Water Environment Association of Texas

WATEREUSE TEXAS

TEXAS ASSOCIATION OF CLEAR WATER AGENCIES
TACWA
A CLEAR COMMITMENT TO TEXAS WATERS

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August 11, 2020

Mr. Peter Schaefer
Team Leader
Standards Implementation Team
Water Quality Division
Texas Commission on Environmental Quality
12100 Park 35 Circle
Austin, Texas 78753

Re: 2021 Revision to Procedures to Implement the Texas Surface Water Quality Standards
Total Dissolved Solids Screening and Permit Limits

Dear Mr. Schaefer,

The Water Environment Association of Texas (WEAT), Texas Association of Clean Water Agencies (TACWA) and WateReuse Texas are organizations of environmental professionals, practitioners, operations specialists, and public officials in the water and wastewater industry working together to benefit society through protection and enhancement of the water environment. The three organizations provide the following comments regarding the planned revisions to the Procedures to Implement the Texas Surface Water Quality Standards (IPs) pertaining to screening and the development of permit requirements for chloride, sulfate, and total dissolved solids (TDS).

The current regulatory program for dissolved salts [represented primarily by chloride, sulfate, and TDS] presents significant challenges for water resource managers in both the water and wastewater fields. The objective of the following comments is to provide the Texas Commission on Environmental Quality (TCEQ) with information that will assist with the development of procedures to assess dissolved salts that are environmentally sound, protective of human health, and also take into consideration current and best available science and technology.

1) **Total Dissolved Solids Screening in Unclassified Waters**

Title 30 Texas Administrative Code Chapter 307, Texas Surface Water Quality Standards (TSWQS) does not establish standards for dissolved salts in unclassified waters. Section 307.4(g)(2) states that standards for chloride, sulfate, and TDS for classified segments are established in Appendix A (*Emphasis added*). The salinity provision for both classified and unclassified waters in Section 307.4(g)(1) is a narrative statement requiring that the concentrations and the relative ratio of dissolved minerals must be maintained such that the existing, designated, presumed, and attainable uses are not impaired. Similarly, in the introduction to Appendix A, it states that the standards for chloride, sulfate, and TDS are maximum annual averages “for the segment.” The TSWQS do not specify that standards in the classified segments apply to unclassified tributaries that flow into the classified

segment. The current TDS screening procedures described in the IPs, however, apply the classified segment numeric standards to the unclassified tributaries. The application of numeric standards of classified segments in tributaries is not appropriate and is problematic for several reasons, including the following:

- The TSWQS do not provide for application of TDS standards outside the classified segment boundaries.

- The numeric TDS standards developed for classified segments are based on site-specific, historical values. The application of the classified segment TDS standards to a tributary during the assessment of a discharge often results in the unreasonable application of screening values to water bodies that have substantially different characteristics. For example, the TDS concentration of a large lake is unlikely to have the same TDS concentration that is in a perennial tributary with low flow, a small urban watershed, and is over 15 miles away.

There is not a reliable method to establish meaningful numerical dissolved salt standards for uses in most unclassified waters. Many of unclassified tributaries are intermittent streams, intermittent streams with perennial pools, or streams that typically have very low flows. The quality of these waterbodies can be substantially affected by evaporation, the presence of livestock, and varying conditions of geology and hydrology. Consequently, the water quality can differ substantially from the quality of downstream classified waters. The current TDS screening procedures for unclassified segments in essence establish the standards for dissolved salts of the first downstream classified water to the unclassified waters without TCEQ approval.

Recommendation

A. Revise the Introduction of the Screening Procedure and Permit Limits for Total Dissolved Solids with the applicable General Criteria definition in Section 307.4 (g), as follows:

Introduction

Concentrations and the relative ratios of dissolved minerals such as chloride, sulfate, and total dissolved solids (TDS) must be maintained to protect existing and attainable uses. ~~The aquatic life attributes in § 307.7(b)(3)(A) of the Standards are used to assign the aquatic life use categories.~~

B. Add a screening procedure for unclassified segments that is based on TDS levels for the presumed uses of the unclassified segment waters such as aquatic life, irrigation, livestock, drinking water supply, etc. In addition, provide screening for the first classified segment downstream of the outfall using the classified segment criteria and the classified segment instream flows, not the unclassified segment instream flows.

2) Actual Effluent Flow Instead of Permitted Flow to Determine Instream Concentration

During the public meeting held on June 30th, 2020, discussing possible changes to the IPs, TCEQ proposed changes to the TDS screening procedures. In particular TCEQ proposed to change the requirement that the municipal discharge permit applications be

screened based on actual flows rather than permitted flows for municipalities that are not experiencing population growth. We agree that the actual flow is an appropriate number to conduct the TDS screening. However, permit applications for communities experiencing growth can also be effectively screened without necessarily applying the permitted flow.

Recommendation:

Specify the use of "effluent flow" for TDS screening of municipalities as follows:

For permittees that are not experiencing growth or significant increase in effluent flow, screening is based on average effluent flow during the previous three years.

For permittees that are projecting population growth or a significant increase in effluent flow during the upcoming permit cycle, screening is based on projected flow at the end of the permit term. The projected flow shall be provided by the permittee. Otherwise, permitted flow will be applied to the screening.

3) Median Flow instead of Harmonic Mean Flow to Determine Instream Concentration

The current IPs provide for the use of harmonic mean flow (HMF) to calculate instream TDS concentrations below the point of discharge. The use of HMF to assess compliance with TDS standards that are applied as annual average is problematic in Texas where many discharges are to intermittent or low-flow streams. The use of the HMF for effluent dominated streams is not appropriate since it always overestimates the long-term instream concentration. Because of the limitations of the HMF, The U.S. Environmental Protection Agency (EPA) Technical Support Document for Water Quality Standards[1] states that HMF may not be appropriate for effluent dominated streams. As shown below, for the annual average TDS standard, a median flow is appropriate to estimate annual average TDS concentration below the point of discharge.

Use of the HMF is specifically proposed by EPA for use with human health toxic criteria, which have a time scale of a lifetime of exposure. The HMF is intended to represent the central tendency of flows during a longer time frame. It has the additional advantage, compared to an arithmetic mean, of not allowing a few extreme flow events to distort the value determined for the central tendency.

Since Texas water quality standards for dissolved salts are applied as annual averages, a statistic that represents the central tendency is appropriate. However, in streams that have periods of zero flow or are effluent-dominated, HMF is not an appropriate statistic.

An article by Daniel McDaniel titled "On Average, You're Using the Wrong Average: Geometric & Harmonic Means in Data Analysis"[2] demonstrates that the median flow is the best measure of the central tendency of flow in streams with periods of zero flow. Key points in McDaniel's paper are as follows:

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[1] Technical Support Document For Water Quality-based Toxics Control, EPA;/505/2-90-001, March 1991

[2] On Average, You're Using the Wrong Average: Geometric & Harmonic Means in Data Analysis, Daniel McNichol, Jan 28, 2018, Medium.com; https://towardsdatascience.com/on-average-youre-using-the-wrong-average-geometric-harmonic-means-in-data-analysis-2a703e21ea0

- Average, Geometric and Harmonic Means, and Median are statistics intended to represent a central tendency. Which statistic is appropriate to use depends on the nature of the data.
- It is not appropriate to use the geometric mean or harmonic mean when there are zero values; a median is the best indication of central tendency in these cases.

In order to demonstrate that the median is the appropriate statistic for estimating the annual average TDS concentration downstream of a discharge flow frequency, flow duration plots were prepared for several classified segments. Figure 1 presents the results of these pots. There is one plot for a large-volume perennial stream and plots for five streams located in various areas of the state that have periods of zero flow. The streams analyzed are as follows:

- Brazos River, Segment 1202, in Fort Bend County (the perennial stream)
- Canadian River, Segment 0101, in Hemphill County
- West Fork Trinity River, Segment 0810, in Wise County
- Mission River, Segment 2002, in Refugio County
- Sabinal River, Segment 2111, in Uvalde County
- Nueces River, Segment 2106, in Live Oak County.

The flow frequency plots present the following statistics:[3]

- Seven-day average low flow with a two-year recurrence interval (7Q2)
- Harmonic Mean Flow
- Median (50th percentile)
- Arithmetic mean
- Geometric Mean

Based on these plots, the following should be noted:

- For large, perennial rivers such as the lower Brazos River, the HMF is reasonably close to the median flow.
- In four of the five intermittent streams, the HMF is less than the 7Q2, and flows at or below the HMF occur only approximately 5% of the time.
- At the Nueces River Station, the HMF is very close to the 7Q2 (36 cfs versus 35 cfs), and flows at or below the HMF occur 15% of the time.

The use of HMF is problematic because it often results in applying a flow condition at which some water quality standards in Appendix A of the TSWQS do not apply.[4] For four of the five intermittent streams plotted, applying the HMF results in an estimate of TDS concentrations downstream of a theoretical discharge point that is below the low-flow condition of the 7Q2. This is fundamentally conflicting with the TSWQS provision that

[3] The HMF and 7Q2 values are values calculated by TCEQ and documented in *Procedures to Implement the Texas Surface Water Quality Standards*, RG-194, January 2012, Appendix C. When calculating the geometric mean, 1 was added to flows less than 1.0 cubic feet per second (cfs), including zero flow; and, then, 1 was subtracted again when the anti-logarithm was calculated.

[4] The *§307.8(a)(1) of the* TSWQS states some standards, including standards in Appendix A, do not apply below critical low-flows,

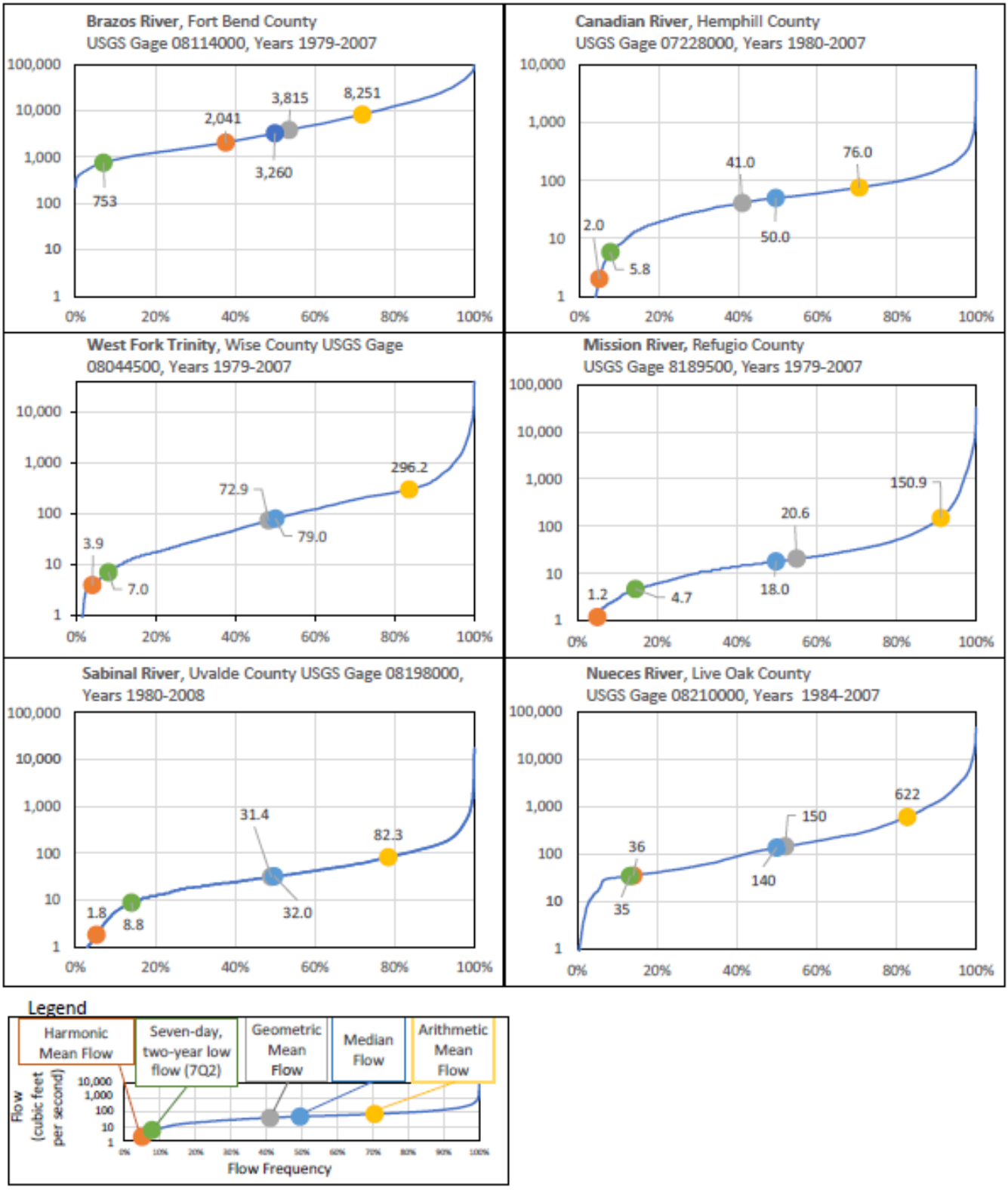

Figure 1
Flow Duration Curves For Selected Flow Monitoring Stations in Texas

standards for chloride, sulfate, and TDS are established as maximum averages over an annual period.[5]

The plots demonstrate that the HMF for intermittent streams is not representative of a central tendency of the flow data and is not suitable to determine long term (annual) TDS concentrations downstream of a discharge.

It is also noted that the EPA guidance says that HMF is not appropriately used when effluent load and downstream flow are not independent. Therefore, it is not appropriately used for effluent dominated streams.

Recommendation

Revise the screening procedure and specify that the median flow be used in estimating annual instream concentration for dissolved salts when a stream is effluent-dominated or experiences periods of zero flow.

4) Ion Balance and Whole Effluent Toxicity

During the public meeting held on June 30th, 2020, TCEQ proposed to continue the current practice of using WET test data to assess whether the effluent anions are balanced. Scientific research has demonstrated that WET test data is an effective tool to determine if an ionic imbalance in the discharge causes toxic effects to aquatic life.[6,7] The use of WET test data in the screening procedures should be continued for the assessment of chloride and sulfate. However, WET test data should also be applied to the assessment of TDS.

Recommendation

It is recommended that the IPs be revised with respect to ion imbalance determination and use of WET testing in lieu of a TDS screening process to assess ion balance. The following changes are proposed:

a) Formalize the current practice of using WET test data to assess if the effluent exhibits an ion imbalance.

b) Provide for a provision that allows for an exemption from TDS limits if WET test data demonstrate the protection of aquatic life.

5) Exemption from Total Dissolved Solids Limits

There is not a proven, practical method to remove and manage dissolved salts in municipal wastewater treatment. Currently, available treatment processes are prohibitively expensive, energy intensive, and generate a highly saline waste stream. In

[5] §307.10.(1) Appendix A The criteria for Cl-1 (chloride), SO4-2 (sulfate), and TDS (total dissolved solids) are listed in this appendix as maximum annual averages for the segment.
[6] https://cdn.ymaws.com/www.setac.org/resource/resmgr/publications_and_resources/tip-ion.pdf
[7] Goodfellow, et. al. (2000), Major ion toxicity in effluents: A review with permitting recommendations. Environmental Toxicology and Chemistry, 19: 175-182. doi:10.1002/etc.5620190121

many cases, the disposal of the high volume, highly saline waste stream remains infeasible.

It is widely recognized that the domestic use of water for laundry, bathrooms, kitchen activities, etc., increases the salt content of the wastewater compared to the water supply. Various researchers have concluded that an increase of 400 milligram per liter (mg/L) is a reasonable estimate of this increase.[8,9]

The Colorado River Basin Salinity Control Forum (Forum) regulates discharges based on the 400 mg/L increase. The Forum is made up of seven states: Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. These states implement salinity control plans for the Colorado River Basin above Imperial Dam. The basic policy of the Forum, which was adopted in 1977 and approved by EPA, is that there is a reasonable increase in salinity allowable for municipal discharges. The reasonable increase accepted by the Forum is 400 mg/L or less. If the increase is greater than 400 mg/L, however, the permittee can avoid a permit limit if the permittee can demonstrate that it is not practicable to attain the 400 mg/L threshold. The policy is reviewed every three years by the States and approved by EPA. In October 2017, the policy regarding the implementation procedures for domestic dischargers was reviewed and approved without any changes.

Recommendation

In the section of the chapter on TDS in the IPs that is titled, "Final Evaluation and Additional Considerations for TDS," revise the following:

- Amend the first bullet as follows:

  "~~The effluent concentration of TDS is comparable to the water supply source; or, for~~ For domestic discharges, ~~any~~ the elevations of salinity compared to the water supply source ~~small and typical of such discharges~~ is less than 400 mg/L TDS."

- Revise the third bullet to read as follows:

  "For industrial discharges, there are no internal discharges of process water that result in a significant elevation of TDS in the external discharge compared to source water. For domestic dischargers, there are no identifiable industrial dischargers to the sewerage system that cause ~~a significant~~ an increase ~~elevation~~ of TDS in the effluent to be greater than 400 mg/L compared to source water.

6) **Net Environmental Benefit**

There will be instances in which a permitted discharge will produce a limited increase in instream concentrations of dissolved salts over a standard. However, the measures required to mitigate that situation may be more disruptive to the environment than the increased salt concentration.

In at least one instance, a municipal wastewater treatment plant relocated an outfall after TCEQ determined that the discharge had a reasonable potential to cause an exceedance

[8] 2017 Review, Water Quality Standards for Salinity Colorado River System, October 2017.

[9] Lock, W.H. Research Report No. 79: Heavy Metals and Organics in Domestic Wastewater, Urban Water Research Association of Australia, 1994.

of the standard for dissolved salts. Treatment to reduce the salt concentrations was not a feasible solution. The permittee relocated the discharge point approximately a mile downstream to a point where there was a larger base flow in order to comply with the dissolved salt screening value.

It is doubtful that relocating the outfall provided a net benefit other than satisfying TCEQ screening procedures. The negative effects of achieving compliance included the following:

- Financial cost of constructing a new effluent pipeline and outfall.
- Environmental disruption associated with the construction of the pipeline and outfall.
- Reduced flow in the reach of stream between the original outfall and the new outfall, as this was an existing discharge and the aquatic life was adapted to the effluent water quality.
- The relocation of the outfall did not change the TDS loading to the classified segment. No environmental benefit was gained.

Recommendation

It is recommended that the IPs be revised to allow the consideration of a net environmental benefit before a permittee is required to make significant adjustments to wastewater treatment services or to relocate an outfall.

The members of WEAT, TACWA, and WateReuse Texas appreciate the opportunity to comment on the proposed revisions to the IPs.

Thank you for your consideration of these recommendations. Please do not hesitate to contact Julie Nahrgang at 210.325.3087 or Chris Pasch at 512.423.4285 if you have any questions.

Sincerely,

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Rick Hidalgo WEAT President	Ron Patel TACWA President	Eva Steinle-Darling Texas WateReuse President