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Via Electronic Mail

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Subject: Comments on Three Biological Objectives Draft Technical Documents

Dear Ms. Larsen

Tri-TAC and the California Association of Sanitation Agencies (CASA) appreciate the opportunity to provide input on the three biological objectives draft technical documents (Assessing Reference Network Performance, Maximizing the Applicability of Bioassessment Scoring Tools in Environmentally Complex Regions, and Causal Assessment Evaluation and Guidance for California) prepared for the State Water Resources Control Board (State Water Board). Our associations represent public wastewater agencies providing sewer collection, wastewater treatment and water recycling services to millions of Californians. Tri-TAC and CASA are fully committed to the effective and appropriate implementation of biological objectives and strongly support the use of bioassessments as a tool to address uncertainties associated with chemical-specific and toxicity monitoring. All three draft documents are intended to assist State Water Board staff with the development of a statewide biological objective policy and two of the three documents are in a manuscript form for eventual submission for peer review publication with the third document prepared as a technical report. Therefore, we acknowledge that some of our comments may be more appropriately addressed or clarified in the Policy as opposed to being directly incorporated into a manuscript intended for scientific journal publication. The following comments are respectfully submitted with this premise in mind.

Assessing Reference Network Performance

Our overarching comment on this manuscript relates to areas that were identified as not being adequately represented in the reference network. The representativeness of the reference network is crucial to all the other elements that rely on this reference network such as the scoring tool and even elements in causal assessment. Based on the manuscript, the identified underrepresented streams are: a) very high elevation streams > 3000 m, b) streams draining large watersheds > 500 km^2, and c) streams on the tails of several distributions (low elevation, low gradient, low precipitation, large watersheds). It is critical that these exceptions be explicitly and unambiguously disclosed in the conclusions. Otherwise, inappropriate, expensive, and ultimately unsuccessful management decisions will be required in these locations. Additionally, the document should also clearly indicates that other, less common or even rare natural gradients MAY also be underrepresented. One such natural gradient that has been suggested as being underrepresented or not represented at all at stakeholder group meetings are naturally high conductivity streams. Since streams meeting all of the primary screening metrics that were used to define reference condition but exhibited high conductivity were excluded from the reference pool, it is highly unlikely that streams with naturally high conductivity were adequately included.

Finally, the pertinent aquatic life beneficial uses as defined by the State of California include both “Cold” and “Warm” freshwater uses intended to protect and enhance “ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates”. However, temperature, particularly elevated temperature, can also be a stressor and at what point it becomes a stressor will be related to whether the stream is designated as having a warm or cold water beneficial use designation. Therefore, the over-all reference network should be split into two distinct reference pools with one containing State designated “cold freshwater habitats” (COLD) and the other containing the streams designated by the State as “warm freshwater habitats” (WARM). This is particularly important considering how the reference network is used in the newly developed scoring tool. It will be critical that cold and warm reference streams are not inadvertently combined and used together to compare the score observed at a site. Warm designated streams should be compared and scored against warm designated reference streams with similar natural gradients and cold designated streams should be compared and scored against cold designated reference streams with similar natural gradients.

Maximizing the Applicability of Bioassessment Scoring Tools in Environmentally Complex Regions
Since this scoring tool relies on the reference network, the same concerns discussed above are applicable to this manuscript. As these documents will be used to inform State Water Board staff as they proceed to develop a statewide biological objective policy, the limitations and reduced confidence associated with the identified underrepresentation of ecosystems and stream sub-categories need to be explicitly identified. Additionally, the apparent bias in the multi-metric component (PMMI) of the overall score when the number of expected taxa is low needs to be more thoroughly addressed. While it is recognized that the two components of the scoring tool (the PMMI and observed over expected) are measuring different characteristics of the biological condition and as such, would not be expected to always score similarly, when one component consistently scores higher or lower than the other, an apparent bias should be suspected. For example, when the number of expected taxa is low, the PMMI component consistently scores significantly lower than the observed over expected (O/E). Since the O/E component excludes taxa with less than a 50% probability of being collected in a sample and that the PMMI consistently scores lower than the O/E when the expected (E) number of taxa is low, it is reasonable to conclude that some of the metrics that comprise the PMMI may be relying on taxa with less than 50% probability of being collected. However, if it was determined that the probability of capture for the individual PMMI metrics was greater than 50%, this analysis should be provided, including tools that can be utilized to verify on a site-by-site basis that such a bias is not occurring. Finally, if it is ultimately determined that a low probability of capture is not the reason that the PMMI component consistently scores lower than the O/E component, some other source for the bias will need to be identified. At a minimum, the authors should clearly acknowledge that this bias exists and that confidence in the scoring tool under these conditions is lessened.

Finally, Figure 5 examines the relationship between three natural habitat gradients and the PMMI, O/E, and overall CSCI score from reference locations. Based on the information presented in this figure for the three natural gradients examined, % slope clearly exhibited a stepped association in the two component scores (PMMI and O/E) as well as in the overall CSCI score. It is also worth noting that the pool of available reference data from lower slope locations is significantly limited. This would indicate that the expected PMMI, O/E, and CSCI score in reference locations is dependent to some extent on % slope with locations exhibiting lower slopes scoring approximately 20% less that the higher slope locations. A similar, but less obvious and inverse relationship also seems to be apparent for % sands and fines. However, current expectations for reference locations exhibiting low slope or high sands and fines remain the same as those exhibiting higher slope and less sands and fines. This is problematic and expectations for these and possibly other locations on the upper and/or lower tail of the reference distribution should be appropriately adjusted downward.

Causal Assessment Evaluation and Guidance for California

The ability to reliably identify the cause of undesirable biological condition is an extremely critical component of any biological objective policy. Even with the most technically sound scoring tools, mitigation or remediation of undesirable biological condition will be impossible without sound and robust methods to reliably identify the causes associated with underperforming streams. As a basic framework, the five-step EPA Causal Assessment/ Diagnostic Decision Information System (CADDIS) framework seems adequate for conducting causal assessments. However, based on the case study evaluations that relied on CADDIS, it seems apparent that the technical tools necessary to adapt this framework for streams throughout California have not been adequately developed or addressed in this guidance document. The comments that follow summarize what we have determined to be the most significant and critical deficiencies in the draft guidance document. We recommend that in the absence of sound technical information and guidance to address these deficiencies, the deficiencies should be noted and listed as the most critical needs for "Recommended Future Work". In at least one of the case study examples, a lack of guidance and available tools to address deficiencies resulted in the erroneous identification of "likely" candidate causes when the available data would indicate otherwise. If this uncertainty is not acknowledged and corrected, significant regulatory and public resources would be wasted to mitigate stressors not associated with the actual or perceived reduction in desired biological condition. Therefore, Tri-TAC and CASA firmly believe and urge the State Water Board to fully address the limitations associated with causal assessments and develop the necessary and appropriate tools BEFORE it adopts any policy or plan dealing with biological condition. Although the authors contend that causal assessments will eventually become more efficient and informative through the development of new assessment tools obtained through the experience gained as more assessments are conducted, we feel that the necessary tools to address the shortcomings and information gaps can only be developed through a concerted effort that includes significant investments of technical and financial resources. We further believe that by not highlighting and acknowledging these deficiencies in the draft causal assessment document, the authors' opinions on the eventual success of causal assessments is overly optimistic and the utility of this document in providing guidance or prioritizing future technical needs is greatly diminished. Our comments on this document are organized into two categories. The first set of comments (1 through 7) detail our concerns associated with insufficient or undeveloped tools and guidance that we feel must be developed before finalizing any biological objective policy. The second set of comments (8, 9 and 10) detail what we feel are errors in interpretation that should be corrected and/or clarified. Finally, apparent data errors were identified in various tables and figures contained in the main document and appendices. Instead of enumerating these here, Tri-TAC and CASA representatives have notified the authors of these errors and are attempting to work directly with members of the Technical Team to rectify or clarify them.

1. The draft document fails to provide guidance on initially evaluating and distinguishing between "pollutant" and "non-pollutant" causes of biological condition impairment.

It should be anticipated that the remediation and restoration for many, if not most, biologically impaired streams in California to levels commensurate with reference condition will be significantly limited due to non-pollutant causes such as altered hydrology, loss of riparian and instream habitat, impervious surface cover, and other stressors that the State Water Board does not have the authority to mitigate. In fact, habitat limitations were identified as a likely cause in two of the four case studies and suspected as an unresolved stressor in another. Therefore, useful causal assessment guidance needs to be provided to the regulated and regulatory community to initially identify and quantify non-pollutant stressor limited streams and reaches. Doing so will facilitate accurate placement of such non-pollutant stressor impacted streams/reaches on the Category 4C 303(d) list that will not require development of a costly and unnecessary TMDL. Likewise, the streams and reaches identified as not being limited by non-pollutant factors can be confidently placed on the Category 5 303(d) that will require development of a TMDL.

It seems apparent that such guidance is not currently available and, at a minimum, any causal assessment guidance document should recognize this shortcoming and provide significant discussion on how this may or should be addressed through additional technical efforts.

2. It is critical that this guidance document identify where the developed scoring tools should or should not apply.

The results contained in the draft on California's Reference Network[1] identified several specific regions that were under-represented in the reference condition data set. Among those specifically identified as "under-represented" included the Central Valley ecoregion, Desert/Modoc, and streams draining large (>500 km^2) watersheds as well as sub-classes of streams that included low elevation, low-gradient, and low precipitation. Other streams were identified as "may be under-represented", including very high elevation streams (>3000 m). Additionally, the draft "Maximizing the Applicability of the Bioassessment Scoring Tool" document[2] indicated that when the number of "expected" taxa is relatively low, a bias in the multi-metric index (PMMI) component of the California Stream Condition Index (CSCI) scoring tool is observed. This bias is reflected in the consistently low PMMI scores compared to the observed over expected (O/E) scores and is associated with the inclusion of rare taxa in the PMMI component that are specifically excluded from the O/E component.

The causal assessment guidance document should reiterate those locations where use of the scoring tool is either inappropriate or questionable based on the findings and information contained in the other two draft documents. Furthermore, any locations or natural gradient ranges subsequently found to be underrepresented (i.e. naturally high conductivity) should also be clearly identified in the causal assessment guidance.

3. ***The guidance document should provide guidance on conducting an "upstream/downstream" causal assessment to evaluate and potentially rule in or out contributions from point sources, tributaries, and/or near-stream actions or events.***

For many stakeholders, it will be important for them to assess whether they are significantly contributing to the low observed biological condition score. This can best be accomplished by examining and comparing a site to a location immediately upstream of a suspected impact or source. Additionally, this type of causal assessment may also be appropriate to evaluate areas where use of the CSCI scoring is less robust such as when the expected number of taxa is low or in underrepresented stream types. Unfortunately, attempts to associate undesirable biological condition due to point sources such as outfalls or tributary confluences were not specifically evaluated in any of the case studies included in the guidance document. Guidance on performing such an evaluation would be extremely helpful for regulated entities

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[1] http://www.waterboards.ca.gov/plans_policies/docs/biological_objective/1_reference.pdf
Draft of "An approach for evaluating the suitability of a reference site network for the ecological assessment of streams in environmentally complex regions". Peter Ode, Andrew Rehn, Raphael Mazor, Kenneth Schiff, Eric Stein, Jason May, Larry Brown , David Gillett , Kevin Lunde and David Herbst.
[2] http://www.waterboards.ca.gov/plans_policies/docs/biological_objective/2_scoring%20tool.pdf
Draft of "Maximizing the applicability of bioassessment scoring tools in environmentally complex regions". R.D. Mazor, A. Rehn, P. R. Ode, M. Engeln, K. Schiff.

responsible for point source contributions to determine if their activities were associated with decreased biological condition.

The Technical Team has failed to provide guidance on any alternative approach to conducting causal assessments or even recognize that alternatives such as an "upstream/downstream" approach can or should be investigated. Developing guidance on alternative approaches would allow more widespread use of the scoring tools in areas and reaches where comparisons to reference condition are not appropriate (underrepresented classes), questionable (low expected taxa numbers resulting in a bias in the PMMI component), or to evaluate changes over time. Unfortunately, the current draft causal assessment guidance document only examined comparisons of test sites to reference condition.

4. The draft causal assessment guidance document provides virtually no guidance or direction in the most technically appropriate way to evaluate bioassessment data collected over multiple years from a single location.

The authors of this technical guidance document erroneously conclude that access to multiple bioassessments conducted at a location will be relatively rare. However, it is has been recognized by the Technical Team and the Science Advisory Group that any management action, including any impairment assessment, should be restricted to only locations with multiple bioassessment results. Therefore, accessibility of biological data collected across multiple years will be routinely available for the vast majority of causal assessments. While the draft causal assessment document suggests various approaches that could be used to evaluate multiple bioassessment results, they were not able to provide specific guidance on the most technically supportable approach to evaluate multiple bioassessment results. Based on the information contained in Table 11 of Appendix D, when examining the data within the case (single and multiple year), one would logically conclude that both elevated conductivity and temperature were either not a likely cause or unresolved. The only data that actually supported a conclusion that elevated conductivity was associated with low biological condition (either for the single year or multiple years) was stressor response data obtained outside the case, even in comparisons where spatial co-occurrence was scored "---"! In other words, conductivity was identified as a "likely" candidate cause based entirely on an evaluation of data collected outside of the watershed even though data in close proximity to the test site indicated that these was no spatial co-occurrence of increasing conductivity to decreasing biological condition. Unfortunately, the inclusion of this as the only example of evaluating data across multiple years is not particularly useful considering that the stressor response data obtained outside the case will not change from year to year.

5. The draft causal assessment guidance document was not able to provide specific recommendations on how associated stressor data (physical habitat, chemical-specific measurements and/or toxicological evaluations) collected prior to bioassessment sampling should be integrated into the causal assessment.

One of the stated advantages of evaluating biological condition is that it integrates stressor exposure over time. When evaluating freshwater benthic macroinvertebrates, the appropriate stressor integration time scale can range from weeks to years. In most instances where a causal assessment is required, associated stressor data collected concurrently with the biological measurements as well as over time will be available. Since stressor data collected concurrently with the biological condition is more likely to be predictive of future biological condition and not as useful for explaining current biological condition, it will be important to provide stakeholders with guidance on what is the most useful stressor data to evaluate from a temporal standpoint. For example, would a three-month mean preceding collection of biological condition data be more useful than a 12-month mean? Clearly, this will most likely depend on the stressor being measured, variability over time of that stressor, the frequency of stressor measurement collection, as well as biotic factors (i.e. uni/multivoltine taxa observed).

6. The draft causal assessment guidance needs to define how similar the natural gradients among comparator sites need to be to adequately minimize confounding changes associated with natural gradient from changes associated with stressors.

The CADDIS framework for conducting causal assessments relies on using representative comparator sites to compare stressors and biological condition to the test site. When utilizing comparator sites in close proximity to the test site, differences in natural gradients potentially impacting expected biological condition among the sites are assumed to be minimal. However, the further away the comparator site is from the test site, the greater the risk that differences in natural environmental factors are confounding the causal assessment outcome. The authors of the causal assessment guidance document recognized this issue and indicated that it is important to ensure that natural environmental factors are as similar as possible to the test site. However, the authors were unable to provide any guidance on when a comparator site is not similar enough. It should be expected that for different environmental factors, different eco-regions, and even differing temporal scales that the acceptable threshold for similarity would be different. Failure to provide such technical detail and guidance can expected to result in associating an incorrect candidate cause as being responsible for the poor biological condition potentially leading to extensive mitigation costs and efforts with no actual improvements in biological condition.

7. The draft Causal Assessment Guidance provides no information on quantifying or even evaluating if the desired biological condition can be reasonably expected after mitigating the identified stressor(s).

Recognizing that the eventual intent of this draft guidance document will be to inform State Water Board as they develop a biological objective policy, the authors indicate that if the control mechanisms that are ultimately identified through a causal assessment are relatively inexpensive and easy to implement, confidence in the assessment outcome need not be as high as it would if the mitigation/remediation is likely to result in significant costs. Considering that the entire causal assessment as recommended in the draft guidance document attempts to link candidate causes/stressors to changes in only selected sub-metrics (loss of sensitive taxa, dominance of insensitive taxa, missing species, etc.), significant uncertainty exists as to whether or not anticipated improvements in such sub-metrics will be successful in increasing the overall CSCI score. Since the overall CSCI score is what is being proposed as a statewide biological condition objective, tools to relate incremental improvements in individual sub-metric scores back to reasonably expected changes in the overall CSCI score need to be developed. Failure to develop and provide guidance on predicting expected improvements in individual sub-metric scores associated with mitigating an identified stressor combined with tools that will reliably estimate the expected improvement in the overall CSCI score in response to sub-metric score improvements will lead to inefficient, potentially costly, and ultimately unsuccessful regulatory actions that are likely to result in little or no improvement in biological condition.

8. There appears to be inconsistencies in defining and evaluating spatial co-occurrence relative to within case comparator sites that resulted in the incorrect stressors being identified as "likely" in at least one of the case studies.

Page iii of the Executive Summary of the draft guidance document recommends the use of comparator sites with "higher quality condition" than the test site to evaluate candidate causes. However, on page 8 of the guidance document, "Spatial and Temporal Co-occurrence" is conceptually defined as "the biological effect must be observed where and when the cause is observed, and must not be observed where and when the cause is absent". The USEPA CADDIS guidance indicates that comparator sites can be unimpaired or impaired sites as long as it is "impaired in a different way". Therefore, when evaluating comparator sites, higher quality biological condition must not be assumed, but evaluated on a case-by-case basis. When evaluating co-occurrence of temperature, conductivity, TDS, and hardness for the Santa Clara River case study, co-occurrence was assumed since the magnitude of the stressor was higher at the test site than the comparator site without regard or examination of the biota. Examination of the associated macroinvertebrate assemblages revealed that biological condition was similar, and actually slightly better at the test site than the comparator site. We have focused our case study evaluation comments (comments 8, 9 and 10) on the Santa Clara River because this appears to be the only case study that specifically examined receiving water conditions potentially impacted by a POTW discharge. It is possible and maybe even likely that these comments are also applicable to the other case studies.

In the Santa Clara River case study, the authors concluded that elevated conductivity was a likely cause based in part by an erroneous application of spatial and temporal co-occurrence between the test site and local sites within the case. Table 3 of Appendix D indicated that, for the immediate upstream RC and further downstream comparator location RE, no such co-occurrence was observed. In fact, spatial co-occurrence was scored "---" between the test site (RD) and RC (immediately upstream of the test site) and RE (downstream from the test site). A score of "+" indicates that the stressor was present and greater at the test site relative to the comparator site and that the biological condition of interest was lower at the test site relative to the comparator site. A score of "-" indicates that the stressor at the test site was either not present at levels greater than the comparator site or that the biological condition of interest was the same or higher at the test site relative to the comparator site. Multiple "-"s indicate that the co-occurrence was even weaker. However, spatial co-occurrence was scored a "+"for the hydrologically disconnected RB location even though biological condition at the test site was actually significantly better than at the RB location. In summary, spatial and temporal co-occurrence was either absent (RC and RE) or erroneously interpreted because changes in biological condition in the expected direction were not observed (RB).

By assuming improved biological condition in comparator sites, conductivity was incorrectly identified as a "likely" candidate cause instead or more appropriately identifying it as "unresolved" or even "unlikely". While it could be reasonably concluded that the magnitude of the candidate cause may have been high enough at both comparator sites and test sites to be responsible for the generally low biotic condition observed at all sites, "this finding convincingly weakens the case for the candidate cause, because causes must co-occur with their effects".[3] However, in terms of temperature, the drastic differences in temperature between the test site (RD) and comparator site (RC) combined with the similar biological condition should have indicated that spatial and temporal co-occurrence was clearly not demonstrated for elevated temperature.

9. The Santa Clara River Case Study Incorrectly Identified Temperature and Conductivity as "Likely" Candidate Causes When a More Complete Analysis Indicates that the Causal Assessment Was Inconclusive.

The Santa Clara River Case Study incorrectly concluded that elevated conductivity and temperature were likely candidate causes and primarily utilized the "uncertain" category for stressors for which there are inadequate tools for analysis. Instead, a reasonable and logical evaluation of the same data and information used in this case study should have concluded that the causal assessment was entirely inconclusive. Elevated conductivity was identified as a likely stressor in the Santa Clara River case study based on three lines of evidence. The first line of evidence was that hardness, conductivity and TDS were

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[3]CADDIS Volume I: Stressor Identification. Accessed at http://epa.gov/caddis/si_step3_cooccurrence.html

elevated at the test site relative to a hydrologically disconnected site (RB) within the watershed. However, as previously discussed, biological condition at the test site (RD) was actually significantly better than the biological condition at the hydrologically disconnected site that exhibited lower hardness, conductivity and TDS. Therefore, the association of elevated conductivity with poor biological condition using data within the watershed is extremely weak and generally leaning towards no association at all. The other two lines of evidence relied on biological condition data collected from sites outside the watershed. The first of these involved comparing conductivity at the test site to the range of conductivity observed at reference sites. While this tool can be useful for ruling out or contextualizing a potential candidate cause (for example, if the magnitude of the candidate stressor at the test site was similar to what has been measured at reference sites), it is not a particularly useful tool to implicate a potential stressor. Therefore, since conductivity was significantly higher at the site compared to reference sites, we certainly cannot rule out conductivity, but using this line of evidence to support identifying conductivity as likely cause is extremely weak. The third and final line of evidence used to support identification of conductivity as being a likely cause of low biological condition in the Santa Clara River was the use of reference and non-reference data from sites outside the watershed that exhibited similar ecological condition as the test site. However, as has been previously discussed, significant effort and resources still need to be committed in order to determine precisely how similar the ecological condition at a comparator site needs to be compared to the test site. For example, slope at the test site was <0.5% but the ecologically similar comparator sites were only constrained to a slope of less than 1.5%. Additionally, no restrictions were placed on minimum watershed area. The Santa Clara River is considered to be an extremely large watershed (>>500 km2) and it was noted in the draft Reference Condition document that reference condition was under-represented in such streams. Furthermore, the authors of the guidance document state that "these analyses were designed to assess whether the degraded biological condition captured in each biological endpoint could be the result of the observed level of the proximate stressor". Therefore, even if we ignore the issue of similar ecological condition and assume that the sites in the statewide database were actually sufficiently representative, this line of evidence only suggests that elevated conductivity could have been the stressor. To ultimately conclude based on this and the other two lines of evidence that elevated conductivity was a likely candidate cause is over reaching. There was virtually no association between elevated conductivity and low biological score using data in close proximity to the test site. If anything, the information from within the case would suggest that biological condition nonsensically improved at the test site in response to elevated conductivity. The second and third lines of evidence that relied on reference site data and data from sites outside the watershed indicated only that conductivity could have been a contributing factor. It is important to understand that stream reaches will be placed on the 303(d) list as being impaired for the candidate causes that identified as "likely". Ultimately, these 303(d) listings will include the development of a TMDL and eventual regulatory controls on the identified candidate cause that can result in significant public investments. For this reason, it is critical that only candidate causes exhibiting the highest degree of certainty are identified as likely (or unlikely). Therefore, any "likely" candidate cause should never be based exclusively on data from outside the case. Considering the data limitations and uncertainty in the causal assessment evaluation for the Santa Clara River case study, a more appropriate determination would be that elevated conductivity is a possible candidate cause, but not a likely candidate cause, and this stressor should have been identified as uncertain.

Elevated temperature was also identified as a likely candidate cause based on two lines of evidence using data from within the case exclusively (no outside of case data evaluations were conducted for temperature). The first line of evidence was that temperature at the test site was elevated compared to three of the four comparator sites that included an immediately upstream location and two locations downstream relative to the test site. The second line of evidence was that "there was a strong stressor response relationship between increasing mean temperature and increasing % of non-insect taxa". This "strong" relationship was indicated by the "+" on Table 3 of Appendix D in the "Temperature" column and "Non-Insect Taxa" row. However, a closer examination of the non-insect taxa scores would justify a "-" relationship for two of the four comparator sites (RB and RE) because non-insect taxa scores were significantly better at the test site and a "0" score for the other two comparator sites (RC and RF) because there was no significant difference in non-insect taxa scores between those sites and the test site. Therefore, since the elevated temperature at the test site was not associated with any significant changes in biological conditions, it is not logical to conclude that temperature was a likely candidate cause. However, unlike conductivity, there appears to be significant information to support identifying temperature as an unlikely candidate stressor. However, considering the lack of overall confidence, categorizing temperature as unresolved would be reasonable with an additional narrative describing that most of the available data would suggest that temperature was an unlikely stressor.

In summary, it is our opinion that the only reasonable conclusion that can be made based on the causal assessment conducted for the Santa Clara River case study was that it was inconclusive. While some information indicated that some compounds were less likely to be a contributing factor, nothing was identified as a likely contributing factor. We feel this assessment most likely failed to implicate a causative stressor for three reasons. First, the actual stressor may not have been evaluated as one of the original candidate causes. Second, the appropriate stressor response metric may not have been evaluated. Finally, several critical tools have not been developed that may have provided additional support in ruling in or ruling out a particular stressor. These missing tools would include predicting biological response associated with changes in stressor followed by an evaluation to determine if desired biological condition would be expected if such improvements were realized. Additionally, tools to assist in selecting appropriate outside of case comparator sites that appropriately defined and incorporated similar natural gradients would have provided more confidence in the "data from elsewhere" analysis. Therefore, it is our opinion that all causal assessments should be a continuous and iterative process. Once it was apparent that the results of the assessment were inconclusive, the stakeholders should have re-evaluated their list of candidate causes and potential stressor response metrics and re-initiated the process. Unfortunately, this was not done for this assessment and instead, likely candidate causes were "forced" into the conclusions even though an objective evaluation of the evaluated data would indicate that the identified "likely" causes were, at best, possible/uncertain causes. We are disappointed that the authors did not seize on this opportunity to provide stakeholders with real guidance on interpreting the results of this assessment and how to move forward when the results are entirely inconclusive.

10. 303(d) listing decisions and eventual TMDL implementation will ultimately be informed by the results of the causal assessment. Therefore, only the candidate causes exhibiting the absolute highest level of certainty should be included in the "likely" and "unlikely" categories.

Upon completion of a causal assessment, the guidance document calls for potential candidate causes to be grouped into one of three categories; likely, unlikely, or uncertain candidate cause. Of the three, the highest certainty is associated with ruling in or ruling out a candidate cause as likely or unlikely. The uncertain category is reserved for potential stressors that may or may not be the cause of poor biological condition and stressors not sufficiently analyzed. It is clear that this draft guidance document is intended to be used by stakeholders to respond to exceedances associated with the eventual State Water Board biological objective or target. In conjunction with the State Water Board's eventual biological objective policy, streams not meeting biological condition expectations will be placed on the 303(d) list as being impaired once a causative pollutant(s) is identified. Therefore, 303(d) listings and eventual regulatory actions (TMDLs) on the candidate causes identified as "likely" will be assessed based on the outcome of the causal assessment. As discussed throughout our comments and for the Santa Clara River case study in particular, the confidence in reliably identifying a "likely" candidate cause is limited by many factors. These factors include confounding interpretations regarding spatial and temporal co-occurrence as well as the lack of available tools to assess representativeness of comparator locations, how to evaluate available physical, chemical, and biological data collected across multiple years, and the inability to accurately predict changes in biological condition scores and confirm that expected changes can reliably be expected to result in attainment of desired biological condition. Even the draft guidance clearly stated that the confidence in identifying likely candidate causes was variable among the four case studies evaluated. Overall, for the reasons discussed in specifically in comments 8 and 9, it is our opinion that the only reasonable conclusion that can be made based on the causal assessment conducted for the Santa Clara River case study was that it was inconclusive. While some information indicated that some compounds were less likely to be a contributing factor, nothing was identified as a likely contributing factor worthy of TMDL implementation. Therefore, we recommend that a fourth category of "possible stressor" be incorporated into the draft guidance to indicate those stressors where a candidate cause is suspected and partially supported in the causal assessment but a lack of overall confidence warrants not identifying the stressor as "likely" and reserve the "likely" designation for only those stressors where confidence is extremely high and controlling the identified stressor(s) is likely to result in attainment of desired biological condition.

Thank you very much for the opportunity to provide our comments.

Very truly yours,

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