Brazos River Authority

We appreciate the opportunity to present the following comments regarding the material presented at the July 27, 2015 Surface Water Quality Monitoring Guidance Advisory Work Group. We have presented our comments below by agenda topic.

Water Quality Standards Update

§307.6 Toxic Materials- Table 2

While we realize it may be too late to do much about it, some of the revised column A parameter criteria are well below the minimum detection level of the applicable EPA methods. These parameters are: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, Pentachlorophenol, and 1,1,2,2-Tetrachloroethane. It will be difficult to assess these parameters when labs cannot actually reach the criteria.

Appendix F – Site-Specific Nutrient Criteria for Selected Reservoirs

We strongly support the site-specific nutrient criteria for Possum Kingdom Reservoir, Stillhouse Hollow Lake (provided it is assed at 5.0 µg/L) and Belton Lake.

Appendix G – Site-Specific Recreational Uses and Criteria for Unclassified Water Bodies

We strongly support the site-specific recreational uses and criteria for the Navasota River above Lake Mexia, East Yegua Creek, Bullhead Bayou, and the Unnamed Tributary of Bullhead Bayou.

Nutrient Assessment in Texas Reservoirs

We have several comments regarding the approach presented. We strongly support the weight of evidence approach, the adoption of numeric criteria and the development of site-specific thresholds for TP and Secchi Depth. We also support the proposed method for implementing/assessing the numeric criteria. We would appreciate more detail on how exactly the Carlson's Trophic Status Index or TSS concentrations will be used to determine that reduced transparency is not related to chlorophyll *a* (Chl *a*). We are also concerned about the impact of prolonged drought events on the proposed response parameters.

We are primarily concerned about creating a screening level criteria for all reservoirs whose numeric criteria was not accepted by EPA. Since EPA rejected all proposed Chl *a* criteria ≥20 µg/L, we are now going to have numeric criteria for only those reservoirs that are not showing major impacts. With nutrient criteria we are now putting our reservoirs that are in relatively good shape in a position to be impaired, while the reservoirs that are showing nutrient impacts will only ever be assessed as a concern. Given the attention applied to 303(d) impaired waterbodies, this could lead to the expenditure of resources to remove impairments on relatively good reservoirs and leave the others, that need the resources, unaddressed. We are not sure continued use of screening levels on the most problematic reservoirs and full-support assessment on our best reservoirs will give the State the best return on its resource expenditures in the long run. Would EPA be more supportive of the previously rejected criteria being used as criteria, now that you have a much more robust assessment proposal that involves TP, TN, DO and Secchi Depth?

We would be amenable to reducing our Chl *a* LOQ to 2.0 µg/L. However, we see little value in considering reducing the LOQ to 0.2 µg/L, when we already know the values on the upper end of the analytical spectrum are the levels that create use impairment. Having a value of <2.0 µg/L does not have any practical value because it is
not in the range where use impairment has been documented. Additionally, there is a disparity in the analytical methodologies, with the LOQ of the spectrophotometer being 2.0 µg/L. Changing to the LOQ to 0.2 µg/L for labs that possess a fluorometer will lead to different data sets across the state based on the analytical equipment employed by each lab.

Additionally, we have concerns with an LOQ of 0.02 mg/L for TP. We can consistently meet a LOQ of 0.04 mg/L for TP. With the range of background water quality conditions we experience monthly (Chloride levels ranging from 5-20,000 mg/L, TDS levels ranging from 50-25,000 mg/L, TSS levels ranging from 2-7,000 mg/L) and limited resources, we will struggle to attain and maintain a LOQ of 0.02 mg/L consistently and efficiently.

Regarding the DO response variable requirements, we are concerned with using DO impairments from any portion of the reservoir. We propose an exclusion for DO measurements taken in coves or man-made canals that are not part of the mainbody of the lake. Additionally, we are concerned about the use of DO concentrations for assessment that are collected immediately (within one month) of a significant flood event.

We are aware that a stakeholder expressed the opinion that reservoirs with numeric criteria <5.0 µg/L should be assessed at the numeric criteria to protect drinking water from taste and odor issues. We do not support this opinion, we believe all uses need to be protected even if they are not all protected perfectly. Attempting to maintain a chlorophyll a value of <5.0 µg/L does not allow for the natural aging processes of reservoirs and does not allow for the development of robust fisheries due to the lack of primary productivity. Additionally, taste and odor issues are not directly correlated to Chl *a* levels, it also depends on the constituent species of the algal community, with certain cyanobacteria being the most common causative issue of taste and odor issues. Of greatest importance in preventing the potential taste and odor issues to develop, is knowing the type of phytoplankton community currently present and the conditions at which a water body may become dominated by problematic cyanobacteria.

A review of recent literature and review of other state regulatory agencies documentation do not support the opinion that Chl *a* levels <5.0 µg/L are a directly correlated with not having taste and odor issues. Downing et al[1] concluded that the risk for cyanobacteria-dominated communities increased when Chl *a* concentrations >10.0 µg/L. Additionally, Dzialowski[2] et al found that lake trophic state alone is not a good indicator of geosmin (a compound that contributes to taste and odor issues) concentrations. Smith et al[3] concludes that a mean concentration of Chl *a* <10.0 µg/L should reduce the frequency of occurrence of taste and odor issues.
The Kansas Department of Health and Environment[4] documents that taste and odor problems begin occurring when Chl *a* concentration are ≥10.0 µg/L. In the Kansas white paper, several options were presented for creating a Chl *a* criteria, the lowest option set the Chl *a* criteria at 8.0 µg/L. To prevent taste and odor issues and trihalomethane formation in drinking water, the State of Oklahoma[5] has adopted a long-term Chl *a* average criteria of 10 µg/L for water supply lakes.

[1]Downing, J.A, S. B. Watson, and E. McCauley. (2001). "Predicting Cyanobacteria Dominance in Lakes". *Canadian Journal of Fisheries and Aquatic Sciences*, 58:1905-1908.
[2]Dzialowski,A.R, V.H. Smith, D.G. Huggins, F. deNoyelles, N.C. Lim, D.S. Baker and J.H. Beury. (2009). "Development of Predictive Models for Geosmin-Related Taste and Odor in Kansas, USA, Drinking Water Reservoirs". *Water Research*, 43:2829-2840.
3Smith, V. H., J. Sieber-Denlinger, F. deNoyelles, Jr., S. Campbell, S. Pan, S. J. Randtke, G. T. Blain and A. A. Strasser, 2002, Managing Taste and Odor Problems in a Eutrophic Drinking Water Reservoir, *Lake & Reservoir Management 18(4):* 319-323.
[4]Kansas Department of Health and Environment. (2011)."Water Quality Standards White Paper: Chlorophyll-A Criteria for Public Water Supply Lakes or Reservoirs.
[5]State of Oklahoma Water Resources Board. (2005). "Justification for Chlorophyll-A Criteria to Protect the Public and Private Water Supply Beneficial Use of Sensitive Water Supplies".

Drought Assessments
We support the incorporation of drought indicators into the assessment for the *Integrated Report* but would appreciate more detail on how exactly the analysis will be incorporated into the assessment (walking through a real-world example or two would be very helpful).

Biological Assessments
We support the addition of coeffienct of variation into biological assessment. However, we do have concerns regarding the robustness of the CV calculation/evaluation when only 2 sampling events have been performed at a site. Additionally, caution needs to be exercised with assessing for use impairment on data was collected to specifically target a short-term disturbance (e.g. South San Gabriel River construction). The data from before the disturbance and months after the disturbance has ceased can be included in use impairment assessment, but data during the disturbance and immediately after it, should probably not be included in assessments.

Tarrant Regional Water District

The TRWD has reviewed your reservoir nutrient assessment guidelines and have a few comments. The first decision box on the reservoirs with disapproved criteria flow chart (Fig 2) that says, “Does Chl-a exceed Threshold?” has many interpreations. The “Chl-a” could be median or all the data from a 7 year period. Likewise the “Threshold” could be the disapproved criteria or the screening level. We have looked at our reservoir data and find that using all the data and the screening level (26.7) with a 20% exceedance seems to work best. We understand that the screening level may not be protective enough for some highland lakes but it is reasonable here.

We are also a bit concerned with the 40 ug/L “threshold”. That seems very high and when coupled in a flow chart with 30 ug/L almost seems like a second standard or the ultimate standard.

City of Austin

Thank you and all of the participating TCEQ staff for sharing information, answering questions, and taking our comments. The City of Austin respectfully submits these comments for your consideration:

1. The City of Austin is supportive of the proposed critical low flow thresholds of 0.1th percentile low flow in lieu of the 7Q2 for springflow dominated streams with threatened or endangered aquatic species. We believe that this would be more protective of aquatic life. Additionally, we respectfully request that you also include segments with aquatic species that are also candidates for federal listing (eg, freshwater mussels) in this criteria to provide proactive protection for species that are likely to become listed as endangered in the future.
2. Please provide a definition for "spring flow dominated perennial streams." Wouldn't any perennial stream without wastewater discharge be springflow dominated during non-storm influenced conditions? If Barton Creek (segment 1430) is included as springflow-dominated as noted in the proposed footnotes to Appendix A, then also please include Onion Creek (segment 1427) as it has extremely similar hydrology and also has many seeps/springs providing baseflow. Both watersheds contribute substantial flow to Barton Springs (Onion contributes even more than Barton), habitat for two federally-listed endangered aquatic salamander species.
3. We do not support removal of chloride, sulfate and dissolved solids data when flows are less than 0.1 cfs in perennial streams. No data for dissolved solids, chloride or sulfate are currently removed from the assessment based on flow condition according to current guidance, and thus we believe this is less protective than current methods. Because TCEQ is incorporating information about drought via the Palmer Index into your assessment, we believe this new exclusion of low flow data to be unnecessary.
4. For Lake Austin (segment 1403) and Lake Travis (segment 1403), please lower the chlorophyll-a criteria to the values calculated and remove the artificial censoring at 5 ug/L from Appendix F, or otherwise re-evaluate the chlorophyll-a criteria to confirm the values below 5 ug/L. While there may have been questions about the validity of the older chlorophyll-a data below 5 ug/L, chlorophyll-a reporting levels are now 2 ug/L for Clean Rivers Program submittals, and thus recent data can be used to validate the accuracy of the calculated averages below 5 ug/L. It is confusing to have two criteria listed for these segments in the tables.
5. Figure 1 in the handouts from the meeting with the flow chart describing attainment of numeric chlorophyll-a criteria in reservoirs indicates that some waters may have exceeded their chlorophyll-a criteria, potentially exceeded one or more nutrient concentration thresholds, and potentially exceeded a secchi or DO level but still be "Fully Supporting". If the median chlorophyll-a criteria is exceeded, these water bodies at a minimum should be identified as "Concern" and not fully supporting.
6. In the proposed reservoir nutrient assessment methodology, including both the TN criteria (which was established based on a model relating TN and Secchi disk depth) and separately the Secchi disk depth criteria appears duplicative. If the TN-Secchi model is mechanistically accurate, in most cases wouldn't both criteria be exceeded if either one was exceeded? If not, this suggests that there may be a problem with the underlying model used to establish the TN criteria. Our understanding of this proposed methodology

is that only eutrophic waters that have exceeded their chlorophyll-a criteria, have exceeded the assimilative capacity of the reservoir such that there are elevated concentrations of ambient water column nutrients, and have degraded clarity and/or dissolved oxygen would be identified as impaired. We believe this to be more reactive than proactive, and will result in impairments only for the most degraded reservoirs which would be the most difficult to remediate through a TMDL or Watershed Protection Plan process since it may take a very long time for these excess nutrients to cycle out of the water column and sediments of these systems.

7. The proposed process for assessing attainment of the numeric criteria would identify only the most degraded reservoirs as not supporting their uses, which would be the most difficult to remediate. This proposed matrix, however, does not recognize that Public Water Supply uses may be negatively impacted by nutrient enrichment even though aesthetic/recreational uses (as represented by Secchi disk depth) and aquatic life uses (as represented by dissolved oxygen) may not be impacted to the degree that the reservoir would impaired for nutrients (based on the proposed assessment method). Thus, the proposed system appears to be biased with less importance placed on drinking water supply protection in favor of more importance placed on recreational and aquatic life uses.
8. The City of Austin would prefer a multi-metric or point-scoring approach to assessing nutrient criteria in reservoirs (such as the one being suggested by the Texas Parks and Wildlife Department in their comments) in lieu of the process described in your flow charts. The TPWD process would be much more likely to identify problematic trends towards eutrophication much earlier (when they are more likely to be successfully remediated) especially for lakes with very low (oligotrophic) chlorophyll-a concentrations currently. Simultaneously assessing stressor and response variables is preferred over a hierarchical approach as described in the TCEQ proposed flow charts, especially in cases when reservoir dissolved oxygen assessments are made solely on the basis of instantaneous grab measurements (versus diel measurements).
9. TCEQ referenced EPA guidance to justify inclusion of dissolved oxygen (DO) in the nutrient assessment for reservoirs as described in the two flow charts. That EPA guidance, however, recommends continuously monitored DO. Instantaneous grab DO sampling is not likely to reflect minimum DO levels because samples are most likely to be collected during high photosynthesis time periods. At a minimum, restrict the inclusion of DO in the nutrient assessment only to diel dissolved oxygen measurements. Since DO is already used as the primary indicator of aquatic life use attainment, there is no need to use it to determine nutrient standards attainment and thus DO ideally should be excluded from this portion of the assessment.
10. The use of the 40 ug/L chlorophyll-a threshold in Figure 2, proposed assessment procedures for reservoirs with disapproved or no criteria, is confusing. First, there is no need on the flow chart to include both the 30 ug/L and 40 ug/L comparison if only the 40 ug/L comparison is relevant. Second, page 3 of the handout notes that EPA capped criteria at 30 ug/L, and cites current literature indicating that chlorophyll-a concentrations greater than 30 ug/L result in nuisance algal blooms, taste/odor problems, and cyanotoxin production. If 40 ug/L is indicative of hypereutrophic status, utilizing it as the criteria threshold is likely to be not protective and result in impairment identification in reservoirs in which the problem is so severe mitigation is likely infeasible. The City of

Austin suggests that the chlorophyll-a threshold for reservoirs with no criteria be 30 ug/L, consistent with the EPA recommended cap.

Bayou Preservation Association

As I mentioned near the close of the meeting, Bayou Preservation Association would like to see action on the aesthetic water quality standards for "floating debris" and "aesthetically attractive". Attached is my recent letter to this regard.

The comment was made that narrative standards are difficult to enforce. My response is that this meeting did just that for the Chlor a standard.

I would be happy to meet with the appropriate staff on these issues.

During the meeting, it was mentioned that the next focus for nutrient standards would be the estuaries, then the stream segments. Is the reason for this because the standards for the estuaries will drive the standards for the watersheds flowing to them? My thoughts are that watersheds and the receiving bays should be treated as a whole and not separately or in phases.

Enclosed Letter:

July 21, 2015

Water Quality Planning Division

Texas Commission on Environmental Quality

P.O. Box 13087

Austin, TX 78711-3087

Email: standards@tceq.state.tx.us

Re: Surface Water Quality Standards - Topic for Upcoming WQS Stakeholder Meeting

Dear Ms. Miller,

Bayou Preservation Association advocates for the environmental quality of the waterways and watersheds in the Houston area. Our mission is to celebrate, protect and restore the natural richness of all our bayous and waterway. During the comment period on the Rule Project No. 2012-001-307-OW, Bayou Preservation Association submitted several comments on the proposed rule changes and other parts of Chapter 307. We continue to be concerned about two issues we commented on and would like for these to be considered in the current request in preparation of review and revision of the Texas Surface Water Quality Standards, specifically: 30 TAC Chapter 307, Rule 307.4 (b) (2) "Surface waters must be essentially free of floating debris…" and Rule 307.4(b) (4) "Surface waters must be maintained in an aesthetically attractive condition."

Here is a recap of the prior comments:

> Aesthetic Water Quality Standards – 30 TAC 307.4 (b):
>
> Houston area waterways are becoming more and more a recreation destination through the help of improved water quality, most recently thanks to the TCEQ approval of the TMDL and Implementation Plan for Indicator Bacteria. The waterways in the Houston area continue to improve in this and other water quality parameters thanks to the many partners in this effort, including the TCEQ. We now need to turn our eye to the aesthetics of the waterways and remove the floating debris that is not only an eyesore, but also impacts water quality, the riparian, bay and ocean habitats and impede the flow of water. What is roadside litter often becomes floating eyesores on waterways, is often mistaken by fish and turtles as food, then flows downstream and also fouls our beaches and the oceans beyond. Many jurisdictions across the U.S. have adopted what are termed "Trash TMDLs" in recognition of this aesthetic issue and to improve water quality. The Houston area, and we suspect much of Texas, is ready to improve the aesthetics and water quality related to floating debris. It is now time to get the trash out of Texas' waterways!
>
> 30 TAC Chapter 307 at Rule 307.4(b) has two aesthetic parameters that state the "Surface water must be essentially free of floating debris…" and also "maintained in an aesthetically attractive condition." Sadly, most of the waterways in the Houston area do not meet these standards. Our organization and many others as well as governmental entities, individuals and business spend countless hours and dollars removing litter from watersheds that becomes floating debris, and also remove tremendous amounts of debris directly from our waterways. With all this effort, these aesthetic standards are still not met. Does the TCEQ have records quantifying the amounts of floating debris in each stream segment? How does Texas document compliance with these standards? Bayou Preservation Association seeks to assist the TCEQ and other stakeholders in achieving compliance with the aesthetic water quality standards of 30 TAC 307.4(b).

Since the time of the comments above, we continue to see unacceptable amounts of litter in our bayous and waterways. A refreshing observation is that we are seeing some reductions in areas where volunteer clean-ups are held and it seems that the older trash is being removed and only newly deposited wastes are collected in our clean-up efforts.

As discussed in the earlier comments, we are seeking to know how the TCEQ determines compliance with the General Criteria aesthetic parameters (30 TAC 307.4 (b)). The draft 2014 Guidance for Assessing and Reporting Surface Water Quality in Texas (June, 2015) is absent methods to determine compliance with these aesthetic parameters. Are methods to assess compliance with these aesthetic water quality standards found somewhere else?

As we recreate more on our area waterways and develop bayou-side trails and paddling trails, having litter free water is more important for recreation and tourism, and is a quality of life issue.

We note that the Upper Guadalupe River Authority has what it calls a “two pronged Trash Free initiative focused on public awareness and community involvement.” This is a part of their bacteria TMDL.

We also note the Reverselitter.com efforts to “collect 10 on Tuesday” in the Upper Trinity River watershed (Dallas, Ft. Worth, Denton, Arlington, Mansfield). We particularly support their efforts because those waters flow to the Houston area.

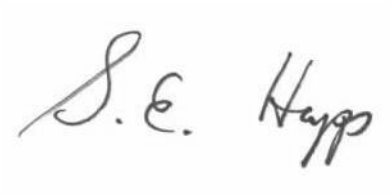
Of particular interest is the USEPA Trash Free Waters initiative. This program focuses on the fact that 80% of ocean litter comes from inland sources. Is there a TCEQ effort to match this USEPA program in Texas or coastal portions of Texas?

Some efforts term litter and floatables in water as “gross pollutants.” Our BPA Symposium this fall will focus on local, state and national efforts to remove gross pollutants.

I will be attending the Water Quality Standards meeting at the TCEQ on July 27th and hope that floating debris and trash in our waterways related to our water quality standards (30 TAC 307.4 (b)) occupies an appropriate portion of the agenda.

Thank you for your attention and I am available for questions at: 713-529-6443 or shupp@bayoupreservation.org .

Sincerely,



Steve Hupp, M. S.

Water Quality Director

Bayou Preservation Association

Lower Colorado River Authority

As a member of the Guidance Advisory Workgroup, LCRA appreciates the opportunity to comment on the 2016 SWQM Assessment Guidance. If you would like to discuss any of the following points in detail, we will be glad to meet with you in person.

1. Revision of the TCEQ chart

LCRA supports the weight of evidence approach for determining attainment of nutrient standards. However, as currently written the TCEQ chart for numeric criteria allows a water body to be fully supporting even though it exceeded its Chl a criteria. This seems to undercut the established standard that was agreed upon by the Nutrient Standards Development Workgroup when they identified Chl a as the primary determiner of nutrient enrichment.

LCRA proposes two alternatives to the TCEQ methodology. Our preferred option is outlined in # 2 below and the attached flow chart for numeric criteria. Our second option would be to replace "fully supporting" elements in the TCEQ chart with "concern". In both cases, LCRA supports the idea that water bodies should not be fully supporting if they exceed their Chl a criteria.

2. Use of dissolved oxygen (DO)

TCEQ includes DO as a parameter in the decision matrix for determining compliance with TSWQS. TCEQ referenced the EPA document *Guiding Principles on an Optional Approach for Developing and Implementing a Numeric Nutrient Criterion that Integrates Causal and Response Variables* to justify inclusion of DO in the assessment. However, the EPA recommendation is for <u>continuously monitored DO in streams</u>. Grab samples would be an inappropriate measure of nutrient enrichment as they are generally collected between 9:00 AM and 3:00 PM, when DO levels are likely high to moderately high due to photosynthesis. Finally, since dissolved oxygen is already used as the primary indicator of aquatic life use attainment, we see no need to use it to determine nutrient standards attainment.

LCRA recommends that DO not be used for the assessment of nutrients. The attached charts for numeric and narrative criteria outline how such a decision matrix could work.

3. LCRA collects surface and bottom samples in the Highland Lakes. Phosphorus data from the surface is almost always censored and do not provide resolution necessary to accurately determine support. On the other hand, bottom samples are not censored as frequently and provide a more accurate reflection nutrient enrichment as phosphorus levels increase in sediment over time.

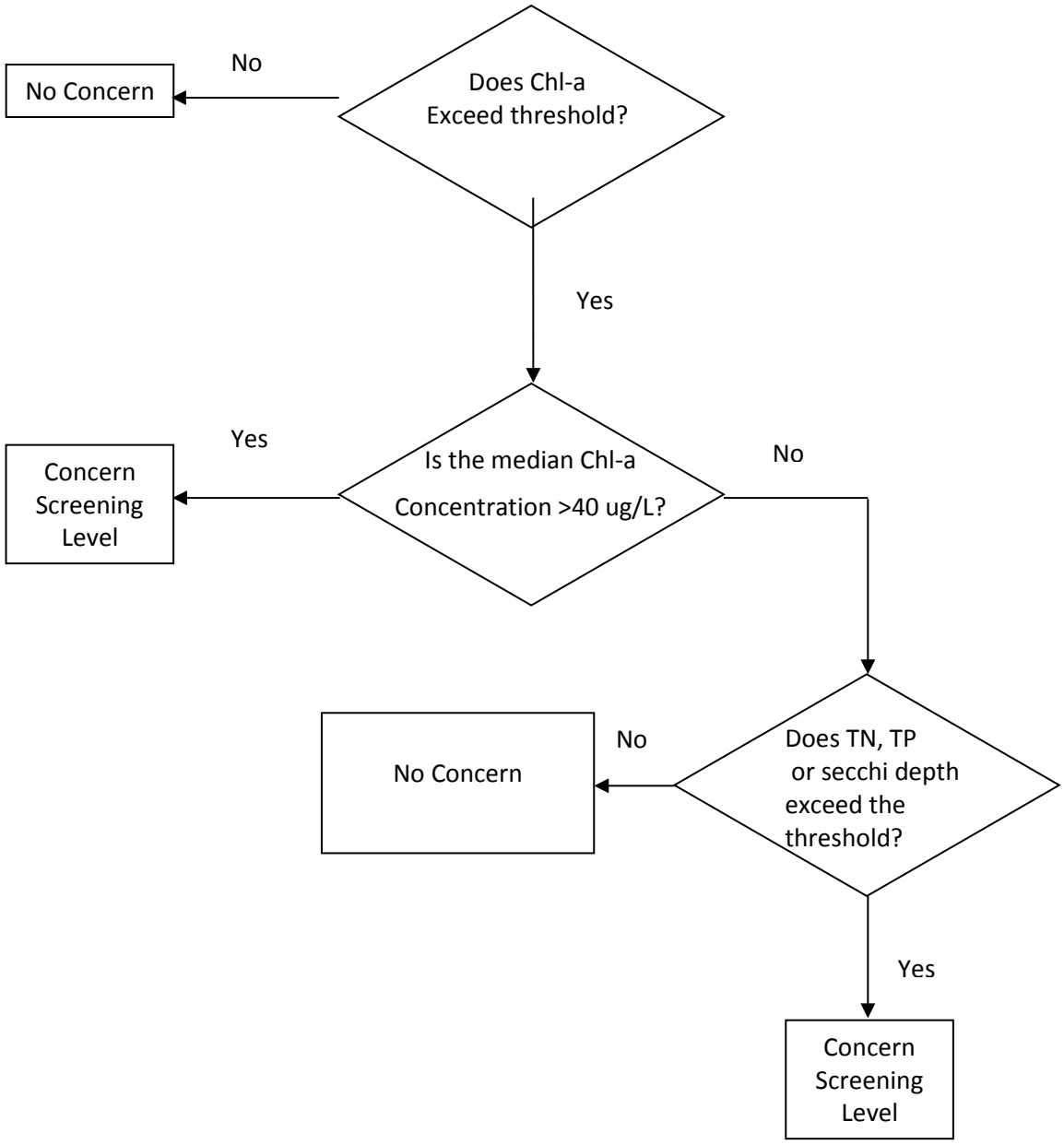
LCRA agrees with the use of Secchi depth in this weight of evidence approach. Secchi depth is a reliable indicator of eutrophication in the Highland Lakes and should be given equal status to nutrients as shown in the LCRA-proposed charts.

LCRA recommends that TCEQ review data from bottom samples as they continue to develop nutrient criteria in the future.

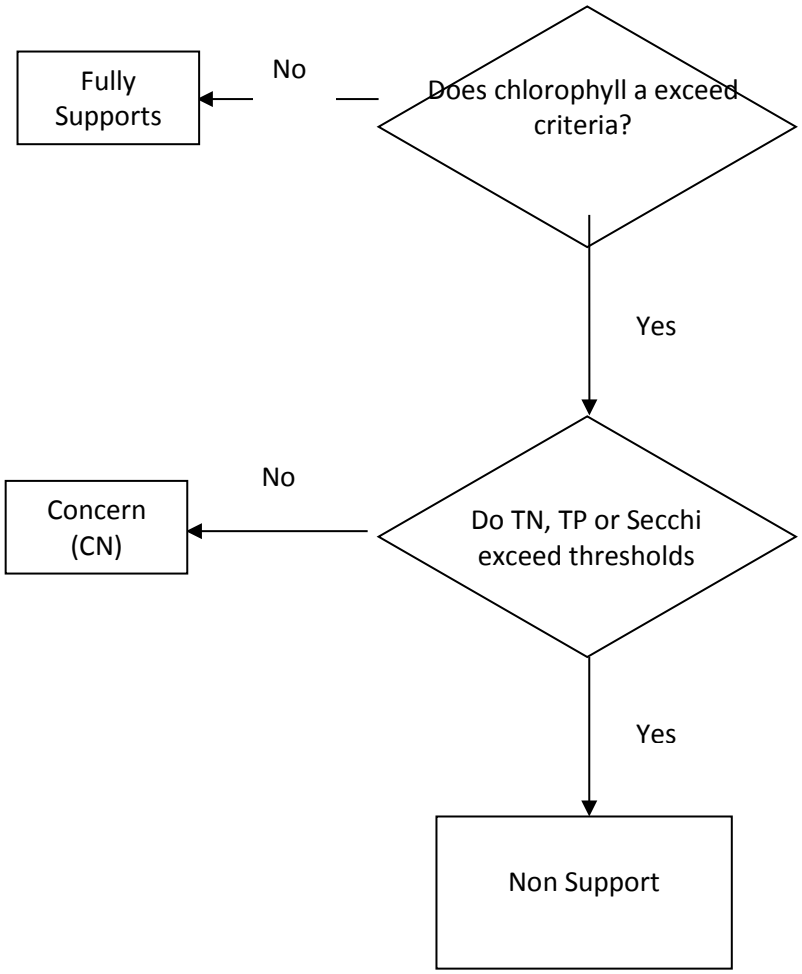
4. Significant figures used for Secchi disk values – Thresholds for Secchi depth were developed using values carried out to the hundreths place. Per the Data Management Reference Guide, Clean Rivers Program partners report to, at most, the hundredths place. In reservoirs, it is generally to the tenths place.

LCRA recommends that Secchi depth data be submitted to the hundreths place to match thresholds outlined in TSWQS.

Flow chart for attainment
of narrative criteria
Proposed by
LCRA



Flow chart for attainment
of Numeric Criteria
Proposed by
LCRA



Sabine River Authority

The Sabine River Authority of Texas respectfully submits the following comments to the proposed nutrient criteria assessment:

We use specific examples from two reservoirs in the Sabine Basin which have excellent water quality and meet their designated uses but can't attain parts of the draft nutrient criteria methodology. Recognizing the proposed methodology uses weight of evidence in a multi-layered flow chart, we propose parts of the flow chart aren't suitable, at least in our region, for describing conditions which lead to non-attainment of designated uses.

1. The median Secchi value for the most recent seven years of data from Lake Fork is 1.43m. The TCEQ's proposed Secchi threshold for Lake Fork is 1.46m. The median Secchi value for the most recent seven years of data from Lake Tawakoni (0.96m) is very close to the proposed threshold (0.89m) but its designated uses are clearly being met. Lake Fork is below the threshold for Chlorophyll a but would exceed proposed thresholds for Secchi and Total Nitrogen (Total Nitrogen is discussed below). Consequently, the proposed threshold for Secchi is not a good indicator for attainment of designated uses.
2. The recommended Total Nitrogen threshold decision box in the flow chart will direct to "Yes" for Lake Fork. For Lake Fork, the median Chlorophyll a is below the threshold and would be meeting state water quality standards, but the median Total Nitrogen for the most recent seven years of data from Lake Fork (0.75mg/L) is above the suggested threshold of 0.58mg/L. The decision box should be "Do TN **AND** TP exceed the threshold?" instead of "Do TN **OR** TP…". Phosphorus is the limiting nutrient for aquatic plant growth and elevated levels of both are required for excessive plant growth.
3. The TSWQS for human health protection and the PWS criteria for Nitrate & Nitrite (Total) is 10mg/L as Nitrogen. Human health is protected at a much higher level than the proposed Total Nitrogen threshold of 0.58mg/L so the Nitrogen threshold should be set at a higher level.
4. The Total Phosphorus threshold is 0.05mg/L and 0.04mg/L, respectively, for Tawakoni and Lake Fork. The TCEQ-approved SRA QAPP AWRL for Total Phosphorus is 0.06mg/L. What data set was used to develop the threshold for Total Phosphorus and did it contain an unreasonably high number of half values (less than detection) for the purposes of developing a threshold? The Total Phosphorus threshold should be greater than the method AWRL.
5. Total Nitrogen should also be reservoir or ecoregion-specific because of regional differences in naturally occurring soil Nitrogen levels.
6. Any nutrient criteria should incorporate reservoir age. Reservoirs are nutrient sinks and become more eutrophic with age[1], regardless of presence or absence of anthropogenic inputs.
7. Drought considerations for TSWQS assessments should apply to nutrient screening methods.
8. If a reservoir does not meet nutrient criteria, will it be listed as a Concern and what can be done to fix it?
9. As per slide 26 of Jill Csekitz's presentation, "DO impairments or concerns from any portion of reservoir incorporated" would only include Dissolved Oxygen data from

[1] http://www.tceq.state.tx.us/assets/public/compliance/monops/water/06twqi/2006_reservoir_narrative.pdf

primary AUs in the main body near the dam and major arms of the reservoir (ex. 0507_01); not from tributary inflow areas (ex. 0507B_01).

Tischler/Kocurek

My only comments on the proposed methodology for assessing nutrient data, as I discussed at the meeting are that the description of the evaluation procedure emphasize the following:

1. The objective of water quality criteria, including chlorophyll a criteria, is to protect the designated and existing uses of each water body. The DO and Secchi comparisons directly relate to protection of the aquatic life use and recreation use so that's TCEQ's basis for doing the comparisons shown in the draft assessment flowsheet.
2. The chlorophyll a criteria adopted by the state and approved by EPA are not based on concentrations required to protect the designated uses. Emphasize that they were set based on existing data for high quality lakes that achieved all their designated uses. The 30 µg/L upper bound cited for the assessment method for lakes with narrative criteria is more equivalent to a concentration that has potential use effects, which the draft document does describe.
3. The assessment method should perhaps call for some sort of chlorophyll a statistical trend analysis over several years when a chlorophyll a criterion is exceeded to determine if there is an increasing trend or the change is simply due to natural variability.

I think that the approach being used for assessing drought conditions in streams to be used in evaluating TDS, chloride and sulfate data could potentially be extended to the assessment of nutrient criteria and chlorophyll a data. The converse may also be true – very high flow years that may transport significant nutrients into the lake over a short period. It would not surprise me if we see some chlorophyll a increases in L. Travis and Canyon due to this years rains and the refilling of the lakes – I saw a lot of submerged vegetation that's going to send nutrients into Travis when I drove over the Pedernales River bridge.

Texas Parks and Wildlife

The Texas Parks and Wildlife Department (TPWD) appreciates the opportunity to provide comment on the 2016 Guidance Proposals presented by TCEQ staff at the Surface Water Quality Monitoring Guidance Advisory Work Group (GAWG) meeting held on July 27, 2015. We commend your efforts and your dedication to protecting water quality in our state. While we concur with most of the directions these proposals are headed, we still have numerous questions about the implementation of these proposals. While several proposals are modifications to existing procedures, some are entirely new and we have yet to see how their implementation will be protective of fish and wildlife resources as well as human health.

Assessment of Nutrient Criteria

TPWD generally supports the weight of evidence approach in assessing nutrient criteria in Texas reservoirs, however, we have several questions on how this will be implemented in the assessment. For ease of communicating our comments on nutrient assessment for the Integrated Report (IR), please find attached Handout 1 from the GAWG with our comments. In general, our interests lie in the balance of maintaining conditions in Texas reservoirs to prevent degradation of trophic status while maintaining the current fisheries around the state. It is not our opinion that "one size fits all" with regards to chlorophyll-a (Chl-a) and that the historical data set should be the determining factor for setting Chl-a criteria rather than selecting an number that is representative of reservoirs in other parts of the country.

TPWD believes a non-degradation approach, regardless of the reservoir trophic state, is the best way to protect the aquatic life and other uses of Texas' many diverse reservoirs. Thresholds and criteria, especially for Chl-a, should therefore be reservoir-specific and not adjusted to meet a statewide standard. For example, we do not believe censoring the developed Chl-a criteria for the Highland Lakes at 5 µg/L when current reporting limits are 2.0 µg/L is a reasonable approach. Likewise, setting the default criterion for Chl-a at 30 µg/L for reservoirs having naturally high Chl-a values, but that show no other problems with excess nutrients is just as problematic.

Threshold and criterion values can be developed by using historical data combined with trend analysis. We contend this would be more appropriate than selecting a number representative of reservoirs in other parts of the country. It is important to note that many of these data elements are non-normal, thus the use of a nonparametric approach would be recommended for setting and assessing the said values. In addition, the sensitivity and specificity of the individual tests needs to be considered in this process to include the risk of making errors in the nutrient assessment of reservoirs and the environmental costs associated with those errors.

Regarding the flow chart weight of evidence approach:

Typically, a weight of evidence approach is not based solely upon exceedances of multiple criteria. Instead, it should combine the results of each line of evidence in a weighted fashion to define the final reservoir status. Weights are assigned on the basis of strength and significance of the metric towards the response, as well as the confidence in the data. In some cases, an exceedance in a single criterion could be sufficient if a strong link exists between the metric and the condition. We feel the weighted approach should determine that a reservoir is fully-

supporting only if all metrics support that conclusion. For example, in the proposed flow chart, if the Chl-a criteria or threshold is not exceeded, then dissolved oxygen and other concerns are not evaluated as part of the assessment of that reservoir, even though EPA guidance states they should be.

The niche concept for fish and its evaluation of three metrics — salinity, temperature, and DO— provides a useful example of a weight of evidence approach more sensitive to potential stressors. With the niche concept, for each metric there are regions of full-support, regions of non-support, and regions in-between where the fish can persist, but experience stress that can reduce fitness. We would recommend a weight of evidence approach based on the sample data across these three axes to determine if the environment was fully-supporting a healthy fish community. In this example, if any one metric was non-supporting, the integrated response should reflect that. Alternatively, if multiple metrics were poor/stressful, the integrated response should reflect a stressful condition as well.

It is important to know exactly how this weight of evidence approach will be used in the assessment. For example, how will future data collection in reservoirs be driven by this approach (i.e., will samples only be collected at dam sites)? How will nutrient data from the arms be used in setting lake criteria and thresholds and how will those arms be assessed?

There seems to be a disconnect with the possible outcomes of the flow chart pathway and what the overall level of protection of the reservoir should be. For lakes with numeric Chl-a criteria to exceed both the median numeric criteria and the TN/TP thresholds (both strong indicators of increasing eutrophication), but to go on to be assessed as fully supporting because neither the Secchi depth nor the dissolved oxygen show problems undermines the intention of the numeric criteria which is to protect reservoirs from excessive eutrophication. This is especially true of oligotrophic lakes with no numeric criteria where the Chl-a levels are very low, say 6.0 ug/L. Chl-a could increase all the way to 39 ug/L, and as long as the TN/TP values did not exceed the thresholds, or if they did as long as both the dissolved oxygen and Secchi depth did not exceed their thresholds, the flow chart leads to the conclusion of “no concern.”

Another example would be for a eutrophic lake with super saturated dissolved oxygen conditions due to algal blooms. Grab dissolved oxygen data collected in the afternoon might show no impairment or concern when in reality a 24-hr sample would show the dissolved oxygen falling to quite low levels during the night. This lack of grab data showing a dissolved oxygen impairment could result in an assessment of “no concern”. The water body should be evaluated as having a concern under these circumstances. There should also be a requirement to collect 24-hour data to confirm the status of dissolved oxygen in a lake when the upper steps are exceeded.

The proposed methods for assessing nutrient criteria attainment does not seem to recognize public water supply use as no variables often associated with public water supply use impairment from nutrient enrichment are in the flow chart. Increases in variables such as algal blooms, cyanobacteria presence, taste and odor problems often occur well below any thresholds that affect aquatic life or recreation uses such as dissolved oxygen or Secchi depth and should be added to the use attainment process.

We support using dam site data to assess reservoirs that have numeric Chl-a criteria; however, it is well-understood that dam sites do not provide an accurate representation of entire reservoirs. As a result, water quality data are collected at numerous stations within reservoirs. It is important to evaluate all the data that are collected. We recommend that data from all reservoir stations be evaluated based on weight of evidence approach for numeric or narrative criteria reservoirs. Using data in this manner may help to detect problems early and provide an opportunity to correct them prior to exceedance of criteria at the dam site.

Proposal for Analyzing Drought Impact to Water Quality Assessments

In the proposal made on assessing the impact of drought conditions on water quality data used in the IR, there are many unanswered questions that need to be clarified before TPWD can determine how this will affect new or existing impairments. As we understand the proposal, this process would only apply to new listings, but it is unclear what specific parameters would be subject to this drought impact analysis. This process needs to be more fully explained in greater detail. TPWD requests that a written proposal be available for comment prior to this methodology being used in the 2016 IR. Some questions we have include:

1. Is this process only to apply to new TDS listings on the lakes listed in the drought presentation?
2. What is the period of record used in determining drought impact to water quality data?
3. Is the drought impact evaluation applied to all data from all stations in an entire segment regardless of where that station falls in proximity to another segment?
4. It is not clear what physical boundaries would be used to show drought affects to a particular station.
5. How would non-drought affected water from an upstream segment affect a drought-impacted segment?

Assessment of Nutrient Criteria

TPWD generally supports the weight of evidence approach in assessing nutrient criteria in Texas reservoirs, however we have several questions on how this will be implemented in the assessment. With regards to the flow charts for both numeric and narrative criteria, TPWD would prefer more of a multi-metric scored point approach where each of the flow chart elements (plus additional indicators of eutrophication as well as impairments to drinking water supply or recreation) accumulate points for each step and those totaled points derive a weight-of-evidence score for the reservoir. See tables 1 and 2 for examples. Note: The expressed numbers and weights are just for example and not what TPWD is recommending. The flow-chart, step-wise approach allows for too many cases where the overwhelming evidence points toward degrading trophic conditions over time, yet the lake is deemed to be fully supporting. For example, a lake can exceed two significant variables, Chlorophyll-a (Chl-a) and TN/TP, and yet still end up fully supporting or no concern. Likewise, a lake that does not exceed the numeric criteria for Chl-a, is automatically determined to be fully supporting regardless of how many other indicators of eutrophication there are.

TPWD feels that protecting against degradation of trophic conditions is paramount over whether specific individual thresholds or criteria are exceeded. This approach would better characterize each lake with a more robust set of variables that accurately describes the historical trophic condition and whether that condition is in decline. TPWD does not support the censoring of Chl-a criteria at 5.0 ug/L when methods are now commonly available to calculate much lower concentrations. Lakes with normally low Chl-a values could become more eutrophic before any concerns would be identified. Likewise, TPWD is opposed to setting 30 ug/L Chl-a as an upper limit in lakes that are naturally eutrophic when there are no demonstrated increasing trends in Chl-a and no other problems appear to be affecting the aquatic life, drinking water supply, or recreational uses.

The TPWD Water Quality Program ran eight random lakes with various presumed trophic statuses to compare how the flow chart vs. the multi-metric point table would characterize each lake. The results of this “beta test” are provided in the attached Excel spreadsheet, Attachment 1. With the exception of one lake, the exercise demonstrated that the flow chart pathway vastly underestimates the attainment of nutrient criteria. In cases of numeric criteria attainment, two out of four lakes indicated fully supporting when compared to the multi-metric pathway that resulted in two concerns and two non-supports. In cases of narrative criteria attainment, all but one lake showed no concerns whereas with the multi-metric pathway, only one lake showed no concern. It should be noted that the multi-metric pathway is only hypothetical and could result in different scores from what is presented here.

It appears that for numeric criteria, the flow chart pathway does not truly use a weight of evidence approach, but rather decides on initial support of the Chl-a criteria and only proceeds through the pathway if it does not meet that criteria. This is counter to the overall goal of using a weight of evidence approach in nutrient attainment decisions. It appears that for narrative criteria, the flow chart pathway allows for significant degradation to occur in response variables with an assessment of “no concern” being made as long as the threshold Chl-a criteria is attained.

ND = no data

NA = not applicable (first two DO questions are mutually exclusive)

Table 1. Draft Numeric Criteria Attainment – Example for Lake A with numeric criteria

Nutrient Variable	Stressor or Response	Exceeded criteria? Y/N	Points if exceeded
Chlorophyll-a in excess of criteria	Response	Y	**10**
TN exceed threshold?	Stressor	Y	**7**
TP exceed threshold?	Stressor	N	7
Secchi Depth indicates enrichment	Response	Y	**3**
Water body listed for DO?	Response	Y	**3**
Water body shows a concern for DO?	Response	NA	2
24-hr DO data shows extreme diel fluctuations?	Response	ND	3
Have fish kills been a problem on this lake?	Response	N	2
Have algal blooms been a problem on this lake?	Response	N	2
If lake is a drinking water supply, are taste and odor problems prevalent?	Response	Y	**2**
Has excessive macrophyte growth been a problem?		N	2
Has lake had positive samples for cyanobacteria?	Response	ND	2
Total points for Lake A (out of 45 possible)			**25**

In this example, Lake A would be assessed as not supporting the numeric criteria.

Example scoring:
≥20 – NS
10 – 20 – Concern
<10 – FS

Table 2. Draft Narritive Criteria Attainment – Example for Lake B with no numeric criteria

Nutrient Variable	Stressor or Response	Exceeded criteria? Y/N	Points if exceeded
Chlorophyll-a exceed threshold	Response	Y	**10**
TN exceed threshold?	Stressor	N	7
TP exceed threshold?	Stressor	N	7
Secchi Depth exceed threshold?	Response	N	3
Water body listed for DO?	Response	NA	3
Water body shows a concern for DO?	Response	Y	**2**
24-hr DO data shows extreme diel fluctuations?	Response	ND	3
Have fish kills been a problem on this lake?	Response	N	2
Have algal blooms been a problem on this lake?	Response	Y	**2**
If lake is a drinking water supply, are taste and odor problems prevalent?	Response	Y	**2**
Has excessive macrophyte growth been a problem?	Response	N	2
Has lake had positive samples for	Response	ND	2

cyanobacteria?			
Total points for Lake B (out of 45 possible)			**16**

In this example, Lake B would be assessed as not having a concern for support of narrative criteria.

Example scoring:
≥20 – Concern
<20 – No Concern

Note: The expressed numbers and weights are just for example and not what TPWD is recommending.

Attachment 1. Flow Chart vs. Multi-metric Beta Test

This excercize is a "beta test" of eight lakes in various presumed trophic states to compare "flow chart" vs. "multi-metric" pathways to assessing attainment of nutrient criteria

Lake Travis - 1404 (Numeric Criteria) - presumed oligotrophic

CHLA (ug/L)		Total Nitrogen(mg/l)		Total Phosphorous(mg/l)		D.O.(mg/l)		Secchi (m)		Assessment Results: Flowchart	Assessment Results: Multi-metric	Notes
Criteria	Median	Threshold	Median	Threshold	Median	Criteria	LOS	Threshold	Median			
5	3	0.58	3.55	0.03	0.03	6	CS	3.13	2.6	FS	(CS)	4 AUs have concern for grab DO screening level of 6.0 mg/L

Stillhouse Hollow Lake - 1216 (Numeric Criteria) - presumed oligotrophic

CHLA (ug/L)		Total Nitrogen(mg/l)		Total Phosphorous(mg/l)		D.O.(mg/l)		Secchi (m)		Assessment Results: Flowchart	Assessment Results: Multi-metric	Notes
Criteria	Median	Threshold	Median	Threshold	Median	Criteria	LOS	Threshold	Median			
5(2.07)	3.6	0.58	1.07	0.03	0.025	6	FS	2.84	2.45	FS?	(CS)	This would have been **NS** using the flow chart if the actual calculated criteria of 2.07 ug/L were used instead of the censored 5.0 ug/L

Lake Buchanan - 1408 (Numeric Criteria) - presumed oligotrophic

CHLA (ug/L)		Total Nitrogen(mg/l)		Total Phosphorous(mg/l)		D.O.(mg/l)		Secchi (m)		Assessment Results: Flowchart	Assessment Results: Multi-metric	Notes
Criteria	Median	Threshold	Median	Threshold	Median	Criteria	LOS	Threshold	Median			
9.82	10.75	0.58	0.62	0.03	0.03	5	FS	1.64	1.2	NS	(NS)	

Lake Cypress Springs - 0405 (Numeric Criteria) - presumed mesotrophic

CHLA (ug/L)		Total Nitrogen(mg/l)		Total Phosphorous(mg/l)		D.O.(mg/l)		Secchi (m)			
Criteria	Median	Threshold	Median	Threshold	Median	Criteria	LOS	Threshold	Median	NS	(NS)
17.54	19.5	0.58	0.915	0.03	0.03	5	FS	1.19	1		

Lake Diversion - 0215 (Narrative Criteria) - presumed oligotrophic

CHLA (ug/L)		Total Nitrogen(mg/l)		Total Phosphorous(mg/l)		D.O.(mg/l)		Secchi (m)			
Threshold	Median	Threshold	Median	Threshold	Median	Criteria	LOS	Threshold	Median	NC	(CS)
8.71	13.8	0.58	0.77	0.03	0.03	5	FS	0.83	0.8		

Four fish kills due to golden alga (Gave extra 4 points for four separate histrical fish kills and golden algal blooms)

Lake Houston - 1002 (Narrative Criteria) - presumed mesotrophic

CHLA (ug/L)		Total Nitrogen(mg/l)		Total Phosphorous(mg/l)		D.O.(mg/l)		Secchi (m)			
Threshold	Median	Threshold	Median	Threshold	Median	Criteria	LOS	Threshold	Median	NC	(CS)
10.82	33.55	0.58	1.21	0.03	0.19	5	FS	0.28	0.34		

Lake Murvaul - 0509 (Narrative Criteria) - presumed eutrophic

CHLA (ug/L)		Total Nitrogen(mg/l)		Total Phosphorous(mg/l)		D.O.(mg/l)		Secchi (m)			
Threshold	Median	Threshold	Median	Threshold	Median	Criteria	LOS	Threshold	Median	NC	(NC)
30	36.7	0.58	1.03	0.07	0.05	5	FS	0.55	0.65		

Lake Somerville - 1212 (Narrative Criteria) - presumed eutrophic

CHLA (ug/L)		Total Nitrogen(mg/l)		Total Phosphorous(mg/l)		D.O.(mg/l)		Secchi (m)	
Criteria	Median	Threshold	Median	Threshold	Median	Criteria	LOS	Threshold	Median
30	43.1	0.58	1.335	0.09	0.09	5	FS	0.63	0.58

CS (CS)

The NS for continuous pH daily maximum exceedance which is indicative of excessive photosynthetic activity.

Handout 1
Establishing a Nutrient Assessment Protocol for Lakes and Reservoirs

Goal

In 2013, the EPA approved 39 of 75 chlorophyll *a* criteria for reservoirs adopted by TCEQ in the 2010 revisions to the Texas Surface Water Quality Standards. The EPA requested the TCEQ "incorporate its plans and timeline for revising the disapproved chlorophyll *a* criteria" for the remaining 36 reservoirs. The following procedures were developed to achieve this goal, and establish a consistent framework to evaluate reservoirs with or without EPA-approved chlorophyll *a* criteria. Reservoirs which did not have chlorophyll *a* criteria adopted as part of the 2010 TSWQS may be evaluated using the framework developed for reservoirs without approved chlorophyll *a* criteria.

To accomplish this, TCEQ established a protocol to assess numeric nutrient criteria for chlorophyll *a*, and developed an alternative protocol to identify concerns for nutrients as part of the Texas Integrated Report of Surface Water Quality (IR). Potential impacts to existing, designated, presumed or attainable uses from excessive nutrients are evaluated in accordance with the narrative and numeric criteria for nutrients in the TSWQS. These criteria are protective of multiple uses such as contact recreation, aquatic life, and public water supplies.

Weight of Evidence Framework

While assessing chlorophyll *a* concentrations provides a more meaningful status of the health of a waterbody than simply examining total nitrogen (TN) and total phosphorus (TP), the evaluation of chlorophyll *a* concentration alone does not allow for a holistic analysis of nutrient enrichment in a reservoir. To better assess whether a reservoir is meeting existing, designated, presumed or attainable uses in relation to nutrients, more parameters must be considered. Indicators of biological response include Secchi depth, dissolved oxygen, and the primary response variable of chlorophyll *a*. Causative parameters evaluated as potential stressors include TN and TP.

TCEQ staff developed a weight of evidence approach for nutrient assessment in lakes and reservoirs which involves the use of numeric translators of narrative criteria as "thresholds", in addition to numeric chlorophyll *a* criteria approved by EPA. Multiple lines of evidence corroborate adverse nutrient conditions before a water body will be identified as impacted, with chlorophyll *a* serving as a primary indicator. This methodology provides a more robust assessment of reservoir conditions, and increases certainty that elevated nutrients are impacting other factors like water clarity, increased algae biomass and dissolved oxygen attainment.

Assessment Protocol

Comment [AR1]: TPWD generally supports the weight of evidence approach in assessing nutrient criteria in Texas reservoirs, however we have several questions on how this will be implemented in the assessment. For those lakes without EPA-approved numeric criteria:

1. Exactly how will thresholds be calculated for all other Texas lakes not part of the original 75 with proposed Chl-a criteria?
2. What will be the period of record used?
3. Where will those calculated threshold numbers be available?
4. For the 39 lakes whose Chl-a criteria were not approved by EPA, where will those threshold be available? They are not in the 2010 WQS.

Results of water quality data are compared to numeric thresholds and criteria in step-wise flow charts. Multiple lines of evidence are evaluated in the flow charts to identify (1) attainment of numeric criteria for nutrients in reservoirs with chlorophyll *a* criteria approved by EPA; and (2) attainment of narrative criteria for nutrients in reservoirs without approved numeric criteria. Separate flow charts were established to determine attainment with numeric and narrative nutrient criteria, and are depicted in Figures 1 and 2 respectively. Exceedances of thresholds for biological response variables and nutrient stressors are assessed to identify nutrient enrichment. This assessment protocol uses samples collected at monitoring sites indicated in Appendix F of the TSWQS for those reservoirs with approved chlorophyll *a* criteria; or from sites closest to the dam for reservoirs without approved criteria. The assessment will only be conducted for lakes or reservoirs where the full suite of parameters was monitored and reported. If a full suite of parameters is not available, the outcome will be "Not Assessed".

Compare water quality results to the associated threshold or criteria in Table 1 to determine which variables indicate potential nutrient enrichment. Indicators of nutrient concentrations (TP and TN) are considered causal variables. Chlorophyll *a*, Secchi depth, and dissolved oxygen are considered response variables. Possible attainment outcomes for each type of criteria are listed below:

- Numeric Nutrient Criteria Flow Chart
    - Not Assessed (NA), limited data.
    - Fully Supporting (FS)
    - Not Supporting (NS)
- Narrative Nutrient Criteria Flow Chart
    - Not Assessed (NA), limited data.
    - No Concern (NC)
    - Concern-screening level (CS)

Comment [AR2]: TPWD recommends consideration of a weighted point table approach as an alternative to the flow charts. Examples attached. This approach may be more protective as it is more holistic in evaluating each variable independently rather than in a step-wise fashion where a single stressor variable can alter the evaluated outcome rather than whether that stressor is truly impacting the water body. It also allows for better detection of trends. For example, eutrophication trends in lakes with very low levels of Chl-a that increase significantly, but stay below the Chl-a threshold, will be able to be identified early as having increasing problems.

Comment [AR3]: For nutrients and Secchi depth only, correct? We recommend that questions about whether the lake is impaired or shows a concern for DO will be based on data from all AUs in the lake as rolled up in the assessment for that lake and not just from DO impairments or concerns from the Appendix F stations or dam station. Those stations will almost never show a DO problem.

Table 1. Threshold (T) and Criteria (C) Value Determination

Attainment of Numeric Criteria: Reservoirs with Chl-a criteria APPROVED by EPA		
Parameter	**Standard Source**	**Notes**
Secchi Depth[T]	Rule Project no. 2007-002-307-PR	Calculated from historical sampling data, set at the lower parametric prediction interval, 90% CI
Dissolved Oxygen [C]	2014 Surface Water Quality Standards	
Total Nitrogen[T]	University of Arkansas 2013 Report	Determined 0.58 mg/L of TN to be the level at which statistically significant changes in Secchi depth and chl-a occur
Total Phosphorus[T]	Rule Project no. 2007-002-307-PR	Calculated from historical sampling data, set at the upper parametric prediction interval, 90% CI
Chl-a[C]	2014 Surface Water Quality Standards	Appendix F

Comment [AR4]: We may want to consider more than a single number for TN for the entire state. In our beta tests of this process, every lake we tested exceeded the TN thresholds, so perhaps it is too sensitive a number?

Comment [AR5]: Likewise, in our beta tests, no lake we tested, regardless of trophic status, exceeded the TP threshold, so this calculation may need to be re-examined as well.

Attainment of Narrative Criteria: Reservoirs with Chl-a Criteria DISAPPROVED by EPA or no criteria adopted		
Parameter	**Standard Source**	**Notes**
Secchi Depth[T]	Rule Project No. 2007-002-307-PR	Calculated from historical sampling data, set at the lower parametric prediction interval, 90% CI
Dissolved Oxygen[C]	2014 Surface Water Quality Standards	
Total Nitrogen[T]	University of Arkansas 2013 Report	Determined 0.58 mg/L of TN to be the level at which statistically significant changes in Secchi depth occur
Total Phosphorus[T]	Rule Project No. 2007-002-307-PR	Calculated from historical sampling data, set at the upper parametric prediction interval, 90% CI
Chl-a[T]	2010 Surface Water Quality Standards (if >30, 30 ug/L used)	Calculated from historical sampling data, set at the upper parametric prediction interval, 95% CI

Additional notes for chlorophyll *a*:

- The values used in place of criteria disapproved by EPA are **more stringent than criteria adopted in the 2010 TSWQS.**
- For reservoirs with EPA disapproved criteria: If a reservoir whose adopted chlorophyll *a* criterion was greater than 30ug/L, then the criterion was capped at 30ug/L. This decision was based on published literature of chlorophyll *a* trends, and EPA's Technical Support Document *EPA Review of Reservoir-specific Chlorophyll a Criteria for 75 Texas Reservoirs.* Current literature suggests that chlorophyll *a* concentrations greater than 30ug/L can result in nuisance algal blooms, toxic cyanobacteria and toxin production, taste and odor compound production and generation of disinfection byproducts in finished drinking water. Therefore, no reservoirs have thresholds above 30ug/L.
- A level of 40 ug/L of chlorophyll *a* is an indication that a reservoir is approaching hypereutrophic status, as observed in the Trophic Classification of Texas Reservoirs. Several states use 40 ug/L as an upper threshold of nuisance conditions.

Comment [AR6]: As mentioned in the TCEQ report, *Trophic Classification of Texas Reservoirs* (2004), it is important to determine if Secchi depth limitations are due to other factors such as increased turbidity from sediment load rather than from phytoplankton abundance.

Comment [AR7]: We feel that a single number for TN, while appropriate for a certain population of lakes in Texas, may not be representative of trophic conditions in other parts of the state. In the TCEQ report Trophic Classification of Texas Reservoirs (2004), TP was better correlated with reduced Secchi depths. Multiple lines of evidence in different ecoregions of the state may be warranted to best represent trophic status.

Comment [AR8]: This information is not located in the 2010 WQS. Please provide correct location of the draft attainment criteria for the list of water bodies with disapproved Chl-a criteria as well as the location of the thresholds which will be used for all lakes not part of the original list of 75 once those are calculated.

Comment [AR9]: Where are these located?

Comment [AR10]: Is this literature based on national conditions or for Texas reservoirs?

Comment [AR11]: TPWD has a concern with applying a single number as a second screening step for lakes with narrative criteria. Rather, each lake with narrative criteria should be evaluated using its own historical data set combined with a trend analysis to determine if trophic status is stable or in decline.

Data Preparation and Manipulation

Table 2. Data Sources

Reservoirs with Chl-a criteria APPROVED and DISAPPROVED by EPA		
Parameter	**Data Source**	**Notes**
Secchi depth	SWQMIS - Median	
Dissolved Oxygen	2012 Integrated Report	Level of Support (LOS)
Total Nitrogen	SWQMIS - Median	Calculated by parameter availability: 00625 + 00630, 00625 + 00593; or 00625 + 00615+00620.
Total Phosphorus	SWQMIS - Median	
Chl-a	SWQMIS - Median	

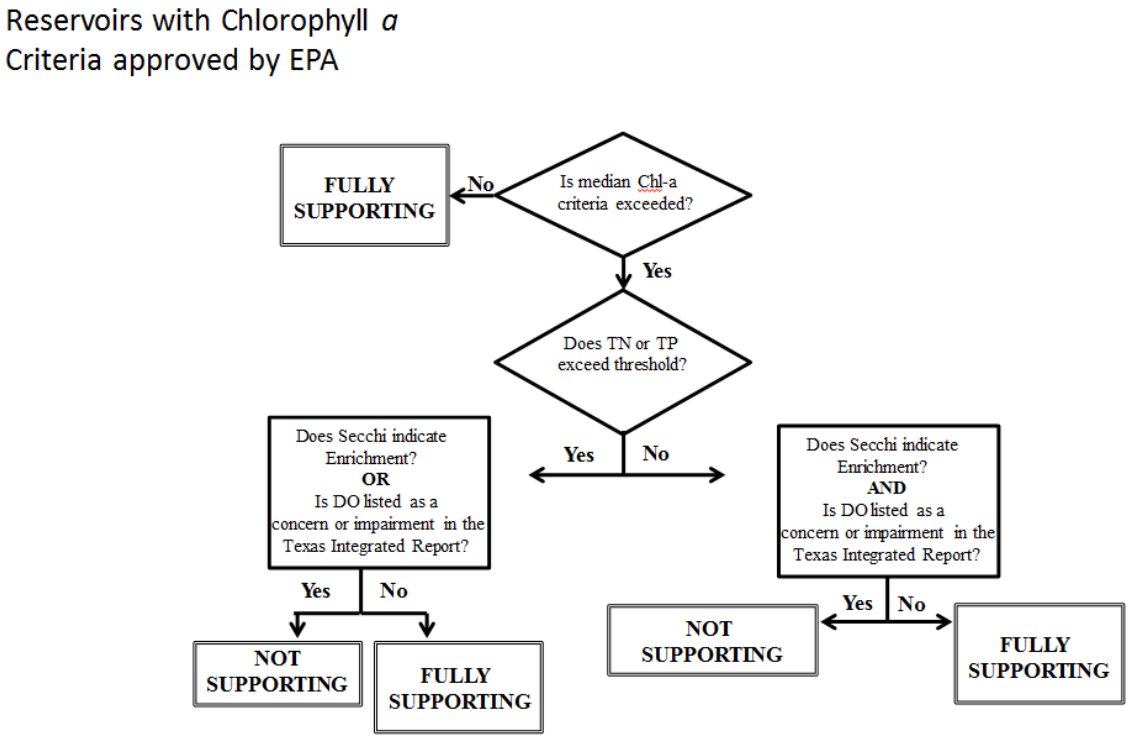
Parameter Codes			
00078	Secchi Depth	00630	Nitrate + Nitrite
00300	Dissolved Oxygen	00625	TKN
00593	Total Nitrate + Nitrite	00665	Total Phosphorus
00615	Nitrite	32211	Chl-a spec
00620	Nitrate	70953	Chl-a fluoro

Notes about the data

- SWQMIS group code “nocri” was created to pull out these parameters.
- Non-detect data point values were halved
    - This is done because SWQM halves the non-detects during assessment and the criteria were created with halved non-detects
- Only the following monitoring codes were utilized: DI, RT, SS, XR, XS, TQ, TI, DL, FL, IS, NS, RG, RS, RW, TS, AC, TM, BS, CT, CS
- Removed all data gathered at a depth greater than 0.3 meters
- Mean, median, count, and standard deviation for each parameter was taken in Excel

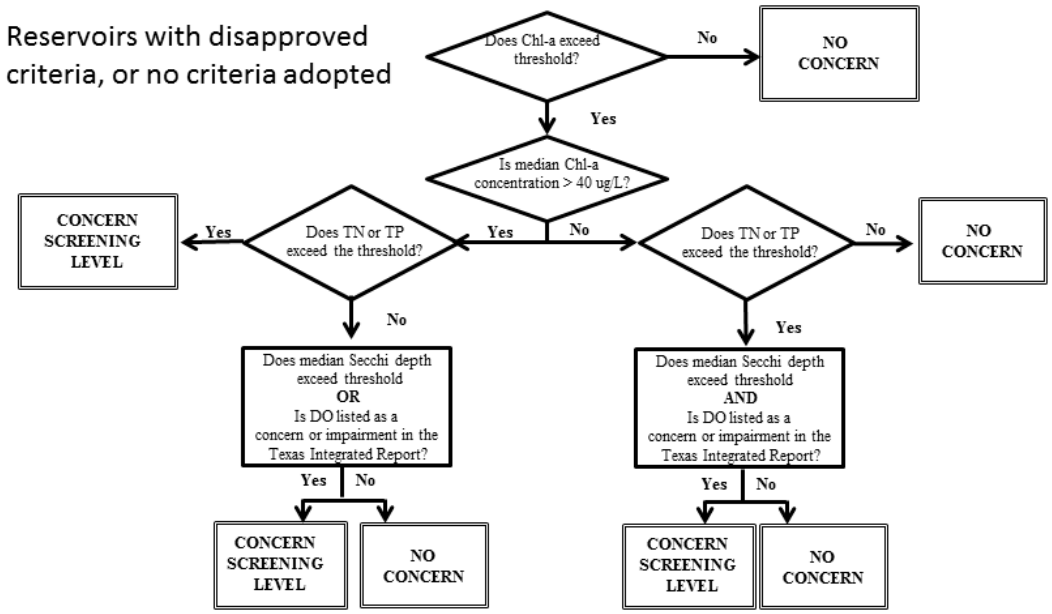
Figure 1. Attainment of Numeric Criteria

Comment [AR12]: Please refer to our suggestion of a weighted point scoring approach for determining numeric nutrient criteria attainment.



Not Assessed: < 10 samples for any variable
Support: adequate data (>= 10 samples for all variables)
The process for reservoirs with EPA approved chlorophyll*a* criteria begins with evaluation of chlorophyll a, then uses a weight of evidence approach to evaluate association with elevated nutrients (TN and TP) and observed ecosystem response (DO and Secchi).

Figure 2. Attainment of Narrative Criteria



Not Assessed: < 10 samples for any variable
Adequate Data: >= 10 samples for all variables
The process for reservoirs without EPA approved chlorophyll *a* criteria begins with evaluations for TN and TP, since it is a translation of TCEQ's narrative criteria for nutrients. Narrative criteria §307.4(f) : Nutrients from permitted discharges or other controllable sources must not cause excessive growth of aquatic vegetation that impairs an existing, designated, presumed, or attainable use.

Comment [AR13]: Please refer to our suggestion of a weighted point scoring approach for determining narrative nutrient criteria attainment.

Handout 2
Water Quality Standards Approvals for 2016 Integrated Report

§307.6. Toxic Materials

Table 2 – Criteria in Water for Specific Toxic Materials (Table 3.11 in Assessment Guidance)

	Previous	Revised	Previous	Revised
	A	A	B	B
	Water and Fish	Water and Fish	Fish Only	Fish Only
COMPOUND	**µg/L**	**µg/L**	**µg/L**	**µg/L**
Benzo(*a*)anthracene	0.068	0.68	0.33	0.328
Bis(2-chloroethyl)ether	0.3	0.57	5.27	10.06
Carbon Tetrachloride	4.1	4.3	29	30.5
Cresols	736	1041	1,981	9,301
4,4' - DDD	166.16 ug/kg	0.0059	166.16 ug/kg	0.0059
4,4' - DDE	214.4 ug/kg	0.0040	214.4 ug/kg	0.0040
4,4' - DDT	209.04 ug/kg	0.0040	209.04 ug/kg	0.0040
Danitol	5.39	262	5.44	473
1,2 - Dibromoethane	0.16	17	2.13	4.24
Dichloromethane			5,926	22,222
Dicofol	0.076	0.30	0.076	0.30
Dieldrin	0.0005	0.001	0.0005	0.001
Dioxins/Furans(TCDD Equivalents, tissue)	4.0E-04 ug/kg	7.80E-8	4.0E-04 ug/kg	7.97E-8
Hexachloroethane	27	4.97	62	11.51
Hexachlorophene	0.0080	2.05	0.0080	2.90
Mercury in freshwater	700 µg/kg	0.0122	700 µg/kg	0.0122
Mercury in saltwater	700 µg/kg	N/A	700 µg/kg	0.0250
Methoxychlor	0.33	1.59	0.33	1.61
Methyl Ethyl Ketone	13,932	13,865	1.50E+6	9.92E+5
Nitrobenzene	11	45	463	1,853
Pentachlorophenol	1.0*	0.80	57	9.1
Polychlorinated Biphenyls *(PCBs)*	19.96 ug/kg	6.4E-4	19.96 ug/kg	6.4E-4
Pyridine			2,014	947
1,1,2,2-Tetrachloroethane	3.2	1.7	76	40
Tetrachloroethylene			49	525
Thallium	0.75	0.12	1.50	0.23
2,4,5 - TP (Silvex)	7.3	19	7.6	21
Trichloroethylene			649	82

These criteria incorporate updated toxicological information and bioconcentration factors, where available. The criteria were calculated using the exposure factors which were approved in the 2010 revision of the Texas WQS. The tissue-based criteria for DDD, DDE, DDT, dioxon/furans and polychlorinated biphenyls, which were approved in the 2010 revision, were replaced with water-column criteria in the 2014 Texas WQS.

§307.8. Application of Standards

The exemption for application of recreational and minerals criteria below seven-day two year (7Q2) stream flows in classified segments and unclassified streams was removed in the 2010 Texas WQS. The exemption for assessment of human health criteria below the harmonic mean flow was removed in the 2010 Texas WQS.

A new provision was adopted to provide increased protection of aquatic species in streams and rivers dominated by springflow. The critical low flow for streams that contain aquatic threatened or endangered species is calculated as the 0.1 percentile low flow. In springflow-dominated rivers and streams, without federally-listed species, the critical low flow value is calculated as the 5th percentile value. These flows will be used in place of the 7Q2 low flow values.

§307.9. Determination of Standards Attainment

Exemption of the application of criteria to protect human health in Table 2, recreational uses, total dissolved solids, chlorides and sulfates at flows below 0.1 cfs in perennial streams. The provision also exempts the application in intermittent streams when less than 20% of the stream bed is covered by pools or extremely dry conditions exist, based on TCEQ's flow severity index.

Appendix A - Site-specific Uses and Criteria for Classified Segments

Segment	Water body	Counties	Aquatic Life Use	Dissolved oxygen criteria * (average)
0406	Black Bayou	Cass	High	DO = 12.11 - 0.309 T + 1.05 logQ - 1.02 logWS where: DO = 24-hour average DO criterion T = temperature in degrees Celsius (C) Q = flow in cubic feet per second (ft3/s) WS = watershed size in square kilometers (up to 1000 km2)
0407	James Bayou	Cass, Marion	High	See above
0409	Little Cypress Creek	Gregg, Harrison, Marion, Upsher	No revision	See above
0410	Black Cypress Bayou	Cass, Marion	High	See above

* A 24-hour average DO criterion of 5 mg/L is the upper bounds if the indicated DO equation predicts DO values that are higher than 5.0 mg/L. When the 24-hour average DO is predicted to be lower than 1.5 mg/L, then the DO criterion is set as 1.5 mg/L. When the 24-hour average DO criterion is greater than 2.0 mg/L, the corresponding 24-hour minimum DO criterion should be 1.0 mg/L less than the calculated 24-hour average criterion. When the 24-hour average DO criterion is less than or equal to 2.0 mg/L, the corresponding 24-hour minimum DO criterion should be 0.5 mg/L less than the calculated 24-hour average criterion. When stream flow is below 0.1 cfs, then 0.1 cfs is the presumed flow that should be used in the equation.

EPA also approves footnote 2 under the Cypress Creek basin in Appendix A which describes segment 0406 –Black Bayou and segment 0407 – James' Bayou as intermittent streams with perennial pools. TCEQ's assessment of physical habitat, flow regime, and the biological community support the revisions to aquatic life uses.

Revised pH Criteria:

0306	Upper South Sulphur River	6.5 – 9.0 (6.5-8.0)
0307	Jim Chapman Lake	6.5 – 9.0 (6.5-8.0)
0401	Caddo Lake	5.5 - 9.0 (6.0-8.5)
0402	Big Cypress Creek below Lake O' the Pines	5.5 - 8.0 (6.0-8.5)
0406	Black Bayou	5.5 - 8.0 (6.0-8.5)
0407	James' Bayou	5.5 - 8.0 (6.0-8.5)
0410	Black Cypress Creek	5.5 - 8.0

Comment [AR14]: How will this be determined? Is this the same list as on page 3 below? Spring-flow dominated stream designation can apply to numerous streams not on this list. Essentially if there is no wastewater discharge, then baseflow is coming from spring flow during non-storm flow periods.

Comment [AR15]: This should also include candidate species for federal listing and state threatened species such the 15 threatened freshwater mussels in Texas.

Comment [AR16]: TPWD agrees with the exemption of human health and recreation standards below 0.1 cfs in perennial streams in the water quality assessment rather than below the 7Q2 as being more protective of these uses. However, mineral standards were never exempt below 7Q2, so to now exempt mineral standards below 0.1 cfs is less protective and we are not in support of this change.

0608 Village Creek 5.5 - 8.0 (6.0-8.5)

A site-specific zinc acute criterion of 29 ug/l was adopted for Segment 2482- Nueces Bay under footnote 2 to protect the oyster waters use and is approved.

Footnotes were added to identify the segments for which the critical low flow is calculated in accordance with §307.8(a)(2) (springflow provisions). These segments include the following water bodies:

0218 – Little Wichita River
1243 – Salado Creek
1415 – South Llano River
1424 – South Concho River
1430 – Barton Creek
1808 – Lower San Marcos River
1811 – Comal River
1813 – Upper Blanco River
1814 – Upper San Marcos River
1817 – North Fork Guadalupe River
1905 – Medina River above Medina Lake
2109 – Leona River
2113 – Upper Frio River
2309 – Devils River
2313 - San Felipe Creek

Comment [AR17]: What will be the period of record used in determining this? It should not just the period of record of the assessment. It is not clear in §307.8(a)(2).

The site-specific critical low flow of 58 cfs for segment 1814 San Marcos River, adopted in the 1995 Texas WQS, was replaced by the reference to the flow provision at §307.8(a)(2).

Appendix B – Sole-source Surface Drinking Water Supplies

The designation of sole-source drinking water supply was removed from the following water bodies, which no longer fit this description.

Caney Creek Reservoir (0302)
Cooper Lake (0307)
Trinity River (0803)
Lake Waxahachie (0816)
Lake Weatherford (0832)
Lake Amon G. Carter (0834)
Lake J.B. Thomas (1413)
O.H. Ivie Reservoir (1433)
Terminal Reservoir (1802)

Appendix C – Segment Boundary Descriptions

Segment 0410 – Black Cypress Bayou (Creek) was added as a classified segment in the 2010 Texas WQS and includes approximately 40 miles of the water body from the confluence with Big Cypress Creek upstream to the confluence with Kelly Creek.
Segment 0801 – Trinity River Tidal was revised to account for the saltwater barrier constructed near Wallisville.
Segment 1258 – Middle Oyster Creek was created from the upper reach of segment 1110, Oyster Creek above Tidal.
Segment 1221- Leon River below Lake Proctor was moved upstream to the confluence with Plum Creek.
Segment 1259 - Leon River above Belton Lake was created from the reach removed from segment 1221.
Segment 1401- Colorado River Tidal was revised to account for the diversion channel to Matagorda Bay.
The boundary between segment 2303, International Falcon Reservoir, and segment 2304, Rio Grande below Amistad Reservoir, was moved upstream to reflect the pool elevation of the lake.
Updated information on elevation level was incorporated in the description of segment 1404, Lake Travis.

Appendix D – Site-specific Uses and Criteria for Unclassified Water Bodies

Segment	Water body	County	Aquatic Life Use	Dissolved oxygen criteria (average, minimum)	Segment Description
0401	Harrison Bayou	Harrison	High	See table under Appendix A	Intermittent stream with perennial pools from the confluence with Caddo Lake within the Caddo Lake National Wildlife Refuge (also known as the Longhorn Ordinance Works facility) east of the City of Karnack upstream to FM 1998 east of the City of Marshall
0410*	Black Cypress Creek/Bayou	Cass	High	See table under Appendix A	Intermittent stream with perennial pools from the confluence with Kelly Creek upstream to FM 250 north of the City of Hughes Springs
1602	Lavaca River	Lavaca	No revision	Footnote 15 – 3.0 mg/L, 2.0 mg/L, applicable March 15-Ocober 15 [no revision for October 16-March 14l	No revision

* Segment number for Black Cypress Creek/Bayou in Appendix D is revised from 0402 to 0410, with the creation of the classified segment in Appendix A and Appendix C for the lower reach of this water body.

The entry for Walnut Creek, previously identified as within segment 0809 was corrected to segment 0409, based on an earlier receiving water assessment that confirmed the presumed high aquatic life use. Corrections in segment descriptions, based on previously-conducted receiving water assessments or use attainability analyses (UAAs) were made for the following water bodies: Spring Branch (segment 0801), Pin Oak Creek (segment 0836), Dry Creek (segment 1009), South Mayde Creek (segment 1014), Garners Bayou (segment 1016), Gilleland Creek (two reaches in segment 1428), Dry Creek (segment 1428), and Wilson Creek (segment 1501).

Appendix E- Site-specific Toxic Criteria

Site-specific lead criteria for segment 0404 – Big Cypress Creek were revised to account for the dissolved portion of the metal. The conversion factor for the dissolved portion is calculated with the formula previously approved in Table 1 of the Texas WQS and a site-specific hardness of 40.1 mg/L. Site-specific copper criteria for a portion of Mill Creek, within segment 0506 of the Sabine River Basin, were developed based on a water effect ratio (WER).

Segment	Site Description	Facility	Parameter	Site-Specific Adjustment Factor	Additional Site-Specific Considerations
0404	Big Cypress Creek in Camp, Titus and Morris counties	Lone Star Steel	Lead	Acute Criterion = 38.3µg/L Chronic Criterion = 5.3µg/L	Hardness = 40.1 mg/L [no change] Criteria listed in "Sitespecific Adjustment Factor" column includes a correction factor of 0.924152
0506	Mill Creek from CR 1106 upstream to the permitted outfall in Van Zandt County	City of Canton	Copper	7.71	

Appendix F – Site-specific Nutrient Criteria for Selected Reservoirs

Segment	Reservoir Name	Site ID	Chlorophyll a Criteria (µg/L)
0208	Lake Crook	10137	7.38
0209	Pat Mayse Lake	10138	12.40
0213	Lake Kickapoo	10143	6.13
0217	Lake Kemp	10159	8.83
0223	Greenbelt Lake	10173	5.00 (4.59)
0405	Lake Cypress Springs	10312	17.54
0510	Lake Cherokee	10445	8.25
0603	B. A. Steinhagen Lake	10582	11.67
0610	Sam Rayburn Reservoir	14906	6.22
0613	Lake Tyler	10637	13.38
0613	Lake Tyler East	10638	10.88
0614	Lake Jacksonville	10639	5.60
0811	Bridgeport Reservoir	10970	5.32
0813	Houston County Lake	10973	11.10
0816	Lake Waxahachie	10980	19.77
0817	Navarro Mills Lake	10981	15.07
1207	Possum Kingdom Lake	11865	10.74
1216	Stillhouse Hollow Lake	11894	5.00 (2.07)
1220	Belton Lake	11921	6.38
1228	Lake Pat Cleburne	11974	19.04
1231	Lake Graham	11979	6.07
1233	Hubbard Creek Reservoir	12002	5.61
1234	Lake Cisco	12005	5.00 (4.64)
1235	Lake Stamford	12006	16.85
1240	White River Lake	12027	13.85

Comment [AR18]: It is not clear why two numbers are listed in this table. What would this mean legally? TPWD recommends using the actual calculated value rather than censoring the criteria at 5. New reporting limits allow for much lower Chl-a values to be determined, so the use of more recent data sets to confirm or re-evaluate the lower criteria is warranted.

Segment	Reservoir Name	Site ID	Chlorophyll a Criteria (µg/L)
1249	Lake Georgetown	12111	5.00 (3.87)
1403	Lake Austin	12294	5.00 (3.58)
1404	Lake Travis	12302	5.00 (3.66)
1405	Marble Falls Lake	12319	10.48
1406	Lake Lyndon B. Johnson	12324	10.29
1408	Lake Buchanan	12344	9.82
1419	Lake Coleman	12398	6.07
1422	Lake Nasworthy	12418	16.91
(1426)	Oak Creek Reservoir	12180	6.93
1429	Lady Bird Lake (Town Lake)	12476	7.56
1433	O.H. Ivie Reservoir	12511	5.77
1805	Canyon Lake	12597	5.00 (4.11)
1904	Medina Lake	12826	5.00 (2.15)
2116	Choke Canyon Reservoir	13019	12.05

Appendix G - Site-specific Recreational Uses and Criteria for Unclassified Water Bodies

Segment	Water body	Use	E. coli criterion (geometric mean)
0810	Big Sandy Creek	SCR 1	630
0810	Garrett Creek	SCR 1	630
0810	Salt Creek	SCR 1	630
1210	Navasota River Above Lake Mexia	SCR 1	630
1212	East Yegua Creek	SCR 1	630
1221	Walnut Creek	SCR 2	1030
1245	Bullhead Bayou	SCR 1	630
1245	Unnamed tributary of Bullhead Bayou	SCR 1	630