NUTRIENT SAMPLING IN PETRONILA CREEK

Final Report

CBBEP Project No. 2003
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Executive Summary

The intent of the nutrient sampling project is to quantify the spacial and temporal distribution of nutrient parameters in the above tidal portion of Petronila Creek (TCEQ Segment 2204). Monthly surface water quality monitoring began in January 2020 and continued through December 2020 at 13 stations that are located throughout the southeastern portion of the watershed east of US 77. Four stations are located on the main stem of the creek and nine stations are located on the tributaries of the creek. Average flow rates at the main stem creek sites average between 1.0 and 3.0 cubic feet per second between rain events. The first five months of the study period coincided with drought conditions that resulted in lower than average flow conditions at all sites. One high flow event was monitored during the project period. An early June rain event resulted in a peak flow of approximately 460 cubic feet per second on June 2nd. Data collection occurred on June 3rd at a flow rate of approximately 160 cubic feet per second measured at the streamgage at FM 665 near Driscoll which is located in the northwestern end of the study area. The remainder of the study period had average precipitation rates and sampling occurred at low flow conditions. Nutrient parameters analyzed for the study include ammonia, nitrate nitrogen, nitrite nitrogen, total phosphorus, total kjeldahl nitrogen, dissolved kjeldahl nitrogen, chlorophyll-*a* and pheophytin. Ammonia concentrations were very low during the study period with the majority of the results being at or below detection limits of laboratory equipment. Nitrate nitrogen concentrations rose in the spring from March through May regardless of streamflow rates while nitrite nitrogen concentrations were consistently at or near the lower detection limits of laboratory equipment. Total phosphorus concentrations were generally moderate with occasional screening level exceedances not associated with streamflow variations. The highest concentrations of total phosphorus (TP) were recorded in the upper portion of the study area on the main stem of the creek just downstream of the Driscoll WWTP outfall. Concentrations of TP decreased as the creek progressed downstream toward the bay. Dissolved and total kjeldahl nitrogen were moderately elevated at many of the tributary and main stem creek sites and decreased as they moved downstream toward the bay. Chlorophyll *a* concentrations were very high in the system throughout the study period under a variety of flow conditions.

Acknowledgements

Sampling for the study was conducted from January through December 2020, during the COVID-19 pandemic. NRA could not have fulfilled the obligations required to complete the study without the data from the laboratories at the City of Corpus Christi Water Utilities Laboratory (WUL) and the Texas A&M Corpus Christi Center for Coastal Studies Lab (CCSL). Nueces River Authority (NRA) staff would like to show its appreciation to these labs for allowing NRA to keep submitting samples to fulfill the needs of the contract. We are grateful for the Coastal Bend Bays and Estuaries (CBBEP) for financial support, interest and expertise.

Figure 1. Picture of Petronila Creek Above Tidal

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Introduction

Surface water quality monitoring in Texas is routinely conducted by the Texas Commission on Environmental Quality (TCEQ) and its Clean Rivers Program (CRP) partners to assess the status of water quality of streams, rivers, lakes, and bays throughout the state. The Texas Surface Water Quality Standards establish criteria to protect designated uses including aquatic life, water supply, and recreation against degradation. The criteria for evaluating support of the designated uses include dissolved oxygen, temperature, pH, dissolved minerals, toxic substances, and bacteria. However, TCEQ does not have numerical criteria for nutrients in their surface water quality standards. In Texas, nutrient controls have taken the form of narrative criteria, watershed rules, and anti-degradation considerations in permitting actions. TCEQ screens ammonia, nitrate nitrogen, total phosphorus, and chlorophyll monitoring data as a preliminary indication of areas of possible concern (TCEQ). The following charts explains the potential causes and impacts when water quality screening levels for certain water quality parameters are not met.

Parameter	Nutrient Screening Levels for Petronila Creek Above Tidal	Calculation Used for Concern
Ammonia-Nitrogen	0.33 mg/l	20% of samples are above the criteria
Nitrate	1.95 mg/l	
Total phosphorus	0.69 mg/l	
Chlorophyll-a	14.1 µg/l	

Figure 2. TCEQ screening levels for nutrient parameters

Figure 3. Aerial view of Petronila Creek and Tributary Station 21598

Parameter	Cause	Impact
Ammonia	Ammonia is excreted by animals and is produced during the decomposition of plants and animals. It is an ingredient in many fertilizers and is also present in sewage, storm water runoff, certain industrial wastewaters, and runoff from animal feedlots.	Elevated levels of ammonia in the environment can adversely affect fish and invertebrate reproductive capacity and reduced growth of the young.
Nitrates & Total phosphorus	Nutrients are found in effluent released from wastewater treatment plants (WWTP)s, fertilizers, and agricultural runoff carrying animal waste from farms and ranches. Soil erosion and runoff from farms, lawns, and gardens can add nutrients to the water.	These nutrients increase plant and algae growth. When plants and algae die, the bacteria that decompose them use oxygen so that is no longer available for fish and other living aquatic life. High levels of nitrate and nitrites can produce Nitrite Toxicity, or "brown blood disease," in fish. This disease reduces the ability of blood to transport oxygen throughout the body.
Chlorophyll-*a*	Modifications to the riparian zone, human activity that causes water increases in organic matter, nutrients, bacteria, and over abundant algae.	Chlorophyll-*a* is the photosynthetic pigment found in all green plants, algae, and cyanobacteria. Elevated levels indicate abundant plant growth which could lead to reduced DO levels.

Figure 4. Causes and impacts of excess nutrient parameters

The designated uses for Petronila Creek Above Tidal (TCEQ Segment 2204) include primary contact recreation and intermediate aquatic life use. Surface water quality monitoring assessments for Segment 2204 indicate impairments exist for total dissolved solids (TDS), sulfate, chloride, and bacteria. In response to the dissolved mineral impairments, a Total Maximum Daily Load (TMDL) project for TDS, sulfate, and chloride have been developed that includes increased water quality monitoring of the main stem and select tributary stations. The bacteria impairment will likely be analyzed through a standards review process called a Recreation Use Attainability Analysis (RUAA) in the future. Segment 2204 also has screening level concerns for Chlorophyll-*a* which indicate a possible degradation of water quality due to excessive nutrients.

The receiving water body for Petronila Creek is Alazan Bay which is an arm of Baffin Bay (TCEQ Segment 2492). Surface water quality monitoring by TCEQ in Baffin Bay has identified an exceedance to the screening level for chlorophyll *a* since 2002. In the last decade, water quality issues resulting in the disruptions of food webs, low dissolved oxygen events, fish kills, and excessive growth of phytoplankton indicators including chlorophyll *a* have led to an increase in concern and awareness from the public,

academia, and government agencies. Scientists at Harte Research Institute (HRI) have determined that the primary causes of the water quality concern is due to excessive nutrients in the bay. Efforts to determine the source of nutrient enrichment have centered on the contributions of surface waters from three main tributaries: Petronila, San Fernando, and Los Olmos creeks, all of which have current quarterly water quality monitoring stations.

To provide further clarity regarding nutrient inputs into the Baffin Bay system, this study presents 12 months of water quality data from thirteen stations located on the main stem and tributaries of Petronila Creek Above Tidal for ammonia, TKN, Dissolved TKN, nitrate nitrogen, nitrite nitrogen, and chlorophyll *a.*

Figure 5. Algal growth at tributary Station 21929

Methods

Study Location – Petronila Creek Above Tidal (TCEQ Segment 2204) is a shallow creek (< 2.0 m depth) that flows 44 miles from the confluence of Aqua Dulce and Banquete creeks in Nueces County to a point 0.6 miles upstream of a private road crossing near Laureles Ranch in Northern Kleberg County. Petronila Creek drains to Alazan Bay which is connected to the northern portion of Baffin Bay. The study area is located east of US 77 in the southeastern portion of the watershed. Land use is dominated by cultivated cropland with cotton, corn and sorghum being the most common crops observed. The northwestern end of the watershed is a mixture of cultivated cropland, hay or pasture, shrub or scrub and mixed forest. There are nine regulated dischargers of effluent to Petronila Creek and/or the tributaries of the creek (See Appendix B).

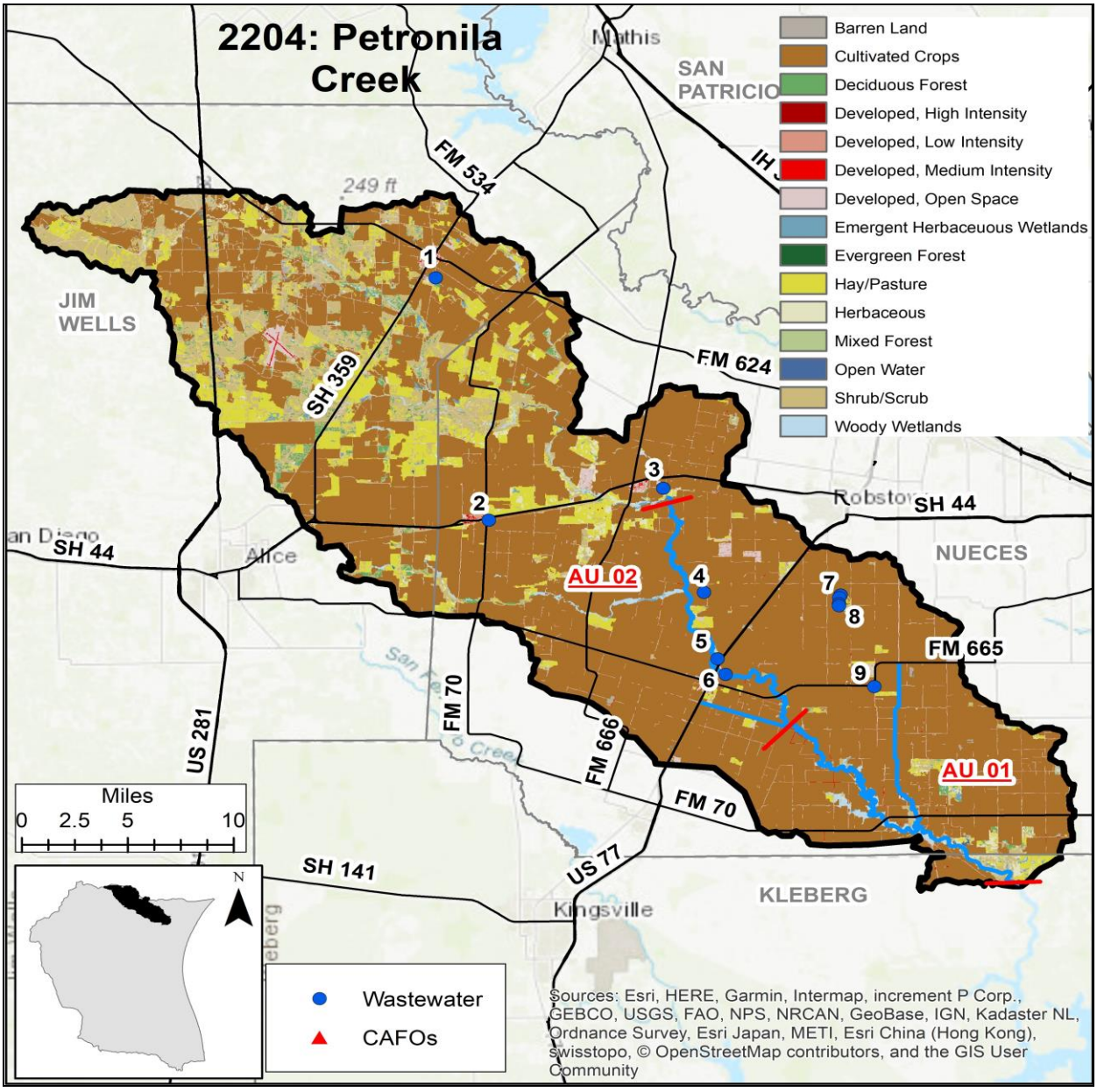


Figure 6. Land Use Land Cover and permitted dischargers to Petronila Creek

Sampling Site Locations – Sampling site locations were identified based on the current sampling locations used in the Petronila Creek Above Tidal TMDL sampling project funded by TCEQ for chloride, sulfate, and total dissolved salts (TDS). Streamflow is typically very low in the segment, often measuring between 1.0 and 5.0 ft^3/s during dry weather on the main stem of the creek. In the tributaries, dry weather flows typically range from 0.1 to 0.4 ft^3/s with occasionally dry creek beds during extended dry periods. A map of sampling stations is provided below.

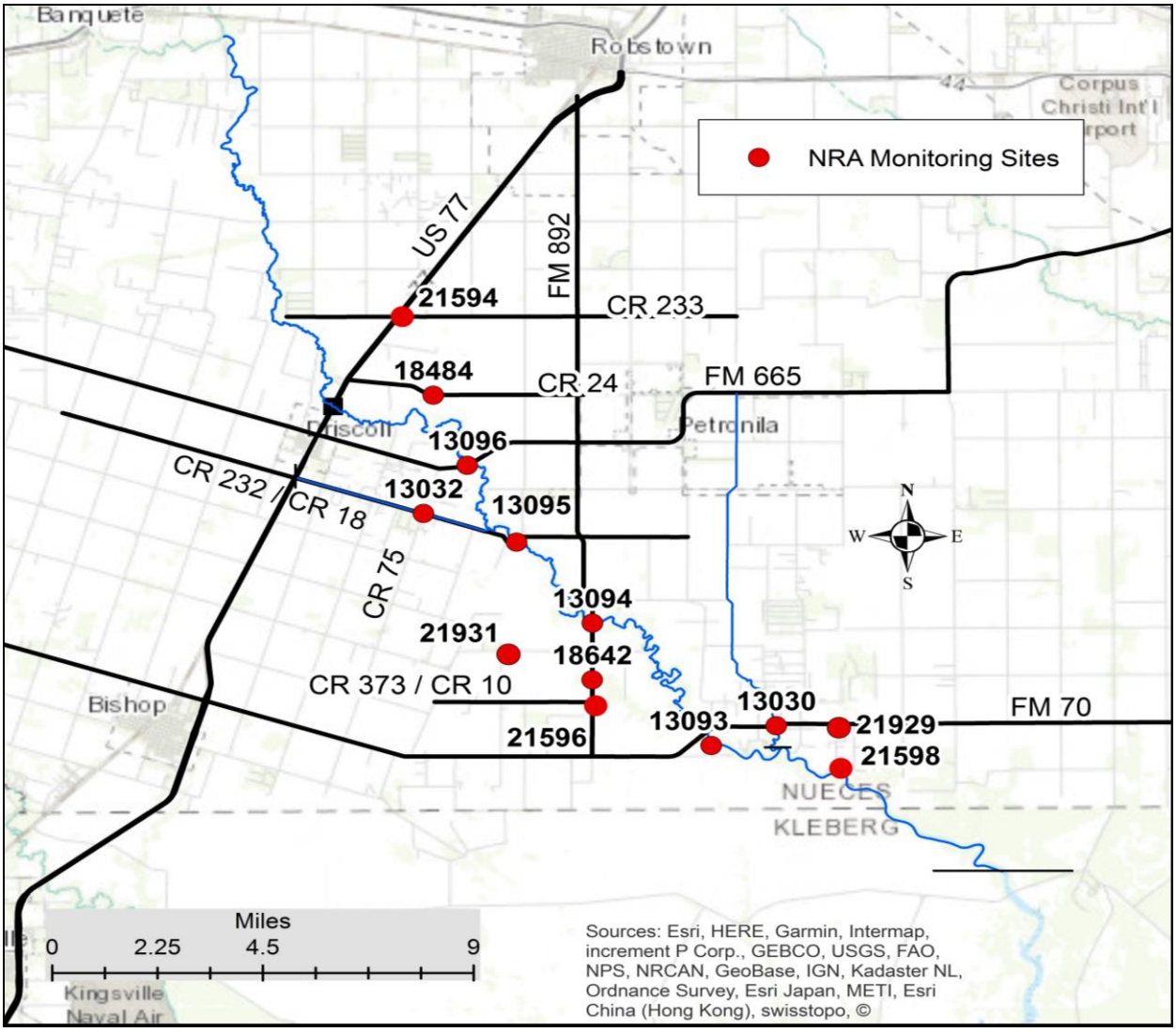


Figure 7. Map of sampling stations in Petronila Creek Above Tidal (Segment 2204)

Meteorological data – At each monthly site visit NRA field staff recorded meteorological information including air temperature, wind direction, wind velocity and precipitation data including days since last precipitation, rainfall in the past day and past seven days. Precipitation data were obtained from multiple sources with the links provided below.

https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?tx4810

https://www.weather.org/weather-history/

https://www.wunderground.com/

Sample collection – Surface water quality data including field and laboratory data were collected on a monthly basis from January 2020 through December 2020 at four sampling stations on the main stem of the creek and at nine sampling stations on the tributaries. At each sampling location, field data including water depth, water temperature, pH, dissolved oxygen and specific conductance were obtained using a Hydrolab MS5 datasonde according to TCEQ Surface Water Quality Manual Procedures (SWQM) Procedures. The datasonde was calibrated and post calibrated after each deployment. Sampling sites with water deeper than 1.5 m but less than 3.0 m had field data gathered at 0.3 m below the water surface, at mid depth and at 0.3 m above the bottom of the water column. Surface water quality samples were collected, preserved with acid when applicable and stored on ice and delivered to the laboratories for analysis.

Figure 8. Hydrolab MS5 datasonde in water at Station 21598

Sample Analysis – Surface water samples were collected and analyzed for nutrient components by two laboratories. Nutrient samples including ammonia, nitrate, nitrite, total kjeldahl nitrogen (TKN), dissolved TKN and total phosphorus were analyzed by the City of Corpus Christi Water Utilities Lab (WUL). All analytes were analyzed by the WUL using National Environmental Laboratory Accreditation Program (NELAP) accredited methods. Chlorophyll-*a* and pheophytin samples were analyzed at the Texas A&M University Corpus Christi's Center for Coastal Studies Laboratory (CCSL). NELAP accreditation for chlorophyll-*a* and pheophytin parameters are not required.

Results

Meteorological and Hydrological – Average annual precipitation in Petronila Creek Above Tidal is 28.98 inches. Petronila Creek Above Tidal (TCEQ Segment 2204) experienced below average rainfall from January through the middle part of May 2020 resulting in very low streamflow values at all stations. In the middle part of May 2020, episodic rain events, some heavy, resulted in increased streamflow due to surface runoff into the tributaries.

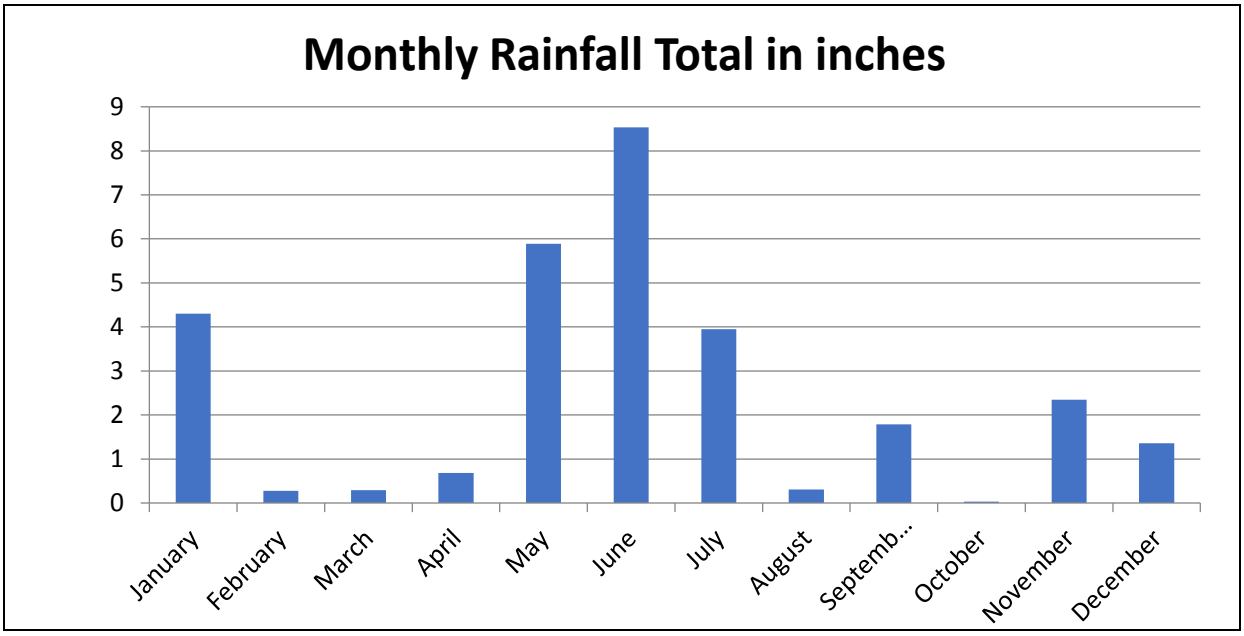


Figure 9. Monthly rainfall amounts in 2020 in Kingsville, Texas

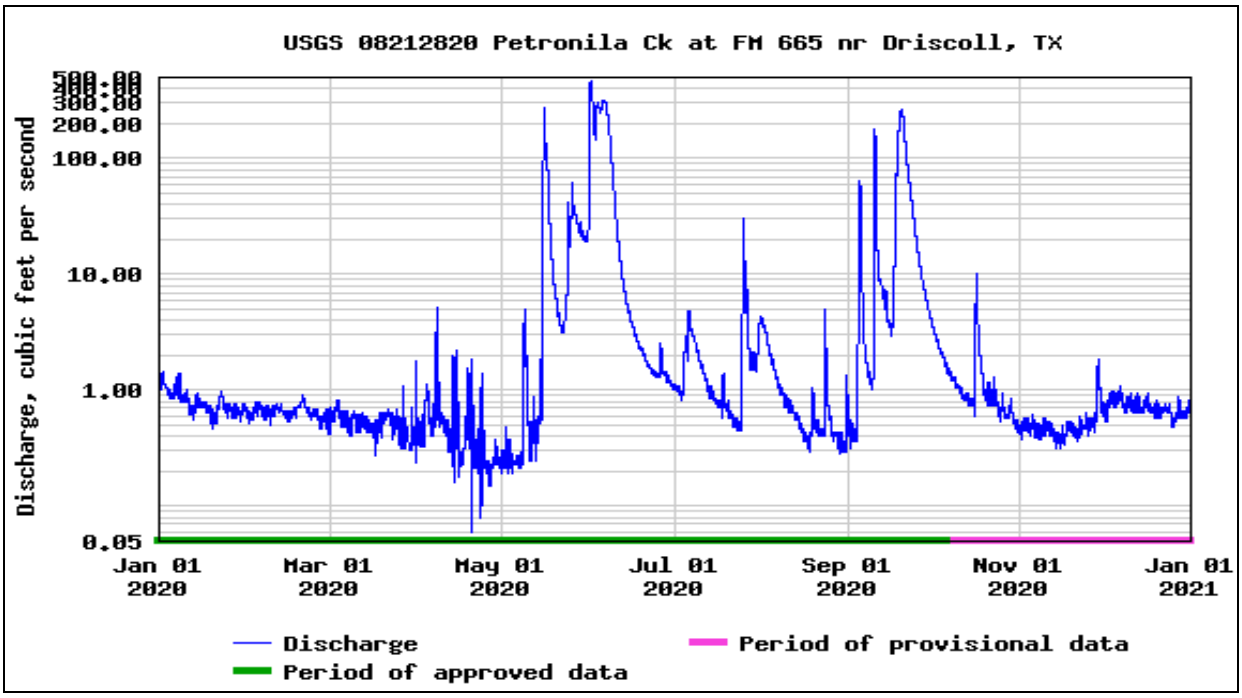


Figure 10. USGS sourced streamflow at Petronila Creek Above Tidal at FM 665

In early June 2020, localized intense rainfall occurred resulting in streamflow of around 500 CFS at the USGS streamgage at FM 665 near Driscoll (USGS gage 08212820). NRA field staff were able to collect data during this event at a flow rate of approximately 160 ft^3/s which occurred on June 3rd. Subsequent sporadic rain events occurred through the end of September 2020. From October through the end of December, precipitation rates were below average resulting in low streamflow values at all stations. The yearly precipitation total for 2020 was 26.22 inches.

Figure 11. High flow at tributary Station 21958

Figure 12. High flow at tributary Station 21594

Ammonia – Ammonia concentrations ranged from less than 0.1 mg/L to 1.1 mg/L. The limit of quantification (LOQ) for ammonia is 0.1 mg/L and the TCEQ screening level is 0.33 mg/L. Out of 129 samples submitted for analysis, 105 were below the LOQ for ammonia and two samples were at or above the screening level. The annual mean ammonia concentration in the main stem of Petronila Creek was 0.14 mg/L and in the tributaries, it was 0.12 mg/L. The highest concentrations were found on the main stem of the creek in April and May. A value of 1.1 mg/L was recorded in April at Station 13096 with the next highest concentrations of 0.33 mg/L at Station 13095 and 0.32 mg/L at Station 13094, both having occurred in May.

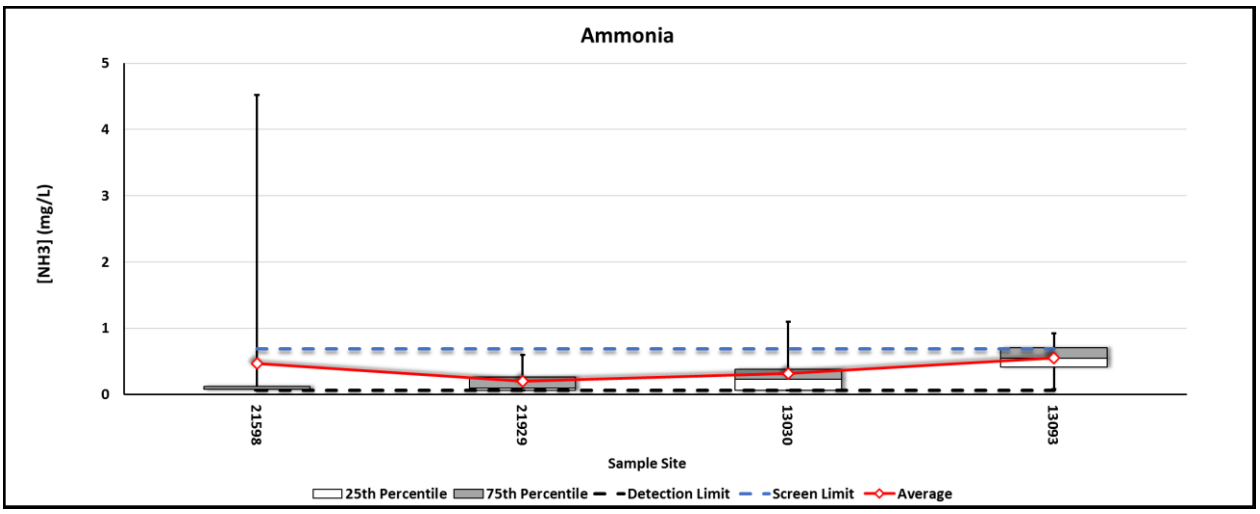


Figure 13. Annual mean ammonia concentrations at main stem stations

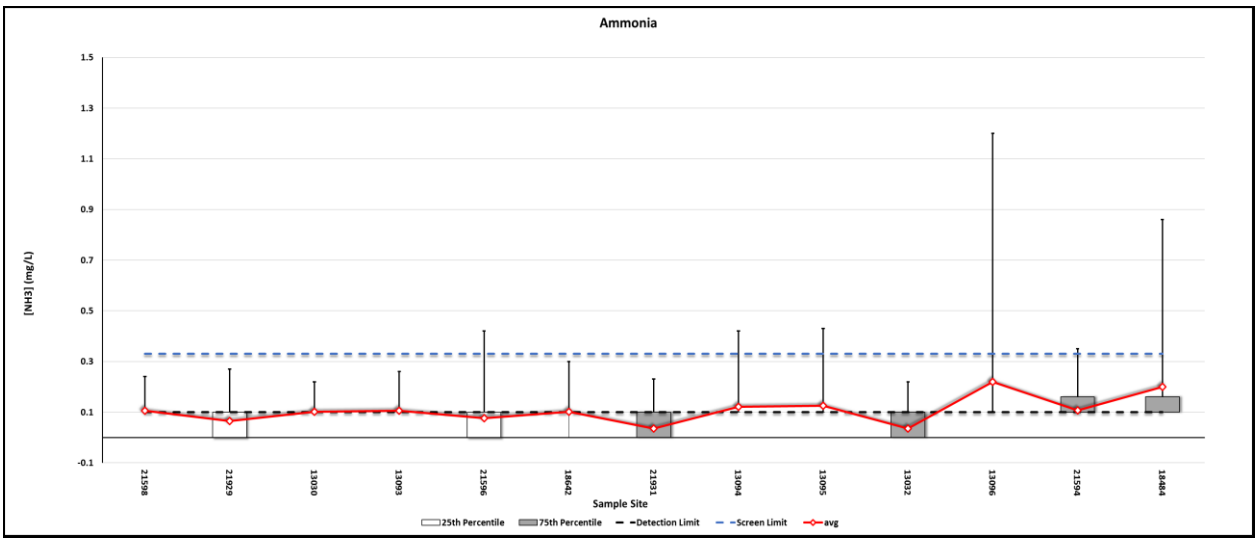


Figure 14. Annual mean ammonia concentrations at tributary stations

Dissolved Total Kjedahl Nitrogen (Dissolved TKN) – Dissolved TKN concentrations ranged from less than 0.2 mg/L to 2.1 mg/L. The LOQ for dissolved TKN is 0.2 mg/L, however no TCEQ screening levels exist for this nutrient parameter. Out of 129 samples submitted for analysis, 7 laboratory results were below the LOQ. The annual mean dissolved TKN concentration in the main stem of Petronila Creek was 0.99 mg/L and in the tributaries, it was 0.81 mg/L. The highest annual mean concentrations were found at Station 13032 (1.46 mg/L), Station 21929 (1.19 mg/L) and Station 21596 (1.16 mg/L). The lowest annual mean concentrations were found at Station 21931 (0.43 mg/L) and Station 21594 (0.49 mg/L).

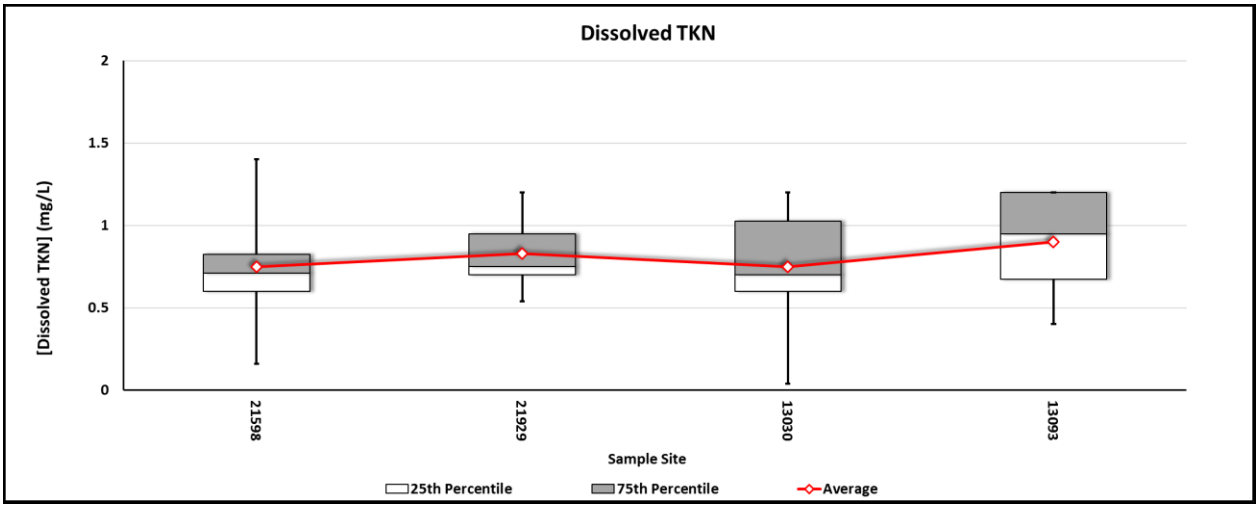


Figure 15. Annual mean dissolved TKN concentrations at main stem stations

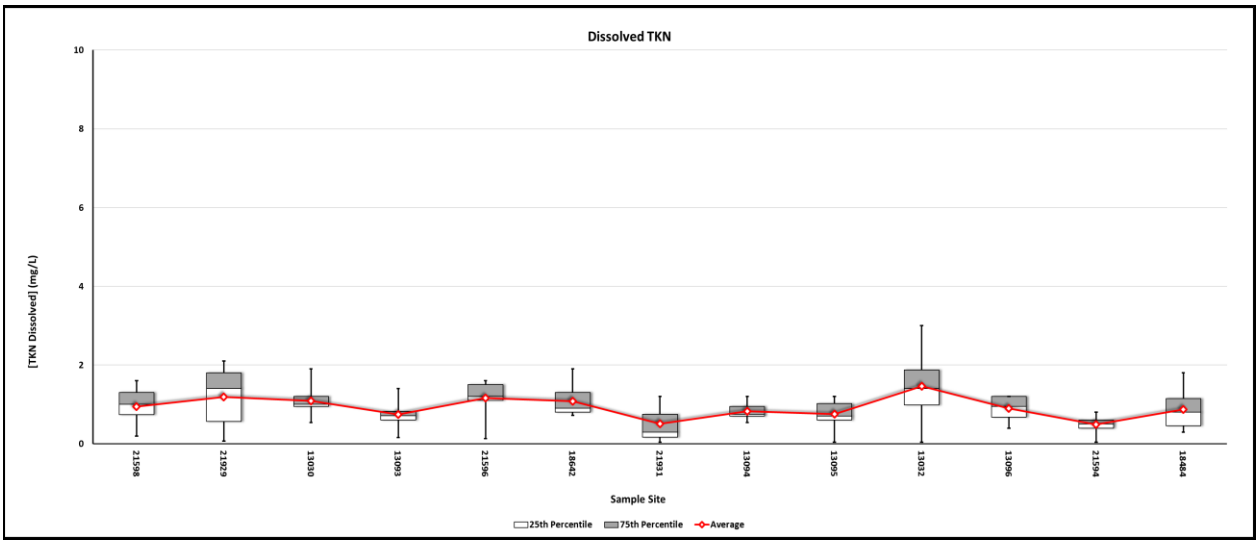


Figure 16. Annual mean dissolved TKN concentrations at main stem stations

Nitrate Nitrogen – Nitrate nitrogen concentrations ranged from less than 0.025 mg/L to 57.0 mg/L. The LOQ for nitrate nitrogen is 0.025 mg/L and the TCEQ screening level is 1.95 mg/L. Out of 129 nitrate samples collected, 63 were below the LOQ and 27 were above the screening level. The annual mean nitrate nitrogen concentration in the main stem of Petronila Creek was 1.23 mg/L and in the tributaries, it was 1.66 mg/L. The lowest annual mean concentrations for nitrate nitrogen were found at Station 21931 and 13032. Station 12931 was dry for eight months out of the year with nitrate concentrations under the LOQ during the four months where streamflow was observed. Station 13032 was also dry for eight months and had three sample results under the LOQ. One sample at Station 13032 had a nitrate value of 0.11 mg/L. The highest concentration occurred at Station 13030 where a value of 57.0 mg/L was recorded on April 8th.

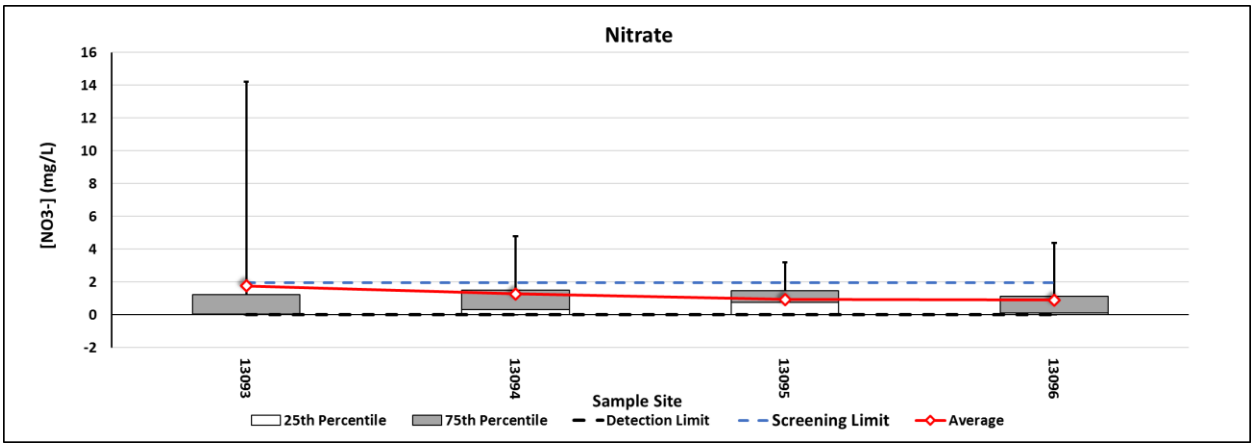


Figure 17. Annual mean nitrate concentrations at main stem stations

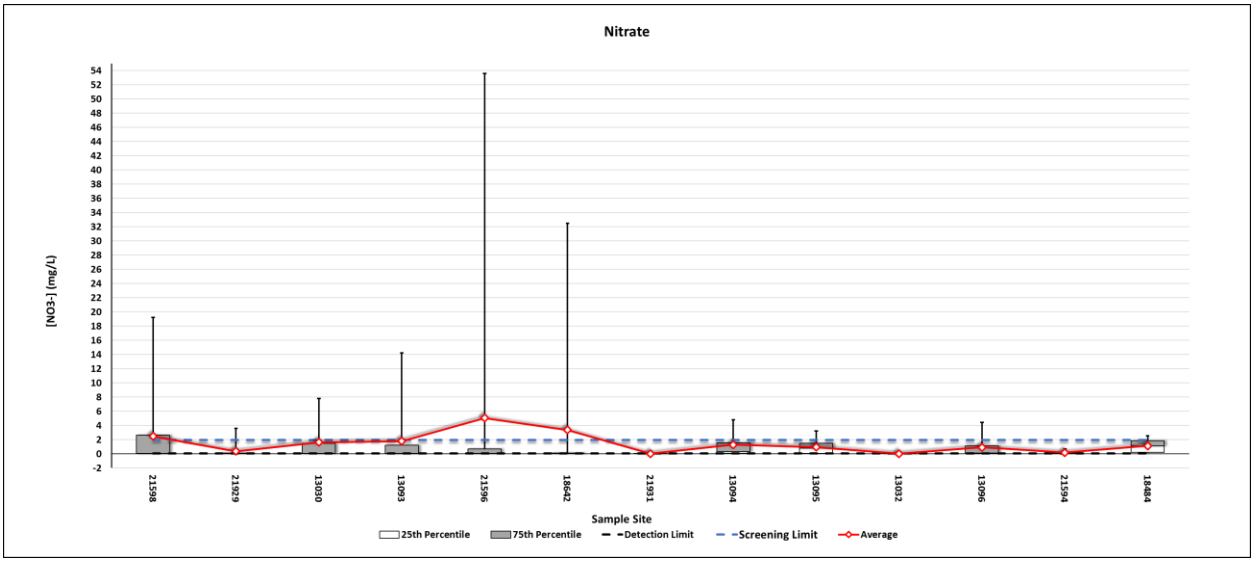


Figure 18. Annual mean nitrate concentrations at tributary stations

Nitrite Nitrogen – Nitrate nitrogen concentrations ranged from less than 0.02 mg/L to 0.37 mg/L. The LOQ for nitrite nitrogen is 0.02 mg/L, however no TCEQ screening level exist for this parameter. Out of 129 samples submitted for nitrite nitrogen analysis, 105 were at or below the LOQ. The highest concentrations were at Station 13096 with an annual mean value of 0.09 mg/L. All other stations had an annual mean of 0.05 mg/L or less.

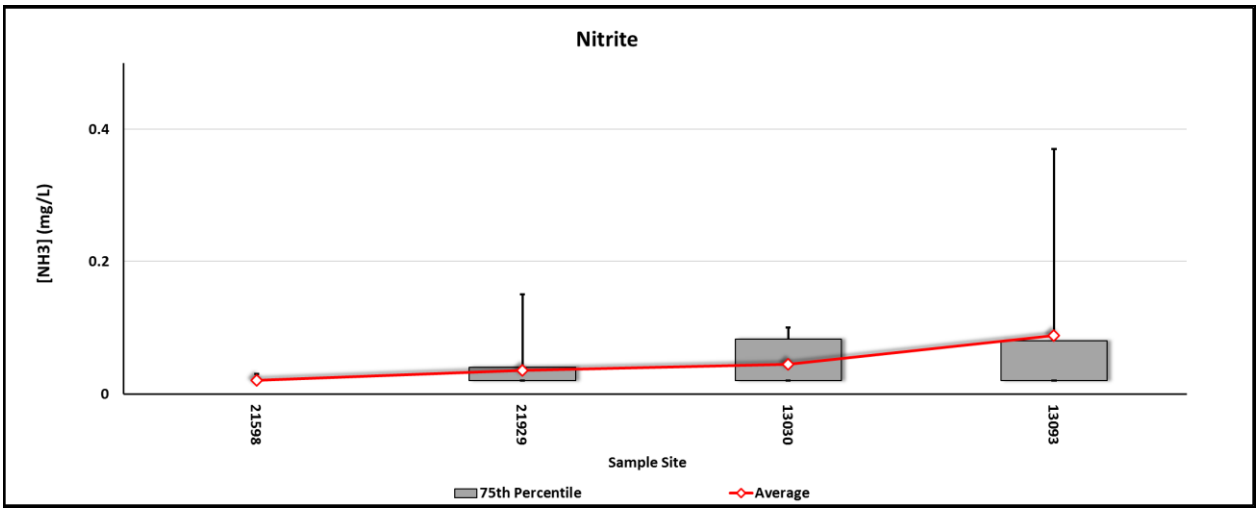


Figure 19. Annual mean nitrite concentrations at main stem stations

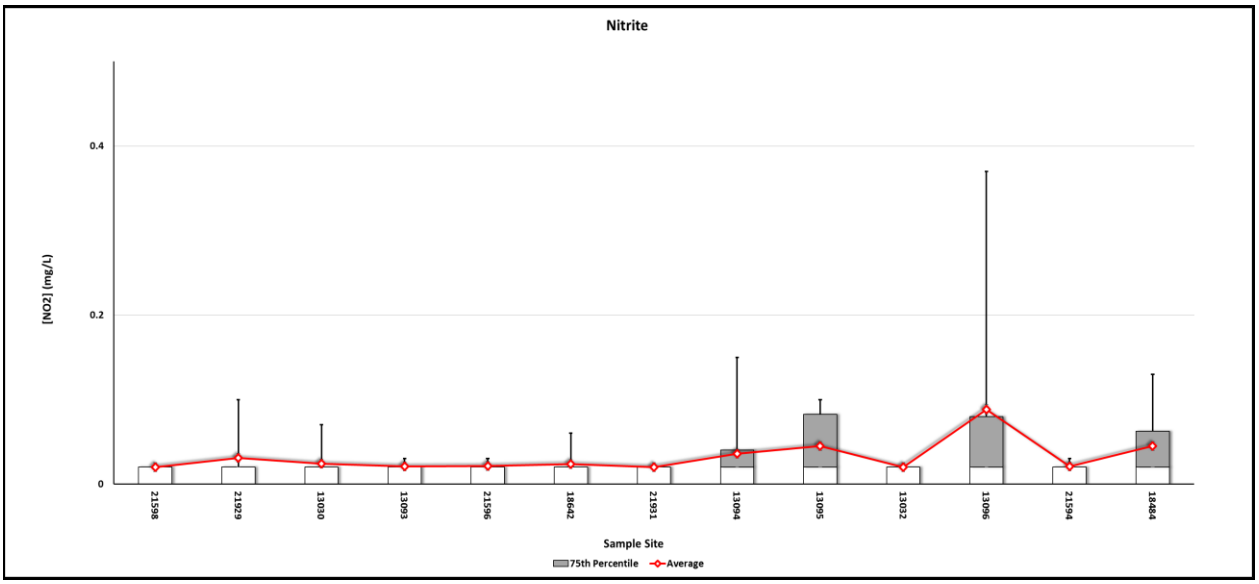


Figure 20. Annual mean nitrite concentrations at tributary stations

Total Kjedahl Nitrogen (TKN) – TKN concentrations ranged from less than 0.2 mg/L to 3.7 mg/L. The LOQ for TKN is 0.2 mg/L, however no TCEQ screening levels exist for this nutrient parameter. Out of 129 samples submitted for TKN analysis, three were at or below the LOQ. The annual mean TKN concentration in the main stem of Petronila Creek was 1.53 mg/L and in the tributaries, it was 1.44 mg/L. The highest annual mean TKN concentration was found at the tributary Station 13032 with an average of 2.43 mg/L over the year and the second highest was found on the main stem at Station 13096 with an average of 2.23 mg/L. The lowest mean annual concentration was 0.81 mg/L at tributary Station 21594 at 1.10 mg/L at Station 18484, both of which are located on the same tributary.

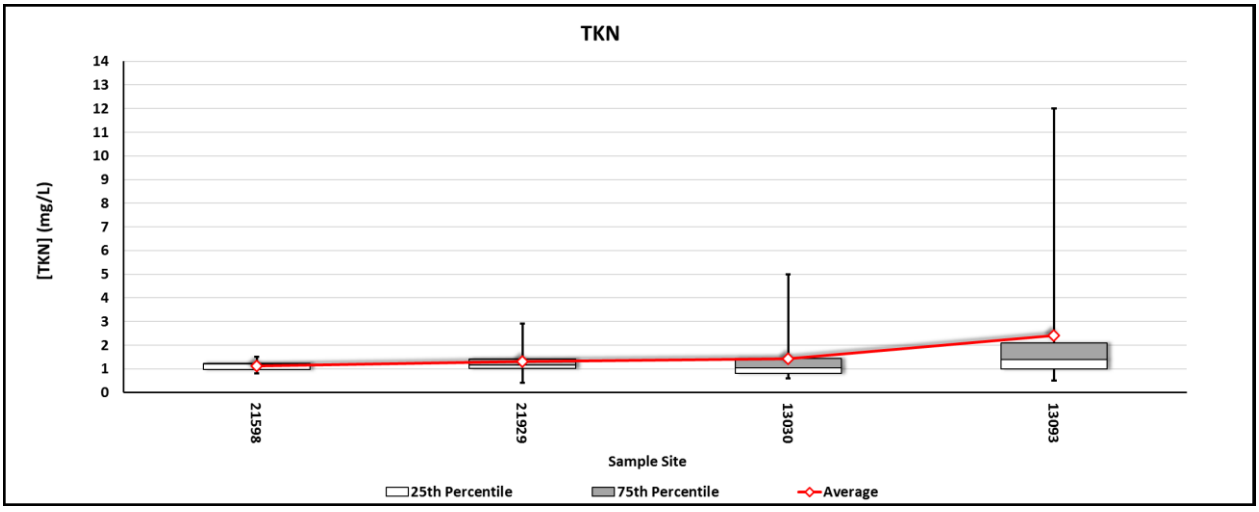


Figure 21. Annual mean TKN concentrations at main stem stations

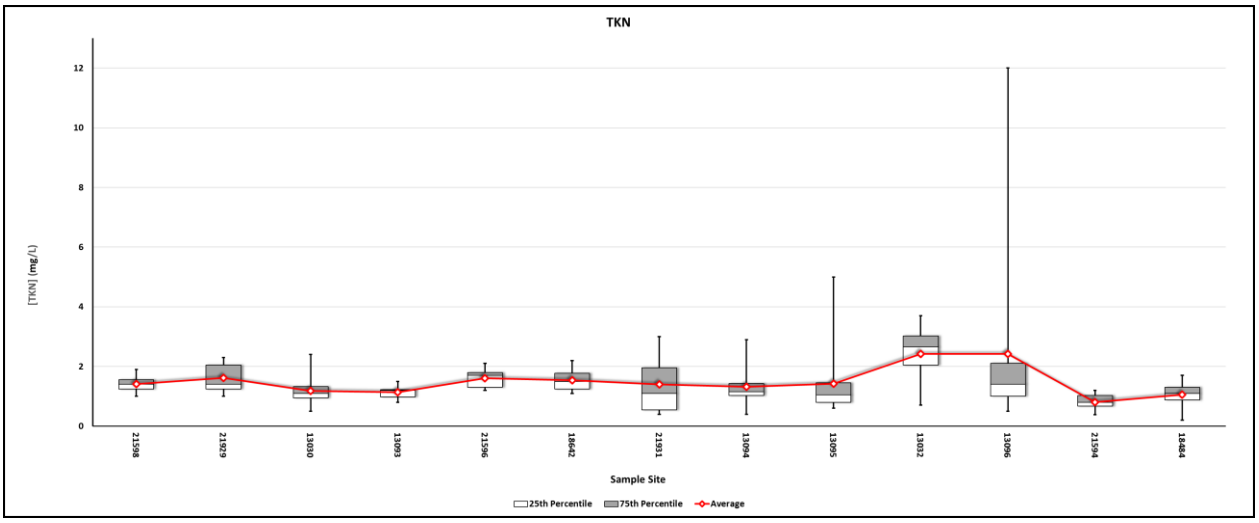


Figure 22. Annual mean TKN concentrations at tributary stations

Total Phosphorus – Total Phosphorus concentrations ranged from less than 0.06 mg/L to 4.52 mg/L. The LOQ for total phosphorus is 0.06 mg/L and the TCEQ screening level is 0.69 mg/L. Out of 129 total phosphorus samples submitted for analysis, 33 were at or below the LOQ and 9 were above of the screening level. The annual mean concentration of total phosphorus concentration in the main stem of Petronila Creek was 0.38 mg/L and in the tributaries, it was 0.29 mg/L.

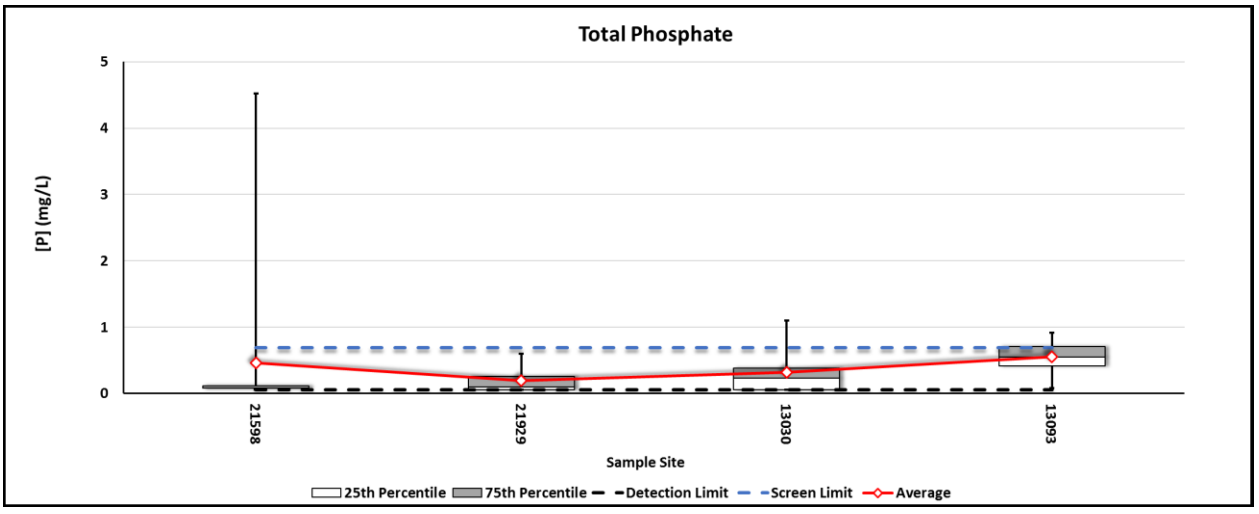


Figure 23. Annual mean total phosphate concentrations at main stem stations

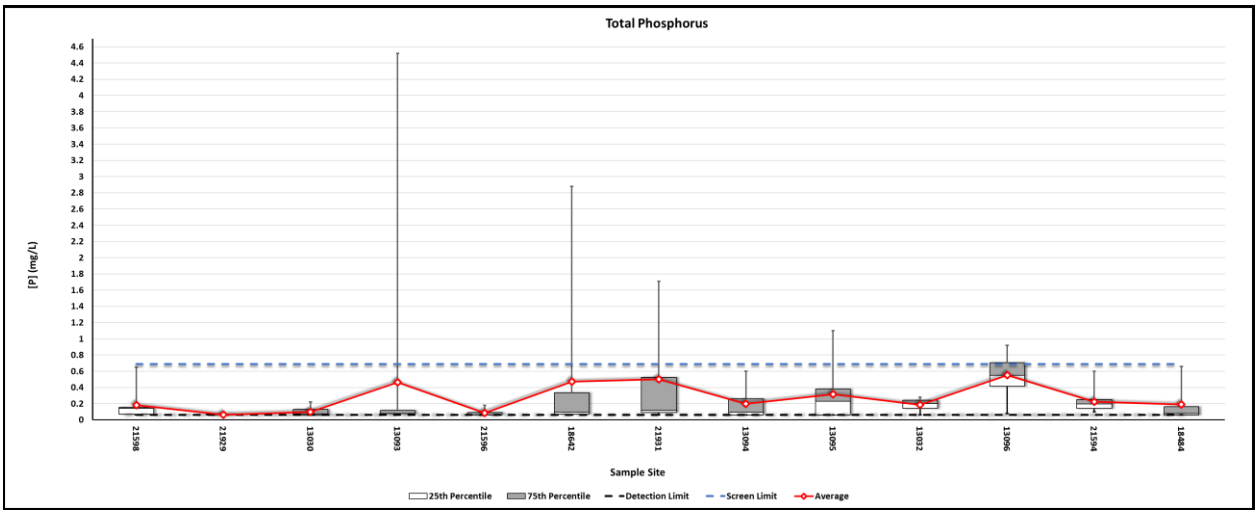


Figure 24. Annual mean total phosphorus concentrations at tributary stations

Chlorophyll a – Chlorophyll *a* concentrations ranged from less than 2.0 µg/L to 800.8 µg/L. The LOQ for chlorophyll is 2.0 mg/L and the TCEQ screening level is 14.1 µg/L. Out of 129 total samples submitted for analysis, 11 were at or below the LOQ and 80 were above of the screening level. The annual mean concentration of chlorophyll *a* concentration in the main stem of Petronila Creek was 70.0 mg/L and in the tributaries, it was 62.1 mg/L. The lowest average yearly concentration, 23.4 µg/L, was at Station 21594 which is the upstream most tributary site in the watershed. The highest annual mean concentrations were recorded at stations 13030 (108.5 µg/L), 13093 (96.5 µg/L), 13032 (86.3 µg/L), and 18484 (81.7 µg/L).

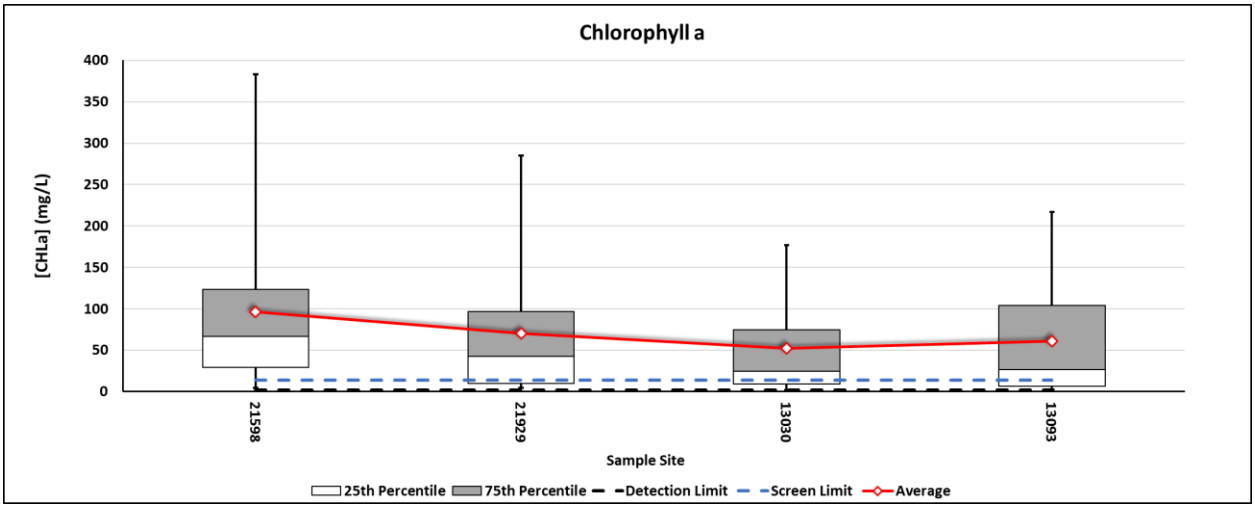


Figure 25. Annual mean chlorophyll *a* concentrations at main stem stations

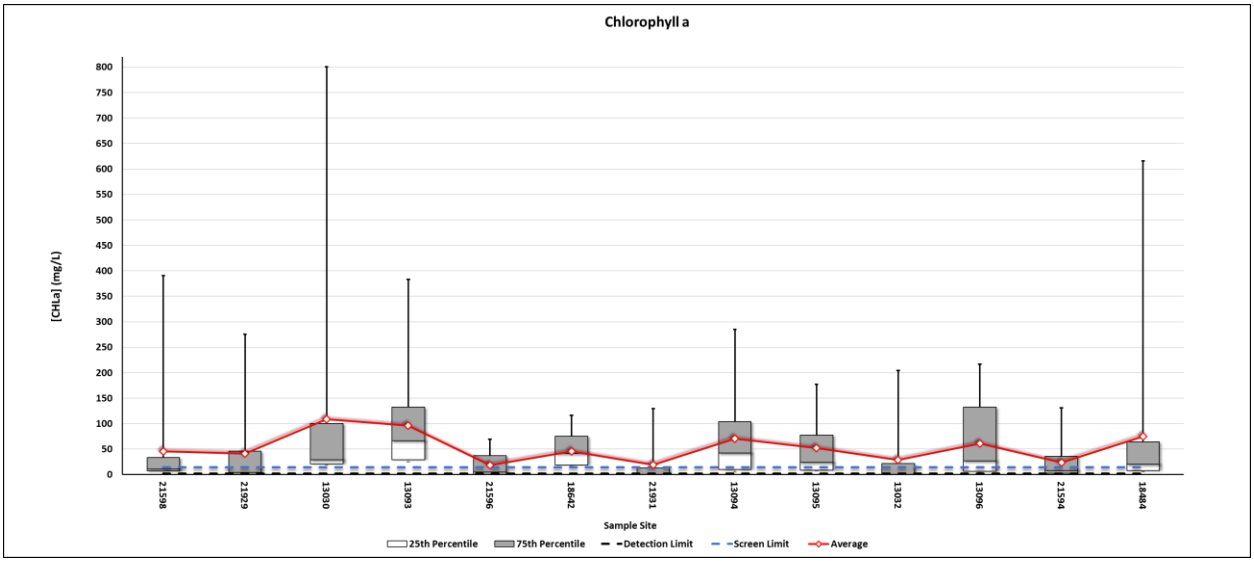


Figure 26. Annual mean chlorophyll *a* concentrations at tributary stations

High Flow Event Data Results

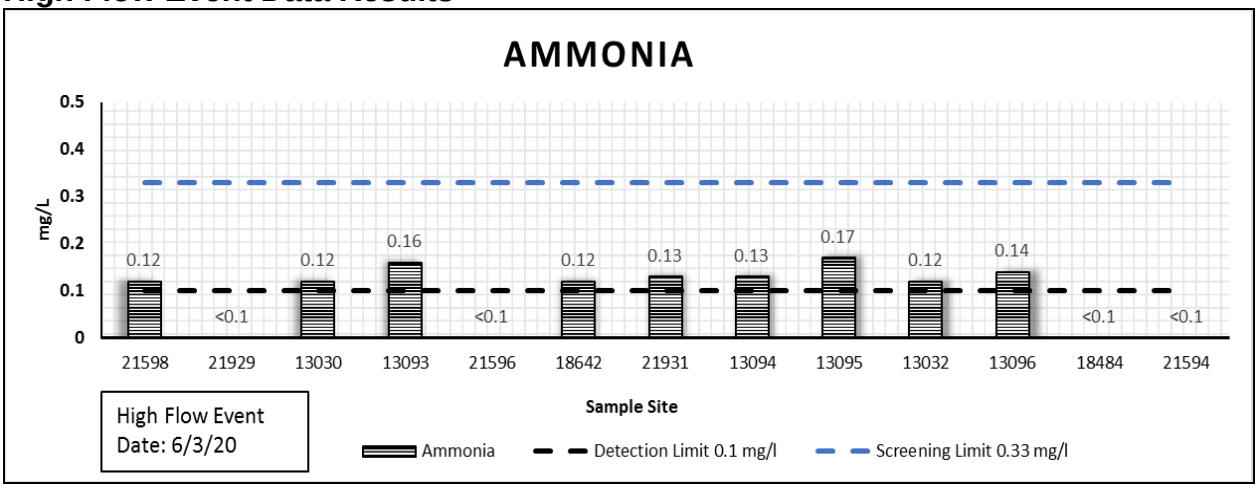


Figure 27. High flow event data for ammonia

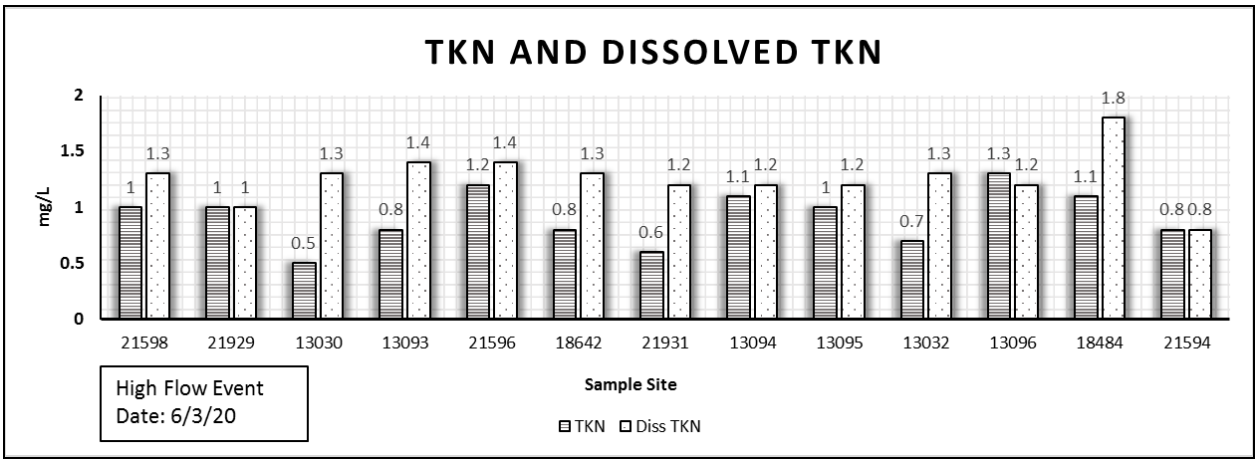


Figure 28. High flow event data for dissolved TKN and TKN

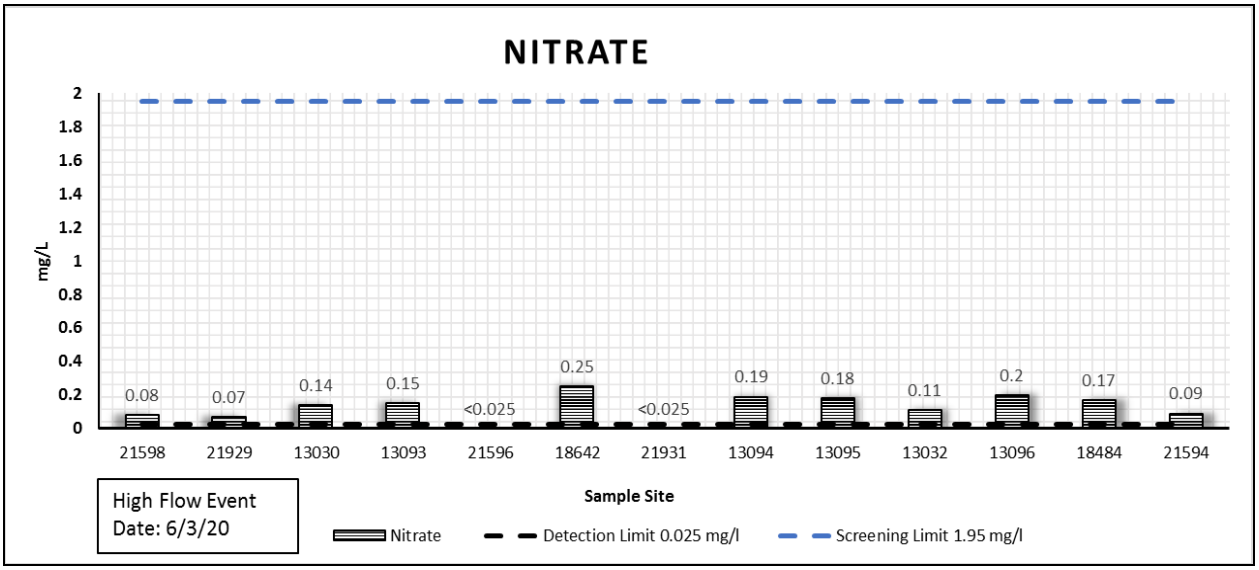


Figure 29. High flow event data for nitrate nitrogen

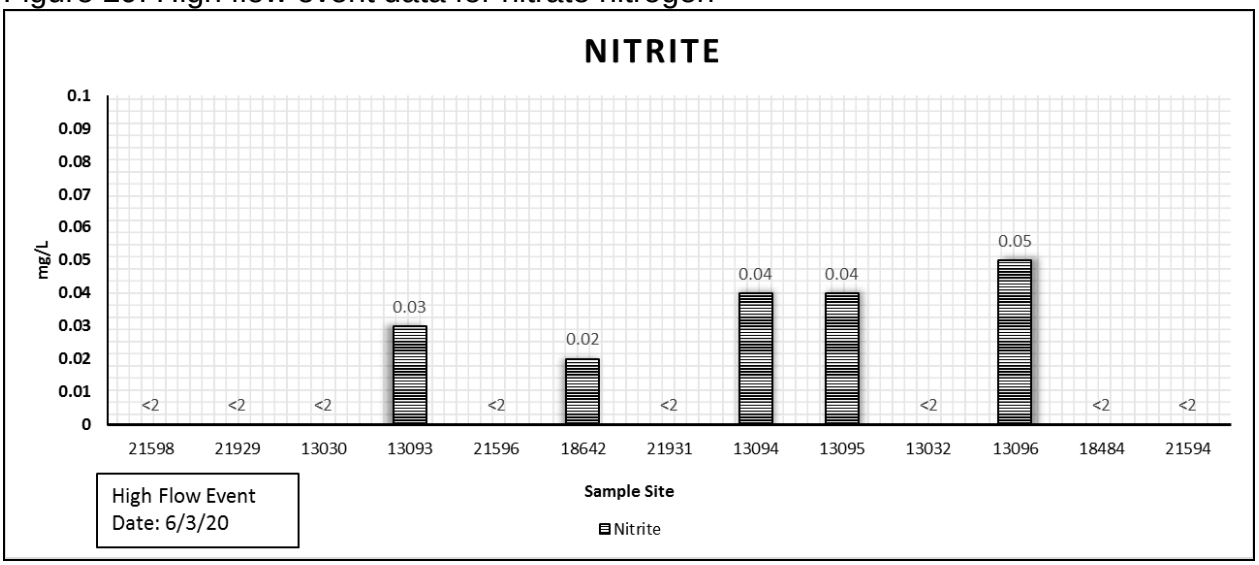


Figure 30. High flow event data for total phosphorus

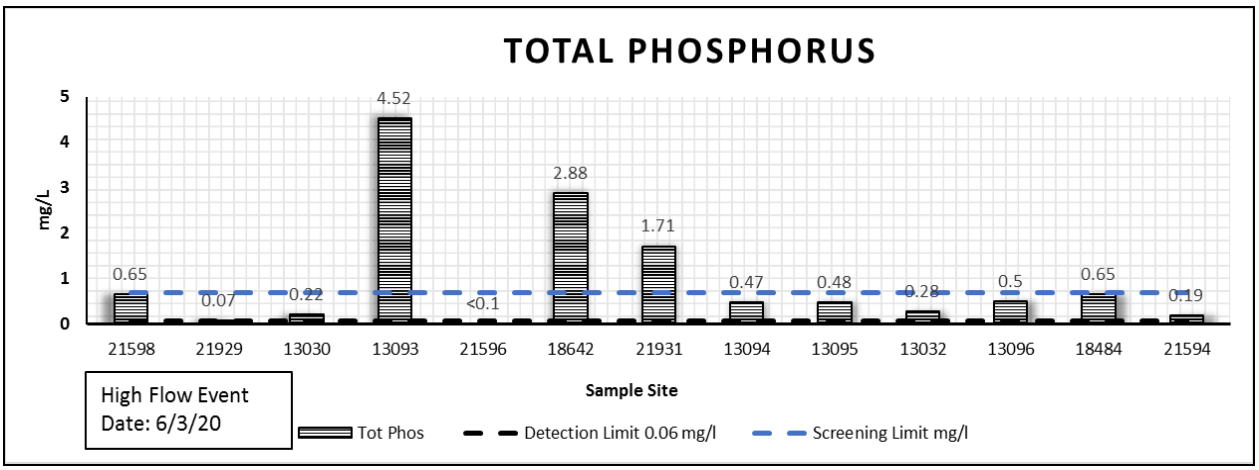


Figure 31. High flow event data for total phosphorus

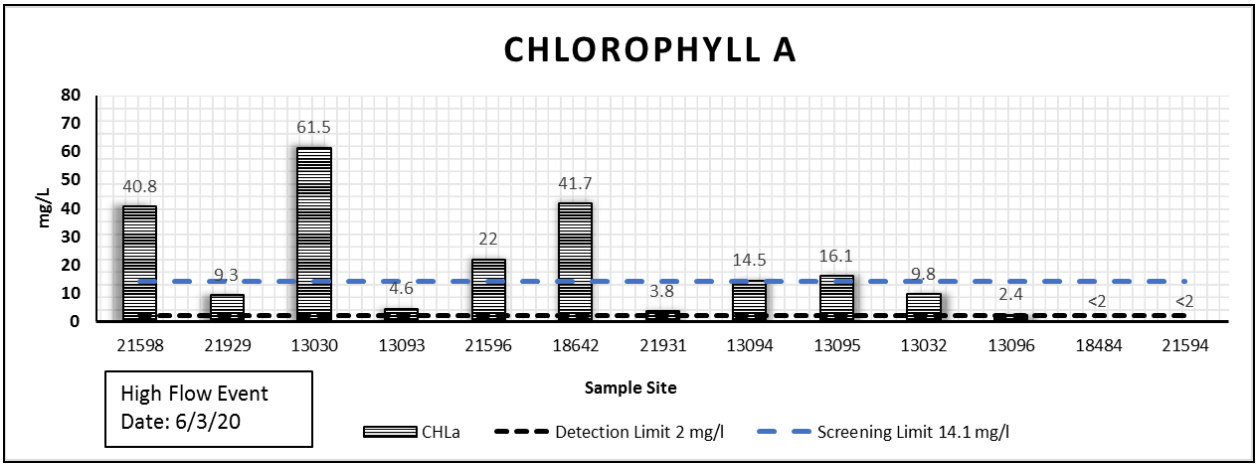


Figure 32. High flow event data for chlorophyll *a*

Conclusions

Nutrient inputs to Petronila Creek Above Tidal (TCEQ Segment 2204) come from a variety of permitted and non-permitted sources including wastewater treatment plants (WWTPs), non-point source (NPS) runoff from cropland, groundwater interactions, wildlife and other natural sources.

Permitted sources include eight WWTPs that contribute treated domestic wastewater to Petronila Creek Above Tidal or its tributaries, one of which contributes measurable flow to the study area. The City of Driscoll is permitted to release up to 100,000 gpd of treated effluent upstream of station 13096. A ninth source, US Ecology, is permitted for stormwater effluent only (Appendix B).

Streamflow in the tributaries is very low during dry weather with flows consistently between 0.1 to 0.4 ft^3/s. Two stations, 21929 and 21956, did not have flowing water from August on through December when rainfall subsided in the study area. Two stations, 21931 and 13032, only had flowing water for 4 months out of the year. There are three tributaries that have two sampling stations on the same tributary with the upstream most sampling sites routinely being dry throughout the year. During dry weather, water quality monitoring stations on the tributaries are supplied by groundwater seeps. The seeps contain high levels of dissolved solids, and moderate amounts of nutrients in the form of nitrate nitrogen and total phosphorus. Low-flow conditions combined with moderate amount of nutrients resulted in the proliferation of high chlorophyll *a* concentrations, aquatic vegetation (widgeon grass), and algal species which were observed throughout the study area.

Ammonia – Ammonia concentrations in the Petronila Creek Watershed were very low throughout the study area and period. The highest concentrations occurred in May and June with June's data being associated with a high flow event. Data evaluated would lead to attainment of TCEQs screening level for this parameter.

Dissolved TKN – Dissolved TKN concentrations in the Petronila Creek Watershed did not show major spikes over the course of the year-long study. Concentrations were typically higher during warm weather months, peaking in May and June at most stations. The lowest levels of dissolved TKN were found at the tributary stations that were flowing for four months out of the year.

Nitrate Nitrogen – Nitrate nitrogen concentrations in Petronila creek had a large range of data results. Approximately half (49%) of the results were below the LOQ and one-fifth (21%) of them were over the TCEQ screening level. Due to the large number of samples that were under the LOQ, the mean results for the main stem (1.23 mg/L) and the tributaries (1.66 mg/L) suggest that attainment of TCEQs screening level (1.95 mg/L) would likely be attainable.

Nitrite Nitrogen – Nitrate nitrogen concentrations in Petronila Creek and its tributaries were very low. Eighty one percent of the samples were at or below the LOQ. Station 13096 which is downstream of the Driscoll WWTP had the highest concentrations.

TKN – TKN concentrations in Petronila Creek, like dissolved TKN results did not show major spikes over the course of the year-long study. Concentrations were typically higher during warm weather months peaking in May and June at most stations.

Total Phosphorus – Total phosphorus concentrations in Petronila Creek Watershed were moderately variable with a quarter of the results under the LOQ and nine exceedances of the TCEQ screening level. Four of the nine exceedances occurred in conjunction with the high flow event that was monitored on June 3rd and likely due to NPS runoff. Station 21931 had phosphorus readings of 1.71 mg/L, Station 18642 which is downstream of Station 21931 had readings of 2.88 mg/L, and Petronila Creek at Station 13093 had readings of 4.52 mg/L. It is important to note that Petronila Creek at Station 13094, which is upstream of the confluence had a phosphorus concentration of 0.47 mg/L during the high flow event. Station 13094 is upstream of the confluence of the tributary where sampling Stations 21931 and 18642 exist. However, due to the large number of samples that were under the LOQ, the mean results for the main stem (1.23 mg/L) and the tributaries (1.66 mg/L) suggest that attainment of TCEQs screening level (14.0 µg/L) would likely be attainable.

Chlorophyll a – Chlorophyll *a* concentrations were generally very high but variable in Petronila Creek and its tributaries. Annual mean concentrations were above the TCEQ screening level of 14.1 µg/L at all stations.

Recommendations

To adequately quantify the spacial and temporal contribution of nutrient inputs to Petronila Creek Above Tidal (TCEQ Segment 2204), special study data collection in the watershed is recommended to continue to further assess hydrologic and climactic variability effects on water quality.

Figure 33. Petronila Creek at sunrise at Station 13093

Appendix A

Photographs of Monitoring Stations

Station 21929 – Unnamed Tributary @ FM 70

Upstream view at Station 21929

Downstream view at Station 21929

Station 21958 – Unnamed Tributary @ FM 70

Upstream view at Station 21958

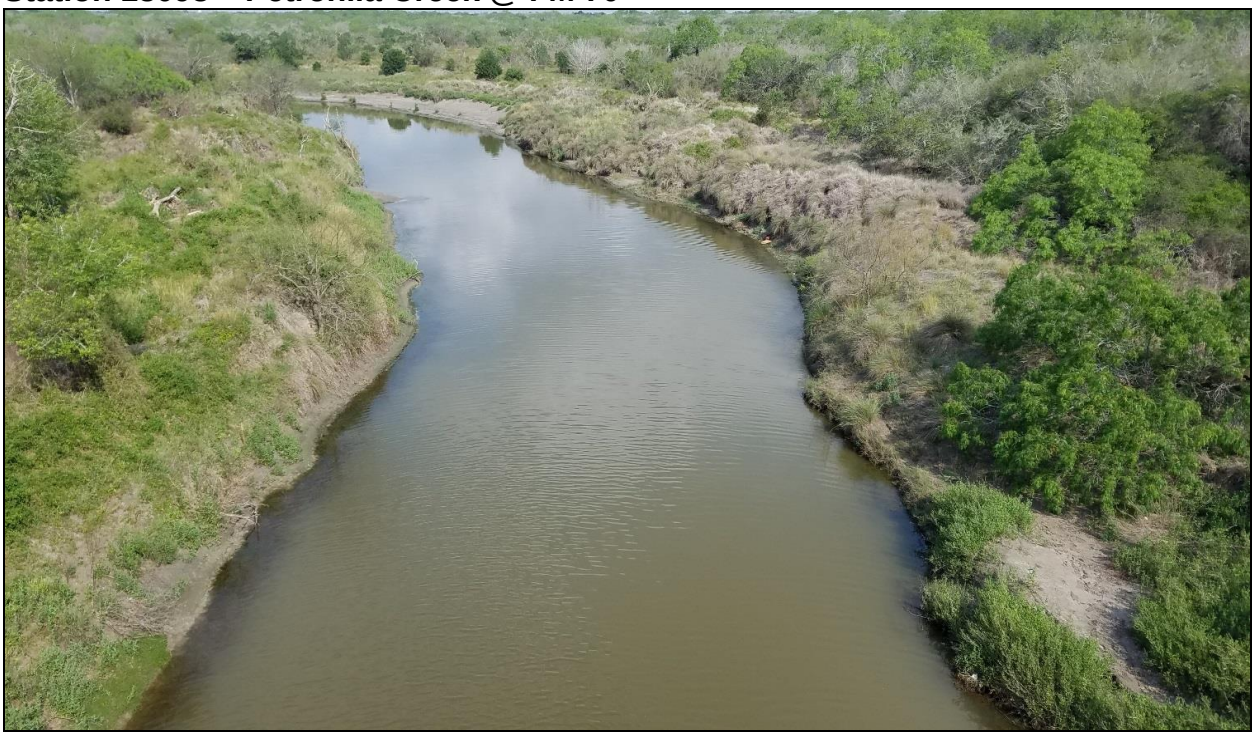
Widgeon grass (*Ruppia maritima)* at Station 21598

Station 13030 – Unnamed Tributary @ FM 70

Upstream view at Station 13030

Downstream view at Station 13030

Station 13093 – Petronila Creek @ FM 70



Upstream view at Station 13093

Downstream view at Station 13093

Station 21596 – Unnamed Tributary @ FM 892

Upstream view at Station 21596

Downstream view at Station 21596

Station 18642 – Unnamed Tributary @ FM 892

Upstream view at Station 18642

Downstream view at Station 18642

Station 13094 – Petronila Creek @ FM 892

Upstream view at Station 13094

Downstream view at Station 13094

Station 21931 – Unnamed Tributary @ FM 3354

Upstream view at Station 21931

Downstream view at Station 21931

Station 13095 - Petronila Creek @ CR 232

Upstream view at Station 13095

Downstream view at Station 13095

Station 13032 – Unnamed Tributary @ CR 18 & CR 75

Upstream view at Station 13032

Downstream view at Station 13032

Station 13096 – Petronila Creek @ FM 665

Upstream view at Station 13096

Downstream view at Station 13096

Station 18484 – Petronila Creek @ CR 24

Upstream view at Station 18484

Downstream view at Station 18484

Station 21594 – Petronila Creek @ CR 233

Upstream view at Station 21594

Downstream view at Station 21594

Appendix B

Wastewater Discharge Permit Information

2204 Petronila Creek Above Tidal

#1. WQ0010592-001 – City of Orange Grove: <200,000 gpd treated domestic wastewater via Agua Dulce Creek

#2 WQ0010140-001 – City of Agua Dulce: <160,000 gpd treated domestic wastewater via Agua Dulce Creek

#3 WQ0011583-002 – Nueces County WCID #5: <100,000 gpd treated domestic wastewater via Banquete Creek

#4 WQ0014802-001 – Geo Group: <150,000 gpd treated domestic wastewater via drainage ditch

#5 WQ0014981-001 – International Education Services: <9,000 gpd treated domestic wastewater via drainage ditch

#6 WQ0011541-001 – City of Driscoll: <100,000 gpd treated domestic wastewater via Petronila Creek

#7 WQ0002888-000 – US Ecology Texas: storm water via Nueces County drainage ditch

#8 WQ0011689-001 – Coastal Bend Youth City: <15,000 gpd treated domestic wastewater via unnamed ditch

#9 WQ0011754-001 – Bishop Consolidated ISD: <8,000 gpd treated domestic wastewater via drainage ditch