter – Board Workshop: Scientific basis for development of statewide policy for biological objectives**

Dear Ms. Townsend:

The Las Virgenes – Triunfo Joint Powers Authority (JPA) appreciates the opportunity to provide comments on the scientific basis of the state's developing Biological Objectives policy. We share the state's goal of watershed stewardship and the protection of stream biology and habitat. JPA staff are regular attendees of Biological Objectives Stakeholder Advisory Group meetings. The technical team has been exceptionally responsive to our suggestions and requests.

Our comments also reflect the unique perspective we have by working in the first watershed in the state to have biological objectives regulations: Malibu Creek watershed. The US EPA is required to develop a TMDL to address a benthic macroinvertebrate bioassessment impairment in Malibu Creek by March 24, 2013, in accordance with the Consent Decree between the EPA and environmental groups. This draft TMDL has given us the unique opportunity to preview potential pitfalls in state biological objectives policy.

Technical document availability

Comment 1. We appreciate the opportunity offered at the Board workshop to review technical documents on the scoring tool and reference pool development in order to provide more complete comments. The Biological Objectives Technical Team presented the newest version of the benthic macroinvertebrate scoring tool at the January 25th, 2013, State Water Resource Control Board workshop on Biological Objectives Scientific Basis. This workshop was the first time the new scoring tool, the California Stream Condition Index, with the latest modifications, had been presented to the public. But no single document describing the scientific basis of the tool has been made available for review, and the link given in the notice led primarily to PowerPoint presentations given over the past two years. The Director of the Office of Information Management & Analysis announced at the January 25th workshop that technical documents would also be made available and comments accepted on those documents, but that this February 25th deadline would be maintained. What follows is our best

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Chair, Triunfo Sanitation District
Board of Directors

Charles Caspary
Vice Chair, Las Virgenes-Triunfo
Joint Powers Authority
President, Las Virgenes Municipal Water District
Board of Directors

attempt to comment on the scientific basis of the State's Biological Objectives policy without having those technical documents.

Reference pool and model development

The following comments are based on stakeholder advisory committee meeting presentations and a draft manuscript on reference pool development (dated 3/10/2012) that was circulated to the Biological Objectives stakeholder groups for input. According to the draft reference manuscript, the ability to determine the biological expectation of a test site depends on knowing the biological state at a site with similar natural environmental characteristics, but with low levels of human disturbance. A full range of environmental gradients is needed in order to generate biological expectation for all or most sites being assessed.

Comment 2. Three reference site selection thresholds referred to as "kill switches" (Table 4, draft reference manuscript) should be removed as they eliminate potential reference sites representative of the full range of water quality conditions in areas with exposures of enriched marine phosphatic shales. There are two sets of screening measures used to differentiate reference from non-reference sites, the first being GIS-based measures of anthropogenic alteration in the upstream area, and the second being "kill switches." The "kill switches" were added to "to exclude sites that passed primary screens yet still showed some indication of stress" (draft reference manuscript). These "kill switches" are 3,000 µg/L (3.0 mg/L) total nitrogen, 500 µg/L (0.5 mg/L) total phosphorus, and conductivity within 99% of prediction interval, but no higher than 2,000 µS/cm. The draft says these kill switches were intentionally set high since they can be "naturally high in certain geological settings and do not necessarily indicate human disturbance." This is a phenomenon we have observed in streams in the undeveloped, Monterey/Modelo Formation[1]-dominated headwaters of Malibu Creek watershed, which exceed phosphorus and conductivity kill switches that were "intentionally set high." At undeveloped headwater sites, specific conductivity measurements range from 1,388 to 5,087 µS/cm, with a median of 3,531 µS/cm (N= 151) and would be eliminated as potential reference by the kill switch. At least one site would be eliminated by the phosphorus kill switch. The developed downstream portions of these tributary streams are all listed for benthic macroinvertebrate bioassessments with TMDLs scheduled for 2021, so the state will need to be prepared to assess and regulate them properly, which will require having appropriate reference sites with values higher than the kill switches allow.

The state should not dismiss the extremes found in Malibu Creek watershed as an exception that can be ignored. The Monterey and Modelo Formations combined constitute 6.5% of the 5,000 sq km area included in the USGS Preliminary Geologic Map of the Los Angeles 30' x 60' Quadrangle, and outcrops occur as far south as Newport Bay (where they cause exceedances of selenium objectives) and as far north as the Eel River area and throughout the central Coast

[1] The Monterey Formation is a Miocene marine shale that is California's primary petroleum source rock. The Modelo Formation is a subunit of the Monterey Formation formed in a unique depositional environment. For reference, see pages 11, 12 and 220 of Isaacs, C. M. and J. Rullkötter (eds.). 2001. *The Monterey Formation: From Rocks to Molecules*. New York: Columbia University Press. xxv-553 pp.

Range. If these extremes in water quality deriving from the Monterey Formation are found in Malibu Creek watershed, then it is likely that similar water quality can be found elsewhere in the state. We also expect that other Miocene marine formations, and especially other oil-source formations (Puente, Sisquoc, etc.), will produce similar water quality. The draft reference manuscript section on threshold sensitivity indicated that 15% of the South Coast Xeric sites failed fewer than five metrics. We are interested in understanding how many of the 15% fail primarily because of two "kill switch" thresholds that we have found can be exceeded naturally. Because petroleum source rock is capable of high nitrogen concentrations, removal of the total nitrogen "kill switch" should be considered, as well.

Comment 3. We would like more detailed information on the geologic variables used in the predictive portion of the predictive MMI. At the October 17th 2012 Stakeholder Advisory Group meeting, the working draft of the new California Stream Condition Index (CSCI) scoring tool was introduced. The CSCI is composed of a measure of species loss (O/E) and a predictive multi metric index (pMMI). We would like to have the opportunity to review a detailed document on this new tool. Those who have attended meetings were able to view presentations and had opportunities to ask questions about the O/E portion of the score, but the pMMI is a new concept that needs more explanation. For example, the pMMI "creates models that adjust metric values to account for major natural sources of metric variation." The GIS-based gradients that were found to be the most influential on metric results included many standard geographic variables (latitude, elevation, precipitation, etc.), but also included many which were unfamiliar (MgO_Mean, Sulfur_Mean, SumAve_Phos, etc.), some of which are potentially related to watershed geology. Because geology is so influential on water quality in Malibu Creek, we would like to see detailed explanations of each of these. How are they derived and what are they based on? The draft reference manuscript based geologic influence on broad geologic categories, such as Cenozoic sediments. We commented on that draft by saying that Cenozoic marine sediments will be more influential than terrestrial sediments, and that Miocene marine sediments will be more influential than earlier epochs because of increased ocean upwelling during that period. We also do not know if these chemical predictors are based on geologic terrain at a point, or within the 1 km, 5 km, or watershed polygons described in the reference manuscript. We recommend these chemical predictors be based on more refined geologic categories and on the entire upstream watershed. We look forward to the opportunity to review a detailed technical document on this topic.

Comment 4. Because the extremes in natural gradient could easily be missed with a probabilistic sampling approach, the state should consider targeted sampling in reference areas known to represent those extremes. For example, targeted sampling of areas with naturally elevated TP, TN and conductivity should be done to establish biological reference condition in areas like Malibu Creek watershed where those water quality parameters are extremely high. Targeted sampling would improve reference pool representation of natural gradients in water quality in terrain with enriched shales and other sources of extremes in natural variation. We know the technical team is looking at reference site gaps in natural gradient multivariate plots and looked for potential reference sites to fill those gaps. The scientific team tested the sensitivity of reference criteria with minor adjustments and found that those minor adjustments did not result in big changes in the number of reference sites per

region. However, we wonder if adjustment of reference criteria for underrepresented extremes in natural gradient might significantly increase the number of reference sites for those extremes. This should be considered, especially for those anthropogenic stressors that differed little in R^2 values between the reference sites and all sites, such as conductivity, as shown in the heatmap of biological integrity shared at the January 12, 2012 Stakeholder Advisory Group meeting.

Comment 5. The reference pool should include high conductivity Miocene marine shale sites including sites influenced by the Monterey-Modelo Formation. Average conductivity at sites in the undeveloped Monterey-Modelo Formation-dominated headwaters of Malibu Creek watershed ranges from 1,859 to 4,082 µS/cm. Average conductivity at developed sites in the these tributaries range from 2,309 to 3,802 µS/cm with obvious downstream dilution. Conductivity is clearly naturally elevated. The developed portions of these northern tributaries are on the current 303(d) list for benthic macroinvertebrate bioassessment impairments. The State will need to be ready to assess these tributaries, but the current reference pool does not include sites with such high conductivity. We have been told that bioassessment sites in the undeveloped northern headwaters of Malibu Creek watershed may not qualify as reference according to the primary GIS screening measures used for Biological Objectives. The state should either allow for further relaxation of the GIS screening measures, or should conduct targeted sampling to find sites with comparable conductivity, in order to be able to properly assess whether Malibu Creek tributary streams are, in fact, impaired and to what degree. The future TMDLs should use benthic macroinvertebrate impairment thresholds specific to the conditions in Malibu Creek watershed, including the influences on water quality from the Monterey/Modelo Formation and other local geologic terrain.

Comment 6. Reference sites should include low gradient sites in the south coast xeric region. One problem with the southern California IBI was that it had not been validated for use at low gradient stream sites because of the paucity of low gradient reference sites in the region. The state should either allow for further relaxation of the GIS screening measures, or should conduct targeted sampling to find sites with comparably low gradient to non-reference sites.

Comment 7. The CSCI should be assessed for response to invasive benthic macroinvertebrate species and adjusted if necessary. The US EPA draft Malibu Creek macroinvertebrate TMDL found that a site where the invasive New Zealand mudsnail constituted 80% of the benthic macroinvertebrate population in one year attained the same score as it had in a prior year when the invasive species represented only 3% of the benthic invertebrate population. The CSCI should be tested to ensure it is capable of distinguishing such a dramatic shift in species composition.

Comment 8. The reference model should be regularly updated as sites are added to the reference pool. There has been some, but very little, discussion at Stakeholder Advisory Groups on the future of the reference model as the reference pool is expanded. It has been suggested that as new sites are assessed, those sites that qualify as reference should be added to the reference pool. We approve of this, since by adding sites, the chances of adding reference sites

that reflect the full range of natural gradients in California will increase. However, it has also been suggested that once the reference model is set, sites would no longer be added to the reference pool and the model would become static. We oppose this and recommend regular updates to the reference pool and to the reference model. We know from experience here in Malibu Creek watershed where conductivity and certain ion concentrations are extremely high, that there are few, if any, appropriate reference sites in the reference pool now. Most recently, the technical team has added four sites to the reference pool that might be comparable to our streams because predicted conductivity is greater than 1,000 µS/cm. The state very likely has streams with other natural extremes, and without appropriate reference for comparison. A growing reference pool and a regularly updated model will make it more likely that the extremes in natural gradient are eventually captured in the reference model.

Perennial and non-perennial flow conditions

Comment 9. The definition of perennial flow needs to be made on a site basis and not a stream basis. According to the CEQA Scoping document, the state is using the following definition: "'Perennial Stream' means: A stream with the year round presence of flowing surface water during a typical water year. Any stream that does not meet this threshold is considered 'non-perennial'." We strongly encourage the state to amend the definition of perennial to be used in the state's Biological Objectives Policy to include the word 'site' as follows: "'Perennial Stream Site' means: A stream site with the year round presence of flowing surface water during a typical water year. Any stream site that does not meet this threshold is considered 'non-perennial'."

Perenniality has been defined in multiple ways by multiple state efforts. A Department of Fish and Game scientist told us that they consider a site perennial if there is flow during the spring index period. Mazor et al. (2012) [2] in their report to the State Water Resources Control Board, define nonperennial as "streams that lack surface flow for at least several days per year in most years."

The problem with defining a stream, rather than a site, as perennial can be illustrated by the US EPA draft Malibu Creek macroinvertebrate TMDL. According to the current definition, Malibu Creek is perennial, since it has year round flow at the gage. However, the EPA verified a macroinvertebrate impairment using two sites on the stream that are far from perennial. One of the test sites for making decisions on benthic macroinvertebrate impairment is non-perennial two to four months per year (USGS gage 11105510) and becomes completely dry part of that time (monthly photo-monitoring data). Another is also non-perennial and becomes mostly dry each year, but with limited flow data to support year round flow condition.

[2] Mazor, R., Schiff, K., Ode, P., Stein, E. 2012. Final Report on Bioassessment in Nonperennial Streams, Technical Report 695, Prepared for the State Water Resources Control Board by the Southern California Coastal Water Research Project Report 695. Available at ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/695_NonperennialStreamsSanDiego.pdf.

Perennial flow or lack thereof can influence biological communities as described in a white paper issued by the Xerces society.[3] A stream may be perennial in one or in most years, but not in all years, or it may be non-perennial every year. The difficulty of establishing causation of environmental stress response is difficult because of natural variability, confounding influences, as well as assessment variability.[4]

Comment 10. Consider adjusting CSCI pMMI metrics for extremes in natural condition. Ephemeroptera are known for their sensitivity to salinity (Hart et al. 1991[5], Hassell et al. 2006[6], Echols et al. 2009[7]), and the EPA found that EPT taxa in Malibu Creek "may be sensitive to the high conductivity associated with the marine sedimentary geologic formations in the watershed" (USEPA 2012). Similarly, Mount et al. (1997)[8] found the relative toxicity of natural ions to be $K>HCO_3 \approx Mg>Cl>SO_4$. Each of these is elevated in Malibu Creek watershed to levels as high or higher than those found to be toxic to macroinvertebrates downstream of mountain top coal mining in West Virginia (Pond et al. 2008)[9]. The EPA has found that ions can affect benthic invertebrate populations at less than toxic levels[10]. Given these findings, the potential effects of high conductivity water draining the Monterey-Modelo Formation should be expected to have low EPT scores. Accordingly, the CSCI should be adjusted to account for the absence of macroinvertebrate taxa sensitive to high conductivity and ionic strength in settings with naturally elevated conductivity and dissolved ions.

Turning to ionic impacts on the algal diatom community, the US EPA draft Malibu Creek macroinvertebrate TMDL did not evaluate ionic impacts on the diatom community despite well-known documentation of effects in the scientific literature. Potapova and Charles (2003)[11] for example showed that diatom assemblages respond not only to conductivity, but to gradients in major ion concentration. We contacted the senior author of this work, Marina Potapova, who reviewed mounted slides from LVMWD's 2011 algal bioassessment and found that "the diatoms

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[3] Mazzacano, C., Black, S.H. 2009. Using aquatic macroinvertebrates as indicators of stream flow duration, http://www.xerces.org/wp-content/uploads/2009/03/xerces_macroinvertebrates_indicators_stream_duration.pdf, last accessed 8/13/2012.

[4] Norris, R. H., Webb, J. A., Nichols, S. J., Stewardson, M. J., Harrison, E. T. 2012. Analyzing cause and effect in environmental assessments: using weighted evidence from the literature, *Freshwater Science*, opinion article, 31(1): 5-21.

[5] Hart, B. T., Bailey, P., Edwards, R., Hortle, K., James, K., McMahon, A., Meredith, C., Swadling, K. 1991. A review of salt sensitivity of the Australian freshwater biota, *Hyrdobiologia*, 210: 105-144.

[6] Hassell, K. L. Kefford, B. J., Nugedoda, D. 2006. Sub-lethal and chronic salinity tolerances of three freshwater insects: *Cloen* sp. and *Centroptilum* sp. (Ephemeroptera: Baetidae) and *Chironomus* sp. (Diptera: Chironomidae), *Journal of Experimental Biology*, 209: 4024-4032.

[7] Echols, B. S., Currie, R. J, Cherry, D. S. 2009. Preliminary results of laboratory toxicity tests with the mayfly, *Isonychia bicolor* (Ephemeroptera: Isonychiidae) for development as a standard test organism for evaluating streams in the Appalachian coalfields of Virginia and West Virginia, *Environmental Monitoring and Assessment,* 169: 487-500.

[8] Mount, D. R., Gulley, D. D., Hockett, J. R., Garrison, T. D., Evans, J. M. 1997. Statistical models to predict the toxicity of major ions to *Ceriodaphnia dubia, Daphna magna, and Pimephales promelas* (fathead minnows), *Environmental Toxicology and Chemistry*, 16(10): 2009-2019.

[9] Pond, G. J., M. E. Passmore, F. A. Borsuk, L. Reynolds and C. J. Rose. 2008. Downstream effects of mountaintop coal mining: comparing biological conditions using family- and genus-level macroinvertebrate bioassessment tools. *Journal of the North American Benthological Society*, 27(3): 717-737.

[10] http://www.epa.gov/caddis/ssr_ion_int.html

[11] Potapova, M., Charles, D. F. 2003. Distribution of benthic diatoms in U.S. rivers in relation to conductivity and ionic composition, *Freshwater Biology*, 48(8): 1311-1328.

clearly indicate a high ionic content," adding that one diatom species found in abundance on the slides "may be new to science and potentially endemic." [12] It is important that state guidance on biological objectives specifically address ionic impacts (regardless of source, i.e. natural or anthropogenic) on freshwater aquatic life, especially for taxonomic groups used as bioindicators of water quality and beneficial use impairments. Diatom surveys are currently required of NPDES permittees in Region 4 (Los Angeles) in addition to benthic macroinvertebrate surveys; both groups of organisms are known to be affected by ionic strength, substantially so in very high ionic strength waterbodies such as Malibu Creek.

Comment 11. An investigation on the role of canopy cover on CSCI scores should be undertaken. Luce (2003)[13] found that "conductivity, embeddedness and canopy cover were the factors most commonly related to BMI metrics" in Malibu Creek watershed. Based on this finding, we believe that information on canopy cover should be collected with each benthic macroinvertebrate bioassessment and included in CSCI score development. If this is not done, then canopy cover effects on CSCI scores can be confounded with other stressors. For example, the US EPA draft Malibu Creek macroinvertebrate TMDL, while relying on Luce (2003) in its stressor linkage analysis, ignored Luce's finding on canopy cover despite the fact that TMDL reference sites all had ranges of canopy cover from 50 to 100%, while test sites had much lower canopy cover.

Comment 12. An investigation of the role of algal percent cover and biomass influence on CSCI scores should be undertaken in both reference and non-reference sites. The US EPA draft Malibu Creek macroinvertebrate TMDL concluded that the cause of impairment was excessive algae growth. We believe that thresholds used to determine algal excess (Biggs 2000; the California NNE Framework) may underestimate the degree of natural algal cover in certain geologic terrain (discussed below under "other concerns.") Excess algae is likely to be one of the more common potential stressors identified in causal assessments, so the effects of natural and culturally enhanced algal growth on benthic macroinvertebrate scores should be assessed.

Comment 13. Biological Objectives scientific basis documents should address metrics and thresholds as applied to nonperennial sites, with both anthropogenic and natural stressors. Mazor et al. (2012) studied a small number of non-perennial stream sites to investigate whether benthic macroinvertebrate indices might give false indications of impairment at nonperennial sites under otherwise natural conditions, and found that nonperenniality increased vulnerability to stress. While they considered only anthropogenic stress, we propose that the natural stress of extremely high concentrations of dissolved solids might also contribute to decreased scores. We also note this study recommended follow-up with a larger study, suggesting that adjustments to scoring thresholds or metrics may be needed for nonperennial sites. We recommend the state fund this study and include sites in Malibu Creek watershed.

[12] Personal communication with Dr. Randal Orton, December 7 and 8, 2011.

[13] Luce, S. L. M. 2003. Urbanization and aquatic ecosystem health in Malibu Creek, California: Impacts on periphyton, benthic macroinvertebrates, and environmental policy. A dissertation submitted for the degree Doctor of Environmental Science and Engineering, University of California, Los Angeles. 133 p.

Uncertainty of scores

Comment 14. We support the development of scoring methods that incorporate measures of uncertainty. The Technical Team has presented on bioassessment uncertainty as demonstrated by variability of scores and has proposed additional assessments to decrease the statistical uncertainty of scores for a site prior to the site being assessed for regulation. We support that idea. We find that southern California IBI scores at sites in the Malibu Creek watershed area are highly variable with the spread of scores at a site ranging from 7 to 65 points even in undeveloped, natural reference areas.

Causal Assessment

Comment 15. Biological Objectives should include a full CADDIS-based causal assessment including full stakeholder participation to ensure that all potential stressors are considered and adequately assessed. The US EPA draft Malibu Creek macroinvertebrate TMDL omitted important analyses that were proposed by local stakeholders and that would have been included with full stakeholder participation. For example, we communicated to the EPA on multiple occasions that naturally elevated ion concentrations were likely to have an impact on macroinvertebrate communities. With only infrequent communication with watershed stakeholders, the EPA applied the CADDIS toxicity module to assess this vulnerability, rather than the more appropriate ionic strength module. We strongly suspect the ionic strength module would have indicated a large degree of impairment is likely natural, making the southern California IBI impairment threshold of 39 inappropriate for this watershed. Similarly, the US EPA was unaware of the regular application of toxic aquatic larvaecide in Malibu Creek, or whether individual sites were perennial or not. All of these examples underscore the vital role of local knowledge in the causal assessment process, and we strongly encourage the state to highlight its importance in its guidance and policy on biological objectives and biological indicators. We are more convinced than ever that local knowledge is essential to the assessment process.

Comment 16. The causal assessment process needs further attention and development, including detailed guidance on the selection of comparator sites, selection of reference sites for use in watersheds that fall outside the experience of the reference model and stressor identification. The state piloted EPA's CADDIS causal assessment program for use with Biological Objectives policy, though CADDIS was developed to identify point sources. The pilot study found that CADDIS was exceptionally deficient in its ability to identify from among multiple non-point sources, such as here in California. At present, the state plans on using CADDIS, but issuing a guidance document with untested suggestions that might improve the process. We urge the state to recognize that it would be a mistake to set regulatory thresholds for Biological Objectives without establishing an adequate method of identifying causes of impairment. Stakeholders expressed concern early on that regulators will use failing scores to apply targets to any pollutant in NPDES permits. If the Causal Assessment is not a robust and useful tool, this concern could be justified. The US EPA draft Malibu Creek macroinvertebrate TMDL provides an

example in that it inappropriately selected reference sites from outside the watershed as comparator sites and led to an insufficient list of potential stressors. When it comes time to develop TMDLs for the listed tributaries to Malibu Creek, the task will be even more difficult. There are currently no sites in the reference pool with conductivity anywhere near the level they are in Malibu Creek or its tributaries. Yet reference sites will be needed for comparison. How will the state find them to verify impairment? How will comparator sites be selected? How will stressors be identified and shown to exert more influence than others? Stressor identification guidance should be completely developed by the technical team.

Comment 17. Water quality data used to determine the degree of nutrient, algal and dissolved oxygen impairment at a bioassessment site should be limited to dates when there is flow. Benthic macroinvertebrate bioassessments are only conducted in Malibu Creek when there is flow during the spring index period in accordance to SWAMP protocol. Yet, the US EPA draft Malibu Creek macroinvertebrate TMDL inappropriately relied on year-round water quality and algal cover data from sites that form isolated pools or dry up in summer. These sites become naturally eutrophic under these conditions. While the larger steelhead pools should maintain algal cover and dissolved oxygen standards, the small pools and puddles that precede drying should not be expected to. These data should not be used in a causal assessment process for benthic macroinvertebrate impairment. Nutrient concentrations and algal percent cover values from drying conditions and pooled periods should not be used.

Comment 18. The state should review algal cover and algal biomass thresholds for streams draining Tertiary marine shales. Both the Regional Board (Region 4) and the US EPA continue to apply algal cover thresholds from Biggs (2000)[14], despite multiple warnings within that document that Tertiary marine shales can cause natural algal proliferations exceeding these thresholds (30% cover for filamentous algae and 60% cover for benthic diatoms). This basic error affects causal assessments not only of algal proliferations, but also in subsequent causal assessments that assume such proliferations are unnatural, and then attempt to link them the proliferations to other aquatic life impairments such as low CSCI scores for benthic macroinvertebrates (which are also affected by Tertiary marine shales due to ionic impacts). Chlorophyll a and ash free dry mass thresholds should also be reassessed for these settings. The CA NNE framework applies a 150 mg/m^2 limit for chlorophyll a, but Stein and Yoon (2007)[15] give average, dry season chlorophyll a concentration in southern California reference streams as 439.2 mg/m^2 for benthic algae. The state should instead develop algal impairment thresholds specific to the type of conditions in Malibu Creek watershed, including the influences on water quality from the Monterey-Modelo Formation and other local geologic terrain and very low flow conditions during summer.

[14] Biggs, B. J. F. 2000. *New Zealand Periphyton Guideline: Detecting, Monitoring and Managing Enrichment of Streams*. Prepared for the New Zealand Ministry for the Environment. Wellington: Ministry for the Environment.
[15] Stein, E. and V. K. Yoon. 2007. Assessment of Water Quality Concentrations and Loads From Natural Landscapes. Southern California Coastal Water Research Project Report 500. Available at www.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/500_natural_loading.pdf.

Other concerns

Comment 19. The state should assess algal biomass using ash free dry weight and not by using chlorophyll-a. There are multiple problems with chlorophyll a assessments: chlorophyll can degrade prior to analysis, results are highly variable by method and by laboratory, and can also vary significantly depending on the time of day (Volkmar et al., 2011)[16].

Comment 20. Algal percent cover values derived from visual assessment should not be used to determine exceedance of thresholds. The US EPA draft Malibu Creek macroinvertebrate TMDL relies on visual estimates of percent floating and benthic percent cover made by volunteers when there is no direction given in the manual they use for making these estimates. Benthic cover estimates are particularly difficult to estimate visually because of reflection. Additionally, new algal bioassessment percent cover methods developed for SWAMP rely on objective sampling techniques on 21 transects in a 150 m reach with five sampling intervals per transect. These objective methods should be used instead of visual percent cover estimates.

SUMMARY

We appreciate your consideration of these comments and requests as outlined above in our letter. We appreciate the opportunity to be of service to the state in the development of Biological Objectives policy and look forward to continued cooperation with the state and other stakeholders in that effort. It is our hope that the unique experience and knowledge we have in the Malibu Creek watershed will help to improve the technical work and the final policy.

If you have any questions regarding these comments, please feel free to contact me at 818-251-2122.

Sincerely,

David W. Pedersen, P.E.
Administering Agent General Manager

[16] Volmar, E.C., S.S. Henson, R. A. Dahlgren, A. T. O'Green, E. V Nieuwenhuyse. Diel patterns of algae and water quality constituents in the San Joaquin River, California, USA. Chem. Geology. 283:56-67.