Regional Stormwater Monitoring Program Fourth Term 2018-2021

Final Comprehensive Report

North Central Texas Council of Governments

December 6, 2022

Table of Contents

Appendices:

Tables — Page

Figures — Page

Notice

This document and its contents have been prepared and are intended solely for the North Central Texas Council of Governments (NCTCOG's) information and use in relation to reporting of the fourth monitoring term monitoring results of the Regional Stormwater Monitoring Program.

Atkins North America assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 194 pages, including the cover but not including the pages of the appendices.

Document history

Job number: 100077363			**Document ref:**			
Revision	Purpose description	Originated	Checked	Reviewed	Authorized	Date
Draft	Regional Stormwater Monitoring Program Fourth Term Final Comprehensive Report Draft Submittal	CER	KNS	CA	LH	10/19/2022
Final	Regional Stormwater Monitoring Program Fourth Term Final Comprehensive Report Final Submittal	CER	KNS	NA	NA	11/30/2022
1	Updated City of Dallas watershed maps	CER	NA	NA	NA	12/06/2022

Acknowledgments

Completion of this report would not have been possible without the stakeholders that funded the project and took the time to respond to the multiple data requests required to assemble this report. These include multiple participants from the Cities of Arlington, Dallas, Fort Worth, Garland, Irving, Mesquite, and Plano and representatives from the North Texas Tollway Authority.

Past and present field data collection crews and laboratory representatives spent multiple nights, weekends, and holidays to collect samples following storm events. We would like to acknowledge Dougherty Sprague Environmental (dse), Inc., and Freese and Nichols, Inc. (FNI). FNI contributed heavily to field data collection as well as storm event reporting duties. FNI led the biomonitoring activities and reporting for the Cities of Plano and Garland. TTI Environmental Laboratories served as the contract laboratory for the monitoring conducted by Atkins, FNI, and dse through 2019. Pace® Analytical Services served as the contract laboratory for the monitoring conducted by Atkins, FNI, and dse from 2020 to 2021. Both laboratories accepted samples submitted 24 hours a day.

Lastly, a special acknowledment to present and past representatives of the North Central Texas Council of Governments Environment and Development Department that provided oversight and guidance to all program participants.

Executive Summary

On October 1, 2017, the North Central Texas Council of Governments (NCTCOG) retained Atkins (in association with Freese and Nichols; Dougherty Sprague Environmental, Inc., and TTI Environmental Laboratories) under a Contract for Consulting Services to develop a comprehensive monitoring plan and perform long-term systematic stormwater quality monitoring at 15 in-stream stations from 2018 to 2019 and 16 in-stream stations from 2020 to 2021 across the Dallas-Fort Worth Metroplex area. Quarterly samples were collected and analyzed and used to determine long-term trends and assess impacts of stormwater on receiving streams. The monitoring was performed in the jurisdiction of six entities, each holding a TPDES stormwater discharge permit (Cities of Arlington, Garland, Irving, Mesquite, Plano, and the roadway authority of North Texas Tollway Authority (NTTA). Atkins was also under contract to develop a comprehensive monitoring plan and perform biomonitoring activities at two Plano watersheds, one Garland watershed, and two Irving watersheds during the monitoring term. Fort Worth and Dallas watersheds were monitored by their own staff. In all, 26 watersheds were chemically monitored and 13 watersheds were bioassessed across the region, with substantial overlap between the two sampling approaches. The program administered by the NCTCOG was known as the Regional Wet Weather Characterization Program (RWWCP).

The primary goals of the RWWCP during the fourth monitoring term were to continue the assessment of urban impact on receiving stream water quality and to document any improvement presumably resulting from local best management practice (BMP) implementation. In order to document locally implemented BMPs, Atkins was under contract to develop and implement a BMP Analysis and Evaluation Plan (BANEP) to evaluate BMPs implemented by the participating entities. The BANEP was a high-level approach for evaluating BMPs through the RWWCP. The BANEP built upon previous program term efforts to create a more-robust inventory of BMP effectiveness. The BANEP provides a methodology for using BMP and water quality data to determine BMP implementation effectiveness at the watershed level.

Data presented in this report was organized and analyzed by subwatershed. This approach allowed for the analysis of potential pollution sources, BMPs, and monitoring recommendations specific to the subwatershed. For each subwatershed, the number of occurrences of benchmark values exceeded was tallied.

Atkins prepared a BMP Analysis and Evaluation Plan (BANEP) as a guidance document to outline a high-level approach to analyze BMPs through the regional program (Atkins, 2020). The plan built upon previous program term efforts to create a more-robust inventory of BMP implementation. The intent of the plan was for participating entities to use as a platform or building block towards more robust BMP effectiveness analysis. The plan provided a methodology for using BMP and water quality data to assist participants with determining BMP implementation effectiveness at the watershed level.

BANEP implementation results for watersheds monitored in the year 2021 were presented. Based on the results it can be inferred most of the watersheds analyzed are trending in the right direction and BMPs are in place and are making a positive impact on watershed health. No watersheds analyzed were observed to be in decline. Participants may interpret the results to draw conclusions based on local conditions, current programmatic activities, and assumptions and deviations in their respective jurisdictions. Participants may not be able to establish BMP effectiveness based on these results. It is the Participants' discretion to incorporate findings from this effort into their stormwater programs or annual reporting.

Atkins provided recommendations for future monitoring terms including data collection and documentation related to water quality in monitored subwatersheds, sampling site selection, and BMP analyses.

The NCTCOG and the participants intend to continue monitoring efforts using an in-stream monitoring approach. The information summarized in this report should provide NCTCOG and the participants information to support the development of a plan for continuing in-stream monitoring and a tool to guide local storm water management.

1. Introduction

"High quality water is more than the dream of the conservationists, more than a political slogan; high quality water, in the right quantity at the right place at the right time, is essential to health, recreation, and economic growth." – Edmund Muskie

1.1. Urban Stormwater Quality

Texas experienced a nearly 16% increase in population over the last decade (US Census Bureau, 2021). Population growth requires modification of the landscape in the form of infrastructure ultimately altering the chemical composition of stormwater runoff. Stormwater runoff from urban landscapes is a principal contributor to water quality impairment of waterbodies nationwide (NRC, 2009). Urban stormwater runoff quality is degraded due to contact with chemical and microbial contaminants from transportation networks, residential and commercial developments, and other altered landscapes within the urban environment. The velocity and volume of stormwater discharges is also impacted by development causing damage to aquatic habitats and stream function. Wastewater inputs in the urban environment can also contribute to stream degradation. The diagram below from the United States Environmental Protection Agency (USEPA) illustrates these pathways and identifies stressors that may be observed in the stream.

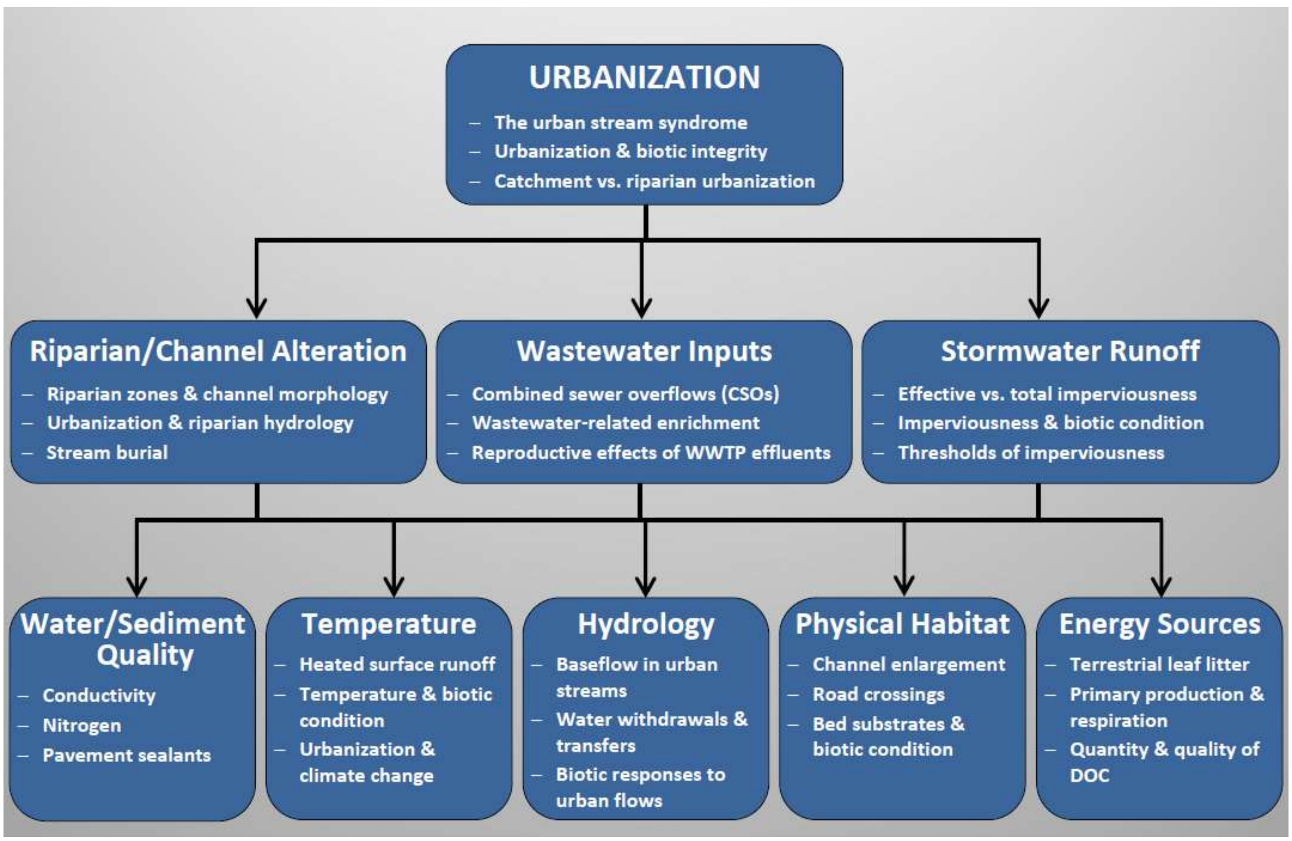


Figure 1-1 Schematic Illustrating Urbanization Effects on Stream Ecosystems (USEPA, 2016a)

1.1.1. History

Stormwater was unregulated at the federal level prior to 1972, when Congress amended the Federal Water Pollution Control Act to address growing public concern regarding surface water pollution. The amendment became commonly known as the Clean Water Act (CWA). The CWA provided EPA the authority to implement pollution control programs and made discharges of any pollutant from a point source into navigable waters unlawful without obtaining a permit following the CWA framework known as the National Pollutant Discharge Elimination System (NPDES). The 1972 amendment focused mainly on industrial and municipal wastewaters and was successful at implementing pollution control measures for those process waters. However, water quality impairments continued throughout the 1970s and 1980s due to a variety of causes including stormwater runoff. To address stormwater, Section 402(p) was added to the CWA that established a two phase approach through the NPDES program. The Phase I Stormwater Rule was issued by EPA in 1990 and was required for operators of municipal separate storm sewer systems (MS4s) serving populations over 100,000; for runoff associated with industrial activity; and for runoff from construction sites five acres or larger. The Phase II Stormwater Rule was issued by EPA in 1999 and expanded requirements to small MS4s in urban areas and to construction sites between one and five acres.

1.1.2. Permit Requirements

Federal regulation of stormwater stems from Section 402 of the CWA, Parts 122 and 126 of Title 40 of the Code of Federal Regulations. The State of Texas assumed the authority to administer the NPDES program in 1998. The Texas Commission on Environmental Quality (TCEQ) Texas Pollutant Discharge Elimination System (TPDES) program now has federal regulatory authority over discharges of pollutants to Texas surface water, with the exception of discharges associated with oil, gas, and geothermal exploration and development activities, which are regulated by the Railroad Commission of Texas. State regulation of stormwater stems from Chapter 26 of the Texas Water Code. State regulations are found in Part I of Title 30 of the Texas Administrative Code. In general, the statutory and regulatory framework requires operators of facilities or systems that discharge pollutants in stormwater runoff to waters of the United States to obtain and maintain authorization for the discharge in the form of a permit. Currently the regulatory framework requires the implementation of programmatic controls (i.e., BMPs) to reduce or eliminate pollutants in stormwater to the maximum extent practicable.

Section 303 of the CWA requires that waters attain designated uses and achieve water quality criteria to protect those uses. If waters do not meet these quality standards, they are deemed impaired, which will trigger the development and implementation of total maximum daily loads (TMDL). TMDLs establish pollutant load allocations, and for point sources, required load reductions are implemented via permit changes.

Under the CWA, the Phase I MS4 permit requires the development and implementation of a stormwater management program (SWMP), which defines BMPs, measurable goals, responsible parties, and an implementation schedule of control measures. The MS4 permit requires annual implementation activities, annual reporting, adjustments to BMPs that needing improvement, and identification of new BMPs where necessary. Stormwater monitoring (wet weather characterization) is a requirement of the Phase I MS4 permit.

1.1.3. Regional Stormwater Quality Issues

The Dallas-Fort Worth regional urban population growth rate remains among the fastest in the nation (US Census Bureau, 2018). In addition to census tracking, the North Central Texas Council of Governments (NCTCOG) has documented growth in population and the number of cities in the region from 1880 to 2010 (Figure 1-2). The estimated January 1, 2020 population for the NCTCOG region was 7,714,230. In 2019, 12 cities grew by 10% or more. Fort Worth led the region in growth, adding more than 24,000 people in 2019 while Dallas grew by more than 12,000, followed by Frisco with 11,290. Collin, Denton, Dallas, and Tarrant Counties each added more than 25,000 people in 2019, accounting for 83% of the regional growth. The region has added almost 1.2 million new residents since 2010 (NCTCOG, 2020a).

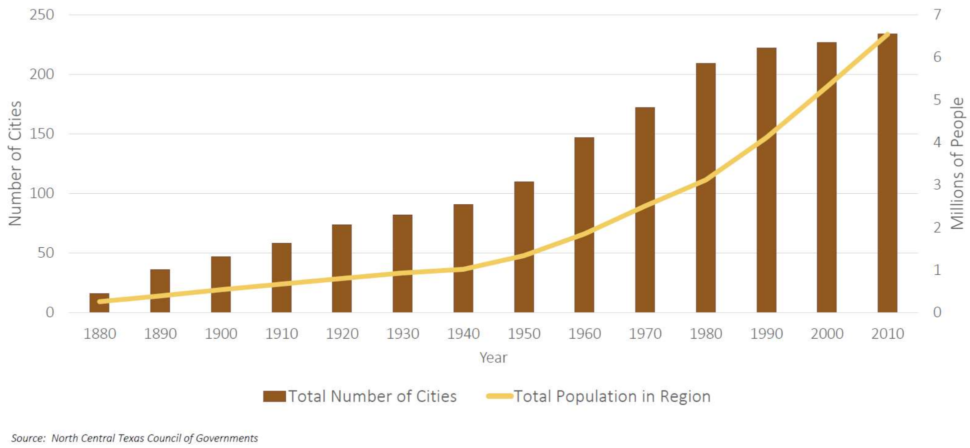


Figure 1-2 North Central Texas City and Population Counts

Incidental to this population growth, surface water quality stream segment impairments affecting Phase I communities as recorded by TCEQ in biannual surface water quality inventories increased more than fivefold from 1992 to 2010. In response, from 2002 to 2022 TMDL increased accordingly (Figure 1-3). The surface water quality inventory describes the status of the state's waters, as required by Sections 305(b) and 303(d) of the CWA. It summarizes the condition of the state's surface waters, including concerns for public health, fitness for use by aquatic species and other wildlife, and specific pollutants and their possible sources. The number of segments affecting Phase I communities in the Dallas-Fort Worth region with EPA approved TMDLs has been also been increasing steadily since 2002 (Figure 1-3).

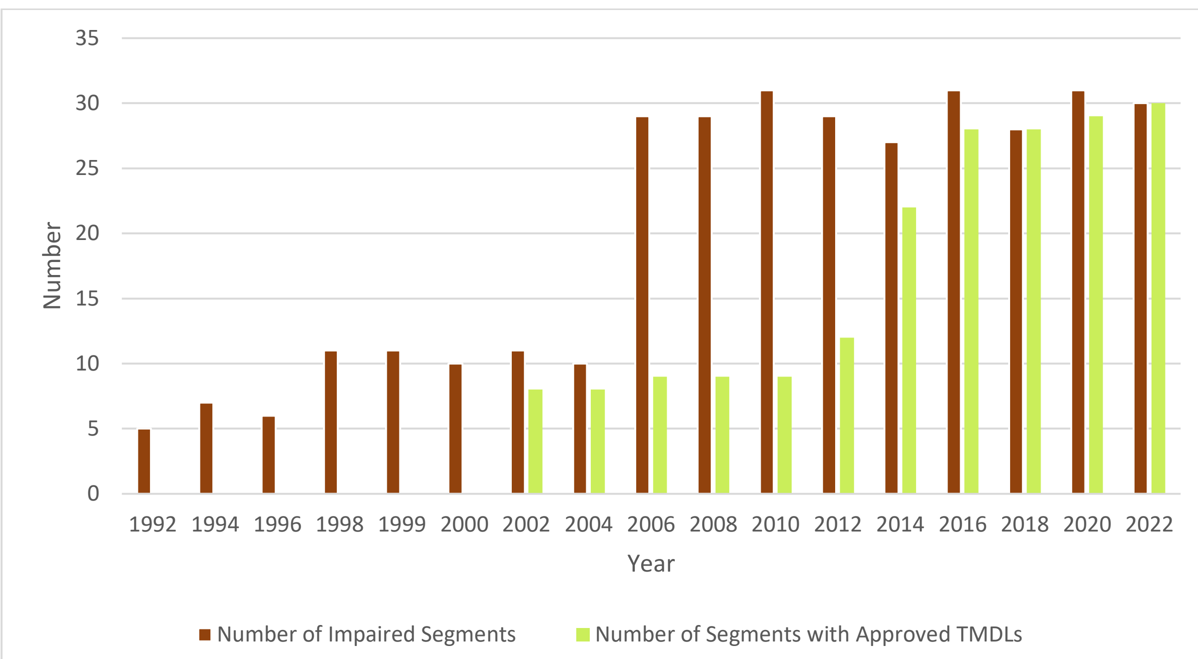


Figure 1-3 North Central Texas Surface Water Quality Impairments Affecting Phase I Communities (1992 to 2022)

Of stream segments that receive stormwater from Phase I regulated entities in the NCTCOG region, the most recent (2022) TCEQ Texas Integrated Report for the Clean Water Act Sections 305(b) and 303(d) identified thirty water quality stream segment impairments (Table 1-1). Bacteria impairments predominate the list affecting a majority of Phase I regulated entities in the region. Dioxin and PCBs are a concern for the Upper Trinity River and major tributaries near the central urban centers of Dallas and Fort Worth. Legacy pollutants (dieldrin) are a concern for waterbodies south and west of Fort Worth (Echo Lake and Lake Como). pH is a concern for Grapevine Lake.

Table 1-1 2022 Index of Water Quality Stream Segment Impairments Affecting Phase I Communities in the Dallas-Fort Worth Region

TCEQ Segment Number	TCEQ Segment Name	Impairment
0805	Upper Trinity River	Bacteria; dioxin and PCBs in edible tissue
0806	West Fork Trinity River Below Lake Worth	Dioxin and PCBs in edible tissue
0806A	Fosdic Lake	PCBs in edible tissue
0806B	Echo Lake	Dieldrin, dioxin, and PCBs in edible tissue
0806D	Marine Creek	Bacteria
0806E	Sycamore Creek	Bacteria
0807	Lake Worth	Dioxin and PCBs in edible tissue
0808	West Fork Trinity River Below Eagle Mountain Reservoir	Dioxin and PCBs in edible tissue
0819	East Fork Trinity River	Bacteria
0820B	Rowlett Creek	Bacteria
0822A	Cottonwood Branch	Bacteria
0822B	Grapevine Creek	Bacteria
0826	Grapevine Lake	pH
0827A	White Rock Creek above White Rock Lake	Bacteria
0828A	Village Creek	Bacteria
0829	Clear Fork Trinity River Below Benbrook Lake	Bacteria; dioxin & PCBs in edible tissue
0829A	Lake Como	Dieldrin, dioxin, and PCBs in edible tissue
0841	Lower West Fork Trinity River	Bacteria; dioxin & PCBs in edible tissue
0841A	Mountain Creek Lake	Dioxin & PCBs in edible tissue
0841F	Cottonwood Creek	Bacteria
0841G	Dalworth Creek	Bacteria
0841I	Dry Branch Creek	Bacteria
0841K	Fish Creek	Bacteria
0841L	Johnson Creek	Bacteria
0841M	Kee Branch	Bacteria
0841N	Kirby Creek	Bacteria
0841P	North Fork Cottonwood Creek	Bacteria
0841Q	North Fork Fish Creek	Bacteria
0841U	West Irving Creek	Bacteria
0841V	Crockett Branch	Bacteria

Segments with approved TMDLs receiving stormwater runoff from Phase I regulated entities in the NCTCOG region fall under four TMDL projects listed below:

- Dallas and Tarrant County Legacy Pollutants
    - Nine Total Maximum Daily Loads for Legacy Pollutants in Streams and a Reservoir in Dallas and Tarrant Counties: For Segments 0805, 0841, and 0841A (approved June 27, 2001)
- Fort Worth Legacy Pollutants
    - Eleven Total Maximum Daily Loads for Legacy Pollutants in Streams and Reservoirs in Fort Worth: For Segments 0806, 0806A, 0806B, 0829, and 0829A (approved May 24, 2001)
- Lake Worth Watershed
    - One Total Maximum Daily Load for Polychlorinated Biphenyls (PCBs) in Fish Tissue in Lake Worth: For Segment 0807 (adopted August 10, 2005)
- Greater Trinity Region TMDLs
    - Two Total Maximum Daily Loads for Indicator Bacteria in Cottonwood Branch and Grapevine Creek: For Segments 0822A and 0822B (approved May 30, 2012)
    - Thirteen Total Maximum Daily Loads for Indicator Bacteria in Lower West Fork Trinity River and Tributaries: For Segments 0841, 0841B, 0841C, 0841E, 0841G, 0841H, 0841J, 0841L, 0841M, 0841R, 0841T, and 0841U (approved November 7, 2013)
    - Four Total Maximum Daily Loads for Indicator Bacteria in the Cottonwood Creek, Fish Creek, Kirby Creek, and Crockett Branch Watersheds Upstream of Mountain Creek Lake: For Segments 0841F, 0841K, 0841N, and 0841V (approved November 2, 2016)
        - Addendum One: One TMDL for Bacteria in North Fork Fish Creek: For Segment 0841Q (approved March 11, 2020)
    - One Total Maximum Daily Load for Bacteria in Sycamore Creek: For Segment 0806E (approved March 27, 2019)
    - Two Total Maximum Daily Loads for Indicator Bacteria in the Upper Trinity River: For Segment 0805 (approved August 3, 2011)

Most of the existing TMDLs are for bacteria impairments. Dioxin, PCBs, and legacy pollutants (aldrin and dieldrin) constitute the remainder of the existing TMDLs.

1.2. North Central Texas Council of Governments Regional Stormwater Management Program

1.2.1. Regional Stormwater Monitoring Program

1.2.1.1. Background

During the application phase of the EPA's NPDES large and medium MS4 (Phase I) permitting program in the 1990s, Dallas-Fort Worth area cities, including Arlington, Dallas, Fort Worth, Garland, Irving, Mesquite, and Plano, along with the Dallas and Fort Worth Districts of the Texas Department of Transportation (TxDOT) , worked with the NCTCOG to form a regional partnership and strategy to conduct wet-weather monitoring activities. This partnership developed a regional monitoring program. A network of 30 monitoring sites was negotiated with EPA Region 6. The 30 sites represented small, single predominant land uses. From 1992 through 1994, 210 storm events were sampled for 188 constituents. The data was used for the application process for their NPDES stormwater permits.

After the application phase, the permit phase (first monitoring term) required a continuation of monitoring activities. The regional program participants analyzed the application period data in order to improve the program and to find cost-effectiveness. The resulting analysis determined that several sites could be discontinued and several of the 188 constituents were never detected and could therefore be dropped from the monitoring list (NCTCOG, 2003). The regional program went forward with a new set of parameters and monitoring locations. From 1997 through 2001, over 330 samples were collected from a 22 site network for 33 constituents. Most of these samples were collected from areas with a small watershed consisting of a predominant land use type. At the conclusion of the monitoring activities, the monitoring partners recognized a need to characterize general urban runoff and its impact to receiving streams.

During the permit renewal phase (second monitoring term) and moving toward a TPDES permit, the regional program participants proposed a strategy of in-stream monitoring during wet-weather conditions to find a means to more accurately evaluate receiving water impacts (NCTCOG, 2003). The revised program was termed the Regional Wet Weather Characterization Program (RWWCP) and was added as an option in the Texas Pollutant Discharge Elimination System (TPDES) Municipal Separate Storm Sewer System (MS4) permits issued to the Phase I North Central Texas governmental entities. The North Texas Tollway Authority (NTTA) joined the regional program and the TxDOT-Fort Worth District became a co-permittee with the cities of Fort Worth and Arlington and was no longer required to conduct wet weather monitoring; however, all other partners remained the same. The goal of the in-stream monitoring program was to determine long-term water quality trends, assess the impacts of stormwater on receiving stream quality, and establish a potential tool to evaluate BMP effectiveness. The permit option was approved by the TCEQ on April 15, 2003. During the second monitoring term, 24 watersheds were monitored using a 77 monitoring site network from 2007 to 2009. A total of 285 samples were collected with each watershed being sampled once per year (**Figure 1-4**).

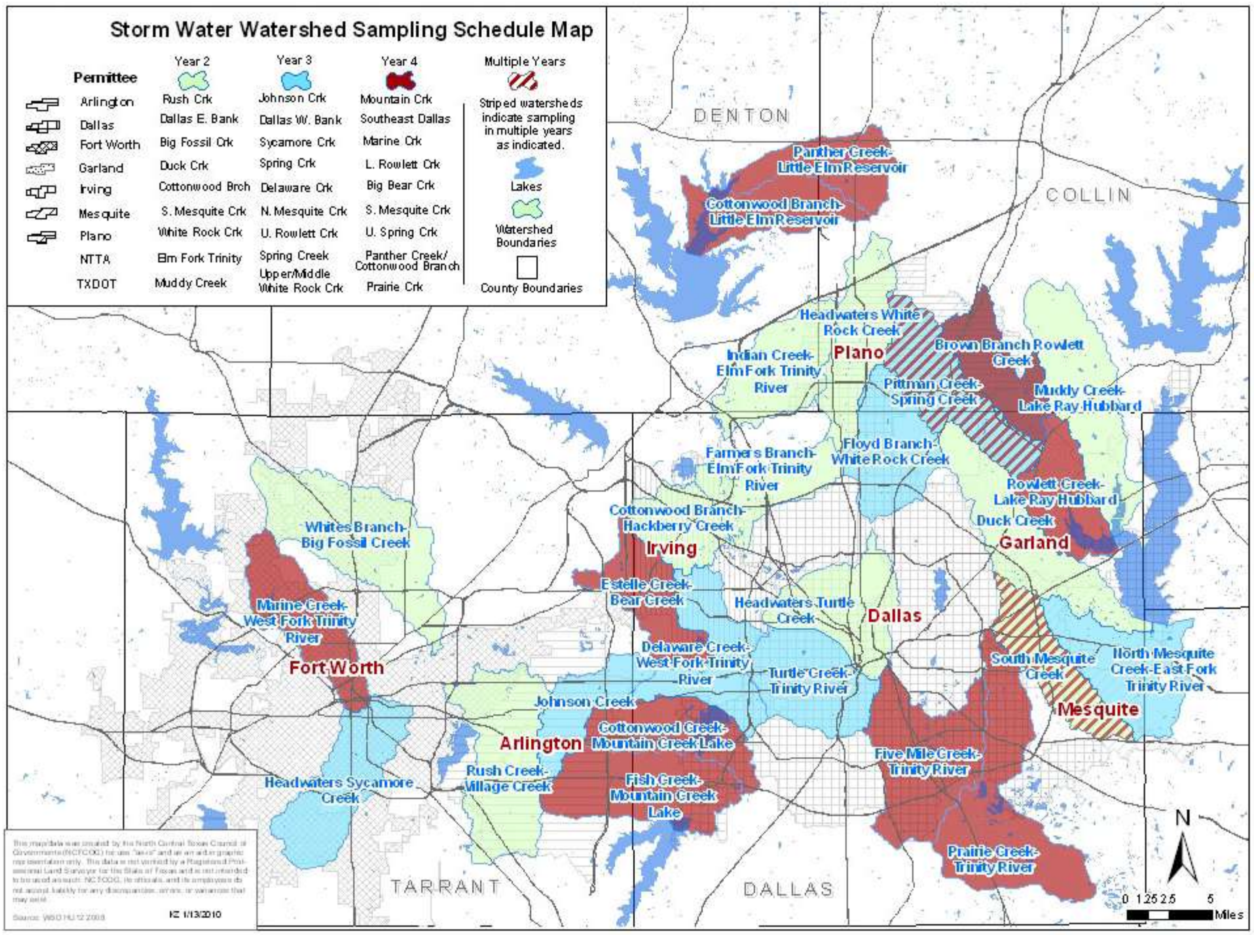


Figure 1-4 RWWCP Second Monitoring Term Monitored Watersheds

An assessment of the second monitoring term's sampling effort resulted in the following recommendations for modifying the RWWCP in the third monitoring term (2011 to 2016): obtain additional data to establish long-term, in-stream water quality trends; increase the frequency of monitoring in watersheds; refine the sampling site selection process; conduct more rapid bioassessments in other jurisdictions; and revise the pollutants monitored.

In the third monitoring term, the Cities of Arlington, Dallas, Fort Worth, Garland, Irving, Mesquite and Plano, together with the North Texas Tollway Authority and TxDOT-Dallas District agreed to continue their regional partnership and work cooperatively through the North Central Texas Council of Governments to develop a revised RWWCP. This revised plan effectively monitored at least 50% of each entity's jurisdictional area by the end of the monitoring term. This extension of jurisdictional coverage allowed a reasonable assessment of each entity's jurisdictional watersheds while also achieving a balance among the various goals of obtaining valid scientific information, meeting permit compliance, and addressing what is practicable for each entity. The primary goal of the RWWCP during the monitoring term was to continue the assessment of urban impact on receiving stream water quality and to document any improvement presumably resulting from local BMP implementation. The data collected during the third monitoring term built upon the set of regional data needed from each site for meaningful trend analysis. Since assessing the impact of urban runoff on receiving stream quality was a primary focus of this program, assessing the biological integrity of the streams was deemed fundamental in the third term. During the third term, 24 watersheds were chemically monitored and 12 watersheds were bioassessed across the region, with substantial overlap between the two sampling approaches. During the third monitoring term, watersheds were monitored using a monitoring site network consisting of 65 independent stations from 2012 to 2015. A total of 424 samples were collected over the monitoring period with each watershed being sampled over at least a two-year period (Figure 1-5).

At the end of the sampling effort, a final summary report was prepared by Atkins to assess the sampling effort. The report found that more than half of the watersheds sampled had high bacteria exceedances, with an average number of nine exceedances in the studied watersheds. Atkins noted stream degradation in about half of the sampled watersheds based on the analyzed data. Additional monitoring was recommended at these sites. The final report also analyzed the specific characteristics of the monitored watersheds. This approach provided participants individual watershed information that could be used to implement BMPs and other monitoring practices in the future. Due to the data collected in the third monitoring term, many of the watersheds studied were classified as a high priority for continued monitoring. Watersheds classified as a high priority were generally those with stream degradation, those with a high number of monitored parameter criteria exceedances, and those with existing TMDLs.

As a result of the third monitoring term findings, several recommendations were made for modifying the RWWCP for the fourth term, including the following:

- Impaired Waterbodies Focus – Focused monitoring of impaired water bodies to assist with TMDL efforts underway in North Central Texas by the participants.
- Rapid Bio-Assessment Improvements – Continue to implement rapid bio-assessments and encourage additional participants to undertake rapid bio-assessments as part of the RWWCP. To allow for comparisons, parameters to record during the bio-assessment chemical monitoring activities should be expanded to include/match those of the wet weather monitoring.
- Revise Monitored Pollutants – During the third term, Carbaryl was chosen to replace Diazinon that was undetected in the second term. Carbaryl was not detected in any watershed during the third term, and therefore was recommended that it no longer needed to be monitored for the fourth term, but possible replacements could be dieldrin or atrazine.
- Revise Monitored Pollutants – Due to no recognized correlation between total coliforms and freshwater pathogens by TCEQ or EPA, it was recommended that total coliforms be removed from the list of monitoring parameters. It was also recommended to add ammonia nitrogen, nitrate-nitrogen, and orthophosphate to the monitoring parameters for wet weather chemical monitoring. The addition of these nutrients would allow for better comparisons between bioassessment and wet weather chemical monitoring results. Additionally, for the Duck Creek, Johnson Creek, and White Rock Creek (headwaters) subwatersheds, it was recommended that sampling of dissolved fractions of metals be included in determining the concentration of bioavailable metals.

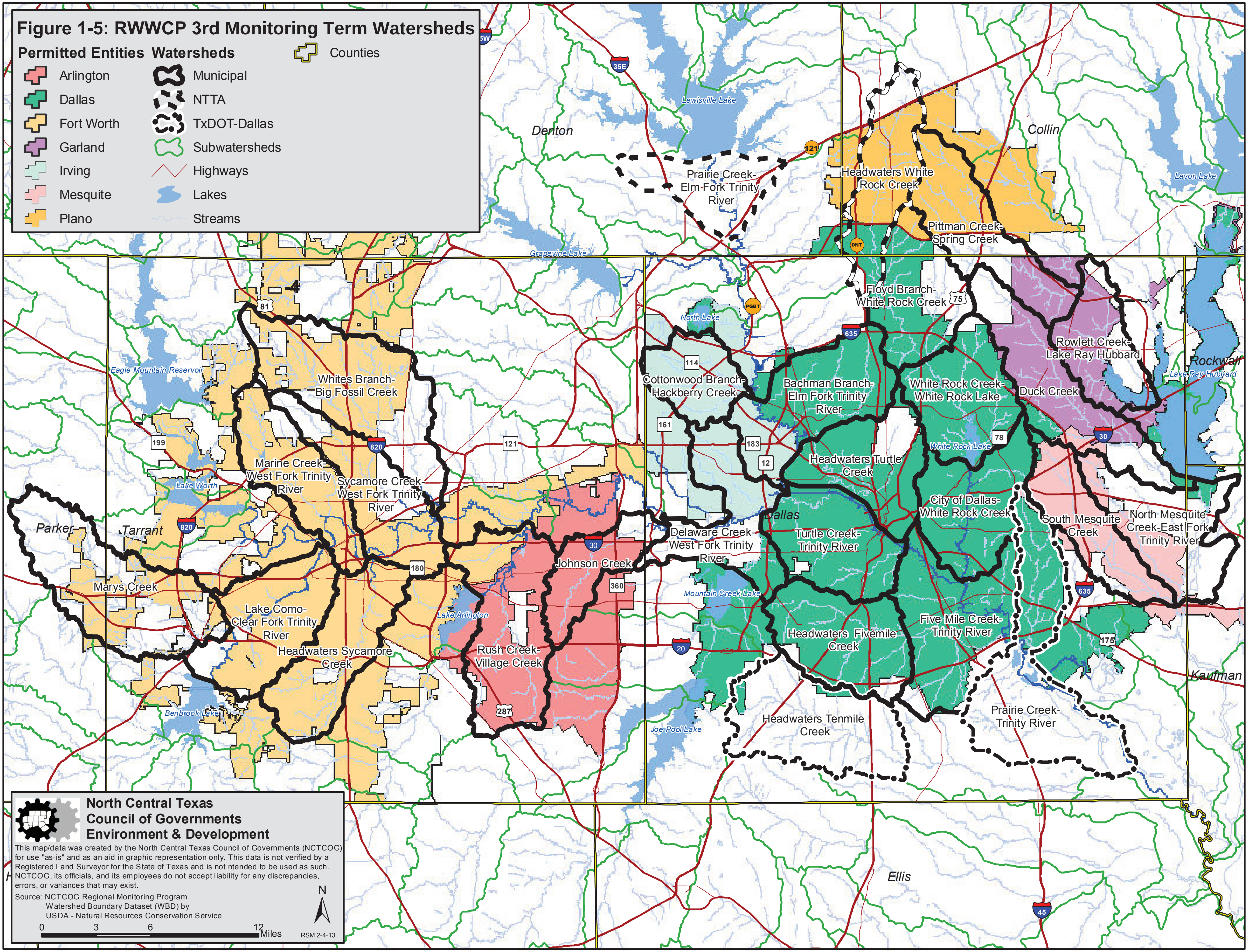


Figure 1-5: RWWCP 3rd Monitoring Term Watersheds
Permitted Entities
Arlington
Dallas
Fort Worth
Garland
Irving
Mesquite
Plano
Watersheds
Municipal
NTTA
TxDOT-Dallas
Subwatersheds
Highways
Lakes
Streams
Counties
Denton
Collin
Parker
Tarrant
Dallas
Rockwall
Kaufman
Ellis
Lewisville Lake
Grapevine Lake
Eagle Mountain Reservoir
Lake Worth
Benbrook Lake
Lake Arlington
Joe Pool Lake
Mountain Creek Lake
North Lake
White Rock Lake
Lake Ray Hubbard
Lavon Lake
Prairie Creek-Elm Fork Trinity River
Headwaters White Rock Creek
Pittman Creek-Spring Creek
Floyd Branch-White Rock Creek
Rowlett Creek-Lake Ray Hubbard
Duck Creek
White Rock Creek-White Rock Lake
Bachman Branch-Elm Fork Trinity River
Cottonwood Branch-Hackberry Creek
Headwaters Turtle Creek
City of Dallas-White Rock Creek
South Mesquite Creek
North Mesquite Creek-East Fork Trinity River
Turtle Creek-Trinity River
Delaware Creek-West Fork Trinity River
Johnson Creek
Five Mile Creek-Trinity River
Headwaters Fivemile Creek
Headwaters Tenmile Creek
Prairie Creek-Trinity River
Rush Creek-Village Creek
Whites Branch-Big Fossil Creek
Marine Creek-West Fork Trinity River
Sycamore Creek-West Fork Trinity River
Marys Creek
Lake Como-Clear Fork Trinity River
Headwaters Sycamore Creek
35E
35W
121
DNT
PGBT
75
635
114
161
183
12
78
30
820
199
81
180
360
20
287
175
45
North Central Texas Council of Governments Environment & Development
This map/data was created by the North Central Texas Council of Governments (NCTCOG) for use "as-is" and as an aid in graphic representation only. This data is not verified by a Registered Land Surveyor for the State of Texas and is not ntended to be used as such. NCTCOG, its officials, and its employees do not accept liability for any discrepancies, errors, or variances that may exist.
Source: NCTCOG Regional Monitoring Program
Watershed Boundary Dataset (WBD) by
USDA - Natural Resources Conservation Service
N
0
3
6
12
Miles
RSM 2-4-13

1.2.1.2. Fourth Monitoring Term Introduction

For the fourth monitoring term (2018-2022), the Cities of Arlington, Dallas, Fort Worth, Garland, Irving, Mesquite and Plano, together with the North Texas Tollway Authority, continued their regional partnership to work cooperatively through the North Central Texas Council of Governments to develop a revised RWWCP. The municipal regional partners used a sampling plan that effectively monitored at least 50% of their jurisdictional area over the monitoring term. This extent of jurisdictional coverage allowed a reasonable assessment of jurisdictional watersheds while striving to achieve a balance among the various goals of obtaining valid scientific information, meeting permit compliance, and addressing what was practicable for each entity. As in the third monitoring term, the fourth monitoring term continued in-stream watershed monitoring but obtained greater statistical robustness of the data by increasing the sampling at each location for a minimum of two years. For the fourth monitoring term, regional partners focused the RWWCP on watersheds with impaired waterbodies draining to them. Watersheds were prioritized based on TMDLs and 303d streams which were in watersheds that cover the jurisdictional area of the municipalities. The primary goal of the RWWCP during the fourth monitoring term was to continue the assessment of urban impact on receiving stream water quality and to document any improvement presumably resulting from local BMP implementation. The data collected during this monitoring term built upon the set of regional data needed from each site for meaningful trend analysis. The fourth monitoring term also included a more comprehensive biomonitoring component. Since assessing the impact of urban runoff on receiving stream quality was a primary focus of the program, assessing the biological integrity of the streams was fundamental. In the fourth term, 26 watersheds were chemically monitored and 13 watersheds were bioassessed across the region, with substantial overlap between the two sampling approaches.

1.2.1.3. Fourth Monitoring Term Monitoring Partners

The RWWCP exists as an option (Part IV.A.1) in the TPDES MS4 permits issued to the Phase I North Central Texas governmental entities. The approved RWWCP must meet or exceed the goals of the Representative Monitoring requirement (Part IV.A.2). The RWWCP language exists outside of each permit, allowing for greater flexibility in this unique program. The fourth monitoring term of the RWWCP began on January 1st, 2018. The RWWCP Proposal for the Fourth Term, dated October 11th, 2016, was approved by TCEQ on June 30th, 2017 (Appendix A). Year 1 of the Regional Monitoring Program was considered to be from January through December 2018. Year 2 and subsequent years also followed the calendar year schedule (e.g.; Year 2, January through December 2019) in accordance with the schedule outlined in the RWWCP and approved by TCEQ.

The permit requirements for collecting storm event data, seasonal loadings, and event mean concentrations as found in Parts IV.A.4 and IV.A.5 of the permit do not apply to the RWWCP, yet the Regional Monitoring Program does include collection and reporting of storm event data. Each program participant must coordinate with all other program participants on any proposed amendments to the RWWCP.

Participant permit numbers are included in Table 1-2.

Table 1-2 List of Permittees Participating in the RWWCP

Permittee	TPDES Permit Number	Date Issued
Arlington	WQ0004635000	8/15/2019
Dallas	WQ0004396000	8/6/2019
Fort Worth	WQ0004350000	3/8/2018
Garland	WQ0004682000	10/15/2019
Irving	WQ0004691000	12/10/2019
Mesquite	WQ0004641000	5/24/2018
Plano	WQ0004775000	12/2/2015
North Texas Tollway Authority	WQ0004400000	8/15/2018

1.2.1.4. Regional Monitoring Contract

On October 1, 2017, NCTCOG retained Atkins (in association with Freese and Nichols; Dougherty Sprague Environmental, Inc., and TTI Environmental Laboratories) under a Contract for Consulting Services to develop a comprehensive monitoring plan and perform long-term systematic stormwater quality monitoring at 15 in-stream stations from 2018 to 2019 and 16 in-stream stations from 2020 to 2021 across the Dallas-Fort Worth Metroplex area. Monitoring consisted of collecting quarterly samples, analyzing them, and assisting with determining long-term trends and potentially assessing impacts of stormwater on receiving streams. The monitoring was performed in the jurisdiction of six entities, each holding a TPDES stormwater discharge permit (Cities of Arlington, Garland, Irving, Mesquite, Plano, and the roadway authority of NTTA). In addition, Atkins was under contract to develop a comprehensive monitoring plan and perform biomonitoring activities at two Plano watersheds, two Irving watersheds, and one Garland watershed during the monitoring term. Fort Worth and Dallas watersheds were monitored by their own staff but are included in this final report. TTI Environmental Laboratories served as the contract laboratory for the monitoring conducted by Atkins, FNI, and dse through 2019. Pace® Analytical Services served as the contract laboratory for the monitoring conducted by Atkins, FNI, and dse from 2020 to 2021.

Stormwater monitoring was conducted four times a year (quarterly) for four years, starting in 2018 and ending in 2021 (Atkins, 2019). The Garland watersheds were monitored at three sites (upstream, midstream, and downstream). Arlington monitored two watersheds with a single monitoring location from 2018 to 2019 and a single watershed with two monitoring locations (upstream and downstream) from 2020 to 2021. Irving monitored a single watershed with two monitoring locations (upstream and downstream) from 2018 to 2019 and two watersheds with a single monitoring location from 2020 to 2021. Mesquite monitored a single two watersheds with single monitoring locations. Plano monitored a single watershed with a single monitoring station from 2018 to 2019 and two watersheds with single monitoring locations from 2020 to 2021. NTTA monitored two watersheds with single monitoring locations.

Biomonitoring was conducted twice a year for four years, starting in 2018 and ending in 2021 (Freese and Nichols, 2019). For Garland, a single watershed was monitored for all four years. For Irving and Plano, one watershed was monitored for the first two years and then another watershed was monitored the final two years.

A BMP Analysis and Evaluation Plan was developed in 2018 to outline a recommended approach for evaluating BMPs through the regional program. The BMP Analysis and Evaluation Plan is a guidance document that outlines the approach to analyze BMPs. The plan is intended to build upon previous program term efforts to create a more robust inventory of BMP effectiveness. The plan provided a methodology for using BMP and water quality data to determine BMP implementation effectiveness at the watershed scale. The plan:

1. Identify pollutants of concern.
2. Identify BMP evaluation metrics such as construction dates, implementation timelines and frequencies, locations, drainage and/or coverage areas, and other quantifiable parameters.
3. Document potential sources of BMP data (i.e., Permits, SWMPs, and Annual Reports)
4. Provide a correlation between pollutant parameters and BMP metrics; and,
5. Recommend a methodology and evaluate BMP implementation effectiveness indicators based on BMP data only, water quality data only, and a combination/aggregation of BMP and water quality data within monitored watersheds.

This report describes the monitoring locations, summarizes the annual monitoring activities, analyzes and discusses the data, evaluates BMP implementation effectiveness indicators from the BMP Analysis and Evaluation Plan, and provides conclusions and recommendations for the future monitoring term. All sample collection occurred during the period from January 1, 2018, through December 31, 2021, with the exception of the City of Fort Worth, which will also conduct bioassessments in 2022. The City of Fort Worth 2022 data is not included in this report.

For this project, Atkins (in association with Freese and Nichols; Dougherty Sprague Environmental, Inc., TTI Environmental Laboratories, and Pace® Analytical Services) performed the following tasks:

- Procured all necessary stormwater quality equipment.
- Conducted initial and refresher training for monitoring staff and stakeholders.
- Developed a monitoring plan and quality assurance project plan for stormwater collection.
- Developed a monitoring plan for bioassessment monitoring.
- Developed a BMP Analysis and Evaluation Plan that outlined a recommended approach for evaluating BMPs through the regional program.
- Assisted six entities with the selection of monitoring sites for each monitoring year.
- Deployed and installed monitoring equipment for six entities each monitoring year.
- Tracked and monitored weather for qualifying storms.
- Developed event summary reports for each successful event and submitted to the NCTCOG for review and posting to the NCTCOG's on-line web data viewer.
- Conducted routine maintenance on all monitoring equipment.
- Reviewed annual reports developed by the NCTCOG for submission to the TCEQ.
- Analyzed data from these activities.
- Evaluated BMP implementation effectiveness indicators for each monitored watershed for CY21 based on the quality and quantity of data collected and reported by the Participants.
- Compiled this report to present the results of in-stream monitoring during wet weather conditions to assist with developing a baseline data set, evaluating the data for trends, evaluating BMP implementation effectiveness indicators for each monitored watershed for CY21, and recommending activities for future monitoring efforts.

1.2.1.5. Assessment Basin and Monitored Watersheds

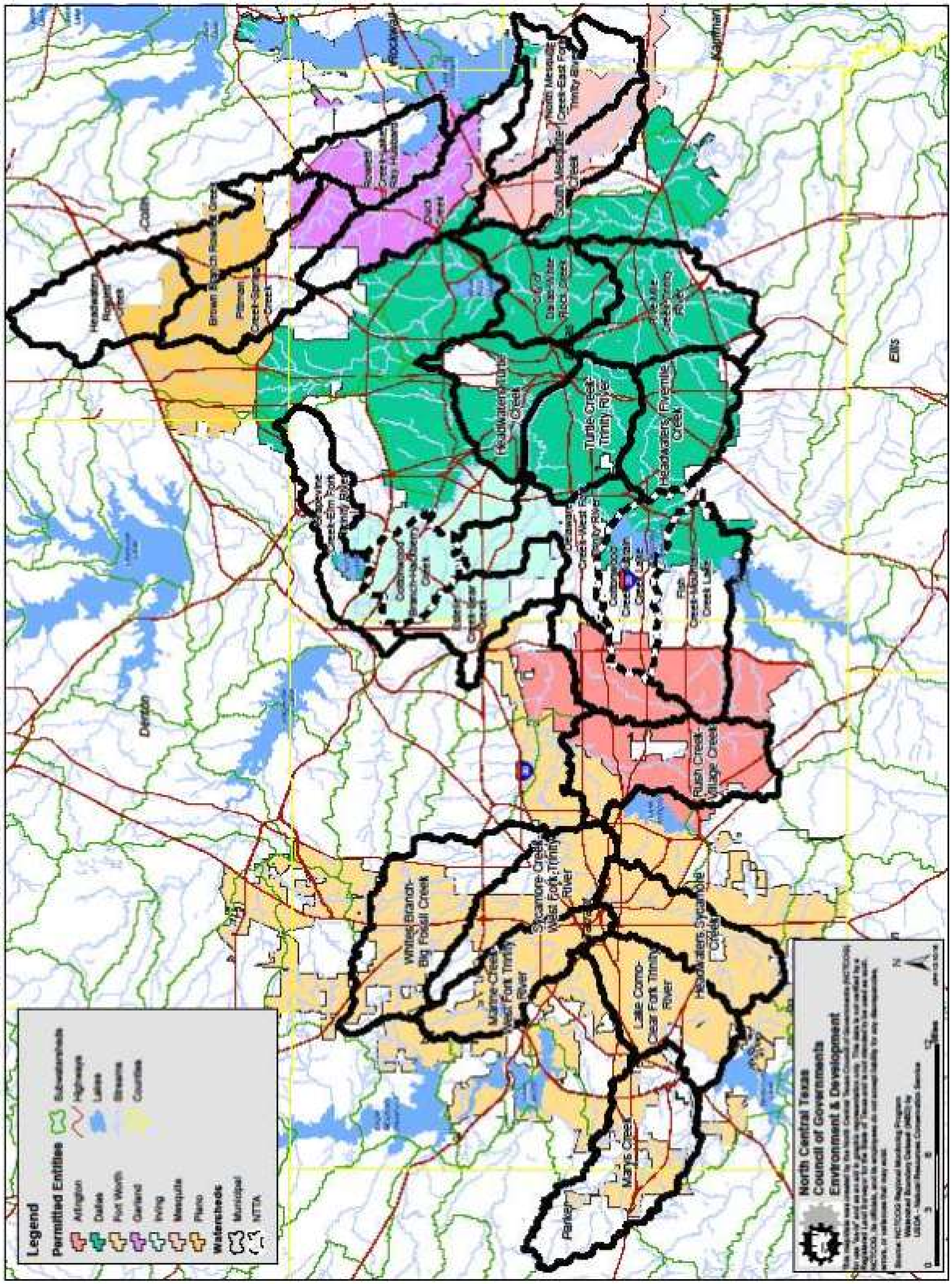
Through the RWWCP, municipal regional partners effectively monitored at least 50 percent of their jurisdictional area (jurisdictional coverage was not considered in the selection of the NTTA watersheds). All of the jurisdictional areas fall within the Trinity River Basin. The West Fork and Clear Fork of the Trinity River flow through jurisdictional areas on the western side of the Dallas-Fort Worth Metroplex receiving flow from Parker, Tarrant, and Wise counties before joining the main stem in Dallas County. The Elm Fork enters jurisdictional areas from the north from Denton County and converges with the West Fork in Dallas County. The river is called the Trinity downstream of the West Fork/Elm Fork confluence. The East Fork passes on the eastern side of the Dallas-Fort Worth Metroplex receiving flow from Collin, Dallas, and Kaufman counties.

The Natural Resource Conservation Service (NRCS), in collaboration with several other federal agencies, developed the Watershed Boundary Dataset (WBD) which was released in 2008. The watershed boundaries are defined as “drainage areas delineated to nest in a multi-level, hierarchical drainage system” (USDA NRCS, 2004). They are characterized by 6-digit, 8-digit, 10-digit, and 12-digit hydrologic unit codes which are associated with the specific hierarchical level (e.g. basin (HUC6) to sub-basin (HUC8) to watershed (HUC10) to subwatershed (HUC12)). These hydrologic boundaries were delineated and georeferenced to the USGS 1:24,000 scale topographic base map, meeting National Map Accuracy Standards (NMAS). The drainage level displayed in maps in this report is the subwatershed (HUC12) level. The NCTCOG identified subwatersheds within the Dallas-Fort Worth Metroplex by using these HUC12 level cataloging units. These cataloging units are referred to within this report as “watersheds”. In many cases, the monitored streams represent only a fraction of the HUC12 watershed. These drainage areas are also identified based upon the location of the monitoring stations within the larger watersheds.

The Regional partners conducted chemical sampling within 24 watersheds and performed rapid bioassessments (biological monitoring) within 15 watersheds, with substantial overlap between the two sampling approaches. Rapid bioassessments were performed by the cities of Dallas, Fort Worth, Garland, Irving, and Plano.

Figure 1-6 provides a map of the watersheds sampled during the fourth monitoring term.

Figure 1-6 RWWCP Fourth Monitoring Term Monitored Watershed Map



1.2.2. Purpose and Use of Data Collection

Chemical monitoring and bioassessments assess the status of a water body relative to the primary goal of the Clean Water Act (CWA). Instream chemical data during wet weather events are useful for documenting and tracking the success or failure of stormwater management in the region. Biological assemblages reflect overall ecological integrity (i.e., chemical, physical, and biological integrity) of the stream. Both chemical and bioassessment data provide direct measurements of water quality and aquatic life use (ALU) criteria that the Texas Surface Water Quality Standards (TSWQS) are meant to protect. Therefore, both chemical and bioassessment monitoring can be effective tools for planning water quality monitoring and management activities.

Long term measurements of instream chemical data as well as biological assemblages integrate the effects of different stressors as well as integrating the stresses over time and thus provide a broad measure of their aggregate impact over time. Both chemical and biological data are of direct interest to the public as measures of a pollution free environment.

2. Fourth Term Program Elements

2.1. Sampling Methodologies

2.1.1. Chemical Monitoring

Arlington, Garland, Plano, and Irving perform chemical sampling on one or two watersheds within their jurisdiction for two consecutive years, then move to another one or two watersheds for another two years. Due to the size of their jurisdictional area, Dallas selected eight watersheds, and Fort Worth selected six watersheds for chemical and/or biological monitoring that rotate. Mesquite has a unique situation where only two watersheds and the two creeks of those watersheds are almost wholly contained within the city limits. Mesquite has chosen to establish permanent in-stream monitoring stations in each of the two creeks and to sample them concurrently all four years. NTTA has also chosen to establish in-stream monitoring stations in two creeks within NTTA rights-of-way and to sample them concurrently all four years. Appendix A provides additional documentation of the chemical sampling occurring for all participants.

For chemical monitoring, grab samples were collected during the first flush (defined as the 30 minutes following a quantifiable rise in stream level) and analyzed for E. coli, oil and grease, and pH. An additional first flush sample and four subsequent samples collected at equal time intervals were taken over the first two hours of the event and combined for a composite sample. Samples were collected for no more than two hours, regardless of storm duration. Grab samples were obtained either manually or through an automated collection device.

Sampling was conducted only on qualifying events which were defined as satisfying the following requirements: 1) antecedent dry period of 72 hours minimum, 2) rainfall volume of 0.10 inch minimum, and a 3) quantifiable increase in water surface elevation attributable to stormwater runoff. Rain gauges were deployed in each watershed to support the assessment of local wet weather conditions.

Composite chemical samples were collected with automatic sampling equipment that allowed the collection of water through a stainless steel strainer and flexible sampling tubing using a peristaltic pump. Samples were then pumped into four 1-gallon glass containers located in a stormwater sampler shelter. The automatic samplers were also equipped with bubbler flow modules that activated the samplers based on an increase in water surface elevation in the stream conveyance channel. Upon successful collection, the samples were preserved in ice and delivered immediately to the laboratory for analysis.

2.1.2. Bioassessments

In the fourth monitoring term, the cities of Dallas, Fort Worth, Garland, Irving, and Plano conducted bioassessments, representing a substantial increase in the use of bioassessments as a component of the RWWCP. EPA and TCEQ have developed an array of methods and approaches that can be used in conducting bioassessments. As EPA states in their manual, Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, 2nd Ed. (1999), the protocols described are “not intended to be used as a rigid protocol without regional modifications. Instead, they provide options for agencies or groups that wish to implement rapid biological assessment and monitoring techniques.”

The regional program participants that are implementing bioassessments performed bioassessments based upon EPA and TCEQ protocols. Specific protocols are detailed in manuals provided by each agency, but generally, program participants conducted bioassessments involving habitat assessment, a measurement of standard field physical conditions, and the collection and identification of macroinvertebrates and other biota. Habitat parameters were compared to baseline standards for a reference site or reference conditions to determine the habitat’s overall health.

2.1.3. Overview of Protocols

2.1.3.1. Regional Stormwater Monitoring and Bioassessment Protocols

The cities of Arlington, Garland, Irving, Mesquite, Plano, and the North Texas Tollway Authority contracted with Atkins (in association with Freese and Nichols; Dougherty Sprague Environmental, Inc., TTI Environmental Laboratories, and Pace® Analytical Services) to assist with the field collection and analysis of their stormwater samples.

Atkins prepared the Regional Wet Weather Characterization Program, Permit Term Four Monitoring Program and Quality Assurance Project Plan for Wet Weather Equipment Deployment and Sampling Protocol 2018-2021 (Atkins, 2019) and Regional Wet Weather Characterization Program Permit Term Four Monitoring Program and Quality Assurance Project Plan for Bioassessments: 2018-2021 (Freese and Nichols, 2019) as the protocols for the listed MS4s.

All chemical sampling sites were equipped with automatic samplers (ISCO 6712, ISCO 730 Bubbler Module) that contained four 1-gallon glass sample containers. The sampler collected 0.5-gallon aliquots every 30 minutes after the initial sample for 120 minutes. Sample container one, or the grab sample container, contained one 1-gallon aliquot, sample containers two and three contained two 0.5-gallon aliquots, and sample container four contained one 0.5-gallon aliquot. Tipping bucket rain gauges (ISCO 674) were used to verify rainfall amounts and antecedent dry periods. Graduated cylinder rain gauges were also used at some sites. In the event that the on-site rain gauge information was not applicable (e.g., malfunction or qualifying storm was not captured by the gauge), an online rain gauge was used to verify the rainfall amount and antecedent dry period. Atkins used TTI Laboratories and Pace® Analytical Services to carry out any analysis of samples collected. Laboratory certification information is available in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022).

Rapid bioassessment monitoring was conducted for the cities of Garland, Irving, and Plano. Benthic macroinvertebrate and fish communities were sampled and data compared with metrics from the Texas Commission on Environmental Quality (TCEQ). Habitat, water chemistry, and flow were also measured in each trip. Streams evaluated were in the Texas Blackland Prairie ecoregion (Ecoregion 32). Within an ecoregion, soils, climate, landforms, and vegetation are expected to be similar. Reference conditions for benthic macroinvertebrates and fish inhabiting wadeable streams in the Texas Blackland Prairie ecoregion are described by TCEQ. Evaluating benthic macroinvertebrates and fish communities with the TCEQ-established metrics to calculate ALU may indicate whether the streams have been impacted by human activities.

The cities of Dallas and Fort Worth conduct their operations separately and have developed protocol documents to address the minor variances in their programs.

2.1.3.2. City of Dallas Protocol

The City of Dallas uses the Regional Stormwater Monitoring and Bioassessment Protocols as their base protocols for stormwater sampling and bioassessment activities. The City of Dallas utilizes city personnel to operate their equipment and collect stormwater samples. City staff also conducts bioassessment activities. The City of Dallas protocol is available in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022)

The City of Dallas uses the ISCO 6712 model with ISCO 674 Rain Gauge and ISCO 750 Flow Meter for stormwater sample collection. The City of Dallas uses a program script designed to collect and analyze samples for parameters with short hold time from the three sampling stations in one rain event. Sampler equipment is programmed to activate at a 1/10-inch level rise recorded by the rain gauge within a two-hour period. At activation, the sampler collects two one-gallon samples (1st flush). After fifteen minutes, the sampler fills the remaining two one-gallon jars (composite) over an hour period in five equal aliquots. The City of Dallas used Pace Analytical Laboratories to carry out analyze the collected samples. Laboratory certification information is available in the Regional Wet Weather Characterization Program Annual

Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022).

The City of Dallas performs rapid bioassessment protocol (RBP) monitoring as a part of the RWWCP and conducts additional RBP monitoring beyond the regional program as part of their individual MS4 Permit Stormwater Management Program. The City uses the RBP as outlined in the TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data (TCEQ, 2007, RG-416). The RBP monitoring evaluates the chemical, physical, and biological in-stream features that promote a healthy and diverse habitat; as such, they provide a good assessment of overall watershed health. The RBP monitoring program involves performing an ALU assessment through benthic macro-invertebrate collection, habitat assessment, and evaluating water quality samples.

Two sampling events were conducted in accordance with the index periods established by TCEQ for biological sampling:

- Spring Period (March 15 to June 30): Targets spring's optimal conditions for biological community growth.
- Summer Period (July 1 to September 30): Reflects impacts from typical summer low flows and higher water temperatures.

Under the RBP, each water body is given a composite score determined by evaluating numbers and diversity of macroinvertebrates, water quality parameters, stream habitat features, and other metrics. A sample of each monitoring site's macroinvertebrate community determines the sites ALU metric. Since 2005, the City of Dallas has used the Benthic Macroinvertebrate Index of Biotic Integrity (IBI) to test ALU. A sample from each monitoring site is tested according to the IBI.

2.1.3.3. City of Fort Worth Protocol

The City of Fort Worth has developed a separate protocol, City of Fort Worth RWWCP Monitoring Plan for conducting their stormwater sampling and bioassessment activities. Fort Worth utilizes city personnel to operate their equipment and collect stormwater samples. City staff also conducts bioassessment activities. The protocol document includes location information for Fort Worth's stormwater sampling and bioassessment sites. The updated City of Fort Worth protocol is available in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022).

The City of Fort Worth has identified chemical sampling sites for the years 2018-2020. Automatic water samplers (ISCO 3700 or other) are deployed at the site(s) to be monitored before the rain event. The samplers are programmed to initiate sampling at a 1.0-inch rise in receiving stream water level. Upon activation, the sampler collects a "first flush" grab sample and the first of four sub-samples for a time-weighted composite sample. Subsequent sub-samples are collected at 30-minute intervals Pace Analytical Services Dallas and Pace Analytical Services Forth Worth Laboratory analyzed all parameters. Laboratory certifications are available in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022).

The City of Fort Worth performs rapid bioassessments on representative creeks within six subwatersheds twice per year as a part of the RWWCP monitoring program and to satisfy their stormwater monitoring program requirements. Methods for bioassessments are based on protocols set forth in TCEQ, EPA, and Texas Parks and Wildlife guidance documents. A description of methodology may be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). Regional rapid bioassessments included habitat assessment, chemical, and physical water quality parameter evaluation, sample collection, and analysis of benthic macroinvertebrate. Sampling was conducted during spring and fall on all creeks.

Habitat assessments are based on USEPA guidelines for high gradient streams as outlined in Rapid

Bioassessment Protocol for Use in Streams and Wadeable Rivers, second edition (EPA 841-B-99-002) (Barbour, et. al., 1999). Macroinvertebrate data were analyzed using methods for the TCEQ-based Texas IBI for kick net samples. The metric calculation scores at a site for the IBI are compared to values in TCEQ guidelines, and each site is assigned an ALU rating. The values for the ALU ratings found in the TCEQ guidelines were developed based on data collected from ecoregional reference sites. This method gives each site an individual value without a direct comparison to a specific reference site but to values from ecoregional reference sites. Individual sites may be compared to themselves year to year on a seasonal basis (spring to spring and fall to fall) to demonstrate community changes within each reach.

2.2. Sample Collection Schedule

Table 2-1 contains information on the watersheds monitored and number of samples collected and bioassessments conducted for each of the monitoring partners during the fourth monitoring term.

2.3. Monitored Parameters

Each sample was analyzed for 19 parameters which are listed in Table 2-2. Although specific conductivity and temperature are not required parameters under the approved Regional Wet Weather Characterization Plan, these parameters were collected in addition to the parameters listed in Table 2-2 at most chemical monitoring locations. Analytical methods, sample hold times, minimum laboratory reporting limits, and method detection limits are available in Atkins, 2019.

Table 2-1 RWWCP Sampling Schedule

Jurisdiction Subwatershed	Number of Samples to be Collected[1]				
	2018	2019	2020	2021[2]	2022[2]
Arlington					
Johnson Creek	4C	4C			
Fish Creek – Mountain Creek Lake	4C	4C			
Rush Creek – Village Creek			8C	8C	
Dallas					
Floyd Branch – White Rock Creek	2B	2B	2B	2B	
Five Mile Creek – Trinity River		12C		12C	
Headwaters Five Mile Creek	2B	2B	2B	2B	
Headwaters Turtle Creek	12C		12C		
White Rock Creek – White Rock Lake	2B	2B	2B	2B	
City of Dallas – White Rock Creek		12C		12C	
Bachman Branch – Elm Fork Creek	2B	2B	2B	2B	
Turtle Creek – Trinity River	12C		12C		
Fort Worth					
Headwaters Sycamore Creek	2C/4B	4B	6B	4B	4B
Lake Como-Clear Fork Trinity River	4B	2C/4B	6B	4B	4B
Marine Creek-West Fork Trinity River	4B	2C/4B	6B	4B	4B
Mary's Creek	2C/4B	4B	6B	4B	4B
Sycamore Creek-West Fork Trinity River	4B	4B	2C/6B	4B	4B
Whites Branch-Big Fossil Creek	4B	4B	2C/6B	4B	4B
Garland					
Duck Creek	12C	12C			
Rowlett Creek – Lake Ray Hubbard	2B	2B	12C/2B	12C/2B	
Irving					
Delaware Creek – West Fork Trinity River	8C/2B	8C/2B			
Grapevine Creek – Elm Fork Trinity River			4C	4C	
Estelle Creek – Bear Creek			4C/2B	4C/2B	
Mesquite					
South Mesquite Creek	4C	4C	4C	4C	
North Mesquite Creek	4C	4C	4C	4C	
Plano					
Spring Creek	4C	4C			
Headwaters Rowlett Creek	2B	2B	4C	4C	
Brown Branch Rowlett Creek			4C/2B	4C/2B	
North Texas Tollway Authority					
Cottonwood Branch – Hackberry Creek	4C	4C	4C	4C	
Cottonwood Creek – Mountain Creek Lake	4C	4C	4C	4C	

Notes:

1. "B" Signifies bioassessment samples, "C" signifies chemical samples.
2. The City of Fort Worth will conduct additional chemical sampling in 2021 and 2022 at watersheds selected after sampling 2020 and based on the chemical, physical, and biological assessment results were done in 2018-2020.

Table 2-2 Regional Parameter Set

Parameter	Method of Collection
Oil and Grease	Grab
pH	Grab
E. Coli	Grab
Total Dissolved Solids (TDS)	Composite
Total Suspended Solids (TSS)	Composite
Biochemical Oxygen Demand (BOD)	Composite
Chemical Oxygen Demand (COD)	Composite
Total Nitrogen	Composite
Dissolved Phosphorus	Composite
Total Phosphorus	Composite
Atrazine	Composite
Total Arsenic	Composite
Total Chromium	Composite
Total Copper	Composite
Total Lead	Composite
Total Zinc	Composite
Ammonia Nitrogen	Composite
Nitrate Nitrogen	Composite
Orthophosphate	Composite

3. Fourth Monitoring Term Monitoring Activities

This section summarizes the monitoring activities for each year. Details of the individual monitoring results (e.g., laboratory data and field summaries) can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022).

3.1. 2018 Monitoring Activity Description

The 2018 Watersheds and Monitoring Sites map (Figure 3-1) shows the watersheds sampled in Year 1 (2018) as well as the location of the chemical sampling stations and bioassessment sites. Table 3-1 contains the corresponding list of Year 1 chemical monitoring and bioassessment sites that are part of the RWWCP along with detailed location information.

3.1.1. Chemical Sampling

All samples were successfully collected and analyzed in Year 1 (January to December 2018). Due to contracting delays, the Atkins team did not collect any samples during the first quarter (January through March 2018). As a result, make-up samples for the first quarter of Year 1 were collected by the Atkins team during quarters two through four.

In September 2018, heavy flooding inundated the sampling equipment at stations AR1801 (Arlington), AR1802 (Arlington), NT1802 (NTTA), MS1801 (Mesquite), and MS 1802 (Mesquite). The equipment located at AR1801 and NT1802 was lost to the flood waters and not recovered. The NT1802 equipment was later recovered. For all sites, the equipment was evaluated by the manufacturer and was placed back in their original location, with the exception of AR1801. Replacement equipment was identified for AR1801 and a new location was chosen and named AR1801A. In September 2018, the consultants and NCTCOG were informed that TTI Laboratories, the laboratory subcontracted by Atkins to analyze the chemical samples, had lost their accreditation (as of September 1, 2018). Atkins acquired quotes from several local laboratories and worked with TTI Laboratories to ensure that collected samples could be analyzed by a subcontracted NELAP laboratory. Samples collected in 2018 after the expiration of the TTI Laboratory accreditation were analyzed by TTI Laboratories sub-contracted laboratories, Armstrong Forensic Laboratory, Inc. and ALS Laboratory.

Sampling data and annual summary statistics can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 (NCTCOG, 2019).

3.1.2. Bioassessments

The Cities of Dallas, Fort Worth, Garland, Irving, and Plano conducted bioassessment activities in Year 1. All scheduled bioassessments were successfully conducted. An overview of each entity's bioassessment activities is provided below. For complete details, refer to bioassessment reports in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 (NCTCOG, 2019).

3.1.2.1. City of Dallas

All scheduled bioassessments were conducted successfully. Two sampling events were conducted in accordance with the index periods established by TCEQ for biological sampling:

- Spring Period (March 15 to June 30): Targets spring's optimal conditions for biological community growth.
- Summer Period (July 1 to September 30): Reflects impacts from typical summer low flows and higher water temperatures.

Figure 3-1 2018 Watersheds and Monitoring Sites

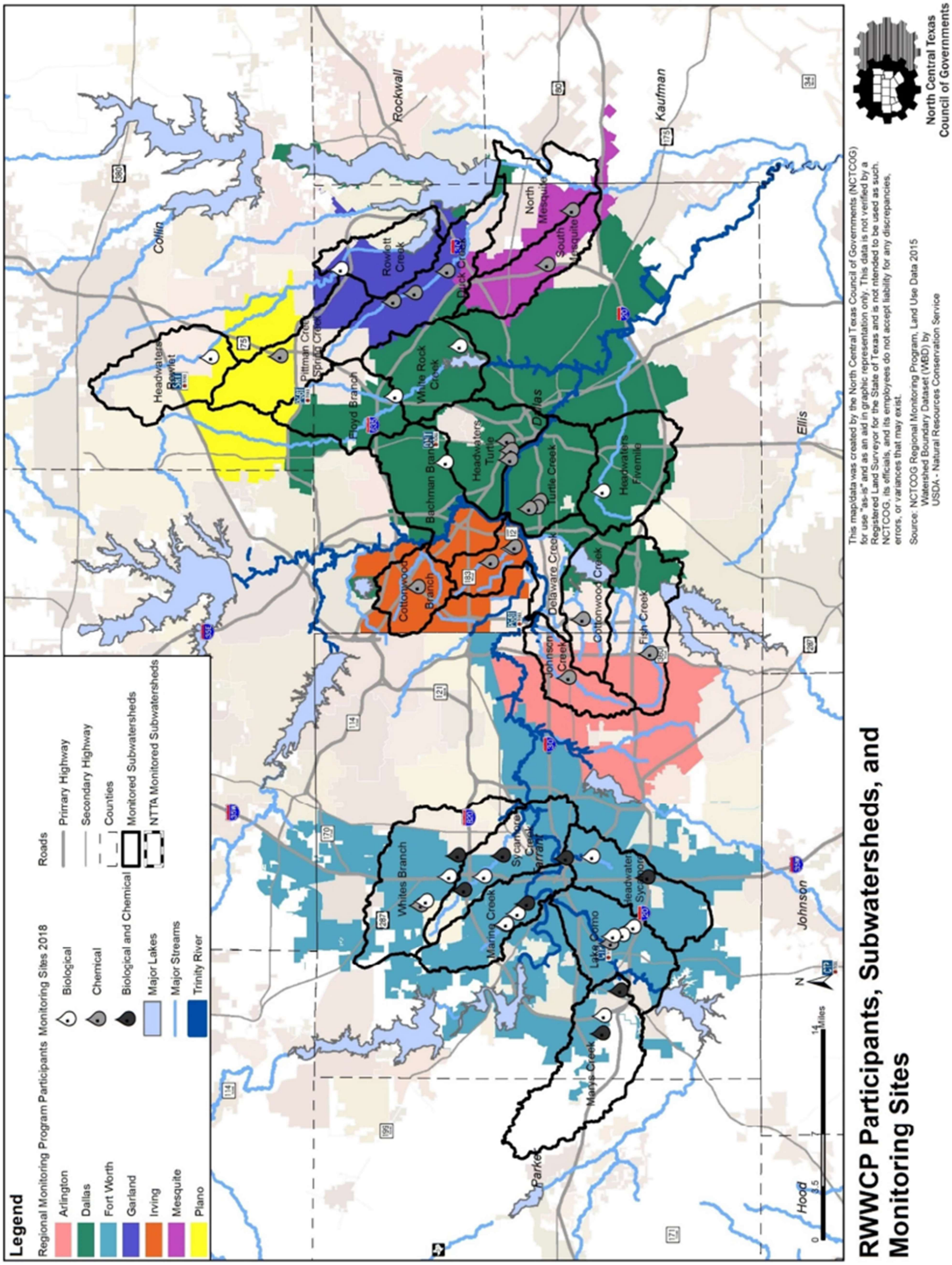


Table 3-1 Year 1 (2018) Chemical Sampling and Bioassessment Site Locations

Table 3-1: Year 1 (2018) Chemical Sampling and Bioassessment Site Locations				
Jurisdiction / Watershed	Station ID	Location	Latitude/Longitude	# of samples in 2018[1]
Arlington				
Johnson Creek	AR1801	Johnson Creek at Six Flags	32.7588056 / -97.0670278	3C
	AR1801A[2]	Johnson Creek at East Sandford Street	32.7428360 / -97.087583	1C
Fish Creek – Mountain Creek Lake	AR1802	Fish Creek at SH 360	32.6623528 / -97.0613889	4C
Dallas				
Headwaters Turtle Creek	HTC-100	3505 Maple Avenue at Turtle Creek	32.7995770 / -96.8130450	4C
	HTC-200	1201 Turtle Creek Boulevard at Turtle Creek	32.7958500 / -96.8242030	4C
	HTC-300	2240 Irving Boulevard at Turtle Creek	32.7969010 / -96.8369522	4C
Turtle Creek-Trinity River	TCTR-100	3805 Pipestone Road at Mican Channel	32.7684940 / -96.8843680	4C
	TCTR-200	3951 La Reunion Parkway at Mican Channel	32.7711350 / -96.8913620	4C
	TCTR-300	4300 Singleton Boulevard at Mican Channel	32.7788600 / -96.8926320	4C
Bachman Branch-Elm Fork Trinity	bab-b	0.25 mile south of Midway Road and W. Northwest Hwy intersection at Bachman Branch	32.8604418 / -96.8369522	2B
Floyd Branch – White Rock Creek	flo-a	Heading West on Forest Lane (towards US 75), turn Right onto gravel road underneath DART Rail	32. 9090690 / -96.7601368	2B
White Rock Creek-White Rock Lake	dix-a	Northeast of Peavy Road and E. Lake Highlands intersection at Dixon Branch	32.8446960 / -96.7047586	2B
Headwaters Five Mile Creek	fiv-d	Westmoreland Road and Pentagon Pkwy intersection at Five Mile Creek	32.7064408 / -96.8745138	2B
Fort Worth				
Headwaters Sycamore Creek	FWSYC1	IH 35W Northbound frontage road beneath SE Loop 820 eastbound	32.6677 / -97.3178	1C/2B
	FWSYC3	Dead end of Scott St. west of Beach St.	32.7475 / -97.2949	1C/2B
Lake Como-Clear Fork Trinity River	FWOVR1	NW of Granbury Rd and Trail Lake Dr.	32.6820 / -97.3738	2B
	FWOVR3	Overton Park West south of intersection with Bellaire	32.7017 / -97.3839	2B
Sycamore Creek – West Fork Trinity River	FWLFC1	2200 block Cantrell Sansom	32.8478 / -97.3297	2B
	FWLFC3	Dead end of Mesquite Rd. south of 3800 Long Ave.	32.8095 / -97.2909	2B
White's Branch - Big Fossil Creek	FWBFC1	West of and parallel to Pepperidge Lane	32.8854 / -97.3421	2B
	FWBFC3	N. Beach St. north of Paula Ridge	32.8536 / -97.2904	2B
Marine Creek – West Fork Trinity River	FWMAR1	3500 Macie, bridge crossing in Buck Sansom Park	32.8079 / -97.3703	--
	FWMAR1	West of Angle Avenue in Buck Sansom Park	32.8069 / -97.3691	2B
	FWMAR3	Saunders Park south of Mule Alley and downstream of JV1A	32.7862 / -97.3460	2B
Mary's Creek	FWMRY1	3900 block Longvue (FM 2871)	32.7133 / -97.4966	1C/2B
	FWMRY3	Winscott Road (Vickery Blvd.) in South Z Boaz Park	32.6954 / -97.4477	1C/2B
Garland				
Duck Creek	GA1801	Duck Creek between Forest North and South	32.9090727 / -96.6503388	4C
	GA1802	Duck Creek at Rick Ogden Park/Briarwood Drive	32.888176 / -96.641277	4C
	GA1803	Duck Creek Under La Prada Bridge	32.8554635 / -96.6168702	4C
Rowlett Creek – Lake Ray Hubbard	GARBA20189	Rowlett Creek below Atchison Topeka and Santa Fe Railroad Bridge	32.960095 / -96.612327	2B
Irving				
Delaware Creek – West Fork Trinity River	IR1801	Delaware Creek at Sowers Road	32.8175600 / -96.9528400	4C
	IR1802	Delaware Creek at Oakdale	32.7938200 / -96.9363500	4C
	IRRBA20189	Delaware Creek at Fritz Park	32.79590 / -96.93770	2B

Table 3-1: Year 1 (2018) Chemical Sampling and Bioassessment Site Locations				
Jurisdiction / Watershed	Station ID	Location	Latitude/Longitude	# of samples in 2018[1]
Mesquite				
South Mesquite Creek	MS1801	North of New Market Road	32.7572500 / -96.6119444	4C
North Mesquite Creek	MS1802	North Mesquite Creek at Edward's Church	32.7321111 / -96.5505000	4C
Plano				
Pittman Creek – Spring Creek	PL1801	Spring Creek at 16th Street	33.021317 / -96712406	4C
Headwaters Rowlett Creek	PLRBA20189	Rowlett Creek at Sun Creek Park	33.08920 / -96.70870	2B
North Texas Tollway Authority				
Cottonwood Branch – Hackberry Creek	NT1801	Unnamed Tributary at SH 161 N. of Gateway Drive	32.889808 / -96.980065	4C
Cottonwood Creek – Mountain Creek Lake	NT1802	Cottonwood Creek at SH 161 S. of Dickey Road	32.728181 / -97.019460	4C

Notes:

1. "B" Signifies bioassessment samples, "C" signifies chemical samples.
2. Due to flooding in the region, AR1801 was moved to a new location and was renamed AR1801A.

3.1.2.2. City of Fort Worth

Rapid bioassessments were performed on stream monitoring sites in 2018 during two separate sampling events. One sampling event occurred in spring 2018 (May) and the second took place in fall 2018 (October). Table 3-1 includes the primary bioassessment sites for the City of Fort Worth for each watershed. The City of Fort Worth Sampling Protocol identifies an additional bioassessment site for each watershed that may be used as an alternative depending on local conditions at the time of sampling.

3.1.2.3. Cities of Garland, Irving, and Plano

Stream rapid bioassessments were conducted on Rowlett Creek in Garland, Delaware Creek in Irving, and Rowlett Creek Headwaters in Plano, in 2018. All three creeks were sampled once between June 18 and 20, 2018, during the "Index" period and another time between September 18 and 20, 2018, during the "Critical" period. Benthic macroinvertebrate and fish communities were sampled and data compared with metrics from the TCEQ. Habitat, water chemistry, and flow were also measured in each trip.

3.2. 2019 Monitoring Activity Description

The 2019 Watersheds and Monitoring Sites map (Figure 3-2) shows the watersheds sampled in Year 2 (2019) as well as the location of the chemical sampling stations and bioassessment sites. Table 3-2 contains the corresponding list of Year 2 chemical monitoring and bioassessment sites that are part of the RWWCP along with detailed location information.

3.2.1. Chemical Sampling

All samples were successfully collected and analyzed in Year 2, January 2019 – December 2019 of the fourth term. Due to construction activities and failed sampling attempts, first quarter sampling of PL1901 was not completed until May 18, 2019. Also due to construction activities in the second quarter, the sampling equipment located at IR1902 was relocated to the nearest upstream access and renamed IR1902A.

Sampling data and annual summary statistics can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 2 (NCTCOG, 2020b).

3.2.2. Bioassessments

The Cities of Dallas, Fort Worth, Garland, Irving, and Plano conducted bioassessment activities in Year 2. All scheduled bioassessments were successfully conducted. An overview of each entity's bioassessment activities is provided below. For complete details, refer to bioassessment reports in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 2 (NCTCOG, 2020b).

3.2.2.1. City of Dallas

All scheduled bioassessments were conducted successfully. Two sampling events were conducted in accordance with the index periods established by TCEQ for biological sampling:

- Spring Period (March 15 to June 30): Targets spring's optimal conditions for biological community growth.
- Summer Period (July 1 to September 30): Reflects impacts from typical summer low flows and higher water temperatures.

3.2.2.2. City of Fort Worth

Rapid bioassessments were performed on stream monitoring sites in 2019 during two separate sampling events. Sampling was conducted during spring (May) and fall (October) 2019 on three sites on most of the creeks. Sycamore Creek site 3 (FWSYC3) wasn't sampled during spring 2019 as it was unwadeable, and Marine Creek site 1 (FWMAR1) wasn't sampled during fall 2019 as it was dry. The City of Fort Worth Sampling Protocol identifies an additional bioassessment site for each watershed that may be used as an alternative depending on local conditions at the time of sampling.

3.2.2.3. Cities of Garland, Irving, and Plano

Stream rapid bioassessments were conducted on Rowlett Creek in Garland, Delaware Creek in Irving, and Rowlett Creek Headwaters in Plano, in 2019. All three creeks were sampled once between June 12 and 14, 2019, during the "Index" period and another time between September 16 and 18, 2019, during the "Critical" period. Benthic macroinvertebrate and fish communities were sampled, and data compared with metrics from the TCEQ. Habitat, water chemistry, and flow were also measured in each trip.

Figure 3-2 2019 Watersheds and Monitoring Sites

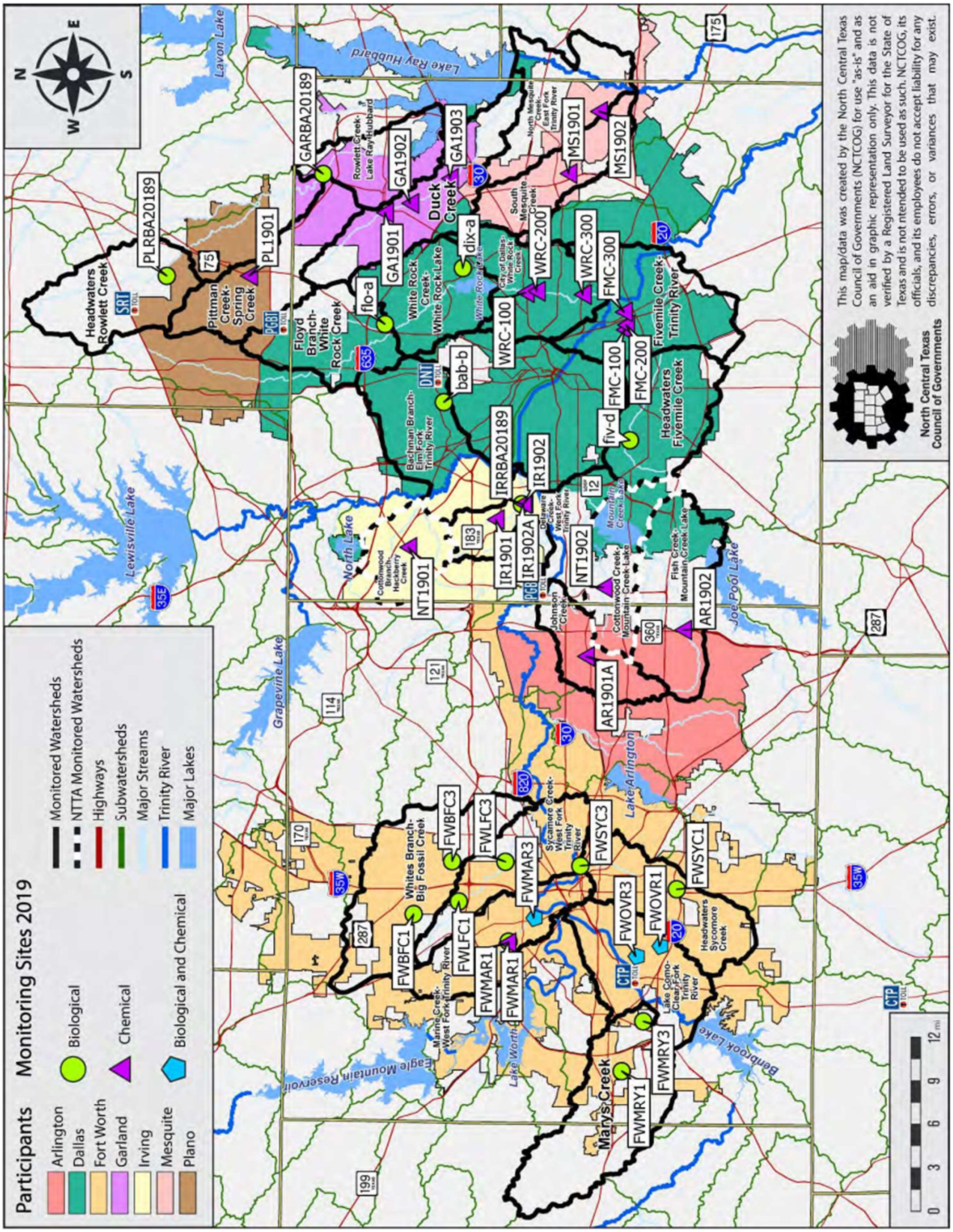


Table 3-2 Year 2 (2019) Chemical Sampling and Bioassessment Site Locations

Table 3-2: Year 2 (2019) Chemical Sampling and Bioassessment Site Locations				
Jurisdiction / **Watershed**	**Station ID**	**Location**	**Latitude/Longitude**	**# of samples in 2019[1]**
Arlington				
Johnson Creek	AR1901	Johnson Creek at East Sandford Street	32.7428360 / -97.087583	4C
Fish Creek – Mountain Creek Lake	AR1902	Fish Creek at SH 360	32.6623528 / -97.0613889	4C
Dallas				
Five Mile Creek-Trinity River	FMC-100	3200 Linfield Road at Honey Springs Branch	32.710769 / -96.765777	4C
	FMC-200	4400 Vandervoort Drive at Honey Springs Branch	32.709680 / -96.760929	4C
	FMC-300	8000 Carbondale St. at Honey Springs Branch	32.711500 / -96.747856	4C
City of Dallas-White Rock Creek	WRC-100	3800 Samuell Blvd. at White Rock Creek	32.792756 / -96.728893	4C
	WRC-200	5219 Military Parkway at White Rock Creek	32.783709 / -97.727515	4C
	WRC-300	5100 C. F. Hawn Frwy at White Rock Creek	32.745551 / -96.730780	4C
Bachman Branch-Elm Fork Trinity	bab-b	0.25 mile south of Midway Road and W. Northwest Hwy intersection at Bachman Branch	32.8604418 / -96.8369522	2B
Floyd Branch – White Rock Creek	flo-a	Heading West on Forest Lane (towards US 75), turn Right onto gravel road underneath DART Rail	32. 9090690 / -96.7601368	2B
White Rock Creek-White Rock Lake	dix-a	Northeast of Peavy Road and E. Lake Highlands intersection at Dixon Branch	32.8446960 / -96.7047586	2B
Headwaters Five Mile Creek	fiv-d	Westmoreland Road and Pentagon Pkwy intersection at Five Mile Creek	32.7064408 / -96.8745138	2B
Fort Worth				
Headwaters Sycamore Creek	FWSYC1	IH 35W Northbound frontage road beneath SE Loop 820 eastbound	32.6677 / -97.3178	2B
	FWSYC3	Dead end of Scott St. west of Beach St.	32.7475 / -97.2949	2B
Lake Como-Clear Fork Trinity River	FWOVR1	NW of Granbury Rd and Trail Lake Dr.	32.6820 / -97.3738	1C/2B
	FWOVR3	Overton Park West south of intersection with Bellaire	32.7017 / -97.3839	1C/2B
Sycamore Creek – West Fork Trinity River	FWLFC1	2200 block Cantrell Sansom	32.8478 / -97.3297	2B
	FWLFC3	Dead end of Mesquite Rd. south of 3800 Long Ave.	32.8095 / -97.2909	2B
White's Branch - Big Fossil Creek	FWBFC1	West of and parallel to Pepperidge Lane	32.8854 / -97.3421	2B
	FWBFC3	N. Beach St. north of Paula Ridge	32.8536 / -97.2904	2B
Marine Creek – West Fork Trinity River	FWMAR1	3500 Macie, bridge crossing in Buck Sansom Park	32.8079 / -97.3703	1C
	FWMAR1	West of Angle Avenue in Buck Sansom Park	32.8069 / -97.3691	2B
	FWMAR3	Saunders Park south of Mule Alley and downstream of JV1A	32.7862 / -97.3460	1C/2B
Mary's Creek	FWMRY1	3900 block Longvue (FM 2871)	32.7133 / -97.4966	2B
	FWMRY3	Winscott Road (Vickery Blvd.) in South Z Boaz Park	32.6954 / -97.4477	2B
Garland				
Duck Creek	GA1901	Duck Creek between Forest North and South	32.9090727 / -96.6503388	4C
	GA1902	Duck Creek at Rick Ogden Park/Briarwood Drive	32.888176 / -96.641277	4C
	GA1903	Duck Creek Under La Prada Bridge	32.8554635 / -96.6168702	4C
Rowlett Creek – Lake Ray Hubbard	GARBA20189	Rowlett Creek below Atchison Topeka and Santa Fe Railroad Bridge	32.960095 / -96.612327	2B
Irving				
Delaware Creek – West Fork Trinity River	IR1901	Delaware Creek at Sowers Road	32.8175600 / -96.9528400	4C
	IR1902	Delaware Creek at Oakdale	32.7938200 / -96.9363500	1C
	IR1902A[2]	Delaware Creek at Maple Street	32.794972 / -96.937083	3C

Table 3-2: Year 2 (2019) Chemical Sampling and Bioassessment Site Locations				
Jurisdiction / **Watershed**	**Station ID**	**Location**	**Latitude/Longitude**	**# of samples in 2019[1]**
	IRRBA20189	Delaware Creek at Fritz Park	32.79590 / -96.93770	2B
Mesquite				
South Mesquite Creek	MS1901	North of New Market Road	32.7572500 / -96.6119444	4C
North Mesquite Creek	MS1902	North Mesquite Creek at Edward's Church	32.7321111 / -96.5505000	4C
Plano				
Pittman Creek – Spring Creek	PL1901	Spring Creek at 16th Street	33.021317 / -96712406	4C
Headwaters Rowlett Creek	PLRBA20189	Rowlett Creek at Sun Creek Park	33.08920 / -96.70870	2B
North Texas Tollway Authority				
Cottonwood Branch – Hackberry Creek	NT1901	Unnamed Tributary at SH 161 N. of Gateway Drive	32.889808 / -96.980065	4C
Cottonwood Creek – Mountain Creek Lake	NT1902	Cottonwood Creek at SH 161 S. of Dickey Road	32.728181 / -97.019460	4C

Notes:

1. "B" Signifies bioassessment samples, "C" signifies chemical samples.
2. Due to construction activities, IR1902 was moved to a new location and was renamed IR1902A.

3.3. 2020 Monitoring Activity Description

The 2020 Watersheds and Monitoring Sites map (Figure 3-3) shows the watersheds sampled in Year 3 (2020) as well as the location of the chemical sampling stations and bioassessment sites. Table 3-3 contains the corresponding list of Year 3 chemical monitoring and bioassessment sites that are part of the RWWCP along with detailed location information.

3.3.1. Chemical Sampling

All samples were successfully collected and analyzed in Year 3, January 2020 – December 2020, of the fourth term. Due to construction in the fourth quarter, the sampling of HTC-300 was relocated to the nearest access point.

Sampling data and annual summary statistics can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 3 (NCTCOG, 2021).

3.3.2. Bioassessments

The Cities of Dallas, Fort Worth, Garland, Irving, and Plano conducted bioassessment activities in Year 3. All scheduled bioassessments were successfully conducted. An overview of each entity's bioassessment activities is provided below. For complete details, refer to bioassessment reports in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 3 (NCTCOG, 2021).

3.3.2.1. City of Dallas

All scheduled bioassessments were conducted successfully. Two sampling events were conducted in accordance with the index periods established by TCEQ for biological sampling:

- Spring Period (March 15 to June 30): Targets spring's optimal conditions for biological community growth.
- Summer Period (July 1 to September 30): Reflects impacts from typical summer low flows and higher water temperatures.

Figure 3-3 2020 Watersheds and Monitoring Sites

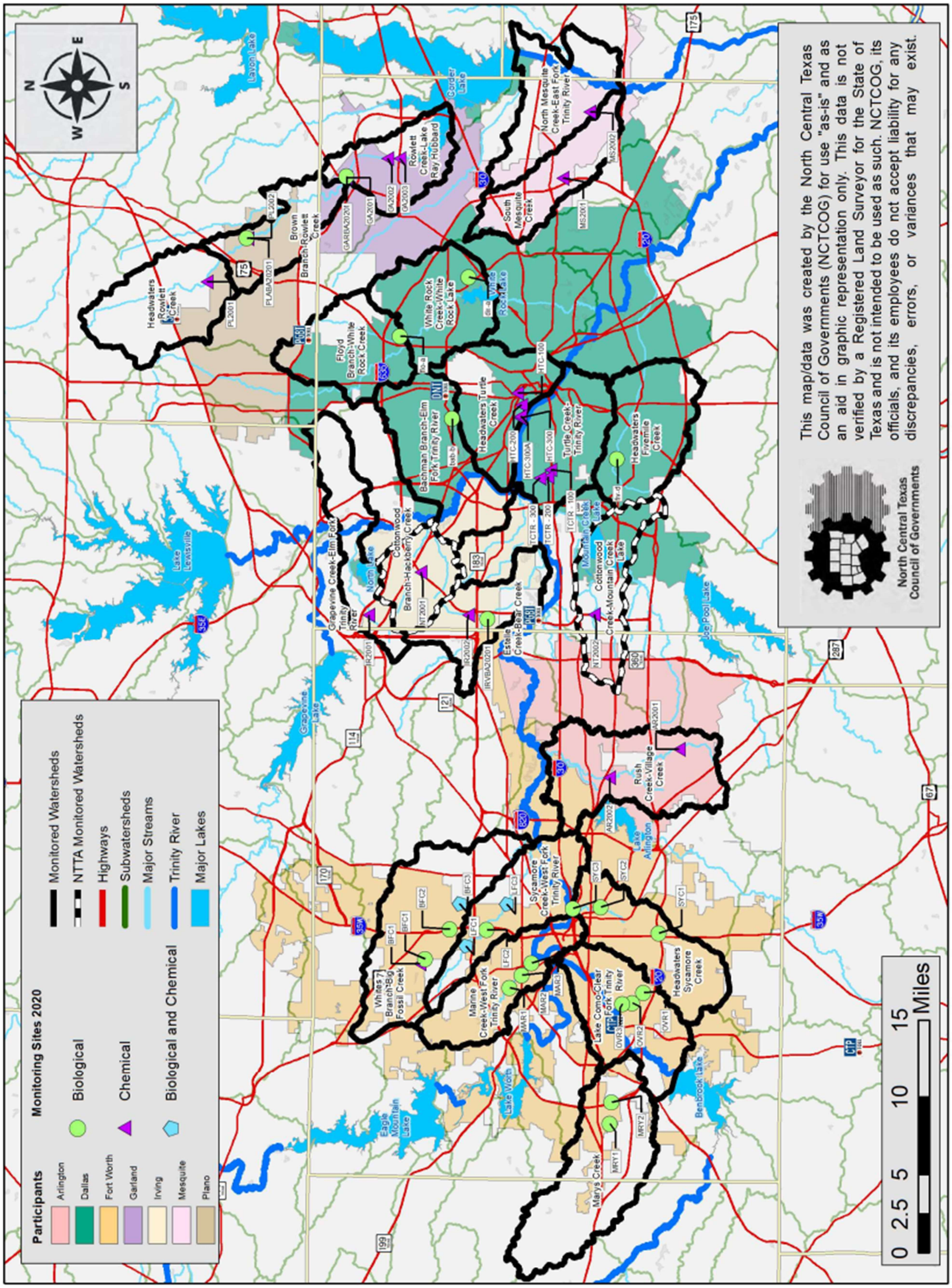


Table 3-3 Year 3 (2020) Chemical Sampling and Bioassessment Site Locations

Table 3-3: Year 3 (2020) Chemical Sampling and Bioassessment Site Locations				
Jurisdiction / Watershed	Station ID	Location	Latitude/Longitude	# of samples in 2020[1]
Arlington				
Rush Creek	AR2001	Rush Creek and West Sublett Road	32.648889 / -97.146389	4C
	AR2002	Rush Creek and Woodland Park Boulevard	32.713889 / -97.172778	4C
Dallas[2]				
Headwaters Turtle Creek	HTC-100	3505 Maple Avenue at Turtle Creek	32.7995770 / -96.8130450	4C
	HTC-200	1201 Turtle Creek Boulevard at Turtle Creek	32.7958500 / -96.8242030	4C
	HTC-300	2240 Irving Blvd.	32.79653494 / -96.834769	4C
Turtle Creek-Trinity River	TCTR-100	3805 Pipestone Road at Mican Channel	32.7684940 / -96.8843680	4C
	TCTR-200	3951 La Reunion Parkway at Mican Channel	32.7711350 / -96.8913620	4C
	TCTR-300	4300 Singleton Boulevard at Mican Channel	32.7788600 / -96.8926320	4C
Bachman Branch-Elm Fork Trinity	bab-b	8900 Midway Rd.	32.86044179 / -96.83695217	2B
Floyd Branch – White Rock Creek	flo-a	8300 Forest Lane	32. 90906899 / -96.76013679	2B
White Rock Creek-White Rock Lake	dix-a	900 Peavy Rd.	32.84469605 / -96.70475864	2B
Headwaters Five Mile Creek	fiv-d	3235 S. Westmoreland Rd.	32.7064408 / -96.87451384	2B
Fort Worth				
Headwaters Sycamore Creek	FWSYC1	IH 35W Northbound frontage road beneath SE Loop 820 eastbound	32.6677 / -97.3178	2B
	FWSYC2	Cobb Park West south of US-287 at low water crossing	32.7217 / -97.2935	2B
	FWSYC3	Dead end of Scott St. west of Beach St.	32.7475 / -97.2949	2B
Lake Como-Clear Fork Trinity River	FWOVR1	NW of Granbury Rd and Trail Lake Dr	32.6820 / -97.3738	2B
	FWOVR2	East of 3808 Overton Park West, near Tanbark Trail intersection	32.6925 / -97.3831	2B
	FWOVR3	Overton Park West south of intersection with Bellaire	32.7017 / -97.3839	2B
Sycamore Creek – West Fork Trinity River	FWLFC1	2200 block Cantrell Sansom	32.8478 / -97.3297	1C/2B
	FWLFC2	100 yards west of and upstream of I-35W crossing	32.8279 / -97.3146	2B
	FWLFC3	Dead end of Mesquite Rd. south of 3800 Long Ave.	32.8095 / -97.2909	1C/2B
White's Branch - Big Fossil Creek	FWBFC1	West of and parallel to Pepperidge Lane	32.8854 / -97.3421	2B
	FWBFC1	7764 N Blue Mound Road	32.8906 / -97.3464	1C
	FWBFC2	I-35W crossing, north of Western Center Blvd	32.8625 / -97.3142	2B
	FWBFC3	N. Beach St. north of Paula Ridge	32.8536 / -97.2904	1C/2B
Marine Creek – West Fork Trinity River	FWMAR1	West of Angle Avenue in Buck Sansom Park	32.8079 / -97.3691	2B
	FWMAR2	Lincoln Park, north of the 28th St crossing	32.7955/ -97.3572	2B
	FWMAR3	Saunders Park south of Mule Alley and downstream of JV1A	32.7862 / -97.3460	2B
Mary's Creek	FWMRY1	3900 block Longvue (FM 2871)	32.7133 / -97.4966	2B
	FWMRY2	Loop IH-820 SW crossing, 0.5 mile south of Chapin Rd	32.7117 / -97.4767	2B
	FWMRY3	Winscott Road (Vickery Blvd.) in South Z Boaz Park	32.6954 / -97.4477	2B
Garland				
Rowlett Creek – Lake Ray Hubbard	GA2001	Rowlett Creek at Ben Davis Bridge	32.9593500 / -96.611373	4C
	GA2002	Rowlett Creek at Centerville Road/Castle Drive	32.9205190 / -96.593322	4C
	GA2003	Rowlett Creek at Highway 66	32.9093670 / -96.593372	4C

Table 3-3: Year 3 (2020) Chemical Sampling and Bioassessment Site Locations				
Jurisdiction / **Watershed**	**Station ID**	**Location**	**Latitude/Longitude**	**# of samples in 2020[1]**
	GARBA20201	Below State Highway 78	32.96 / -96.615	2B
Irving				
Grapevine Creek – Elm Fork Trinity River	IR2001	Grapevine Creek at N. Royal Lane	32.9382140 / -97.019672	4C
Estelle Creek – Bear Creek	IR2002	Estelle Creek at W. Rochelle Road	32.8452560 / -97.019568	4C
	IRVBA20201	Below Pioneer Dr.	32.8294 / -97.022	2B
Mesquite				
South Mesquite Creek	MS2001	North of New Market Road	32.7572500 / -96.6119444	4C
North Mesquite Creek	MS2002	North Mesquite Creek at Edward's Church	32.7321111 / -96.5505000	4C
Plano				
Headwaters Rowlett Creek	PL2001	Rowlett Creek at Alma Drive	33.0890760 / -96.708830	4C
Brown Branch Rowlett Creek	PL2002	Rowlett Creek in Oak Point Park	33.0510280 / -96.668944	4C
	PLABA20201	Rowlett Creek in Oak Point Park	33.0523 / -96.6701	2B
North Texas Tollway Authority				
Cottonwood Branch – Hackberry Creek	NT2001	Unnamed Tributary at SH 161 N. of Gateway Drive	32.889808 / -96.980065	4C
Cottonwood Creek – Mountain Creek Lake	NT2002	Cottonwood Creek at SH 161 S. of Dickey Road	32.728181 / -97.019460	4C

Notes:

1. "B" Signifies bioassessment samples, "C" signifies chemical samples.
2. Due to construction activities, HTC-300 was relocated to the nearest access point.

3.3.2.2. City of Fort Worth

Sampling was conducted during spring (May) and fall (October) 2020 on three sites on all creeks. Rapid bioassessments were performed on stream sites within nine watersheds in Fort Worth during spring and fall 2020. The City of Fort Worth Sampling Protocol identifies an additional bioassessment site for each watershed that may be used as an alternative depending on local conditions at the time of sampling.

3.3.2.3. Cities of Garland, Irving, and Plano

Stream rapid bioassessments were conducted on Rowlett Creek in Garland, Estelle Creek-Bear Creek in Irving, and Brown Branch-Rowlett Creek in Plano, in 2020. All three creeks were sampled once between June 16 and 18, 2020, during the "Index" period and another time between September 23 and 25, 2020, during the "Critical" period. Benthic macroinvertebrate and fish communities were sampled, and data compared with metrics from the TCEQ. Habitat, water chemistry, and flow were also measured in each trip.

3.4. 2021 Monitoring Activity Description

The 2021 Watersheds and Monitoring Sites map (Figure 3-4) shows the watersheds sampled in Year 4 (2021) as well as the location of the chemical sampling stations and bioassessment sites. Table 3-4 contains the corresponding list of Year 4 chemical monitoring and bioassessment sites that are part of the RWWCP along with detailed location information.

3.4.1. Chemical Sampling

The sample for AR2102 (Q2) was unsuccessfully collected on the first attempt. Make-up sample collection was conducted in October 2021. All other samples were successfully collected and analyzed in Year 4, January 2021 – December 2021, of the fourth term.

Sampling data and annual summary statistics can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 4 (NCTCOG, 2022).

3.4.2. Bioassessments

The Cities of Dallas, Fort Worth, Garland, Irving, and Plano conducted bioassessment activities in Year 4. All scheduled bioassessments were successfully conducted. An overview of each entity's bioassessment activities is provided below. For complete details, refer to bioassessment reports in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 4 (NCTCOG, 2022).

3.4.2.1. City of Dallas

All scheduled bioassessments were conducted successfully. Two sampling events were conducted in accordance with the index periods established by TCEQ for biological sampling:

- Spring Period (March 15 to June 30): Targets spring's optimal conditions for biological community growth.
- Summer Period (July 1 to September 30): Reflects impacts from typical summer low flows and higher water temperatures.

3.4.2.2. City of Fort Worth

Sampling was conducted during spring (May) and fall (October) 2021 on three sites on all creeks. Rapid bioassessments were performed on stream sites within nine watersheds in Fort Worth during spring and fall 2021. The City of Fort Worth Sampling Protocol identifies an additional bioassessment site for each watershed that may be used as an alternative depending on local conditions at the time of sampling.

3.4.2.3. Cities of Garland, Irving, and Plano

Stream rapid bioassessments were conducted on Rowlett Creek in Garland, Estelle Creek-Bear Creek in Irving, and Brown Branch-Rowlett Creek in Plano, in 2021. All three creeks were sampled once between June 21 and 23, 2021, during the Index period and another time between September 15 and 17, 2021, during the Critical period. Benthic macroinvertebrate and fish communities were sampled, and data compared with metrics from the TCEQ. Habitat, water chemistry, and flow were also measured in each trip.

Figure 3-4 2021 Watersheds and Monitoring Sites

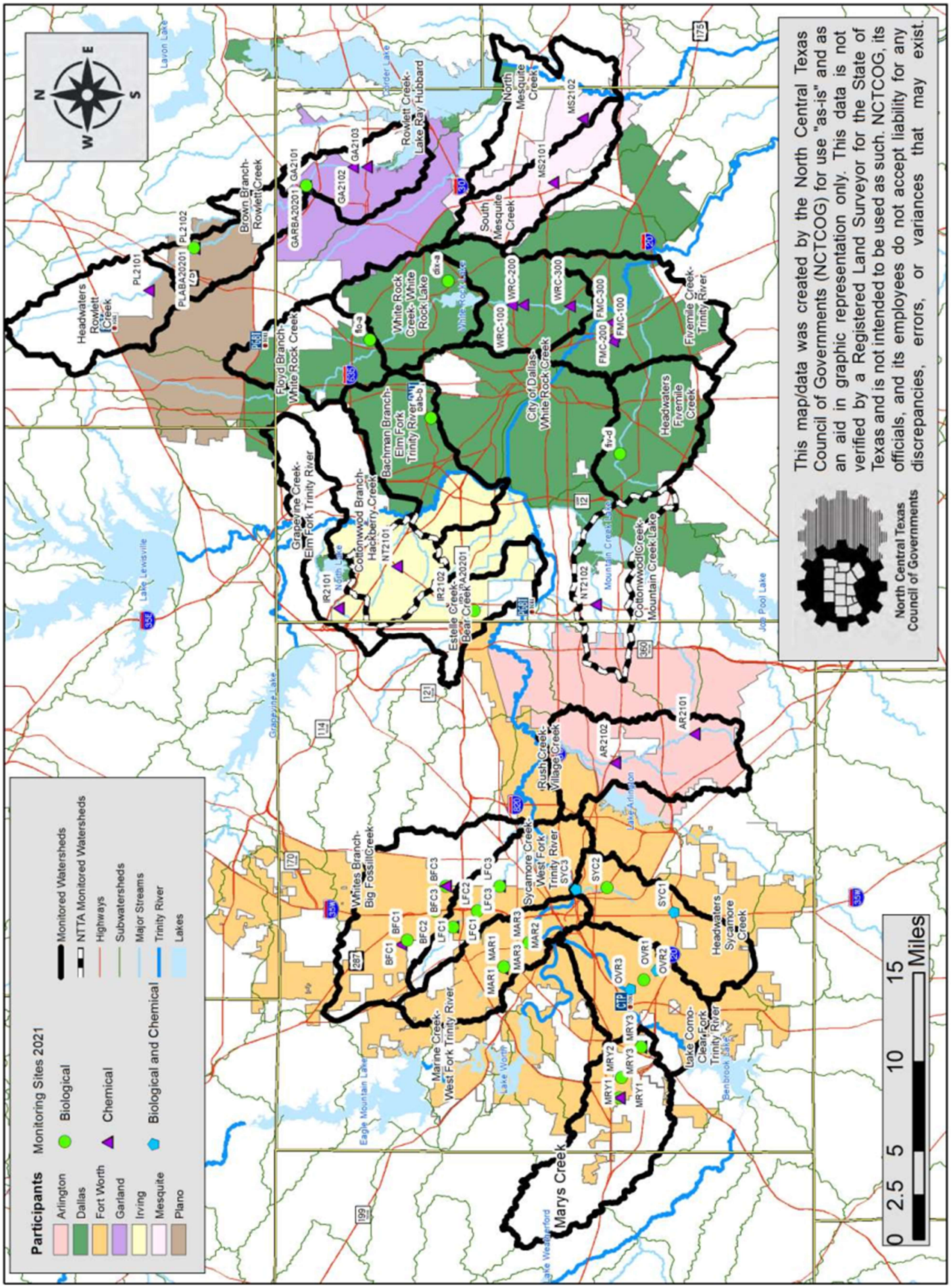


Table 3-4 Year 4 (2021) Chemical Sampling and Bioassessment Site Locations

Table 3-4: Year 4 (2021) Chemical Sampling and Bioassessment Site Locations				
Jurisdiction / **Watershed**	**Station ID**	**Location**	**Latitude/Longitude**	**# of samples in 2021[1]**
Arlington				
Rush Creek	AR2101	Rush Creek and West Sublett Road	32.648889 / -97.146389	4C
	AR2102	Rush Creek and Woodland Park Boulevard	32.713889 / -97.172778	4C
Dallas				
Five Mile Creek-Trinity River	FMC-100	3200 Linfield Road at Honey Springs Branch	32.710769 / -96.765777	4C
	FMC-200	4400 Vandervoort Drive at Honey Springs Branch	32.709680 / -96.760929	4C
	FMC-300	8000 Carbondale St. at Honey Springs Branch	32.711500 / -96.747856	4C
City of Dallas-White Rock Creek	WRC-100	3800 Samuell Blvd. at White Rock Creek	32.792756 / -96.728893	4C
	WRC-200	5219 Military Parkway at White Rock Creek	32.78357 / -97.72908	4C
	WRC-300	5100 C. F. Hawn Frwy at White Rock Creek	32.745551 / -96.730780	4C
Bachman Branch-Elm Fork Trinity	bab-b	8900 Midway Rd.	32.86044179 / -96.83695217	2B
Floyd Branch – White Rock Creek	flo-a	8300 Forest Lane	32. 90906899 / -96.76013679	2B
White Rock Creek-White Rock Lake	dix-a	900 Peavy Rd.	32.84469605 / -96.70475864	2B
Headwaters Five Mile Creek	fiv-d	3235 S. Westmoreland Rd.	32.7064408 / -96.87451384	2B
Fort Worth				
Headwaters Sycamore Creek	FWSYC1	IH 35W Northbound frontage road beneath SE Loop 820 eastbound	32.6677 / -97.3178	1C/2B
	FWSYC2	Cobb Park West south of US-287 at low water crossing	32.7217 / -97.2935	2B
	FWSYC3	Dead end of Scott St. west of Beach St.	32.7475 / -97.2949	1C/2B
Lake Como-Clear Fork Trinity River	FWOVR1	Across from 4413 Trail Lake in Foster Park	32.6823 / -97.3739	2C
	FWOVR1	NW of Granbury Rd and Trail Lake Dr	32.6820 / -97.3738	2B
	FWOVR2	East of 3808 Overton Park West, near Tanbark Trail intersection	32.6925 / -97.3831	2B
	FWOVR3	4600 Bellaire Dr. S west of Hulen St.	32.704 / -97.392	2C
	FWOVR3	Overton Park West south of intersection with Bellaire	32.7017 / -97.3839	2B
Sycamore Creek – West Fork Trinity River	FWLFC1	2200 block Cantrell Sansom	32.8478 / -97.3297	2B
	FWLFC2	100 yards west of and upstream of I-35W crossing	32.8279 / -97.3146	2B
	FWLFC3	Dead end of Mesquite Rd. south of 3800 Long Ave.	32.8095 / -97.2909	2B
White's Branch - Big Fossil Creek	FWBFC1	West of and parallel to Pepperidge Lane	32.8854 / -97.3421	2B
	FWBFC2	I-35W crossing, north of Western Center Blvd	32.8625 / -97.3142	2B
	FWBFC3	N. Beach St. north of Paula Ridge	32.8536 / -97.2904	2B
Marine Creek – West Fork Trinity River	FWMAR1	West of Angle Avenue in Buck Sansom Park	32.8069 / -97.3691	2B
	FWMAR2	Lincoln Park, north of the 28th St crossing	32.7955/ -97.3572	2B
	FWMAR3	Saunders Park south of Mule Alley and downstream of JV1A	32.7862 / -97.3460	2B
Mary's Creek	FWMRY1	3900 block Longvue (FM 2871)	32.7133 / -97.4966	2B
	FWMRY2	Loop IH-820 SW crossing, 0.5 mile south of Chapin Rd	32.7117 / -97.4767	2B
	FWMRY3	Winscott Road (Vickery Blvd.) in South Z Boaz Park	32.6954 / -97.4477	2B
Garland				
	GA2101	Rowlett Creek at Ben Davis Bridge	32.9593500 / -96.611373	4C

Table 3-4: Year 4 (2021) Chemical Sampling and Bioassessment Site Locations				
Jurisdiction / **Watershed**	**Station ID**	**Location**	**Latitude/Longitude**	**# of samples in 2021[1]**
Rowlett Creek – Lake Ray Hubbard	GA2102	Rowlett Creek at Centerville Road/Castle Drive	32.9205190 / -96.593322	4C
	GA2103	Rowlett Creek at Highway 66	32.9093670 / -96.593372	4C
	GARBA20201	Below State Highway 78	32.96 / -96.615	2B
Irving				
Grapevine Creek – Elm Fork Trinity River	IR2001	Grapevine Creek at N. Royal Lane	32.9382140 / -97.019672	4C
Estelle Creek – Bear Creek	IR2002	Estelle Creek at W. Rochelle Road	32.8452560 / -97.019568	4C
	IRVBA20201	Below Pioneer Dr.	32.8294 / -97.022	2B
Mesquite				
South Mesquite Creek	MS2101	North of New Market Road	32.7572500 / -96.6119444	4C
North Mesquite Creek	MS2102	North Mesquite Creek at Edward's Church	32.7321111 / -96.5505000	4C
Plano				
Headwaters Rowlett Creek	PL2101	Rowlett Creek at Alma Drive	33.0890760 / -96.708830	4C
Brown Branch Rowlett Creek	PL2102	Rowlett Creek in Oak Point Park	33.0510280 / -96.668944	4C
	PLRBA20201	Rowlett Creek in Oak Point Park	33.0523 / -96.6701	2B
North Texas Tollway Authority				
Cottonwood Branch – Hackberry Creek	NT2101	Unnamed Tributary at SH 161 N. of Gateway Drive	32.889808 / -96.980065	4C
Cottonwood Creek – Mountain Creek Lake	NT2102	Cottonwood Creek at SH 161 S. of Dickey Road	32.728181 / -97.019460	4C

Notes:

1. "B" Signifies bioassessment samples, "C" signifies chemical samples.

4. Fourth Monitoring Term Monitored Watershed Characterizations

4.1. Water Quality Standards Assessment

EPA and the State of Texas do not promulgate wet-weather specific in-stream water quality standards. It should be noted that for purposes of official assessment of standards attainment in the State of Texas, samples must be collected following TCEQ's *Surface Water Quality Monitoring Quality Assurance Project Plan*, *Surface Water Quality Monitoring Procedures Manual*, and *Guidance for Assessing and Reporting Surface Water Quality in Texas*. In addition to various differences in data collection techniques described in the TCEQ guidance documents, data collected under the RWWCP program is biased towards wet weather events. Therefore, the numerical criteria comparisons to the data collected under the RWWCP presented within this section (and in the Appendices) is strictly for comparison purposes. For the purposes of water quality assessment, Atkins reviewed the TSWQS to generate standards for monitored parameters for each monitored stream segment. Numerical criteria (water quality parameter concentrations) established in the TSWQS provide a quantitative basis for evaluating use support and for managing point and nonpoint loadings in Texas surface waters. These criteria are used as maximum or minimum instream concentrations that may result from permitted discharges and nonpoint sources.

Each stream segment was assigned site-specific uses and criteria based upon assumed uses and criteria found in Appendix A of the TSWQS for classified segments. Aquatic life protection criteria were obtained from Table 1 of the TSWQS and where applicable for dissolved fractions, the estimated total fraction criteria were calculated utilizing segment-specific values for total suspended solids (TSS), hardness, slope (m) and intercept (b) values found in Table 6 and Appendix D of the TCEQ *Procedures to Implement the Texas Surface Water Quality Standards (June 2010).* Stream order was determined from United States Geological Survey topographic maps with a scale of 1:24,000 following Texas Water Code §26.023 Texas Surface Water Quality Standards Chapter §307.3 and used to determine waters with sustainable fisheries to calculate the human health protection criteria. Human health protection criteria were obtained from Table 2 of the TSWQS or from the federal surface water quality criteria where applicable. The estimated total fraction criteria were again calculated utilizing segment-specific values for total suspended solids (TSS), hardness, slope (m) and intercept (b) values found in Table 6 and Appendix D of the TCEQ *Procedures to Implement the Texas Surface Water Quality Standards (June 2010).* Therefore, total fraction numerical criteria comparisons to the data collected under the RWWCP presented within this section (and in the Appendices) is strictly for comparison purposes and may not represent criteria used for evaluating use support and for managing point and nonpoint loadings in Texas surface waters.

4.2. Water Quality Screening Level Assessment

Numeric criteria do not exists for all parameters that were measured. However, screening levels (instream concentrations) for nutrients have been established by the TCEQ as targets that can be directly compared to monitoring data. The TCEQ statistically derived screening levels from long-term monitoring data or published levels of concern. Nutrient screening levels were obtained from the TCEQ's *2016 Guidance for Assessing and Reporting Surface Water Quality in Texas (August 6, 2019)*.

4.3. Comparison to Other Data Sources

Numeric criteria and screening levels are not available for TSS, oil and grease, biochemical oxygen demand, chemical oxygen demand, total nitrogen, and conductivity. Because of the lack of numeric criteria or screening levels; TSS, oil and grease, biochemical oxygen demand, total nitrogen, and chemical oxygen demand were compared to the third quartile of the National Stormwater Quality Database (NSQD) data for each parameter. Conductivity was compared to criteria proposed by the National Rivers and Streams Assessment (NRSA) 2008–2009: A Collaborative Survey (USEPA, 2016b). In addition, for all parameters, Clear Rivers Program (CRP) data was included where available.

The NSQD is an urban stormwater runoff characterization database developed under the direction of Dr. Robert Pitt, P.E., of the University of Alabama and the Center for Watershed Protection under support from the USEPA. It is now supported as a companion project to the International Stormwater BMP Database. The NSQD is maintained as a separate stand-alone database, serving as an important resource for municipal stormwater managers and researchers who are seeking urban runoff characterization data. The NSQD can be downloaded from www.bmpdatabase.org. The NRSA presents the general overview and results of national sampling effort undertaken by the USEPA and its state and tribal partners. NRSA provides information on the ecological condition of the nation's rivers and streams and the key stressors that affect them, both on a national and an ecoregional scale. EPA used NRSA and other data to develop thresholds for good, fair, and poor designations.

The CRP data was assembled by the Trinity River Authority and TCEQ through state funds for in-stream water quality monitoring, evaluation, and decision-making. The CRP data represents ambient, in-stream concentrations during mostly dry conditions.

4.4. Monitored Subwatershed Characterization

The following subsections present data available for each monitored subwatershed along with an analysis of potential pollution sources, BMPs, and monitoring recommendations specific to the subwatershed. Only fourth monitoring term RWWCP parameters are presented and evaluated. Although data for additional parameters may have been available, evaluation of those parameters was beyond the scope of this assessment.

4.4.1. Bachman Branch

The City of Dallas performed bioassessment monitoring only each monitoring year of the fourth monitoring term on Bachman Branch, a stream of a stream order greater than three draining to the Elm Fork of the Trinity River in the Bachman Branch-Elm Fork of the Trinity River watershed. The Bachman Branch-Elm Fork of the Trinity River watershed is located in Dallas County. Bachman Branch drains into Bachman Lake just prior to discharging into the Elm Fork of the Trinity River (see Appendix B, Figure 1). The bioassessment monitoring station (BAB-B) is located at the Midway Road crossing. Nearly all of the Bachman Branch subwatershed area is within the jurisdictional limits of the City of Dallas, except for the small area located north of Interstate 635 and west of the Dallas North Tollway which is within the jurisdictional limits of the City of Farmers Branch. NTTA contributes flow to the subwatershed through the Dallas North Tollway. TxDOT contributes flow to the subwatershed through Interstate 635 and State Highway 12.

4.4.1.1. Summary Statistics

No wet weather chemical monitoring data was collected within this watershed.

4.4.1.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, and the NSQD where applicable. Additional pesticide parameters were collected at station BAB-B by the City of Dallas outside of the RWWCP and are not presented in this report. The Bachman Branch graphs are located in Appendix C. The *E. coli* geometric mean over the fourth term (129 col/100 mL) exceeds the primary contact recreation (PCR) geometric mean standard of 126 col/100 mL.

The City of Dallas has tracked bacteria trends for *E. coli* at BAB-B over the period of 2007-2021. The geometric mean over the period of record (134 col/100 mL) exceeds the PCR geometric mean standard of 126 col/100 mL. Of 29 samples collected, the City of Dallas has documented 19 exceedances of the bacteria standard over the period of record.

4.4.1.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix C).

Over the fourth monitoring term, the habitat scores for Bachman Branch in the reach studied were generally lower than observed in the third monitoring term. Half of the habitat scores were in the sub-optimum range. Aquatic life use scores were also generally lower than observed in the third monitoring term. Given the sub-optimum habitat, the intermediate aquatic life use scores generally correspond with the available habitat indicating that water quality may not be limiting fish and macroinvertebrate communities.

4.4.1.4. Potential Pollution Sources and BMP Recommendations

During the RWWCP fourth monitoring term the wet weather *E. coli* results exceeded the PCR geometric mean criterion. There were no other indicators of potential pollution observed in the fourth monitoring term. Land use of the Bachman Branch drainage area was not available from the NCTCOG annual reports. However, a visual analysis of the drainage area reveals a predominately single-family residential land use.

For bacteria, potential sources may be domestic animals, wildlife, and illicit connections. BMPs recommended for these sources include public education for residential landowners and compliance inspections for illicit connections. Due to the decline in habitat scores ranging from sub-optimal to optimal, small stream restoration projects may be able to increase the biological productivity of the stream.

4.4.1.5. Monitoring Recommendations

Data analyzed presents low indications of stream degradation or chemical indicators of water quality decline. In addition, there are no TMDLs or impairments identified for either Bachman Branch or the Elm Fork of the Trinity River. It is recommended that additional monitoring at this site be assigned a low priority.

4.4.2. Big Fossil Creek

The City of Fort Worth performed bioassessment and chemical monitoring on Big Fossil Creek (TCEQ segment 0806C), a stream with a stream order of one draining to the West Fork of the Trinity River Below Lake Worth (TCEQ segment 0806) within the White’s Branch – Big Fossil Creek watershed. Additional bioassessment monitoring is scheduled for 2022.

The White’s Branch – Big Fossil Creek watershed is located in north central Tarrant County. This 35,840-acre watershed is predominately open space (36.3%) and residential (34.5%) property. The open space is located in the northern part of the watershed while the residential property is primarily in the south. Major roads that cross through the subwatershed are Hwy 30 and Hwy 35W, its land use is estimated at 15%. Commercial land use is estimated at 12.3%. Industrial land use is estimated at 1.2% and water features are estimated at 0.6%.

The City of Fort Worth has one bioassessment and chemical monitoring site, one chemical monitoring only site, and one bioassessment monitoring only site located within the Big Fossil Creek subwatershed. The chemical monitoring site, FWBFC1, was located west of and parallel to Pepperidge Lane at the Blue Mound Rd. crossing immediately south of Harmon Rd. and north of the City of Saginaw. Much of the subwatershed upstream of this location was rural or undeveloped. The subwatershed delineated for this site covered a 6,066-acre area and consisted primarily of open space (58.8%). The majority of the open space was vacant, ranchland and farmland that was dispersed throughout the subwatershed. Residential land use (21.9%) was in the upper part of the subwatershed, and minor arterials (6.1%) that ran through the area. Commercial land use (11.5%) was located primarily in the lower part of the subwatershed. There was some industrial (1.2%) sites in the subwatershed. The subwatershed contained 0.8% water features.

The bioassessment monitoring site, FWBFC2, was located at the I-35W crossing, north of Western Center Boulevard. No subwatershed information was available for this site.

The chemical and bioassessment site, FWBFC3, was located at the Beach St. crossing north of Paula Ridge. Below this point, the creek flowed through Haltom City, North Richland Hills and Richland Hills before converging with Little Fossil Creek and the West Fork Trinity River. This subwatershed covered a 19,707-

acre area that was composed primarily of open (47.8%) space. The majority of the open space was vacant land and ranchland. The residential land use (27.6%) was dispersed throughout the entire subwatershed. There were major arterials (12.9%) that crossed through the drainage area. Commercial (10.4%) property was evenly dispersed throughout the subwatershed. There were a couple of industrial (0.8%) sites in the upper subwatershed. The subwatershed contained 0.7% water features.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 2. The monitored subwatershed is primarily within the jurisdictional limits of the City of Fort Worth. However, the cities of Saginaw and Haslet have small portions of jurisdictional limits within the watershed. TxDOT contributes flow to the subwatershed through Interstate 35 and State Highway 81. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.2.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-1. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-1 Big Fossil Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia N (mg/L)	Nitrate N (mg/L)
No. of Samples	6	6	6	6	5	6	6
Minimum	246.0	1.00	1.00	15.00	0.250	0.003	0.025
Maximum	315.0	20.00	5.60	41.90	1.200	0.025	0.690
Median	296.5	3.50	1.00	17.50	0.290	0.025	0.130
Arithmetic Mean	288.0	7.02	1.77	20.73	0.480	0.018	0.212
Geometric Mean	286.8	3.79	1.33	19.23	0.389	0.012	0.103
Standard Deviation	27.8	7.81	1.88	10.44	0.408	0.011	0.256
Coefficient of Variation	0.10	1.11	1.06	0.50	0.85	0.64	1.21
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	6	6	6	6	6	6	6
Minimum	0.003	0.003	0.025	0.001	0.002	0.001	0.0003
Maximum	0.025	0.025	0.500	0.003	0.003	0.003	0.003
Median	0.025	0.025	0.041	0.002	0.002	0.002	0.000
Arithmetic Mean	0.018	0.018	0.189	0.002	0.002	0.002	0.001
Geometric Mean	0.012	0.012	0.078	0.002	0.002	0.002	0.001
Standard Deviation	0.011	0.011	0.242	0.001	0.001	0.001	0.001
Coefficient of Variation	0.639	0.639	1.282	0.279	0.282	0.537	1.162
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	6	6	6	6	0	6	6
Minimum	0.003	2.50	7.40	420.000	-	1	0.10
Maximum	0.013	2.50	8.43	590.000	-	2420	0.51
Median	0.005	2.50	7.92	540.000	-	56	0.15
Mean	0.005	2.50	7.94	521.667	-	684	0.25
Geometric Mean	0.005	2.50	7.93	518.436	-	77	0.19
Standard Deviation	0.004	0.00	0.38	61.779	-	1046	0.20
Coefficient of Variation	0.699	0.00	0.05	0.118	-	1.53	0.80

4.4.2.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, CRP and NSQD data where applicable. These graphs are located in Appendix D. During the fourth monitoring term, there were two exceedances of the *E. coli* PCR single sample criterion. The *E. coli* concentrations exceeded the single sample primary contact standards during the August and December 2020 wet weather chemical monitoring events at FWBFC3. The *E. coli* PCR geometric mean criterion was not exceeded for the wet weather samples.

The water quality data collected during bioassessments was also plotted and compared to water quality standards, screening levels, and other data sources including CRP data where applicable. CRP station 17133 located near FWBFC3 was utilized for this analysis. These graphs are also located in Appendix D. The geometric mean of the bioassessment E. coli data was 122 col/100 mL which was less than the PCR geometric mean standard of 126 col/100 mL. Ammonia nitrogen exceeded the TCEQ screening level seven times in the fourth monitoring term (multiple events across the period). Orthophosphate exceeded the TCEQ screening level once in October 2020.

Due to the exceedance discussed above and the availability of bioassessment and wet weather chemical data, boxplots were created for ammonia nitrogen and orthophosphate for comparison of the datasets. The data does not indicate that stormwater runoff is providing a significant different input of orthophosphate to the stream compared to the bioassessment data which was collected during dry weather (see Figure 4-2). However, there is a significant difference between the fourth monitoring term wet weather data for ammonia nitrogen and the bioassessment data indicating the stormwater runoff typically was observed to have a lower concentration of this pollutant than dry weather flow (see Figure 4-1).

Figure 4-1 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and Third and Fourth Term Bioassessment Ammonia Nitrogen Data at Big Fossil Creek

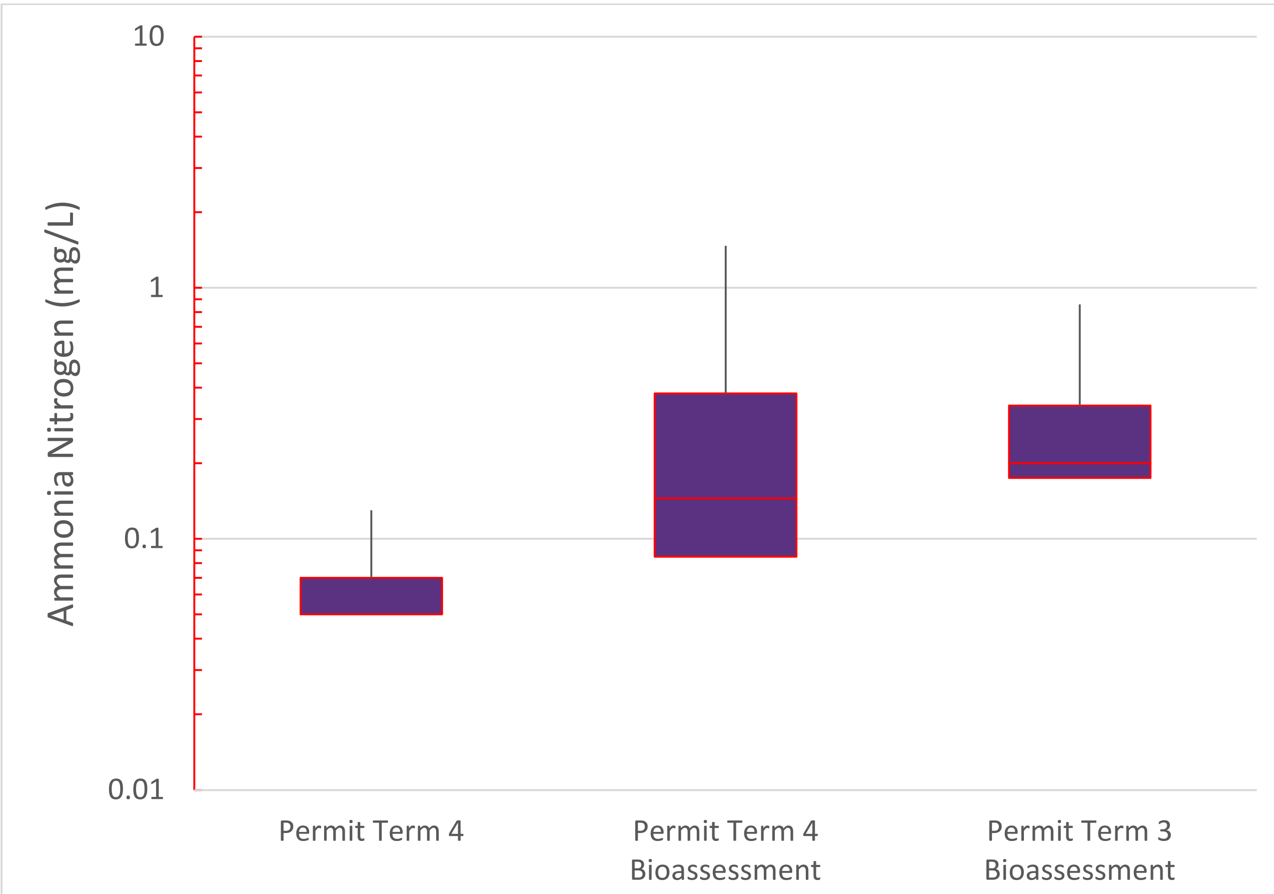
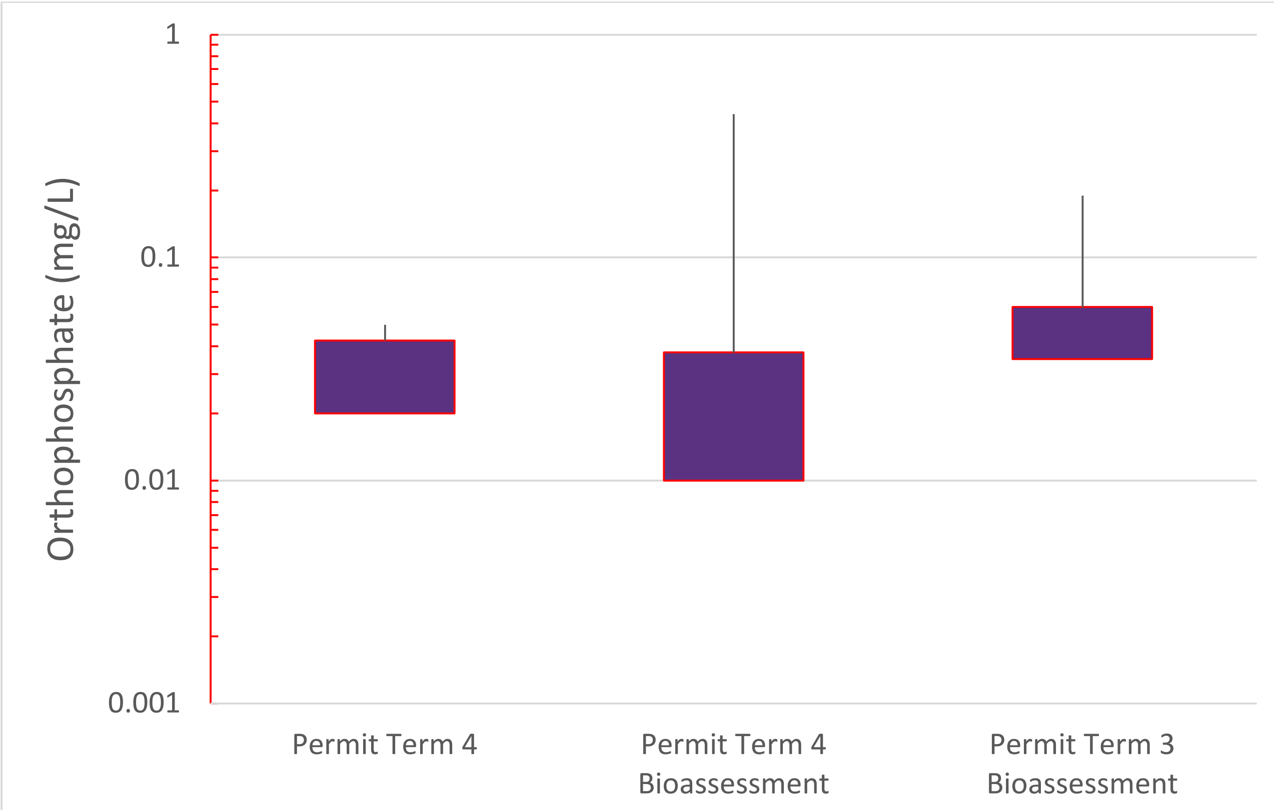


Figure 4-2 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and Third and Fourth Term Bioassessment Orthophosphate Data at Big Fossil Creek



4.4.2.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix D). The habitat scores at BCF1 remained in the optimal range over the fourth monitoring term with the exception of sub-optimal scores at BCF1 in the fall of 2019 and 2021. The habitat scores at BCF2 remained in the sub-optimal range with the exception of marginal scores in the spring of 2019 and the spring and fall of 2020. The habitat scores at BCF3 remained in the sub-optimal range with the exception of an optimal score in the spring of 2018.

Texas macroinvertebrate index of biotic integrity (IBI) scores remained in the intermediate to high range over the fourth term at all sites. The high to intermediate IBI scores generally correspond with the available habitat indicating that water quality may not be limiting macroinvertebrate communities.

4.4.2.4. Potential Pollution Sources and BMP Recommendations

Land use of the Big Fossil Creek subwatershed is predominately open followed by residential. Given the high residential and open land use in the subwatershed, the potential source of the ammonia nitrogen and orthophosphate loadings may be excessive lawn, garden, and agricultural fertilization. Also, legacy nutrients from agricultural land may be present in area soils. In addition, riparian alteration can affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). However, dissolved oxygen concentrations over the monitoring term did not fall below TCEQ criteria for aquatic life protection suggesting that the nutrient loadings were not contributing to low dissolved oxygen events.

BMPs recommended for these sources include public education for agricultural and residential land owners, and compliance inspections for illicit connections. Due to habitat scores ranging from marginal to optimal, small stream restoration projects may be able to increase the biological productivity of the stream.

4.4.2.5. Monitoring Recommendations

Data analyzed presented increased exceedances to ammonia nitrogen screening criterion but decreased exceedances to *E. coli* and low indications of stream degradation. There are no bacteria TMDLs or impairments identified for either Big Fossil Creek or the West Fork of the Trinity River Below Lake Worth. The West Fork of the Trinity River Below Lake Worth is impaired for dioxin and PCBs in fish tissue and there is a TMDL for legacy pollutants. Additional monitoring at this site is recommended to be continued assigned a low priority.

4.4.3. Cottonwood Branch

The NTTA performed chemical monitoring on Cottonwood Branch (TCEQ segment 0822A), a stream with a stream order of one draining to Hackberry Creek and the Elm Fork of the Trinity River within the Cottonwood Branch – Hackberry Creek watershed.

Cottonwood Branch – Hackberry Creek Watershed is a 13,325-acre watershed located in northeast Dallas County. This watershed is composed predominately of roads acreage (39.0%) which is due to a large portion of the DFW International Airport residing in the western side of the watershed. Also contributing to this percentage are three major highways that converge within the Cottonwood Branch watershed: SH 114, IH 635, and the President George Bush Turnpike (PGBT). Throughout the watershed, there are patches of open areas (22.7%) and clusters of commercial (23.1%) areas located in the vicinity of major highways. Some of the residential (13.2%) areas are scattered along the southern edge of the watershed and there is a large residential community north of the PGBT, between SH 114 and IH 635. The water bodies composition for this watershed is 1.2% and industrial land use is just 0.7%.

The NTTA has one chemical monitoring site located within the Cottonwood Branch subwatershed. The chemical monitoring site, NT1801/1901/2001/2101 was located at SH 161 north of Gateway Drive. The conveyance at this site was a manmade trapezoidal channel. This subwatershed delineated area covered 1,509 acres and was estimated to have 36.9% open space. The PGBT (SH 161) ran through this subwatershed and contributed to the predominate roadway (43.4%) land use estimate for this area in addition to DFW International Airport. There were few small residential (1.2%) areas located in the drainage area. Most of the commercial (18.4%) property in this subwatershed was located along SH 161. There were no areas designated as industrial or water in this subwatershed.

The monitoring site, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 3. The monitoring site is shown as NT2001. NT1801/1901/2101 were located in the same location. The monitored subwatershed is entirely within the jurisdictional limits of the City of Irving. An upper portion of the subwatershed is occupied by the Dallas/Fort Worth International Airport. NTTA contributes flow to the subwatershed through State Highway 161 (PGBT). There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.3.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-4. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-2 Cottonwood Branch RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia N (mg/L)	Nitrate N (mg/L)
No. of Samples	16	16	16	16	16	16	16
Minimum	77.0	6.00	1.00	5.00	1.100	0.014	0.400
Maximum	192.0	1570.00	21.30	85.00	6.600	1.640	1.190
Median	145.0	66.25	9.14	36.80	2.415	0.326	0.780
Arithmetic Mean	139.3	223.27	10.57	42.20	2.819	0.411	0.813
Geometric Mean	132.9	67.90	8.39	32.39	2.458	0.259	0.755
Standard Deviation	41.8	407.86	6.37	27.01	1.587	0.423	0.307
Coefficient of Variation	0.30	1.83	0.60	0.64	0.56	1.03	0.38
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.037	0.015	0.056	0.001	0.002	0.001	0.001
Maximum	0.310	0.660	0.900	0.022	0.027	0.106	0.022
Median	0.086	0.086	0.213	0.003	0.005	0.012	0.003
Arithmetic Mean	0.119	0.151	0.283	0.004	0.008	0.024	0.005
Geometric Mean	0.099	0.082	0.216	0.003	0.005	0.013	0.003
Standard Deviation	0.078	0.197	0.245	0.005	0.008	0.032	0.006
Coefficient of Variation	0.655	1.298	0.863	1.264	0.966	1.329	1.152
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.011	0.18	7.91	151	52.5	10.0	0.01
Maximum	0.300	8.33	9.50	1029	80.8	24196	0.19
Median	0.065	0.85	8.40	397	72.4	1995	0.05
Mean	0.090	1.85	8.52	419	69.2	4032	0.07
Geometric Mean	0.066	1.09	8.51	372	68.5	839	0.04
Standard Deviation	0.076	2.10	0.42	220	10.0	6720	0.06
Coefficient of Variation	0.841	1.14	0.05	0.52	0.14	1.67	0.88

4.4.3.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, CRP and NSQD data where applicable. These graphs are located in Appendix E. CRP stations 17165, 17166, 17167, and 17168 were utilized for this analysis. All CRP stations were located downstream of NTTA's chemical monitoring site.

During the fourth monitoring term, there was one exceedance of the TCEQ human health estimated criterion for total arsenic in June 2018, one exceedance of the TCEQ aquatic life use estimated chronic criterion for total copper in July 2020, two exceedances of the TCEQ aquatic life use estimated acute criterion for total copper (June and August 2018), two exceedances of the TCEQ human health estimated criterion for total lead (June 2018 and October 2019), one exceedance of the TCEQ aquatic life use estimated chronic criterion for total lead (July 2020), two exceedances of the pH TCEQ basin specific criterion (January 2019 and January 2021), eight exceedances of the TCEQ nutrient screening criterion for ammonia nitrogen (multiple events across the period), two exceedances of the TCEQ nutrient screening criterion for orthophosphate (June and August 2018) and total phosphorus (October 2019 and July 2020), and ten exceedances of the *E. coli* PCR single sample criterion (multiple events across the period and the geometric mean exceeded the PCR geometric mean criterion). In addition, there were four occurrences where the TSS concentration, four occurrences where the total nitrogen concentration, four occurrences where the BOD concentration, one occurrence where the dissolved phosphorus concentration, and one occurrence where the oil and grease concentration was higher than 75% of the NSQD data for those parameters. There was one occurrence where the specific conductance exceeded the NRSA good category. Lastly, CRP data indicated five exceedances due to low dissolved oxygen in July 2018, April 2019, April 2020, and July 2020.

The elevated TSS concentrations occurred in August and October 2018, October 2019, and July 2020. The elevated total nitrogen concentrations occurred in August and October 2019 and April and July 2020. The elevated BOD concentrations occurred in April and October 2019, July 2020, and April 2021. The elevated dissolved phosphorus concentration occurred in October 2019 and the elevated oil and grease concentration occurred in January 2018.

Due to the exceedances and elevated concentrations discussed above and the availability of CRP and wet weather chemical data, boxplots were created for total arsenic, total copper, total lead, BOD, ammonia nitrogen, total nitrogen, orthophosphate, total phosphorus, pH, specific conductance, and *E. coli* for comparison of the datasets. The data does not indicate that stormwater runoff is providing a significant different input of orthophosphate, arsenic, specific conductance, or *E. coli* to the stream compared to CRP data which was predominately collected during dry weather (see Figures 4-6, 4-8, 4-12, and 4-13). However, there is a significant difference between the fourth monitoring term wet weather data for BOD, ammonia nitrogen, total nitrogen, total phosphorus, total copper, total lead, and pH and the CRP data indicating the stormwater runoff typically was observed to have higher concentrations of these pollutants than dry weather flow (see Figures 4-3, 4-4, 4-5, 4-7, 4-9, 4-10, and 4-11). There was no difference between the monitoring terms for BOD, arsenic, total copper, total lead, and *E. coli* (Figures 4-3, 4-8, 4-9, 4-10, and 4-13). For total nitrogen, the observed concentrations in the third and fourth terms were lower than the second term (Figure 4-4). For total phosphorus and pH, the observed concentrations in the third and fourth terms were higher than the second term (Figures 4-7 and 4-11). For specific conductance, the observed concentrations in the fourth term were lower than the third term (Figure 4-12).

Figure 4-3 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP BOD Data at Cottonwood Branch

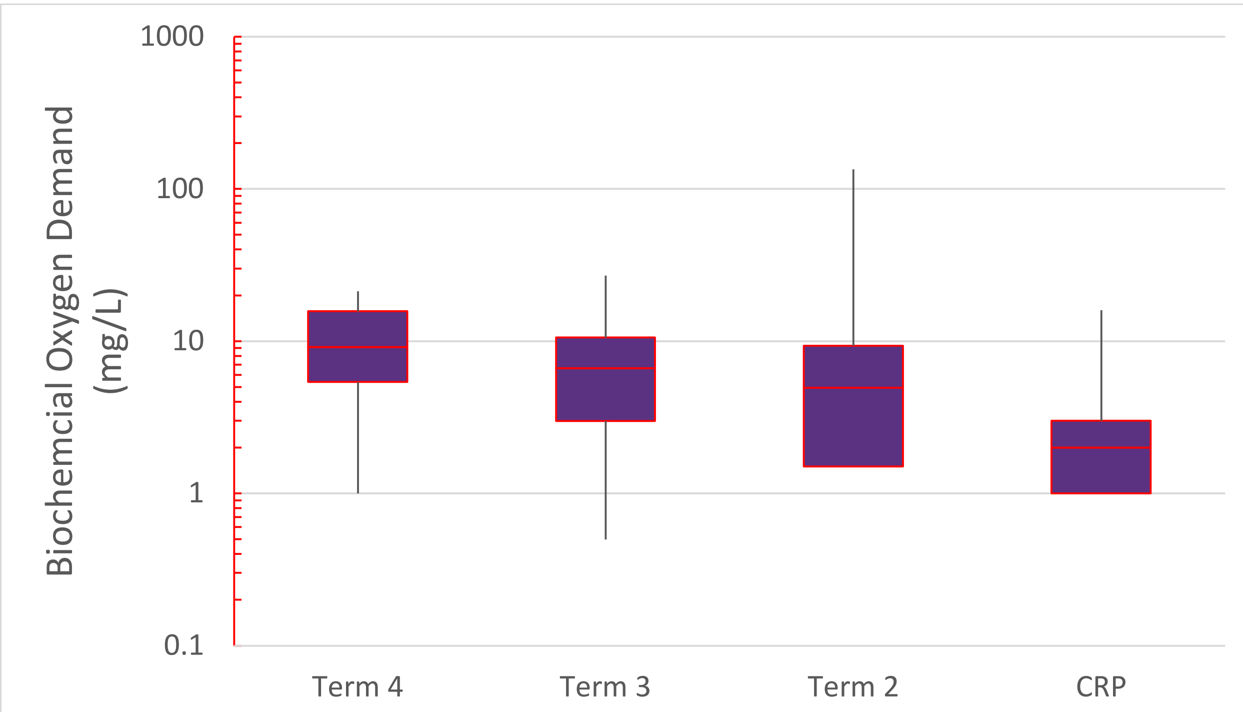


Figure 4-4 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Nitrogen Data at Cottonwood Branch

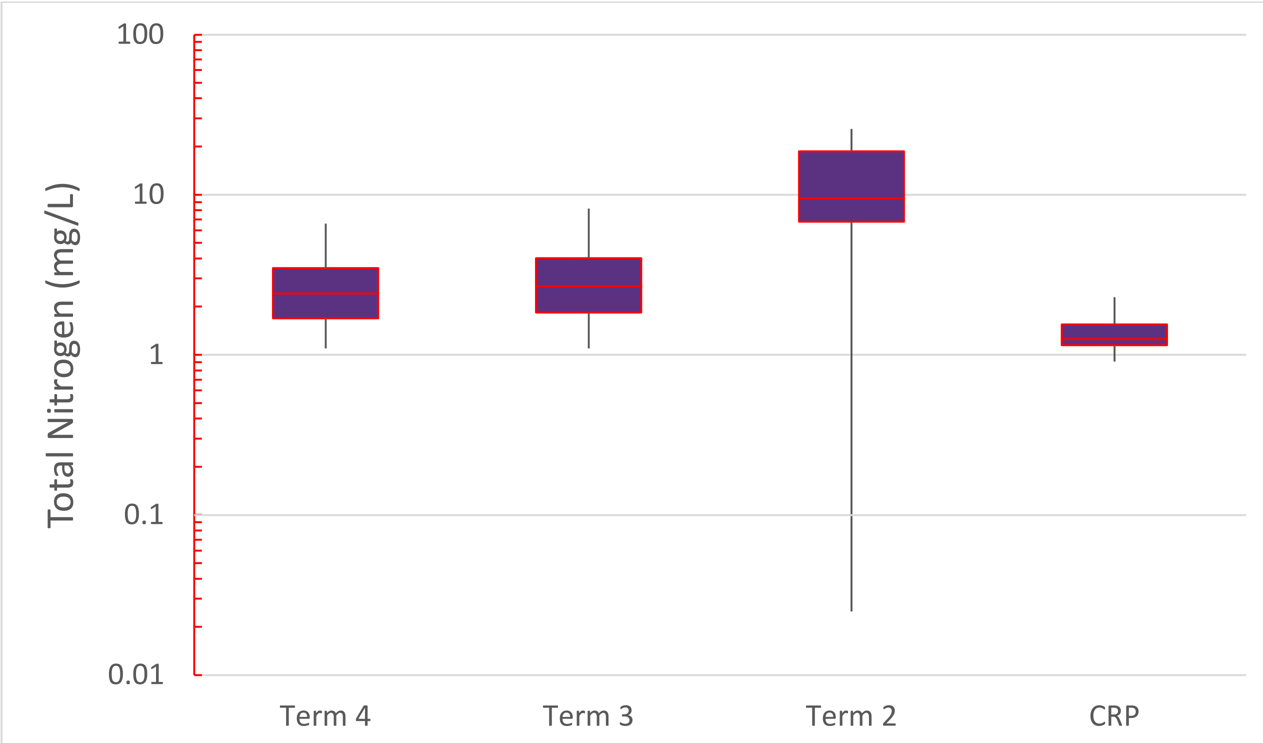


Figure 4-5 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Ammonia Nitrogen Data at Cottonwood Branch

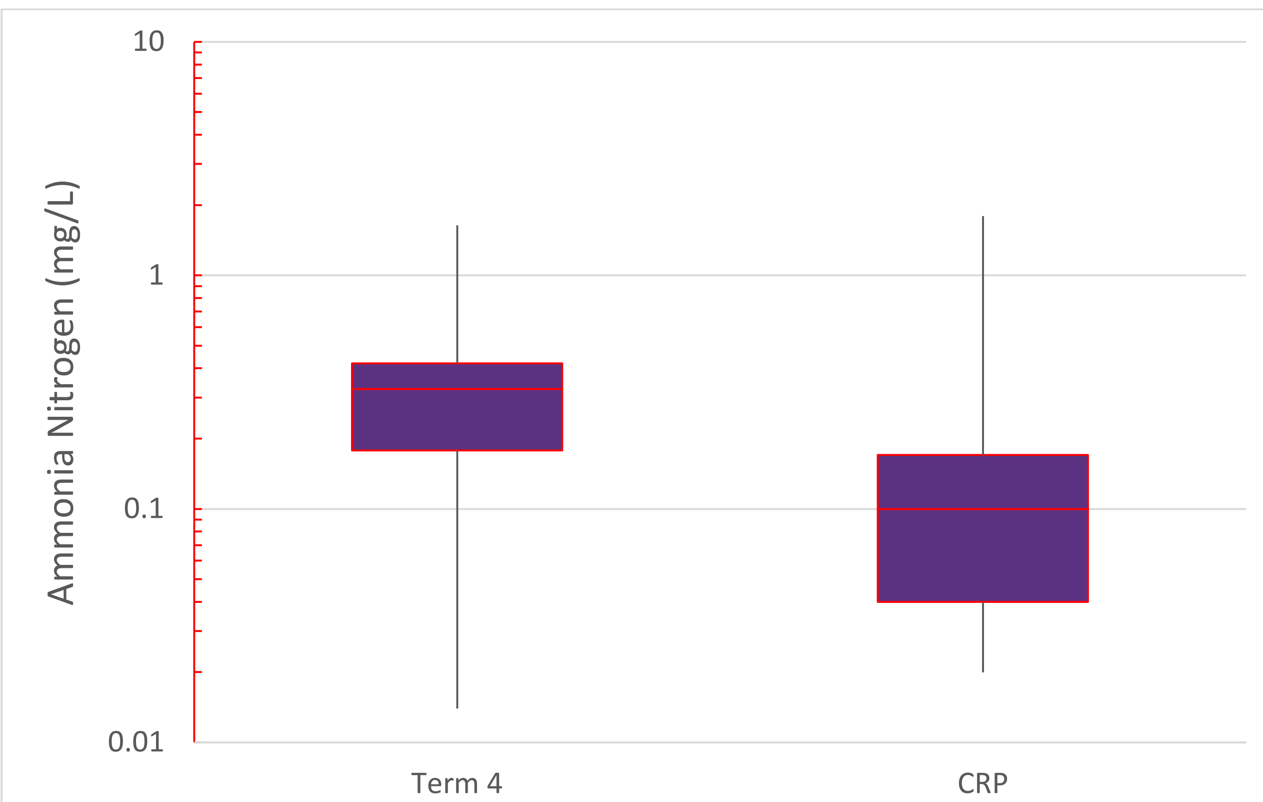


Figure 4-6 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Orthophosphate Data at Cottonwood Branch

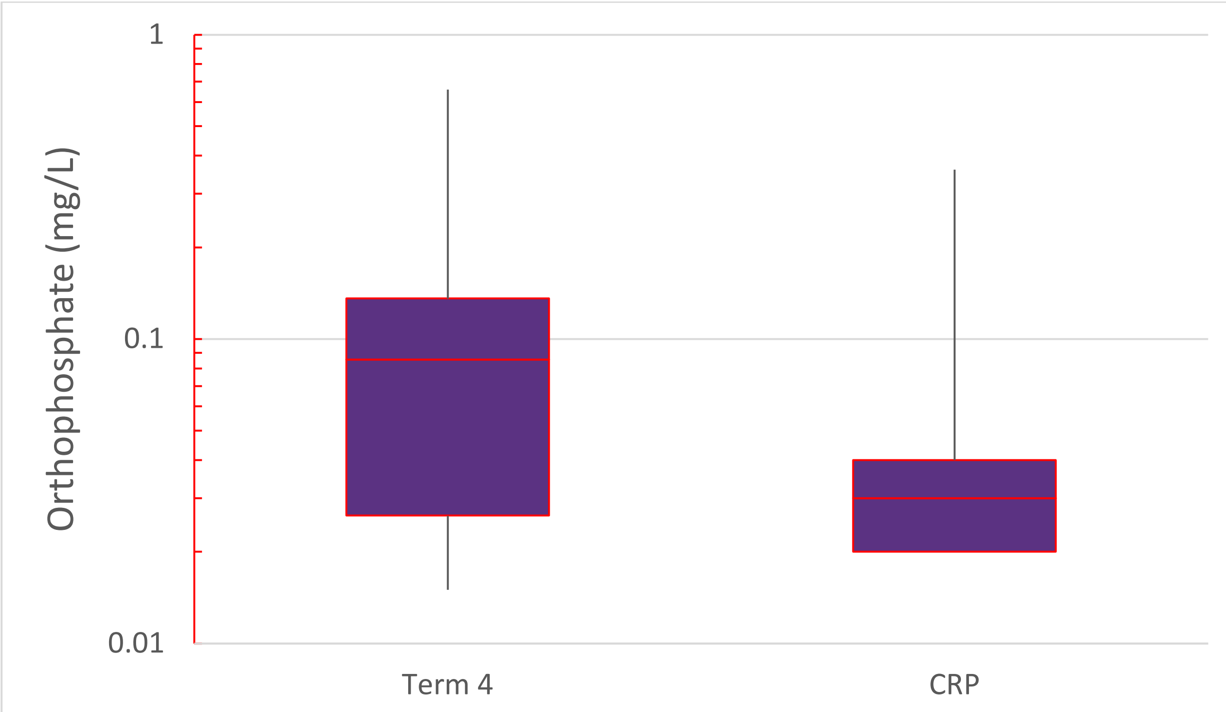


Figure 4-7 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Phosphorus Data at Cottonwood Branch

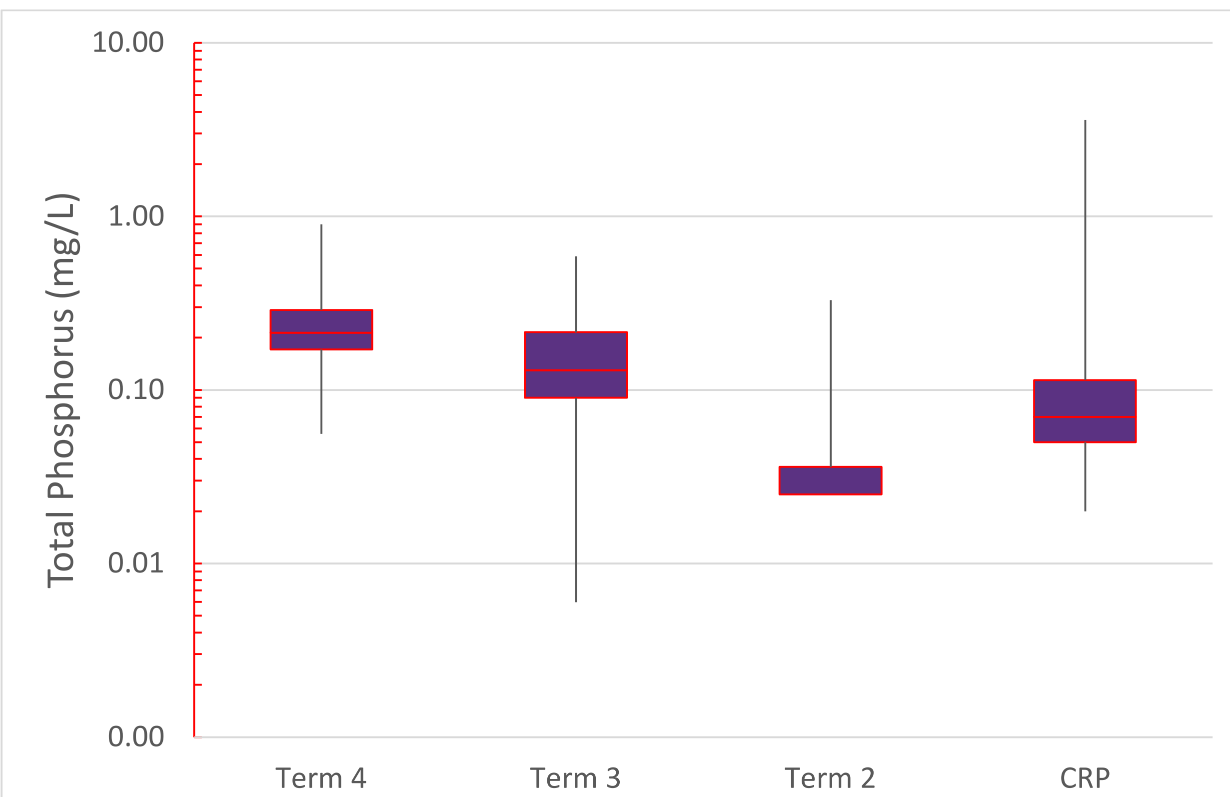


Figure 4-8 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Arsenic Data at Cottonwood Branch

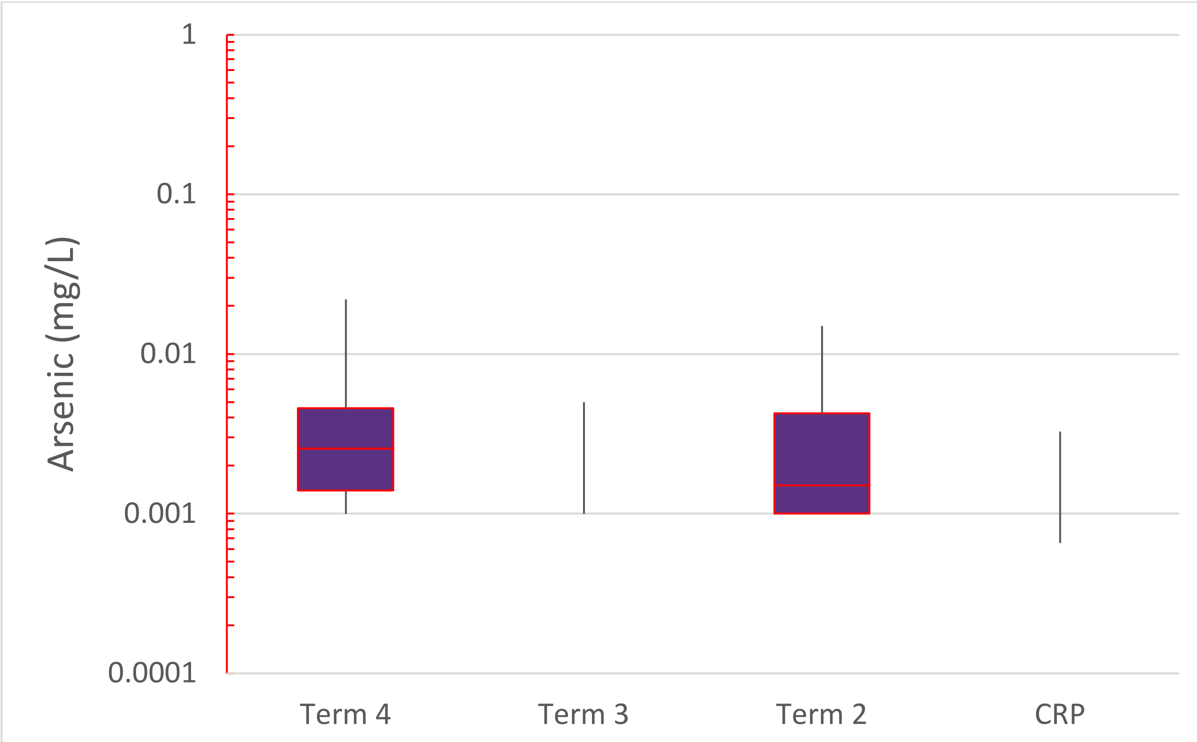


Figure 4-9 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Copper Data at Cottonwood Branch

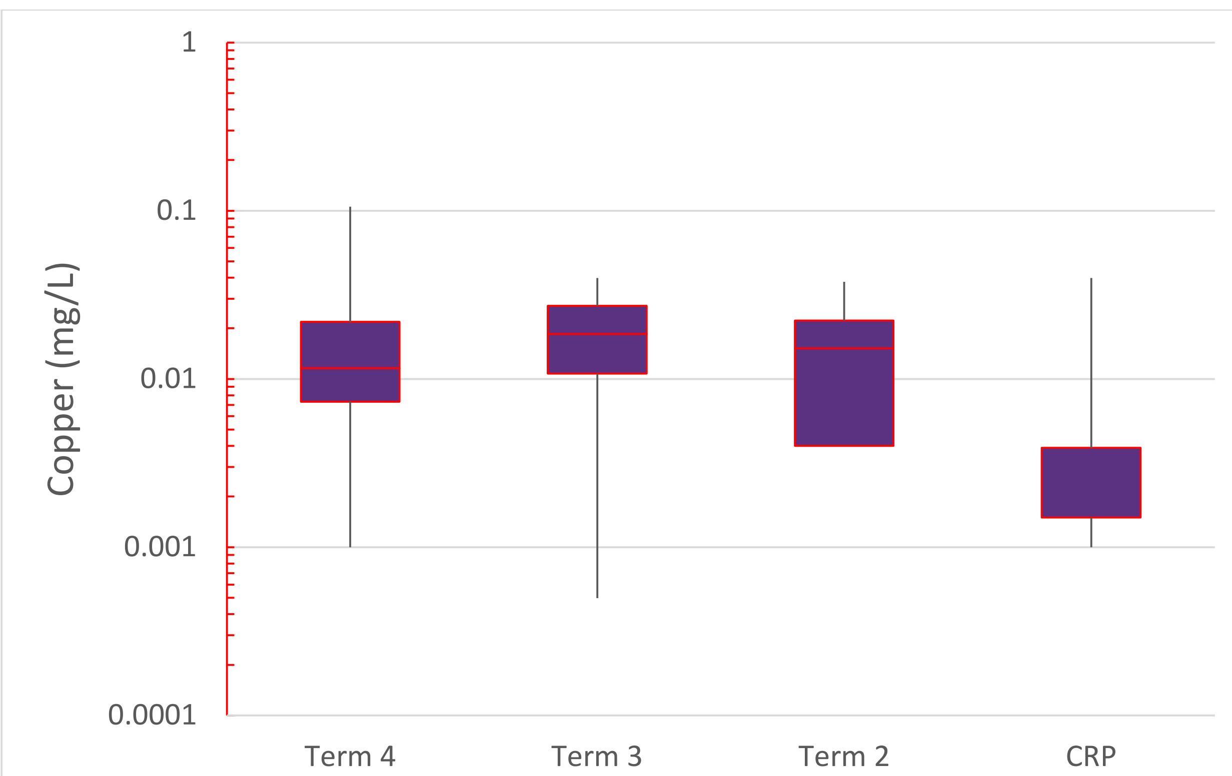


Figure 4-10 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Lead Data at Cottonwood Branch

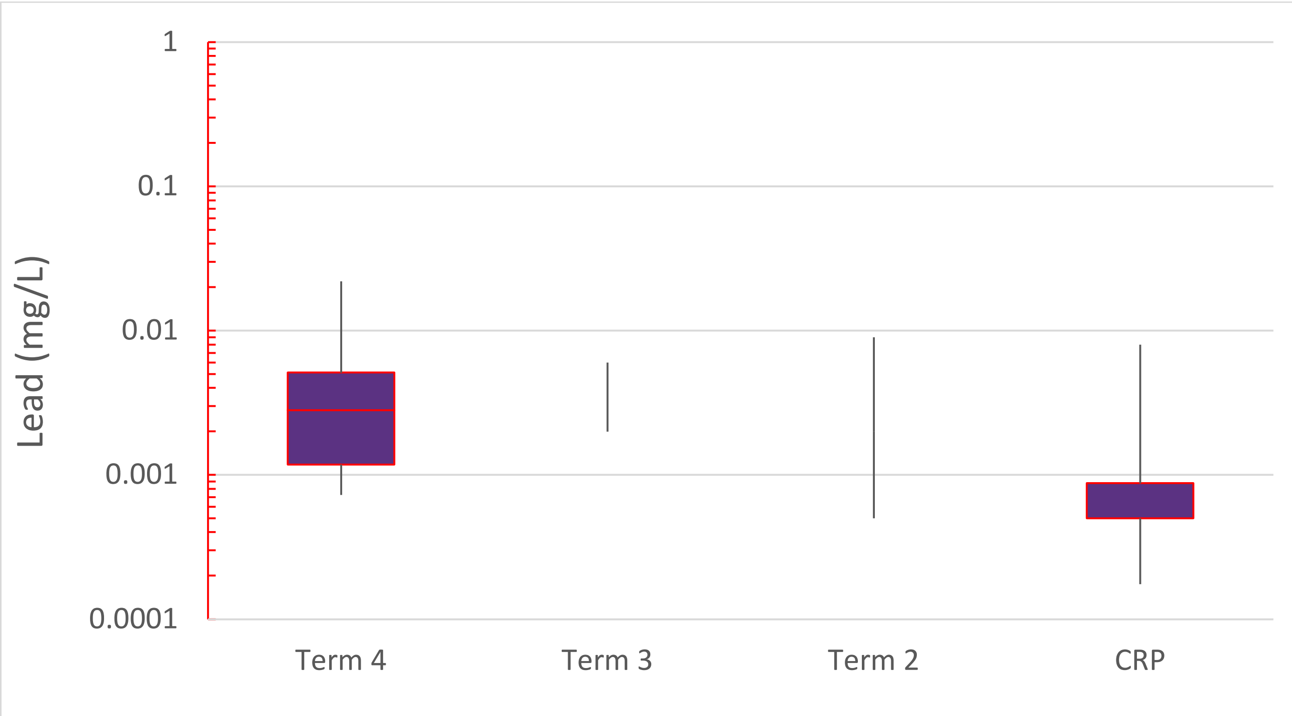


Figure 4-11 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP pH Data at Cottonwood Branch

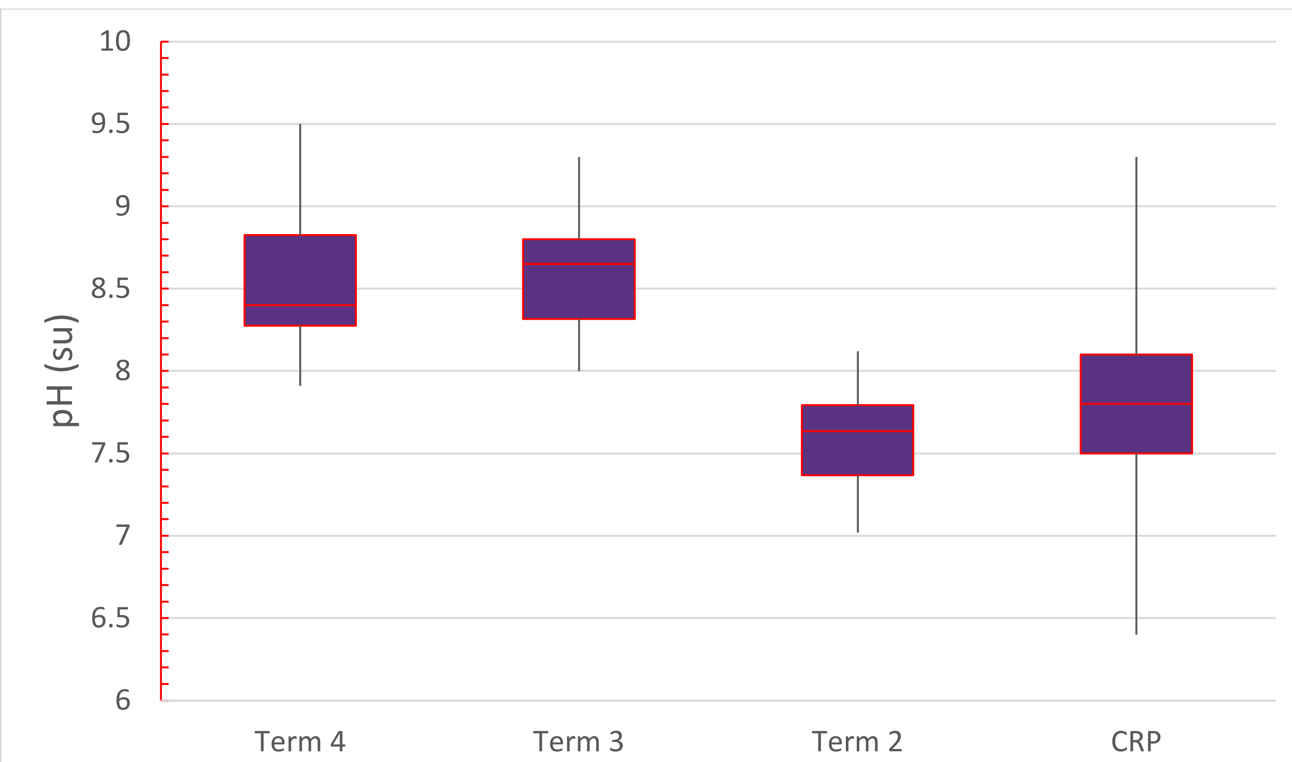


Figure 4-12 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms and CRP Specific Conductance Data at Cottonwood Branch

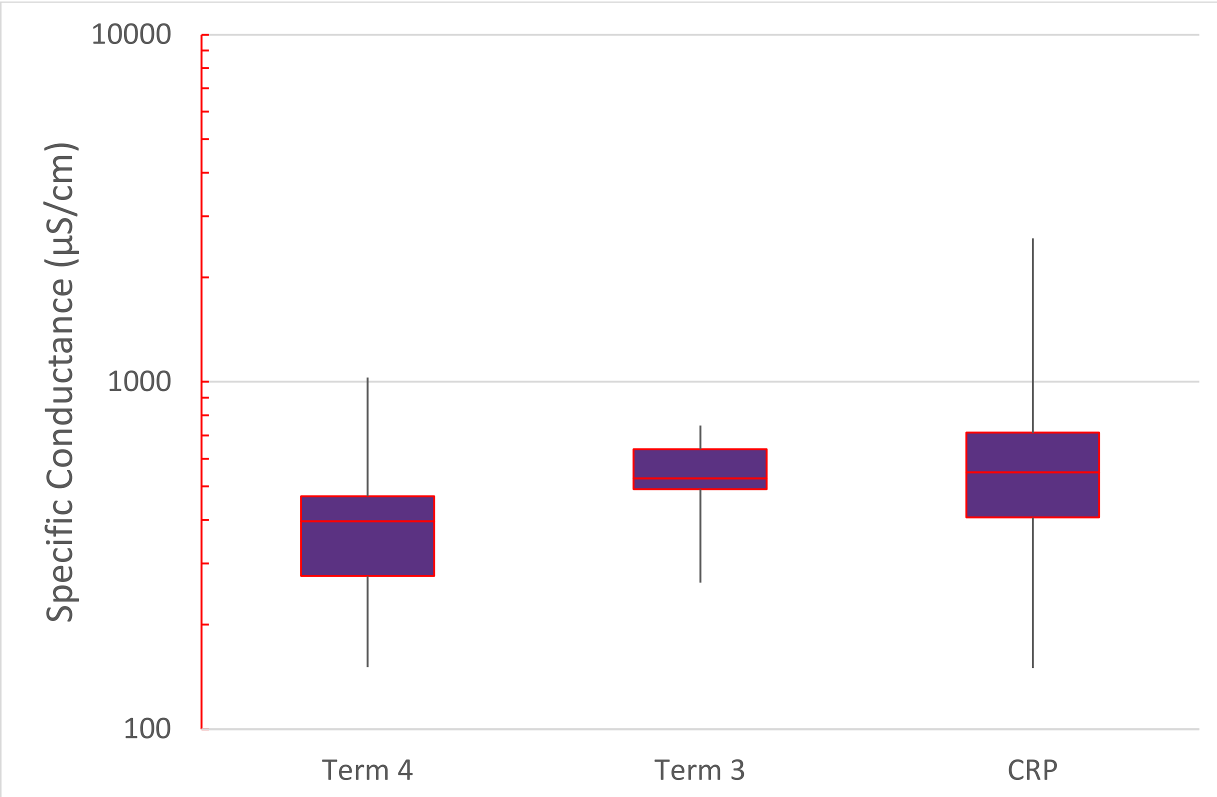
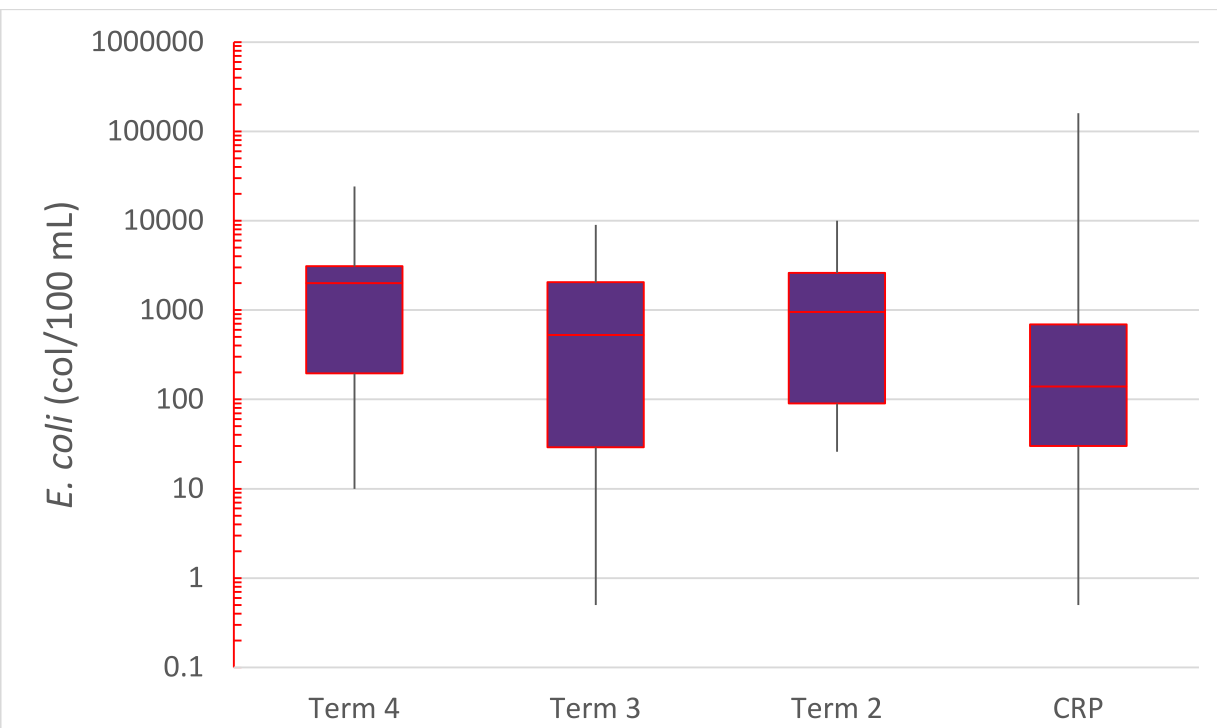


Figure 4-13 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP *E. coli* Data at Cottonwood Branch



4.4.3.3. Biological Data Analysis

No bioassessment monitoring data was collected within this watershed.

4.4.3.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that commercial development occurred in the drainage area. The development was located north of PGBT near gateway drive. Given the commercial land use in the subwatershed there are potential sources of illicit connections, unauthorized industrial discharges, or illegal dumping that may contribute to BOD. Elevated nutrient concentrations may have been a factor in the elevated BOD concentrations due to increased organic matter in the stream. In addition to illicit connections, sources of ammonia nitrogen, total nitrogen, orthophosphate, dissolved phosphorus, and total phosphorus could include over fertilization in residential and commercial areas. Riparian alteration can also affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). Nutrient exceedances were only observed during wet weather. Elevated BOD and nutrient concentrations may have been a factor in the low dissolved oxygen concentrations recorded in the CRP data below TCEQ criteria for aquatic life protection. For bacteria, there was no significant difference to the stormwater biased dataset. Potential sources of bacteria loading may be illicit connections, wildlife, and domestic animals.

Stormwater was shown to be a potential source of total copper and total lead to the stream. Land use of the Cottonwood Branch subwatershed is a predominately road land use which may contribute to the copper and lead exceedances. Stormwater was not shown to be a potential source of arsenic. Arsenic is found in industry, in copper chromated arsenate treated lumber, and in groundwater in some areas. The single observed exceedance over the period of record can be viewed as an outlier. The pH exceedances occurred during stormwater runoff events in the winter (January). A potential source of the elevated pH may be roadway deicing. The elevated oil and grease concentration may have been the result of a vehicular oil leak or staining from the roadway.

BMPs recommended for these sources include increased compliance inspections for illicit connections, public education for illegal dumping, identification and removal of illegal dumping, public education of home and business owners regarding fertilization and turf management, public education for pet owners regarding pet waste management, review/improvement of construction inspection protocols or BMP requirements, review/improvement of roadway deicing protocols, street sweeping, and review/improvement of roadway BMPs for capture of heavy metals.

4.4.3.5. Monitoring Recommendations

Data analyzed presented multiple exceedances to various criteria, screening levels, and comparison datasets. In addition, there is a bacteria TMDL and current impairment for Cottonwood Branch. Therefore additional monitoring at this site is recommended to be assigned a high priority. Bioassessment data collection is recommended to determine whether the biological community may be impacted by the chemical pollutants documented above. In order to determine the concentration of bioavailable metals, it is recommended that sampling of dissolved fractions of copper and lead is conducted.

4.4.4. Cottonwood Creek

The North Texas Tollway Authority performed chemical monitoring on Cottonwood Creek (TCEQ segment 0841P), a stream with a stream order of one draining to Mountain Creek Lake and the West Fork of the Trinity River within the Cottonwood Creek – Mountain Creek Lake watershed.

Cottonwood Creek – Mountain Creek Lake Watershed is a 18,857.1-acre watershed located in southwestern Dallas County and southeastern Tarrant County. This watershed is composed predominately of residential (24.2%) sites and open space (23.8%). Roads acreage contributes with 17.3% of land use composition, which includes Dallas NAS and part of Grand Prairie Municipal Airport. Throughout the watershed, there are patches of commercial (13.1%) areas and industrial (8.5%) sites located in the vicinity of major highways. The water bodies composition for this watershed is 13.1% due to Mountain Creek Lake's location within the watershed.

The North Texas Tollway Authority has one chemical monitoring site located within the Cottonwood Creek subwatershed. The chemical monitoring site, NT1802/1902/2002/2102, was located at SH 161 south of Dickey Road. The conveyance at this site was a rip-rap lined channel. This subwatershed delineated area covered 3,318.1 acres and was estimated to be predominately residential properties (35.7%) and open space (20.2%). Industrial sites (16.2%) and open spaces are mainly concentrated on the east side of the drainage area near the chemical sampling site. Commercial properties (14.0%) are dispersed throughout the drainage area and roads compose 18.0% of the land use. There were no areas designated as water bodies in this subwatershed.

The monitoring site, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 4. The monitoring site is shown as NT2002. NT1802/1902/2102 were located in the same location. The monitored subwatershed is within the jurisdictional limits of the City of Arlington and the City of Grand Prairie. NTTA contributes flow to the subwatershed through State Highway 161 (PGBT). There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.4.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-3. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-3 Cottonwood Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia N (mg/L)	Nitrate N(mg/L)
No. of Samples	16	16	16	16	16	16	16
Minimum	104.0	12.80	1.00	5.00	0.880	0.041	0.090
Maximum	812.0	383.00	16.80	99.20	3.370	1.637	1.310
Median	159.5	59.85	8.25	27.00	1.700	0.175	0.555
Arithmetic Mean	236.3	86.81	8.50	31.73	1.835	0.289	0.554
Geometric Mean	192.2	57.55	7.11	24.82	1.725	0.185	0.454
Standard Deviation	200.0	93.74	4.38	23.53	0.681	0.386	0.330
Coefficient of Variation	0.85	1.08	0.52	0.74	0.37	1.336	0.596
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.008	0.010	0.035	0.001	0.002	0.002	0.001
Maximum	0.680	0.880	1.700	0.032	0.015	0.099	0.009
Median	0.050	0.033	0.184	0.004	0.005	0.008	0.004
Arithmetic Mean	0.132	0.135	0.261	0.006	0.006	0.021	0.004
Geometric Mean	0.061	0.047	0.163	0.004	0.005	0.010	0.003
Standard Deviation	0.212	0.231	0.392	0.007	0.004	0.030	0.003
Coefficient of Variation	1.603	1.716	1.501	1.229	0.716	1.435	0.733
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.014	0.18	7.30	104	50.6	0.5	0.01
Maximum	0.230	9.10	9.20	1489	84.2	20000	0.52
Median	0.050	1.35	8.25	326	69.3	1357	0.05
Mean	0.079	2.03	8.23	480	68.5	2520	0.09
Geometric Mean	0.056	1.32	8.22	342	67.8	350	0.04
Standard Deviation	0.069	2.22	0.56	462	9.9	4840	0.13
Coefficient of Variation	0.874	1.09	0.07	0.96	0.14	1.92	1.47

4.4.4.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, CRP and NSQD data where applicable. These graphs are located in Appendix F. CRP stations 10722 and 20836 were utilized for this analysis. The CRP stations were located upstream of NTTA's chemical monitoring site.

During the fourth monitoring term, there was one exceedance of the TCEQ human health estimated criterion for total arsenic in June 2018, one exceedance of the TCEQ aquatic life use estimated chronic criterion for total copper in July 2018, two exceedances of the TCEQ aquatic life use estimated acute criterion for total copper (June and July 2018), one exceedance of the pH TCEQ basin specific criterion (October 2019), two exceedances of the TCEQ nutrient screening criterion for ammonia nitrogen (July 2018 and April 2019), two exceedances of the TCEQ nutrient screening criterion for orthophosphate (June and July 2018), one exceedance of the TCEQ nutrient screening criterion for total phosphorus (February 2021), and ten exceedances of the *E. coli* PCR single sample criterion (multiple events across the period). The geometric mean however remained within the PCR geometric mean criterion. In addition, there were two occurrences where the TSS (July 2018 and February 2021) concentration, two occurrences where the BOD concentration (July 2018 and April 2019), one occurrence where the COD concentration (February 2021), two occurrences where the dissolved phosphorus concentration (February and April 2021), and one occurrence where the oil and grease concentration (July 2018) was higher than 75% of the NSQD data for those parameters. There were three occurrences where the specific conductance exceeded the NRSA good category into the fair category.

Due to the exceedances and elevated concentrations discussed above and the availability of CRP and wet weather chemical data, boxplots were created for total copper, BOD, ammonia nitrogen, orthophosphate, total phosphorus, pH, and specific conductance for comparison of the datasets. The data indicates that stormwater runoff is lower for specific conductance compared to CRP data which was predominately collected during dry weather (see Figure 4-19). However, there is a significant difference between the fourth monitoring term wet weather data for BOD, ammonia nitrogen, total phosphorus, total copper, and pH and the CRP data indicating the stormwater runoff typically was observed to have higher concentrations of these pollutants than dry weather flow (see Figures 4-14, 4-15, 4-16, 4-17, and 4-18). There was no difference between the monitoring terms for BOD, total copper, and pH (Figures 4-14, 4-17, and 4-18). For total phosphorus, the observed concentrations in the fourth term were higher than the second term (Figure 4-16).

Figure 4-14 Boxplot Comparing Wet Weather Chemical Monitoring Second and Fourth Monitoring Terms and CRP BOD Data at Cottonwood Creek

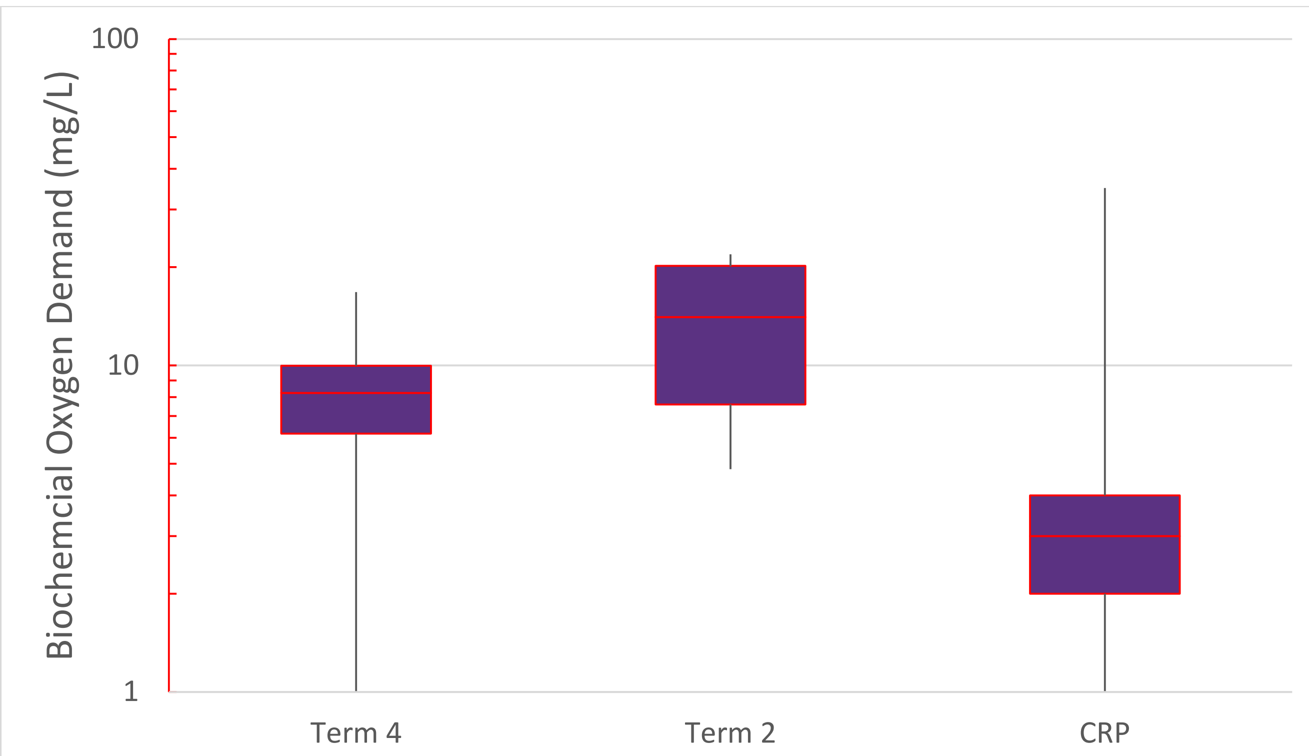


Figure 4-15 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Ammonia Nitrogen Data at Cottonwood Creek

Figure 4-16 Boxplot Comparing Wet Weather Chemical Monitoring Second and Fourth Monitoring Terms and CRP Total Phosphorus Data at Cottonwood Creek

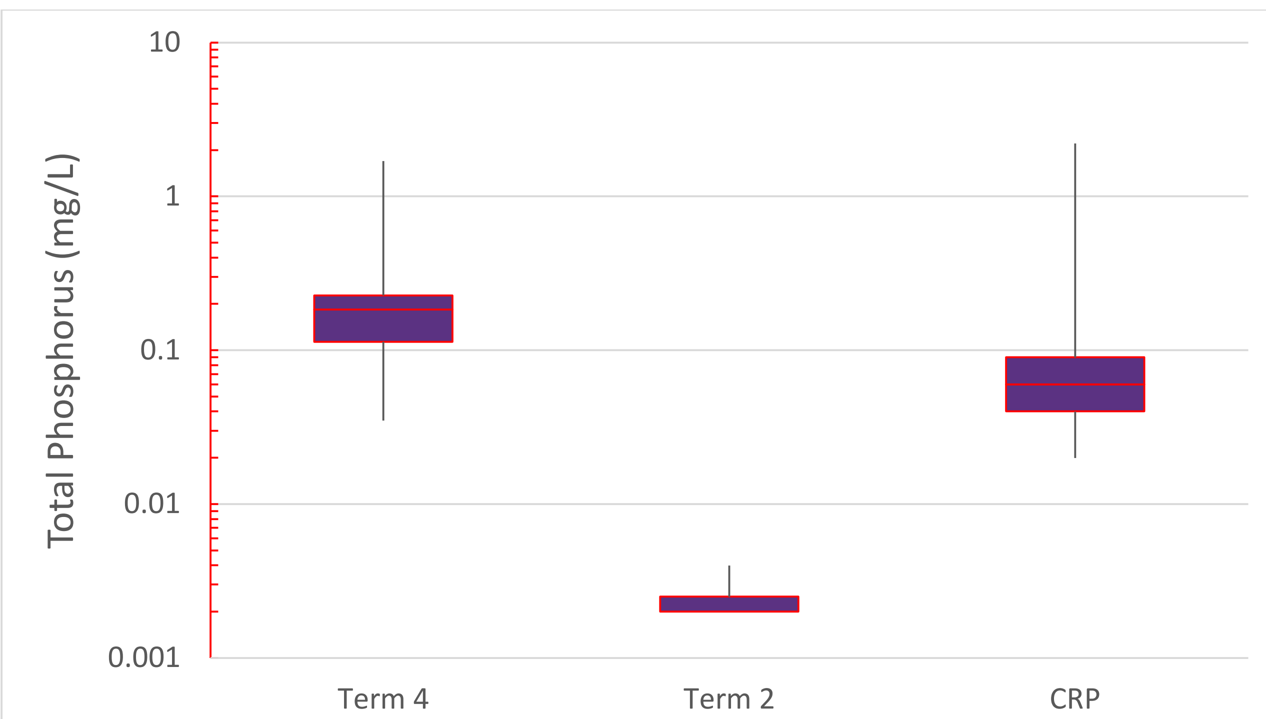


Figure 4-17 Boxplot Comparing Wet Weather Chemical Monitoring Second and Fourth Monitoring Terms and CRP Total Copper Data at Cottonwood Creek

Figure 4-18 Boxplot Comparing Wet Weather Chemical Monitoring Second and Fourth Monitoring Terms and CRP pH Data at Cottonwood Creek

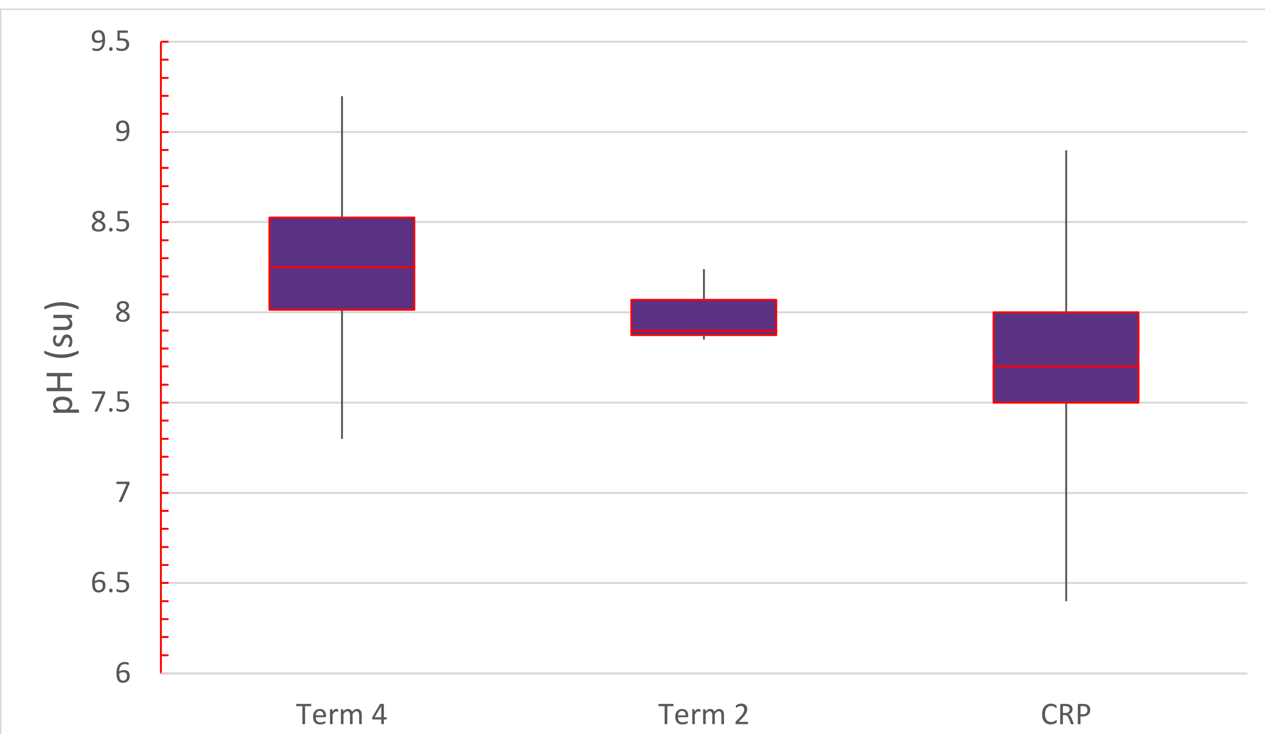


Figure 4-19 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Specific Conductance Data at Cottonwood Creek

4.4.4.3. Biological Data Analysis

No bioassessment monitoring data was collected within this watershed.

4.4.4.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that although there were no large-scale development activities, there were several small construction activities that occurred throughout the drainage area. Given the industrial and commercial land uses in the subwatershed there are potential sources of illicit connections, unauthorized industrial discharges, or illegal dumping that may contribute to BOD. Elevated nutrient concentrations may have been a factor in the elevated BOD concentrations due to increased organic matter in the stream. In addition to illicit connections, sources of ammonia nitrogen, orthophosphate, dissolved phosphorus, and total phosphorus could include over fertilization in residential and commercial areas. In addition, riparian alteration can affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). These nutrients exceedances were only observed during wet weather over the fourth monitoring term. Despite elevated BOD and nutrient concentrations, the dissolved oxygen concentrations recorded in the CRP data remained above TCEQ ALU criteria.

Stormwater was shown to be a potential source of total copper to the stream. Roadway land use of the Cottonwood Creek subwatershed may contribute to the copper exceedances. Arsenic is found in industry, in copper chromated arsenate treated lumber, and in groundwater in some areas. The single observed exceedance over the period of record may be viewed as an outlier. A potential source of elevated pH may be roadway deicing but the single pH exceedance above 9 SU over the period of record occurred during a stormwater runoff event in October. The station is proceeded by a pond. A potential source of the elevated pH may be the growth of aquatic plants and algae within the pond during that period. Excessive growth of aquatic plants and algae could be a result of the elevated nutrient concentrations. The elevated oil and grease concentration may have been the result of a vehicular oil leak or staining from the roadway.

BMPs recommended for these sources include increased compliance inspections for illicit connections, public education for illegal dumping, identification and removal of illegal dumping, public education of home and business owners regarding fertilization and turf management, review/improvement of construction inspection protocols or BMP requirements, street sweeping, and review/improvement of roadway BMPs for capture of heavy metals.

4.4.4.5. Monitoring Recommendations

Data analyzed presented multiple exceedances to various criteria, screening levels, and comparison datasets. In addition, there is a current impairment for bacteria for Cottonwood Creek. Therefore additional monitoring at this site is recommended to be assigned a high priority. Bioassessment data collection is recommended to determine whether the biological community may be impacted by the chemical pollutants documented above. In order to determine the concentration of bioavailable metals, it is recommended that sampling of the dissolved fraction of copper is conducted.

4.4.5. Delaware Creek

The City of Irving performed chemical and bioassessment monitoring on Delaware Creek (TCEQ segment 0841H), a stream with a stream order of three or greater draining to the Lower West Fork of the Trinity River within the Delaware Creek – West Fork Trinity River watershed.

The Delaware Creek watershed is located within the city boundaries of Dallas, Grand Prairie, and Irving on the western side of Dallas County. Delaware Creek Watershed covers a 21,599-acre area and is predominately made up of open space (32.4%) and residential (26.8%) property. Open space is mostly found in the central portion of the watershed with the residential property located in the north and west. Major roadways (16.5%) intersecting in this watershed are SH 183, SH 356, SH 12, SH 161, SH 408, SH 180, and IH 30. There are a few industrial (4.3%) sites located along some major highways such as SH 180 and IH 30 in the south and SH 356 and SH 12 in the north. The land use estimate for commercial sites is 17.9%. Commercial sites are scattered among residential property in the north and are located along major roadways in the south-central portions of the watershed. This watershed contains 2.1% water features including part of the Trinity River.

The City of Irving has two chemical monitoring sites located within the Delaware Creek subwatershed. The chemical monitoring site, IR1801/1901 was an upstream sampling site located near Sowers Road just downstream from the W. Pioneer Drive crossing. The conveyance at this site was a concrete, trapezoidal channel with low vegetative cover. The subwatershed delineated for this sampling location covered 3,107-acres and and was mainly composed of residential properties (55.3%). Commercial properties (19.3%) and a few open space (3.8%) were dispersed throughout. Roads composed 21.6% of the drainage site and no industrial land use features were present. Water features composed 0.1% of this watershed.

The chemical monitoring site, IR1802/1902 was a downstream sampling site located west of SH 12 where East Oakdale Road crosses Delaware Creek. The conveyance at this site was a natural, unlined channel with medium vegetative cover. The subwatershed delineated for this sampling location covered a 4,755-acre area and consisted predominately of residential (50.4%) acreage. SH 356 was the only major highway going through this subwatershed area (20.9%). The majority of commercial (20.5%) sites were located along SH 356. Open space (7.9%) in the southern portion seemed to follow along Delaware Creek. There were only a few small industrial (0.4%) sites in the subwatershed. This subwatershed contained no distinct water (0%) features.

Due to construction activities in the second quarter of 2019, the sampling equipment located at IR1902 was relocated to the nearest upstream access and renamed IR1902A. IR1902A was located north of East Oakdale Road at the terminus of Maple Street. The subwatershed for IR1902A was nearly identical to IR1902 except the area was reduced to 4,741-acres and open space land use was reduced to 7.8%.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 5. The monitoring sites are shown as IR1901, IR1902, and IR1902A. IR1801 and IR1802 were located in the same locations as IR1901 and IR1902, respectively. The monitored subwatershed is entirely within the jurisdictional limits of the City of Irving. TxDOT contributes flow to the subwatershed through SH 183 and SH 356. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.5.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-4. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-4 Delaware Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Nitrate N (mg/L)	Ammonia N (mg/L)
No. of Samples	16	16	16	16	16	16	16
Minimum	106.0	4.29	1.00	6.10	0.940	0.1200	0.0980
Maximum	454.0	1440.00	35.20	211.00	6.000	0.8600	1.0000
Median	198.0	207.00	8.70	45.05	1.800	0.3950	0.2300
Arithmetic Mean	236.2	274.10	11.56	51.94	2.021	0.4388	0.3516
Geometric Mean	214.0	131.68	8.17	36.99	1.837	0.3972	0.2687
Standard Deviation	113.6	349.48	8.99	48.21	1.152	0.1967	0.2864
Coefficient of Variation	0.48	1.27	0.78	0.93	0.57	0.45	0.81
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.010	0.015	0.037	0.001	0.001	0.002	0.001
Maximum	0.59	0.810	0.880	0.014	0.052	0.112	0.040
Median	0.13	0.165	0.262	0.003	0.008	0.039	0.006
Arithmetic Mean	0.15	0.244	0.328	0.004	0.014	0.047	0.010
Geometric Mean	0.10	0.139	0.257	0.003	0.007	0.024	0.006
Standard Deviation	0.14	0.251	0.218	0.004	0.015	0.042	0.011
Coefficient of Variation	0.91	1.030	0.664	0.821	1.076	0.894	1.057
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.012	0.18	5.50	81	52.0	0.5	0.01
Maximum	0.250	8.50	9.00	762	86.2	25600	0.11
Median	0.083	2.27	8.40	349	76.0	1250	0.05
Mean	0.108	2.38	8.14	377	73.5	5085	0.04
Geometric Mean	0.074	1.78	8.08	325	72.7	432	0.02
Standard Deviation	0.083	1.90	0.95	190	11.2	8086	0.03
Coefficient of Variation	0.769	0.80	0.12	0.50	0.15	1.59	0.93

4.4.5.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, CRP and NSQD data where applicable. These graphs are located in Appendix G. CRP station 17178 was utilized for this analysis. It is located near the City of Irving's downstream station. During the fourth monitoring term, there were two exceedances of the TCEQ aquatic life use estimated chronic criterion for total copper (August and October 2019), four exceedances of the TCEQ aquatic life use estimated acute criterion for total copper (June, July [both stations], and August 2018), two exceedances of the TCEQ aquatic life use estimated chronic criterion for total lead (April and October 2019), six exceedances of the TCEQ nutrient screening criterion for ammonia nitrogen (multiple events across the period), one exceedance of the TCEQ nutrient screening criterion for total nitrogen (October 2019), three exceedances of the TCEQ nutrient screening criterion for orthophosphate (June [both stations] and August 2018), one exceedance of the TCEQ nutrient screening criterion for total phosphorus (October 2019), two exceedances of the pH TCEQ basin specific criterion (June 2018 and January 2019), and nine exceedances of the *E. coli* PCR single sample criterion (multiple events across the period and the geometric mean exceeded the PCR geometric mean criterion). Dissolved oxygen fell below the spring criterion in April 2019. In addition, there were nine occurrences where the TSS concentration, one occurrence where the COD concentration, five occurrences where the recorded BOD concentration, one occurrence where the total nitrogen concentration, one occurrence where the dissolved phosphorus concentration, and one occurrence where the oil and grease concentration was higher than 75% of NSQD data for each parameters.

The elevated TSS and BOD concentrations occurred in multiple events across the period. The elevated COD concentration occurred in August 2019. The elevated total nitrogen and dissolved phosphorus concentrations occurred in October 2019. The elevated oil and grease concentration occurred in July 2018.

Due to the exceedances and elevated concentrations discussed above and the availability of CRP and wet weather chemical data, boxplots were created for BOD, COD, ammonia nitrogen, total nitrogen, orthophosphate, total phosphorus, total copper, total lead, pH, and *E. coli* for comparison of the datasets.

The boxplots do not indicate that stormwater runoff is providing a significant different input of COD or *E. coli* to the stream compared to CRP data which was predominately collected during dry weather (see Figures 4-21 and 4-29). However, there is a significant difference between the fourth monitoring term wet weather data for BOD, total nitrogen, ammonia nitrogen, total phosphorus, orthophosphate, total copper, total lead, and pH and CRP data indicating the stormwater runoff typically was observed to have higher concentrations of these pollutants than dry weather flow (see Figures 4-20, 4-22, 4-23, 4-24, 4-25, 4-26, 4-27, and 4-28). There was no difference between the monitoring terms for BOD, COD, total phosphorus, total copper, and *E. coli* (Figures 4-20, 4-21, 4-24, 4-26, and 4-29). For total nitrogen, the observed concentrations in the fourth term were lower than the third term (Figure 4-22). For total lead, the observed concentrations in the second term were higher than the third term but there was no difference between the second and fourth terms (Figure 4-27). For pH, the observed concentrations in the third and fourth terms were higher than the second term and the fourth term bioassessment data (Figure 4-28).

Figure 4-20 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP BOD Data at Delaware Creek

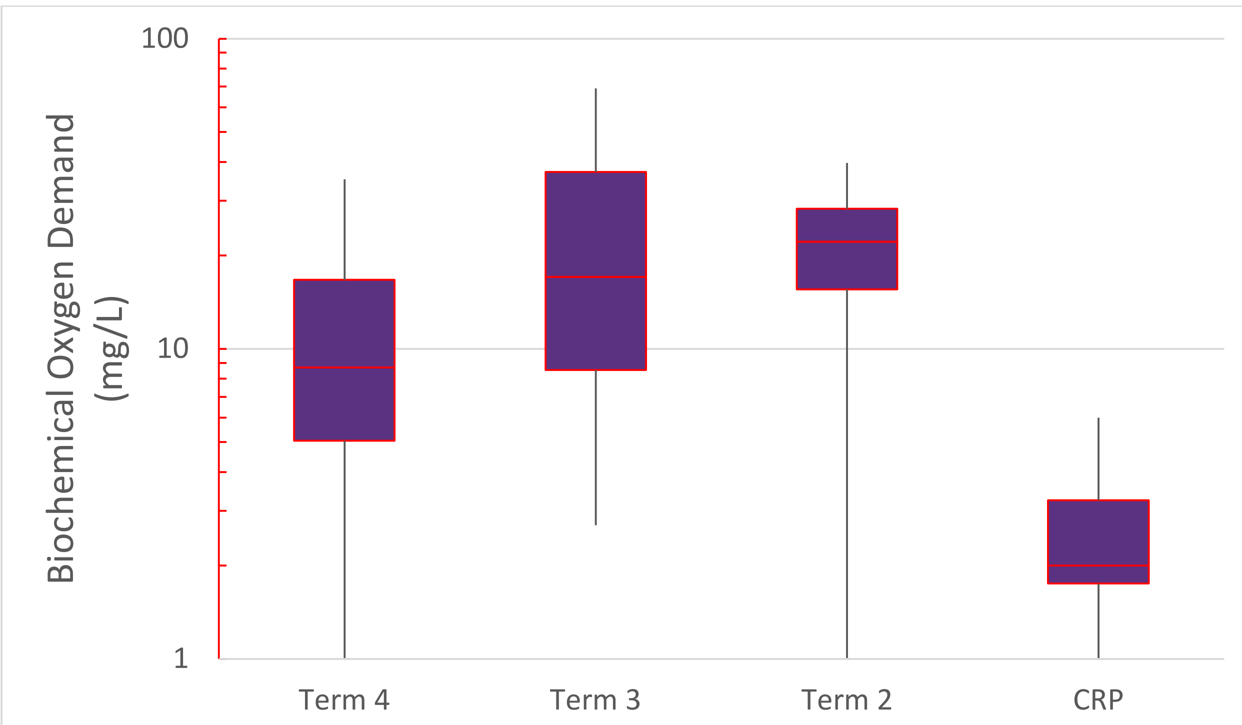


Figure 4-21 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP COD Data at Delaware Creek

Figure 4-22 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Nitrogen Data at Delaware Creek

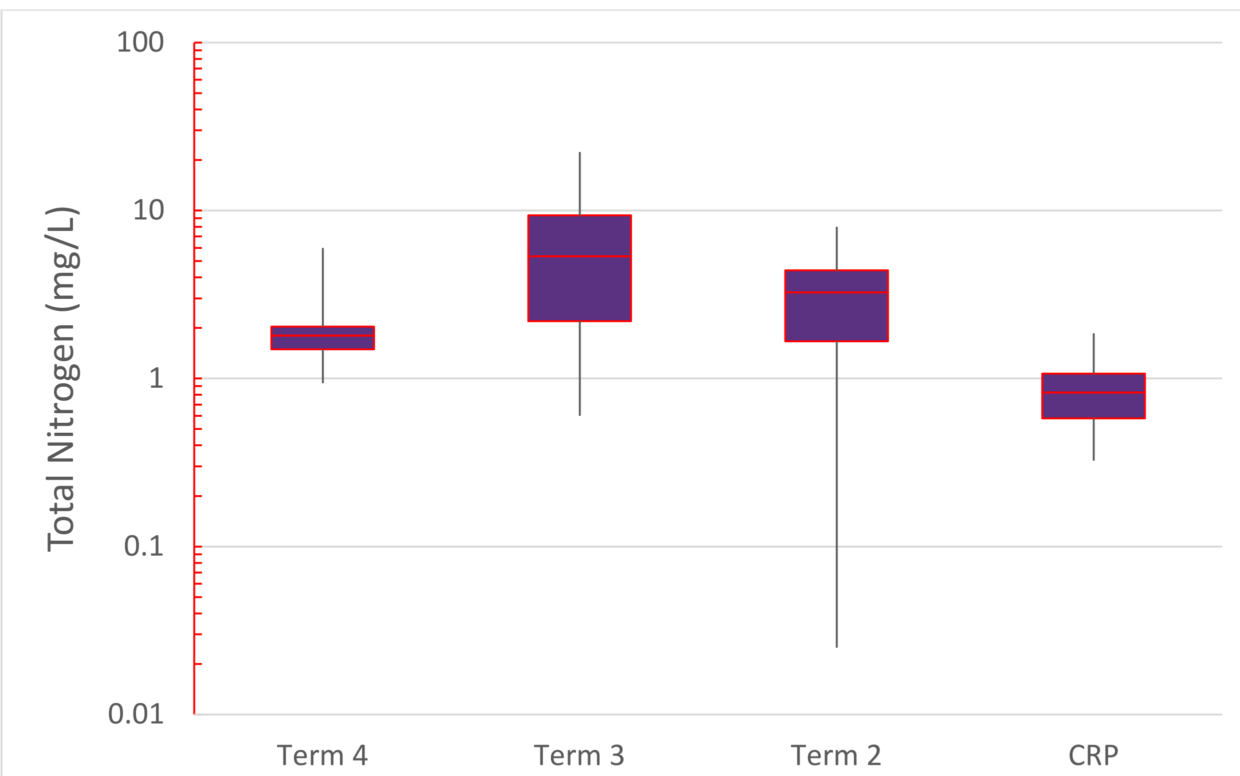


Figure 4-23 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Ammonia Nitrogen Data at Delaware Creek

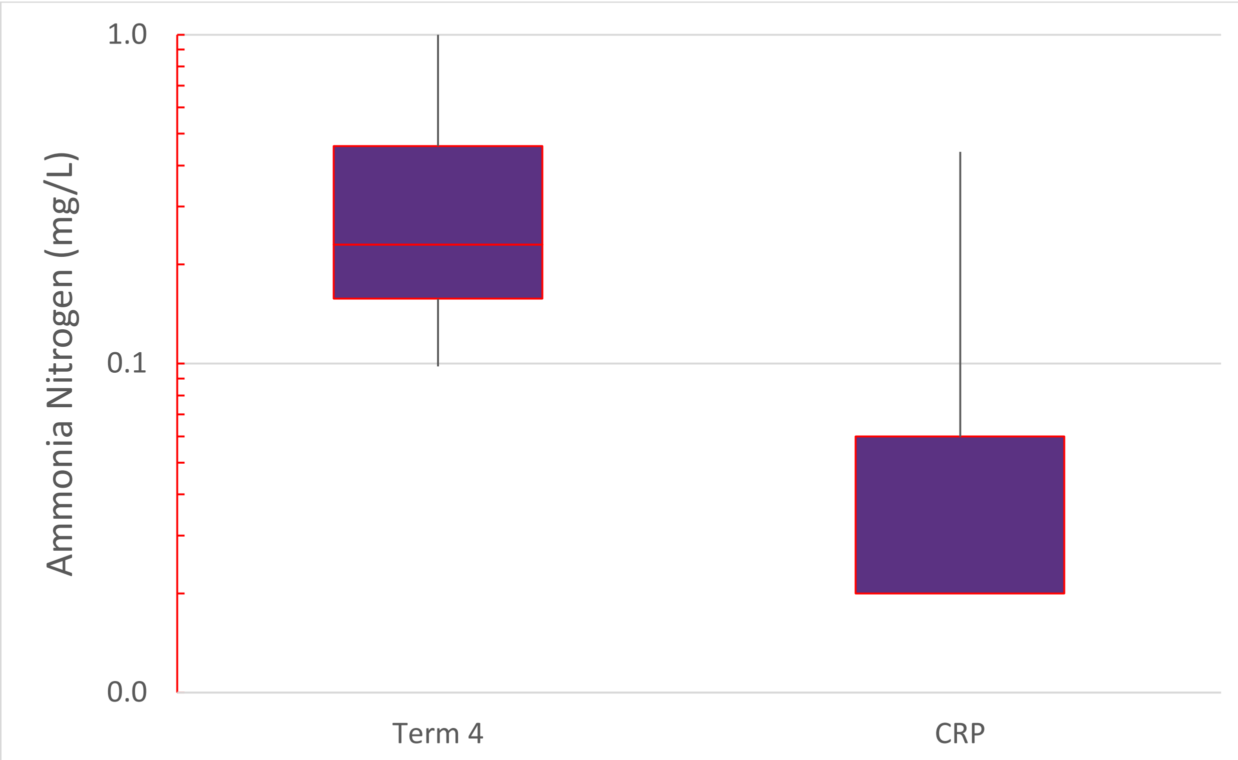


Figure 4-24 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Phosphorus Data at Delaware Creek

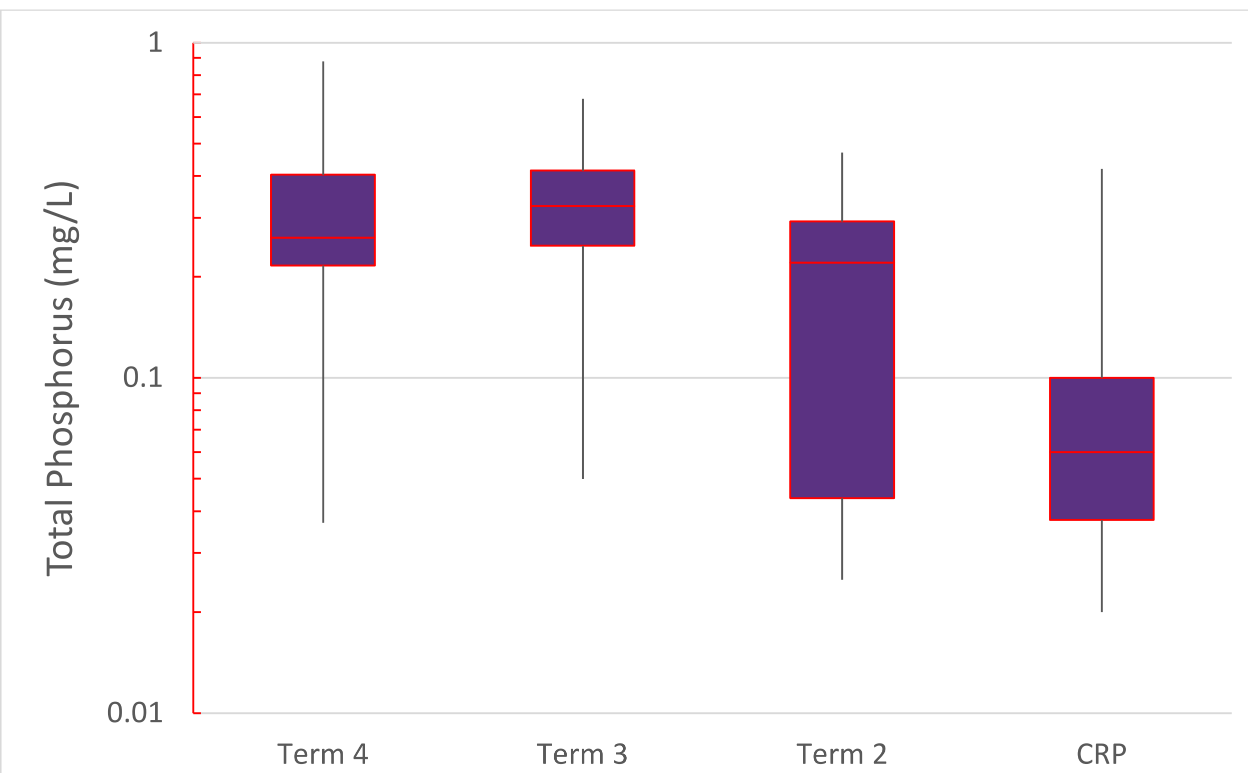


Figure 4-25 Boxplot Comparing Wet Weather and Bioassessment Chemical Monitoring Fourth Monitoring Term and CRP Orthophosphate Data at Delaware Creek

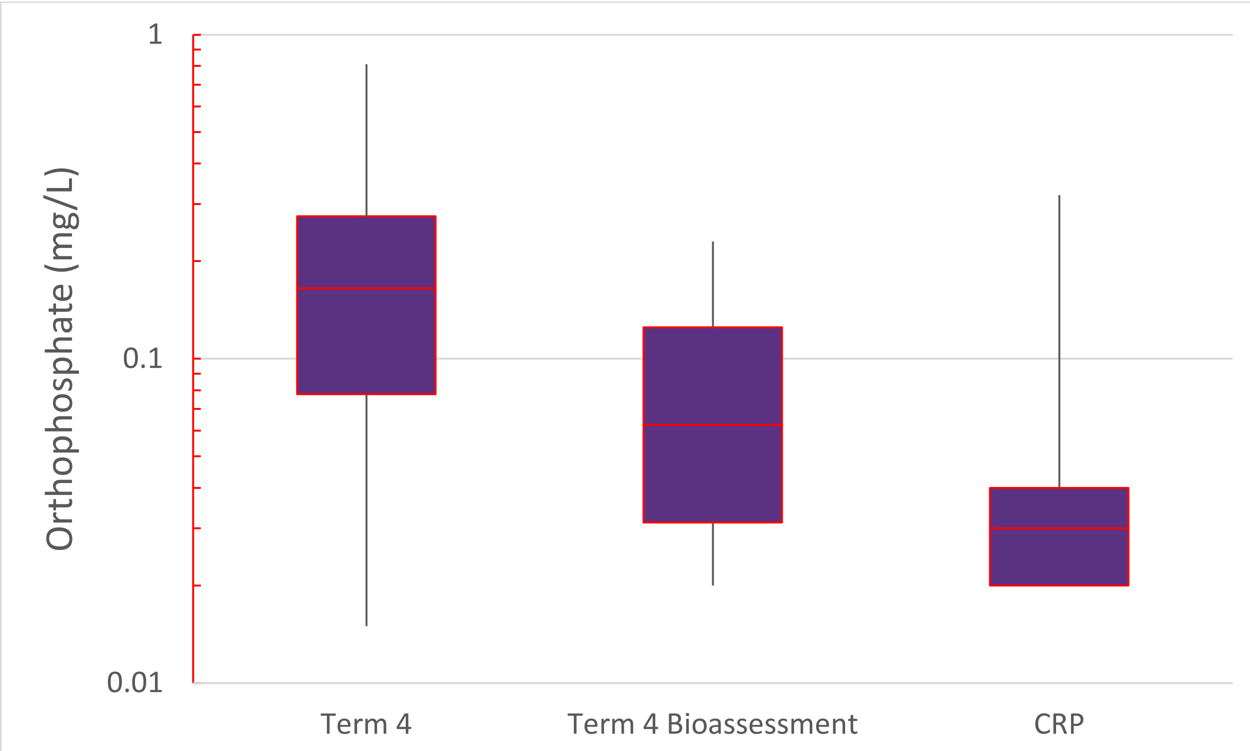


Figure 4-26 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Copper Data at Delaware Creek

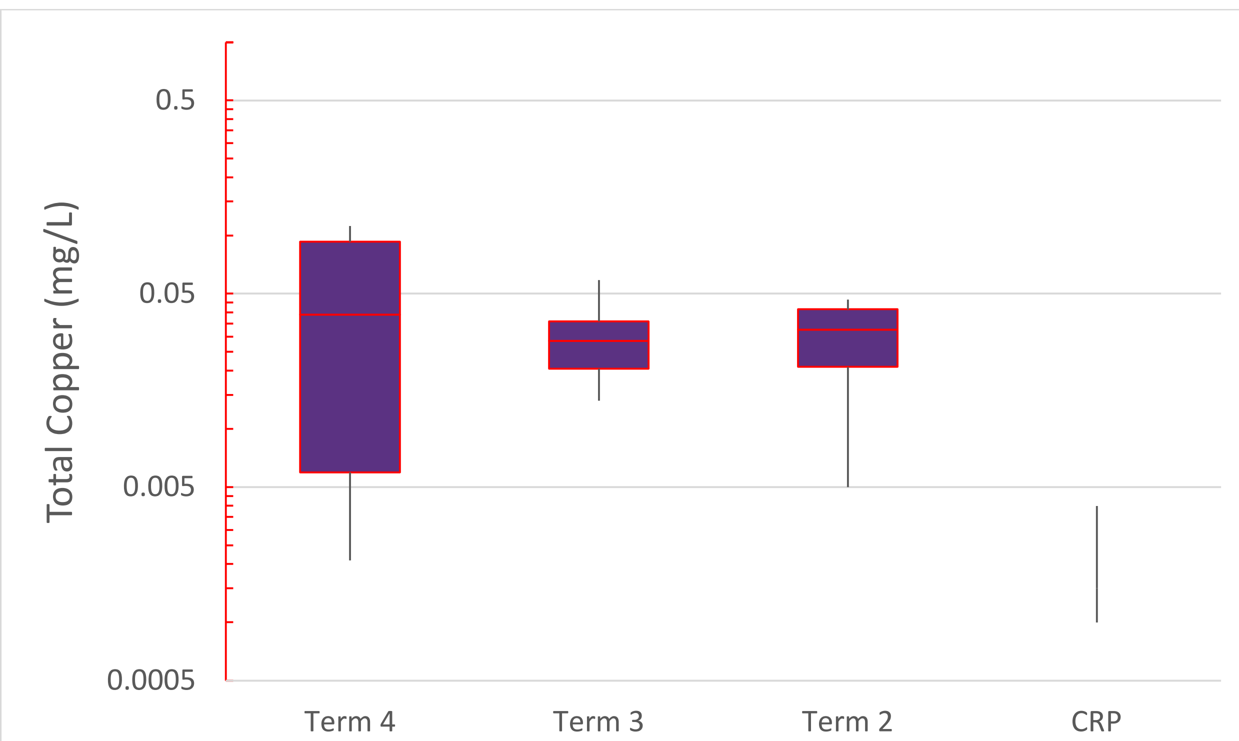


Figure 4-27 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Lead Data at Delaware Creek

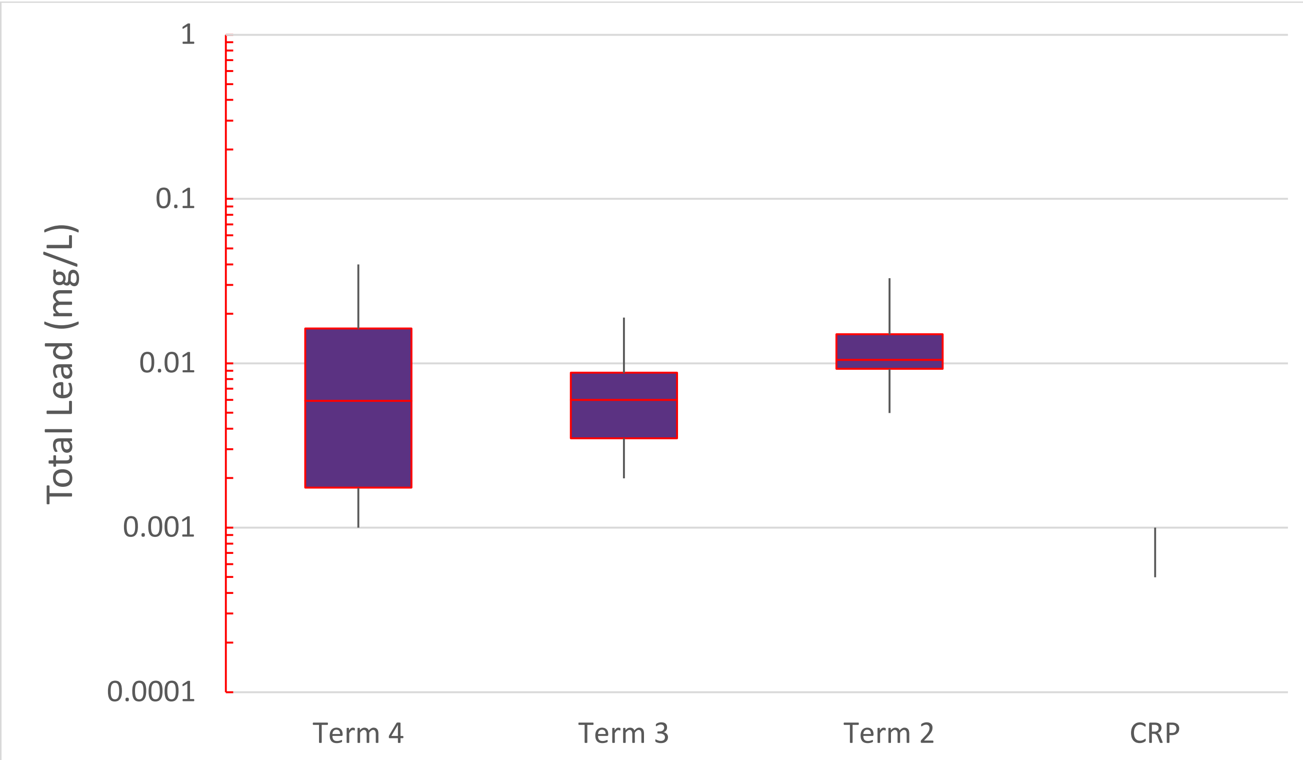


Figure 4-28 Boxplot Comparing Wet Weather and Bioassessment Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP pH Data at Delaware Creek

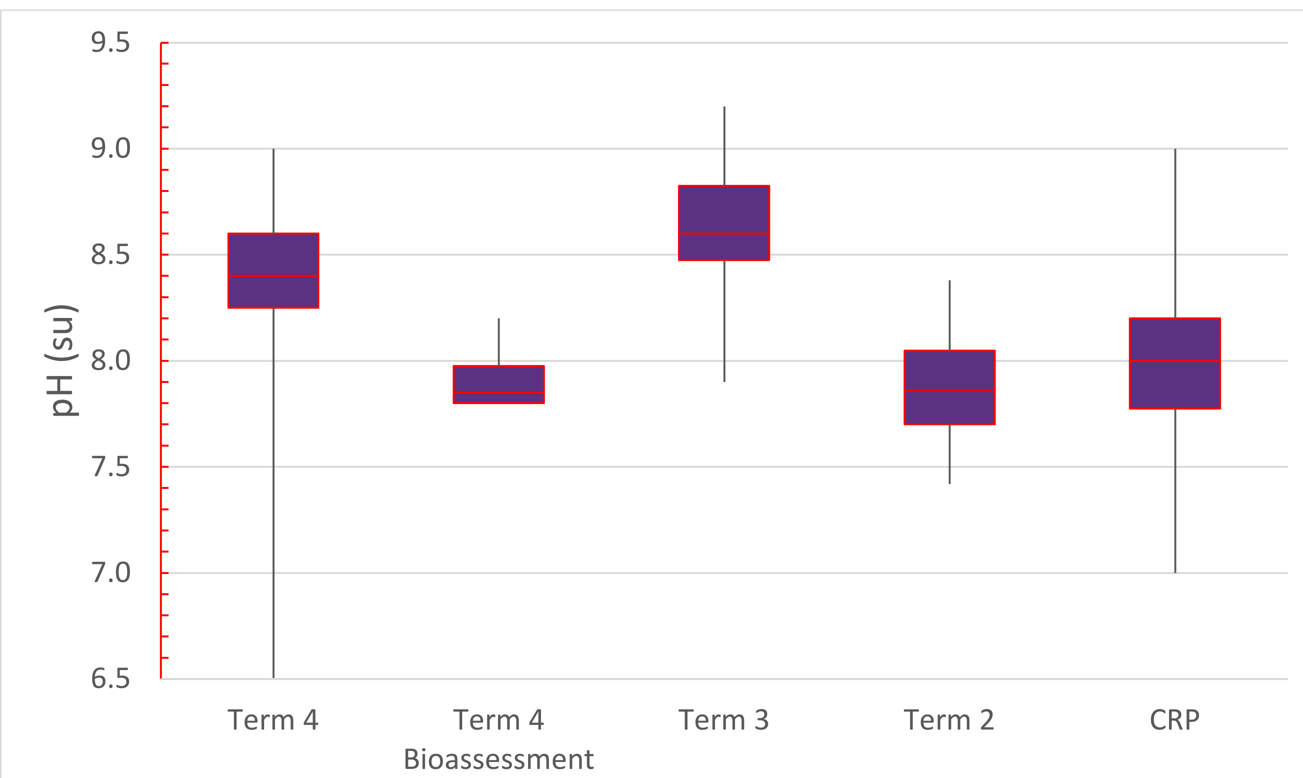
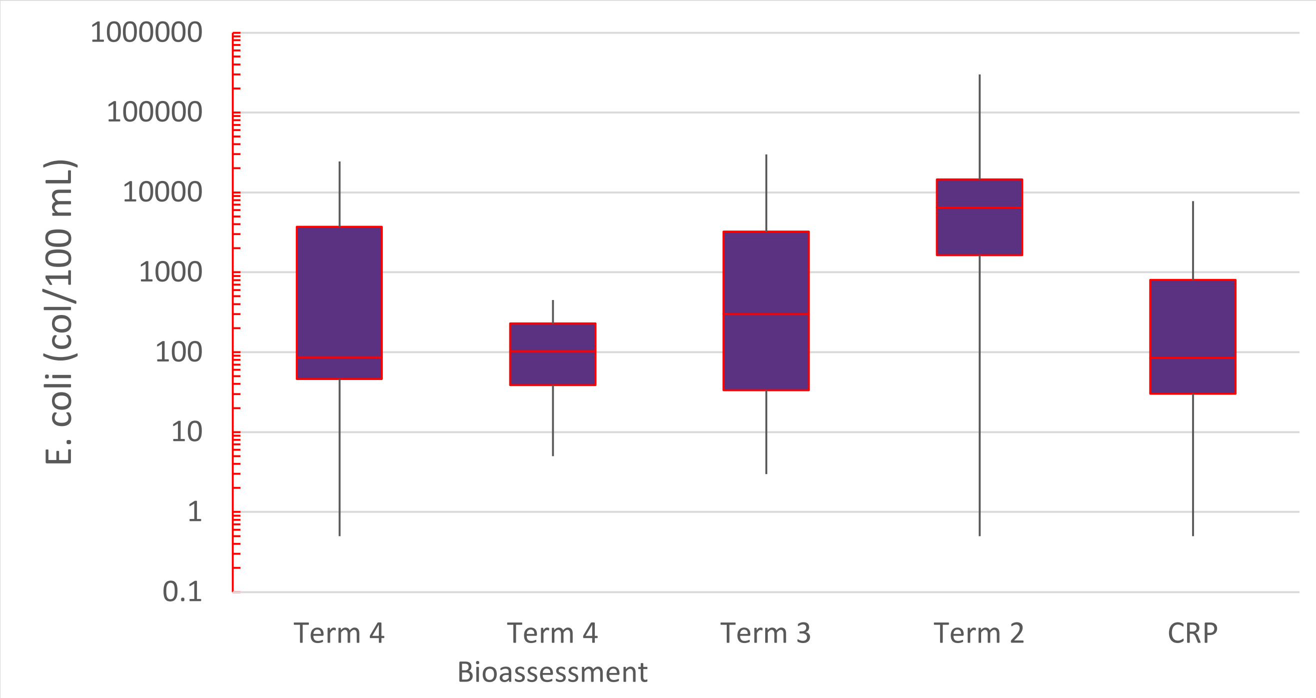


Figure 4-29 Boxplot Comparing Wet Weather and Bioassessment Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP *E. coli* Data at Delaware Creek



4.4.5.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix G).

Delaware Creek, in the reach studied, received a high quality habitat score and high benthic macroinvertebrate community scores, while fish community scores ranged from limited to intermediate. This part of Duck Creek may not be considered ecologically healthy because the fish community scores were not consistently high even though habitat quality and benthic macroinvertebrate communities received high scores. This is an indication that chemical factors may be impacting the fish community. Delaware Creek is a highly altered watercourse with substantially modified sections. The creek is embedded in a trapezoidal concrete channel for over 2 stream miles and impounded in on-channel reservoirs in several areas. Delaware Creek appears to meet the intermediate ALU established in Texas' surface water quality standards.

4.4.5.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that construction activities occurred on the Delaware Creek channel throughout the monitoring term. Given the commercial land uses in the subwatershed there are potential sources of illicit connections, unauthorized discharges, or illegal dumping that may contribute to COD and BOD. Elevated nutrient concentrations may have been a factor in the elevated BOD concentrations due to increased organic matter in the stream. In addition to illicit connections, sources of ammonia nitrogen, nitrate nitrogen, total nitrogen, orthophosphate, dissolved phosphorus, and total phosphorus could include over fertilization in residential and commercial areas. Riparian alteration can also affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). These nutrients exceedances were only observed during wet weather over the fourth monitoring term. Elevated BOD, COD, and nutrient concentrations may have been a factor in the low dissolved oxygen concentration recorded in the CRP data below TCEQ criteria for aquatic life protection in the spring of 2019. For bacteria, there was no significance to the stormwater biased dataset. Potential sources of bacteria loading may be illicit connections, wildlife, and domestic animals.

Stormwater was shown to be a potential source of total copper and total lead to the stream. Land use of the Delaware Creek subwatershed includes roadway land uses over 20% at each monitoring station which may contribute to these pollutants. The pH exceedances only occurred at each monitoring station during separate stormwater runoff events. Low pH can be caused by industrial effluent. The elevated oil and grease concentration may have been the result of a vehicular oil leak, staining, or residential oil changes either from residential areas or from one of the numerous parking areas or roadways located in the subwatershed.

BMPs recommended for these sources include compliance inspections for illicit connections, public education of home and business owners regarding fertilization, turf management and oil and grease handling, public education for pet owners regarding pet waste management, review of construction site inspection protocols or BMP requirements, review of industrial inspection protocols or BMP requirements, street sweeping, and drop inlet or other parking lot treatment devices or layouts to capture oil and grease from stormwater runoff.

4.4.5.5. Monitoring Recommendations

Data analyzed presented multiple exceedances to various criteria, screening levels, and comparison datasets. There is a bacteria TMDL for Delaware Creek. Therefore additional monitoring at this site should be assigned a high priority. Bioassessment data collection is recommended to be continued to determine future trends of the biological community. In order to determine the concentration of bioavailable metals, it is recommended that sampling of dissolved fractions of copper and lead is conducted.

4.4.6. Duck Creek

The City of Garland performed chemical monitoring on Duck Creek (TCEQ segment 0819A), a stream with a stream order of three or greater draining to the East Fork of the Trinity River within the Duck Creek watershed.

Duck Creek watershed is a 27,179.5-acre watershed located on the southeastern edge of Dallas County. This watershed encompasses a small portion of Richardson, the western edge of Garland and extends to the northern tip of Mesquite and into Sunnyvale. The majority of this watershed is residential (34.8%). There is a large section of commercial (17.4%) with some industrial (4.6%) property mixed in located on the western side of the watershed. There is also a small section of mixed commercial and industrial located in the northern part of the watershed with additional commercial patches located along the major highways in the watershed. Approximately 17.2% is considered roadway land use which includes two major highways, IH 635 and IH 30. The southern portion of the watershed contains large areas of open space (25.4%) and the overall watershed contains 0.6% water features.

The City of Garland had three chemical monitoring sites located within the Duck Creek watershed. The chemical monitoring site, GA1801/1901 was an upstream sampling site located between Forest North and South west of Garland Avenue on Duck Creek. The conveyance at this site was an unlined channel with rock bottom and earthen sides. The subwatershed delineated for this sampling site covered approximately 4,644.7 acres and consisted predominately of residential (40.6%) property. There were no major highways that ran through this area but several major roadways (Walnut Street, Jupiter Road, Shiloh Road, etc.) contributed to the highway land use estimate of 20.9%. The majority of commercial (24.2%) sites were located along major roadways in the subwatershed. There was a section of industrial (4.1%) property located upstream and west of GA1801/1901. There were a few open areas in the subwatershed which made up 10.1% of the land use composition. This subwatershed had a water land use composition estimate of 0.1%.

The chemical monitoring site, GA1802/1902 was a midstream sampling site located at Duck Creek at Rick Oden Park along Briarwood Drive. The conveyance at this site was an unlined channel with a gravel and rock bottom and heavily eroded side slopes. The subwatershed delineated for this site covered a total area of 8754.2-acres. The predominant land use was residential properties (41.2%) and roads (20.6%). Commercial properties (22.6%) are centralized in this drainage site, and industrial areas (4.8%) can be found south among commercial properties. Open space composes 10.7% of the drainage area. 0.1% of water features are found in this watershed.

The chemical monitoring site, GA1803/1903 was a downstream sampling site located at Duck Creek under La Prada Bridge in the Gatewood Park area. The conveyance at this site was an unlined channel with a gravel bottom. The subwatershed delineated for this sampling site covered a 14,587-acre area and was mostly made up of residential property (39.9%). The majority of the northwestern portion of the subwatershed was a mix of commercial (22.0%) and industrial (7.7%) property. There was also commercial sites throughout the subwatershed with most located along SH 78 and other major roadways. SH 78 and a few major roadways made up the roadway land use estimate of 29.7%. There were patches of open space which made up 10.5% of the subwatershed. The water feature composition for this area was 0.1%.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 6. The monitoring sites are shown as GA1901, GA1902, and GA1903. GA1801, GA1802, and GA1803 were located in the same locations, respectively. The monitored subwatershed is mostly within the jurisdictional limits of the City of Garland with a portion of the upper subwatershed occupied by the City of Richardson. TxDOT contributes flow to the subwatershed through US 75 and SH 78. There is one TCEQ permitted wastewater outfall within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022. The permittee is identified as the City of Garland and the outfall is located just downstream of the W Centerville Road crossing.

4.4.6.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-5. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-5 Duck Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia N (mg/L)	Nitrate N(mg/L)
No. of Samples	24	24	24	24	24	24	24
Minimum	120.0	6.00	0.50	7.50	0.660	0.058	0.015
Maximum	704.0	316.00	88.00	72.00	19.400	1.364	19.400
Median	317.0	38.30	7.21	28.55	1.645	0.206	0.770
Arithmetic Mean	384.3	66.57	11.02	34.14	3.735	0.357	2.555
Geometric Mean	340.6	40.62	6.31	30.38	2.170	0.234	0.681
Standard Deviation	185.4	79.25	17.61	16.30	4.826	0.384	4.422
Coefficient of Variation	0.48	1.19	1.60	0.48	1.29	1.08	1.73
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	24	24	24	24	24	24	24
Minimum	0.003	0.010	0.041	0.001	0.001	0.004	0.001
Maximum	4.100	14.200	4.200	0.009	0.030	0.109	0.021
Median	0.069	0.190	0.167	0.002	0.002	0.018	0.003
Arithmetic Mean	0.502	2.014	0.868	0.003	0.005	0.040	0.004
Geometric Mean	0.090	0.205	0.278	0.002	0.003	0.023	0.003
Standard Deviation	1.016	4.522	1.347	0.002	0.006	0.037	0.005
Coefficient of Variation	2.024	2.25	1.552	0.763	1.271	0.924	1.095
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field**	**Specific Conductivity**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	24	24	24	24	23	24	24
Minimum	0.017	0.56	6.90	250	52.8	0.5	0.01
Maximum	0.167	9.20	8.80	1040	84.6	5600	2.50
Median	0.060	0.96	8.05	625	72.1	80	0.03
Mean	0.070	1.71	7.90	643	70.5	1246	0.13
Geometric Mean	0.059	1.22	7.89	615	69.6	120	0.02
Standard Deviation	0.041	1.88	0.53	183	10.8	1911	0.51
Coefficient of Variation	0.588	1.10	0.07	0.29	0.15	1.53	3.89

4.4.6.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, and NSQD data where applicable. These graphs are located in Appendix H. During the fourth monitoring term, there were eight exceedances of the TCEQ TDS basin specific criterion (multiple events across the period), two exceedances of the TCEQ aquatic life use estimated chronic criterion for total copper (July 2018 and October 2019, six exceedances of the TCEQ aquatic life use estimated acute criterion for total copper (multiple occurrences in 2018), one exceedance of the TCEQ aquatic life use estimated chronic criterion for total lead (April 2019), and seven exceedances of the *E. coli* PCR single sample criterion (multiple events across the period) The geometric mean however remained within the PCR geometric mean criterion. There were six ammonia nitrogen, twelve nitrate nitrogen, eight orthophosphate, and eight total phosphorus exceedances of the TCEQ nutrient screening criteria through multiple events across the period. In addition, there were two occurrences where the TSS concentration (July and August 2018), two occurrences where the BOD concentration (April and October 2019), seven occurrences where the dissolved phosphorus concentration, and six occurrences where the total nitrogen concentration was higher than 75% of NSQD data for each parameter. There was one occurrence where the specific conductance exceeded the NRSA good category into the fair category.

Due to the exceedances and elevated concentrations discussed above and the availability of bioassessment and wet weather chemical data, boxplots were created for nitrate nitrogen, total nitrogen, orthophosphate, total phosphorus, and specific conductance for comparison of the datasets. The total nitrogen, nitrate nitrogen, orthophosphate, and specific conductance boxplots show significant differences between the bioassessment and the wet weather data indicating that these concentrations were higher during the dry period than during runoff events (Figures 4-30, 4-31, and 4-34). The total phosphorus boxplot does not indicate that stormwater runoff is providing a significant different input of this nutrient to the stream compared to the bioassessment data which was collected during dry weather (see Figure 4-32). There was no difference between the monitoring terms for total nitrogen, or total phosphorus (Figures 4-30 and 4-32). The fourth monitoring term had higher concentrations of specific conductance compared to the third monitoring term (Figure 4-34).

Figure 4-30 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and Bioassessment Total Nitrogen Data at Duck Creek

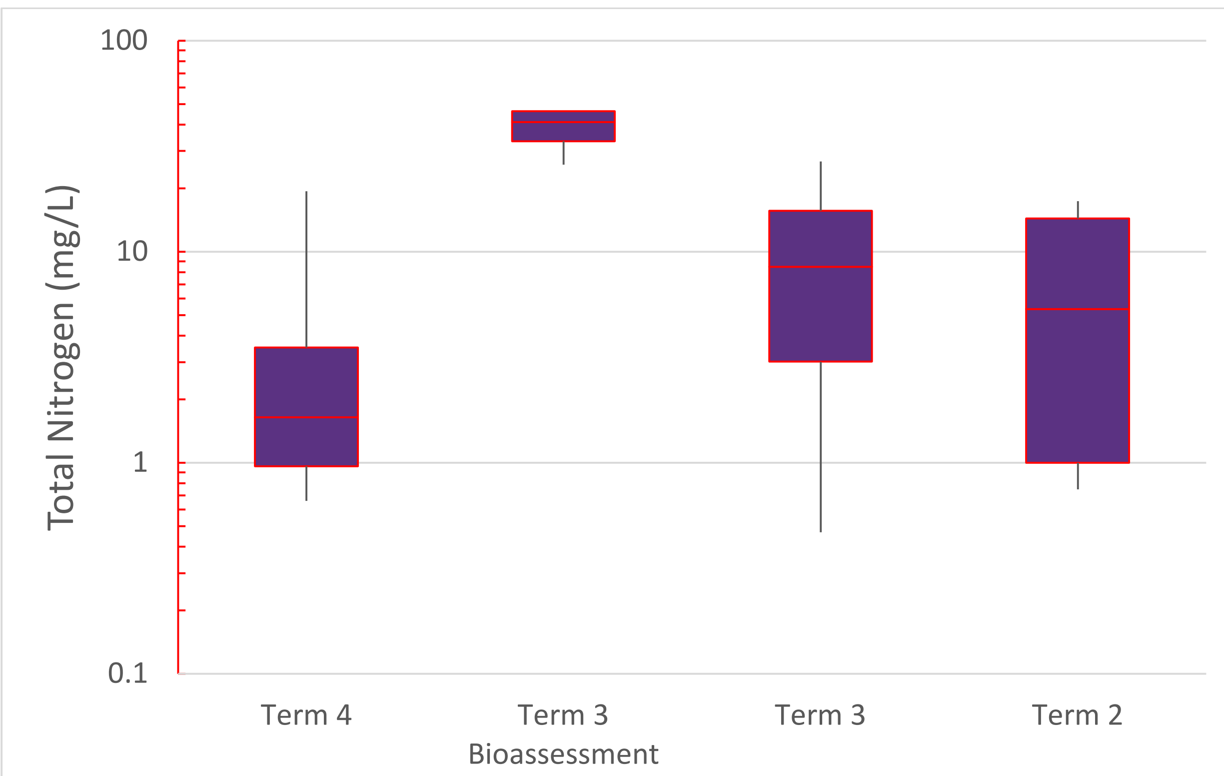


Figure 4-31 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms Nitrate Nitrogen Data at Duck Creek

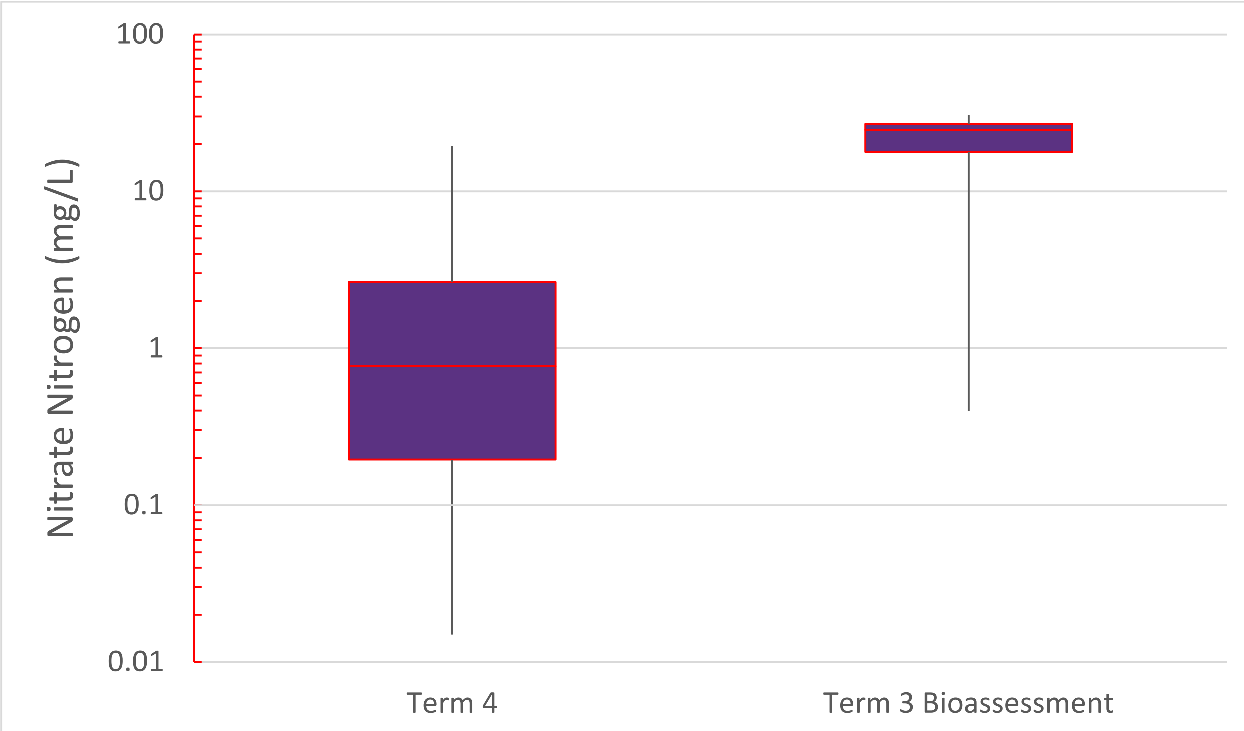


Figure 4-32 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and Bioassessment Total Phosphorus Data at Duck Creek

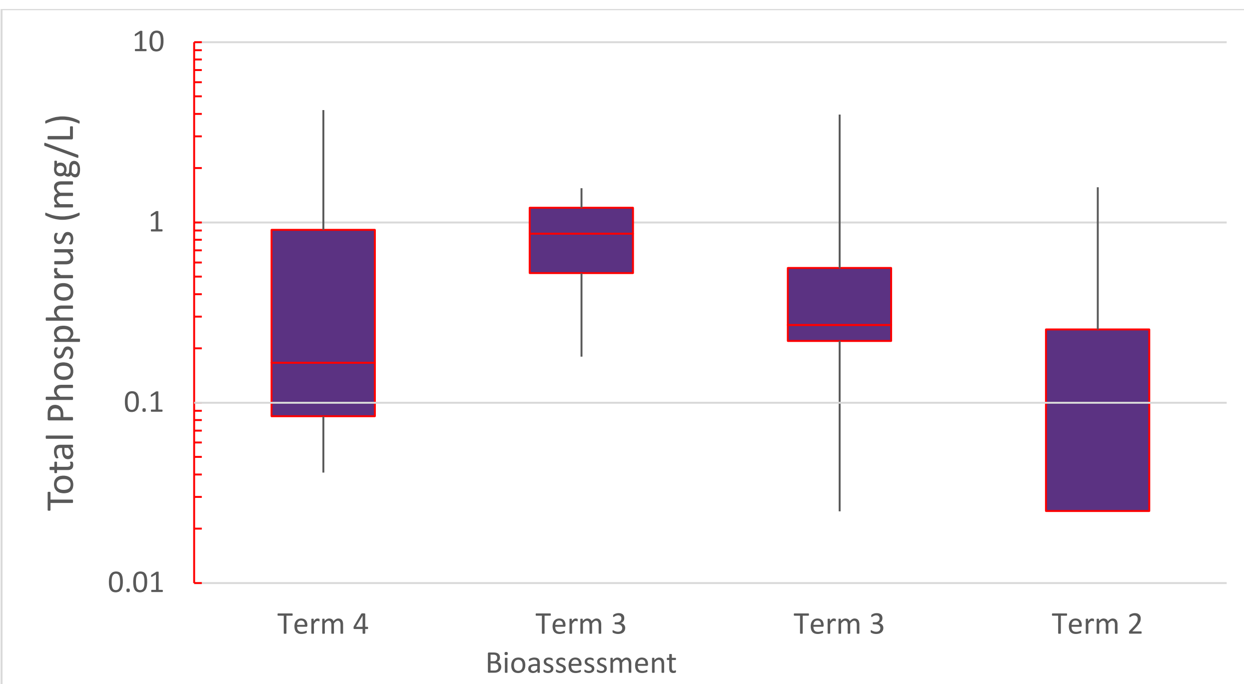


Figure 4-33 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms Orthophosphate Data at Duck Creek

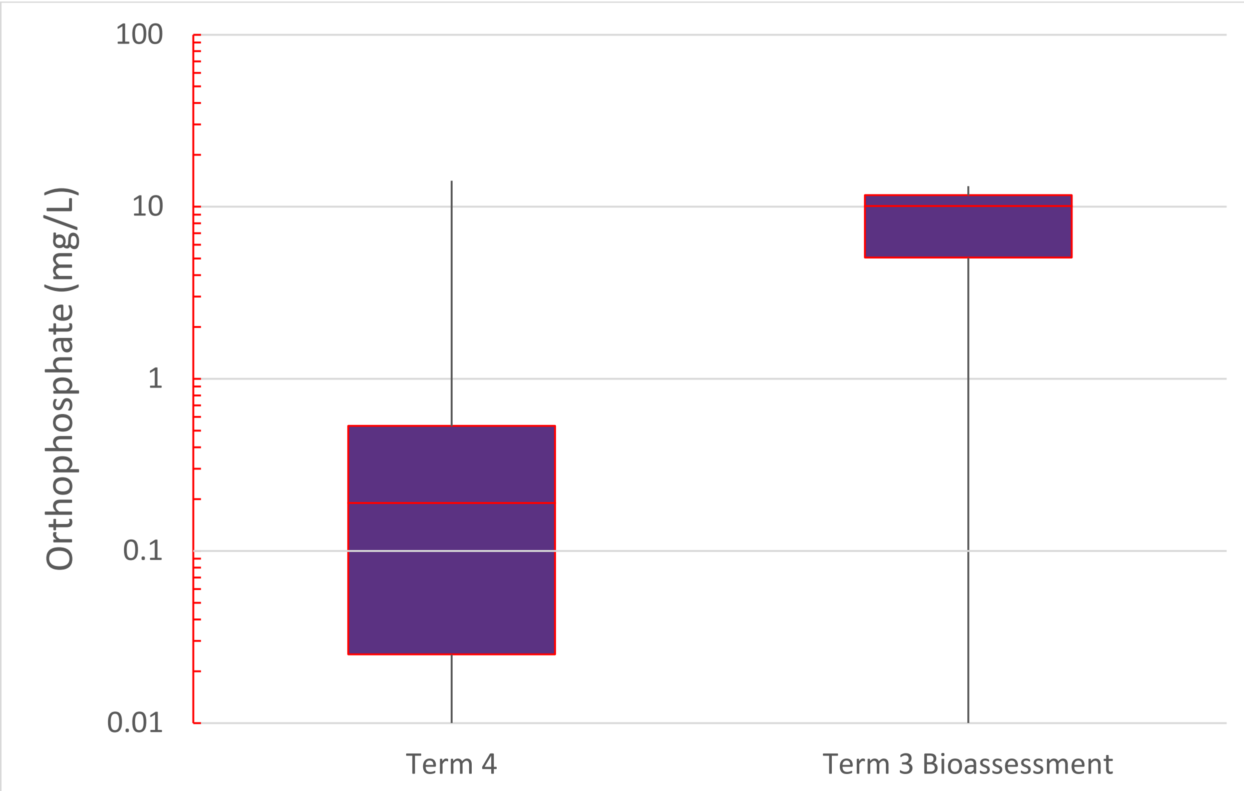
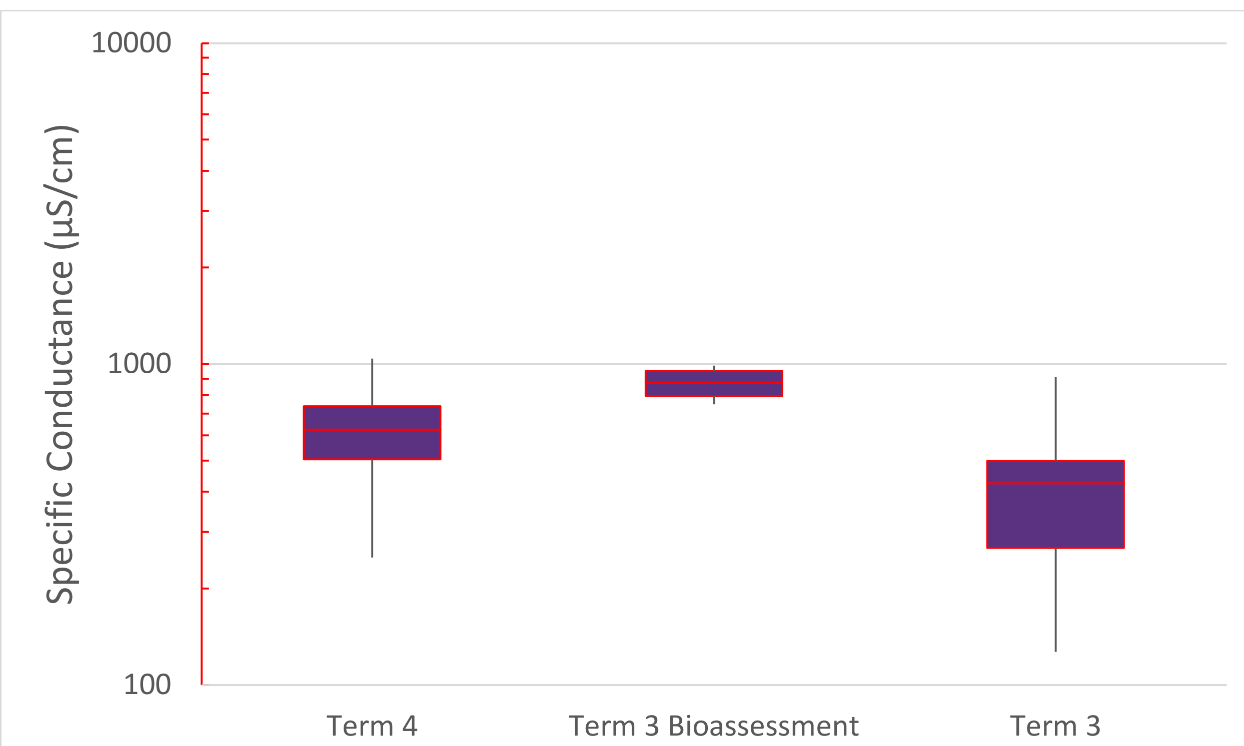


Figure 4-34 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms Specific Conductance Data at Duck Creek



4.4.6.3. Biological Data Analysis

No bioassessment monitoring data was collected within this watershed within this monitoring term. Bioassessment data from the third term were used in the analyses described in Section 4.4.6.2.

4.4.6.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that although there were no large-scale development activities, there may have been small scale construction activities that occurred throughout the drainage area. Industrial/commercial activities such as bulk material storage yards may also have contributed to the TSS loadings. Lastly, the Duck Creek channel has undergone significant streambank erosion which may also be a source of TSS.

Given the commercial land uses in the subwatershed there are potential sources of illicit connections, unauthorized discharges, or illegal dumping that may contribute to TDS and BOD. Additional sources of TDS, BOD, and nutrients can be from wastewater effluent. Elevated nutrient concentrations may have been a factor in the elevated BOD concentrations due to increased organic matter in the stream. In addition to illicit connections, sources of ammonia nitrogen, nitrate nitrogen, total nitrogen, orthophosphate, dissolved phosphorus, and total phosphorus could include over fertilization in residential and commercial areas. During the third term bioassessments, it was noted that an absence of substantial aquatic plant growth and dissolved oxygen levels below saturation was indicating nitrogen and phosphorus are not substantially assimilated by aquatic vegetation in the study reach or immediately upstream of the study reach. The lack of substantial plant growth suggests shading from trees along the creek may be preventing adequate sunlight from reaching the creek and aquatic plants from utilizing the high nutrient concentrations. Riparian alteration can affect nitrogen uptake and cycling and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003).

Land use of the Duck Creek subwatershed includes several industrial and commercial land uses as well as roadways which may contribute to TDS, total copper, and total lead. Potential sources of bacteria loading may be from pets/domestic animals, illicit connections, or wastewater upsets.

BMPs recommended for these sources include compliance inspections for illicit connections, public education for illegal dumping, identification and removal of illegal dumping areas, public education of home and business owners regarding fertilization and turf management, review of construction site inspection protocols or BMP requirements, review of industrial inspection protocols or BMP requirements, review and inspection of wastewater treatment plant for potential maintenance or redesign, stream stabilization, and street sweeping.

4.4.6.5. Monitoring Recommendations

Data analyzed presented multiple exceedances to various criteria, screening levels, and comparison datasets. There are currently no TMDLs or impairments for Duck Creek but there is a TMDL for TDS and sulfate in the East Fork of the Trinity River. Additional monitoring at this site is recommended to be assigned a high priority. It is recommended that bioassessment monitoring is continued. In order to determine the concentration of bioavailable metals, it is recommended that sampling of dissolved fractions of copper and lead is conducted.

4.4.7. Estelle Creek

The City of Irving performed bioassessment and chemical monitoring on Estelle Creek (TCEQ segment 0841J). The stream has a stream order of one and is located within the Estelle Creek – Bear Creek watershed.

Estelle Creek – Bear Creek is located in Tarrant and Dallas Counties. The 16,957-acre watershed is primarily comprised of open (32.3%) space located around Bear Creek with significant roadway (30.6%) land use around the DFW International Airport. Residential land use (17%) can be found in the east and west of the watershed. There are several industrial (6.2%) sites in scattered locations and commercial land use is estimated at 10.7%. There are 3.2% identified water features.

The City of Irving had one chemical monitoring site located in the watershed. The monitoring site, IR2002/2102, was located at West Rochelle Road. The area delineated for this sampling site was 1,458.7 acres and was dominated by roads (43.9%) due to DFW International Airport and the PGBT. Commercial properties (10.7%) and open space (30.5%) were found throughout. Residential land use composed 14.8% of the drainage site and no industrial land use or water features were present.

The monitoring site, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 7. The subwatershed area is within the jurisdictional limits of the City of Irving. NTTA contributed flow to the subwatershed through SH 161 (PGBT) and TxDOT contributed flow through SH 183. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.7.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-6. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-6 Estelle Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia N (mg/L)	Nitrate N (mg/L)
No. of Samples	8	8	8	8	8	8	8
Minimum	111.0	23.80	3.40	5.00	0.910	0.049	0.333
Maximum	266	171.0	21.20	71.7	2.07	0.160	1.200
Median	154.0	68.00	5.97	35.60	1.600	0.117	0.580
Arithmetic Mean	174.0	79.36	8.44	34.78	1.517	0.115	0.633
Geometric Mean	165.8	61.50	7.07	24.84	1.464	0.106	0.586
Standard Deviation	59.2	58.84	6.12	22.93	0.400	0.044	0.278
Coefficient of Variation	0.34	0.74	0.72	0.66	0.26	0.38	0.44

Parameter	Phosphorus, Dissolved (mg/L)	Ortho-phosphate (mg/L)	Phosphorus, Total (mg/L)	Arsenic, Total (mg/L)	Chromium, Total (mg/L)	Copper, Total (mg/L)	Lead, Total (mg/L)
No. of Samples	8	8	8	8	8	8	8
Minimum	0.027	0.010	0.061	0.001	0.004	0.005	0.001
Maximum	0.260	0.222	0.310	0.006	0.019	0.015	0.005
Median	0.085	0.093	0.149	0.002	0.008	0.009	0.002
Arithmetic Mean	0.094	0.086	0.183	0.003	0.010	0.009	0.003
Geometric Mean	0.076	0.048	0.158	0.002	0.009	0.008	0.002
Standard Deviation	0.073	0.076	0.100	0.002	0.005	0.003	0.002
Coefficient of Variation	0.774	0.882	0.548	0.593	0.553	0.378	0.588

Parameter	Zinc, Total (mg/L)	Oil & Grease (mg/L)	pH, Field (su)	Specific Conductivity (µS/cm)	Temperature (°F)	E. Coli (col/100 mL)	Atrazine (µg/L)
No. of Samples	8	8	8	8	8	8	8
Minimum	0.015	0.18	8.20	202	49.8	323.0	0.02
Maximum	0.065	3.20	9.30	813	81.4	24196	0.08
Median	0.038	0.88	8.85	564	67.6	2934	0.05
Mean	0.037	1.18	8.81	514	66.7	6071	0.05
Geometric Mean	0.033	0.78	8.80	464	65.8	2916	0.05
Standard Deviation	0.018	1.05	0.39	219	12.3	7978	0.02
Coefficient of Variation	0.486	0.89	0.04	0.43	0.18	1.31	0.32

4.4.7.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, and NSQD data where applicable. These graphs are located in Appendix I. During the fourth monitoring term, there were three exceedances of the pH TCEQ basin specific criterion (January 2020 and January and April 2021) and seven exceedances of the *E. coli* PCR single sample criterion (multiple events across the period and the *E. coli* PCR geometric mean criterion was exceeded). In addition, there were two occurrences where the TSS concentration (January 2020 and April 2021), one occurrence where the BOD concentration (January 2021), and one occurrence where the dissolved phosphorus concentration (April 2020) was higher than 75% of NSQD data for each parameter. There was one occurrence where the specific conductance exceeded the NRSA good category into the fair category (June 2021). Lastly, CRP data indicated two exceedances due to low dissolved oxygen in April 2019 and April 2020.

Due to the exceedances and elevated concentrations discussed above and the availability of bioassessment, CRP, and wet weather chemical data, boxplots were created for BOD, pH, specific conductance, and *E. coli* for comparison of the datasets. The BOD, pH, and *E. coli* boxplots show significant differences between the bioassessment and CRP and the wet weather data indicating that these constituents had higher concentrations during runoff events (Figures 4-35, 4-36, and 4-38). The specific conductance boxplot does not indicate that stormwater runoff is providing a significantly different input of specific conductance to the stream compared to the bioassessment data which was collected during dry weather (see Figure 4-37).

Figure 4-35 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP BOD Data at Estelle Creek

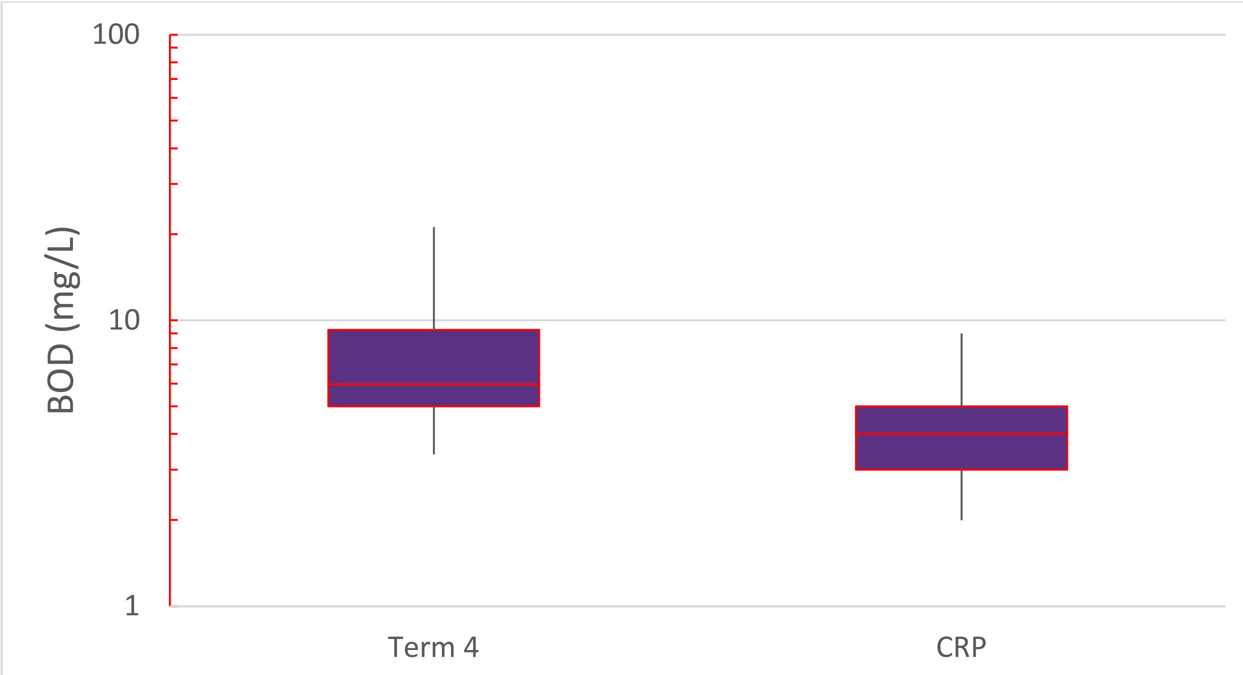


Figure 4-36 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP pH Data at Estelle Creek

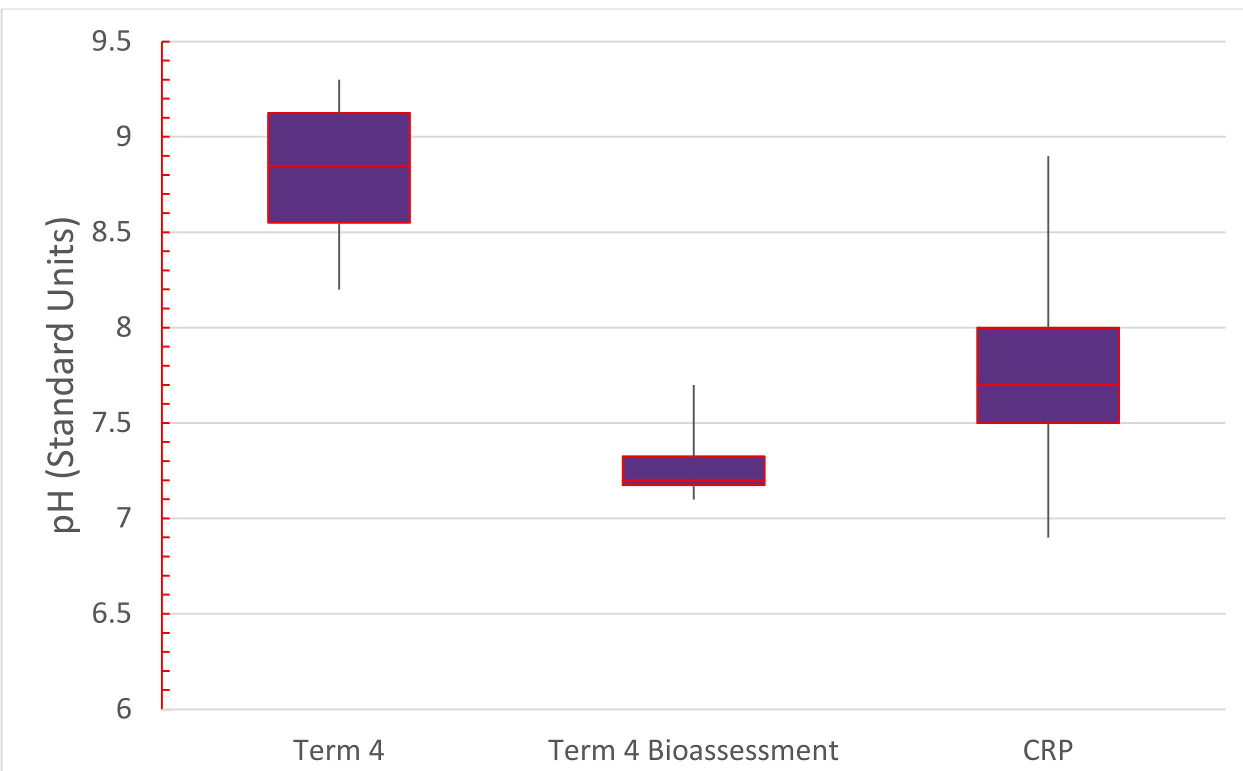


Figure 4-37 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Specific Conductance Data at Estelle Creek

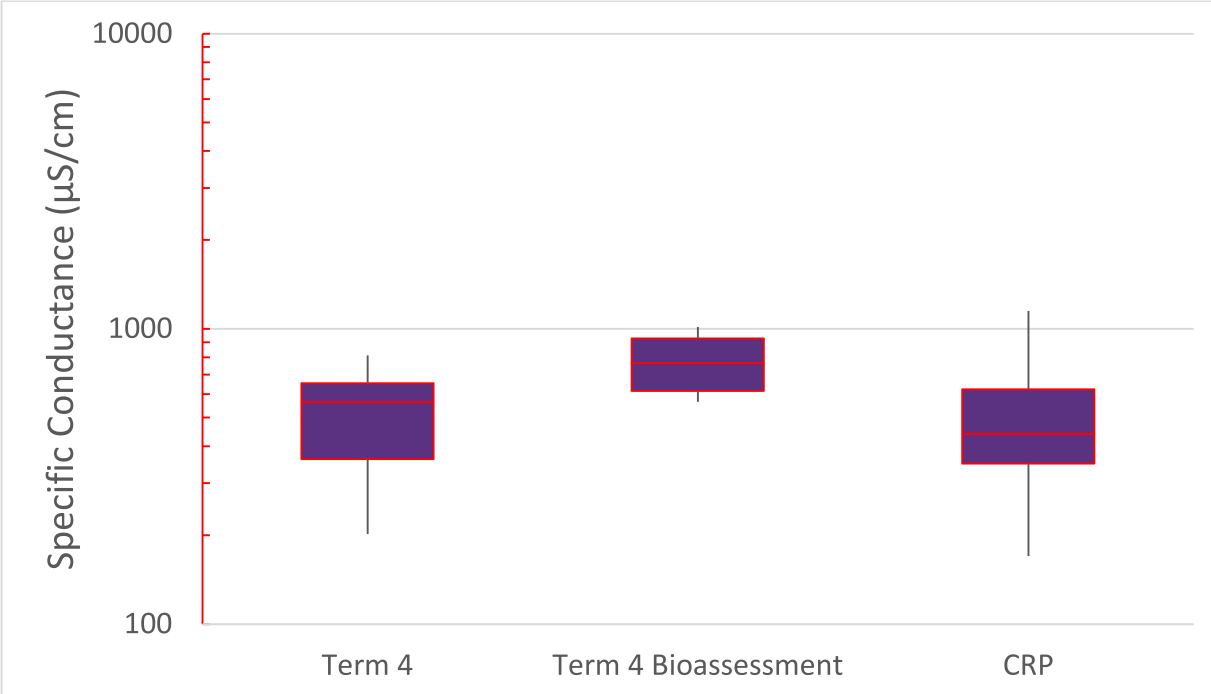
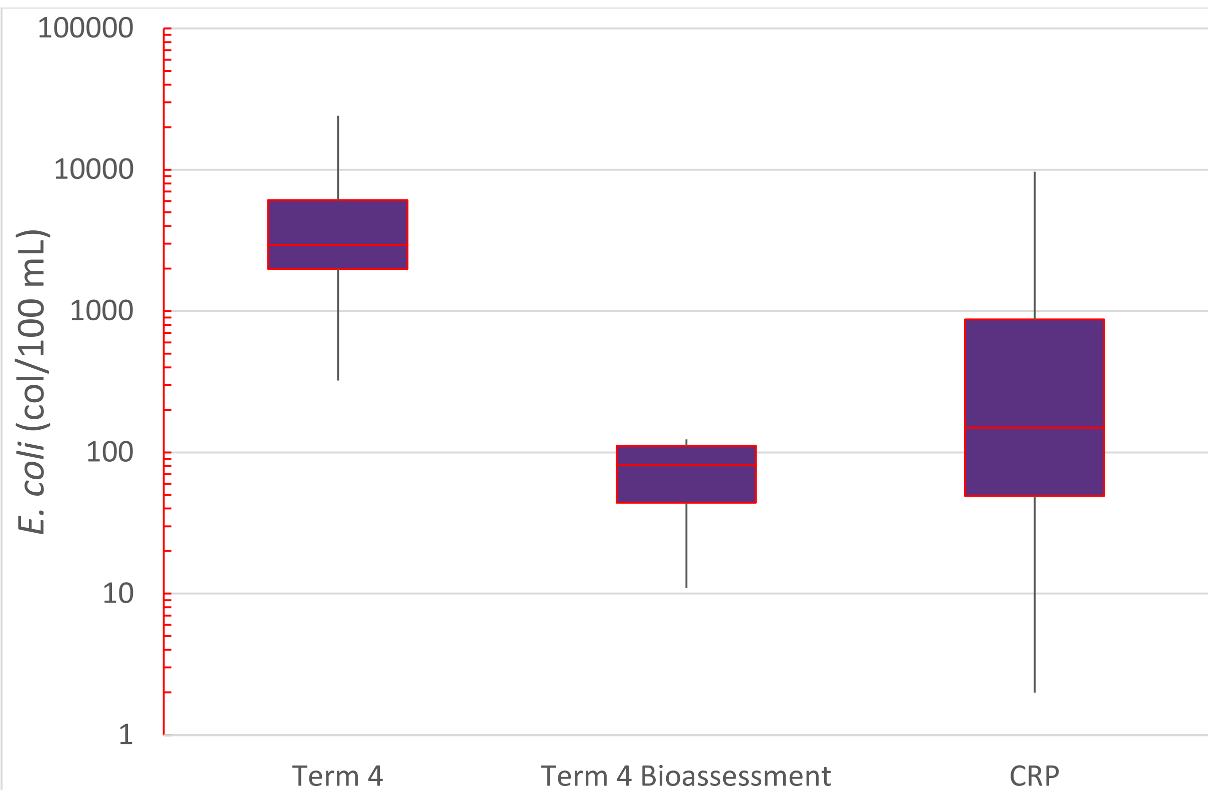


Figure 4-38 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP *E. coli* Data at Estelle Creek



4.4.7.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4

(NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix I).

Estelle Creek, in the reach studied, received intermediate habitat scores and limited to intermediate benthic macroinvertebrate community and fish community scores. Overall, Estelle Creek appears to meet the intermediate ALU established in Texas' surface water quality standards. Estelle Creek is a highly altered watercourse with two low-head dams within the study reach that form impoundments. The creek is confined to a concrete channel for over 3 miles. The 2-year results were mixed with alternating limited and intermediate ALU benthic scores. Despite an intermediate ranking for the average of 4 benthic samples, Estelle Creek has poor benthic macroinvertebrate habitat with only one small riffle.

4.4.7.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that construction activities occurred on the Estelle Creek channel during the monitoring term. Given the commercial land uses in the subwatershed there are potential sources of illicit connections, unauthorized discharges, or illegal dumping that may contribute to BOD. Elevated nutrient concentrations may have been a factor in the elevated BOD concentrations due to increased organic matter in the stream. In addition to illicit connections, sources of dissolved phosphorus could include over fertilization in residential and commercial areas. Elevated BOD and dissolved phosphorus concentrations may have been a factor in the low dissolved oxygen concentrations recorded in the CRP data below TCEQ criteria for aquatic life protection. For bacteria, there was a significant difference to the stormwater biased dataset. Potential sources of bacteria loading may be wildlife and domestic animals from the residential and commercial areas.

The pH exceedances occurred during stormwater runoff events in the winter (January) and spring (April). A potential source of the elevated pH may be roadway deicing.

BMPs recommended for these sources include compliance inspections for illicit connections, public education of home and business owners regarding fertilization and turf management, public education for pet owners regarding pet waste management, review of construction site inspection protocols or BMP requirements, review/improvement of roadway deicing protocols, and street sweeping.

4.4.7.5. Monitoring Recommendations

Data analyzed presented multiple exceedances to various criteria, screening levels, and comparison datasets. There is a TMDL for bacteria for Estelle Creek. Additional monitoring at this site is recommended to be assigned a high priority. It is recommended that bioassessment monitoring is continued.

4.4.8. Fish Creek

The City of Arlington performed chemical monitoring on Fish Creek (TCEQ segment 0841K). The stream has a stream order of three or greater and is located within the Fish Creek – Mountain Creek Lake watershed.

Fish Creek – Mountain Creek Lake is located in southeast of Tarrant County and southwest of Dallas County and has a total area of 27537.3-acre. The land use is predominantly made up of open space (35.2%) and residential areas (28.7%). Roads cover up 20.1% of land use and includes the Tarrant Arlington Municipal, and part of Grand Prairie Municipal airports. Commercial (11.3%) and Industrial (2.2%) areas are spread out along the subwatershed, and water features counts for 2.5% of land use composition.

The City of Arlington had one chemical monitoring site located in the watershed. The monitoring site, AR1802/1902, was located at SH360. The area delineated for this sampling site was 4915.5-acres and consisted predominantly of residential (33.7%) and open space (20.5%) properties and commercial (18.2%). Arlington Municipal Airport was located inside of this drainage site and composed roads land use of 26.0%. Industrial (1.4%) land use was observed west of Arlington Municipal Airport. Water bodies counted for 0.1%

of this delineated drainage site.

The monitoring site, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 8. The monitoring site is shown as AR1902. AR1802 was located in the same location. The subwatershed area is within the jurisdictional limits of the City of Arlington. TxDOT contributes flow to the subwatershed through SH 360 and I-20. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.8.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-7. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-7 Fish Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia N (mg/L)	Nitrate N (mg/L)
No. of Samples	8	8	8	8	8	8	8
Minimum	156.0	23.60	0.50	12.00	0.500	0.120	0.070
Maximum	770	325.0	28.00	98.3	3.60	1.090	0.630
Median	420.0	87.00	6.10	21.50	2.300	0.236	0.440
Arithmetic Mean	450.5	138.79	8.42	35.99	2.238	0.390	0.413
Geometric Mean	403.8	90.42	5.02	28.32	1.935	0.290	0.358
Standard Deviation	212.5	121.93	8.80	29.50	1.064	0.342	0.167
Coefficient of Variation	0.47	0.88	1.04	0.82	0.48	0.877	0.405
Parameter	**Phosphorus, Dissolved (mg/L)**	**Orthophosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	8	8	8	8	8	8	8
Minimum	0.039	0.003	0.025	0.001	0.002	0.003	0.001
Maximum	0.152	0.470	3.720	0.009	0.026	0.088	0.018
Median	0.050	0.034	0.123	0.005	0.005	0.012	0.004
Arithmetic Mean	0.073	0.108	0.620	0.005	0.007	0.028	0.006
Geometric Mean	0.065	0.043	0.177	0.004	0.005	0.014	0.004
Standard Deviation	0.043	0.159	1.262	0.003	0.008	0.033	0.006
Coefficient of Variation	0.585	1.472	2.037	0.607	1.091	1.179	0.928
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	8	8	8	8	8	8	8
Minimum	0.014	0.70	8.10	188	51.0	10.0	0.005
Maximum	0.177	2.92	9.10	1325	83.6	4352	0.058
Median	0.057	2.20	8.50	542	70.6	1025	0.050
Mean	0.079	1.93	8.53	697	69.6	1626	0.040
Geometric Mean	0.053	1.71	8.52	551	68.8	293	0.029
Standard Deviation	0.066	0.91	0.32	472	11.4	1869	0.022
Coefficient of Variation	0.844	0.47	0.04	0.68	0.16	1.15	0.544

4.4.8.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, and NSQD data where applicable. These graphs are located in Appendix J. During the fourth monitoring term, there was one exceedance of the TCEQ aquatic life use estimated chronic criterion for total copper (July 2018), one exceedance of the TCEQ aquatic life use estimated acute criterion for total copper (August 2018), one exceedance of the pH TCEQ basin specific criterion (October 2018), and four exceedances of the *E. coli* PCR single sample criterion (multiple events across the period and the *E. coli* PCR geometric mean criterion was exceeded). There were three ammonia nitrogen (July, August, and October 2018), one orthophosphate (July 2018), and one total phosphorus (October 2018) exceedances of the TCEQ nutrient screening criteria. In addition, there were three occurrences where the TSS concentration (October 2018 and July and October 2019), one occurrence where the BOD concentration (October 2019), one occurrence where the COD concentration (July 2018), and two occurrences where the total nitrogen (July and October 2019) was higher than 75% of NSQD data for each parameter. There were three occurrences where the specific conductance exceeded the NRSA good category into the fair category (October 2018 and January and April 2019).

Due to the exceedances and elevated concentrations discussed above and the availability of CRP and wet weather chemical data, boxplots were created for BOD, ammonia nitrogen, total nitrogen, orthophosphate, total phosphorus, total copper, pH, specific conductance, and *E. coli* for comparison of the datasets. The boxplots do not indicate that stormwater runoff is providing a significantly different input of BOD, orthophosphate, total phosphorus, total copper, specific conductance, or *E. coli* to the stream compared to CRP data which was predominately collected during dry weather (see Figures 4-39, 4-42, 4-43, 4-44, 4-46, and 4-47). However, there is a significant difference between the fourth monitoring term wet weather data for total nitrogen, ammonia nitrogen and pH and CRP data indicating the stormwater runoff typically was observed to have higher concentrations of these pollutants than dry weather flow (see Figures 4-40, 4-41, and 4-45). There was no difference between the monitoring terms for orthophosphate, total phosphorus, total copper, and pH (Figures 4-42, 4-43, 4-44, and 4-45). For BOD and *E. coli*, the observed concentrations in the fourth term were lower than the second term (Figures 4-39 and 4-47). For total nitrogen, the observed concentrations in the second term were higher than the fourth term (Figure 4-41).

Figure 4-39 Boxplot Comparing Wet Weather Chemical Monitoring Second and Fourth Monitoring Terms and CRP BOD Data at Fish Creek

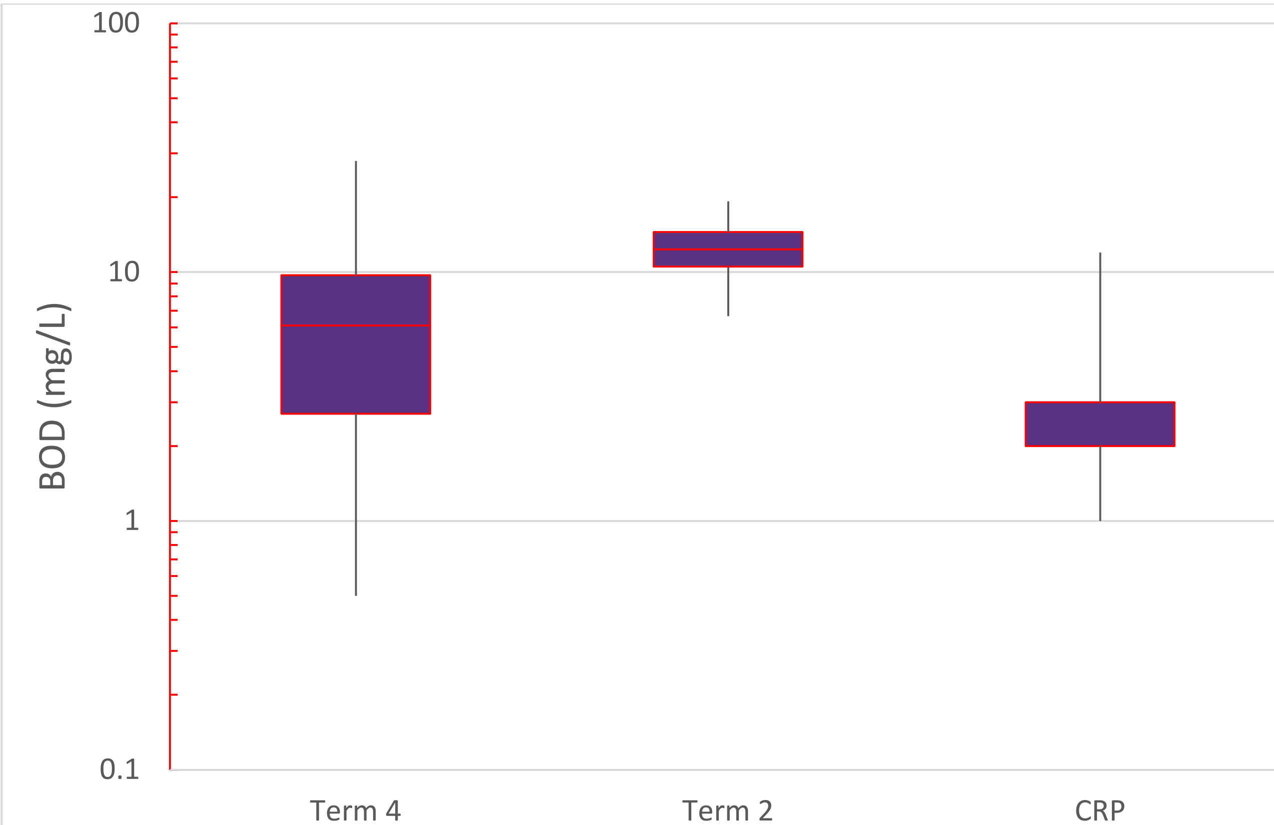


Figure 4-40 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Ammonia Nitrogen Data at Fish Creek

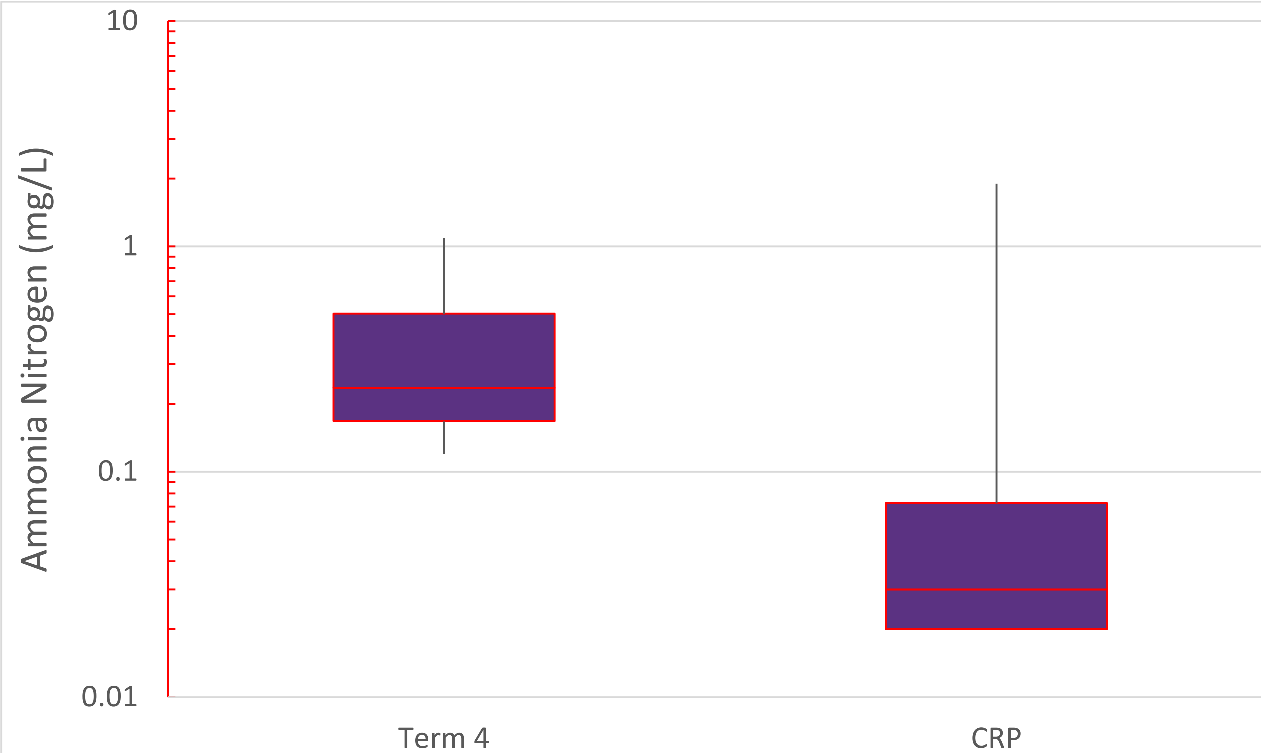


Figure 4-41 Boxplot Comparing Wet Weather Chemical Monitoring Second and Fourth Monitoring Terms and CRP Total Nitrogen Data at Fish Creek

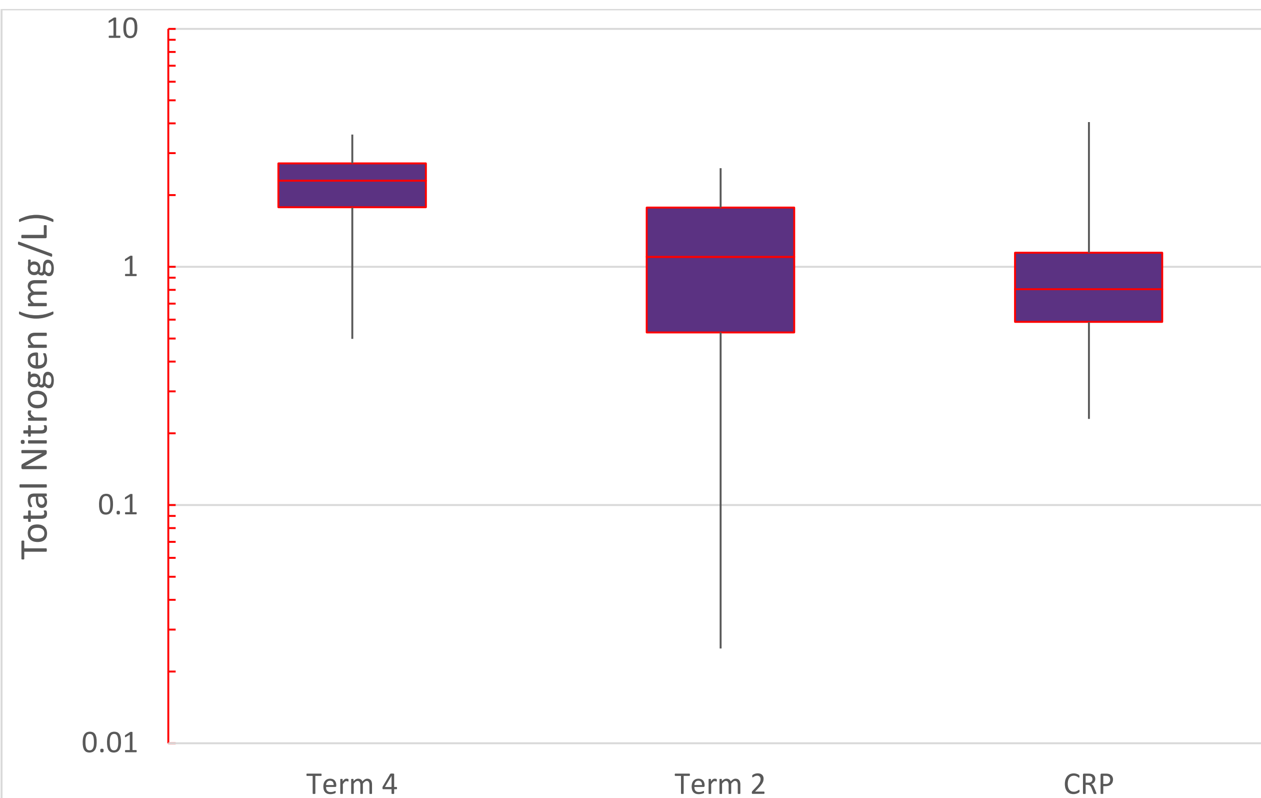


Figure 4-42 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Orthophosphate Data at Fish Creek

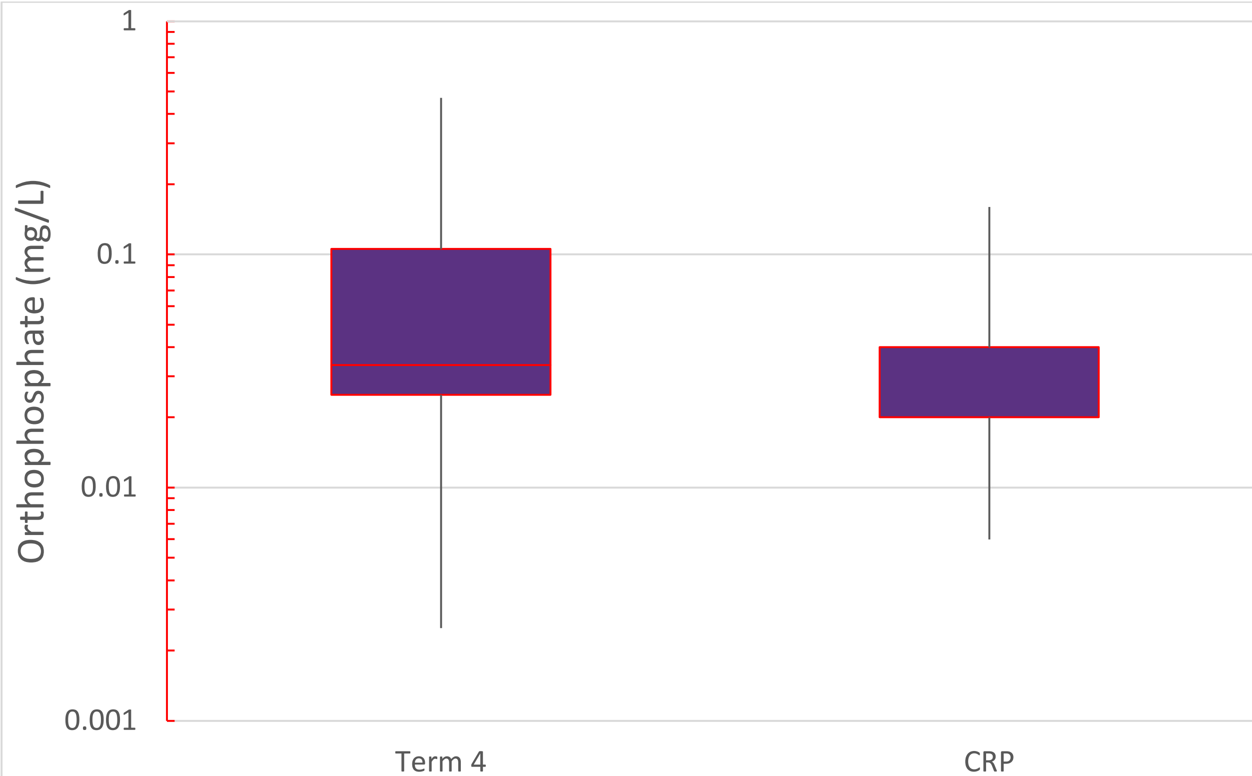


Figure 4-43 Boxplot Comparing Wet Weather Chemical Monitoring Second and Fourth Monitoring Terms and CRP Total Phosphorus Data at Fish Creek

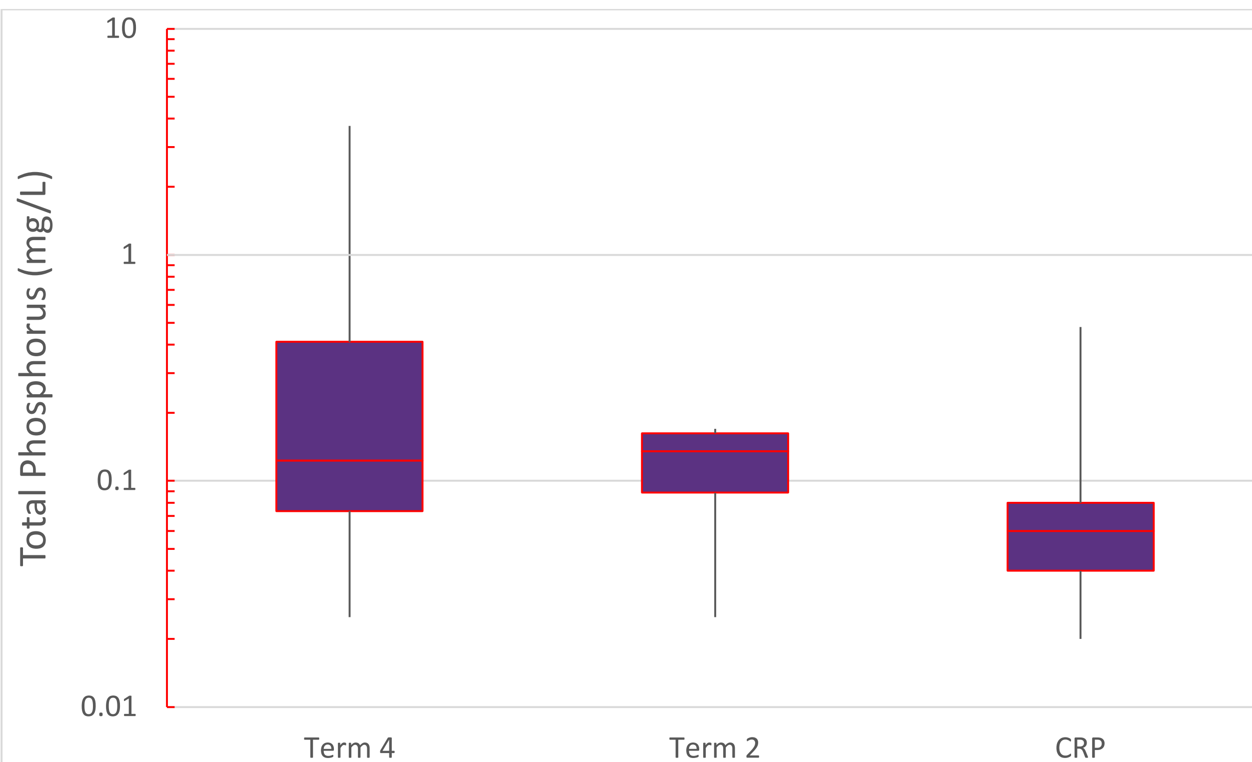


Figure 4-44 Boxplot Comparing Wet Weather Chemical Monitoring Second and Fourth Monitoring Terms and CRP Total Copper Data at Fish Creek

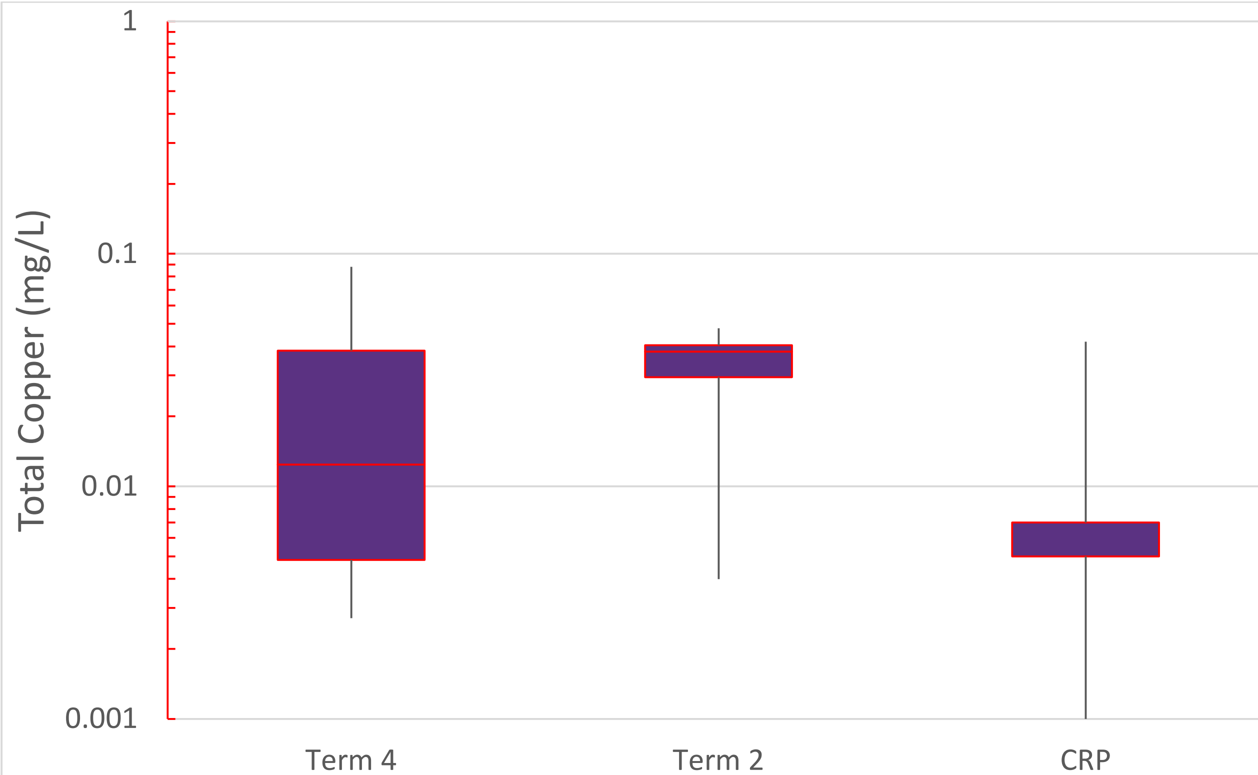


Figure 4-45 Boxplot Comparing Wet Weather Chemical Monitoring Second and Fourth Monitoring Terms and CRP pH Data at Fish Creek

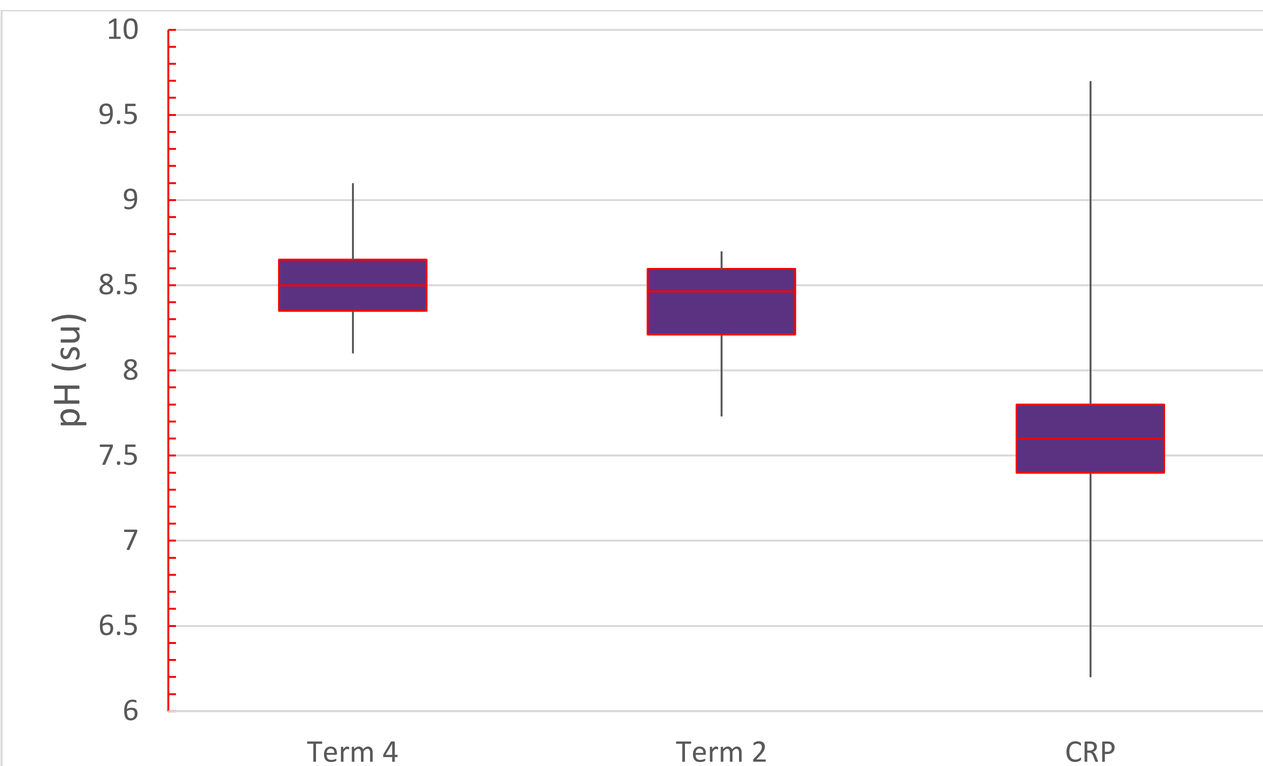


Figure 4-46 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Specific Conductance Data at Fish Creek

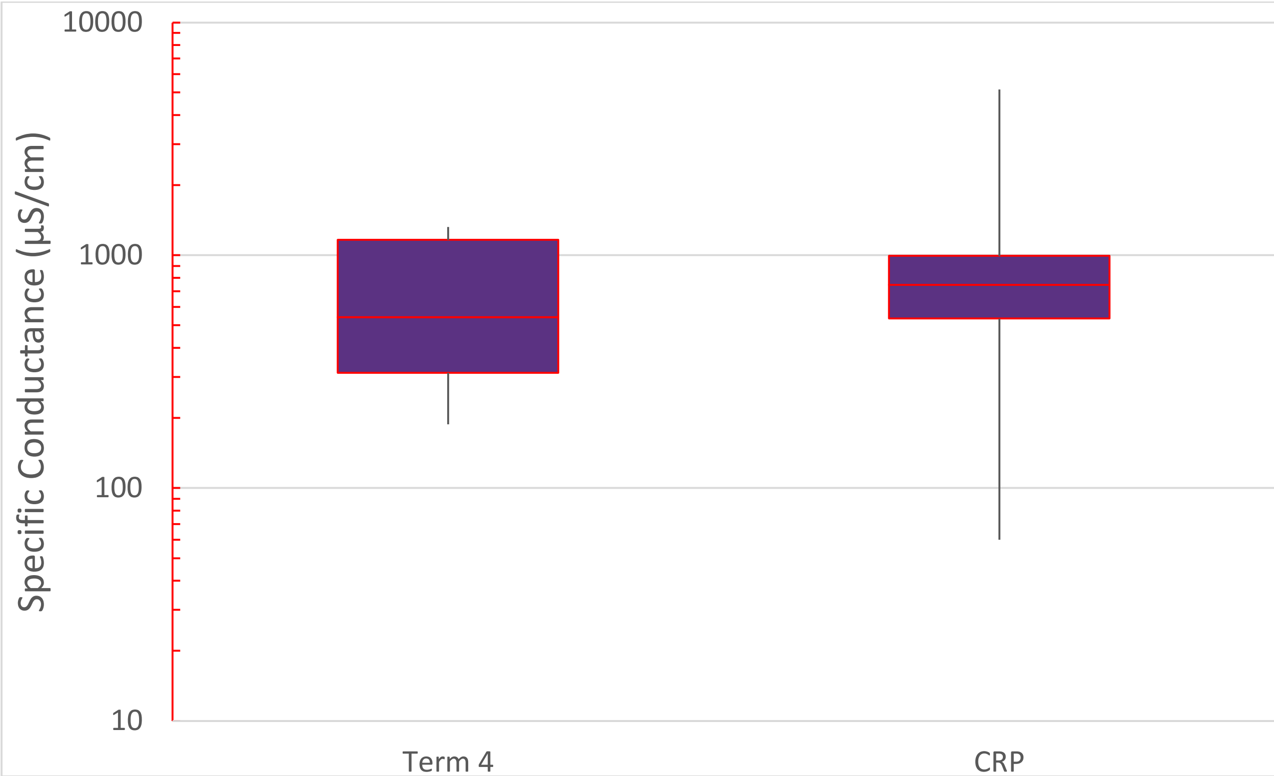
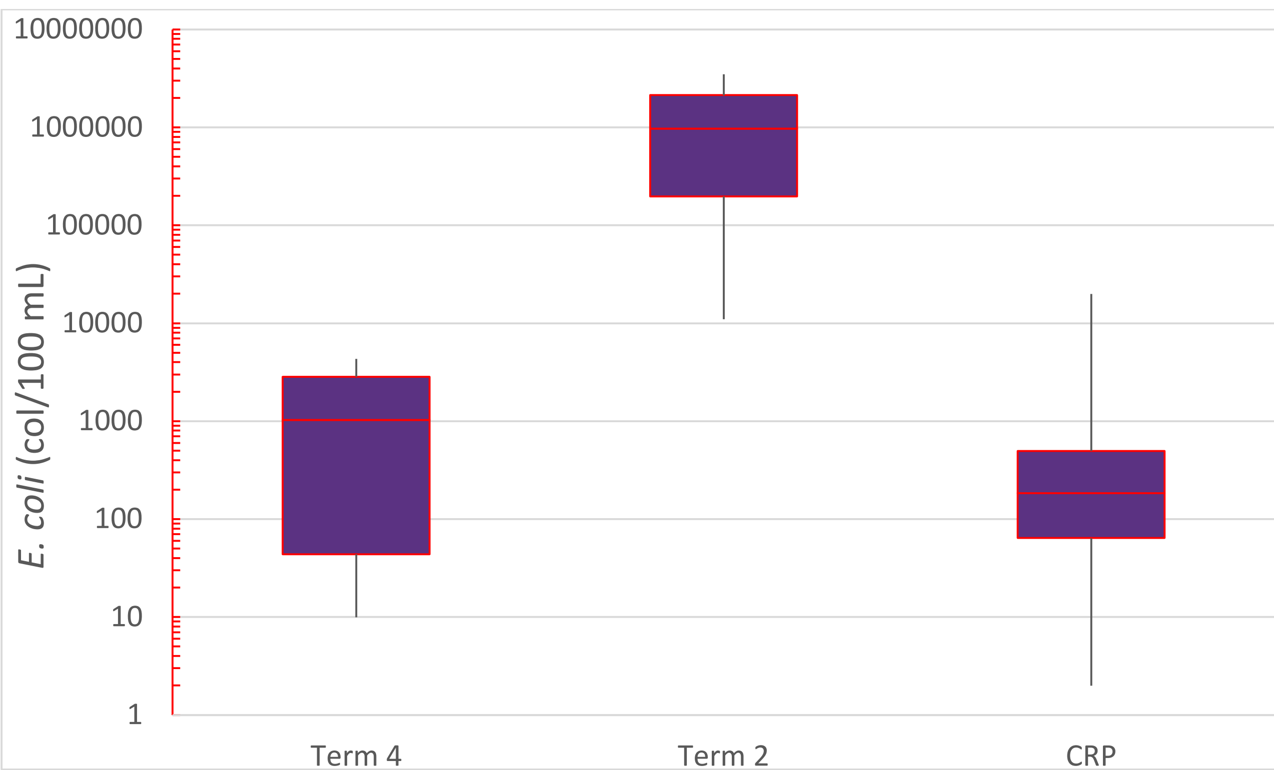


Figure 4-47 Boxplot Comparing Wet Weather Chemical Monitoring Second and Fourth Monitoring Terms and CRP *E. coli* Data at Fish Creek



4.4.8.3. Biological Data Analysis

No bioassessment monitoring data was collected within this watershed.

4.4.8.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period indicated small scale construction activities occurred throughout the drainage area. Industrial/commercial activities such as bulk material storage yards may also have contributed to the TSS loadings.

Given the industrial and commercial land uses in the subwatershed there are potential sources of illicit connections, unauthorized discharges, or illegal dumping that may contribute to BOD and high pH. Elevated nutrient concentrations may have been a factor in the elevated BOD concentrations due to increased organic matter in the stream. In addition to illicit connections, sources of nutrients could include over fertilization in residential and commercial areas. Riparian alteration can also affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003).

Land use of the Fish Creek subwatershed includes several industrial and commercial land uses as well as roadways which may contribute to total copper. Potential sources of bacteria loading may be from pets/domestic animals or illicit connections.

BMPs recommended for these sources include compliance inspections for illicit connections, public education for illegal dumping, identification and removal of illegal dumping areas, public education of home and business owners regarding fertilization and turf management, public education for pet owners regarding pet waste management, review of construction site inspection protocols or BMP requirements, review of industrial inspection protocols or BMP requirements, street sweeping, and review/improvement of roadway BMPs for capture of heavy metals.

4.4.8.5. Monitoring Recommendations

Data analyzed presented multiple exceedances to various criteria, screening levels, and comparison datasets. There is a TMDL and existing impairment for bacteria for Fish Creek. Additional monitoring at this site is recommended to be assigned a high priority. Bioassessment data collection is recommended to determine whether the biological community may be impacted by the chemical pollutants documented above. In order to determine the concentration of bioavailable metals, it is recommended that sampling of the dissolved fraction of copper is conducted.

4.4.9. Five Mile Creek

The City of Dallas performed bioassessment monitoring only each monitoring year of the fourth permit term on Five Mile Creek (TCEQ segment 0805D), a stream with a stream order of three or greater that drains to the Upper Trinity River in the Headwaters Five Mile Creek watershed. The Headwaters Five Mile Creek watershed is located in the southwestern portion of Dallas County (see Appendix B, Figure 9). The bioassessment monitoring station (FIV-D) is located at the Westmoreland Road and Pentagon Parkway intersection at Five Mile Creek. Through visual assessment of the watershed, the Five Mile Creek monitored subwatershed appears to serve a third of the larger identified watershed. Nearly all of the Five Mile Creek subwatershed area is within the jurisdictional limits of the City of Dallas, except for a small area located on the western boundary which is within the jurisdictional limits of the City of Duncanville. TxDOT contributes flow to the subwatershed through SH 12 and SH 303. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.9.1. Summary Statistics

No wet weather chemical monitoring data was collected within this watershed.

4.4.9.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, and the NSQD where applicable. Additional pesticide parameters were collected at station FIV-D by the City of Dallas outside of the RWWCP and are not presented in this report. The Five Mile Creek graphs are located in Appendix K. During the fourth monitoring term, there was one exceedance of the TCEQ aquatic life use estimated acute criterion for total copper (April 2018) and the *E. coli* PCR geometric mean criterion of 126 col/100 mL was exceeded.

The City of Dallas has tracked bacteria trends for *E. coli* at FIV-D over the period of 2007-2021. The geometric mean over the period of record (154 col/100 mL) exceeds the PCR geometric mean standard of 126 col/100 mL. Of 30 samples collected, the City of Dallas has documented 16 exceedances of the bacteria standard over the period of record.

4.4.9.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix K).

The habitat scores remained in the optimal range from 2018 to summer 2019, then the habitat score decreased to the sub-optimal range. The aquatic life use scores remained in the intermediate range over the fourth term except for the summer of 2020 when it decreased to marginal. Given the optimal to sub-optimum habitat, the intermediate to marginal aquatic life use scores indicate that water quality may be limiting fish and macroinvertebrate communities.

Over the fourth monitoring term, the habitat scores for Five Mile Creek in the reach studied were generally in line with the observations in the third monitoring term. Aquatic life use scores were generally lower than observed in the third monitoring term.

4.4.9.4. Potential Pollution Sources and BMP Recommendations

Land use of the Five Mile Creek drainage area was not available from the NCTCOG annual reports. However, a visual analysis of the drainage area reveals a mix of residential, commercial, and open land uses. Commercial land uses as well as roadways may contribute to total copper.

For bacteria, potential sources may be domestic animals, wildlife, and illicit connections. BMPs recommended for these sources include public education for residential landowners and compliance inspections for illicit connections.

BMPs recommended for these sources include compliance inspections for illicit connections, public education for pet owners regarding pet waste management, street sweeping, and review/improvement of roadway BMPs for capture of heavy metals.

Due to sub-optimal habitat scores ranging to optimal, small stream restoration projects may be able to increase the biological productivity of the stream.

4.4.9.5. Monitoring Recommendations

Data analyzed presents low indications of stream degradation. However, bacteria concentrations have a potential to impact primary contact recreation and total copper has the potential to impact aquatic life. There are no TMDLs or impairments identified for Five Mile Creek. There is a current TMDL for bacteria and for legacy pollutants for the Upper Trinity River Segment 0805. Additional monitoring at this site is recommended to be assigned a medium priority.

4.4.10. Floyd Branch

The City of Dallas performed bioassessment monitoring only each monitoring year of the fourth monitoring term on Floyd Branch, a stream with a stream order of one that drains to Cottonwood Creek (TCEQ segment 0827B) in the Floyd Branch – White Rock Creek watershed. The Floyd Branch – White Rock Creek watershed is located in the northern portion of Dallas County (see Appendix B, Figure 10). The bioassessment monitoring station (FLO-A) is located at near Forest Lane and the DART rail. Through visual assessment of the watershed, the Floyd Branch monitored subwatershed appears to serve less than a quarter of the larger identified watershed. Half of the Floyd Branch subwatershed area is within the jurisdictional limits of the City of Dallas, and the remainder is within the jurisdictional limits of the City of Richardson. TxDOT contributes flow to the subwatershed through IH 635 and SH 75. There is one TCEQ permitted wastewater outfall within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022. The permittee is identified as the North Texas Municipal Water District and the outfall is where E. Buckingham Road crosses over Floyd Branch, at Floyd Branch Wastewater Plant.

4.4.10.1. Summary Statistics

No wet weather chemical monitoring data was collected within this watershed.

4.4.10.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, and the NSQD where applicable. Additional pesticide parameters were collected at station FLO-A by the City of Dallas outside of the RWWCP and are not presented in this report. The Floyd Branch graphs are located in Appendix L. During the fourth monitoring term, there was one exceedance of the TCEQ aquatic life use estimated acute criterion for total copper (April 2018) and four exceedances of the *E. coli* PCR single sample criterion. The geometric mean however remained within the PCR geometric mean criterion. There were eight total phosphorus exceedances of the TCEQ nutrient screening criteria.

The City of Dallas has tracked bacteria trends for *E. coli* at FLO-A over the period of 2007-2021. The geometric mean over the period of record (465 col/100 mL) exceeds the PCR geometric mean standard of 126 col/100 mL. Of 33 samples collected, the City of Dallas has documented 33 exceedances of the bacteria standard over the period of record.

4.4.10.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix L).

The habitat scores remained in the sub-optimal range over the fourth term period except for the spring of 2019, spring of 2020, and summer of 2021 when the habitat score increased to the optimal range. The aquatic life use scores remained in the intermediate range over the fourth term period except for the spring of 2020 when the aquatic life use score decreased to marginal. Given the predominately sub-optimum habitat, the intermediate aquatic life use scores generally correspond with the available habitat indicating that water quality may not be limiting fish and macroinvertebrate communities.

Over the fourth monitoring term, the habitat scores for Floyd Branch in the reach studied were generally lower than the observations in the third monitoring term. Aquatic life use scores were generally lower than observed in the third monitoring term.

4.4.10.4. Potential Pollution Sources and BMP Recommendations

Land use of the Floyd Branch drainage area was not available from the NCTCOG annual reports. However, a visual analysis of the drainage area reveals a mix of residential, commercial, and open land uses. Over fertilization in open, residential, and commercial areas may be a source of total phosphorus as may be the treated wastewater effluent. Although nutrient concentrations were observed to be elevated, dissolved oxygen concentrations over the monitoring term did not fall below TCEQ criteria for aquatic life protection.

Several industrial and commercial land uses are visible in the drainage area which may be a potential source of copper. Additional sources of copper could be from illicit connections, illegal dumping, high traffic roadways, and wastewater effluent.

BMPs recommended for these sources include compliance inspections for illicit connections, identification and removal of illegal dumping areas, public education of home and business owners regarding fertilization and turf management, and review and inspection of wastewater treatment plant for potential maintenance or redesign. Due to sub-optimal habitat scores ranging to optimal, small stream restoration projects may be able to increase the biological productivity of the stream.

4.4.10.5. Monitoring Recommendations

Data analyzed presents moderate indications of stream degradation. Nutrients and copper have the potential to impact aquatic life. There are no TMDLs or impairments identified for Floyd Branch or for Cottonwood Creek. Additional monitoring at this site is recommended to be assigned a medium priority.

4.4.11. Grapevine Creek

The City of Irving performed chemical monitoring on Grapevine Creek (TCEQ segment 0822B). The stream has a stream order of two and is located within the Grapevine Creek – Elm Fork Trinity River watershed.

Grapevine Creek – Elm Fork Trinity River is located in Tarrant and Dallas Counties. The 19,441-acre watershed is primarily comprised of open (26.1%) space with significant commercial (20.5%) and residential (19.2%) areas. Roads are estimated at 19.2% due to the close proximity to DFW International Airport. There are several industrial (11.5%) sites in scattered locations. There are 3.6% identified water features.

The City of Irving had one chemical monitoring site located in the watershed. The monitoring site, IR2001/2101, was located at N. Royal Lane. The area delineated for this sampling site was 2,296 acres and was dominated by roads (64.9%) due to DFW International Airport. Industrial properties (26.0%) and a few open spaces (9.2%) are found within the site. There are no residential, commercial or water features within the drainage area.

The monitoring site, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 11. The subwatershed area is within the jurisdictional limits of the City of Irving and the City of Grapevine. TxDOT contributes flow to the subwatershed through SH 121. There is one TCEQ permitted wastewater outfall within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022. The permittee is identified as the DFW International Airport Board and the outfall is along Grapevine Creek, between International Parkway and SH 114.

4.4.11.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-8. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-8 Grapevine Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia N (mg/L)	Nitrate N (mg/L)
No. of Samples	8	8	8	8	8	8	8
Minimum	170.0	21.30	1.00	5.00	0.780	0.014	0.310
Maximum	476	349	9.0	38.1	7.700	0.130	0.760
Median	310.0	66.35	5.90	14.80	1.150	0.092	0.394
Arithmetic Mean	304.0	105.66	4.85	20.06	1.913	0.084	0.472
Geometric Mean	290.8	72.32	3.95	14.83	1.353	0.072	0.447
Standard Deviation	95.6	107.70	2.75	15.01	2.353	0.038	0.170
Coefficient of Variation	0.31	1.02	0.57	0.75	1.23	0.45	0.36
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead , Total (mg/L)**
No. of Samples	8	8	8	8	8	8	8
Minimum	0.016	0.010	0.038	0.001	0.002	0.005	0.001
Maximum	0.066	0.160	0.280	0.008	0.006	0.012	0.004
Median	0.044	0.016	0.089	0.002	0.003	0.008	0.002
Arithmetic Mean	0.043	0.046	0.116	0.003	0.004	0.008	0.002
Geometric Mean	0.039	0.026	0.088	0.003	0.004	0.007	0.002
Standard Deviation	0.018	0.055	0.092	0.002	0.002	0.003	0.001
Coefficient of Variation	0.418	1.183	0.790	0.705	0.442	0.323	0.550
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field**	**Specific Conductivity**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (μg/L)**
No. of Samples	8	8	8	8	8	8	8
Minimum	0.025	0.18	8.60	144	52.1	331.0	0.02
Maximum	0.075	4.40	9.20	1030	79.4	8164	1.65
Median	0.035	1.00	8.90	531	66.7	1985	0.05
Mean	0.039	1.61	8.94	550	67.8	2954	0.26
Geometric Mean	0.036	0.91	8.93	475	67.2	1634	0.08
Standard Deviation	0.016	1.64	0.24	287	9.0	3183	0.56
Coefficient of Variation	0.425	1.01	0.03	0.52	0.13	1.08	2.13

4.4.11.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, and NSQD data where applicable. These graphs are located in Appendix M. During the fourth monitoring term, there were three exceedances of the pH TCEQ basin specific criterion (October 2020, April 2021, and October 2021), and seven exceedances of the *E. coli* PCR single sample criterion (multiple events across the period and the *E. coli* PCR geometric mean criterion was exceeded). In addition, there were two occurrences where the TSS concentration (January 2020 and October 2020) was higher than 75% of NSQD data. There was one occurrence (July 2020) where the specific conductance exceeded the NRSA good category into the fair category.

Due to the exceedances and elevated concentrations discussed above and the availability of CRP and wet weather chemical data, boxplots were created for pH, specific conductance, and *E. coli* for comparison of the datasets. The boxplots do not indicate that stormwater runoff is providing a significantly different input of specific conductance to the stream compared to CRP data which was predominately collected during dry weather (see Figure 4-49). However, there is a significant difference between the fourth monitoring term wet weather data for pH and *E. coli* and CRP data indicating the stormwater runoff typically was observed to have higher concentrations of these pollutants than dry weather flow (see Figures 4-48 and 4-50).

Figure 4-48 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP pH Data at Grapevine Creek

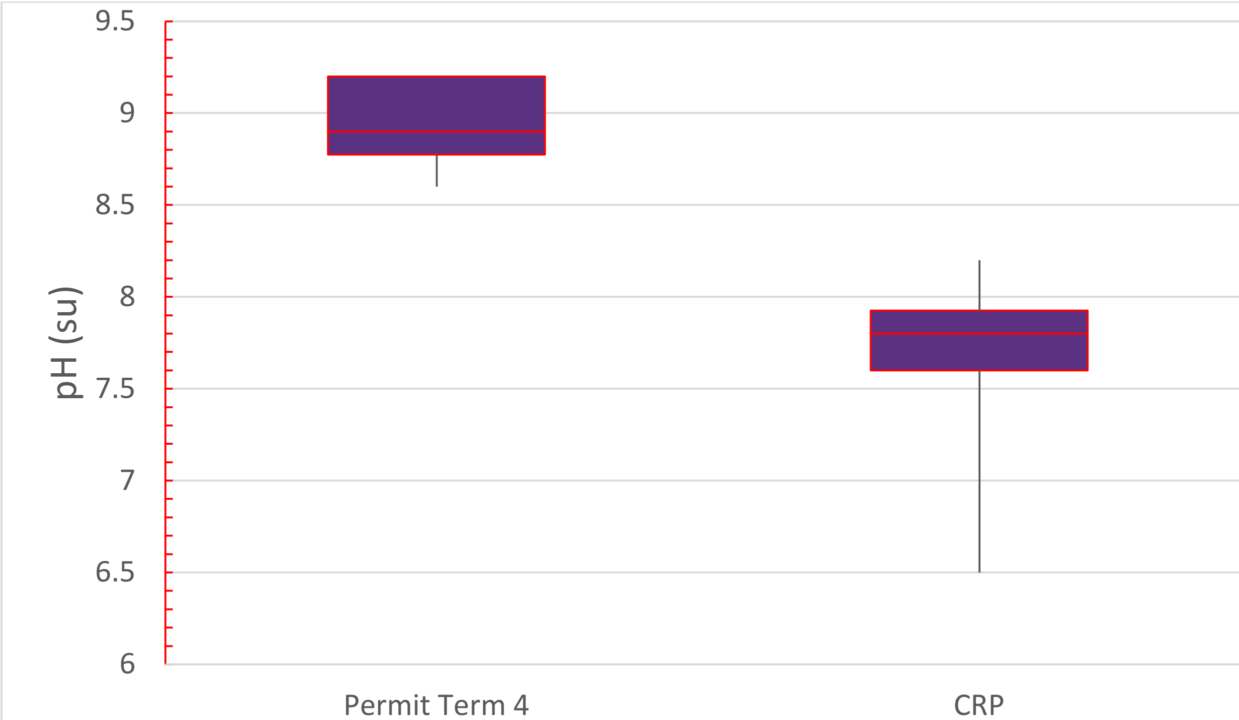


Figure 4-49 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Specific Conductance Data at Grapevine Creek

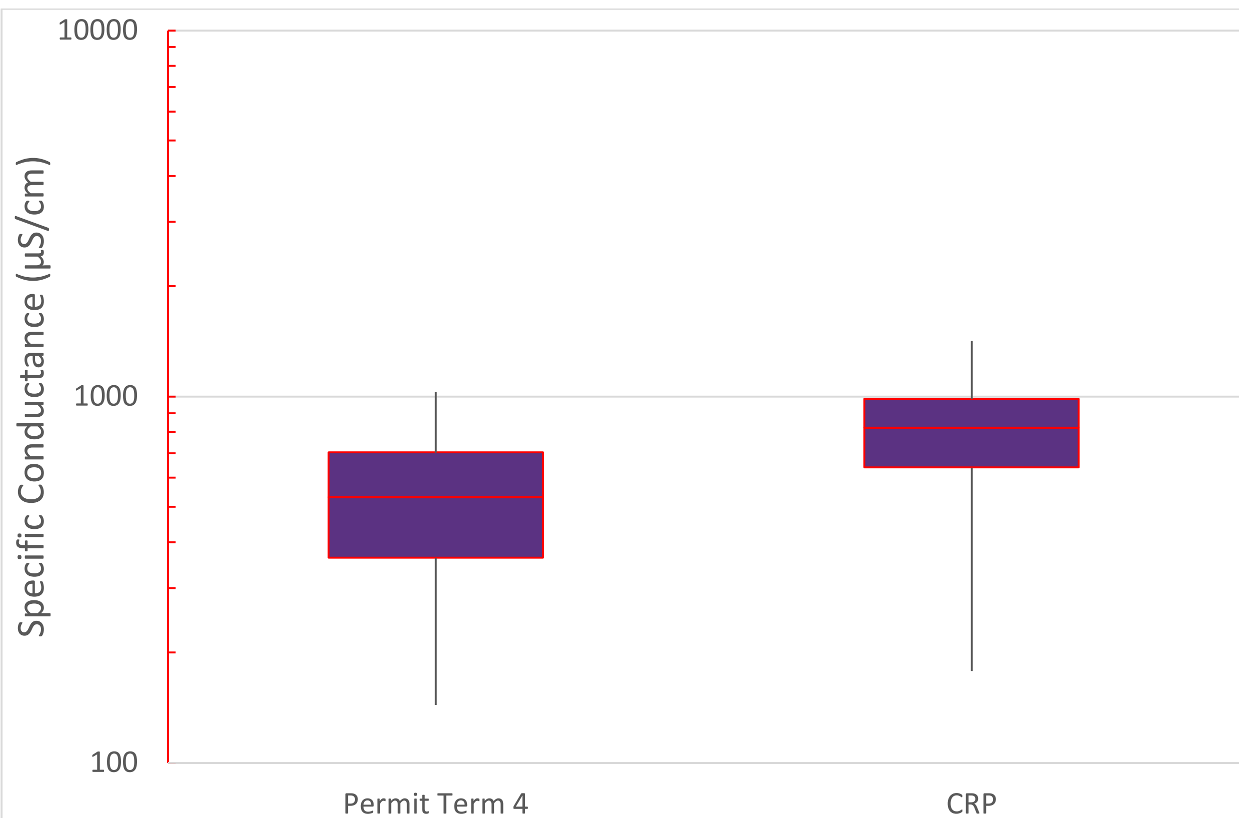
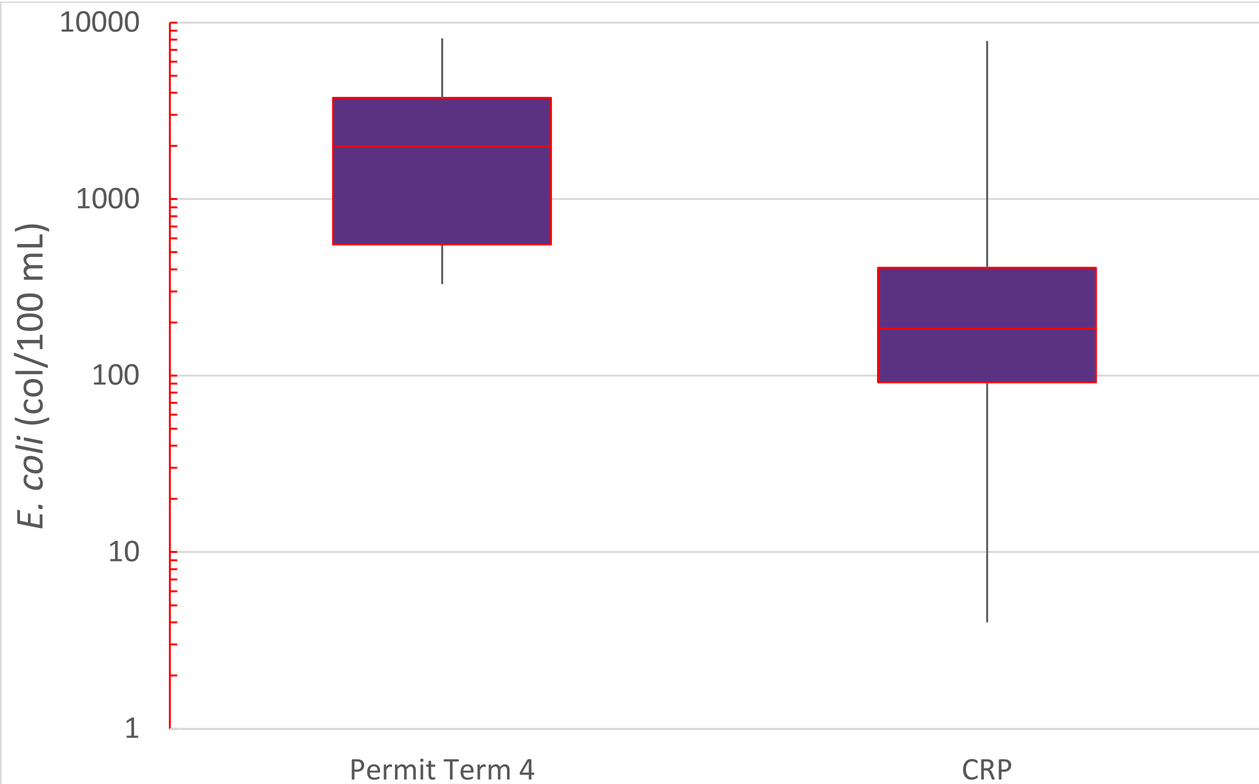


Figure 4-50 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP *E. coli* Data at Grapevine Creek



4.4.11.3. Biological Data Analysis

No bioassessment monitoring data was collected within this watershed.

4.4.11.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that there were construction activities that occurred within the drainage area. The development was located at DFW Airport. Industrial activities such as bulk material storage yards may also have contributed to the TSS loadings. Given the industrial land uses in the subwatershed there are potential sources of illicit connections, unauthorized discharges, or illegal dumping that may contribute to high pH and *E. coli*. Other potential sources of bacteria loading may be from wildlife.

BMPs recommended for these sources include compliance inspections for illicit connections, public education for illegal dumping, identification and removal of illegal dumping areas, review of construction site inspection protocols or BMP requirements, review of industrial inspection protocols or BMP requirements, and street sweeping.

4.4.11.5. Monitoring Recommendations

Data analyzed presented multiple exceedances to various criteria, screening levels, and comparison datasets. There is a TMDL and existing impairment for bacteria for Grapevine Creek. Additional monitoring at this site is recommended to be assigned a high priority. Bioassessment data collection is recommended to determine whether the biological community may be impacted by the chemical pollutants documented above.

4.4.12. Honey Springs Branch

The City of Dallas performed chemical monitoring on Honey Springs Branch, a stream with a stream order of one draining to the Upper Trinity River (TCEQ segment 0805) within the Five Mile Creek – Trinity River watershed.

Five Mile Creek – Trinity River Watershed is located in south-central Dallas County. This 30,309.3-acre watershed is predominately made up of open space (48.1%) and residential (18.9%) property. The open space is along the eastern and southern part of the watershed, along Five Mile Creek and its tributaries. There are several highways (13.2%) that go through this area: IH 20, IH 45, SH 12, SH 31, US 175, and SH 352. The majority of the industrial (4.0%) area is located in the southern part of the watershed, south of IH 20. The commercial (13.6%) sites are in the center of the watershed, along IH 45. This watershed contains 2.3% water features.

The City of Dallas has three chemical monitoring sites located within the Honey Springs Branch subwatershed. The chemical monitoring site, FMC-100 was an upstream sampling site located at the creek's intersection with Linfield Road. This subwatershed covered a 1,096.5-acre area and was primarily composed of residential property (57.1%) dispersed evenly throughout. Roadways accounted for 19.4% of the subwatershed, while commercial property (10.9%) was found in the center of the subwatershed. Open space (12.5%) was along the stream bank. There was one industrial (0.1%) site in the lower watershed. There were no water features in the subwatershed.

The chemical monitoring site, FMC-200 was a midstream sampling site located on the east side of Vandervoort Drive. This subwatershed covered a 1,167.2-acre area and was primarily residential (57.3%) property that was evenly distributed. Roadways made up 19.0% of the area, and commercial (10.5%) property was located close by. Open space (13.1%) was fairly even throughout the drainage area. There was 0.1% industrial land use and no water features in this subwatershed.

The chemical monitoring site, FMC-300 was a downstream sampling site located on the east side of Carbondale Street, downstream from the bridge crossing. This subwatershed covered a 1,509.4-acre area and was predominately residential (48.8%). IH-45 and SH-310 crossed through this subwatershed, and the majority of the commercial (13.5%) property was located along either side of the highways. There was a large industrial site (0.1%) just east of SH-310. Residential property was located in the upper subwatershed, while the open (16.3%) was just below it. There were no water features in this subwatershed.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 12. The subwatershed area is entirely within the jurisdictional limits of the City of Dallas. TxDOT contributes flow to the subwatershed through IH 45 and SH 310. There are no TCEQ permitted wastewater outfalls within the subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.12.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-9. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-9 Honey Springs Branch RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Nitrate N (mg/L)	Ammonia N (mg/L)
No. of Samples	24	24	24	24	24	24	24
Minimum	136.0	21.0	1.00	10.00	0.130	0.020	0.050
Maximum	10020.0	933	81.3	198.30	4.10	0.250	1.670
Median	252.0	91.5	6.62	20.65	1.500	0.079	0.110
Arithmetic Mean	1461.5	150.8	12.72	46.17	1.720	0.093	0.270
Geometric Mean	411.0	98.6	6.93	32.43	1.270	0.075	0.127
Standard Deviation	3200.1	191.3	18.67	47.40	1.188	0.063	0.465
Coefficient of Variation	2.19	1.27	1.47	1.03	0.69	0.67	1.72
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	24	24	24	24	24	24	24
Minimum	0.025	0.130	0.106	0.010	0.004	0.010	0.004
Maximum	0.910	2.900	0.920	0.024	0.124	0.084	0.029
Median	0.101	0.460	0.215	0.010	0.004	0.010	0.005
Arithmetic Mean	0.179	0.681	0.324	0.011	0.010	0.020	0.009
Geometric Mean	0.102	0.516	0.266	0.011	0.005	0.014	0.007
Standard Deviation	0.221	0.635	0.232	0.003	0.024	0.023	0.007
Coefficient of Variation	1.24	0.93	0.715	0.277	2.484	1.158	0.802
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field**	**Specific Conductivity**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	24	24	24	24	24	24	24
Minimum	0.013	0.70	6.69	124	60.4	1	0.048
Maximum	0.097	2.66	8.24	708	78.6	24196	2.900
Median	0.032	2.50	7.57	567	66.2	1267	0.050
Mean	0.039	2.13	7.58	477	68.0	2593	0.519
Geometric Mean	0.030	2.00	7.57	422	67.8	792	0.146
Standard Deviation	0.029	0.64	0.37	199	5.2	5017	0.976
Coefficient of Variation	0.737	0.30	0.05	0.42	0.08	1.93	1.88

4.4.12.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, and NSQD data where applicable. These graphs are located in Appendix N. During the fourth monitoring term, there were three exceedances of the TCEQ basin specific criterion for TDS (all stations on October 2021), one exceedance of the TCEQ estimated human health criterion for total arsenic (upstream station on October 2021), three exceedances of the TCEQ aquatic life use estimated acute criterion for total copper (all stations on October 2021), one exceedance of the TCEQ aquatic life use estimated chronic criterion for total lead (upstream station on October 2019), and fourteen exceedances of the *E. coli* PCR single sample criterion (multiple events across the period at all stations and the *E. coli* PCR geometric mean criterion was exceeded). There were four ammonia nitrogen (upstream station on October 2019 and all stations on October 2021), sixteen orthophosphate (multiple events across the period at all stations), and two total phosphorus (upstream station on April and October 2019) exceedances of the TCEQ nutrient screening criteria. In addition, there were seven occurrences where the TSS concentration (multiple events across the period at all three stations), three occurrences where the BOD concentration (upstream station on October 2019 and upstream and midstream stations on October 2021), two occurrences where the COD concentration (upstream and midstream stations on October 2021), three occurrences where the total nitrogen concentration (upstream station on February, April and October 2019), and five occurrences where the dissolved phosphorus concentration (upstream and midstream stations on October 2019, upstream station on August 2021, and upstream and midstream stations October 2021), was higher than 75% of NSQD data for those parameters. No box plots were created due to the absence of CRP and bioassessment data within the watershed.

4.4.12.3. Biological Data Analysis

No bioassessment monitoring data was collected within this watershed.

4.4.12.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that construction activities occurred on the Honey Springs Branch channel during the monitoring term. Given the commercial land use in the subwatershed there are potential sources of illicit connections, unauthorized discharges, or illegal dumping that may contribute to BOD, nutrients, and *E. coli*. Elevated nutrient concentrations may have been a factor in the elevated BOD and COD concentrations due to increased organic matter in the stream. In addition to illicit connections, sources of ammonia nitrogen, total nitrogen, orthophosphate, dissolved phosphorus, and total phosphorus could include over fertilization in residential and commercial areas. Riparian alteration can also affect nitrogen uptake and cycling and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). Potential sources of bacteria loading may be illicit connections, wildlife, and domestic animals.

Land use of the Honey Springs Branch subwatershed is predominantly residential with the remainder split between commercial, roadway, and open land uses. Commercial and roadway land use may have contributed to the copper and lead exceedances. Additional sources of lead and copper could be from illicit connections and illegal dumping. Arsenic is found in industry, in copper chromated arsenate treated lumber, and in groundwater in some areas. The single observed exceedance over the period of record can be viewed as an outlier.

BMPs recommended for these sources include increased compliance inspections for illicit connections, public education for illegal dumping, identification and removal of illegal dumping, public education of home and business owners regarding fertilization and turf management, public education for pet owners regarding pet waste management, review/improvement of construction inspection protocols or BMP requirements, street sweeping, and review/improvement of roadway BMPs for capture of heavy metals.

4.4.12.5. Monitoring Recommendations

Data analyzed presents several indications of stream degradation. Bacteria concentrations have a potential to impact primary contact recreation and nutrients, copper, and lead have the potential to impact aquatic life. There are no TMDLs or impairments identified for Honey Springs Branch. There is a current TMDL for bacteria and for legacy pollutants for the Upper Trinity River Segment 0805. Additional monitoring at this site is recommended to be assigned a high priority. Bioassessment data collection is recommended to determine whether the biological community may be impacted by the chemical pollutants documented above. In order to determine the concentration of bioavailable metals, it is recommended that sampling of dissolved fractions of copper and lead is conducted.

4.4.13. Johnson Creek

The City of Arlington performed chemical monitoring on Johnson Creek (TCEQ segment 0841L), a stream with a stream order of three or greater draining to the Lower West Fork of the Trinity River within the Johnson Creek watershed.

Johnson Creek Watershed is mostly located in Tarrant County with a small piece (north of IH 30) falling within Dallas County. Johnson Creek’s 13,580.9-acre watershed is predominately residential (29.4%), with small patches of open areas (14.0%) spread throughout. This watershed is made up of 19.8% roadway which includes four major highways: IH 20, SH 360, SH 303, and IH 30. A significant amount of commercial (26.8%) and industrial (9.7%) property is located on both sides of SH 360 and IH 30 in the northern part of the watershed. There are also a few industrial sites located south of SH 303. This watershed is comprised of 0.3% water features.

The City of Arlington had one chemical monitoring sites located within the Johnson Creek subwatershed. The chemical monitoring site, AR1801 was an upstream sampling site located south of IH 30 near Six Flags Over Texas where East Copeland Road crosses Johnson Creek. The conveyance at this site was an open, unlined channel with gabion banks and low vegetative cover and maintained grass bordering the creek line. In September 2018, heavy flooding inundated the sampling equipment at station AR1801. The equipment located at AR1801 was lost to the flood waters and not recovered. Replacement equipment was identified for AR1801 and a new location was chosen and named AR1801A/1901A. AR1801A/1901A was located at the East Sanford Street crossing of Johnson Creek. The subwatershed delineated for this sampling location covered a 3,539-acre area and was made up of mostly commercial (35.4%) and roadway (20.9%) land use. Highways going through this area were IH 30 and SH 180 (Division Street). Several major roadways that ran through this subwatershed were Cooper Street, Collins Street, Lamar Boulevard, Sanford Street, Randol Mill Road, Six Flags Drive, and Stadium Drive/Ballpark Way. Residential (19.5%) property was mostly located in the western half of the subwatershed area up to Stadium Drive/Ballpark Way. Industrial (5.6%) sites were primarily located in the far eastern part of the subwatershed. There were some large sections of open space (18.0%) spread throughout the subwatershed area. It is important to note that Six Flags Over Texas in the northern part of the subwatershed was categorized as “Open Space” because it is designated as a “Park”. Obviously this park has a significant proportion of impervious surface, including its expansive parking lot that should be taken into account. This subwatershed contained 0.7% water features.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 13. The monitoring sites are shown as AR1801 and AR1801A. AR1901A was located in the same location as AR1801A. The subwatershed area is within the jurisdictional limits of the City of Arlington. TxDOT contributes flow to the subwatershed through IH 30, SH 180, SH 303, and IH 20. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the T*CEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.13.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-10. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-10 Johnson Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	8	8	8	8	8	8	8
Minimum	124.0	12.33	0.50	6.19	1.100	0.061	0.040
Maximum	772.0	438.0	16.40	34.30	11.000	1.090	0.590
Median	419.0	24.89	4.09	12.77	1.395	0.330	0.380
Arithmetic Mean	433.3	106.06	5.86	16.77	2.919	0.425	0.341
Geometric Mean	351.2	46.22	3.27	13.79	2.039	0.298	0.254
Standard Deviation	264.1	149.55	5.69	11.46	3.372	0.349	0.195
Coefficient of Variation	0.61	1.41	0.97	0.68	1.16	0.822	0.573
Parameter	**Phosphorus, Dissolved (mg/L)**	**Orthophosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	8	8	8	8	8	8	8
Minimum	0.011	0.003	0.025	0.001	0.001	0.004	0.001
Maximum	0.170	0.470	0.650	0.014	0.016	0.079	0.022
Median	0.048	0.053	0.161	0.004	0.002	0.024	0.004
Arithmetic Mean	0.054	0.161	0.248	0.004	0.005	0.035	0.007
Geometric Mean	0.040	0.060	0.156	0.003	0.003	0.019	0.004
Standard Deviation	0.050	0.185	0.234	0.004	0.006	0.033	0.008
Coefficient of Variation	0.928	1.152	0.944	0.961	1.188	0.935	1.121
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	8	8	8	8	8	8	8
Minimum	0.021	0.70	7.80	217	51.0	12.0	0.005
Maximum	0.140	7.9	9.10	1350	88.7	11200	0.050
Median	0.075	2.25	8.35	887	78.9	1007	0.005
Mean	0.068	2.53	8.39	822	74.8	2352	0.022
Geometric Mean	0.056	1.86	8.38	691	73.6	554	0.012
Standard Deviation	0.040	2.35	0.38	412	13.6	3762	0.023
Coefficient of Variation	0.592	0.93	0.04	0.50	0.18	1.60	1.065

4.4.13.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, NSQD, and CRP data where applicable. These graphs are located in Appendix O. CRP stations 10718, 10719, 10721, 17664, and 18311 were utilized for this analysis. Station 10721 was the most upstream station located at the SH 303 crossing. Stations 10718, 10719, 17664, and 18311 were all located between SH 360 and PGBT (prior to the Arbor Creek intersection).

During the fourth monitoring term, there was one exceedance of the TCEQ aquatic life use estimated chronic criterion for total copper (June 2018), two exceedances of the TCEQ aquatic life use estimated acute criterion for total copper (June and July 2018), one exceedance of the TCEQ pH basin specific criterion for maximum pH (October 2019), and five exceedances of the *E. coli* PCR single sample criterion (multiple events across the period at all stations and the *E. coli* PCR geometric mean criterion was exceeded). There were four ammonia nitrogen (June 2018, January, May, and July 2019) and one orthophosphate (July 2019) exceedances of the TCEQ nutrient screening criteria. There were two occurrences where the TSS concentration (July and October 2019), one occurrence where the BOD concentration (October 2019), and one occurrence where the total nitrogen concentration (May 2019) was higher than 75% of the NSQD data for those parameters. In addition, there were three specific conductance readings greater than 1,000 µS/cm in July and November 2018 and January 2019 exceeded the NRSA good category into the fair category.

Due to the exceedances and elevated concentrations discussed above and the availability of CRP and wet weather chemical data, boxplots were created for BOD, total nitrogen, orthophosphate, total copper, pH, conductivity, and *E. coli*. The total nitrogen, total copper, and pH boxplots show a significant difference between the CRP and the wet weather data indicating that these constituent concentrations were lower during the predominantly dry weather periods than during runoff events (Figures 4-52, 4-53, and 4-54). The BOD, specific conductance, and *E. coli* boxplots do not indicate that stormwater runoff is providing a significant different input of these pollutants to the stream compared to the CRP data which was collected predominately during dry weather (see Figures 4-51, 4-55, and 4-56). The pH boxplot indicates the third and fourth monitoring term RWWCP data was higher than the second monitoring term and CRP data.

Figure 4-51 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP BOD Data at Johnson Creek

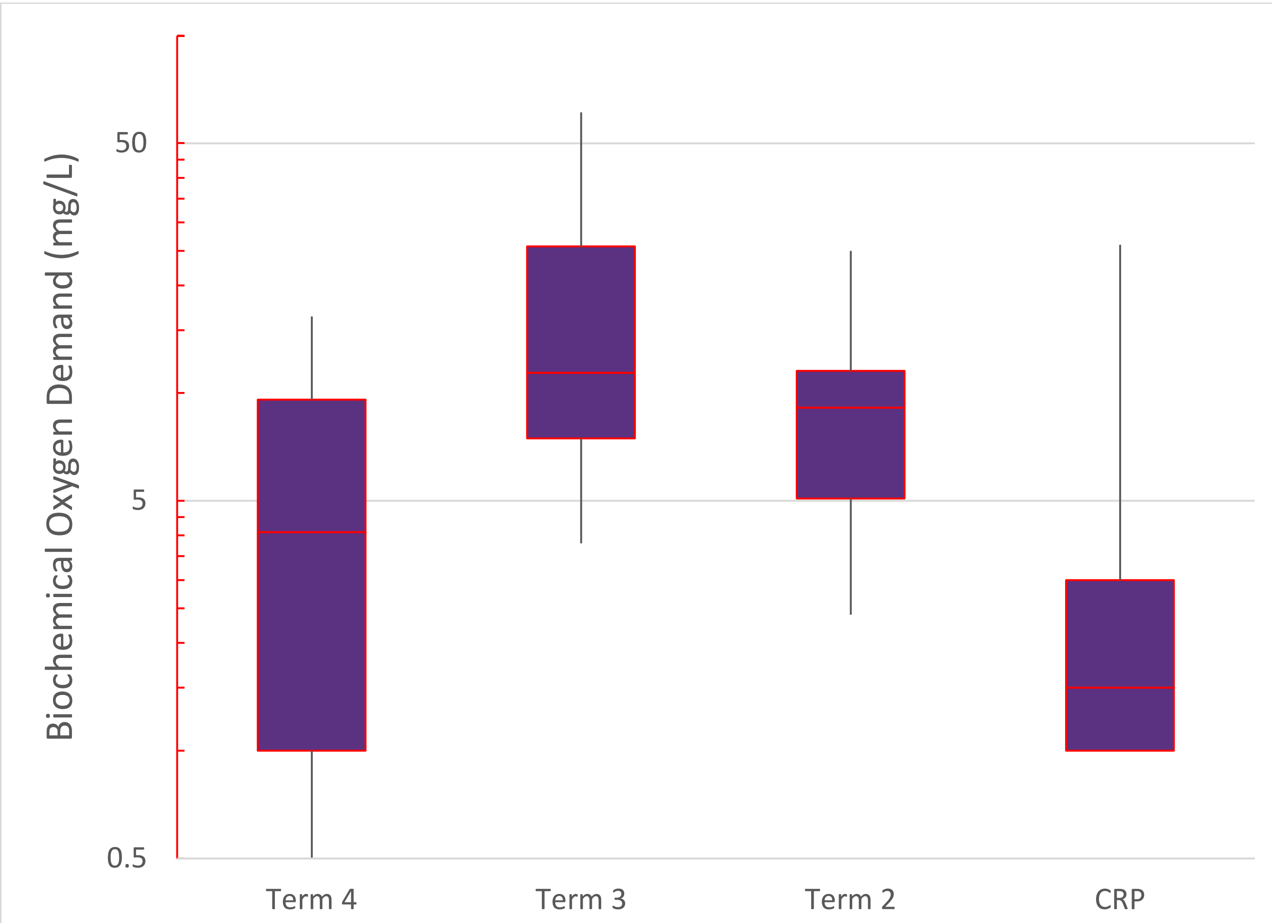


Figure 4-52 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Nitrogen Data at Johnson Creek

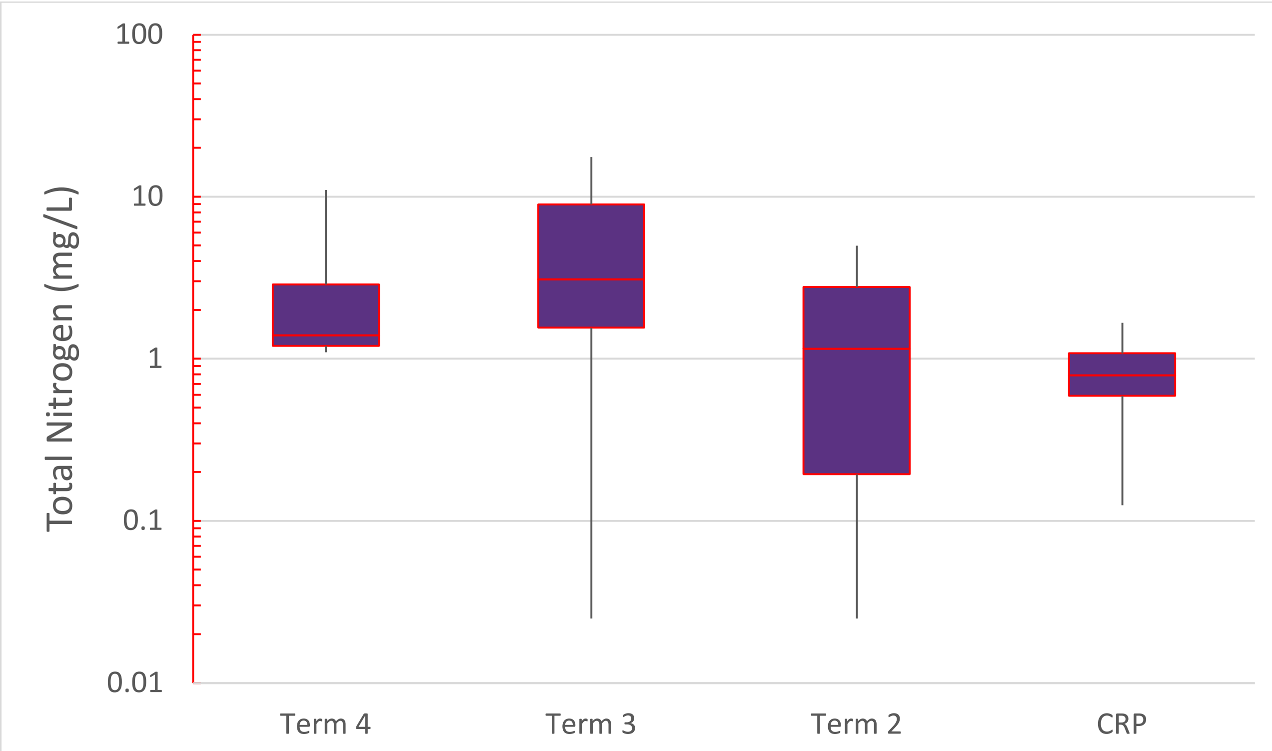


Figure 4-53 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Copper Data at Johnson Creek

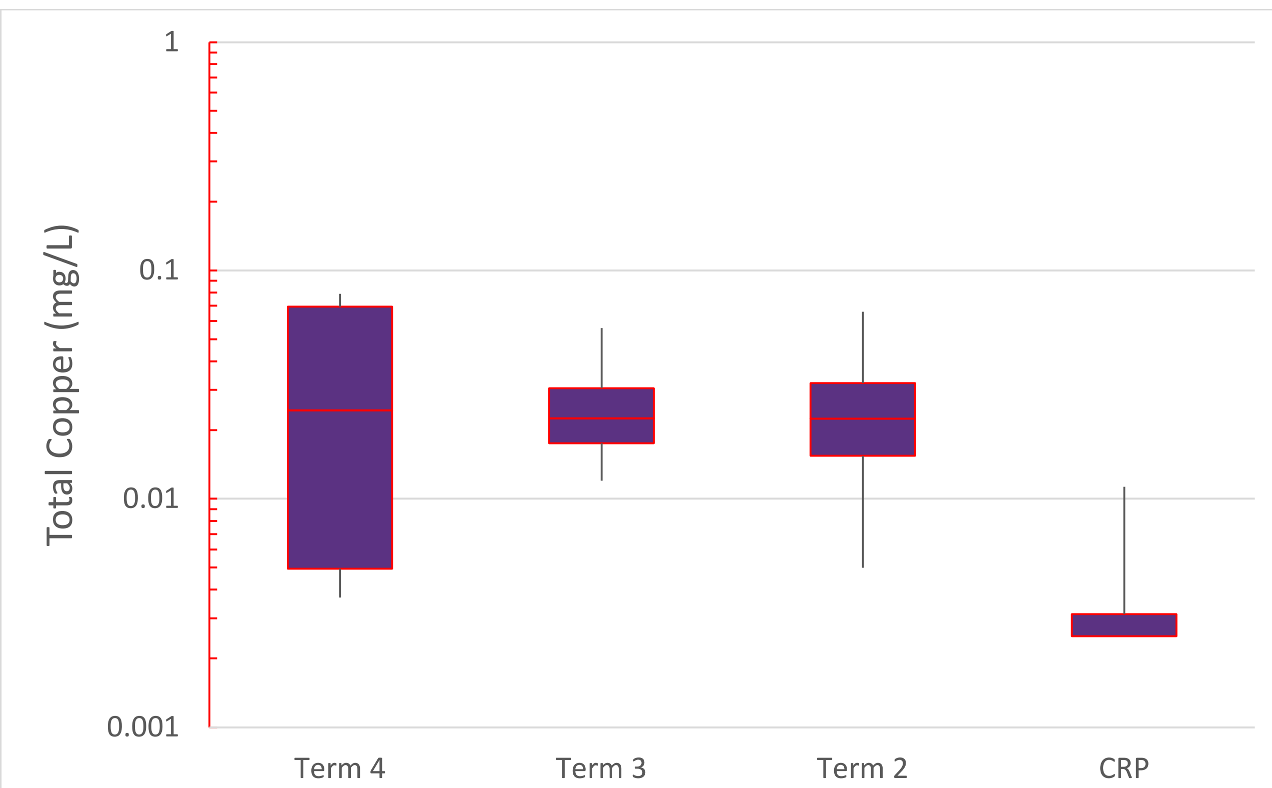


Figure 4-54 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP pH Data at Johnson Creek

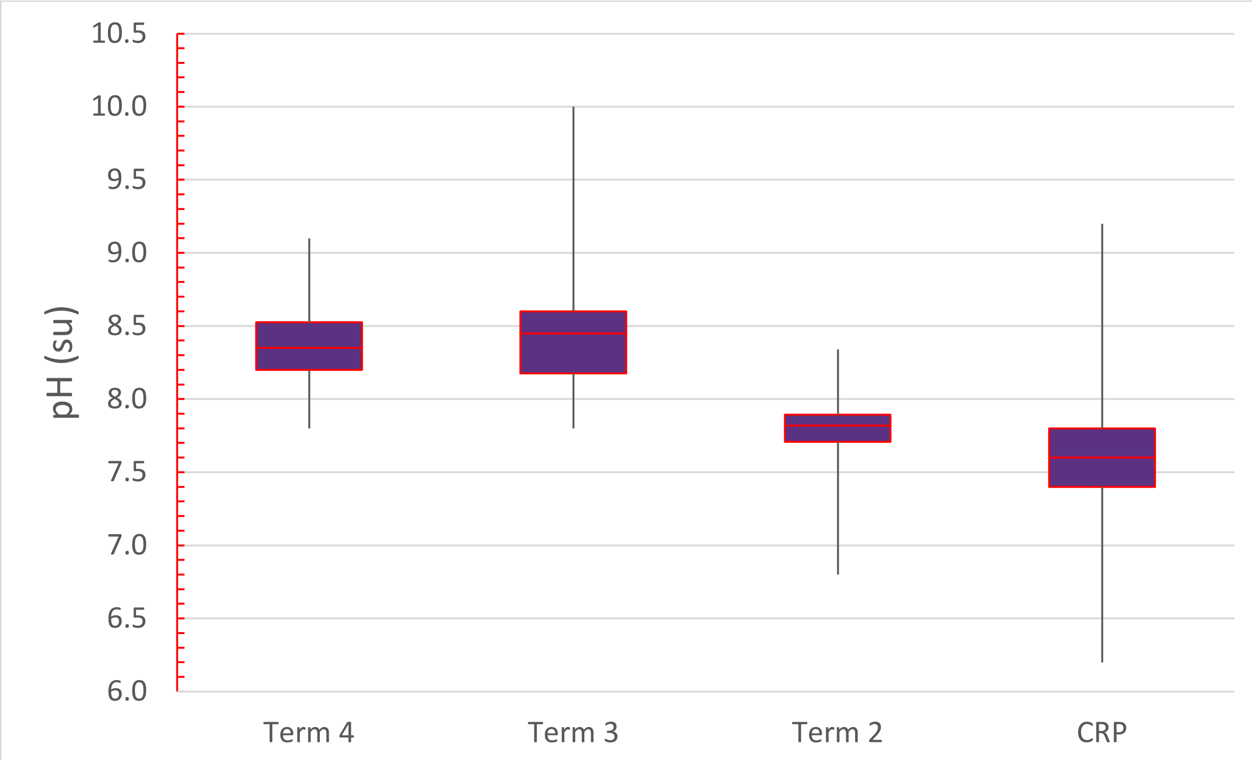


Figure 4-55 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms and CRP Specific Conductance Data at Johnson Creek

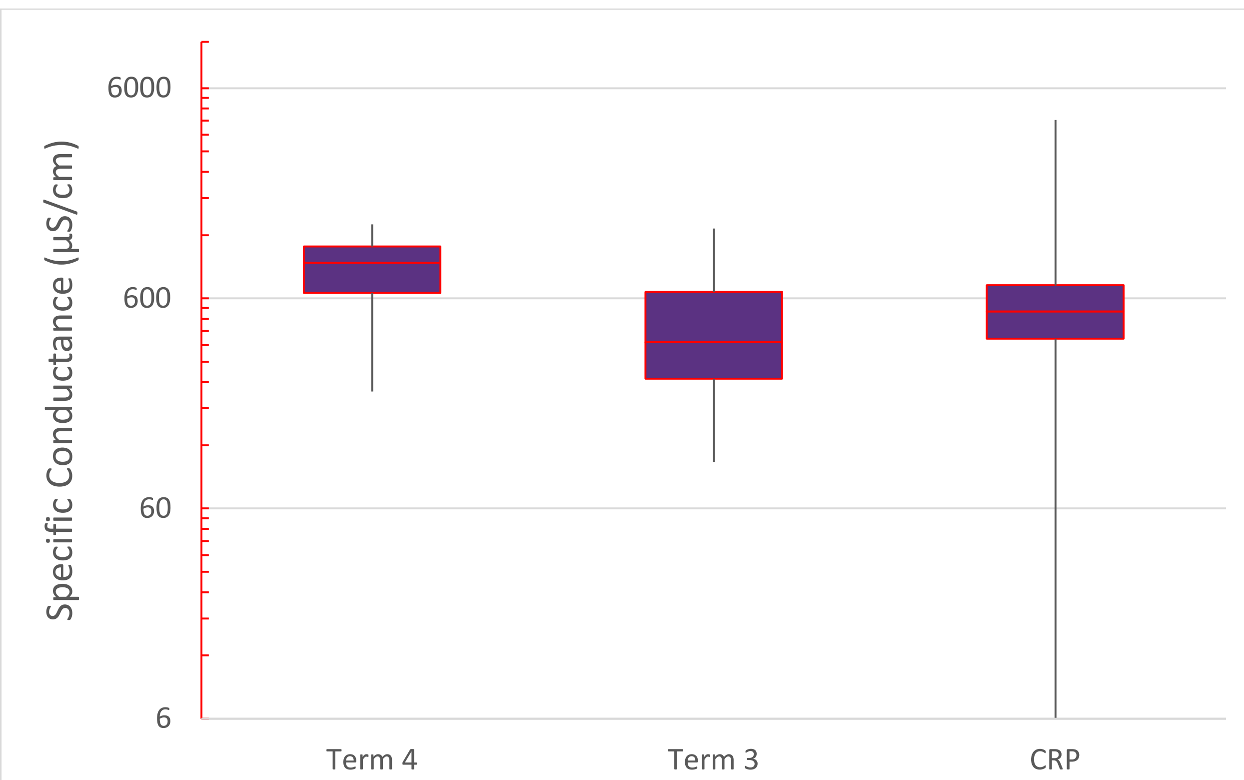
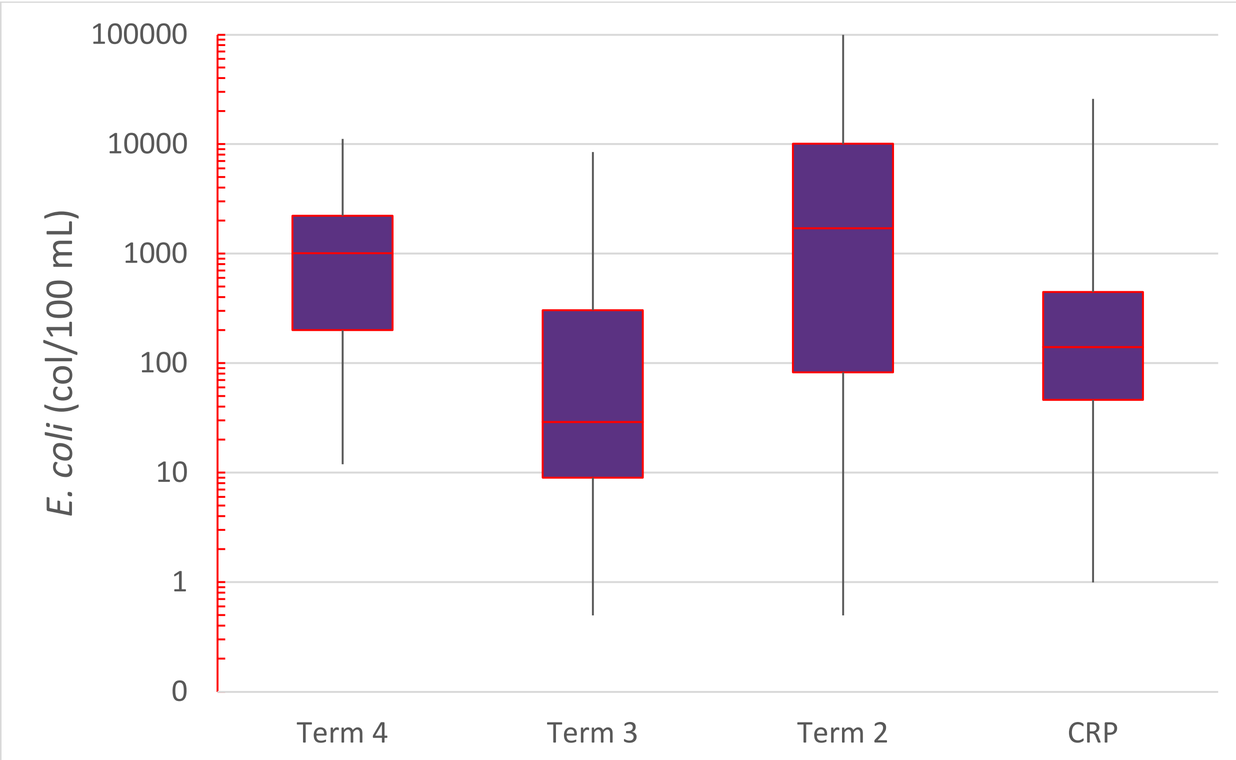


Figure 4-56 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP *E. coli* Data at Johnson Creek



4.4.13.3. Biological Data Analysis

No bioassessment monitoring data was collected within this watershed.

4.4.13.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that there were construction activities that occurred within the drainage area. An example of major development is the Arlington Independent School District Center for Visual and Performing Arts. Given the industrial and commercial land use in the subwatershed there are potential sources of illicit connections, unauthorized industrial discharges, or illegal dumping that may contribute to BOD, nutrients, and *E. coli*. Elevated nutrient concentrations may have been a factor in the elevated BOD concentration due to increased organic matter in the stream. In addition to illicit connections, sources of ammonia nitrogen, total nitrogen, and orthophosphate could include over fertilization in residential and commercial areas. Riparian alteration can also affect nitrogen uptake and cycling and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). Despite elevated BOD and nutrient concentrations, the dissolved oxygen concentrations recorded in the CRP data remained above TCEQ ALU criteria. Potential sources of bacteria loading may be illicit connections, wildlife, and domestic animals.

Land use of the Johnson Creek monitored subwatershed is predominately mixed residential and commercial with smaller percentages of roadway and open land uses. Commercial and roadway land use may have contributed to the copper exceedances. Additional sources of copper could be from illicit connections and illegal dumping.

A potential source of elevated pH may be roadway deicing but the single pH exceedance above 9 SU occurred during a stormwater runoff event in October. A potential source of the elevated pH may be the growth of aquatic plants and algae within the stream during that period. Excessive growth of aquatic plants and algae could be a result of the elevated nutrient concentrations.

BMPs recommended for these sources include increased compliance inspections for illicit connections, public education for illegal dumping, identification and removal of illegal dumping, public education of home and business owners regarding fertilization and turf management, public education for pet owners regarding pet waste management, review/improvement of construction inspection protocols or BMP requirements, street sweeping, and review/improvement of roadway BMPs for capture of heavy metals.

4.4.13.5. Monitoring Recommendations

Data analyzed presents several indications of stream degradation. Bacteria concentrations have a potential to impact primary contact recreation and nutrients and copper have the potential to impact aquatic life. Johnson Creek has a TMDL and is currently impaired for bacteria. Additional monitoring at this site is recommended to be assigned a high priority. Bioassessment data collection is recommended to determine whether the biological community may be impacted by the chemical pollutants documented above. In order to determine the concentration of bioavailable metals, it is recommended that sampling of dissolved fractions of copper is conducted.

4.4.14. Lake Como – Clear Fork of the Trinity River

The City of Fort Worth performed bioassessment and chemical monitoring on an unnamed tributary in Overton Park to the Clear Fork of the Trinity River (TCEQ segment 0829). The stream has a stream order of two and is located within the Lake Como – Clear Fork Trinity River watershed. Additional bioassessment monitoring is scheduled for 2022.

Lake Como – Clear Fork Trinity River is located in the southwestern portion of Tarrant County and encompasses southwest Fort Worth and part of Benbrook. The 25,064.8-acre watershed is primarily comprised of residential (38.2%) property with significant open (20.0%) areas, primarily along the Clear Fork of the Trinity River. Major highways in the watershed include IH 20, IH 30, SH 183, and Chisholm Trail Parkway and a dense street network contribute to a 21.4% roadway land use. Commercial (18.6%) areas are distributed throughout the subwatershed with concentrations in the northeastern portion near downtown Fort Worth. There are a few industrial (0.7%) sites in scattered locations. There are 1.1% identified water features.

The City of Fort Worth had two chemical and bioassessment sites and one bioassessment site only located on the unnamed tributary in Overton Park. The monitoring site, FWOVR1 was an upstream sampling site located in Foster Park at a bridge crossing on South Drive west of Trail Lake Drive (approximately 0.10 mile downstream). The area delineated for this sampling site was 473.3 acres and was dominated by residential (64.6%) land use. IH 20 crossed the lower part of the subwatershed and Granbury Road and Westcreek Drive were larger roadways (25.7% roadway). Foster Park contributed to the 4.1% open area. Commercial (5.6%) land use was located near IH 20 and along other major streets. There was no industrial land use or identified water features.

The monitoring site, FWOVR2 was a bioassessment site only and was located east of 3808 Overton Park West, near the Tanbark Trail intersection. No subwatershed information was available for this site.

The monitoring site, FWOVR3 was a downstream sampling site located in a gabion-lined channel below the Bellaire Drive S bridge crossing. The 2,887.5-acre watershed delineated for this sampling site was comprised primarily of residential (60.2%) land use. Hulen Mall was located in the western part of the watershed and contributed to the 12.7% commercial land use. Additional commercial areas were located along IH 20 and Granbury Road among other major streets (22.3% roadway).

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 14. The subwatershed area is within the jurisdictional limits of the City of Fort Worth. TxDOT contributes flow to the subwatershed through IH 20. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.14.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-11. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-11 Lake Como – Clear Fork Trinity River RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	3	3	3	3	3	1	3
Minimum	161.0	3.30	1.00	15.00	0.250	0.075	0.050
Maximum	261.0	35.60	4.80	33.00	0.250	0.075	0.430
Median	253.0	19.00	3.00	15.00	0.250	0.075	0.050
Arithmetic Mean	225.0	19.30	2.93	21.00	0.250	0.075	0.177
Geometric Mean	219.9	13.07	2.43	19.51	0.250	0.075	0.102
Standard Deviation	55.6	16.15	1.90	10.39	0.000	N/A	0.219
Coefficient of Variation	0.25	0.84	0.65	0.49	0.00	N/A	1.242
Parameter	**Phosphorus, Dissolved (mg/L)**	**Orthophosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	3	3	3	3	3	3	3
Minimum	0.003	0.050	0.500	0.003	0.003	0.003	0.003
Maximum	0.027	0.050	0.500	0.003	0.003	0.003	0.003
Median	0.009	0.050	0.500	0.003	0.003	0.003	0.003
Arithmetic Mean	0.013	0.050	0.500	0.003	0.003	0.003	0.003
Geometric Mean	0.009	0.050	0.500	0.003	0.003	0.003	0.003
Standard Deviation	0.012	0.000	0.000	0.000	0.000	0.000	0.000
Coefficient of Variation	0.954	0.000	0.000	0.000	0.000	0.000	0.000
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	3	3	3	3	0	3	4
Minimum	0.005	2.50	7.05	450.000	-	24	0.510
Maximum	0.017	2.50	7.90	460.000	-	5650	0.525
Median	0.005	2.50	7.32	460.000	-	579	0.515
Mean	0.009	2.50	7.42	456.667	-	2084	0.517
Geometric Mean	0.008	2.50	7.41	456.642	-	428	0.517
Standard Deviation	0.007	0.00	0.43	5.774	-	3100	0.008
Coefficient of Variation	0.770	0.00	0.06	0.013	-	1.49	0.015

4.4.14.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, NSQD, and CRP data where applicable. These graphs are located in Appendix P.

During the fourth monitoring term, there were two exceedances of the *E. coli* PCR single sample criterion. The *E. coli* concentrations exceeded the single sample primary contact standards during the June 2018 and November 2019 wet weather chemical monitoring events at FWOVR1. The *E. coli* PCR geometric mean criterion was exceeded for the three wet weather samples.

The water quality data collected during bioassessments was also plotted and compared to water quality standards, screening levels, and other data sources. These graphs are also located in Appendix P. The geometric mean of the bioassessment E. coli data was 363.9 col/100 mL which was more than the PCR geometric mean standard of 126 col/100 mL. There were nine exceedances of the *E. coli* PCR single sample criterion. There were two nitrate nitrogen (May and October 2018) and eight ammonia nitrogen (multiple events across the period) exceedances of the TCEQ nutrient screening criteria.

4.4.14.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix P). The habitat scores at FWOVR1 remained in the sub-optimal range over the fourth monitoring term with the exception of marginal scores at FWOVR1 in the fall of 2018, spring of 2020, and fall of 2021. The habitat scores at FWOVR2 remained in the sub-optimal range with the exception of marginal scores in the spring and fall of 2018 and the spring of 2019. The habitat scores at FWOVR3 fell between the sub-optimal range and the marginal range.

Texas macroinvertebrate IBI scores at FWOVR1 were primarily marginal with intermediate scores in the spring and fall of 2019. IBI scores at FWOVR2 were primarily intermediate with marginal scores in the spring and fall of 2018 and fall of 2019. IBI scores at FWOVR3 were primarily intermediate with a marginal score in the spring of 2019. The marginal to intermediate IBI scores generally correspond with the available habitat indicating that water quality may not be limiting macroinvertebrate communities. Overall, the IBI scores for FWOVR1 and FWOVR3 from the fourth monitoring term were generally lower than the IBI scores from the third term indicating declining macroinvertebrate communities.

4.4.14.4. Potential Pollution Sources and BMP Recommendations

Land use of the unnamed tributary subwatershed is predominately residential followed by roadway and commercial land uses. The potential source of the nitrate nitrogen and ammonia nitrogen loadings may be excessive lawn and garden fertilization. In addition, riparian alteration can affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). However, dissolved oxygen concentrations over the monitoring term did not fall below TCEQ criteria for aquatic life protection suggesting that the nutrient loadings were not contributing to low dissolved oxygen events. For bacteria, potential sources may be domestic animals, wildlife, and illicit connections.

BMPs recommended for these sources include public education for residential land owners regarding fertilization and turf management, public education for pet owners regarding pet waste management, and compliance inspections for illicit connections. Due to marginal habitat scores, stream restoration would benefit the biological productivity of the stream.

4.4.14.5. Monitoring Recommendations

Data analyzed presents moderate indications of stream degradation. Bacteria concentrations have a potential to impact primary contact recreation and nutrients have the potential to impact aquatic life. The unnamed tributary does not have an identified TMDL or impairment. The Clear Fork of the Trinity River (TCEQ segment 0829) is impaired for dioxin and PCBs in fish tissue and there is a TMDL under development to assess PCBs in fish tissue. Additional monitoring at this site is recommended to be assigned a moderate priority.

4.4.15. Little Fossil Creek

The City of Fort Worth performed bioassessment and chemical monitoring on Little Fossil Creek (TCEQ segment 0806F) a stream with a stream order of two draining to Big Fossil Creek (TCEQ segment 0806C) within the Sycamore Creek – West Fork Trinity River watershed. Additional bioassessment monitoring is scheduled for 2022.

Sycamore Creek-West Fork Trinity River Watershed is located in central Tarrant County. This 22,339-acre watershed is predominately open space (29.6%) and residential (25.4%). The residential area is located in the central and southern part of the watershed, and the open space is dispersed throughout, with a large section in the southern tip of the watershed along the banks of the West Fork Trinity River. Commercial (19.4%) also makes up a large part of the watershed and is dispersed throughout. There are several roadways (15.2%) that go through this watershed, including: IH 30, IH 35W, IH820, SH 183, SH 121, and SH 180. The industrial (9.2%) areas are dispersed in the north part of the watershed, as well as a large section just south of SH 121. This watershed contains 1.2% water features.

The City of Fort Worth had two chemical and bioassessment monitoring sites and one bioassessment only monitoring site located on Little Fossil Creek. The monitoring site, FWLFC1, was an upstream sampling site located in the 2200 block of Cantrell Sansom Rd. at a bridge crossing approximately 0.25 mile north of NE Loop IH 820 and 1.0 mile west of I-35W. This subwatershed covered a 3,257.9-acre area that was composed of open space (27.7%), commercial (24%) property, and residential (21.5%) property. The open space and commercial property were fairly evenly distributed throughout the subwatershed, while the residential property was limited to the upper and lower reaches of the drainage area. There were industrial (14.6%) sites through the center of the subwatershed. Roads occupied 12.2% of the subwatershed. This drainage area contained no water features.

The monitoring site, FWLFC2, was a bioassessment site only and was located 100 yards west of and upstream of the I-35W crossing. No subwatershed information was available for this site.

The monitoring site, FWLFC3, was a downstream sampling site located at the northern dead end of Mesquite Road south of 3800 Long Avenue. Little Fossil Creek flowed from this point through residential areas of Haltom City to its confluence with Big Fossil Creek and then southeast to the West Fork Trinity River. This subwatershed covered a 8,123.2-acre area and was comprised of open space (34.7%) and commercial (24.0%) property. Both open space and commercial land were evenly distributed throughout the watershed. There were a few roadways (14.9%) in the drainage area, including IH 35W and IH 820. There were several industrial (14.4%) sites in the subwatershed. This drainage area contained 0.1% water features.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 15. Much of the subwatershed area is within the jurisdictional limits of the City of Fort Worth. However, the Cities of Haltom City and Saginaw also have jurisdictional limits within the subwatershed. TxDOT contributes flow to the subwatershed through IH 820 and IH 35W. There are no TCEQ permitted wastewater outfalls located within the subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.15.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-12. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-12 Little Fossil Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	6	6	6	6	6	4	6.000
Minimum	163.0	1.25	1.00	15.00	0.250	0.050	0.050
Maximum	888.0	118.00	16.30	65.30	2.600	0.140	1.100
Median	235.0	8.35	1.00	17.50	0.690	0.050	0.180
Arithmetic Mean	353.5	35.28	4.88	28.32	0.892	0.073	0.332
Geometric Mean	290.6	10.79	2.30	23.72	0.636	0.065	0.212
Standard Deviation	277.5	48.81	6.44	20.41	0.877	0.045	0.386
Coefficient of Variation	0.79	1.38	1.32	0.72	0.983	0.621	1.164
Parameter	**Phosphorus, Dissolved (mg/L)**	**Orthophosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	6	6	6	6	6	6	6
Minimum	0.008	0.020	0.120	0.003	0.003	0.003	0.003
Maximum	0.250	0.180	0.500	3.200	3.400	8.700	4.700
Median	0.167	0.050	0.280	2.350	1.500	1.000	0.250
Arithmetic Mean	0.143	0.068	0.322	1.818	1.568	2.818	1.268
Geometric Mean	0.075	0.050	0.289	0.263	0.229	0.264	0.128
Standard Deviation	0.120	0.060	0.151	1.450	1.437	3.701	1.915
Coefficient of Variation	0.840	0.888	0.471	0.798	0.916	1.314	1.511
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	6	6	6	6	0	6	6
Minimum	0.005	2.50	7.40	290.00	-	23	0.050
Maximum	47.200	2.50	8.36	850.00	-	24196	0.515
Median	3.800	2.50	7.95	630.00	-	155	0.050
Mean	16.168	2.50	7.92	586.67	-	4127	0.204
Geometric Mean	0.927	2.50	7.91	549.99	-	206	0.109
Standard Deviation	22.237	0.00	0.41	212.29	-	9832	0.239
Coefficient of Variation	1.375	0.00	0.05	0.36	-	2.38	1.170

4.4.15.2. Water Quality Data Analysis

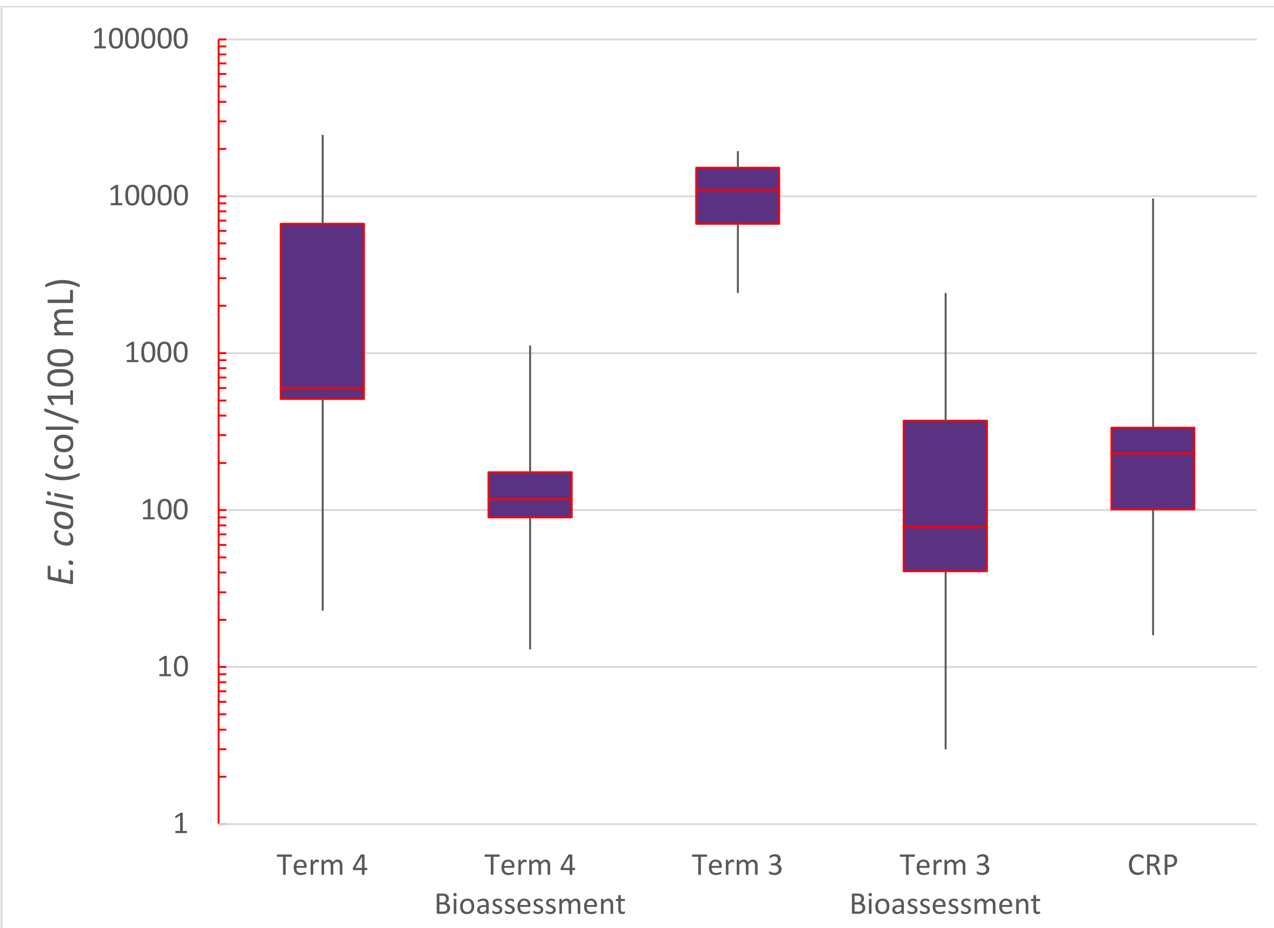
Monitored parameters were plotted and compared to water quality standards, screening levels, NSQD, and CRP data where applicable. CRP station 21425 was utilized for this analysis. Station 21425 is located at the same location as FWLFC3. These graphs are located in Appendix Q.

During the fourth monitoring term, there was one exceedance of the basin specific criterion for TDS at LCF1 in August 2020. There was one exceedance of the *E. coli* PCR single sample criterion during the October 2020 wet weather chemical monitoring event at FWLFC1. The *E. coli* PCR geometric mean criterion was exceeded for the six wet weather samples.

The water quality data collected during bioassessments was also plotted and compared to water quality standards, screening levels, and other data sources. These graphs are also located in Appendix Q. The geometric mean of the bioassessment E. coli data was 117.2 col/100 mL which was less than the PCR geometric mean standard of 126 col/100 mL. There were six ammonia nitrogen (multiple events across the period) exceedances of the TCEQ nutrient screening criteria. There was one exceedance due to low dissolved oxygen in October 2021 at FWLFC1.

Due to the exceedances discussed above and the availability of bioassessment, CRP and wet weather chemical data, a boxplot was created for *E. coli* for comparison of the datasets. These data indicate that stormwater runoff is providing a significantly different input of *E. coli* to the stream compared to bioassessment and CRP data which was predominately collected during dry weather (see Figure 4-57).

Figure 4-57 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms, Bioassessment, and CRP *E. coli* Data at Little Fossil Creek



4.4.15.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix Q). The habitat scores at FWLFC1 remained in the sub-optimal range over the fourth monitoring term with the exception of a marginal score in the spring of 2018. The habitat scores at FWLFC2 remained in the sub-optimal range with the exception of an optimal score in the spring of 2018. The habitat scores at FWLFC3 fell between the sub-optimal range and the marginal range. Overall, the habitat scores for FWLFC1 and FWLFC3 from the fourth monitoring term were generally higher than the habitat scores from the third term.

Texas macroinvertebrate IBI scores at FWLFC1 were intermediate. IBI scores at FWLFC2 were primarily intermediate with a marginal score in the spring of 2021 and a high score in the fall of 2019. IBI scores at FWLFC3 were primarily intermediate with marginal scores in the fall of 2018 and spring of 2021. The intermediate IBI scores generally correspond with the available habitat indicating that water quality may not be limiting macroinvertebrate communities. Overall, there was generally no change of the IBI scores for FWLFC1 and FWLFC3 from the fourth monitoring term and the third term indicating stable macroinvertebrate communities.

4.4.15.4. Potential Pollution Sources and BMP Recommendations

Land use of the subwatershed is mostly open with sizable commercial, roadway, industrial, and residential land uses. The potential source of the ammonia nitrogen loadings may be excessive lawn and garden fertilization. In addition, riparian alteration can affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). Elevated nutrient concentrations may have been a factor in the low dissolved oxygen concentration recorded in the bioassessment data below TCEQ criteria for aquatic life protection. For bacteria, potential sources may be livestock, agricultural manure application, domestic animals, wildlife, septic system failure, and illicit connections.

BMPs recommended for these sources include public education for agricultural and residential land owners regarding fertilization and turf management, public education for pet owners regarding pet waste management, and compliance inspections for illicit connections. In addition, maintenance and education for septic system owners regarding frequent maintenance and pump out may be considered. Due to marginal habitat scores, stream restoration would benefit the biological productivity of the stream.

4.4.15.5. Monitoring Recommendations

Data analyzed presents moderate indications of stream degradation. Bacteria concentrations have a potential to impact primary contact recreation and nutrients have the potential to impact aquatic life. There are no bacteria TMDLs or impairments identified for either Little Fossil Creek or Big Fossil Creek. Therefore, additional monitoring at this site is recommended to be assigned a moderate priority.

4.4.16. Marine Creek

The City of Fort Worth performed bioassessment and chemical monitoring on Marine Creek (TCEQ segment 0806D) a stream with a stream order of two draining to the West Fork of the Trinity River (TCEQ segment 0806) within the Marine Creek – West Fork Trinity River watershed. Additional bioassessment monitoring is scheduled for 2022.

Marine Creek-West Fork Trinity River is located on the western side of Fort Worth’s city limits in Tarrant County. Marine Creek-West Fork Trinity River covers a 20,021.9-acre area and consists predominately of open space (30.2%) with dense residential (24.4%), commercial (14.7%), and industrial (6.6%) areas in the southern portion and along the western and eastern corners. The roadway land use estimate for this watershed is 22.4% which includes IH Loop 820 and SH 183 (NW 28th Street). This watershed has 1.7% water features.

The City of Fort Worth had two chemical and bioassessment monitoring sites and one bioassessment only monitoring site located on Marine Creek. The monitoring site, FWMAR1, was an upstream sampling site located at the Macie Avenue bridge crossing in Buck Sansom Park. The subwatershed delineated for this sampling location covered a 7,595.3-acre area and almost half of the area consisted of open space (45.7%), followed by residential (27.1%) properties. Roadways (11.9%) including IH Loop 820 and major arterials such as Angle Avenue, Marine Creek Parkway and commercial (10.1%) properties comprised most of the remaining areas. Water (3.4%) features such as Marine Creek Reservoir on the north side of IH Loop 820 and industrial (1.9%) areas rounded out the balance of this area.

The monitoring site, FWMAR2, was located at Lincoln Park, north of the 28th street crossing. No subwatershed information was available for this site.

The monitoring site, FWMAR3, was a downstream sampling site accessed through Saunders Park on the south end of the Fort Worth Stockyards and north of the NE 23rd Street bridge crossing. The drainage area delineated for this site covered 13,130.7 acres and consisted primarily of open space (34.9%) land use, residential (27.6%) properties and roadways (20.5%). The remaining areas were commercial (11.2%) and industrial (3.6%) sites with scattered areas of water (2.1%) features. Roadways and major roadways going through this area were SH 183 (NW 28th Street), a short section of IH Loop 820, Long Avenue, Longhorn Road, McLeroy Boulevard and all of Meacham International Airport.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 16. Much of the subwatershed area is within the jurisdictional limits of the City of Fort Worth. However, a portion of the City of Saginaw is located within the upper portion of the subwatershed. TxDOT contributes flow to the subwatershed through IH 820 and SH 183. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.16.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-13. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-13 Marine Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	4	4	4	4	4	2	4
Minimum	180.0	4.20	2.20	15.00	0.250	0.075	0.050
Maximum	443.0	182.00	6.30	40.00	1.250	0.075	0.870
Median	281.5	41.50	4.30	33.50	0.805	0.075	0.425
Arithmetic Mean	296.5	67.30	4.28	30.50	0.778	0.075	0.443
Geometric Mean	281.4	33.82	3.96	28.64	0.661	0.075	0.287
Standard Deviation	110.7	78.51	1.83	10.79	0.439	0.000	0.358
Coefficient of Variation	0.37	1.17	0.43	0.35	0.57	0.000	0.810
Parameter	**Phosphorus, Dissolved (mg/L)**	**Orthophosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	4	4	4	4	4	4	4
Minimum	0.014	0.050	0.500	0.003	0.003	0.003	0.003
Maximum	0.042	0.050	0.500	0.008	0.006	0.010	0.008
Median	0.028	0.050	0.500	0.003	0.003	0.004	0.003
Arithmetic Mean	0.028	0.050	0.500	0.004	0.003	0.005	0.004
Geometric Mean	0.026	0.050	0.500	0.003	0.003	0.004	0.003
Standard Deviation	0.012	0.000	0.000	0.003	0.002	0.004	0.003
Coefficient of Variation	0.428	0.000	0.000	0.710	0.519	0.707	0.710
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	4	4	4	4	0	4	4
Minimum	0.005	2.50	6.45	320.00	-	56	0.500
Maximum	0.033	2.50	8.11	760.00	-	770	0.520
Median	0.009	2.50	7.65	465.00	-	279	0.515
Mean	0.014	2.50	7.46	502.50	-	346	0.513
Geometric Mean	0.010	2.50	7.43	478.86	-	240	0.512
Standard Deviation	0.013	0.00	0.75	184.82	-	303	0.009
Coefficient of Variation	0.944	0.00	0.10	0.37	-	0.88	0.017

4.4.16.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, and other data sources where applicable. CRP station 17370 was utilized for this analysis. Station 17370 is located just downstream of the NE 23rd Street crossing prior to the intersection with the West Fork of the Trinity River. The graphs are located in Appendix R.

During the fourth monitoring term, there was one exceedance of the TCEQ estimated human health criterion for total lead (November 2019), one exceedance of the TCEQ pH basin specific criterion for minimum pH (June 2018), and one exceedance of the *E. coli* PCR single sample criterion (October 2019) and the *E. coli* PCR geometric mean criterion was exceeded. There was one occurrence where the TSS concentration (November 2019) was higher than 75% of the NSQD data for that parameter.

The water quality data collected during bioassessments was also plotted and compared to water quality standards, screening levels, and other data sources. These graphs are also located in Appendix R. The geometric mean of the bioassessment E. coli data was 162.2 col/100 mL which was more than the PCR geometric mean standard of 126 col/100 mL. There were two nitrate nitrogen (October 2018 and October 2019), seven ammonia nitrogen (multiple events across the period), and one orthophosphate (October 2019) exceedances of the TCEQ nutrient screening criteria.

Due to the exceedances discussed above and the availability of bioassessment, CRP and wet weather chemical data, a boxplot was created for nitrate nitrogen, orthophosphate, pH, and *E. coli* for comparison of the datasets. A boxplot for ammonia nitrogen was not created because there isn't enough wet weather chemical data. According to the boxplots, there is no significant difference between the fourth monitoring term wet weather, bioassessment, and CRP data for nitrate nitrogen or orthophosphate (Figures 4-58 and 4-59). For *E. coli*, there was a significant increase between the second monitoring term wet weather data and the other datasets (Figure 4-61). However, that trend did not continue into the fourth monitoring term. For pH, there was a significant increase between the third monitoring term and the other datasets with the exception of the fourth term bioassessment data (Figure 4-60). Overall, there was no indication that stormwater runoff in the fourth monitoring term provided a significantly different input of nitrate nitrogen, pH, or *E. coli* to the stream compared to the CRP and bioassessment data which was collected predominately during dry weather.

Figure 4-58 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term, Third and Fourth Monitoring Term Bioassessment Nitrate Nitrogen Data at Marine Creek

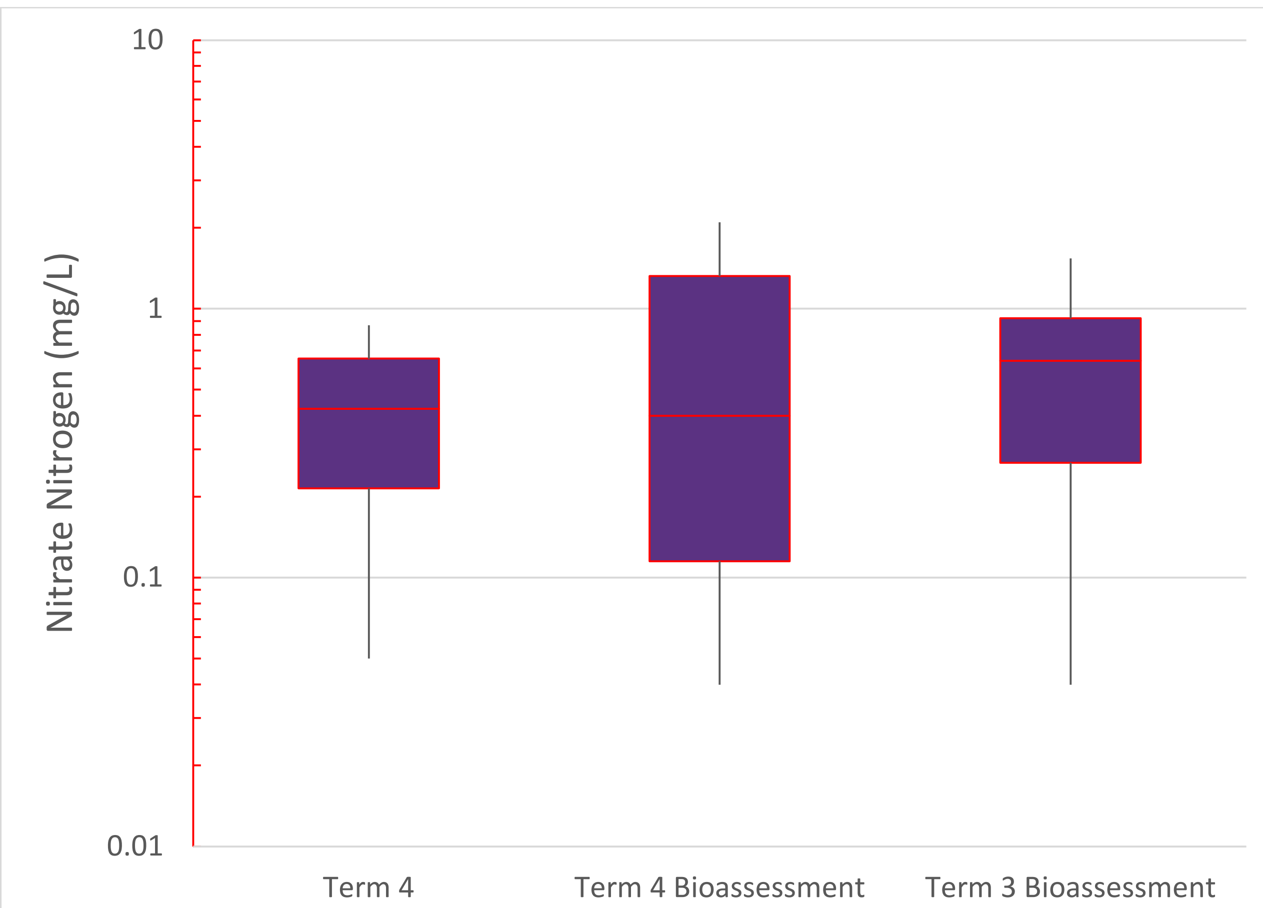


Figure 4-59 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and Third and Fourth Monitoring Term Bioassessment Orthophosphate Data at Marine Creek

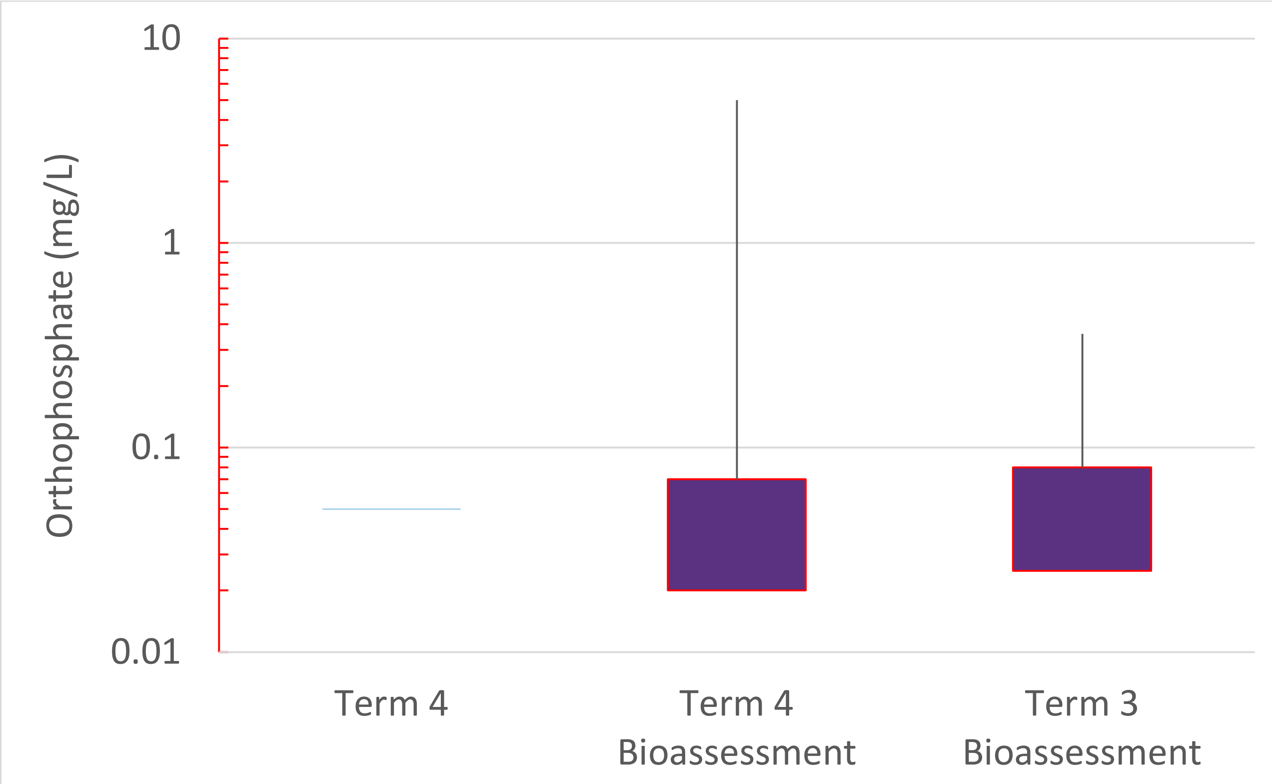


Figure 4-60 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms, Third and Fourth Monitoring Term Bioassessment, and CRP pH Data at Marine Creek

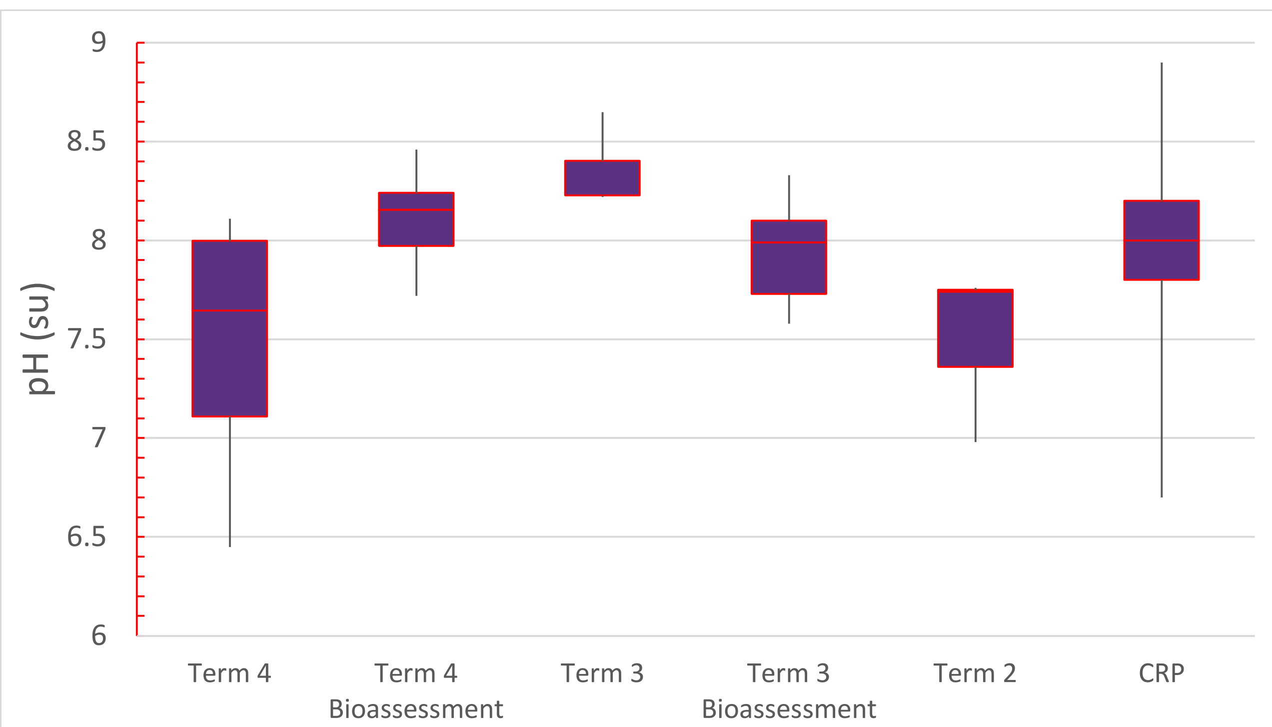
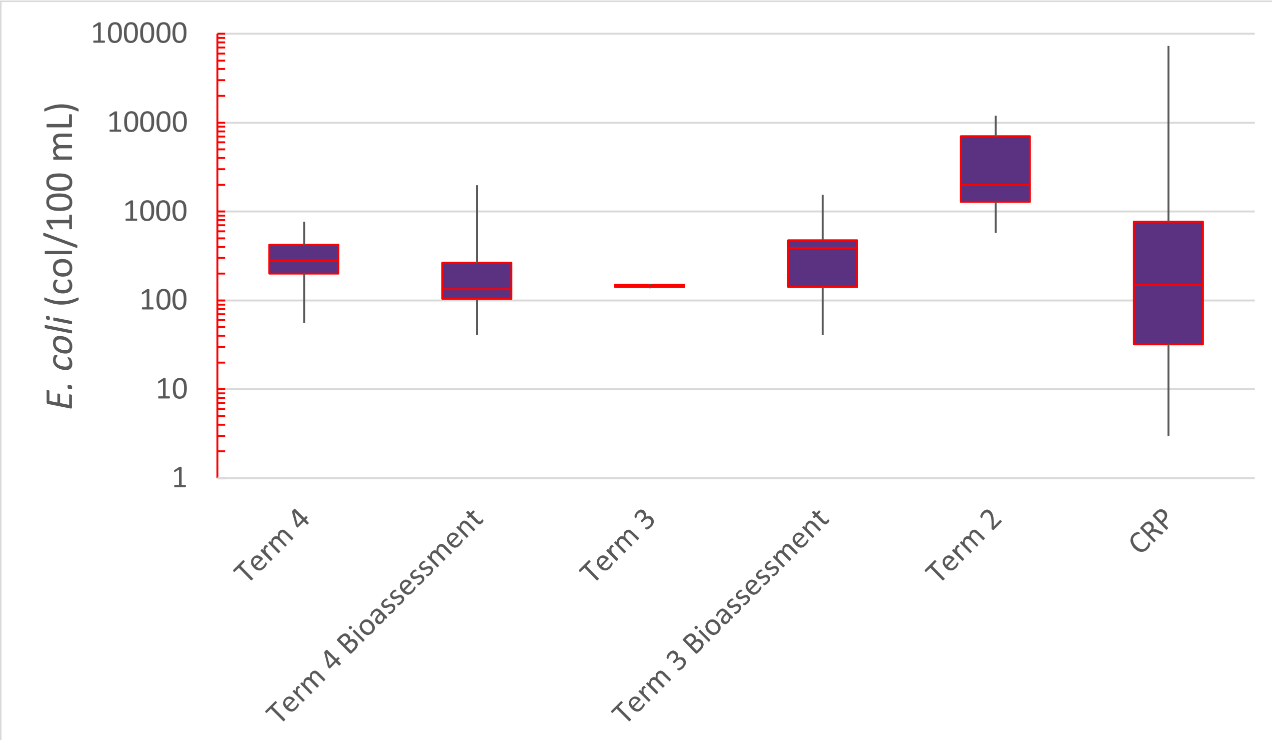


Figure 4-61 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms, Third and Fourth Monitoring Term Bioassessment, and CRP *E. coli* Data at Marine Creek



4.4.16.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix R). The habitat scores at FWMAR1 remained in the sub-optimal range over the fourth term with the exception of a marginal score in the spring of 2019. The habitat scores at FWMAR2 also remained in the sub-optimal range with the exception of a marginal score in the fall of 2019. The habitat scores at FWMAR3 were in the sub-optimal range with the exception of an optimal score in the spring of 2020. Overall, the habitat scores for FWMAR1 and FWMAR3 from the fourth monitoring term were generally higher than the habitat scores from the third term.

Texas macroinvertebrate IBI scores at FWMAR1 ranged from limited to high throughout the fourth term. IBI scores at FWMAR2 were primarily intermediate with three limited scores in the spring and fall of 2018 and spring of 2019. IBI scores at FWMAR3 were intermediate. The intermediate IBI scores generally correspond with the available habitat indicating that water quality may not be limiting macroinvertebrate communities. The IBI scores for FWMAR1 from the fourth monitoring term were generally in-line with the third term indicating stable macroinvertebrate communities. The IBI scores for FWMAR3 from the fourth monitoring term were generally lower than the third term indicating declining macroinvertebrate communities.

4.4.16.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that although there were no large-scale development activities, there may have been small scale construction activities that occurred throughout the drainage area. Industrial/commercial activities such as bulk material storage yards may also have contributed to the TSS loadings and for total lead.

Land use of the unnamed tributary subwatershed is predominately open followed by residential, roadway and commercial land uses. The potential source of the nitrate nitrogen, ammonia nitrogen, and orthophosphate loadings may be excessive lawn and garden fertilization. In addition, riparian alteration can affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). For bacteria, potential sources may be domestic animals, wildlife, and illicit connections.

BMPs recommended for these sources include public education for agricultural and residential land owners regarding fertilization and turf management, public education for livestock and pet owners regarding waste management, review/improvement of construction inspection protocols or BMP requirements, review of industrial inspection protocols or BMP requirements, and compliance inspections for illicit connections. Due to marginal habitat scores, stream restoration would benefit the biological productivity of the stream.

4.4.16.5. Monitoring Recommendations

Data analyzed presents moderate indications of stream degradation. Bacteria concentrations have a potential to impact primary contact recreation and nutrients and lead have the potential to impact aquatic life. Marine Creek is currently impairment for bacteria. The West Fork of the Trinity River (TCEQ segment 0806) is impaired for dioxin and PCBs in fish tissue. Additional monitoring at this site is recommended to be assigned a high priority. In order to determine the concentration of bioavailable metals, it is recommended that sampling of the dissolved fraction of lead is conducted.

4.4.17. Mary’s Creek

The City of Fort Worth performed bioassessment and chemical monitoring on Mary’s Creek, a stream with a stream order of three or greater draining to the Clear Fork of the Trinity River (TCEQ segment 0829) within the Mary’s Creek watershed. Additional bioassessment monitoring is scheduled for 2022.

Mary’s Creek Watershed is located in western Tarrant County and eastern Parker County and flows southeasterly through south Fort Worth eventually emptying into the West Fork Trinity River. Mary’s Creek Watershed covers a 35,357.4-acre area and is predominately made up of open space (72.9%). Residential property (13.8%), commercial development (4.3%), and industrial use (0.3%) occur primarily in the far eastern portion of the subwatershed. The roadway land use estimate for this watershed is 7.9%. Major highways running through this area are IH 20, IH 30, and IH 820. This watershed consists of 0.8% water features.

The City of Fort Worth had two chemical and bioassessment monitoring sites and one bioassessment only monitoring site located on Mary’s Creek. The monitoring site, FWMRY1, was an upstream sampling site located just downstream of the bridge crossing at 3900 Longvue (FM 2871), approximately 1.0 mile west of West Loop IH 820. The subwatershed delineated for this sampling location covered a 22,908-acre area and was predominately made up of open space (84.4%) and some residential land use (9.5%) between the sample site and IH 30. Roadways (4.4%) located in the subwatershed included IH 20, IH 30, and Hwy 80. Commercial made up just 0.8% of the land area and there were 0.2% industrial land uses in the subwatershed. Water features made up 0.7% of the land area.

The monitoring site, FWMRY2, was located at the Loop IH-820 SW crossing, 0.5 miles south of Chapin Road. No subwatershed information was available for this monitoring site.

The monitoring site, FWMRY3, was a downstream sampling site located approximately 0.10 upstream of the Winscott Road crossing in South Z Boaz Park. Below this point, the creek continued through the City of Benbrook prior to its convergence with the Clear Fork of the Trinity River. The subwatershed delineated for this sampling location covered an 11,675.2-acre area and was predominately made up of open space (52.6%). Residential land use (20.7%) and associated commercial development (10.2%) were located primarily in the northern part of the subwatershed between IH 820 and Hwy 183. These roadways and IH 20 and IH 30 contributed to 15.6% roadway land use. The western part of the subwatershed was largely undeveloped. There were just 0.1% industrial uses in the subwatershed. Water features made up 0.8% of the land area.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 17. The City of Fort Worth and Parker and Tarrant Counties have jurisdictions occurring in the subwatershed area. TxDOT contributes flow to the subwatershed through IH 30, IH 20, IH 820, US 80, and US 183. There are three TCEQ permitted wastewater outfalls within the monitored subwatershed according to the *TCEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022. One permittee is identified as Markum Land Properties LLC and the outfall is located south of the IH 20 interchange with Markum Ranch Road E. Another permittee is identified as City of Fort Worth and the outfall is located on Mary's Creek north of IH 30. The last permittee is identified as JMR100 LLC and is located south of White Settlement Road between Mesa Grande Drive and Tara Lane.

4.4.17.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-14. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-14 Mary's Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	4	4	4	4	4	0	4
Minimum	235.0	1.00	1.00	15.00	0.25	-	0.05
Maximum	343.0	14.80	2.40	15.00	1.01	-	1.01
Median	317.0	8.05	1.00	15.00	0.48	-	0.38
Arithmetic Mean	303.0	7.98	1.35	15.00	0.55	-	0.45
Geometric Mean	299.8	5.23	1.24	15.00	0.46	-	0.21
Standard Deviation	48.7	6.41	0.70	0.00	0.37	-	0.48
Coefficient of Variation	0.16	0.80	0.52	0.00	0.67	-	1.06
Parameter	**Phosphorus, Dissolved (mg/L)**	**Orthophosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	4	4	4	4	4	4	4
Minimum	0.003	0.050	0.500	0.003	0.003	0.003	0.003
Maximum	0.030	0.050	0.500	0.003	0.003	0.008	0.003
Median	0.006	0.050	0.500	0.003	0.003	0.003	0.003
Arithmetic Mean	0.012	0.050	0.500	0.003	0.003	0.004	0.003
Geometric Mean	0.007	0.050	0.500	0.003	0.003	0.003	0.003
Standard Deviation	0.013	0.000	0.000	0.000	0.000	0.003	0.000
Coefficient of Variation	1.115	0.000	0.000	0.000	0.000	0.710	0.000
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	4	4	4	4	0	4	4
Minimum	0.005	2.50	7.68	370.00	-	24	0.500
Maximum	0.005	2.50	8.53	600.00	-	461	0.515
Median	0.005	2.50	8.24	525.00	-	64	0.505
Mean	0.005	2.50	8.17	505.00	-	153	0.506
Geometric Mean	0.005	2.50	8.17	496.80	-	82	0.506
Standard Deviation	0.000	0.00	0.36	100.83	-	206	0.008
Coefficient of Variation	0.000	0.00	0.04	0.20	-	1.35	0.015

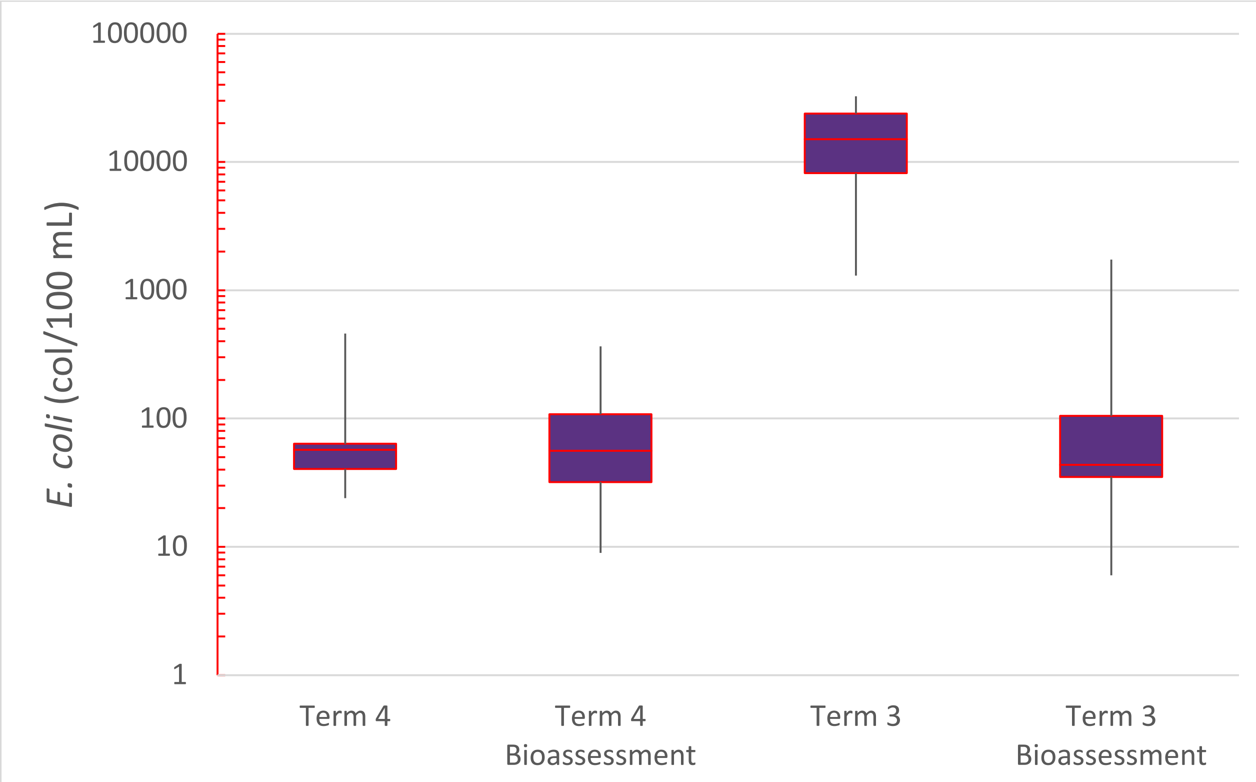
4.4.17.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, and other data sources where applicable. The graphs are located in Appendix S. During the fourth monitoring term, there was one exceedance of the *E. coli* PCR single sample criterion (October 2018) but the geometric mean criterion was not exceeded.

The water quality data collected during bioassessments was also plotted and compared to water quality standards, screening levels, other data sources where applicable. The graphs are also located in Appendix S. The geometric mean of the bioassessment *E. coli* data was 57.3 col/100 mL which was less than the PCR geometric mean standard of 126 col/100 mL. Ammonia nitrogen exceeded the TCEQ screening level two times in May 2018.

Due to the exceedances and elevated concentrations discussed above and the availability of bioassessment and wet weather chemical data, a boxplot was created for *E. coli* for comparison of the datasets. According to the boxplot, there was no significant difference between the fourth monitoring term wet weather and bioassessment data. The third monitoring term wet weather data for E. coli was higher than the fourth term data and third term bioassessment data (Figure 4-62).

Figure 4-62 Boxplot Comparing Wet Weather Chemical Monitoring and Bioassessment Third and Fourth Monitoring Terms *E. coli* Data at Mary's Creek



4.4.17.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix S). At FWMRY1, the habitat scores remained in the sub-optimal range over the fourth term period with the exception of a marginal score in the fall of 2020. At FWMRY2, the habitat scores were mostly in the marginal range with the exception of sub-optimal scores in the fall of 2019, spring of 2020, and spring of 2021. At FWMRY3, the habitat scores remained in the sub-optimal range over the fourth term period with the exception of a marginal score in the fall of 2020.

Texas macroinvertebrate IBI scores at FWMRY1 ranged from intermediate to high throughout the fourth term. IBI scores at FWMRY2 were primarily intermediate with one high score in the fall of 2019 and two limited scores in the fall of 2018 and the spring of 2020. IBI scores at FWMRY3 were primarily intermediate with one high score in the fall of 2019 and one limited score in the spring of 2020. The intermediate IBI scores generally correspond with the available habitat indicating that water quality may not be limiting macroinvertebrate communities. The IBI scores at FWMRY1 from the fourth monitoring term were generally in-line with the third term indicating stable macroinvertebrate communities. The IBI scores for FWMRY3 from the fourth monitoring term were generally lower than the third term indicating declining macroinvertebrate communities.

4.4.17.4. Potential Pollution Sources and BMP Recommendations

Land use of the subwatershed is a predominately open land use. Given the open land use in the subwatershed, the potential source of the ammonia nitrogen loadings may be excessive lawn, garden, and agricultural fertilization. However, dissolved oxygen concentrations over the monitoring term did not fall below TCEQ criteria for aquatic life protection suggesting that the nutrient loadings were not contributing to low dissolved oxygen events.

For bacteria, potential sources may be livestock, agricultural manure application, domestic animals, wildlife, septic system failure, and illicit connections. BMPs recommended for these sources include public education for agricultural and residential landowners and compliance inspections for illicit connections. In addition, maintenance and education for septic system owners regarding frequent maintenance and pump out may be considered. Due to marginal habitat scores ranging to sub-optimal, stream restoration projects may be able to increase the biological productivity of the stream.

4.4.17.5. Monitoring Recommendations

Data analyzed presents moderate indications of stream degradation. Bacteria concentrations have a potential to impact primary contact recreation and nutrients have the potential to impact aquatic life. Mary's Creek does not have an identified TMDL or impairment. The Clear Fork of the Trinity River (TCEQ segment 0829) is impaired for dioxin and PCBs in fish tissue and there is a TMDL for PCBs in fish tissue. Additional monitoring at this site is recommended to be assigned a moderate priority.

4.4.18. North Mesquite Creek

The City of Mesquite performed chemical monitoring on North Mesquite Creek, a stream with a stream order of one draining to the East Fork of the Trinity River (TCEQ segment 0819) within the North Mesquite Creek – East Fork Trinity River watershed.

North Mesquite Creek Watershed is located on the far eastern edge of Dallas County and partially within the Dallas city limits. North Mesquite Creek Watershed covers a 21,862.5-acre area and consists mostly of open space (64.3%) and residential (20.9%) property. Residential property is primarily located on the western side of the watershed with a small section along the southern edge. The roadway land use estimate for this watershed is 10.9% which includes SH 80, SH 352 and other major roadways such as East Glen Boulevard, Belt Line Road, North Galloway Avenue, and Town East Boulevard. The roadway estimate also includes the Mesquite Metro Airport, located at the intersection of Scyene Road and Airport Boulevard. Industrial (1.5%) sites are mostly located in the central portion of this watershed along SH 80 and SH 352. Most of the commercial (10.5%) areas are located throughout the watershed along the major roadways and intermixed with the residential areas. This watershed contains 1.3% water features.

The City of Mesquite had one chemical monitoring site located within the North Mesquite Creek subwatershed. The chemical monitoring site, MS1802/1902/2002/2102 was located between Cartwright Road and Clay Mathis Road where Edwards Church Road crosses North Mesquite Creek. The conveyance at this site was an unlined channel with gabions. The subwatershed delineated for this sampling location covered a 6,239.4-acre area and consists primarily of residential (34.7%) property and open space (30.8%). There were large sections of open space in the north and center of the subwatershed along the banks of North Mesquite Creek. The roadway land use estimate was 17.4% which included major highways and roadways such as SH 80, Belt Line Road, East Glen Boulevard, Clay Mathis Road, and Town East Boulevard. Industrial (3.7%) sites were located south of SH 80, along SH 352, and north of East Glen Boulevard. Commercial (13.2%) property was scattered throughout the watershed, mostly located along major roads adjacent to residential areas. This subwatershed contained 0.2% water features.

The monitoring site, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 18. The monitoring site is shown as MS2102. MS1802/1902/2002 were located in the same location. The subwatershed area is within the jurisdictional limits of the City of Mesquite and the City of Sunnyvale. TxDOT contributes flow to the subwatershed through SH 80 and SH 352. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the T*CEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.18.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-15. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-15 North Mesquite Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	16	16	16	16	16	16	16
Minimum	121.0	4.40	0.50	5.00	0.220	0.002	0.220
Maximum	484	723.0	35.9	113.0	2.40	0.180	0.730
Median	286.5	50.20	4.62	21.10	1.255	0.083	0.455
Arithmetic Mean	302.7	121.4	7.16	29.85	1.202	0.076	0.472
Geometric Mean	279.4	49.99	4.25	22.06	1.081	0.050	0.440
Standard Deviation	116.8	190.01	8.67	26.82	0.497	0.052	0.174
Coefficient of Variation	0.39	1.57	1.21	0.90	0.41	0.688	0.368
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.008	0.010	0.025	0.001	0.001	0.003	0.000
Maximum	0.241	0.370	0.330	0.016	0.011	0.108	0.011
Median	0.061	0.066	0.151	0.003	0.002	0.005	0.002
Arithmetic Mean	0.085	0.088	0.156	0.004	0.003	0.022	0.003
Geometric Mean	0.057	0.053	0.119	0.003	0.002	0.008	0.002
Standard Deviation	0.070	0.093	0.101	0.004	0.003	0.037	0.003
Coefficient of Variation	0.825	1.060	0.649	0.960	1.023	1.682	1.137
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.002	0.18	6.34	199	51.2	5.0	0.005
Maximum	0.104	8.92	8.60	881	78.3	10000	1.960
Median	0.018	1.00	8.20	671	69.2	1200	0.050
Mean	0.029	2.06	8.04	647	65.6	2279	0.296
Geometric Mean	0.017	0.97	8.02	617	64.9	405	0.073
Standard Deviation	0.030	2.49	0.52	171	9.8	3149	0.578
Coefficient of Variation	1.060	1.21	0.07	0.26	0.15	1.38	1.956

4.4.18.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, NSQD, and other data where applicable. These graphs are located in Appendix T. During the fourth monitoring term, there were three exceedances (June and August 2018 and October 2021) of the TCEQ aquatic life use estimated chronic criterion for total copper, one exceedance of the basin specific criteria for pH (July 2021), and nine exceedances of the *E. coli* PCR single sample criterion (multiple events across the period and the *E. coli* PCR geometric mean criterion was exceeded). There were four occurrences where the TSS concentration (June 2018, May and October 2019, and July 2020), two occurrences where the BOD concentration (April and October 2021), and one occurrence where the oil and grease concentration (October 2021) was higher than 75% of NSQD data for those parameters.

4.4.18.3. Biological Data Analysis

No bioassessment monitoring data was collected within this watershed.

4.4.18.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that there were construction activities that occurred within the drainage area. An example of major development is the commercial/industrial development at Planters Road near US 80. Industrial/commercial activities may have contributed to sediment loading through bulk material storage and earth disturbance activities. Given the industrial and commercial land use in the subwatershed there are potential sources of illicit connections, unauthorized industrial discharges, or illegal dumping that may contribute to BOD and *E. coli*. Other potential sources of bacteria loading may be illicit connections, wildlife, and domestic animals. Potential sources of oil and grease and copper could be from illicit connections, illegal dumping, and high traffic roadways.

BMPs recommended for these sources include compliance inspections for illicit connections, identification and removal of illegal dumping areas, public education of home and business owners regarding fertilization and turf management, public education for pet owners regarding pet waste management, review of construction site inspection protocols or BMP requirements, and review of industrial inspection protocols or BMP requirements.

4.4.18.5. Monitoring Recommendations

Data analyzed presents several indications of stream degradation. Bacteria concentrations have a potential to impact primary contact recreation and BOD and copper have the potential to impact aquatic life. There are currently no TMDLs or impairments for North Mesquite Creek but the East Fork of the Trinity River is impaired for TDS and sulfate. Therefore additional monitoring at this site is recommended to be assigned a high priority. Bioassessment data collection is recommended to determine whether the biological community may be impacted by the chemical pollutants documented above. Also, dry weather chemical monitoring data is recommended to further determine potential sources of pollutants. In order to determine the concentration of bioavailable metals, it is recommended that sampling of dissolved fractions of copper is conducted.

4.4.19. Rowlett and Spring Creeks

Rowlett Creek is a stream with a stream order of three or greater that flows for twenty-six miles before emptying into Lake Ray Hubbard (TCEQ segment 0820). Rowlett Creek and a major tributary, Spring Creek, were monitored by the cities of Garland and Plano. The City of Garland performed chemical and bioassessment monitoring on lower Rowlett Creek (TCEQ segment 0820B) within the Rowlett Creek – Lake Ray Hubbard watershed. The City of Plano performed chemical and bioassessment monitoring on Spring Creek and Upper Rowlett Creek, each draining to lower Rowlett Creek. Spring Creek was monitored within the Pittman Creek – Spring Creek watershed. Upper Rowlett Creek was monitored within the Headwaters Rowlett Creek and Brown Branch Rowlett Creek watersheds. See Figure 1-6 for an overview of the watershed locations.

Headwaters Rowlett Creek Watershed was located within Collin County and was 24,773-acres. The watershed was predominantly residential (35.9%) and open space (36.9%). Water features and industrial land uses were low with 0.3% and 0.7% estimates. Commercial land use was estimated at 8.4% and roads were estimated at 17.6%.

The City of Plano had one chemical monitoring site located within the Headwaters Rowlett Creek Watershed. The chemical monitoring site, PL2001/2101 was an upstream sampling site located at Alma Drive. The drainage area delineated for this site covered a 16,626.7-acre area and primarily consisted of residential properties (33.9%) and open space (41.0%). Industrial space (0.5%) was scattered throughout the drainage area but was mostly located along Sam Rayburn Tollway. Clusters of commercial (8.3%) properties were dispersed in this drainage area. There was a very small section of water bodies (0.3%) present.

The monitoring site, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 19. The monitoring site is shown as PL2101. PL2001 was located in the same location. The subwatershed areas are within the jurisdictional limits of the City of Plano, the City of Allen, the City of McKinney, and the City of Frisco. NTTA contributes flow to the subwatershed through the Sam Rayburn Tollway. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the T*CEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

The Brown Branch Rowlett Creek Watershed was located in Collin and Dallas Counties and was 16,252-acres and was predominantly residential (32.7%). Open space accounted for 28.9% of the area and was mostly found around Rowlett creek. Commercial properties (13.1%) were located throughout the site. Road land use estimates for this subwatershed were 17.3% and included major highways such as President George Bush Turnpike and Sam Johnson Hwy. Industrial sites made up 7.5% of the watershed while water features made up 0.5%.

The City of Plano had one chemical monitoring site located within the Brown Branch Rowlett Creek Watershed. The chemical monitoring site, PL2002/2102 was a downstream sampling site located in Oak Point Park. The drainage area delineated for this site covered a 2,234.5-acre area and primarily consisted of residential properties (22.0%) and open space (38.3%). Industrial property (6.6%) was in the north section of the drainage area. Clusters of commercial (15.8%) properties were dispersed along Sam Johnson Hwy in this drainage area. There was a very small section of water bodies (0.3%) present. Roads consisted of the major highway Sam Johnson, major and minor arterials, collectors, and smaller roads.

The monitoring site, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 20. The monitoring site is shown as PL2102. PL2002 was located in the same location. The subwatershed areas are within the jurisdictional limits of the City of Plano and the City of Allen. TxDOT contributes flow to the subwatershed through US75. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the T*CEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

Pittman Creek-Spring Creek Watershed was located partially in southeastern Collin County and northcentral Dallas County. Pittman Creek-Spring Creek covered a 23,387.2-acre area and consisted predominately of residential (45.4%) and open space (20.9%) land use. The open space was mostly located along the highways and residential areas. The main highways that intersect in this watershed were US 75 (Central Expressway), PGBT, and SH 78 on the southern edge. The residential areas seemed to be divided between US 75 (Central Expressway) and PGBT. Commercial (18.1%) property was located mostly in the central portion of the watershed around some of the major roadways and highways. This watershed contained 0.2% water features.

The City of Plano had one chemical monitoring site located within the Pittman Creek-Spring Creek Watershed. The chemical monitoring site, PL1801/1901 was located at 16th Street. The drainage area delineated for this site covered a 5,129.4-acre area and primarily consisted of residential properties (52.9%) and roads (24.8%). Open space (8.9%) was scattered throughout the drainage area but was mostly located along Spring Creek and mixed in with the residential and commercial property. Clusters of commercial (12.8%) properties were dispersed in this drainage area. There was a very small section of industrial (0.5%) sites and water bodies (0.1%) present.

The monitoring site, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 21. The monitoring site is shown as PL1801. PL1901 was located in the same location. The subwatershed areas are within the jurisdictional limits of the City of Plano. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the T*CEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

Rowlett Creek – Lake Ray Hubbard Watershed was located in northeast Dallas County near Lake Ray Hubbard. This watershed covered a 17,257-acre area and consisted predominately of residential (34.0%) property and open space (26.9%). There were several roadways (16.9%) that went through this watershed. These highways were SH 121, US 75 (Central Expressway), SH 5, PGBT, SH 78, SH 66, and IH 30. This watershed had very few industrial (1.7%) and some commercial (10.9%) sites. The industrial sites were found mainly along roadways and near commercial property in residential areas. This watershed contained 10.9% water features which included a portion of Lake Ray Hubbard.

The City of Garland had three chemical monitoring sites located within the Rowlett Creek – Lake Ray Hubbard Watershed. The chemical monitoring site, GA2001/2101 was an upstream sampling site located at Ben Davis Bridge. The conveyance at this site was a natural, unlined channel with rock substrate. The drainage area delineated for this site covered 566.4-acres. The land use in this area was primarily residential property (61.6%) and roads (15.6%), Lavon Drive and minor arterial streets. Most of the commercial (7.4%) properties are in the north portion of this drainage site. Open space composes 15.3% of the drainage area and 0.1% of water features are found in this watershed. There are no industrial uses in the drainage area.

The chemical monitoring site, GA2002/2102 was a midstream sampling site located just east of the intersection of Castle Drive and Centerville Road at Rowlett Creek. The conveyance at this site was a natural, unlined channel with medium vegetation and tree cover. The drainage area delineated for this site covered 5,297.5 acres and was located completely within the Rowlett Creek-Lake Ray Hubbard watershed. The land use in this area was predominately open space (39.4%) and residential (32.3%) property. The highways and major roadways that made up the roadway (17.2%) land use estimate was the PGBT and other minor and major arterials. There were very few industrial (0.8%) sites in this subwatershed; but a cluster could be found in the southeast and the southwest. Most of the commercial (10.1%) property was found throughout. This drainage area had 0.2% water features.

The chemical monitoring site, GA2003/2103 was a downstream sampling site located downstream of SH 66. The conveyance was a natural unlined channel with low vegetative cover consisting mainly of brush. The drainage area delineated for this site covered 5,916.6 acres and was located completely within the Rowlett Creek-Lake Ray Hubbard watershed. The predominant land use was residential property (32.6%) and open space (39.1%). Commercial properties (10.1%) can be found throughout this drainage site, and industrial areas (0.7%) can be found in the southeast and southwest. Roads composed 15.6% of the drainage area with PGBT and other minor and major arterials. 0.8% of water features are found in this watershed.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 22. The monitoring sites are shown as GA2101, GA2102, and GA2103. GA2001, GA2002, and GA2003 were located in the same locations, respectively. The monitoring sites receive drainage from the City of Garland, the City of Rowlett, the City of Sachse, the City of Murphy, the City of Plano, the City of Parker, the City of Allen, the City of McKinney, the City of Frisco, and the City of Richardson. NTTA contributes flow through SH 121, the Sam Rayburn Tollway and TX-190, and the PGBT. TxDOT contributes flow through US 66, SH 78, US 75, SH 5, FM 2478 (Custer Road), FM 2170 (McDermott Drive), and FM 2514 (Parker Road). There is one TCEQ permitted wastewater outfall upstream of the monitoring sites according to the T*CEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022. One permittee is identified as the North Teas Municipal Water District and the outfall is located at Los Rios Golf Club.

The results below were grouped into upper Rowlett Creek (Headwaters Rowlett Creek and Brown Branch Rowlett Creek), Spring Creek (Pittman Creek-Spring Creek Watershed), and lower Rowlett Creek (Rowlett Creek – Lake Ray Hubbard Watershed). In the second monitoring term, Spring Creek was divided into upper and lower sections. The upper section was monitored by the City of Plano while the lower section was monitored by the City of Garland and NTTA. In the fourth monitoring term, upper Rowlett Creek and Spring Creek were monitored by the City of Plano and lower Rowlett Creek was monitored by the City of Garland.

4.4.19.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Tables 4-16 through 4-18. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-16 Upper Rowlett Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia N (mg/L)	Nitrate N (mg/L)
No. of Samples	16	16	16	16	16	16	16
Minimum	140.0	4.70	1.00	5.00	0.52	0.01	0.45
Maximum	452.0	1440	24.9	127.0	4.70	0.38	2.10
Median	261.0	104.65	4.81	22.30	2.10	0.08	0.71
Arithmetic Mean	289.1	318.76	6.50	28.62	2.33	0.11	0.99
Geometric Mean	271.6	88.35	4.38	17.23	2.02	0.06	0.87
Standard Deviation	103.9	448.64	6.12	32.29	1.18	0.11	0.55
Coefficient of Variation	0.36	1.41	0.94	1.13	0.51	1.01	0.56
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead , Total (mg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.008	0.010	0.008	0.001	0.000	0.001	0.000
Maximum	0.310	0.340	1.700	0.010	0.029	0.029	0.019
Median	0.028	0.010	0.186	0.002	0.006	0.007	0.002
Arithmetic Mean	0.050	0.083	0.401	0.004	0.009	0.010	0.005
Geometric Mean	0.026	0.031	0.142	0.003	0.004	0.006	0.002
Standard Deviation	0.074	0.119	0.503	0.003	0.010	0.009	0.007
Coefficient of Variation	1.478	1.435	1.254	0.863	1.038	0.927	1.223
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field**	**Specific Conductivity**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	16	16	16	15	16	16	16
Minimum	0.001	0.18	7.20	482	53.1	154.2	0.044
Maximum	0.250	10.30	8.70	915	84.4	24196	0.602
Median	0.029	0.18	8.23	719	67.1	1384	0.114
Mean	0.054	1.08	8.12	672	67.3	3498	0.179
Geometric Mean	0.025	0.37	8.11	657	66.6	1391	0.129
Standard Deviation	0.066	2.52	0.43	142	10.0	6033	0.167
Coefficient of Variation	1.214	2.33	0.05	0.21	0.15	1.72	0.936

Table 4-17 Spring Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	8	8	8	8	8	8	8
Minimum	152.0	130.20	0.50	13.00	0.670	0.03	0.40
Maximum	356.0	410.0	21.7	90.00	4.30	0.95	0.93
Median	215.0	331.0	9.85	31.80	1.700	0.22	0.64
Arithmetic Mean	232.3	315.4	10.59	45.98	2.058	0.29	0.65
Geometric Mean	223.5	298.40	7.44	38.14	1.778	0.18	0.62
Standard Deviation	70.2	97.3	6.69	29.26	1.186	0.30	0.18
Coefficient of Variation	0.30	0.31	0.63	0.64	0.58	1.01	0.28
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	8	8	8	8	8	8	8
Minimum	0.022	0.015	0.073	0.001	0.001	0.012	0.006
Maximum	0.190	1.030	0.470	0.011	0.014	0.088	0.016
Median	0.056	0.098	0.353	0.004	0.008	0.031	0.011
Arithmetic Mean	0.087	0.196	0.327	0.004	0.008	0.044	0.011
Geometric Mean	0.068	0.087	0.291	0.004	0.006	0.032	0.010
Standard Deviation	0.066	0.339	0.130	0.003	0.005	0.034	0.004
Coefficient of Variation	0.760	1.728	0.397	0.675	0.584	0.776	0.368
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field(su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	8	8	8	8	8	8	8
Minimum	0.062	0.19	6.70	114	62.0	50.0	0.005
Maximum	0.200	5.0	9.00	820	82.3	8800	0.266
Median	0.129	2.77	8.25	518	75.3	4000	0.028
Mean	0.123	2.68	8.11	486	74.3	3610	0.057
Geometric Mean	0.114	1.90	8.09	403	74.0	1534	0.020
Standard Deviation	0.047	1.66	0.66	261	6.6	3085	0.088
Coefficient of Variation	0.386	0.62	0.08	0.54	0.09	0.85	1.550

Table 4-18 Lower Rowlett Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia N (mg/L)	Nitrate N (mg/L)
No. of Samples	24	24	24	24	24	24	24
Minimum	50.0	1.40	1.00	5.00	1.20	0.01	0.01
Maximum	705.0	182	106.0	217.0	12.10	7.60	11.20
Median	470.0	31.45	3.94	18.55	6.195	0.08	5.57
Arithmetic Mean	451.1	50.83	8.57	25.81	6.51	0.49	5.43
Geometric Mean	421.6	30.67	3.78	16.40	5.83	0.12	3.83
Standard Deviation	113.7	49.53	20.96	41.77	2.72	1.53	2.78
Coefficient of Variation	0.25	0.97	2.45	1.62	0.42	3.14	0.51
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead , Total (mg/L)**
No. of Samples	24	24	24	24	24	24	24
Minimum	0.008	0.010	0.009	0.001	0.000	0.000	0.000
Maximum	0.460	0.460	0.670	0.024	0.005	0.008	0.003
Median	0.082	0.102	0.137	0.002	0.001	0.003	0.001
Arithmetic Mean	0.135	0.146	0.207	0.003	0.002	0.003	0.001
Geometric Mean	0.084	0.093	0.147	0.002	0.001	0.003	0.001
Standard Deviation	0.129	0.128	0.171	0.006	0.001	0.002	0.001
Coefficient of Variation	0.960	0.878	0.824	1.631	0.697	0.493	0.758
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	24	24	24	24	24	24	24
Minimum	0.004	0.18	6.90	392	49.6	5.0	0.050
Maximum	0.029	7.45	8.67	1440	84.3	9208	0.916
Median	0.011	0.78	8.06	874	65.6	285	0.091
Mean	0.013	1.32	7.94	867	66.3	1070	0.167
Geometric Mean	0.012	0.70	7.92	842	65.3	369	0.122
Standard Deviation	0.007	1.66	0.50	198	11.5	1946	0.180
Coefficient of Variation	0.519	1.26	0.06	0.23	0.17	1.82	1.080

4.4.19.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, NSQD, CRP, and second, third, and fourth monitoring term data where applicable. CRP stations 10753, 17845, and 21478 were utilized for this analysis. Station 10753 is located downstream of SH66. Station 17845 is located at SH 78. Station 21478 is located at Firewheel Parkway. Graphs are located in Appendix U.

During the fourth monitoring term in lower Rowlett Creek, there were three exceedances of the TCEQ TDS basin specific criterion (January, April, and August 2020), two exceedances of the human health estimated criterion for total arsenic (January and April 2020), and eleven exceedances of the *E. coli* PCR single sample criterion (multiple events across the period and the *E. coli* PCR geometric mean criterion was exceeded). There were four ammonia nitrogen (January, April, October, and December 2020), twenty-one nitrate nitrogen (multiple events), and two orthophosphate (August 2020), exceedances of the TCEQ nutrient screening criteria. There were two occurrences where the TSS concentration (April 2020), one occurrence where the BOD concentration (January 2020), one occurrence where the COD concentration (January 2020), twenty-one occurrences where the total nitrogen concentration (multiple events), and three occurrences where the dissolved phosphorus concentration (August 2020) was higher than 75% of NSQD data for each parameter. In addition, there were four specific conductance readings (January (2), April, and August 2020) greater than 1,000 µS/cm which exceeded the NRSA good category into the fair category.

For upper Rowlett Creek, there were two exceedances (August and October 2020) of the aquatic life use estimated chronic criterion for total copper, two exceedances (April and October 2020) of the TCEQ aquatic life use estimated chronic criterion and three exceedances (August and October 2020) of the human health criterion for total lead, and thirteen exceedances of the *E. coli* PCR single sample criterion (multiple events across the period and the *E. coli* PCR geometric mean criterion was exceeded). There was one ammonia nitrogen (January 2021) and two nitrate nitrogen (January 2020) exceedances of the TCEQ nutrient screening criteria. There were six occurrences where the TSS concentration (multiple events), one occurrence where the BOD concentration (October 2020), one occurrence where the COD concentration (August 2020), three occurrences where the total nitrogen concentration (April, August, and October 2020), one occurrence where the dissolved phosphorus concentration (August 2020), and one occurrence where the oil and grease concentration (April 2021) was higher than 75% of NSQD data for each parameter.

For Spring Creek, there were four exceedances (May, June, and August 2018 and August 2019) of the aquatic life use estimated acute criterion for total copper, four exceedances (June and August of 2018 and May and October 2019) of the human health estimated criterion and two exceedances (May 2018 and May 2019) of the TCEQ aquatic life use estimated chronic criterion for total lead, and six exceedances of the *E. coli* PCR single sample criterion (multiple events across the period and the *E. coli* PCR geometric mean criterion was exceeded). There were two ammonia nitrogen (June and August 2018) and one orthophosphate (June 2018) exceedances of the TCEQ nutrient screening criteria. There were seven occurrences where the TSS concentration (multiple events), two occurrences where the BOD concentration (August and October 2019), one occurrence where the total nitrogen concentration (October 2019), and one occurrence where the dissolved phosphorus concentration (August 2020) was higher than 75% of NSQD data for each parameter.

Due to the exceedances and elevated concentrations discussed above and the availability of bioassessment, CRP, and wet weather chemical data, boxplots were created for BOD, ammonia nitrogen, nitrate nitrogen, total nitrogen, orthophosphate, total phosphorus, pH, conductivity, and *E. coli* for comparison of the datasets. Boxplots were also created to compare the second, third, and fourth monitoring term data from upper and lower Rowlett Creek and Spring Creek. This comparison was done to review the impact of upstream subwatershed available data to the receiving subwatershed.

For BOD, ammonia, and pH there was a significantly difference in the fourth term for upper Spring Creek compared to CRP data indicating that stormwater in upper Spring Creek was contributing to pollutant loading for these parameters (Figures 4-63, 4-65, and 4-73). For BOD there was a significant difference in the fourth term between upper Spring Creek and lower Rowlett Creek (Figure 4-64). For pH there was also a significant difference in the fourth term for upper Rowlett Creek compared to CRP data indicating that stormwater in upper Rowlett Creek was also contributing to pH (Figure 4-73). For nitrate nitrogen, the wet weather data at all locations was lower than the dry weather data including CRP and bioassessment data indicating that stormwater was not a significant source of this pollutant (Figure 4-66). The total nitrogen, orthophosphate, total phosphorus, and *E. coli* boxplots do not show a significant difference between the CRP data and the wet weather data at all locations (Figures 4-67, 4-69, 4-70, and 4-75). For orthophosphate, however, there was a significant difference between the wet weather data in upper Spring Creek and the bioassessment data in upper Spring Creek which indicated stormwater to be a source of orthophosphate into the creek (Figure 4-69). In addition, there was a significant difference between the wet weather data in lower Rowlett Creek and the third term bioassessment data in lower Rowlett Creek which indicated stormwater was not a source of orthophosphate into the creek (Figure 4-69). For specific conductance, the lower Rowlett Creek wet weather and bioassessment data was higher than the CRP data (Figure 4-72). This indicates that this segment of the creek had the highest specific conductance but does not indicate a source of the specific conductance. For *E. coli*, there was a significant difference between the wet weather data in upper Spring Creek and the bioassessment data in upper Spring Creek which indicated stormwater as a source (Figure 4-75). In addition, in the fourth term there was a significant difference between the wet weather data in upper

Spring Creek and the wet weather data in lower Rowlett Creek indicating higher concentrations of *E. coli* in Spring Creek (Figure 4-76).

Figure 4-63 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP BOD Data at Upper Rowlett Creek, Upper Spring Creek, and Lower Rowlett Creek

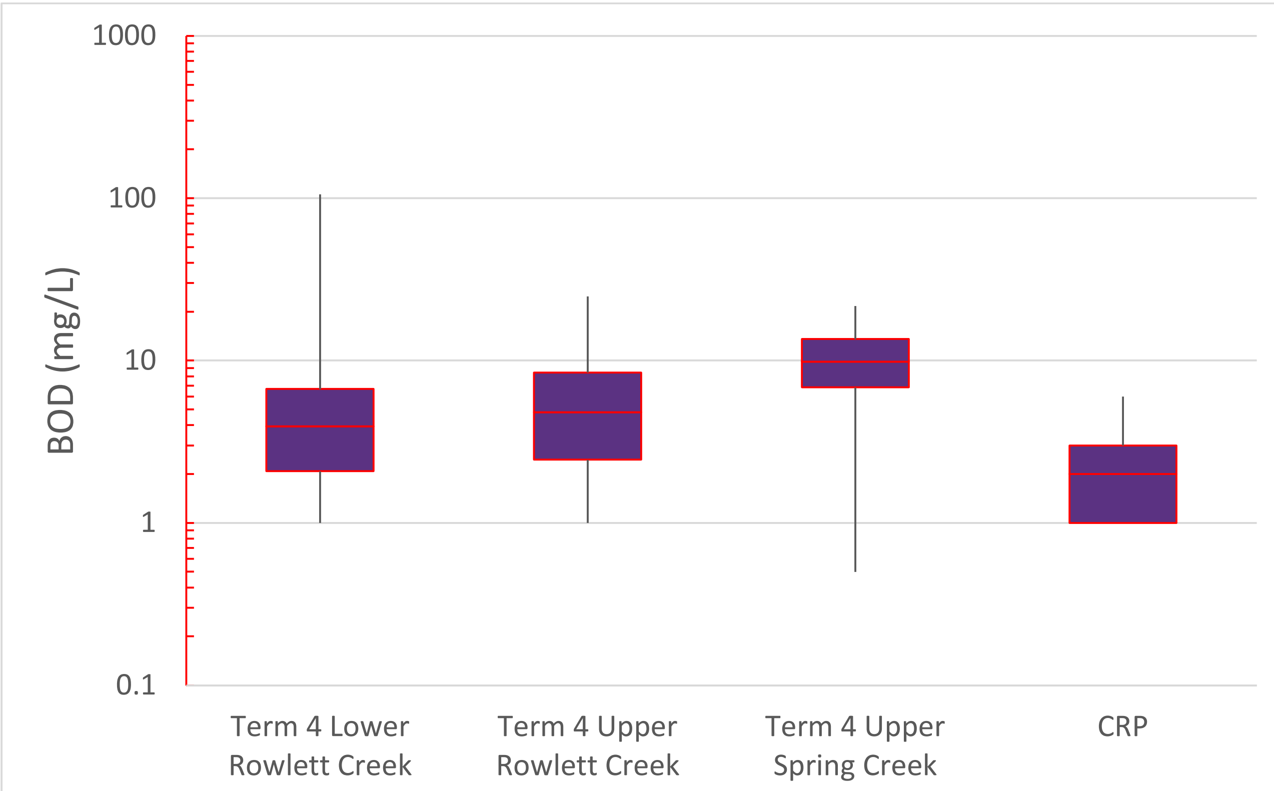


Figure 4-64 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms BOD Data at Upper and Lower Rowlett Creek, and Upper and Lower Spring Creek

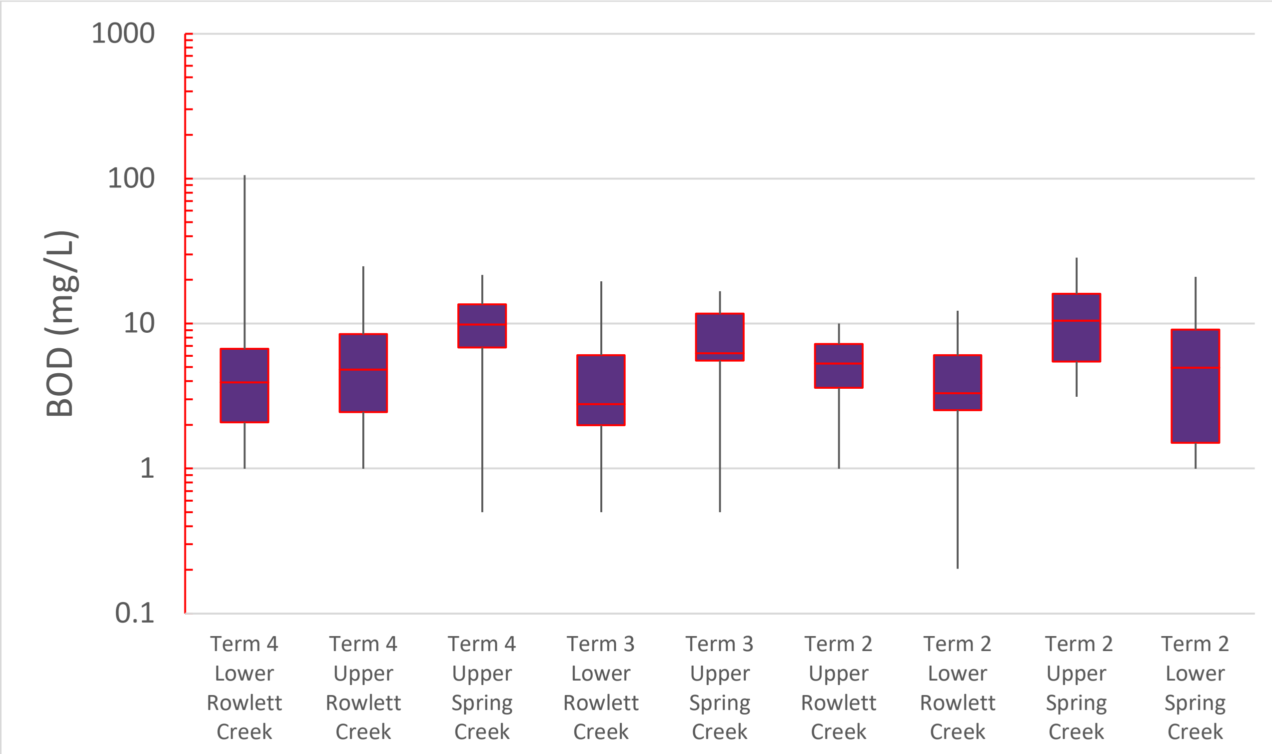


Figure 4-65 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Ammonia Nitrogen Data at Upper and Lower Rowlett Creek, and Upper Spring Creek

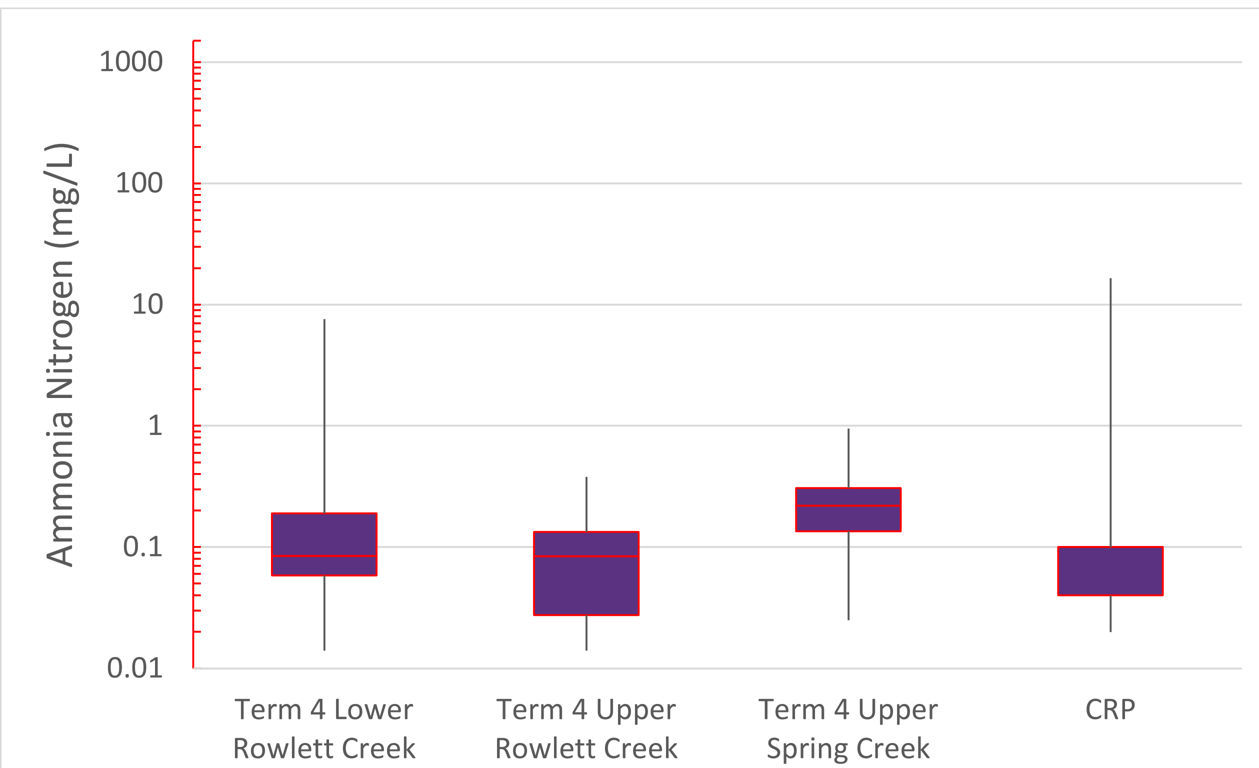


Figure 4-66 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms, Bioassessment, and CRP Nitrate Nitrogen Data at Upper and Lower Rowlett Creek, and Upper Spring Creek

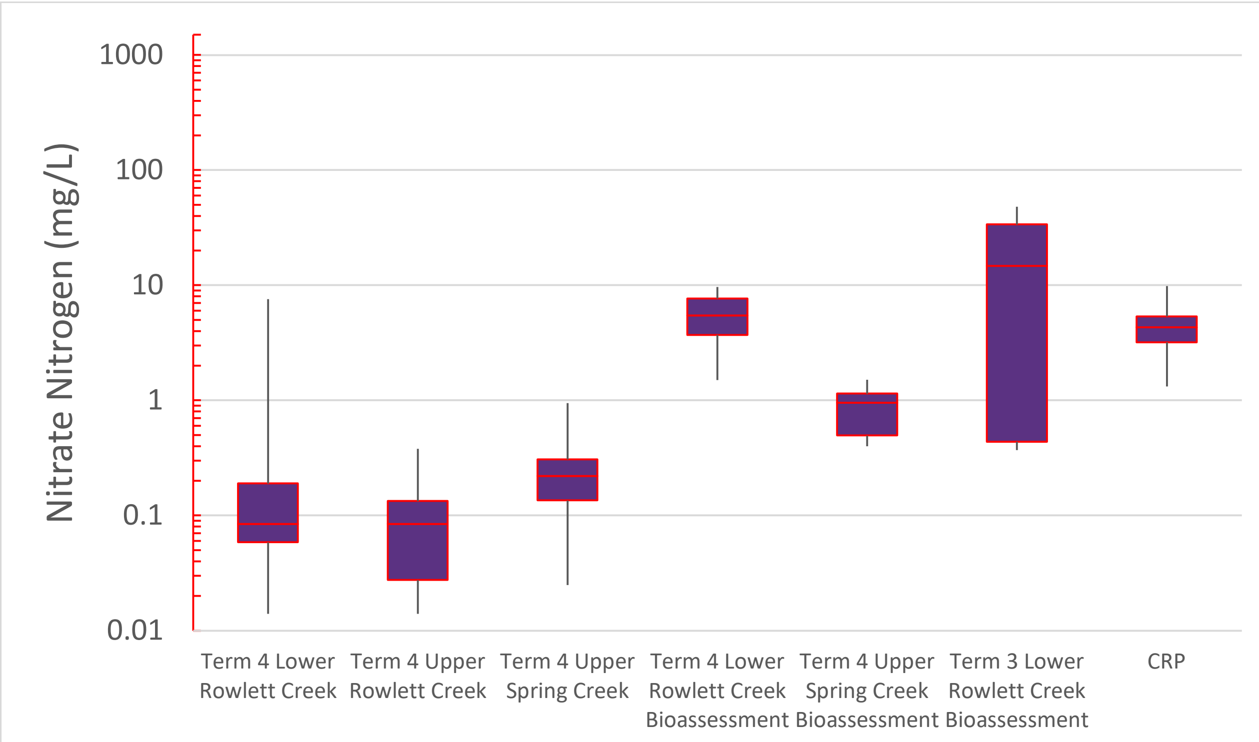


Figure 4-67 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Total Nitrogen Data at Upper and Lower Rowlett Creek, and Upper Spring Creek

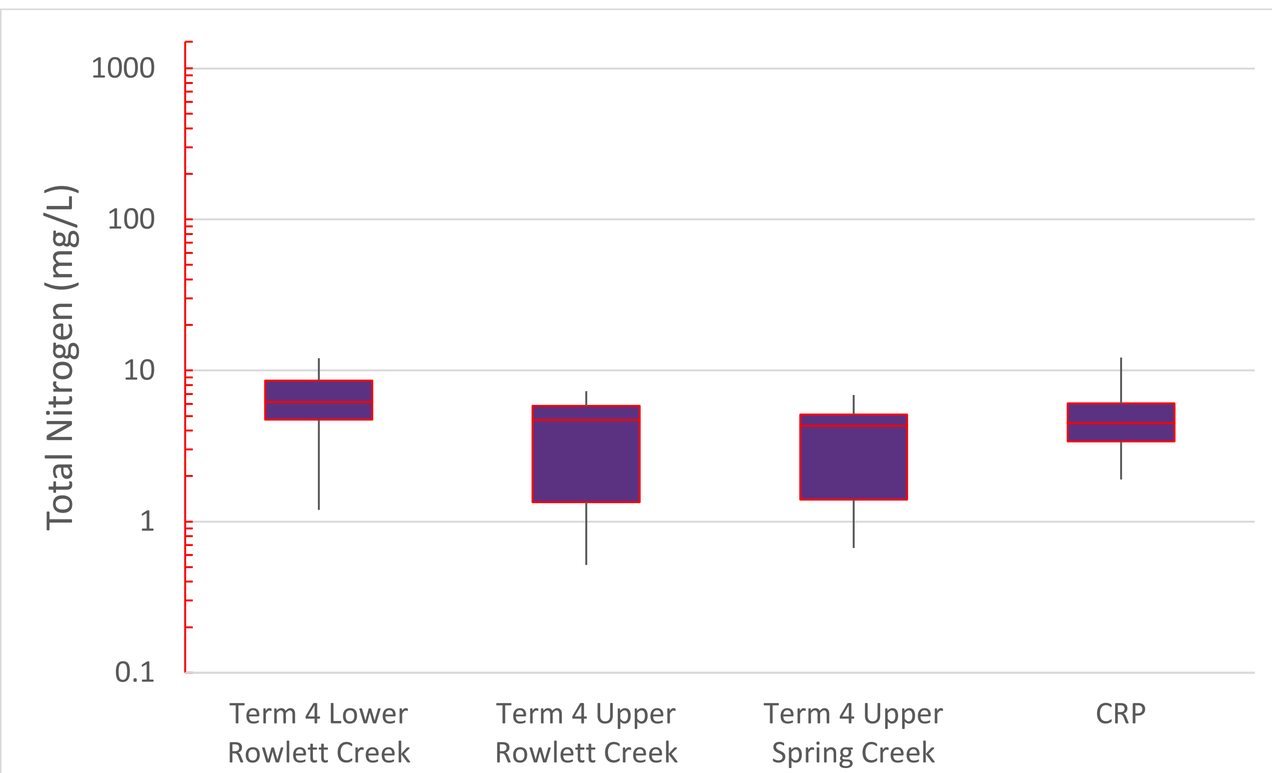


Figure 4-68 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms Total Nitrogen Data at Upper and Lower Rowlett Creek, and Upper and Lower Spring Creek

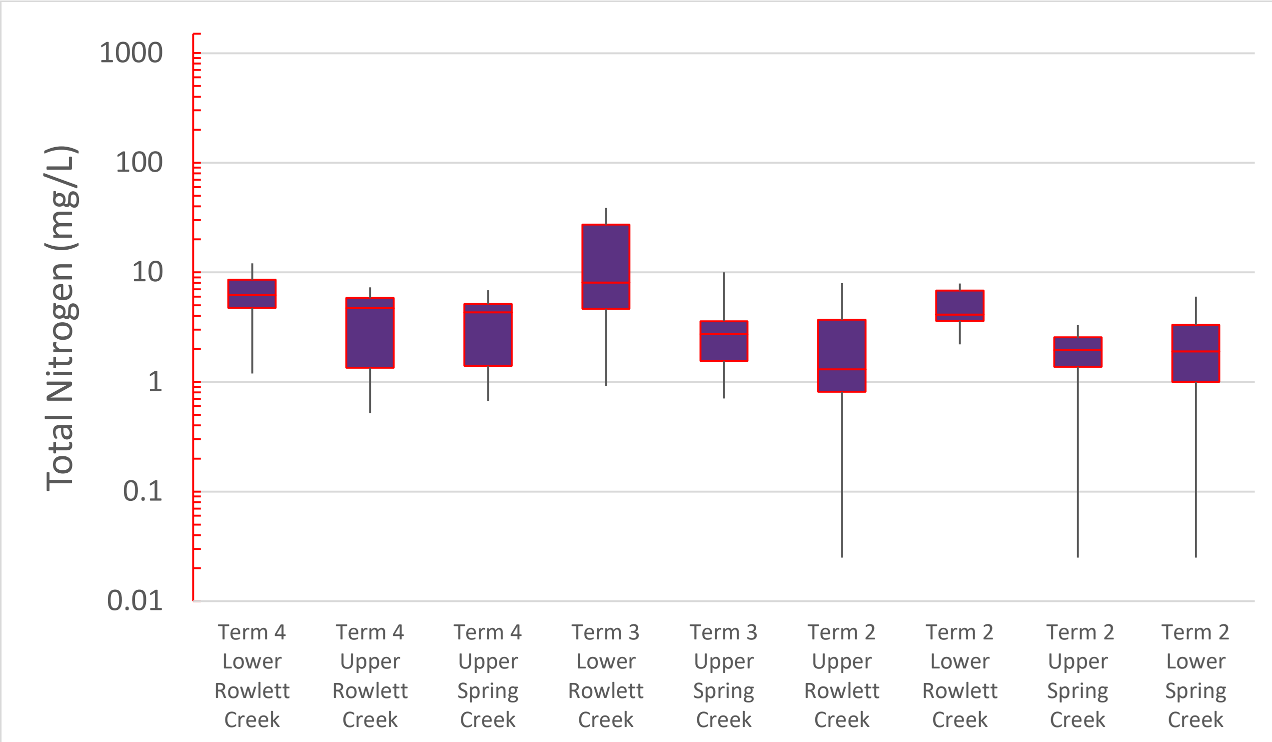


Figure 4-69 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms, Bioassessment, and CRP Orthophosphate Data at Upper and Lower Rowlett Creek, and Upper Spring Creek

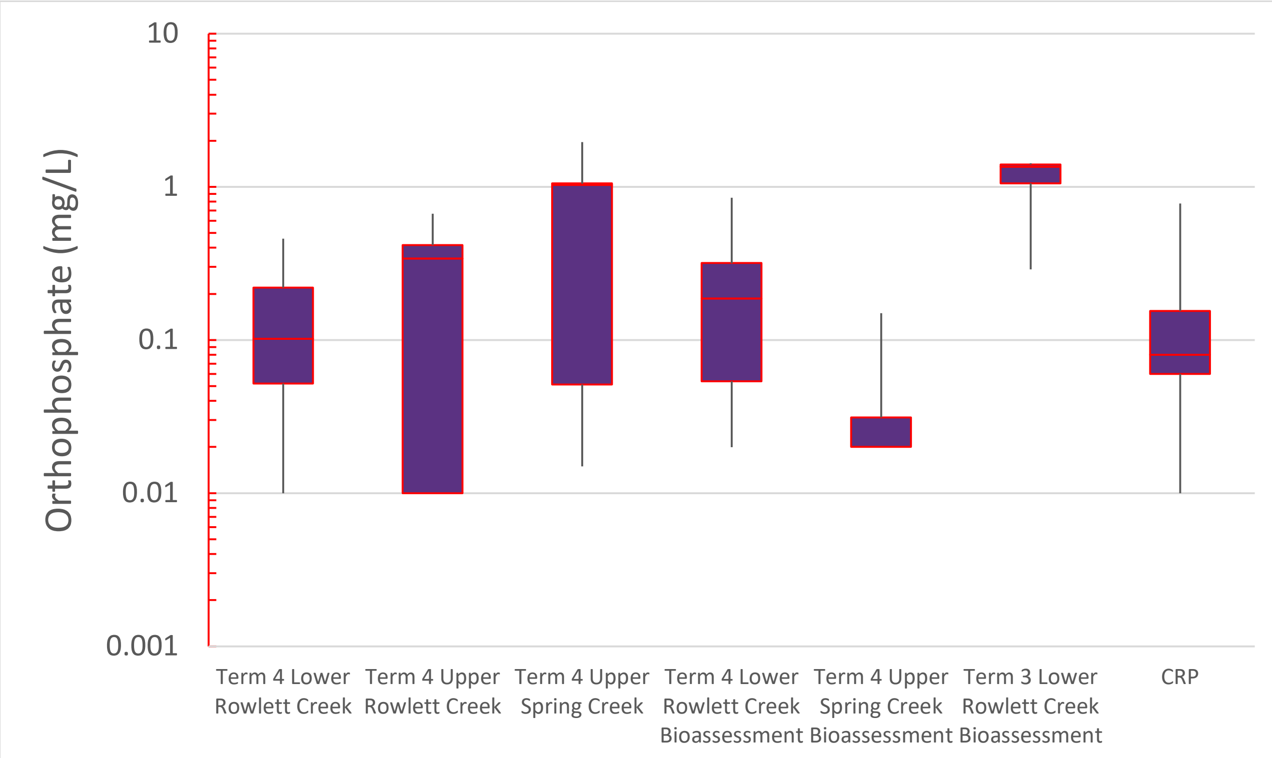


Figure 4-70 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Total Phosphorus Data at Upper and Lower Rowlett Creek, and Upper Spring Creek

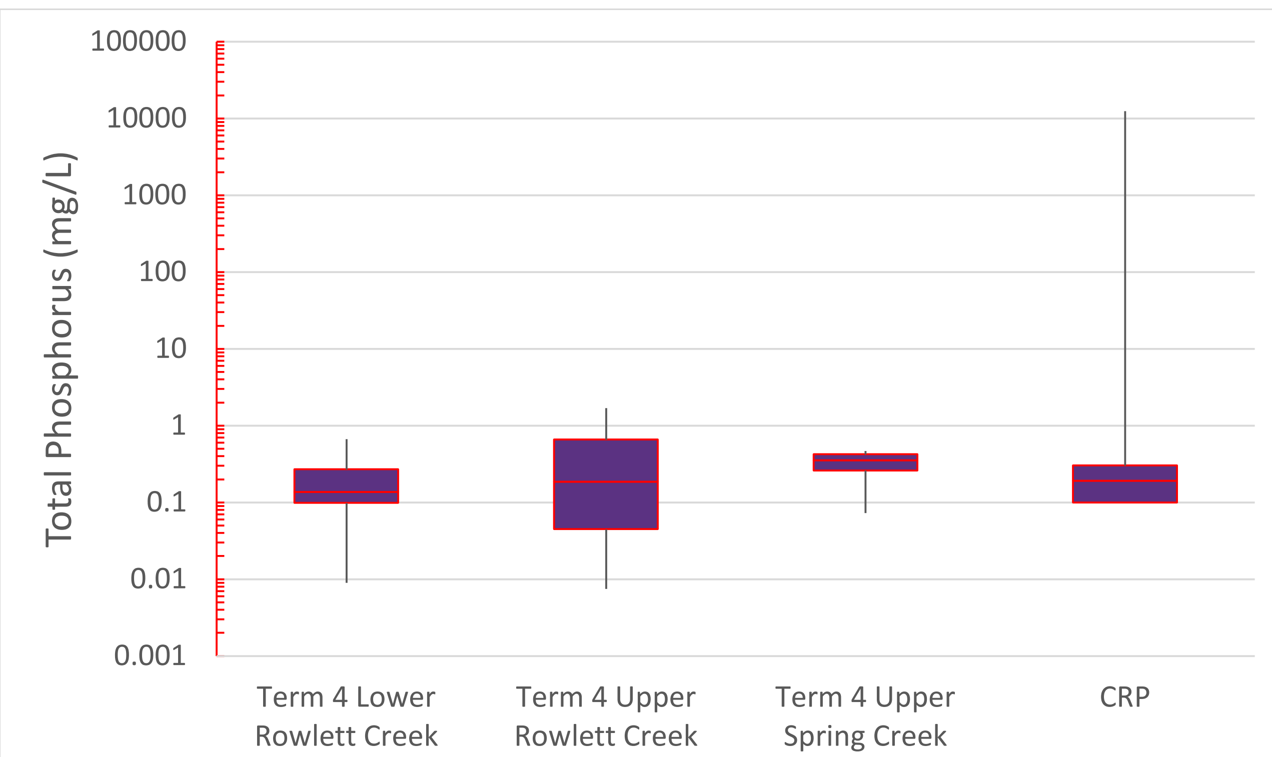


Figure 4-71 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms Total Phosphorus Data at Upper and Lower Rowlett Creek, and Upper and Lower Spring Creek

Figure 4-72 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms, Bioassessment, and CRP Specific Conductance Data at Upper and Lower Rowlett Creek, and Upper Spring Creek

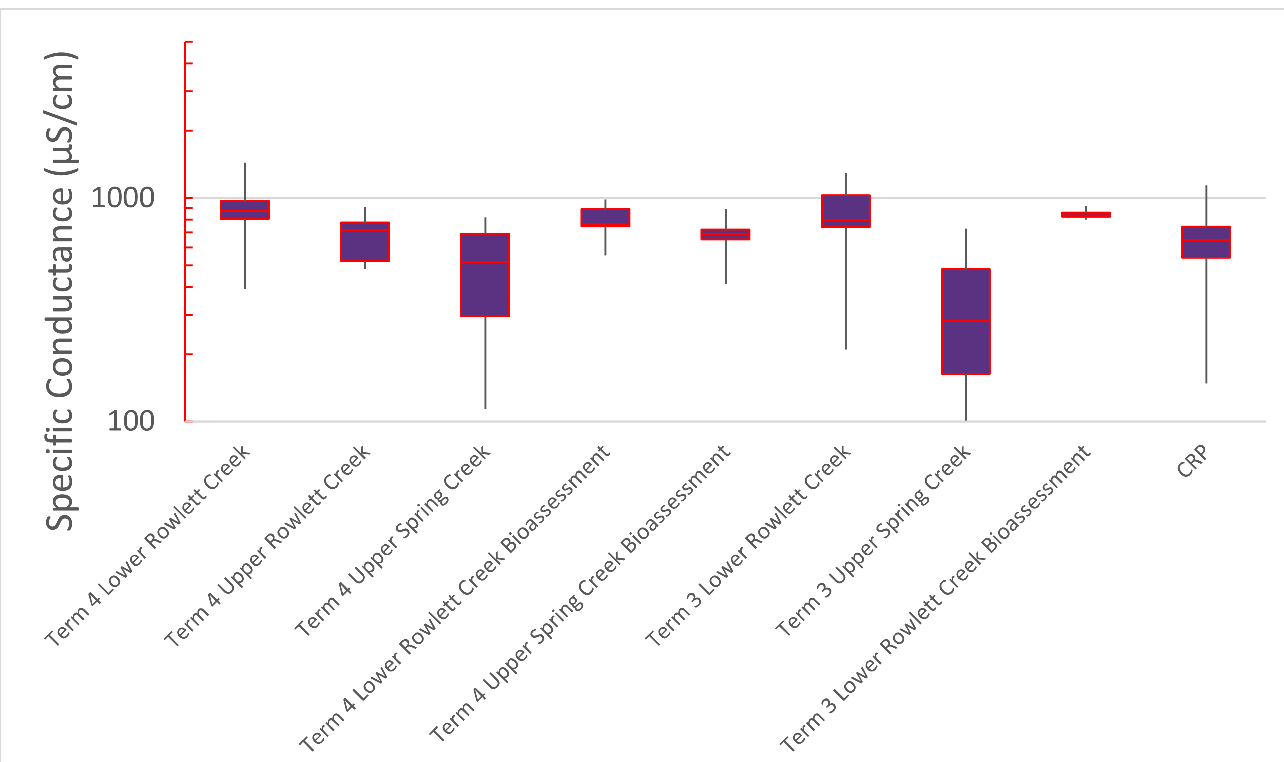


Figure 4-73 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms, Bioassessment, and CRP pH Data at Upper and Lower Rowlett Creek, and Upper Spring Creek

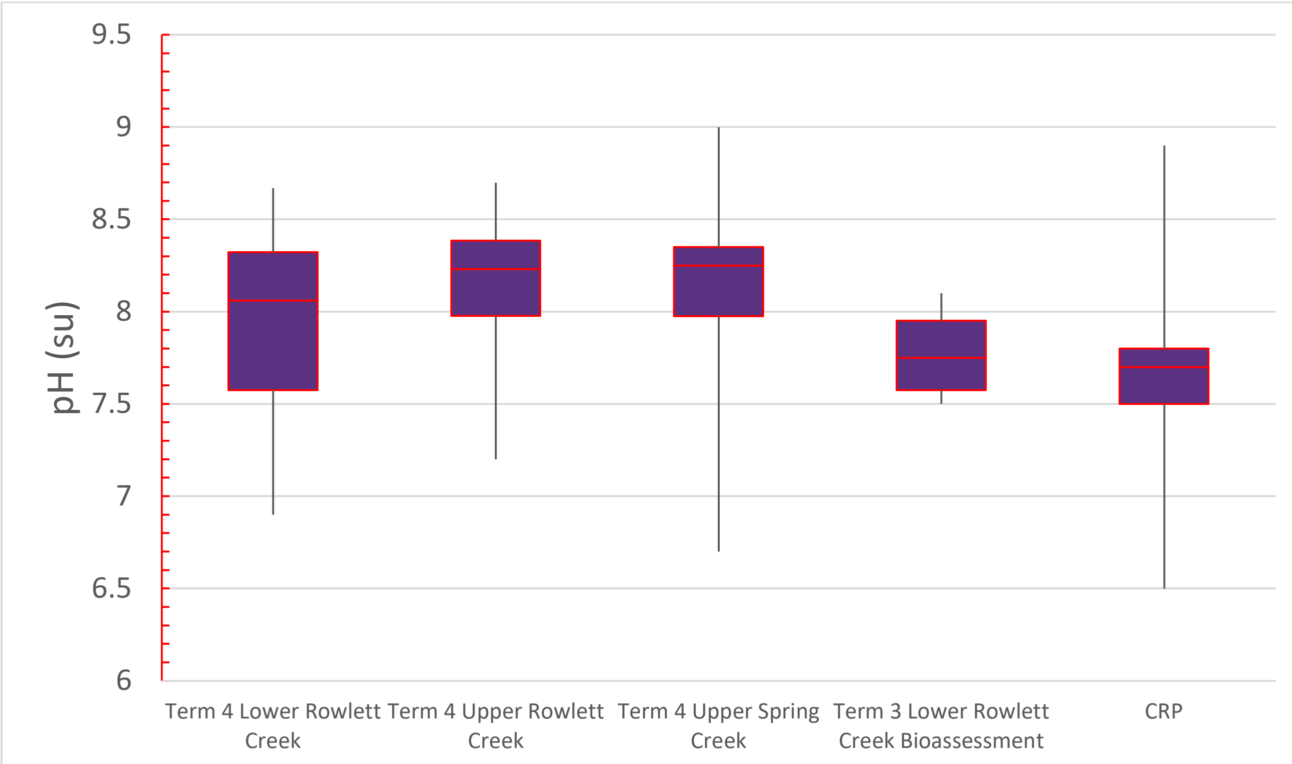


Figure 4-74 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms pH Data at Upper and Lower Rowlett Creek, and Upper and Lower Spring Creek

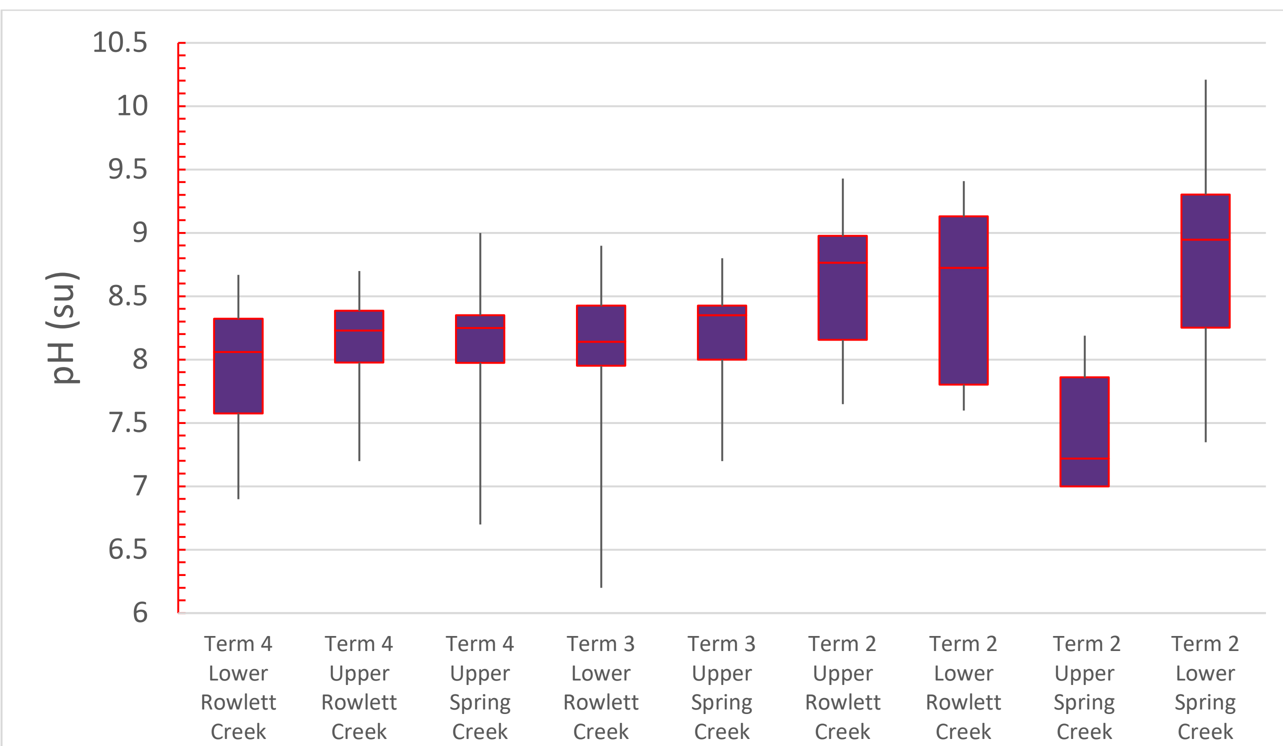


Figure 4-75 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms, Bioassessment, and CRP *E. coli* Data at Upper and Lower Rowlett Creek, and Upper Spring Creek

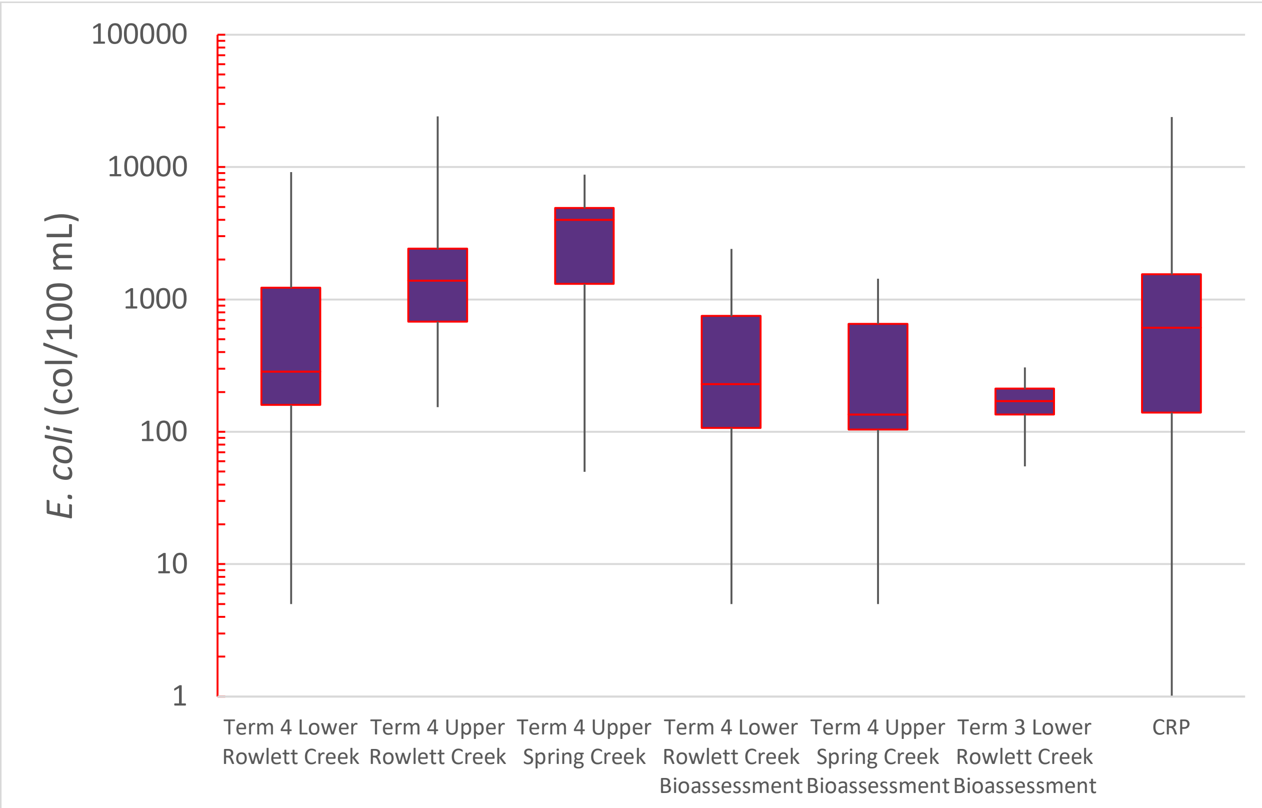
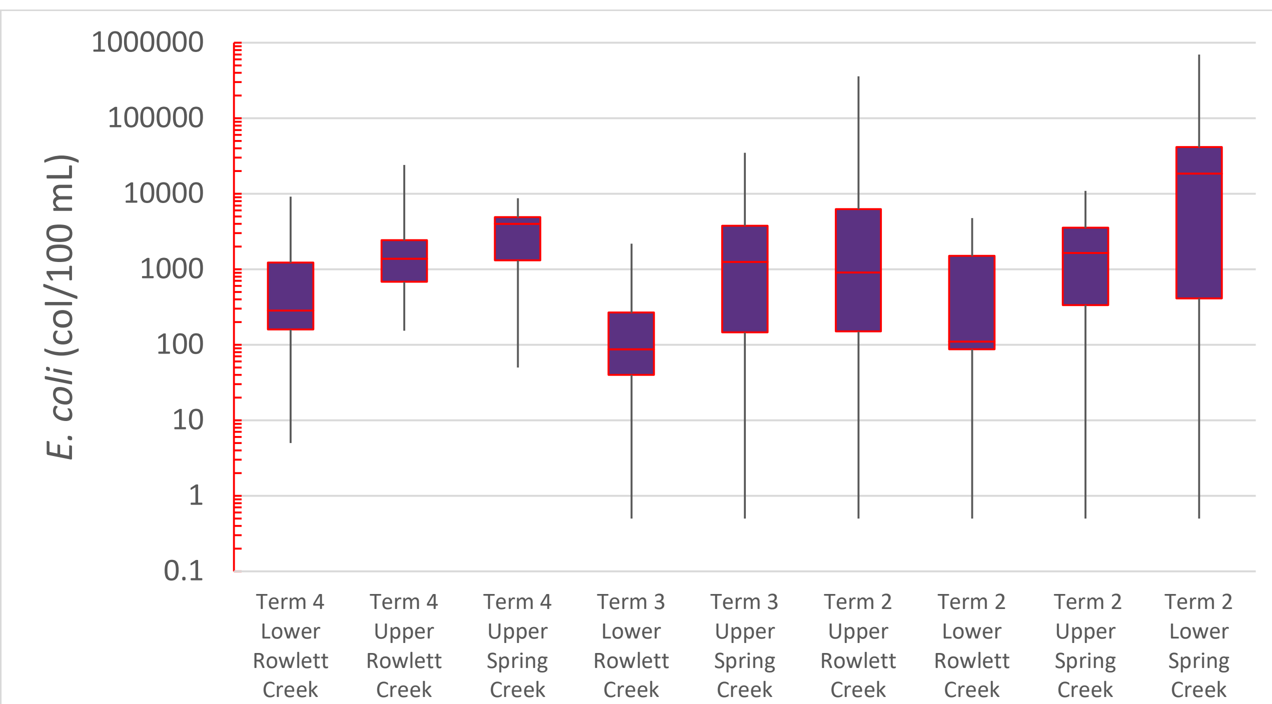


Figure 4-76 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms *E. coli* Data at Upper and Lower Rowlett Creek, and Upper and Lower Spring Creek



4.4.19.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix U).

Upper and lower Rowlett Creek received high habitat scores, while the fish community IBI scores ranged from intermediate to high, and benthic macroinvertebrate community IBI scores ranged from intermediate to high. Rowlett Creek may not be considered to have a high aquatic life use since fish IBI were mixed, and were sometimes less than the habitat score. Chemical factors may be impacting the biological community including high levels of nutrients. Chemical factors like potentially toxic heavy metals or pesticides may also impact the biological community. High nutrient concentrations and flows above historical levels suggest water quality under normal to low flow conditions is substantially influenced by treated wastewater in lower Rowlett Creek. Rowlett Creek appears to meet the Intermediate ALU established in the Texas surface water quality standards.

4.4.19.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period revealed multiple development projects and construction activities within the subwatersheds of Rowlett and Spring Creeks. Given the commercial land uses in the subwatershed there are potential sources of illicit connections, unauthorized discharges, or illegal dumping that may contribute to TDS, COD, and BOD. Elevated nutrient concentrations may have been a factor in the elevated BOD concentrations due to increased organic matter in the stream. In addition to illicit connections, sources of ammonia nitrogen, nitrate nitrogen, total nitrogen, orthophosphate, dissolved phosphorus, and total phosphorus could include over fertilization in residential and commercial areas. Riparian alteration can also affect nitrogen uptake and cycling and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). For bacteria, there was no significance to the stormwater biased dataset. Potential sources of bacteria loading may be illicit connections, wildlife, and domestic animals.

Land use of the Rowlett Creek watershed includes a fairly even mix of residential and open land uses followed by roadway and commercial. Over fertilization in open and residential areas may be a source of these nutrients as may be treated wastewater effluent and illicit discharges. Although BOD, COD, and nutrient concentrations were observed to be elevated, dissolved oxygen concentrations over the monitoring term did not fall below TCEQ criteria for aquatic life protection.

Road, commercial, and industrial land uses may contribute to the TDS, copper, and lead exceedances. Arsenic can be found in industry, in copper chromated arsenate treated lumber, and in groundwater in some areas. Other likely sources may be from illicit connections, illegal dumping, high traffic roadways, and wastewater effluent. The elevated oil and grease concentration may have been the result of a vehicular oil leak or staining from a roadway.

BMPs recommended for these sources include compliance inspections for illicit connections, identification and removal of illegal dumping areas, public education of home and business owners regarding fertilization, turf management and oil and grease handling, public education for pet owners regarding pet waste management, review of construction site inspection protocols or BMP requirements, review of industrial inspection protocols or BMP requirements, review and inspection of treatment plant for potential maintenance or redesign, street sweeping, and drop inlet or other parking lot treatment devices or layouts to capture oil and grease from stormwater runoff.

4.4.19.5. Monitoring Recommendations

Data analyzed presented multiple exceedances for bacteria, TDS, total copper, and total lead, and elevated TSS, BOD, COD, nutrients, and conductivity that may impact aquatic life use and primary contact recreation. Rowlett Creek is currently impaired for bacteria. Therefore, additional monitoring under the RWWCP at these sites are recommended to be assigned a high priority. It is recommended that bioassessment monitoring is continued. In order to determine the concentration of bioavailable metals, it is recommended that sampling of dissolved fractions of arsenic, lead, and copper is conducted.

4.4.20. Rush Creek

The City of Arlington performed chemical monitoring on Rush Creek (TCEQ segment 0841R), a stream with a stream order of two draining to Village Creek (TCEQ segment 0841T) within the Rush Creek – Village Creek watershed.

Rush Creek Watershed is located in southeast Tarrant County within Arlington's city limits. Rush Creek's 31,007.3-acre watershed is predominately residential (39.7%) with open areas (34.3%) in the south (south of US 287). This watershed is made up of 2.5% roadways which includes four major roadways: IH 20, US 287, SH 303, and SH 180. A significant amount of commercial (11.5%) and industrial sites are located along SH 303 and SH 180. There are also large amounts of commercial sites located along IH 20. This watershed is comprised of 0.3% water features.

The City of Arlington had two chemical monitoring sites located within the Rush Creek subwatershed. The chemical monitoring site, AR2001/2101 was an upstream sampling site located between South Bowen Road and South Cooper Street where W Sublett Road crossed Rush Creek. The conveyance at this site was an unlined channel with medium sized gravel. The subwatershed delineated for this sampling location covered a 5,900.8-acre area and consisted predominately of 39.7% residential property and 34.3% open space. US 287 was the only major highway (2.5%) running through this area. There were several commercial (11.5%) and industrial (1.3%) sites scattered throughout this subwatershed, but most were located along US 287. This subwatershed consisted of 0.1% water features.

The chemical monitoring site, AR2002/2102 was a downstream sampling site located south of Pioneer Parkway where Woodland Park Boulevard crossed Rush Creek. The conveyance at this site was an unlined channel with high vegetative cover. This subwatershed covered an 18,358-acre area and was predominately made up of residential (48.8%) property. IH 20 and US 287 were the main highways (17.6%) running through this area and 19.1% of the subwatershed was considered open space. There was a large commercial (13.3%) area on the eastern edge, north and south of IH 20. There were a few industrial (0.9%) facilities scattered throughout the subwatershed. This area was composed of 0.3% water features.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 23. The monitoring sites are shown as AR2101 and AR2102. AR2001 and AR 2002 were located in the same locations respectively. The subwatershed areas are entirely within the jurisdictional limits of the City of Arlington. TxDOT contributes flow to the subwatershed through IH 20 and US 287. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the T*CEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.20.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-19. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-19 Rush Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	16	16	16	16	16	16	16
Minimum	150.0	3.80	1.00	5.00	0.410	0.01	0.11
Maximum	877	211.0	46.2	110.00	4.90	0.29	0.55
Median	316.5	62.60	7.35	35.70	1.040	0.06	0.31
Arithmetic Mean	382.8	72.16	10.17	41.26	1.520	0.08	0.32
Geometric Mean	337.3	41.83	6.87	27.36	1.223	0.05	0.29
Standard Deviation	207.3	63.77	11.03	31.61	1.155	0.08	0.13
Coefficient of Variation	0.54	0.88	1.08	0.77	0.76	1.00	0.41
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.008	0.010	0.049	0.001	0.000	0.000	0.000
Maximum	0.150	0.190	0.740	0.016	0.005	0.050	0.005
Median	0.038	0.044	0.200	0.002	0.003	0.006	0.002
Arithmetic Mean	0.051	0.067	0.239	0.003	0.002	0.010	0.002
Geometric Mean	0.037	0.046	0.193	0.002	0.002	0.006	0.001
Standard Deviation	0.042	0.057	0.171	0.004	0.002	0.012	0.002
Coefficient of Variation	0.811	0.848	0.717	1.153	0.650	1.215	0.807
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.004	0.18	6.50	477	52.5	10.0	0.050
Maximum	0.059	13.40	9.10	1045	90.0	12033	3.470
Median	0.023	0.51	8.20	814	68.5	424	0.214
Mean	0.027	1.62	8.28	789	69.4	1560	0.589
Geometric Mean	0.021	0.59	8.25	768	68.7	392	0.240
Standard Deviation	0.018	3.24	0.60	173	10.0	2949	0.943
Coefficient of Variation	0.658	2.00	0.07	0.22	0.14	1.89	1.601

4.4.20.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, NSQD, and CRP data where applicable. CRP stations 10791, 10792, 15103, 16896, 17190, and 17191 were utilized for this analysis. Station 10791 is located at the same location as the RWWCP upstream monitoring station. Station 17190 is located at the IH 20 Rush Creek crossing. Station 15103 is located on Kee Branch at the Bardin Road crossing. Station 10792 is located where West Pleasant Ridge Road crossed Kee Branch. Station 16896 is located on Kee Branch at the Mayfield Road crossing. Station 17191 is located on Rush Creek near the SH 180 crossing downstream of the RWWCP downstream monitoring location. Graphs are located in Appendix V.

During the fourth monitoring term, there was one exceedance (January 2020) of the TCEQ TDS basin specific criterion, one exceedance (October 2021) of the TCEQ aquatic life use estimated chronic criterion for total copper, one exceedance of the basin specific criteria for pH (April 2021), eight exceedances of the *E. coli* PCR single sample criterion (and the geometric mean criterion was exceeded), and one exceedance of the TCEQ human health criterion for atrazine (February 2021). There was one total phosphorus (October 2020) exceedance of the TCEQ nutrient screening criteria. There were three occurrences where the TSS concentration (July and October 2020 and February 2021), two occurrences where the BOD concentration (October 2020), two occurrences where the COD concentration (January and October 2020), one occurrence where the total nitrogen concentration (October 2020), and one occurrence where the oil and grease concentration (April 2021) was higher than 75% of NSQD data for each parameter. There were two specific conductance readings (April and July 2020) greater than 1,000 µS/cm which exceeded the NRSA good category into the fair category.

Due to the exceedances and elevated concentrations discussed above and the availability of CRP and wet weather chemical data, boxplots were created for total nitrogen, total phosphorus, pH, conductivity, and *E. coli* for comparison of the datasets. The boxplots do not indicate that stormwater runoff is providing a significantly different input of total nitrogen, total phosphorus, specific conductance, or *E. coli* to the stream compared to the CRP data which was collected during dry weather (Figures 4-77, 4-78, 4-80, and 4-81). For pH, the boxplot does indicate that stormwater runoff is providing a higher input to the stream compared to the CRP data during the third and fourth monitoring terms (Figure 4-79).

Figure 4-77 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Nitrogen Data at Rush Creek

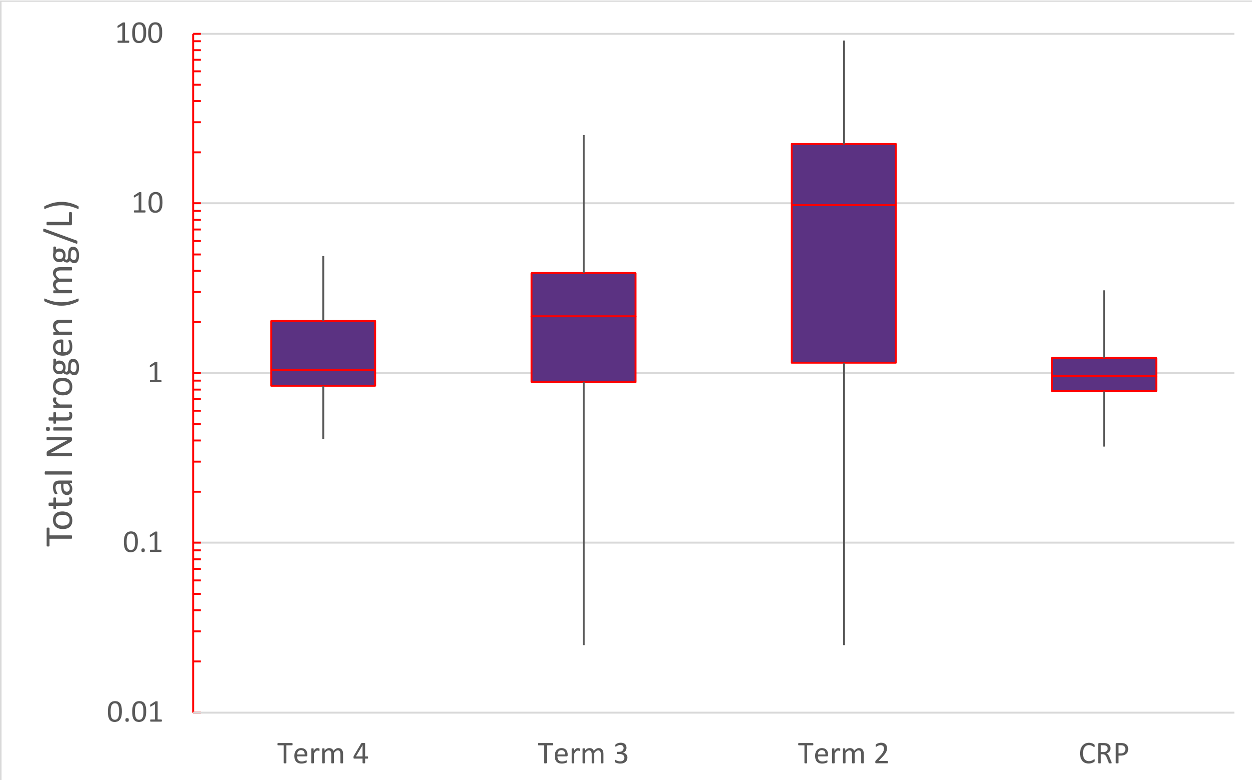


Figure 4-78 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP Total Phosphorus Data at Rush Creek

Figure 4-79 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP pH Data at Rush Creek

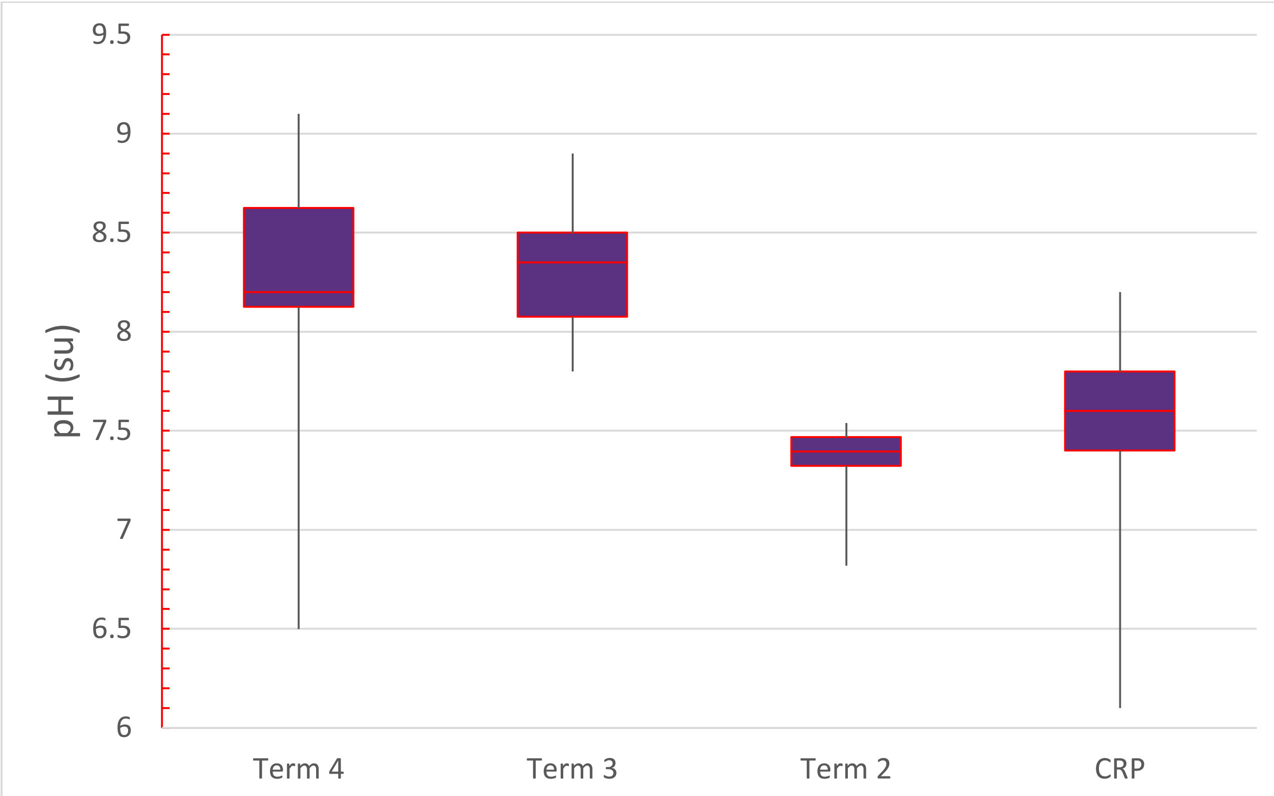


Figure 4-80 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms and CRP Specific Conductance Data at Rush Creek

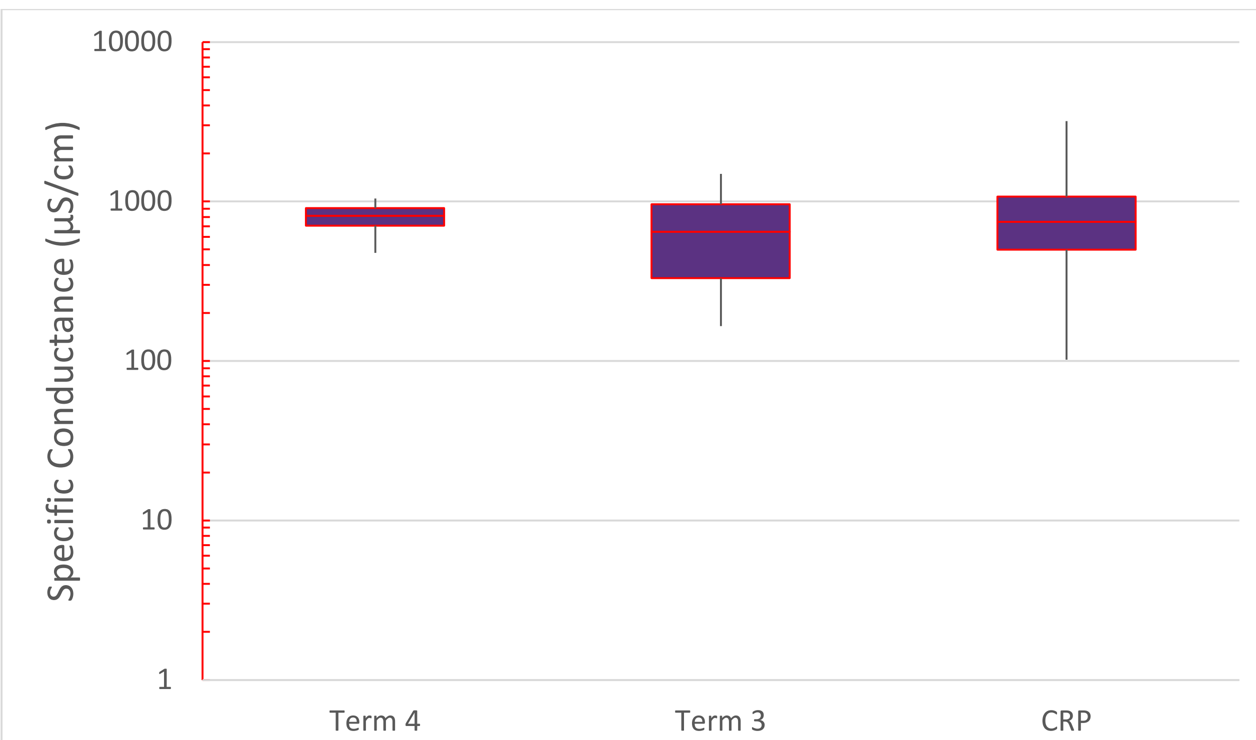
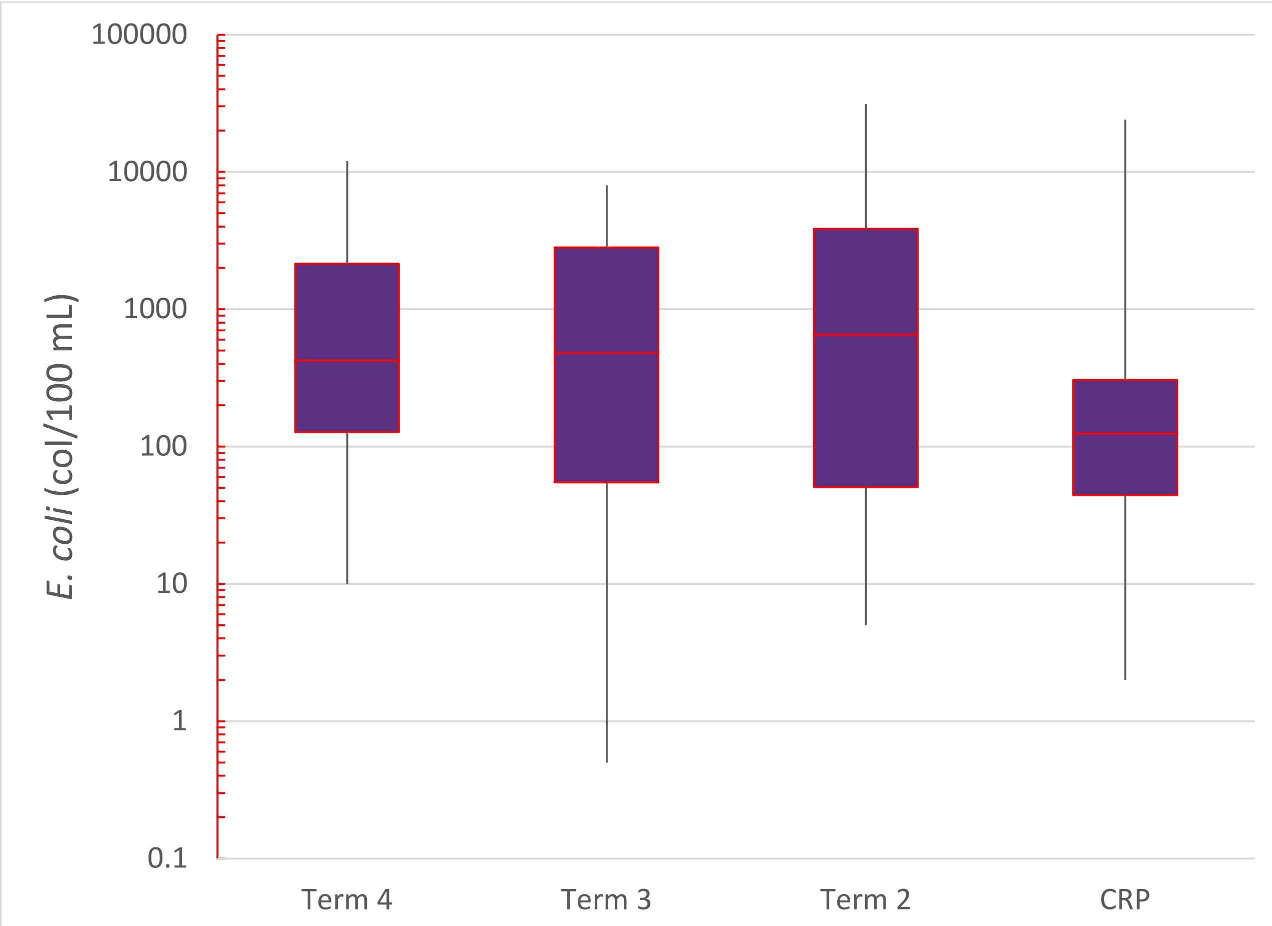


Figure 4-81 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms and CRP *E. coli* Data at Rush Creek



4.4.20.3. Biological Data Analysis

No bioassessment monitoring data was collected within this watershed.

4.4.20.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that there were construction activities that occurred within the drainage area. Land use of the Rush Creek subwatershed is mainly residential with lower but fairly even mixes of commercial, roadway, and open land uses. Given the commercial land uses in the subwatershed there are potential sources of illicit connections, unauthorized discharges, or illegal dumping that may contribute to TDS, COD, and BOD. Elevated nutrient concentrations may have been a factor in the elevated BOD concentrations due to increased organic matter in the stream. In addition to illicit connections, sources of total nitrogen and total phosphorus could include over fertilization in residential and commercial areas. Stormwater was not a significant source of total nitrogen, however the highest concentrations of total nitrogen were observed during runoff events and no elevated total nitrogen concentrations were observed in the CRP data. In addition, riparian alteration can affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). Although BOD, COD, and nutrient concentrations were observed to be elevated, dissolved oxygen concentrations over the monitoring term did not fall below TCEQ criteria for aquatic life protection. For bacteria, there was no significance to the stormwater biased dataset. Potential sources of bacteria loading may be illicit connections, wildlife, and domestic animals.

Road, commercial, and industrial land uses may contribute to the TDS, conductivity, and copper exceedances. Atrazine is a common herbicide that is used to selectively control annual grasses and broadleaf weeds before they emerge. Sources of atrazine in an urban landscape are typically residential and commercial lawns. The elevated oil and grease concentration may have been the result of a vehicular oil leak or staining from a roadway.

BMPs recommended for these sources include compliance inspections for illicit connections, identification and removal of illegal dumping areas, public education of home and business owners regarding fertilization and turf management and oil and grease handling, public education for pet owners regarding pet waste management, review of construction site inspection protocols or BMP requirements, street sweeping, drop inlet or other parking lot treatment devices or layouts to capture oil and grease from stormwater runoff, and review of industrial inspection protocols or BMP requirements.

4.4.20.5. Monitoring Recommendations

Data analyzed presented exceedances for bacteria, TDS, pH, copper, and atrazine, and elevated TSS, COD, BOD, nutrients, oil and grease, and conductivity that may impact aquatic life use and primary contact recreation. There is a current TMDL for bacteria on Rush Creek. Therefore, additional monitoring under the RWWCP at these sites are recommended to be assigned a high priority. Bioassessment data collection is recommended to determine whether the biological community may be impacted by the chemical pollutants documented above. In order to determine the concentration of bioavailable metals, it is recommended that sampling of the dissolved fraction of copper is conducted.

4.4.21. South Mesquite Creek

The City of Mesquite performed chemical monitoring on South Mesquite Creek a stream with a stream order of three or greater draining to the East Fork of the Trinity River (TCEQ segment 0819) within the South Mesquite Creek watershed.

South Mesquite Creek Watershed is located in eastern Dallas County, southwest of Lake Ray Hubbard. South Mesquite Creek Watershed covers a 17,840-acre area and the land use is predominantly made up of residential (30.5%) and open space (31.1%) areas which are dispersed across the entire watershed. There are patches of residential sites located along the highways (18.2%) in this area: SH 352, IH 635, US 80, and IH 30. The majority of commercial (17.1%) areas are located along the major highways. The industrial sites (2.6%) are concentrated in the western part of the watershed with a few patches along SH 352 and SH 80. This watershed has 0.6% water features.

The City of Mesquite had one chemical monitoring site located within the South Mesquite Creek subwatershed. The chemical monitoring site, MS1801/1901/2001/2101 was located north of New Market Road near Paschall Park. The conveyance at this site was a concrete-lined channel with low vegetative cover. The subwatershed delineated for this sampling location covered a 9,962.1-acre area and consisted mostly of residential (33.0%) property. Several highways (22.7%) went through this drainage area: SH 352, IH 30, IH 635 and US 80. Most of the commercial (23.1%) areas were located along these highways and major roadways such as Gus Thomasson Road. Open areas (16.5%) were mostly located along South Mesquite Creek or adjacent to residential property. Only a few industrial sites could be found in this area which made up 4.6% of the land use coverage. This drainage area contained 0.1% water features.

The monitoring site, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 24. The monitoring site is shown as MS2101. MS1801/1901/2001 were located in the same location. The subwatershed area is mostly within the jurisdictional limits of the City of Mesquite with the northern tip within the jurisdictional limits of the City of Dallas. TxDOT contributes flow to the subwatershed through IH 30, IH 635, US 80 and SH 352. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the T*CEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.21.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-20. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-20 South Mesquite Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	16	16	16	16	16	16	16
Minimum	56.0	7.10	0.50	7.50	0.150	0.01	0.07
Maximum	506.0	1010.0	10.50	138.00	4.20	1.00	0.60
Median	326.5	88.10	4.16	34.00	0.815	0.11	0.28
Arithmetic Mean	312.6	165.50	4.68	38.15	1.056	0.21	0.32
Geometric Mean	280.1	86.18	3.99	30.62	0.832	0.10	0.27
Standard Deviation	123.7	243.62	2.33	30.11	0.917	0.26	0.17
Coefficient of Variation	0.40	1.47	0.50	0.79	0.87	1.24	0.53
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.008	0.010	0.025	0.001	0.001	0.001	0.000
Maximum	0.196	0.810	0.563	0.014	0.022	0.112	0.022
Median	0.048	0.038	0.116	0.002	0.002	0.005	0.004
Arithmetic Mean	0.061	0.160	0.171	0.003	0.006	0.024	0.006
Geometric Mean	0.038	0.052	0.123	0.002	0.004	0.009	0.003
Standard Deviation	0.059	0.253	0.159	0.003	0.006	0.039	0.007
Coefficient of Variation	0.955	1.576	0.928	1.111	1.063	1.595	1.190
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	16	16	16	16	16	16	16
Minimum	0.003	0.18	6.10	81	53.1	0.5	0.005
Maximum	0.224	15.20	8.80	1156	80.4	4600	1.360
Median	0.026	1.10	8.35	525	68.1	327	0.050
Mean	0.057	2.74	8.18	523	69.0	1015	0.218
Geometric Mean	0.031	1.13	8.15	424	68.3	195	0.052
Standard Deviation	0.070	4.08	0.67	301	9.7	1482	0.398
Coefficient of Variation	1.225	1.49	0.08	0.58	0.14	1.46	1.828

4.4.21.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, NSQD, and other data where applicable. These graphs are located in Appendix W. During the fourth monitoring term, there was one exceedance (August 2019) of the TCEQ TDS basin specific criterion, three exceedances (May, July, and August 2018) of the TCEQ aquatic life use estimated chronic criterion and acute criterion for total copper, three exceedances (May and July 2018 and July 2020) of the TCEQ aquatic life use estimated chronic criterion for total lead, one exceedance of the basin specific criteria for pH (May 2018), and seven exceedances of the *E. coli* PCR single sample criterion (and the geometric mean was above the criterion). There were three ammonia nitrogen (July and August 2018 and February 2019) and two orthophosphate (May and August 2018) exceedances of the TCEQ nutrient screening criteria. There were five occurrences where the TSS concentration (multiple events), one occurrence where the chemical oxygen demand (July 2020), one occurrence where the total nitrogen concentration (July 2020), and two occurrences where the oil and grease concentration (July 2018 and April 2021) was higher than 75% of NSQD data for those parameters. In addition, there was one specific conductance reading greater than 1,000 µS/cm in July 2020 which exceeded the NRSA good category into the fair category.

4.4.21.3. Biological Data Analysis

No bioassessment monitoring data was collected within this watershed.

4.4.21.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that there were construction activities that occurred within the drainage area. Also, industrial/commercial activities may have contributed to sediment loading through bulk material storage and earth disturbance activities.

Approximately 80 percent of the land use of the South Mesquite Creek monitored subwatershed is almost evenly distributed between residential, commercial and roadway uses. Given the commercial land uses in the subwatershed there are potential sources of illicit connections, unauthorized discharges, or illegal dumping that may contribute to TDS, TSS, COD, oil and grease, copper, and lead. In addition to illicit connections, sources of ammonia nitrogen, total nitrogen, and orthophosphate could include over fertilization in residential and commercial areas. In addition, riparian alteration can affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). Potential sources of bacteria loading may be illicit connections, wildlife, and domestic animals. The elevated oil and grease concentration may have been the result of a vehicular oil leak or staining from a roadway.

BMPs recommended for these sources include compliance inspections for illicit connections, identification and removal of illegal dumping areas, public education of home and business owners regarding fertilization and turf management and oil and grease handling, public education for pet owners regarding pet waste management, review of construction site inspection protocols or BMP requirements, street sweeping, drop inlet or other parking lot treatment devices or layouts to capture oil and grease from stormwater runoff, and review of industrial inspection protocols or BMP requirements.

4.4.21.5. Monitoring Recommendations

Data analyzed presented a exceedances for TDS, total copper, total lead, oil and grease, and conductivity and elevated TSS and nutrients that may impact aquatic life use. There are currently no TMDLs or impairments for South Mesquite Creek but the East Fork of the Trinity River is impaired for TDS and sulfate. Therefore additional monitoring at this site is recommended to be assigned a high priority. Bioassessment data collection is recommended to determine whether the biological community may be impacted by the chemical pollutants documented above. In order to determine the concentration of bioavailable metals, it is recommended that sampling of the dissolved fractions of copper and lead is conducted.

4.4.22. Sycamore Creek

The City of Fort Worth performed bioassessment and chemical monitoring on Sycamore Creek (TCEQ segment 0806E), a stream with a stream order of three or greater draining to the West Fork of the Trinity River Below Lake Worth (TCEQ segment 0806) within the Headwaters Sycamore Creek watershed. Additional bioassessment monitoring is scheduled for 2022.

Headwaters Sycamore Creek watershed is located in south-central Tarrant County and flows northeastwardly through Fort Worth eventually emptying into the West Fork Trinity River. Sycamore Creek Watershed covers a 23,679.1-acre area and was predominately residential (42.8%) and commercial (28.6%). Open space (19.4%) also made up a large part of the subwatershed and was dispersed throughout. Industrial areas (2.6%) were concentrated in the middle of this subwatershed. Roads made up 6.9% and water bodies 1.6% of this subwatershed. Major highways running through this area are IH 20, IH 30, IH 35W, US 287, SH 180 and SH 303.

The City of Fort Worth had two chemical and bioassessment monitoring sites and one bioassessment only monitoring site. The monitoring site, FWSYC1, was an upstream sampling site located at the IH 35W northbound frontage road beneath SE Loop IH-820 eastbound. The subwatershed delineated for this sampling location covered an 11,489.7-acre area and consisted mostly of residential (43.6%) property and open space (21.6%). There were some industrial (3.8%) sites in the northern part of the area near IH 20 and IH 35W and a few patches in the south near FM-731. Major highways including IH 20 and IH 35W contributed to 18.7% of the land use composition in this subwatershed. There were a few commercial (12.0%) sites along some of the major roadways/highways such as Alta Mesa Boulevard, McCart Avenue, IH 20 and IH 35W. This subwatershed contained some small water features.

The monitoring site, FWSYC2, was located at Cobb Park West, south of US-287 at a low water crossing. No subwatershed information was available for this monitoring site.

The monitoring site, FWSYC3, was a downstream sampling site located just south of IH 30 where Scott Avenue ends as it reaches Sycamore Creek. The subwatershed delineated for this sampling location covered a 23,545.6-acre area and was predominately made up of residential (37.9%) property and open space (22.8%) primarily located along Sycamore Creek. There was also significant roadway (20.3%) acreage, with IH 35W, US 287, SH 180, SH 303, and IH 30 and a well-developed local street grid contributing. There were a few large commercial (15.6%) sites northeast of SH 303, west of IH 35W, and southwest of US 287 along major arterial such as Berry Street, Hemphill Street, and Seminary Drive. There was a large section of industrial property (3.1%) in the southern part of the subwatershed, just north of IH 20 and west of IH 35W and smaller patches of industrial sites were dispersed throughout the area in the west, central, and eastern sections of the subwatershed. This subwatershed contained some small water features.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 25. The majority of the subwatershed area is within the jurisdiction of the City of Fort

Worth. TxDOT contributes flow to the subwatershed through IH 35W, US 287, SH 180, SH 303, IH 20, FM 731, and IH 30. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the T*CEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.22.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-21. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-21 Sycamore Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	3	3	3	3	3	0	3
Minimum	238.0	5.60	1.00	15.00	0.250	-	0.05
Maximum	320.0	38.6	3.2	63.00	0.250	-	0.84
Median	314.0	7.63	1.00	15.00	0.250	-	0.05
Arithmetic Mean	290.7	17.3	1.73	31.00	0.250	-	0.31
Geometric Mean	288.1	11.81	1.47	24.20	0.250	-	0.13
Standard Deviation	45.7	18.49	1.27	27.71	0.000	-	0.46
Coefficient of Variation	0.16	1.07	0.73	0.89	0.000	-	1.46
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	3	3	3	3	3	3	3
Minimum	0.003	0.050	0.500	0.003	0.003	0.003	0.003
Maximum	0.017	0.050	0.500	0.003	0.003	0.005	0.003
Median	0.009	0.050	0.500	0.003	0.003	0.003	0.003
Arithmetic Mean	0.010	0.050	0.500	0.003	0.003	0.003	0.003
Geometric Mean	0.008	0.050	0.500	0.003	0.003	0.003	0.003
Standard Deviation	0.007	0.000	0.000	0.000	0.000	0.001	0.000
Coefficient of Variation	0.717	0.000	0.000	0.000	0.000	0.433	0.000
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	3	3	3	3	0	3	3
Minimum	0.005	2.50	7.30	370.000	-	12	0.500
Maximum	0.026	2.50	8.40	530.000	-	3640	0.505
Median	0.005	2.50	7.37	520.000	-	142	0.505
Mean	0.012	2.50	7.69	473.333	-	1265	0.503
Geometric Mean	0.009	2.50	7.67	467.190	-	184	0.503
Standard Deviation	0.012	0.00	0.62	89.629	-	2058	0.003
Coefficient of Variation	1.010	0.00	0.08	0.189	-	1.63	0.006

4.4.22.2. Water Quality Data Analysis

These data were plotted and compared to water quality standards, screening levels, and CRP data where applicable. CRP station 17369 was utilized for this analysis. Station 17369 is located at the same location as the RWWCP downstream monitoring station. The graphs are located in Appendix X. During the fourth monitoring term, there was one exceedance of the *E. coli* PCR single sample criterion (and the geometric mean criterion was exceeded).

The water quality data collected during bioassessments was also plotted and compared to water quality standards, screening levels, and CRP data where applicable. All graphs are located in Appendix X. The geometric mean of the bioassessment *E. coli* data was 201.6 col/100 mL which was more than the PCR geometric mean standard of 126 col/100 mL. There were two nitrate nitrogen exceedances (October 2018) and four ammonia nitrogen exceedances (May 2019 and May 2021) of the TCEQ nutrient screening levels.

Due to the exceedances and elevated concentrations discussed above and the availability of bioassessment and wet weather chemical data, a boxplot was created for nitrate nitrogen and *E. coli* for comparison of the datasets. According to the boxplot, there was no significant difference between the fourth monitoring term wet weather and bioassessment data for nitrate nitrogen or *E. coli* (Figures 4-82 and 4-83). For *E. coli*, the third monitoring term wet weather data was higher than the other datasets.

Figure 4-82 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and Bioassessment Nitrate Nitrogen Data at Sycamore Creek

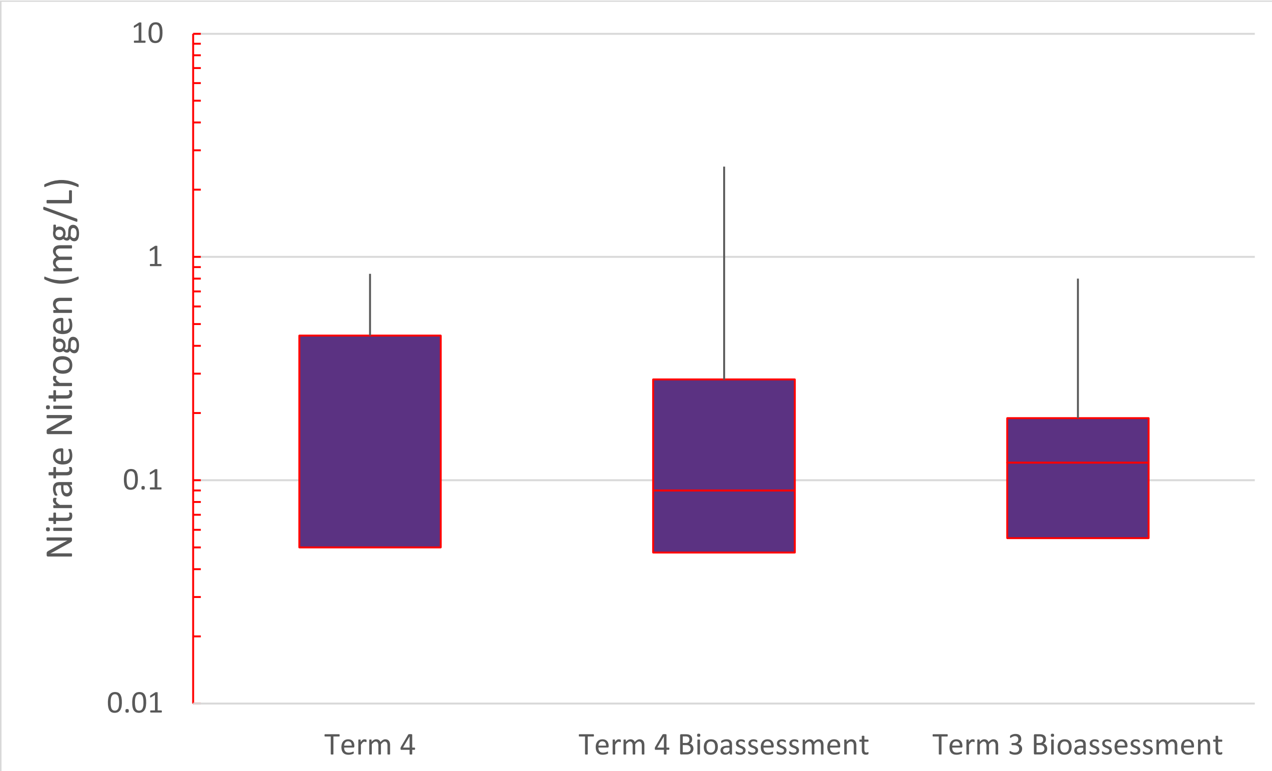
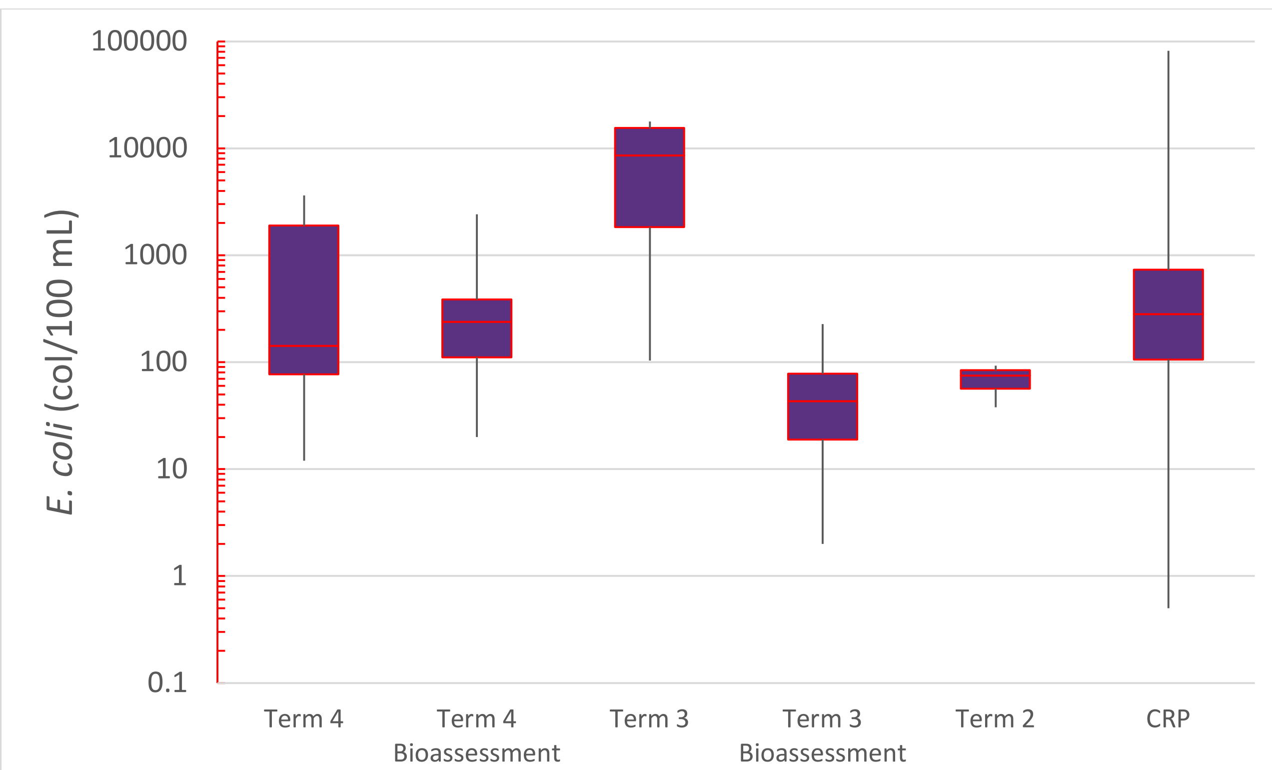


Figure 4-83 Boxplot Comparing Wet Weather Chemical Monitoring Second, Third, and Fourth Monitoring Terms, Bioassessment, and CRP *E. coli* Data at Sycamore Creek



4.4.22.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix X).

The habitat scores at FWSYC1 remained in the marginal range over the fourth term period with the exception of a sub-optimal score in the spring of 2018. At FWSYC2 and FWSYC3, the habitat scores remained in the sub-optimal range. Texas macroinvertebrate IBI scores at FWSYC1 ranged from limited to high throughout the fourth term. IBI scores at FWSYC2 ranged between intermediate to high. IBI scores at FWSYC3 ranged from limited to high. The intermediate IBI scores generally correspond with the available habitat indicating that water quality may not be limiting macroinvertebrate communities. The IBI scores at FWSYC1 and FWSYC3 from the fourth monitoring term were generally lower than the third term indicating declining macroinvertebrate communities.

4.4.22.4. Potential Pollution Sources and BMP Recommendations

Land use of the Sycamore Creek subwatershed is mainly residential with lower but fairly even mixes of commercial, roadway, and open land uses. Over fertilization in residential areas may be a source of nutrients as may be illicit discharges. Stormwater was not shown to be a significant source of bacteria. Potential sources of bacteria loading may be from wildlife or illicit connections.

BMPs recommended for these sources include compliance inspections for illicit connections, public education of home and business owners regarding fertilization and turf management, and public education for pet owners regarding pet waste management.

4.4.22.5. Monitoring Recommendations

Data analyzed presented exceedances for bacteria that may impact primary contact recreation. Elevated nutrient concentrations were also noted, however the bioassessment activities did not show an impact to aquatic life. Sycamore Creek is currently impaired for bacteria and there is a TMDL for bacteria. The West Fork of the Trinity River Below Lake Worth is impaired for dioxin and PCBs in fish tissue and there is a TMDL for legacy pollutants. Additional monitoring under the RWWCP at these sites are recommended to be assigned a high priority. Bioassessment monitoring is recommended to be continued.

4.4.23. Turtle Creek (Headwaters)

The City of Dallas performed chemical monitoring on Turtle Creek, a stream with a stream order of three or greater draining to the Upper Trinity River (TCEQ segment 0805) within the Headwaters Turtle Creek watershed.

Headwaters Turtle Creek Watershed is a 21,888 acre heavily urbanized watershed in the central portion of Dallas County. Several major highways including I-35E, Dallas North Tollway, State Hwy. 75, I-30, and the Woodall Rogers Expressway traverse this subwatershed. The roadway network and a majority of Dallas Love Field, which lies in the northwestern portion of the subwatershed, result in a 28.7% roadway land use. Dallas' Central Business District, located at the lower end of the watershed, is a major commercial hub and along with significant commercial land use in the western portion of the subwatershed contribute to a 27.4% commercial land use. The areas on the western edge between I-35E and the Trinity River contains some large industrial areas (3.5%). Open areas along Turtle Creek and scattered throughout the subwatershed provide 11% open land use. The subwatershed contains 0.9% water.

The City of Dallas had three chemical monitoring sites located within the Turtle Creek subwatershed. The chemical monitoring site, HTC-100 was an upstream sampling site located at Maple Avenue. The subwatershed delineated for this sampling location covered a 481.8-acre area and consisted predominately of residential (56.4%) property and roadways (23%). There was one major arterial in the northern portion of the area. Commercial (11.0%) properties encompassed much of the southern portion of this area and Southern Methodist University in the east-central edge of the drainage area. Open (9.1%) areas were scattered throughout this drainage area, including a large country club in the central portion of the area. This subwatershed contained very little distinct water (0.5%) features, mostly wide sections of Turtle Creek which flowed north to south. Industrial (0.1%) areas were almost non-existent.

The chemical monitoring site, HTC-200 was a midstream sampling site located at Turtle Creek Boulevard. The subwatershed delineated for this sampling location covered a 155-acre area and consisted of commercial (51.5%) and roadway (23.9%). The commercial areas along with most of the roadways encompassed Turtle Creek and abutted the main channel of the Trinity River to the south. Specific highways through this area included IH 35E, Dallas North Tollway, and State Highway 354 (Harry Hines Boulevard). Open (13.4%) areas were scattered throughout this drainage area, while industrial (10.9%) was mixed in with the southern commercial properties. Water features occupied 0.2% of the subwatershed.

The chemical monitoring site, HTC-300 was a downstream sampling site located at Irving Boulevard. The subwatershed delineated for this sampling location covered 8,160.5-acres and consisting predominately of residential (44.4%), roadway (26.3%) and industrial (18.6%) property. Specific highways through this area included IH 35E and State Highways 183 (Airport Freeway), 354 (Harry Hines Boulevard), and 356 (Irving Boulevard). A major portion of Dallas Love Field also contributed to the roadway land use percentage. Open (9.2%) areas were mainly in the Southwest portions of the area. Water (0.8%) features were almost non-existent except for the narrow channels of Turtle Creek.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 26. The subwatershed area is entirely within the jurisdictional limits of the City of Dallas. TxDOT contributes flow to the subwatershed through IH 35E, SH 354, SH 183 (Airport Freeway), SH 354 (Harry Hines Boulevard), and SH 356. NTTA contributes flow to the subwatershed through the Dallas North Tollway. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the T*CEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.23.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-22. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-22 Turtle Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	24	24	24	24	24	12	12
Minimum	115.0	21.00	5.00	0.01	0.250	0.05	0.19
Maximum	528.0	178.0	16.5	114.0	6.20	0.52	2.20
Median	373.0	79.50	7.50	41.50	2.500	0.20	1.50
Arithmetic Mean	368.3	87.28	9.09	42.05	3.073	0.19	1.35
Geometric Mean	337.2	79.45	8.53	25.76	2.550	0.15	1.15
Standard Deviation	132.5	36.97	3.43	28.18	1.749	0.14	0.62
Coefficient of Variation	0.36	0.42	0.38	0.67	0.57	0.70	0.46
Parameter	**Phosphorus, Dissolved (mg/L)**	**Orthophosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	24	12	24	24	24	24	24
Minimum	0.025	0.020	0.110	0.006	0.002	0.006	0.004
Maximum	0.650	0.140	0.470	0.010	0.010	0.024	0.029
Median	0.120	0.068	0.235	0.008	0.004	0.010	0.015
Arithmetic Mean	0.145	0.076	0.249	0.008	0.004	0.010	0.015
Geometric Mean	0.103	0.064	0.231	0.008	0.003	0.009	0.012
Standard Deviation	0.133	0.042	0.096	0.002	0.002	0.005	0.008
Coefficient of Variation	0.919	0.554	0.385	0.263	0.626	0.512	0.545
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	24	24	24	24	24	24	12
Minimum	0.013	0.35	6.85	237.00	43.34	105	0.049
Maximum	0.130	10.20	8.11	997.00	80.20	64880	0.200
Median	0.054	2.53	7.80	711.50	64.15	1733	0.050
Mean	0.061	2.29	7.66	688.00	64.16	4852	0.087
Geometric Mean	0.050	1.47	7.65	653.18	63.12	1343	0.074
Standard Deviation	0.034	2.09	0.37	191.06	11.50	13392	0.058
Coefficient of Variation	0.562	0.91	0.05	0.28	0.18	2.76	0.658

4.4.23.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, and NSQD data where applicable. These graphs are located in Appendix Y. During the fourth monitoring term, there were two exceedances (May 2018) of the TCEQ estimated human health criterion for total lead and fifteen exceedances of the *E. coli* PCR single sample criterion (and the *E. coli* PCR geometric mean criterion was exceeded). There was one ammonia nitrogen (February 2020) and eleven orthophosphate (multiple events) exceedances of the TCEQ nutrient screening criteria. In addition, there were two occurrences where the TSS concentration (February 2018 and February 2020), two occurrences where the BOD concentration (February and May 2018), two occurrences where the COD concentration (February and May 2018), seven occurrences where the total nitrogen concentration (multiple events), three occurrences where the dissolved phosphorus concentration (February 2018 and April 2020), and one occurrence where the oil and grease concentration (February 2018) was higher than 75% of NSQD data for those parameters.

4.4.23.3. Biological Data Analysis

No bioassessment monitoring data was collected within this watershed.

4.4.23.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that there were construction activities that occurred within the drainage area. For example the construction of the Cedar Branch Townhomes at Hawthorne Avenue. Also, industrial/commercial activities may have contributed to sediment loading through bulk material storage and earth disturbance activities.

Land use of the Turtle Creek subwatershed is mainly split between residential, commercial, and roadway land uses with lower percentages of industrial and open land uses. Possible sources of *E. coli* are illicit connections and wildlife or pets. The elevated concentrations of nutrients may have been a factor in elevated BOD and COD concentrations due to increased organic matter in the stream. Over fertilization of residential and commercial landscaping may be a source of these nutrients as may be illicit connections. In addition, riparian alteration can affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). Dissolved oxygen was not measured during the monitoring term and therefore it is unknown whether the elevated nutrient, BOD, and COD concentrations may be impacting the aquatic community by decreasing the amount of available oxygen.

Industrial and commercial land uses may have been the source of the exceedances of lead. Additional sources of metals could be from illicit connections and illegal dumping. The elevated oil and grease concentration may have been the result of a vehicular oil leak or staining from a roadway.

BMPs recommended for these sources include compliance inspections for illicit connections, identification and removal of illegal dumping areas, public education of home and business owners regarding fertilization and turf management and oil and grease handling, public education for pet owners regarding pet waste management, review of construction site inspection protocols or BMP requirements, street sweeping, drop inlet or other parking lot treatment devices or layouts to capture oil and grease from stormwater runoff, and review of industrial inspection protocols or BMP requirements.

4.4.23.5. Monitoring Recommendations

Data analyzed presents several indications of stream degradation. Bacteria concentrations have a potential to impact primary contact recreation and TSS, COD, BOD, nutrients, and lead have the potential to impact aquatic life. There are no TMDLs or impairments identified for Turtle Creek. There is a current TMDL and impairment for bacteria and for legacy pollutants for the Upper Trinity River Segment 0805. Additional monitoring at this site is recommended to be assigned a high priority. Bioassessment data collection is recommended to determine whether the biological community may be impacted by the chemical pollutants documented above. In order to determine the concentration of bioavailable metals, it is recommended that sampling of the dissolved fraction of lead is conducted.

4.4.24. Turtle Creek – Trinity River

The City of Dallas performed chemical monitoring on the Mican Channel, a stream with a stream order of three or greater draining to the Upper Trinity River (TCEQ segment 0805) within the Turtle Creek – Trinity River watershed.

Turtle Creek – Trinity River Watershed is located on the western side of Dallas County. This 22,443.5-acre watershed area is predominately made up of residential (31.3%) property and open space (27.6%). Most of the open space is dispersed throughout the watershed but there is an exceptionally large section of open space along the bank of the Trinity River. There are several highways (20.9%) that go through this area: IH 30, SH 12, SH 180, SH 354, and IH 35E. The majority of the industrial (11.6%) and commercial (11.6%) sites are located north of I-30 with a few others located along other major roadways in the watershed. This watershed contains 1.2% water features.

The City of Dallas has three chemical monitoring sites located within the Mican Channel subwatershed. The chemical monitoring site, TCTR-100 was an upstream sampling site located on the south side of Pipestone Road. The stream consisted of a concrete channel for base flow with grassy side slopes; the sample site was located on the north side of the channel. The subwatershed delineated for this sampling location covered a 569.7-acre area and consisted predominately of open (49.3%) areas and industrial (22.4%) warehouse properties. Roadways (11.7%) entailed mostly SH 180 and local roads. Commercial (8.4%) and residential (8.0%) land uses lined the eastern edge and composed nearly all of the remaining area. This subwatershed contained very little distinct water (0.3%) features consisting of one small pond and various tributaries which flow north to the main stem of the Trinity River.

The chemical monitoring site, TCTR-200 was a midstream sampling site located at the intersection of La Reunion Parkway and Bastille Road. The stream consisted of a concrete channel for base flow with grassy side slopes; the sample site was located on the west side of the channel. The subwatershed delineated for this sampling location covered just 232.1 acres and consisted predominately of industrial (65.5%) warehouse areas followed by highways (20.5%) which would be IH 30 (Tom Landry Highway) and open (10.8%) space. There were a few commercial (3.2%) properties along the western edge by the highway. This subwatershed contained no residential areas or distinct water features.

The chemical monitoring site, TCTR-300 was a downstream sampling site located on the north side of Singleton Boulevard. The stream consisted of concrete bottom and side slopes. The subwatershed delineated for this sampling location covered just 980.7 acres and consisted predominately of industrial (36.6%) space around the open (28.1%) areas. Commercial (18.6%) areas near the Tom Landry Freeway and in the far southern edge of the study area comprised this category. Roadways (10.5%) were IH 30 (Tom Landry Highway) and three major arterials. Some residential areas occupied the southern half of the site drainage area. There were 1.4% identified water features.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 27. The subwatershed area is entirely within the jurisdictional limits of the City of Dallas. TxDOT contributes flow to the subwatershed through SH 180 and IH 30. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the T*CEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.24.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-23. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-23 Turtle Creek – Trinity River RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	24	24	24	24	24	12	12
Minimum	100.0	53.00	2.00	10.00	0.300	0.05	0.41
Maximum	996.0	370	35.4	154.0	5.30	0.44	1.90
Median	347.0	143.50	8.70	53.25	1.600	0.12	0.62
Arithmetic Mean	401.0	143.5	10.3	55.16	2.073	0.14	0.74
Geometric Mean	345.2	126.7	8.37	40.86	1.655	0.11	0.67
Standard Deviation	233.4	73.8	7.6	40.51	1.382	0.12	0.41
Coefficient of Variation	0.58	0.51	0.74	0.73	0.67	0.86	0.55
Parameter	**Phosphorus, Dissolved (mg/L)**	**Orthophosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	24	12	24	24	24	24	24
Minimum	0.018	0.02	0.025	0.006	0.002	0.006	0.001
Maximum	0.190	0.20	0.500	0.010	0.035	0.031	0.029
Median	0.025	0.02	0.225	0.008	0.004	0.010	0.005
Arithmetic Mean	0.055	0.06	0.227	0.008	0.005	0.012	0.009
Geometric Mean	0.040	0.04	0.199	0.008	0.004	0.011	0.006
Standard Deviation	0.049	0.07	0.104	0.002	0.007	0.007	0.007
Coefficient of Variation	0.894	1.06	0.456	0.263	1.347	0.594	0.822
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	24	24	24	24	24	24	12
Minimum	0.013	0.35	6.46	140.30	56.12	517	0.049
Maximum	0.160	3.50	9.96	1859.00	79.90	24196	0.050
Median	0.064	2.45	7.68	650.50	67.90	2420	0.050
Mean	0.064	1.57	7.77	708.56	69.62	3906	0.050
Geometric Mean	0.054	1.04	7.74	587.19	69.25	2637	0.050
Standard Deviation	0.036	1.16	0.71	418.01	7.28	4833	0.000
Coefficient of Variation	0.557	0.74	0.09	0.59	0.10	1.24	0.006

4.4.24.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, and NSQD data where applicable. These graphs are located in Appendix Z. During the fourth monitoring term, there were two exceedances (January 2018 and April 2020) of the TCEQ TDS basin specific criterion, one exceedance of the TCEQ estimated human health criteria for total lead, two exceedances of the basin specific criteria for pH (October 2020), and twenty-four exceedances of the *E. coli* PCR single sample criterion (all events and the *E. coli* PCR geometric mean criterion was exceeded). There was one ammonia nitrogen (April 2020) and twenty-four orthophosphate (all events) exceedances of the TCEQ nutrient screening criteria. In addition, there were thirteen occurrences where the TSS concentration (multiple events), three occurrences where the BOD concentration (July 2018 and October 2020), five occurrences where the COD concentration (April and July 2018 and October 2020), and five occurrences where the total nitrogen concentration (January and July 2018 and July 2020) was higher than 75% of NSQD data for those parameters. In addition, there were two specific conductance readings greater than 1,000 µS/cm in April and July 2020 which exceeded the NRSA good category into the fair category.

4.4.24.3. Biological Data Analysis

No bioassessment monitoring data was collected within this watershed.

4.4.24.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that there were construction activities that occurred within the drainage area. Also, industrial/commercial activities may have contributed to sediment loading through bulk material storage and earth disturbance activities.

Land use of the Mican Channel subwatershed is mainly open and industrial with lesser parts commercial and roadway land uses. Possible sources of *E. coli* are illicit connections and wildlife. The elevated concentrations of nutrients may have been a factor in elevated BOD and COD concentrations due to increased organic matter in the stream. Over fertilization of commercial landscaping may be a source of these nutrients as may be illicit connections. In addition, riparian alteration can affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). Dissolved oxygen was not measured during the monitoring term and therefore it is unknown whether the elevated nutrient, BOD, and COD concentrations may be impacting the aquatic community by decreasing the amount of available oxygen.

Industrial, roadway, and commercial land uses may have been the source of the exceedances of lead. Additional sources of metals could be from illicit connections and illegal dumping.

BMPs recommended for these sources include compliance inspections for illicit connections, identification and removal of illegal dumping areas, public education of home and business owners regarding fertilization and turf management, public education for pet owners regarding pet waste management, review of construction site inspection protocols or BMP requirements, street sweeping, and review of industrial inspection protocols or BMP requirements.

4.4.24.5. Monitoring Recommendations

Data analyzed presents several indications of stream degradation. Bacteria concentrations have a potential to impact primary contact recreation and TSS, BOD, COD, nutrients, and lead have the potential to impact aquatic life. There are no TMDLs or impairments identified for Mican Channel. There is a current TMDL for bacteria and for legacy pollutants for the Upper Trinity River Segment 0805. Additional monitoring at this site is recommended to be assigned a high priority. Bioassessment data collection is recommended to determine whether the biological community may be impacted by the chemical pollutants documented above. In order to determine the concentration of bioavailable metals, it is recommended that sampling of the dissolved fraction of lead is conducted.

4.4.25. White Rock Creek

The City of Dallas performed chemical monitoring on White Rock Creek (TCEQ segment 0805C), a stream with a stream order of three or greater draining to the Upper Trinity River (TCEQ segment 0805) within the City of Dallas – White Rock Creek watershed.

City of Dallas – White Rock Creek Watershed is located in central Dallas County. This 22,322.7-acre watershed is predominately made up of residential (36.5%) property and open space (28.0%). The open space is primarily in the central and southern part of the watershed, around the bank of White Rock Creek. There are several highways (19.5%) that go through this area: IH 30, SH 12, SH 78, US 175, and SH 352. The majority of the industrial (0.4%) and commercial (13.8%) sites are located south of IH 30 with a few others along the other major roadways in the watershed. This watershed contains 1.7% water features.

The City of Dallas had three chemical monitoring sites located within the White Rock Creek subwatershed. The chemical monitoring site, WRC-100 was an upstream sampling site located between Samuell Boulevard and IH 30. This subwatershed covered a 7,708.0-acre area and consisted primarily of residential (52.1%) property in the upper reaches of the watershed. There were a few highways (16.5%) that crossed through this drainage area and included IH 30, SH 12, and SH 78. Open space (15.4%) was located around the banks of White Rock Creek. Commercial (15.3%) was located near the residential area. There was one small industrial (0.2%) site that was close to SH 12. This subwatershed contained 0.6% water features.

The chemical monitoring site, WRC-200 was a midstream sampling site located near Military Parkway. This subwatershed covered an 8,307.0-acre area. Residential (47.8%) property and roadways (21.0%) made up the majority of this subwatershed. Residential property was located in the upper part of the subwatershed. Highways that were in this drainage area included: IH 30, SH 12, SH 78, and SH 352. Commercial (14.8%) property was evenly dispersed and open space (15.6%) was primarily along the banks of White Rock Creek and included parks and recreation. There were a couple of industrial sites south of IH 30.

The chemical monitoring site, WRC-300 was a downstream sampling site located where US 175 crosses over White Rock Creek. This subwatershed covered an 16,901.1-acre area. Residential (43.4%) property and open space (36.2%) made up the majority of this subwatershed. Residential property was located towards the eastern and western sides of the subwatershed. Commercial (14.8%) property was evenly dispersed throughout.

The monitoring sites, watershed and subwatershed boundaries, and land use types are shown in Appendix B, Figure 28. The subwatershed area is entirely within the jurisdictional limits of the City of Dallas. TxDOT contributes flow to the subwatershed through IH 30, SH 12, SH 78, US 175, and SH 352. There are no TCEQ permitted wastewater outfalls within the monitored subwatershed according to the T*CEQ Permitted Wastewater Outfall* shapefile accessed August 10, 2022.

4.4.25.1. Summary Statistics

Summary statistics for chemical monitoring data are presented in Table 4-24. The summary statistics include number of samples, minimum and maximum values, median, arithmetic mean, geometric mean, standard deviation, and coefficient of variation.

Table 4-24 White Rock Creek RWWCP Fourth Monitoring Term Summary Statistics

Parameter	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen, Total (mg/L)	Ammonia Nitrogen (mg/L)	Nitrate Nitrogen (mg/L)
No. of Samples	24	24	24	24	24	21	21
Minimum	168.0	20.00	1.00	17.50	0.005	0.04	0.01
Maximum	794.0	191.0	36.00	63.1	2.150	0.51	0.14
Median	271.5	40.00	5.00	23.20	0.780	0.10	0.02
Arithmetic Mean	275.9	50.50	7.77	28.45	0.821	0.14	0.04
Geometric Mean	261.2	42.94	4.86	26.05	0.547	0.10	0.03
Standard Deviation	119.7	36.91	9.63	12.89	0.546	0.12	0.04
Coefficient of Variation	0.43	0.73	1.24	0.45	0.67	0.91	0.86
Parameter	**Phosphorus, Dissolved (mg/L)**	**Ortho-phosphate (mg/L)**	**Phosphorus, Total (mg/L)**	**Arsenic, Total (mg/L)**	**Chromium, Total (mg/L)**	**Copper, Total (mg/L)**	**Lead, Total (mg/L)**
No. of Samples	24	21	24	24	24	24	24
Minimum	0.025	0.010	0.025	0.003	0.002	0.010	0.004
Maximum	0.170	1.870	0.242	0.010	0.004	0.045	0.014
Median	0.025	0.130	0.116	0.010	0.004	0.010	0.005
Arithmetic Mean	0.056	0.314	0.118	0.009	0.003	0.014	0.005
Geometric Mean	0.043	0.177	0.107	0.009	0.003	0.012	0.005
Standard Deviation	0.044	0.399	0.050	0.002	0.000	0.010	0.002
Coefficient of Variation	0.788	1.268	0.428	0.243	0.126	0.727	0.348
Parameter	**Zinc, Total (mg/L)**	**Oil & Grease (mg/L)**	**pH, Field (su)**	**Specific Conductivity (µS/cm)**	**Temperature (°F)**	**E. Coli (col/100 mL)**	**Atrazine (µg/L)**
No. of Samples	24	24	24	24	24	24	21
Minimum	0.013	1.30	6.93	283.00	50.18	52	0.050
Maximum	0.046	31.20	8.31	515.00	80.24	2510	2.100
Median	0.013	2.50	7.68	378.00	66.20	436	0.100
Mean	0.017	3.46	7.63	387.17	66.59	892	0.490
Geometric Mean	0.015	2.44	7.62	382.23	65.93	433	0.159
Standard Deviation	0.009	5.93	0.42	63.64	9.40	932	0.749
Coefficient of Variation	0.559	1.71	0.05	0.16	0.14	1.04	1.528

4.4.25.2. Water Quality Data Analysis

Monitored parameters were plotted and compared to water quality standards, screening levels, NSQD and CRP data where applicable. CRP station 18458 was utilized for this analysis. Station 18458 is located just upstream from the RWWCP downstream monitoring station. These graphs are located in Appendix AA. During the fourth monitoring term, there was one exceedance of the TCEQ aquatic life use estimated chronic criterion for total copper (October 2021) and twelve exceedances of the *E. coli* PCR single sample criterion (multiple events and the geometric mean exceeded the TCEQ criterion). There were two ammonia nitrogen (October 2021) and seven orthophosphate (multiple events) exceedances of the TCEQ nutrient screening criteria. There was one occurrence where the TSS concentration (July 2021), three occurrences where the BOD concentration (April 2019), and one occurrence where the oil and grease concentration (April 2019) was higher than 75% of NSQD data for those parameters.

The water quality data collected during bioassessments was also plotted and compared to water quality standards, screening levels, and CRP data where applicable. All graphs are located in Appendix AA. The geometric mean of the bioassessment *E. coli* data was 363.9 col/100 mL which was more than the PCR geometric mean standard of 126 col/100 mL.

Due to the exceedances and elevated concentrations discussed above and the availability of bioassessment and wet weather chemical data, boxplots were created for TSS, COD, ammonia nitrogen, total nitrogen, and *E. coli* for comparison of the datasets. According to the boxplots, there was no significant difference between the fourth monitoring term wet weather and bioassessment data for COD or *E. coli* (Figures 4-85 and 4-88). For TSS, the boxplot does indicate that stormwater runoff is providing a higher input to the stream compared to the bioassessment data during the fourth monitoring term (Figure 4-84). For ammonia nitrogen and total nitrogen, the boxplots indicate that stormwater runoff in the fourth monitoring term was lower compared to the CRP data (Figures 4-86 and 4-87).

Figure 4-84 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms and Bioassessment TSS Data at White Rock Creek

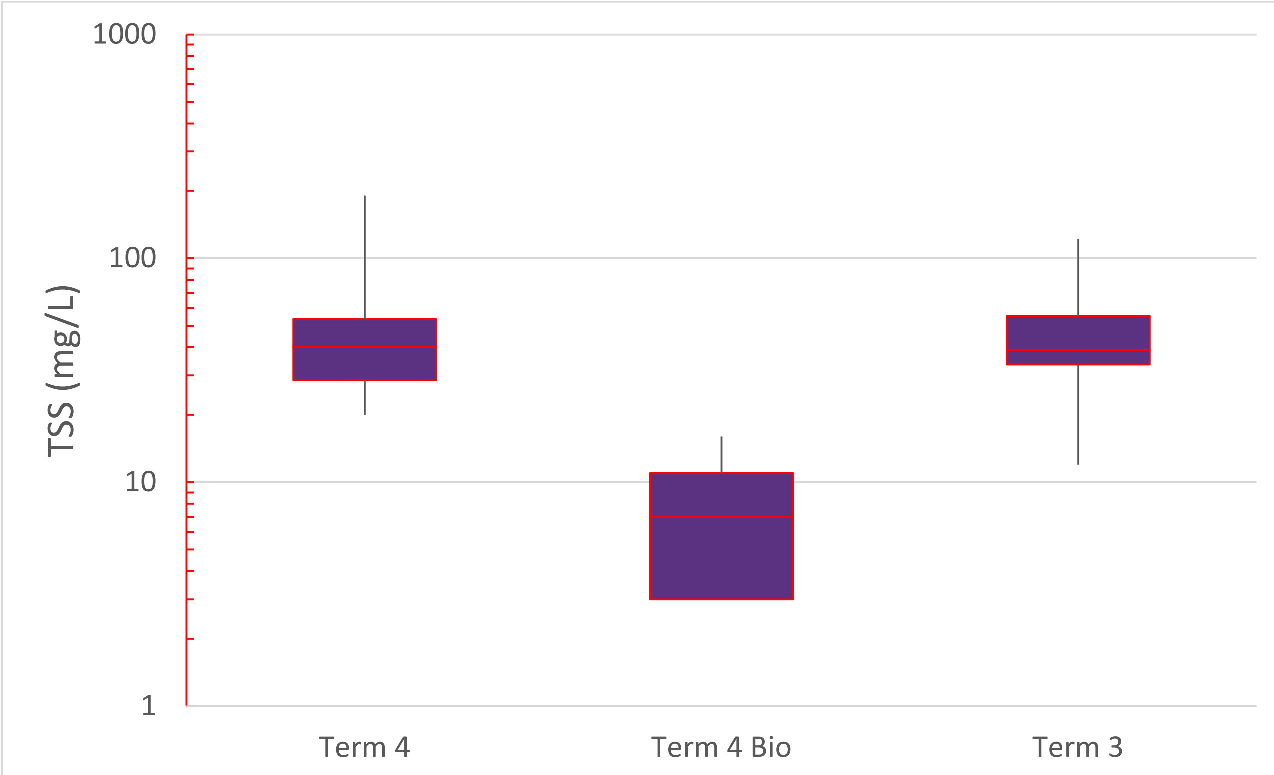


Figure 4-85 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms and Bioassessment COD Data at White Rock Creek

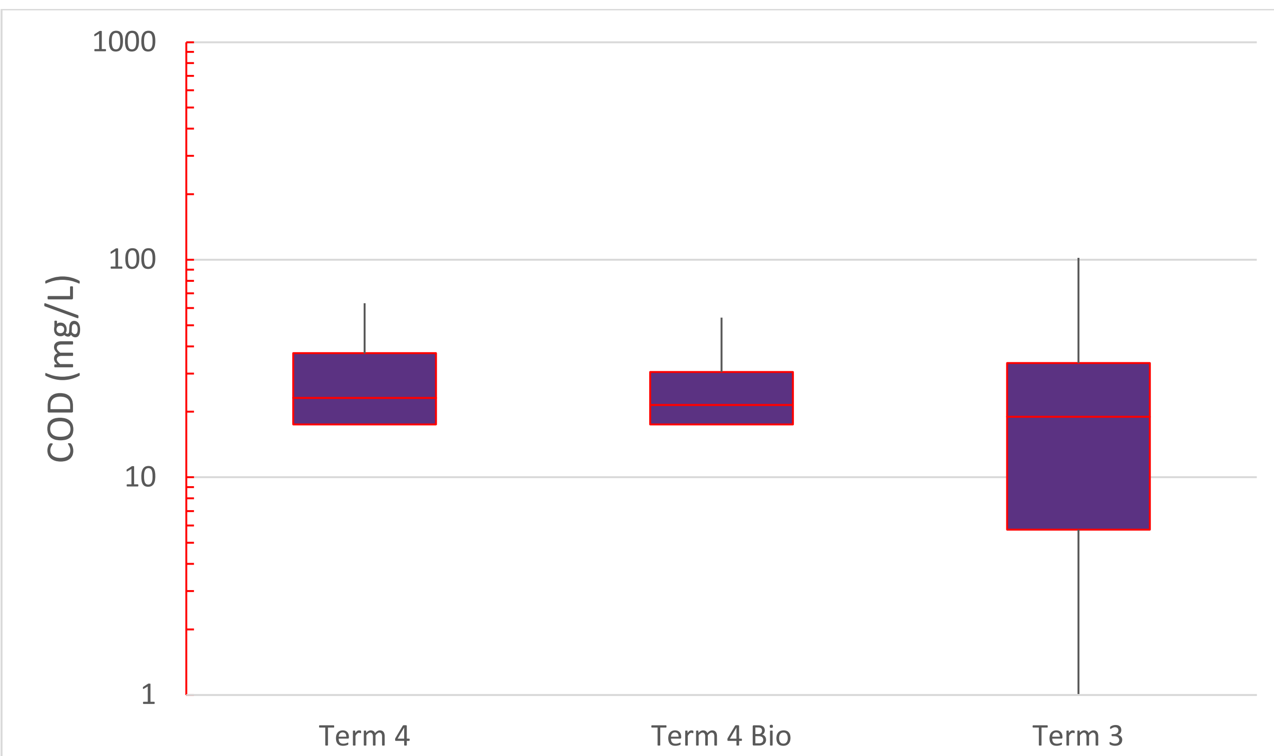


Figure 4-86 Boxplot Comparing Wet Weather Chemical Monitoring Fourth Monitoring Term and CRP Ammonia Nitrogen Data at White Rock Creek

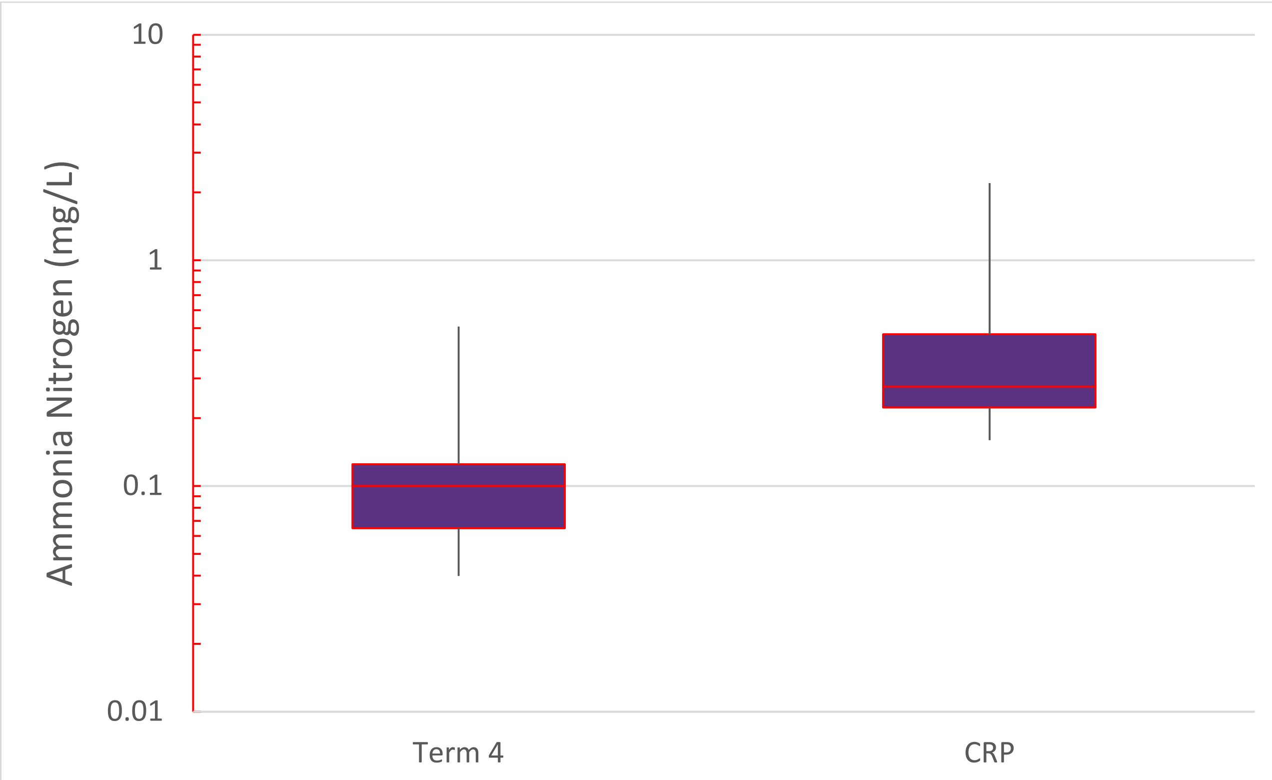


Figure 4-87 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms and CRP Total Nitrogen Data at White Rock Creek

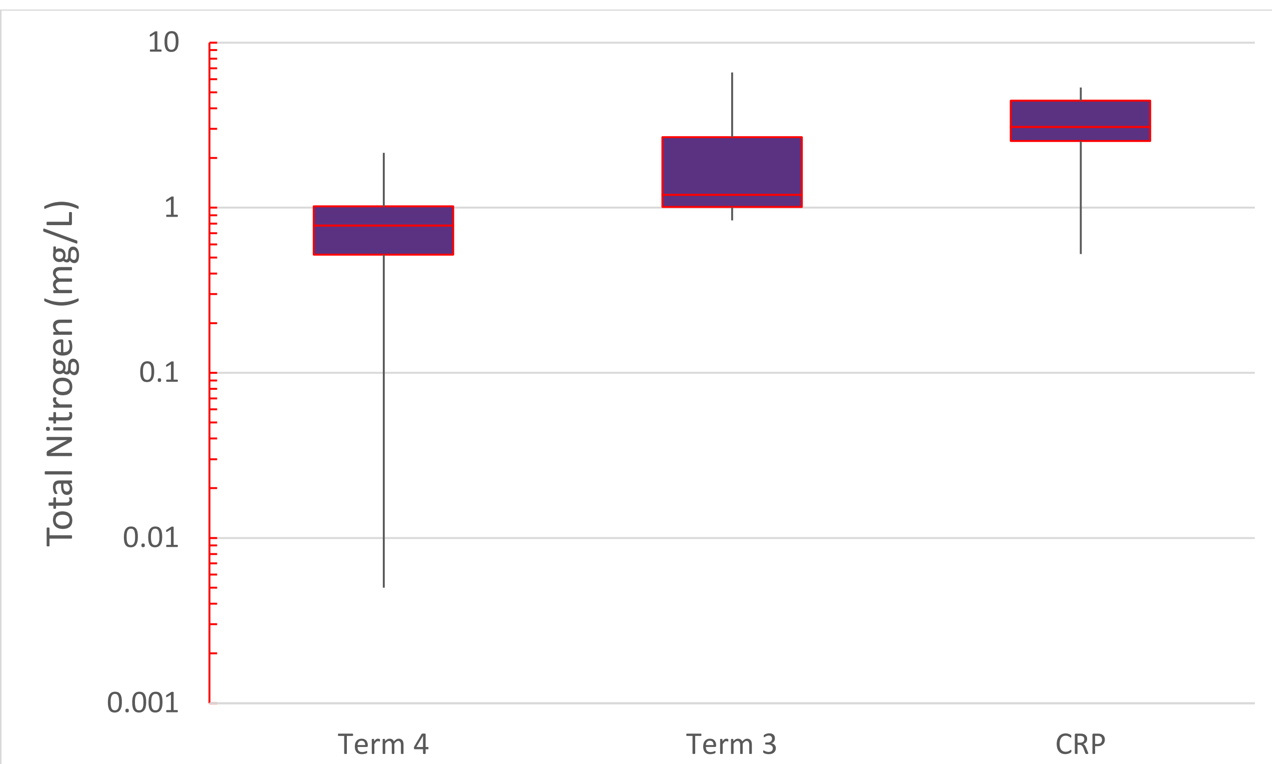
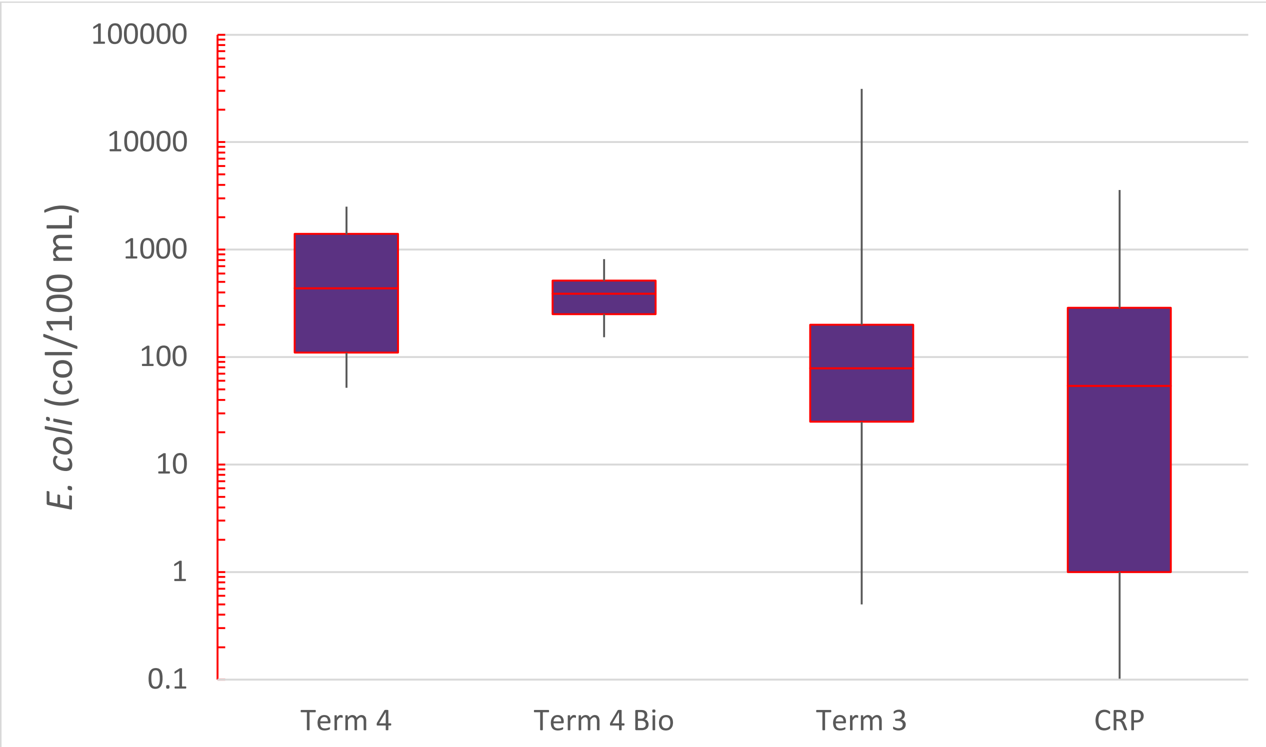


Figure 4-88 Boxplot Comparing Wet Weather Chemical Monitoring Third and Fourth Monitoring Terms, Bioassessment, and CRP *E. coli* Data at White Rock Creek



4.4.25.3. Biological Data Analysis

Detailed reports of the biological assessments including data summaries can be found in the Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1 through Year 4 (NCTCOG, 2019; NCTCOG, 2020b; NCTCOG, 2021; NCTCOG, 2022). The habitat assessment scores and aquatic life use scores were plotted and compared to the habitat and aquatic life use categories (see Appendix AA).

The habitat scores remained in the sub-optimal range over the fourth term period with the exception of a marginal score in the spring of 2021. Aquatic life use scores remained in the intermediate range with the exception of a limited score in the spring of 2021. The intermediate ALU scores generally correspond with the available habitat indicating that water quality may not be limiting macroinvertebrate communities.

4.4.25.4. Potential Pollution Sources and BMP Recommendations

A common source of TSS loadings is construction activities. A review of the aerial photography over the period shows that there were construction activities that occurred within the drainage area.

Land use of the White Rock Creek subwatershed is mainly residential followed by open, roadway, and commercial land uses. The elevated concentrations of nutrients may have been a factor in elevated BOD concentrations due to increased organic matter in the stream. Over fertilization of residential lawns and open areas may be a source of these nutrients. In addition, riparian alteration can affect nitrogen uptake and cycling, and turn urban riparian areas into nitrogen sources (Groffman et al. 2002, 2003). Dissolved oxygen was not measured during the monitoring term and therefore it is unknown whether the elevated nutrient and BOD concentrations may be impacting the aquatic community by decreasing the amount of available oxygen.

Roadway, and commercial land uses may have been the source of the exceedance of copper. Additional sources of metals could be from illicit connections and illegal dumping. The elevated oil and grease concentration may have been the result of a vehicular oil leak or staining from a roadway.

BMPs recommended for these sources include compliance inspections for illicit connections, identification and removal of illegal dumping areas, public education of home and business owners regarding fertilization and turf management and oil and grease handling, public education for pet owners regarding pet waste management, review of construction site inspection protocols or BMP requirements, street sweeping, drop inlet or other parking lot treatment devices or layouts to capture oil and grease from stormwater runoff, and review of industrial inspection protocols or BMP requirements.

4.4.25.5. Monitoring Recommendations

Data analyzed presents several indications of stream degradation. Bacteria concentrations have a potential to impact primary contact recreation and TSS, BOD, nutrients, and copper have the potential to impact aquatic life. There are no TMDLs or impairments identified for this segment of White Rock Creek. There is a current TMDL for bacteria and for legacy pollutants for the Upper Trinity River Segment 0805. Additional monitoring at this site is recommended to be assigned a medium priority. In order to determine the concentration of bioavailable metals, it is recommended that sampling of the dissolved fraction of copper is conducted.

4.5. Flow and Pollutant Load Estimates

The annual pollutant loading from each watershed were estimated for the parameters monitored with the exception of *E. coli* during runoff events using the following equation:

Annual Pollutant Loading (lb) = Estimated Mean Annual Pollutant Concentration (mg/L) x 2.2046 x 10-6 (conversion factor) x Estimated Annual Flow Volume (L)

For *E. coli*, the following equation was used:

Annual Pollutant Loading (billion colonies) = Estimated Mean Annual Pollutant Concentration (colonies/100 mL) x 1.0 x 10^{-8} (conversion factor) x Estimated Annual Flow Volume (L)

The Estimated Mean Annual Pollutant Concentration was calculated by taking the average of the pollutant concentrations collected through in-stream stormwater monitoring within each watershed per year.

The annual flow volume was estimated using the annual precipitation and annual flow equations developed for each watershed. The annual precipitation was estimated for each watershed by utilizing rain gauges located both at the monitoring site and nearby locations, where available. Annual flow equations and description of methods can be found in Atkins, 2019.

The City of Dallas uses the Regional Stormwater Monitoring Protocol as their base protocol for stormwater sampling activities. The City of Fort Worth does not calculate annual loads due to the low number of wet weather samples collected per watershed.

Annual load tables are provided in Appendix AB.

5. BMP Analysis and Evaluation

Atkins prepared a BMP Analysis and Evaluation Plan (BANEP) as a guidance document to outline a high-level approach to analyze BMPs through the regional program (Atkins, 2020). The plan built upon previous program term efforts to create a more-robust inventory of BMP implementation.

The intent of the plan was for participating entities to use as a platform or building block towards more robust BMP effectiveness analysis. The plan provided a methodology for using BMP and water quality data to assist participants with determining BMP implementation effectiveness at the watershed level. The implementation of the plan:

1. Identifies pollutants of concern (POC).
2. Identifies BMP evaluation metrics such as construction dates, implementation timelines and frequencies, locations, drainage and/or coverage areas, and other quantifiable parameters.
3. Documents potential sources of BMP data (i.e., permits, SWMPs, and annual reports).
4. Provides a correlation between pollutant parameters and BMP metrics.
5. Provides information to be used by Participants to evaluate BMP implementation effectiveness indicators based on BMP data only, water quality data only, and a combination/aggregation of BMP and water quality data within monitored watersheds.

During the fourth monitoring term, the NCTCOG and participants agreed to use the BANEP to collect BMP data/metrics during calendar year 2021 and to report BMP data/metrics during annual reporting activities.

5.1. Data Collection

Participants performed data collection and provided data to NCTCOG. A collection constraints form was distributed to participants to document any constraints that prevent the collection of specific BMP data.

Data received from participants was collected, grouped and/or categorized to allow for the analysis and evaluation. The scope of the data was restricted to the watersheds under investigation in calendar year 2021. The City of Fort Worth scope was adjusted to the calendar year 2020 in order to capture chemical monitoring activities which were not conducted in the year 2021. The NCTCOG coordinated with participants to identify appropriate sources of BMP data and created maps of collected BMPs in the monitored watersheds. Atkins used the data collected to complete BANEP worksheets to populate analysis results and grouping tables.

The sources of data for BMPs were SWMPs, annual reports, and SWMP reporting data collection tools and databases such as:

- Municipal Capital Improvements Databases
- Municipal Stormwater Budgets and Fiscal Databases
- Municipal/MS4 Maintenance Management Systems
- Maintenance Management Consultants and Contractors
- The North Central Texas Council of Governments
- Various Municipal Government Departments
- Engineering or Other Consultants
- Geographic Information System Databases

As part of the evaluation of the water quality component of the BANEP, water quality data was collected from multiple sources. Water quality data sources included:

- NCTCOG Regional Wet Weather Characterization Program
- Texas Surface Water Quality Standards
- 2014 Guidance for Assessing and Reporting

- TCEQ's *2016 Guidance for Assessing and Reporting Surface Water Quality in Texas (August 6, 2019)*.
- National Stormwater Quality Database
- National Rivers and Streams Assessment
- Nationwide Urban Runoff Program
- Texas Clean Rivers Program
- Total Maximum Daily Loads
- Multi-Sector General Permits

5.2. Analysis and Evaluation

The sample results, statistical summaries and statistical figures (where applicable), and bioassessment indices/scores presented in this report and in the annual reports served as the POC metrics for the water quality analysis component of the BANEP.

In order to facilitate a uniform evaluation of different types of BMPs implemented by each participant, the BANEP was designed to utilize metrics in an evaluation/analysis process with results rolled up to the minimum control measure (MCM) level where all BMPs are considered a subset.

The metrics used for the BMP analysis were: the quantity and types of BMP structures; enforcement/criteria documents, activities and activity units; the locations/coverage areas of the BMP structures, activities and activity units; the dates of implementation or availability of the structures, documents, activities, and activity units; and pollutants of concern potentially addressed by the structures, activities, and activity units. The activity units and land use data were also used to determine the pollution potential risk levels (ranging from high to low) for each watershed.

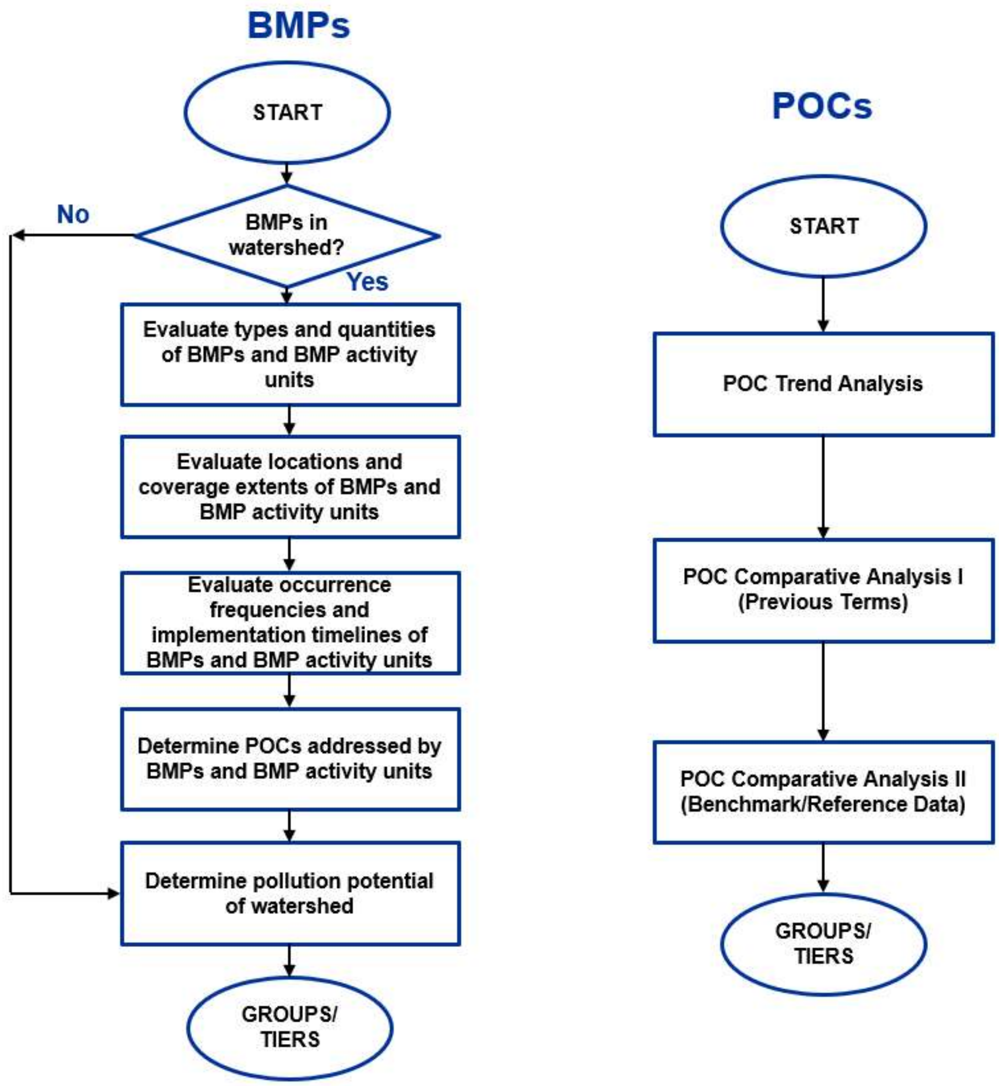
BMP metrics considered included the following:

- Number and types of structural controls (stormwater infrastructure), facilities, industries, construction sites, waste collection schemes, storm events, reviews, meetings, notifications, complaints/reports, training sessions, monitoring activities, and public interaction tools.
- Maintenance and/or BMP activity units (e.g., miles, acreage, volume and hours) expended.
- Number and types of enforcement mechanisms and criteria manuals implemented.
- Number of inspections, response, follow-up, investigative, and mitigation actions employed.
- Training and/or event participation and attendee records.
- Population distribution records.
- Geographic coordinates of BMP structures or activities and activity units with point location data.
- Coverage/service/source areas for BMP activities where point location data may not be available.
- Dates of implementation or installation of BMP structures and/or occurrence of BMP activities.
- Frequency of occurrence or availability of BMP events, activities, training, mechanisms, and/or tools.

BMP and POC metrics were evaluated against the BANEP criteria using worksheets. Individual BMP and POC groups/tiers (ranging from tier V to tier I) were assigned using the worksheets and were cumulatively rolled up into overall groups/tiers at the MCM and POC level for each watershed.

The BMP and POC evaluation and analysis steps are shown in Figure 5-1.

Figure 5-1 BANEP Analysis Steps



5.2.1. BMP Analysis

A five-step process was utilized to evaluate and analyze BMP data. Analysis steps were broadly classified under quantity and types (quantitative and qualitative), location/coverage (spatial), timelines and frequency (trends), POCs addressed (qualitative) and pollution potential (quantitative, qualitative, comparative, spatial, and trends).

In the first step, based on the MCM under evaluation, structural BMP types and quantities, BMP maintenance activity units, water quality considerations employed during project designs, enforcement/criteria manuals, spill and illicit discharge response actions, quantity and type of staff trained, quantity and types of facilities inspected, quantity and types of waste collected, quantity and types of construction related reviews, meetings, and training conducted, active construction sites inspected, quantity and types of public interaction tools implemented, target audiences and audiences reached, types of monitoring activities conducted, and types and quantity of targeted controls installed were assessed against the evaluation/analysis criteria provided in the MCM/BMP worksheets.

In the second step, the locations of structural BMPs and focused BMPs (where applicable), maintenance activities, flood control, and other drainage improvements projects within the watershed were evaluated. Step two analysis also included the evaluation of the coverage areas/extents of waste collection activities, response/mitigation activities, inspection activities, public education events and platforms, and monitoring activities.

The timing and frequencies of BMPs were evaluated as part of step three. This step evaluated the dates that structural BMPs were fully functional, how frequently maintenance activities, training events, inspection activities, and monitoring activities were conducted, and how often waste collection schemes and public interaction tools were made available to the watershed communities. The timeliness of responses to spills, illicit discharges, and citizen complaints were also reviewed in this step.

The penultimate step comprised the determination of the POCs that were potentially addressed by the BMPs under evaluation for each MCM.

The final step of the BMP evaluation and analysis process involved the determination of the risk potential (based on land use, watershed activities, and pollution sources) for the release of pollutants within the watershed. Grouping was tempered for watersheds with higher pollution potential risk.

Results determined from each step were tabulated to determine a final group/tier for each MCM for the watershed (See Appendix AC).

5.2.2. POC Analysis

A three-step process was utilized to evaluate and analyze POC data. Analysis steps were broadly classified under trend analysis (year/period-to-date), and comparative analysis (previous terms and other reference/benchmark data).

In the first step, applicable sampling station/site results were evaluated against the evaluation criteria provided in the POC worksheet forms. The evaluation criteria included an assessment of whether individual results or quarterly results averages improved, declined or were sporadic during the year under review. Water quality groupings were applied per guidelines in the POC evaluation worksheets.

In the second step, data from the current year under evaluation were compared with prior years of the current term, and previous terms where applicable. In this analysis, each calculated metric was compared with a similar metric from previous years. Grouping was assigned to metrics based on whether the metrics were observed to meet the evaluation criteria when compared with all previous-year metrics.

In the third and final step, statistical data from the period of interest were compared with similar benchmark/reference data. Water quality tiers were applied per the POC worksheet.

Results determined from each step were tabulated to determine a final group/tier for each POC for the watershed (See Appendix AC).

5.2.3. Assigning BMP/Water Quality Groups/Tiers

Each watershed was assigned a BMP implementation-only group/tier and a water quality POC only-group/tier after tabulation of results. BMP and POC groups/tiers were combined to determine the combined group/tier for each watershed. This was done by calculating the cumulative average of all results assigned to each MCM or POC for the watershed (See Appendix AC).

BMP only, water quality (POCs) only, and overall group/tier classifications were assigned as follows:

- Tier V – POC metrics show a consistent improvement or were undetected and meet the evaluation criteria; BMPs are located in the drainage area upstream of monitoring location and addresses all POCs; BMPs are in place year-round and the drainage areas exhibit the lowest pollution potential.
- Tier IV – The majority of POC metrics show a consistent improvement and meet the evaluation criteria; the majority of BMPs are located in the drainage area upstream of monitoring location and

addresses all POCs; the majority of BMPs are in place year-round and the drainage areas exhibit a low pollution potential.

- Tier III – POC metrics remain the same (within a 10% window of reference result) or an equal number shows improvement/positive trend or decline/negative trends and an equal number meet/do not meet evaluation criteria; an equal number of BMPs are located in the drainage area upstream of monitoring location and address POCs; BMPs are in place part of the year and the drainage areas exhibit a medium pollution potential.
- Tier II – The majority of POC metrics show a consistent decline and do meet the evaluation criteria; the majority of BMPs are not located in the drainage area upstream of monitoring location and do not address all POCs; the majority of BMPs are not in place year-round and the drainage areas exhibit a higher pollution potential.
- Tier I – POC metrics show a consistent decline and do meet the evaluation criteria; BMPs are not located in the drainage area upstream of monitoring location and do not address any POCs; BMPs are not in place year-round and the drainage areas exhibit the highest pollution potential.
- ND – No Data Collected (data not collected by participant due to various constraints or watershed area outside RWWCP participant's jurisdiction or historical data not available or data was collected but not part of this program)
- N/A – Data not applicable (BMP not applicable for participant)

5.3. Results

BANEP implementation results for watersheds monitored in the year 2021 are presented in Table 5-1. Detailed analysis results can be found in Appendix AC. Analysis results were generated for datasets where more than 50% of BMP criteria and 70% of POC criteria could be evaluated based on the data that was collected or available from previous terms.

Participants may interpret the results to draw conclusions based on local conditions, current programmatic activities, and assumptions and deviations in their respective jurisdictions. Participants may not be able to establish BMP effectiveness based on these results. It is the Participants' discretion to incorporate findings from this effort into their stormwater programs or annual reporting.

Table 5-1 BANEP Results

Participating Entity	Watershed	Percentage of City/ROW (Watershed)	BMP/Water Quality (POC) Tiers		
			POC	BMP	Overall
Arlington	Rush Creek – Village Creek[5]	35%	Tier IV	Tier IV	Tier IV
Dallas	Five Mile Creek – Trinity River	11%	ND[1]	ND[3]	Undefined
	City of Dallas – White Rock Creek[4]	9%	Tier III	ND[3]	Undefined
Fort Worth	Sycamore Creek – West Fork Trinity River[4,6,7]	7%	Tier III	ND[3]	Undefined
	Whites Branch – Big Fossil Creek[5,6,7]	10%	Tier IV	ND[3]	Undefined
Garland	Rowlett Creek – Lake Ray Hubbard[5,6]	30%	Tier IV	Tier IV[2]	Tier IV
Irving	Estelle Creek – Bear Creek[4,6]	19%	Tier IV	ND[3]	Undefined

Participating Entity	Watershed	Percentage of City/ROW (Watershed)	BMP/Water Quality (POC) Tiers		
			POC	BMP	Overall
	Grapevine Creek – Elm Fork Trinity River[1,3]	5%	ND[1]	ND[3]	Undefined
Mesquite	South Mesquite Creek[5]	52%	Tier IV	Tier IV	Tier IV
	North Mesquite Creek[5]	26%	Tier IV	Tier IV	Tier IV
NTTA	Cottonwood Branch – Hackberry Creek[5]	N/A	Tier III	Tier IV	Tier IV
	Cottonwood Creek – Mountain Creek Lake[4]	N/A	Tier III	Tier IV	Tier IV
Plano	Headwaters Rowlett Creek[1]	11%	ND[1]	Tier IV	Undefined
	Brown Branch Rowlett Creek[4,6]	21%	Tier IV	Tier IV	Tier IV

1. Historical data not available to complete analysis
2. 40 – 50% of maximum available criteria evaluated
3. BMP data provided by the entity did not meet minimum evaluation criteria threshold due to data collection constraints.
4. Evaluated POC metrics collected over two terms
5. Evaluated POC metrics collected over three terms
6. Biomonitoring assessment conducted in this watershed in 2021
7. Four quarters of annual data not collected in this watershed

6. Conclusions and Recommendations

Monitoring activities were conducted from 2018 to 2021 in various receiving streams in the North Central Texas region both during wet weather conditions and as part of biological monitoring efforts. The chemical monitoring activities resulted in the collection of 308 samples, which were subsequently analyzed for atrazine, total arsenic, BOD, COD, total copper, total chromium, E. coli, pH, total lead, ammonia nitrogen, nitrate nitrogen, total nitrogen, oil and grease, dissolved phosphorus, orthophosphate, total phosphorus, TDS, TSS, and total zinc. The NCTCOG RWWCP continues to be a unique and evolving program in that it is not of the traditional outfall monitoring for storm water permitting compliance.

6.1. Future Monitoring Recommendations

Atkins recommends that NCTCOG continue the regional wet-weather in-stream water quality monitoring approach with supplemented bioassessment activities and/or dry weather monitoring as needed. The approach provides many benefits and allows MS4 operators to assess wet weather water quality in a holistic manner. The current approach leverages MS4 operator resources, coordinates monitoring efforts, and builds on the baseline data obtained to date. In continuing the regional watershed approach, the participants should consider the program recommendations discussed below.

6.1.1. Sampling Site Selection

Sampling site selection process should continue to consider locating sampling sites within impaired watersheds and focusing on measuring concentrations of pollutants causing watershed impairments. This will help with assessing TMDL implementation and restoration efforts. In addition, the site selection criteria should be expanded to inform the BANEP results such that more water quality and BMP data may be available to refine and process.

6.1.2. Bioassessments

Rapid bio-assessments are usually conducted in dry weather conditions and evaluate additional parameters (e.g., water chemistry, benthic and nekton populations, in-stream habitat, etc.) that the wet weather in-stream monitoring does not. Bioassessments are recommended to use as biological end points for storm water management programs and biological monitoring for assessing program progress. In addition, the dry weather chemical monitoring data that results from bioassessments can be compared to the wet weather monitoring data to provide information regarding the source of pollutants.

6.1.3. Monitored Parameters

6.1.3.1. Pesticides and Herbicides

Atrazine is one of the most commonly detected herbicides contaminating drinking water in the United States (Gilliom et al., 2007). Atrazine was detected in the fourth monitoring term and continues to be a commonly used herbicide in the urban environment. Atkins recommends continuing to monitor for atrazine and simazine may be included at no to low additional cost due to detection through the same analytical method. Monitoring for simazine would provide more information on the use of herbicides in the urban environment.

6.1.3.2. Nutrients

In order to continue to compare results directly to the TCEQ nutrient screening criteria, to identify the forms of nitrogen and phosphorus impacting streams, to better determine the sources of nutrients in the stream, and to compare between wet weather chemical monitoring and bioassessment results, Atkins recommends continuing to monitor for ammonia nitrogen, nitrate nitrogen, and orthophosphate in wet weather chemical monitoring.

6.1.3.3. Metals

In order to identify areas of concern based upon monitoring data, Atkins identified aquatic life protection and human health criteria from the TSWQS. For most metals, with the exceptions of mercury and selenium, water quality criteria are expressed as dissolved concentrations. The dissolved concentration of a metal is the bioavailable fraction of the total metal concentration. Atkins estimated total fraction criteria by calculating segment-specific values.

It is recommended that sampling of dissolved fractions of metals is continued in order to determine the concentration of bioavailable metals. This sampling is recommended to be conducted during wet weather activities and would be used to determine whether concentrations of observed metals may be impacting aquatic communities in those streams.

6.1.4. BMP Analyses

Based on the results it can be inferred most of the watersheds analyzed are trending in the right direction and BMPs are in place and are making a positive impact on watershed health. No watersheds analyzed were observed to be in decline.

The BMP analyses conducted met the requirements of the proposal for the fourth monitoring term. A greater effort was conducted that analyzed the data and this report provided a summary of the results. BMPs implemented during the monitoring period were identified and an assessment was conducted to document water quality trends presumably resulting from the implementation of the BMPs. The results provide participating entities with data that may be used at their discretion to facilitate BMP implementation decision-making processes.

7. References

Atkins. 2019. *Regional Wet Weather Characterization Program, Permit Term Four Monitoring Program and Quality Assurance Project Plan for Wet Weather Equipment Deployment and Sampling Protocol 2018-2021*. North Central Texas Council of Governments (NCTCOG). Updated February 2019.

Atkins. 2020. *Regional Wet Weather Characterization Program, Permit Term Four Best Management Practice Analysis and Evaluation Plan*. North Central Texas Council of Governments (NCTCOG). Updated July 2020.

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

City of Dallas. 2012. *Texas Pollutant Discharge Elimination System Permit No. WQ0004396000 Draft Stormwater Management Plan*. Prepared by City of Dallas Trinity Watershed Department. April 2012.

Freese and Nichols, Inc. 2019. *Regional Wet Weather Characterization Program Permit Term Four Monitoring Program and Quality Assurance Project Plan for Bioassessments: 2018-2021*. North Central Texas Council of Governments (NCTCOG). Updated February 2019.

Gilliom, Robert J., Jack E. Barbash, Charles G. Crawford, Pixie A. Hamilton, Jeffrey D. Martin, Naomi Nakagaki, Lisa H. Nowell, Jonathan C. Scott, Paul E. Stackelberg, Gail P. Thelin, and David M. Wolock. 2007. The Quality of Our Nation's Waters: Pesticides in the Nation's Streams and Ground Water, 1992–2001. US Geological Survey March 2006. Revised February 15, 2007.

Groffman, P.M., N.J. Boulware, W.C. Zipperer, R.V. Pouyat, L.E. Band, and M.F. Colosimo. 2002. Soil nitrogen cycle processes in urban riparian zones. Environmental Science & Technology 36:4547-4552.

Groffman, P.M., D.J. Bain, L.E. Band, K.T., G.S. Brush, J.M. Grove, R.V. Pouyat, I.C. Yesilonis, and W.C. Zipperer. 2003. Down by the riverside: urban riparian ecology. Frontiers in Ecology and the Environment 1:315-321.

Linam, Gordan, L. Kleinsasser, and K. Mayes. *Regionalization of the Index of Biotic Integrity for Texas Streams*. Resource Protection Division, Texas Parks and Wildlife, June, 2002.

North Central Texas Council of Governments (NCTCOG). 2003. *Summary of the Dallas-Fort Worth Regional Monitoring Program. Letter to the Texas Commission on Environmental Quality dated January 30, 2003.* North Central Texas Council of Governments.

———. 2019. *Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 1*. Prepared by the North Central Texas Council of Governments. March 2019.

———. 2020a. *2020 Population Estimates.* Prepared by the North Central Texas Council of Governments. https://rdc.dfwmaps.com/pdfs/2020%20NCTCOG%20Population%20Estimates%20Publication.pdf. Accessed July 31, 2022.

———. 2020b. *Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 2*. Prepared by the North Central Texas Council of Governments. March 2020.

———. 2021. *Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 3*. Prepared by the North Central Texas Council of Governments. March 2021.

———. 2022. *Regional Wet Weather Characterization Program Annual Monitoring Report for North Central Texas Year 4*. Prepared by the North Central Texas Council of Governments. March 2022.

Texas Commission on Environmental Quality (TCEQ). 2007. *Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data*. TCEQ Surface Water Quality Monitoring Program. TCEQ RG-416. June 2007.

———. 2012. *Improving Water Quality in Dallas and Tarrant Counties Nine TMDLs for Legacy Pollutants.* TCEQ Total Maximum Daily Load Program. Project Overview Sheet. December 2012.

———. 2016. *Improving Water Quality in the Fort Worth Area Eleven TMDLs for Legacy Pollutants.* TCEQ Total Maximum Daily Load Program. Project Overview Sheet. March 2016.

———. 2019. *2016 Guidance for Assessing and Reporting Surface Water Quality in Texas.* TCEQ Surface Water Quality Monitoring Program. August 2019.

United States Census Bureau. 2018. https://www.census.gov/newsroom/press-releases/2018/popest-metro-county.html. Accessed July 31, 2022.

United States Census Bureau. 2021. https://www.census.gov/library/stories/state-by-state/texas-population-change-between-census-decade.html. Accessed July 31, 2022.

National Research Council. 2009. Urban Stormwater Management in the United States. Committee on Reducing Stormwater Discharge Contributions to Water Pollution. Water Science and Technology Board. Division on Earth and Life Studies. National Research Council of the National Academies. The National Academies Press. Washington, DC.

United States Environmental Protection Agency (USEPA). 2016a. *CADDIS: The Casual Analysis/Diagnosis Decision Information System.* U.S. Environmental Protection Agency. https://www3.epa.gov/caddis/index.html Updated March 10, 2016.

———. 2016b. *National Rivers and Streams Assessment 2008-2009 Technical Report.* U.S. Environmental Protection Agency Office of Wetlands, Oceans and Watersheds Office of Research and Development. Washington, DC. March 2016.

———. 2012. http://www.census.gov/newsroom/releases/archives/population/cb12-55.html. Accessed April 14, 2016.

United States Geological Survey (USGS). 1999. *The Quality of Our Nation's Waters: Nutrients and Pesticides.* Circular 1225. Reston, Virginia. 1999.

Index

Appendix A

Regional Wet Weather Characterization Plan Proposal for the Fourth Monitoring Term Submission and Letter of Approval from TCEQ

The North Central Texas Regional Wet Weather Characterization Plan Proposal for the Fourth Permit Term

I. History of the Regional Program

Since 1996, a regional storm water monitoring program has been on-going in the Dallas-Fort Worth (DFW) metropolitan area among the seven largest cities and major transportation agencies for compliance with Federal and State storm water permit requirements. During the initial permit term (1996 -2001), seven municipalities (Dallas, Fort Worth, Arlington, Irving, Garland, Plano and Mesquite) and two local districts of the Texas Department of Transportation (TxDOT) received joint approval from U.S. Environmental Protection Agency (EPA) for a regional monitoring program which utilized the assistance of a shared consultant team and the United States Geological Survey (USGS) to sample and analyze 22 outfalls primarily from small watersheds of a predominantly single land use type. Although these sample collections served to characterize typical urban runoff from these limited land use types, and were useful for estimating general pollutant loadings, they did little to evaluate impacts on actual receiving streams.

In the next permit term, now administered by the Texas Commission on Environmental Quality (TCEQ), approval was obtained to utilize in-stream stations for the regional monitoring program to better assess this impact. The revised program was termed the Regional Wet Weather Characterization Program (RWWCP) and was added as an option in Part IV.A.3 of the Texas Pollutant Discharge Elimination System (TPDES) Municipal Separate Storm Sewer System (MS4) permits issued to the Phase I North Central Texas governmental entities. The primary goal of this new in-stream monitoring program was to obtain baseline data on receiving streams in the DFW Metroplex for use in determining long-term water quality trends. Since the RWWCP language existed outside of each permit, it allowed greater flexibility for making changes to the program. During this second permit term, the North Texas Tollway Authority (NTTA) joined the regional program. All other participants remained the same, except for the TxDOT-Fort Worth District who became a co-permittee with the cities of Fort Worth and Arlington and were no longer required to conduct wet weather monitoring. According to the original RWWCP protocol, municipal participants collected data from three sampling sites in the watershed (typically upstream, midstream and downstream) and the transportation agencies collected data from two sites (upstream and downstream stations only). Samples were collected quarterly from each site during a qualifying rain event and were analyzed for 18 parameters.

As an added component, the City of Fort Worth selected the Representative Rapid Bioassessment Monitoring Option (Part IV.A.2) in their permit, which allowed the chemical sampling frequency to be reduced from four times per year per site to once per year per site. In its place, two bioassessments were conducted each year at a minimum of nine sites. These bioassessments were based on protocols developed by the EPA. A summarization of this bioassessment data was included along with the chemical data in the annual regional monitoring report each year of the permit term.

In the third permit term, the Cities of Arlington, Dallas, Fort Worth, Garland, Irving, Mesquite and Plano, together with the North Texas Tollway Authority and TxDOT-Dallas District agreed to continue their regional partnership and work cooperatively through the North Central Texas

Council of Governments to develop a revised RWWCP. This revised plan effectively monitored at least 50% of each entity's jurisdictional area by the end of the permit term. This extension of jurisdictional coverage allowed a reasonable assessment of each entity's jurisdictional watersheds while also achieving a balance among the various goals of obtaining valid scientific information, meeting permit compliance, and addressing what is practicable for each entity. The primary goal of the RWWCP during this permit term was to continue the assessment of urban impact on receiving stream water quality and to document any improvement presumably resulting from local BMP implementation. The data collected during this permit term built upon the set of regional data needed from each site for meaningful trend analysis. Since assessing the impact of urban runoff on receiving stream quality is a primary focus of this program, assessing the biological integrity of the streams was deemed fundamental in the third term. During the third term, 24 watersheds were chemically monitored and 12 watersheds were bioassessed across the region, with substantial overlap between the two sampling approaches. "

II. Lessons Learned from the Most Recent Permit Term

At the end of the third permit term's sampling effort, a final summary report was prepared by the regional consultant, Atkins, to assess the sampling effort. The report found that in more than half of the watersheds sampled had high bacteria exceedances, with the average number of nine exceedances in these watersheds. Stream degradation was noted by Atkins' monitoring team in about half of the sampled watersheds based on the data analyzed, and additional monitoring was recommended at these sites.

The report analyzed each of the monitored watersheds, and looked at characteristics specific to each watershed. This approach provided more usable information for each entity, and each individual watershed's information can be reviewed and used to implement BMPs and other monitoring practices in the future. Many of the watersheds that were studied in the third term were classified as high priorities to be studied again due to the data was collected during the third term. The watersheds that were classified as high priority were generally those with stream degradation, those with high number of exceedances of criteria of monitored parameters, and those with existing TMDLs.

Taking into account each watershed's characteristics and evaluating the RWWCP as a whole, Atkins made various recommendations for modifying the RWWCP in the next term, including the following that were applied to the proposal:

<u>Focus on Impaired Waterbodies</u> –This suggestion is supported by TCEQ and EPA feedback provided to NCTCOG and the monitoring partners. Atkins suggests a focus on monitoring impaired water bodies will also help with TMDL efforts already underway in the area.

<u>Rapid bio-assessment improvements</u> – Rapid bio-assessments should continue to be part of the RWWCP, and entities that are not currently completing RBAs should be encouraged to do so. Atkins recommends that the parameters that are recorded during bio-assessment chemical monitoring activities be expanded to include/match those of the wet weather monitoring to allow for easier comparison.

<u>Revise monitored pollutants: Pesticides and Herbicides</u> – During the third permit term, Carbaryl was chosen to replace Diazaon that was undetected in the second permit term. Carbaryl was not detected in any watershed during the third permit term, and therefore was recommended that it no longer be monitored for the fourth permit term. Suggestions for replacement are dieldrin or atrazine.

<u>Revise monitored pollutants: indicator bacteria</u> – Remove total coliforms from list of monitoring parameters. There is no recognized correlation between total coliforms and fresh water pathogens by TCEQ or EPA.

<u>Revise monitored pollutants: nutrients</u> – Add ammonia nitrogen, nitrate nitrogen, and orthophosphate to the monitoring parameters for wet weather chemical monitoring. These additions would allow for better comparisons between bioassessment and wet weather chemical monitoring results.

<u>Revise monitored pollutants: metals</u> - For the Duck Creek, Johnson Creek, and White Rock Creek (headwaters) subwatersheds, it is recommended that sampling of dissolved fractions of metals is conducted in order to determine the concentration of bioavailable metals.

Many of these recommendations were incorporated in this proposal for the next permit term.

III. Characterization of the Proposed Program

Proposed Plan for Fourth Permit Term

As previously mentioned, the primary goal of the monitoring program was to obtain baseline data on receiving streams in the DFW Metroplex for use in determining long-term water quality trends. Long term measurement of instream chemical data as well as biological assemblages integrate the effects of different stressors as well as integrating the stresses over time and thus provide a broad measure of their aggregate impact over time. The establishment of baseline data was generally achieved in the past two permit terms but final analysis indicated that more data is needed to establish actual trends. The populations in the monitored watersheds are growing at a very high rate, and the cities in this program look to implement BMPs to combat the stress that the growing population puts on these watersheds. It is important to continue monitoring these watersheds, and to shift the focus to study impaired watersheds to document population impacts on these watersheds.

In order to assess the impacts, a greater effort will be made to analyze the data and to provide a summary of the results of the data analysis. In addition, the best management practices (BMPs) that were implemented during the monitoring period will be identified in order to better assess and document any improvements in water quality presumably resulting from the implementation of the BMPs. If it is found that the implementation of the BMPs did not result in any reduction of pollutants or improvement in water quality, then different or improved BMPs will be implemented. Appendix C illustrates the BMPs that are currently being implemented across the region, broken down by entity.

The Regional Storm Water Monitoring Partners of North Central Texas seek to continue documenting water quality improvements resulting from BMP effectiveness in impaired watersheds.

The regional partners would like to continue with the RWWCP because it has allowed for: 1) more coordinated and comprehensive water quality sampling; 2) more sound and reliable data collection; 3) greater cost effectiveness; and 4) a truer assessment of regional impact on stream water quality.

For this upcoming permit term, the Cities of Arlington, Dallas, Fort Worth, Garland, Irving, Mesquite and Plano, together with the North Texas Tollway Authority, have agreed to continue their regional partnership to work cooperatively through the North Central Texas Council of Governments to develop a revised RWWCP. Permit numbers and relevant dates for each participant are included in Table 2.

TABLE 2: LIST OF PERMITTEES			
PERMITTEE	TPDES PERMIT NUMBER	DATE ISSUED	EXPIRATION DATE
City of Arlington	WQ0004635000	4/26/2012	4/26/2017
City of Dallas	WQ0004396000	10/6/2011	10/6/2016
City of Fort Worth	WQ0004350000	Pending	Pending
City of Garland	WQ0004682000	Pending	Pending
City of Irving	WQ0004691000	8/6/2014	8/6/2019
City of Mesquite	WQ0004641000	10/18/2011	10/18/2016
City of Plano	WQ0004775000	12/2/2015	12/2/2020
North Texas Tollway Authority	WQ0004400000	Pending	Pending

The municipal regional partners propose to continue to use a sampling plan that will effectively monitor at least 50% of their jurisdictional area by the end of the permit term. This extent of jurisdictional coverage will allow a reasonable assessment of jurisdictional watersheds while striving to achieve a balance among the various goals of obtaining valid scientific information, meeting permit compliance, and addressing what is practicable for each entity. As in the previous term, this plan proposes to continue in-stream watershed monitoring, but seeks to obtain greater statistical robustness of the data by increasing the sampling at each location for a minimum of two years.

There may be some need to move stations or include new stations from time to time but the municipal regional partners will maintain fixed SAMPLING stations to the extent practicable. This would enable the data to be examined for trends and show improvements or decline in water quality within the fixed sampling period. An effort will be made for in-stream sampling locations to be located be located downstream to priority drainage basins (e.g., high risk areas or priority areas defined in the permittees stormwater management program (SWMP) document: industrial areas, impaired waters, targeted areas, etc.

For the fourth permit term, regional partners have determined that it would be beneficial to focus the RWWCP on watersheds with impaired waterbodies draining to them. Watersheds that will be monitored for this permit term were prioritized based on TMDLs and 303d streams which were in watersheds that cover the jurisdictional area of the municipalities. Regional partners propose to monitor in these impaired waterbodies in order to better assess the impacts of stormwater on these impaired streams It is primarily the same area monitored during the previous permit terms with some additional watersheds. The jurisdictional area was determined by taking into consideration the data needs, areas of concerns, and/or sampling purposes (e.g., further collect data to support statistically analysis of pollutant trends). . Table 2 describes the percentage each jurisdiction will cover per watershed, as well as indicating if it is a newly added watershed to be monitored in permit term .

The primary goal of the RWWCP during this permit term will be to continue the assessment of urban impact on receiving stream water quality and to document any improvement presumably resulting from local BMP implementation. The data collected during this permit term will build upon the set of regional data needed from each site for meaningful trend analysis. This proposal also includes a more comprehensive biomonitoring component. Since assessing the impact of urban runoff on receiving stream quality is a primary focus of this program, assessing the biological integrity of the streams is fundamental. With this proposed plan, 26 watersheds will be chemically monitored and 13 watersheds will be bioassessed across the region, with substantial overlap between the two sampling approaches.

A map with each entity's selected watersheds is shown in Figure 1. Specific locations of sampling sites in each watershed will be determined prior to each sampling year and will be submitted in each prior year's annual regional monitoring report.. Refer to Table 2 for identification of the watersheds selected by each entity and their relative proportion to jurisdictional area. The relative percent and the area of the selected watersheds are indicated with bold type. Unbolded watersheds indicate unselected, shared watersheds that were selected by other entities. Most of the municipal entities were able to achieve the 50% coverage with only two watersheds; exceptions being the City of Dallas who selected eight and the City of Fort Worth who selected six. Jurisdictional coverage was not a considered factor in the selection of the one transportation agency watersheds.

The North Central Texas Council of Governments' (NCTCOG) role in the regional monitoring program will be to coordinate the overall program; obtain consultant assistance on behalf of the regional partners, as needed; assist participants in site selection and the development of the sampling protocol; collect and summarize the data; and generate/deliver annual compliance reports.

Sampling Metrics

Monitoring is proposed to commence January 1, 2018 of the year following the issuance of the City of Garland's permit, anticipated in mid-2011. Given the existing staggered permit expiration dates among the participants, it is likely that permit renewals issued by TCEQ will also be staggered. Consequently, the regional program will need to have written endorsement from TCEQ that participants will receive credit for any monitoring they contribute as part of the regional effort that would be applied toward their eventual permit. However, by incorporating a lag period to maintain a calendar year-based schedule, most of the participating permittees will likely have their renewals issued by then, making for a smoother transition.

The sampling conducted in all cities (other than Fort Worth and Dallas) will follow the standardized sampling methodology as found in the TCEQ *Surface Water Quality Monitoring Procedures,* Volumes 1 and 2, to the extent practicable Permitees will use sufficiently sensitive test methods for Texas Pollutant Discharge Elimination System (TPDES) permit reporting requirements. The Minimum Levels (MLs) for pollutant analyses should be sensitive enough to ascertain whether a discharge is causing or contributing to an in-stream water quality standard exceedance.

Refer to Table 3 for a detailed breakdown of the count and frequency of each partner's proposed sampling activity. The cities of Garland and Mesquite along with NTTA will be monitoring one watershed for the entire permit term. The cities of Arlington, Plano, and Irving will be monitoring three watershed during the permit term, and will be monitoring two of the watersheds for two years, and then the third watershed for the other two years.

The City of Dallas will need to sample at least five watersheds in order to achieve the 50% coverage; however, they have opted to chemically sample four watersheds and to bioassess four additional watersheds with only one watershed having both chemical sampling and bioassessment occurring in the same watershed. The City of Dallas's sampling methodology is attached as Attachment A.

To achieve the 50% area coverage, the City of Fort Worth needs to sample six watersheds. They intend to bioassess all six watersheds at two locations twice a year for all five years of the permit term. For chemical sampling, they intend to collect in-stream samples at two sites within two watersheds each year. By the end of the third year, they will have monitored each of their six selected watersheds once. They propose to then select the top four most biologically-impaired watersheds to continue with a second sample in the remaining two years of the permit term. Table 3 attempts to reflect this dual pattern of four watersheds being sampled twice while two of their watersheds are only sampled once for a total of 120 chemical samples in the permit term. The City of Fort Worth's sampling methodology is attached as Attachment B.

Chemical Sampling Details

Each participating entity will be responsible for final selection of sampling sites. Samples will be collected from these sites according to the schedule identified previously and analyzed for the parameters listed in the table below. Following consultant recommendations (see Section II Lessons Learned…), Carbaryl has been replaced with Atrazine and total coliforms has been dropped from the parameter list. Entities may use in-house staff or a consultant of their choice for sample collection. Although we encourage the use of a common laboratory for analysis to ensure consistency, entities may also select the laboratory of their choice, as long as procedures are followed and data quality objectives are met as specified in the approved regional monitoring protocol (to be finalized prior to the first sampling year).

TABLE 3: LIST OF PARAMETERS	
Parameter	**Method of Collection**
Oil & Grease	Grab
pH	Grab
E. coli	Grab
Total Dissolved Solids (TDS)	Composite
Total Suspended Solids (TSS)	Composite
Biochemical Oxygen Demand	Composite
Chemical Oxygen Demand (COD)	Composite
Total Nitrogen	Composite
Dissolved Phosphorus	Composite
Total Phosphorus	Composite
Atrazine	Composite
Total Arsenic	Composite
Total Chromium	Composite
Total Copper	Composite
Total Lead	Composite
Total Zinc	Composite
Ammonia Nitrogen	Composite
Nitrate Nitrogen	Composite
Orthophosphate	Composite

Grab samples will be collected during the first flush and analyzed for *E. coli*, oil and grease, and pH. An additional first flush sample and four subsequent samples collected at equal time intervals will be taken over the first two hours of the event and combined for a composite sample.

The composite sample for each constituent has a component that analyses the first flush discrete sample. These first flushes are ultimately composited and analyzed for all constituents. Samples will be collected for no more than two hours, regardless of storm duration. The grab samples can be obtained either manually or from some type of automated collection device to better address safety concerns. Sampling will be conducted only on qualifying events which are defined as satisfying the following requirements: 1) Antecedent dry period of 72 hours minimum; 2) Rainfall volume of 0.10 inch minimum; and 3) Rise in stream level of at least one inch in a one-hour span of time as determined by level sensors (i.e. bubbler module), stream gauges, or other methods of determining water level that will be installed at each sampling location. Rain gauges will be deployed in each watershed; however rain does not need to fall at the site in order to have a rise in the level of the stream that would trigger sampling. Rainfall in the basin upstream of the site would cause a rise downstream without any rain actually falling at the sampling location; therefore, rainfall level alone is not a satisfactory gauge of adequate runoff.

Bioassessments

The recent National Research Council (NRC) report Urban Stormwater Management in the United States recommends including bioassessments for assessing storm water management program progress. It also recommends that storm water management strategies should address all stressors to a stream which can be accomplished through biological monitoring since biota naturally integrate the environmental conditions that impact them. TCEQ has continued the option established by EPA in the MS4 permit language of allowing bioassessments to be used as a replacement for a portion of the chemical monitoring requirement. The RWWCP has always had a bioassessment component as part of its overall approach and the partners would like to continue including it. In fact, this proposal suggests a greater use of bioassessments across the region than ever before.

Both EPA and TCEQ have developed an array of methods and approaches that can be used in conducting bioassessments. Each of these regulatory entities has developed manuals outlining these various steps. As EPA states in their manual, Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, 2nd Ed. (1999) the protocols described are not "intended to be used as a rigid protocol without regional modifications. Instead, they provide options for agencies or groups that wish to implement rapid biological assessment and monitoring techniques." As such, the regional program participants that are implementing bioassessments (Dallas, Fort Worth, Garland, Irving, and Plano) will each develop their own array of methods and techniques; all adapted from the EPA and TCEQ manuals. Specifics of their protocols will be detailed in each annual report but generally speaking, all will involve a habitat assessment, a measurement of standard field physical conditions, and collection and identification of macroinvertebrates and possibly other biota. Some method will be used to provide a means of comparison to a standard in order to determine the habitat's health, such as using a reference site or by using known metrics of habitat comparison. The number of watersheds being sampled, stations per watershed and samples per year are all listed in Table 5.

IV. Summary of the RWWCP Proposal for the Fourth Permit Term

In summary:

- Each participant has selected watersheds to achieve greater than 50% coverage of their jurisdictional area.
- To increase statistical robustness, most watersheds will be sampled for a minimum of two years.
- Most watersheds will be sampled quarterly; Fort Worth is putting a greater effort into the bioassessment sampling instead.
- The number of sites per watershed varies per entity based on local conditions.
- Arlington, Dallas, Garland, Irving, Mesquite, Plano, and NTTA will collect samples for the first four years of the five-year permit term.
- Fort Worth has elected to perform chemical monitoring for the entire five-year permit term.
- 18 chemical parameters will be analyzed in each storm event sample.
- Dallas, Fort Worth, Garland, Irving, and Plano will also do biological assessments.

Regional Monitoring Entities & Selected HUC-12 Subwatersheds for Fourth Term Monitoring

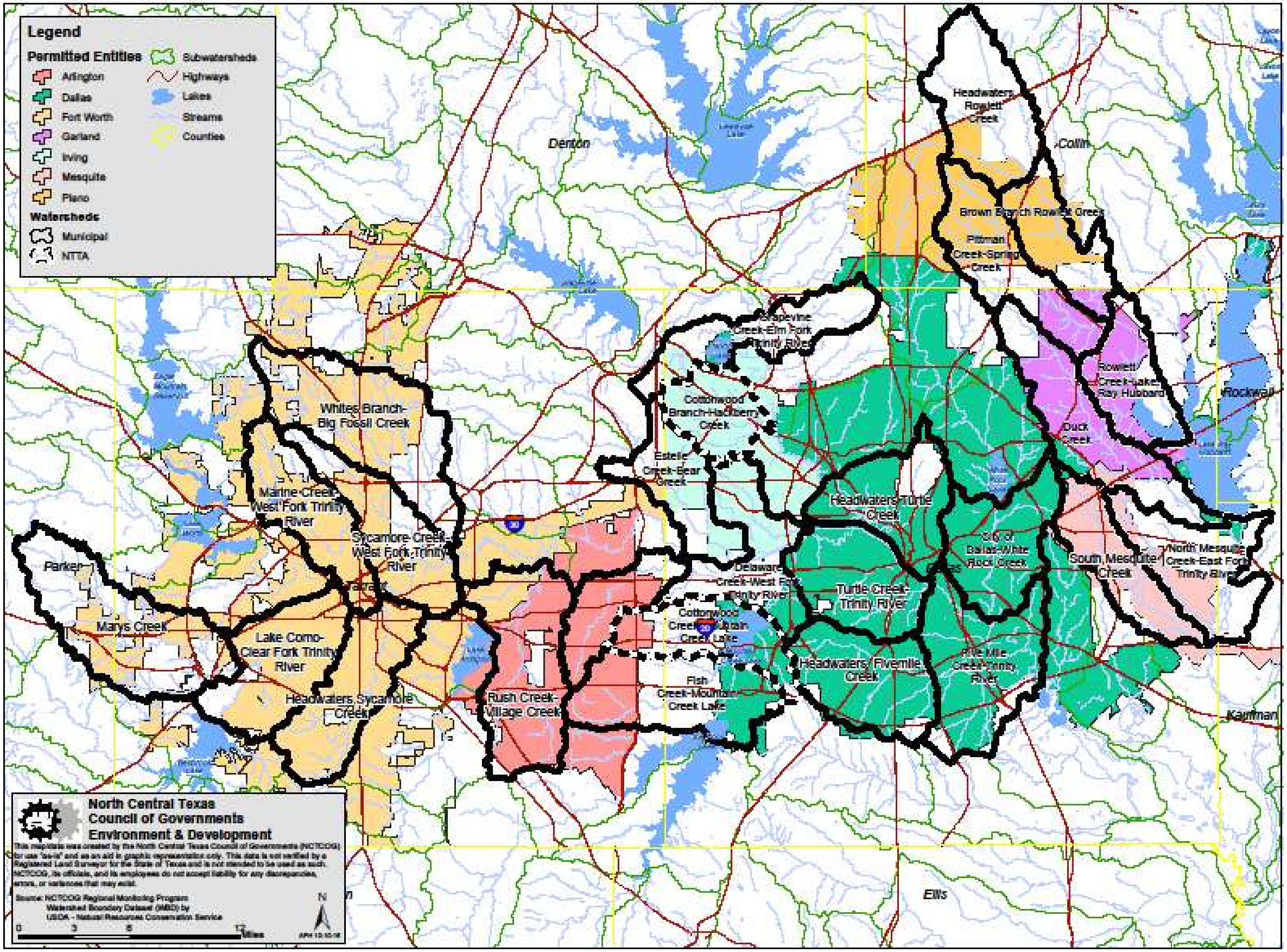


TABLE 4		Arlington	Dallas	Fort Worth	Garland	Irving	Mesquite	Plano	NTTA
HUC-12 Watersheds	*	% of City	% of City	% of City	% of City	% of City	% of City	% of City	
Fish Creek-Mountain Creek Lake [1]	C	**13.28%**	3.01%						
Johnson Creek [1]	C	**17.50%**							
Rush Creek-Village Creek [1]	C	**35.22%**		2.31%					
Floyd Branch - White Rock Creek	B		**5.50%**						
Five Mile Creek-Trinity River [1]	C		**10.80%**						
Headwaters Five Mile Creek	B		**9.00%**						
Headwaters Turtle Creek [1]	C		**7.38%**						
White Rock Creek - White Rock Lake	BC		**8.73%**						
Bachman Branch - Elm Fork Trinity	B		**7.98%**						
Turtle Creek-Trinity River [1]	C		**8.95%**						
Headwaters Sycamore Creek [1]	BC			**10.06%**					
Lake Como-Clear Fork Trinity River	BC			**9.77%**					
Marine Creek-West Fork Trinity River	BC			**8.50%**					
Mary's Creek	BC			**6.37%**					
Sycamore Creek-West Fork Trinity River	BC			**6.66%**					
Whites Branch-Big Fossil Creek	BC			**9.60%**					
Rowlett Creek-Lake Ray Hubbard [1]	BC				**29.97%**				
Grapevine Creek-Elm Fork Trinity River [1]	C					**4.81%**			
Estelle Creek-Bear Creek [1]	BC					**19.33%**			
Delaware Creek-West Fork Trinity River [1]	BC		1.53%			**22.06%**			
South Mesquite Creek [1]	C						**52.57%**		
Brown Branch Rowlett Creek [1]	BC				5.32%			**21.23%**	
Spring Creek	C				15.90%			**25.55%**	
Headwaters Rowlett Creek	BC							**11.02%**	
Cottonwood Branch-Hackberry Creek [1]	C					29.72%			**X**
Cottonwood Creek-Mountain Creek Lake [1]	C	4.59%	3.17%						**X**
North Mesquite Creek [1]	C						26.28%		
Duck Creek	C				42.24%				
Independent Coverage		**66.00%**	**58.34%**	**50.96%**	**29.97%**	**46.20%**	**52.57%**	**57.80%**	**N/A**
Program Coverage		**70.59%**	**66.05%**	**53.27%**	**93.43%**	**75.92%**	**78.85%**	**57.80%**	**N/A**

*** (C) – Chemical (B) – Bioassessment (BC) – Both Bioassessment & Chemical "HUC12 Sq. Mi" indicates the area of the watershed within the jurisdictional boundary**
[1] Impaired Waterbodies

TABLE 5: SAMPLING METRICS														
	Chemical Sampling								-	Bioassessment Sampling				
	Annual				Permit Term				-	Annual			Permit Term	
Entity	Sampling Sites per Watershed	Number of Watersheds Sampled	Frequency of Sampling	Total Annual Samples	Number of Years Sampling	Number of Watersheds Sampled	Number of Samples Taken in Each Watershed	Number of Samples Per Site	Total Samples For Permit Term	Sites Per Watershed Per Year	Frequency of Sampling	Watersheds Per Year	Number of Years Sampling	Total Samples
	A	**B**	**C**	**D (A×B×C)**	**E**	**F**	**G (I÷F)**	**H (G÷A)**	**I (D×E)**	**J**	**K**	**L**	**M**	N **(J×K×L×M)**
Arlington	1 or 2	2 or 1	4	**8**	4	3	16 or 8	8	**32**	-	-	-	-	-
Dallas	3	2	4	**24**	4	4	24	8	**96**	1	2	4	4	32
Fort Worth	2	2	1	**4**	4 and 1	4 and 2	4 + 2	2 and 1	**16 + 4**	2	2	6	5	120
Garland	3	1	4	**12**	4	2	24	8	**48**	1	2	1	4	8
Irving	2 or 1	1 or 2	4	**8**	2	3	8 or 16	8	**32**	1	2	1	4	8
Mesquite	1	2	4	**8**	4	2	16	16	**32**	-	-	-	-	-
Plano	1	1 or 2	4	**4 or 8**	2	3	8	8	**24**	1	2	1	4	8
NTTA	1	2	4	**8**	2	2	8	8	**16**	-	-	-	-	-

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

June 30, 2017

Ms. Derica Peters, Senior Planner
North Central Texas Council of Governments (NCTCOG)
P.O. Box 5888
Arlington, Texas 76005-5888

Re: Approval of the North Central Texas Regional Wet Weather Characterization Plan Proposal for the Fourth Permit Term

Dear Ms. Peters:

The Texas Commission on Environmental Quality (TCEQ) received the final revised North Central Texas Regional Wet Weather Characterization Plan Proposal for the Fourth Permit Term (Proposal) on June 12, 2017, along with your response letter. The Proposal was originally submitted to TCEQ for review via electronic mail on October 11, 2016. TCEQ and EPA reviewed the Proposal and submitted comments to NCTCOG on March 7, 2017, and further discussed our comments with NCTCOG on a telephone conference on April 11, 2017.

We appreciate the opportunity to review the Proposal and appreciate NCTCOG' efforts to update the Proposal and provide responses to EPA's and TCEQ's comments. All comments have been addressed and TCEQ approves this Proposal for the fourth permit term.

If you have any questions, you are most welcome to call me at (512) 239-4784 or Ms. Hanne Nielsen at (512) 239-6524.

Best regards,

Rebecca L. Villalba

Rebecca L. Villalba, Team Leader
Stormwater & Pretreatment Team (MC 148)
Water Quality Division

RLV/HN/fc

cc: Ms. Allison Henry, Environment and Development Planner
North Central Texas Council of Governments (NCTCOG), P.O. Box 5888
Arlington, Texas 76005-5888

Appendix B

Watershed Land Use Maps (Obtained from NCTCOG and City of Dallas)

Figure 1: Dallas, Bachman Branch - Elm Fork Trinity River

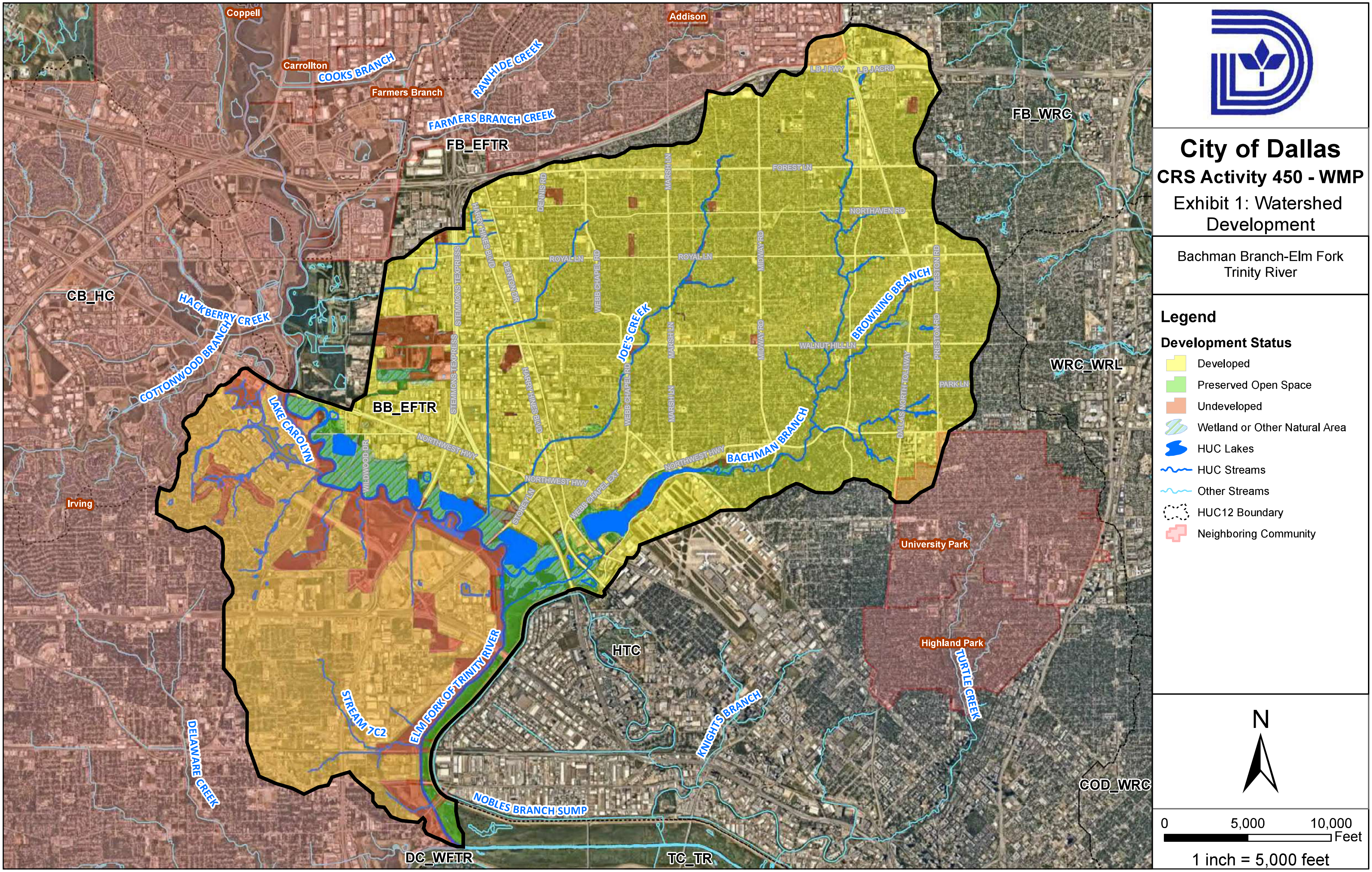


Figure 2: Fort Worth, Whites Branch – Big White Fossil Creek Subwatershed, BFC1, BFC2, BFC3

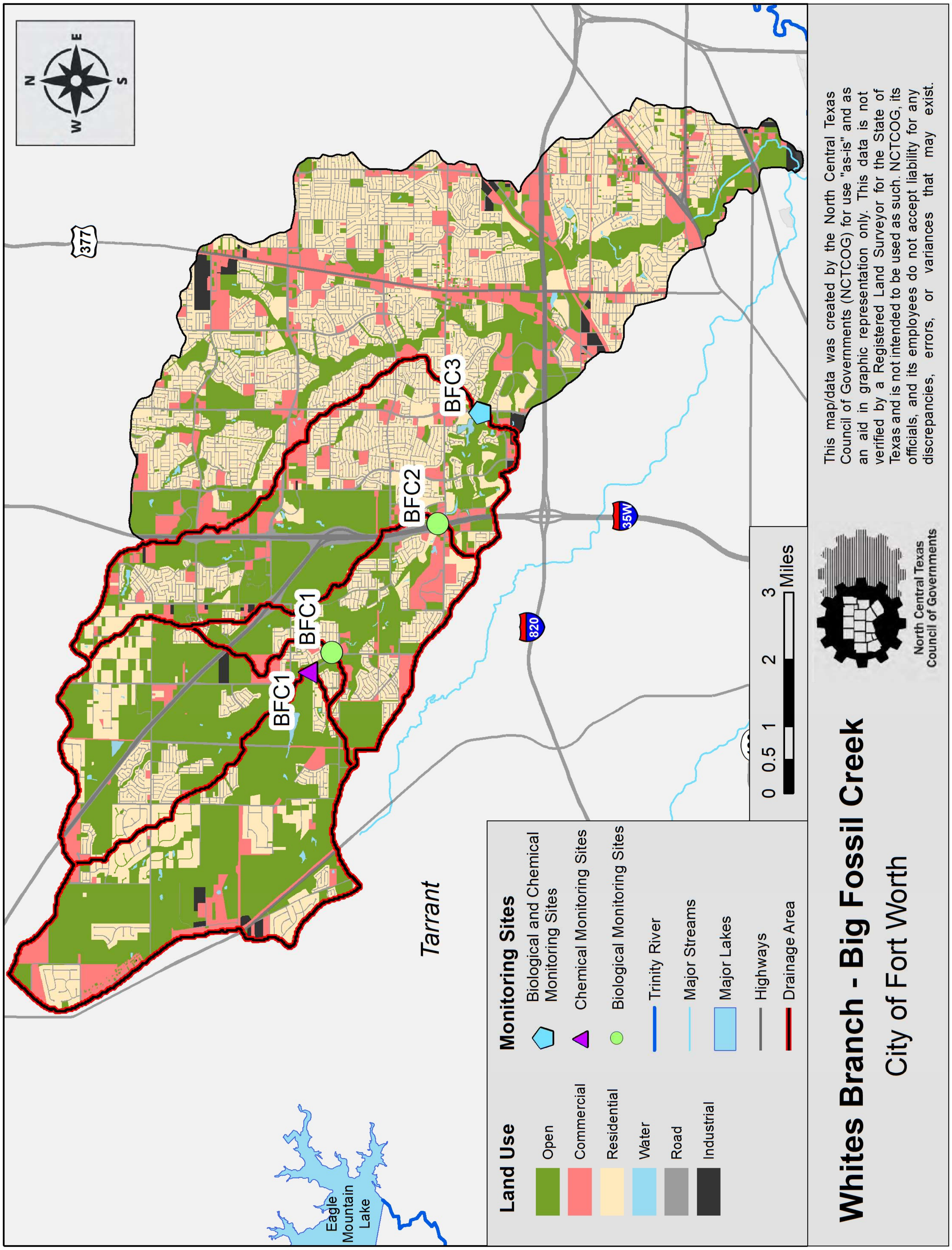


Figure 3: North Texas Tollway Authority, Cottonwood Branch – Hackberry Creek Subwatershed, NT1801/1901/2001/2101

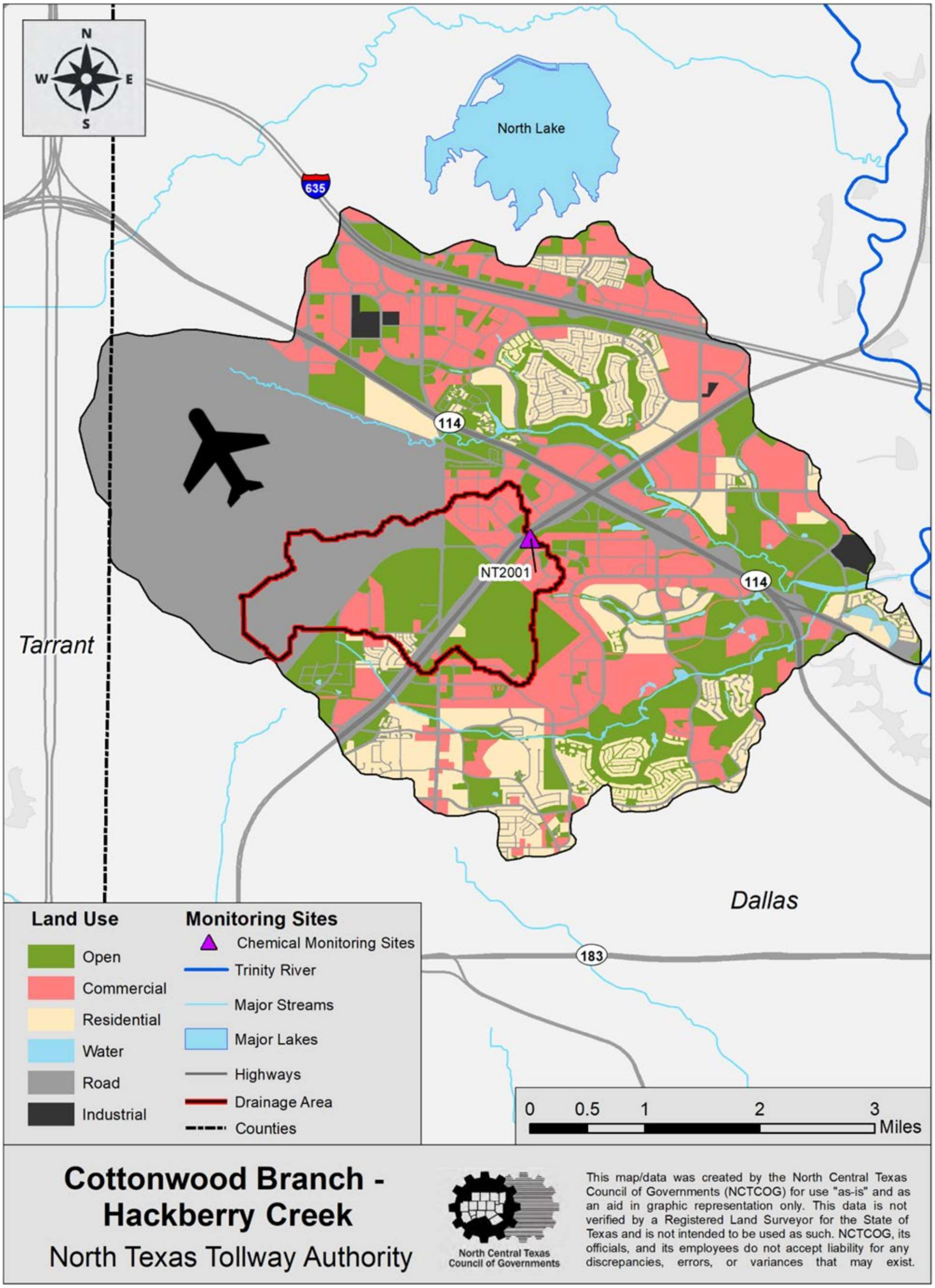


Figure 4: North Texas Tollway Authority, Cottonwood Creek - Mountain Creek Lake Subwatershed, NT1802/1902/2002/2102

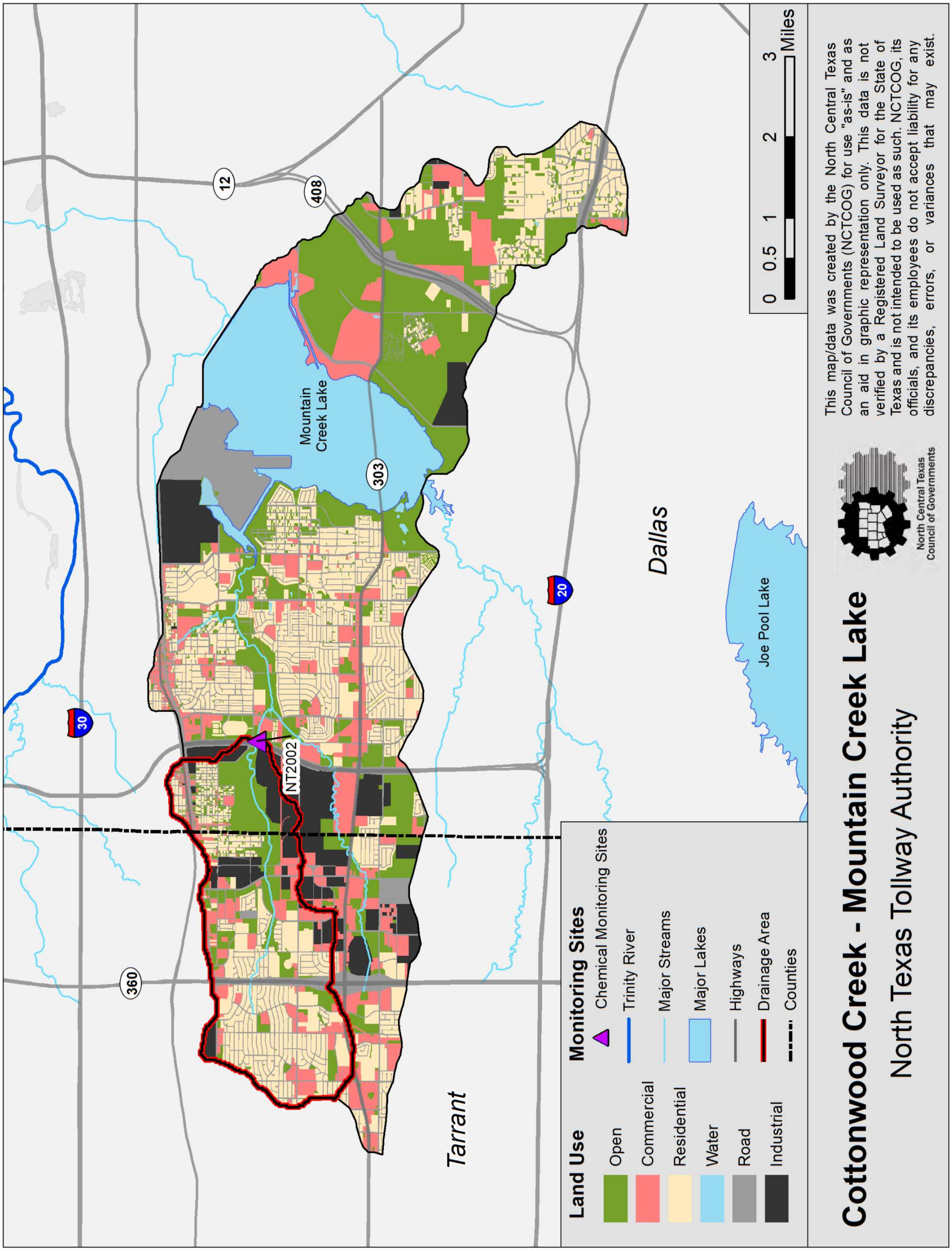


Figure 5: Irving, Delaware Creek - West Fork Trinity River Subwatershed, IR1801/1901, IR1802/1902, IR1902A*

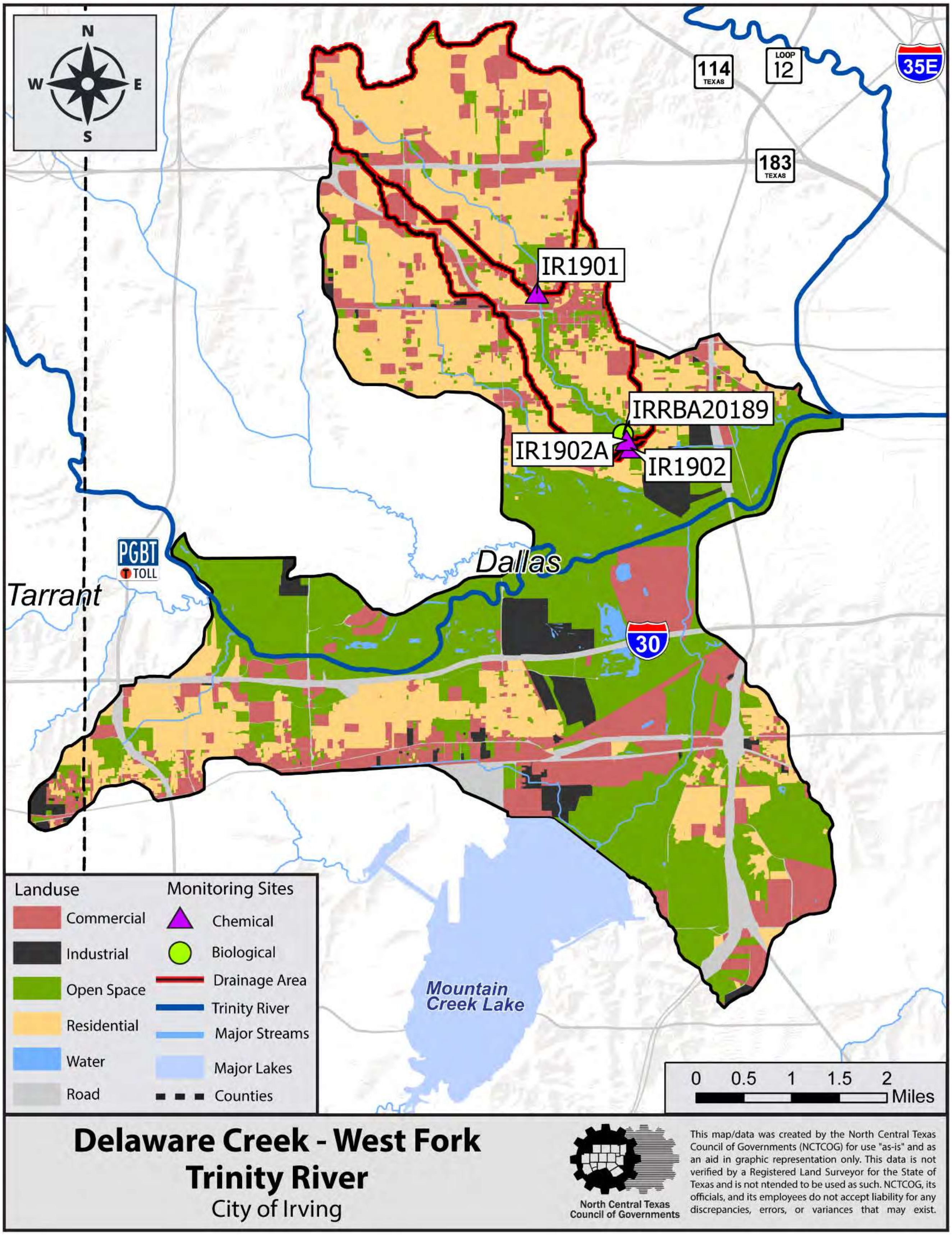


Figure 6: Garland, Duck Creek - GA1801/1901, GA1802/1902, GA1803/1903

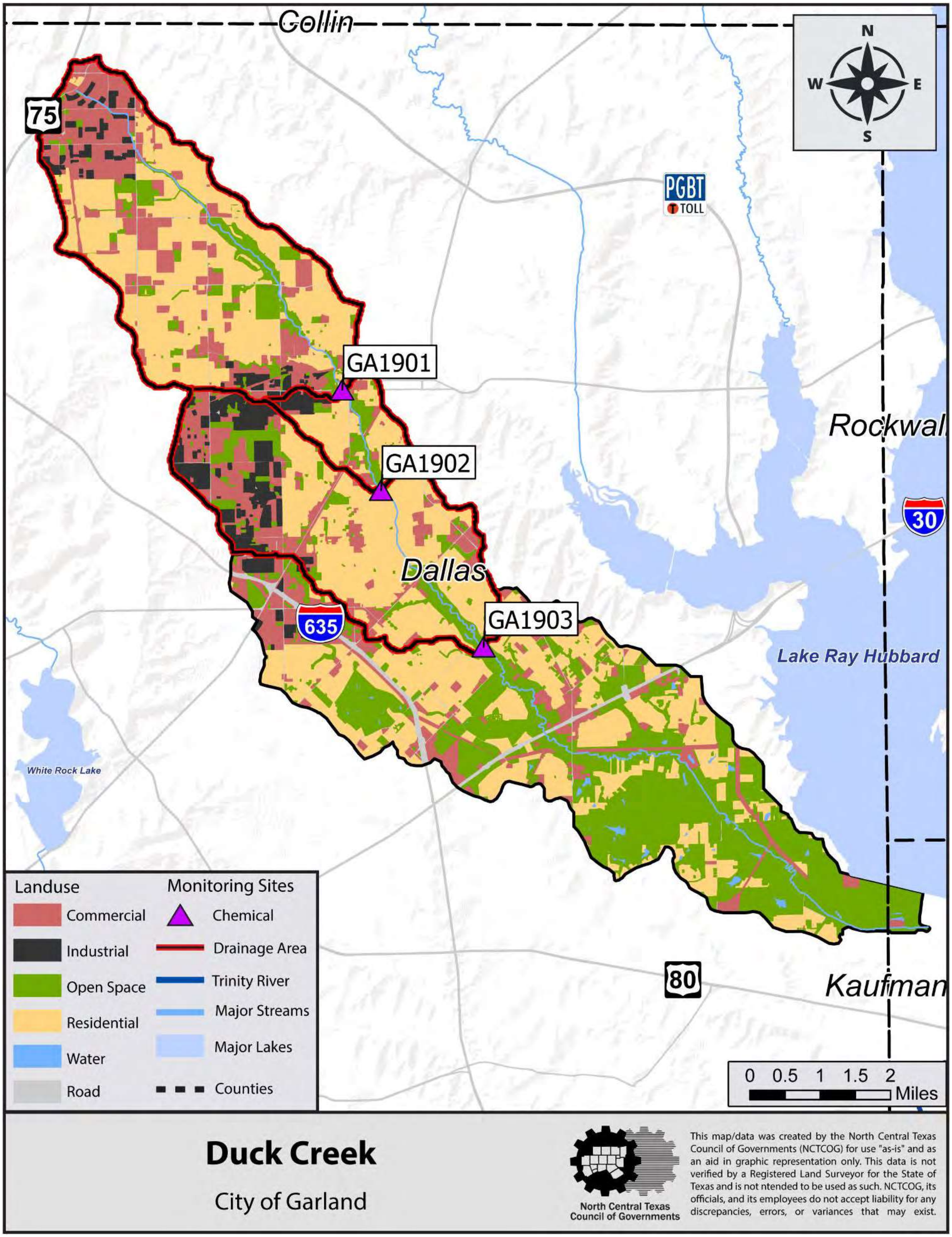


Figure 7: Irving, Estelle Creek – Bear Creek Subwatershed, IR2002/2102

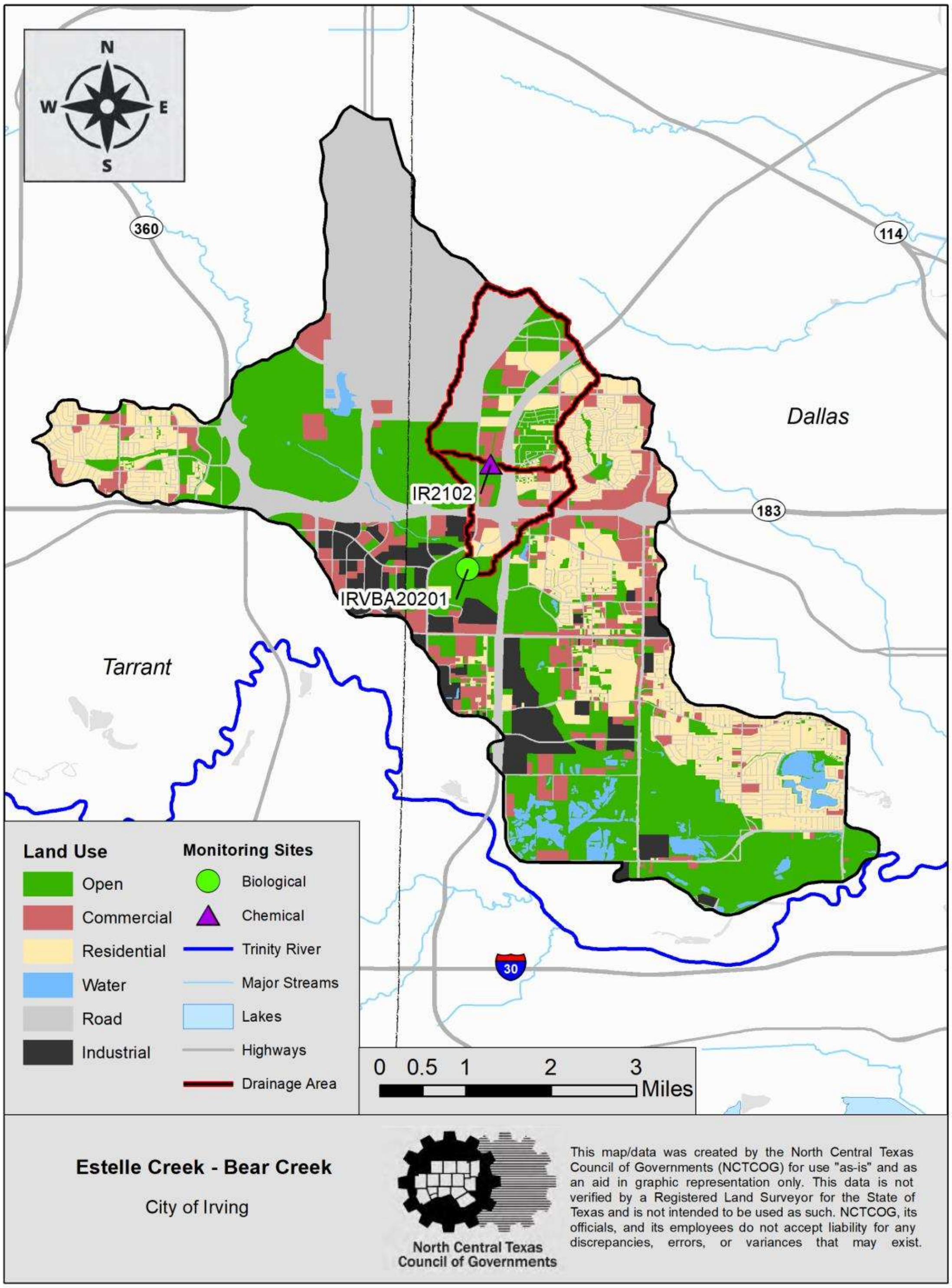


Figure 8: Arlington, Fish Creek - Mountain Creek Lake Subwatershed, AR1802/1902

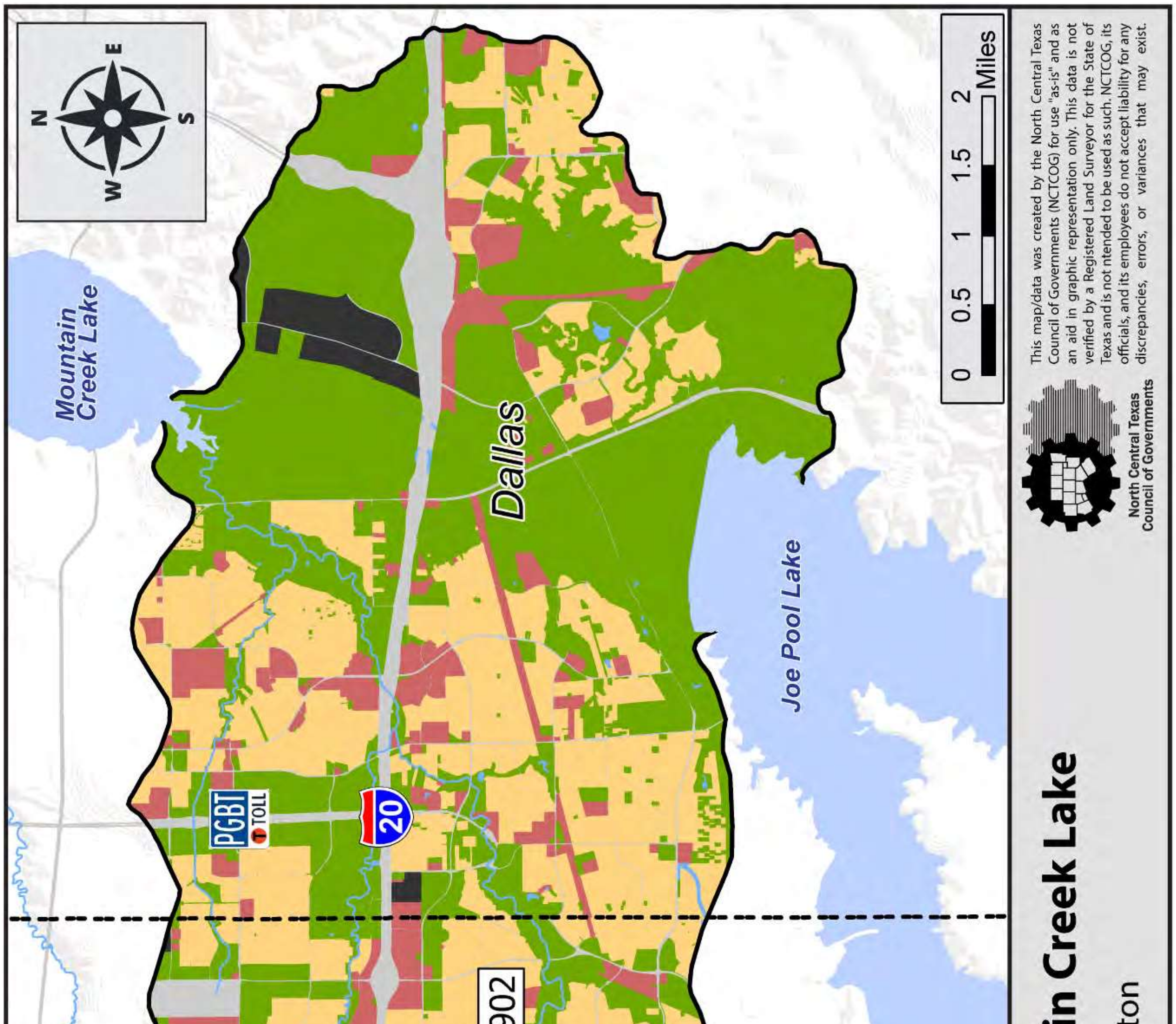


Figure 9: Dallas, Headwaters Fivemile Creek

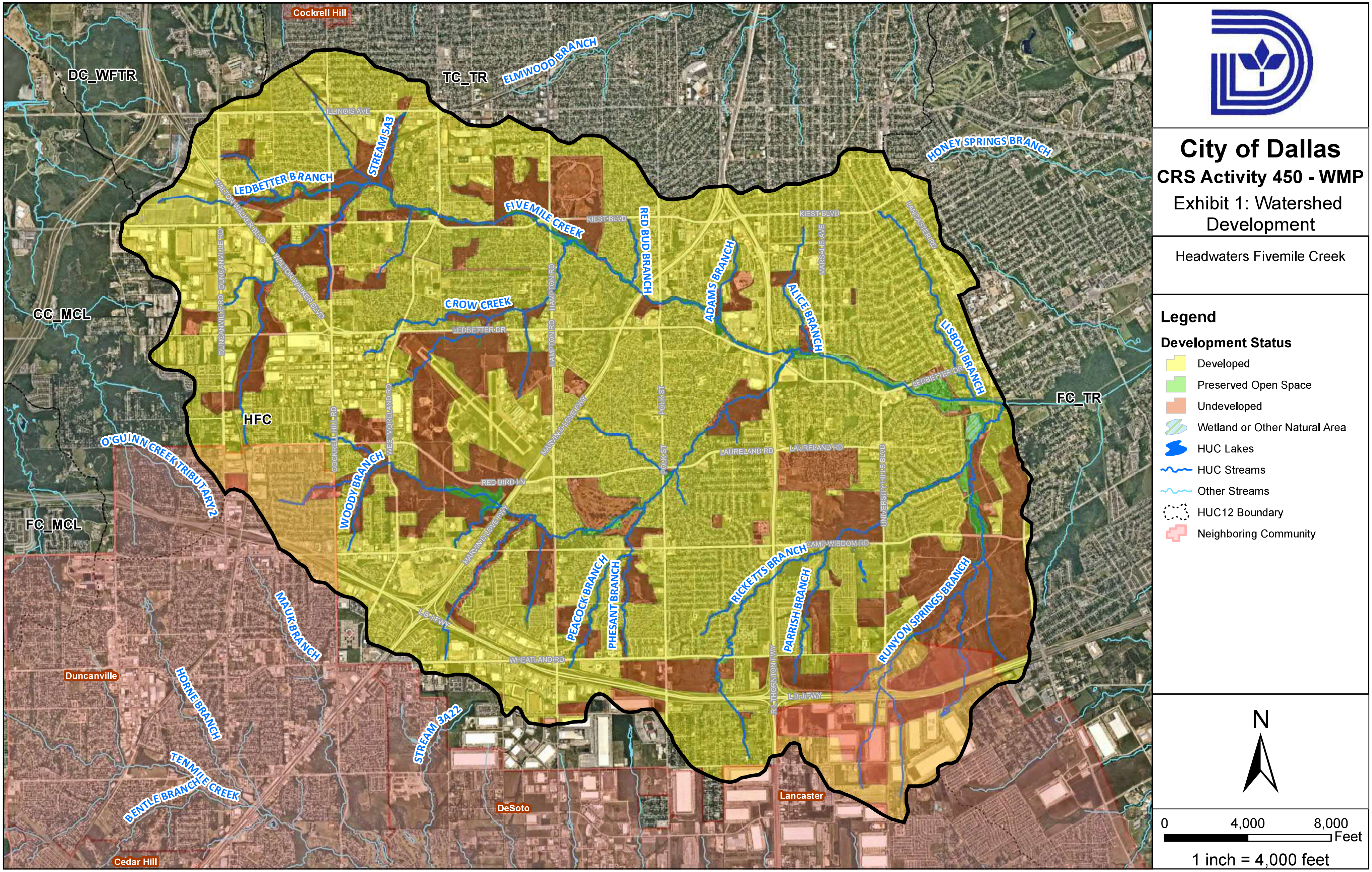


Figure 10: Dallas, Floyd Branch - White Rock Creek

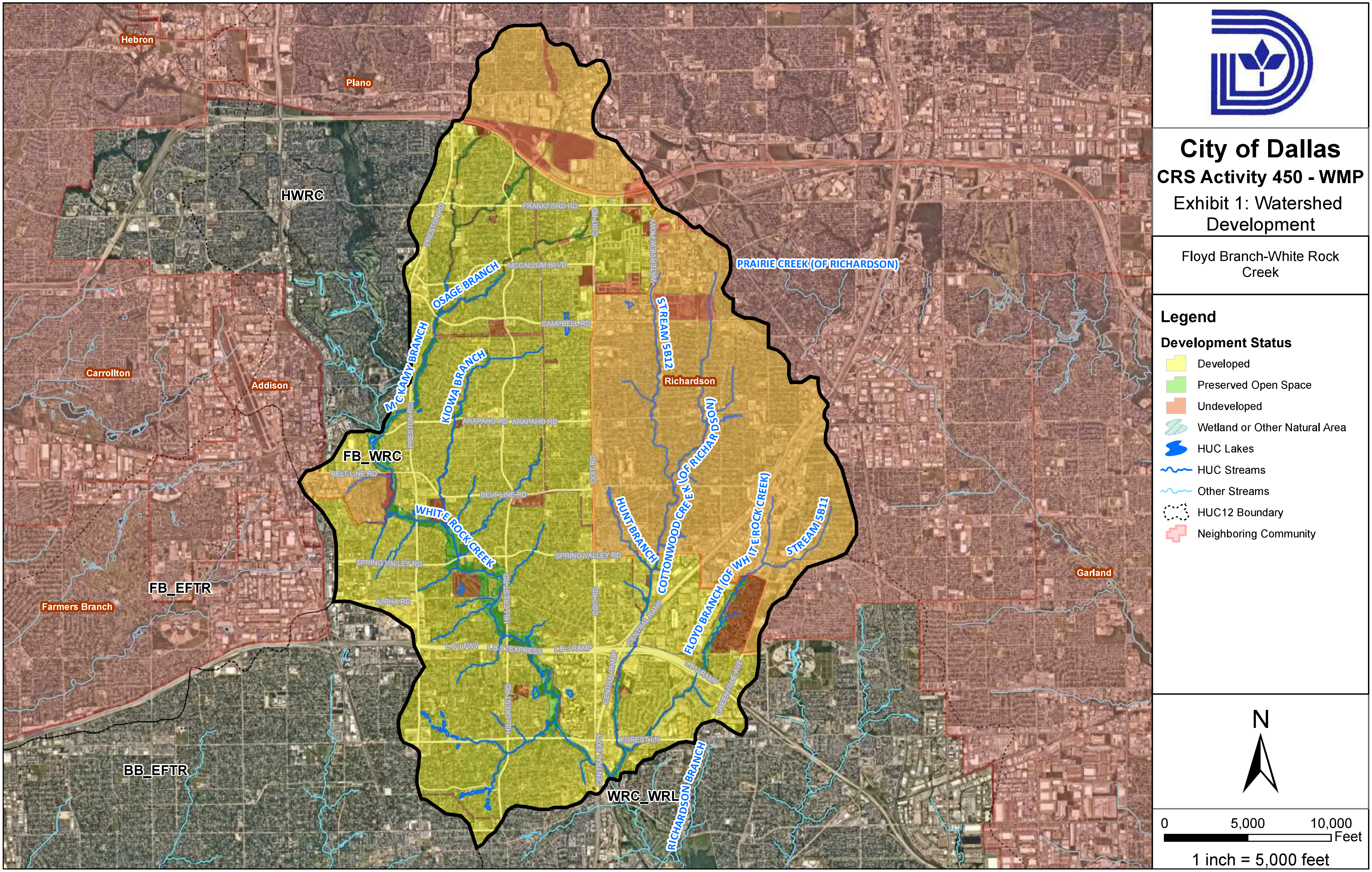
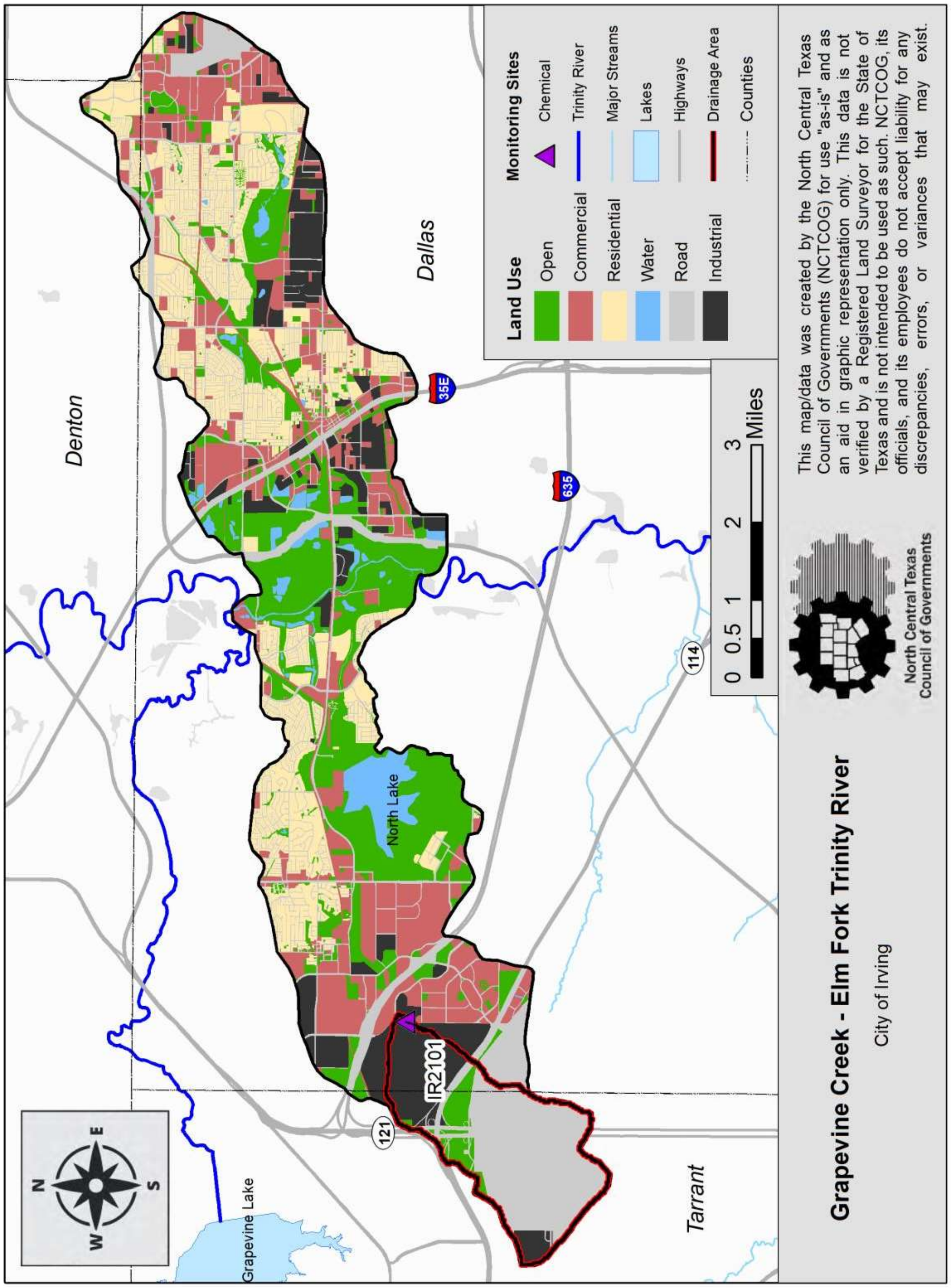
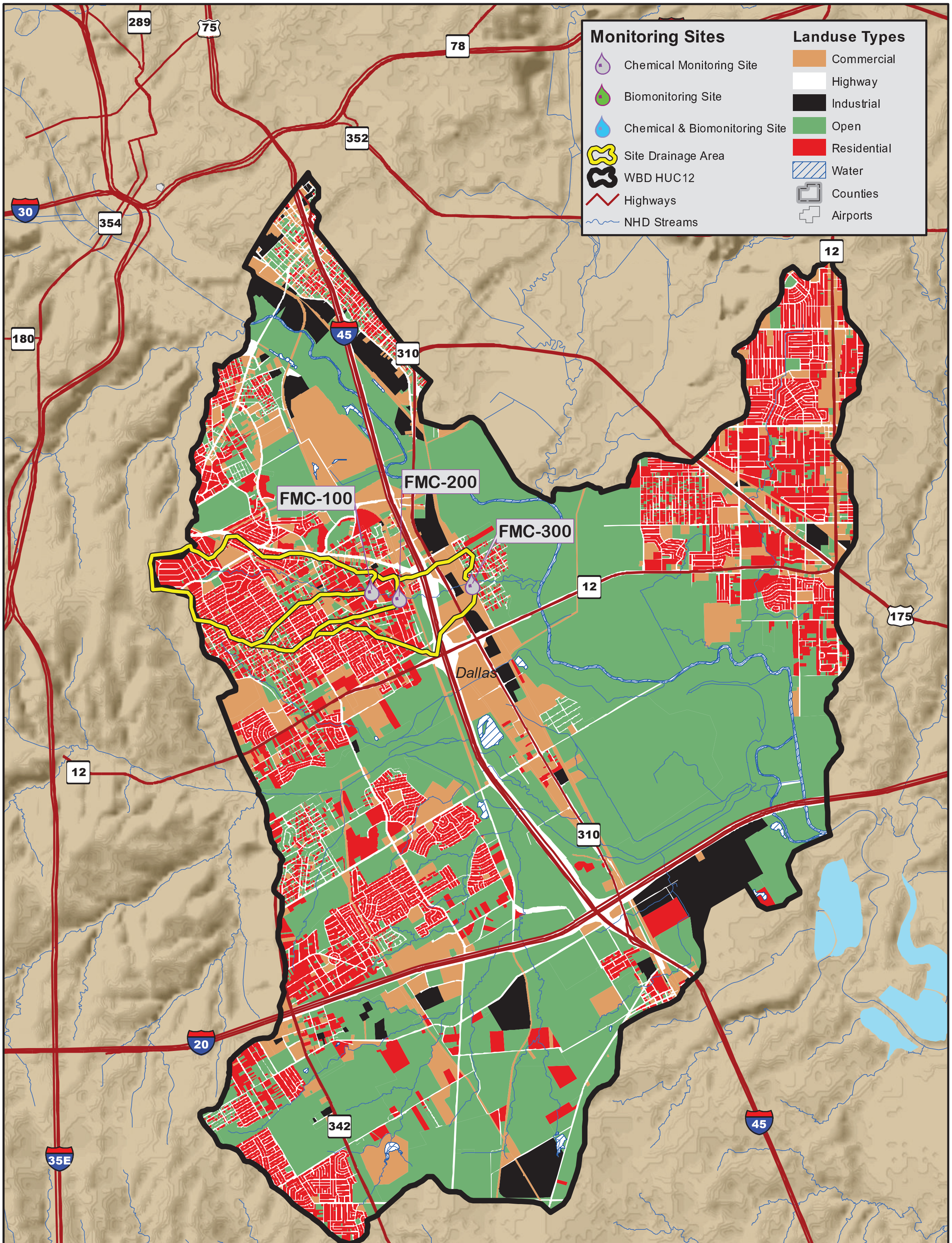


Figure 11: Irving, Grapevine Creek – Elm Fork Trinity River Subwatershed, IR2001/2101





North Central Texas
Council of Governments
Environment & Development

This map/data was created by the North Central Texas Council of Governments (NCTCOG) for use "as-is" and as an aid in graphic representation only. This data is not verified by a Registered Land Surveyor for the State of Texas and is not ntended to be used as such. NCTCOG, its officials, and its employees do not accept liability for any discrepancies, errors, or variances that may exist.

Figure 13: Five Mile Creek - Trinity River

City of Dallas

Source: NCTCOG Regional Monitoring Program, Land Use Data 2010
Watershed Boundary Dataset (WBD) by
USDA - Natural Resources Conservation Service

0 0.5 1 2 Miles

N

RSM 1-20-14

Figure 13: Arlington, Johnson Creek Subwatershed, AR1801 and AR1801A/1901

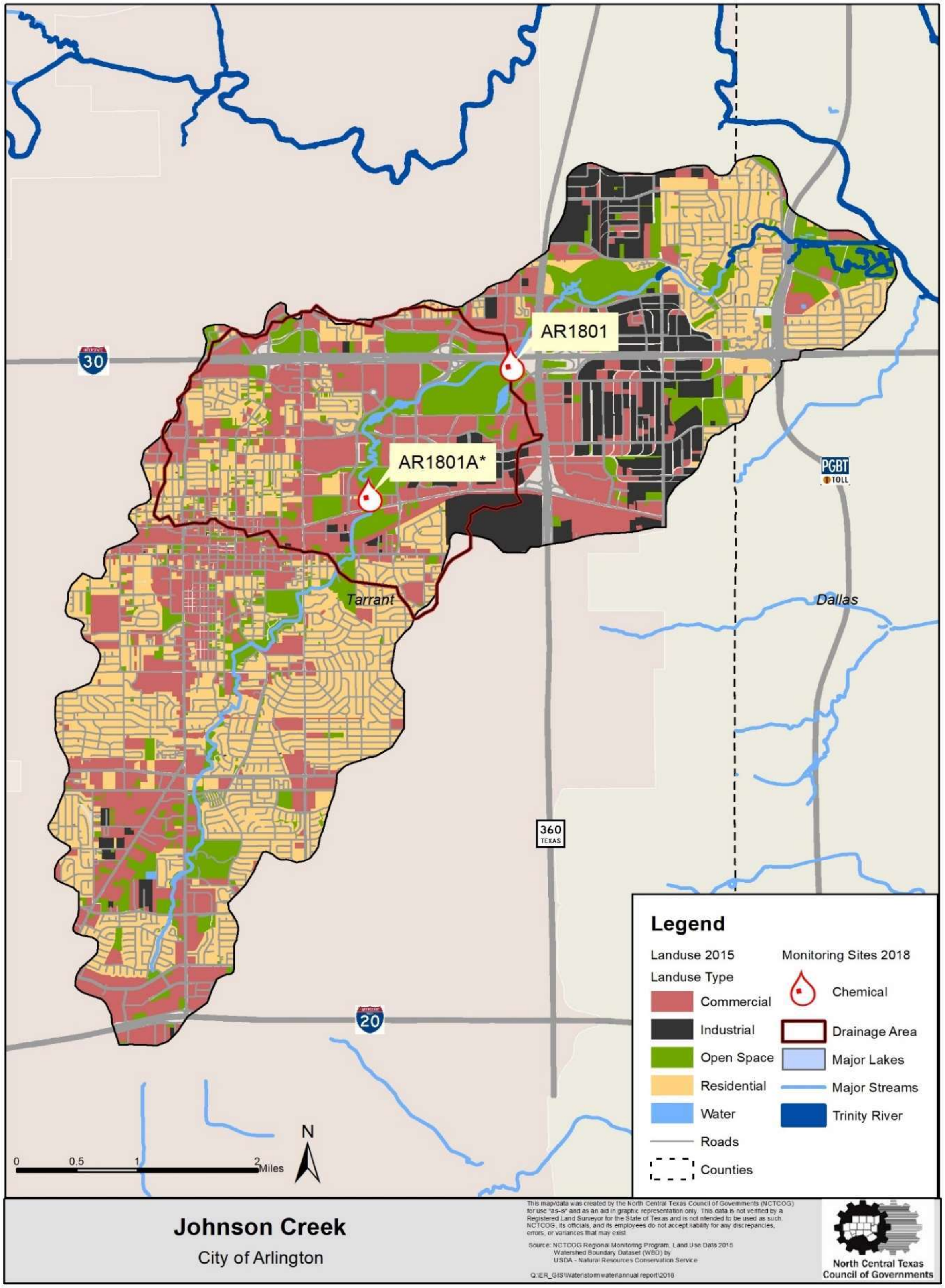


Figure 14: Fort Worth, Lake Como – Clear Fork Trinity River Subwatershed, OVR1, OVR2, OVR3

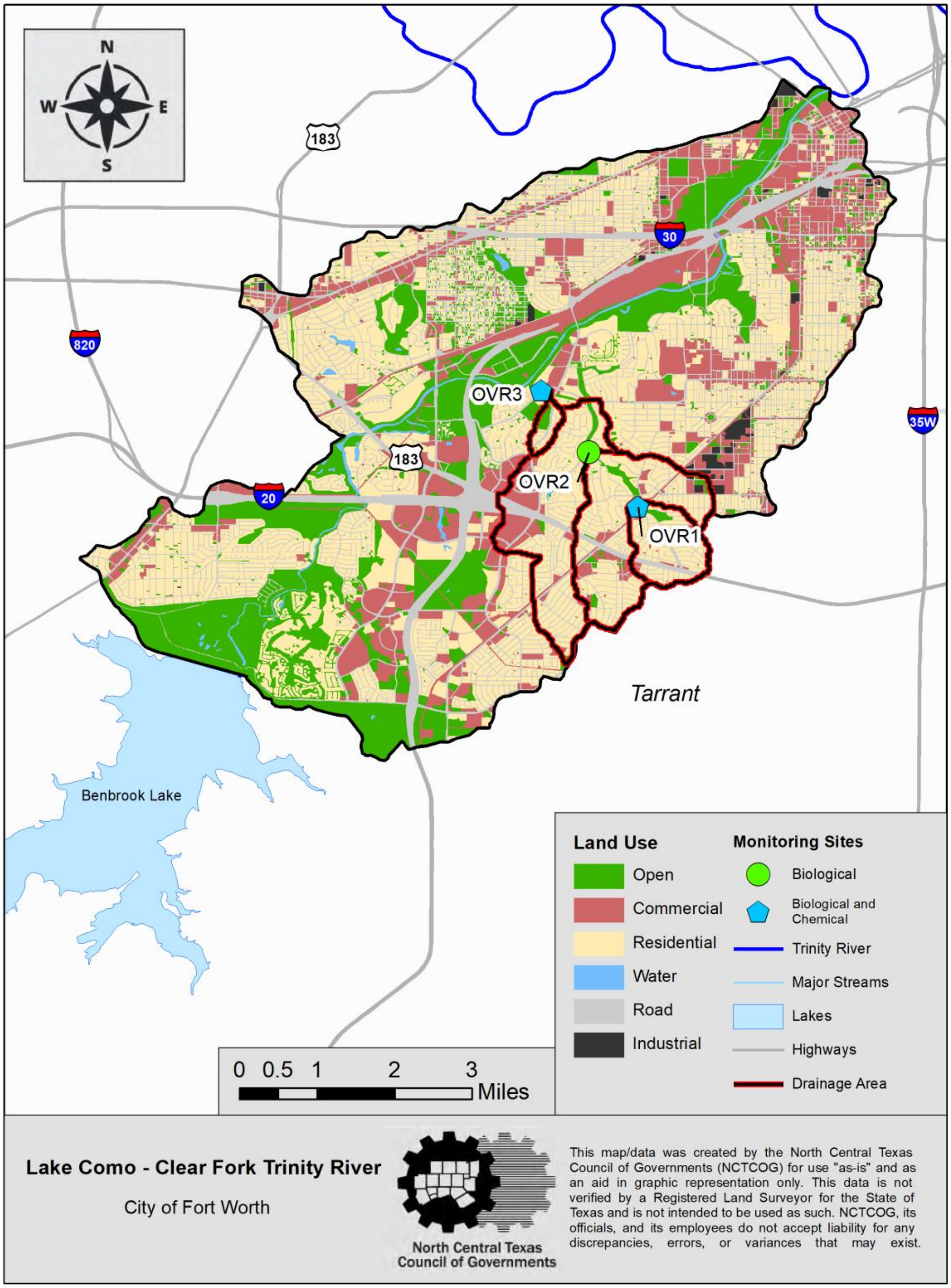


Figure 15: Fort Worth, Sycamore Creek – West Fork Trinity River, LFC1, LFC2, LFC3

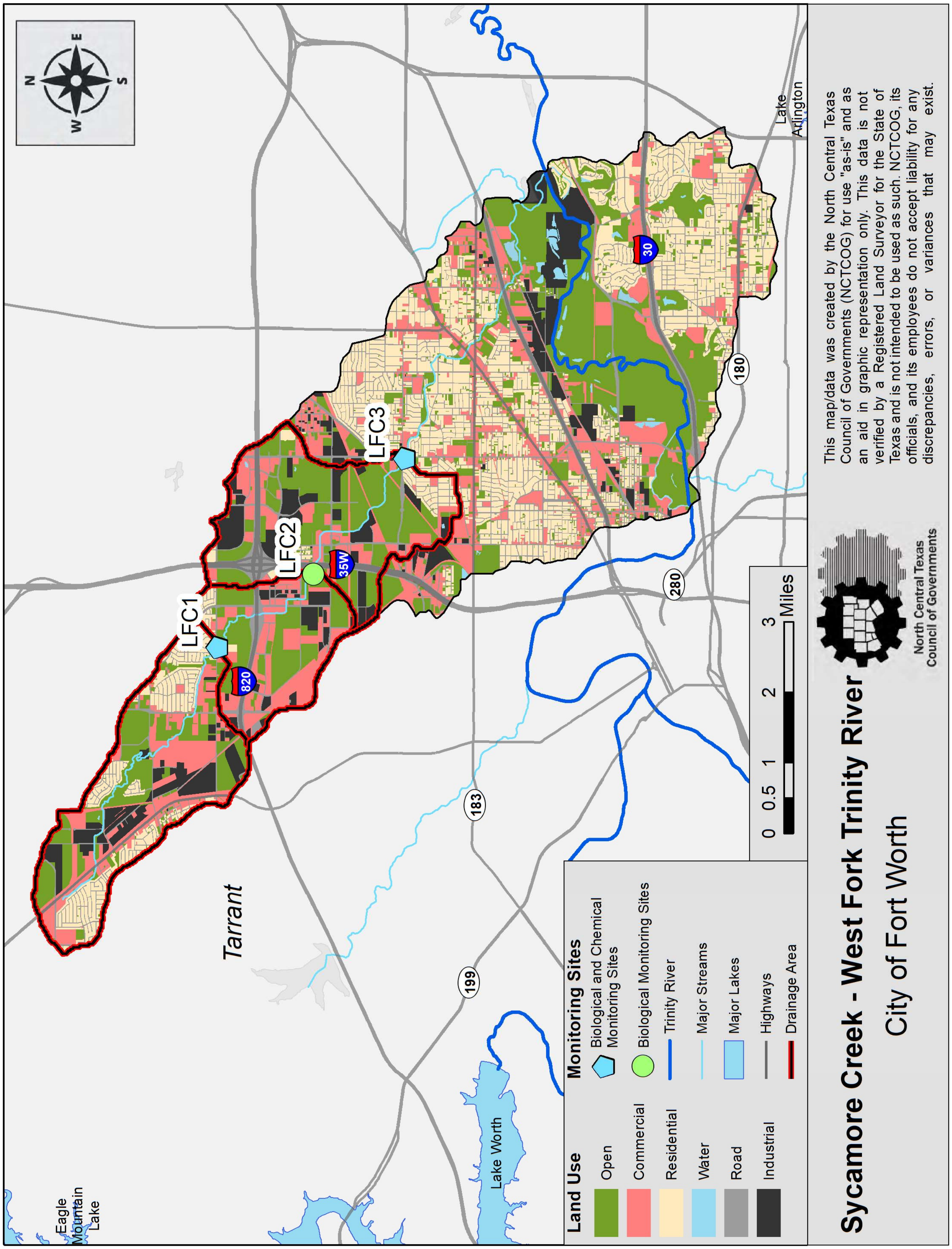


Figure 16: Fort Worth, Marine Creek - West Fork Trinity River Subwatershed, MAR1, MAR2, MAR3

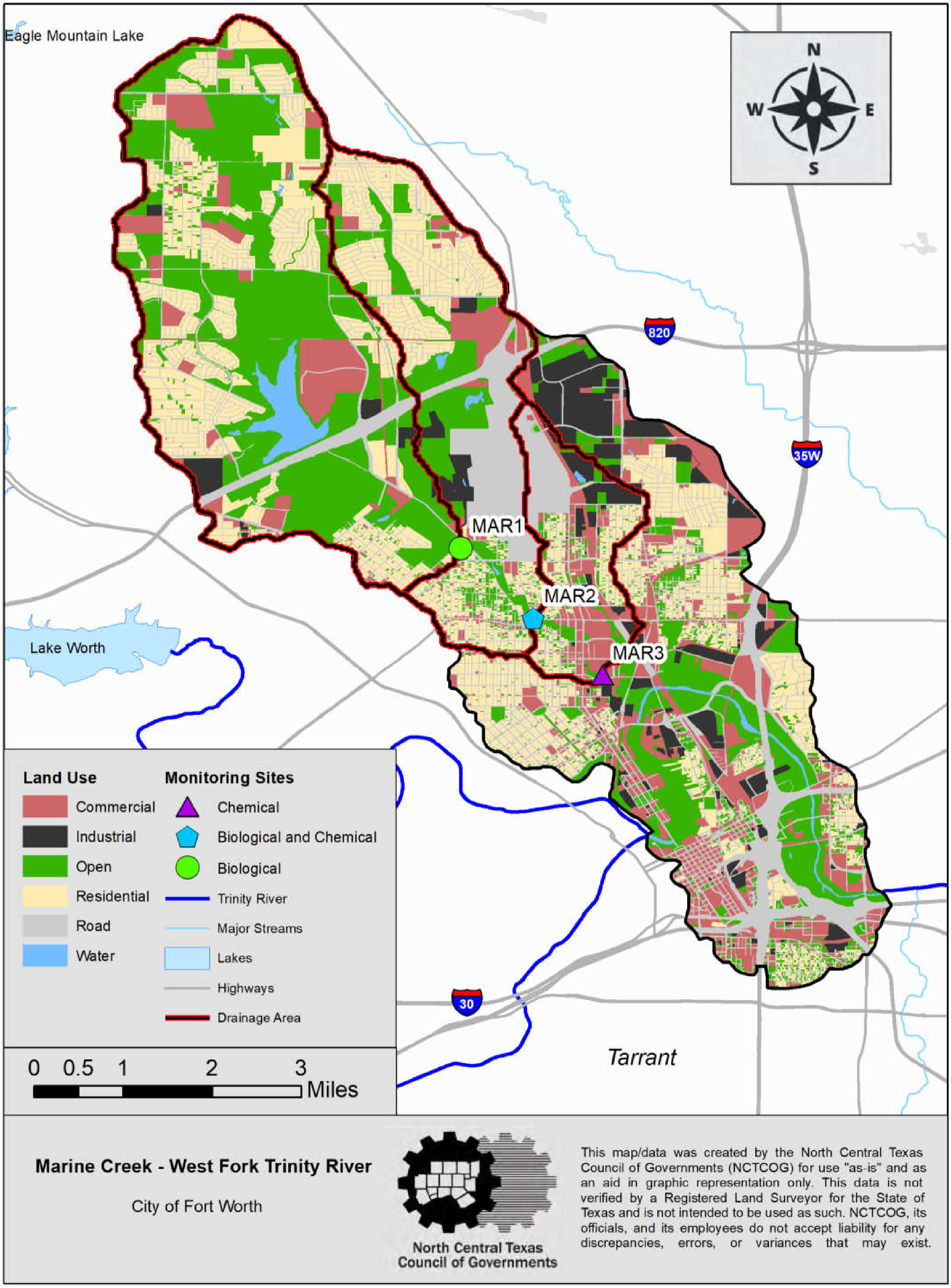


Figure 17: Fort Worth, Mary's Creek Subwatershed, MRY1, MRY2, MRY3

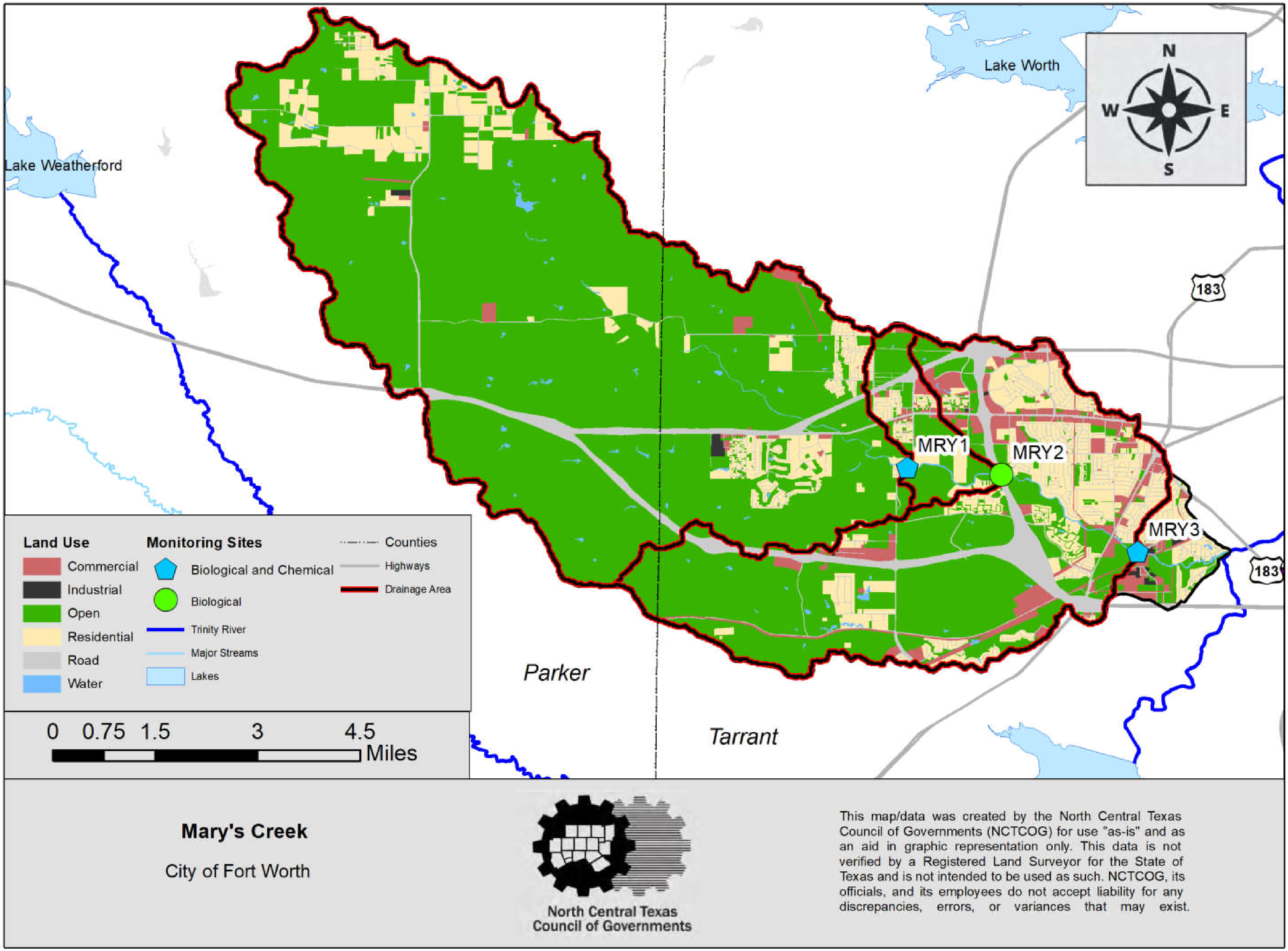


Figure 18: Mesquite, North Mesquite Creek Subwatershed, MS1802/1902/2002/2102

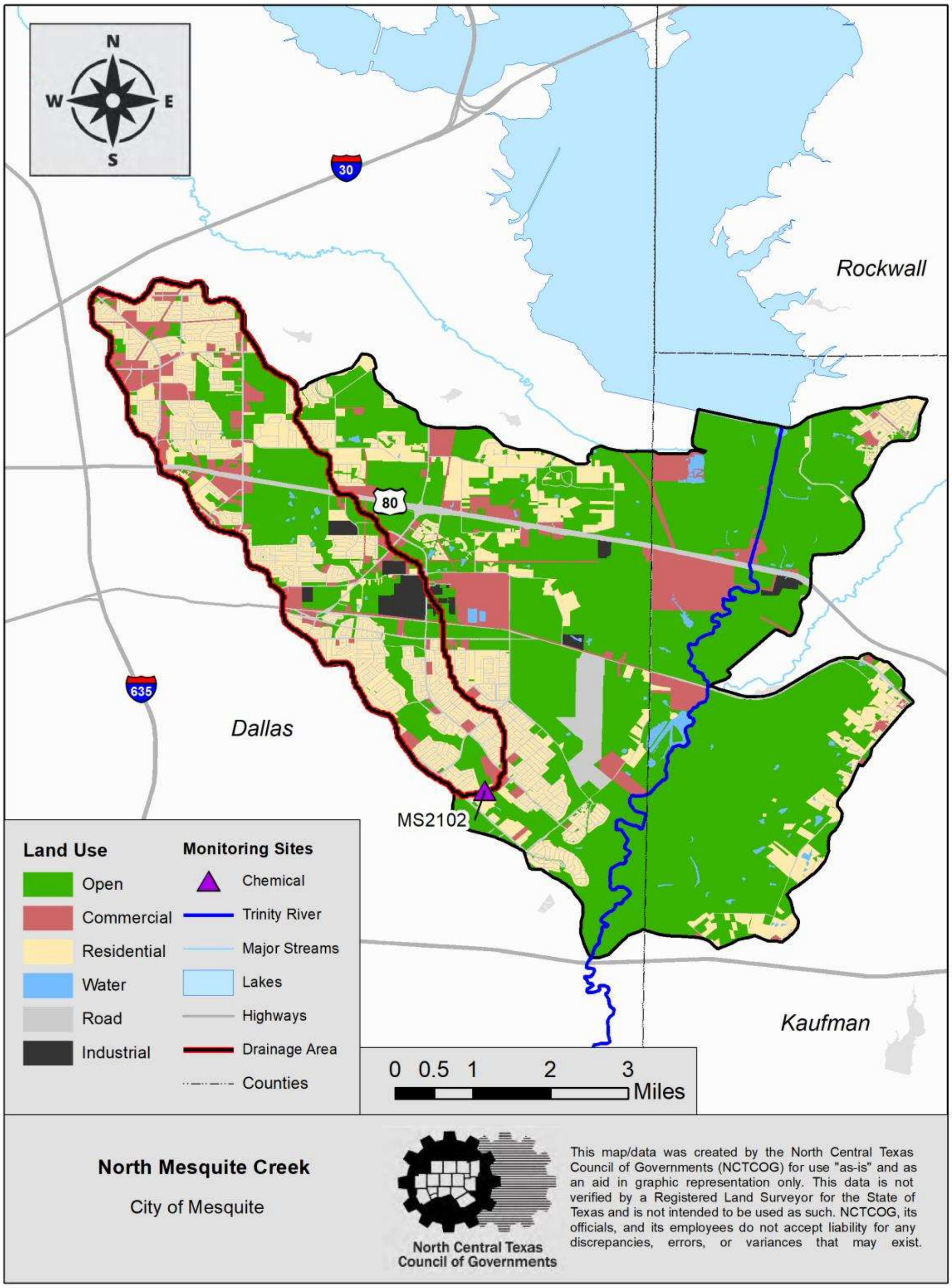


Figure 19: Plano, Headwaters Rowlett Creek Subwatershed, PL2001/2101

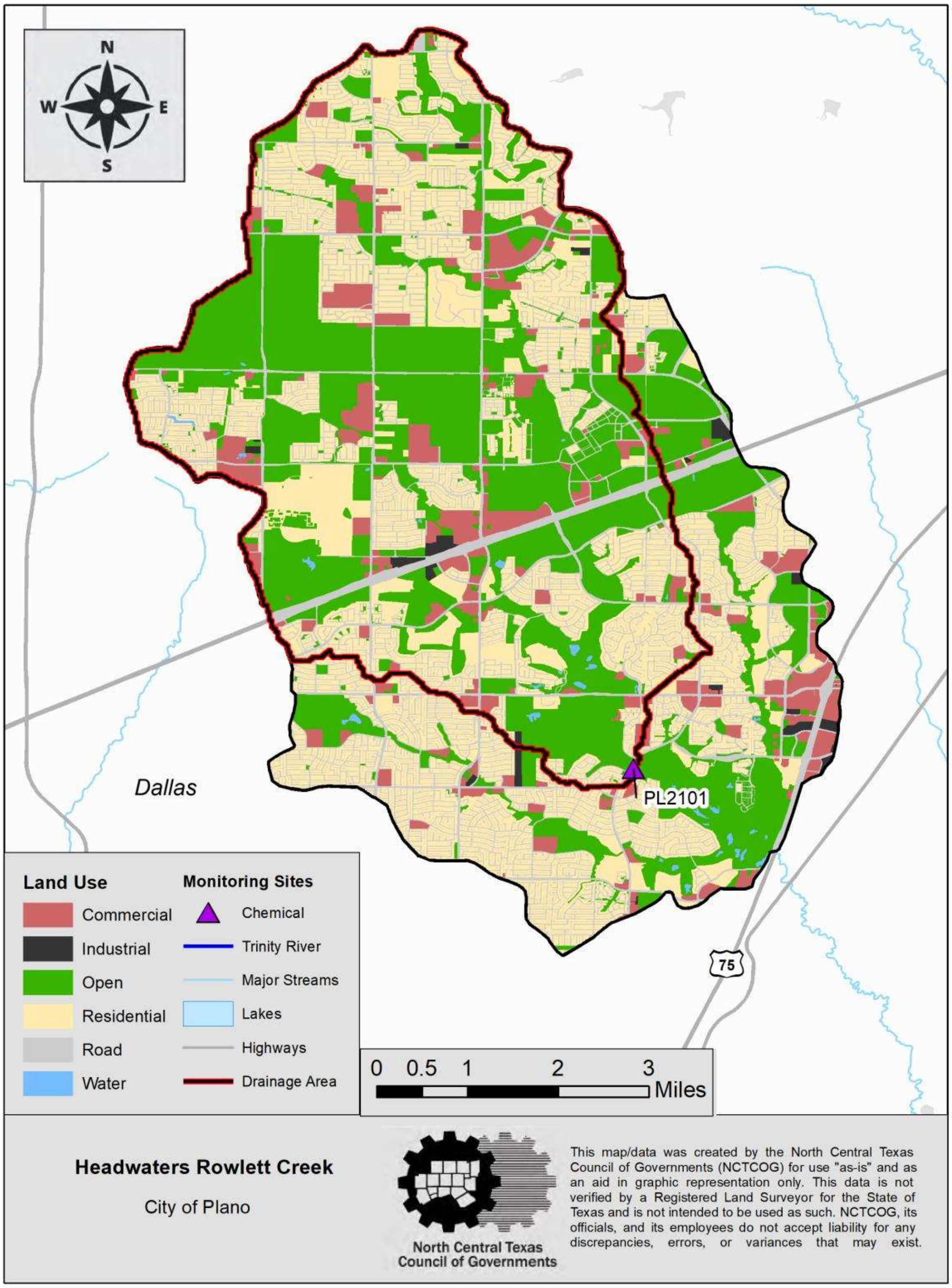


Figure 20: Plano, Brown Branch Rowlett Creek Subwatershed, PL2002/2102

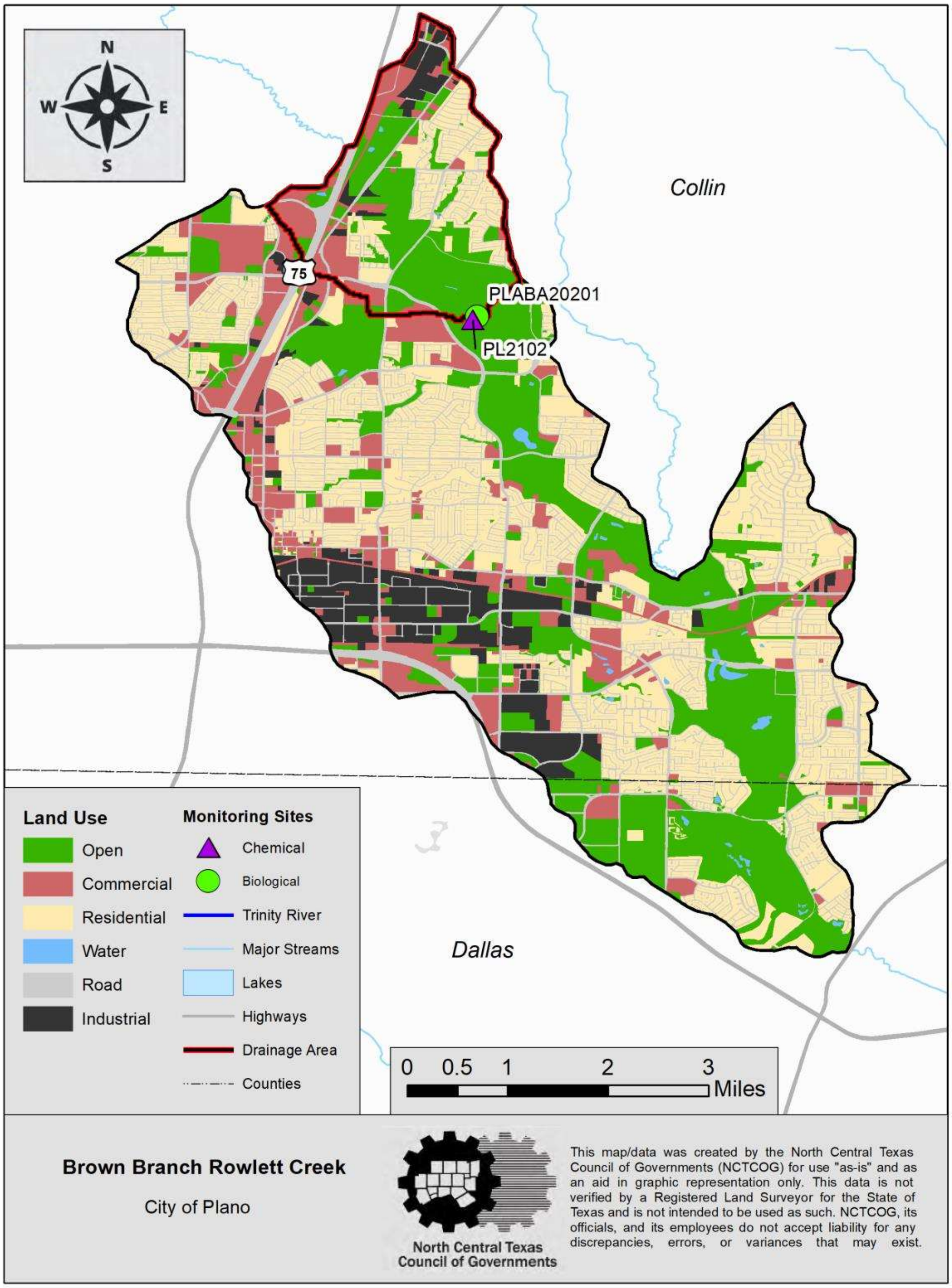


Figure 21: Plano, Pittman Creek – Spring Creek Subwatershed, PL1801/1901

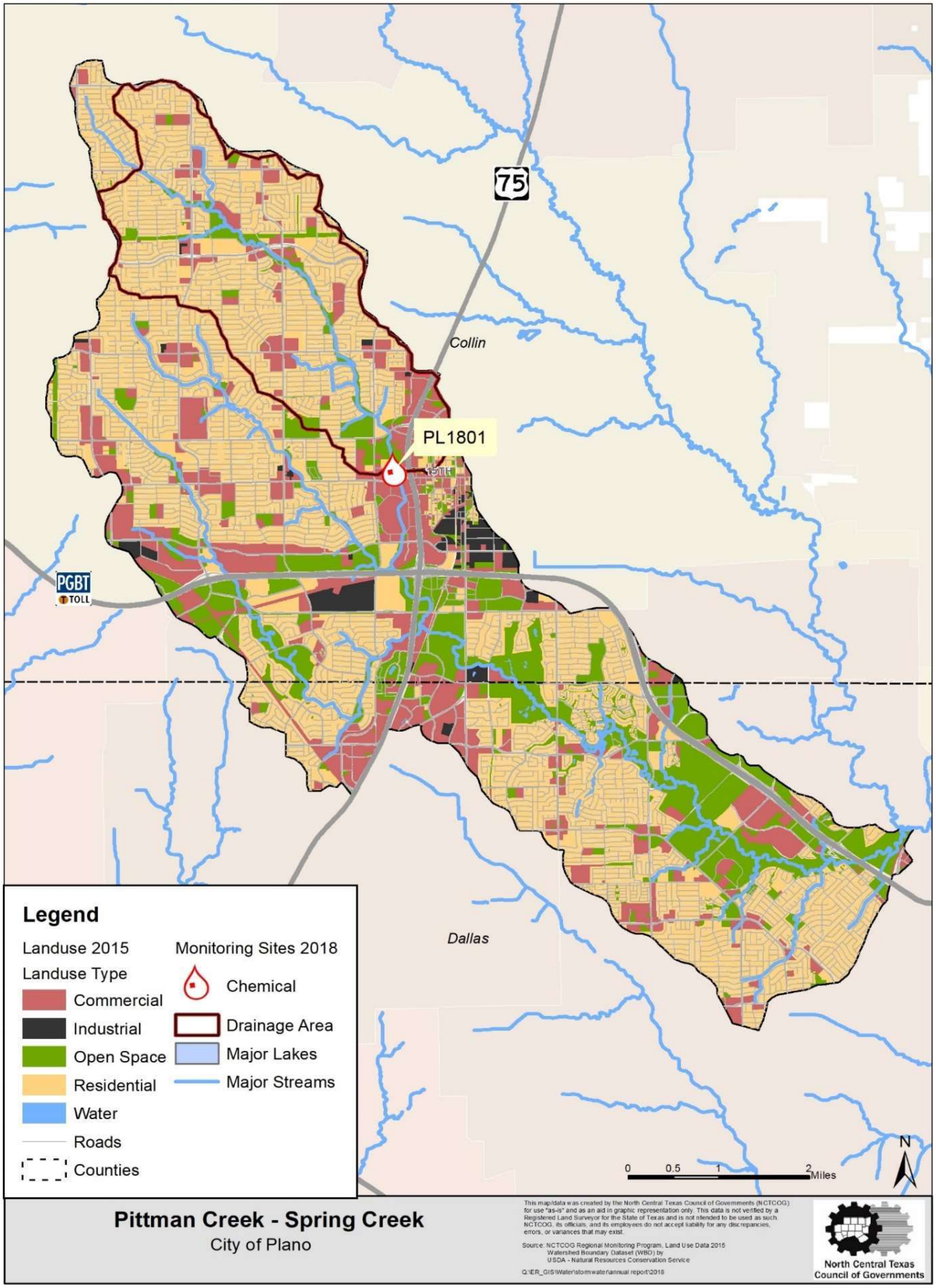


Figure 22: Garland, Rowlett Creek – Lake Ray Hubbard Subwatershed, GA2101, GA2102, GA2103

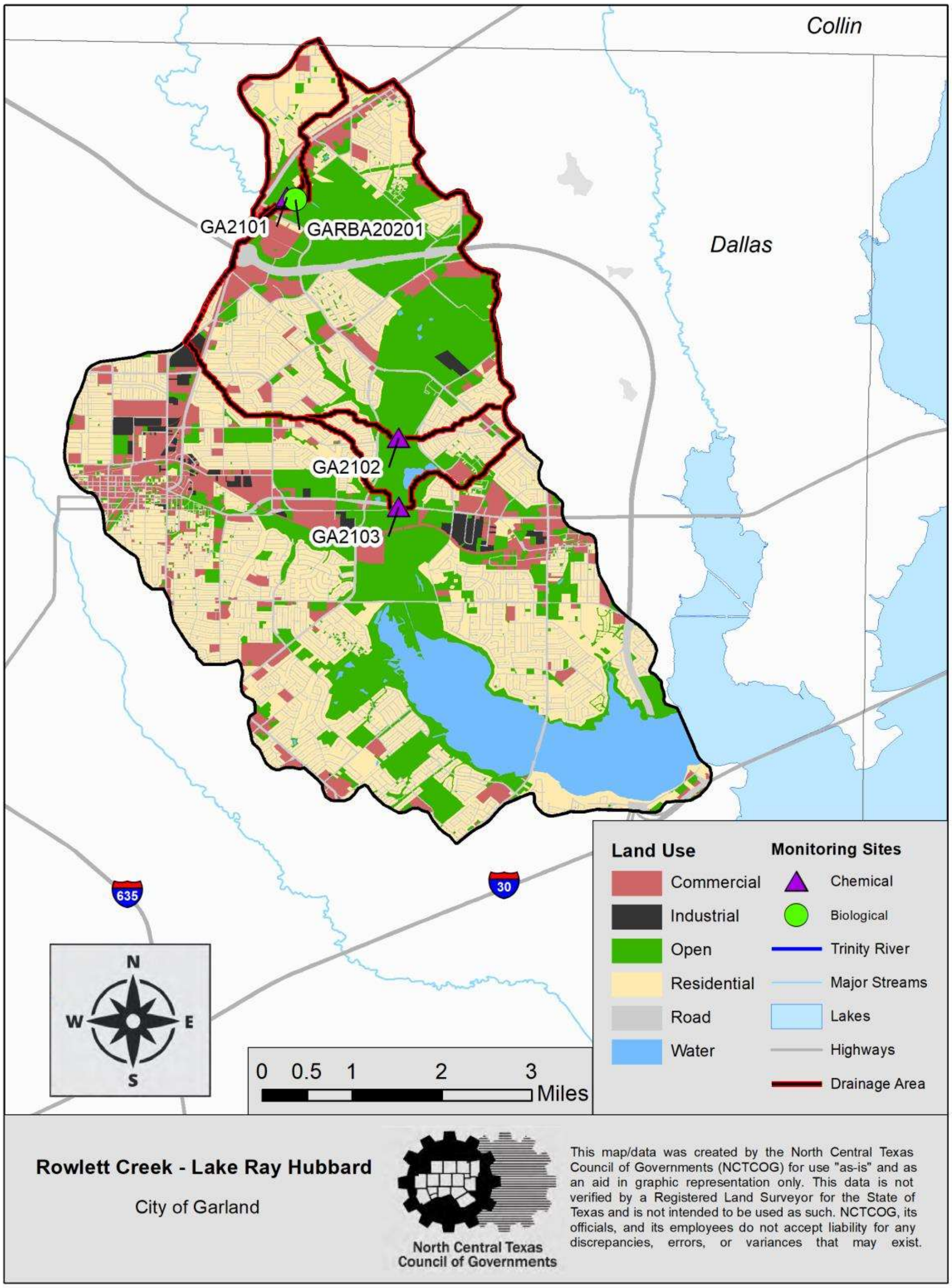


Figure 23: Arlington, Rush Creek – Village Creek Subwatershed, AR2001/2101, AR2002/2102

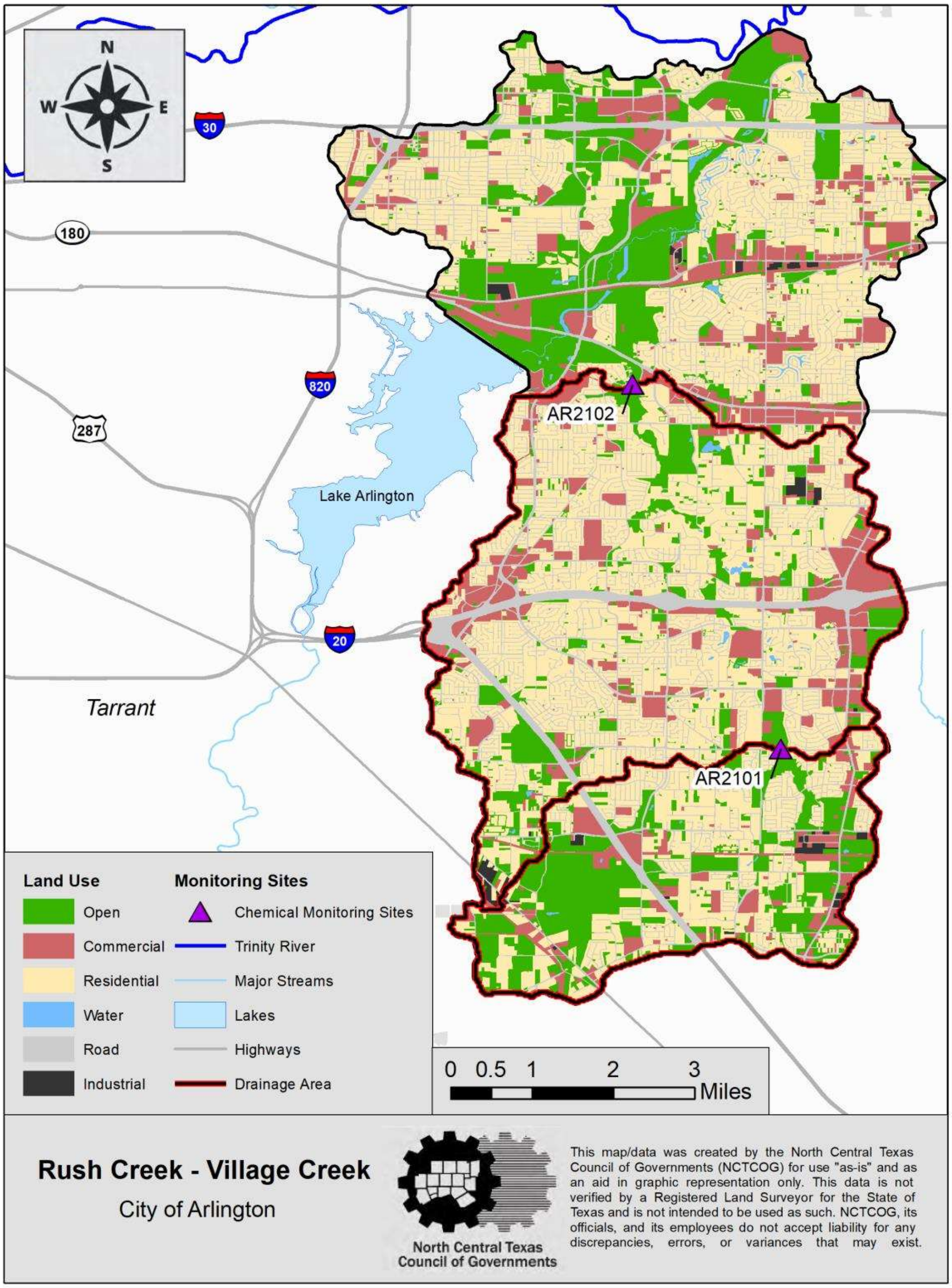


Figure 24: Mesquite, South Mesquite Creek Subwatershed, MS1801/1901/2001/2101

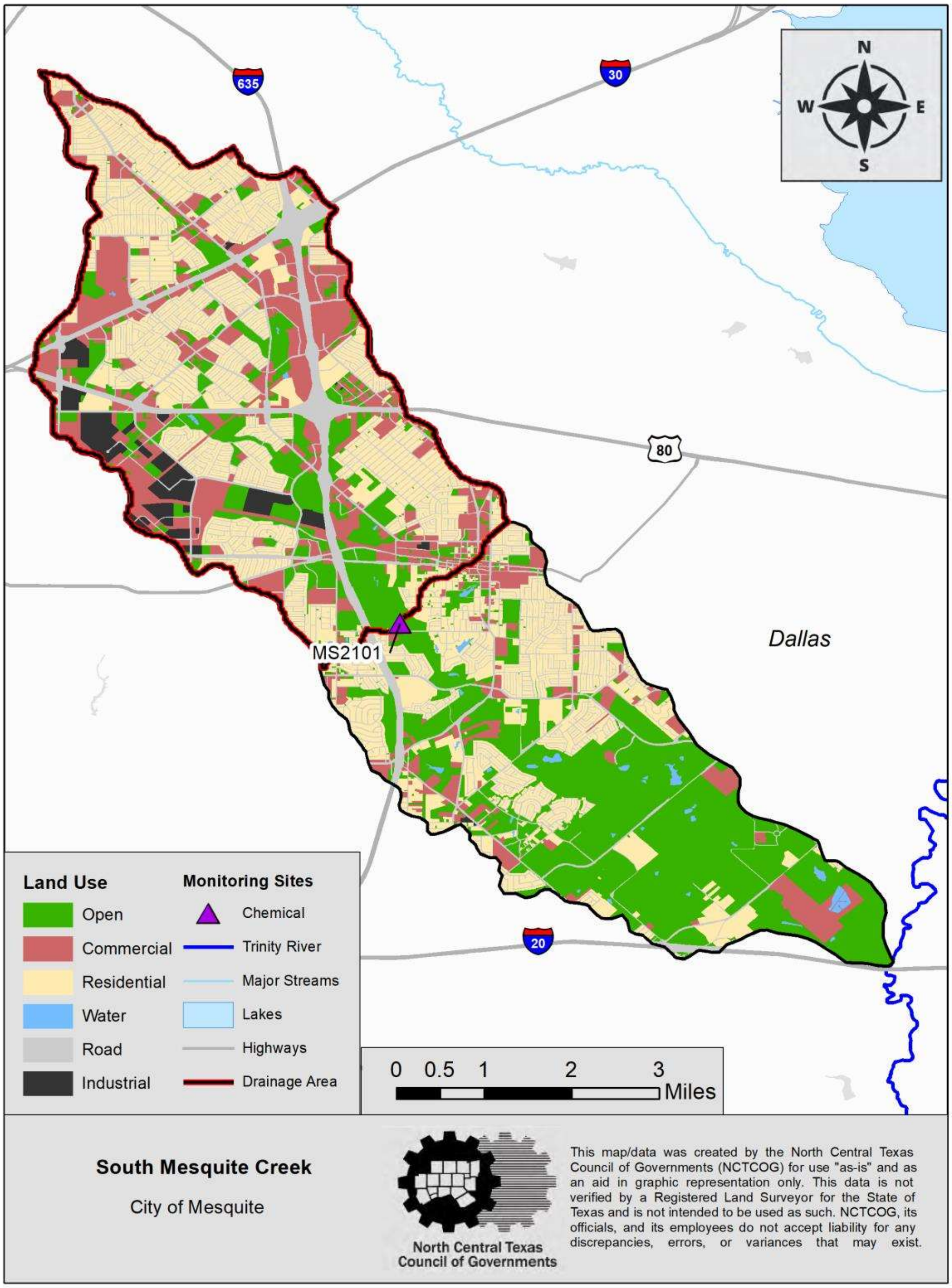


Figure 25: Fort Worth, Headwaters Sycamore Creek Subwatershed, SYC1, SYC2, SYC3

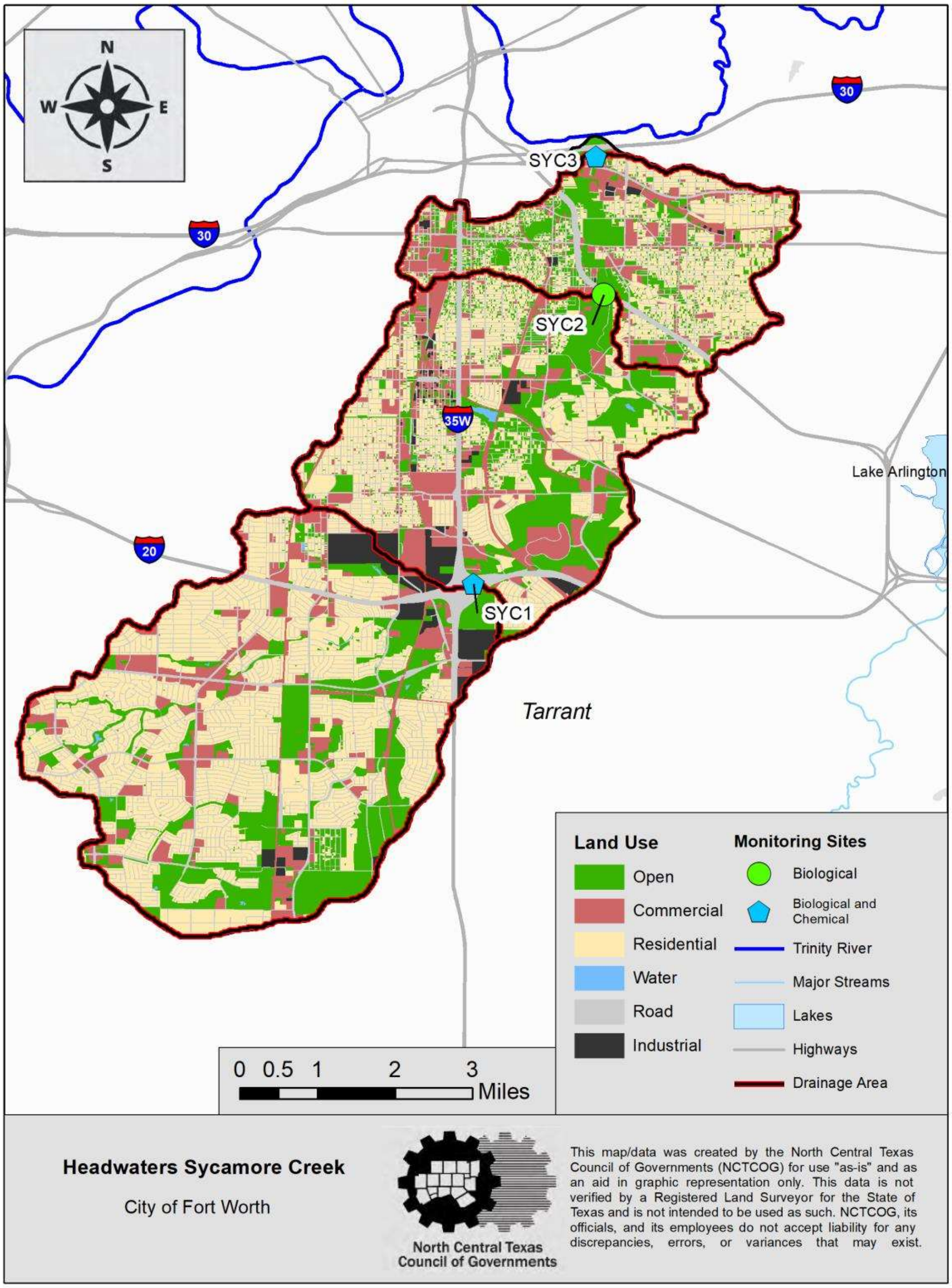


Figure 26: Dallas, Headwaters Turtle Creek – Headwaters Subwatershed, HTC-100, HTC-200, HTC-300

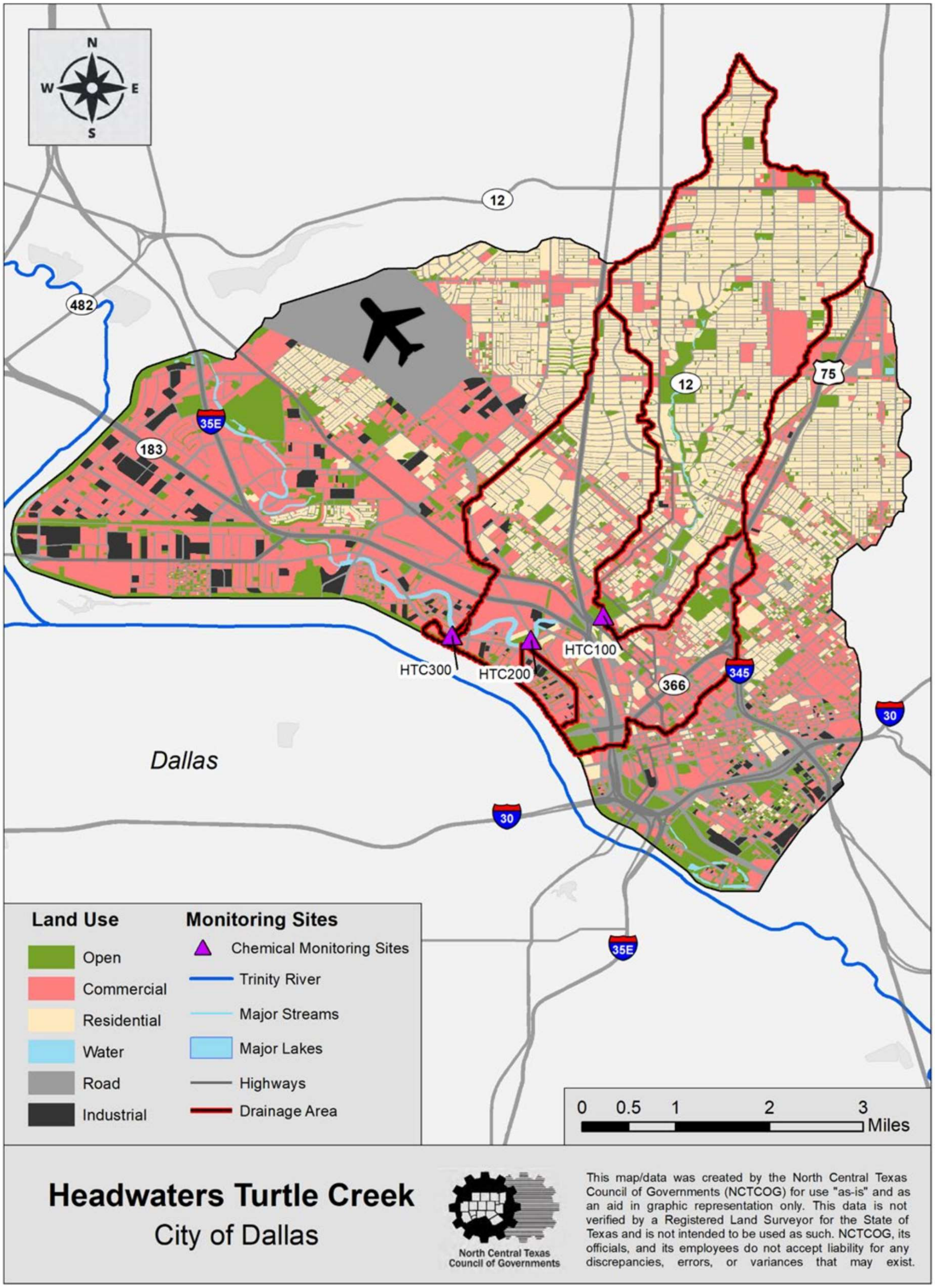


Figure 27: Dallas, Turtle Creek – Trinity River Subwatershed, TCTR-100, TCTR-200–3951, TCTR-300

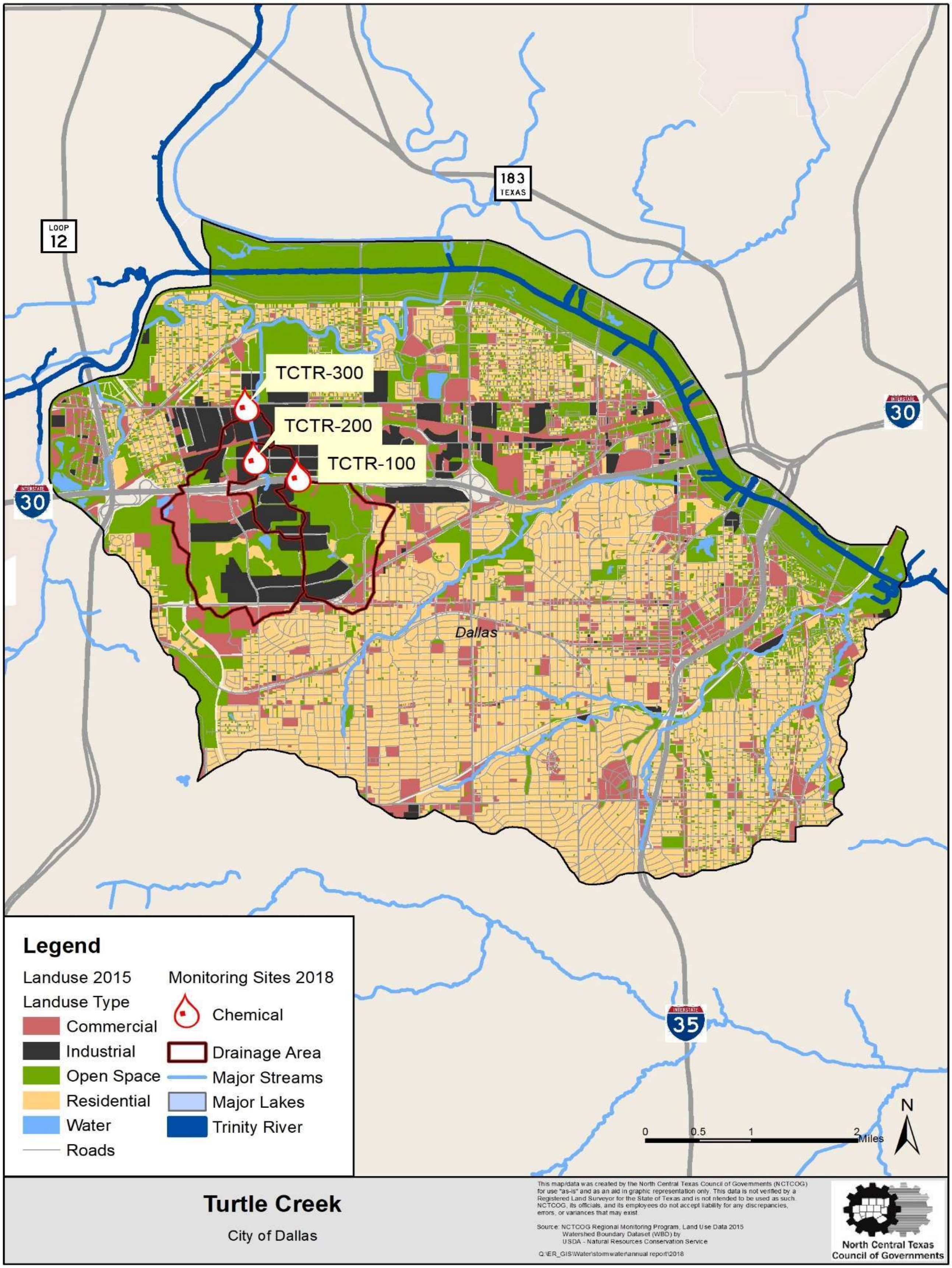
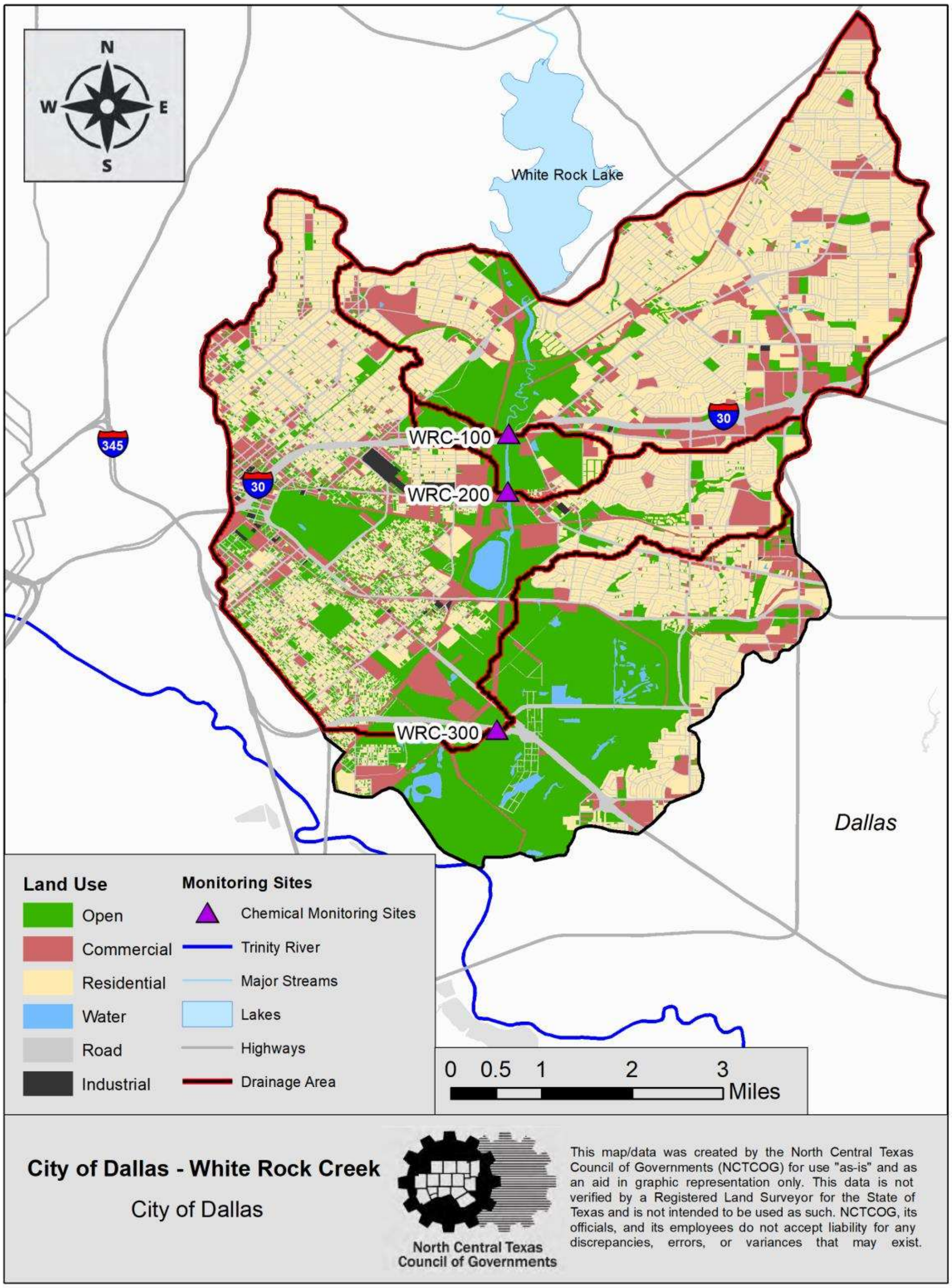
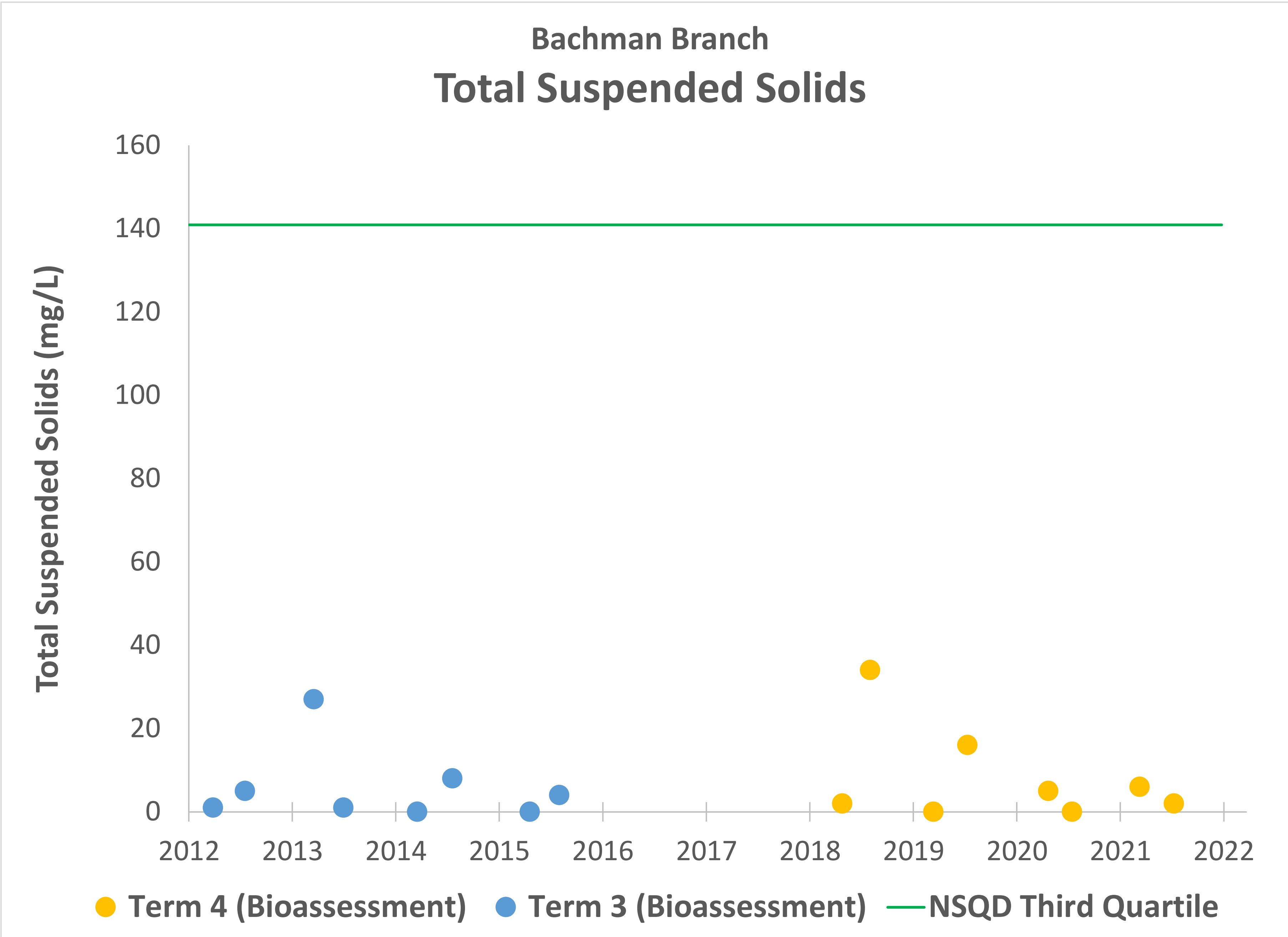


Figure 28: Dallas, City of Dallas – White Rock Creek Subwatershed, WRC-100, WRC-200, WRC-300

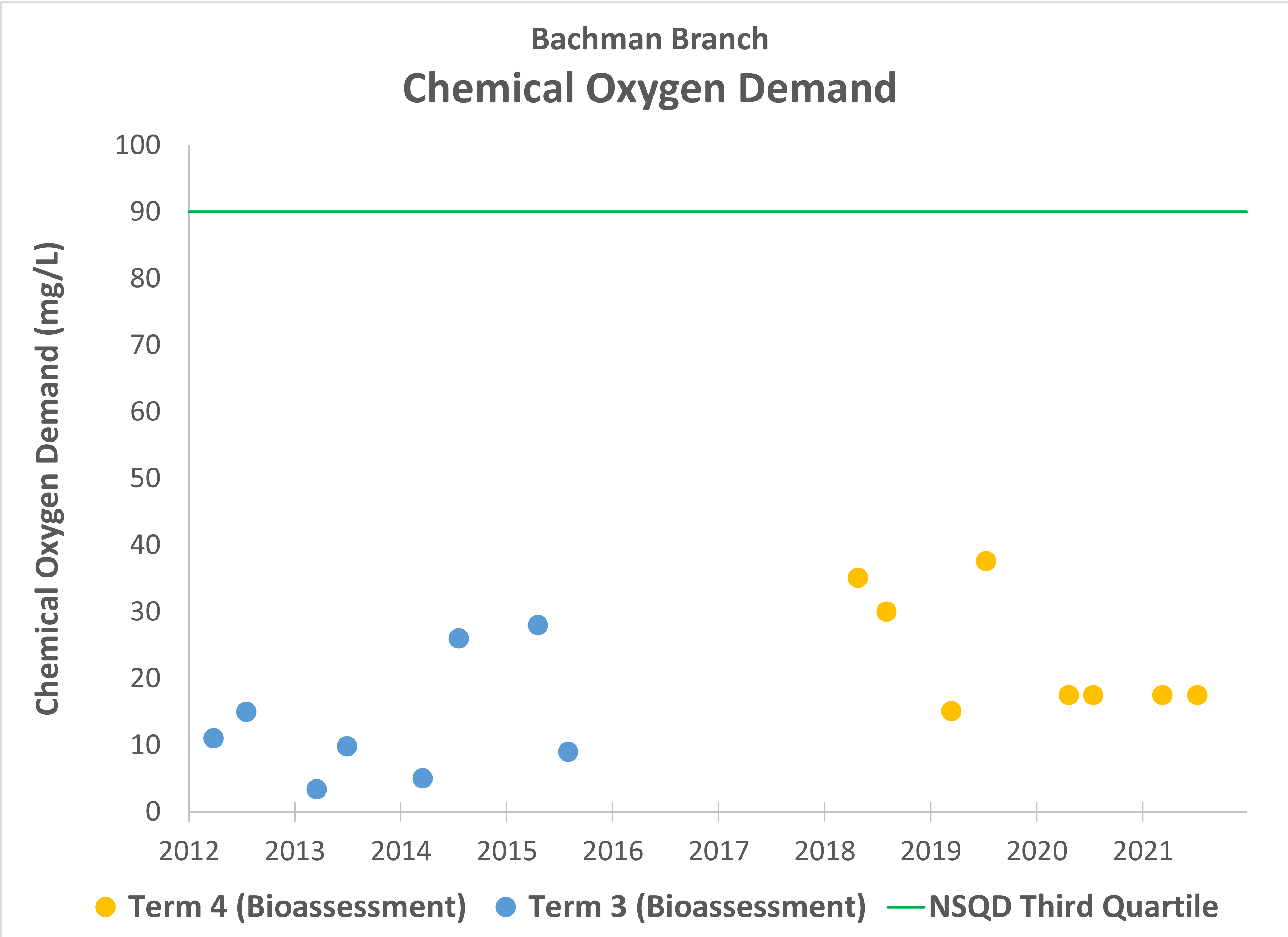


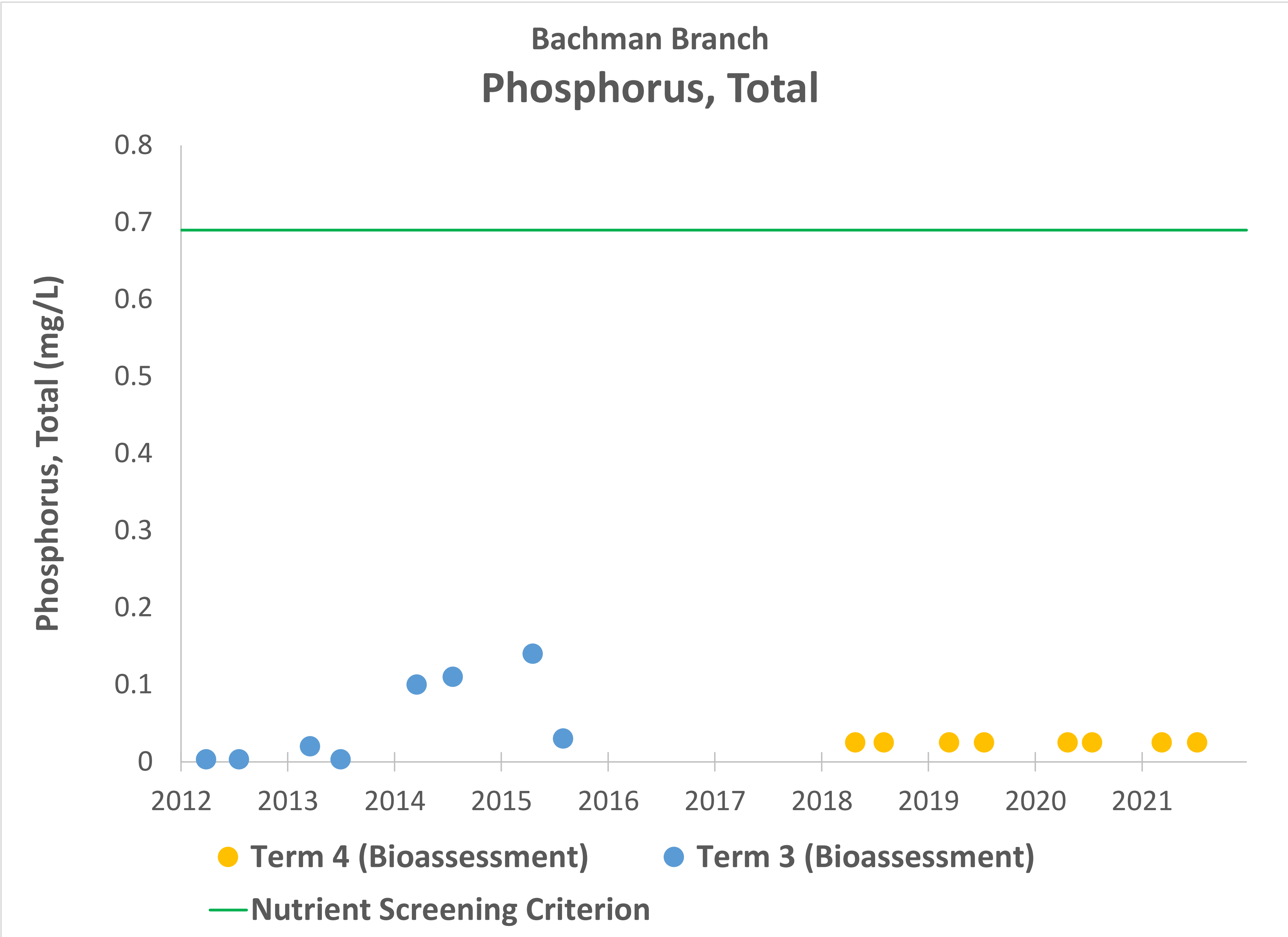
Appendix C

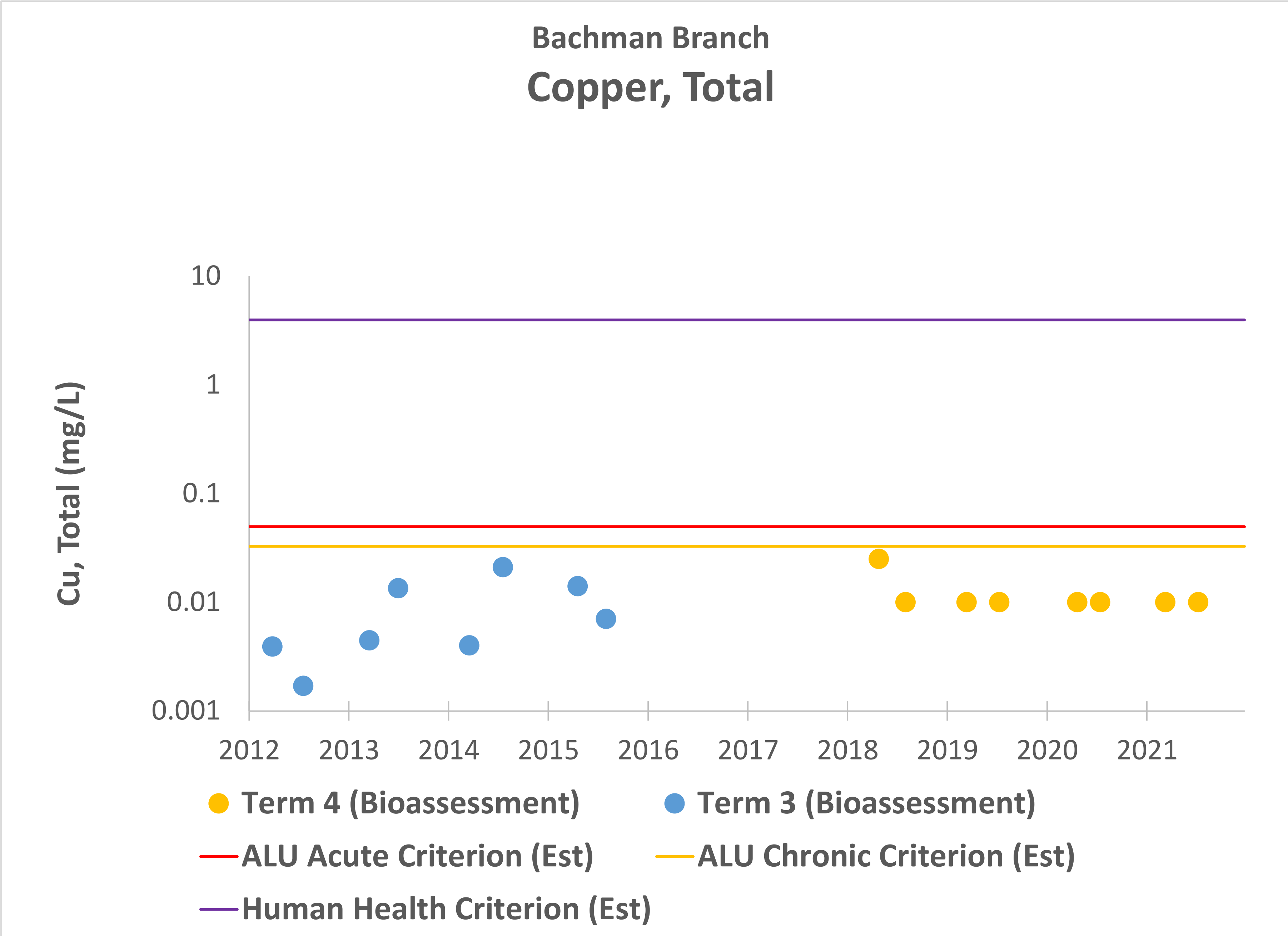
Bachman Branch Water Quality Data Graphs

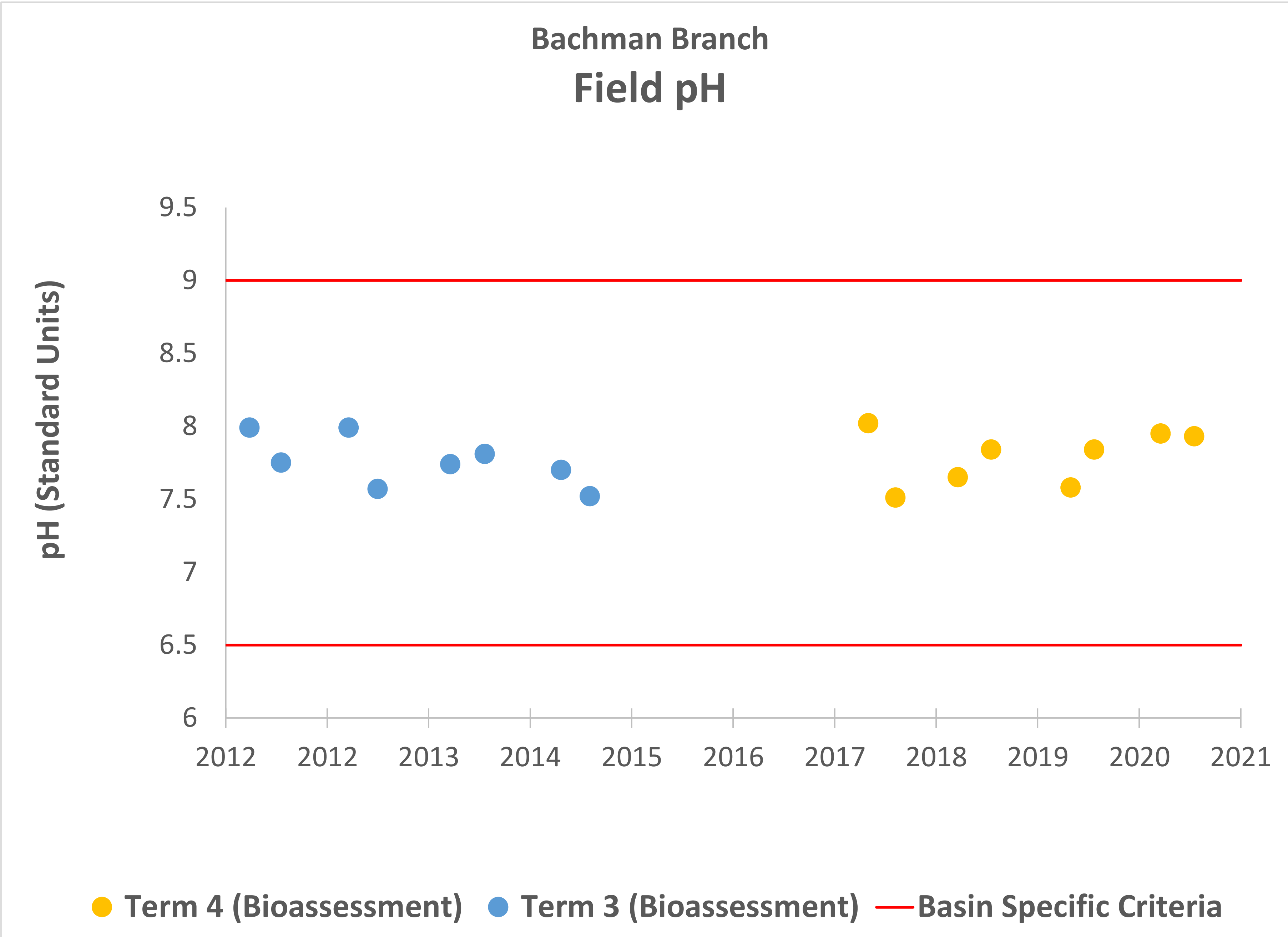


Bachman Branch
Total Suspended Solids
Total Suspended Solids (mg/L)
160
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
Term 4 (Bioassessment)
Term 3 (Bioassessment)
NSQD Third Quartile

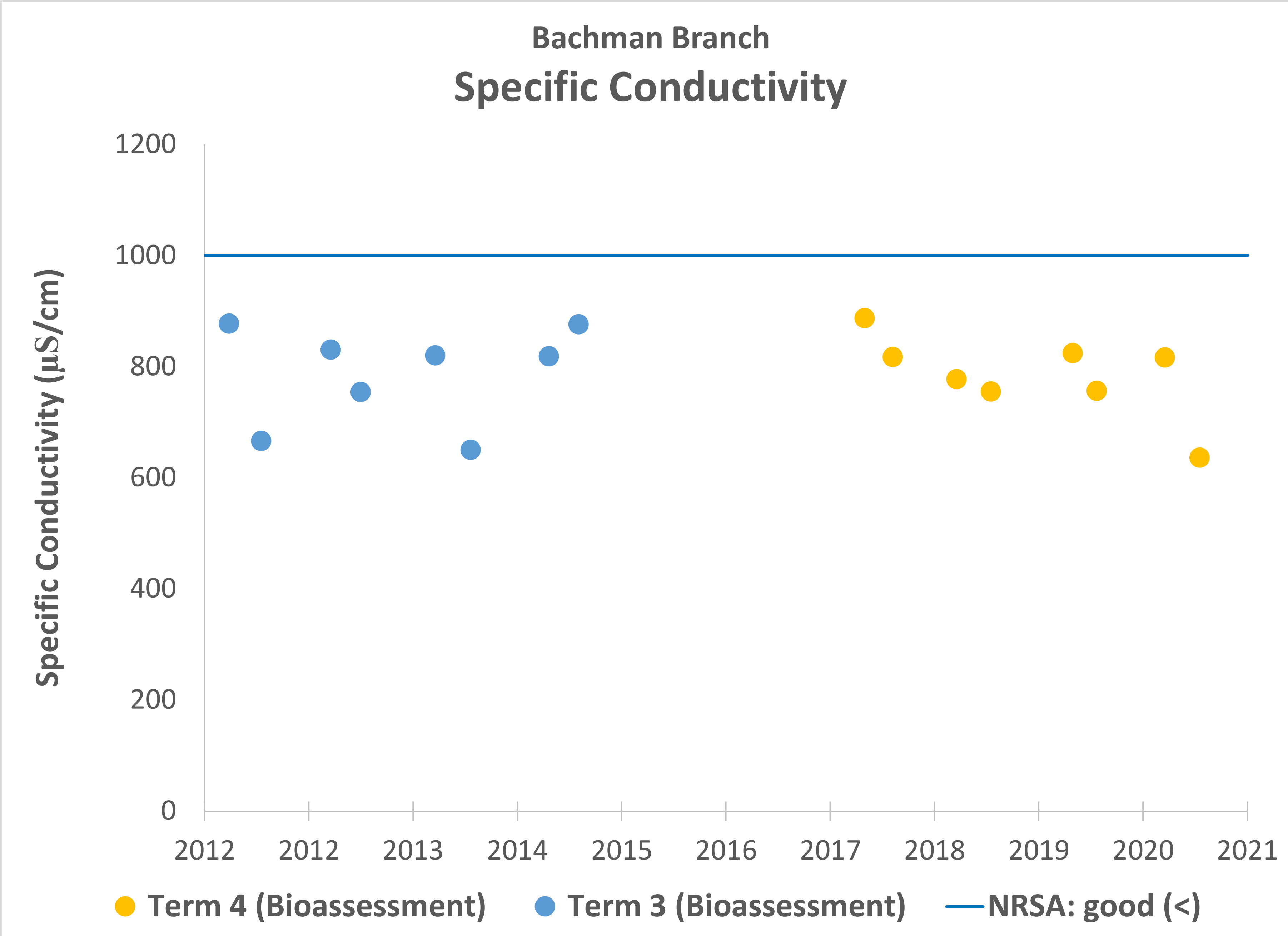

Bachman Branch
Chemical Oxygen Demand
Chemical Oxygen Demand (mg/L)
100
90
80
70
60
50
40
30
20
10
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
NSQD Third Quartile


Bachman Branch
Phosphorus, Total
Phosphorus, Total (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion

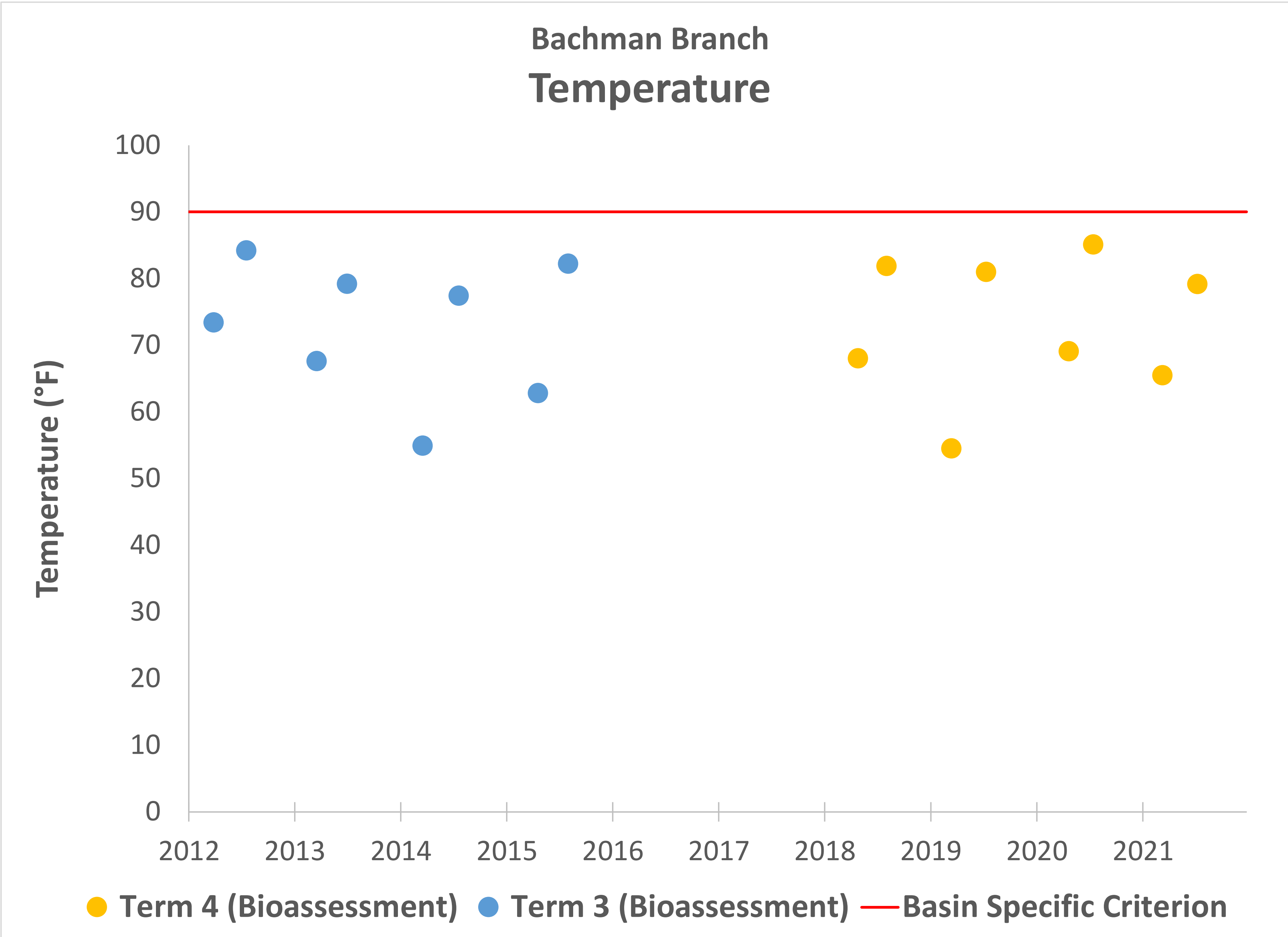

Bachman Branch
Copper, Total
Cu, Total (mg/L)
10
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

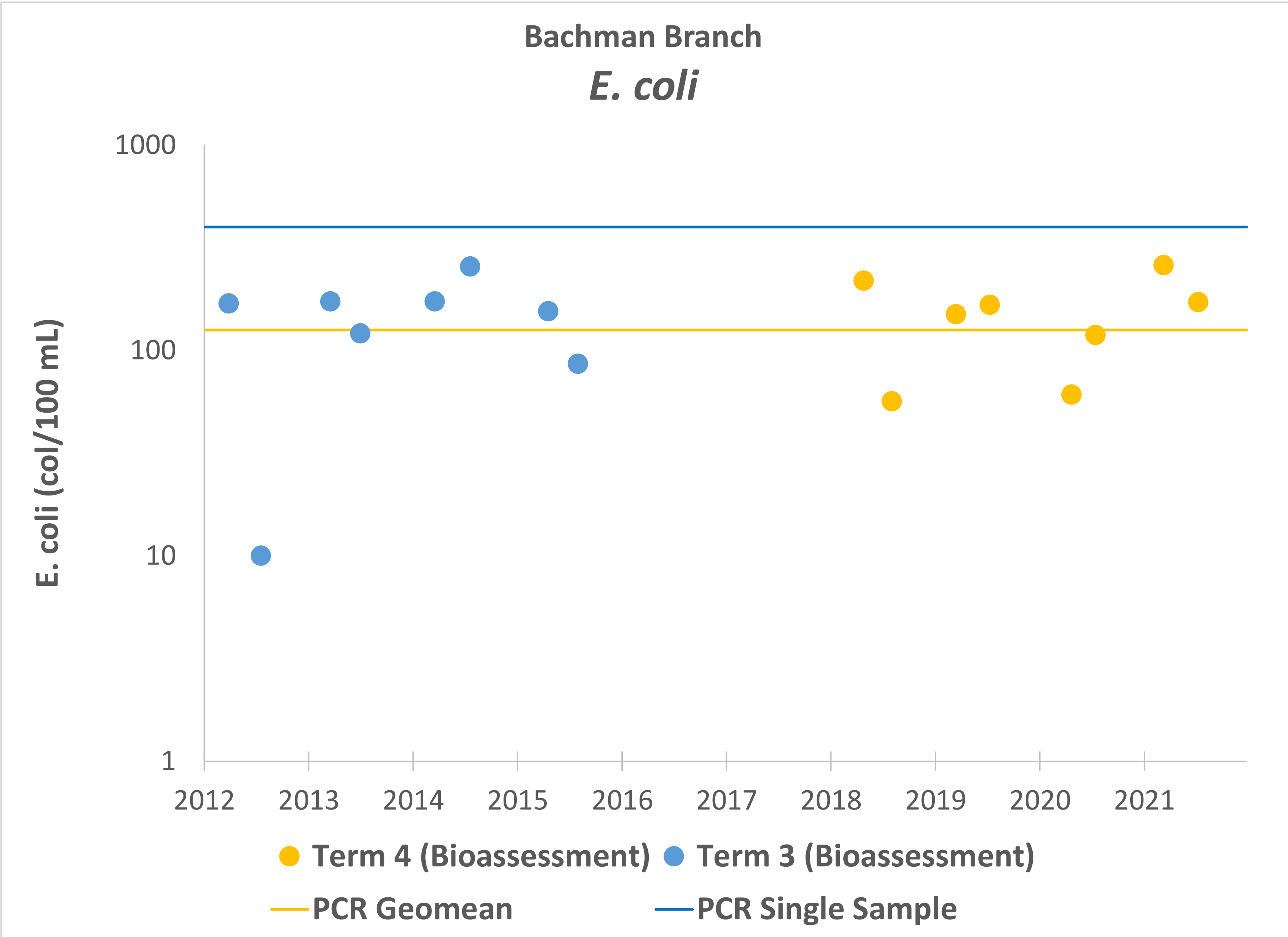


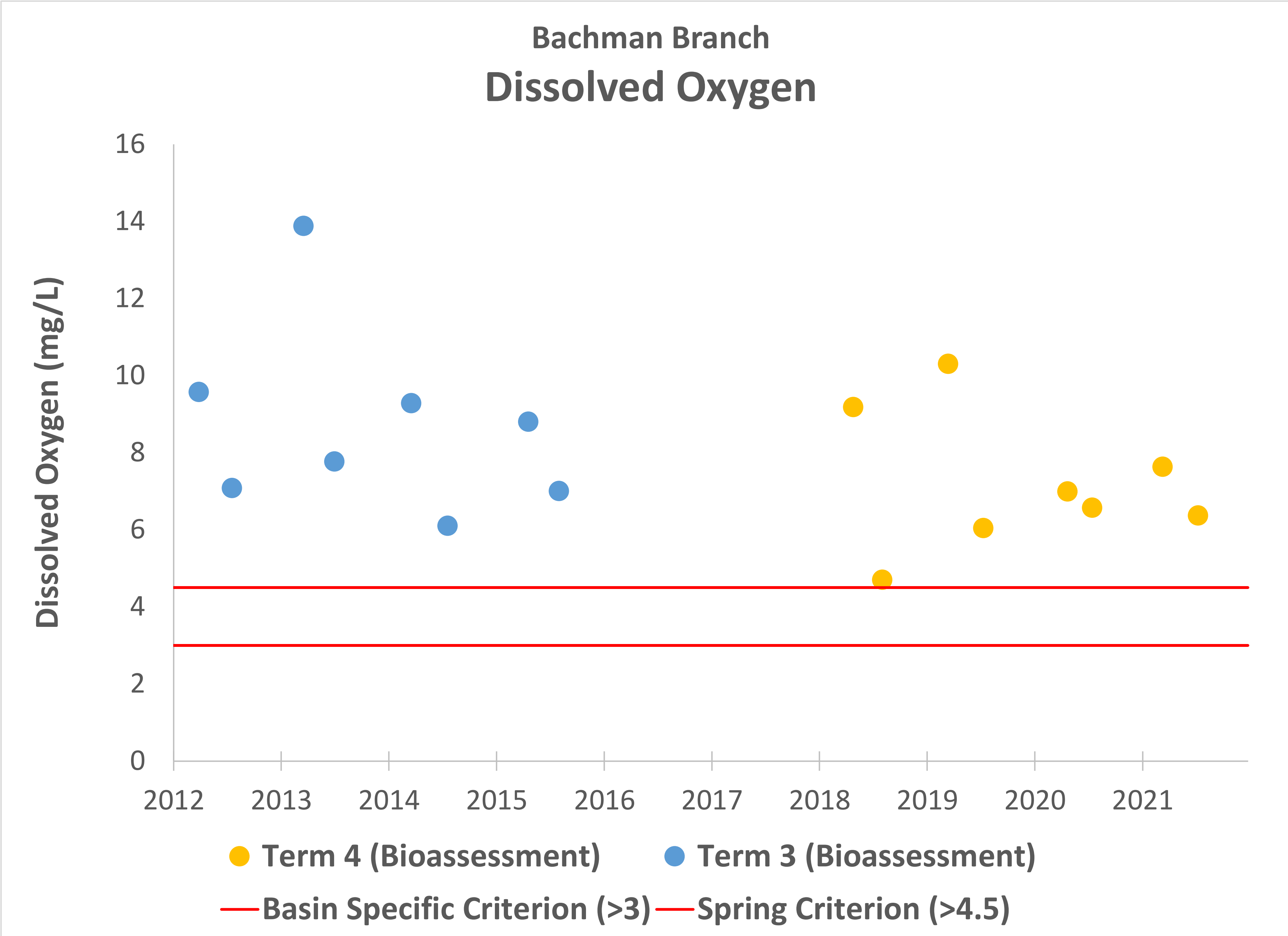
Bachman Branch
Field pH
pH (Standard Units)
9.5
9
8.5
8
7.5
7
6.5
6
2012
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Basin Specific Criteria

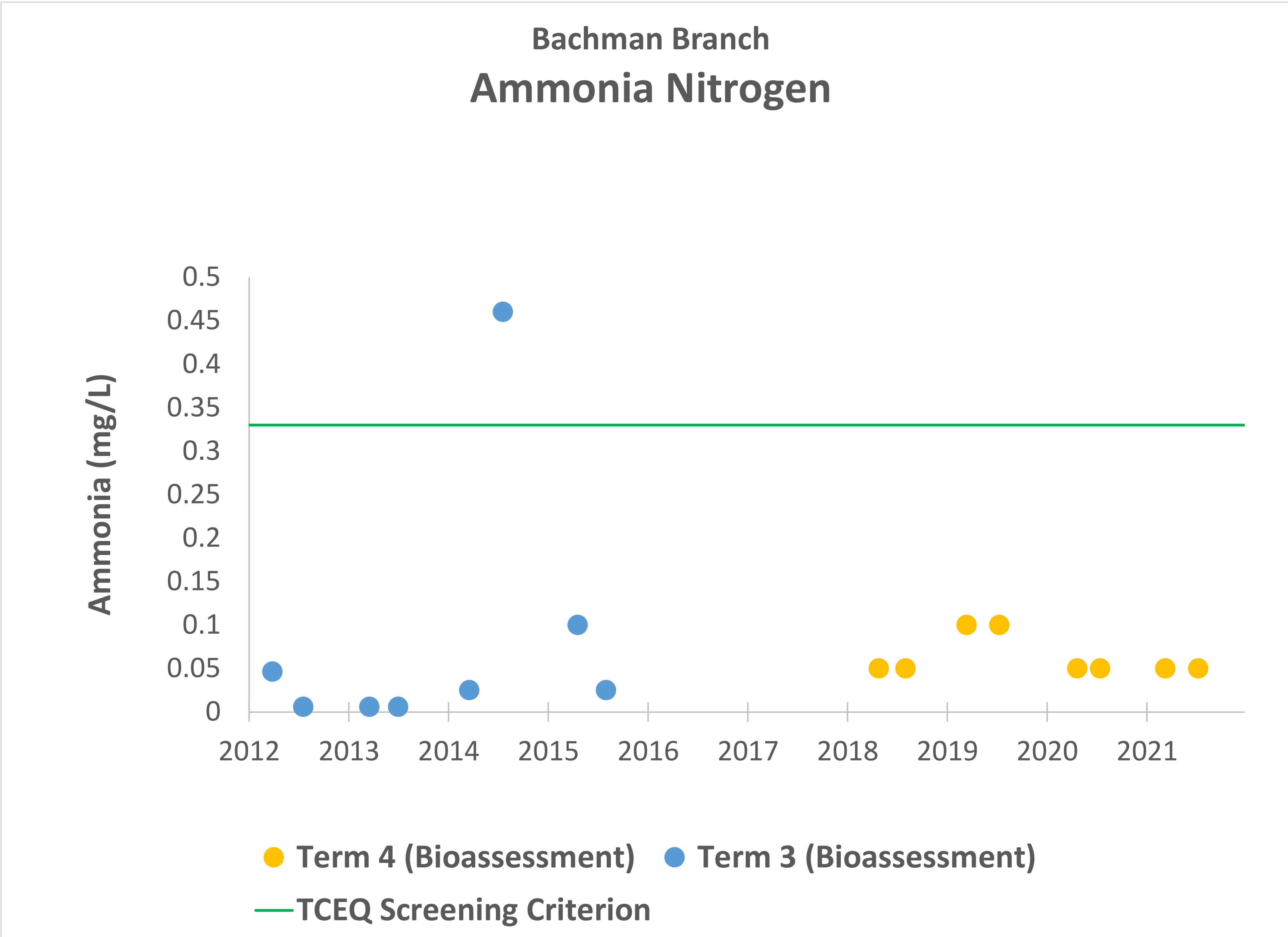


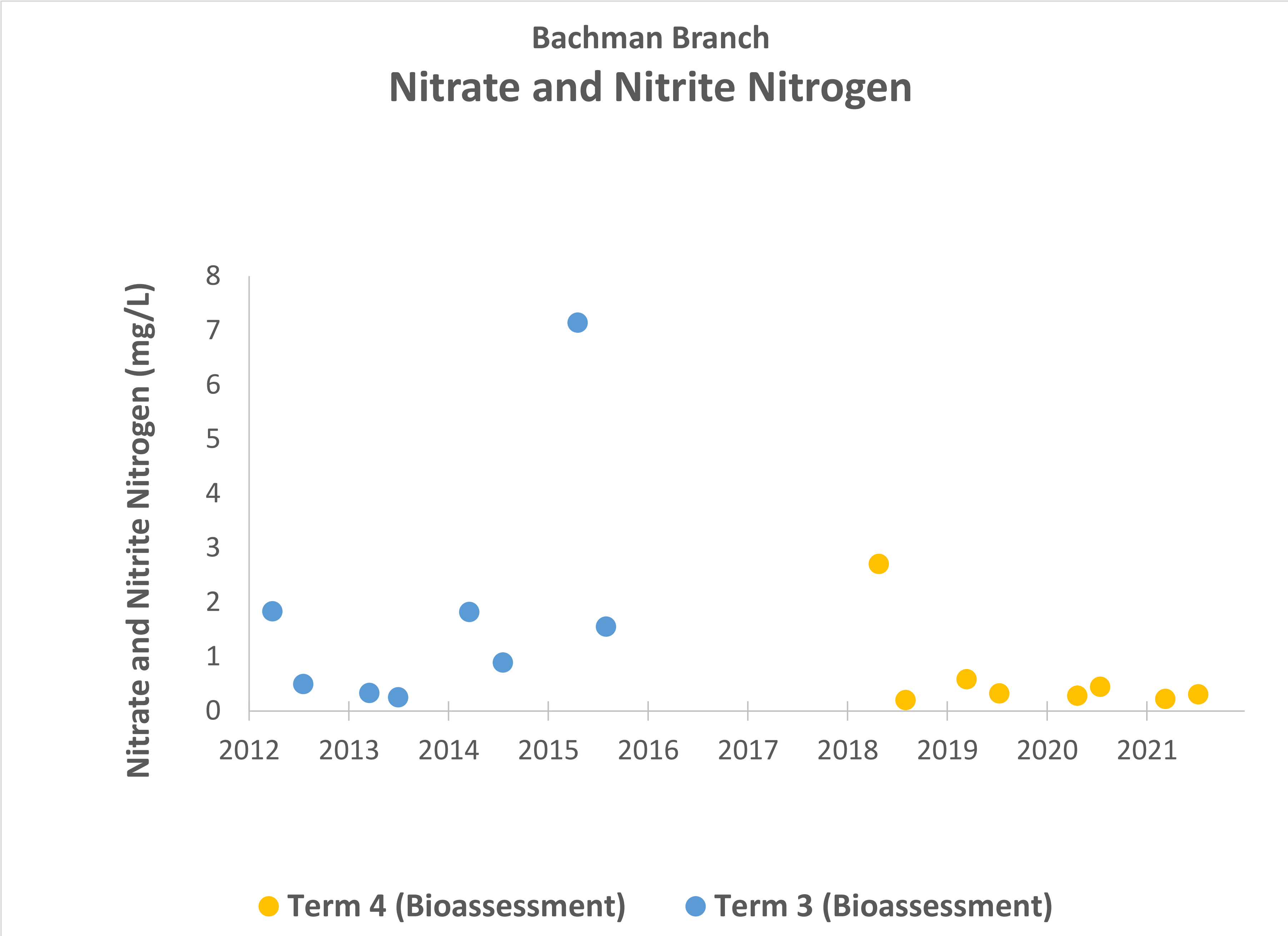
Bachman Branch
Specific Conductivity
Specific Conductivity (µS/cm)
1200
1000
800
600
400
200
0
2012
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
NRSA: good (<)


Bachman Branch
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Basin Specific Criterion

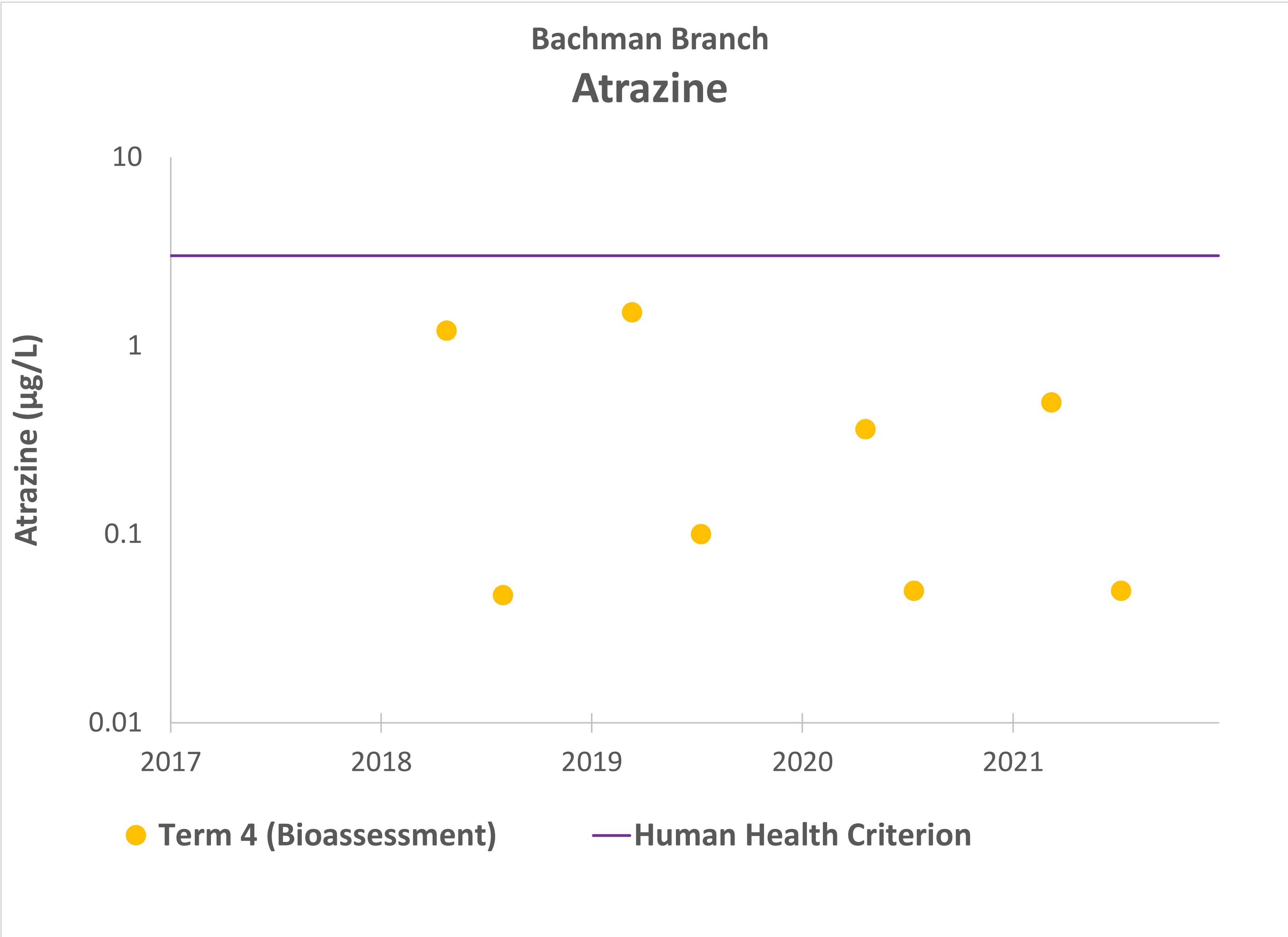

Bachman Branch
E. coli
1000
100
10
1
E. coli (col/100 mL)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
PCR Geomean
PCR Single Sample

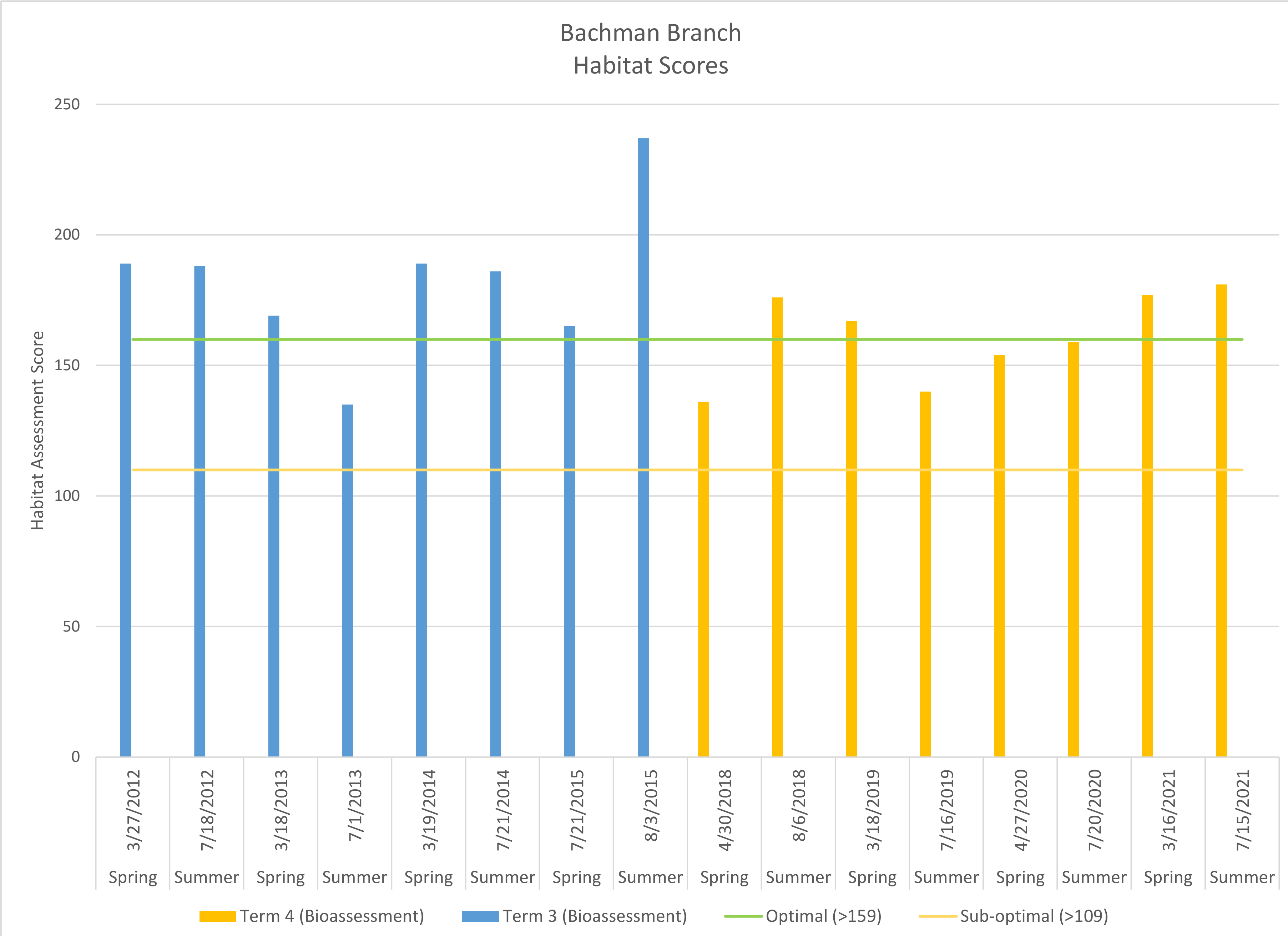

Bachman Branch
Dissolved Oxygen
Dissolved Oxygen (mg/L)
16
14
12
10
8
6
4
2
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Basin Specific Criterion (>3)
Spring Criterion (>4.5)

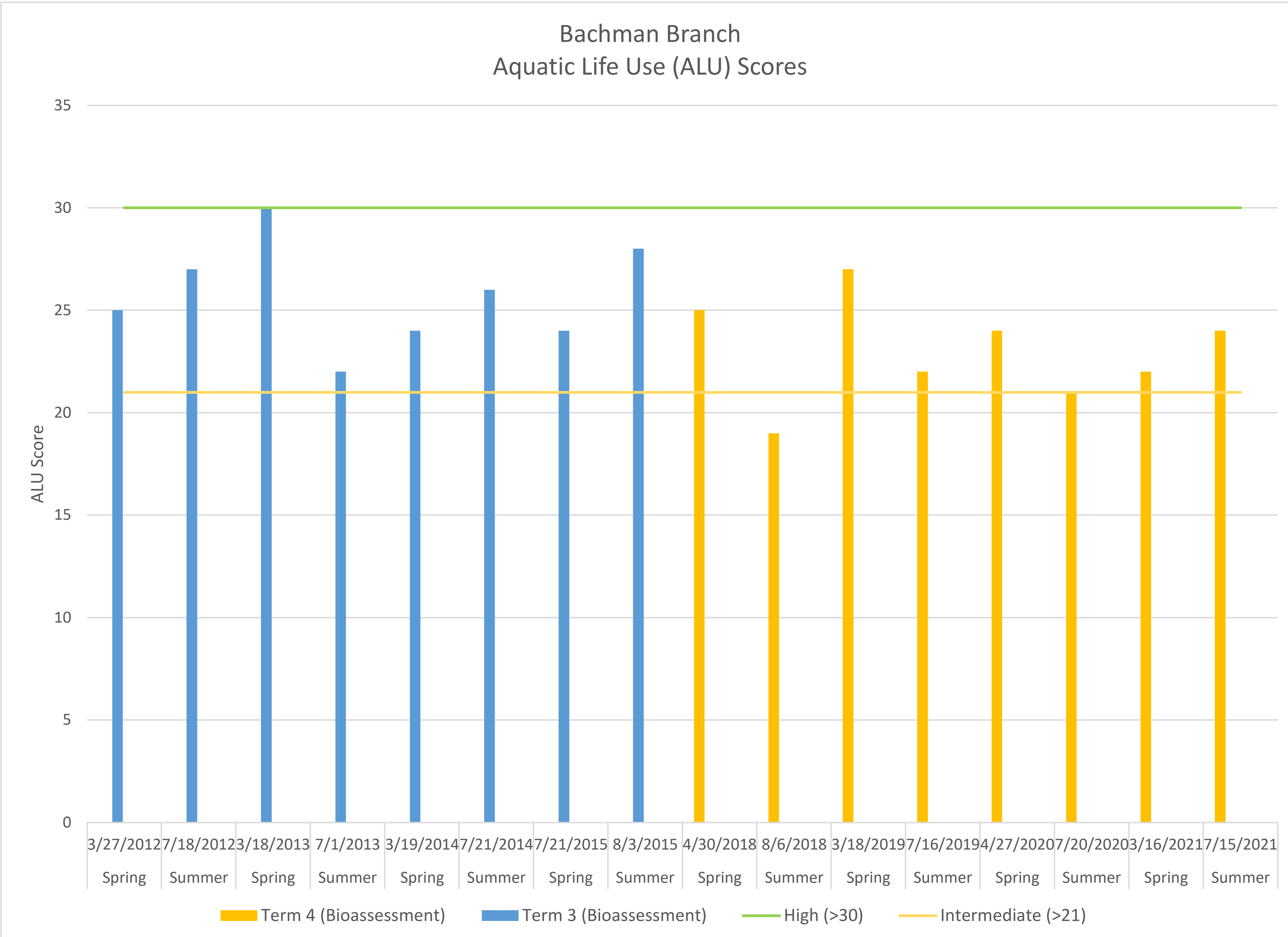

Bachman Branch
Ammonia Nitrogen
Ammonia (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
TCEQ Screening Criterion



Bachman Branch
Nitrate and Nitrite Nitrogen
Nitrate and Nitrite Nitrogen (mg/L)
0
1
2
3
4
5
6
7
8
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)


Bachman Branch
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Human Health Criterion

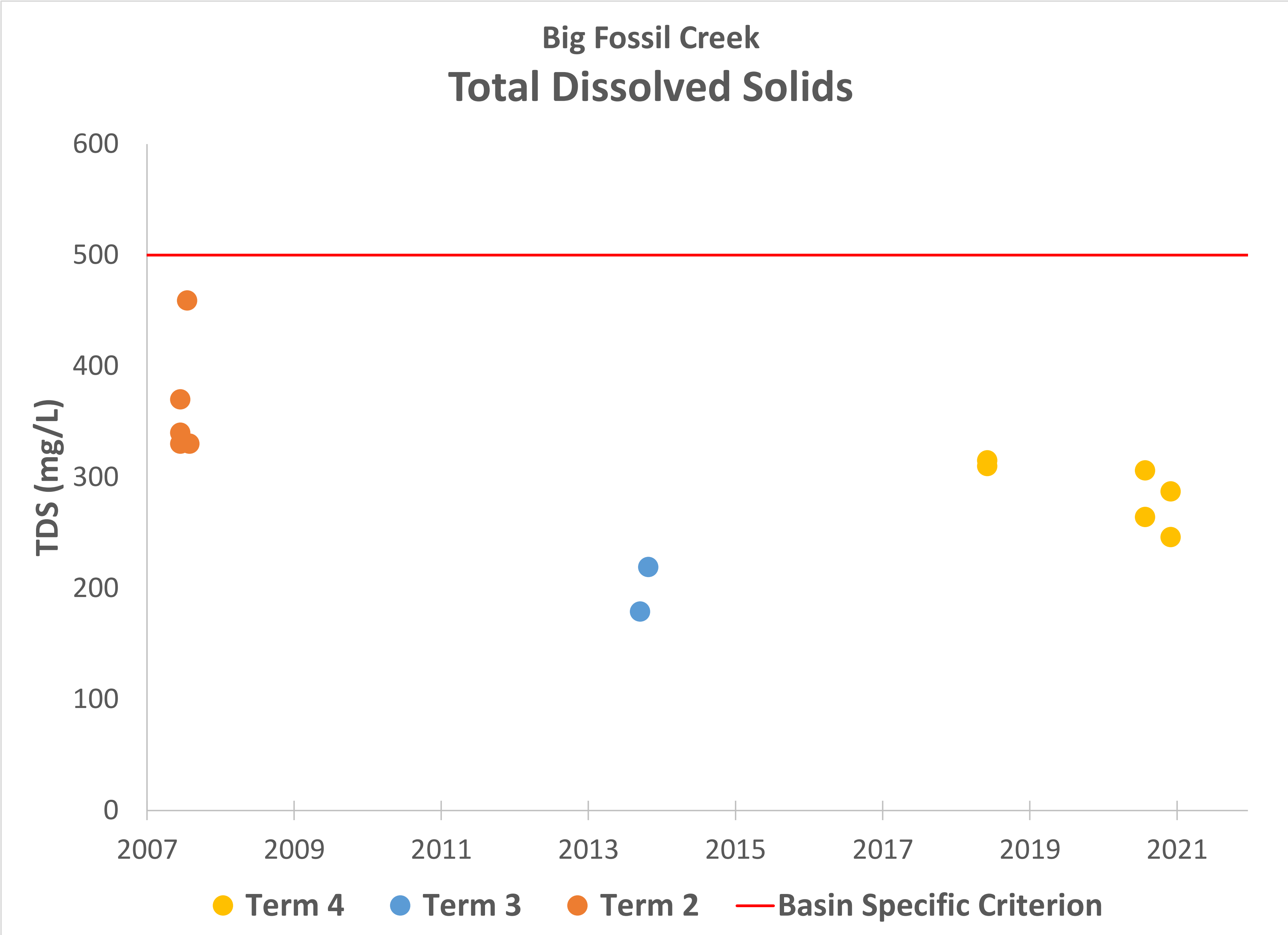

Bachman Branch
Habitat Scores
Habitat Assessment Score
250
200
150
100
50
0
3/27/2012
7/18/2012
3/18/2013
7/1/2013
3/19/2014
7/21/2014
7/21/2015
8/3/2015
4/30/2018
8/6/2018
3/18/2019
7/16/2019
4/27/2020
7/20/2020
3/16/2021
7/15/2021
Spring
Summer
Spring
Summer
Spring
Summer
Spring
Summer
Spring
Summer
Spring
Summer
Spring
Summer
Spring
Summer
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Optimal (>159)
Sub-optimal (>109)



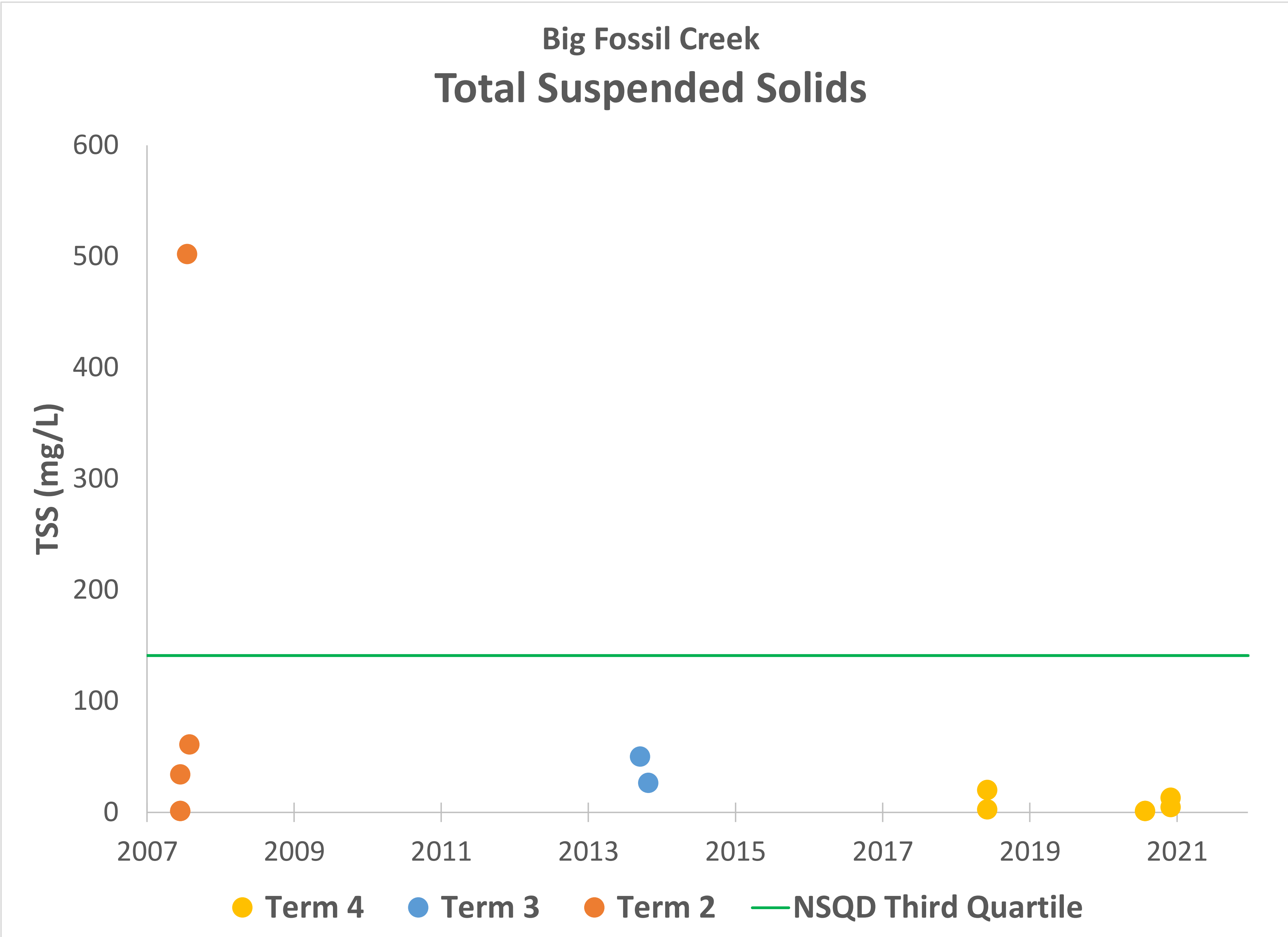
Bachman Branch
Aquatic Life Use (ALU) Scores
ALU Score
35
30
25
20
15
10
5
0
3/27/2012 Spring
7/18/2012 Summer
3/18/2013 Spring
7/1/2013 Summer
3/19/2014 Spring
7/21/2014 Summer
7/21/2015 Spring
8/3/2015 Summer
4/30/2018 Spring
8/6/2018 Summer
3/18/2019 Spring
7/16/2019 Summer
4/27/2020 Spring
7/20/2020 Summer
3/16/2021 Spring
7/15/2021 Summer
Term 4 (Bioassessment)
Term 3 (Bioassessment)
High (>30)
Intermediate (>21)

Appendix D

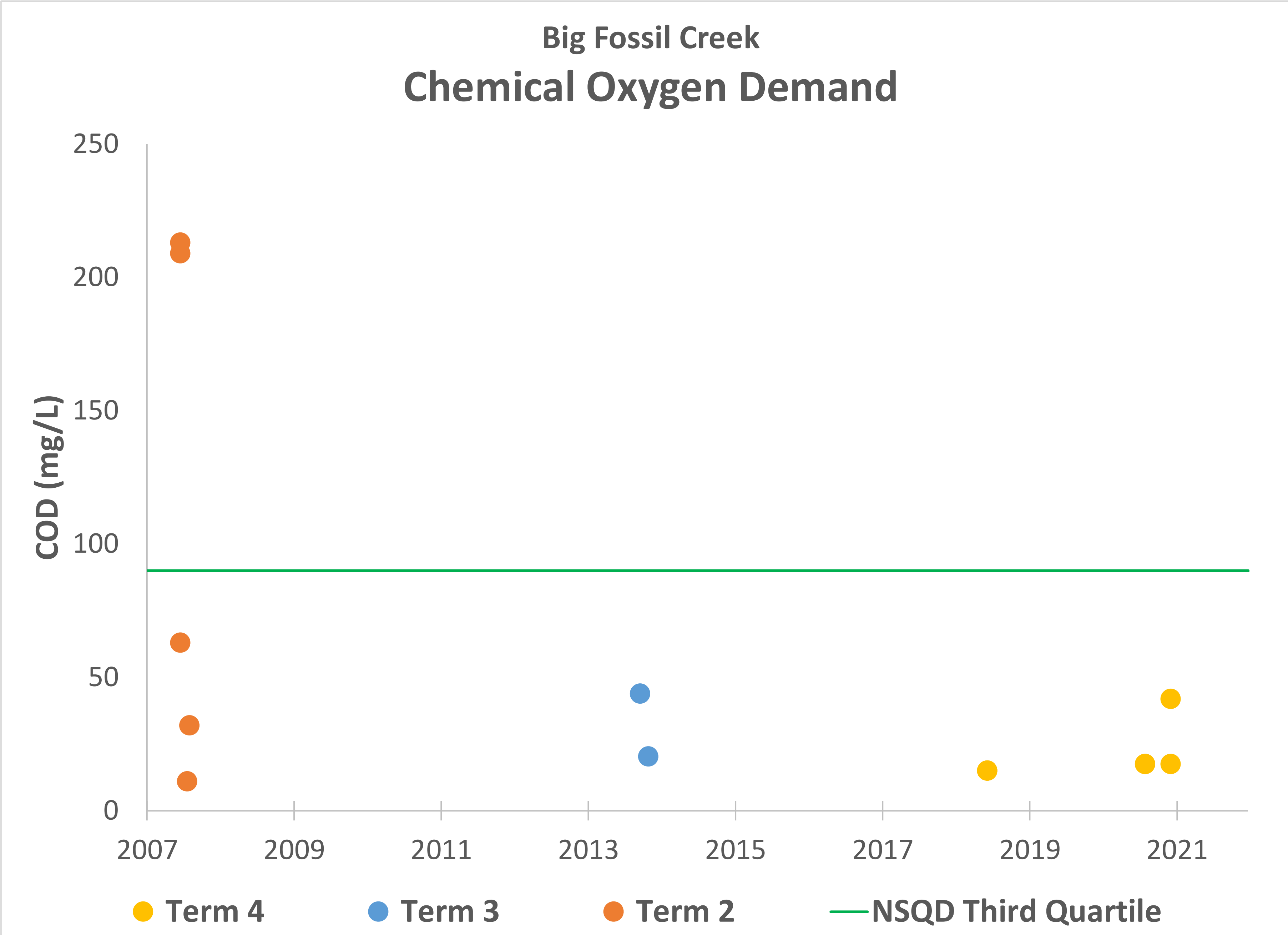
Big Fossil Creek Water Quality Data Graphs



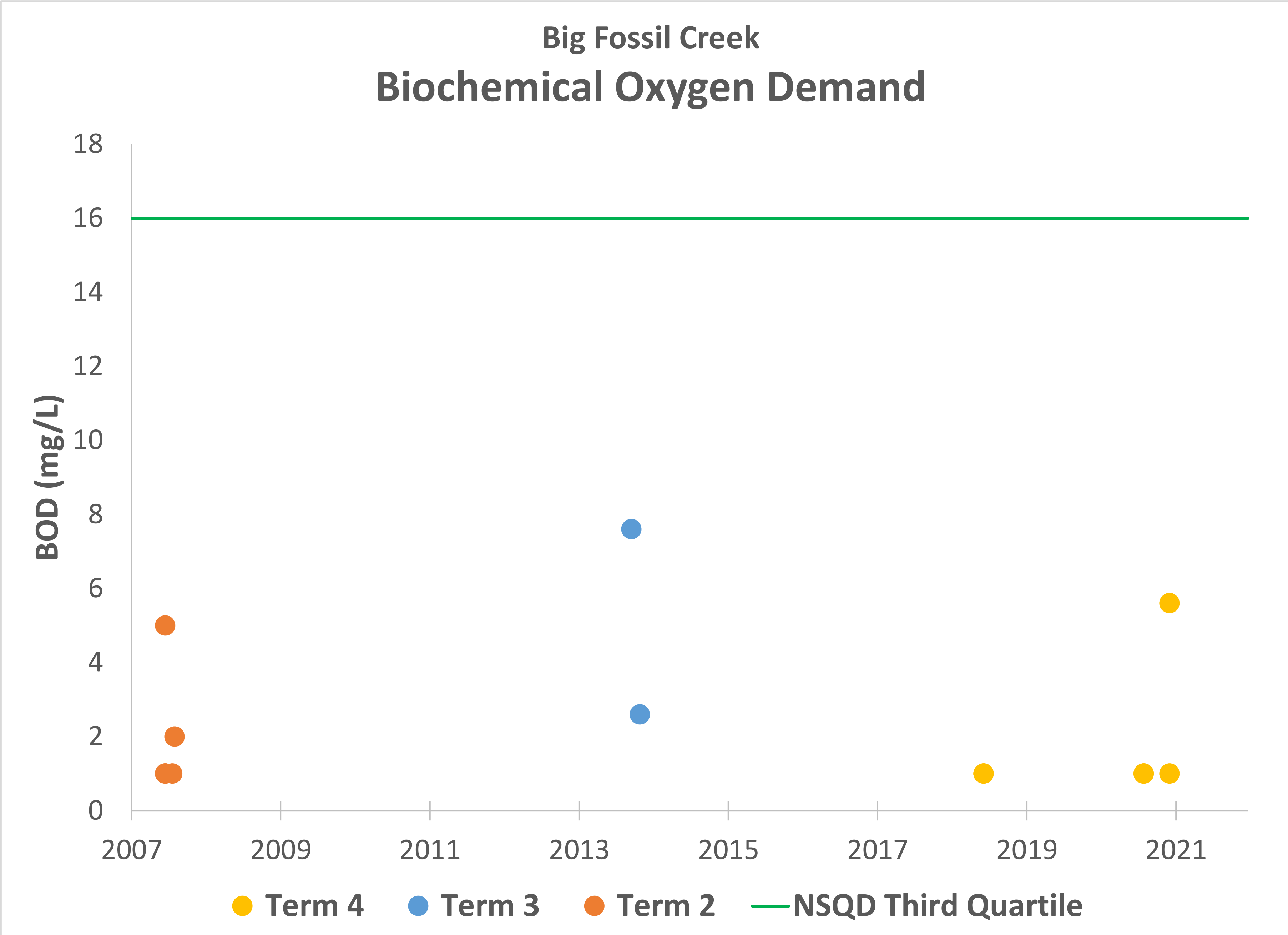
Big Fossil Creek
Total Dissolved Solids
TDS (mg/L)
600
500
400
300
200
100
0
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
Basin Specific Criterion



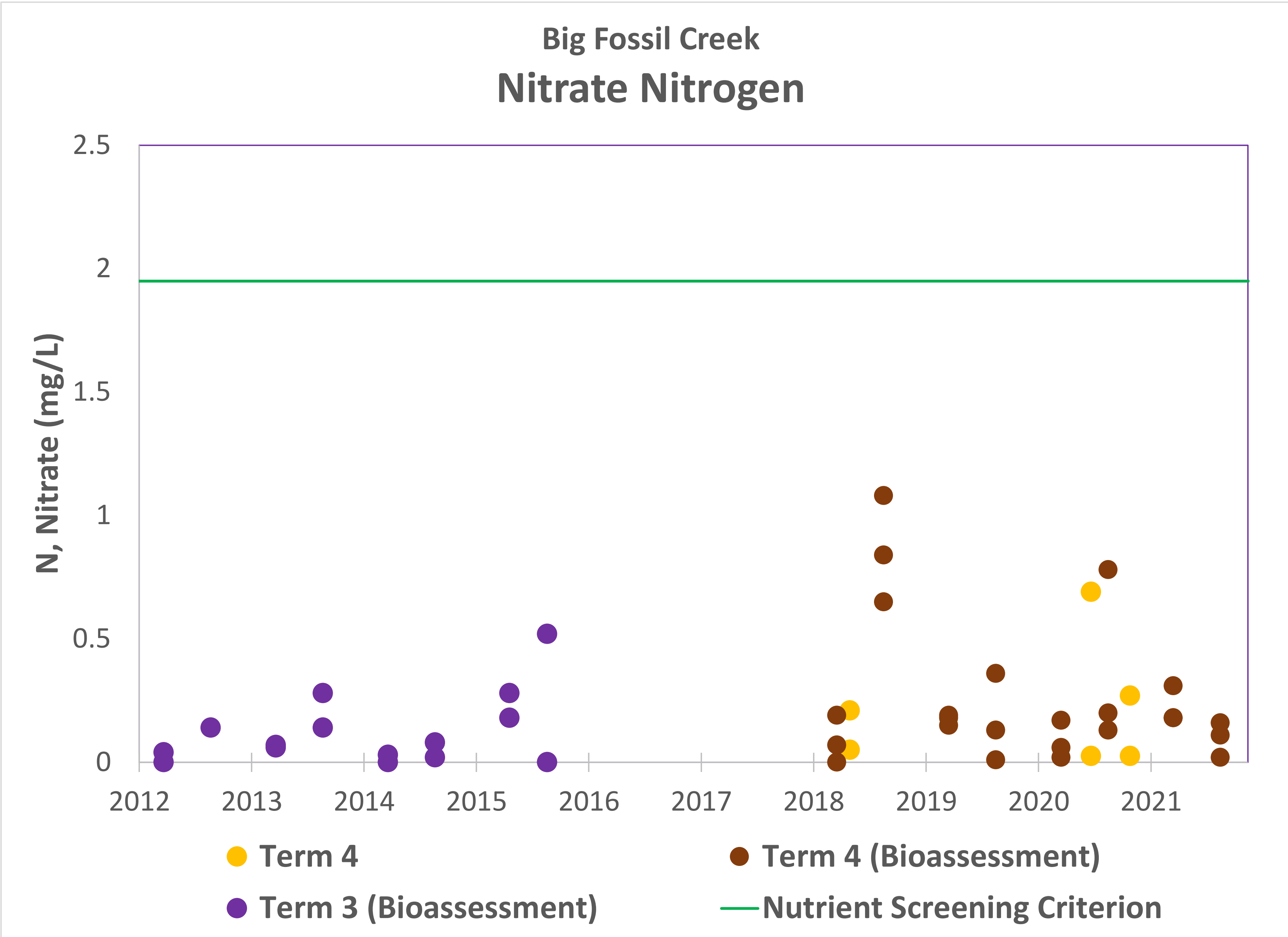
Big Fossil Creek
Total Suspended Solids
TSS (mg/L)
600
500
400
300
200
100
0
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

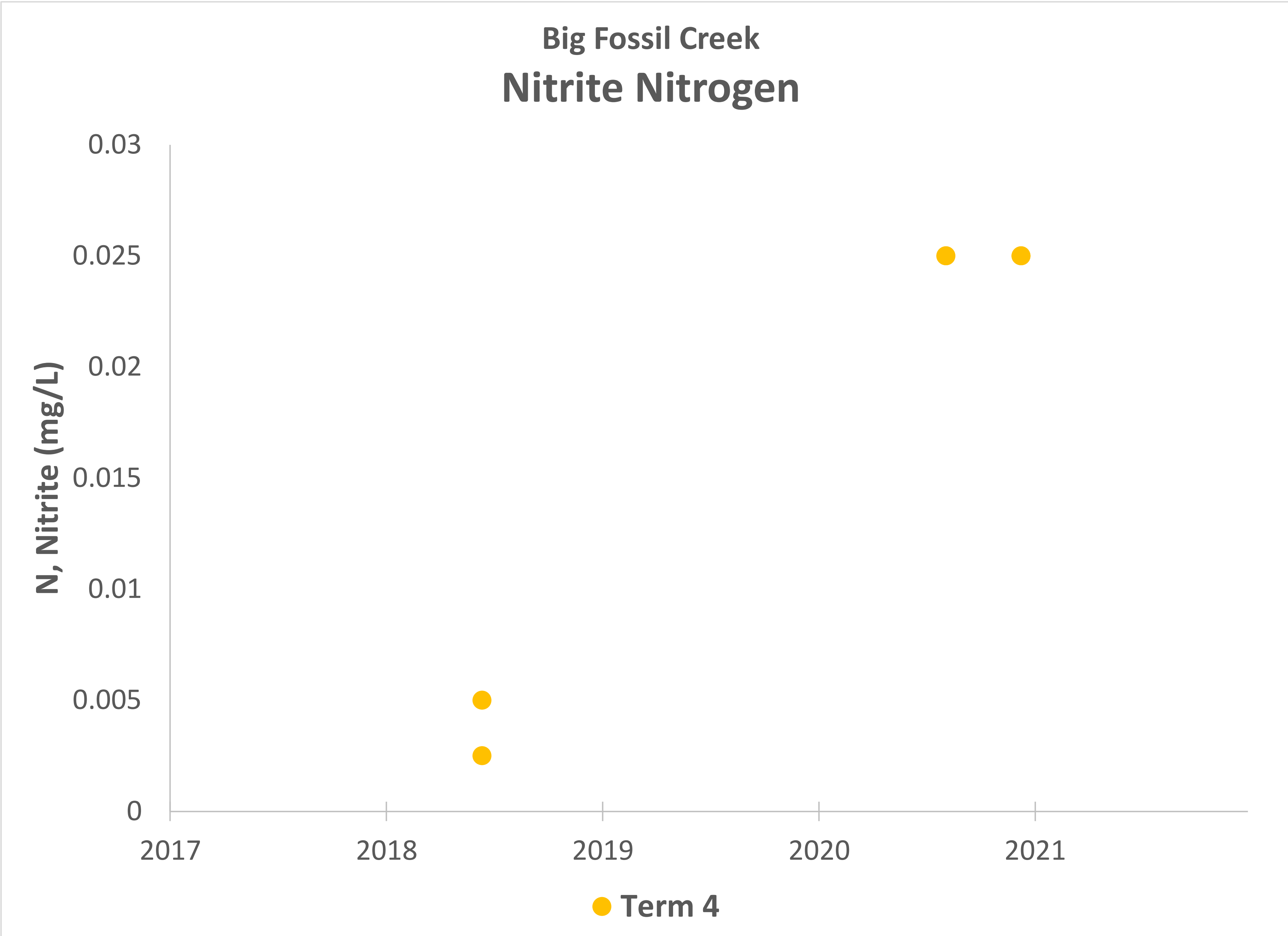


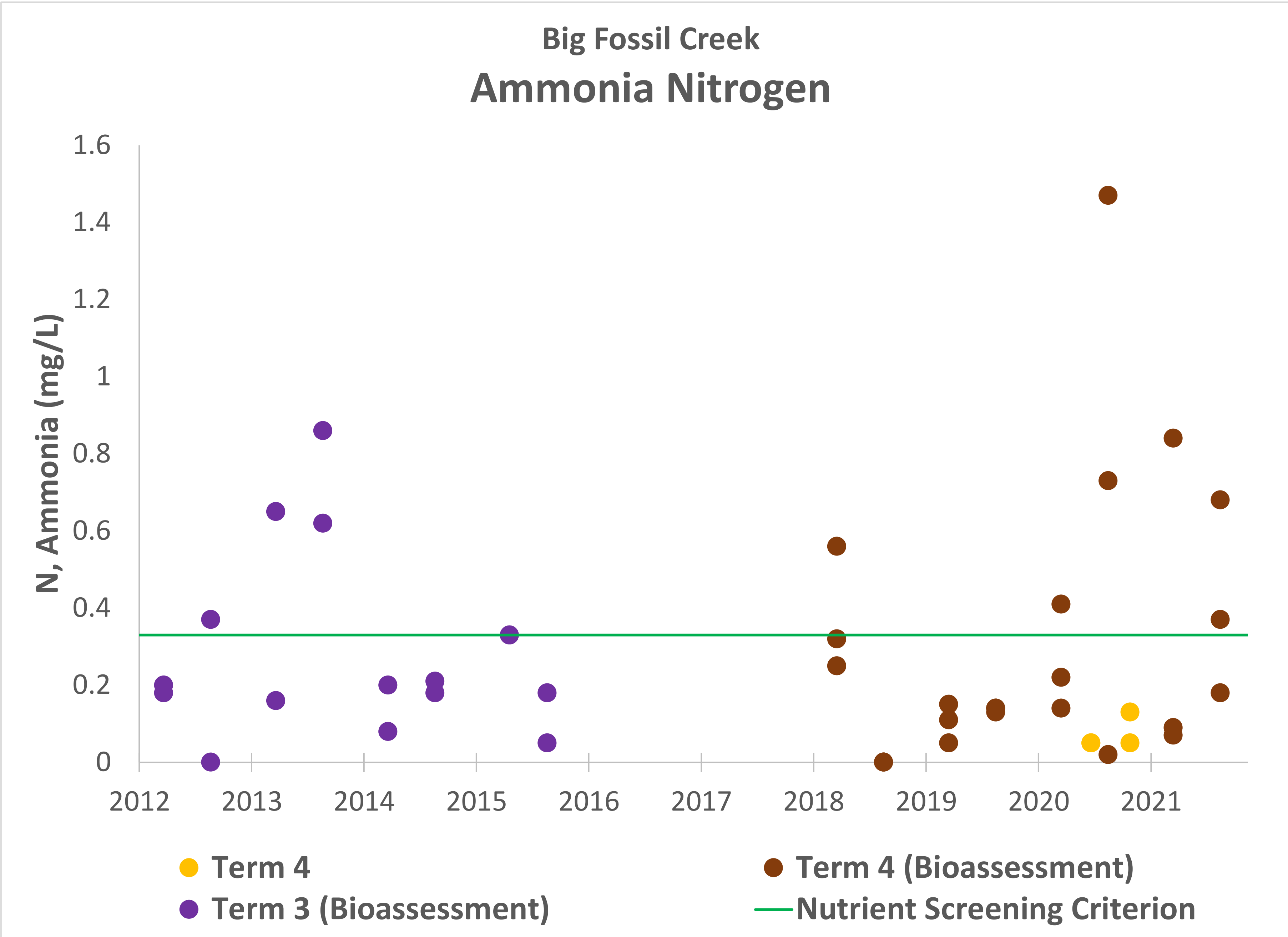
Big Fossil Creek
Chemical Oxygen Demand
COD (mg/L)
250
200
150
100
50
0
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
NSQD Third Quartile



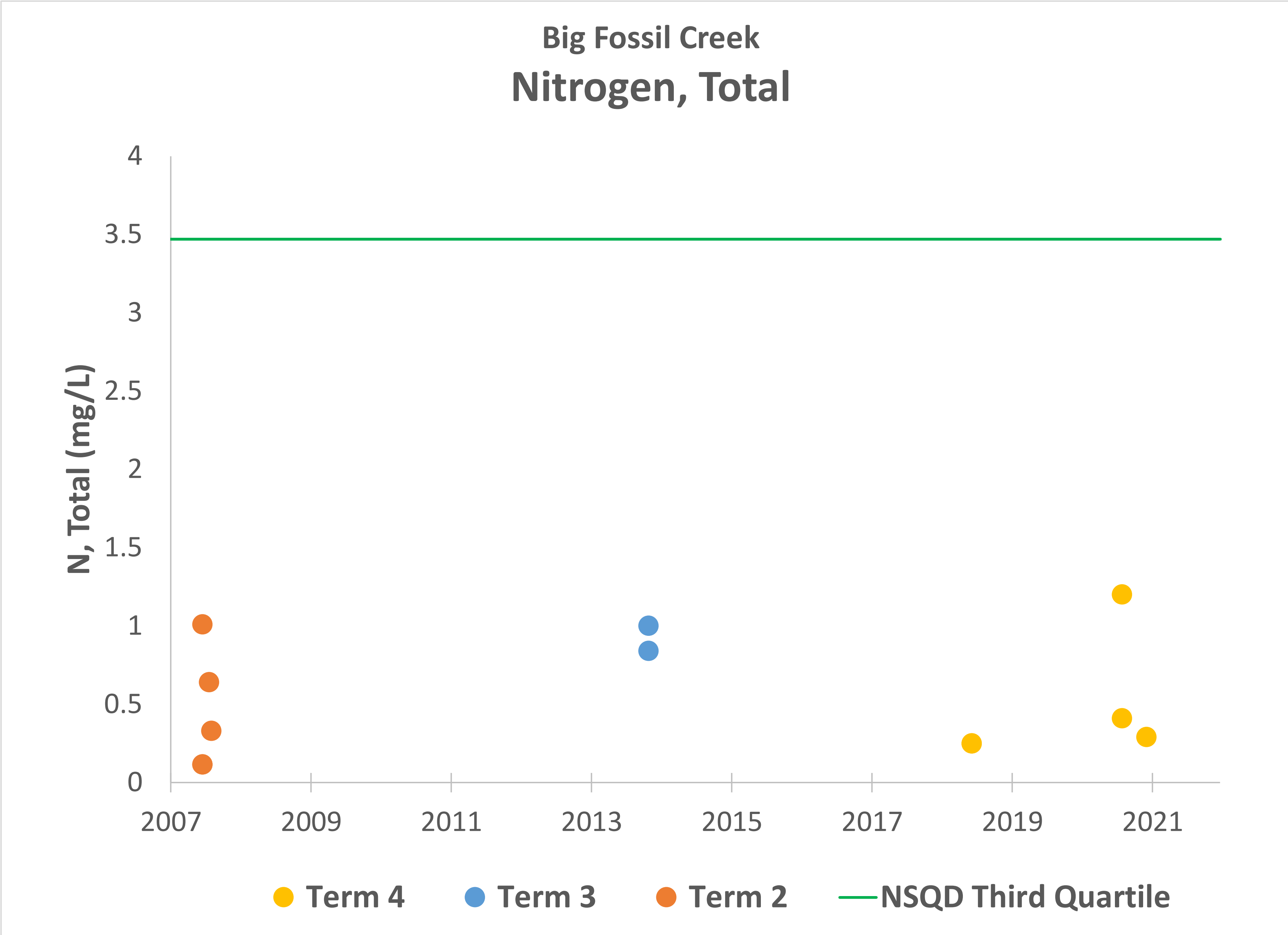
Big Fossil Creek
Biochemical Oxygen Demand
BOD (mg/L)
0
2
4
6
8
10
12
14
16
18
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

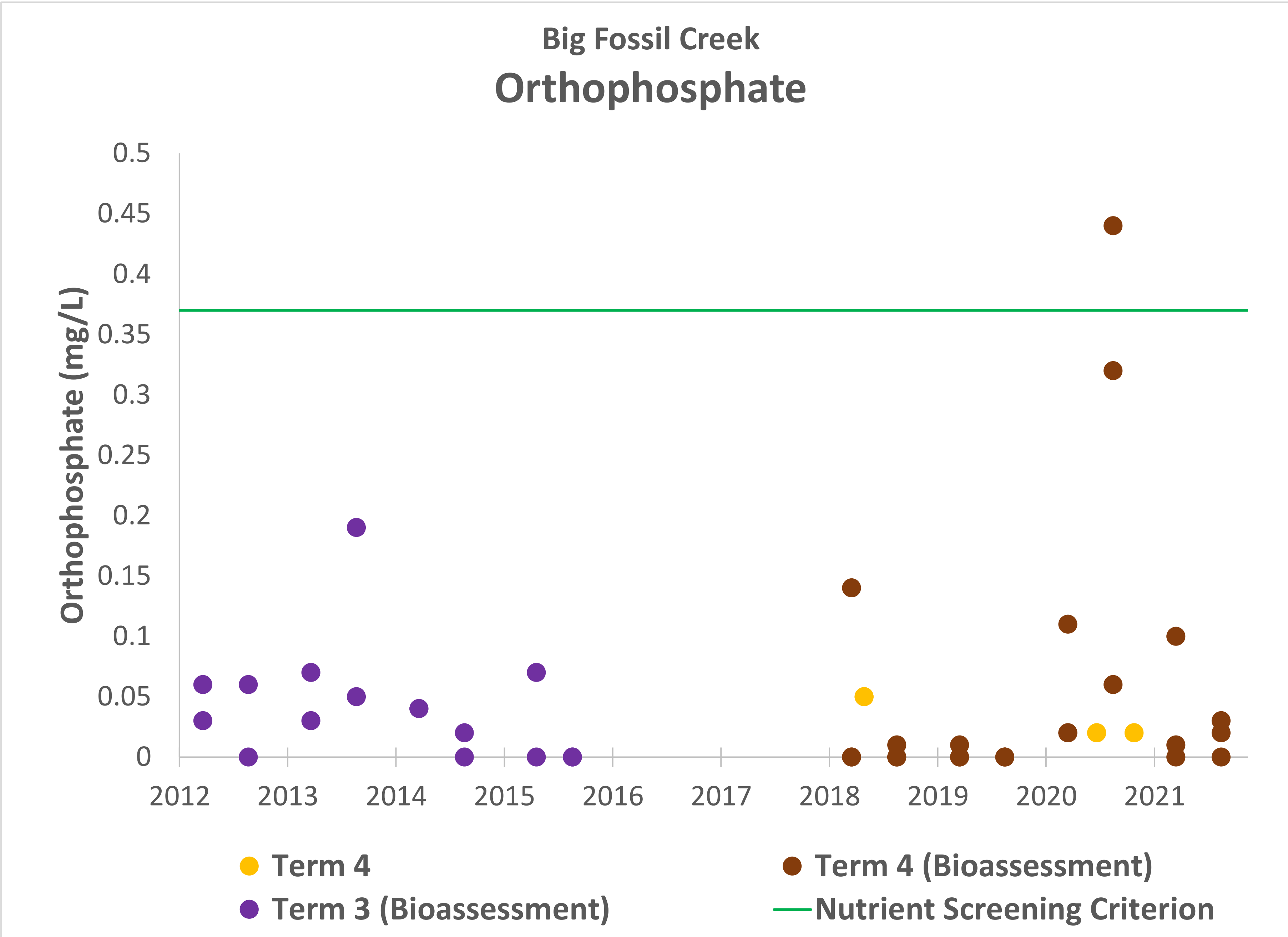

Big Fossil Creek
Nitrate Nitrogen
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion


Big Fossil Creek
Nitrite Nitrogen
N, Nitrite (mg/L)
0.03
0.025
0.02
0.015
0.01
0.005
0
2017
2018
2019
2020
2021
Term 4

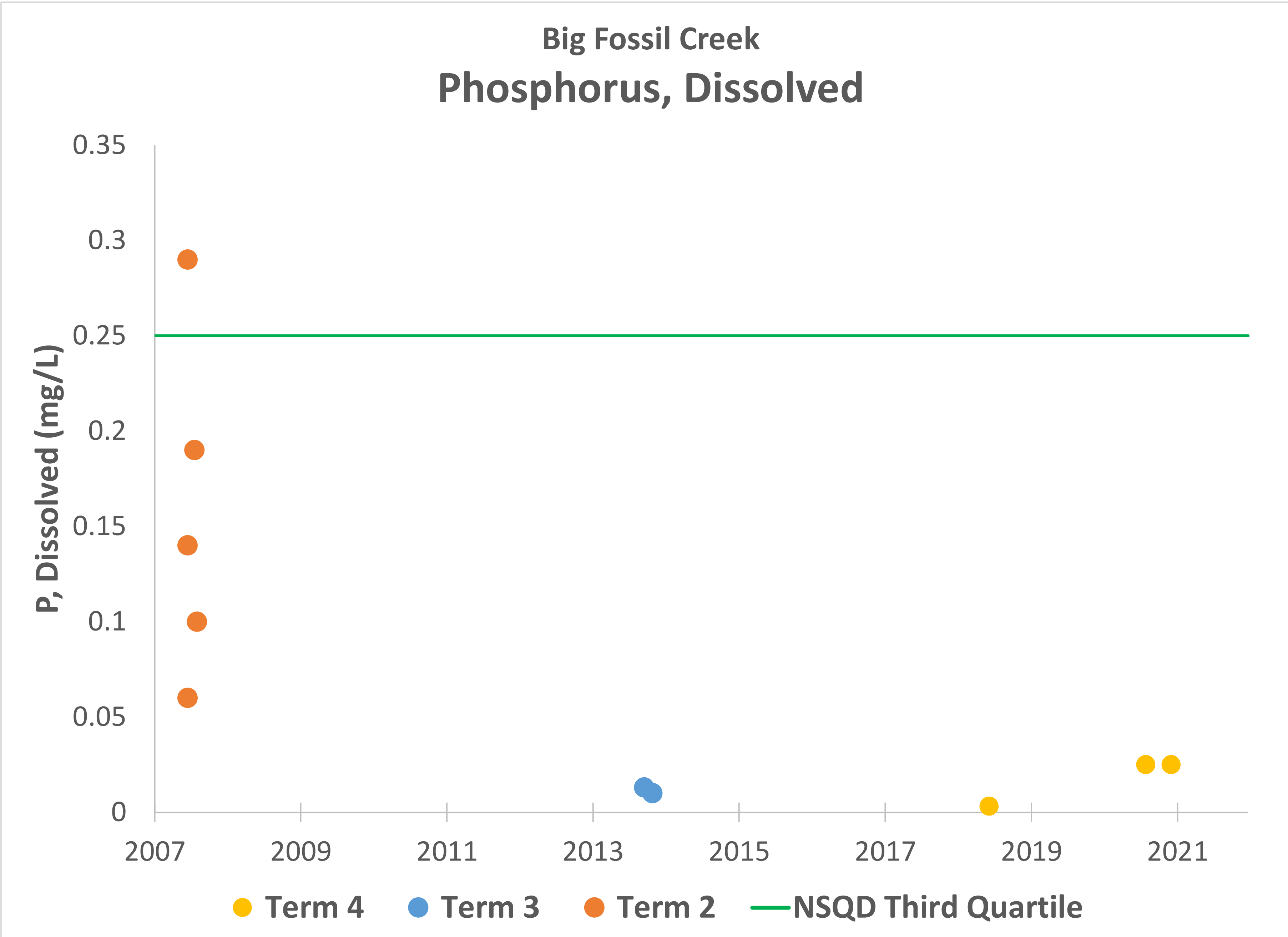


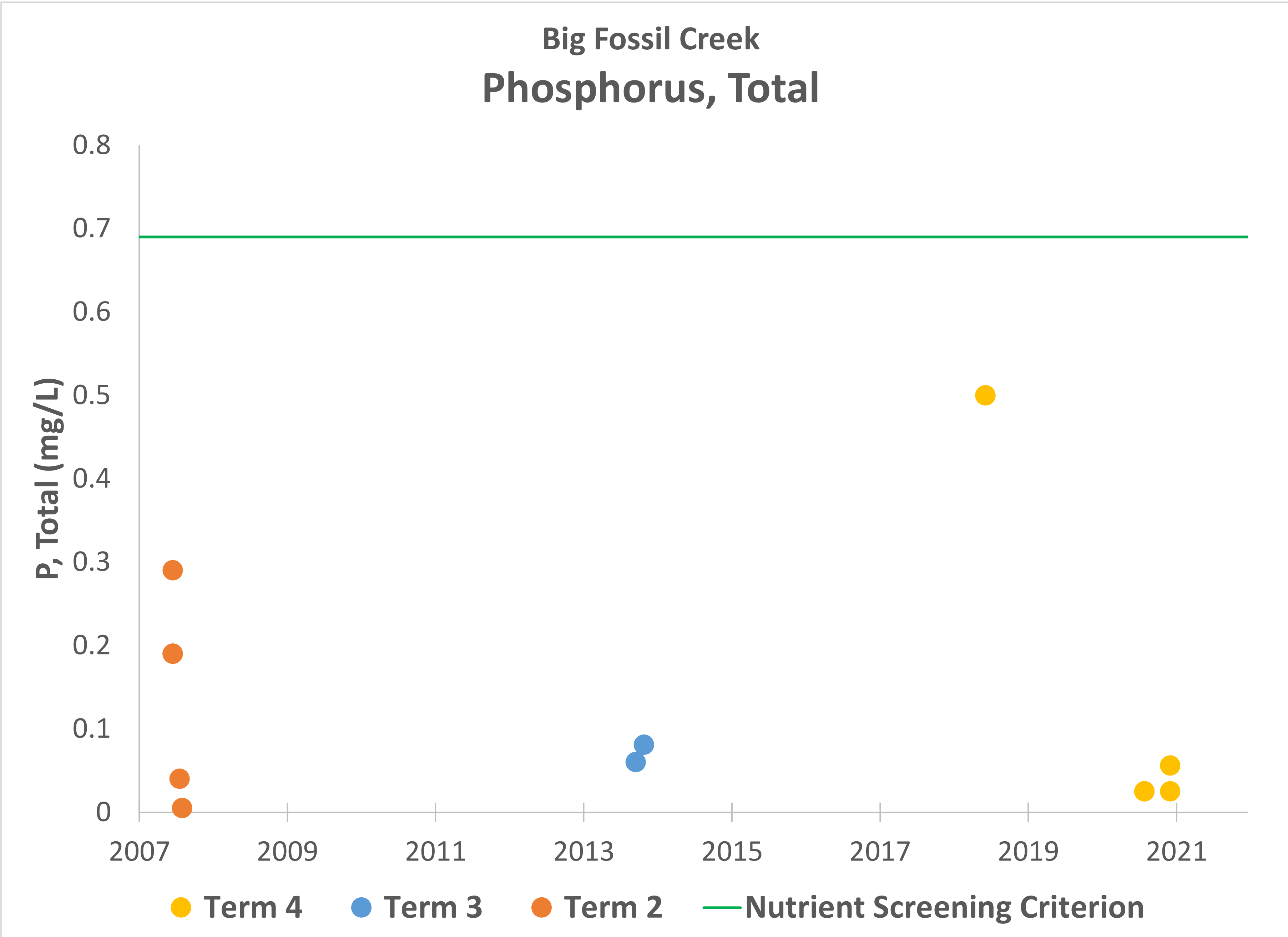
Big Fossil Creek
Ammonia Nitrogen
N, Ammonia (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion


Big Fossil Creek
Nitrogen, Total
N, Total (mg/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

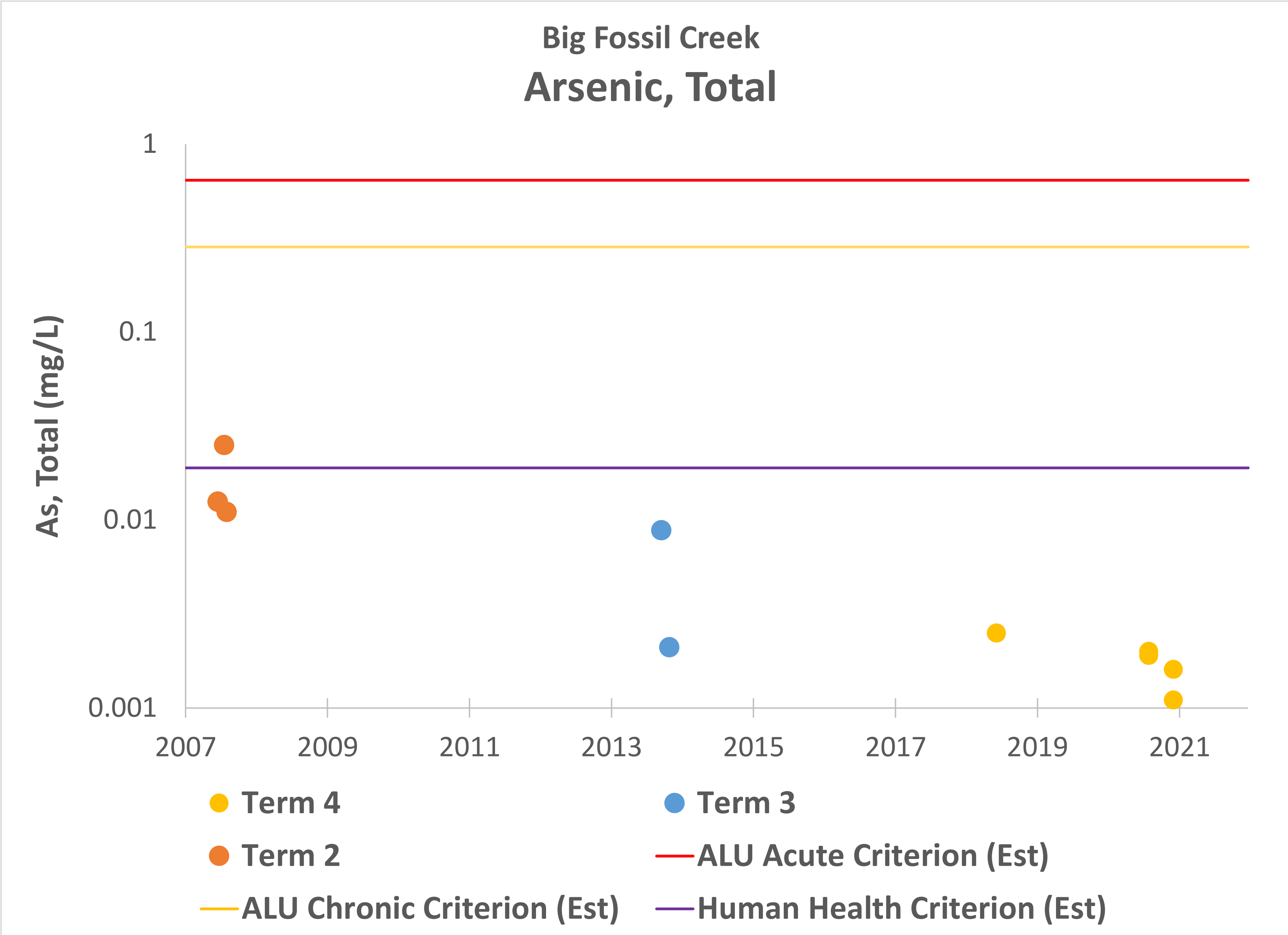


Big Fossil Creek
Orthophosphate
Orthophosphate (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion

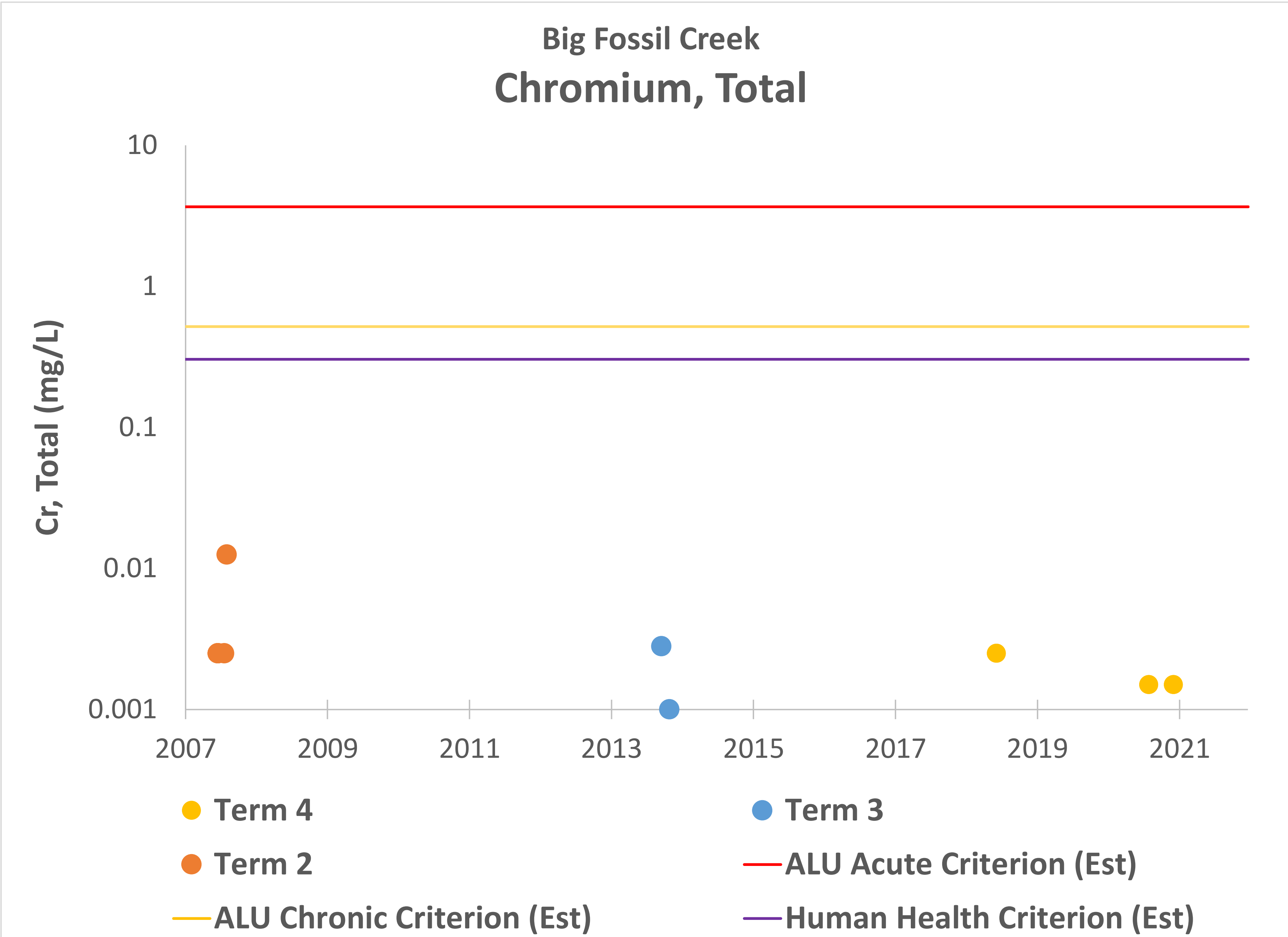

Big Fossil Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

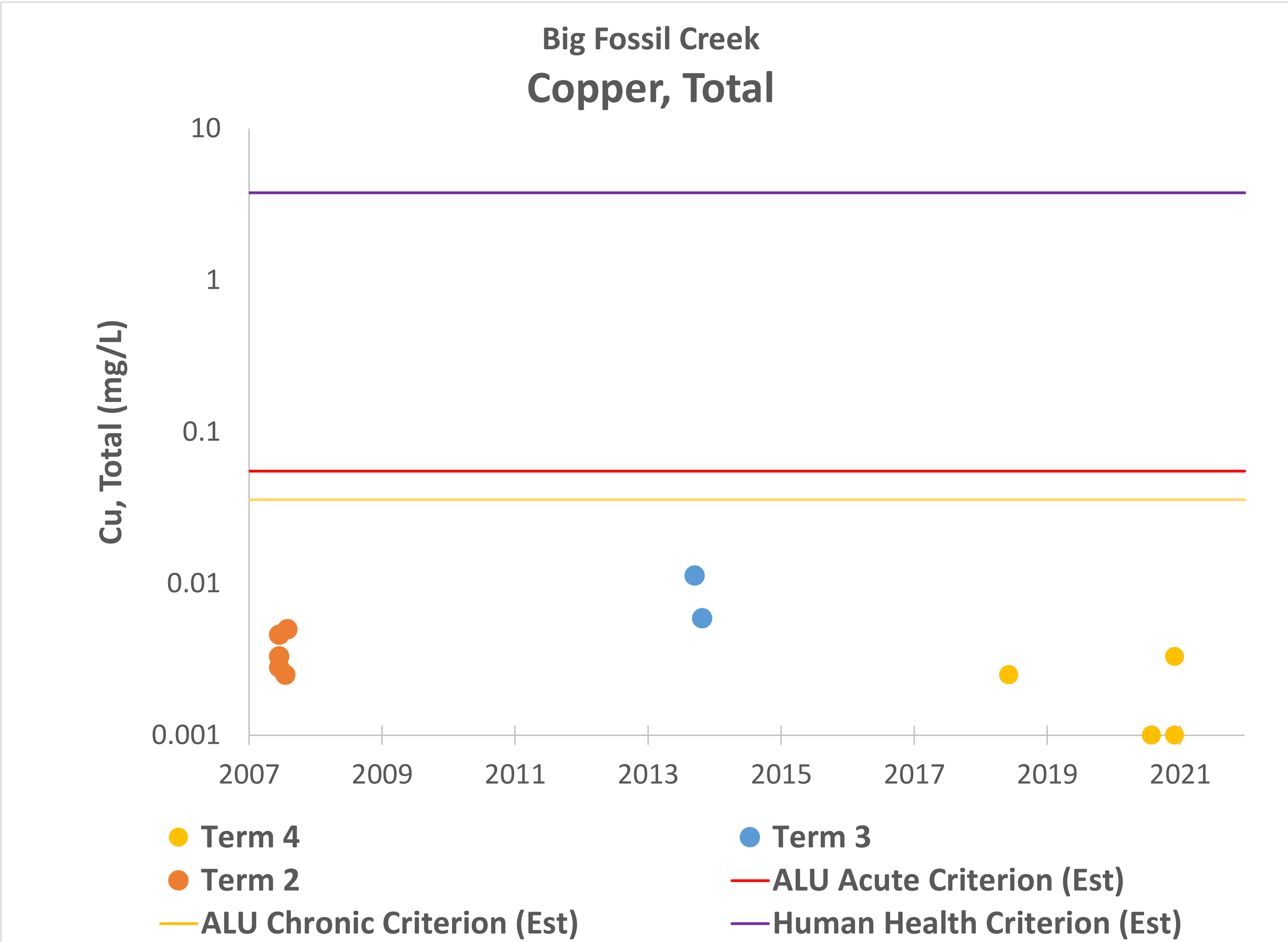


Big Fossil Creek
Phosphorus, Total
P, Total (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
Nutrient Screening Criterion

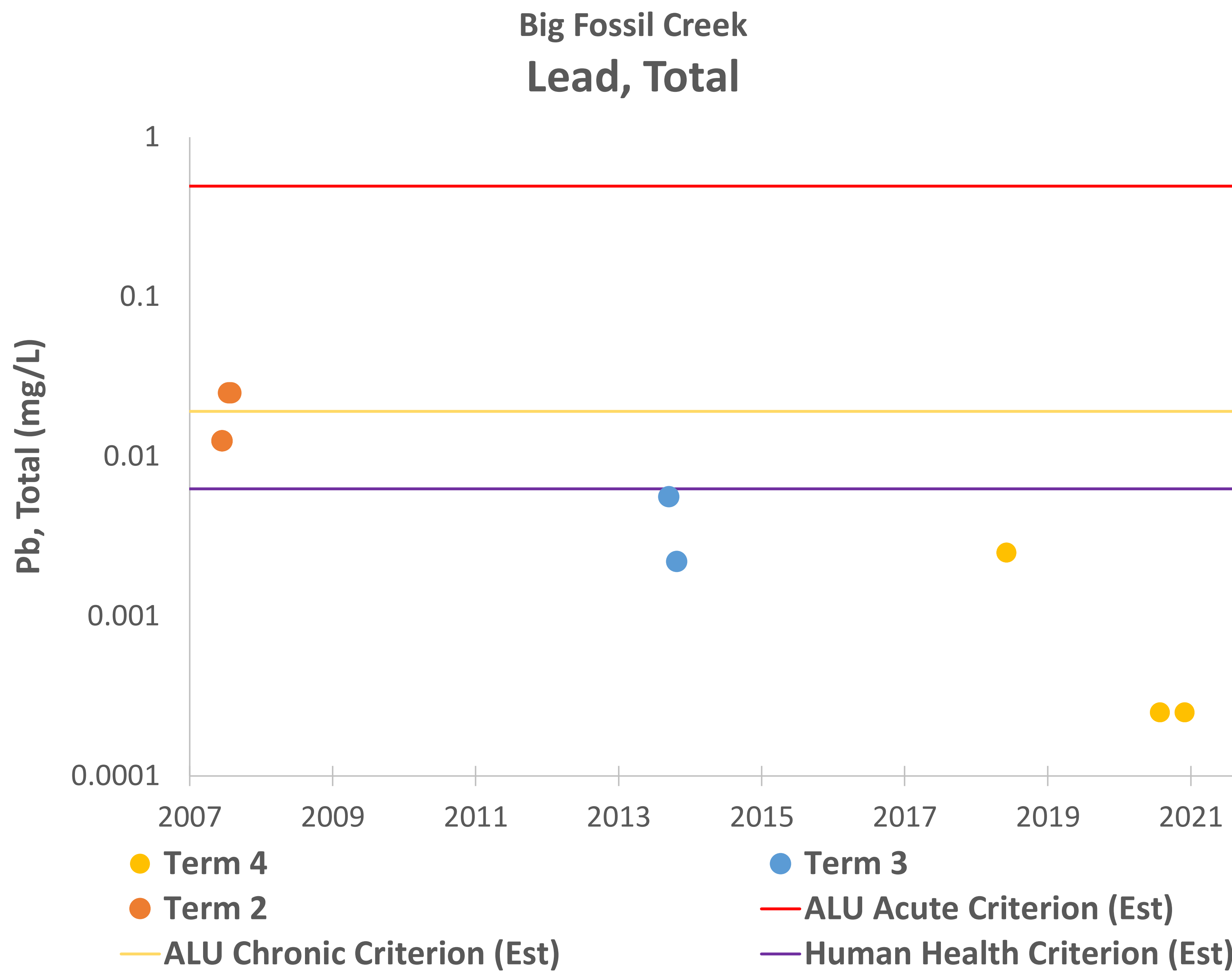


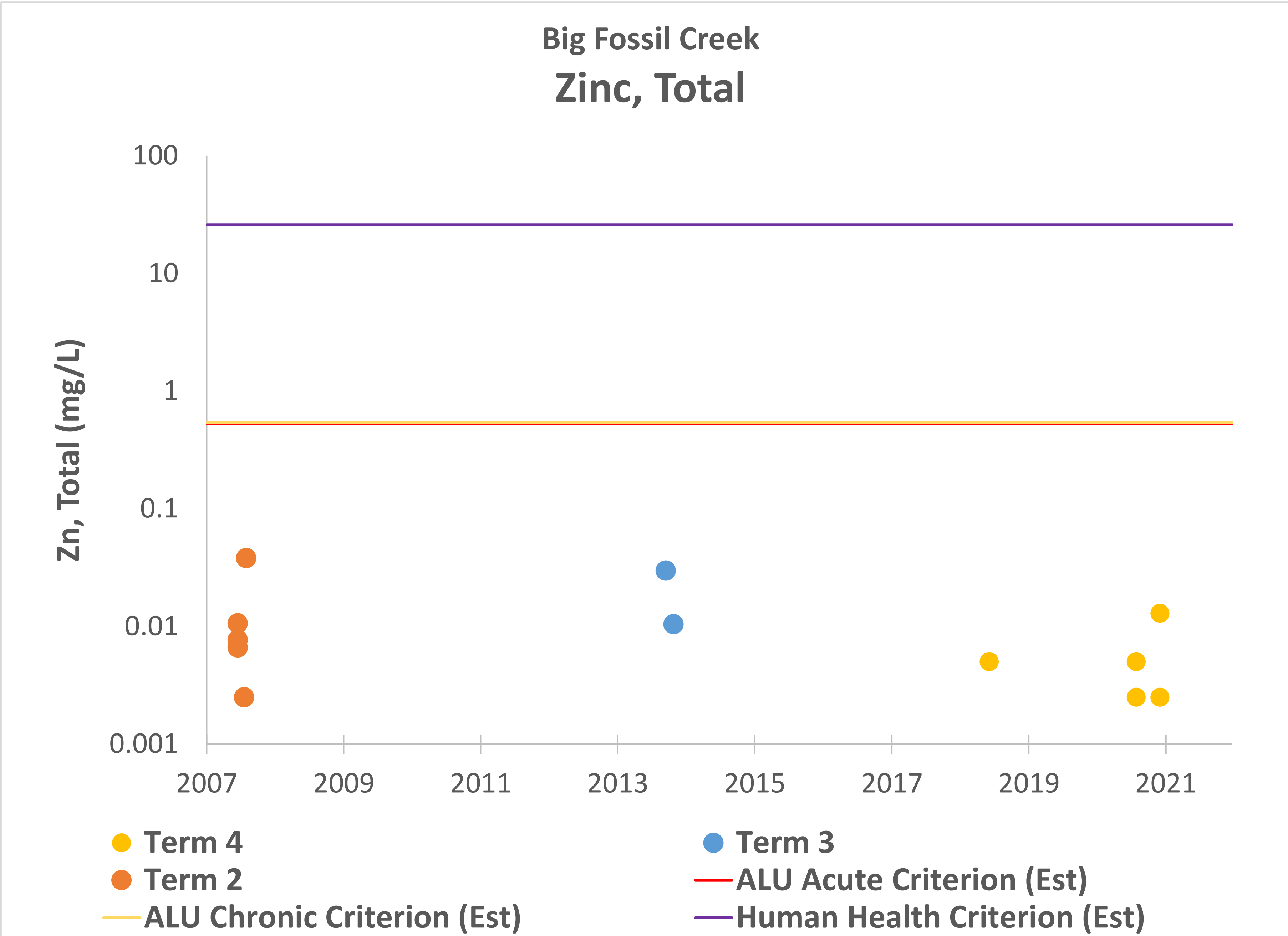
Big Fossil Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)


Big Fossil Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

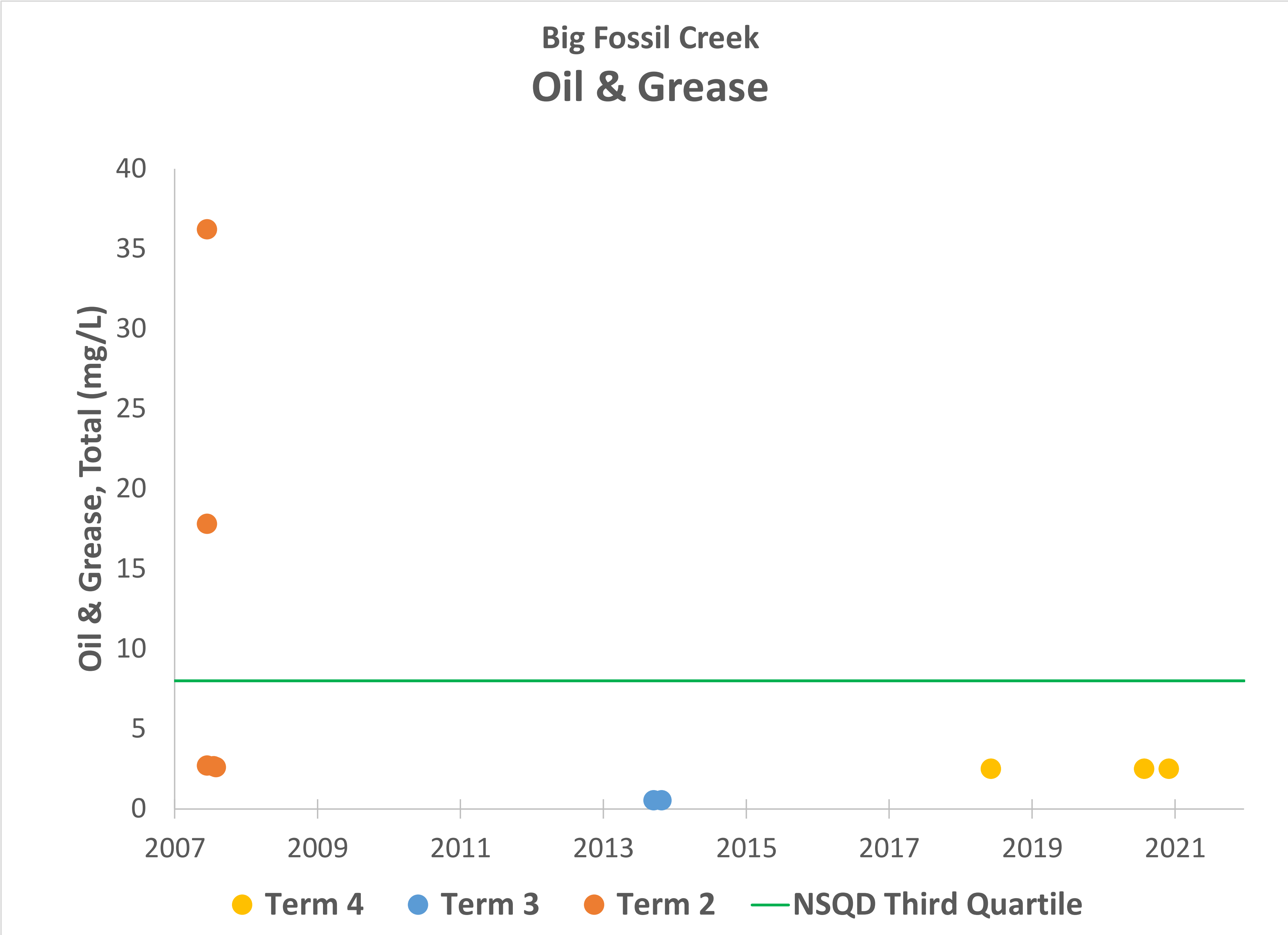


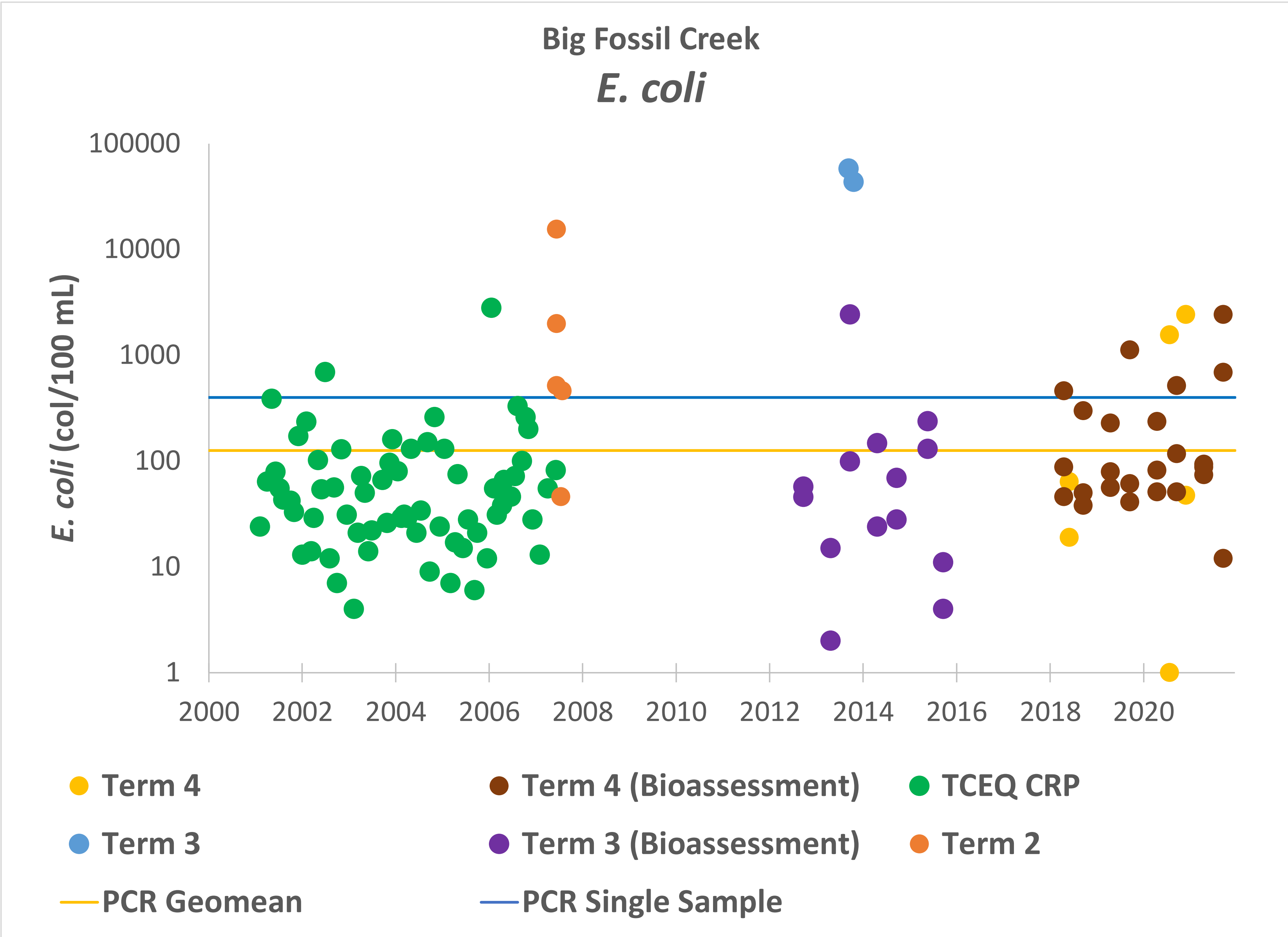
Big Fossil Creek
Copper, Total
Cu, Total (mg/L)
10
1
0.1
0.01
0.001
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)


Big Fossil Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

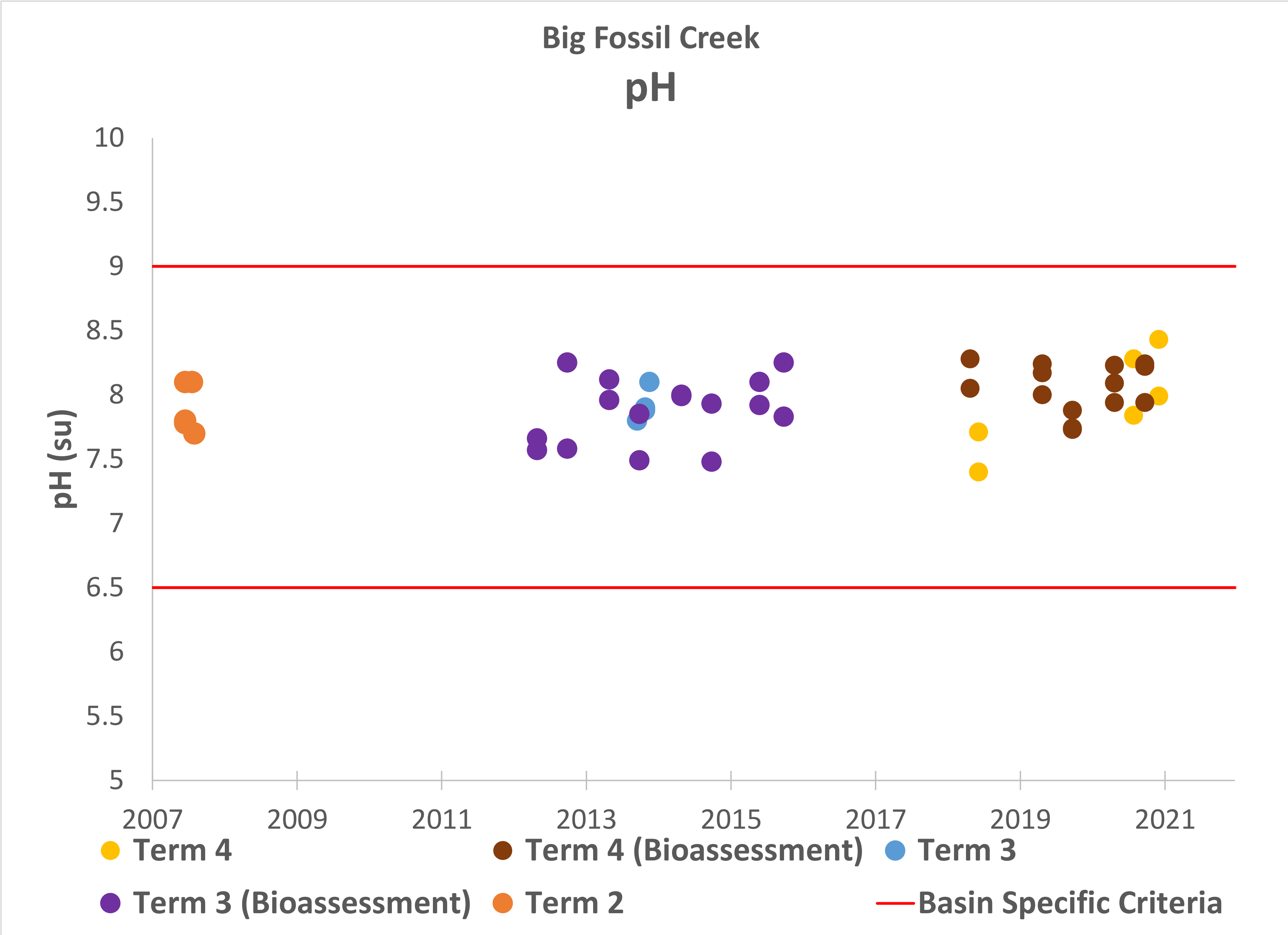


Big Fossil Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

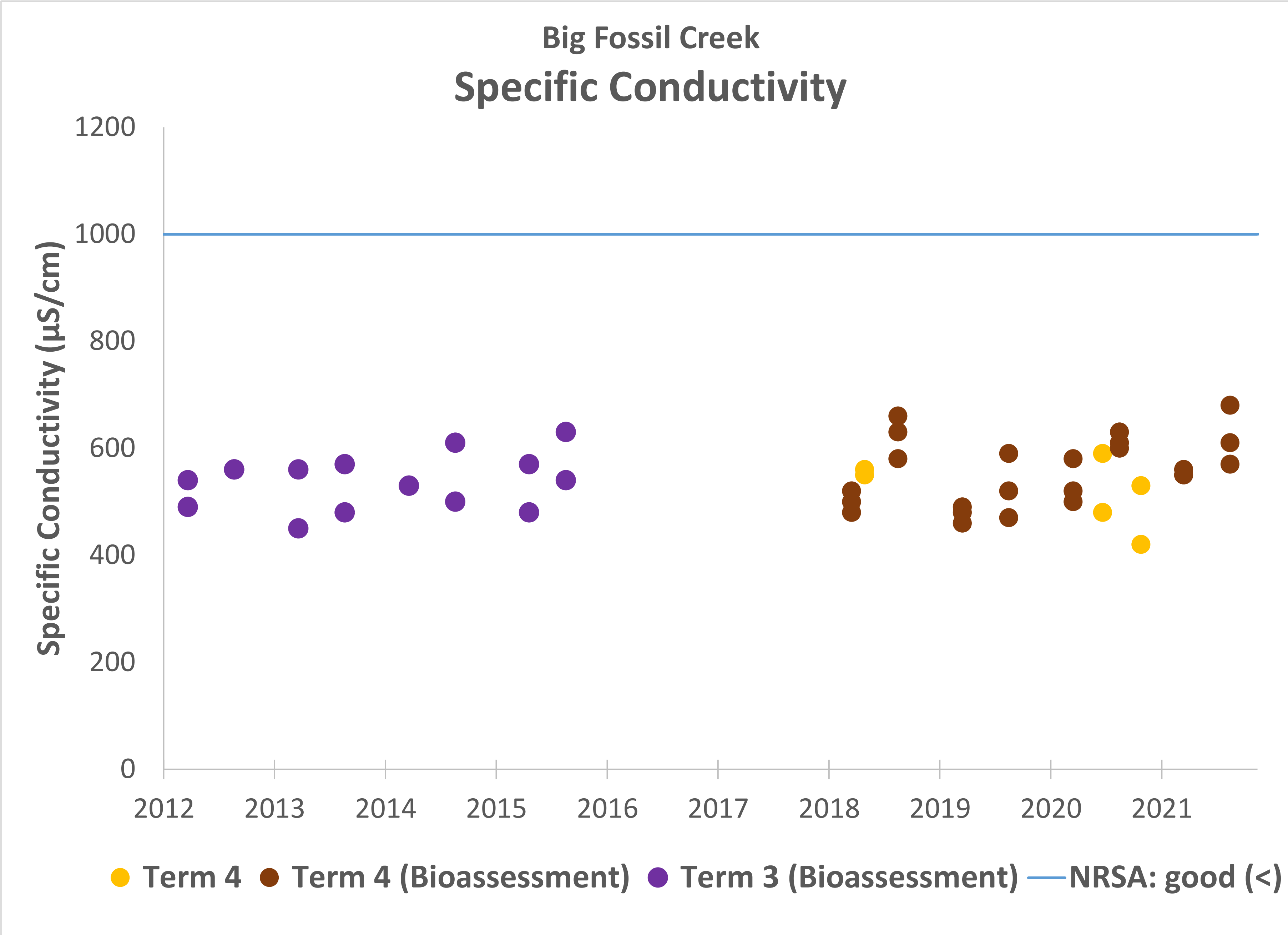

Big Fossil Creek
Oil & Grease
Oil & Grease, Total (mg/L)
0
5
10
15
20
25
30
35
40
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

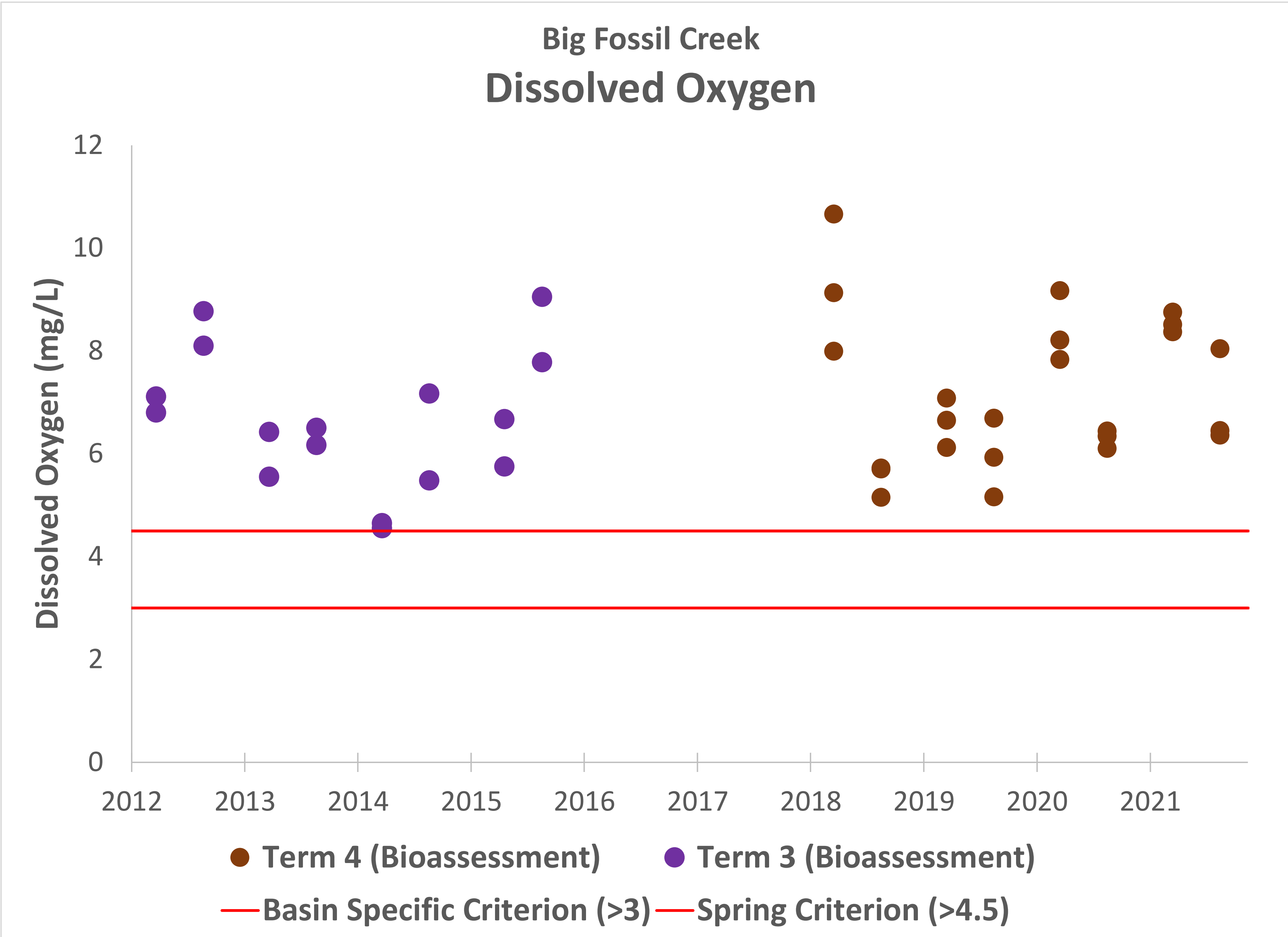


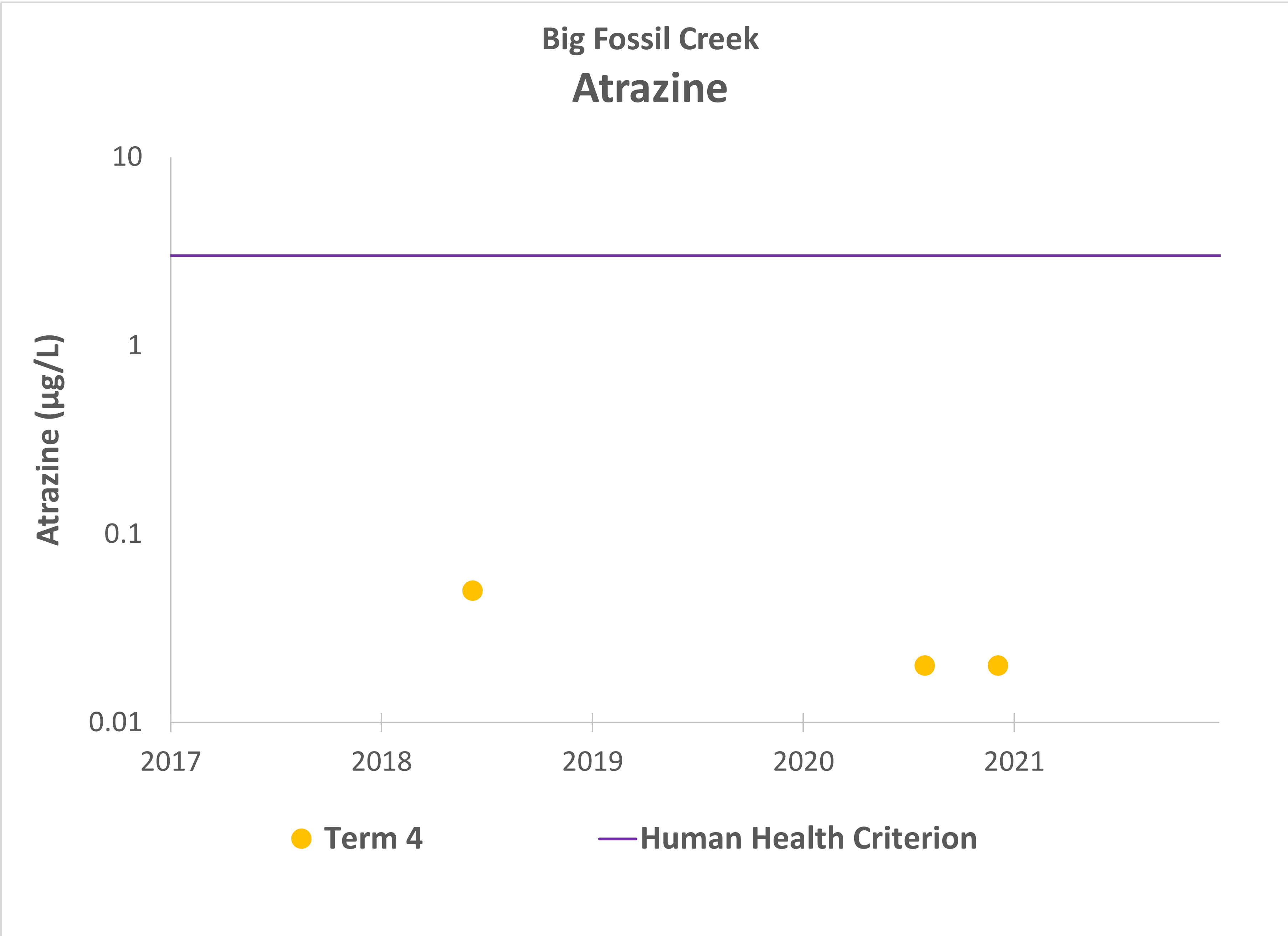
Big Fossil Creek
E. coli
E. coli (col/100 mL)
100000
10000
1000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 4 (Bioassessment)
TCEQ CRP
Term 3
Term 3 (Bioassessment)
Term 2
PCR Geomean
PCR Single Sample



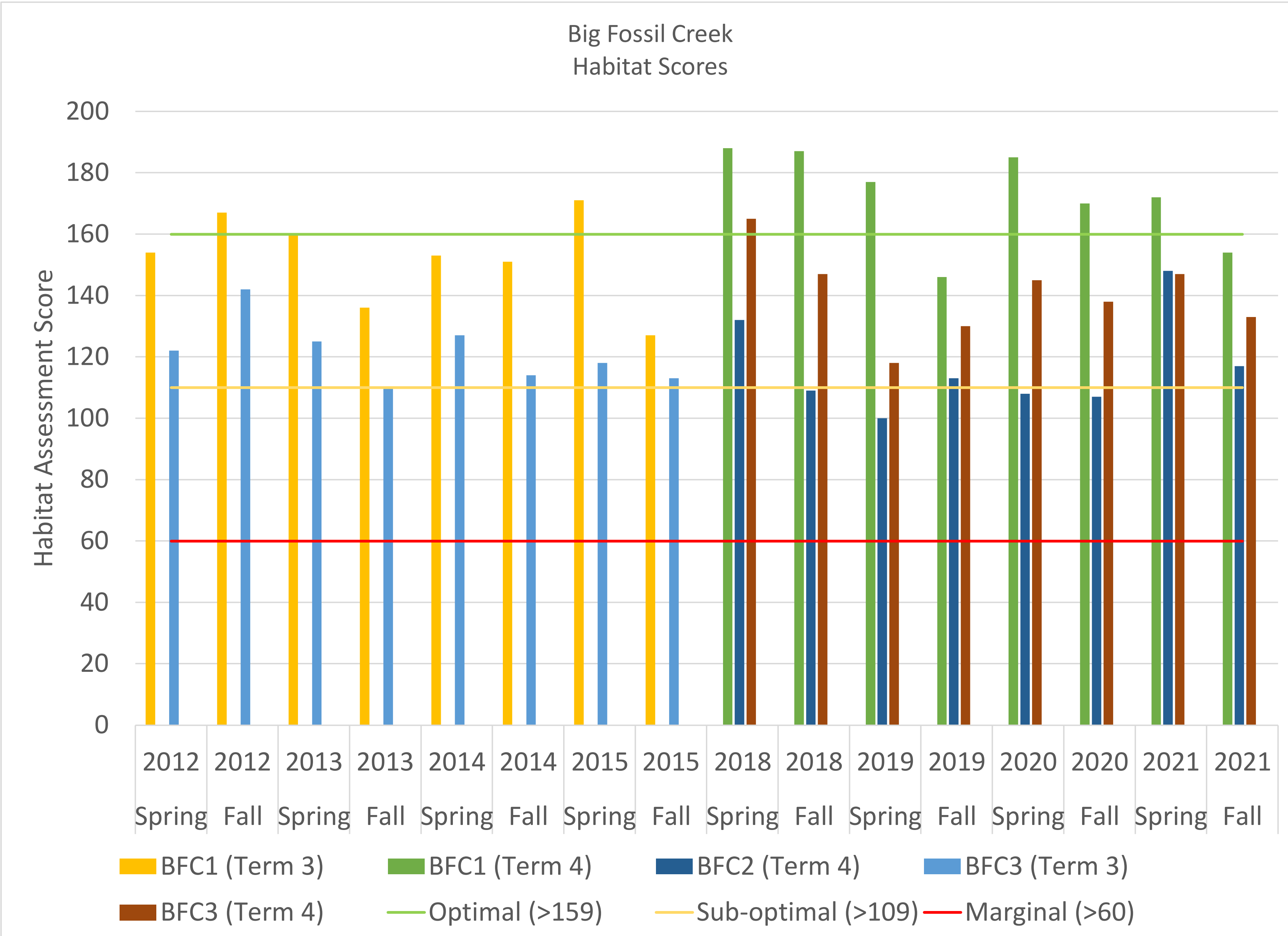
Big Fossil Creek
pH
pH (su)
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 4 (Bioassessment)
Term 3
Term 3 (Bioassessment)
Term 2
Basin Specific Criteria

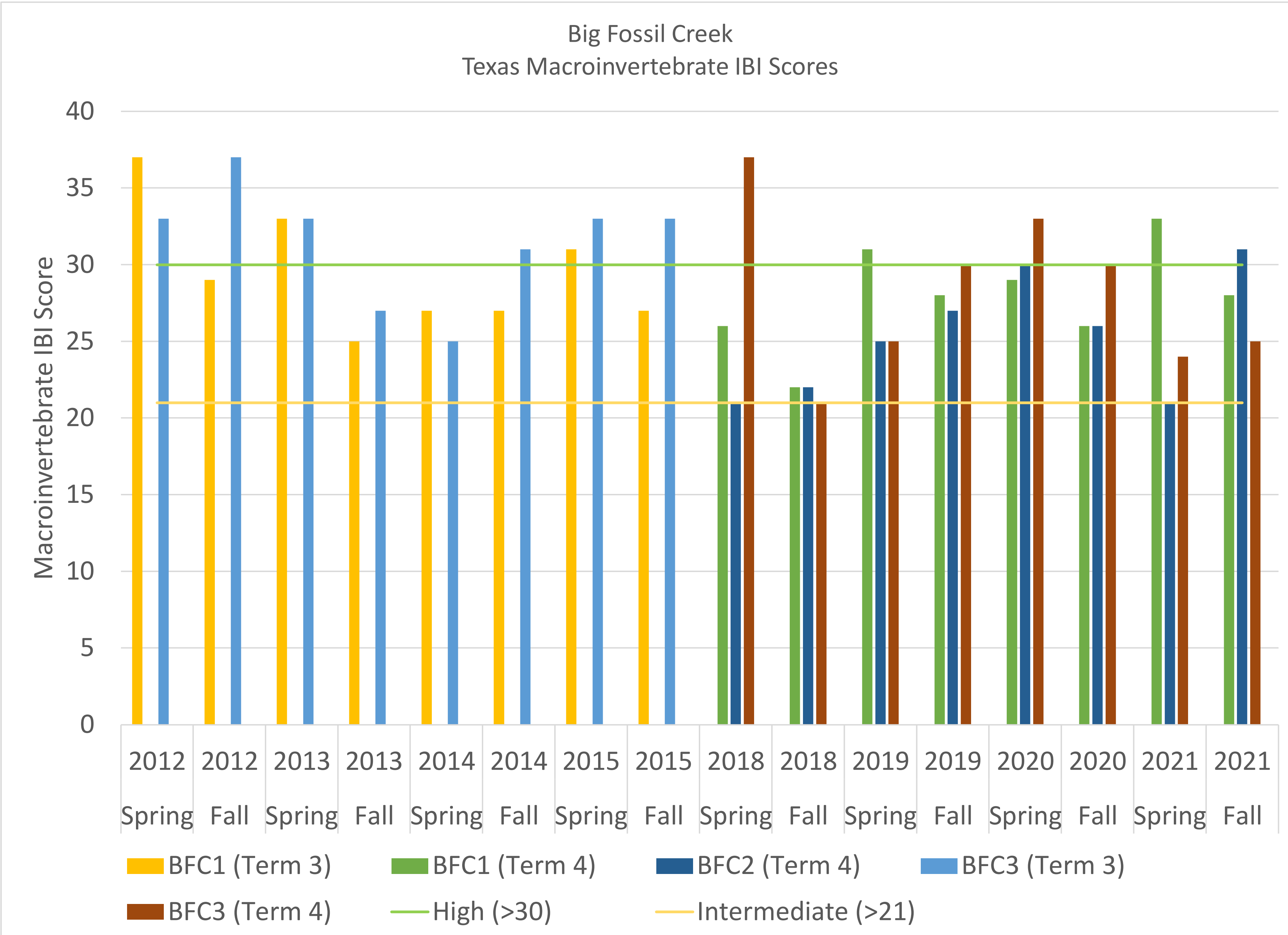

Big Fossil Creek
Specific Conductivity
Specific Conductivity (µS/cm)
1200
1000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
NRSA: good (<)


Big Fossil Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Basin Specific Criterion (>3)
Spring Criterion (>4.5)



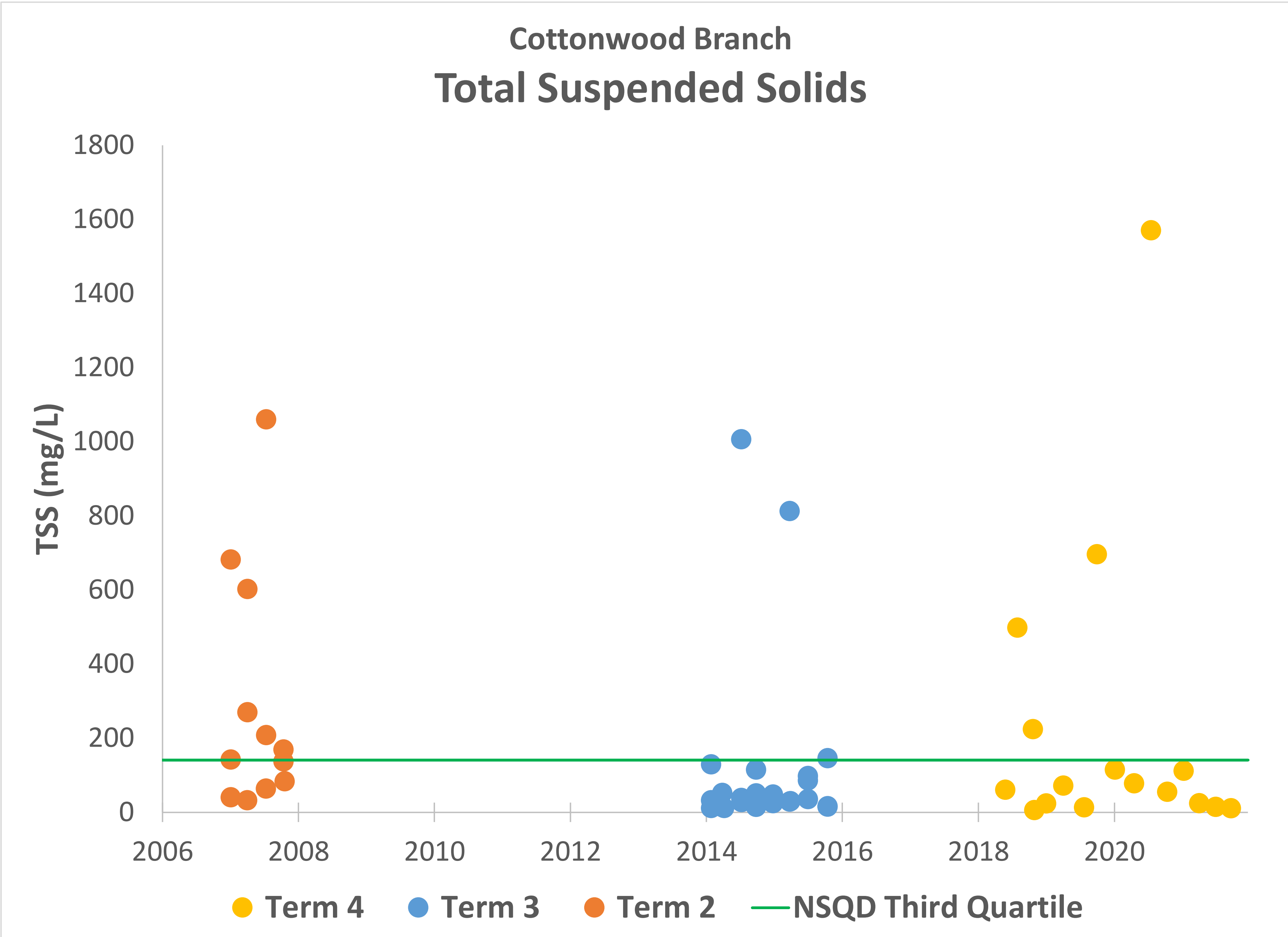
Big Fossil Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
2017
2018
2019
2020
2021
Term 4
Human Health Criterion


Big Fossil Creek
Habitat Scores
Habitat Assessment Score
200
180
160
140
120
100
80
60
40
20
0
2012 Spring
2012 Fall
2013 Spring
2013 Fall
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
BFC1 (Term 3)
BFC1 (Term 4)
BFC2 (Term 4)
BFC3 (Term 3)
BFC3 (Term 4)
Optimal (>159)
Sub-optimal (>109)
Marginal (>60)

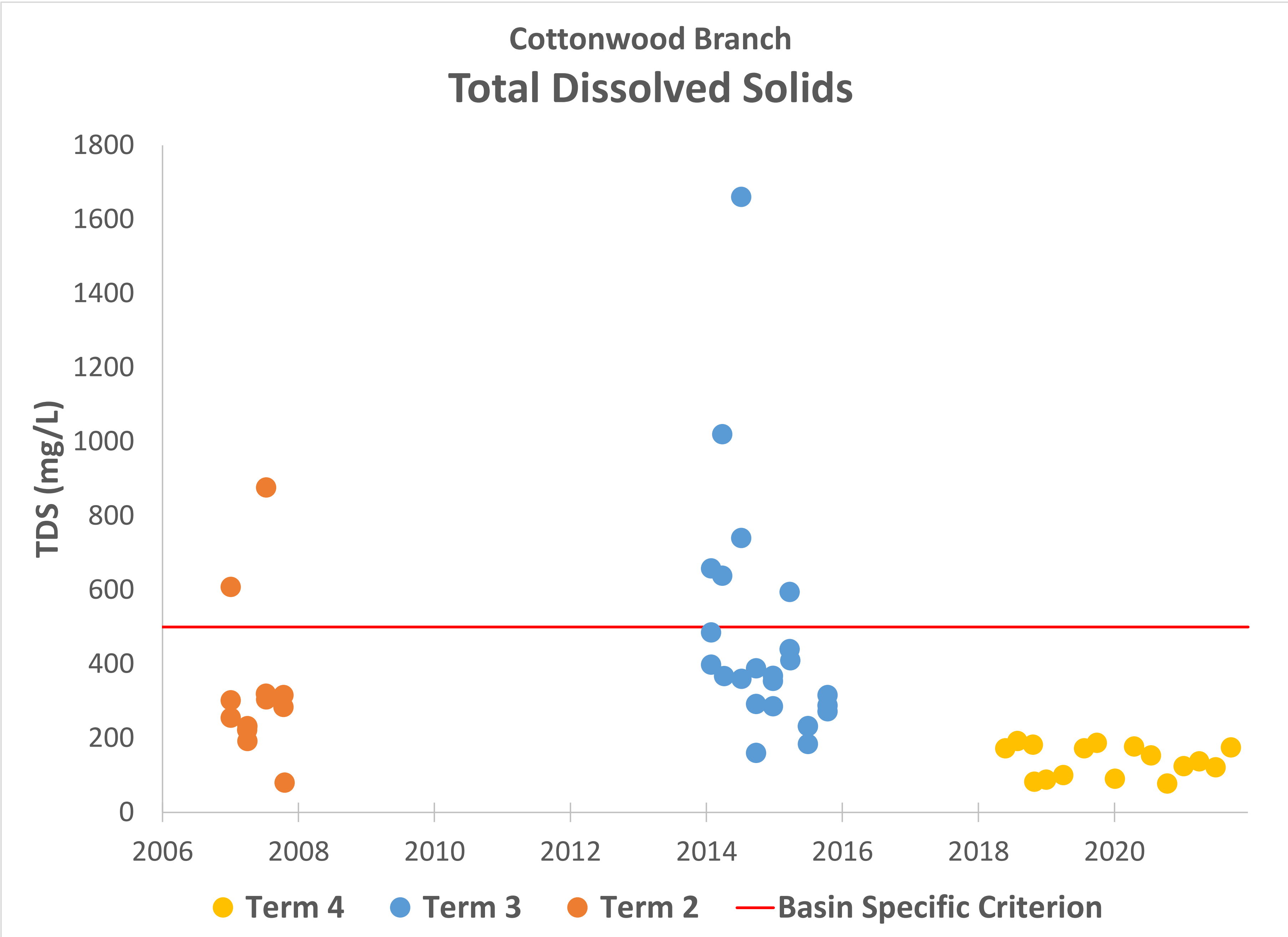

Big Fossil Creek
Texas Macroinvertebrate IBI Scores
Macroinvertebrate IBI Score
40
35
30
25
20
15
10
5
0
2012 Spring
2012 Fall
2013 Spring
2013 Fall
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
BFC1 (Term 3)
BFC1 (Term 4)
BFC2 (Term 4)
BFC3 (Term 3)
BFC3 (Term 4)
High (>30)
Intermediate (>21)

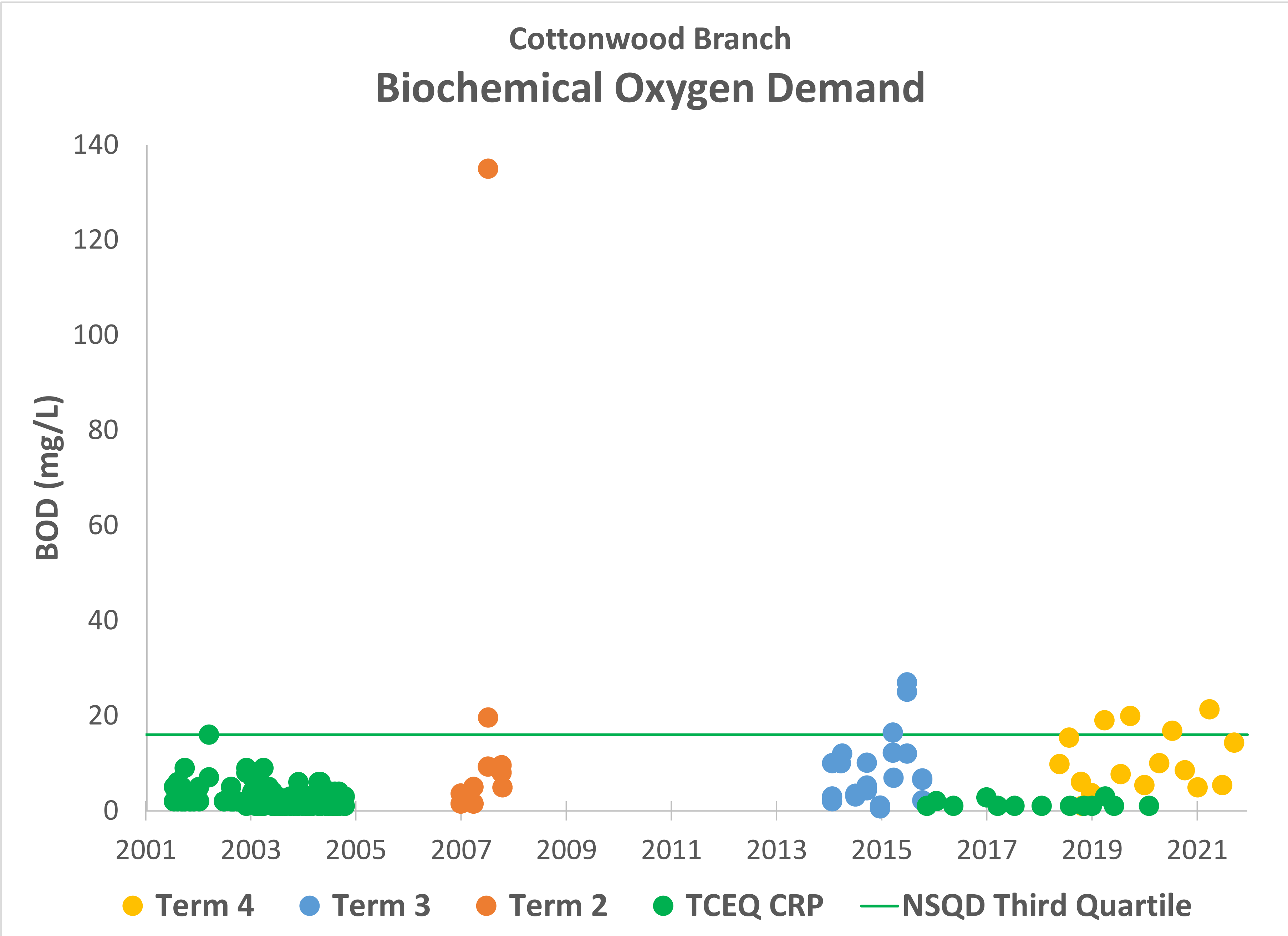
Appendix E

Cottonwood Branch Water Quality Data Graphs

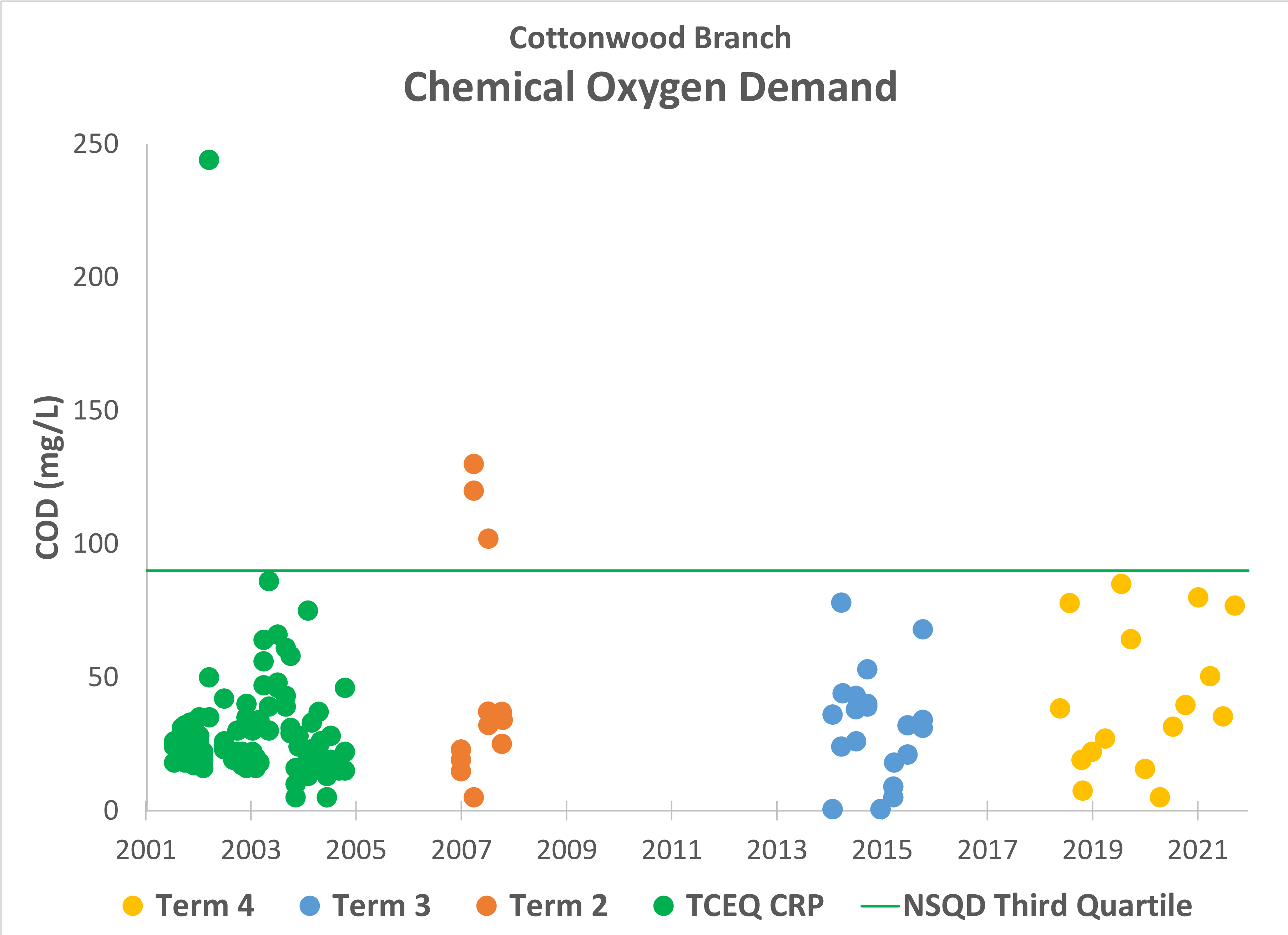


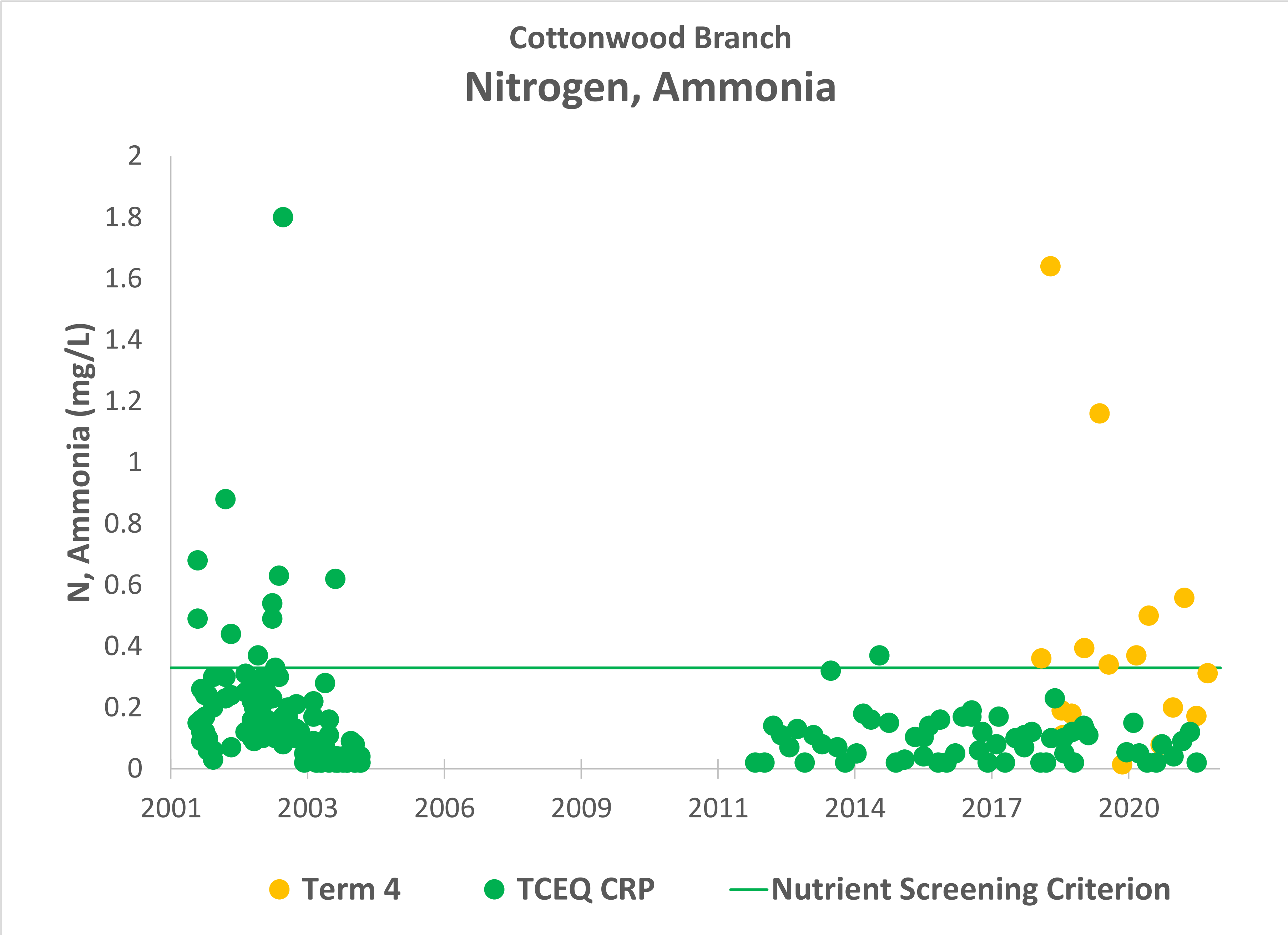
Cottonwood Branch
Total Suspended Solids
TSS (mg/L)
1800
1600
1400
1200
1000
800
600
400
200
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile


Cottonwood Branch
Total Dissolved Solids
TDS (mg/L)
1800
1600
1400
1200
1000
800
600
400
200
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
Basin Specific Criterion

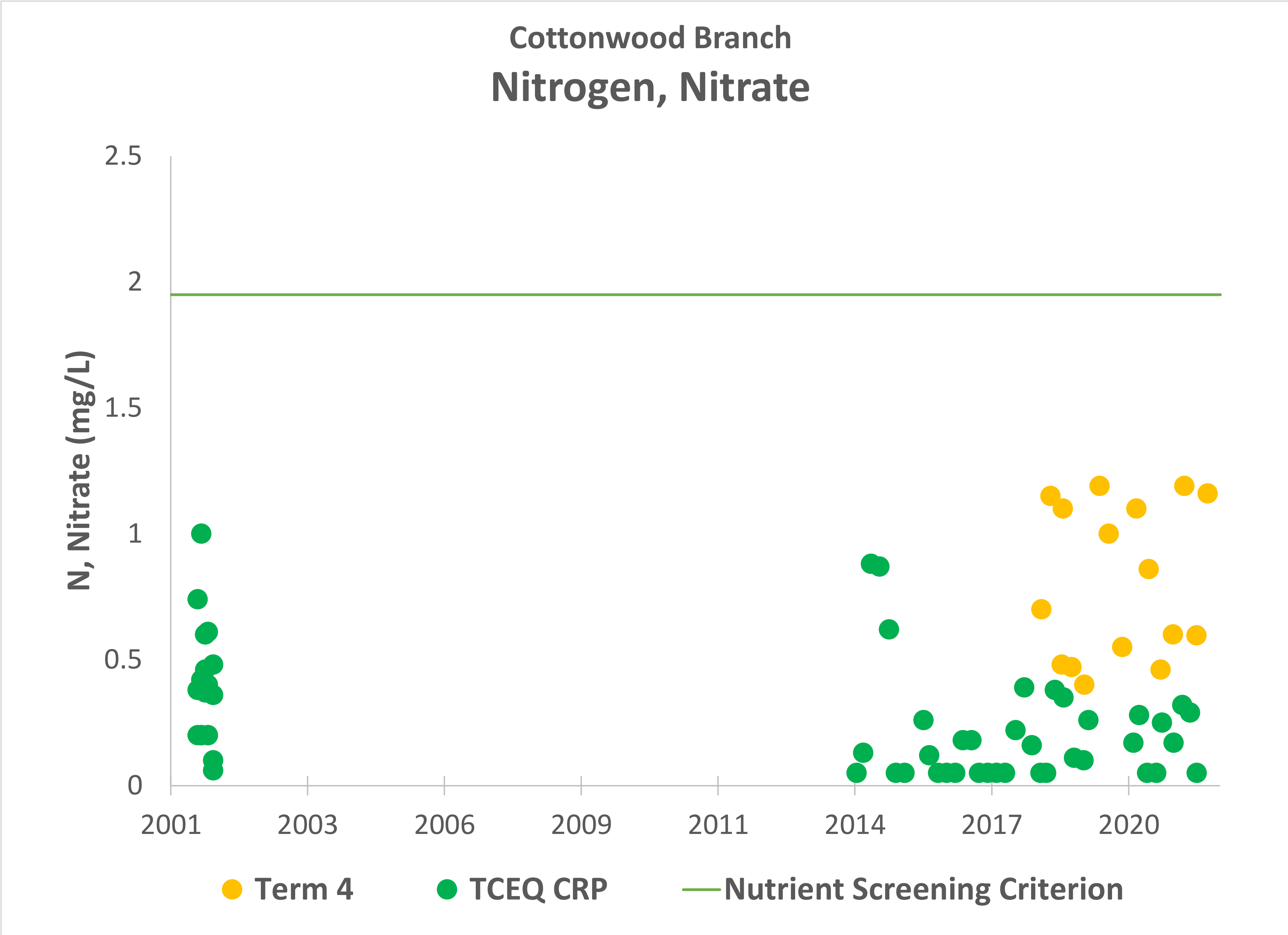


Cottonwood Branch
Biochemical Oxygen Demand
BOD (mg/L)
140
120
100
80
60
40
20
0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
NSQD Third Quartile

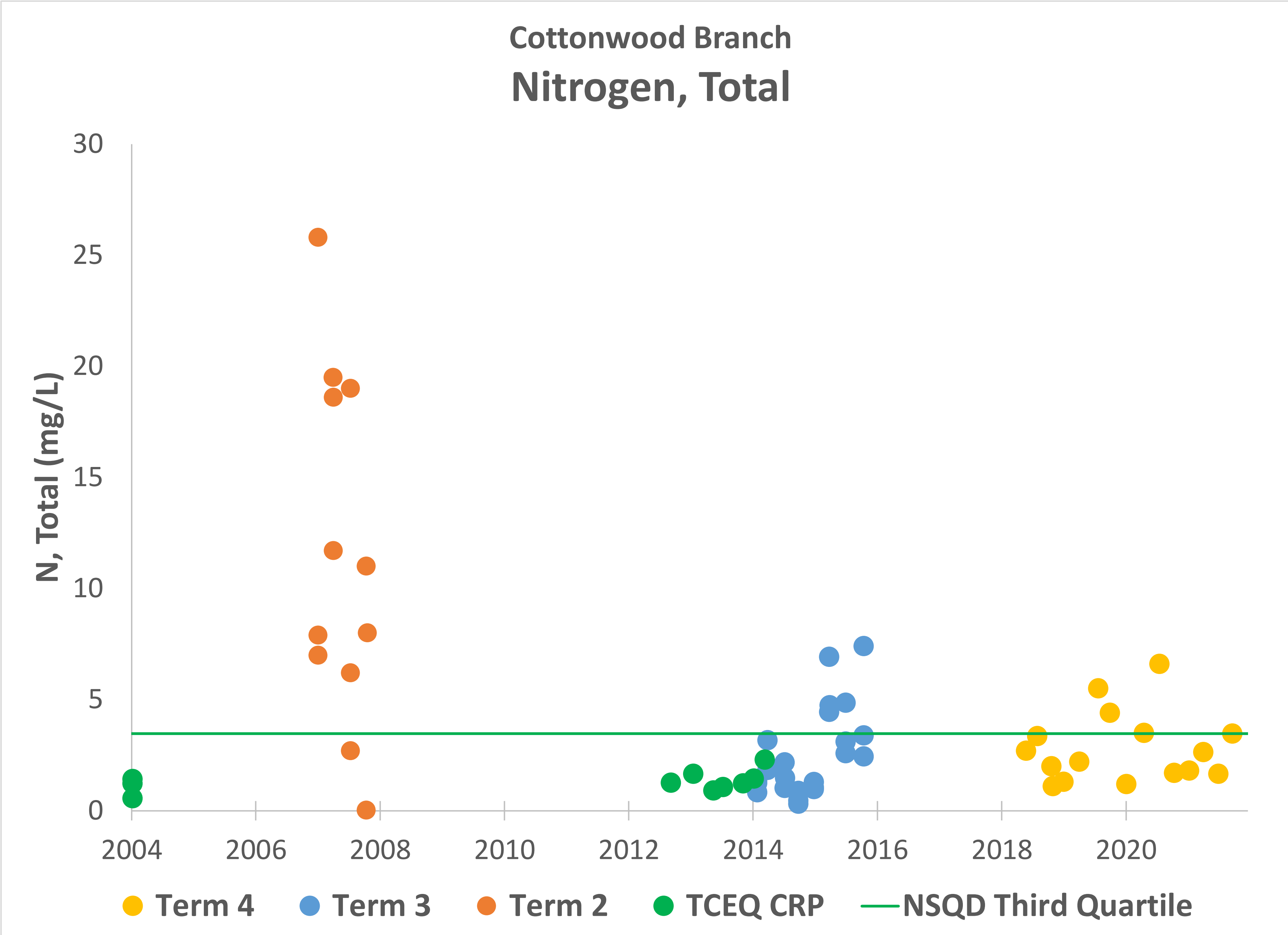

Cottonwood Branch
Chemical Oxygen Demand
COD (mg/L)
250
200
150
100
50
0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
NSQD Third Quartile



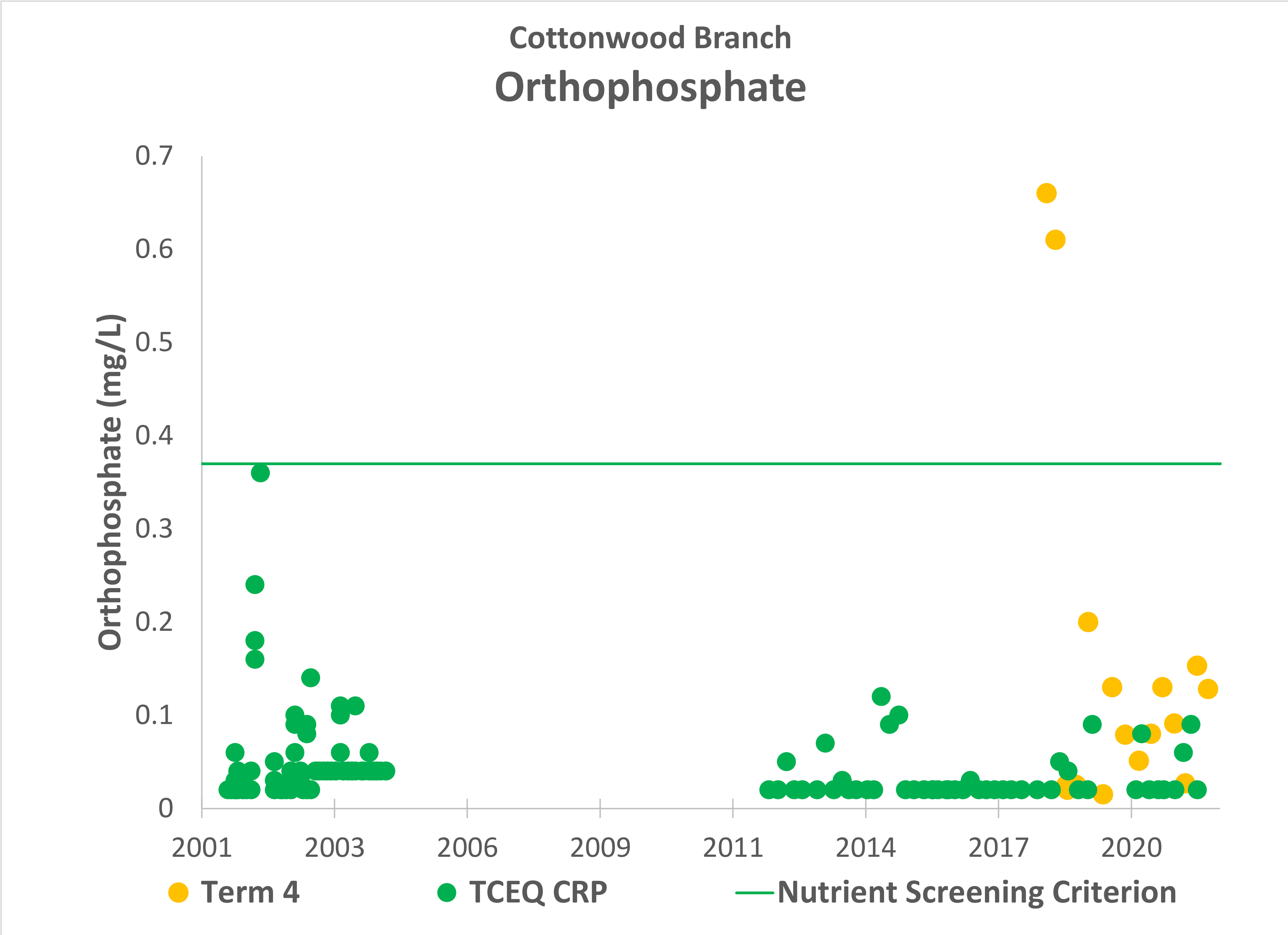
Cottonwood Branch
Nitrogen, Ammonia
N, Ammonia (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion



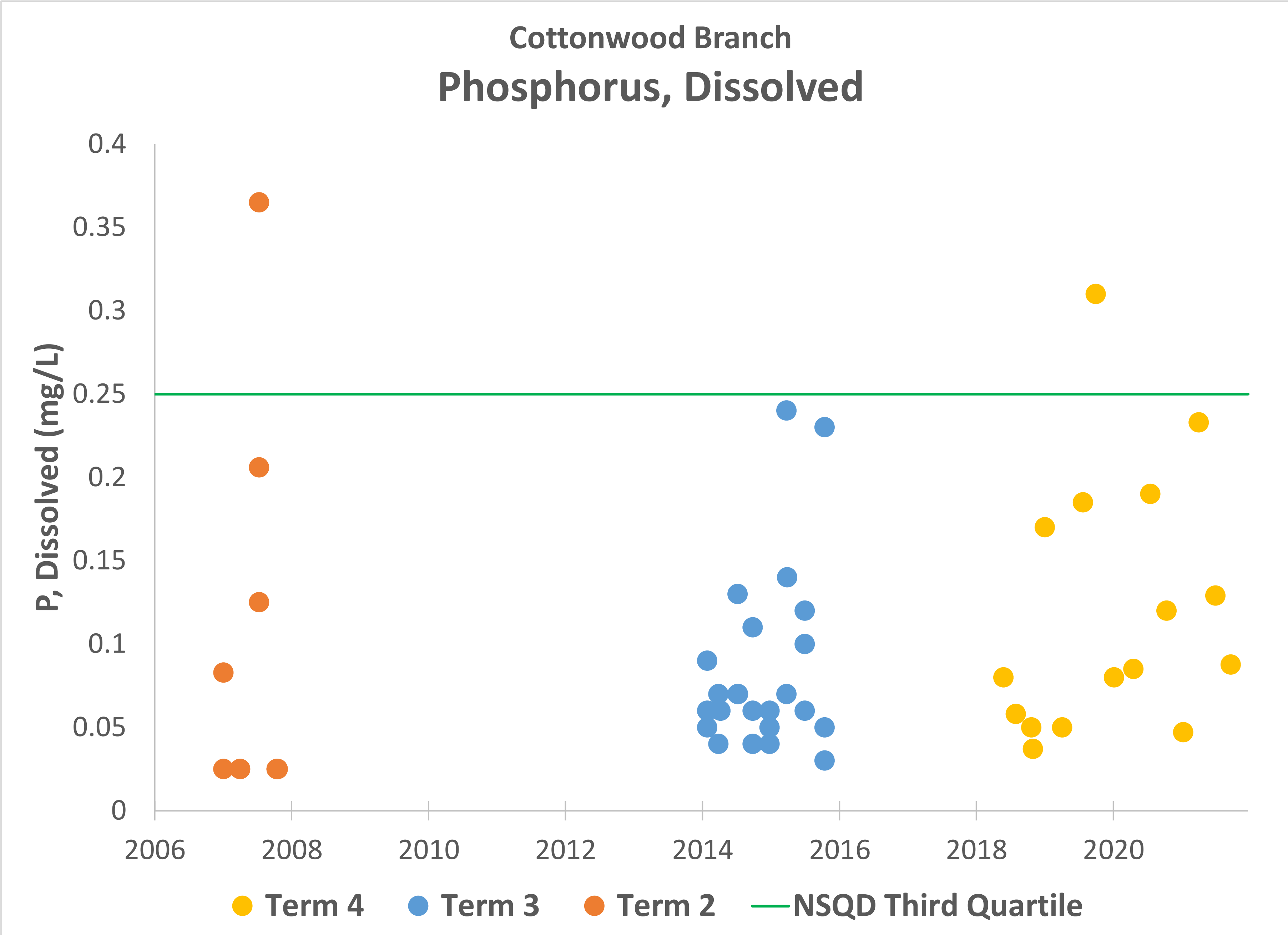
Cottonwood Branch
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion



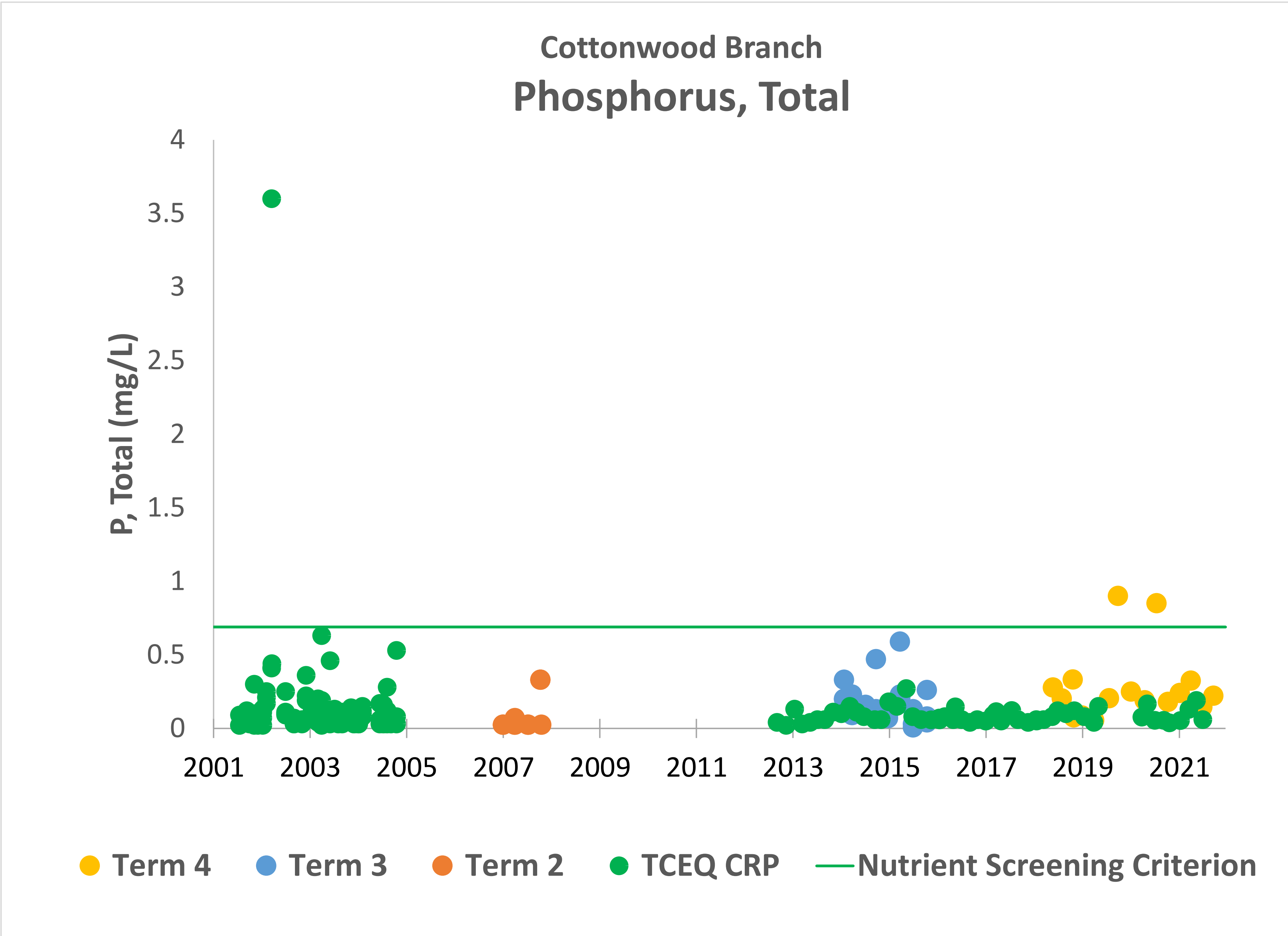
Cottonwood Branch
Nitrogen, Total
N, Total (mg/L)
0
5
10
15
20
25
30
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
TCEQ CRP
NSQD Third Quartile



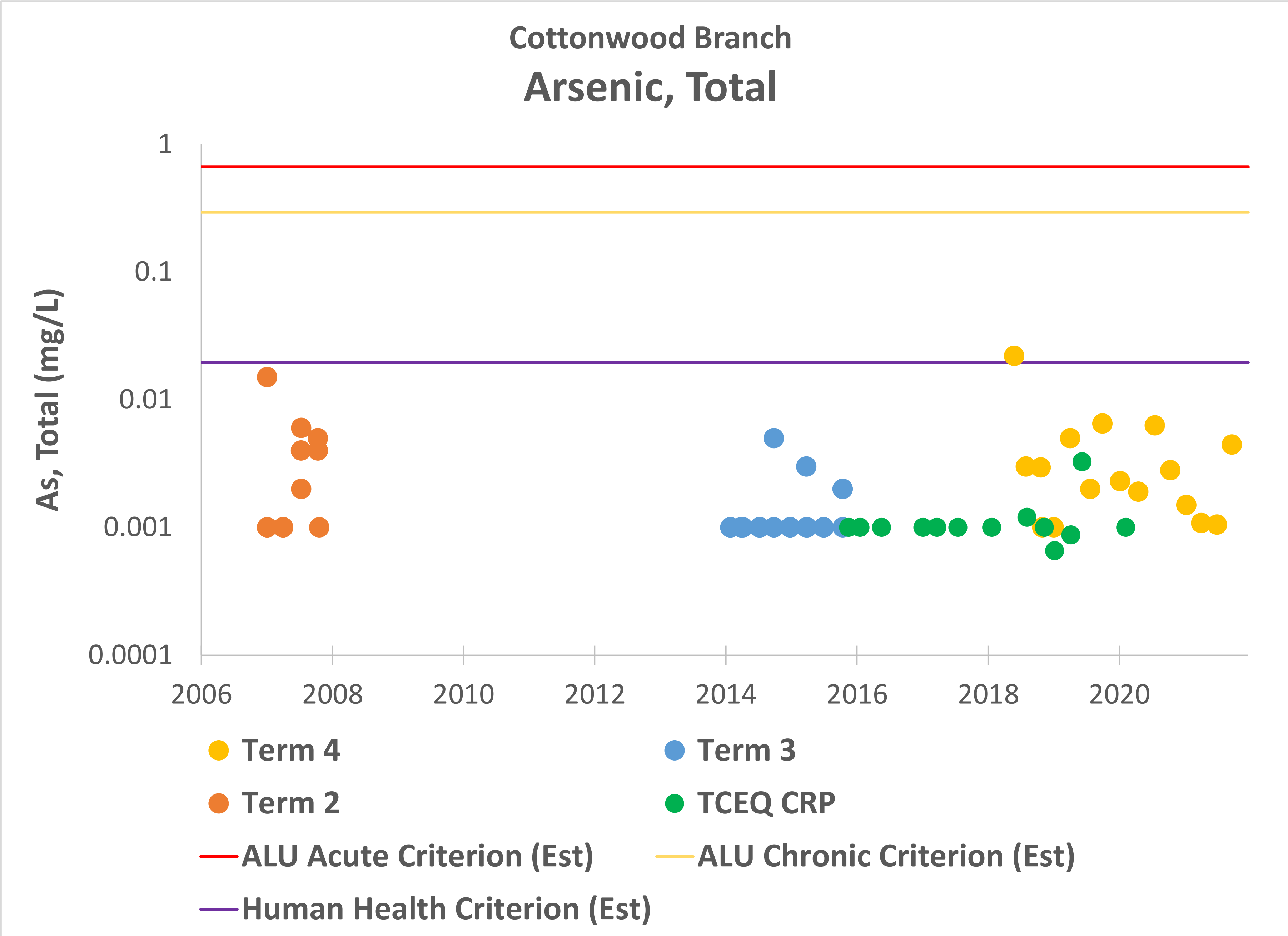
Cottonwood Branch
Orthophosphate
Orthophosphate (mg/L)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion



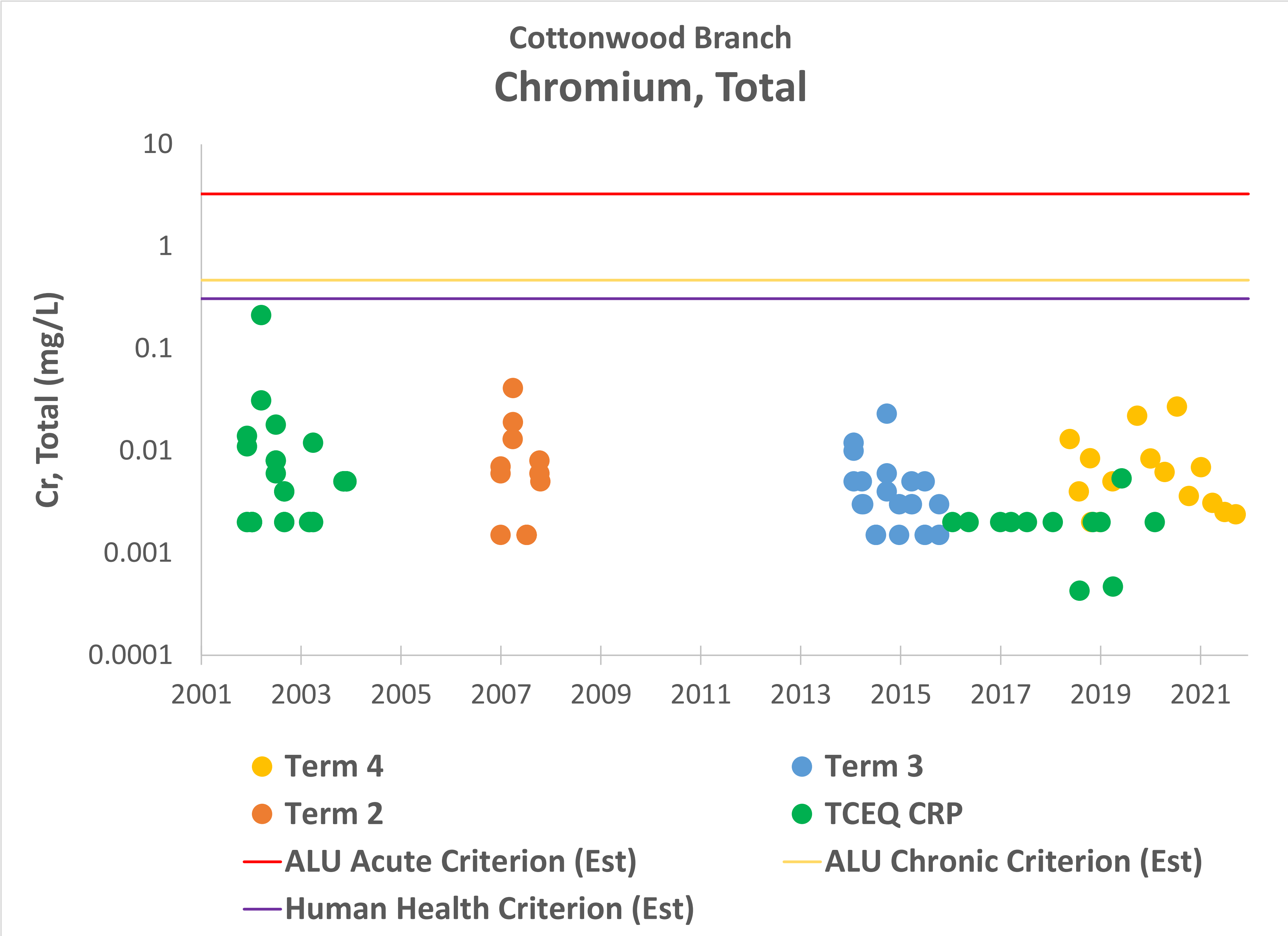
Cottonwood Branch
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile



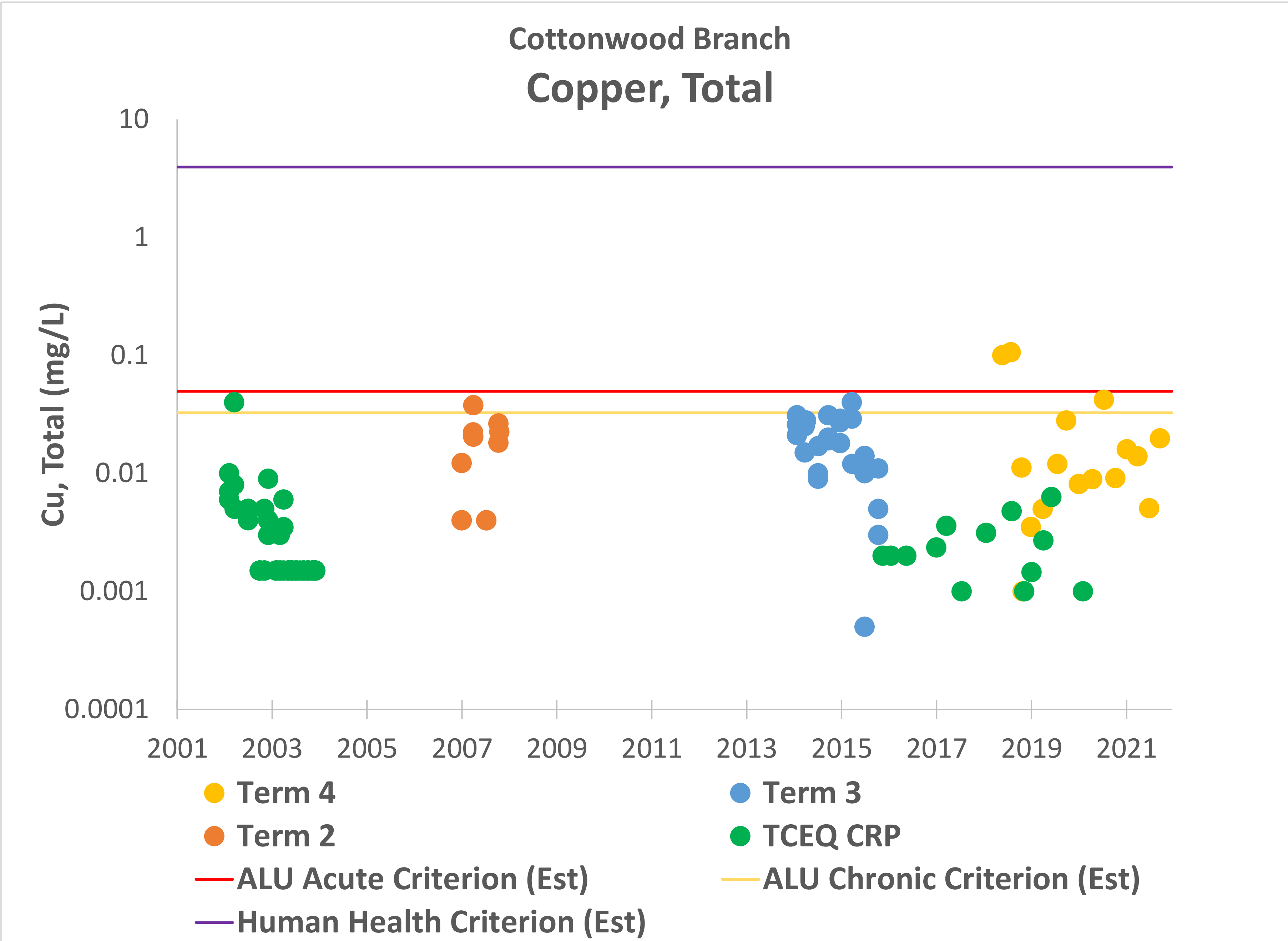
Cottonwood Branch
Phosphorus, Total
P, Total (mg/L)
0
0.5
1
1.5
2
2.5
3
3.5
4
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
Nutrient Screening Criterion



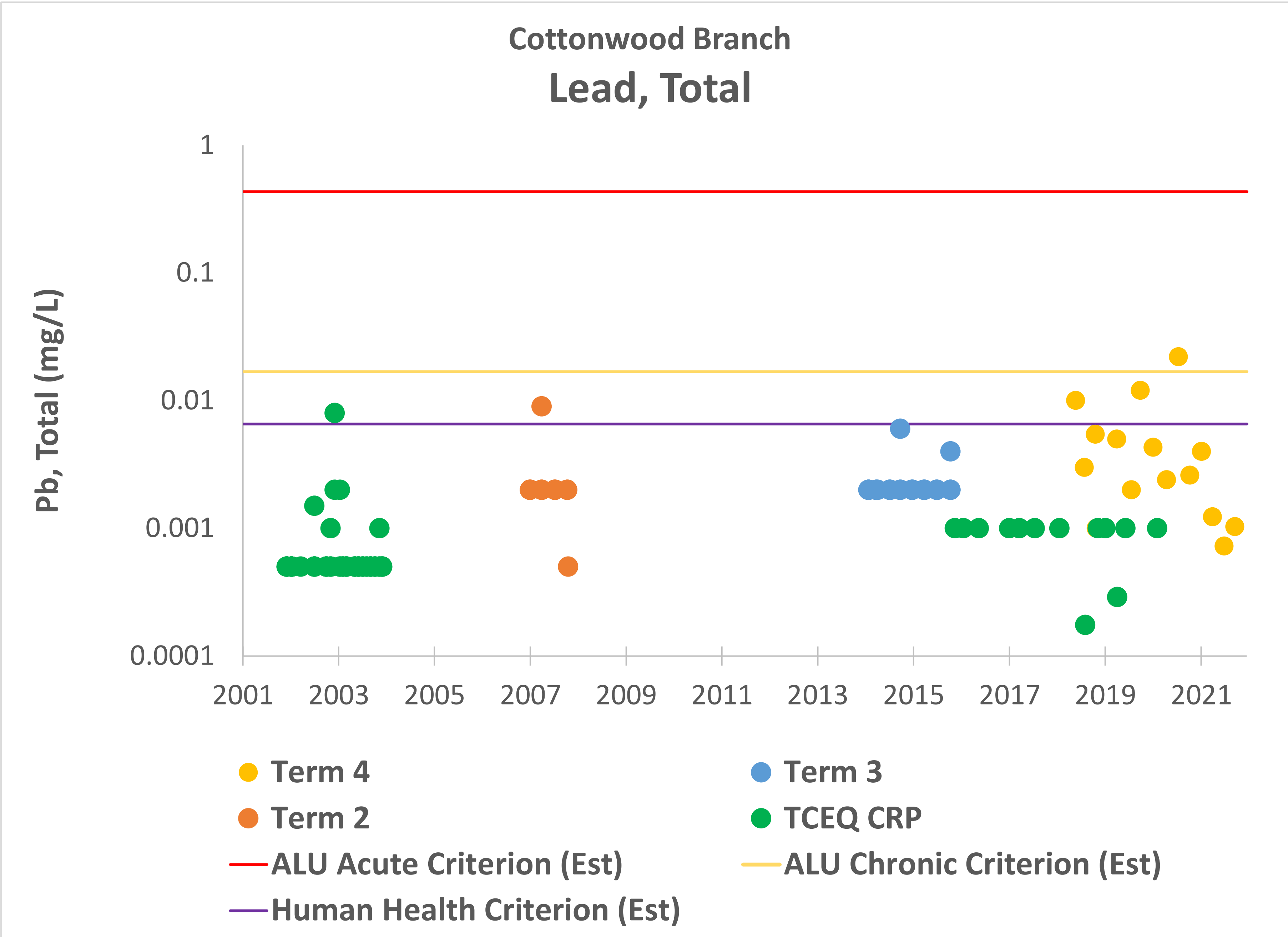
Cottonwood Branch
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

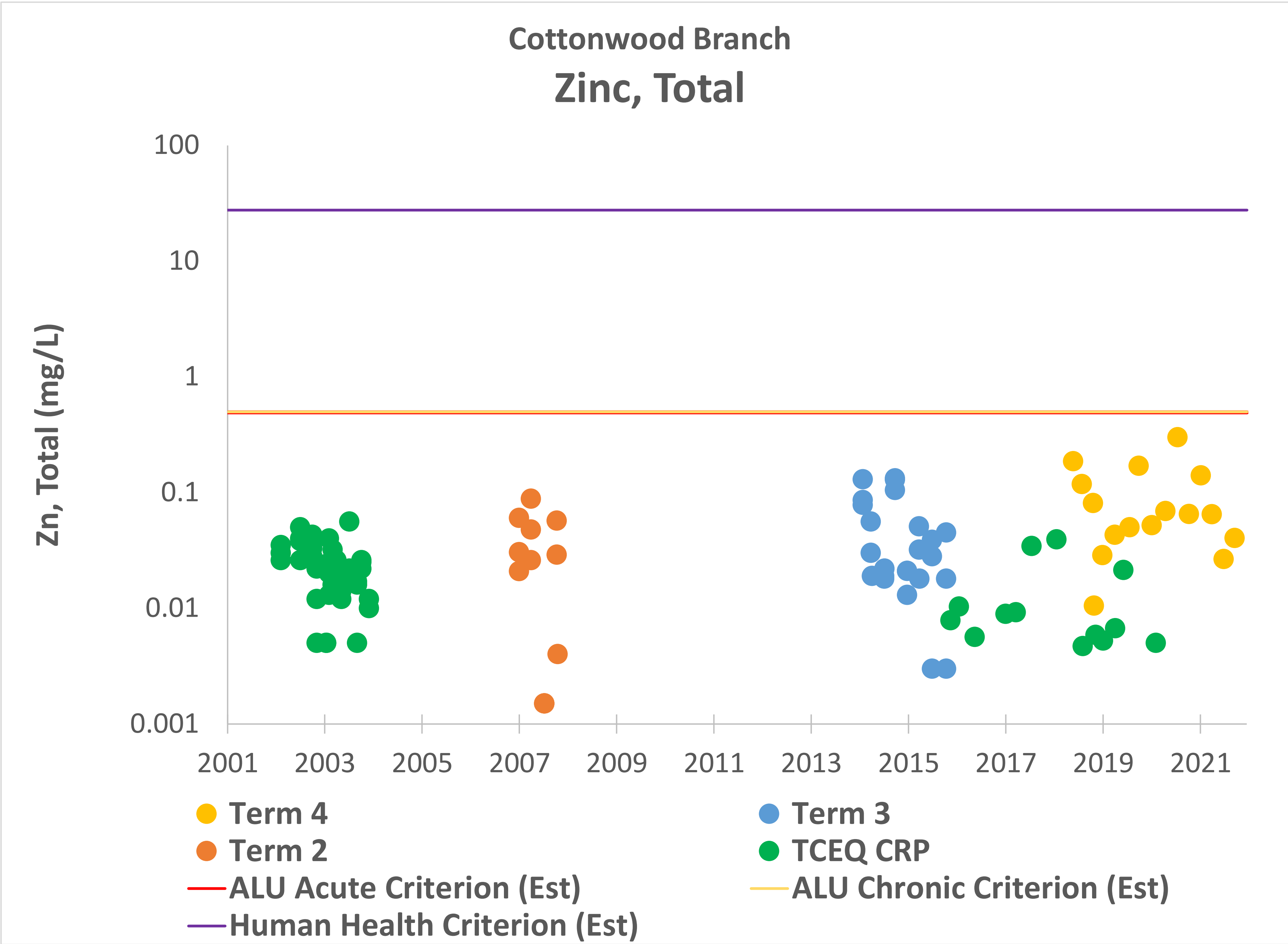


Cottonwood Branch
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
0.0001
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

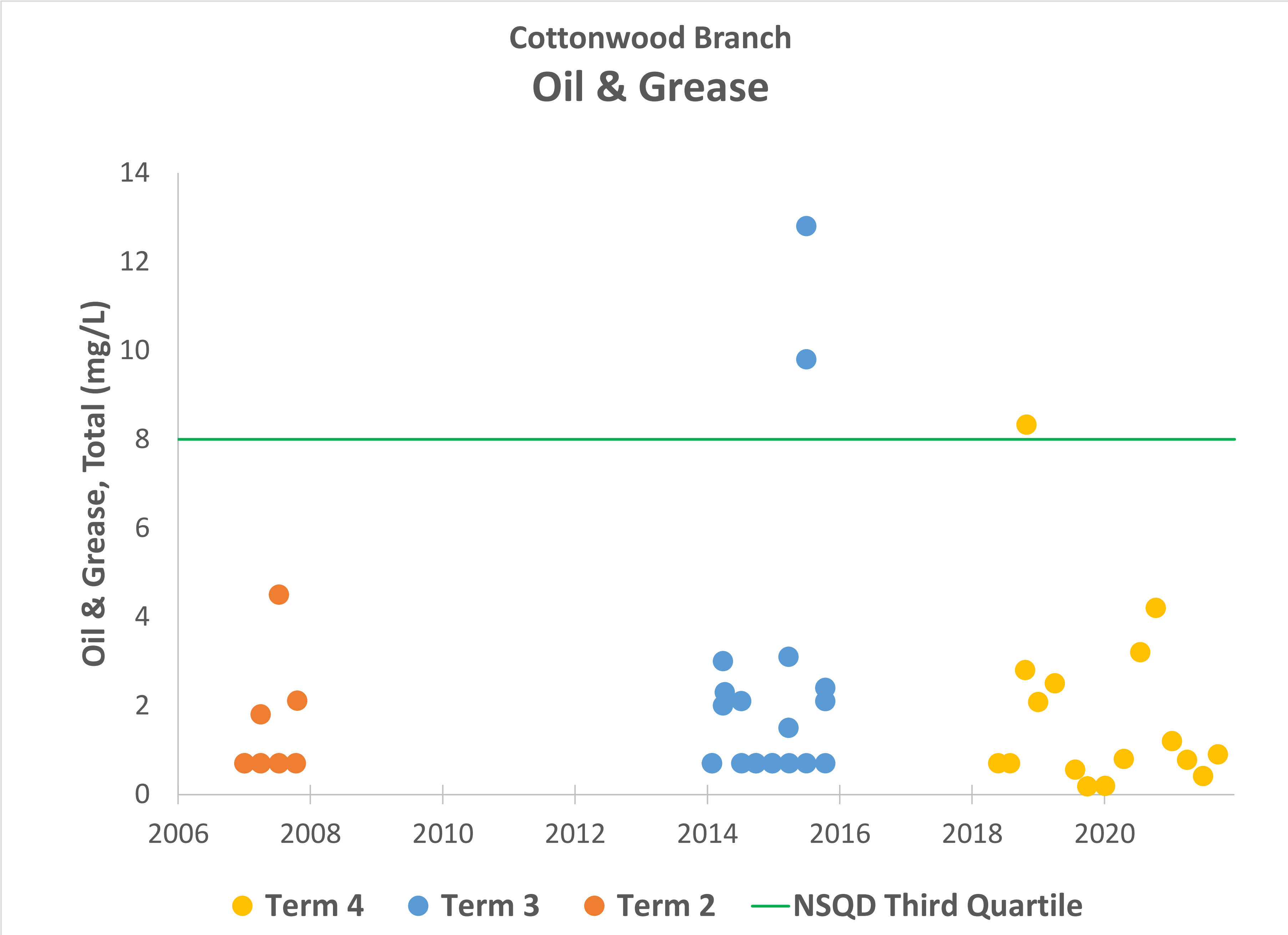


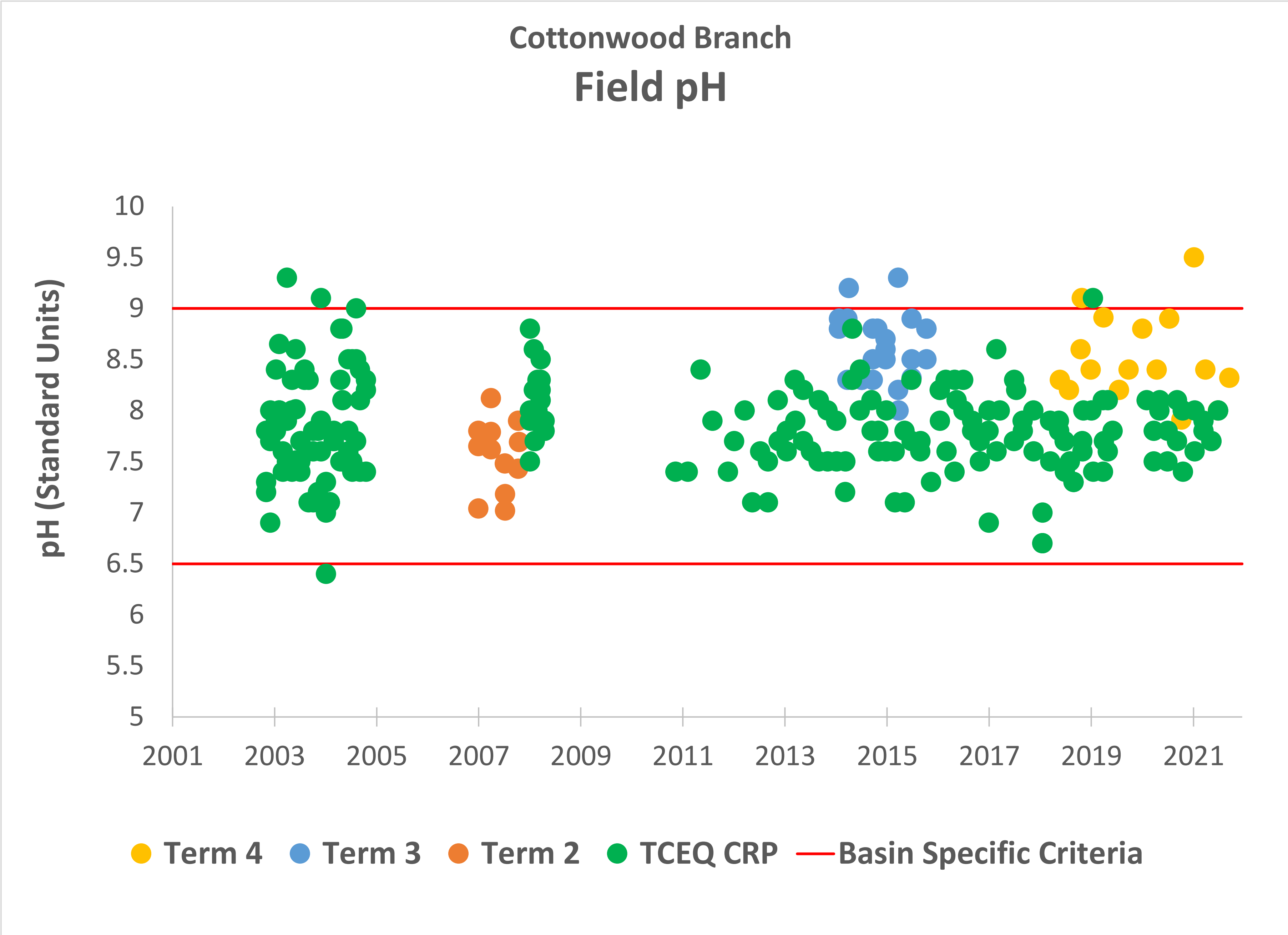
Cottonwood Branch
Copper, Total
10
1
0.1
0.01
0.001
0.0001
Cu, Total (mg/L)
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)


Cottonwood Branch
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

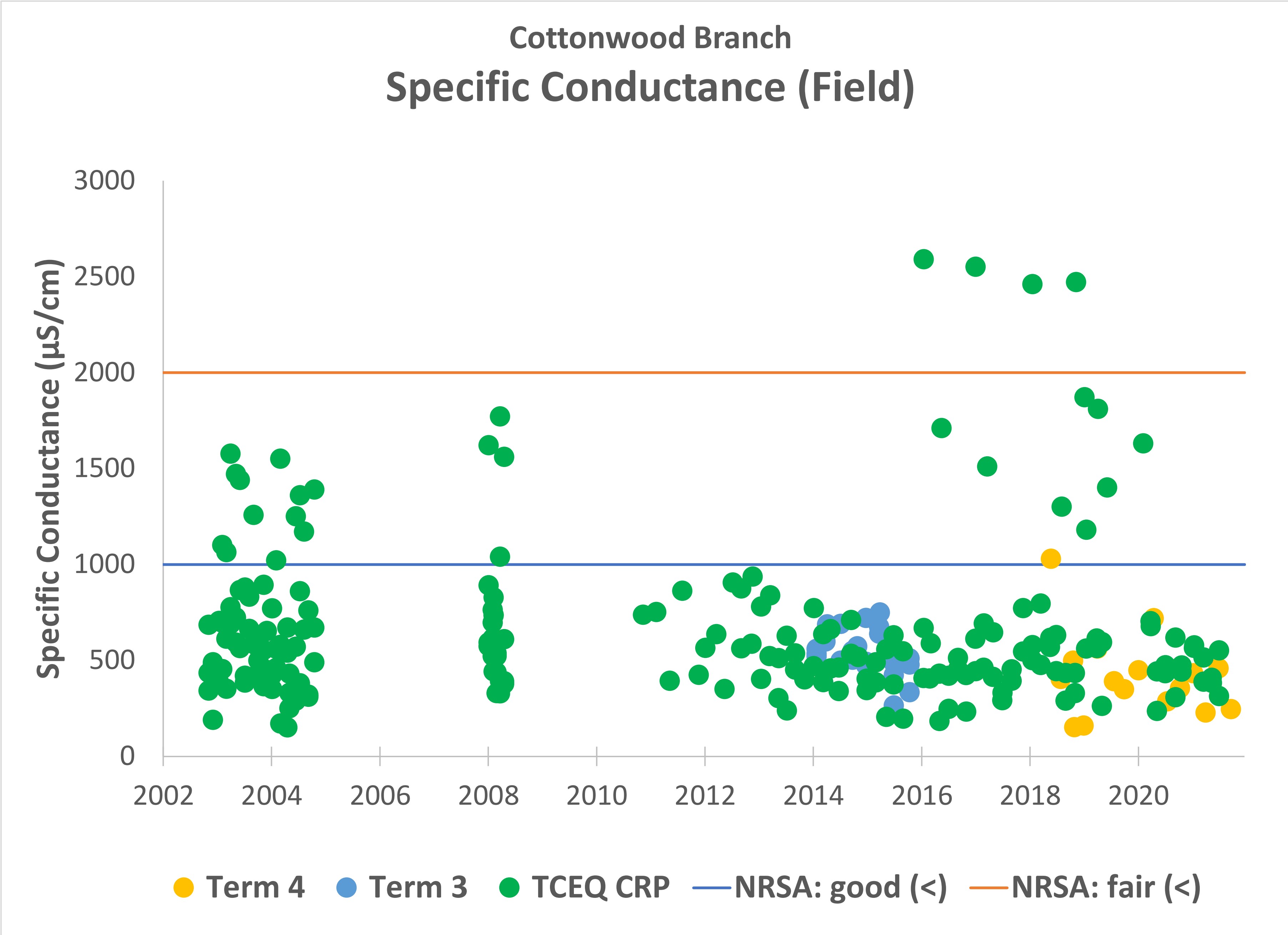


Cottonwood Branch
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

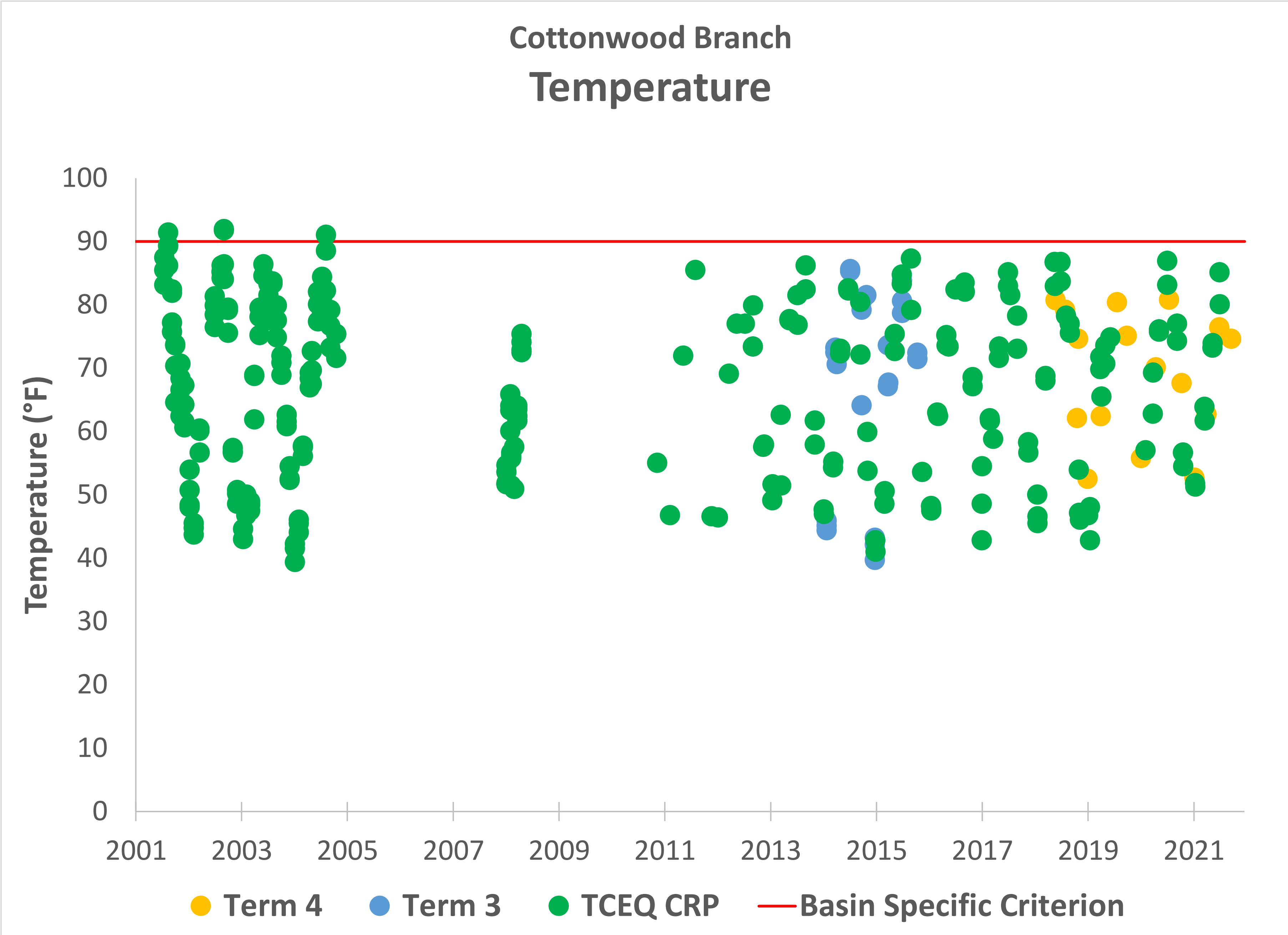

Cottonwood Branch
Oil & Grease
Oil & Grease, Total (mg/L)
0
2
4
6
8
10
12
14
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile



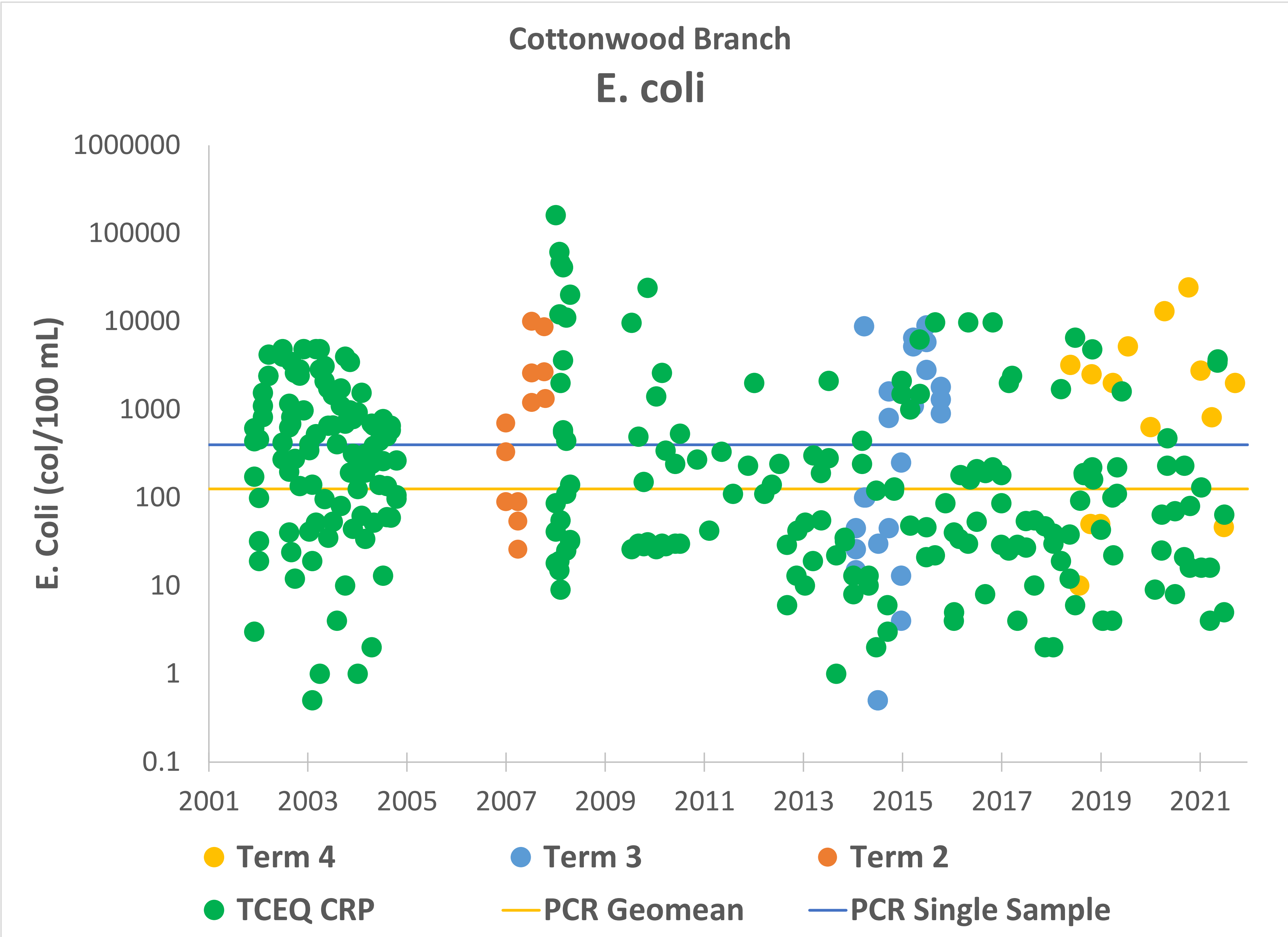
Cottonwood Branch
Field pH
pH (Standard Units)
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
Basin Specific Criteria



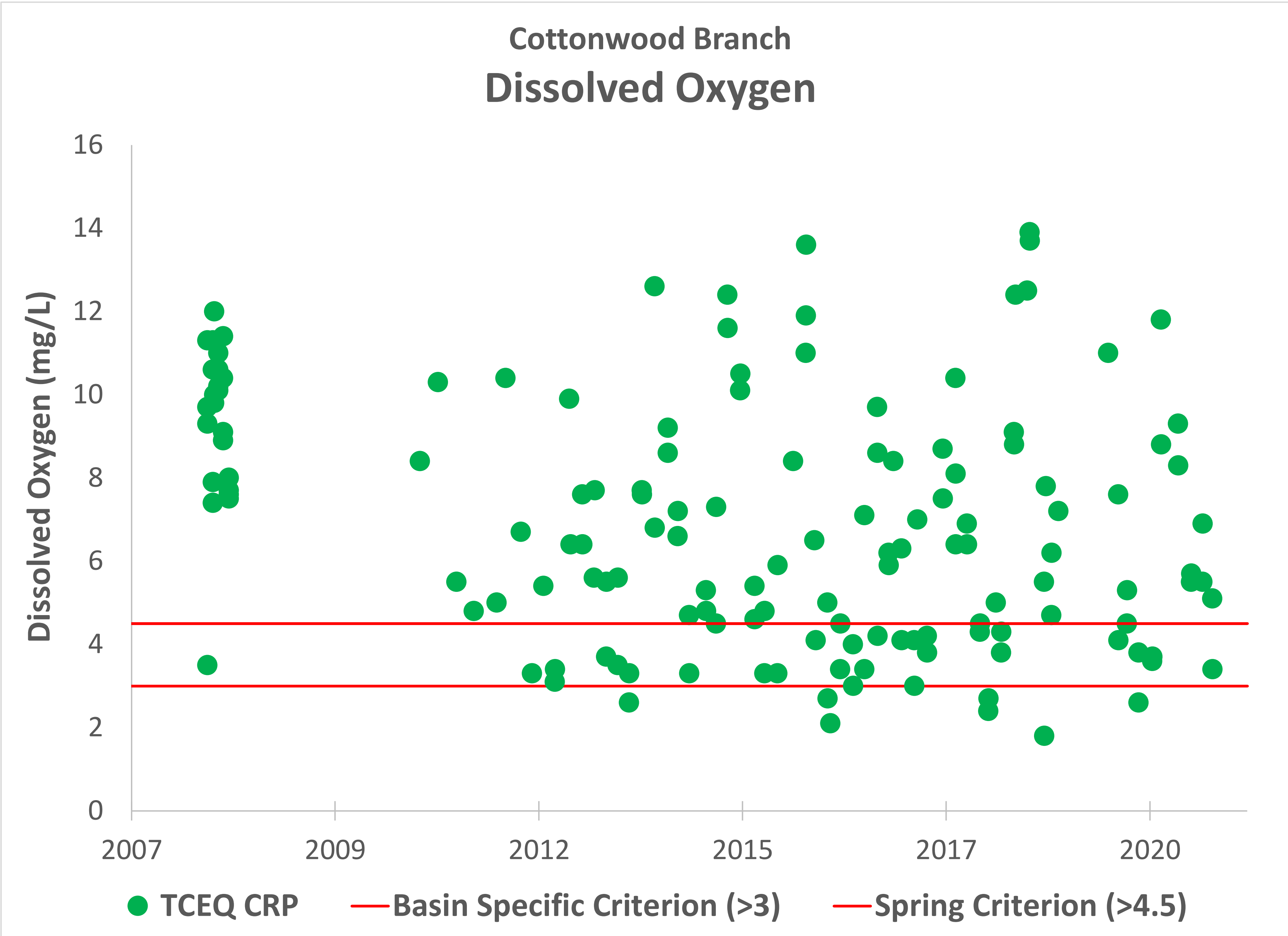
Cottonwood Branch
Specific Conductance (Field)
Specific Conductance (µS/cm)
3000
2500
2000
1500
1000
500
0
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
TCEQ CRP
NRSA: good (<)
NRSA: fair (<)

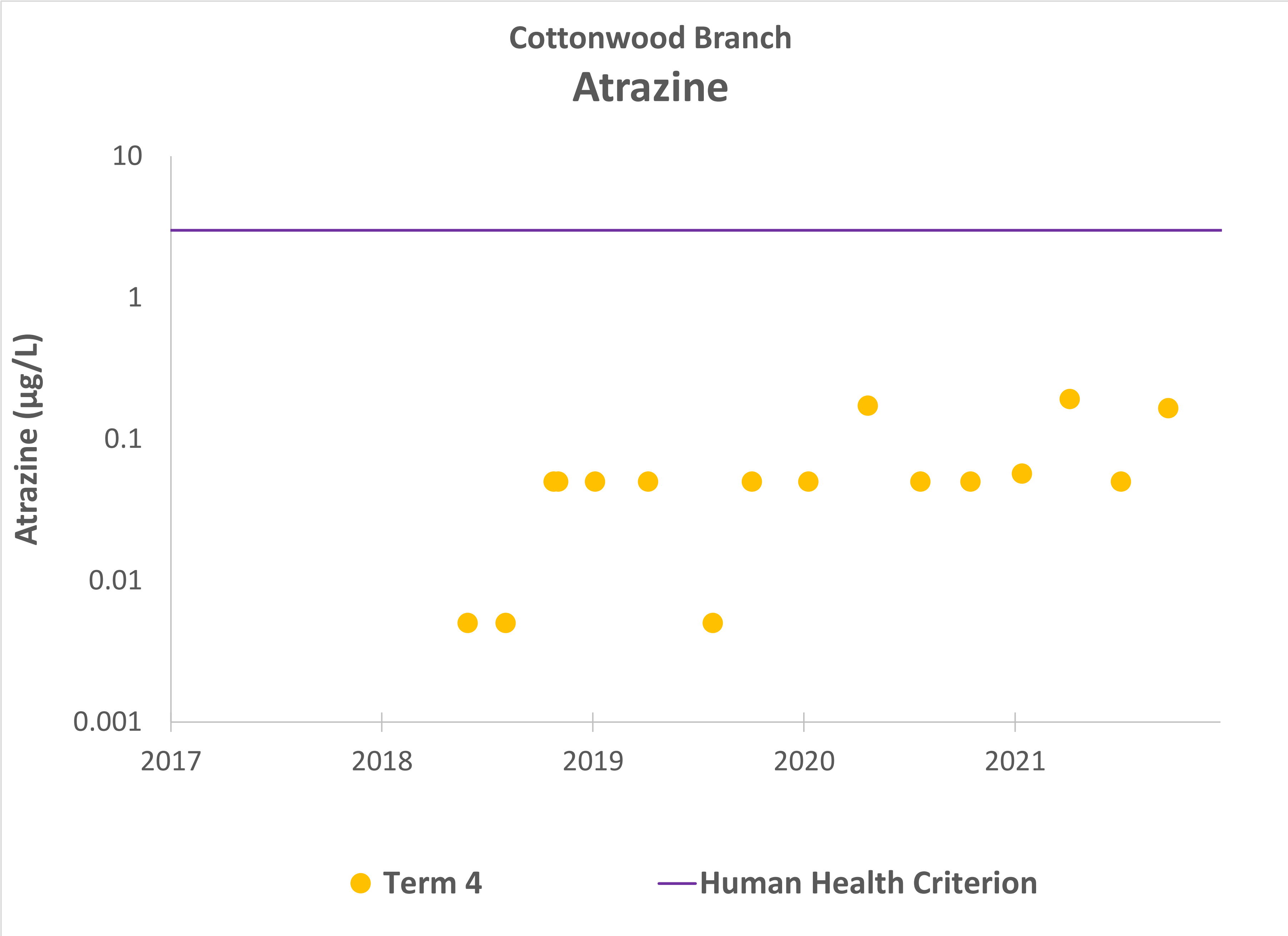


Cottonwood Branch
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
TCEQ CRP
Basin Specific Criterion



Cottonwood Branch
E. coli
E. Coli (col/100 mL)
1000000
100000
10000
1000
100
10
1
0.1
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
PCR Geomean
PCR Single Sample

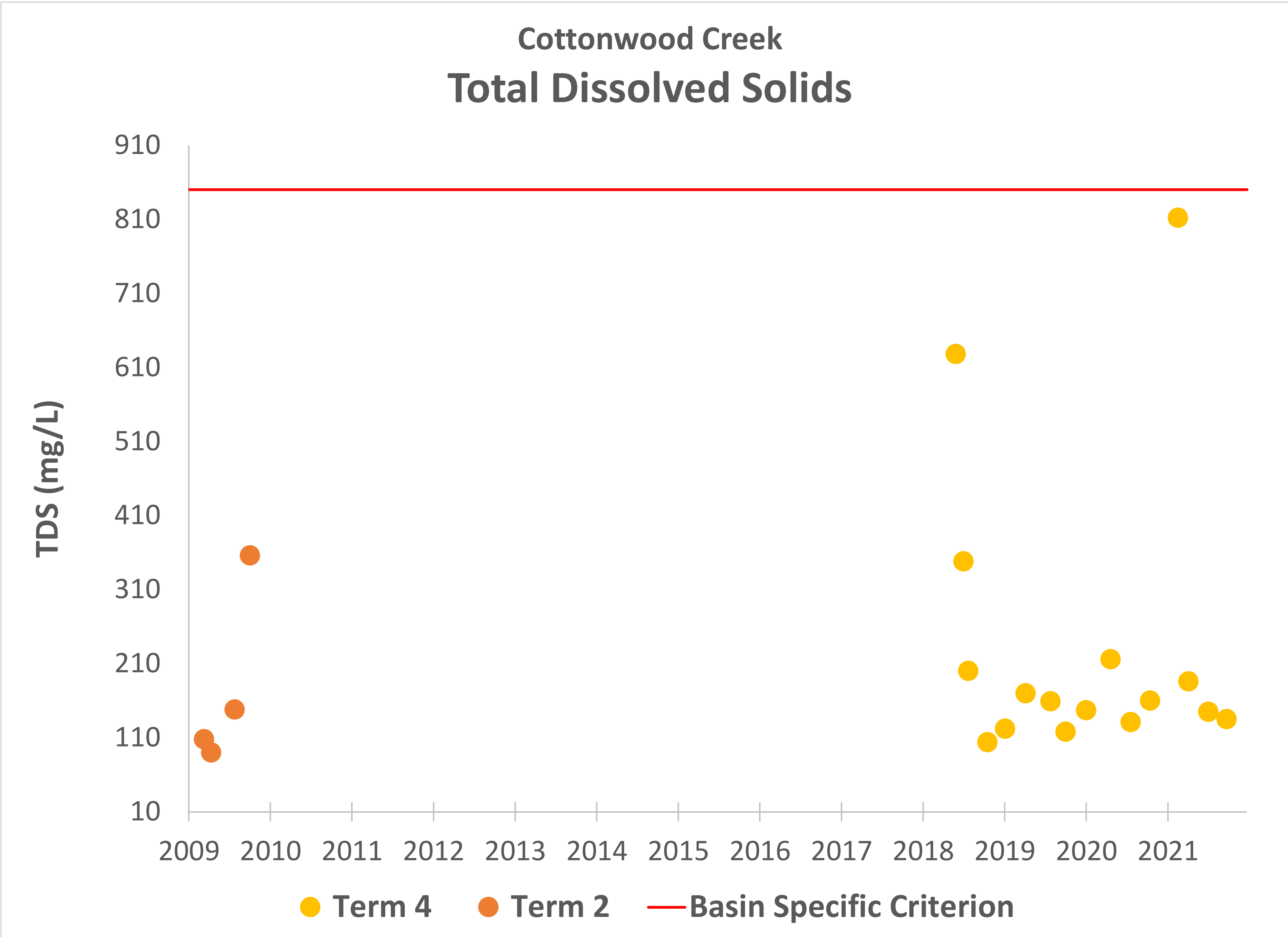

Cottonwood Branch
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
14
16
2007
2009
2012
2015
2017
2020
TCEQ CRP
Basin Specific Criterion (>3)
Spring Criterion (>4.5)

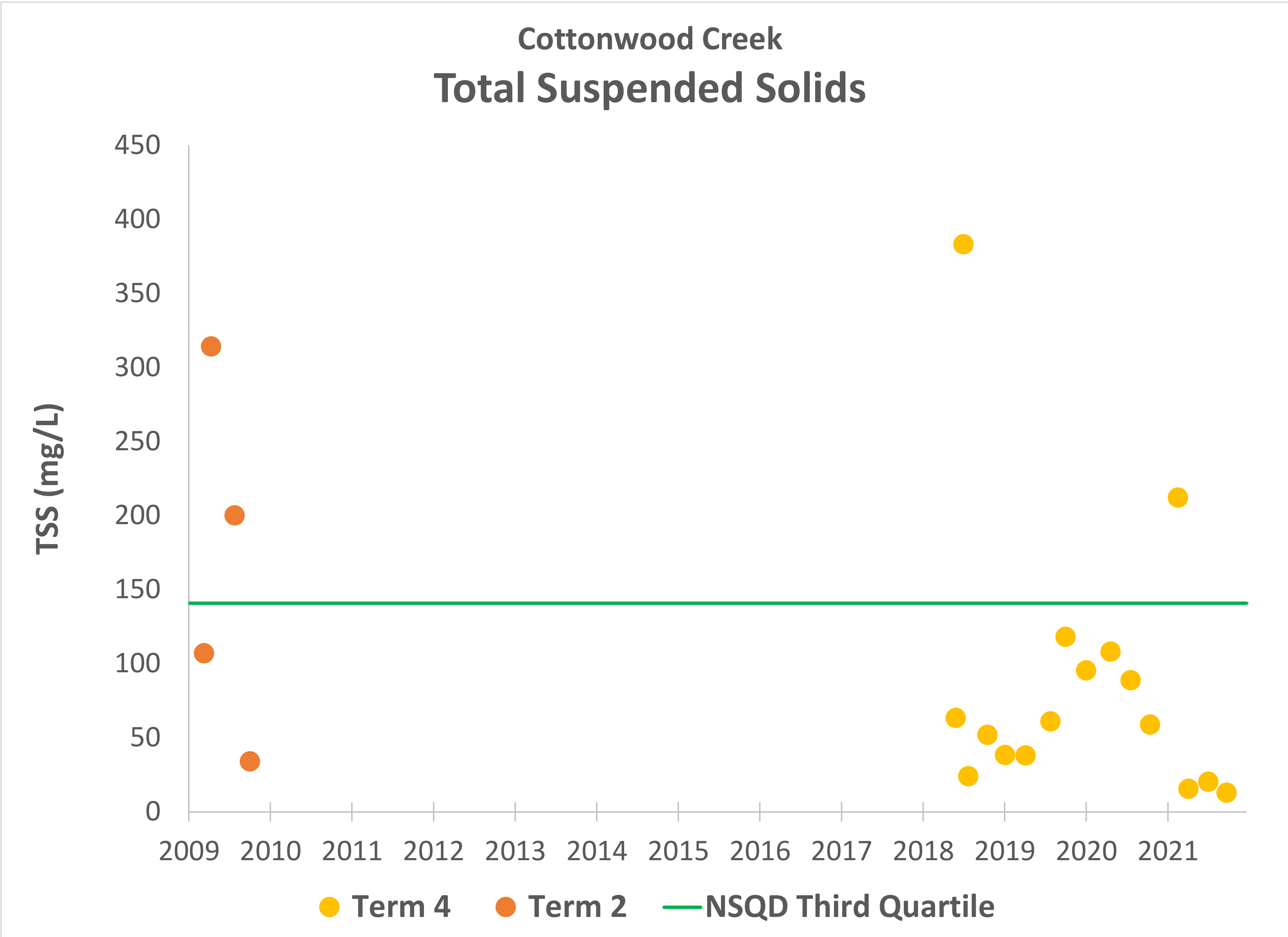


Cottonwood Branch
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
0.001
2017
2018
2019
2020
2021
Term 4
Human Health Criterion

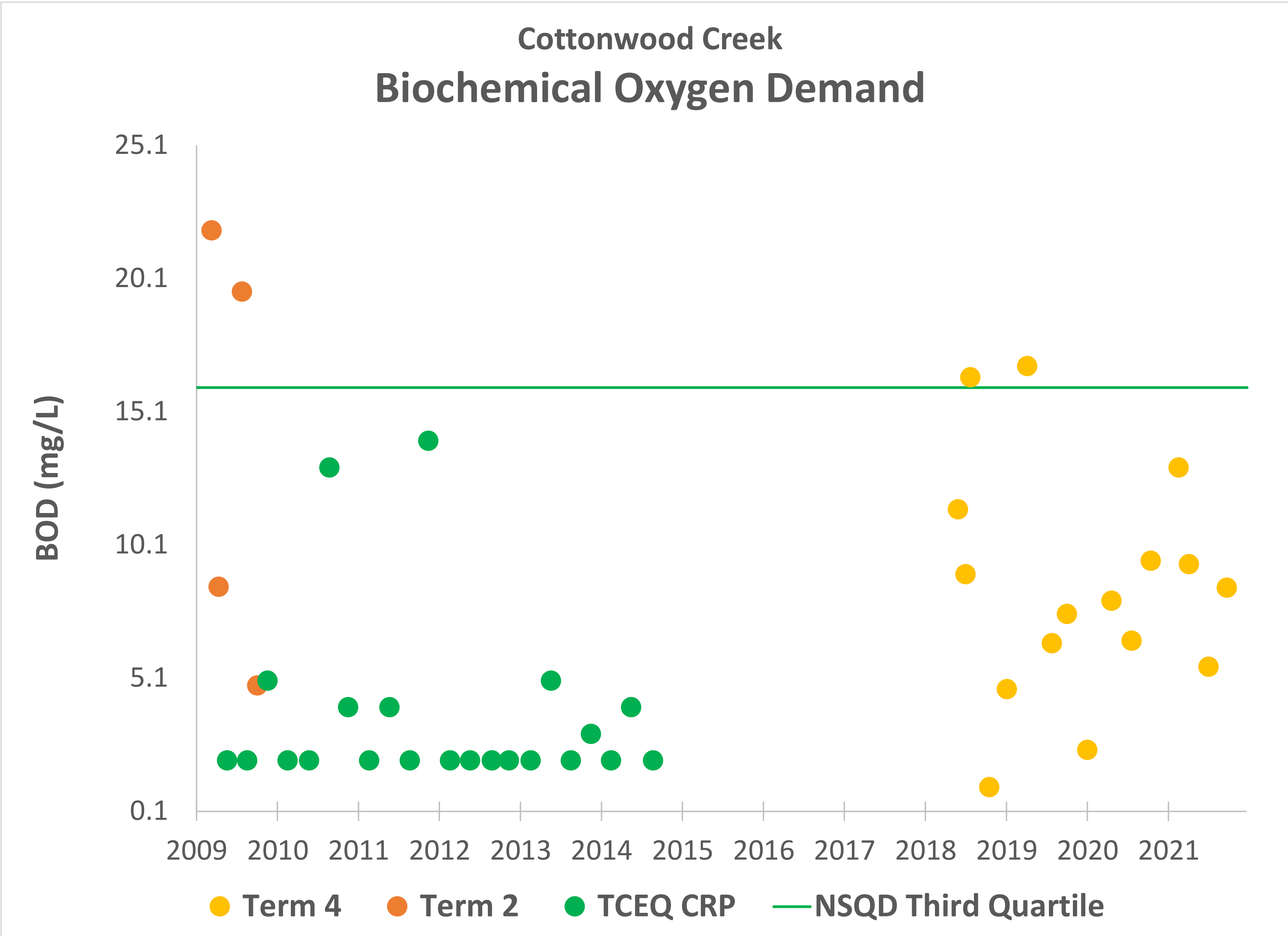
Appendix F

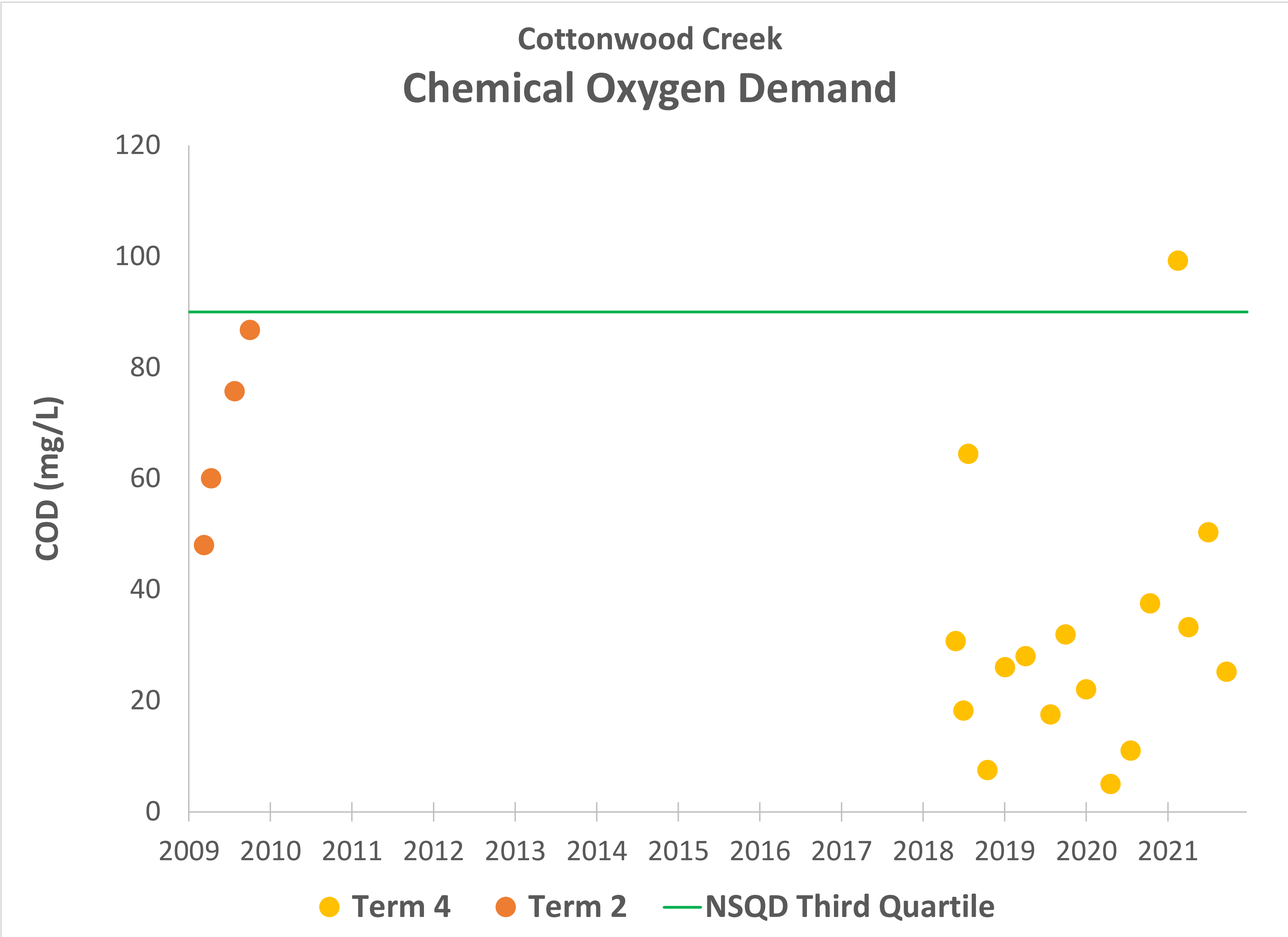
Cottonwood Creek Water Quality Data Graphs

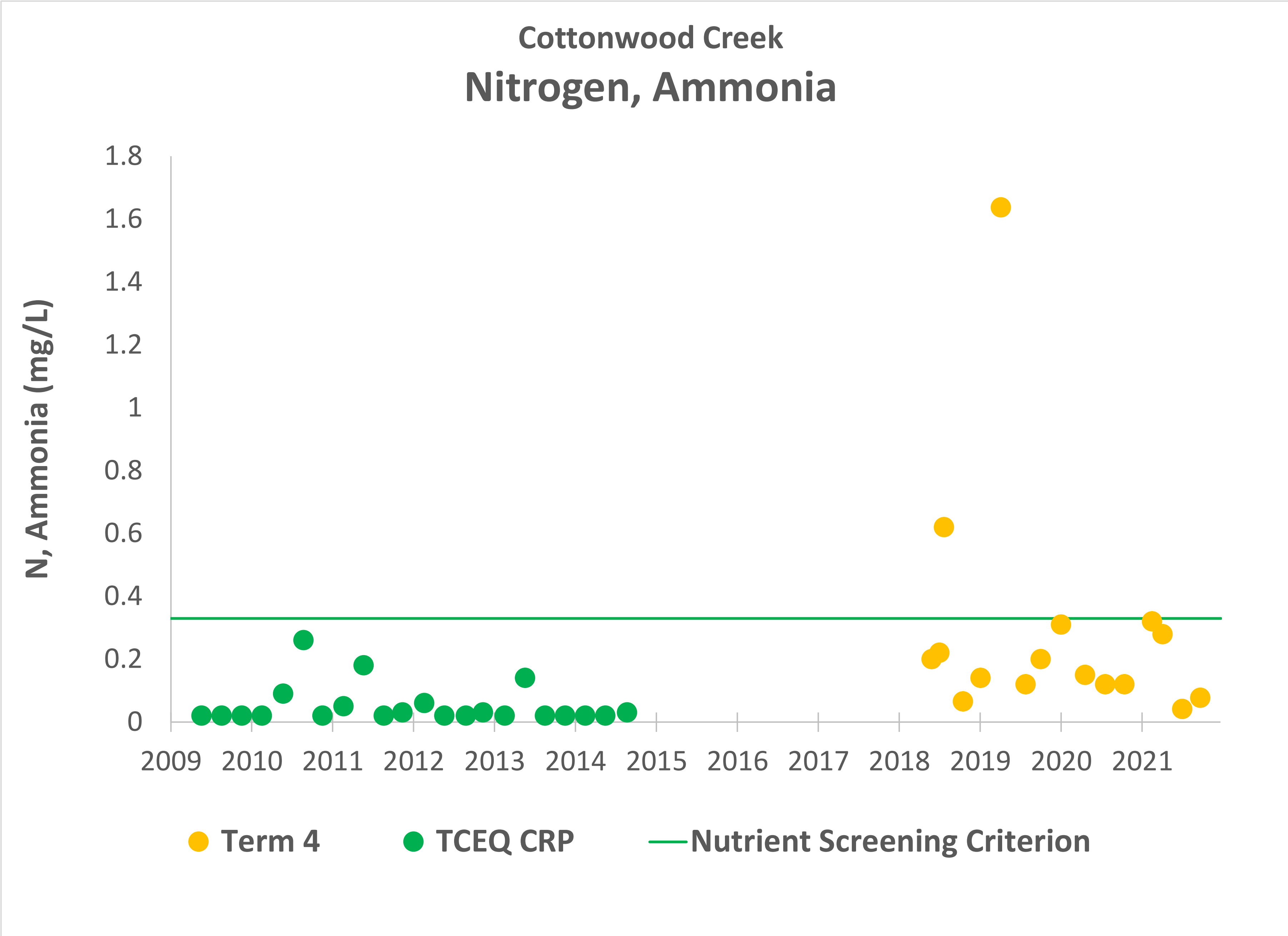

Cottonwood Creek
Total Dissolved Solids
TDS (mg/L)
910
810
710
610
510
410
310
210
110
10
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 2
Basin Specific Criterion



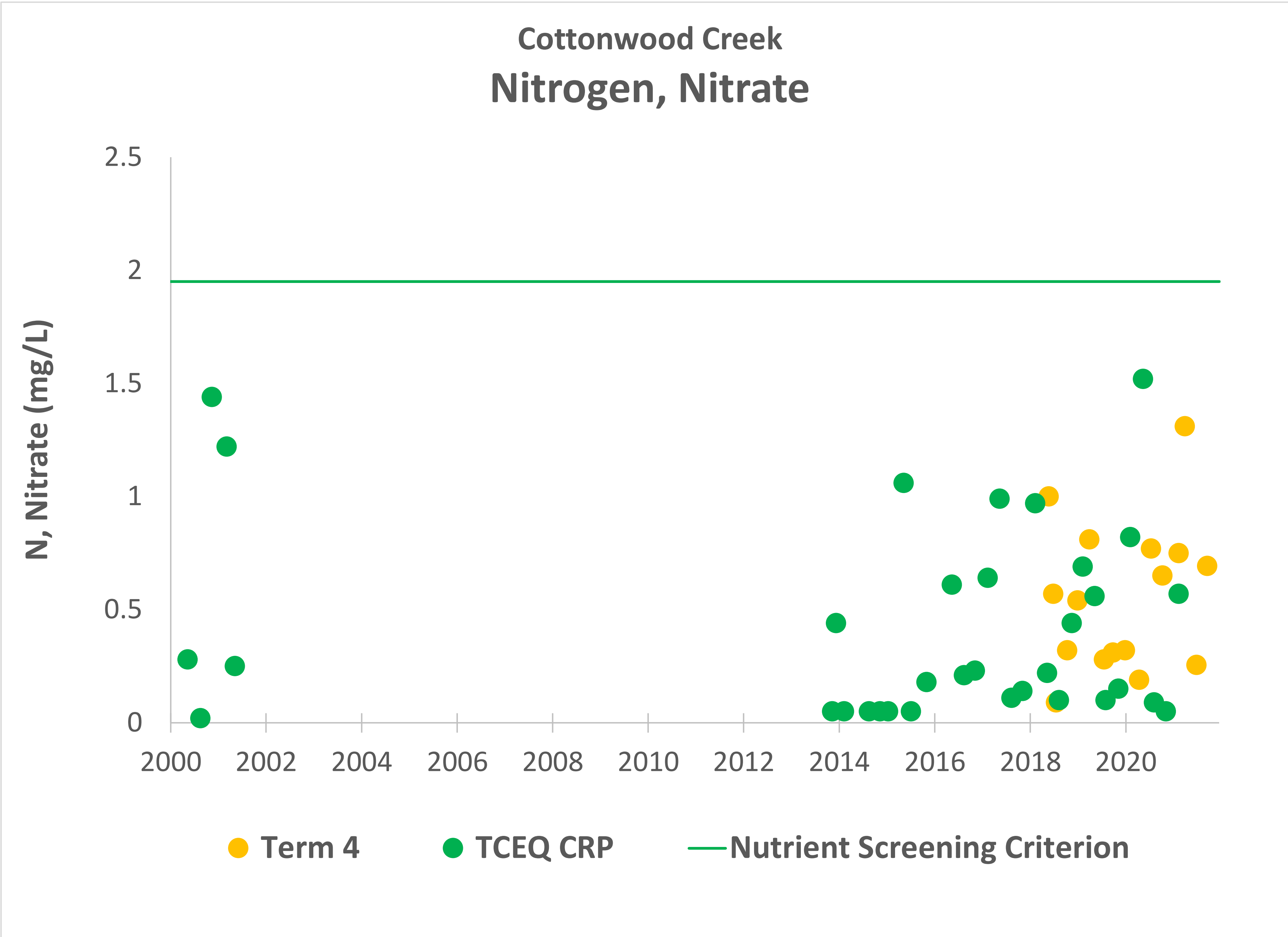
Cottonwood Creek
Total Suspended Solids
TSS (mg/L)
450
400
350
300
250
200
150
100
50
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 2
NSQD Third Quartile


Cottonwood Creek
Biochemical Oxygen Demand
BOD (mg/L)
25.1
20.1
15.1
10.1
5.1
0.1
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 2
TCEQ CRP
NSQD Third Quartile

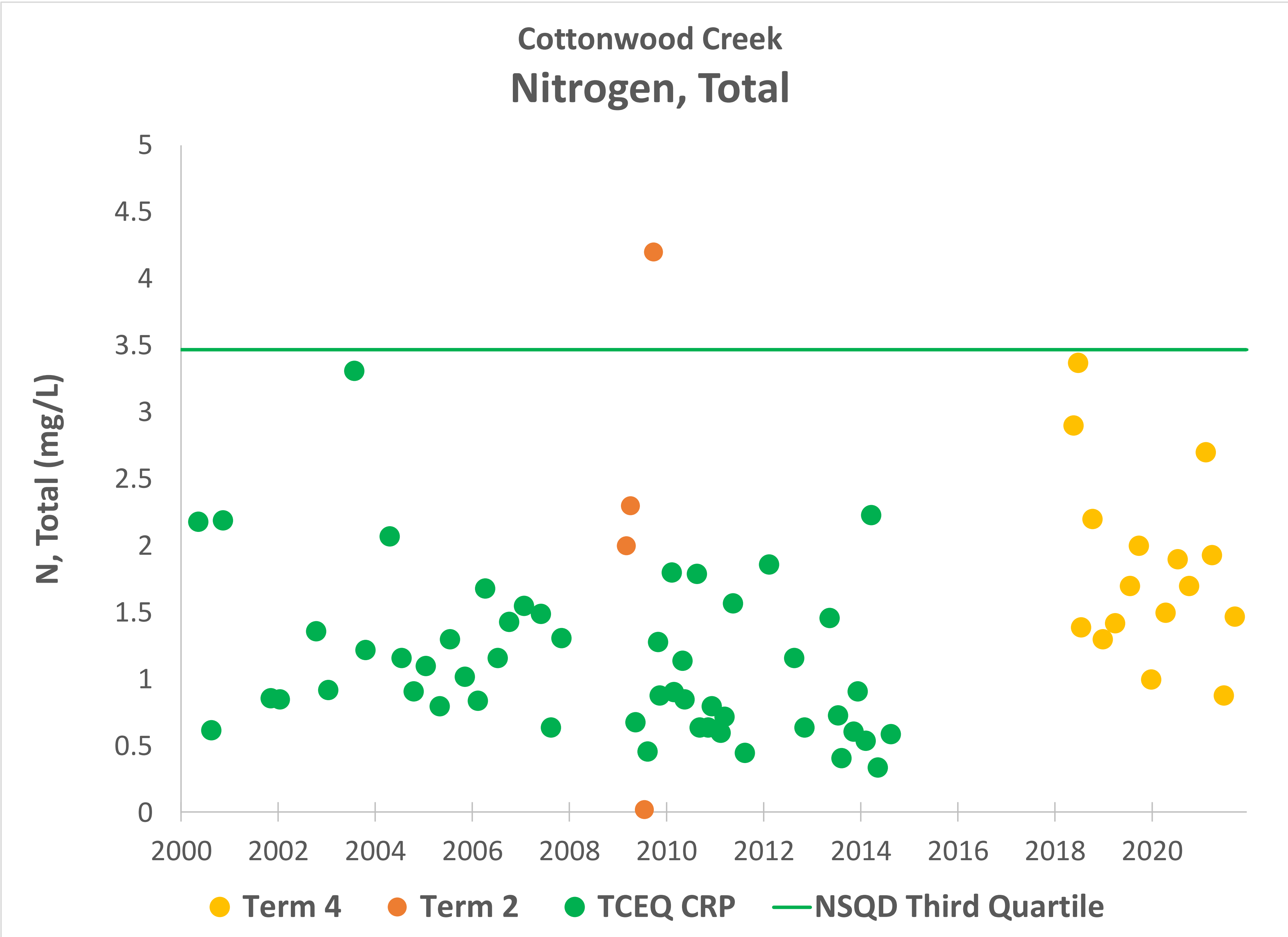

Cottonwood Creek
Chemical Oxygen Demand
COD (mg/L)
0
20
40
60
80
100
120
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 2
NSQD Third Quartile



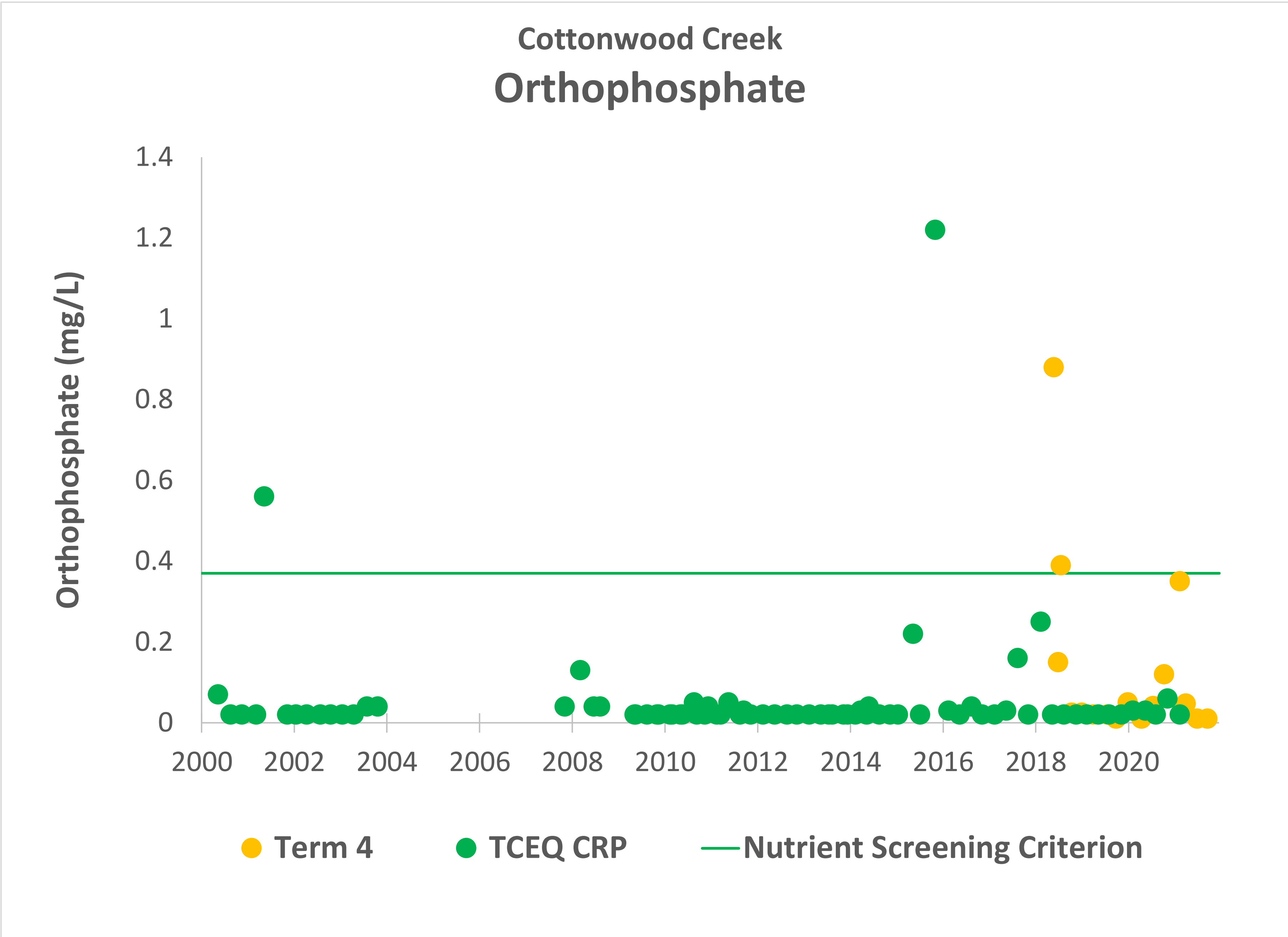
Cottonwood Creek
Nitrogen, Ammonia
N, Ammonia (mg/L)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
TCEQ CRP
Nutrient Screening Criterion

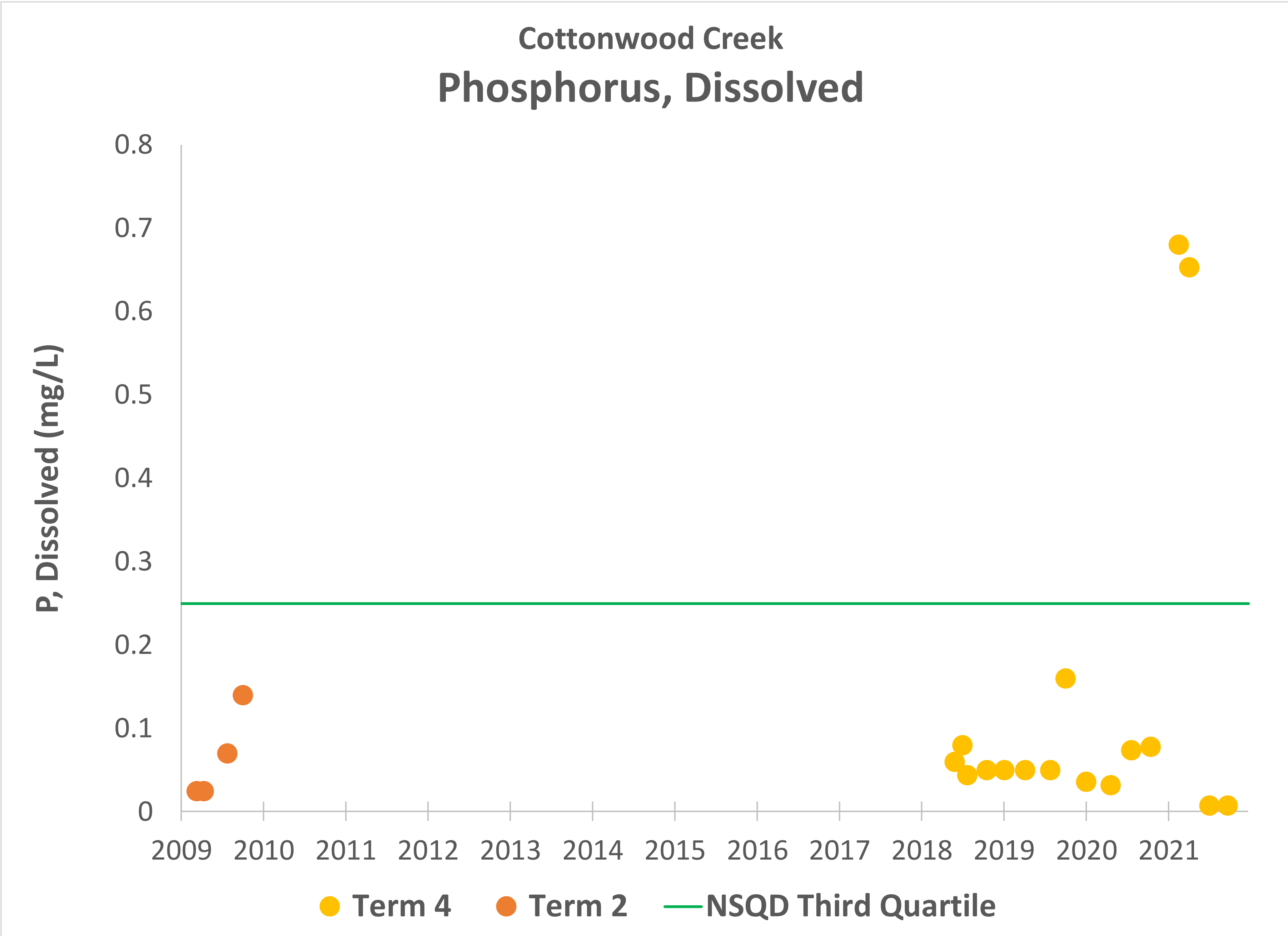


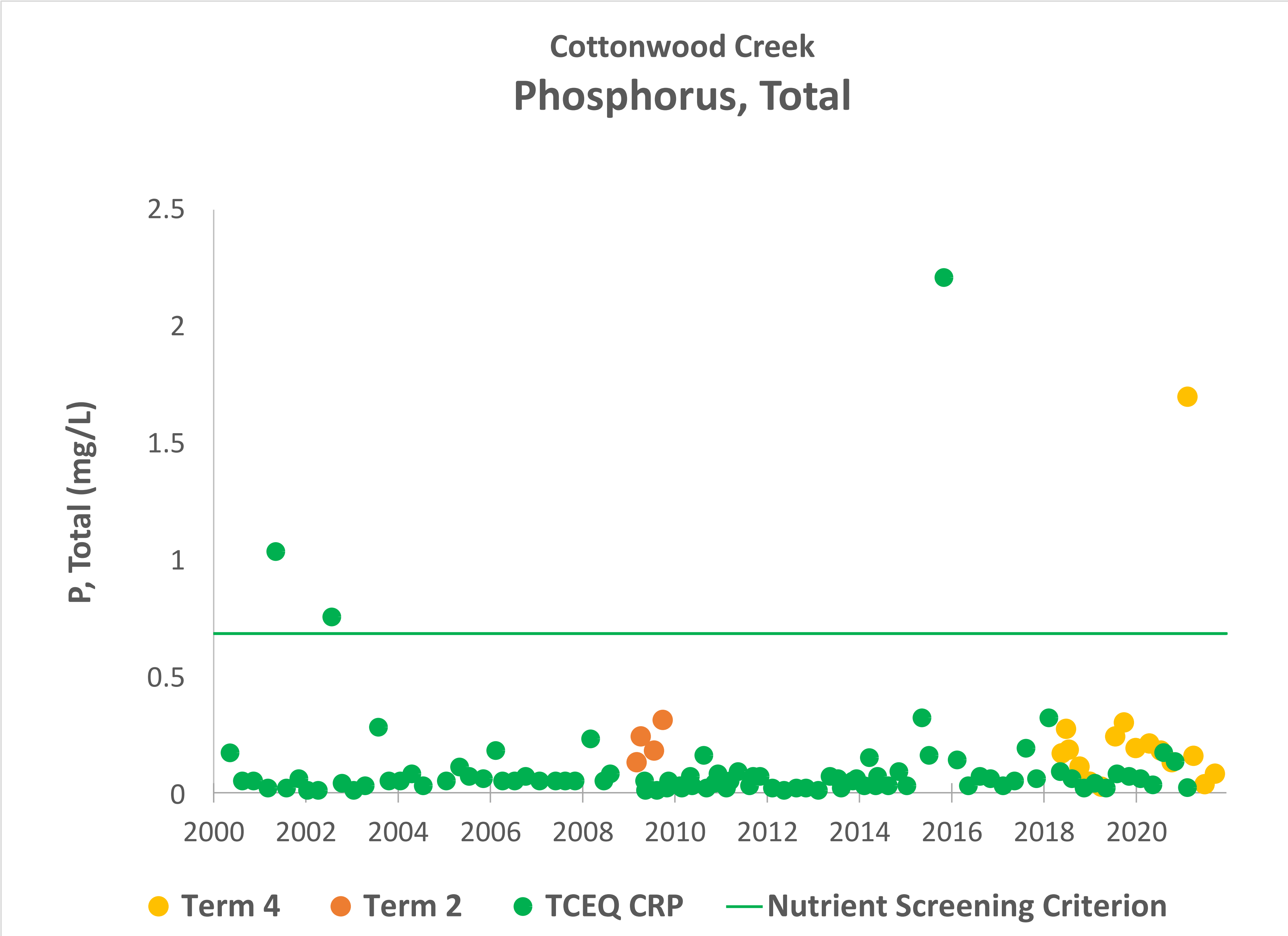
Cottonwood Creek
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion



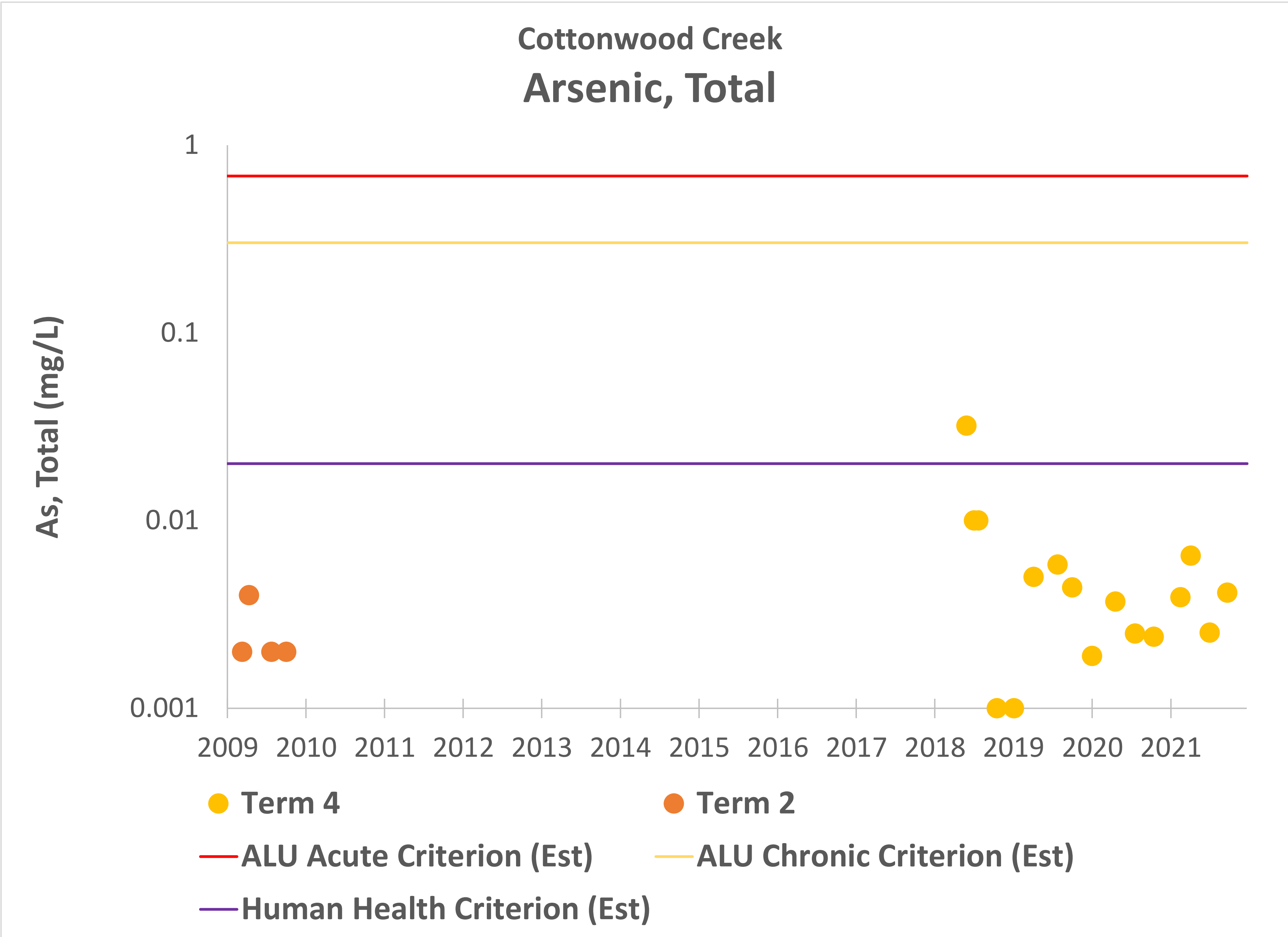
Cottonwood Creek
Nitrogen, Total
N, Total (mg/L)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 2
TCEQ CRP
NSQD Third Quartile

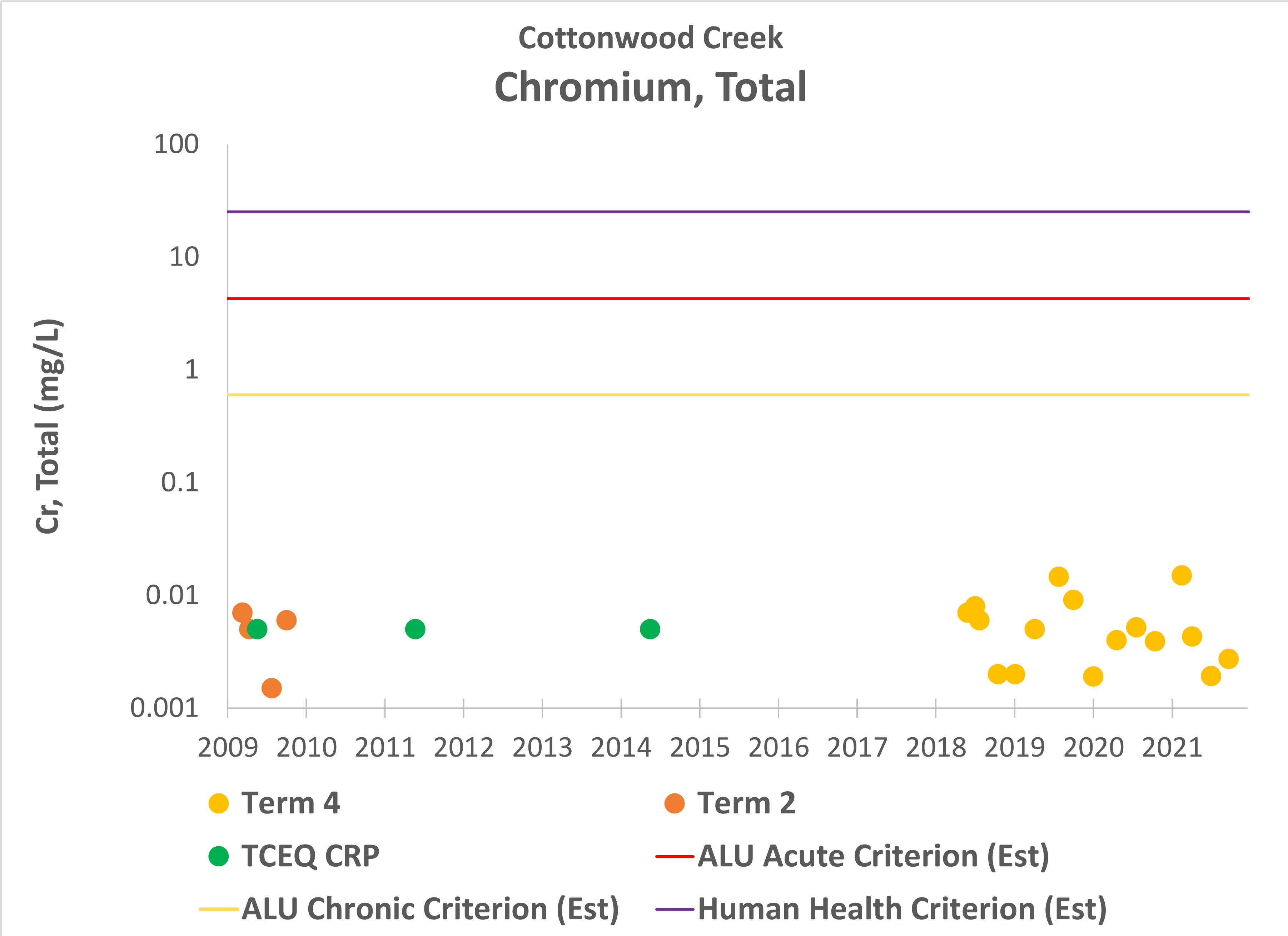

Cottonwood Creek
Orthophosphate
Orthophosphate (mg/L)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion


Cottonwood Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 2
NSQD Third Quartile

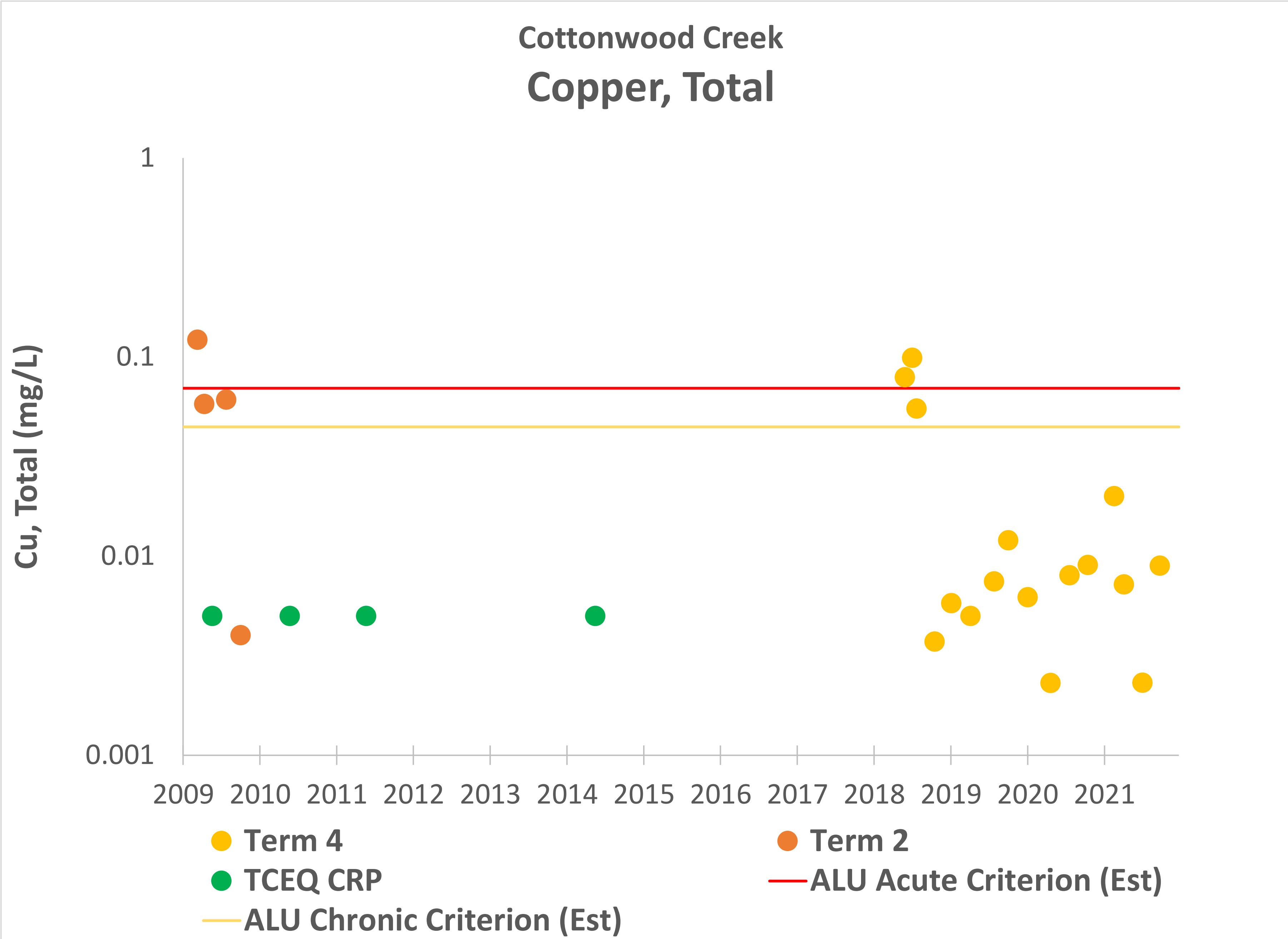


Cottonwood Creek
Phosphorus, Total
P, Total (mg/L)
2.5
2
1.5
1
0.5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 2
TCEQ CRP
Nutrient Screening Criterion

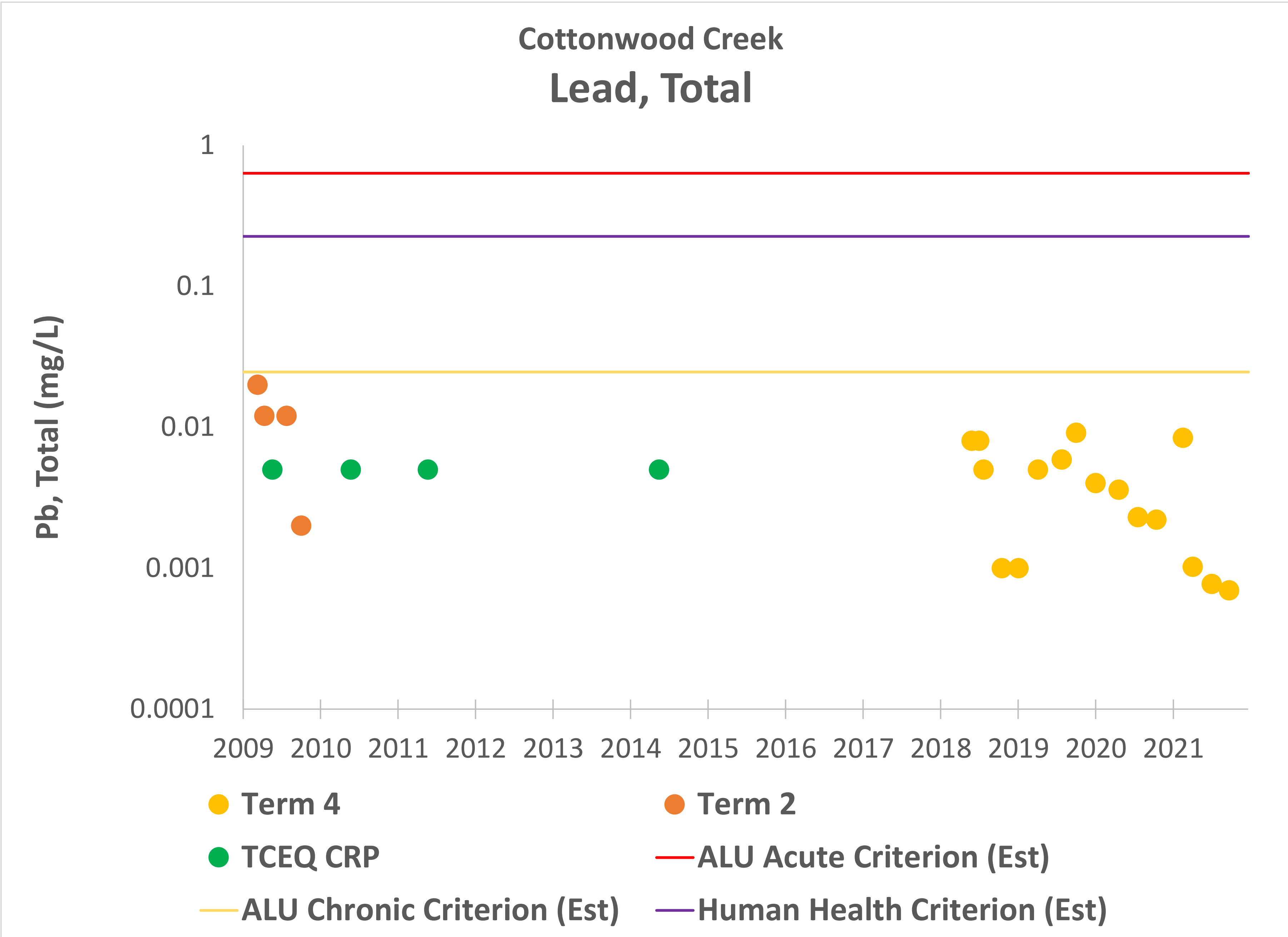

Cottonwood Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

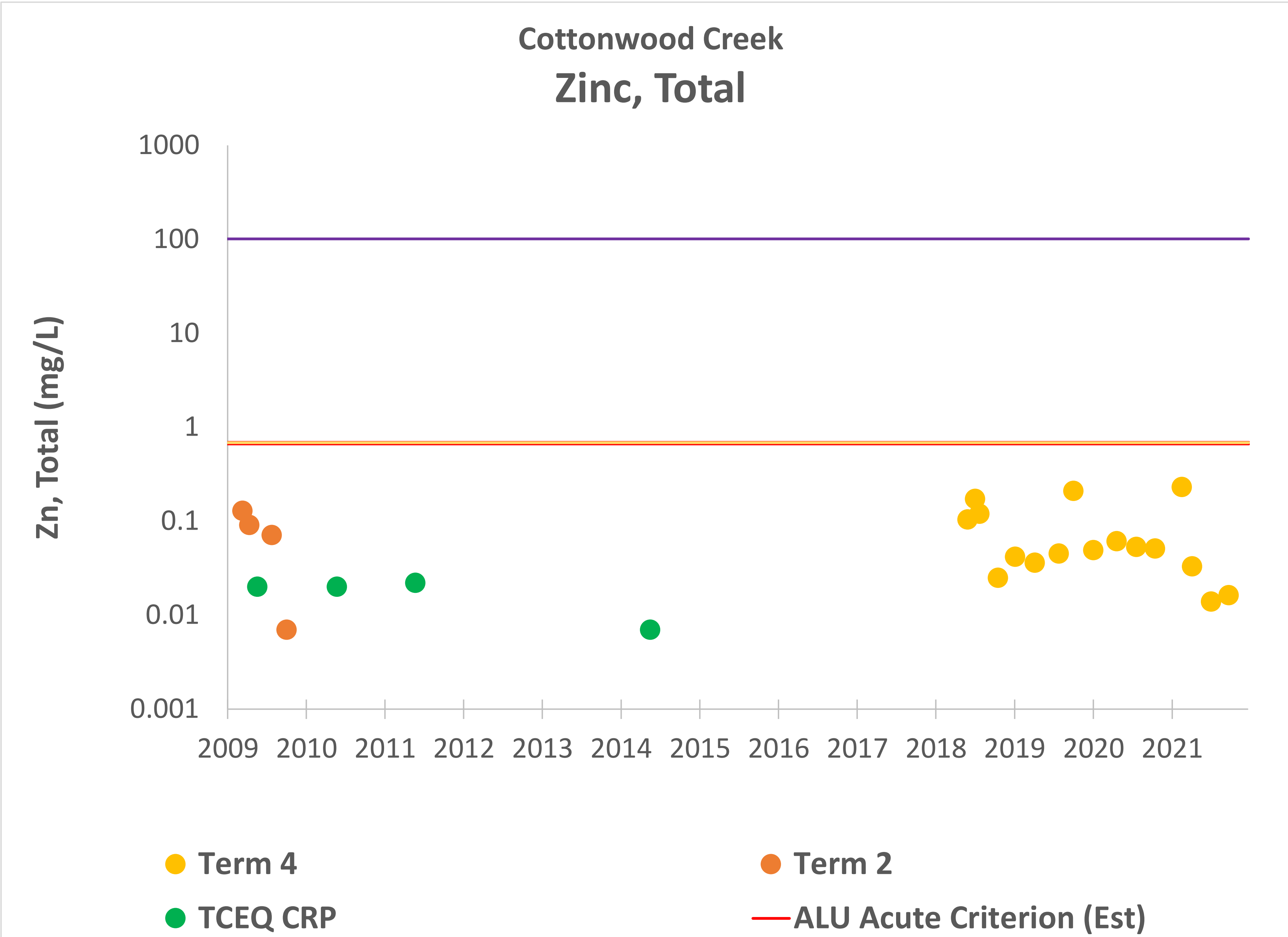


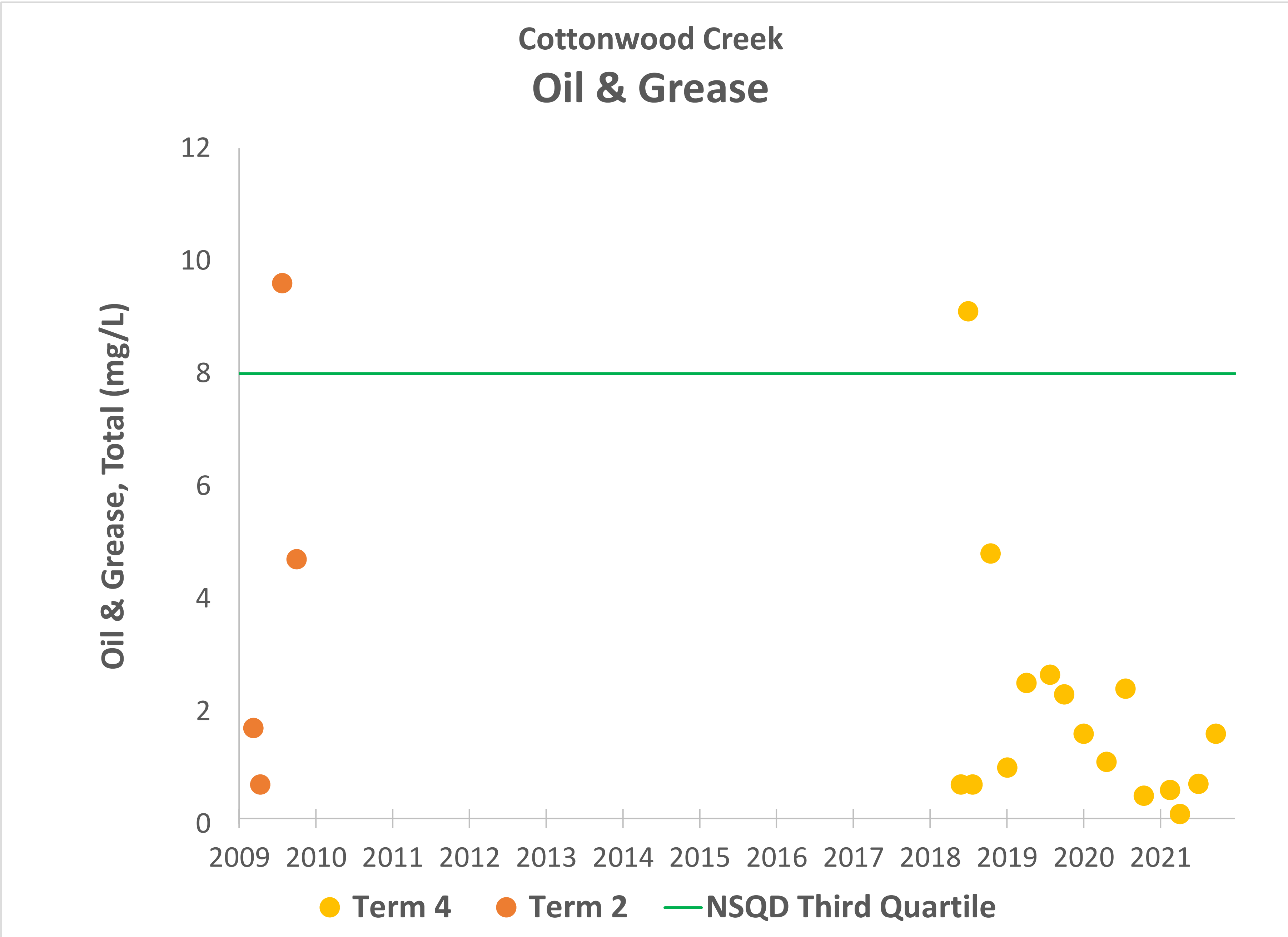
Cottonwood Creek
Chromium, Total
Cr, Total (mg/L)
100
10
1
0.1
0.01
0.001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



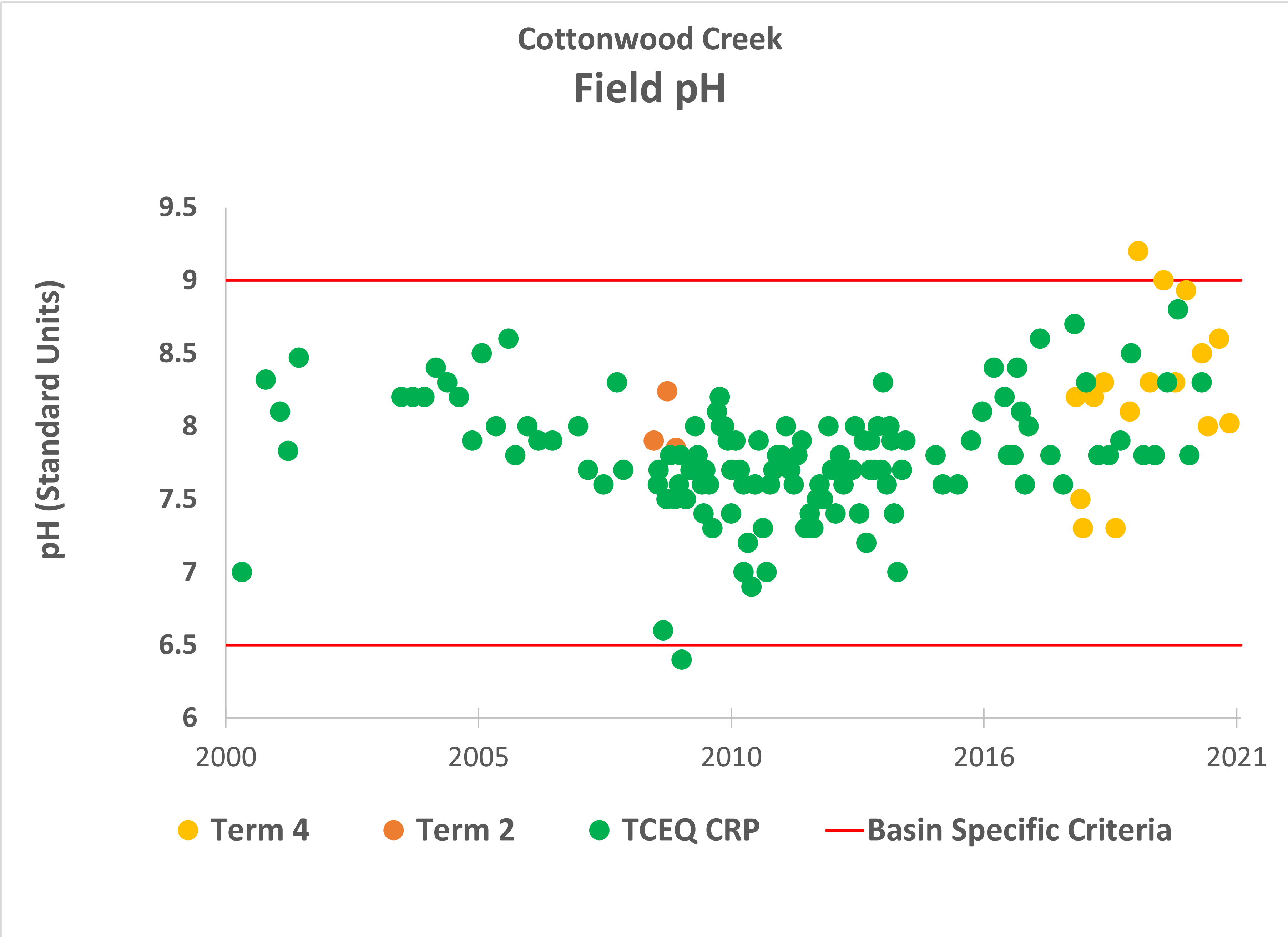
Cottonwood Creek
Copper, Total
1
0.1
0.01
0.001
Cu, Total (mg/L)
2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)


Cottonwood Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

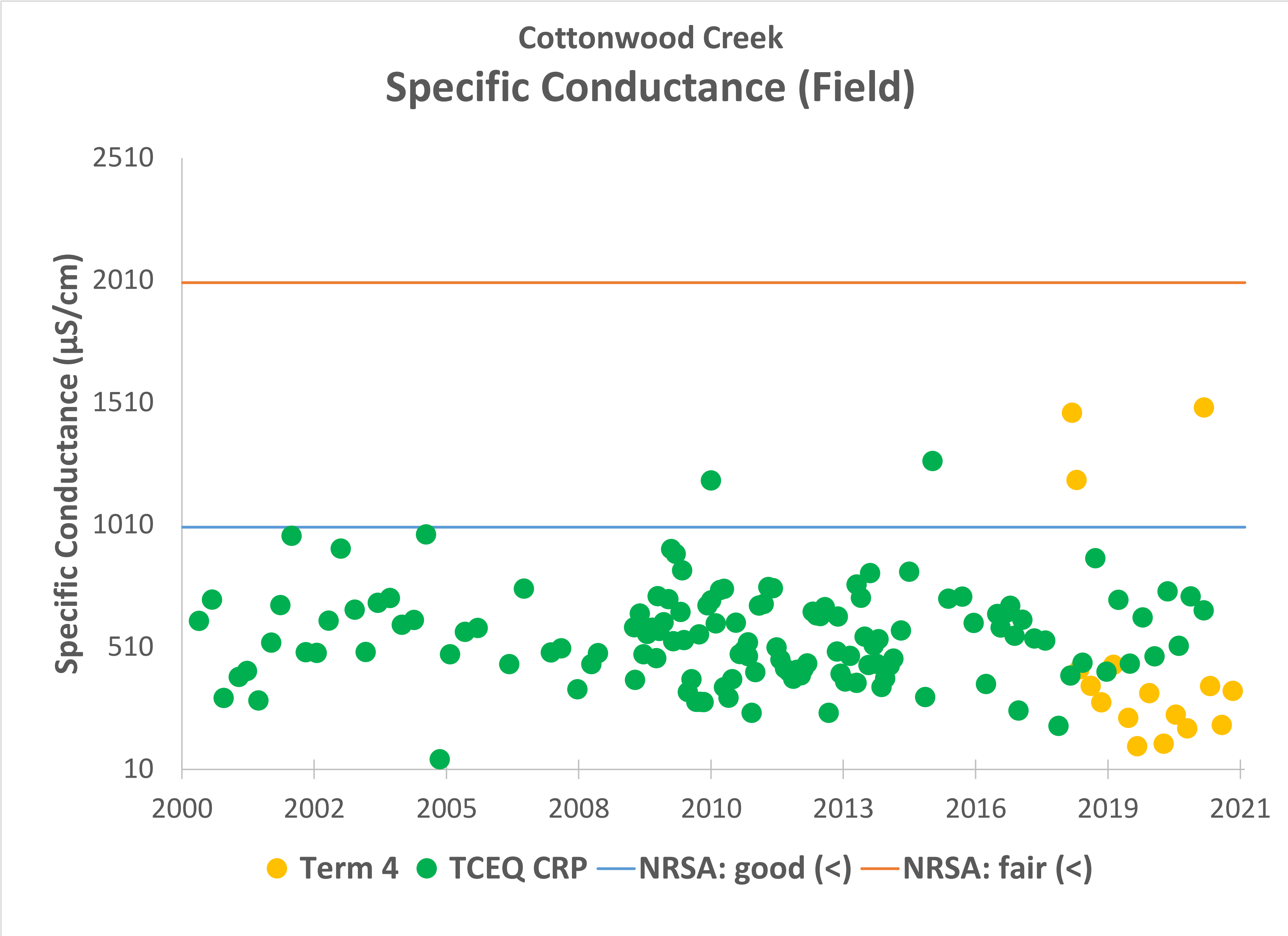

Cottonwood Creek
Zinc, Total
Zn, Total (mg/L)
1000
100
10
1
0.1
0.01
0.001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 2
TCEQ CRP
ALU Acute Criterion (Est)



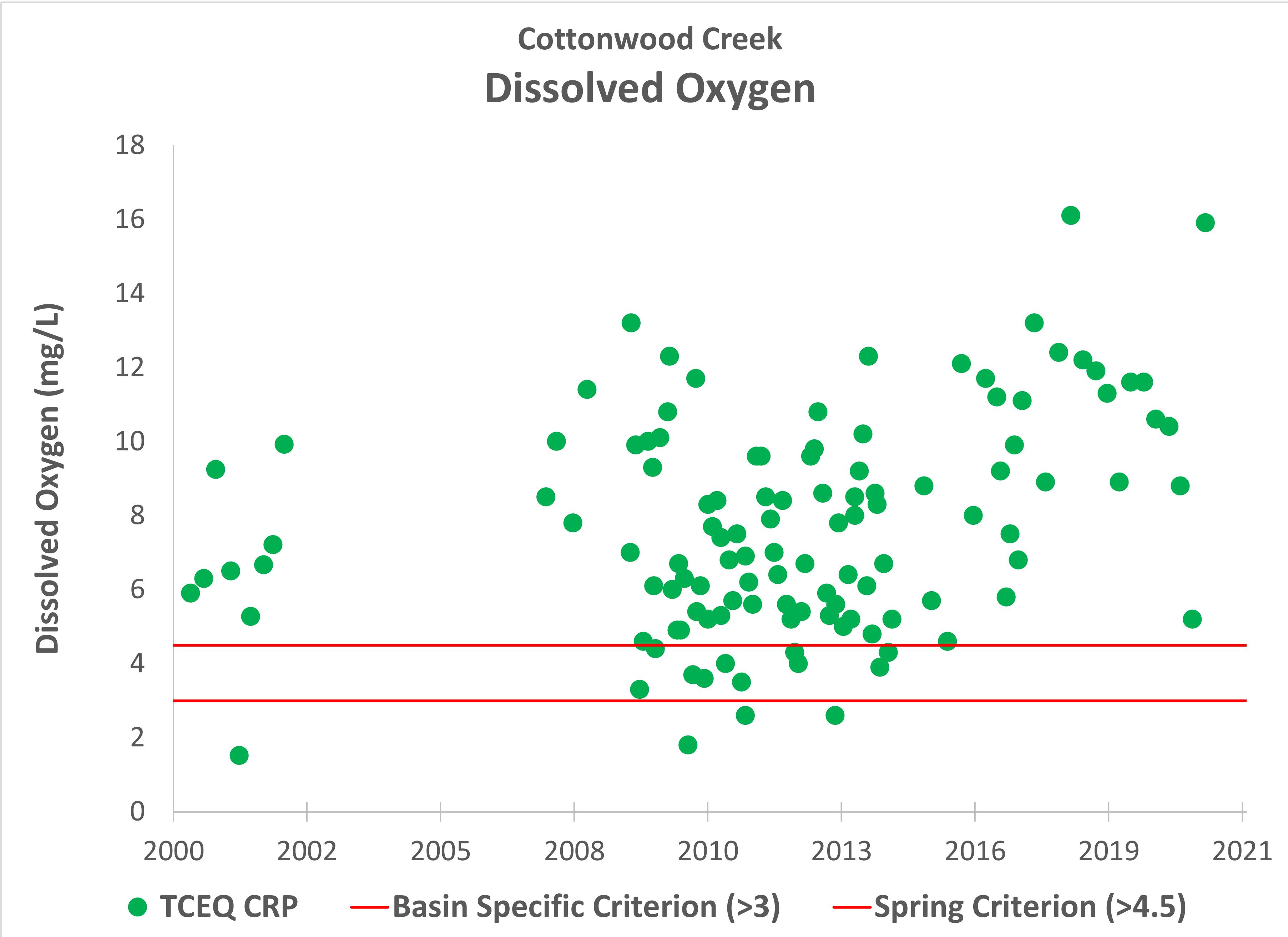
Cottonwood Creek
Oil & Grease
Oil & Grease, Total (mg/L)
12
10
8
6
4
2
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 2
NSQD Third Quartile

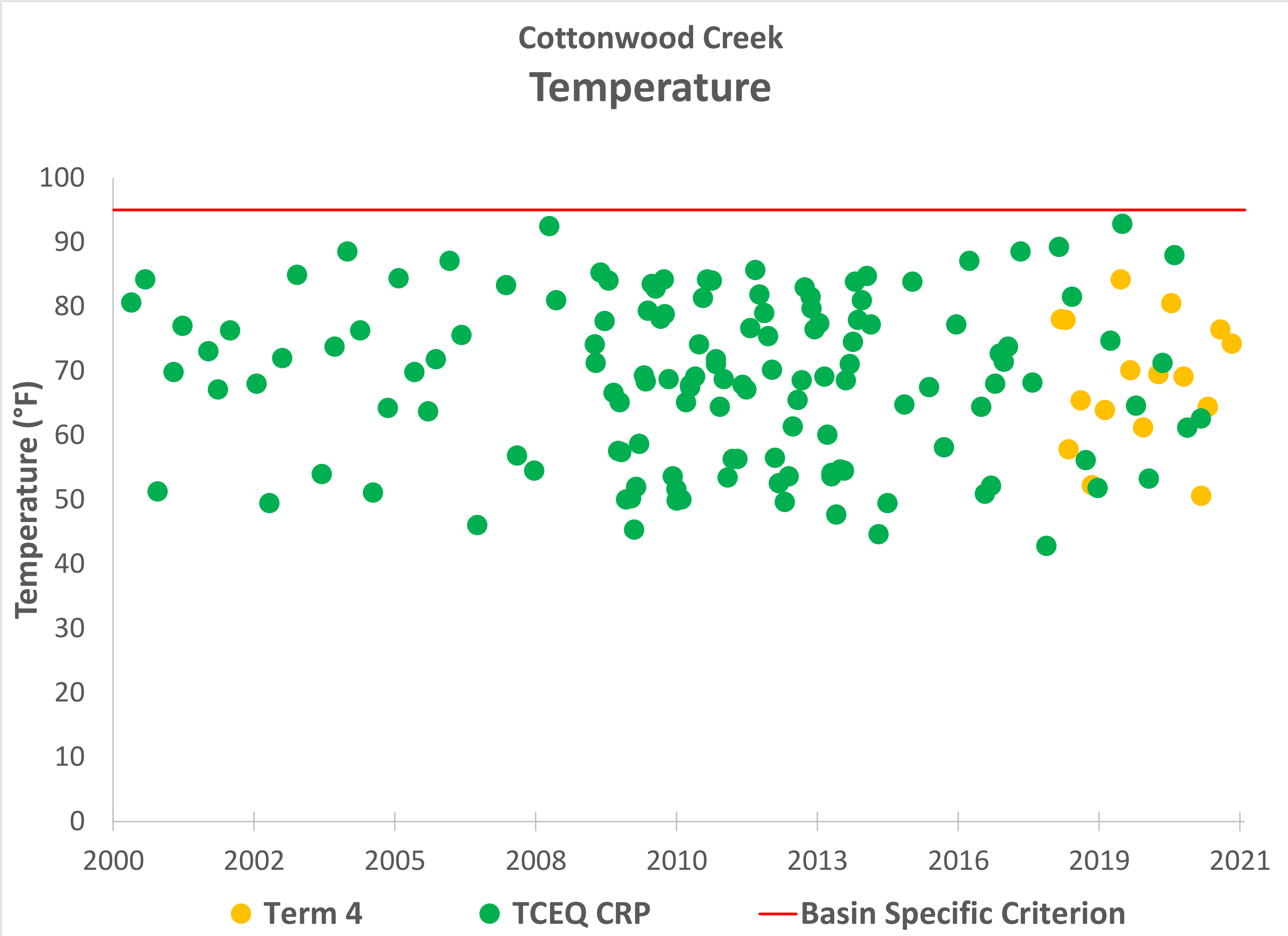


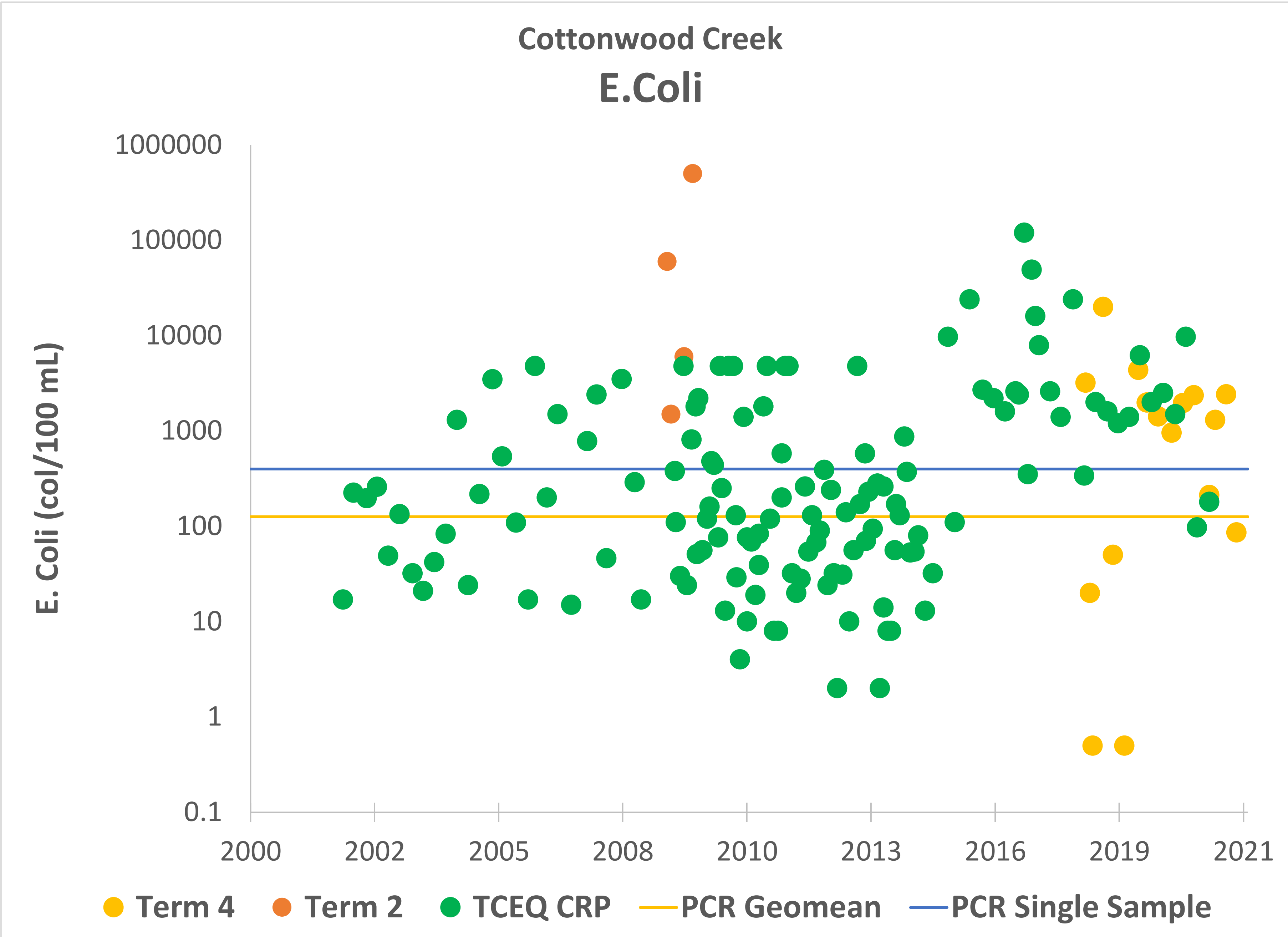
Cottonwood Creek
Field pH
pH (Standard Units)
9.5
9
8.5
8
7.5
7
6.5
6
2000
2005
2010
2016
2021
Term 4
Term 2
TCEQ CRP
Basin Specific Criteria



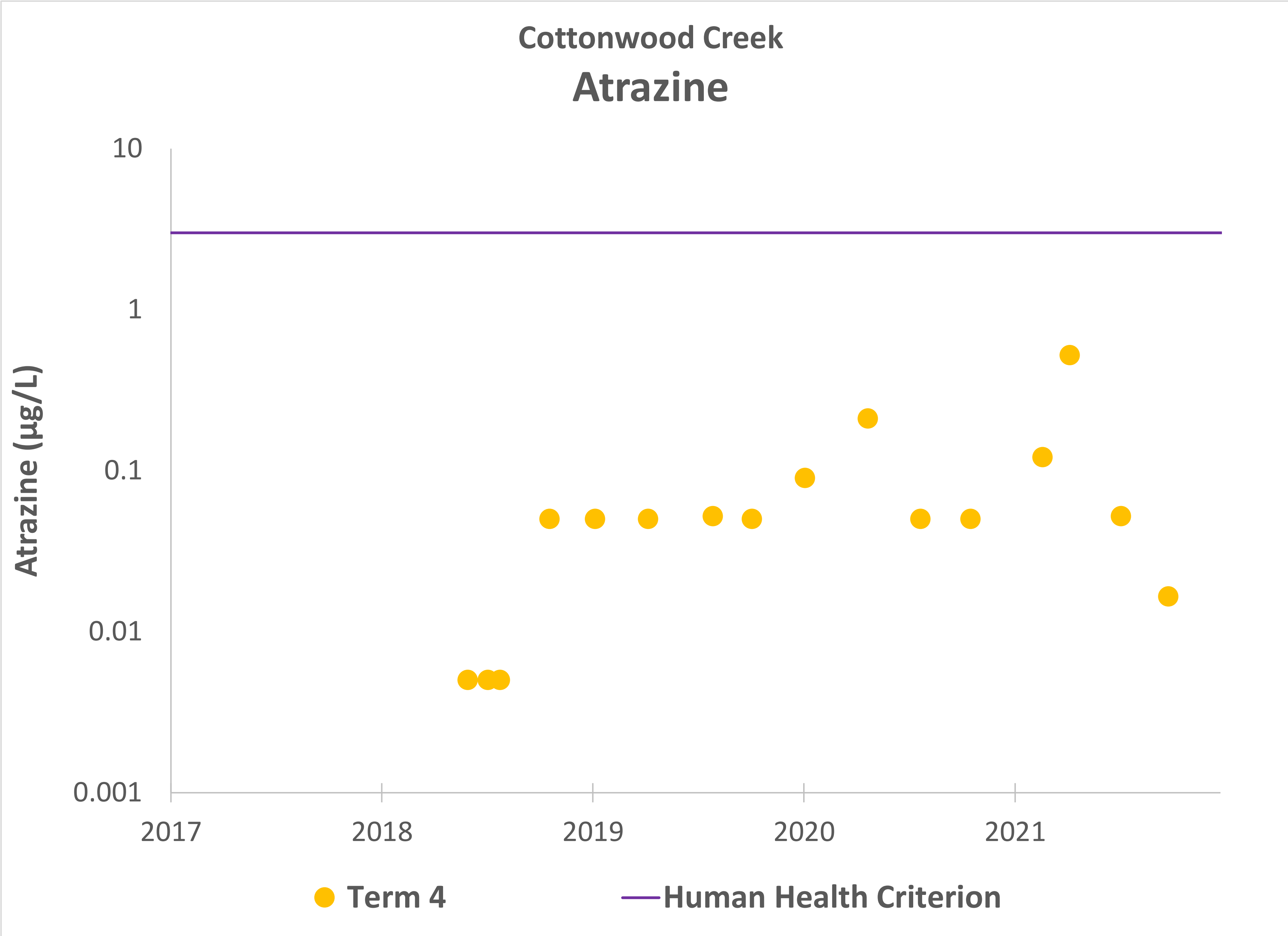
Cottonwood Creek
Specific Conductance (Field)
Specific Conductance (µS/cm)
2510
2010
1510
1010
510
10
2000
2002
2005
2008
2010
2013
2016
2019
2021
Term 4
TCEQ CRP
NRSA: good (<)
NRSA: fair (<)


Cottonwood Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
14
16
18
2000
2002
2005
2008
2010
2013
2016
2019
2021
TCEQ CRP
Basin Specific Criterion (>3)
Spring Criterion (>4.5)


Cottonwood Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2000
2002
2005
2008
2010
2013
2016
2019
2021
Term 4
TCEQ CRP
Basin Specific Criterion

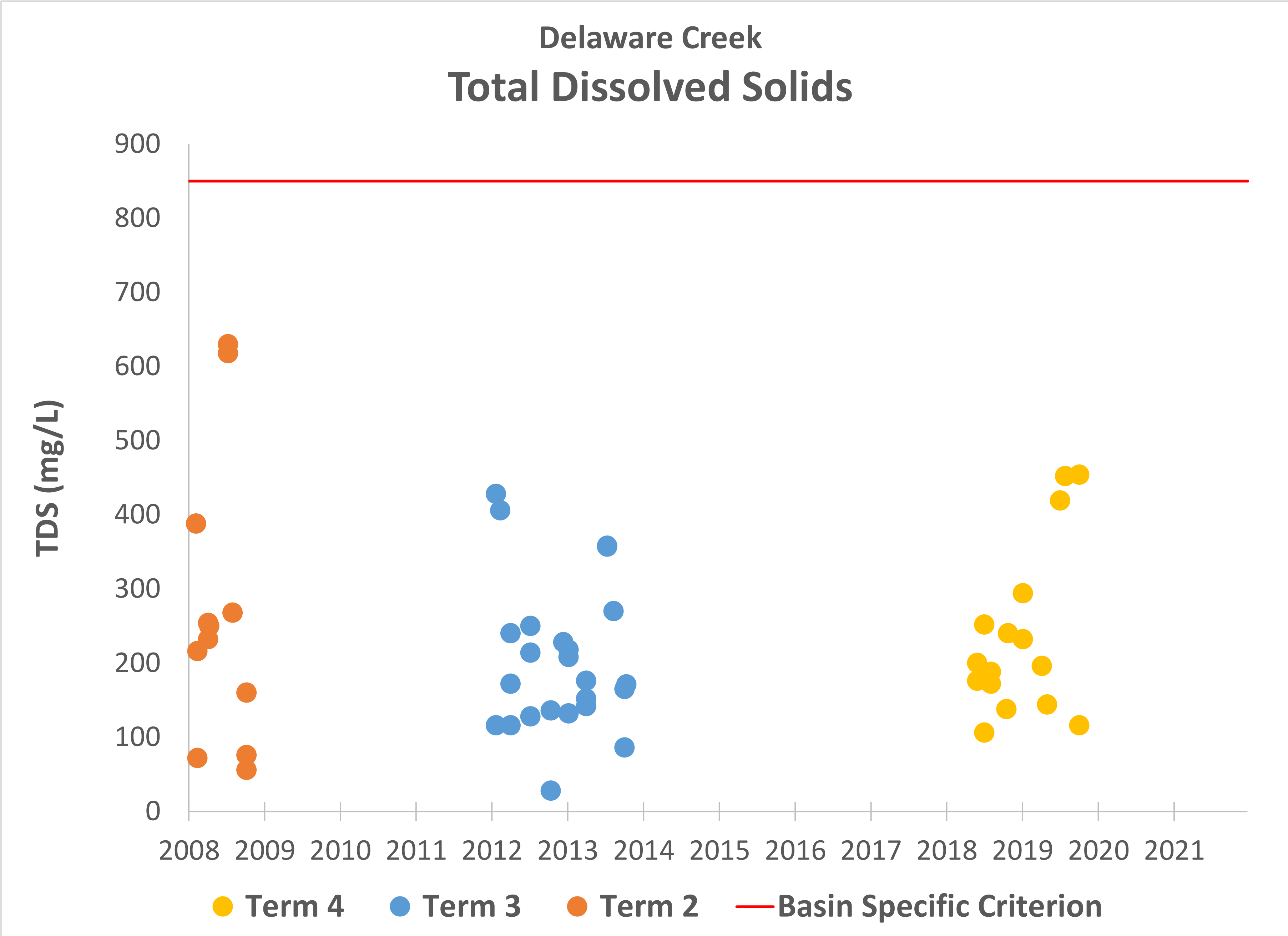


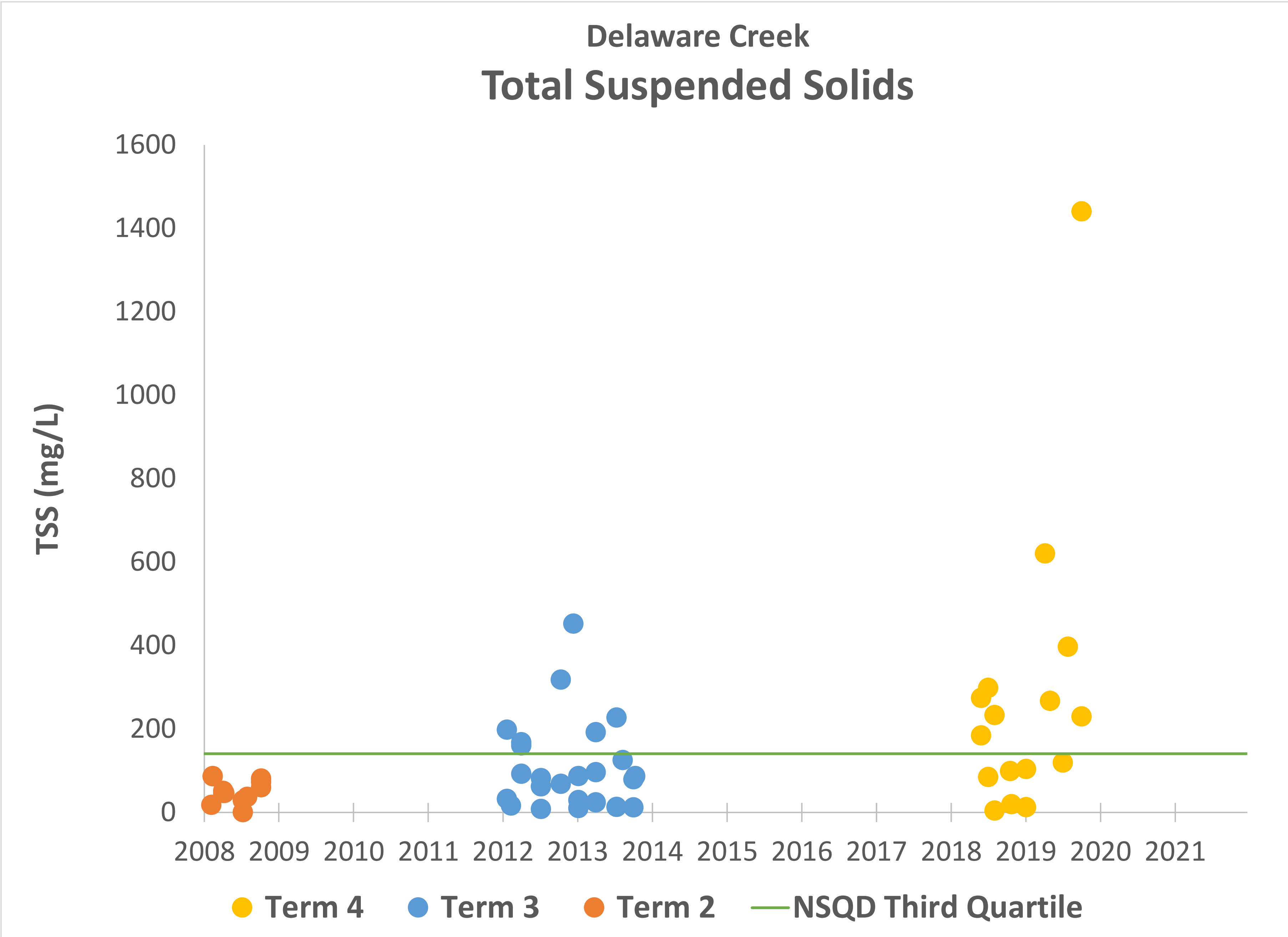
Cottonwood Creek
E.Coli
E. Coli (col/100 mL)
1000000
100000
10000
1000
100
10
1
0.1
2000
2002
2005
2008
2010
2013
2016
2019
2021
Term 4
Term 2
TCEQ CRP
PCR Geomean
PCR Single Sample


Cottonwood Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
0.001
2017
2018
2019
2020
2021
Term 4
Human Health Criterion

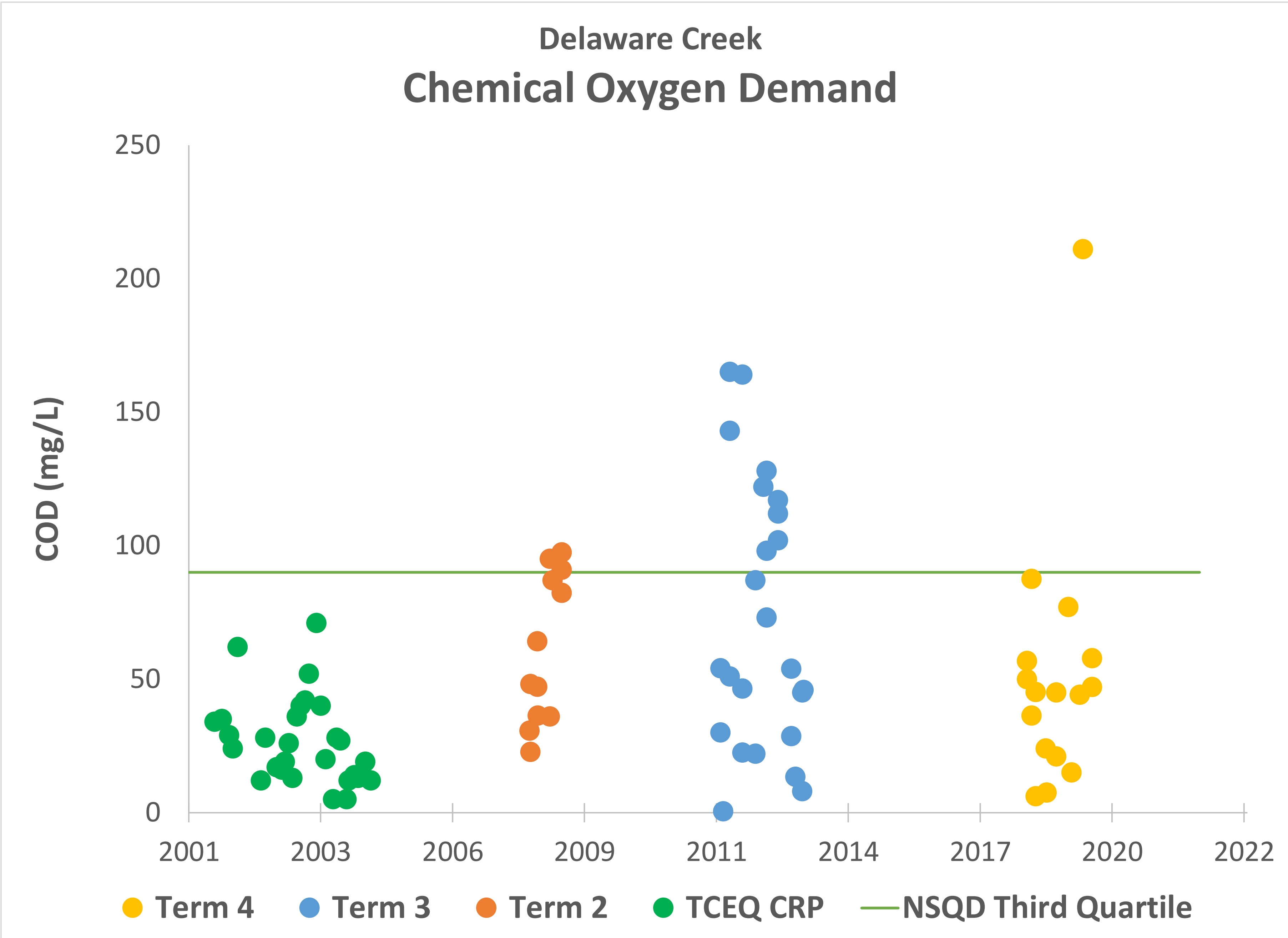
Appendix G

Delaware Creek Water Quality Data Graphs

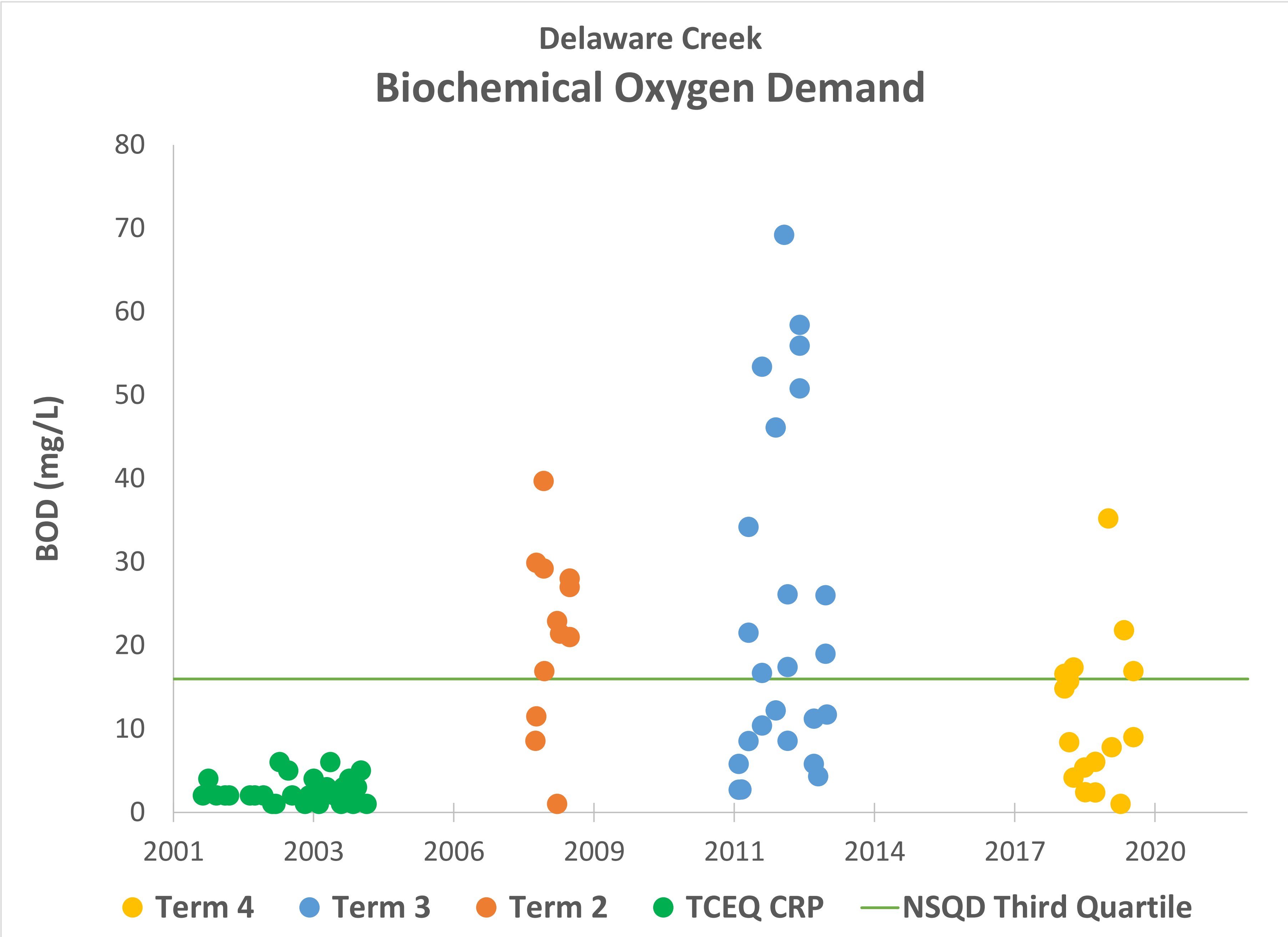

Delaware Creek
Total Dissolved Solids
TDS (mg/L)
900
800
700
600
500
400
300
200
100
0
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
Basin Specific Criterion

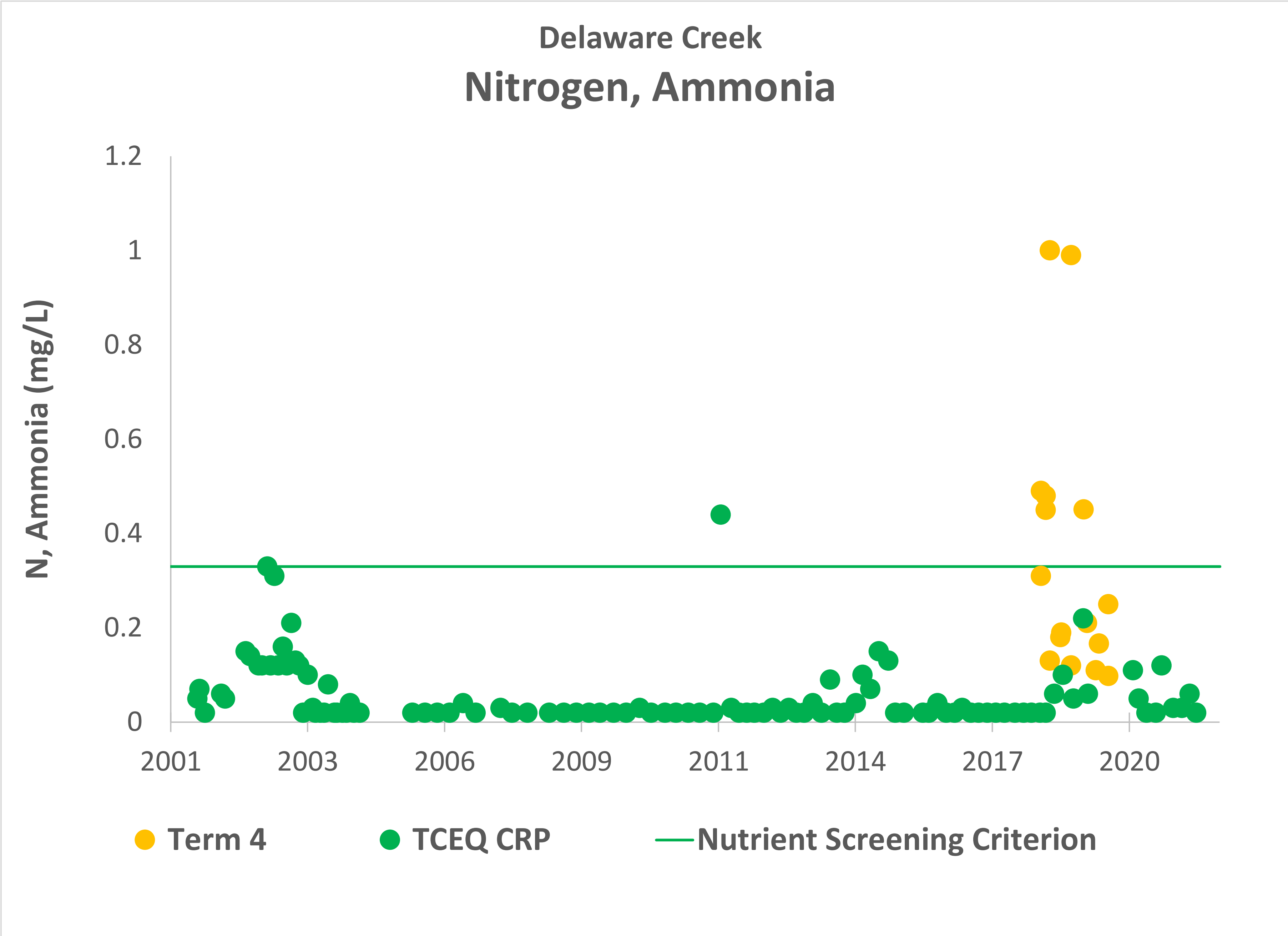


Delaware Creek
Total Suspended Solids
TSS (mg/L)
1600
1400
1200
1000
800
600
400
200
0
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

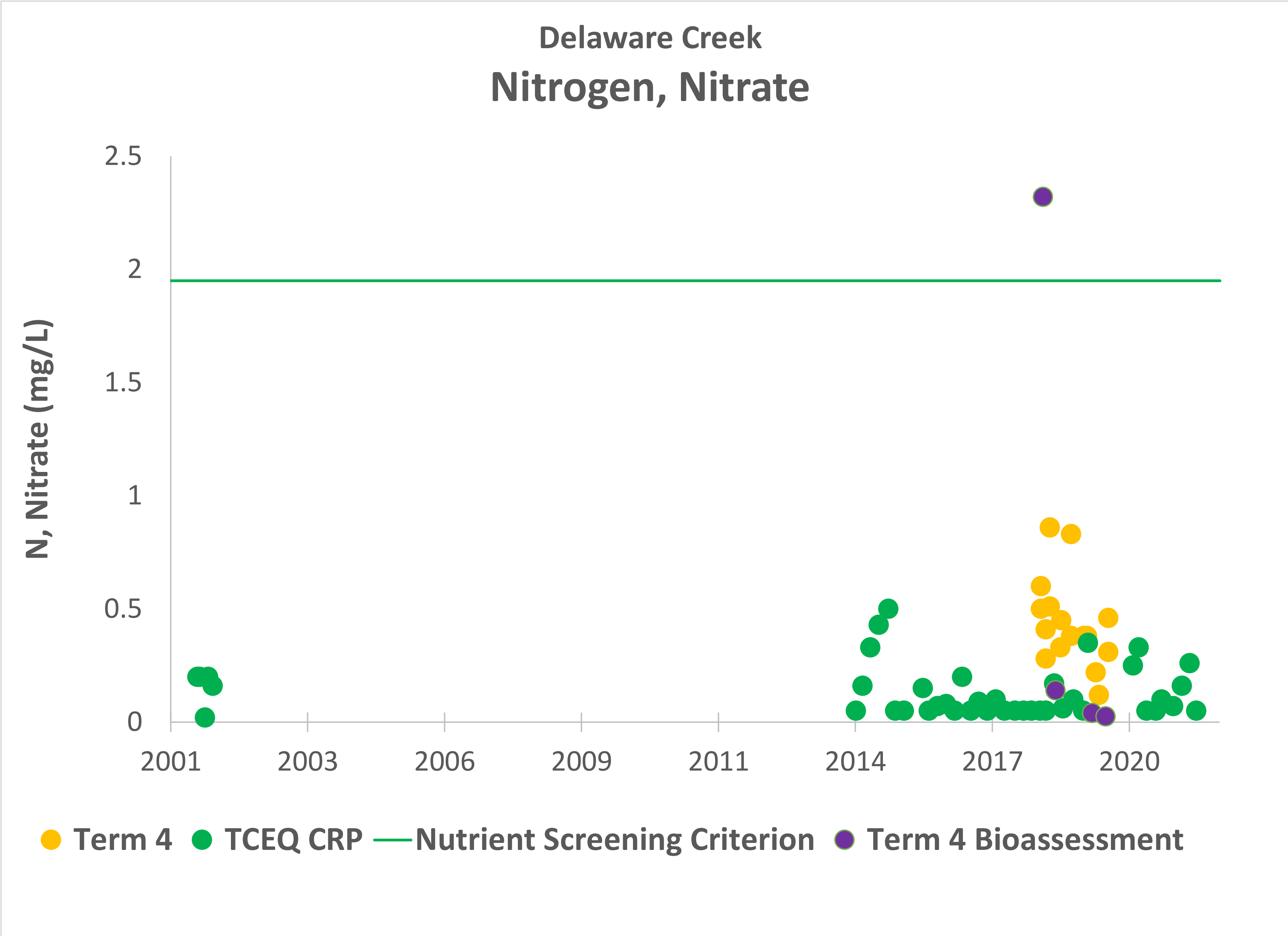


Delaware Creek
Chemical Oxygen Demand
COD (mg/L)
250
200
150
100
50
0
2001
2003
2006
2009
2011
2014
2017
2020
2022
Term 4
Term 3
Term 2
TCEQ CRP
NSQD Third Quartile

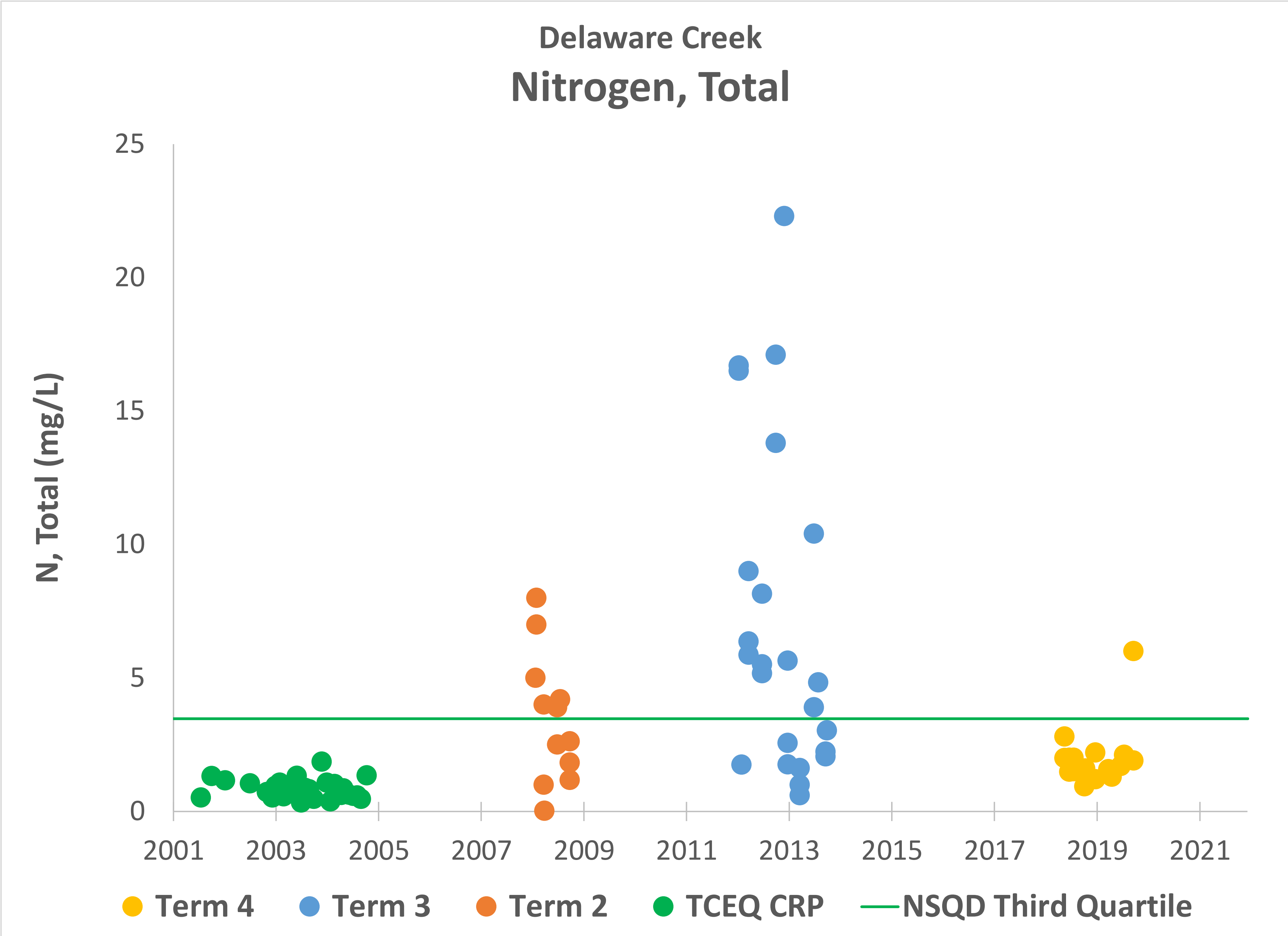

Delaware Creek
Biochemical Oxygen Demand
BOD (mg/L)
80
70
60
50
40
30
20
10
0
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
Term 3
Term 2
TCEQ CRP
NSQD Third Quartile



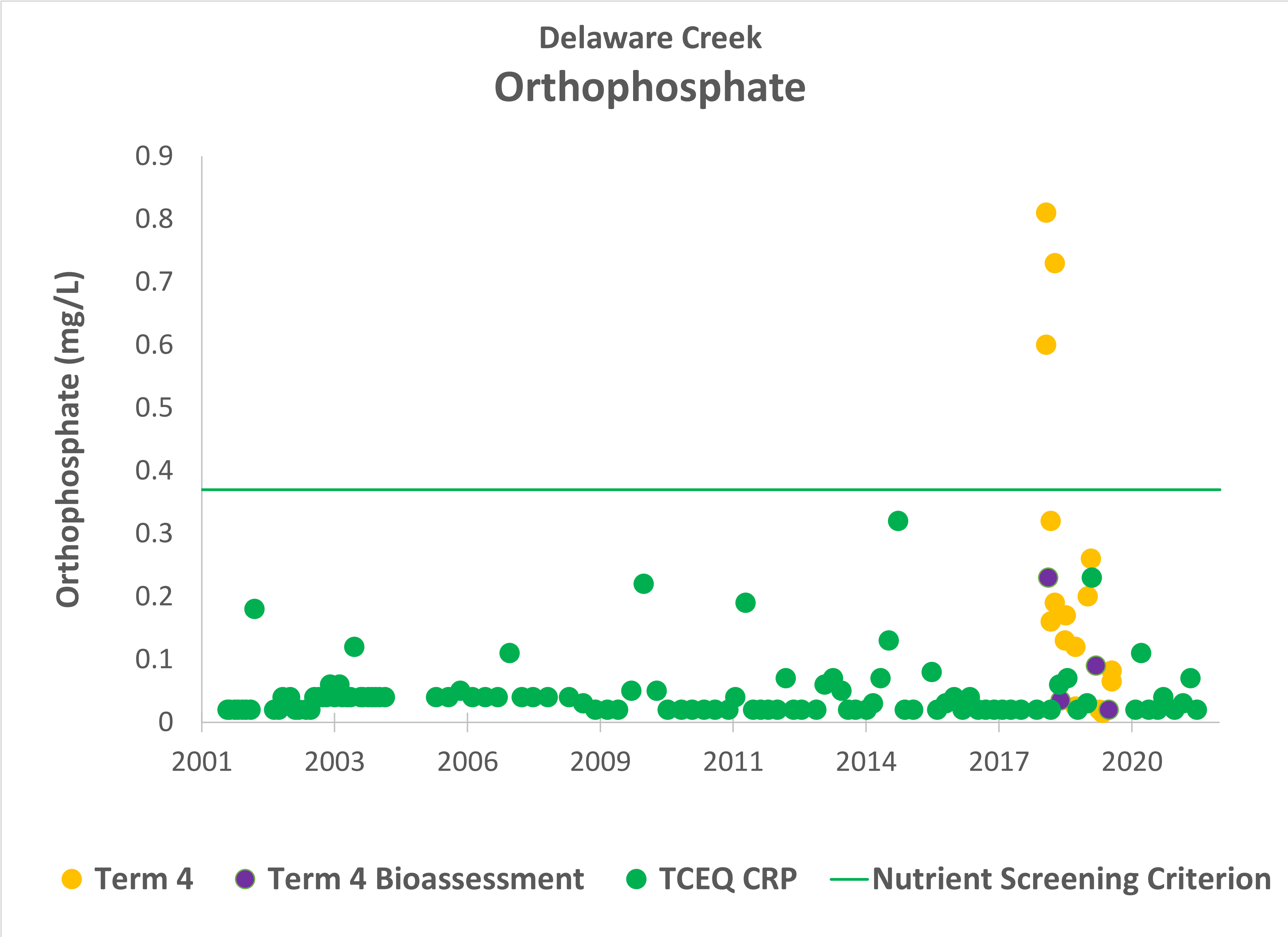
Delaware Creek
Nitrogen, Ammonia
N, Ammonia (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion



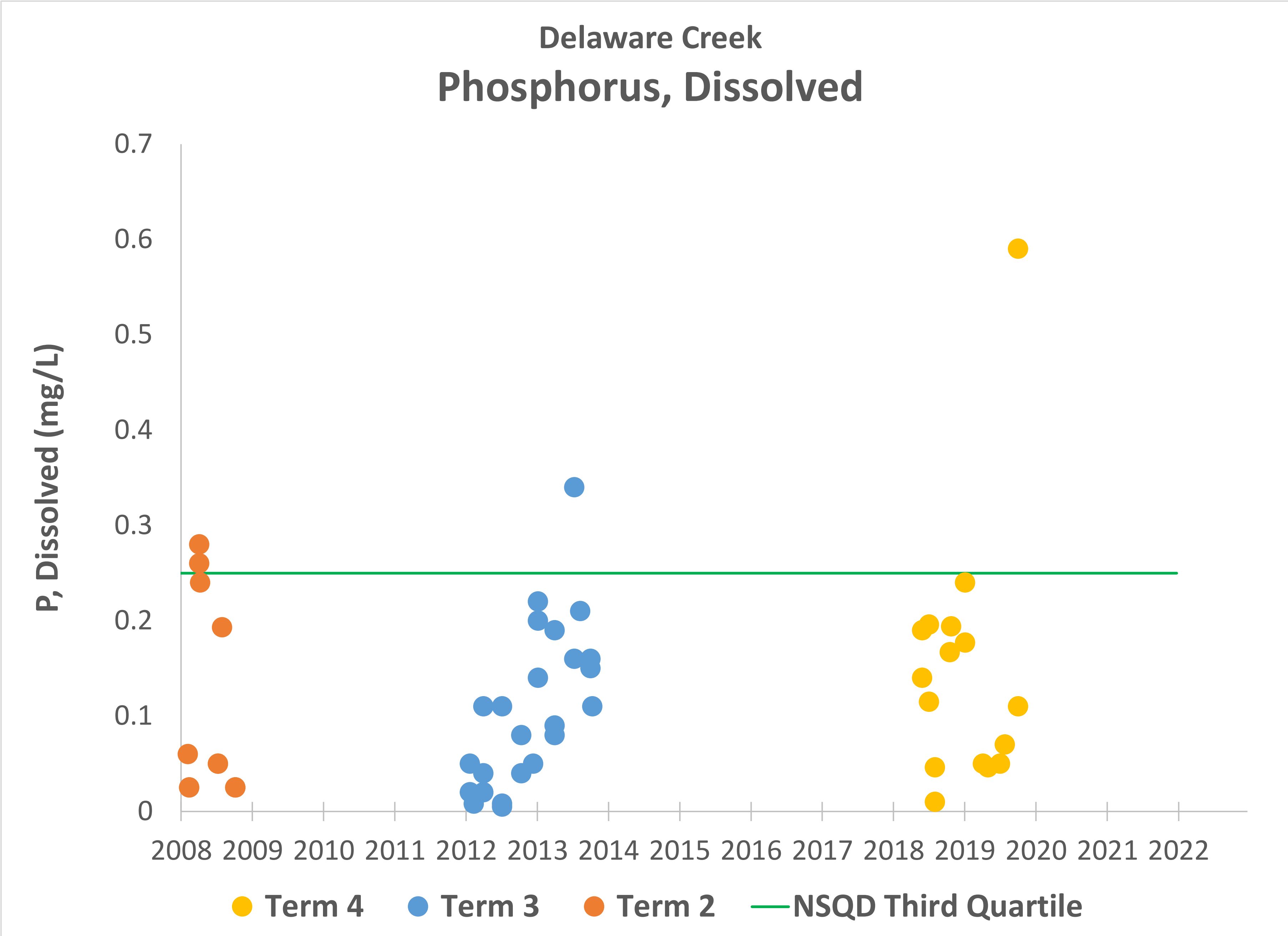
Delaware Creek
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion
Term 4 Bioassessment

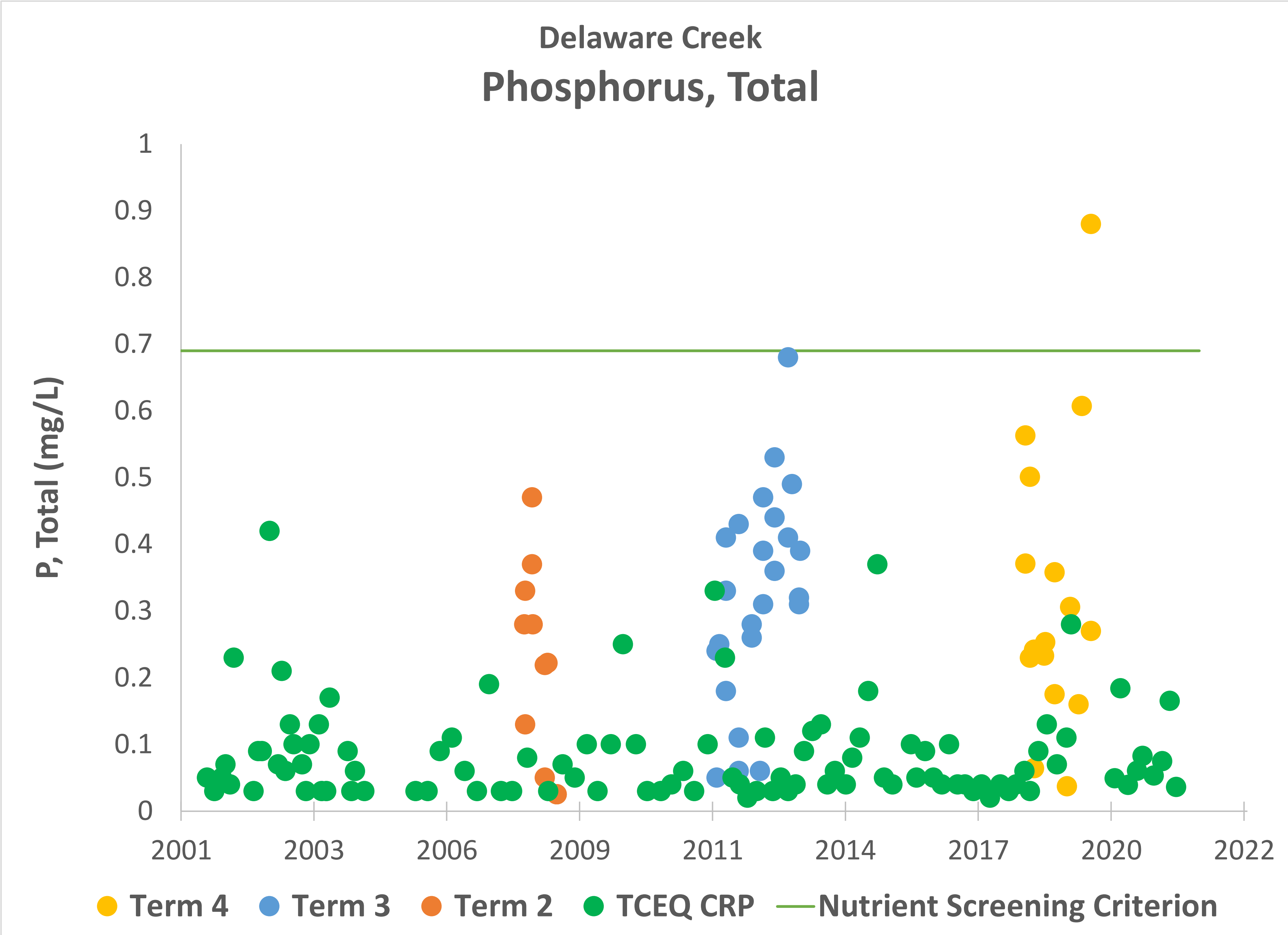


Delaware Creek
Nitrogen, Total
N, Total (mg/L)
25
20
15
10
5
0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
NSQD Third Quartile

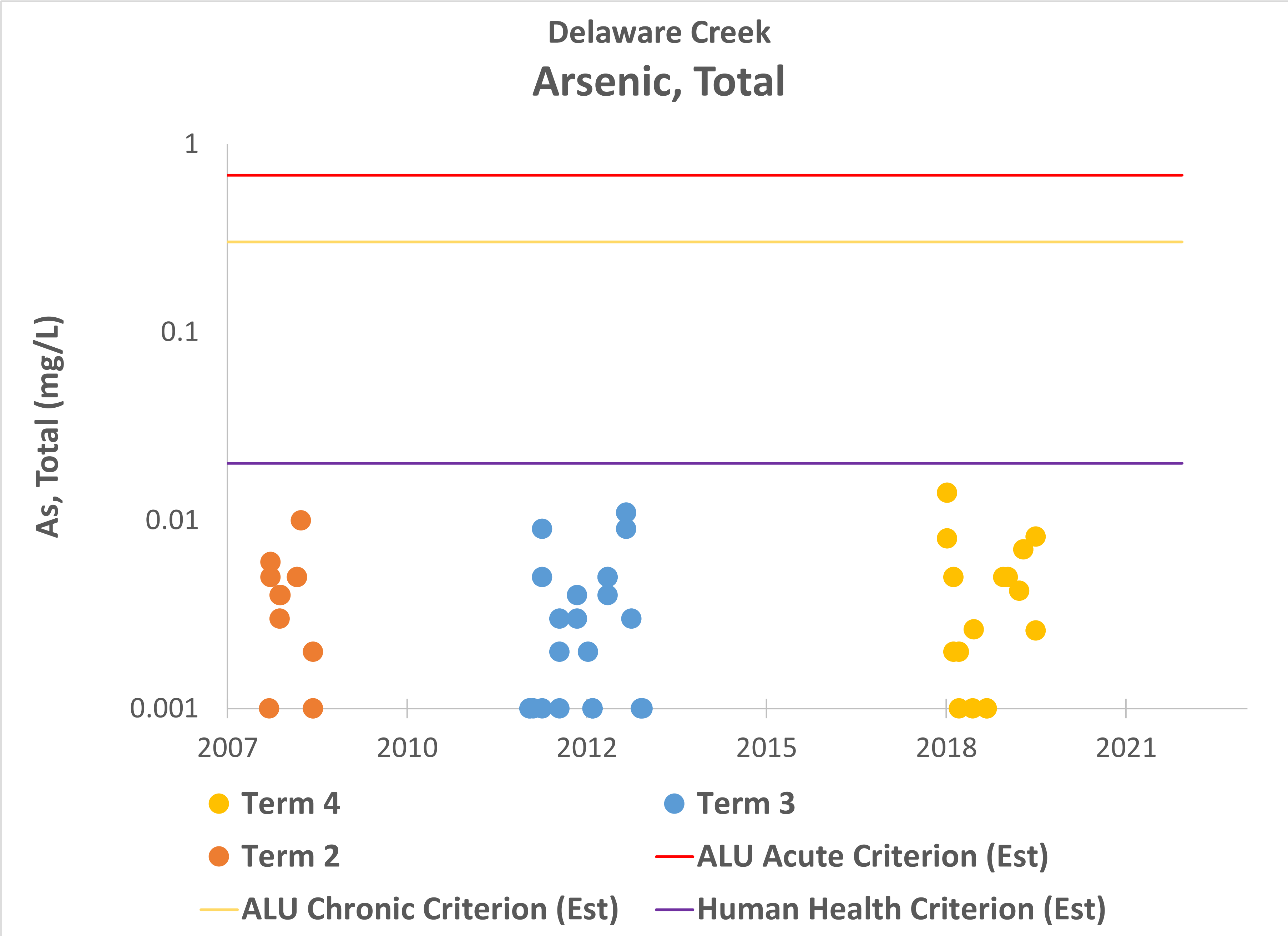


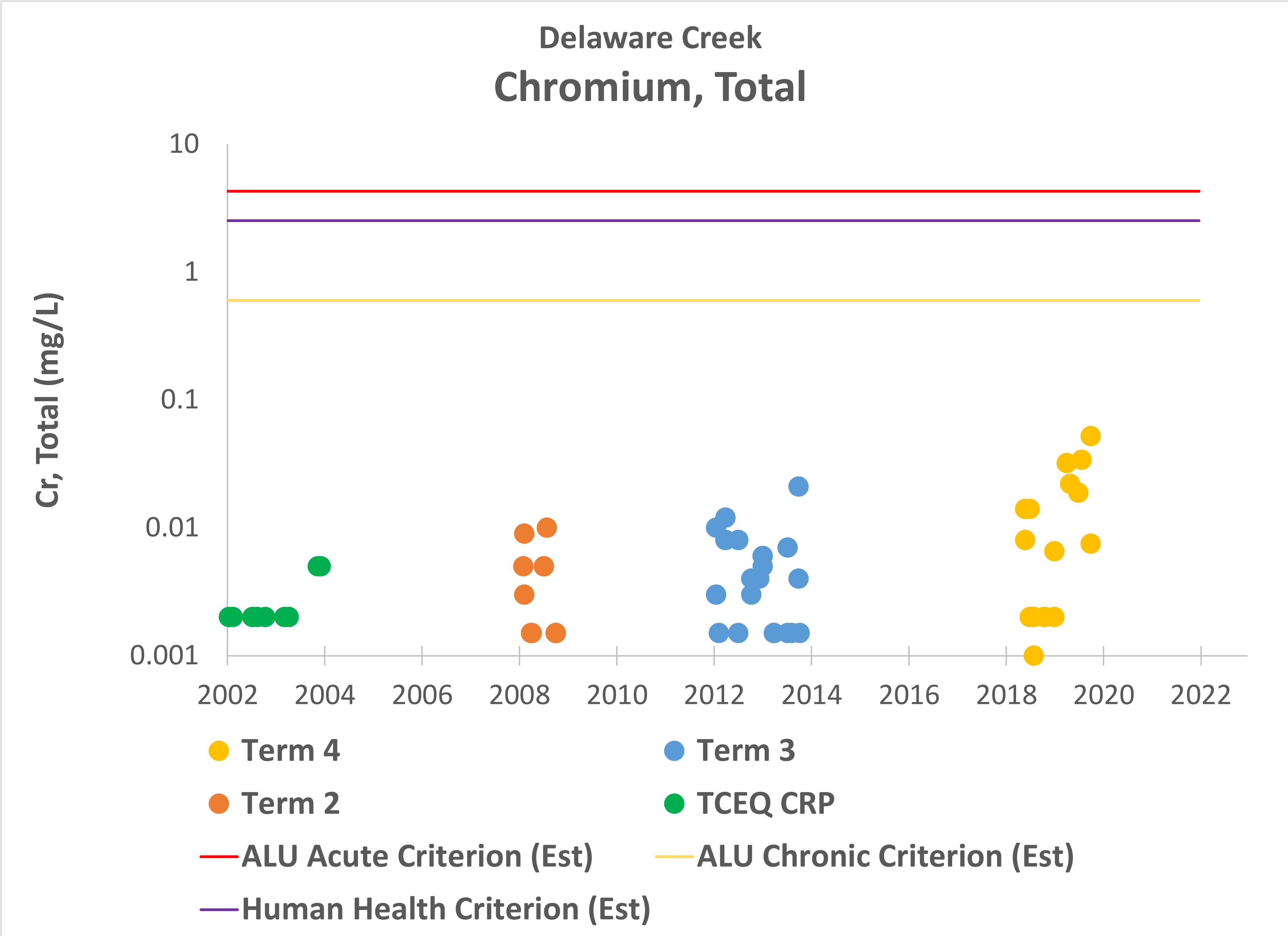
Delaware Creek
Orthophosphate
Orthophosphate (mg/L)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
Term 4 Bioassessment
TCEQ CRP
Nutrient Screening Criterion

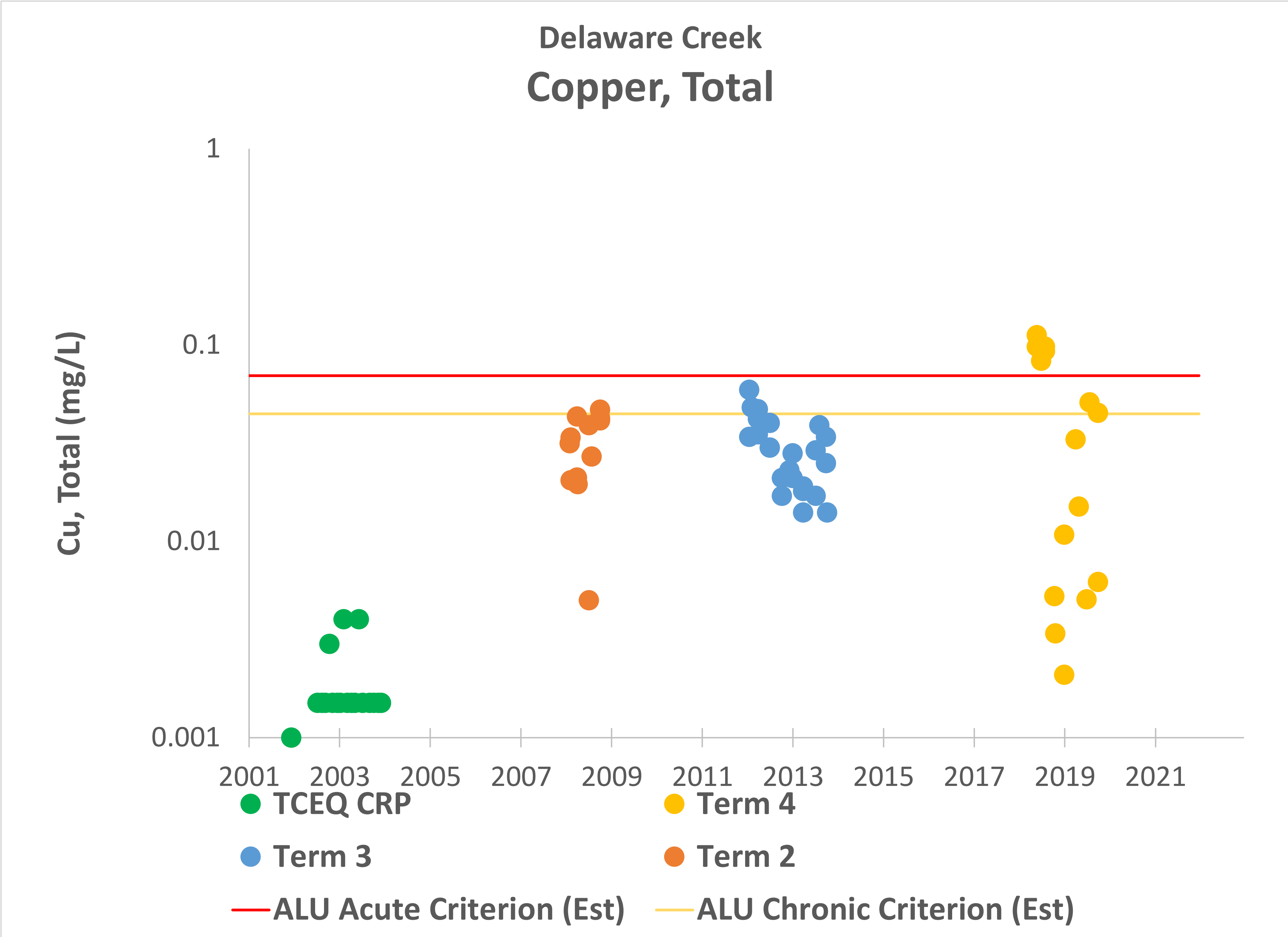

Delaware Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022
Term 4
Term 3
Term 2
NSQD Third Quartile

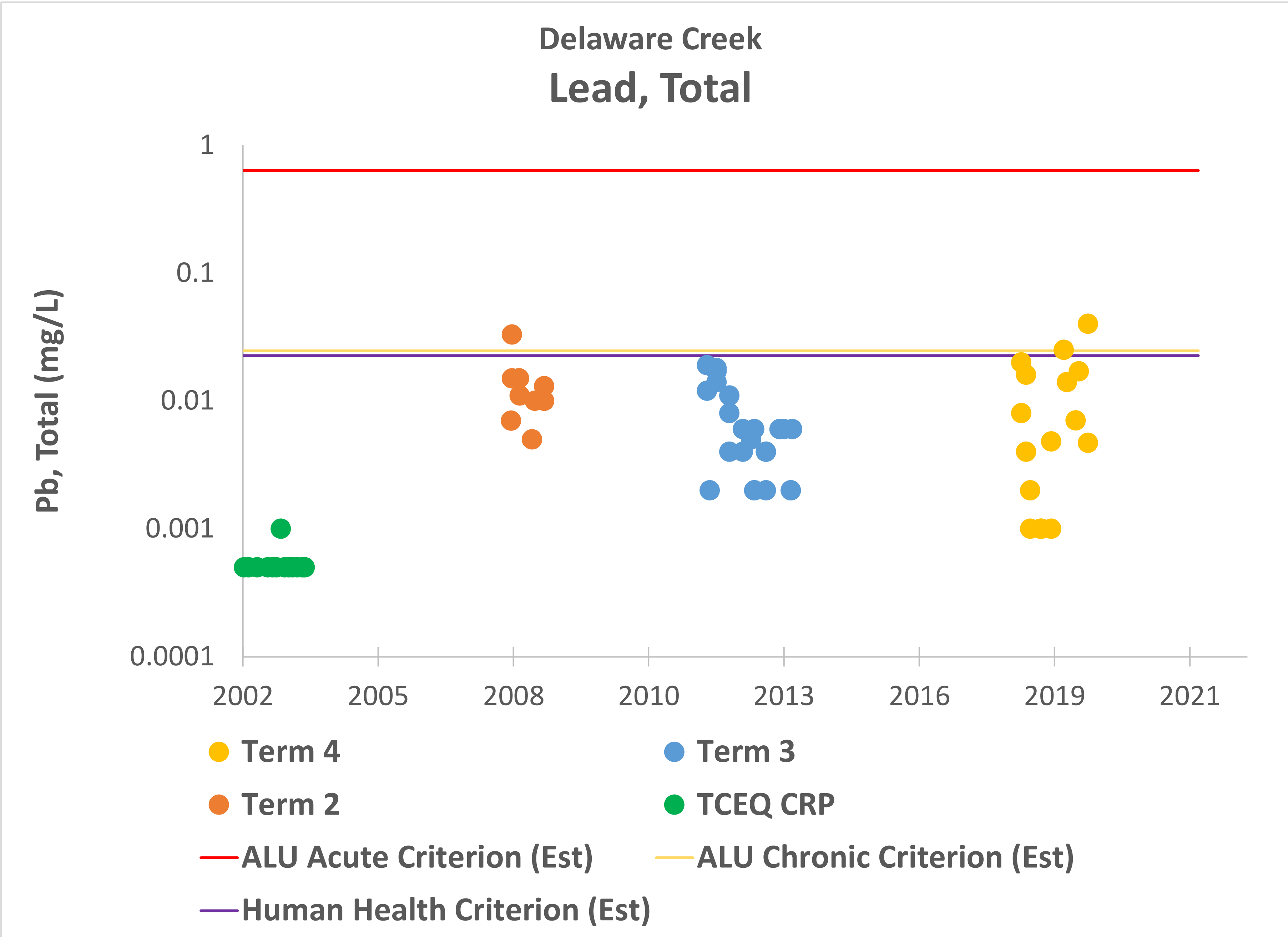


Delaware Creek
Phosphorus, Total
P, Total (mg/L)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
2001
2003
2006
2009
2011
2014
2017
2020
2022
Term 4
Term 3
Term 2
TCEQ CRP
Nutrient Screening Criterion

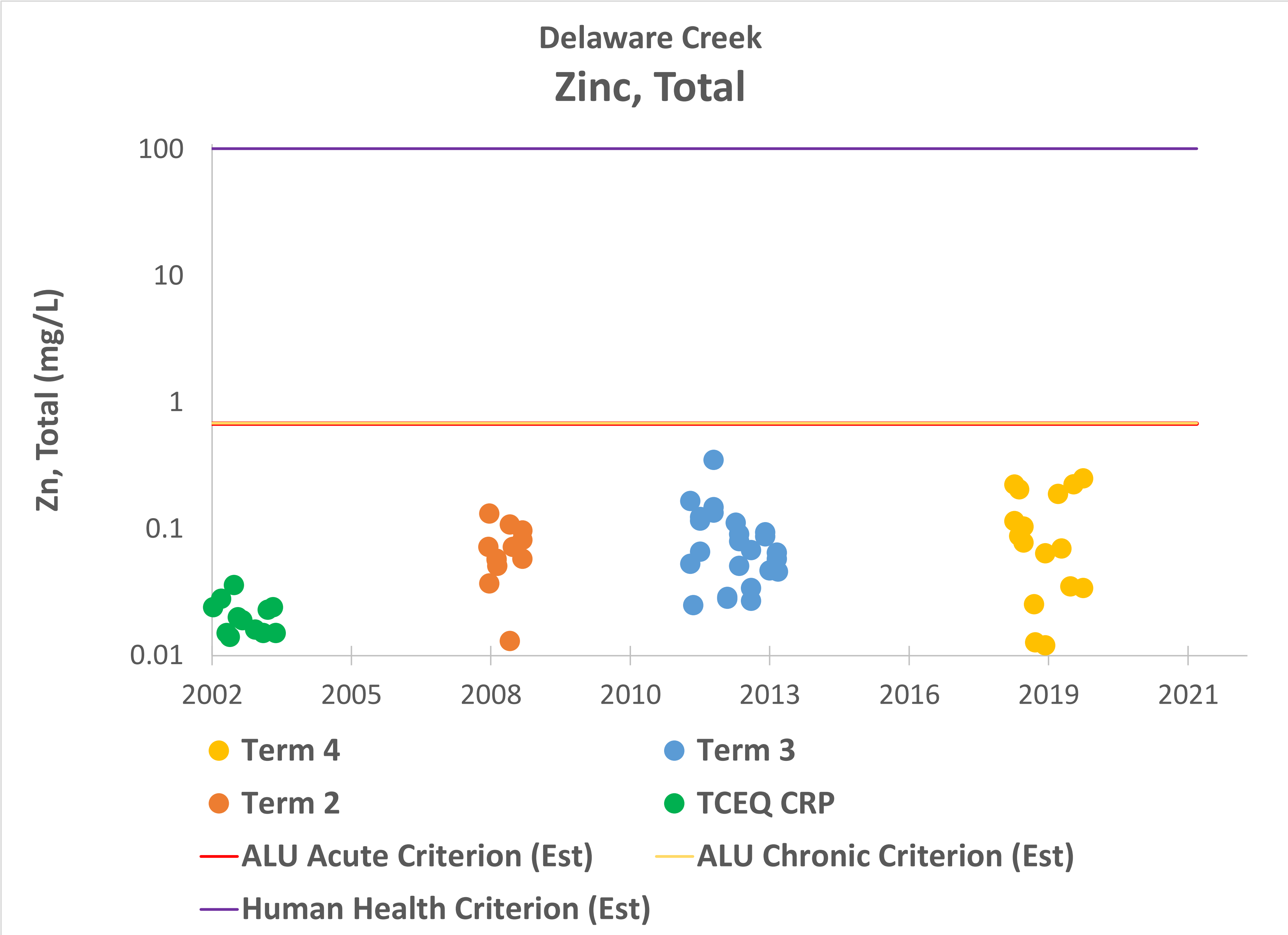

Delaware Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2007
2010
2012
2015
2018
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)


Delaware Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

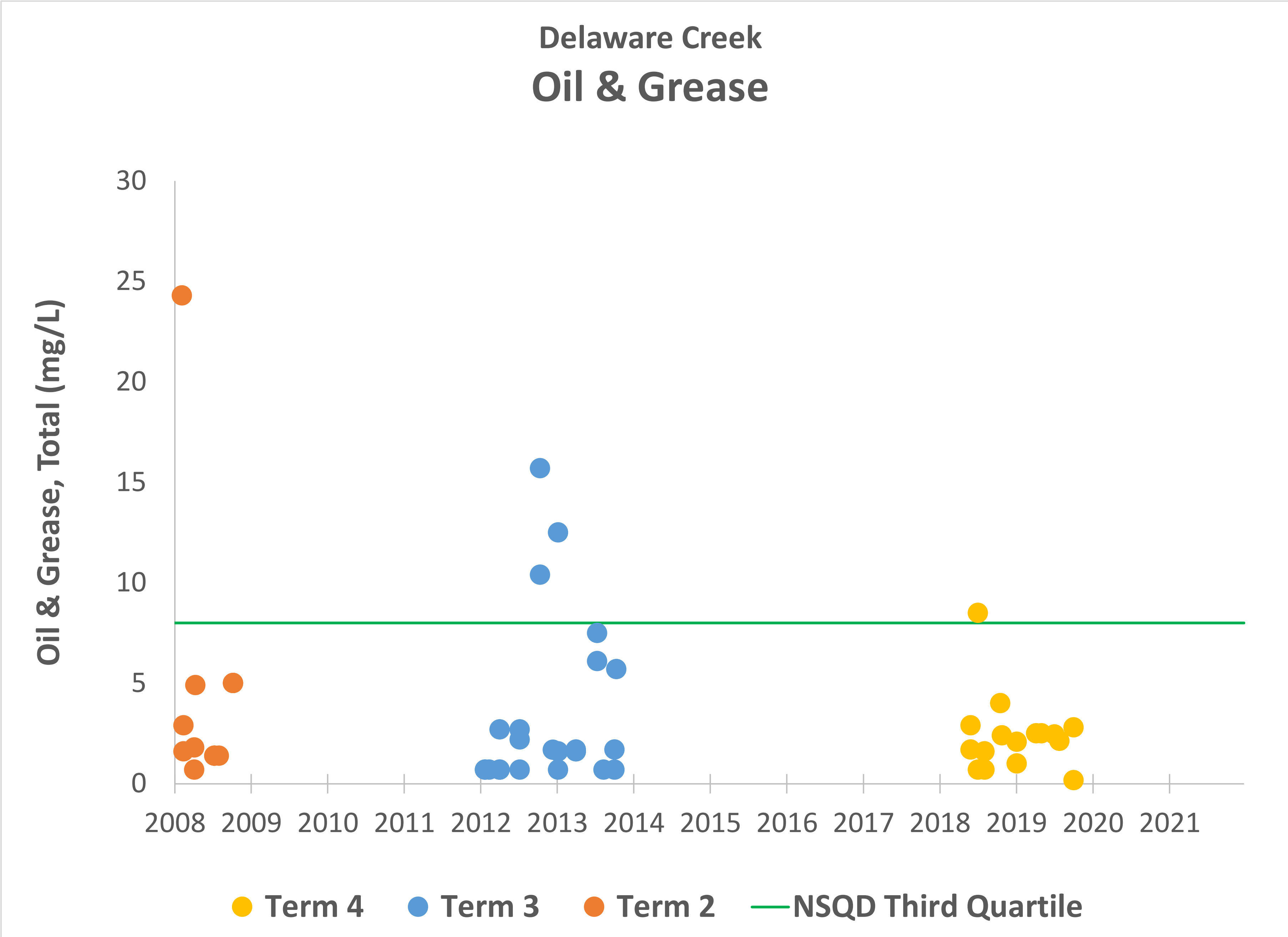

Delaware Creek
Copper, Total
Cu, Total (mg/L)
1
0.1
0.01
0.001
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
TCEQ CRP
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)

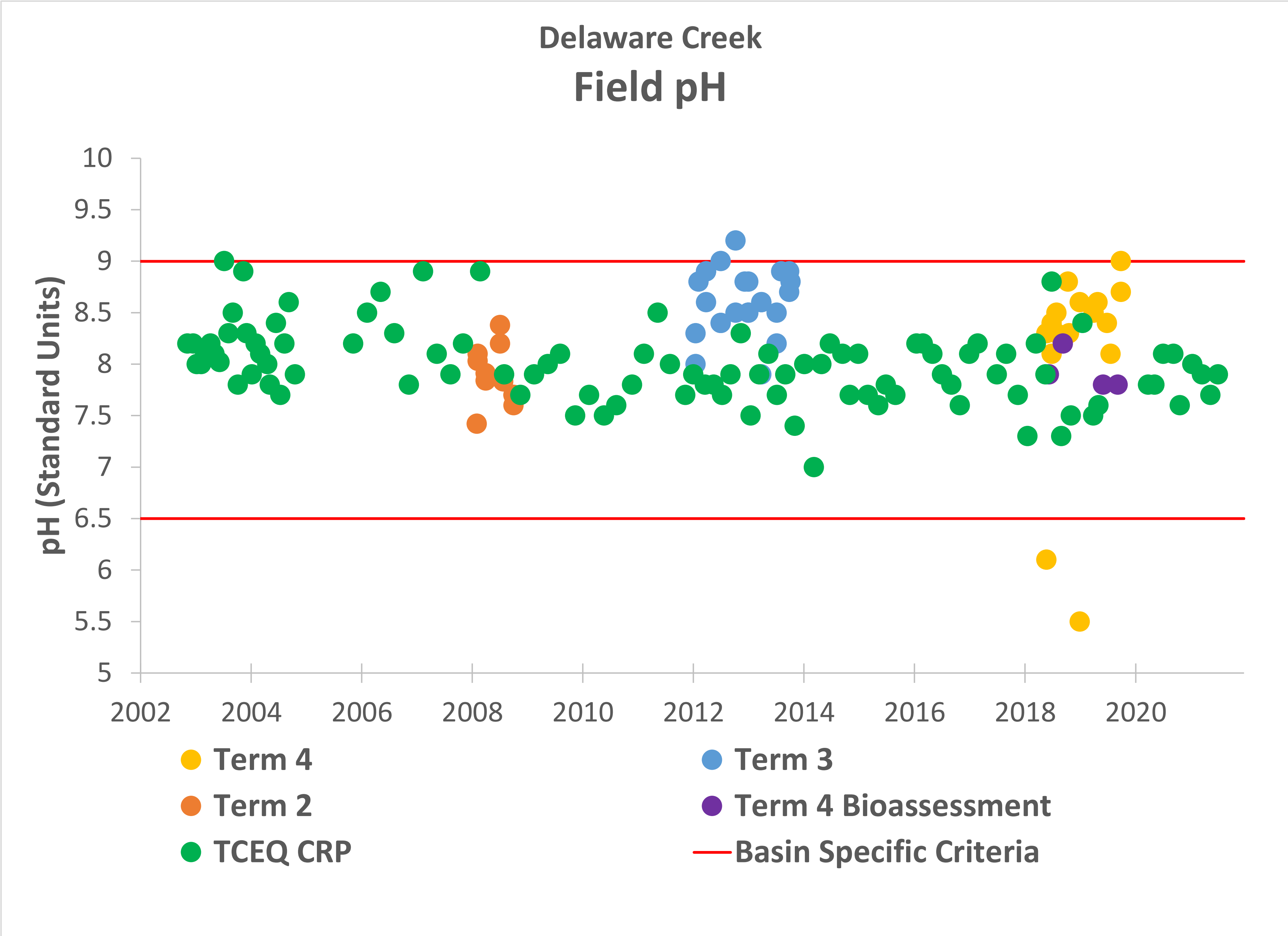


Delaware Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2002
2005
2008
2010
2013
2016
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

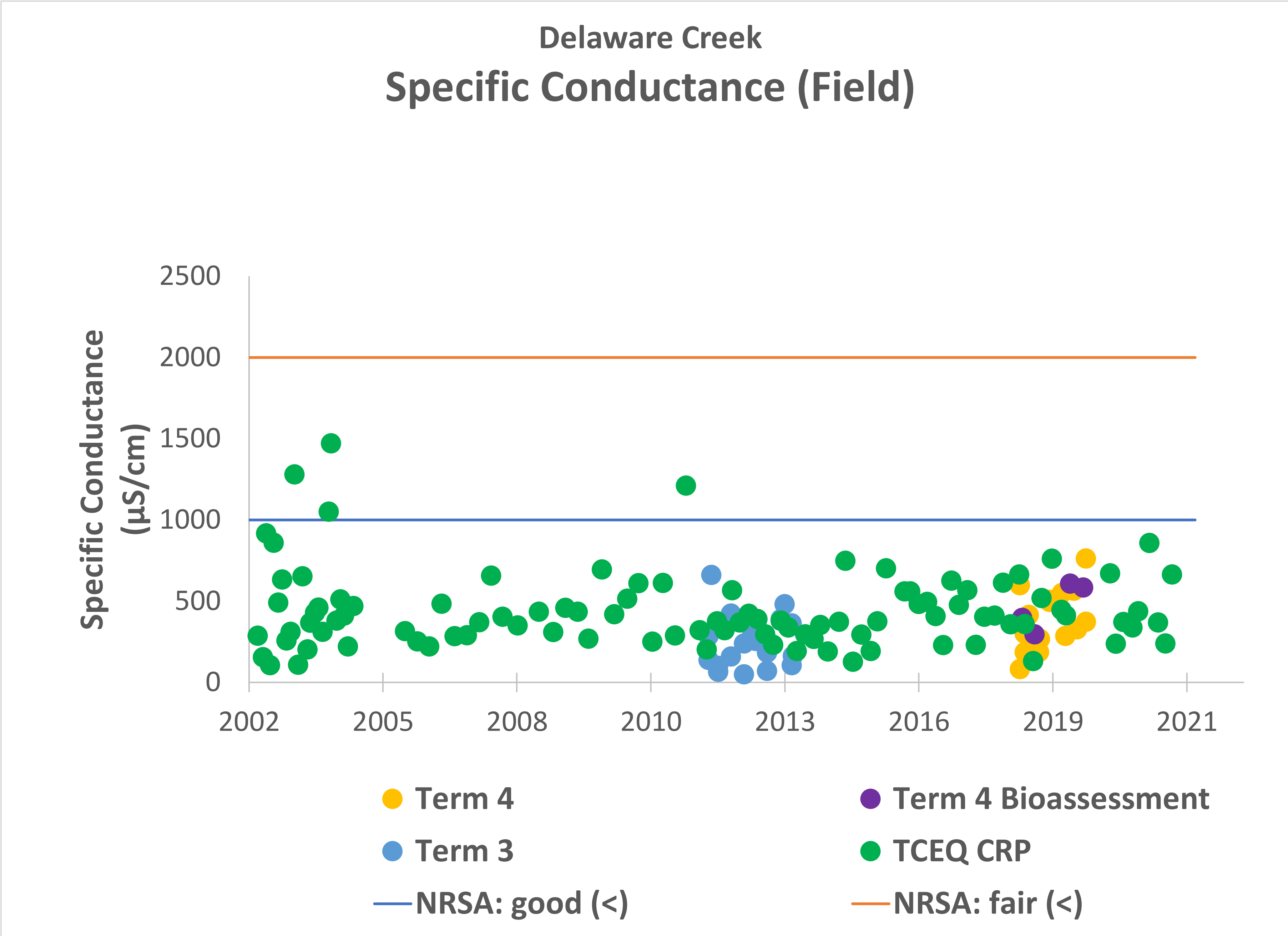


Delaware Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
2002
2005
2008
2010
2013
2016
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

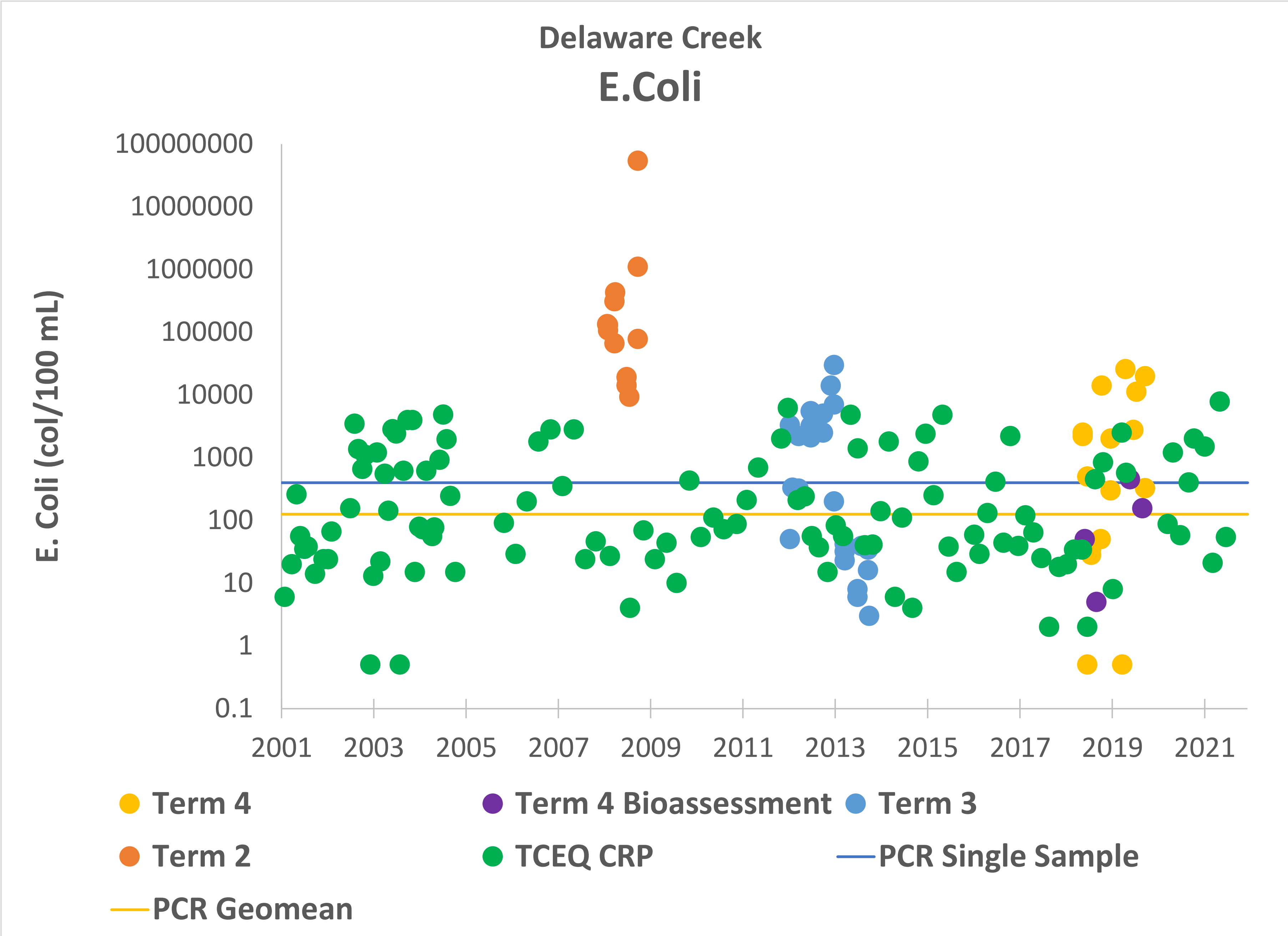

Delaware Creek
Oil & Grease
Oil & Grease, Total (mg/L)
30
25
20
15
10
5
0
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

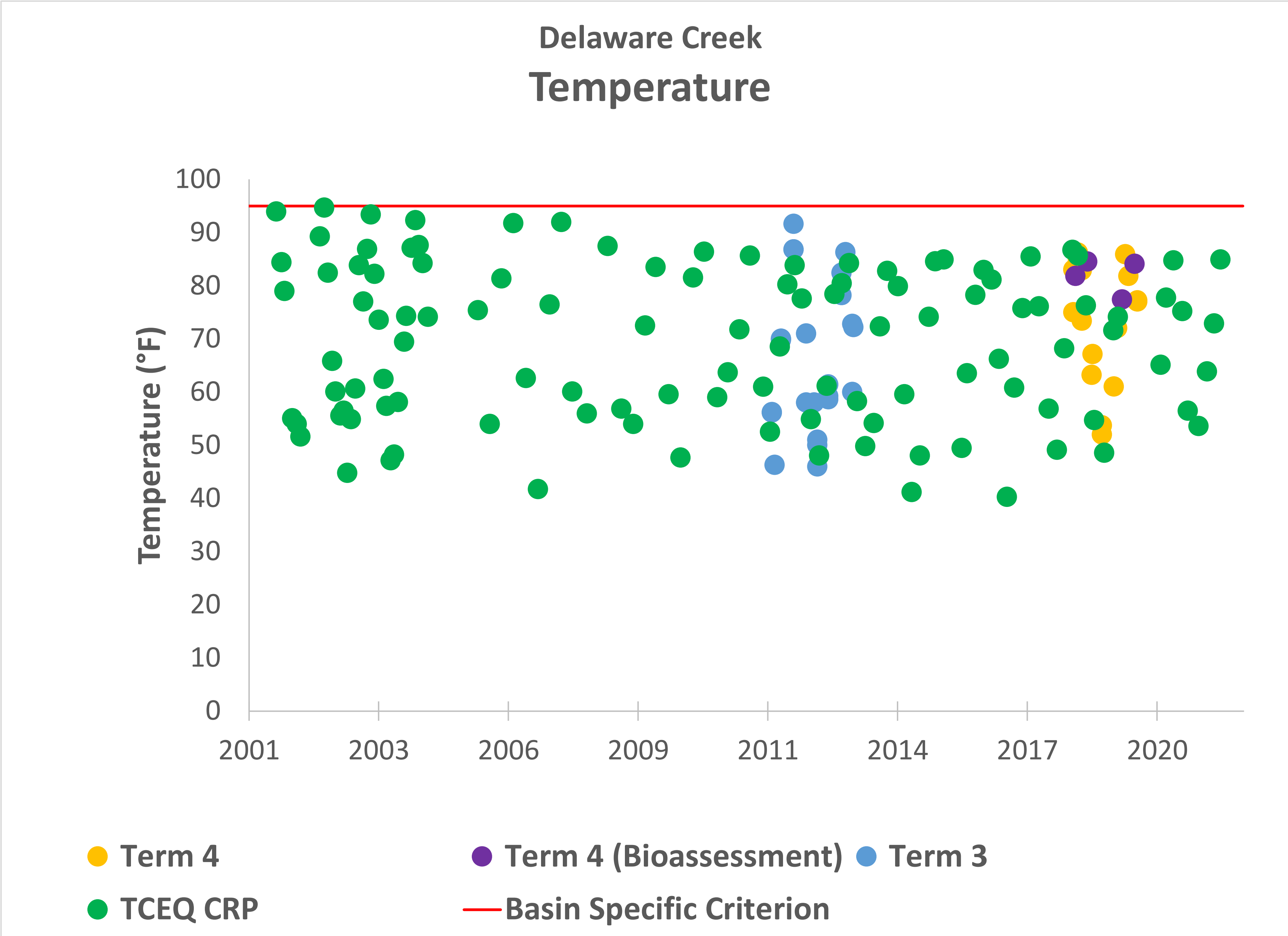


Delaware Creek
Field pH
pH (Standard Units)
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
Term 4 Bioassessment
TCEQ CRP
Basin Specific Criteria

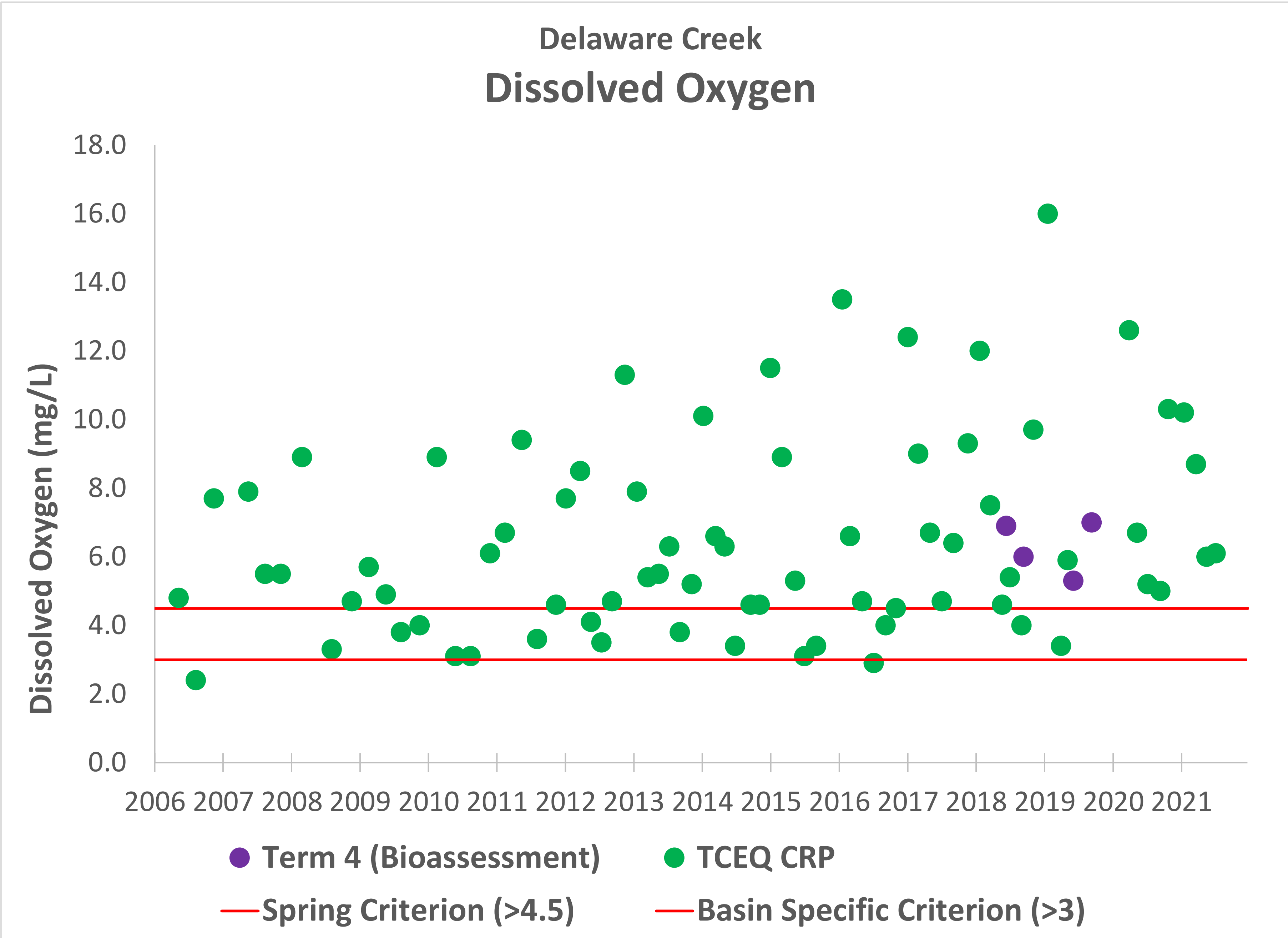


Delaware Creek
Specific Conductance (Field)
Specific Conductance (µS/cm)
2500
2000
1500
1000
500
0
2002
2005
2008
2010
2013
2016
2019
2021
Term 4
Term 4 Bioassessment
Term 3
TCEQ CRP
NRSA: good (<)
NRSA: fair (<)

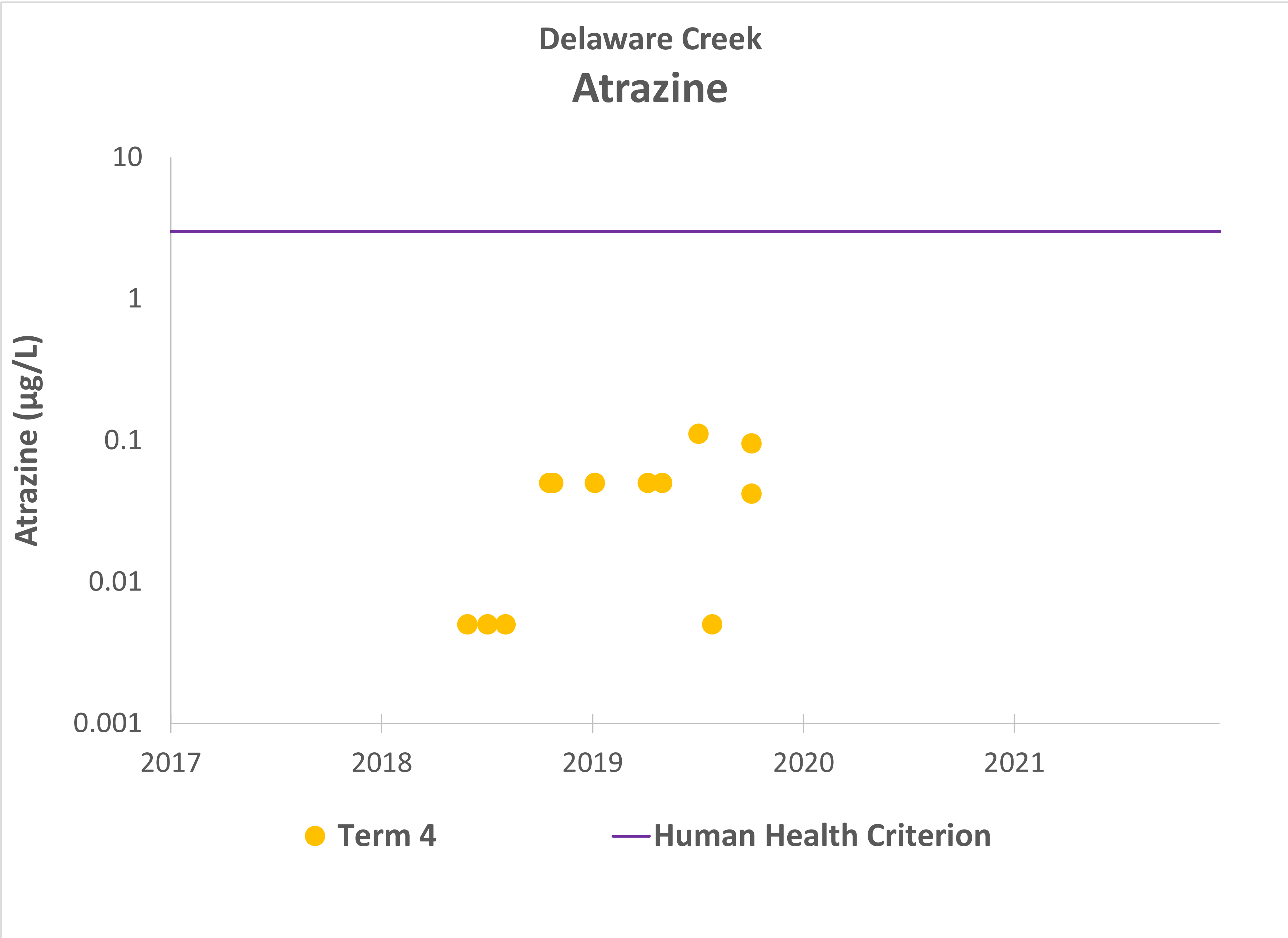

Delaware Creek
E.Coli
E. Coli (col/100 mL)
100000000
10000000
1000000
100000
10000
1000
100
10
1
0.1
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 4 Bioassessment
Term 3
Term 2
TCEQ CRP
PCR Single Sample
PCR Geomean

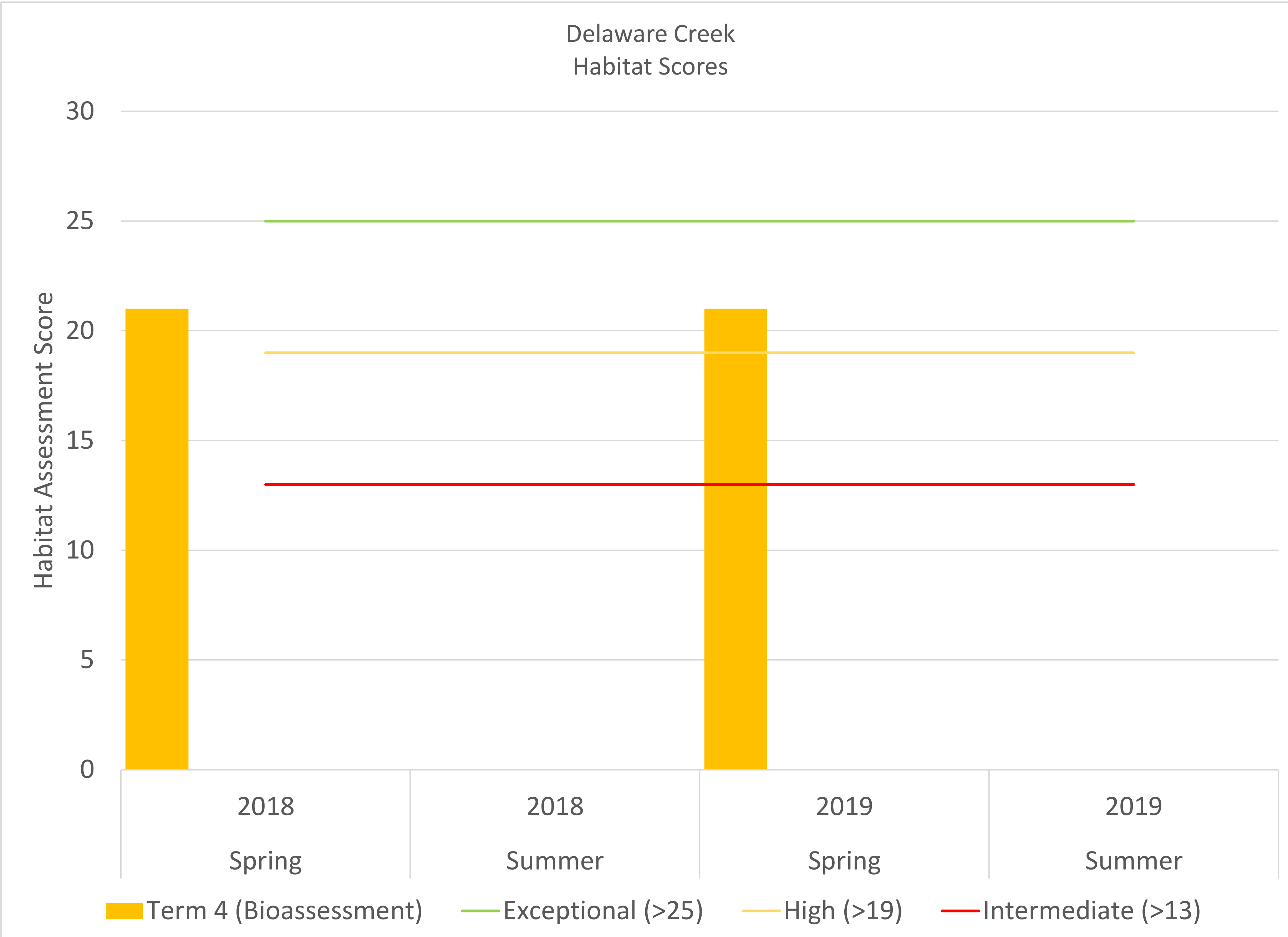


Delaware Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
Term 4 (Bioassessment)
Term 3
TCEQ CRP
Basin Specific Criterion

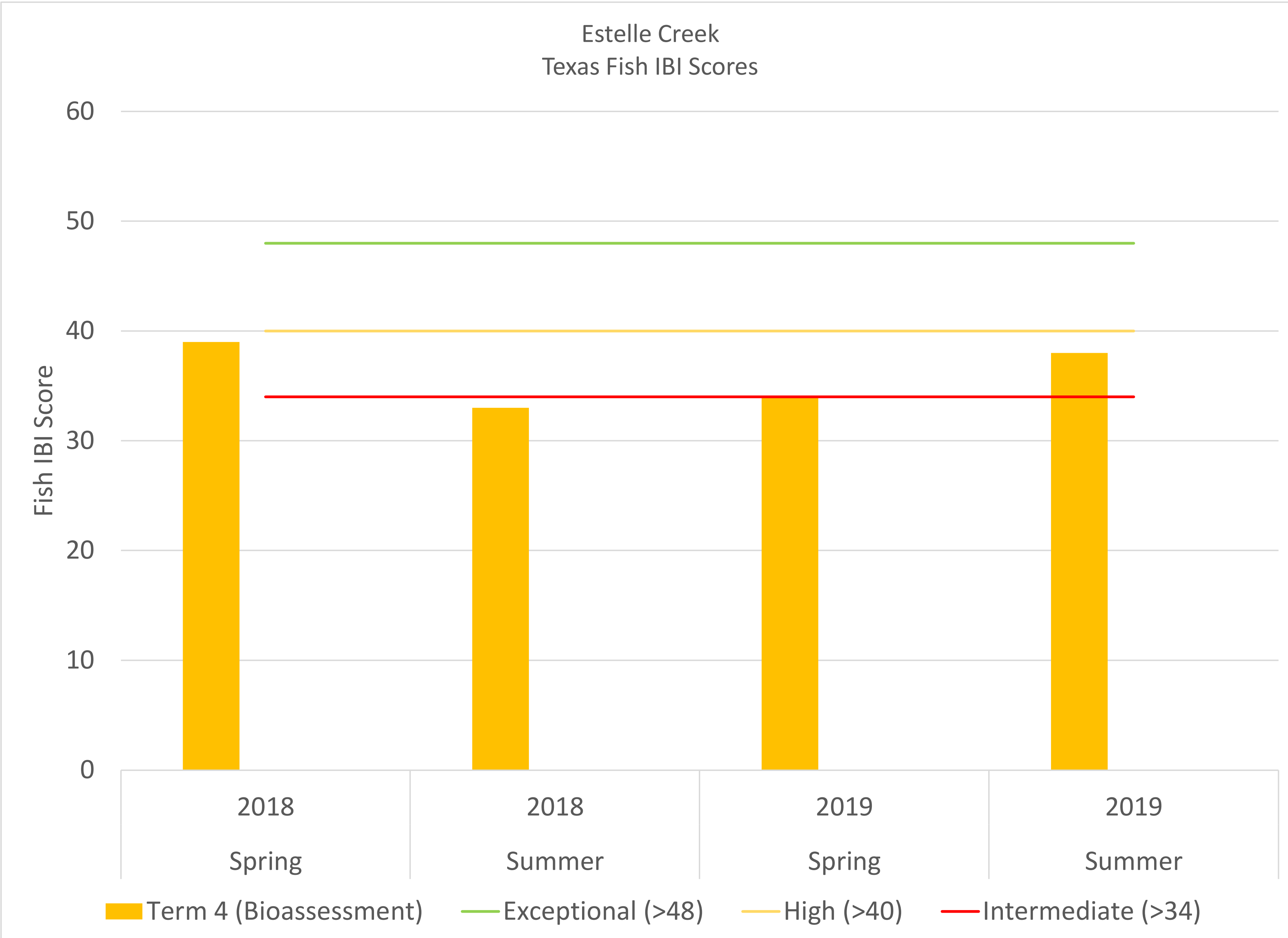


Delaware Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4 (Bioassessment)
TCEQ CRP
Spring Criterion (>4.5)
Basin Specific Criterion (>3)


Delaware Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
0.001
2017
2018
2019
2020
2021
Term 4
Human Health Criterion

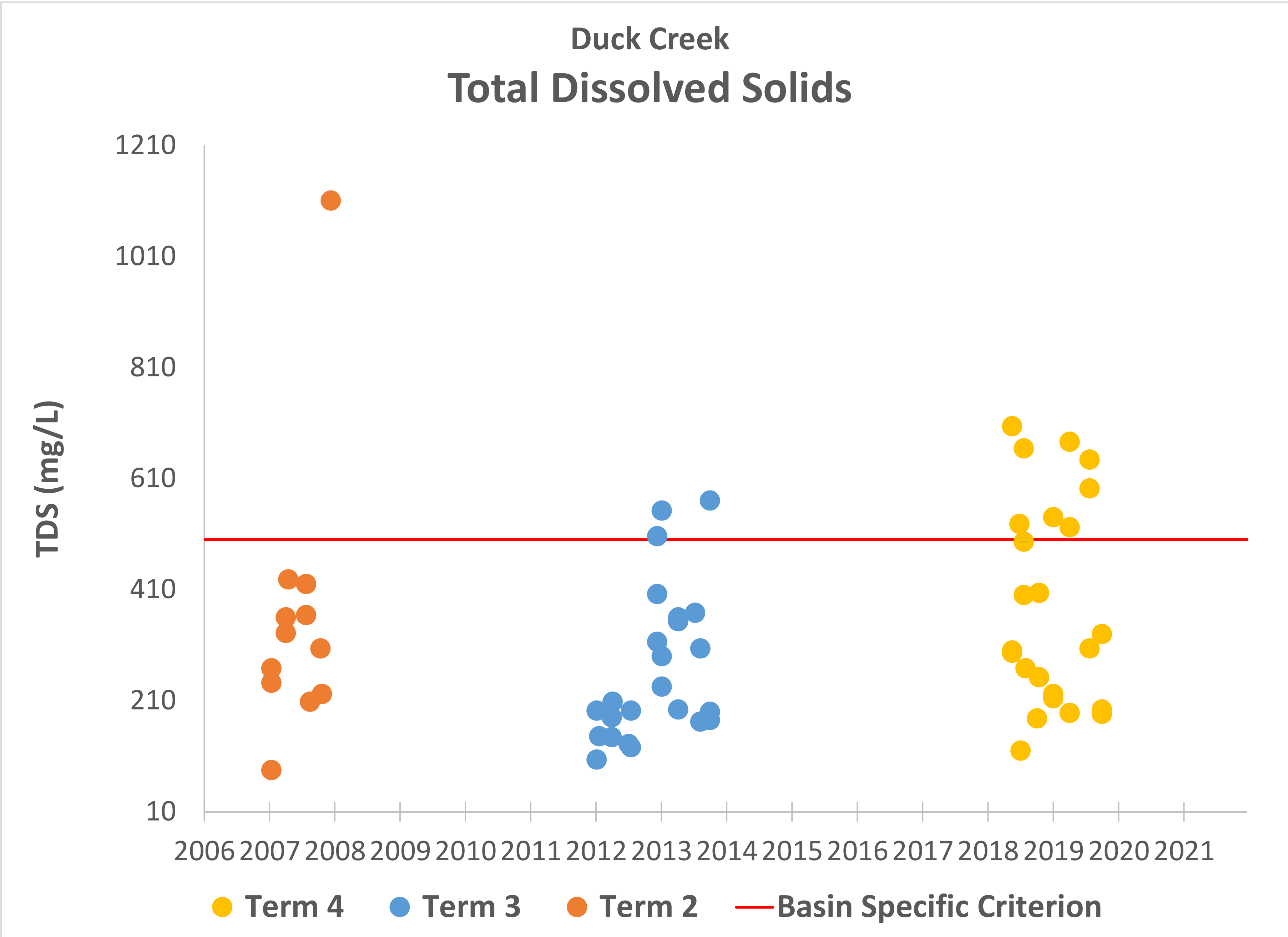

Delaware Creek
Habitat Scores
Habitat Assessment Score
30
25
20
15
10
5
0
2018 Spring
2018 Summer
2019 Spring
2019 Summer
Term 4 (Bioassessment)
Exceptional (>25)
High (>19)
Intermediate (>13)


Estelle Creek
Texas Macroinvertebrate IBI Scores
Macroinvertebrate IBI Score
40
35
30
25
20
15
10
5
0
2018
Spring
2018
Summer
2019
Spring
2019
Summer
Term 4 (Bioassessment)
Exceptional (>32)
High (>28)
Intermediate (>21)

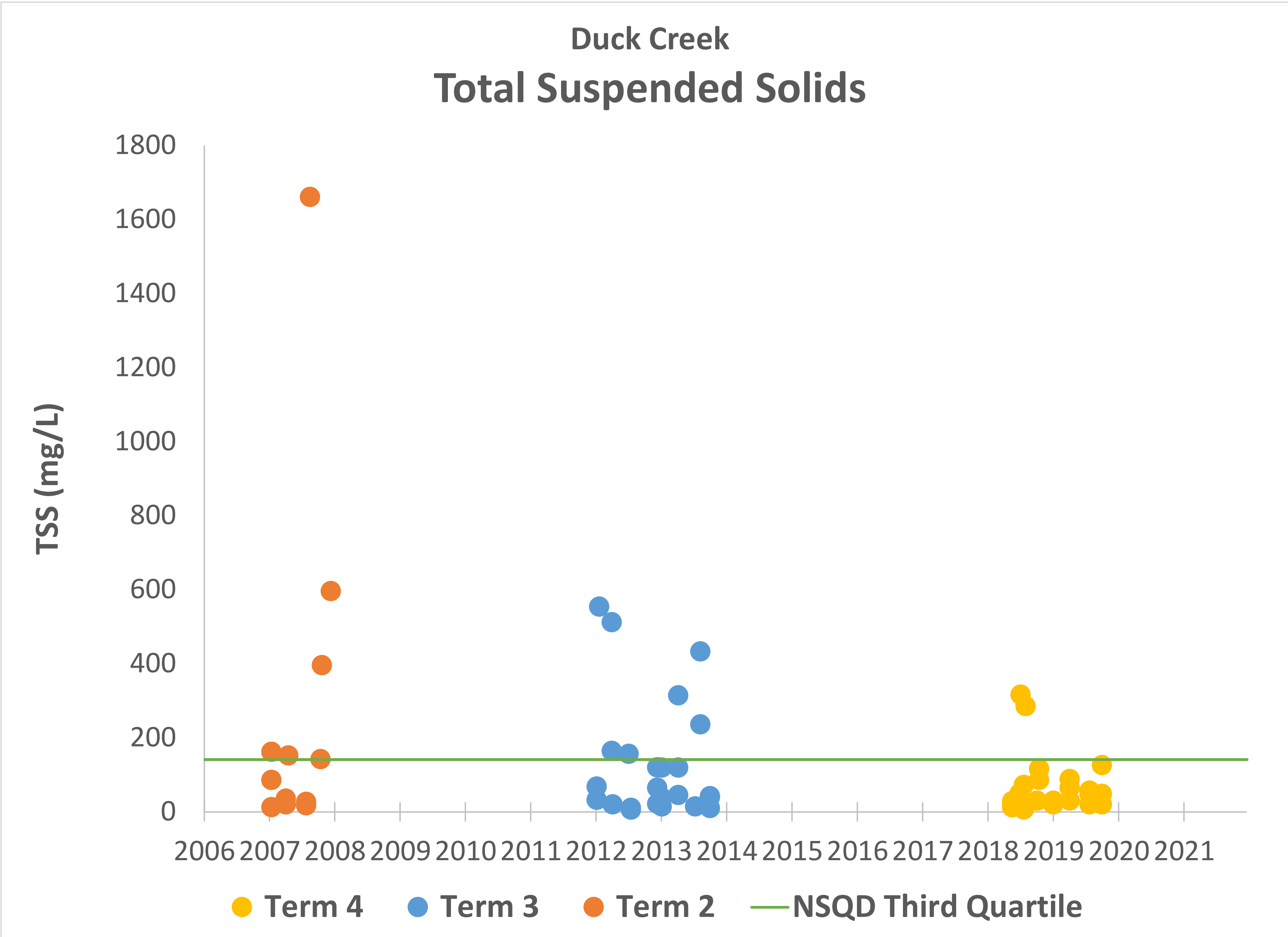

Estelle Creek
Texas Fish IBI Scores
60
50
40
30
20
10
0
Fish IBI Score
2018
Spring
2018
Summer
2019
Spring
2019
Summer
Term 4 (Bioassessment)
Exceptional (>48)
High (>40)
Intermediate (>34)

Appendix H

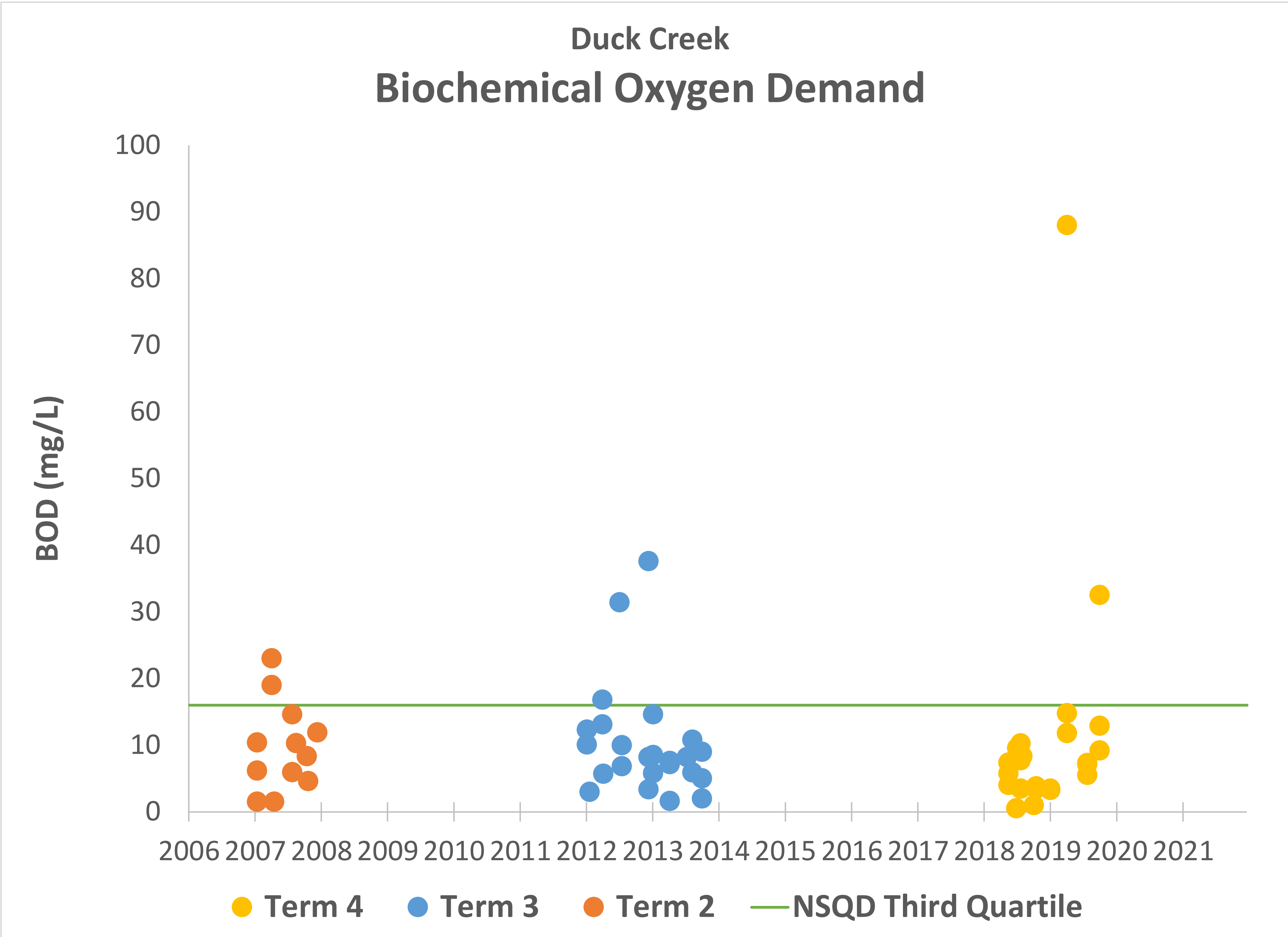
Duck Creek Water Quality Data Graphs

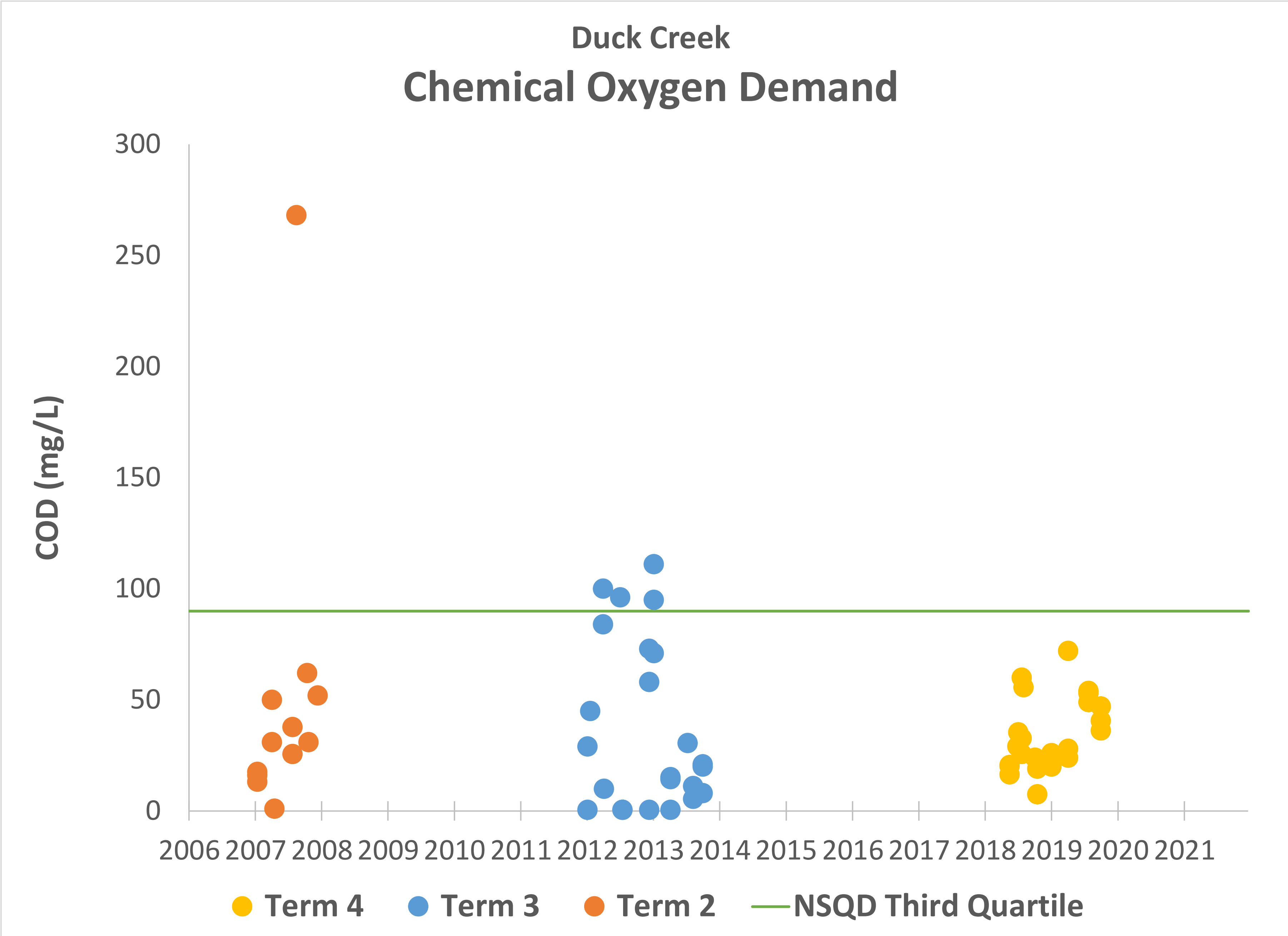


Duck Creek
Total Dissolved Solids
TDS (mg/L)
1210
1010
810
610
410
210
10
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
Basin Specific Criterion

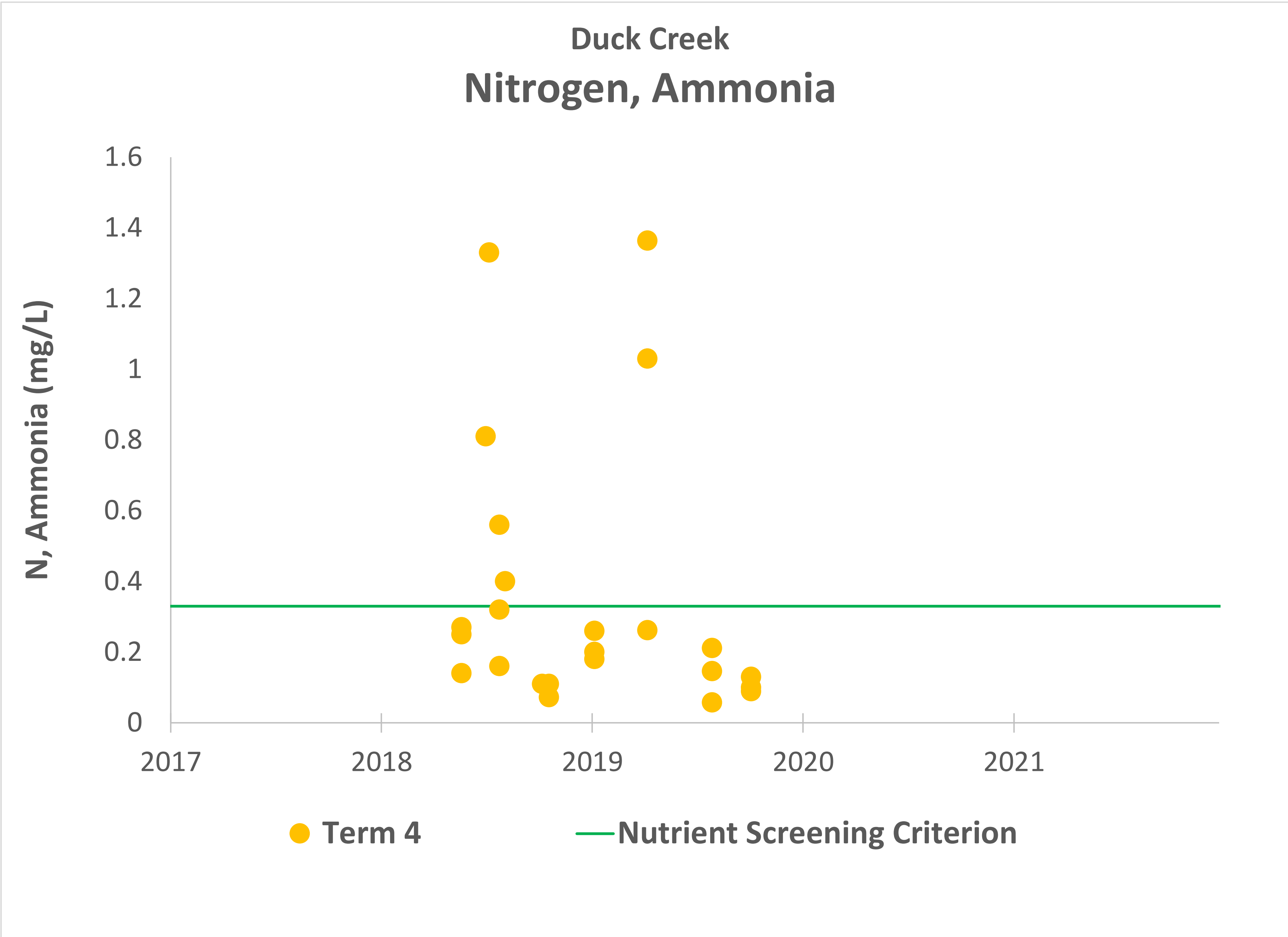


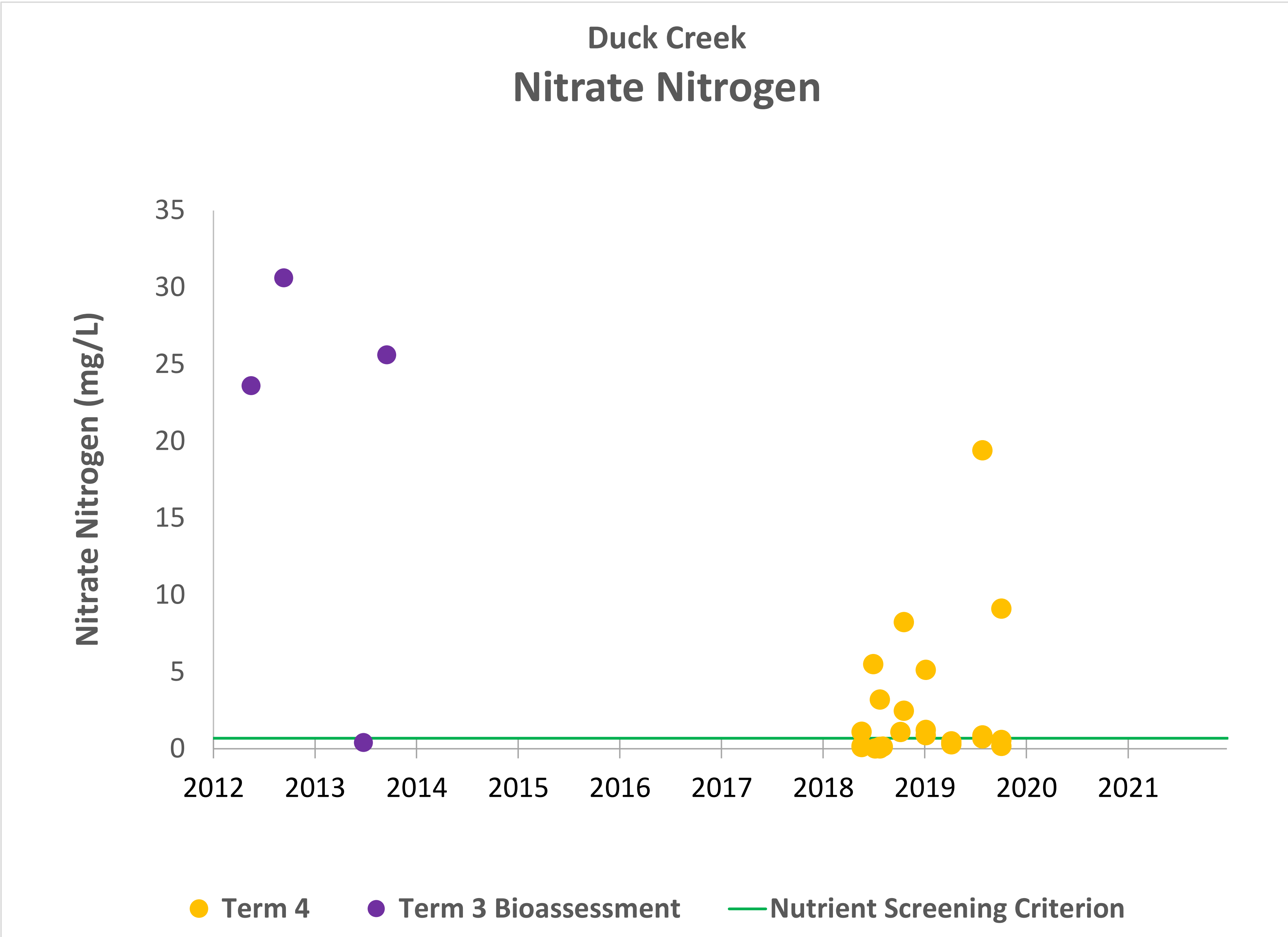
Duck Creek
Total Suspended Solids
TSS (mg/L)
1800
1600
1400
1200
1000
800
600
400
200
0
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

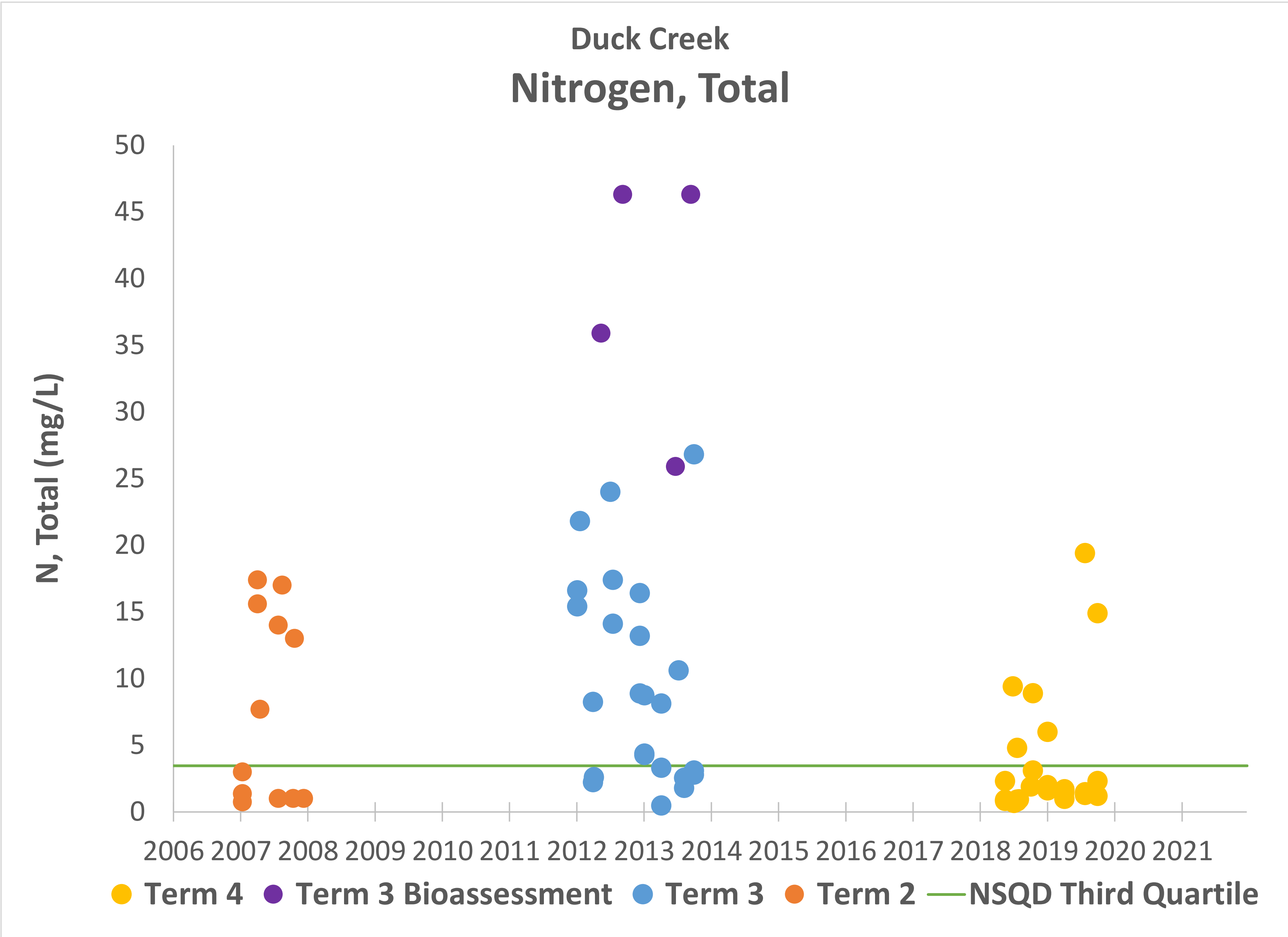

Duck Creek
Biochemical Oxygen Demand
BOD (mg/L)
100
90
80
70
60
50
40
30
20
10
0
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
NSQD Third Quartile

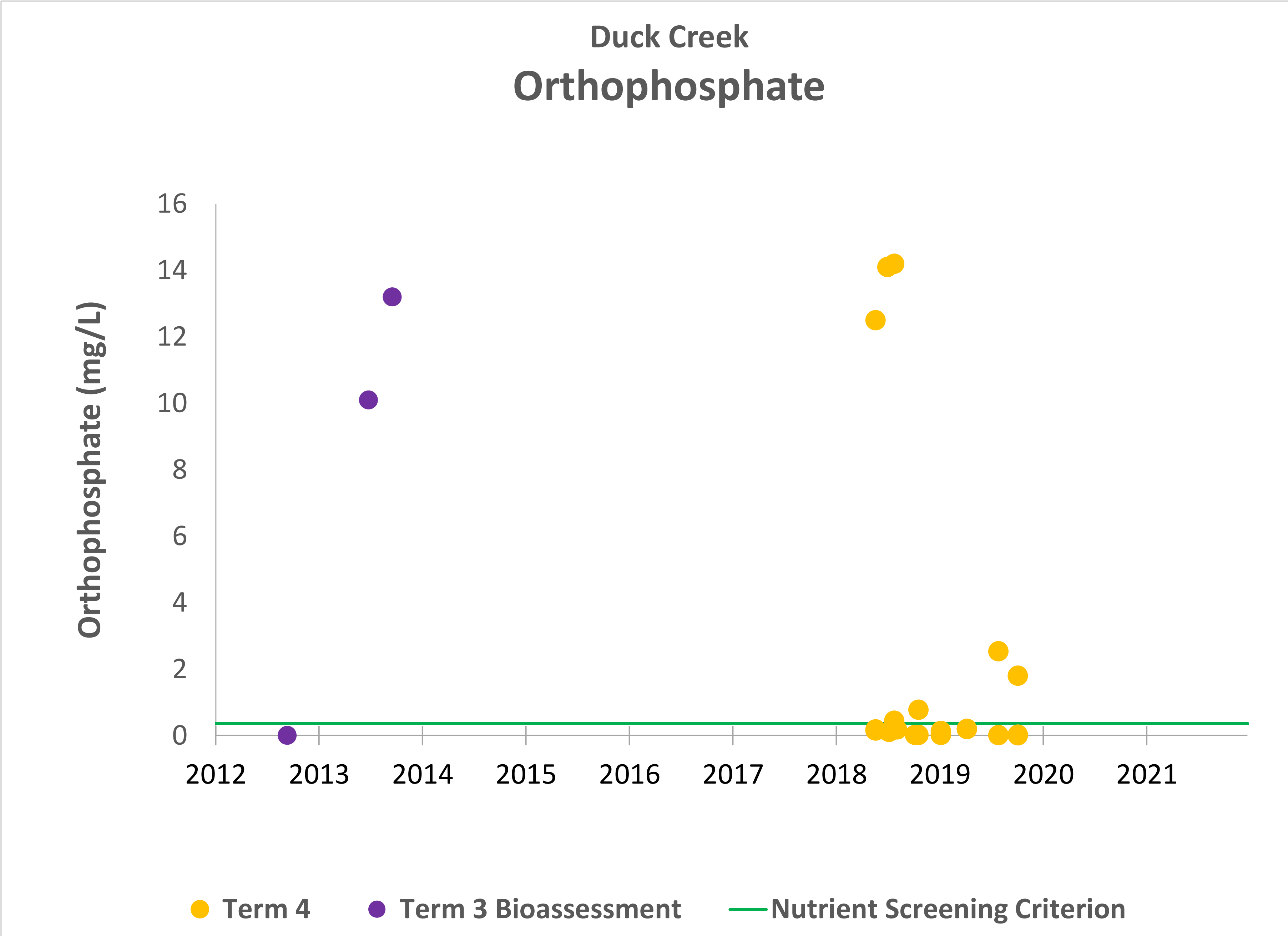


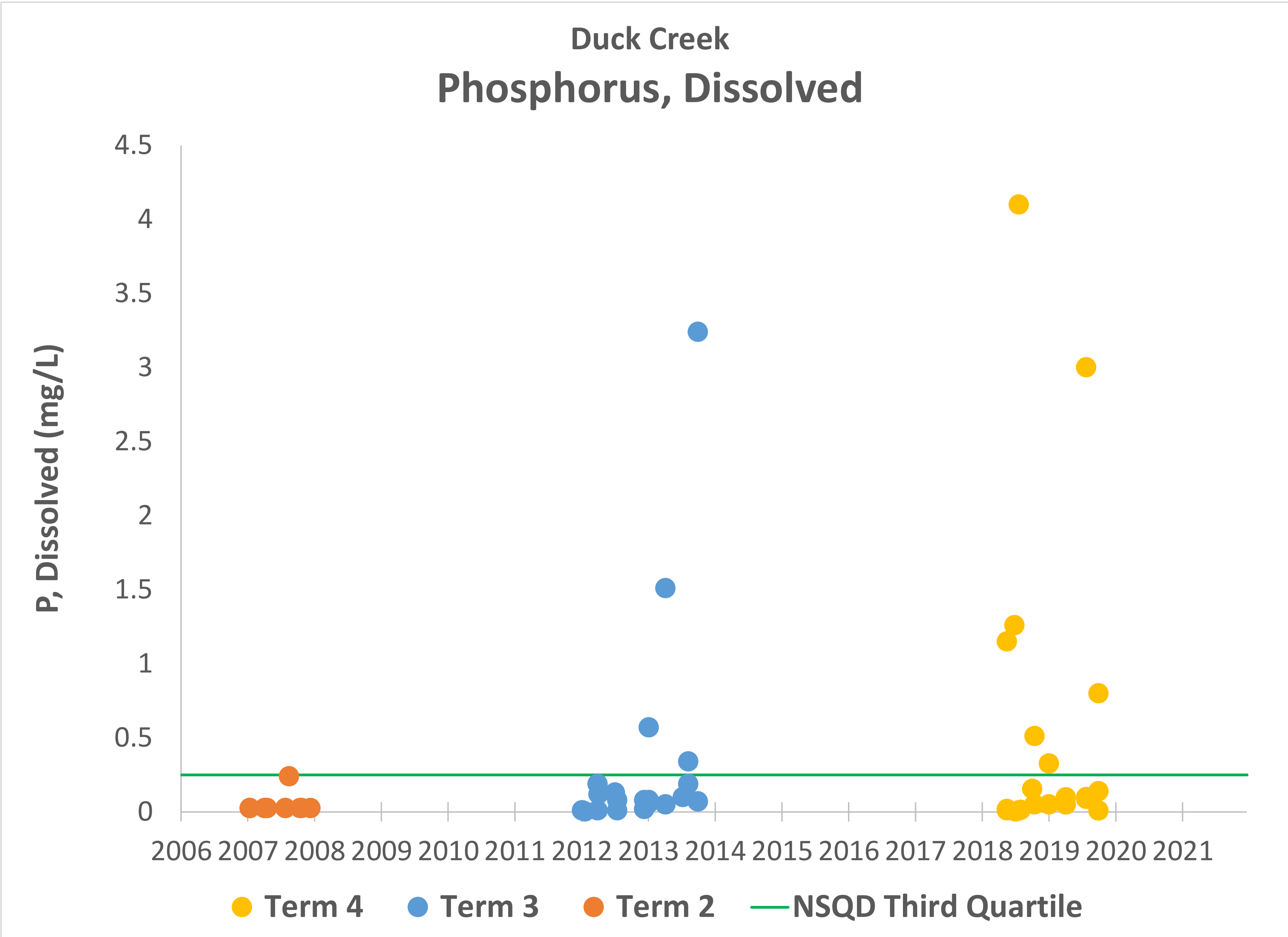
Duck Creek
Chemical Oxygen Demand
300
250
200
150
100
50
0
COD (mg/L)
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
NSQD Third Quartile

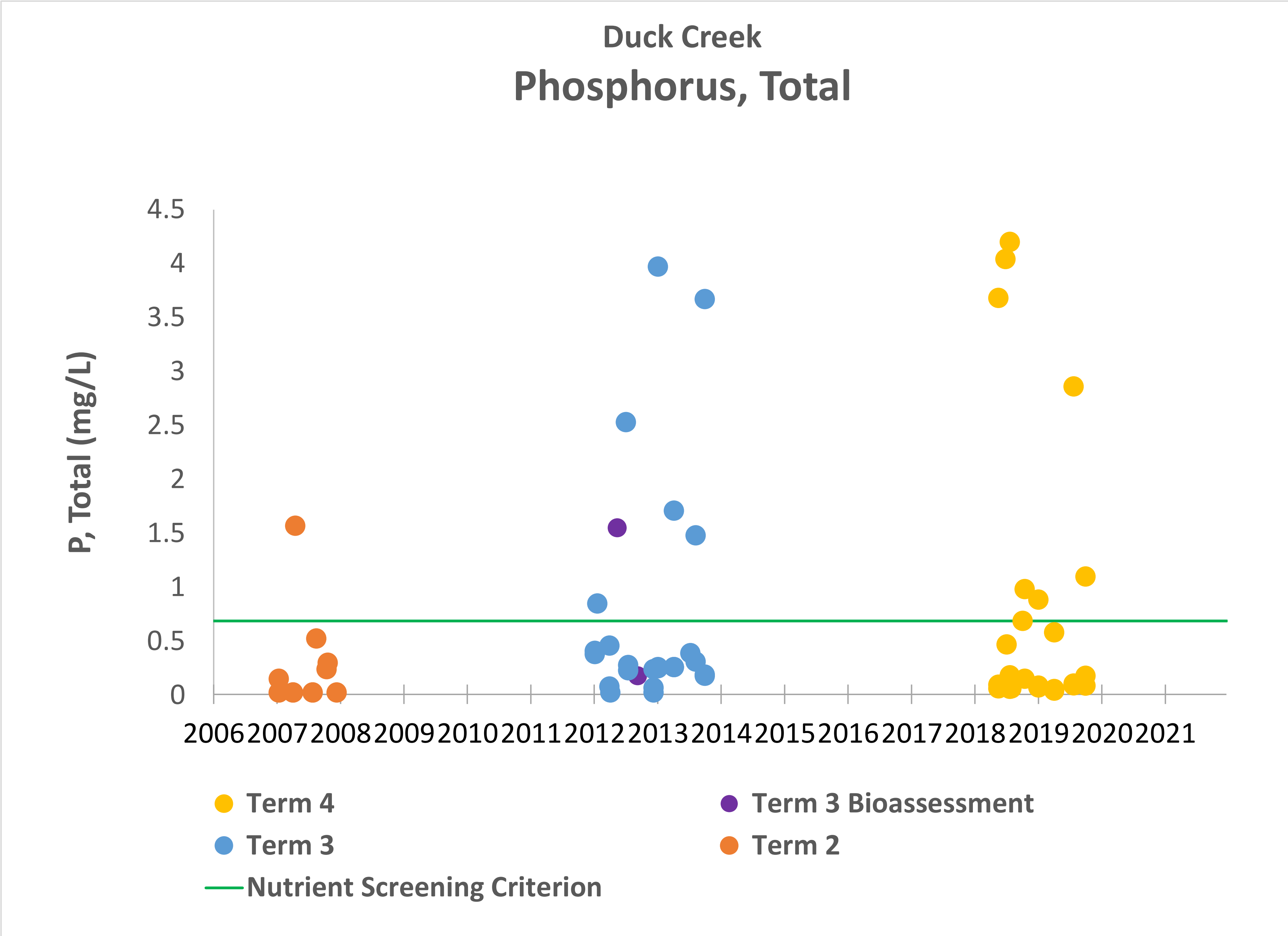

Duck Creek
Nitrogen, Ammonia
N, Ammonia (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion


Duck Creek
Nitrate Nitrogen
Nitrate Nitrogen (mg/L)
0
5
10
15
20
25
30
35
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3 Bioassessment
Nutrient Screening Criterion

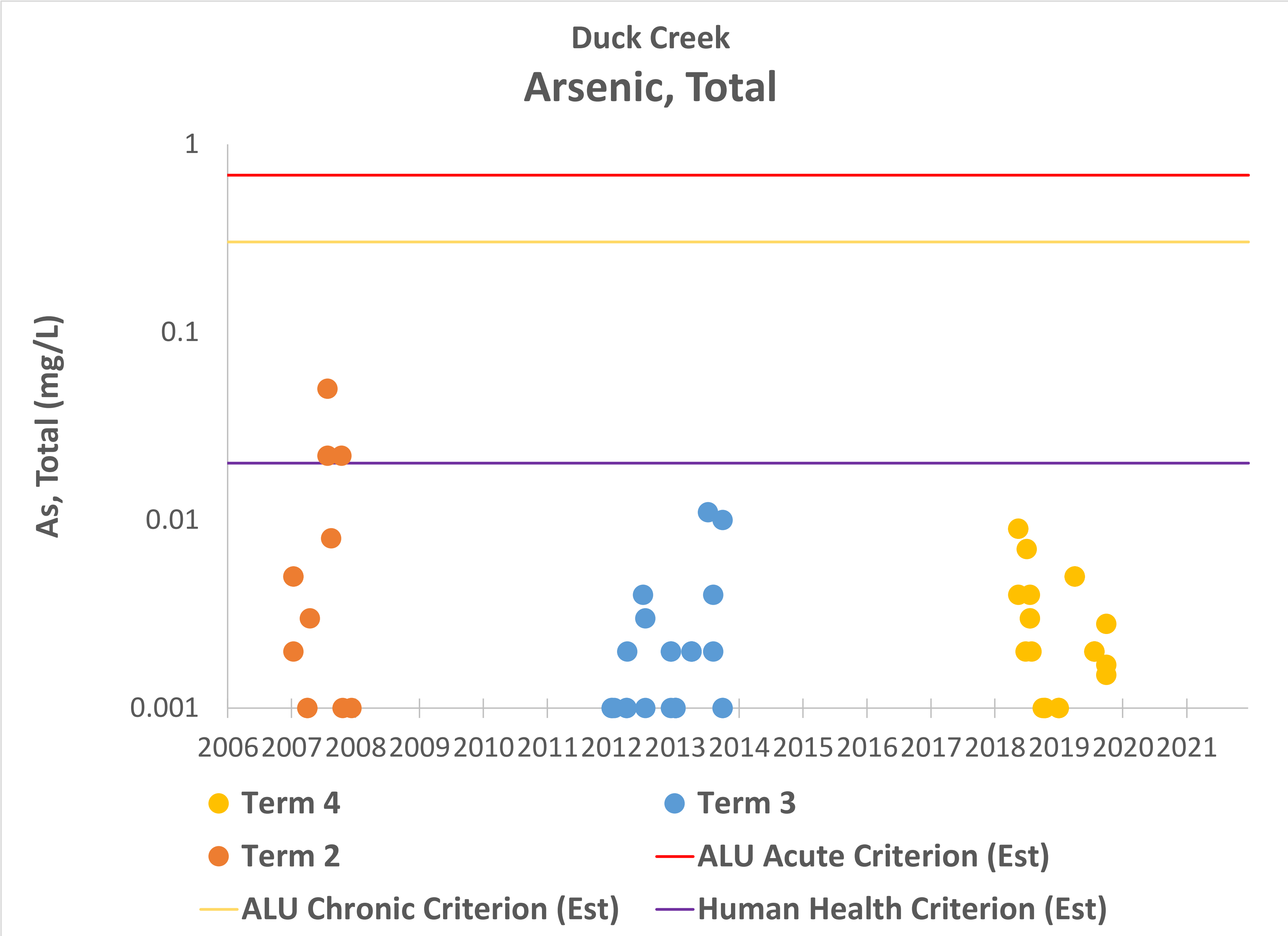

Duck Creek
Nitrogen, Total
N, Total (mg/L)
50
45
40
35
30
25
20
15
10
5
0
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3 Bioassessment
Term 3
Term 2
NSQD Third Quartile


Duck Creek
Orthophosphate
Orthophosphate (mg/L)
16
14
12
10
8
6
4
2
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3 Bioassessment
Nutrient Screening Criterion

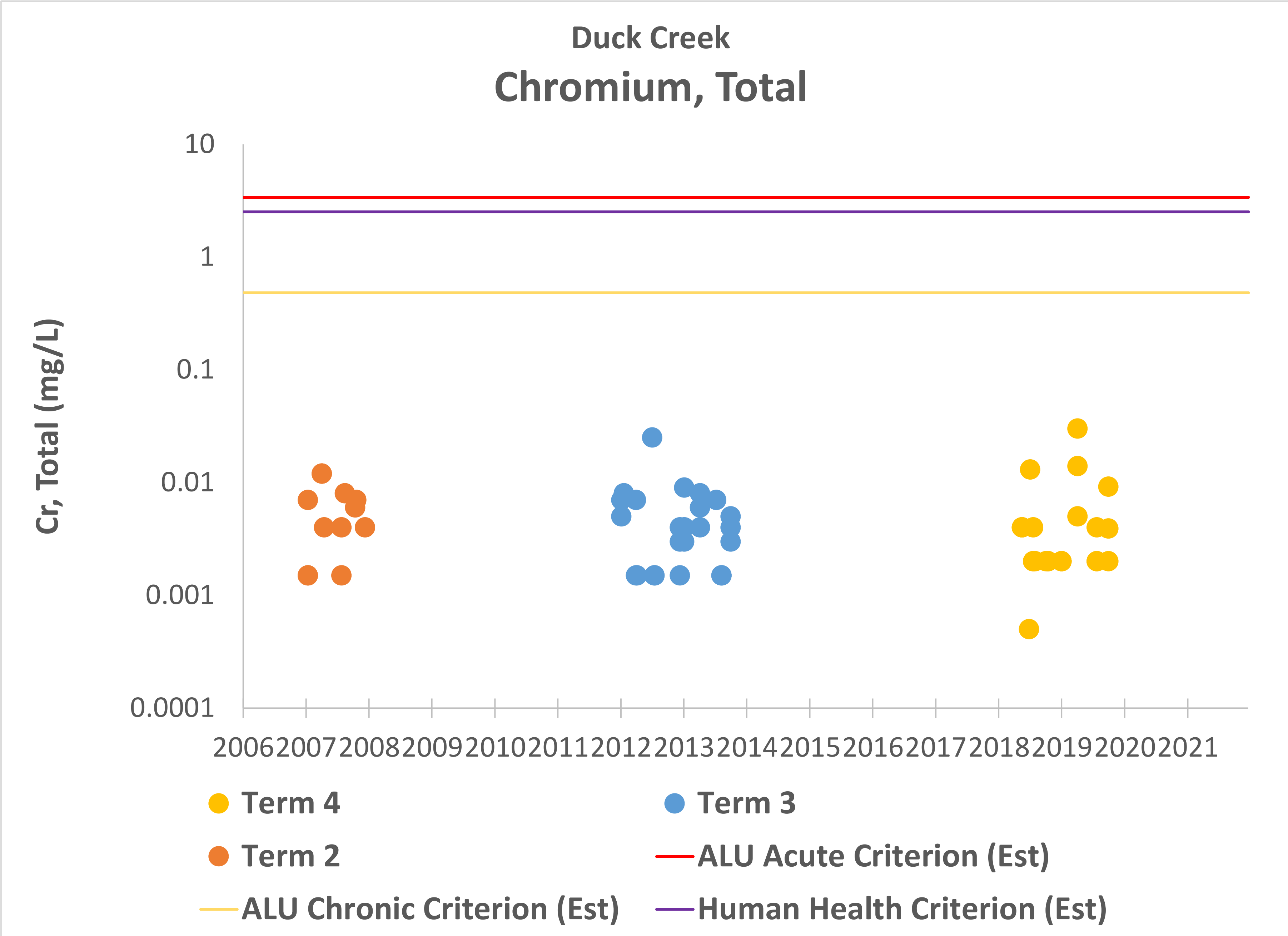

Duck Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
NSQD Third Quartile



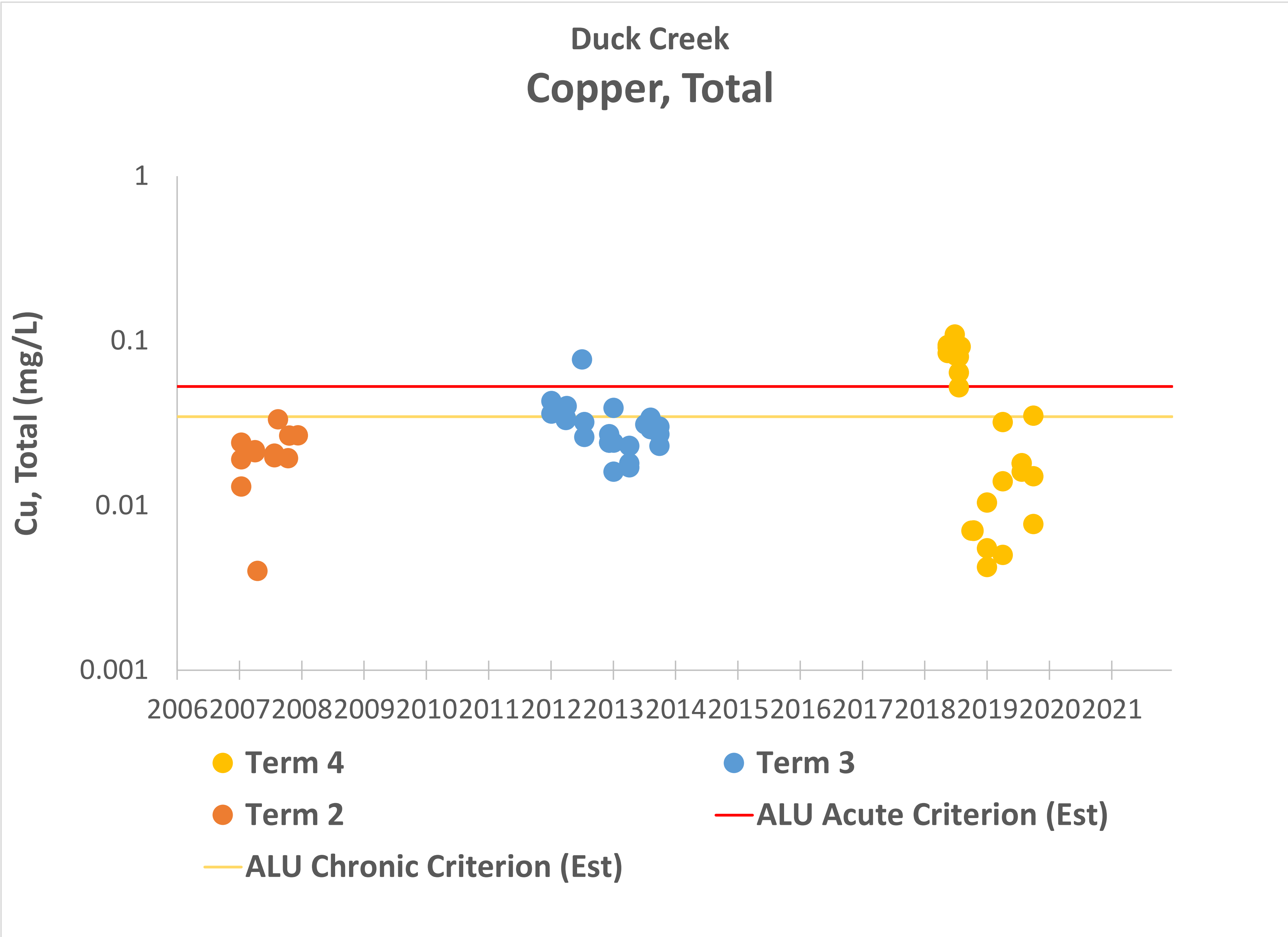
Duck Creek
Phosphorus, Total
P, Total (mg/L)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3 Bioassessment
Term 3
Term 2
Nutrient Screening Criterion



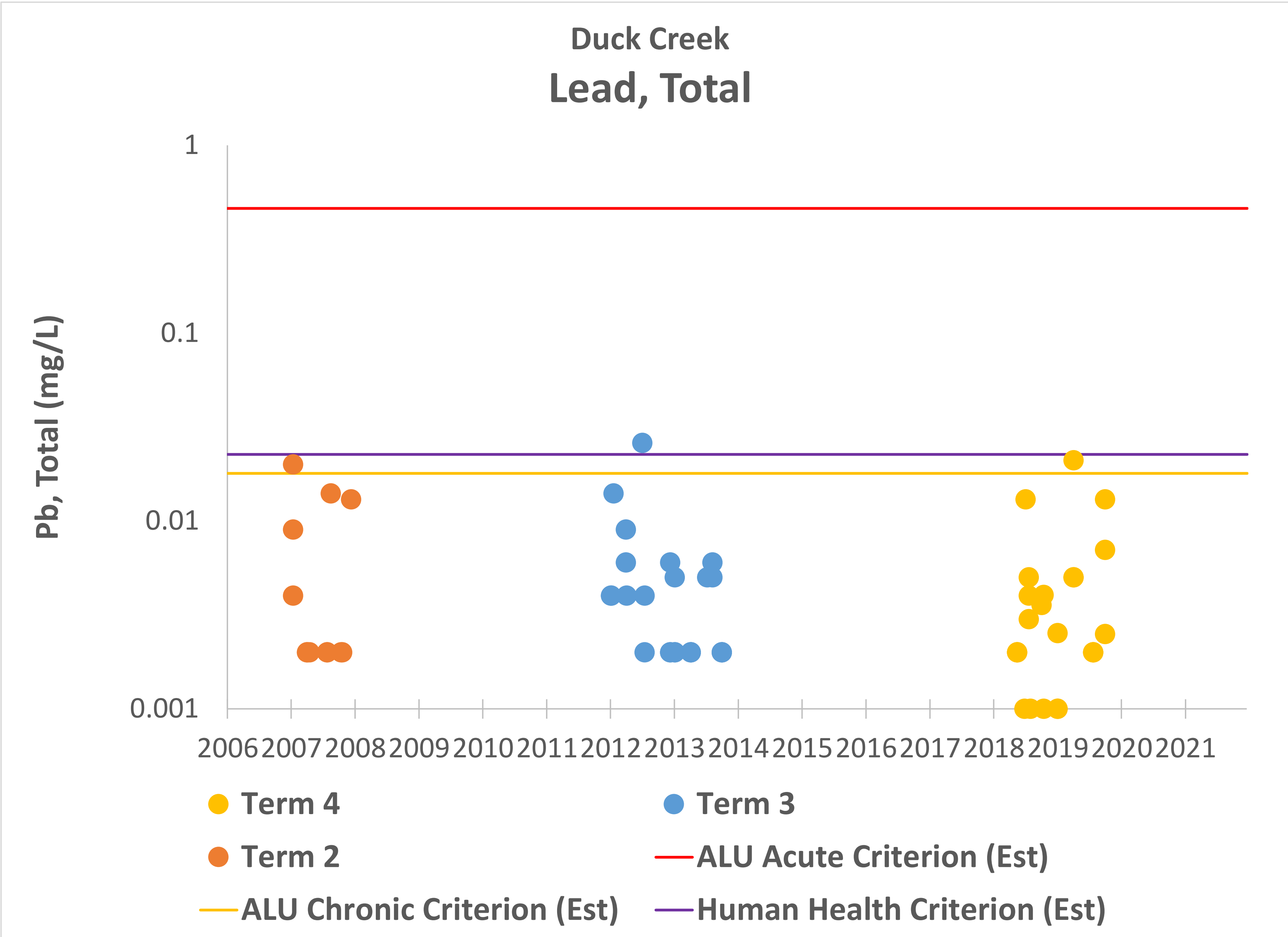
Duck Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



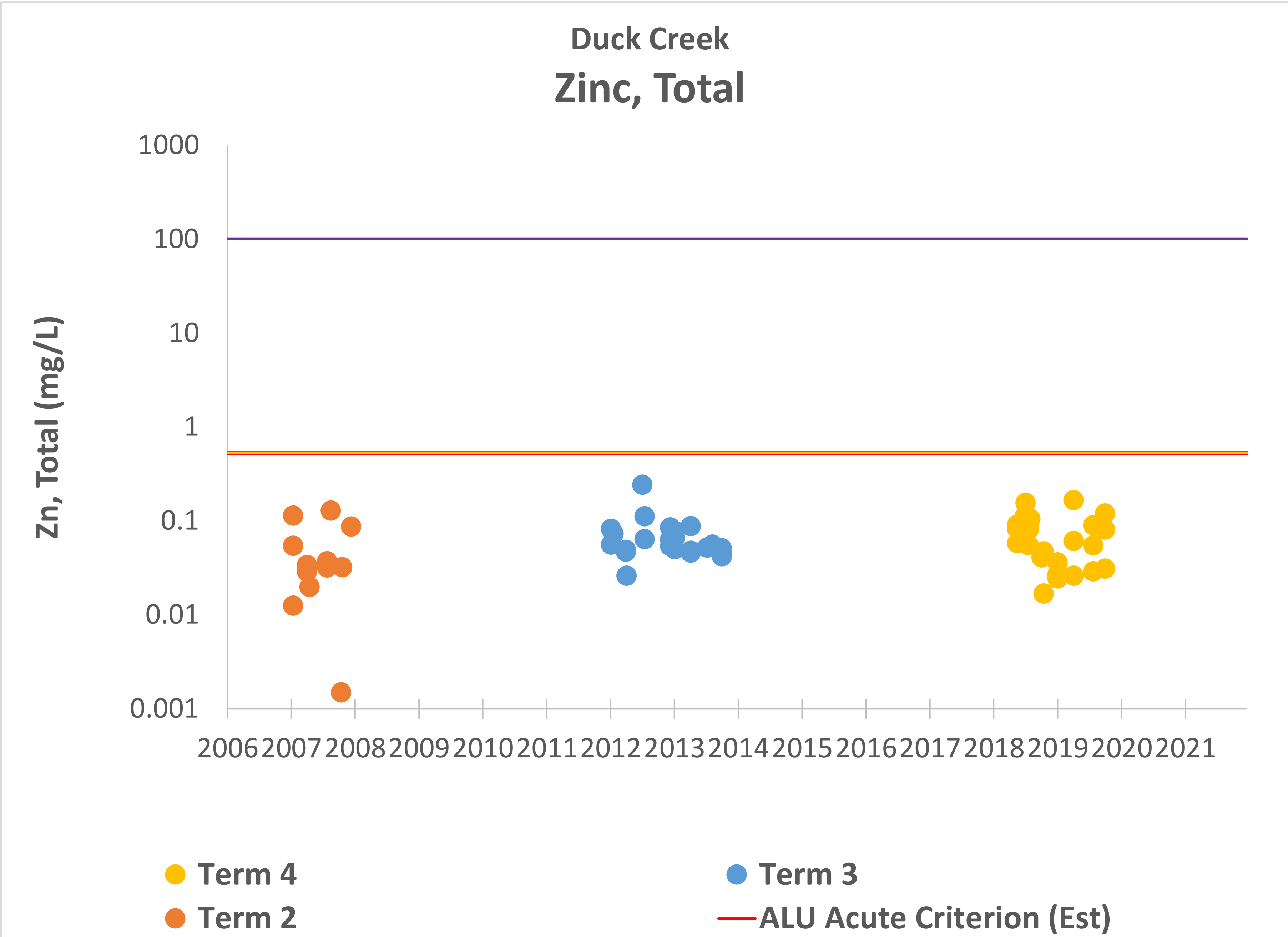
Duck Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
0.0001
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



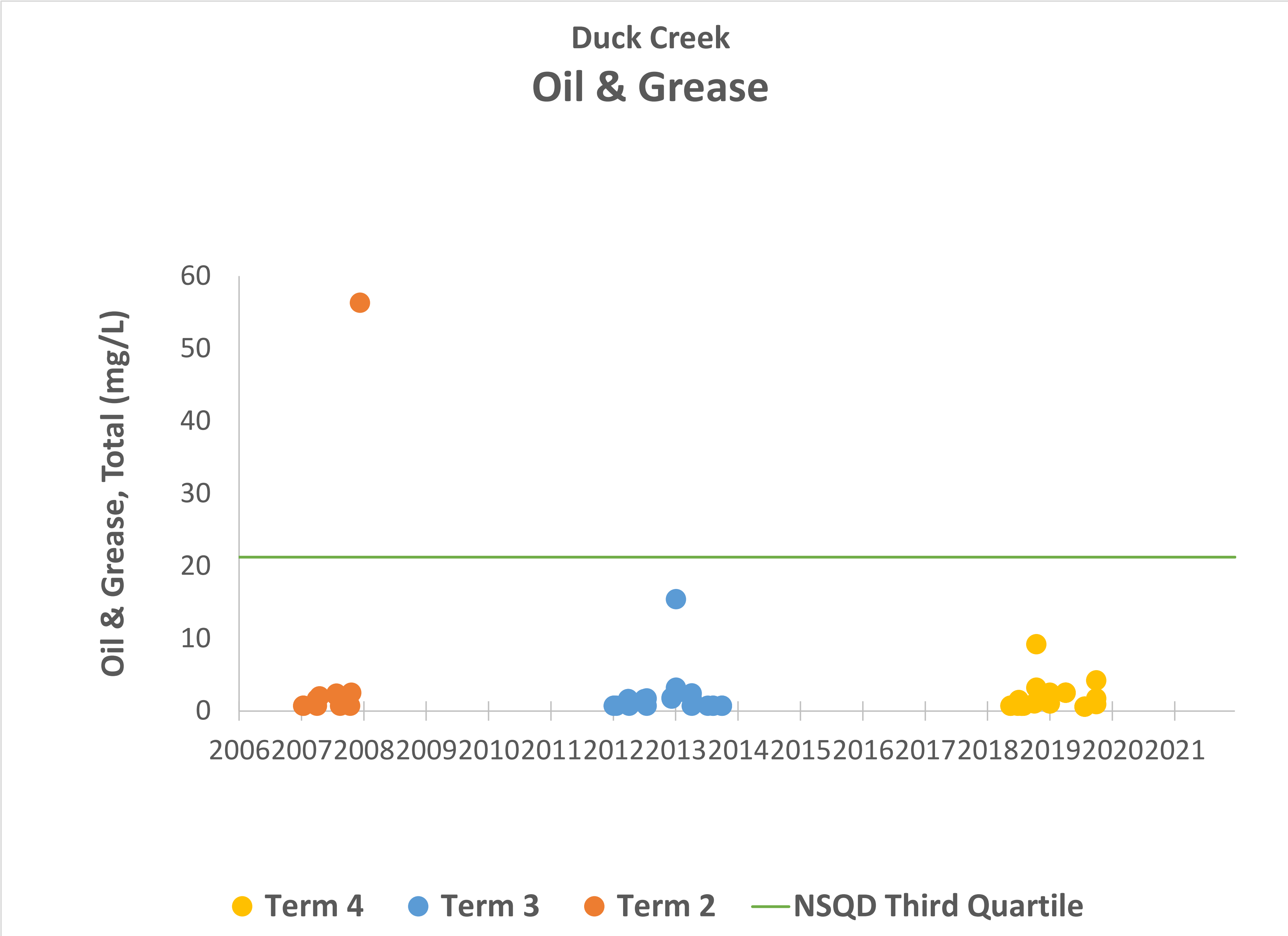
Duck Creek
Copper, Total
Cu, Total (mg/L)
1
0.1
0.01
0.001
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)

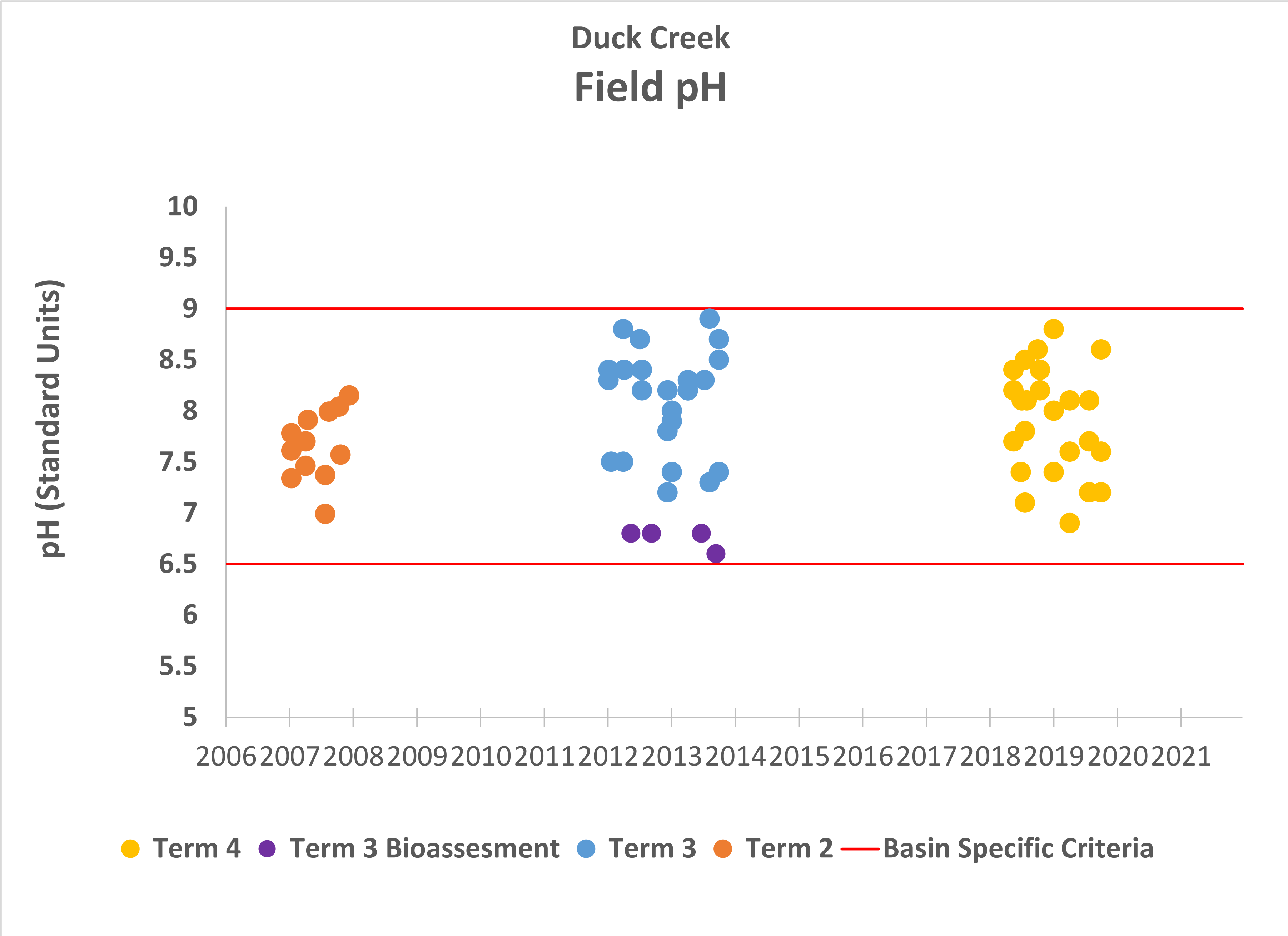


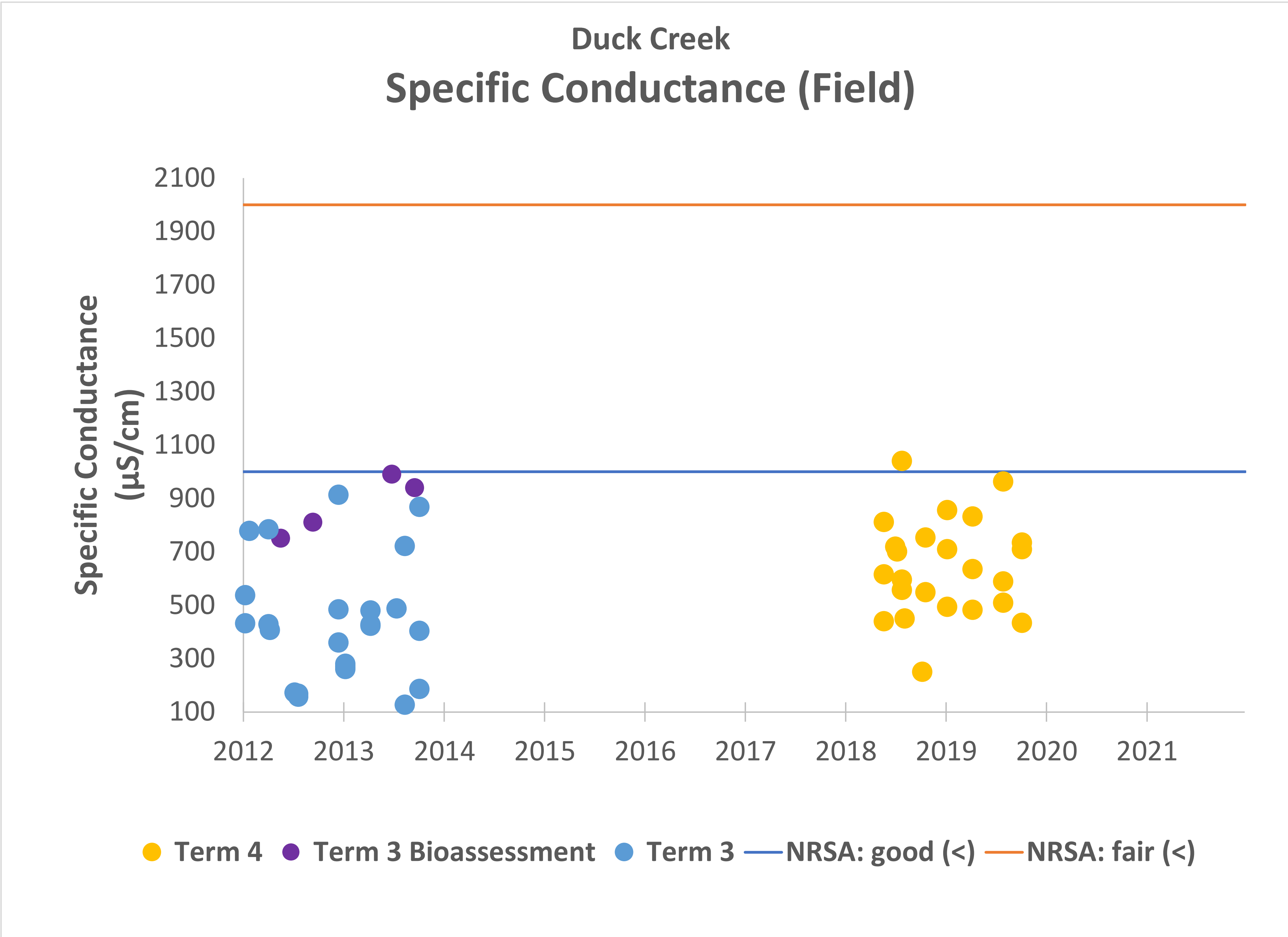
Duck Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

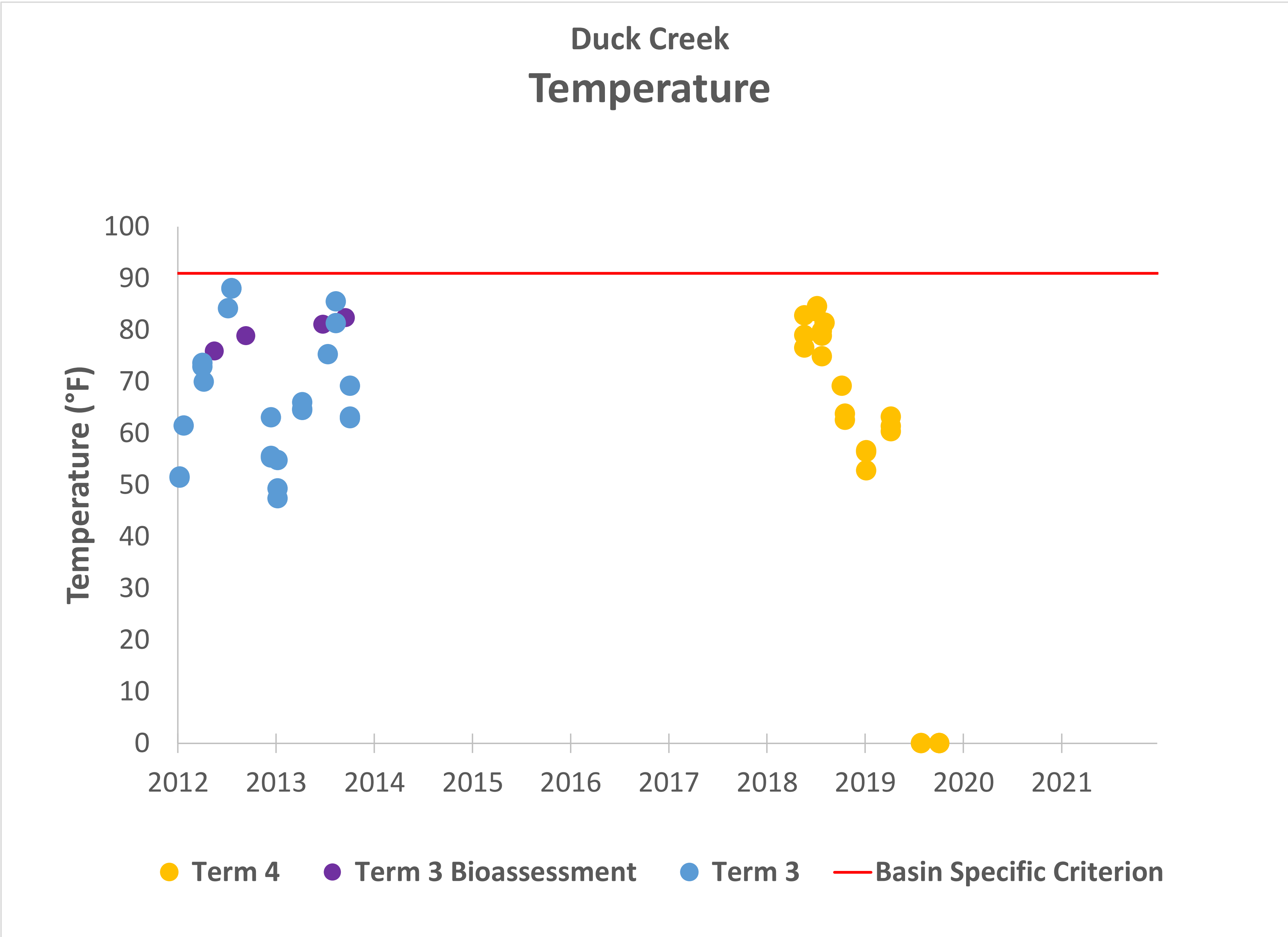


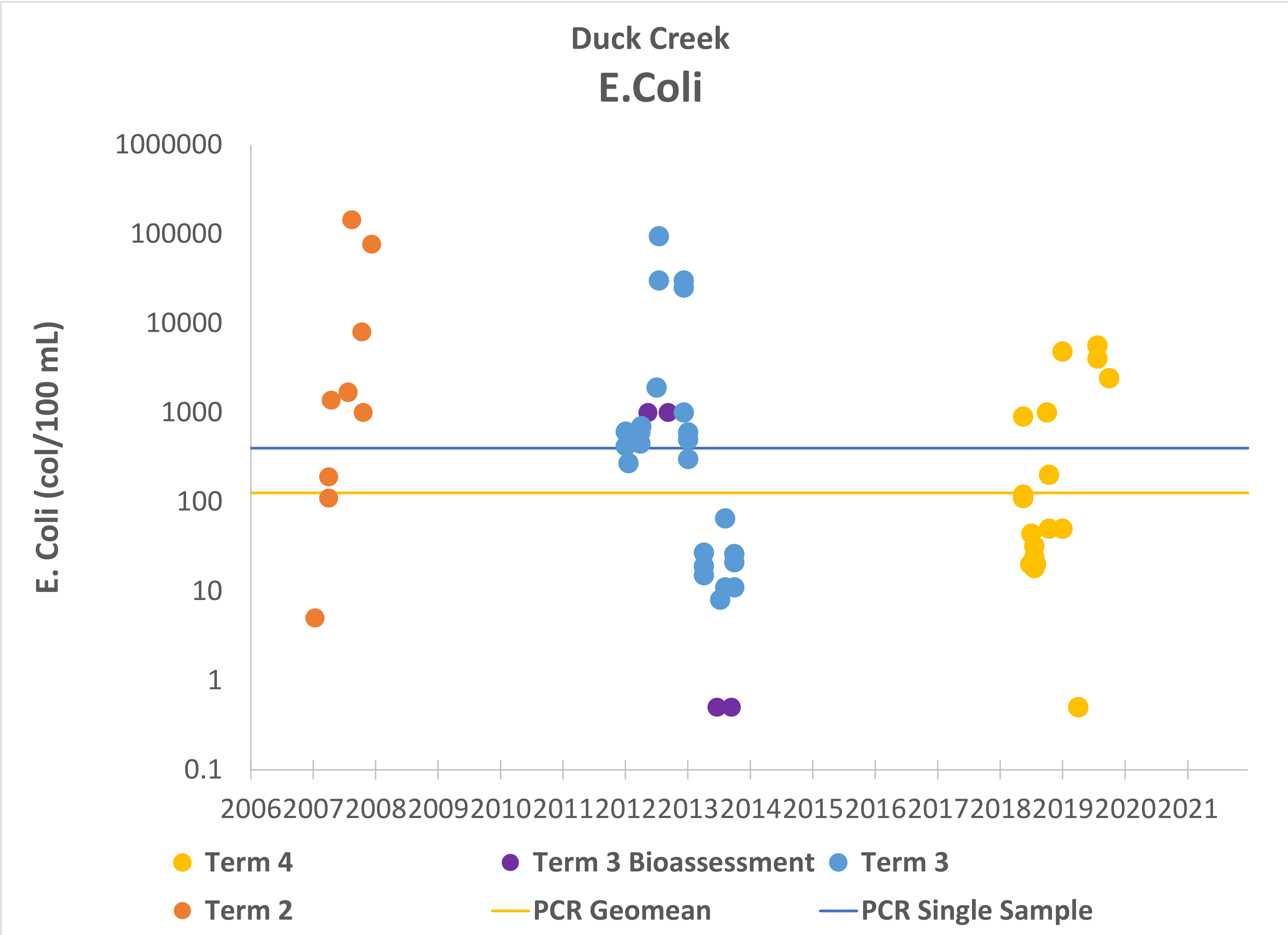
Duck Creek
Zinc, Total
Zn, Total (mg/L)
1000
100
10
1
0.1
0.01
0.001
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)

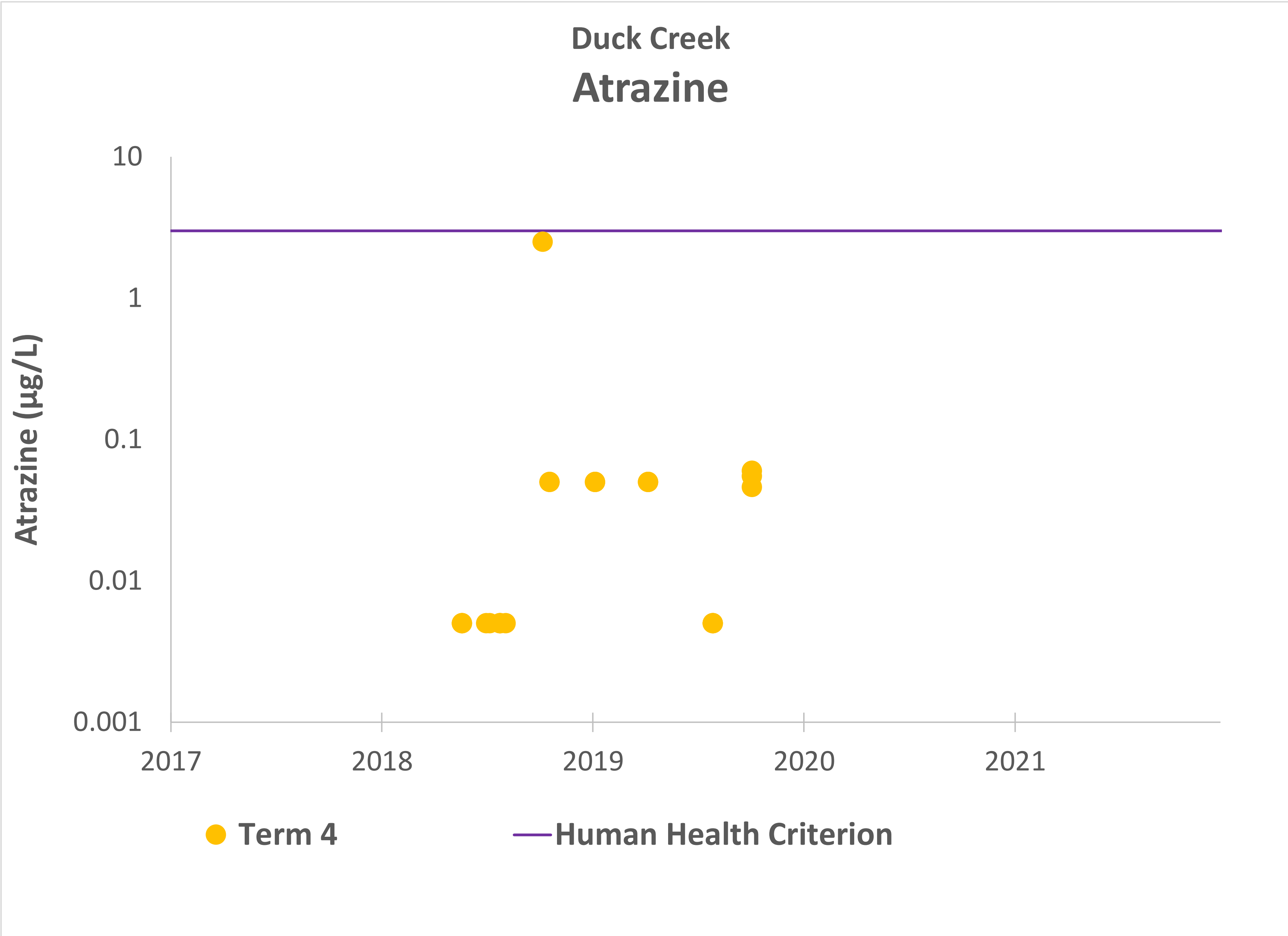

Duck Creek
Oil & Grease
Oil & Grease, Total (mg/L)
60
50
40
30
20
10
0
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile


Duck Creek
Field pH
pH (Standard Units)
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3 Bioassesment
Term 3
Term 2
Basin Specific Criteria


Duck Creek
Specific Conductance (Field)
Specific Conductance (µS/cm)
2100
1900
1700
1500
1300
1100
900
700
500
300
100
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3 Bioassessment
Term 3
NRSA: good (<)
NRSA: fair (<)


Duck Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3 Bioassessment
Term 3
Basin Specific Criterion

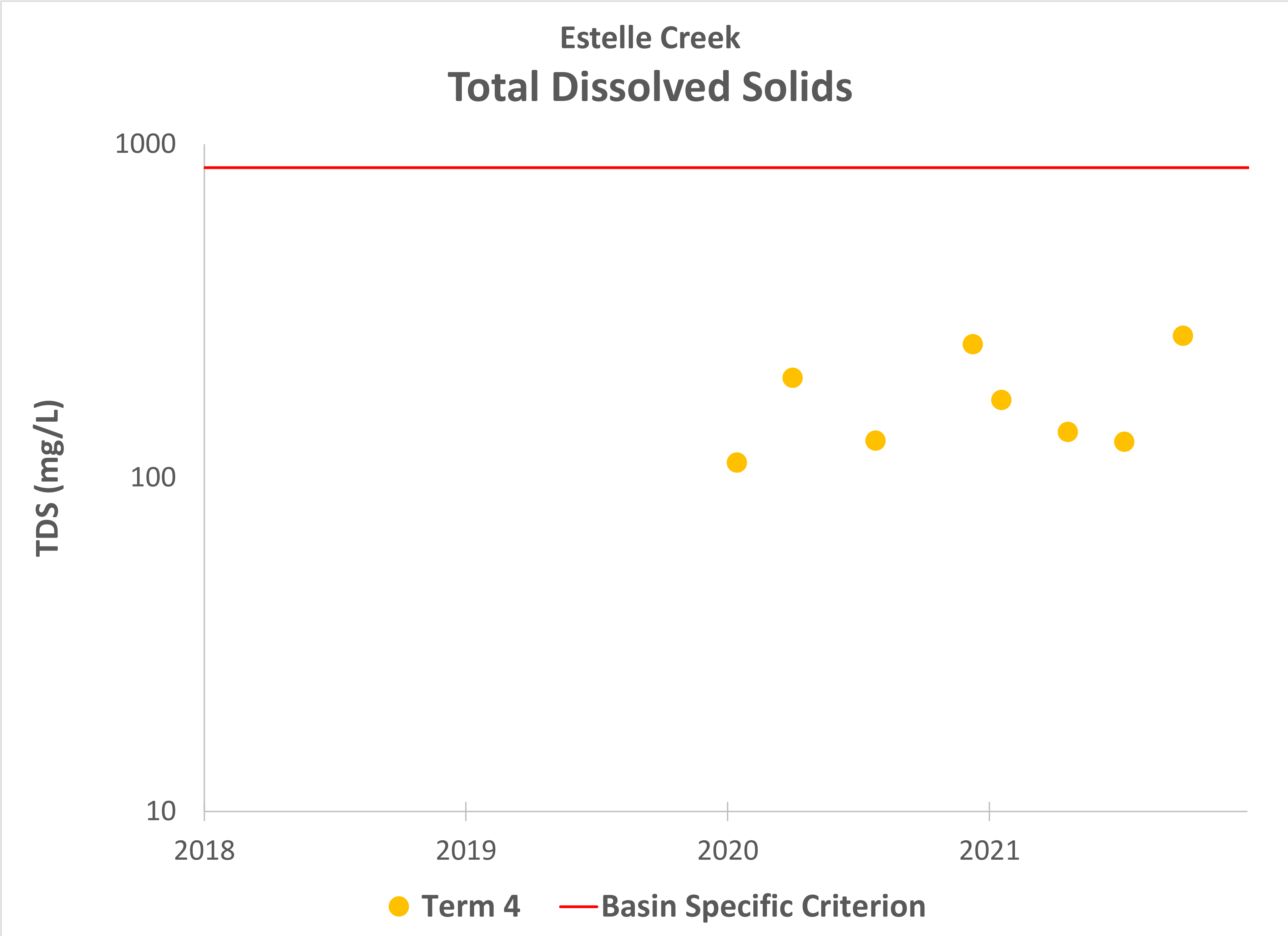

Duck Creek
E.Coli
E. Coli (col/100 mL)
1000000
100000
10000
1000
100
10
1
0.1
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3 Bioassessment
Term 3
Term 2
PCR Geomean
PCR Single Sample



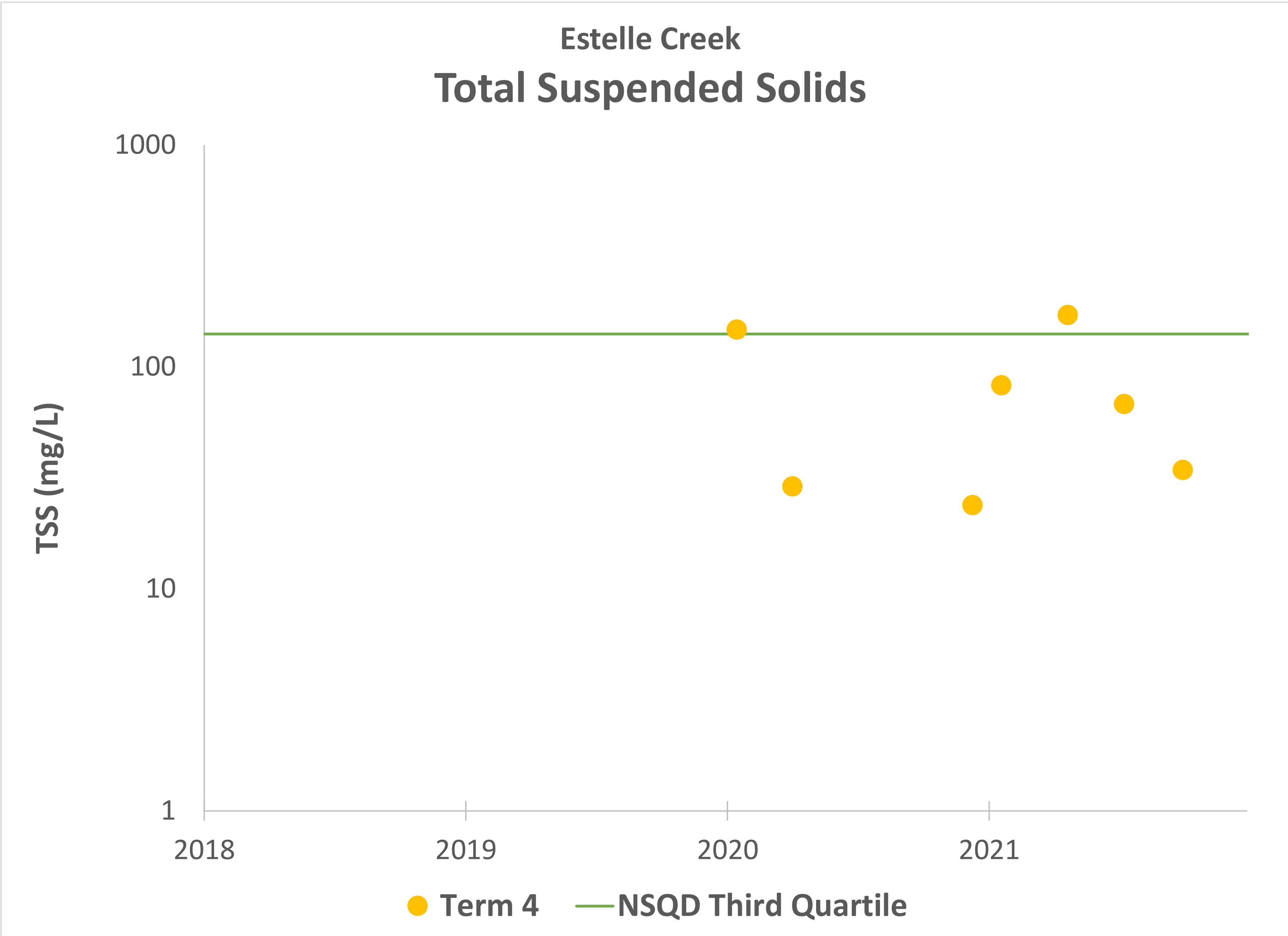
Duck Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
0.001
2017
2018
2019
2020
2021
Term 4
Human Health Criterion

Appendix I

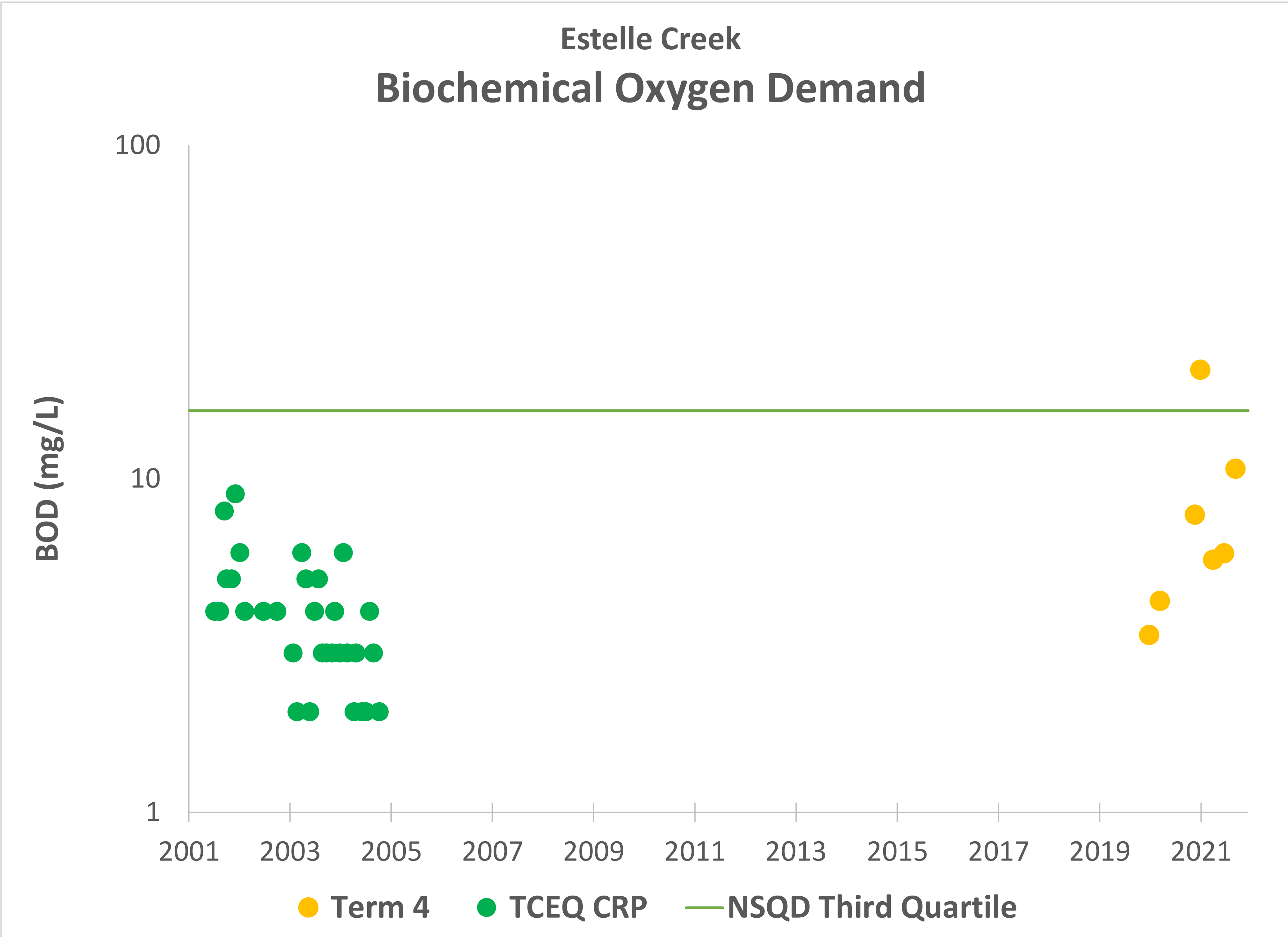
Estelle Creek Water Quality Data Graphs



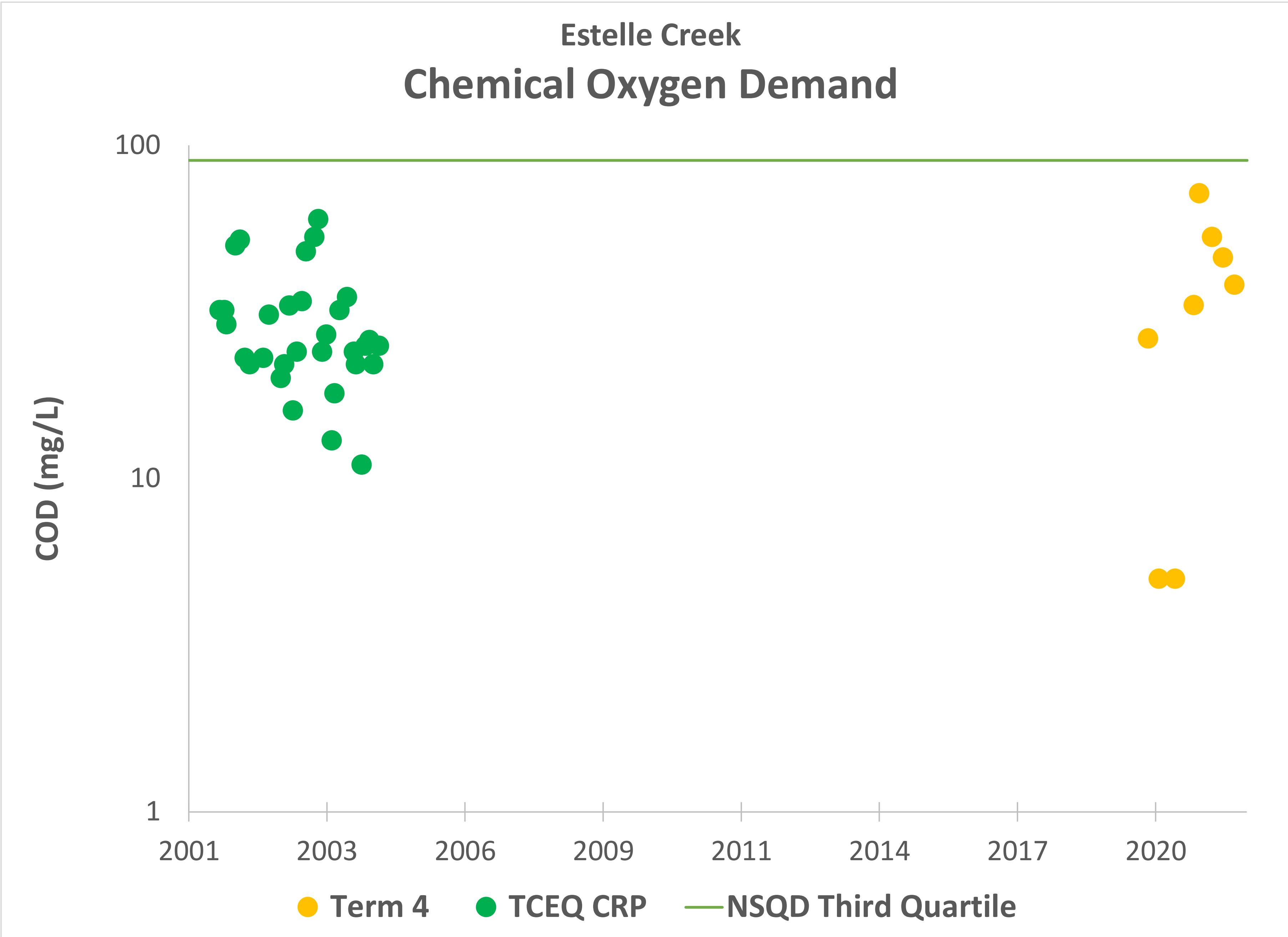
Estelle Creek
Total Dissolved Solids
TDS (mg/L)
1000
100
10
2018
2019
2020
2021
Term 4
Basin Specific Criterion

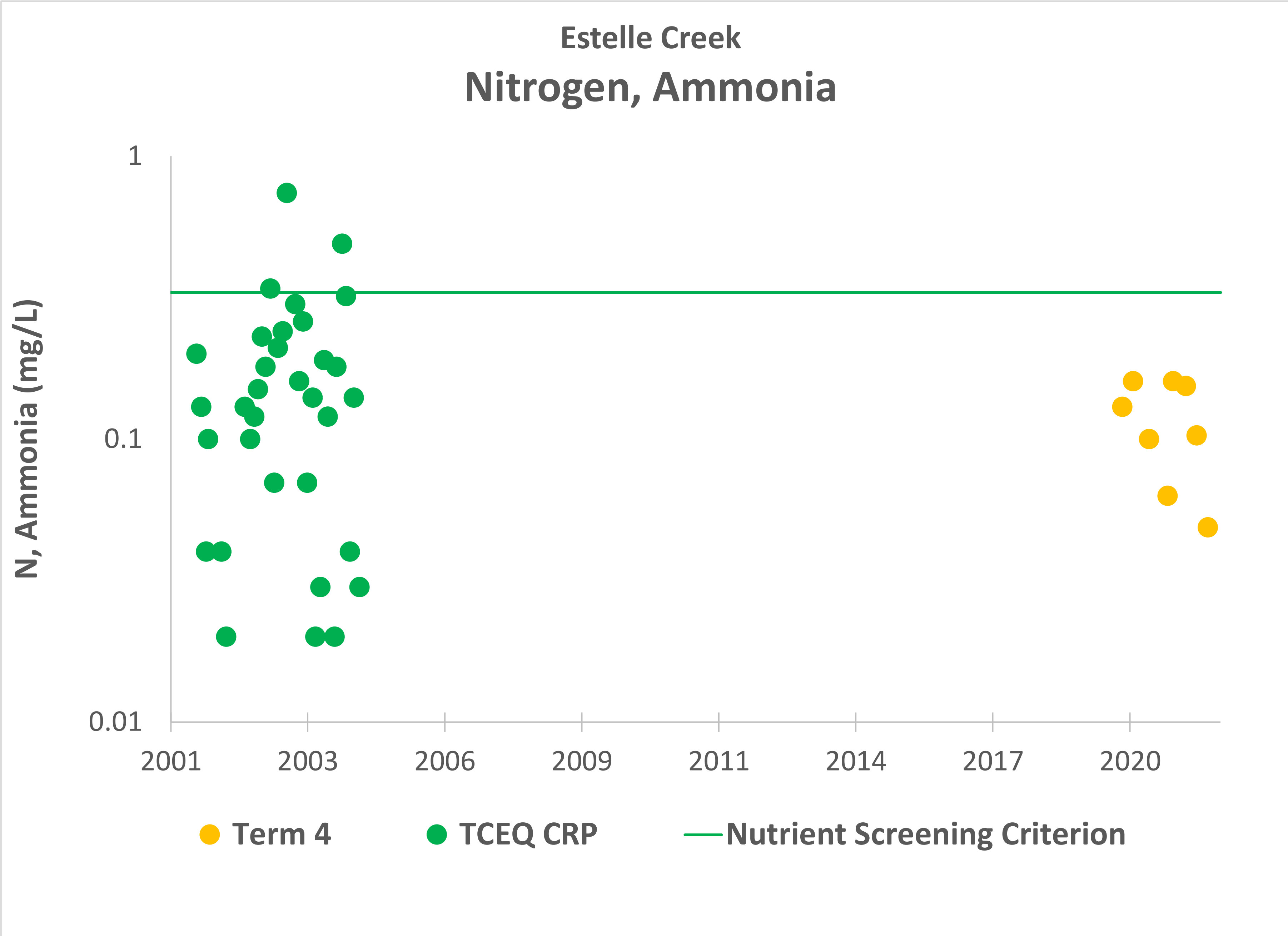


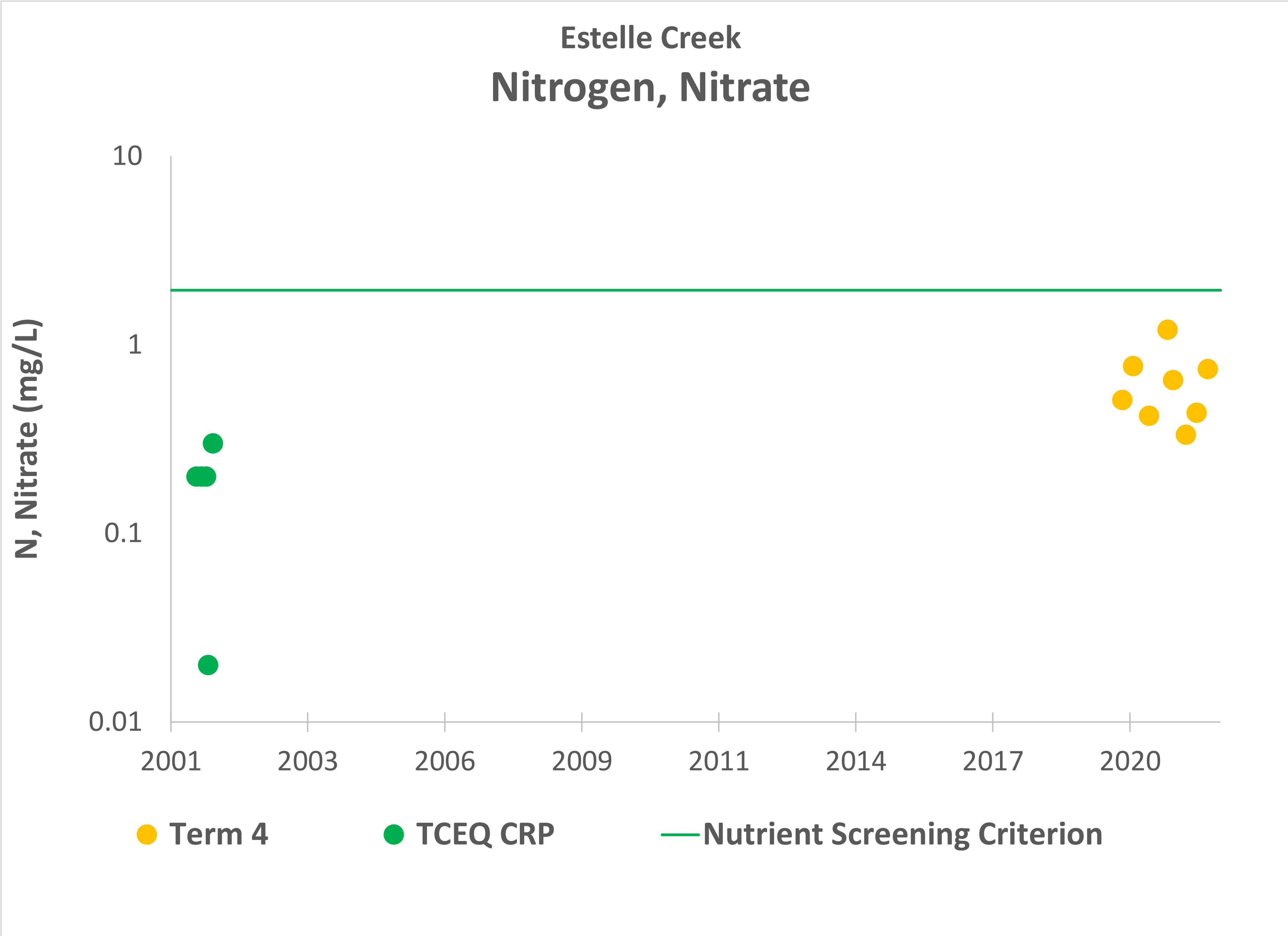
Estelle Creek
Total Suspended Solids
1000
100
10
1
TSS (mg/L)
2018
2019
2020
2021
Term 4
NSQD Third Quartile

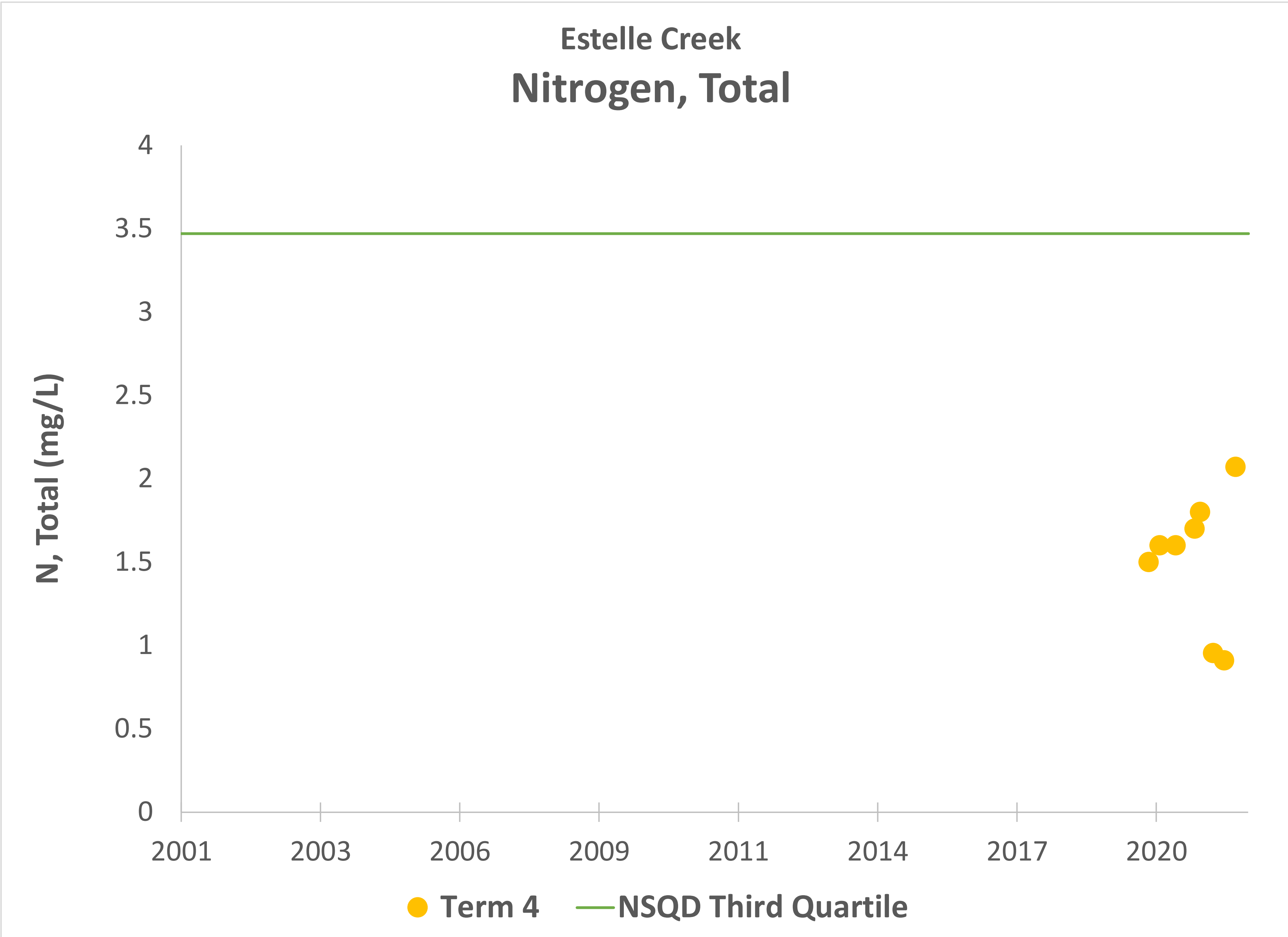


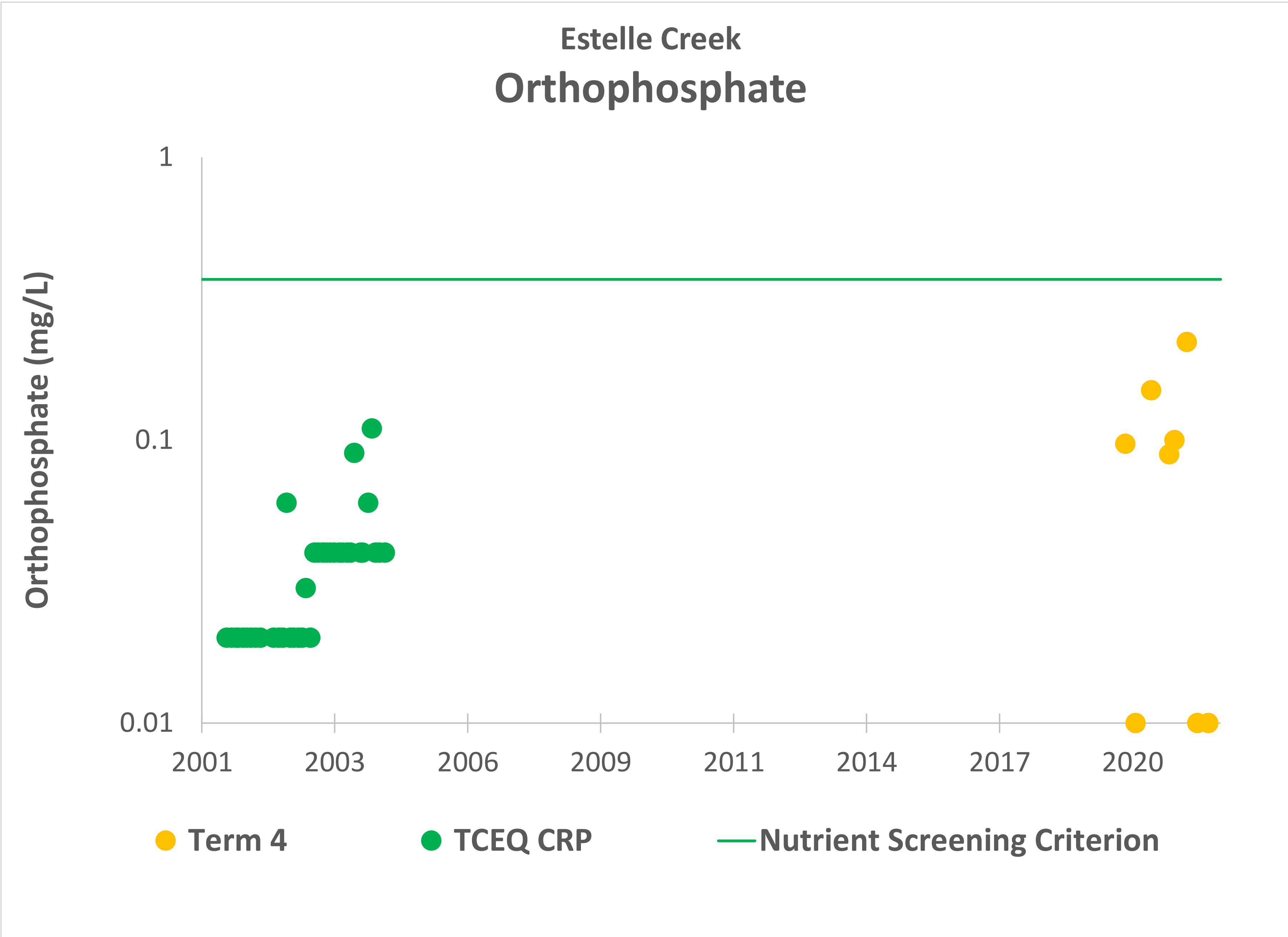
Estelle Creek
Biochemical Oxygen Demand
100
10
1
BOD (mg/L)
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
TCEQ CRP
NSQD Third Quartile


Estelle Creek
Chemical Oxygen Demand
100
10
1
COD (mg/L)
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
NSQD Third Quartile

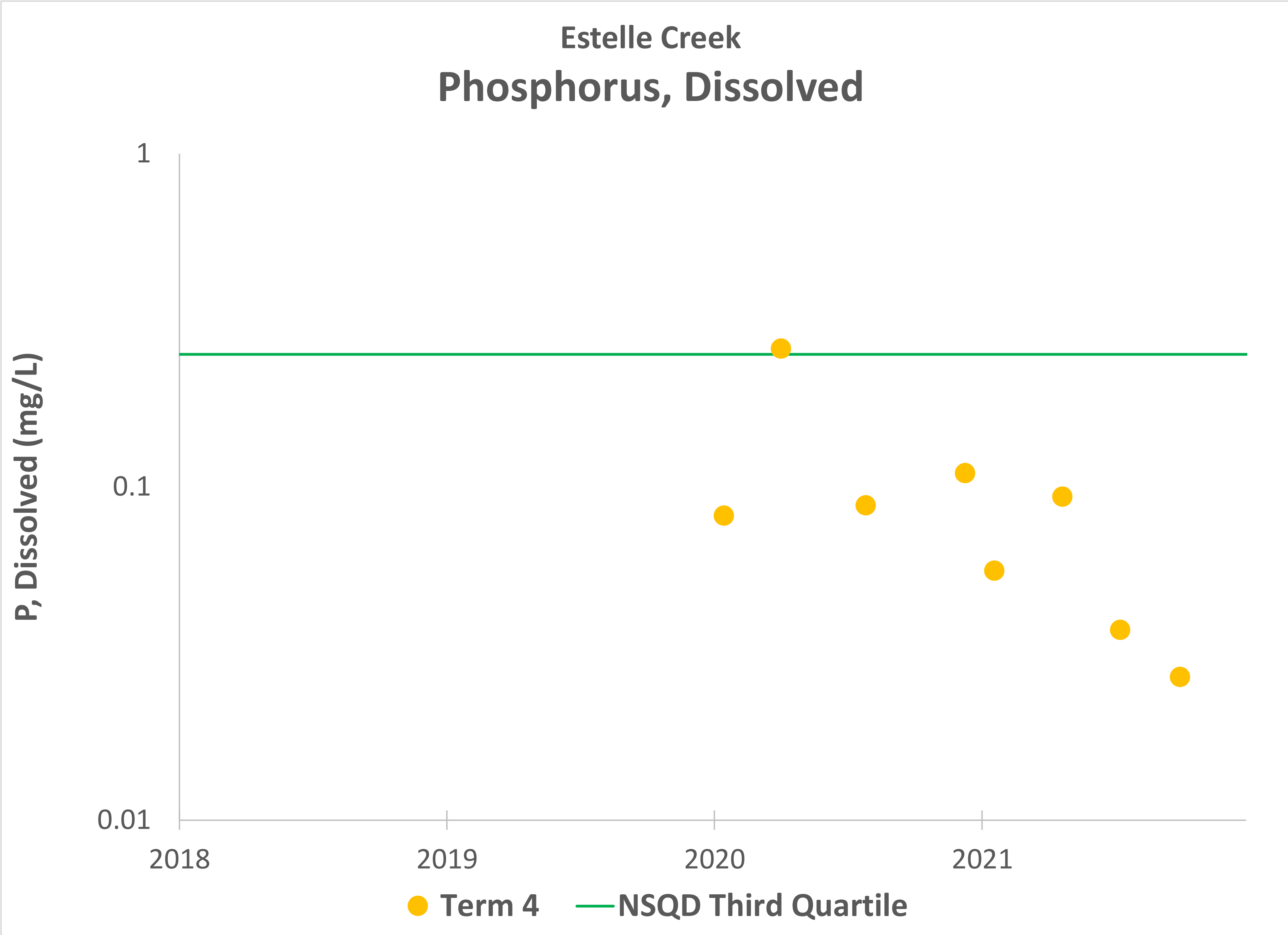

Estelle Creek
Nitrogen, Ammonia
N, Ammonia (mg/L)
1
0.1
0.01
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion

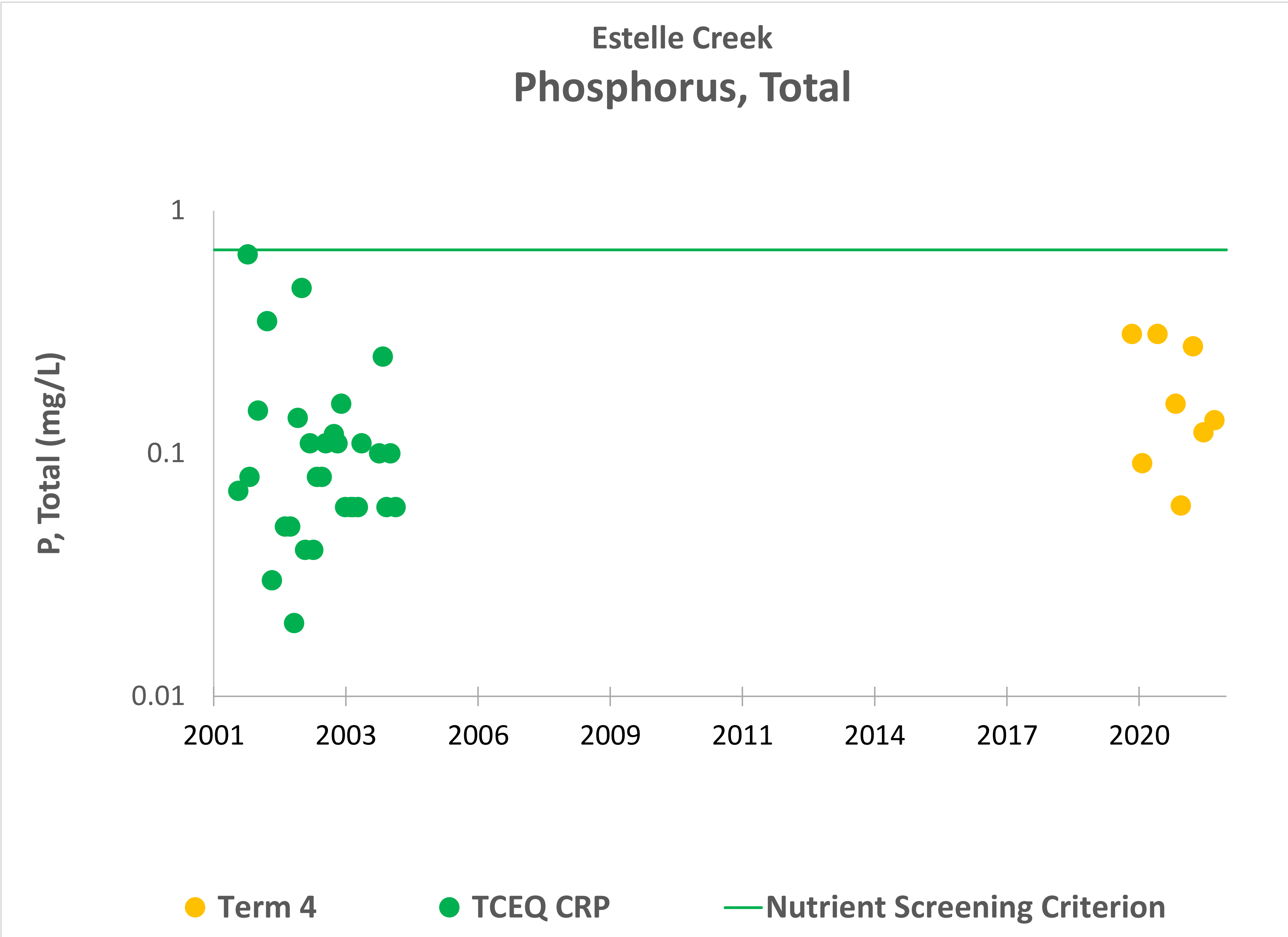

Estelle Creek
Nitrogen, Nitrate
N, Nitrate (mg/L)
10
1
0.1
0.01
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion


Estelle Creek
Nitrogen, Total
N, Total (mg/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
NSQD Third Quartile

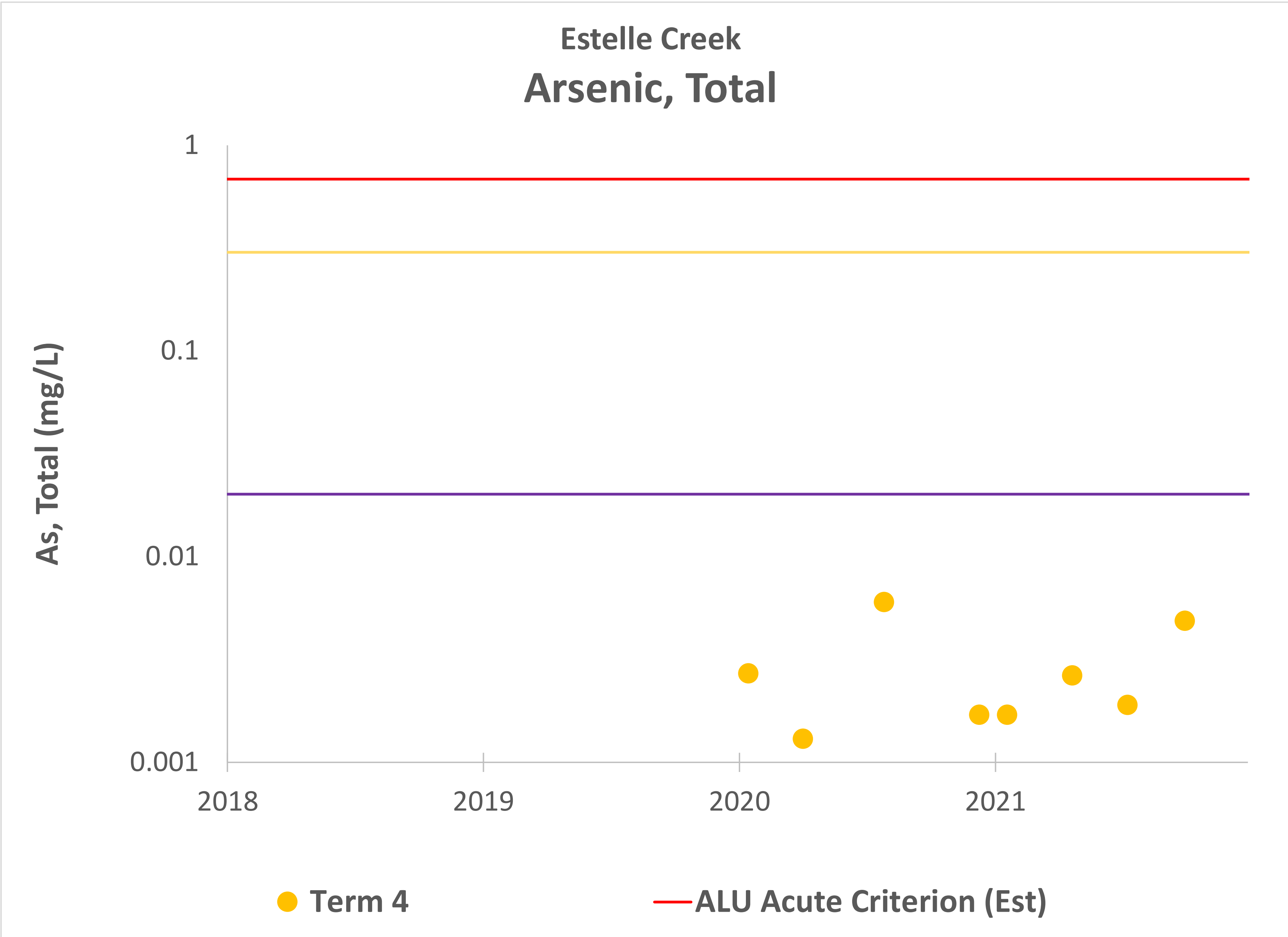


Estelle Creek
Orthophosphate
Orthophosphate (mg/L)
1
0.1
0.01
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion

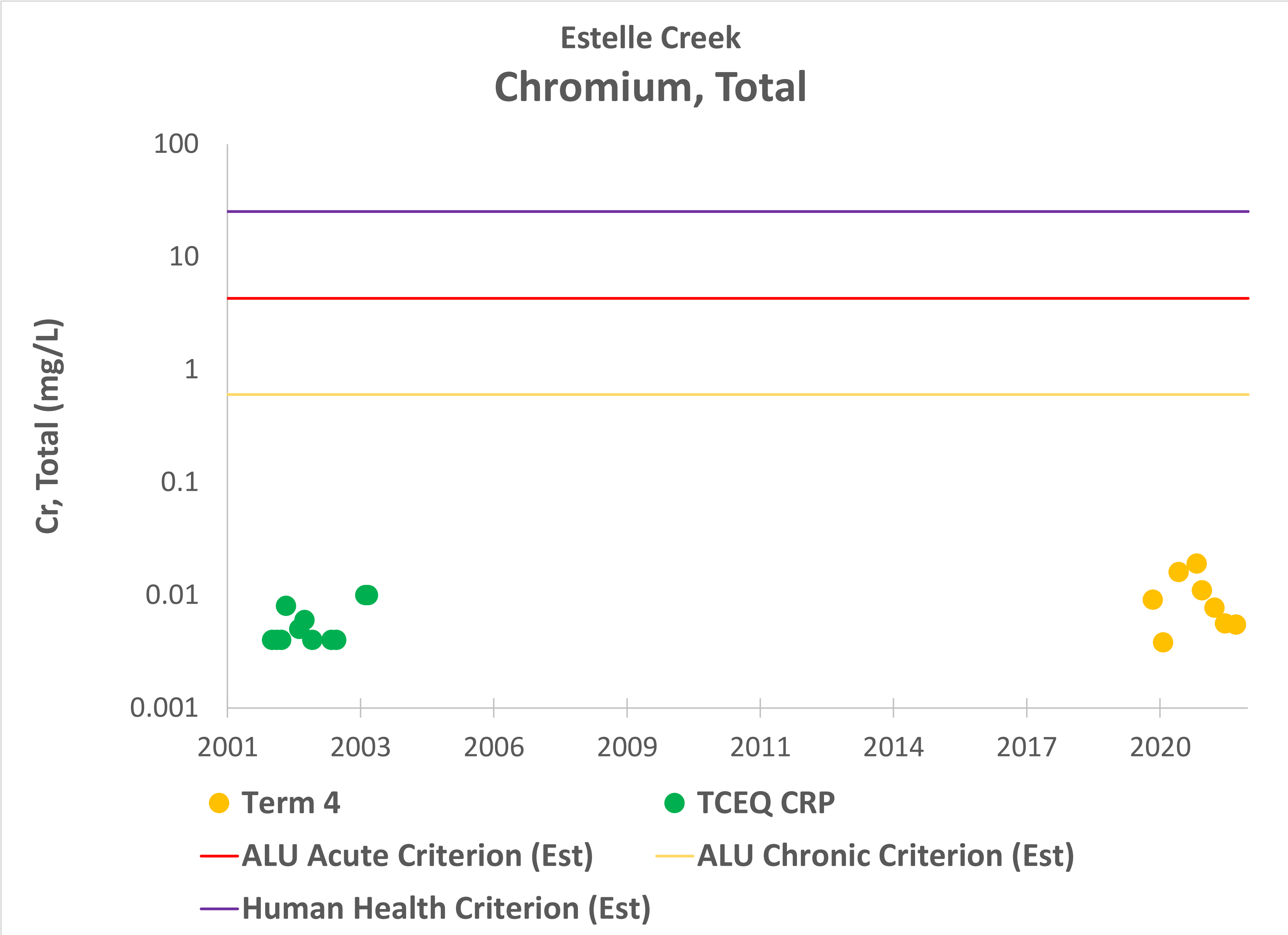

Estelle Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
1
0.1
0.01
2018
2019
2020
2021
Term 4
NSQD Third Quartile



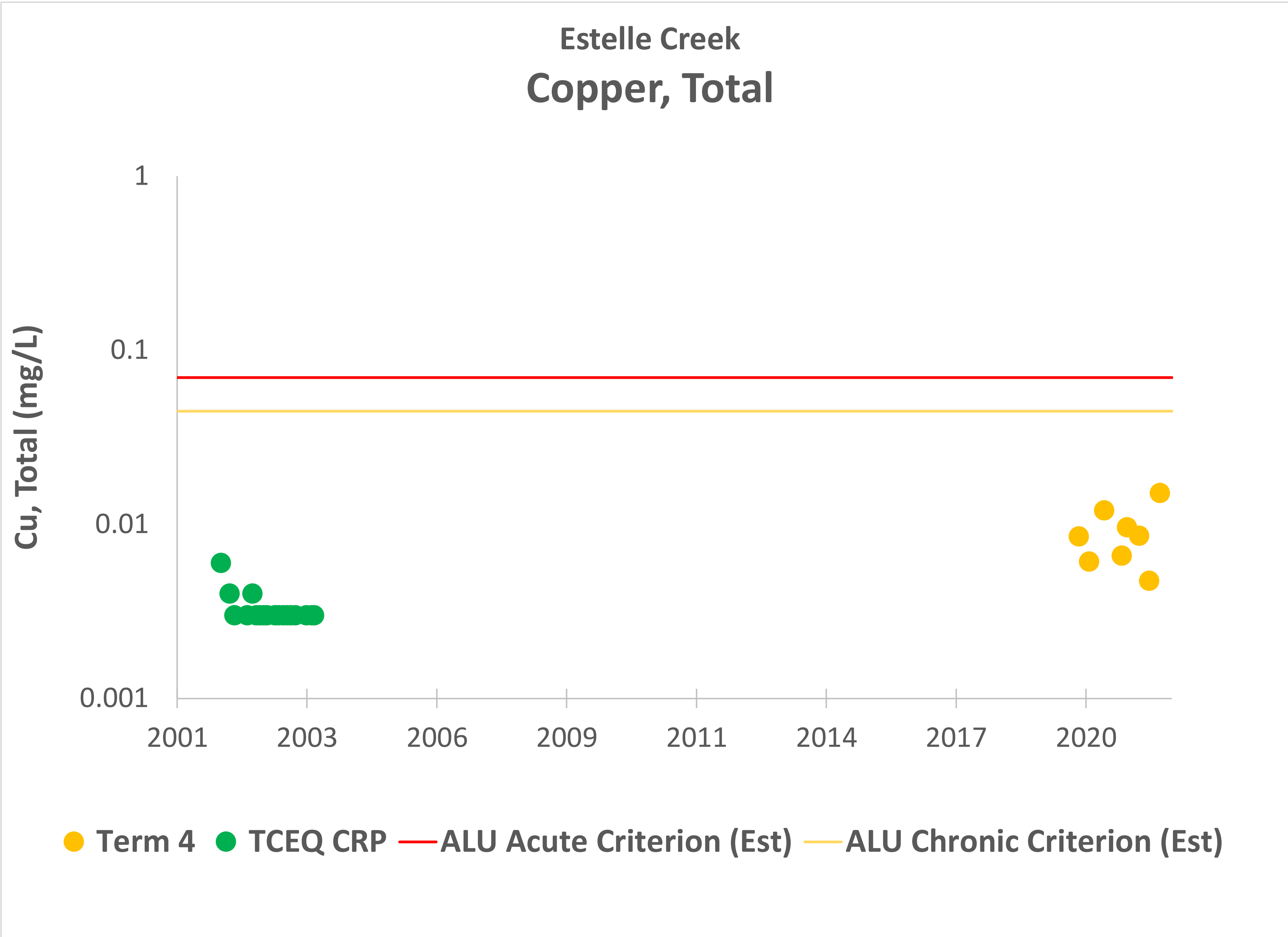
Estelle Creek
Phosphorus, Total
P, Total (mg/L)
1
0.1
0.01
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion



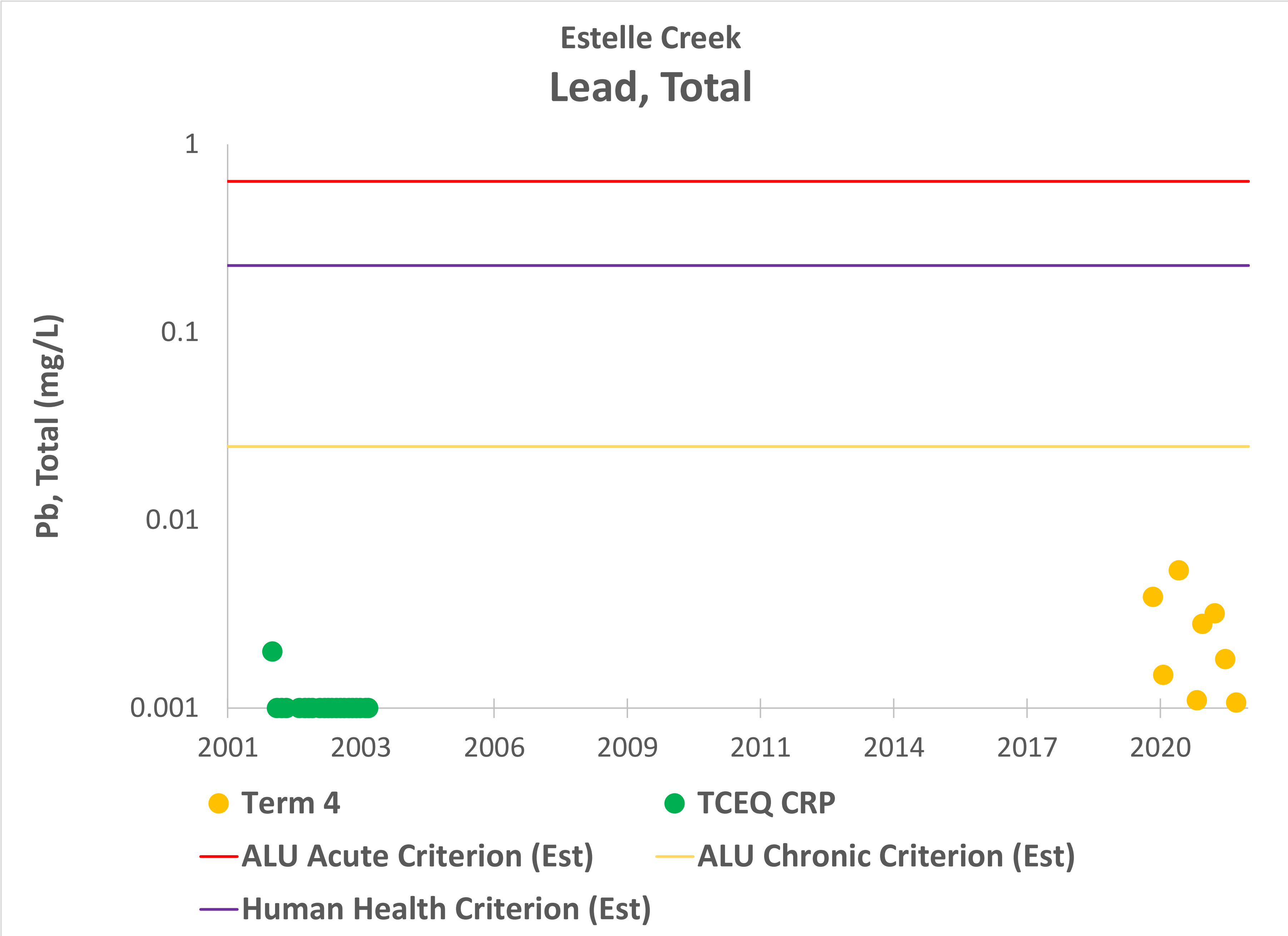
Estelle Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2018
2019
2020
2021
Term 4
ALU Acute Criterion (Est)



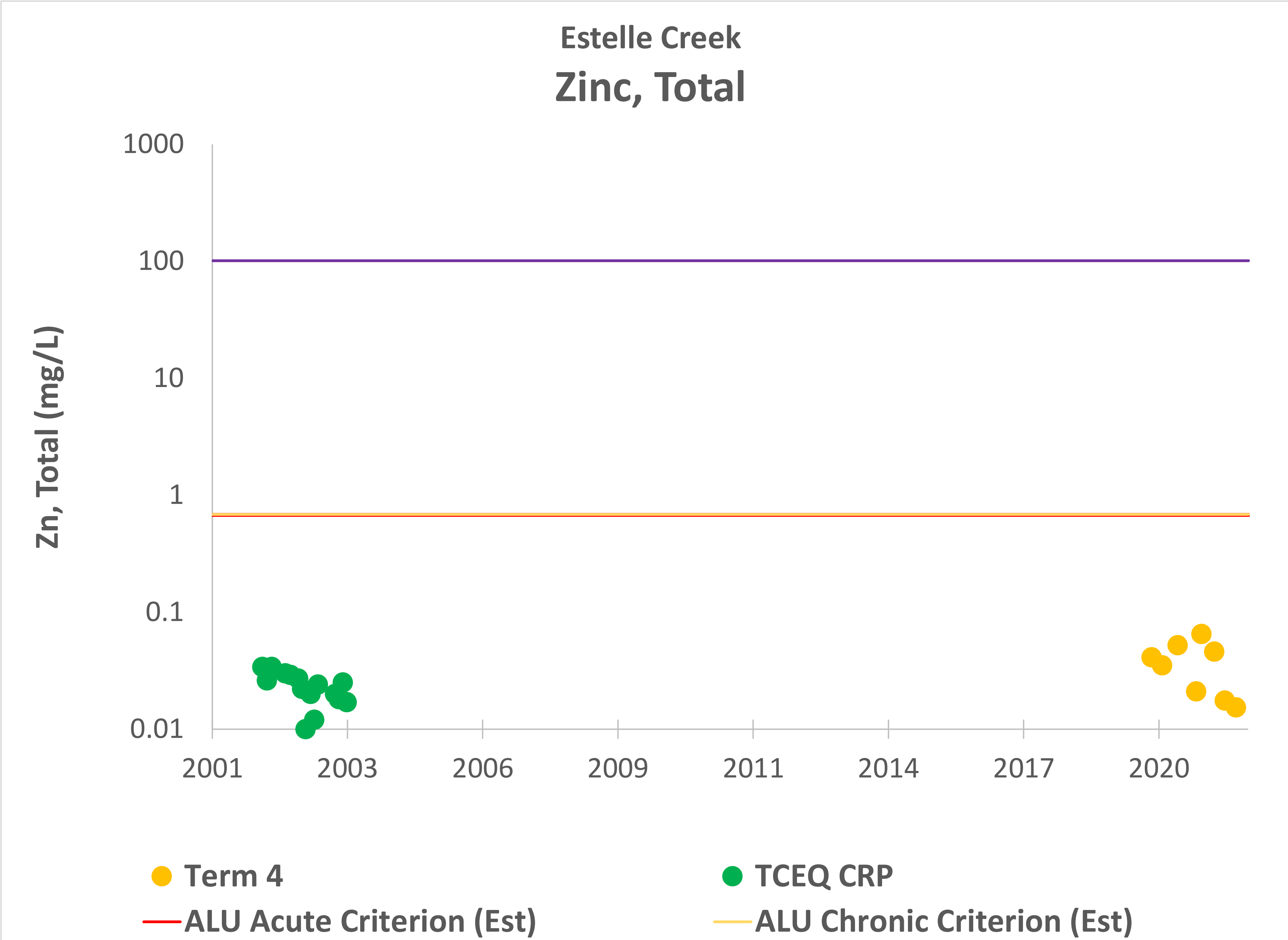
Estelle Creek
Chromium, Total
Cr, Total (mg/L)
100
10
1
0.1
0.01
0.001
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



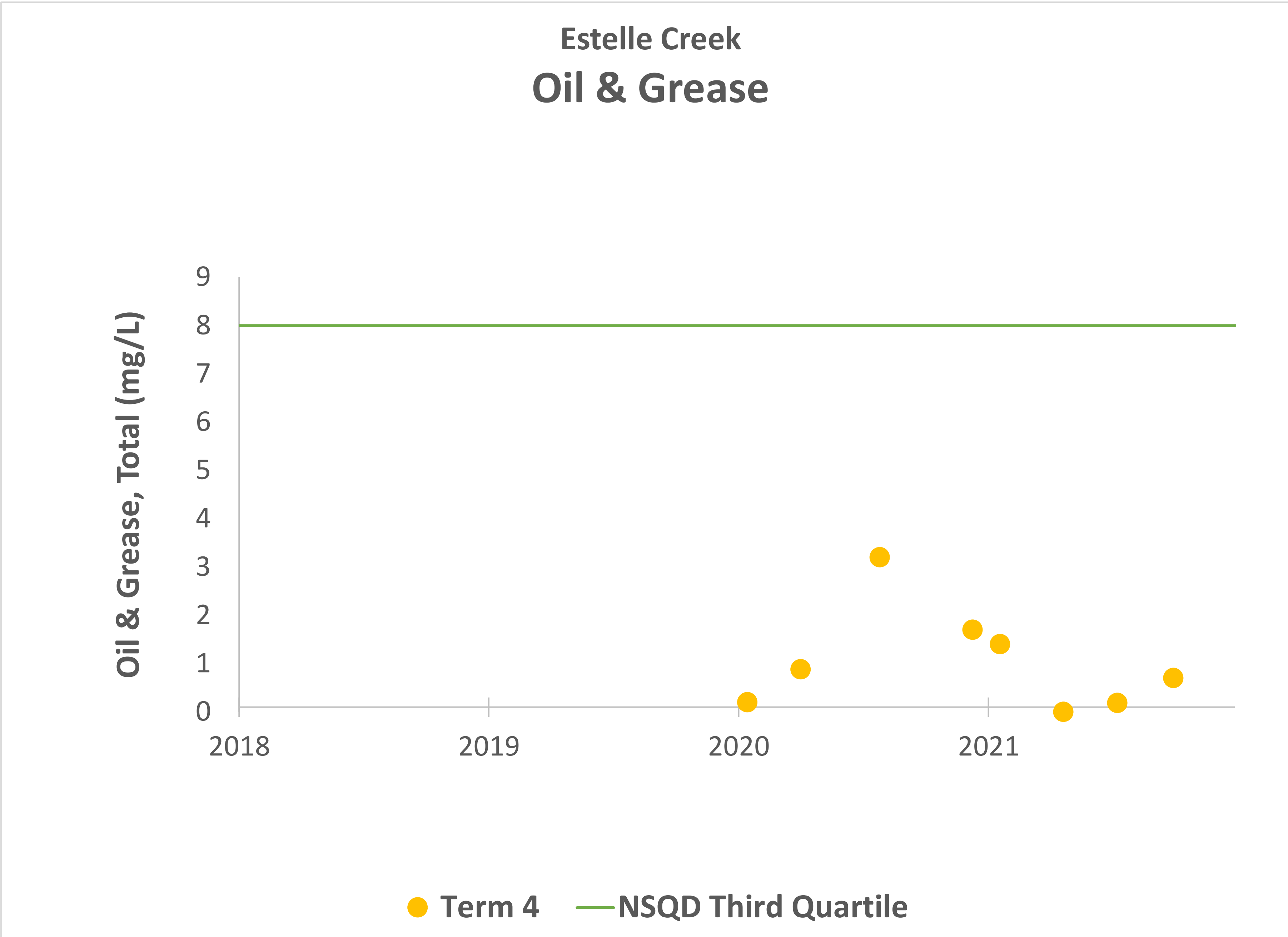
Estelle Creek
Copper, Total
Cu, Total (mg/L)
1
0.1
0.01
0.001
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)

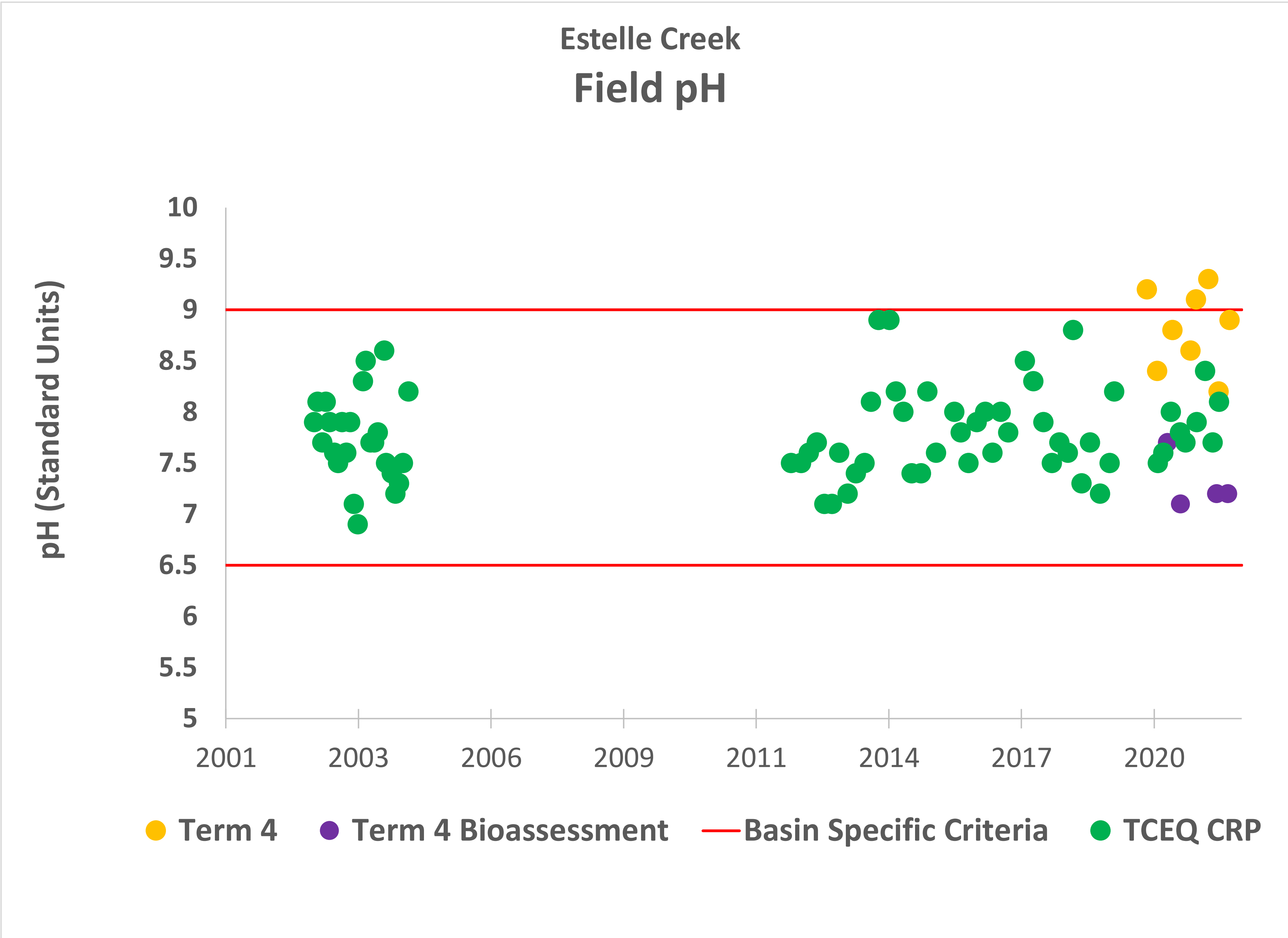


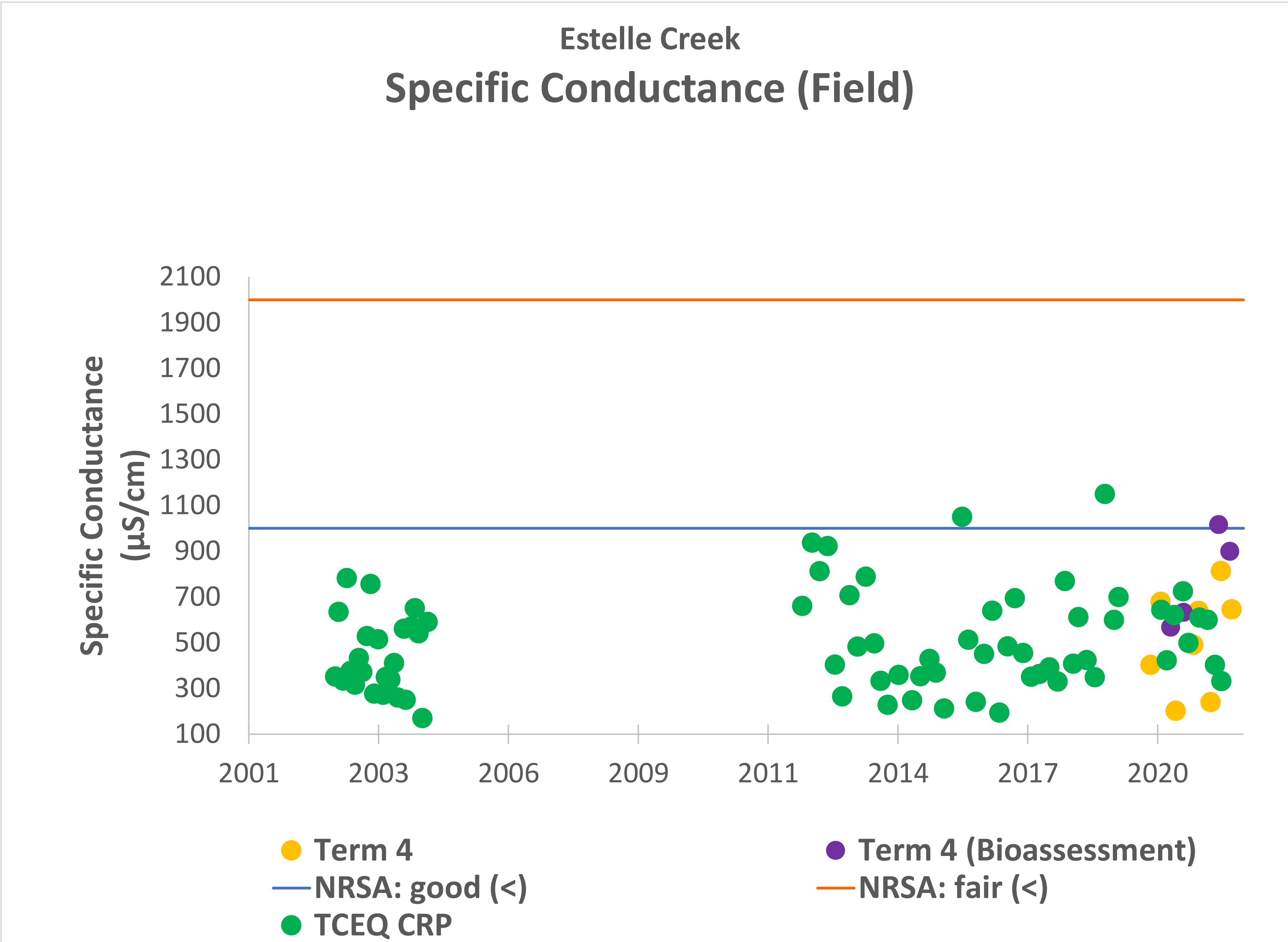
Estelle Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



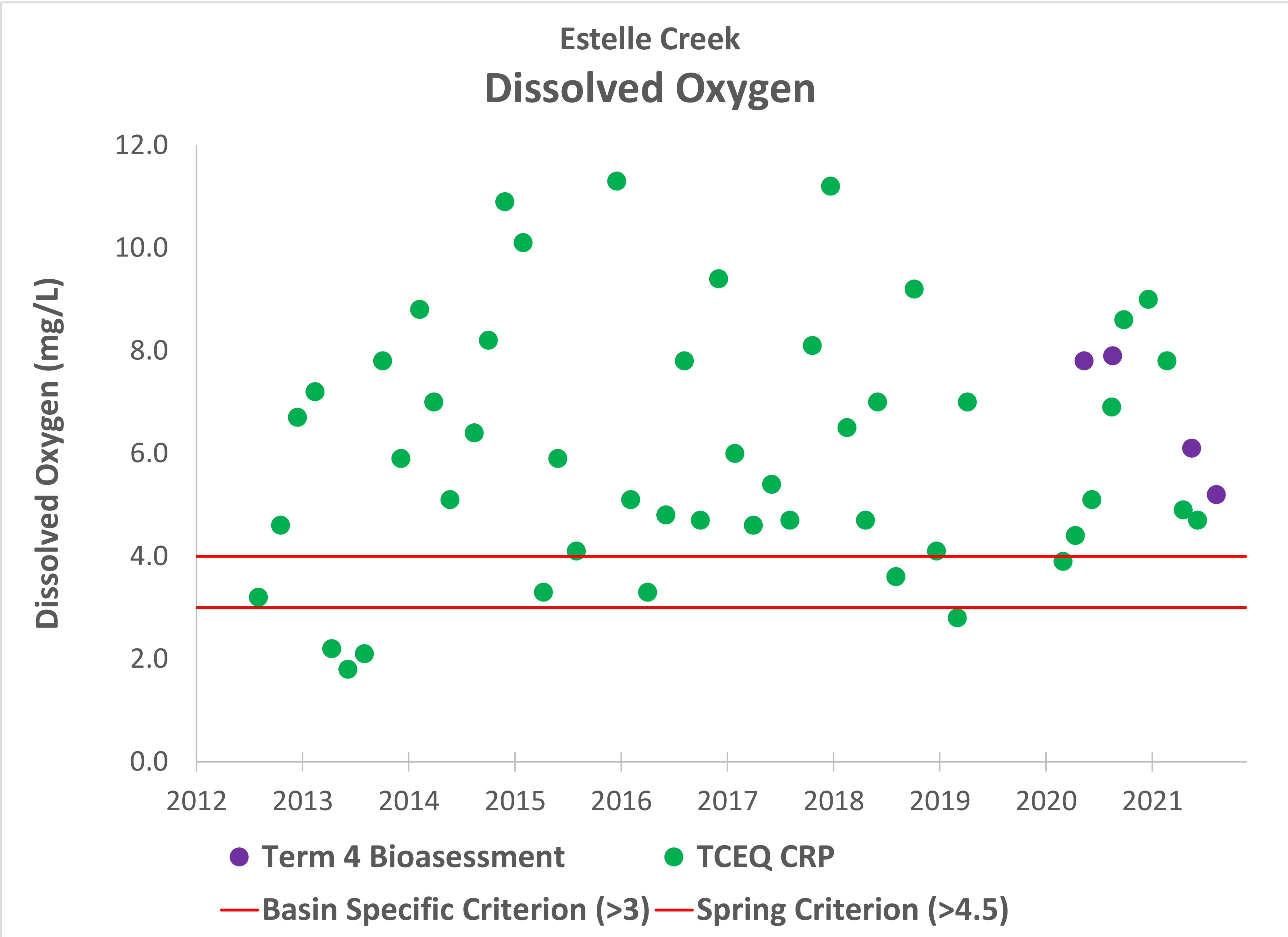
Estelle Creek
Zinc, Total
Zn, Total (mg/L)
1000
100
10
1
0.1
0.01
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)


Estelle Creek
Oil & Grease
Oil & Grease, Total (mg/L)
0
1
2
3
4
5
6
7
8
9
2018
2019
2020
2021
Term 4
NSQD Third Quartile

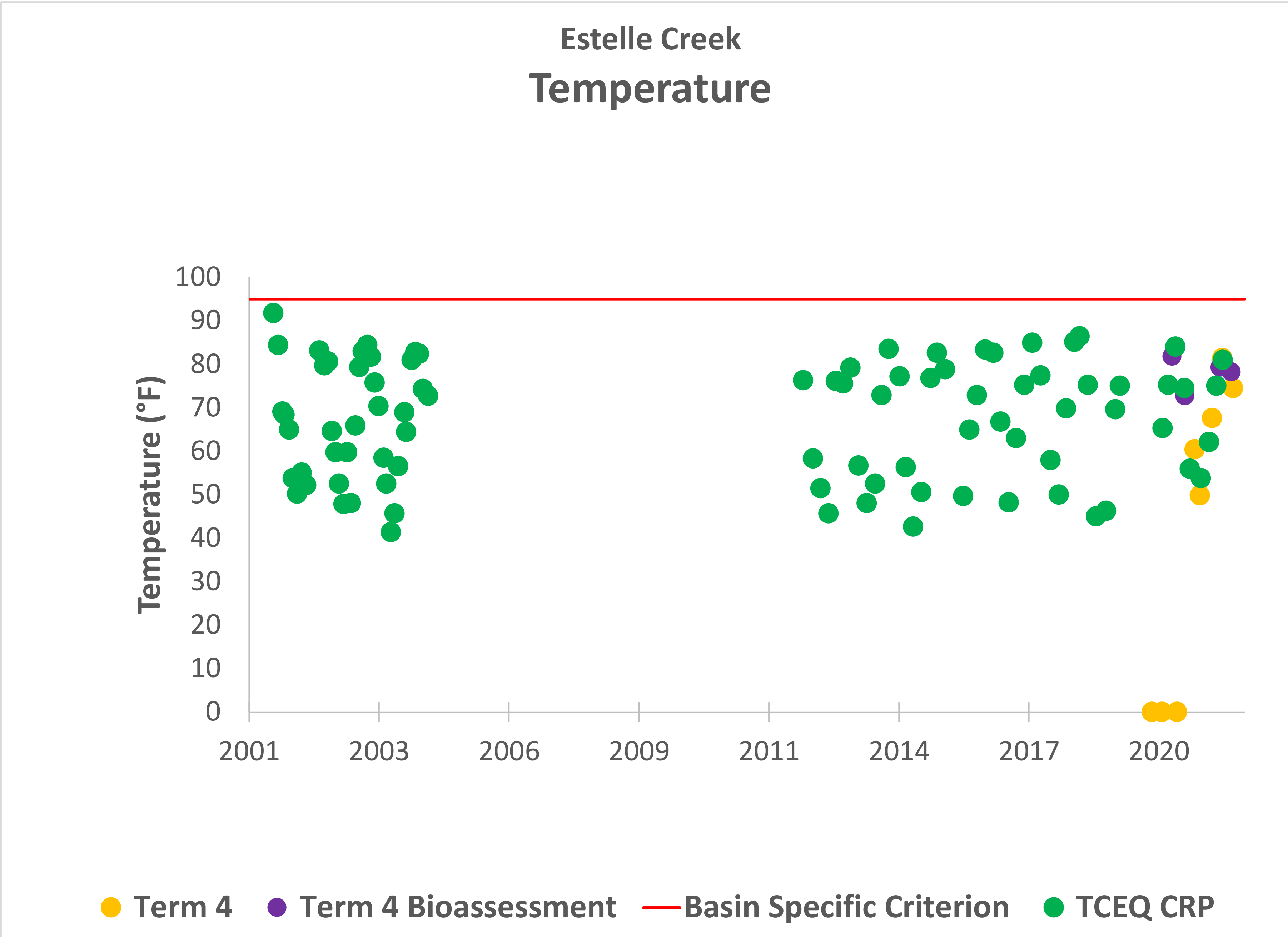

Estelle Creek
Field pH
pH (Standard Units)
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
Term 4 Bioassessment
Basin Specific Criteria
TCEQ CRP



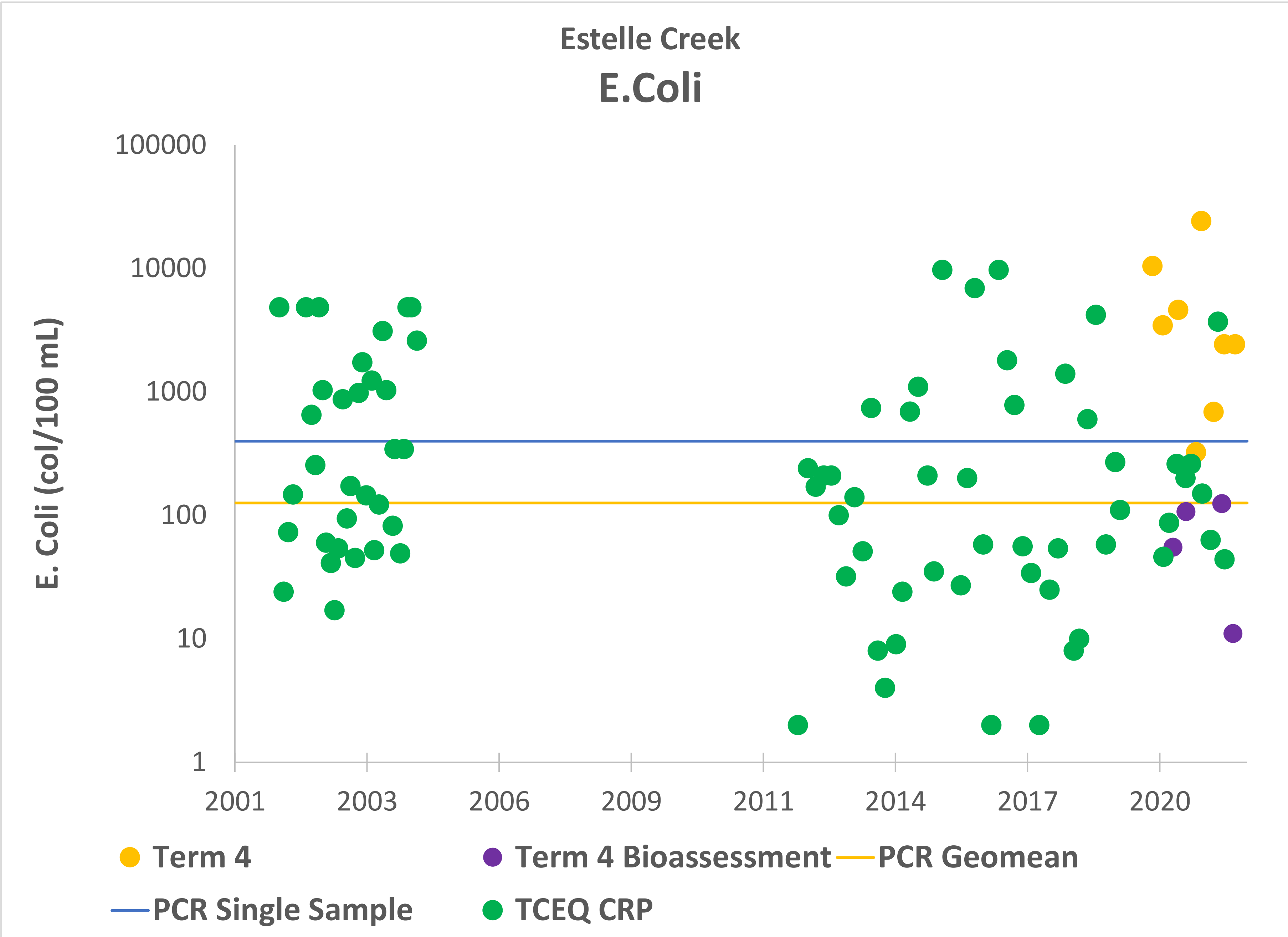
Estelle Creek
Specific Conductance (Field)
Specific Conductance (µS/cm)
2100
1900
1700
1500
1300
1100
900
700
500
300
100
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
Term 4 (Bioassessment)
NRSA: good (<)
NRSA: fair (<)
TCEQ CRP

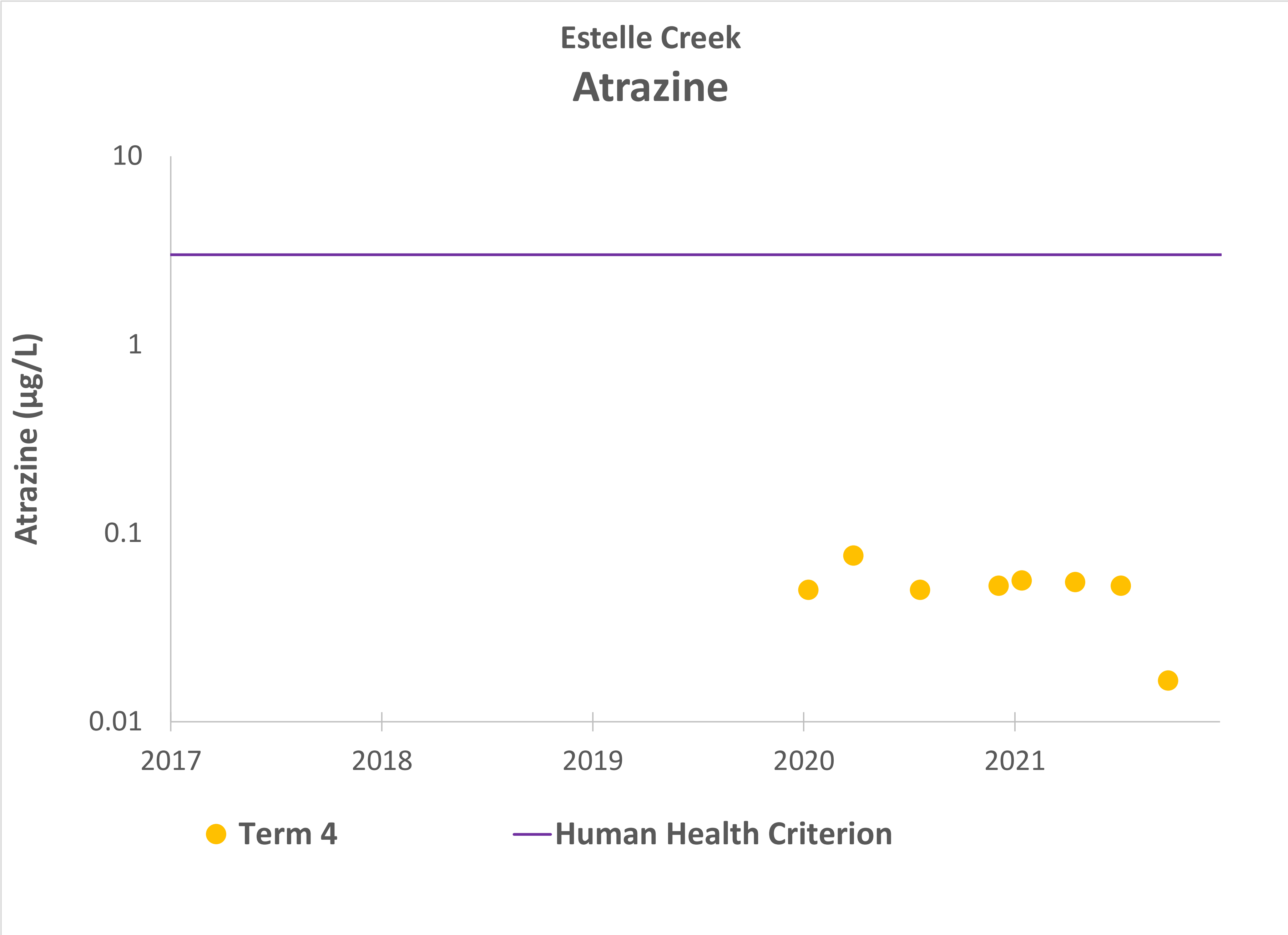


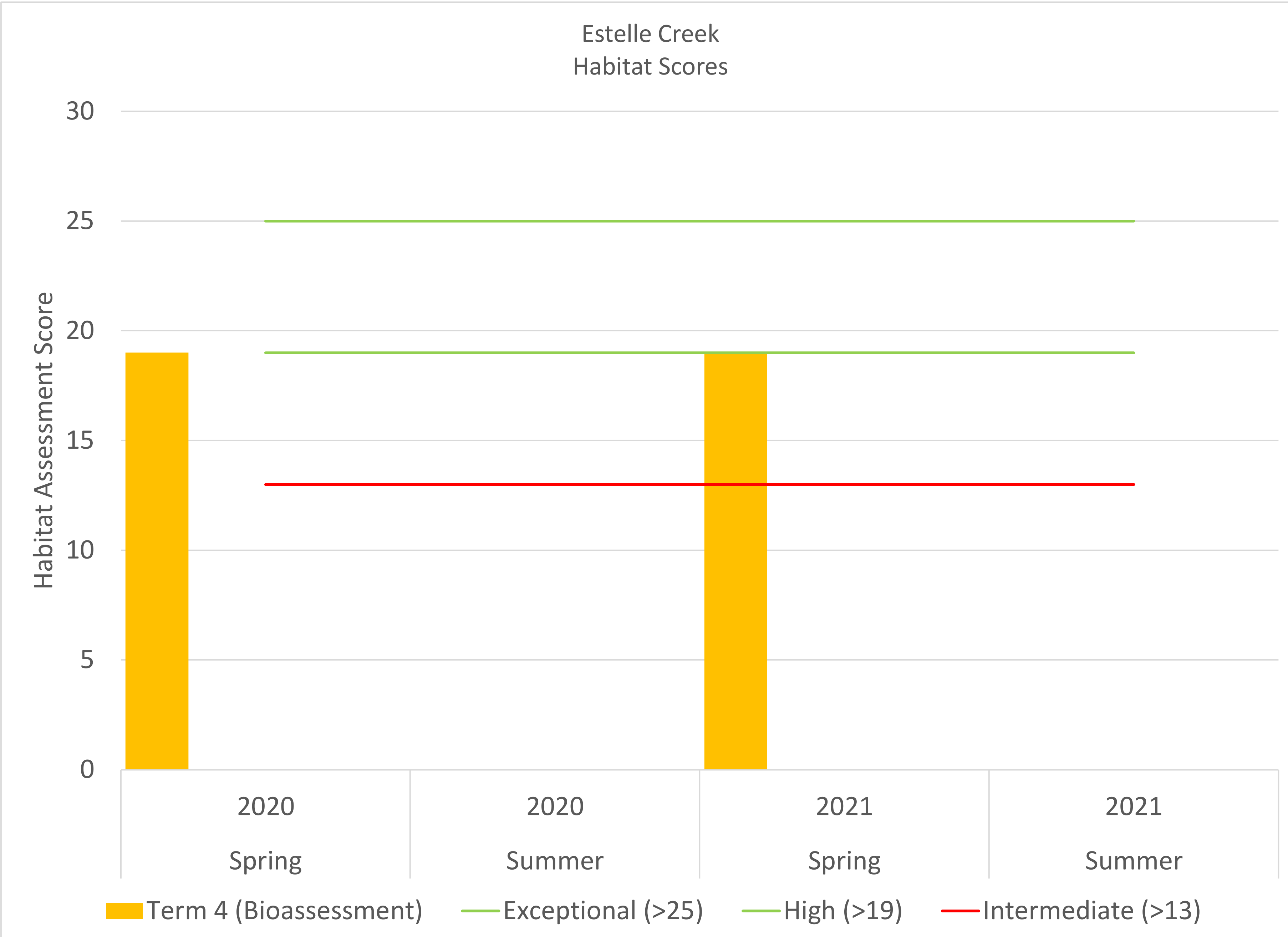
Estelle Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 Bioasessment
TCEQ CRP
Basin Specific Criterion (>3)
Spring Criterion (>4.5)



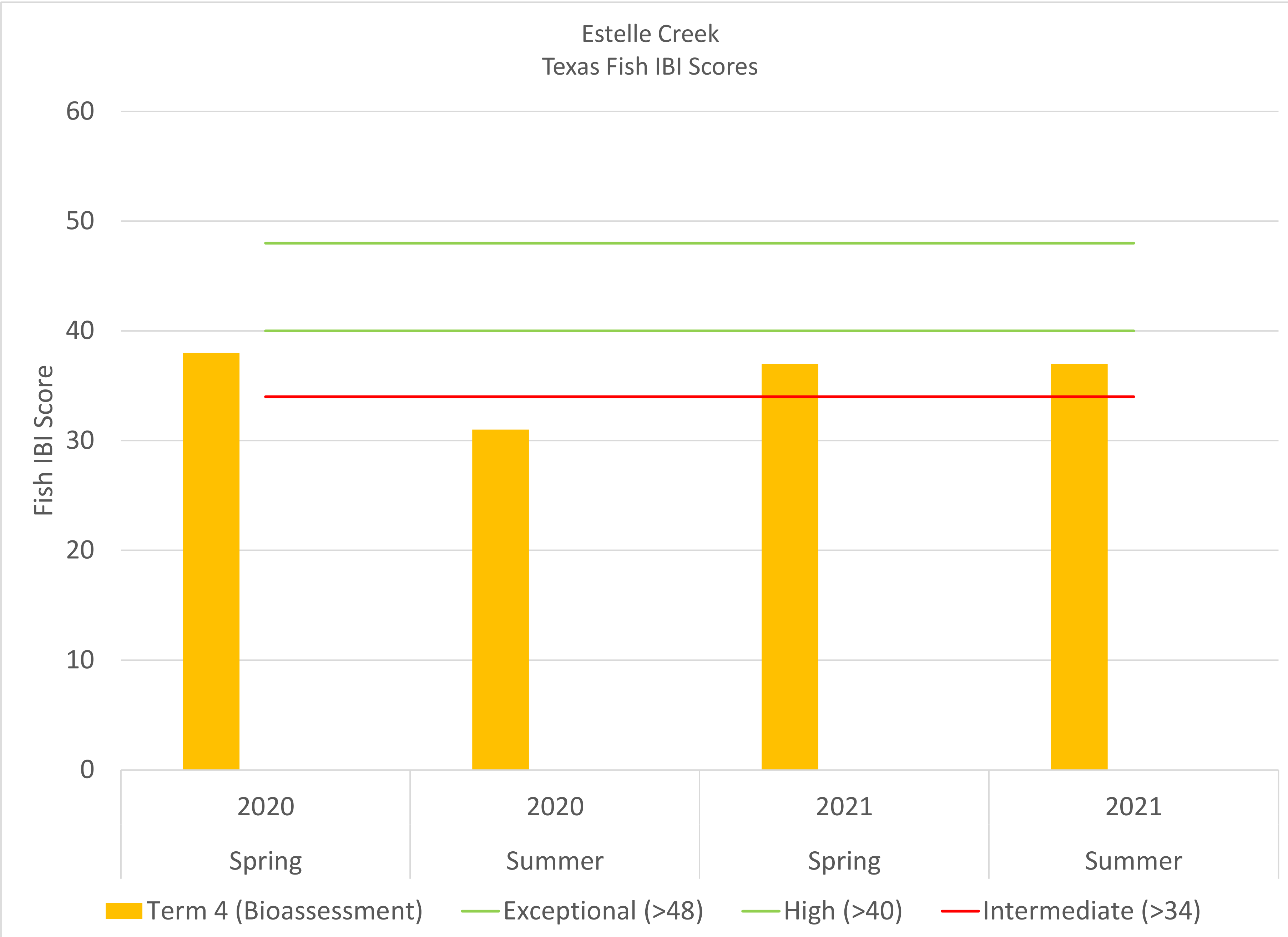
Estelle Creek
Temperature
100
90
80
70
60
50
40
30
20
10
0
Temperature (°F)
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
Term 4 Bioassessment
Basin Specific Criterion
TCEQ CRP


Estelle Creek
E.Coli
E. Coli (col/100 mL)
100000
10000
1000
100
10
1
2001
2003
2006
2009
2011
2014
2017
2020
Term 4
Term 4 Bioassessment
PCR Geomean
PCR Single Sample
TCEQ CRP


Estelle Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
2017
2018
2019
2020
2021
Term 4
Human Health Criterion

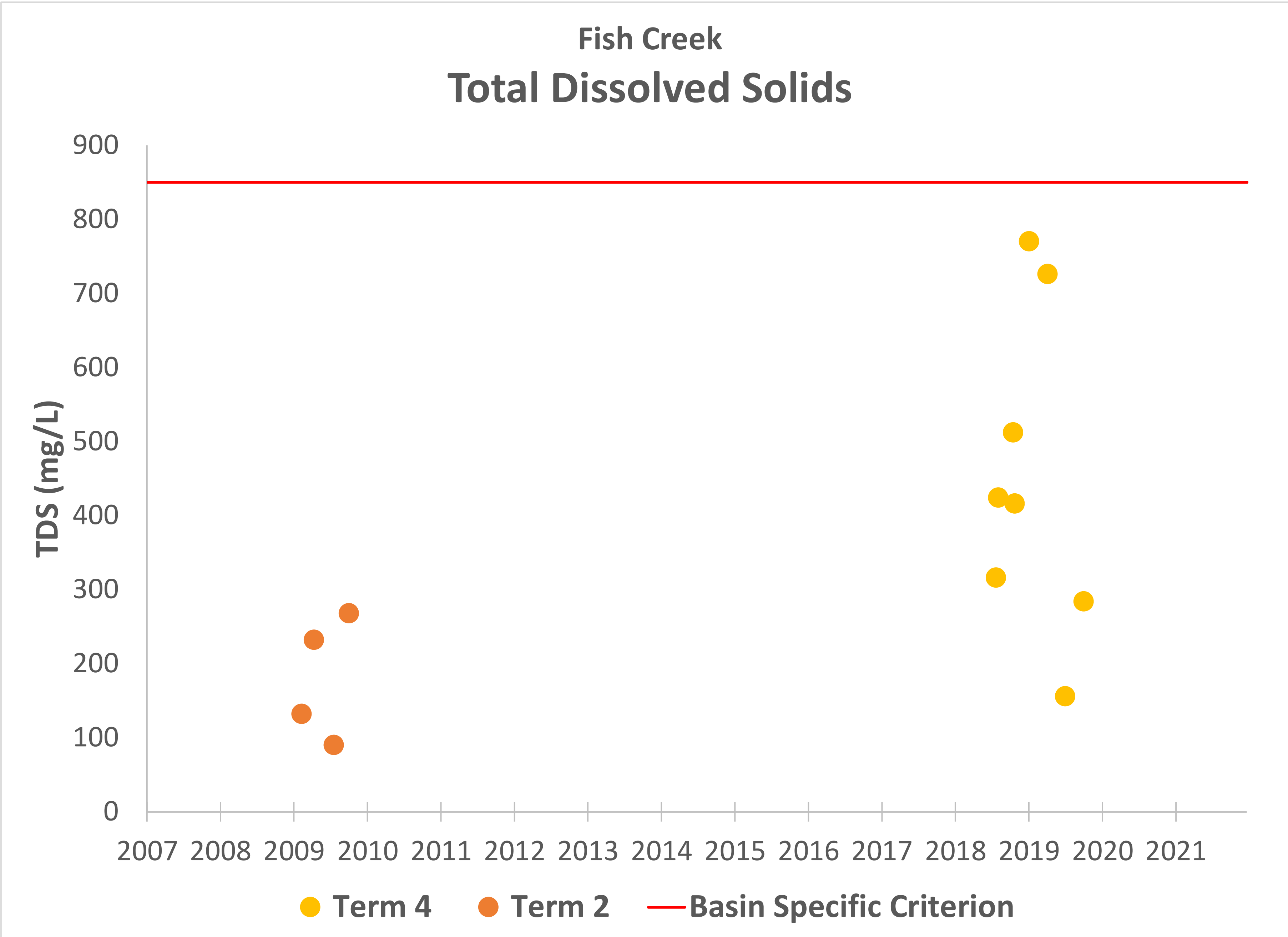

Estelle Creek
Habitat Scores
Habitat Assessment Score
30
25
20
15
10
5
0
2020
Spring
2020
Summer
2021
Spring
2021
Summer
Term 4 (Bioassessment)
Exceptional (>25)
High (>19)
Intermediate (>13)

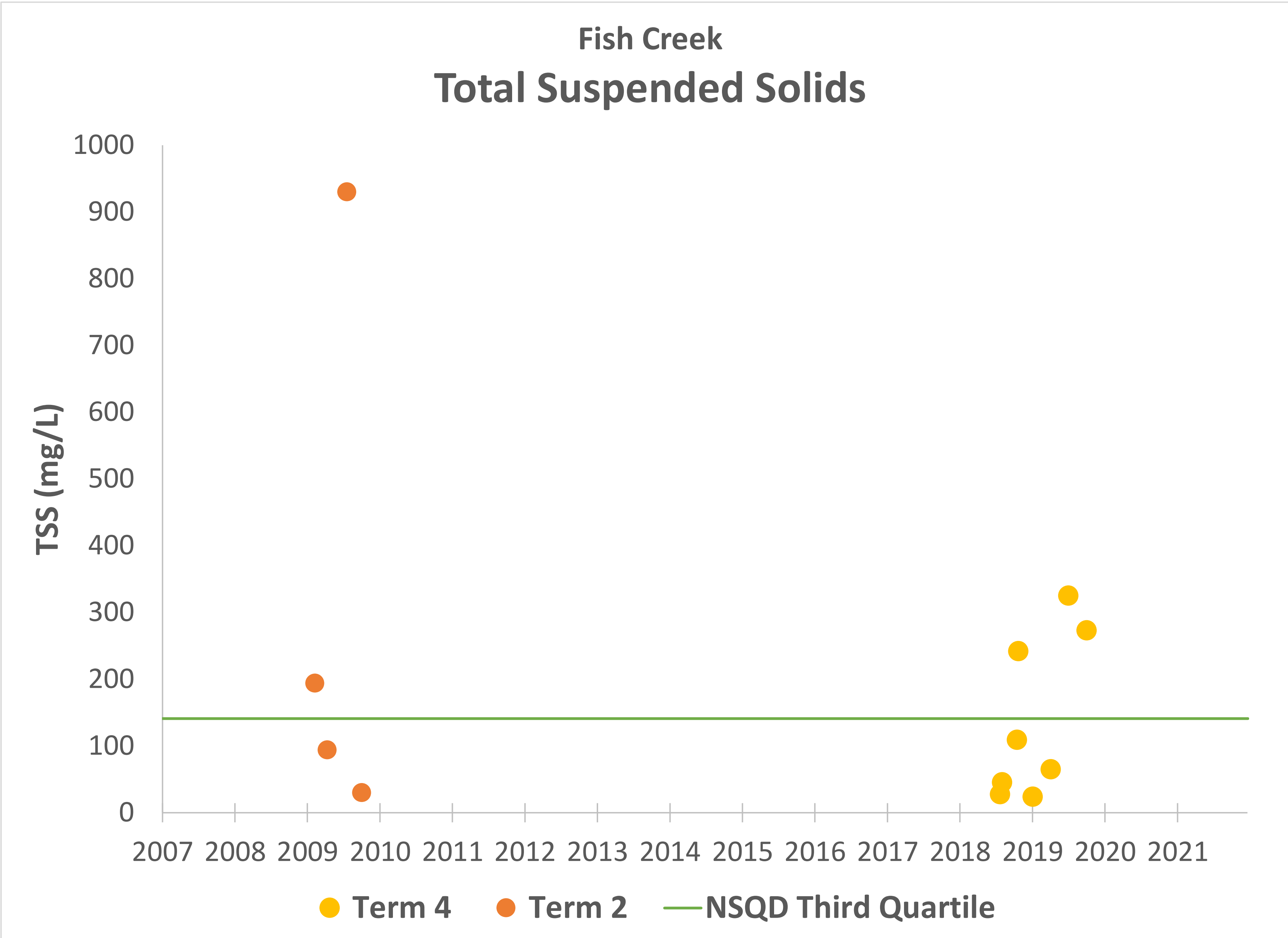

Estelle Creek
Texas Macroinvertebrate IBI Scores
Macroinvertebrate IBI Score
35
30
25
20
15
10
5
0
2020
Spring
2020
Summer
2021
Spring
2021
Summer
Term 4 (Bioassessment)
Exceptional (>32)
High (>28)
Intermediate (>21)

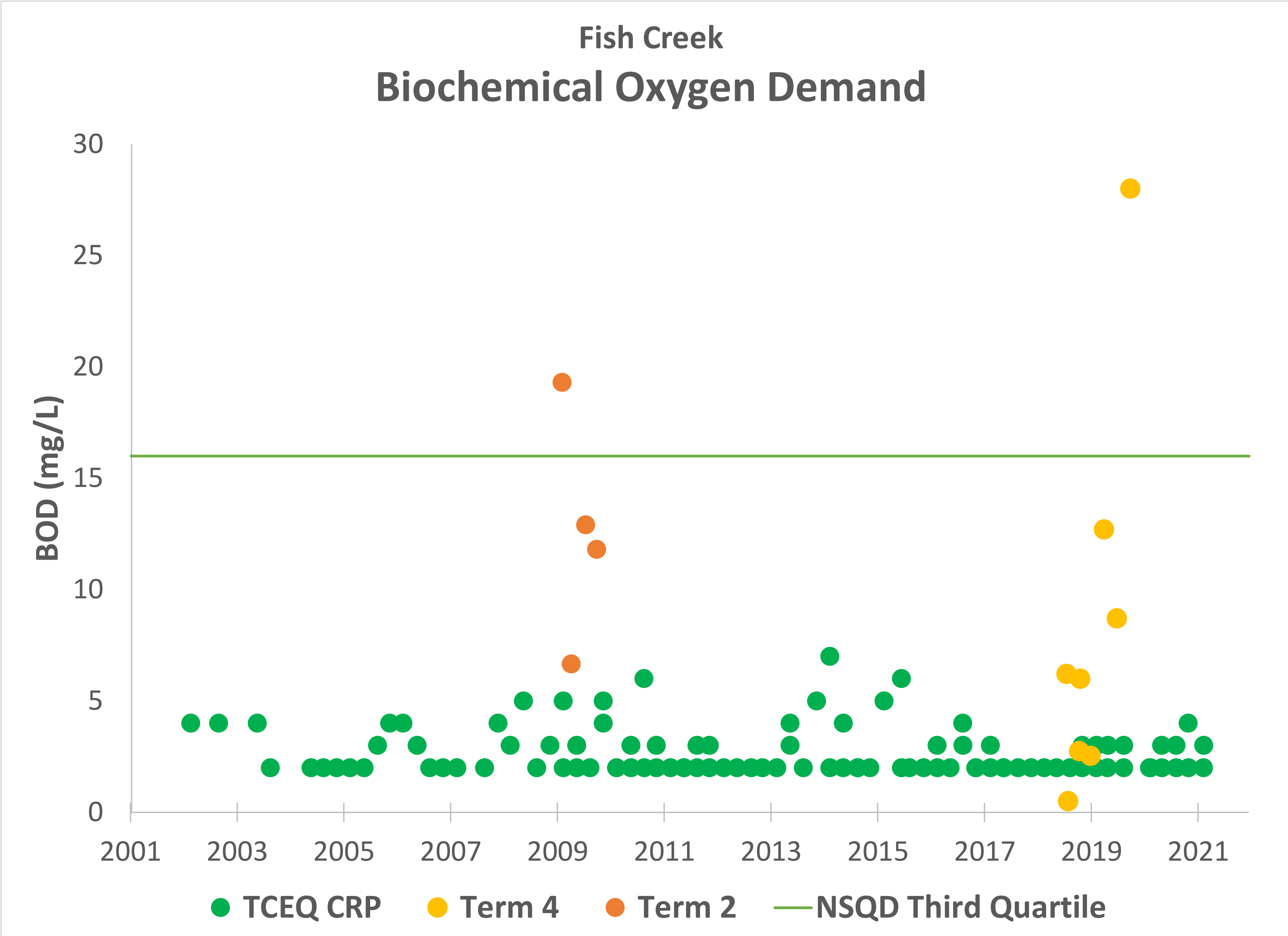

Estelle Creek
Texas Fish IBI Scores
60
50
40
30
20
10
0
Fish IBI Score
2020
Spring
2020
Summer
2021
Spring
2021
Summer
Term 4 (Bioassessment)
Exceptional (>48)
High (>40)
Intermediate (>34)

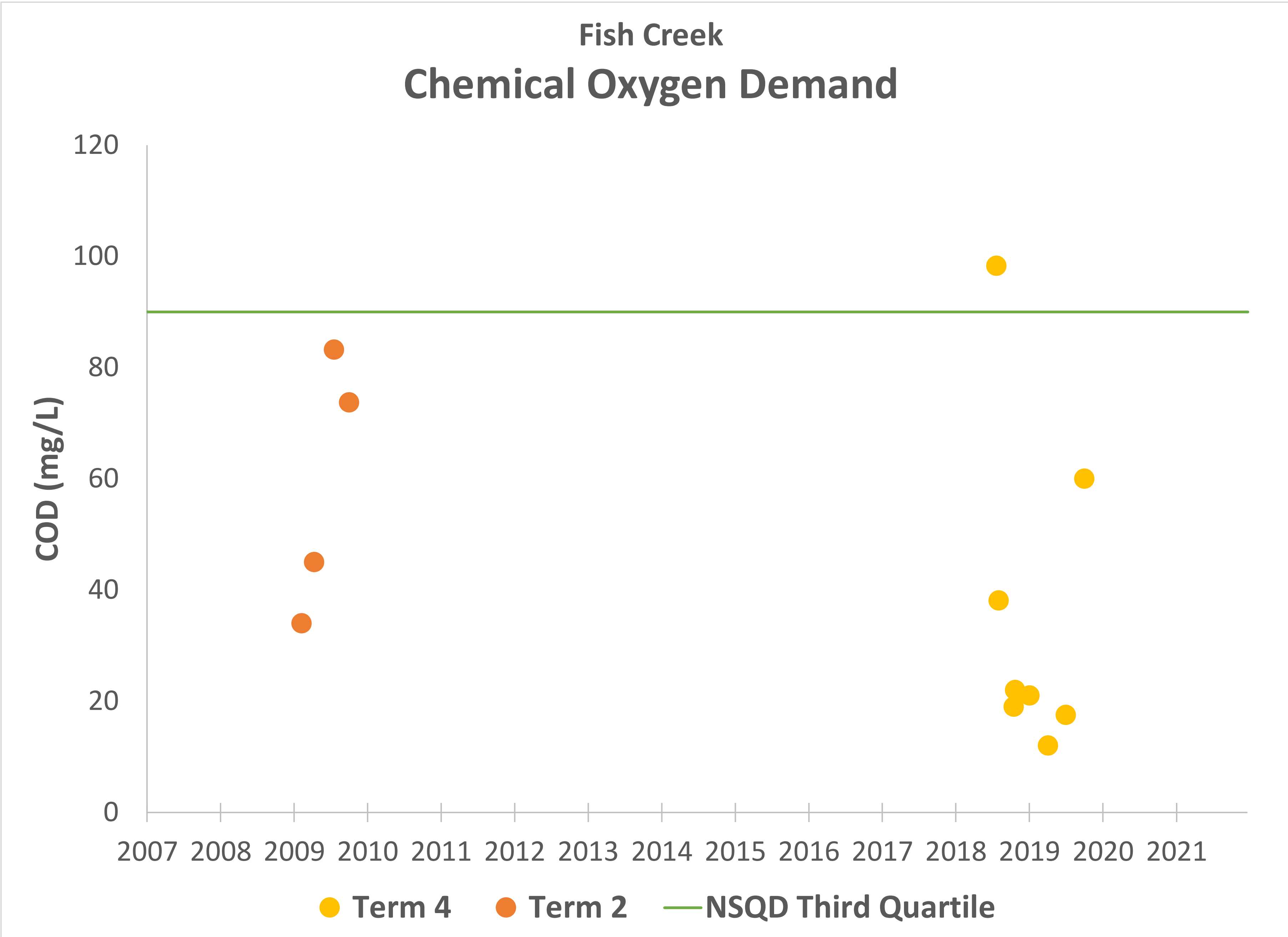
Appendix J

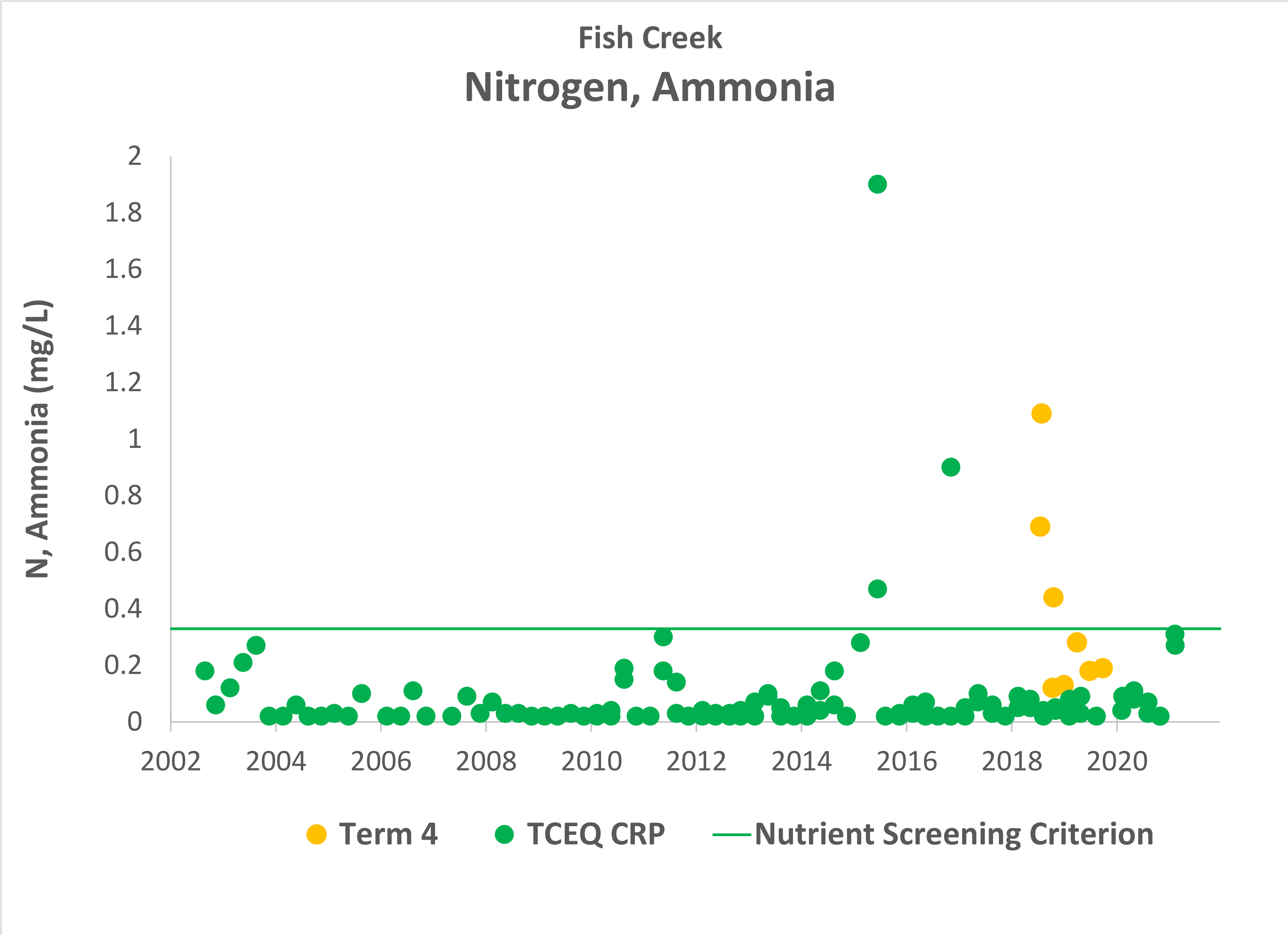
Fish Creek Water Quality Data Graphs


Fish Creek
Total Dissolved Solids
TDS (mg/L)
900
800
700
600
500
400
300
200
100
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 2
Basin Specific Criterion

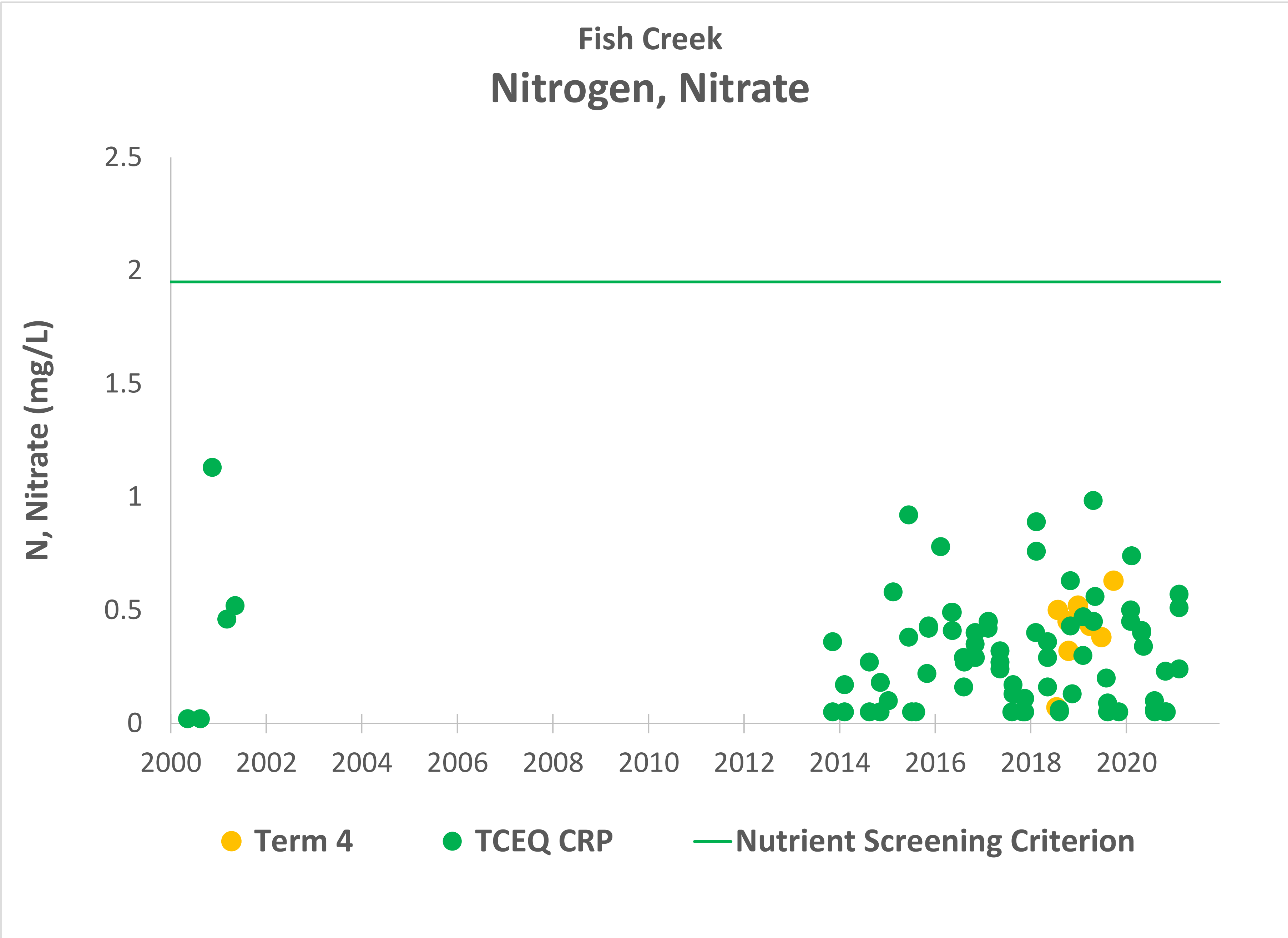

Fish Creek
Total Suspended Solids
TSS (mg/L)
0
100
200
300
400
500
600
700
800
900
1000
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 2
NSQD Third Quartile


Fish Creek
Biochemical Oxygen Demand
BOD (mg/L)
30
25
20
15
10
5
0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
TCEQ CRP
Term 4
Term 2
NSQD Third Quartile

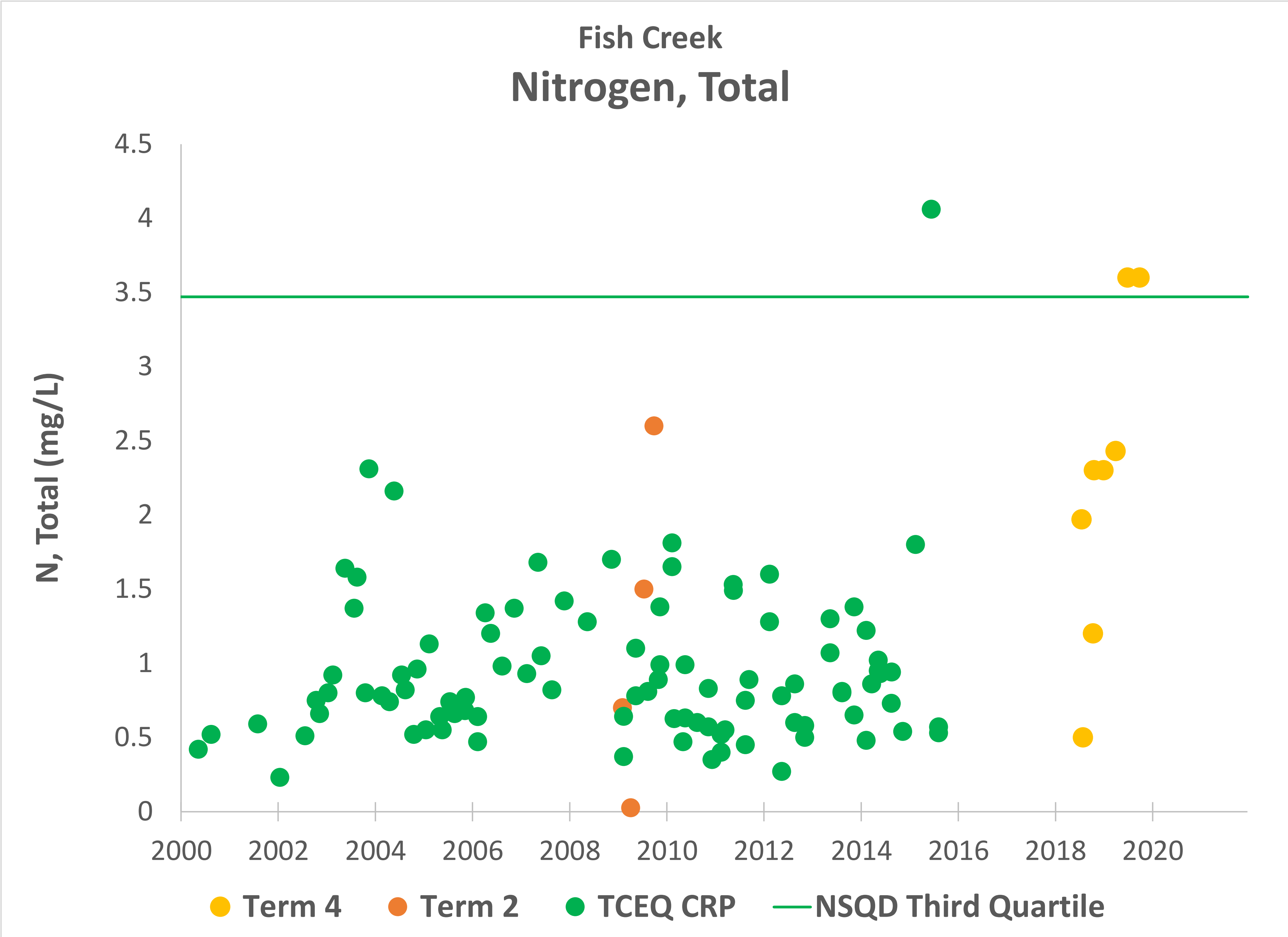

Fish Creek
Chemical Oxygen Demand
COD (mg/L)
0
20
40
60
80
100
120
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 2
NSQD Third Quartile



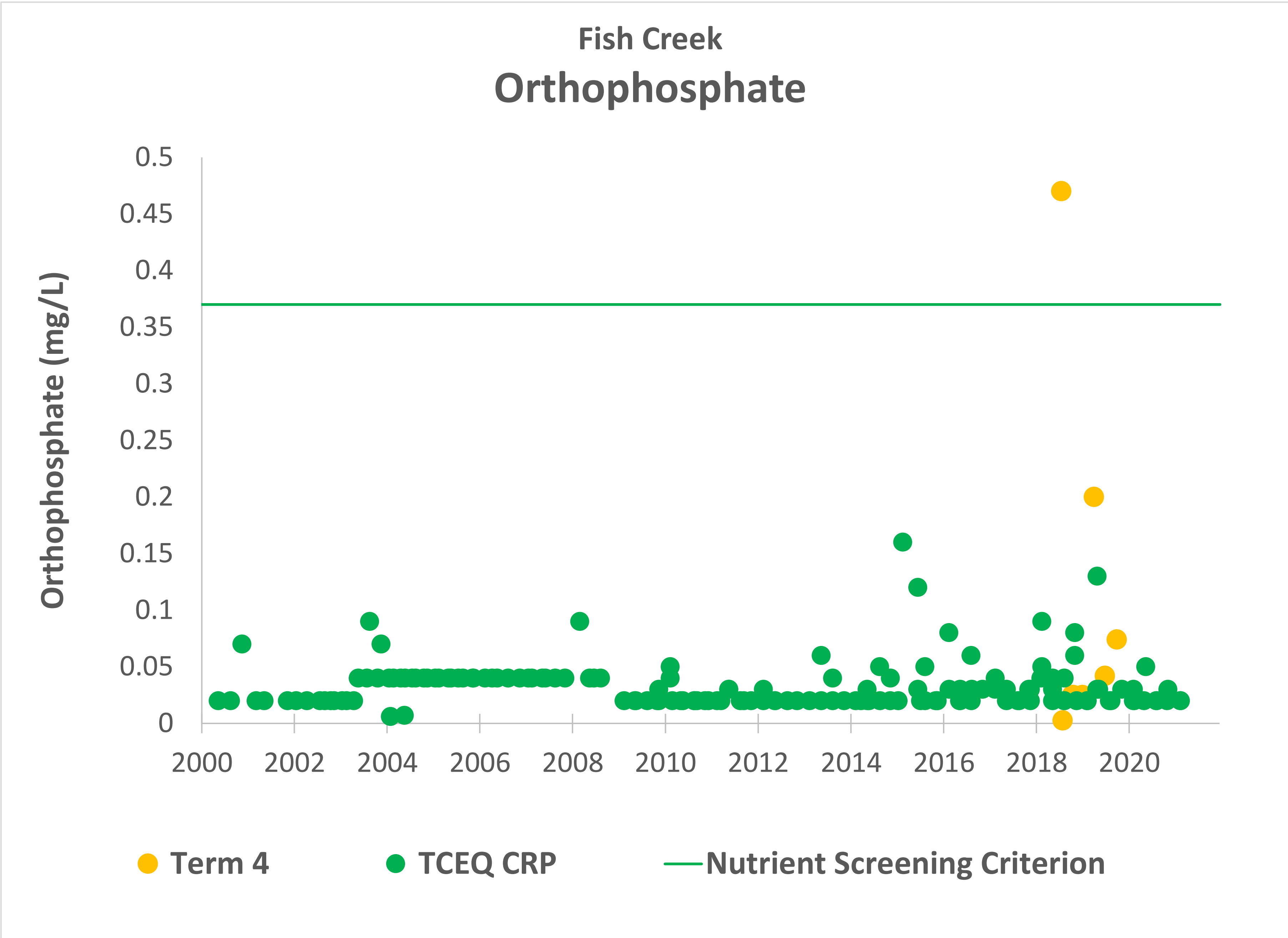
Fish Creek
Nitrogen, Ammonia
N, Ammonia (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion

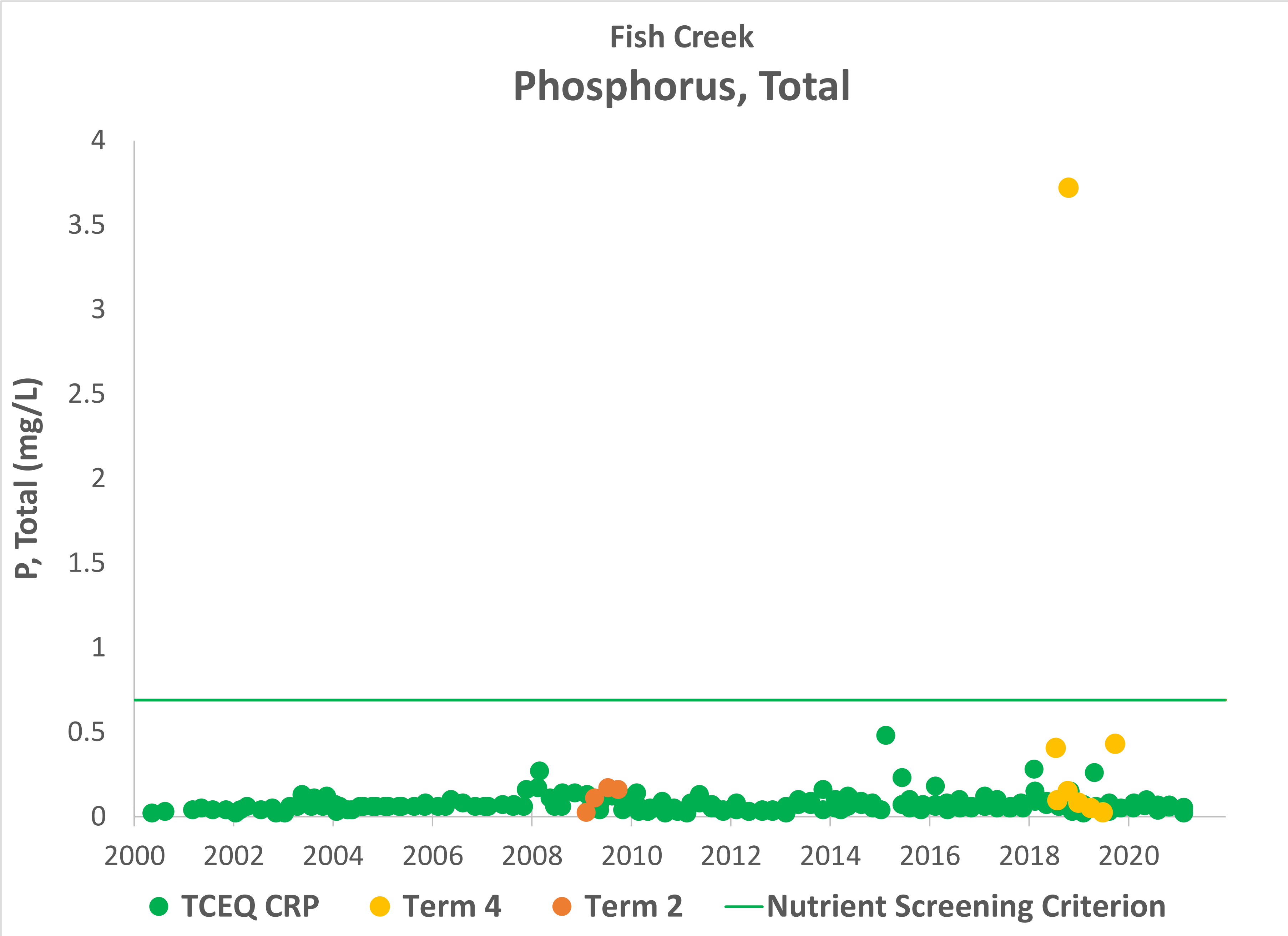


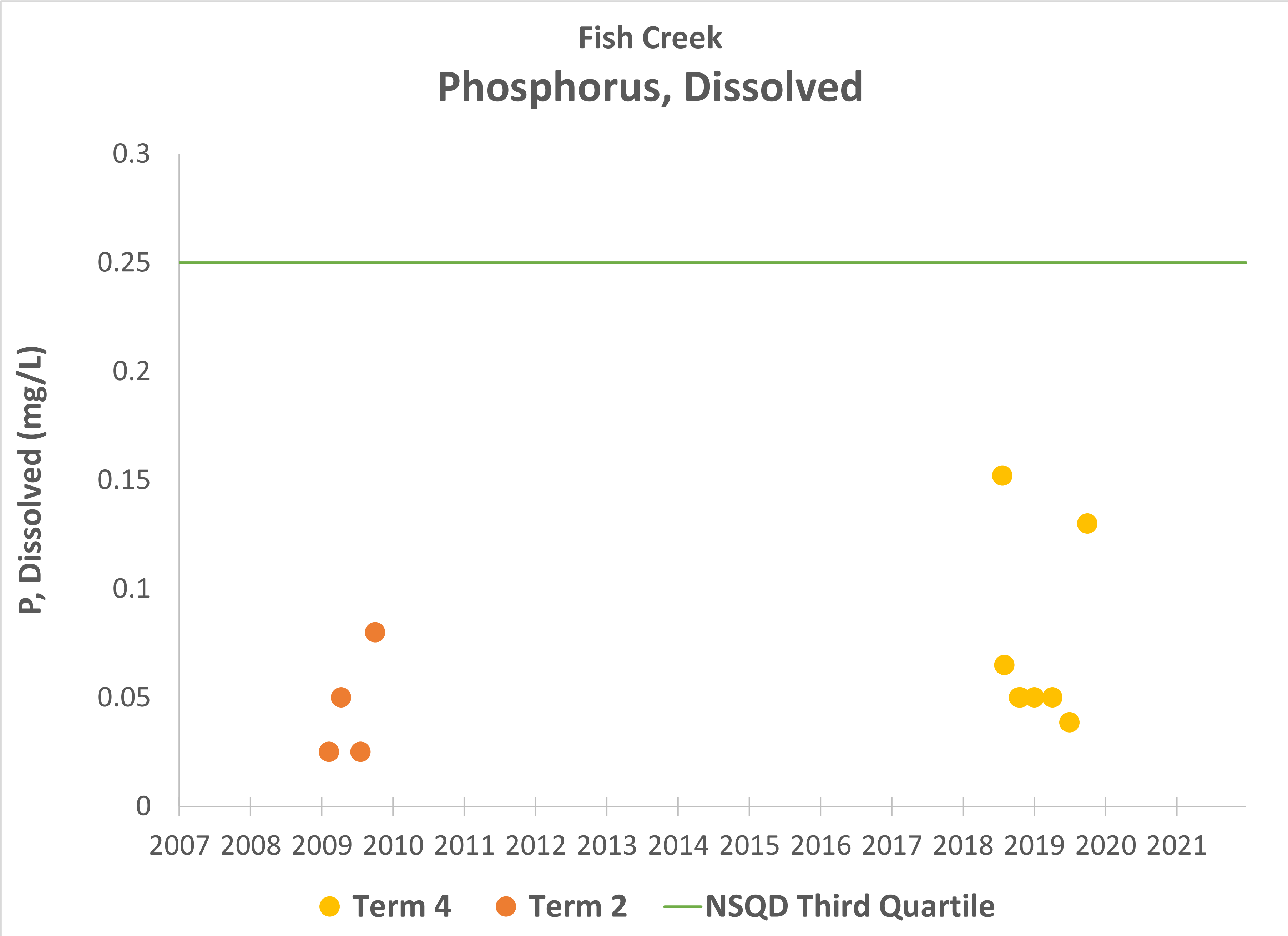
Fish Creek
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion



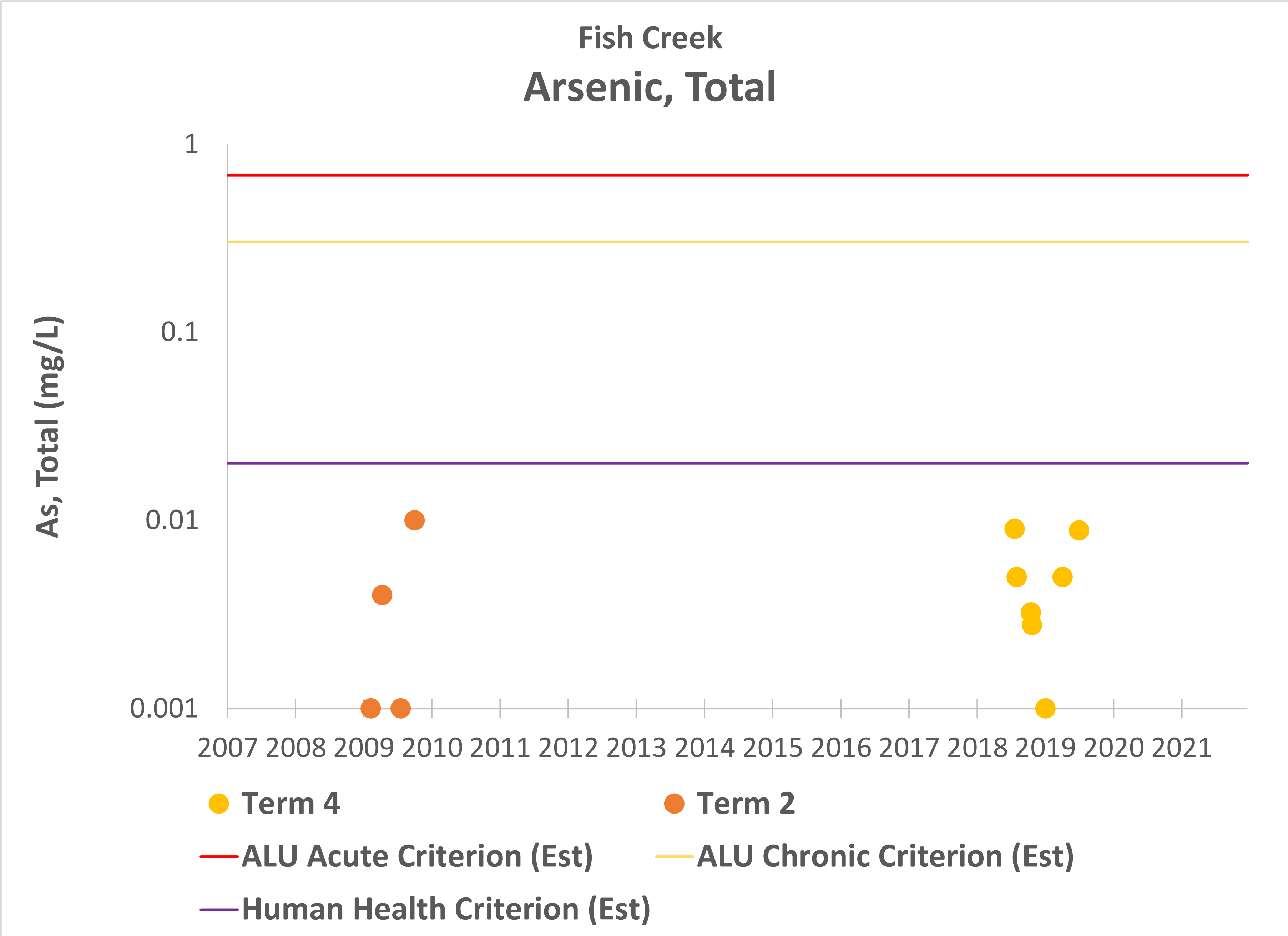
Fish Creek
Nitrogen, Total
N, Total (mg/L)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 2
TCEQ CRP
NSQD Third Quartile


Fish Creek
Orthophosphate
Orthophosphate (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion

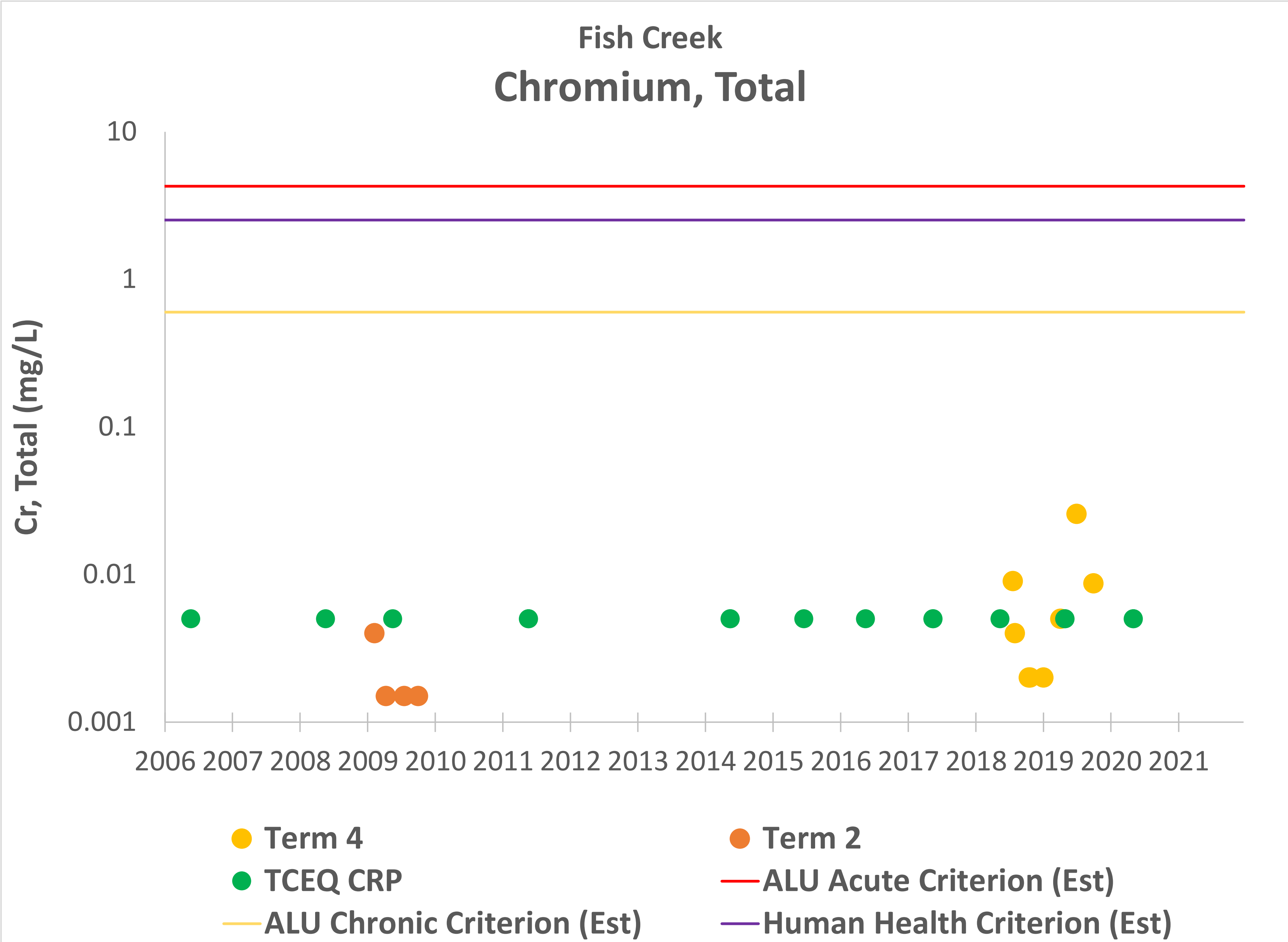

Fish Creek
Phosphorus, Total
P, Total (mg/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
TCEQ CRP
Term 4
Term 2
Nutrient Screening Criterion



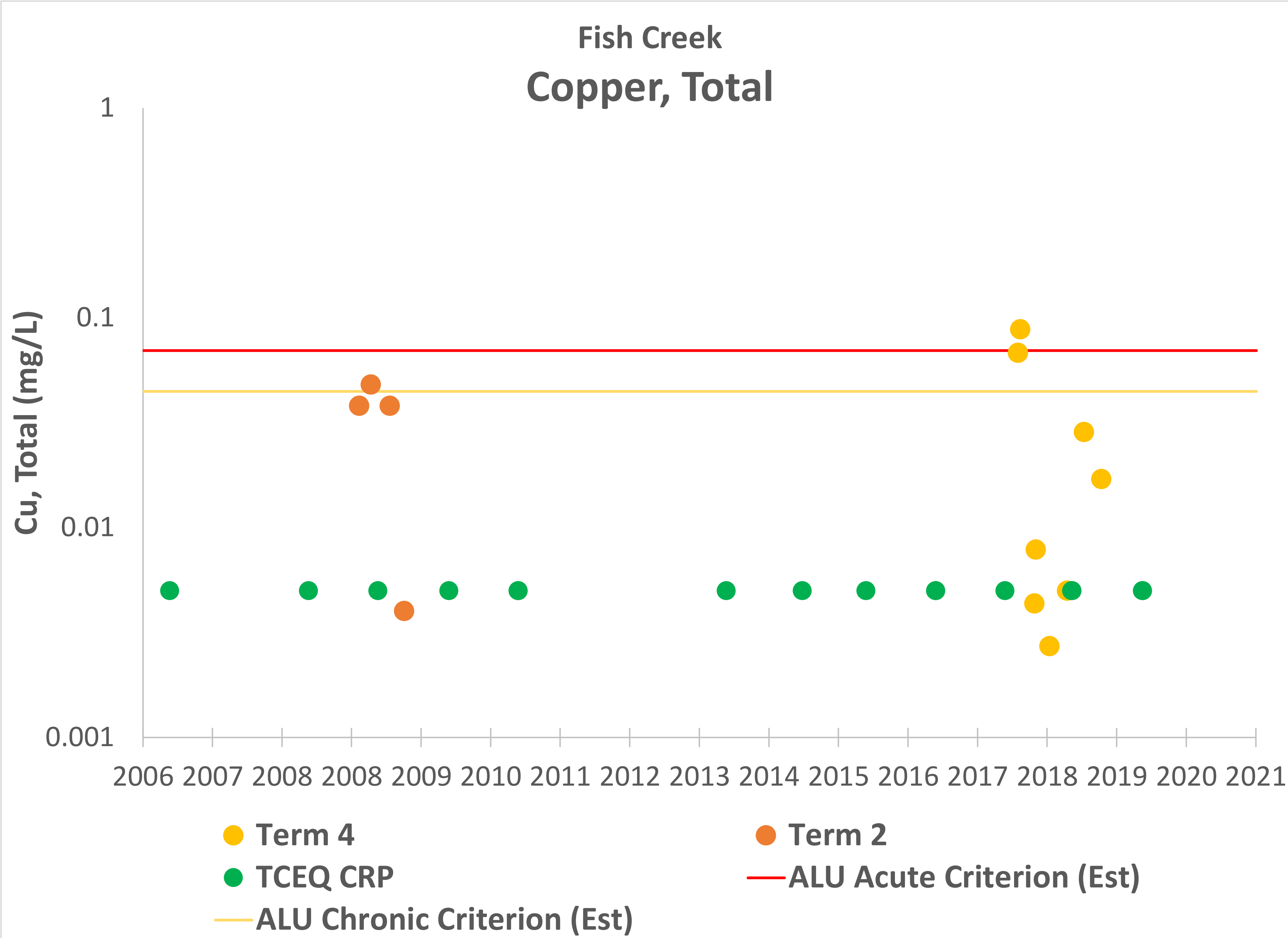
Fish Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 2
NSQD Third Quartile



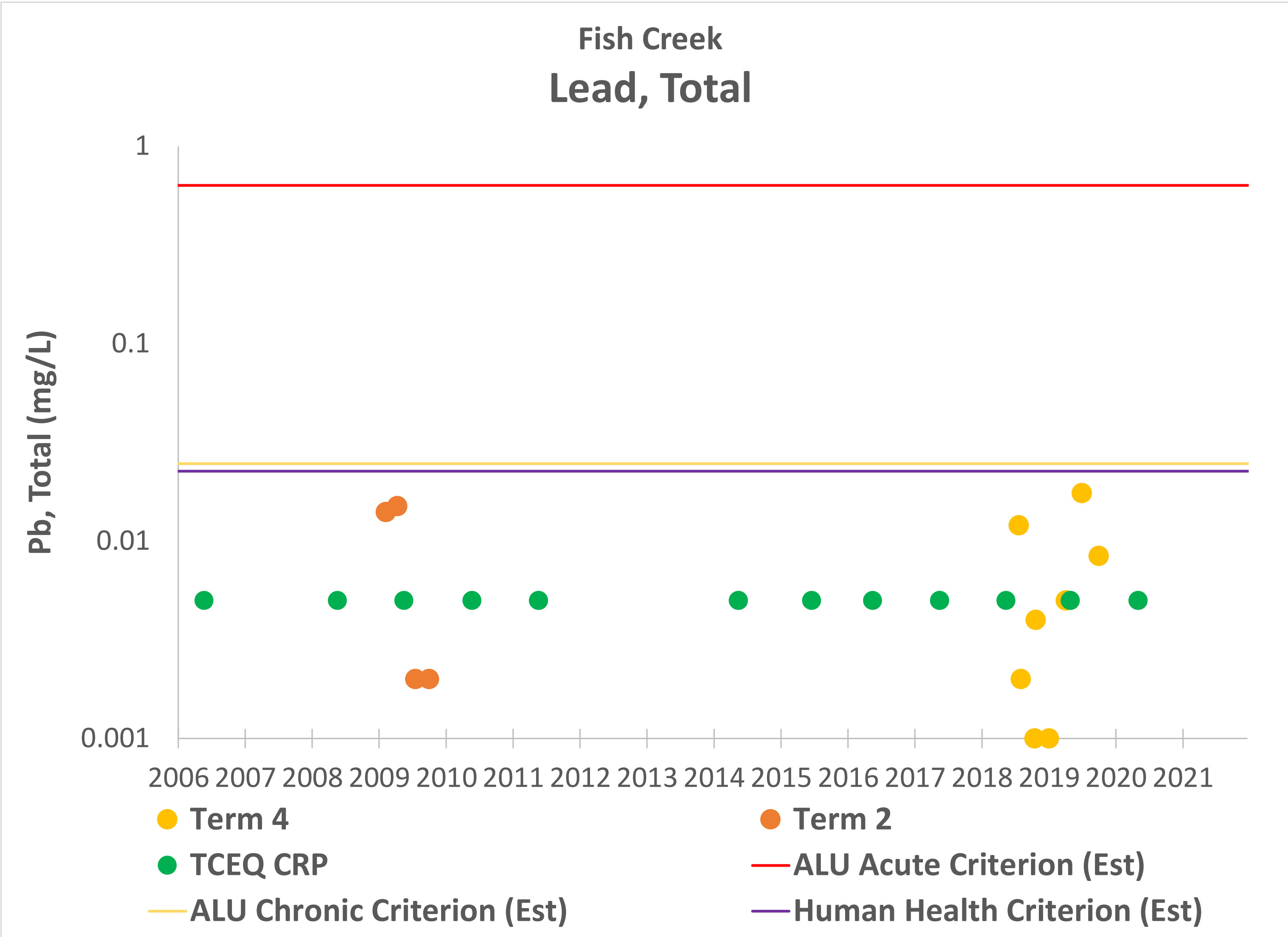
Fish Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



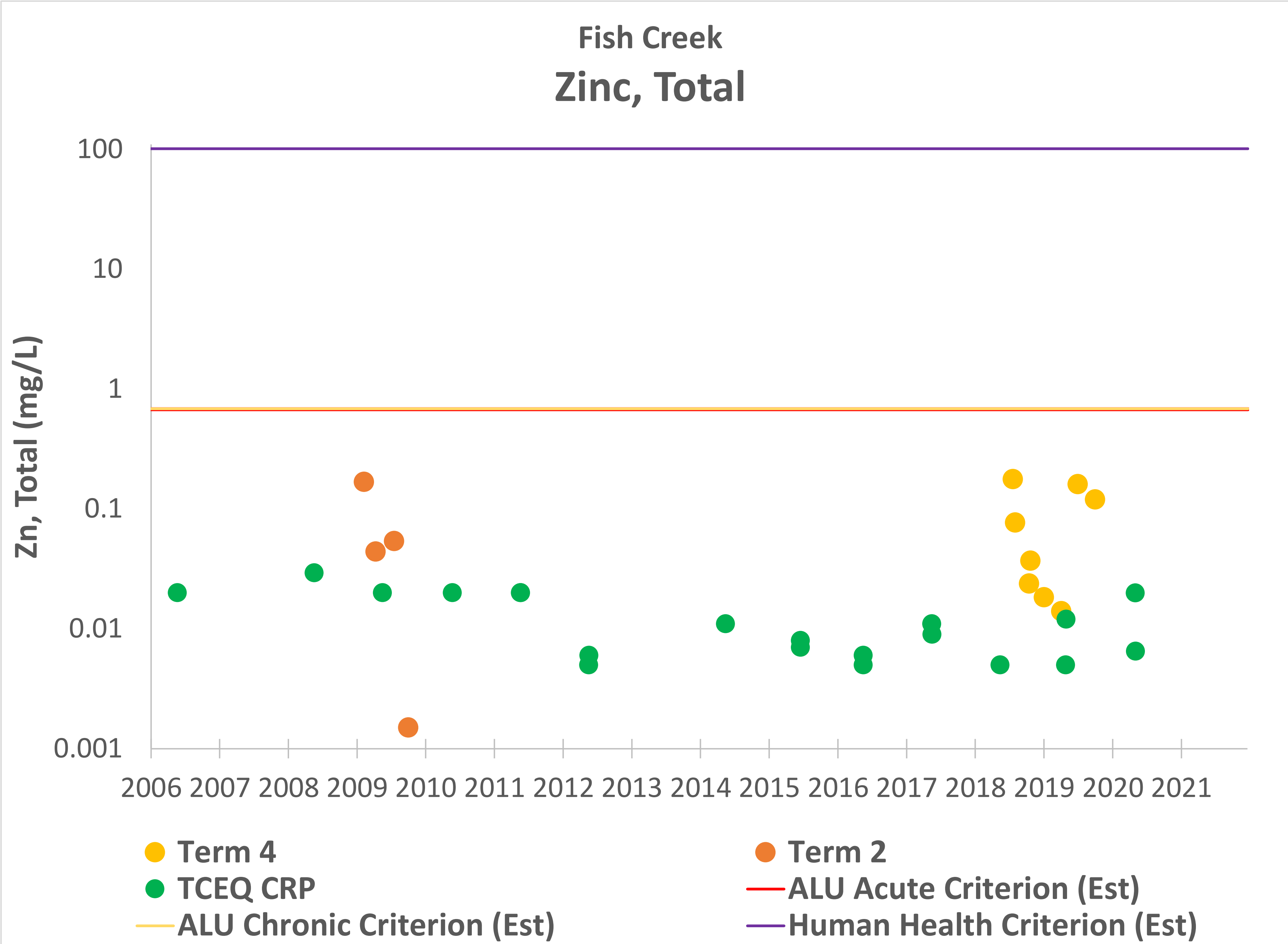
Fish Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



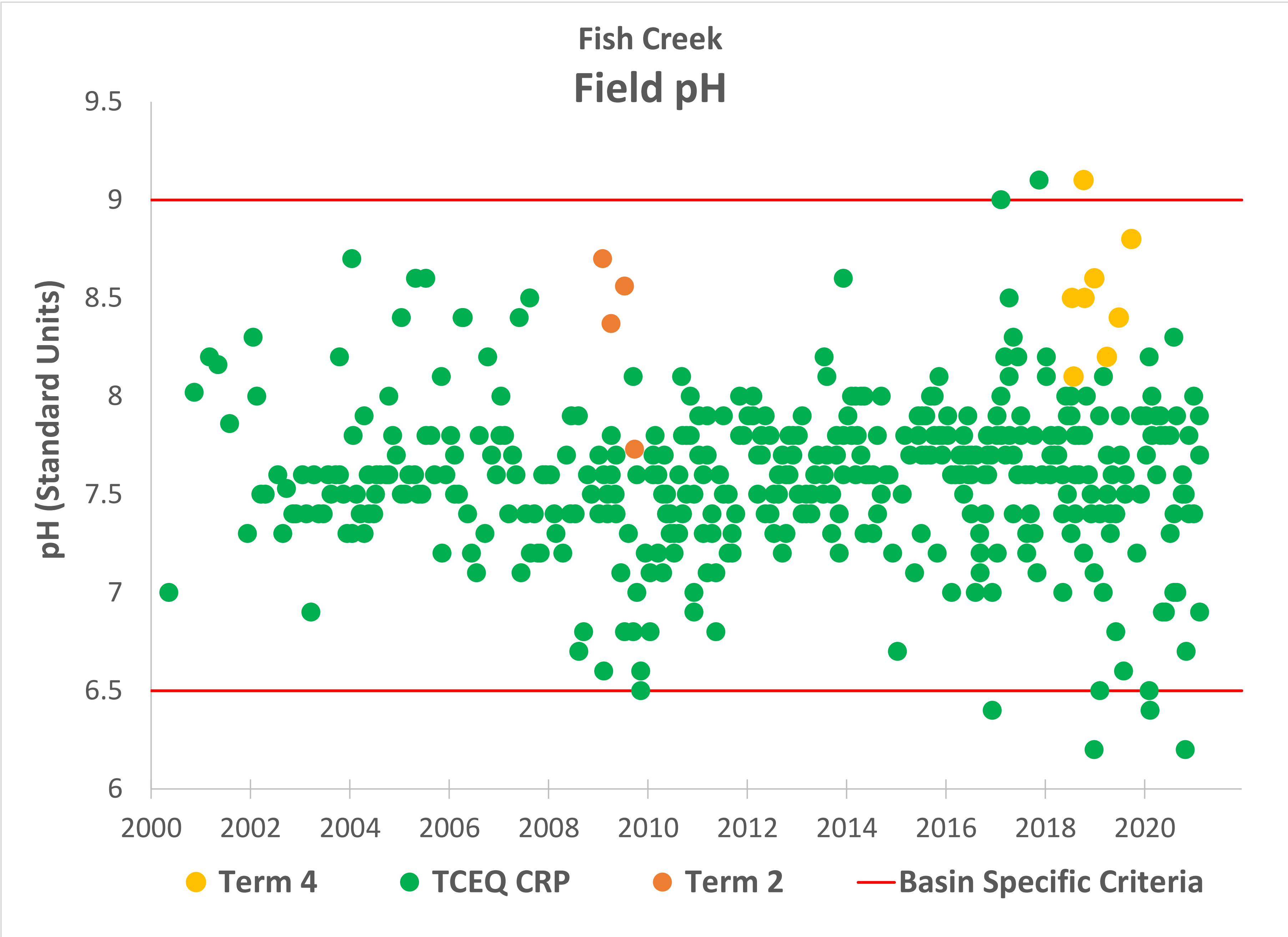
Fish Creek
Copper, Total
Cu, Total (mg/L)
1
0.1
0.01
0.001
2006 2007 2008 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)



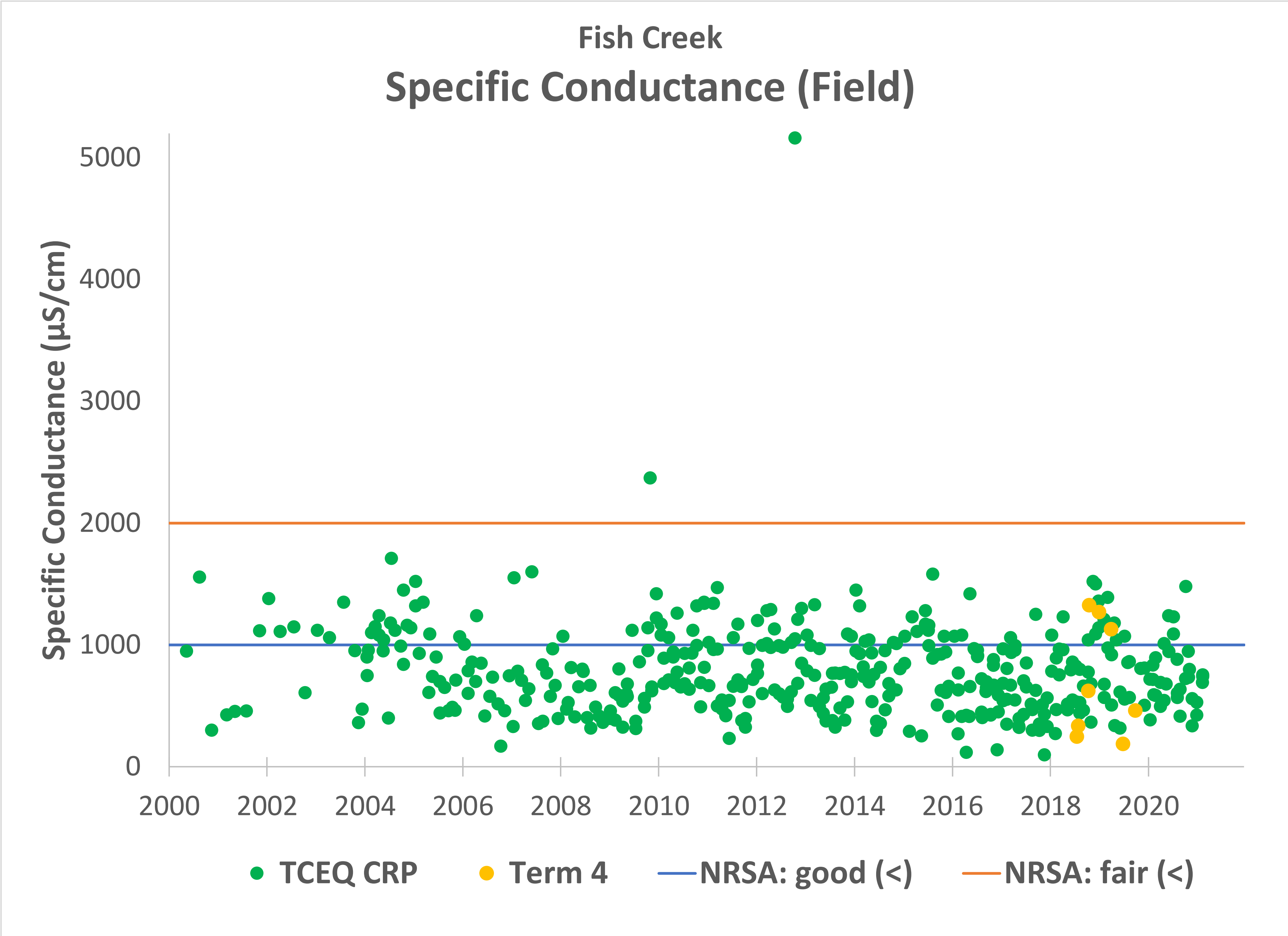
Fish Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



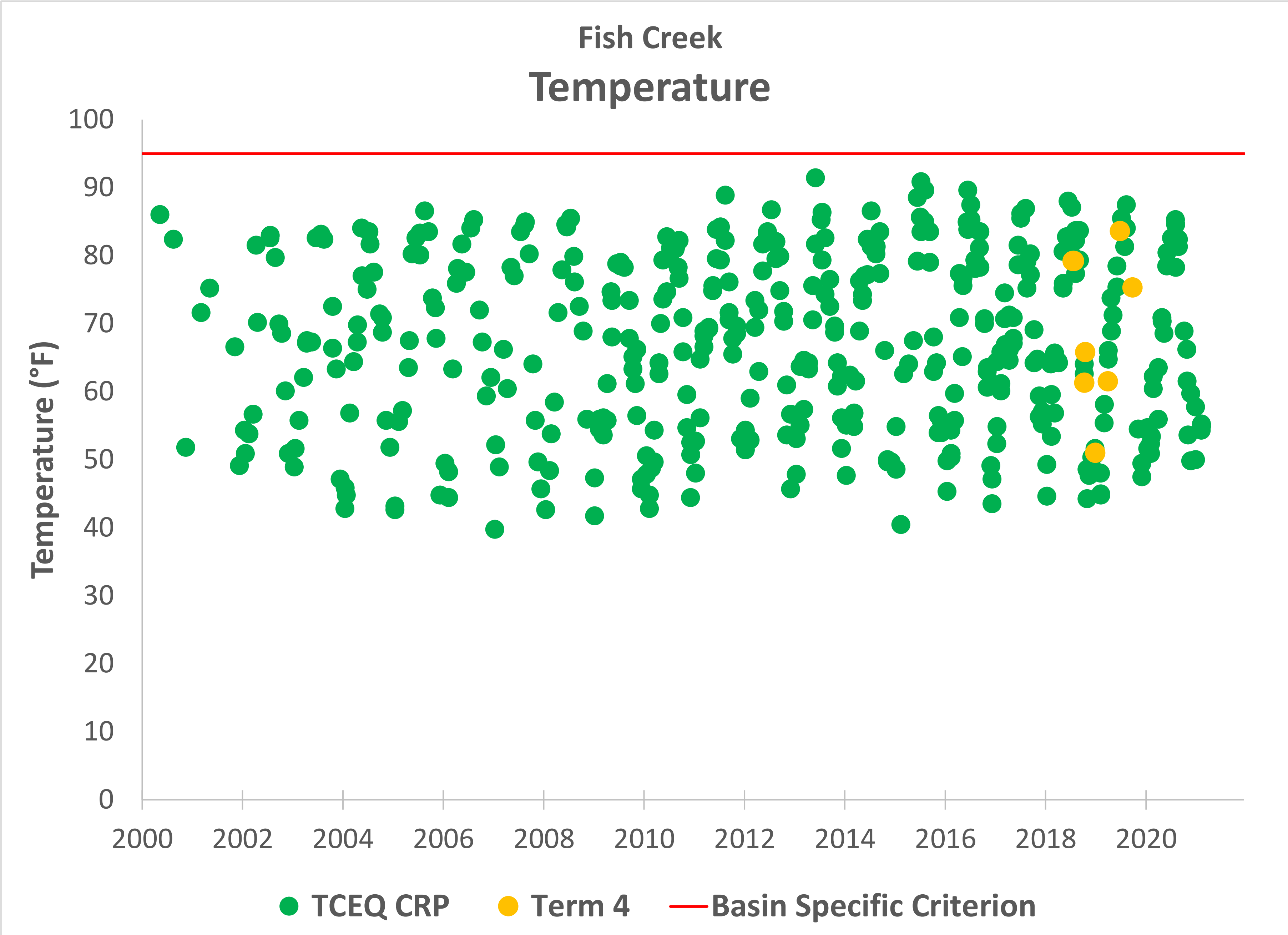
Fish Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

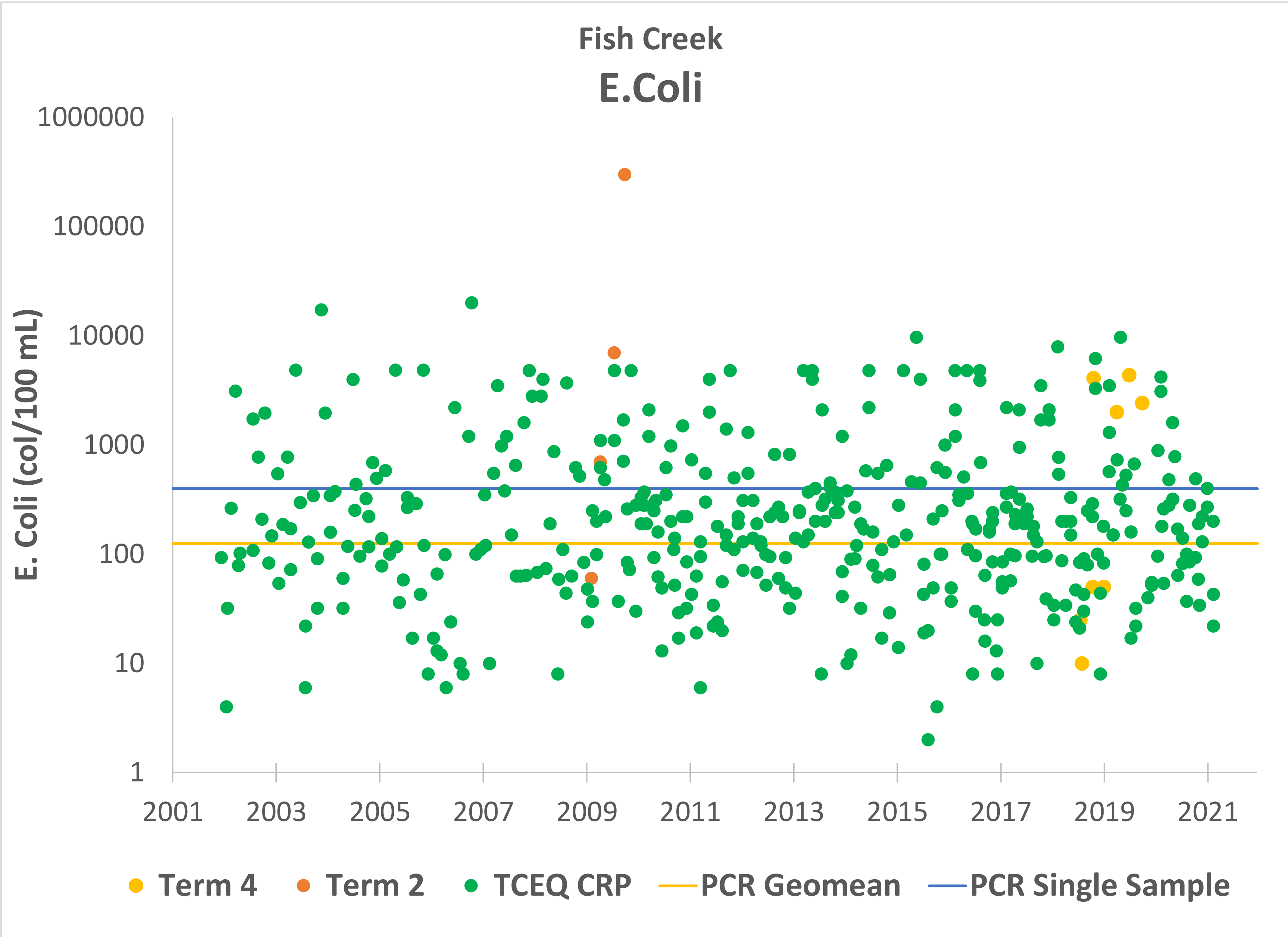


Fish Creek
Field pH
pH (Standard Units)
9.5
9
8.5
8
7.5
7
6.5
6
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Term 2
Basin Specific Criteria

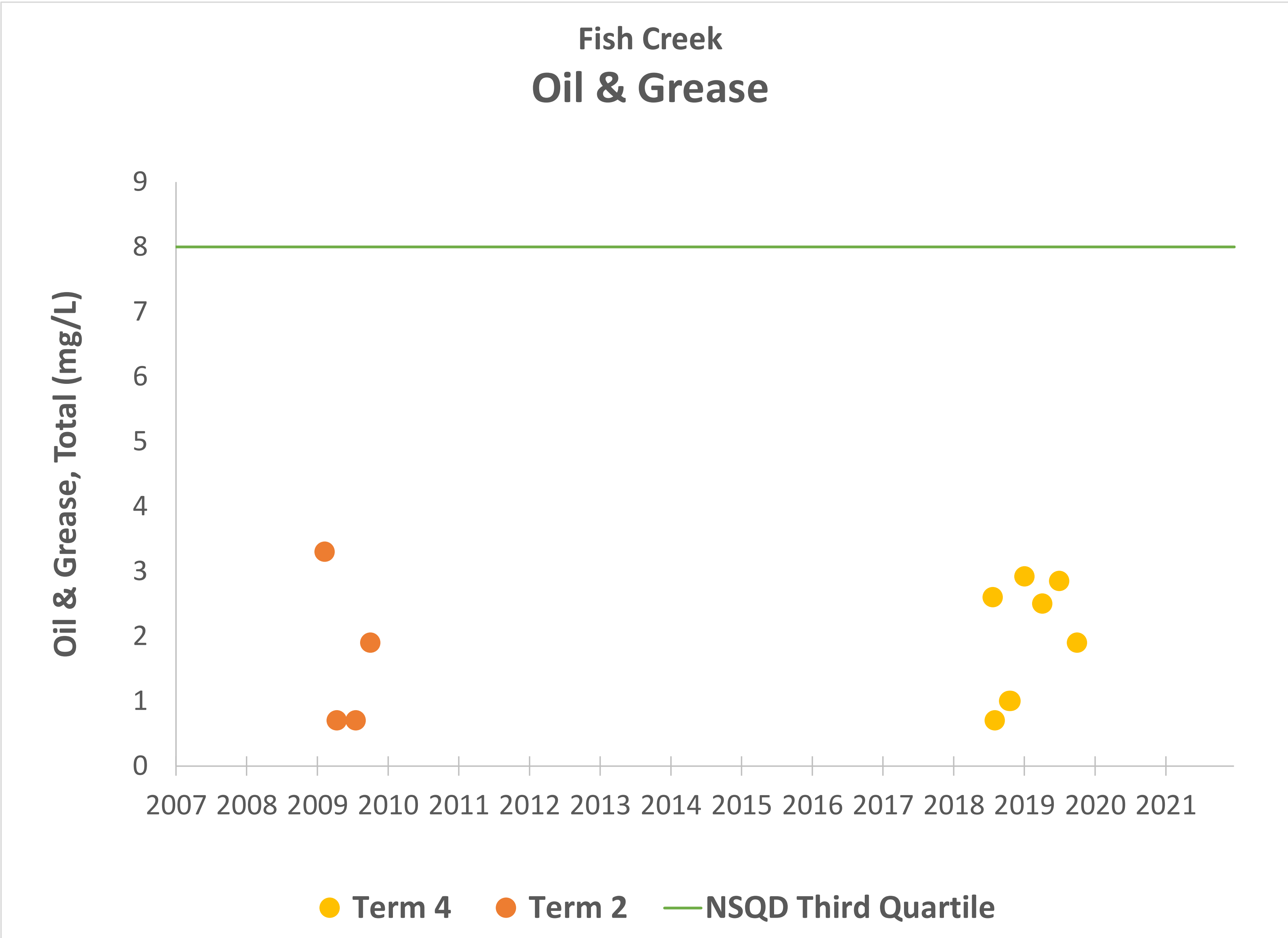


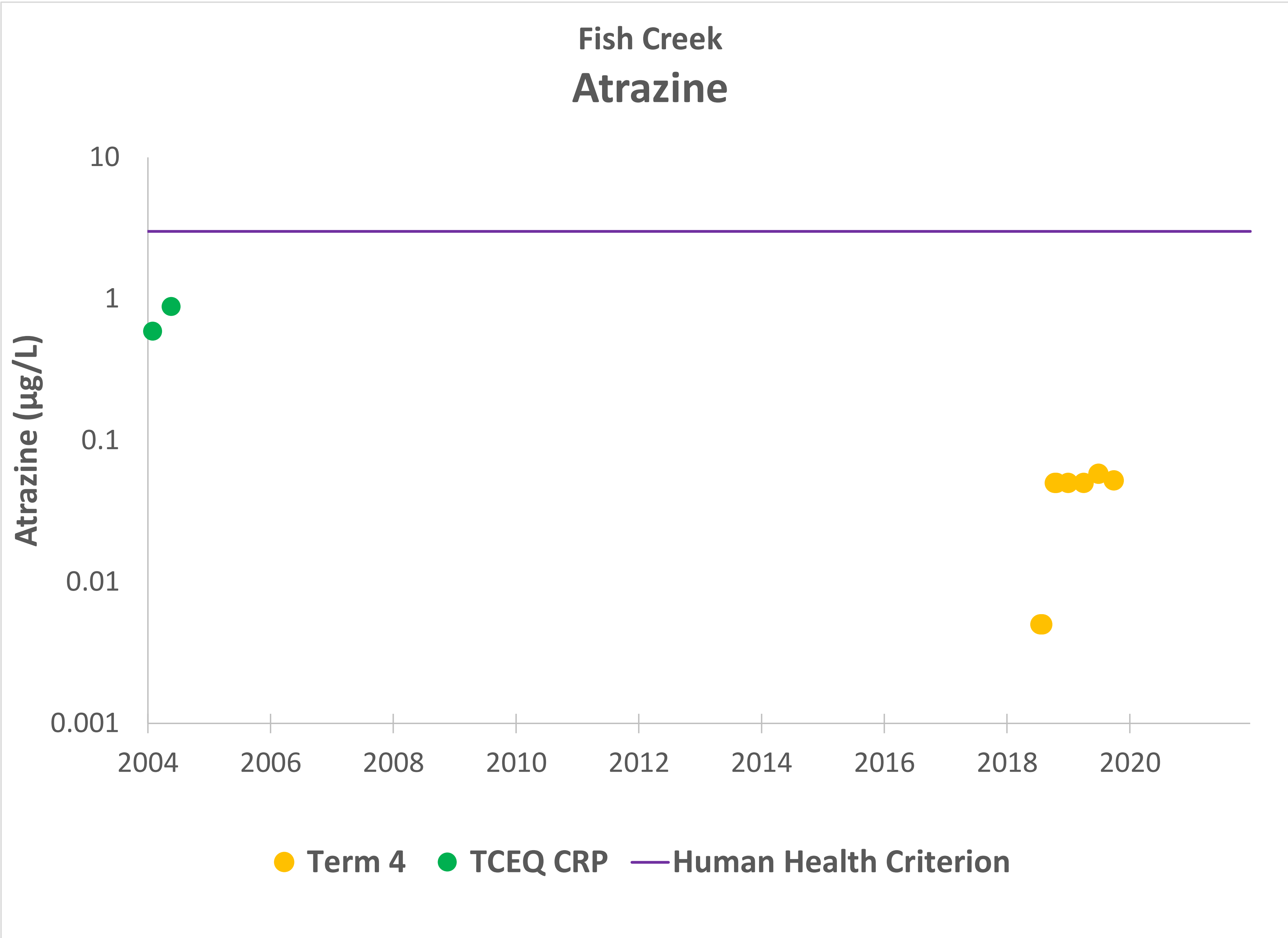
Fish Creek
Specific Conductance (Field)
Specific Conductance (µS/cm)
5000
4000
3000
2000
1000
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
TCEQ CRP
Term 4
NRSA: good (<)
NRSA: fair (<)


Fish Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
TCEQ CRP
Term 4
Basin Specific Criterion



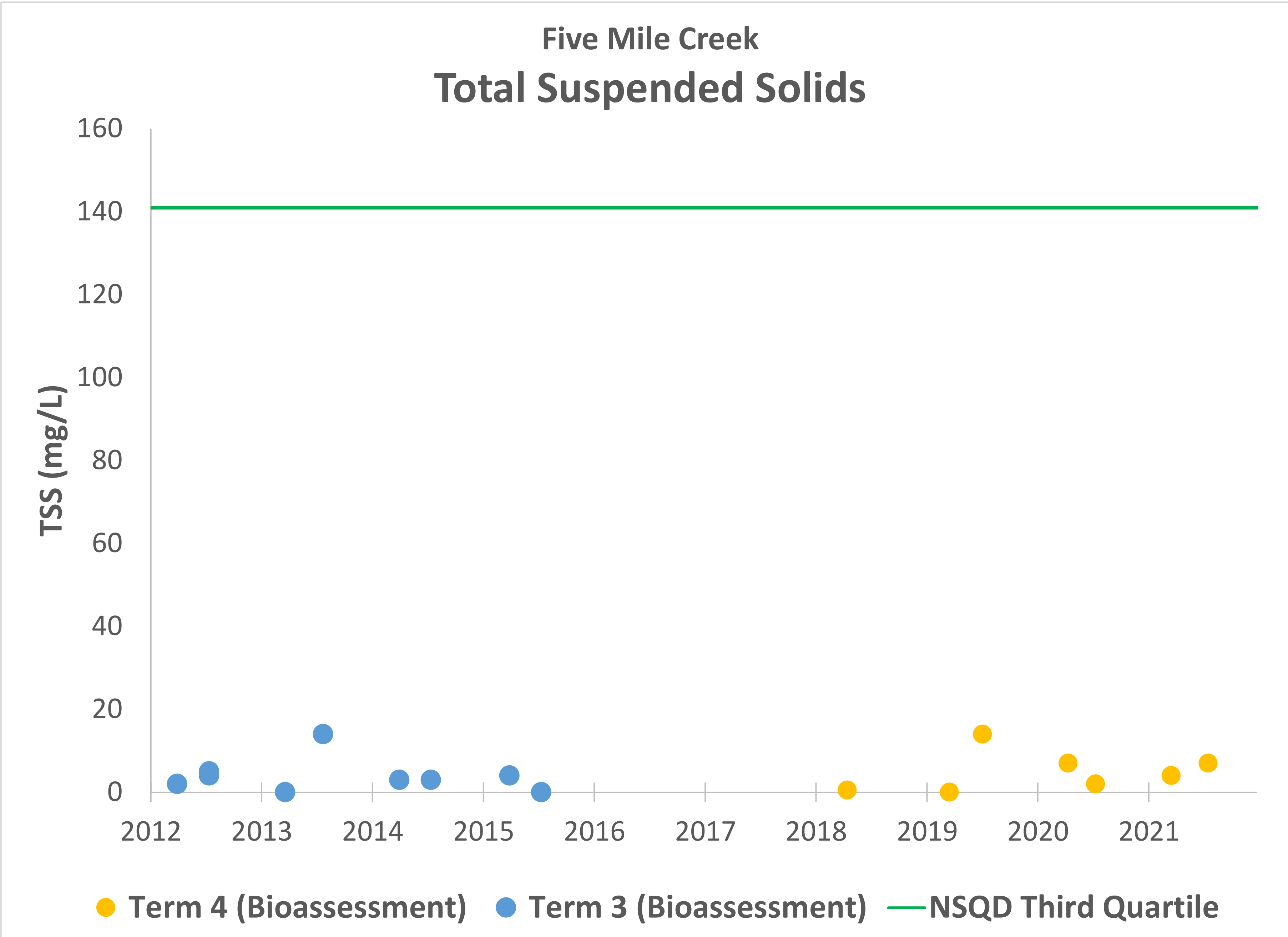
Fish Creek
E.Coli
E. Coli (col/100 mL)
1000000
100000
10000
1000
100
10
1
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 2
TCEQ CRP
PCR Geomean
PCR Single Sample

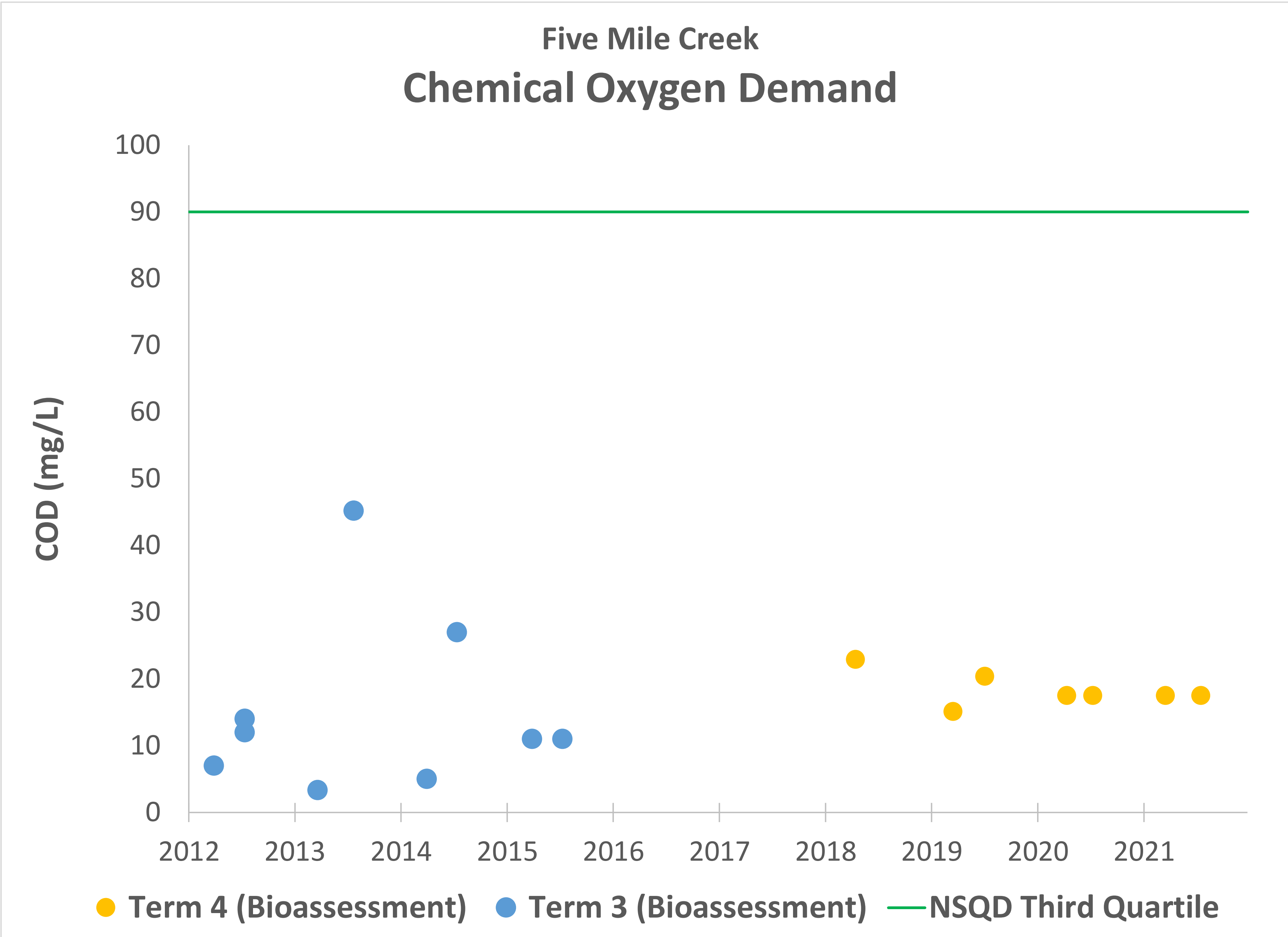

Fish Creek
Oil & Grease
Oil & Grease, Total (mg/L)
0
1
2
3
4
5
6
7
8
9
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 2
NSQD Third Quartile


Fish Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
0.001
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Human Health Criterion

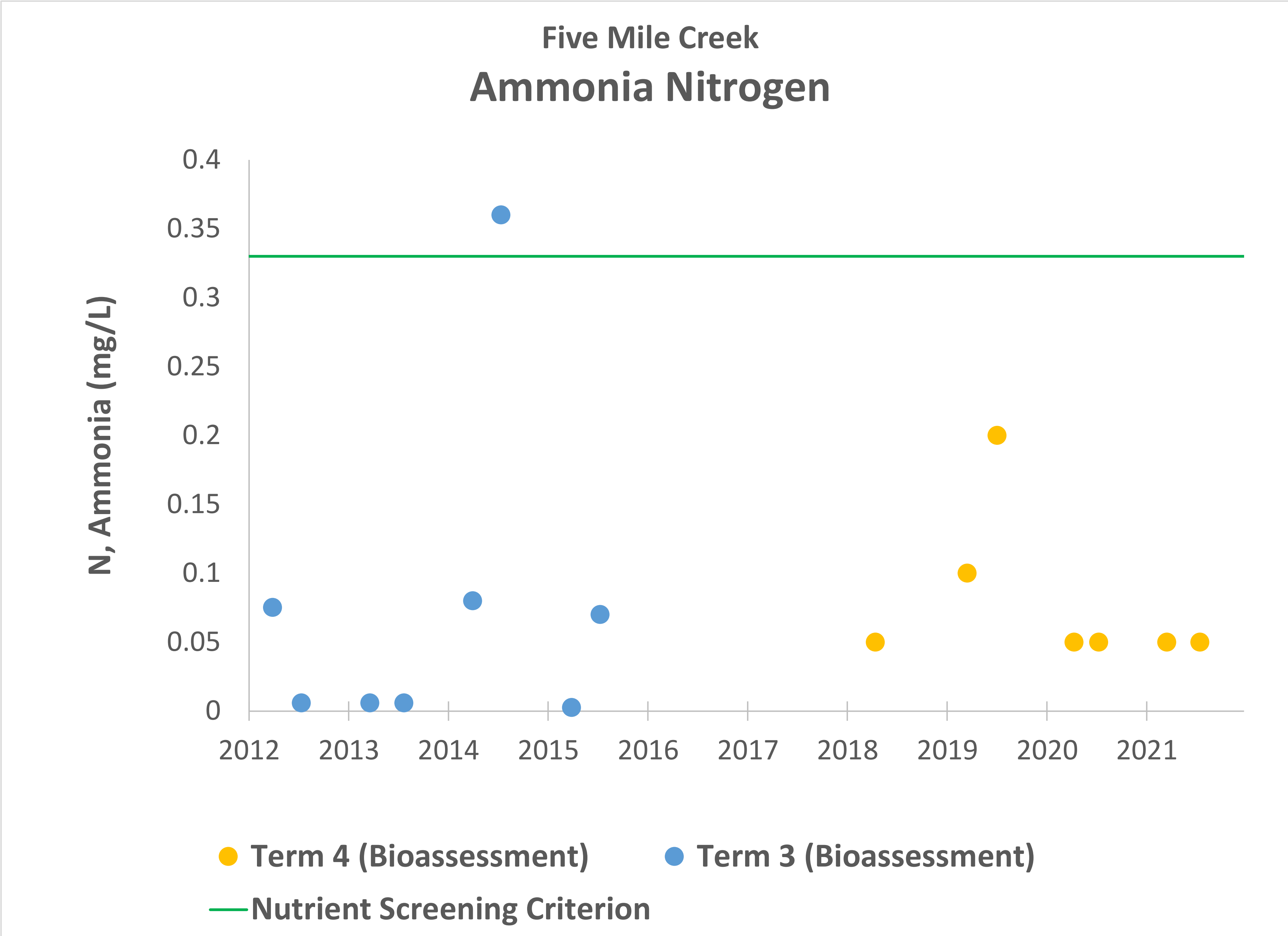
Appendix K

Five Mile Creek Water Quality Data Graphs

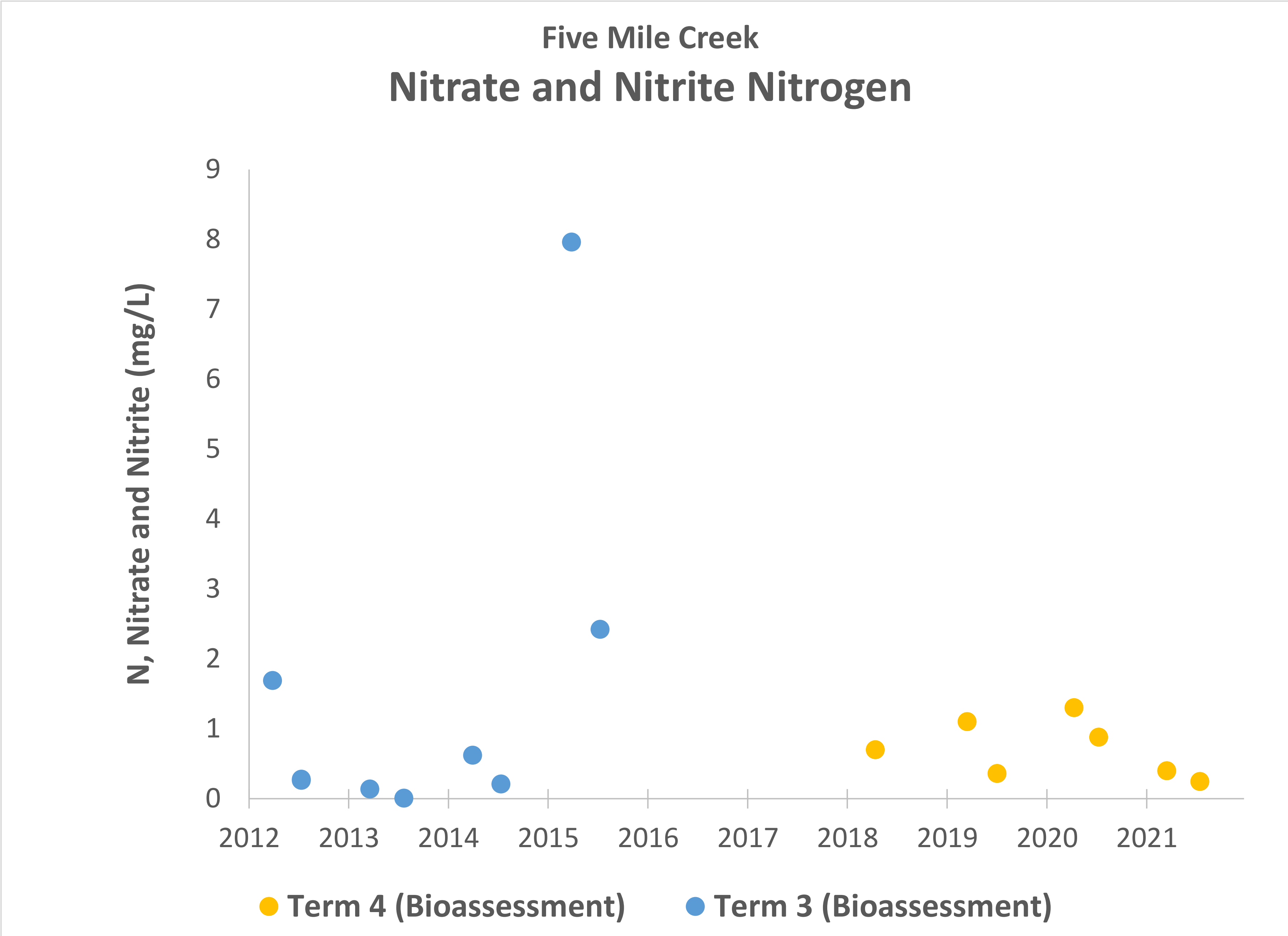

Five Mile Creek
Total Suspended Solids
TSS (mg/L)
160
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
NSQD Third Quartile



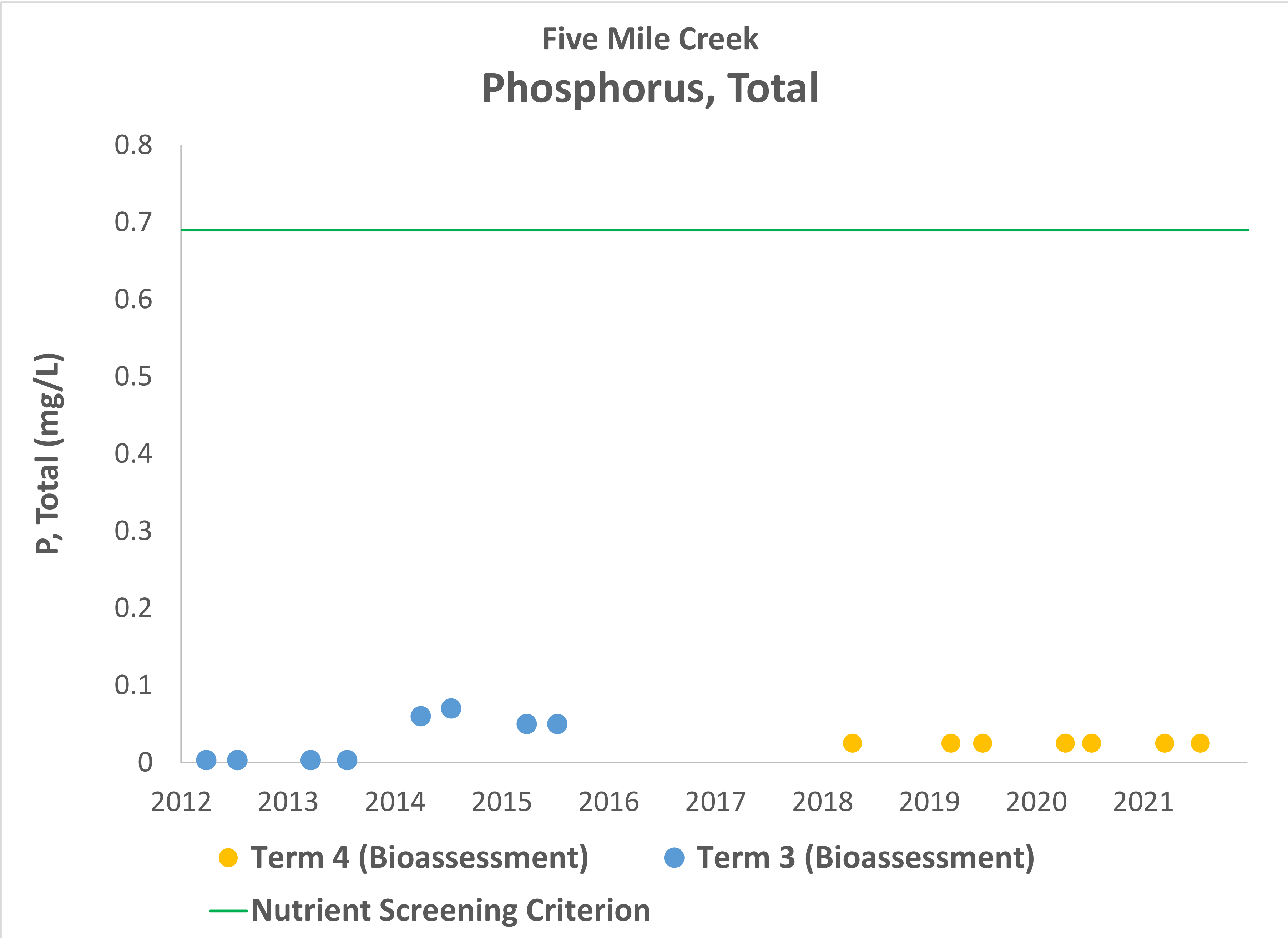
Five Mile Creek
Chemical Oxygen Demand
COD (mg/L)
100
90
80
70
60
50
40
30
20
10
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
NSQD Third Quartile

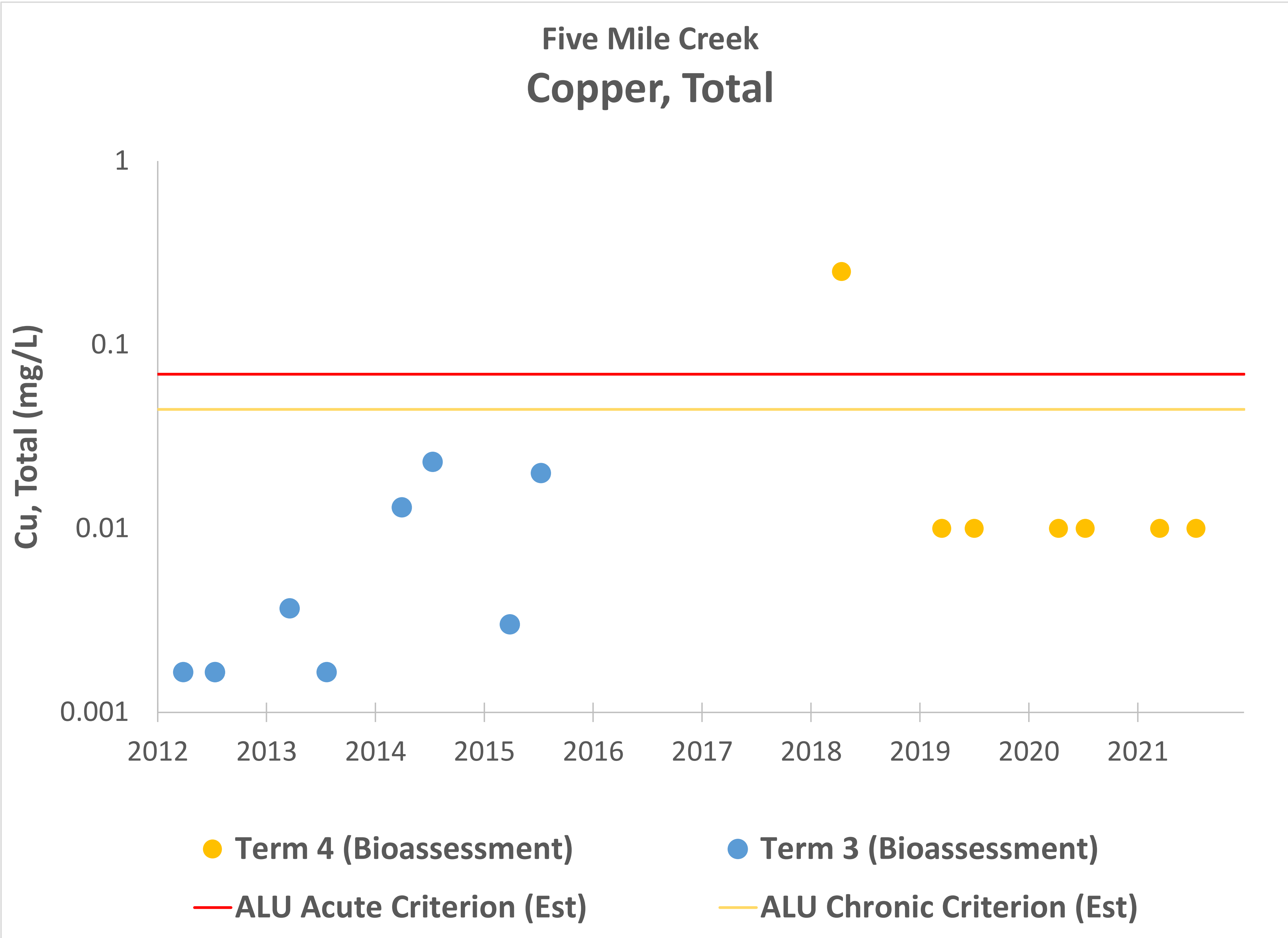


Five Mile Creek
Ammonia Nitrogen
N, Ammonia (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion

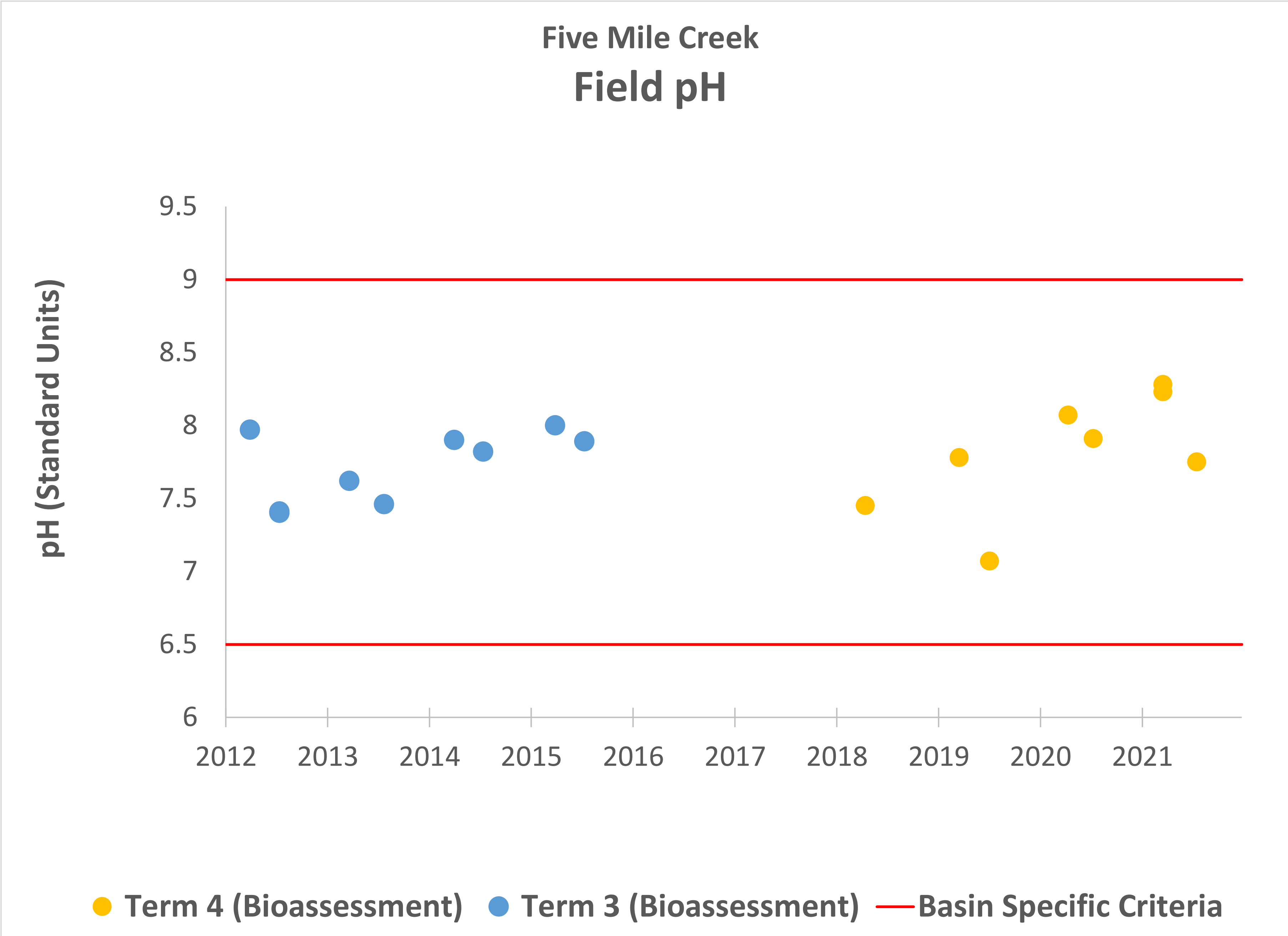


Five Mile Creek
Nitrate and Nitrite Nitrogen
N, Nitrate and Nitrite (mg/L)
9
8
7
6
5
4
3
2
1
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)

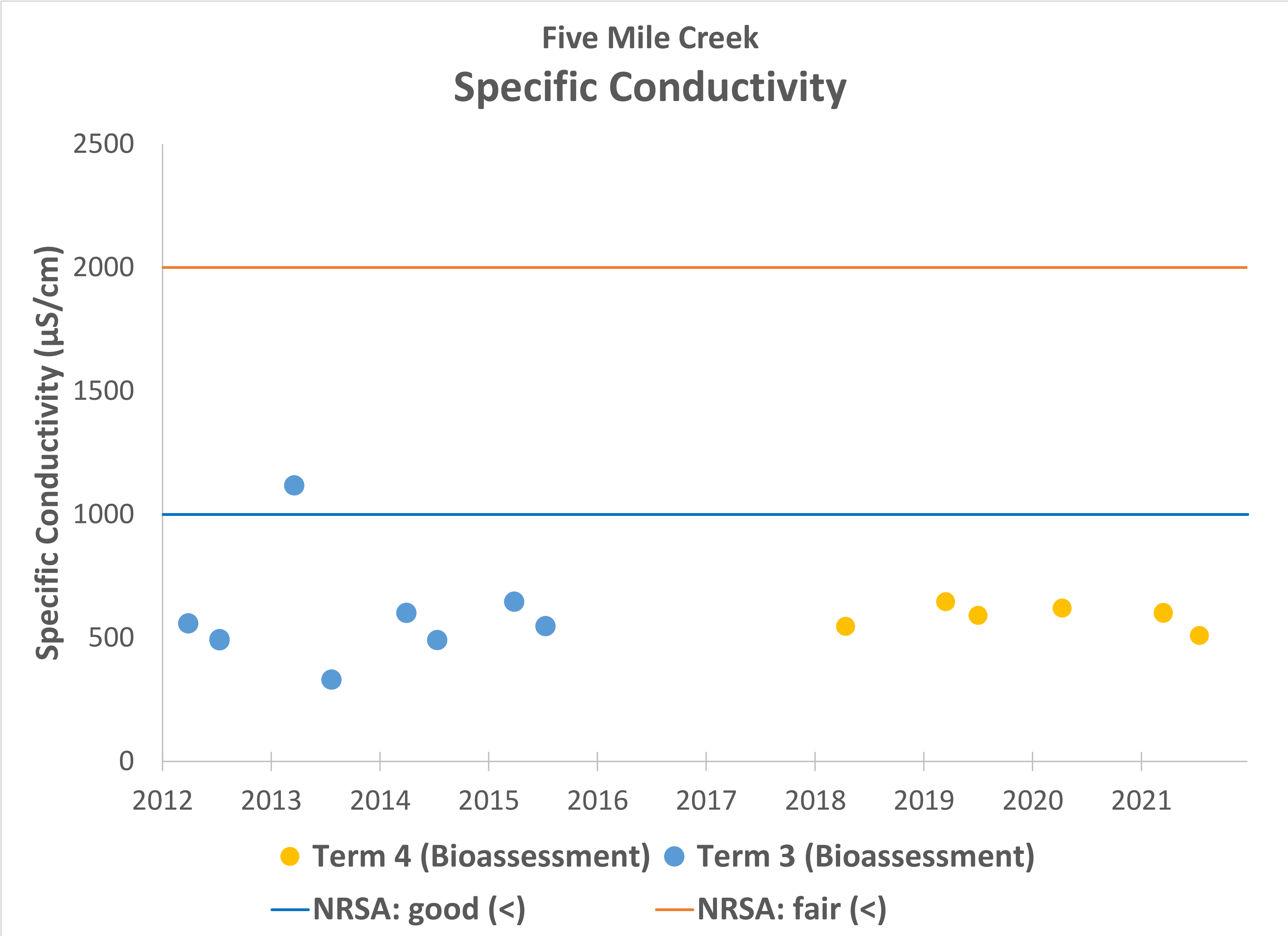

Five Mile Creek
Phosphorus, Total
P, Total (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion



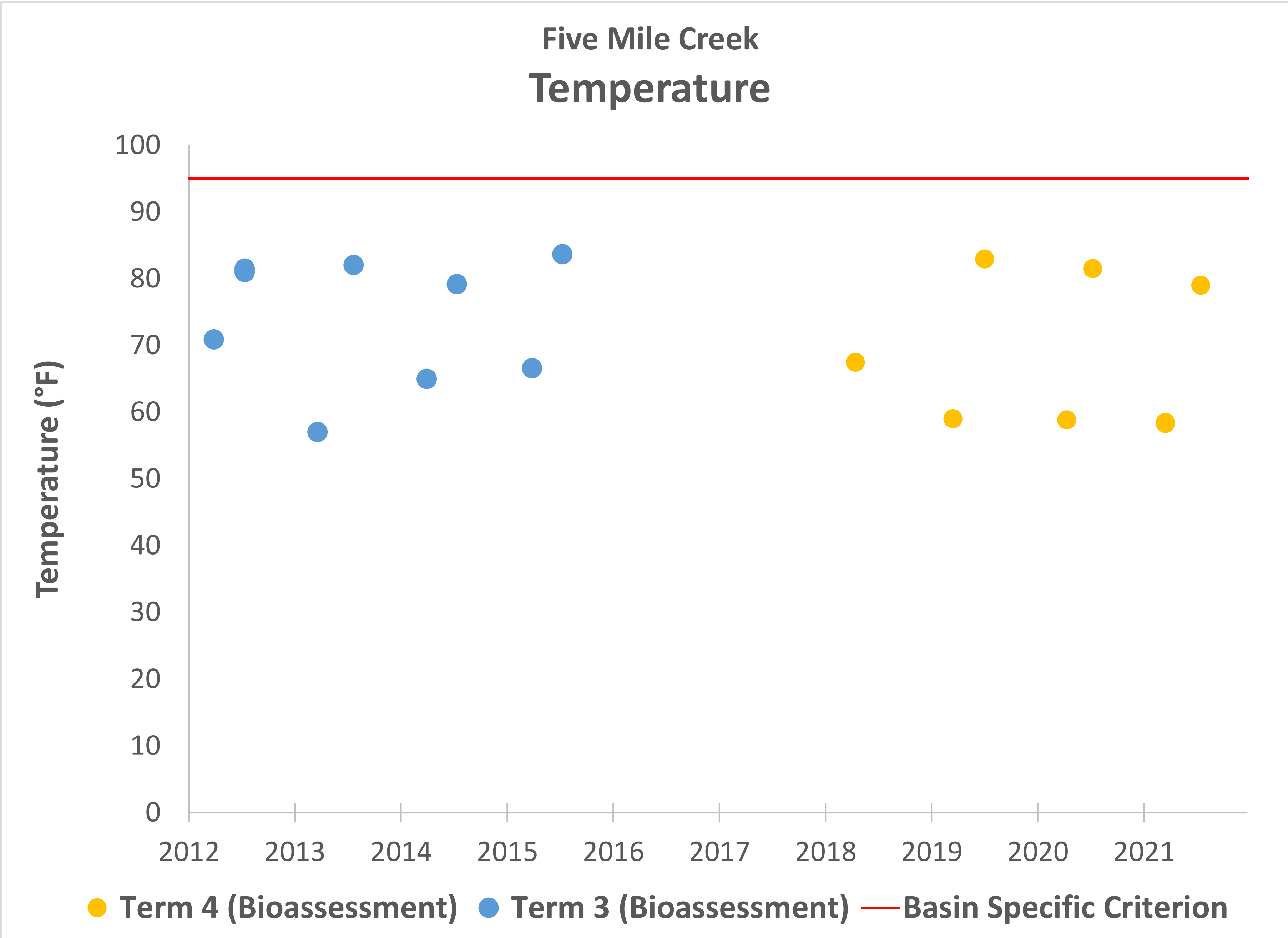
Five Mile Creek
Copper, Total
Cu, Total (mg/L)
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)

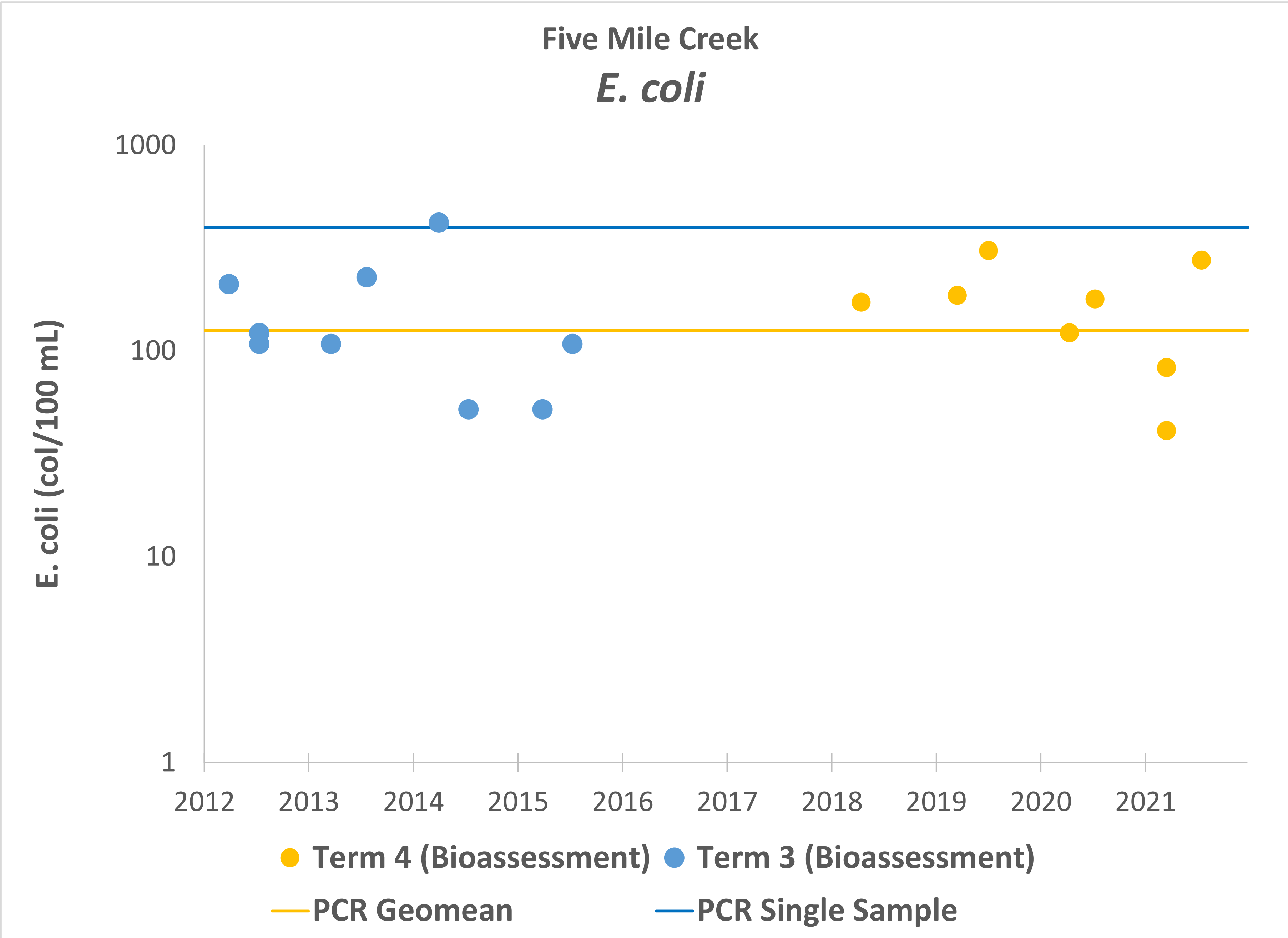


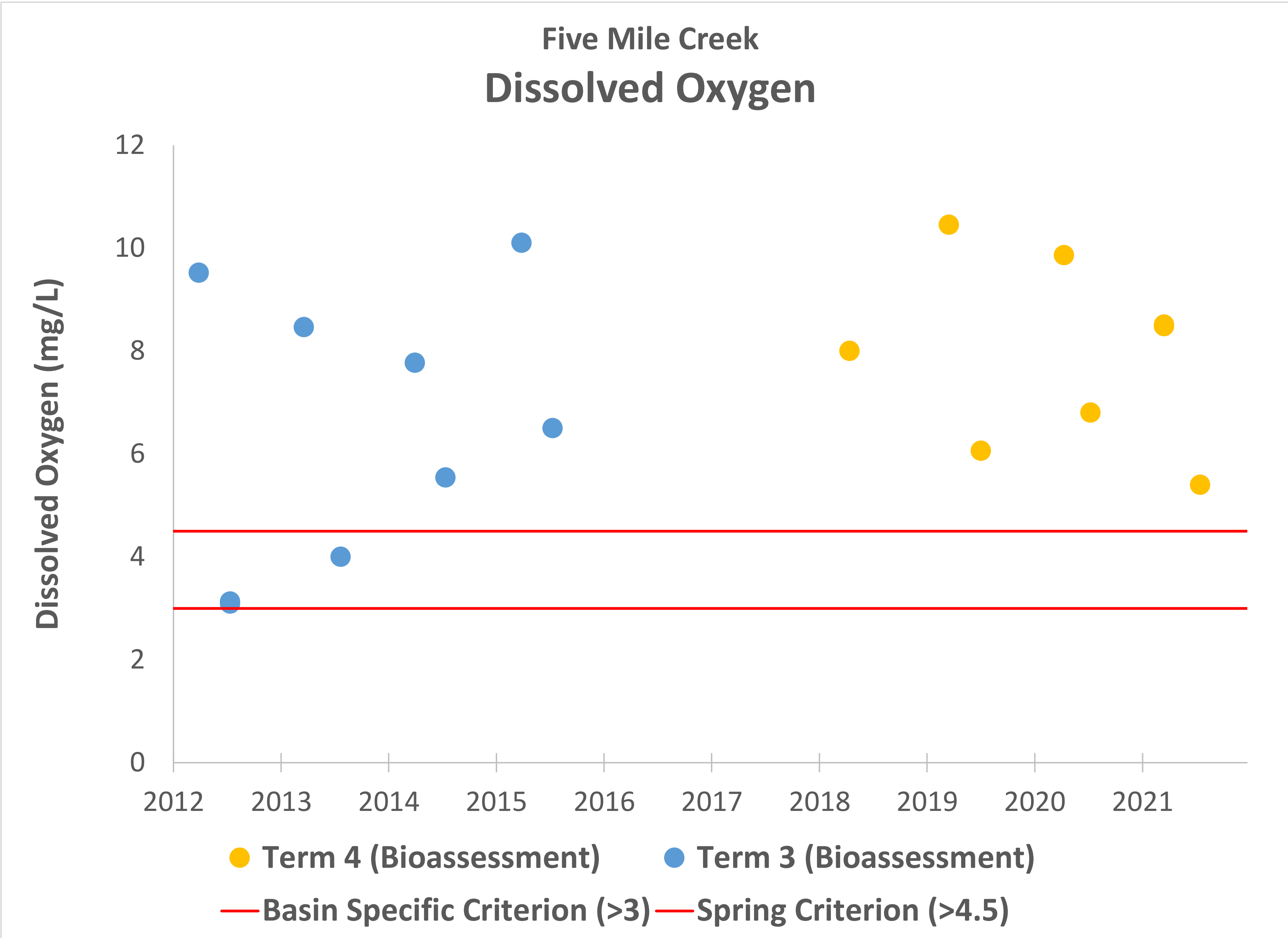
Five Mile Creek
Field pH
pH (Standard Units)
9.5
9
8.5
8
7.5
7
6.5
6
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Basin Specific Criteria

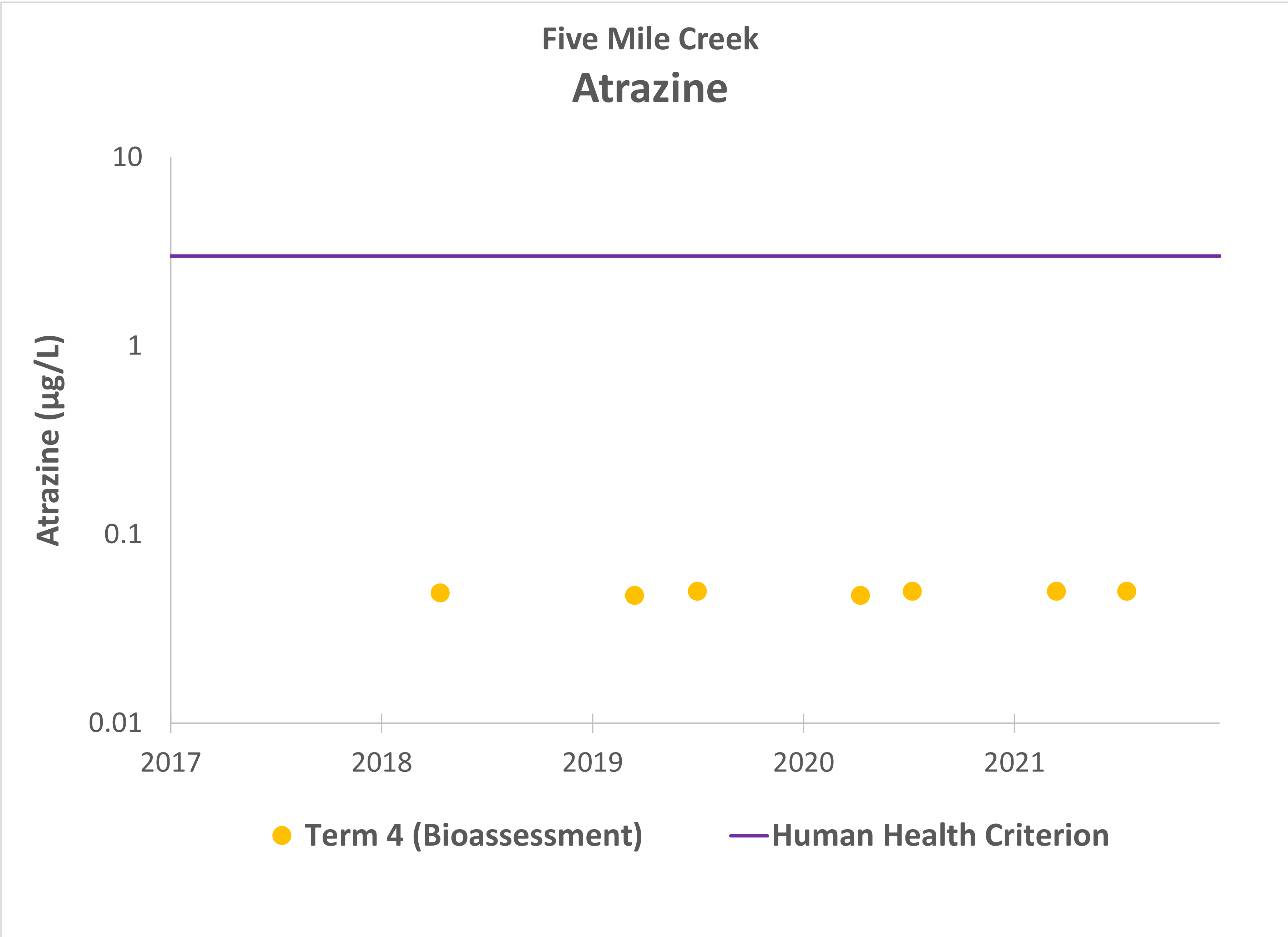


Five Mile Creek
Specific Conductivity
Specific Conductivity (µS/cm)
2500
2000
1500
1000
500
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
NRSA: good (<)
NRSA: fair (<)

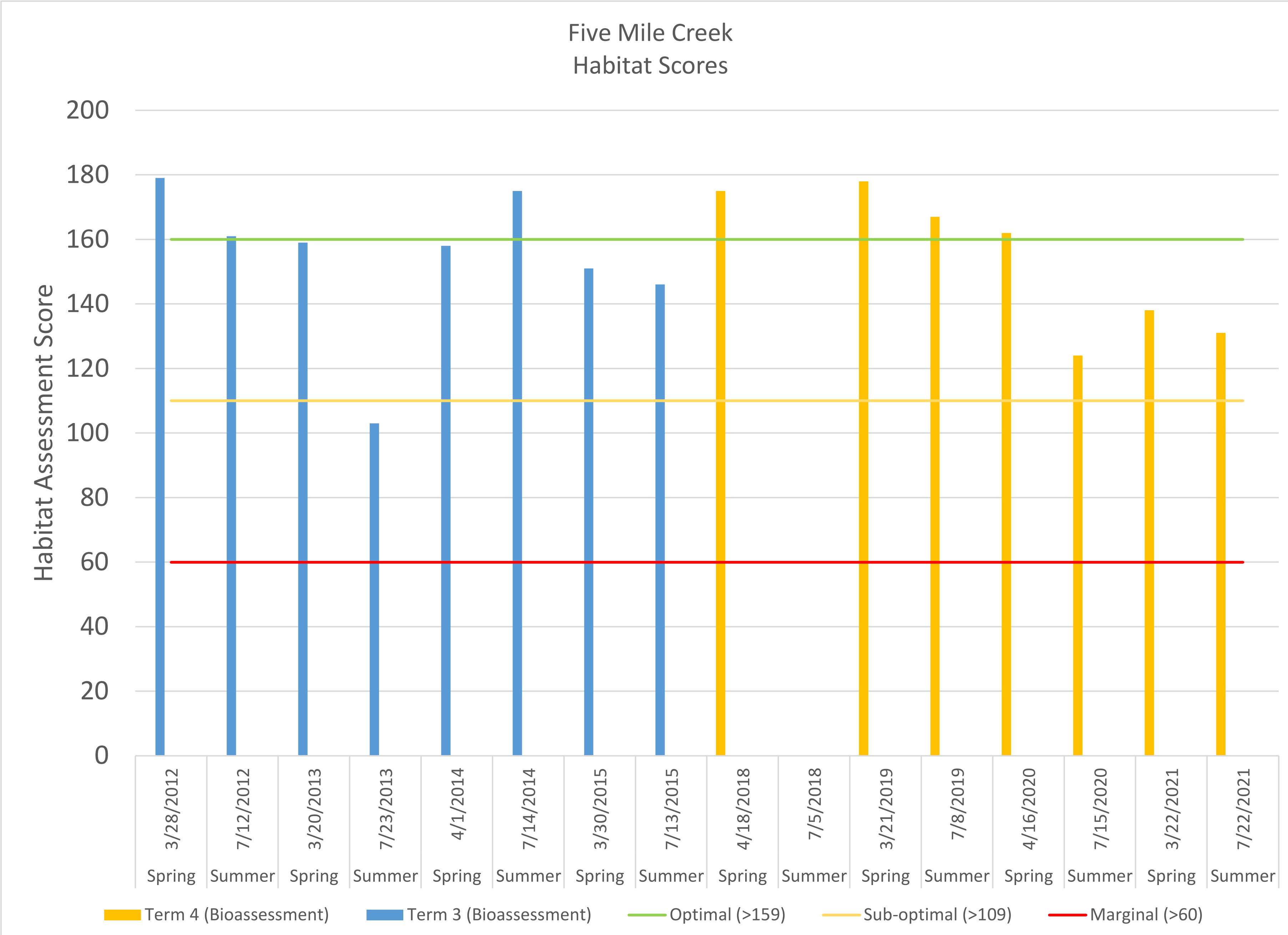

Five Mile Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Basin Specific Criterion


Five Mile Creek
E. coli
1000
100
10
1
E. coli (col/100 mL)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
PCR Geomean
PCR Single Sample


Five Mile Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Basin Specific Criterion (>3)
Spring Criterion (>4.5)



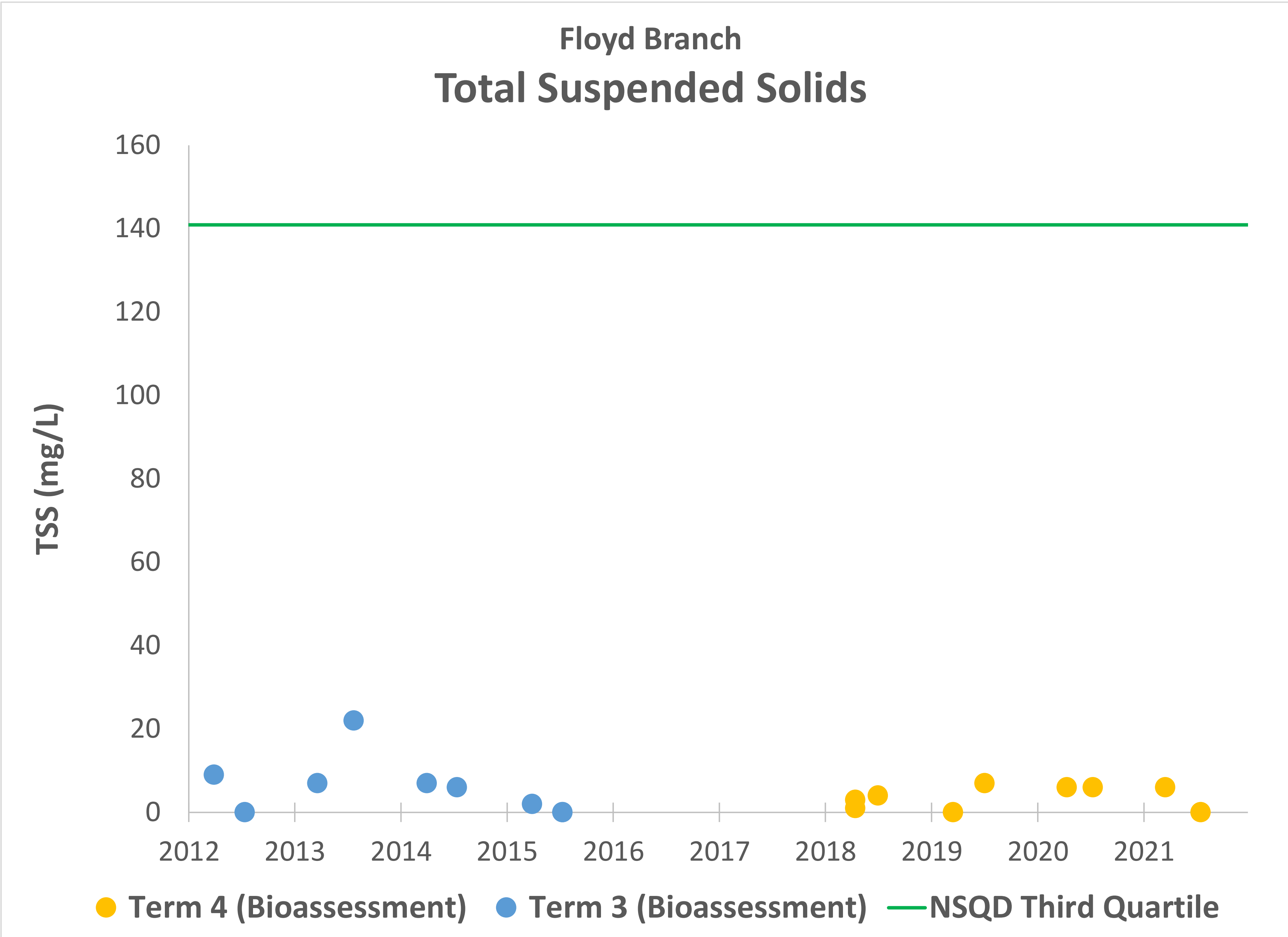
Five Mile Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Human Health Criterion



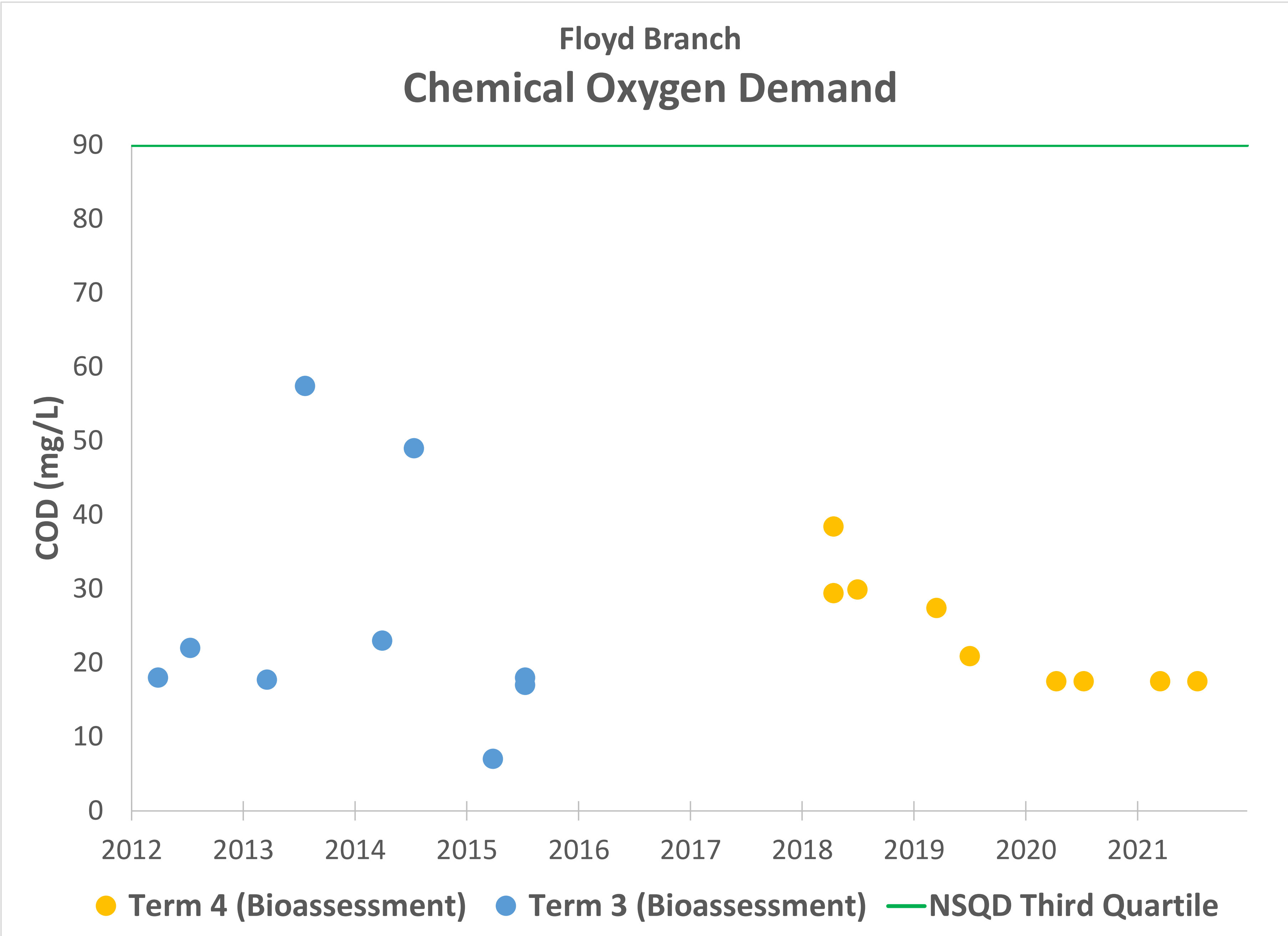
Five Mile Creek
Habitat Scores
Habitat Assessment Score
200
180
160
140
120
100
80
60
40
20
0
3/28/2012
7/12/2012
3/20/2013
7/23/2013
4/1/2014
7/14/2014
3/30/2015
7/13/2015
4/18/2018
7/5/2018
3/21/2019
7/8/2019
4/16/2020
7/15/2020
3/22/2021
7/22/2021
Spring
Summer
Spring
Summer
Spring
Summer
Spring
Summer
Spring
Summer
Spring
Summer
Spring
Summer
Spring
Summer
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Optimal (>159)
Sub-optimal (>109)
Marginal (>60)

Appendix L

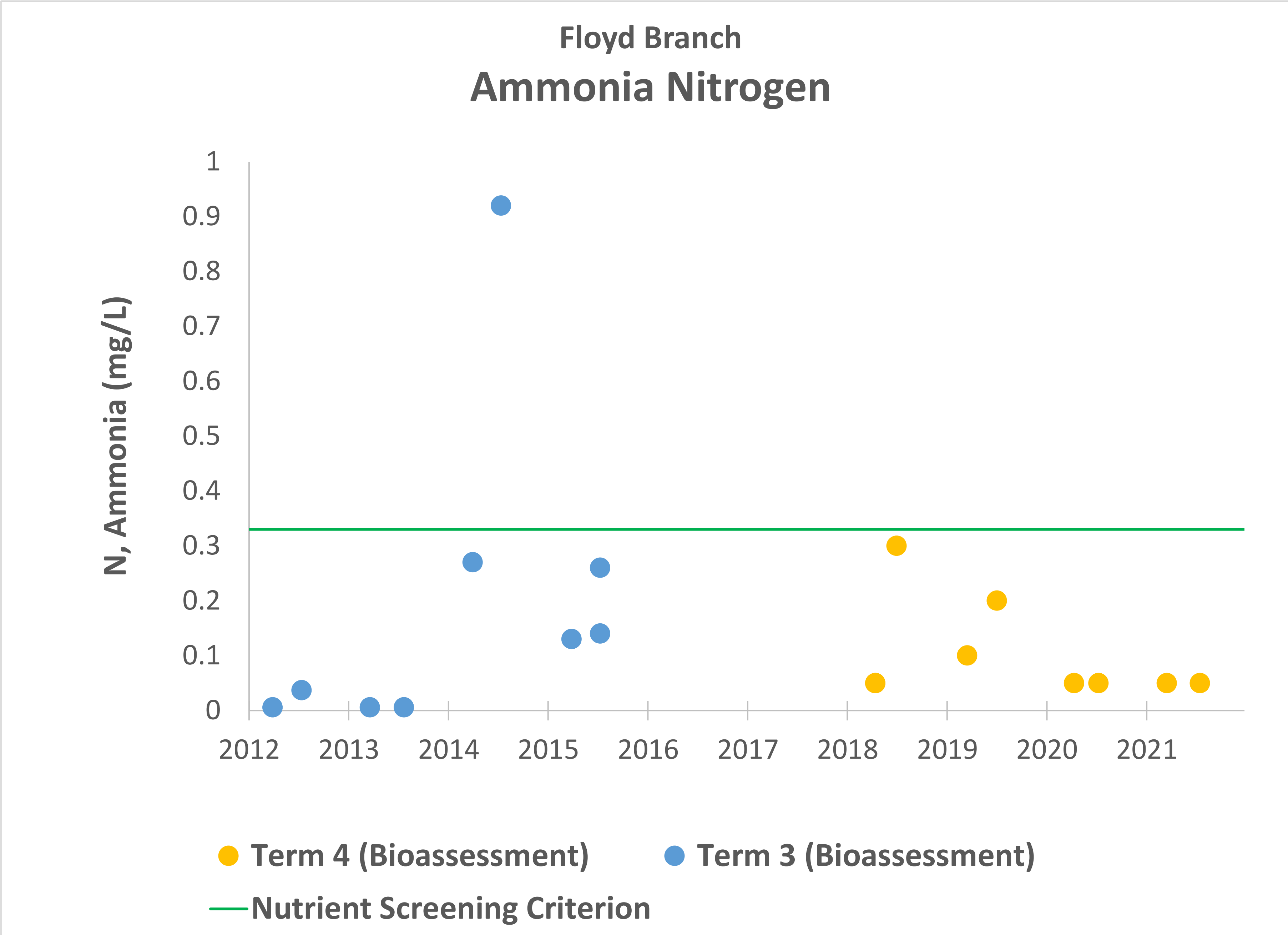
Floyd Branch Water Quality Data Graphs

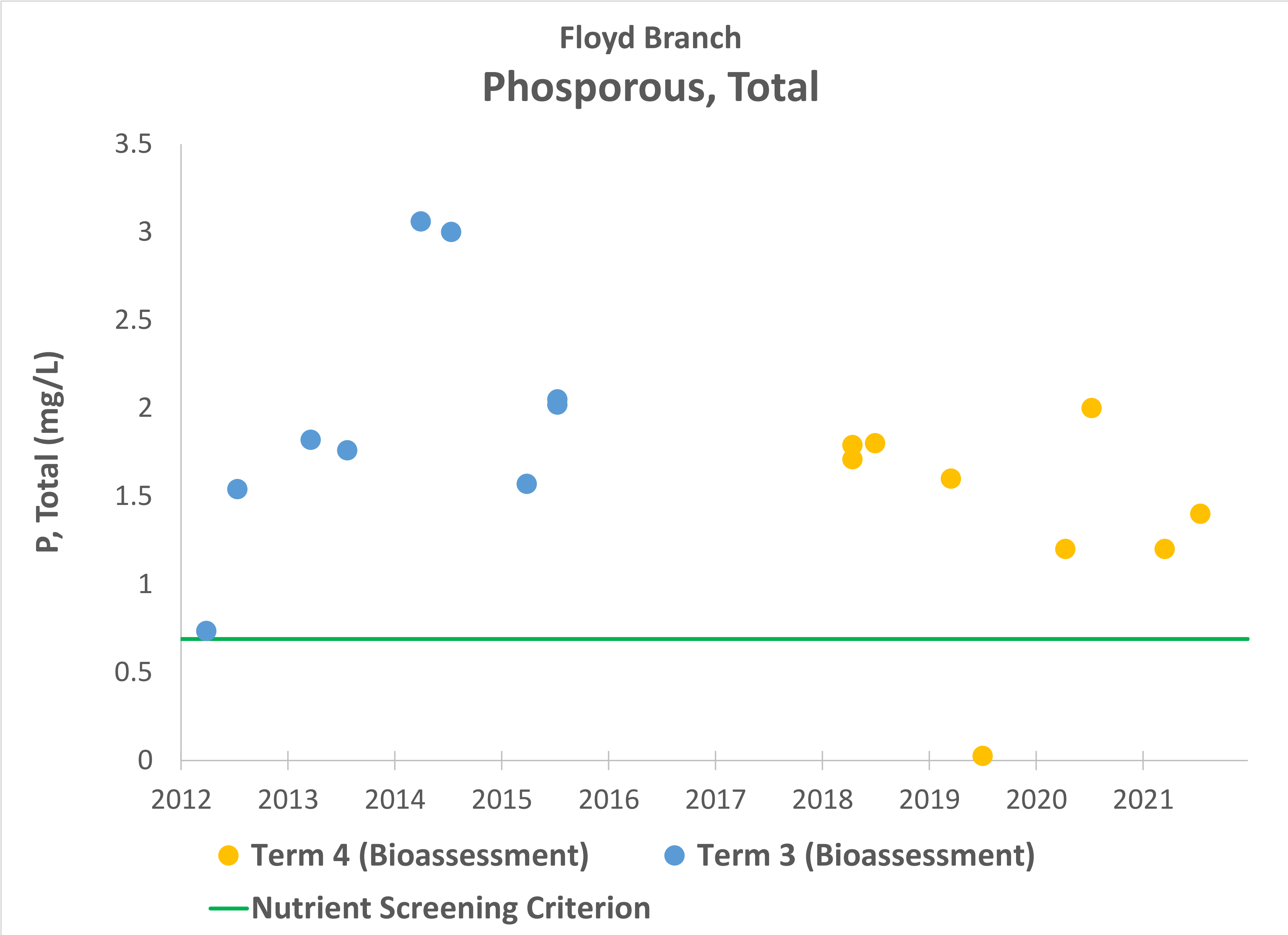


Floyd Branch
Total Suspended Solids
TSS (mg/L)
160
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
NSQD Third Quartile

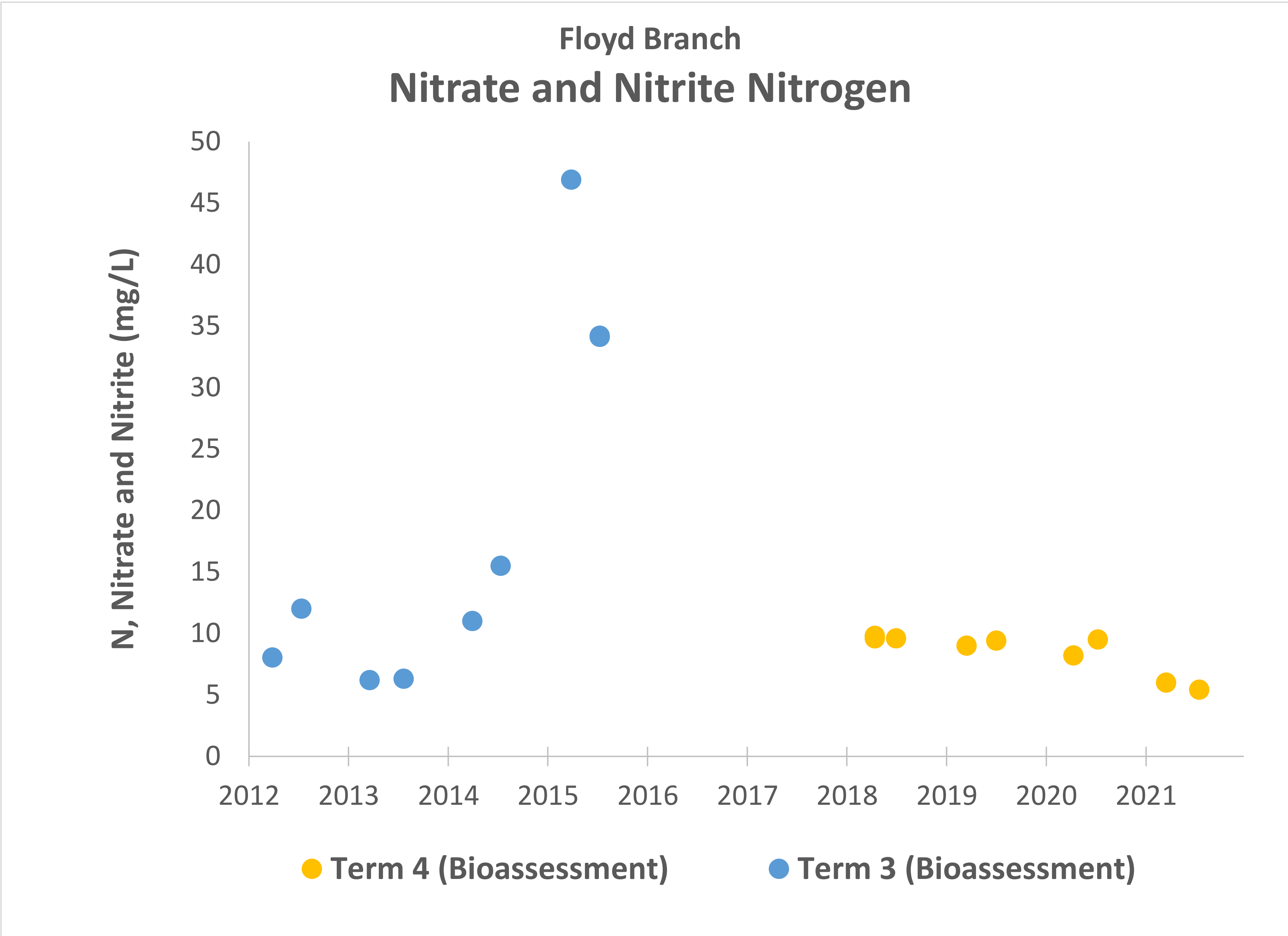


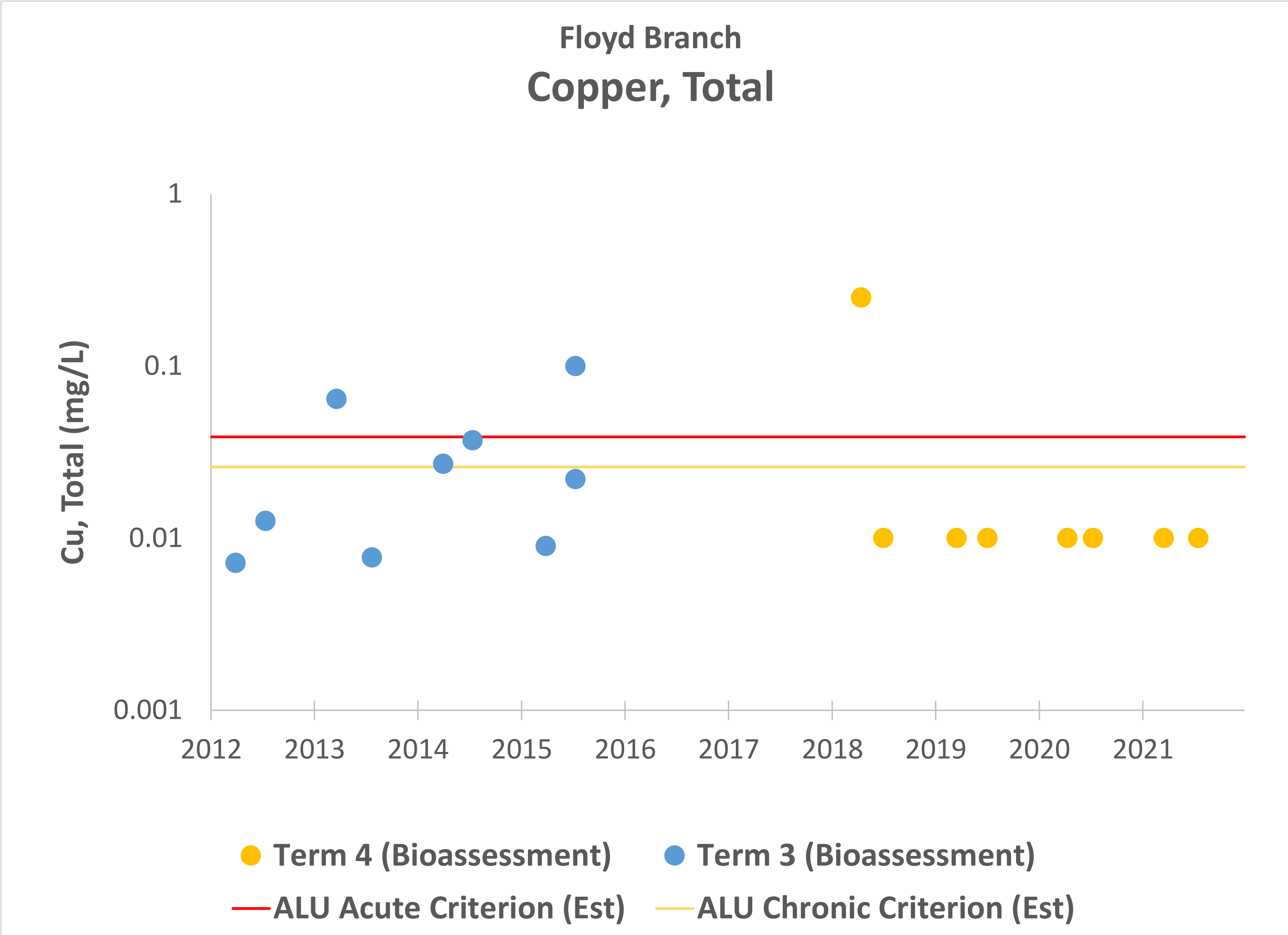
Floyd Branch
Chemical Oxygen Demand
COD (mg/L)
90
80
70
60
50
40
30
20
10
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
NSQD Third Quartile

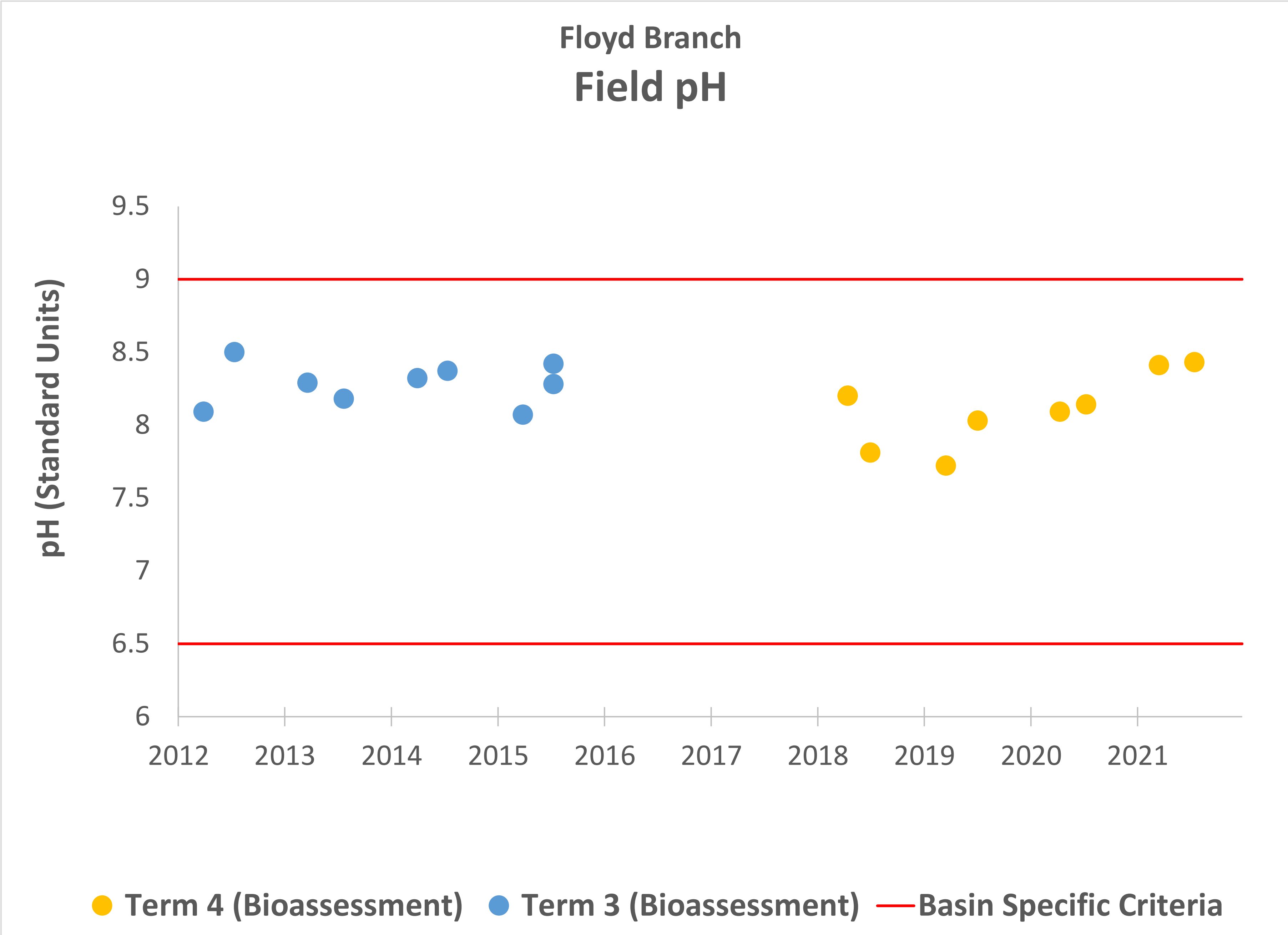

Floyd Branch
Ammonia Nitrogen
N, Ammonia (mg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion

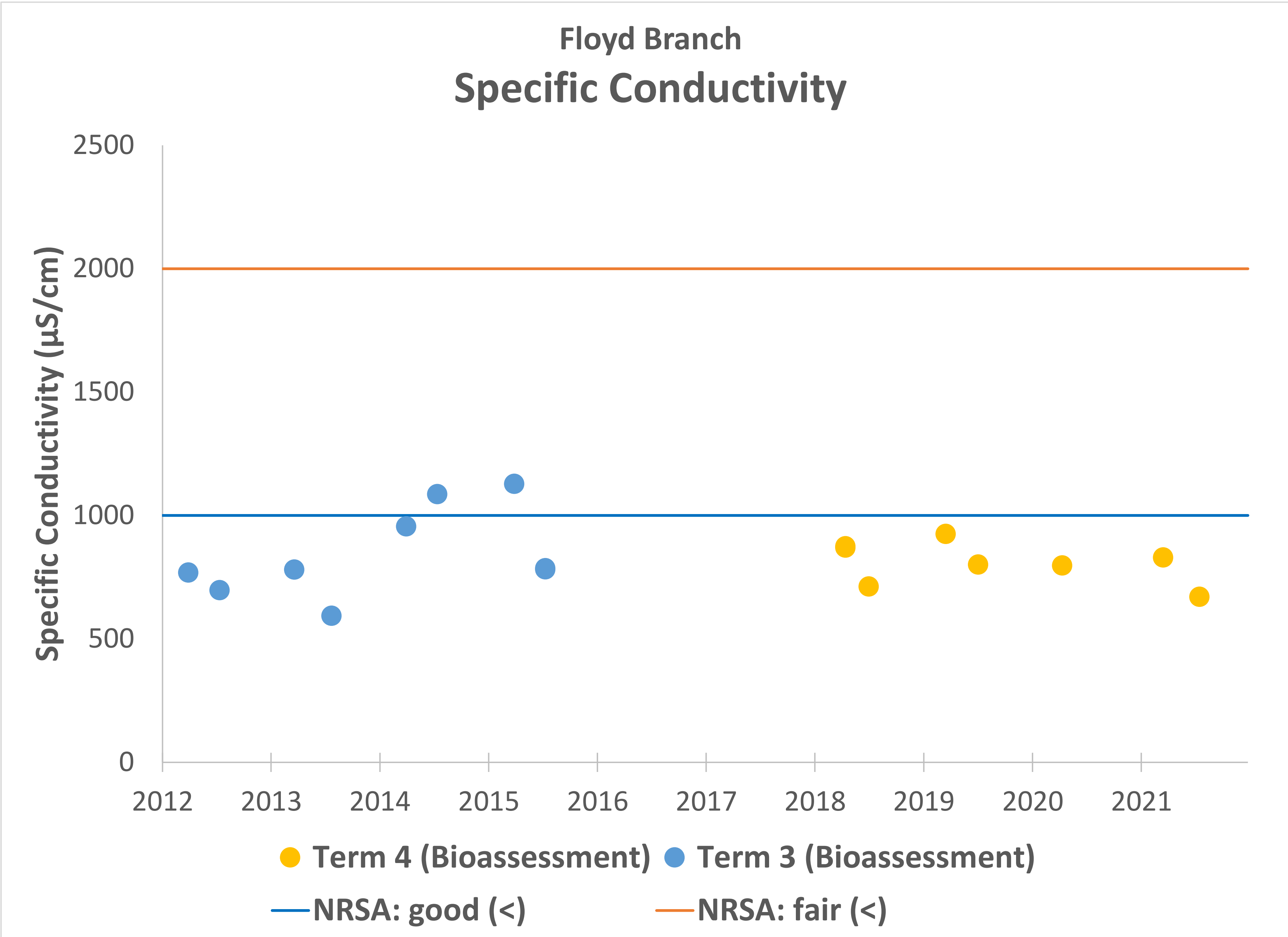


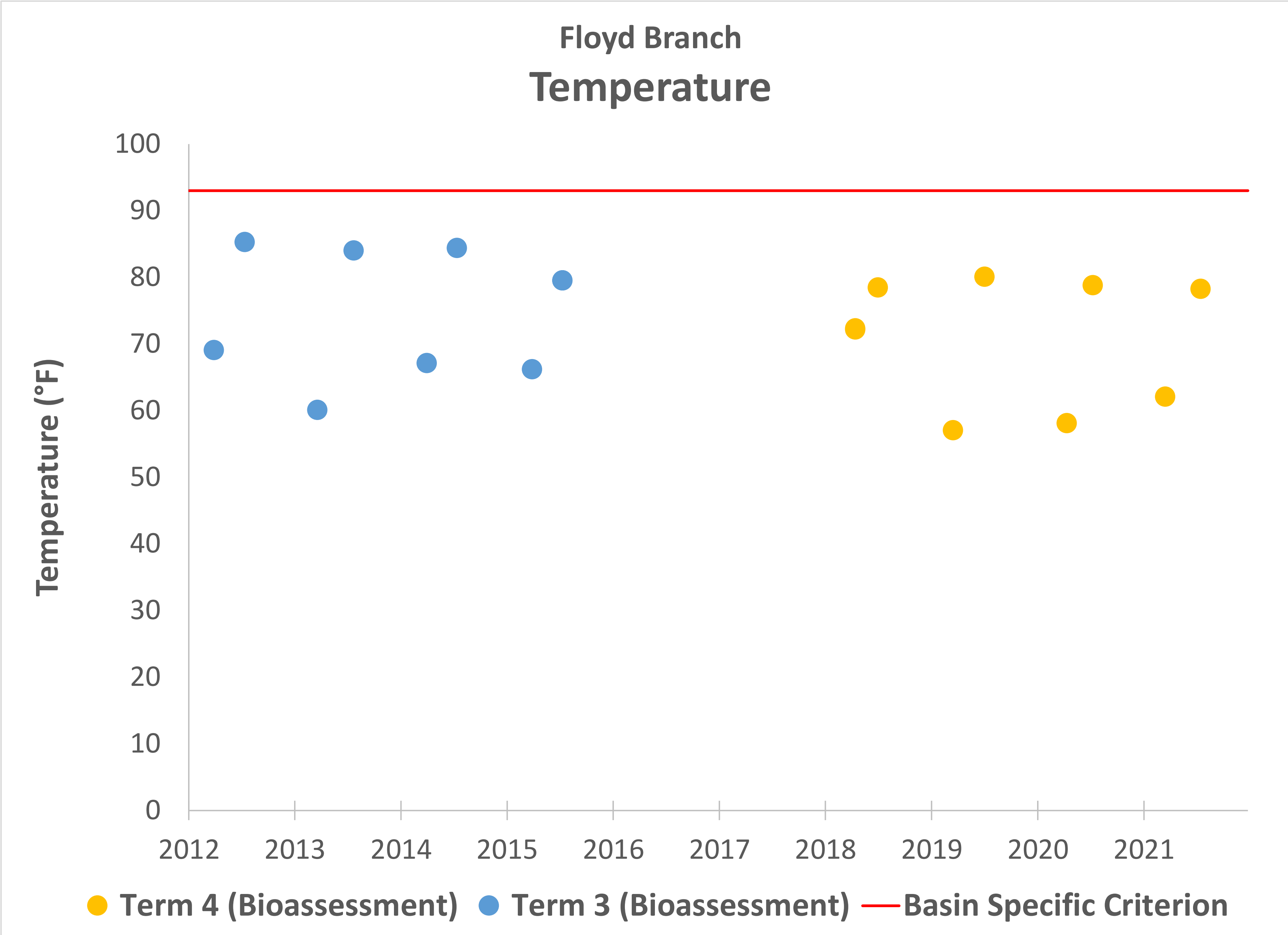
Floyd Branch
Phosporous, Total
P, Total (mg/L)
3.5
3
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion


Floyd Branch
Nitrate and Nitrite Nitrogen
N, Nitrate and Nitrite (mg/L)
0
5
10
15
20
25
30
35
40
45
50
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)

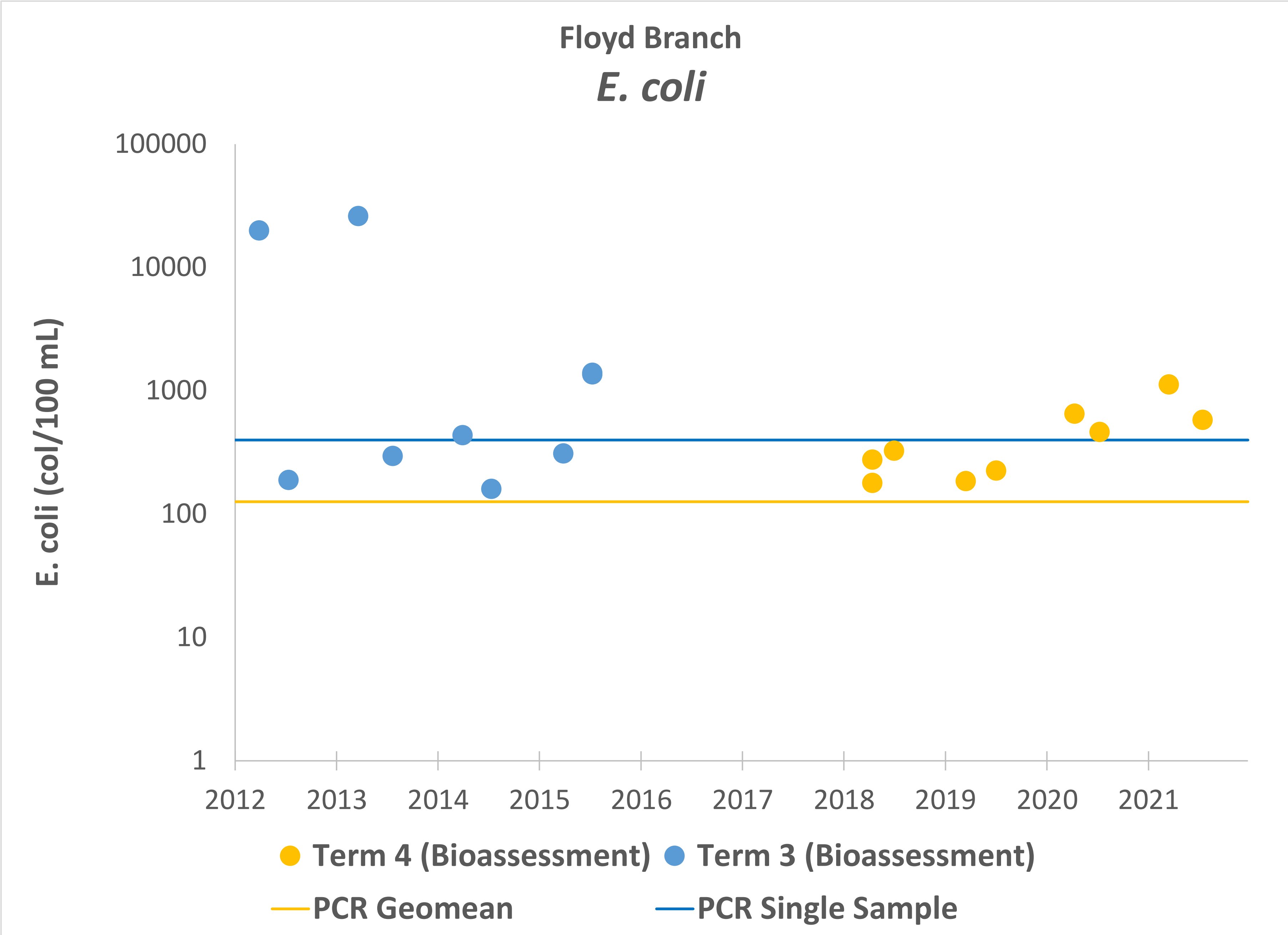

Floyd Branch
Copper, Total
Cu, Total (mg/L)
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)


Floyd Branch
Field pH
pH (Standard Units)
9.5
9
8.5
8
7.5
7
6.5
6
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Basin Specific Criteria

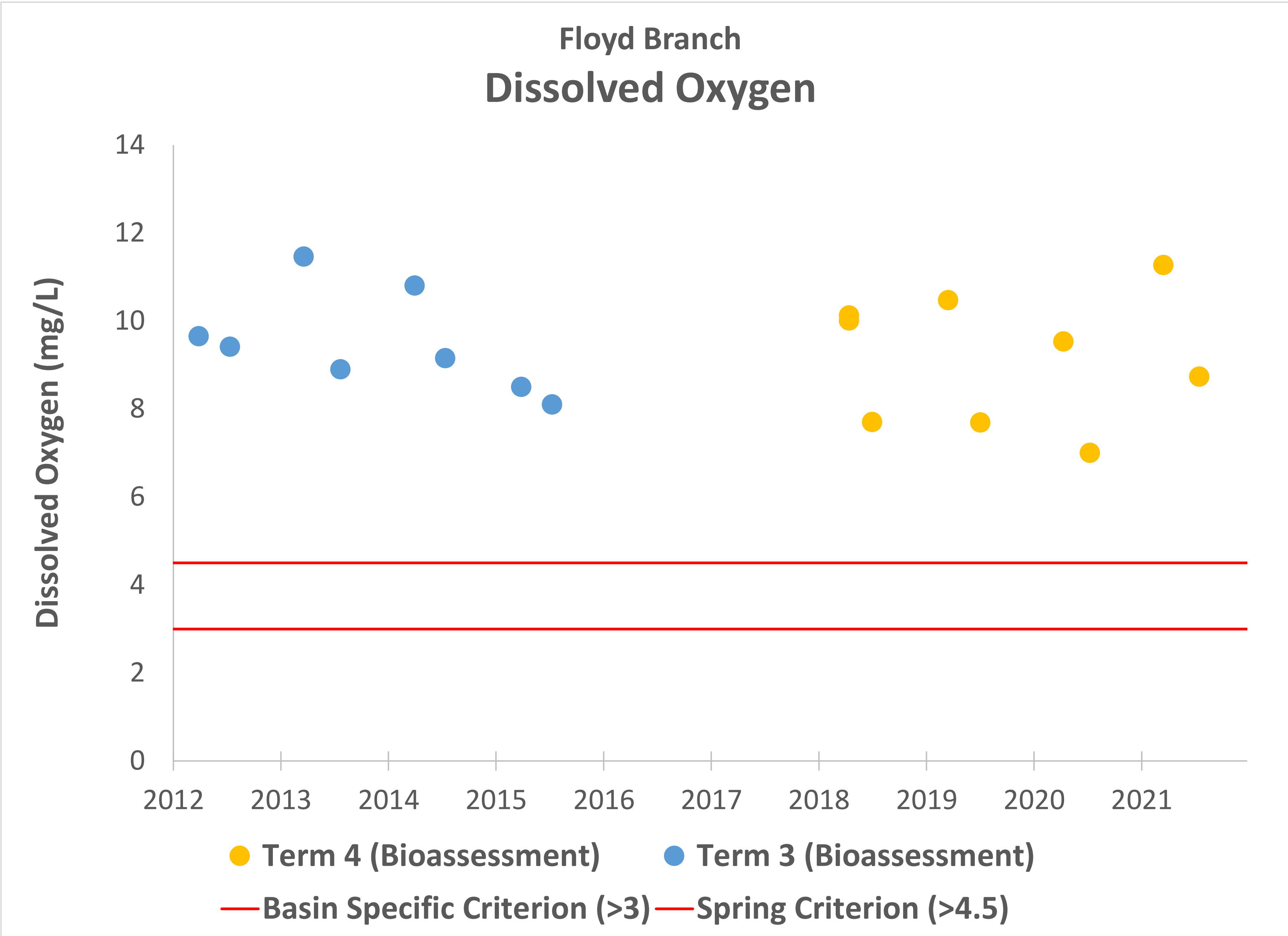

Floyd Branch
Specific Conductivity
Specific Conductivity (µS/cm)
2500
2000
1500
1000
500
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
NRSA: good (<)
NRSA: fair (<)

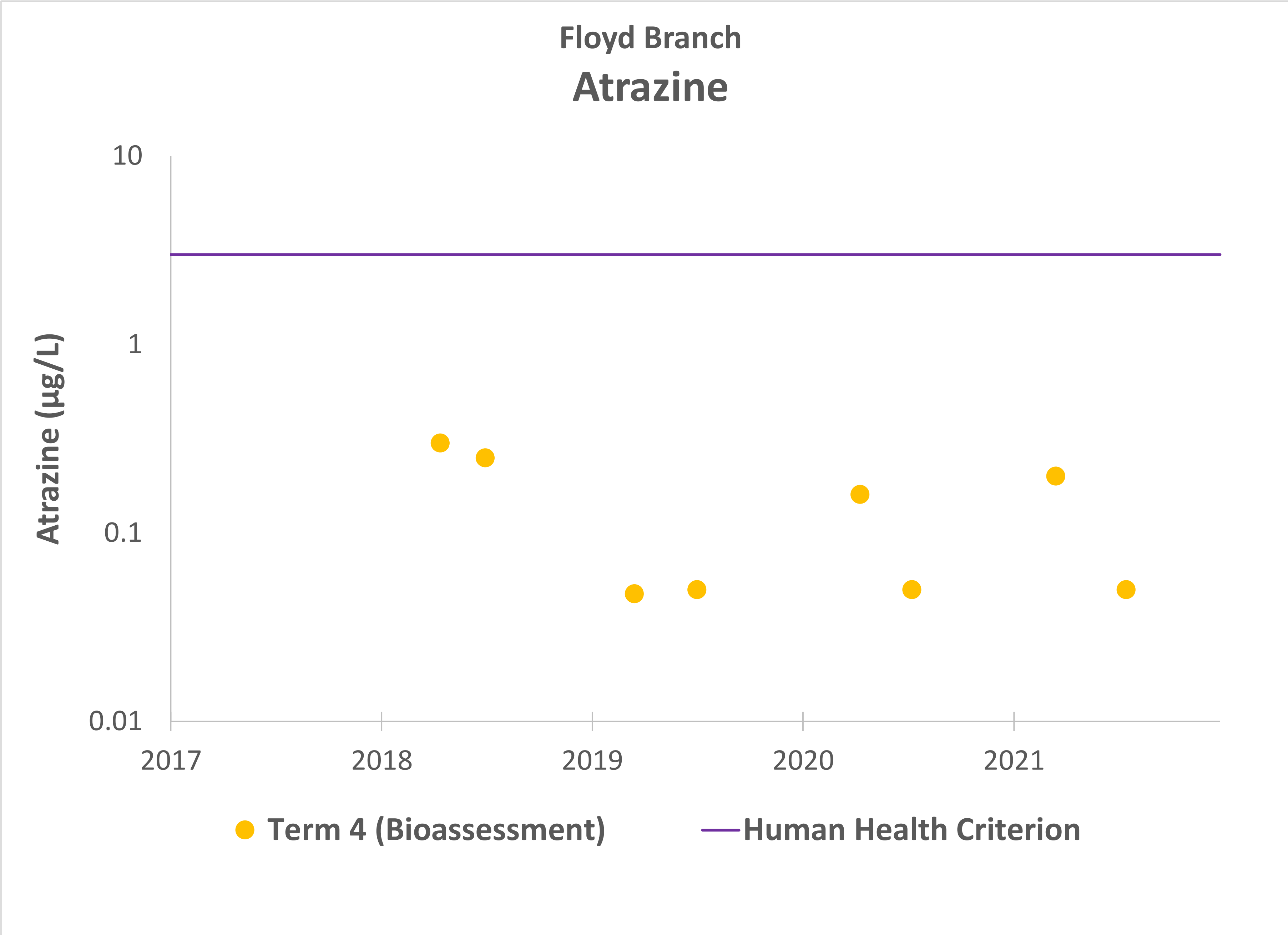


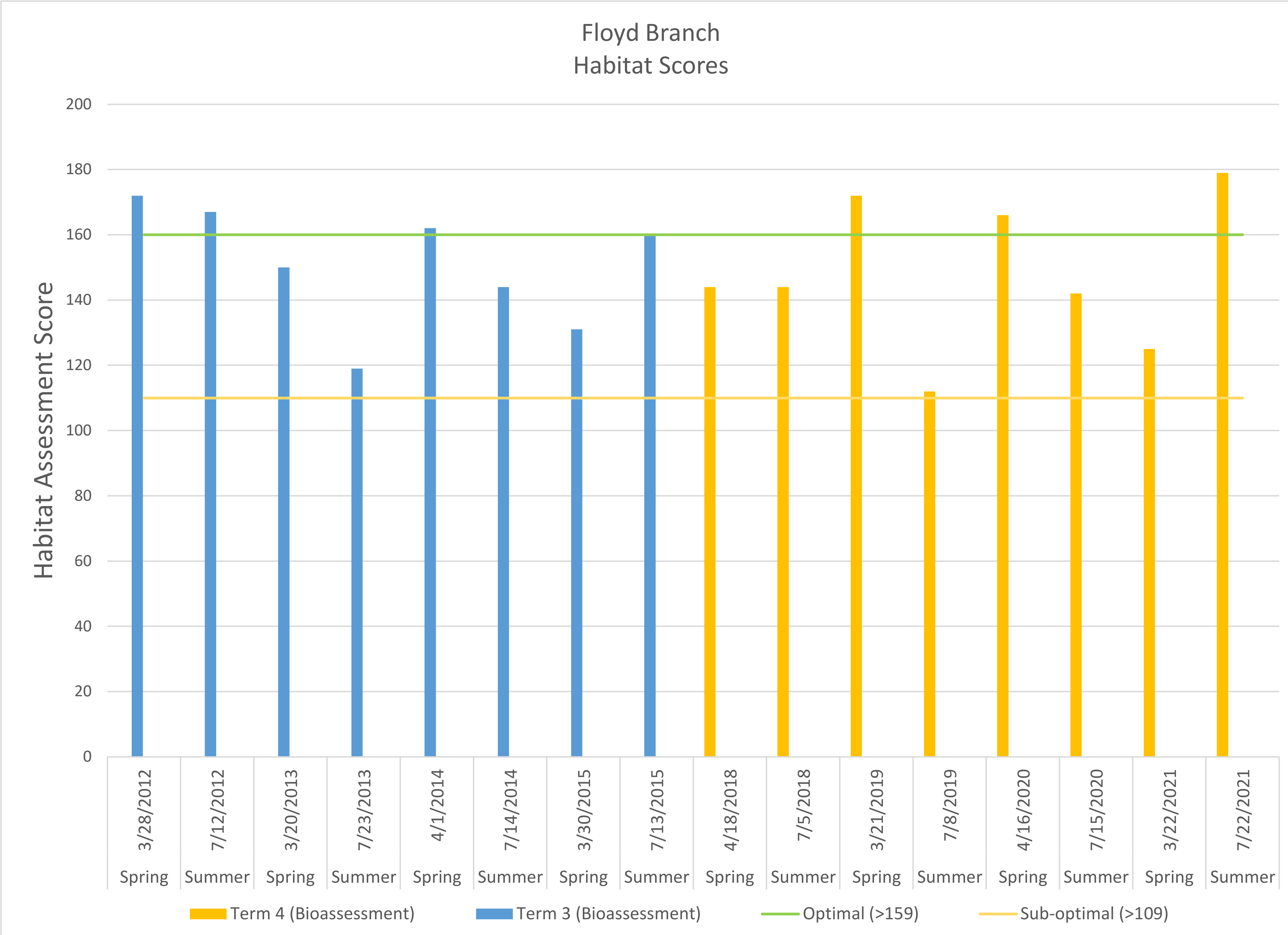
Floyd Branch
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Basin Specific Criterion

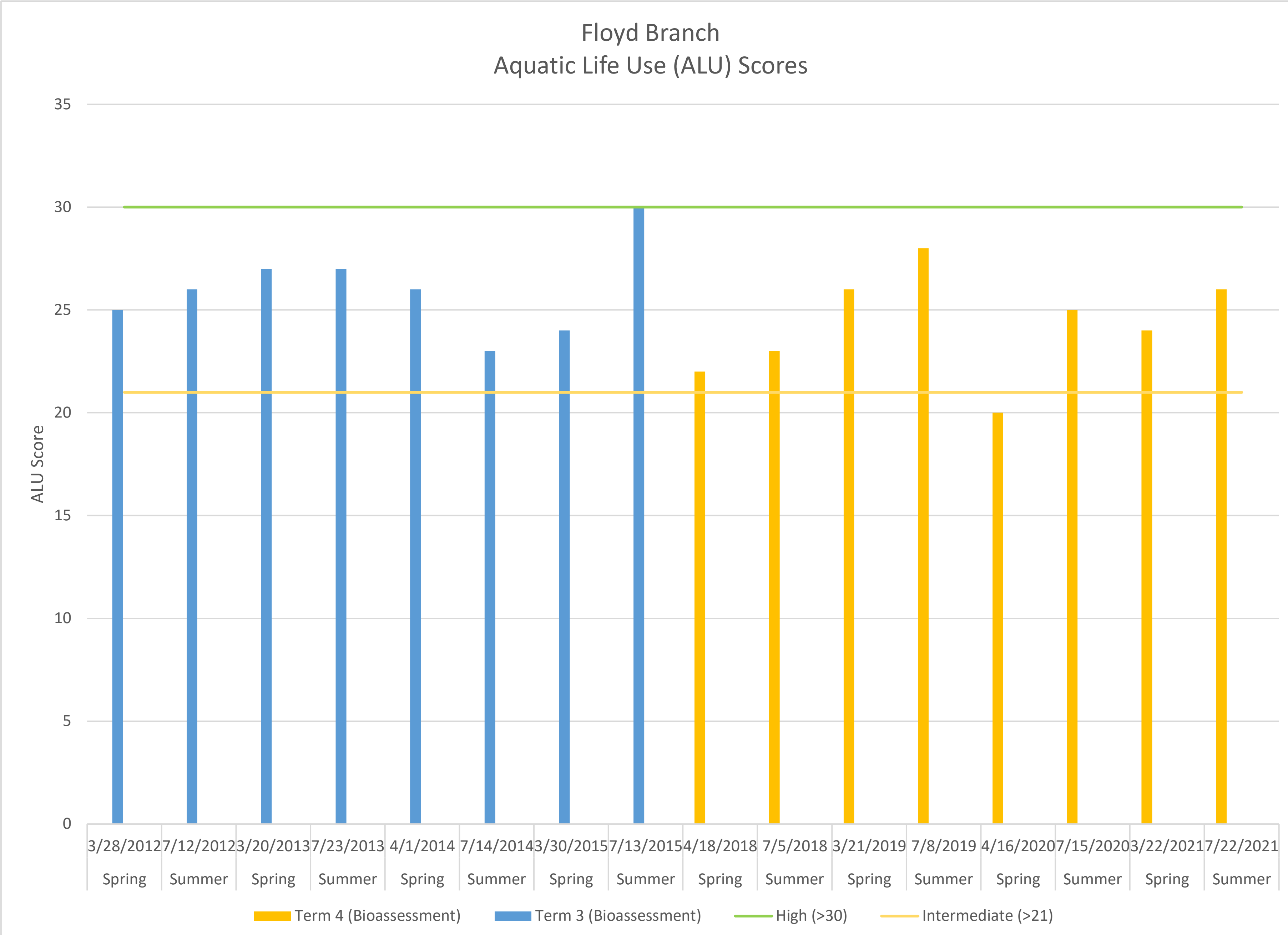


Floyd Branch
E. coli
E. coli (col/100 mL)
100000
10000
1000
100
10
1
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
PCR Geomean
PCR Single Sample


Floyd Branch
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
14
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Basin Specific Criterion (>3)
Spring Criterion (>4.5)


Floyd Branch
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Human Health Criterion

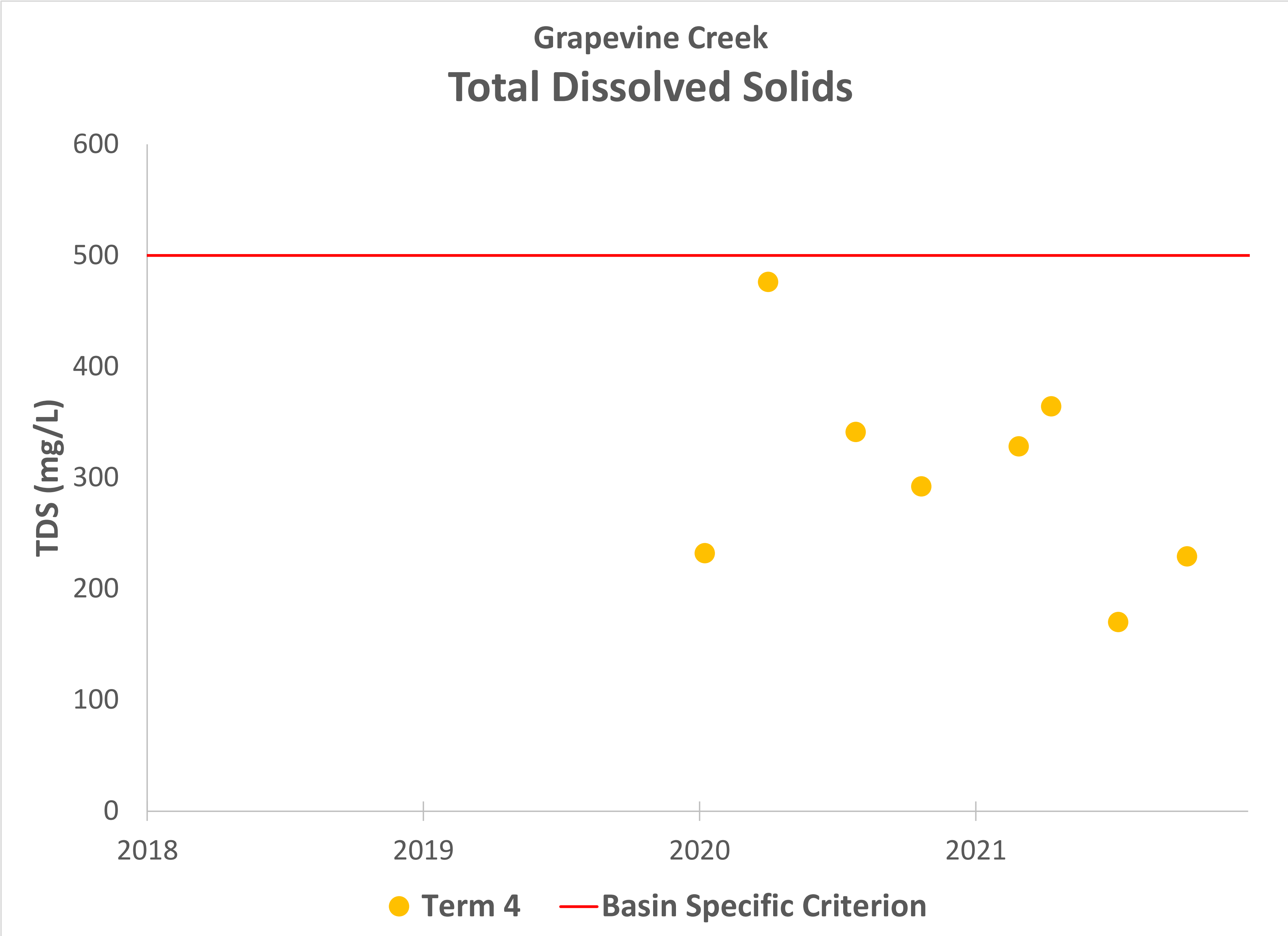

Floyd Branch
Habitat Scores
Habitat Assessment Score
200
180
160
140
120
100
80
60
40
20
0
3/28/2012
Spring
7/12/2012
Summer
3/20/2013
Spring
7/23/2013
Summer
4/1/2014
Spring
7/14/2014
Summer
3/30/2015
Spring
7/13/2015
Summer
4/18/2018
Spring
7/5/2018
Summer
3/21/2019
Spring
7/8/2019
Summer
4/16/2020
Spring
7/15/2020
Summer
3/22/2021
Spring
7/22/2021
Summer
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Optimal (>159)
Sub-optimal (>109)



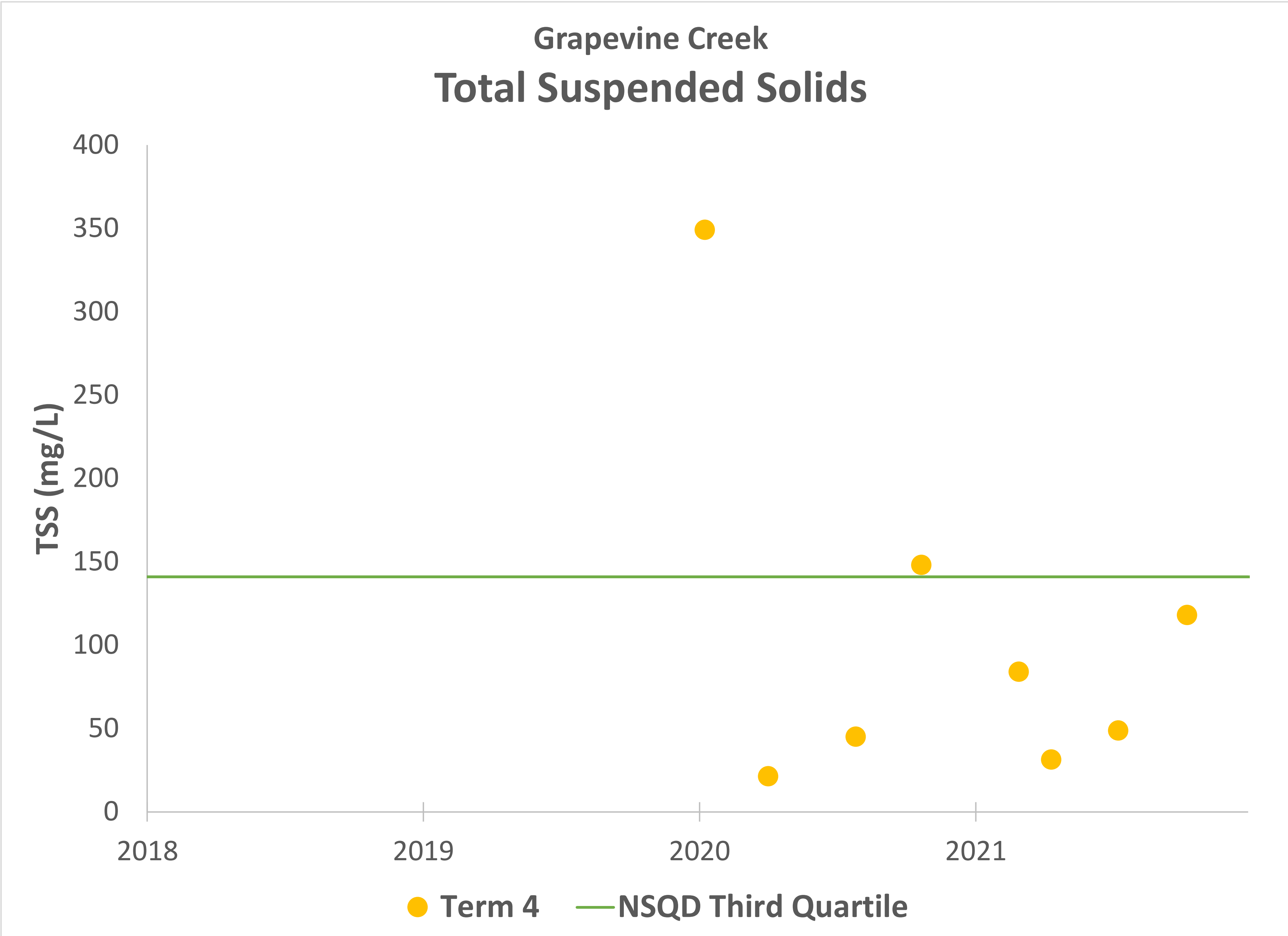
Floyd Branch
Aquatic Life Use (ALU) Scores
ALU Score
35
30
25
20
15
10
5
0
3/28/2012 Spring
7/12/2012 Summer
3/20/2013 Spring
7/23/2013 Summer
4/1/2014 Spring
7/14/2014 Summer
3/30/2015 Spring
7/13/2015 Summer
4/18/2018 Spring
7/5/2018 Summer
3/21/2019 Spring
7/8/2019 Summer
4/16/2020 Spring
7/15/2020 Summer
3/22/2021 Spring
7/22/2021 Summer
Term 4 (Bioassessment)
Term 3 (Bioassessment)
High (>30)
Intermediate (>21)

Appendix M

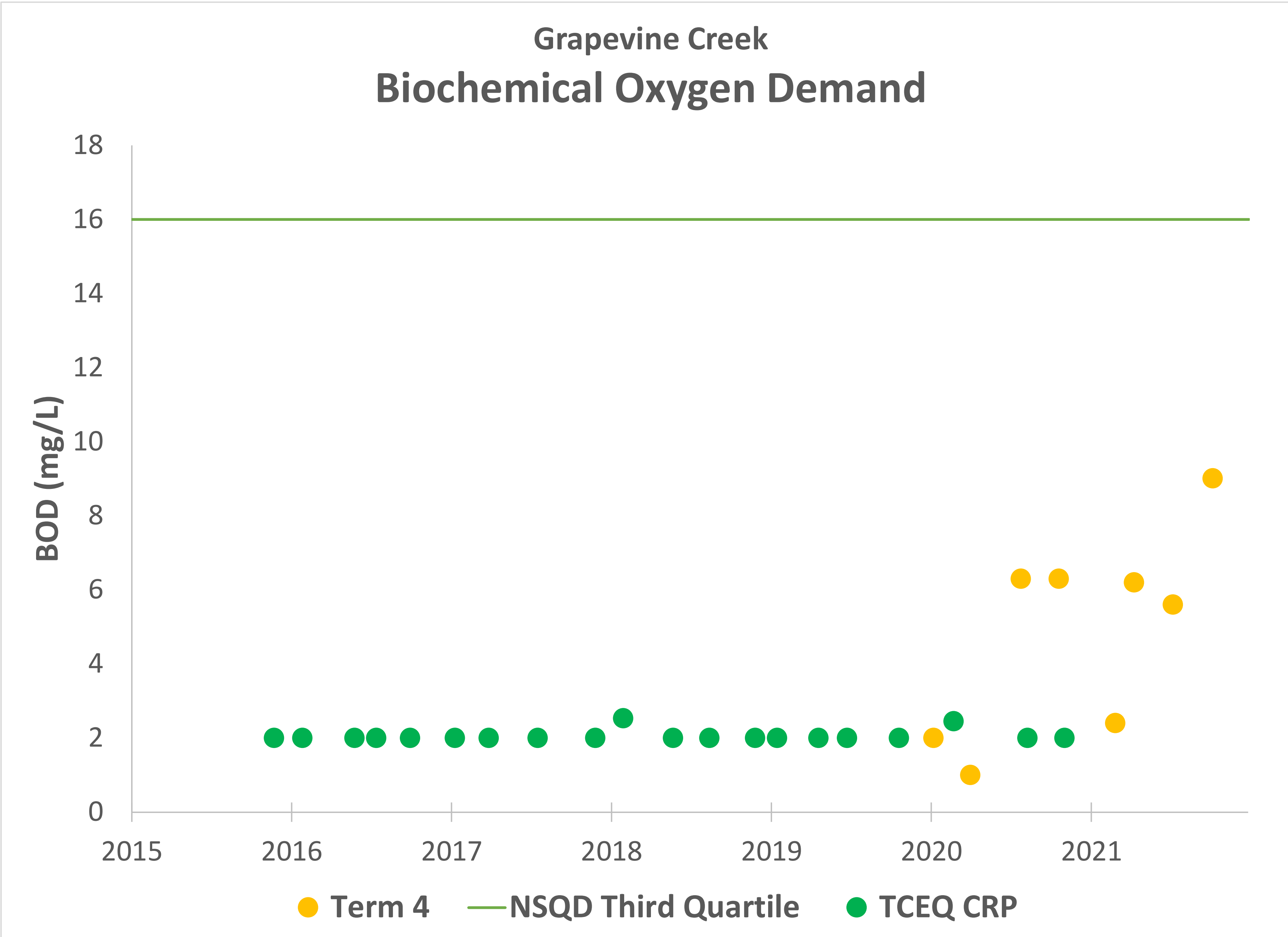
Grapevine Creek Water Quality Data Graphs



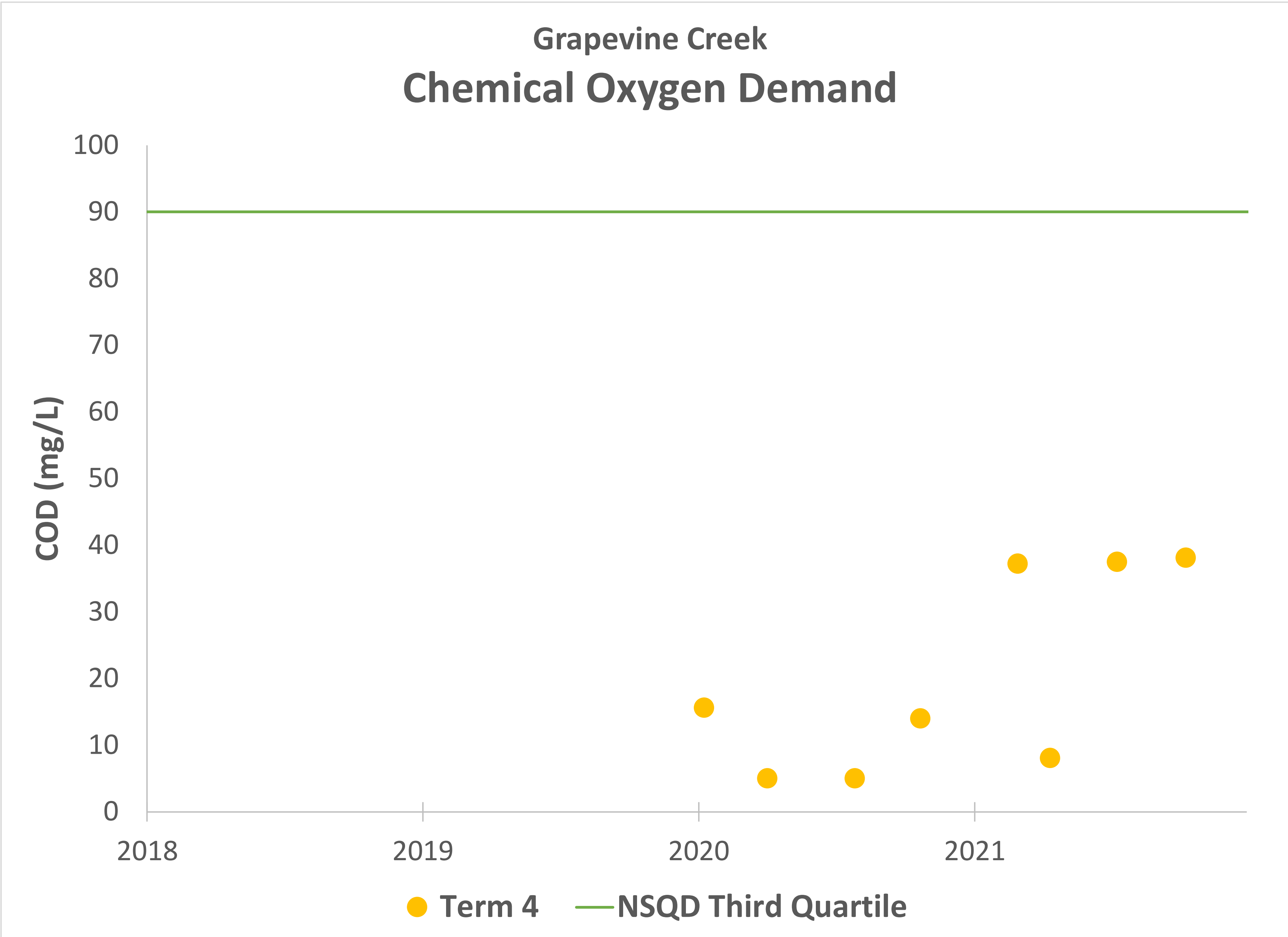
Grapevine Creek
Total Dissolved Solids
TDS (mg/L)
600
500
400
300
200
100
0
2018
2019
2020
2021
Term 4
Basin Specific Criterion



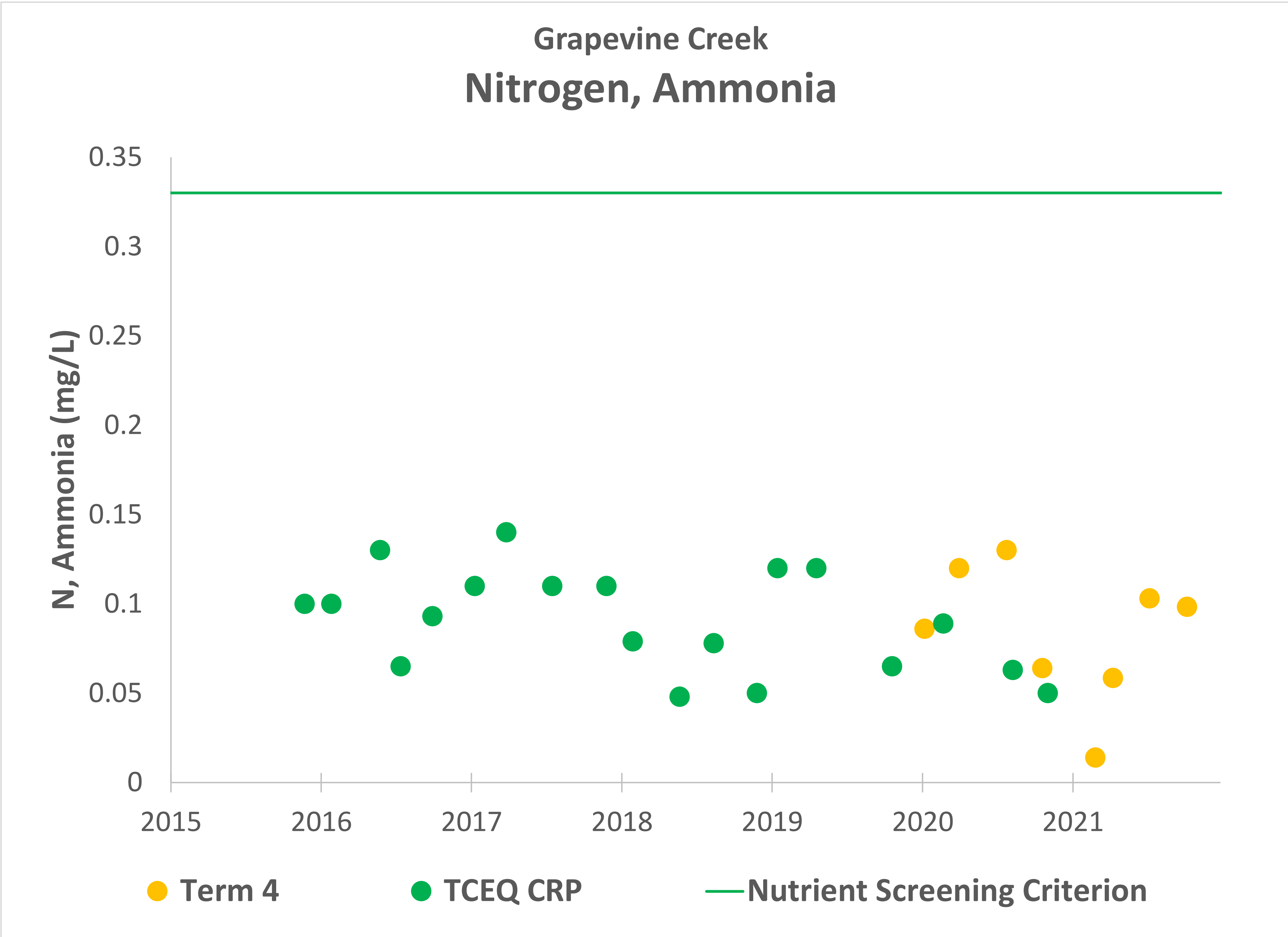
Grapevine Creek
Total Suspended Solids
TSS (mg/L)
400
350
300
250
200
150
100
50
0
2018
2019
2020
2021
Term 4
NSQD Third Quartile

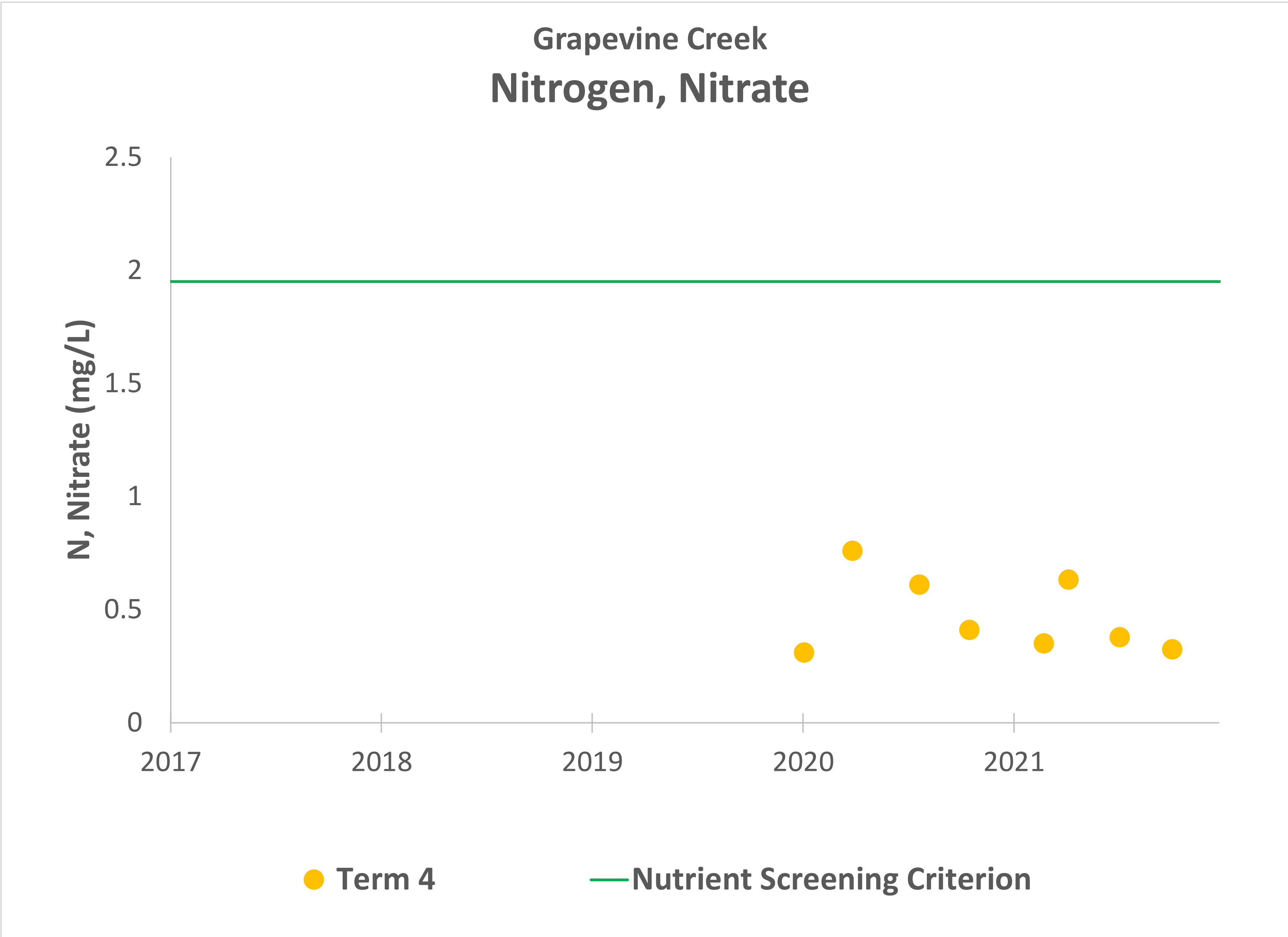


Grapevine Creek
Biochemical Oxygen Demand
BOD (mg/L)
0
2
4
6
8
10
12
14
16
18
2015
2016
2017
2018
2019
2020
2021
Term 4
NSQD Third Quartile
TCEQ CRP

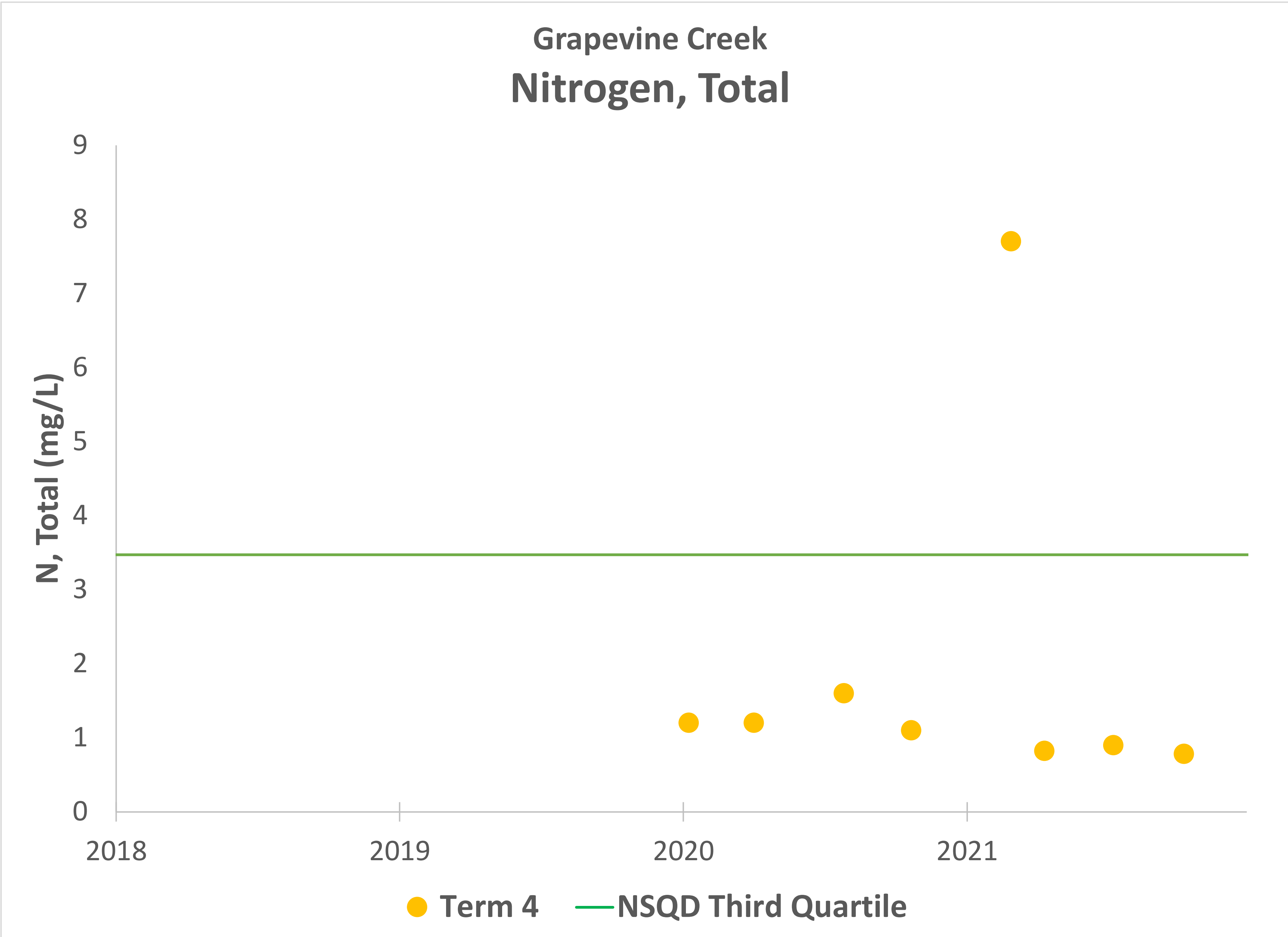


Grapevine Creek
Chemical Oxygen Demand
COD (mg/L)
100
90
80
70
60
50
40
30
20
10
0
2018
2019
2020
2021
Term 4
NSQD Third Quartile

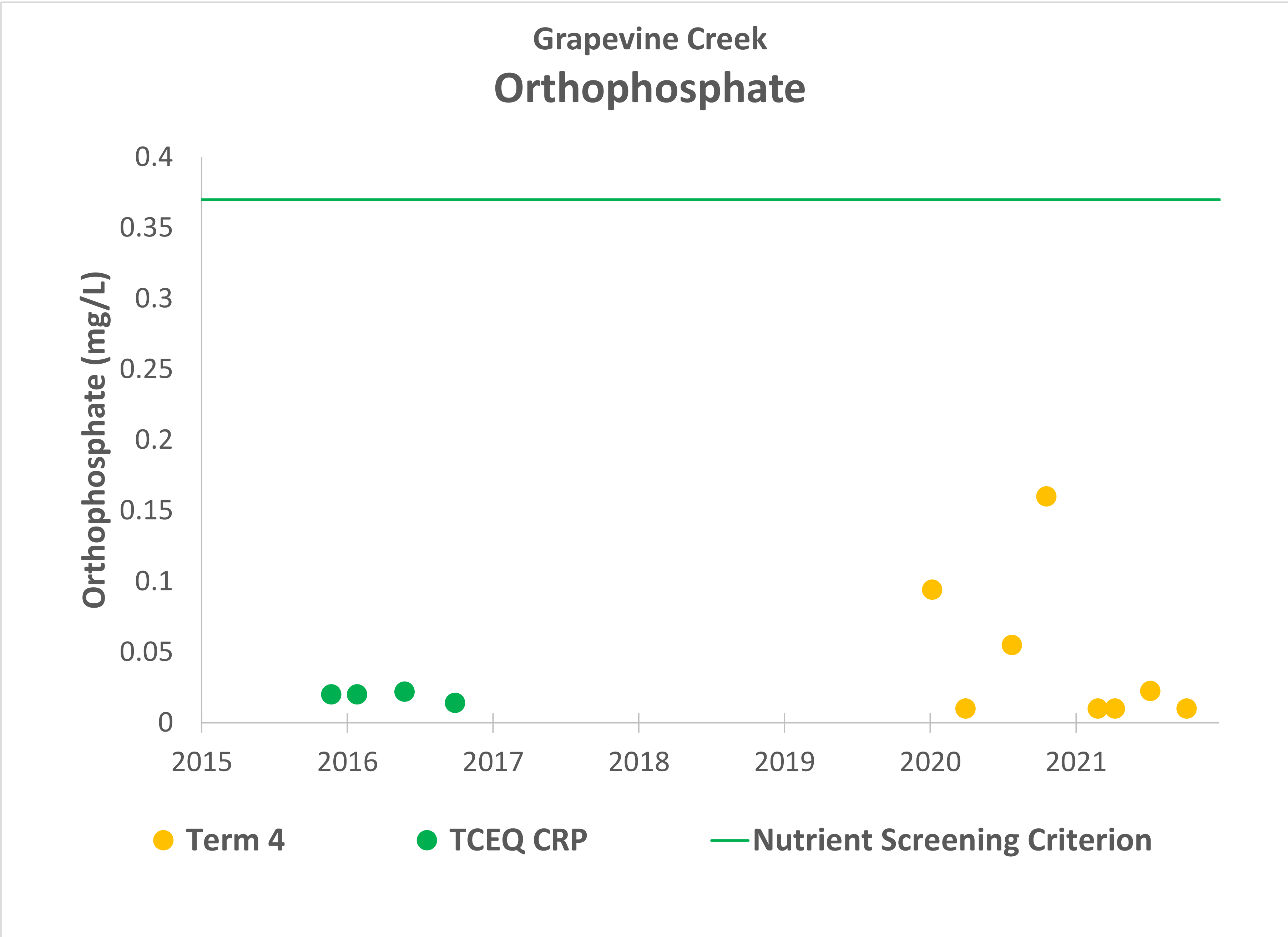

Grapevine Creek
Nitrogen, Ammonia
N, Ammonia (mg/L)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2015
2016
2017
2018
2019
2020
2021
Term 4
TCEQ CRP
Nutrient Screening Criterion



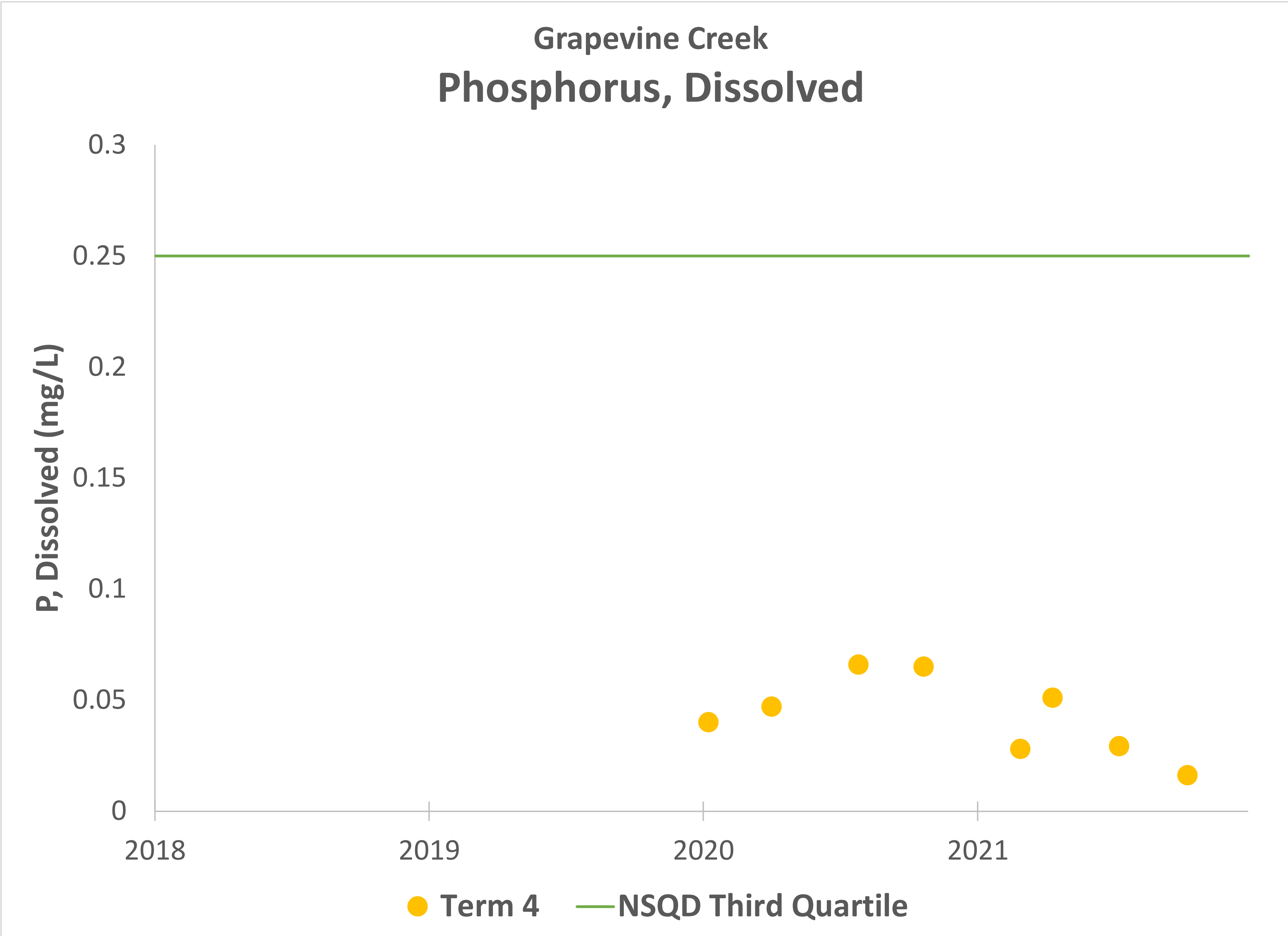
Grapevine Creek
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion



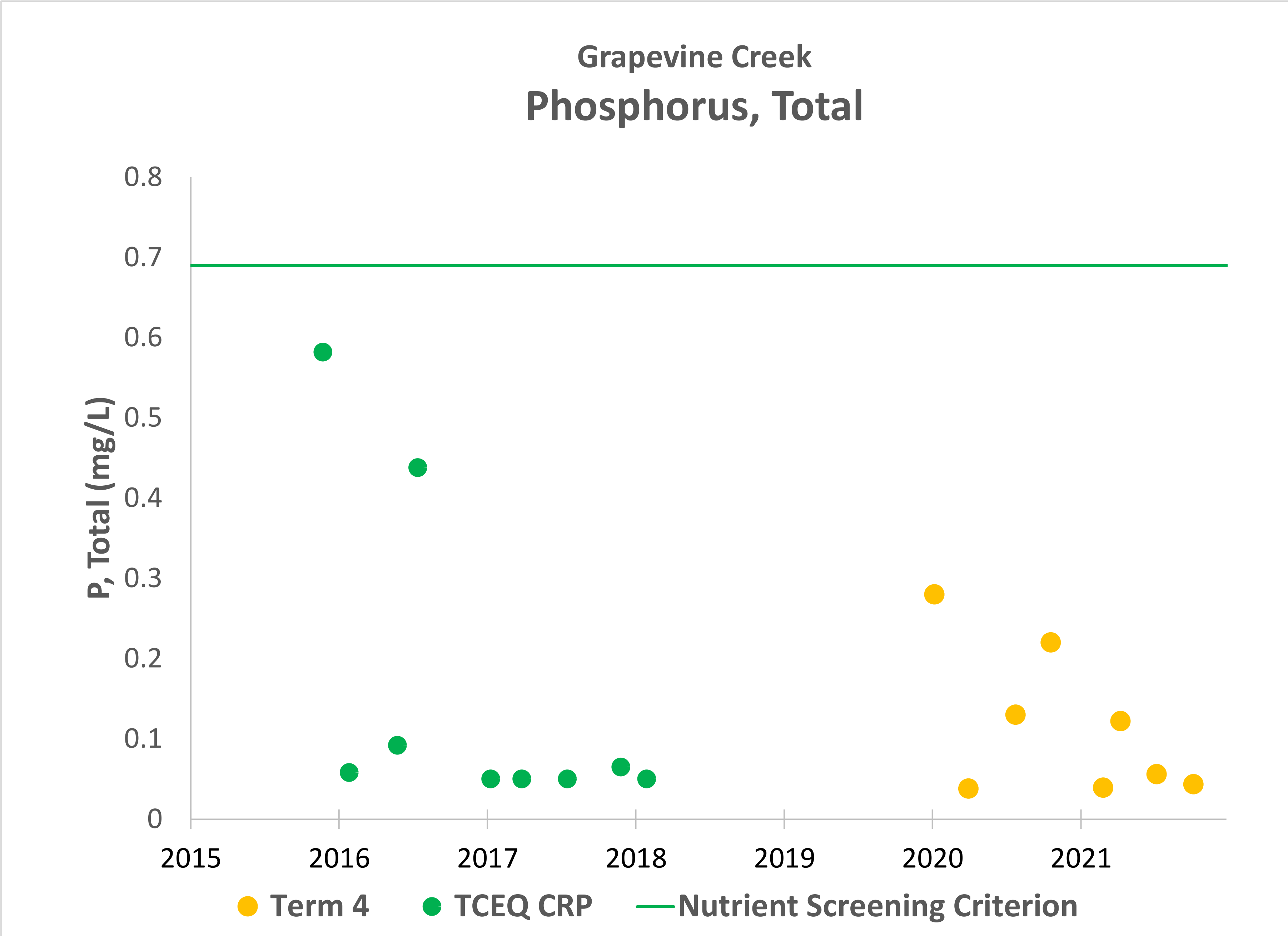
Grapevine Creek
Nitrogen, Total
N, Total (mg/L)
0
1
2
3
4
5
6
7
8
9
2018
2019
2020
2021
Term 4
NSQD Third Quartile

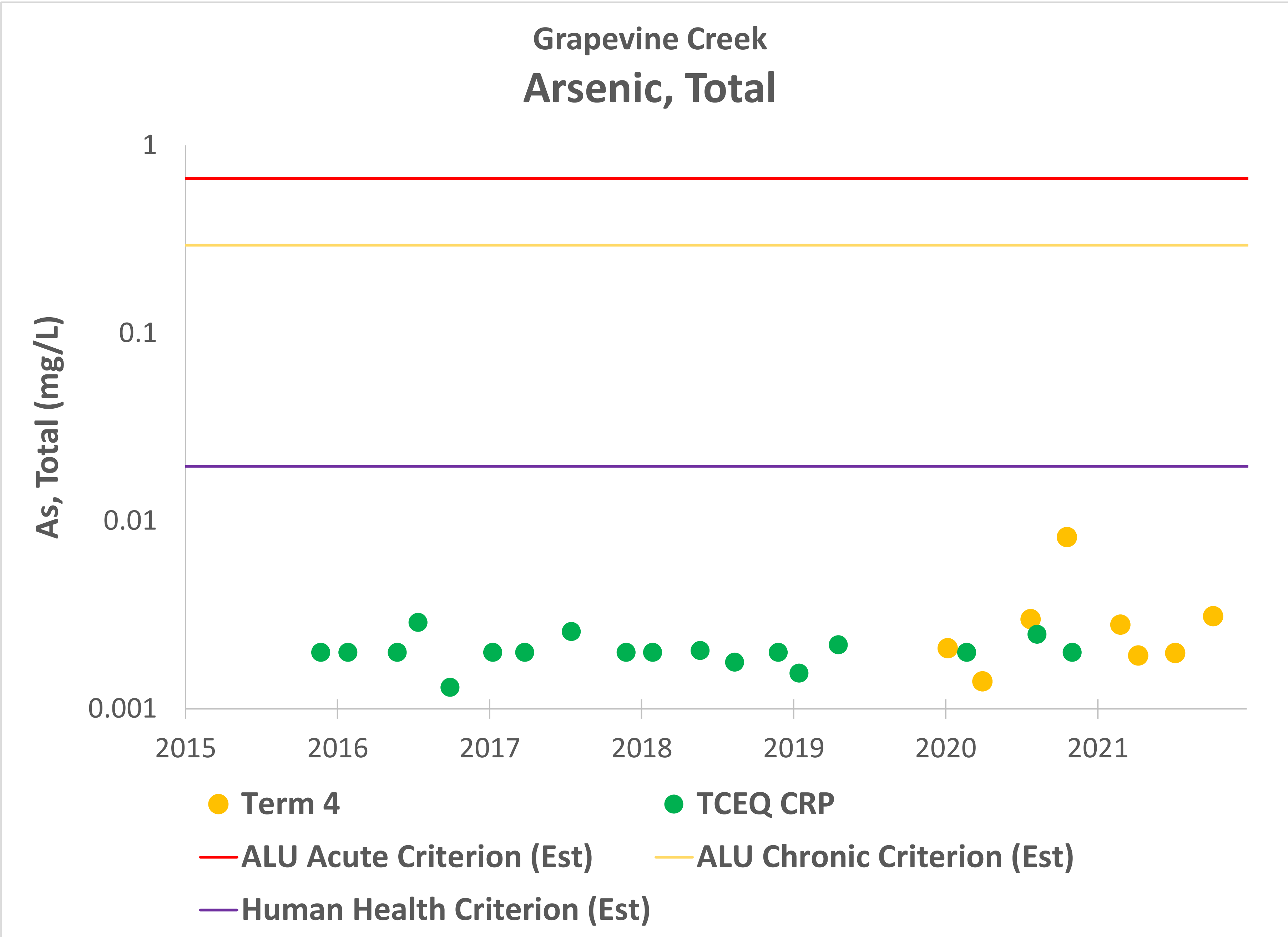


Grapevine Creek
Orthophosphate
Orthophosphate (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2015
2016
2017
2018
2019
2020
2021
Term 4
TCEQ CRP
Nutrient Screening Criterion

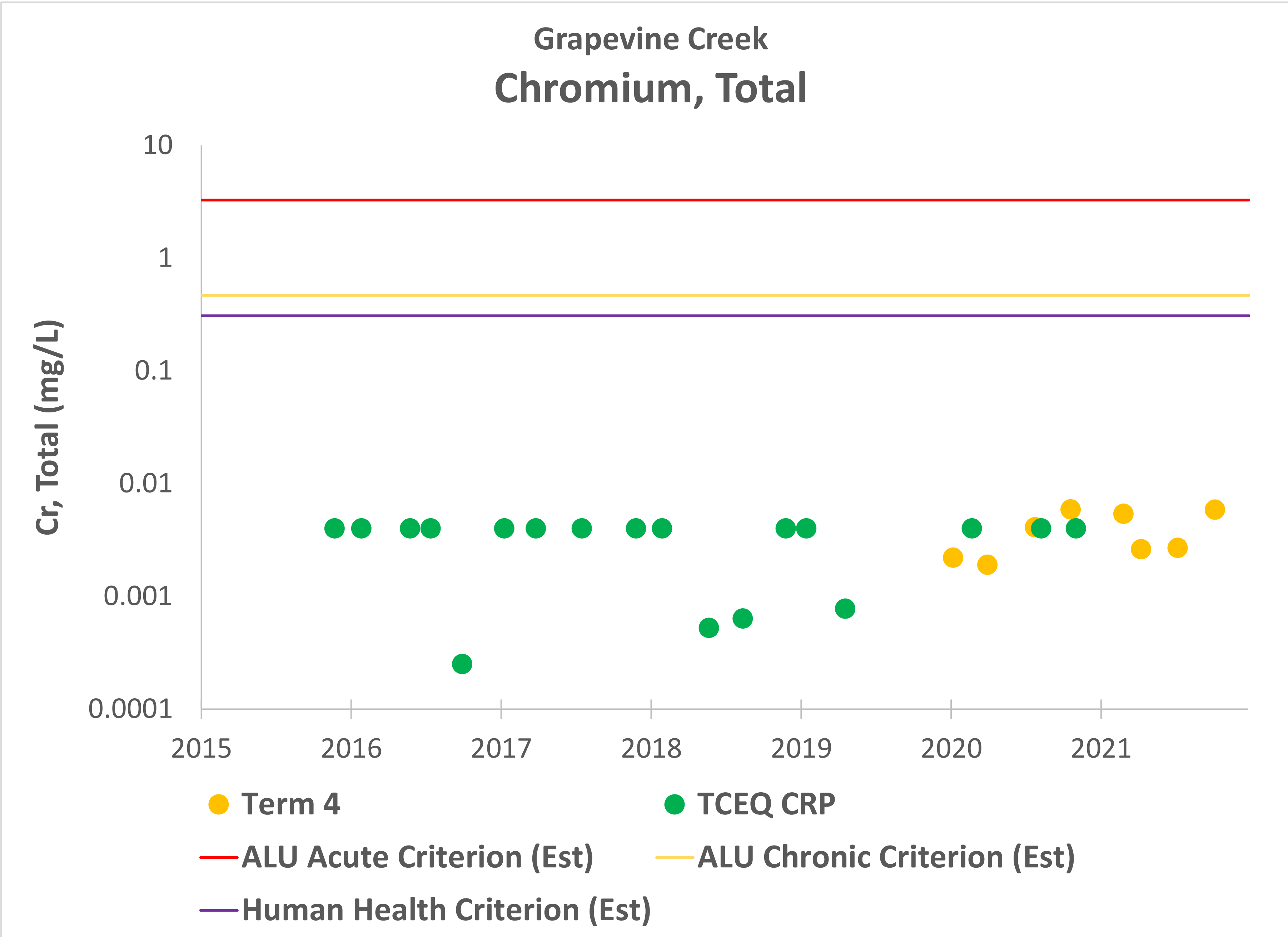


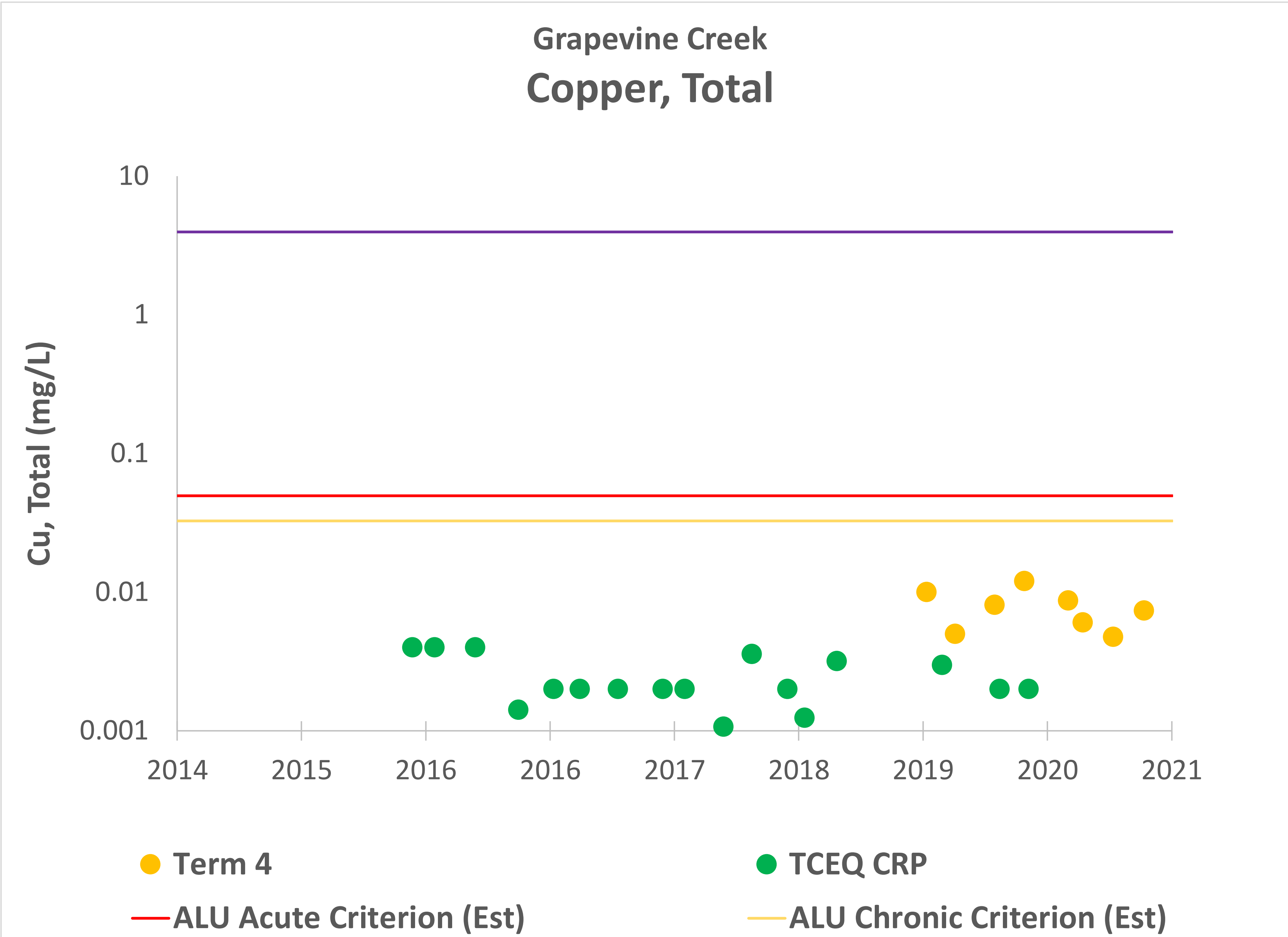
Grapevine Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
2018
2019
2020
2021
Term 4
NSQD Third Quartile


Grapevine Creek
Phosphorus, Total
P, Total (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2015
2016
2017
2018
2019
2020
2021
Term 4
TCEQ CRP
Nutrient Screening Criterion

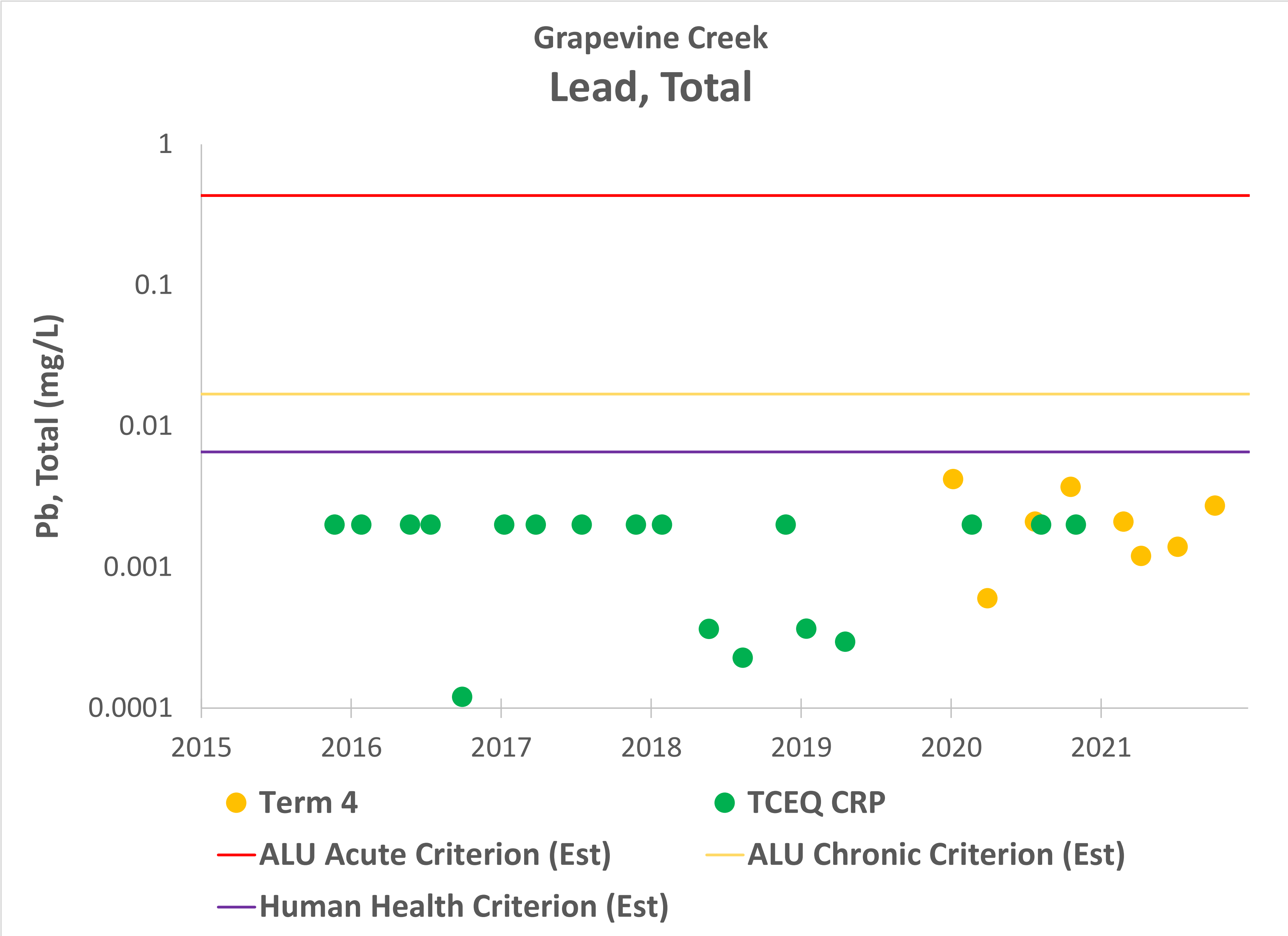


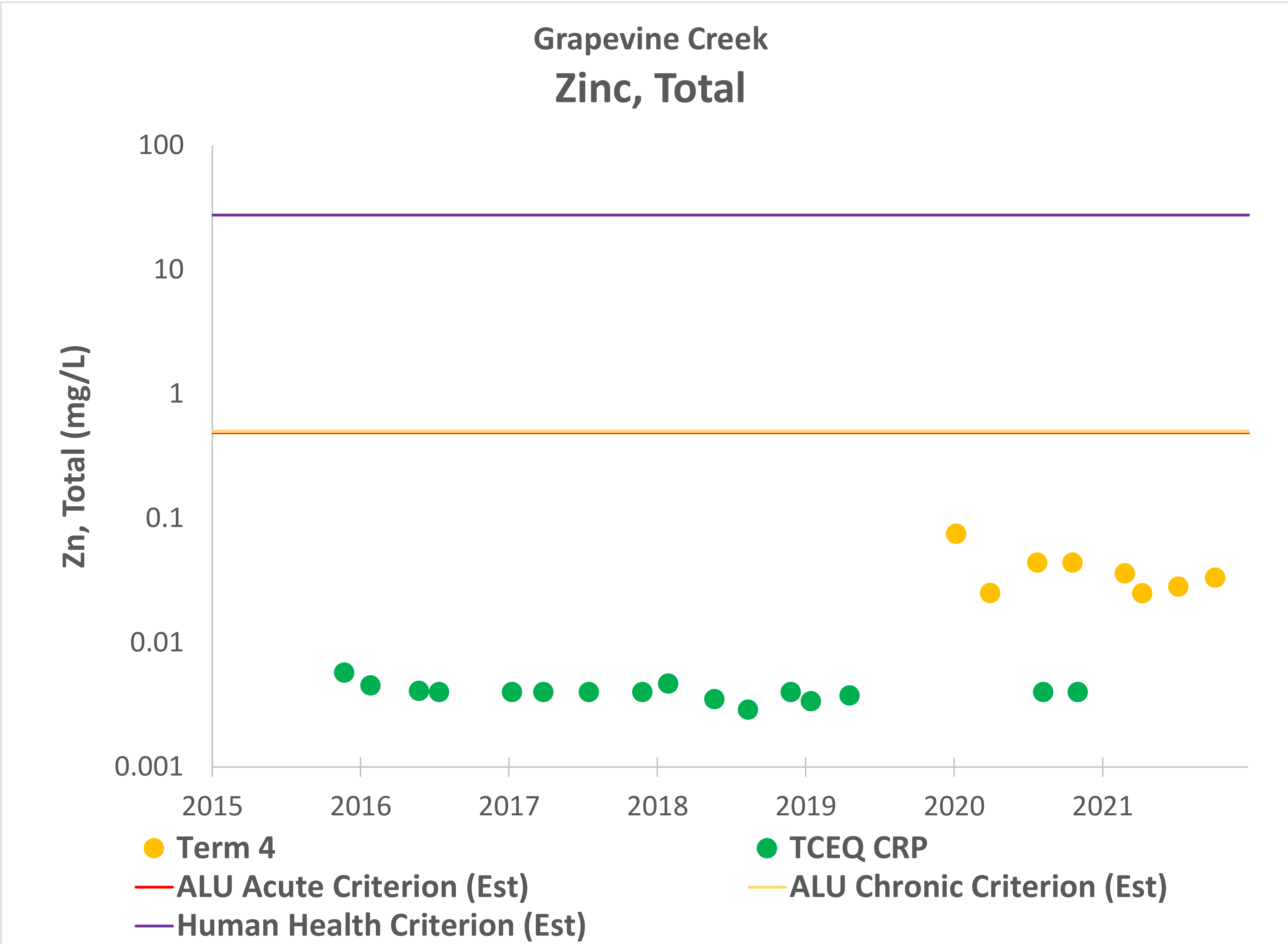
Grapevine Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2015
2016
2017
2018
2019
2020
2021
Term 4
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)


Grapevine Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
0.0001
2015
2016
2017
2018
2019
2020
2021
Term 4
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

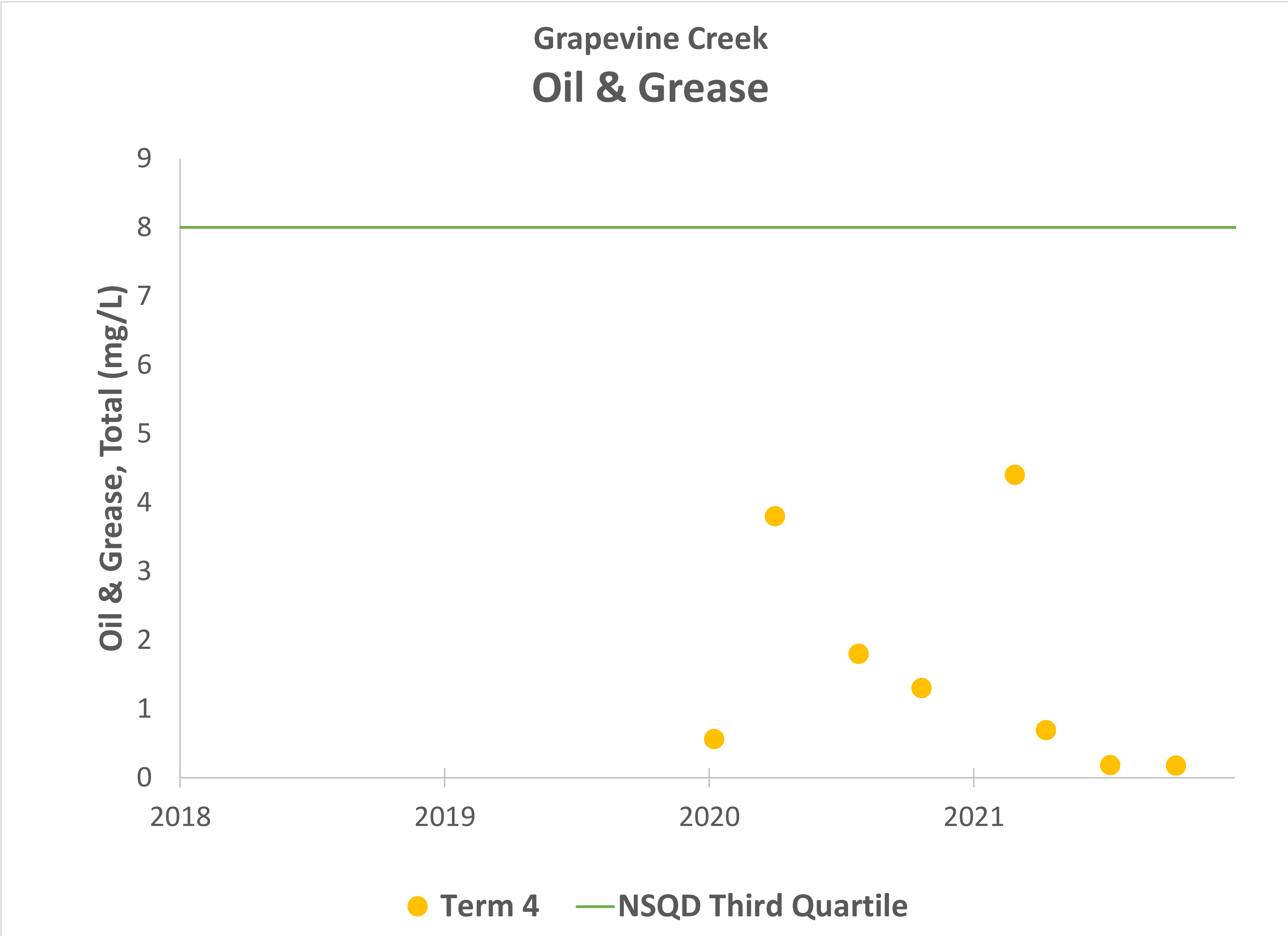


Grapevine Creek
Copper, Total
Cu, Total (mg/L)
10
1
0.1
0.01
0.001
2014
2015
2016
2016
2017
2018
2019
2020
2021
Term 4
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)

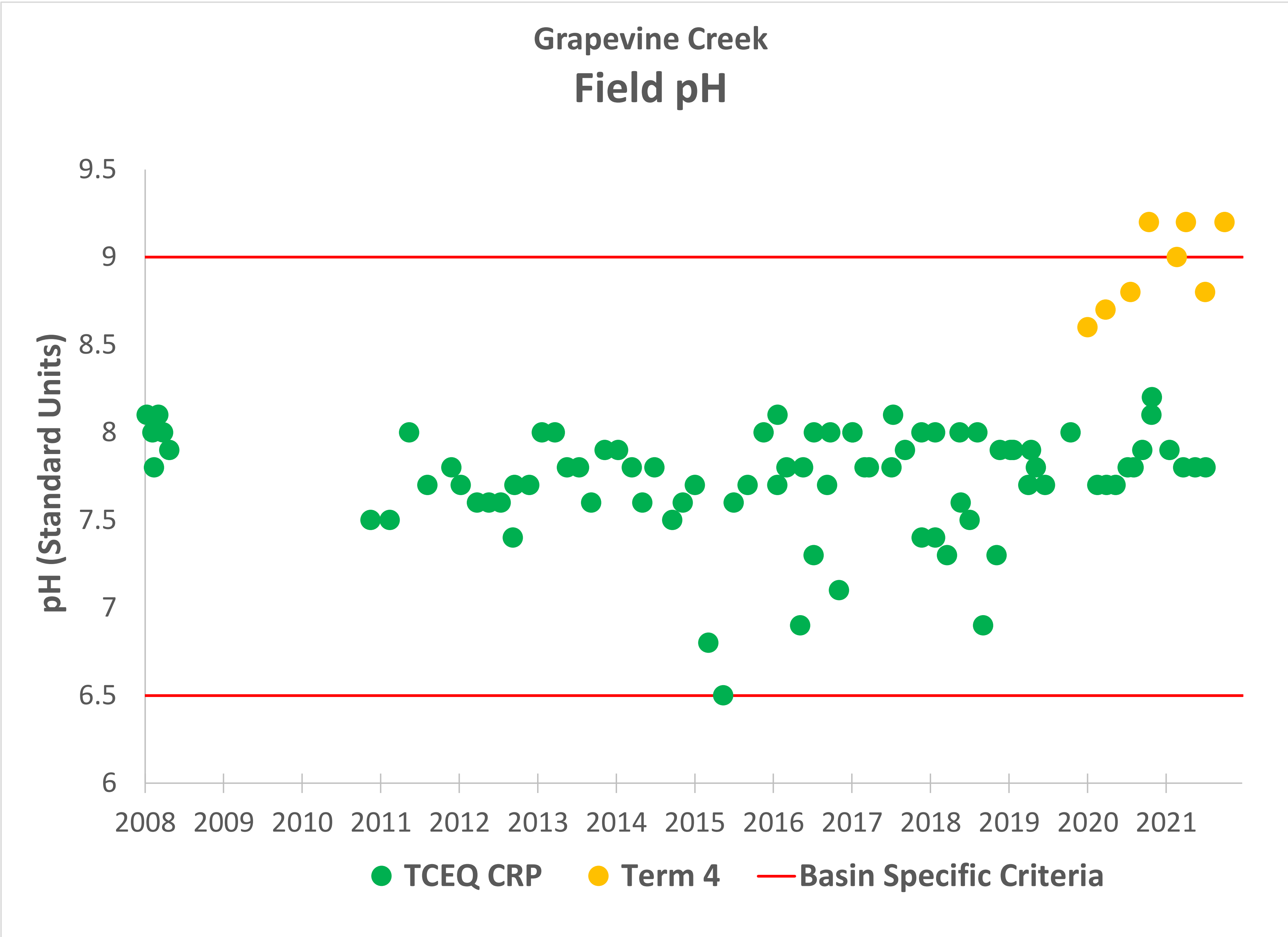

Grapevine Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2015
2016
2017
2018
2019
2020
2021
Term 4
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

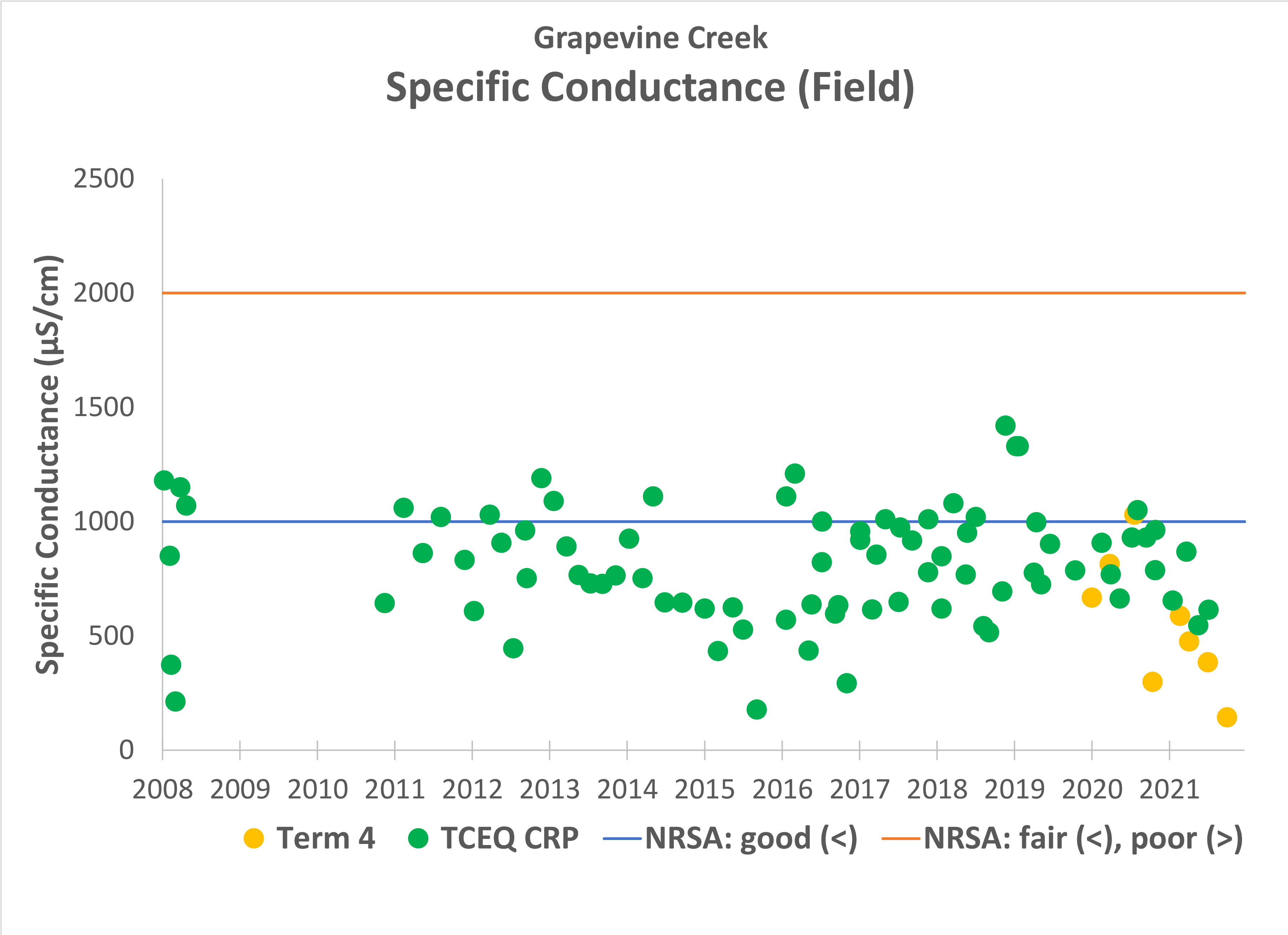


Grapevine Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2015
2016
2017
2018
2019
2020
2021
Term 4
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

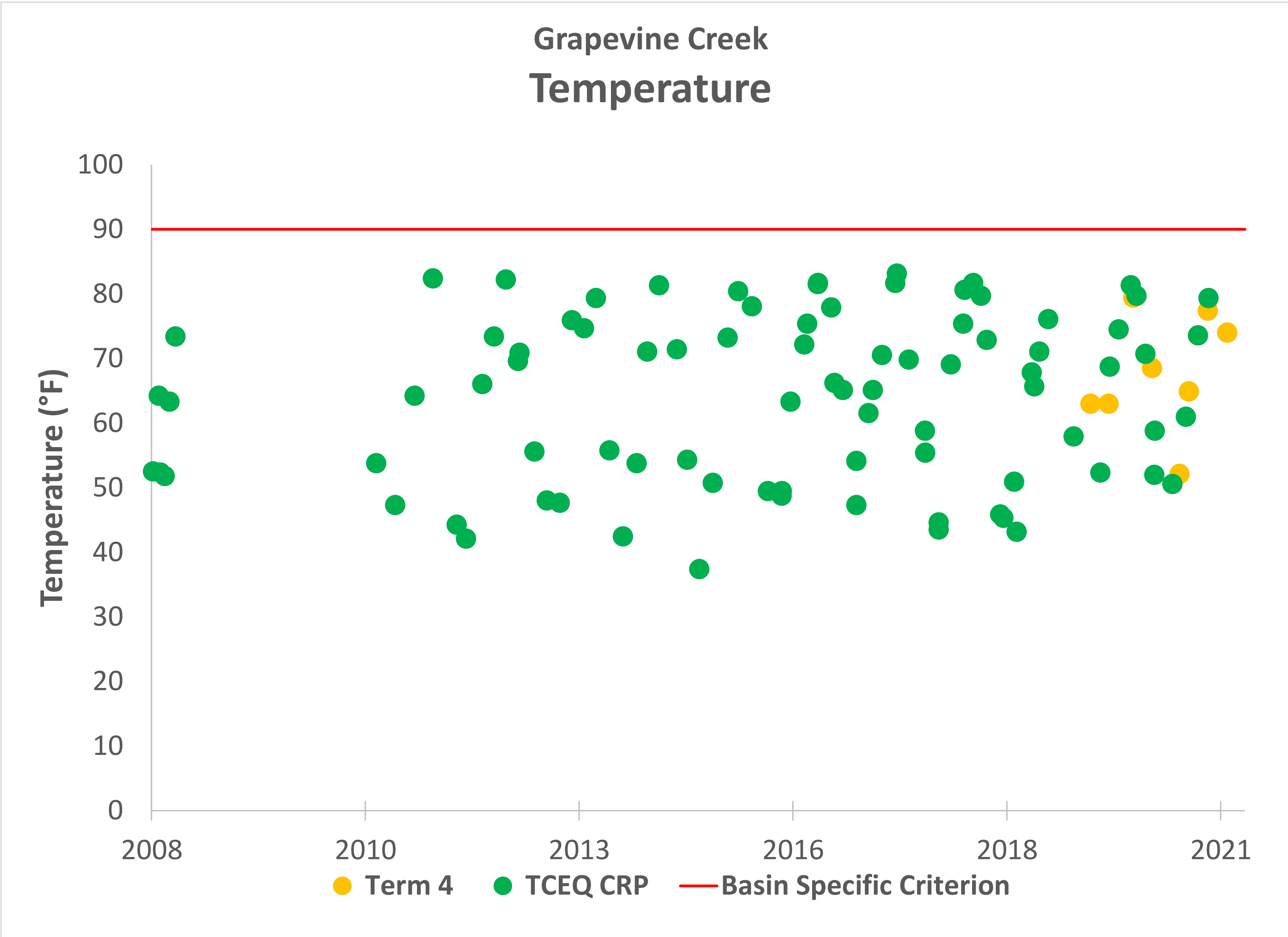


Grapevine Creek
Oil & Grease
Oil & Grease, Total (mg/L)
9
8
7
6
5
4
3
2
1
0
2018
2019
2020
2021
Term 4
NSQD Third Quartile

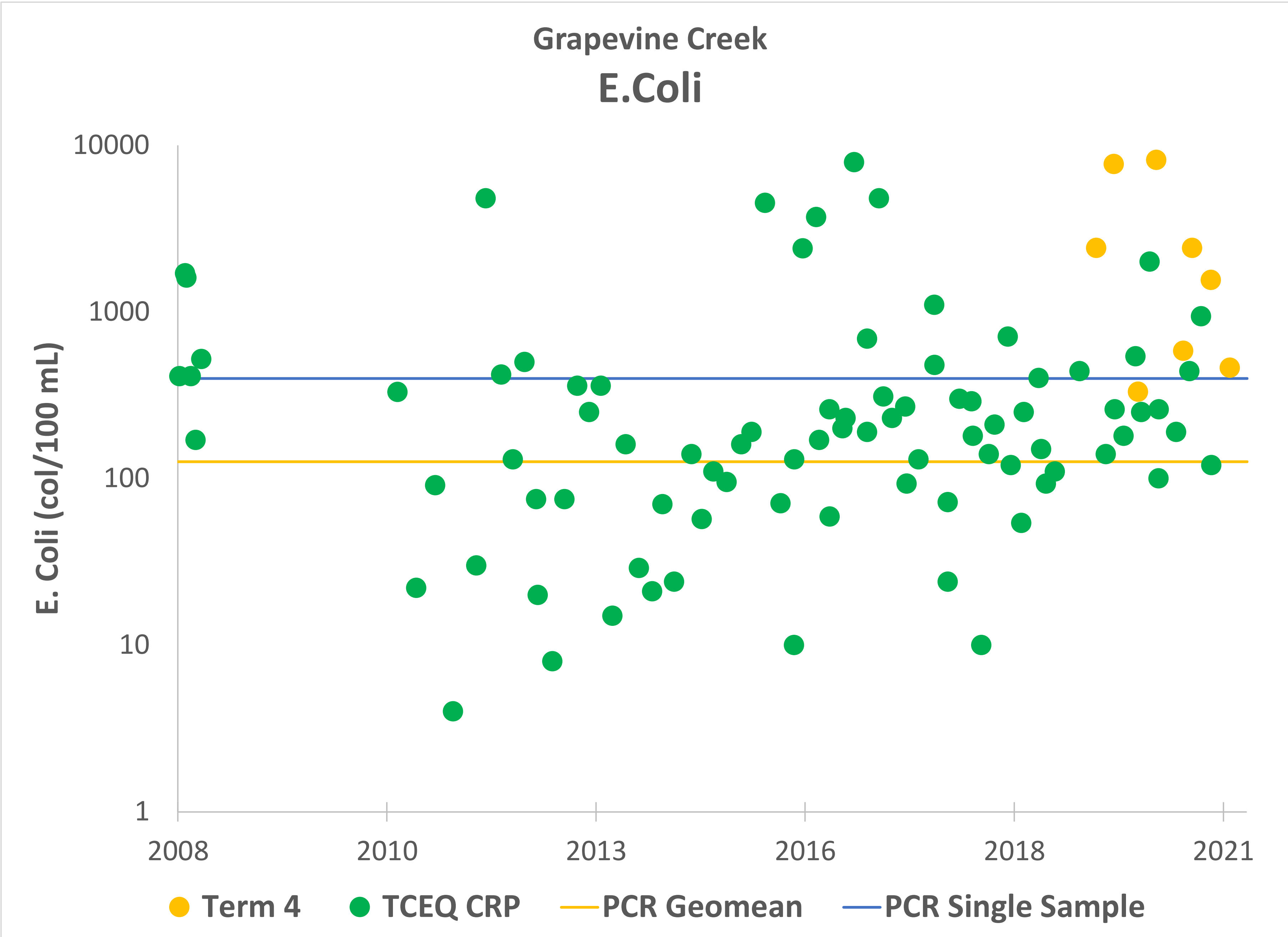

Grapevine Creek
Field pH
pH (Standard Units)
9.5
9
8.5
8
7.5
7
6.5
6
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
TCEQ CRP
Term 4
Basin Specific Criteria



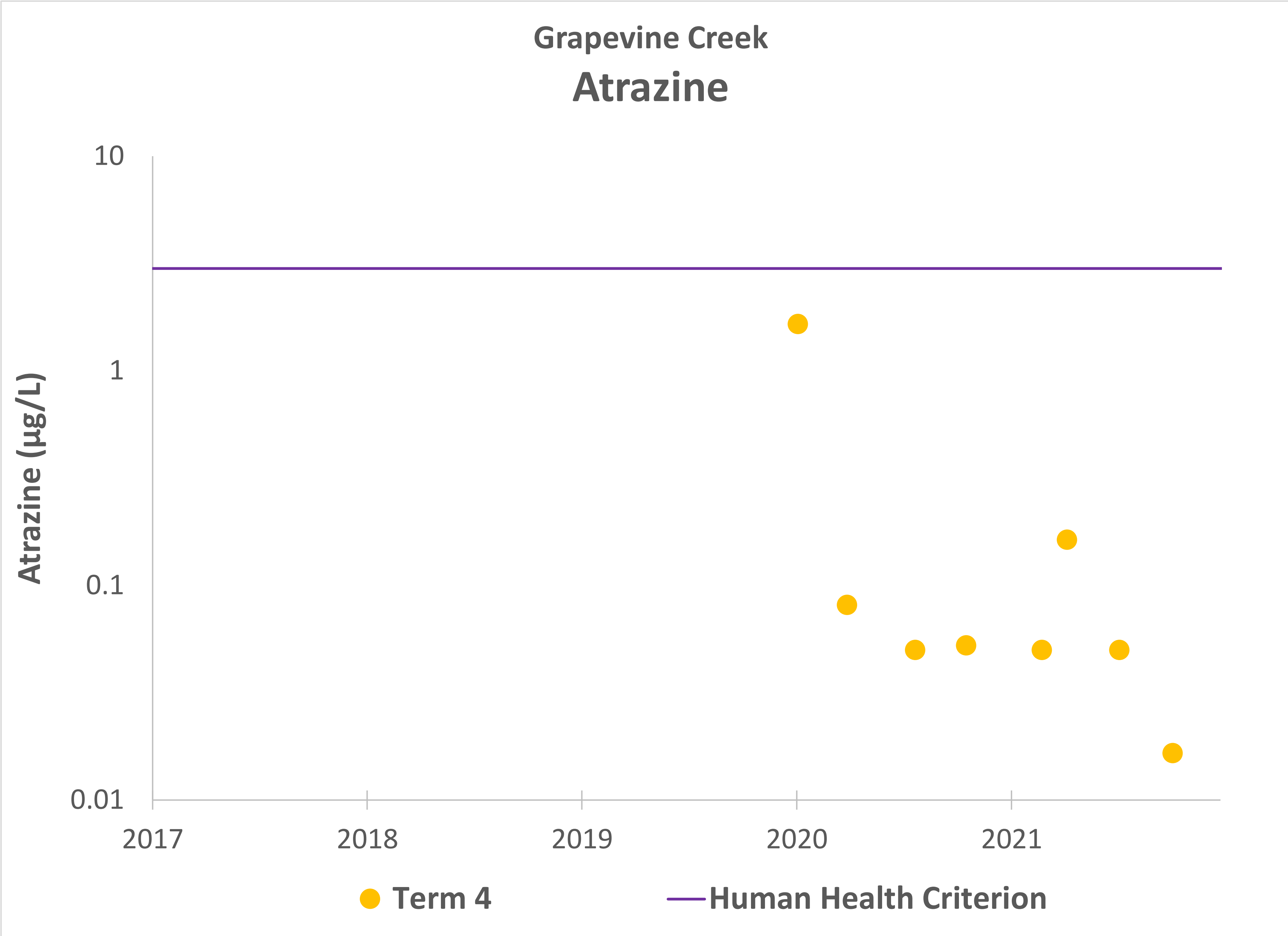
Grapevine Creek
Specific Conductance (Field)
Specific Conductance (µS/cm)
2500
2000
1500
1000
500
0
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
TCEQ CRP
NRSA: good (<)
NRSA: fair (<), poor (>)



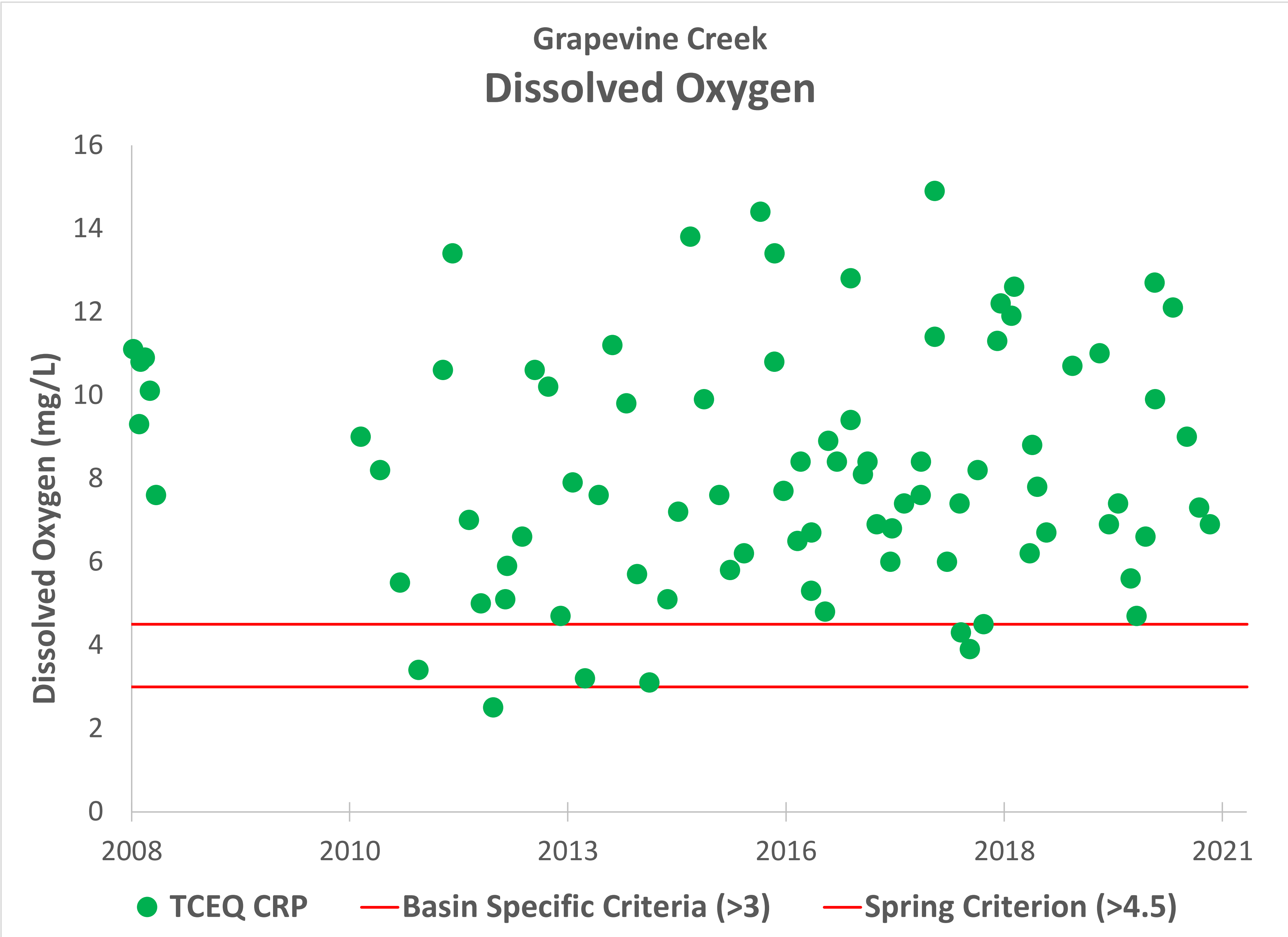
Grapevine Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2008
2010
2013
2016
2018
2021
Term 4
TCEQ CRP
Basin Specific Criterion



Grapevine Creek
E.Coli
10000
1000
100
10
1
E. Coli (col/100 mL)
2008
2010
2013
2016
2018
2021
Term 4
TCEQ CRP
PCR Geomean
PCR Single Sample

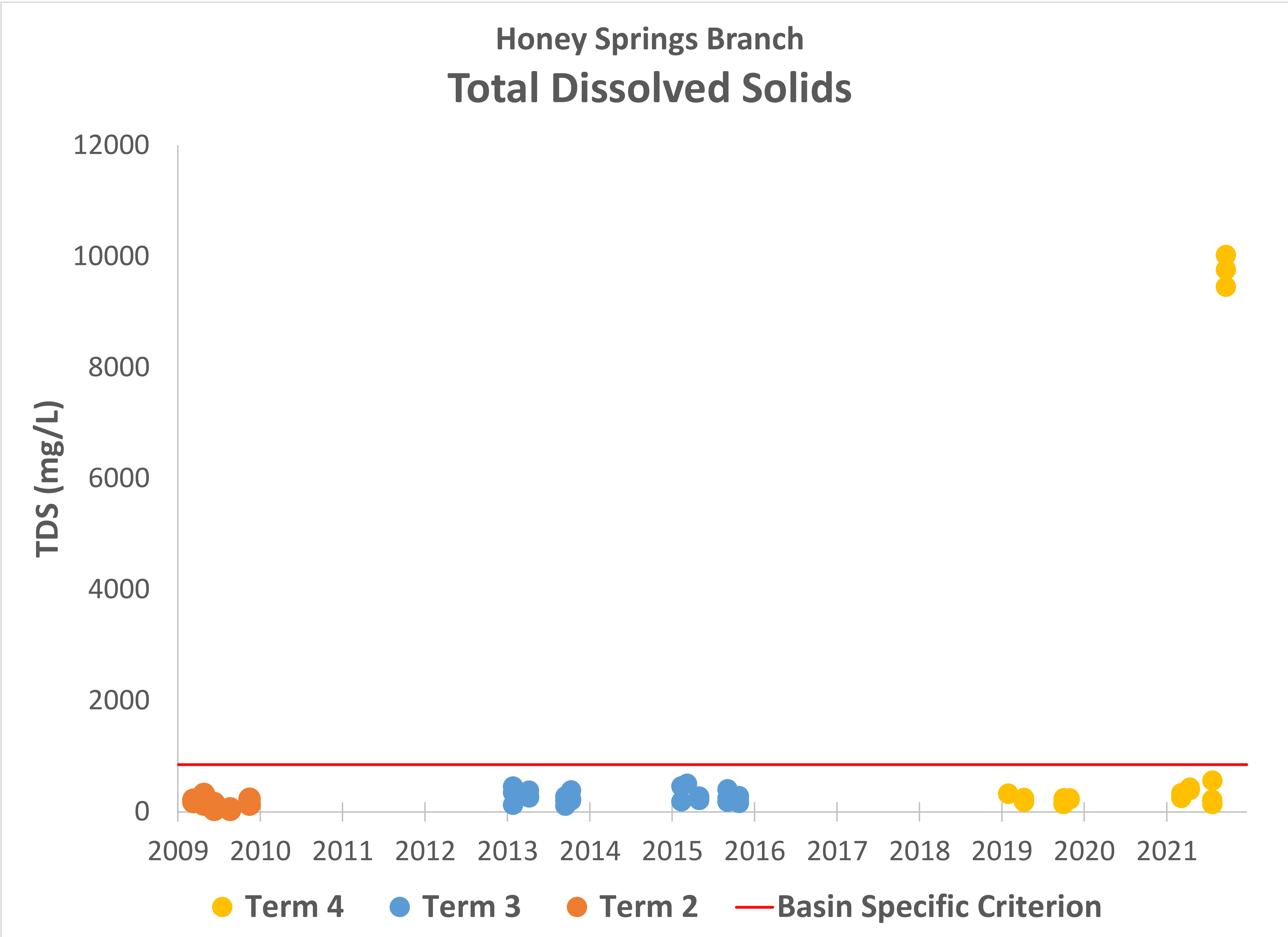


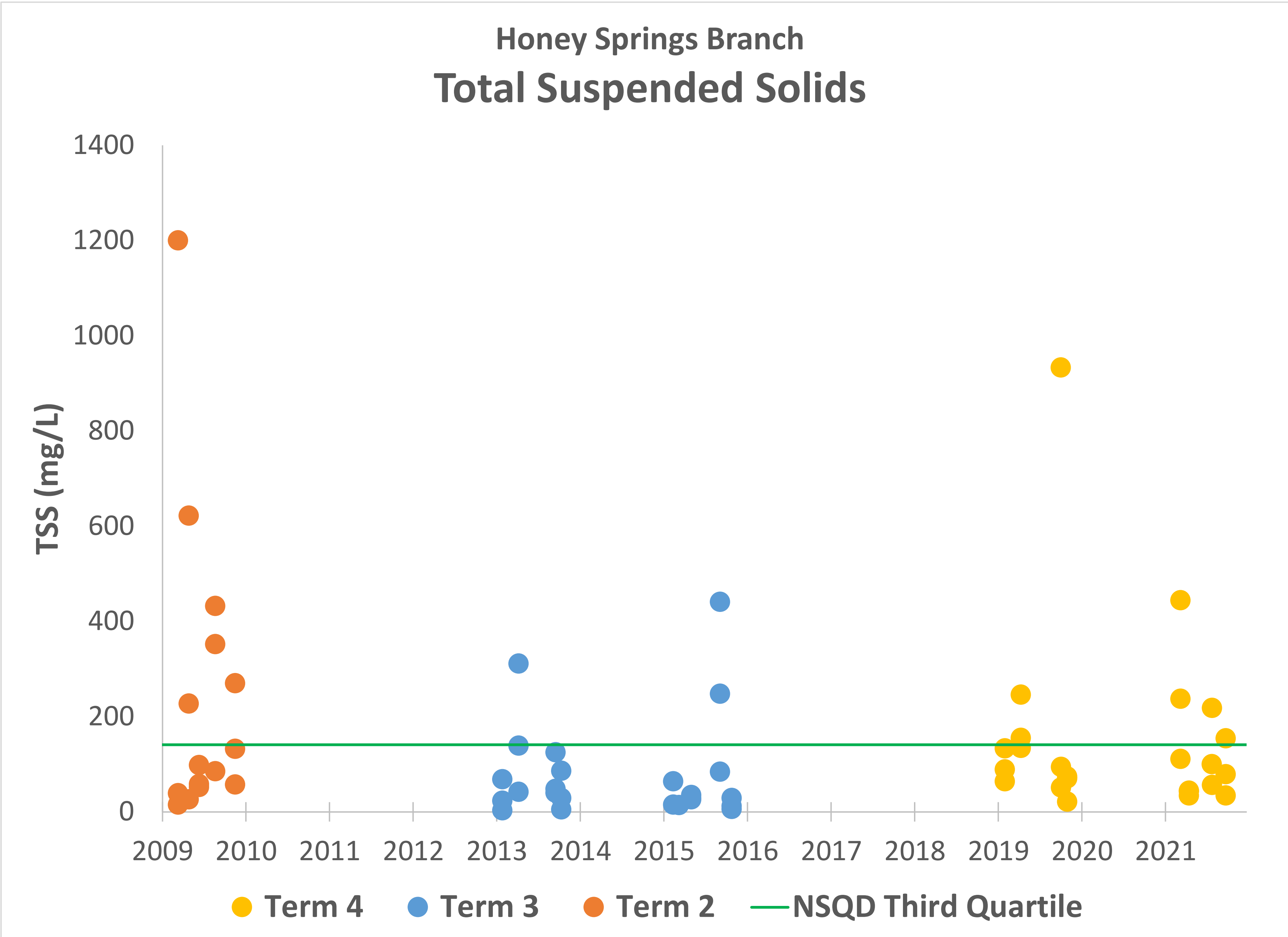
Grapevine Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
2017
2018
2019
2020
2021
Term 4
Human Health Criterion


Grapevine Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
14
16
2008
2010
2013
2016
2018
2021
TCEQ CRP
Basin Specific Criteria (>3)
Spring Criterion (>4.5)

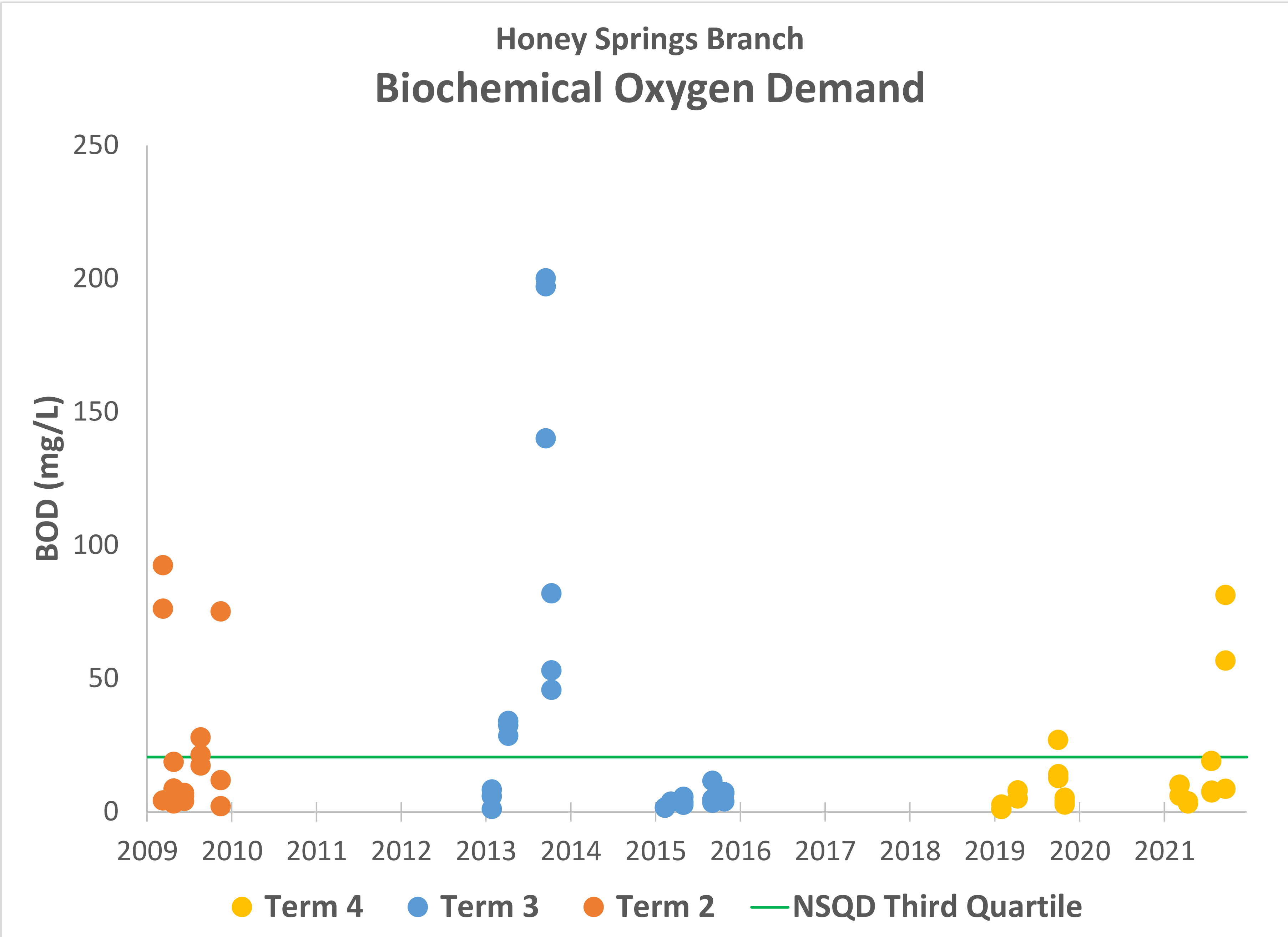
Appendix N

Honey Springs Branch Water Quality Data Graphs

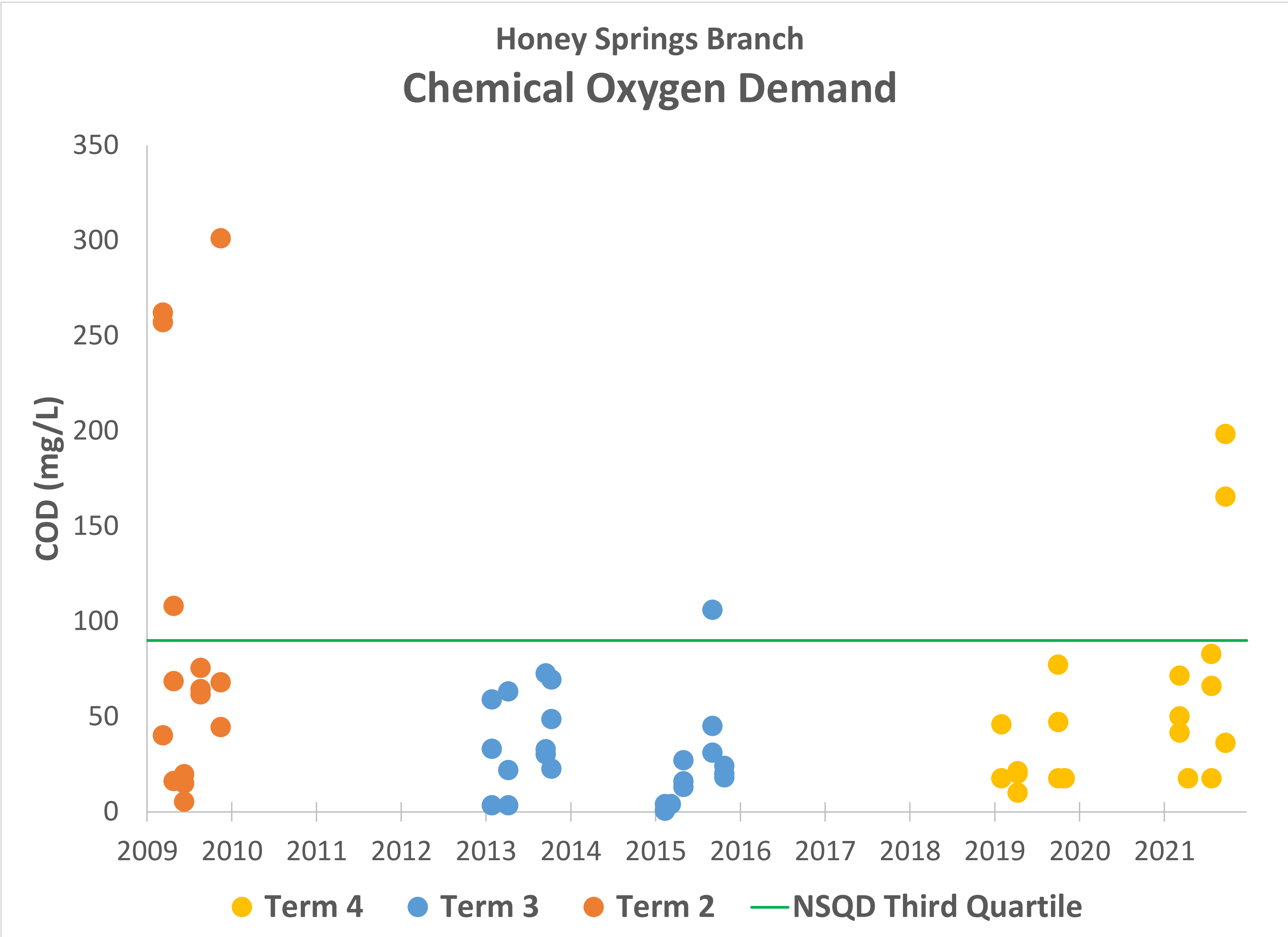

Honey Springs Branch
Total Dissolved Solids
TDS (mg/L)
12000
10000
8000
6000
4000
2000
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
Basin Specific Criterion



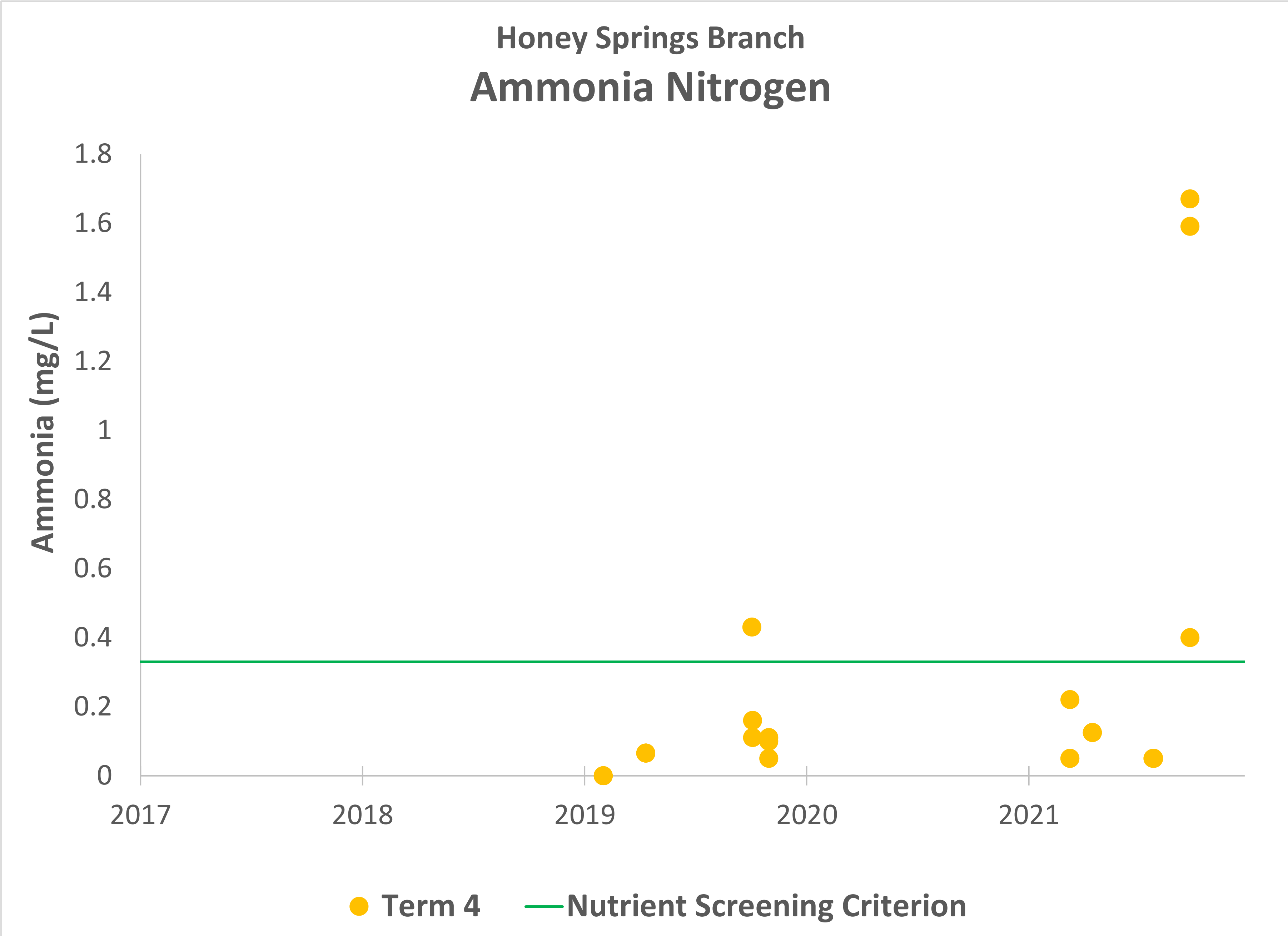
Honey Springs Branch
Total Suspended Solids
TSS (mg/L)
1400
1200
1000
800
600
400
200
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile



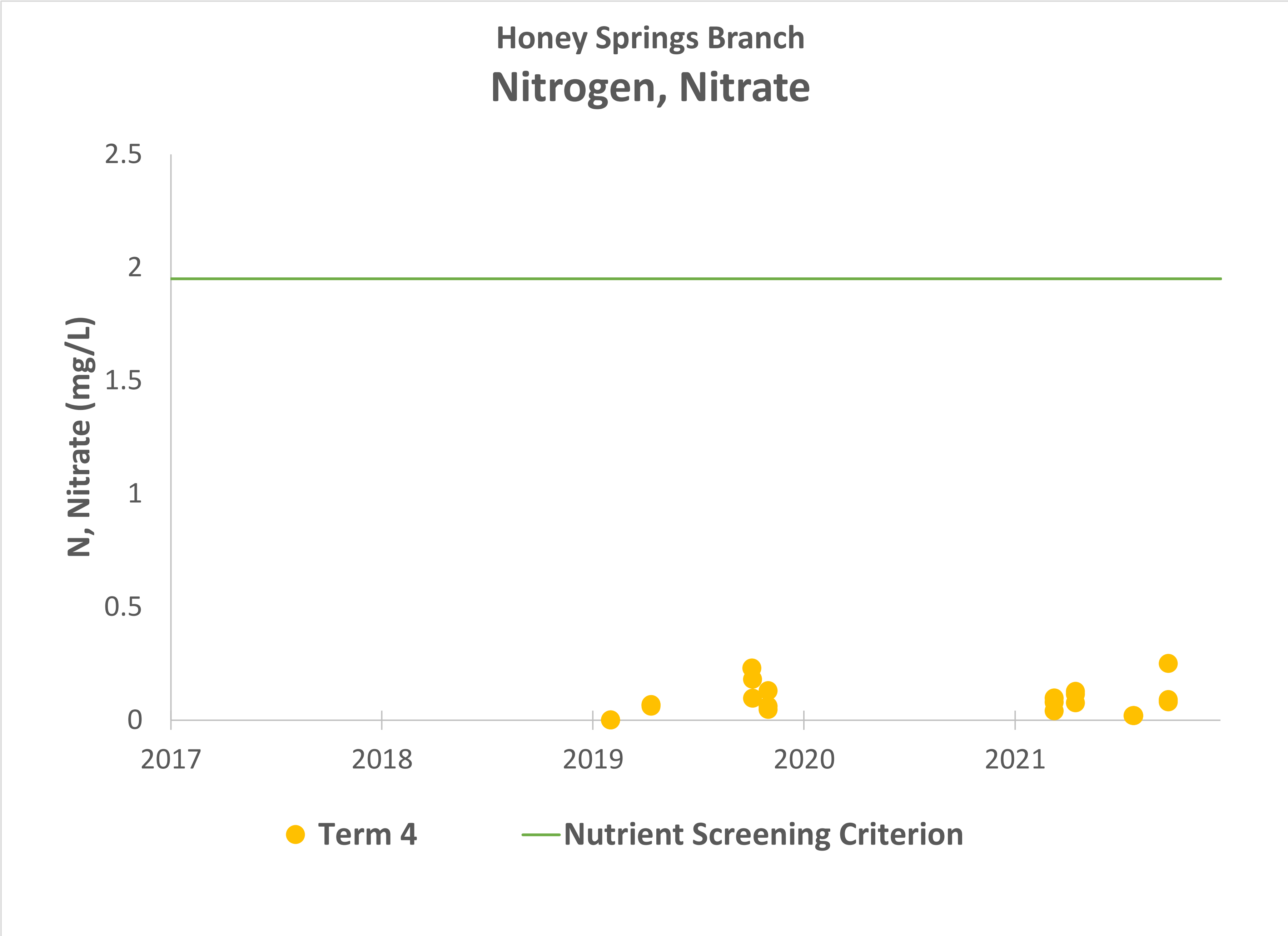
Honey Springs Branch
Biochemical Oxygen Demand
BOD (mg/L)
250
200
150
100
50
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile



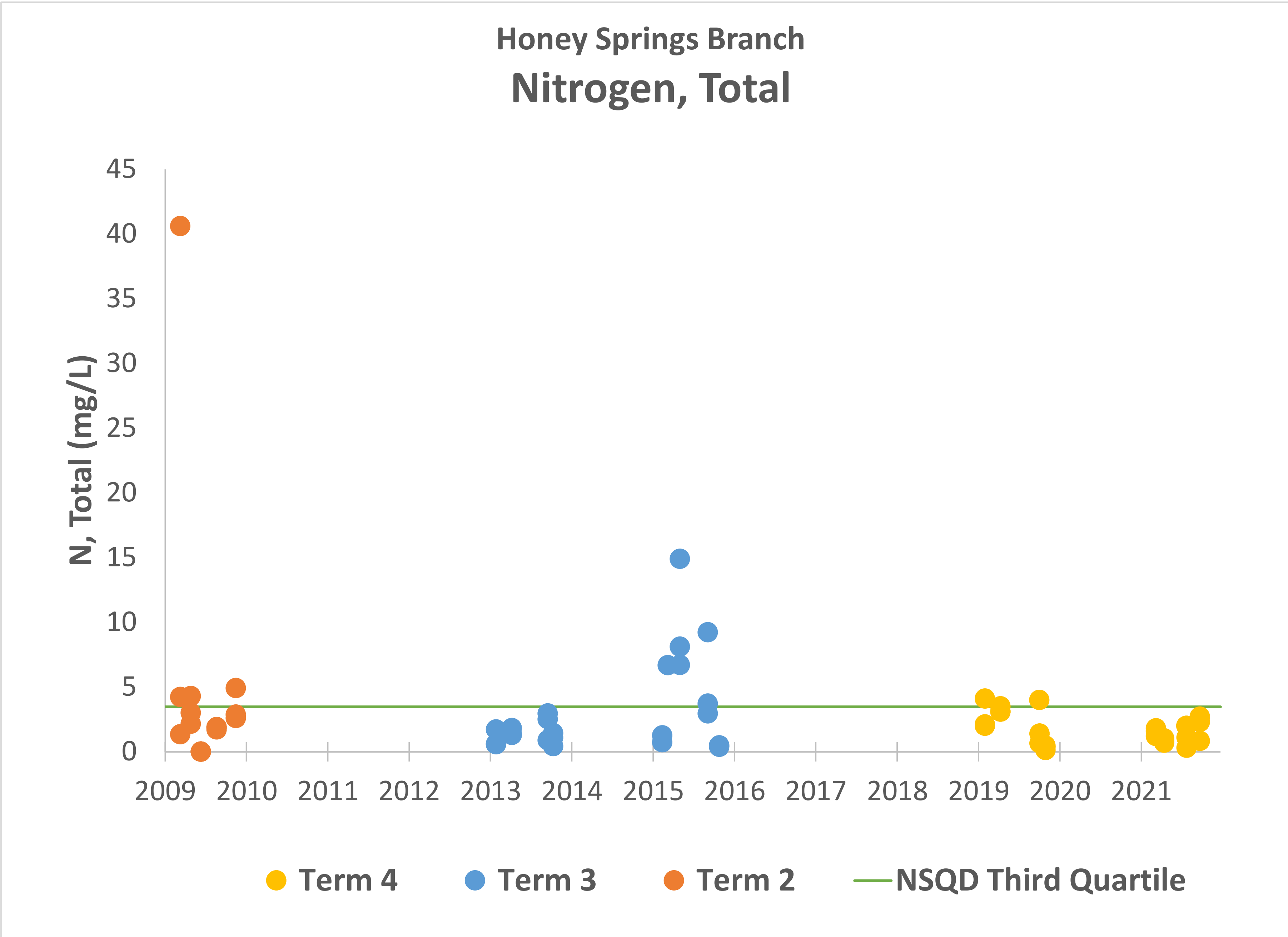
Honey Springs Branch
Chemical Oxygen Demand
COD (mg/L)
350
300
250
200
150
100
50
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile



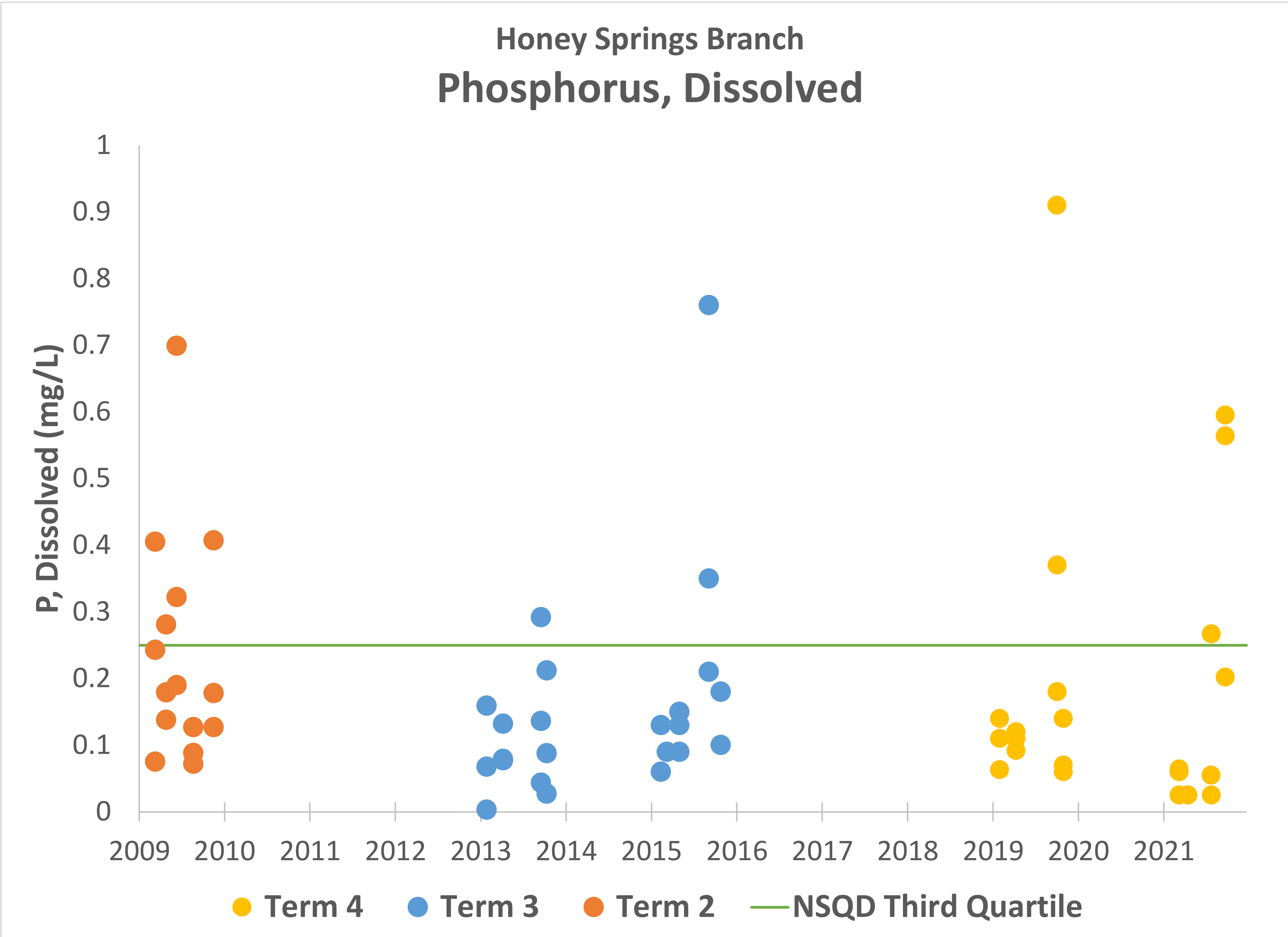
Honey Springs Branch
Ammonia Nitrogen
Ammonia (mg/L)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

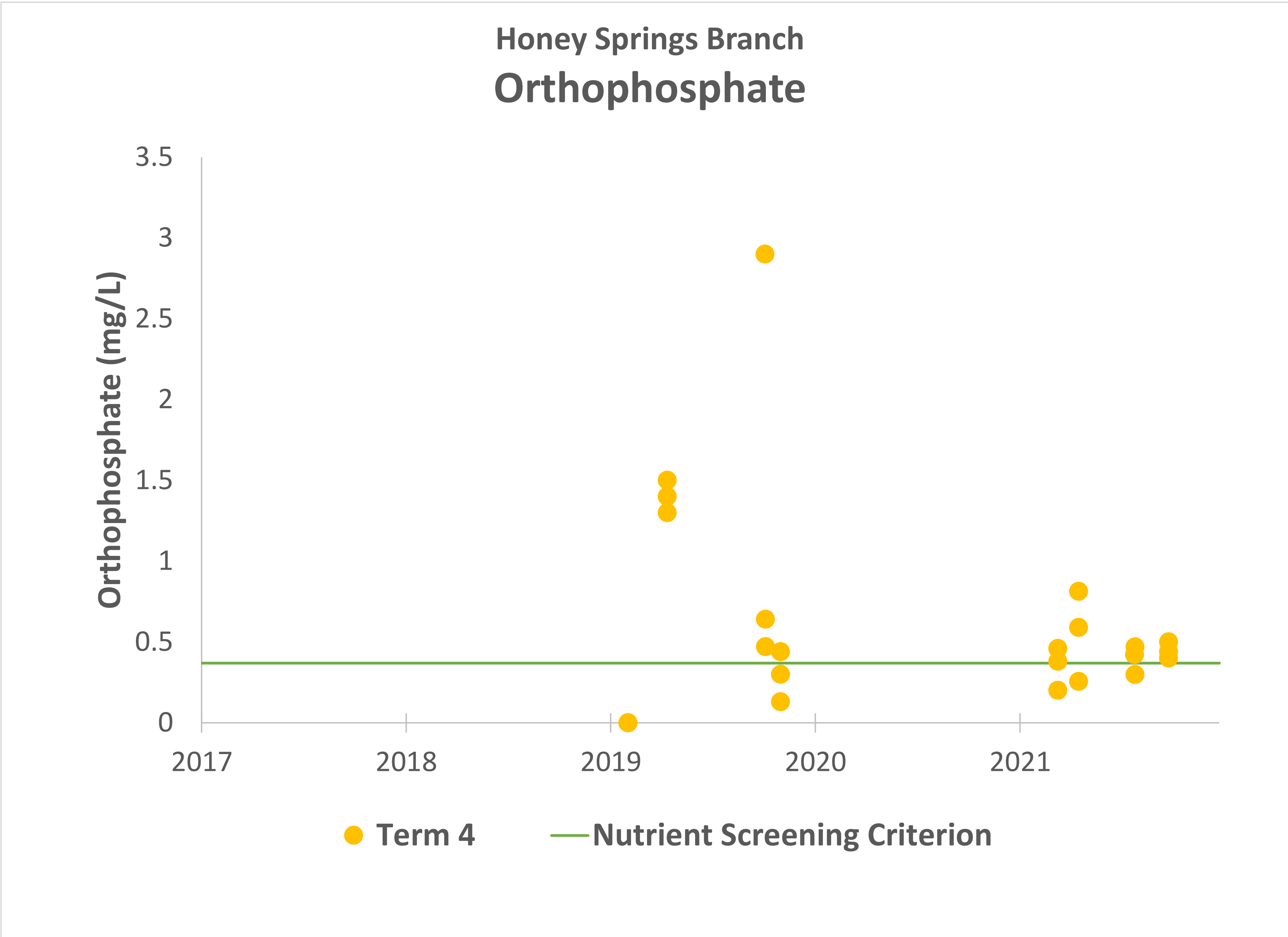


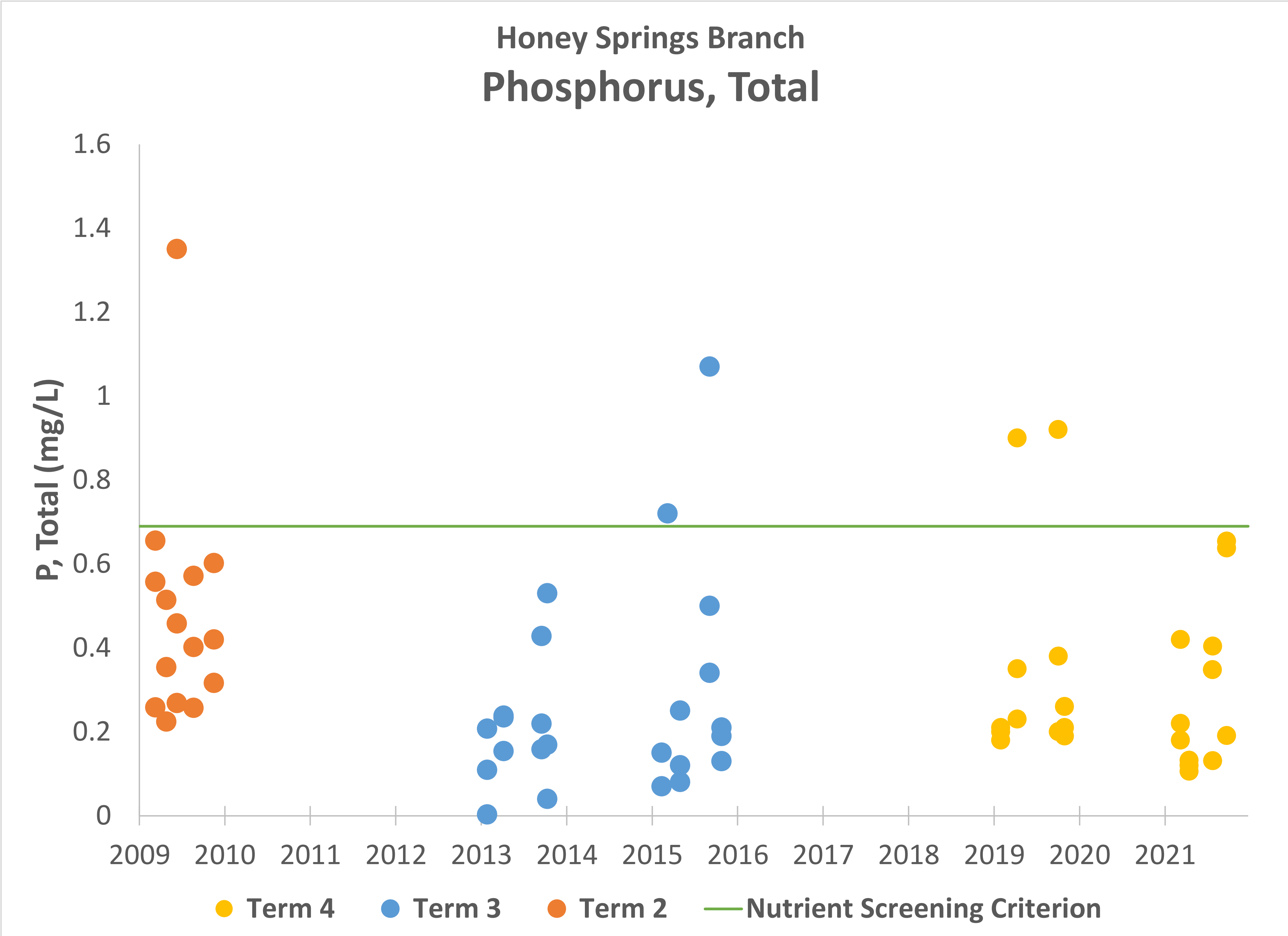
Honey Springs Branch
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion



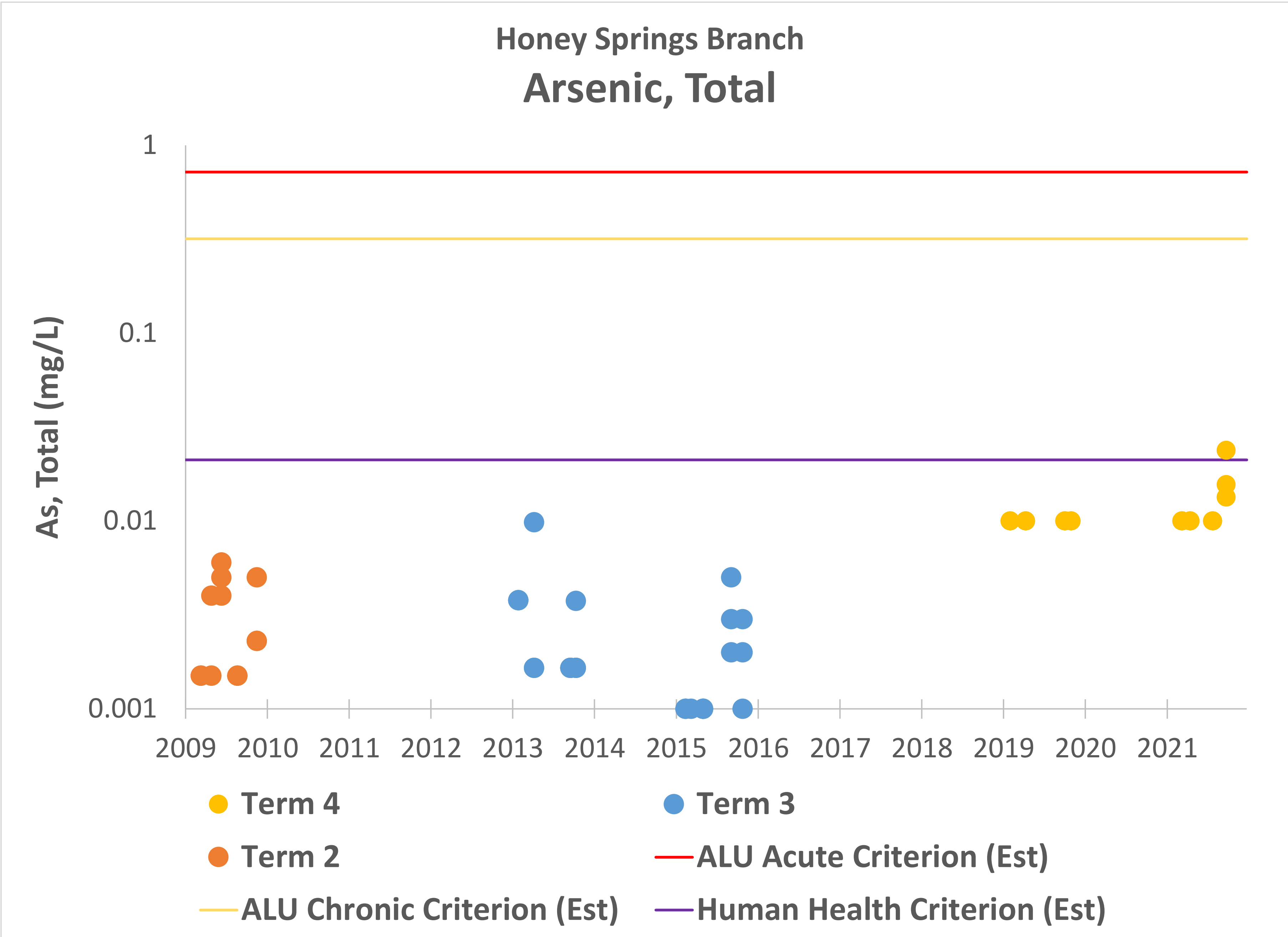
Honey Springs Branch
Nitrogen, Total
N, Total (mg/L)
45
40
35
30
25
20
15
10
5
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile


Honey Springs Branch
Phosphorus, Dissolved
P, Dissolved (mg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

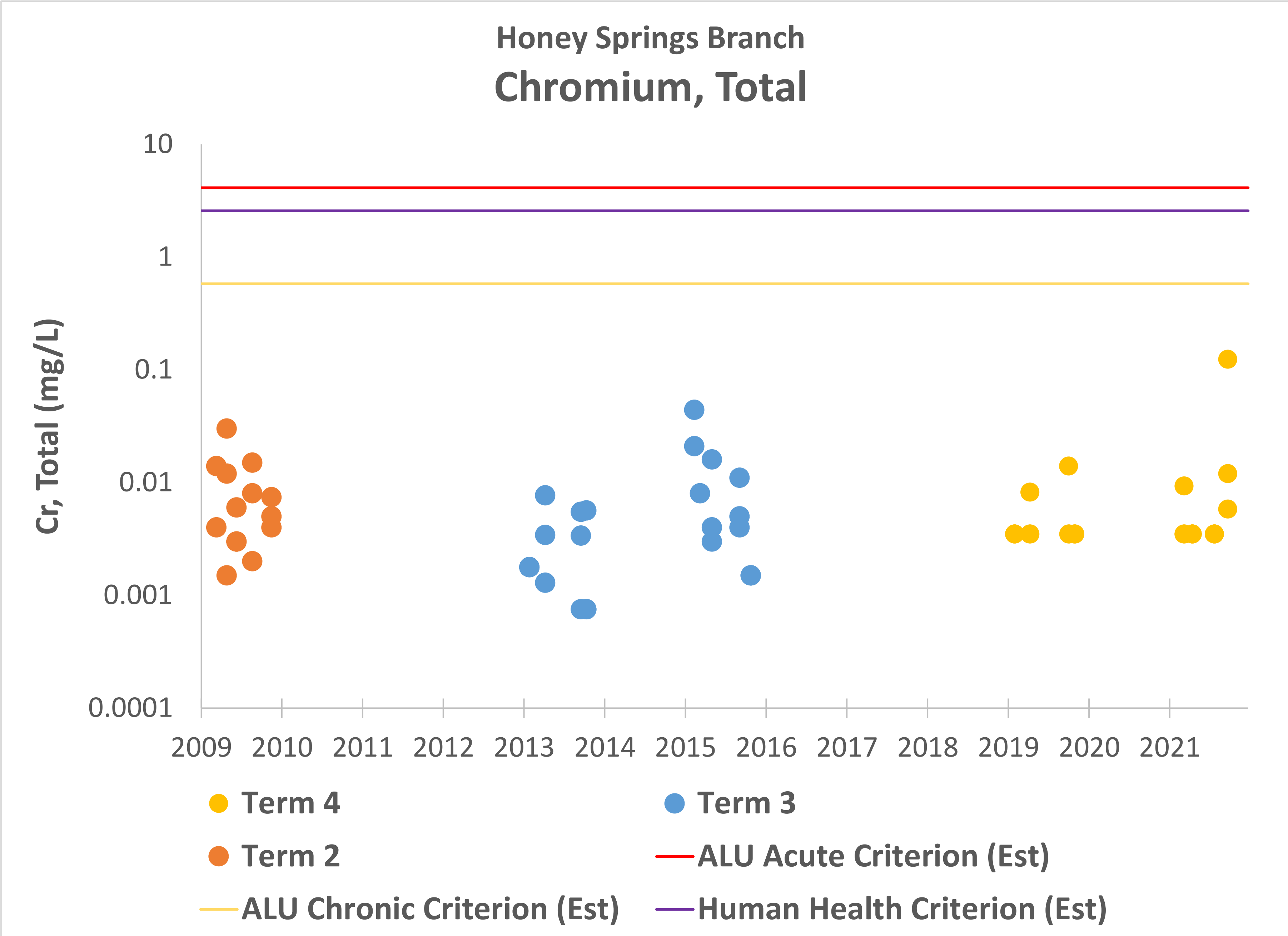

Honey Springs Branch
Orthophosphate
Orthophosphate (mg/L)
3.5
3
2.5
2
1.5
1
0.5
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

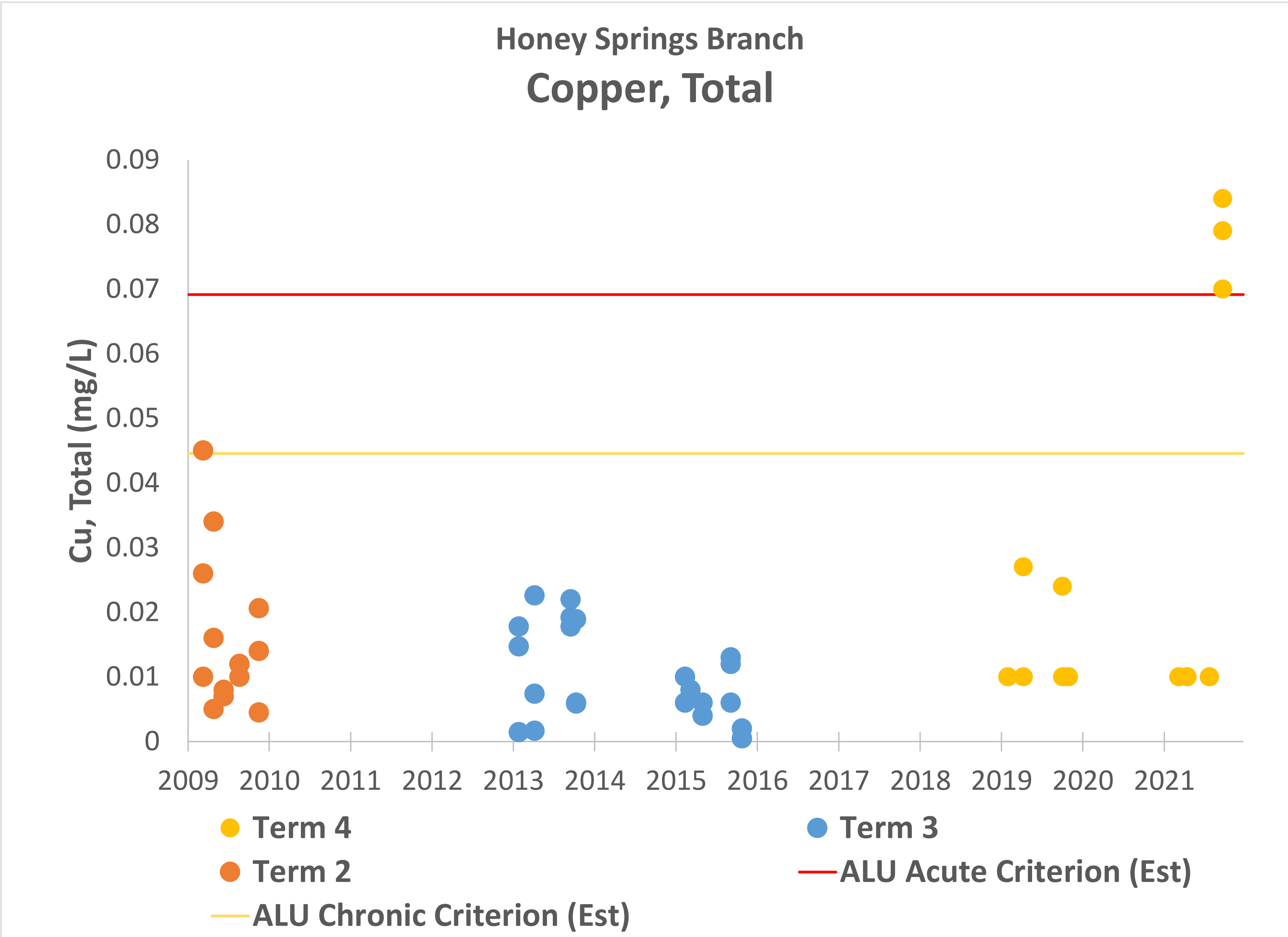


Honey Springs Branch
Phosphorus, Total
P, Total (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
Nutrient Screening Criterion

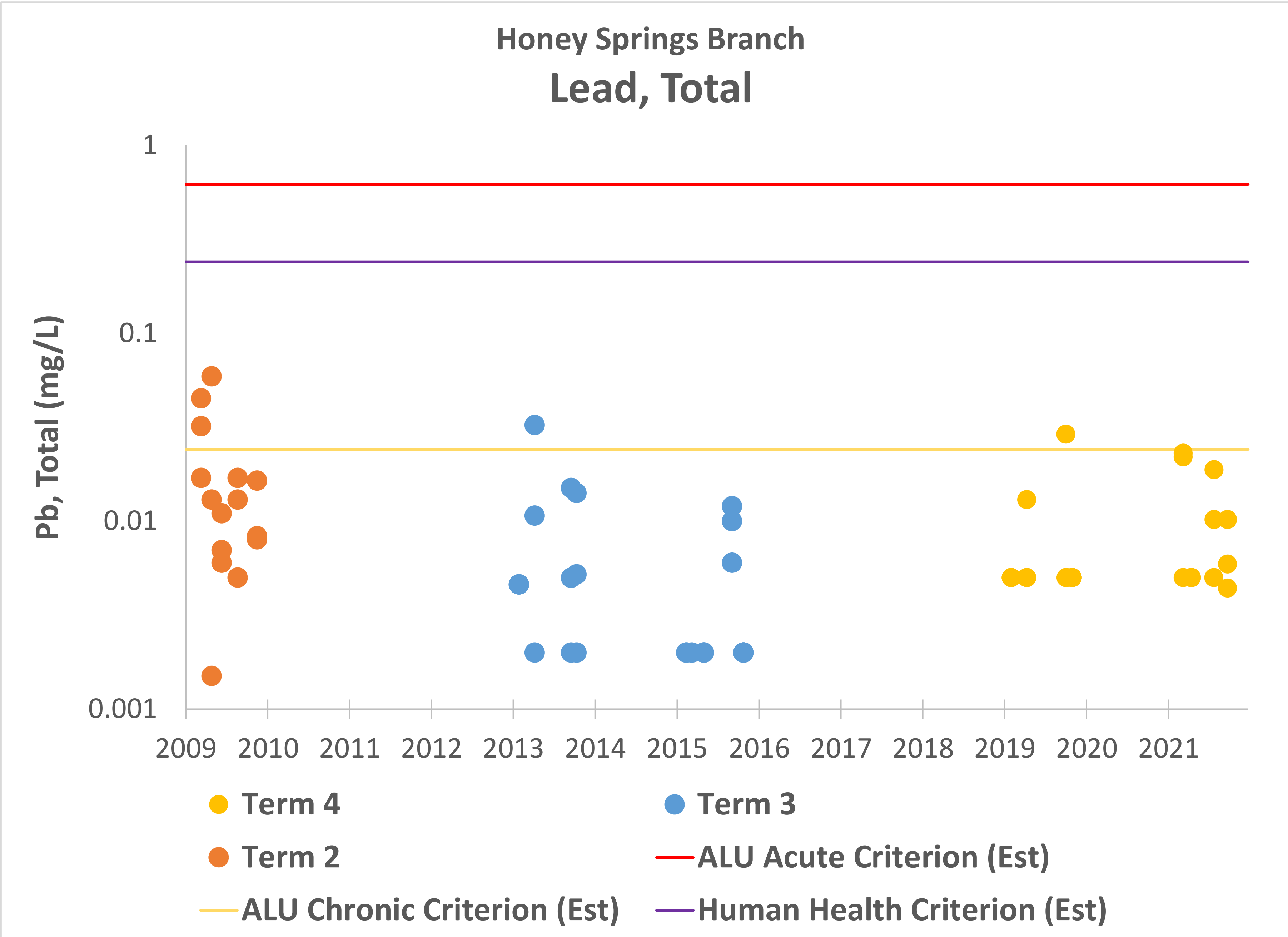


Honey Springs Branch
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

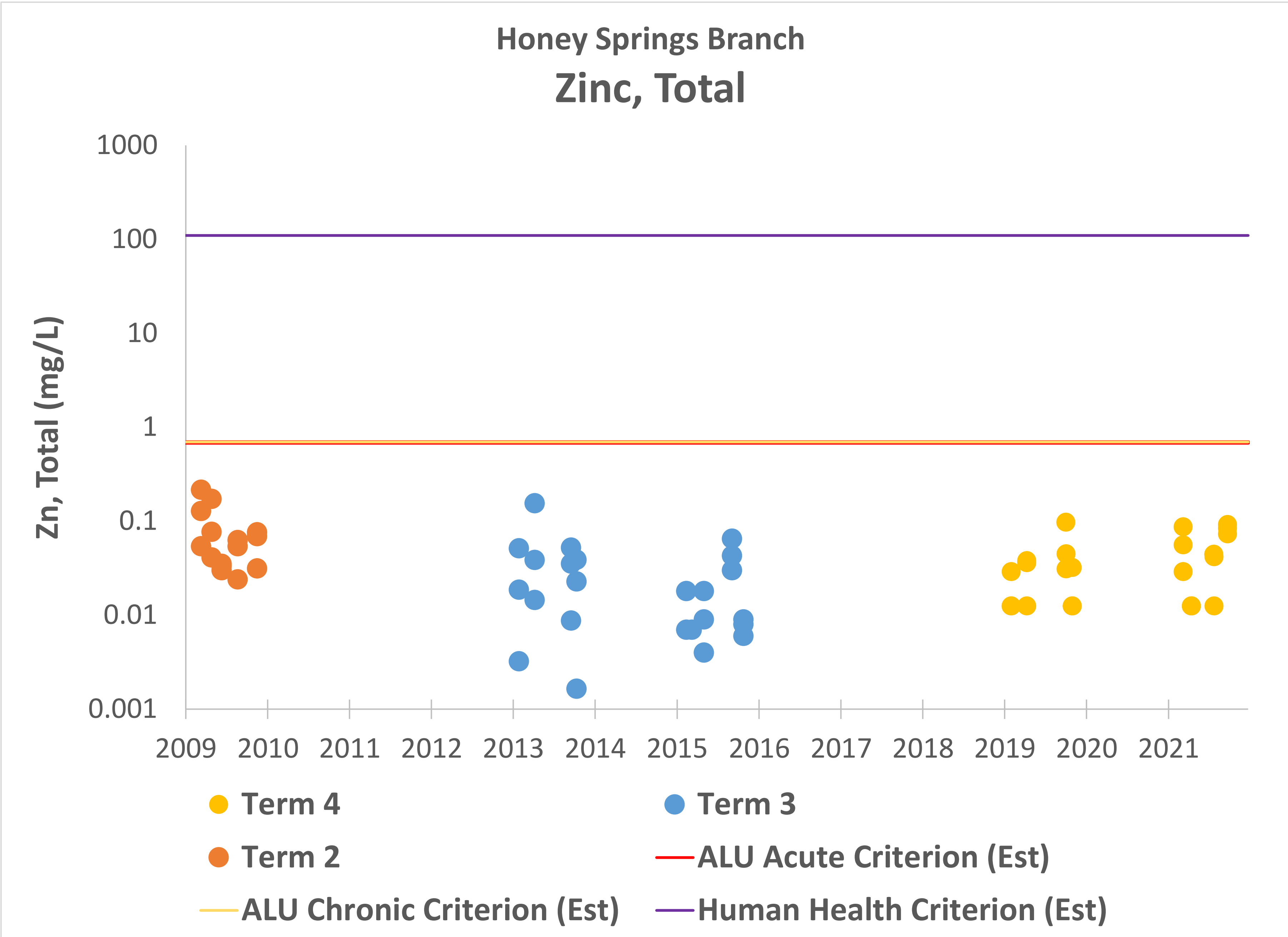

Honey Springs Branch
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
0.0001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



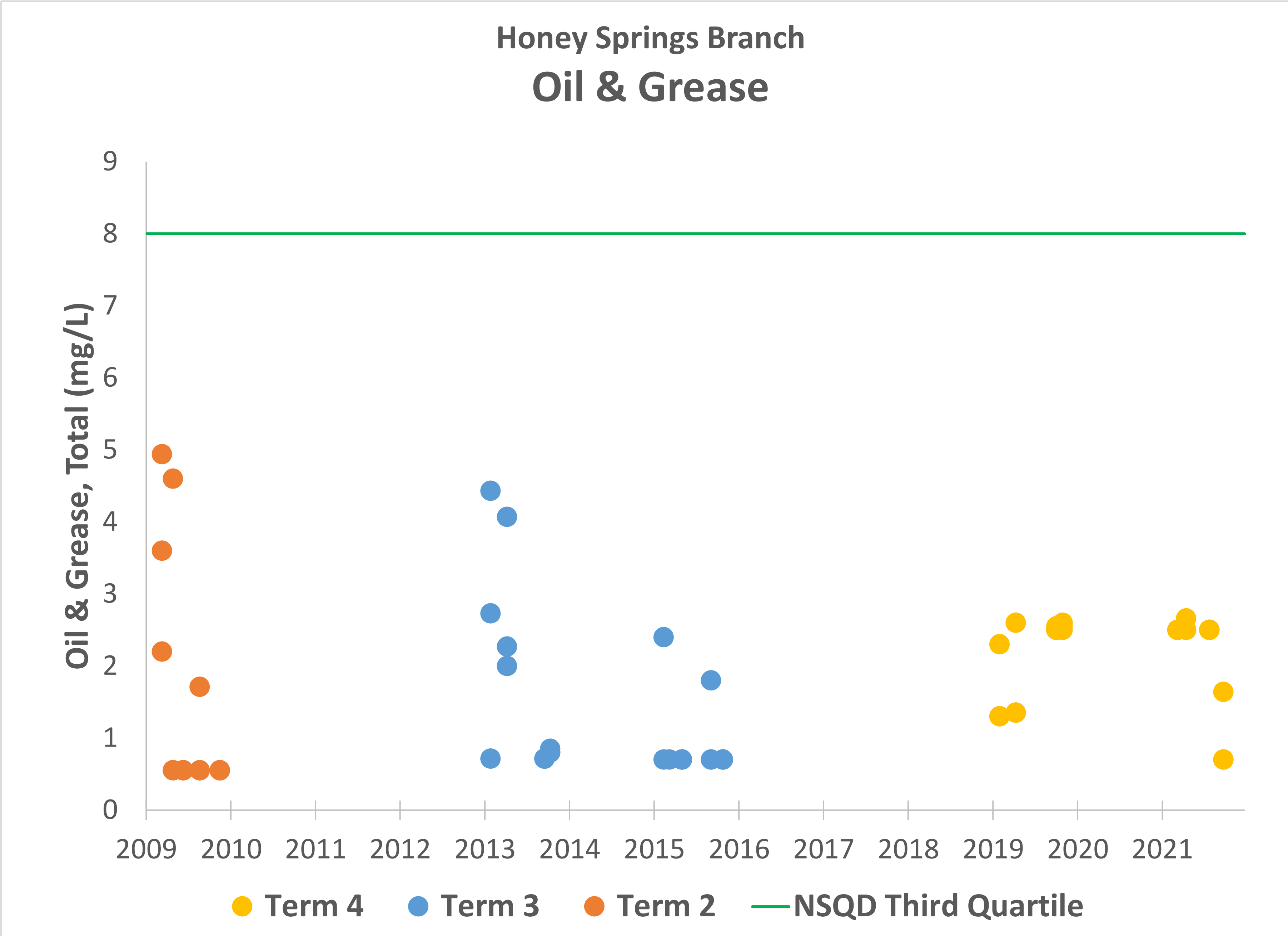
Honey Springs Branch
Copper, Total
Cu, Total (mg/L)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)



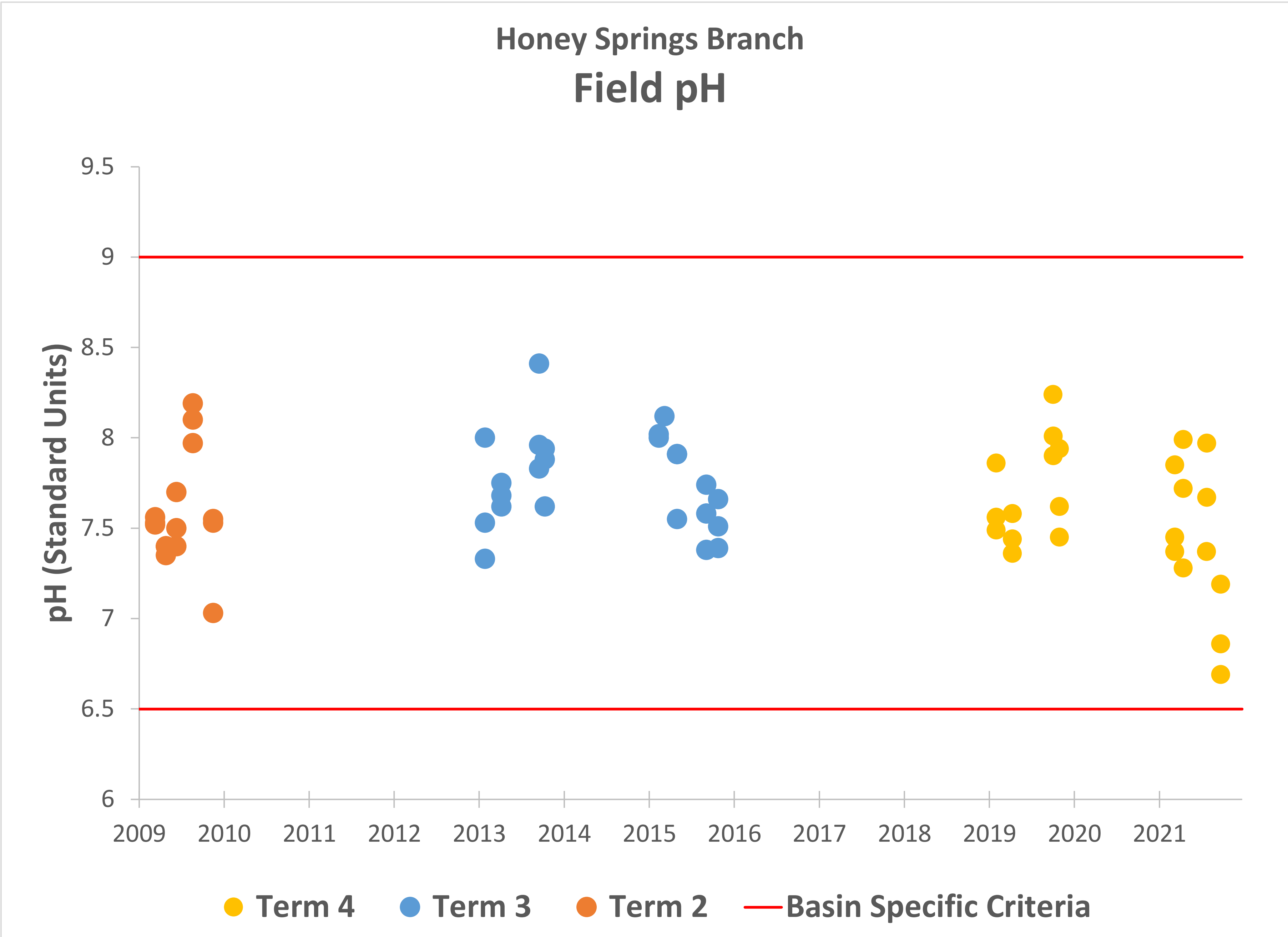
Honey Springs Branch
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

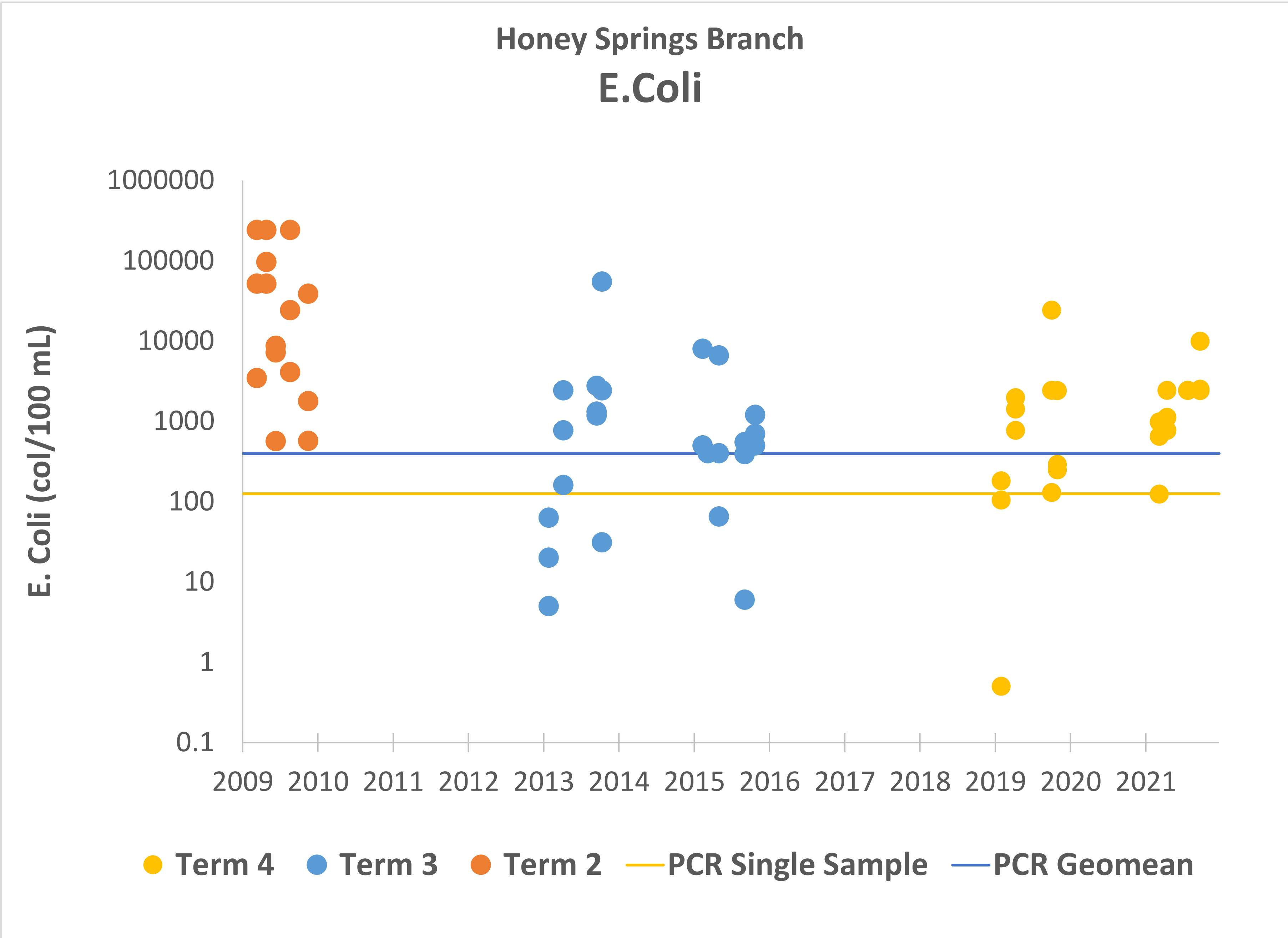


Honey Springs Branch
Zinc, Total
Zn, Total (mg/L)
1000
100
10
1
0.1
0.01
0.001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

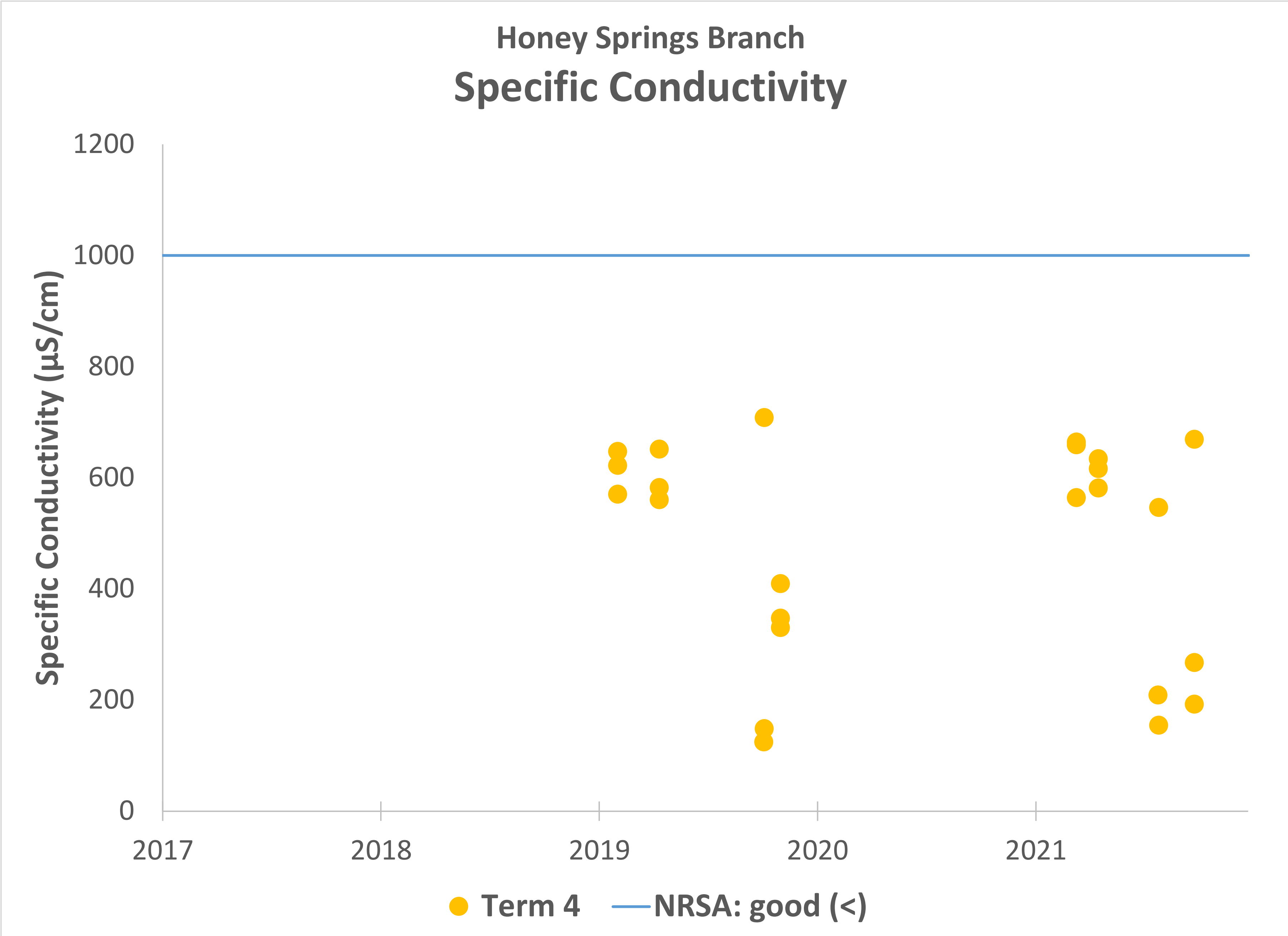


Honey Springs Branch
Oil & Grease
Oil & Grease, Total (mg/L)
0
1
2
3
4
5
6
7
8
9
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

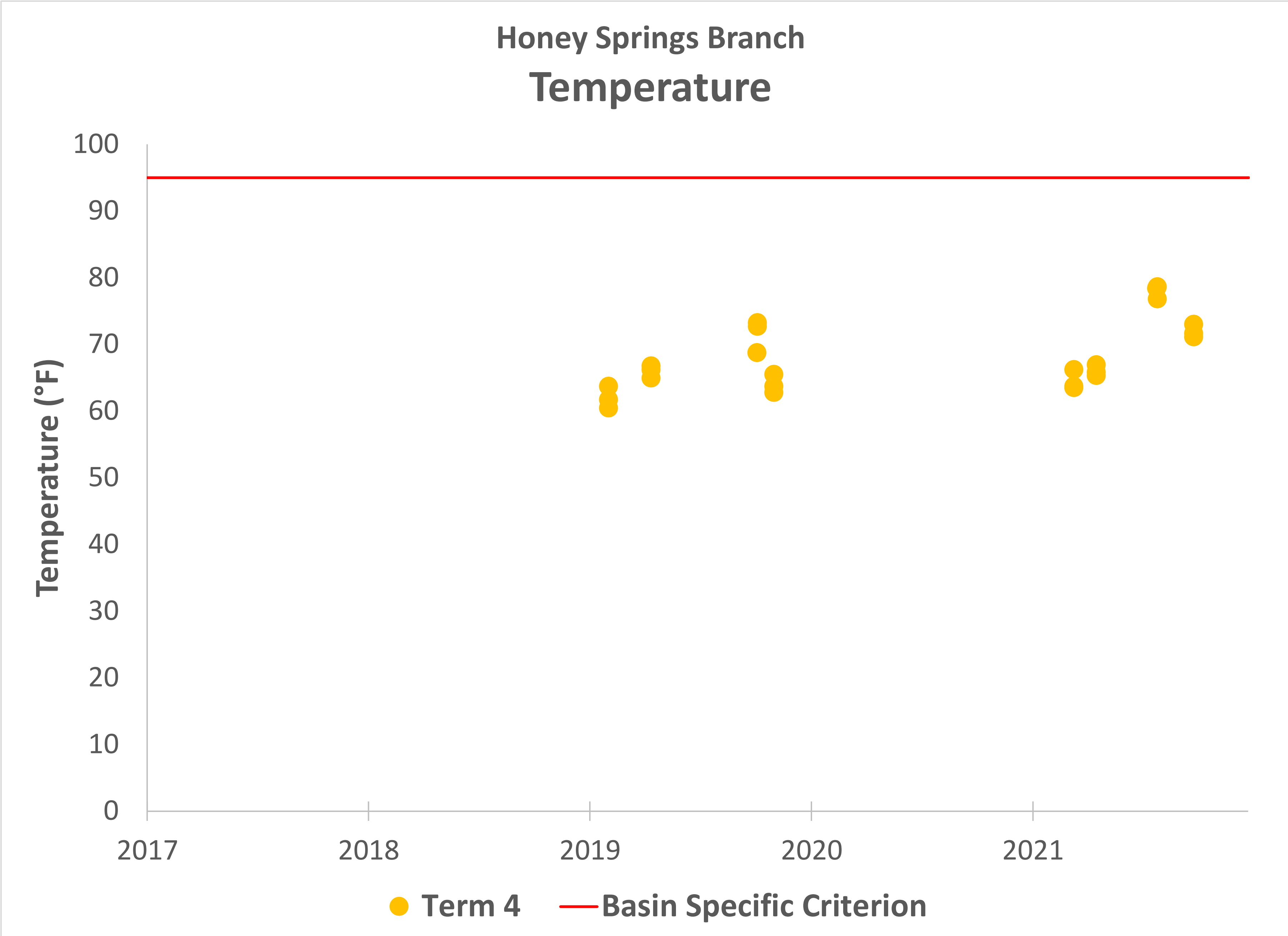

Honey Springs Branch
Field pH
pH (Standard Units)
9.5
9
8.5
8
7.5
7
6.5
6
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
Basin Specific Criteria

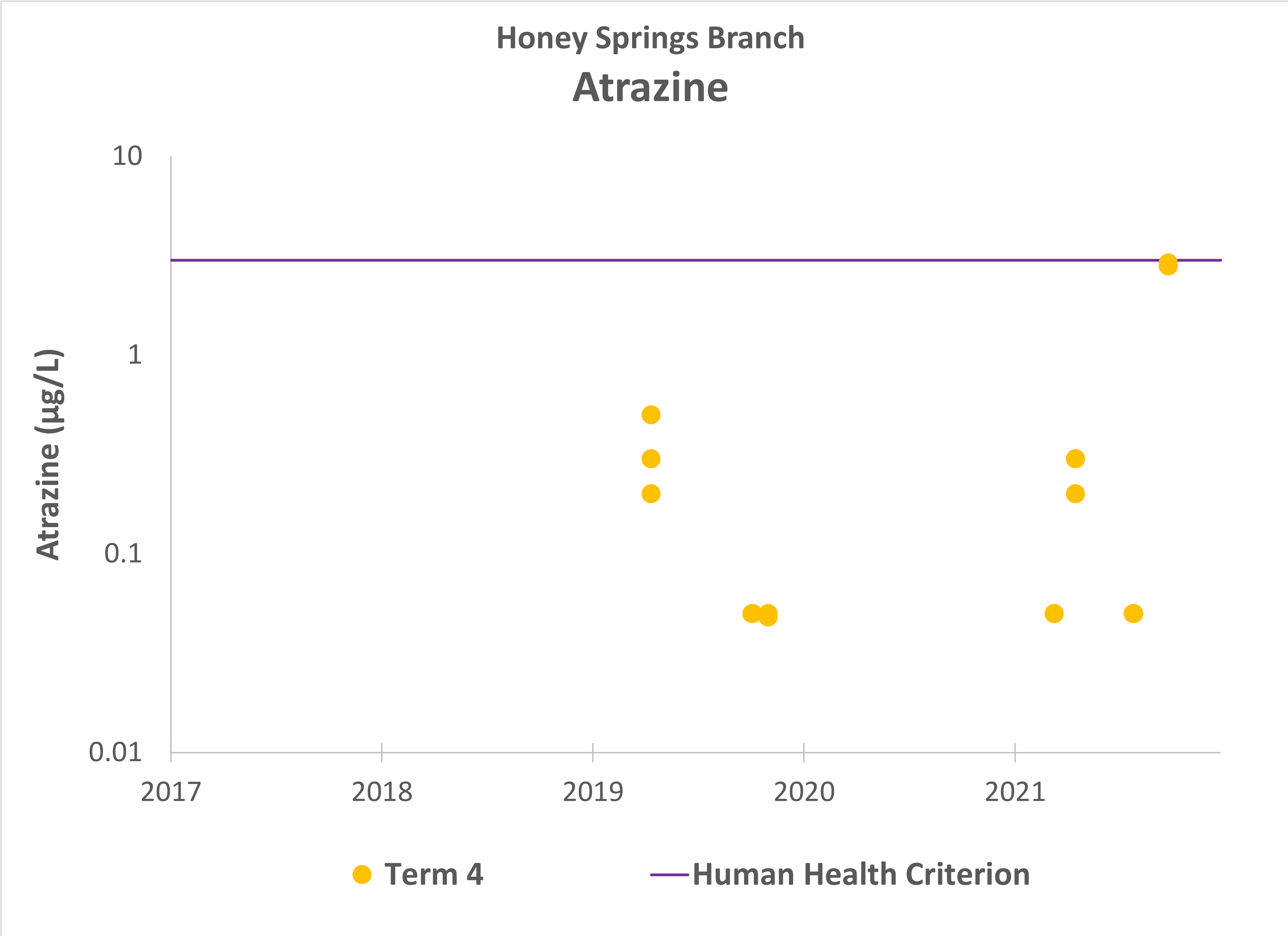


Honey Springs Branch
E.Coli
E. Coli (col/100 mL)
1000000
100000
10000
1000
100
10
1
0.1
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
PCR Single Sample
PCR Geomean



Honey Springs Branch
Specific Conductivity
Specific Conductivity (µS/cm)
1200
1000
800
600
400
200
0
2017
2018
2019
2020
2021
Term 4
NRSA: good (<)

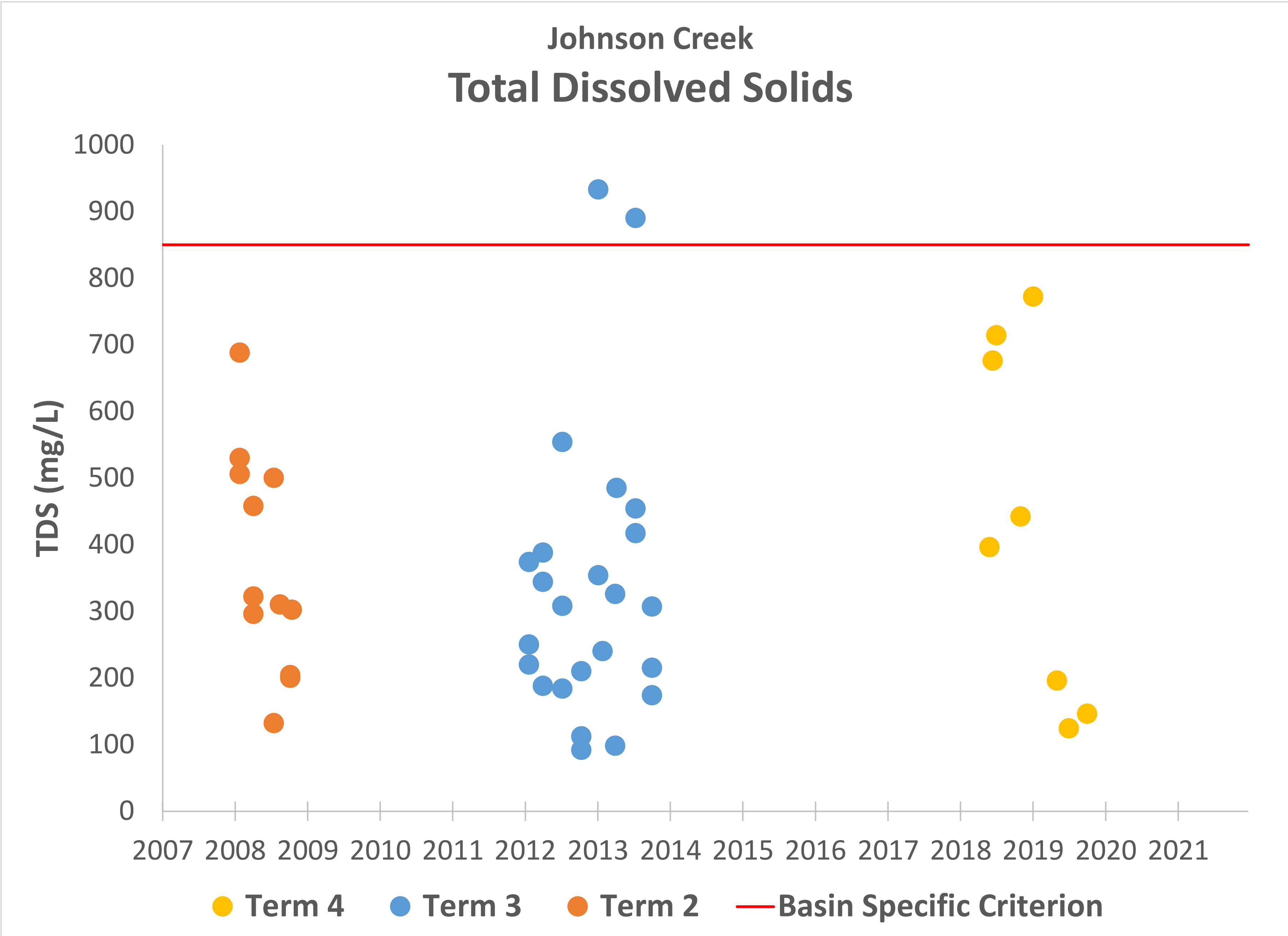

Honey Springs Branch
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2017
2018
2019
2020
2021
Term 4
Basin Specific Criterion



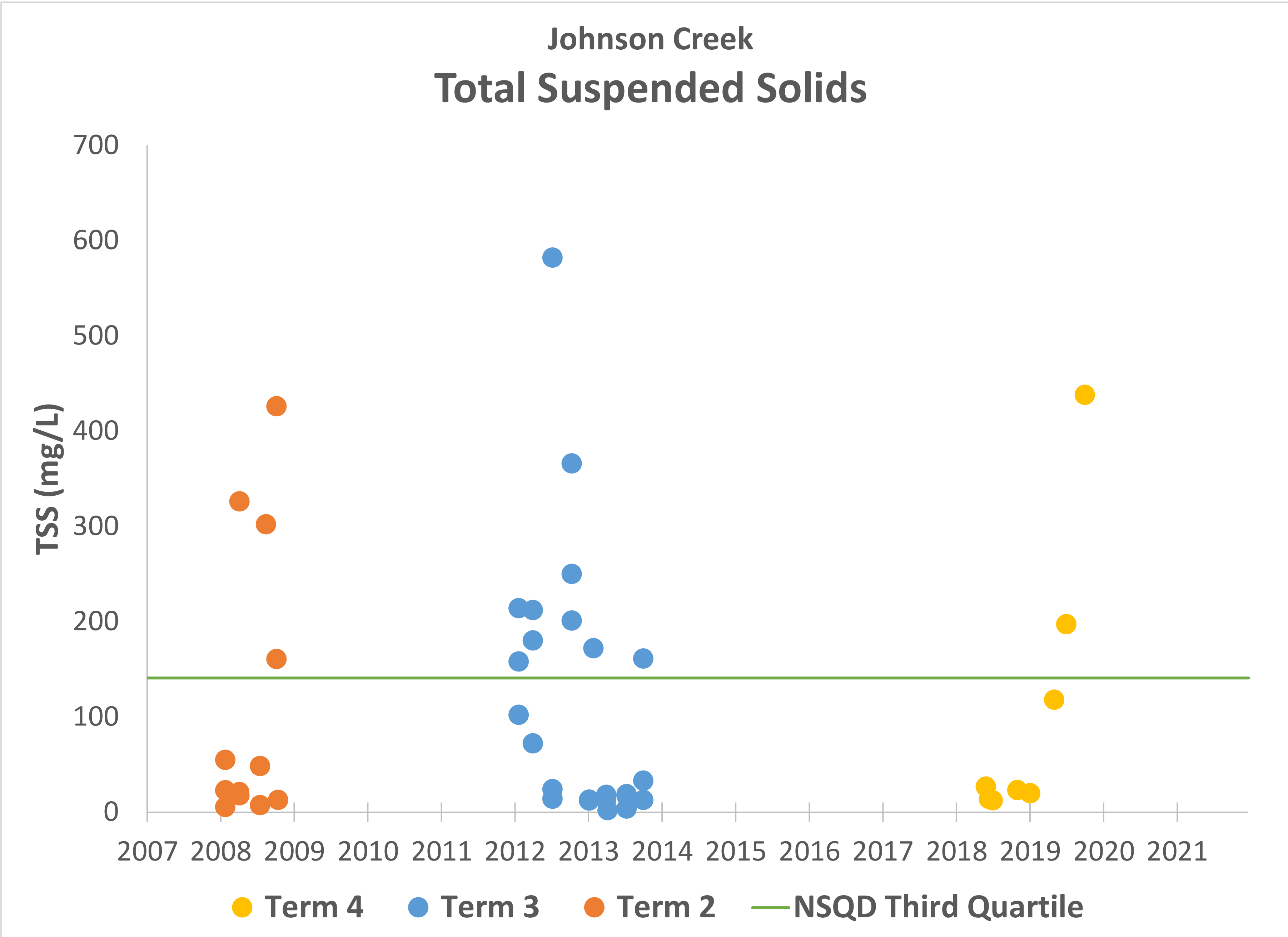
Honey Springs Branch
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
2017
2018
2019
2020
2021
Term 4
Human Health Criterion

Appendix O

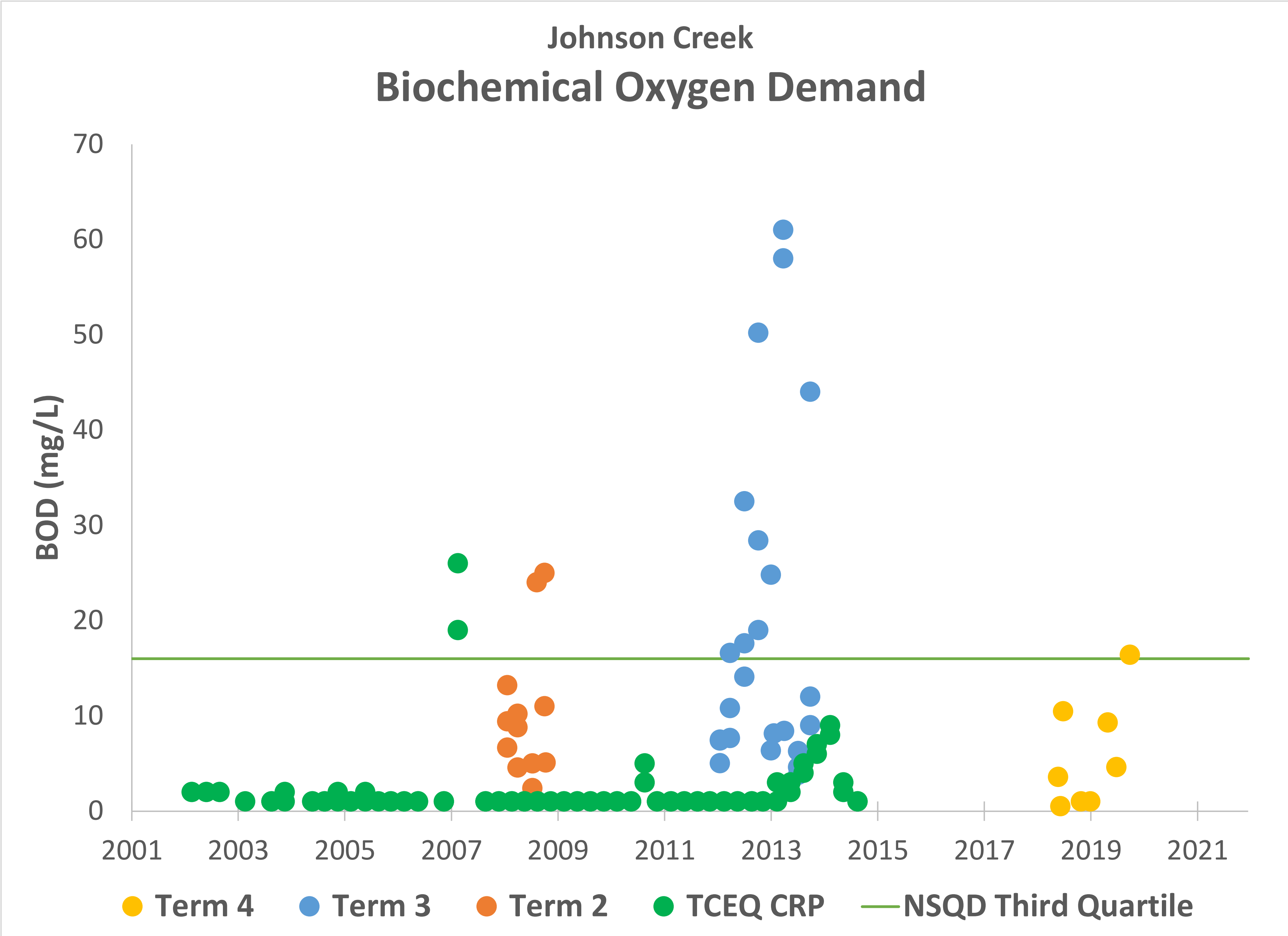
Johnson Creek Water Quality Data Graphs

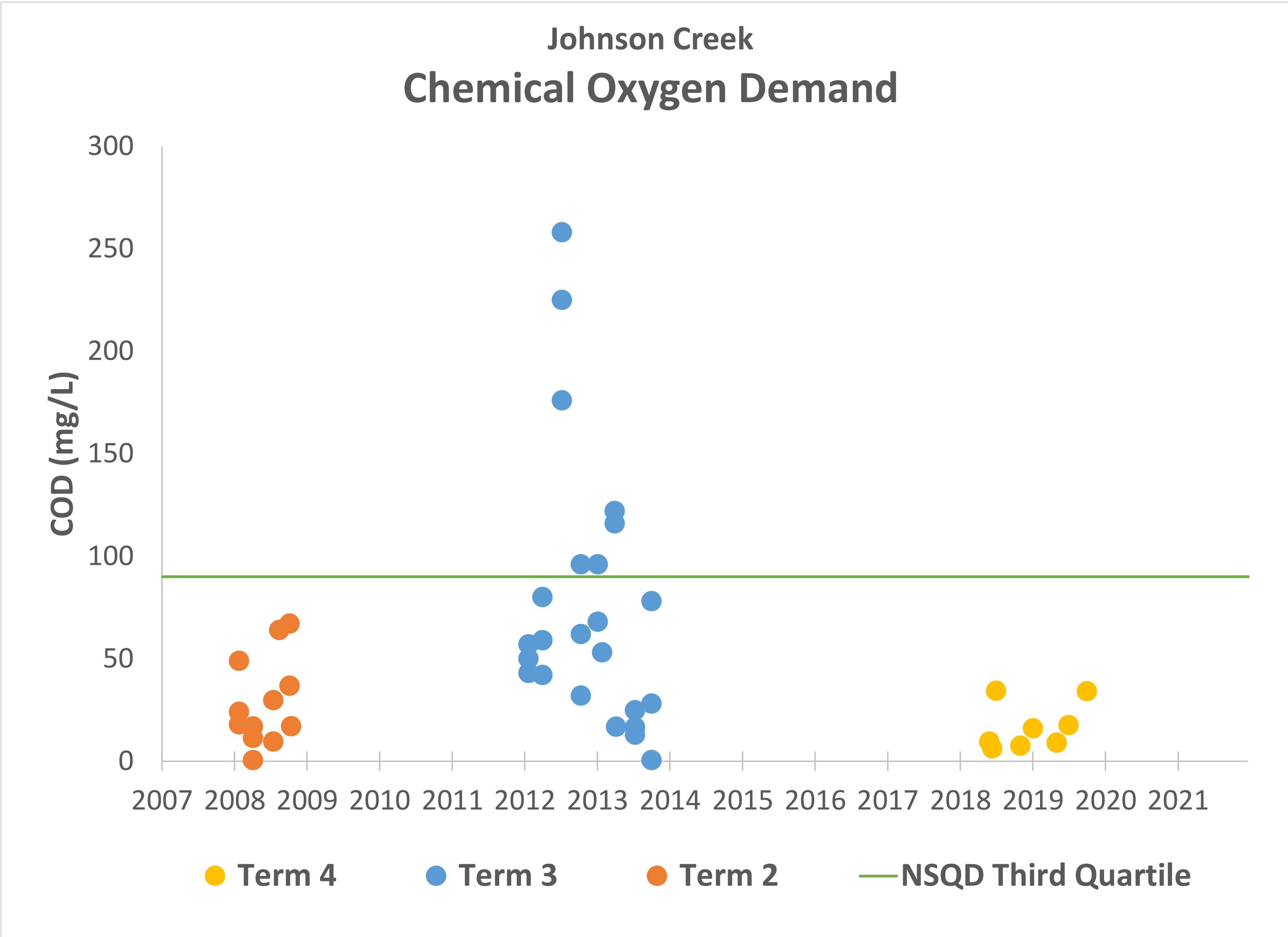


Johnson Creek
Total Dissolved Solids
TDS (mg/L)
1000
900
800
700
600
500
400
300
200
100
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
Basin Specific Criterion

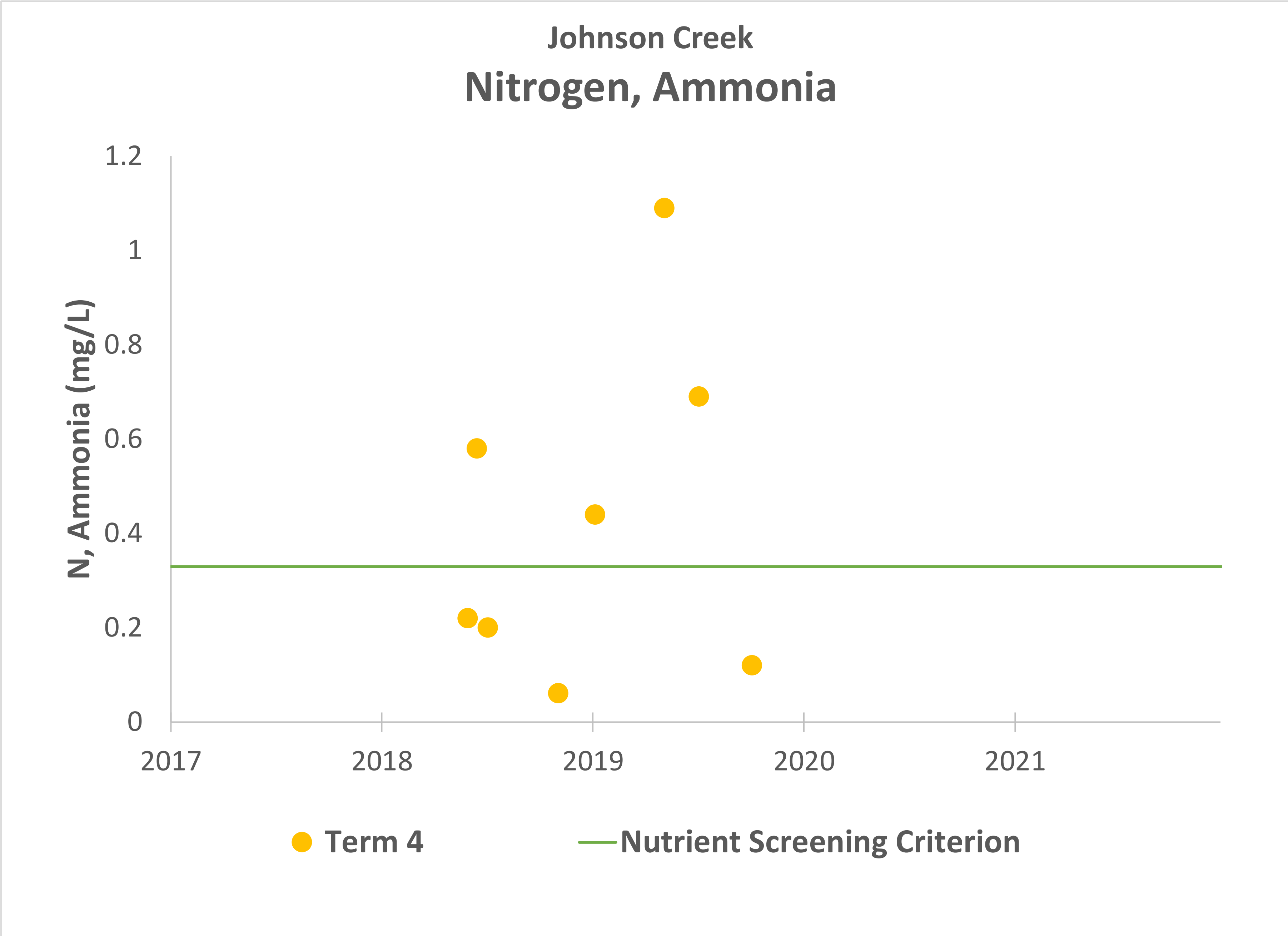


Johnson Creek
Total Suspended Solids
TSS (mg/L)
700
600
500
400
300
200
100
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

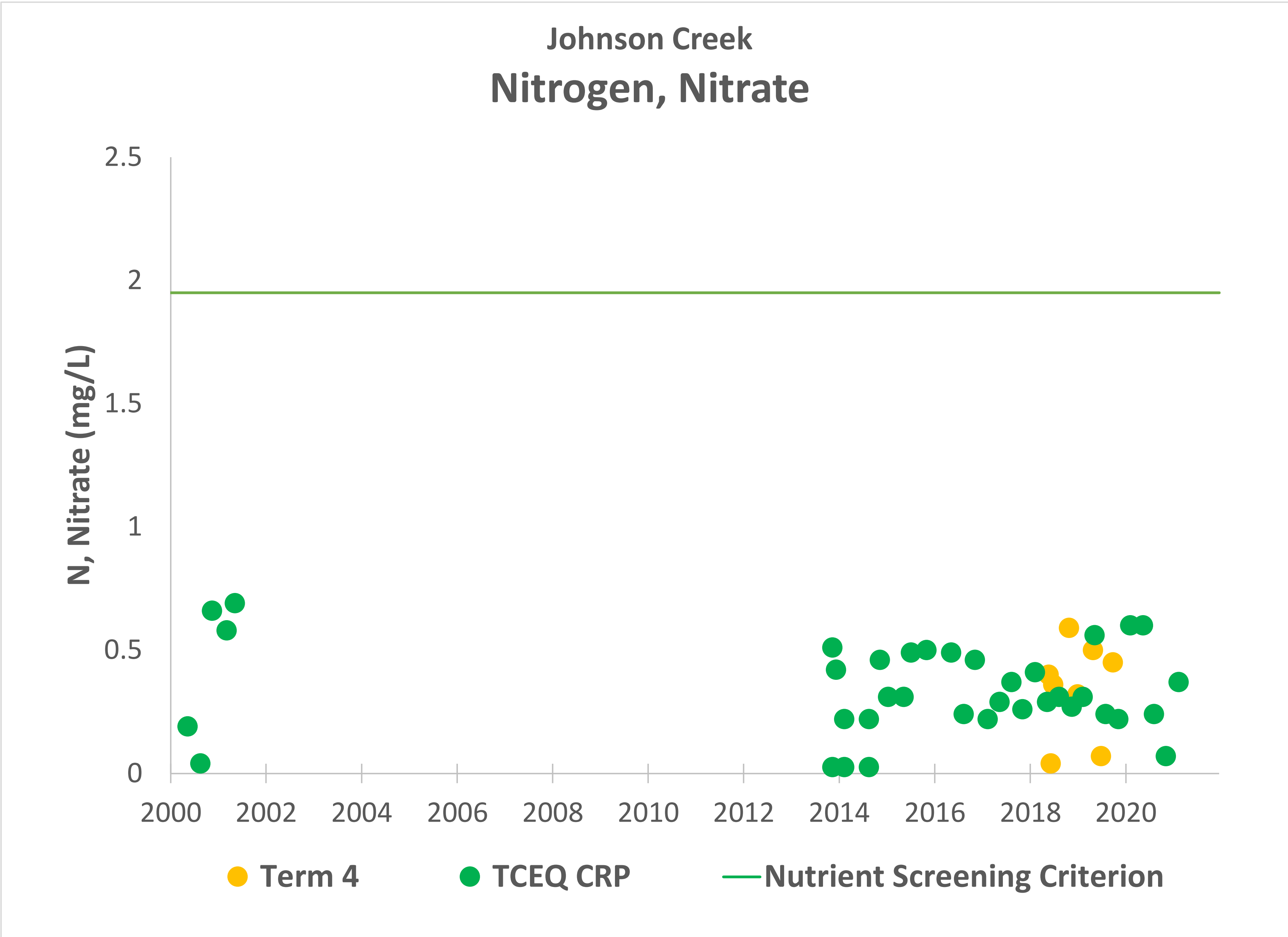

Johnson Creek
Biochemical Oxygen Demand
BOD (mg/L)
70
60
50
40
30
20
10
0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
NSQD Third Quartile

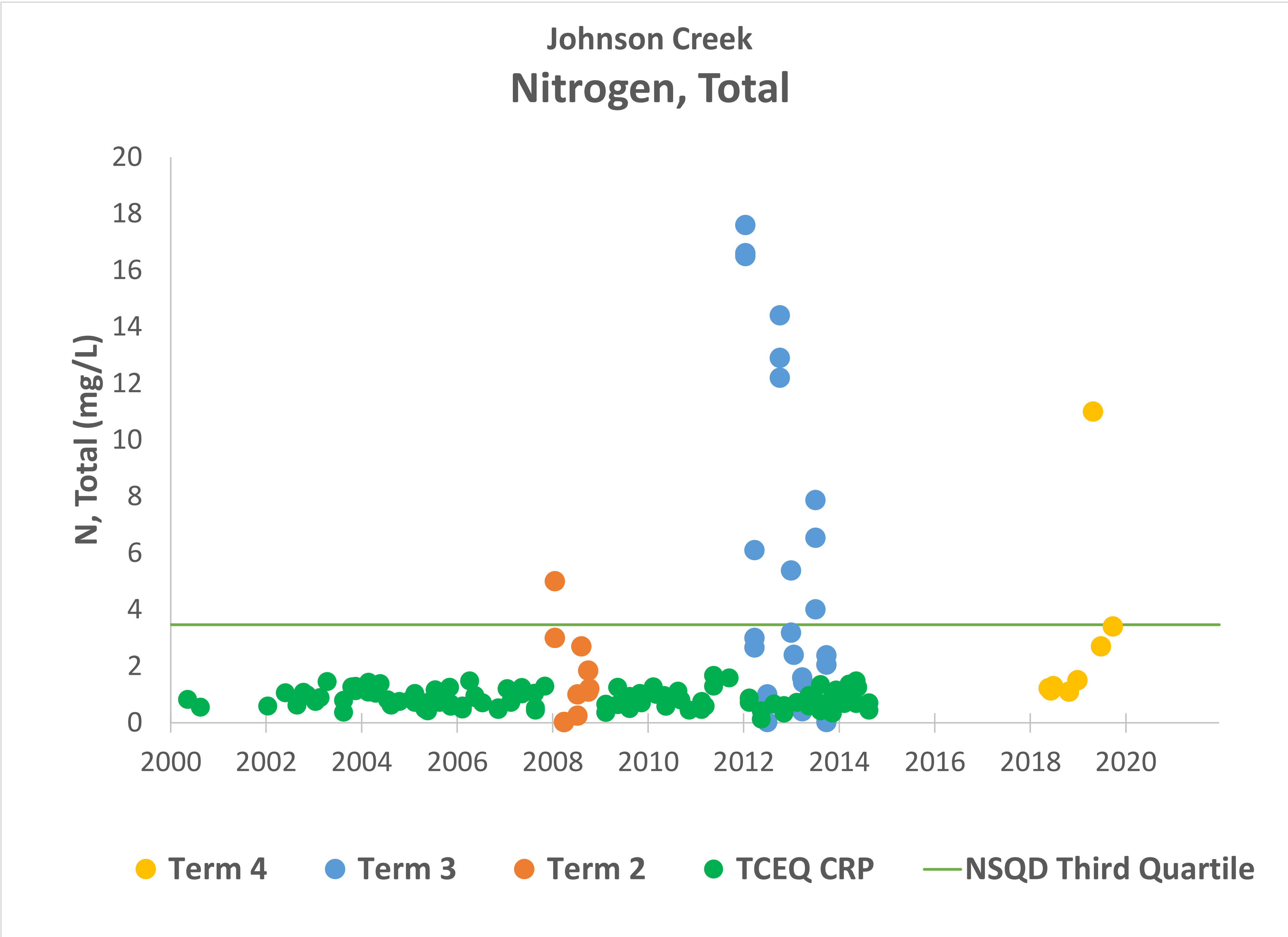


Johnson Creek
Chemical Oxygen Demand
COD (mg/L)
300
250
200
150
100
50
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

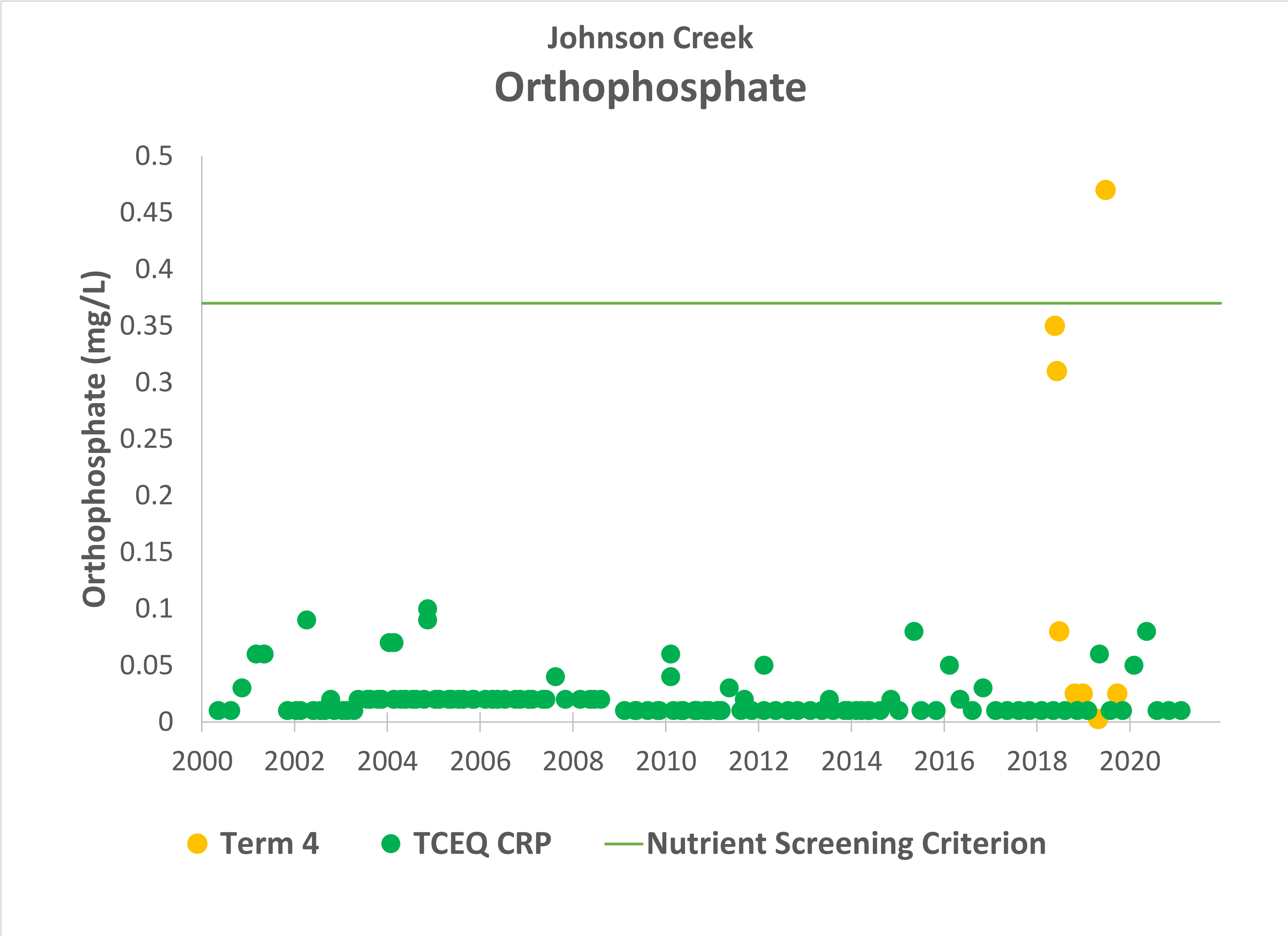


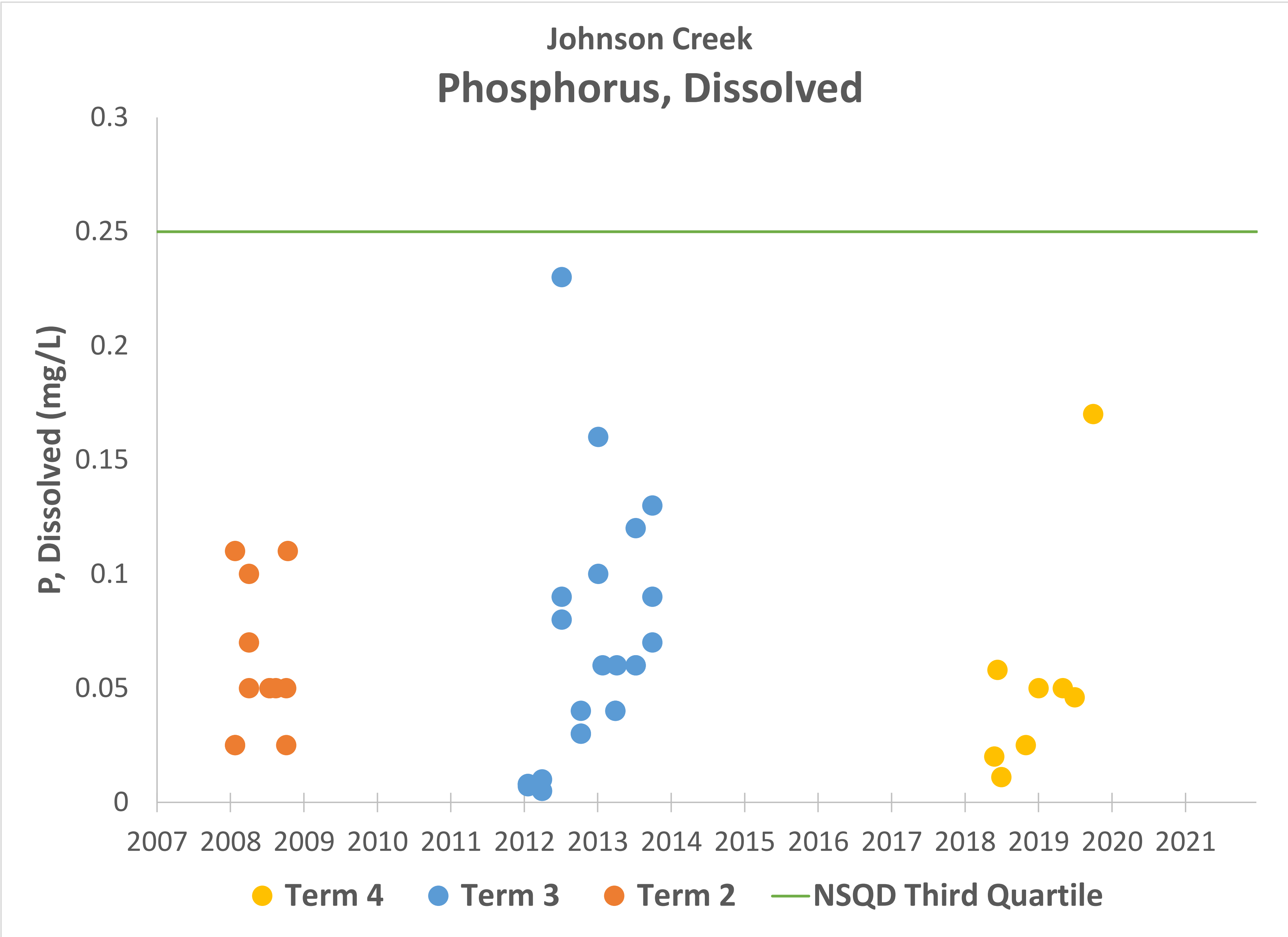
Johnson Creek
Nitrogen, Ammonia
N, Ammonia (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion


Johnson Creek
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion

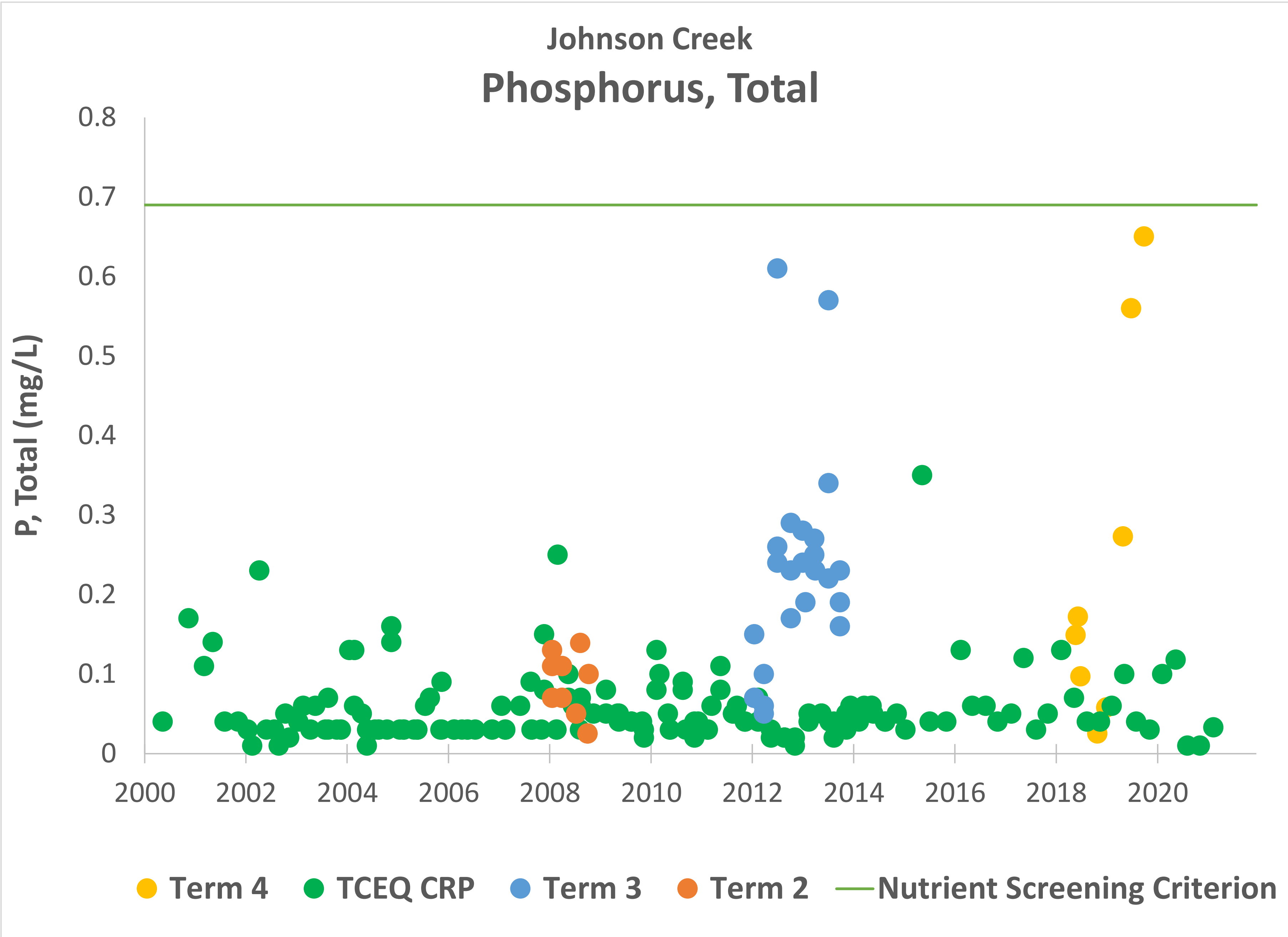


Johnson Creek
Nitrogen, Total
N, Total (mg/L)
0
2
4
6
8
10
12
14
16
18
20
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
TCEQ CRP
NSQD Third Quartile

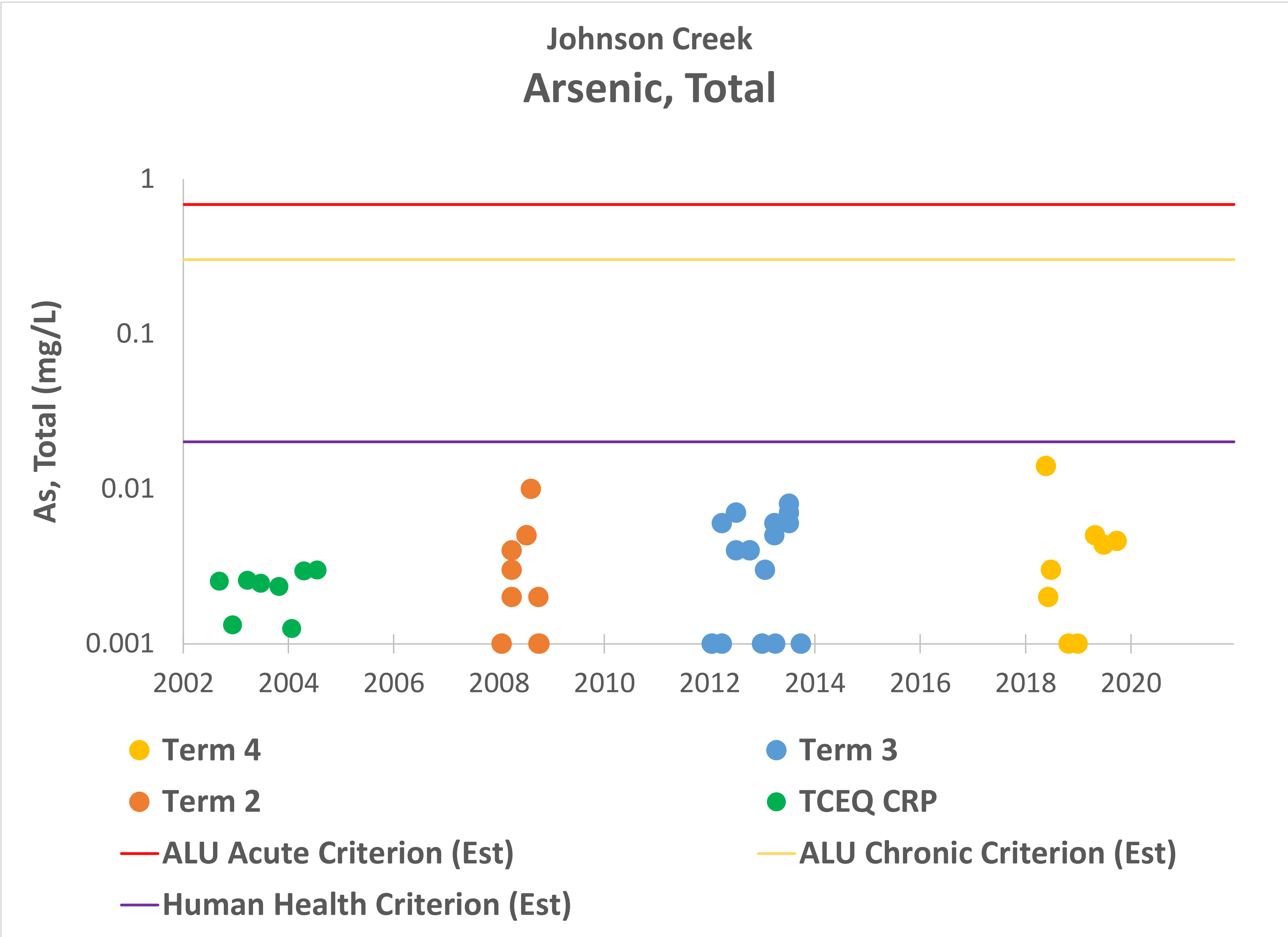

Johnson Creek
Orthophosphate
Orthophosphate (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Nutrient Screening Criterion



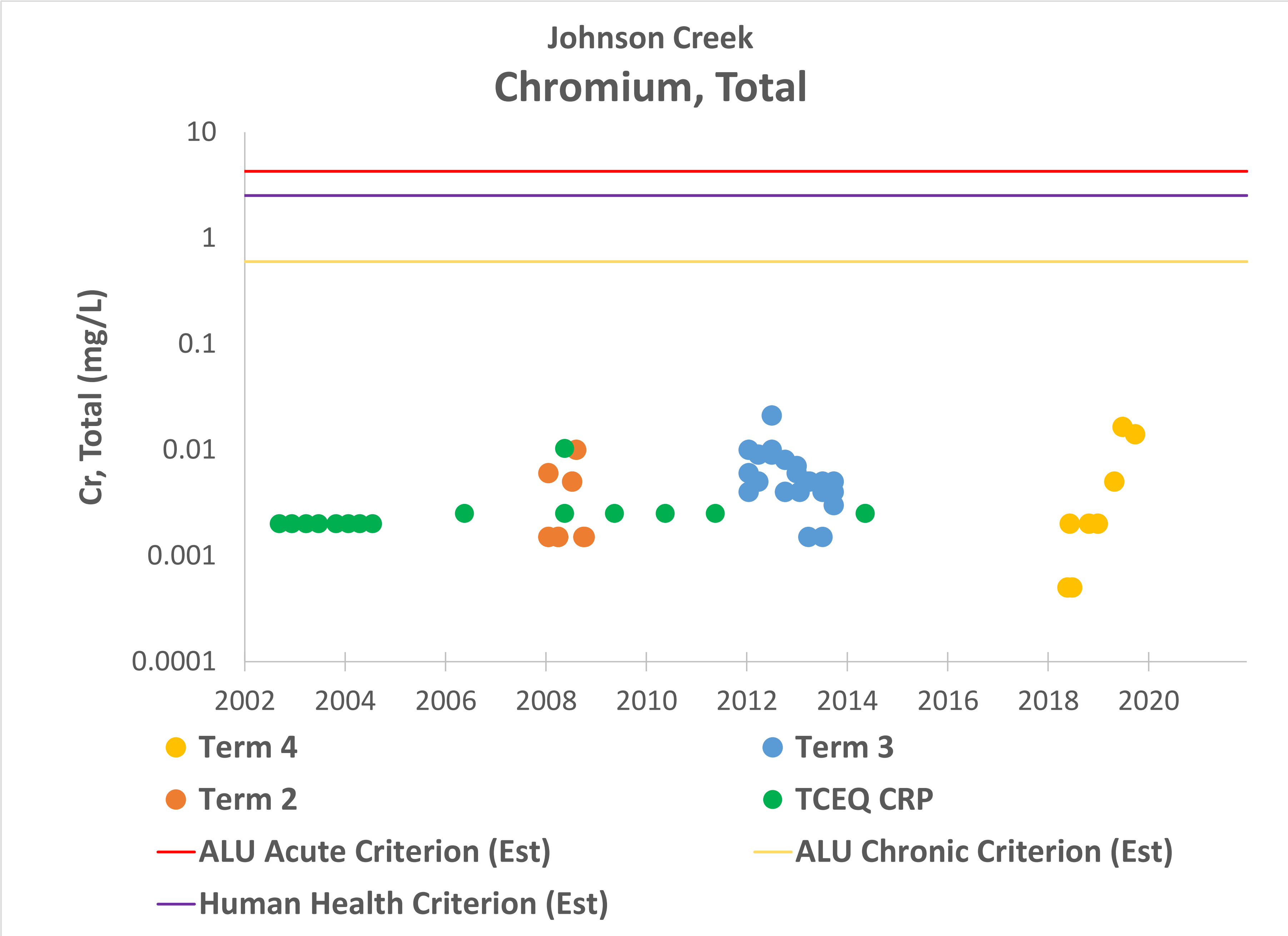
Johnson Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
NSQD Third Quartile



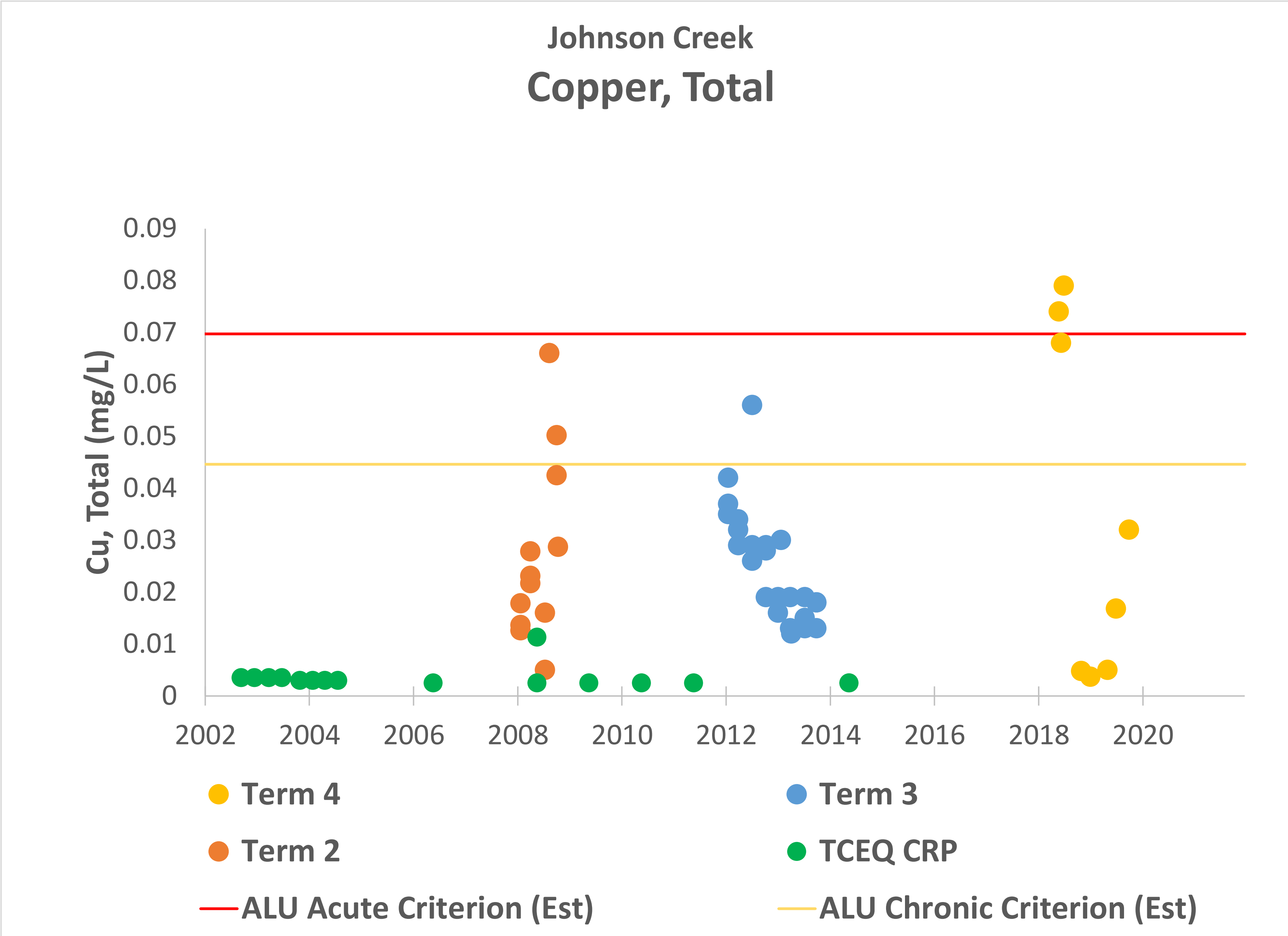
Johnson Creek
Phosphorus, Total
P, Total (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Term 3
Term 2
Nutrient Screening Criterion

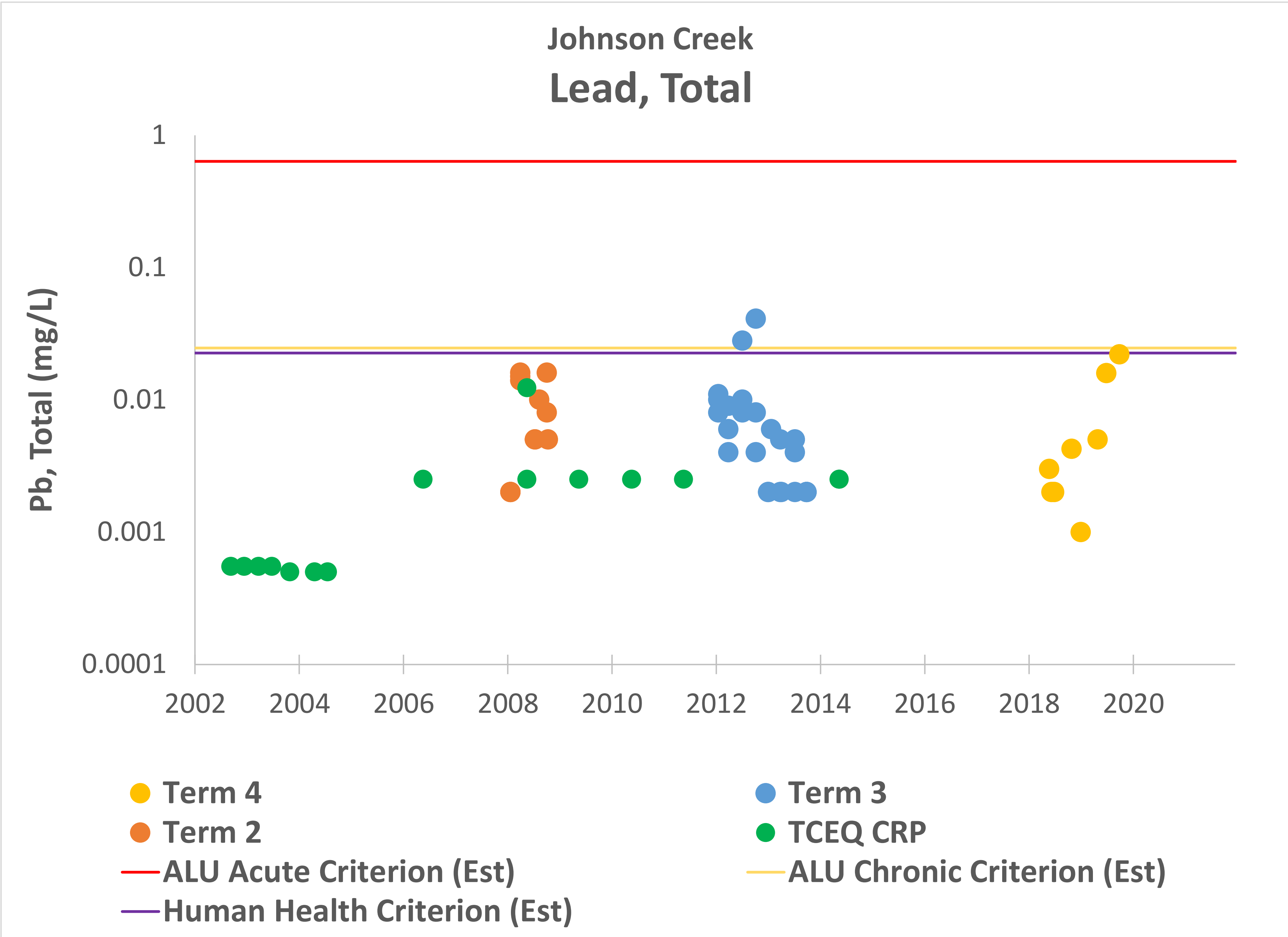


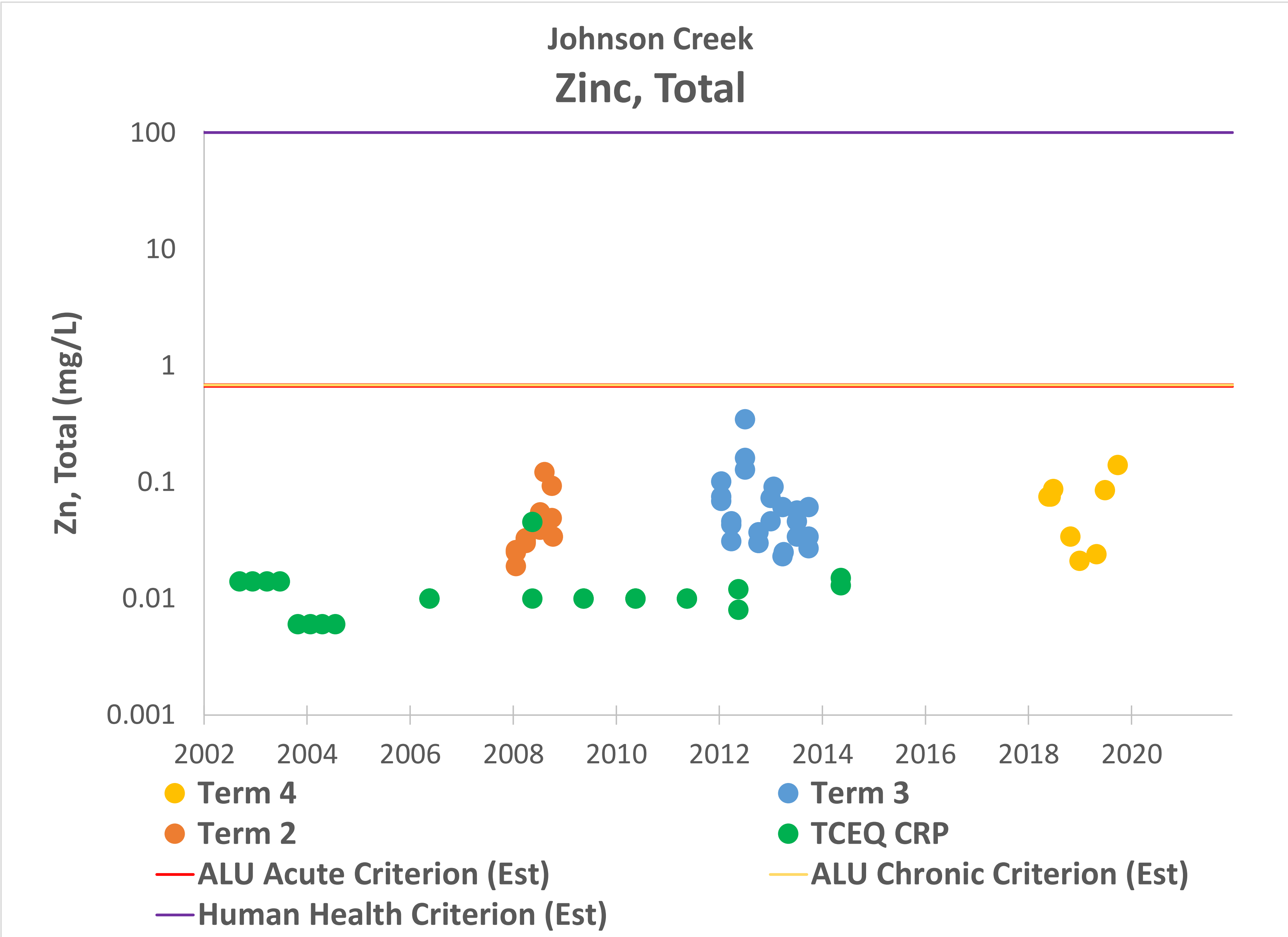
Johnson Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



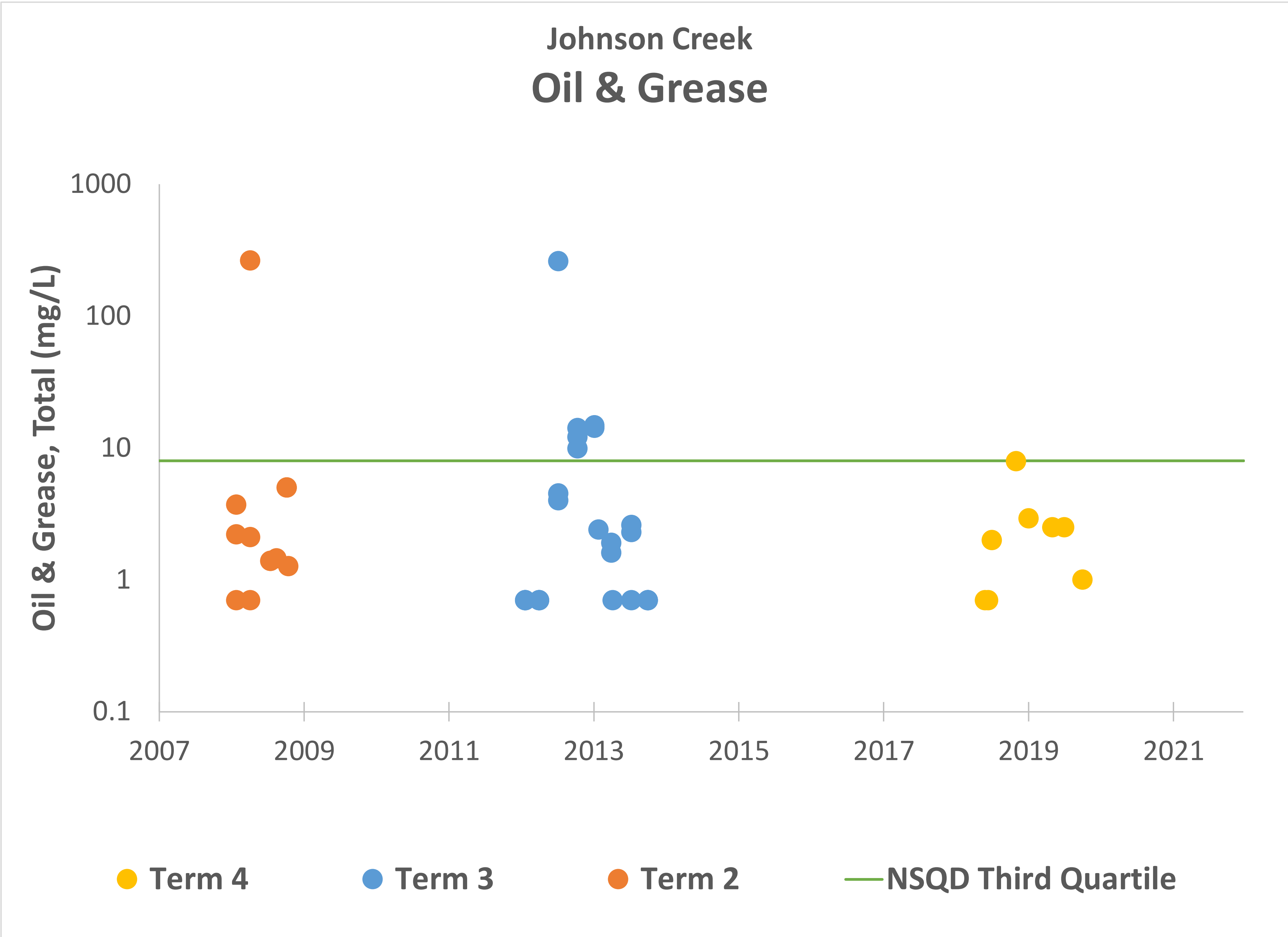
Johnson Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
0.0001
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

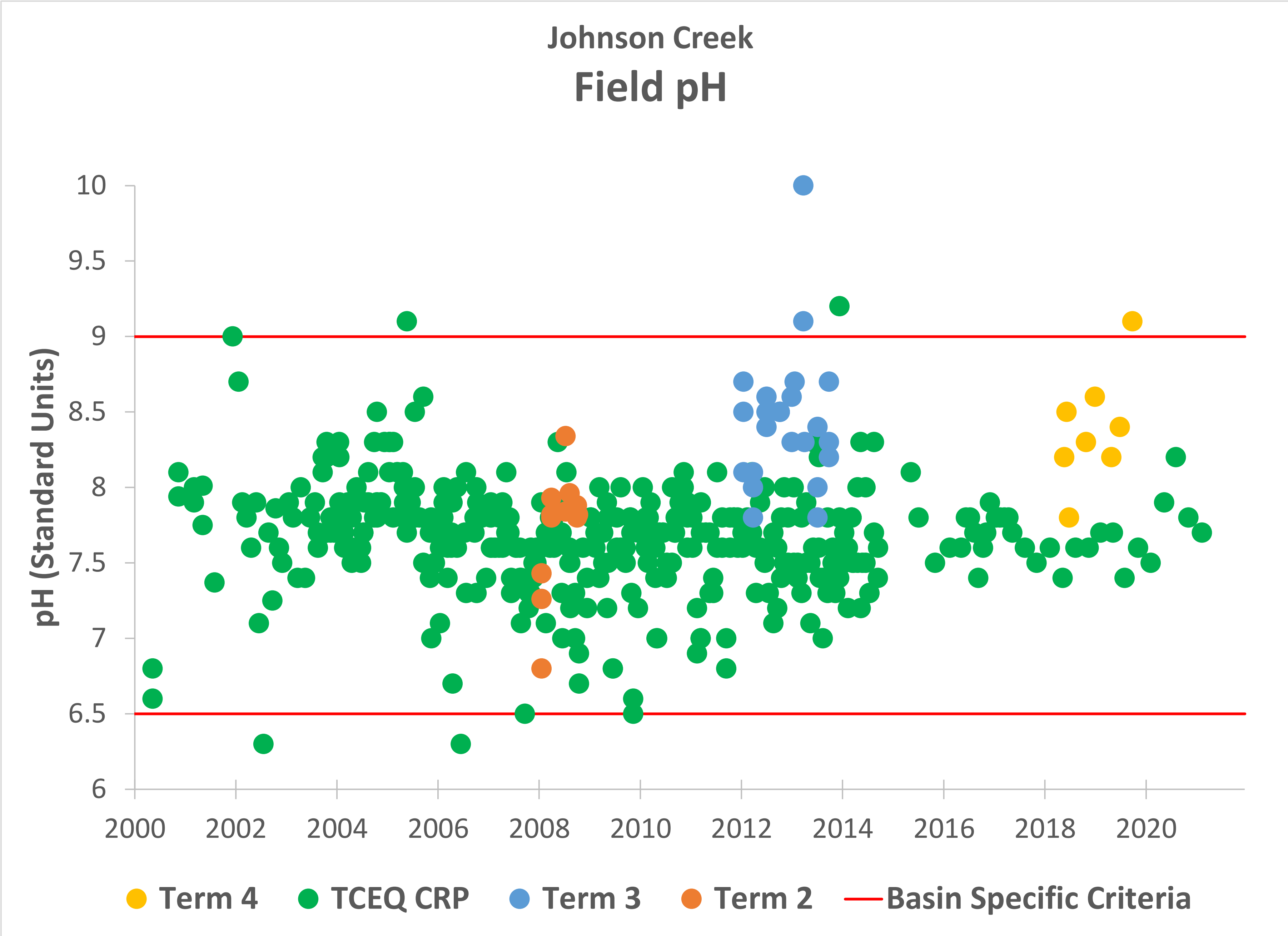

Johnson Creek
Copper, Total
Cu, Total (mg/L)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)

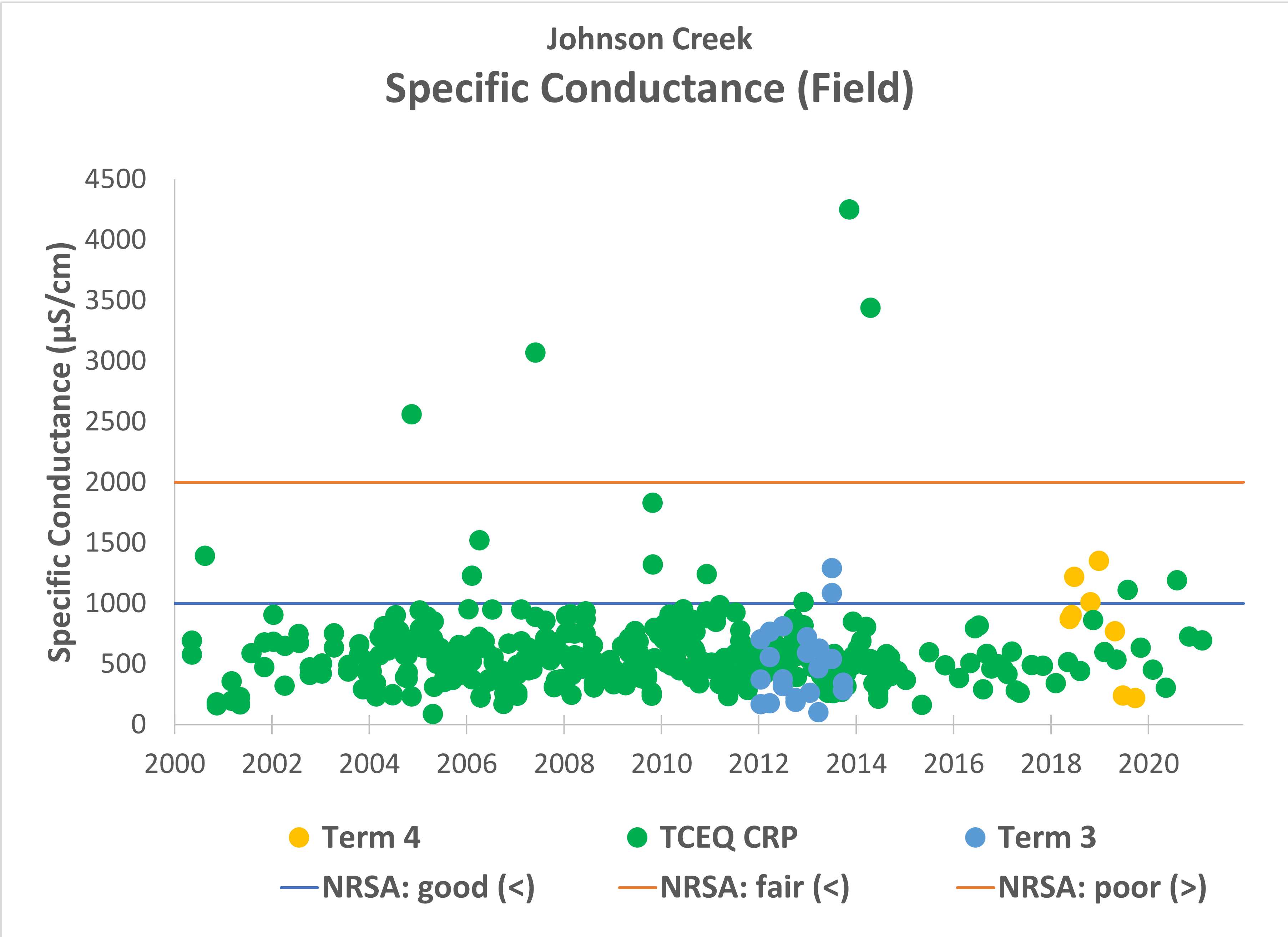

Johnson Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

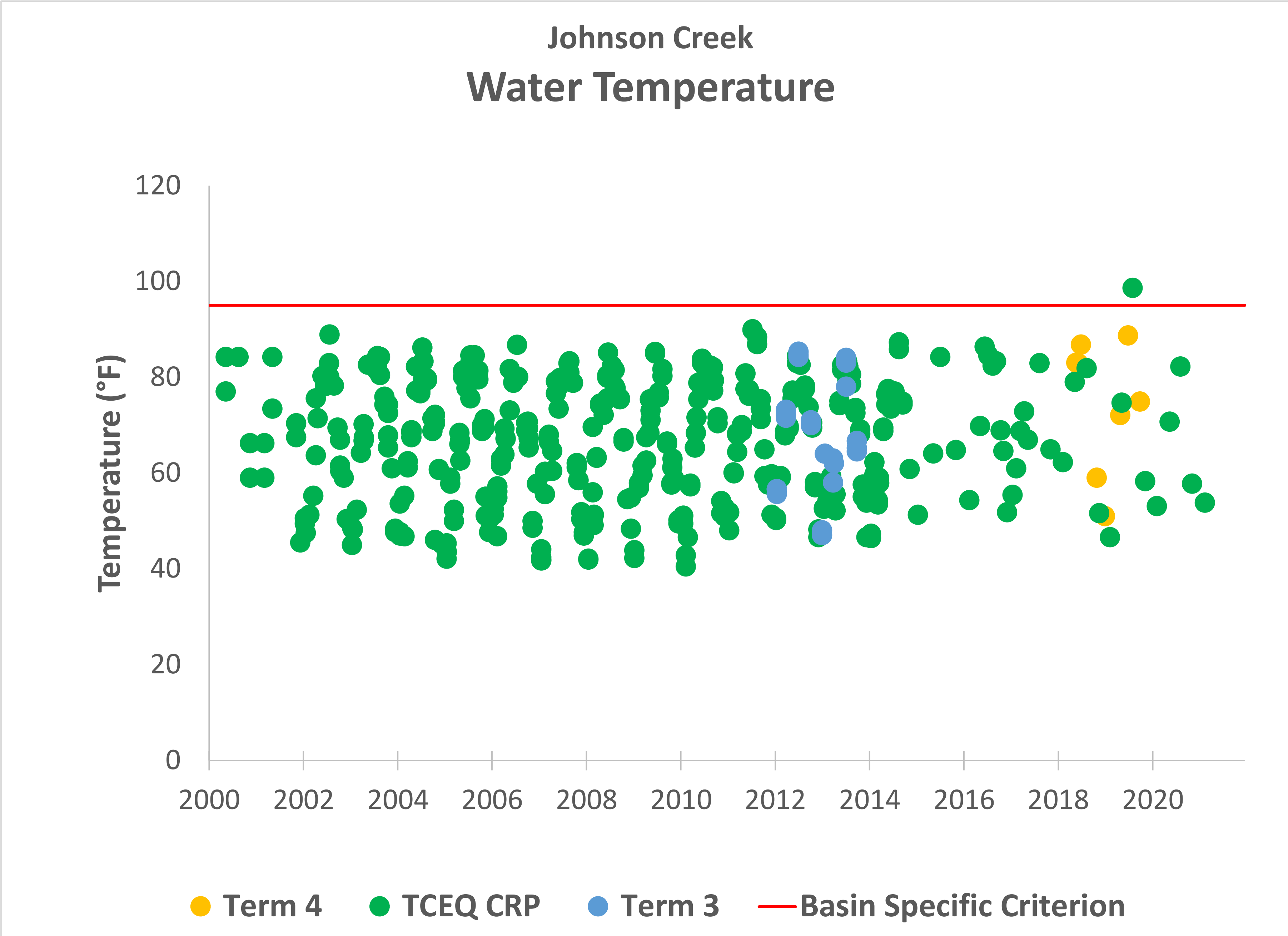


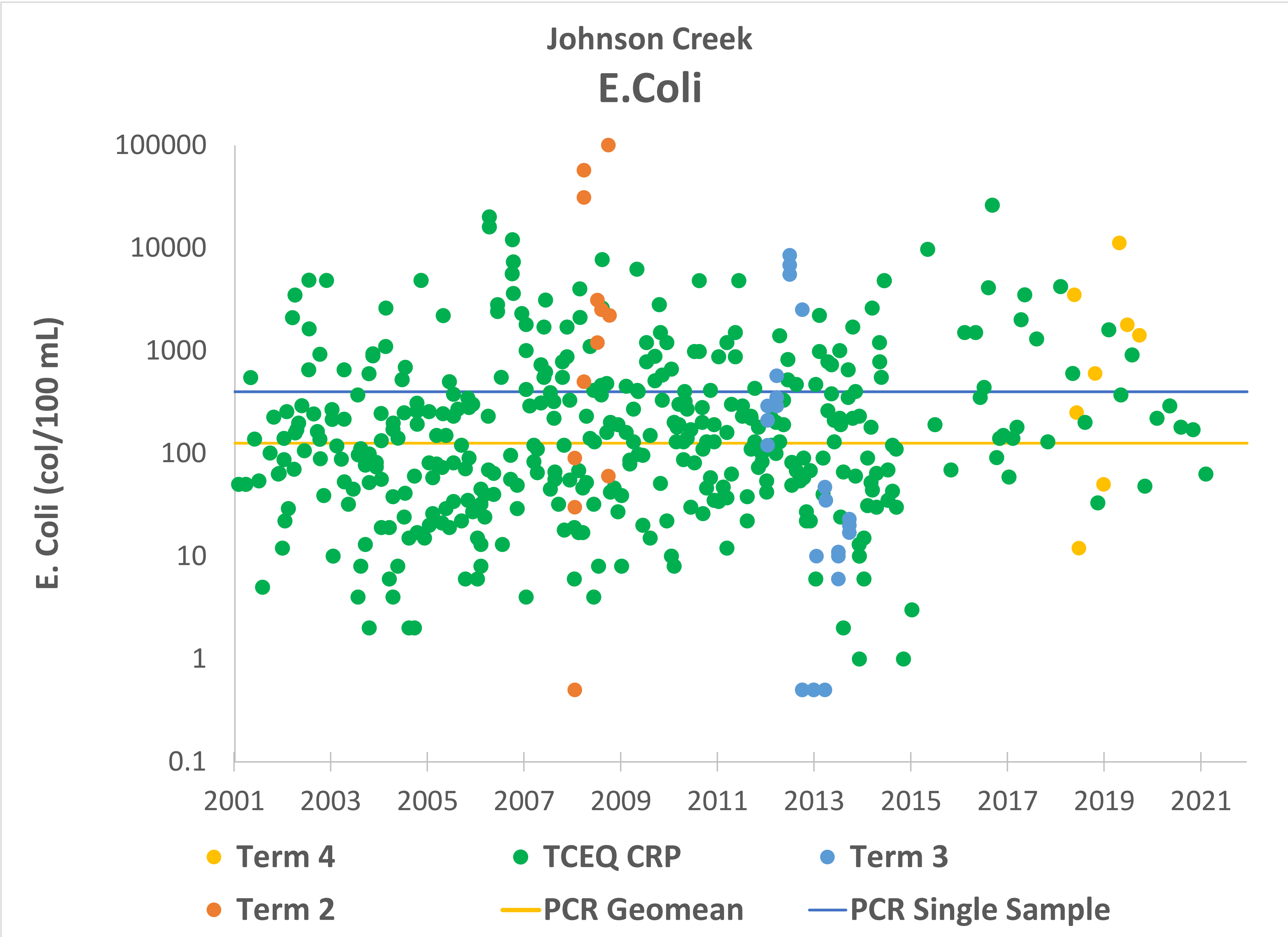
Johnson Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
TCEQ CRP
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)


Johnson Creek
Oil & Grease
Oil & Grease, Total (mg/L)
1000
100
10
1
0.1
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

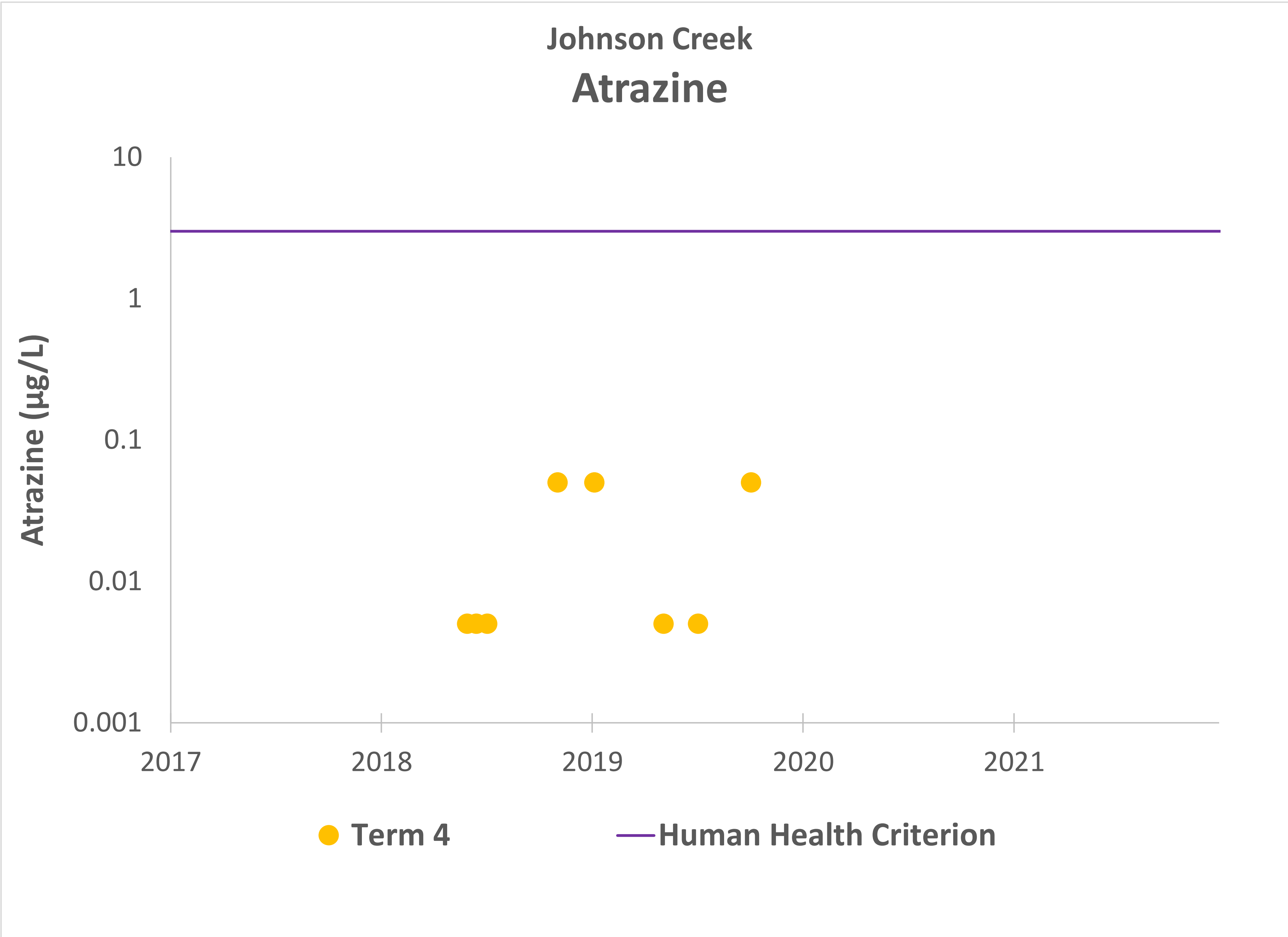

Johnson Creek
Field pH
pH (Standard Units)
10
9.5
9
8.5
8
7.5
7
6.5
6
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Term 3
Term 2
Basin Specific Criteria

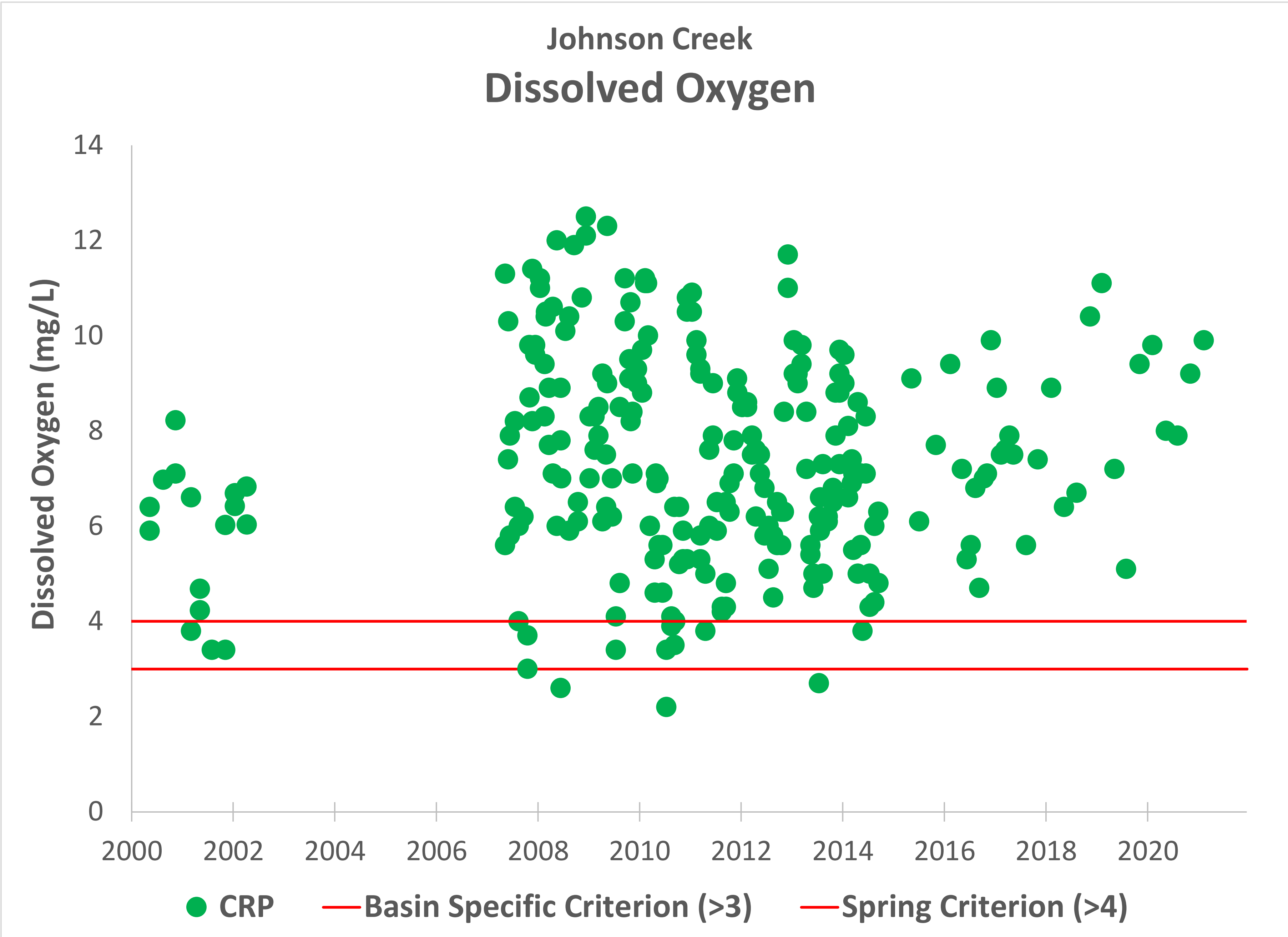

Johnson Creek
Specific Conductance (Field)
Specific Conductance (µS/cm)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Term 3
NRSA: good (<)
NRSA: fair (<)
NRSA: poor (>)


Johnson Creek
Water Temperature
Temperature (°F)
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Term 3
Basin Specific Criterion



Johnson Creek
E.Coli
E. Coli (col/100 mL)
100000
10000
1000
100
10
1
0.1
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
TCEQ CRP
Term 3
Term 2
PCR Geomean
PCR Single Sample

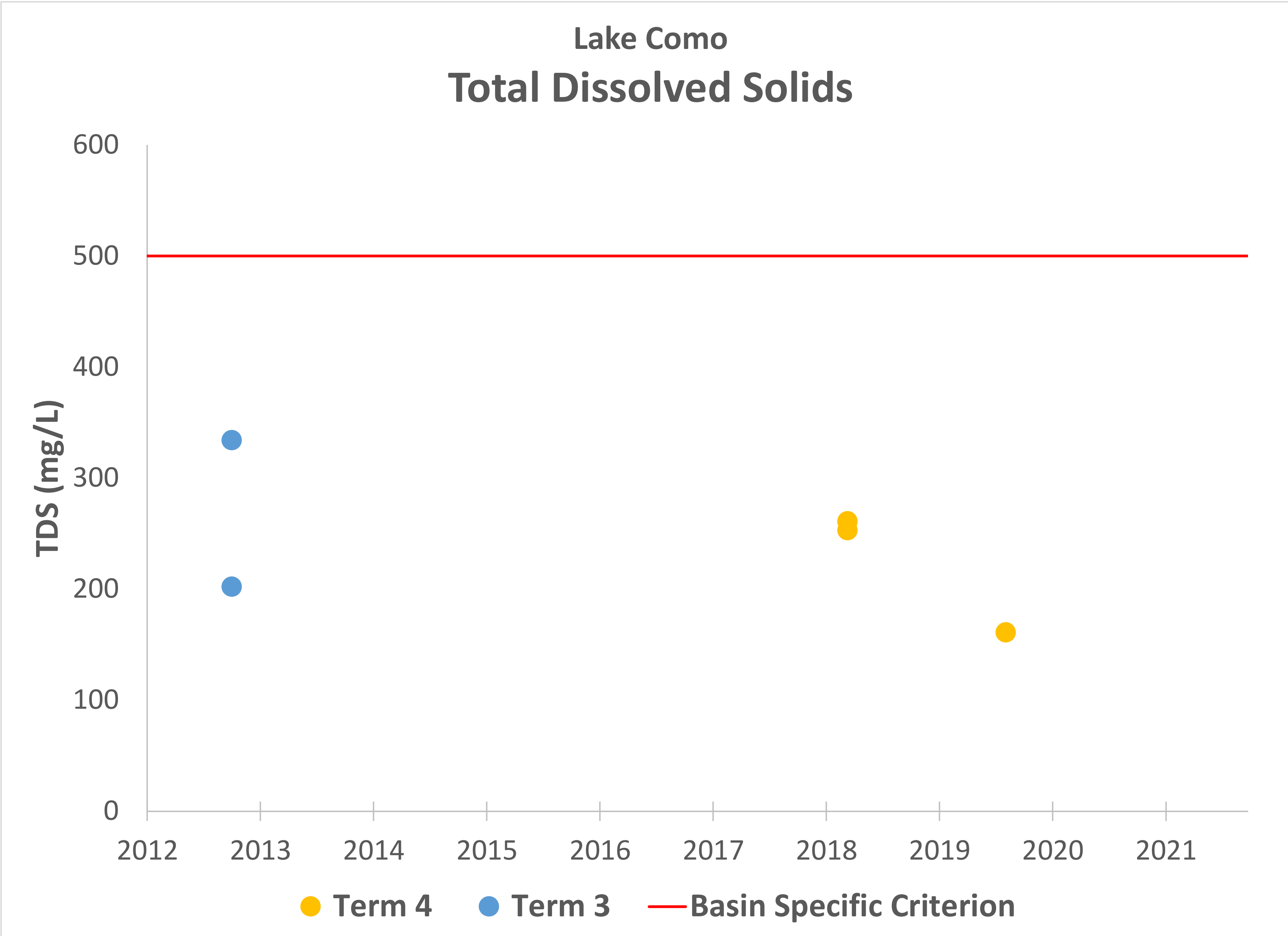

Johnson Creek
Atrazine
10
1
0.1
0.01
0.001
Atrazine (µg/L)
2017
2018
2019
2020
2021
Term 4
Human Health Criterion



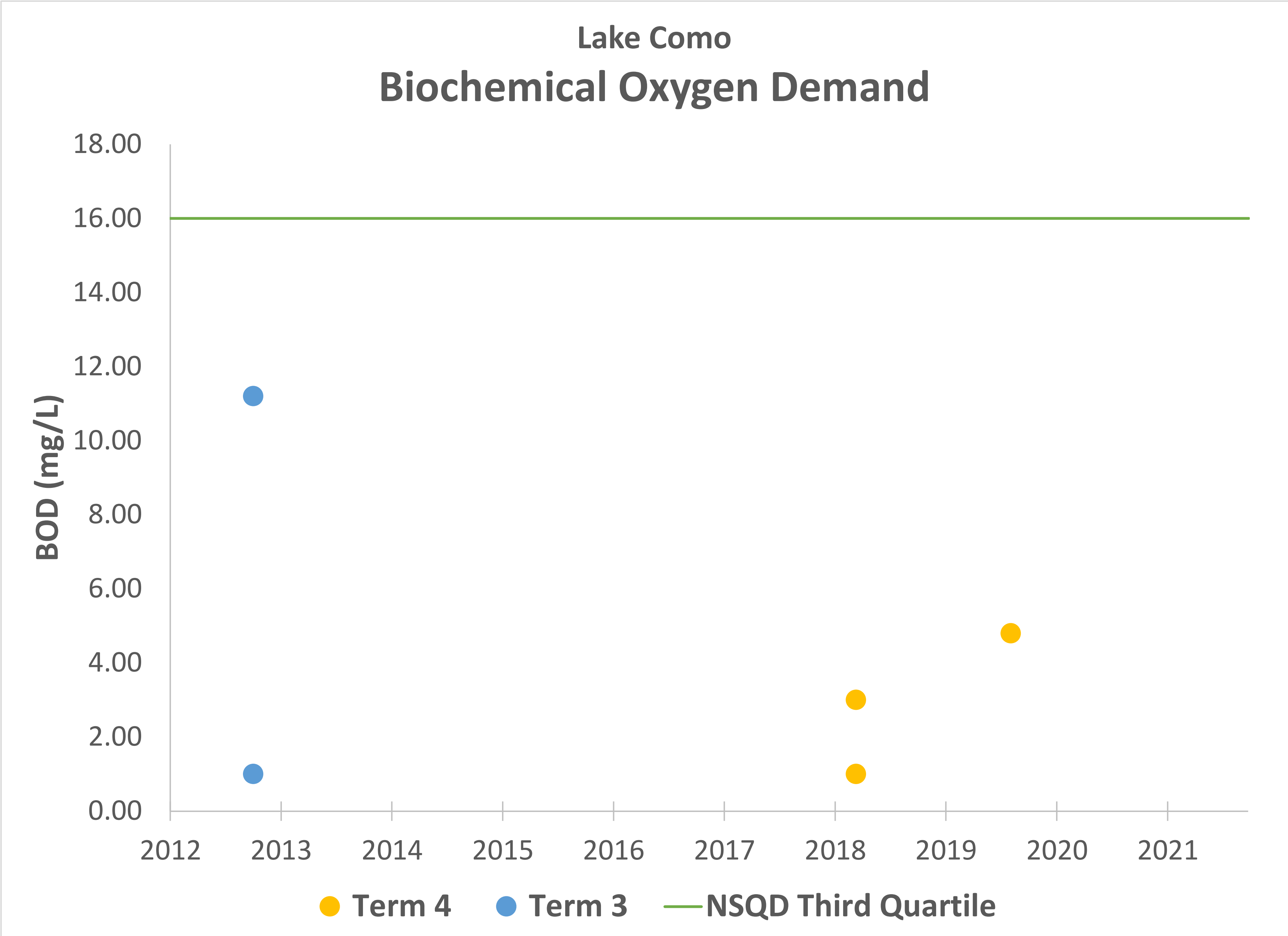
Johnson Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
14
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
CRP
Basin Specific Criterion (>3)
Spring Criterion (>4)

Appendix P

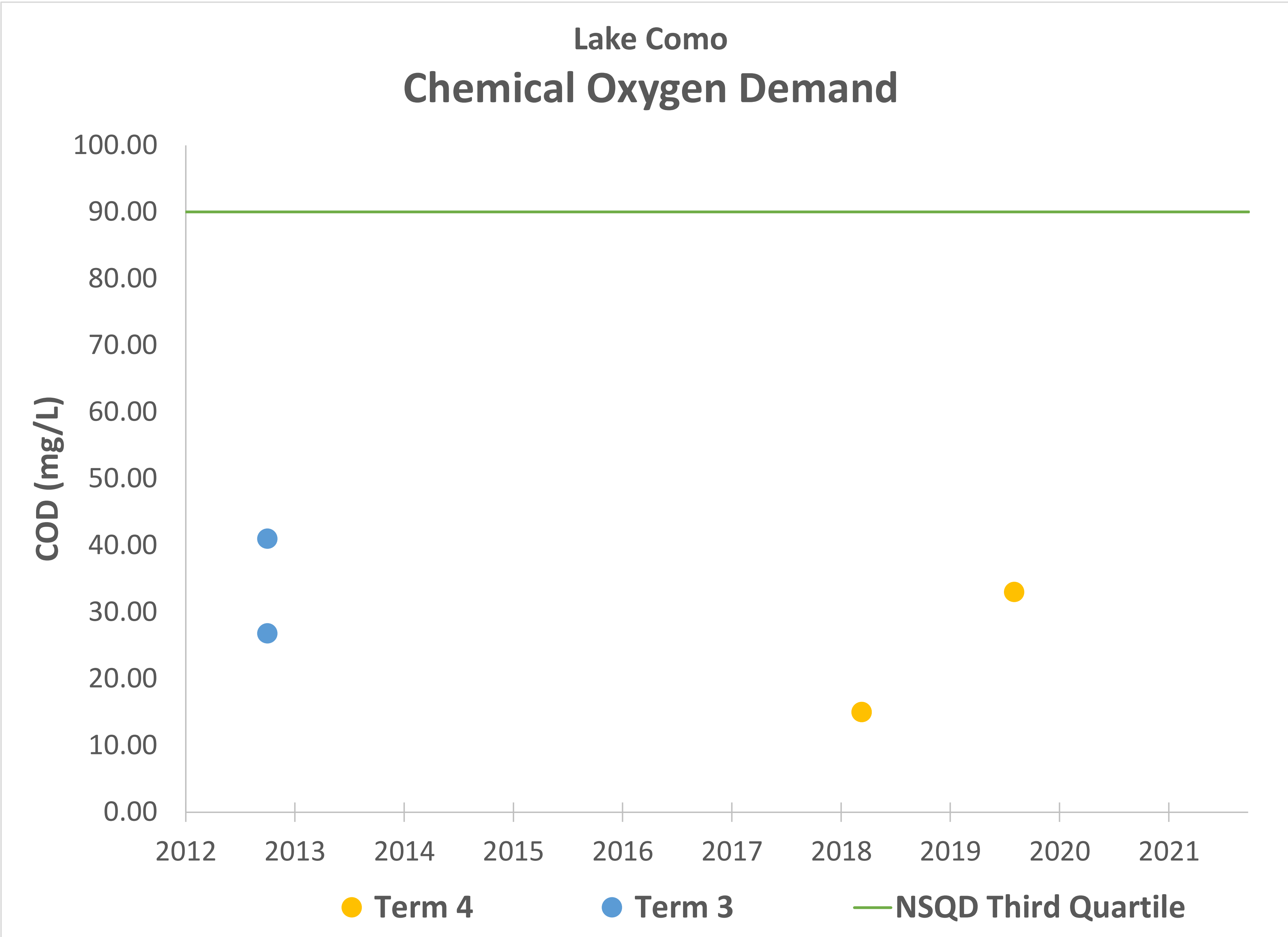
Lake Como – Clear Fork Trinity River Water Quality Data Graphs


Lake Como
Total Dissolved Solids
TDS (mg/L)
600
500
400
300
200
100
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Basin Specific Criterion

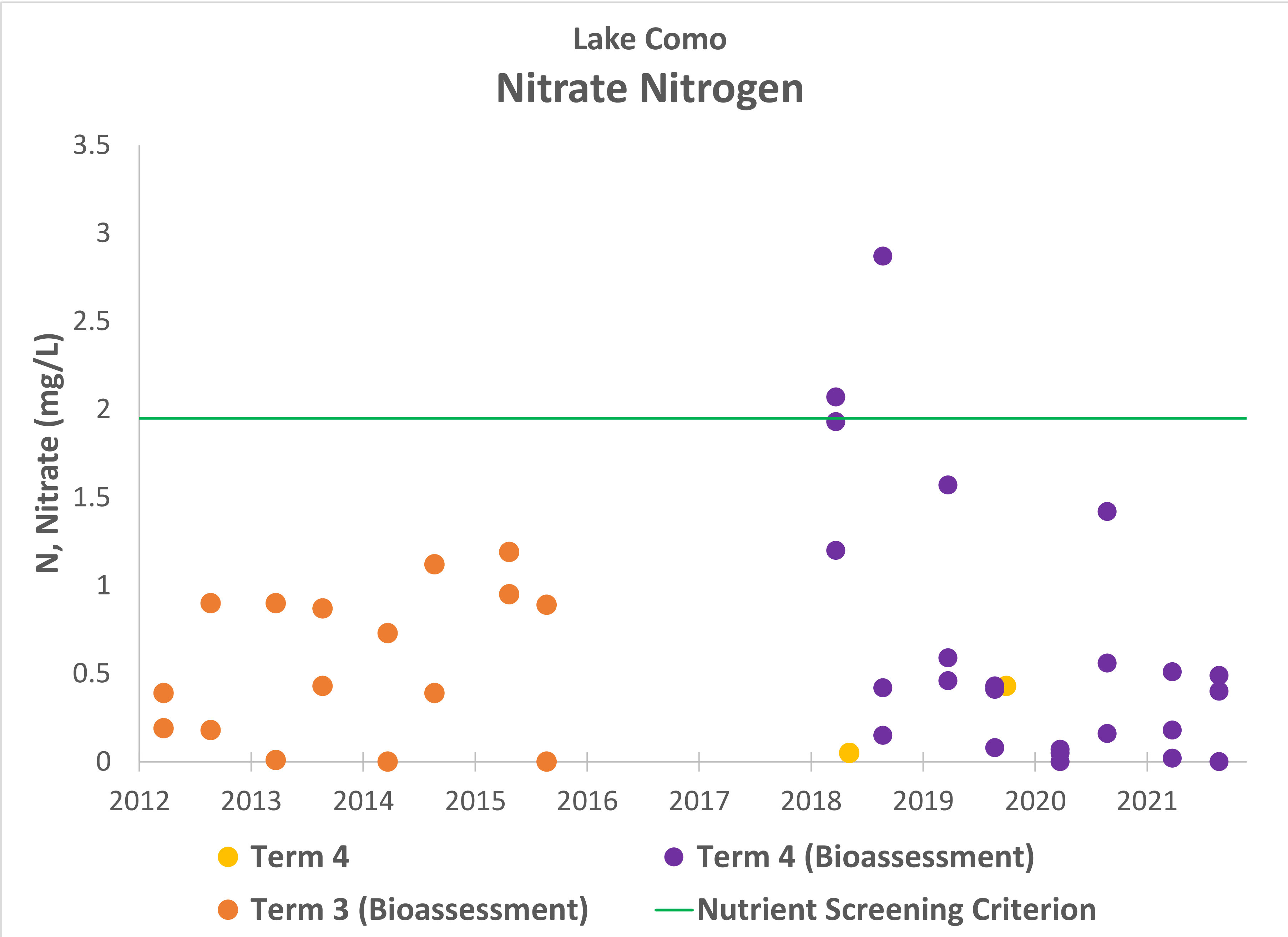

Lake Como
Total Suspended Solids
TSS (mg/L)
160
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile



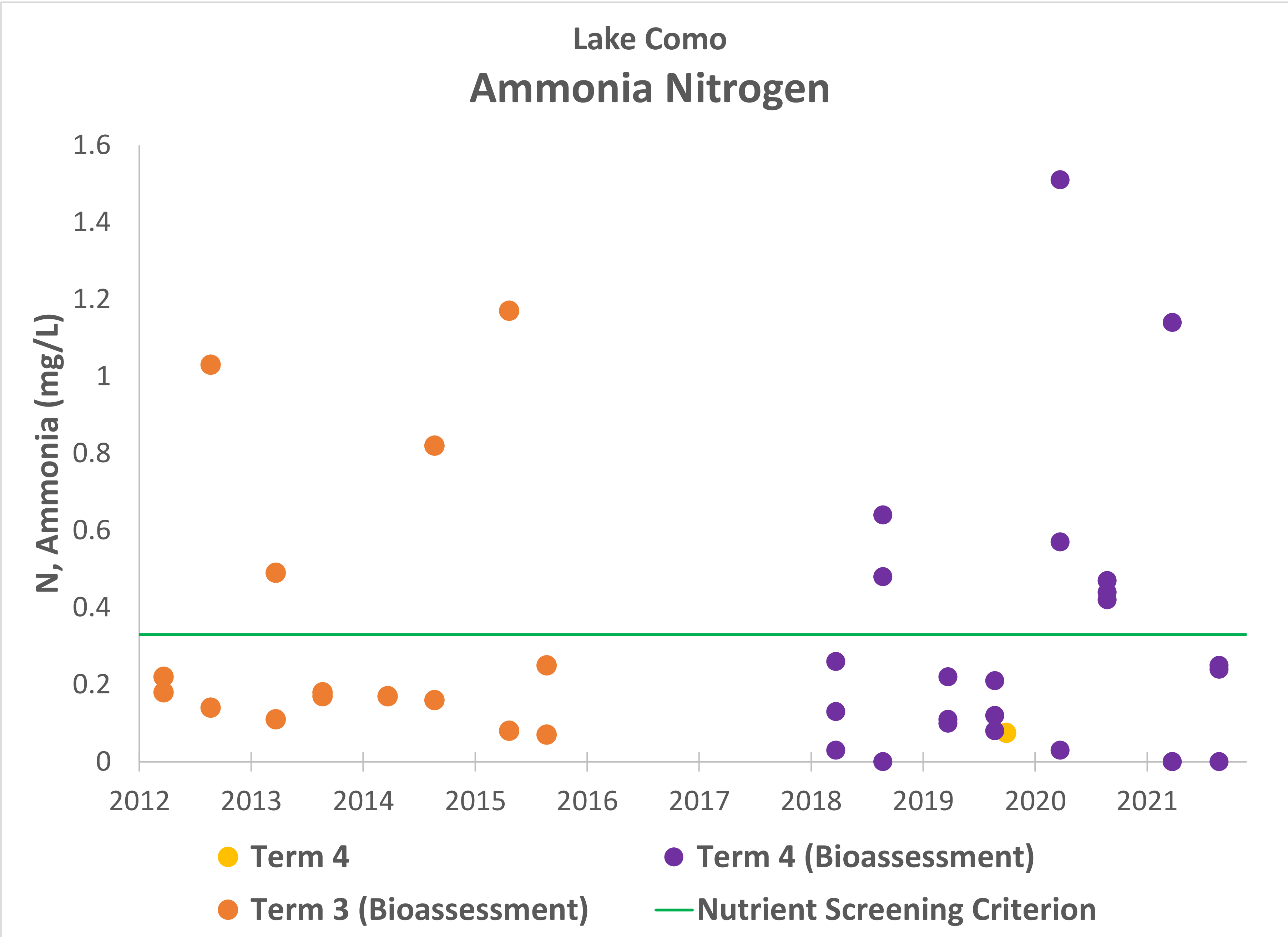
Lake Como
Biochemical Oxygen Demand
BOD (mg/L)
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile



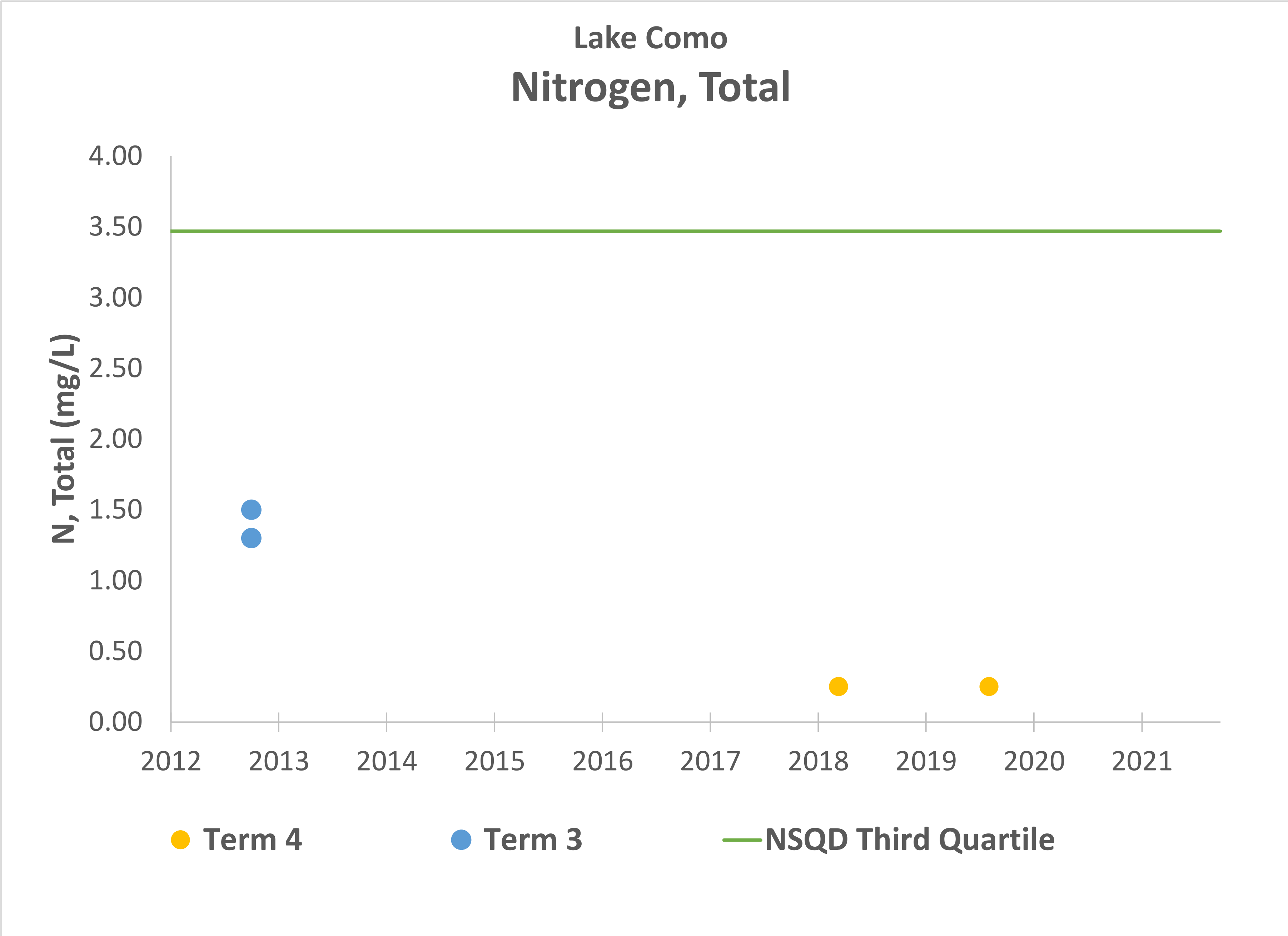
Lake Como
Chemical Oxygen Demand
COD (mg/L)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

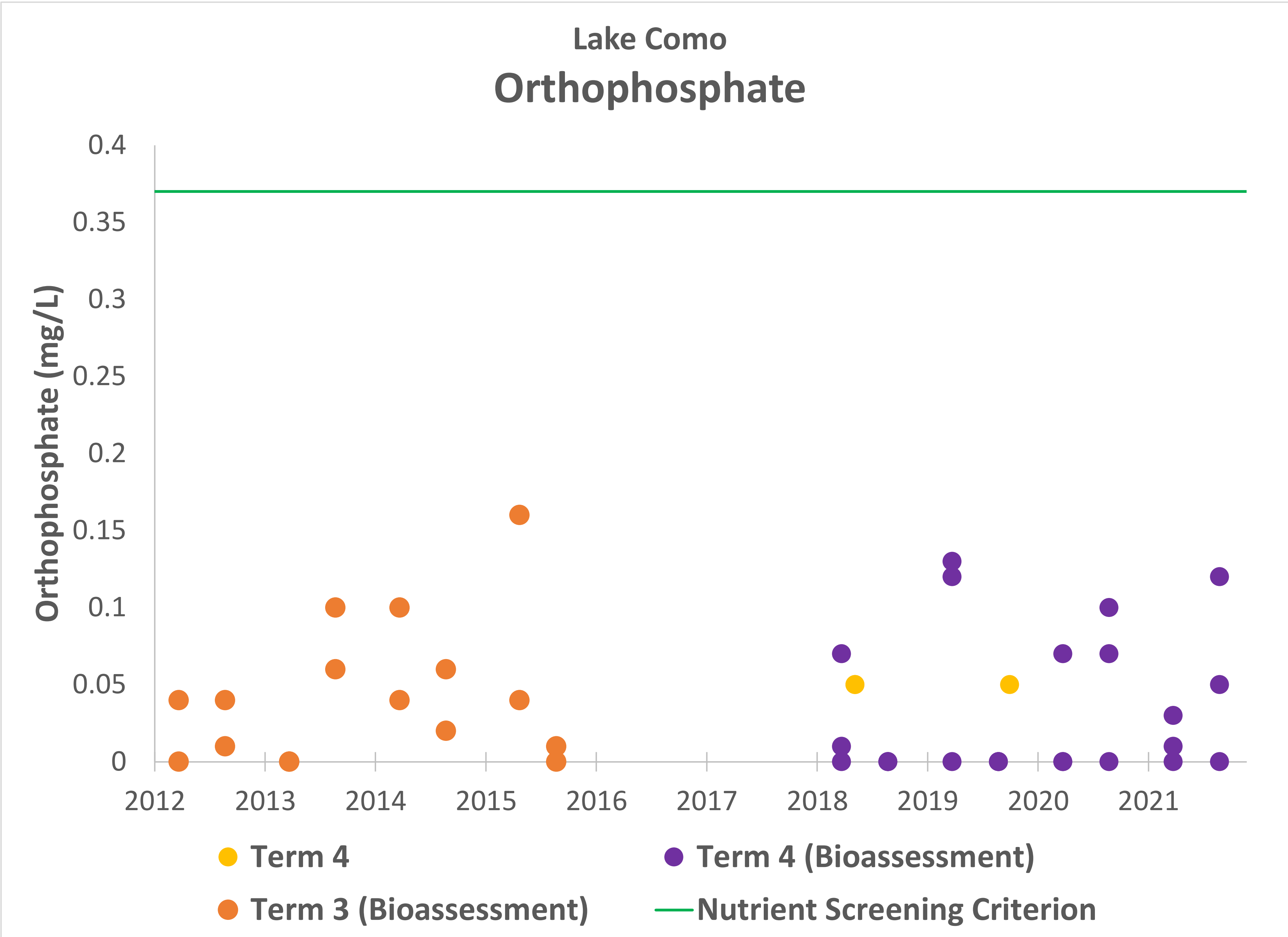


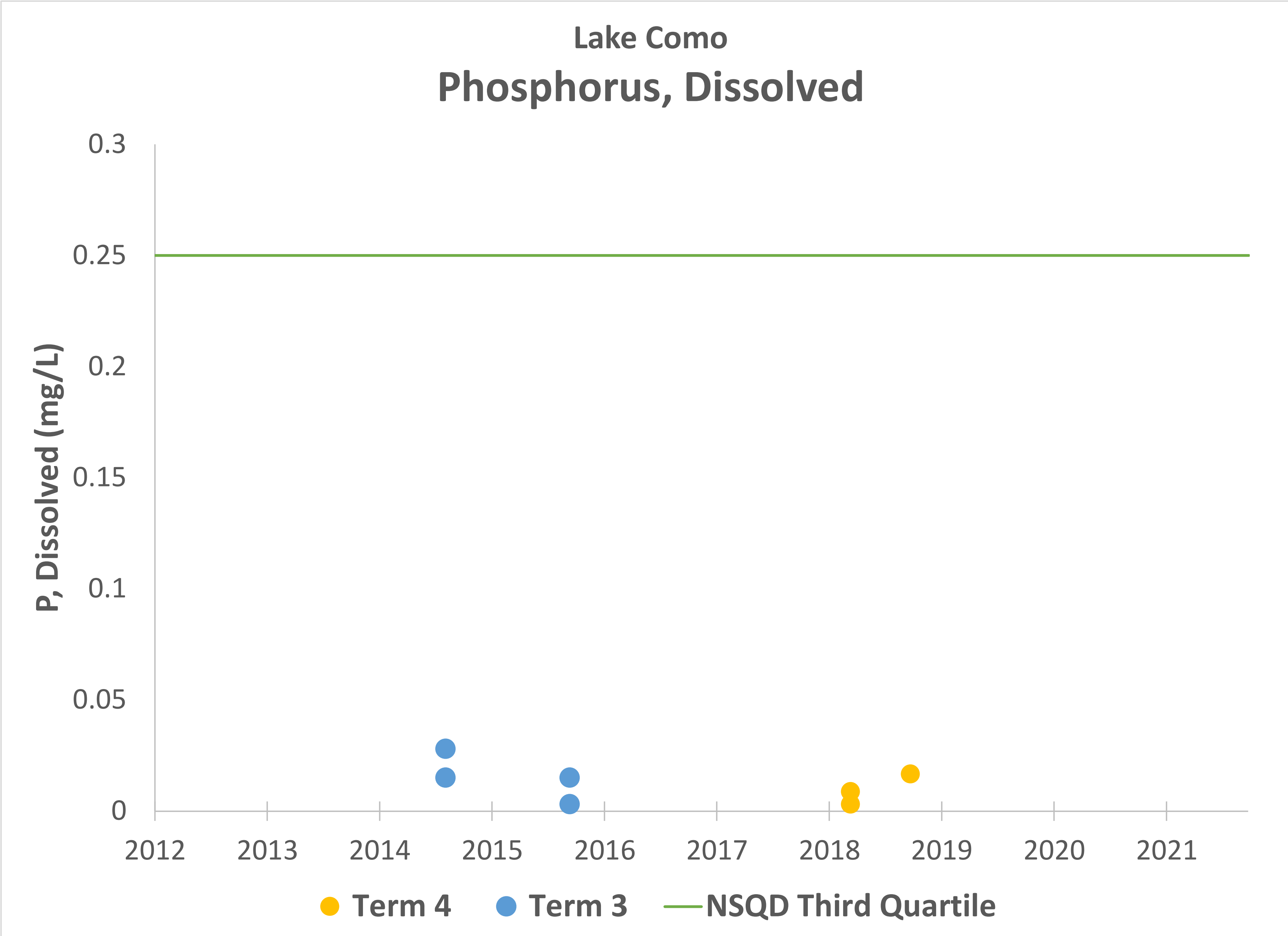
Lake Como
Nitrate Nitrogen
N, Nitrate (mg/L)
3.5
3
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion



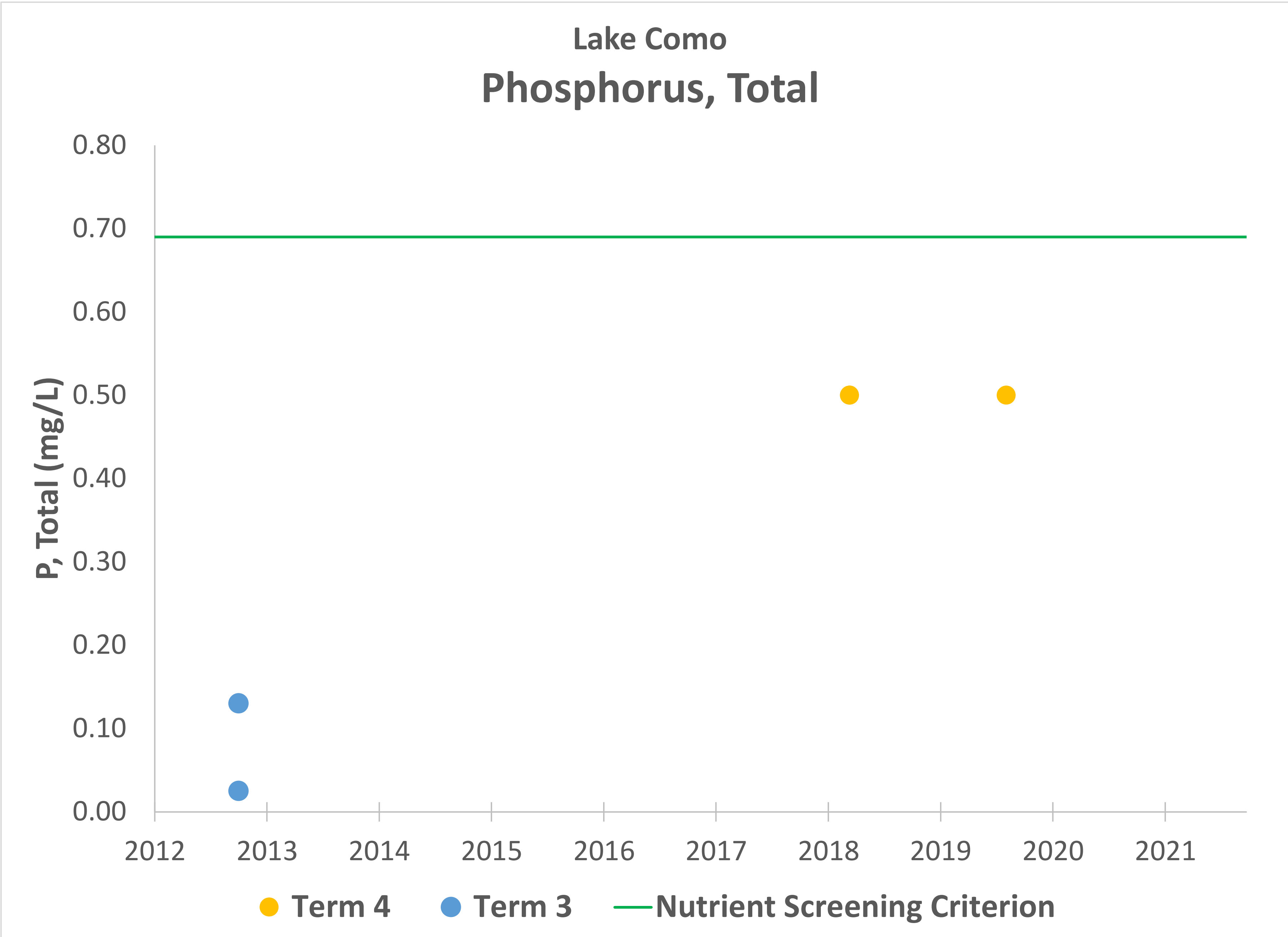
Lake Como
Ammonia Nitrogen
N, Ammonia (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion

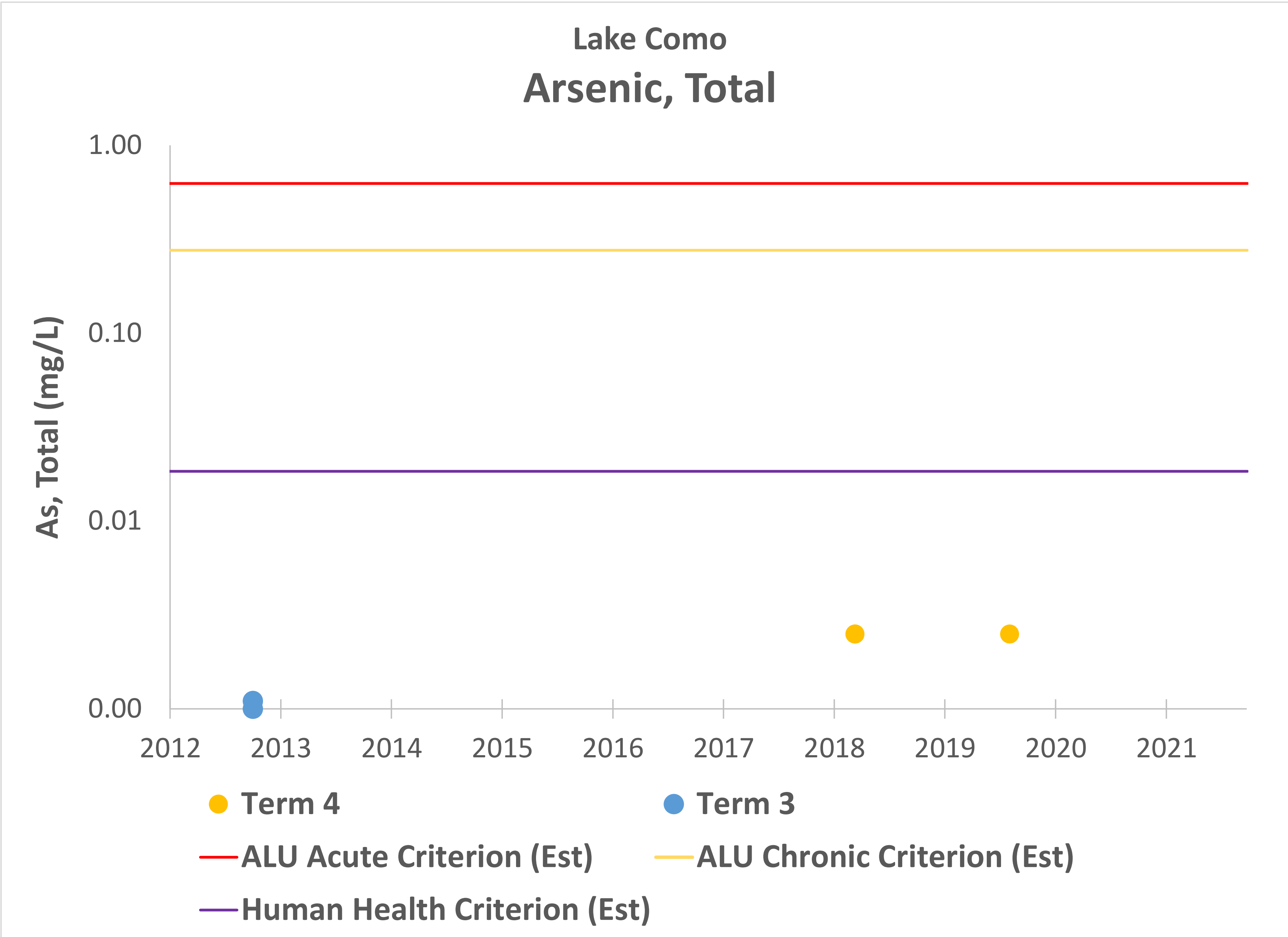

Lake Como
Nitrogen, Total
N, Total (mg/L)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile


Lake Como
Orthophosphate
Orthophosphate (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion

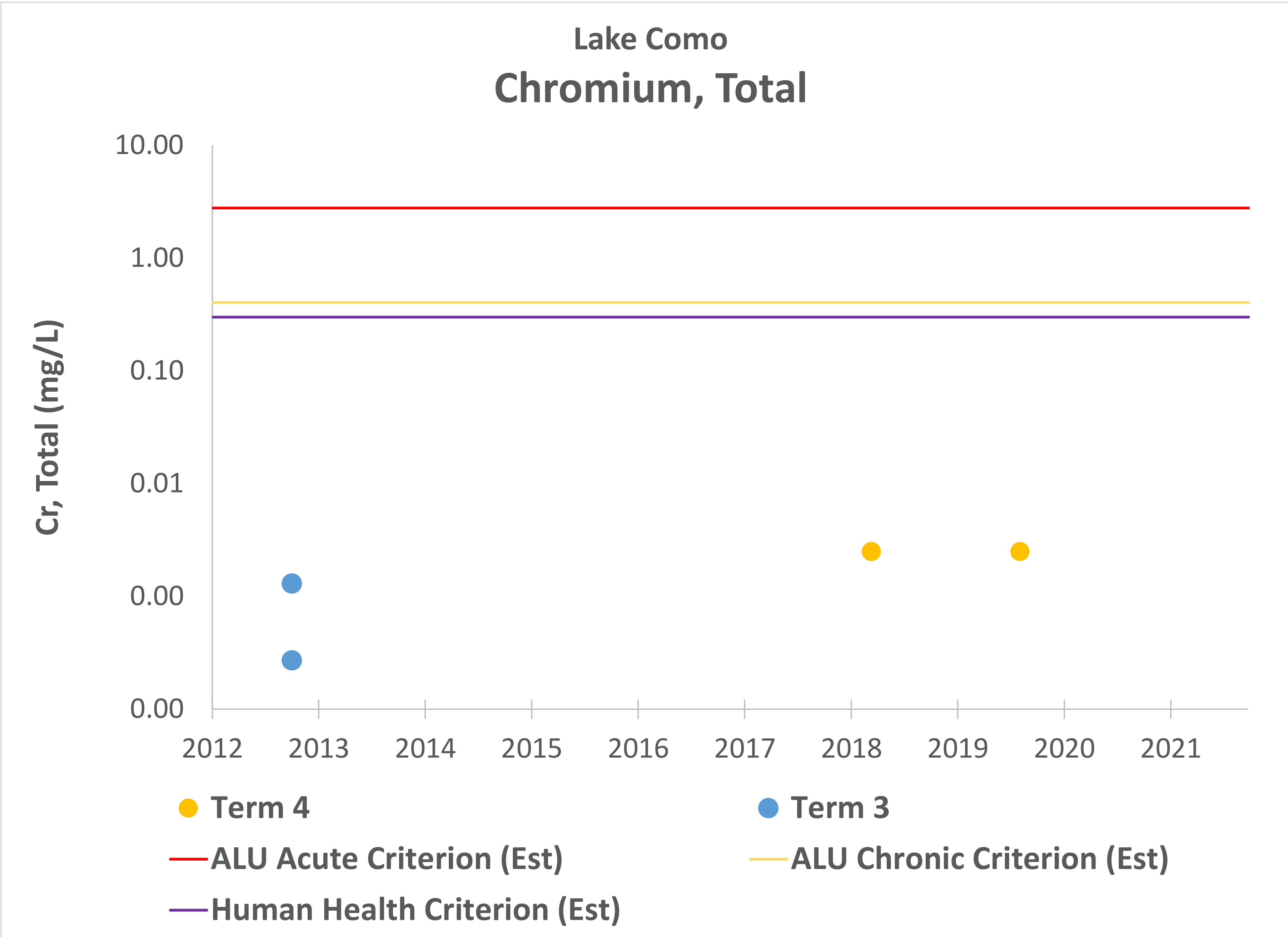


Lake Como
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

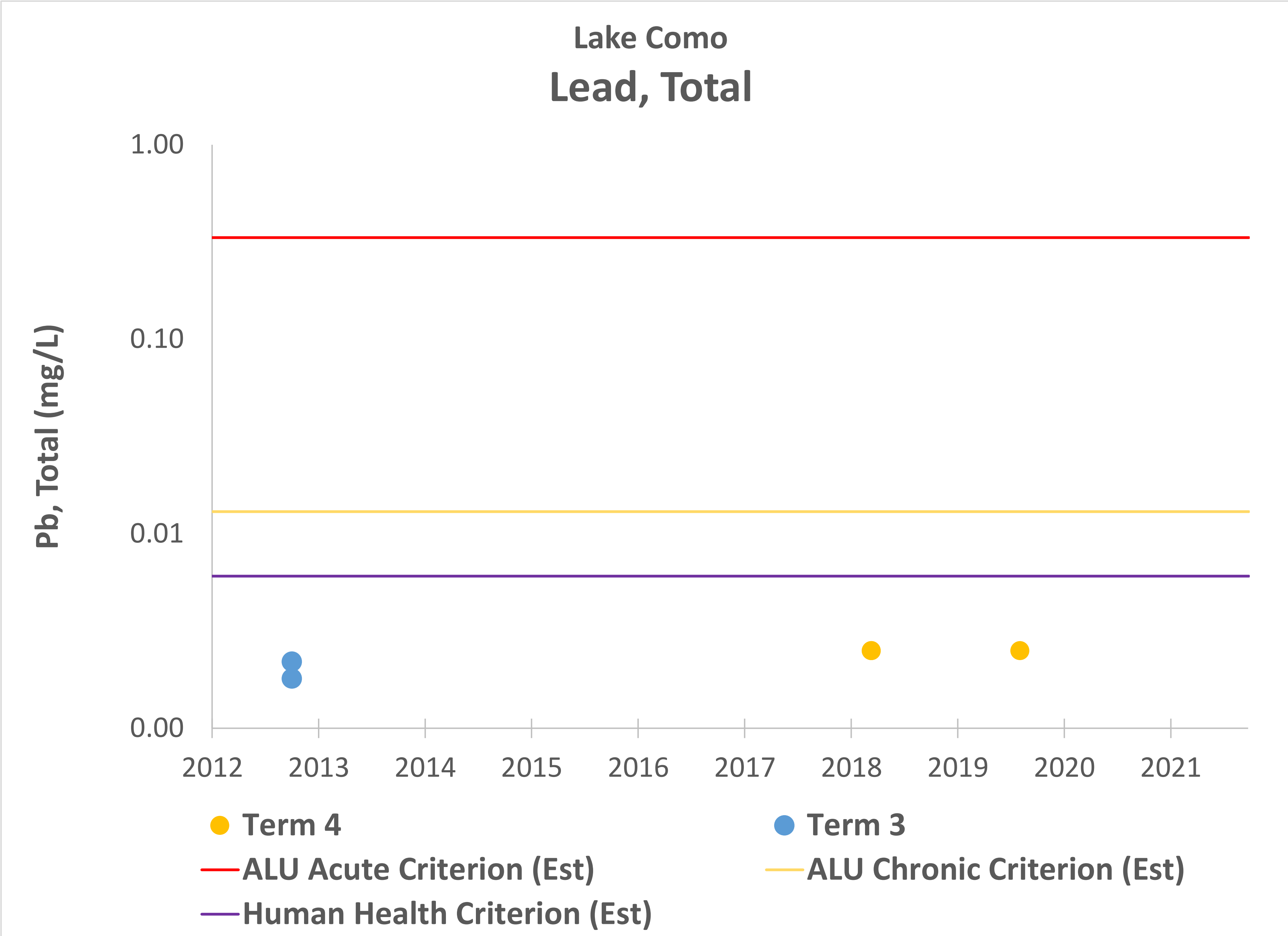

Lake Como
Phosphorus, Total
P, Total (mg/L)
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Nutrient Screening Criterion

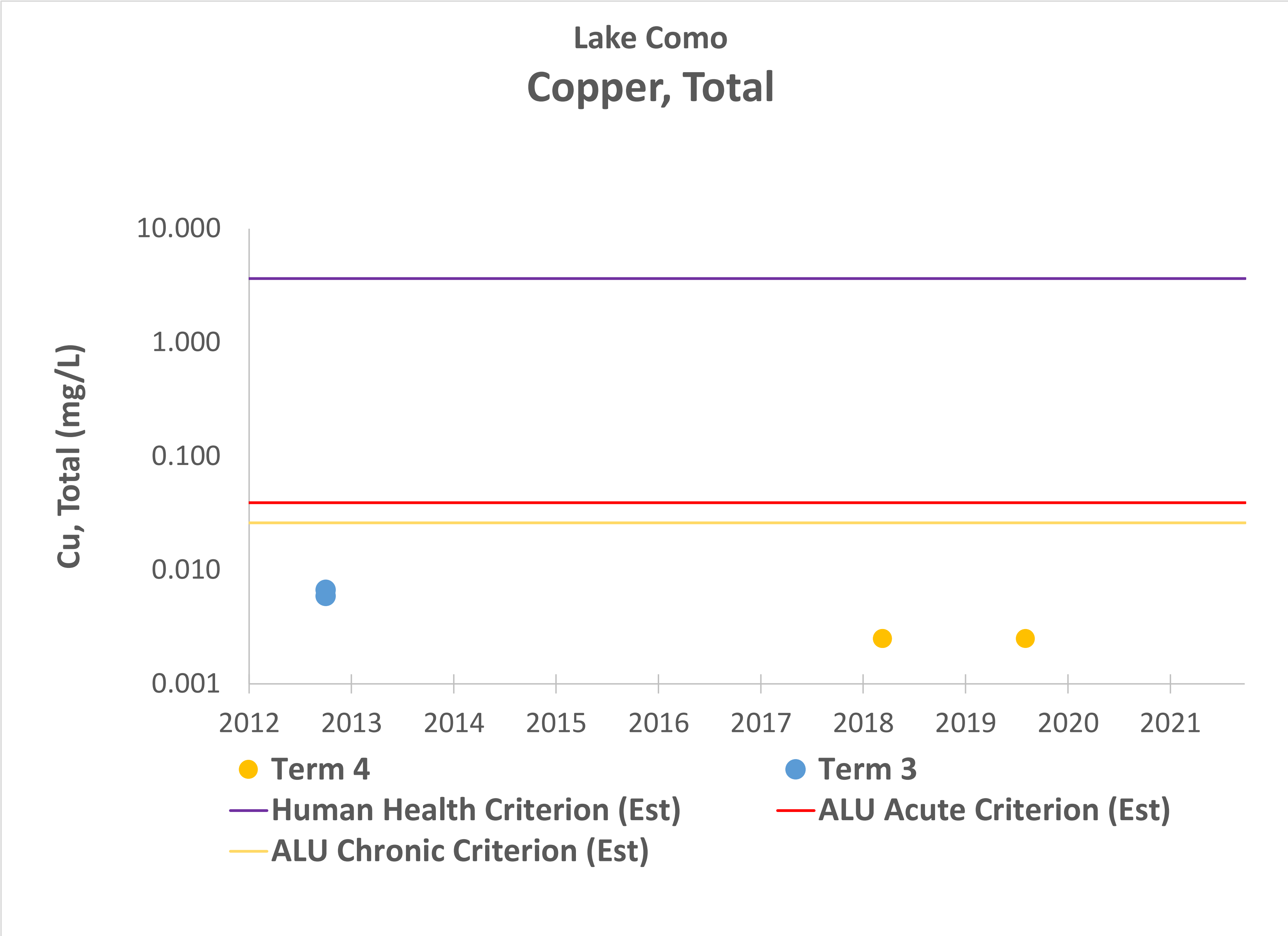


Lake Como
Arsenic, Total
As, Total (mg/L)
1.00
0.10
0.01
0.00
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

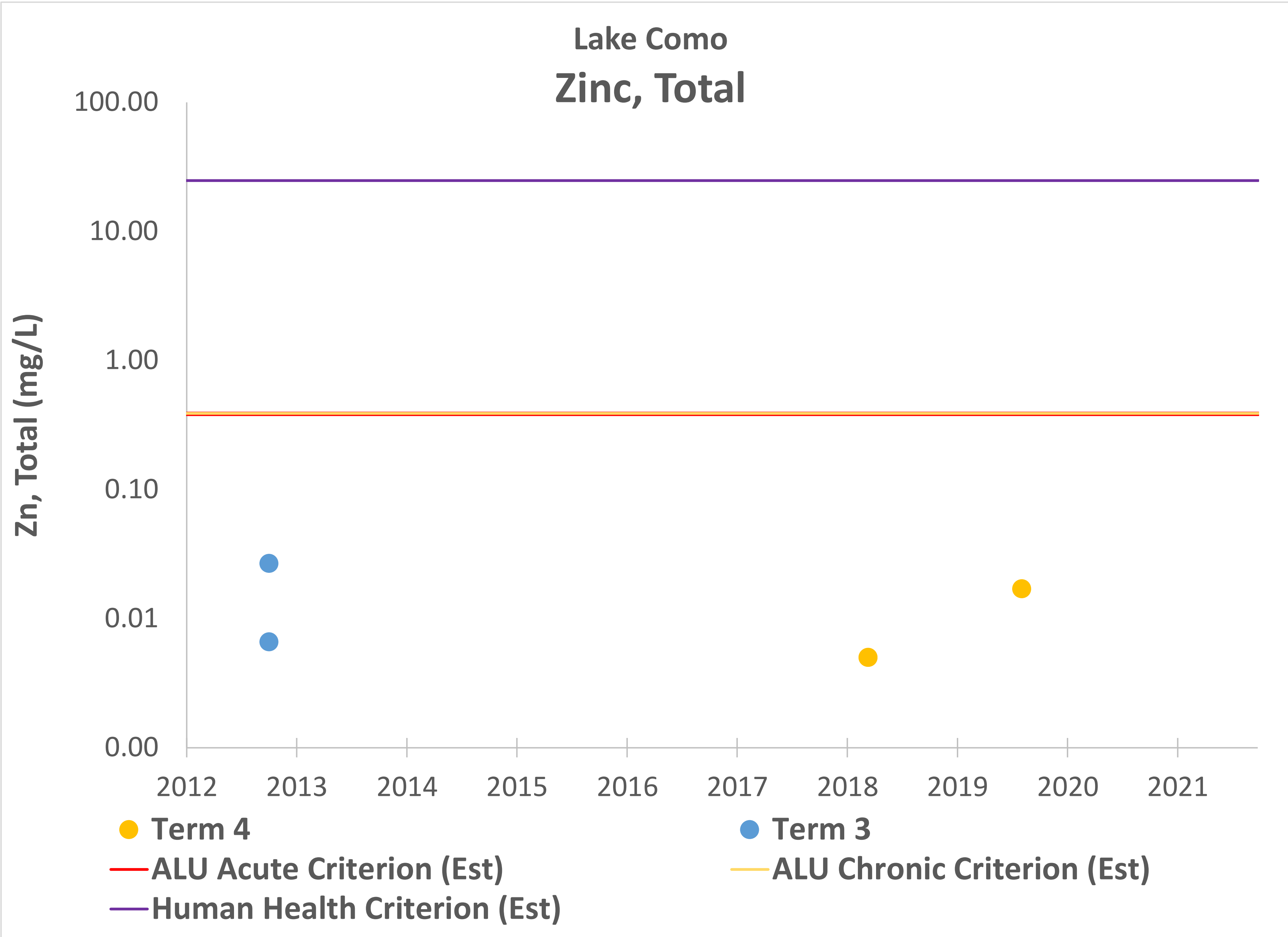


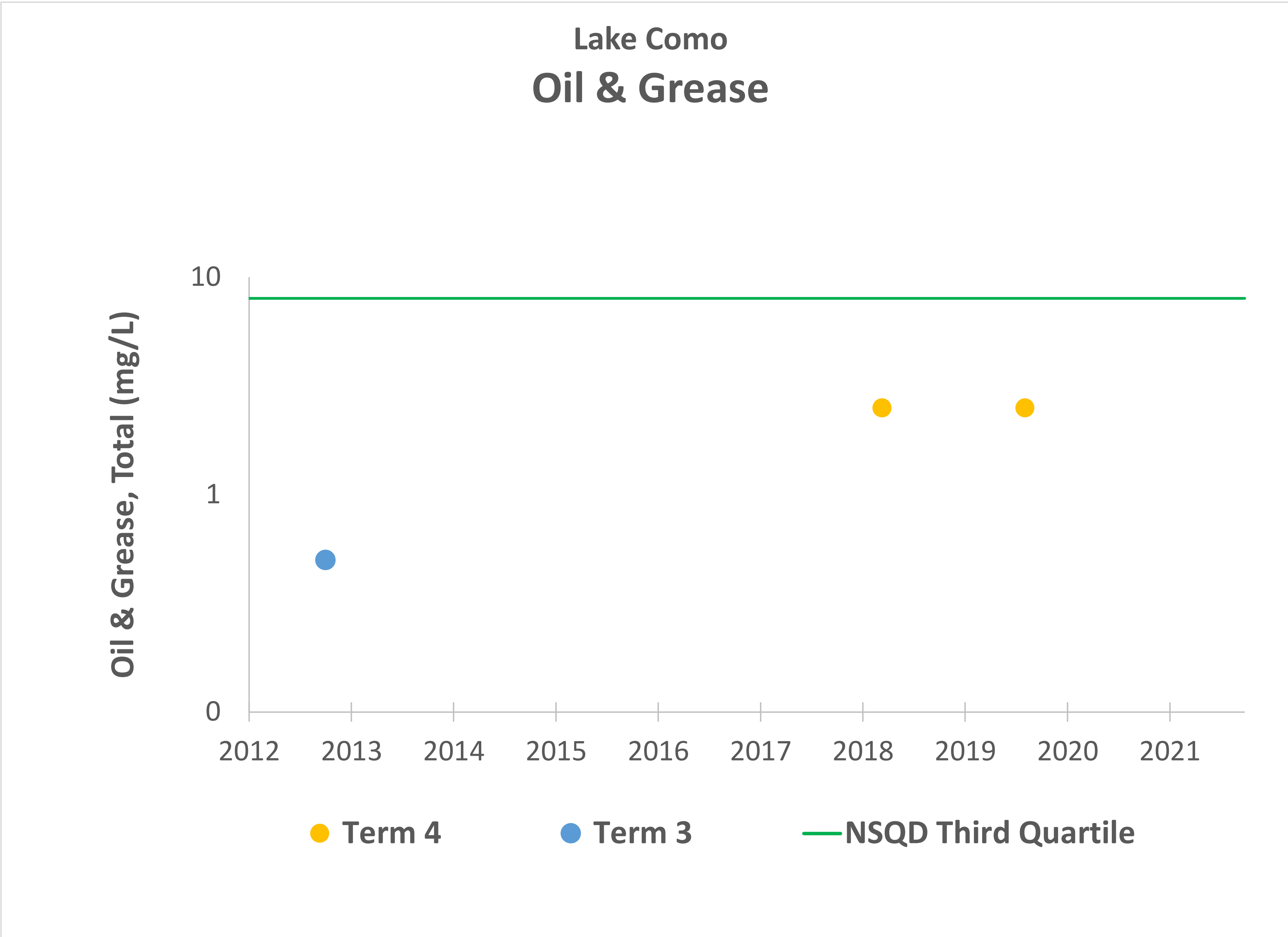
Lake Como
Chromium, Total
Cr, Total (mg/L)
10.00
1.00
0.10
0.01
0.00
0.00
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

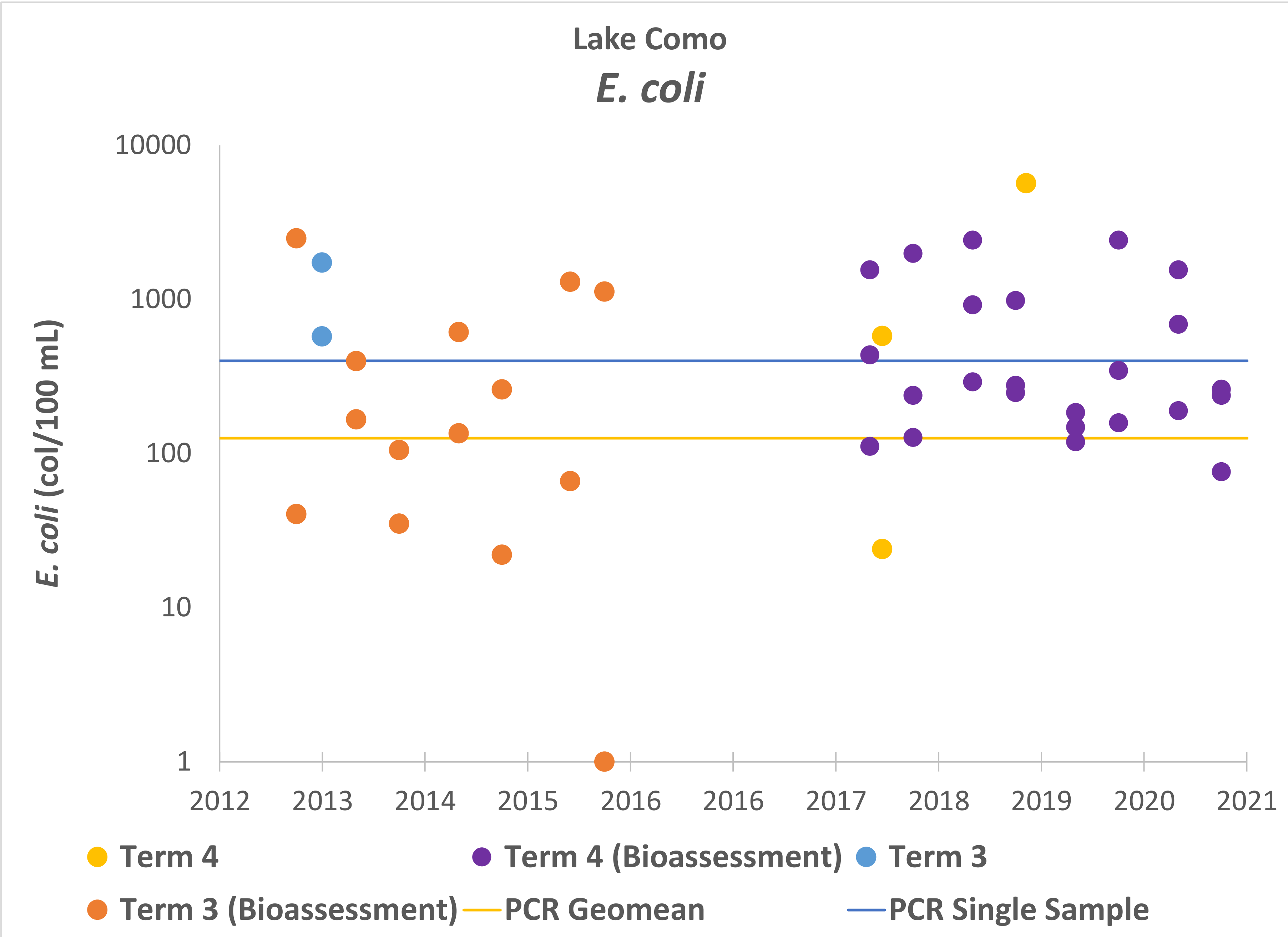

Lake Como
Lead, Total
Pb, Total (mg/L)
1.00
0.10
0.01
0.00
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



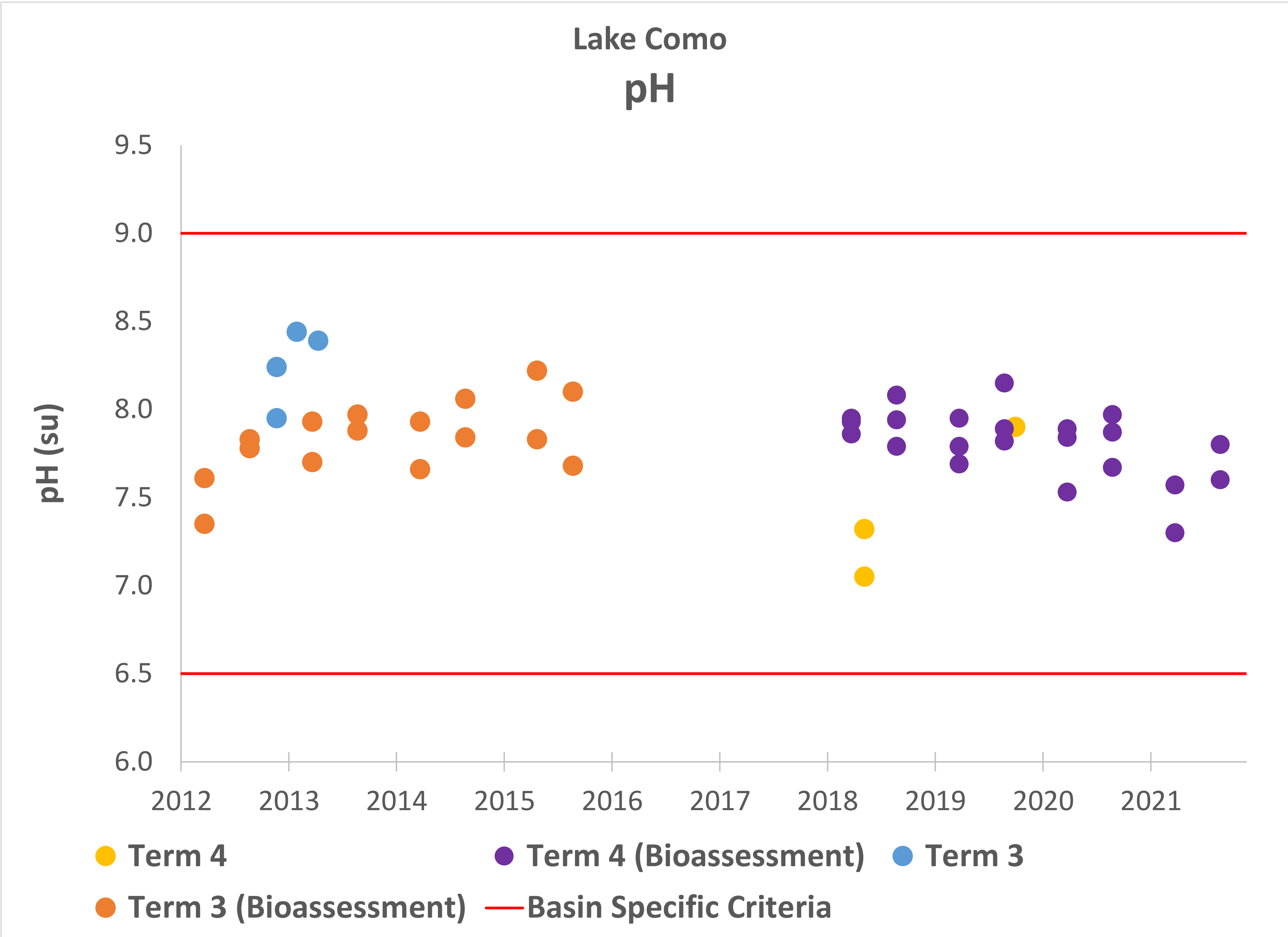
Lake Como
Copper, Total
Cu, Total (mg/L)
10.000
1.000
0.100
0.010
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Human Health Criterion (Est)
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)


Lake Como
Zinc, Total
100.00
10.00
1.00
0.10
0.01
0.00
Zn, Total (mg/L)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

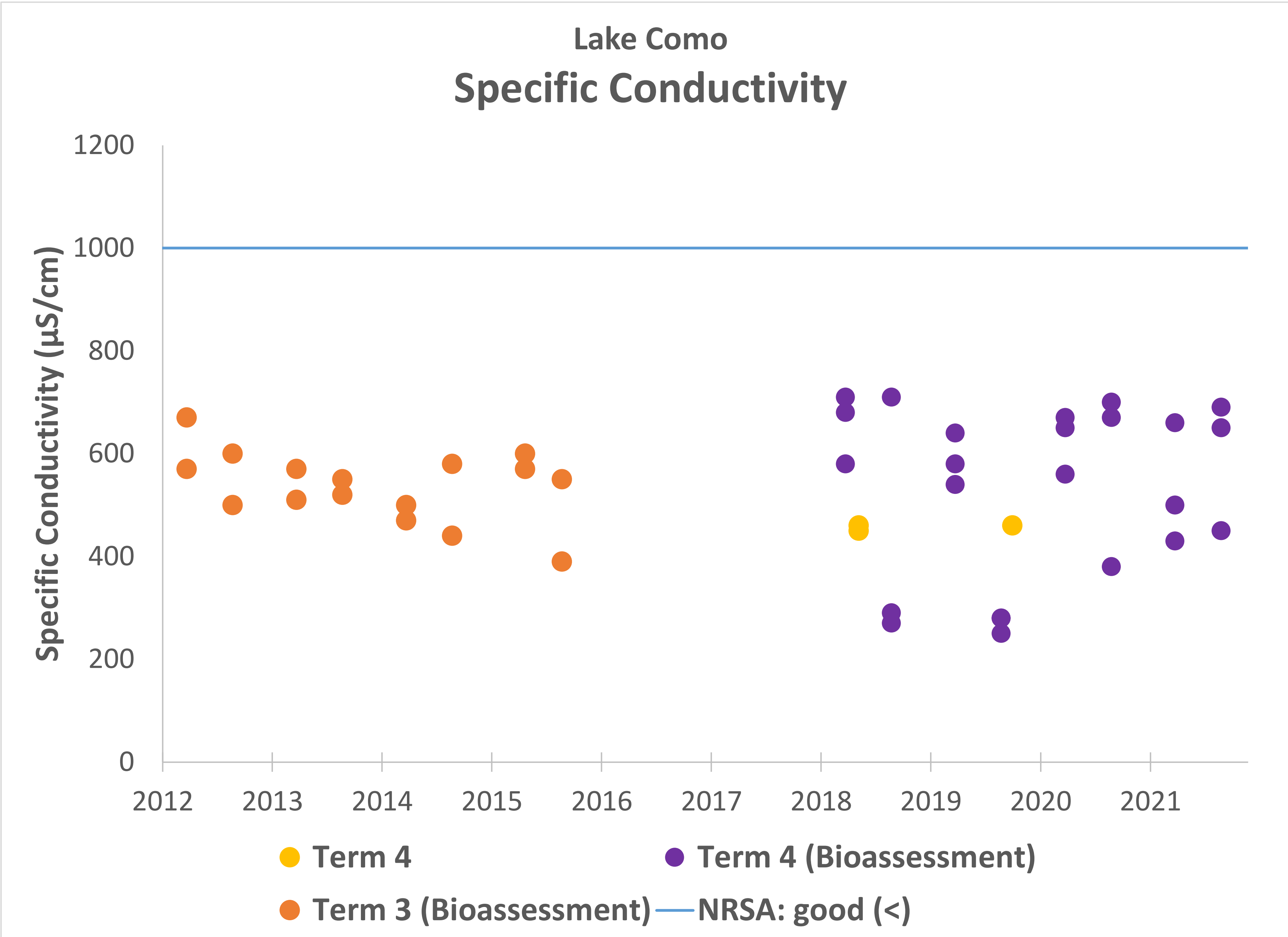

Lake Como
Oil & Grease
Oil & Grease, Total (mg/L)
10
1
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile



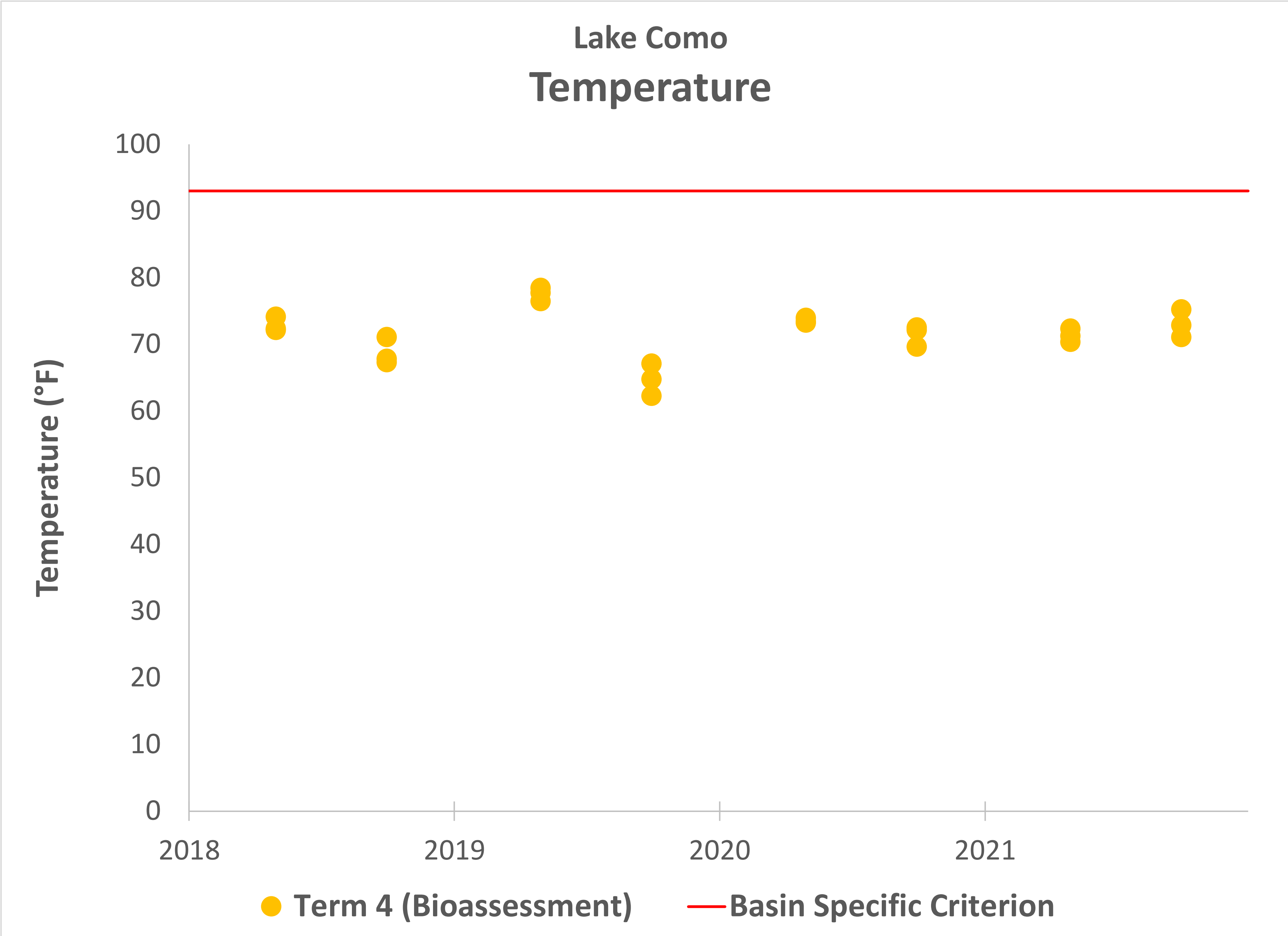
Lake Como
E. coli
10000
1000
100
10
1
E. coli (col/100 mL)
2012
2013
2014
2015
2016
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3
Term 3 (Bioassessment)
PCR Geomean
PCR Single Sample

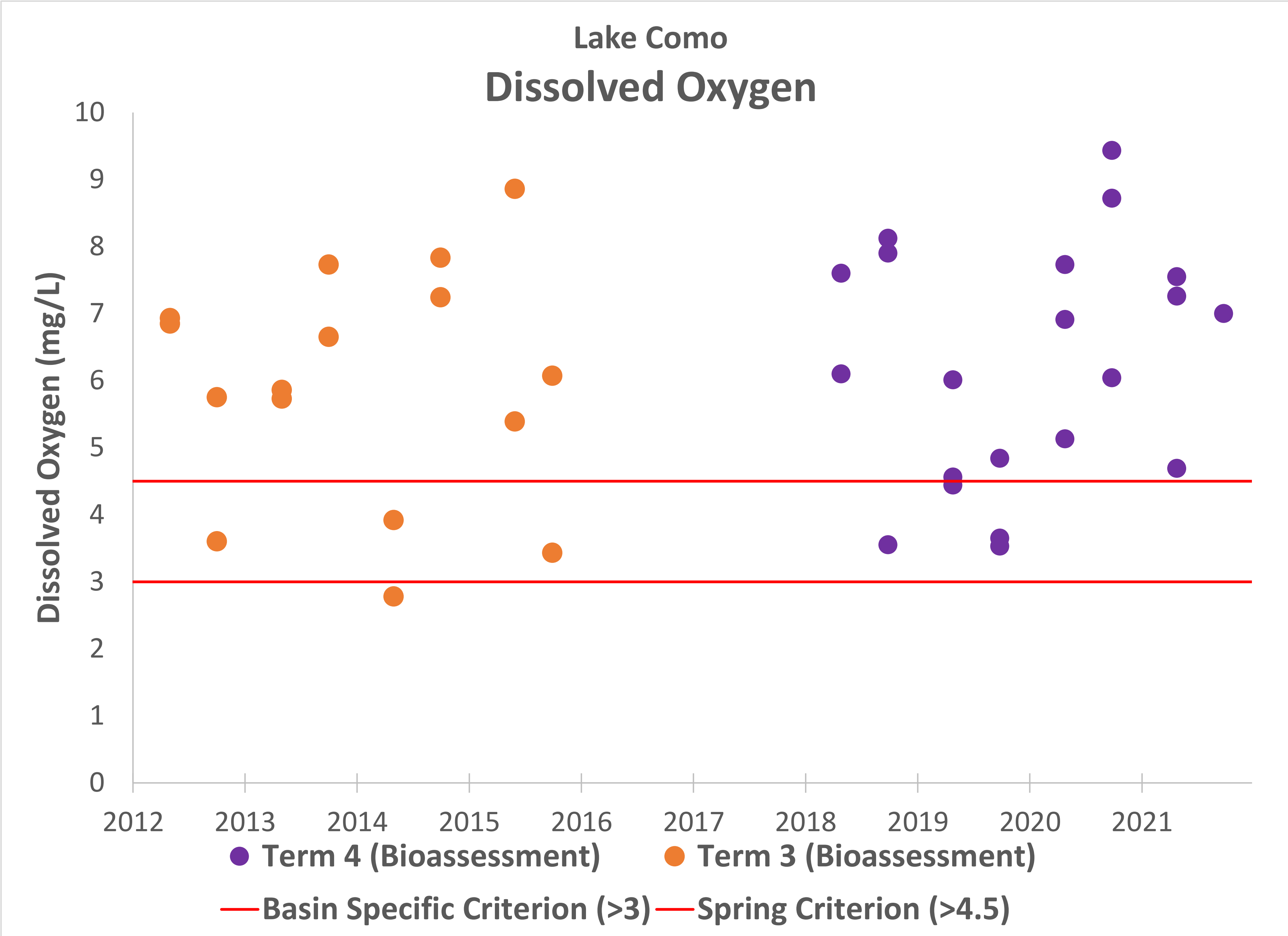


Lake Como
pH
pH (su)
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3
Term 3 (Bioassessment)
Basin Specific Criteria

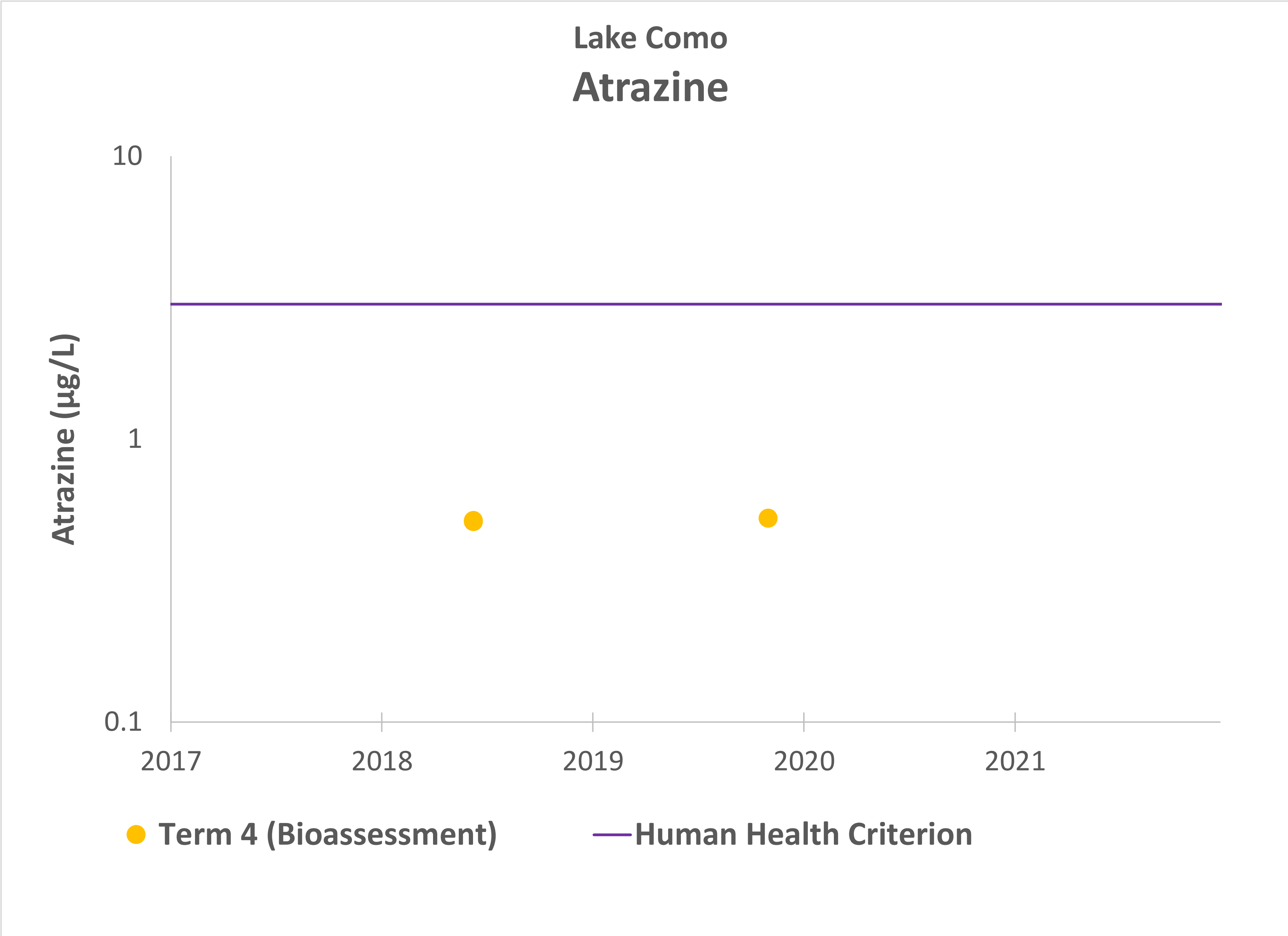


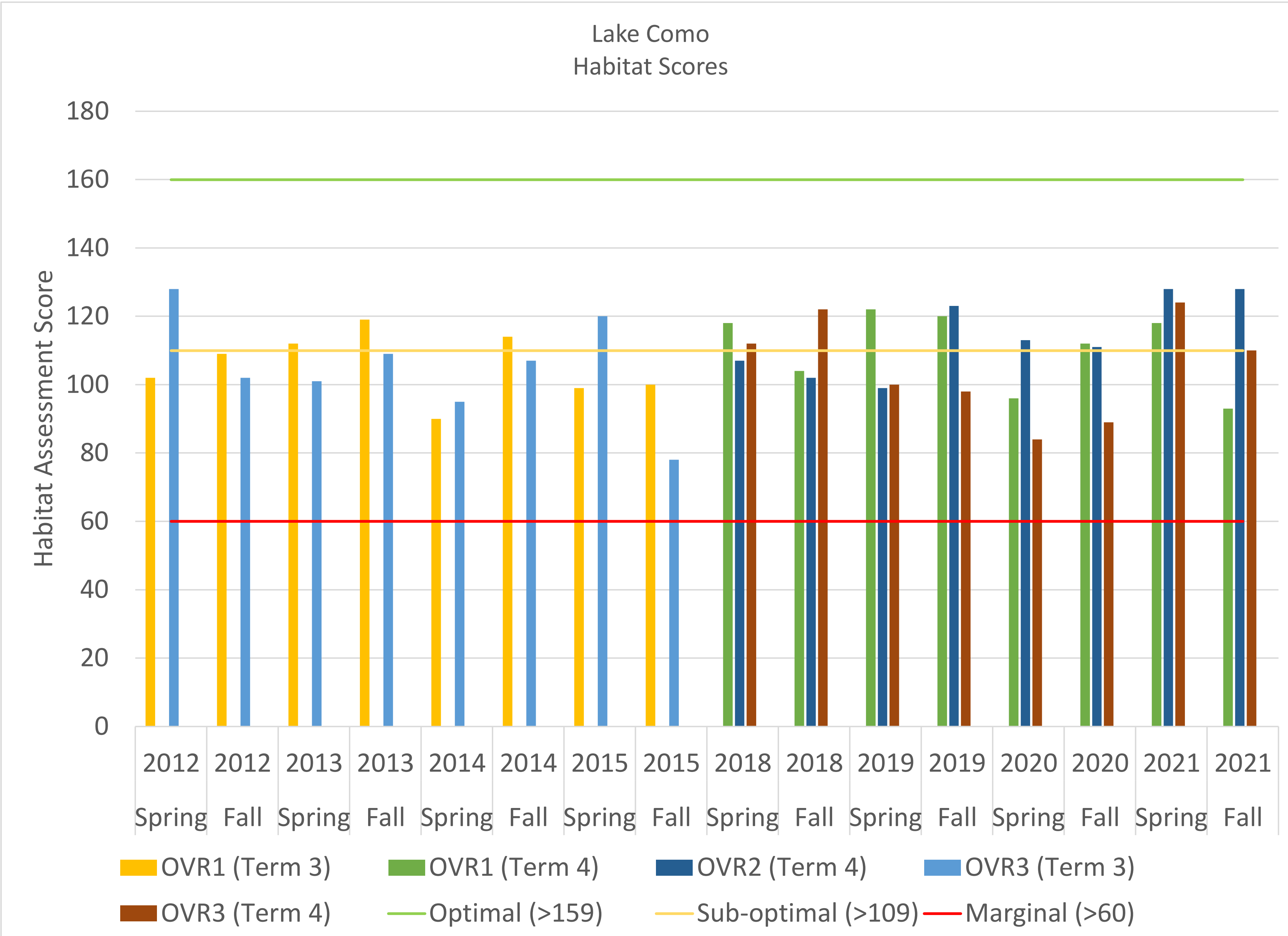
Lake Como
Specific Conductivity
Specific Conductivity (µS/cm)
1200
1000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
NRSA: good (<)

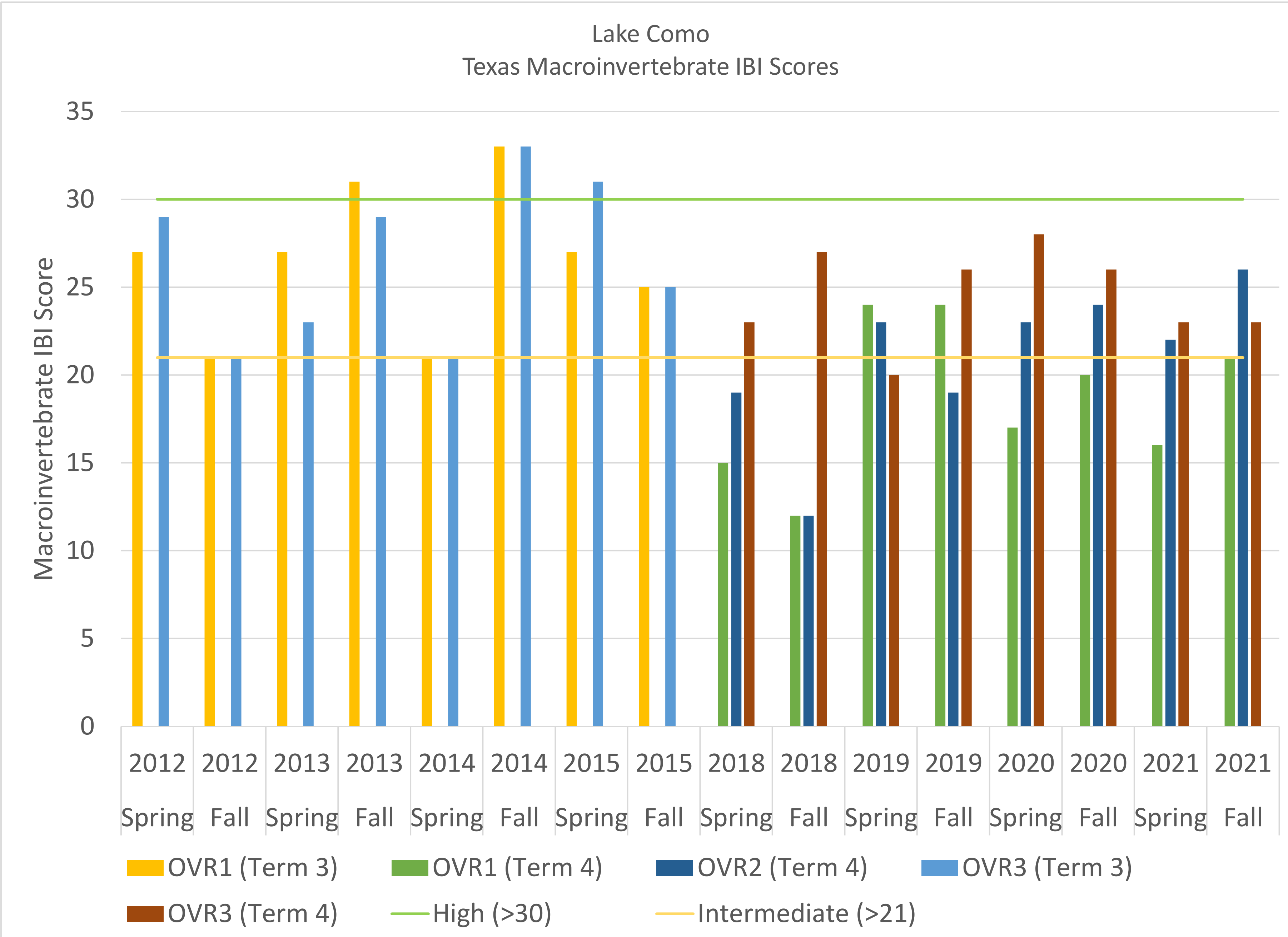

Lake Como
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2018
2019
2020
2021
Term 4 (Bioassessment)
Basin Specific Criterion



Lake Como
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
1
2
3
4
5
6
7
8
9
10
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Basin Specific Criterion (>3)
Spring Criterion (>4.5)


Lake Como
Atrazine
Atrazine (µg/L)
10
1
0.1
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Human Health Criterion

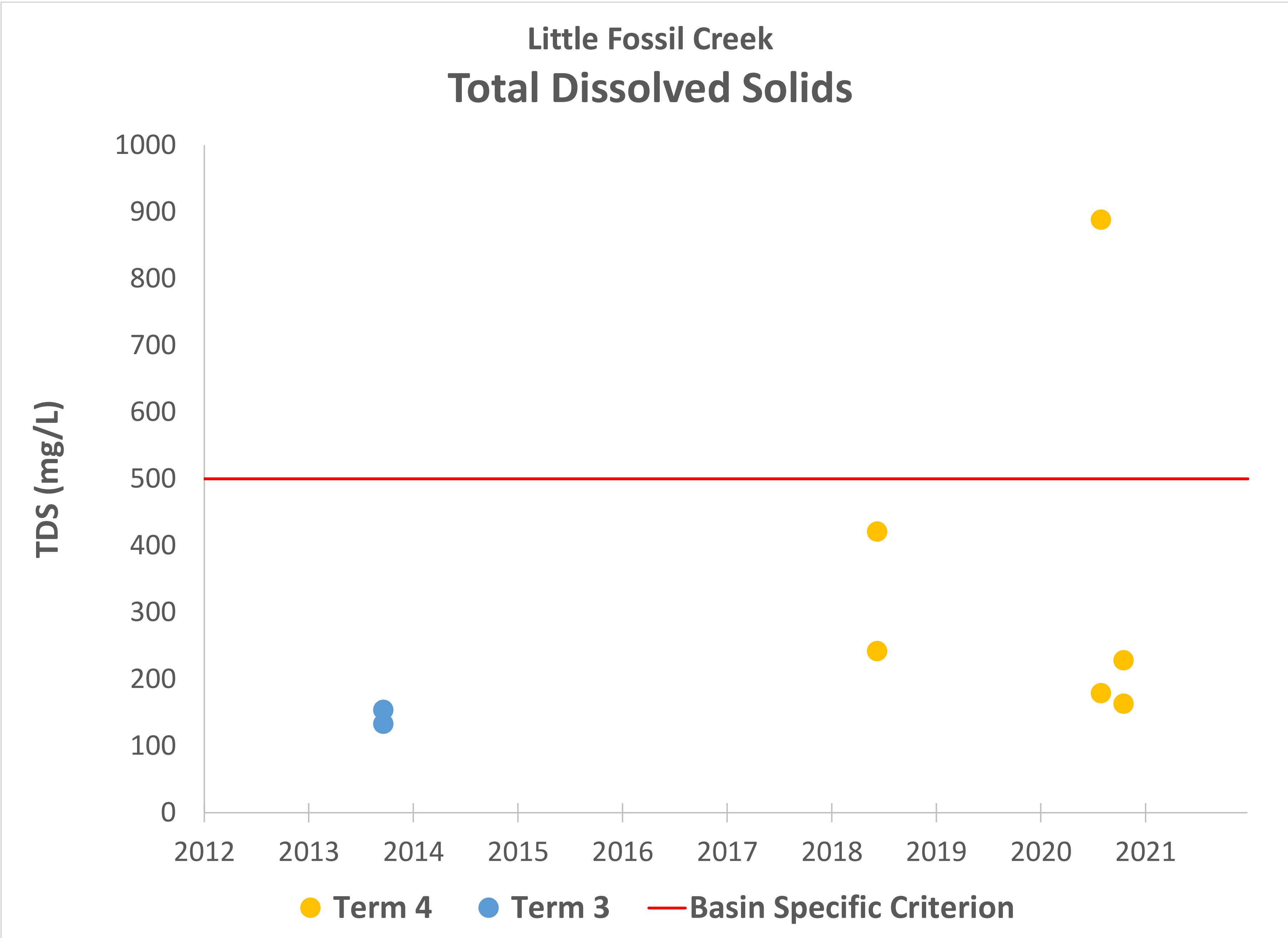

Lake Como
Habitat Scores
Habitat Assessment Score
180
160
140
120
100
80
60
40
20
0
2012 Spring
2012 Fall
2013 Spring
2013 Fall
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
OVR1 (Term 3)
OVR1 (Term 4)
OVR2 (Term 4)
OVR3 (Term 3)
OVR3 (Term 4)
Optimal (>159)
Sub-optimal (>109)
Marginal (>60)

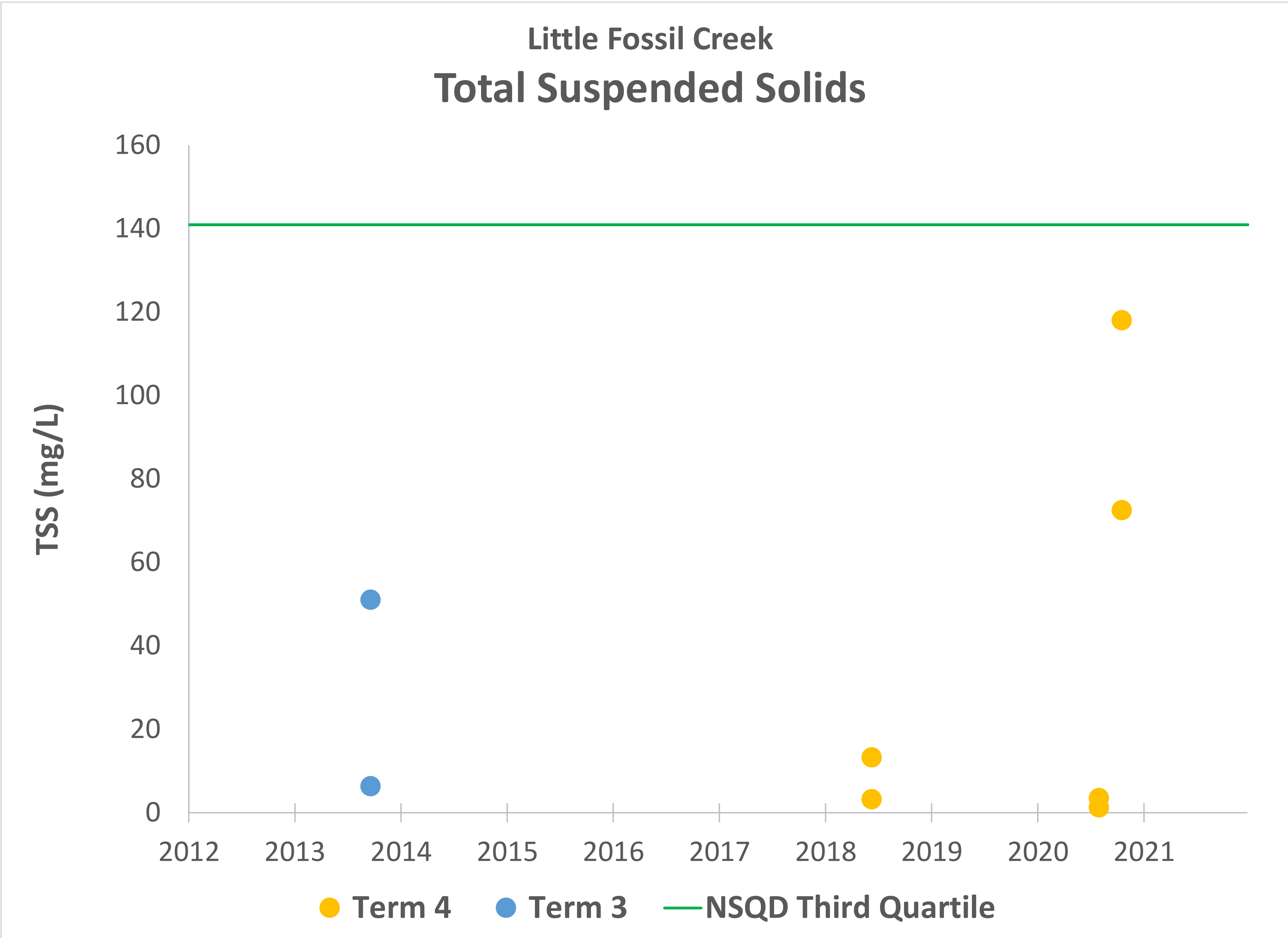


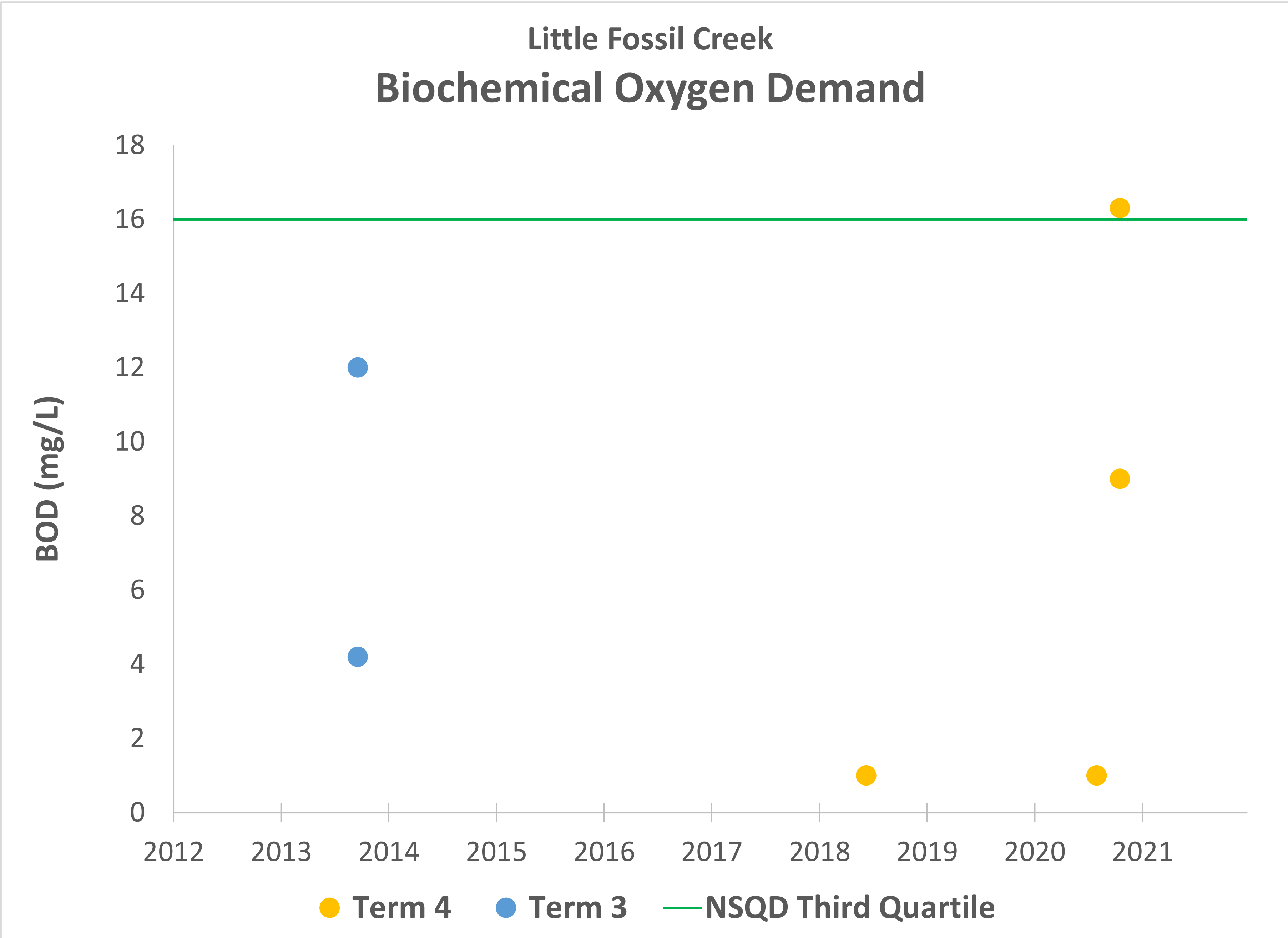
Lake Como
Texas Macroinvertebrate IBI Scores
Macroinvertebrate IBI Score
35
30
25
20
15
10
5
0
2012 Spring
2012 Fall
2013 Spring
2013 Fall
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
OVR1 (Term 3)
OVR1 (Term 4)
OVR2 (Term 4)
OVR3 (Term 3)
OVR3 (Term 4)
High (>30)
Intermediate (>21)

Appendix Q

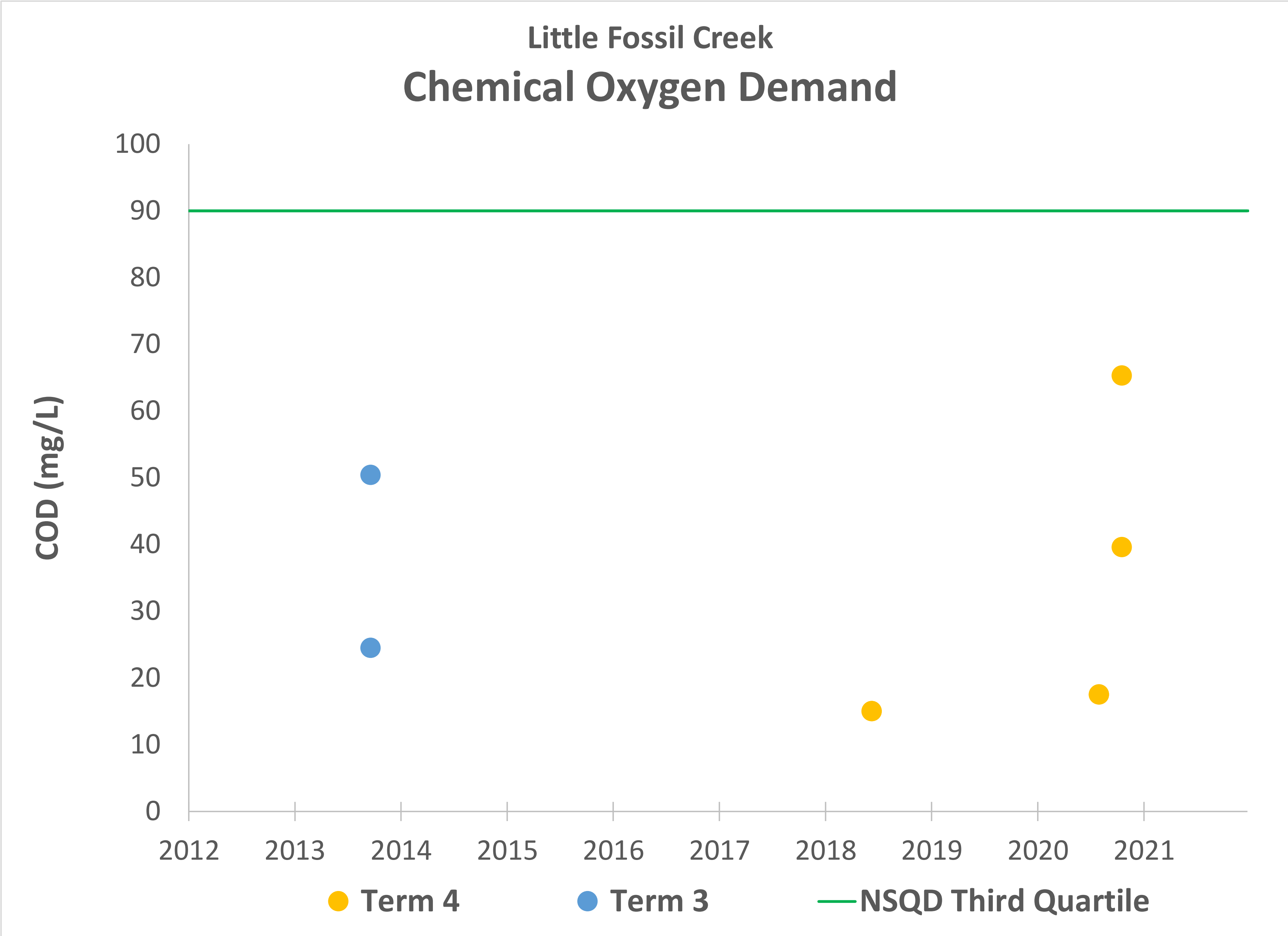
Little Fossil Creek Water Quality Data Graphs


Little Fossil Creek
Total Dissolved Solids
TDS (mg/L)
1000
900
800
700
600
500
400
300
200
100
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Basin Specific Criterion

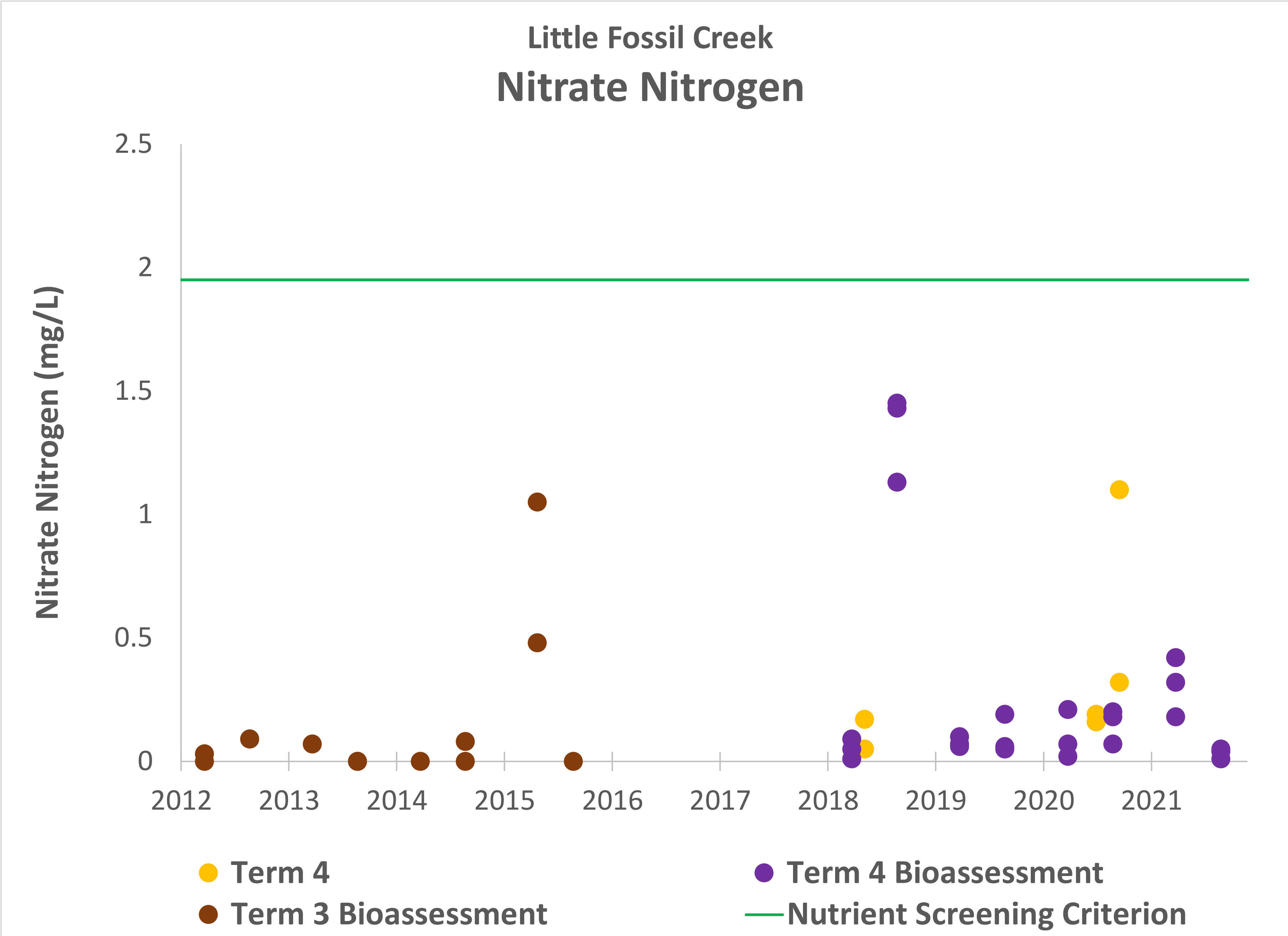

Little Fossil Creek
Total Suspended Solids
TSS (mg/L)
160
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile



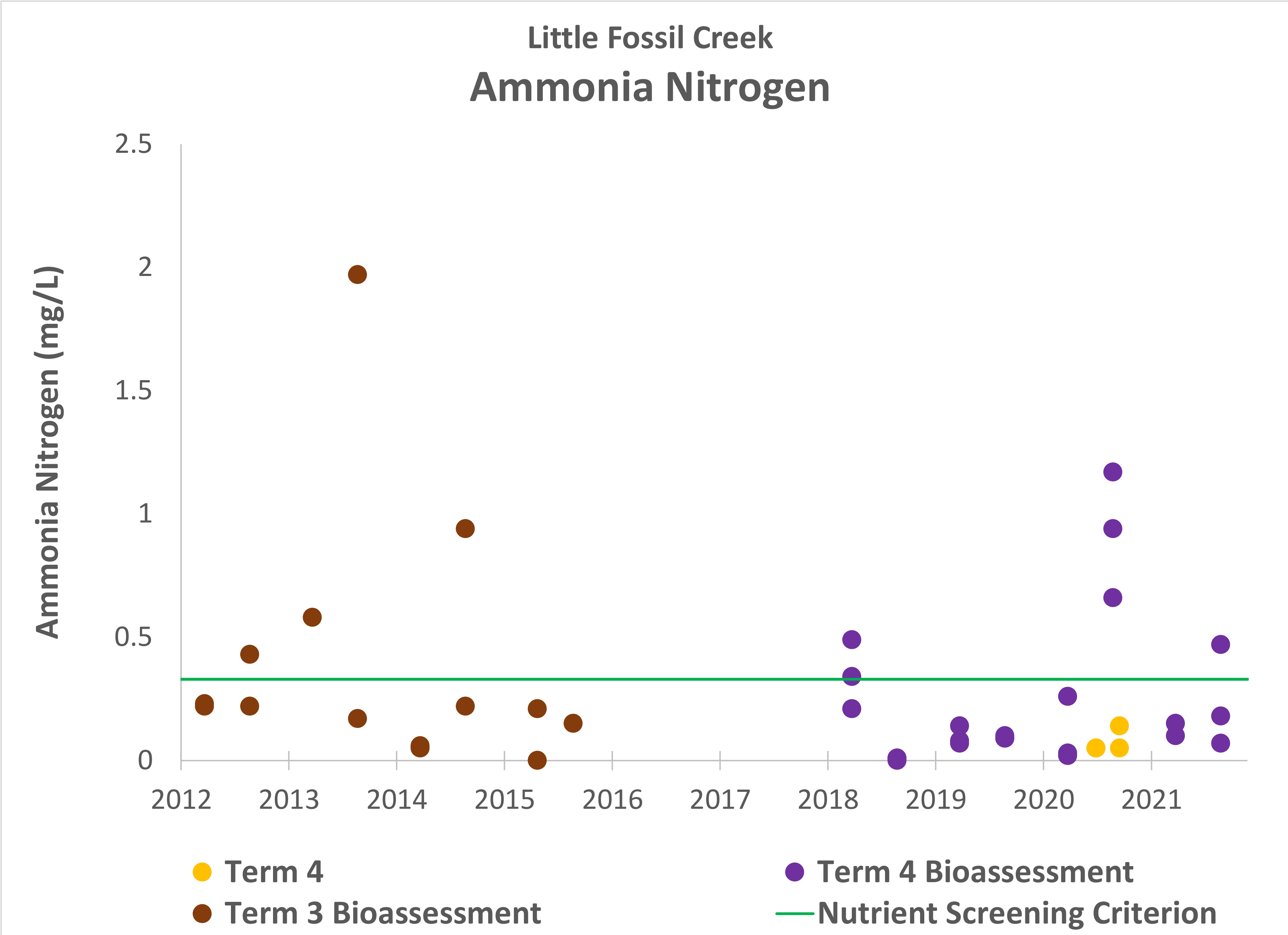
Little Fossil Creek
Biochemical Oxygen Demand
BOD (mg/L)
18
16
14
12
10
8
6
4
2
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile



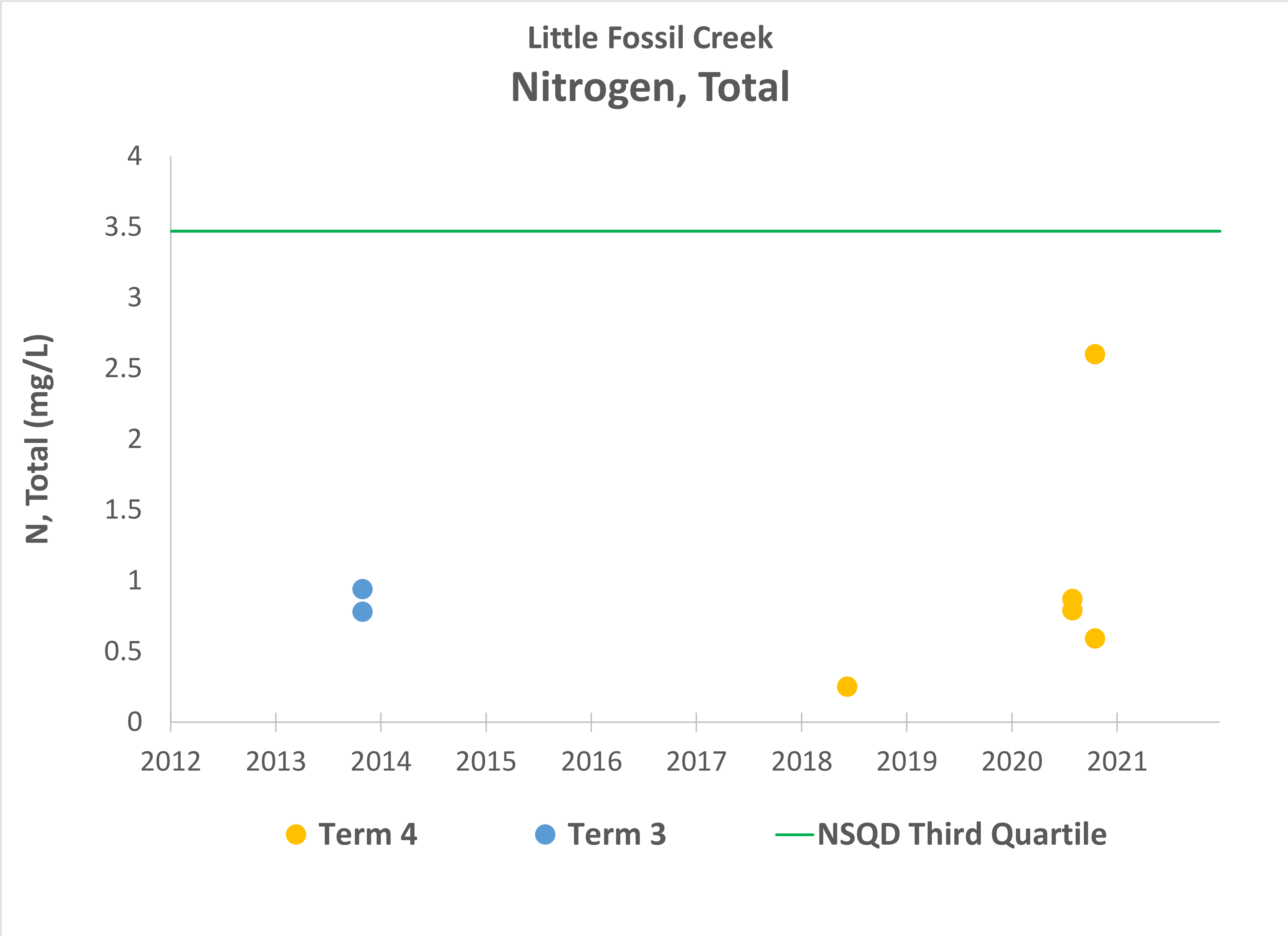
Little Fossil Creek
Chemical Oxygen Demand
COD (mg/L)
100
90
80
70
60
50
40
30
20
10
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

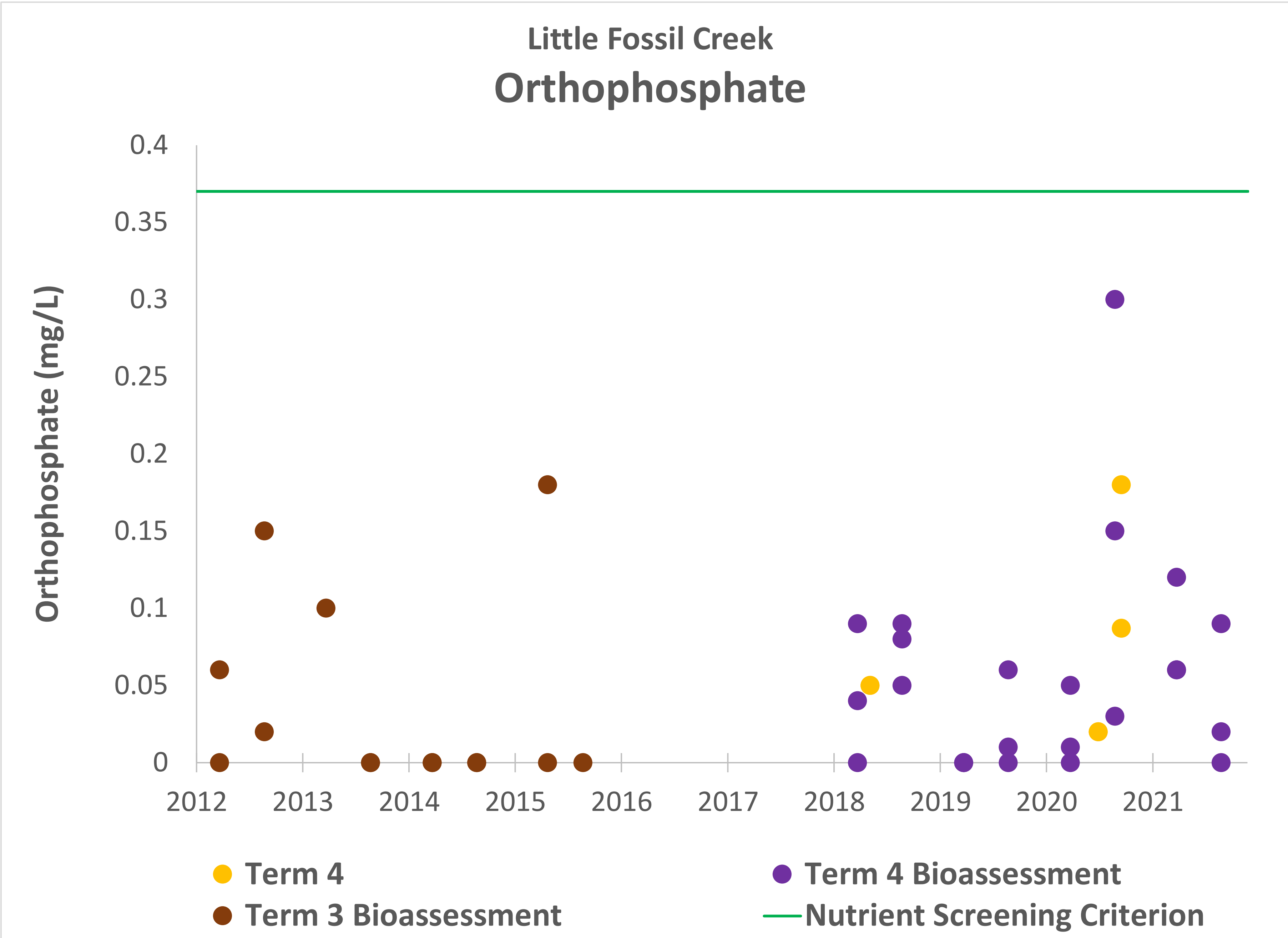


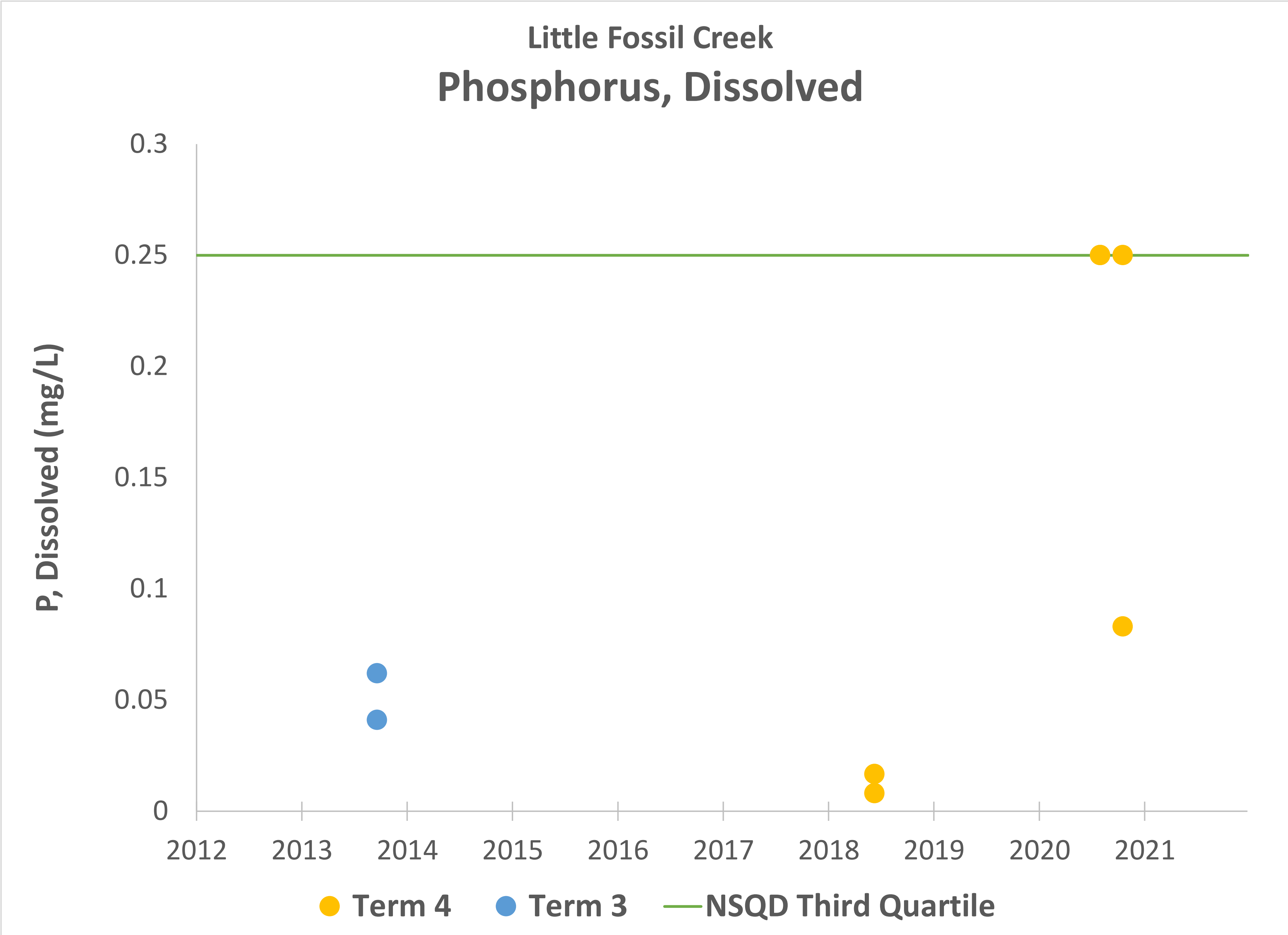
Little Fossil Creek
Nitrate Nitrogen
Nitrate Nitrogen (mg/L)
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 Bioassessment
Term 3 Bioassessment
Nutrient Screening Criterion



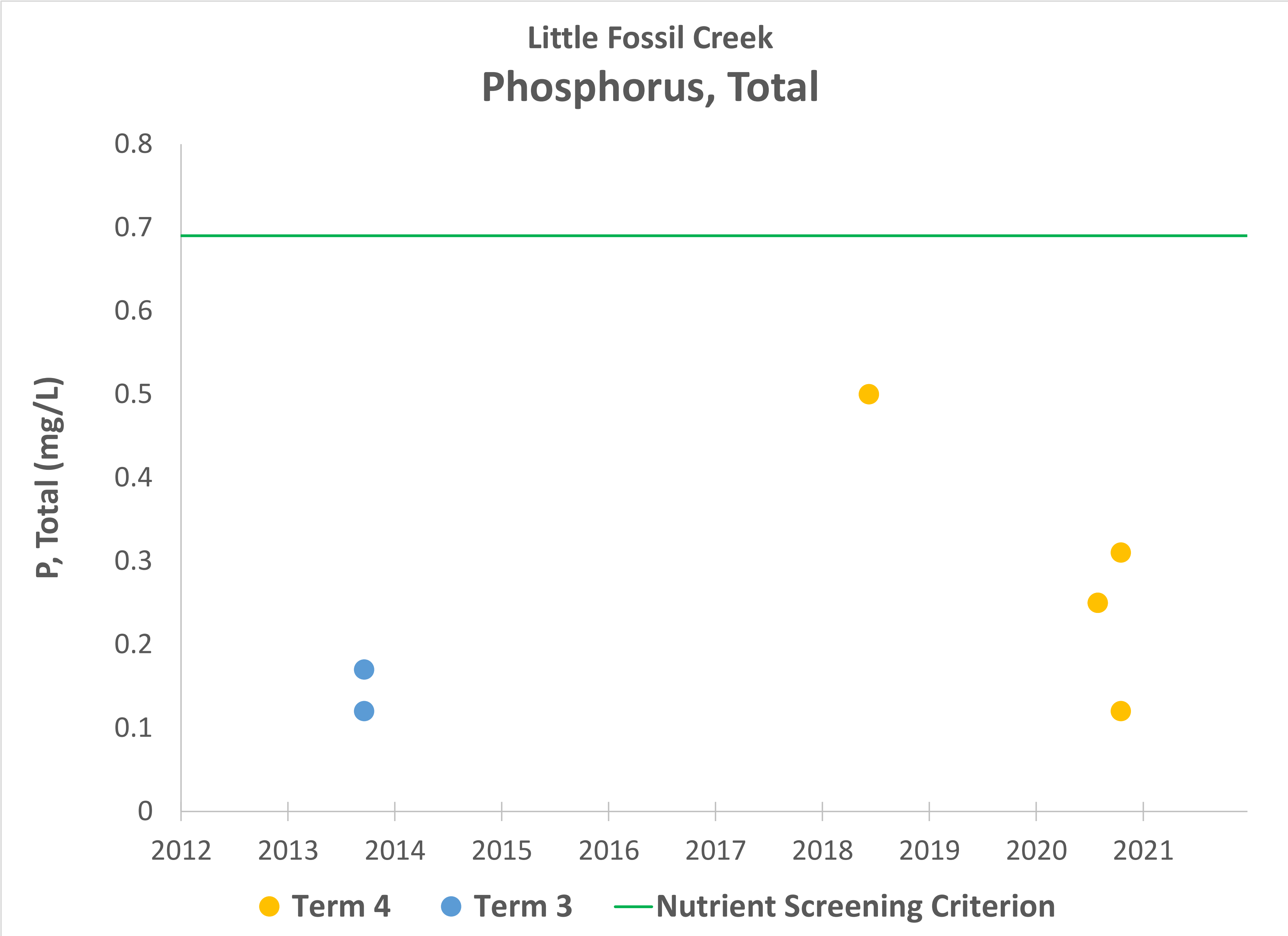
Little Fossil Creek
Ammonia Nitrogen
Ammonia Nitrogen (mg/L)
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 Bioassessment
Term 3 Bioassessment
Nutrient Screening Criterion

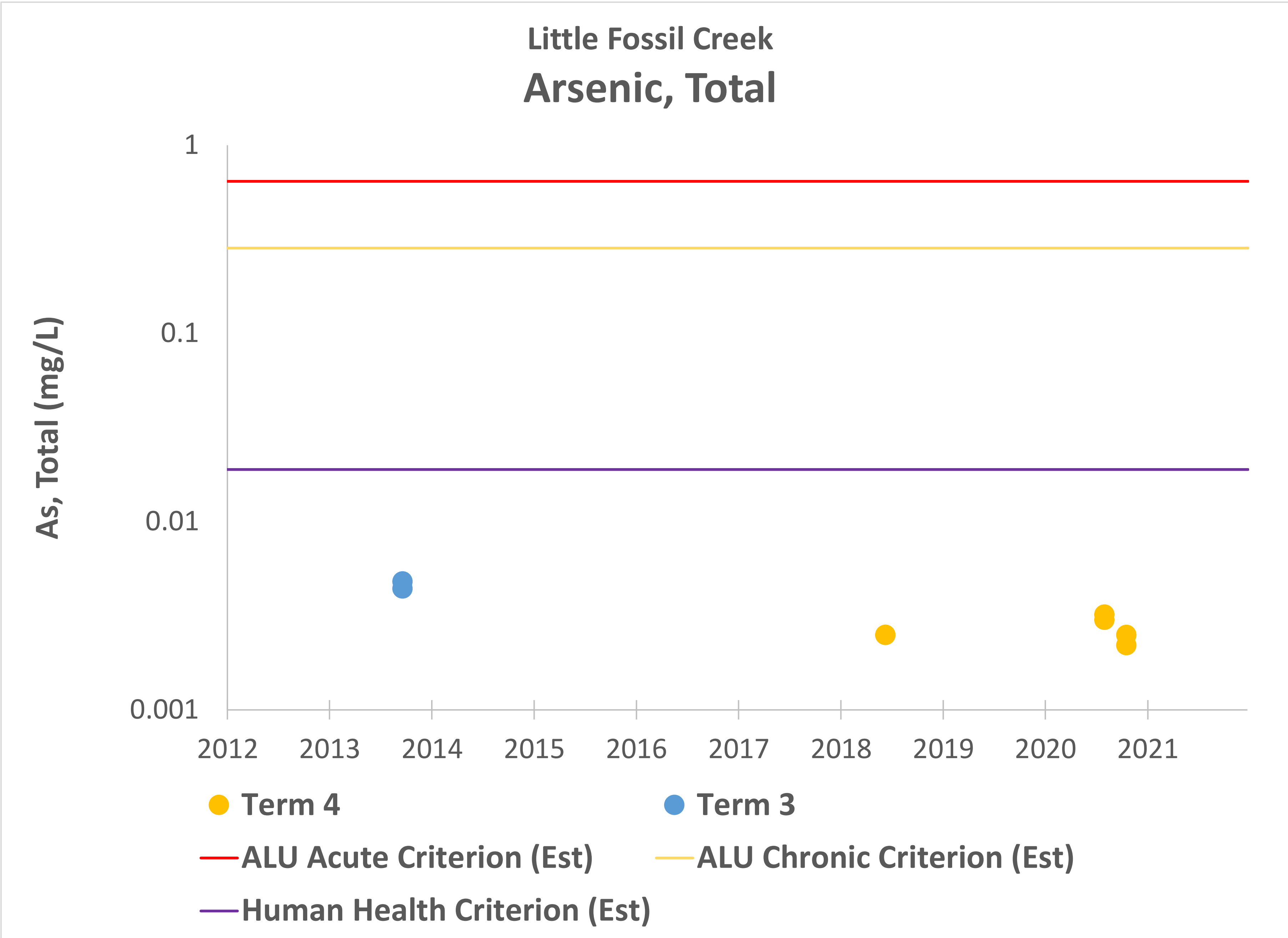

Little Fossil Creek
Nitrogen, Total
N, Total (mg/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile


Little Fossil Creek
Orthophosphate
Orthophosphate (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 Bioassessment
Term 3 Bioassessment
Nutrient Screening Criterion

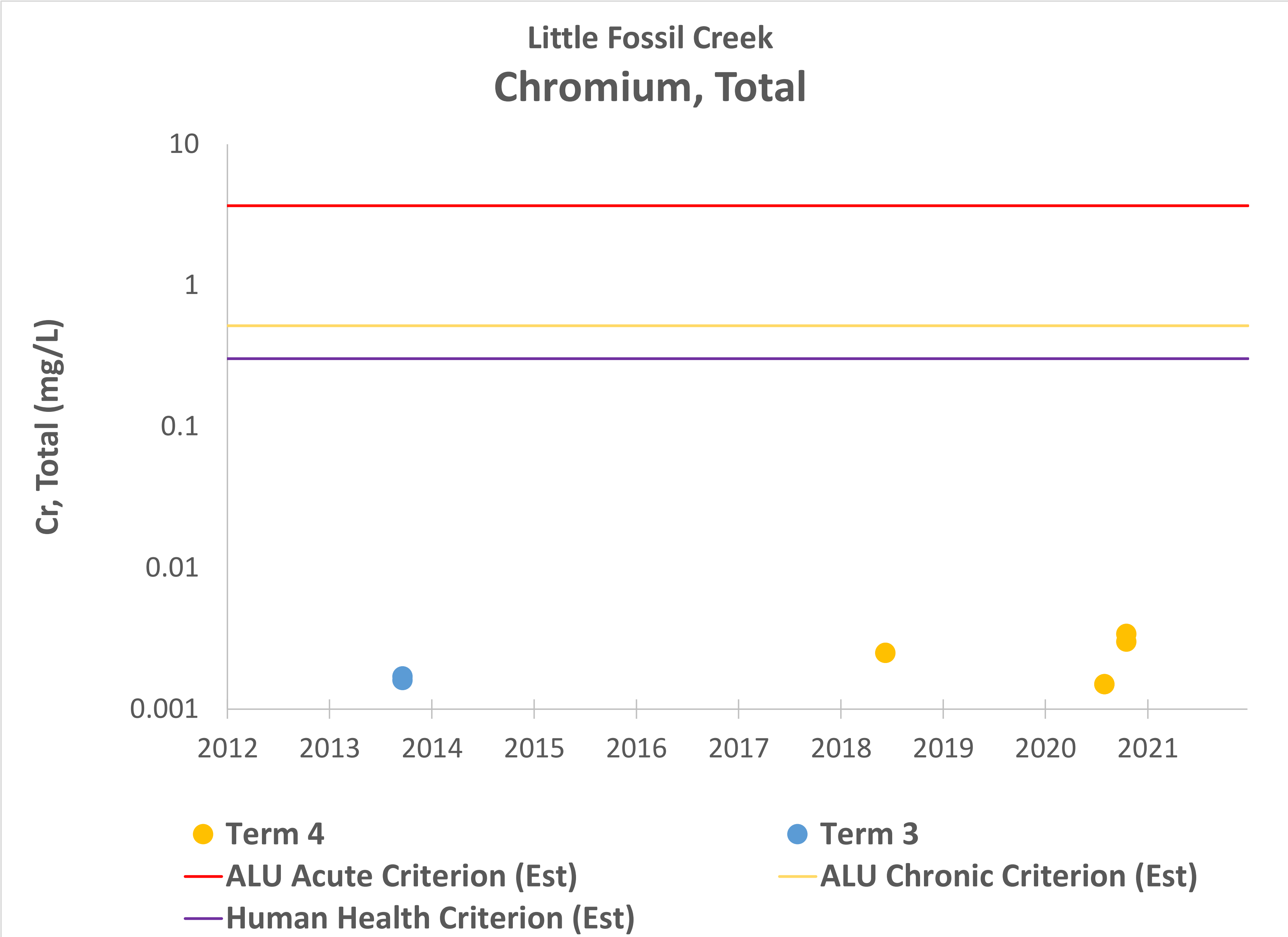


Little Fossil Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

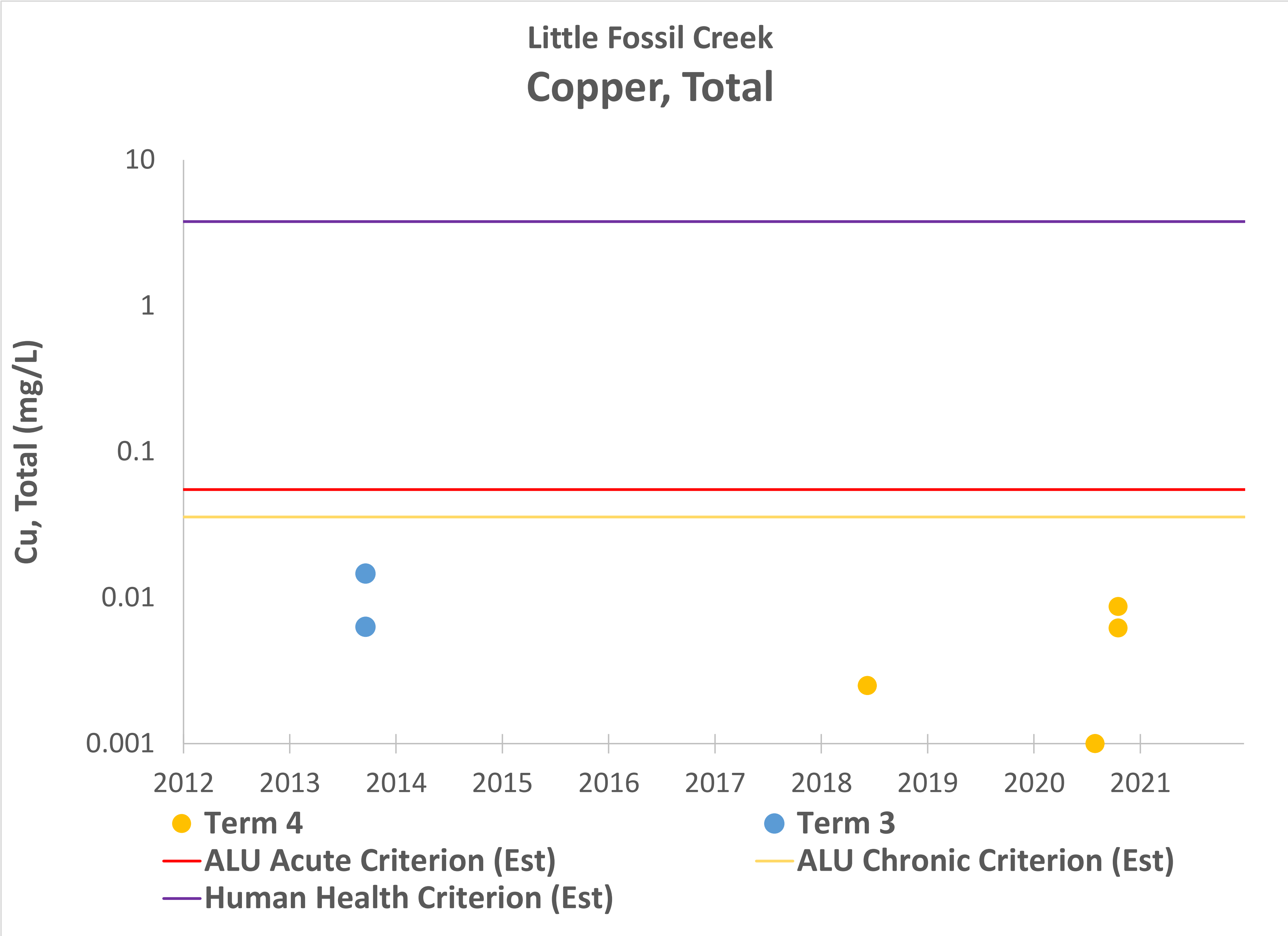

Little Fossil Creek
Phosphorus, Total
P, Total (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Nutrient Screening Criterion



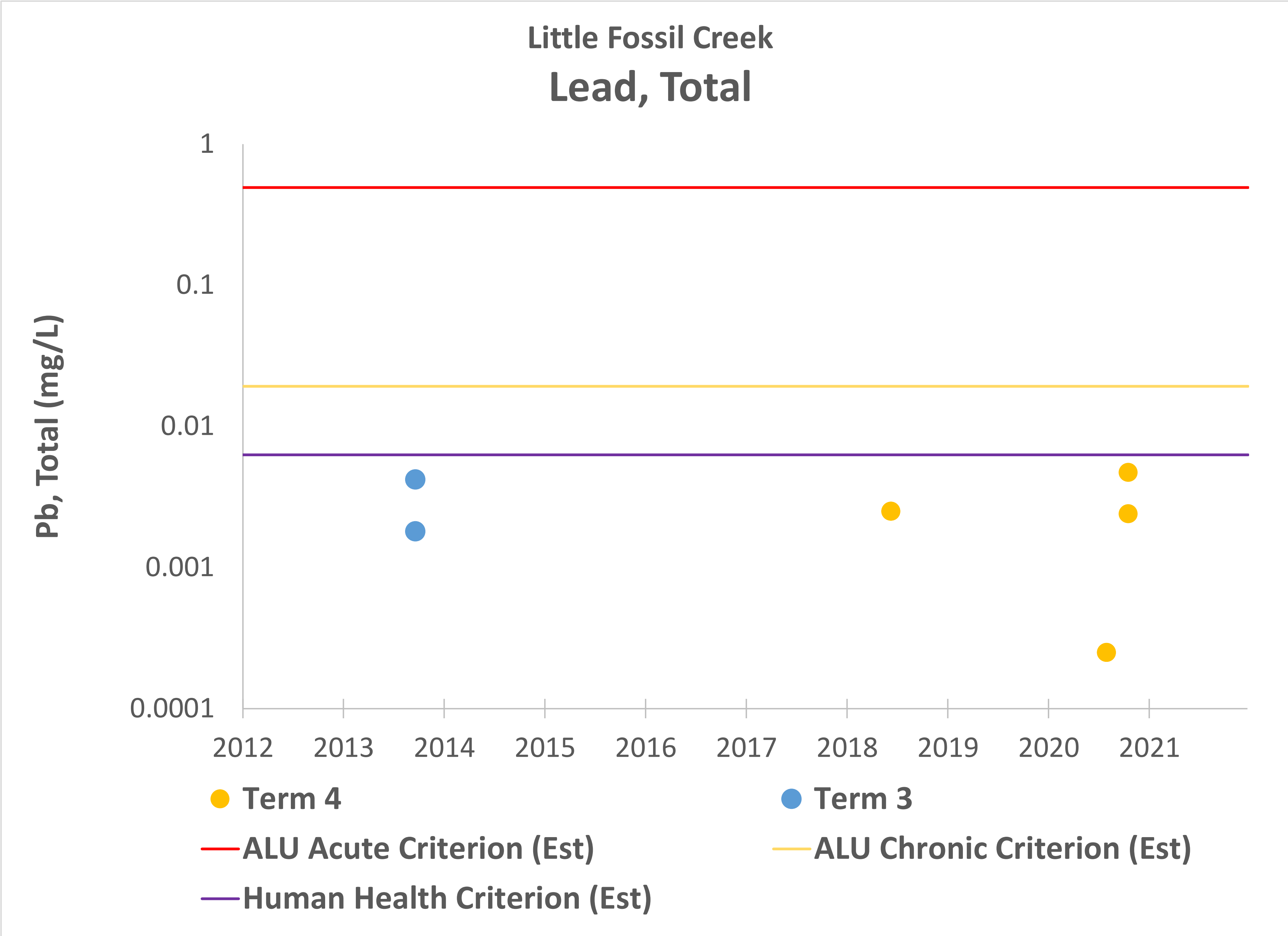
Little Fossil Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



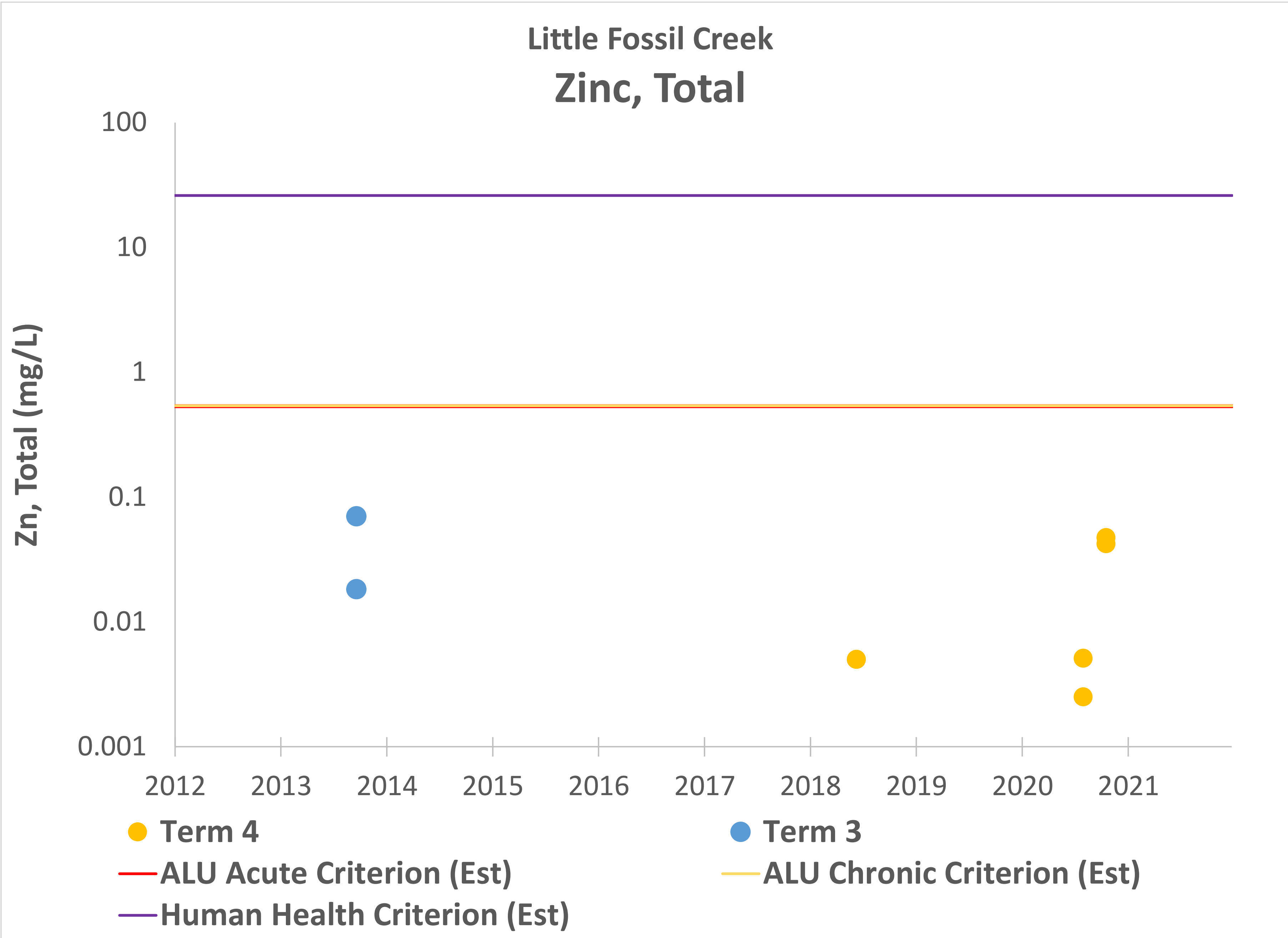
Little Fossil Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

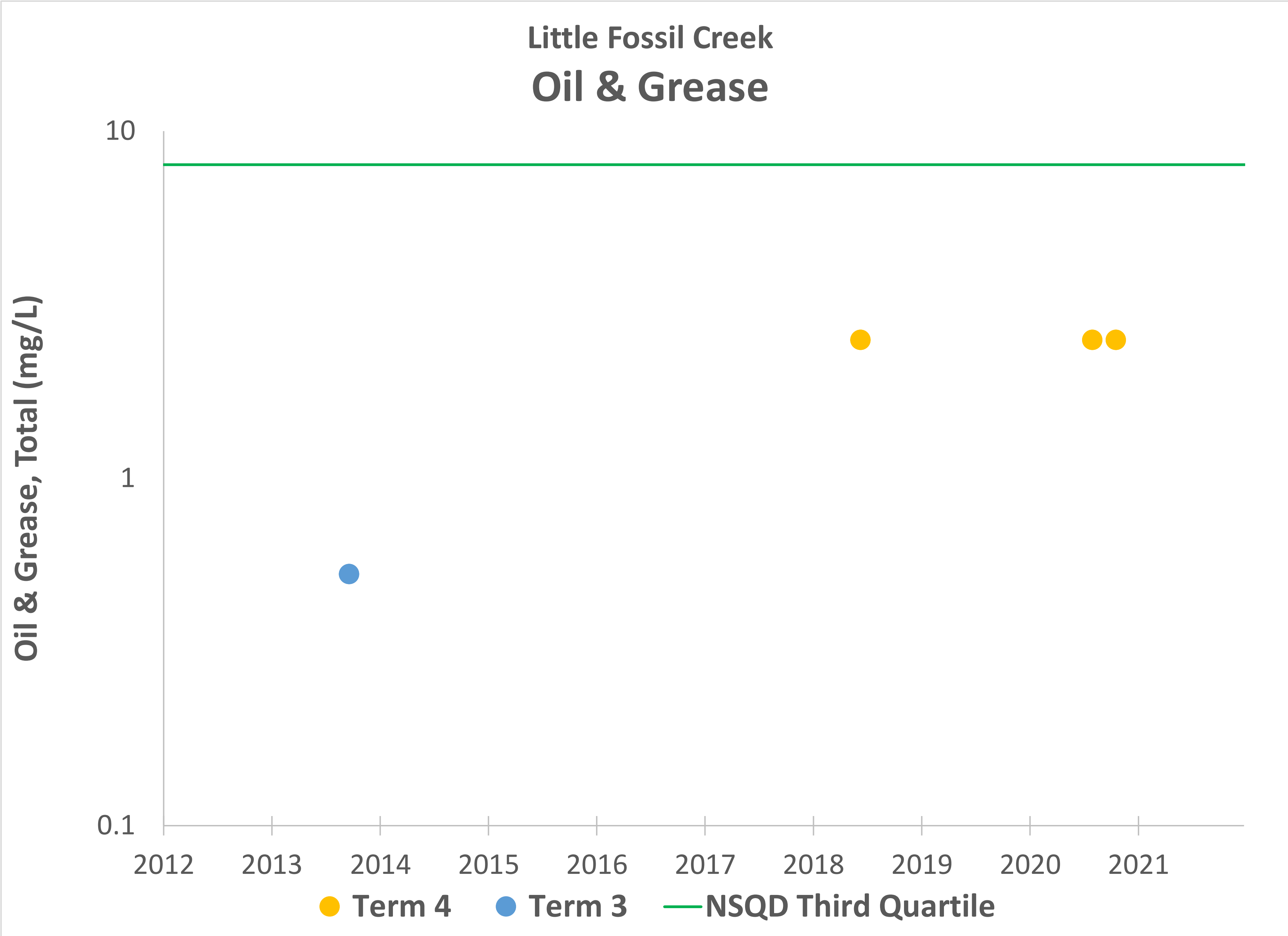


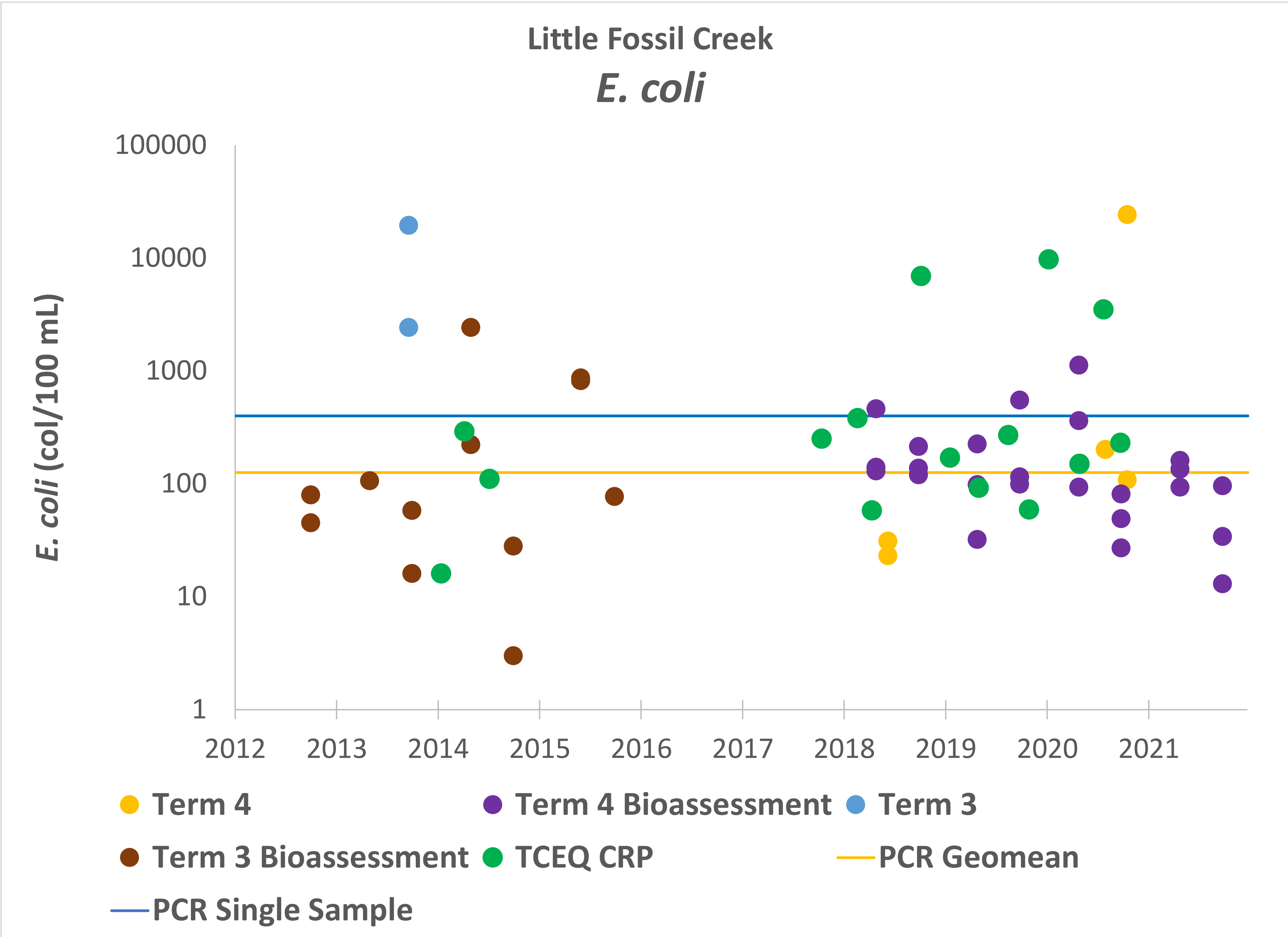
Little Fossil Creek
Copper, Total
Cu, Total (mg/L)
10
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



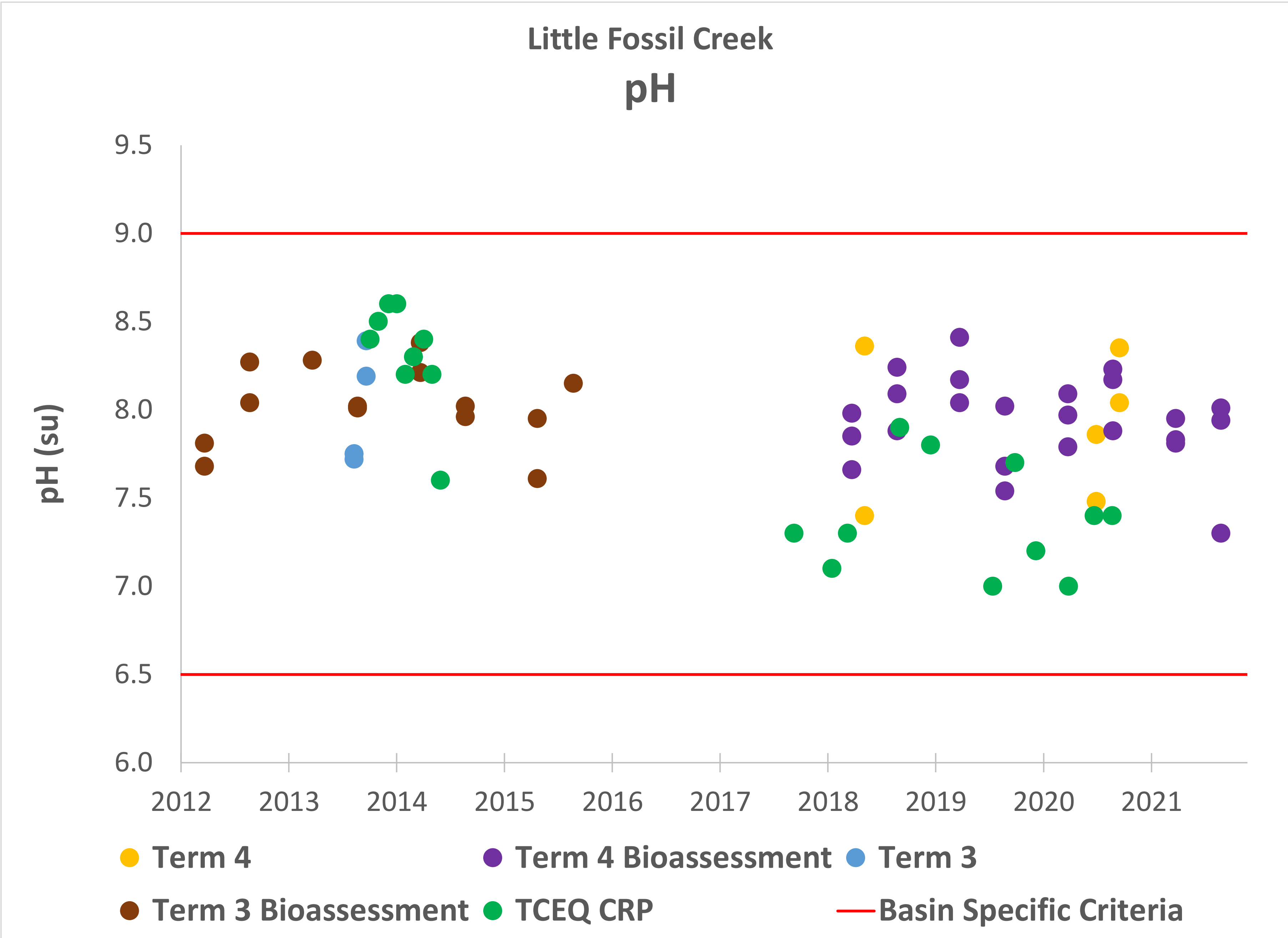
Little Fossil Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)


Little Fossil Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

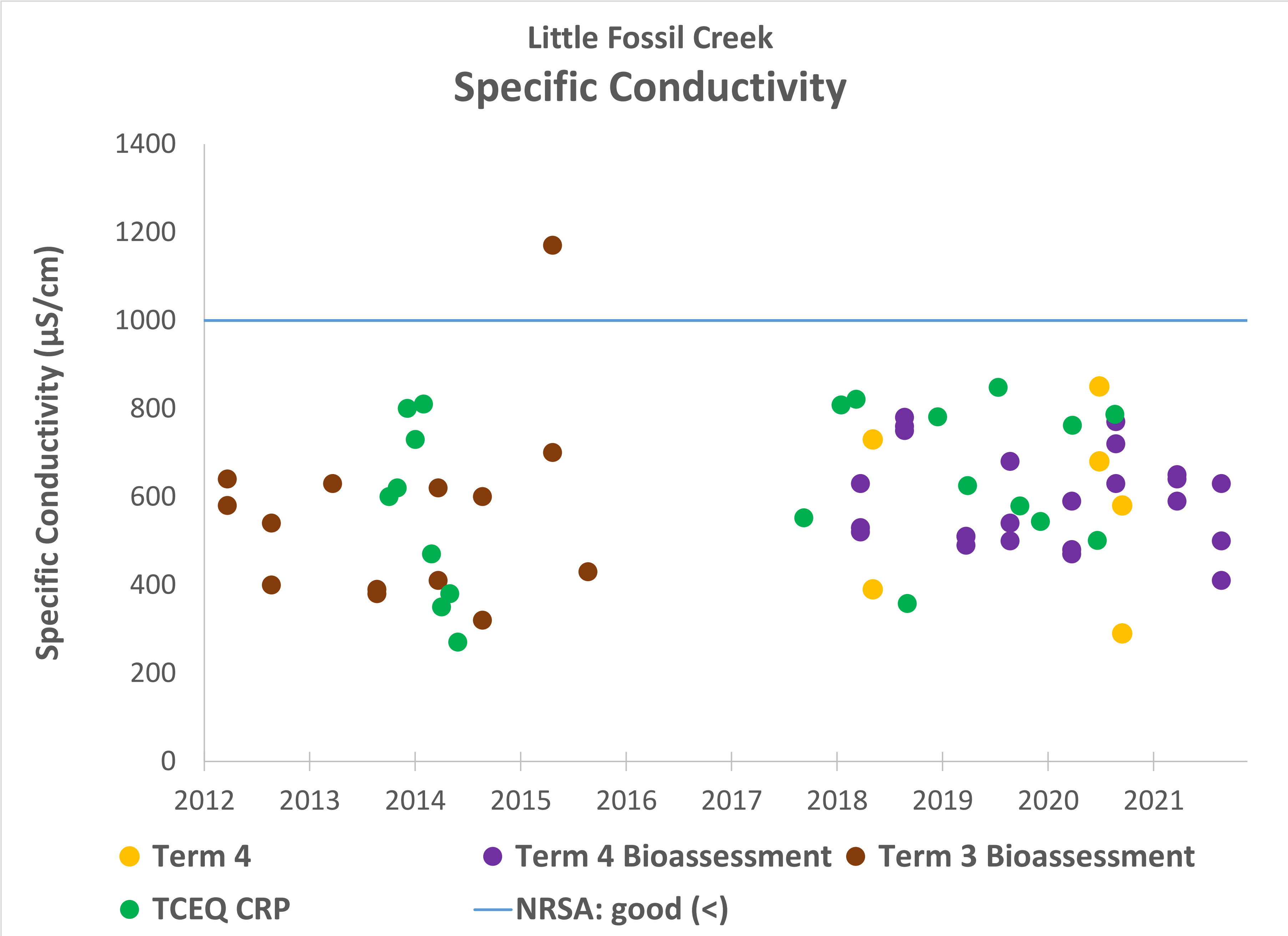

Little Fossil Creek
Oil & Grease
Oil & Grease, Total (mg/L)
10
1
0.1
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

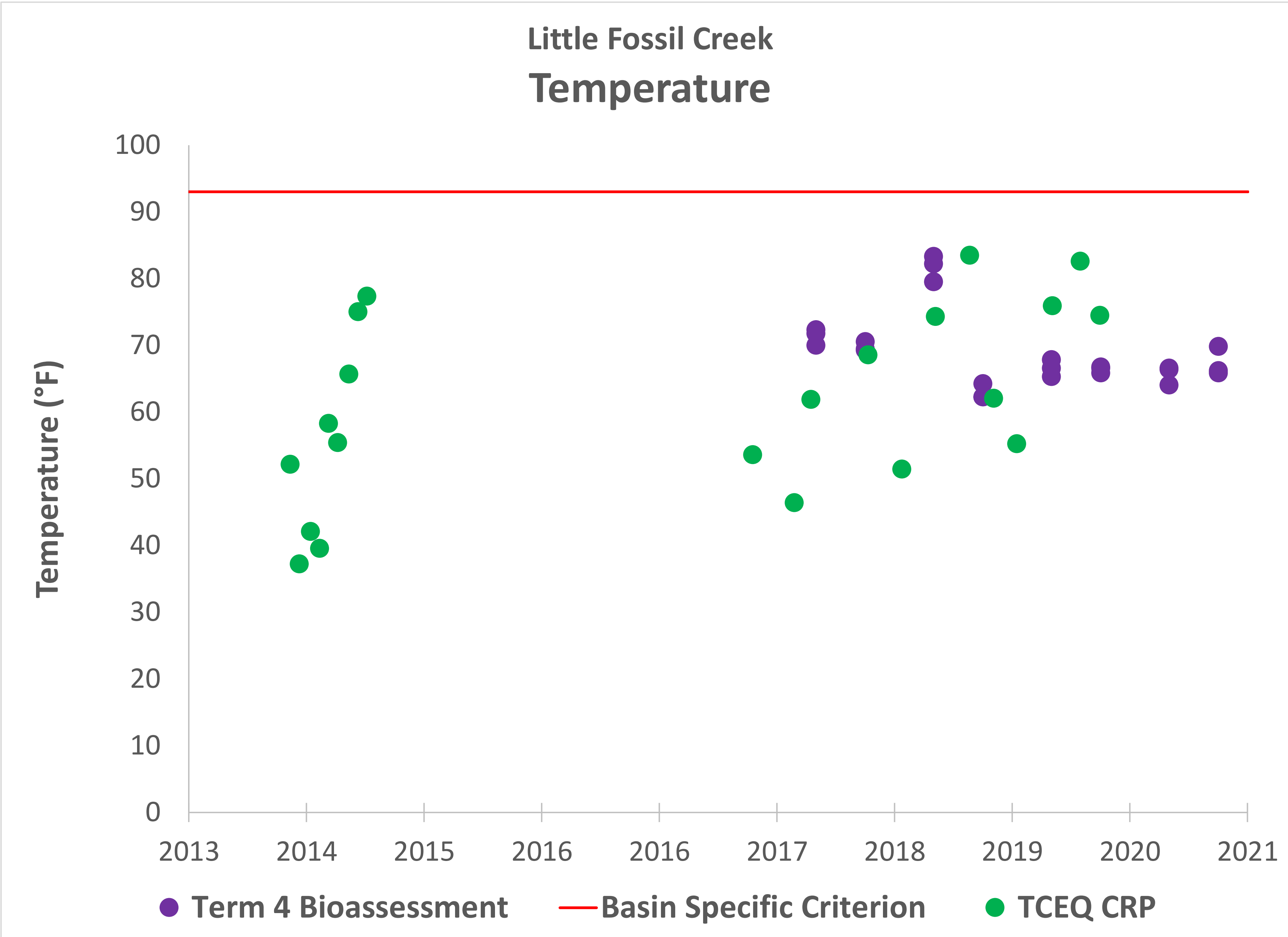


Little Fossil Creek
E. coli
100000
10000
1000
100
10
1
E. coli (col/100 mL)
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 Bioassessment
Term 3
Term 3 Bioassessment
TCEQ CRP
PCR Geomean
PCR Single Sample

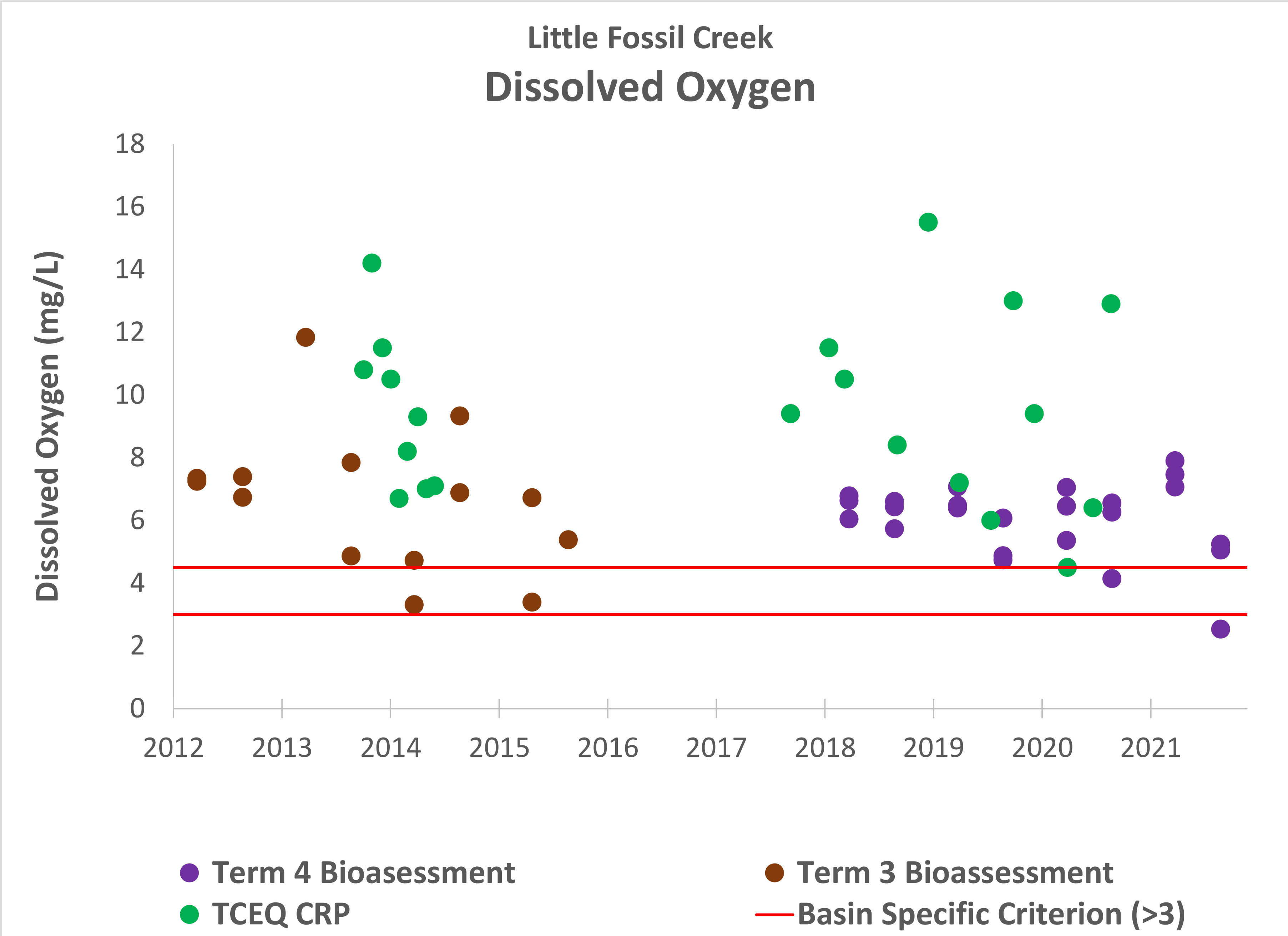


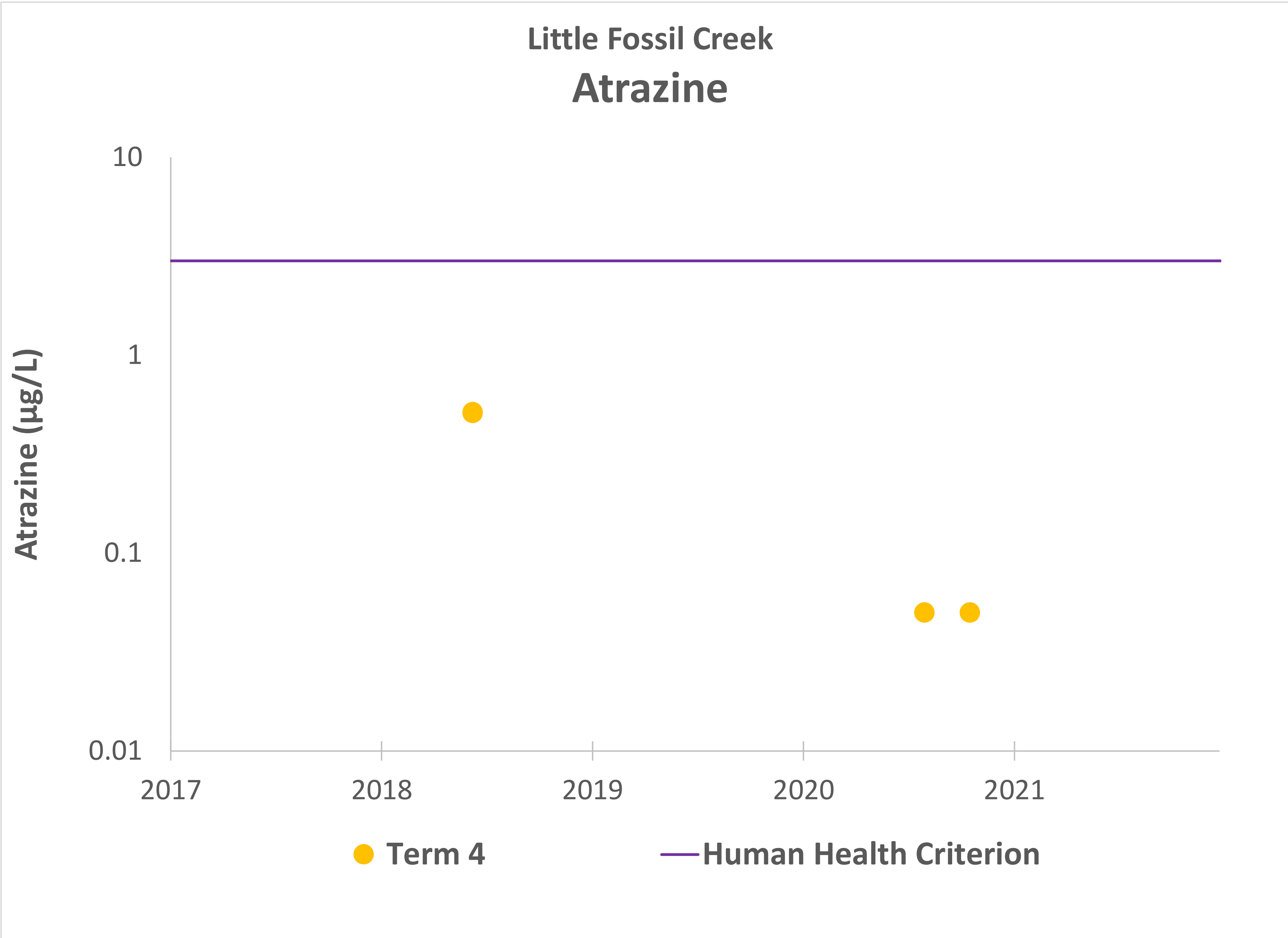
Little Fossil Creek
pH
pH (su)
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 Bioassessment
Term 3
Term 3 Bioassessment
TCEQ CRP
Basin Specific Criteria

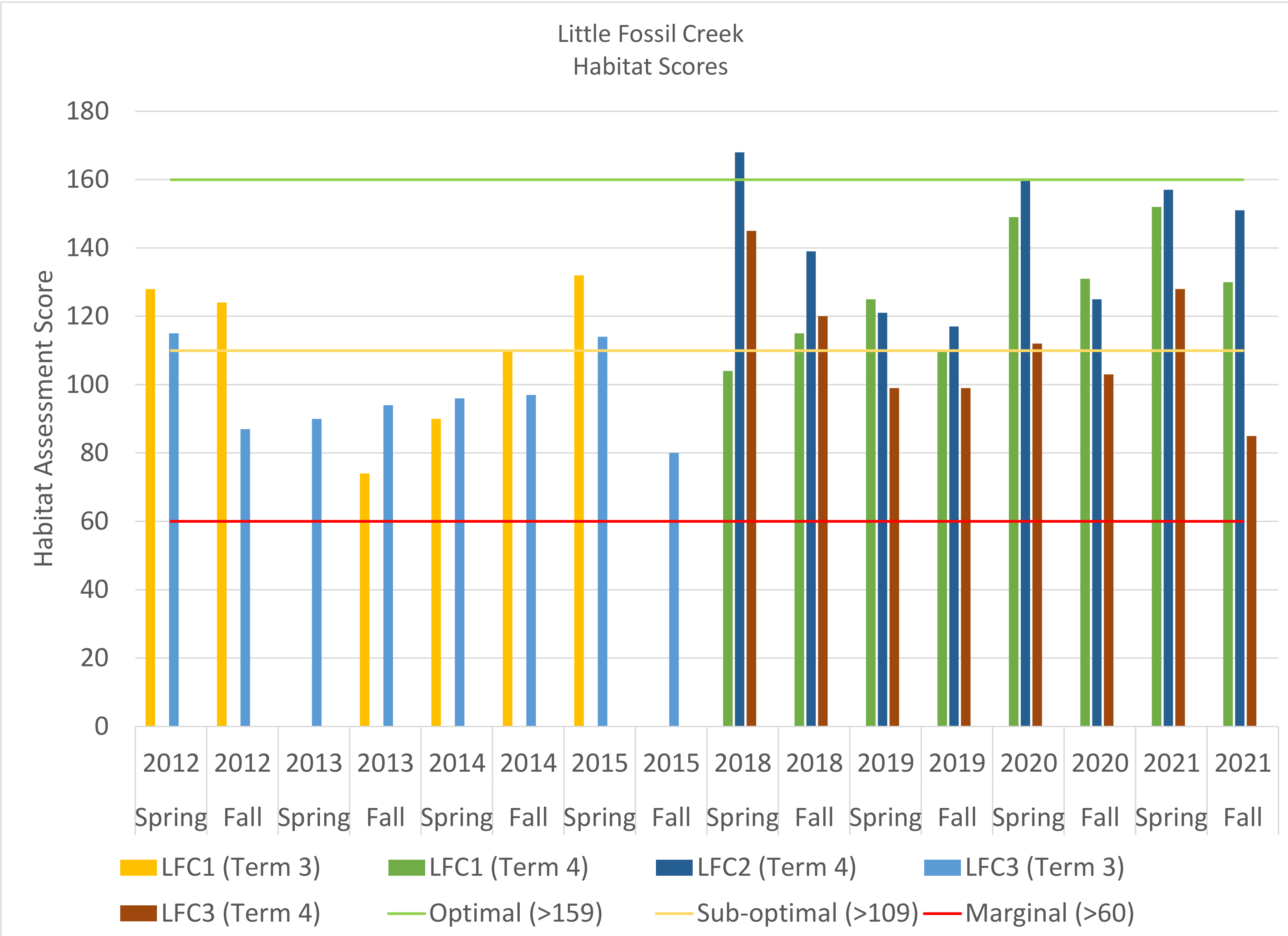

Little Fossil Creek
Specific Conductivity
Specific Conductivity (µS/cm)
0
200
400
600
800
1000
1200
1400
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 Bioassessment
Term 3 Bioassessment
TCEQ CRP
NRSA: good (<)



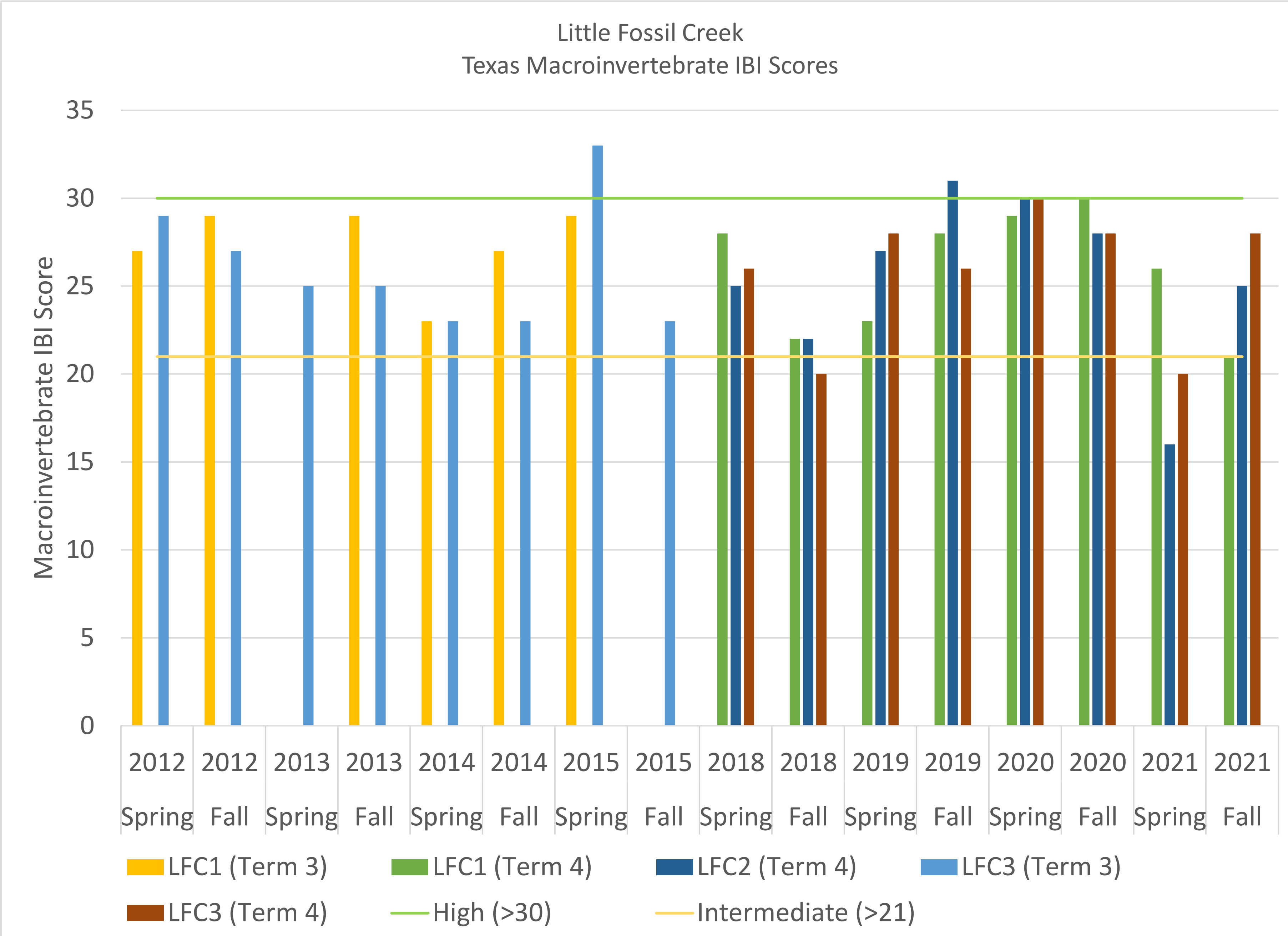
Little Fossil Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2013
2014
2015
2016
2016
2017
2018
2019
2020
2021
Term 4 Bioassessment
Basin Specific Criterion
TCEQ CRP


Little Fossil Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
14
16
18
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 Bioasessment
Term 3 Bioassessment
TCEQ CRP
Basin Specific Criterion (>3)


Little Fossil Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
2017
2018
2019
2020
2021
Term 4
Human Health Criterion

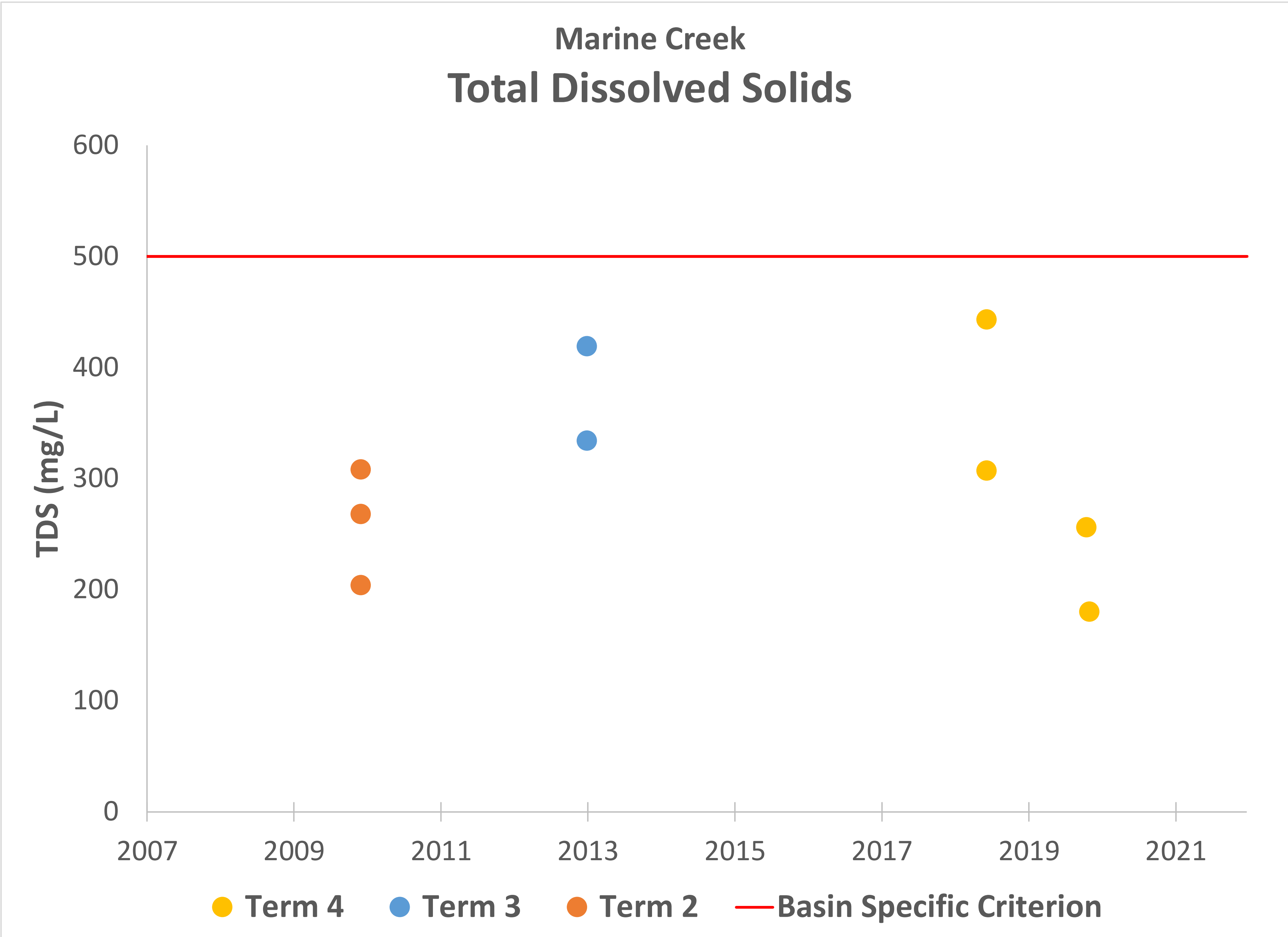


Little Fossil Creek
Habitat Scores
Habitat Assessment Score
180
160
140
120
100
80
60
40
20
0
2012 Spring
2012 Fall
2013 Spring
2013 Fall
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
LFC1 (Term 3)
LFC1 (Term 4)
LFC2 (Term 4)
LFC3 (Term 3)
LFC3 (Term 4)
Optimal (>159)
Sub-optimal (>109)
Marginal (>60)

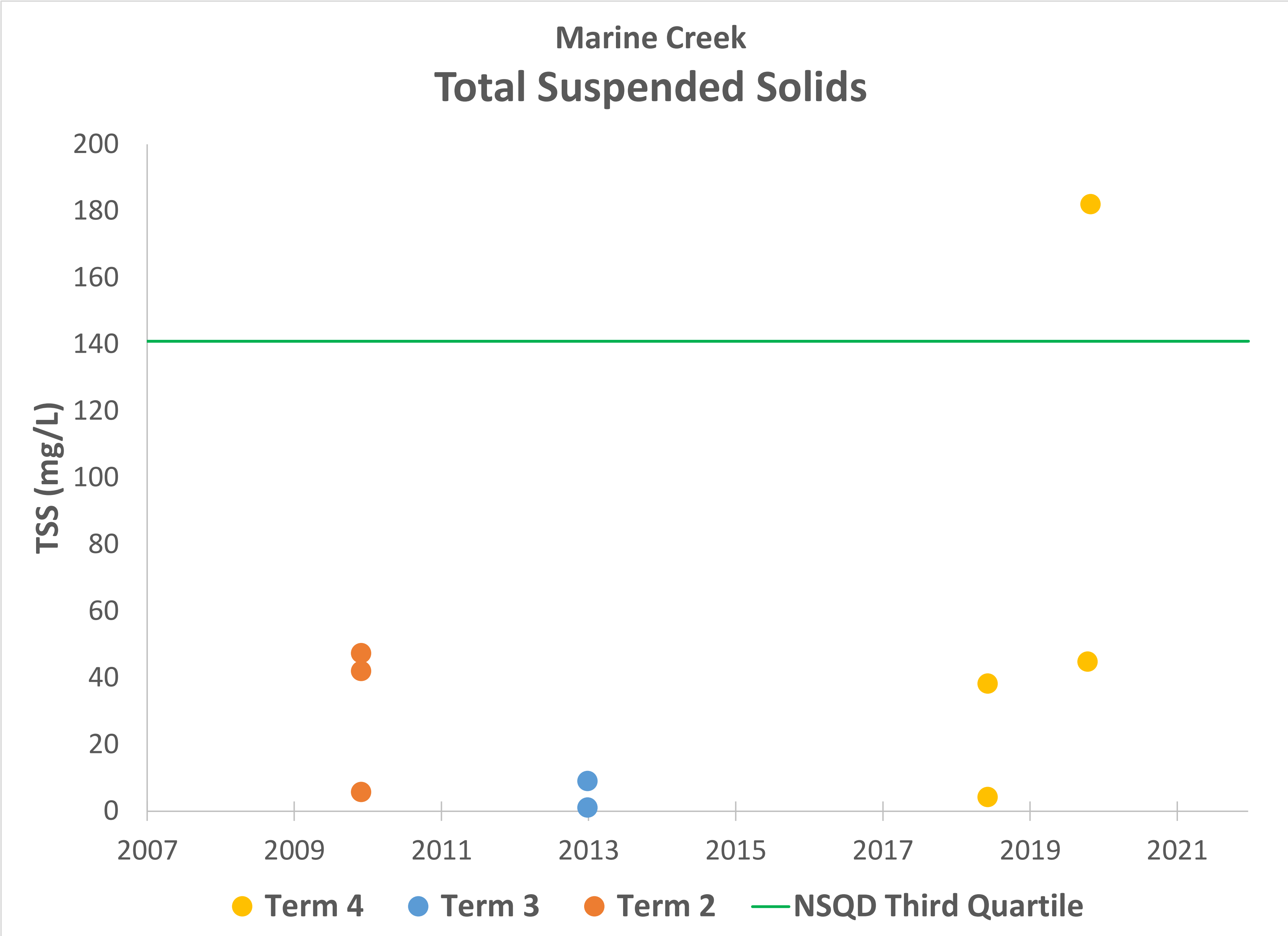

Little Fossil Creek
Texas Macroinvertebrate IBI Scores
Macroinvertebrate IBI Score
35
30
25
20
15
10
5
0
2012 Spring
2012 Fall
2013 Spring
2013 Fall
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
LFC1 (Term 3)
LFC1 (Term 4)
LFC2 (Term 4)
LFC3 (Term 3)
LFC3 (Term 4)
High (>30)
Intermediate (>21)

Appendix R

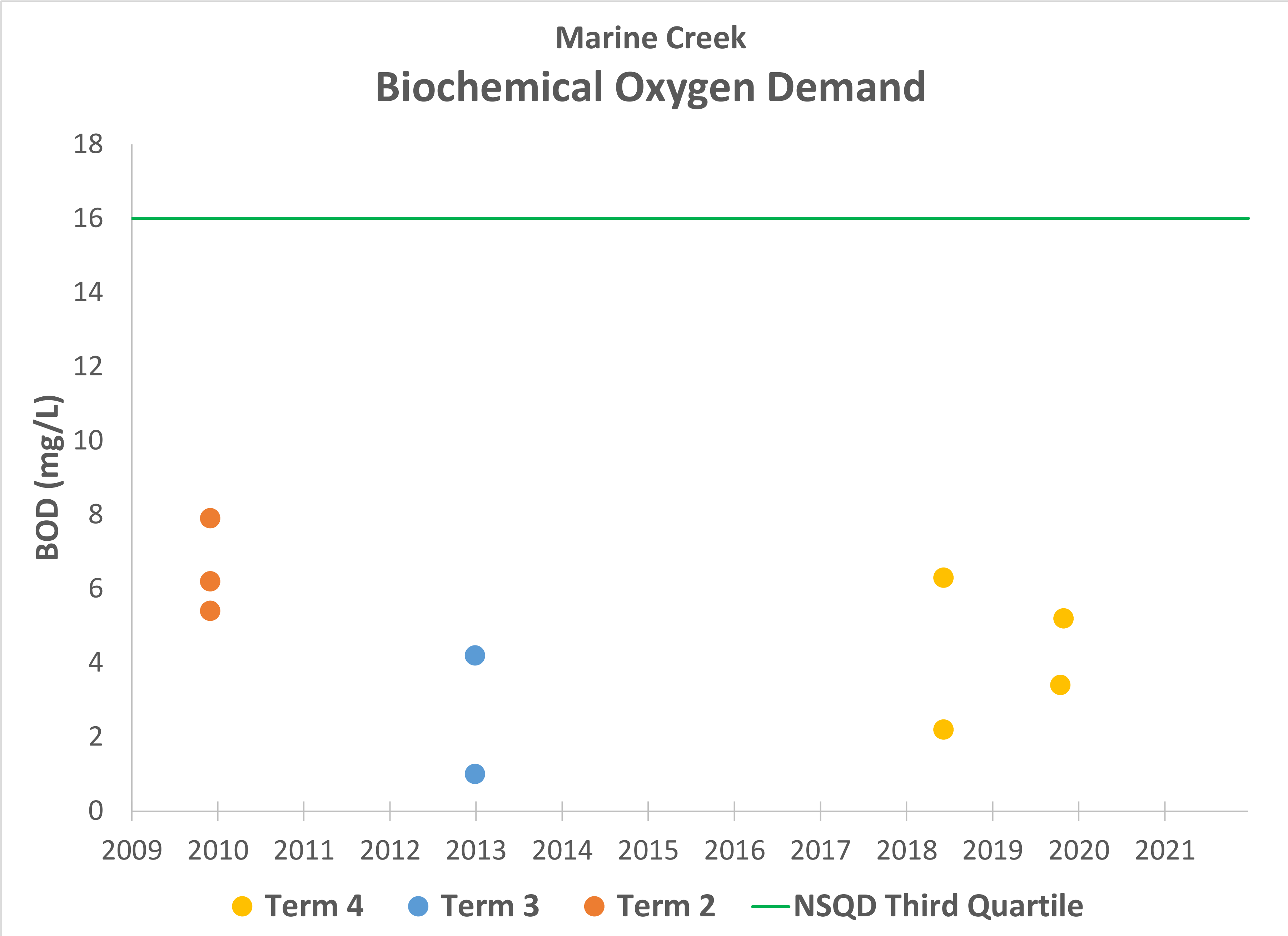
Marine Creek Water Quality Data Graphs



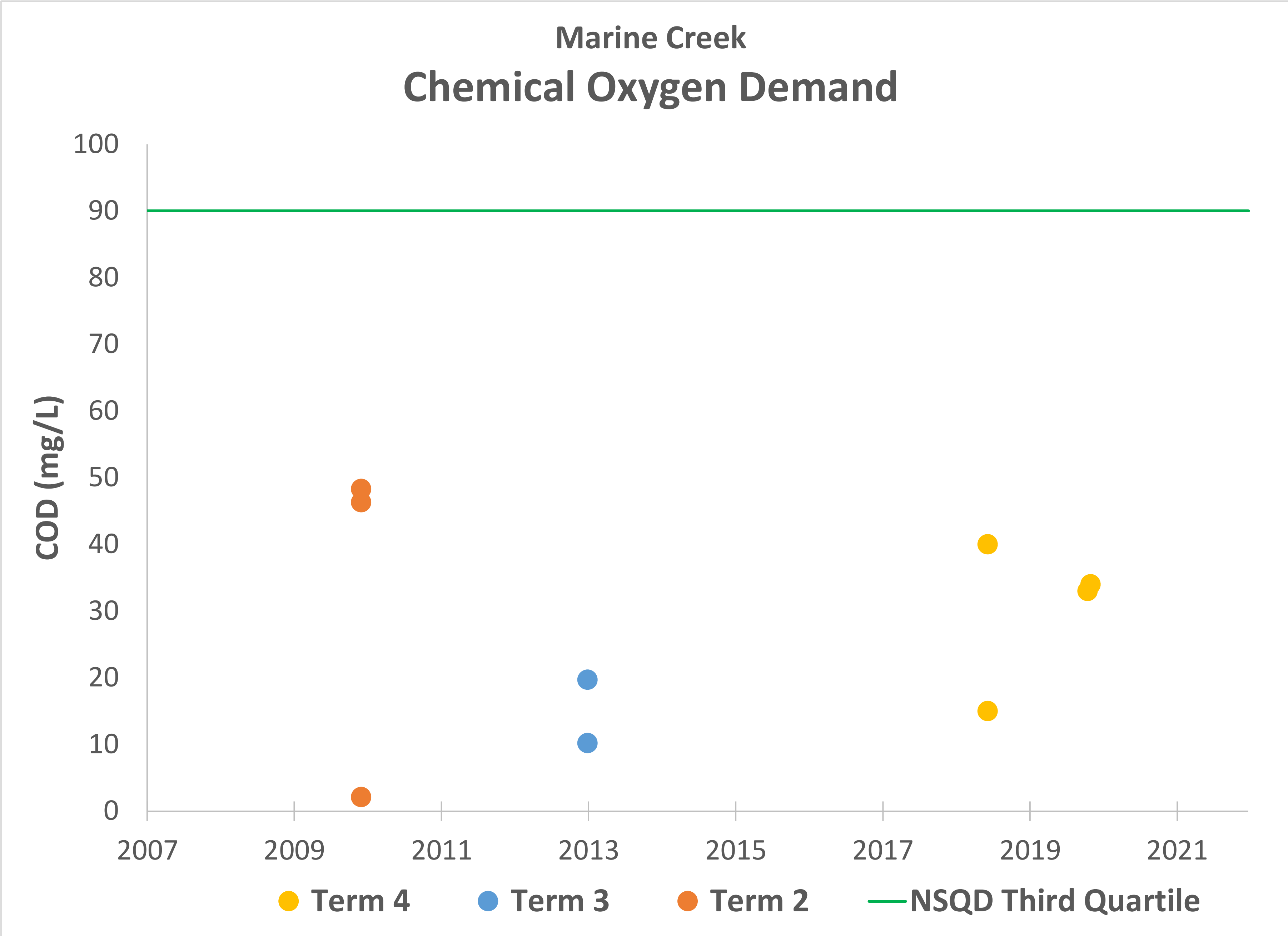
Marine Creek
Total Dissolved Solids
TDS (mg/L)
600
500
400
300
200
100
0
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
Basin Specific Criterion



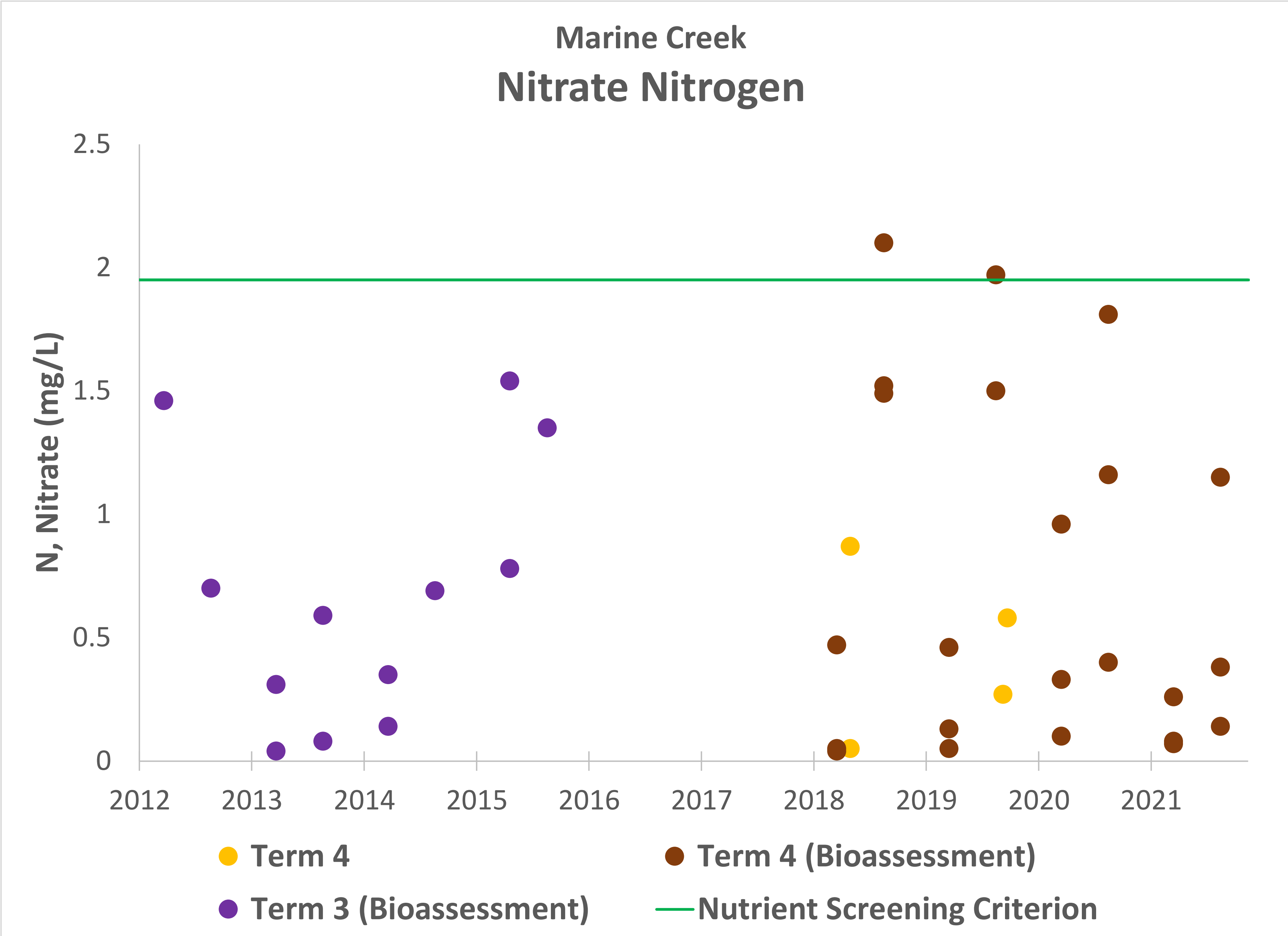
Marine Creek
Total Suspended Solids
TSS (mg/L)
200
180
160
140
120
100
80
60
40
20
0
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
NSQD Third Quartile



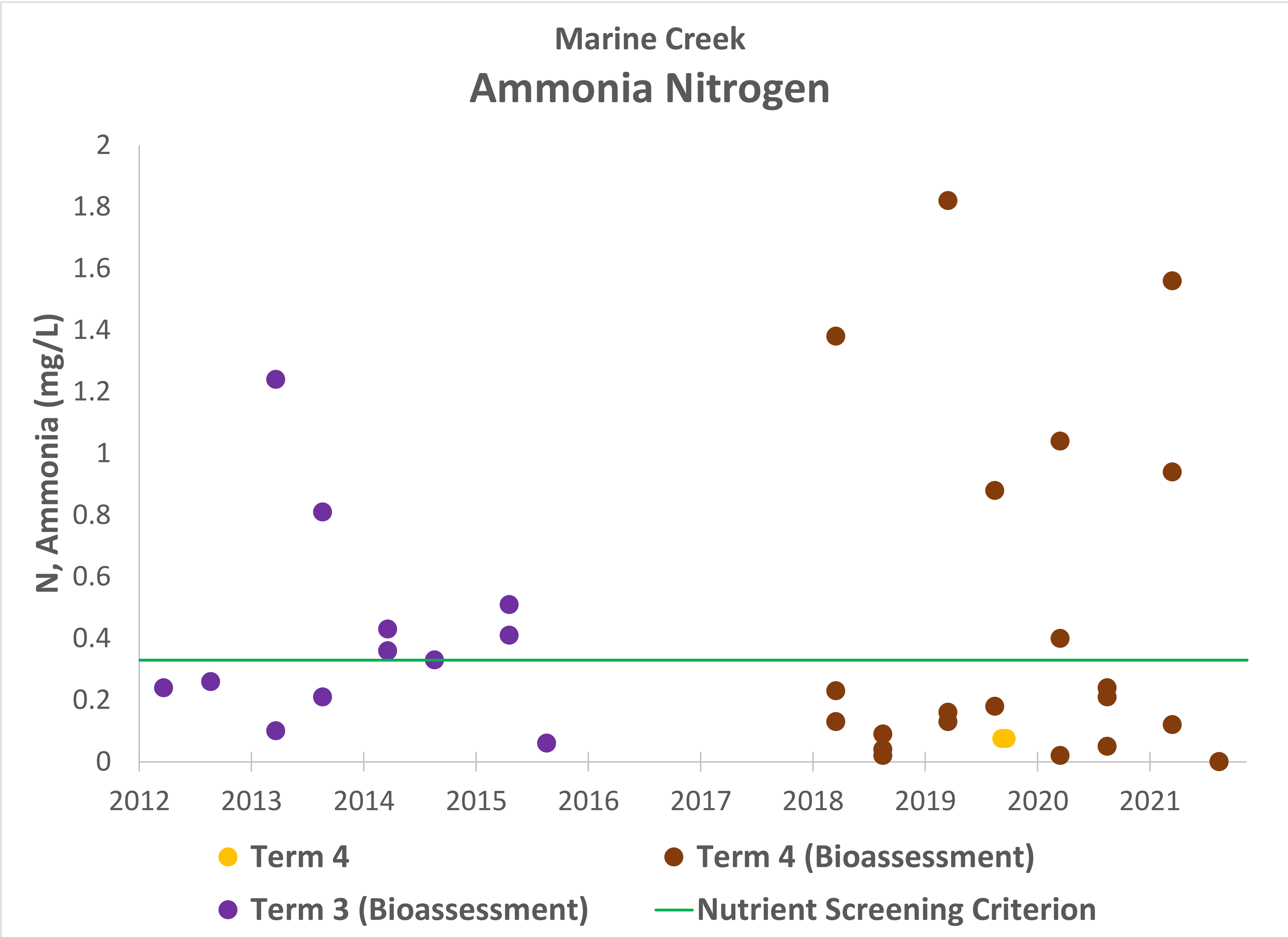
Marine Creek
Biochemical Oxygen Demand
BOD (mg/L)
0
2
4
6
8
10
12
14
16
18
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

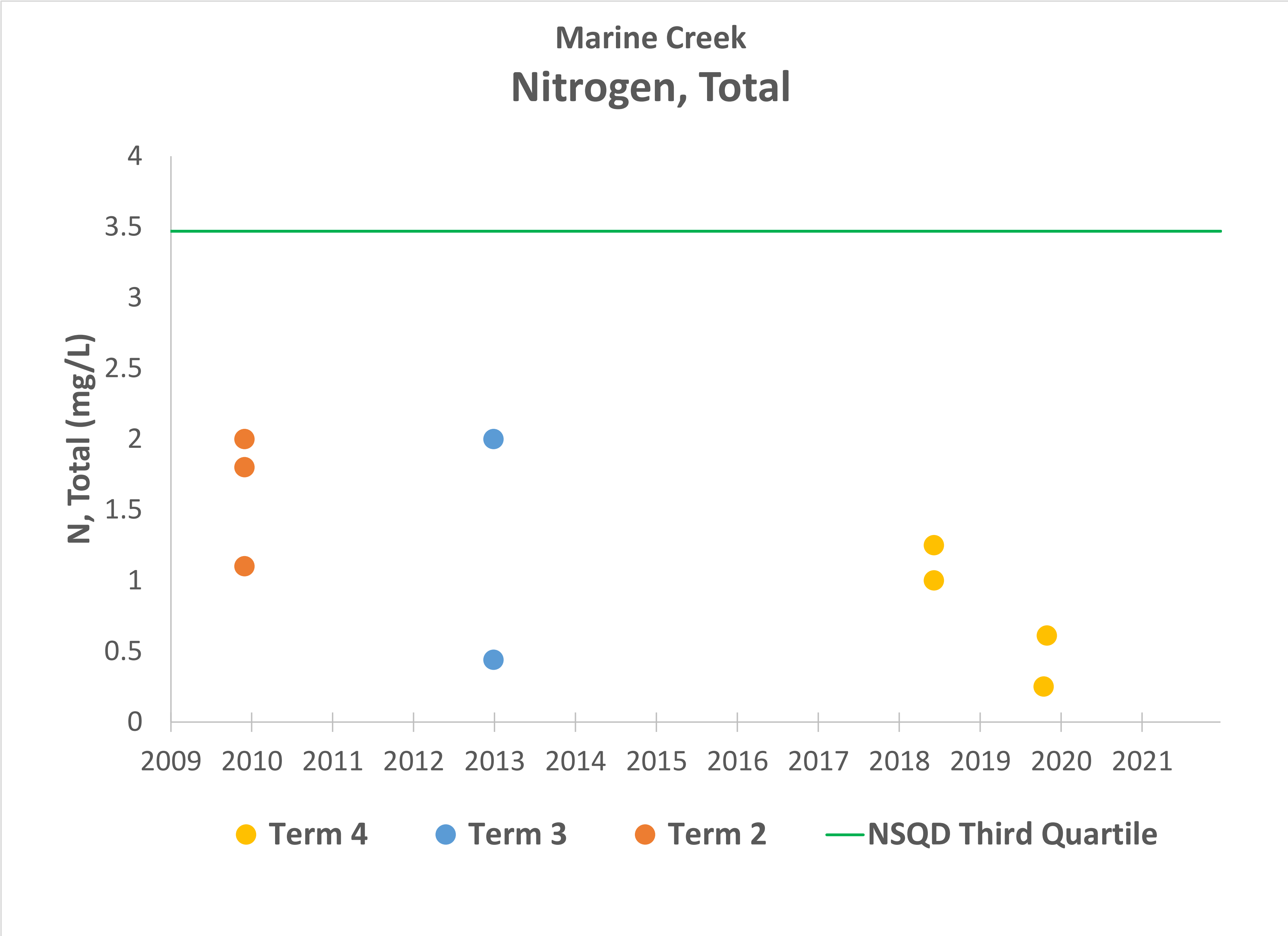


Marine Creek
Chemical Oxygen Demand
COD (mg/L)
100
90
80
70
60
50
40
30
20
10
0
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

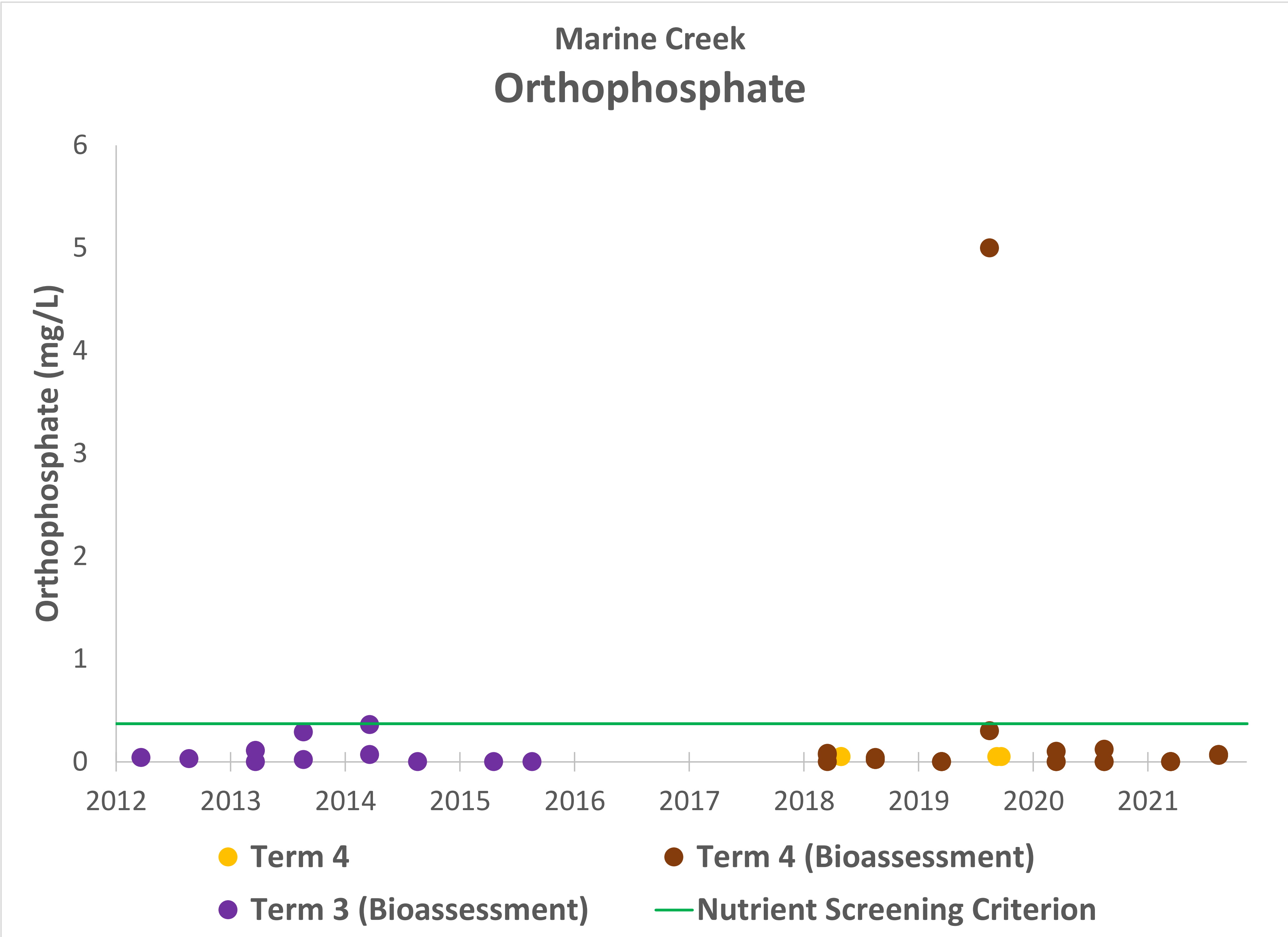


Marine Creek
Nitrate Nitrogen
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion

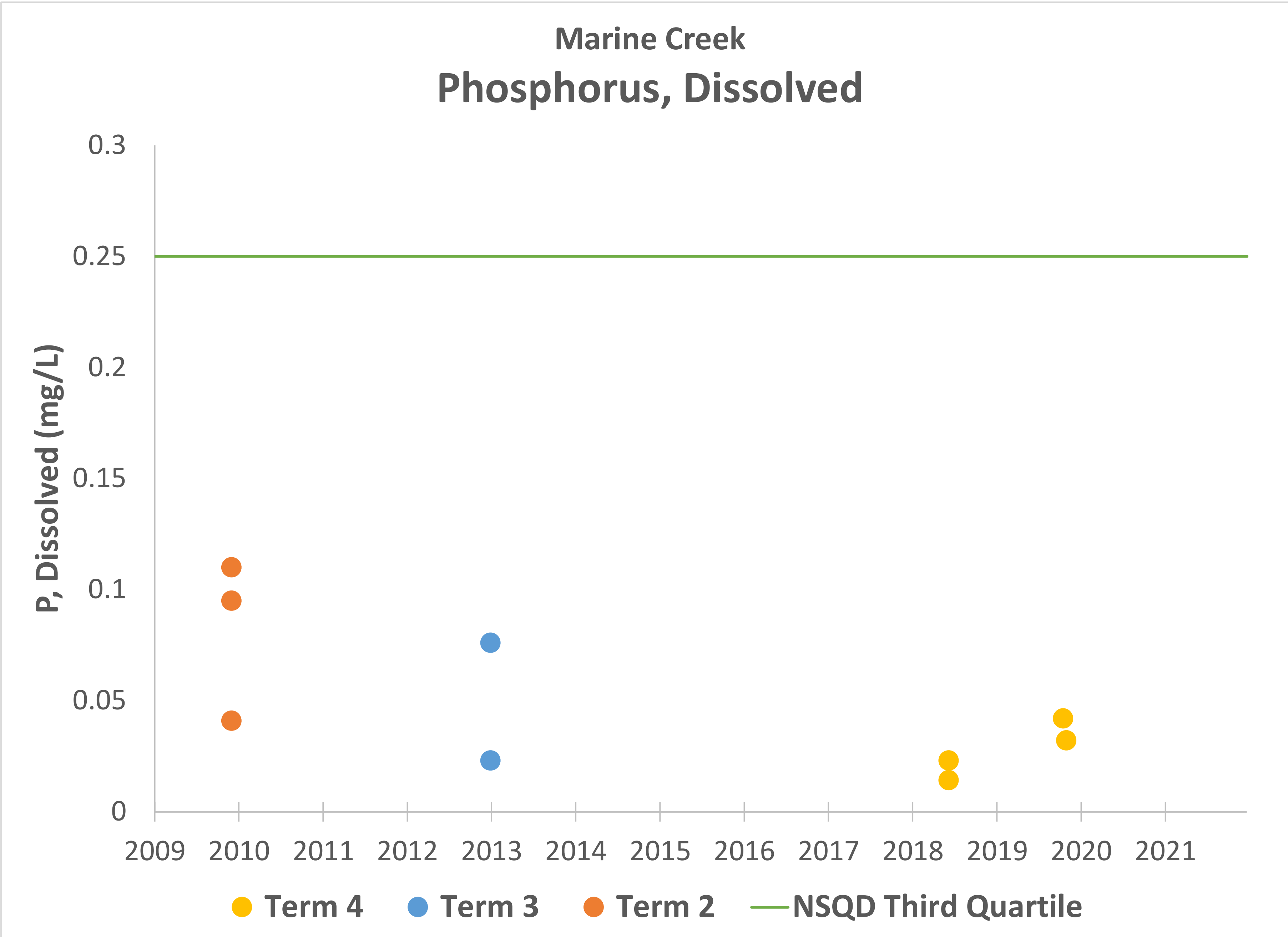

Marine Creek
Ammonia Nitrogen
N, Ammonia (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion



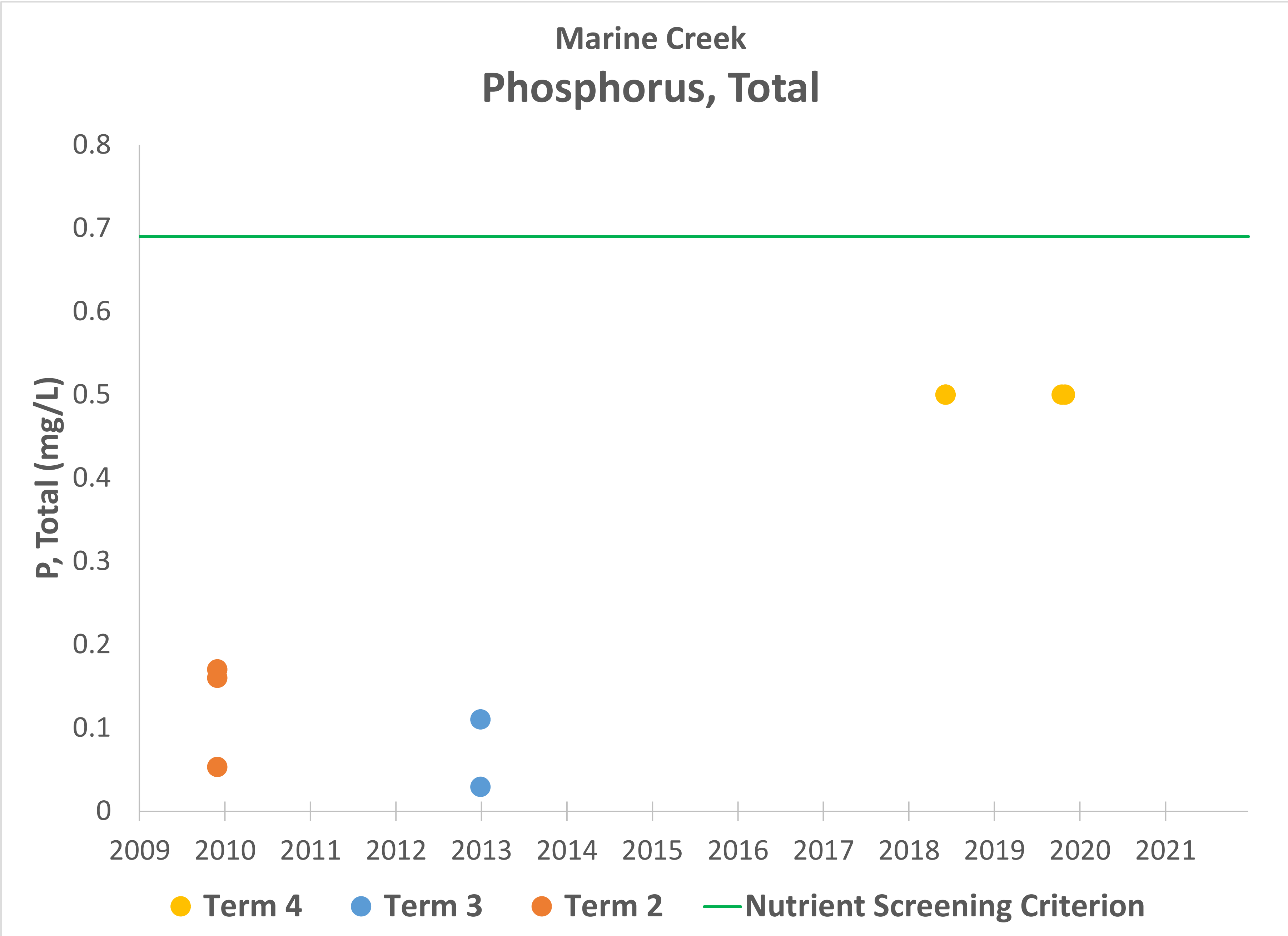
Marine Creek
Nitrogen, Total
N, Total (mg/L)
0
0.5
1
1.5
2
2.5
3
3.5
4
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

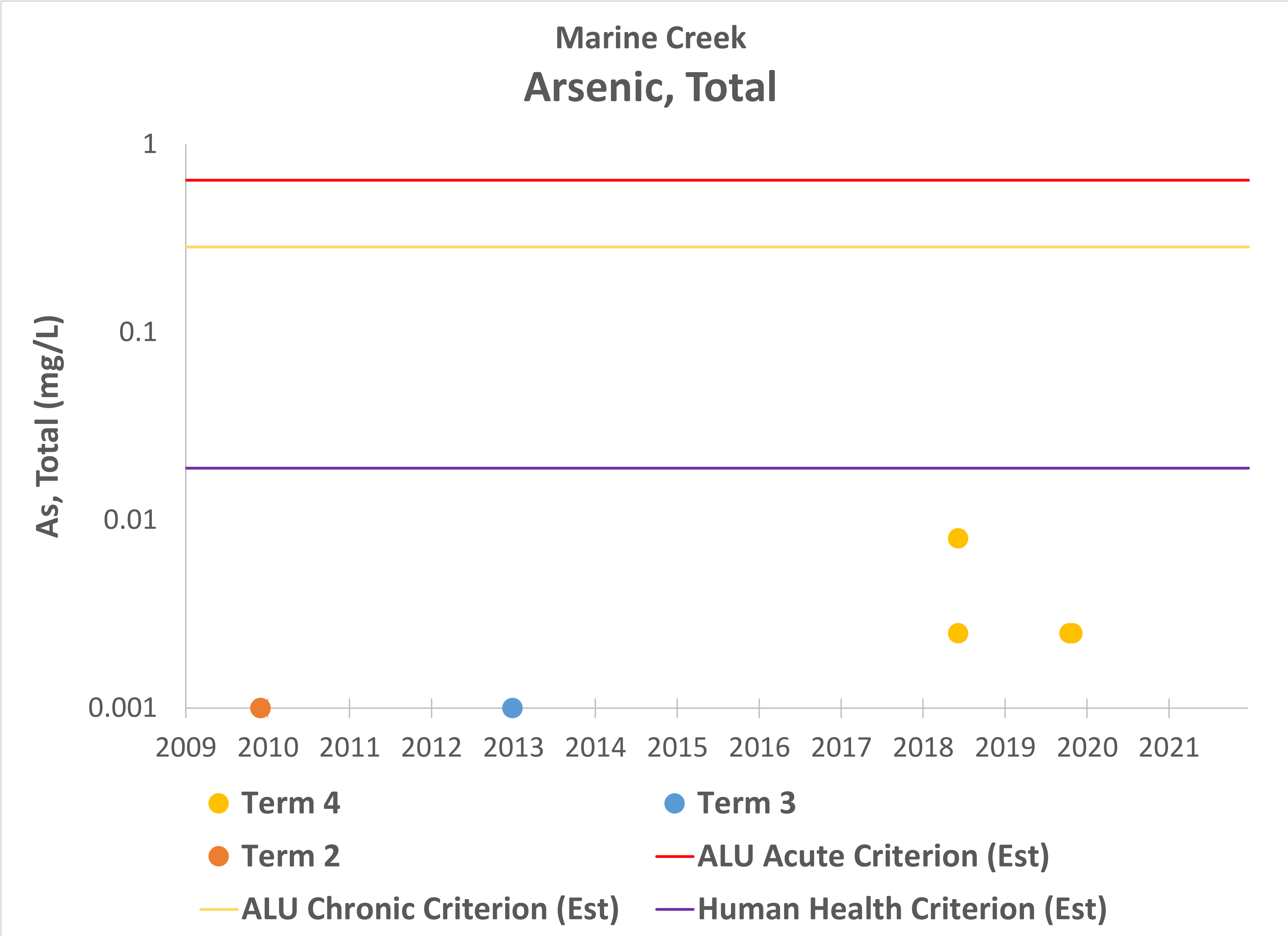


Marine Creek
Orthophosphate
Orthophosphate (mg/L)
6
5
4
3
2
1
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion

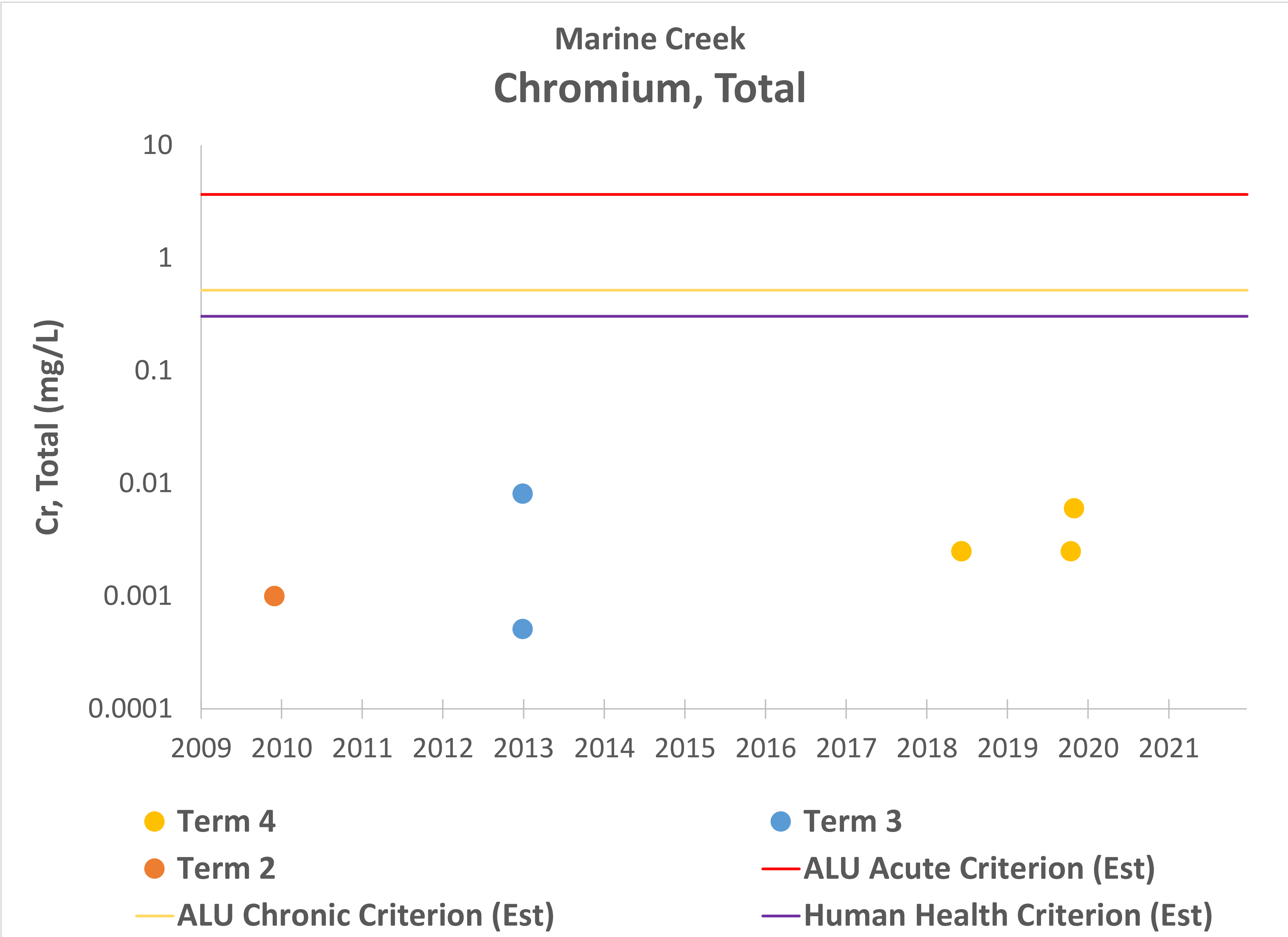


Marine Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

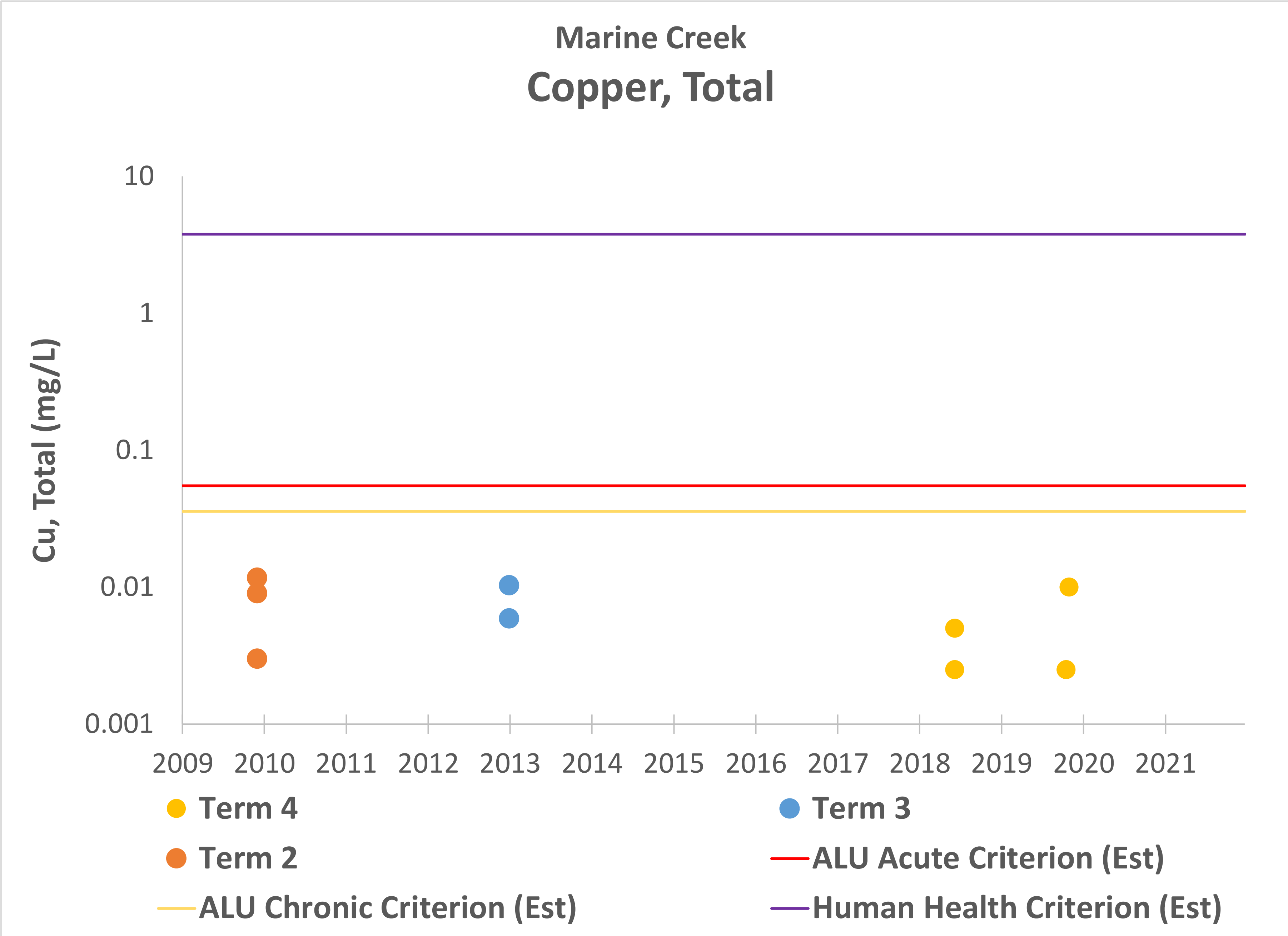

Marine Creek
Phosphorus, Total
P, Total (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
Nutrient Screening Criterion



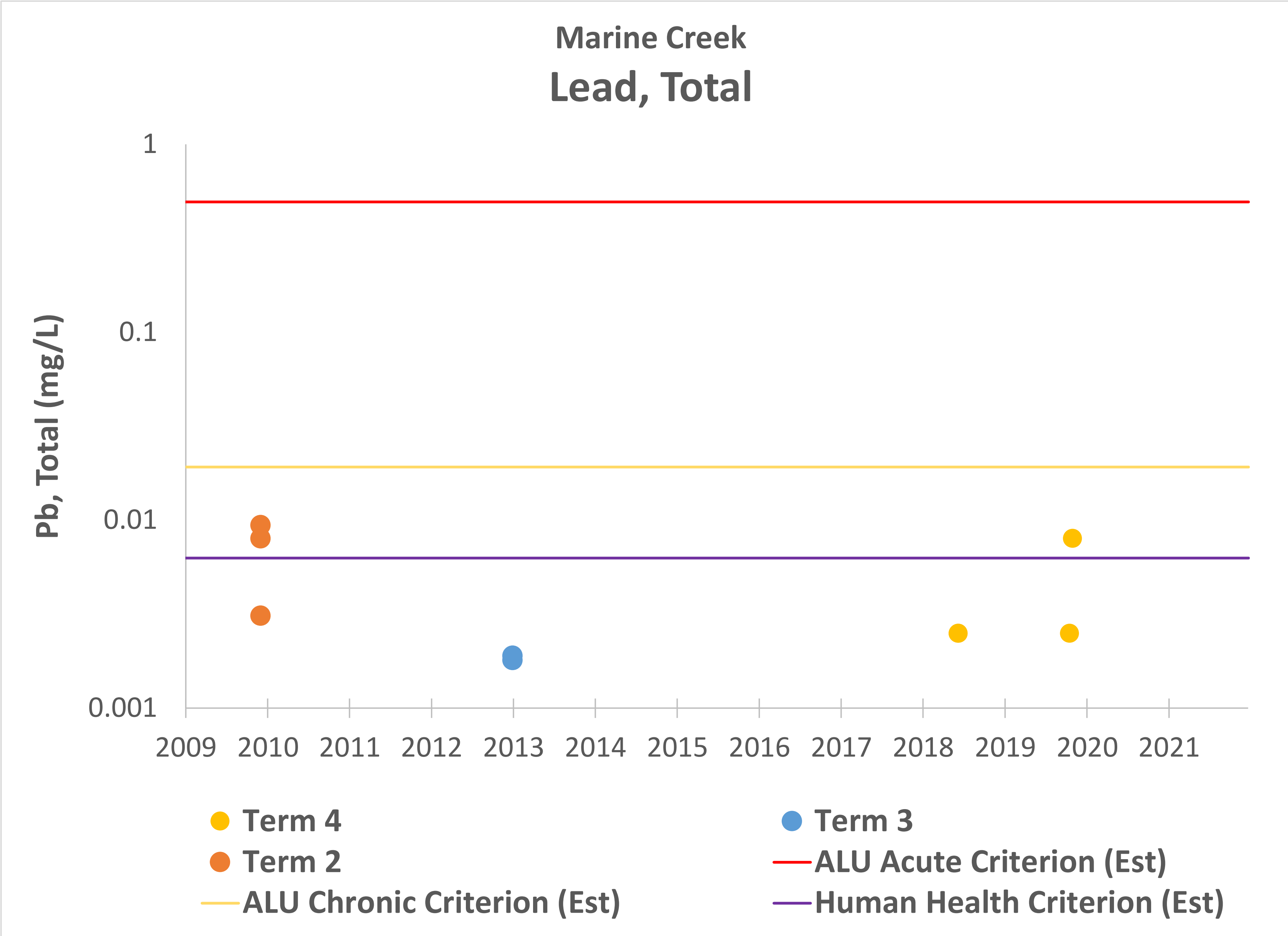
Marine Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

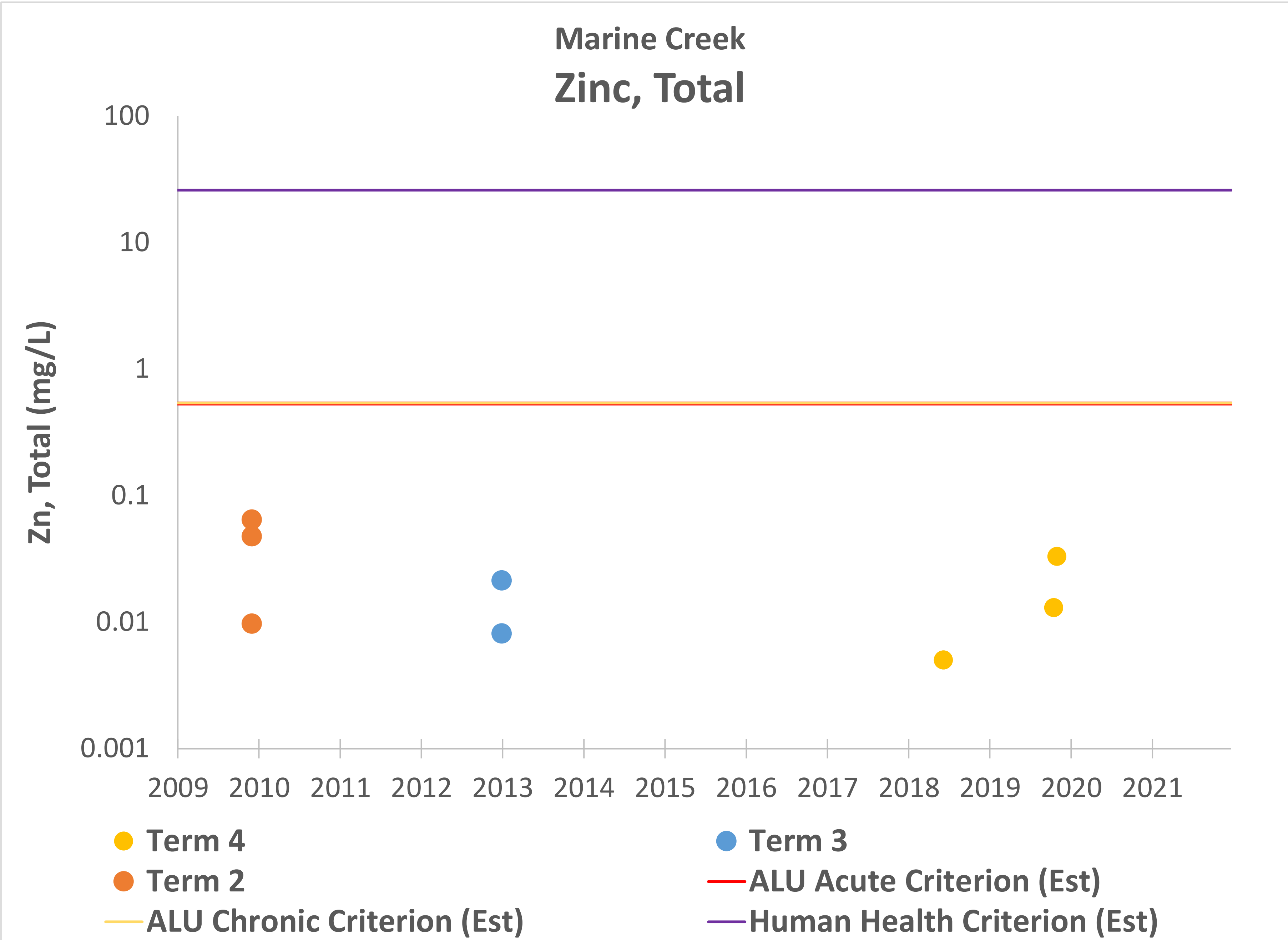


Marine Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
0.0001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

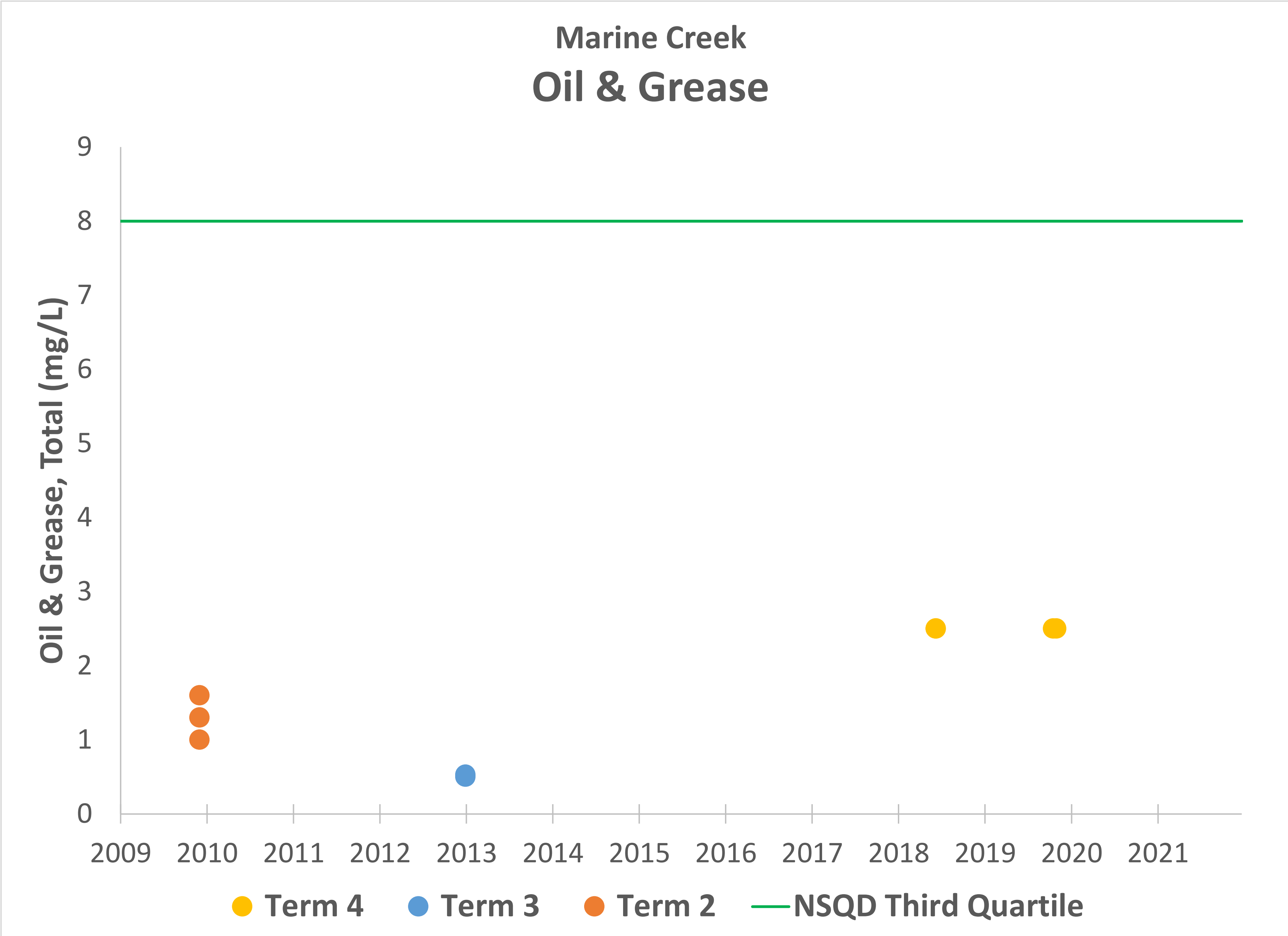


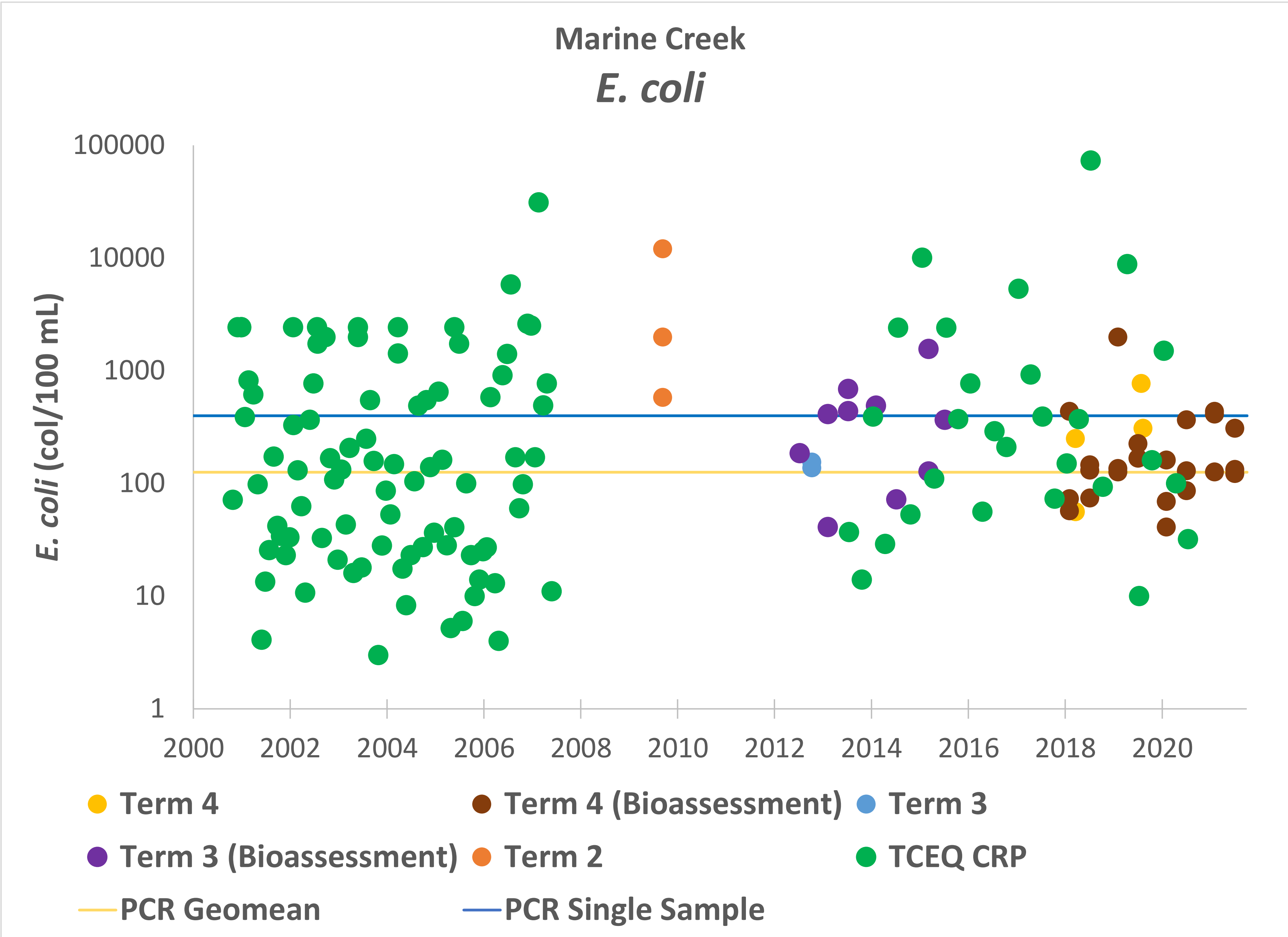
Marine Creek
Copper, Total
Cu, Total (mg/L)
10
1
0.1
0.01
0.001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

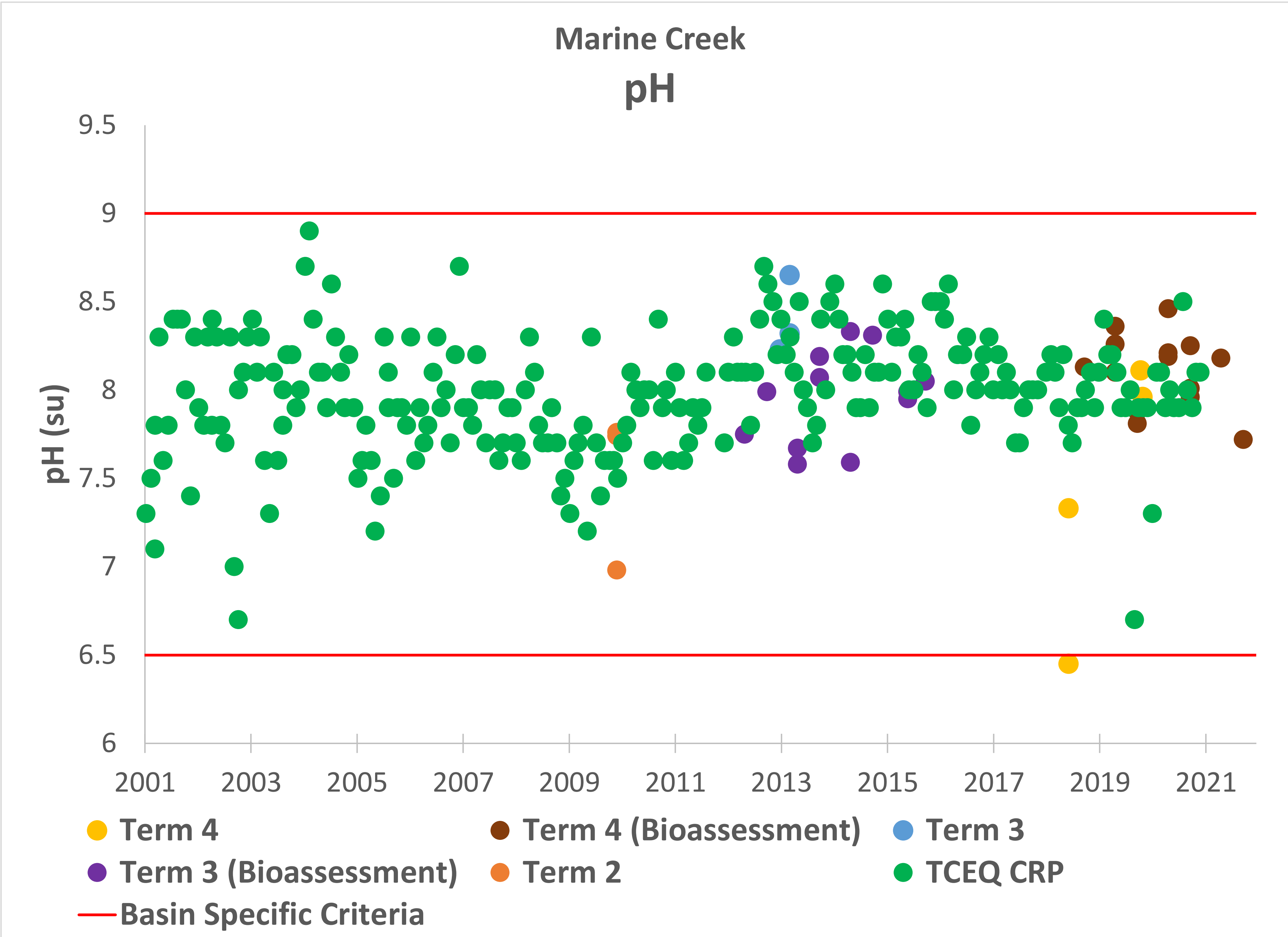

Marine Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

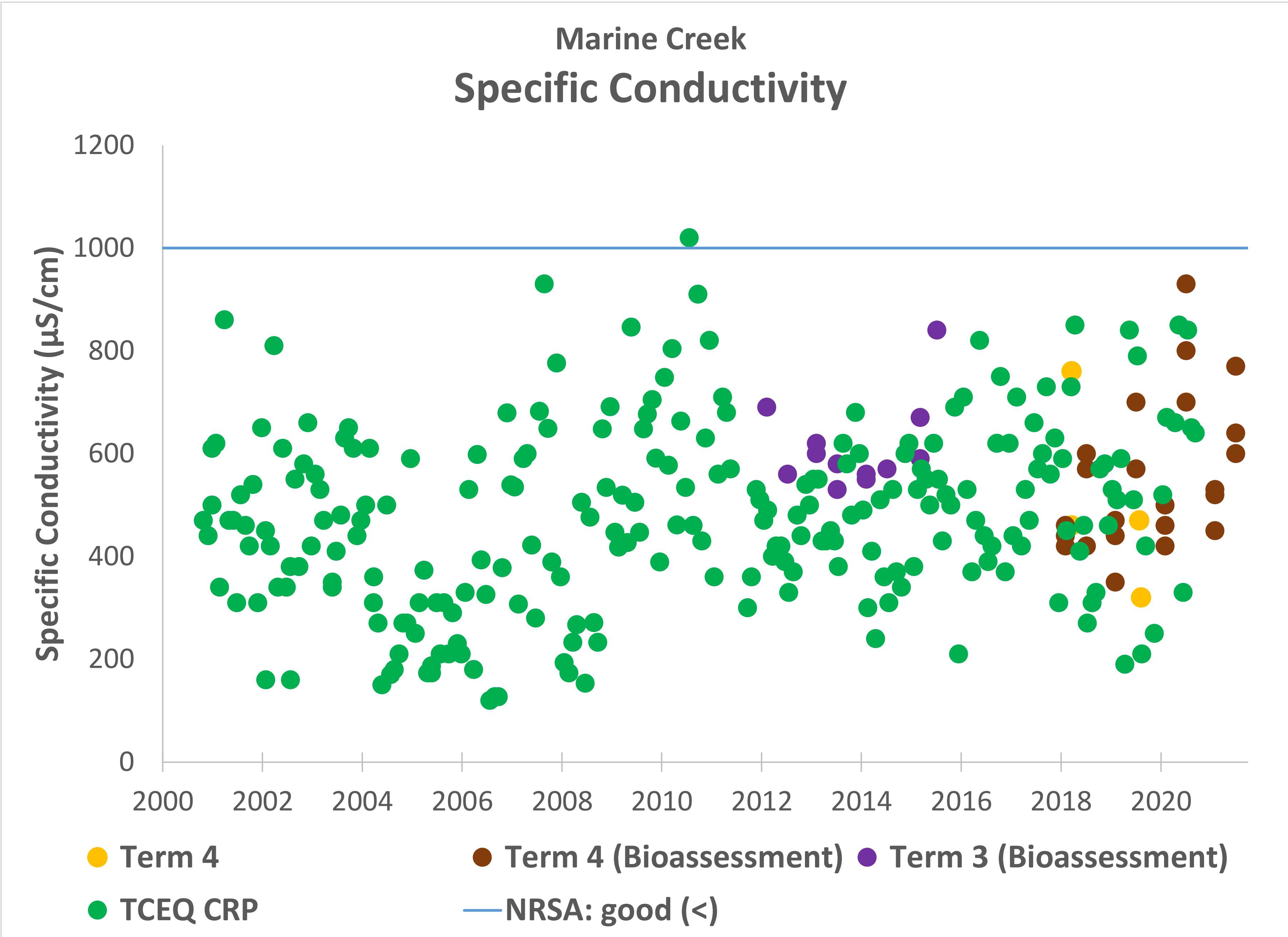


Marine Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

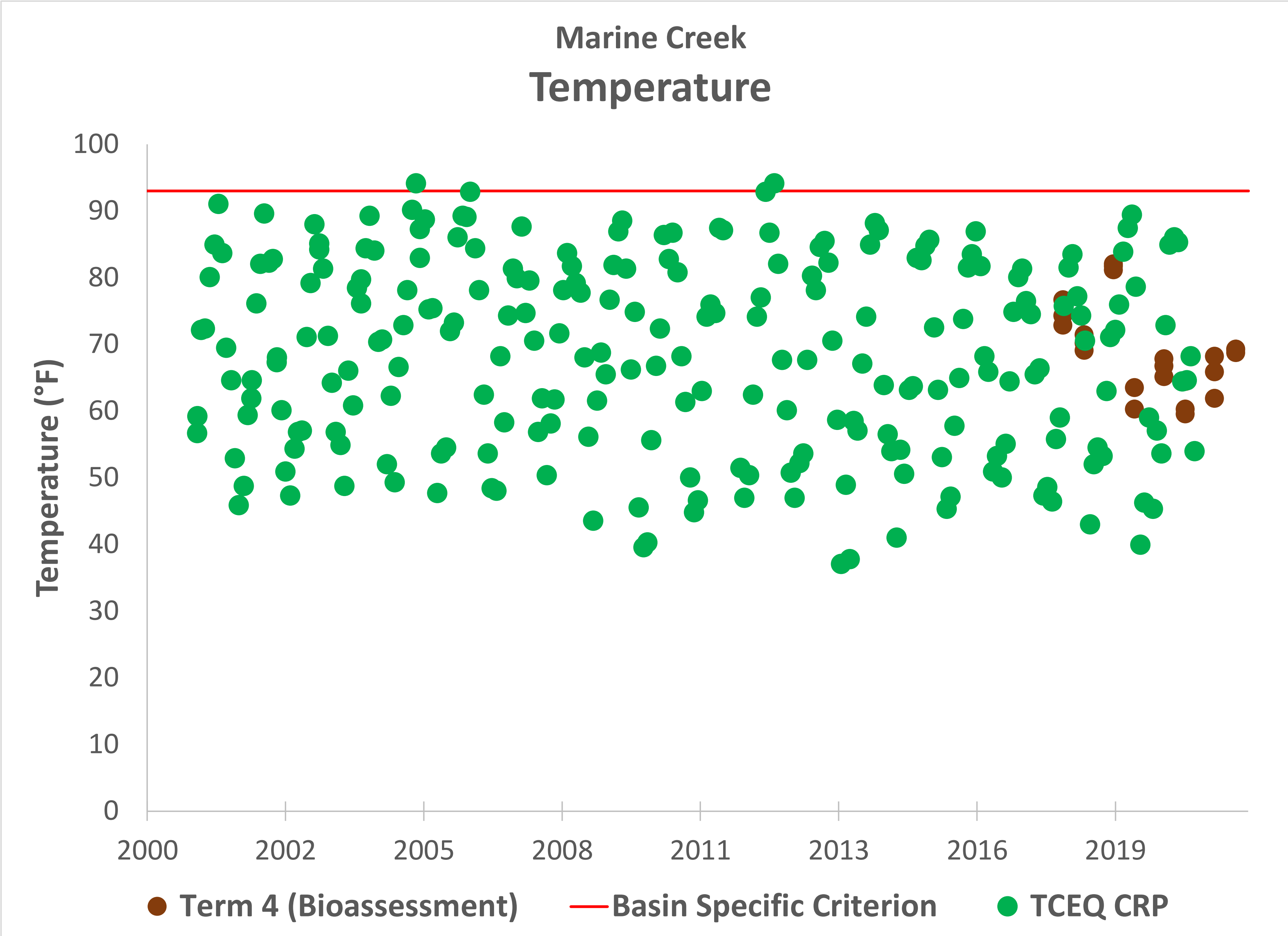

Marine Creek
Oil & Grease
Oil & Grease, Total (mg/L)
0
1
2
3
4
5
6
7
8
9
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile


Marine Creek
E. coli
E. coli (col/100 mL)
100000
10000
1000
100
10
1
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 4 (Bioassessment)
Term 3
Term 3 (Bioassessment)
Term 2
TCEQ CRP
PCR Geomean
PCR Single Sample

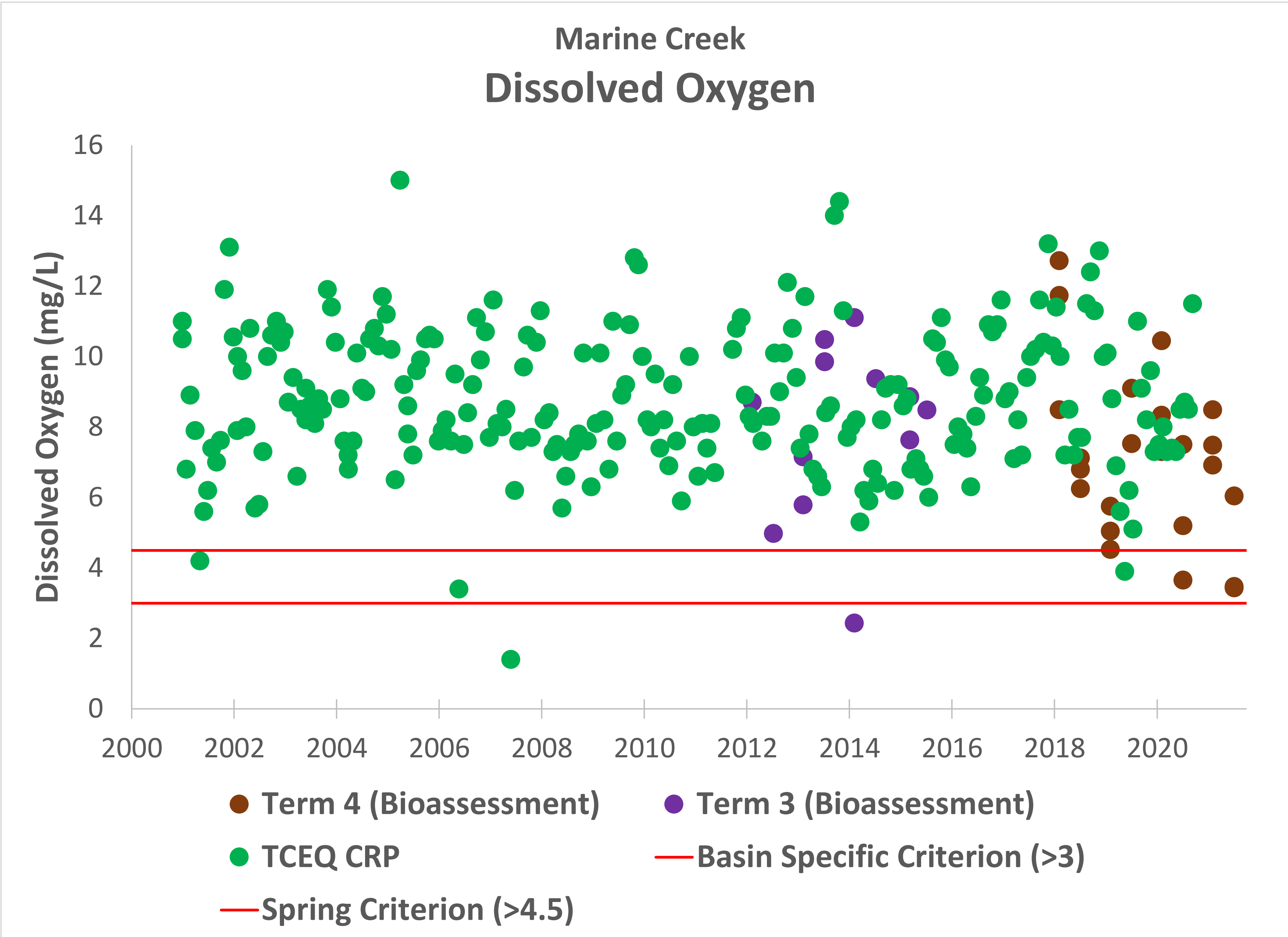

Marine Creek
pH
pH (su)
9.5
9
8.5
8
7.5
7
6.5
6
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 4 (Bioassessment)
Term 3
Term 3 (Bioassessment)
Term 2
TCEQ CRP
Basin Specific Criteria



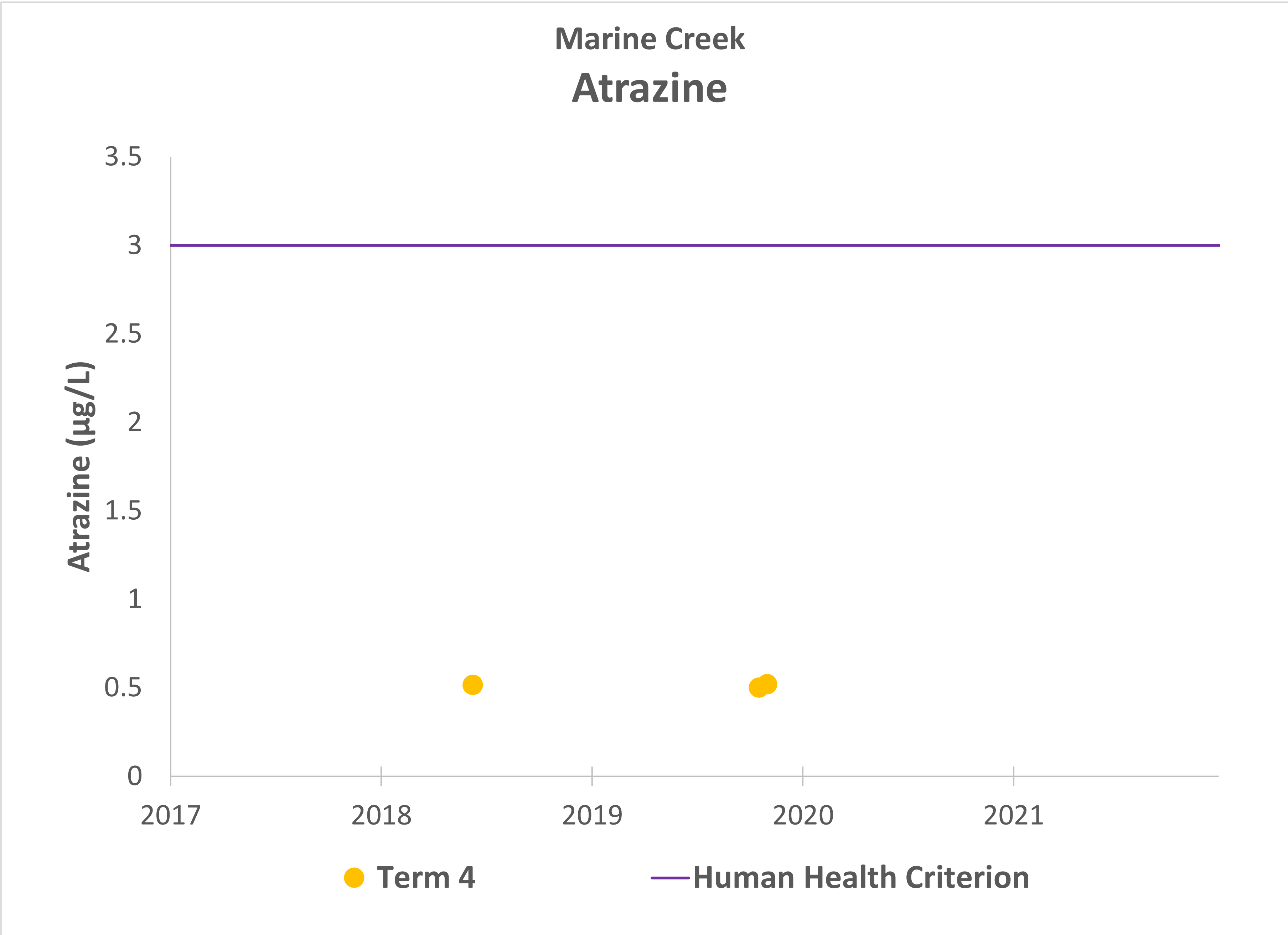
Marine Creek
Specific Conductivity
Specific Conductivity (µS/cm)
0
200
400
600
800
1000
1200
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
TCEQ CRP
NRSA: good (<)

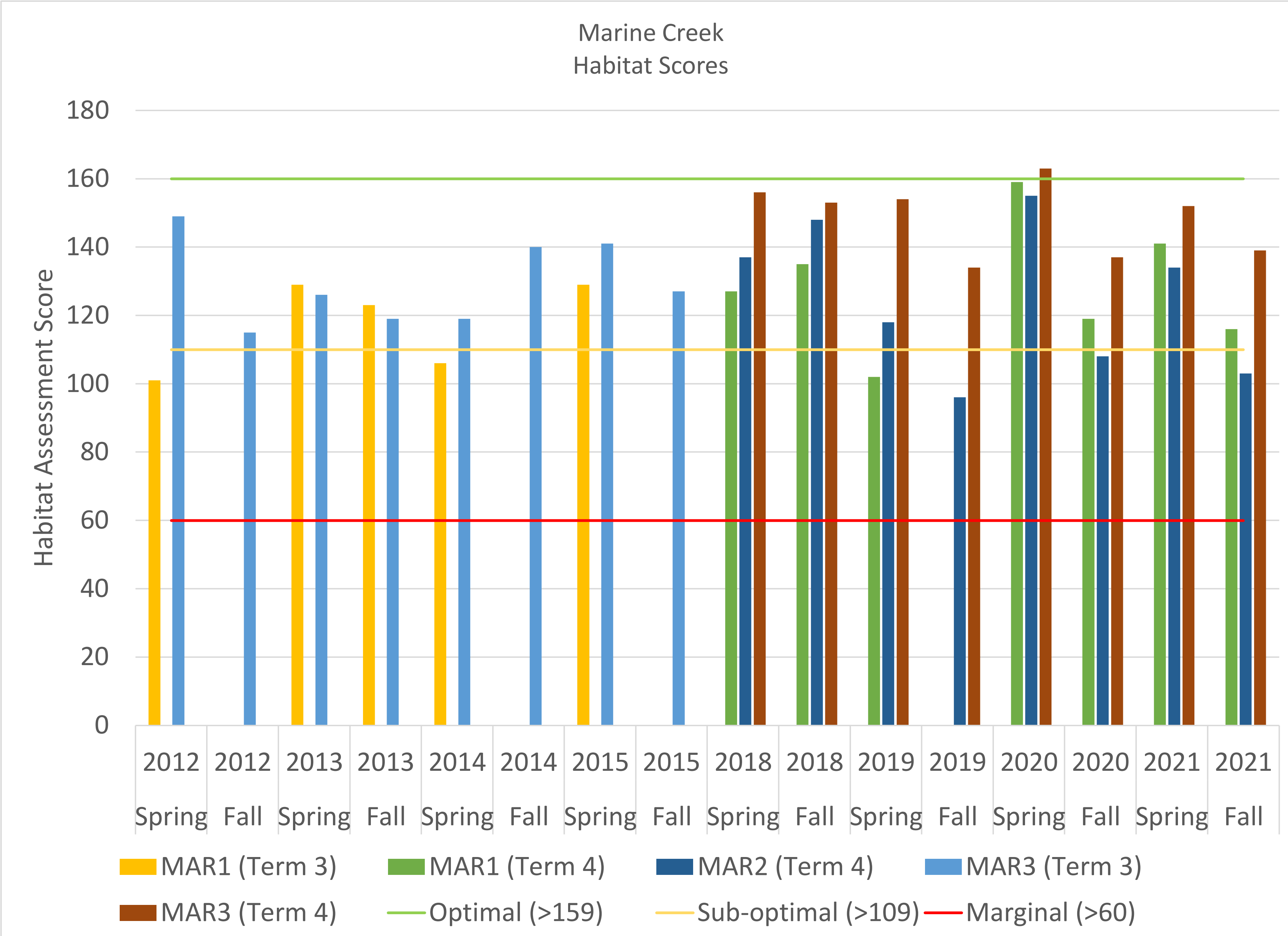


Marine Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2000
2002
2005
2008
2011
2013
2016
2019
Term 4 (Bioassessment)
Basin Specific Criterion
TCEQ CRP

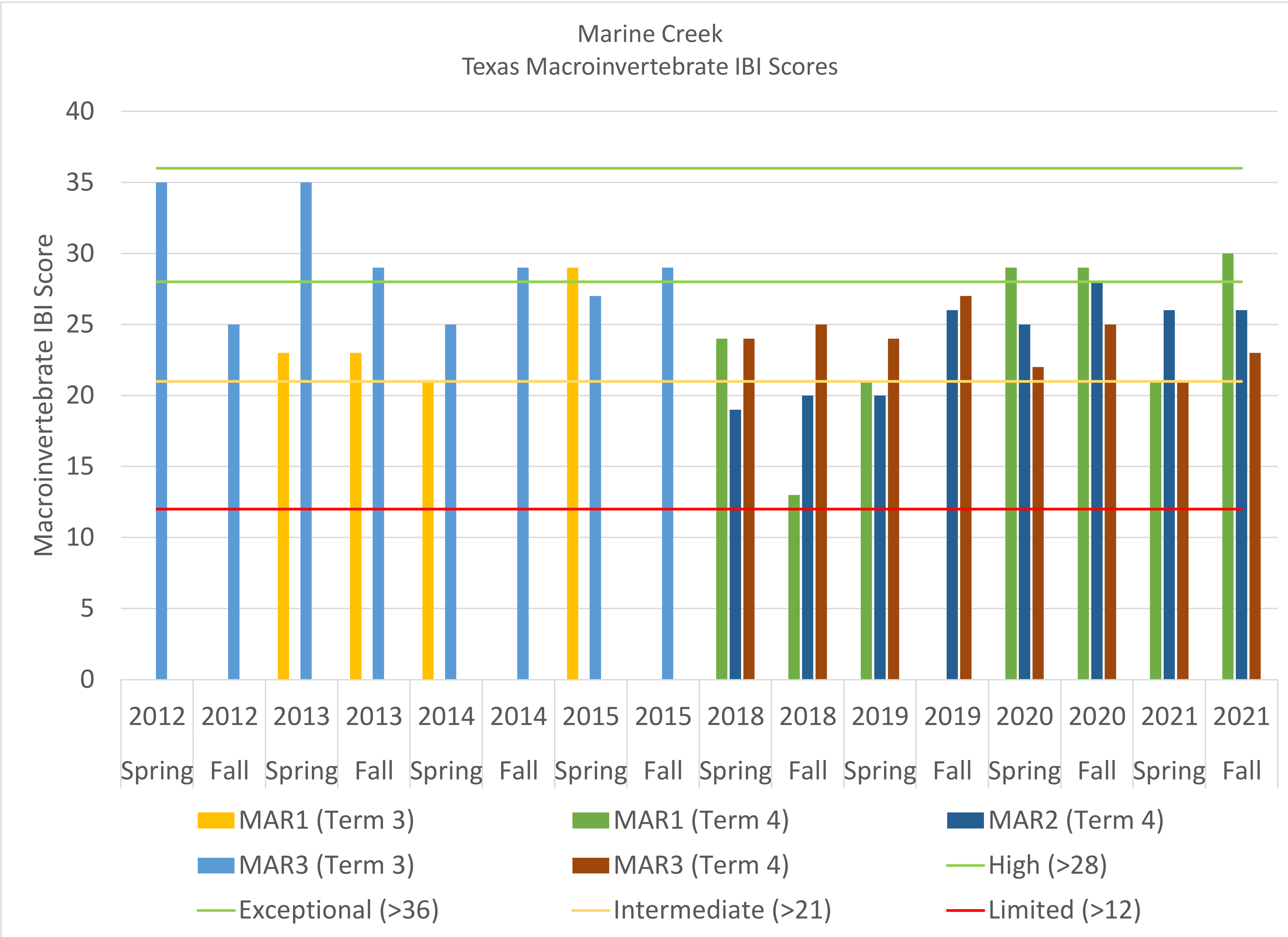


Marine Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
14
16
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4 (Bioassessment)
Term 3 (Bioassessment)
TCEQ CRP
Basin Specific Criterion (>3)
Spring Criterion (>4.5)


Marine Creek
Atrazine
Atrazine (µg/L)
3.5
3
2.5
2
1.5
1
0.5
0
2017
2018
2019
2020
2021
Term 4
Human Health Criterion



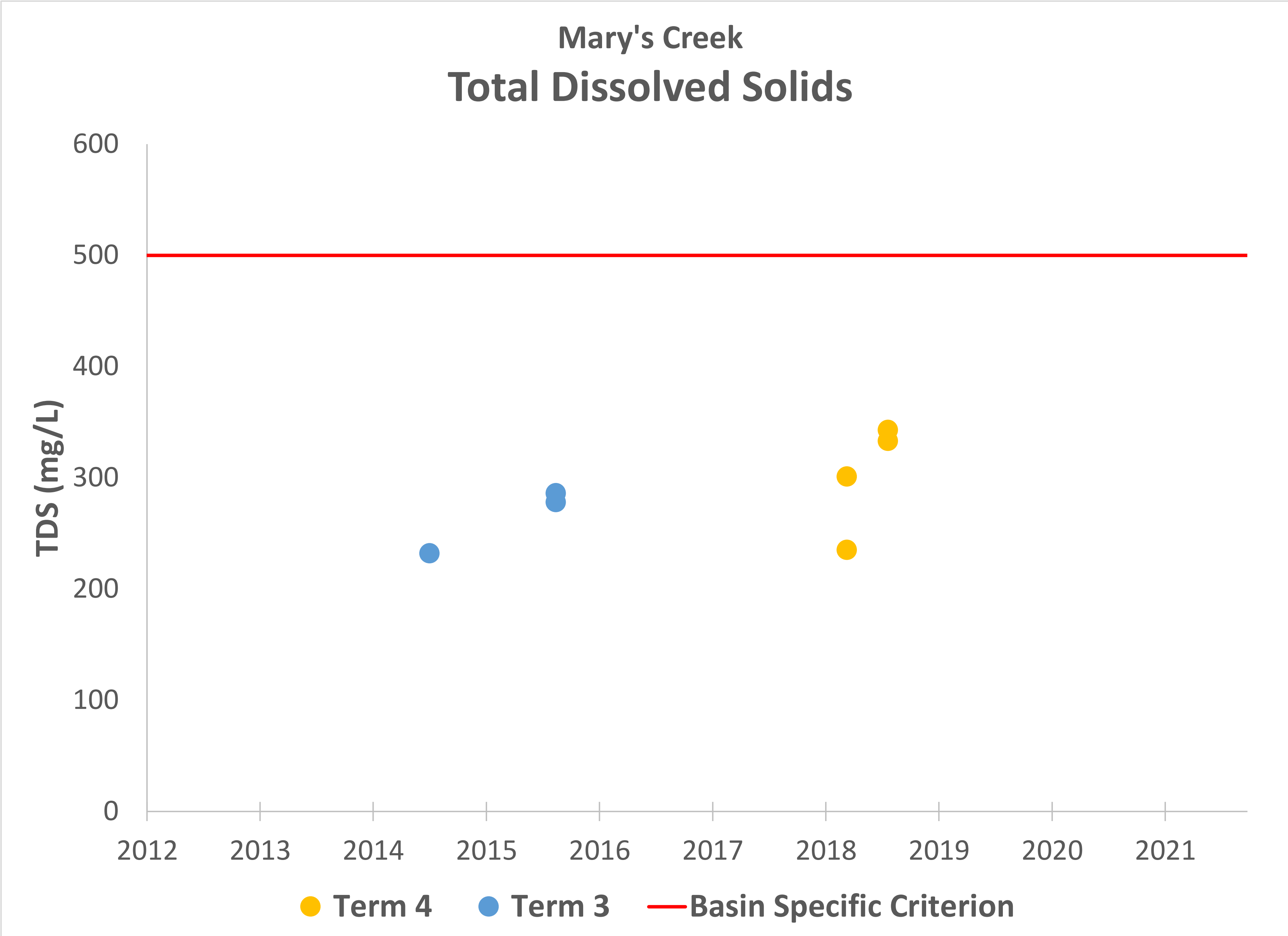
Marine Creek
Habitat Scores
Habitat Assessment Score
180
160
140
120
100
80
60
40
20
0
2012 Spring
2012 Fall
2013 Spring
2013 Fall
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
MAR1 (Term 3)
MAR1 (Term 4)
MAR2 (Term 4)
MAR3 (Term 3)
MAR3 (Term 4)
Optimal (>159)
Sub-optimal (>109)
Marginal (>60)



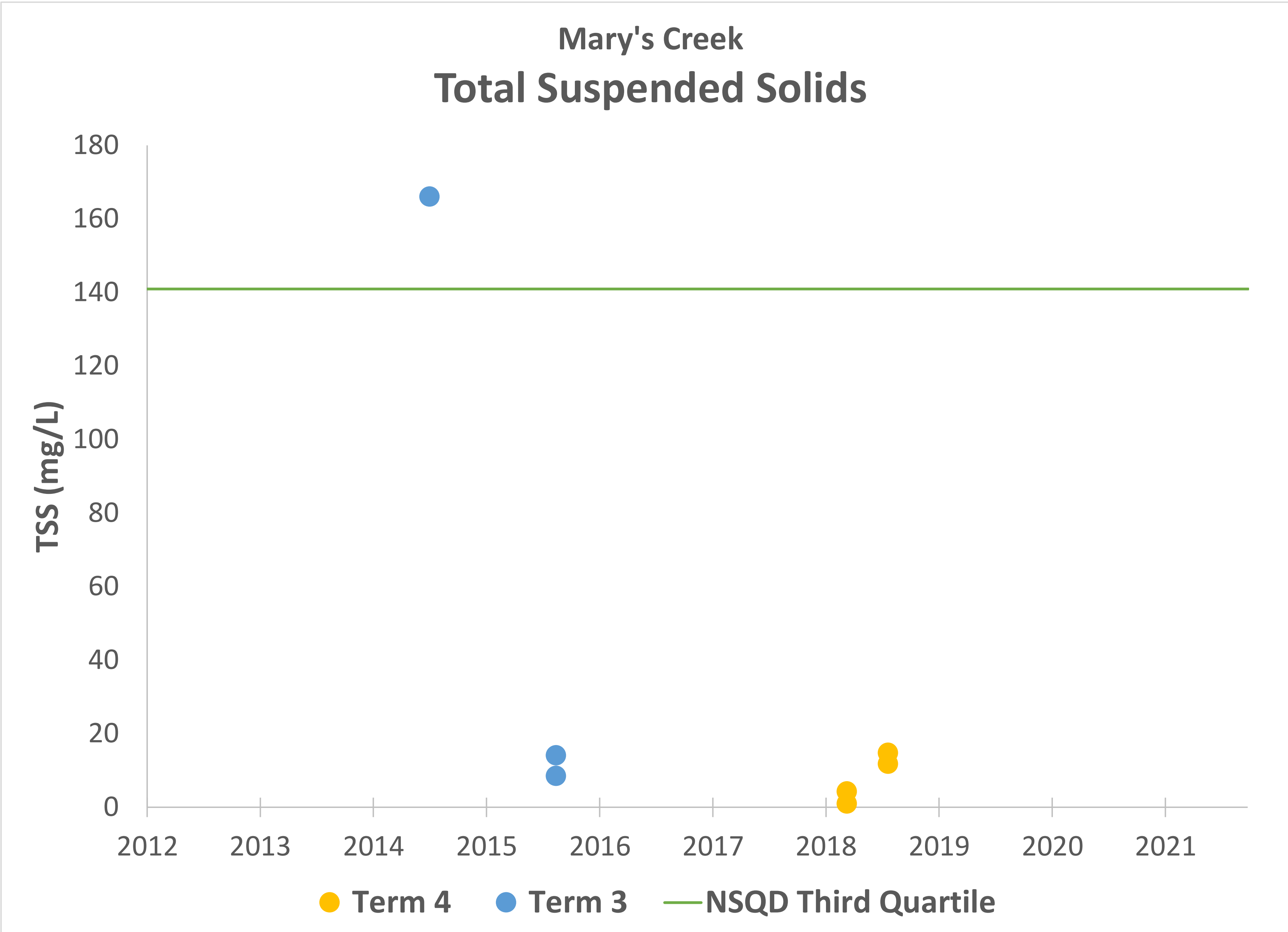
Marine Creek
Texas Macroinvertebrate IBI Scores
Macroinvertebrate IBI Score
40
35
30
25
20
15
10
5
0
2012 Spring
2012 Fall
2013 Spring
2013 Fall
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
MAR1 (Term 3)
MAR1 (Term 4)
MAR2 (Term 4)
MAR3 (Term 3)
MAR3 (Term 4)
High (>28)
Exceptional (>36)
Intermediate (>21)
Limited (>12)

Appendix S

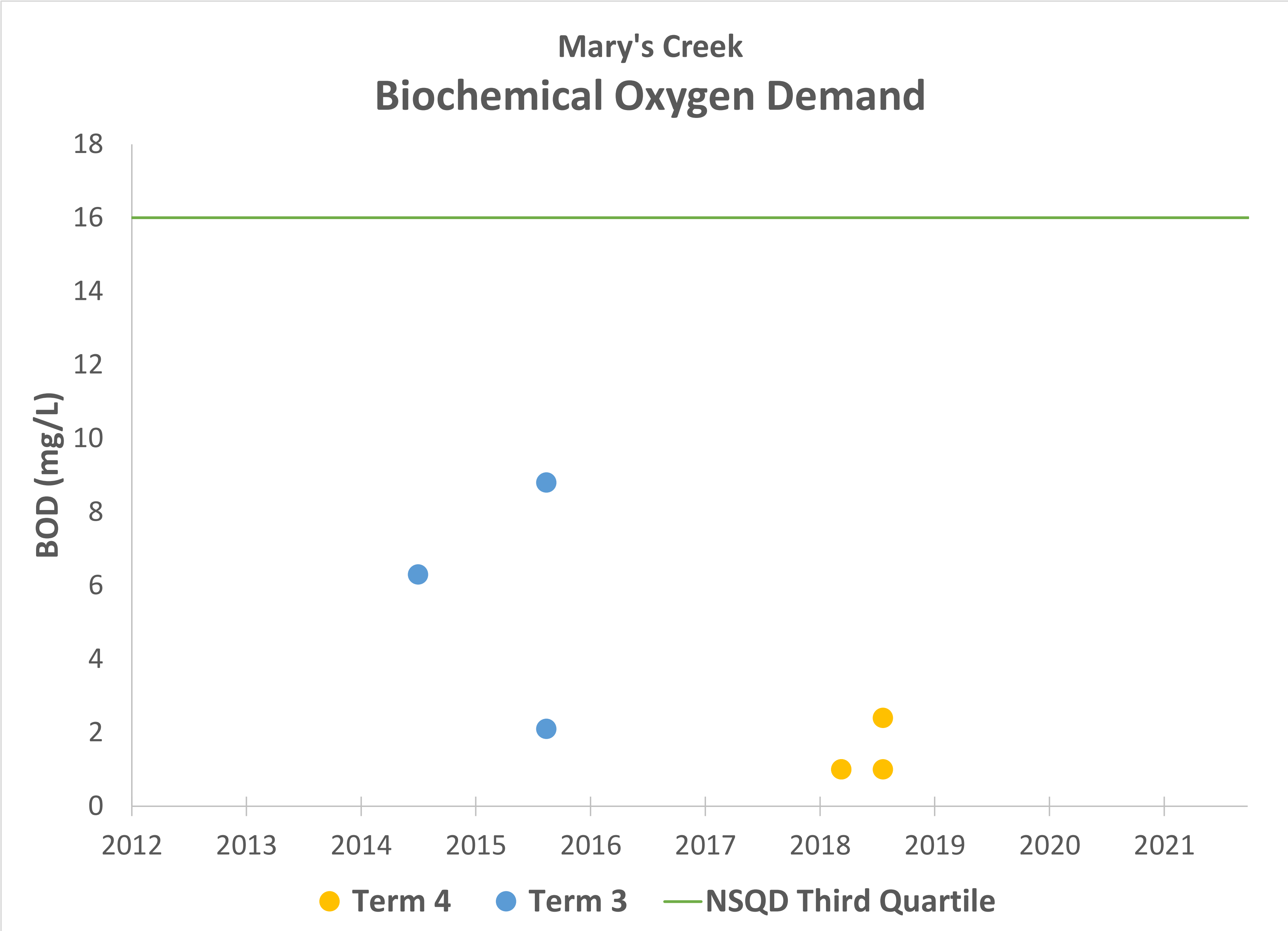
Mary’s Creek Water Quality Data Graphs

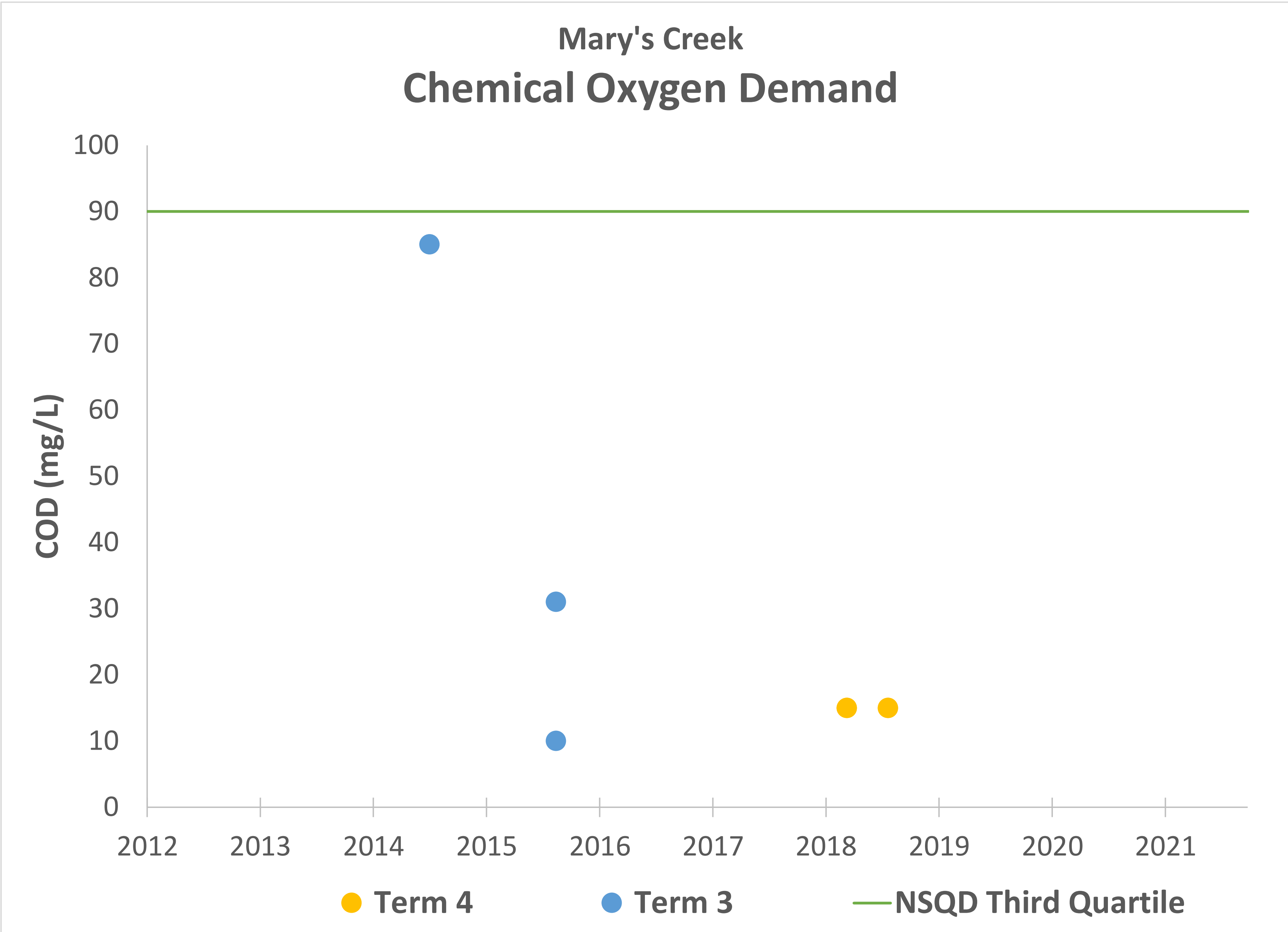


Mary's Creek
Total Dissolved Solids
TDS (mg/L)
600
500
400
300
200
100
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Basin Specific Criterion

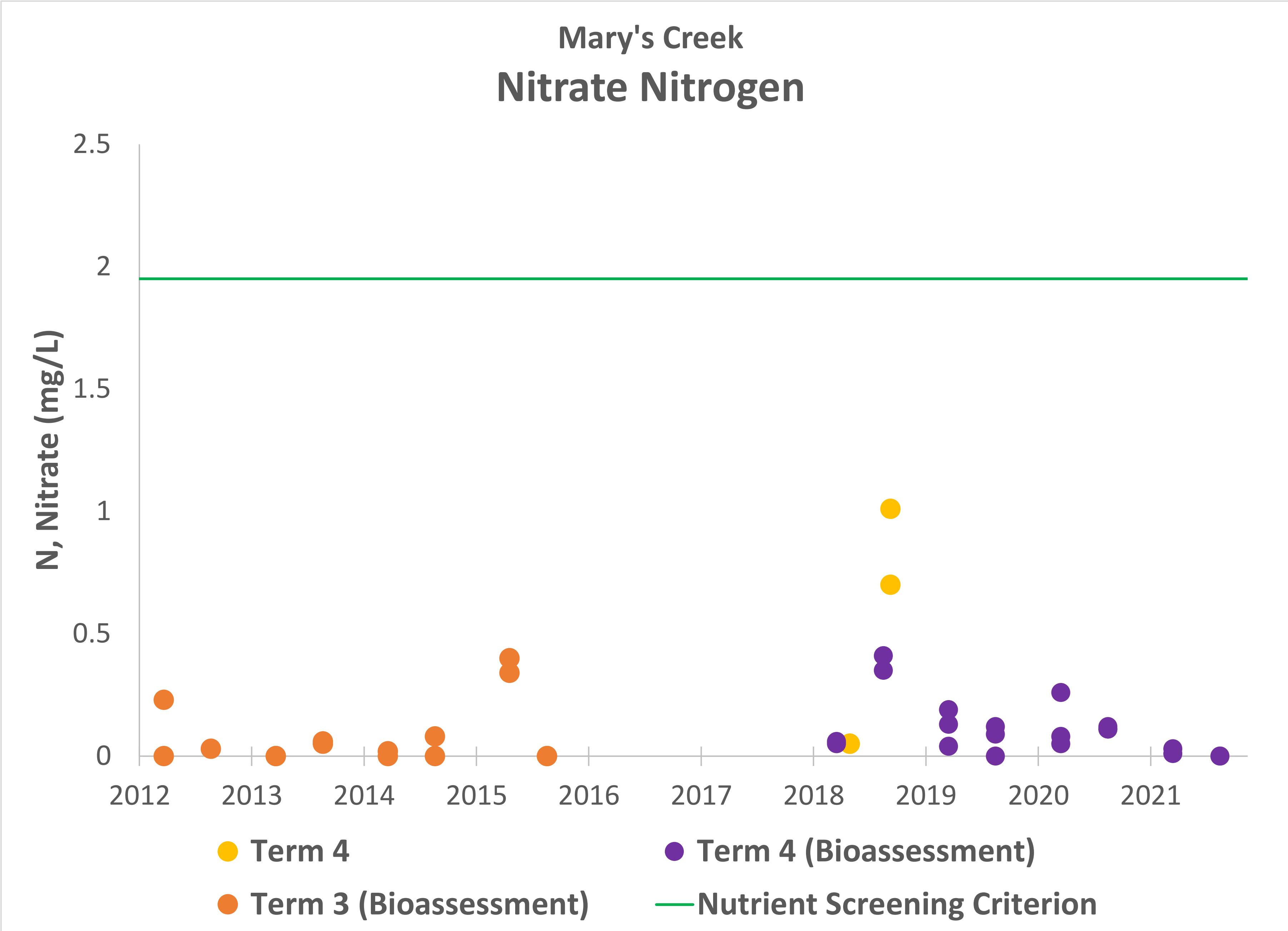


Mary's Creek
Total Suspended Solids
TSS (mg/L)
180
160
140
120
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

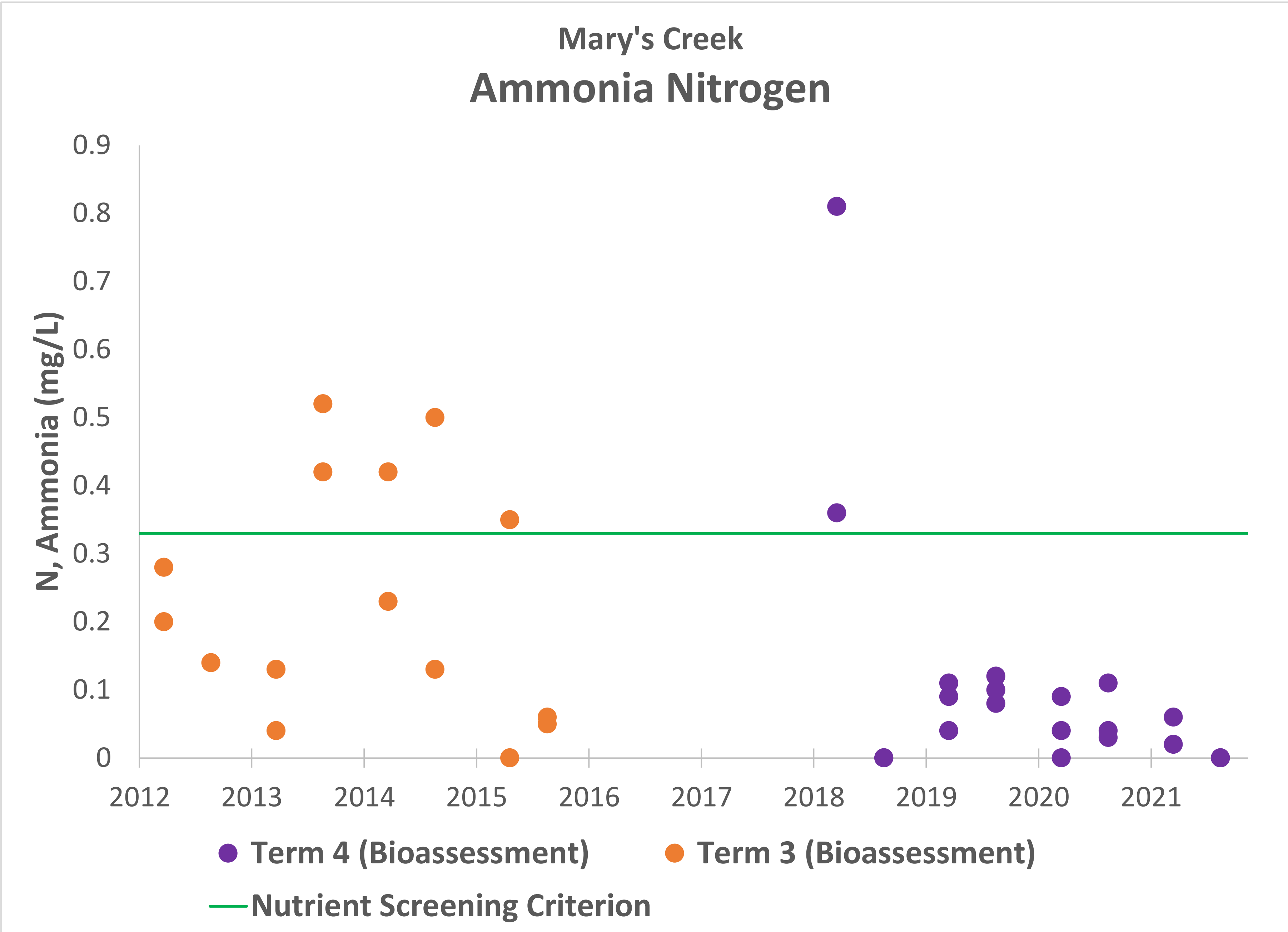

Mary's Creek
Biochemical Oxygen Demand
BOD (mg/L)
0
2
4
6
8
10
12
14
16
18
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile



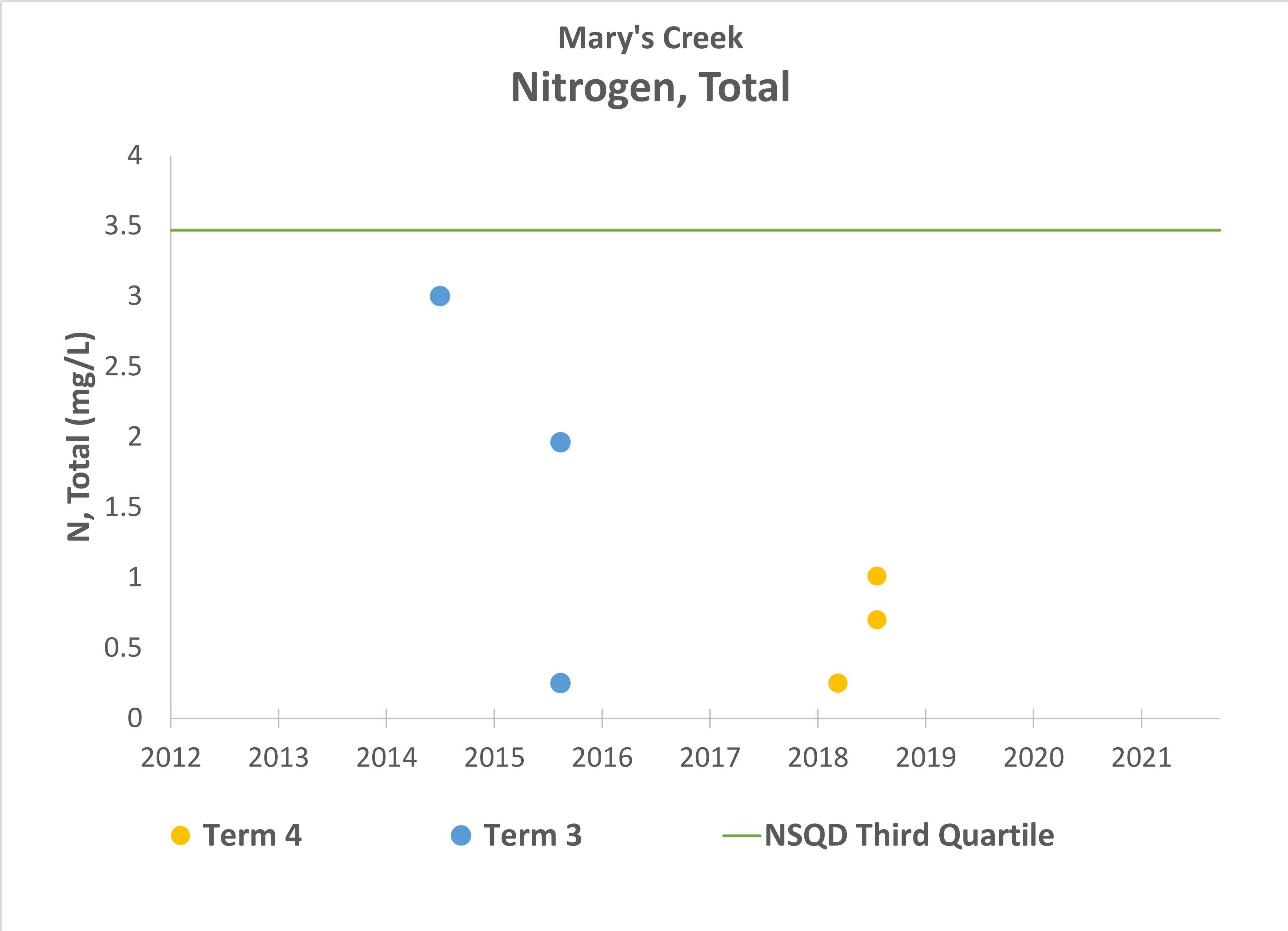
Mary's Creek
Chemical Oxygen Demand
COD (mg/L)
100
90
80
70
60
50
40
30
20
10
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

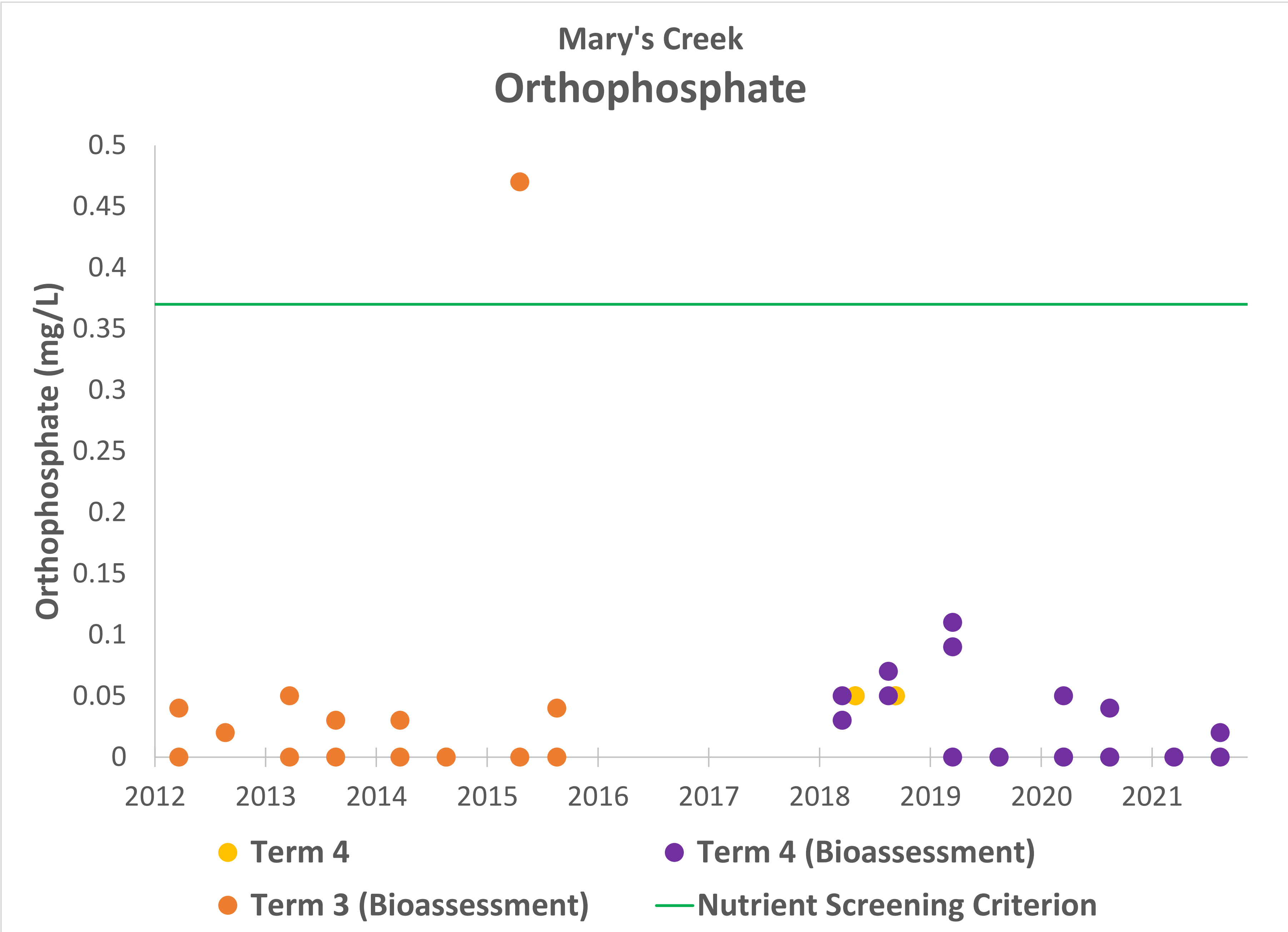


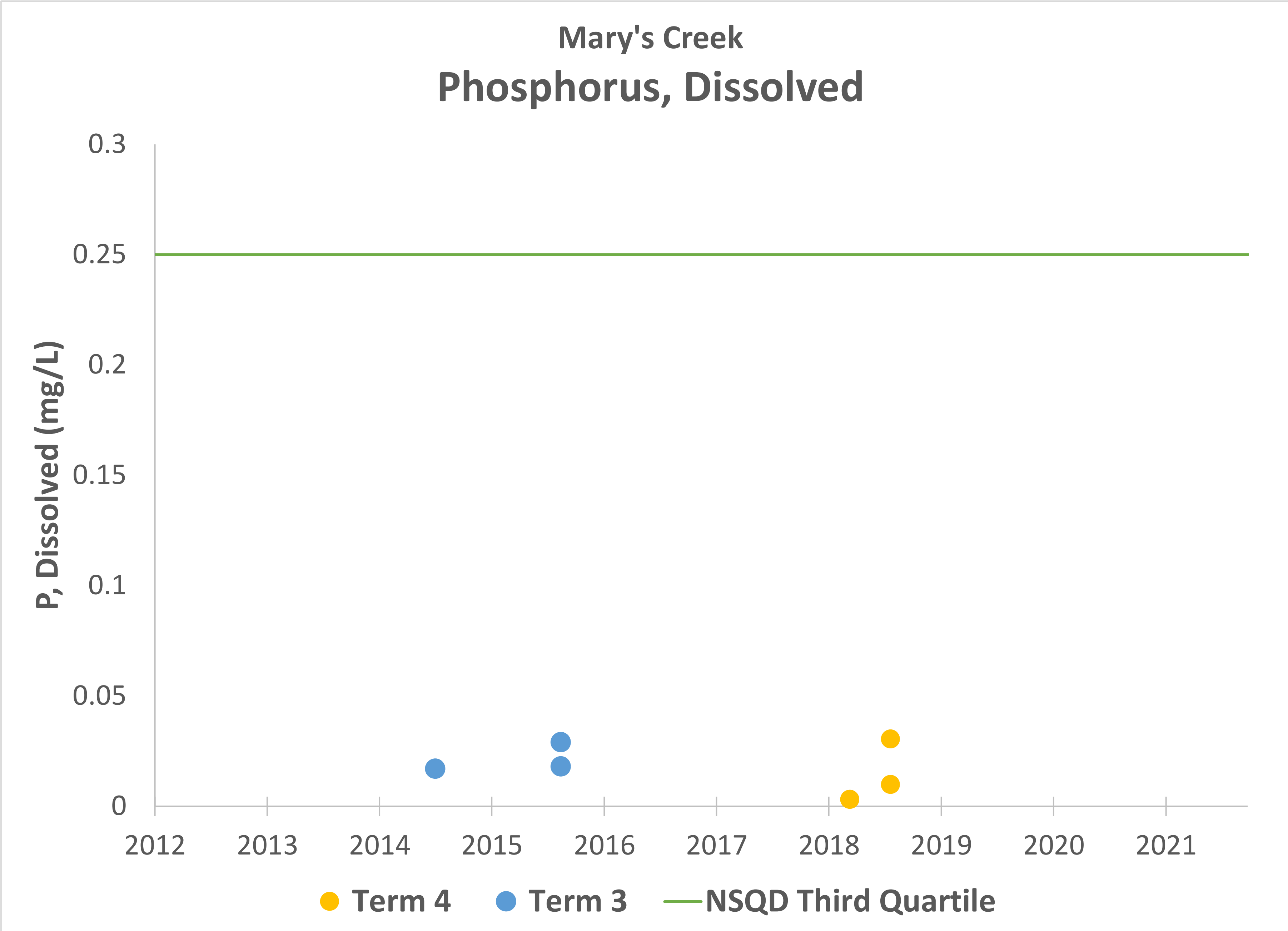
Mary's Creek
Nitrate Nitrogen
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion

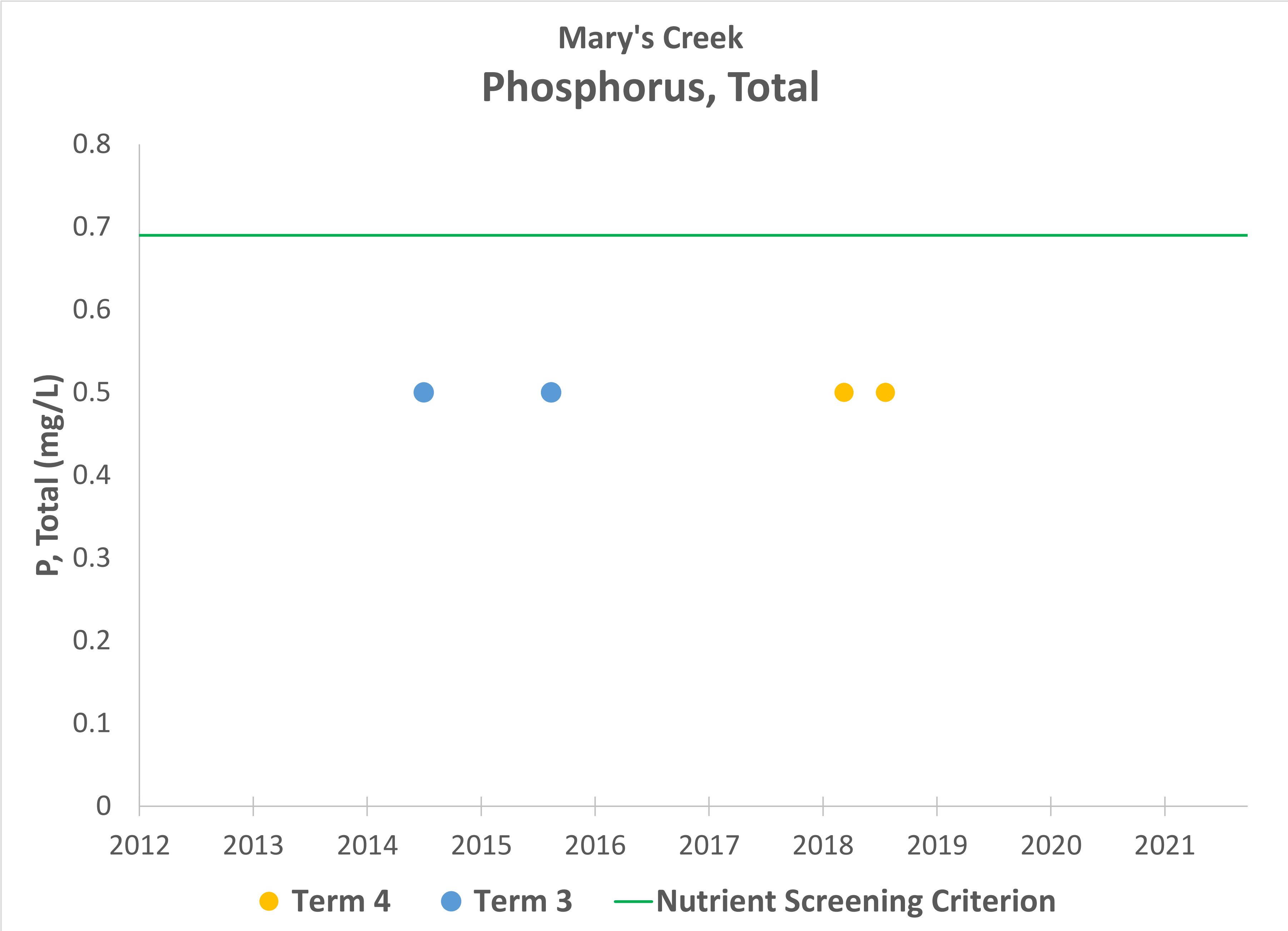


Mary's Creek
Ammonia Nitrogen
N, Ammonia (mg/L)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion

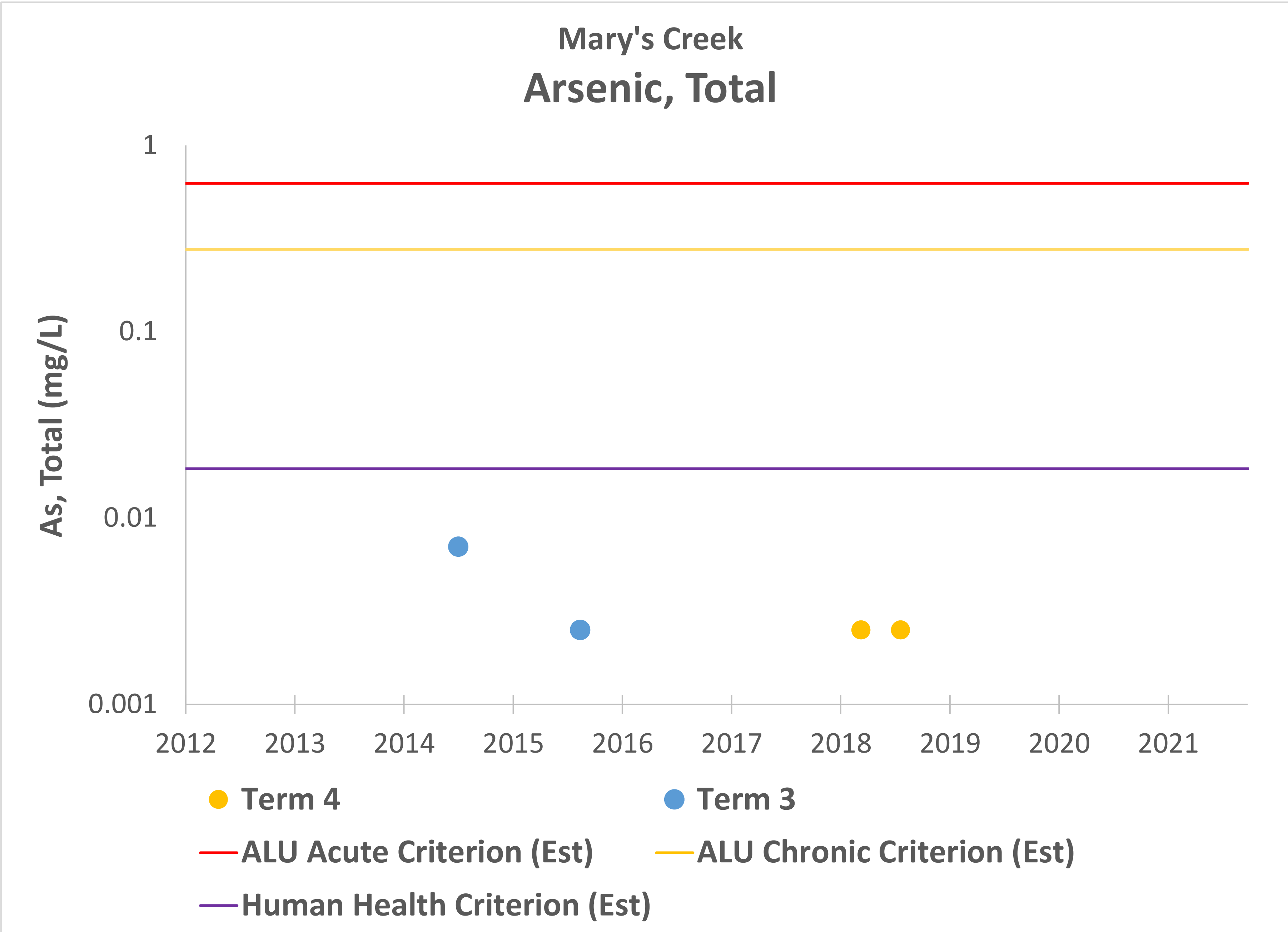

Mary's Creek
Nitrogen, Total
N, Total (mg/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile


Mary's Creek
Orthophosphate
Orthophosphate (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion

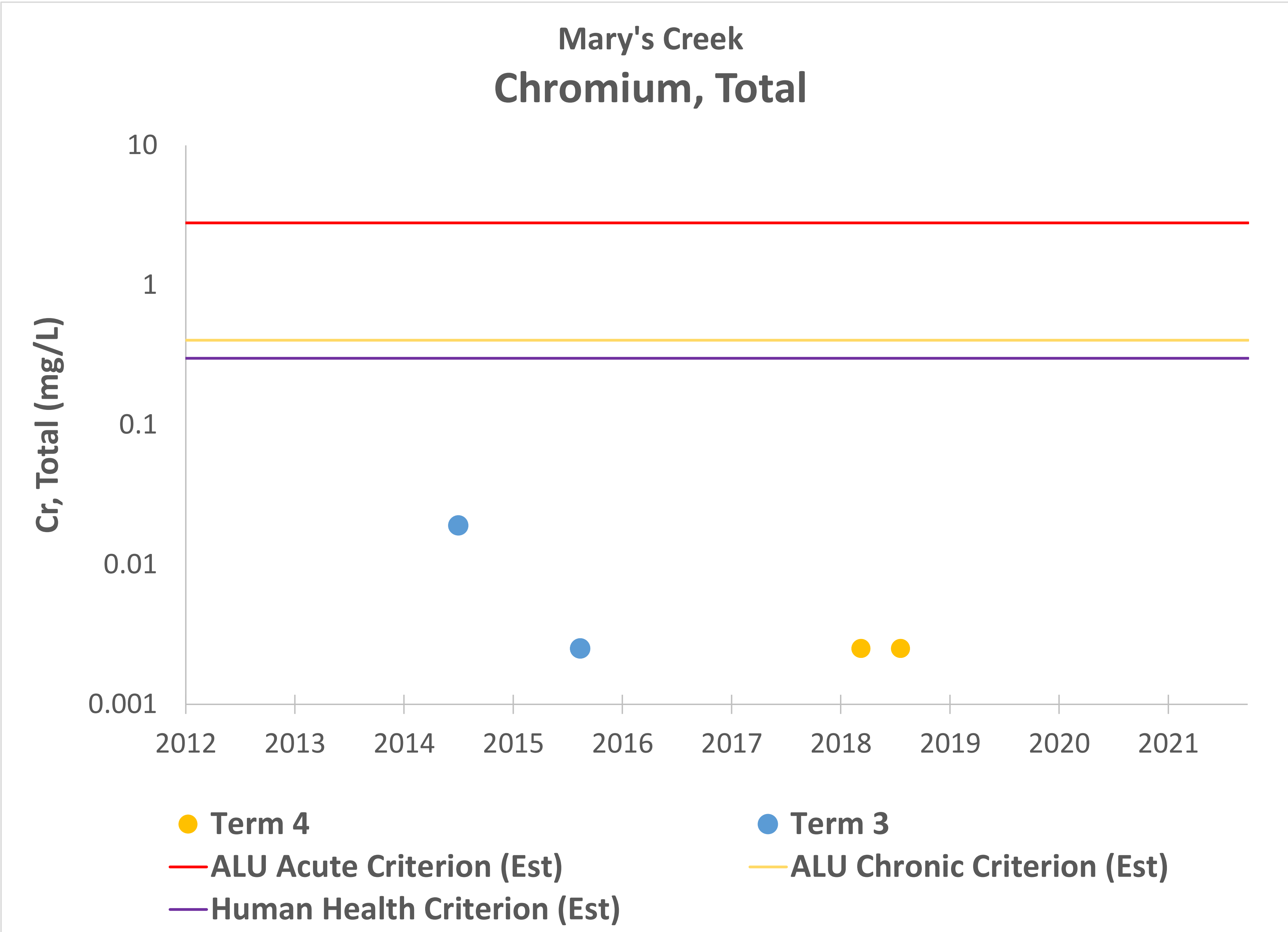

Mary's Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

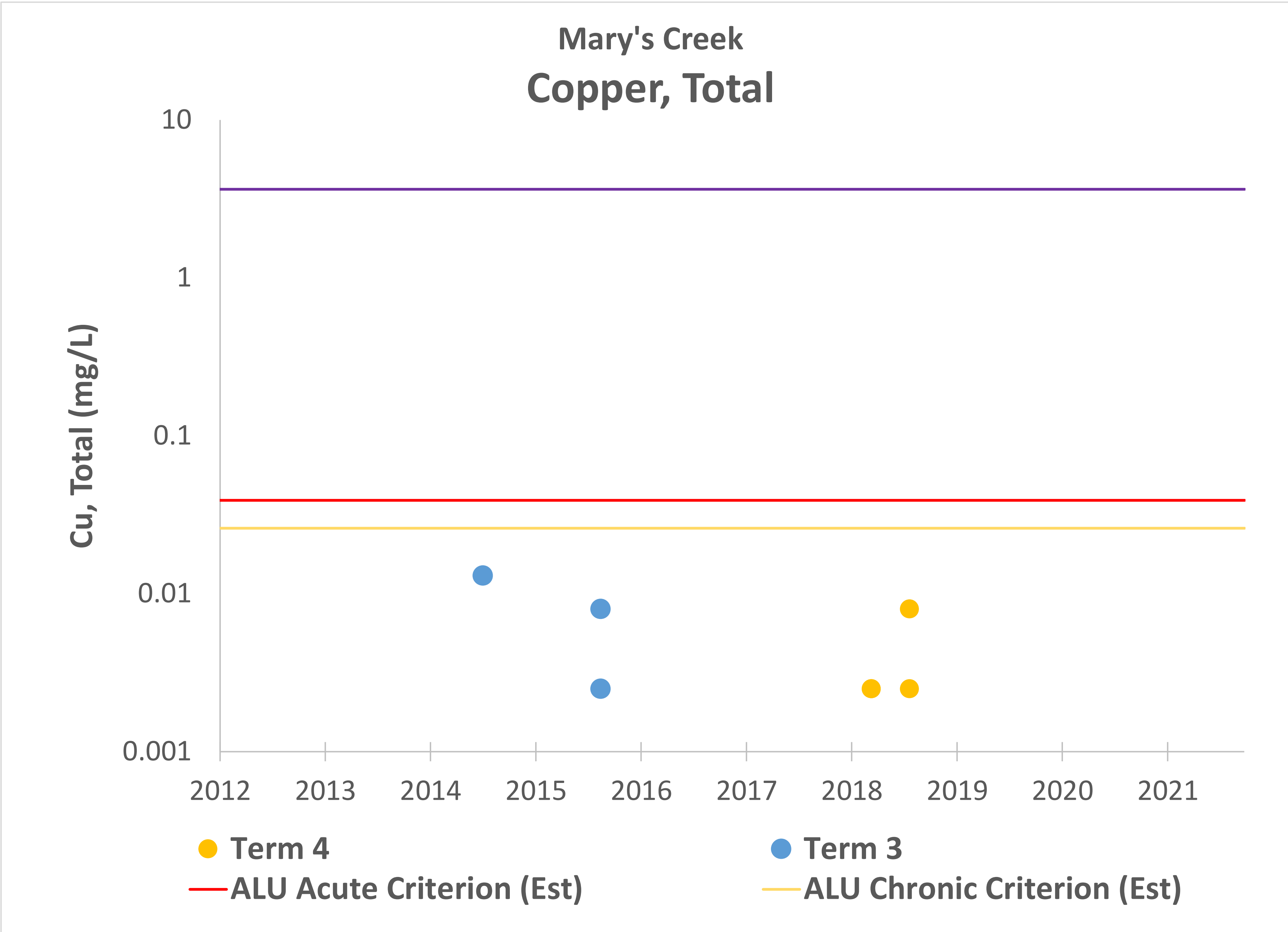


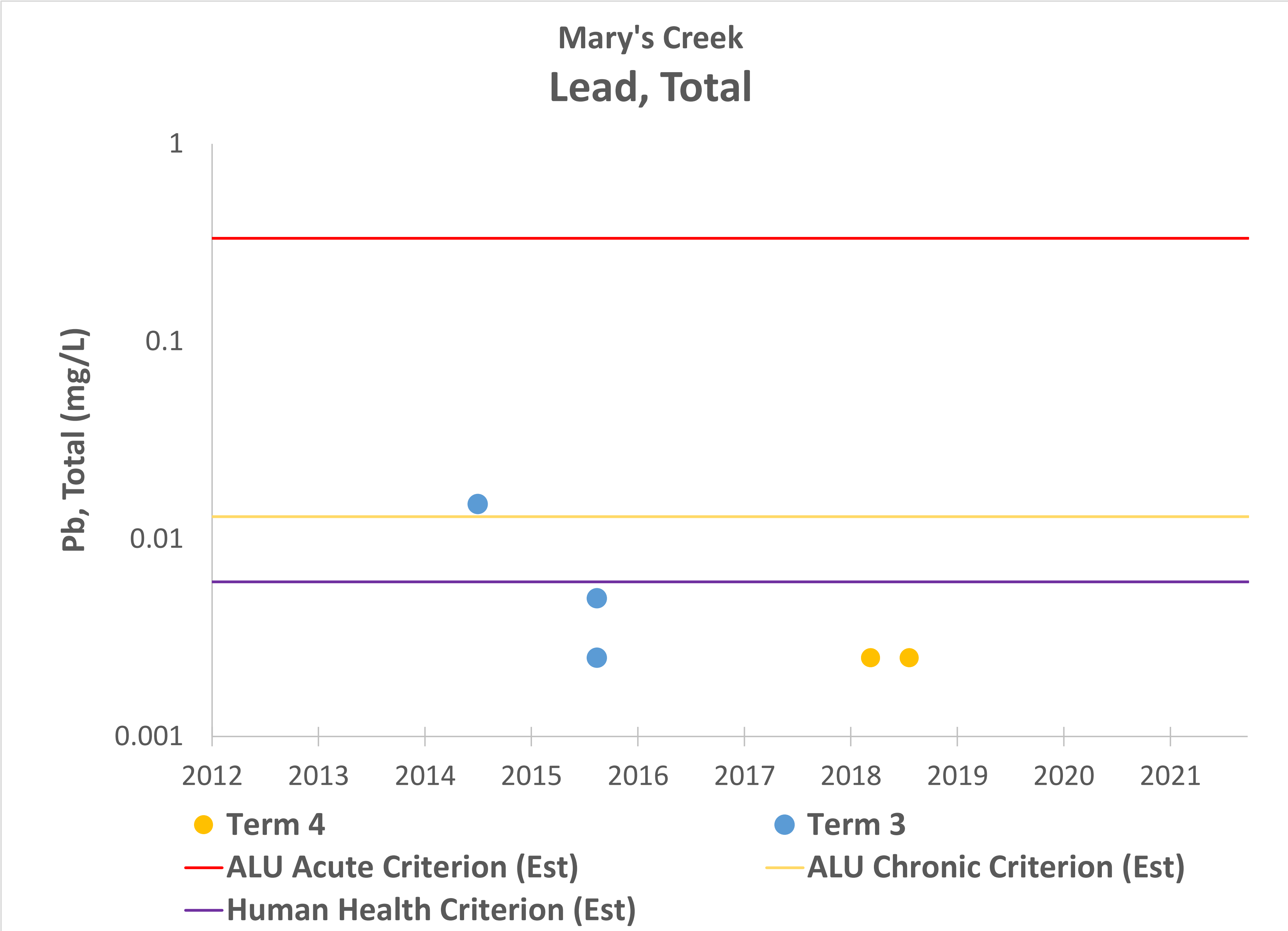
Mary's Creek
Phosphorus, Total
P, Total (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Nutrient Screening Criterion

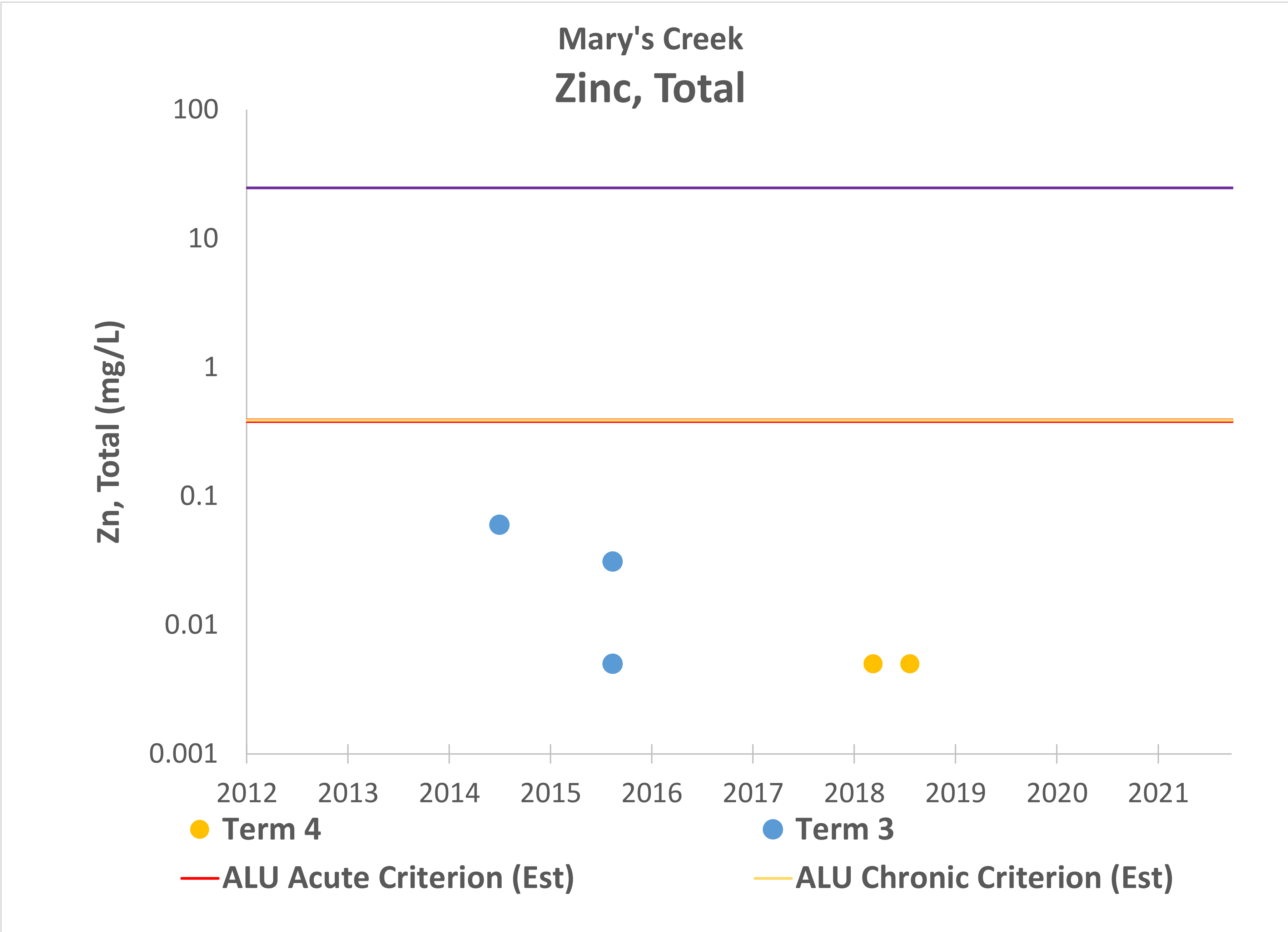


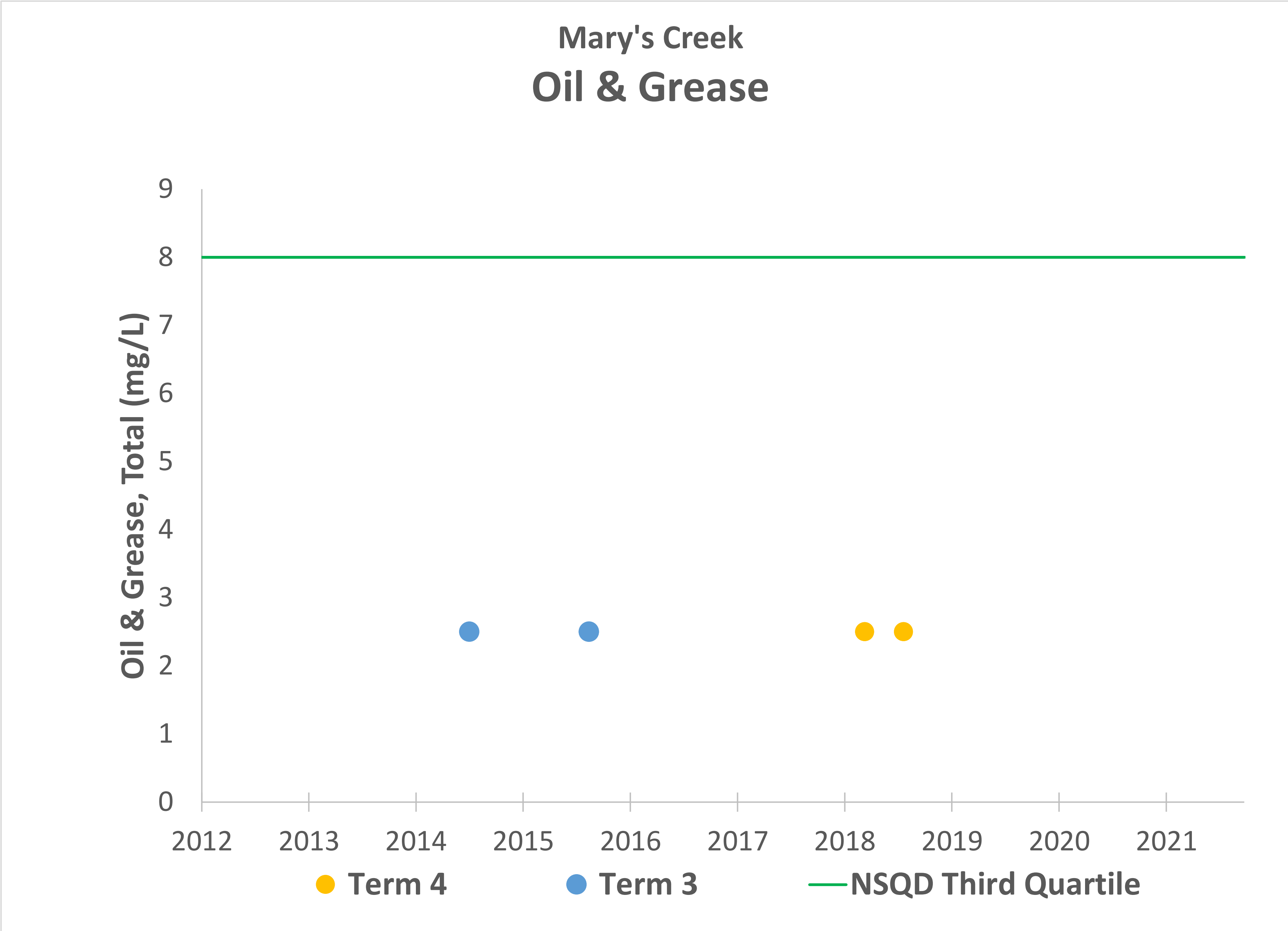
Mary's Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)


Mary's Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

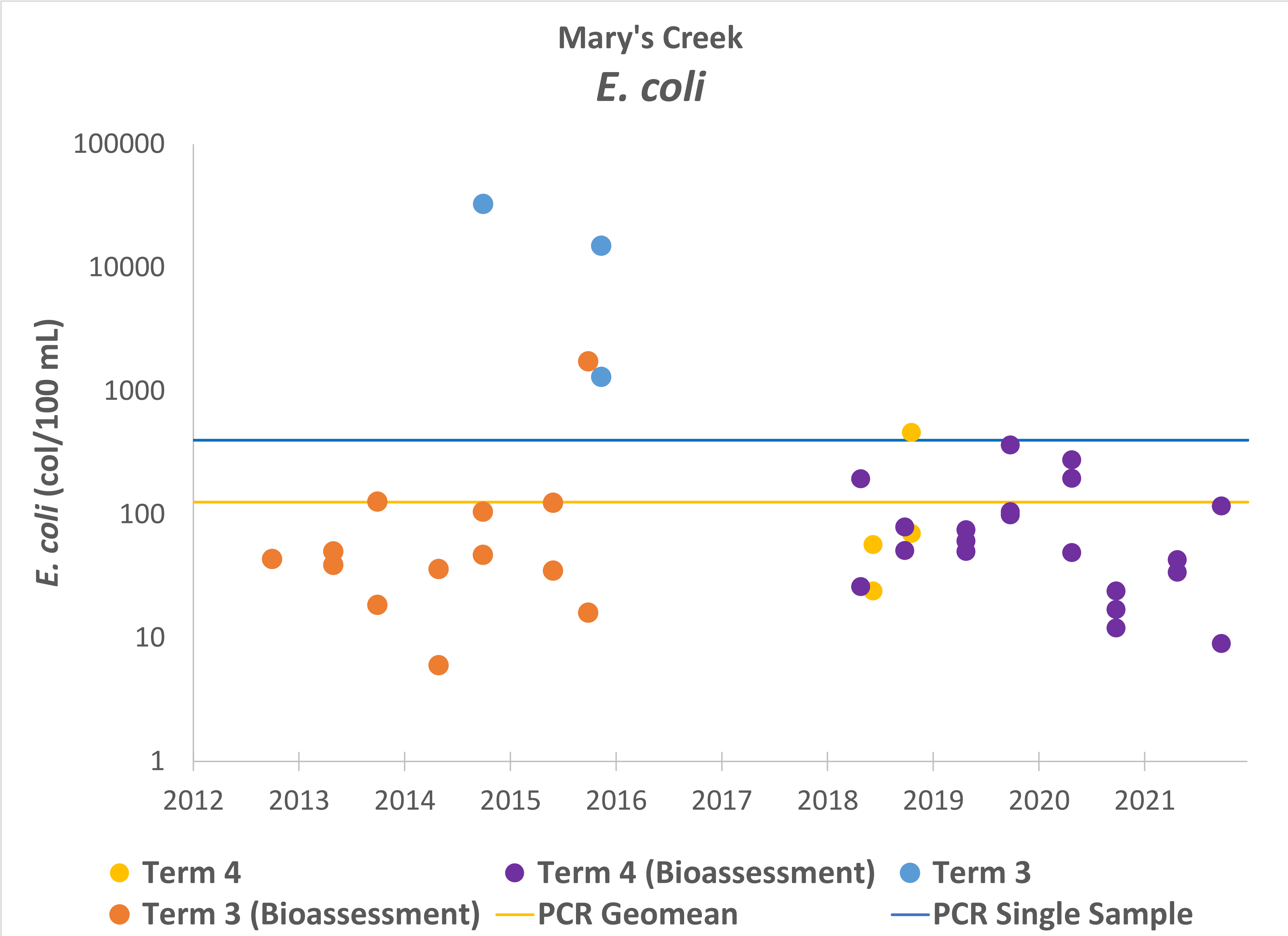

Mary's Creek
Copper, Total
Cu, Total (mg/L)
10
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)


Mary's Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

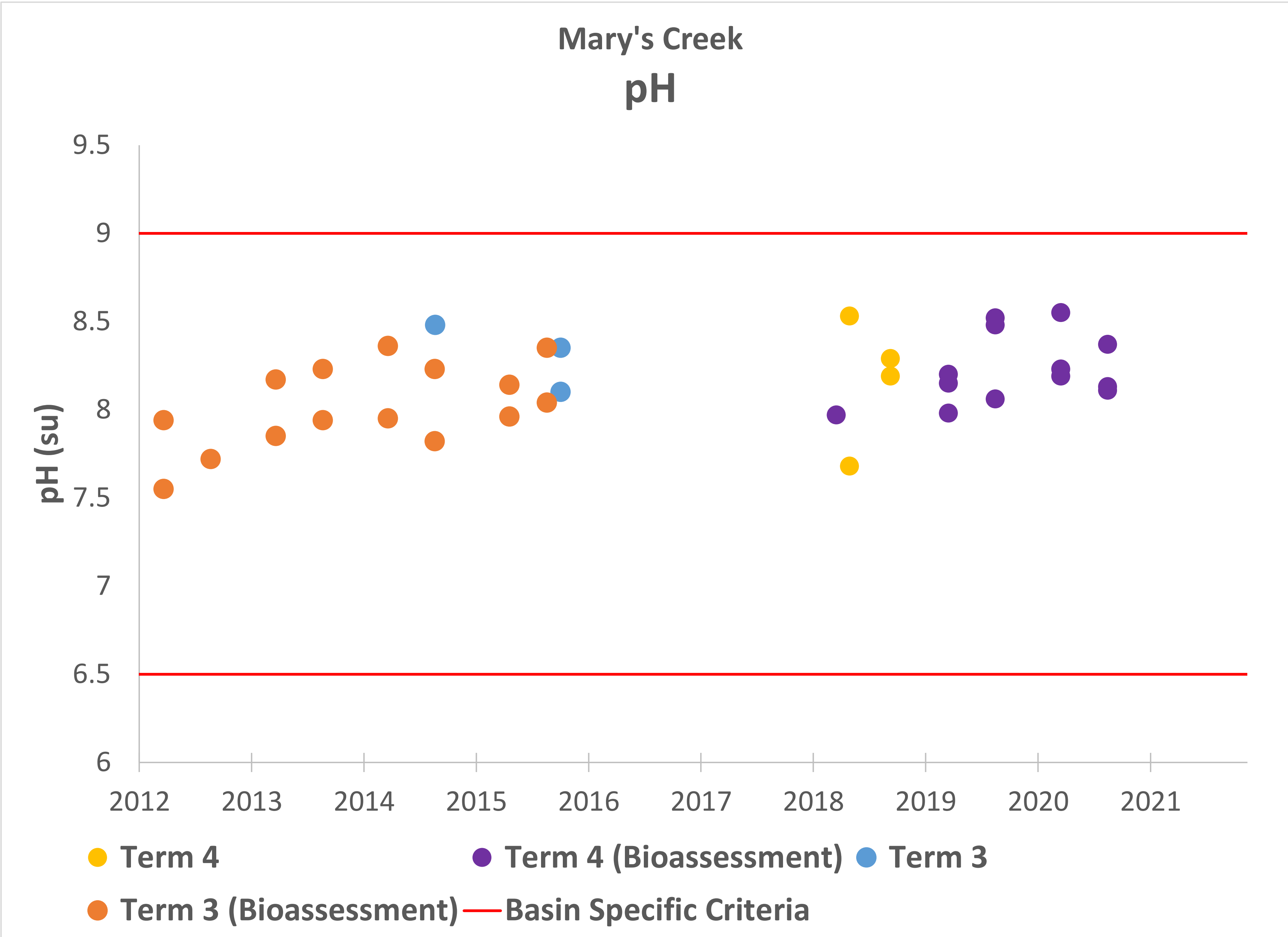

Mary's Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)



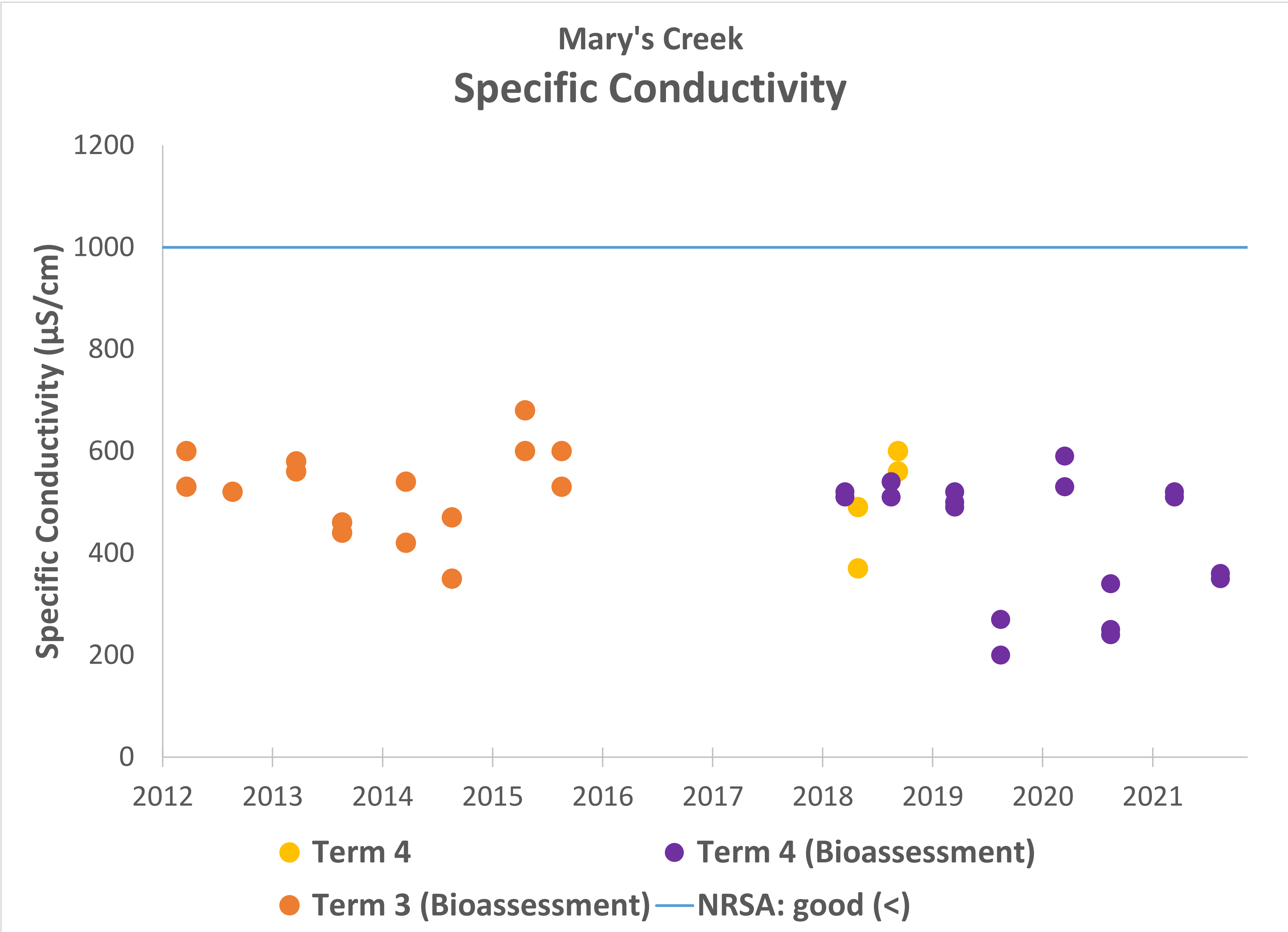
Mary's Creek
Oil & Grease
Oil & Grease, Total (mg/L)
9
8
7
6
5
4
3
2
1
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

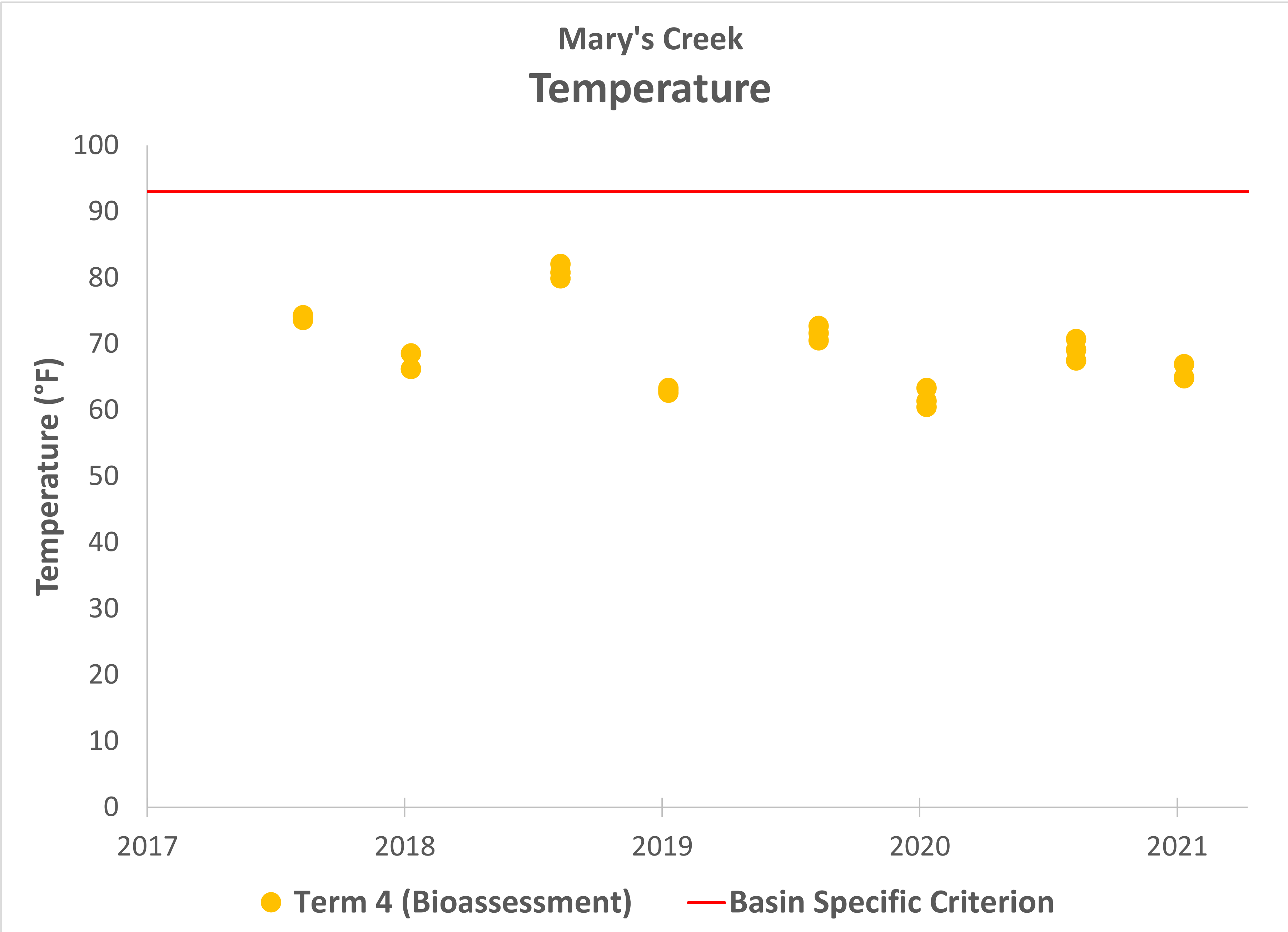


Mary's Creek
E. coli
E. coli (col/100 mL)
100000
10000
1000
100
10
1
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3
Term 3 (Bioassessment)
PCR Geomean
PCR Single Sample

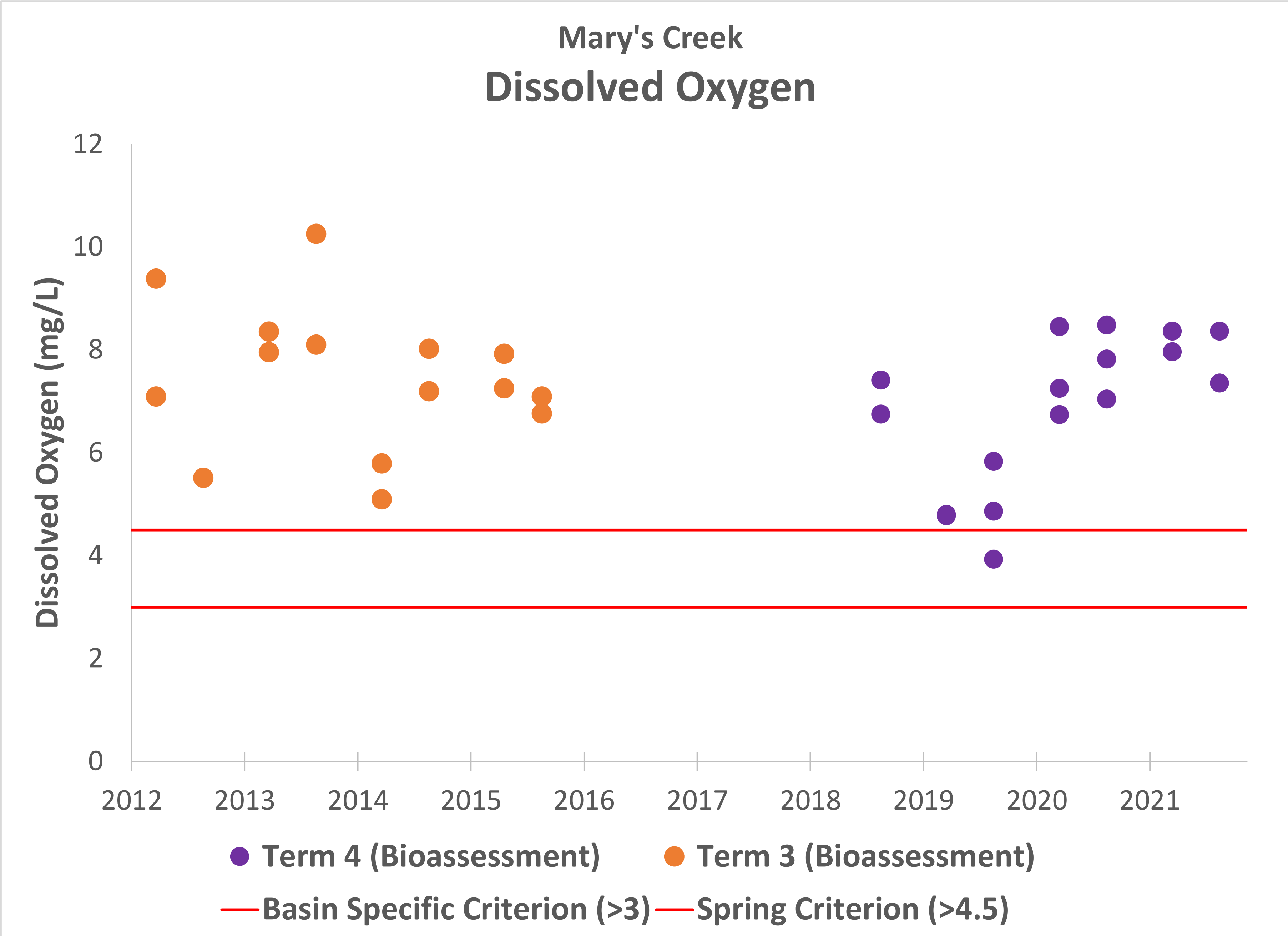


Mary's Creek
pH
pH (su)
9.5
9
8.5
8
7.5
7
6.5
6
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3
Term 3 (Bioassessment)
Basin Specific Criteria

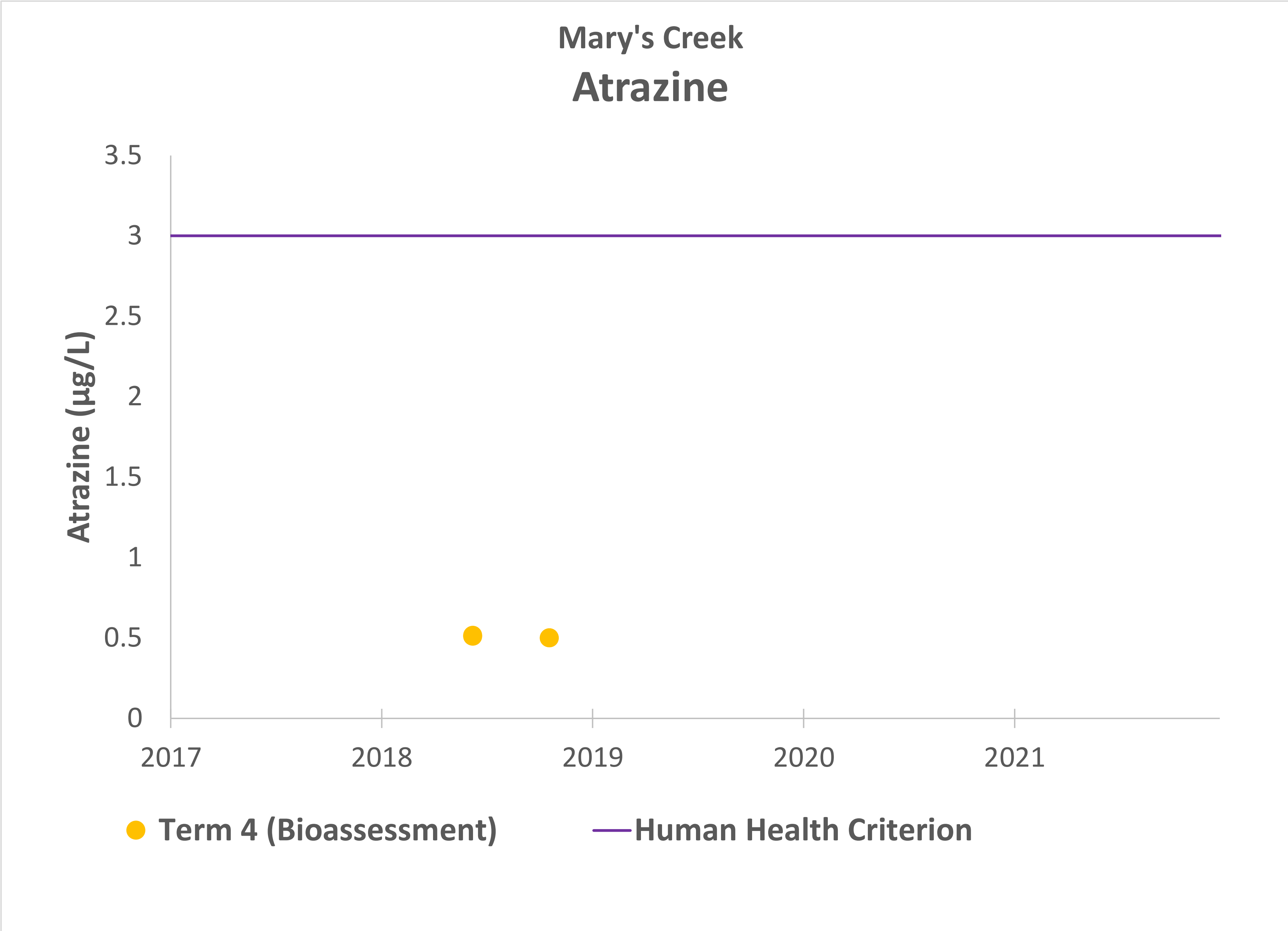

Mary's Creek
Specific Conductivity
Specific Conductivity (µS/cm)
1200
1000
800
600
400
200
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
NRSA: good (<)



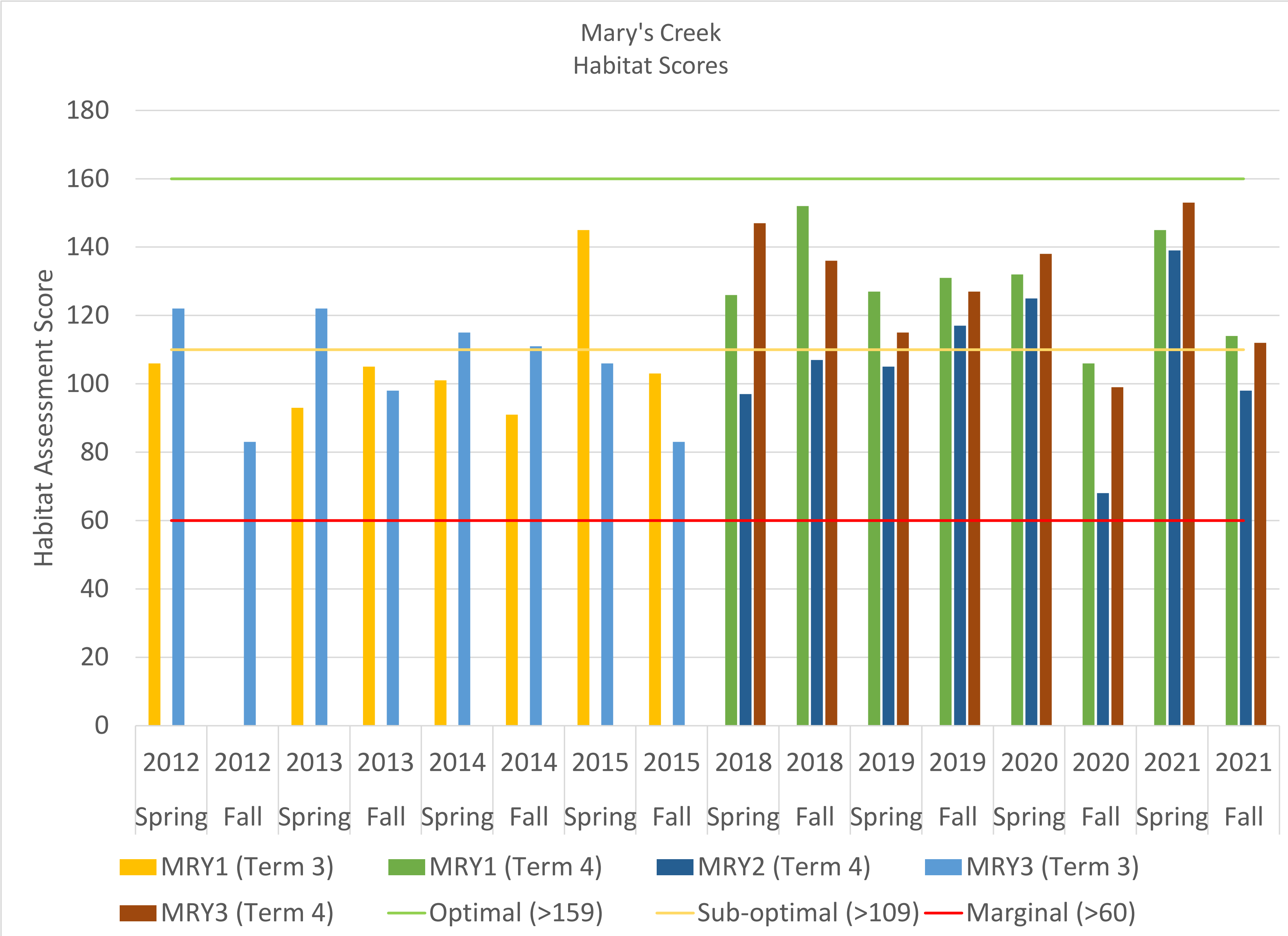
Mary's Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Basin Specific Criterion



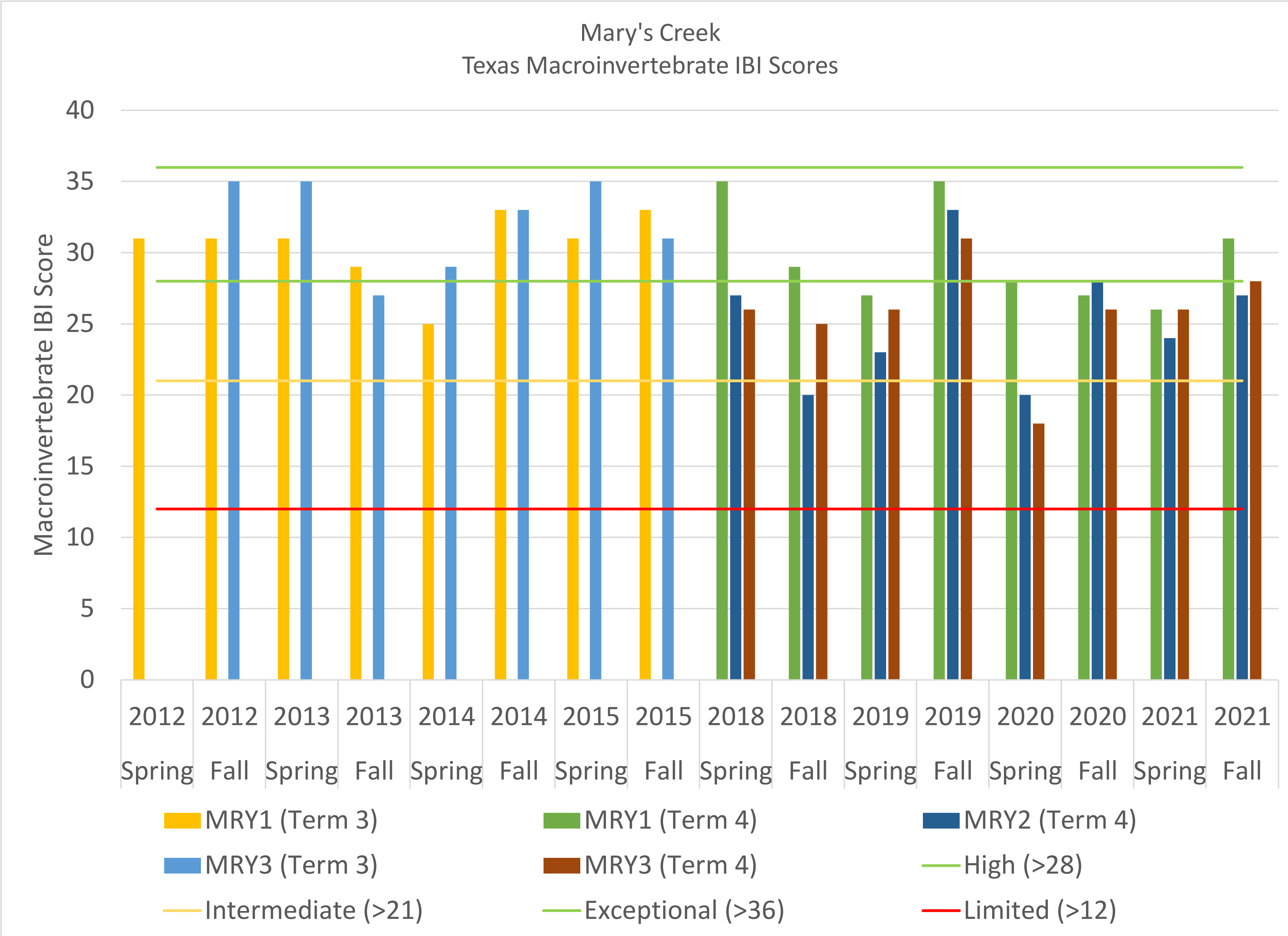
Mary's Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Basin Specific Criterion (>3)
Spring Criterion (>4.5)



Mary's Creek
Atrazine
Atrazine (µg/L)
3.5
3
2.5
2
1.5
1
0.5
0
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Human Health Criterion

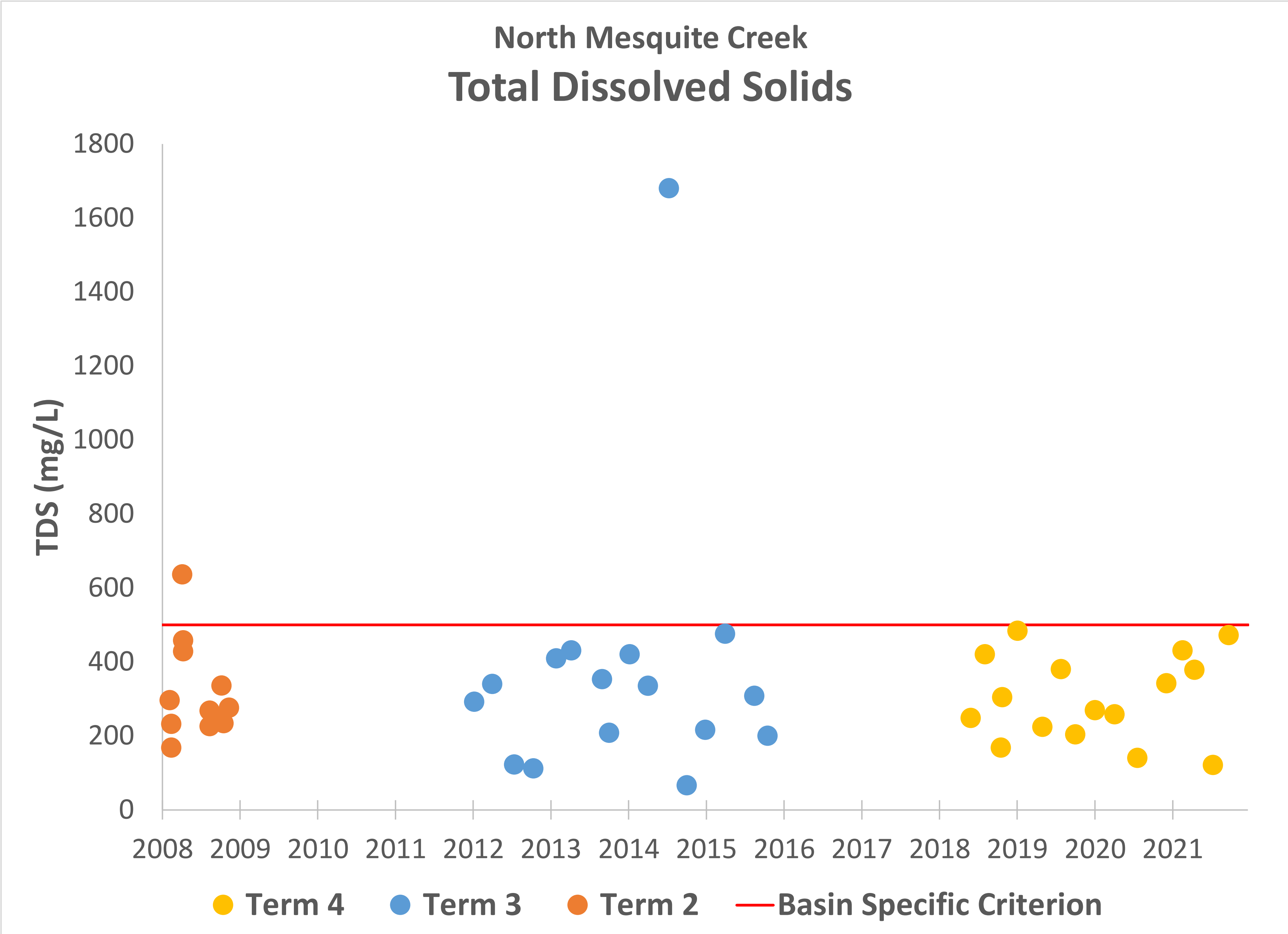


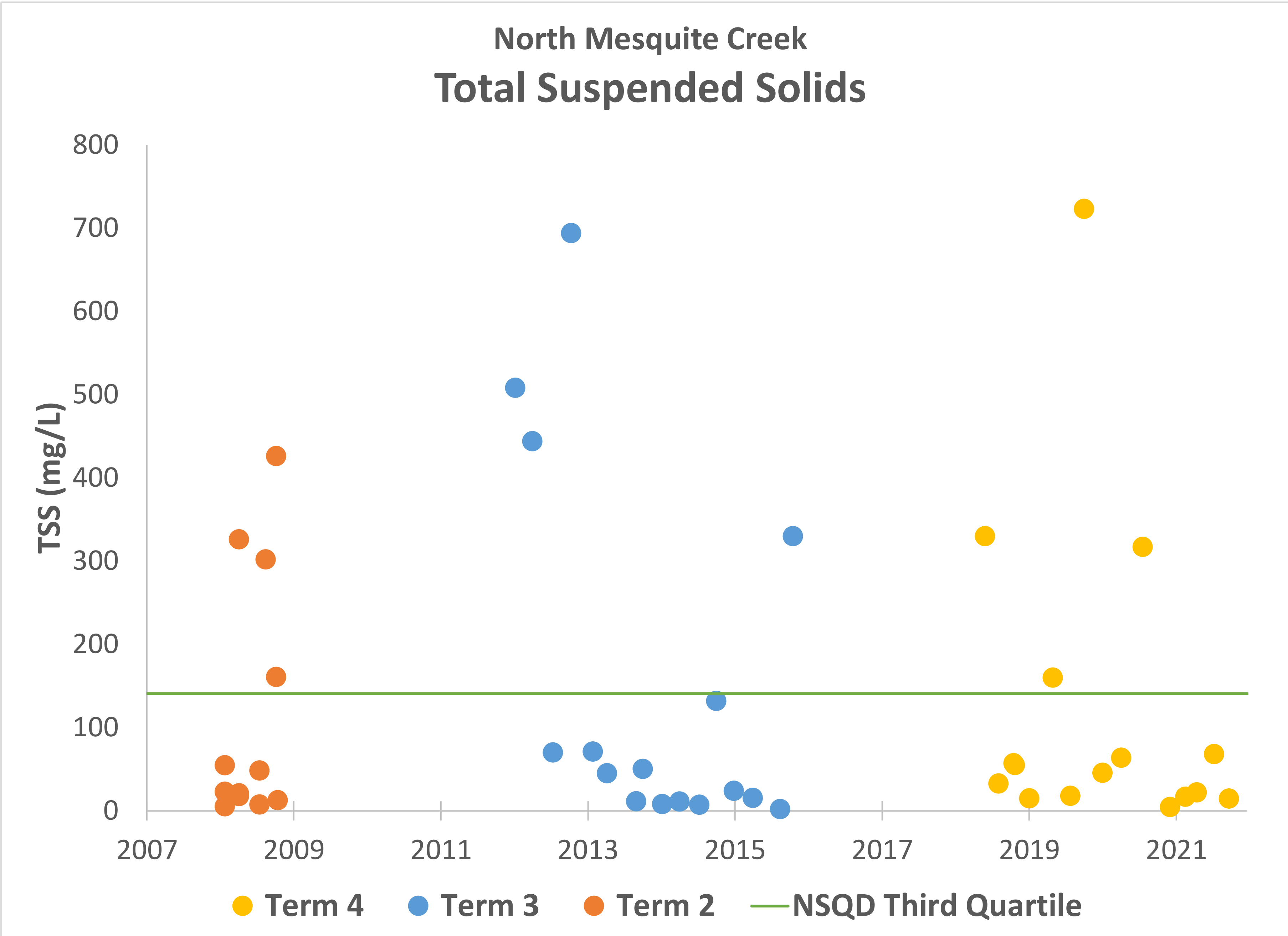
Mary's Creek
Habitat Scores
Habitat Assessment Score
180
160
140
120
100
80
60
40
20
0
2012 Spring
2012 Fall
2013 Spring
2013 Fall
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
MRY1 (Term 3)
MRY1 (Term 4)
MRY2 (Term 4)
MRY3 (Term 3)
MRY3 (Term 4)
Optimal (>159)
Sub-optimal (>109)
Marginal (>60)


Mary's Creek
Texas Macroinvertebrate IBI Scores
Macroinvertebrate IBI Score
40
35
30
25
20
15
10
5
0
2012 Spring
2012 Fall
2013 Spring
2013 Fall
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
MRY1 (Term 3)
MRY1 (Term 4)
MRY2 (Term 4)
MRY3 (Term 3)
MRY3 (Term 4)
High (>28)
Intermediate (>21)
Exceptional (>36)
Limited (>12)

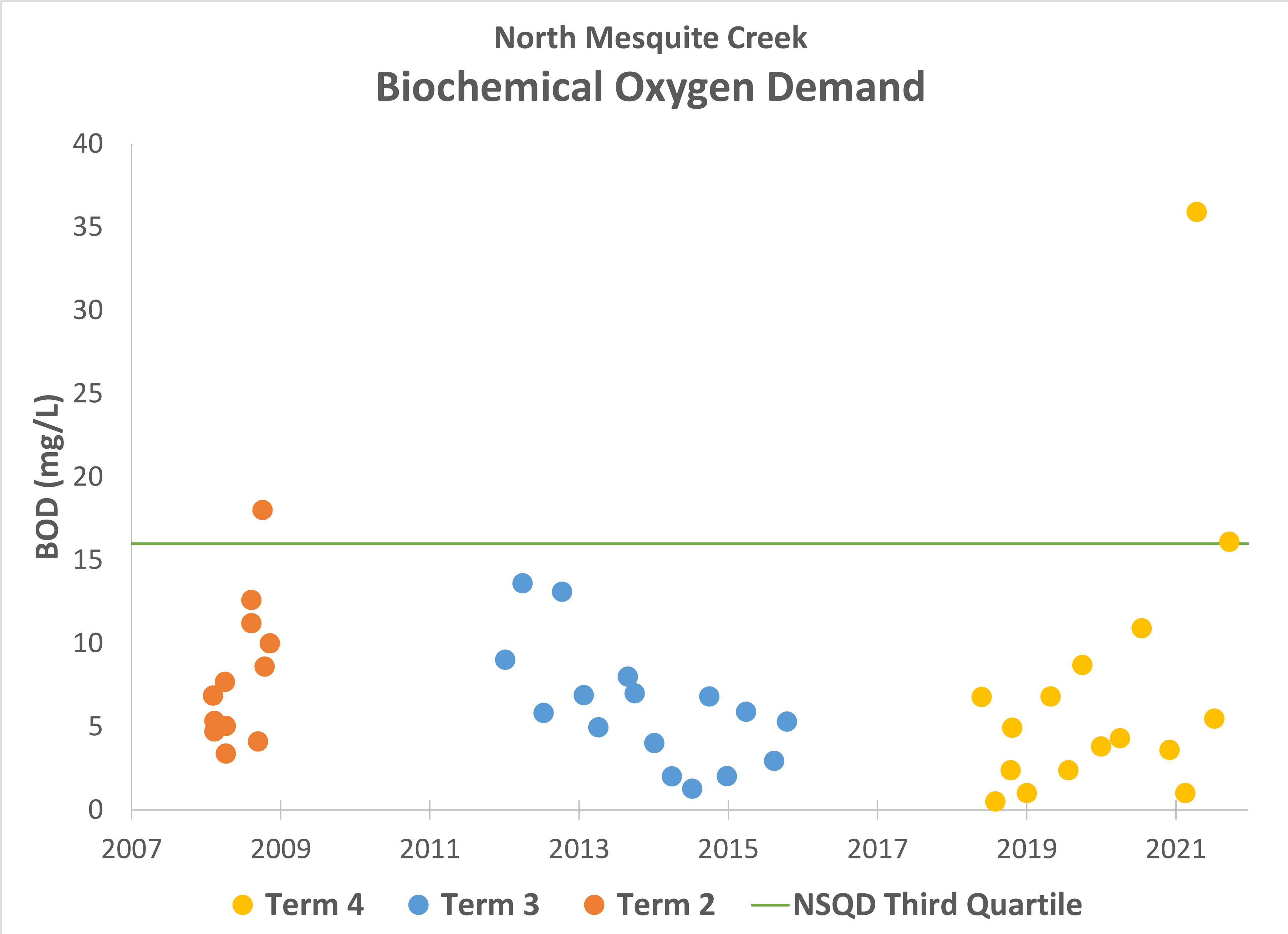
Appendix T

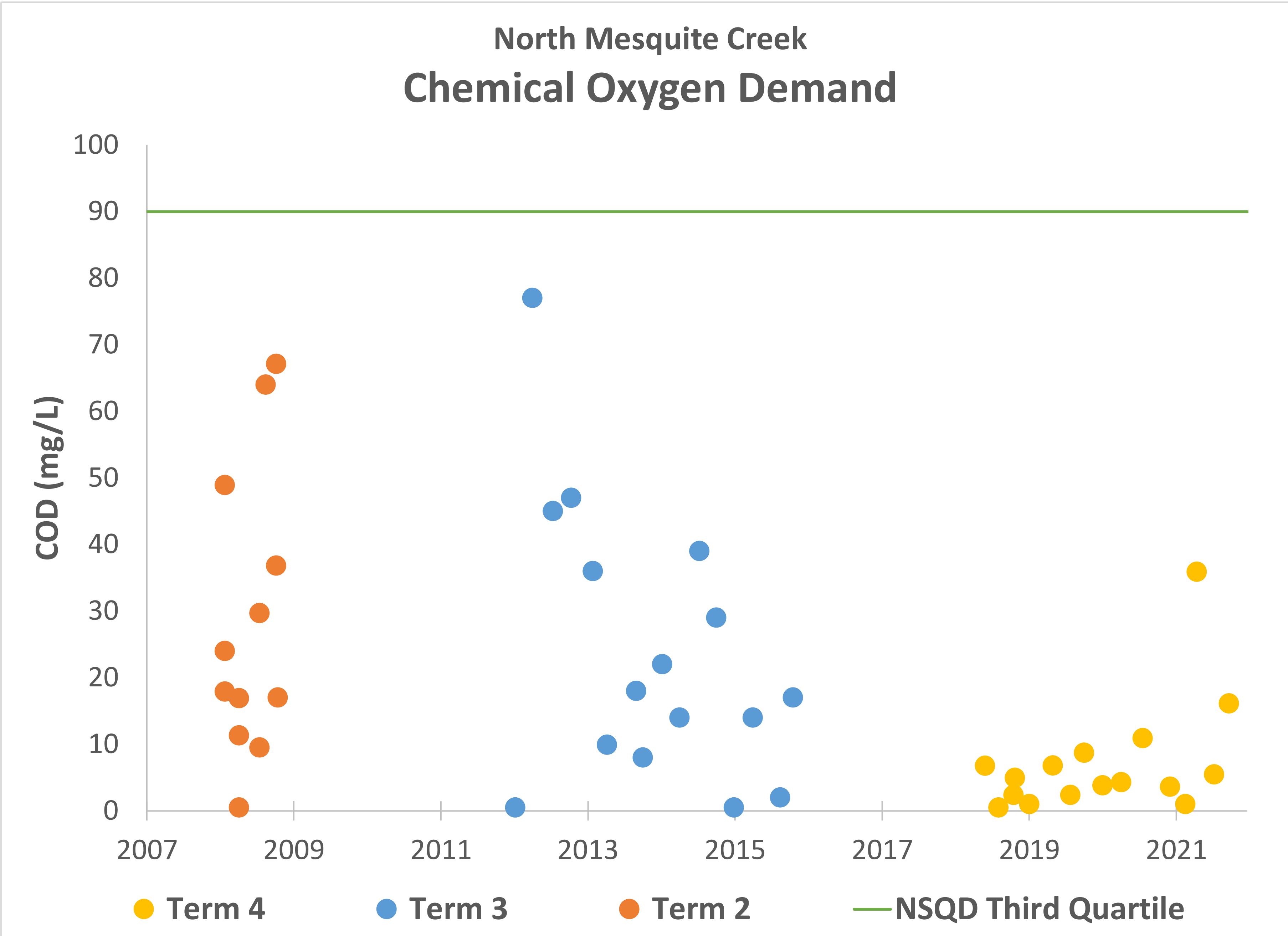
North Mesquite Creek Water Quality Data Graphs

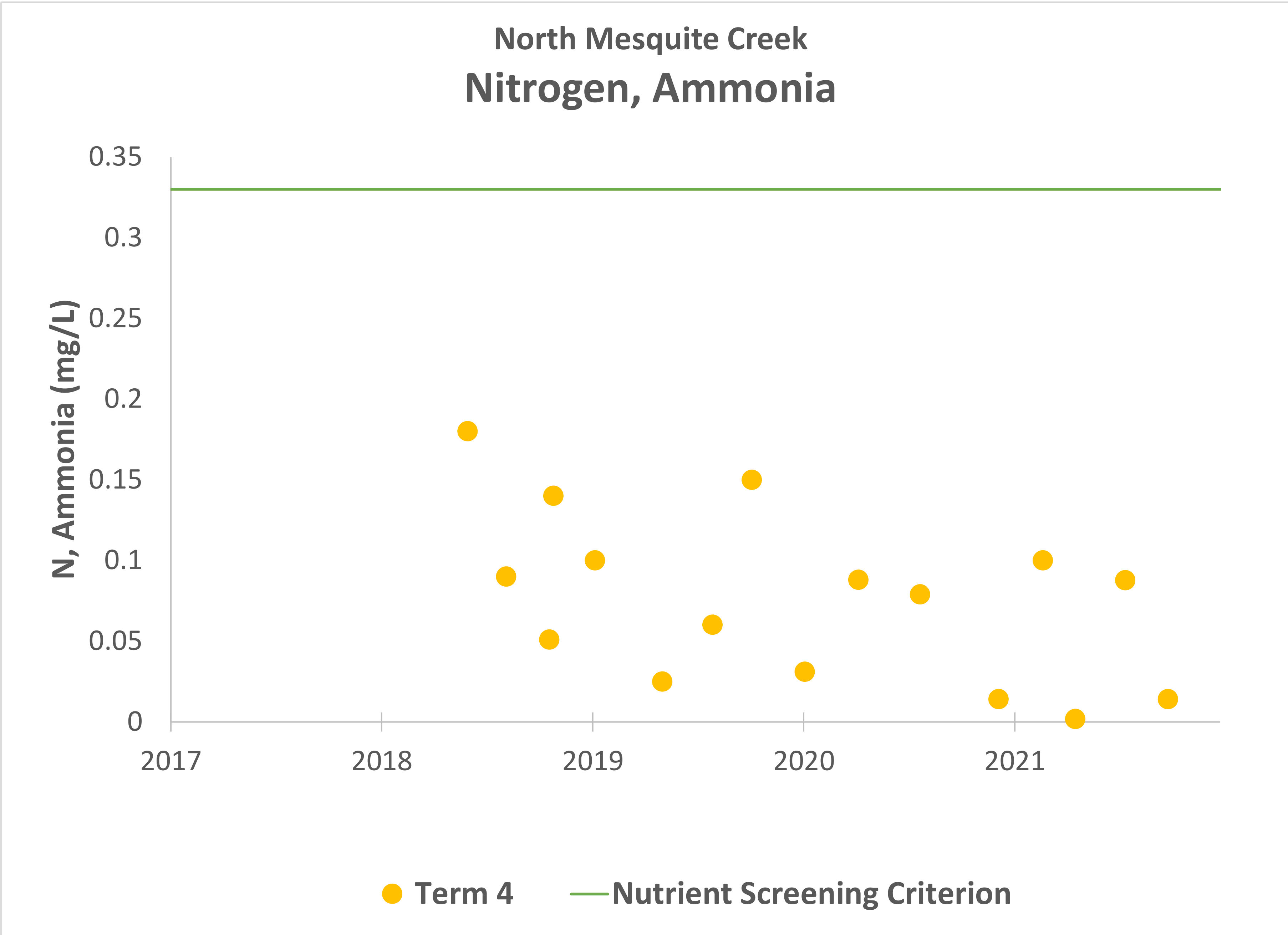

North Mesquite Creek
Total Dissolved Solids
TDS (mg/L)
1800
1600
1400
1200
1000
800
600
400
200
0
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
Basin Specific Criterion

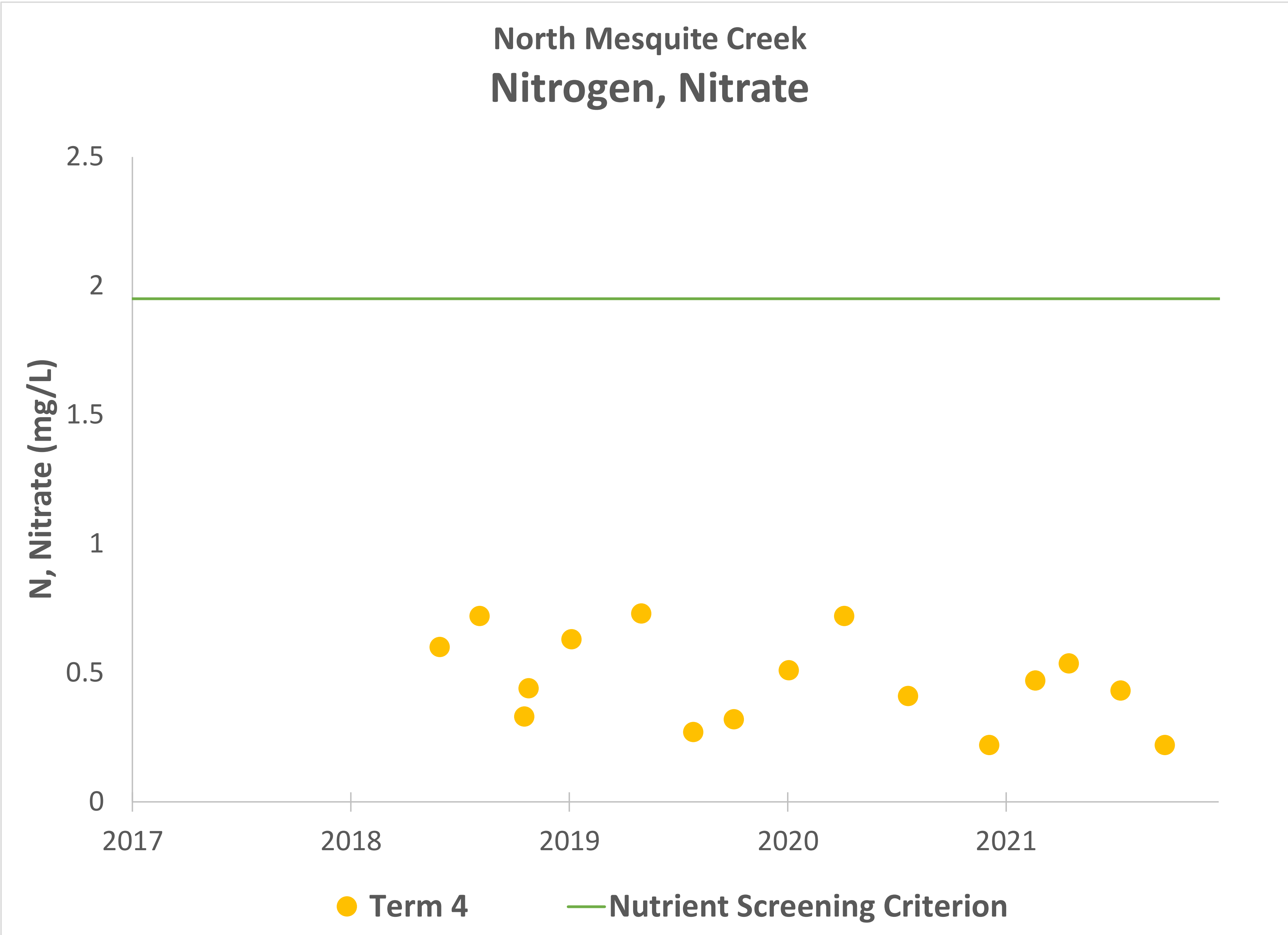


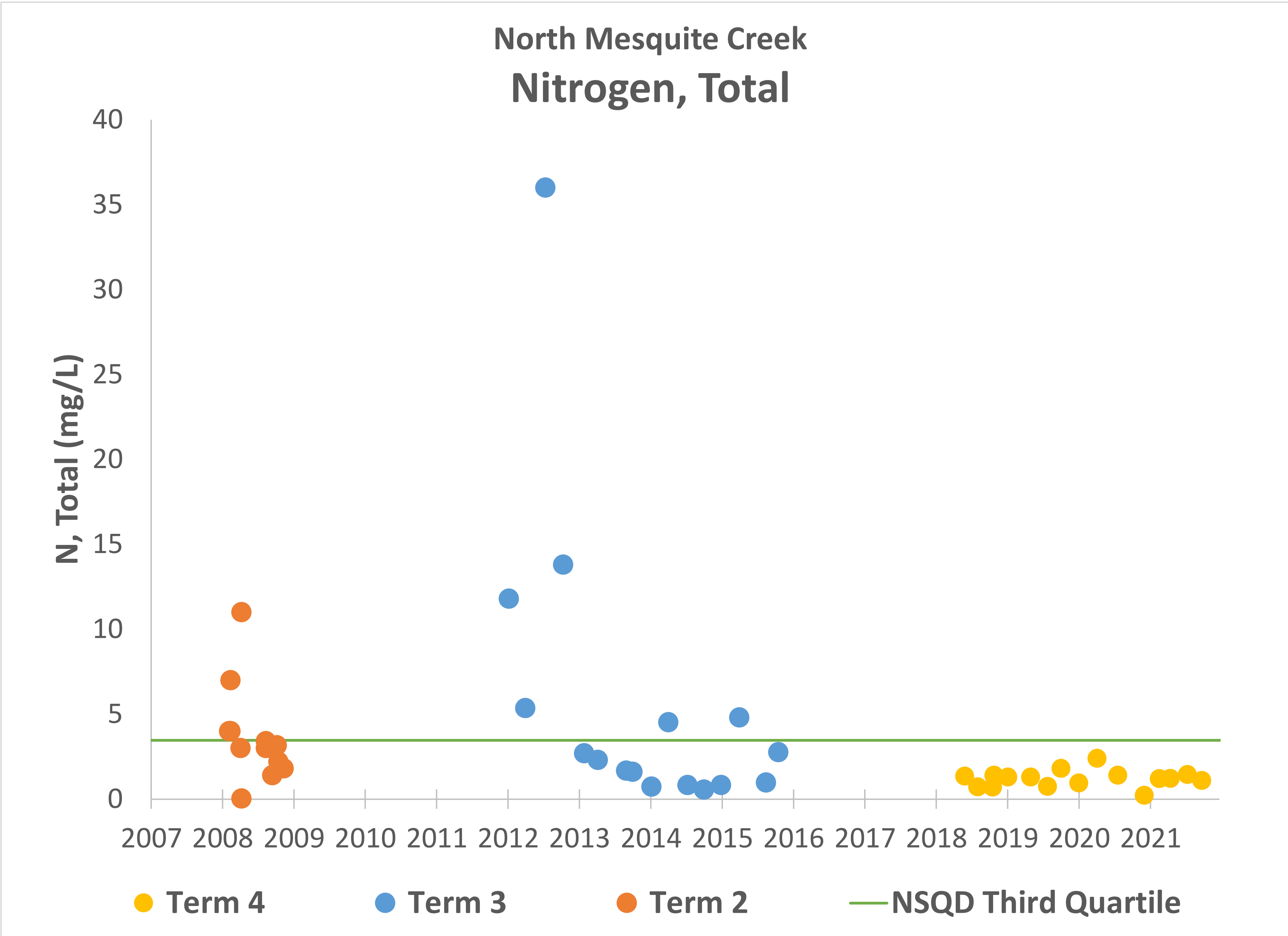
North Mesquite Creek
Total Suspended Solids
TSS (mg/L)
800
700
600
500
400
300
200
100
0
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

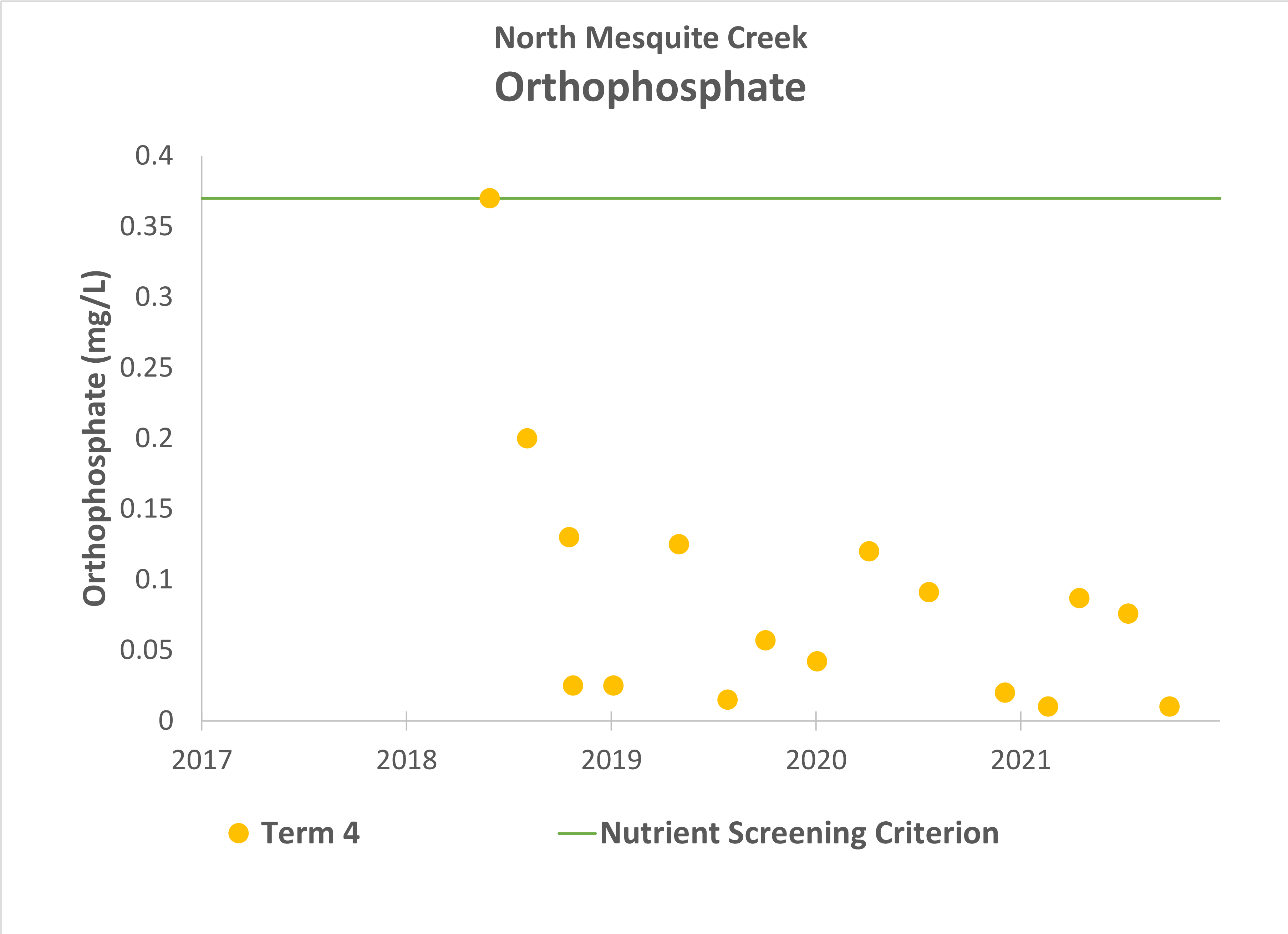

North Mesquite Creek
Biochemical Oxygen Demand
BOD (mg/L)
40
35
30
25
20
15
10
5
0
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

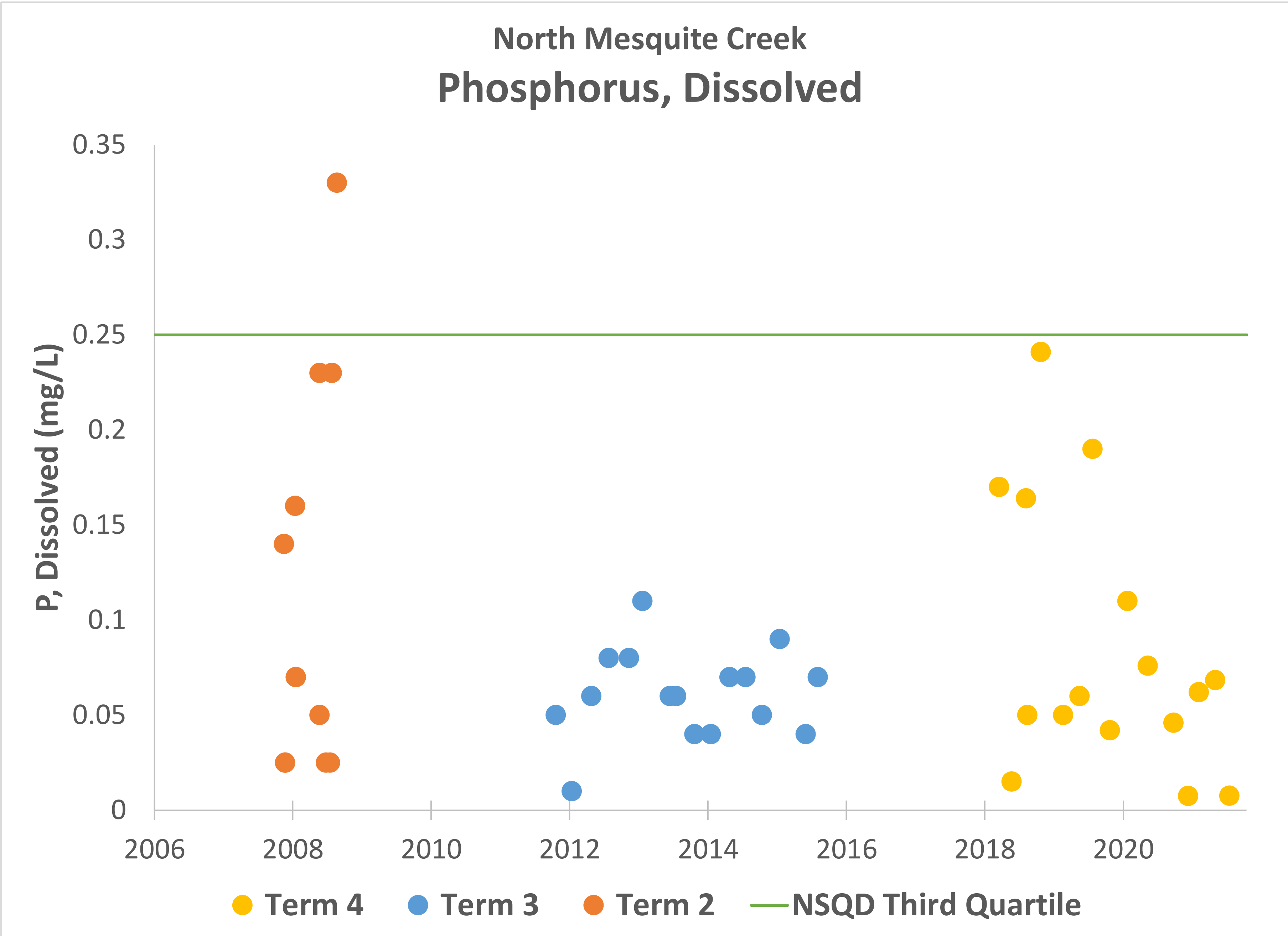

North Mesquite Creek
Chemical Oxygen Demand
COD (mg/L)
100
90
80
70
60
50
40
30
20
10
0
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
NSQD Third Quartile


North Mesquite Creek
Nitrogen, Ammonia
N, Ammonia (mg/L)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

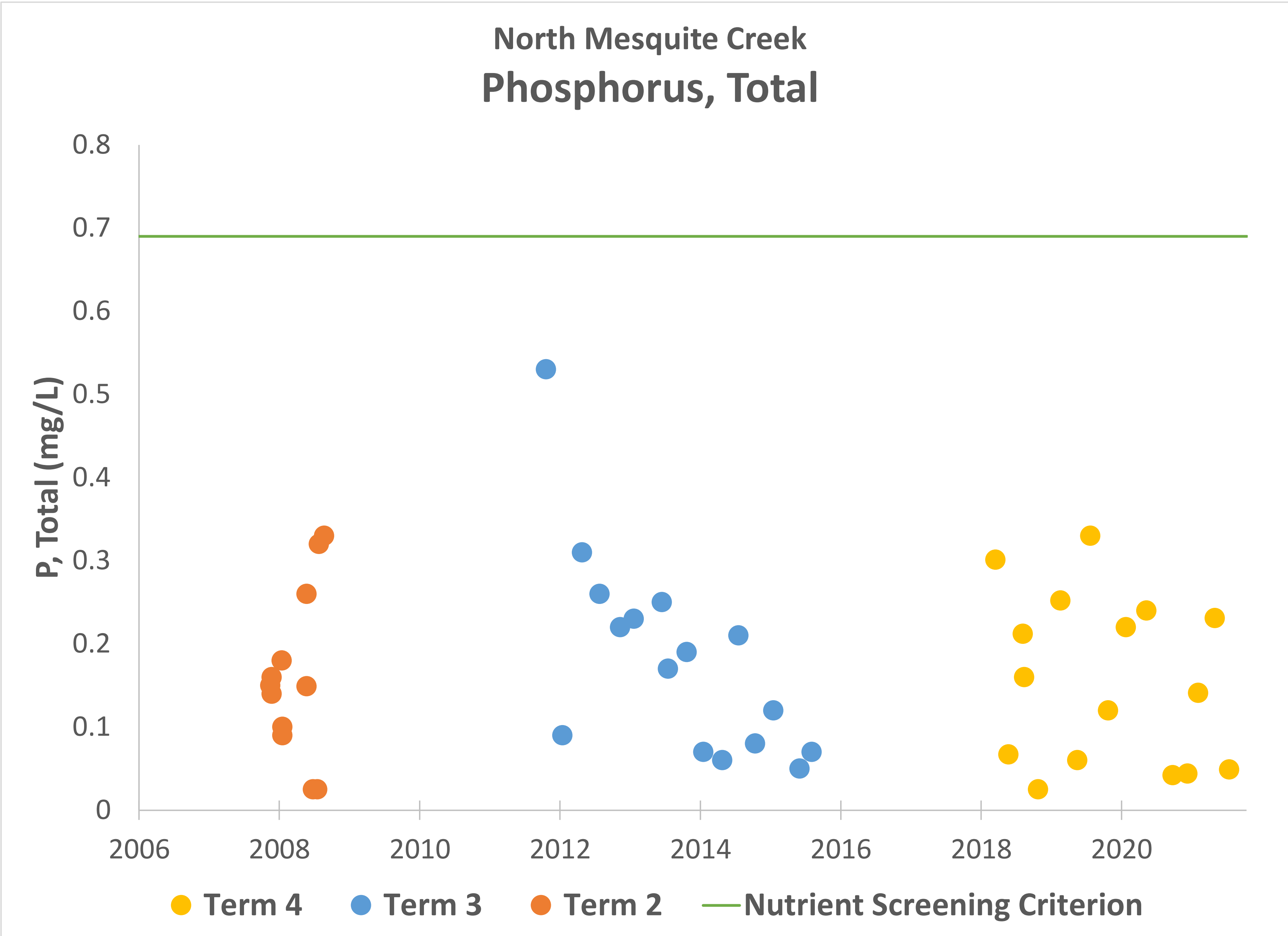

North Mesquite Creek
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

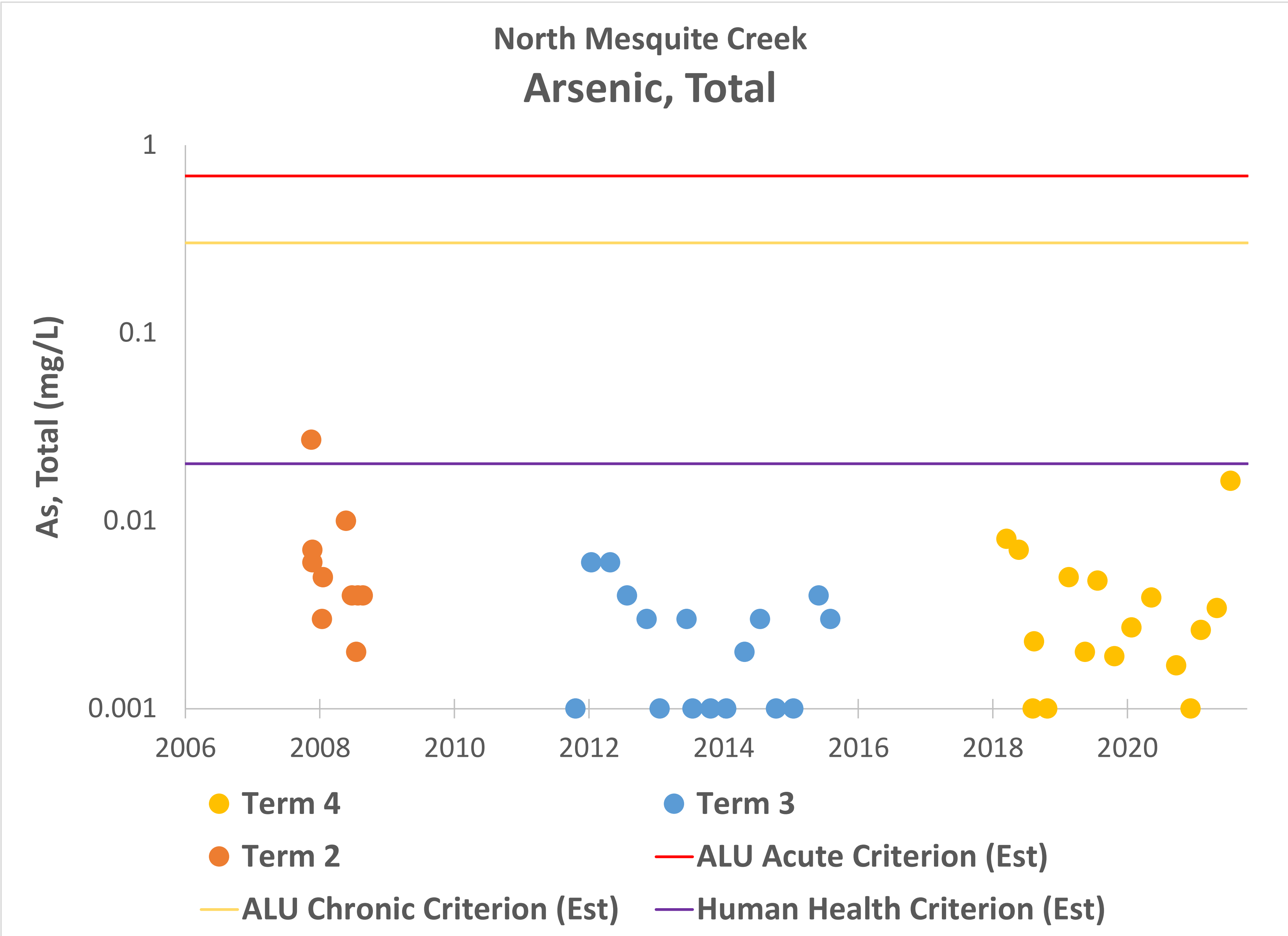

North Mesquite Creek
Nitrogen, Total
N, Total (mg/L)
0
5
10
15
20
25
30
35
40
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
NSQD Third Quartile

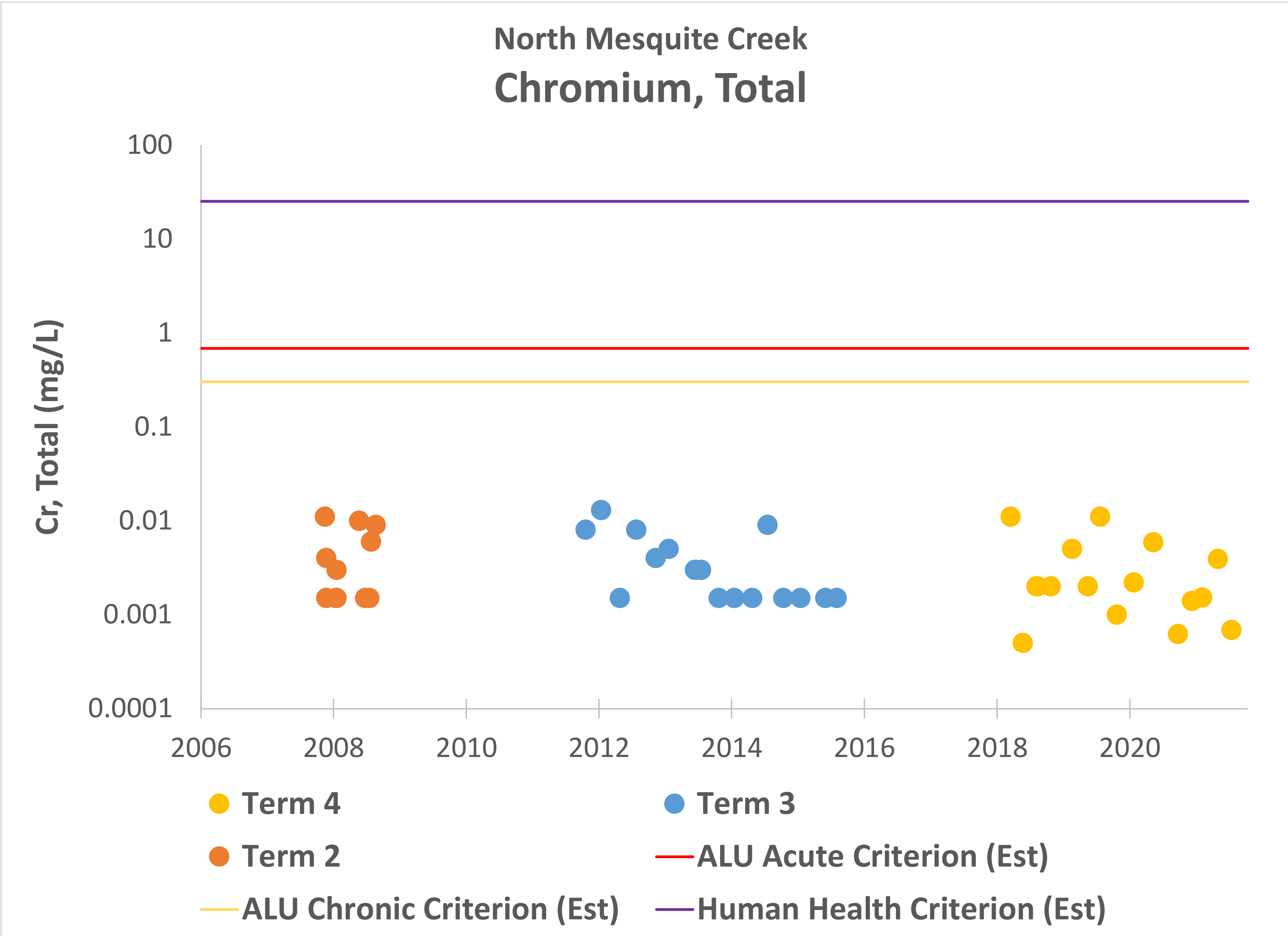

North Mesquite Creek
Orthophosphate
Orthophosphate (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion



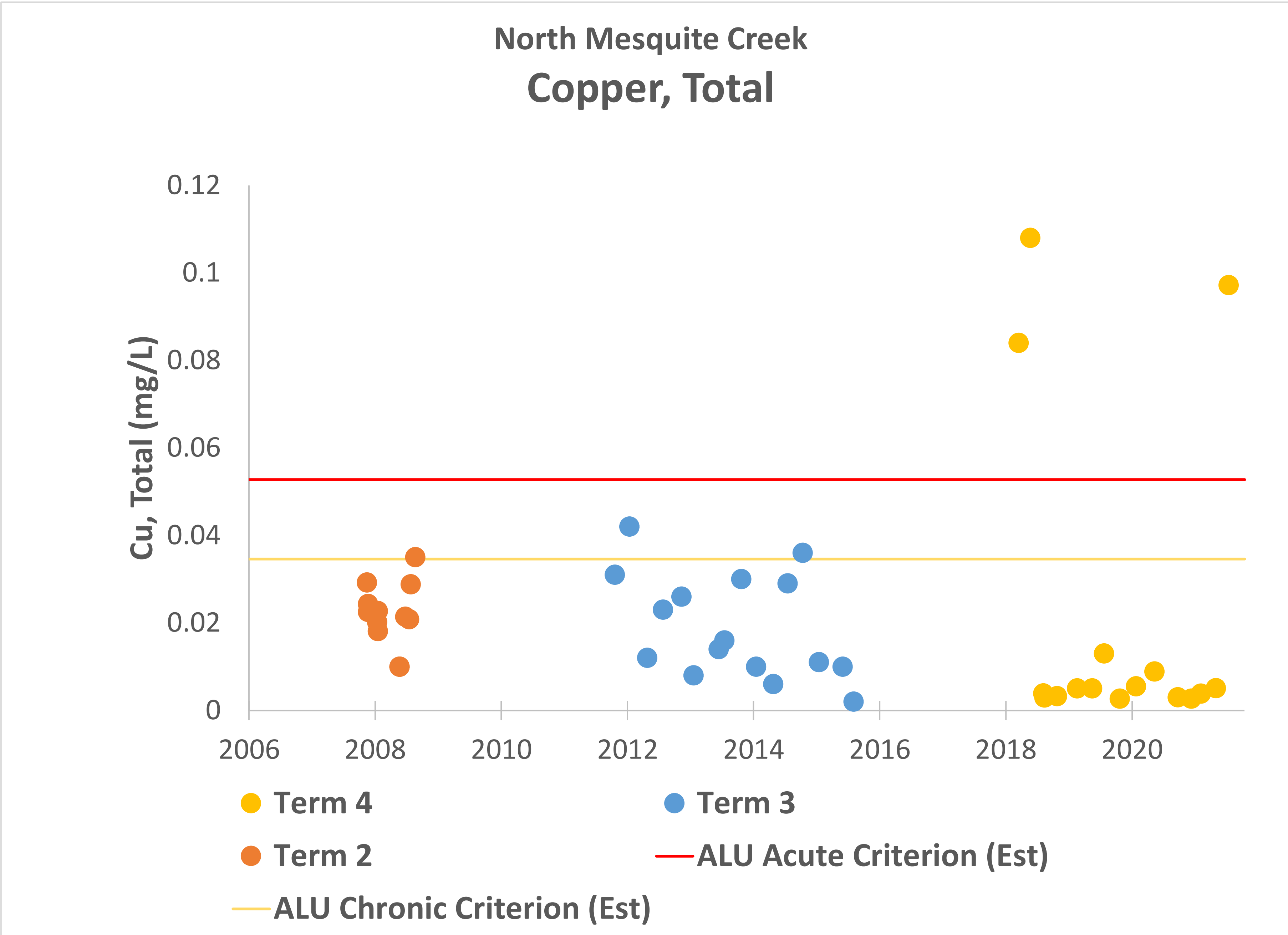
North Mesquite Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile

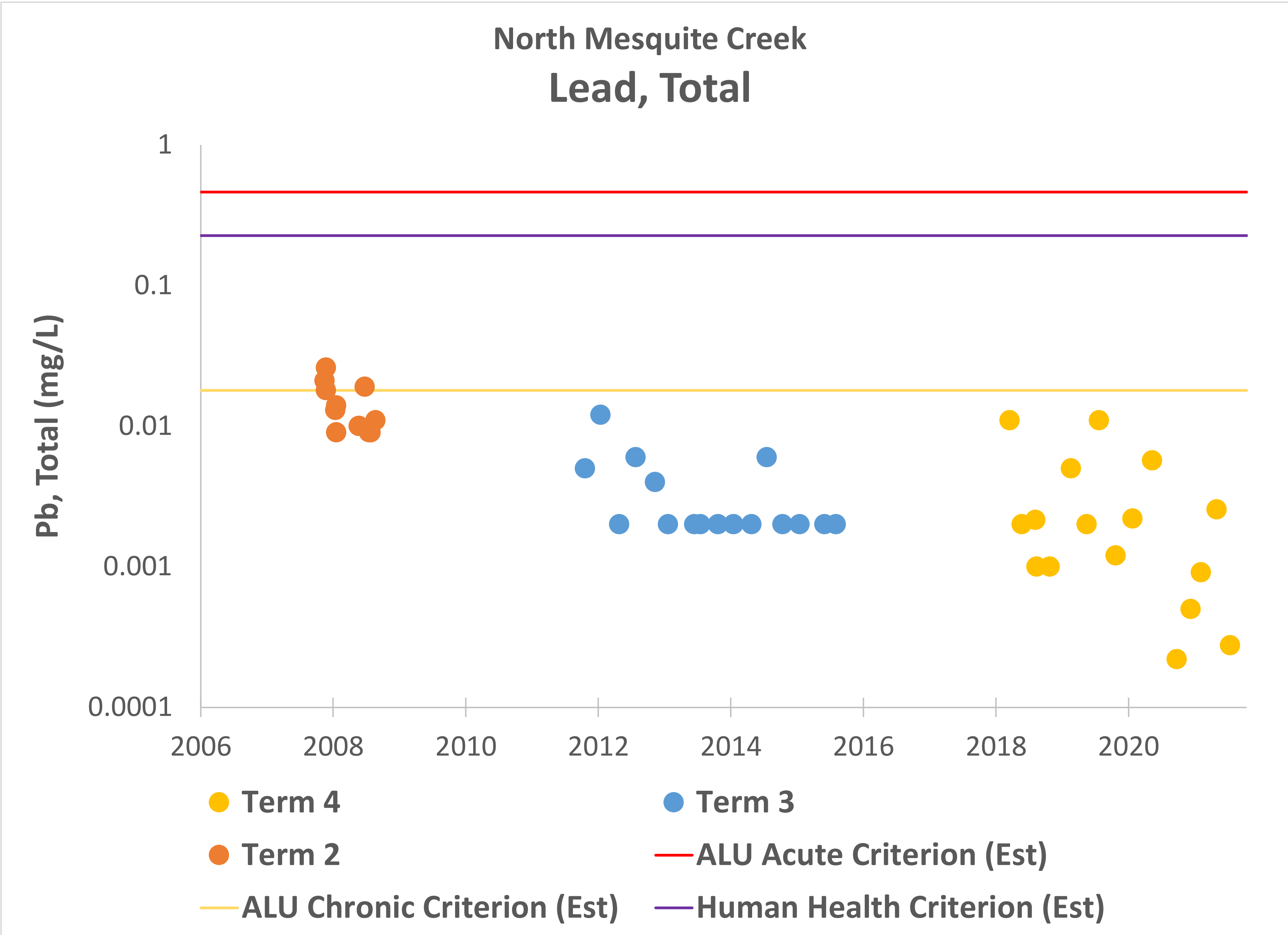

North Mesquite Creek
Phosphorus, Total
P, Total (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
Nutrient Screening Criterion

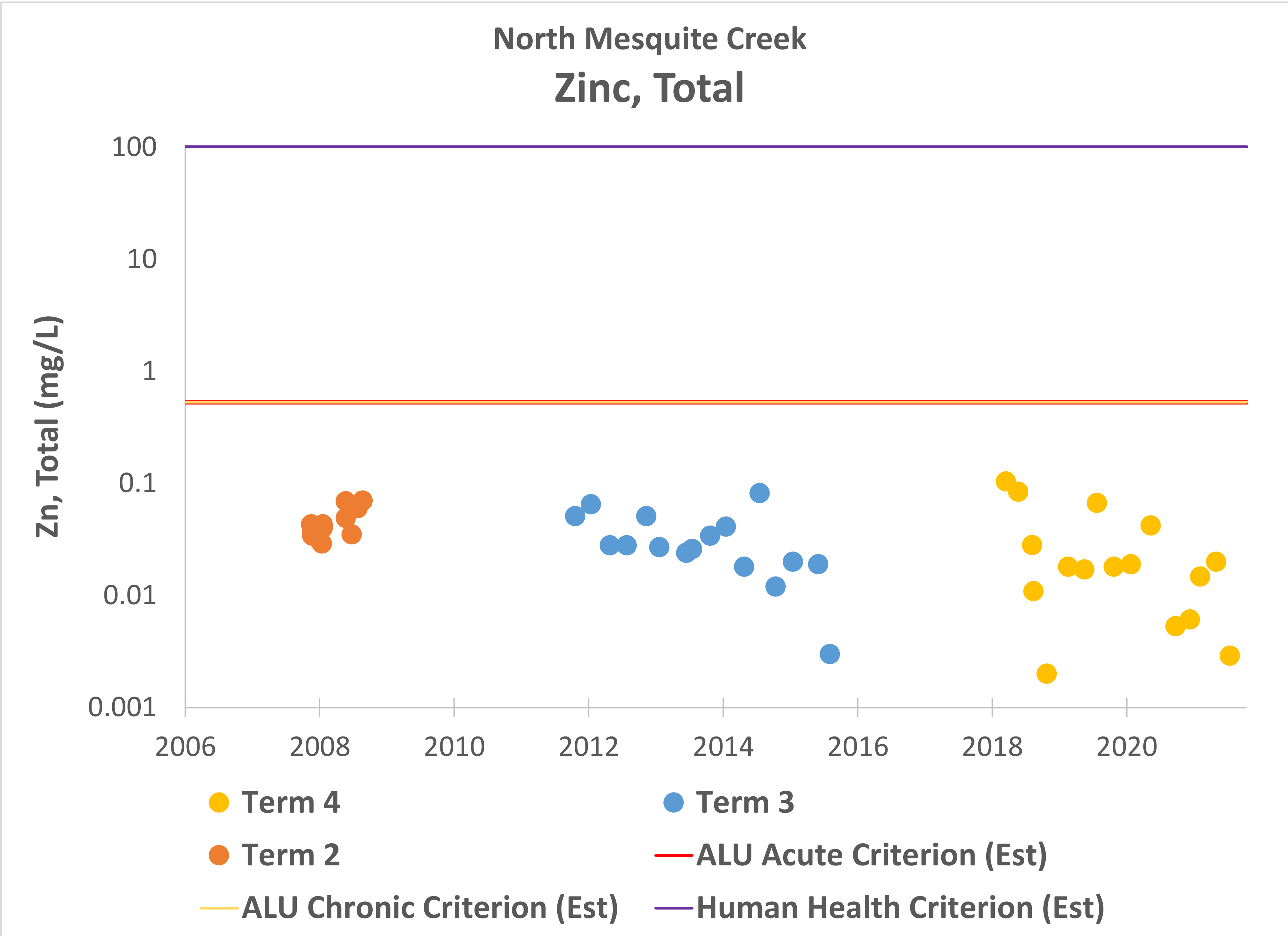

North Mesquite Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

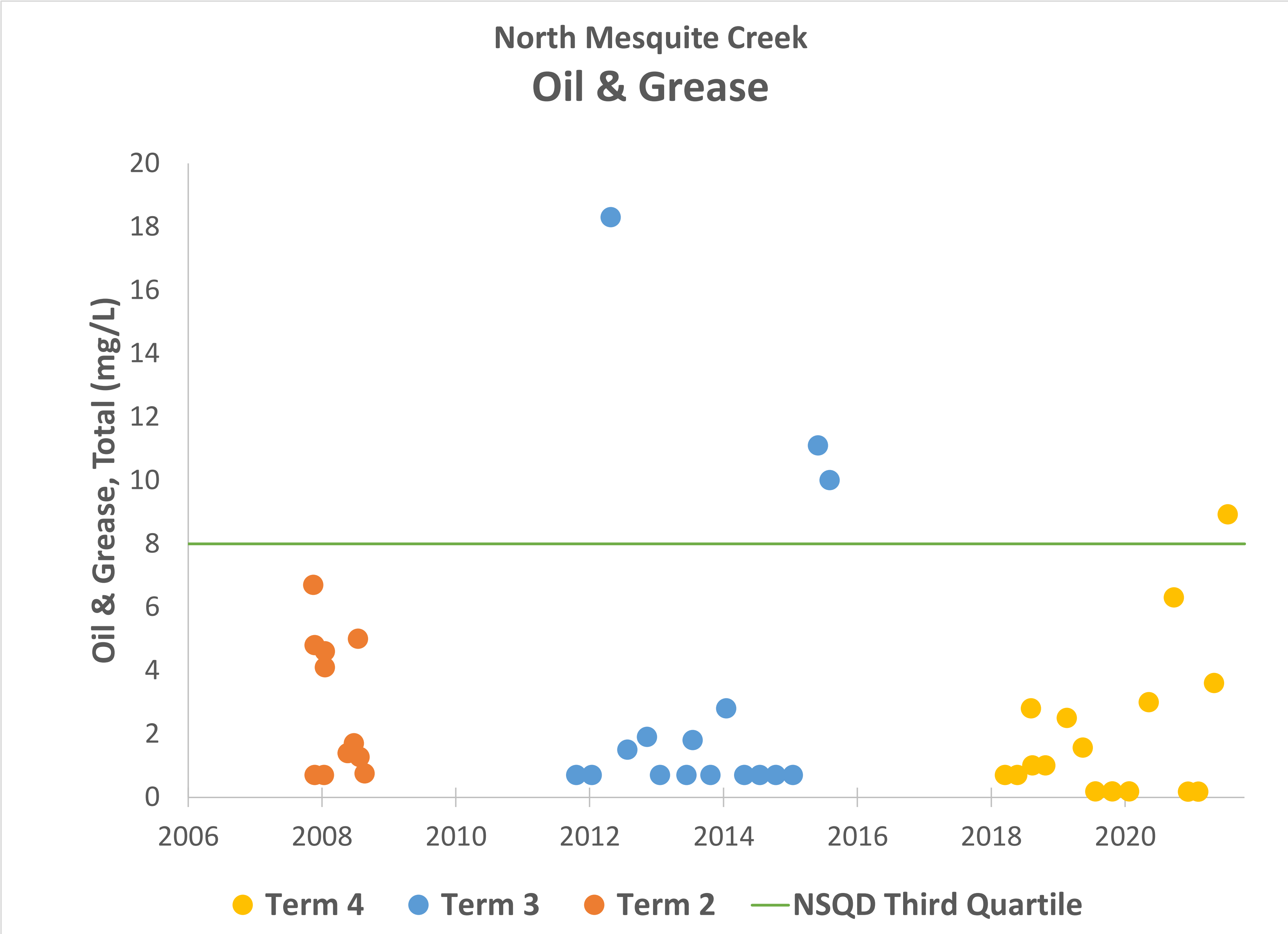


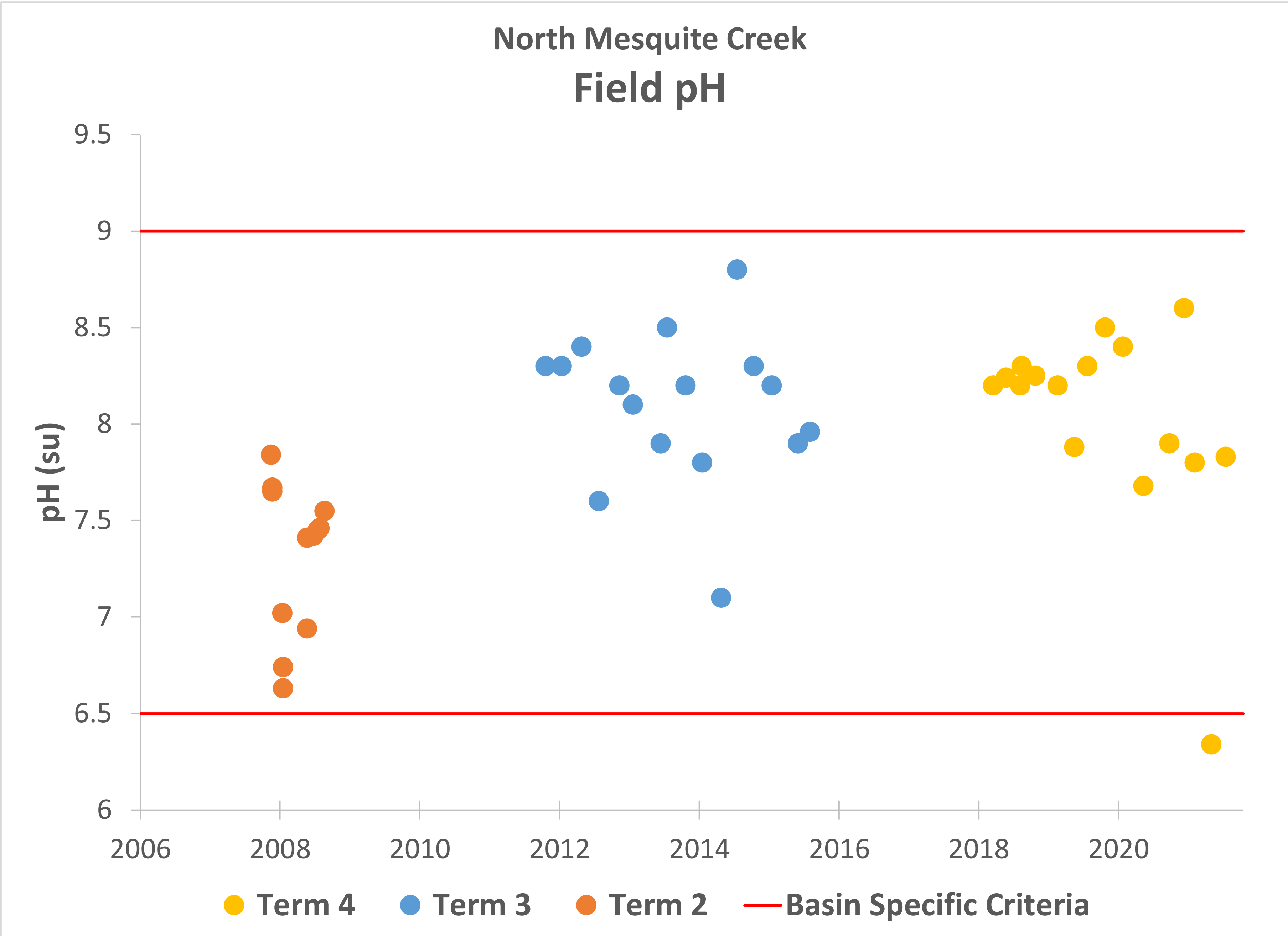
North Mesquite Creek
Chromium, Total
Cr, Total (mg/L)
100
10
1
0.1
0.01
0.001
0.0001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)


North Mesquite Creek
Copper, Total
Cu, Total (mg/L)
0.12
0.1
0.08
0.06
0.04
0.02
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)

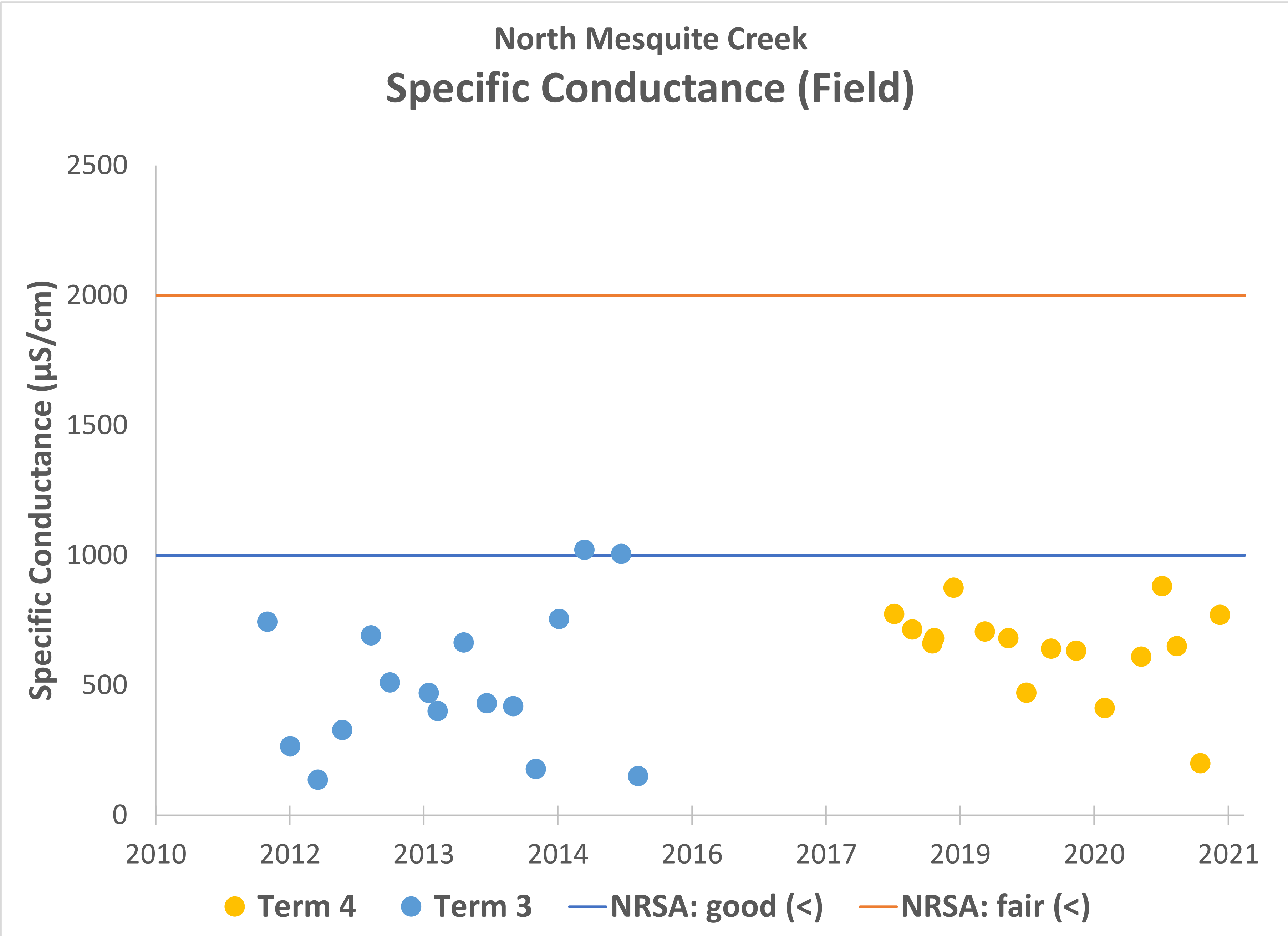

North Mesquite Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

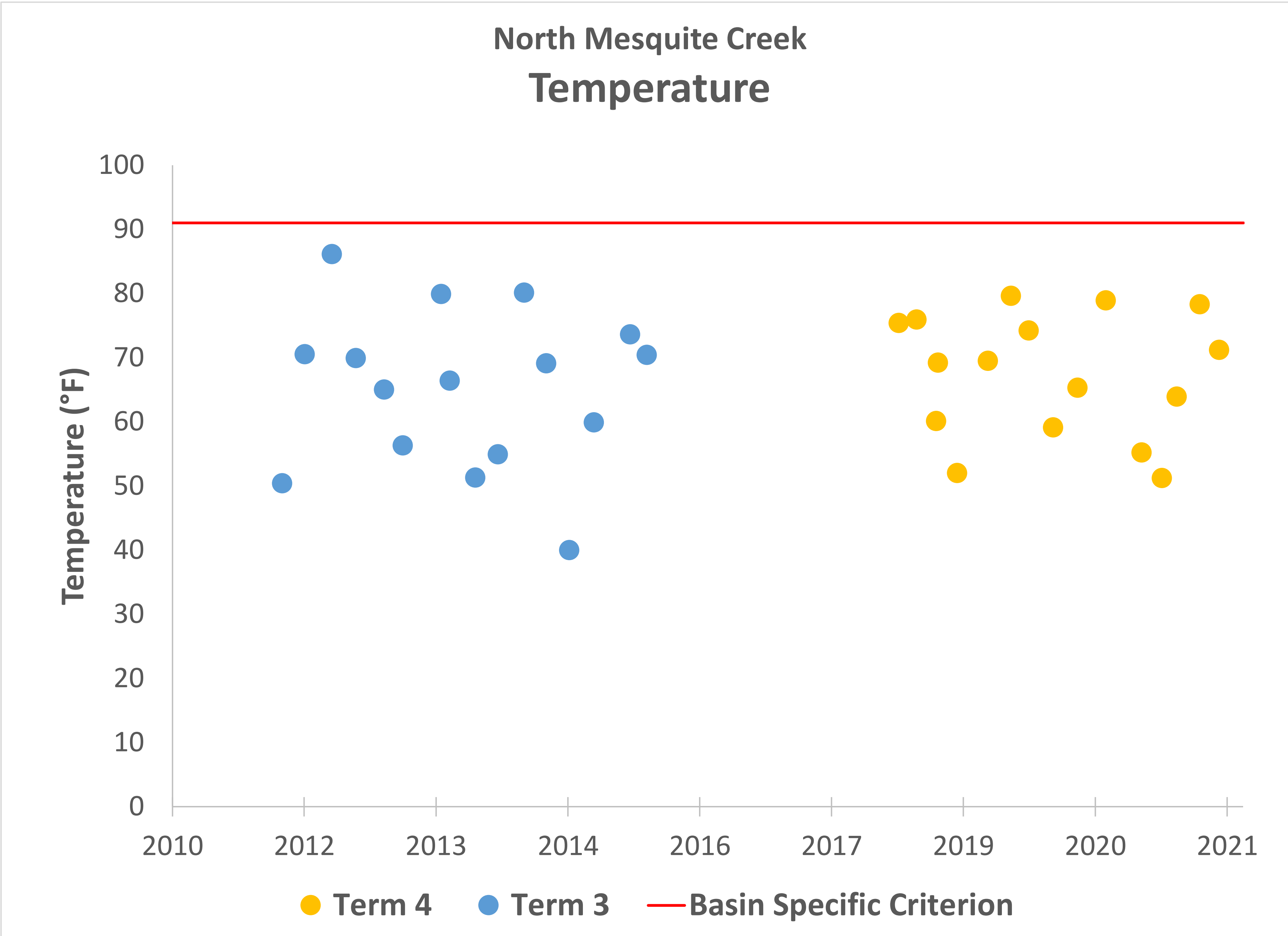

North Mesquite Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

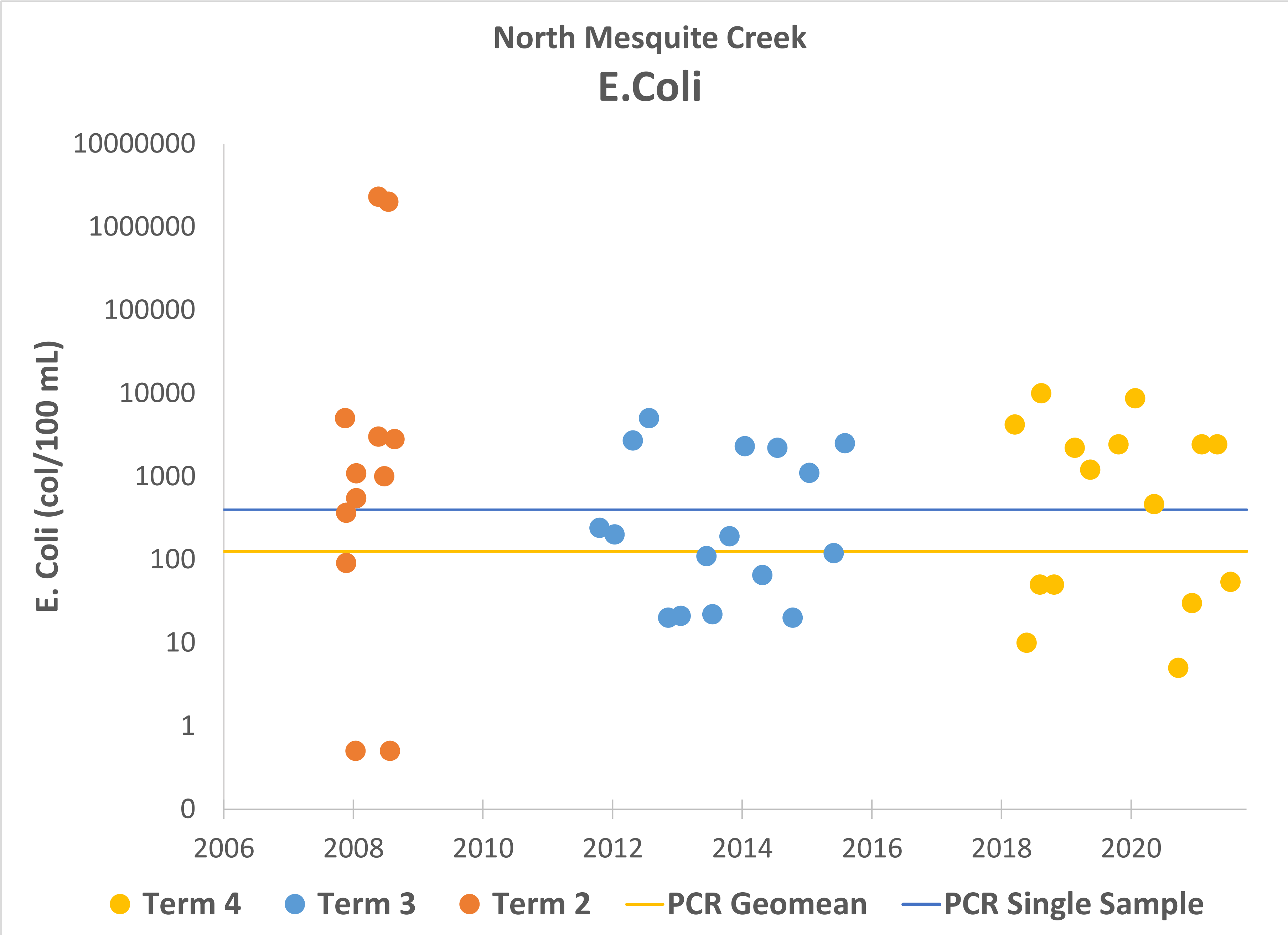

North Mesquite Creek
Oil & Grease
Oil & Grease, Total (mg/L)
0
2
4
6
8
10
12
14
16
18
20
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile

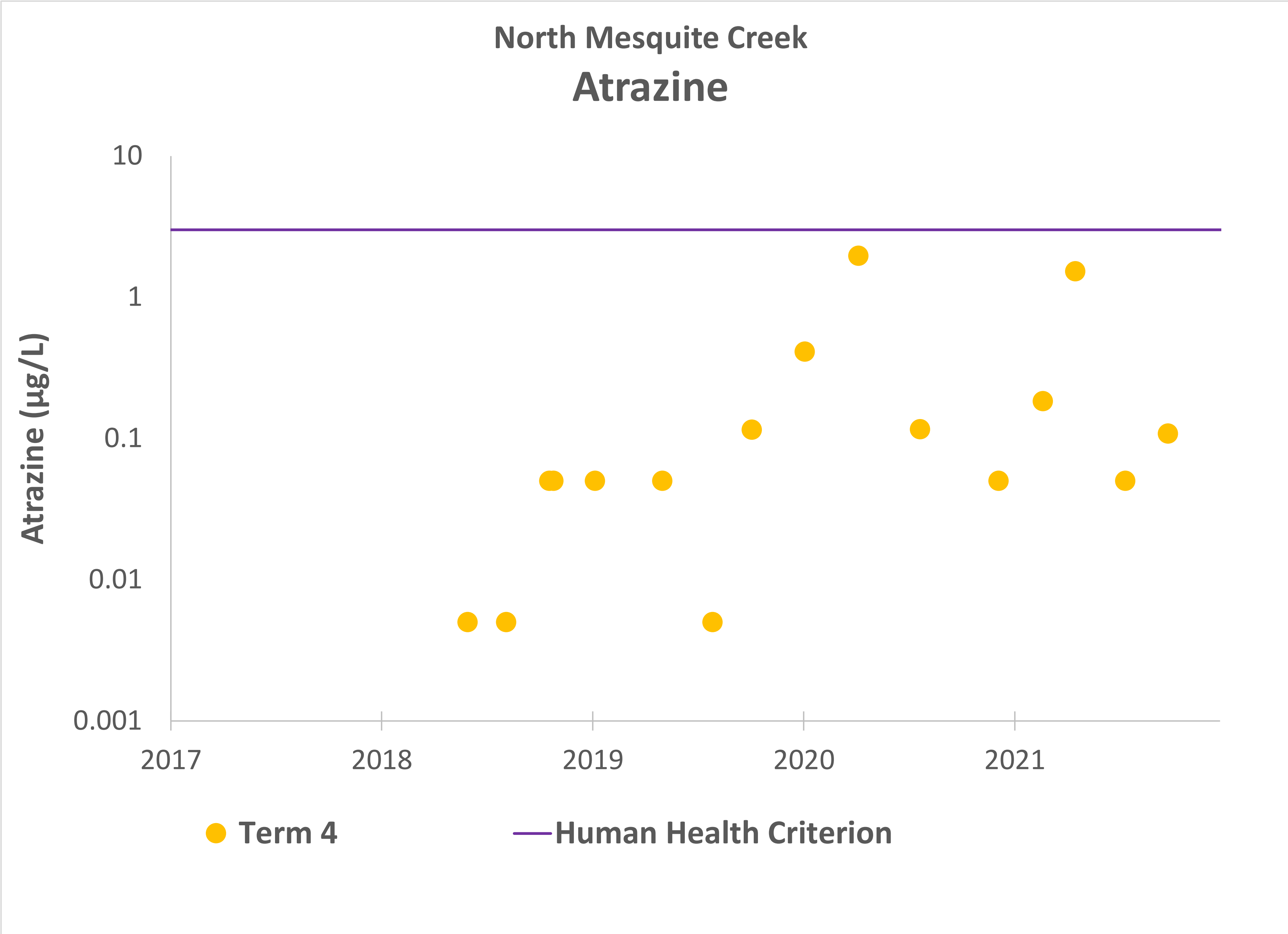


North Mesquite Creek
Field pH
pH (su)
9.5
9
8.5
8
7.5
7
6.5
6
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
Basin Specific Criteria


North Mesquite Creek
Specific Conductance (Field)
Specific Conductance (µS/cm)
2500
2000
1500
1000
500
0
2010
2012
2013
2014
2016
2017
2019
2020
2021
Term 4
Term 3
NRSA: good (<)
NRSA: fair (<)

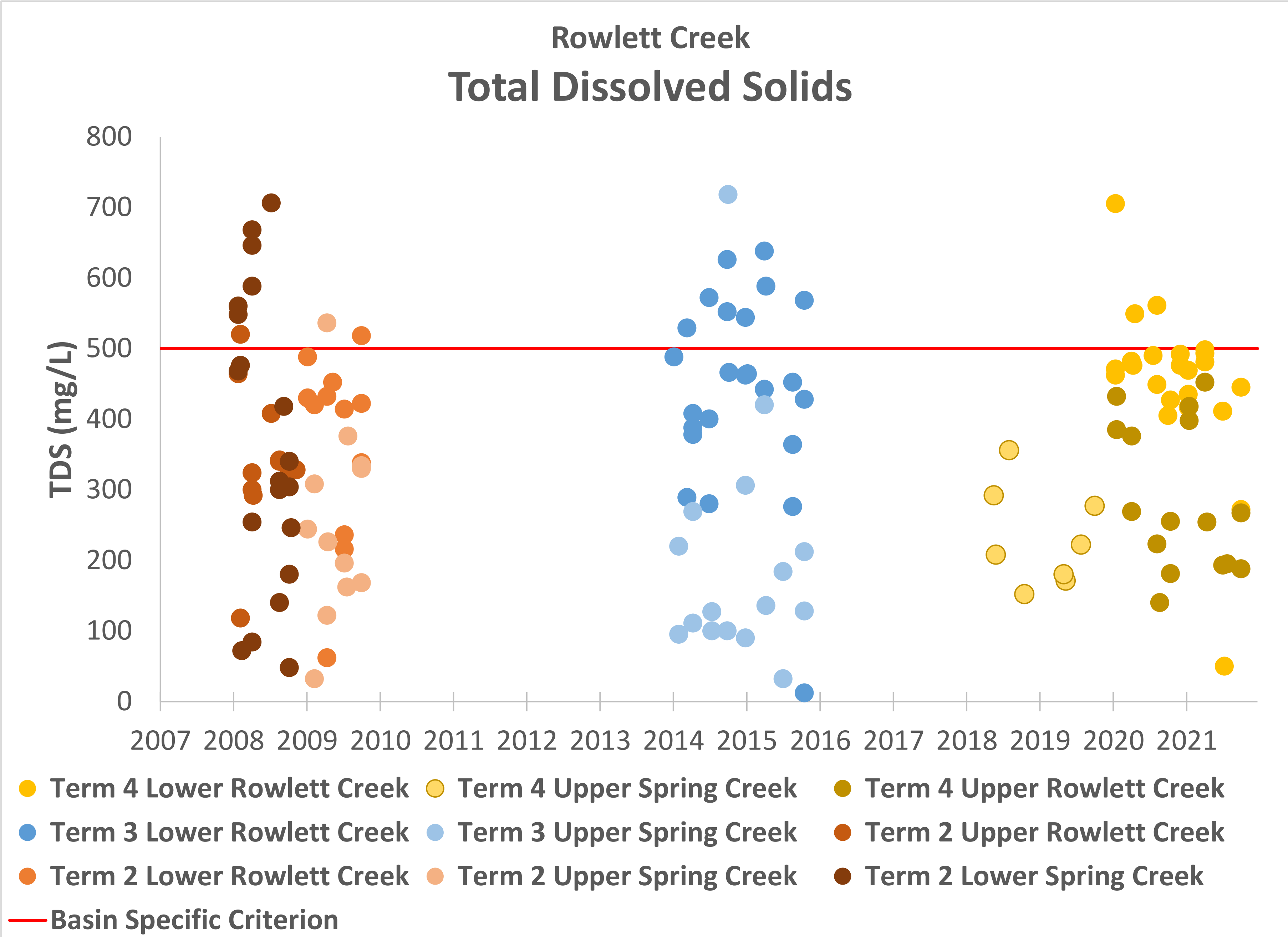

North Mesquite Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2010
2012
2013
2014
2016
2017
2019
2020
2021
Term 4
Term 3
Basin Specific Criterion

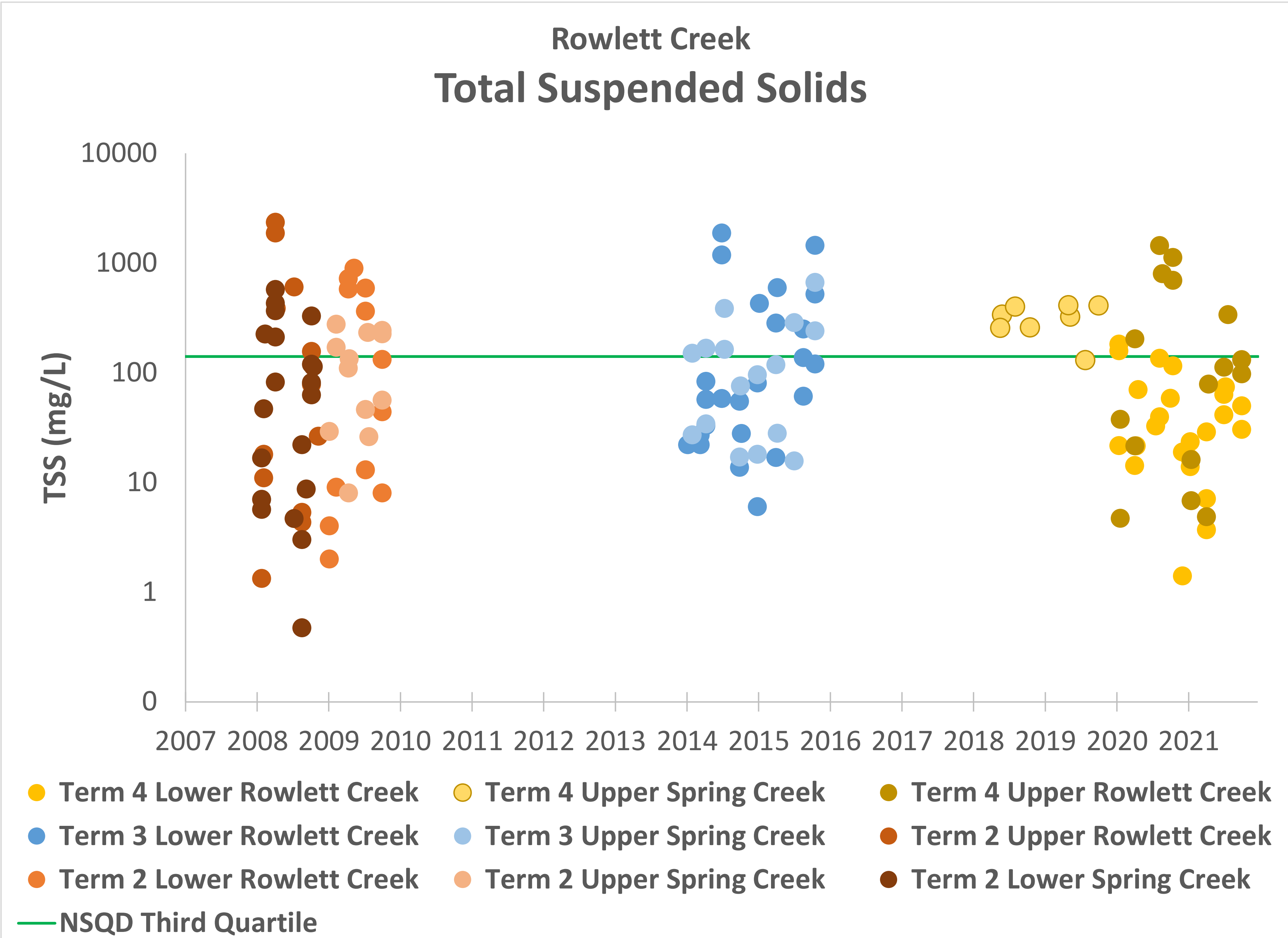

North Mesquite Creek
E.Coli
E. Coli (col/100 mL)
10000000
1000000
100000
10000
1000
100
10
1
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
PCR Geomean
PCR Single Sample

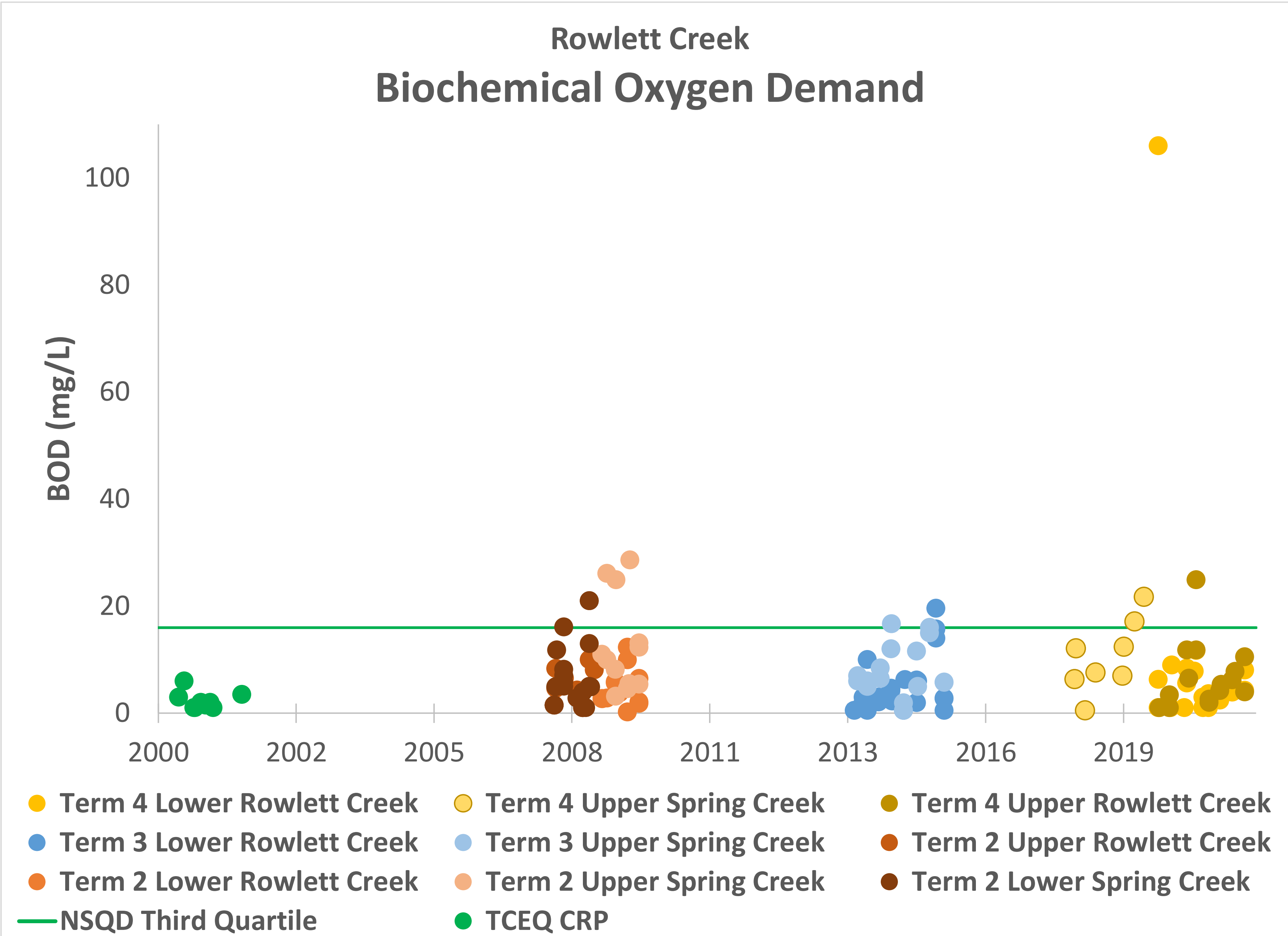

North Mesquite Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
0.001
2017
2018
2019
2020
2021
Term 4
Human Health Criterion

Appendix U

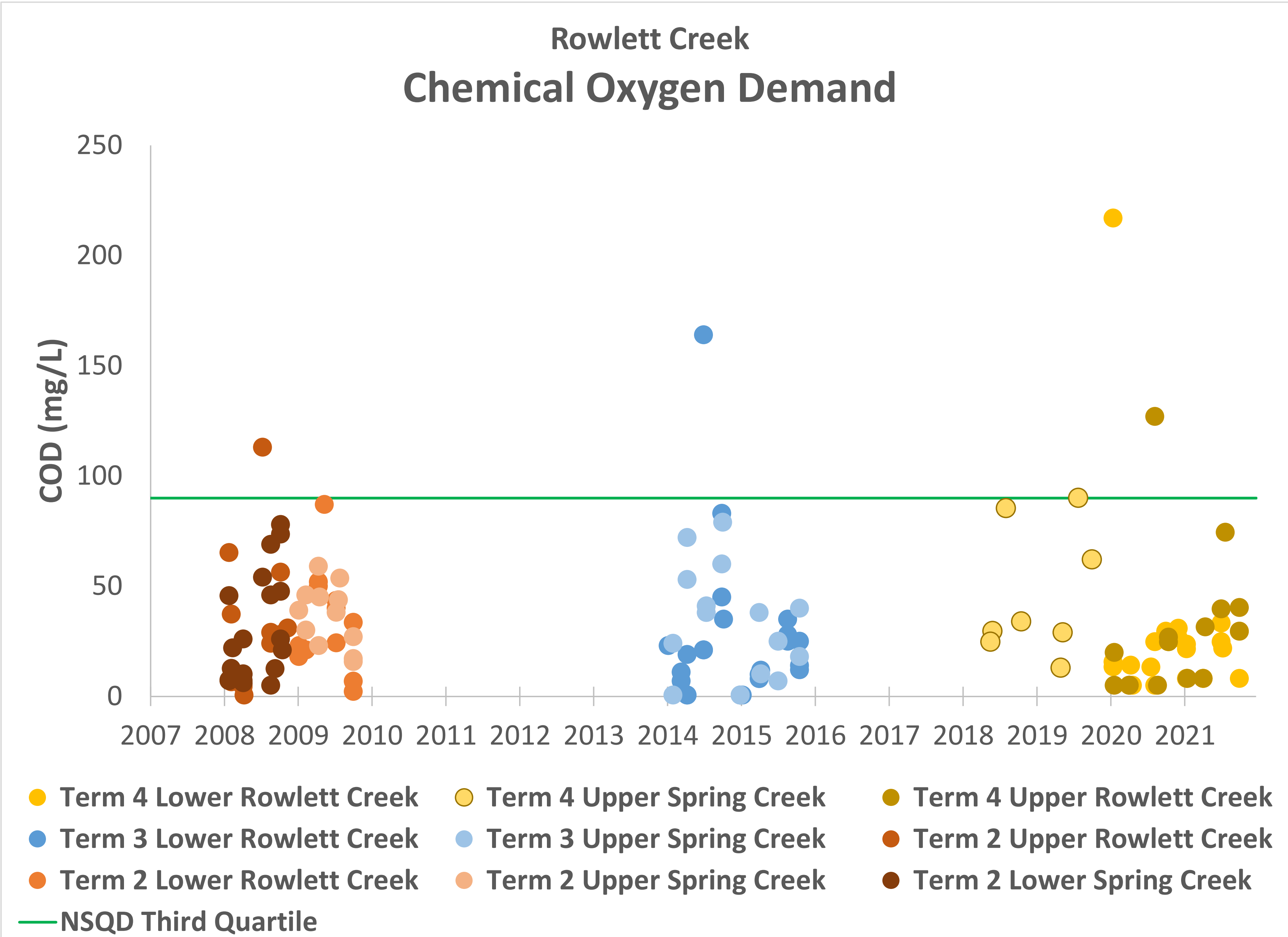
Rowlett and Spring Creeks Water Quality Data Graphs


Rowlett Creek
Total Dissolved Solids
TDS (mg/L)
0
100
200
300
400
500
600
700
800
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
Basin Specific Criterion

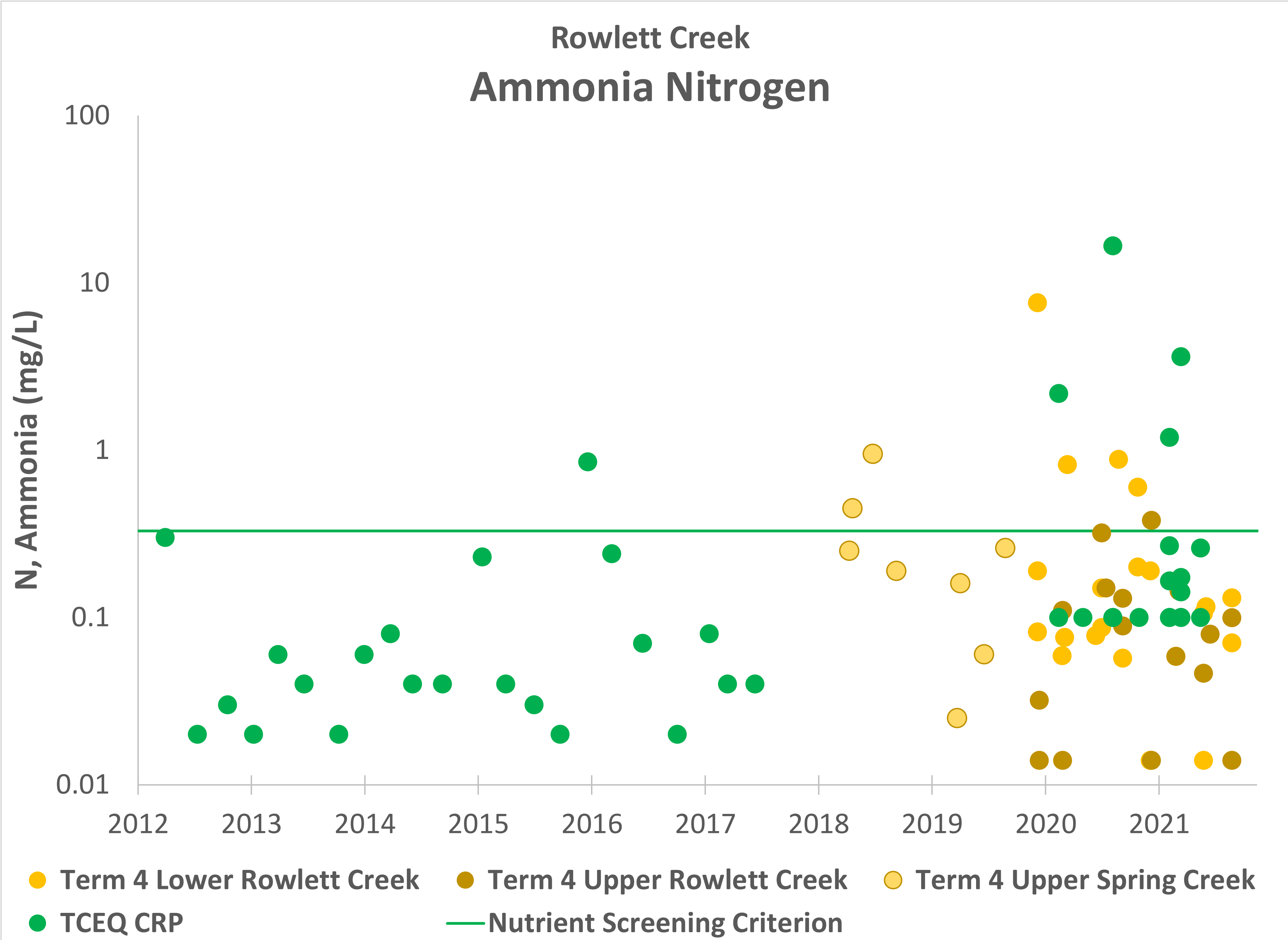

Rowlett Creek
Total Suspended Solids
TSS (mg/L)
10000
1000
100
10
1
0
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
NSQD Third Quartile



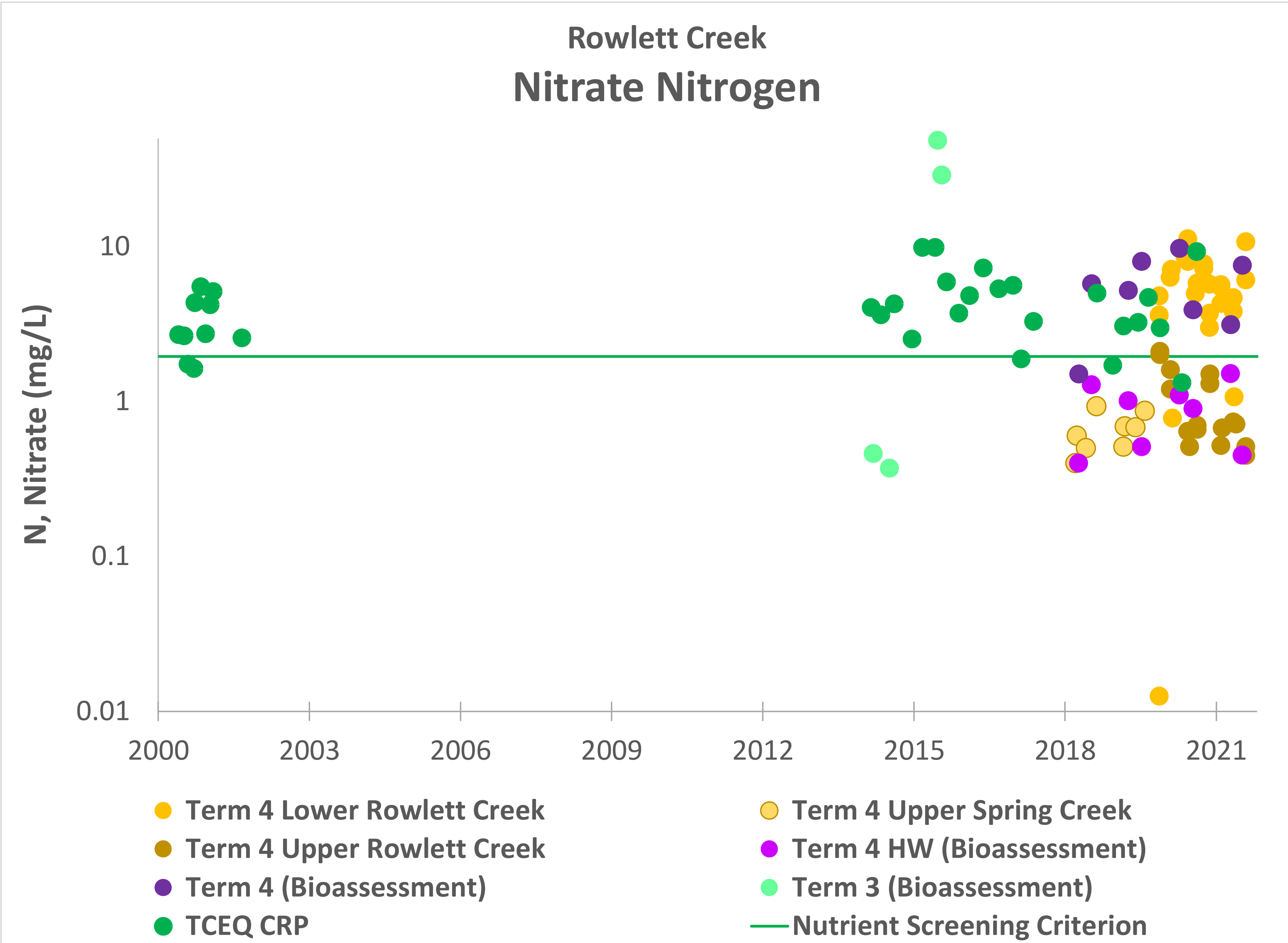
Rowlett Creek
Biochemical Oxygen Demand
BOD (mg/L)
100
80
60
40
20
0
2000
2002
2005
2008
2011
2013
2016
2019
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
NSQD Third Quartile
TCEQ CRP

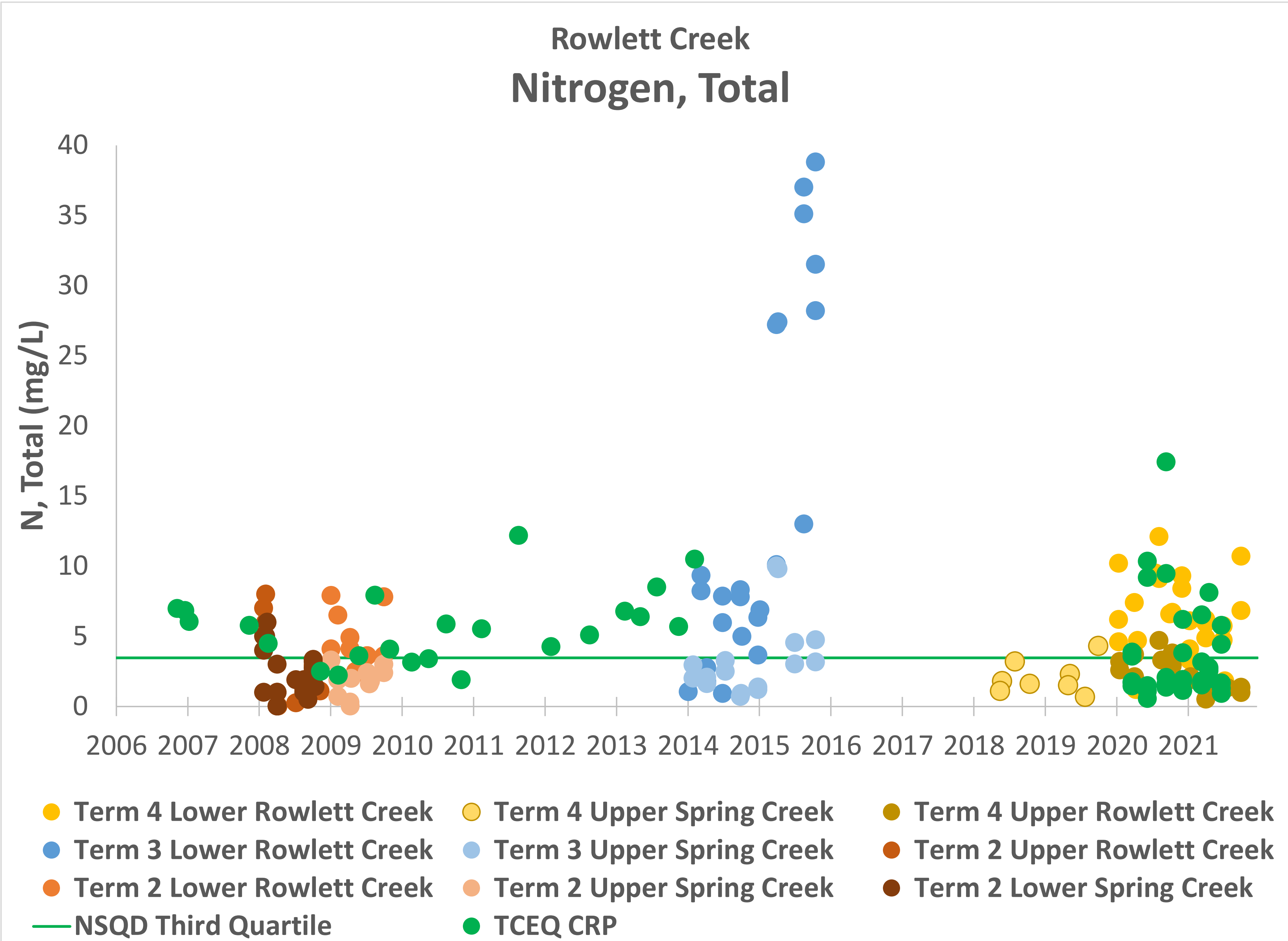


Rowlett Creek
Chemical Oxygen Demand
COD (mg/L)
250
200
150
100
50
0
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
NSQD Third Quartile

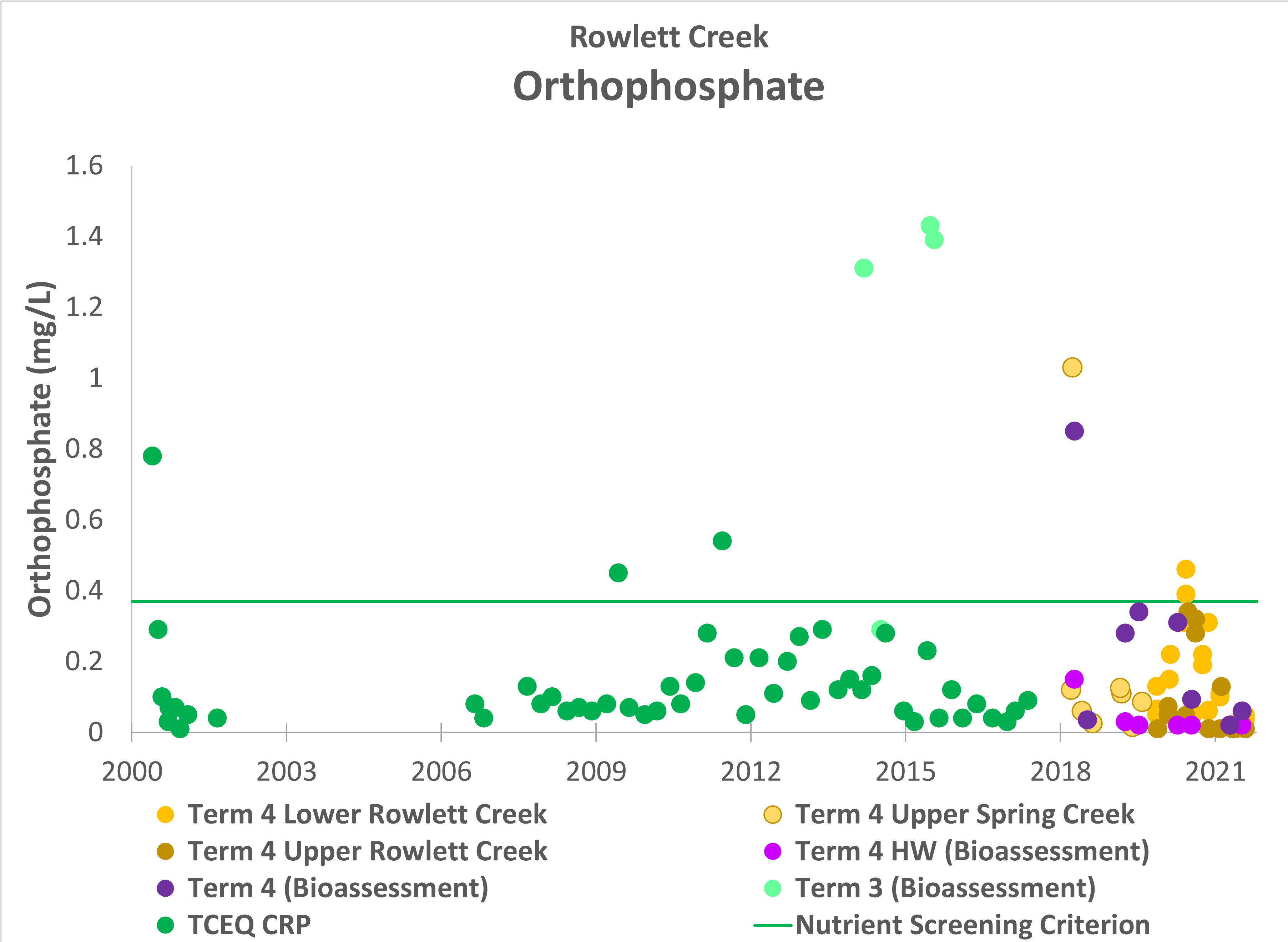


Rowlett Creek
Ammonia Nitrogen
N, Ammonia (mg/L)
100
10
1
0.1
0.01
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 Lower Rowlett Creek
Term 4 Upper Rowlett Creek
Term 4 Upper Spring Creek
TCEQ CRP
Nutrient Screening Criterion

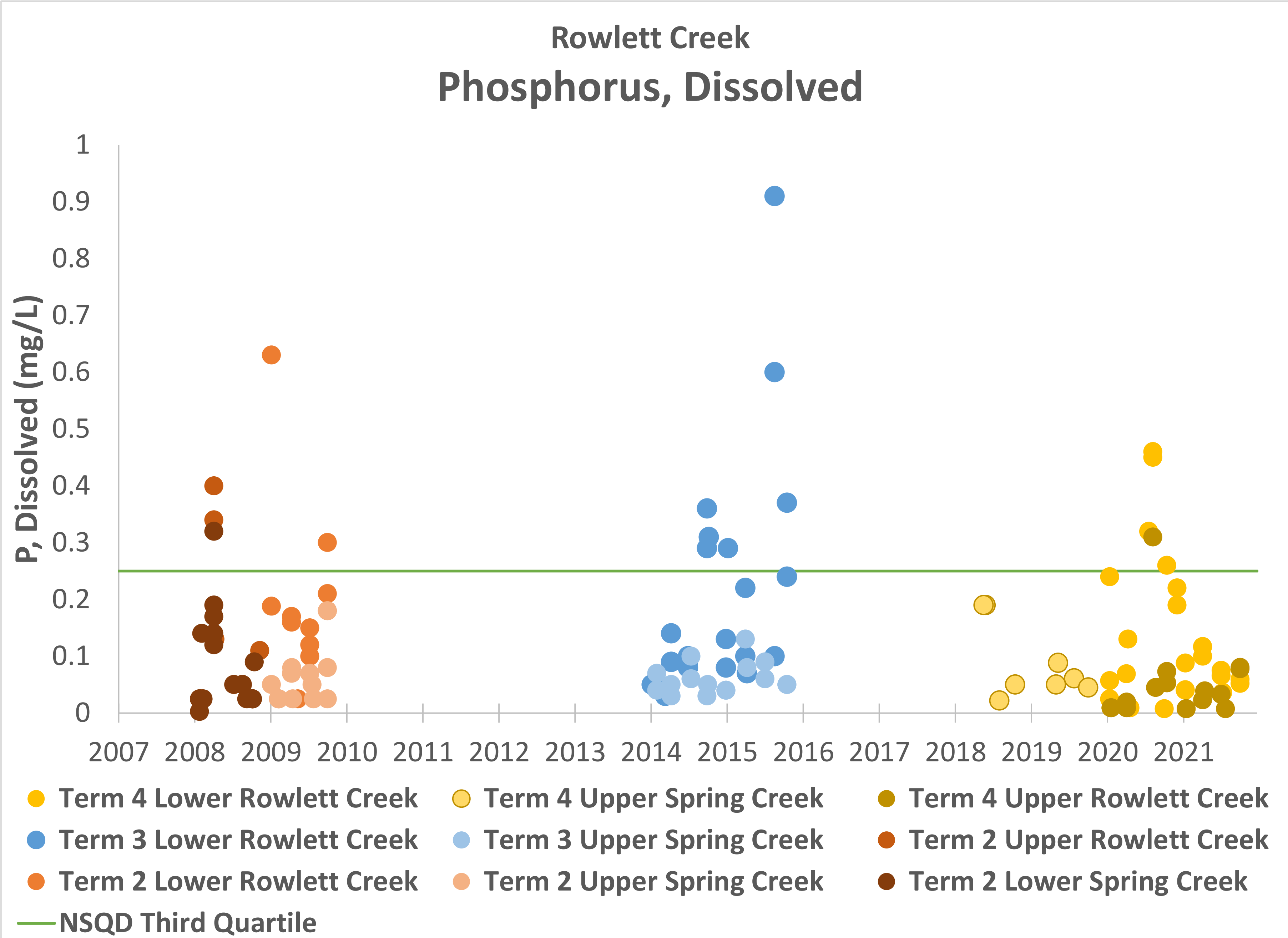

Rowlett Creek
Nitrate Nitrogen
N, Nitrate (mg/L)
10
1
0.1
0.01
2000
2003
2006
2009
2012
2015
2018
2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 4 HW (Bioassessment)
Term 4 (Bioassessment)
Term 3 (Bioassessment)
TCEQ CRP
Nutrient Screening Criterion



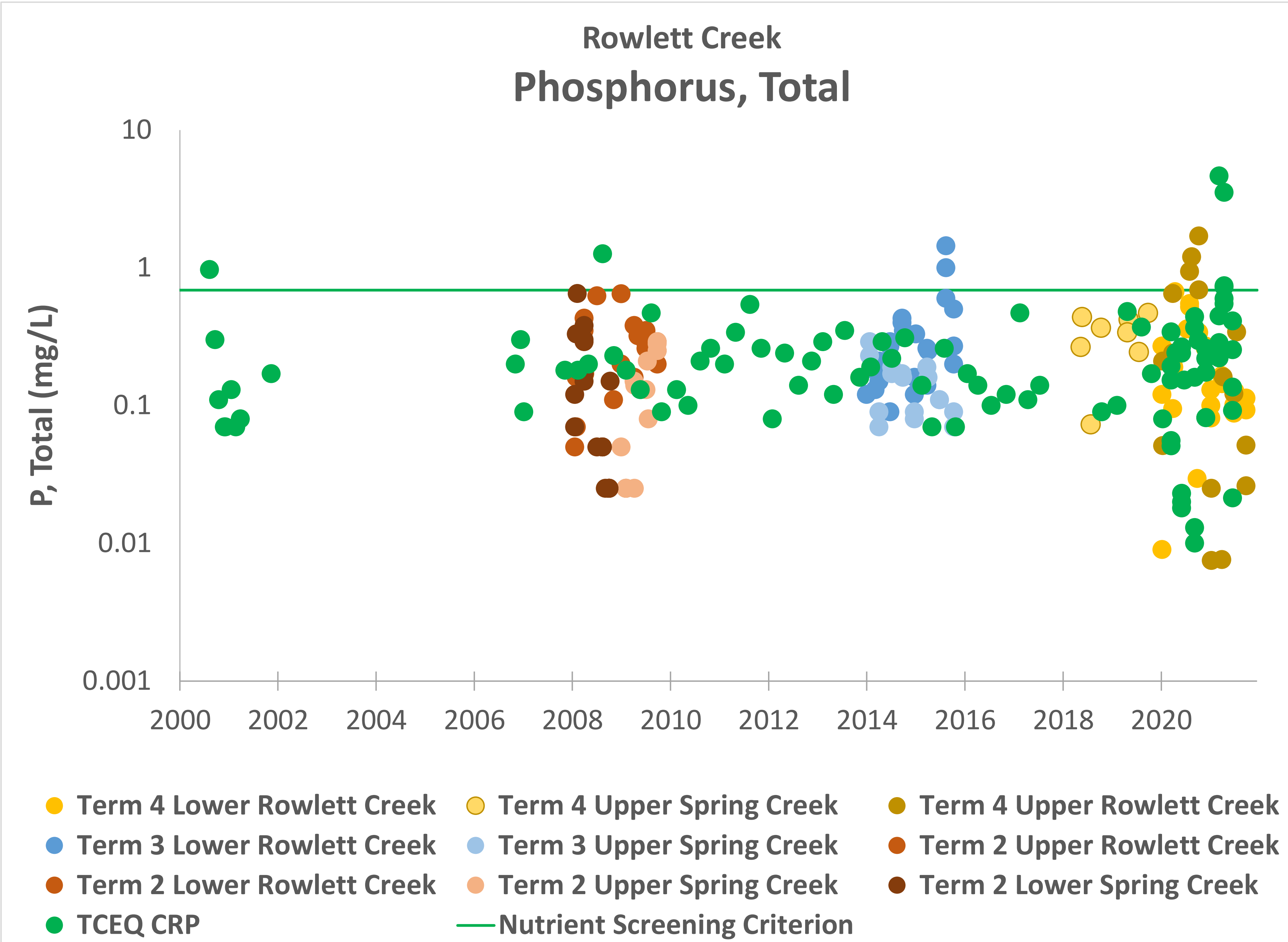
Rowlett Creek
Nitrogen, Total
N, Total (mg/L)
0
5
10
15
20
25
30
35
40
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
NSQD Third Quartile
TCEQ CRP



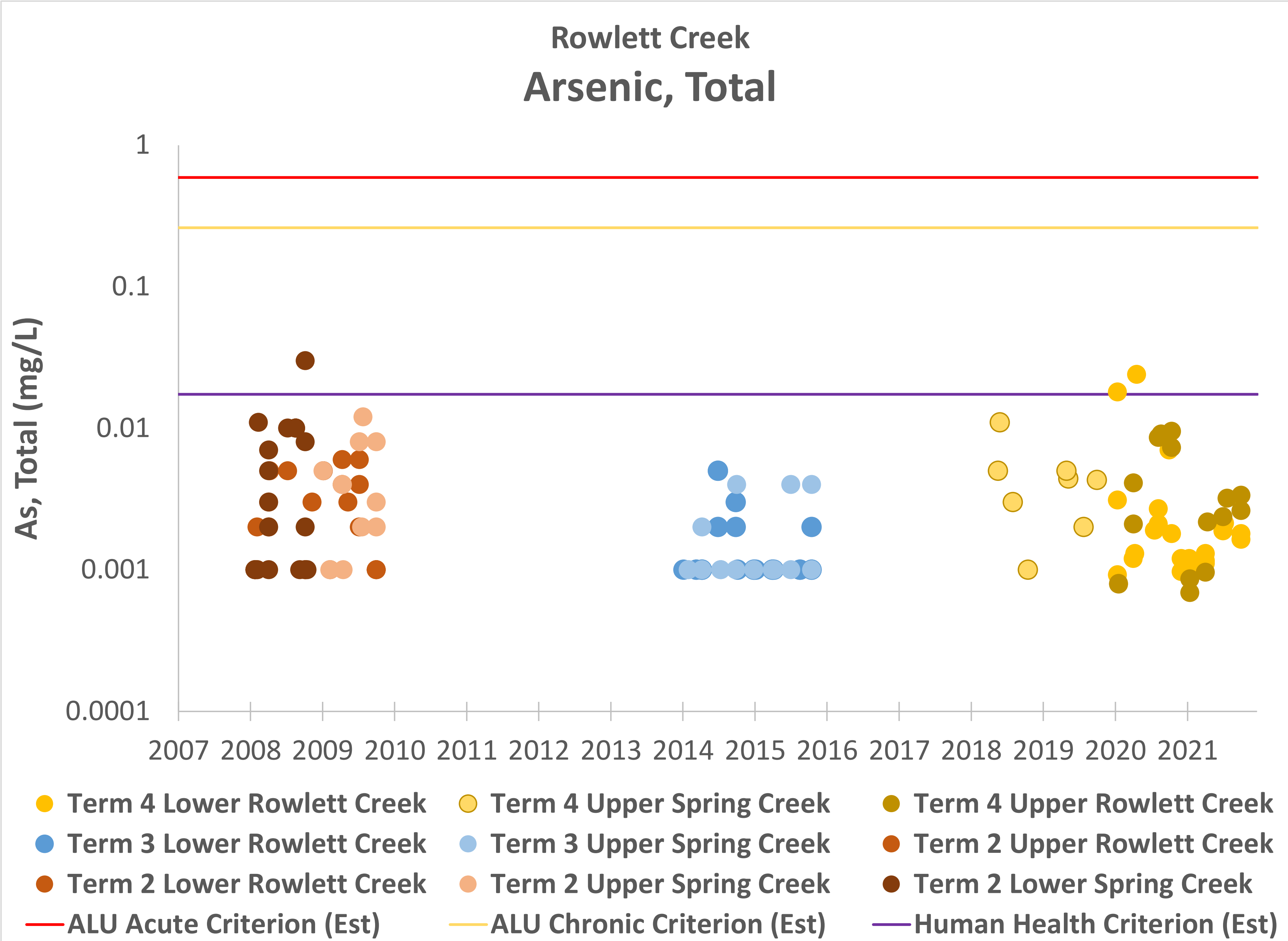
Rowlett Creek
Orthophosphate
Orthophosphate (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2000
2003
2006
2009
2012
2015
2018
2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 4 HW (Bioassessment)
Term 4 (Bioassessment)
Term 3 (Bioassessment)
TCEQ CRP
Nutrient Screening Criterion



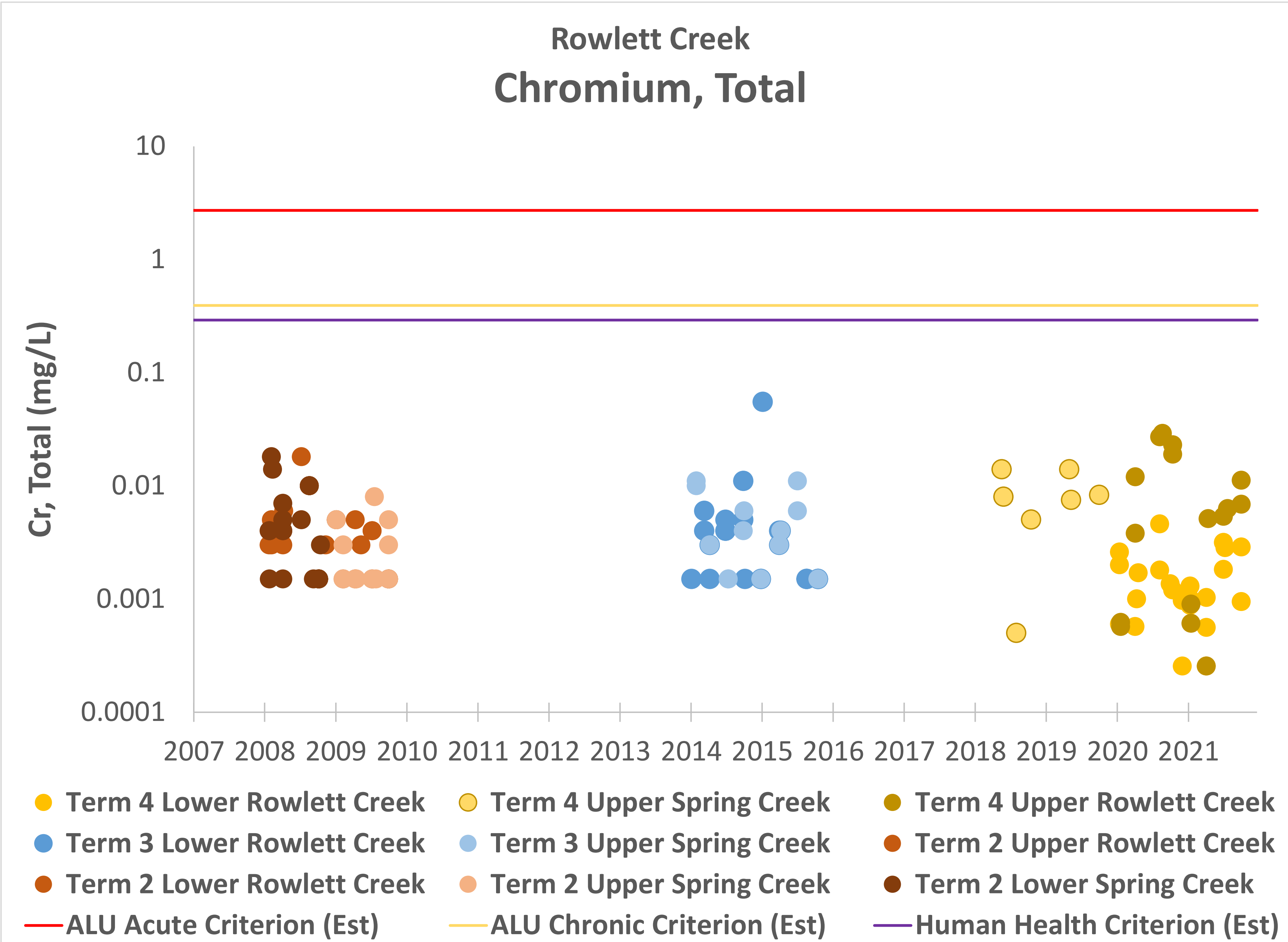
Rowlett Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
NSQD Third Quartile



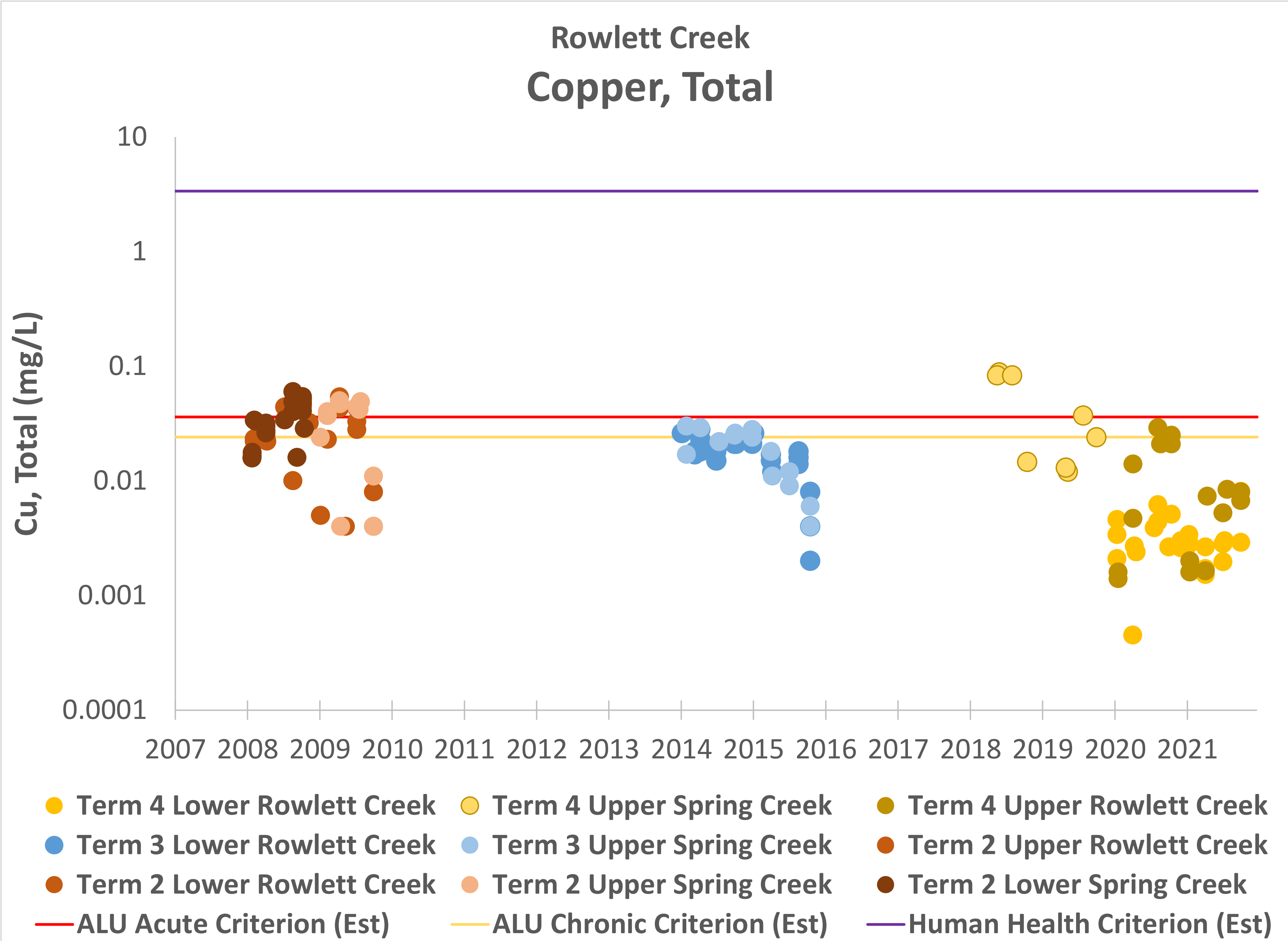
Rowlett Creek
Phosphorus, Total
P, Total (mg/L)
10
1
0.1
0.01
0.001
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
TCEQ CRP
Nutrient Screening Criterion



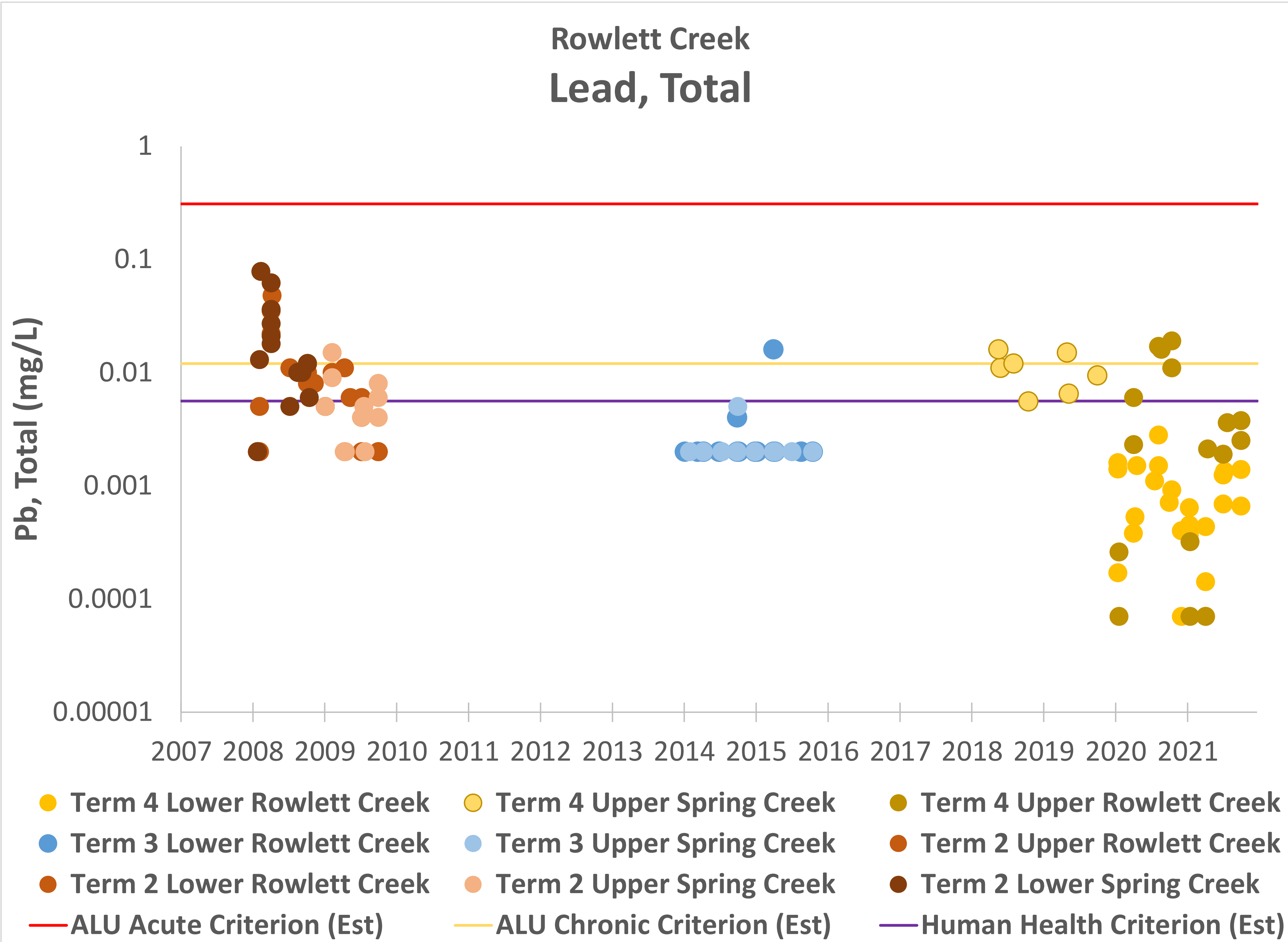
Rowlett Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

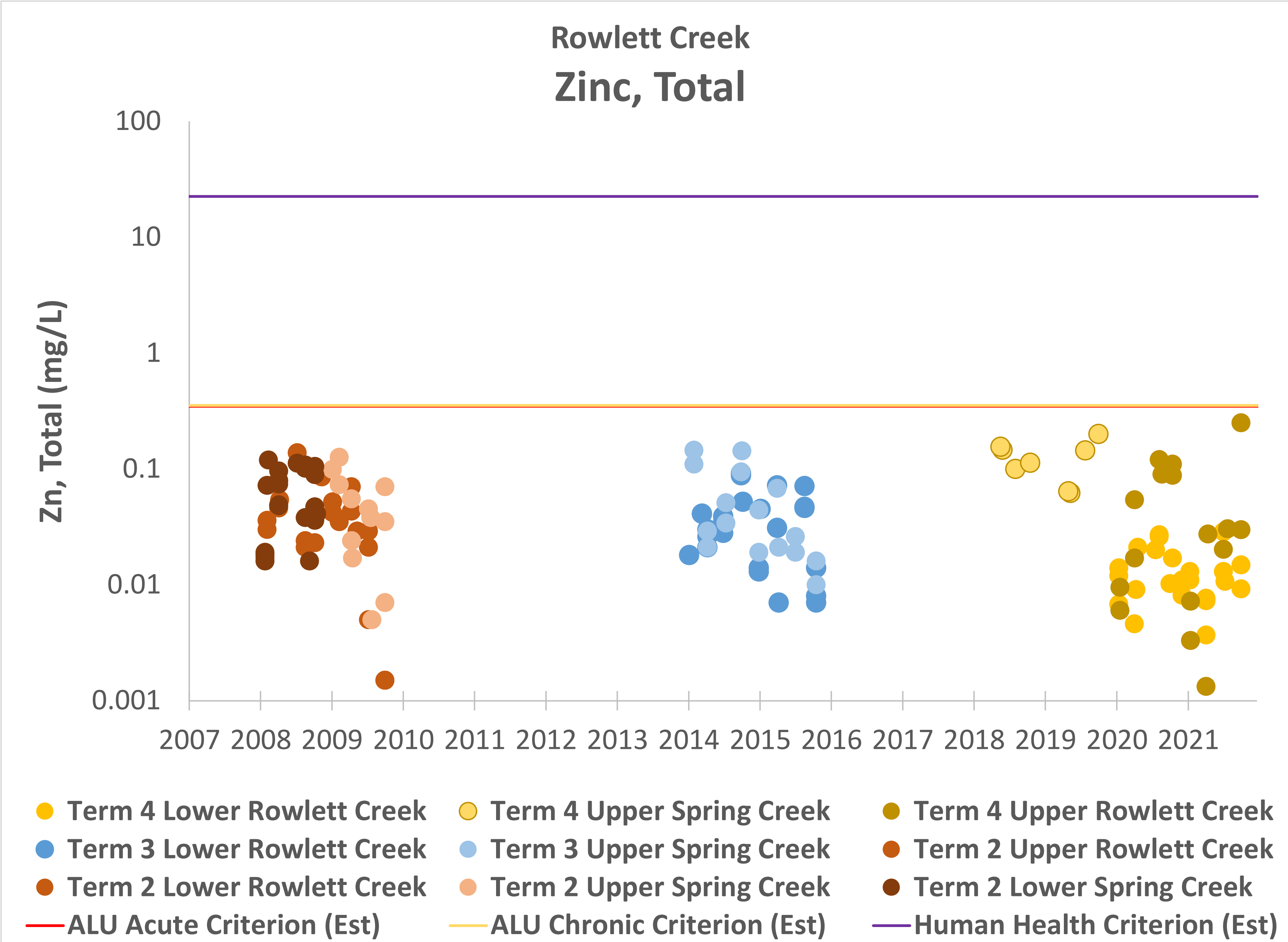


Rowlett Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
0.0001
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

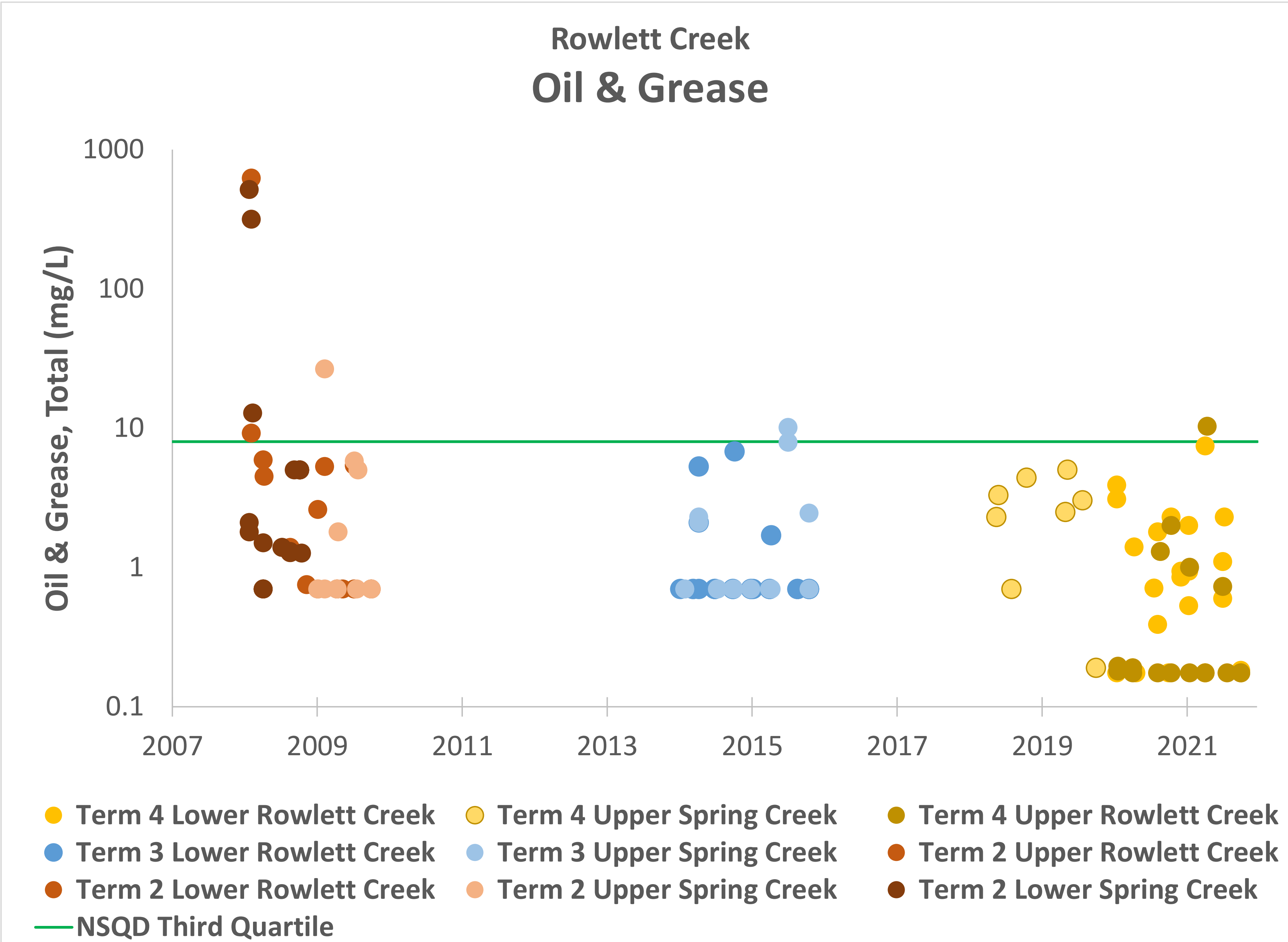


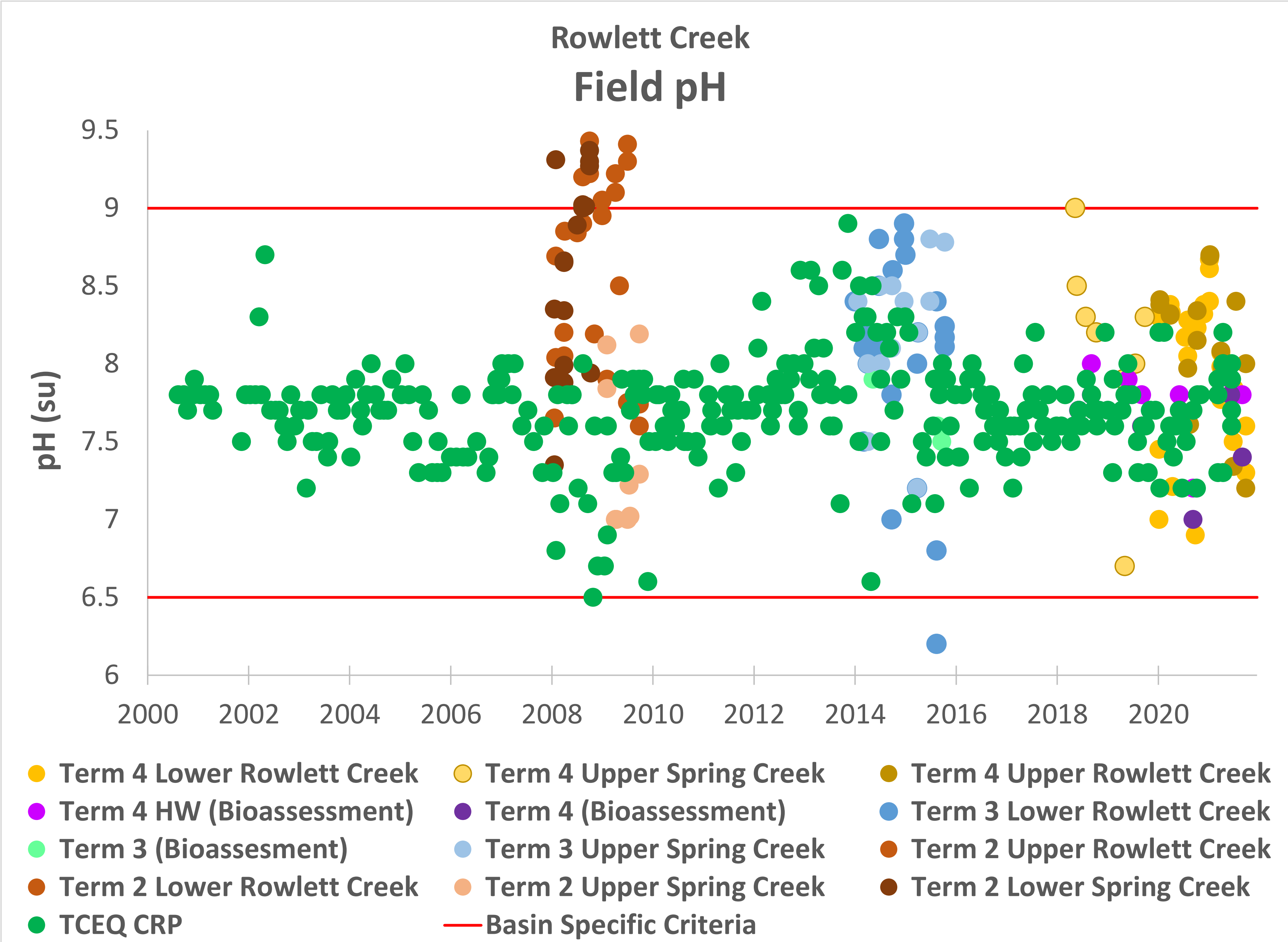
Rowlett Creek
Copper, Total
Cu, Total (mg/L)
10
1
0.1
0.01
0.001
0.0001
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)


Rowlett Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
0.00001
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

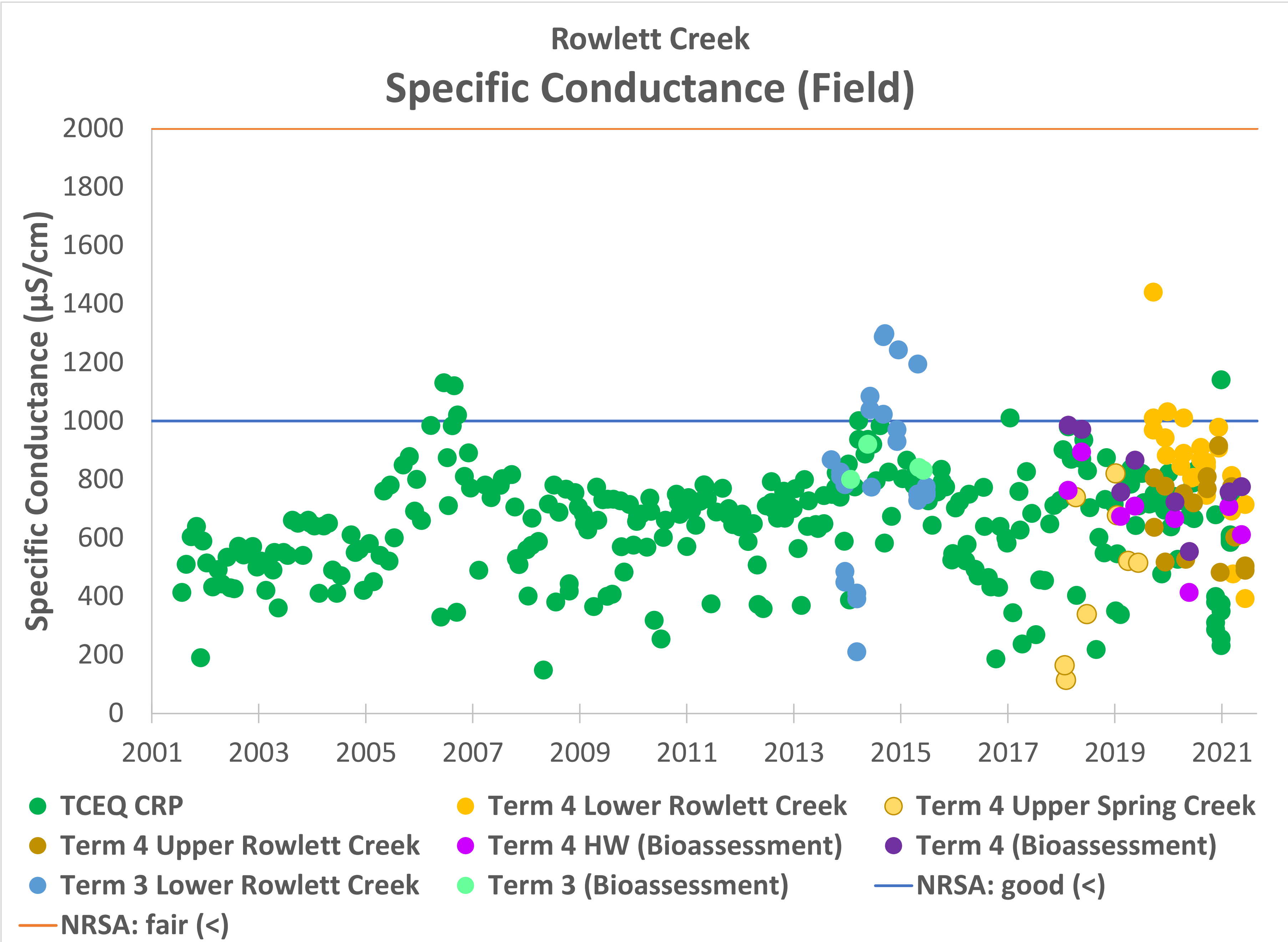


Rowlett Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

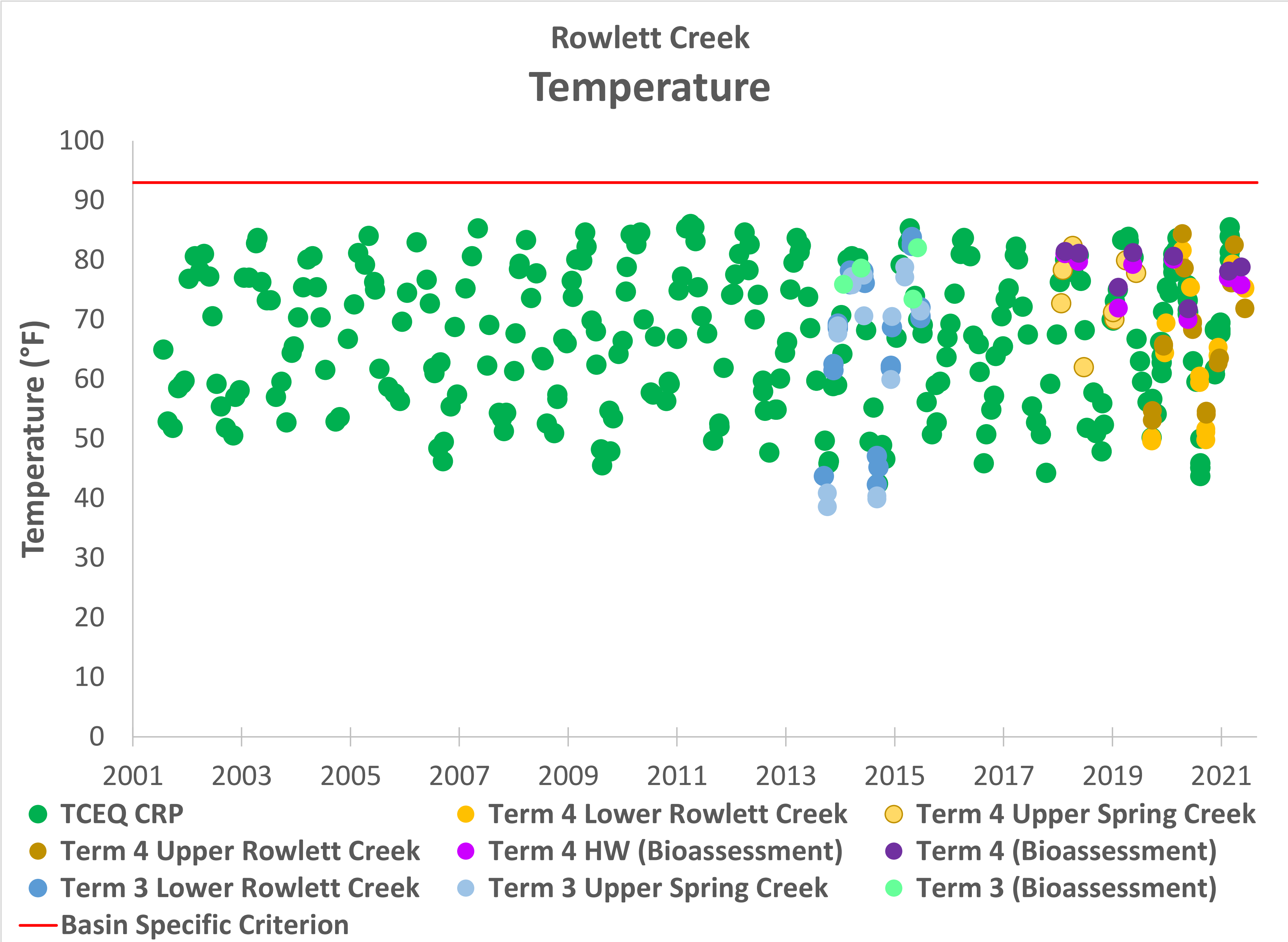

Rowlett Creek
Oil & Grease
Oil & Grease, Total (mg/L)
1000
100
10
1
0.1
2007
2009
2011
2013
2015
2017
2019
2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
NSQD Third Quartile



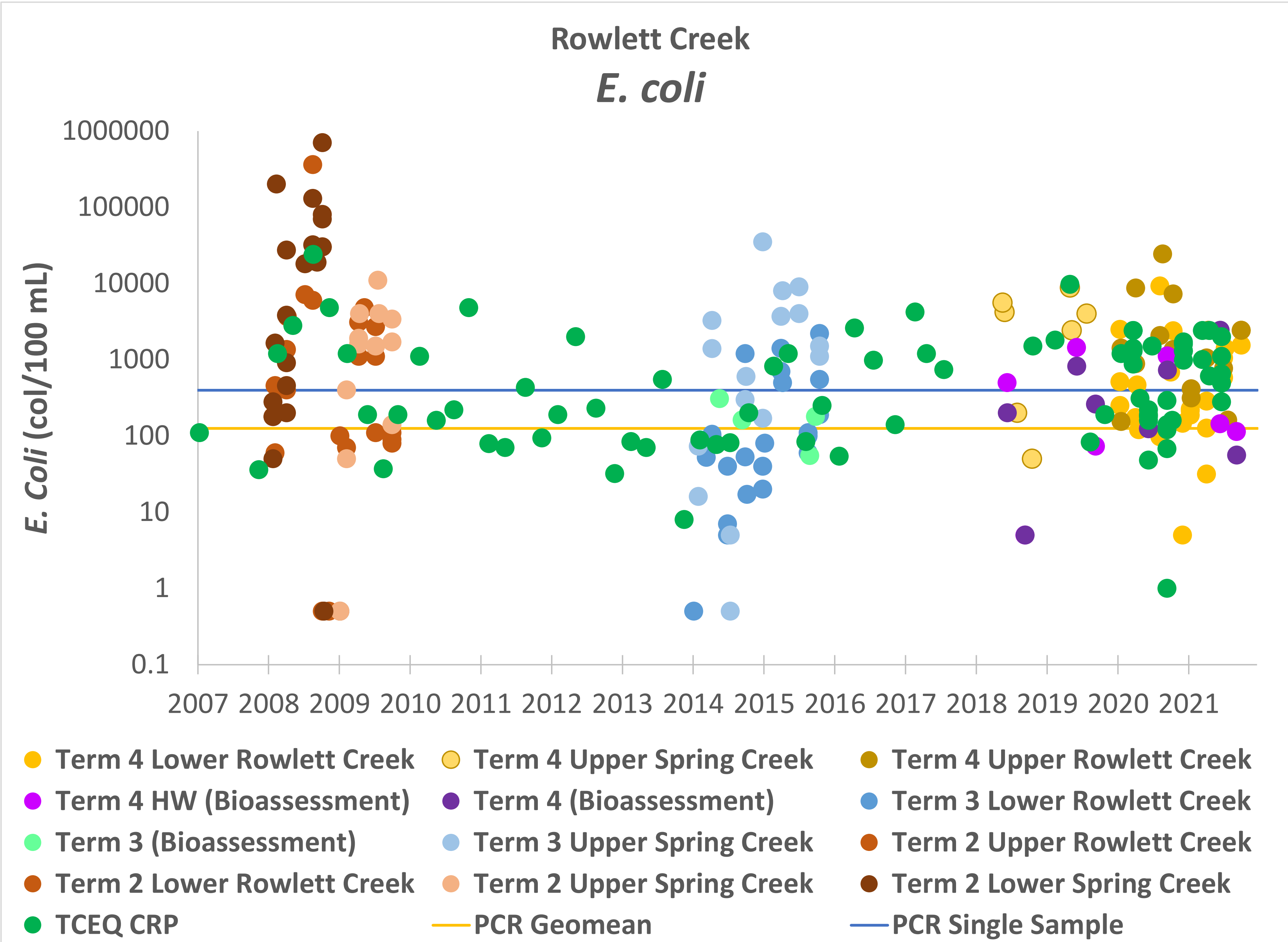
Rowlett Creek
Field pH
pH (su)
9.5
9
8.5
8
7.5
7
6.5
6
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 4 HW (Bioassessment)
Term 4 (Bioassessment)
Term 3 Lower Rowlett Creek
Term 3 (Bioassesment)
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
TCEQ CRP
Basin Specific Criteria

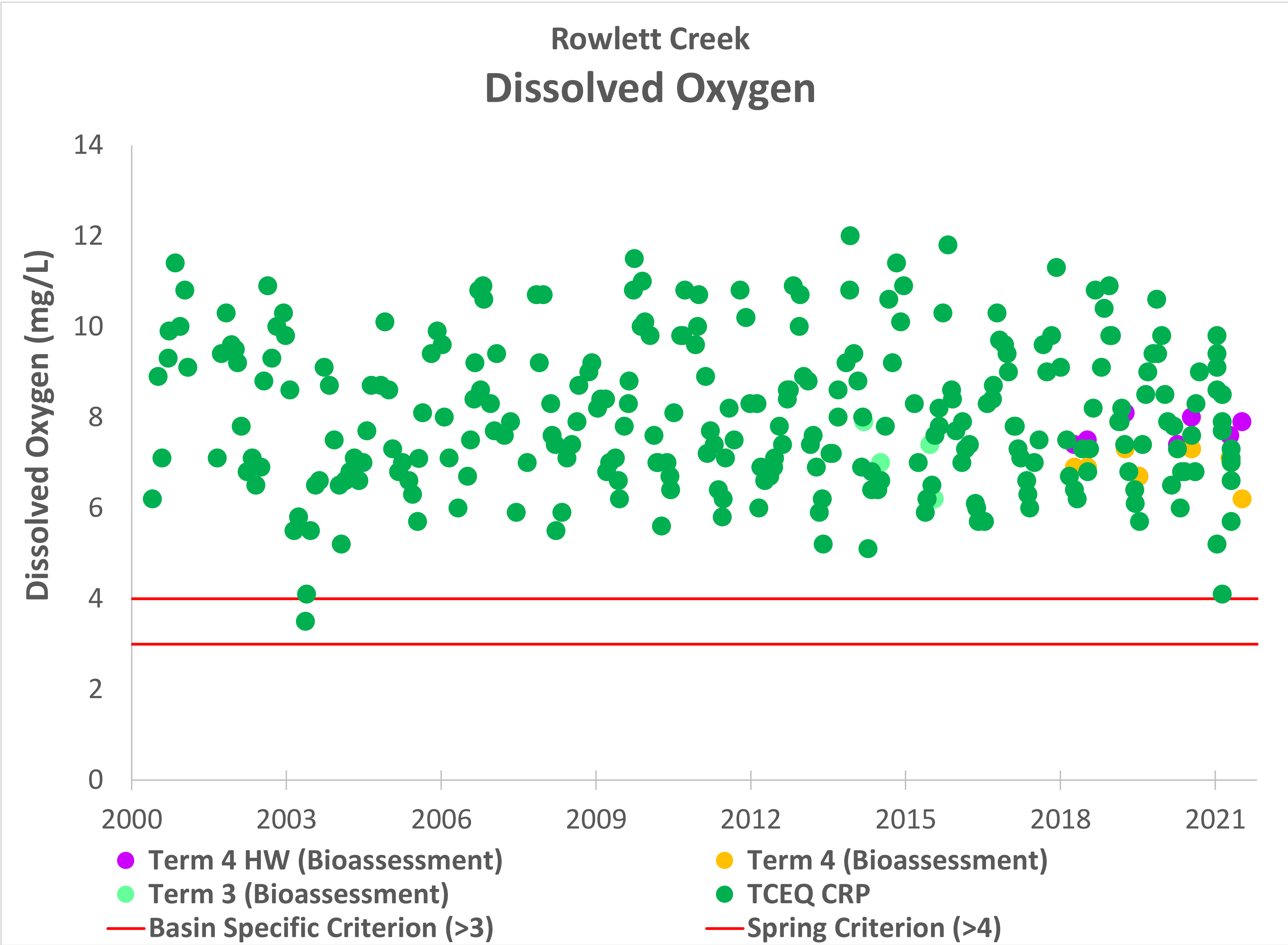


Rowlett Creek
Specific Conductance (Field)
Specific Conductance (µS/cm)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
TCEQ CRP
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 4 HW (Bioassessment)
Term 4 (Bioassessment)
Term 3 Lower Rowlett Creek
Term 3 (Bioassessment)
NRSA: good (<)
NRSA: fair (<)

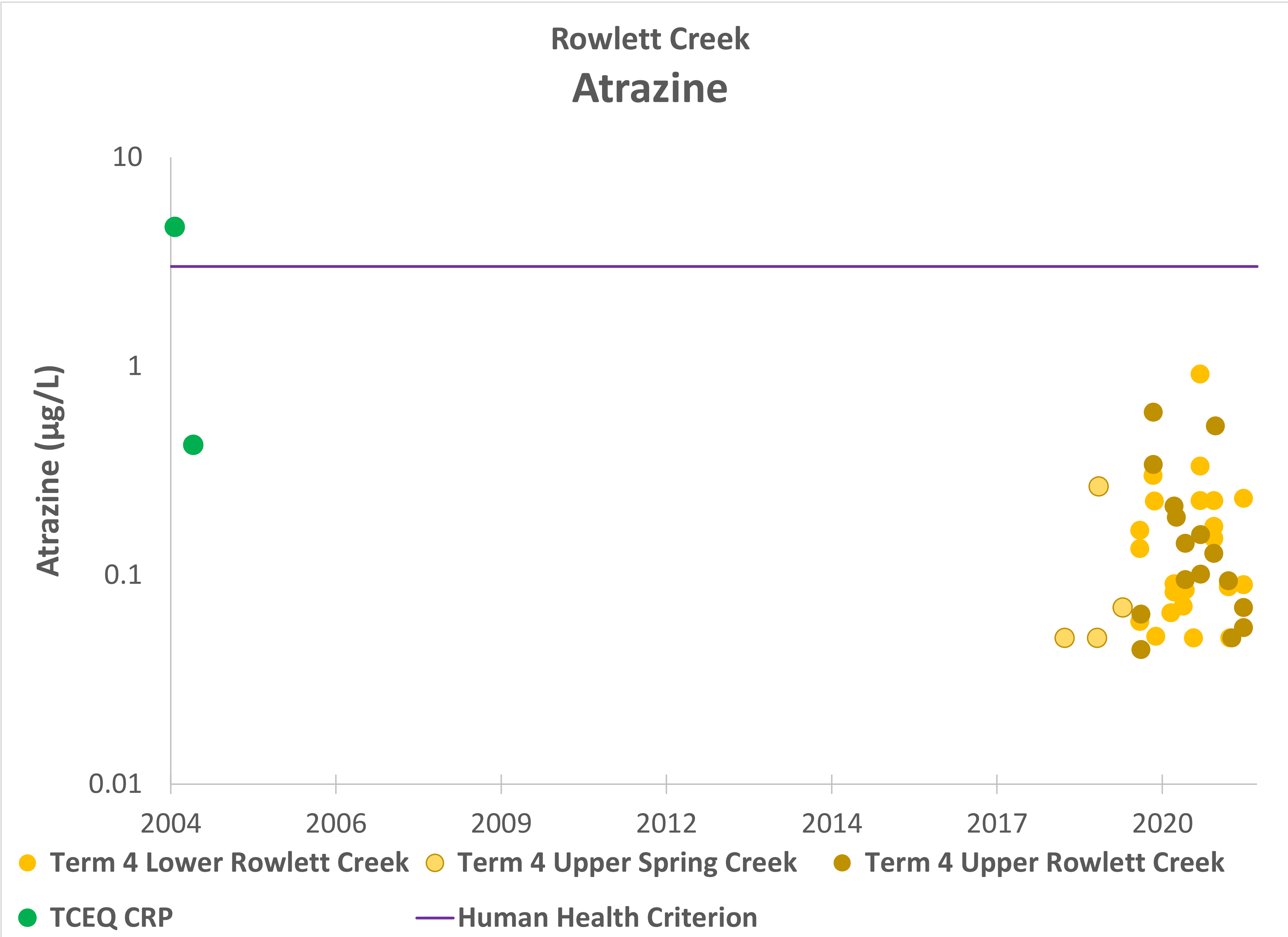


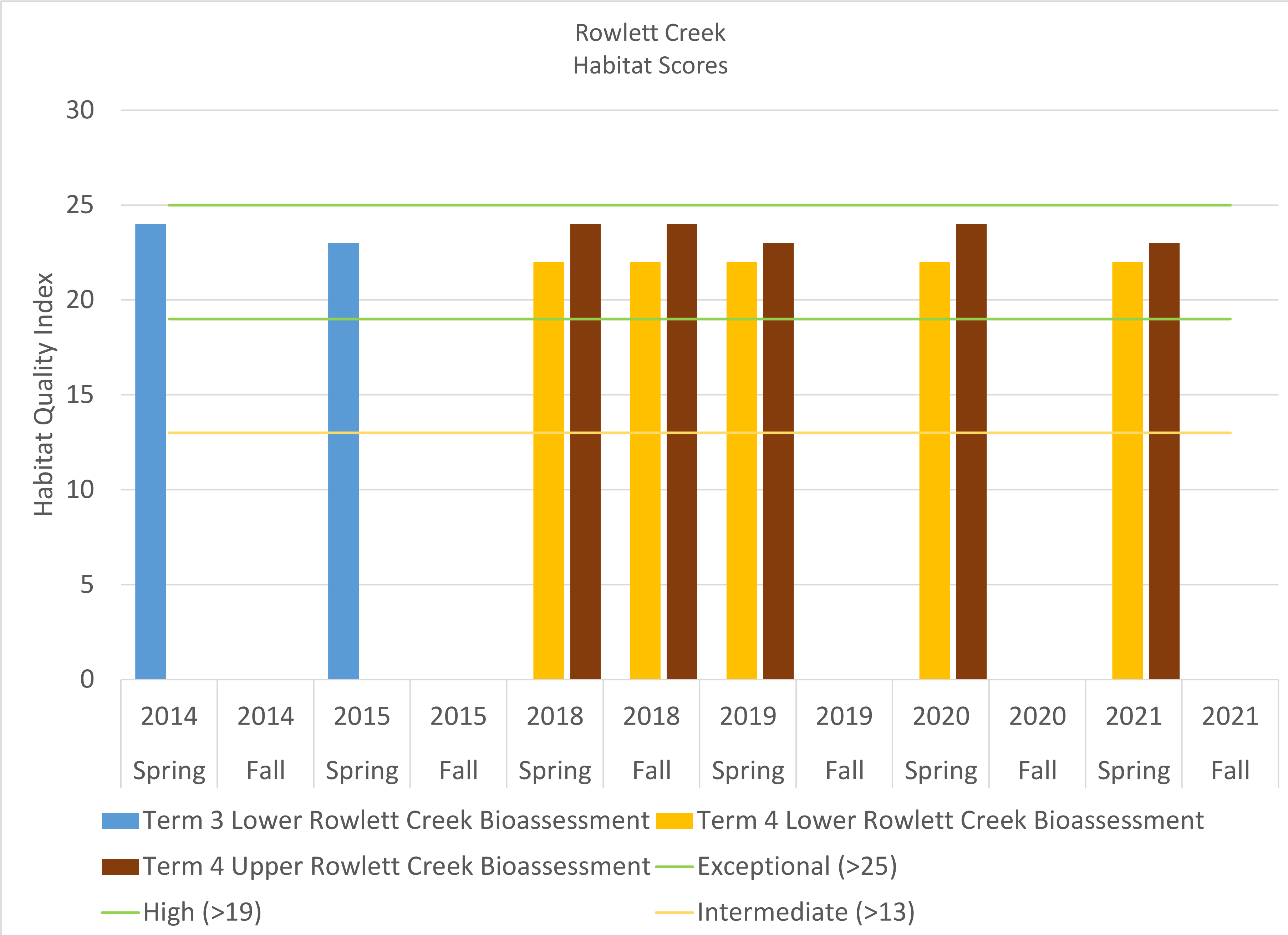
Rowlett Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
TCEQ CRP
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 4 HW (Bioassessment)
Term 4 (Bioassessment)
Term 3 Lower Rowlett Creek
Term 3 Upper Spring Creek
Term 3 (Bioassessment)
Basin Specific Criterion


Rowlett Creek
E. coli
E. Coli (col/100 mL)
1000000
100000
10000
1000
100
10
1
0.1
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
Term 4 HW (Bioassessment)
Term 4 (Bioassessment)
Term 3 Lower Rowlett Creek
Term 3 (Bioassessment)
Term 3 Upper Spring Creek
Term 2 Upper Rowlett Creek
Term 2 Lower Rowlett Creek
Term 2 Upper Spring Creek
Term 2 Lower Spring Creek
TCEQ CRP
PCR Geomean
PCR Single Sample

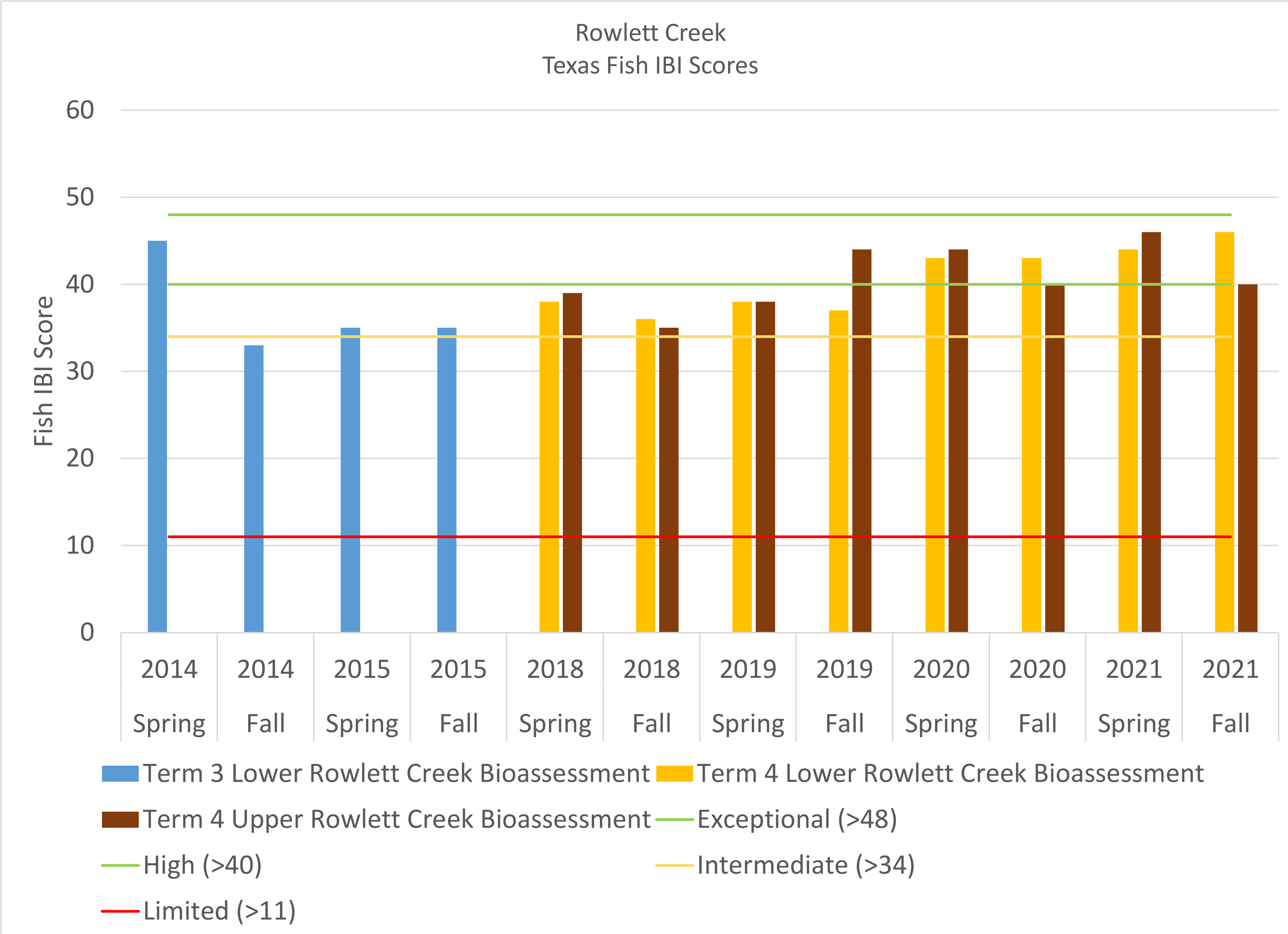


Rowlett Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
14
12
10
8
6
4
2
0
2000
2003
2006
2009
2012
2015
2018
2021
Term 4 HW (Bioassessment)
Term 4 (Bioassessment)
Term 3 (Bioassessment)
TCEQ CRP
Basin Specific Criterion (>3)
Spring Criterion (>4)

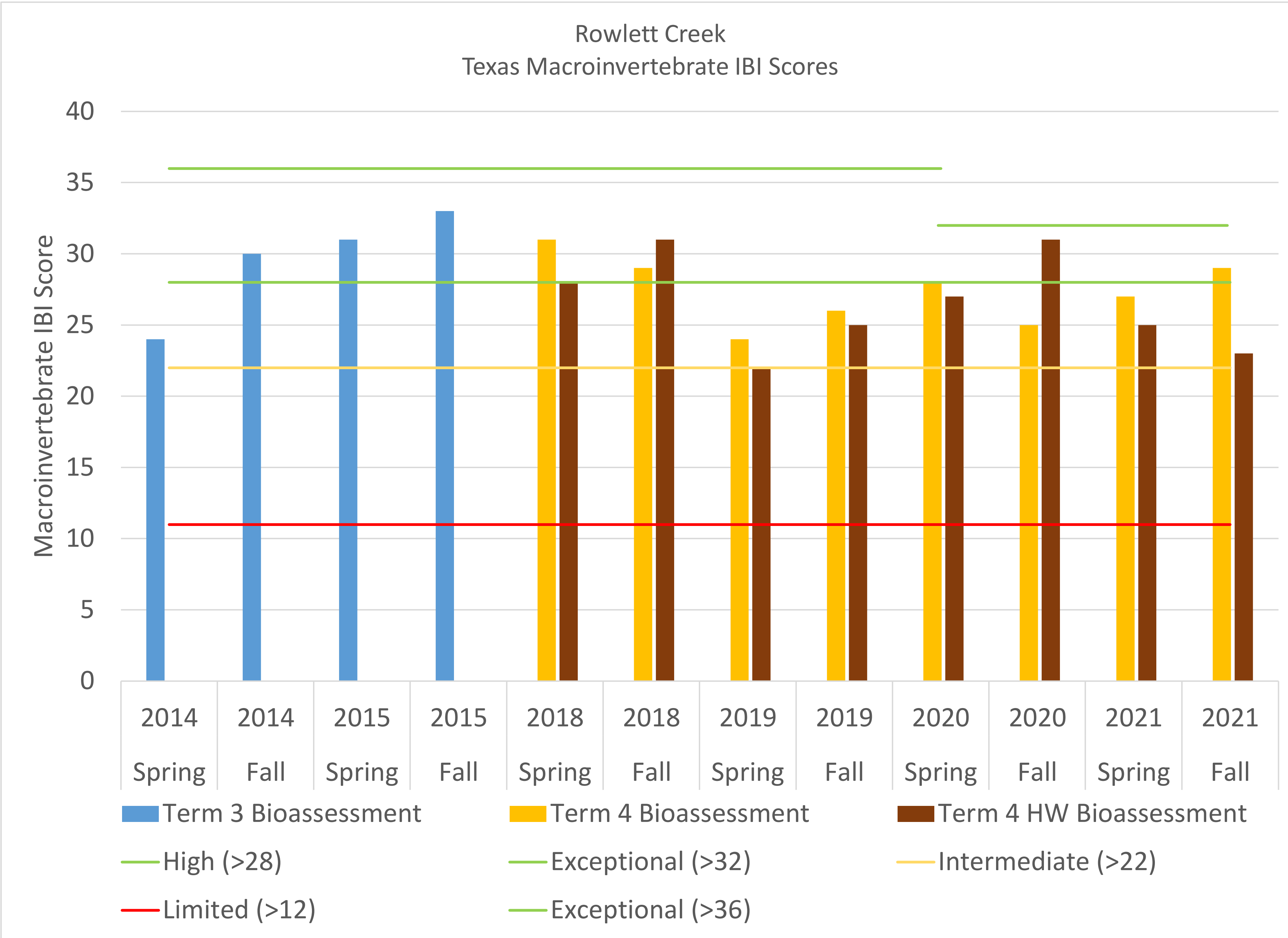

Rowlett Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
2004
2006
2009
2012
2014
2017
2020
Term 4 Lower Rowlett Creek
Term 4 Upper Spring Creek
Term 4 Upper Rowlett Creek
TCEQ CRP
Human Health Criterion



Rowlett Creek
Habitat Scores
30
25
20
15
10
5
0
Habitat Quality Index
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
Term 3 Lower Rowlett Creek Bioassessment
Term 4 Lower Rowlett Creek Bioassessment
Term 4 Upper Rowlett Creek Bioassessment
Exceptional (>25)
High (>19)
Intermediate (>13)

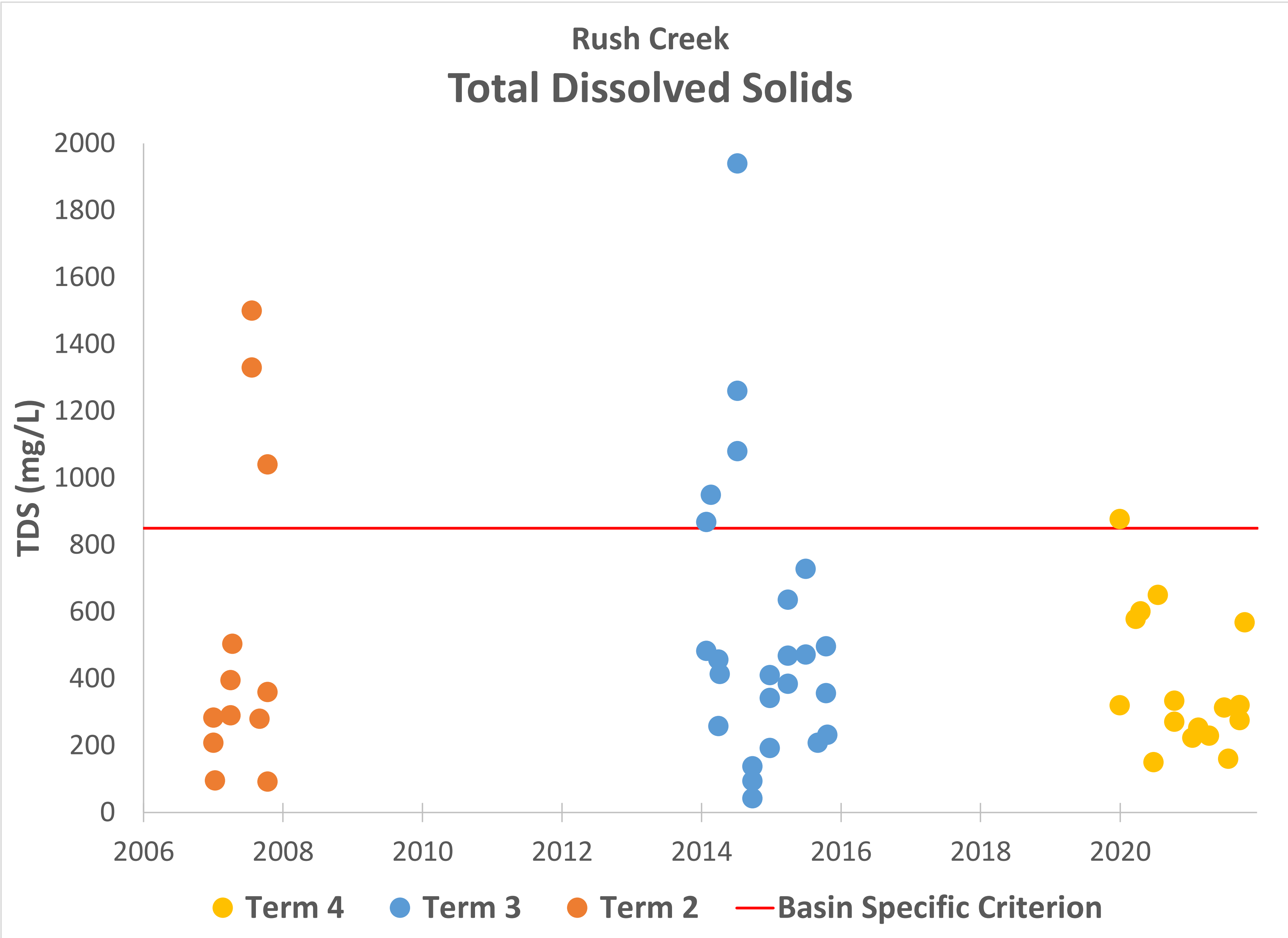


Rowlett Creek
Texas Fish IBI Scores
Fish IBI Score
60
50
40
30
20
10
0
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
Term 3 Lower Rowlett Creek Bioassessment
Term 4 Lower Rowlett Creek Bioassessment
Term 4 Upper Rowlett Creek Bioassessment
Exceptional (>48)
High (>40)
Intermediate (>34)
Limited (>11)

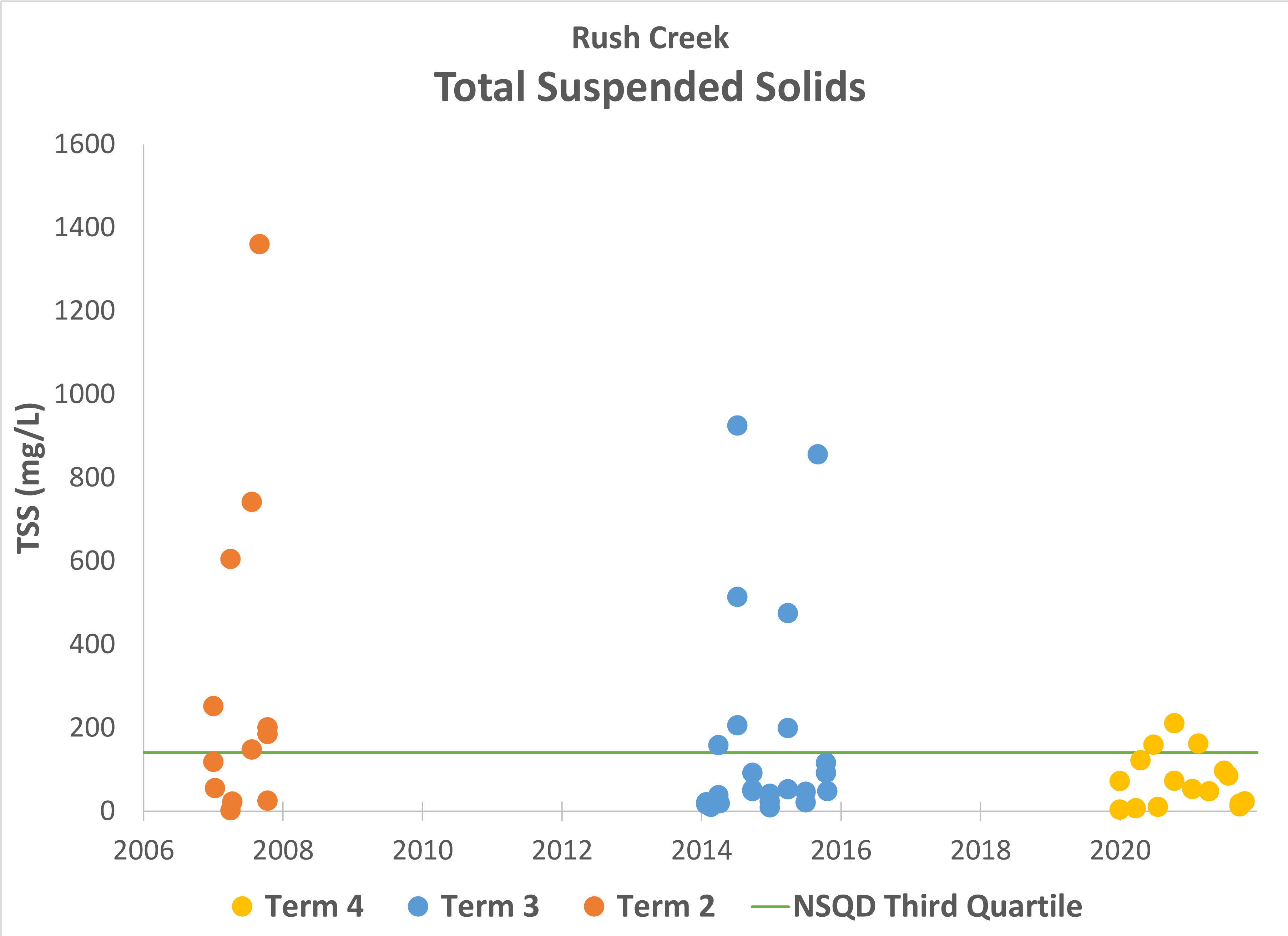

Rowlett Creek
Texas Macroinvertebrate IBI Scores
Macroinvertebrate IBI Score
40
35
30
25
20
15
10
5
0
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
Term 3 Bioassessment
Term 4 Bioassessment
Term 4 HW Bioassessment
High (>28)
Exceptional (>32)
Intermediate (>22)
Limited (>12)
Exceptional (>36)

Appendix V

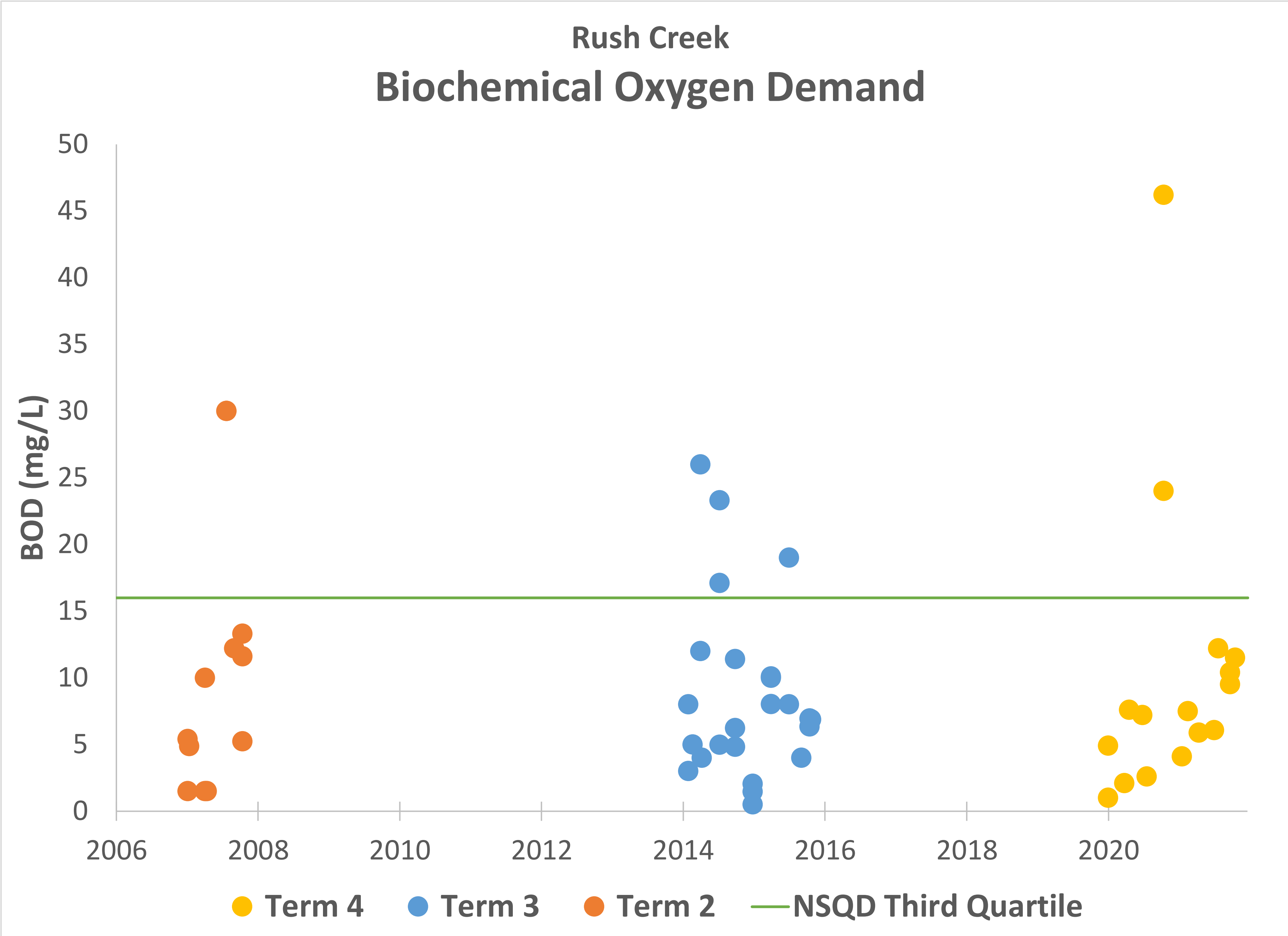
Rush Creek Water Quality Data Graphs

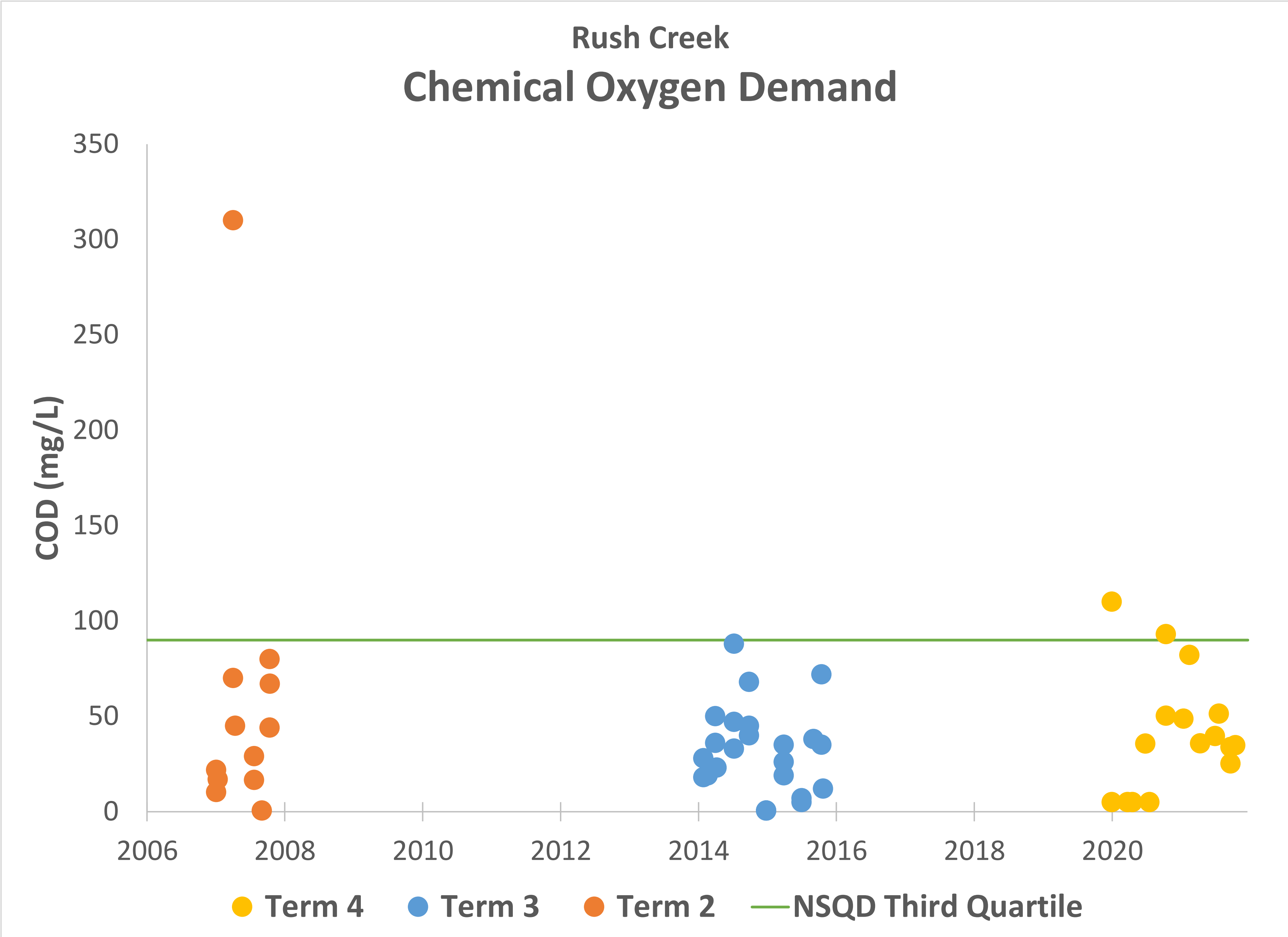


Rush Creek
Total Dissolved Solids
TDS (mg/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
Basin Specific Criterion

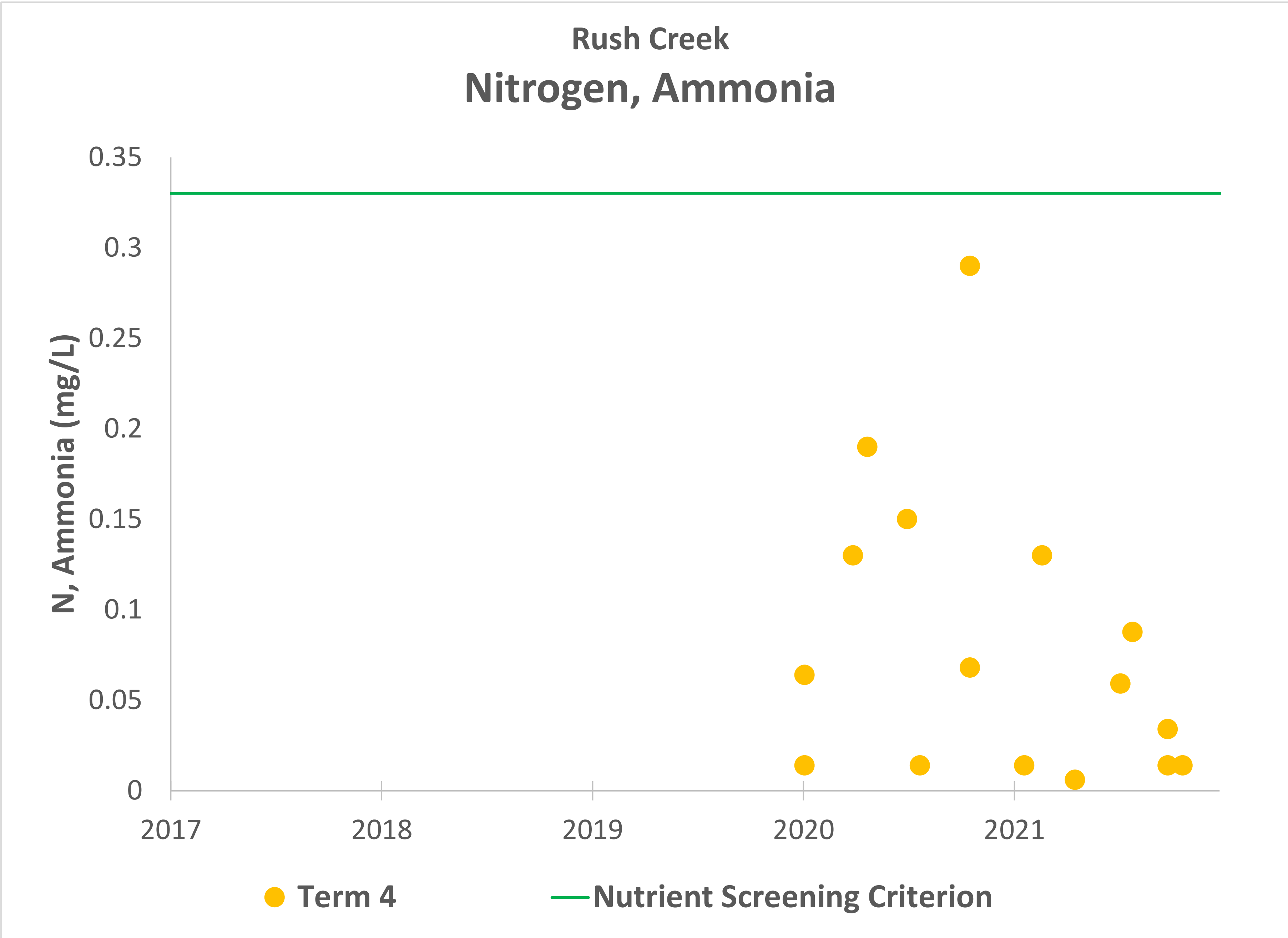


Rush Creek
Total Suspended Solids
TSS (mg/L)
1600
1400
1200
1000
800
600
400
200
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile

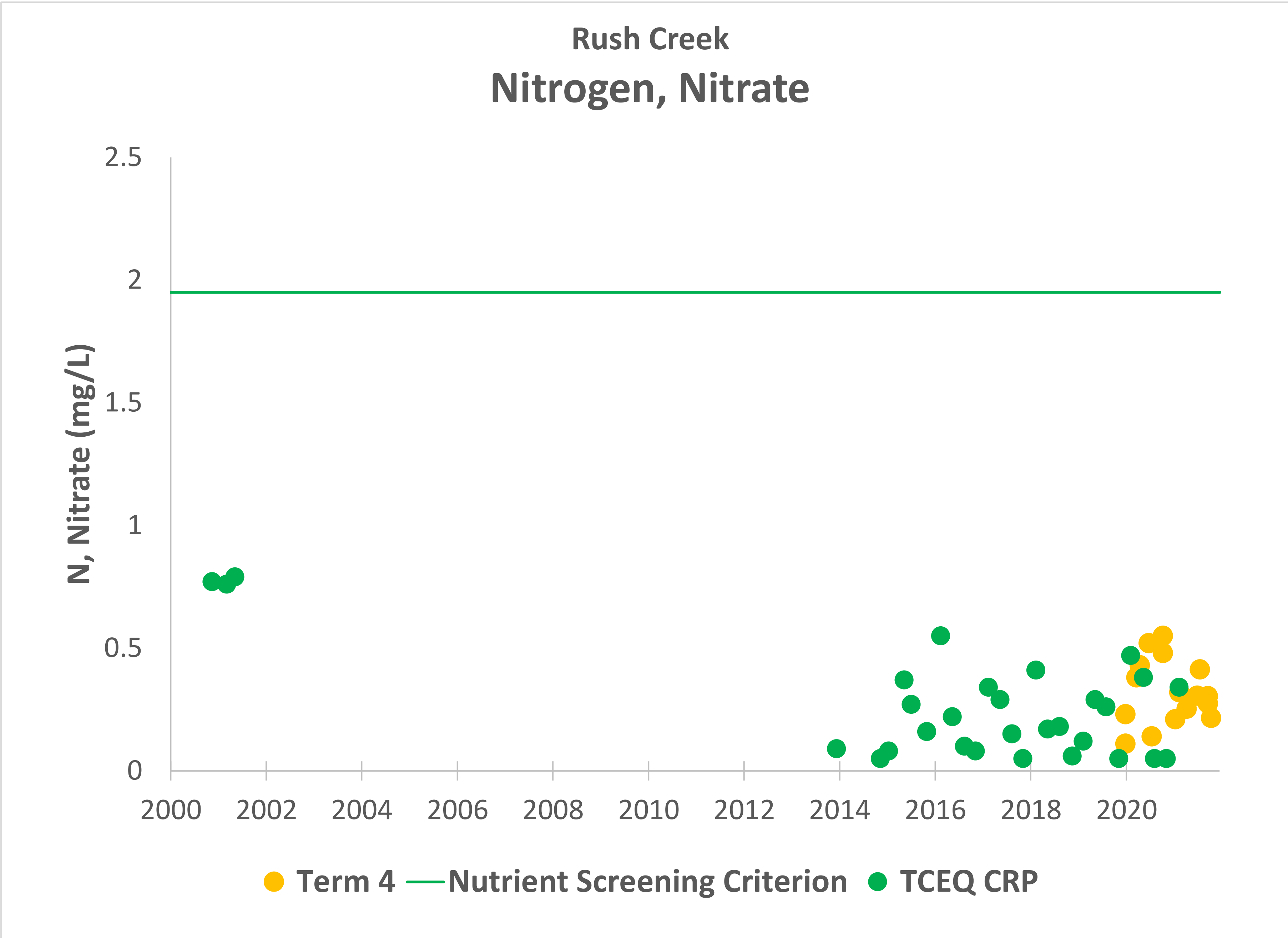

Rush Creek
Biochemical Oxygen Demand
BOD (mg/L)
50
45
40
35
30
25
20
15
10
5
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile



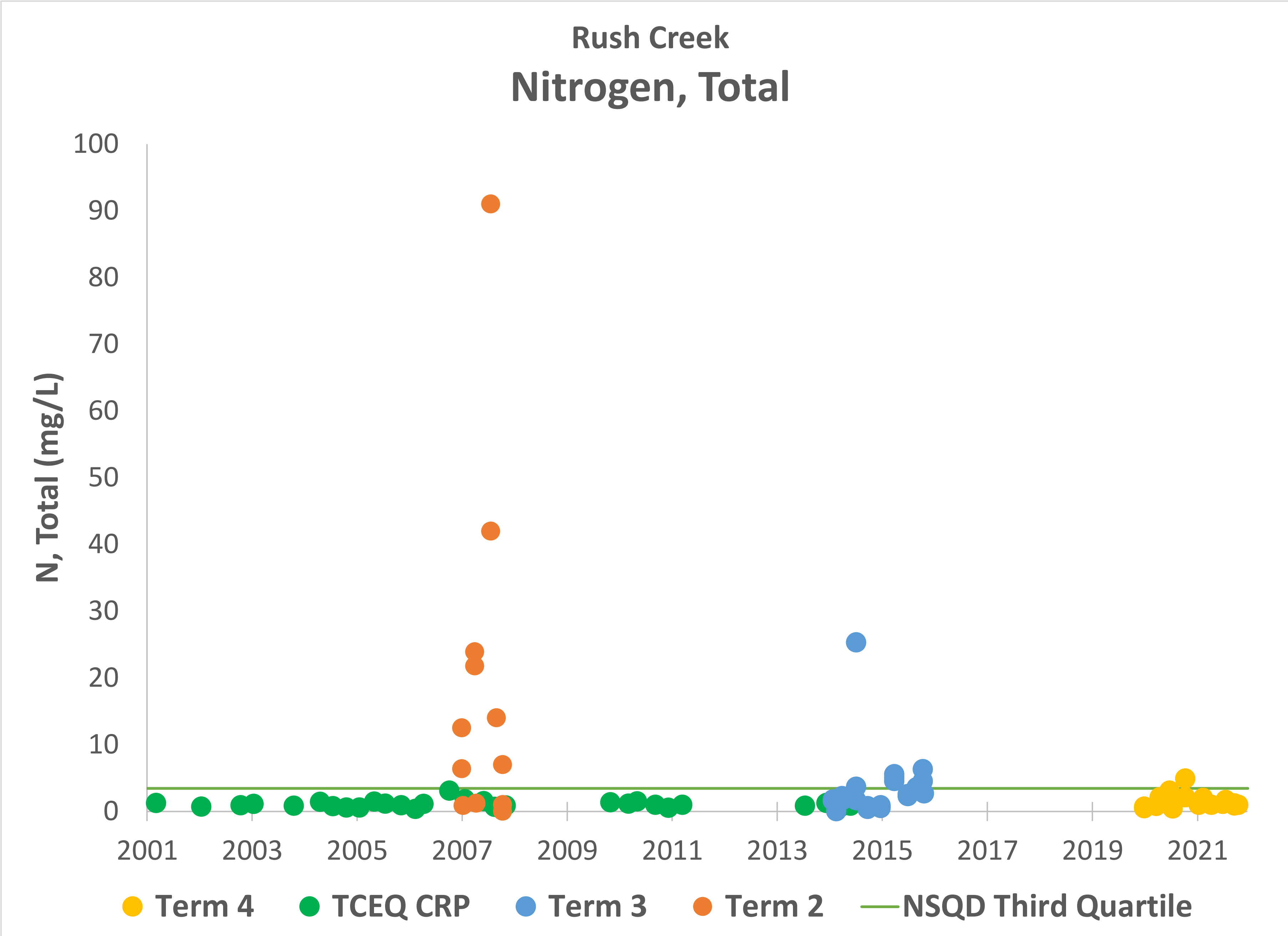
Rush Creek
Chemical Oxygen Demand
COD (mg/L)
350
300
250
200
150
100
50
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile

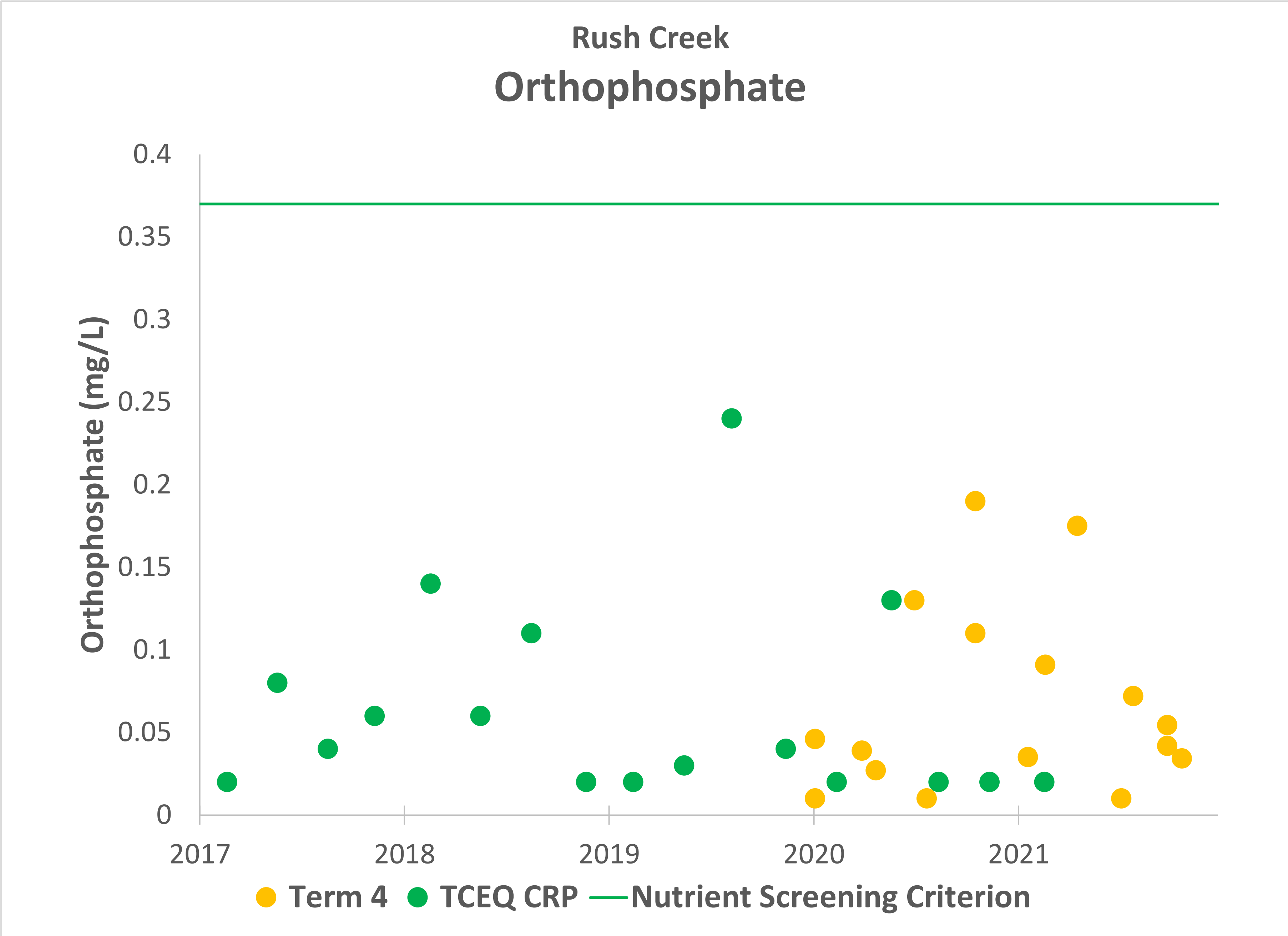


Rush Creek
Nitrogen, Ammonia
N, Ammonia (mg/L)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

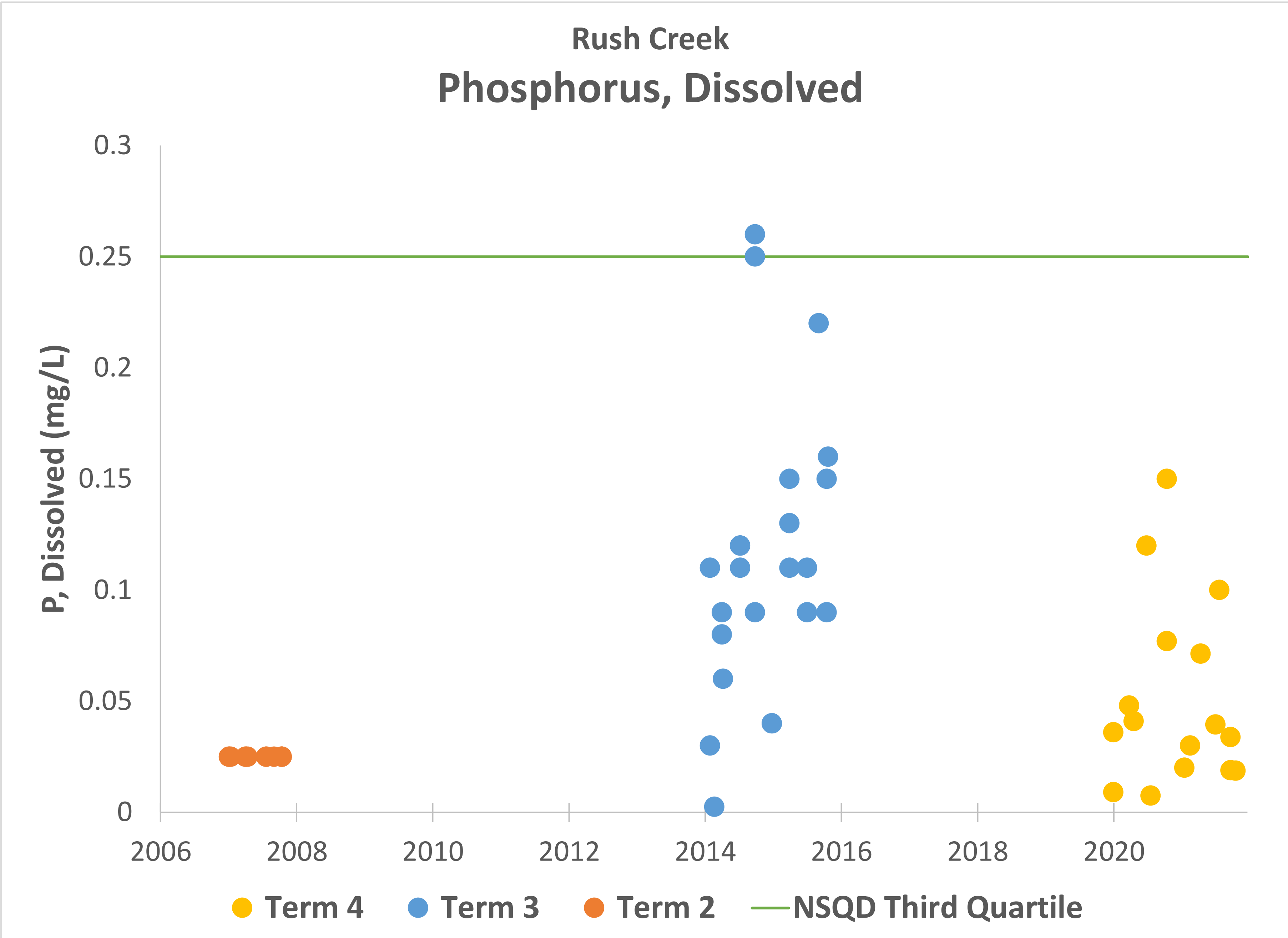


Rush Creek
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Nutrient Screening Criterion
TCEQ CRP

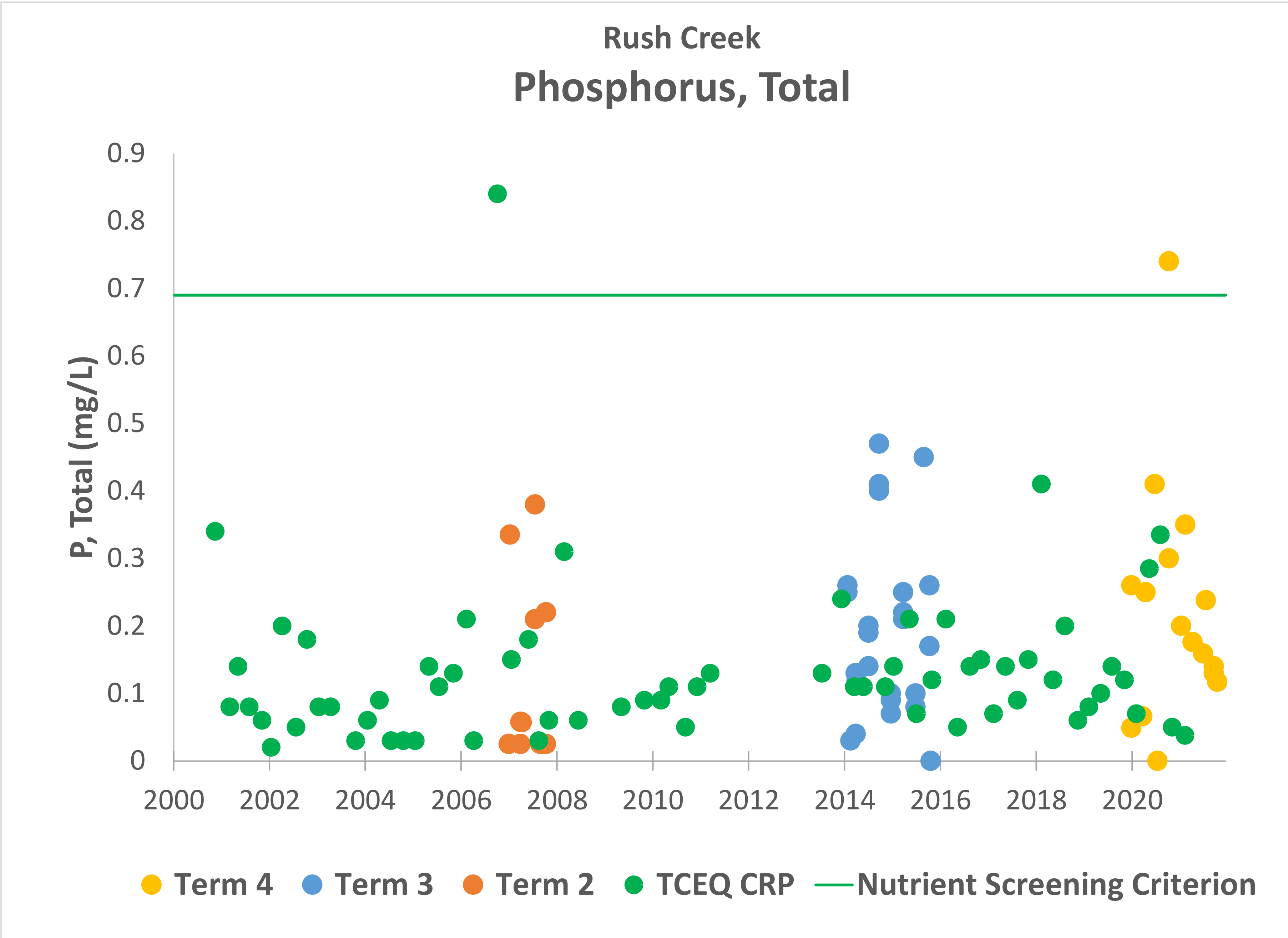

Rush Creek
Nitrogen, Total
N, Total (mg/L)
100
90
80
70
60
50
40
30
20
10
0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
TCEQ CRP
Term 3
Term 2
NSQD Third Quartile



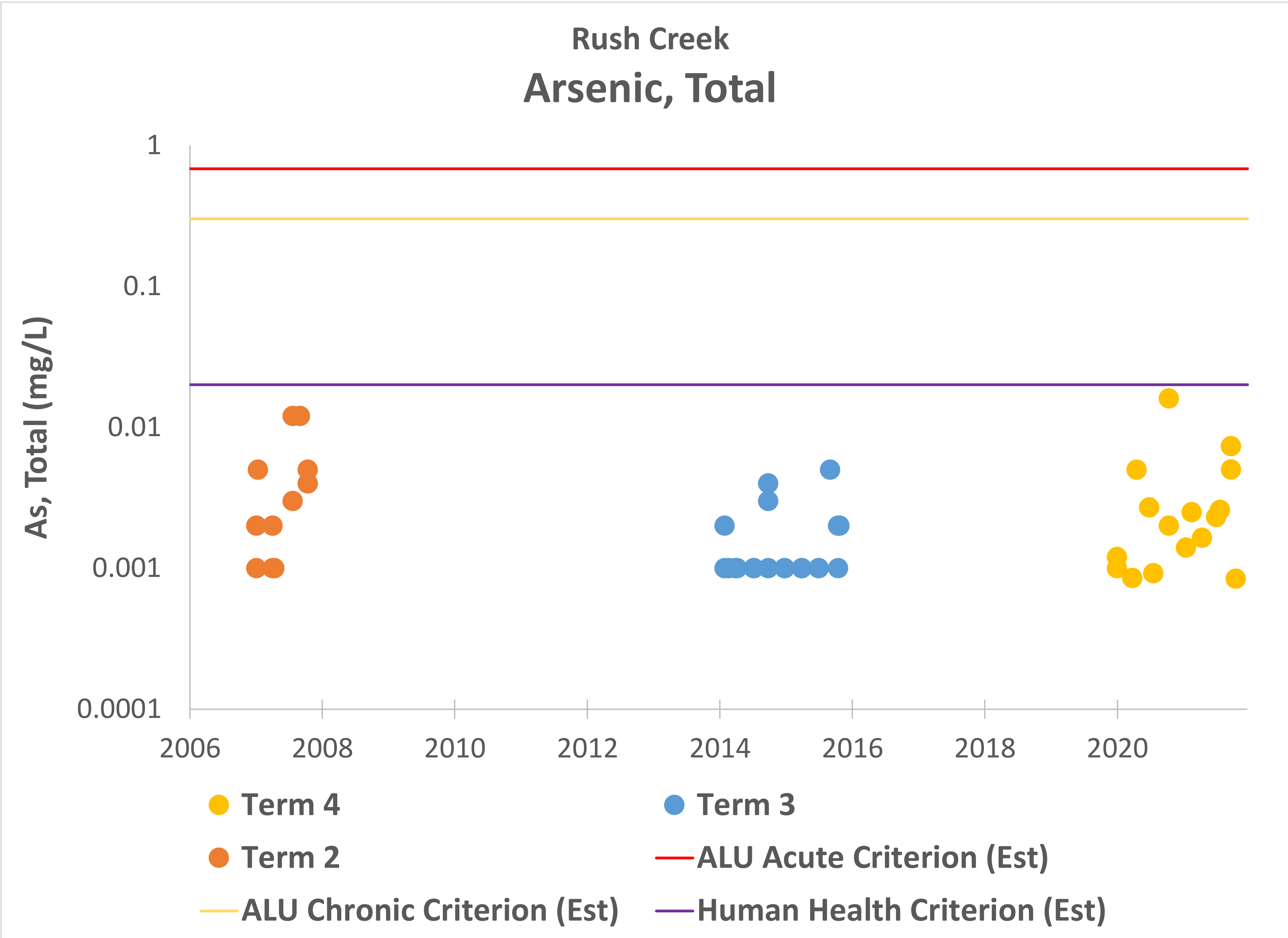
Rush Creek
Orthophosphate
Orthophosphate (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2017
2018
2019
2020
2021
Term 4
TCEQ CRP
Nutrient Screening Criterion

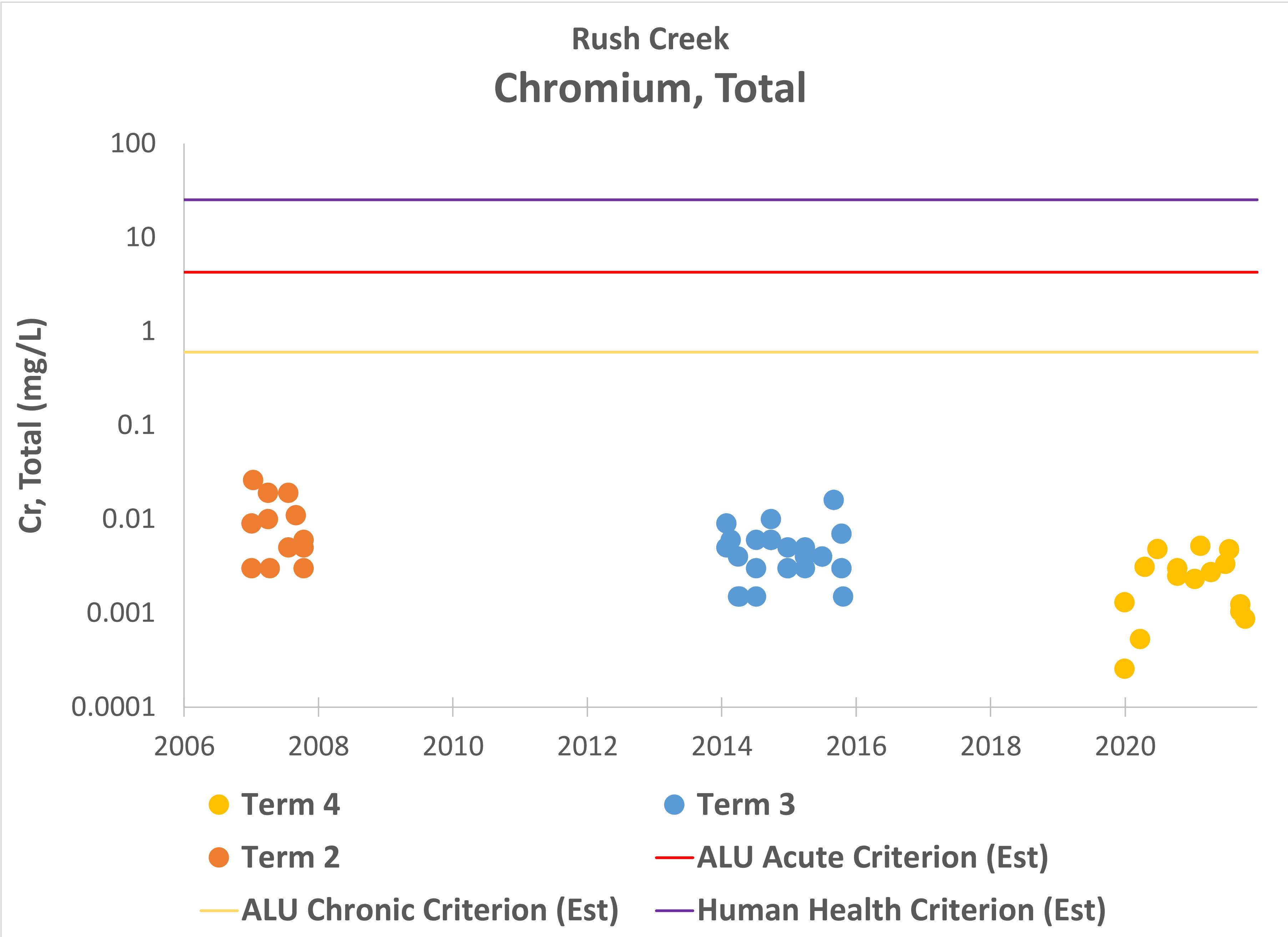


Rush Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile

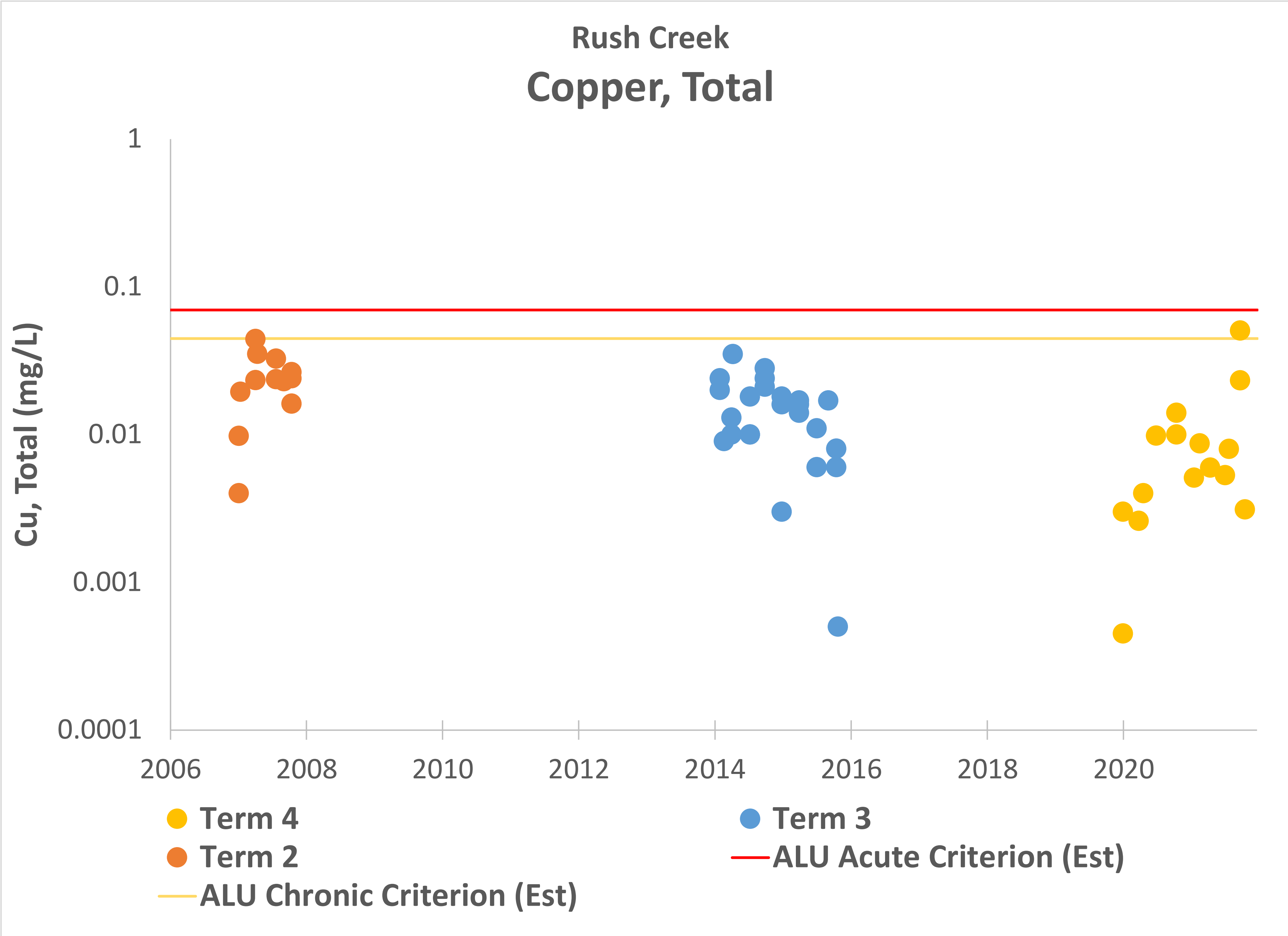


Rush Creek
Phosphorus, Total
P, Total (mg/L)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
TCEQ CRP
Nutrient Screening Criterion

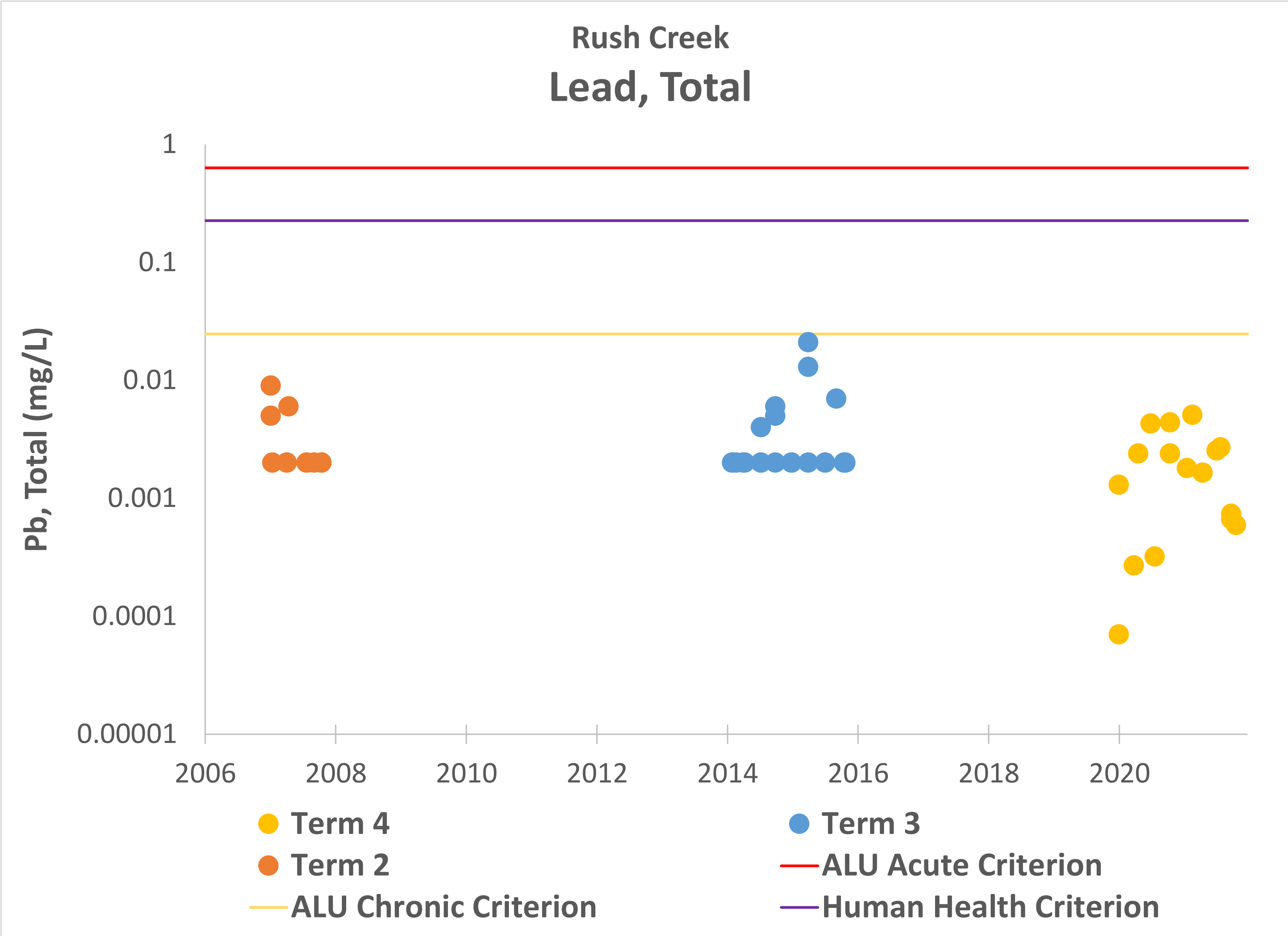

Rush Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



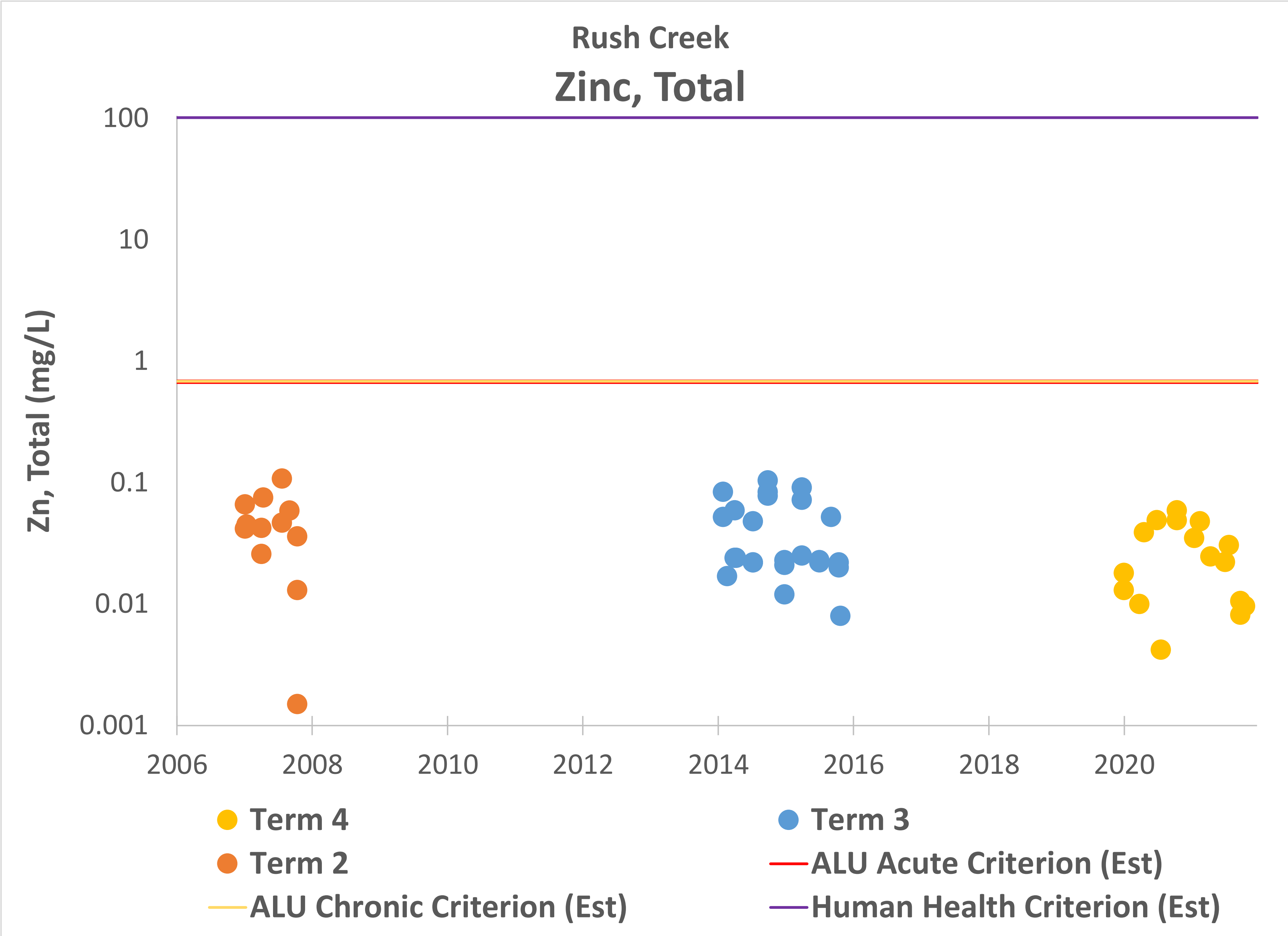
Rush Creek
Chromium, Total
Cr, Total (mg/L)
100
10
1
0.1
0.01
0.001
0.0001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



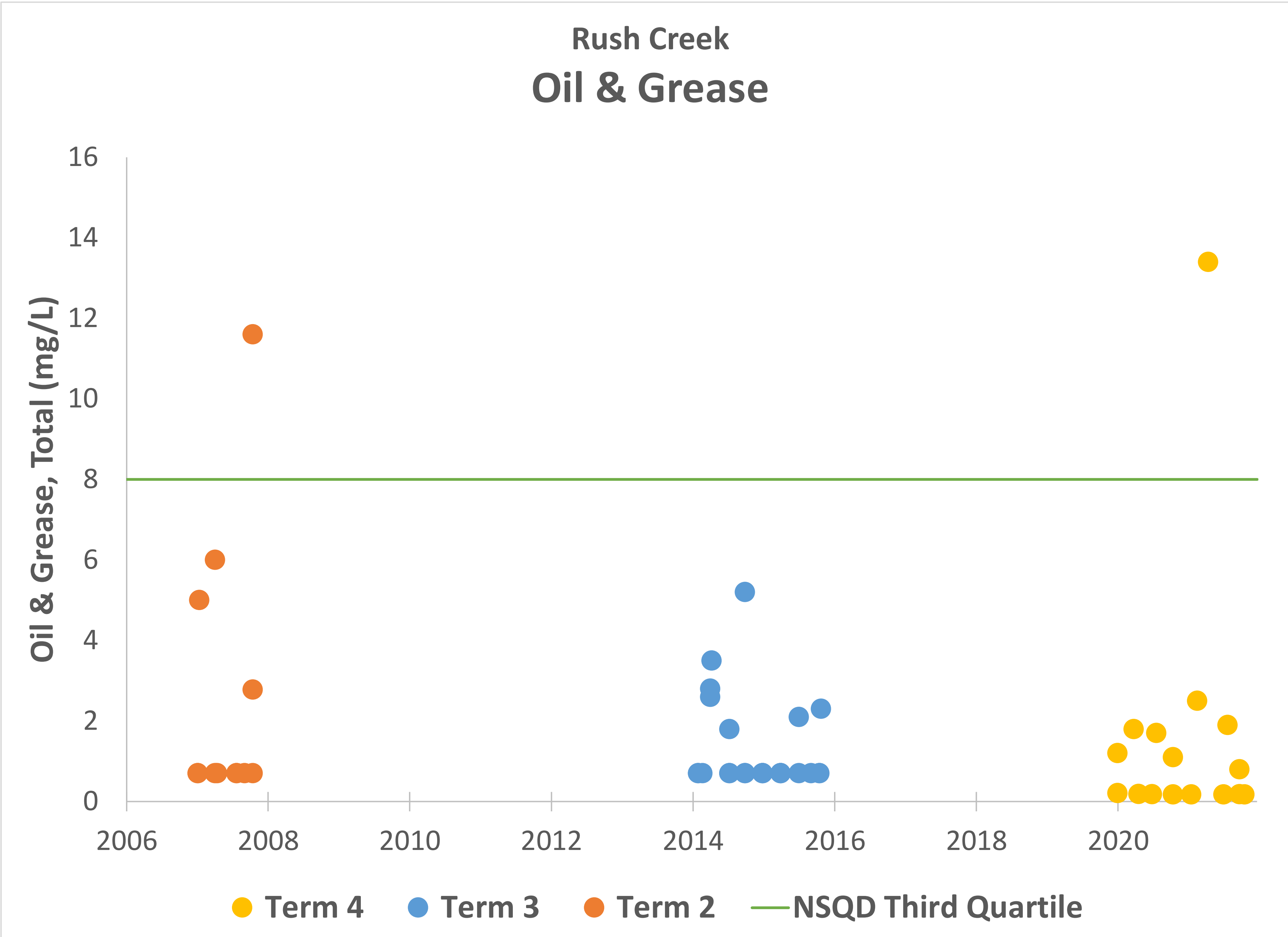
Rush Creek
Copper, Total
Cu, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)

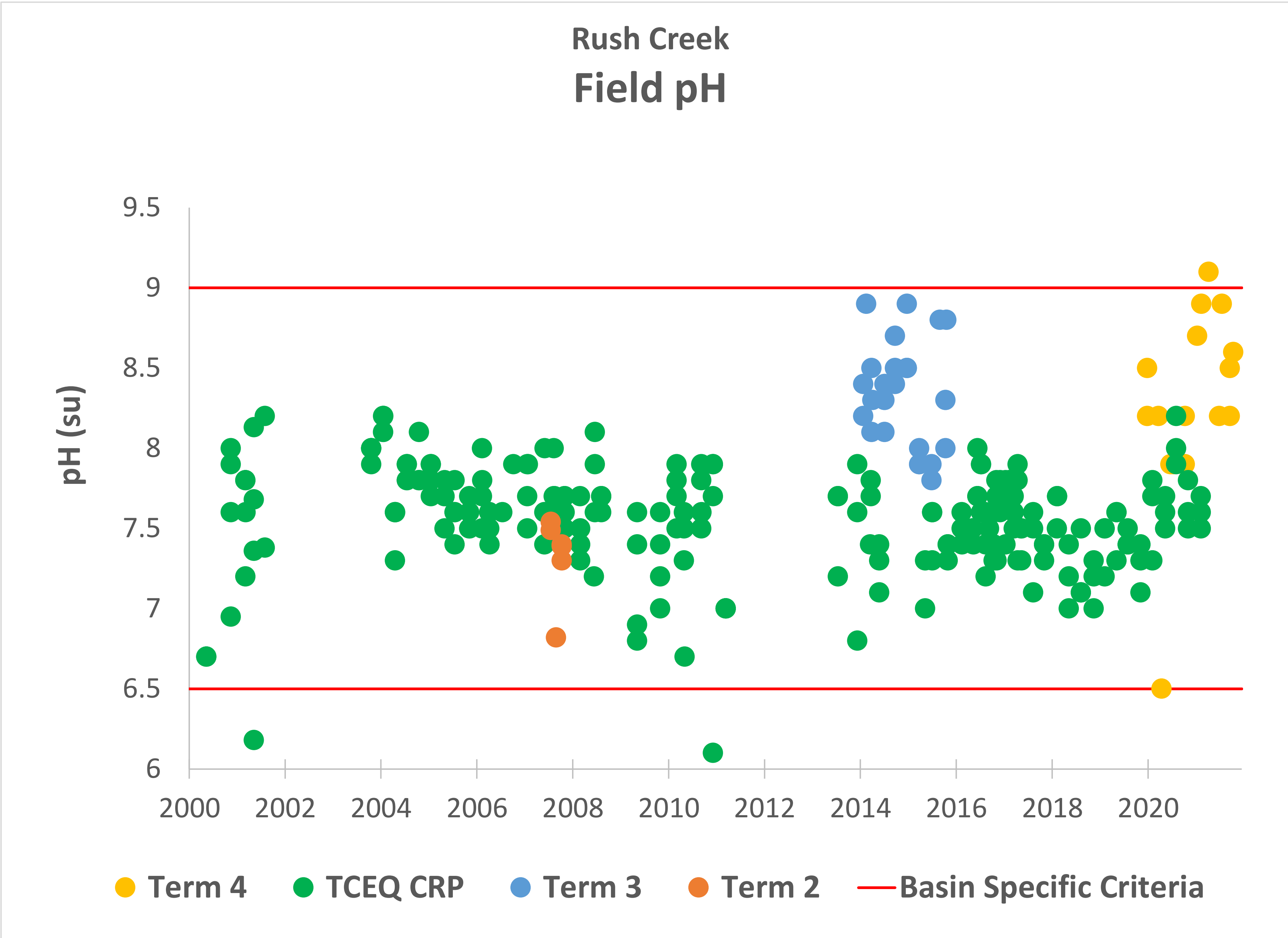


Rush Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
0.00001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion
ALU Chronic Criterion
Human Health Criterion

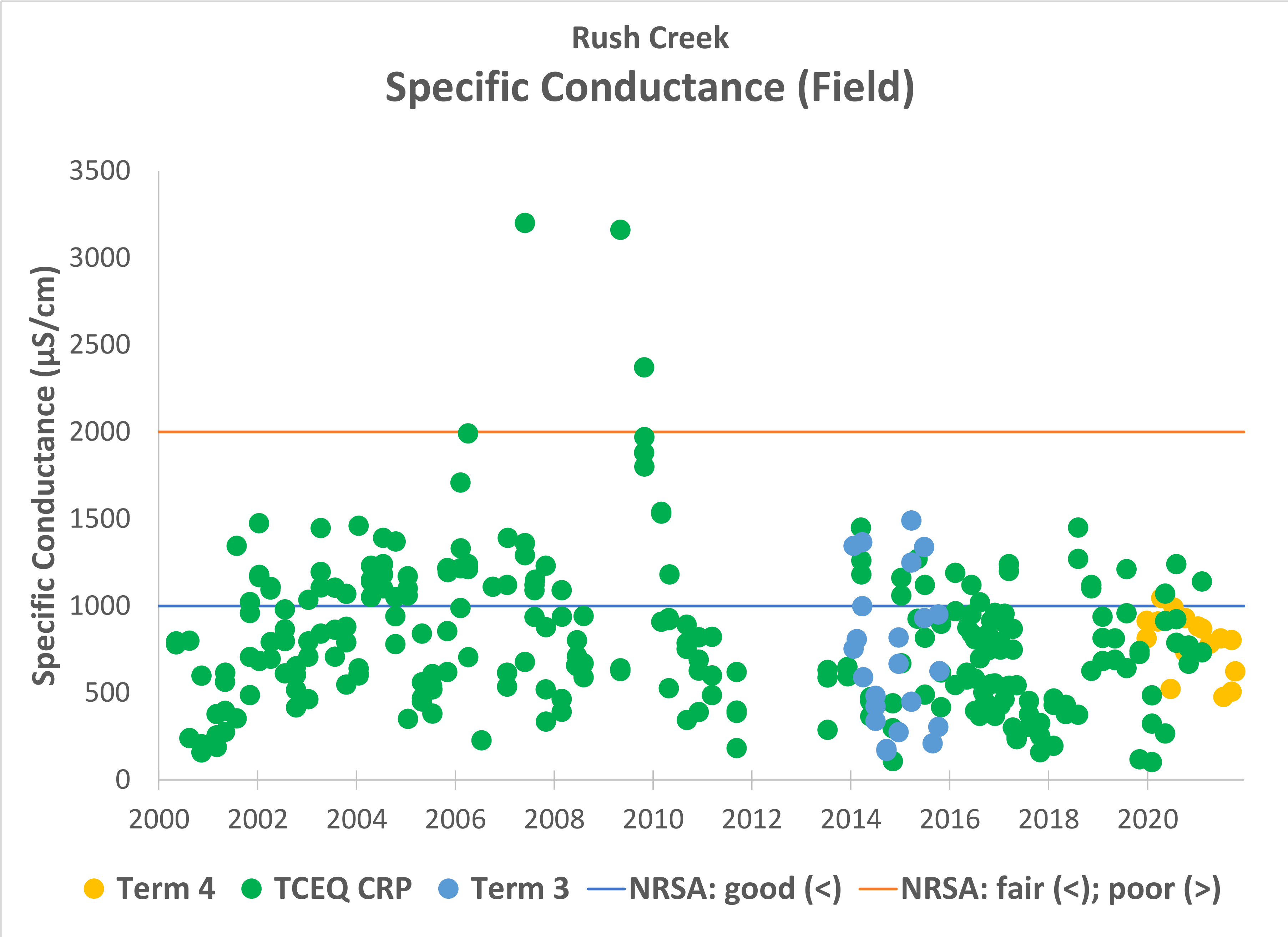


Rush Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

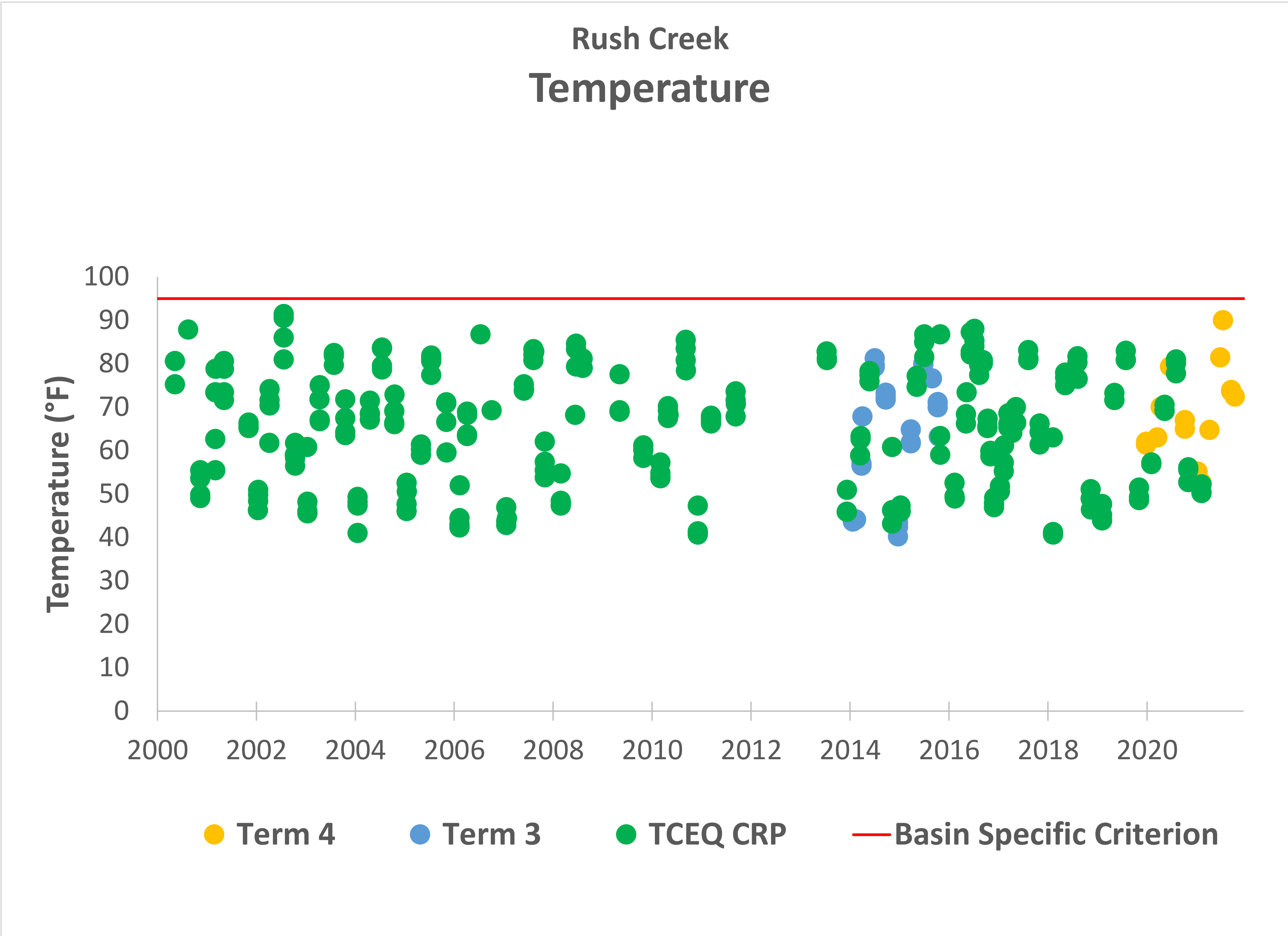

Rush Creek
Oil & Grease
Oil & Grease, Total (mg/L)
16
14
12
10
8
6
4
2
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile

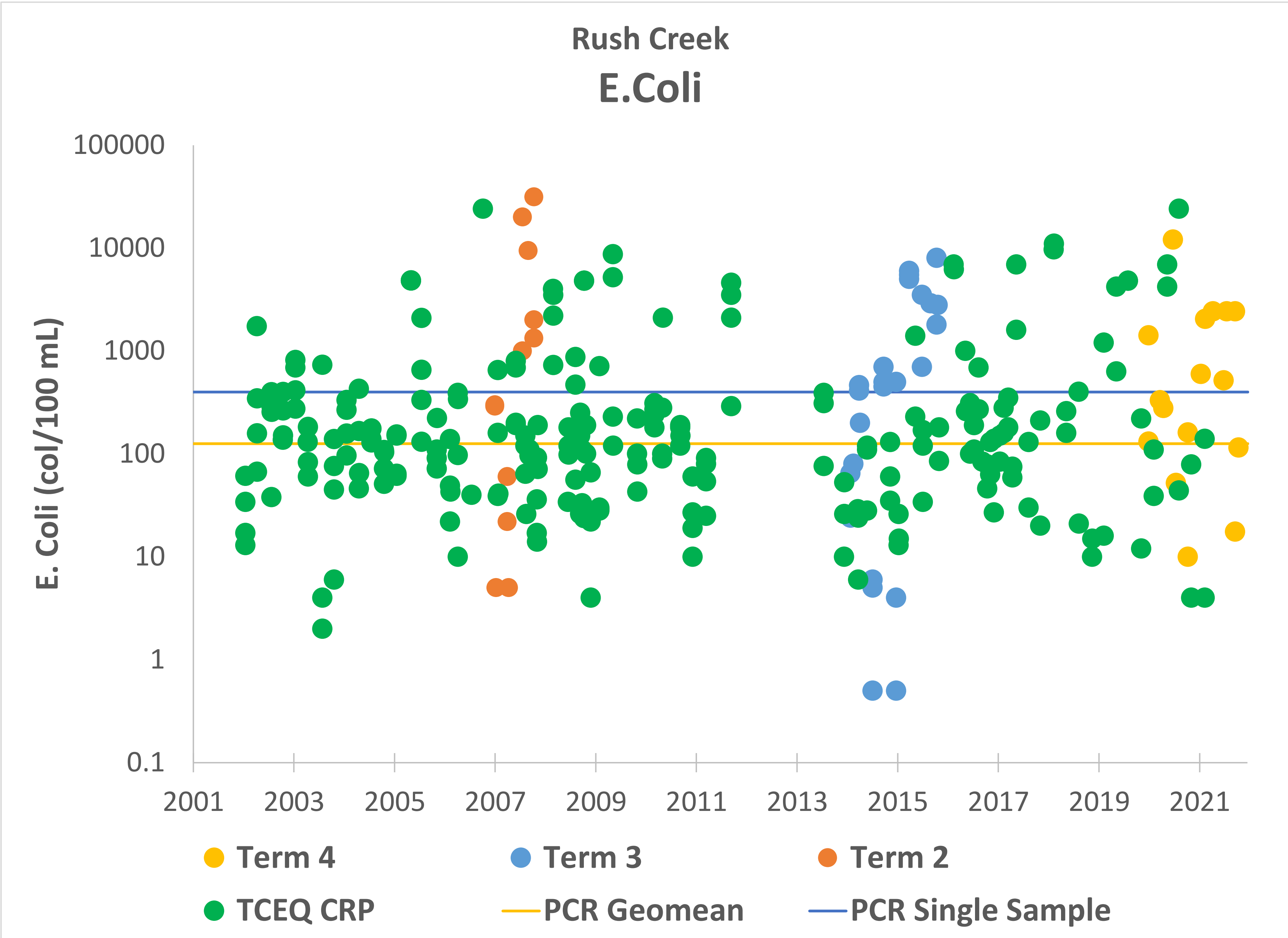


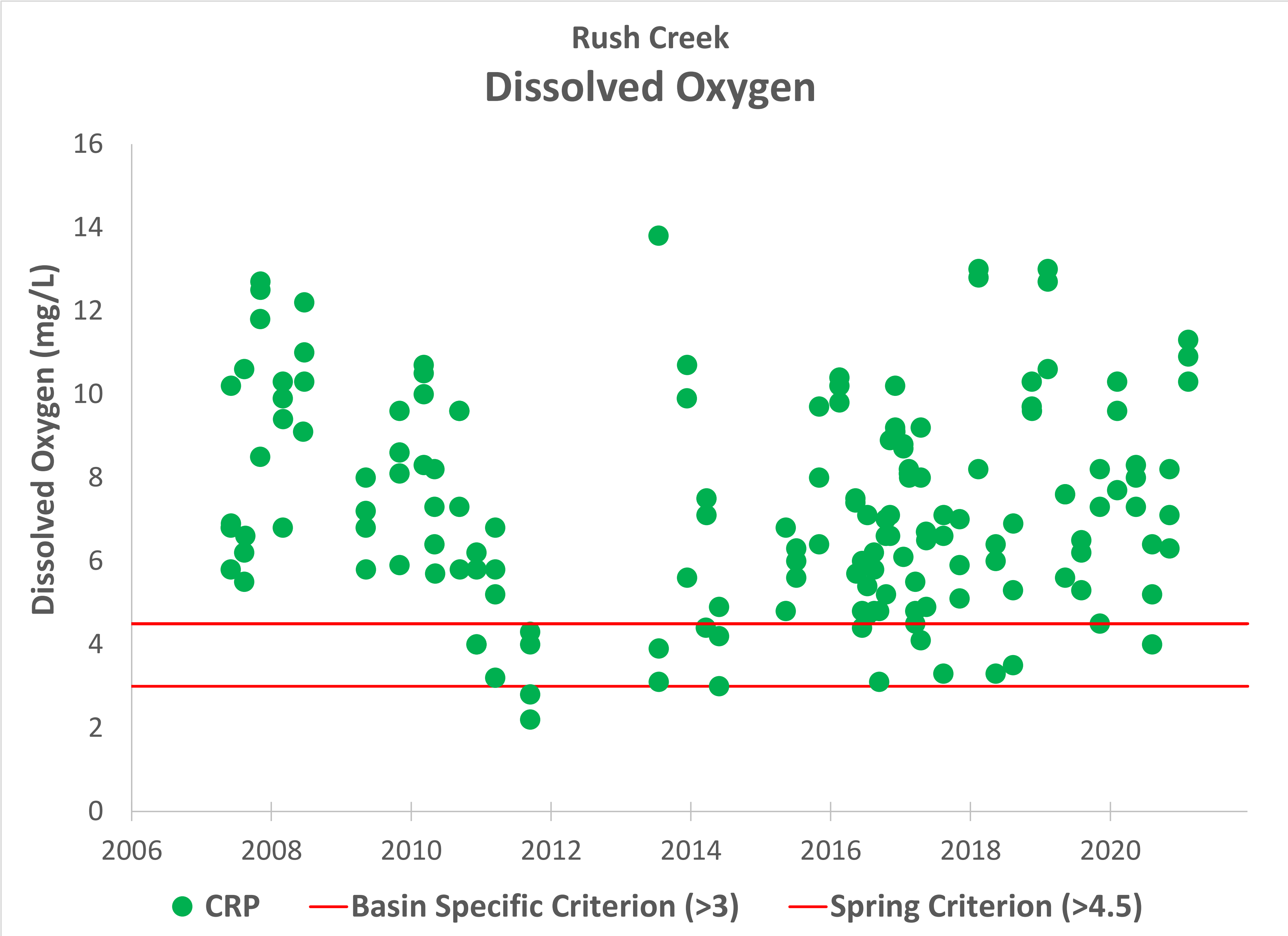
Rush Creek
Field pH
pH (su)
9.5
9
8.5
8
7.5
7
6.5
6
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Term 3
Term 2
Basin Specific Criteria

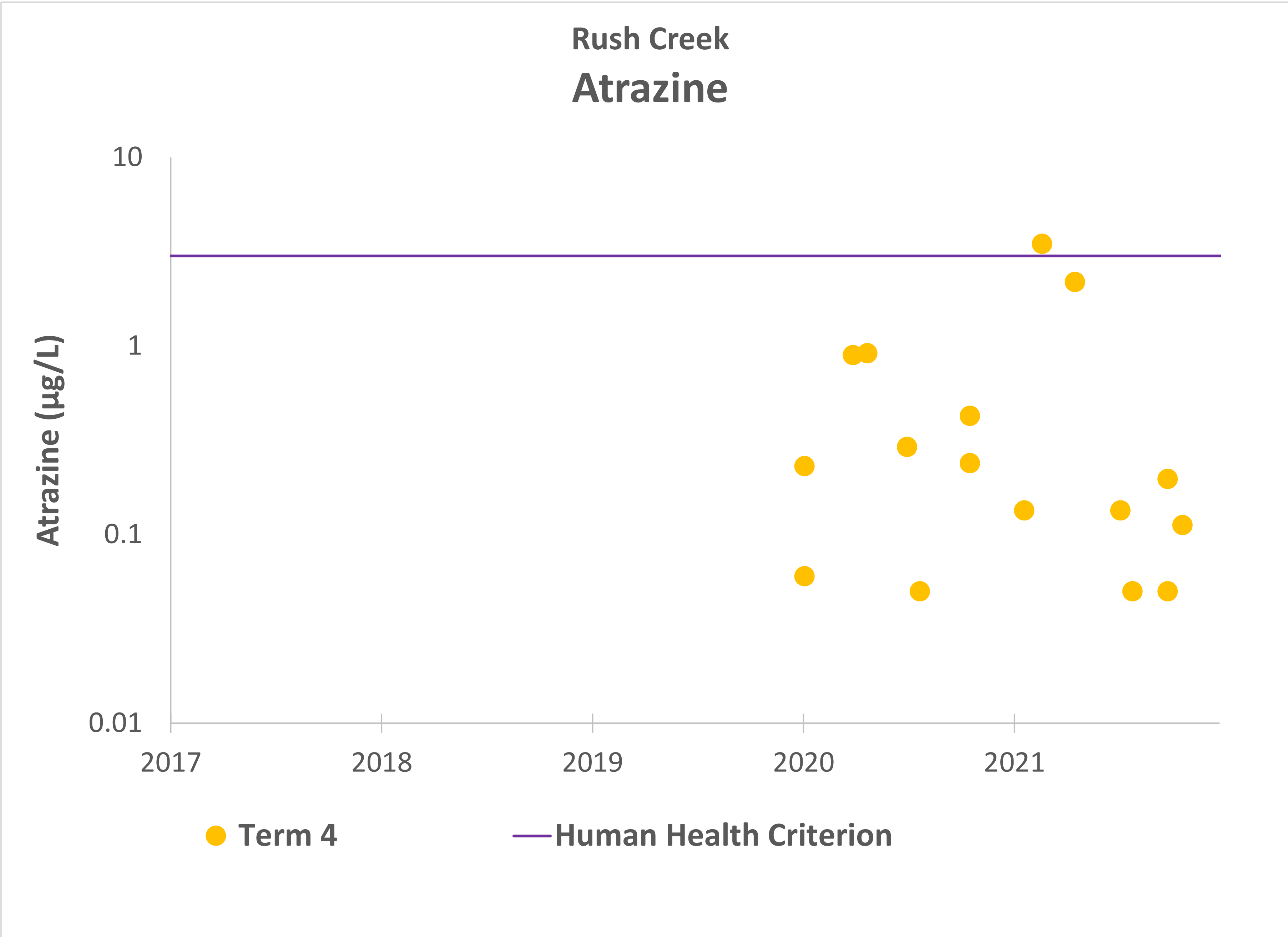


Rush Creek
Specific Conductance (Field)
Specific Conductance (µS/cm)
3500
3000
2500
2000
1500
1000
500
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
TCEQ CRP
Term 3
NRSA: good (<)
NRSA: fair (<); poor (>)


Rush Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
TCEQ CRP
Basin Specific Criterion

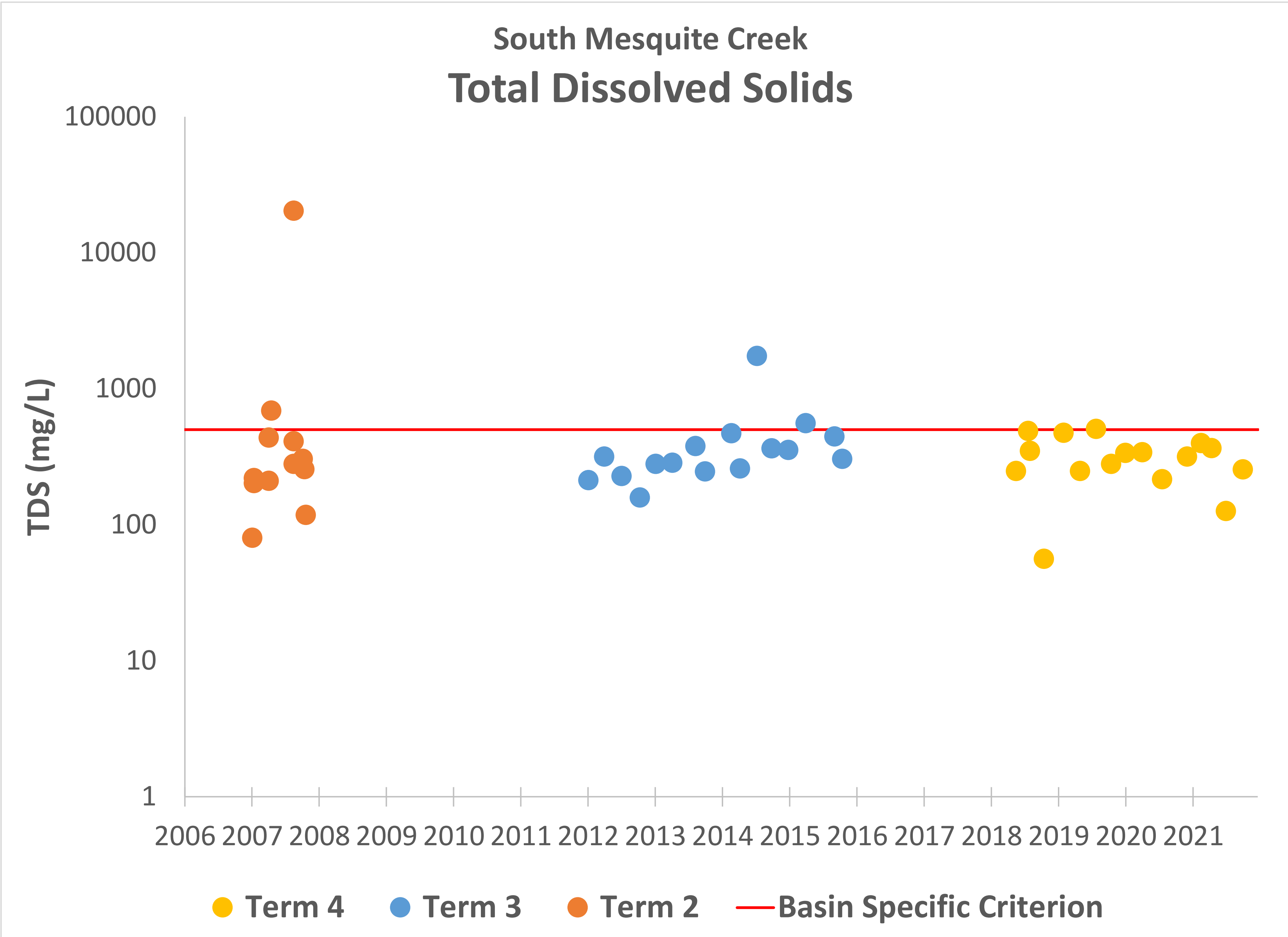

Rush Creek
E.Coli
E. Coli (col/100 mL)
100000
10000
1000
100
10
1
0.1
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
TCEQ CRP
PCR Geomean
PCR Single Sample

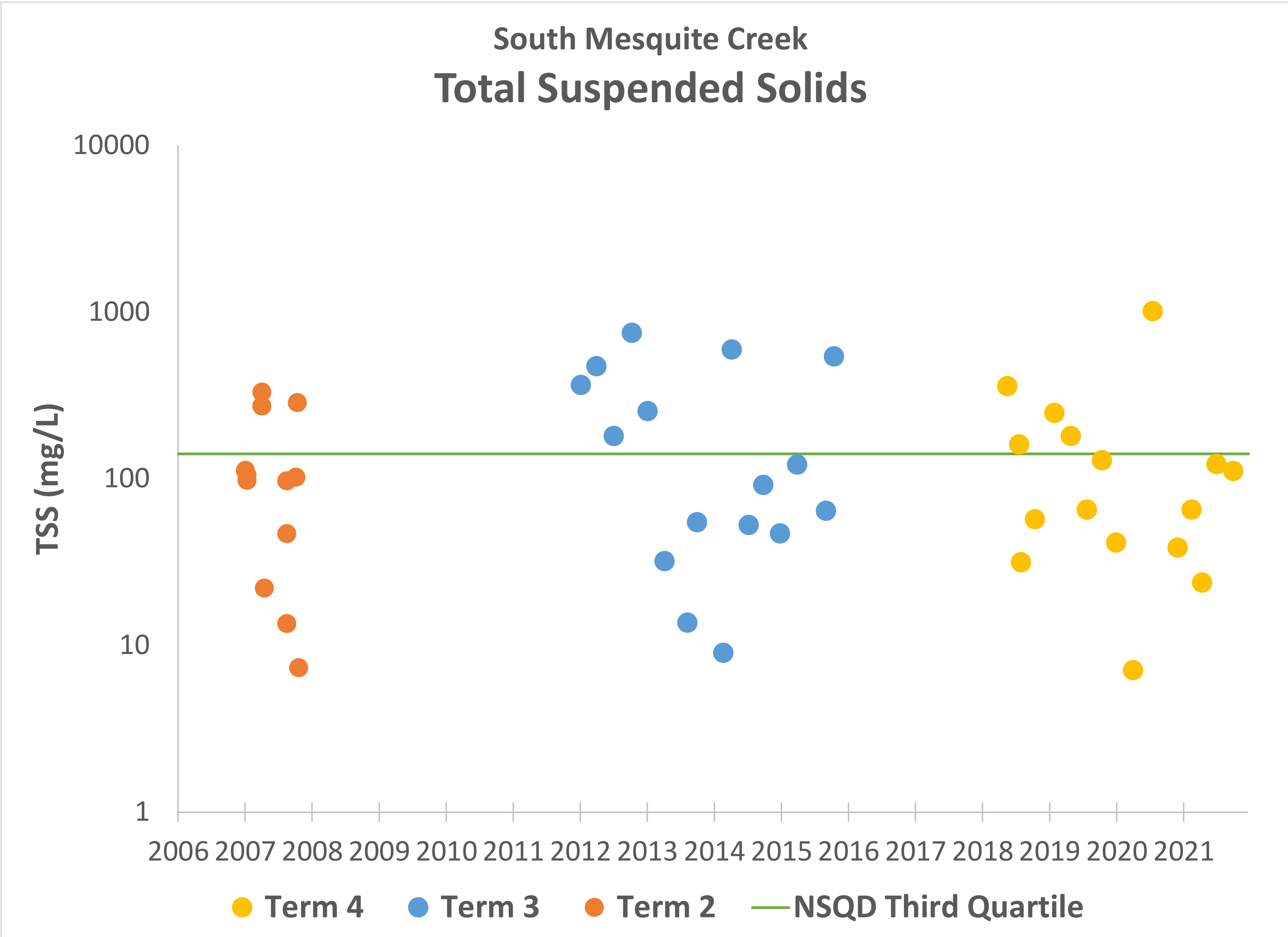

Rush Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
14
16
2006
2008
2010
2012
2014
2016
2018
2020
CRP
Basin Specific Criterion (>3)
Spring Criterion (>4.5)


Rush Creek
Atrazine
10
1
0.1
0.01
Atrazine (µg/L)
2017
2018
2019
2020
2021
Term 4
Human Health Criterion

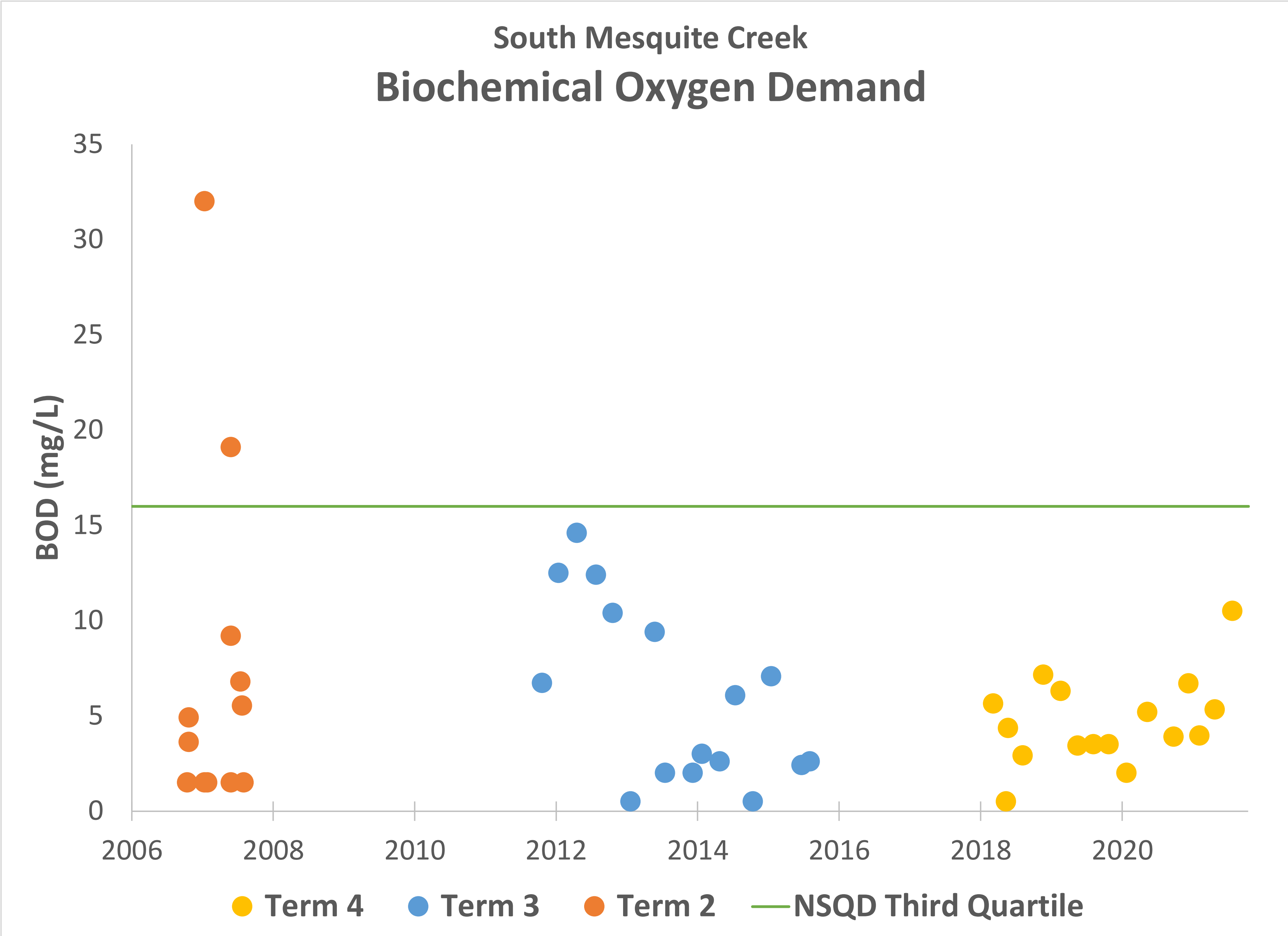
Appendix W

South Mesquite Creek Water Quality Data Graphs

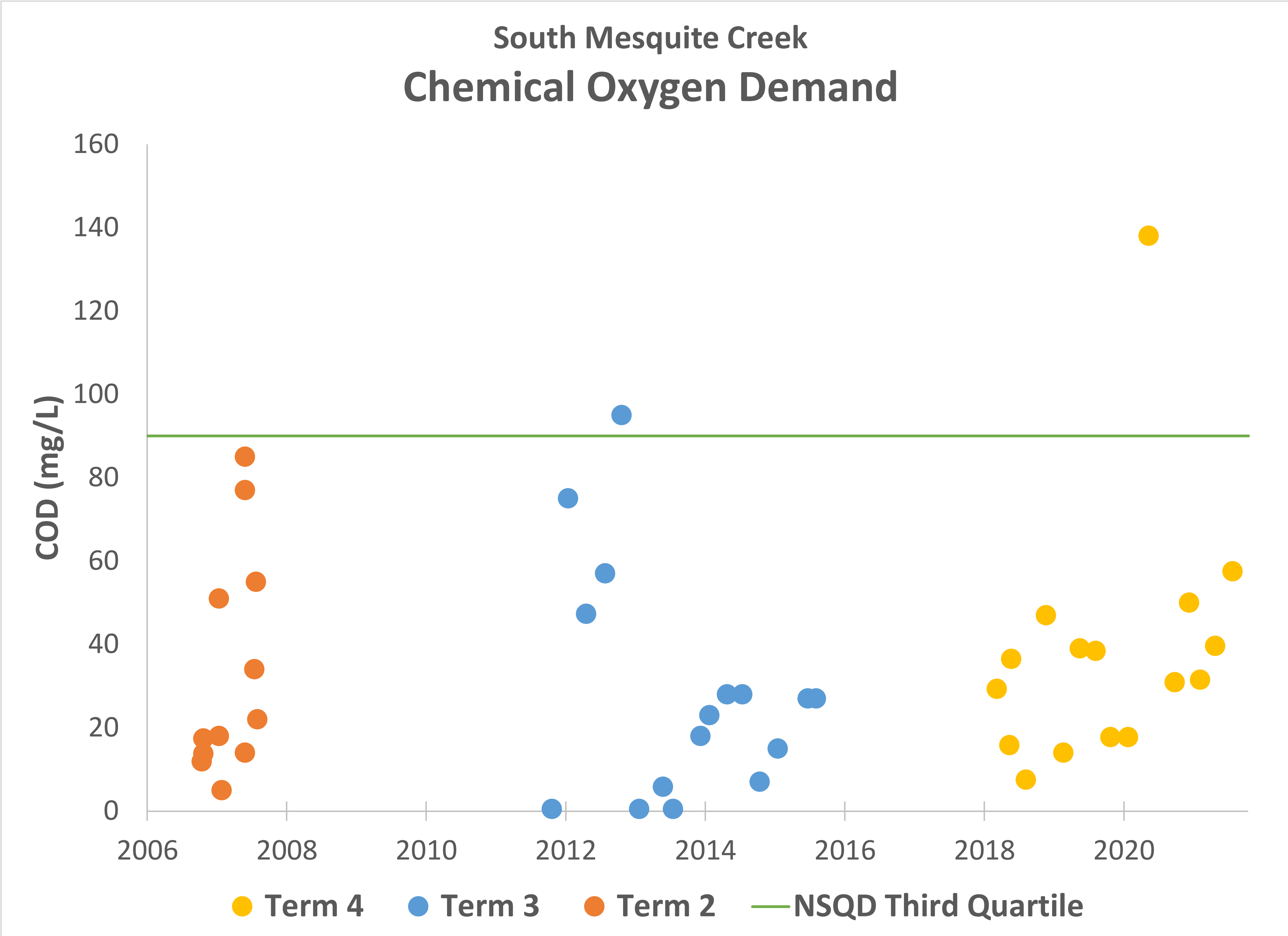

South Mesquite Creek
Total Dissolved Solids
TDS (mg/L)
100000
10000
1000
100
10
1
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
Basin Specific Criterion



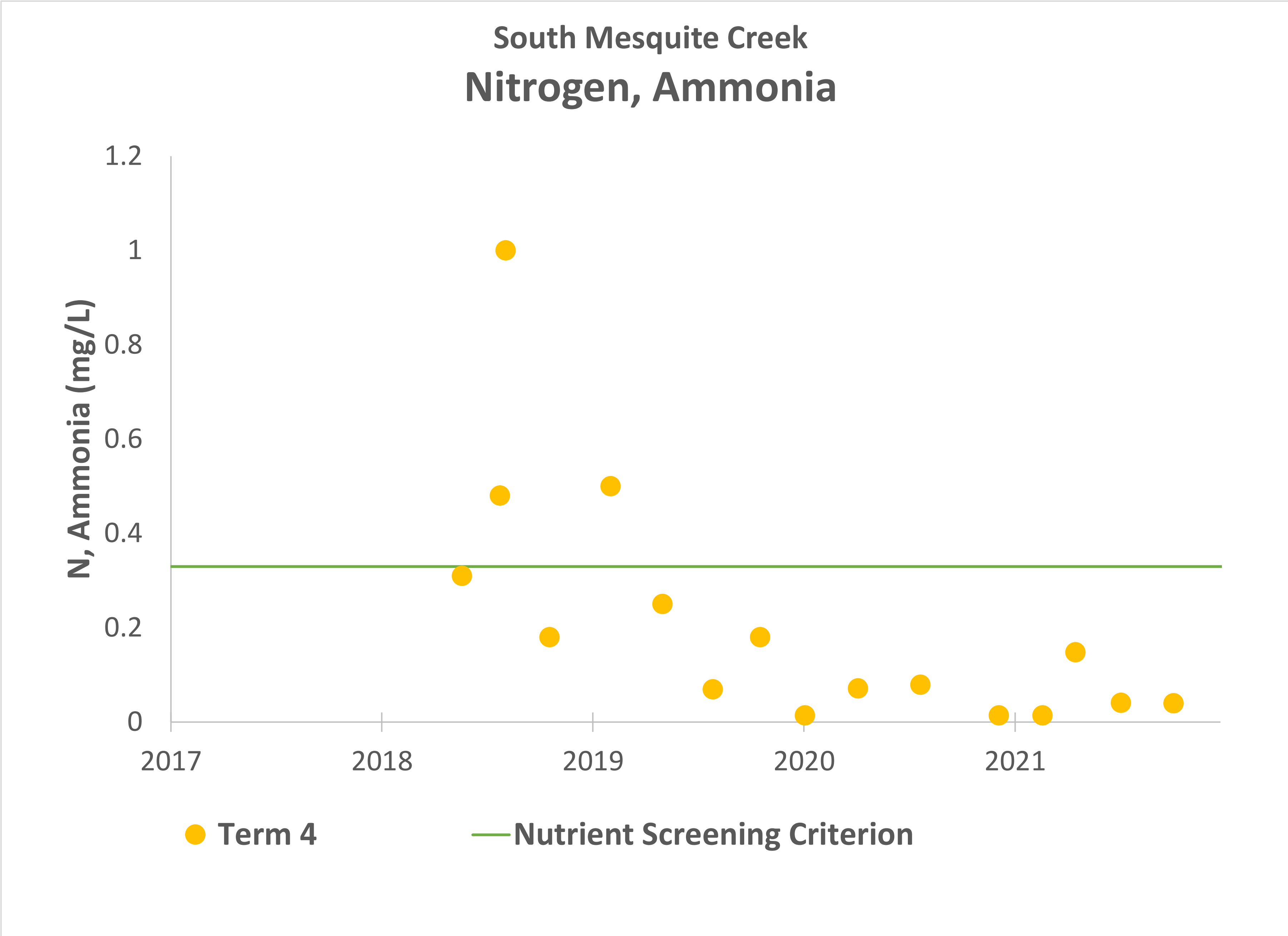
South Mesquite Creek
Total Suspended Solids
TSS (mg/L)
10000
1000
100
10
1
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
NSQD Third Quartile

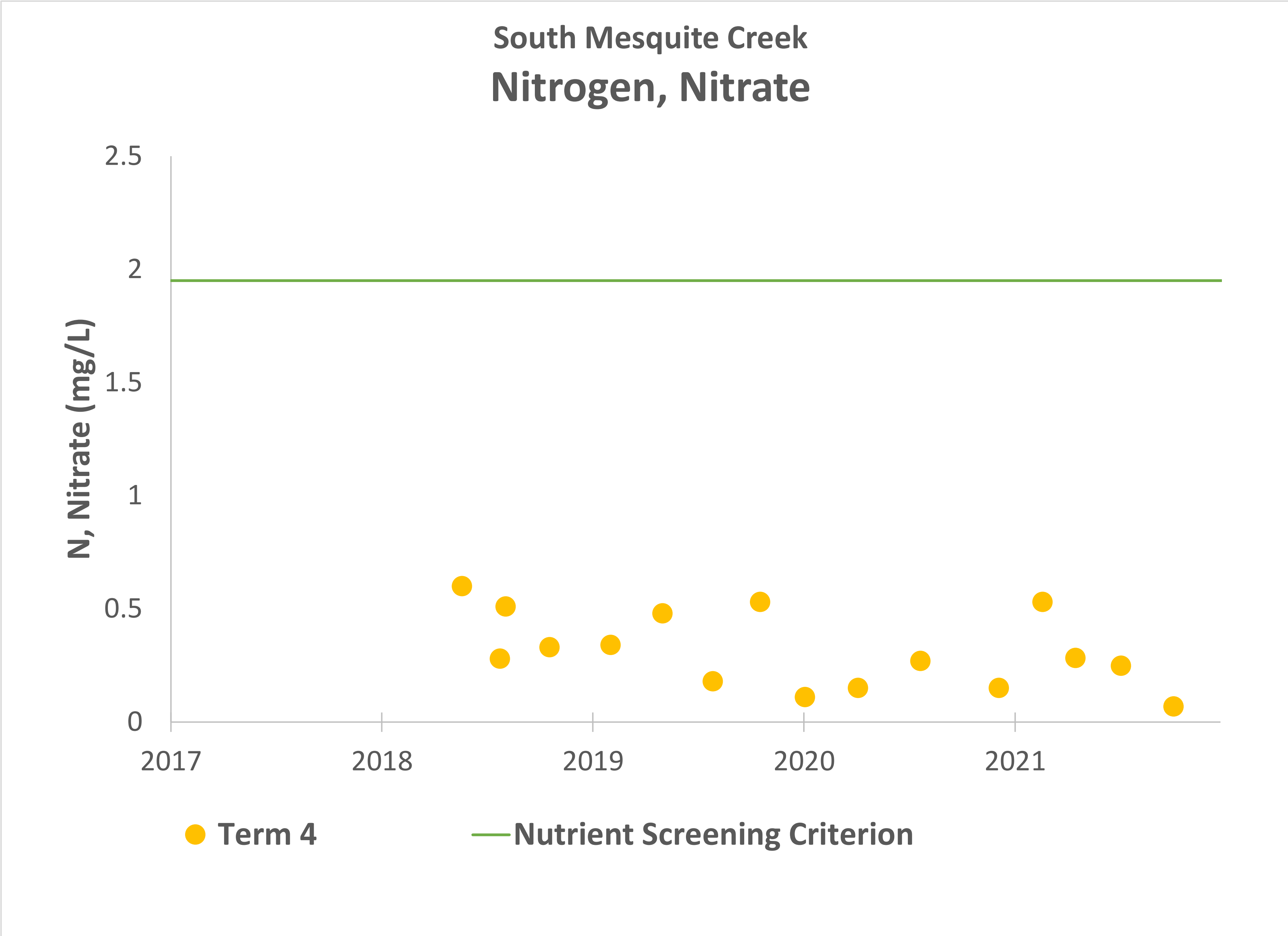


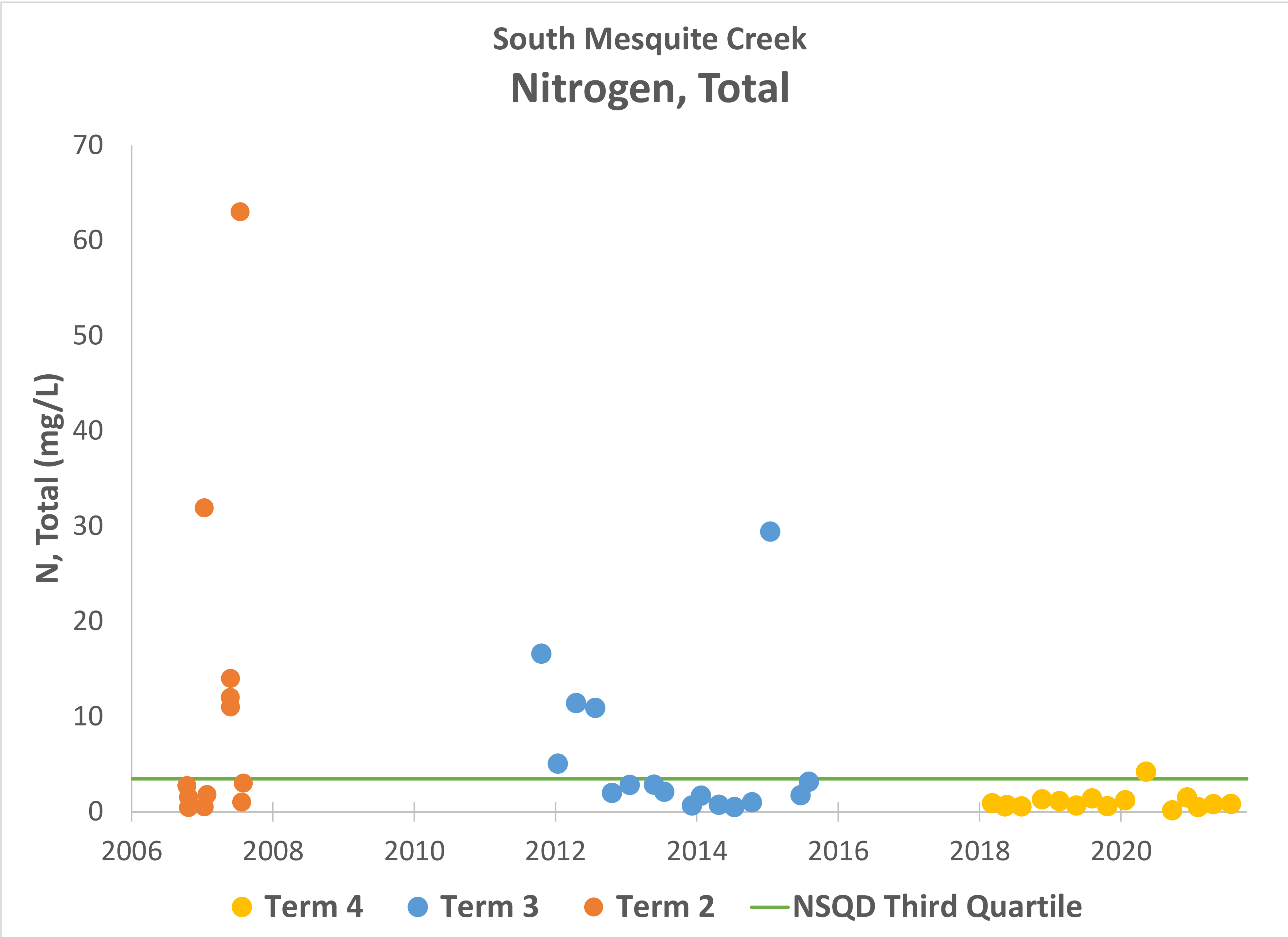
South Mesquite Creek
Biochemical Oxygen Demand
BOD (mg/L)
35
30
25
20
15
10
5
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile

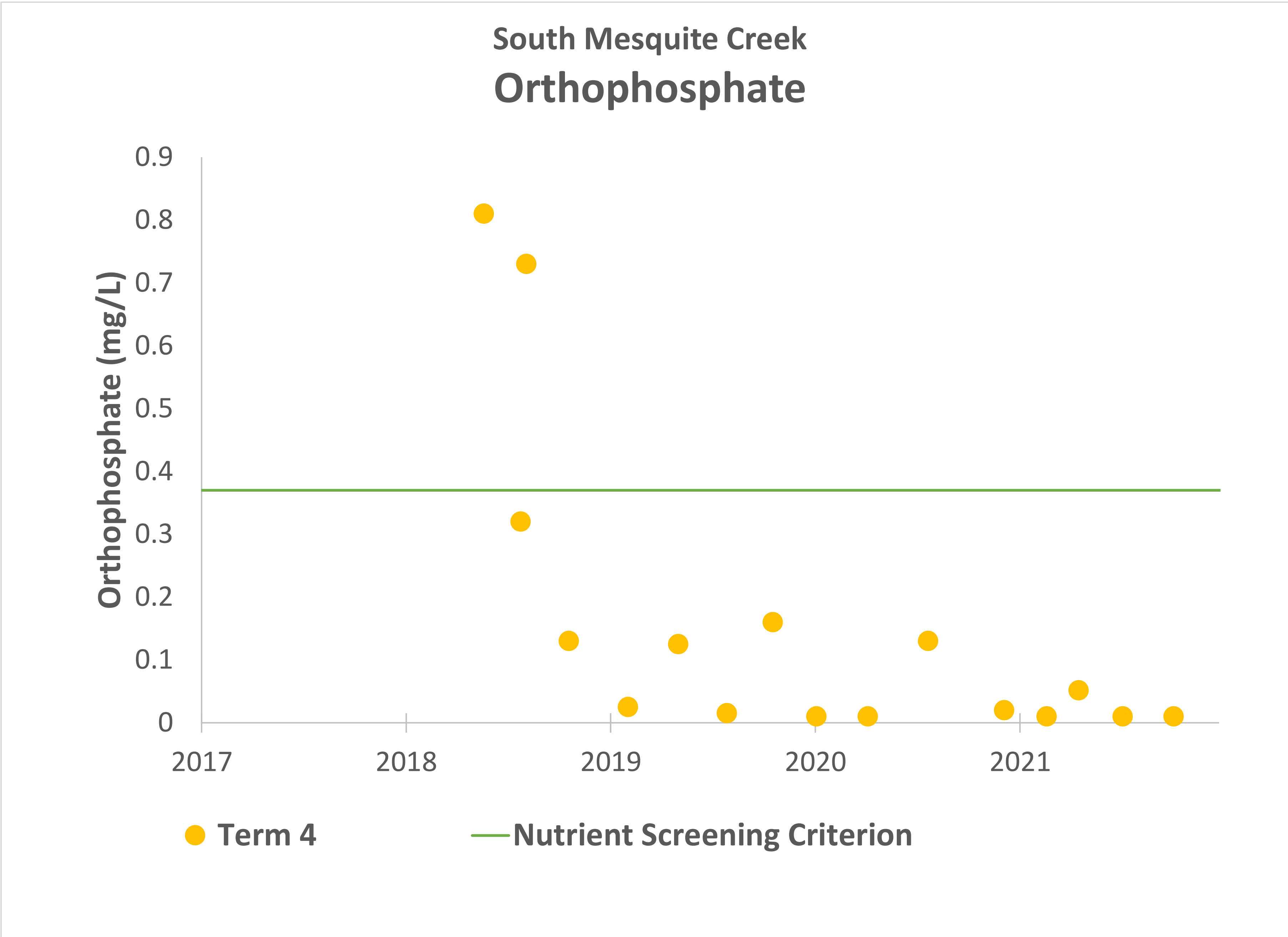


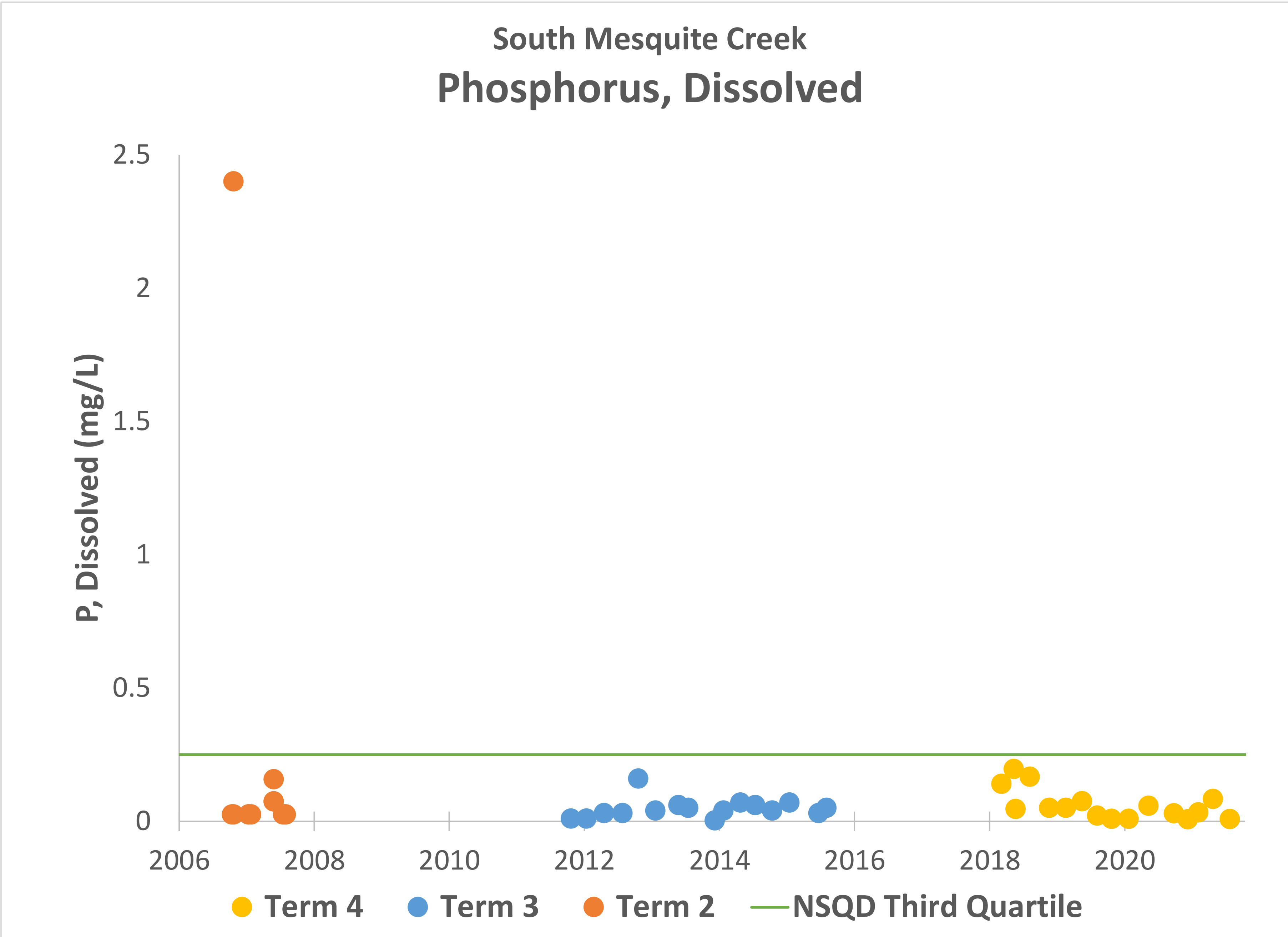
South Mesquite Creek
Chemical Oxygen Demand
COD (mg/L)
160
140
120
100
80
60
40
20
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile


South Mesquite Creek
Nitrogen, Ammonia
N, Ammonia (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

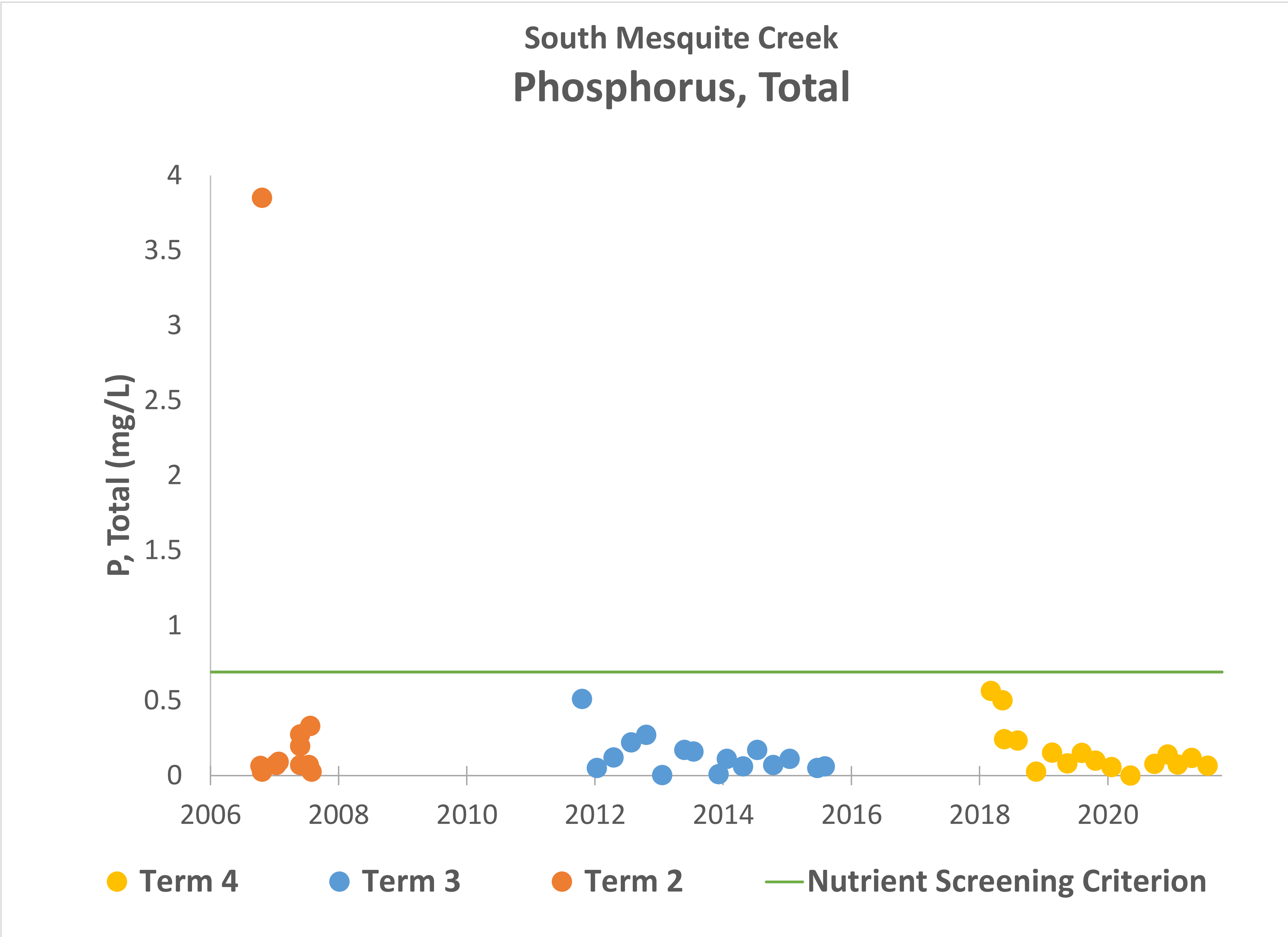

South Mesquite Creek
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

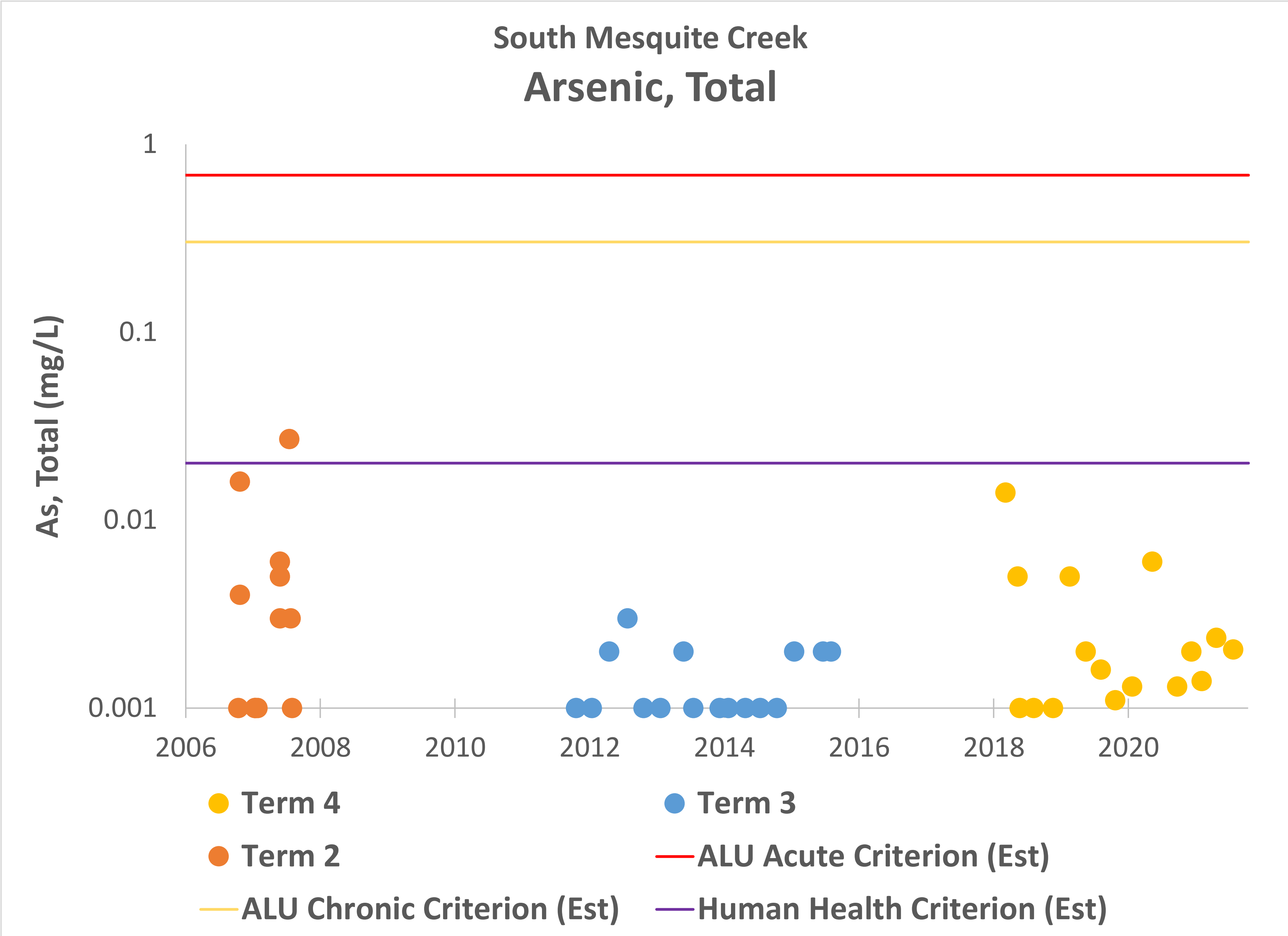

South Mesquite Creek
Nitrogen, Total
N, Total (mg/L)
70
60
50
40
30
20
10
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile

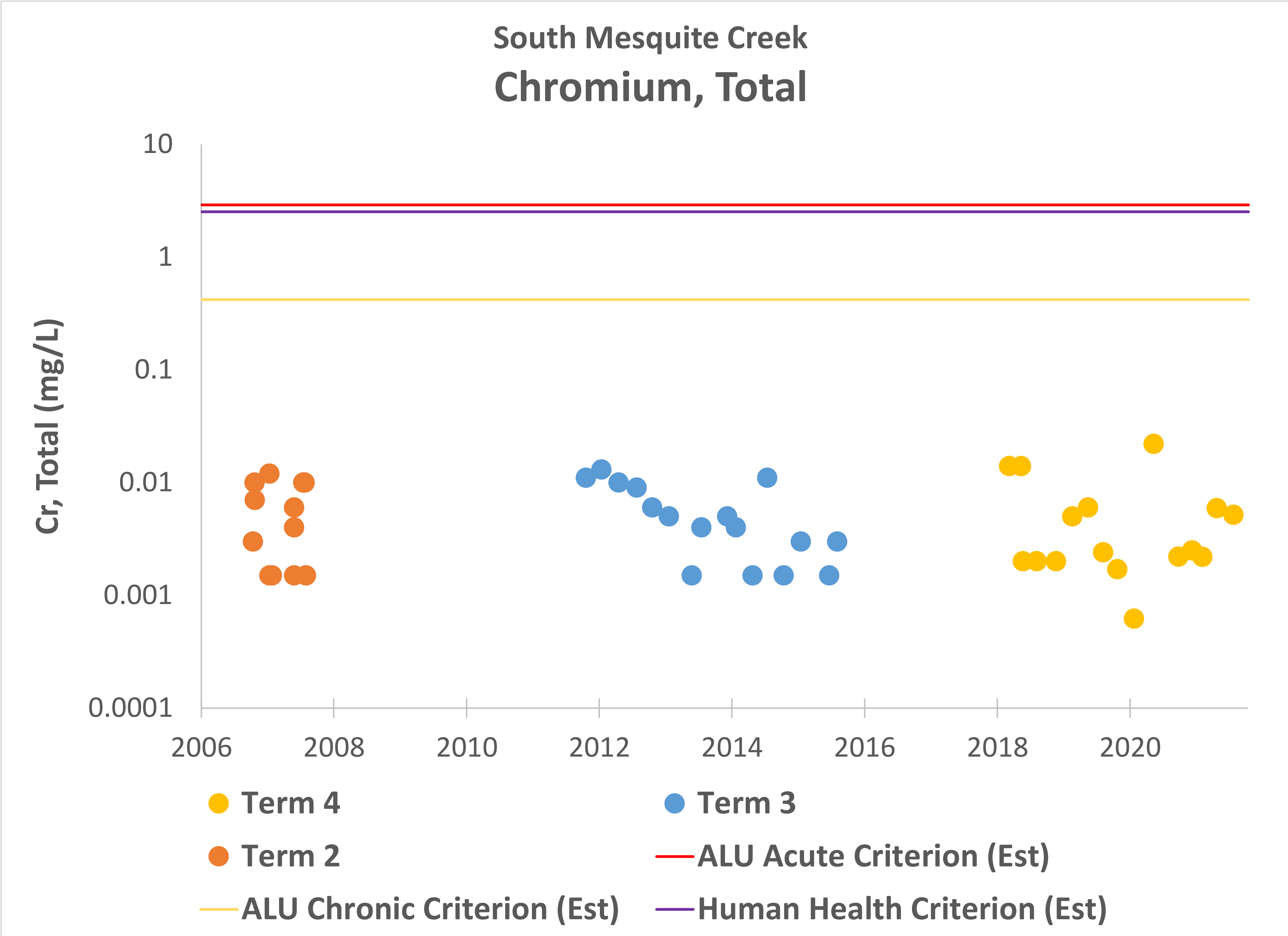

South Mesquite Creek
Orthophosphate
Orthophosphate (mg/L)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

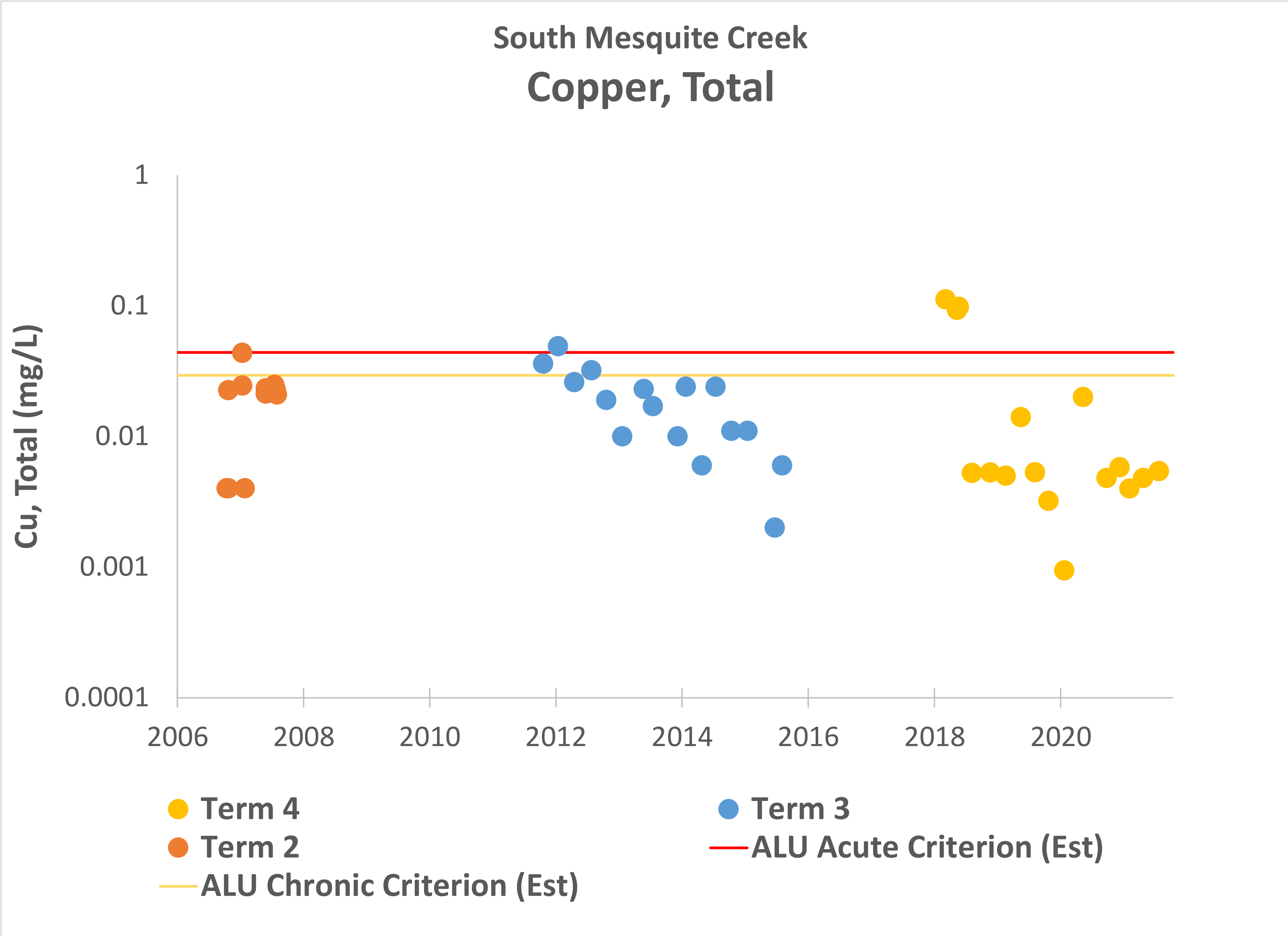


South Mesquite Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
2.5
2
1.5
1
0.5
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile

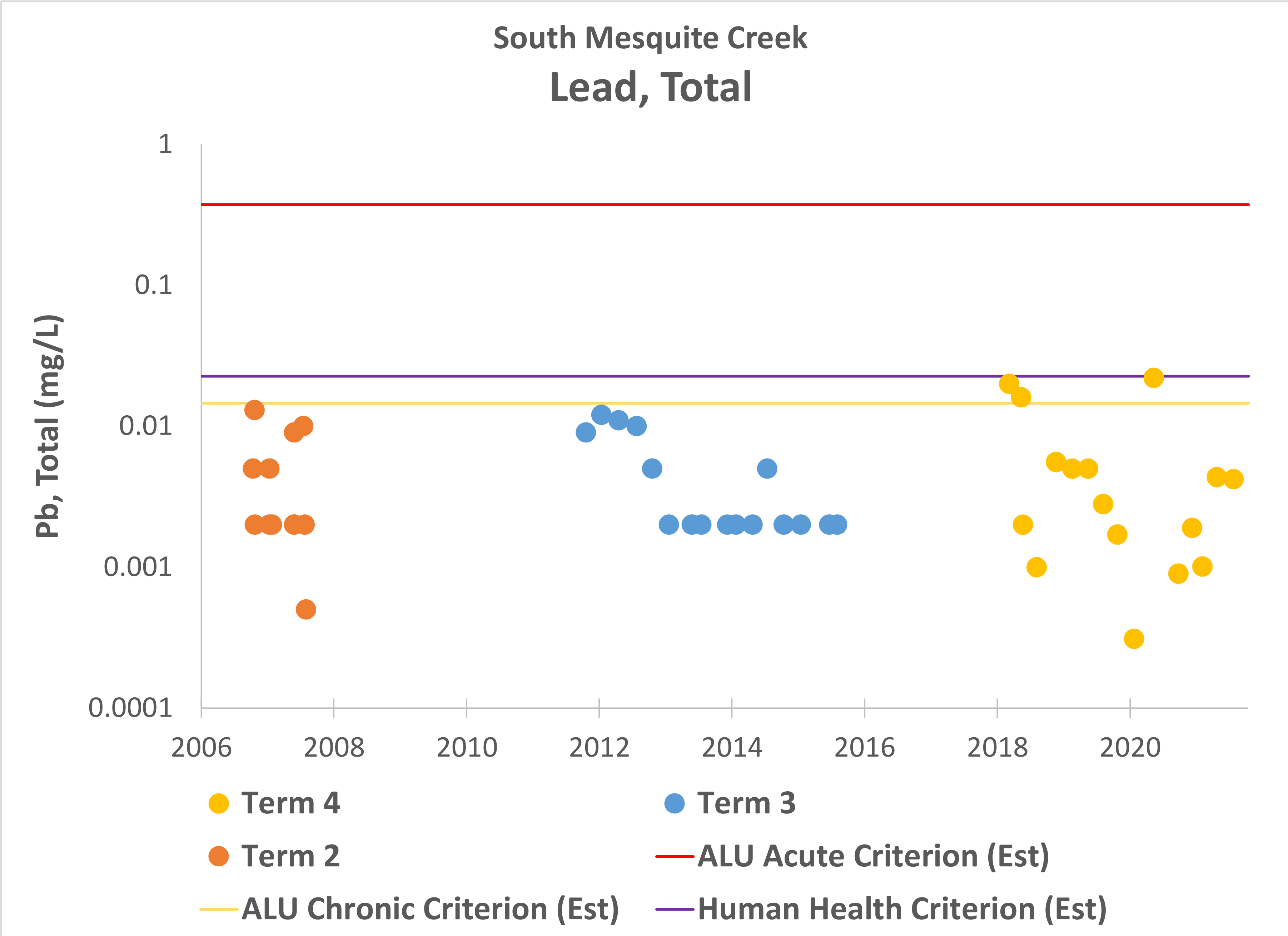

South Mesquite Creek
Phosphorus, Total
P, Total (mg/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
Nutrient Screening Criterion


South Mesquite Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

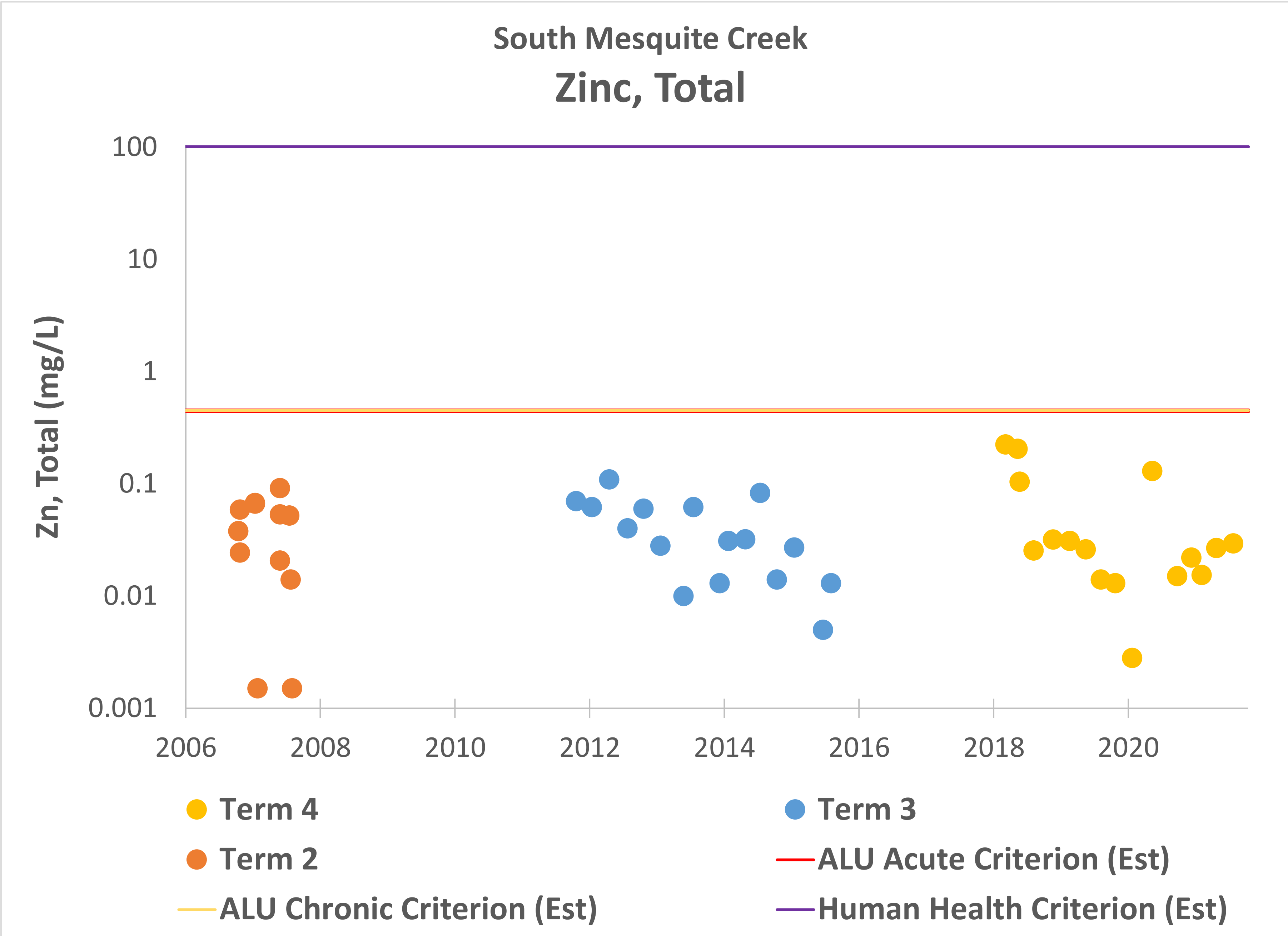

South Mesquite Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
0.0001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

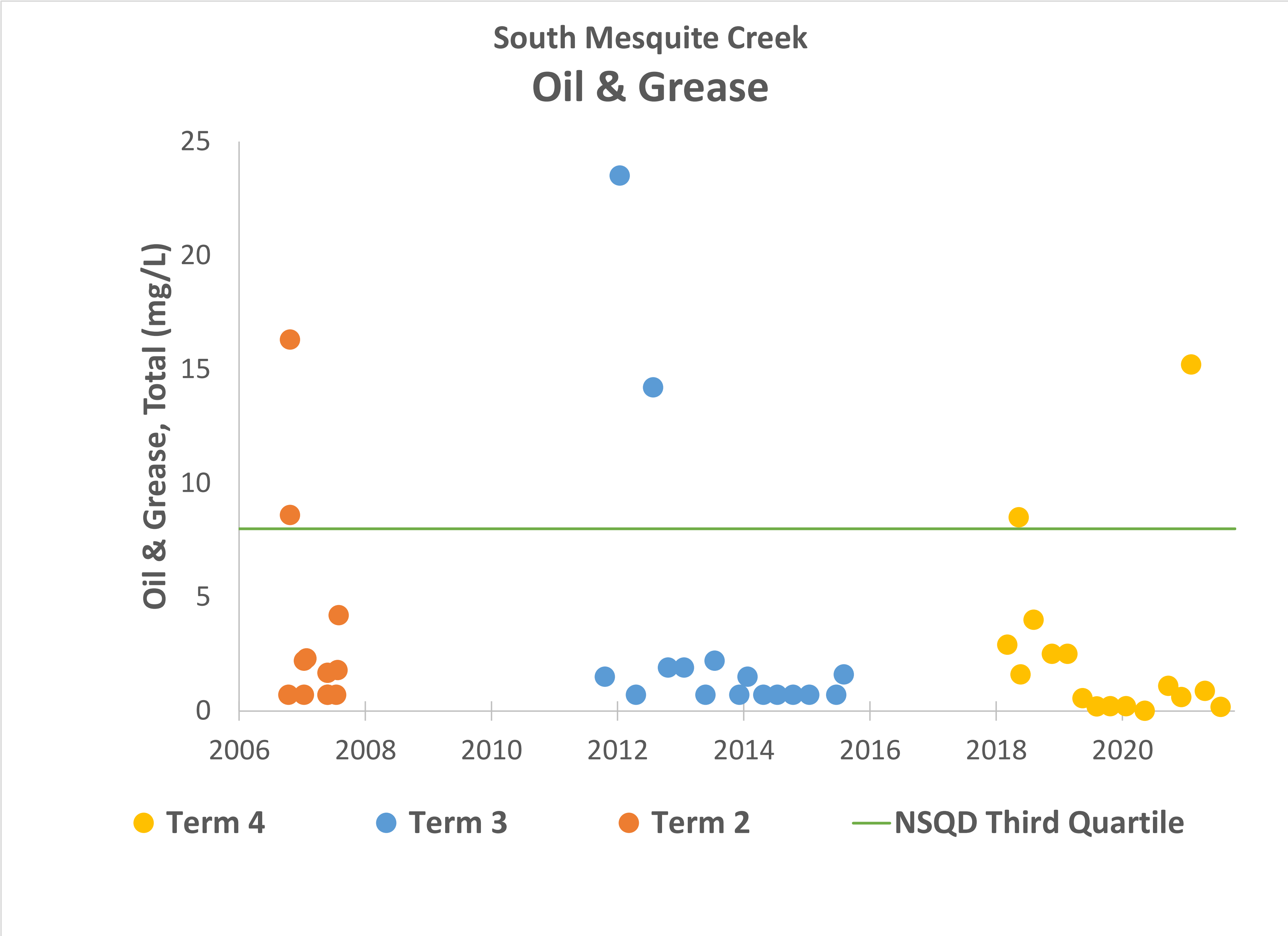


South Mesquite Creek
Copper, Total
Cu, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)

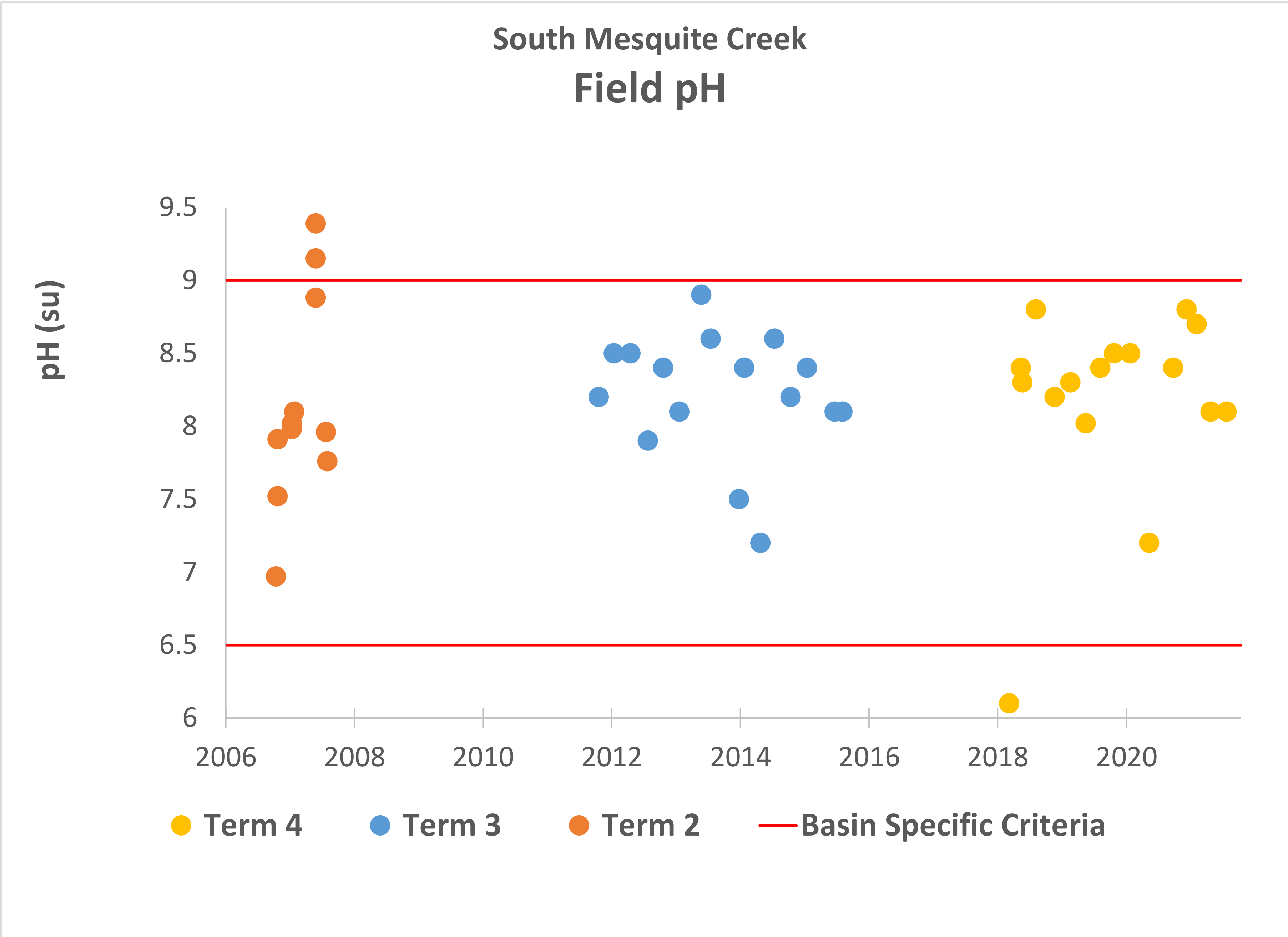


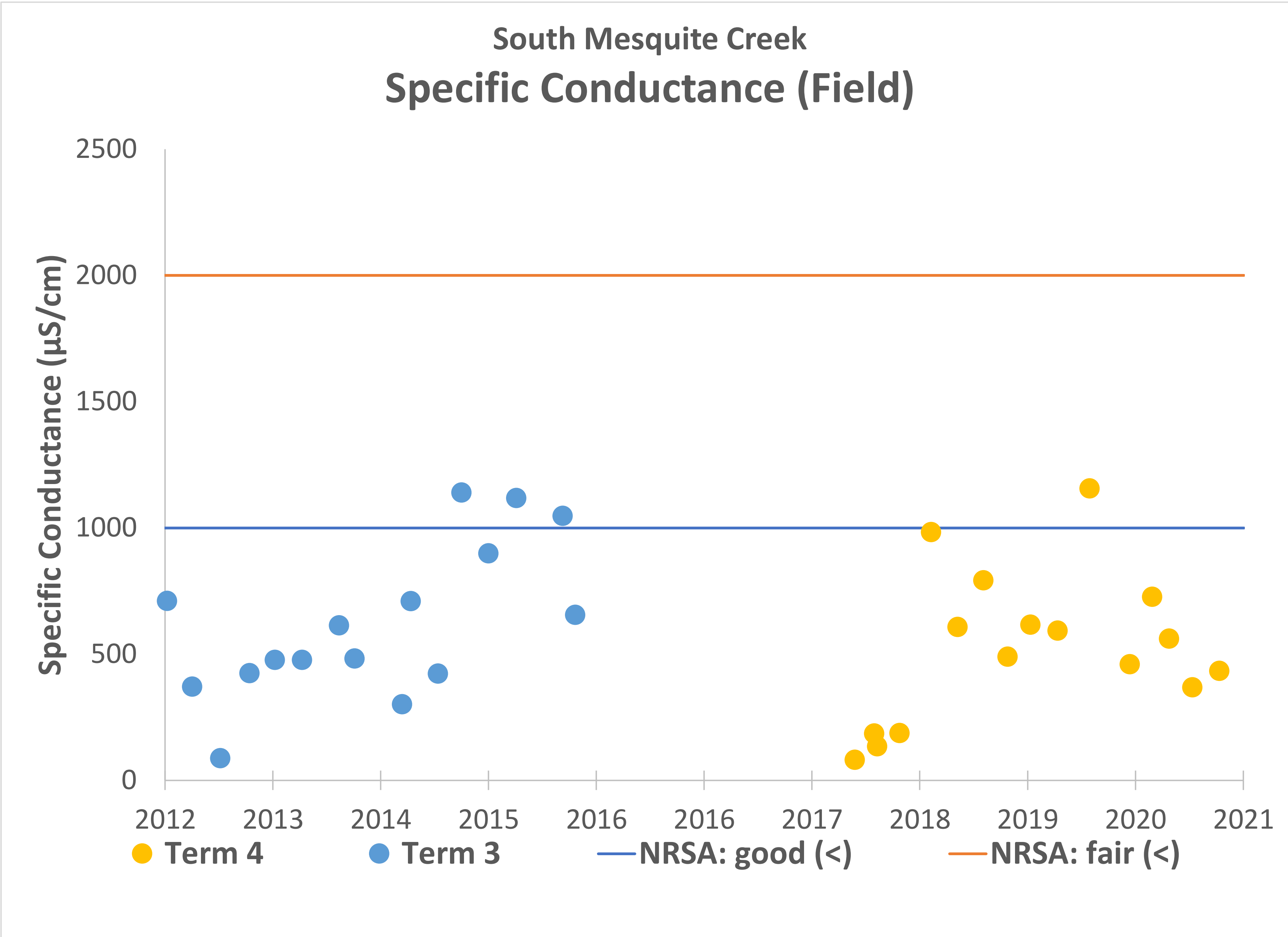
South Mesquite Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

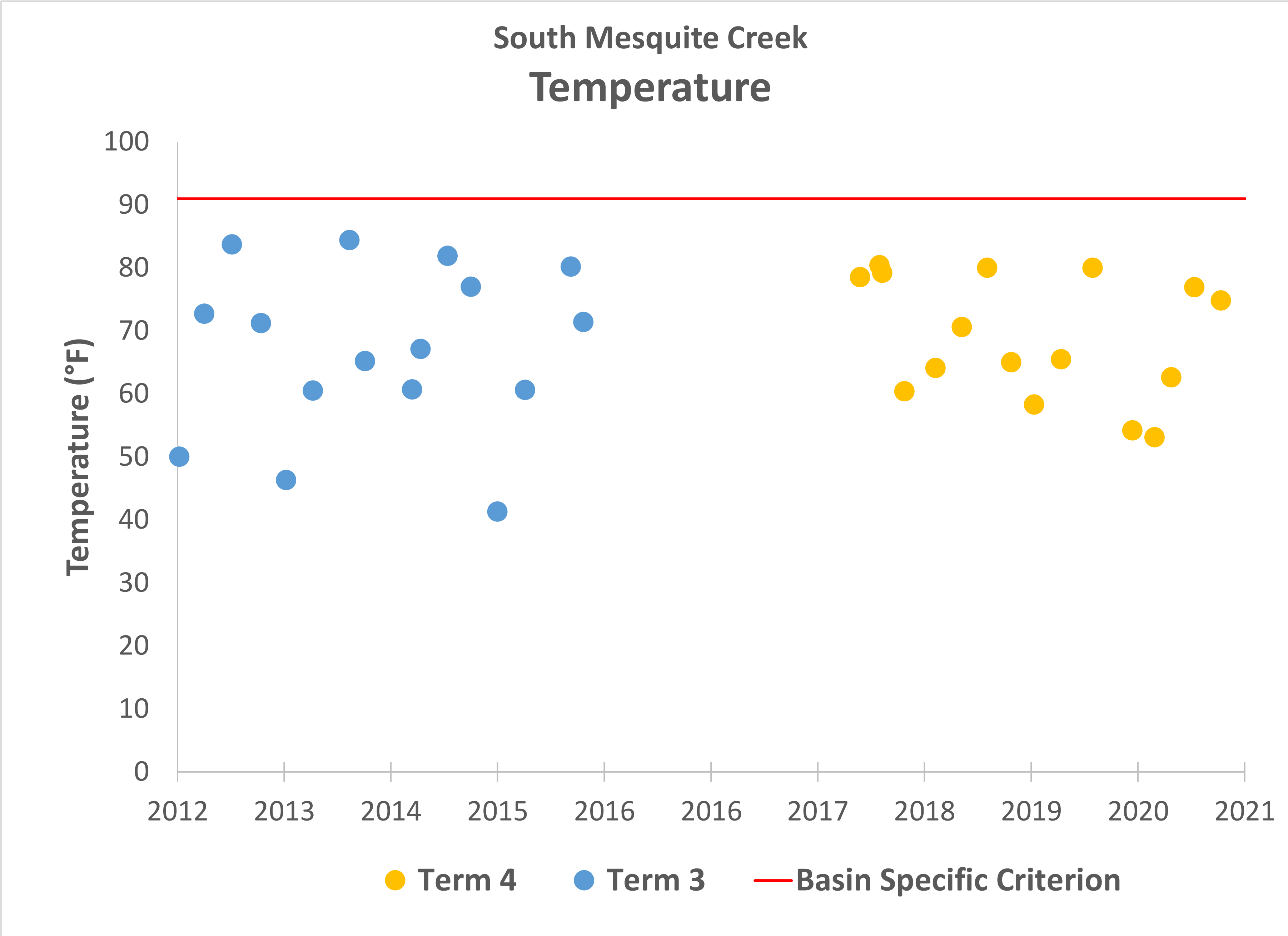

South Mesquite Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

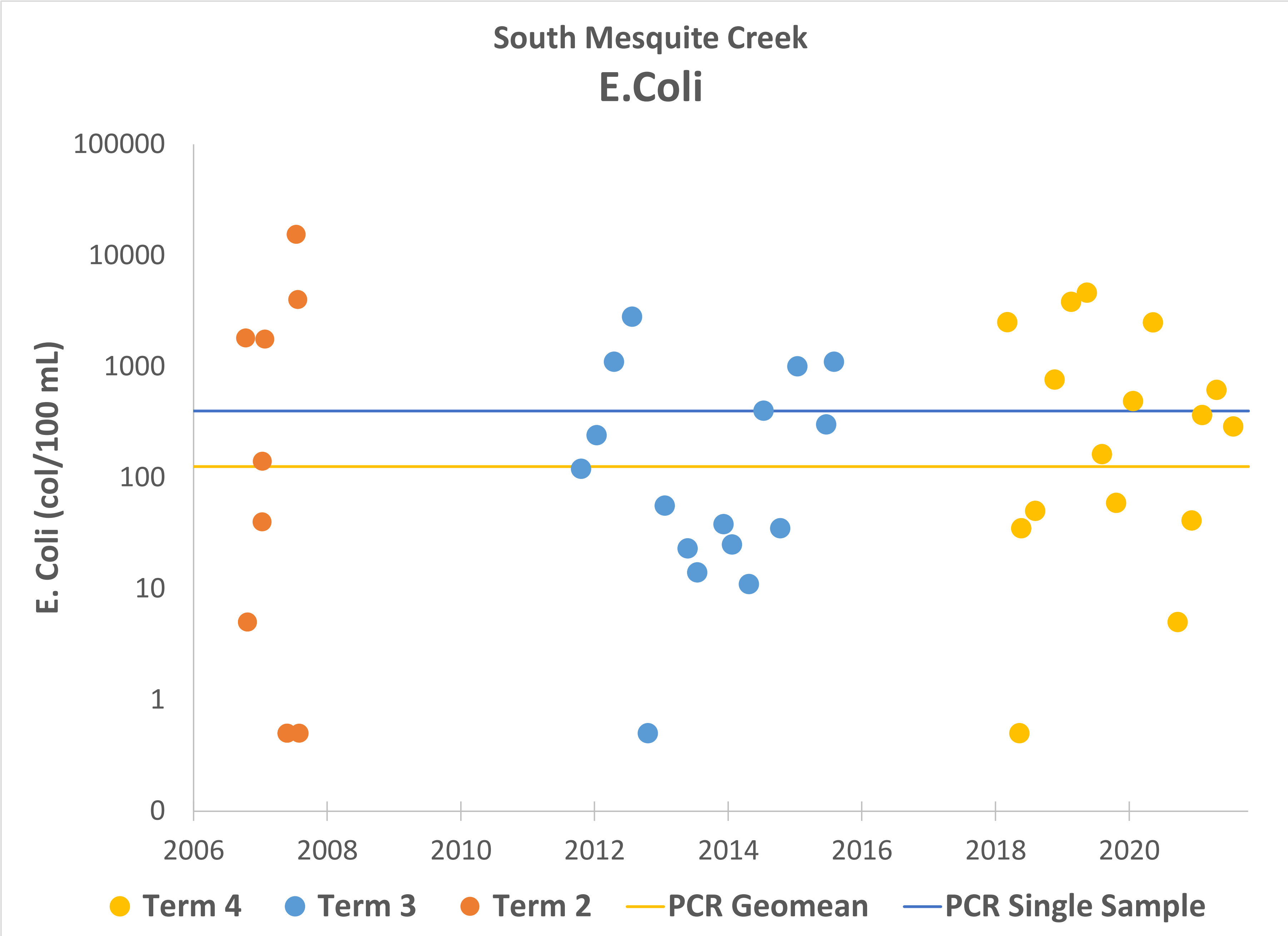


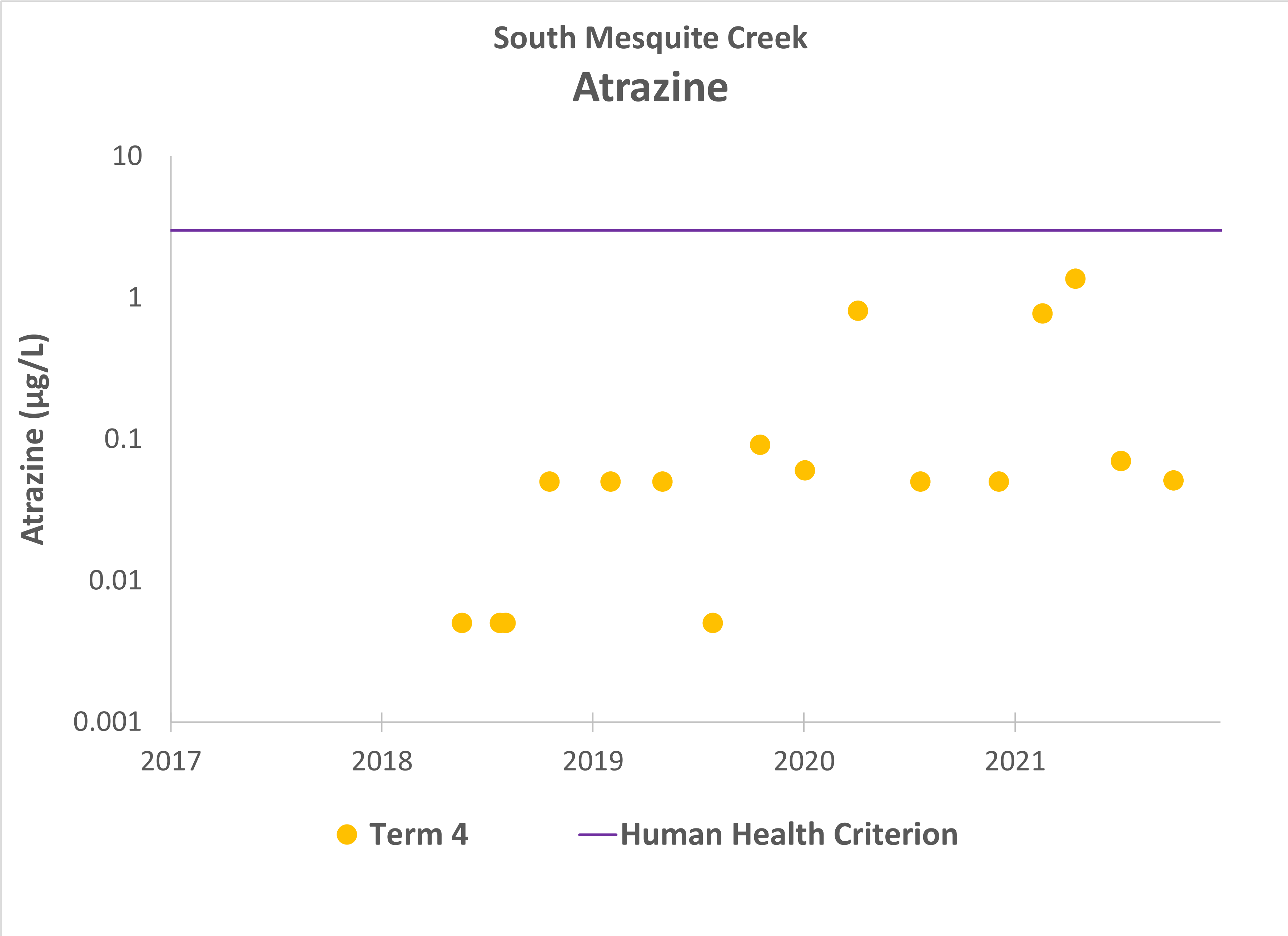
South Mesquite Creek
Oil & Grease
Oil & Grease, Total (mg/L)
0
5
10
15
20
25
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile


South Mesquite Creek
Field pH
pH (su)
9.5
9
8.5
8
7.5
7
6.5
6
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
Basin Specific Criteria


South Mesquite Creek
Specific Conductance (Field)
Specific Conductance (µS/cm)
2500
2000
1500
1000
500
0
2012
2013
2014
2015
2016
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NRSA: good (<)
NRSA: fair (<)

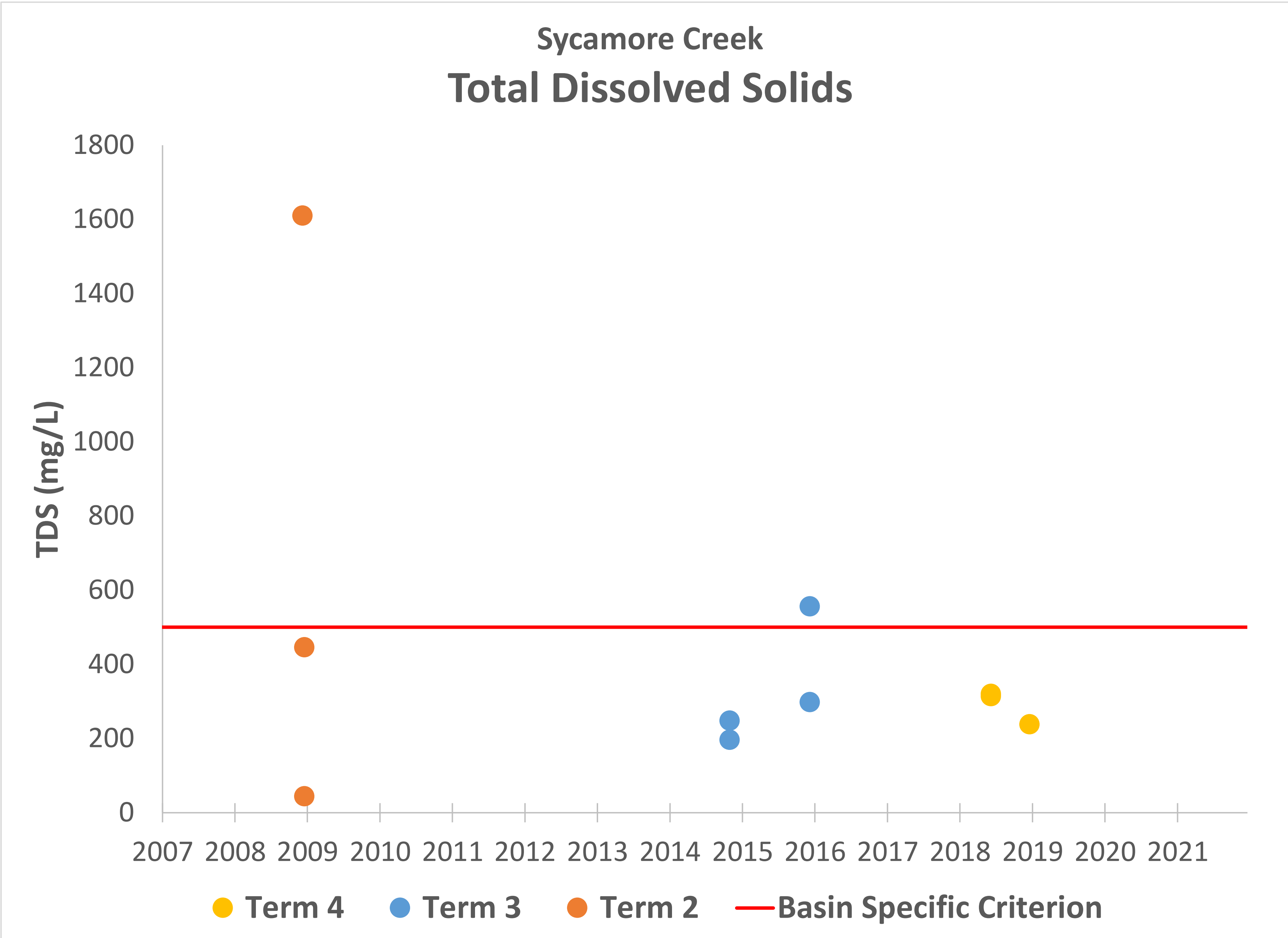

South Mesquite Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2012
2013
2014
2015
2016
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Basin Specific Criterion


South Mesquite Creek
E.Coli
E. Coli (col/100 mL)
100000
10000
1000
100
10
1
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
PCR Geomean
PCR Single Sample

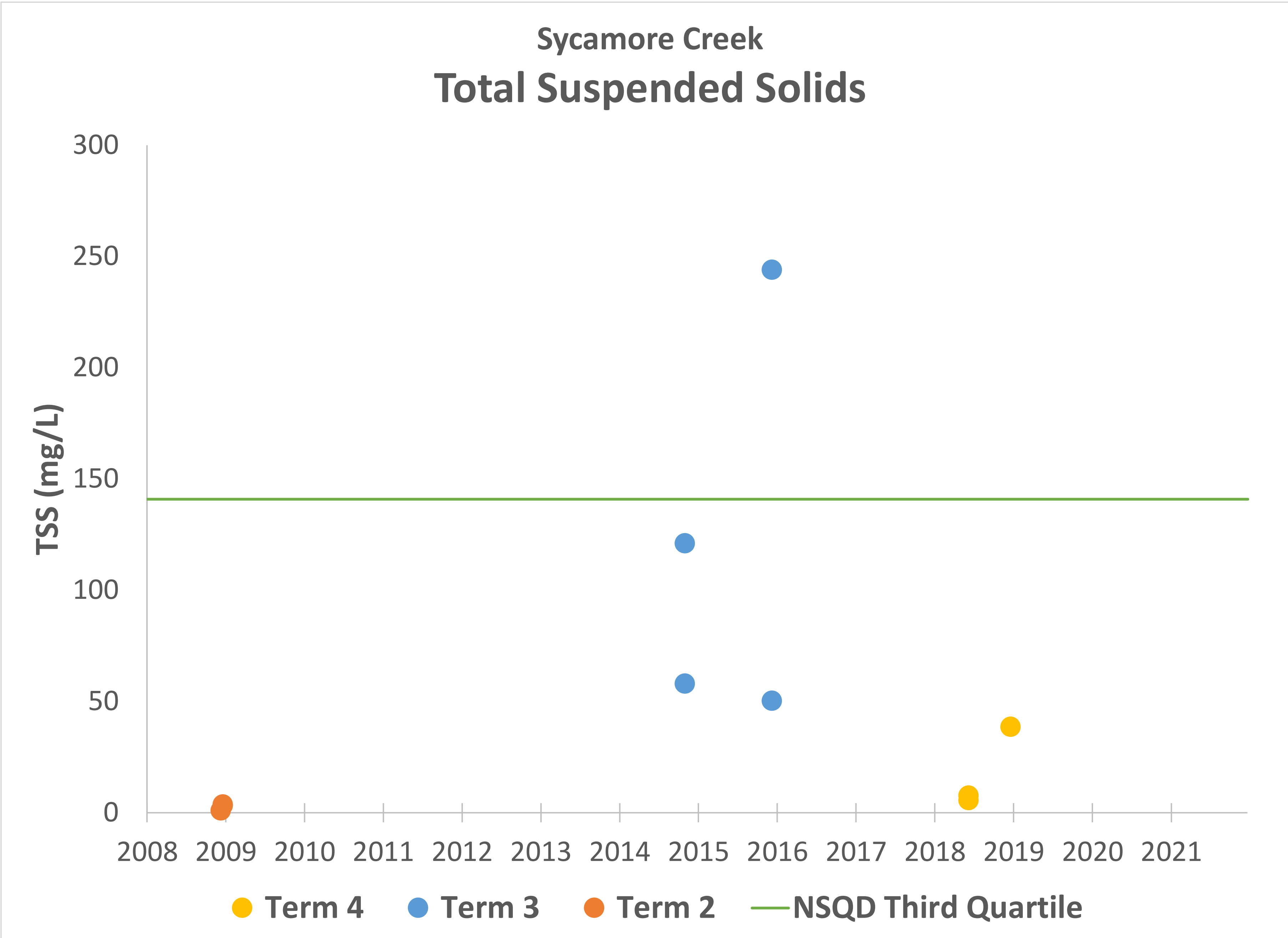

South Mesquite Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
0.001
2017
2018
2019
2020
2021
Term 4
Human Health Criterion

Appendix X

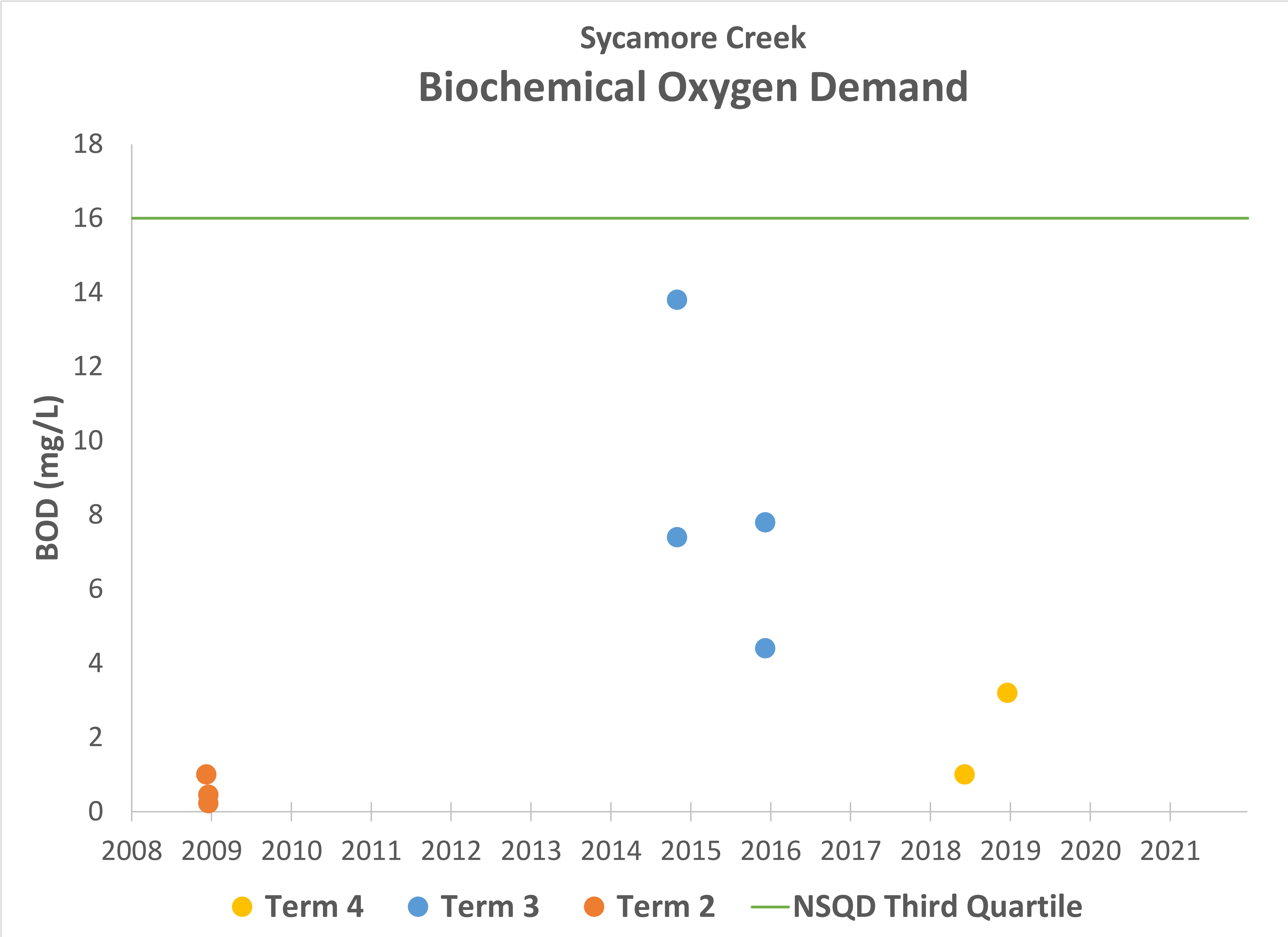
Sycamore Creek Water Quality Data Graphs



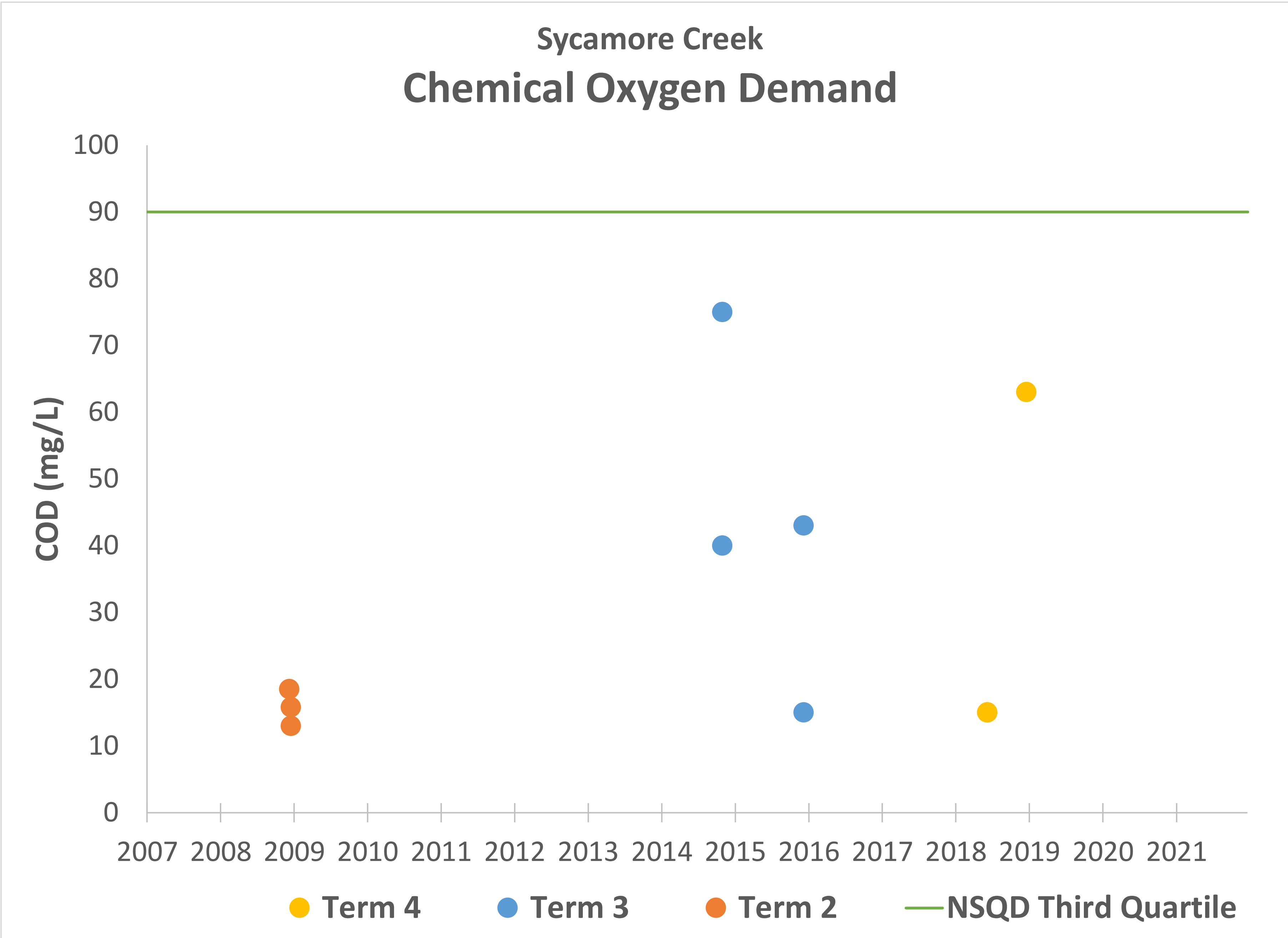
Sycamore Creek
Total Dissolved Solids
TDS (mg/L)
1800
1600
1400
1200
1000
800
600
400
200
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
Basin Specific Criterion



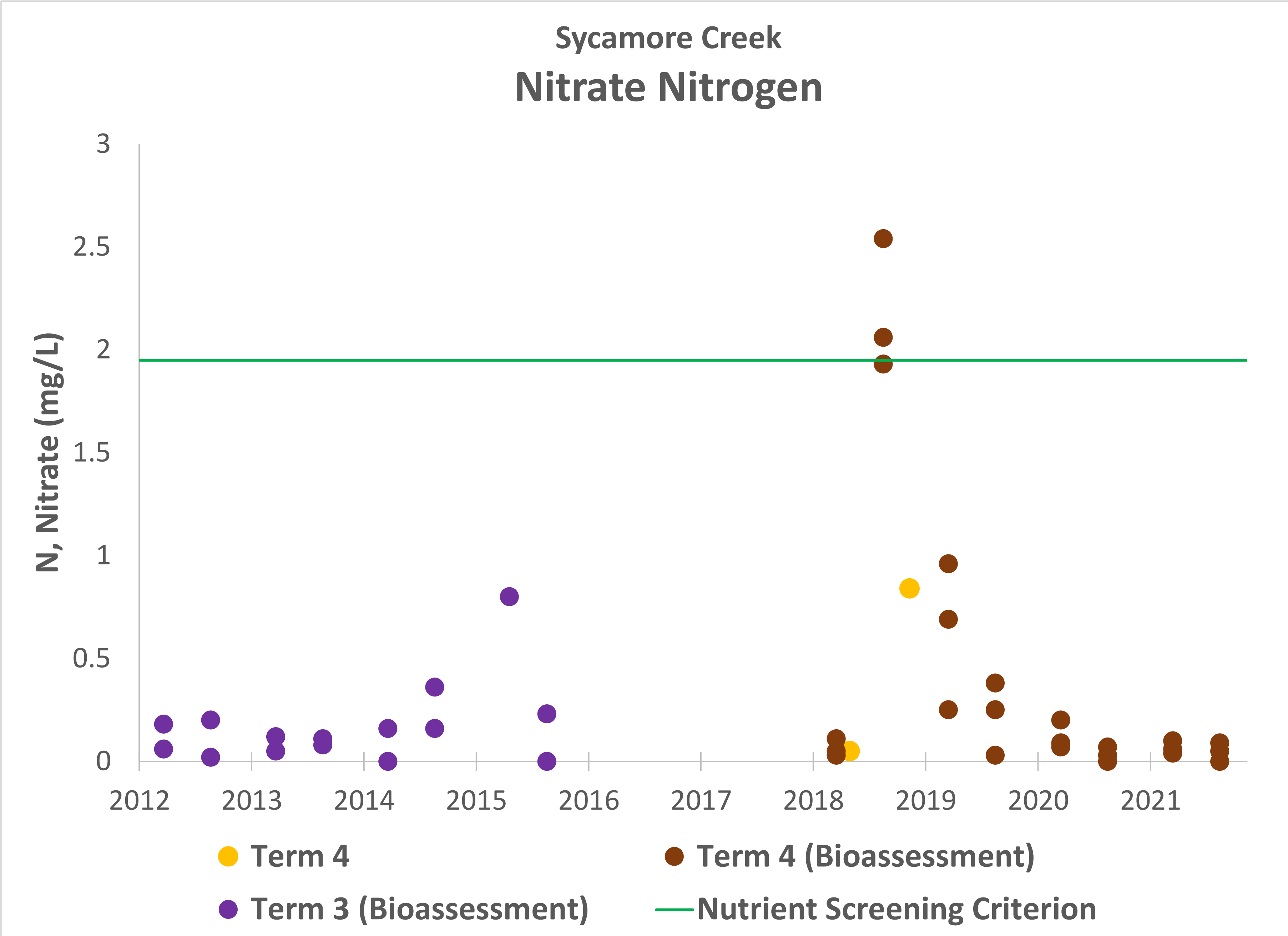
Sycamore Creek
Total Suspended Solids
TSS (mg/L)
300
250
200
150
100
50
0
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile



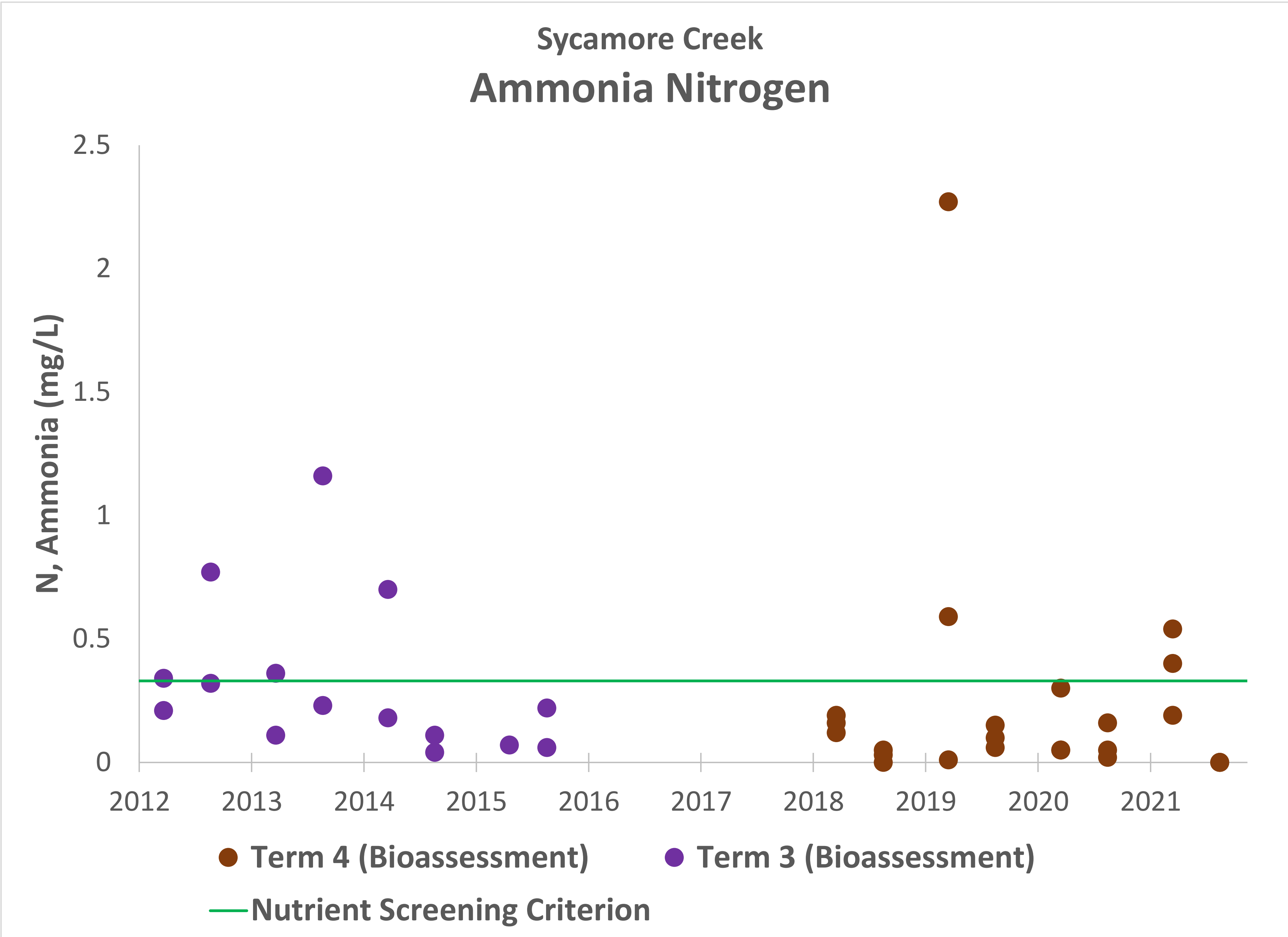
Sycamore Creek
Biochemical Oxygen Demand
BOD (mg/L)
0
2
4
6
8
10
12
14
16
18
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

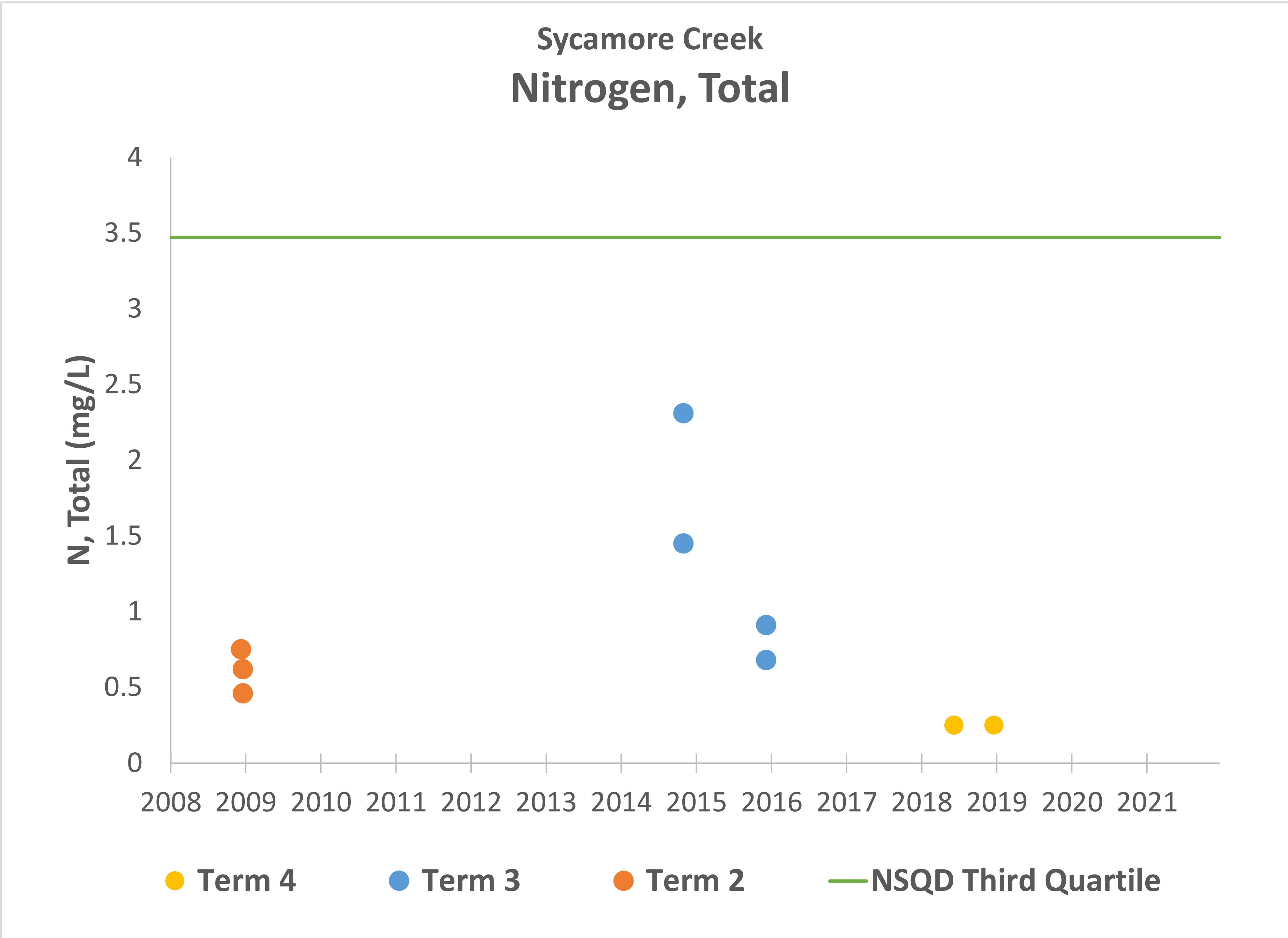


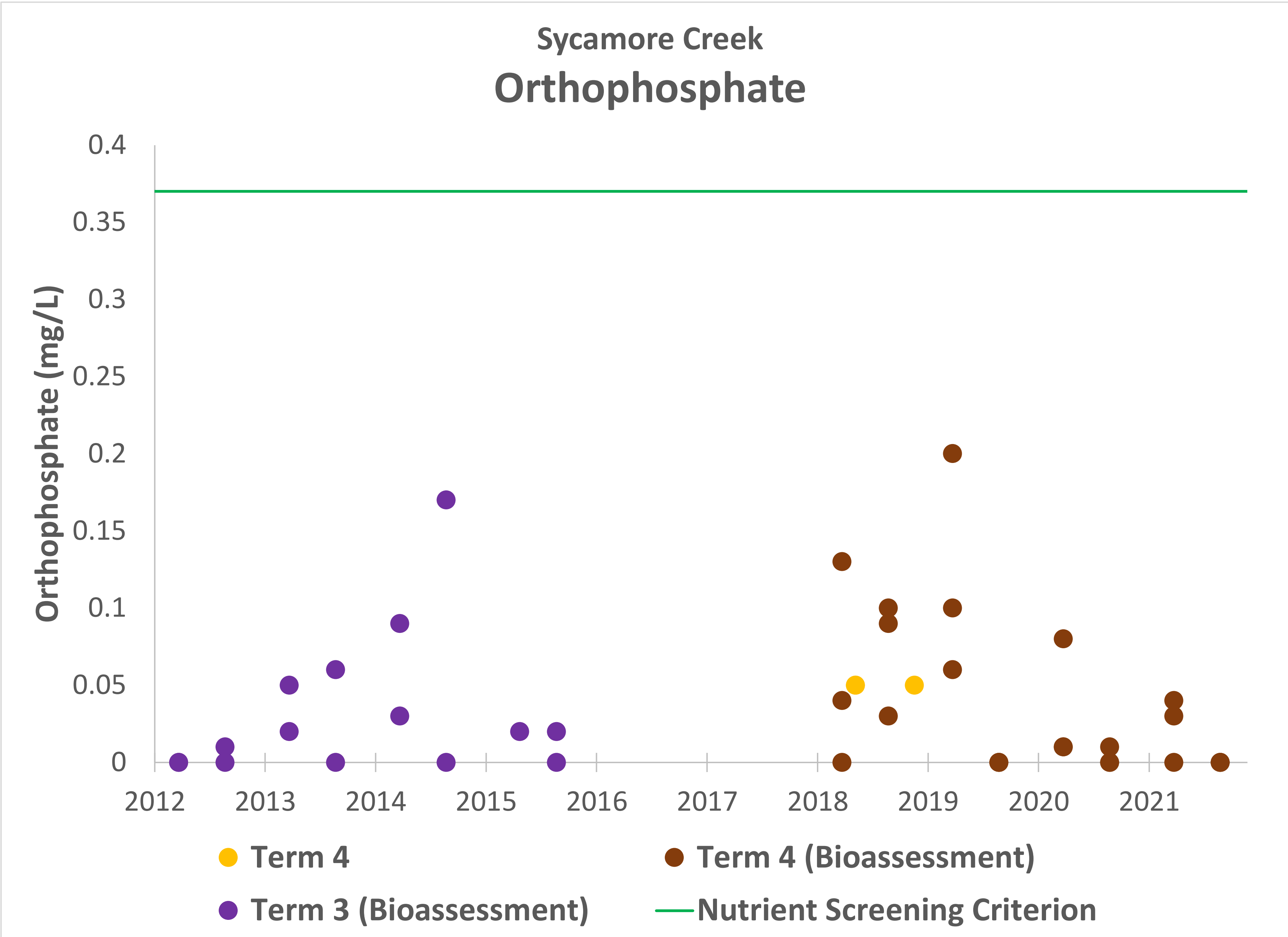
Sycamore Creek
Chemical Oxygen Demand
COD (mg/L)
100
90
80
70
60
50
40
30
20
10
0
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

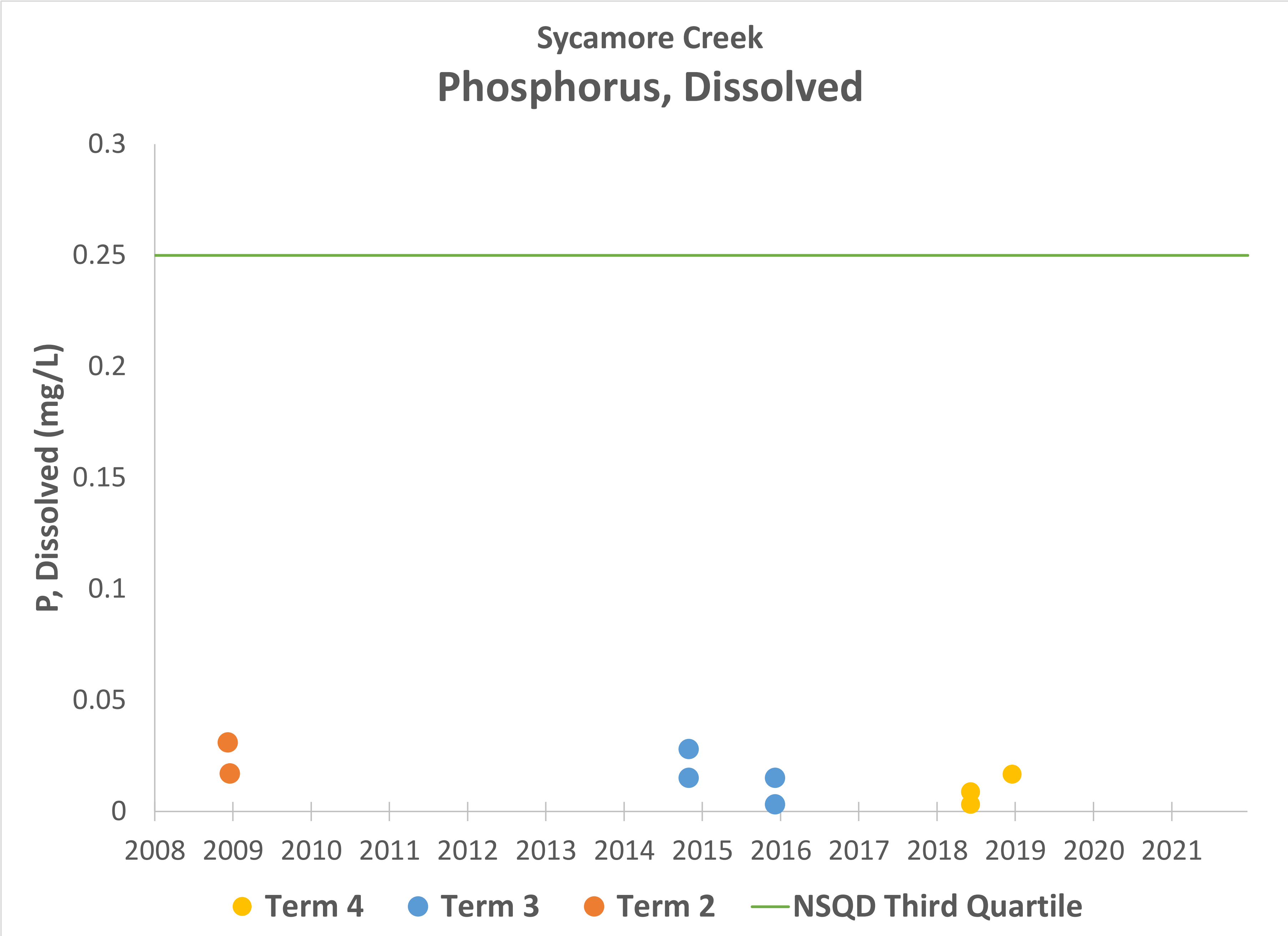


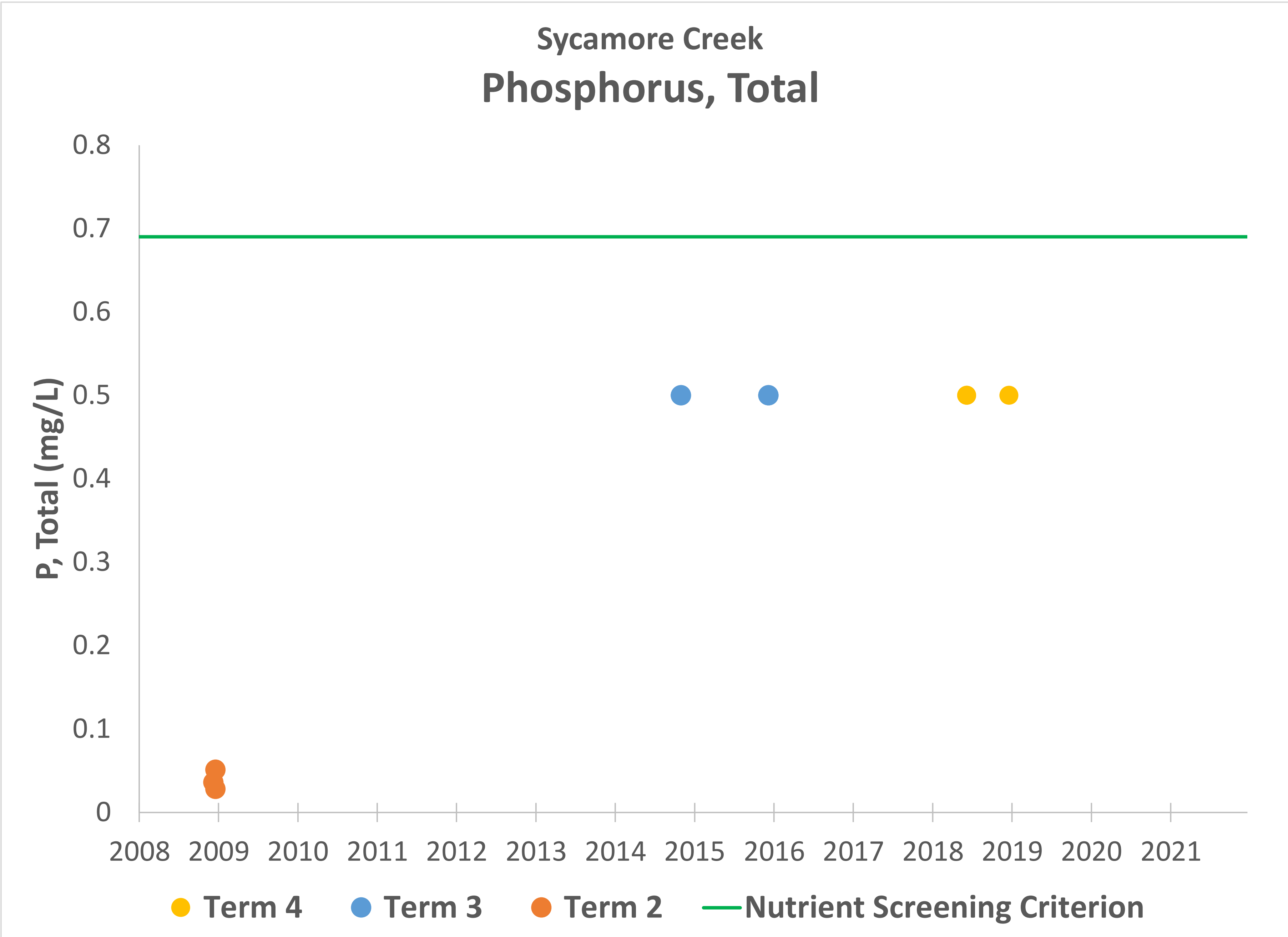
Sycamore Creek
Nitrate Nitrogen
N, Nitrate (mg/L)
3
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion


Sycamore Creek
Ammonia Nitrogen
N, Ammonia (mg/L)
2.5
2
1.5
1
0.5
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion

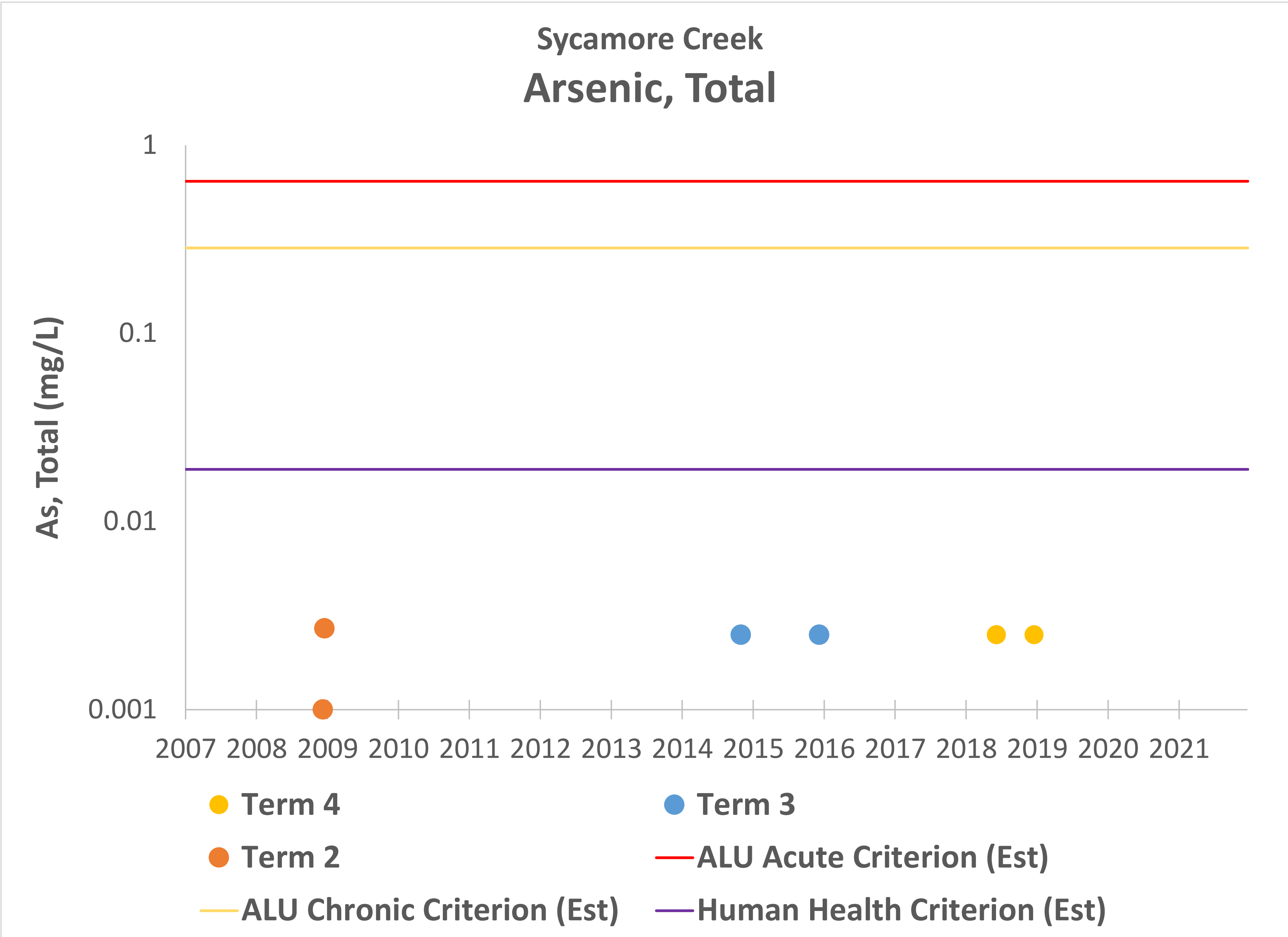

Sycamore Creek
Nitrogen, Total
N, Total (mg/L)
0
0.5
1
1.5
2
2.5
3
3.5
4
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

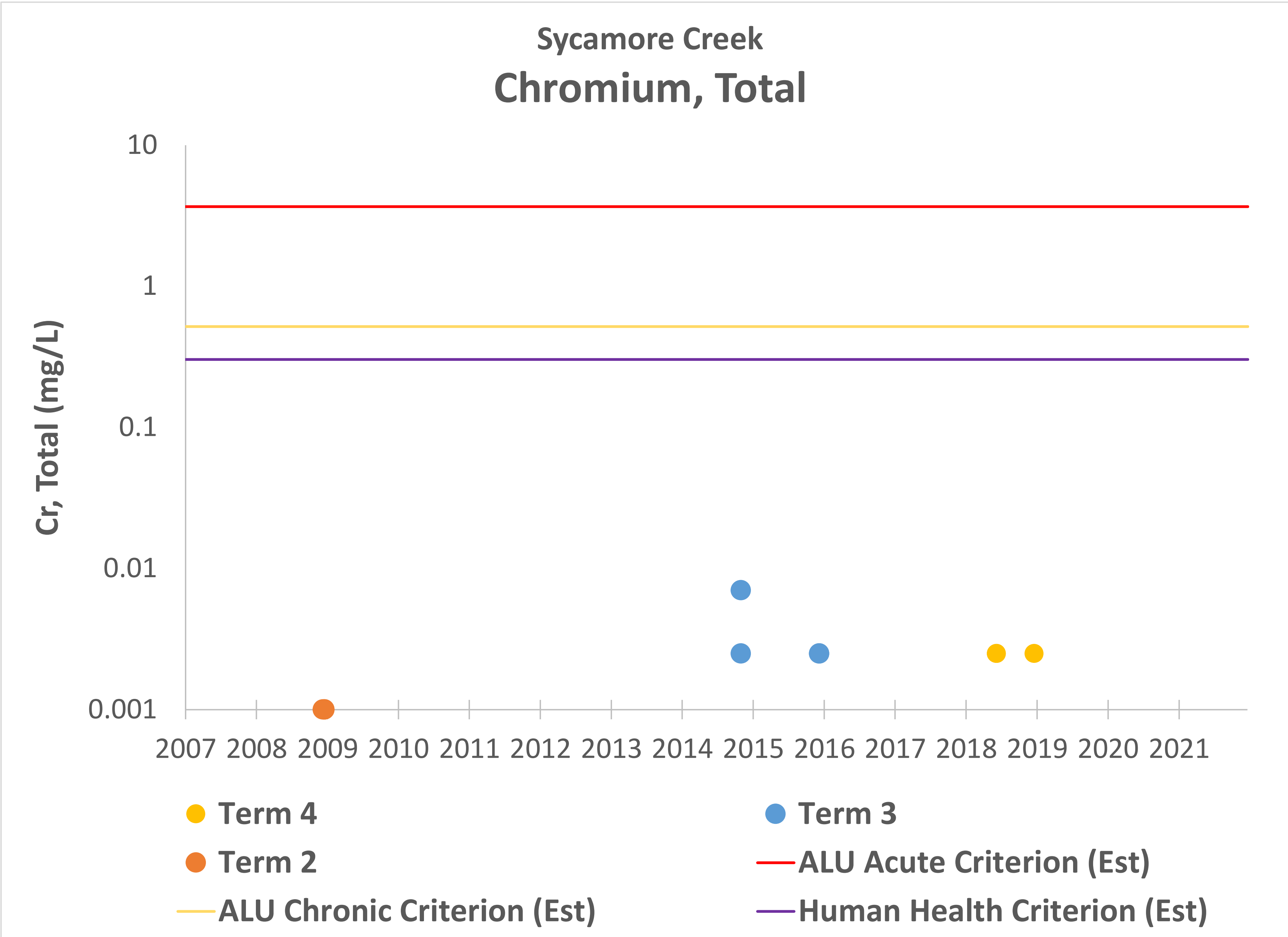

Sycamore Creek
Orthophosphate
Orthophosphate (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
Nutrient Screening Criterion


Sycamore Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
NSQD Third Quartile

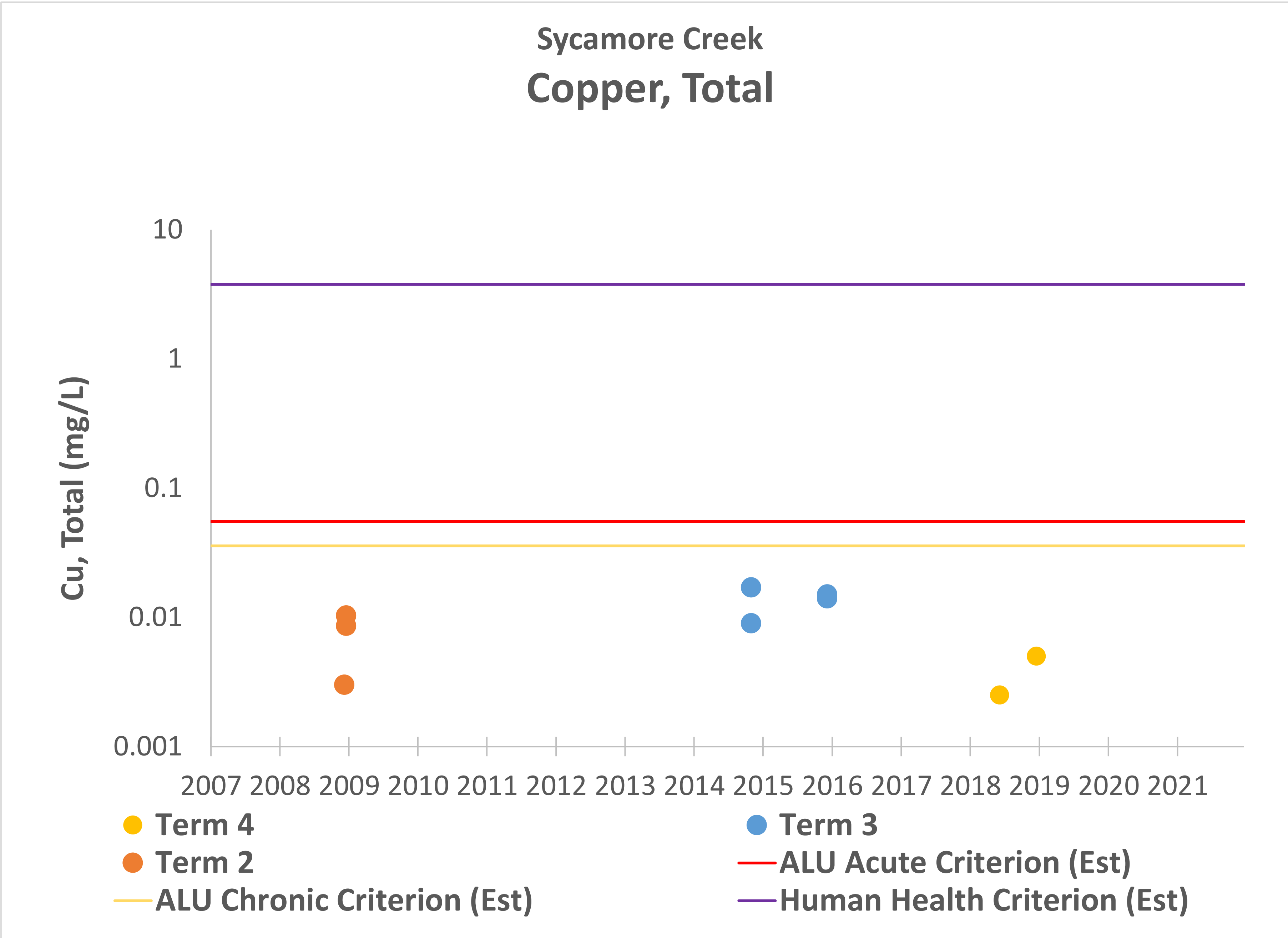


Sycamore Creek
Phosphorus, Total
P, Total (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Term 2
Nutrient Screening Criterion

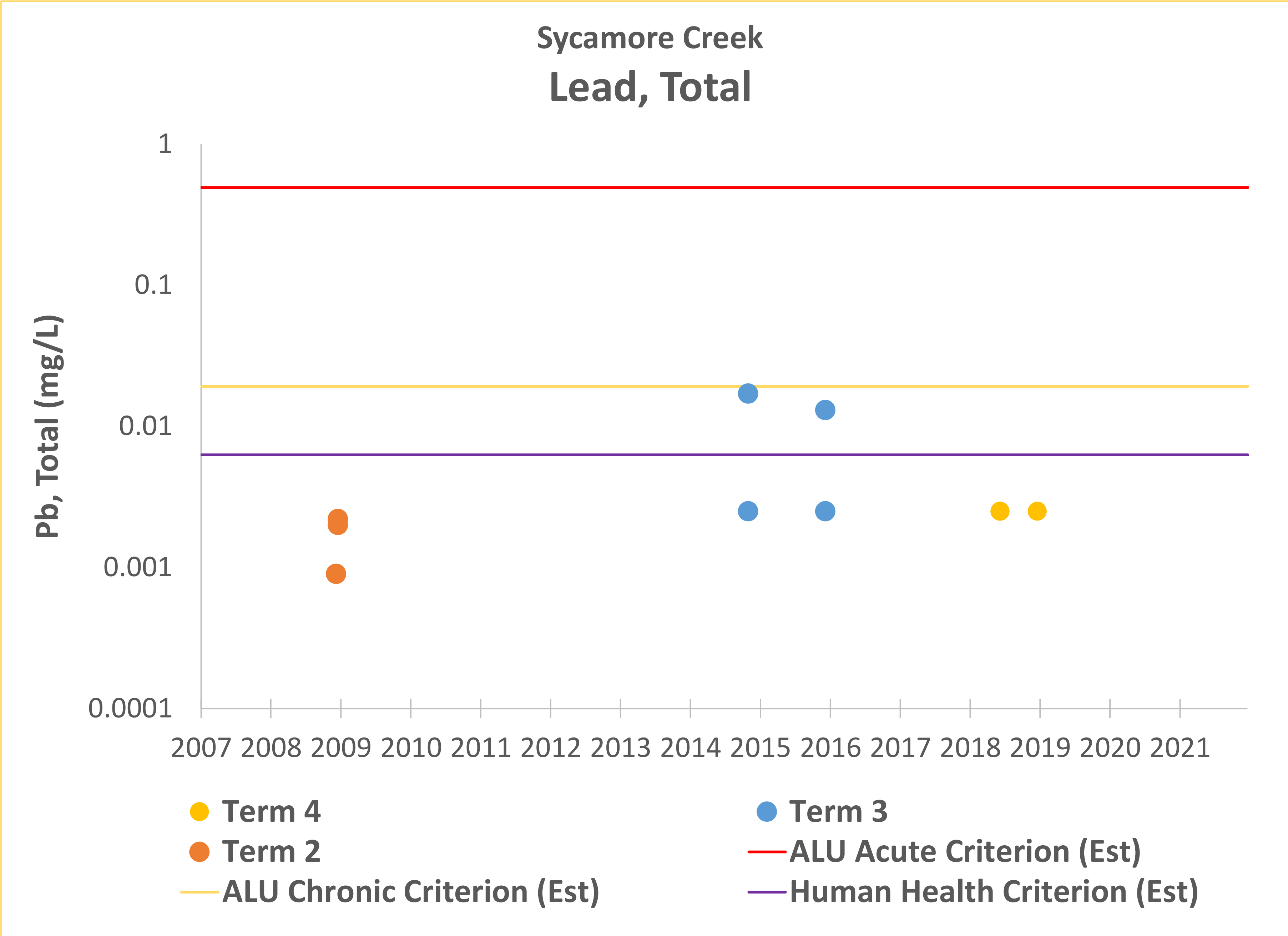

Sycamore Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)



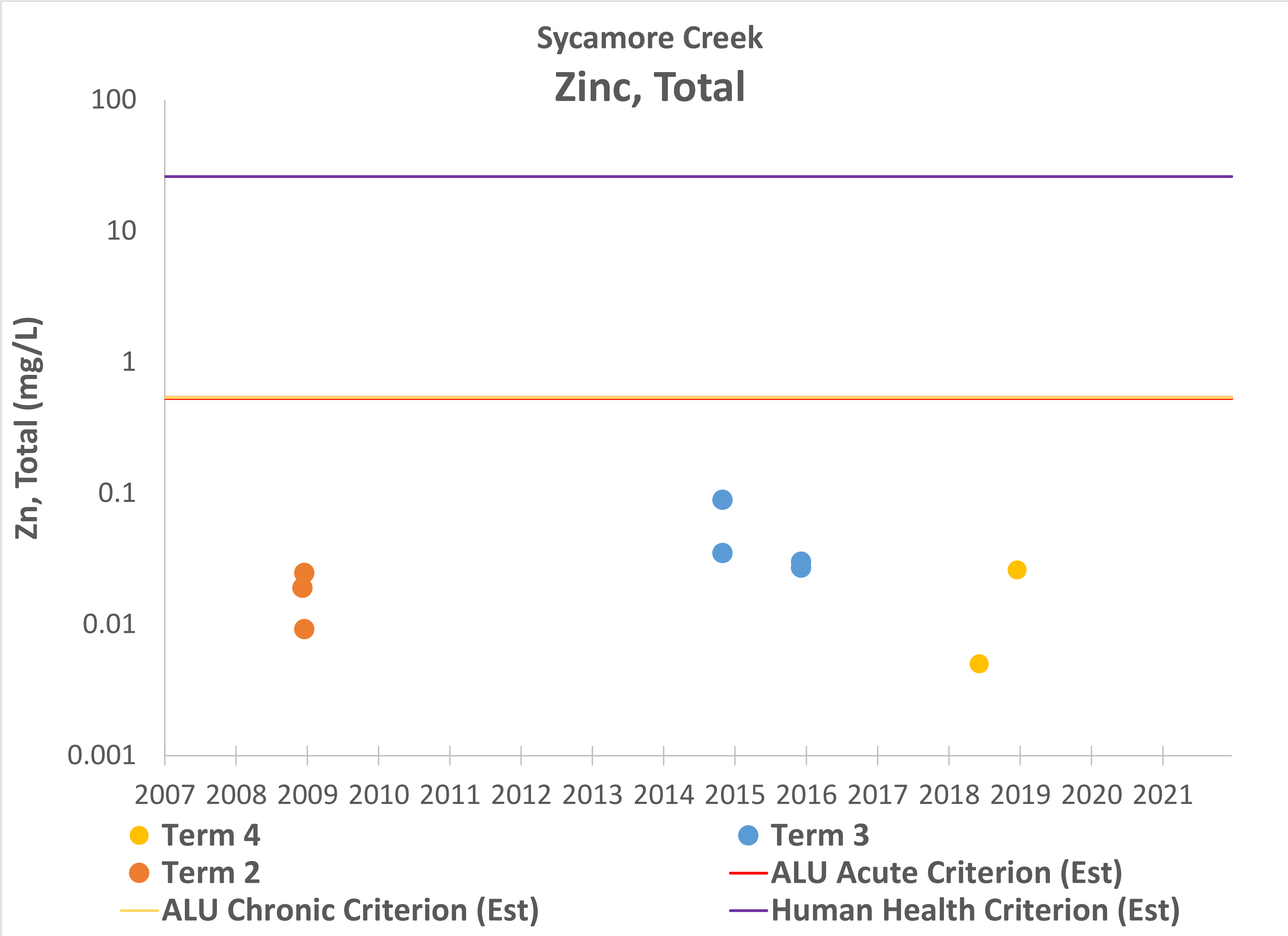
Sycamore Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

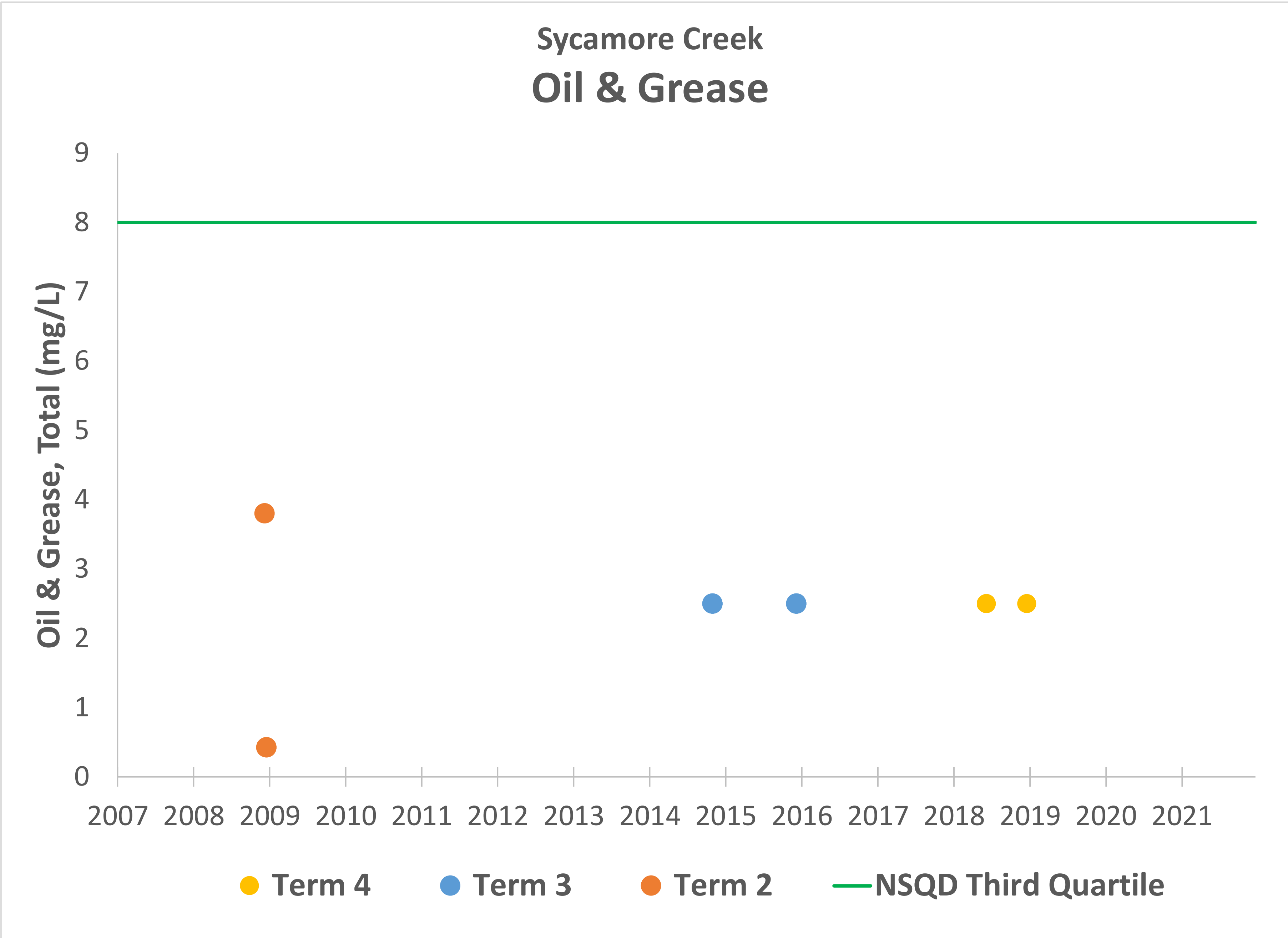


Sycamore Creek
Copper, Total
Cu, Total (mg/L)
10
1
0.1
0.01
0.001
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

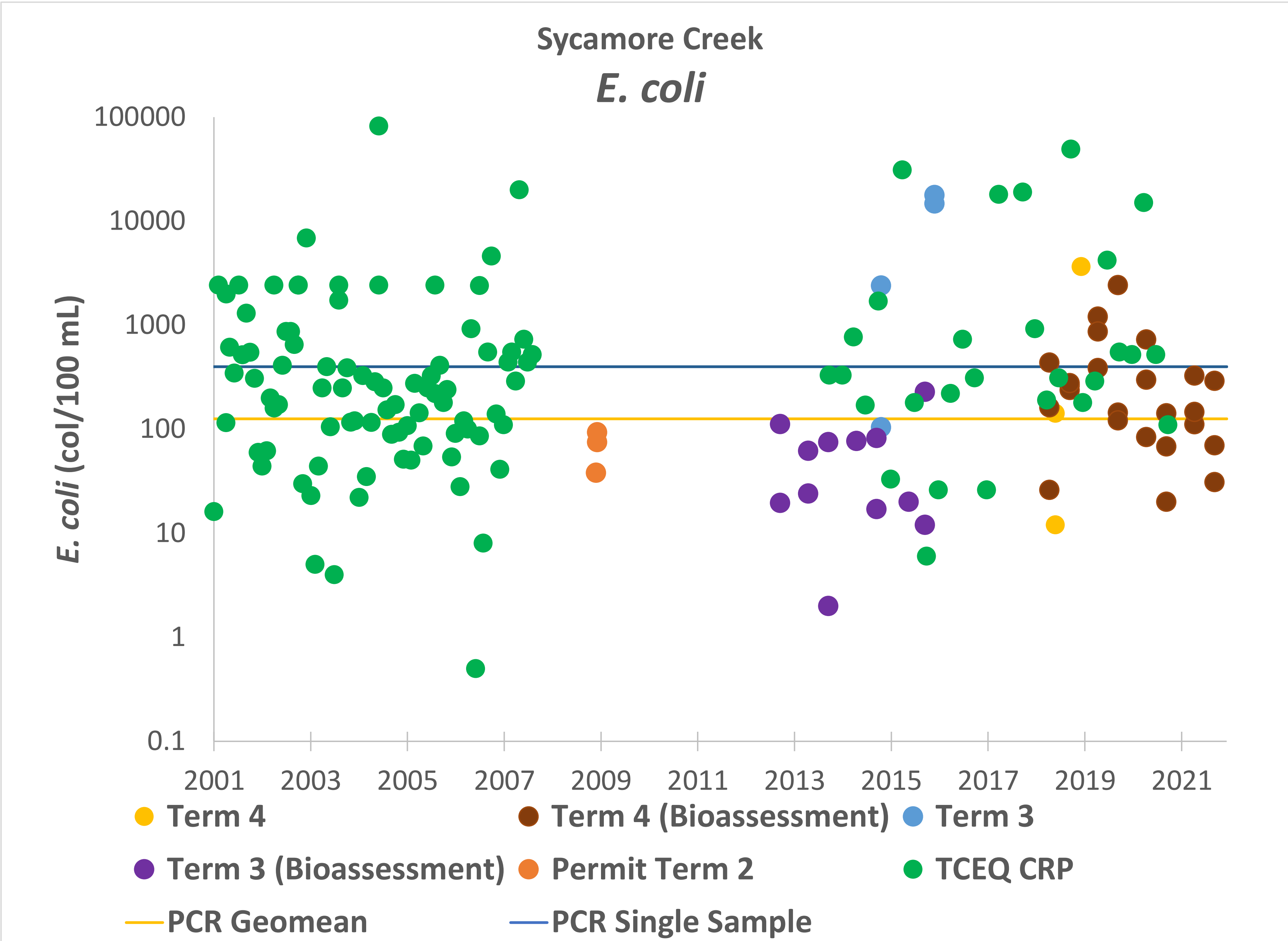


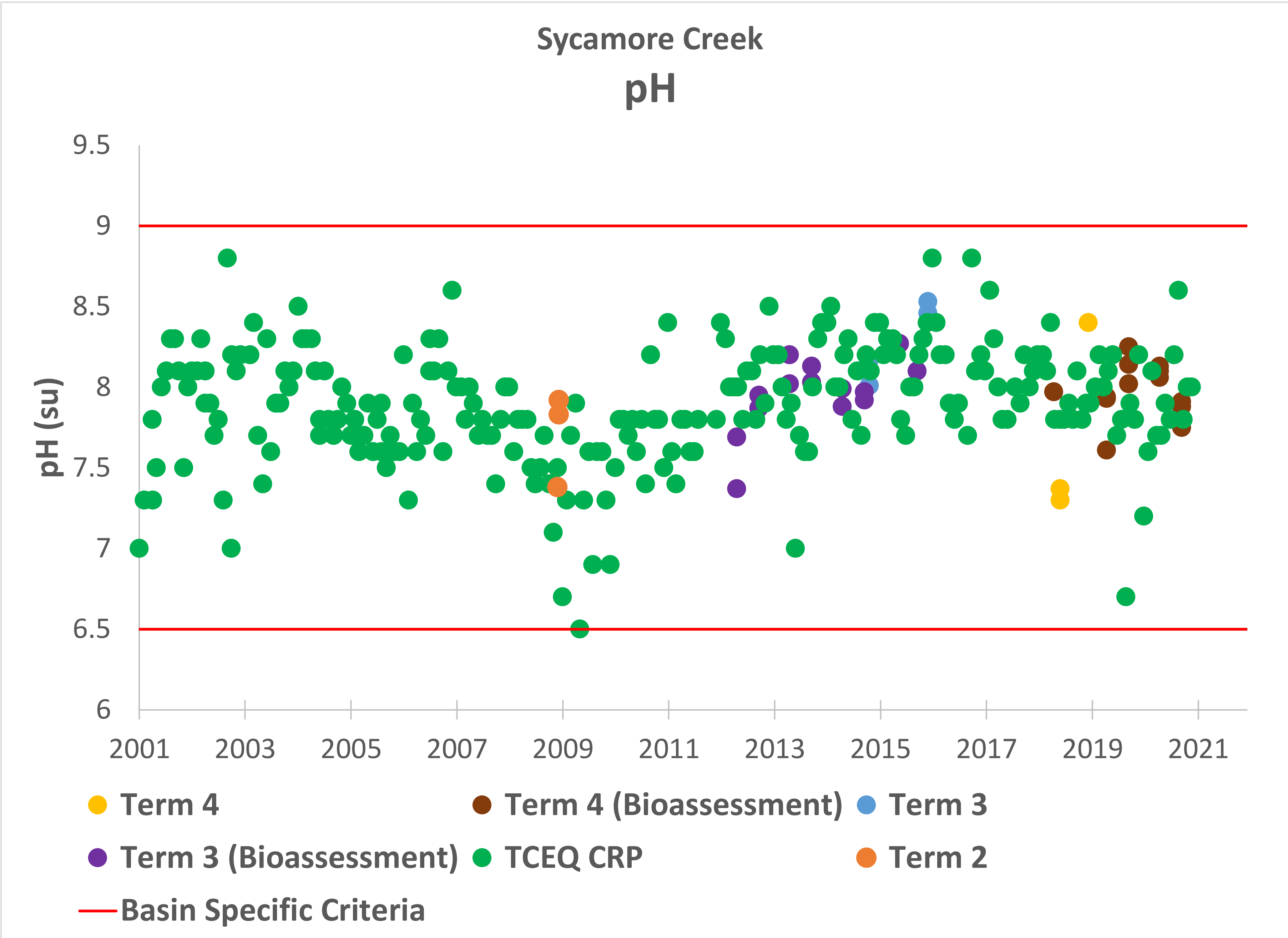
Sycamore Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

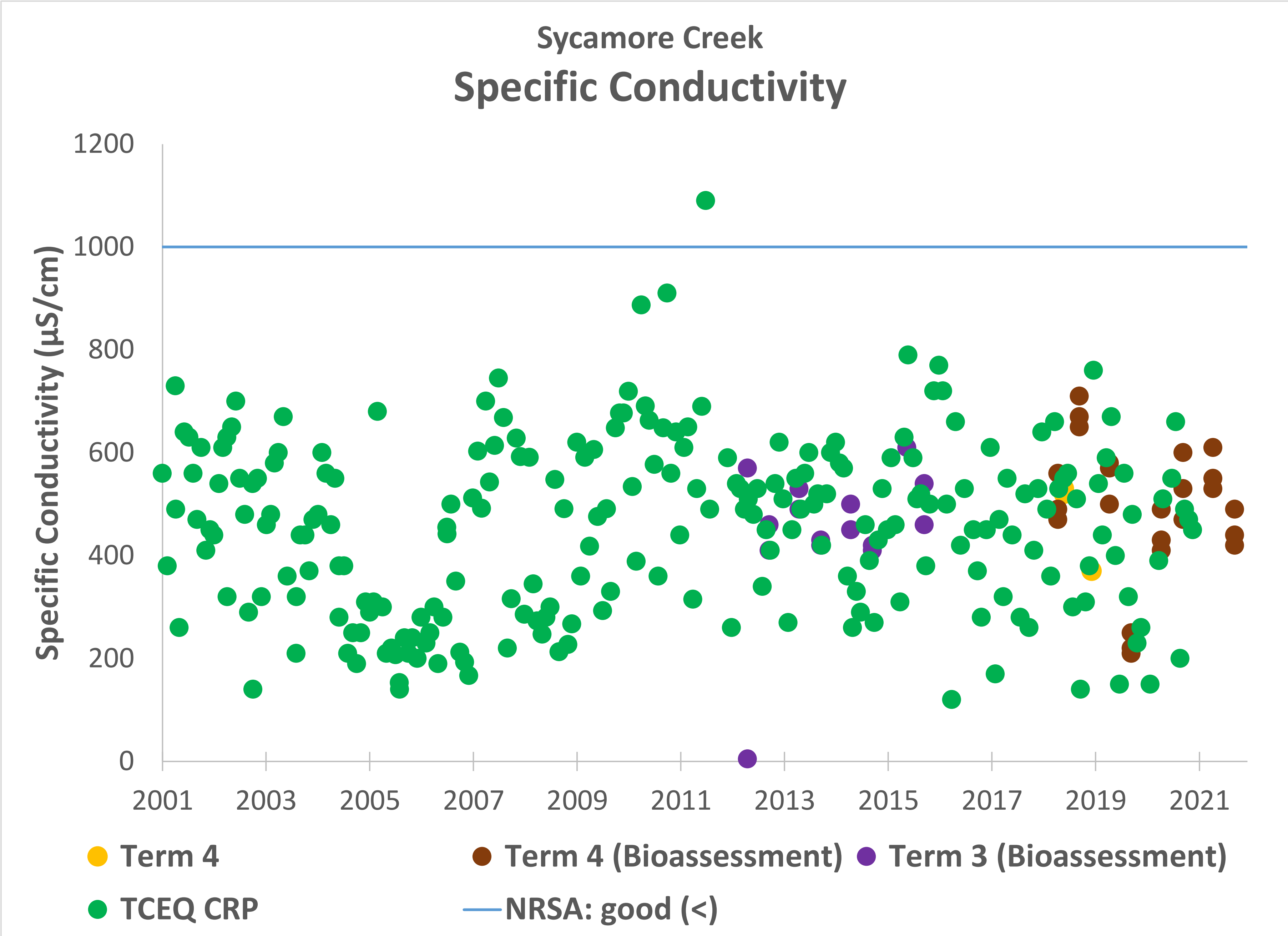

Sycamore Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

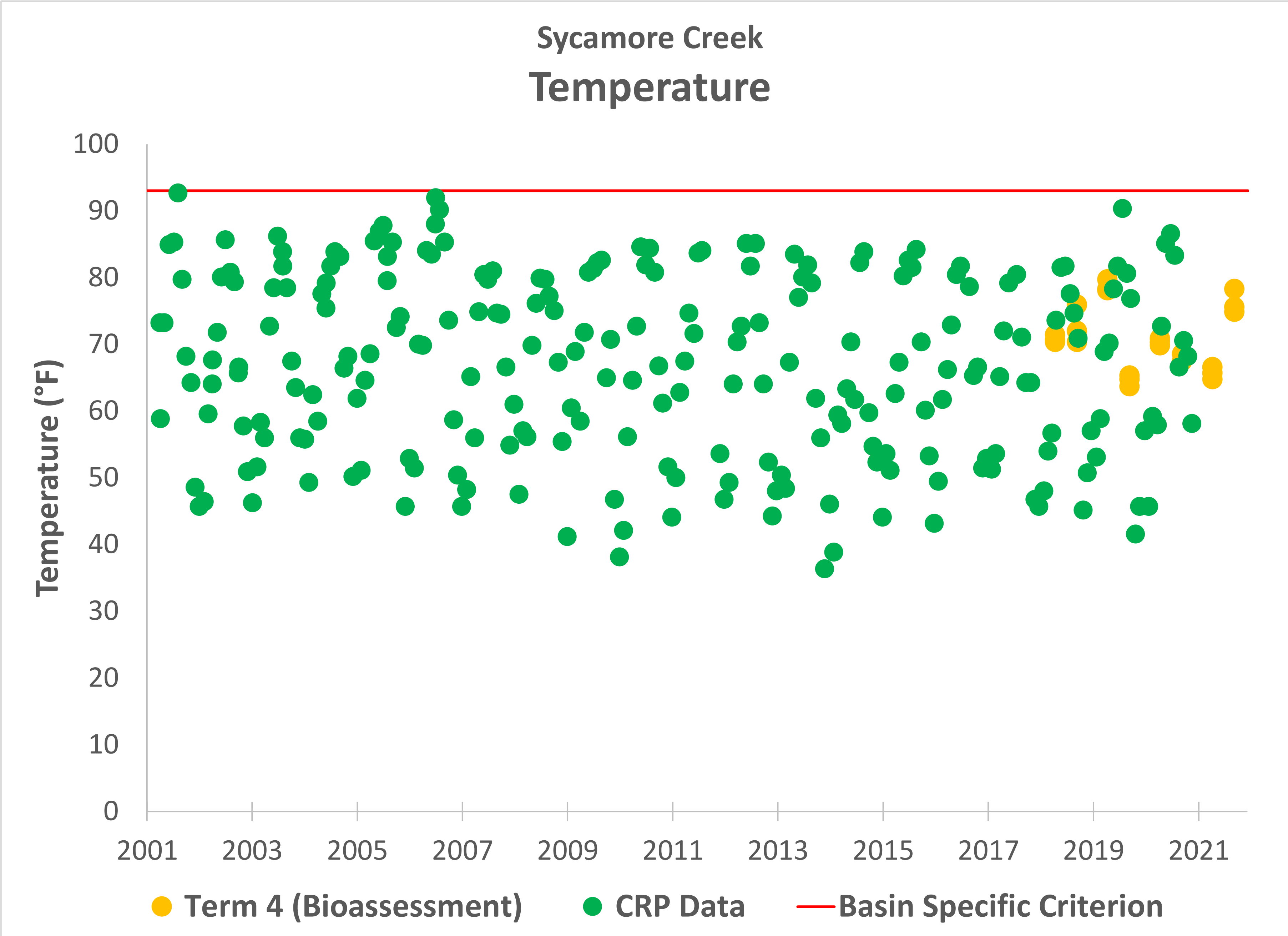


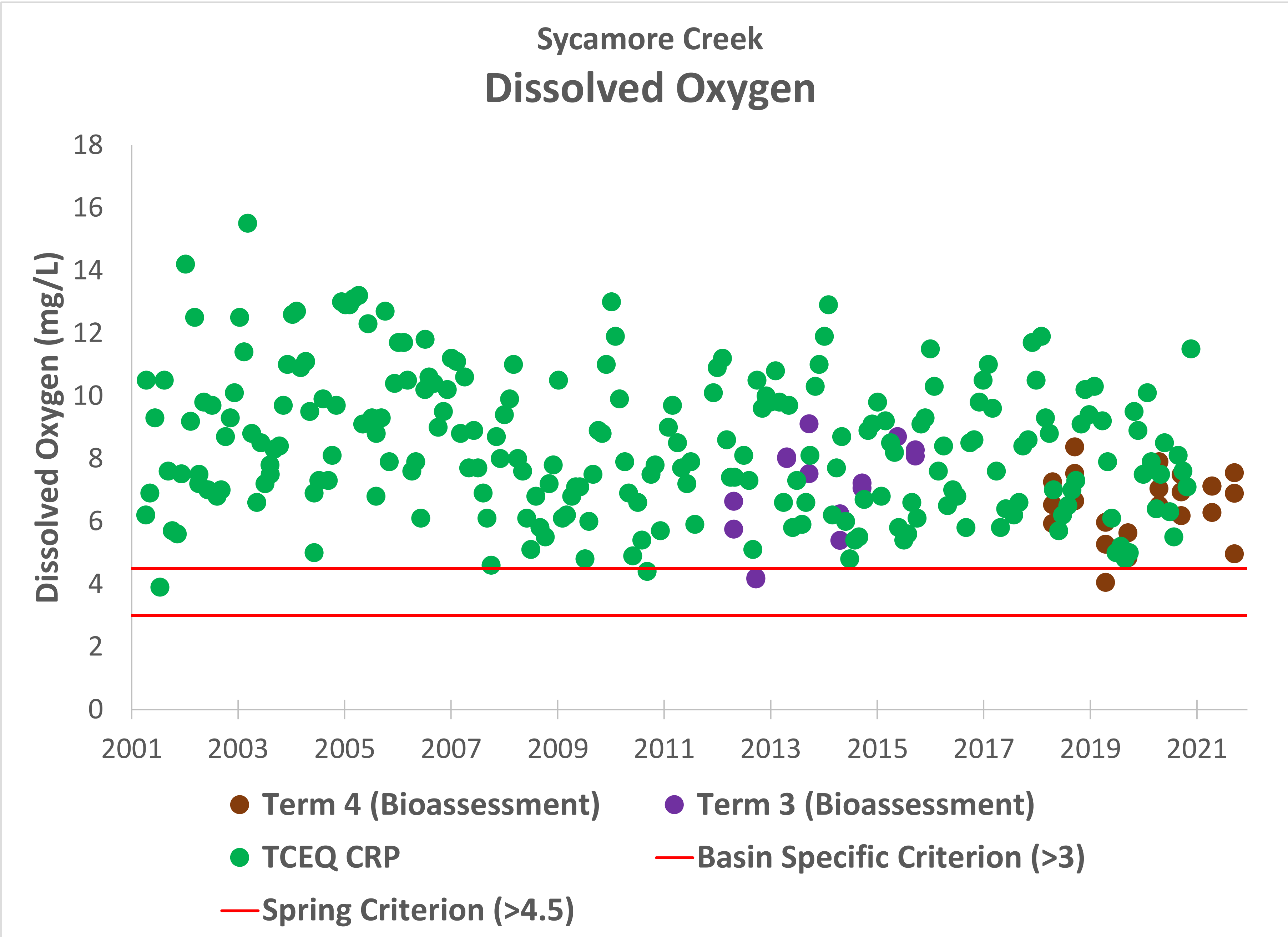
Sycamore Creek
Oil & Grease
Oil & Grease, Total (mg/L)
0
1
2
3
4
5
6
7
8
9
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Term 4
Term 3
Term 2
NSQD Third Quartile


Sycamore Creek
E. coli
E. coli (col/100 mL)
100000
10000
1000
100
10
1
0.1
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 4 (Bioassessment)
Term 3
Term 3 (Bioassessment)
Permit Term 2
TCEQ CRP
PCR Geomean
PCR Single Sample

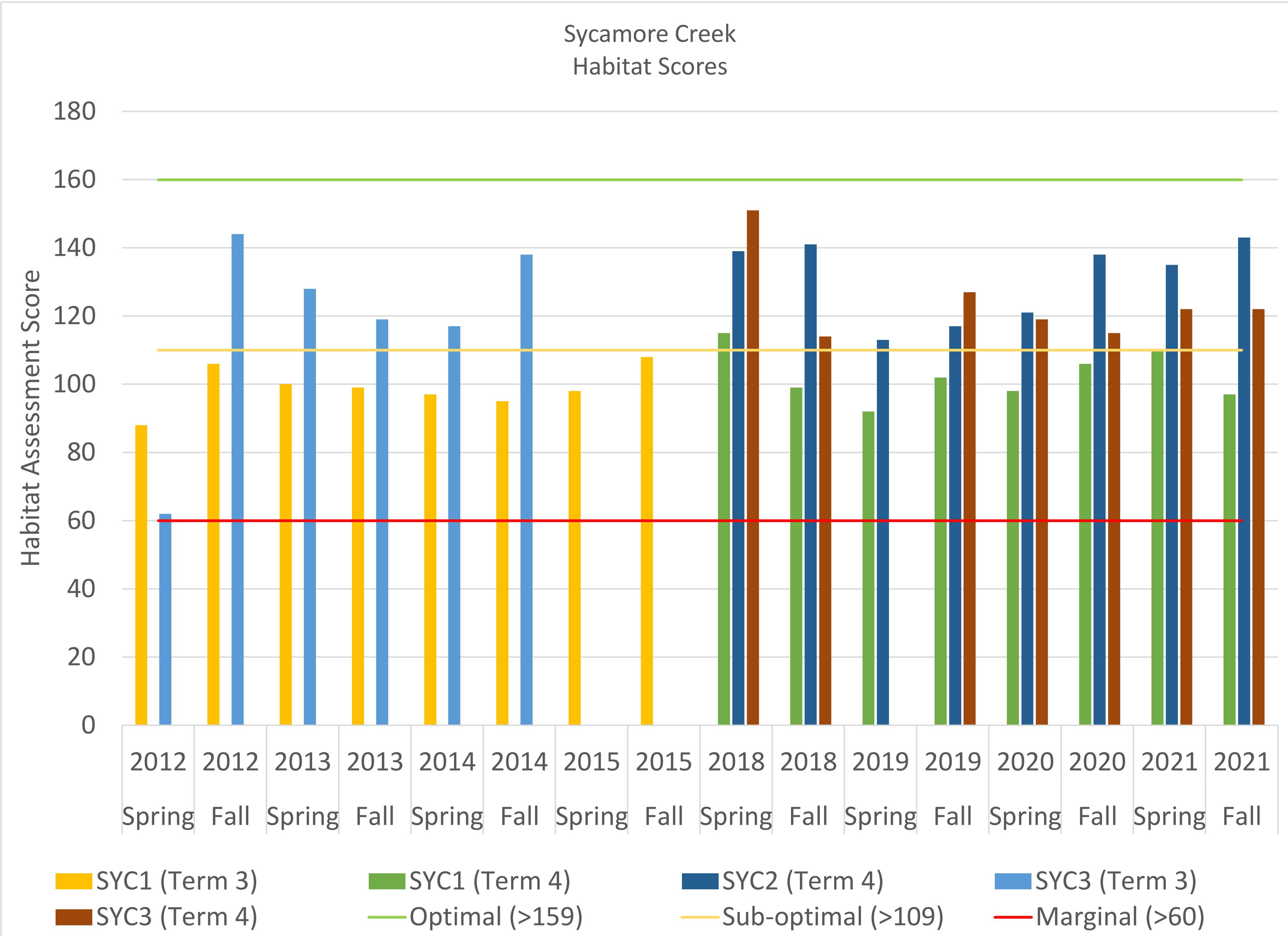

Sycamore Creek
pH
pH (su)
9.5
9
8.5
8
7.5
7
6.5
6
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 4 (Bioassessment)
Term 3
Term 3 (Bioassessment)
TCEQ CRP
Term 2
Basin Specific Criteria


Sycamore Creek
Specific Conductivity
Specific Conductivity (µS/cm)
1200
1000
800
600
400
200
0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 4 (Bioassessment)
Term 3 (Bioassessment)
TCEQ CRP
NRSA: good (<)

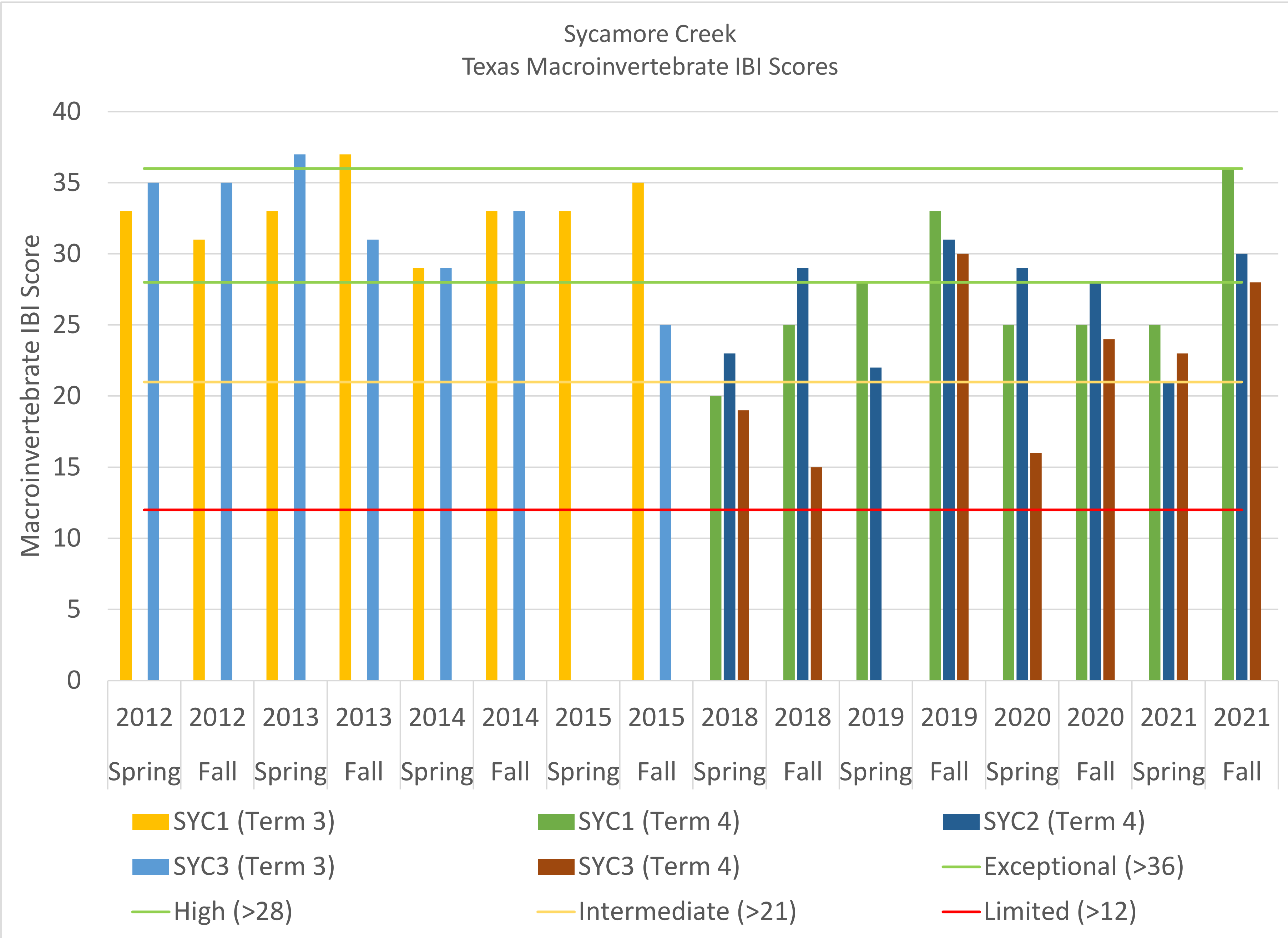

Sycamore Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4 (Bioassessment)
CRP Data
Basin Specific Criterion



Sycamore Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
0
2
4
6
8
10
12
14
16
18
2001
2003
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4 (Bioassessment)
Term 3 (Bioassessment)
TCEQ CRP
Basin Specific Criterion (>3)
Spring Criterion (>4.5)



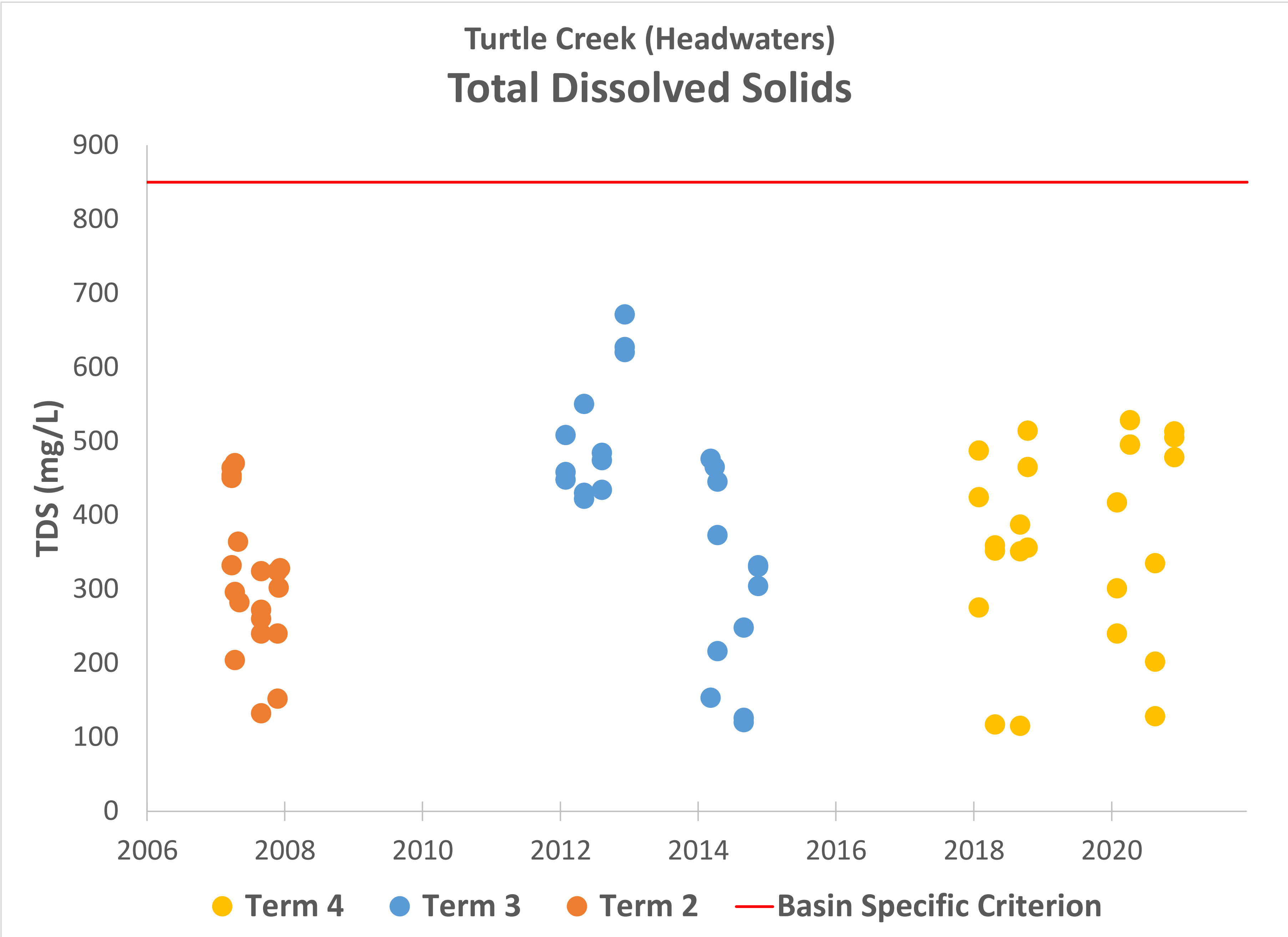
Sycamore Creek
Habitat Scores
Habitat Assessment Score
180
160
140
120
100
80
60
40
20
0
2012 Spring
2012 Fall
2013 Spring
2013 Fall
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
SYC1 (Term 3)
SYC1 (Term 4)
SYC2 (Term 4)
SYC3 (Term 3)
SYC3 (Term 4)
Optimal (>159)
Sub-optimal (>109)
Marginal (>60)

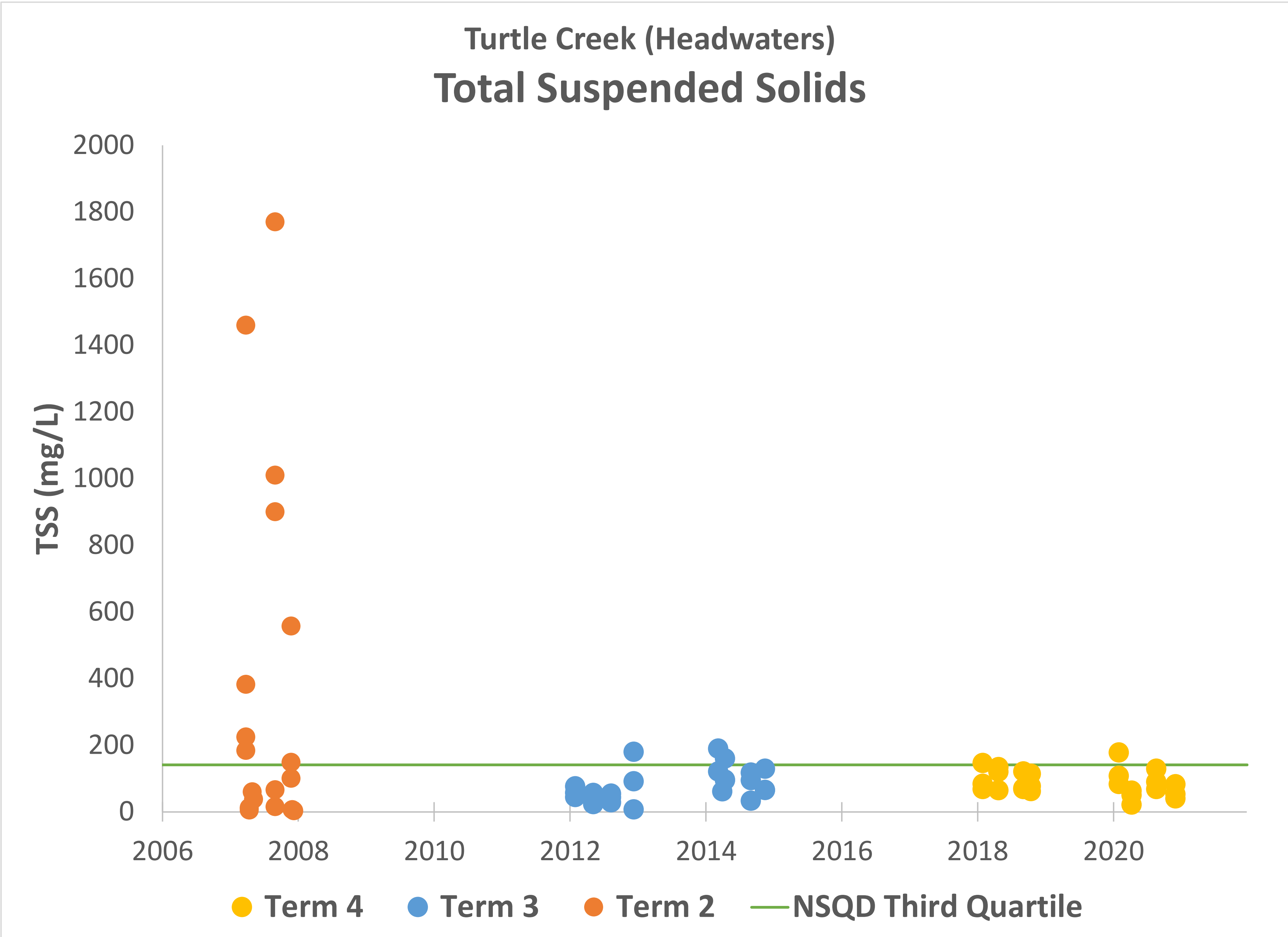


Sycamore Creek
Texas Macroinvertebrate IBI Scores
Macroinvertebrate IBI Score
40
35
30
25
20
15
10
5
0
2012 Spring
2012 Fall
2013 Spring
2013 Fall
2014 Spring
2014 Fall
2015 Spring
2015 Fall
2018 Spring
2018 Fall
2019 Spring
2019 Fall
2020 Spring
2020 Fall
2021 Spring
2021 Fall
SYC1 (Term 3)
SYC1 (Term 4)
SYC2 (Term 4)
SYC3 (Term 3)
SYC3 (Term 4)
Exceptional (>36)
High (>28)
Intermediate (>21)
Limited (>12)

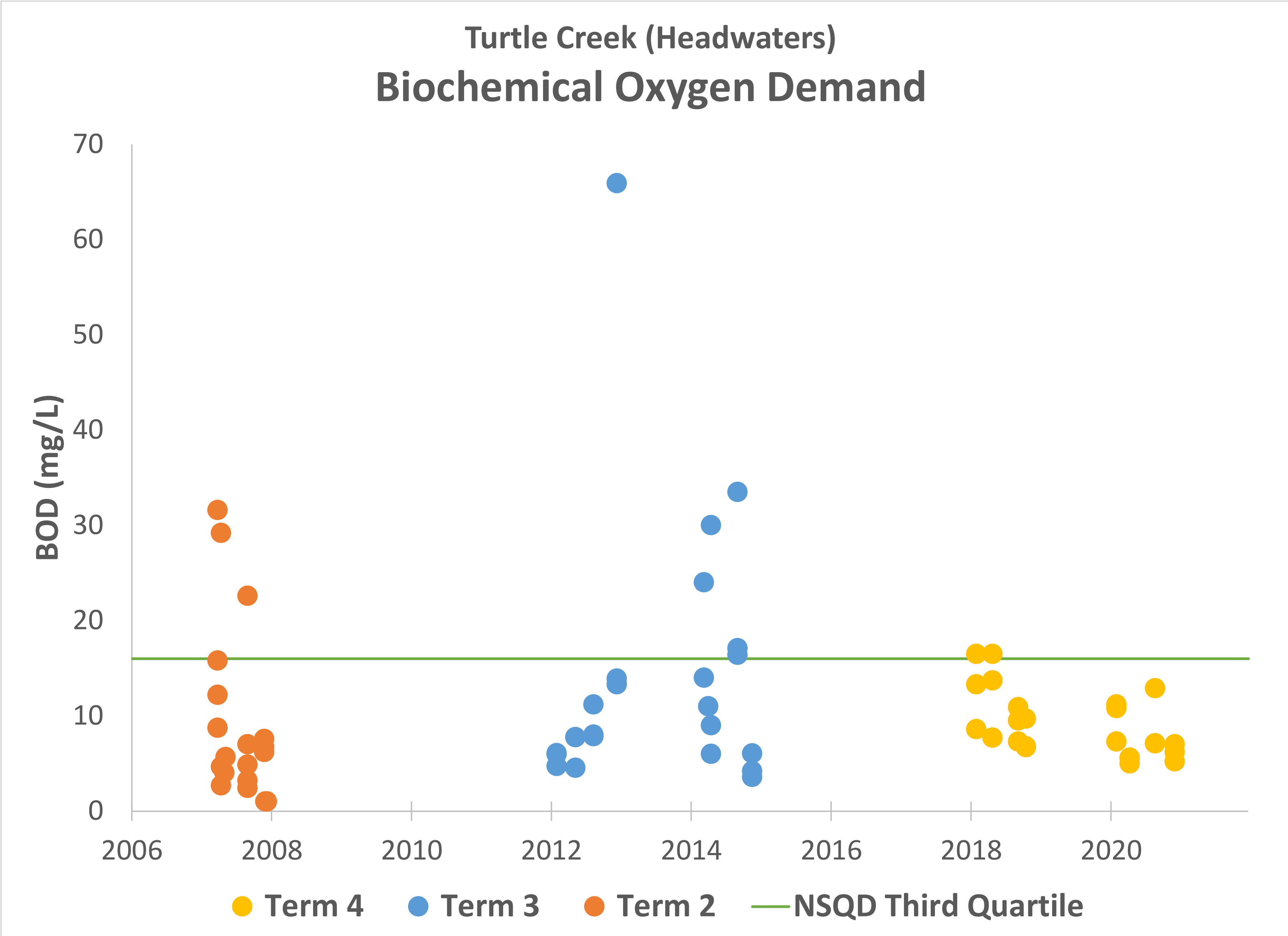
Appendix Y

Turtle Creek (Headwaters) Water Quality Data Graphs

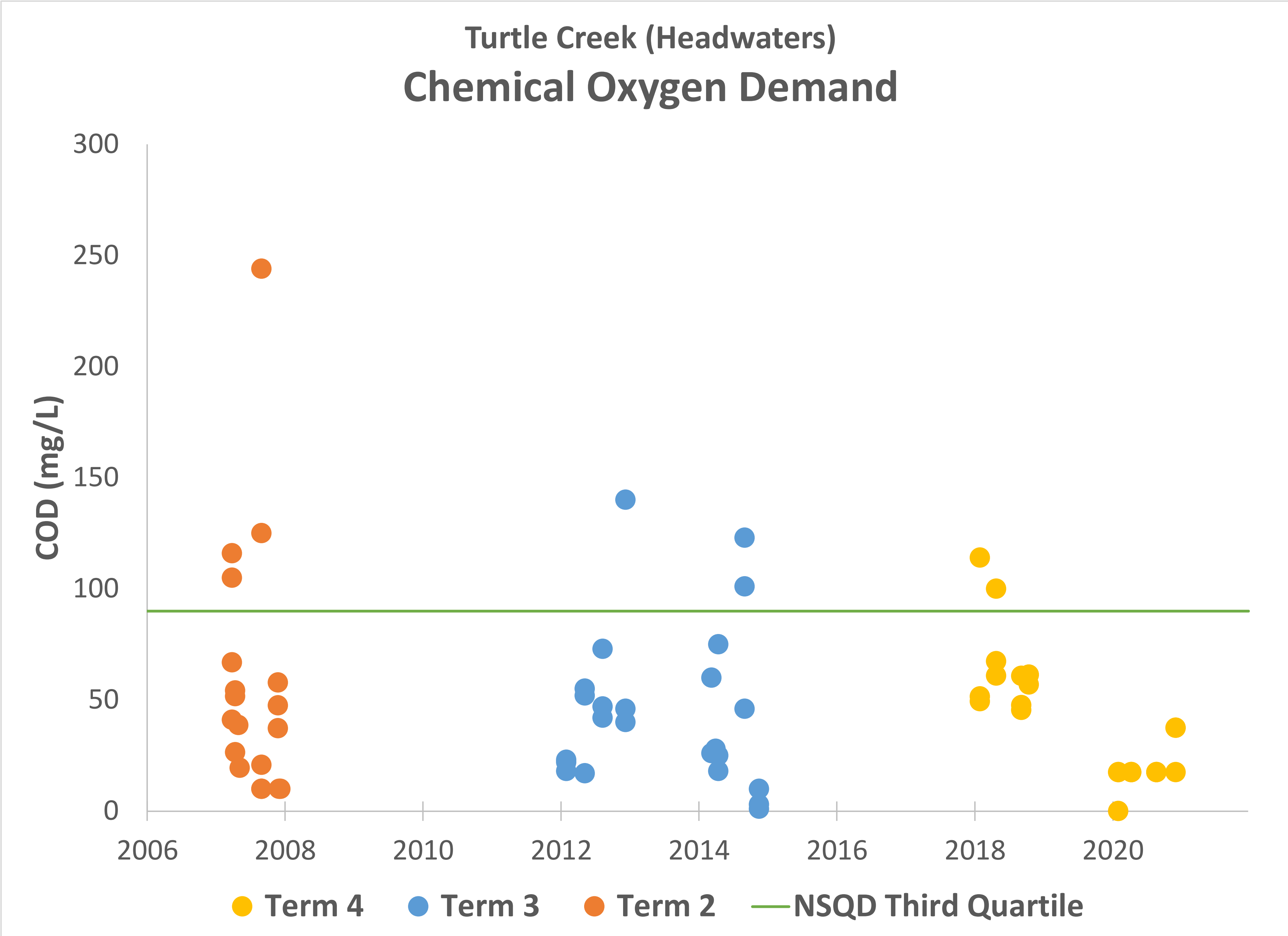

Turtle Creek (Headwaters)
Total Dissolved Solids
TDS (mg/L)
900
800
700
600
500
400
300
200
100
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
Basin Specific Criterion



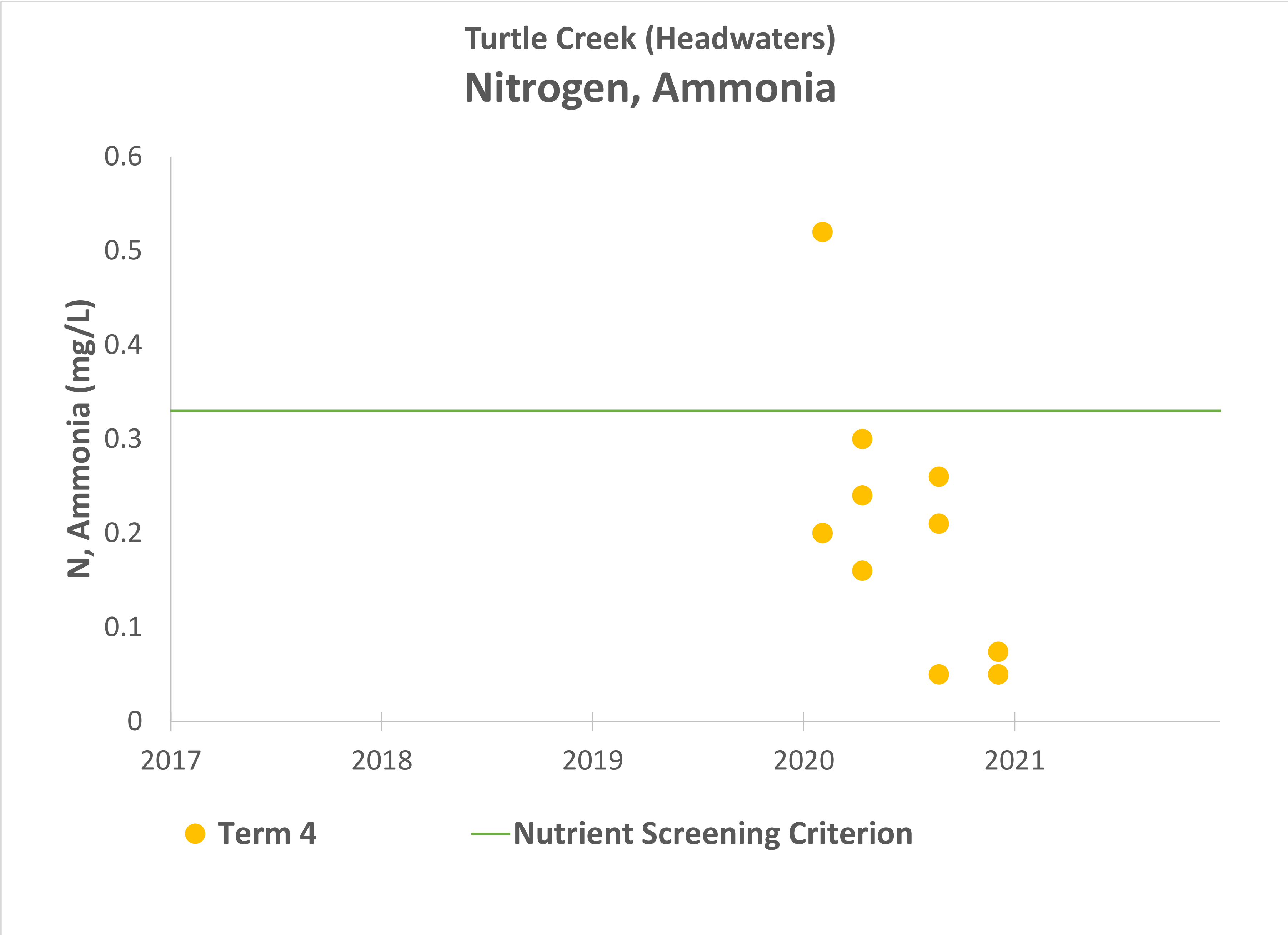
Turtle Creek (Headwaters)
Total Suspended Solids
TSS (mg/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile

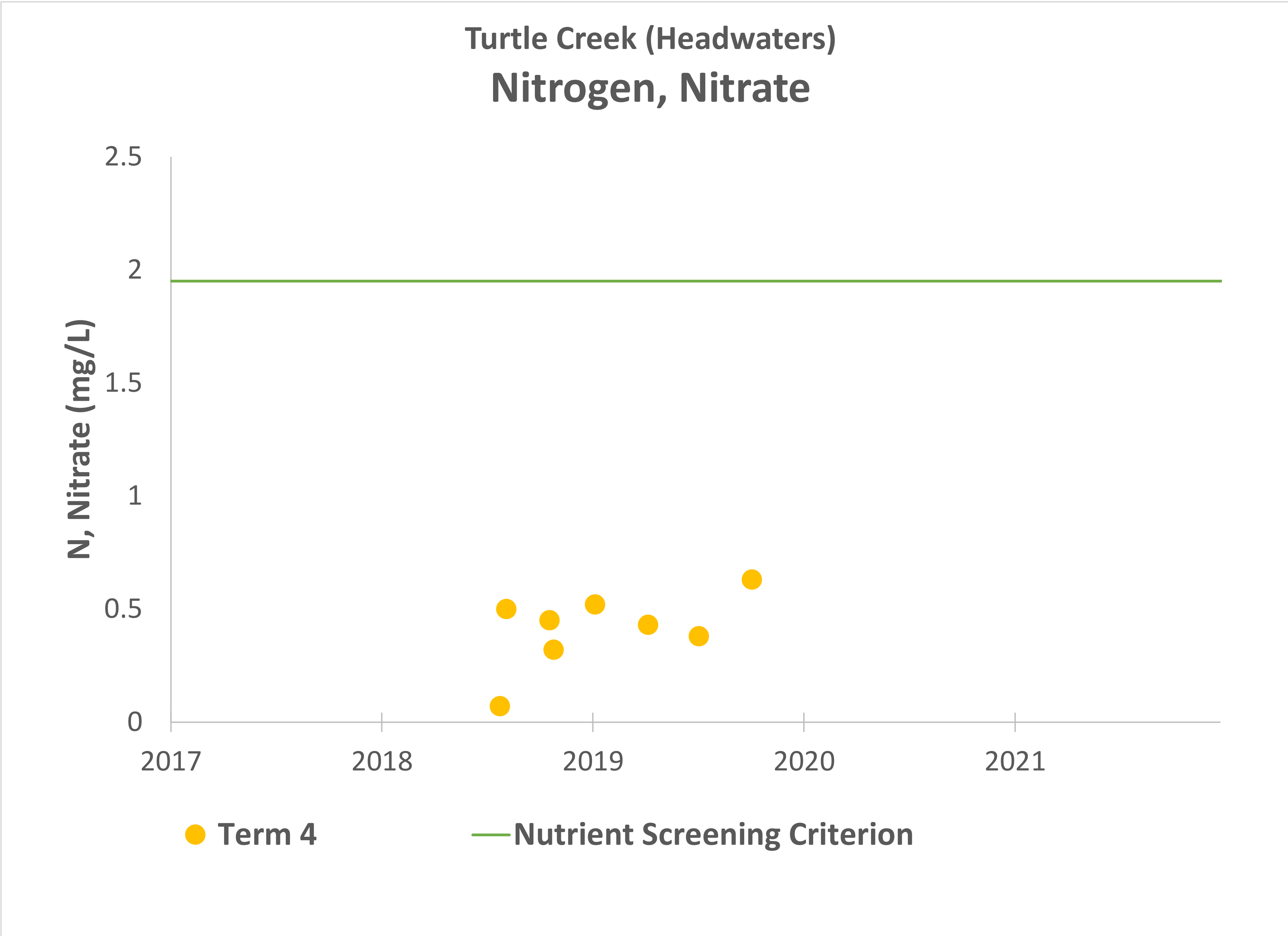


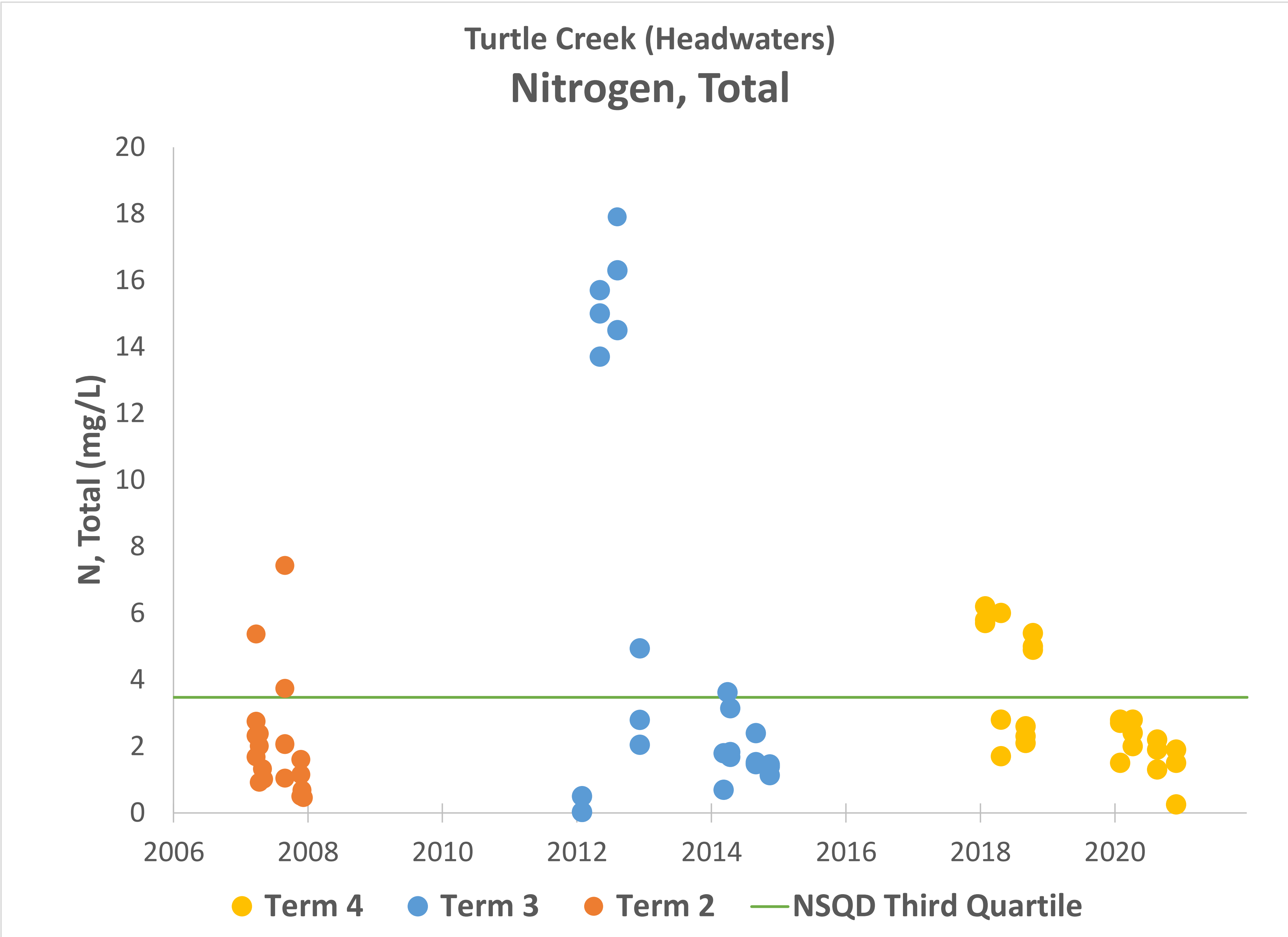
Turtle Creek (Headwaters)
Biochemical Oxygen Demand
BOD (mg/L)
70
60
50
40
30
20
10
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile



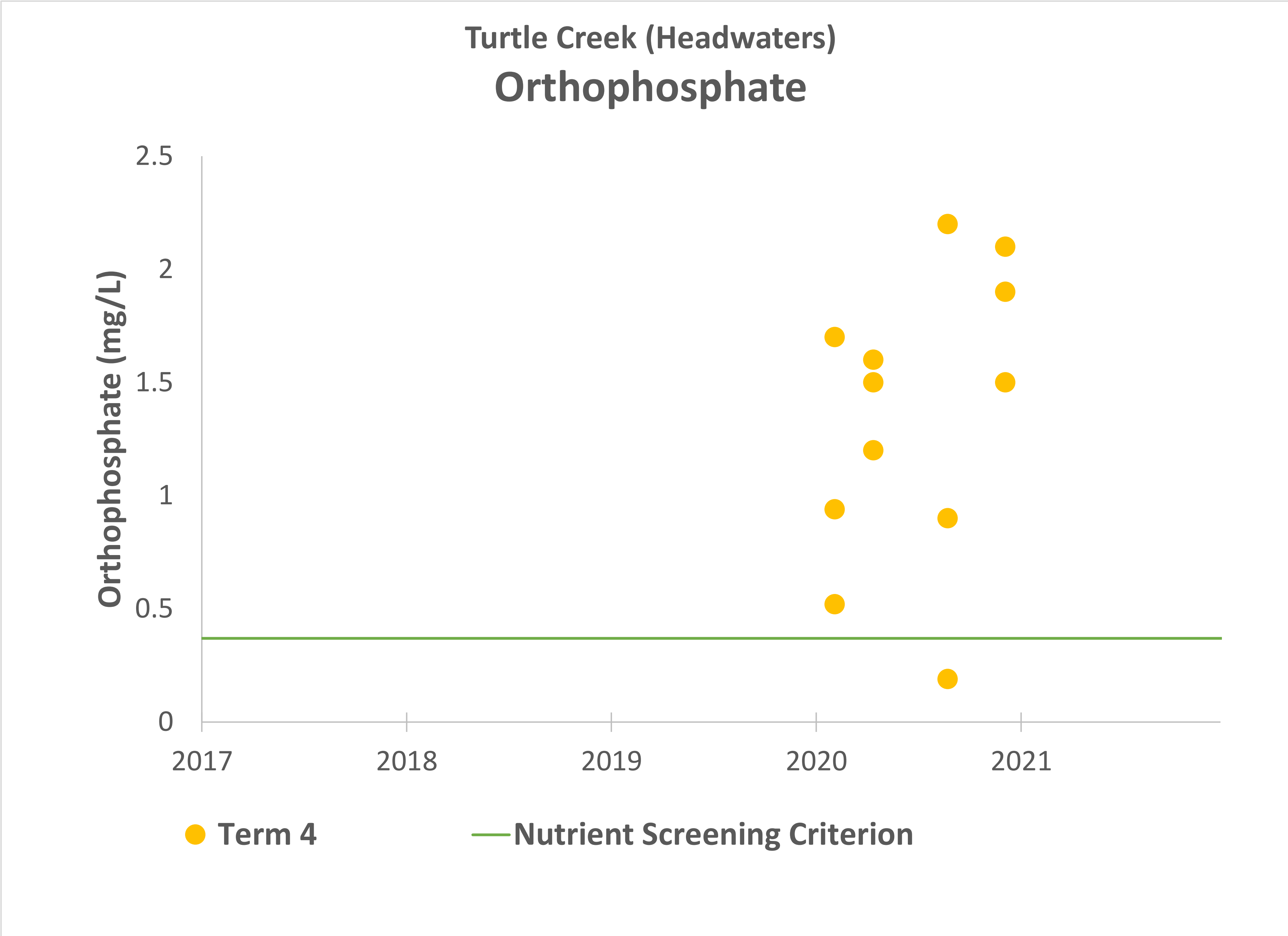
Turtle Creek (Headwaters)
Chemical Oxygen Demand
COD (mg/L)
300
250
200
150
100
50
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile


Turtle Creek (Headwaters)
Nitrogen, Ammonia
N, Ammonia (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

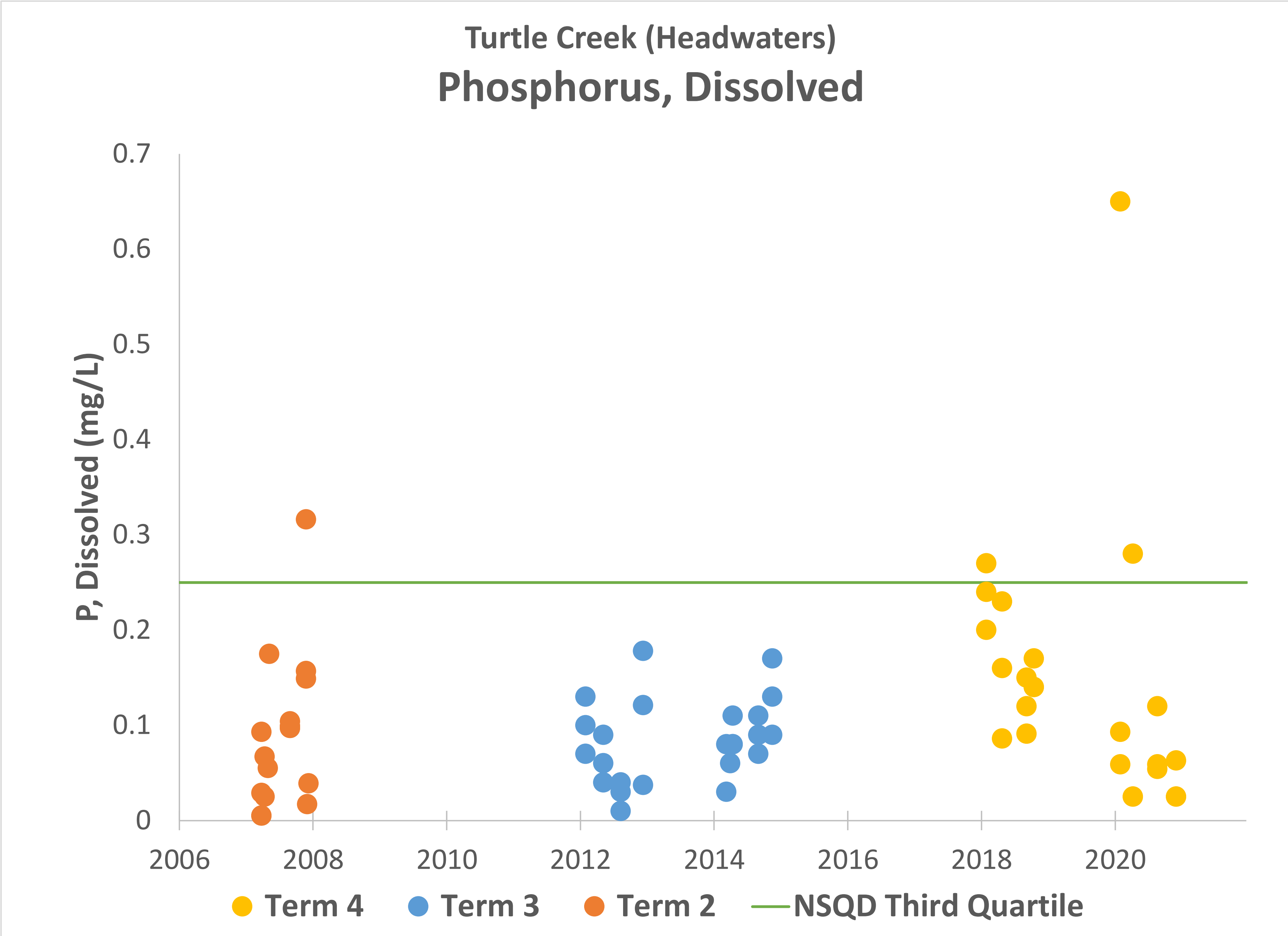

Turtle Creek (Headwaters)
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion



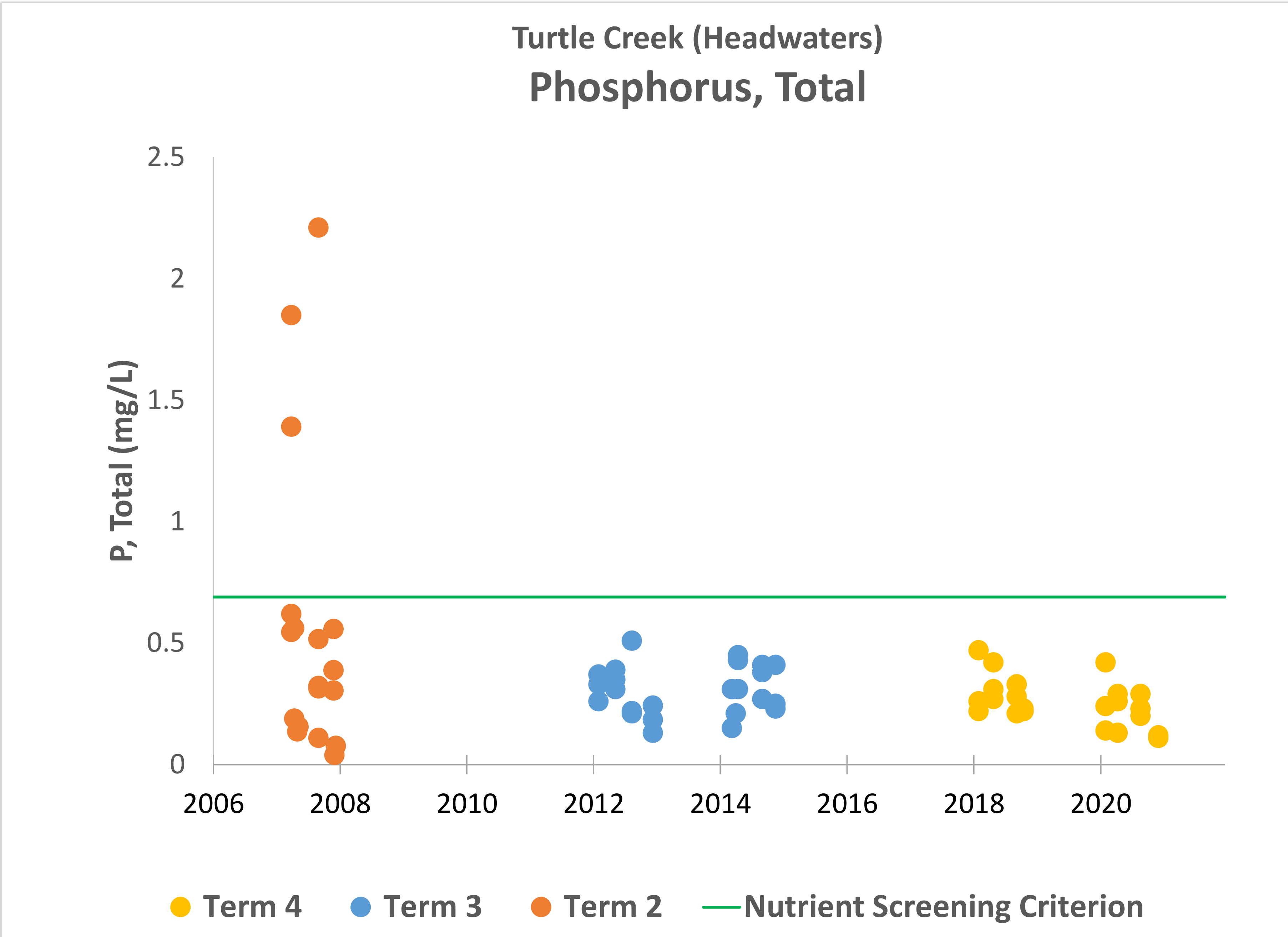
Turtle Creek (Headwaters)
Nitrogen, Total
N, Total (mg/L)
20
18
16
14
12
10
8
6
4
2
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile



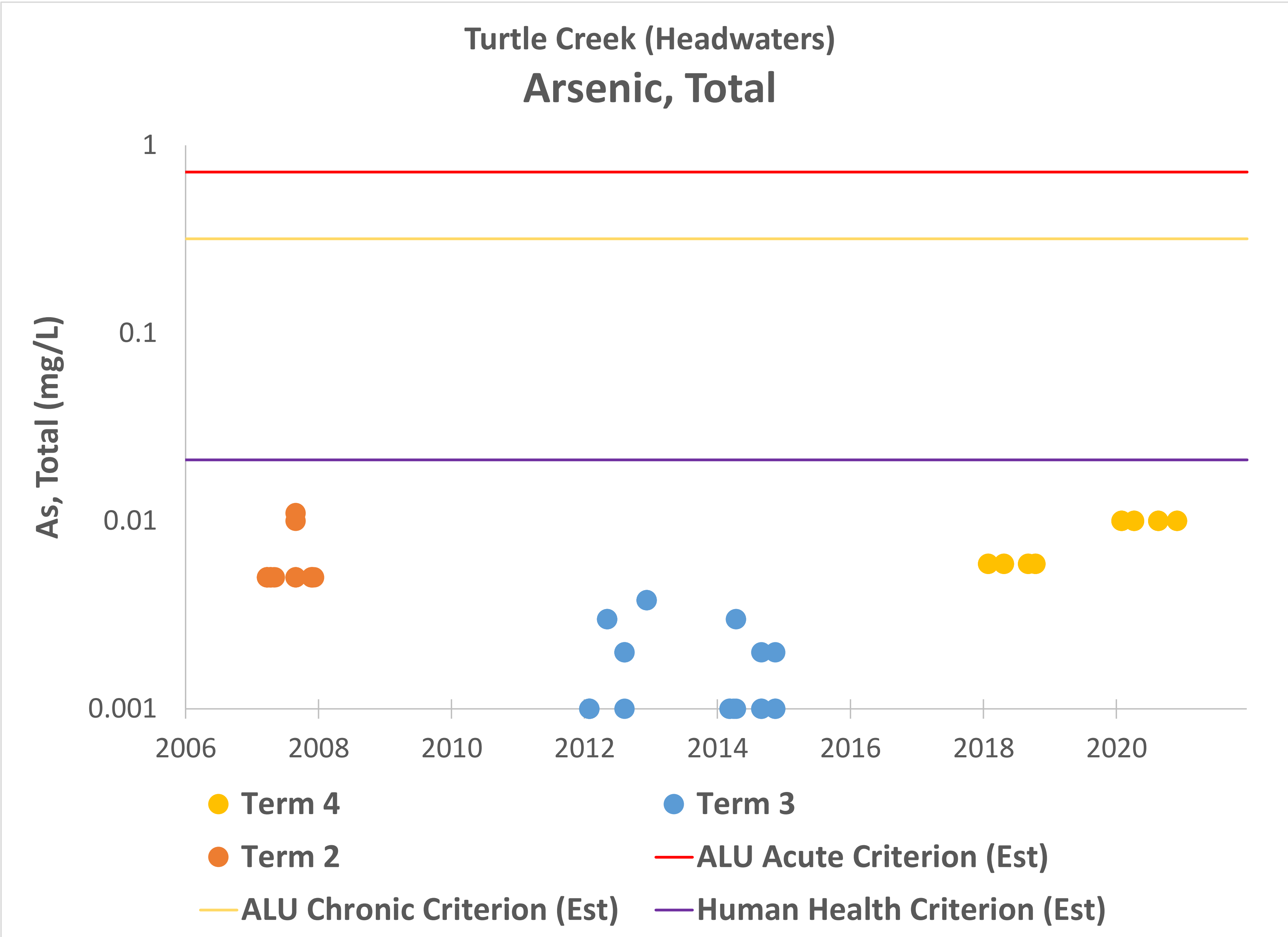
Turtle Creek (Headwaters)
Orthophosphate
Orthophosphate (mg/L)
2.5
2
1.5
1
0.5
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

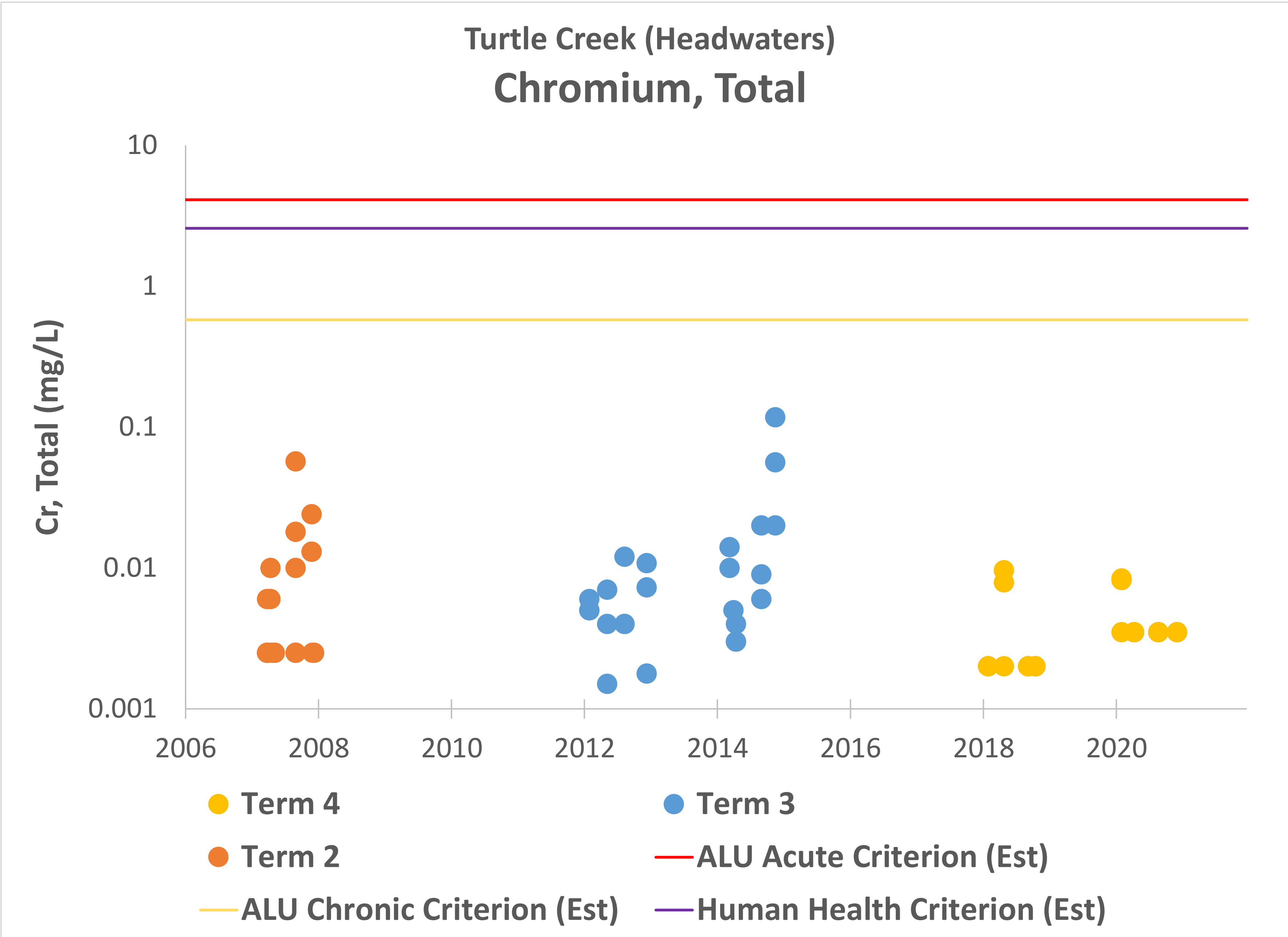


Turtle Creek (Headwaters)
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile

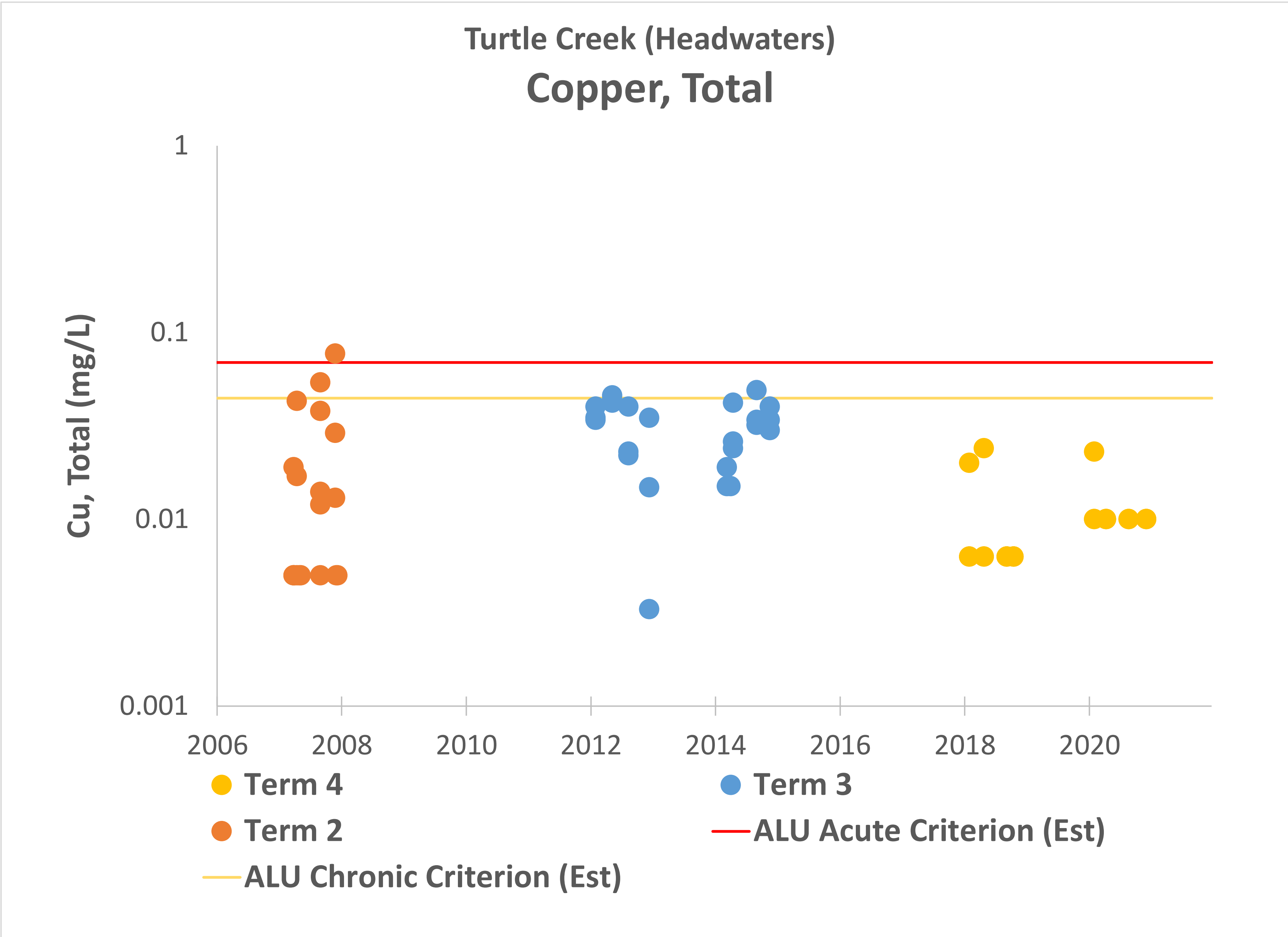


Turtle Creek (Headwaters)
Phosphorus, Total
P, Total (mg/L)
2.5
2
1.5
1
0.5
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
Nutrient Screening Criterion

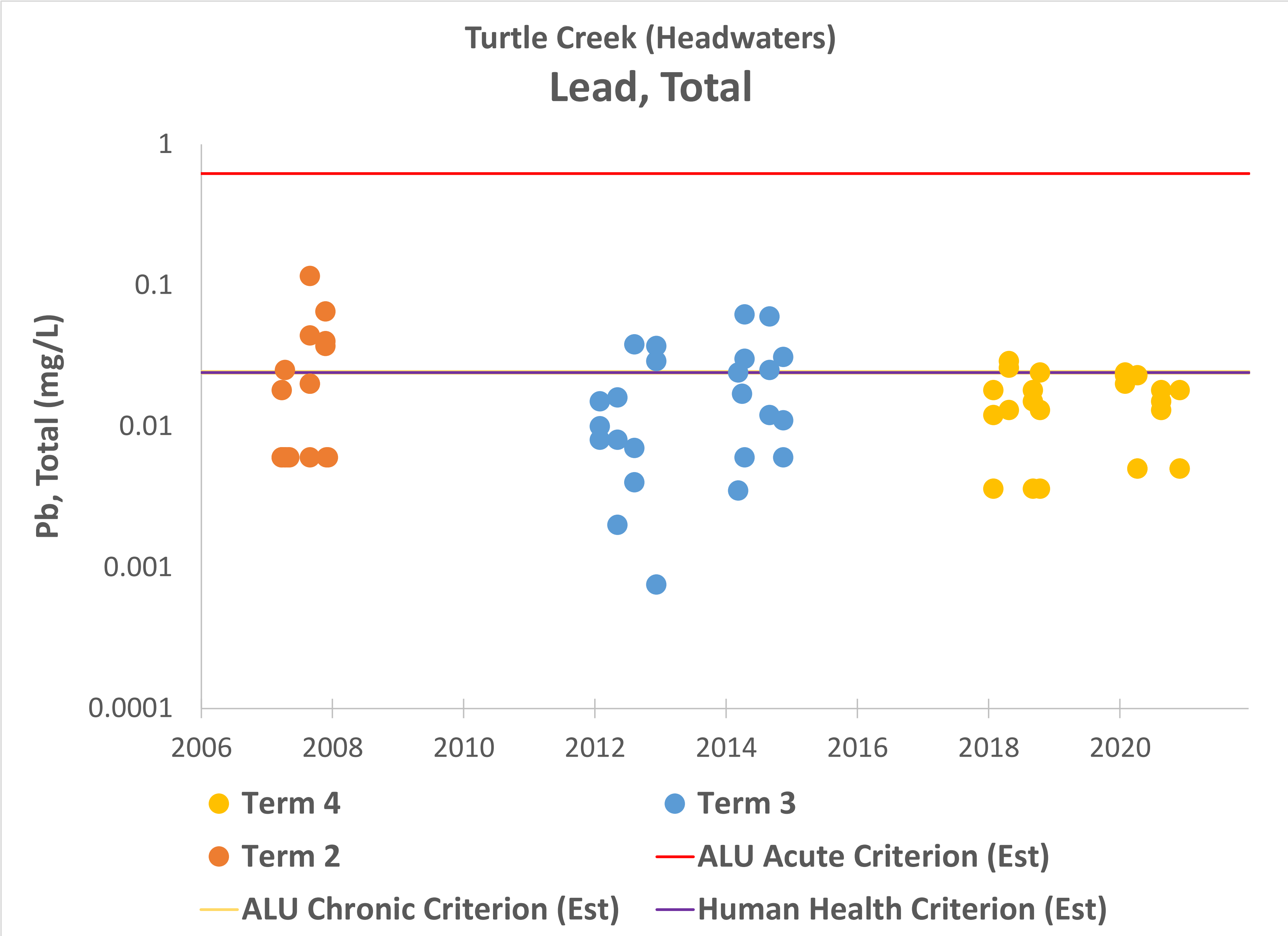

Turtle Creek (Headwaters)
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

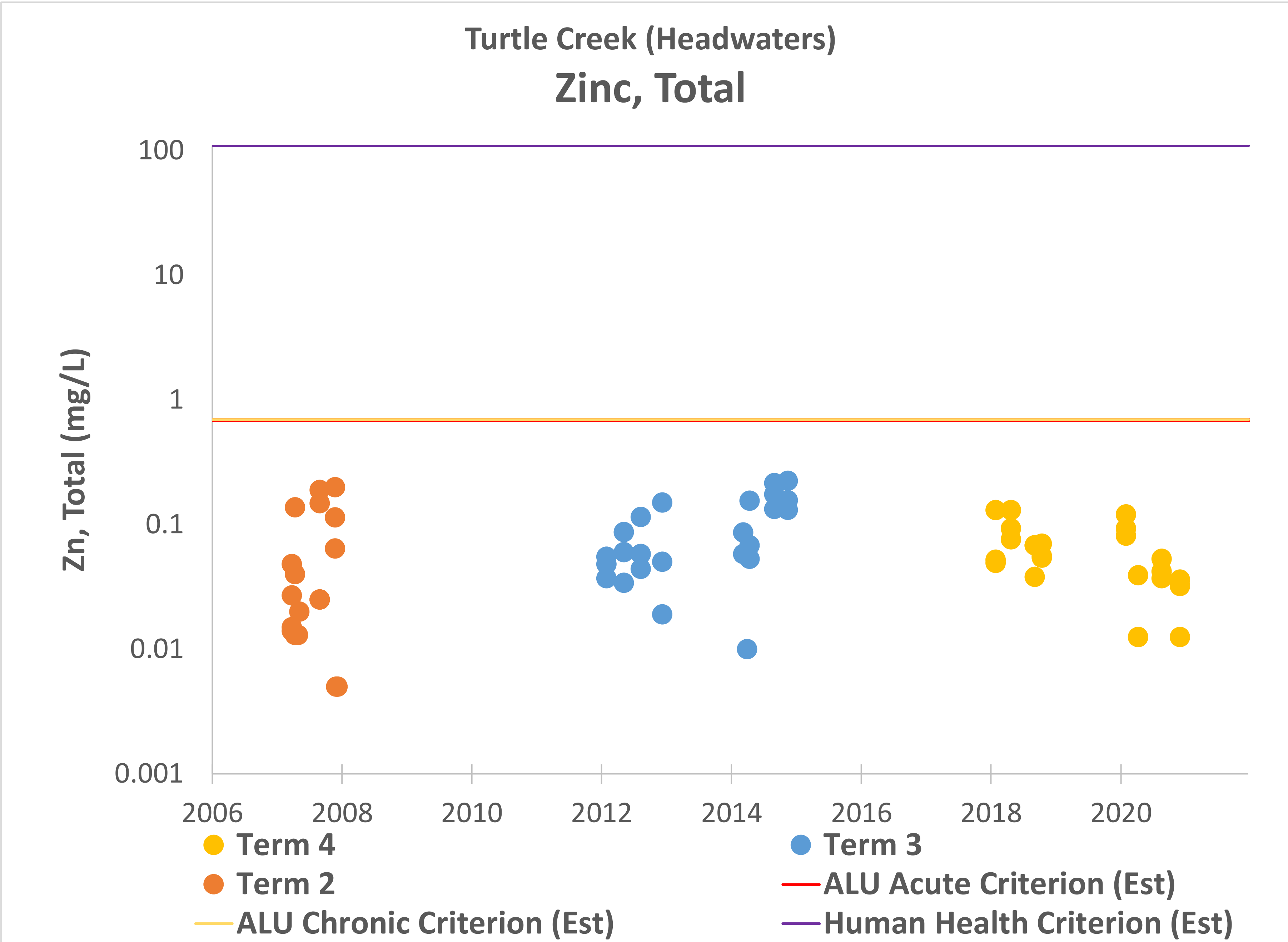


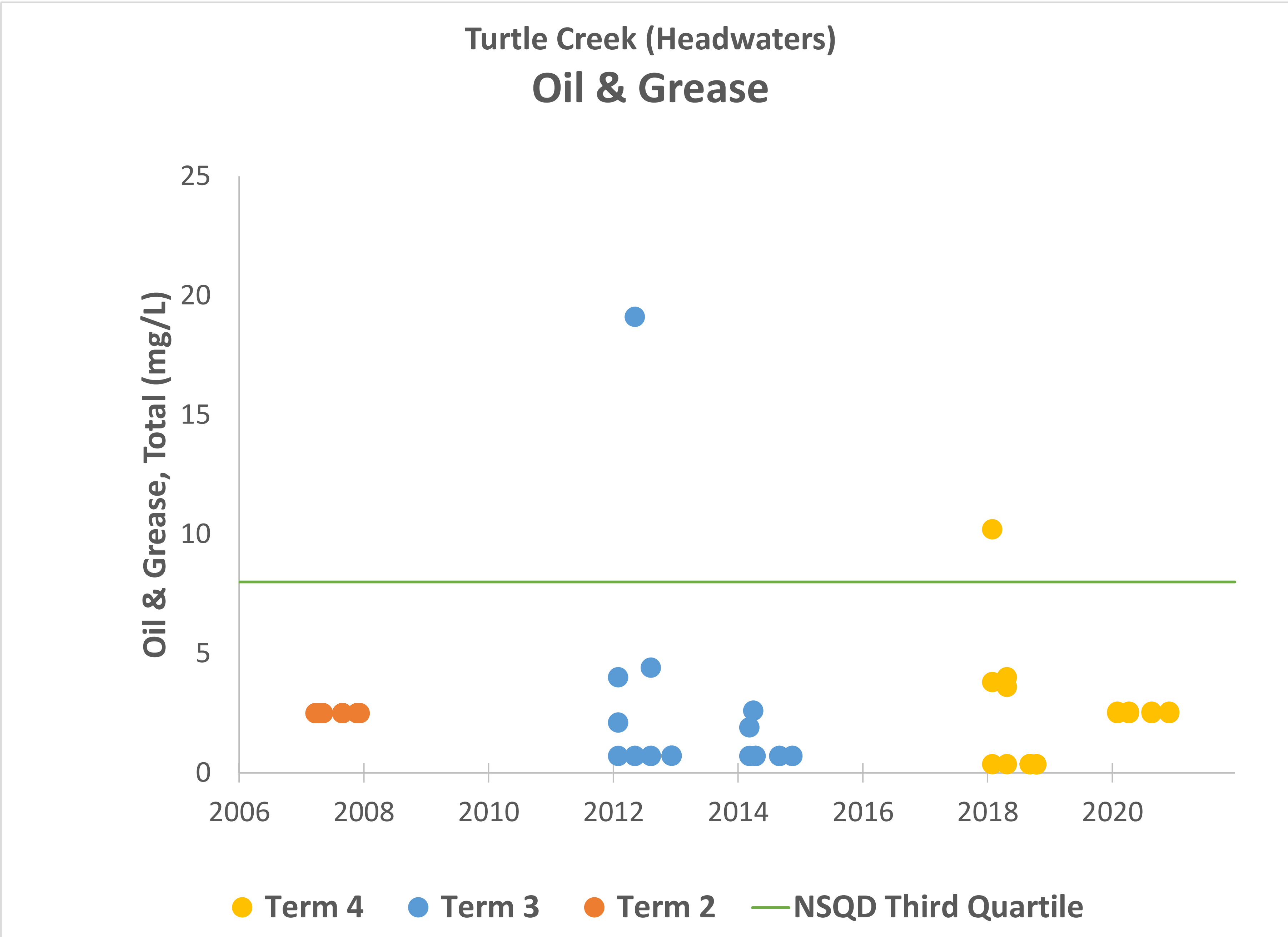
Turtle Creek (Headwaters)
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

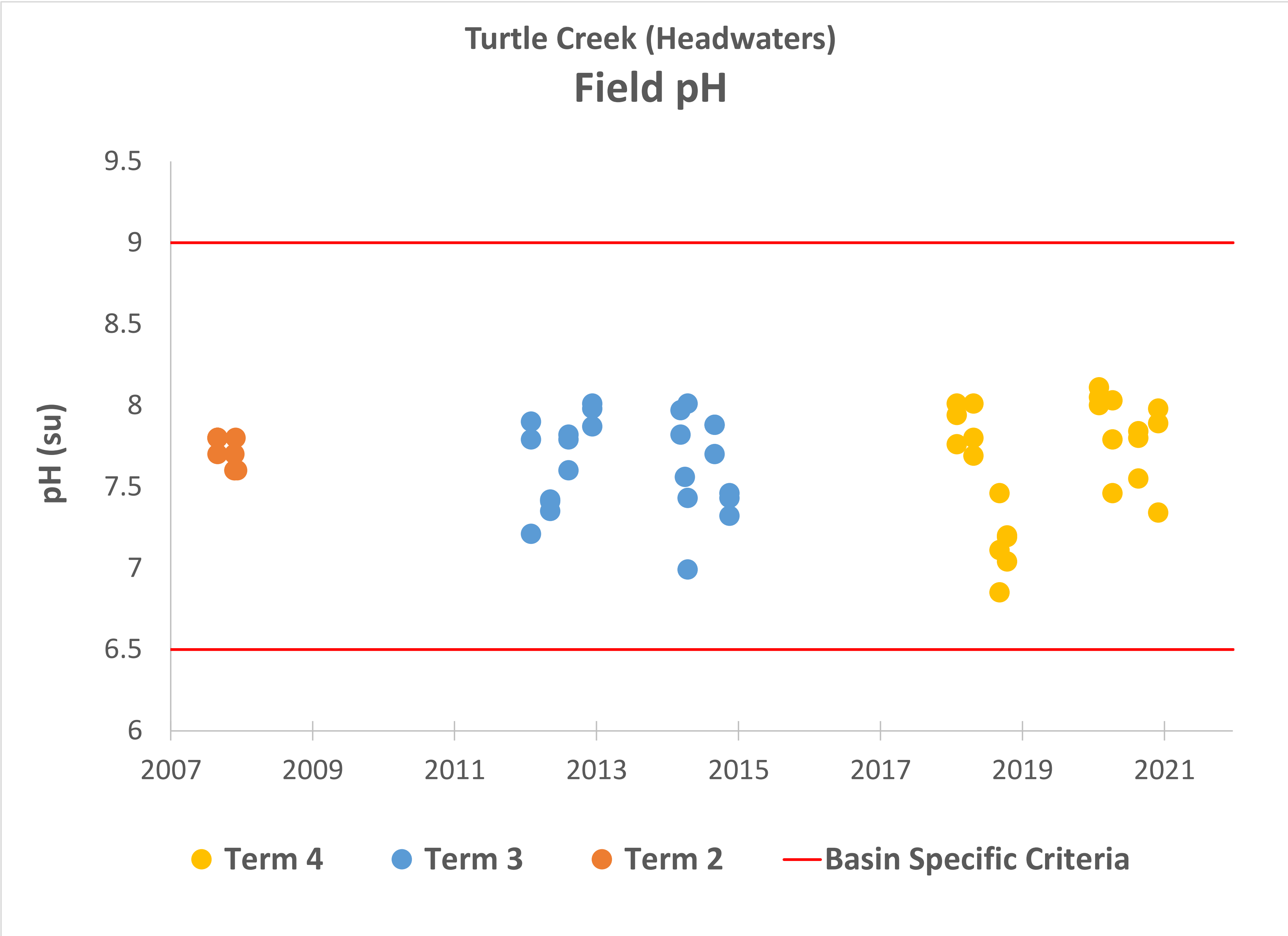


Turtle Creek (Headwaters)
Copper, Total
Cu, Total (mg/L)
1
0.1
0.01
0.001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)

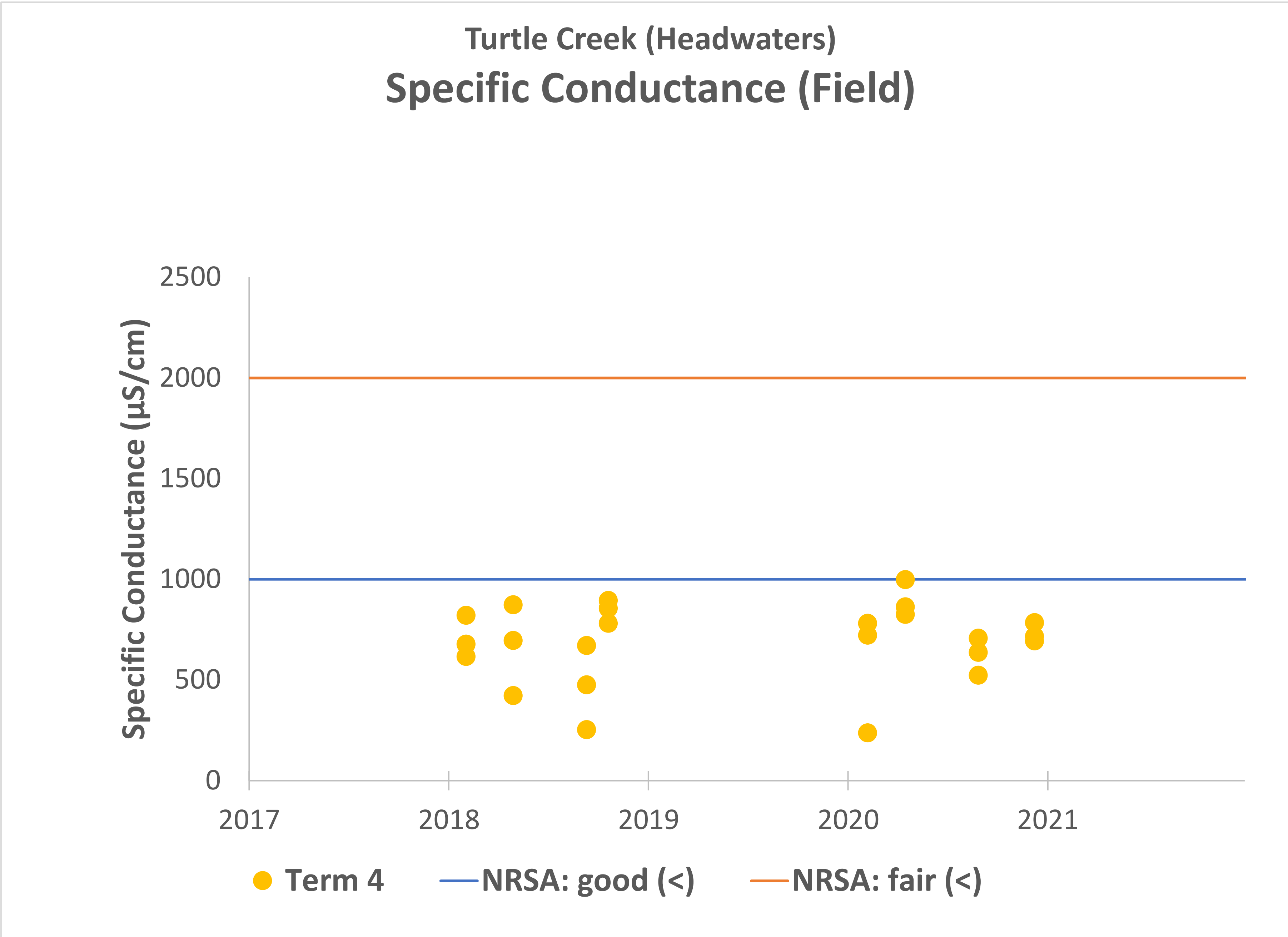

Turtle Creek (Headwaters)
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

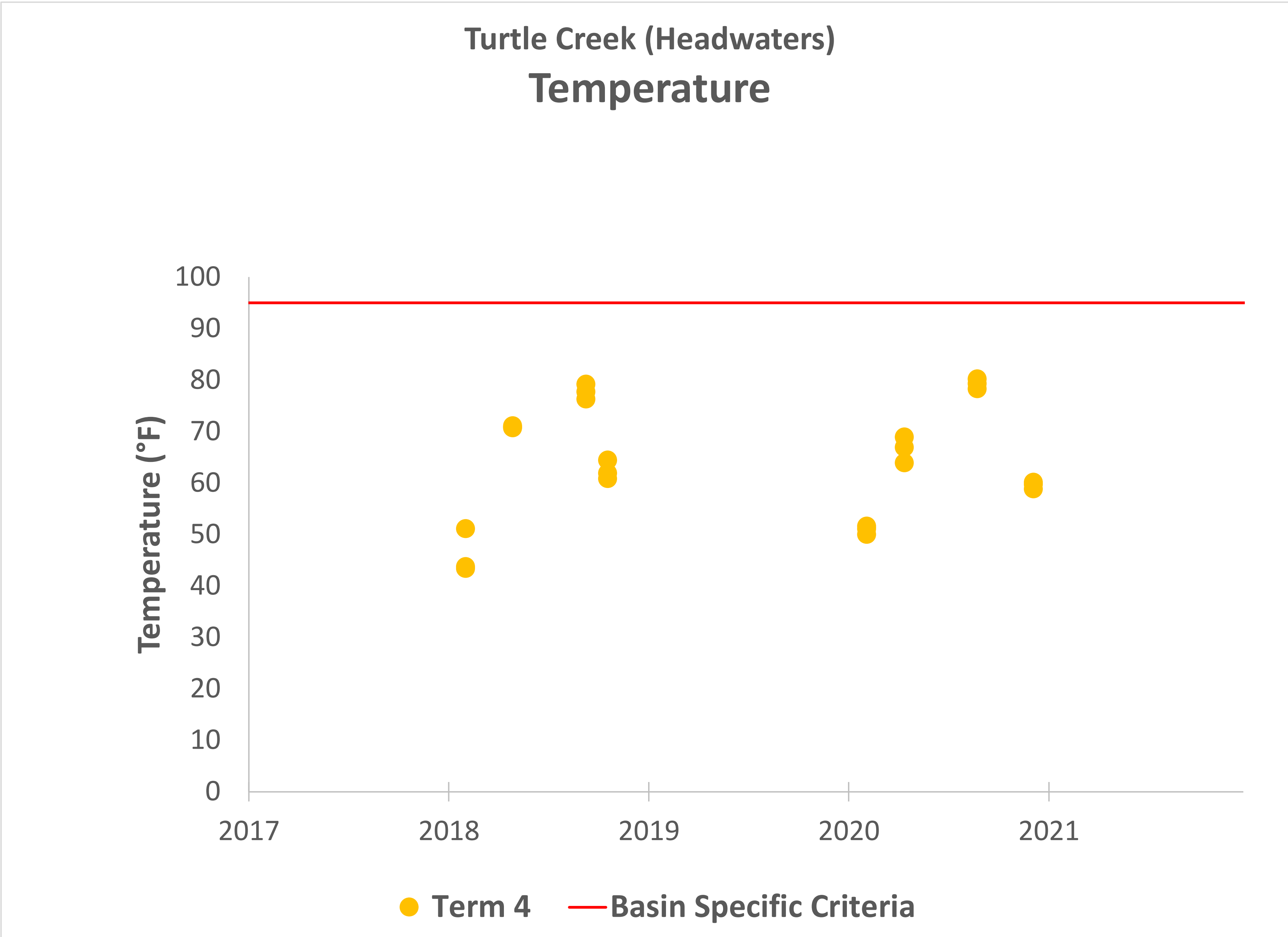

Turtle Creek (Headwaters)
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

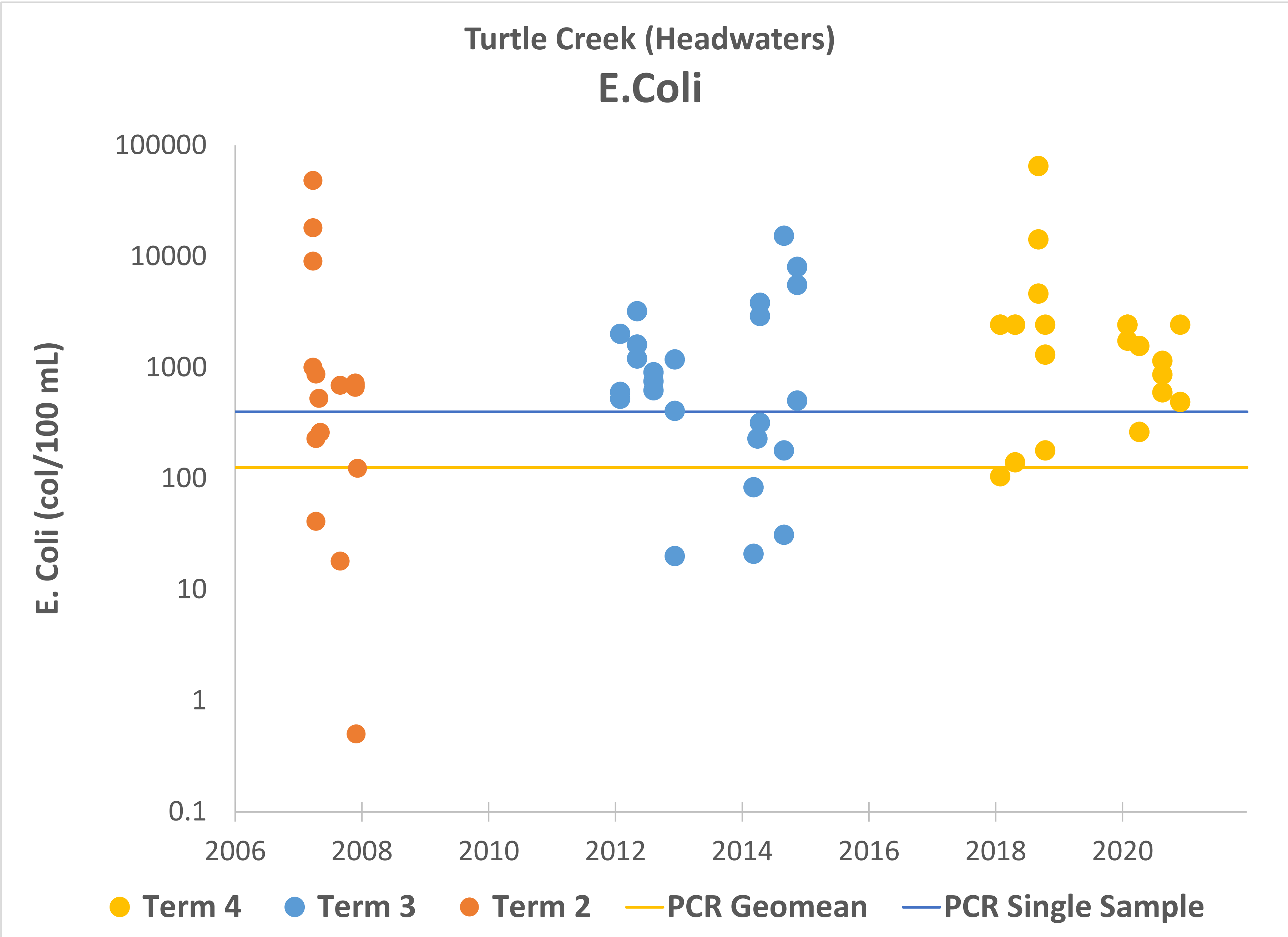

Turtle Creek (Headwaters)
Oil & Grease
Oil & Grease, Total (mg/L)
25
20
15
10
5
0
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
NSQD Third Quartile



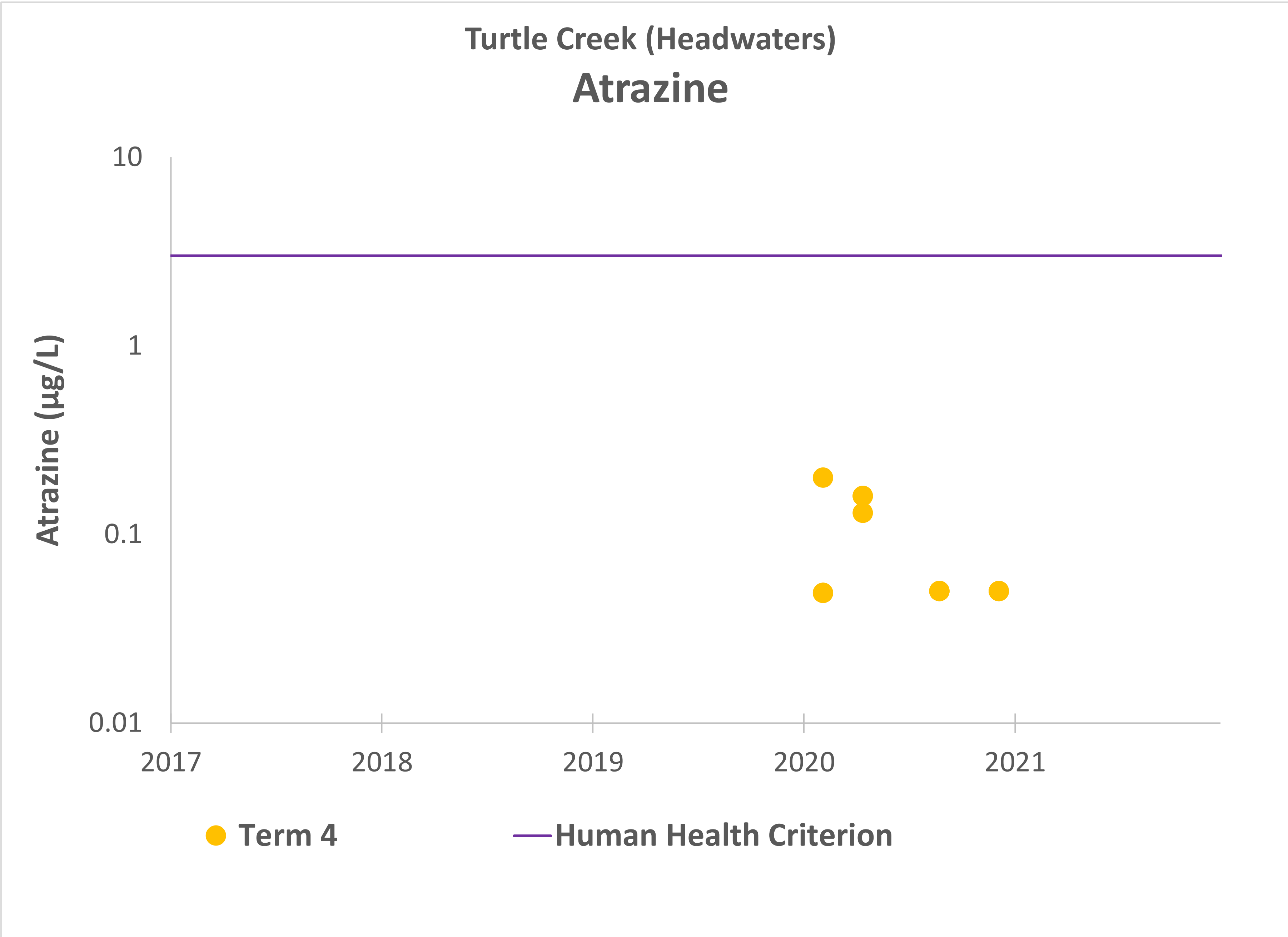
Turtle Creek (Headwaters)
Field pH
pH (su)
9.5
9
8.5
8
7.5
7
6.5
6
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 3
Term 2
Basin Specific Criteria


Turtle Creek (Headwaters)
Specific Conductance (Field)
Specific Conductance (µS/cm)
2500
2000
1500
1000
500
0
2017
2018
2019
2020
2021
Term 4
NRSA: good (<)
NRSA: fair (<)


Turtle Creek (Headwaters)
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2017
2018
2019
2020
2021
Term 4
Basin Specific Criteria

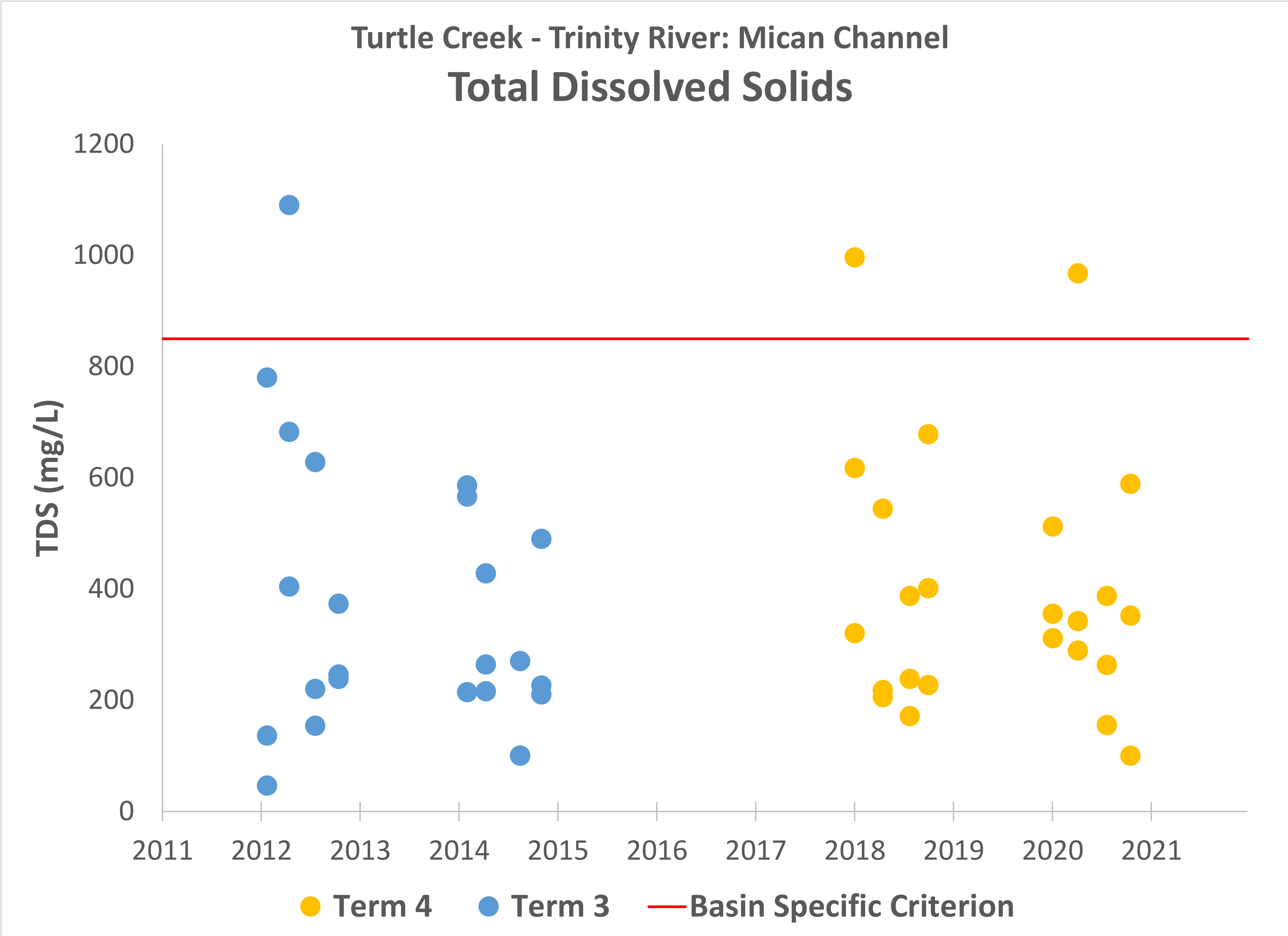


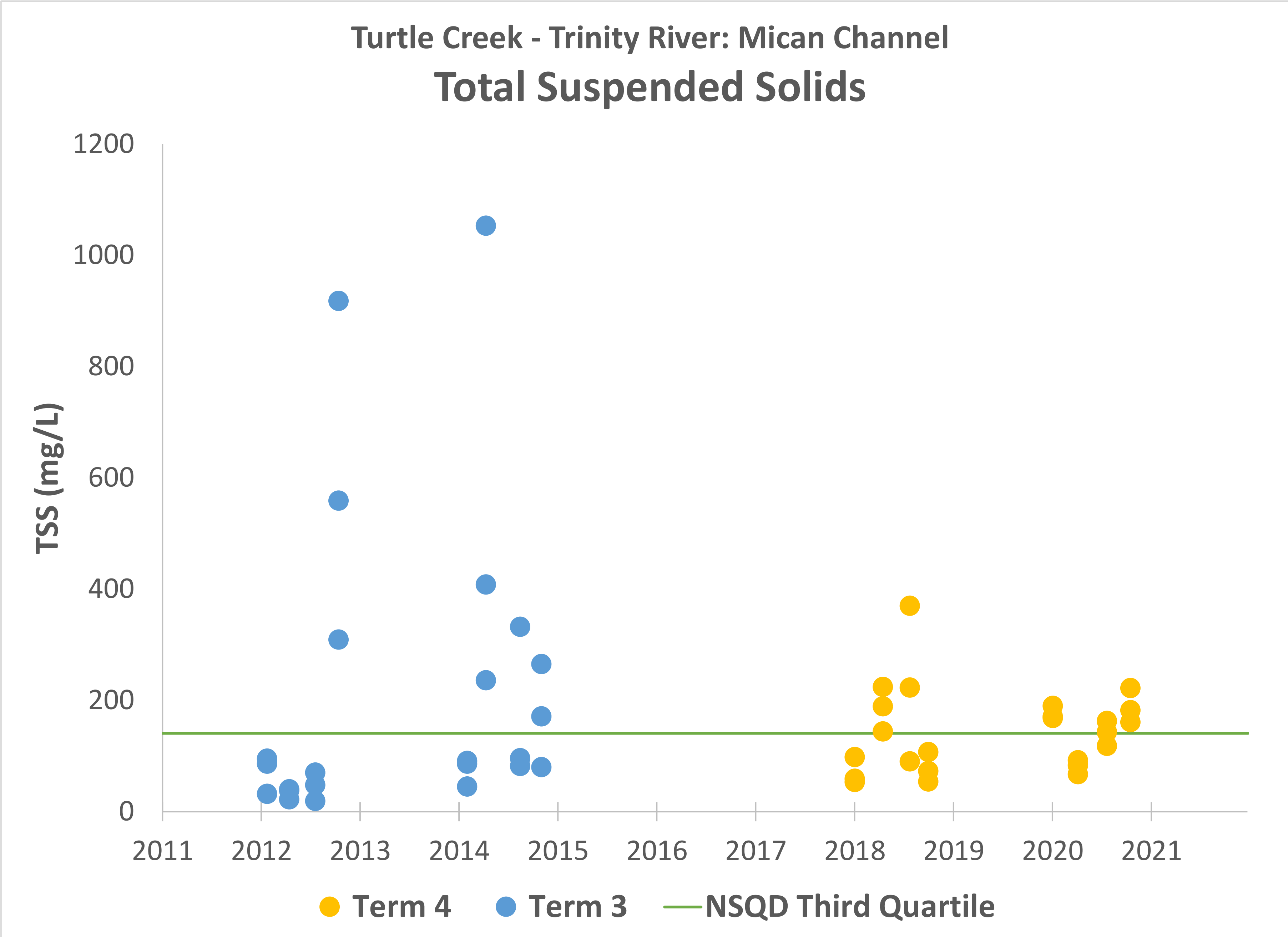
Turtle Creek (Headwaters)
E.Coli
E. Coli (col/100 mL)
100000
10000
1000
100
10
1
0.1
2006
2008
2010
2012
2014
2016
2018
2020
Term 4
Term 3
Term 2
PCR Geomean
PCR Single Sample


Turtle Creek (Headwaters)
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
2017
2018
2019
2020
2021
Term 4
Human Health Criterion

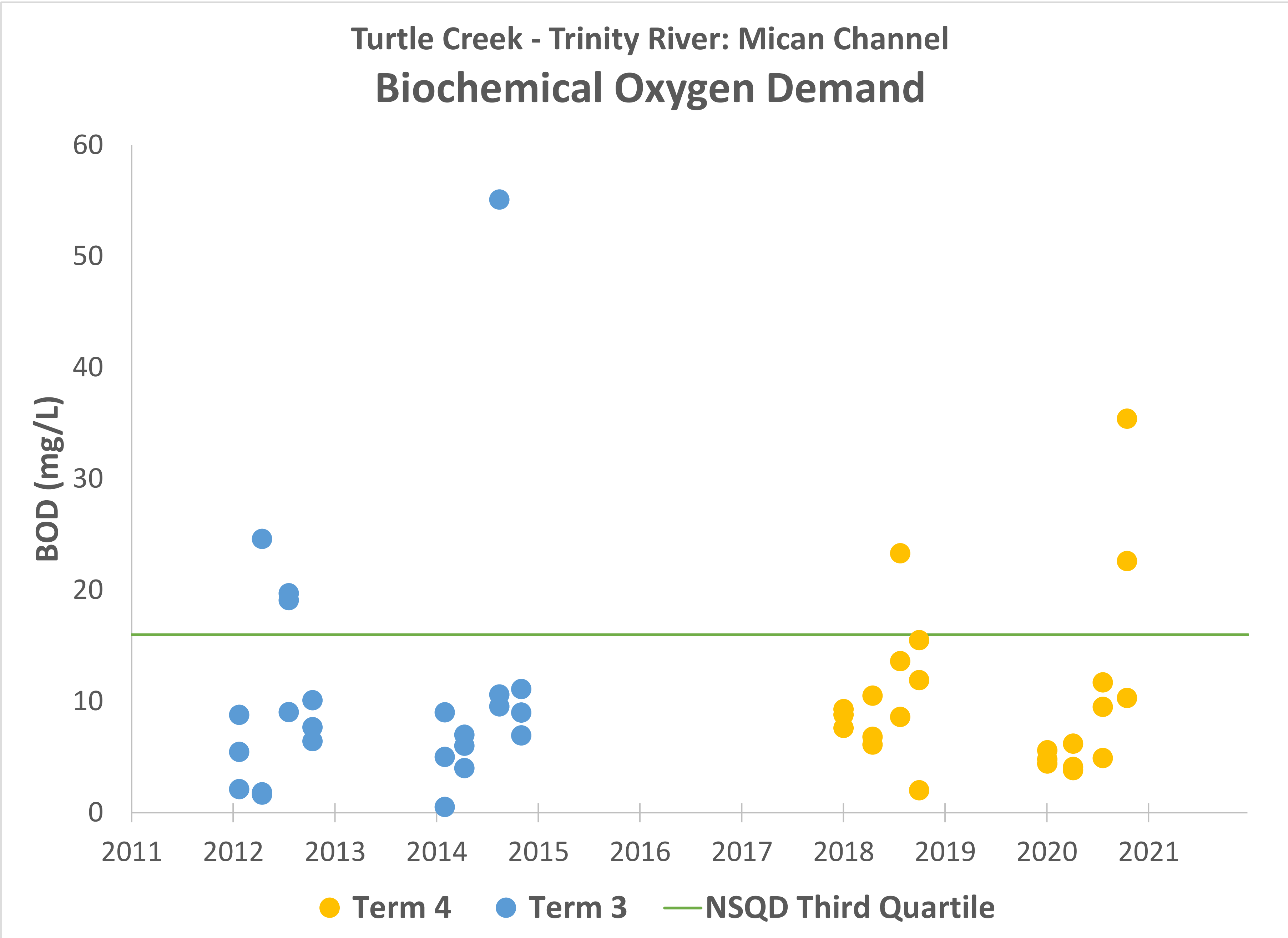
Appendix Z

Turtle Creek – Trinity River Water Quality Data Graphs

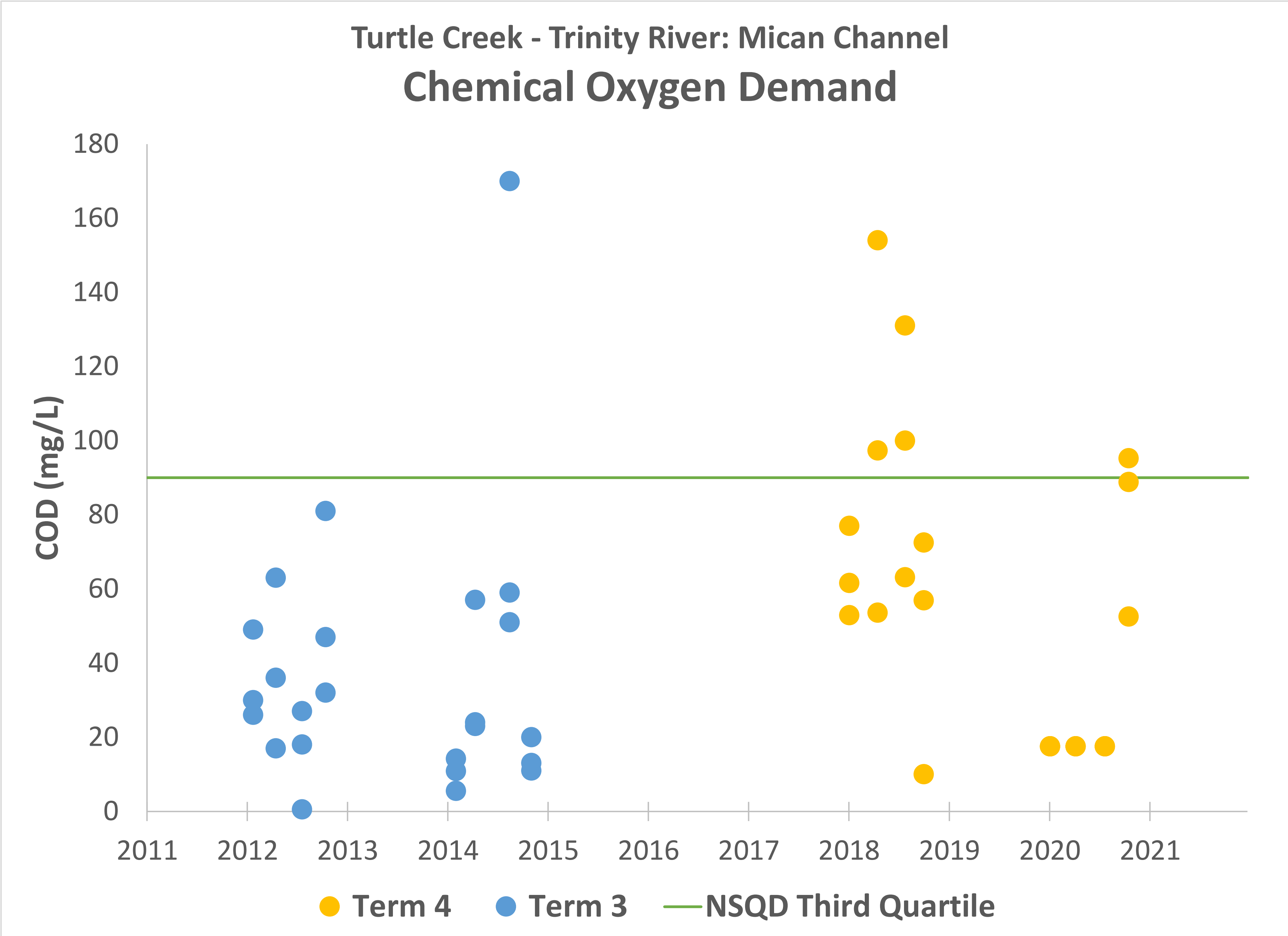

Turtle Creek - Trinity River: Mican Channel
Total Dissolved Solids
TDS (mg/L)
1200
1000
800
600
400
200
0
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Basin Specific Criterion



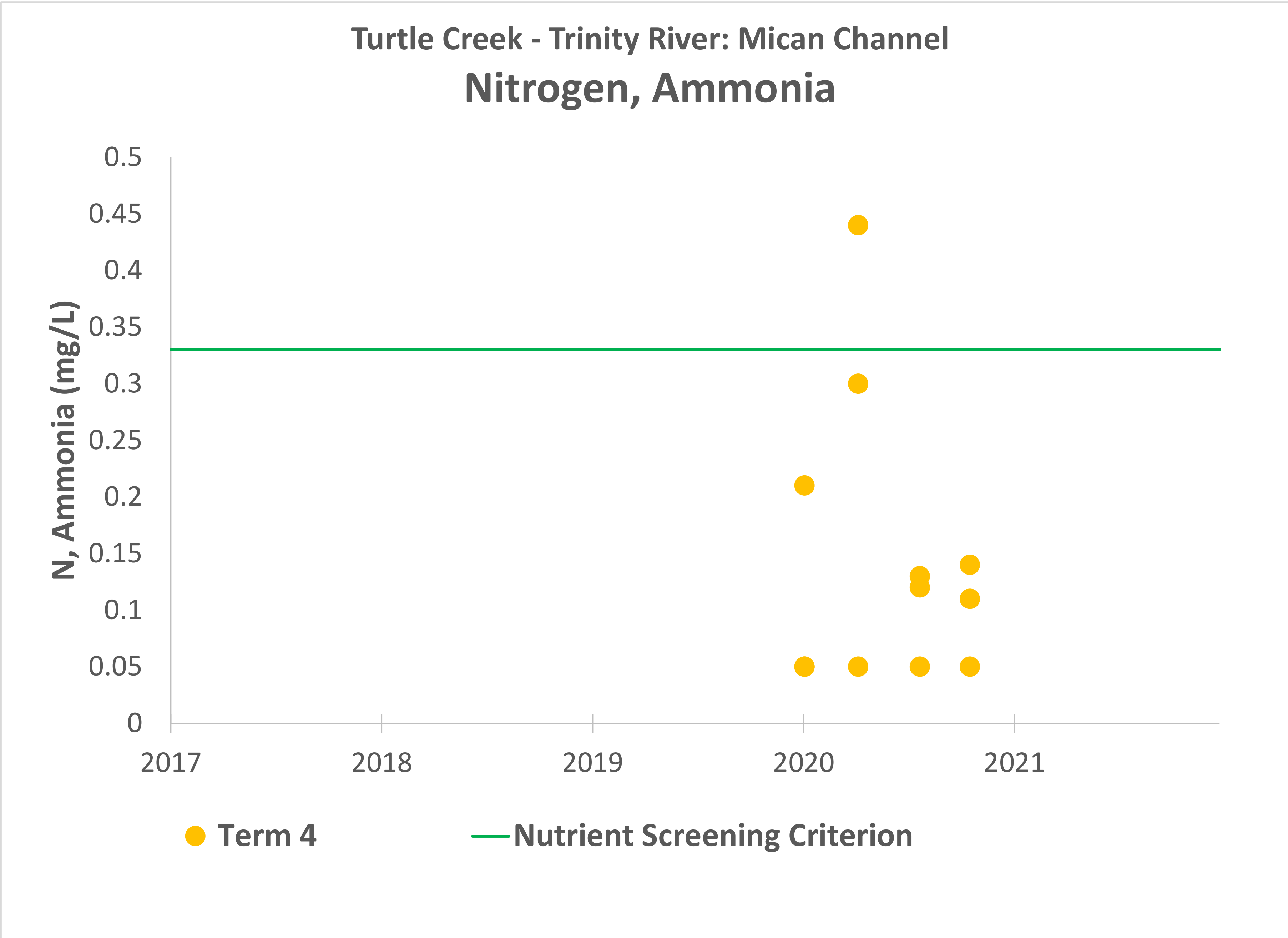
Turtle Creek - Trinity River: Mican Channel
Total Suspended Solids
TSS (mg/L)
1200
1000
800
600
400
200
0
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile



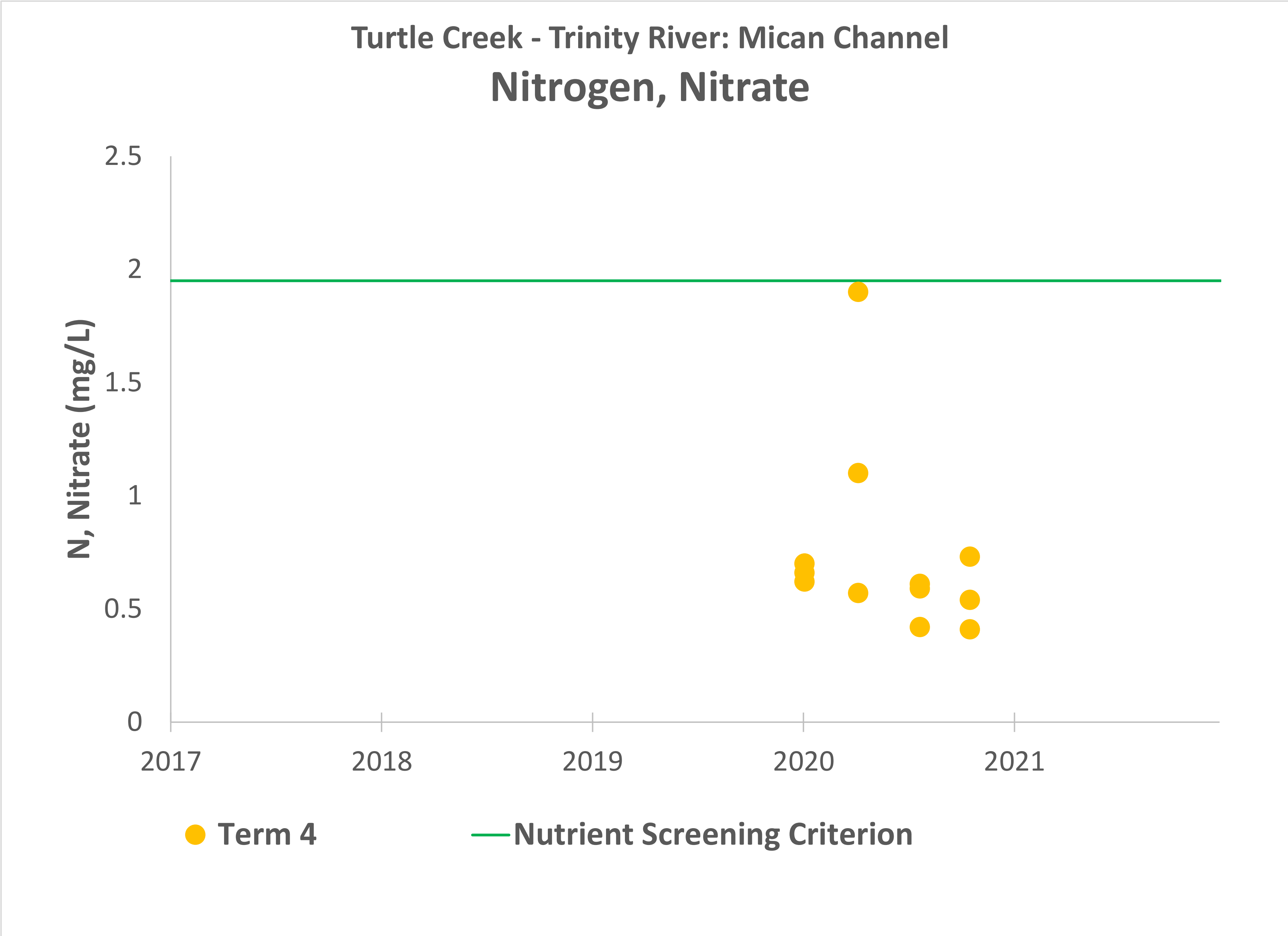
Turtle Creek - Trinity River: Mican Channel
Biochemical Oxygen Demand
BOD (mg/L)
0
10
20
30
40
50
60
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

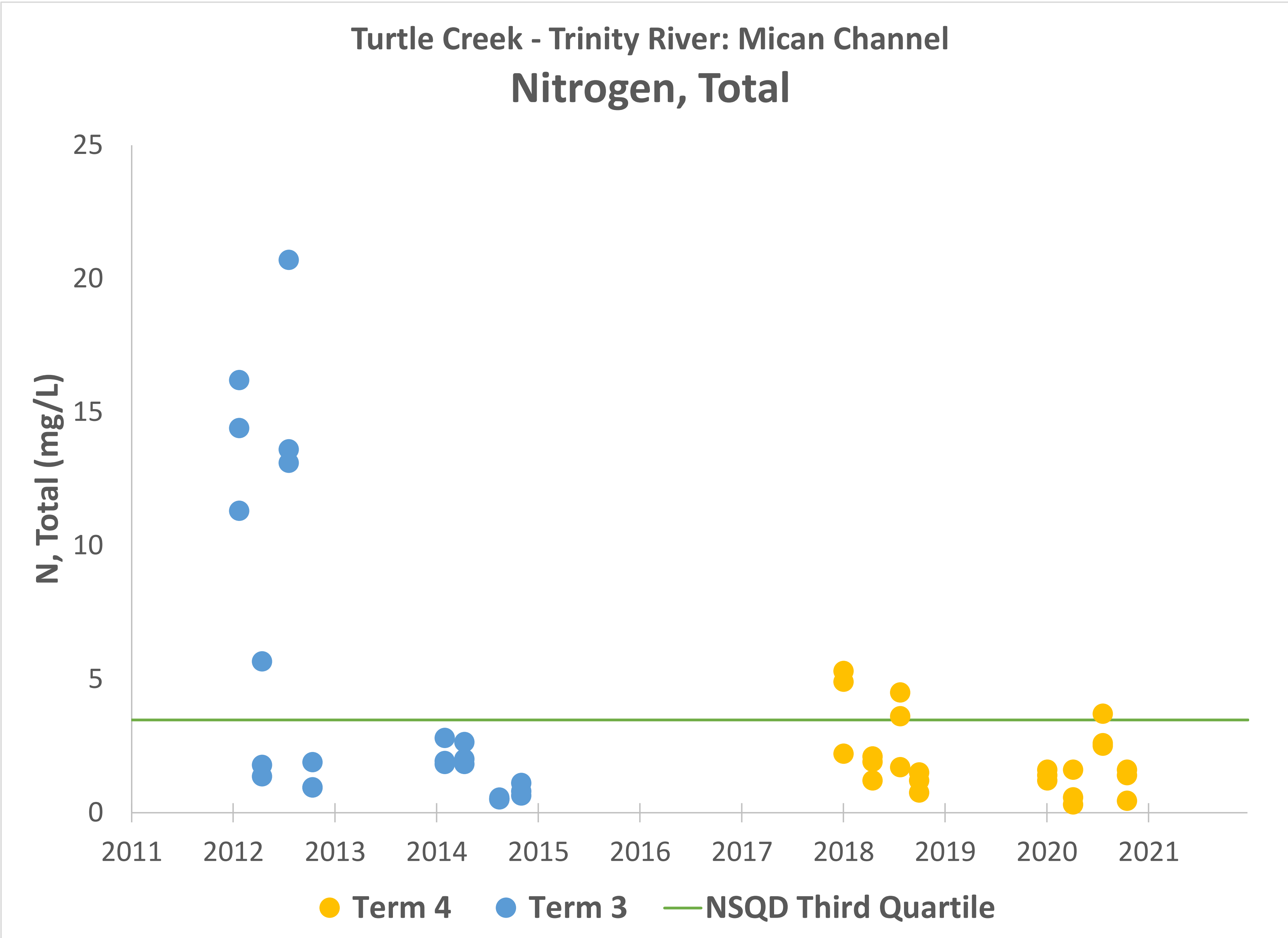


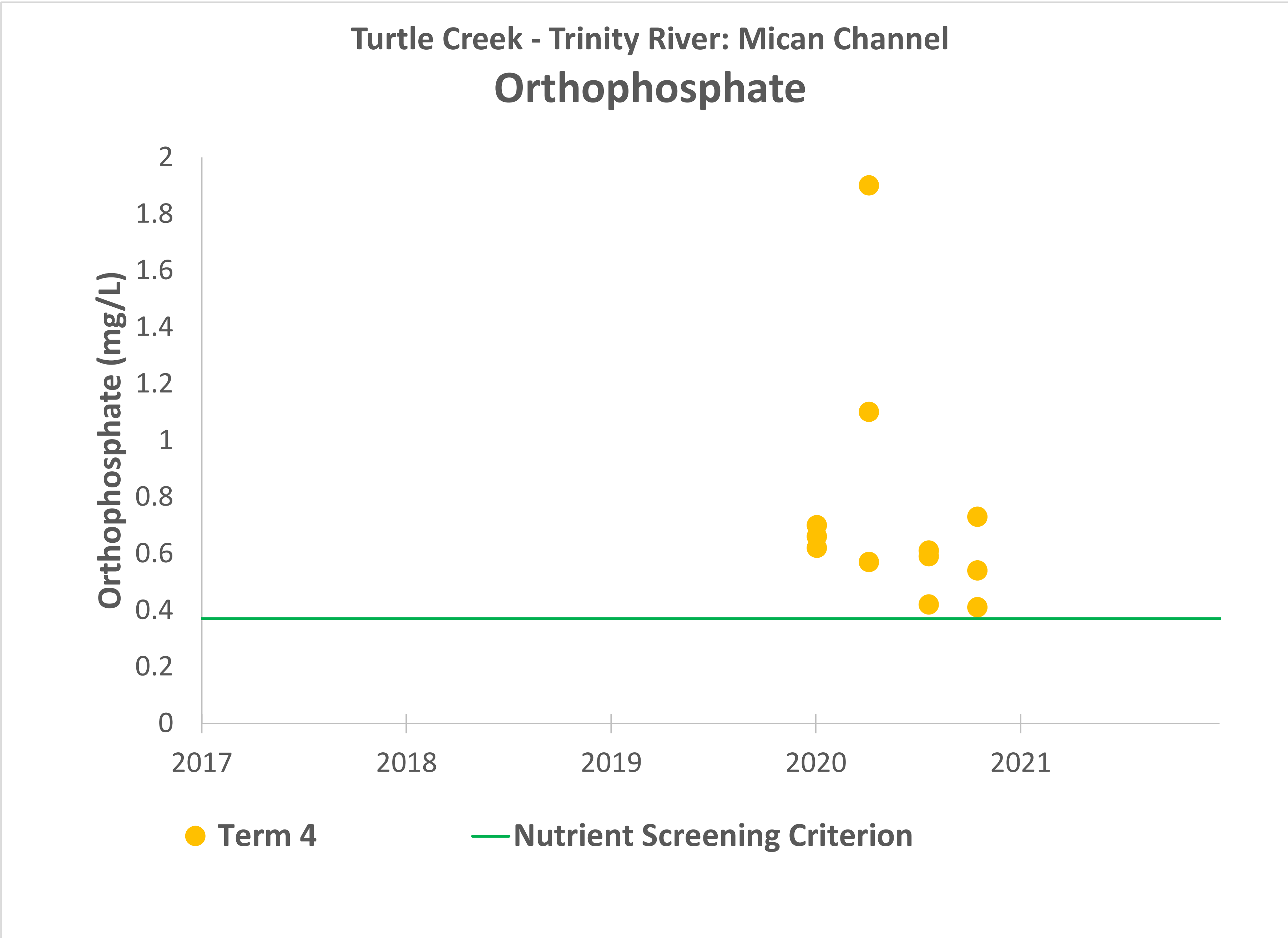
Turtle Creek - Trinity River: Mican Channel
Chemical Oxygen Demand
COD (mg/L)
0
20
40
60
80
100
120
140
160
180
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile



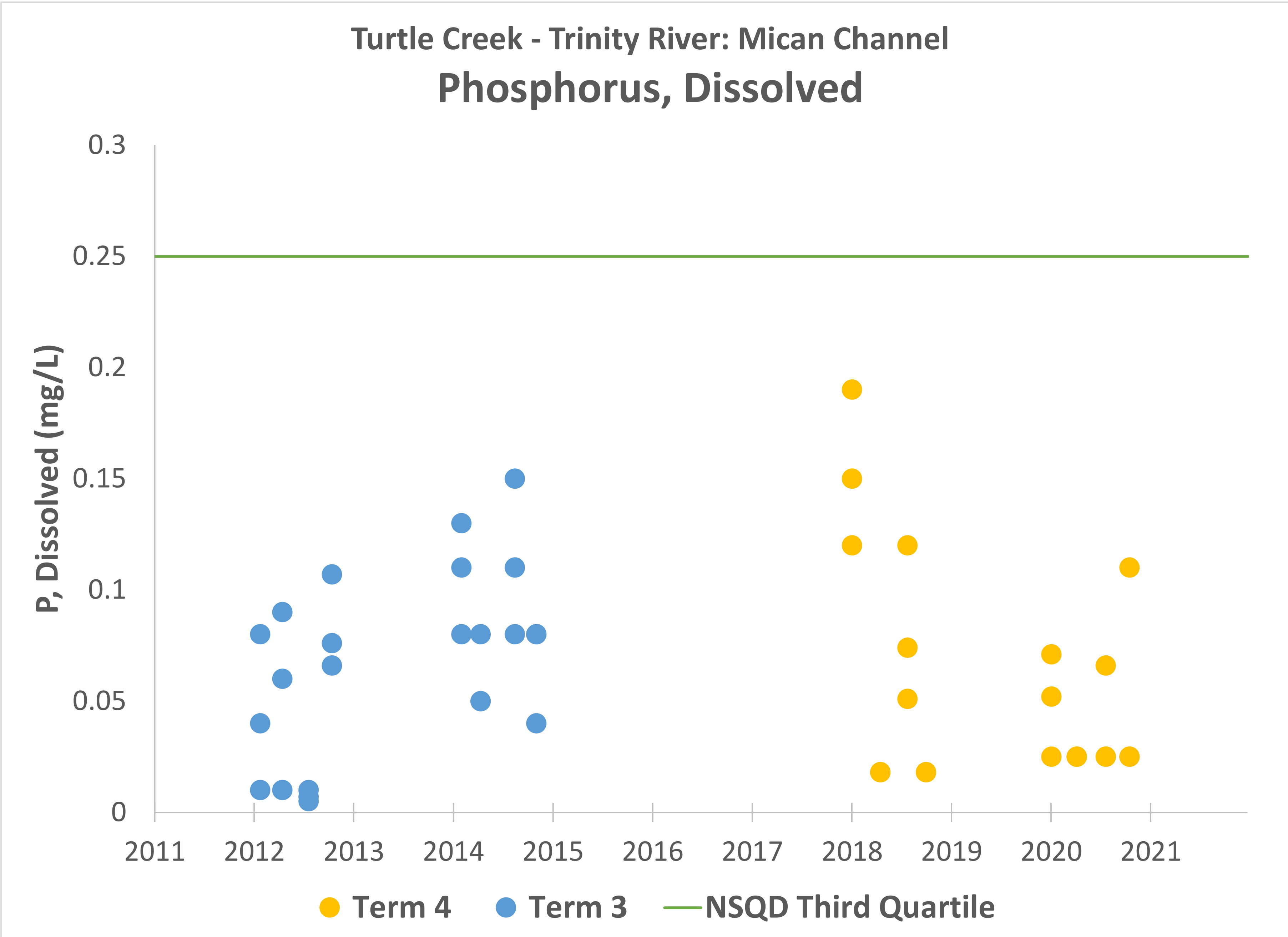
Turtle Creek - Trinity River: Mican Channel
Nitrogen, Ammonia
N, Ammonia (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

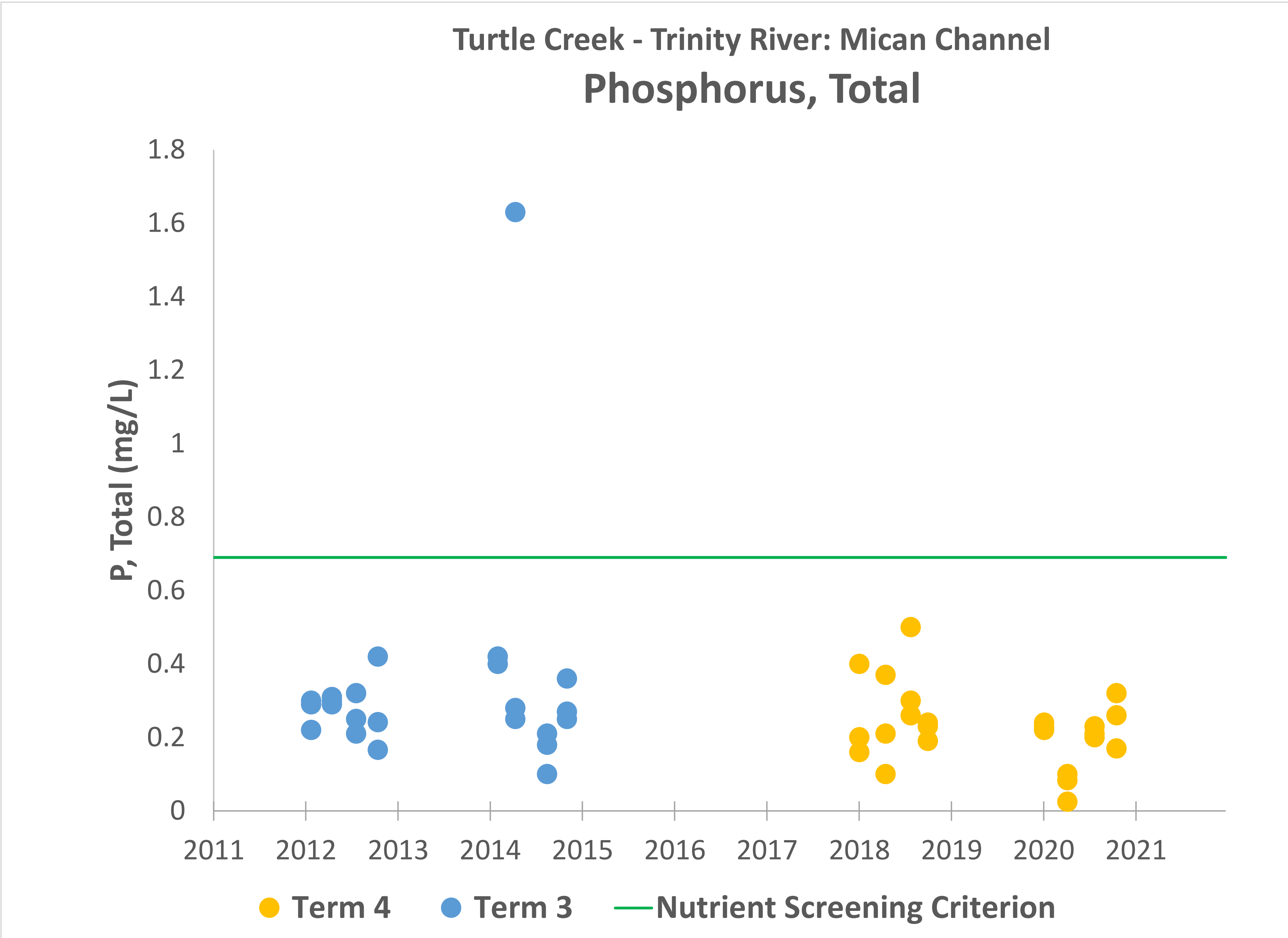

Turtle Creek - Trinity River: Mican Channel
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

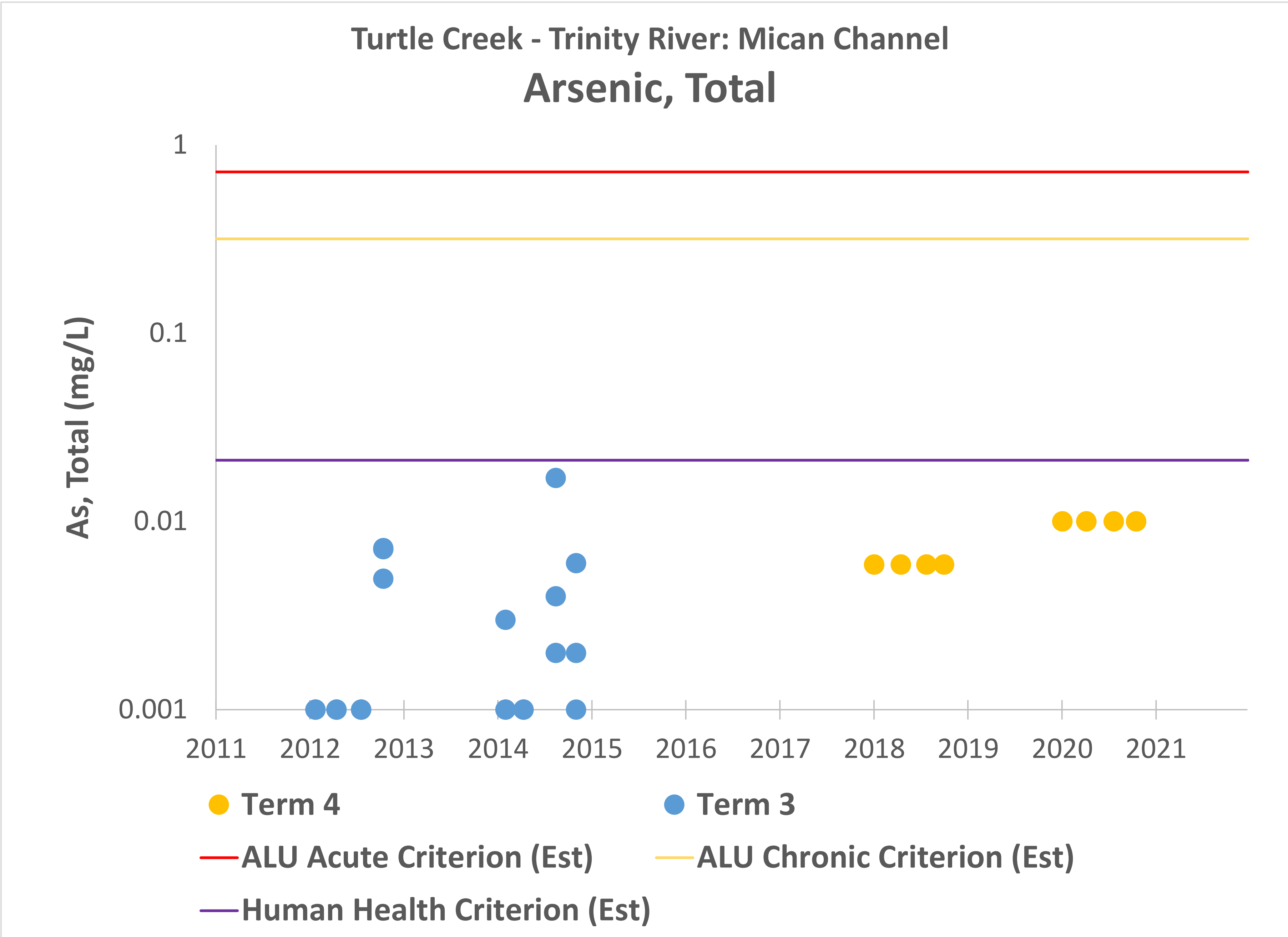

Turtle Creek - Trinity River: Mican Channel
Nitrogen, Total
N, Total (mg/L)
0
5
10
15
20
25
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

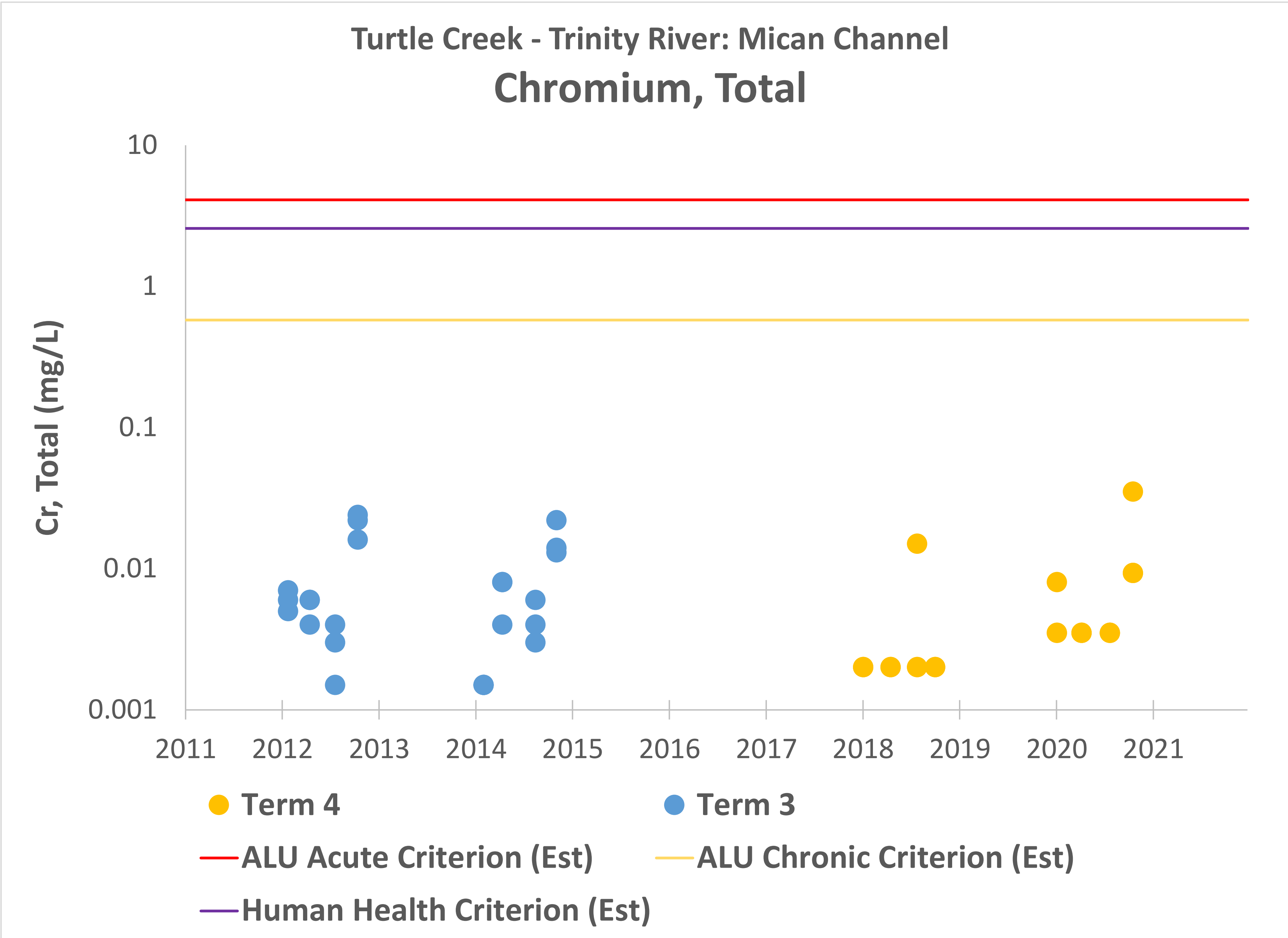


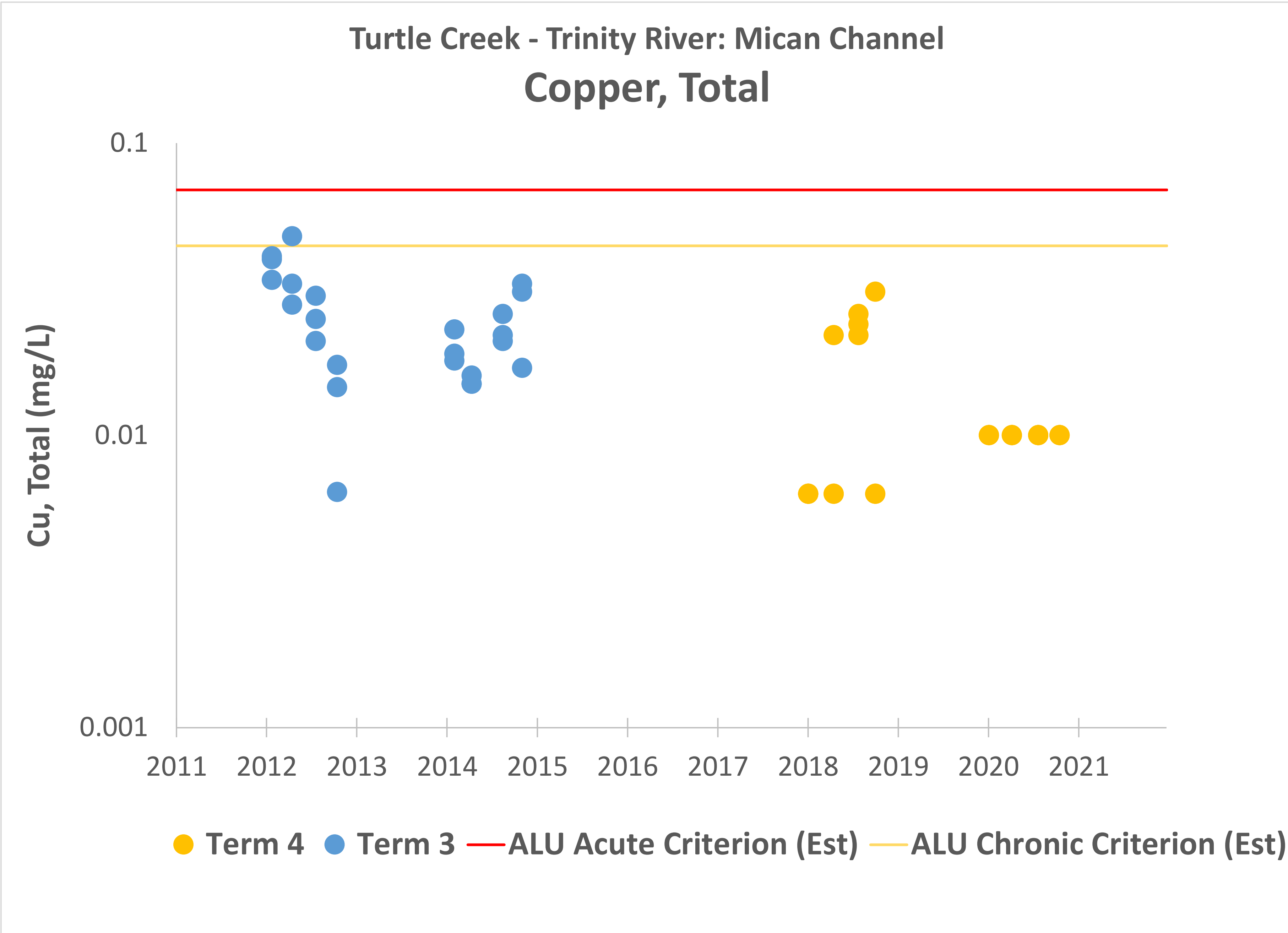
Turtle Creek - Trinity River: Mican Channel
Orthophosphate
Orthophosphate (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion


Turtle Creek - Trinity River: Mican Channel
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

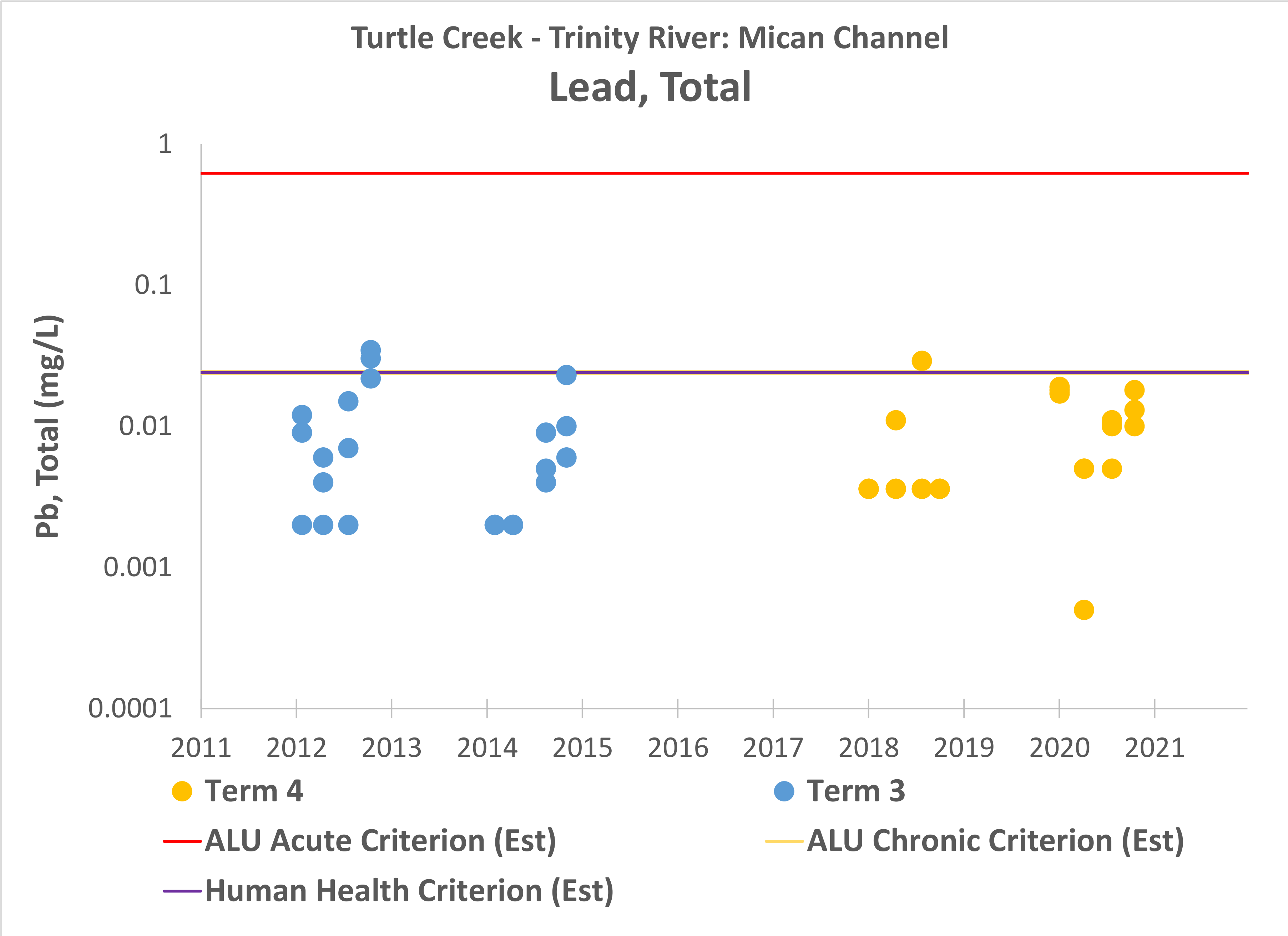

Turtle Creek - Trinity River: Mican Channel
Phosphorus, Total
P, Total (mg/L)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Nutrient Screening Criterion


Turtle Creek - Trinity River: Mican Channel
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

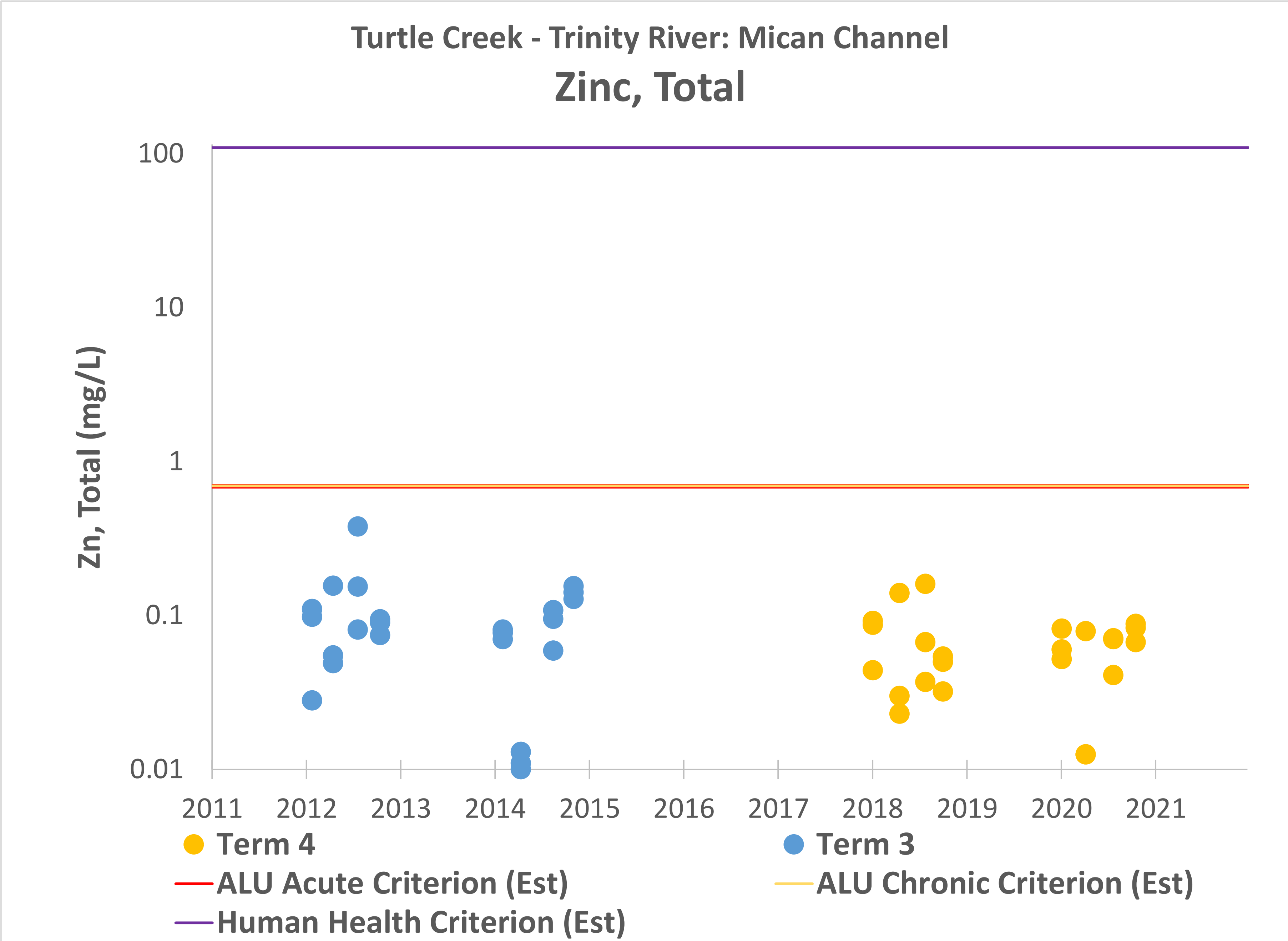

Turtle Creek - Trinity River: Mican Channel
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

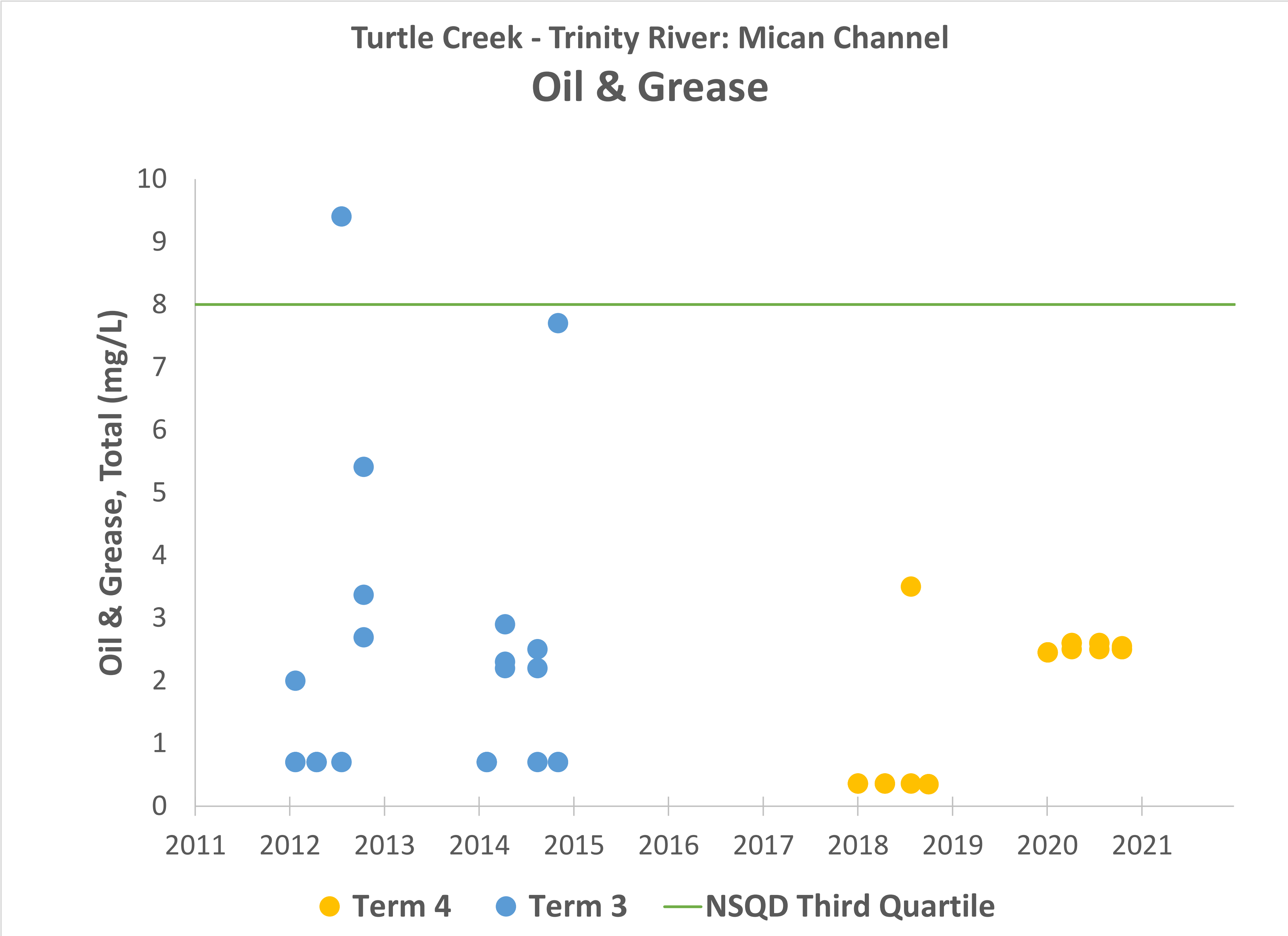


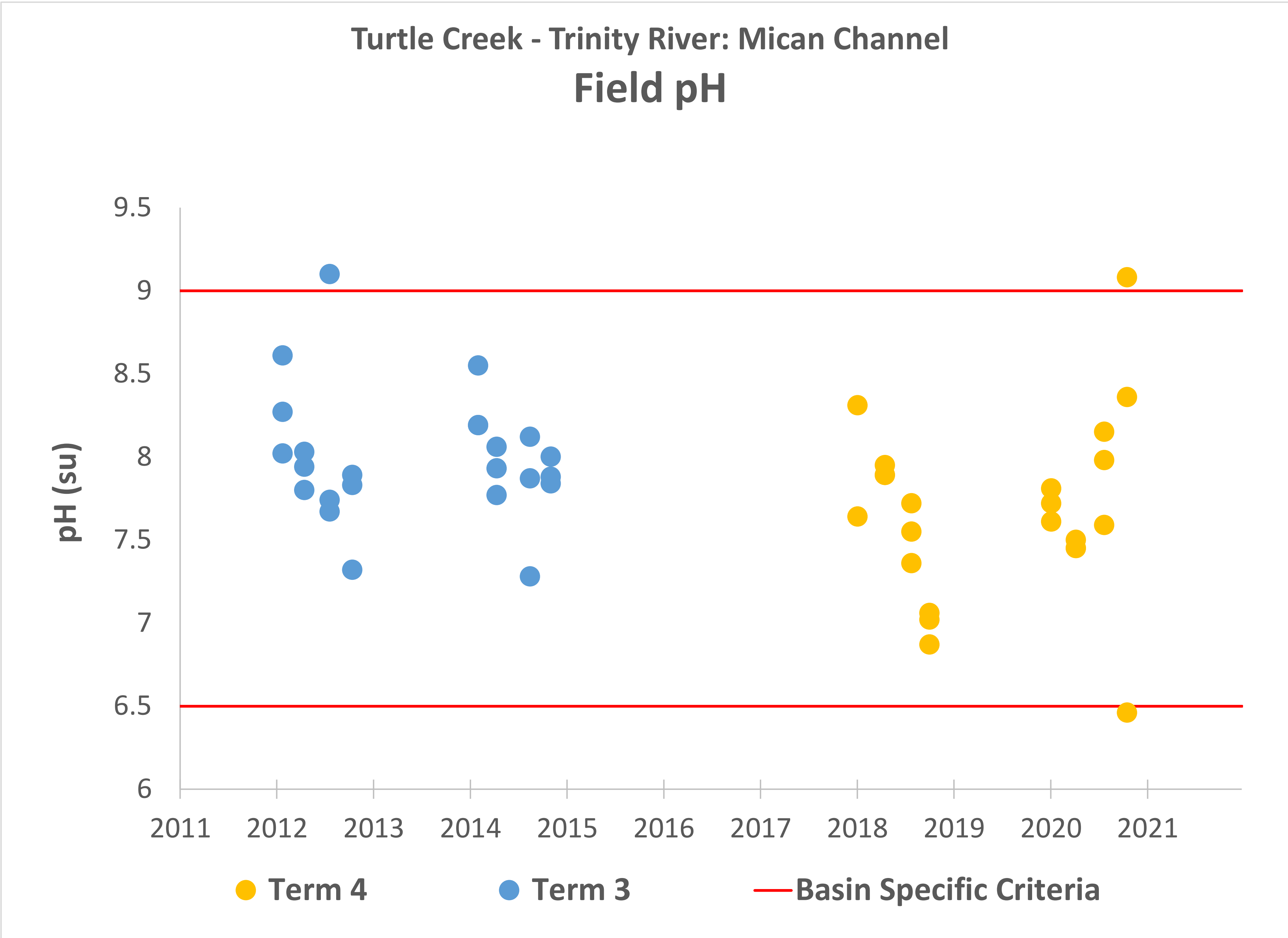
Turtle Creek - Trinity River: Mican Channel
Copper, Total
Cu, Total (mg/L)
0.1
0.01
0.001
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)



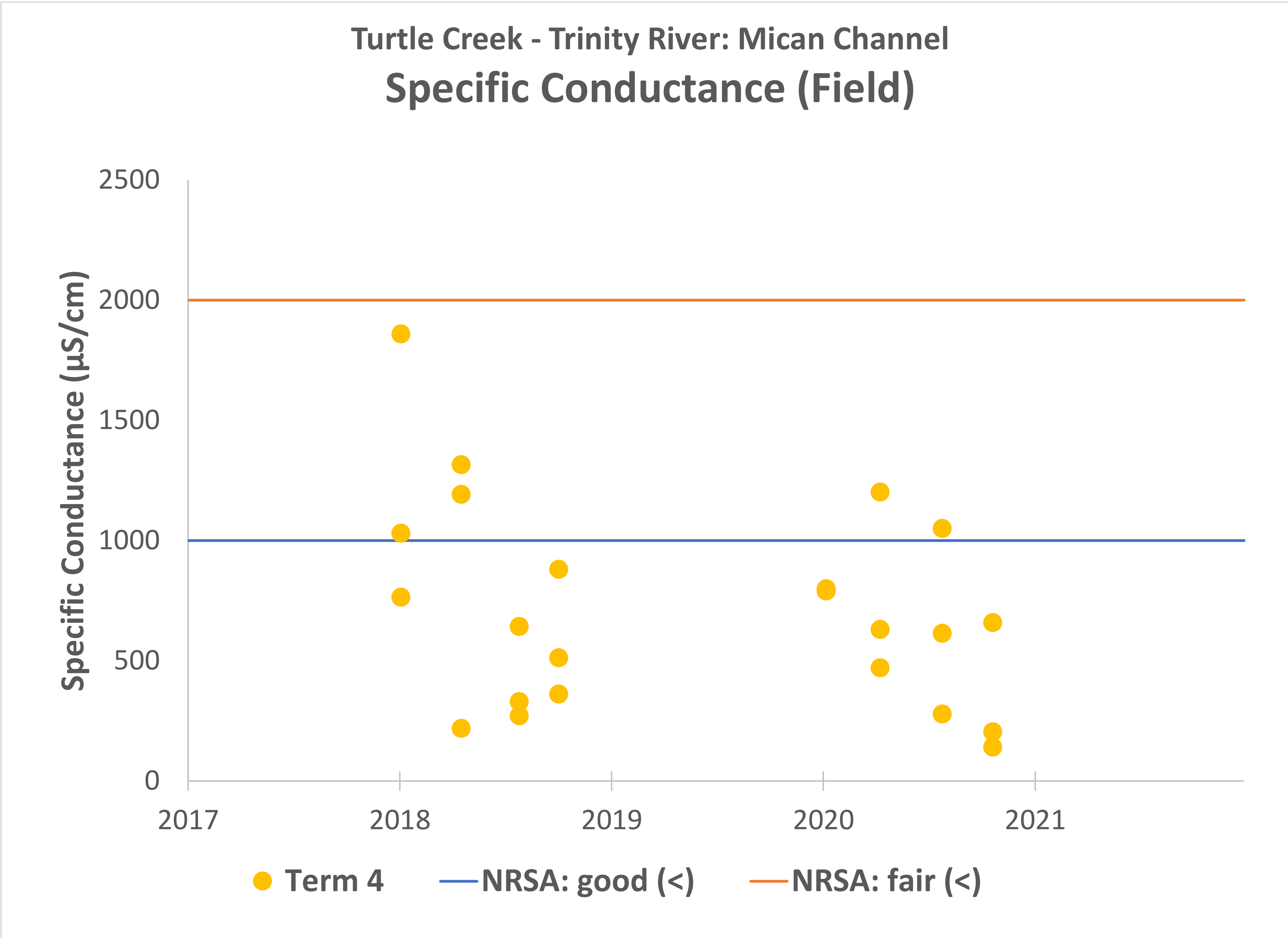
Turtle Creek - Trinity River: Mican Channel
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

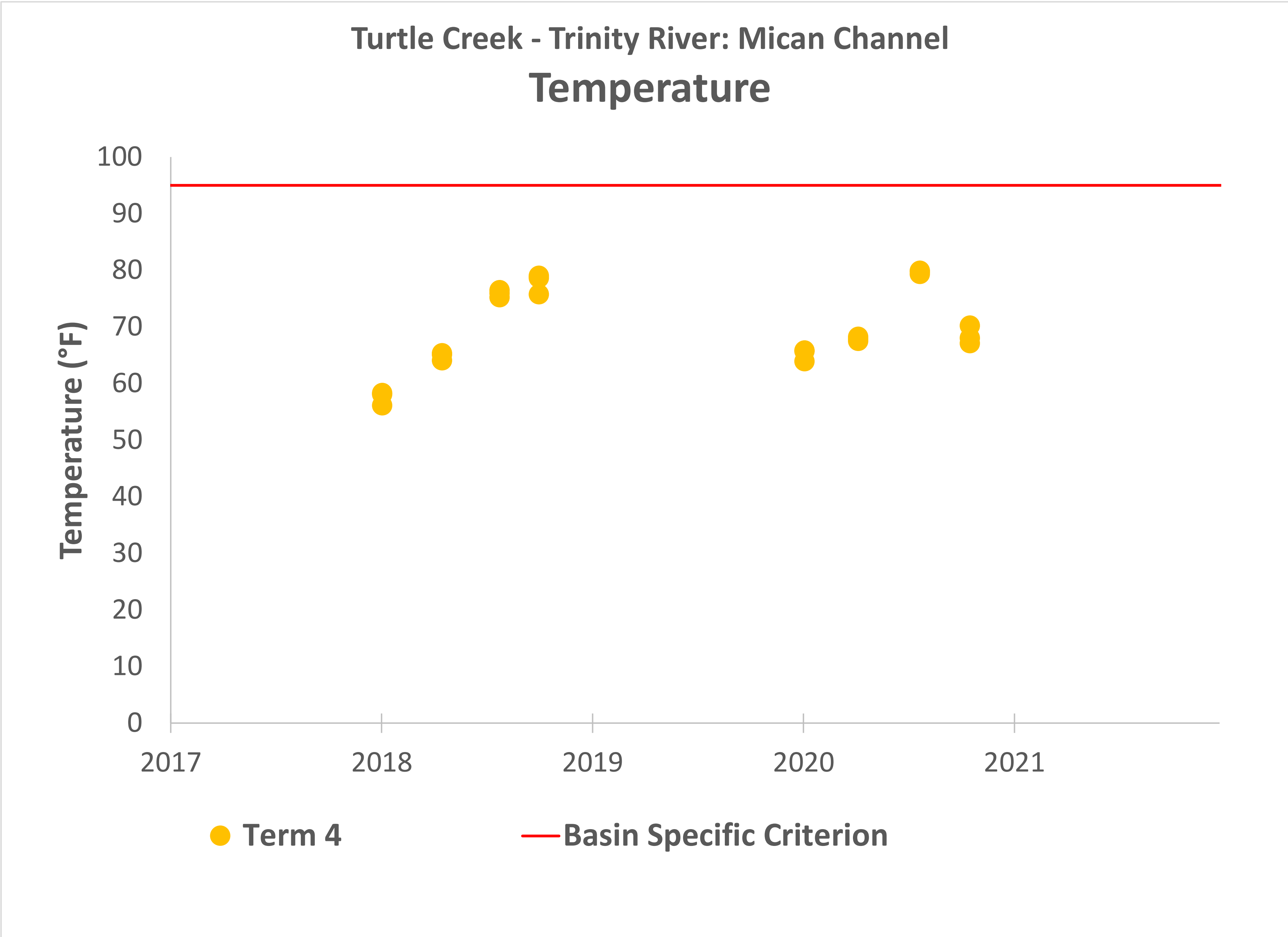

Turtle Creek - Trinity River: Mican Channel
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)


Turtle Creek - Trinity River: Mican Channel
Oil & Grease
Oil & Grease, Total (mg/L)
0
1
2
3
4
5
6
7
8
9
10
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

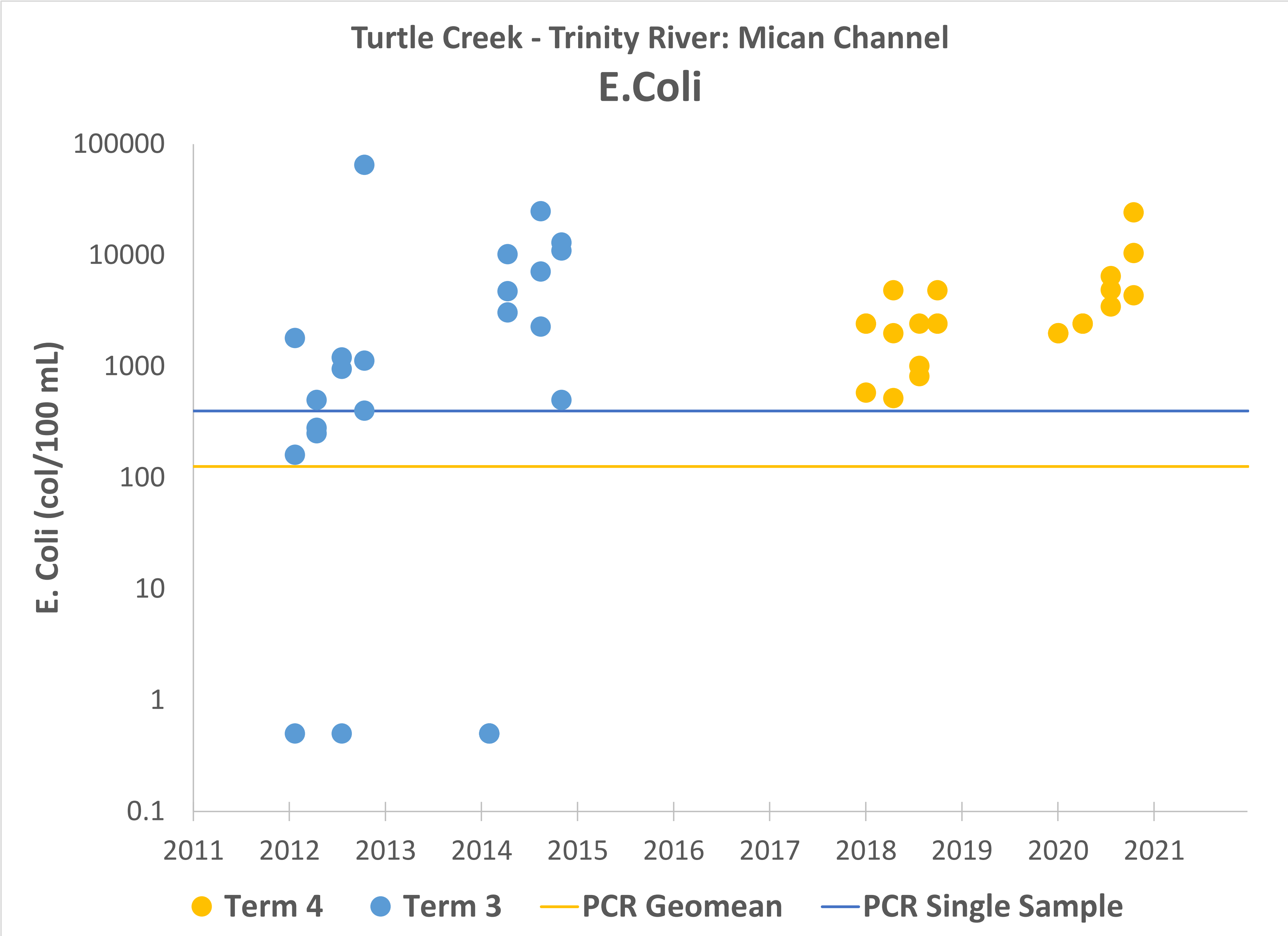


Turtle Creek - Trinity River: Mican Channel
Field pH
pH (su)
9.5
9
8.5
8
7.5
7
6.5
6
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Basin Specific Criteria

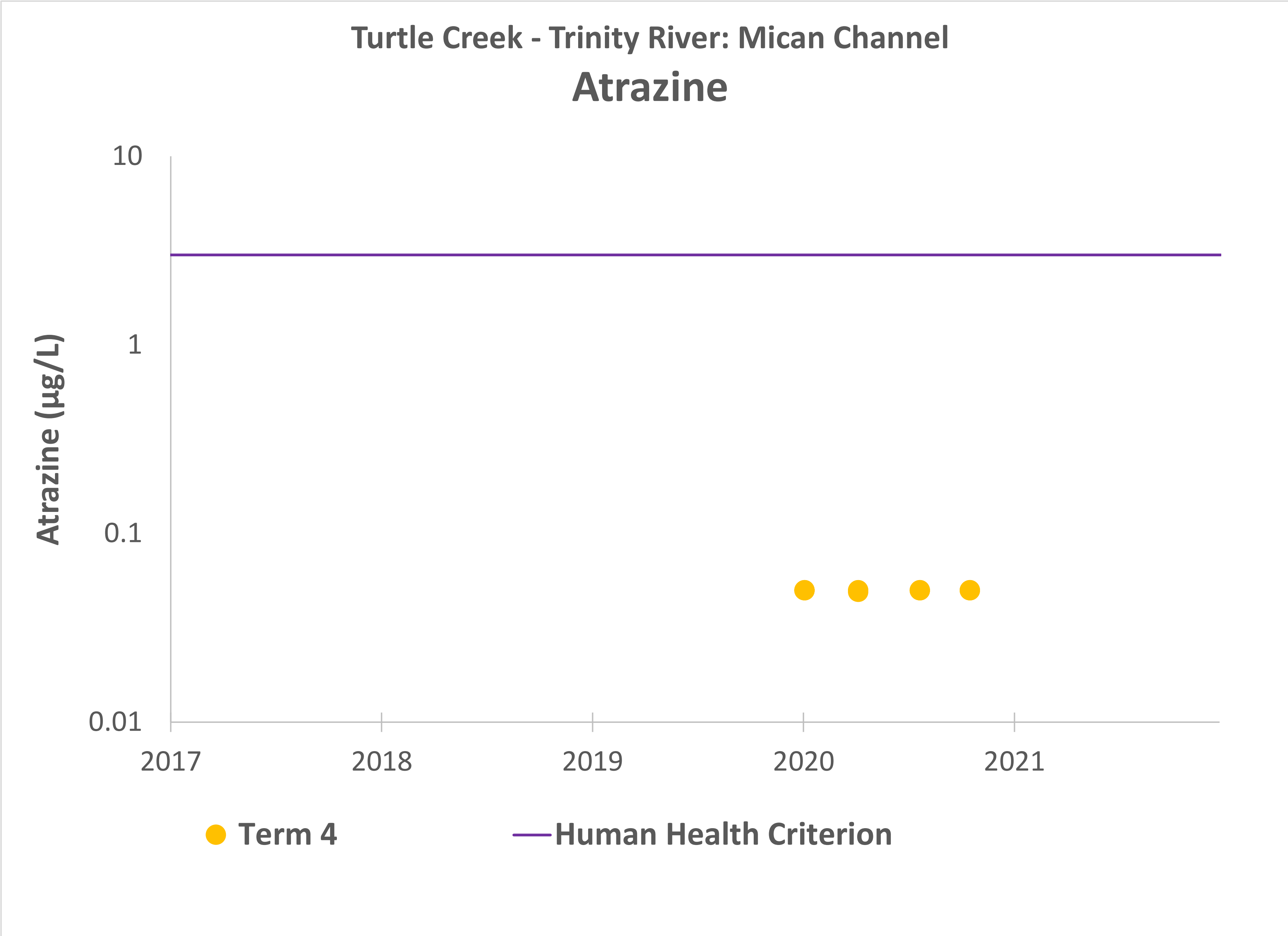

Turtle Creek - Trinity River: Mican Channel
Specific Conductance (Field)
Specific Conductance (µS/cm)
2500
2000
1500
1000
500
0
2017
2018
2019
2020
2021
Term 4
NRSA: good (<)
NRSA: fair (<)



Turtle Creek - Trinity River: Mican Channel
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2017
2018
2019
2020
2021
Term 4
Basin Specific Criterion

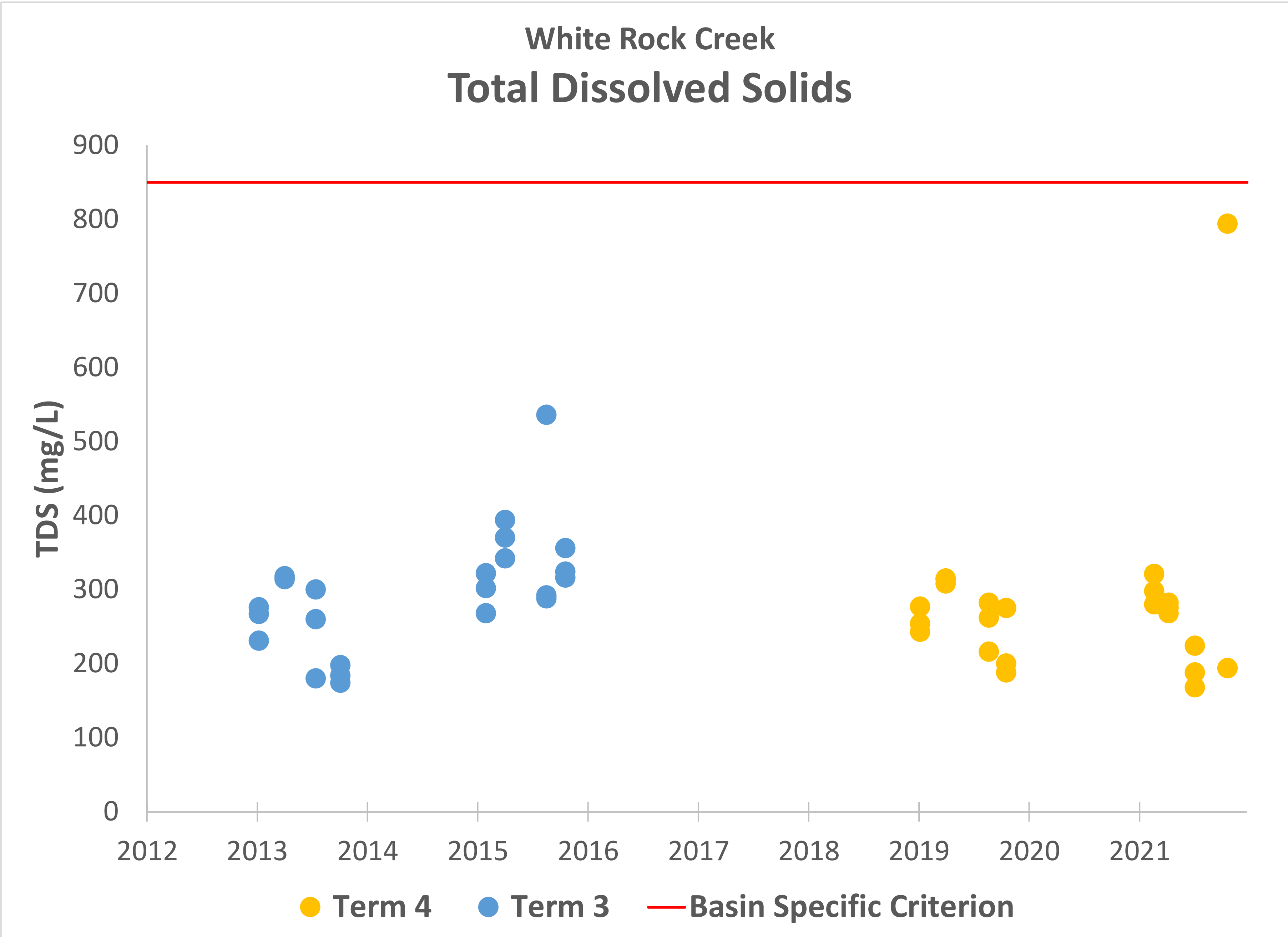


Turtle Creek - Trinity River: Mican Channel
E.Coli
E. Coli (col/100 mL)
100000
10000
1000
100
10
1
0.1
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
PCR Geomean
PCR Single Sample

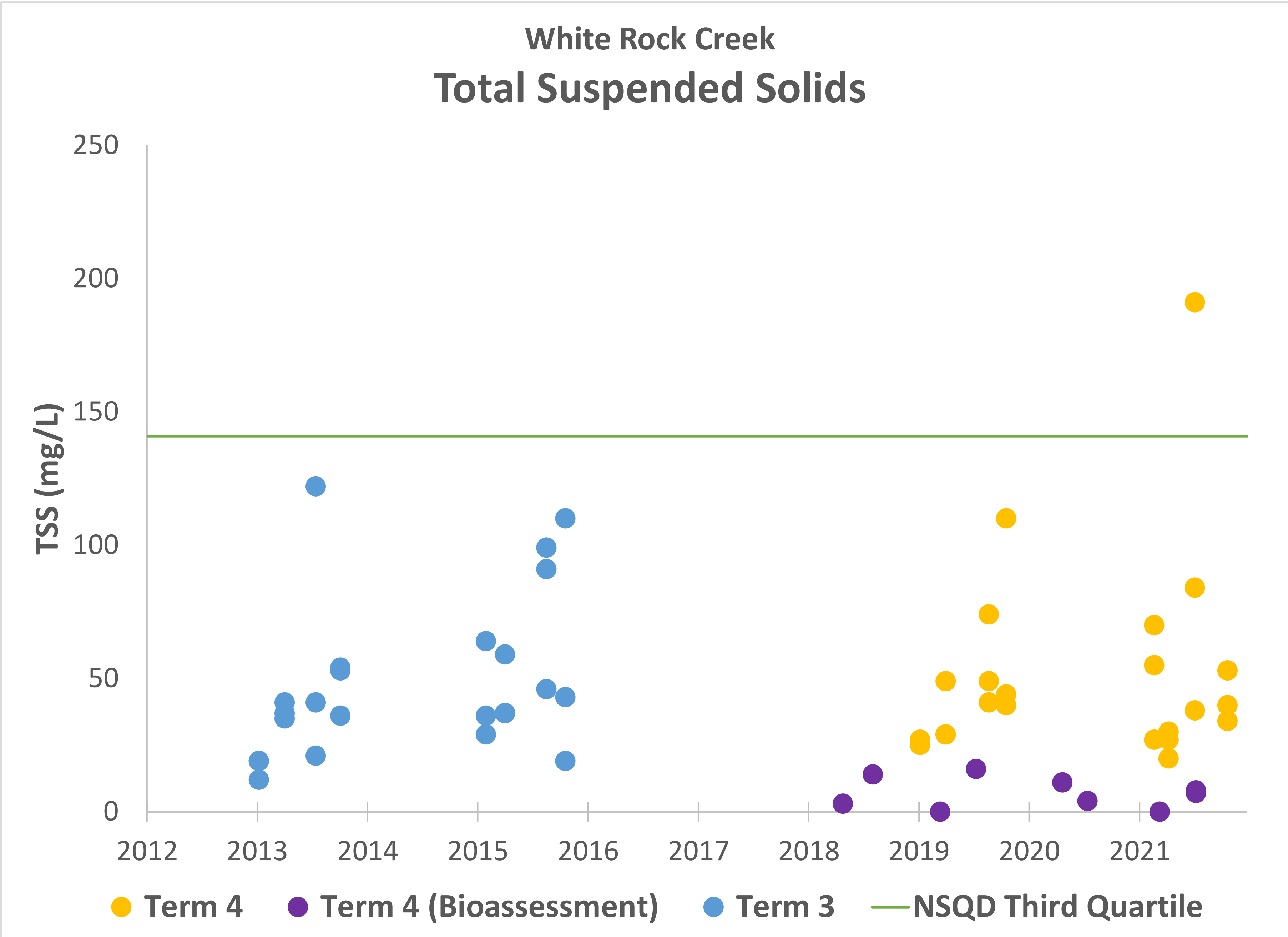

Turtle Creek - Trinity River: Mican Channel
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
2017
2018
2019
2020
2021
Term 4
Human Health Criterion

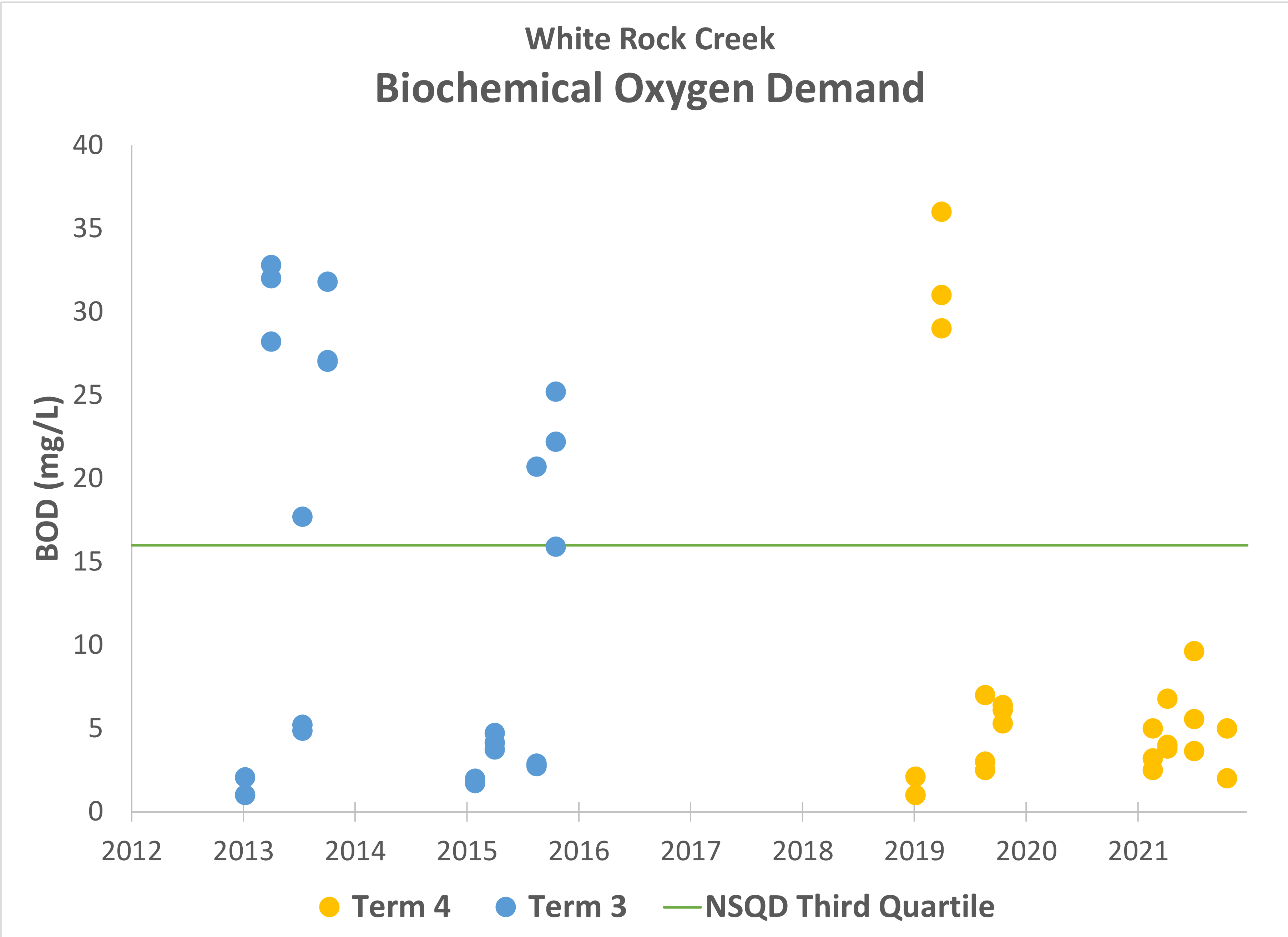
Appendix AA

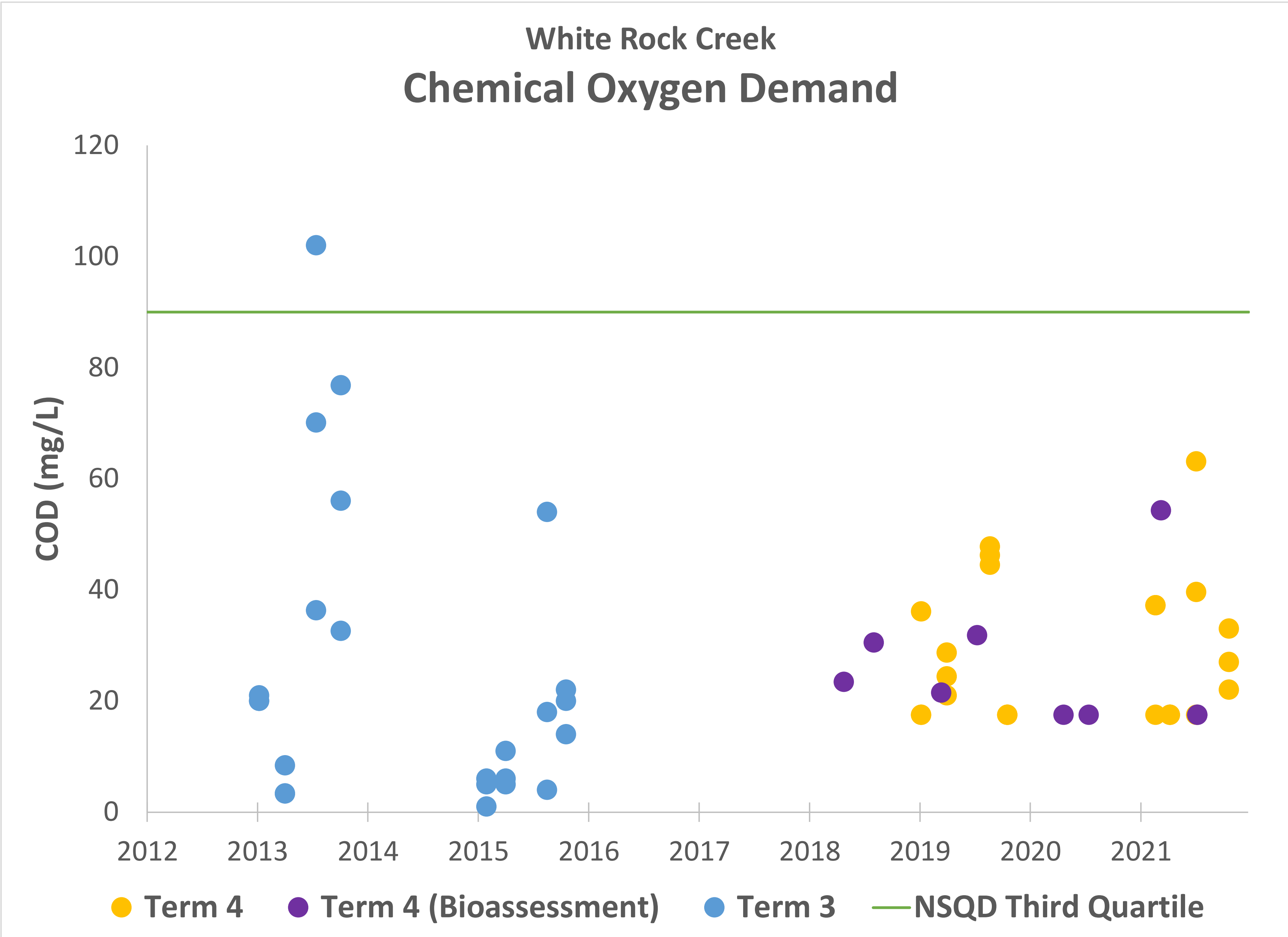
White Rock Creek Water Quality Data Graphs

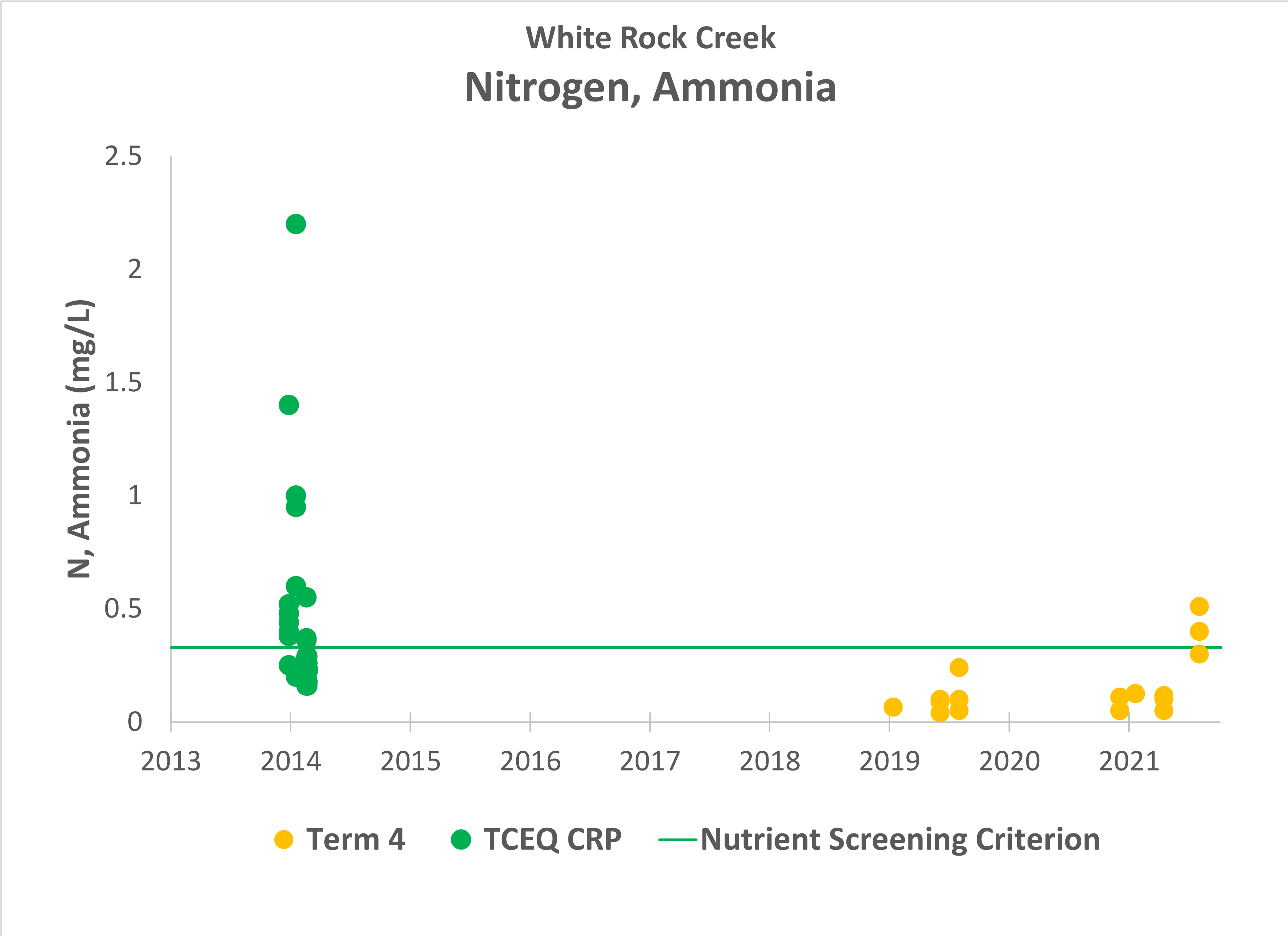


White Rock Creek
Total Dissolved Solids
TDS (mg/L)
900
800
700
600
500
400
300
200
100
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
Basin Specific Criterion

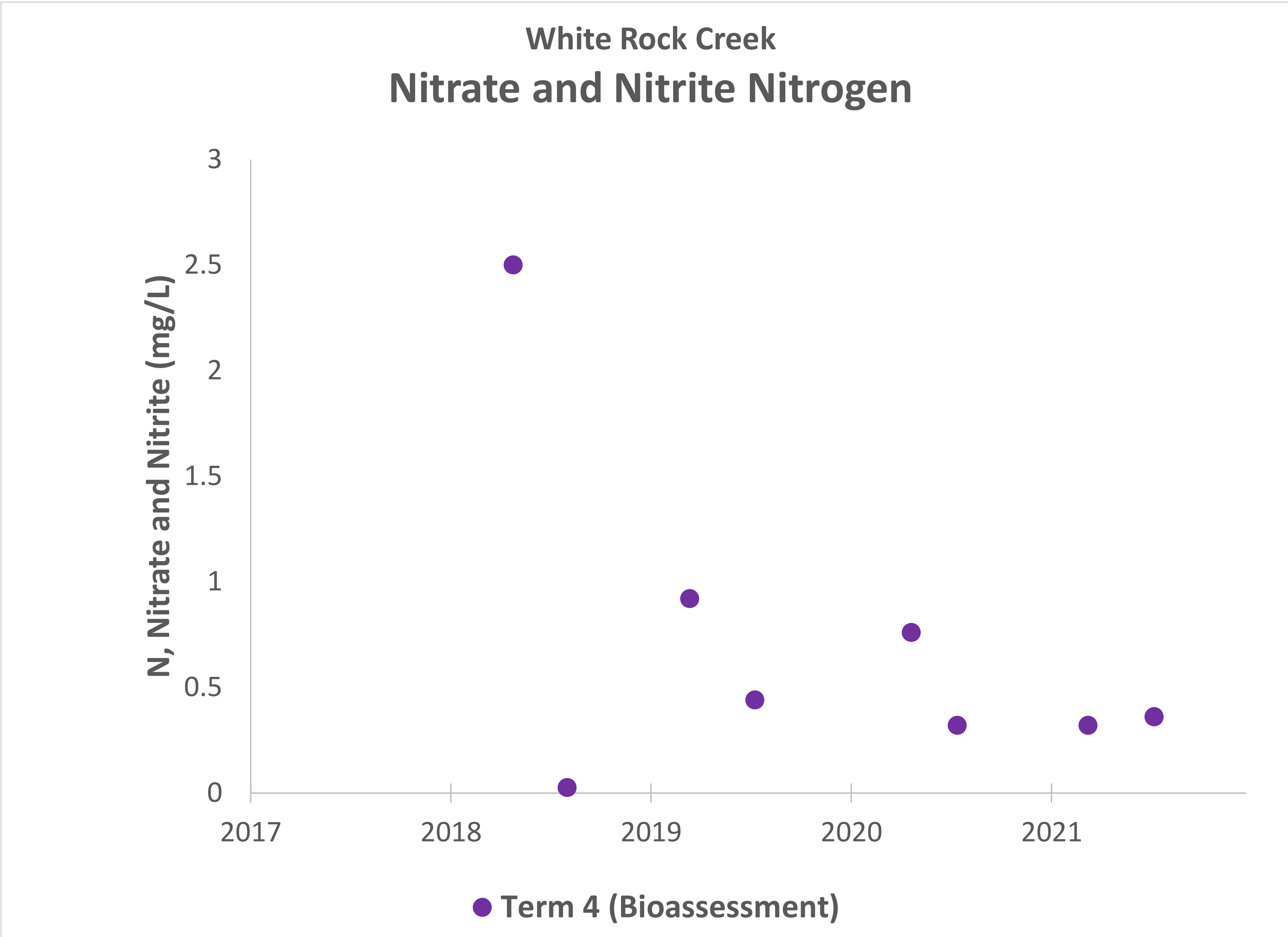

White Rock Creek
Total Suspended Solids
TSS (mg/L)
250
200
150
100
50
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3
NSQD Third Quartile

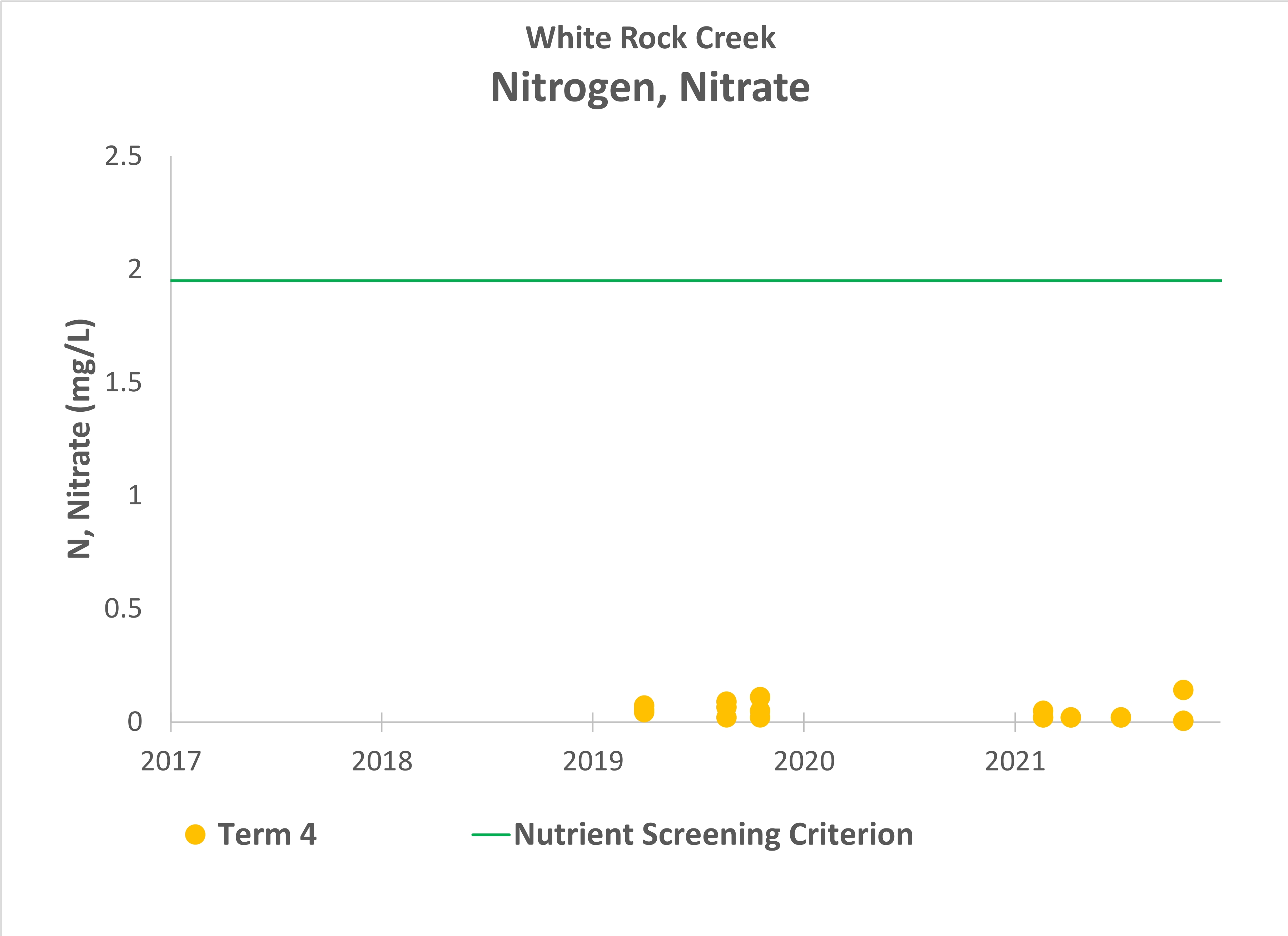

White Rock Creek
Biochemical Oxygen Demand
BOD (mg/L)
0
5
10
15
20
25
30
35
40
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

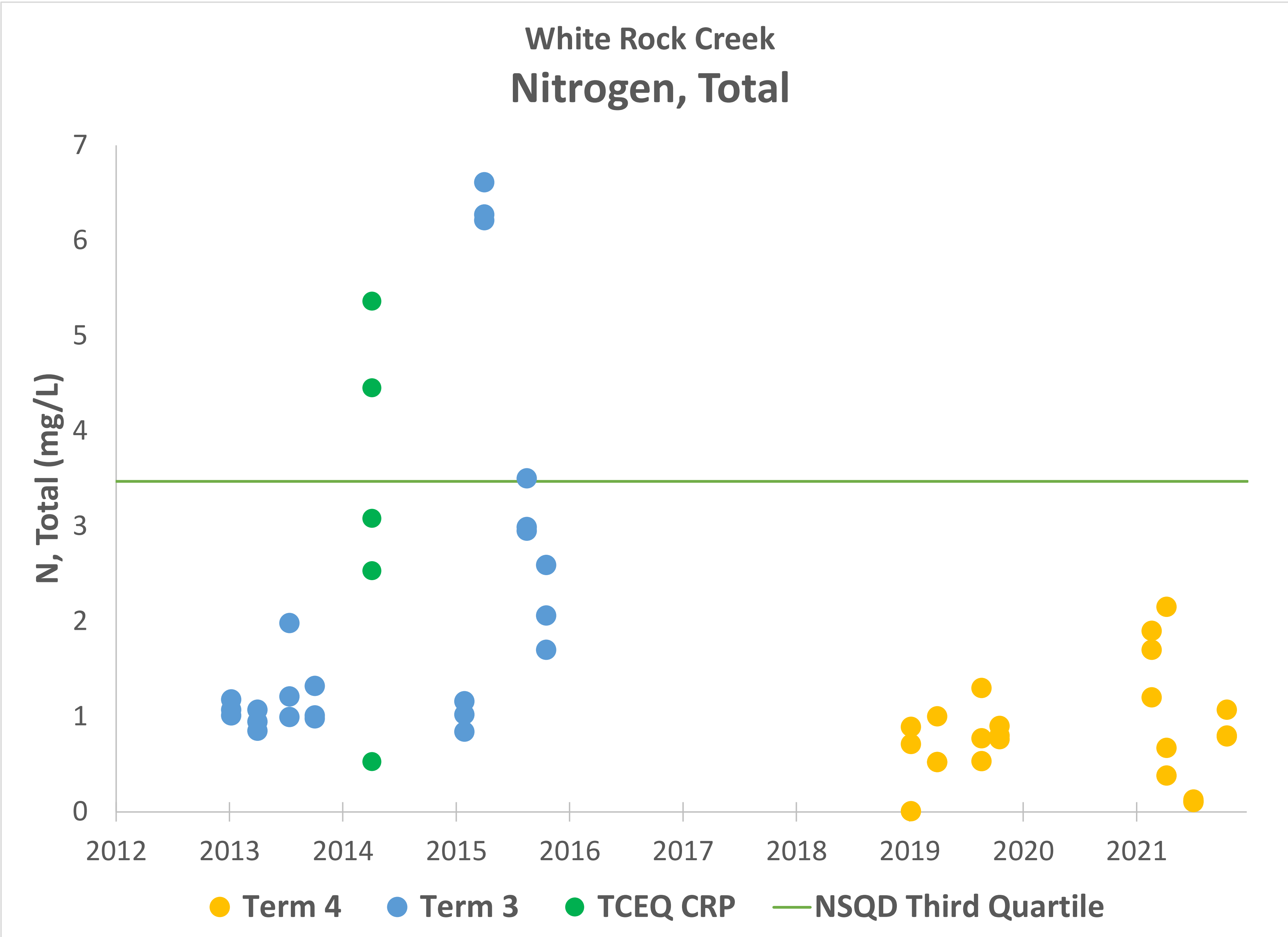

White Rock Creek
Chemical Oxygen Demand
COD (mg/L)
0
20
40
60
80
100
120
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3
NSQD Third Quartile



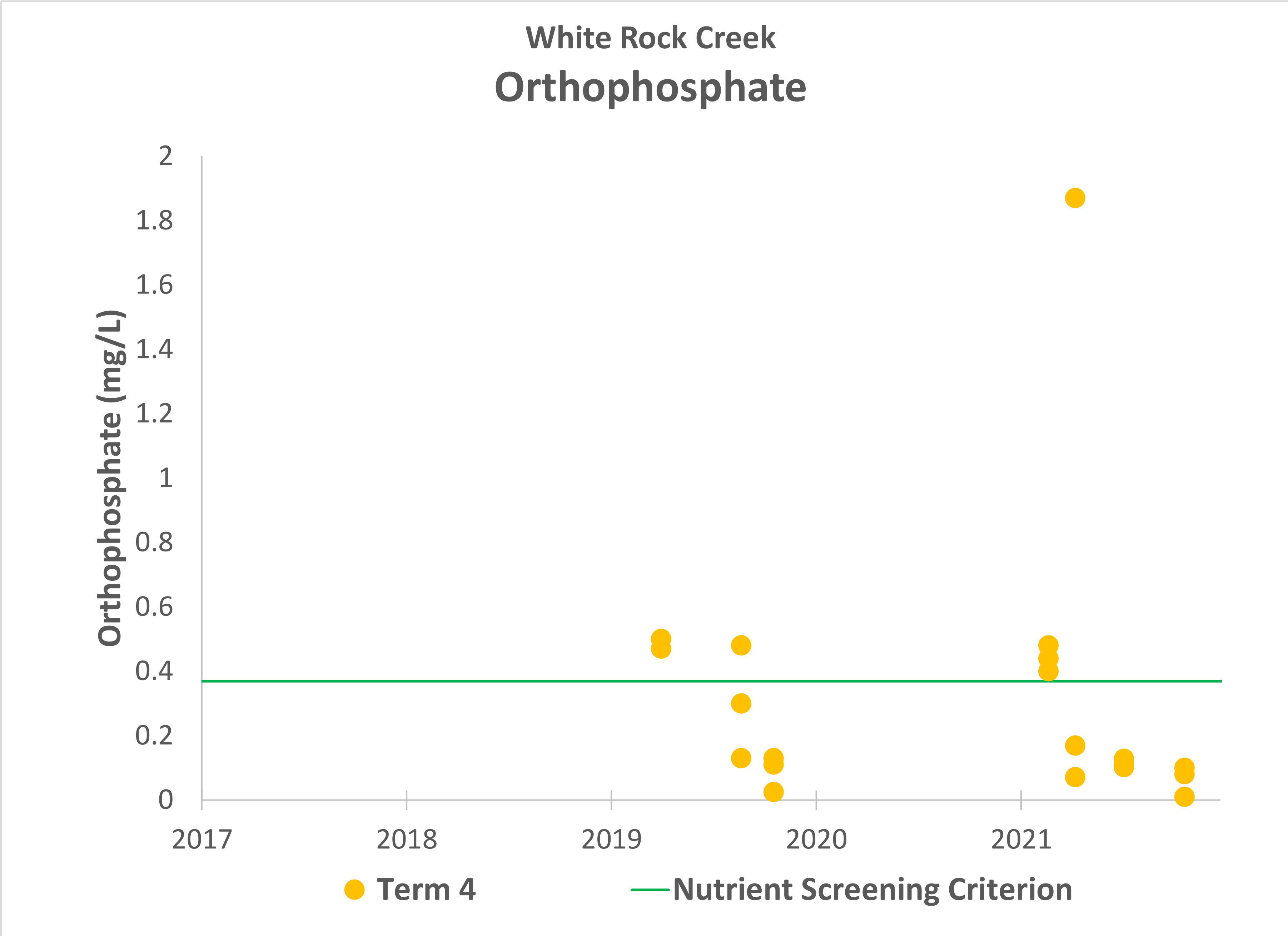
White Rock Creek
Nitrogen, Ammonia
N, Ammonia (mg/L)
2.5
2
1.5
1
0.5
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
TCEQ CRP
Nutrient Screening Criterion

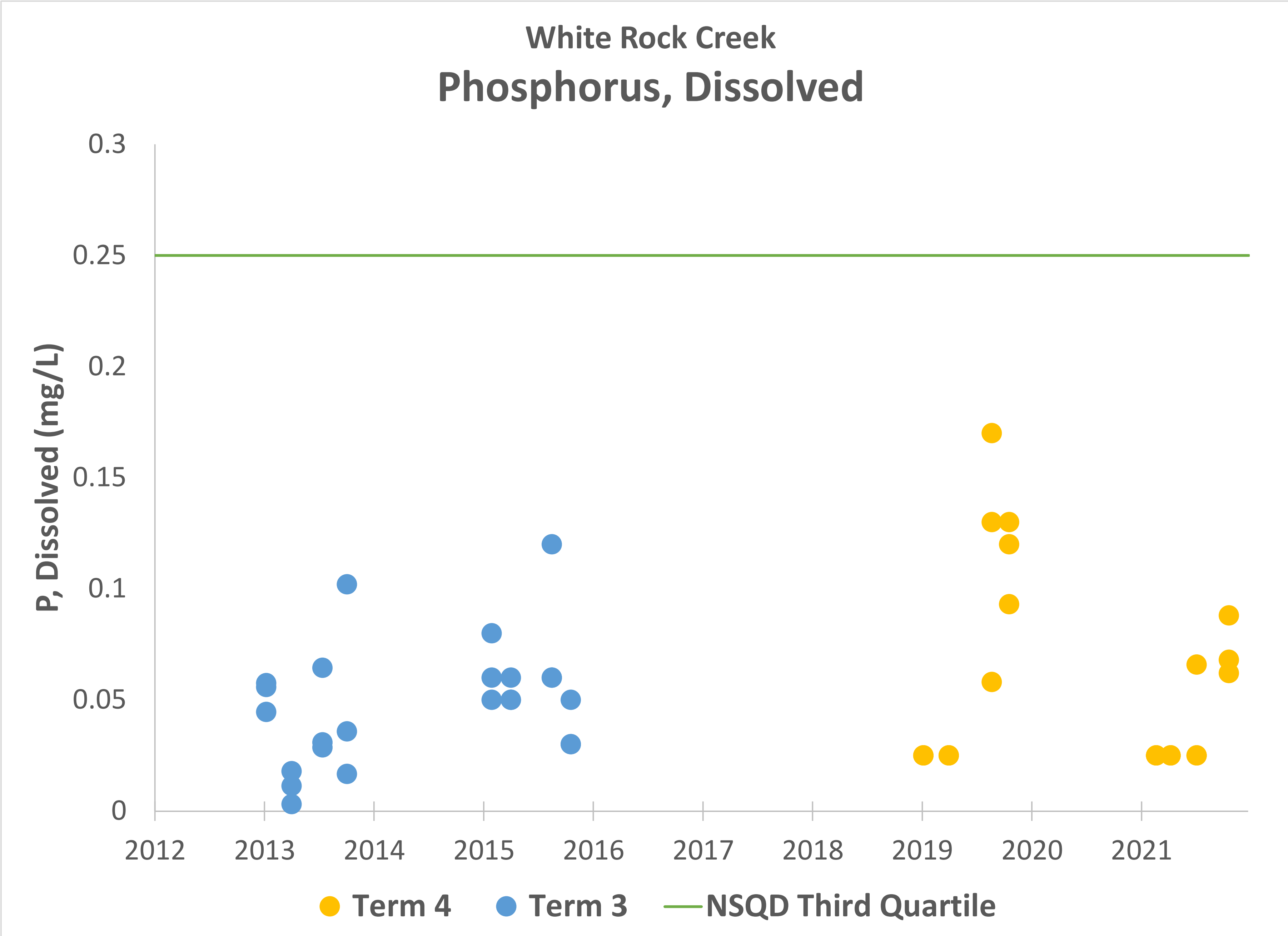

White Rock Creek
Nitrate and Nitrite Nitrogen
N, Nitrate and Nitrite (mg/L)
3
2.5
2
1.5
1
0.5
0
2017
2018
2019
2020
2021
Term 4 (Bioassessment)

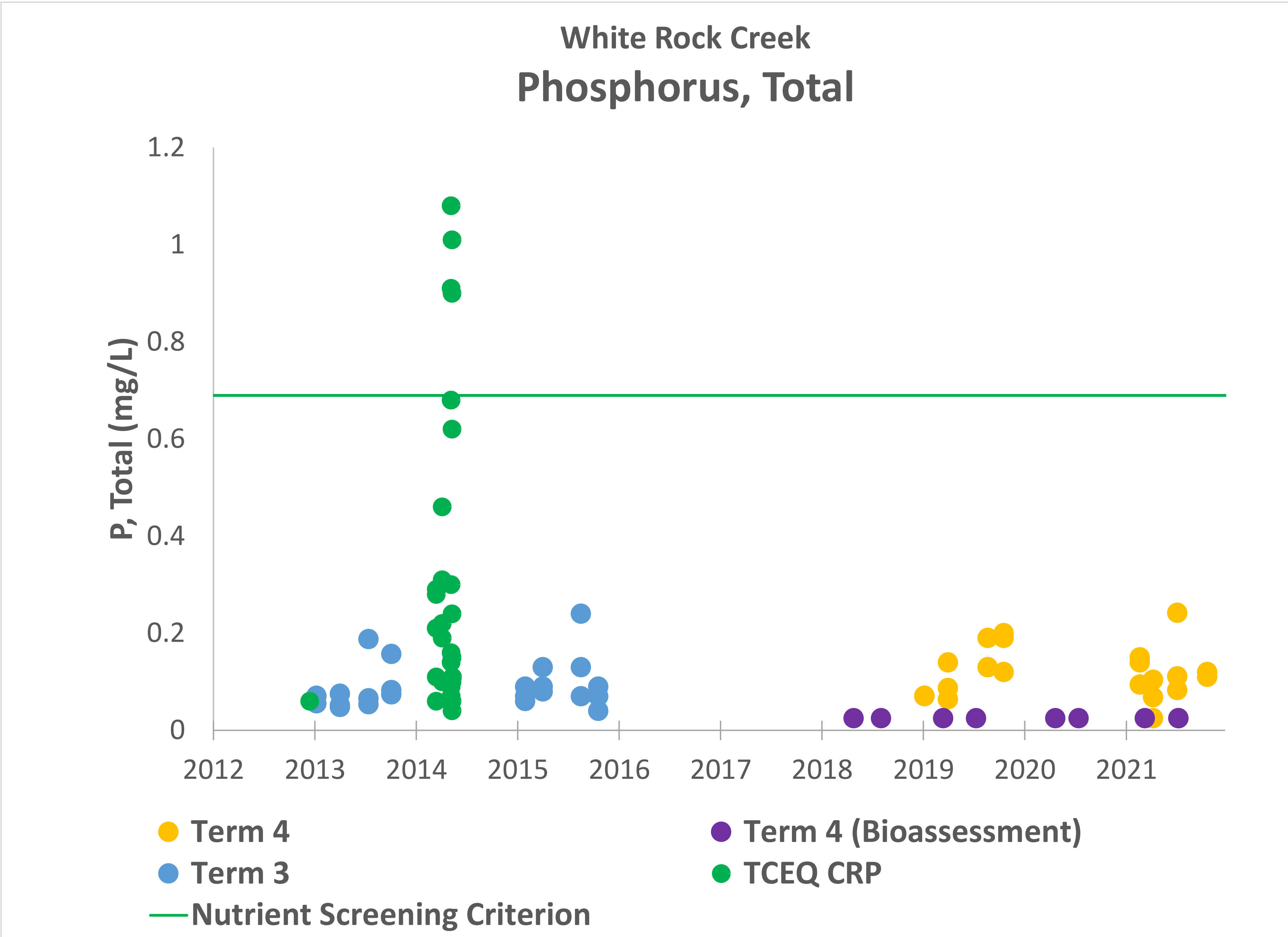

White Rock Creek
Nitrogen, Nitrate
N, Nitrate (mg/L)
2.5
2
1.5
1
0.5
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion



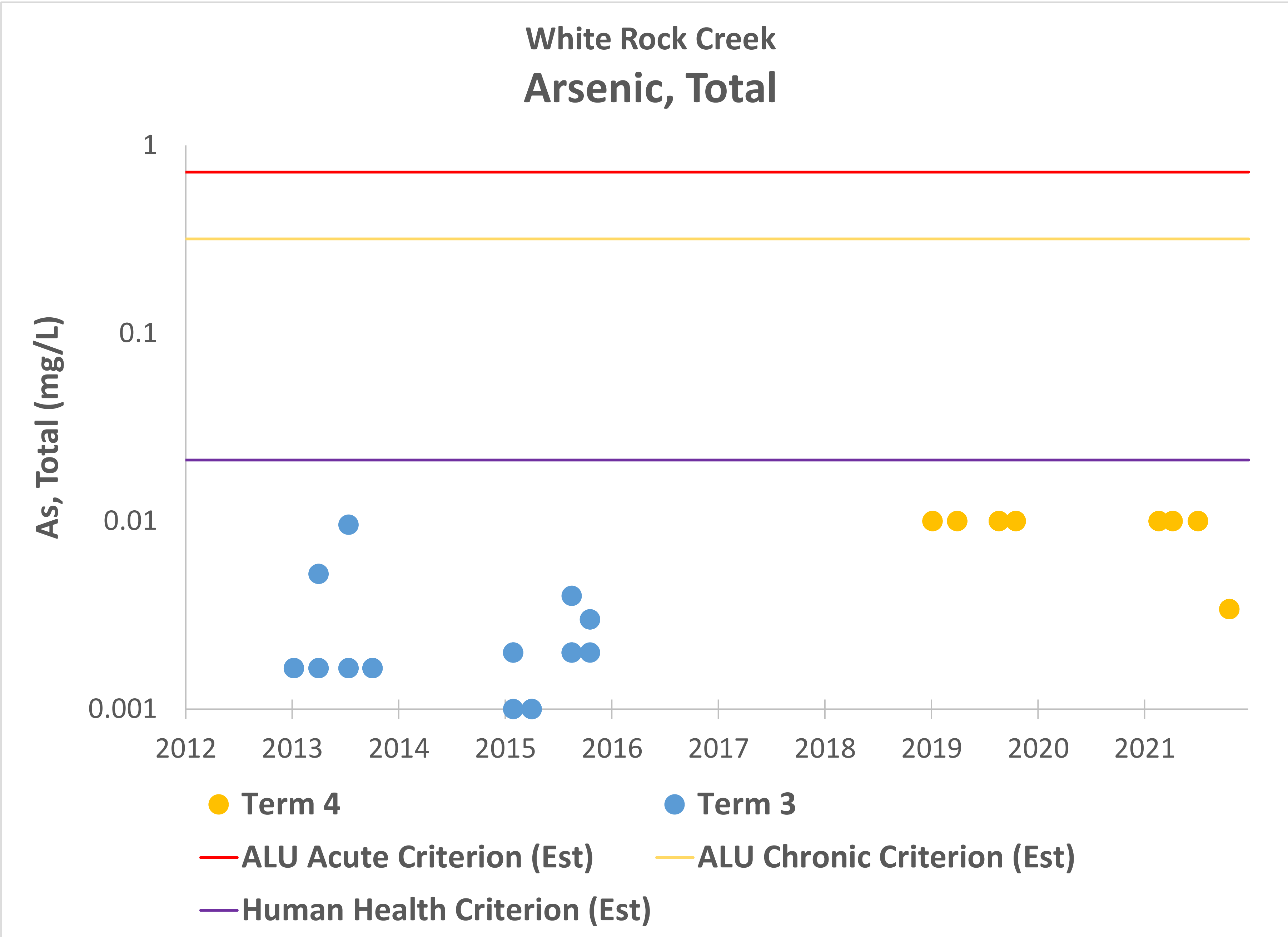
White Rock Creek
Nitrogen, Total
N, Total (mg/L)
0
1
2
3
4
5
6
7
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
TCEQ CRP
NSQD Third Quartile

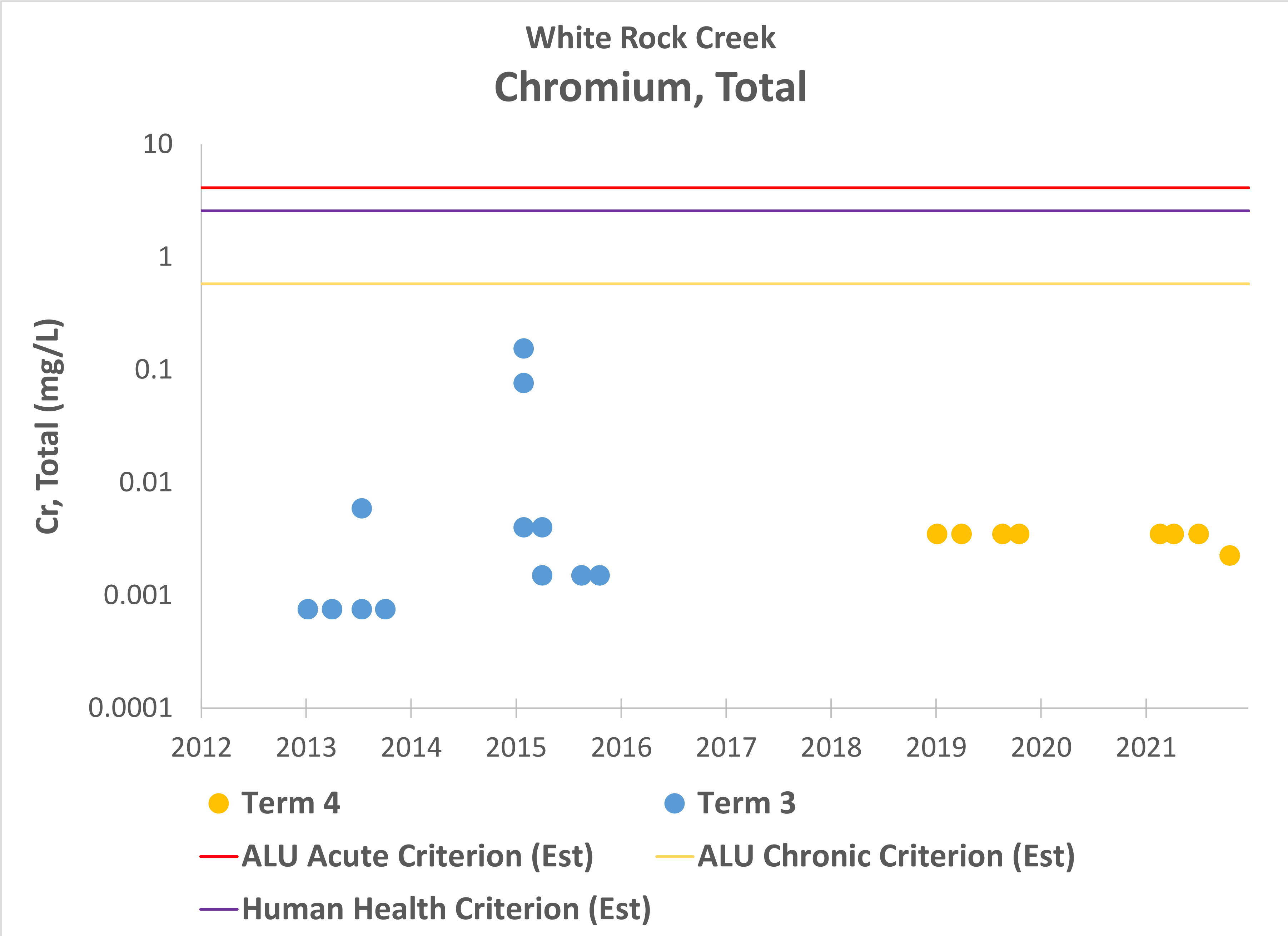

White Rock Creek
Orthophosphate
Orthophosphate (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2017
2018
2019
2020
2021
Term 4
Nutrient Screening Criterion

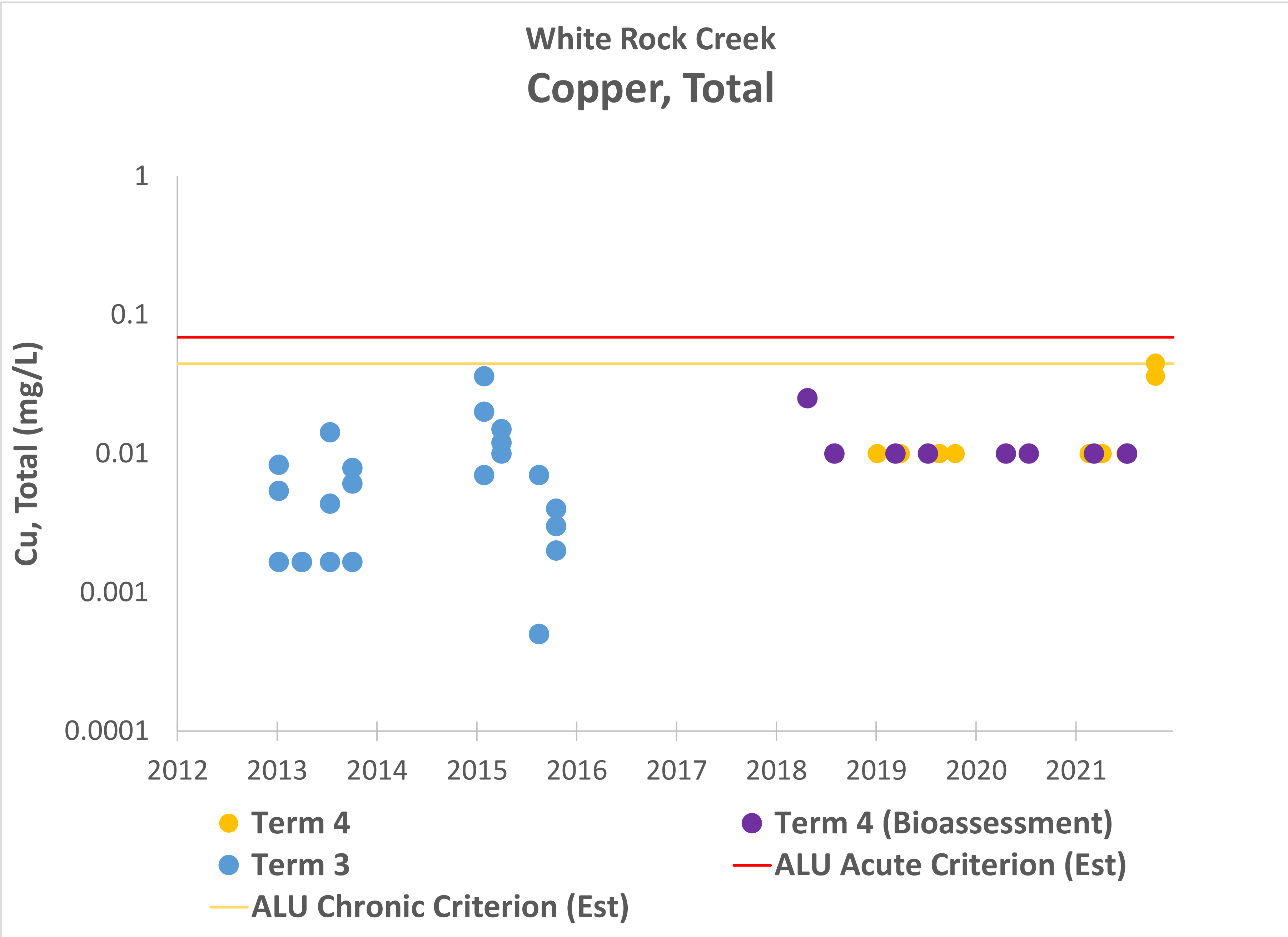

White Rock Creek
Phosphorus, Dissolved
P, Dissolved (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile



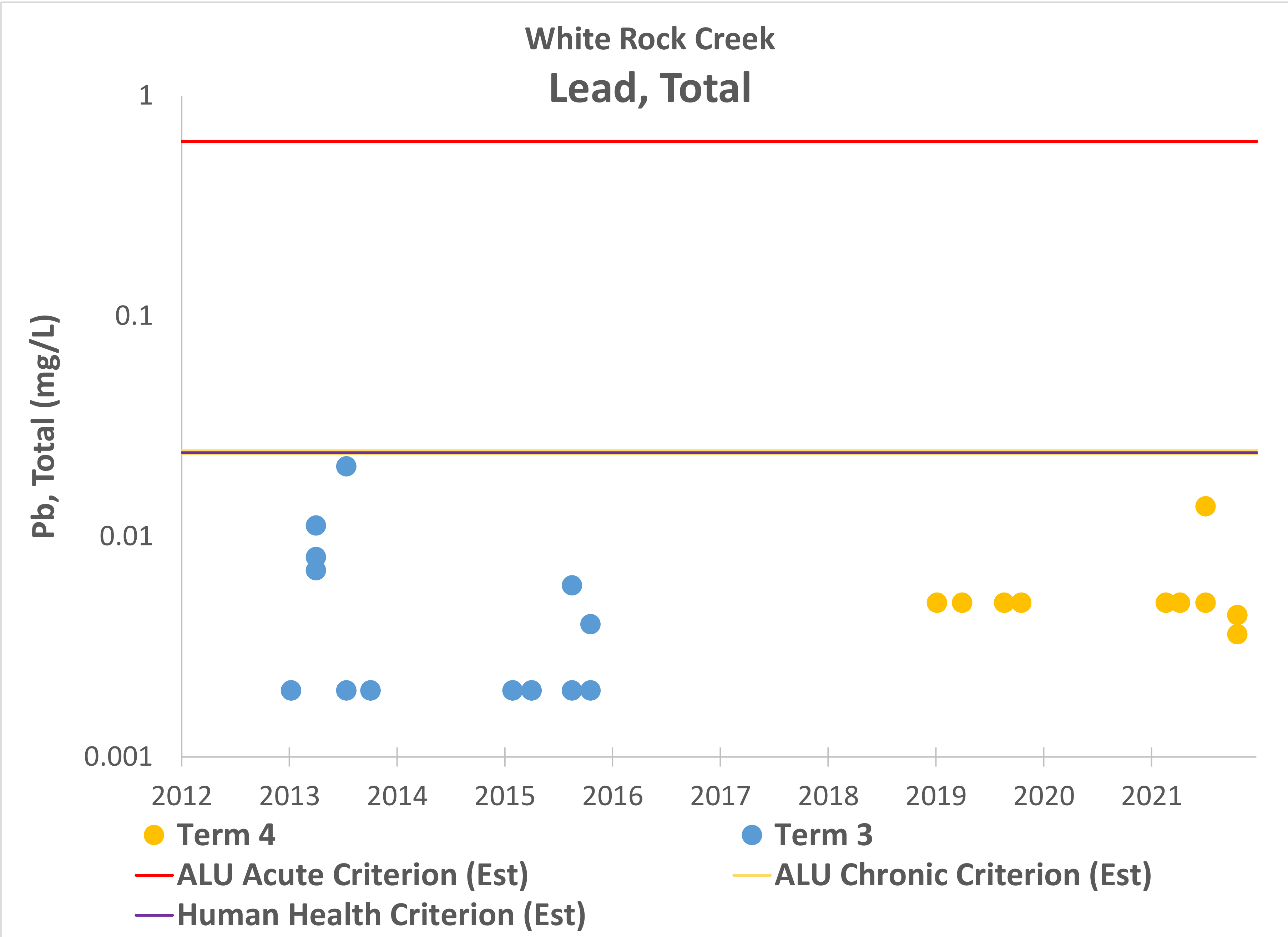
White Rock Creek
Phosphorus, Total
P, Total (mg/L)
1.2
1
0.8
0.6
0.4
0.2
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3
TCEQ CRP
Nutrient Screening Criterion

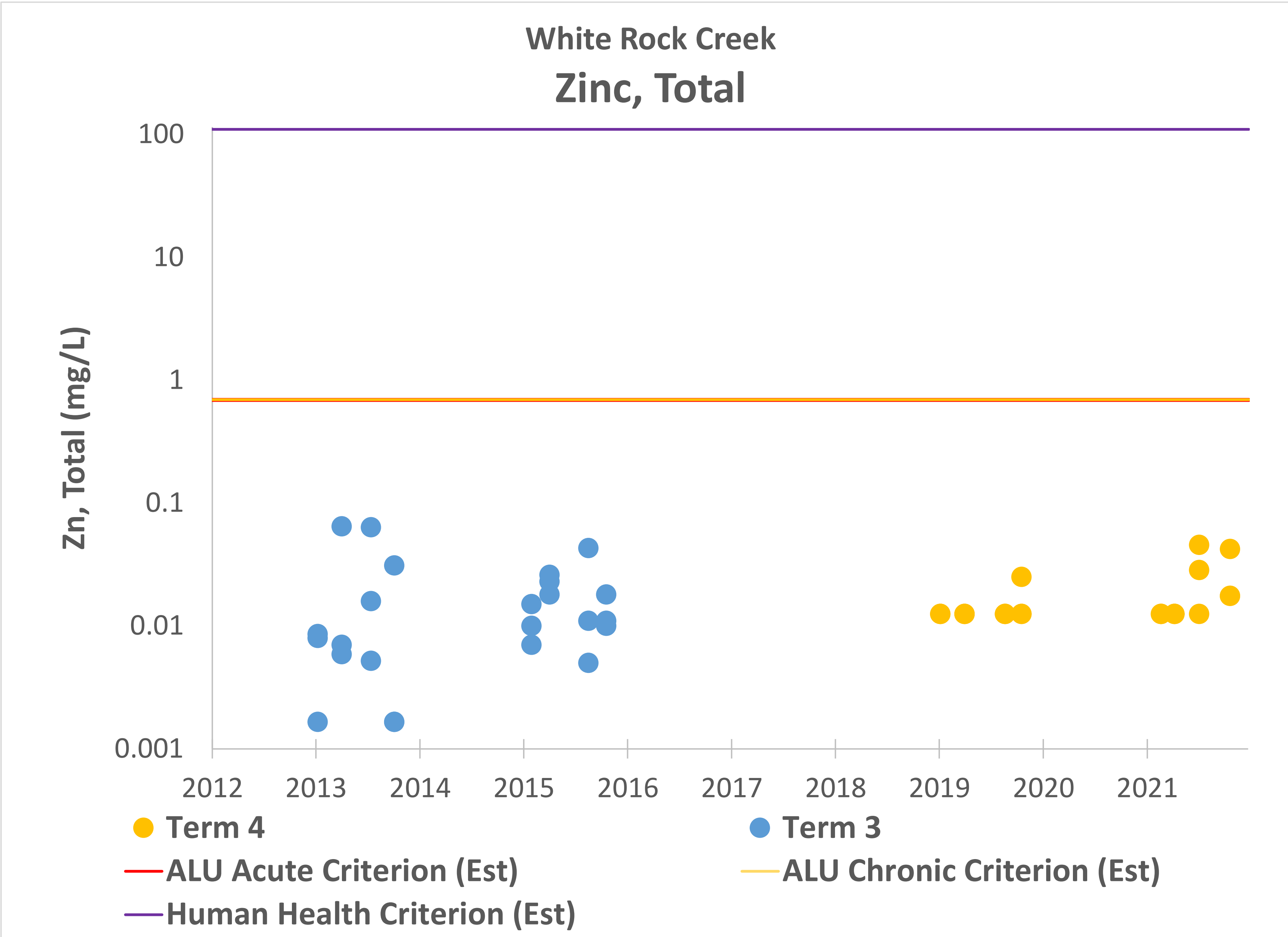

White Rock Creek
Arsenic, Total
As, Total (mg/L)
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

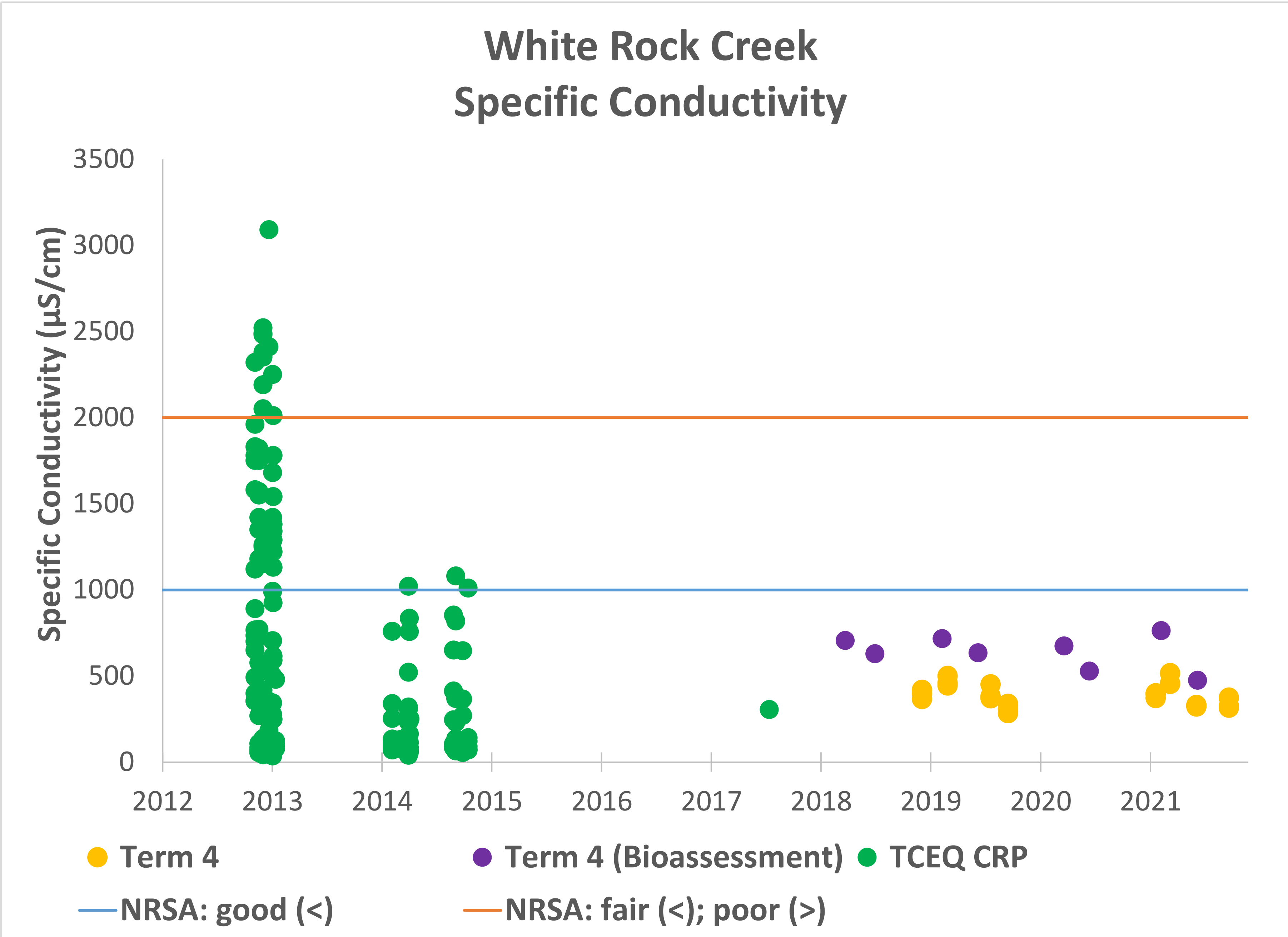

White Rock Creek
Chromium, Total
Cr, Total (mg/L)
10
1
0.1
0.01
0.001
0.0001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

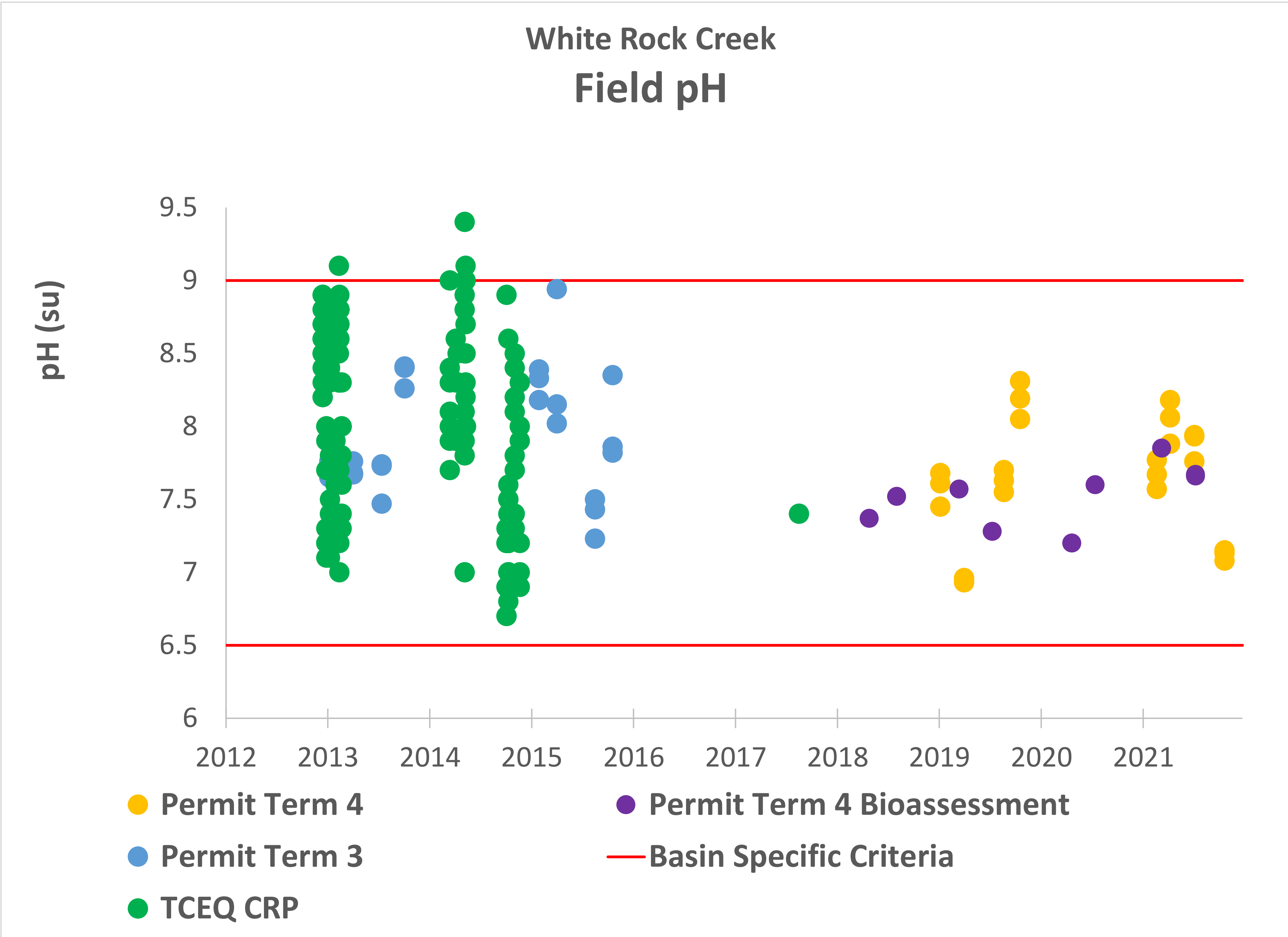


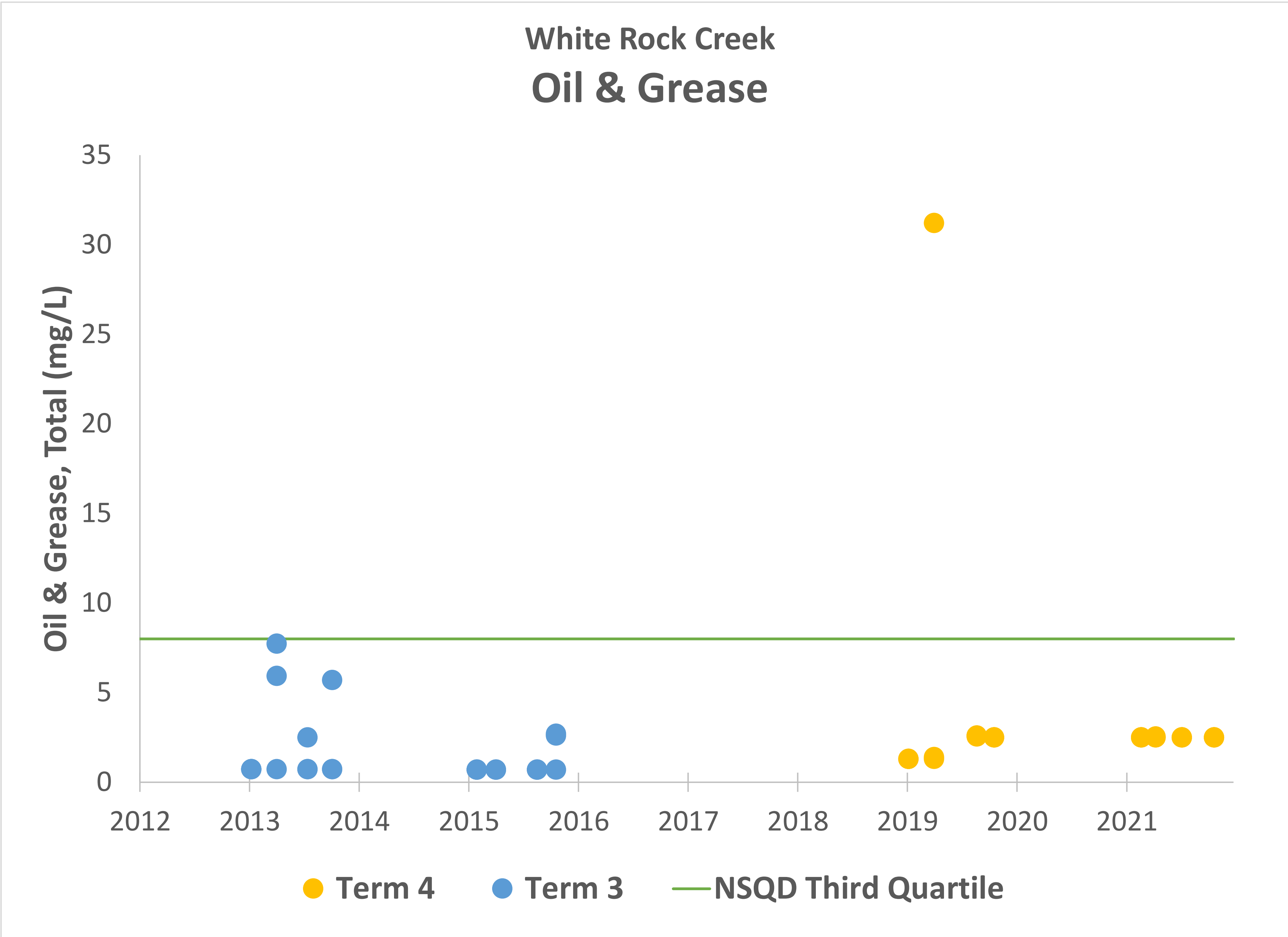
White Rock Creek
Copper, Total
Cu, Total (mg/L)
1
0.1
0.01
0.001
0.0001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)


White Rock Creek
Lead, Total
Pb, Total (mg/L)
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)

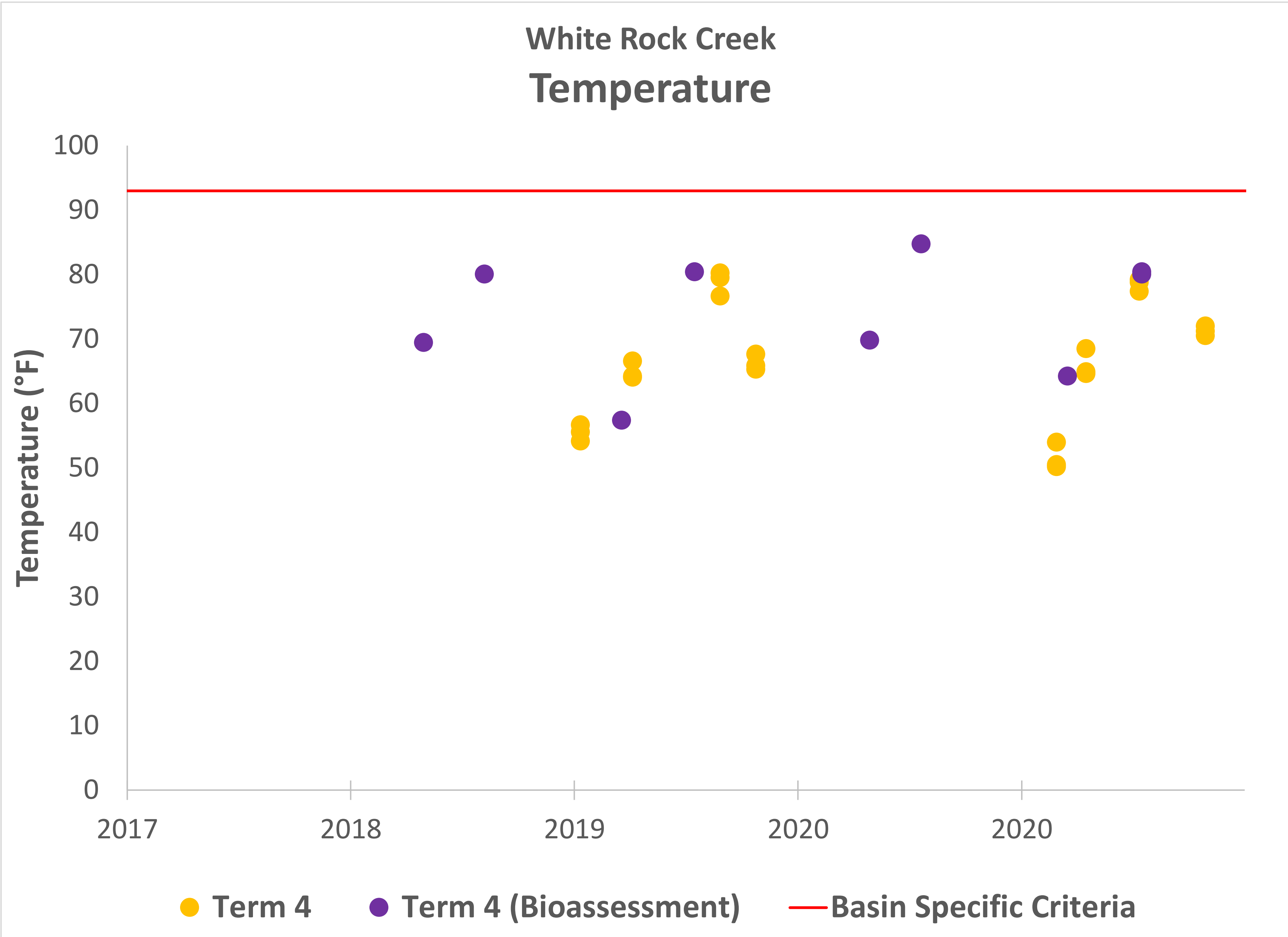

White Rock Creek
Zinc, Total
Zn, Total (mg/L)
100
10
1
0.1
0.01
0.001
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
ALU Acute Criterion (Est)
ALU Chronic Criterion (Est)
Human Health Criterion (Est)


White Rock Creek
Specific Conductivity
Specific Conductivity (µS/cm)
3500
3000
2500
2000
1500
1000
500
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 4 (Bioassessment)
TCEQ CRP
NRSA: good (<)
NRSA: fair (<); poor (>)

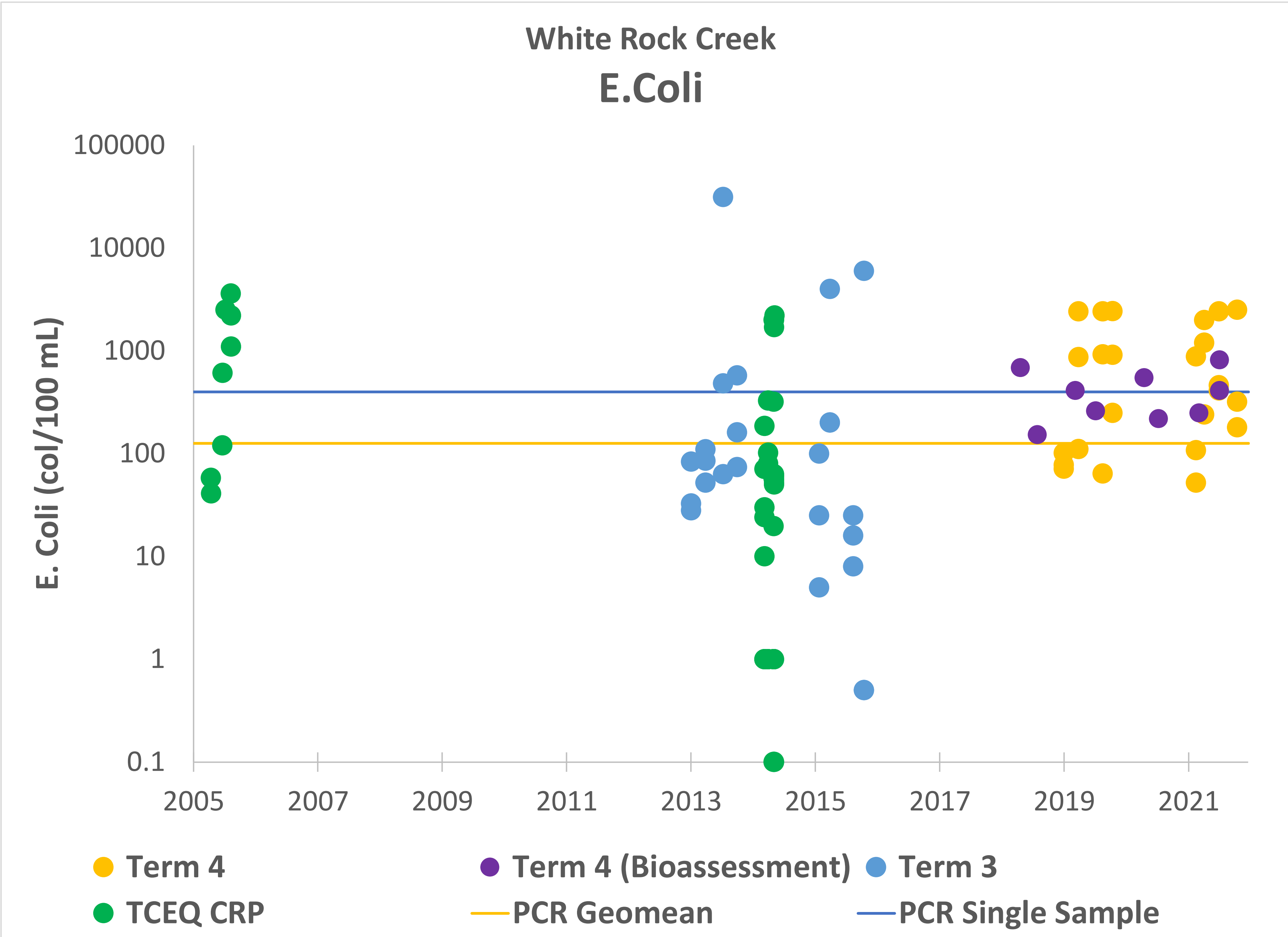

White Rock Creek
Field pH
pH (su)
9.5
9
8.5
8
7.5
7
6.5
6
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Permit Term 4
Permit Term 4 Bioassessment
Permit Term 3
Basin Specific Criteria
TCEQ CRP



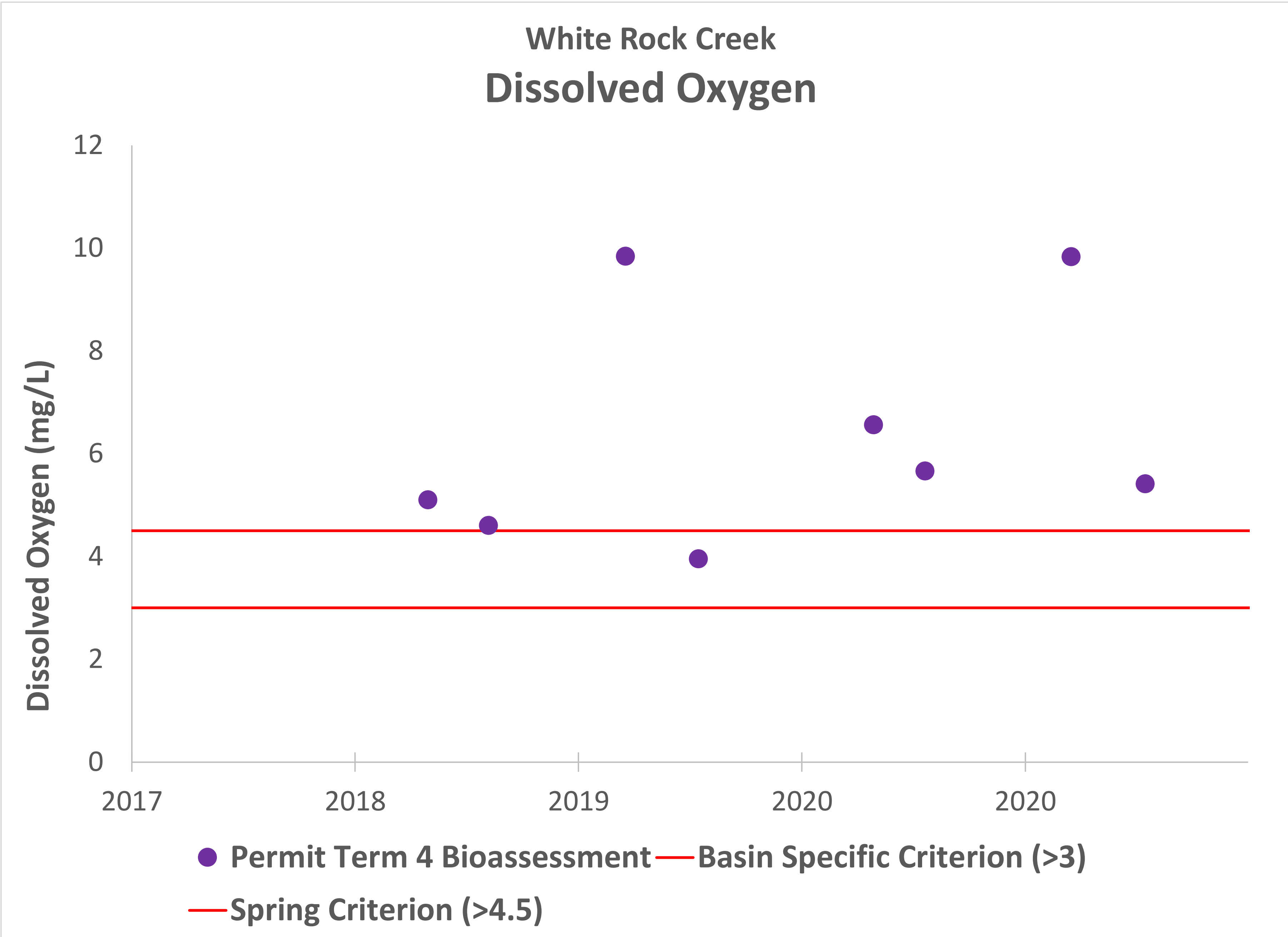
White Rock Creek
Oil & Grease
Oil & Grease, Total (mg/L)
35
30
25
20
15
10
5
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
Term 4
Term 3
NSQD Third Quartile

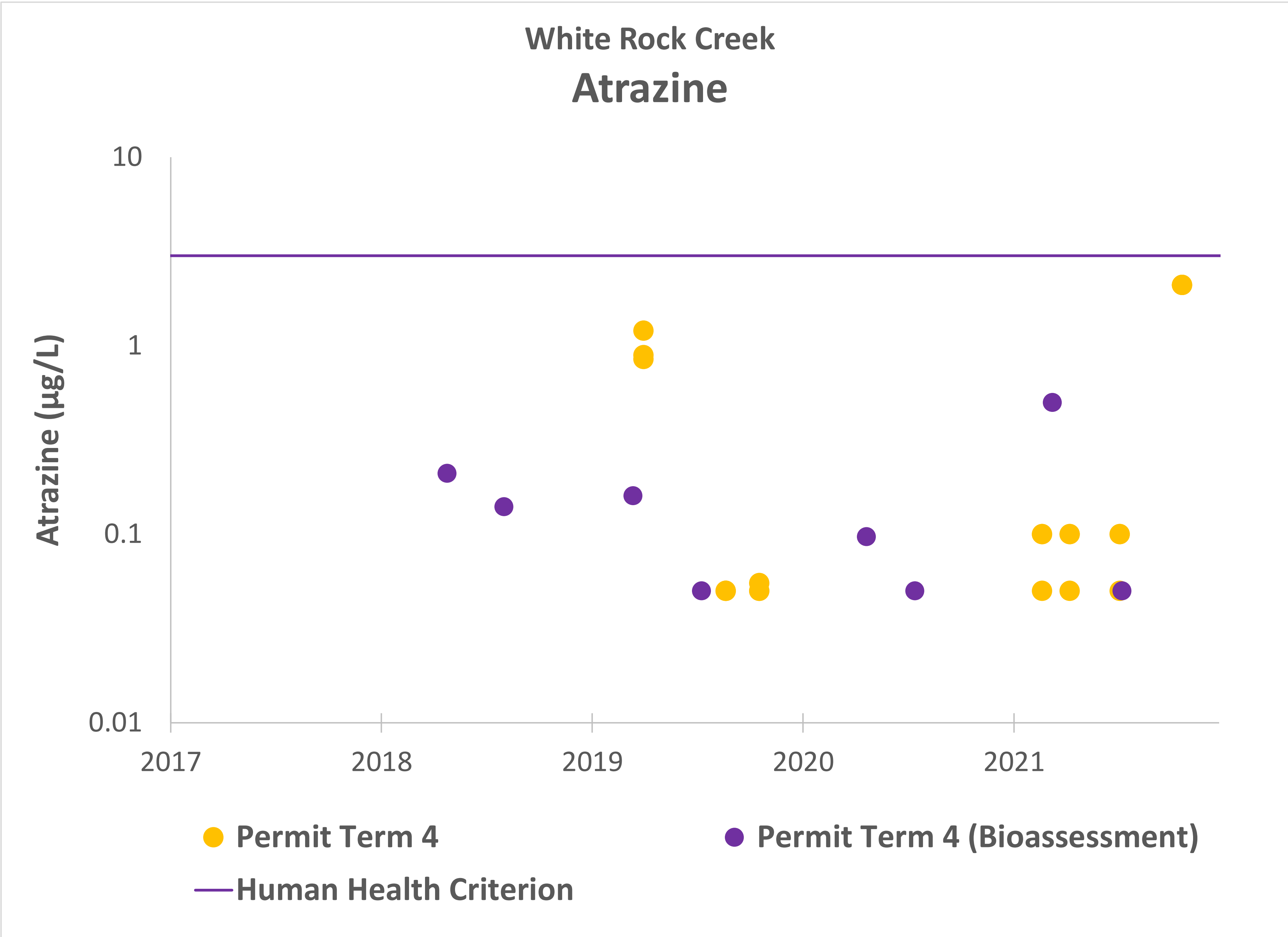


White Rock Creek
Temperature
Temperature (°F)
100
90
80
70
60
50
40
30
20
10
0
2017
2018
2019
2020
2020
Term 4
Term 4 (Bioassessment)
Basin Specific Criteria

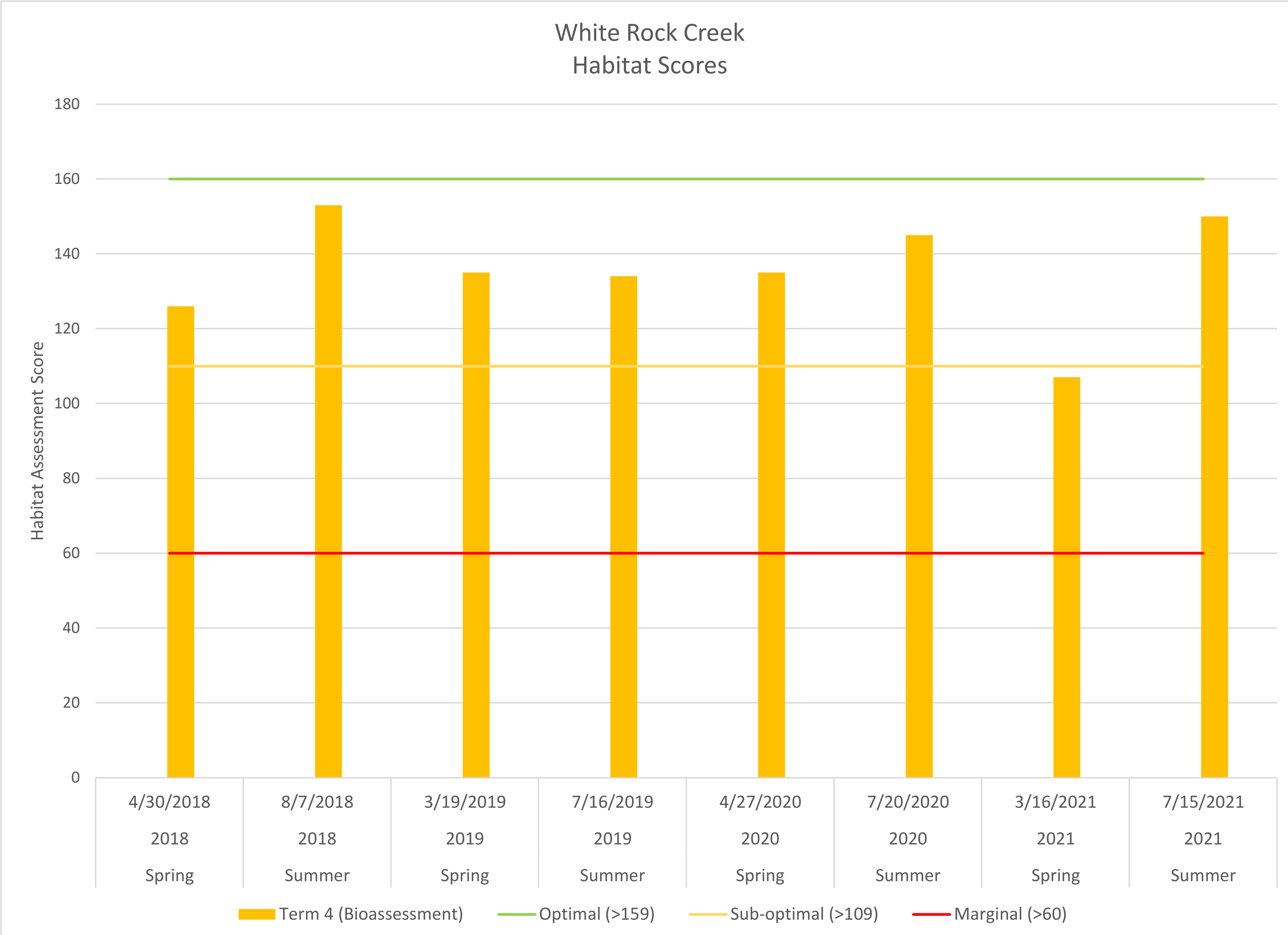


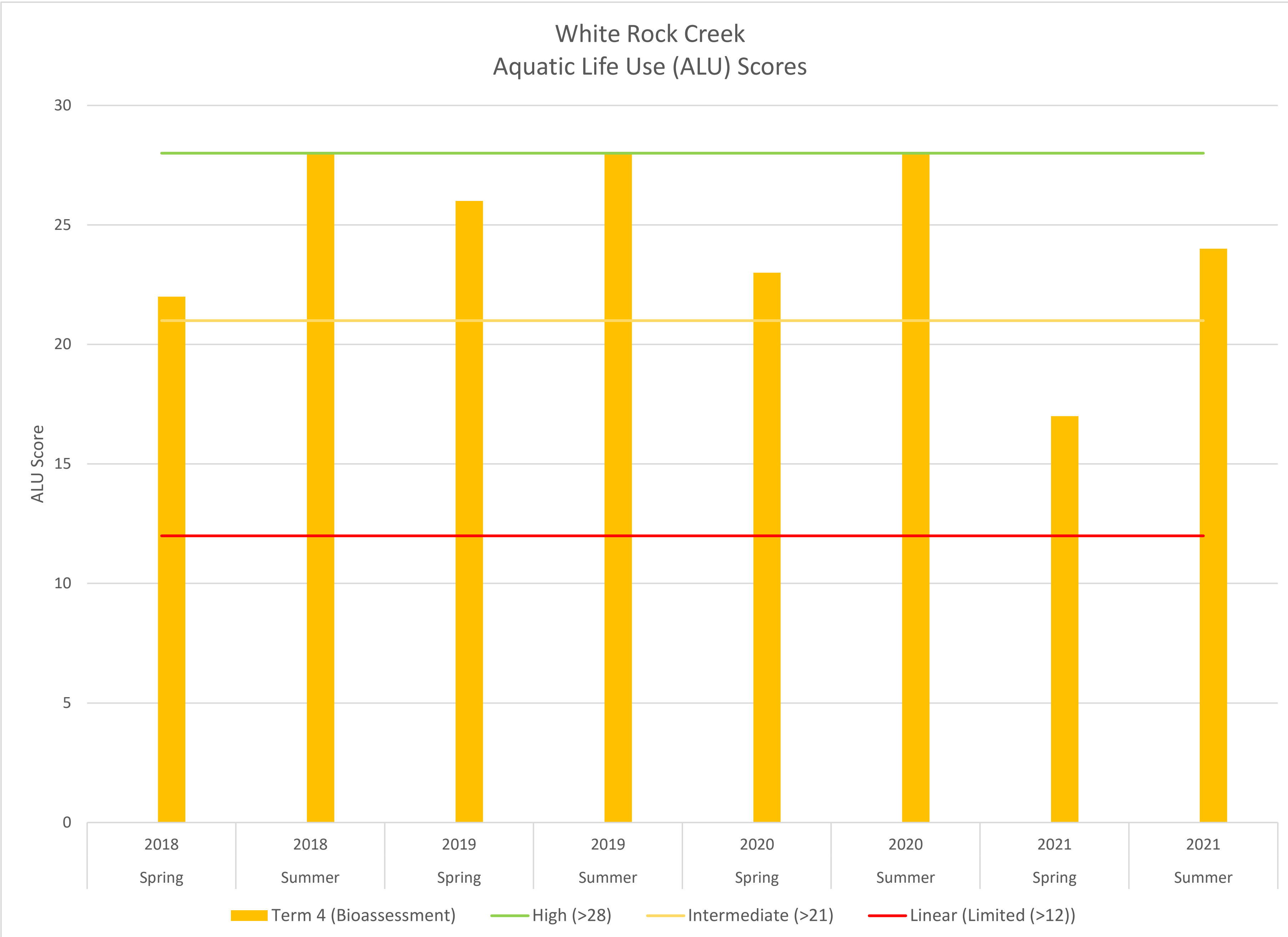
White Rock Creek
E.Coli
E. Coli (col/100 mL)
100000
10000
1000
100
10
1
0.1
2005
2007
2009
2011
2013
2015
2017
2019
2021
Term 4
Term 4 (Bioassessment)
Term 3
TCEQ CRP
PCR Geomean
PCR Single Sample


White Rock Creek
Dissolved Oxygen
Dissolved Oxygen (mg/L)
12
10
8
6
4
2
0
2017
2018
2019
2020
2020
Permit Term 4 Bioassessment
Basin Specific Criterion (>3)
Spring Criterion (>4.5)



White Rock Creek
Atrazine
Atrazine (µg/L)
10
1
0.1
0.01
2017
2018
2019
2020
2021
Permit Term 4
Permit Term 4 (Bioassessment)
Human Health Criterion


White Rock Creek
Habitat Scores
Habitat Assessment Score
180
160
140
120
100
80
60
40
20
0
4/30/2018
2018
Spring
8/7/2018
2018
Summer
3/19/2019
2019
Spring
7/16/2019
2019
Summer
4/27/2020
2020
Spring
7/20/2020
2020
Summer
3/16/2021
2021
Spring
7/15/2021
2021
Summer
Term 4 (Bioassessment)
Optimal (>159)
Sub-optimal (>109)
Marginal (>60)



White Rock Creek
Aquatic Life Use (ALU) Scores
ALU Score
30
25
20
15
10
5
0
2018 Spring
2018 Summer
2019 Spring
2019 Summer
2020 Spring
2020 Summer
2021 Spring
2021 Summer
Term 4 (Bioassessment)
High (>28)
Intermediate (>21)
Linear (Limited (>12))

Appendix AB

Annual Load Tables

Watershed	Annual Load																				
	Annual Flow (litre)	TDS(lb)	TSS(lb)	BOD (lb)	COD (lb)	Nitrogen Total (lb)	Nitrate N (lb)	Ammonia N (lb)	Ortho-phosphate (lb)	Phosphorus Dissolved (lb)	Phosphorus Total (lb)	Atrazine (lb)	Arsenic Total (lb)	Chromium Total (lb)	Copper Total (lb)	Lead Total (lb)	Zinc Total (lb)	Oil and Grease (lb)	Spec. Cond. (uS/cm)	pH Field (su)	E. coli (billion Col.)
Johnson Creek	17,947,365,005.60	22,038,685.82	748,800.95	153,716.87	569,068.94	46,985.53	13,749.45	10,495.08	7,567.14	1,127.65	4,382.02	Not Detected	197.83	49.46	2,233.35	111.28	2,680.65	111,973.93	999.75	8.20	195,716.02
Fish Creek - Mountain Creek Lake	6,444,982,757.90	5,924,989.95	1,505,224.51	54,880.75	630,151.81	21,206.35	4,759.88	8,312.04	1,776.08	1,126.03	15,530.01	Not Detected	71.11	60.39	597.44	67.42	1,117.86	18,826.41	632.25	8.55	67,430.63
Duck Creek	25,840,591,842.00	21,885,271.50	4,867,787.60	309,906.84	1,644,955.87	168,056.10	105,201.22	21,514.98	204,753.09	34,620.03	69,681.57	Not Detected	218.38	197.01	3,646.25	197.49	4,404.59	97,320.62	623.17	8.04	54,652.85
Delaware Creek - West Fork Trinity River	15,498,626,875.57	6,286,962.20	5,110,548.56	362,140.98	1,337,687.88	61,246.63	16,827.87	13,795.44	13,282.92	4,518.75	10,493.93	Not Detected	152.18	192.20	2,501.29	226.36	3,639.35	96,098.27	270.88	8.10	390,849.54
South Mesquite Creek	11,517,893,245.22	7,236,819.02	3,853,288.73	85,191.33	565,614.54	17,203.32	2,475.75	7,078.12	5,713.28	1,491.80	2,805.85	Not Detected	171.40	101.57	1,396.33	101.57	1,578.77	26,027.16	612.75	7.92	4,808.72
North Mesquite Creek	17,742,602,890.74	11,147,872.56	4,642,013.25	142,477.63	597,584.64	40,777.74	20,437.77	4,508.04	6,869.63	3,901.76	7,236.34	Not Detected	178.76	151.57	1,944.03	157.93	2,219.80	50,849.95	707.25	8.24	632,523.79
Spring Creek	432,440,045.85	240,246.05	298,162.50	6,320.76	41,399.54	1,832.83	579.16	438.54	294.35	107.73	272.42	Not Detected	4.77	6.56	64.02	10.62	122.51	2,550.23	339.00	8.50	10,865.06
Cottonwood Branch - Hackberry Creek	5,077,115,332.03	1,757,302.33	2,206,421.79	90,075.74	399,030.75	25,604.01	9,598.00	6,435.98	3,679.70	629.61	2,476.45	Not Detected	80.98	76.78	610.58	54.43	1,106.99	35,062.10	520.00	8.55	73,110.46
Cottonwood Creek - Mountain Creek Lake	4,413,911,707.30	3,113,891.12	1,270,199.98	91,957.10	293,873.47	23,986.69	4,816.80	2,688.16	3,515.29	569.26	1,882.93	Not Detected	128.93	55.95	575.88	53.52	1,023.93	37,220.73	857.00	7.80	256,233.09

Watershed	Annual Load																						
	Annual Flow (litre)	TDS(lb)	TSS(lb)	BOD (lb)	COD (lb)	Nitrogen Total (lb)	Nitrate N (lb)	Ammonia N (lb)	Ortho-phosphate (lb)	Phosphorus Dissolved (lb)	Phosphorus Total (lb)	Atrazine (lb)	Arsenic Total (lb)	Chromium Total (lb)	Copper Total (lb)	Lead Total (lb)	Zinc Total (lb)	Oil and Grease (lb)	Spec. Cond. (uS/cm)	pH Field (su)	E. coli (billion Col.)
Johnson Creek	10,486,425,835.26	7,155,136.88	4,466,469.93	180,901.28	442,716.87	107,500.44	62,708.59	6,473.14	1,658.74	1,826.35	8,906.35	1.13	86.40	216.16	332.33	253.72	1,561.65	51,553.97	643.75	8.58	378,890.30
Fish Creek - Mountain Creek Lake	7,976,544,041.95	8,511,183.07	3,018,480.53	228,298.42	485,788.08	52,447.53	8,616.69	3,433.49	1,499.13	1,180.84	2,580.61	0.92	86.99	182.01	233.97	140.24	1,377.35	44,710.09	761.75	8.50	175,914.70
Duck Creek	24,899,480,475.66	21,097,361.35	2,617,500.04	611,009.23	2,162,799.75	248,118.14	179,135.44	18,432.29	33,965.29	21,783.53	28,142.01	2.18	137.23	357.26	827.06	292.90	3,418.49	93,684.73	661.92	7.77	567,714.38
Delaware Creek - West Fork Trinity River	9,562,099,259.84	6,079,119.19	8,403,519.29	263,797.41	1,364,705.60	47,431.36	8,116.03	6,312.32	2,073.80	3,512.56	7,359.77	1.19	89.65	460.74	443.09	299.16	2,316.49	41,199.41	482.75	8.18	741,588.61
South Mesquite Creek	4,370,836,979.33	3,632,752.10	1,498,871.59	49,119.24	333,403.77	10,695.90	3,685.75	2,406.58	782.92	472.16	978.05	0.47	23.13	37.10	71.28	44.25	247.88	13,839.63	717.75	8.23	101,868.91
North Mesquite Creek	9,759,162,942.04	6,949,361.35	4,924,795.09	101,551.04	555,626.18	27,700.63	10,488.59	1,802.96	1,194.09	2,909.91	3,587.63	1.18	68.85	107.58	141.30	102.20	559.39	28,184.72	683.25	8.16	112,230.37
Spring Creek	277,162,721.87	129,844.50	194,339.03	8,890.53	29,650.37	1,339.69	420.09	77.17	51.33	37.32	225.17	0.06	2.40	6.07	13.14	6.29	71.80	1,642.15	633.25	7.73	14,061.02
Cottonwood Branch - Hackberry Creek	3,132,398,834.31	944,352.62	1,389,078.83	86,804.48	342,349.41	23,134.05	5,282.85	3,580.60	638.78	1,234.39	2,154.57	Not Detected	25.03	66.75	83.75	34.53	503.60	9,175.93	365.08	8.48	75,699.64
Cottonwood Creek - Mountain Creek Lake	5,462,816,962.13	1,713,163.16	768,364.22	106,523.22	311,319.98	19,329.54	5,841.01	6,313.71	Not Detected	933.36	1,963.06	0.61	48.84	92.43	91.05	63.20	1,002.00	25,441.53	261.00	8.23	87,252.11

Permitted Entity	Location	Mean Annual Concentration																				
		Annual Flow (litre)	TDS (mg/L)	TSS (mg/L)	BOD (mg/L)	COD (mg/L)	Nitrogen Total (mg/L)	Nitrate N (mg/L)	Ammonia N (mg/L)	Ortho-phosphate (mg/L)	Phosphorus Dissolved (mg/L)	Phosphorus Total (mg/L)	Atrazine (µg/L)	Arsenic Total (mg/L)	Chromium Total (mg/L)	Copper Total (mg/L)	Lead Total (mg/L)	Zinc Total (mg/L)	Oil and Grease (mg/L)	Spec. Cond. (uS/cm)	pH (su)	*E. coli* (col/100 mL)
Arlington	Rush Creek and Sublett Road	7,884,664,653.05	491	123.95	15.50	34.65	2.64	0.39	0.16	0.07	0.062	0.362	0.376	0.006	0.003	0.007	0.0028	0.0375	0.67	853	7.6	3151
	Rush Creek and Woodland Park Boulevard	35,510,058,179.01	455	40.35	8.40	42.58	1.01	0.33	0.07	0.07	0.060	0.209	0.399	0.001	0.001	0.005	0.0011	0.0228	0.97	862	8.2	452
Garland	Rowlett Creek at Ben Davis Bridge	3,732,639,396.02	484	51.55	2.33	16.20	7.70	6.55	0.20	0.17	0.212	0.249	0.161	0.002	0.001	0.003	0.0007	0.0112	0.48	926	8.1	889
	Rowlett Creek at Centerville Road/Castle Drive	4,105,281,229.06	533	125.50	33.78	67.85	7.68	3.65	2.16	0.26	0.189	0.385	0.065	0.012	0.003	0.005	0.0017	0.0198	2.04	1042	7.7	3056
	Rowlett Creek at Highway 66	4,156,605,020.76	494	25.40	2.65	14.75	6.98	7.58	0.14	0.21	0.207	0.280	0.133	0.001	0.001	0.003	0.0007	0.0132	1.46	932	8.3	239
Irving	Grapevine Creek at N. Royal Lane	7,482,359,813.02	335	140.83	3.90	9.90	1.28	0.52	0.10	0.08	0.055	0.167	0.458	0.004	0.004	0.009	0.0027	0.0470	1.87	703	8.8	4654
	Estelle Creek at W. Rochelle Road	57,633,310.97	173	66.57	5.17	17.35	1.60	0.73	0.11	0.09	0.135	0.218	0.057	0.003	0.012	0.008	0.0030	0.0373	1.50	443	8.8	4711
Mesquite	North of New Market Road	1,953,565,842.13	303	274.23	3.65	51.08	1.53	0.17	0.03	0.04	0.026	0.077	0.242	0.002	0.007	0.007	0.0062	0.0402	0.50	706	8.2	758
	North Mesquite Creek at Edward's Church	7,059,010,845.07	252	107.68	5.65	20.03	1.24	0.47	0.05	0.07	0.069	0.156	0.634	0.003	0.002	0.005	0.0023	0.0211	2.42	573	8.1	2888
Plano	Rowlett Creek at Alma Drive	808,116,429.24	265	593.38	10.28	40.95	3.48	1.13	0.14	0.11	0.103	0.623	0.251	0.005	0.015	0.016	0.0086	0.0679	0.64	656	8.2	4853
	Rowlett Creek in Oak Point Park	1,309,223,268.16	301	485.55	5.08	13.65	3.10	1.23	0.07	0.17	0.029	0.798	0.172	0.005	0.014	0.013	0.0093	0.0558	0.46	702	8.2	6647
NTTA	Unnamed Tributary at SH 161 N. of Gateway Dr.	3,961,963,214.46	124	454.48	10.18	22.93	3.25	0.74	0.24	0.09	0.119	0.368	0.081	0.003	0.011	0.017	0.0078	0.1215	2.10	452	8.5	12608
	Cottonwood Creek at SH 161 S. of Dickey Road	6,755,911,800.10	164	87.75	6.60	18.88	1.53	0.48	0.18	0.06	0.055	0.188	0.100	0.003	0.004	0.006	0.0030	0.0535	1.40	211	8.6	1672

Watershed	Annual Load																					
	Annual Flow (litre)	TDS(lb)	TSS(lb)	BOD (lb)	COD (lb)	Nitrogen Total (lb)	Nitrate N (lb)	Ammonia N (lb)	Ortho-phosphate (lb)	Phosphorus Dissolved (lb)	Phosphorus Total (lb)	Atrazine (lb)	Arsenic Total (lb)	Chromium Total (lb)	Copper Total (lb)	Lead Total (lb)	Zinc Total (lb)	Oil and Grease (lb)	Spec. Cond. (uS/cm)	pH Field (su)	E. coli (billion Col.)
Rush Creek - Village Creek	30,745,565,159.38	19,851,557.47	4,213,478.24	569,196.60	2,976,462.71	82,295.42	19,444.87	3,040.86	4,349.89	2,814.63	12,793.79	53.61	200.22	182.06	929.80	133.74	1,599.31	163,552.94	719.50	8.64	405,545.53
Rowlett Creek - Lake Ray Hubbard	4,690,517,439.90	4,125,083.46	353,462.86	43,637.82	193,155.93	57,640.87	50,945.25	1,476.14	798.82	688.43	1,133.08	2.28	20.21	15.54	31.36	7.01	120.70	13,617.43	766.67	7.87	34,256.80
Grapevine Creek - Elm Fork Trinity River	5,756,451,645.62	3,461,381.14	894,692.47	73,637.63	383,416.97	32,361.22	5,342.77	868.68	166.25	394.68	825.53	0.89	31.12	52.57	85.22	23.54	388.02	17,283.11	397.50	9.05	72,151.36
Estelle Creek - Bear Creek	46,267,590.32	17,901.27	9,073.04	1,111.31	5,324.48	146.19	55.11	11.88	8.72	5.44	15.20	0.00	0.28	0.76	0.97	0.23	3.67	77.61	584.00	8.88	3,437.94
South Mesquite Creek	2,184,031,562.68	1,377,065.97	387,480.36	31,886.78	214,986.00	4,347.87	1,359.01	291.66	98.10	157.81	473.79	2.71	9.39	19.01	24.06	13.79	112.67	20,276.81	522.25	8.43	7,136.32
North Mesquite Creek	7,316,446,797.98	5,653,508.43	489,137.36	235,777.92	939,966.35	19,960.68	6,681.79	820.12	736.73	586.72	1,874.29	7.50	94.16	30.32	438.65	17.09	176.22	51,897.76	625.00	7.64	90,045.34
Headwaters Rowlett Creek	911,918,304.94	529,241.77	148,016.81	12,404.26	60,036.02	3,101.07	1,719.41	336.74	79.91	78.81	180.64	0.39	3.95	9.02	11.15	3.31	40.61	6,134.28	632.25	7.80	13,505.97
Brown Branch Rowlett Creek	1,477,391,895.87	1,068,315.08	398,957.06	14,616.05	97,711.75	3,855.54	2,425.69	135.09	Not Detected	96.33	312.03	0.32	6.82	15.17	15.29	6.30	235.26	569.99	703.75	8.30	14,940.13
Cottonwood Branch - Hackberry Creek	3,048,082,454.69	935,732.51	270,976.04	77,059.34	407,556.03	16,060.33	5,957.10	2,086.50	669.80	834.26	1,562.35	0.78	13.56	25.00	91.98	11.74	456.61	5,527.04	340.50	8.56	42,729.54
Cottonwood Creek - Mountain Creek Lake	5,849,450,468.76	4,120,175.67	840,154.76	117,286.38	670,253.93	22,502.99	9,697.57	2,312.20	1,345.34	4,346.50	6,461.07	2.29	55.00	77.25	123.96	35.10	944.93	9,945.81	590.00	8.28	58,775.28

City of Dallas 2020-2021 Chemical Monitoring Pollution Load Estimates: Methods and References

Calculating Area and Impervious Surfaces

NCTCOG personnel gave the City of Dallas broad latitude in deciding how impervious surface area would be calculated. In the spreadsheets provided to the City of Dallas from NCTCOG, watershed acreage and impervious surface area is calculated as thus:

Watershed	Areas (acres)	Impervious (acres)	Impervious (%)	[redacted]
Five Mile Creek Trinity River	30,302	4,451	15%	15%
Headwaters Turtle Creek	21,887	8,563	39%	
Turtle Creek-Trinity River	22,353	6,248	28%	
White Rock Creek_White Rock Lake	22,712	6,785	30%	30%
[redacted]	97,254	26,137	26.9	
[redacted]	24,134			

Where the 5th row is the sum of the columns above it, and the 6th row is the average of the column above it.

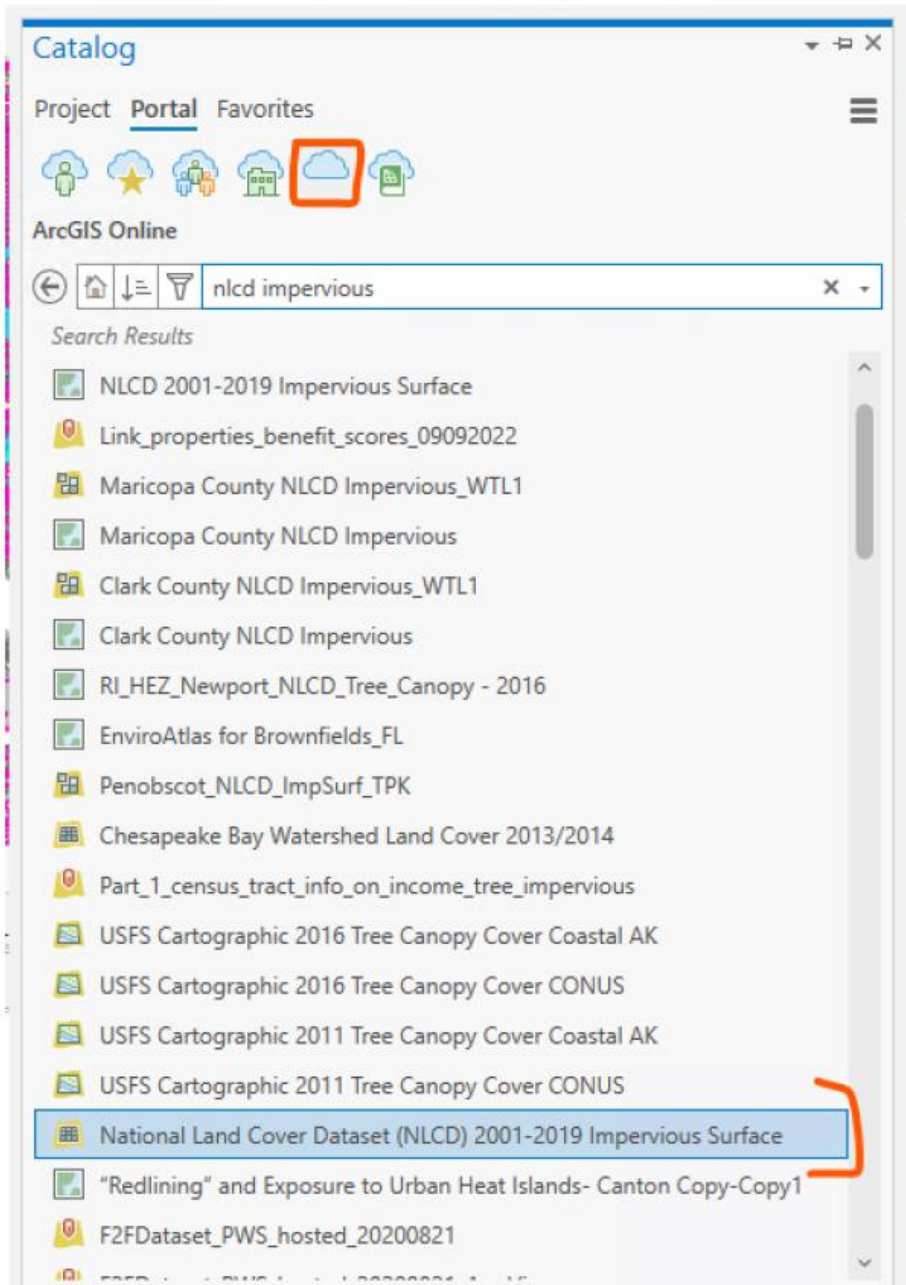
The issue with the provided chart is that no methodology was provided. In the Regional Stormwater Monitoring Program, Third Term 2011 – 2015: Final Comprehensive Report, NCTCOG uses the 12-digit hydrologic unit code (HUC12) from the Watershed Boundary Dataset (WBD) to define subwatersheds. Throughout the report, subwatersheds are theretofore referred to as "watersheds".

The City presumes that the area of each watershed was determined by the Watershed Boundary Dataset, as their internal GIS data obtained from the WDB shows identical area. A review of NCTOG's Regional Data Center Website shows feature layers for land use from the years 1990-2020, with updates every five years. These Land Use layers may have been used in calculating impervious surfaces.

Rather than use the 2020 Land Use layer, which was not made available until September 19, 2022, the City instead extrapolated the data for impervious surfaces using the following method. This account comes from the GIS specialist who developed it on behalf of SWO-WQ:

A. Data:
    a. The data [in RASTER format] description is available from:

i. https://www.mrlc.gov/data/nlcd-2019-percent-developed-imperviousness-conus
ii. Data is accessed from ArcGIS Pro on September 14, 2022
    1. https://landscape10.arcgis.com/arcgis/services/USA_NLCD_Impervious_Surface_TimeSeries/ImageServer



iii.
iv. The data provides % of imperviousness of each 30 m x 30 m pixel for the entire 48 Contiguous United States (CONUS).

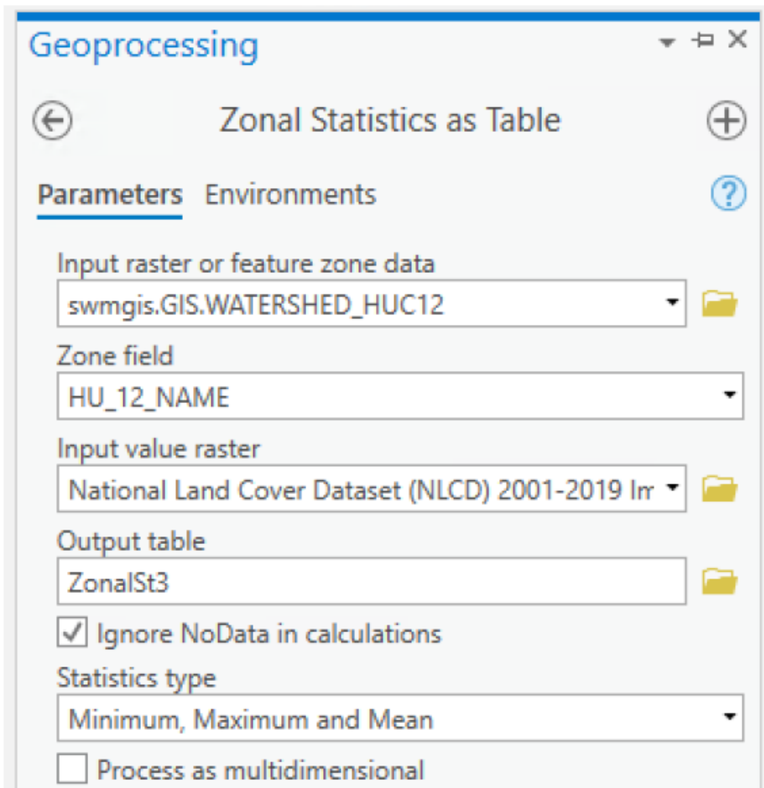
b. Watershed boundary: The data is on current production, swmgis.GIS.WATERSHED_HUC12

B. Software:

   a. ArcGIS Pro Version 2.9.3

C. Procedure:

   a. Bring the NLCD data mentioned previously. The data time enabled and contained data for 2001, 2004, 2006, 2008, 2011, 2013, 2016, and 2019.
   b. Select the 2019 and display it.
   c. Lay over the watershed boundary layer swmgis.GIS.WATERSHED_HUC12
   d. Select the watershed or watersheds you want to extract impervious area for. Here I selected the following watersheds.
      i. White Rock Creek-White Rock Lake
      ii. Five Mile Creek-Trinity River
      iii. Turtle Creek-Trinity River, and
      iv. Headwaters Turtle Creek
   e. Run the Zonal statistics tool (Zonal Statistics as a Table). Use watershed boundary layer with 4 watersheds selected as Input raster or feature zone data, HU_12_NAME as Zone Field, National Land Cover Dataset Imperviousness as Input value raster and use Minimum, Maximum and Mean as Statistics type. Use appropriate name for Output table.



      i.

   f. Run the tool. A table named ZonalSt3 would be added to the Table of Content of ArcGIS Pro document with the Minimum, Maximum and Mean statistics for each watershed. You can export the added table in the format you desired.
   g. Note the MEAN value of imperviousness for each watershed.

h. Multiply area of the watershed with the mean % imperviousness value divided by 100 OR [(MEAN/100) * AREA OF THE WATERSHED] to obtain the Impervious area.

After processing the geospatial data, we are left with the following summary table:

HUC_12_NAME	AREA (ACRES)	% IMPERVIOUSNESS (MEAN)	IMPERVIOUS AREA (G*J/100)
Five Mile Creek – Trinity River	30,302.00	24.07	7,293
Headwaters Turtle Creek	21,887.00	64.55	14,129
Turtle Creek – Trinity River	22,353.00	42.23	9,439
White Rock Creek – White Rock Lake	22,712.00	46.97	10,667
Total =	**97,254.00**		**41,527**

Calculating Storm Event Volume

Several equations and conversions are used in calculating Storm Event Volume, but the basic calculation comes from the rain catchment formula, and is as follows:

Rainfall (volume) = Rainfall Depth x Area (catchment)

Where Catchment Area is:

Area = Length (catchment) x Width (catchment)

The area of each watershed is already provided in acres. To convert the area to square feet, multiply the total area of the watershed by 43,650, as one acre is equal to 43,650:

Area (sq. ft) = Total area (acres) x 43,650

After converting each wateshed's area from acres to sq. ft., we are left with the following table:

Watershed	Area (Acres)	Area (Sq Ft)
Five Mile Creek - Trinity River	30,302.00	1,319,955,120.00
Headwater - Turtle Creek	21,887.00	953,397,720.00
Turtle Creek - Trinity River	22,353.00	973,696,680.00
White Rock Creek - White Rock Lake	22,712.00	989,334,720.00
Total Area	97,254.00	4,236,384,240.00
Average Area	24,313.50	1,059,096,060.00

From here, we can calculate rainfall volume using the rainfall catchment formula, modified for sq. ft.:

Rainfall volume (cu. ft.) = Total area (sq. ft.) x Rainfall Depth (in.)

Where rainfall depth is the mean of the rainfall total from the representative storm events. The City used chemical monitoring events for all four watersheds between 2020 and 2021, and converted the rainfall volume using the following table:

Volumetric Conversions	
Rainfall Volume (cu. ft)	Total Area (sq. ft) x Rainfall Depth (in) x 0.0833333
1 inch = 0.0833333 feet	
Rainfall Volume (Gallons)	Rainfall Volume (cu. ft.) x 7.48051948
1 cubic foot = 7.48051948 gallons	
Rainfall Volume (liters)	Rainfall Volume (gal.) x 3.785
1 gallon = 3.785 liters	
Rainfall Volume (lbs.)	Rainfall Volume (gal.) X 8.327
1 gallon = 8.327 lbs.	
Mega-Gallons per Day (MGD)	Rainfall Volume (gal.) / 1,000,000
	1 mega-gallon = 1 gallon
Gallons per Day (GPD)	Rainfall Volume (gal.) x 0.000001
	1 gallon = 0.000001
Either equation can be used (see below conversions)	

The Simple Method to Calculate Urban Stormwater Loads

Per the Regional Stormwater Monitoring Program, Third Term 2011 – 2015: Final Comprehensive Report, the City "[used] "The Simple Method" for load calculation from the Center for Watershed Protection. The City no longer has access to that specific reference item. However, the given equations in the Final Comprehensive Report is identical to The Simple Method to Calculate Urban Stormwater Loads, which is modified from the 1987 text, *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban Best Management Practices*. For this report, the City used the modified equation from **The Stormwater Manager's Resource Center**, which was created and is maintained by the Center for Watershed Protection (who provided the original formula).

The Simple Method estimates pollutant loads for chemical constituents as a product of annual runoff volume and pollutant concentration, as:

$$\mathbf{L = 0.226 * R * C * A}$$

Where: L = Annual load (lbs)
R = Annual runoff (inches)
C = Pollutant concentration (mg/l)
A = Area (acres)
0.226 = Unit conversion factor

For **bacteria**, the equation is slightly different, to account for the differences in units. The modified equation for bacteria is:

$$\mathbf{L = 1.03 * 10^{-3} * R * C * A}$$

Where: L = Annual load (Billion Colonies)
R = Annual runoff (inches)
C = Bacteria concentration (#/100 ml)
A = Area (acres)
$1.03 * 10^{-3}$ = Unit conversion factor

Annual Runoff - The Simple Method calculates annual runoff as a product of annual runoff volume, and a runoff coefficient (Rv). Runoff volume is calculated as:

$$\mathbf{R = P * P_j * Rv}$$

Where: R = Annual runoff (inches)
P = Annual rainfall (inches)
P_j = Fraction of annual rainfall events that produce runoff (usually 0.9)
Rv = Runoff coefficient

Runoff coefficient – The runoff coefficient is calculated as:

$$\mathbf{Rv = 0.005 + 0.9(I)}$$

Where I = the watershed's impervious area (represented as a fraction, decimal or percentage). Impervious area

The City obtained the P and Pj values using the EPA's Pollution Load Estimation Tool. After creating models for each watershed, we are left with the following table:

Watershed	P (annual rainfall in inches)	Pj (runoff coefficient)
Five Mile Creek - Trinity River	35.24	0.6282
Headwater - Turtle Creek	34.81	0.5656
Turtle Creek - Trinity River	34.81	0.5656
White Rock Creek - White Rock Lake	38.19	0.5637

Where Rv is the amount of rain days that produced run-off.

Pollutant Concentrations are calculated by taking the mean of all sampled for parameters in a given time period. The City used chemical monitoring results for calendar years 2020 and 2021. Once the parameter means have been calculated, simply substitute the necessary values for the equation to obtain each parameters load in lbs.

Excel

In order to estimate pollutant loads using **The Simple Method**, the City entered in all raw values for calendar years 2020 and 2021 into several Excel spreadsheets, and used the formula function to complete any necessary arithmetic.

References:

https://data-nctcoggis.opendata.arcgis.com/search?tags=landuse

https://www.nctcog.org/getmedia/c4d565e1-eef2-4462-aa4e-831c4764ca43/Regional-Storm-Water-Monitoring-Program-Third-Term-Final-Report-July-26-2016.pdf

https://www.epa.gov/sites/default/files/2020-11/documents/appa.pdf

https://www.stormwatercenter.net/monitoring%20and%20assessment/simple%20meth/simple.htm

https://epa.gov/nps/plet

2018-2019 Pollutant Loads											
Test Name	Units	Water Quality Standard	FMC Mean	FMC Load (lbs)	HTC Mean	HTC Load (lbs)	TCTR Mean	TCTR Load (lbs)	WRC Mean	WRC Load (lbs)
Duration of Storm Event	hr		3		5.18		1.63		3.9	
Annual Rainfall	in		35.24		34.81		34.81		38.19	
Raindays Correction Factor	%		0.6282		0.5656		0.5656		0.5637	
Average Rainfall (per event)	in		0.960		0.751		0.19		0.435	
Antecedent Dry Period	hr		277.9		484.07		395.8		280	
Total Volume of Discharge Sampled	gal		4		4		4		4	
Total Dissolved Solids (TDS)	mg/L	SM2540 C	239.3333333	8,040,907.37	350.1666667	19,983,527.63	416.8333333	15,963,543.34	261.1666667	12,342,857.60
Total Suspended Solids (TSS)	mg/L	DR890/900	172	5,778,702.23	95.08333333	5,426,274.40	140.3333333	5,374,371.65	45.25	2,138,535.95
BOD	mg/L	SM5210 B	8.6	288,935.11	10.6	604,927.35	11.08181818	424,402.44	13.98888889	661,121.37
COD	mg/L	SM5220D	42.28	1,420,485.64	64.725	3,693,766.28	83.62727273	3,202,689.15	35.52857143	1,679,096.74
Total Nitrogen	mg/L	Calculated	2.074166667	69,686.00	4.208333333	240,163.77	2.570833333	98,455.68	0.790909091	37,378.73
Phosphorus Dissolved	mg/L	EPA 200.7	0.197083333	6,621.43	0.166416667	9,497.17	0.1175	4,499.92	0.116833333	5,521.60
Total Phosphorus (as P)	mg/L	EPA 200.7	0.3525	11,842.98	0.286666667	16,359.67	0.263333333	10,084.93	0.121916667	5,761.84
Orthophosphate	mg/L	EPA 300.0	0.104555556	3,512.76	N/A	N/A	N/A	N/A	0.069	3,260.97
Ammonia Nitrogen	mg/L	EPA 350.1	0.182	6,114.67	N/A	N/A	N/A	N/A	0.1325	6,262.01
Nitrate-Nitrogen	mg/L	EPA 300.0	1.008888889	33,895.75	N/A	N/A	N/A	N/A	0.3275	15,477.80
Atrazine	µg/L	EPA 525.2	0.333333333	11,199.04	N/A	N/A	N/A	N/A	0.98	46,315.25
Carbaryl	µg/L	EPA 632	BDC	BDC	BDC	BDC	8.7	333,185.51	BDC	BDC
Arsenic (As)	mg/L	EPA 200.7	BDC	BDC	BDC	BDC	BDC	BDC	BDC	BDC
Chromium (Cr)	mg/L	EPA 200.7	0.0111	372.93	0.00875	499.35	0.015	574.46	BDC	BDC
Copper (Cu)	mg/L	EPA 200.7	0.0255	856.73	0.022	1,255.51	BDC	BDC	BDC	BDC
Lead (Pb)	mg/L	EPA 200.7	0.021	705.54	0.018666667	1,065.28	0.02	765.94	BDC	BDC
Zinc (Zn)	mg/L	EPA 200.7	0.046	1,545.47	0.073666667	4,204.05	0.070454545	2,698.21	BDC	BDC
Oil & Grease, Total Recovered	mg/L	1664 A	2.6	87,352.48	5.48	312,736.03	3.5	134,040.15	31.2	1,474,526.45
			FMC Bacteria Concentration	FMC Load (Billon Colonies)	HTC Bacteria Concentration	HTC Load (Billon Colonies)	TCTR Bacteria Concentration	TCTR Load (Billon Colonies)	WRC Bacteria Concentration	WRC Load (Billon Colonies)
E. coli	MPN	SM9221C	2817.807692	19,489.84	11512.45	2,994,290.25	2223.633333	388,113.56	886.8666667	191,022.75

BDC = below detectable concentrations

Impervious Surface, 4th Permit Term			
Watershed	Area (Acres)	Impervious Area (Acres)	Impervious Area (%)
Five Mile Creek - Trinity River	30,302	7,293	24.07%
Headwater - Turtle Creek	21,887	14,129	64.55%
Turtle Creek - Trinity River	22,353	9,439	42.23%
White Rock Creek - White Rock Lake	22,712	10,667	46.97%
Total	97,254	41,528	0.43

Annual Runoff Calculations		
R = P * Pj * Rv		
Watershed	Rv	R= P * Pj * Rv

Five Mile Creek - Trinity River	0.221609465	4.905938917
Headwater - Turtle Creek	0.585988715	11.53725991
Turtle Creek - Trinity River	0.385042947	7.580931929
White Rock Creek - White Rock Lake	0.427697253	9.207339427

The Simple Method to Calculate Urban Stormwater Loads
The Simple Method estimates pollutant loads for chemical constituents as a product of annual runoff volume and pollutant concentration, as:
L = 0.226 * R * C * A
Where: L = Annual load (lbs) R = Annual runoff (inches) C = Pollutant concentration (mg/l) A = Area (acres)
For bacteria, the equation is slightly different, to account for the differences in units. The modified equation for bacteria is:
L = 0.00103 * R * C * A
Where: L = Annual load (Billion Colonies) R = Annual runoff (inches) C = Bacteria concentration (#/100 ml) A = Area (acres) 0.00103 = Unit conversion factor
Annual Runoff
The Simple Method calculates annual runoff as a product of annual runoff volume, and a runoff coefficient (Rv). Runoff volume is calculated as:
R = P * Pj * Rv
Where: R = Annual runoff (inches) P = Annual rainfall (inches) Pj = Fraction of annual rainfall events that produce runoff (given here as the rainfall correction factor) Rv = Runoff coefficient
Rv = 0.005 + 0.9(I)
Where: I = Impervious Area

2020-2021 Pollutant Loads

Test Name	Units	Water Quality Standard	FMC Mean	FMC Load (lbs)	HTC Mean	HTC Load (lbs)	TCTR Mean	TCTR Load (lbs)	WRC Mean	WRC Load (lbs)
Duration of Storm Event	hr		2.7		1.88		4.6		4.2	
Annual Rainfall	in		35.24		34.81		34.81		38.19	
Raindays Correction Factor	%		0.6282		0.5656		0.5656		0.5637	
Average Rainfall (per event)	in		0.411		0.705		0.714		0.682	
Antecedent Dry Period	hr		415.4		279.77		441.8		346.1	
Total Volume of Discharge Sampled	gal		4		4		4		4	
Total Dissolved Solids (TDS)	mg/L	SM2540 C	2683.75	90,166,233.22	386.4166667	22,052,265.03	385.1666667	14,750,799.14	290.5833333	13,733,102.88
Total Suspended Solids (TSS)	mg/L	DR890/900	129.5	4,350,825.23	80.41666667	4,589,268.01	146.6666667	5,616,920.49	55.75	2,634,770.81
BOD	mg/L	SM5210 B	18.10583333	608,303.60	7.583333333	432,770.35	10.275	393,503.58	4.674166667	220,903.28
COD	mg/L	SM5220D	88.9575	2,988,714.56	37.5	2,140,073.16	78.83333333	3,019,094.76	37.01428571	1,749,312.28
Total Nitrogen	mg/L	Calculated	1.365333333	45,871.25	2.090909091	119,325.29	1.575833333	60,349.98	0.9165	43,314.21
Phosphorus Dissolved	mg/L	EPA 200.7	0.258128571	8,672.37	0.17225	9,830.07	0.07475	2,862.71	0.070975	3,354.31
Total Phosphorus (as P)	mg/L	EPA 200.7	0.295333333	9,922.35	0.211666667	12,079.52	0.205727273	7,878.78	0.123909091	5,856.00
Arsenic (As)	mg/L	EPA 200.7	0.0176	591.31	BDC	BDC	BDC	BDC	BDC	BDC
Chromium (Cr)	mg/L	EPA 200.7	0.037675	1,265.77	0.0083	473.67	0.0154	589.78	BDC	BDC
Copper (Cu)	mg/L	EPA 200.7	0.077666667	2,609.38	0.023	1,312.58	BDC	BDC	0.037833333	1,788.02
Lead (Pb)	mg/L	EPA 200.7	0.0135	453.56	0.01925	1,098.57	0.0145	555.31	0.006425	303.65
Zinc (Zn)	mg/L	EPA 200.7	0.0634375	2,131.32	0.059222222	3,379.73	0.0693	2,653.99	0.038766667	1,832.13
Oil & Grease, Total Recovered	mg/L	1664 A	1.64	55,099.25	BDC	BDC	BDC	BDC	BDC	BDC
[redacted]			**FMC Bacteria Concentration**	**FMC Load (Billon Colonies)**	**HTC Bacteria Concentration**	**HTC Load (Billon Colonies)**	**TCTR Bacteria Concentration**	**TCTR Load (Billon Colonies)**	**WRC Bacteria Concentration**	**WRC Load (Billon Colonies)**
E. coli	MPN	SM9221C	2349.292308	359,722.59	1358.646154	353,372.30	3668.530769	640,306.35	928.7923077	200,053.14

BDC = below detectable concentrations

Impervious Surface, 4th Permit Term

Watershed	Area (Acres)	Impervious Area (Acres)	Impervious Area (%)
Five Mile Creek - Trinity River	30,302	7,293	24.07%
Headwater - Turtle Creek	21,887	14,129	64.55%
Turtle Creek - Trinity River	22,353	9,439	42.23%
White Rock Creek - White Rock Lake	22,712	10,667	46.97%
Total	97,254	41,528	0.43

Annual Runoff Calculations

R = P * Pj * Rv

Watershed	Rv	R= P * Pj * Rv
Five Mile Creek - Trinity River	0.221609465	4.905938917
Headwater - Turtle Creek	0.585988715	11.53725991
Turtle Creek - Trinity River	0.385042947	7.580931929

White Rock Creek - White Rock Lake	0.427697253	9.207339427

The Simple Method to Calculate Urban Stormwater Loads
The Simple Method estimates pollutant loads for chemical constituents as a product of annual runoff volume and pollutant concentration, as:
L = 0.226 * R * C * A
Where: L = Annual load (lbs) R = Annual runoff (inches) C = Pollutant concentration (mg/l) A = Area (acres)
For bacteria, the equation is slightly different, to account for the differences in units. The modified equation for bacteria is:
L = 0.00103 * R * C * A
Where: L = Annual load (Billion Colonies) R = Annual runoff (inches) C = Bacteria concentration (#/100 ml) A = Area (acres) 0.00103 = Unit conversion factor
Annual Runoff
The Simple Method calculates annual runoff as a product of annual runoff volume, and a runoff coefficient (Rv). Runoff volume is calculated as:
R = P * Pj * Rv
Where: R = Annual runoff (inches) P = Annual rainfall (inches) Pj = Fraction of annual rainfall events that produce runoff (given here as the rainfall correction factor) Rv = Runoff coefficient
Rv = 0.005 + 0.9(I)
Where: I = Impervious Area

Appendix AC

BANEP BMP and Water Quality Data Metrics and Evaluation Results Summaries and Tiers

BMP/POC Groups/Tiers
Results

Watershed Name: Rush Creek - Village Creek   Number of Entities: 2

Entity Names (% Jurisdiction): Arlington (35%), Fort Worth (2%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	7%	~
MCM 2 - Post Construction Storm Water Control Measures	62%	III
MCM 3 - IDDE	81%	IV
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	62%	IV
MCM 5 - Industrial and High Risk Runoff	0%	~
MCM 6 - Construction Site Stormwater Runoff	77%	IV
MCM 7 - Public Education, Outreach, Involvement and Participation	94%	V
MCM 8 - Monitoring, Evaluation and Reporting	88%	V
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	77%	
BMP Tier	IV	
POC Analysis Results	**Group Result**	**Tier**
Oil and Grease	83%	IV
pH	50%	III
Conductivity	68%	III
E. Coli	80%	IV
TDS	80%	IV
TSS	83%	IV
Atrazine	23%	~
Total Arsenic	68%	III
Total Chromium	93%	V
Total Copper	78%	IV
Total Lead	95%	V
Total Zinc	90%	V
BOD	60%	III
COD	60%	III
Total Phosphorus	53%	III
Dissolved Phosphorus	73%	IV
Orthophosphate	33%	~
Total Nitrogen	83%	IV
Ammonia-Nitrogen	33%	~
Nitrate-Nitrogen	30%	~
Bioassessment Water Quality	0%	~
Bioassessment Indices	0%	~
POC Group Result	70%	
POC Tier	IV	
Overall Watershed BMP/POC Group/Tier	**74%**	**IV**

BMP/POC Groups/Tiers
Results

Watershed Name: Rush Creek - Village Creek

Number of Entities: 2

Entity Names (% Jurisdiction): Arlington (35%), Fort Worth (2%)

BMP Analysis Comments:

POC Analysis Comments:

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Rush Creek - Village Creek

Bold Text in Table Indicates MCMs and BMPs

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			5								5	5		5
				Types of structural controls			2								2	5		2
				Number of structural controls in watershed			5								5	5		5
				Locations of structural controls							3				3	5		3
				Fully Operational Dates								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															21	29	72%	3.86
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities											0	5		ND
				Maintenance Activity hours											0	5		ND
				Number of maintained infrastructure			0								0	5		ND
				Locations of activity hours											0	5		ND
				Locations of maintained infrastructure											0	5		ND
				Dates of maintenance activities											0	5		ND
				Applicable POCs addressed											0	5		ND
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															-4	34	-12%	2.00
MCM 1 - Maintenance Activities	**Roadways**	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours											0	5		ND
				Street Sweeping miles											0	5		ND
				Locations of street sweeping hours and/or miles											0	5		ND
				Dates of street sweeping activities											0	5		ND
				Applicable POCs									2		2	5		2
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)										-5	-5	-1		1
															-3	24	-13%	1.50
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles											0	5		ND
				Litter pickup hours											0	5		ND
				Litter pickup tonnage											0	5		ND
				Summary of litter pickup											0	5		ND
				Locations of litter pickup miles, hours and tonnage											0	5		ND
				Dates of litter pickup activities and associated mileage, hours and tonnage											0	5		ND
				Applicable POCs addressed											0	5		ND
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-5	-5	-1		1
															-5	34	-15%	1.00
															9	121	7%	2.09
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			5								5	5		5
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects			5								5	5		5
MCM 2 - Post Construction Storm Water Control Measures				Documentation of the consideration/not of WQ measures for above listed projects			5								5	5		5
				Locations of completed flood control/drainage improvement and other projects							2				2	5		2
				Dates of completion of the above listed projects								1			1	5		1
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															18	29	62%	3.43

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Rush Creek - Village Creek

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 3 - IDDE	Illicit and Allowable Discharges	Non-Structural	Ordinance/Criteria Manual	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			5								5	5		5
	MS4 Outfall Map	Non-Structural	Documentation	Implemented HHW			5								5	5		5
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	Non-Structural	Interactive/Operational/Municipal	HHW program details including types of collected items			5								5	5		5
				Tonnage and associated sources of collected waste											0	0		ND
				Locations/sources or coverage/service areas of waste collection											0	0		ND
				Tonnage and associated sources of collected waste											0	0		ND
				Dates of waste collection or availability of collection mechanisms								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)										-4	-4	-1		2
															20	24	83%	4.33
	SSOs and Response Actions	Non-Structural	Operational/Municipal	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			5								5	5		5
	Other Spill/Hazardous Event Responses	Non-Structural	Operational/Municipal	Listing of responses including immediate actions and follow up work orders and investigations			4								4	5		4
	Illicit Discharge Response	Non-Structural	Operational/Municipal	Locations of SSOs, spills, hazardous events and illicit discharges							3				3	5		3
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)										-2	-2	-1		4
															19	24	79%	4.17
															39	48	81%	4.25

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			3								3	5		3
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees			5								5	5		5
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program											0	0		ND
				Dates of training activities for municipal operational staff											0	0		ND
				Applicable POCs addressed											0	0		ND
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)										-4	-4	-1		2
															4	9	44%	3.33
	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			5								5	5		5
				Number of facilities inspected			4								4	5		4
				Locations of facilities inspected							1				1	5		1
				Dates when facilities were inspected								5			5	5		5
				Dates when identified issues were resolved								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)										-1	-1	-1		5
															24	29	83%	4.29
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4											0	0		ND
				Locations of waste collection and handling services											0	0		ND
				Dates of availability of waste collection services											0	0		ND
				Applicable POCs addressed											0	0		ND
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services										-5	-5	-1		1
															-5	-1	500%	1.00
															23	37	62%	3.81

Arlington

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Rush Creek - Village Creek

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			5								5	5		5
				Locations of facilities from above list							0				0	5		ND
				List of facilities that were inspected											0	5		ND
				Dates when facilities were inspected and records of issues identified and response action items											0	5		ND
				Dates when identified issues were resolved											0	5		ND
				Applicable POCs addressed											0	5		ND
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)										-5	-5	-1		1
															0	29	0%	3.00
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			5								5	5		5
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects			5								5	5		5
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable			5								5	5		5
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)			5								5	5		5
				Records of inspection activities			4								4	5		4
				Number of inspected sites			3								3	5		3
				Locations of construction projects and associated inspection activities							3				3	5		3
				Dates of inspection activities								5			5	5		5
				Response times to inspection deficiencies											0	0		ND
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)										-5	-5	-1		1
															34	44	77%	4.00
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			5								5	5		5
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms			5								5	5		5
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)							4				4	5		4
				Record of audiences targeted by public education tools			3								3	5		3
				Level of participation using public education tools											0	0		ND
				List of citizen complaint tools and/or modes			5								5	5		5
				Availability and/or accessibility of complaint tools											0	0		ND
				Complaint records			5								5	5		5
				Response records to complaints including dates of resolution											0	0		ND
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)											0	-1		ND
															32	34	94%	4.57

Arlington

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 8 - Monitoring, Evaluation and Reporting	Screening and Monitoring	Non-Structural	Monitoring/Sampling	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	Non-Structural	Data Management	Locations of monitoring activities							2				2	5		2
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted			5								5	5		5
				Response timelines to resolution of illicit discharges and exceedances											0	0		ND
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)										-1	-1	-1		5
															21	24	88%	4.50
OTHER - Impaired Receiving Waters	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Records of identified targeted controls and/or focused BMPs			5								5	5		5
	TMDL Water Bodies	Non-Structural/ Structural	Monitoring/Performance	Number and types of targeted controls and/or focused BMPs											0	5		ND
	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Locations of targeted controls and/or focused BMPs											0	5		ND
				Fully operational dates of controls or frequency of implementation											0	5		ND
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	5		ND
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)										-5	-5	-1		1
															0	24	0%	3.00

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Rush Creek - Village Creek

Bold Text in Table Indicates POC Group and Status																						
								Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)														
POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Oil and Grease	**Oils**		**Repeated**	Q1 -Q4	x		4												4	5		4
				Min				5											5	5		5
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				3											3	5		3
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			33	40	83%	4.125
pH	**Acidity**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				2											2	5		2
				Max				2											2	5		2
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading															0	0		
				Event Mean Concentration															0	5		0
																			20	40	50%	2.857
Conductivity	**Other**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				2											2	5		2
				Max				5											5	5		5
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			27	40	68%	3.375
E. Coli	**Bacteria**		**Repeated (Three Terms)**	Q1 -Q4			4												4	5		4
				Min				2											2	5		2
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				5			GM								5	5		5
				Geometric Mean				5	GM								GM		5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			32	40	80%	4
TDS	**Solids**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				2											2	5		2
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			32	40	80%	4
TSS	**Solids**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				3											3	5		3
				Max				5											5	5		5
				Median				3											3	5		3
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			33	40	83%	4.125
Atrazine	**Toxic**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			9	40	23%	1.125

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Rush Creek - Village Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status: New	POC Status: Repeated	POC Metric: Data Required	Analysis Category: Trend	Analysis Category: Comparative	Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
Total Arsenic	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				5											5	5		5
				Max				2											2	5		2
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			27	40	68%	3.375
Total Chromium	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			37	40	93%	4.625
Total Copper	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				5											5	5		5
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				2											2	5		2
				Event Mean Concentration															0	0		
																			31	40	78%	3.875
Total Lead	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			38	40	95%	4.75
Total Zinc	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				3											3	5		3
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			36	40	90%	4.50
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			1												1	5		1
				Min				3											3	5		3
				Max				2											2	5		2
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				2											2	5		2
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			24	40	60%	3.00

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Rush Creek - Village Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
COD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				2											2	5		2
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				2											2	5		2
				Event Mean Concentration															0	0		
																			24	40	60%	3.00
Total Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				2											2	5		2
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			21	40	53%	2.63
Dissolved Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				3											3	5		3
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			29	40	73%	3.63
Orthophosphate	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			13	40	33%	1.63
Total Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				2											2	5		2
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			33	40	83%	4.125
Ammonia-Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			13	40	33%	1.625
Nitrate-Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			12	40	30%	1.5

Arlington

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Rush Creek - Village Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			NM												0	5		0
				pH			NM												0	5		0
				Specific Conductance			NM												0	5		0
				Temperature			NM												0	5		0
				Turbidity			NM												0	5		0
				E. Coli			NM												0	5		0
				Phosphorus as Orthophosphate			NM												0	5		0
				Nitrate as Nitrogen			NM												0	5		0
				Dissolved Oxygen (Spring)				NM											0	5		0
				pH (Spring)				NM											0	5		0
				Specific Conductance (Spring)				NM											0	5		0
				Temperature (Spring)				NM											0	5		0
				Turbidity (Spring)				NM											0	5		0
				E. Coli (Spring)				NM											0	5		0
				Phosphorus as Orthophosphate (Spring)				NM											0	5		0
				Nitrate as Nitrogen (Spring)				NM											0	5		0
				Dissolved Oxygen (Fall)				NM											0	5		0
				pH (Fall)				NM											0	5		0
				Specific Conductance (Fall)				NM											0	5		0
				Temperature (Fall)				NM											0	5		0
				Turbidity (Fall)				NM											0	5		0
				E. Coli (Fall)				NM											0	5		0
				Phosphorus as Orthophosphate (Fall)				NM											0	5		0
				Nitrate as Nitrogen (Fall)				NM											0	5		0
																			0	120	0%	0
Bioassessment Other	**Bioassessment**			Fish IBI Score			NM												0	5		0
				Habitat Quality Index			NM												0	5		0
				Macroinvertebrate IBI Score			NM												0	5		0
				Fish IBI Score (Spring)				NM											0	5		0
				Habitat Quality Index (Spring)				NM											0	5		0
				Macroinvertebrate IBI Score (Spring)				NM											0	5		0
				Fish IBI Score (Fall)				NM											0	5		0
				Habitat Quality Index (Fall)				NM											0	5		0
				Macroinvertebrate IBI Score (Fall)				NM											0	5		0
																			0	45	0%	0

BMP/POC Groups/Tiers
Results

Watershed Name: Five Mile Creek - Trinity River — Number of Entities: 1

Entity Names (% Jurisdiction): Dallas (11%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	10%	~
MCM 2 - Post Construction Storm Water Control Measures	0%	~
MCM 3 - IDDE	0%	~
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	0%	~
MCM 5 - Industrial and High Risk Runoff	0%	~
MCM 6 - Construction Site Stormwater Runoff	0%	~
MCM 7 - Public Education, Outreach, Involvement and Participation	0%	~
MCM 8 - Monitoring, Evaluation and Reporting	83%	IV
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	ND	
BMP Tier	ND	
POC Analysis Results	**Group Result**	**Tier**
Oil and Grease	14%	~
pH	23%	~
Conductivity	20%	~
E. Coli	83%	IV
TDS	9%	~
TSS	94%	V
Atrazine	23%	~
Total Arsenic	6%	~
Total Chromium	6%	~
Total Copper	49%	II
Total Lead	9%	~
Total Zinc	6%	~
BOD	9%	~
COD	80%	IV
Total Phosphorus	91%	V
Dissolved Phosphorus	6%	~
Orthophosphate	9%	~
Total Nitrogen	6%	~
Ammonia-Nitrogen	23%	~
Nitrate-Nitrogen	9%	~
Bioassessment Water Quality	0%	~
Bioassessment Indices	0%	~
POC Group Result	33%	
POC Tier	III	
Overall Watershed BMP/POC Group/Tier	ND	**ND**

BMP/POC Groups/Tiers
Results

Watershed Name: Five Mile Creek - Trinity River **Number of Entities: 1**
Entity Names (% Jurisdiction): Dallas (11%)

BMP Analysis Comments:

POC Analysis Comments:
Annual loading not applicable to this watershed. Monitored in Terms 2 and 4 only. Minimum amount of data not collected to facilitate analysis.

BMP/POC Groups/Tiers
Results

Watershed Name: City of Dallas - White Rock Creek | **Number of Entities: 1**

Entity Names (% Jurisdiction): Dallas (9%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	12%	~
MCM 2 - Post Construction Storm Water Control Measures	0%	~
MCM 3 - IDDE	0%	~
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	0%	~
MCM 5 - Industrial and High Risk Runoff	0%	~
MCM 6 - Construction Site Stormwater Runoff	0%	~
MCM 7 - Public Education, Outreach, Involvement and Participation	0%	~
MCM 8 - Monitoring, Evaluation and Reporting	92%	IV
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	ND	
BMP Tier	ND	
POC Analysis Results	**Group Result**	**Tier**
Oil and Grease	40%	II
pH	97%	V
Conductivity	20%	~
E. Coli	54%	III
TDS	80%	IV
TSS	34%	II
Atrazine	26%	~
Total Arsenic	51%	III
Total Chromium	66%	III
Total Copper	40%	II
Total Lead	51%	III
Total Zinc	63%	III
BOD	80%	IV
COD	49%	II
Total Phosphorus	49%	II
Dissolved Phosphorus	54%	III
Orthophosphate	20%	~
Total Nitrogen	91%	V
Ammonia-Nitrogen	23%	~
Nitrate-Nitrogen	26%	~
Bioassessment Water Quality	0%	~
Bioassessment Indices	0%	~
POC Group Result	60%	
POC Tier	III	
Overall Watershed BMP/POC Group/Tier	**ND**	**ND**

BMP/POC Groups/Tiers
Results

Watershed Name: City of Dallas - White Rock Creek **Number of Entities: 1**
Entity Names (% Jurisdiction): Dallas (9%)

BMP Analysis Comments:

POC Analysis Comments:

Annual loading not applicable to this watershed.
Monitored in Terms 3 and 4 only.
Bioassessment monitoring not conducted in this watershed.

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Five Mile Creek - Trinity River

Bold Text in Table Indicates MCMs and BMPs

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Quantity/Type: #	Quantity/Type: hrs.	Quantity/Type: miles	Quantity/Type: Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			0								0	5		0
				Types of structural controls											0	5		0
				Number of structural controls in watershed											0	5		0
				Locations of structural controls											0	5		0
				Fully Operational Dates											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-3	-3	-1		3
															-3	29	-10%	3
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					5						5	5		5
				Maintenance Activity hours				2							2	5		2
				Number of maintained infrastructure											0	5		0
				Locations of activity hours							4				4	5		4
				Locations of maintained infrastructure							1				1	5		1
				Dates of maintenance activities								1			1	5		1
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-3	-3	-1		3
															15	34	44%	3
MCM 1 - Maintenance Activities	**Roadways**	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				0							0	5		0
				Street Sweeping miles											0	5		0
				Locations of street sweeping hours and/or miles											0	5		0
				Dates of street sweeping activities											0	5		0
				Applicable POCs											0	5		0
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)											0	-1		0
															0	24	0%	ND
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					0						0	5		0
				Litter pickup hours											0	5		0
				Litter pickup tonnage											0	5		0
				Summary of litter pickup											0	5		0
				Locations of litter pickup miles, hours and tonnage											0	5		0
				Dates of litter pickup activities and associated mileage, hours and tonnage											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															0	34	0%	ND
															12	121	10%	ND
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			0								0	5		0
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects											0	5		0
MCM 2 - Post Construction Storm Water Control Measures				Documentation of the consideration/not of WQ measures for above listed projects											0	5		0
				Locations of completed flood control/drainage improvement and other projects											0	5		0
				Dates of completion of the above listed projects											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															0	29	0%	ND

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Five Mile Creek - Trinity River

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
					Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	Illicit and Allowable Discharges	Non-Structural	Ordinance/Criteria Manual	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			0								0	5		0
	MS4 Outfall Map	Non-Structural	Documentation	Implemented HHW											0	5		0
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	Non-Structural	Interactive/Operational/Municipal	HHW program details including types of collected items											0	5		0
				Tonnage and associated sources of collected waste											0	5		0
				Locations/sources or coverage/service areas of waste collection											0	5		0
				Tonnage and associated sources of collected waste											0	5		0
				Dates of waste collection or availability of collection mechanisms											0	5		0
				Applicable POCs addressed											0	5		0
MCM 3 - IDDE				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)											0	-1		0
															0	39	0%	ND
	SSOs and Response Actions	Non-Structural	Operational/Municipal	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			0								0	5		0
	Other Spill/Hazardous Event Responses	Non-Structural	Operational/Municipal	Listing of responses including immediate actions and follow up work orders and investigations											0	5		0
	Illicit Discharge Response	Non-Structural	Operational/Municipal	Locations of SSOs, spills, hazardous events and illicit discharges											0	5		0
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)											0	-1		0
															0	24	0%	ND
															0	63	0%	

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category		Quantity/Type				Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)			Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential				
					Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			0								0	5		0
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees											0	5		0
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program											0	5		0
				Dates of training activities for municipal operational staff											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)											0	-1		0
															0	24	0%	ND
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			0								0	5		0
				Number of facilities inspected											0	5		0
				Locations of facilities inspected											0	5		0
				Dates when facilities were inspected											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)											0	-1		0
															0	29	0%	ND
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4			0								0	5		0
				Locations of waste collection and handling services											0	5		0
				Dates of availability of waste collection services											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services											0	-1		0
															0	19	0%	ND
															0	72	0%	IV

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Five Mile Creek - Trinity River

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			0								0	5		0
				Locations of facilities from above list											0	5		0
				List of facilities that were inspected											0	5		0
				Dates when facilities were inspected and records of issues identified and response action items											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)											0	-1		0
															0	29	0%	ND
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			0								0	5		0
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects											0	5		0
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable											0	5		0
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)											0	5		0
				Records of inspection activities											0	5		0
				Number of inspected sites											0	5		0
				Locations of construction projects and associated inspection activities											0	5		0
				Dates of inspection activities											0	5		0
				Response times to inspection deficiencies											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)											0	-1		0
															0	49	0%	ND
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			0								0	5		0
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms											0	5		0
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)											0	5		0
				Record of audiences targeted by public education tools											0	5		0
				Level of participation using public education tools											0	5		0
				List of citizen complaint tools and/or modes											0	5		0
				Availability and/or accessibility of complaint tools											0	5		0
				Complaint records											0	5		0
				Response records to complaints including dates of resolution											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)											0	-1		0
															0	49	0%	ND

Dallas

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Five Mile Creek - Trinity River

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)			Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential				
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
MCM 8 - Monitoring, Evaluation and Reporting	Screening and Monitoring	Non-Structural	Monitoring/Sampling	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	Non-Structural	Data Management	Locations of monitoring activities							3				3	5		3
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted			2								2	5		2
				Response timelines to resolution of illicit discharges and exceedances											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)											0	-1		0
															20	24	83%	4
OTHER - Impaired Receiving Waters	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Records of identified targeted controls and/or focused BMPs			0								0	5		0
	TMDL Water Bodies	Non-Structural/ Structural	Monitoring/Performance	Number and types of targeted controls and/or focused BMPs											0	5		0
	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Locations of targeted controls and/or focused BMPs											0	5		0
				Fully operational dates of controls or frequency of implementation											0	5		0
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	5		0
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											0	-1		0
															0	24	0%	ND

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
City of Dallas - White Rock Creek

Bold Text in Table Indicates MCMs and BMPs

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			0								0	5		0
				Types of structural controls											0	5		0
				Number of structural controls in watershed											0	5		0
				Locations of structural controls											0	5		0
				Fully Operational Dates											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															-4	29	-14%	2
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					5						5	5		5
				Maintenance Activity hours				4							4	5		4
				Number of maintained infrastructure											0	5		0
				Locations of activity hours							4				4	5		4
				Locations of maintained infrastructure							3				3	5		3
				Dates of maintenance activities								1			1	5		1
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															18	34	53%	3.43
MCM 1 - Maintenance Activities	**Roadways**	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				0							0	5		0
				Street Sweeping miles											0	5		0
				Locations of street sweeping hours and/or miles											0	5		0
				Dates of street sweeping activities											0	5		0
				Applicable POCs											0	5		0
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)											0	-1		0
															0	24	0%	ND
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					0						0	5		0
				Litter pickup hours											0	5		0
				Litter pickup tonnage											0	5		0
				Summary of litter pickup											0	5		0
				Locations of litter pickup miles, hours and tonnage											0	5		0
				Dates of litter pickup activities and associated mileage, hours and tonnage											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															0	34	0%	ND
															14	121	12%	ND
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			0								0	5		0
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects											0	5		0
MCM 2 - Post Construction Storm Water Control Measures				Documentation of the consideration/not of WQ measures for above listed projects											0	5		0
				Locations of completed flood control/drainage improvement and other projects											0	5		0
				Dates of completion of the above listed projects											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															0	29	0%	ND

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Quantity/Type: #	Quantity/Type: hrs.	Quantity/Type: miles	Quantity/Type: Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
MCM 3 - IDDE	Illicit and Allowable Discharges	Non-Structural	Ordinance/Criteria Manual	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			0								0	5		0
	MS4 Outfall Map	Non-Structural	Documentation	Implemented HHW											0	5		0
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	Non-Structural	Interactive/Operational/Municipal	HHW program details including types of collected items											0	5		0
				Tonnage and associated sources of collected waste											0	5		0
				Locations/sources or coverage/service areas of waste collection											0	5		0
				Tonnage and associated sources of collected waste											0	5		0
				Dates of waste collection or availability of collection mechanisms											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)											0	-1		0
															0	39	0%	ND
	SS0s and Response Actions	Non-Structural	Operational/Municipal	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			0								0	5		0
	Other Spill/Hazardous Event Responses	Non-Structural	Operational/Municipal	Listing of responses including immediate actions and follow up work orders and investigations											0	5		0
	Illicit Discharge Response	Non-Structural	Operational/Municipal	Locations of SSOs, spills, hazardous events and illicit discharges											0	5		0
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)											0	-1		0
															0	24	0%	ND
															0	63	0%	

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			0								0	5		0
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees											0	5		0
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program											0	5		0
				Dates of training activities for municipal operational staff											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)											0	-1		0
															0	24	0%	ND
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			0								0	5		0
				Number of facilities inspected											0	5		0
				Locations of facilities inspected											0	5		0
				Dates when facilities were inspected											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)											0	-1		0
															0	29	0%	ND
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4			0								0	5		0
				Locations of waste collection and handling services											0	5		0
				Dates of availability of waste collection services											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services											0	-1		0
															0	19	0%	ND
															0	72	0%	ND

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Quantity/Type: #	Quantity/Type: hrs.	Quantity/Type: miles	Quantity/Type: Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential				Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			0								0	5		0
				Locations of facilities from above list											0	5		0
				List of facilities that were inspected											0	5		0
				Dates when facilities were inspected and records of issues identified and response action items											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)											0	-1		0
															0	29	0%	ND
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			0								0	5		0
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects											0	5		0
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable											0	5		0
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)											0	5		0
				Records of inspection activities											0	5		0
				Number of inspected sites											0	5		0
				Locations of construction projects and associated inspection activities											0	5		0
				Dates of inspection activities											0	5		0
				Response times to inspection deficiencies											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)											0	-1		0
															0	49	0%	ND
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			0								0	5		0
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms											0	5		0
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)											0	5		0
				Record of audiences targeted by public education tools											0	5		0
				Level of participation using public education tools											0	5		0
				List of citizen complaint tools and/or modes											0	5		0
				Availability and/or accessibility of complaint tools											0	5		0
				Complaint records											0	5		0
				Response records to complaints including dates of resolution											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)											0	-1		0
															0	49	0%	ND

Dallas

BMP Data Metrics and Evaluation Results Summary Table

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 8 - Monitoring, Evaluation and Reporting	Screening and Monitoring	Non-Structural	Monitoring/Sampling	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	Non-Structural	Data Management	Locations of monitoring activities							5				5	5		5
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted			2								2	5		2
				Response timelines to resolution of illicit discharges and exceedances											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)											0	-1		0
															22	24	92%	4.4
OTHER - Impaired Receiving Waters	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Records of identified targeted controls and/or focused BMPs			0								0	5		0
	TMDL Water Bodies	Non-Structural/ Structural	Monitoring/Performance	Number and types of targeted controls and/or focused BMPs											0	5		0
	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Locations of targeted controls and/or focused BMPs											0	5		0
				Fully operational dates of controls or frequency of implementation											0	5		0
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	5		0
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											0	-1		0
															0	24	0%	ND

Dallas

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Five Mile Creek - Trinity River
Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Oil and Grease	**Oils**		**Repeated**	Q1 -Q4	x		5												5	5		5
				Min				NT											0	5		0
				Max				NT											0	5		0
				Median				NT											0	5		0
				Arithmetic Mean				NT											0	5		0
				Geometric Mean				NT											0	5		0
																		NT	0	5		0
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			5	35	14%	5.00
pH	**Acidity**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			8	35	23%	4.00
Conductivity	**Other**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			7	35	20%	3.50
E. Coli	**Bacteria**		**Repeated (Three Terms)**	Q1 -Q4			1												1	5		1
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5			GM								5	5		5
				Geometric Mean				5	GM								GM		5	5		5
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			29	35	83%	4.14
TDS	**Solids**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				NT											0	5		0
				Max				NT											0	5		0
				Median				NT											0	5		0
				Arithmetic Mean				NT											0	5		0
				Geometric Mean				NT											0	5		0
																		NT	0	5		0
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			3	35	9%	3.00
TSS	**Solids**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			33	35	94%	4.71
Atrazine	**Toxic**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			8	35	23%	4.00

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Five Mile Creek - Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				NT											0	5		0
				Max				NT											0	5		0
				Median				NT											0	5		0
				Arithmetic Mean				NT											0	5		0
				Geometric Mean				NT											0	5		0
																		NT	0	5		0
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			2	35	6%	2.00
Total Chromium	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				NT											0	5		0
				Max				NT											0	5		0
				Median				NT											0	5		0
				Arithmetic Mean				NT											0	5		0
				Geometric Mean				NT											0	5		0
																		NT	0	5		0
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			2	35	6%	2.00
Total Copper	**Metals**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				1											1	5		1
				Median				5											5	5		5
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			17	35	49%	2.43
Total Lead	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				NT											0	5		0
				Max				NT											0	5		0
				Median				NT											0	5		0
				Arithmetic Mean				NT											0	5		0
				Geometric Mean				NT											0	5		0
																		NT	0	5		0
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			3	35	9%	3.00
Total Zinc	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				NT											0	5		0
				Max				NT											0	5		0
				Median				NT											0	5		0
				Arithmetic Mean				NT											0	5		0
				Geometric Mean				NT											0	5		0
																		NT	0	5		0
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			2	35	6%	2.00
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				NT											0	5		0
				Max				NT											0	5		0
				Median				NT											0	5		0
				Arithmetic Mean				NT											0	5		0
				Geometric Mean				NT											0	5		0
																		NT	0	5		0
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			3	35	9%	3.00

Dallas

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Five Mile Creek - Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
COD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				1											1	5		1
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			28	35	80%	4.00
Total Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			32	35	91%	4.57
Dissolved Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				NT											0	5		0
				Max				NT											0	5		0
				Median				NT											0	5		0
				Arithmetic Mean				NT											0	5		0
				Geometric Mean				NT											0	5		0
																		NT	0	5		0
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			2	35	6%	2.00
Orthophosphate	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				NT											0	5		0
				Max				NT											0	5		0
				Median				NT											0	5		0
				Arithmetic Mean				NT											0	5		0
				Geometric Mean				NT											0	5		0
																		NT	0	5		0
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			3	35	9%	3.00
Total Nitrogen	**Nutrients**	**New**		Q1 -Q4			2												2	5		2
				Min				NT											0	5		0
				Max				NT											0	5		0
				Median				NT											0	5		0
				Arithmetic Mean				NT											0	5		0
				Geometric Mean				NT											0	5		0
																		NT	0	5		0
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			2	35	6%	2.00
Ammonia-Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			8	35	23%	4.00
Nitrate-Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				NT											0	5		0
				Max				NT											0	5		0
				Median				NT											0	5		0
				Arithmetic Mean				NT											0	5		0
				Geometric Mean				NT											0	5		0
																		NT	0	5		0
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			3	35	9%	3.00

Dallas

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Five Mile Creek - Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			NM												0	5		0
				pH			NM												0	5		0
				Specific Conductance			NM												0	5		0
				Temperature			NM												0	5		0
				Turbidity			NM												0	5		0
				E. Coli			NM												0	5		0
				Phosphorus as Orthophosphate			NM												0	5		0
				Nitrate as Nitrogen			NM												0	5		0
				Dissolved Oxygen (Spring)				NM											0	5		0
				pH (Spring)				NM											0	5		0
				Specific Conductance (Spring)				NM											0	5		0
				Temperature (Spring)				NM											0	5		0
				Turbidity (Spring)				NM											0	5		0
				E. Coli (Spring)				NM											0	5		0
				Phosphorus as Orthophosphate (Spring)				NM											0	5		0
				Nitrate as Nitrogen (Spring)				NM											0	5		0
				Dissolved Oxygen (Fall)				NM											0	5		0
				pH (Fall)				NM											0	5		0
				Specific Conductance (Fall)				NM											0	5		0
				Temperature (Fall)				NM											0	5		0
				Turbidity (Fall)				NM											0	5		0
				E. Coli (Fall)				NM											0	5		0
				Phosphorus as Orthophosphate (Fall)				NM											0	5		0
				Nitrate as Nitrogen (Fall)				NM											0	5		0
																			0	120	0%	0.00
Bioassessment Other	**Bioassessment**			Fish IBI Score			NM												0	0		ND
				Habitat Quality Index			NM												0	5		0
				Macroinvertebrate IBI Score			NM												0	5		0
				Fish IBI Score (Spring)				NM											0	0		ND
				Habitat Quality Index (Spring)				NM											0	5		0
				Macroinvertebrate IBI Score (Spring)				NM											0	5		0
				Fish IBI Score (Fall)				NM											0	0		ND
				Habitat Quality Index (Fall)				NM											0	5		0
				Macroinvertebrate IBI Score (Fall)				NM											0	5		0
																			0	30	0%	0.00

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
City of Dallas - White Rock Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Oil and Grease	**Oils**		**Repeated**	Q1 -Q4	x		4												4	5		4
				Min				1											1	5		1
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			14	35	40%	2.00
pH	**Acidity**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			34	35	97%	4.86
Conductivity	**Other**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				NM											0	0		0
				Event Mean Concentration															0	0		
																			7	35	20%	3.50
E. Coli	**Bacteria**		**Repeated (Three Terms)**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				5											5	5		5
				Median				1											1	5		1
				Arithmetic Mean				5			GM								5	5		5
				Geometric Mean				1	GM								GM		1	5		1
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			19	35	54%	2.71
TDS	**Solids**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			28	35	80%	4.00
TSS	**Solids**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				1											1	5		1
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			12	35	34%	1.71
Atrazine	**Toxic**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			9	35	26%	4.50

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	**Metrics**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				5											5	5		5
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			18	35	51%	2.57
Total Chromium	**Metrics**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				1											1	5		1
				Max				5											5	5		5
				Median				1											1	5		1
				Arithmetic Mean				5											5	5		5
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			23	35	66%	3.29
Total Copper	**Metrics**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			14	35	40%	2.00
Total Lead	**Metrics**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				5											5	5		5
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			18	35	51%	2.57
Total Zinc	**Metrics**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				5											5	5		5
				Median				1											1	5		1
				Arithmetic Mean				5											5	5		5
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			22	35	63%	3.14
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				1											1	5		1
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			28	35	80%	4.00

Dallas

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
COD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				1											1	5		1
				Max				5											5	5		5
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			17	35	49%	2.43
Total Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			17	35	49%	2.43
Dissolved Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			1												1	5		1
				Min				5											5	5		5
				Max				1											1	5		1
				Median				5											5	5		5
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			19	35	54%	2.71
Orthophosphate	**Nutrients**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			7	35	20%	3.50
Total Nitrogen	**Nutrients**	**New**		Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			32	35	91%	4.57
Ammonia-Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			8	35	23%	4.00
Nitrate-Nitrogen	**Nutrients**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			9	35	26%	4.50

Dallas

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			NM												0	5		0
				pH			NM												0	5		0
				Specific Conductance			NM												0	5		0
				Temperature			NM												0	5		0
				Turbidity			NM												0	5		0
				E. Coli			NM												0	5		0
				Phosphorus as Orthophosphate			NM												0	5		0
				Nitrate as Nitrogen			NM												0	5		0
				Dissolved Oxygen (Spring)				NM											0	5		0
				pH (Spring)				NM											0	5		0
				Specific Conductance (Spring)				NM											0	5		0
				Temperature (Spring)				NM											0	5		0
				Turbidity (Spring)				NM											0	5		0
				E. Coli (Spring)				NM											0	5		0
				Phosphorus as Orthophosphate (Spring)				NM											0	5		0
				Nitrate as Nitrogen (Spring)				NM											0	5		0
				Dissolved Oxygen (Fall)				NM											0	5		0
				pH (Fall)				NM											0	5		0
				Specific Conductance (Fall)				NM											0	5		0
				Temperature (Fall)				NM											0	5		0
				Turbidity (Fall)				NM											0	5		0
				E. Coli (Fall)				NM											0	5		0
				Phosphorus as Orthophosphate (Fall)				NM											0	5		0
				Nitrate as Nitrogen (Fall)				NM											0	5		0
																			0	120	0%	0.00
Bioassessment Other	**Bioassessment**			Fish IBI Score			NM												0	0		ND
				Habitat Quality Index			NM												0	5		0
				Macroinvertebrate IBI Score			NM												0	5		0
				Fish IBI Score (Spring)				NM											0	0		ND
				Habitat Quality Index (Spring)				NM											0	5		0
				Macroinvertebrate IBI Score (Spring)				NM											0	5		0
				Fish IBI Score (Fall)				NM											0	0		ND
				Habitat Quality Index (Fall)				NM											0	5		0
				Macroinvertebrate IBI Score (Fall)				NM											0	5		0
																			0	30	0%	0.00

BMP/POC Groups/Tiers
Results

Watershed Name: Sycamore Creek - West Fork Trinity River　　Number of Entities: 1
Entity Names (% Jurisdiction): Fort Worth (7%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	-7%	~
MCM 2 - Post Construction Storm Water Control Measures	72%	IV
MCM 3 - IDDE	35%	~
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	7%	~
MCM 5 - Industrial and High Risk Runoff	3%	~
MCM 6 - Construction Site Stormwater Runoff	20%	~
MCM 7 - Public Education, Outreach, Involvement and Participation	66%	IV
MCM 8 - Monitoring, Evaluation and Reporting	76%	IV
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	ND	
BMP Tier	ND	
POC Analysis Results	**Group Result**	**Tier**
Oil and Grease	33%	II
pH	97%	V
Conductivity	0%	~
E. Coli	87%	IV
TDS	27%	I
TSS	73%	IV
Atrazine	17%	~
Total Arsenic	33%	II
Total Chromium	30%	II
Total Copper	33%	II
Total Lead	23%	I
Total Zinc	23%	I
BOD	87%	IV
COD	87%	IV
Total Phosphorus	47%	II
Dissolved Phosphorus	47%	II
Orthophosphate	17%	~
Total Nitrogen	70%	IV
Ammonia-Nitrogen	17%	~
Nitrate-Nitrogen	17%	~
Bioassessment Water Quality	72%	IV
Bioassessment Indices	93%	V
POC Group Result	57%	
POC Tier	III	
Overall Watershed BMP/POC Group/Tier	**ND**	**ND**

BMP/POC Groups/Tiers
Results

Watershed Name: Sycamore Creek - West Fork Trinity River **Number of Entities: 1**
Entity Names (% Jurisdiction): Fort Worth (7%)

BMP Analysis Comments:

POC Analysis Comments:
Annual loading not applicable to this watershed. Monitored in Terms 3 and 4 only. Analysis conducted for the 2020 permit year in order to capture monitored chemical data. No chemical monitoring conducted in 2021.

BMP/POC Groups/Tiers
Results

Watershed Name: Whites Branch - Big Fossil Creek **Number of Entities: 1**
Entity Names (% Jurisdiction): Fort Worth (10%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	-5%	~
MCM 2 - Post Construction Storm Water Control Measures	7%	~
MCM 3 - IDDE	32%	~
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	31%	~
MCM 5 - Industrial and High Risk Runoff	3%	~
MCM 6 - Construction Site Stormwater Runoff	20%	~
MCM 7 - Public Education, Outreach, Involvement and Participation	39%	~
MCM 8 - Monitoring, Evaluation and Reporting	92%	IV
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	ND	
BMP Tier	ND	
POC Analysis Results	**Group Result**	**Tier**
Oil and Grease	67%	III
pH	43%	II
Conductivity	10%	~
E. Coli	97%	V
TDS	60%	III
TSS	93%	V
Atrazine	17%	~
Total Arsenic	100%	V
Total Chromium	93%	V
Total Copper	100%	V
Total Lead	100%	V
Total Zinc	100%	V
BOD	80%	IV
COD	93%	V
Total Phosphorus	63%	III
Dissolved Phosphorus	73%	IV
Orthophosphate	17%	~
Total Nitrogen	70%	IV
Ammonia-Nitrogen	17%	~
Nitrate-Nitrogen	17%	~
Bioassessment Water Quality	72%	IV
Bioassessment Indices	49%	III
POC Group Result	80%	
POC Tier	IV	
Overall Watershed BMP/POC Group/Tier	**ND**	**ND**

BMP/POC Groups/Tiers
Results

Watershed Name: Whites Branch - Big Fossil Creek **Number of Entities: 1**
Entity Names (% Jurisdiction): Fort Worth (10%)

BMP Analysis Comments:

POC Analysis Comments:
Annual loading not applicable to this watershed. All evaluated parameters (except pH) monitored in Terms 2, 3 and 4 only. Analysis conducted for the 2020 permit year in order to capture monitored chemical data. No chemical monitoring conducted in 2021.

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Sycamore Creek - West Fork Trinity River

Bold Text in Table Indicates MCMs and BMPs

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			0								0	5		0
				Types of structural controls											0	5		0
				Number of structural controls in watershed											0	5		0
				Locations of structural controls											0	5		0
				Fully Operational Dates											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															-4	29	-14%	2
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					0						0	5		0
				Maintenance Activity hours											0	5		0
				Number of maintained infrastructure											0	5		0
				Locations of activity hours											0	5		0
				Locations of maintained infrastructure											0	5		0
				Dates of maintenance activities											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															-4	34	-12%	2
MCM 1 - Maintenance Activities	**Roadways**	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				0							0	5		0
				Street Sweeping miles											0	5		0
				Locations of street sweeping hours and/or miles											0	5		0
				Dates of street sweeping activities											0	5		0
				Applicable POCs											0	5		0
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)											0	-1		0
															0	24	0%	ND
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					0						0	5		0
				Litter pickup hours											0	5		0
				Litter pickup tonnage											0	5		0
				Summary of litter pickup											0	5		0
				Locations of litter pickup miles, hours and tonnage											0	5		0
				Dates of litter pickup activities and associated mileage, hours and tonnage											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															0	34	0%	ND
															-8	121	-7%	ND
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			5								5	5		5
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects			5								5	5		5
MCM 2 - Post Construction Storm Water Control Measures				Documentation of the consideration/not of WQ measures for above listed projects			5								5	5		5
				Locations of completed flood control/drainage improvement and other projects							1				1	5		1
				Dates of completion of the above listed projects								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															21	29	72%	3.86

Fort Worth

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Sycamore Creek - West Fork Trinity River

Bold Text in Table Indicates MCMs and BMPs

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 3 - IDDE	**Illicit and Allowable Discharges**	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			5								5	5		5
	MS4 Outfall Map	**Non-Structural**	**Documentation**	Implemented HHW			5								5	5		5
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	**Non-Structural**	**Interactive/Operational/Municipal**	HHW program details including types of collected items			5								5	5		5
				Tonnage and associated sources of collected waste											0	5		0
				Locations/sources or coverage/service areas of waste collection											0	5		0
				Tonnage and associated sources of collected waste											0	5		0
				Dates of waste collection or availability of collection mechanisms								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)										-2	-2	-1		4
															22	39	56%	4.67
	SSOs and Response Actions	**Non-Structural**	**Operational/Municipal**	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			0								0	5		0
	Other Spill/Hazardous Event Responses	**Non-Structural**	**Operational/Municipal**	Listing of responses including immediate actions and follow up work orders and investigations											0	5		0
	Illicit Discharge Response	**Non-Structural**	**Operational/Municipal**	Locations of SSOs, spills, hazardous events and illicit discharges											0	5		0
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)											0	-1		0
															0	24	0%	ND
															22	63	35%	

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Sycamore Creek - West Fork Trinity River

Bold Text in Table Indicates MCMs and BMPs											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	PP/GH Program (Including Training)	**Non-Structural**	**Criteria Manual/Guidelines/Educational**	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			3								3	5		3
	Municipal Facilities	**Non-Structural**	**Documentation**	Training records for operational staff including attendees											0	5		0
	Pesticide, Herbicide and Fertilizer Application	**Non-Structural**	**Guidelines/Documentation**	Locations of application of pesticide program											0	5		0
				Dates of training activities for municipal operational staff											0	5		0
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)											0	-1		0
															7	24	29%	3.5
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	**PP/GH Program (Facility Inspections)**	**Non-Structural**	**Guidelines/Inspections/Surveys**	Listing of facilities inspected			0								0	5		0
				Number of facilities inspected											0	5		0
				Locations of facilities inspected											0	5		0
				Dates when facilities were inspected											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)											0	-1		0
															0	29	0%	ND
	Waste Handling	**Non-Structural & Structural**	**Operational/Municipal**	Number and types of waste collection and handling mechanisms employed by MS4											0	5		0
				Locations of waste collection and handling services											0	5		0
				Dates of availability of waste collection services											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services										-2	-2	-1		4
															-2	19	-11%	4
															5	72	7%	ND

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Sycamore Creek - West Fork Trinity River

Bold Text in Table Indicates MCMs and BMPs

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)
Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)
Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
					Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 5 - Industrial and High Risk Runoff	**Policies, Procedures & Monitoring and/or Oversight**	**Non-Structural**	**Guidelines/Inspections/ Permits/Monitoring Oversight**	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			1								1	5		1
				Locations of facilities from above list											0	5		0
				List of facilities that were inspected			0								0	5		0
				Dates when facilities were inspected and records of issues identified and response action items											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)											0	-1		0
															1	29	3%	1
MCM 6 - Construction Site Stormwater Runoff	**Regulatory Requirements**	**Non-Structural**	**Ordinance/Review Guidelines/Criteria Manuals/Permits**	Implemented ordinance or enforcement mechanism and design/development criteria manual			5								5	5		5
	Active Construction Sites Listings	**Non-Structural**	**Documentation**	Listing of active construction projects			5								5	5		5
	Site Operator Training and Notifications	**Non-Structural**	**Educational**	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable											0	5		0
	Inspections and Enforcement	**Non-Structural**	**Inspections/Surveys/ Investigations**	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)											0	5		0
				Records of inspection activities											0	5		0
				Number of inspected sites											0	5		0
				Locations of construction projects and associated inspection activities											0	5		0
				Dates of inspection activities											0	5		0
				Response times to inspection deficiencies											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)											0	-1		0
															10	49	20%	5
MCM 7 - Public Education, Outreach, Involvement and Participation	**Education and Outreach**	**Non-Structural & Structural**	**Educational/Interactive**	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			5								5	5		5
	Public Input	**Non-Structural**	**Educational/Interactive**	Types of public education mechanisms			5								5	5		5
	Citizen complaint mechanism	**Non-Structural**	**Interactive/Operational/Municipal**	Locations of all of public education platforms (if trackable)											0	0		0
				Record of audiences targeted by public education tools			2								2	5		2
				Level of participation using public education tools			2								2	5		2
				List of citizen complaint tools and/or modes											0	5		0
				Availability and/or accessibility of complaint tools								5			5	5		5
				Complaint records											0	0		0
				Response records to complaints including dates of resolution											0	0		0
				Applicable POCs addressed											0	0		0
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)											0	-1		0
															19	29	66%	3.8

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Sycamore Creek - West Fork Trinity River

Bold Text in Table Indicates MCMs and BMPs

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 8 - Monitoring, Evaluation and Reporting	**Screening and Monitoring**	**Non-Structural**	**Monitoring/Sampling**	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	**Non-Structural**	**Data Management**	Locations of monitoring activities							3				3	5		3
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted			4								4	5		4
				Response timelines to resolution of illicit discharges and exceedances											0	5		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)											0	-1		0
															22	29	76%	4.4
OTHER - Impaired Receiving Waters	**Impaired water bodies and TMDL Requirements**	**Non-Structural/ Structural**	**Monitoring/Performance**	Records of identified targeted controls and/or focused BMPs			0								0	5		0
	TMDL Water Bodies	**Non-Structural/ Structural**	**Monitoring/Performance**	Number and types of targeted controls and/or focused BMPs											0	5		0
	Impaired water bodies and TMDL Requirements	**Non-Structural/ Structural**	**Monitoring/Performance**	Locations of targeted controls and/or focused BMPs											0	5		0
				Fully operational dates of controls or frequency of implementation											0	5		0
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	5		0
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											0	-1		0
															0	24	0%	ND

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Whites Branch - Big Fossil Creek
Bold Text in Table Indicates MCMs and BMPs

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Quantity/Type: #	Quantity/Type: hrs.	Quantity/Type: miles	Quantity/Type: Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
	Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)																	
	Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential																	
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			0								0	5		0
				Types of structural controls											0	5		0
				Number of structural controls in watershed											0	5		0
				Locations of structural controls											0	5		0
				Fully Operational Dates											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-3	-3	-1		3
															-3	29	-10%	3
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					0						0	5		0
				Maintenance Activity hours											0	5		0
				Number of maintained infrastructure											0	5		0
				Locations of activity hours											0	5		0
				Locations of maintained infrastructure											0	5		0
				Dates of maintenance activities											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-3	-3	-1		3
															-3	34	-9%	3
MCM 1 - Maintenance Activities	**Roadways**	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				0							0	5		0
				Street Sweeping miles											0	5		0
				Locations of street sweeping hours and/or miles											0	5		0
				Dates of street sweeping activities											0	5		0
				Applicable POCs											0	5		0
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)											0	-1		0
															0	24	0%	ND
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					0						0	5		0
				Litter pickup hours											0	5		0
				Litter pickup tonnage											0	5		0
				Summary of litter pickup											0	5		0
				Locations of litter pickup miles, hours and tonnage											0	5		0
				Dates of litter pickup activities and associated mileage, hours and tonnage											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															0	34	0%	ND
															-6	121	-5%	ND
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			5								5	5		5
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects			0								0	5		0
MCM 2 - Post Construction Storm Water Control Measures				Documentation of the consideration/not of WQ measures for above listed projects											0	5		0
				Locations of completed flood control/drainage improvement and other projects											0	5		0
				Dates of completion of the above listed projects											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-3	-3	-1		3
															2	29	7%	4

Fort Worth

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Whites Branch - Big Fossil Creek

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 3 - IDDE	Illicit and Allowable Discharges	Non-Structural	Ordinance/Criteria Manual	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			5								5	5		5
	MS4 Outfall Map	Non-Structural	Documentation	Implemented HHW			5								5	5		5
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	Non-Structural	Interactive/Operational/Municipal	HHW program details including types of collected items			5								5	5		5
				Tonnage and associated sources of collected waste											0	5		0
				Locations/sources or coverage/service areas of waste collection											0	5		0
				Tonnage and associated sources of collected waste											0	5		0
				Dates of waste collection or availability of collection mechanisms								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)										-4	-4	-1		2
															20	39	51%	4.33
	SSOs and Response Actions	Non-Structural	Operational/Municipal	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			0								0	5		0
	Other Spill/Hazardous Event Responses	Non-Structural	Operational/Municipal	Listing of responses including immediate actions and follow up work orders and investigations											0	5		0
	Illicit Discharge Response	Non-Structural	Operational/Municipal	Locations of SSOs, spills, hazardous events and illicit discharges											0	5		0
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)											0	-1		0
															0	24	0%	ND
															20	63	32%	ND

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Whites Branch - Big Fossil Creek

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential				Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			3								3	5		3
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees											0	5		0
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program											0	5		0
				Dates of training activities for municipal operational staff											0	5		0
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)											0	-1		0
															7	24	29%	3.5
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			5								5	5		5
				Number of facilities inspected			4								4	5		4
				Locations of facilities inspected							5				5	5		5
				Dates when facilities were inspected											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)											0	-1		0
															19	29	66%	4.75
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4											0	5		0
				Locations of waste collection and handling services											0	5		0
				Dates of availability of waste collection services											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services										-4	-4	-1		2
															-4	19	-21%	2
															22	72	31%	3.416666667

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Whites Branch - Big Fossil Creek

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			1								1	5		1
				Locations of facilities from above list											0	5		0
				List of facilities that were inspected			0								0	5		0
				Dates when facilities were inspected and records of issues identified and response action items											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)											0	-1		0
															1	29	3%	1
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			5								5	5		5
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects			5								5	5		5
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable											0	5		0
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)											0	5		0
				Records of inspection activities											0	5		0
				Number of inspected sites											0	5		0
				Locations of construction projects and associated inspection activities											0	5		0
				Dates of inspection activities											0	5		0
				Response times to inspection deficiencies											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)											0	-1		0
															10	49	20%	5
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			5								5	5		5
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms			5								5	5		5
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)											0	5		0
				Record of audiences targeted by public education tools			2								2	5		2
				Level of participation using public education tools			2								2	5		2
				List of citizen complaint tools and/or modes											0	5		0
				Availability and/or accessibility of complaint tools								5			5	5		5
				Complaint records											0	5		0
				Response records to complaints including dates of resolution											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)											0	-1		0
															19	49	39%	3.8

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Whites Branch - Big Fossil Creek

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Quantity/Type: #	Quantity/Type: hrs.	Quantity/Type: miles	Quantity/Type: Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
MCM 8 - Monitoring, Evaluation and Reporting	Screening and Monitoring	Non-Structural	Monitoring/Sampling	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	Non-Structural	Data Management	Locations of monitoring activities							3				3	5		3
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted			4								4	5		4
				Response timelines to resolution of illicit discharges and exceedances											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)											0	-1		0
															22	24	92%	4.4
OTHER - Impaired Receiving Waters	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Records of identified targeted controls and/or focused BMPs			0								0	5		0
	TMDL Water Bodies	Non-Structural/ Structural	Monitoring/Performance	Number and types of targeted controls and/or focused BMPs											0	5		0
	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Locations of targeted controls and/or focused BMPs											0	5		0
				Fully operational dates of controls or frequency of implementation											0	5		0
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	5		0
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											0	-1		0
															0	24	0%	ND

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Sycamore Creek - West Fork Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Oil and Grease	**Oils**		**Repeated**	Q1 -Q4	x		ND												0	0		0
				Min				1											1	5		1
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			10	30	33%	1.67
pH	**Acidity**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			29	30	97%	4.83
Conductivity	**Other**		**Repeated**	Q1 -Q4			NM												0	0		0
				Min				NM											0	5		0
				Max				NM											0	5		0
				Median				NM											0	5		0
				Arithmetic Mean				NM											0	5		0
				Geometric Mean				NM											0	5		0
																		NM	0	5		0
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				NM											0	0		0
				Event Mean Concentration															0	0		
																			0	30	0%	ND
E. Coli	**Bacteria**		**Repeated (Three Terms)**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				1											1	5		1
				Median				5											5	5		5
				Arithmetic Mean				5			GM								5	5		5
				Geometric Mean				5	GM								GM		5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			26	30	87%	4.33
TDS	**Solids**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				1											1	5		1
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			8	30	27%	1.33
TSS	**Solids**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				1											1	5		1
				Median				5											5	5		5
				Arithmetic Mean				1											1	5		1
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			22	30	73%	3.67
Atrazine	**Toxic**	**New**		Q1 -Q4			ND												0	0		0
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			5	30	17%	5.00

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Sycamore Creek - West Fork Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	Metals		Repeated	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		1	1	5		1
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			10	30	33%	1.67
Total Chromium	Metals		Repeated	Q1 -Q4			ND												0	0		0
				Min				1											1	5		1
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			9	30	30%	1.50
Total Copper	Metals		Repeated	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		1	1	5		1
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			10	30	33%	1.67
Total Lead	Metals		Repeated	Q1 -Q4			ND												0	0		0
				Min				1											1	5		1
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			7	30	23%	1.17
Total Zinc	Metals		Repeated	Q1 -Q4			ND												0	0		0
				Min				1											1	5		1
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			7	30	23%	1.17
BOD	Oxygen Demanding		Repeated	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				1											1	5		1
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			26	30	87%	4.33

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Sycamore Creek - West Fork Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
COD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				1											1	5		1
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			26	30	87%	4.33
Total Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			14	30	47%	2.33
Dissolved Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			14	30	47%	2.33
Orthophosphate	**Nutrients**	**New**		Q1 -Q4			ND												0	0		0
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			5	30	17%	5.00
Total Nitrogen	**Nutrients**	**New**		Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				1											1	5		1
				Median				5											5	5		5
				Arithmetic Mean				1											1	5		1
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			21	30	70%	3.50
Ammonia-Nitrogen	**Nutrients**	**New**		Q1 -Q4			ND												0	0		0
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			5	30	17%	5.00
Nitrate-Nitrogen	**Nutrients**	**New**		Q1 -Q4			ND												0	0		0
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			5	30	17%	5.00

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Sycamore Creek - West Fork Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric Data Required	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated		Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			3												3	5		3
				pH			5												5	5		5
				Specific Conductance			5												5	5		5
				Temperature			3												3	5		3
				Turbidity			5												5	5		5
				E. Coli			2												2	5		2
				Phosphorus as Orthophosphate			5												5	5		5
				Nitrate as Nitrogen			5												5	5		5
				Dissolved Oxygen (Spring)				1											1	5		1
				pH (Spring)				3											3	5		3
				Specific Conductance (Spring)				1											1	5		1
				Temperature (Spring)				5											5	5		5
				Turbidity (Spring)				5											5	5		5
				E. Coli (Spring)				3											3	5		3
				Phosphorus as Orthophosphate (Spring)				3											3	5		3
				Nitrate as Nitrogen (Spring)				3											3	5		3
				Dissolved Oxygen (Fall)				1											1	5		1
				pH (Fall)				5											5	5		5
				Specific Conductance (Fall)				4											4	5		4
				Temperature (Fall)				1											1	5		1
				Turbidity (Fall)				5											5	5		5
				E. Coli (Fall)				4											4	5		4
				Phosphorus as Orthophosphate (Fall)				5											5	5		5
				Nitrate as Nitrogen (Fall)				4											4	5		4
																			86	**120**	**72%**	**3.58**
Bioassessment Other	**Bioassessment**			Fish IBI Score			ND												0	0		ND
				Habitat Quality Index			4												4	5		4
				Macroinvertebrate IBI Score			5												5	5		5
				Fish IBI Score (Spring)				ND											0	0		ND
				Habitat Quality Index (Spring)				4											4	5		4
				Macroinvertebrate IBI Score (Spring)				5											5	5		5
				Fish IBI Score (Fall)				ND											0	0		ND
				Habitat Quality Index (Fall)				5											5	5		5
				Macroinvertebrate IBI Score (Fall)				5											5	5		5
																			28	**30**	**93%**	**4.67**

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Whites Branch - Big Fossil Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Oil and Grease	**Oils**		**Repeated**	Q1 -Q4	x		ND												0	0		0
				Min				3											3	5		3
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			20	30	67%	3.33
pH	**Acidity**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			13	30	43%	2.17
Conductivity	**Other**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			3	30	10%	ND
E. Coli	**Bacteria**		**Repeated (Three Terms)**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5			GM								5	5		5
				Geometric Mean				5	GM								GM		5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			29	30	97%	4.83
TDS	**Solids**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				3											3	5		3
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			18	30	60%	3.00
TSS	**Solids**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				3											3	5		3
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			28	30	93%	4.67
Atrazine	**Toxic**	**New**		Q1 -Q4			ND												0	0		0
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			5	30	17%	5.00

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Whites Branch - Big Fossil Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	**Metals**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			30	30	100%	5.00
Total Chromium	**Metals**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				3											3	5		3
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			28	30	93%	4.67
Total Copper	**Metals**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			30	30	100%	5.00
Total Lead	**Metals**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			30	30	100%	5.00
Total Zinc	**Metals**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			30	30	100%	5.00
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				3											3	5		3
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			24	30	80%	4.00

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Whites Branch - Big Fossil Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status: New	POC Status: Repeated	POC Metric Data Required	Analysis Category: Trend	Analysis Category: Comparative	Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
COD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				3											3	5		3
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			28	30	93%	4.67
Total Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				3											3	5		3
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			19	30	63%	3.17
Dissolved Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			ND												0	0		0
				Min				5											5	5		5
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			22	30	73%	3.67
Orthophosphate	**Nutrients**	**New**		Q1 -Q4			ND												0	0		0
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			5	30	17%	5.00
Total Nitrogen	**Nutrients**	**New**		Q1 -Q4			ND												0	0		0
				Min				3											3	5		3
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			21	30	70%	3.50
Ammonia-Nitrogen	**Nutrients**	**New**		Q1 -Q4			ND												0	0		0
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			5	30	17%	5.00
Nitrate-Nitrogen	**Nutrients**	**New**		Q1 -Q4			ND												0	0		0
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			5	30	17%	5.00

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Whites Branch - Big Fossil Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			3												3	5		3
				pH			5												5	5		5
				Specific Conductance			4												4	5		4
				Temperature			5												5	5		5
				Turbidity			5												5	5		5
				E. Coli			1												1	5		1
				Phosphorus as Orthophosphate			5												5	5		5
				Nitrate as Nitrogen			5												5	5		5
				Dissolved Oxygen (Spring)				5											5	5		5
				pH (Spring)				5											5	5		5
				Specific Conductance (Spring)				3											3	5		3
				Temperature (Spring)				1											1	5		1
				Turbidity (Spring)				1											1	5		1
				E. Coli (Spring)				5											5	5		5
				Phosphorus as Orthophosphate (Spring)				5											5	5		5
				Nitrate as Nitrogen (Spring)				3											3	5		3
				Dissolved Oxygen (Fall)				2											2	5		2
				pH (Fall)				5											5	5		5
				Specific Conductance (Fall)				1											1	5		1
				Temperature (Fall)				2											2	5		2
				Turbidity (Fall)				5											5	5		5
				E. Coli (Fall)				1											1	5		1
				Phosphorus as Orthophosphate (Fall)				5											5	5		5
				Nitrate as Nitrogen (Fall)				4											4	5		4
																			86	120	72%	3.58
Bioassessment Other	**Bioassessment**			Fish IBI Score			ND												0	5		ND
				Habitat Quality Index			1												1	5		1
				Macroinvertebrate IBI Score			5												5	5		5
				Fish IBI Score (Spring)				ND											0	0		ND
				Habitat Quality Index (Spring)				5											5	5		5
				Macroinvertebrate IBI Score (Spring)				1											1	5		1
				Fish IBI Score (Fall)				ND											0	0		ND
				Habitat Quality Index (Fall)				1											1	5		1
				Macroinvertebrate IBI Score (Fall)				4											4	5		4
																			17	35	49%	2.83

BMP/POC Groups/Tiers
Results

Watershed Name: Rowlett Creek - Lake Ray Hubbard   Number of Entities: 2
Entity Names (% Jurisdiction): Garland (30%), Dallas (0.6%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	18%	~
MCM 2 - Post Construction Storm Water Control Measures	3%	~
MCM 3 - IDDE	77%	IV
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	49%	III
MCM 5 - Industrial and High Risk Runoff	84%	IV
MCM 6 - Construction Site Stormwater Runoff	51%	~
MCM 7 - Public Education, Outreach, Involvement and Participation	45%	~
MCM 8 - Monitoring, Evaluation and Reporting	100%	V
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	77%	
BMP Tier	IV	
POC Analysis Results	**Group Result**	**Tier**
Oil and Grease	78%	IV
pH	90%	IV
Conductivity	40%	II
E. Coli	50%	II
TDS	53%	II
TSS	90%	V
Atrazine	20%	~
Total Arsenic	63%	III
Total Chromium	93%	V
Total Copper	90%	V
Total Lead	95%	V
Total Zinc	98%	V
BOD	50%	III
COD	63%	III
Total Phosphorus	90%	V
Dissolved Phosphorus	90%	V
Orthophosphate	30%	~
Total Nitrogen	60%	III
Ammonia-Nitrogen	23%	~
Nitrate-Nitrogen	23%	~
Bioassessment Water Quality	69%	III
Bioassessment Indices	96%	V
POC Group Result	75%	
POC Tier	IV	
Overall Watershed BMP/POC Group/Tier	**76%**	**IV**

BMP/POC Groups/Tiers
Results

Watershed Name: Rowlett Creek - Lake Ray Hubbard **Number of Entities: 2**

Entity Names (% Jurisdiction): Garland (30%), Dallas (0.6%)

BMP Analysis Comments:
POC Analysis Comments:

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Rowlett Creek - Lake Ray Hubbard

Bold Text in Table Indicates MCMs and BMPs

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			5								5	5		5
				Types of structural controls			2								2	5		2
				Number of structural controls in watershed			2								2	5		2
				Locations of structural controls							5				5	5		5
				Fully Operational Dates								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															19	29	66%	3.57
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					0						0	5		0
				Maintenance Activity hours											0	5		0
				Number of maintained infrastructure											0	5		0
				Locations of activity hours											0	5		0
				Locations of maintained infrastructure											0	5		0
				Dates of maintenance activities											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															-4	34	-12%	2
MCM 1 - Maintenance Activities	**Roadways**	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				5							5	5		5
				Street Sweeping miles											0	5		0
				Locations of street sweeping hours and/or miles											0	5		0
				Dates of street sweeping activities											0	5		0
				Applicable POCs									2		2	5		2
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)											0	-1		0
															7	24	29%	3.5
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					0						0	5		0
				Litter pickup hours											0	5		0
				Litter pickup tonnage											0	5		0
				Summary of litter pickup											0	5		0
				Locations of litter pickup miles, hours and tonnage											0	5		0
				Dates of litter pickup activities and associated mileage, hours and tonnage											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															0	34	0%	ND
															22	121	18%	ND
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			5								5	5		5
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects			0								0	5		0
MCM 2 - Post Construction Storm Water Control Measures				Documentation of the consideration/not of WQ measures for above listed projects											0	5		0
				Locations of completed flood control/drainage improvement and other projects											0	5		0
				Dates of completion of the above listed projects											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															1	29	3%	3.5

Garland

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Rowlett Creek - Lake Ray Hubbard

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 3 - IDDE	Illicit and Allowable Discharges	Non-Structural	Ordinance/Criteria Manual	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			5								5	5		5
	MS4 Outfall Map	Non-Structural	Documentation	Implemented HHW			5								5	5		5
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	Non-Structural	Interactive/Operational/Municipal	HHW program details including types of collected items			5								5	5		5
				Tonnage and associated sources of collected waste											0	0		0
				Locations/sources or coverage/service areas of waste collection											0	0		0
				Tonnage and associated sources of collected waste											0	0		0
				Dates of waste collection or availability of collection mechanisms								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)										-1	-1	-1		5
															23	24	96%	4.833
	SSOs and Response Actions	Non-Structural	Operational/Municipal	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			5								5	5		5
	Other Spill/Hazardous Event Responses	Non-Structural	Operational/Municipal	Listing of responses including immediate actions and follow up work orders and investigations			2								2	5		2
	Illicit Discharge Response	Non-Structural	Operational/Municipal	Locations of SSOs, spills, hazardous events and illicit discharges							1				1	5		1
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)										-3	-3	-1		3
															14	24	58%	3.333
															37	48	77%	4.083

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			3								3	5		3
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees			4								4	5		4
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program							1				1	5		1
				Dates of training activities for municipal operational staff											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)										-4	-4	-1		2
															9	19	47%	3
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			5								5	5		5
				Number of facilities inspected			4								4	5		4
				Locations of facilities inspected							1				1	5		1
				Dates when facilities were inspected											0	0		0
				Dates when identified issues were resolved											0	0		0
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)										-5	-5	-1		1
															9	19	47%	3
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4			0								0	0		0
				Locations of waste collection and handling services											0	0		0
				Dates of availability of waste collection services											0	0		0
				Applicable POCs addressed											0	0		0
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services											0	-1		0
															0	-1	0%	ND
															18	37	49%	3

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Rowlett Creek - Lake Ray Hubbard

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)			Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential				
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			5								5	5		5
				Locations of facilities from above list							1				1	5		1
				List of facilities that were inspected			5								5	5		5
				Dates when facilities were inspected and records of issues identified and response action items											0	0		0
				Dates when identified issues were resolved											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)											0	-1		0
															16	19	84%	4
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			5								5	5		5
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects			5								5	5		5
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable			5								5	5		5
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)											0	5		0
				Records of inspection activities											0	5		0
				Number of inspected sites			5								5	5		5
				Locations of construction projects and associated inspection activities											0	5		0
				Dates of inspection activities											0	5		0
				Response times to inspection deficiencies											0	5		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)											0	-1		0
															25	49	51%	5
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			5								5	5		5
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms			5								5	5		5
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)											0	5		0
				Record of audiences targeted by public education tools			2								2	5		2
				Level of participation using public education tools											0	5		0
				List of citizen complaint tools and/or modes											0	5		0
				Availability and/or accessibility of complaint tools											0	5		0
				Complaint records											0	5		0
				Response records to complaints including dates of resolution								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)											0	-1		0
															22	49	45%	4.4

Garland

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Rowlett Creek - Lake Ray Hubbard

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category Spatial	Analysis Category Non-Spatial	Quantity/Type #	Quantity/Type hrs.	Quantity/Type miles	Quantity/Type Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
MCM 8 - Monitoring, Evaluation and Reporting	Screening and Monitoring	Non-Structural	Monitoring/Sampling	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	Non-Structural	Data Management	Locations of monitoring activities											0	0		0
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted											0	0		0
				Response timelines to resolution of illicit discharges and exceedances								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)											-1	-1		5
															19	19	100%	5
OTHER - Impaired Receiving Waters	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Records of identified targeted controls and/or focused BMPs			0								0	5		0
	TMDL Water Bodies	Non-Structural/ Structural	Monitoring/Performance	Number and types of targeted controls and/or focused BMPs											0	5		0
	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Locations of targeted controls and/or focused BMPs											0	5		0
				Fully operational dates of controls or frequency of implementation											0	5		0
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	5		0
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											0	-1		0
															0	24	0%	ND

Garland

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Rowlett Creek - Lake Ray Hubbard

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Oil and Grease	**Oils**		**Repeated**	Q1 -Q4	x		4												4	5		4
				Min				5											5	5		5
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				3											3	5		3
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		ND
				Event Mean Concentration															0	0		
																			31	40	78%	3.71
pH	**Acidity**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				3											3	5		3
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		
				Event Mean Concentration															0	0		
																			36	40	90%	4.429
Conductivity	**Other**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		
				Event Mean Concentration															0	0		
																			16	40	40%	1.571
E. Coli	**Bacteria**		**Repeated (Three Terms)**	Q1 -Q4			2												2	5		2
				Min				2											2	5		2
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				3			GM								3	5		3
				Geometric Mean				2	GM								GM		2	5		2
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		
				Event Mean Concentration															0	0		
																			20	40	50%	2.143
TDS	**Solids**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				3											3	5		3
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		ND
				Event Mean Concentration															0	0		
																			21	40	53%	2.43
TSS	**Solids**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		ND
				Event Mean Concentration															0	0		
																			36	40	90%	4.571
Atrazine	**Toxic**	**New**		Q1 -Q4			2												2	5		2
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			8	40	20%	1.000

Garland

Regional Wet Weather Characterization Program (RWWCP) Program Term Four

Best Management Practice Analysis and Evaluation Plan (BANEP)

WQ Data Metrics and Evaluation Results Summary Table

Rowlett Creek - Lake Ray Hubbard

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				5											5	5		5
				Max				2											2	5		2
				Median				3											3	5		3
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			25	40	63%	3.13
Total Chromium	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			37	40	93%	4.63
Total Copper	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			36	40	90%	4.50
Total Lead	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			38	40	95%	4.75
Total Zinc	**Metals**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			39	40	98%	4.88
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			1												1	5		1
				Min				2											2	5		2
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			20	40	50%	2.50

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Rowlett Creek - Lake Ray Hubbard

Bold Text in Table Indicates POC Group and Status — **Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)**

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
	Oxygen Demanding		**Repeated**	Q1 -Q4			3												3	5		3
				Min				2											2	5		2
				Max				2											2	5		2
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
COD																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			25	40	63%	3.13
	Nutrients		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				3											3	5		3
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
Total Phosphorus																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			36	40	90%	4.50
	Nutrients		**Repeated**	Q1 -Q4			2												2	5		2
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
Dissolved Phosphorus																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			36	40	90%	4.50
	Nutrients	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
Orthophosphate																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			12	40	30%	1.50
	Nutrients	**New**		Q1 -Q4			3												3	5		3
				Min				3											3	5		3
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
Total Nitrogen																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			24	40	60%	3.00
	Nutrients	**New**		Q1 -Q4			2												2	5		2
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
Ammonia-Nitrogen																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			9	40	23%	1.125
	Nutrients	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
Nitrate-Nitrogen																		1	1	5		1
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			9	40	23%	1.13

Garland

Regional Wet Weather Characterization Program (RWWCP) Program Term Four

Best Management Practice Analysis and Evaluation Plan (BANEP)

WQ Data Metrics and Evaluation Results Summary Table

Rowlett Creek - Lake Ray Hubbard

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			5												5	5		5
				pH			5												5	5		5
				Specific Conductance			5												5	5		5
				Temperature			5												5	5		5
				Turbidity			5												5	5		5
				E. Coli			2												2	5		2
				Phosphorus as Orthophosphate			5												5	5		5
				Nitrate as Nitrogen			1												1	5		1
				Dissolved Oxygen (Spring)				2											2	5		2
				pH (Spring)				2											2	5		2
				Specific Conductance (Spring)				2											2	5		2
				Temperature (Spring)				3											3	5		3
				Turbidity (Spring)				3											3	5		3
				E. Coli (Spring)				2											2	5		2
				Phosphorus as Orthophosphate (Spring)				5											5	5		5
				Nitrate as Nitrogen (Spring)				5											5	5		5
				Dissolved Oxygen (Fall)				2											2	5		2
				pH (Fall)				5											5	5		5
				Specific Conductance (Fall)				1											1	5		1
				Temperature (Fall)				2											2	5		2
				Turbidity (Fall)				5											5	5		5
				E. Coli (Fall)				5											5	5		5
				Phosphorus as Orthophosphate (Fall)				4											4	5		4
				Nitrate as Nitrogen (Fall)				2											2	5		2
																			83	120	69%	3.46
Bioassessment Other	**Bioassessment**			Fish IBI Score			5												5	5		5
				Habitat Quality Index			5												5	5		5
				Macroinvertebrate IBI Score			5												5	5		5
				Fish IBI Score (Spring)				5											5	5		5
				Habitat Quality Index (Spring)				5											5	5		5
				Macroinvertebrate IBI Score (Spring)				3											3	5		3
				Fish IBI Score (Fall)				5											5	5		5
				Habitat Quality Index (Fall)				5											5	5		5
				Macroinvertebrate IBI Score (Fall)				5											5	5		5
																			43	45	96%	4.78

Garland

BMP/POC Groups/Tiers
Results

Watershed Name: Estelle Creek - Bear Creek   Number of Entities: 2
Entity Names (% Jurisdiction): Irving (19%), Fort Worth (0.4%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	7%	~
MCM 2 - Post Construction Storm Water Control Measures	3%	~
MCM 3 - IDDE	29%	~
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	29%	~
MCM 5 - Industrial and High Risk Runoff	3%	~
MCM 6 - Construction Site Stormwater Runoff	0%	~
MCM 7 - Public Education, Outreach, Involvement and Participation	27%	~
MCM 8 - Monitoring, Evaluation and Reporting	92%	IV
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	ND	
BMP Tier	ND	
POC Analysis Results	**Group Result**	**Tier**
Oil and Grease	98%	V
pH	30%	II
Conductivity	15%	~
E. Coli	50%	III
TDS	83%	IV
TSS	75%	IV
Atrazine	38%	~
Total Arsenic	60%	III
Total Chromium	50%	III
Total Copper	88%	IV
Total Lead	98%	V
Total Zinc	90%	V
BOD	80%	IV
COD	90%	V
Total Phosphorus	83%	IV
Dissolved Phosphorus	68%	III
Orthophosphate	30%	~
Total Nitrogen	75%	IV
Ammonia-Nitrogen	38%	~
Nitrate-Nitrogen	28%	~
Bioassessment Water Quality	75%	IV
Bioassessment Indices	84%	IV
POC Group Result	72%	
POC Tier	IV	
Overall Watershed BMP/POC Group/Tier	ND	ND

BMP/POC Groups/Tiers
Results

Watershed Name: Estelle Creek - Bear Creek **Number of Entities: 2**

Entity Names (% Jurisdiction): Irving (19%), Fort Worth (0.4%)

BMP Analysis Comments:

POC Analysis Comments:

BMP/POC Groups/Tiers
Results

Watershed Name: Grapevine Creek - Elm Fork Trinity River | **Number of Entities: 2**

Entity Names (% Jurisdiction): Irving (5%), Dallas (0.8%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	-7%	~
MCM 2 - Post Construction Storm Water Control Measures	3%	~
MCM 3 - IDDE	30%	~
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	-6%	~
MCM 5 - Industrial and High Risk Runoff	3%	~
MCM 6 - Construction Site Stormwater Runoff	0%	~
MCM 7 - Public Education, Outreach, Involvement and Participation	27%	~
MCM 8 - Monitoring, Evaluation and Reporting	92%	IV
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	ND	
BMP Tier	ND	
POC Analysis Results	**Group Result**	**Tier**
Oil and Grease	38%	~
pH	18%	~
Conductivity	35%	~
E. Coli	25%	~
TDS	28%	~
TSS	28%	~
Atrazine	35%	~
Total Arsenic	30%	~
Total Chromium	30%	~
Total Copper	35%	~
Total Lead	30%	~
Total Zinc	30%	~
BOD	30%	~
COD	20%	~
Total Phosphorus	33%	~
Dissolved Phosphorus	35%	~
Orthophosphate	35%	~
Total Nitrogen	23%	~
Ammonia-Nitrogen	30%	~
Nitrate-Nitrogen	35%	~
Bioassessment Water Quality	0%	~
Bioassessment Indices	0%	~
POC Group Result	ND	
POC Tier	ND	
Overall Watershed BMP/POC Group/Tier	**ND**	**ND**

BMP/POC Groups/Tiers
Results

BMP Analysis Comments:

POC Analysis Comments:

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Estelle Creek - Bear Creek

Bold Text in Table Indicates MCMs and BMPs											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			5								5	5		5
				Types of structural controls			2								2	5		2
				Number of structural controls in watershed			5								5	5		5
				Locations of structural controls							1				1	5		1
				Fully Operational Dates											0	5		0
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															13	29	45%	3.167
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					0						0	5		0
				Maintenance Activity hours											0	5		0
				Number of maintained infrastructure											0	5		0
				Locations of activity hours											0	5		0
				Locations of maintained infrastructure											0	5		0
				Dates of maintenance activities											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															-4	34	-12%	2
MCM 1 - Maintenance Activities	**Roadways**	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				0							0	5		0
				Street Sweeping miles											0	5		0
				Locations of street sweeping hours and/or miles											0	5		0
				Dates of street sweeping activities											0	5		0
				Applicable POCs											0	5		0
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)											0	-1		0
															0	24	0%	ND
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					0						0	5		0
				Litter pickup hours											0	5		0
				Litter pickup tonnage											0	5		0
				Summary of litter pickup											0	5		0
				Locations of litter pickup miles, hours and tonnage											0	5		0
				Dates of litter pickup activities and associated mileage, hours and tonnage											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															0	34	0%	ND
															9	121	7%	ND
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			5								5	5		5
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects			0								0	5		0
MCM 2 - Post Construction Storm Water Control Measures				Documentation of the consideration/not of WQ measures for above listed projects											0	5		0
				Locations of completed flood control/drainage improvement and other projects											0	5		0
				Dates of completion of the above listed projects											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															1	29	3%	3.5

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Estelle Creek - Bear Creek

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Quantity/Type: #	Quantity/Type: hrs.	Quantity/Type: miles	Quantity/Type: Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
MCM 3 - IDDE	Illicit and Allowable Discharges	Non-Structural	Ordinance/Criteria Manual	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			5								5	5		5
	MS4 Outfall Map	Non-Structural	Documentation	Implemented HHW			5								5	5		5
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	Non-Structural	Interactive/Operational/Municipal	HHW program details including types of collected items			4								4	5		4
				Tonnage and associated sources of collected waste											0	5		0
				Locations/sources or coverage/service areas of waste collection											0	5		0
				Tonnage and associated sources of collected waste											0	5		0
				Dates of waste collection or availability of collection mechanisms								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)										-2	-2	-1		4
															21	39	54%	4.5
	SS0s and Response Actions	Non-Structural	Operational/Municipal	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			0								0	5		0
	Other Spill/Hazardous Event Responses	Non-Structural	Operational/Municipal	Listing of responses including immediate actions and follow up work orders and investigations											0	5		0
	Illicit Discharge Response	Non-Structural	Operational/Municipal	Locations of SSOs, spills, hazardous events and illicit discharges											0	5		0
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)										-3	-3	-1		3
															-3	24	-13%	3
															18	63	29%	

Irving

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Estelle Creek - Bear Creek

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			1								1	5		1
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees											0	5		0
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program											0	5		0
				Dates of training activities for municipal operational staff											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)										-3	-3	-1		3
															-2	24	-8%	2
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			5								5	5		5
				Number of facilities inspected			4								4	5		4
				Locations of facilities inspected							2				2	5		2
				Dates when facilities were inspected								5			5	5		5
				Dates when identified issues were resolved								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)										-1	-1	-1		5
															25	29	86%	4.43
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4											0	5		0
				Locations of waste collection and handling services											0	5		0
				Dates of availability of waste collection services											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services										-2	-2	-1		4
															-2	19	-11%	4
															21	72	29%	IV

Irving

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Estelle Creek - Bear Creek

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			1								1	5		1
				Locations of facilities from above list											0	5		0
				List of facilities that were inspected			0								0	5		0
				Dates when facilities were inspected and records of issues identified and response action items											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)											0	-1		0
															1	29	3%	1
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			0								0	5		0
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects											0	5		0
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable											0	5		0
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)											0	5		0
				Records of inspection activities											0	5		0
				Number of inspected sites											0	5		0
				Locations of construction projects and associated inspection activities											0	5		0
				Dates of inspection activities											0	5		0
				Response times to inspection deficiencies											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)											0	-1		0
															0	49	0%	ND
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			5								5	5		5
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms			5								5	5		5
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)											0	5		0
				Record of audiences targeted by public education tools			2								2	5		2
				Level of participation using public education tools			1								1	5		1
				List of citizen complaint tools and/or modes											0	5		0
				Availability and/or accessibility of complaint tools											0	5		0
				Complaint records											0	5		0
				Response records to complaints including dates of resolution											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)											0	-1		0
															13	49	27%	3.25

Irving

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Estelle Creek - Bear Creek

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 8 - Monitoring, Evaluation and Reporting	Screening and Monitoring	Non-Structural	Monitoring/Sampling	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	Non-Structural	Data Management	Locations of monitoring activities							5				5	5		5
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted			2								2	5		2
				Response timelines to resolution of illicit discharges and exceedances											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)											0	-1		0
															22	24	92%	4.4
OTHER - Impaired Receiving Waters	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Records of identified targeted controls and/or focused BMPs			0								0	5		0
	TMDL Water Bodies	Non-Structural/ Structural	Monitoring/Performance	Number and types of targeted controls and/or focused BMPs											0	5		0
	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Locations of targeted controls and/or focused BMPs											0	5		0
				Fully operational dates of controls or frequency of implementation											0	5		0
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	5		0
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											0	-1		0
															0	24	0%	ND

Irving

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Grapevine Creek - Elm Fork Trinity River

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Quantity/Type: #	Quantity/Type: hrs.	Quantity/Type: miles	Quantity/Type: Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
Bold Text in Table Indicates MCMs and BMPs											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			0								0	5		0
				Types of structural controls											0	5		0
				Number of structural controls in watershed											0	5		0
				Locations of structural controls											0	5		0
				Fully Operational Dates											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															-4	29	-14%	2
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					0						0	5		0
				Maintenance Activity hours											0	5		0
				Number of maintained infrastructure											0	5		0
				Locations of activity hours											0	5		0
				Locations of maintained infrastructure											0	5		0
				Dates of maintenance activities											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															-4	34	-12%	2
MCM 1 - Maintenance Activities	**Roadways**	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				0							0	5		0
				Street Sweeping miles											0	5		0
				Locations of street sweeping hours and/or miles											0	5		0
				Dates of street sweeping activities											0	5		0
				Applicable POCs											0	5		0
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)											0	-1		0
															0	24	0%	ND
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					0						0	5		0
				Litter pickup hours											0	5		0
				Litter pickup tonnage											0	5		0
				Summary of litter pickup											0	5		0
				Locations of litter pickup miles, hours and tonnage											0	5		0
				Dates of litter pickup activities and associated mileage, hours and tonnage											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															0	34	0%	ND
															-8	121	-7%	ND
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			5								5	5		5
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects			0								0	5		0
MCM 2 - Post Construction Storm Water Control Measures				Documentation of the consideration/not of WQ measures for above listed projects											0	5		0
				Locations of completed flood control/drainage improvement and other projects											0	5		0
				Dates of completion of the above listed projects											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															1	29	3%	3.5

Irving

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Grapevine Creek - Elm Fork Trinity River

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 3 - IDDE	Illicit and Allowable Discharges	Non-Structural	Ordinance/Criteria Manual	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			5								5	5		5
	MS4 Outfall Map	Non-Structural	Documentation	Implemented HHW			5								5	5		5
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	Non-Structural	Interactive/Operational/Municipal	HHW program details including types of collected items			4								4	5		4
				Tonnage and associated sources of collected waste											0	5		0
				Locations/sources or coverage/service areas of waste collection											0	5		0
				Tonnage and associated sources of collected waste											0	5		0
				Dates of waste collection or availability of collection mechanisms								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)										-4	-4	-1		2
															19	39	49%	4.167
	SS0s and Response Actions	Non-Structural	Operational/Municipal	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			0								0	5		0
	Other Spill/Hazardous Event Responses	Non-Structural	Operational/Municipal	Listing of responses including immediate actions and follow up work orders and investigations											0	5		0
	Illicit Discharge Response	Non-Structural	Operational/Municipal	Locations of SSOs, spills, hazardous events and illicit discharges											0	5		0
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)											0	-1		0
															0	24	0%	ND
															19	63	30%	

Irving

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Grapevine Creek - Elm Fork Trinity River

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			1								1	5		1
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees											0	5		0
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program											0	5		0
				Dates of training activities for municipal operational staff											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)											0	-1		0
															1	24	4%	1
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			0								0	5		0
				Number of facilities inspected											0	5		0
				Locations of facilities inspected											0	5		0
				Dates when facilities were inspected											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)										-1	-1	-1		5
															-1	29	-3%	5
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4											0	5		0
				Locations of waste collection and handling services											0	5		0
				Dates of availability of waste collection services											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services										-4	-4	-1		2
															-4	19	-21%	2
															-4	72	-6%	ND

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Grapevine Creek - Elm Fork Trinity River

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)
Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Quantity/Type: #	Quantity/Type: hrs.	Quantity/Type: miles	Quantity/Type: Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			1								1	5		1
				Locations of facilities from above list											0	5		0
				List of facilities that were inspected			0								0	5		0
				Dates when facilities were inspected and records of issues identified and response action items											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)											0	-1		0
															1	29	3%	1
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			0								0	5		0
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects											0	5		0
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable											0	5		0
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)											0	5		0
				Records of inspection activities											0	5		0
				Number of inspected sites											0	5		0
				Locations of construction projects and associated inspection activities											0	5		0
				Dates of inspection activities											0	5		0
				Response times to inspection deficiencies											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)											0	-1		0
															0	49	0%	ND
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			5								5	5		5
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms			5								5	5		5
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)											0	5		0
				Record of audiences targeted by public education tools			2								2	5		2
				Level of participation using public education tools			1								1	5		1
				List of citizen complaint tools and/or modes											0	5		0
				Availability and/or accessibility of complaint tools											0	5		0
				Complaint records											0	5		0
				Response records to complaints including dates of resolution											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)											0	-1		0
															13	49	27%	3.25

Irving

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Grapevine Creek - Elm Fork Trinity River

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 8 - Monitoring, Evaluation and Reporting	**Screening and Monitoring**	**Non-Structural**	**Monitoring/Sampling**	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	**Non-Structural**	**Data Management**	Locations of monitoring activities							5				5	5		5
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted			2								2	5		2
				Response timelines to resolution of illicit discharges and exceedances											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)											0	-1		0
															22	24	92%	4.4
OTHER - Impaired Receiving Waters	**Impaired water bodies and TMDL Requirements**	**Non-Structural/ Structural**	**Monitoring/Performance**	Records of identified targeted controls and/or focused BMPs			0								0	5		0
	TMDL Water Bodies	**Non-Structural/ Structural**	**Monitoring/Performance**	Number and types of targeted controls and/or focused BMPs											0	5		0
	Impaired water bodies and TMDL Requirements	**Non-Structural/ Structural**	**Monitoring/Performance**	Locations of targeted controls and/or focused BMPs											0	5		0
				Fully operational dates of controls or frequency of implementation											0	5		0
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	5		0
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											0	-1		0
															0	24	0%	ND

Irving

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Estelle Creek - Bear Creek

Bold Text in Table Indicates POC Group and Status																						
Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)																						
POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Oil and Grease	**Oils**		**Repeated**	Q1 -Q4	x		4												4	5		4
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			39	40	98%	4.88
pH	**Acidity**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				1											1	5		1
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			12	40	30%	1.500
Conductivity	**Other**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			6	40	15%	0.750
E. Coli	**Bacteria**		**Repeated (Three Terms)**	Q1 -Q4			1												1	5		1
				Min				1											1	5		1
				Max				5											5	5		5
				Median				1											1	5		1
				Arithmetic Mean				5			GM								5	5		5
				Geometric Mean				1	GM								GM		1	5		1
																		1	1	5		1
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			20	40	50%	2.500
TDS	**Solids**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			33	40	83%	4.13
TSS	**Solids**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			30	40	75%	3.750
Atrazine	**Toxic**	**New**		Q1 -Q4			5												5	5		5
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			15	40	38%	1.875

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Estelle Creek - Bear Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	**Metrics**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				1											1	5		1
				Max				5											5	5		5
				Median				1											1	5		1
				Arithmetic Mean				5											5	5		5
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				3											3	5		3
				Event Mean Concentration															0	0		
																			24	40	60%	3.00
Total Chromium	**Metrics**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				1											1	5		1
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			20	40	50%	2.50
Total Copper	**Metrics**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			35	40	88%	4.38
Total Lead	**Metrics**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			39	40	98%	4.88
Total Zinc	**Metrics**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				1											1	5		1
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			36	40	90%	4.50
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				1											1	5		1
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											4	5		4
				Event Mean Concentration															0	0		
																			32	40	80%	4.00

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Estelle Creek - Bear Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
COD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			36	40	90%	4.50
Total Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				1											1	5		1
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			33	40	83%	4.13
Dissolved Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				5											5	5		5
				Median				1											1	5		1
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		1	1	5		1
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			27	40	68%	3.38
Orthophosphate	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			12	40	30%	1.50
Total Nitrogen	**Nutrients**	**New**		Q1 -Q4			5												5	5		5
				Min				1											1	5		1
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				1											1	5		1
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			30	40	75%	3.75
Ammonia-Nitrogen	**Nutrients**	**New**		Q1 -Q4			5												5	5		5
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			15	40	38%	1.875
Nitrate-Nitrogen	**Nutrients**	**New**		Q1 -Q4			2												2	5		2
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			11	40	28%	1.38

Irving

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Estelle Creek - Bear Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			3												3	5		3
				pH			4												4	5		4
				Specific Conductance			5												5	5		5
				Temperature			5												5	5		5
				Turbidity			5												5	5		5
				E. Coli			5												5	5		5
				Phosphorus as Orthophosphate			4												4	5		4
				Nitrate as Nitrogen			4												4	5		4
				Dissolved Oxygen (Spring)				1											1	5		1
				pH (Spring)				5											5	5		5
				Specific Conductance (Spring)				1											1	5		1
				Temperature (Spring)				3											3	5		3
				Turbidity (Spring)				3											3	5		3
				E. Coli (Spring)				1											1	5		1
				Phosphorus as Orthophosphate (Spring)				5											5	5		5
				Nitrate as Nitrogen (Spring)				5											5	5		5
				Dissolved Oxygen (Fall)				1											1	5		1
				pH (Fall)				5											5	5		5
				Specific Conductance (Fall)				2											2	5		2
				Temperature (Fall)				4											4	5		4
				Turbidity (Fall)				4											4	5		4
				E. Coli (Fall)				5											5	5		5
				Phosphorus as Orthophosphate (Fall)				5											5	5		5
				Nitrate as Nitrogen (Fall)				5											5	5		5
																			90	120	75%	3.75
Bioassessment Other	**Bioassessment**			Fish IBI Score			4												4	5		4
				Habitat Quality Index			4												4	5		4
				Macroinvertebrate IBI Score			5												5	5		5
				Fish IBI Score (Spring)				3											3	5		3
				Habitat Quality Index (Spring)				5											5	5		5
				Macroinvertebrate IBI Score (Spring)				3											3	5		3
				Fish IBI Score (Fall)				4											4	5		4
				Habitat Quality Index (Fall)				5											5	5		5
				Macroinvertebrate IBI Score (Fall)				5											5	5		5
																			38	45	84%	4.22

Irving

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Grapevine Creek - Elm Fork Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Oil and Grease	**Oils**		**Repeated**	Q1 -Q4	x		5												5	5		5
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			15	40	38%	1.88
pH	**Acidity**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			7	40	18%	0.875
Conductivity	**Other**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			14	40	35%	1.750
E. Coli	**Bacteria**		**Repeated (Three Terms)**	Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND			GM								0	5		0
				Geometric Mean				ND	GM								GM		0	5		0
																		1	1	5		1
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			10	40	25%	1.250
TDS	**Solids**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			11	40	28%	1.38
TSS	**Solids**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			11	40	28%	1.375
Atrazine	**Toxic**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			14	40	35%	1.750

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Grapevine Creek - Elm Fork Trinity River

Bold Text in Table Indicates POC Group and Status — Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			12	40	30%	1.50
Total Chromium	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			12	40	30%	1.50
Total Copper	**Metals**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			14	40	35%	1.75
Total Lead	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			12	40	30%	1.50
Total Zinc	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			12	40	30%	1.50
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											4	5		4
				Event Mean Concentration															0	0		
																			12	40	30%	1.50

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Grapevine Creek - Elm Fork Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
COD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			8	40	20%	1.00
Total Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			13	40	33%	1.63
Dissolved Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			14	40	35%	1.75
Orthophosphate	**Nutrients**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			14	40	35%	1.75
Total Nitrogen	**Nutrients**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			9	40	23%	1.13
Ammonia-Nitrogen	**Nutrients**	**New**		Q1 -Q4			2												2	5		2
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			12	40	30%	1.5
Nitrate-Nitrogen	**Nutrients**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			14	40	35%	1.75

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Grapevine Creek - Elm Fork Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			NM												0	5		0
				pH			NM												0	5		0
				Specific Conductance			NM												0	5		0
				Temperature			NM												0	5		0
				Turbidity			NM												0	5		0
				E. Coli			NM												0	5		0
				Phosphorus as Orthophosphate			NM												0	5		0
				Nitrate as Nitrogen			NM												0	5		0
				Dissolved Oxygen (Spring)				NM											0	5		0
				pH (Spring)				NM											0	5		0
				Specific Conductance (Spring)				NM											0	5		0
				Temperature (Spring)				NM											0	5		0
				Turbidity (Spring)				NM											0	5		0
				E. Coli (Spring)				NM											0	5		0
				Phosphorus as Orthophosphate (Spring)				NM											0	5		0
				Nitrate as Nitrogen (Spring)				NM											0	5		0
				Dissolved Oxygen (Fall)				NM											0	5		0
				pH (Fall)				NM											0	5		0
				Specific Conductance (Fall)				NM											0	5		0
				Temperature (Fall)				NM											0	5		0
				Turbidity (Fall)				NM											0	5		0
				E. Coli (Fall)				NM											0	5		0
				Phosphorus as Orthophosphate (Fall)				NM											0	5		0
				Nitrate as Nitrogen (Fall)				NM											0	5		0
																			0	120	0%	0.00
Bioassessment Other	**Bioassessment**			Fish IBI Score			NM												0	5		0
				Habitat Quality Index			NM												0	5		0
				Macroinvertebrate IBI Score			NM												0	5		0
				Fish IBI Score (Spring)				NM											0	5		0
				Habitat Quality Index (Spring)				NM											0	5		0
				Macroinvertebrate IBI Score (Spring)				NM											0	5		0
				Fish IBI Score (Fall)				NM											0	5		0
				Habitat Quality Index (Fall)				NM											0	5		0
				Macroinvertebrate IBI Score (Fall)				NM											0	5		0
																			0	45	0%	0.00

BMP/POC Groups/Tiers
Results

Watershed Name: North Mesquite Creek - East Fork Trinity River | Number of Entities: 2

Entity Names (% Jurisdiction): Mesquite (26%), Dallas (0.4%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	30%	~
MCM 2 - Post Construction Storm Water Control Measures	7%	~
MCM 3 - IDDE	84%	IV
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	70%	IV
MCM 5 - Industrial and High Risk Runoff	83%	IV
MCM 6 - Construction Site Stormwater Runoff	67%	IV
MCM 7 - Public Education, Outreach, Involvement and Participation	79%	IV
MCM 8 - Monitoring, Evaluation and Reporting	92%	V
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	69%	
BMP Tier	IV	
POC Analysis Results	**Group Result**	**Tier**
Oil and Grease	78%	IV
pH	93%	V
Conductivity	48%	II
E. Coli	60%	III
TDS	80%	IV
TSS	38%	II
Atrazine	33%	~
Total Arsenic	65%	III
Total Chromium	88%	IV
Total Copper	65%	III
Total Lead	98%	V
Total Zinc	83%	IV
BOD	80%	IV
COD	55%	III
Total Phosphorus	75%	IV
Dissolved Phosphorus	73%	IV
Orthophosphate	35%	~
Total Nitrogen	75%	IV
Ammonia-Nitrogen	33%	~
Nitrate-Nitrogen	35%	~
Bioassessment Water Quality	0%	~
Bioassessment Indices	0%	~
POC Group Result	72%	
POC Tier	IV	
Overall Watershed BMP/POC Group/Tier	**70%**	**IV**

BMP/POC Groups/Tiers
Results

Watershed Name: North Mesquite Creek - East Fork Trinity River **Number of Entities: 2**
Entity Names (% Jurisdiction): Mesquite (26%), Dallas (0.4%)

BMP Analysis Comments:

POC Analysis Comments:

Annual Loading not applicable to this watershed

BMP/POC Groups/Tiers
Results

Watershed Name: South Mesquite Creek — Number of Entities: 2

Entity Names (% Jurisdiction): Mesquite (53%), Dallas (0.2%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	29%	~
MCM 2 - Post Construction Storm Water Control Measures	76%	IV
MCM 3 - IDDE	73%	IV
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	23%	II
MCM 5 - Industrial and High Risk Runoff	79%	IV
MCM 6 - Construction Site Stormwater Runoff	67%	IV
MCM 7 - Public Education, Outreach, Involvement and Participation	82%	IV
MCM 8 - Monitoring, Evaluation and Reporting	79%	IV
OTHER - Impaired Receiving Waters	74%	IV
BMP Group Result	69%	
BMP Tier	IV	

POC Analysis Results	Group Result	Tier
Oil and Grease	80%	IV
pH	85%	IV
Conductivity	83%	IV
E. Coli	58%	III
TDS	75%	IV
TSS	75%	IV
Atrazine	25%	~
Total Arsenic	68%	III
Total Chromium	85%	IV
Total Copper	80%	IV
Total Lead	70%	IV
Total Zinc	70%	IV
BOD	85%	IV
COD	58%	III
Total Phosphorus	65%	III
Dissolved Phosphorus	63%	III
Orthophosphate	35%	~
Total Nitrogen	83%	IV
Ammonia-Nitrogen	25%	~
Nitrate-Nitrogen	28%	~
Bioassessment Water Quality	0%	~
Bioassessment Indices	0%	~
POC Group Result	74%	
POC Tier	IV	
Overall Watershed BMP/POC Group/Tier	**71%**	**IV**

BMP/POC Groups/Tiers
Results

Watershed Name: South Mesquite Creek **Number of Entities: 2**

Entity Names (% Jurisdiction): Mesquite (53%), Dallas (0.2%)

BMP Analysis Comments:

POC Analysis Comments:

Annual Loading not applicable to this watershed

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
North Mesquite Creek - East Fork Trinity River

Bold Text in Table Indicates MCMs and BMPs											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			5								5	5		5
				Types of structural controls			2								2	5		2
				Number of structural controls in watershed			2								2	5		2
				Locations of structural controls							5				5	5		5
				Fully Operational Dates								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-3	-3	-1		3
															20	29	69%	3.71
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					5						5	5		5
				Maintenance Activity hours				4							4	5		4
				Number of maintained infrastructure											0	5		0
				Locations of activity hours							5				5	5		5
				Locations of maintained infrastructure											0	5		0
				Dates of maintenance activities											0	5		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-3	-3	-1		3
															16	34	47%	4.4
MCM 1 - Maintenance Activities	**Roadways**	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				0							0	5		0
				Street Sweeping miles											0	5		0
				Locations of street sweeping hours and/or miles											0	5		0
				Dates of street sweeping activities											0	5		0
				Applicable POCs											0	5		0
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)											0	-1		0
															0	24	0%	ND
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					0						0	5		0
				Litter pickup hours											0	5		0
				Litter pickup tonnage											0	5		0
				Summary of litter pickup											0	5		0
				Locations of litter pickup miles, hours and tonnage											0	5		0
				Dates of litter pickup activities and associated mileage, hours and tonnage											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															0	34	0%	ND
															36	121	30%	ND
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			5								5	5		5
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects			0								0	5		0
MCM 2 - Post Construction Storm Water Control Measures				Documentation of the consideration/not of WQ measures for above listed projects											0	5		0
				Locations of completed flood control/drainage improvement and other projects											0	5		0
				Dates of completion of the above listed projects											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-3	-3	-1		3
															2	29	7%	4

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
North Mesquite Creek - East Fork Trinity River

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
				BMP Activity/Metrics	Analysis Category		Quantity/Type											
MCM	**BMP**	**BMP Type**	**BMP Subtype**	**Data Required**	**Spatial**	**Non-Spatial**	**#**	**hrs.**	**miles**	**Other (cy, acres, $)**	**Location/Coverage**	**Timelines/Frequency**	**POCs Addressed**	**Land Use/Pollution Potential**	**Total**	**Max**	**Total/Max**	**Tier**
MCM 3 - IDDE	**Illicit and Allowable Discharges**	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			5								5	5		5
	MS4 Outfall Map	**Non-Structural**	**Documentation**	Implemented HHW			5								5	5		5
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	**Non-Structural**	**Interactive/Operational/Municipal**	HHW program details including types of collected items			5								5	5		5
				Tonnage and associated sources of collected waste											0	0		0
				Locations/sources or coverage/service areas of waste collection											0	0		0
				Tonnage and associated sources of collected waste											0	0		0
				Dates of waste collection or availability of collection mechanisms											0	0		0
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)										-1	-1	-1		5
															18	19	95%	4.8
	SSOs and Response Actions	**Non-Structural**	**Operational/Municipal**	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			5								5	5		5
	Other Spill/Hazardous Event Responses	**Non-Structural**	**Operational/Municipal**	Listing of responses including immediate actions and follow up work orders and investigations			2								2	5		2
	Illicit Discharge Response	**Non-Structural**	**Operational/Municipal**	Locations of SSOs, spills, hazardous events and illicit discharges							3				3	5		3
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)										-2	-2	-1		4
															18	24	75%	4
															36	43	84%	4.4

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			5								5	5		5
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees			2								2	5		2
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program							1				1	5		1
				Dates of training activities for municipal operational staff											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)										-2	-2	-1		4
															11	19	58%	3.4
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			5								5	5		5
				Number of facilities inspected			4								4	5		4
				Locations of facilities inspected							2				2	5		2
				Dates when facilities were inspected											0	0		0
				Dates when identified issues were resolved								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)										-1	-1	-1		5
															19	24	79%	4.17
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4											0	0		0
				Locations of waste collection and handling services											0	0		0
				Dates of availability of waste collection services								4			4	5		4
				Applicable POCs addressed											0	0		0
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services										-1	-1	-1		5
															3	4	75%	4.5
															33	47	70%	4.02

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
North Mesquite Creek - East Fork Trinity River

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			5								5	5		5
				Locations of facilities from above list							2				2	5		2
				List of facilities that were inspected			5								5	5		5
				Dates when facilities were inspected and records of issues identified and response action items											0	0		0
				Dates when identified issues were resolved								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)										-1	-1	-1		5
															20	24	83%	4.33
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			5								5	5		5
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects			5								5	5		5
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable			2								2	5		2
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)			5								5	5		5
				Records of inspection activities			2								2	5		2
				Number of inspected sites			2								2	5		2
				Locations of construction projects and associated inspection activities							1				1	5		1
				Dates of inspection activities											0	0		0
				Response times to inspection deficiencies											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)										-1	-1	-1		5
															26	39	67%	3.56
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			5								5	5		5
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms			2								2	5		2
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)							5				5	5		5
				Record of audiences targeted by public education tools											0	0		0
				Level of participation using public education tools											0	0		0
				List of citizen complaint tools and/or modes											0	0		0
				Availability and/or accessibility of complaint tools								5			5	5		5
				Complaint records			5								5	5		5
				Response records to complaints including dates of resolution								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)										-5	-5	-1		1
															27	34	79%	4.125

Mesquite

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
North Mesquite Creek - East Fork Trinity River

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
							Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria) / Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
					Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 8 - Monitoring, Evaluation and Reporting	Screening and Monitoring	Non-Structural	Monitoring/Sampling	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	Non-Structural	Data Management	Locations of monitoring activities											0	0		0
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted			3								3	5		3
				Response timelines to resolution of illicit discharges and exceedances								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)										-1	-1	-1		5
															22	24	92%	4.67
OTHER - Impaired Receiving Waters	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Records of identified targeted controls and/or focused BMPs			0								0	5		0
	TMDL Water Bodies	Non-Structural/ Structural	Monitoring/Performance	Number and types of targeted controls and/or focused BMPs											0	5		0
	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Locations of targeted controls and/or focused BMPs											0	5		0
				Fully operational dates of controls or frequency of implementation											0	5		0
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	5		0
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											0	-1		0
															0	24	0%	ND

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
South Mesquite Creek

Bold Text in Table Indicates MCMs and BMPs

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Quantity/Type: #	Quantity/Type: hrs.	Quantity/Type: miles	Quantity/Type: Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			5								5	5		5
				Types of structural controls			2								2	5		2
				Number of structural controls in watershed			5								5	5		5
				Locations of structural controls							3				3	5		3
				Fully Operational Dates								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															20	29	69%	3.714
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					5						5	5		5
				Maintenance Activity hours				5							5	5		5
				Number of maintained infrastructure											0	5		0
				Locations of activity hours							4				4	5		4
				Locations of maintained infrastructure											0	5		0
				Dates of maintenance activities											0	5		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															15	34	44%	4.2
MCM 1 - Maintenance Activities	**Roadways**	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				0							0	5		0
				Street Sweeping miles											0	5		0
				Locations of street sweeping hours and/or miles											0	5		0
				Dates of street sweeping activities											0	5		0
				Applicable POCs											0	5		0
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)											0	-1		0
															0	24	0%	ND
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					0						0	5		0
				Litter pickup hours											0	5		0
				Litter pickup tonnage											0	5		0
				Summary of litter pickup											0	5		0
				Locations of litter pickup miles, hours and tonnage											0	5		0
				Dates of litter pickup activities and associated mileage, hours and tonnage											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															0	34	0%	ND
															35	121	29%	ND
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			5								5	5		5
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects			5								5	5		5
MCM 2 - Post Construction Storm Water Control Measures				Documentation of the consideration/not of WQ measures for above listed projects			2								2	5		2
				Locations of completed flood control/drainage improvement and other projects							5				5	5		5
				Dates of completion of the above listed projects								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															22	29	76%	4

Mesquite

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
South Mesquite Creek

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 3 - IDDE	Illicit and Allowable Discharges	Non-Structural	Ordinance/Criteria Manual	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			5								5	5		5
	MS4 Outfall Map	Non-Structural	Documentation	Implemented HHW			5								5	5		5
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	Non-Structural	Interactive/Operational/Municipal	HHW program details including types of collected items			5								5	5		5
				Tonnage and associated sources of collected waste											0	0		0
				Locations/sources or coverage/service areas of waste collection											0	0		0
				Tonnage and associated sources of collected waste											0	0		0
				Dates of waste collection or availability of collection mechanisms											0	5		0
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)										-5	-5	-1		1
															14	24	58%	4
	SS0s and Response Actions	Non-Structural	Operational/Municipal	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			5								5	5		5
	Other Spill/Hazardous Event Responses	Non-Structural	Operational/Municipal	Listing of responses including immediate actions and follow up work orders and investigations			5								5	5		5
	Illicit Discharge Response	Non-Structural	Operational/Municipal	Locations of SSOs, spills, hazardous events and illicit discharges							3				3	5		3
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)										-2	-2	-1		4
															21	24	88%	4.5
															35	48	73%	4.25

Mesquite

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
South Mesquite Creek

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			3								3	5		3
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees			2								2	5		2
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program							1				1	5		1
				Dates of training activities for municipal operational staff								2			2	5		2
				Applicable POCs addressed									2		2	5		2
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)										-2	-2	-1		4
															8	24	33%	2.33
	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			2								2	5		2
				Number of facilities inspected			2								2	5		2
				Locations of facilities inspected							1				1	5		1
				Dates when facilities were inspected								1			1	5		1
				Dates when identified issues were resolved											0	0		0
				Applicable POCs addressed									2		2	5		2
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)										-5	-5	-1		1
															3	24	13%	1.5
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4											0	0		0
				Locations of waste collection and handling services											0	0		0
				Dates of availability of waste collection services											0	0		0
				Applicable POCs addressed											0	0		0
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services										0	0	-1		0
															0	-1	0%	ND
															11	47	23%	1.92

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria) Quantity/Type: #	Quantity/Type: hrs.	Quantity/Type: miles	Quantity/Type: Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential) Land Use/Pollution Potential	Total	Max	Total/Max	Tier
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			5								5	5		5
				Locations of facilities from above list							5				5	5		5
				List of facilities that were inspected			5								5	5		5
				Dates when facilities were inspected and records of issues identified and response action items											0	0		0
				Dates when identified issues were resolved											0	0		0
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)										-4	-4	-1		2
															15	19	79%	4.2
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			5								5	5		5
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects			5								5	5		5
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable			2								2	5		2
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)			5								5	5		5
				Records of inspection activities			4								4	5		4
				Number of inspected sites			2								2	5		2
				Locations of construction projects and associated inspection activities							3				3	5		3
				Dates of inspection activities											0	0		0
				Response times to inspection deficiencies											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)										-5	-5	-1		1
															26	39	67%	3.56
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			5								5	5		5
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms			5								5	5		5
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)							2				2	5		2
				Record of audiences targeted by public education tools			2								2	5		2
				Level of participation using public education tools											0	0		0
				List of citizen complaint tools and/or modes											0	0		0
				Availability and/or accessibility of complaint tools								5			5	5		5
				Complaint records			5								5	5		5
				Response records to complaints including dates of resolution											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)										-1	-1	-1		5
															28	34	82%	4.25

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 8 - Monitoring, Evaluation and Reporting	Screening and Monitoring	Non-Structural	Monitoring/Sampling	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	Non-Structural	Data Management	Locations of monitoring activities							1				1	5		1
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted			3								3	5		3
				Response timelines to resolution of illicit discharges and exceedances								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)										-1	-1	-1		5
															23	29	79%	4.14
OTHER - Impaired Receiving Waters	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Records of identified targeted controls and/or focused BMPs			2								2	5		2
	TMDL Water Bodies	Non-Structural/ Structural	Monitoring/Performance	Number and types of targeted controls and/or focused BMPs			5								5	5		5
	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Locations of targeted controls and/or focused BMPs							2				2	5		2
				Fully operational dates of controls or frequency of implementation								5			5	5		5
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	0		0
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											0	-1		0
															14	19	74%	3.5

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
North Mesquite Creek - East Fork Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status: New	POC Status: Repeated	POC Metric / Data Required	Analysis Category: Trend	Analysis Category: Comparative	Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
Oil and Grease	**Oils**		**Repeated**	Q1 -Q4	x		1												1	5		1
				Min				5											5	5		5
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			31	40	78%	3.88
pH	**Acidity**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				5											5	5		5
				Median				4											4	5		4
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			37	40	93%	4.625
Conductivity	**Other**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				5											5	5		5
				Median				1											1	5		1
				Arithmetic Mean				1											1	5		1
				Geometric Mean				1											1	5		1
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				3											3	5		3
				Event Mean Concentration															0	0		
																			19	40	48%	2.375
E. Coli	**Bacteria**		**Repeated (Three Terms)**	Q1 -Q4			3												3	5		3
				Min				3											3	5		3
				Max				3											3	5		3
				Median				2											2	5		2
				Arithmetic Mean				3			GM								3	5		3
				Geometric Mean				3	GM								GM		3	5		3
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			24	40	60%	3.000
TDS	**Solids**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				3											3	5		3
				Max				5											5	5		5
				Median				3											3	5		3
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			32	40	80%	4.00
TSS	**Solids**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				1											1	5		1
				Max				1											1	5		1
				Median				1											1	5		1
				Arithmetic Mean				3											3	5		3
				Geometric Mean				1											1	5		1
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			15	40	38%	1.875
Atrazine	**Toxic**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			13	40	33%	1.625

Mesquite

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
North Mesquite Creek - East Fork Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	**Metals**		**Repeated**	Q1 -Q4			1												1	5		1
				Min				4											4	5		4
				Max				3											3	5		3
				Median				5											5	5		5
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				3											3	5		3
				Event Mean Concentration															0	0		
																			26	40	65%	3.25
Total Chromium	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				5											5	5		5
				Max				4											4	5		4
				Median				4											4	5		4
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			35	40	88%	4.38
Total Copper	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				2											2	5		2
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				2											2	5		2
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				3											3	5		3
				Event Mean Concentration															0	0		
																			26	40	65%	3.25
Total Lead	**Metals**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			39	40	98%	4.88
Total Zinc	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				5											5	5		5
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			33	40	83%	4.13
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				3											3	5		3
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			32	40	80%	4.00

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
North Mesquite Creek - East Fork Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
COD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				2											2	5		2
				Max				2											2	5		2
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				2											2	5		2
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			22	40	55%	2.75
Total Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				4											4	5		4
				Max				4											4	5		4
				Median				3											3	5		3
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				2											2	5		2
				Event Mean Concentration															0	0		
																			30	40	75%	3.75
Dissolved Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			29	40	73%	3.63
Orthophosphate	**Nutrients**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			14	40	35%	1.75
Total Nitrogen	**Nutrients**	**New**		Q1 -Q4			2												2	5		2
				Min				3											3	5		3
				Max				3											3	5		3
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				3											3	5		3
				Event Mean Concentration															0	0		
																			30	40	75%	3.75
Ammonia-Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			13	40	33%	1.625
Nitrate-Nitrogen	**Nutrients**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			14	40	35%	1.75

Mesquite

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
North Mesquite Creek - East Fork Trinity River

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			NM												0	5		0
				pH			NM												0	5		0
				Specific Conductance			NM												0	5		0
				Temperature			NM												0	5		0
				Turbidity			NM												0	5		0
				E. Coli			NM												0	5		0
				Phosphorus as Orthophosphate			NM												0	5		0
				Nitrate as Nitrogen			NM												0	5		0
				Dissolved Oxygen (Spring)				NM											0	5		0
				pH (Spring)				NM											0	5		0
				Specific Conductance (Spring)				NM											0	5		0
				Temperature (Spring)				NM											0	5		0
				Turbidity (Spring)				NM											0	5		0
				E. Coli (Spring)				NM											0	5		0
				Phosphorus as Orthophosphate (Spring)				NM											0	5		0
				Nitrate as Nitrogen (Spring)				NM											0	5		0
				Dissolved Oxygen (Fall)				NM											0	5		0
				pH (Fall)				NM											0	5		0
				Specific Conductance (Fall)				NM											0	5		0
				Temperature (Fall)				NM											0	5		0
				Turbidity (Fall)				NM											0	5		0
				E. Coli (Fall)				NM											0	5		0
				Phosphorus as Orthophosphate (Fall)				NM											0	5		0
				Nitrate as Nitrogen (Fall)				NM											0	5		0
																			0	120	0%	0.00
Bioassessment Other	**Bioassessment**			Fish IBI Score			NM												0	5		0
				Habitat Quality Index			NM												0	5		0
				Macroinvertebrate IBI Score			NM												0	5		0
				Fish IBI Score (Spring)				NM											0	5		0
				Habitat Quality Index (Spring)				NM											0	5		0
				Macroinvertebrate IBI Score (Spring)				NM											0	5		0
				Fish IBI Score (Fall)				NM											0	5		0
				Habitat Quality Index (Fall)				NM											0	5		0
				Macroinvertebrate IBI Score (Fall)				NM											0	5		0
																			0	45	0%	0.00

Mesquite

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
South Mesquite Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status: New	POC Status: Repeated	POC Metric / Data Required	Analysis Category: Trend	Analysis Category: Comparative	Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
Oil and Grease	**Oils**		**Repeated**	Q1 -Q4	x		4												4	5		4
				Min				5											5	5		5
				Max				5											5	5		5
				Median				2											2	5		2
				Arithmetic Mean				3											3	5		3
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				3											3	5		3
				Event Mean Concentration															0	0		
																			32	40	80%	4.00
pH	**Acidity**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				5											5	5		5
				Max				3											3	5		3
				Median				2											2	5		2
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			34	40	85%	4.250
Conductivity	**Other**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				1											1	5		1
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			33	40	83%	4.125
E. Coli	**Bacteria**		**Repeated (Three Terms)**	Q1 -Q4			2												2	5		2
				Min				3											3	5		3
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				3			GM								3	5		3
				Geometric Mean				2	GM								GM		2	5		2
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			23	40	58%	2.875
TDS	**Solids**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				5											5	5		5
				Median				2											2	5		2
				Arithmetic Mean				5											5	5		5
				Geometric Mean				3											3	5		3
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				3											3	5		3
				Event Mean Concentration															0	0		
																			30	40	75%	3.75
TSS	**Solids**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				3											3	5		3
				Max				3											3	5		3
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			30	40	75%	3.750
Atrazine	**Toxic**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			10	40	25%	1.250

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
South Mesquite Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				3											3	5		3
				Event Mean Concentration															0	0		
																			27	40	68%	3.38
Total Chromium	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			34	40	85%	4.25
Total Copper	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				3											3	5		3
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			32	40	80%	4.00
Total Lead	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				2											2	5		2
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			28	40	70%	3.50
Total Zinc	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				3											3	5		3
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			28	40	70%	3.50
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			34	40	85%	4.25

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
South Mesquite Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status: New	POC Status: Repeated	POC Metric / Data Required	Analysis Category: Trend	Analysis Category: Comparative	Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
COD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				2											2	5		2
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			23	40	58%	2.88
Total Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				4											4	5		4
				Max				3											3	5		3
				Median				2											2	5		2
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				3											3	5		3
				Event Mean Concentration															0	0		
																			26	40	65%	3.25
Dissolved Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				3											3	5		3
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				3											3	5		3
				Event Mean Concentration															0	0		
																			25	40	63%	3.13
Orthophosphate	**Nutrients**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			14	40	35%	1.75
Total Nitrogen	**Nutrients**	**New**		Q1 -Q4			2												2	5		2
				Min				3											3	5		3
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			33	40	83%	4.13
Ammonia-Nitrogen	**Nutrients**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			10	40	25%	1.25
Nitrate-Nitrogen	**Nutrients**	**New**		Q1 -Q4			5												5	5		5
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			11	40	28%	1.38

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
South Mesquite Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			NM												0	5		0
				pH			NM												0	5		0
				Specific Conductance			NM												0	5		0
				Temperature			NM												0	5		0
				Turbidity			NM												0	5		0
				E. Coli			NM												0	5		0
				Phosphorus as Orthophosphate			NM												0	5		0
				Nitrate as Nitrogen			NM												0	5		0
				Dissolved Oxygen (Spring)				NM											0	5		0
				pH (Spring)				NM											0	5		0
				Specific Conductance (Spring)				NM											0	5		0
				Temperature (Spring)				NM											0	5		0
				Turbidity (Spring)				NM											0	5		0
				E. Coli (Spring)				NM											0	5		0
				Phosphorus as Orthophosphate (Spring)				NM											0	5		0
				Nitrate as Nitrogen (Spring)				NM											0	5		0
				Dissolved Oxygen (Fall)				NM											0	5		0
				pH (Fall)				NM											0	5		0
				Specific Conductance (Fall)				NM											0	5		0
				Temperature (Fall)				NM											0	5		0
				Turbidity (Fall)				NM											0	5		0
				E. Coli (Fall)				NM											0	5		0
				Phosphorus as Orthophosphate (Fall)				NM											0	5		0
				Nitrate as Nitrogen (Fall)				NM											0	5		0
																			0	120	0%	0.00
Bioassessment Other	**Bioassessment**			Fish IBI Score			NM												0	5		0
				Habitat Quality Index			NM												0	5		0
				Macroinvertebrate IBI Score			NM												0	5		0
				Fish IBI Score (Spring)				NM											0	5		0
				Habitat Quality Index (Spring)				NM											0	5		0
				Macroinvertebrate IBI Score (Spring)				NM											0	5		0
				Fish IBI Score (Fall)				NM											0	5		0
				Habitat Quality Index (Fall)				NM											0	5		0
				Macroinvertebrate IBI Score (Fall)				NM											0	5		0
																			0	45	0%	0.00

BMP/POC Groups/Tiers
Results

Watershed Name: Cottonwood Branch - Hackberry Creek   Number of Entities: 3

Entity Names (% Jurisdiction): NTTA (N/A), Irving (29%), Dallas (0.04%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	22%	~
MCM 2 - Post Construction Storm Water Control Measures	83%	IV
MCM 3 - IDDE	8%	~
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	67%	IV
MCM 5 - Industrial and High Risk Runoff	14%	~
MCM 6 - Construction Site Stormwater Runoff	18%	~
MCM 7 - Public Education, Outreach, Involvement and Participation	71%	IV
MCM 8 - Monitoring, Evaluation and Reporting	92%	V
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	78%	
BMP Tier	IV	

POC Analysis Results	Group Result	Tier
Oil and Grease	75%	IV
pH	55%	III
Conductivity	83%	IV
E. Coli	53%	III
TDS	93%	V
TSS	68%	III
Atrazine	25%	~
Total Arsenic	63%	III
Total Chromium	63%	III
Total Copper	73%	IV
Total Lead	65%	III
Total Zinc	53%	III
BOD	65%	III
COD	63%	III
Total Phosphorus	53%	III
Dissolved Phosphorus	60%	III
Orthophosphate	30%	~
Total Nitrogen	63%	III
Ammonia-Nitrogen	28%	~
Nitrate-Nitrogen	30%	~
Bioassessment Water Quality	0%	~
Bioassessment Indices	0%	~
POC Group Result	61%	
POC Tier	III	
Overall Watershed BMP/POC Group/Tier	**70%**	**IV**

BMP/POC Groups/Tiers
Results

Watershed Name: Cottonwood Branch - Hackberry Creek **Number of Entities: 3**

Entity Names (% Jurisdiction): NTTA (N/A), Irving (29%), Dallas (0.04%)

BMP Analysis Comments:

POC Analysis Comments:

BMP/POC Groups/Tiers
Results

Watershed Name: Cottonwood Creek - Mountain Creek Lake   Number of Entities: 3
Entity Names (% Jurisdiction): NTTA (N/A), Arlington (5%), Dallas (3%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	32%	~
MCM 2 - Post Construction Storm Water Control Measures	72%	IV
MCM 3 - IDDE	8%	~
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	89%	IV
MCM 5 - Industrial and High Risk Runoff	17%	~
MCM 6 - Construction Site Stormwater Runoff	20%	~
MCM 7 - Public Education, Outreach, Involvement and Participation	71%	IV
MCM 8 - Monitoring, Evaluation and Reporting	92%	V
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	81%	
BMP Tier	IV	
POC Analysis Results	**Group Result**	**Tier**
Oil and Grease	93%	V
pH	53%	II
Conductivity	23%	~
E. Coli	85%	IV
TDS	48%	II
TSS	93%	V
Atrazine	25%	~
Total Arsenic	53%	III
Total Chromium	65%	III
Total Copper	85%	IV
Total Lead	100%	V
Total Zinc	55%	III
BOD	85%	IV
COD	85%	IV
Total Phosphorus	48%	II
Dissolved Phosphorus	63%	III
Orthophosphate	25%	~
Total Nitrogen	65%	III
Ammonia-Nitrogen	33%	~
Nitrate-Nitrogen	20%	~
Bioassessment Water Quality	0%	~
Bioassessment Indices	0%	~
POC Group Result	64%	
POC Tier	III	
Overall Watershed BMP/POC Group/Tier	**73%**	**IV**

BMP/POC Groups/Tiers
Results

Watershed Name: Cottonwood Creek - Mountain Creek Lake **Number of Entities: 3**

Entity Names (% Jurisdiction): NTTA (N/A), Arlington (5%), Dallas (3%)

BMP Analysis Comments:
POC Analysis Comments:

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Cottonwood Branch - Hackberry Creek

Bold Text in Table Indicates MCMs and BMPs											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			5								5	5		5
				Types of structural controls			2								2	5		2
				Number of structural controls in watershed			2								2	5		2
				Locations of structural controls											0	5		0
				Fully Operational Dates								5			5	5		5
				Applicable POCs addressed									2		2	5		2
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															12	29	41%	3
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					5						5	5		5
				Maintenance Activity hours											0	5		0
				Number of maintained infrastructure			4								4	5		4
				Locations of activity hours							3				3	5		3
				Locations of maintained infrastructure											0	5		0
				Dates of maintenance activities								3			3	5		3
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															15	34	44%	3.5
	Roadways	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				0							0	5		0
MCM 1 - Maintenance Activities				Street Sweeping miles											0	5		0
				Locations of street sweeping hours and/or miles											0	5		0
				Dates of street sweeping activities											0	5		0
				Applicable POCs											0	5		0
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)											0	-1		0
															0	24	0%	ND
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					0						0	5		0
				Litter pickup hours											0	5		0
				Litter pickup tonnage											0	5		0
				Summary of litter pickup											0	5		0
				Locations of litter pickup miles, hours and tonnage											0	5		0
				Dates of litter pickup activities and associated mileage, hours and tonnage											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															0	34	0%	ND
															27	121	22%	ND
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			5								5	5		5
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects			5								5	5		5
				Documentation of the consideration/not of WQ measures for above listed projects			5								5	5		5
MCM 2 - Post Construction Storm Water Control Measures				Locations of completed flood control/drainage improvement and other projects							3				3	5		3
				Dates of completion of the above listed projects								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															24	29	83%	4.29

NTTA

Regional Wet Weather Characterization Program (RWWCP) Program Term Four

Best Management Practice Analysis and Evaluation Plan (BANEP)

BMP Data Metrics and Evaluation Results Summary Table

Cottonwood Branch - Hackberry Creek

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	**BMP**	**BMP Type**	**BMP Subtype**	**BMP Activity/Metrics**	**Analysis Category**		**Quantity/Type**				**Location/Coverage**	**Timelines/Frequency**	**POCs Addressed**	**Land Use/Pollution Potential**	**Total**	**Max**	**Total/Max**	**Tier**
				Data Required	**Spatial**	**Non-Spatial**	**#**	**hrs.**	**miles**	**Other (cy, acres, $)**								
MCM 3 - IDDE	**Illicit and Allowable Discharges**	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			5								**5**	**5**		**5**
	MS4 Outfall Map	**Non-Structural**	**Documentation**	Implemented HHW			0								**0**	**5**		**0**
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	**Non-Structural**	**Interactive/Operational/Municipal**	HHW program details including types of collected items											**0**	**5**		**0**
				Tonnage and associated sources of collected waste											**0**	**5**		**0**
				Locations/sources or coverage/service areas of waste collection											**0**	**5**		**0**
				Tonnage and associated sources of collected waste											**0**	**5**		**0**
				Dates of waste collection or availability of collection mechanisms											**0**	**5**		**0**
				Applicable POCs addressed											**0**	**5**		**0**
				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)											**0**	**-1**		**0**
															5	**39**	**13%**	**5**
	SS0s and Response Actions	**Non-Structural**	**Operational/Municipal**	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			0								**0**	**5**		**0**
	Other Spill/Hazardous Event Responses	**Non-Structural**	**Operational/Municipal**	Listing of responses including immediate actions and follow up work orders and investigations											**0**	**5**		**0**
	Illicit Discharge Response	**Non-Structural**	**Operational/Municipal**	Locations of SSOs, spills, hazardous events and illicit discharges											**0**	**5**		**0**
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.											**0**	**5**		**0**
				Applicable POCs addressed											**0**	**5**		**0**
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)											**0**	**-1**		**0**
															0	**24**	**0%**	**ND**
															5	**63**	**8%**	

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
											Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential							
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
					Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			4								4	5		4
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees			5								5	5		5
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program							5				5	5		5
				Dates of training activities for municipal operational staff								2			2	5		2
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)										-4	-4	-1		2
															17	24	71%	3.83
	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			0								0	0		0
				Number of facilities inspected											0	0		0
				Locations of facilities inspected											0	0		0
				Dates when facilities were inspected											0	0		0
				Dates when identified issues were resolved											0	0		0
				Applicable POCs addressed											0	0		0
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)											0	-1		0
															0	-1	0%	ND
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4			5								5	5		5
				Locations of waste collection and handling services							1				1	5		1
				Dates of availability of waste collection services								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services										-4	-4	-1		2
															11	19	58%	3.4
															28	42	67%	3.62

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			5								5	5		5
				Locations of facilities from above list											0	5		0
				List of facilities that were inspected			0								0	5		0
				Dates when facilities were inspected and records of issues identified and response action items											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)										-1	-1	-1		5
															4	29	14%	5
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			5								5	5		5
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects			5								5	5		5
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable											0	5		0
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)											0	5		0
				Records of inspection activities											0	5		0
				Number of inspected sites											0	5		0
				Locations of construction projects and associated inspection activities											0	5		0
				Dates of inspection activities											0	5		0
				Response times to inspection deficiencies											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)										-1	-1	-1		5
															9	49	18%	5
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			5								5	5		5
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms			5								5	5		5
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)							1				1	5		1
				Record of audiences targeted by public education tools			5								5	5		5
				Level of participation using public education tools											0	0		0
				List of citizen complaint tools and/or modes											0	0		0
				Availability and/or accessibility of complaint tools								5			5	5		5
				Complaint records			2								2	5		2
				Response records to complaints including dates of resolution											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)										-4	-4	-1		2
															24	34	71%	3.75

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Cottonwood Branch - Hackberry Creek

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category Spatial	Analysis Category Non-Spatial	Quantity/Type #	Quantity/Type hrs.	Quantity/Type miles	Quantity/Type Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential				Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
MCM 8 - Monitoring, Evaluation and Reporting	Screening and Monitoring	Non-Structural	Monitoring/Sampling	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	Non-Structural	Data Management	Locations of monitoring activities							5				5	5		5
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted			3								3	5		3
				Response timelines to resolution of illicit discharges and exceedances											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)										-1	-1	-1		5
															22	24	92%	4.667
OTHER - Impaired Receiving Waters	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Records of identified targeted controls and/or focused BMPs			0								0	5		0
	TMDL Water Bodies	Non-Structural/ Structural	Monitoring/Performance	Number and types of targeted controls and/or focused BMPs											0	5		0
	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Locations of targeted controls and/or focused BMPs											0	5		0
				Fully operational dates of controls or frequency of implementation											0	5		0
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	5		0
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											0	-1		0
															0	24	0%	ND

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Cottonwood Creek - Mountain Creek Lake

Bold Text in Table Indicates MCMs and BMPs											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 1 - Maintenance Activities	**Structural Controls**	**Structural**	**Performance**	Listing of structural controls			5								5	5		5
				Types of structural controls			2								2	5		2
				Number of structural controls in watershed			2								2	5		2
				Locations of structural controls											0	5		0
				Fully Operational Dates								5			5	5		5
				Applicable POCs addressed									2		2	5		2
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															12	29	41%	3
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					5						5	5		5
				Maintenance Activity hours											0	5		0
				Number of maintained infrastructure			4								4	5		4
				Locations of activity hours							3				3	5		3
				Locations of maintained infrastructure											0	0		0
				Dates of maintenance activities								3			3	5		3
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															15	29	52%	3.5
	Roadways	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				5							5	5		5
				Street Sweeping miles											0	5		0
				Locations of street sweeping hours and/or miles											0	5		0
				Dates of street sweeping activities											0	5		0
				Applicable POCs											0	5		0
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)											0	-1		0
															5	24	21%	ND
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					5						5	5		5
				Litter pickup hours											0	5		0
				Litter pickup tonnage											0	5		0
				Summary of litter pickup											0	5		0
				Locations of litter pickup miles, hours and tonnage											0	5		0
				Dates of litter pickup activities and associated mileage, hours and tonnage											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)											0	-1		0
															5	34	15%	ND
															37	116	32%	ND
MCM 2 - Post Construction Storm Water Control Measures	**New Development and Significant Redevelopment**	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			5								5	5		5
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects			2								2	5		2
				Documentation of the consideration/not of WQ measures for above listed projects			5								5	5		5
				Locations of completed flood control/drainage improvement and other projects							3				3	5		3
				Dates of completion of the above listed projects								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															21	29	72%	3.86

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Cottonwood Creek - Mountain Creek Lake

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	Illicit and Allowable Discharges	Non-Structural	Ordinance/Criteria Manual	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			5								5	5		5
	MS4 Outfall Map	Non-Structural	Documentation	Implemented HHW			0								0	5		0
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	Non-Structural	Interactive/Operational/Municipal	HHW program details including types of collected items											0	5		0
				Tonnage and associated sources of collected waste											0	5		0
				Locations/sources or coverage/service areas of waste collection											0	5		0
				Tonnage and associated sources of collected waste											0	5		0
				Dates of waste collection or availability of collection mechanisms											0	5		0
				Applicable POCs addressed											0	5		0
MCM 3 - IDDE				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)											0	-1		0
															5	39	13%	5
	SSOs and Response Actions	Non-Structural	Operational/Municipal	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			0								0	5		0
	Other Spill/Hazardous Event Responses	Non-Structural	Operational/Municipal	Listing of responses including immediate actions and follow up work orders and investigations											0	5		0
	Illicit Discharge Response	Non-Structural	Operational/Municipal	Locations of SSOs, spills, hazardous events and illicit discharges											0	5		0
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)											0	-1		0
															0	24	0%	ND
															5	63	8%	ND

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			4								4	5		4
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees			5								5	5		5
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program							5				5	0		5
				Dates of training activities for municipal operational staff								2			2	5		2
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)										-4	-4	-1		2
															17	19	89%	3.83
	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			5								5	0		5
				Number of facilities inspected											0	0		0
				Locations of facilities inspected											0	0		0
				Dates when facilities were inspected											0	0		0
				Dates when identified issues were resolved											0	0		0
				Applicable POCs addressed											0	0		0
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)											0	-1		0
															5	-1	-500%	5
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4			5								5	5		5
				Locations of waste collection and handling services							1				1	5		1
				Dates of availability of waste collection services								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services										-4	-4	-1		2
															11	19	58%	3.4
															33	37	89%	3.62

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Cottonwood Creek - Mountain Creek Lake

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			5								5	5		5
				Locations of facilities from above list											0	5		0
				List of facilities that were inspected			0								0	5		0
				Dates when facilities were inspected and records of issues identified and response action items											0	5		0
				Dates when identified issues were resolved											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)											0	-1		0
															5	29	17%	5
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			5								5	5		5
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects			5								5	5		5
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable											0	5		0
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)											0	5		0
				Records of inspection activities											0	5		0
				Number of inspected sites											0	5		0
				Locations of construction projects and associated inspection activities											0	5		0
				Dates of inspection activities											0	5		0
				Response times to inspection deficiencies											0	5		0
				Applicable POCs addressed											0	5		0
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)											0	-1		0
															10	49	20%	5
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			5								5	5		5
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms			5								5	5		5
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)							1				1	5		1
				Record of audiences targeted by public education tools			5								5	5		5
				Level of participation using public education tools											0	0		0
				List of citizen complaint tools and/or modes											0	0		0
				Availability and/or accessibility of complaint tools								5			5	5		5
				Complaint records			2								2	5		2
				Response records to complaints including dates of resolution											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)										-4	-4	-1		2
															24	34	71%	3.75

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 8 - Monitoring, Evaluation and Reporting	Screening and Monitoring	Non-Structural	Monitoring/Sampling	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	Non-Structural	Data Management	Locations of monitoring activities							5				5	5		5
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted			3								3	5		3
				Response timelines to resolution of illicit discharges and exceedances											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)										-1	-1	-1		5
															22	24	92%	4.67
OTHER - Impaired Receiving Waters	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Records of identified targeted controls and/or focused BMPs			0								0	5		0
	TMDL Water Bodies	Non-Structural/ Structural	Monitoring/Performance	Number and types of targeted controls and/or focused BMPs											0	5		0
	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Locations of targeted controls and/or focused BMPs											0	5		0
				Fully operational dates of controls or frequency of implementation											0	5		0
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	5		0
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											0	-1		0
															0	24	0%	ND

NTTA

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Cottonwood Branch - Hackberry Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Oil and Grease	**Oils**		**Repeated**	Q1 -Q4	x		4												4	5		4
				Min				5											5	5		5
				Max				3											3	5		3
				Median				2											2	5		2
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			30	40	75%	3.75
pH	**Acidity**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				3											3	5		3
				Max				2											2	5		2
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	0		
				Event Mean Concentration															0	5		0
																			22	40	55%	3.000
Conductivity	**Other**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			33	40	83%	4.125
E. Coli	**Bacteria**		**Repeated (Three Terms)**	Q1 -Q4			4												4	5		4
				Min				3											3	5		3
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2			GM								2	5		2
				Geometric Mean				2	GM								GM		2	5		2
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			21	40	53%	2.625
TDS	**Solids**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			37	40	93%	4.625
TSS	**Solids**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				5											5	5		5
				Max				2											2	5		2
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			27	40	68%	3.375
Atrazine	**Toxic**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			10	40	25%	1.25

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Cottonwood Branch - Hackberry Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	**Metals**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			25	40	63%	3.125
Total Chromium	**Metals**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				2											2	5		2
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			25	40	63%	3.125
Total Copper	**Metals**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				2											2	5		2
				Geometric Mean				3											3	5		3
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			29	40	73%	3.625
Total Lead	**Metals**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			26	40	65%	3.25
Total Zinc	**Metals**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				2											2	5		2
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				3											3	5		3
				Event Mean Concentration															0	0		
																			21	40	53%	2.63
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				3											3	5		3
				Max				5											5	5		5
				Median				2											2	5		2
				Arithmetic Mean				3											3	5		3
				Geometric Mean				2											2	5		2
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			26	40	65%	3.25

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Cottonwood Branch - Hackberry Creek

Bold Text in Table Indicates POC Group and Status									Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)													
POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
COD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				3											3	5		3
				Max				3											3	5		3
				Median				2											2	5		2
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				3											3	5		3
				Event Mean Concentration															0	0		
																			25	40	63%	3.13
Total Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				2											2	5		2
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			21	40	53%	2.63
Dissolved Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				2											2	5		2
				Max				3											3	5		3
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			24	40	60%	3.00
Orthophosphate	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			12	40	30%	1.50
Total Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				2											2	5		2
				Max				5											5	5		5
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				3											3	5		3
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				4											4	5		4
				Event Mean Concentration															0	0		
																			25	40	63%	3.125
Ammonia-Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			11	40	28%	1.375
Nitrate-Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			12	40	30%	1.5

Regional Wet Weather Characterization Program (RWWCP) Program Term Four

Best Management Practice Analysis and Evaluation Plan (BANEP)

WQ Data Metrics and Evaluation Results Summary Table

Cottonwood Branch - Hackberry Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			NM												0	5		0
				pH			NM												0	5		0
				Specific Conductance			NM												0	5		0
				Temperature			NM												0	5		0
				Turbidity			NM												0	5		0
				E. Coli			NM												0	5		0
				Phosphorus as Orthophosphate			NM												0	5		0
				Nitrate as Nitrogen			NM												0	5		0
				Dissolved Oxygen (Spring)				NM											0	5		0
				pH (Spring)				NM											0	5		0
				Specific Conductance (Spring)				NM											0	5		0
				Temperature (Spring)				NM											0	5		0
				Turbidity (Spring)				NM											0	5		0
				E. Coli (Spring)				NM											0	5		0
				Phosphorus as Orthophosphate (Spring)				NM											0	5		0
				Nitrate as Nitrogen (Spring)				NM											0	5		0
				Dissolved Oxygen (Fall)				NM											0	5		0
				pH (Fall)				NM											0	5		0
				Specific Conductance (Fall)				NM											0	5		0
				Temperature (Fall)				NM											0	5		0
				Turbidity (Fall)				NM											0	5		0
				E. Coli (Fall)				NM											0	5		0
				Phosphorus as Orthophosphate (Fall)				NM											0	5		0
				Nitrate as Nitrogen (Fall)				NM											0	5		0
																			0	120	0%	0
Bioassessment Other	**Bioassessment**			Fish IBI Score			NM												0	5		0
				Habitat Quality Index			NM												0	5		0
				Macroinvertebrate IBI Score			NM												0	5		0
				Fish IBI Score (Spring)				NM											0	5		0
				Habitat Quality Index (Spring)				NM											0	5		0
				Macroinvertebrate IBI Score (Spring)				NM											0	5		0
				Fish IBI Score (Fall)				NM											0	5		0
				Habitat Quality Index (Fall)				NM											0	5		0
				Macroinvertebrate IBI Score (Fall)				NM											0	5		0
																			0	45	0%	0

Regional Wet Weather Characterization Program (RWWCP) Program Term Four

Best Management Practice Analysis and Evaluation Plan (BANEP)

WQ Data Metrics and Evaluation Results Summary Table

Cottonwood Creek - Mountain Creek Lake

Bold Text in Table Indicates POC Group and Status | Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Oil and Grease	**Oils**		**Repeated**	Q1 -Q4	x		2												2	5		2
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			37	40	93%	4.625
pH	**Acidity**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				2											2	5		2
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	0		
				Event Mean Concentration															0	5		0
																			21	40	53%	2.286
Conductivity	**Other**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			9	40	23%	1.125
E. Coli	**Bacteria**		**Repeated (Three Terms)**	Q1 -Q4			2												2	5		2
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5			GM								5	5		5
				Geometric Mean				5	GM								GM		5	5		5
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			34	40	85%	4.25
TDS	**Solids**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				2											2	5		2
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			19	40	48%	2.375
TSS	**Solids**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			37	40	93%	4.625
Atrazine	**Toxic**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			10	40	25%	1.25

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Cottonwood Creek - Mountain Creek Lake

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			21	40	53%	2.625
Total Chromium	**Metals**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			26	40	65%	3.25
Total Copper	**Metals**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			34	40	85%	4.25
Total Lead	**Metals**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			40	40	100%	5
Total Zinc	**Metals**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				2											2	5		2
				Max				2											2	5		2
				Median				5											5	5		5
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			22	40	55%	2.75
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			34	40	85%	4.25

NTTA

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Cottonwood Creek - Mountain Creek Lake

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
COD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			34	40	85%	4.25
Total Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				2											2	5		2
				Max				2											2	5		2
				Median				2											2	5		2
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			19	40	48%	2.38
Dissolved Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			5												5	5		5
				Min				5											5	5		5
				Max				2											2	5		2
				Median				3											3	5		3
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			25	40	63%	3.13
Orthophosphate	**Nutrients**	**New**		Q1 -Q4			5												5	5		5
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			10	40	25%	1.25
Total Nitrogen	**Nutrients**	**New**		Q1 -Q4			4												4	5		4
				Min				2											2	5		2
				Max				5											5	5		5
				Median				3											3	5		3
				Arithmetic Mean				2											2	5		2
				Geometric Mean				2											2	5		2
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			26	40	65%	3.25
Ammonia-Nitrogen	**Nutrients**	**New**		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				5											5	5		5
				Event Mean Concentration															0	0		
																			13	40	33%	1.625
Nitrate-Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				1											1	5		1
				Event Mean Concentration															0	0		
																			8	40	20%	1

NTTA

Regional Wet Weather Characterization Program (RWWCP) Program Term Four

Best Management Practice Analysis and Evaluation Plan (BANEP)

WQ Data Metrics and Evaluation Results Summary Table

Cottonwood Creek - Mountain Creek Lake

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			NM												0	5		0
				pH			NM												0	5		0
				Specific Conductance			NM												0	5		0
				Temperature			NM												0	5		0
				Turbidity			NM												0	5		0
				E. Coli			NM												0	5		0
				Phosphorus as Orthophosphate			NM												0	5		0
				Nitrate as Nitrogen			NM												0	5		0
				Dissolved Oxygen (Spring)				NM											0	5		0
				pH (Spring)				NM											0	5		0
				Specific Conductance (Spring)				NM											0	5		0
				Temperature (Spring)				NM											0	5		0
				Turbidity (Spring)				NM											0	5		0
				E. Coli (Spring)				NM											0	5		0
				Phosphorus as Orthophosphate (Spring)				NM											0	5		0
				Nitrate as Nitrogen (Spring)				NM											0	5		0
				Dissolved Oxygen (Fall)				NM											0	5		0
				pH (Fall)				NM											0	5		0
				Specific Conductance (Fall)				NM											0	5		0
				Temperature (Fall)				NM											0	5		0
				Turbidity (Fall)				NM											0	5		0
				E. Coli (Fall)				NM											0	5		0
				Phosphorus as Orthophosphate (Fall)				NM											0	5		0
				Nitrate as Nitrogen (Fall)				NM											0	5		0
																			0	120	0%	0
Bioassessment Other	**Bioassessment**			Fish IBI Score			NM												0	5		0
				Habitat Quality Index			NM												0	5		0
				Macroinvertebrate IBI Score			NM												0	5		0
				Fish IBI Score (Spring)				NM											0	5		0
				Habitat Quality Index (Spring)				NM											0	5		0
				Macroinvertebrate IBI Score (Spring)				NM											0	5		0
				Fish IBI Score (Fall)				NM											0	5		0
				Habitat Quality Index (Fall)				NM											0	5		0
				Macroinvertebrate IBI Score (Fall)				NM											0	5		0
																			0	45	0%	0

BMP/POC Groups/Tiers
Results

Watershed Name: Brown Branch Rowlett Creek   Number of Entities: 2
Entity Names (% Jurisdiction): Plano (21%), Garland (5%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	61%	III
MCM 2 - Post Construction Storm Water Control Measures	72%	IV
MCM 3 - IDDE	81%	IV
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	56%	III
MCM 5 - Industrial and High Risk Runoff	72%	IV
MCM 6 - Construction Site Stormwater Runoff	64%	III
MCM 7 - Public Education, Outreach, Involvement and Participation	59%	III
MCM 8 - Monitoring, Evaluation and Reporting	79%	IV
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	68%	
BMP Tier	IV	
POC Analysis Results	**Group Result**	**Tier**
Oil and Grease	100%	V
pH	89%	IV
Conductivity	23%	~
E. Coli	69%	III
TDS	77%	IV
TSS	66%	III
Atrazine	26%	~
Total Arsenic	89%	IV
Total Chromium	74%	IV
Total Copper	94%	V
Total Lead	89%	IV
Total Zinc	80%	IV
BOD	86%	IV
COD	91%	V
Total Phosphorus	77%	IV
Dissolved Phosphorus	94%	V
Orthophosphate	26%	~
Total Nitrogen	71%	IV
Ammonia-Nitrogen	20%	~
Nitrate-Nitrogen	14%	~
Bioassessment Water Quality	84%	IV
Bioassessment Indices	47%	II
POC Group Result	78%	
POC Tier	IV	
Overall Watershed BMP/POC Group/Tier	**73%**	**IV**

BMP/POC Groups/Tiers
Results

Watershed Name: Brown Branch Rowlett Creek **Number of Entities: 2**
Entity Names (% Jurisdiction): Plano (21%), Garland (5%)

BMP Analysis Comments:

POC Analysis Comments:
Annual Loading not applicable to this watershed

BMP/POC Groups/Tiers
Results

Watershed Name: Headwaters Rowlett Creek Number of Entities: 1
Entity Names (% Jurisdiction): Plano (11%)

BMP Analysis Results	Group Result	Tier
MCM 1 - Maintenance Activities	64%	IV
MCM 2 - Post Construction Storm Water Control Measures	76%	IV
MCM 3 - IDDE	77%	IV
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	74%	IV
MCM 5 - Industrial and High Risk Runoff	97%	V
MCM 6 - Construction Site Stormwater Runoff	67%	IV
MCM 7 - Public Education, Outreach, Involvement and Participation	69%	III
MCM 8 - Monitoring, Evaluation and Reporting	75%	IV
OTHER - Impaired Receiving Waters	0%	~
BMP Group Result	75%	
BMP Tier	IV	
POC Analysis Results	**Group Result**	**Tier**
Oil and Grease	26%	~
pH	23%	~
Conductivity	20%	~
E. Coli	11%	~
TDS	23%	~
TSS	9%	~
Atrazine	29%	~
Total Arsenic	17%	~
Total Chromium	17%	~
Total Copper	23%	~
Total Lead	23%	~
Total Zinc	23%	~
BOD	17%	~
COD	17%	~
Total Phosphorus	23%	~
Dissolved Phosphorus	26%	~
Orthophosphate	23%	~
Total Nitrogen	17%	~
Ammonia-Nitrogen	26%	~
Nitrate-Nitrogen	14%	~
Bioassessment Water Quality	0%	~
Bioassessment Indices	0%	~
POC Group Result	17%	
POC Tier	I	
Overall Watershed BMP/POC Group/Tier	**46%**	**II**

BMP/POC Groups/Tiers
Results

Watershed Name: Headwaters Rowlett Creek **Number of Entities: 1**

Entity Names (% Jurisdiction): Plano (11%)

BMP Analysis Comments:

POC Analysis Comments:
Annual Loading not applicable to this watershed. Minimum amount of data (70%) not avaiable to conduct WQ analysis.

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Brown Branch Rowlett Creek

Bold Text in Table Indicates MCMs and BMPs

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			5								5	5		5
				Types of structural controls			2								2	5		2
				Number of structural controls in watershed			5								5	5		5
				Locations of structural controls							1				1	5		1
				Fully Operational Dates								3			3	5		3
				Applicable POCs addressed									3		3	5		3
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															15	29	52%	3
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					5						5	5		5
				Maintenance Activity hours				4							4	5		4
				Number of maintained infrastructure			4								4	5		4
				Locations of activity hours							3				3	5		3
				Locations of maintained infrastructure							1				1	5		1
				Dates of maintenance activities								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															23	34	68%	3.625
MCM 1 - Maintenance Activities	**Roadways**	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				5							5	5		5
				Street Sweeping miles					5						5	5		5
				Locations of street sweeping hours and/or miles							1				1	5		1
				Dates of street sweeping activities								3			3	5		3
				Applicable POCs									2		2	5		2
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)										-5	-5	-1		1
															11	24	46%	2.833
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					5						5	5		5
				Litter pickup hours				5							5	5		5
				Litter pickup tonnage			5								5	5		5
				Summary of litter pickup			5								5	5		5
				Locations of litter pickup miles, hours and tonnage							1				1	5		1
				Dates of litter pickup activities and associated mileage, hours and tonnage								3			3	5		3
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															25	34	74%	3.875
															74	121	61%	3.333
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			5								5	5		5
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects			5								5	5		5
MCM 2 - Post Construction Storm Water Control Measures				Documentation of the consideration/not of WQ measures for above listed projects			5								5	5		5
				Locations of completed flood control/drainage improvement and other projects							1				1	5		1
				Dates of completion of the above listed projects								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															21	29	72%	3.857

Plano

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Brown Branch Rowlett Creek

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
MCM 3 - IDDE	Illicit and Allowable Discharges	Non-Structural	Ordinance/Criteria Manual	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			5								5	5		5
	MS4 Outfall Map	Non-Structural	Documentation	Implemented HHW			5								5	5		5
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	Non-Structural	Interactive/Operational/Municipal	HHW program details including types of collected items			5								5	5		5
				Tonnage and associated sources of collected waste											0	0		0
				Locations/sources or coverage/service areas of waste collection											0	0		0
				Tonnage and associated sources of collected waste											0	0		0
				Dates of waste collection or availability of collection mechanisms								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)										-3	-3	-1		3
															21	24	88%	4.5
	SS0s and Response Actions	Non-Structural	Operational/Municipal	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			5								5	5		5
	Other Spill/Hazardous Event Responses	Non-Structural	Operational/Municipal	Listing of responses including immediate actions and follow up work orders and investigations			5								5	5		5
	Illicit Discharge Response	Non-Structural	Operational/Municipal	Locations of SSOs, spills, hazardous events and illicit discharges							1				1	5		1
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)										-2	-2	-1		4
															18	24	75%	4
															39	48	81%	4.25

Plano

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Brown Branch Rowlett Creek

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Quantity/Type: #	hrs.	miles	Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			5								5	5		5
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees			5								5	5		5
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program											0	0		0
				Dates of training activities for municipal operational staff								2			2	5		2
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)										-3	-3	-1		3
															14	19	74%	4
	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			5								5	5		5
				Number of facilities inspected			4								4	5		4
				Locations of facilities inspected							1				1	5		1
				Dates when facilities were inspected								3			3	5		3
				Dates when identified issues were resolved								1			1	5		1
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)										-5	-5	-1		1
															13	29	45%	2.714
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4			3								3	5		3
				Locations of waste collection and handling services											0	0		0
				Dates of availability of waste collection services											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services										-3	-3	-1		3
															5	9	56%	3.667
															32	57	56%	3.460

Plano

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Quantity/Type: #	Quantity/Type: hrs.	Quantity/Type: miles	Quantity/Type: Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential				Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			5								5	5		5
				Locations of facilities from above list							1				1	5		1
				List of facilities that were inspected			5								5	5		5
				Dates when facilities were inspected and records of issues identified and response action items								5			5	5		5
				Dates when identified issues were resolved								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)										-4	-4	-1		2
															21	29	72%	3.857
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			5								5	5		5
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects			5								5	5		5
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable			2								2	5		2
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)			5								5	5		5
				Records of inspection activities			4								4	5		4
				Number of inspected sites			3								3	5		3
				Locations of construction projects and associated inspection activities							1				1	5		1
				Dates of inspection activities								3			3	5		3
				Response times to inspection deficiencies											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)										-5	-5	-1		1
															28	44	64%	3.4
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			5								5	5		5
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms			5								5	5		5
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)							1				1	5		1
				Record of audiences targeted by public education tools			2								2	5		2
				Level of participation using public education tools											0	0		0
				List of citizen complaint tools and/or modes											0	0		0
				Availability and/or accessibility of complaint tools											0	0		0
				Complaint records			2								2	5		2
				Response records to complaints including dates of resolution											0	5		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)											0	-1		0
															20	34	59%	3.333

Plano

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	**BMP**	**BMP Type**	**BMP Subtype**	**BMP Activity/Metrics**	**Analysis Category**		**Quantity/Type**				**Location/Coverage**	**Timelines/Frequency**	**POCs Addressed**	**Land Use/Pollution Potential**	**Total**	**Max**	**Total/Max**	**Tier**
				Data Required	**Spatial**	**Non-Spatial**	**#**	**hrs.**	**miles**	**Other (cy, acres, $)**								
MCM 8 - Monitoring, Evaluation and Reporting	**Screening and Monitoring**	**Non-Structural**	**Monitoring/Sampling**	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								**5**	**5**		**5**
	Evaluations/Reporting	**Non-Structural**	**Data Management**	Locations of monitoring activities							1				**1**	**5**		**1**
				Dates of monitoring activities								5			**5**	**5**		**5**
				Types of monitoring activities conducted			4								**4**	**5**		**4**
				Response timelines to resolution of illicit discharges and exceedances											**0**	**0**		**0**
				Applicable POCs addressed									5		**5**	**5**		**5**
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)										-1	**-1**	**-1**		**5**
															19	**24**	**79%**	**4.167**
OTHER - Impaired Receiving Waters	**Impaired water bodies and TMDL Requirements**	**Non-Structural/ Structural**	**Monitoring/Performance**	Records of identified targeted controls and/or focused BMPs											**0**	**5**		**0**
	TMDL Water Bodies	**Non-Structural/ Structural**	**Monitoring/Performance**	Number and types of targeted controls and/or focused BMPs											**0**	**5**		**0**
	Impaired water bodies and TMDL Requirements	**Non-Structural/ Structural**	**Monitoring/Performance**	Locations of targeted controls and/or focused BMPs											**0**	**5**		**0**
				Fully operational dates of controls or frequency of implementation											**0**	**5**		**0**
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											**0**	**5**		**0**
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											**0**	**-1**		**0**
															0	**24**	**0%**	**ND**

Plano

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Headwaters Rowlett Creek

Bold Text in Table Indicates MCMs and BMPs

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	Structural Controls	**Structural**	**Performance**	Listing of structural controls			5								5	5		5
				Types of structural controls			2								2	5		2
				Number of structural controls in watershed			2								2	5		2
				Locations of structural controls							5				5	5		5
				Fully Operational Dates								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-4	-4	-1		2
															19	29	66%	3.57
	Structural Controls	**Non-Structural & Structural**	**Maintenance/Operational/ Municipal**	Listing of Maintenance Activities					5						5	5		5
				Maintenance Activity hours				2							2	5		2
				Number of maintained infrastructure			2								2	5		2
				Locations of activity hours							3				3	5		3
				Locations of maintained infrastructure							1				1	5		1
				Dates of maintenance activities								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-3	-3	-1		3
															20	34	59%	3.25
MCM 1 - Maintenance Activities	**Roadways**	**Non-Structural**	**Operational/Municipal**	Street Sweeping hours				5							5	5		5
				Street Sweeping miles					2						2	5		2
				Locations of street sweeping hours and/or miles							3				3	5		3
				Dates of street sweeping activities								3			3	5		3
				Applicable POCs									2		2	5		2
				Sources of POCs in watershed (Active construction sites and locations, Ice Events & Locations, Other Deicing Mitigation, Paved/transportation ROWs)										-1	-1	-1		5
															14	24	58%	3.33
	Floatables	**Non-Structural**	**Operational/Municipal**	Litter pickup miles					5						5	5		5
				Litter pickup hours				5							5	5		5
				Litter pickup tonnage			5								5	5		5
				Summary of litter pickup			2								2	5		2
				Locations of litter pickup miles, hours and tonnage							1				1	5		1
				Dates of litter pickup activities and associated mileage, hours and tonnage								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-3	-3	-1		3
															25	34	74%	3.875
															78	121	64%	3.51
	New Development and Significant Redevelopment	**Non-Structural**	**Ordinance/Criteria Manual**	Implemented Ordinance/Enforcement Mechanism/Development Criteria Manual			5								5	5		5
	Flood Control	**Non-Structural & Structural**	**Documentation**	Listings of completed flood control/drainage improvement and other projects			5								5	5		5
MCM 2 - Post Construction Storm Water Control Measures				Documentation of the consideration/not of WQ measures for above listed projects			5								5	5		5
				Locations of completed flood control/drainage improvement and other projects							1				1	5		1
				Dates of completion of the above listed projects								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Locations of Residential, Commercial, Industrial, Transportation, Undeveloped, Recreational/Open Areas)										-3	-3	-1		3
															22	29	76%	4

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Headwaters Rowlett Creek

											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)								
	Illicit and Allowable Discharges	Non-Structural	Ordinance/Criteria Manual	Implemented ordinance or enforcement mechanism, IDDE Manual & up-to-date MS4 outfall map			5								5	5		5
	MS4 Outfall Map	Non-Structural	Documentation	Implemented HHW			5								5	5		5
	Household Hazardous Waste (HHW) & Used Motor Vehicle Fluids	Non-Structural	Interactive/Operational/Municipal	HHW program details including types of collected items			5								5	5		5
				Tonnage and associated sources of collected waste											0	0		0
				Locations/sources or coverage/service areas of waste collection											0	0		0
				Tonnage and associated sources of collected waste											0	0		0
				Dates of waste collection or availability of collection mechanisms								5			5	5		5
				Applicable POCs addressed									4		4	5		4
MCM 3 - IDDE				Sources of POCs in watershed (quantity and types of waste, locations of Residential, Commercial, Industrial, Transportation, Recreational/Open Areas)										-3	-3	-1		3
															21	24	88%	4.5
	SSOs and Response Actions	Non-Structural	Operational/Municipal	Listing of SSOs, spills, Hazardous Events, and Illicit Discharges			5								5	5		5
	Other Spill/Hazardous Event Responses	Non-Structural	Operational/Municipal	Listing of responses including immediate actions and follow up work orders and investigations			2								2	5		2
	Illicit Discharge Response	Non-Structural	Operational/Municipal	Locations of SSOs, spills, hazardous events and illicit discharges							1				1	5		1
				Dates and times of SSOs, spills, hazardous events and illicit discharges, dates and times of responses, and dates and times of complete eradication of causes and effects.								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (# and sizes of spills and illicit discharges, locations of outfalls, WWTPs, Storm Events, Discharges that make it to the storm sewer, Industries, illegal Dumping Incidents)										-1	-1	-1		5
															16	24	67%	3.667
															37	48	77%	4.083

Plano

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Headwaters Rowlett Creek

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics	Analysis Category		Quantity/Type				Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)			Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential				
				Data Required	Spatial	Non-Spatial	#	hrs.	miles	Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
MCM 4 - Pollution Prevention and Good Housekeeping (PP/GH) for Municipal Operations	PP/GH Program (Including Training)	Non-Structural	Criteria Manual/Guidelines/Educational	Implemented program document and guidelines including listing of Municipal Facilities including POCs, prioritization, inspection guidelines and records of pesticide, herbicide and fertilizer application program			5								5	5		5
	Municipal Facilities	Non-Structural	Documentation	Training records for operational staff including attendees			5								5	5		5
	Pesticide, Herbicide and Fertilizer Application	Non-Structural	Guidelines/Documentation	Locations of application of pesticide program											0	0		0
				Dates of training activities for municipal operational staff								2			2	5		2
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Animal Services, Airports, Landfills, Recreational Centers, Parks and Golf Courses, Storage Facilities, Maintenance Facilities, Water/Wastewater Plants, Fire Stations, Pools, Waste Handling)										-2	-2	-1		4
															15	19	79%	4.2
	PP/GH Program (Facility Inspections)	Non-Structural	Guidelines/Inspections/Surveys	Listing of facilities inspected			5								5	5		5
				Number of facilities inspected			2								2	5		2
				Locations of facilities inspected							3				3	5		3
				Dates when facilities were inspected								5			5	5		5
				Dates when identified issues were resolved								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (Issues identified; rain events prior to issues resolution; elapsed time prior to resolution)										-2	-2	-1		4
															22	29	76%	4
	Waste Handling	Non-Structural & Structural	Operational/Municipal	Number and types of waste collection and handling mechanisms employed by MS4			3								3	5		3
				Locations of waste collection and handling services											0	0		0
				Dates of availability of waste collection services											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (Locations of municipal waste generation sources and handling services										-3	-3	-1		3
															5	9	56%	3.667
															42	57	74%	3.956

Plano

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
BMP Data Metrics and Evaluation Results Summary Table
Headwaters Rowlett Creek

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category: Spatial	Analysis Category: Non-Spatial	Quantity/Type: #	Quantity/Type: hrs.	Quantity/Type: miles	Quantity/Type: Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
											Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)							
							Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential											
MCM 5 - Industrial and High Risk Runoff	Policies, Procedures & Monitoring and/or Oversight	Non-Structural	Guidelines/Inspections/ Permits/Monitoring Oversight	Listing of facilities subject to MSGPs, Individual and other environmental permits (pretreatment, EPCRA, SARA)			5								5	5		5
				Locations of facilities from above list							5				5	5		5
				List of facilities that were inspected			5								5	5		5
				Dates when facilities were inspected and records of issues identified and response action items								5			5	5		5
				Dates when identified issues were resolved								5			5	5		5
				Applicable POCs addressed									4		4	5		4
				Sources of POCs in watershed (quantity and types of facilities, issues identified, response timelines, benchmark/numeric exceedances, storm events)										-1	-1	-1		5
															28	29	97%	4.857
MCM 6 - Construction Site Stormwater Runoff	Regulatory Requirements	Non-Structural	Ordinance/Review Guidelines/Criteria Manuals/Permits	Implemented ordinance or enforcement mechanism and design/development criteria manual			5								5	5		5
	Active Construction Sites Listings	Non-Structural	Documentation	Listing of active construction projects			5								5	5		5
	Site Operator Training and Notifications	Non-Structural	Educational	Records of reviews, predevelopment meetings, notifications, training for site operators as applicable			2								2	5		2
	Inspections and Enforcement	Non-Structural	Inspections/Surveys/ Investigations	Details of reviews, predevelopment meetings, notifications, training for site operators as applicable (including related projects & attendees)			5								5	5		5
				Records of inspection activities			2								2	5		2
				Number of inspected sites			3								3	5		3
				Locations of construction projects and associated inspection activities							1				1	5		1
				Dates of inspection activities								1			1	5		1
				Response times to inspection deficiencies								5			5	5		5
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (acreage of construction activities by site, # of inspection deficiencies, response timelines, storm events, enforcement actions, TxDOT or other MS4 projects listings)										-1	-1	-1		5
															33	49	67%	3.545
MCM 7 - Public Education, Outreach, Involvement and Participation	Education and Outreach	Non-Structural & Structural	Educational/Interactive	Records of public education tools and mechanisms (online, radio and tv, billboards, material, decals, events, target audiences reached, other)			5								5	5		5
	Public Input	Non-Structural	Educational/Interactive	Types of public education mechanisms			2								2	5		2
	Citizen complaint mechanism	Non-Structural	Interactive/Operational/Municipal	Locations of all of public education platforms (if trackable)							5				5	5		5
				Record of audiences targeted by public education tools			2								2	5		2
				Level of participation using public education tools											0	0		0
				List of citizen complaint tools and/or modes			1								1	5		1
				Availability and/or accessibility of complaint tools											0	0		0
				Complaint records											0	0		0
				Response records to complaints including dates of resolution											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of complaints and sources, types of issues reported, response timelines, storm events between responses)											0	-1		0
															20	29	69%	3.333

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Even distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)
Evaluation Criteria (-1 - Low pollution potential; -2 - Average to low pollution potential; -3 - Average pollution potential; -4 - medium to high pollution potential; -5 - High Pollution Potential

MCM	BMP	BMP Type	BMP Subtype	BMP Activity/Metrics Data Required	Analysis Category Spatial	Analysis Category Non-Spatial	Quantity/Type #	Quantity/Type hrs.	Quantity/Type miles	Quantity/Type Other (cy, acres, $)	Location/Coverage	Timelines/Frequency	POCs Addressed	Land Use/Pollution Potential	Total	Max	Total/Max	Tier
MCM 8 - Monitoring, Evaluation and Reporting	Screening and Monitoring	Non-Structural	Monitoring/Sampling	Records/Details of monitoring activities (Dry Weather, Wet Weather, Representative, Industrial & High-Risk, Floatables, Bioassessment, Other)			5								5	5		5
	Evaluations/Reporting	Non-Structural	Data Management	Locations of monitoring activities							1				1	5		1
				Dates of monitoring activities								5			5	5		5
				Types of monitoring activities conducted			4								4	5		4
				Response timelines to resolution of illicit discharges and exceedances											0	0		0
				Applicable POCs addressed									5		5	5		5
				Sources of POCs in watershed (# of issues identified, exceedances recorded, storm events, third party connections, # of outfalls, sampling results and evaluation conclusions)										-2	-2	-1		4
															18	24	75%	4
OTHER - Impaired Receiving Waters	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Records of identified targeted controls and/or focused BMPs											0	5		0
	TMDL Water Bodies	Non-Structural/ Structural	Monitoring/Performance	Number and types of targeted controls and/or focused BMPs											0	5		0
	Impaired water bodies and TMDL Requirements	Non-Structural/ Structural	Monitoring/Performance	Locations of targeted controls and/or focused BMPs											0	5		0
				Fully operational dates of controls or frequency of implementation											0	5		0
				POCs addressed (Performance in relation to benchmarks/WLAs I applicable)											0	5		0
				Sources of POCs in watershed (POCs and bacteria related sources [Land use data], storm events, third party connections to MS4)											0	-1		0
															0	24	0%	ND

Plano

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Brown Branch Rowlett Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Oil and Grease	Oils		Repeated	Q1 -Q4	x		5												5	5		5
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			35	35	100%	5.00
pH	Acidity		Repeated	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading															0	0		
				Event Mean Concentration															0	0		
																			31	35	89%	4.429
Conductivity	Other		Repeated	Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		
				Event Mean Concentration															0	0		
																			8	35	23%	1.143
E. Coli	Bacteria		Repeated (Three Terms)	Q1 -Q4			3												3	5		3
				Min				3											3	5		3
				Max				5											5	5		5
				Median				3											3	5		3
				Arithmetic Mean				5			GM								5	5		5
				Geometric Mean				3	GM								GM		3	5		3
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		
				Event Mean Concentration															0	0		
																			24	35	69%	3.429
TDS	Solids		Repeated	Q1 -Q4			3												3	5		3
				Min				3											3	5		3
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				3											3	5		3
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			27	35	77%	3.86
TSS	Solids		Repeated	Q1 -Q4			3												3	5		3
				Min				3											3	5		3
				Max				5											5	5		5
				Median				3											3	5		3
				Arithmetic Mean				5											5	5		5
				Geometric Mean				3											3	5		3
																		1	1	5		1
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			23	35	66%	3.286
Atrazine	Toxic	New		Q1 -Q4			5												5	5		5
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			9	35	26%	1.286

Plano

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Brown Branch Rowlett Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	**Metals**		**Repeated**	Q1 -Q4			1												1	5		1
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			31	35	89%	4.43
Total Chromium	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				5											5	5		5
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			26	35	74%	3.71
Total Copper	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			33	35	94%	4.71
Total Lead	**Metals**		**Repeated**	Q1 -Q4			1												1	5		1
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			31	35	89%	4.43
Total Zinc	**Metals**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				5											5	5		5
				Max				3											3	5		3
				Median				5											5	5		5
				Arithmetic Mean				3											3	5		3
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			28	35	80%	4.00
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			2												2	5		2
				Min				5											5	5		5
				Max				3											3	5		3
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			30	35	86%	4.29

Plano

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Brown Branch Rowlett Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
COD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				3											3	5		3
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			32	35	91%	4.57
Total Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			4												4	5		4
				Min				5											5	5		5
				Max				3											3	5		3
				Median				3											3	5		3
				Arithmetic Mean				3											3	5		3
				Geometric Mean				5											5	5		5
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			27	35	77%	3.86
Dissolved Phosphorus	**Nutrients**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				5											5	5		5
				Max				5											5	5		5
				Median				5											5	5		5
				Arithmetic Mean				5											5	5		5
				Geometric Mean				5											5	5		5
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			33	35	94%	4.71
Orthophosphate	**Nutrients**	**New**		Q1 -Q4			5												5	5		5
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			9	35	26%	1.29
Total Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				3											3	5		3
				Max				5											5	5		5
				Median				3											3	5		3
				Arithmetic Mean				5											5	5		5
				Geometric Mean				3											3	5		3
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			25	35	71%	3.57
Ammonia-Nitrogen	**Nutrients**	**New**		Q1 -Q4			2												2	5		2
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			7	35	20%	0.875
Nitrate-Nitrogen	**Nutrients**	**New**		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			5	35	14%	0.71

Plano

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Brown Branch Rowlett Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			5												5	5		5
				pH			5												5	5		5
				Specific Conductance			5												5	5		5
				Temperature			5												5	5		5
				Turbidity			5												5	5		5
				E. Coli			5												5	5		5
				Phosphorus as Orthophosphate			5												5	5		5
				Nitrate as Nitrogen			5												5	5		5
				Dissolved Oxygen (Spring)				3											3	5		3
				pH (Spring)				3											3	5		3
				Specific Conductance (Spring)				2											2	5		2
				Temperature (Spring)				3											3	5		3
				Turbidity (Spring)				3											3	5		3
				E. Coli (Spring)				3											3	5		3
				Phosphorus as Orthophosphate (Spring)				5											5	5		5
				Nitrate as Nitrogen (Spring)				2											2	5		2
				Dissolved Oxygen (Fall)				4											4	5		4
				pH (Fall)				5											5	5		5
				Specific Conductance (Fall)				4											4	5		4
				Temperature (Fall)				4											4	5		4
				Turbidity (Fall)				5											5	5		5
				E. Coli (Fall)				5											5	5		5
				Phosphorus as Orthophosphate (Fall)				5											5	5		5
				Nitrate as Nitrogen (Fall)				5											5	5		5
																			101	120	84%	4.21
Bioassessment Other	**Bioassessment**			Fish IBI Score			1												1	5		1
				Habitat Quality Index			5												5	5		5
				Macroinvertebrate IBI Score			1												1	5		1
				Fish IBI Score (Spring)				5											5	5		5
				Habitat Quality Index (Spring)				2											2	5		2
				Macroinvertebrate IBI Score (Spring)				2											2	5		2
				Fish IBI Score (Fall)				2											2	5		2
				Habitat Quality Index (Fall)				2											2	5		2
				Macroinvertebrate IBI Score (Fall)				1											1	5		1
																			21	45	47%	2.33

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Headwaters Rowlett Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
	Oils		**Repeated**	Q1 -Q4	x		4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
Oil and Grease																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			9	35	26%	1.29
	Acidity		**Repeated**	Q1 -Q4			5												5	5		5
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
pH																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading															0	0		
				Event Mean Concentration															0	0		
																			8	35	23%	1.143
	Other		**Repeated**	Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
Conductivity																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		
				Event Mean Concentration															0	0		
																			7	35	20%	1.000
	Bacteria		**Repeated (Three Terms)**	Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND			GM								0	5		0
				Geometric Mean				ND	GM								GM		0	5		0
E. Coli																		1	1	5		1
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		
				Event Mean Concentration															0	0		
																			4	35	11%	0.571
	Solids		**Repeated**	Q1 -Q4			5												5	5		5
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
TDS																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			8	35	23%	1.14
	Solids		**Repeated**	Q1 -Q4			2												2	5		2
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
TSS																		1	1	5		1
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			3	35	9%	0.429
	Toxic	**New**		Q1 -Q4			5												5	5		5
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
Atrazine																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			10	35	29%	1.429

Plano

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Total Arsenic	**Metals**		**Repeated**	Q1 -Q4			1												1	5		1
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			6	35	17%	0.86
Total Chromium	**Metals**		**Repeated**	Q1 -Q4			1												1	5		1
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			6	35	17%	0.86
Total Copper	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			8	35	23%	1.14
Total Lead	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			8	35	23%	1.14
Total Zinc	**Metals**		**Repeated**	Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			8	35	23%	1.14
BOD	**Oxygen Demanding**		**Repeated**	Q1 -Q4			1												1	5		1
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			6	35	17%	0.86

Plano

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Headwaters Rowlett Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
COD	Oxygen Demanding		Repeated	Q1 -Q4			1												1	5		1
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			6	35	17%	0.86
Total Phosphorus	Nutrients		Repeated	Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			8	35	23%	1.14
Dissolved Phosphorus	Nutrients		Repeated	Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			9	35	26%	1.29
Orthophosphate	Nutrients	New		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		4	4	5		4
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			8	35	23%	1.14
Total Nitrogen	Nutrients	New		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		3	3	5		3
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			6	35	17%	0.86
Ammonia-Nitrogen	Nutrients	New		Q1 -Q4			4												4	5		4
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		5	5	5		5
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		0
				Event Mean Concentration															0	0		
																			9	35	26%	1.125
Nitrate-Nitrogen	Nutrients	New		Q1 -Q4			3												3	5		3
				Min				ND											0	5		0
				Max				ND											0	5		0
				Median				ND											0	5		0
				Arithmetic Mean				ND											0	5		0
				Geometric Mean				ND											0	5		0
																		2	2	5		2
				Standard Deviation															0	0		
				Coefficient of Variation															0	0		
				Annual Loading				ND											0	0		ND
				Event Mean Concentration															0	0		
																			5	35	14%	0.71

Regional Wet Weather Characterization Program (RWWCP) Program Term Four
Best Management Practice Analysis and Evaluation Plan (BANEP)
WQ Data Metrics and Evaluation Results Summary Table
Headwaters Rowlett Creek

Bold Text in Table Indicates POC Group and Status

Evaluation Criteria (5 - Meets Criteria; 4 - Majority meets criteria; 3 - Sporadic distribution; 2 - Majority not meeting criteria; 1 - Does Not Meet Criteria)

POC	POC Group	POC Status		POC Metric	Analysis Category		Year to Date	Previous Terms	TSWQ	TCEQ NSL	NSQD	NRSAB	MSGP-Numeric	MSGP-Benchmark	TMDL	NURP	CRP	Comparative (Other WQ Data)	Total	Max	Total/Max	Tier
		New	Repeated	Data Required	Trend	Comparative																
Bioassessment Water Quality	**Bioassessment**			Dissolved Oxygen			NM												0	5		0
				pH			NM												0	5		0
				Specific Conductance			NM												0	5		0
				Temperature			NM												0	5		0
				Turbidity			NM												0	5		0
				E. Coli			NM												0	5		0
				Phosphorus as Orthophosphate			NM												0	5		0
				Nitrate as Nitrogen			NM												0	5		0
				Dissolved Oxygen (Spring)				NM											0	5		0
				pH (Spring)				NM											0	5		0
				Specific Conductance (Spring)				NM											0	5		0
				Temperature (Spring)				NM											0	5		0
				Turbidity (Spring)				NM											0	5		0
				E. Coli (Spring)				NM											0	5		0
				Phosphorus as Orthophosphate (Spring)				NM											0	5		0
				Nitrate as Nitrogen (Spring)				NM											0	5		0
				Dissolved Oxygen (Fall)				NM											0	5		0
				pH (Fall)				NM											0	5		0
				Specific Conductance (Fall)				NM											0	5		0
				Temperature (Fall)				NM											0	5		0
				Turbidity (Fall)				NM											0	5		0
				E. Coli (Fall)				NM											0	5		0
				Phosphorus as Orthophosphate (Fall)				NM											0	5		0
				Nitrate as Nitrogen (Fall)				NM											0	5		0
																			0	120	0%	0.00
Bioassessment Other	**Bioassessment**			Fish IBI Score			NM												0	5		0
				Habitat Quality Index			NM												0	5		0
				Macroinvertebrate IBI Score			NM												0	5		0
				Fish IBI Score (Spring)				NM											0	5		0
				Habitat Quality Index (Spring)				NM											0	5		0
				Macroinvertebrate IBI Score (Spring)				NM											0	5		0
				Fish IBI Score (Fall)				NM											0	5		0
				Habitat Quality Index (Fall)				NM											0	5		0
				Macroinvertebrate IBI Score (Fall)				NM											0	5		0
																			0	45	0%	0.00

Plano