



December 2018

2018 Tributary and Groundwater Sampling Program for Pennichuck Water Works



Prepared for:



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EXECUTIVE SUMMARY

In 2018, water quality sampling was conducted by Comprehensive Environmental Inc. (CEI) at 10 locations in the Pennichuck watershed on April 24, May 30, July 12, August 16, September 5, October 10, and October 31. Major findings and recommendations from this sampling effort are as follows:

Tributary Phosphorus Levels:

The table to the right summarizes tributary total phosphorus (TP) results. TP averages for 2007-2018 are notably similar and within a relatively narrow range. Eight of the ten locations have an average TP separated by the small margin of 0.005 mg/L (0.026 mg/L - 0.031 mg/L), all within the NHDES “*more than desirable*” category for TP. The 2018 tributary TP data was generally consistent with the averages for 2007-2018, although 2018 averages at 12-PEN, 01-MUD, and 09-XPB were significantly lower.

- These results support **continued efforts to reduce TP loads** through best management practices and improved land use management, with a goal of reducing TP to 0.025 mg/L or lower at all locations.
- Additional field investigations are recommended to **identify potential pollutant sources** that may contribute to the historically erratic tributary TP results at 02-WCH, 12-PEN, and 09T-PEN. Field efforts could include identification of land use activities associated with high pollutant loads and potential opportunities for nutrient attenuation through stormwater best management practices.

Tributary Sampling Location	2018 Avg. TP (mg/L)	2007-2018 Avg. TP (mg/L)	Note: NHDES TP (mg/L) categories: • 0.011 - 0.025: Average • 0.026 – 0.049: More than desirable * Data for 2016-2018 only
01-HAY*	0.022	0.017	
02-WCH	0.028	0.022	
12-PEN	0.013	0.026	
01-WCH	0.021	0.027	
09-PEN	0.028	0.029	
01-MUD	0.017	0.030	
09-XPB	0.020	0.030	
09T-PEN	0.032	0.030	
01-XWB	0.029	0.030	
01-BFB	0.032	0.031	
Averages	0.024	0.027	

Groundwater Monitoring / Groundwater Phosphorus Levels:

2018 groundwater TP results continued to significantly exceed the typical ranges for groundwater TP, in some cases by more than an order of magnitude. To continue to improve the groundwater sampling program and reduce the potential for TP results that are skewed high by suspended solids in sample water, the following additional protocols are recommended:

- Groundwater samples should be collected and measured for turbidity with an *in-situ* turbidity meter. **Groundwater samples should be accepted only if turbidity is ≤5 NTUs.**
- For sampling locations that consistently fail to meet the 5 NTU threshold, the use of **low-flow sampling equipment** should be considered. Although more time and labor-intensive, low flow sampling creates less disturbance and allows for better settling of solids following well purging.

Tributary Conductivity:

Conductivity at 01-BFB, 09-XPB, and 09-PEN is categorized by NHDES as either having moderate impact (09-PEN, 09-XPB) or high impact (01-BFB) for both 2018 and the 2007-2018 period of record.

- Investigate potential opportunities to **reduce elevated conductivity levels at the locations listed above.** These investigations should include coordination with local highway departments to determine road salting practices and opportunities to safely reduce use of de-icing salt (e.g., reduced salt zones, alternative de-icing products, etc.) in road areas nearest to the streams.

Bacteria:

E. coli levels at 01-BFB have a 2007-2018 geometric mean that exceeds New Hampshire Class A Water Quality Standards. 01-XWB and 01-WCH are close to this threshold. 01-BFB and 01-XWB have the highest rate *E. coli* exceedances, indicating persistent sources of bacterial contamination.

- **Investigate potential land use and wastewater issues** that could be contributing to elevated indicator bacteria levels at 01-BFB, 01-WCH, and 01-XWB.

1.0 BACKGROUND

Pennichuck Water Works (PWW) has been collecting data from its supply watershed since 1991. Sampling locations and parameters were varied until around 2005, when a sampling program was developed using a specific set of water quality parameters for nine tributary locations within the watershed. This program was further refined in 2007 to include continuous flow monitoring. Since then, water quality sampling and flow measurements at tributary locations have been ongoing, with modifications and adjustments made as needed.

In 2013, PWW initiated a pilot groundwater sampling program to compare water quality parameters to those found in the tributaries. The sampling program has undergone some modifications over the past several years; including the addition and removal of locations, the replacement of monitoring wells, and the analysis of various parameters through multiple laboratories.

2.0 MONITORING LOCATIONS

The ten groundwater and tributary sampling locations are shown on Figure 1 with descriptions provided in Table 1.

Table 1 – Groundwater and Tributary Sampling Locations

Sampling Location	Tributary Station ID	Groundwater Station ID	Location / Description
01-BFB	01-BFB-T	01-BFB-MW	Boire Field Brook, Tinker Road
09-PEN	09-PEN-T	N/A ¹	Holts Pond Dam
09T-PEN ²	09T-PEN-T	09T-PEN-MW	Route 101A Bridge
09-XPB	09-XPB-T	09-XPB-MW (01-CML)	Unnamed Tributary to Pennichuck Brook on 101A. (Craftsman Lane Bridge)
01-WCH	01-WCH-T	01-WCH-MW	South Merrimack Road Bridge
01-XWB	01-XWB-T	01-XWB-MW	Unnamed Tributary to Witches Brook
12-PEN	12-PEN-T	12-PEN-MW	Nevins Road Bridge
01-MUD	01-MUD-T	01-MUD-MW	Farley Road Bridge
02-WCH	02-WCH-T	02-WCH-MW	Ames Road Bridge on Route 122
01-HAY ³	01-HAY-T	01-HAY-MW	Hayden Road in Eversource power line right-of-way

¹Groundwater monitoring discontinued in 2016 due to poor recharge through locally restrictive soils.

²Groundwater monitoring well not installed adjacent to tributary sampling locations.

³Groundwater and tributary monitoring was added in 2016.



3.0 DATA COLLECTION

In 2018, water samples were collected by Comprehensive Environmental Inc. (CEI) on the following dates: April 24, May 30, July 12, August 16, September 5, October 10, and October 31. Due to poor well recharge and/or low water levels observed during portions of the 2018 sampling program, particularly during summer months, some groundwater locations (02-WCH, 09T-PEN and 01-HAY) had occurrences where no water was present for sample collection. The parameters analyzed both in the field by CEI and in the lab by Granite State Analytical and Chemserve are summarized in Table 2.

Table 2 – Sampling Parameters

Field Analysis	Laboratory Analysis	
Groundwater and Tributaries	Tributaries	Groundwater
• Conductivity • Dissolved Oxygen • pH • Temperature • Groundwater Level / Staff Gauge Reading	• Ammonia-Nitrogen • Chloride • E. Coli • Fecal Coliform • Nitrate-Nitrogen • Nitrite-Nitrogen • Total Kjeldahl Nitrogen • Total Nitrogen • Total Phosphorus • Total Suspended Solids	• Ammonia-Nitrogen • Chloride • Nitrate-Nitrogen • Nitrite-Nitrogen • Total Alkalinity • Total Dissolved Solids • Total Kjeldahl Nitrogen • Total Nitrogen • Total Phosphorus

Precipitation Data: In addition to data collection and analyses conducted in previous years, this 2018 report also includes a comparison of tributary phosphorus results to precipitation. This was done for each monitoring station and included data from 2014-2018, with precipitation data downloaded from the National Oceanic and Atmospheric Association (NOAA) National Climatic Data Center (NCDC), which monitors daily rainfall at Boire Field Airport in Nashua (Station WBAN 54754). The resulting graphs can be found in Appendix E but were not included in the analysis below due to multiple factors. Gaps and inconsistencies in the rainfall data rendered it questionable (for example, NCDC's hourly rainfall data did not add up to its respective daily rainfall values), and tributary sampling was done exclusively in dry weather over the period of interest in order to avoid the effects of precipitation on sampling results. Thus, although a comparison of precipitation and phosphorus levels in the Pennichuck watershed is presented in the Appendix E graphs, CEI did not consider the data sufficient to draw any conclusions regarding the relationship between those parameters at any of the monitoring stations.

Sampling Equipment Notes: Staff gauges and electronic dataloggers were previously installed at nine of the ten tributary locations (the exception being 01-HAY due to low or sometimes absent water levels) to collect year-round stream elevations, and stage-discharge relationship equations were developed based on field measurements. Data was downloaded by CEI approximately every six weeks during spring, summer, and fall months and converted to an approximate flow for each tributary. In 2018, there were multiple equipment failures at a total of 4 different locations, necessitating replacement of wireless dataloggers at stations 01-BFB, 01-WCH, 02-WCH, and 01-XWB. This was highly unusual, as recent years have typically only had one datalogger fail on average. Replacement was covered under the project contingency and all dataloggers at each location are currently operational.

Stage-Discharge Relationships: CEI revisited tributary locations 09-XPB, 01-XWB, and 12-PEN to attempt to reestablish stage-discharge relationships, as ongoing beaver activity in these areas has altered

the previously established streamflow equations for those tributaries. CEI went a total of 5 times to these locations, and each exhibited varying flow and water level fluctuations, indicating that all three locations are still subject to the effects of beaver activity and dam construction. CEI was able to successfully establish revised stage-discharge relationships at 12-PEN and 01-XWB, however 09-XPB exhibited too great a variation to adequately establish a new flow equation. In the interest of conserving available budget and due to the unlikelihood of achieving better results, it is recommended to utilize the existing stage-discharge information for streamflow calculations unless beavers are regularly trapped out or otherwise thwarted in the affected areas.

4.0 DATA ANALYSIS

The following sections provide a summary of data for each location, including graphs of phosphorus trends at each tributary sampling location and analysis of other parameters of note for each location.

It should be noted that New Hampshire currently does not have numeric nutrient criteria for rivers and streams, but is currently in the process of developing them. The most recent national guidance on nutrient standards for streams is provided by the USEPA in Quality Criteria for Water (1986)¹. According to this guidance, total phosphorus (TP) should not exceed 0.05 mg/L in any stream at the point where it enters any lake or reservoir. The New Hampshire Department of Environmental Services (NHDES) also provides guidance² that categorizes freshwater TP levels as follows:

TP (mg/L)	Category
< 0.010	Ideal
0.011- 0.025	Average
0.026 - 0.049	More than desirable
≥ 0.050	Potential nuisance concentration

To provide a point of reference for the TP data presented in graphs in Section 4.1, the USEPA guidance criteria for stream TP (0.050 mg/L, also the NHDES nuisance concentration threshold) is presented as a horizontal line on the graphs.

For complete sampling results for each sampling station, see the attachments at the end of this report.

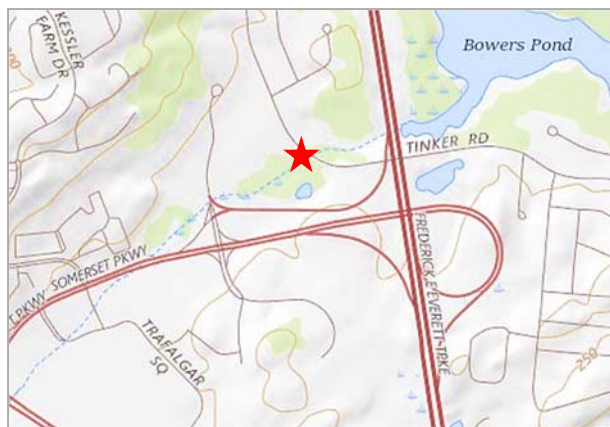


Pennichuck Brook at sampling location 12-PEN

¹ United States Environmental Protection Agency, 1986. Quality Criteria for Water (Gold Book). EPA 440/5-86-001. Office of Water, Regulations and Standards. Washington, D.C.

² New Hampshire Department of Environmental Services, 2008 (Revised 2011). Interpreting VRAP Water Quality Parameters – Chemical Parameters.

4.1 01-BFB



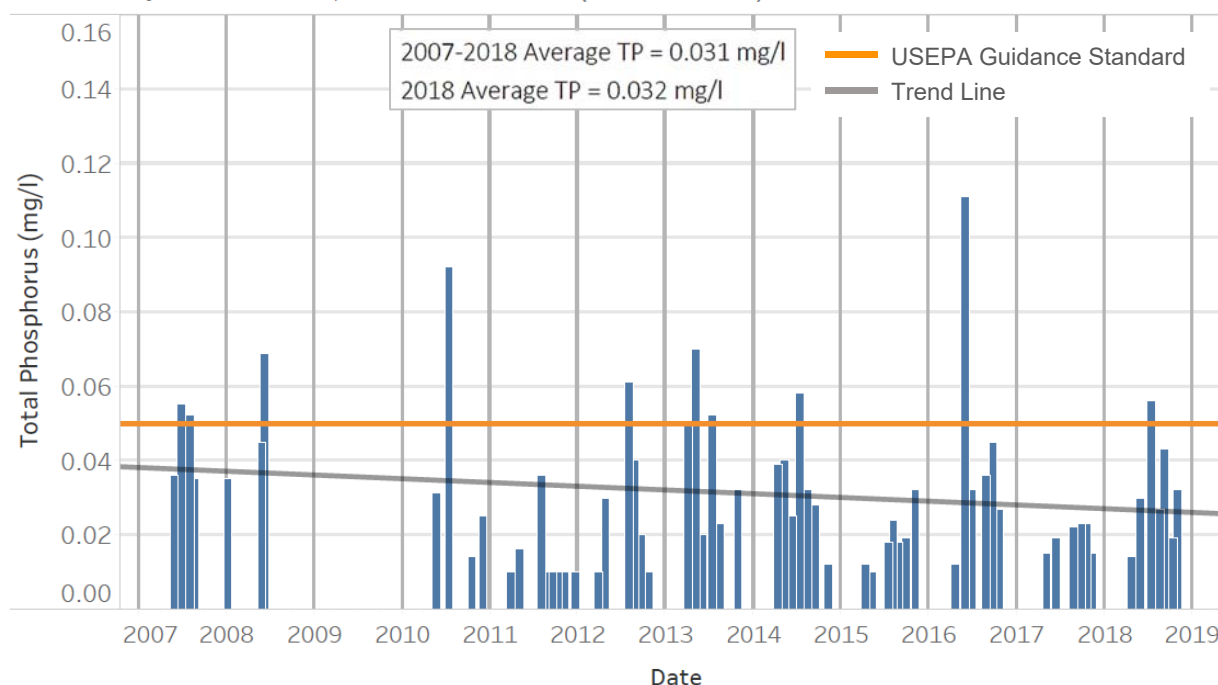
01-BFB is located at the culverted crossing of Boire Field Brook at Tinker Road. The immediate vicinity of the sampling location is forested and residential land, but the upstream watershed includes commercialized areas of Route 101A, including Nashua Municipal Airport.

Total Phosphorus Analysis

- The contributing watershed for 01-BFB is the smallest and most heavily developed of the sampling locations. TP results since 2014 for this location have been relatively stable.
- TP levels at 01-BFB have historically been similar to, but just slightly higher than, most of the sampling stations. In 2018, average TP was 0.032 mg/l, tied with 09T-PEN for the highest value among all stations. Although this represented an increase from the 2017 average (0.021 mg/l), it is similar to the average for the 2007-2018 period of record (0.031 mg/L).
- 2018 tributary TP measurements exceeded the USEPA stream guidance standard once (July 12, 2018).
- Groundwater phosphorus levels at 01-BFB were mid-range when compared to other sampling locations within the watershed and have remained relatively consistent since 2016.

Note that this location is currently undergoing a more detailed subwatershed analysis as part of a New Hampshire Department of Environmental Services (NHDES) Source Water Protection Grant (SWPG) in order to better understand potential impacts of stormwater and other natural contaminant sources (e.g., eroded banks). This project will be completed in May 2019.

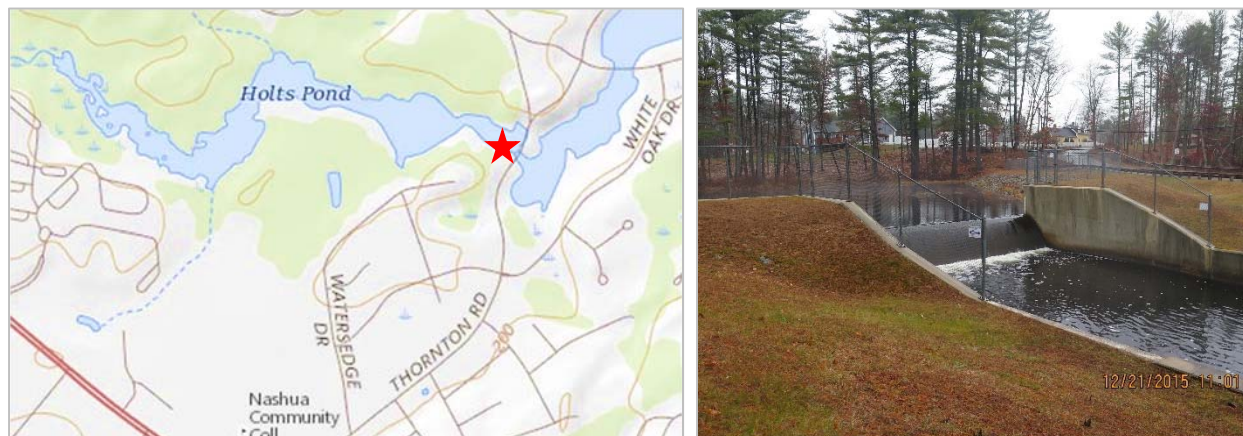
Tributary Total Phosphorus, 01-BFB (2007-2018)



Other Analyses of Note

- pH levels for both the 01-BFB groundwater and tributary locations have consistently been higher (more basic) than other sampling locations, with highest levels (e.g. pH of 9.97) generally occurring during the mid to late summer.
- Conductivity levels for surface water at 01-BFB have historically been by far the highest among the sampling locations in the watershed. The average conductivity value for 2018 (851.0 $\mu\text{S}/\text{cm}$) exceeded the New Hampshire chronic chloride standard (835 $\mu\text{S}/\text{cm}$), and this location exceeds the NHDES “high impact” threshold for the 2007-2018 period of record. High conductivity levels at this location may be associated with de-icing salt applied nearby on the Everett Turnpike and at the airport that is washed into the tributary via snowmelt and storm runoff in the spring. Groundwater alkalinity was approximately 5 to 6 times higher than average among sampling locations, further indicating potential contamination from road salt.
- 01-BFB continues to have the highest levels of *E. coli* bacteria and the highest rate of *E. coli* exceedances of all tributary sampling locations. See additional discussion in Section 5 (Recommendations).
- 01-BFB continues to have the highest concentrations of nitrate among the tributary sampling locations.

4.2 09-PEN

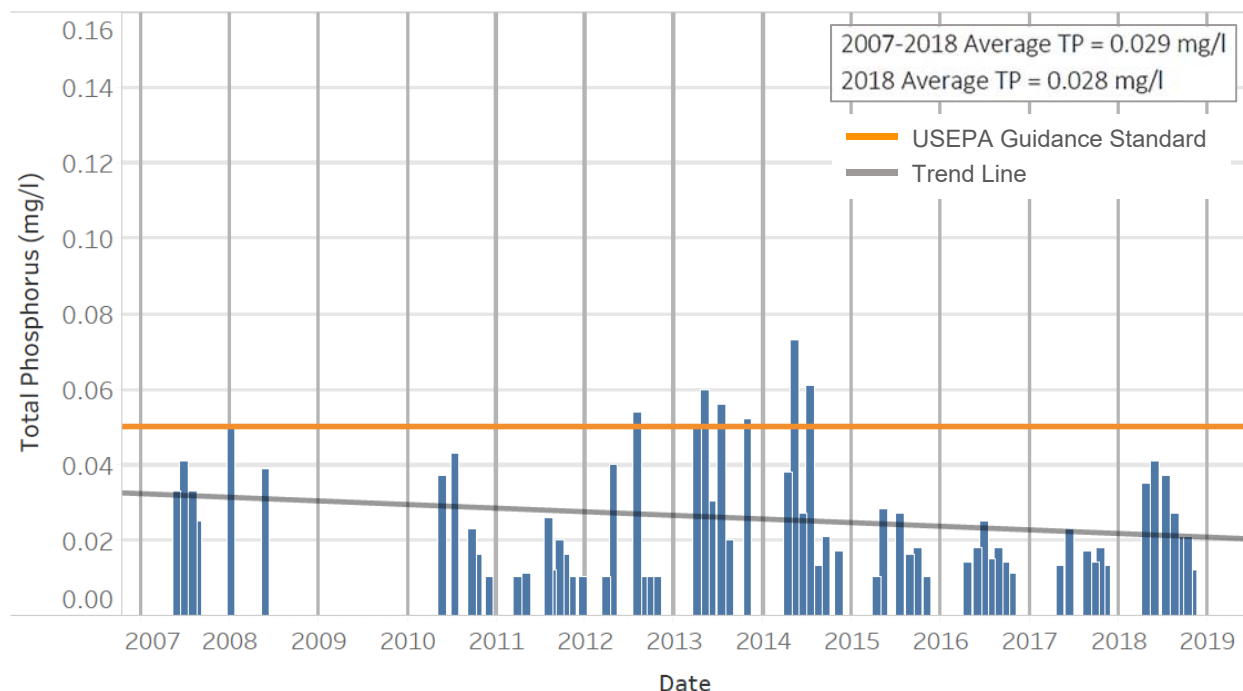


09-PEN is located at the eastern, downstream end of Holts Pond, just upstream of the dam separating Holts Pond and Bowers Pond.

Total Phosphorus Analysis

- The 2018 TP results for 09-PEN presented a moderate increase from the relatively stable results over the previous three sampling seasons. However, the average TP level for 2018 (0.028 mg/L) was comparable to the TP average for the 2007-2018 period of record at this location (0.029 mg/L), and was mid-range among all tributary locations for 2018.
- Because phosphorous levels in the next upstream location (09T-PEN) have generally been slightly higher than those at 09-PEN, it is likely that Holts Pond acts as a phosphorus sink, with deeper water and slower flow velocities allowing for the settling of phosphorus attached to particulate matter. Phosphorus in both sediment and the water column also can be partially uptaken by rooted aquatic plants and therefore temporarily removed during the growing season.
- TP levels at 09-PEN have remained below the USEPA stream standard (0.050 mg/L) since the summer of 2015. However, the equivalent USEPA TP guidance concentration¹ for this in-pond location is 0.025 mg/l for in-pond TP. 09-PEN slightly exceeds this guidance concentration both for 2018 and for the 2007-2018 period of record, indicating that TP levels are sufficient to support eutrophic conditions, such as abundant aquatic vegetation and high algal productivity.
- Groundwater sampling at 09-PEN was discontinued at the end of the 2015 sampling rounds, as the existing monitoring well had been historically unreliable due to poor recharge associated with silty soils.

Tributary Total Phosphorus, 09-PEN (2007-2018)



Note: Surface water data for 8/6/2015 was removed due to outlier data/assumed lab error.

Other Analyses of Note

- 09-PEN has consistently exhibited conductance levels in the low end of the NHDES category for “moderate impact”, and this trend continued in 2018 with an average conductance of 230.6 $\mu\text{S}/\text{cm}$.
- Total nitrogen levels in 2018 were almost double 2017 levels, with average concentrations of 1.1 mg/l and 0.63 mg/l, respectively.
- Other parameters were consistent with previous years.

4.3 09T-PEN

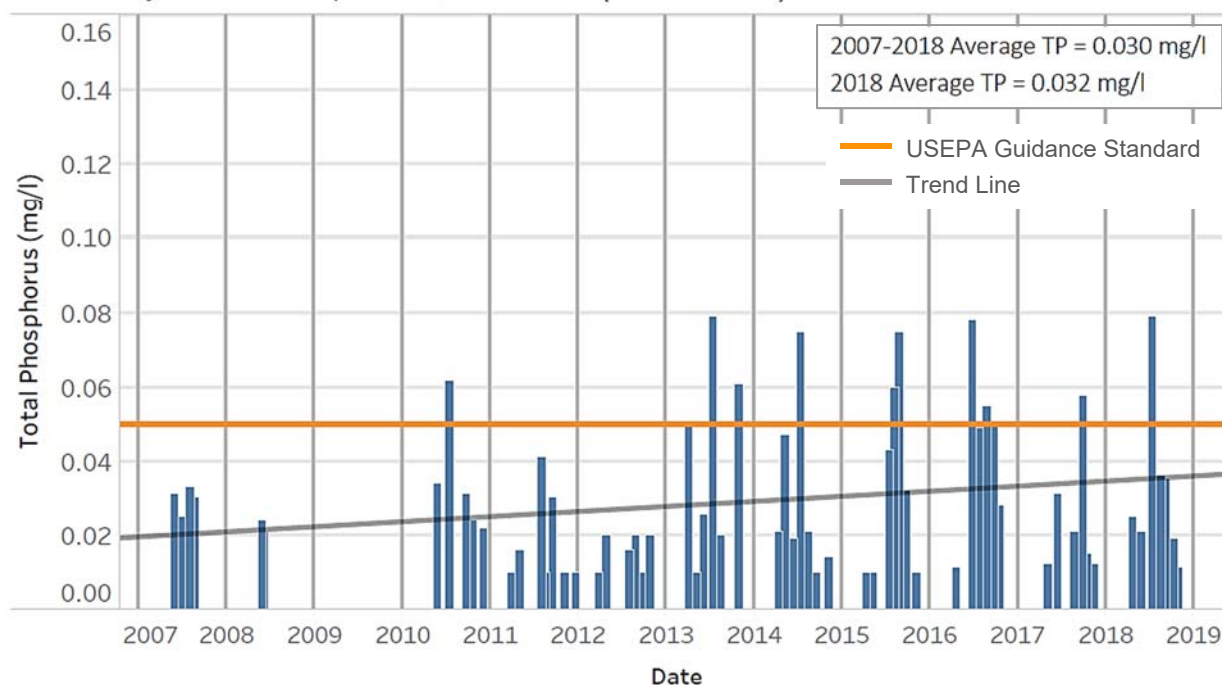


09T-PEN is located at the culvert where Pennichuck Brook passes underneath Route 101A. The contributing watershed is moderately developed and includes medium-density residential areas. The terrain at this location is unsuitable for microwell installation, so the groundwater sampling station is located a few hundred yards downstream, behind the Pennichuck Square shopping complex.

Total Phosphorus Analysis

- TP results for this location have been erratic over the period of record, with results fluctuating between approximately 0.01 mg/L and 0.08 mg/L over the past five years.
- 2018 tributary TP levels (0.032 mg/L) were generally consistent with those reported since 2013, and also similar to the average for the period of record (0.030 mg/L). In 2018, 09T-PEN was tied with 01-BFB for having the highest average TP among all sampling locations.
- TP levels at 09T-PEN exceeded the USEPA stream standard on one sampling event in 2018, and have exceeded that standard on at least one sampling event for each of the past five years.
- The contributing watershed of 09T-PEN has also seen historic dumping of assorted yard wastes immediately upstream of the location in the vicinity of the groundwater well, potentially contributing to elevated phosphorus levels.

Tributary Total Phosphorus, 09T-PEN (2007-2018)

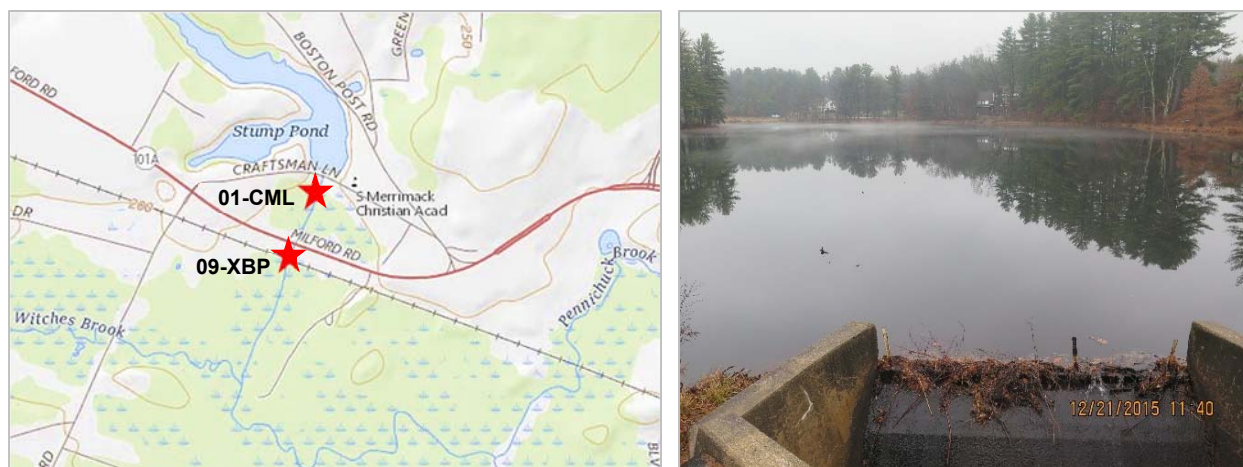


Note: Surface water data for 1/8/2008 and 6/2/2016 removed due to outlier data/lab error.

Other Analyses of Note

- Historically, tributary pH levels at 09T-PEN have been among the highest (most basic) in the watershed.
- Total nitrogen levels have typically been more or less average within the tributary when compared to other stations, but they spiked to among the highest levels recorded in 2018.
- Other groundwater parameters have remained consistent over a 5-year period and are average relative to the other the sampling locations.

4.4 09-XPB / 01-CML



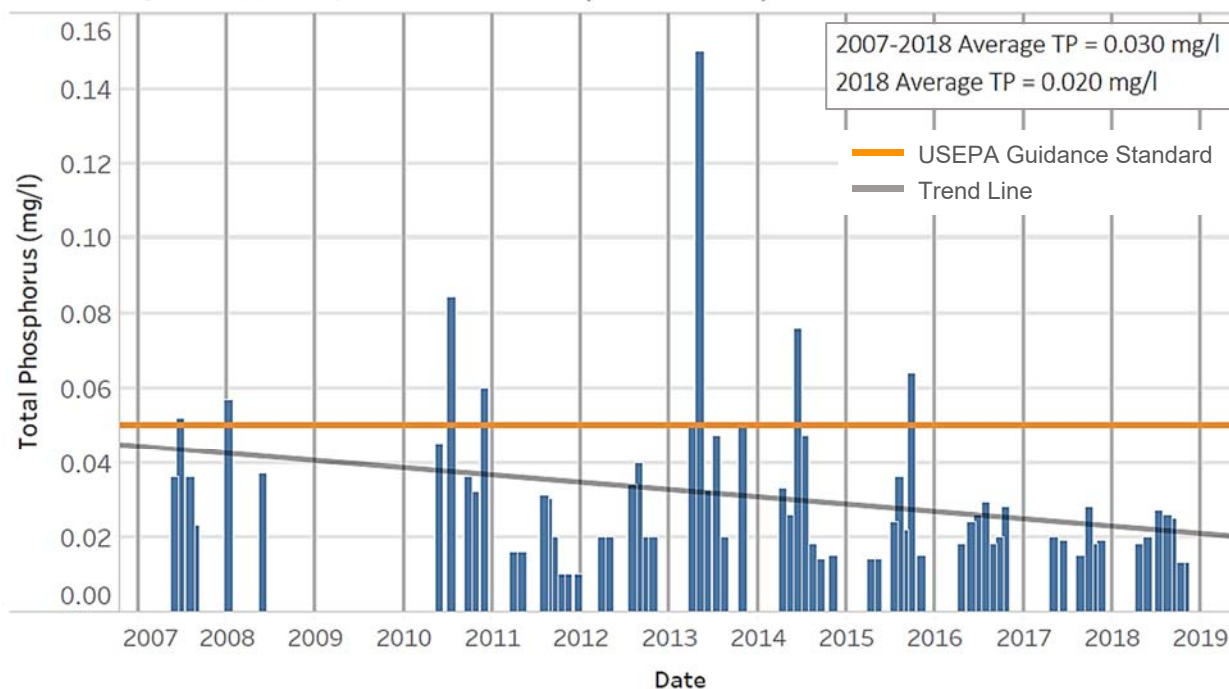
Sampling location 09-XPB is split into two sites. Groundwater and tributary monitoring are conducted at 01-CML (south of Craftsman Lane), while data logging and stage discharge readings are performed at 09-XPB, located just south of Rt. 101A. During sampling efforts, the culvert under Craftsman Lane was observed to be in generally poor condition. The contributing watershed includes a small developed area and forested, medium-density residential neighborhoods.

Total Phosphorus Analysis

- 09-XPB has exhibited a decreasing trend in TP concentrations over the 2007-2018 period of record. Average TP concentrations at 09-XPB have also gone from some of the highest in the Pennichuck Brook watershed to more average relative to the other sampling stations.
- TP levels at this location have been relatively stable over the last three years, compared to the more erratic results seen in earlier years.
- TP results at 09-XPB have not exceeded the USEPA stream standard for phosphorus since 2015.
- Historically, groundwater phosphorus levels for this location have been relatively low when compared to other monitoring locations, but groundwater TP levels in 2018 were among the highest of all locations.

A SWPG application was submitted to NHDES to complete a more detailed subwatershed analysis in order to better understand potential impacts of stormwater and other natural contaminant sources (e.g., eroded banks). Pending approval by NHDES, this project will be completed by May 2020.

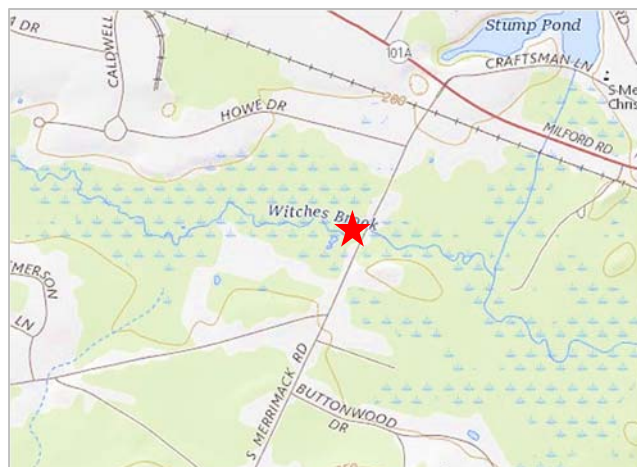
Tributary Total Phosphorus, 09-XPB (2007-2018)



Other Analyses of Note

- 09-XPB has consistently exhibited conductance levels in the low end of the NHDES category for “moderate impact”, and this trend continued in 2018 with an average conductance of 236.2 $\mu\text{S}/\text{cm}$.
- Ammonia nitrogen levels at all tributary sampling locations have typically been below the laboratory detection limit of 0.2 mg/l. However, 09-XPB saw three occurrences in 2018 in which ammonia levels were slightly elevated, an increase from one such occurrence in 2017.

4.5 01-WCH

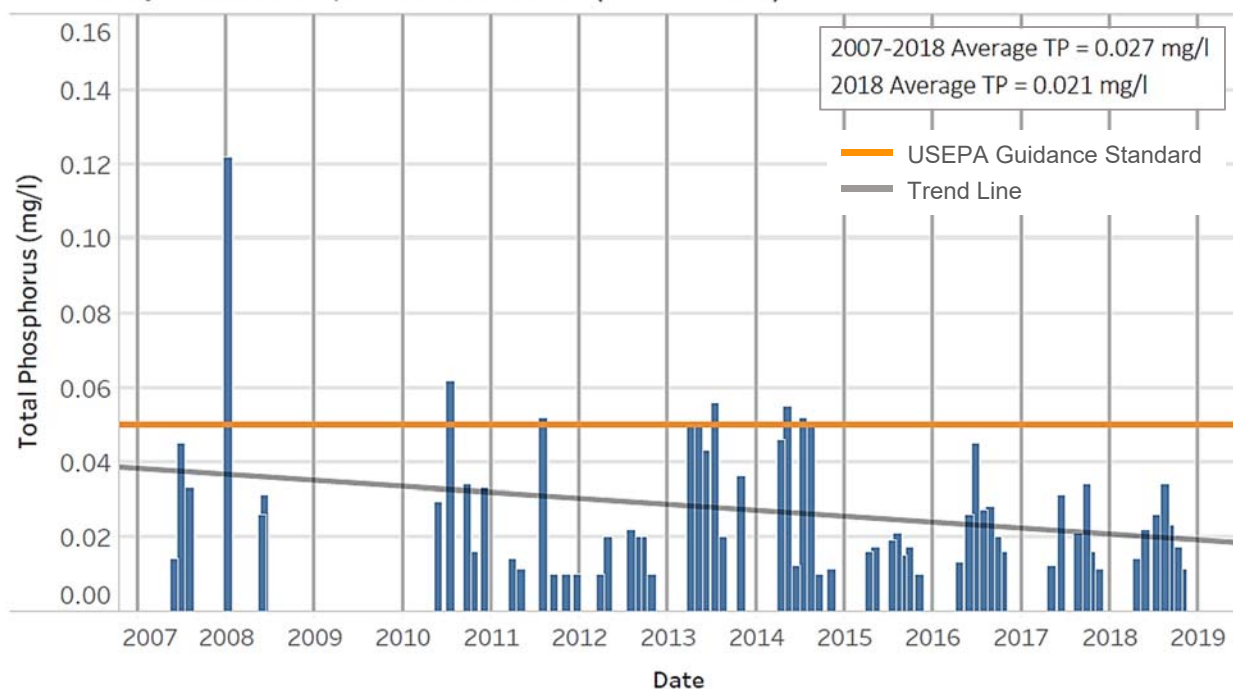


01-WCH is located at the South Merrimack Road culverted crossing of Witches Brook. Large wetlands exist on both sides of the Witches Brook culvert, with the brook forming a meandering channel through emergent vegetation. Water velocity is typically slow in this area but water levels are deep, especially after heavy rain events.

Total Phosphorus Analysis

- Tributary TP levels at 01-WCH have exhibited a moderate decreasing trend over the 2007-2018 period of record.
- TP has averaged 0.027 mg/L over the period of record (fourth lowest among all sampling locations) with a slightly lower average of 0.021 mg/L for 2018.
- Average TP in 2018 was comparable to 2017 (0.022 mg/L) and slightly below the average for all tributary sampling locations.
- Tributary TP has been relatively stable at this location over the past three years, and levels have been below the USEPA stream standard since 2015.
- Groundwater TP levels at this location continue to be extremely varied throughout the sampling rounds, with frequent fluctuations between the highest and lowest recorded values relative to the other locations. See Section 5 for recommendations related to future groundwater monitoring protocols.

Tributary Total Phosphorus, 01-WCH (2007-2018)



Other Analyses of Note

- Groundwater at this location continues to show higher total nitrogen concentrations than other monitoring well locations. Other nitrogen components (nitrate, nitrite, and ammonia) were consistent with other locations, indicating that organic sources of nitrogen are relatively high at this location.
- 01-WCH has reported some of the highest levels of indicator pathogens (*E. coli* and fecal coliform bacteria) among all sampling locations. See additional discussion and table in Section 5.

4.6 01-XWB

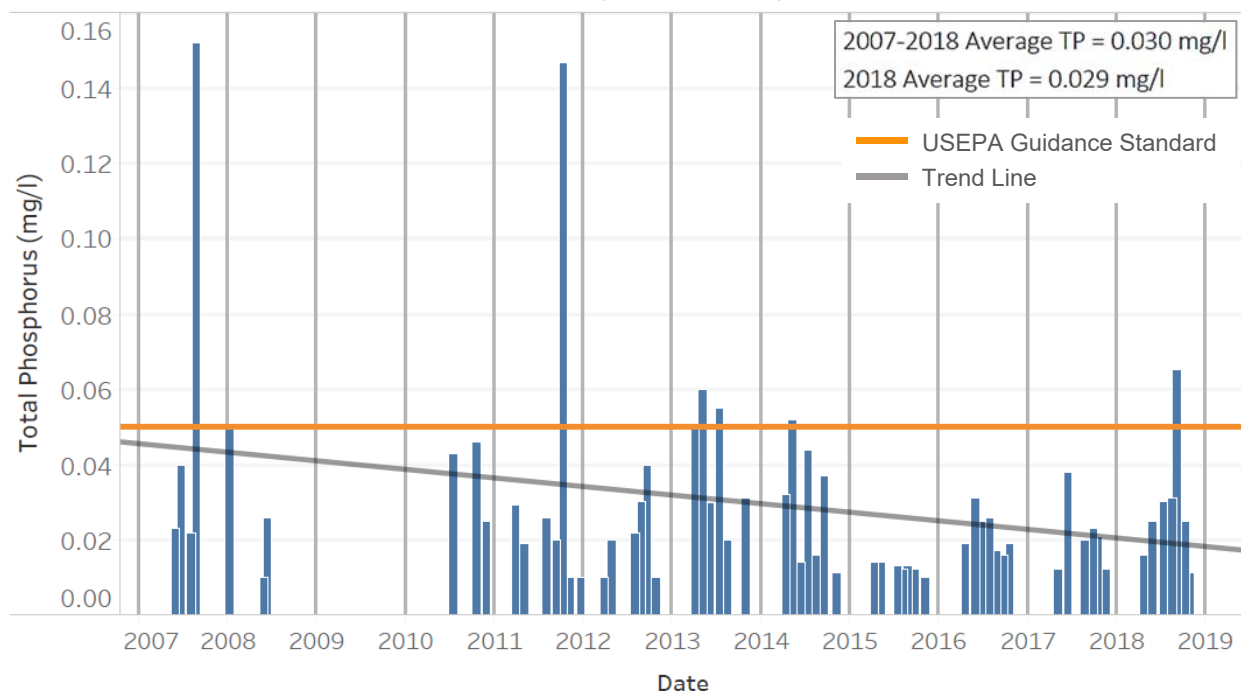


01-XWB is located along the southern side of Witches Brook, on a farm plot off of Witches Spring Road. The brook flows through a combination of wooded, residential, agricultural, and wetland areas. The farm is used for hay production and there are small livestock enclosures in the area. This portion of the brook is wide and deep but typically moves slowly.

Total Phosphorus Analysis

- TP levels at 01-XWB have been relatively stable since 2014 when compared to the more erratic results from earlier sampling years. Although the 2018 average TP (0.029 mg/L) was moderately higher than observed in 2017 (0.022 mg/L), it is comparable to the TP average for the 2007-2018 period of record (0.030 mg/L).
- Tributary TP levels at this location are mid-range when compared to other locations in the Pennichuck watershed and have generally fallen below the USEPA stream standard over the past five years with the exceptions of two exceedances in 2015 and 2018, respectively.
- Groundwater phosphorus concentrations are moderate to high at this location relative to the other sampling locations. See Section 5 for recommendations related to future groundwater monitoring protocols.

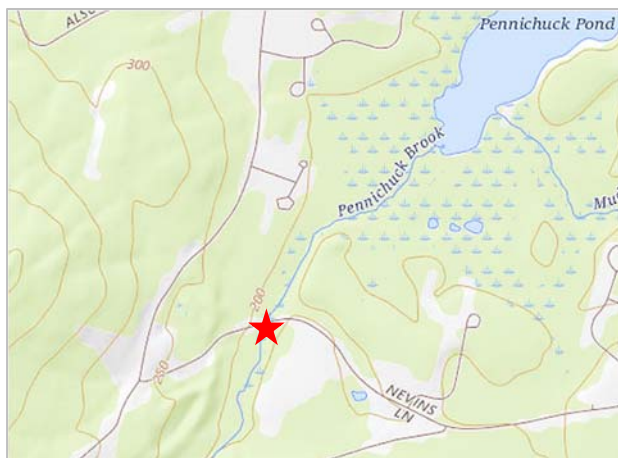
Tributary Total Phosphorus, 01-XWB (2007-2018)



Other Analyses of Note

- 01-XWB has historically seen some of the highest tributary *E. coli* and fecal coliform concentrations of all the sampling locations. This location is second only to 01-BFB in percentage of single sample *E. coli* exceedances from 2007-2018 (see additional discussion and table in Section 5). Livestock located nearby could contribute to these elevated concentrations, which were also observed in 2018.
- Although nitrogen levels in the tributary are in line with most other locations, groundwater nitrogen concentrations at 01-XWB have historically been among the highest. These concentrations were lower in 2018, closer to the average for all monitoring well locations.

4.7 12-PEN

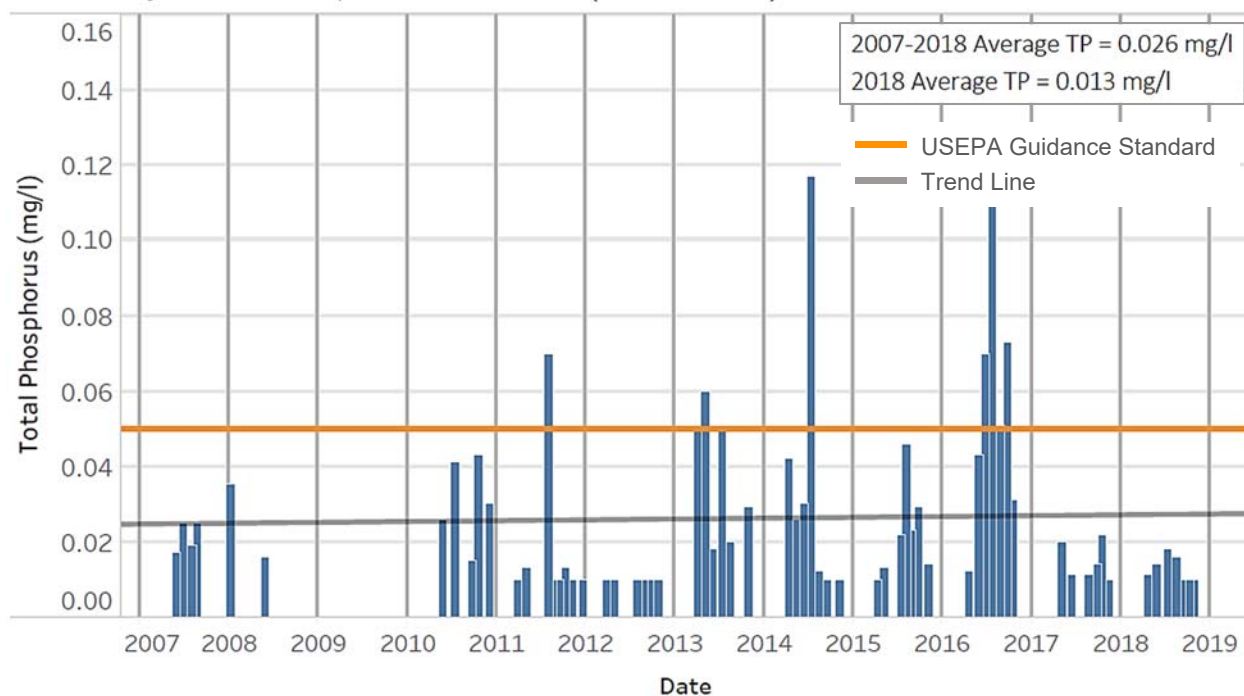


12-PEN is located at the Pennichuck Brook crossing of Nevins Road in Hollis. The contributing watershed is mostly wooded and residential, but there are some small livestock enclosures in the area. This subwatershed also includes an apple orchard (Scooter's Farm of Woodmont). Water velocity is generally high while water depth is low. However, beaver dams constructed downstream have caused the water in this area to stagnate on occasion.

Total Phosphorus Analysis

- TP results for this sampling locations have been notably erratic over the past five years. Average TP was amongst the highest of all sampling locations in 2016, yet the second lowest in 2017 and lowest in 2018 (0.013 mg/L).
- The erratic nature of the TP data for this location is further emphasized by the fact that average TP for the period of record (0.026 mg/l) is twice the 2018 average concentration, the largest such disparity among the sampling locations.
- Although this location had three exceedances of the USEPA stream standard for TP in 2016, all measurements over the past two years have been well below the standard.
- Groundwater concentrations have historically been relatively average at this location, with some instances of higher-than-average concentrations. Groundwater total phosphorus levels in 2018 remained average.

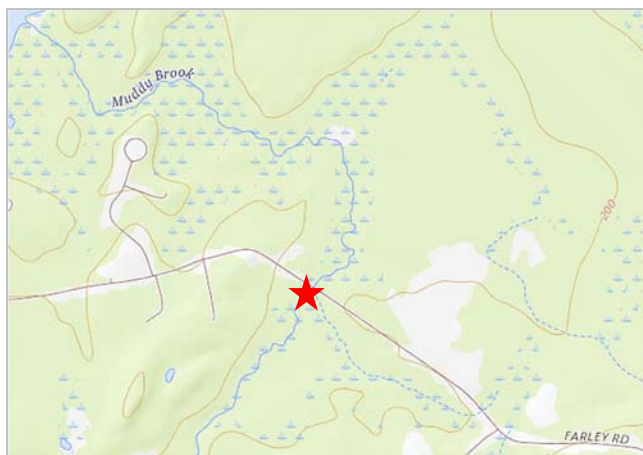
Tributary Total Phosphorus, **12-PEN** (2007-2018)



Other Analyses of Note

- Water levels have begun to decrease following elevated levels observed in 2016.

4.8 01-MUD

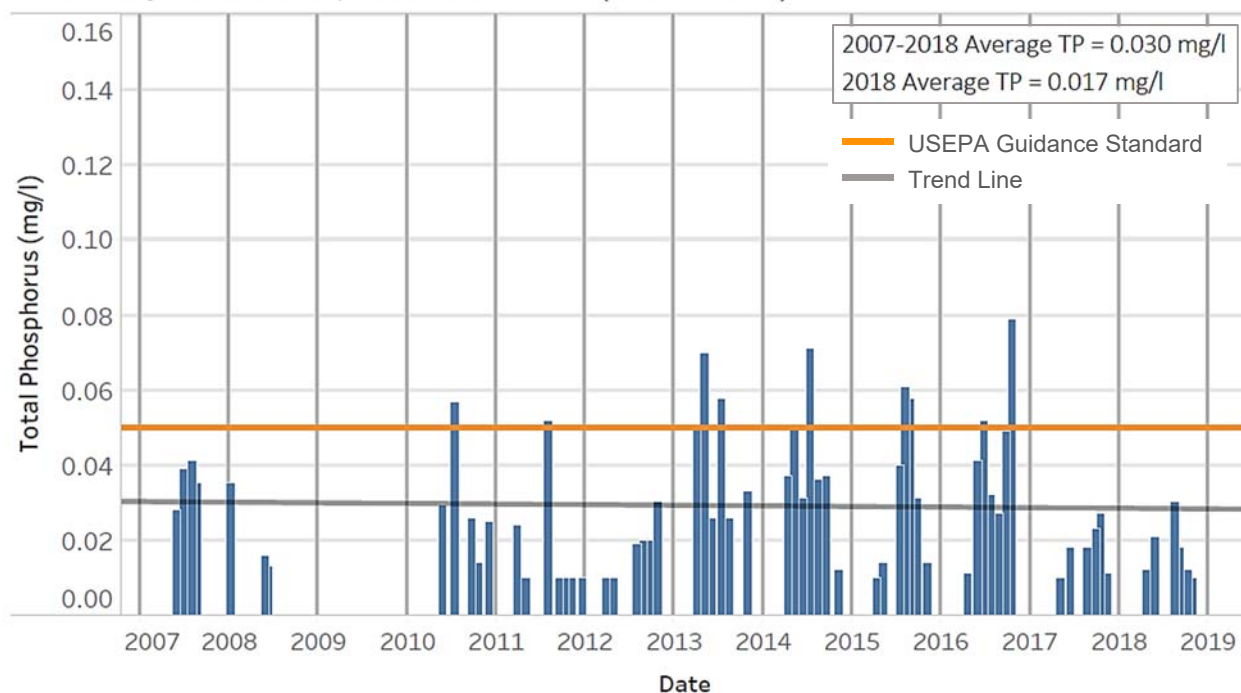


01-MUD is located at the crossing of Muddy Brook and Farley Road. Much like 01-WCH, this area is characterized by a large wetland/stream complex, with the Muddy Brook stream channel meandering through emergent and scrub/shrub wetland vegetation. Water velocity is typically low with deep water levels.

Total Phosphorus Analysis

- Tributary phosphorus levels at this location were notably lower in 2017 and 2018 than in the preceding four years (2013-2016). The 2018 average TP (0.017 mg/L) was the second lowest among all locations, and was significantly lower than the average for the period of record (0.030 mg/L).
- TP levels did not exceed the USEPA stream standard in 2017 or 2018, after having multiple exceedances in each of the preceding four years (and six out of the nine preceding sampling years).
- Groundwater phosphorus levels at 01-MUD have historically been among the highest of all sampling locations. This trend continued in 2018, although concentrations were more average during sampling events in May and September. See Section 5 for recommendations related to future groundwater monitoring protocols.

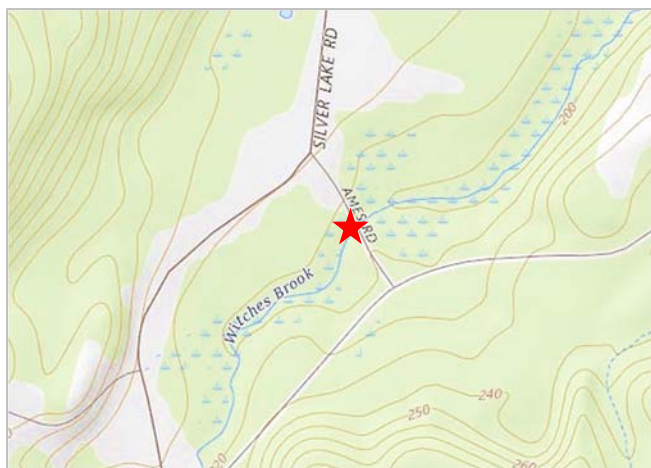
Tributary Total Phosphorus, 01-MUD (2007-2018)



Other Analyses of Note

- Groundwater at this location has the lowest (most acidic) pH (e.g. pH of 5.53) and alkalinity levels and the highest conductivity, total dissolved solids, and total phosphorus levels of all sampling locations in the watershed.
- 01-MUD has some of the lowest tributary dissolved oxygen (DO) levels of all the locations. Low DO levels can occur naturally in slow moving stream/wetland areas such as 01-MUD, particularly in summer when base flows are typically low and oxygen consumption due to decomposition of organic material is at its highest.
- This location has consistently exhibited the highest levels of total dissolved solids (TDS) of all locations. TDS is a measure of the combined total of organic and inorganic substances contained in the water, including minerals, salts and organic matter.

4.9 02-WCH

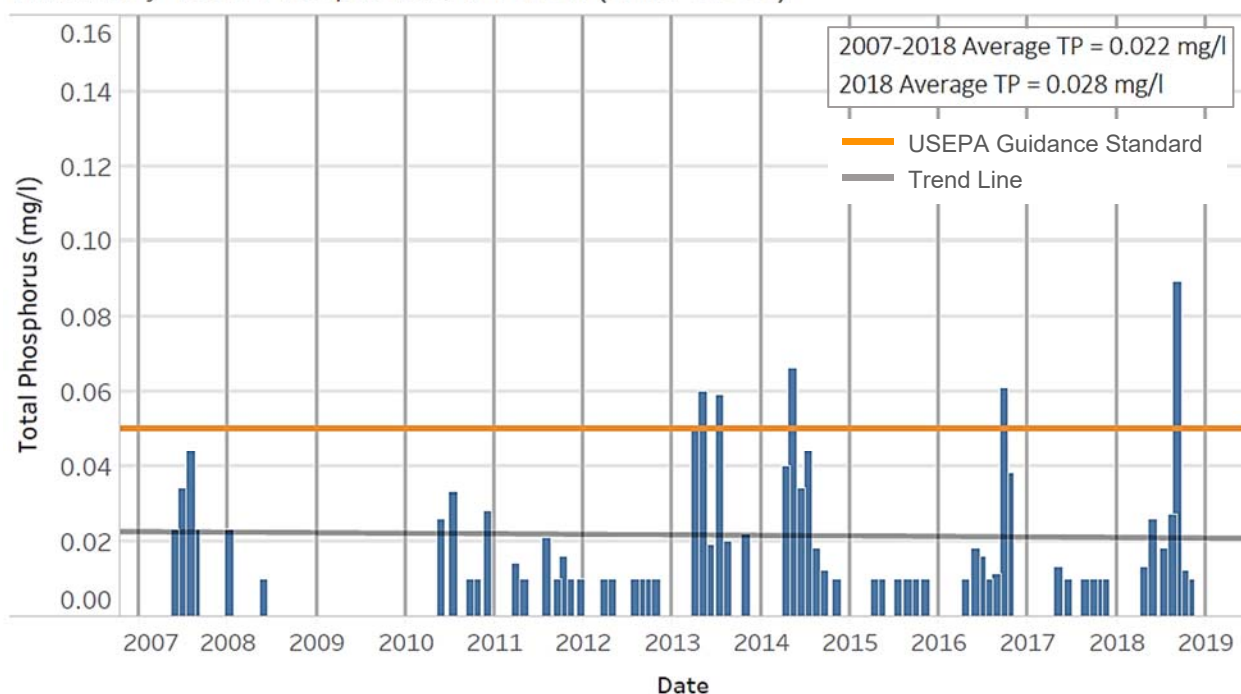


02-WCH is located at the crossing of Witches Brook and Ames Road. The brook flows through a largely wooded and residential area of Hollis, NH. This site has a groundwater well adjacent to the tributary, installed in 2016. This well has poor recharge and was often dry during parts of the year, resulting in fewer samples and associated data than other locations.

Total Phosphorus Analysis

- TP results from 02-WCH have been erratic over the past five years. The average TP for 2018 (0.028 mg/L) was nearly triple the average for 2017 (0.01 mg/l). The 2018 average was also moderately higher than the average for the period of record at this location (0.022 mg/L), which is the lowest average of all locations that have been sampled since 2007. Only 01-HAY has a lower average TP, but this location has only been sampled since 2016.
- In 2018, there was one exceedance of the USEPA stream standard (September 2018).
- Groundwater phosphorus levels at this location were below average in 2016 relative to the other locations, and they have risen to slightly above average in recent years, albeit with some variation.

Tributary Total Phosphorus, 02-WCH (2007-2018)

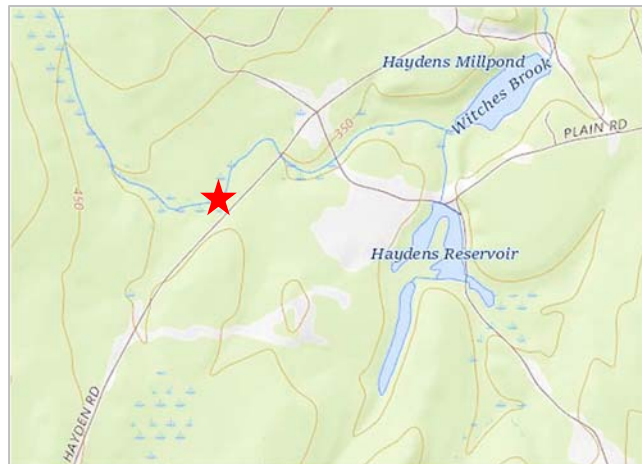


Note: Surface water data for 8/6/2015 was removed due to outlier data/assumed lab error.

Other Analyses of Note

- Nitrates at this location have been historically high, with this trend continuing into 2018. However, there is no obvious reason for this location to have concentrations approximately three times higher than other locations.
- Other water quality parameters for both the groundwater and tributary at this location are either average or below average relative to the other sites, with the exception of nitrates and total nitrogen, which are present in some of the highest levels in both groundwater and tributaries of all the locations.

4.10 01-HAY

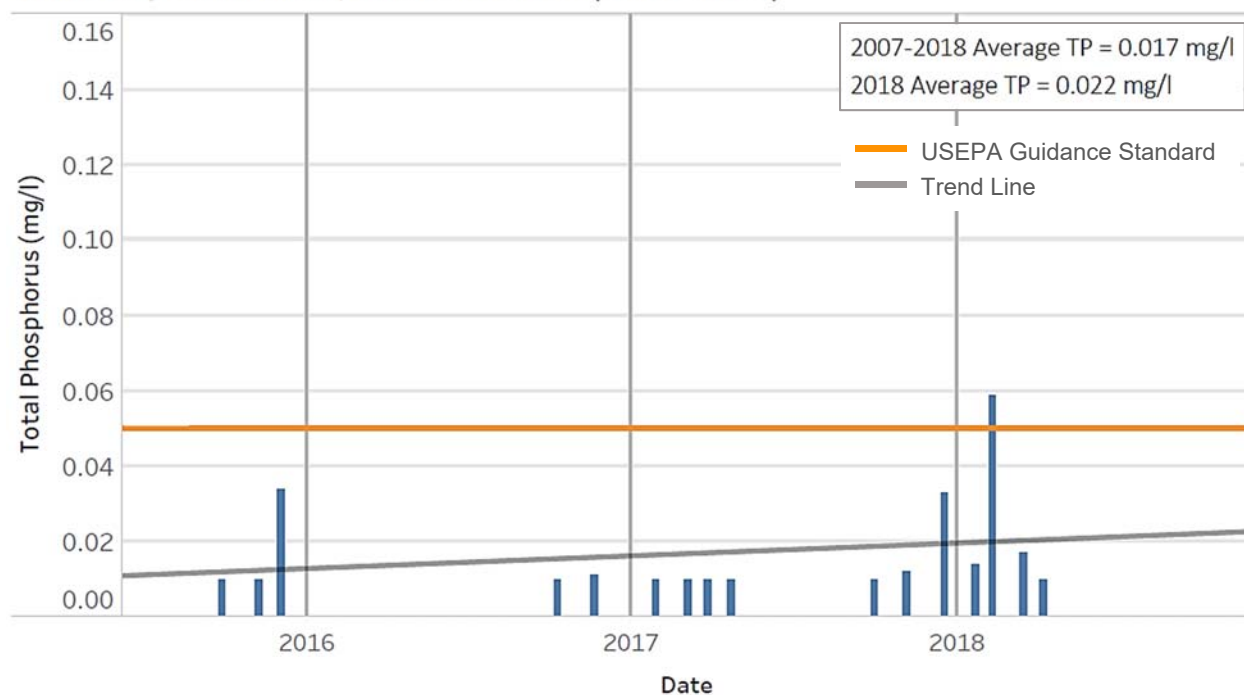


01-HAY is located at Witches Brook, just west of Hayden Road and beneath the Eversource power line right-of-way. Tributary and groundwater sampling at this site were added at the beginning of the 2016 sampling round, to allow for headwaters sampling of Witches Brook. The headwaters reach of Witches Brook runs through an area of Hollis, NH with predominantly forested land and low- to medium-density residential development.

Total Phosphorus Analysis

- Tributary phosphorus concentrations at 01-HAY were among the lowest in the watershed in 2017, which was expected due to its relatively undeveloped surroundings towards the headwaters of the watershed. Although TP levels increased in 2018, the average TP for 01-HAY (0.022 mg/L) was still lower than the average for all sampling locations. This site has the lowest average TP for the period of record, although sampling has only been conducted for three years at this location.
- One TP measurement in 2018 exceeded the USEPA stream standard,
- Although groundwater sampling events at this location have been limited over the past three years due to poor well recharge, the available measurements show above-average groundwater TP levels at this location, and this trend continued in 2018. This is consistent with the overall trend of higher phosphorus levels in the southern portion of the overall watershed.

Tributary Total Phosphorus, 01-HAY (2016-2018)



Other Analyses of Note

- Alkalinity measurements at 01-HAY include some of the highest concentrations of all the sites.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Tributary Phosphorus Levels

A summary of TP results for all tributary sampling locations is provided below. Sampling locations are listed below from lowest to highest average TP levels for the 2007-2018 period of record. As noted in Section 4.0, NHDES guidance categorizes TP concentrations from 0.026 mg/L – 0.049 mg/L as “more than desirable”

Tributary Sampling Location	2018 Avg. TP (mg/L)	2007-2018 Avg. TP (mg/L)	Notes: NHDES guidance ² categorizes freshwater TP (mg/L) as follows: 0.011 - 0.025: Average 0.026 – 0.049: More than desirable * Data only for 2016-2018
01-HAY*	0.022	0.017	
02-WCH	0.028	0.022	
12-PEN	0.013	0.026	
01-WCH	0.021	0.027	
09-PEN	0.028	0.029	
01-MUD	0.017	0.030	
09-XPB	0.020	0.030	
09T-PEN	0.032	0.030	
01-XWB	0.029	0.030	
01-BFB	0.032	0.031	
Averages	0.024	0.027	

- Although the sampling locations have varied considerably over the years with regard to the range and consistency of TP results, the TP averages for the 2007-2018 period of record are notably similar and within a relatively narrow range. Eight of the ten locations have an average TP separated by the small margin of 0.005 mg/L (0.026 mg/L - 0.031 mg/L), all which fall in the low end of the NHDES “more than desirable” category for freshwater TP. These results support continued efforts to reduce TP loads through best management practices and improved land use management, with a goal of reducing TP to 0.025 mg/L or lower at all locations.
- With a few exceptions, the 2018 tributary TP data was consistent with the averages for the period of record for each sampling location. 12-PEN, 01-MUD, and 09-XPB had 2018 TP averages that were significantly below their period of record averages.
- 09-PEN is the only sampling location located within a pond (Holts Pond). As an in-pond location, the relevant USEPA TP guidance for 09-PEN would be 0.025 mg/l for in-pond TP. 09-PEN slightly exceeds this guidance concentration both for 2018 and for the 2007-2018 period of record, indicating that TP levels are sufficient to support eutrophic conditions, such as abundant aquatic vegetation and high algal productivity.
- Additional field investigations are recommended to identify potential pollutant sources that may contribute to the erratic tributary TP results at locations 02-WCH, 12-PEN, and 09T-PEN. Field investigations could include identification of land use activities resulting in elevated pollutant loads and potential opportunities for nutrient attenuation through construction of new or upgraded stormwater management practices (e.g., pretreatment BMPs, improved vegetative buffers, etc.)

Groundwater Monitoring / Groundwater Phosphorus Levels

- In 2018, groundwater TP results from the Pennichuck watershed sampling locations have continued to significantly exceed the typical ranges for groundwater TP. The national background concentration for groundwater TP is 0.03 mg/L, with a typical range of 0.05mg/L to 0.5 mg/L. TP results for 2018 and preceding years have regularly exceeded the high end of this range, in some cases by more than an order of magnitude.
- CEI has taken an adaptive management approach to modifying groundwater sampling protocols to improve the reliability of the groundwater sampling results, including:
 - Physical improvements (i.e., drilling deeper wells at 02-WCH and 01-HAY) to improve recharge;
 - Eliminating well sites with poor recharge from the sampling program; and
 - Establishing a sample filtering protocol to prevent inaccurate measurements due to an elevated presence of suspended solids (and associated constituents attached to particulate matter, such as phosphorus). Because of concerns that sample filtering was potentially lowering the TP results to unrepresentative levels, this approach was curtailed and only unfiltered groundwater samples have been analyzed since 2016.

To continue to improve the groundwater sampling program, the following additional protocols are recommended:

- After well purging, groundwater samples should be collected and measured for turbidity with an *in-situ* turbidity meter. Groundwater samples should be accepted for further analysis only if turbidity is 5 NTUs or less.

USEPA guidance suggests that a properly constructed well with adequate recharge should be capable of yielding samples with a turbidity of 5 NTUs or less. Although total suspended solids (TSS) is a more precise measure of particulate matter in sample water, there is a strong linear relationship between TSS and turbidity, and turbidity can be quickly and easily measured in the field. As such, the recommended threshold of 5 NTUs has wide use and acceptance for this kind of environmental monitoring.

- For sampling locations that consistently fail to meet the 5 NTU threshold, the use of low-flow sampling equipment should be considered. Low flow sampling equipment creates less disturbance within the well, and allows for better settling of solids following the well purging process that precedes sample water collection. Because this sampling protocol is more time and labor intensive, it should be employed on an as-needed at sampling locations based on well recharge conditions and the *in-situ* turbidity measurements described above. Alternatively, representative locations could be selected for low-flow sampling in order to be time sensitive to completing field sampling while meeting bacteria hold times. Well conditions should be evaluated throughout 2019 and adaptive changes made as needed.

Other Recommendations

- Investigate potential opportunities to reduce elevated conductivity levels at sampling locations 01-BFB, 09-XPB, and 09-PEN. As shown in the table below, these locations are categorized by

NHDES as either having moderate impact (09-PEN, 09-XPB) or high impact (01-BFB) for both 2018 and the 2007-2018 period of record. These investigations should include coordination with local highway departments to determine road salting practices and potential opportunities to safely reduce the use of de-icing salt (e.g., reduced salt zones, use of alternative de-icing products, etc.) in the road areas nearest to the streams.

Tributary Sampling Location	2018 Avg. Conductivity (μS/cm)	2007-2018 Avg. Conductivity (μS/cm)	Notes: NHDES Conductivity Categories² (μS/cm) 0-100: normal 101-200: low impact 201-500: moderate impact >501: high impact >835: exceeds chronic chloride standard * Data only for 2016-2018
01-HAY*	51.4	48.4	
02-WCH	128.7	125.6	
01-XWB	149.5	135.1	
12-PEN	182.1	140.5	
01-MUD	166.3	155.0	
09T-PEN	191.0	179.6	
01-WCH	173.6	182.9	
09-PEN	228.9	230.6	
09-XPB	255.5	236.2	
01-BFB	851.9	690.5	
Averages	237.9	212.4	

- Investigate potential land use and wastewater issues that could be contributing to elevated indicator pathogen (*E.coli*) levels at sampling locations 01-BFB, 01-WCH, and 01-XWB. As shown in the table below, 01-BFB has a geometric mean for the period of record that exceeds New Hampshire Class A Water Quality Standards, with 01-XWB and 01-WCH close to this threshold. 01-BFB and 01-XWB should be considered the highest priority because they have the highest rate of single sample *E. coli* exceedances, indicating persistent sources of bacterial contamination that need to be addressed.

Tributary Sampling Location	% E. Coli Exceedances, 2007-2018 (single sample > 153 cts/100 ml)	E. Coli Geometric Mean, 2007-2018	Notes: NH Water Quality Standards (RSA 485-A:8): Class A water shall contain not more than: - a geometric mean of 47 <i>E.coli</i> cts/100 mL based on at least 3 samples obtained over a 60-day period, or - greater than 153 <i>E.coli</i> cts/100 mL in any one sample. * Data only for 2016-2018
02-WCH	4.5	12.3	
09-XPB	7.6	13.5	
01-HAY*	5.9	22.3	
09-PEN	0.0	22.8	
12-PEN	9.1	27.6	
01-MUD	10.6	30.7	
09T-PEN	6.1	34.9	
01-XWB	20.3	44.4	
01-WCH	7.7	46.0	
01-BFB	25.0	53.2	
Averages	9.9	30.8	

Attachment A:

Tributary Sampling Data, 2007 through 2018

Laboratory Detection Limit
For detection of <i>C. difficile</i> in Food samples, see File #

[illegible]

091-PEN Tributary Sampling Data 2007-2018

Date	Staff Gauge Reading	Ammonia	Chloride	Conductivity	DO	E. coli	Fecal Coliform	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	TKN	Laboratory Detection Limit		
														Expected Outlier or Equipment Failure	Total Nitrogen	Total Phosphorus
5/30/2007		0.1	mg/L		3.42	mg/L	33.1	cs100 mL			6.47	19.7 °C	0.637	mg/L	4	mg/L
6/26/2007		0.1	mg/L	159	µS/cm	103.6	cs100 mL				6.43	22.9 °C	0.819	mg/L	6	mg/L
8/2/2007		0.243	mg/L	174	µS/cm	45	cs100 mL				6.36	23.4 °C	0.883	mg/L	4	mg/L
8/22/2007		0.333	mg/L	209.36	µS/cm	64	cs100 mL				6.26	16.8 °C	1.08	mg/L	4	mg/L
1/6/2008		0.198	mg/L			83.6	cs100 mL									
5/26/2008		0.194	mg/L	185.3	µS/cm	70.6	cs100 mL				6.4	17.6 °C	3.66	mg/L	546	mg/L
6/2/2008		0.291	mg/L										0.28	mg/L	4	mg/L
6/11/2008		0.313	mg/L										0.815	mg/L	4	mg/L
7/9/2008				62	µS/cm						6.25	26.5 °C	0.815	mg/L	4	mg/L
8/24/2008				103	µS/cm	95.9	cs100 mL				5.9					
5/25/2010		0.1	mg/L	171.2	µS/cm	5.71	cs100 mL				6.54	21.8 °C	0.5	mg/L	4	mg/L
7/13/2010		0.4	mg/L	251	µS/cm	75.9	cs100 mL				6.67	23.8 °C	0.5	mg/L	4	mg/L
9/22/2010		0.2	mg/L	146.7	µS/cm	146.7	cs100 mL				7.14	31.1 °C	0.5	mg/L	4	mg/L
10/6/2010		0.2	mg/L		0.76	25.3	cs100 mL				7.51	8.5 °C	0.5	mg/L	4	mg/L
10/6/2010		0.2	mg/L		0.5											
11/6/2010		0.2	mg/L	0.17	µS/cm	28.1	cs100 mL				5.9	2.4 °C	0.5	mg/L	4	mg/L
3/30/2011		0.2	mg/L	137.6	µS/cm	10.72	mg/L				6.34	5.1 °C	0.5	mg/L	4	mg/L
5/2/2011		0.297	mg/L	142	µS/cm	8.61	mg/L				6.68	16.1 °C	0.5	mg/L	4	mg/L
8/4/2011		0.2	mg/L	193.9	µS/cm	2.88	mg/L				6.47	23 °C	0.5	mg/L	4	mg/L
8/16/2011		0.2	mg/L	164.9	µS/cm	4.77	mg/L				6	23 °C	0.5	mg/L	4	mg/L
9/14/2011		0.2	mg/L	130.2	µS/cm	2.02	mg/L				6.4	21.5 °C	0.5	mg/L	4	mg/L
10/4/2011								No Data								
11/7/2011		0.2	mg/L	75.9	µS/cm	8.4	mg/L				6.09	5 °C	0.5	mg/L	4	mg/L
12/20/2011		0.2	mg/L	127	µS/cm	10.76	mg/L				6.46	1.3 °C	0.5	mg/L	4	mg/L
3/28/2012		0.05	mg/L	144	µS/cm	8.48	mg/L				6.05	6.2 °C	0.5	mg/L	5	mg/L
4/26/2012		2.90	mg/L	109	µS/cm	7.04	mg/L				6.29	12.7 °C	0.5	mg/L	5	mg/L
8/2/2012		0.05	mg/L	310	µS/cm	1.45	cs100 mL				6.19	22.2 °C	0.5	mg/L	5	mg/L
8/27/2012		0.05	mg/L	264	µS/cm	2.36	cs100 mL				6.43	20.3 °C	0.7	mg/L	5	mg/L
9/18/2012		1.59	mg/L	366	µS/cm	2.93	cs100 mL				6.35	35 °C	0.5	mg/L	5	mg/L
10/25/2012		0.05	mg/L	176.2	µS/cm	5.91	mg/L				6.1	10.1 °C	0.5	mg/L	5	mg/L
4/4/2013		3.00	mg/L	115.3	µS/cm	9.73	mg/L			0.5	6.22	5.1 °C	0.5	mg/L	6	mg/L
5/6/2013		2.24	mg/L	163.1	µS/cm	8.53	cs100 mL	3			6.56	20 °C	0.5	mg/L	6	mg/L
6/6/2013		0.2	mg/L	116.3	µS/cm	4.05	cs100 mL	12			5.95	20.1 °C	0.5	mg/L	6	mg/L
7/17/2013		2.59	mg/L	166.8	µS/cm	0.91	cs100 mL	0.2			6.15	25.6 °C	0.5	mg/L	7	mg/L
8/16/2013		2.54	mg/L	139	µS/cm	2.72	mg/L	0.2			6.23	34.3 °C	0.5	mg/L	6	mg/L
9/10/2013		1.63	mg/L	187.8	µS/cm	3.85	cs100 mL	0.2			7.06	16.6 °C	0.5	mg/L	6	mg/L
10/28/2013		1.84	mg/L	147.1	µS/cm	7.57	mg/L	0.2			6.41	5.5 °C	0.5	mg/L	6	mg/L
4/14/2014		3.06	mg/L	120	µS/cm	34.5	cs100 mL	0.2		0.2	7.23	11.8 °C	0.2	mg/L	4	mg/L
5/8/2014		2.64	mg/L	149.2	µS/cm	7.86	mg/L	0.2		0.2	7.06	14.7 °C	0.2	mg/L	4	mg/L
6/11/2014		2.14	mg/L	117	µS/cm	5.12	cs100 mL	0.2		0.2	7.14	20.5 °C	0.2	mg/L	4	mg/L
7/14/2014		0.2	mg/L	41	µS/cm	1.66	mg/L	0.2		0.2	6.58	24.4 °C	1.21	mg/L	4	mg/L
8/2/2014		1.86	mg/L	54	µS/cm	145.2	cs100 mL	0.2		0.2	6.63	20.9 °C	0.2	mg/L	4	mg/L
9/16/2014		1.72	mg/L	57	µS/cm	138.9	cs100 mL	0.2		0.2	6.38	13.6 °C	0.788	mg/L	4	mg/L
11/5/2014		3.00	mg/L	39	µS/cm	94.5	µS/cm	0.2		0.2	7.08	7.4 °C	0.2	mg/L	4	mg/L
4/13/2015		3.30	mg/L	26	µS/cm	121.5	µS/cm	0.2		0.2	6.34	10 °C	0.876	mg/L	4	mg/L
5/7/2015		2.53	mg/L	40	µS/cm	6.72	cs100 mL	0.2		0.2	6.49	19.4 °C	0.88	mg/L	4	mg/L
7/16/2015		2.30	mg/L	42	µS/cm	185.5	cs100 mL	0.2		0.2	6.49	21.8 °C	0.573	mg/L	7	mg/L
8/6/2015		1.95	mg/L	52	µS/cm	1.01	cs100 mL	0.2		0.2	6.40	21.4 °C	0.889	mg/L	8	mg/L
8/27/2015		-	mg/L	58	µS/cm	0.81	cs100 mL	0.2		0.2	6.38	21.6 °C	0.987	mg/L	8	mg/L
9/24/2015		1.10	mg/L	75	µS/cm	2.43	cs100 mL	0.2		0.2	6.77	15.6 °C	0.701	mg/L	4	mg/L
11/5/2015		1.97	mg/L	51	µS/cm	157.2	µS/cm	0.2		0.2	6.68	9 °C	0.393	mg/L	4	mg/L
4/27/2016		0.34	mg/L	191	µS/cm	16.1	cs100 mL	0.2		0.2	6.48	13.52 °C	0.538	mg/L	4	mg/L
6/2/2016		1.82	mg/L	51	µS/cm	216.7	µS/cm	0.2		0.2	7.33	20.2 °C	1.84	mg/L	15	mg/L
6/27/2016		1.20	mg/L	296.5	µS/cm	1.58	cs100 mL	0.2		0.2	7.28	23.3 °C	1.19	mg/L	13	mg/L
7/26/2016		0.90	mg/L	328	µS/cm	1.22	cs100 mL	0.2		0.2	7.40	22.7 °C	1.17	mg/L	4	mg/L
8/25/2016		1.50	mg/L	306.5	µS/cm	1.50	mg/L	0.2		0.2	7.25	20.1 °C	0.728	mg/L	24	mg/L
9/2/2016		2.50	mg/L	63	µS/cm	255.3	µS/cm	0.2		0.2	7.74	24.1 °C	0.38	mg/L	7	mg/L
10/19/2016		1.55	mg/L	72	µS/cm	239.1	µS/cm	0.2		0.2	8.25	13.7 °C	0.64	mg/L	4	mg/L
5/4/2017		3.05	mg/L	226	µS/cm	6.04	mg/L	0.2		0.2	8.35	14 °C	0.53	mg/L	4	mg/L
6/4/2017		2.81	mg/L	17.3	µS/cm	1.51	cs100 mL	0.2		0.2	8.21	24.5 °C	0.34	mg/L	4	mg/L
7/6/2017		2.59	mg/L	43	µS/cm	197.2	cs100 mL	0.2		0.2	7.30	22.8 °C	0.2	mg/L	4	mg/L
8/22/2017		2.26	mg/L	52	µS/cm	6.76	cs100 mL	0.2		0.2	6.92	22.8 °C	0.66	mg/L	4	mg/L
9/7/2017		1.77	mg/L	58	µS/cm		cs100 mL	0.2		0.2	6.95	13.3 °C	0.658	mg/L	12	mg/L
10/19/2017		2.14	mg/L	165	µS/cm	4.43	cs100 mL	0.2		0.2	6.48	3.6 °C	0.428	mg/L	4	mg/L
11/15/2017		2.42	mg/L	129	µS/cm	7.20	cs100 mL	0.2		0.2	7.18	11.5 °C	0.65	mg/L	4	mg/L
4/24/2018		2.78	mg/L	155	µS/cm	8.88	mg/L	0.2		0.2	8.03	12.9 °C	0.78	mg/L	4	mg/L
5/30/2018		2.21	mg/L	205.7	µS/cm	4.05	cs100 mL	0.2		0.2	7.91	20.9 °C	1.77	mg/L	4	mg/L
7/12/2018		1.50	mg/L	60	µS/cm	4.46	cs100 mL	0.2		0.2	8.81	23.1 °C	2.02	mg/L	9	mg/L
8/16/2018		2.60	mg/L	36	µS/cm	172	cs100 mL	0.2		0.2	7.87	23.8 °C	1.02	mg/L	4	mg/L
9/6/2018		1.70	mg/L	57	µS/cm	238.7	cs100 mL	0.2		0.2	8.19	23.8 °C	2.1	mg/L	4	mg/L
10/07/2018		2.75	mg/L	37	µS/cm	3.27	cs100 mL	0.2		0.2	7.69	16.9 °C	0.768	mg/L	4	mg/L
10/31/2018		3.05	mg/L	34	µS/cm	4.20	cs100 mL	0.2		0.2	6.70	5.4 °C	2.37	mg/L	4	mg/L

09-PEN Tributary Sampling Data 2007-2018

Date	Staff Gauge Reading	Ammonia	Chloride	Conductivity	DO	E. coli	Fecal Coliform	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	TKN	Laboratory Detection Limit					
													Expected Outlier or Equipment Failure	Total Nitrogen	Total Phosphorus	TSS			
5/20/2007	0.1	mg/L			6.20	mg/L	45.7	csd1000 mL			6.78	pH units	22.1	°C	0.496	mg/L	4	mg/L	
6/26/2007	0.2	mg/L		192	µS/cm	7.69	mg/L	37.9	csd1000 mL		6.70	pH units	24.8	°C	0.556	mg/L	6	mg/L	
8/27/2007	0.253	mg/L		20222	µS/cm	25.9	mg/L	25.9	csd1000 mL		6.74	pH units	25.6	°C	0.576	mg/L	4	mg/L	
8/22/2007	0.1	mg/L		242	µS/cm	106.8	csd1000 mL				6.66	pH units	17.9	°C	0.572	mg/L	4	mg/L	
1/6/2008	0.352	mg/L																	
5/29/2008	0.127	mg/L		2042	µS/cm	7.33	mg/L	10.8	csd1000 mL		6.74	pH units	16.9	°C	0.781	mg/L	16	mg/L	
6/2/2008															0.039	mg/L	4	mg/L	
7/9/2008																			
8/2/2008																			
5/28/2009																			
7/3/2009																			
9/22/2009																			
10/20/2009																			
11/30/2009																			
3/20/2011	0.2	mg/L		153.5	µS/cm	10.86	mg/L	16.1	csd1000 mL		6.7	pH units	5	°C	0.5	mg/L	4	mg/L	
5/2/2011	0.529	mg/L		100.9	µS/cm	7.27	mg/L	23.3	csd1000 mL		6.67	pH units	15	°C	0.5	mg/L	4	mg/L	
8/4/2011	0.2	mg/L		268	µS/cm	5.3	mg/L	18.3	csd1000 mL		6.79	pH units	23.3	°C	0.5	mg/L	4	mg/L	
8/16/2011	0.448	mg/L		242	µS/cm	8.81	mg/L				7	pH units		°C	0.5	mg/L	4	mg/L	
9/14/2011	0.2	mg/L		142.9	µS/cm	3.51	mg/L	49.5	csd1000 mL		6.73	pH units	21.6	°C	0.5	mg/L	4	mg/L	
10/4/2011	0.468	mg/L		152	µS/cm	8.83	mg/L				7	pH units		°C	0.5	mg/L	4	mg/L	
11/7/2011	0.2	mg/L		88.7	µS/cm	9.82	mg/L	12.1	csd1000 mL		6.34	pH units	5.9	°C	0.5	mg/L	4	mg/L	
12/20/2011	0.2	mg/L		137.3	µS/cm	10.85	mg/L	7.5	csd1000 mL		6.75	pH units	1.2	°C	0.5	mg/L	4	mg/L	
3/26/2012	0.31	mg/L		170.3	µS/cm	10.75	mg/L	28.8	csd1000 mL		6.55	pH units	6.5	°C	0.5	mg/L	5	mg/L	
4/26/2012	0.45	mg/L		117.6	µS/cm	7.07	mg/L	27.2	csd1000 mL		6.41	pH units	11.8	°C	0.5	mg/L	5	mg/L	
8/2/2012	0.09	mg/L		370	µS/cm	3.18	mg/L	9.8	csd1000 mL		6.58	pH units	23.9	°C	0.5	mg/L	5	mg/L	
8/27/2012	0.09	mg/L		273	µS/cm	4.35	mg/L				6.66	pH units	22.3	°C	0.5	mg/L	5	mg/L	
9/18/2012	0.05	mg/L		390	µS/cm	6.1	mg/L	8.6	csd1000 mL		6.31	pH units	17.1	°C	0.5	mg/L	5	mg/L	
10/25/2012	0.15	mg/L		217.1	µS/cm	7.31	mg/L	21.1	csd1000 mL		6.52	pH units	11.4	°C	0.5	mg/L	5	mg/L	
4/4/2013	0.46	mg/L	27	mg/L	127.3	µS/cm	10.09	mg/L	18.7	csd1000 mL	0.5	mg/L	4.7	°C	0.5	mg/L	0.05	mg/L	
5/6/2013	0.393	mg/L		138.8	µS/cm	8.26	mg/L	22	csd1000 mL		6.56	pH units	20.1	°C	0.5	mg/L	0.05	mg/L	
7/12/2013	0.35	mg/L		138.2	µS/cm	5.20	mg/L	24.5	csd1000 mL		6.41	pH units	20.2	°C	0.5	mg/L	0.05	mg/L	
7/12/2013	0.35	mg/L	41	mg/L	138.2	µS/cm	24.5	mg/L	0.2	mg/L	0.2	mg/L	24.4	°C	0.2	mg/L	0.2	mg/L	
8/16/2013	0.35	mg/L	38	mg/L	143.7	µS/cm	52.8	csd1000 mL	0.2	mg/L	0.3	mg/L	33.6	°C	0.2	mg/L	0.02	mg/L	
9/10/2013	0.18	mg/L	71	mg/L	226	µS/cm	8.79	mg/L	0.2	mg/L	0.2	mg/L	37.8	°C	0.5	mg/L	0.02	mg/L	
10/26/2013	0.20	mg/L	68	mg/L	178.5	µS/cm	9.16	mg/L	0.2	mg/L	0.2	mg/L	7.7	°C	0.5	mg/L	0.02	mg/L	
4/12/2014	0.54	mg/L	33	mg/L	150	µS/cm			0.2	mg/L	0.2	mg/L	6.66	pH units	0.2	mg/L	0.038	mg/L	
5/12/2014	0.42	mg/L	38	mg/L	169.1	µS/cm	7.63	mg/L	0.2	mg/L	0.2	mg/L	13.9	°C	0.2	mg/L	0.2	mg/L	
6/11/2014	0.15	mg/L	53	mg/L	144.6	µS/cm	5.98	mg/L	0.2	mg/L	0.2	mg/L	21	°C	0.2	mg/L	0.073	mg/L	
7/14/2014	0.24	mg/L	55	mg/L	157.5	µS/cm	4.49	mg/L	0.2	mg/L	0.2	mg/L	25	°C	0.2	mg/L	0.027	mg/L	
8/22/2014	0.15	mg/L	70	mg/L	186.2	µS/cm	5.55	mg/L	0.2	mg/L	0.2	mg/L	22.9	°C	0.2	mg/L	0.061	mg/L	
9/18/2014	0.18	mg/L	81	mg/L	198.8	µS/cm	6.87	mg/L	0.2	mg/L	0.2	mg/L	14.8	°C	0.2	mg/L	0.013	mg/L	
11/5/2014	0.32	mg/L	46	mg/L	108.6	µS/cm	9.39	mg/L	0.2	mg/L	0.2	mg/L	6.54	pH units	0.2	mg/L	0.021	mg/L	
4/3/2015	0.80	mg/L	31	mg/L	139.7	µS/cm	9.61	mg/L	0.2	mg/L	0.2	mg/L	6.25	pH units	0.2	mg/L	0.017	mg/L	
5/7/2015	0.44	mg/L	47	mg/L	196.1	µS/cm	6.63	mg/L	0.2	mg/L	0.2	mg/L	18.4	°C	0.976	mg/L	0.01	mg/L	
7/16/2015	0.22	mg/L	54	mg/L	231.8	µS/cm	2.44	mg/L	0.2	mg/L	0.2	mg/L	6.74	pH units	0.6	mg/L	0.028	mg/L	
8/6/2015	0.15	mg/L	76	mg/L	316.3	µS/cm	2.20	mg/L	0.2	mg/L	0.2	mg/L	23.5	°C	0.617	mg/L	0.027	mg/L	
8/27/2015	0.08	mg/L	85	mg/L	349.1	µS/cm	3.16	mg/L	0.2	mg/L	0.2	mg/L	6.80	pH units	0.97	mg/L	0.13	mg/L	
9/24/2015	0.05	mg/L	96	mg/L	330.5	µS/cm	4.05	mg/L	0.2	mg/L	0.2	mg/L	7.56	pH units	0.5	mg/L	0.016	mg/L	
11/5/2015	0.18	mg/L	64	mg/L	194.1	µS/cm		7.5	csd1000 mL	0.2	mg/L	0.2	mg/L	37	°C	0.503	mg/L	0.018	mg/L
4/2/2016	0.2	mg/L	48	mg/L					0.2	mg/L	0.2	mg/L	6.94	pH units	0.039	mg/L	0.01	mg/L	
6/2/2016	0.14	mg/L	65	mg/L	272.1	µS/cm	3.54	mg/L	0.2	mg/L	0.2	mg/L			0.562	mg/L	0.014	mg/L	
6/27/2016	0.04	mg/L	84	mg/L	310.7	µS/cm	5.11	mg/L	0.2	mg/L	0.2	mg/L	7.88	pH units	0.2	mg/L	0.018	mg/L	
8/2/2016	0.2	mg/L	131	mg/L	558	µS/cm	4.72	mg/L	0.2	mg/L	0.2	mg/L	6.20	pH units	0.2	mg/L	0.025	mg/L	
8/26/2016	0.04	mg/L	231	mg/L	566	µS/cm	4.72	mg/L	0.2	mg/L	0.2	mg/L	7.88	pH units	0.2	mg/L	0.025	mg/L	
9/29/2016	0.05	mg/L	344	mg/L	566	µS/cm	3.76	mg/L	0.2	mg/L	0.2	mg/L	6.84	pH units	0.64	mg/L	0.018	mg/L	
10/19/2016	0.10	mg/L	342	mg/L	450.2	µS/cm	6.84	mg/L	0.2	mg/L	0.2	mg/L	7.26	pH units	0.45	mg/L	0.014	mg/L	
5/4/2017	0.45	mg/L	41	mg/L	142.3	µS/cm			0.2	mg/L	0.2	mg/L	8.23	pH units	0.55	mg/L	0.011	mg/L	
6/4/2017	0.44	mg/L	42	mg/L	198.4	µS/cm	5.97	mg/L	0.2	mg/L	0.2	mg/L	8.96	pH units	0.62	mg/L	0.013	mg/L	
7/7/2017	0.28	mg/L	55	mg/L	241.4	µS/cm	2.89	mg/L	0.2	mg/L	0.2	mg/L	7.75	pH units	0.73	mg/L	0.023	mg/L	
8/22/2017	0.23	mg/L	65	mg/L		49.6	csd1000 mL	0.2	mg/L	0.2	mg/L	1.16	pH units	0.58	mg/L	0.019	mg/L		
9/7/2017	0.10	mg/L	84	mg/L			24	csd1000 mL	0.2	mg/L	0.2	mg/L	0.315	mg/L	0.32	mg/L	0.017	mg/L	
10/19/2017	0.18	mg/L	77	mg/L	236	µS/cm	6.37	mg/L	0.2	mg/L	0.2	mg/L	7.41	pH units	0.428	mg/L	0.018	mg/L	
11/15/2017	0.31	mg/L	51	mg/L	130.8	µS/cm	10.55	mg/L	0.2	mg/L	0.2	mg/L	8.39	pH units	0.54	mg/L	0.013	mg/L	
4/24/2018	0.55	mg/L	42	mg/L	175.3	µS/cm	8.13	mg/L	0.2	mg/L	0.2	mg/L	8.75	pH units	0.57	mg/L	0.035	mg/L	
5/30/2018	0.28	mg/L	58	mg/L	250.7	µS/cm	4.70	mg/L	0.2	mg/L	0.2	mg/L	8.12	pH units	0.86	mg/L	0.041	mg/L	
7/12/2018	0.10	mg/L	76	mg/L	315.5	µS/cm	5.66	mg/L	0.2	mg/L	0.2	mg/L	9.01	pH units	0.93	mg/L	0.037	mg/L	
8/16/2018	0.46	mg/L	40	mg/L	178.3	µS/cm	3.60	mg/L	0.2	mg/L	0.2	mg/L	8.28	pH units	1.33	mg/L	0.027	mg/L	
9/6/2018	0.10	mg/L	82	mg/L	324.1	µS/cm	32.7	mg/L	0.2	mg/L	0.2	mg/L	8.31	pH units	1.16	mg/L	0.021	mg/L	
10/07/2018	0.45	mg/L	39	mg/L	184.9	µS/cm	6.50	mg/L	0.2	mg/L	0.2	mg/L	7.50	pH units	1.99	mg/L	0.021	mg/L	
11/01/2018	0.62	mg/L						0.2	mg/L	0.2	mg/L	7.50	pH units	1.02	mg/L	0.012	mg/L		

01-XWB Tributary Sampling Data 2007-2018

Date	Staff Gauge Reading	Ammonia	Chloride	Conductivity	DO	E. coli	Fecal Coliform	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	TKN	Laboratory Detection Limit	
													Total Nitrogen	Total Phosphorus	TSS
5/30/2007		0.271			7.45	mg/L	33.6				7.34	pH units	0.614	mg/L	4
6/29/2007		0.1		140	8.02	mg/L	48				6.77	pH units	0.90	mg/L	4
8/2/2007		0.377		151.6	8.36	mg/L	93.3				6.56	pH units	0.989	mg/L	10
8/22/2007		0.1		139.6	9.5	mg/L	84.2				6.22	pH units	0.989	mg/L	4
1/9/2008		0.1						2008							
5/29/2008		0.24		150.4	9.04	mg/L	35.4				6.34	pH units	0.523	mg/L	4
6/6/2008	No Data													0.01	mg/L
6/12/2008		0.225		0.4	8.29	mg/L	224.7				7.04	pH units	0.952	mg/L	4
7/6/2008				201							6.56				
8/20/2008								2010							
5/29/2010	No Data														
7/13/2010		0.4		124.8	1.25	mg/L	101.9				6.48	pH units	0.5	mg/L	4
9/22/2010	No Data													0.043	mg/L
10/20/2010		0.2		0.4			29.5				7.22	pH units	0.5	mg/L	244
11/30/2010		0.2		9.1			8.4						0.025	mg/L	4
3/30/2011		0.2		104.1	12.97	mg/L	8.4				6.83	pH units	0.5	mg/L	5
5/2/2011		0.2		112.7	11.3	mg/L	18.5				6.58	pH units	0.5	mg/L	4
6/4/2011		0.2		148.6	5.65	mg/L	142.1				6.25	pH units	0.5	mg/L	4
8/16/2011								No Data							
9/14/2011		0.2		124.7	5.53	mg/L	118.7				6.08	pH units	0.5	mg/L	5
10/14/2011		0.2		93.7	7.98	mg/L	3.1				6	pH units	0.5	mg/L	62
11/7/2011		0.2		101.3	10.57	mg/L					6.29	pH units	0.5	mg/L	4
12/28/2011		0.2		108.7	12.71	mg/L	4.1				6.69	pH units	0.5	mg/L	4
3/29/2012	2.34	0.05		114.6	10.46	mg/L	6.3				5.19	pH units	0.5	mg/L	5
4/16/2012	2.36	0.05		90.6	9.82	mg/L	9.8				6.6	pH units	0.5	mg/L	6
5/2/2012	1.56	0.05		140.3	0.99	mg/L	121.1				6.19	pH units	0.5	mg/L	5
6/27/2012		0.05		140.7	0.26	mg/L	146.7				6.48	pH units	0.5	mg/L	12
9/18/2012	1.78	0.05		151.3	6.05	mg/L	155.3				6.29	pH units	0.6	mg/L	12
10/29/2012	1.78	0.05		138.4	5.64	mg/L	30.1				5.99	pH units	0.5	mg/L	5
4/4/2013	2.46	0.2		87.1	12.10	mg/L					6.81	pH units	0.5	mg/L	6
5/6/2013	1.98	0.2		123	8.77	mg/L	34.1				7.21	pH units	0.5	mg/L	6
6/6/2013	2.42	0.374		91.5	6.02	mg/L	142				6.03	pH units	0.5	mg/L	6
7/17/2013	2.32	0.2		138.4	8.57	mg/L	67.6	0.2	mg/L	0.2	6.03	pH units	0.2	mg/L	6
8/16/2013	2.44	0.2		106.9	5.82	mg/L	98.5	0.2	mg/L	0.2	6.08	pH units	0.2	mg/L	6
9/17/2013	2.25	0.2		104.7	9.39	mg/L	179	0.2	mg/L	0.2	6.01	pH units	0.2	mg/L	6
10/28/2013	2.67	0.1		97.6	7.11	mg/L	186	0.2	mg/L	0.2	6.30	pH units	0.2	mg/L	6
4/14/2014	2.76	0.2		110	8.46	mg/L	6.3				11.8	°C	0.2	mg/L	4
5/6/2014	2.77	0.2		124.5	8.47	mg/L	18.5				6.77	pH units	0.2	mg/L	4
6/11/2014	2.62	0.2		94.3	6.39	mg/L	248				6.42	pH units	0.2	mg/L	4
7/14/2014	2.60	0.2		103.1	6.39	mg/L	41.9				6.58	pH units	0.2	mg/L	4
8/12/2014	2.26	0.2		106.7	7.70	mg/L	124				6.58	pH units	0.2	mg/L	4
9/19/2014	2.30	0.2		96.7	8.38	mg/L	29.5				6.64	pH units	0.2	mg/L	7
11/5/2014	2.58	0.2		76	9.76	mg/L	11				9.40	pH units	0.2	mg/L	4
4/13/2015	1.89	0.2		134.9	12.27	mg/L	1				6.54	pH units	0.2	mg/L	4
4/23/2015	2.57	0.1		136.8	6.67	mg/L	7.4				6.54	pH units	0.2	mg/L	4
7/6/2015	2.51	0.1		156.8	6.82	mg/L	26.9				6.55	pH units	0.2	mg/L	4
8/6/2015	2.73	0.2		164	5.24	mg/L	98.7				6.34	pH units	0.2	mg/L	4
8/27/2015	2.81	0.2		164.1	4.77	mg/L	125				6.34	pH units	0.2	mg/L	4
9/24/2015	2.87	0.2		147.1	5.03	mg/L	225				6.34	pH units	0.2	mg/L	4
11/6/2015	2.96	0.2		126.7		mg/L	16.1				6.35	pH units	0.2	mg/L	4
4/21/2016	3.14	0.2		142	2.69	mg/L	12				6.36	pH units	0.2	mg/L	7
6/2/2016		0.2		153.9	2.69	mg/L	178				6.46	pH units	0.2	mg/L	4
6/27/2016		0.2		195.6	3.09	mg/L	67.7				6.44	pH units	0.2	mg/L	4
7/28/2016	2.00	0.2		207.8	3.68	mg/L	23.1				6.81	pH units	0.2	mg/L	4
8/25/2016	2.90	0.2		188.6	4.30	mg/L	133				6.36	pH units	0.2	mg/L	4
9/22/2016	2.70	0.2		183.5	4.12	mg/L	248				6.63	pH units	0.31	mg/L	4
10/19/2016	2.70	0.2		161.2	4.73	mg/L	69.1				6.47	pH units	0.394	mg/L	4
5/4/2017	2.82	0.2		92	8.39	mg/L	14.8				7.80	pH units	0.51	mg/L	4
6/14/2017	2.63	0.2		158.2	5.05	mg/L	248				6.45	pH units	0.57	mg/L	4
7/6/2017	3.32	0.2		183.8	6.14	mg/L	2420				6.39	pH units	0.2	mg/L	4
8/22/2017	2.06	0.2				mg/L	194						0.46	mg/L	4
9/27/2017	2.04	0.2		144	5.48	mg/L	147						0.2	mg/L	4
10/19/2017	2.50	0.2		84.8	10.25	mg/L	48.7				5.71	pH units	0.2	mg/L	4
11/19/2017	2.60	0.2		117.2		mg/L	35				6.92	pH units	0.43	mg/L	4
4/24/2018	2.77	0.2		125.9	9.08	mg/L	2				7.02	pH units	0.96	mg/L	4
5/30/2018	2.89	0.29		107.9	5.76	mg/L	83.7				6.54	pH units	0.78	mg/L	5
6/6/2018	0.60	0.2		116.1	7.88	mg/L	172				6.37	pH units	0.63	mg/L	4
8/16/2018	2.80	0.2		138.1	5.30	mg/L	201				6.57	pH units	0.77	mg/L	4
9/6/2018	2.86	0.2		118	5.90	mg/L	63.1				6.68	pH units	0.66	mg/L	10
10/10/2018	2.80	0.2		117.2	14.90	mg/L	29				6.63	pH units	0.87	mg/L	4
10/13/2018	2.18	0.2		117.2		mg/L	35				6.63	pH units	0.87	mg/L	4

01-WCH Tributary Sampling Data 2007-2018

Date	Staff Gauge Reading	Ammonia	Chloride	Conductivity	DO	E. coli	Fecal Coliform	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	TKN	Laboratory Detection Limit			
														Expected	Outlier or Equipment Failure		
2007																	
5/30/2007		0.1	mg/L		6.38	mg/L	67.6	csi100 mL			6.73	pH units	0.59	mg/L	0.014	mg/L 4	
6/29/2007		0.1	mg/L	177	µS/cm	mg/L	145.5	csi100 mL			6.58	pH units	2.22	°C	1.08	mg/L 4	
8/2/2007		0.307	mg/L	195.7	µS/cm	mg/L	122.3	csi100 mL			6.43	pH units	-0.5	mg/L	0.033	mg/L 6	
8/22/2007																	
Under Construction																	
2008																	
1/8/2008		0.164	mg/L														
5/29/2008		0.466	mg/L	173.4	µS/cm	mg/L	63.7	csi100 mL			6.21	pH units	1.23	mg/L	0.122	mg/L 50	
6/9/2008		0.357	mg/L		5.54			csi100 mL				16.4	°C	0.753	mg/L 4	mg/L 4	
6/12/2008		302	mg/L										0.743	mg/L	0.031	mg/L 4	
7/8/2008					6.49	mg/L	77.6	csi100 mL			7.04	pH units	0.648	mg/L	0.015	mg/L 4	
8/23/2008				130	µS/cm							26.4	°C				
8/23/2008												13.9	°C				
2010																	
5/29/2010		0.1	mg/L	172.5	µS/cm	mg/L	73.8	csi100 mL			6.45	pH units	0.5	mg/L	0.038	mg/L 4	
7/2/2010		0.1	mg/L	175.5	µS/cm	mg/L	54.8	csi100 mL			6.22	pH units	0.5	mg/L	0.038	mg/L 4	
9/22/2010		0.2	mg/L	182	µS/cm	mg/L	93.3	csi100 mL			6.22	pH units	0.5	mg/L	0.034	mg/L 4	
10/20/2010		0.2	mg/L	182	µS/cm	mg/L	30.1	csi100 mL			7.48	pH units	14.2	°C	0.034	mg/L 4	
11/30/2010		0.2	mg/L	0.35	µS/cm		21.6	csi100 mL			7.89	pH units	8.4	°C	0.016	mg/L 4	
11/30/2010		0.2	mg/L	0.35	µS/cm							1.6	°C	0.5	mg/L 4	mg/L 4	
2011																	
3/30/2011		0.2	mg/L	136.2	µS/cm	mg/L	1	csi100 mL			6.32	pH units	0.5	mg/L	0.014	mg/L 4	
5/2/2011		0.4	mg/L	143.8	µS/cm	mg/L	14.8	csi100 mL			6.65	pH units	15	°C	0.5	mg/L 4	
8/4/2011		0.2	mg/L	229	µS/cm	mg/L	73.3	csi100 mL			6.38	pH units	22.1	°C	0.5	mg/L 4	
8/16/2011																	
9/14/2011		0.2	mg/L	163	µS/cm	mg/L	176.9	csi100 mL			6.39	pH units	20.6	°C	0.5	mg/L 4	
10/4/2011																	
11/7/2011		0.2	mg/L	114.7	µS/cm	mg/L	32.3	csi100 mL			6.04	pH units	5.4	°C	0.5	mg/L 4	
12/20/2011		0.2	mg/L	138.2	µS/cm	mg/L	7.4	csi100 mL			6.73	pH units	1	°C	0.5	mg/L 4	
2012																	
3/29/2012		1.22	mg/L	144.9	µS/cm	mg/L	13	csi100 mL			5.96	pH units	5.4	°C	0.5	mg/L 4	
4/29/2012		0.41	mg/L	110.5	µS/cm	mg/L	12.1	csi100 mL			6.1	pH units	12.3	°C	0.5	mg/L 5	
8/2/2012		0.49	mg/L	369	µS/cm	mg/L	122.3	csi100 mL			6.26	pH units	20.5	°C	0.5	mg/L 5	
8/27/2012		0.5	mg/L	276	µS/cm	mg/L	53.7	csi100 mL			6.21	pH units	19.3	°C	0.5	mg/L 5	
9/18/2012		0.43	mg/L	284	µS/cm	mg/L	95.9	csi100 mL			6.42	pH units	14.5	°C	0.5	mg/L 5	
10/25/2012		0.5	mg/L	197.3	µS/cm	mg/L	8.5	csi100 mL			6.27	pH units	10	°C	0.5	mg/L 5	
2013																	
4/4/2013		0.2	mg/L	240	µS/cm	mg/L	3.1	csi100 mL		0.5	mg/L	6.20	pH units	5.8	°C	0.5	mg/L 6
5/20/2013		1.04	mg/L	104.2	µS/cm	mg/L	14.6	csi100 mL			7.06	pH units	15.1	°C	0.5	mg/L 6	
6/20/2013		1.09	mg/L	104.4	µS/cm	mg/L	4.9	csi100 mL			6.99	pH units	24.3	°C	0.5	mg/L 6	
7/1/2013		1.07	mg/L	126.2	µS/cm	mg/L	26.3	csi100 mL		0.3	mg/L	6.27	pH units	24.3	°C	0.5	mg/L 6
8/1/2013		1.09	mg/L	126.2	µS/cm	mg/L	55.9	csi100 mL		0.3	mg/L	6.27	pH units	24.3	°C	0.5	mg/L 6
9/1/2013		1.09	mg/L	126.2	µS/cm	mg/L	120	csi100 mL		0.3	mg/L	6.27	pH units	24.3	°C	0.5	mg/L 6
9/1/2013		1.12	mg/L	126.2	µS/cm	mg/L	190	csi100 mL		0.3	mg/L	6.27	pH units	24.3	°C	0.5	mg/L 6
9/1/2013		1.12	mg/L	126.2	µS/cm	mg/L	190	csi100 mL		0.3	mg/L	6.27	pH units	24.3	°C	0.5	mg/L 6
10/26/2013		1.48	mg/L	146.4	µS/cm	mg/L	41	csi100 mL		0.2	mg/L	6.68	pH units	6.4	°C	0.5	mg/L 6
2014																	
4/14/2014		1.65	mg/L	100	µS/cm	mg/L	6.3	csi100 mL		0.2	mg/L	12.4	°C	0.2	mg/L	0.046	mg/L 4
5/9/2014		1.40	mg/L	140.3	µS/cm	mg/L	8.6	csi100 mL		0.2	mg/L	14.4	°C	0.2	mg/L	0.055	mg/L 4
6/12/2014		1.44	mg/L	123.7	µS/cm	mg/L	140	csi100 mL		0.2	mg/L	20	°C	0.2	mg/L	0.055	mg/L 4
7/14/2014		1.25	mg/L	52	µS/cm	mg/L	38.4	csi100 mL		0.2	mg/L	6.50	pH units	20	°C	0.2	mg/L 4
8/12/2014		1.08	mg/L	60	µS/cm	mg/L	41.9	csi100 mL		0.2	mg/L	25.5	°C	0.2	mg/L	0.012	mg/L 4
9/18/2014		1.12	mg/L	61	µS/cm	mg/L	5.51	csi100 mL		0.2	mg/L	21	°C	0.2	mg/L	0.062	mg/L 4
9/18/2014		1.12	mg/L	61	µS/cm	mg/L	42.6	csi100 mL		0.2	mg/L	6.40	pH units	14	°C	0.2	mg/L 6
11/9/2014		1.59	mg/L	40	µS/cm	mg/L	55.6	csi100 mL		0.2	mg/L	14	°C	0.2	mg/L	0.05	mg/L 4
2015																	
4/13/2015		1.90	mg/L	25	µS/cm	mg/L	10.12	csi100 mL		0.2	mg/L	6.25	pH units	7.4	°C	0.2	mg/L 4
5/7/2015		1.49	mg/L	43	µS/cm	mg/L	2	csi100 mL		0.2	mg/L	6.81	pH units	10.4	°C	0.2	mg/L 4
7/16/2015		1.10	mg/L	51	µS/cm	mg/L	58.3	csi100 mL		0.2	mg/L	18.5	°C	0.2	mg/L	0.017	mg/L 4
8/6/2015		0.94	mg/L	61	µS/cm	mg/L	39.9	csi100 mL		0.2	mg/L	6.46	pH units	21.1	°C	0.672	mg/L 4
8/27/2015		0.96	mg/L	61	µS/cm	mg/L	61.3	csi100 mL		0.2	mg/L	6.42	pH units	21.6	°C	1.01	mg/L 4
9/4/2015		1.00	mg/L	249.1	µS/cm	mg/L	131	csi100 mL		0.2	mg/L	6.30	pH units	21.5	°C	0.593	mg/L 4
9/4/2015		1.00	mg/L	222.5	µS/cm	mg/L	152	csi100 mL		0.2	mg/L	6.40	pH units	15	°C	0.613	mg/L 4
11/9/2015		1.49	mg/L	60	µS/cm	mg/L	33.2	csi100 mL		0.2	mg/L	6.52	pH units	8.5	°C	0.349	mg/L 4
2016																	
4/23/2016		1.38	mg/L	383	µS/cm	mg/L	5.2	csi100 mL		0.2	mg/L	6.22	pH units	13.32	°C	0.2	mg/L 4
6/2/2016		1.20	mg/L	202.6	µS/cm	mg/L	104	csi100 mL		0.2	mg/L	6.72	pH units	13.3	°C	0.538	mg/L 4
7/2/2016		1.24	mg/L	277.7	µS/cm	mg/L	86.2	csi100 mL		0.2	mg/L	6.52	pH units	25.0	°C	0.29	mg/L 4
7/28/2016		1.20	mg/L	384.2	µS/cm	mg/L	41.3	csi100 mL		0.2	mg/L	6.81	pH units	23.0	°C	0.369	mg/L 4
8/1/2016		1.16	mg/L	48	µS/cm	mg/L	139	csi100 mL		0.2	mg/L	6.35	pH units	23.7	°C	0.53	mg/L 4
8/1/2016		1.16	mg/L	234.8	µS/cm	mg/L	139	csi100 mL		0.2	mg/L	6.35	pH units	23.7	°C	0.53	mg/L 4
10/19/2016		1.50	mg/L	70	µS/cm	mg/L	140	csi100 mL		0.2	mg/L	6.65	pH units	14.4	°C	0.765	mg/L 4
2017																	
5/4/2017		1.75	mg/L	28	µS/cm	mg/L	18.5	csi100 mL		0.2	mg/L	7.60	pH units	13.8	°C	1.58	mg/L 4
6/14/2017		1.60	mg/L	43	µS/cm	mg/L	131	csi100 mL		0.2	mg/L	6.82	pH units	24.5	°C	0.34	mg/L 4
7/6/2017		1.51	mg/L	49	µS/cm	mg/L	56.5	csi100 mL		0.2	mg/L	6.23	pH units	23.6	°C	0.2	mg/L 4
8/22/2017		1.46	mg/L	57	µS/cm	mg/L	77.6	csi100 mL		0.2	mg/L	6.23	pH units	23.6	°C	0.909	mg/L 4
9/17/2017		na	mg/L	65	µS/cm	mg/L	22.8	csi100 mL		0.2	mg/L	6.50	pH units	12	°C	0.2	mg/L 4
10/19/2017		1.45	mg/L	64	µS/cm	mg/L	24	csi100 mL		0.2	mg/L	6.50	pH units	12	°C	0.2	mg/L 4
11/15/2017		1.59	mg/L	43	µS/cm	mg/L	11.7	csi100 mL		0.2	mg/L	6.76	pH units	3.4	°C	0.315	mg/L 4
2018																	
4/24/2018		1.62	mg/L	38	µS/cm	mg/L	85.2	csi100 mL		0.2	mg/L	6.76	pH units	12.9	°C	0.717	mg/L 4
5/30/2018		1.25	mg/L	56	µS/cm	mg/L	120	csi100 mL		0.2	mg/L	6.23	pH units	20.1	°C	0.864	mg/L 4
7/12/2018		1.30	mg/L	65	µS/cm	mg/L	248.8	csi100 mL		0.2	mg/L	7.94	pH units	23.3	°C	0.612	mg/L 4

	Laboratory Detection Limit	
	Expected Outlier or Equipment Failure	

	Laboratory Detection Limit	
	Expected Outlier or Equipment Failure	

01-HAY Tributary Sampling Data 2016-2018

01-HAY Tributary Sampling Data 2016-2018																					
Date	Staff Gauge Reading	Ammonia	Chloride	Conductivity	DO	E. coli	Fecal Coliform	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	TKN	Laboratory Detection Limit							
														Total Nitrogen	Total Phosphorus	Expected Outlier or Equipment Failure					
4/21/2016	0.98	0.2	mg/L	51	µS/cm	1	cfu/100 mL	0.2	mg/L	0.2	mg/L	12.54	°C	0.2	mg/L	0.01	mg/L	4	mg/L		
6/2/2016	1.71	0.2	mg/L	41.9	µS/cm	135	cfu/100 mL	0.2	mg/L	0.2	mg/L	15.1	°C	0.2	mg/L	0.01	mg/L	4	mg/L		
6/27/2016	0.00	0.2	mg/L	107.2	µS/cm	6.3	cfu/100 mL	0.2	mg/L	0.2	mg/L	20.7	°C	0.247	mg/L	0.034	mg/L	4	mg/L		
7/28/2016																					
8/25/2016																					
9/22/2016																					
10/19/2016																					
No Data																					
2017																					
5/4/2017	1.10	0.2	mg/L	32	µS/cm	7.4	cfu/100 mL	0.2	mg/L	0.2	mg/L	13	°C	0.506	mg/L	0.010	mg/L	4	mg/L		
6/14/2017	0.76	0.31	mg/L	41	µS/cm	63.8	cfu/100 mL	0.2	mg/L	0.2	mg/L	6.53	pH units	20.2	°C	0.46	mg/L	0.011	mg/L	4	mg/L
7/6/2017	0.63	0.2	mg/L	36.7	µS/cm	22.6	cfu/100 mL	0.2	mg/L	0.2	mg/L	6.54	pH units	19.7	°C	0.576	mg/L	0.011	mg/L	4	mg/L
8/2/2017	0.47	0.2	mg/L			36.4	cfu/100 mL	0.2	mg/L	0.2	mg/L			3.13	mg/L	0.010	mg/L	4	mg/L		
9/27/2017	1.50	0.2	mg/L			199	cfu/100 mL	185	cfu/100 mL	0.2	mg/L	0.2	mg/L	0.88	mg/L	0.010	mg/L	4	mg/L		
10/19/2017	0.50	0.2	mg/L	39	µS/cm	8.11	mg/L	0.2	mg/L	0.2	mg/L	6.40	pH units	12.2	°C	0.2	mg/L	0.010	mg/L	4	mg/L
11/15/2017	0.79	0.2	mg/L	20.2	µS/cm	21.3	cfu/100 mL	0.2	mg/L	0.2	mg/L	6.80	pH units	4.8	°C	0.655	mg/L	0.010	mg/L	4	mg/L
2018																					
4/24/2018	1.18	0.2	mg/L	62.1	µS/cm	21.3	cfu/100 mL	0.2	mg/L	0.2	mg/L	6.72	pH units	0.7	mg/L	0.010	mg/L	4	mg/L		
5/2/2018	0.55	0.2	mg/L	45.2	µS/cm	12	cfu/100 mL	0.2	mg/L	0.2	mg/L	5.51	pH units	1.49	mg/L	0.012	mg/L	4	mg/L		
7/12/2018	0.00	0.2	mg/L	80.7	µS/cm	27.2	cfu/100 mL	0.2	mg/L	0.2	mg/L	7.66	pH units	0.91	mg/L	0.033	mg/L	4	mg/L		
8/15/2018	0.85	0.2	mg/L	41	µS/cm	40.4	cfu/100 mL	0.2	mg/L	0.2	mg/L	7.32	pH units	0.2	mg/L	0.014	mg/L	4	mg/L		
9/5/2018		0.2	mg/L	7	mg/L	107	cfu/100 mL	329	cfu/100 mL	0.2	mg/L	0.2	mg/L	1.81	mg/L	0.059	mg/L	14	mg/L		
10/10/2018	0.80	0.2	mg/L	36.6	µS/cm	5.1	cfu/100 mL	0.2	mg/L	0.2	mg/L	16.1	°C	0.768	mg/L	0.017	mg/L	4	mg/L		
10/31/2018	1.09	0.2	mg/L	42.8	µS/cm	12.1	cfu/100 mL	0.2	mg/L	0.2	mg/L	6.80	pH units	0.77	mg/L	0.037	mg/L	4	mg/L		
10/31/2018	1.09	0.2	mg/L					0.2	mg/L	0.2	mg/L	6.62	mg/L	0.62	mg/L	0.01	mg/L	4	mg/L		

01-8FB Tributary Sampling Data 2007-2018

Staff Gauge Reading										Laboratory Detection Limit								
										Expected Outlier or Equipment Failure								
Date	Ammonia	Chloride	Conductivity	DO	E. coli	Fecal Coliform	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	TKN	Total Nitrogen	Total Phosphorus	TSS			
2007																		
5/20/2007	0.1	mg/L		6.15	mg/L	145	cs1000 mL			6.57	pH units	0.25	mg/L	0.038	mg/L	4	mg/L	
6/26/2007	0.293	mg/L	619	6.64	mg/L	344.8	cs1000 mL			6.50	pH units	21.8	mg/L	0.055	mg/L	11	mg/L	
8/2/2007	0.264	mg/L	486	6.11	mg/L	66.9	cs1000 mL			7.27	pH units	23.1	mg/L	0.052	mg/L	4	mg/L	
8/22/2007	0.1	mg/L	704	8.25	mg/L	290.9	cs1000 mL			7.10	pH units	16.7	mg/L	0.035	mg/L	14	mg/L	
2008																		
1/6/2008	0.277	mg/L				85.7	cs1000 mL											
5/29/2008	0.365	mg/L	711	6.23	mg/L	261.3	cs1000 mL			7.18	pH units	15.2	mg/L	0.035	mg/L	4	mg/L	
6/5/2008	0.6	mg/L												0.045	mg/L	4	mg/L	
6/12/2008														0.063	mg/L	4	mg/L	
7/9/2008														0.069	mg/L	4	mg/L	
8/2/2008																		
No Data																		
8/2/2008										7.13	pH units	25.7	mg/L					
8/2/2008										7.13	pH units	26.1	mg/L					
2010																		
5/26/2010	0.418	mg/L	789	6.34	mg/L	81.6	cs1000 mL			7.49	pH units	20.1	mg/L	0.031	mg/L	16	mg/L	
7/13/2010	0.4	mg/L	854	7.06	mg/L	155.8	cs1000 mL			7.77	pH units	23.4	mg/L	0.032	mg/L	4	mg/L	
9/22/2010																		
No Data																		
10/20/2010	0.2	mg/L				90.6	cs1000 mL			8.31	pH units	9.1	mg/L	0.014	mg/L	4	mg/L	
11/30/2010	0.2	mg/L				12.2	cs1000 mL			8.33	pH units	3.8	mg/L	0.025	mg/L	4	mg/L	
2011																		
3/29/2011	0.2	mg/L	925	11.8	mg/L	3.1	cs1000 mL			7.24	pH units	5.8	mg/L	0.01	mg/L	4	mg/L	
5/2/2011	0.49	mg/L	868	9.05	mg/L	21.3	cs1000 mL			7.46	pH units	13.4	mg/L	0.016	mg/L	4	mg/L	
8/4/2011	0.2	mg/L	720	7.4	mg/L	148.3	cs1000 mL			6.9	pH units	22.1	mg/L	0.038	mg/L	4	mg/L	
8/16/2011	0.2	mg/L	544	8.51	mg/L					7	pH units		mg/L	0.01	mg/L	4	mg/L	
9/14/2011	0.2	mg/L	638	7.34	mg/L	248.1	cs1000 mL			7.3	pH units	20.4	mg/L	0.01	mg/L	4	mg/L	
10/4/2011	0.2	mg/L	566	9.28	mg/L					8	pH units		mg/L	0.01	mg/L	4	mg/L	
11/7/2011	0.2	mg/L	668	10.88	mg/L	14.5	cs1000 mL			7.17	pH units	6.5	mg/L	0.01	mg/L	4	mg/L	
12/20/2011	0.2	mg/L	650	11.73	mg/L	26.5	cs1000 mL			7.21	pH units	4.4	mg/L	0.01	mg/L	4	mg/L	
2012																		
3/28/2012	0.53	mg/L	820	10.22	mg/L	10.1	cs1000 mL			7.16	pH units	7.8	mg/L	0.01	mg/L	5	mg/L	
4/26/2012	0.54	mg/L	477	9.42	mg/L	44.1	cs1000 mL			6.59	pH units	10.6	mg/L	0.03	mg/L	5	mg/L	
8/2/2012	0.41	mg/L	568	6	mg/L	1046.2	cs1000 mL			6.92	pH units	22.7	mg/L	0.061	mg/L	8	mg/L	
8/27/2012	0.06	mg/L	596	7.34	mg/L	166.4	cs1000 mL			7.2	pH units	20.5	mg/L	0.04	mg/L	7	mg/L	
9/18/2012	0.41	mg/L	666	8.73	mg/L	35	cs1000 mL			7.43	pH units	16.9	mg/L	0.05	mg/L	5	mg/L	
10/25/2012	0.46	mg/L	576	8.06	mg/L	19.9	cs1000 mL			6.95	pH units	11.7	mg/L	0.02	mg/L	5	mg/L	
2013																		
4/4/2013	0.2	mg/L	930	10.78	mg/L	1	cs1000 mL			6.86	pH units	4.8	mg/L	0.05	mg/L	6	mg/L	
5/6/2013	0.63	mg/L	513	10.23	mg/L	7.3	cs1000 mL			6.97	pH units	13.2	mg/L	0.07	mg/L	6	mg/L	
5/23/2013	0.52	mg/L	518	9.86	mg/L	79	cs1000 mL			6.92	pH units	13.2	mg/L	0.07	mg/L	6	mg/L	
7/12/2013	0.59	mg/L	567	7.18	mg/L	140	cs1000 mL	0.38	mg/L	6.87	pH units	23.6	mg/L	0.062	mg/L	6	mg/L	
8/16/2013	0.50	mg/L	539	8.56	mg/L	260	cs1000 mL	0.3	mg/L	6.92	pH units	23.6	mg/L	0.03	mg/L	6	mg/L	
9/10/2013	0.48	mg/L	533	8.73	mg/L	88.5	cs1000 mL	0.28	mg/L	6.76	pH units	38.4	mg/L	0.03	mg/L	6	mg/L	
9/10/2013	0.53	mg/L	533	11.51	mg/L	71.7	cs1000 mL	0.28	mg/L	6.98	pH units	37.3	mg/L	0.025	mg/L	6	mg/L	
10/26/2013	0.43	mg/L	417	10.32	mg/L	21.3	cs1000 mL	0.2	mg/L	6.98	pH units	9.1	mg/L	0.032	mg/L	6	mg/L	
2014																		
4/12/2014	0.62	mg/L	259	mg/L	17.3	cs1000 mL	0.55	mg/L	0.65	mg/L	7.46	pH units	10.3	mg/L	0.039	mg/L	4	mg/L
5/12/2014	0.54	mg/L	246	9.89	mg/L	16.1	cs1000 mL	0.2	mg/L	0.33	mg/L	12.4	mg/L	0.03	mg/L	4	mg/L	
6/11/2014	0.46	mg/L	531	8.28	mg/L	1300	cs1000 mL	0.26	mg/L	0.26	mg/L	17.6	mg/L	0.025	mg/L	4	mg/L	
7/14/2014	0.42	mg/L	172	7.79	mg/L	201	cs1000 mL	0.2	mg/L	0.2	mg/L	23.2	mg/L	0.02	mg/L	4	mg/L	
8/12/2014	0.42	mg/L	402	138	mg/L	154	cs1000 mL	0.2	mg/L	7.63	pH units	23.2	mg/L	0.058	mg/L	4	mg/L	
9/18/2014	0.36	mg/L	364	8.61	mg/L	24.6	cs1000 mL	0.2	mg/L	7.20	pH units	21.3	mg/L	0.032	mg/L	4	mg/L	
11/5/2014	0.52	mg/L	157	11.38	mg/L	9.6	cs1000 mL	0.2	mg/L	6.56	pH units	13.4	mg/L	0.028	mg/L	4	mg/L	
2015																		
4/13/2015	0.66	mg/L	1022	11.70	mg/L	1	cs1000 mL	0.2	mg/L	0.3	mg/L	7.18	pH units	0.2	mg/L	4	mg/L	
5/7/2015	0.53	mg/L	257	9.70	mg/L	3	cs1000 mL	0.2	mg/L	0.5	mg/L	7.66	pH units	0.12	mg/L	4	mg/L	
7/16/2015	0.46	mg/L	708	4.04	mg/L	127	cs1000 mL	0.25	mg/L	0.25	mg/L	14.2	mg/L	0.01	mg/L	4	mg/L	
8/6/2015	0.38	mg/L	287	774	mg/L	162	cs1000 mL	0.2	mg/L	7.52	pH units	18.7	mg/L	0.037	mg/L	4	mg/L	
8/27/2015	0.32	mg/L	203	5.96	mg/L	55.6	cs1000 mL	0.2	mg/L	7.66	pH units	18.9	mg/L	0.037	mg/L	4	mg/L	
9/24/2015	0.32	mg/L	561	7.45	mg/L	53	cs1000 mL	0.22	mg/L	7.62	pH units	19.3	mg/L	0.018	mg/L	4	mg/L	
11/5/2015	0.38	mg/L	150	481.3	mg/L	5	cs1000 mL	0.2	mg/L	8.27	pH units	14.2	mg/L	0.019	mg/L	4	mg/L	
2016																		
4/21/2016	0.49	mg/L	1659	mg/L						mg/L				0.032	mg/L	4	mg/L	
6/2/2016	0.41	mg/L	218	4.15	mg/L	6.3	cs1000 mL	0.21	mg/L	7.53	pH units	10.46	mg/L	0.012	mg/L	4	mg/L	
6/27/2016	3.00	mg/L	770	mg/L	116	cs1000 mL	0.2	mg/L	0.2	mg/L	8.11	pH units	10.6	mg/L	0.111	mg/L	8	mg/L
8/25/2016	0.3	mg/L	226	4.19	mg/L	73.3	cs1000 mL	0.25	mg/L	8.18	pH units	20.7	mg/L	0.032	mg/L	4	mg/L	
No Data																		
9/25/2016	0.30	mg/L	159	5.74	mg/L	248	cs1000 mL	0.2	mg/L	8.19	pH units	29.3	mg/L	0.036	mg/L	4	mg/L	
10/19/2016	0.30	mg/L	126	6.15	mg/L	121	cs1000 mL	0.2	mg/L	8.08	pH units	37.2	mg/L	0.045	mg/L	4	mg/L	
10/19/2016	0.30	mg/L	119	6.98	mg/L	56.5	cs1000 mL	0.2	mg/L	8.94	pH units	14.7	mg/L	0.068	mg/L	4	mg/L	
2017																		
5/4/2017	0.54	mg/L	723	7.40	mg/L	40.2	cs1000 mL	0.2	mg/L	0.37	mg/L	11.2	mg/L	0.015	mg/L	4	mg/L	
6/4/2017	0.50	mg/L	287	983	mg/L	172	cs1000 mL	0.34	mg/L	8.87	pH units	10.3	mg/L	0.019	mg/L	4	mg/L	
7/9/2017	0.51	mg/L	254	mg/L	261	cs1000 mL	0.34	mg/L	0.34	mg/L	8.23	pH units	10.3	mg/L	0.031	mg/L	4	mg/L
8/22/2017	0.45	mg/L	300	936	mg/L	5.25	cs1000 mL	0.27	mg/L	9.18	pH units	10.6	mg/L	0.022	mg/L	4	mg/L	
9/7/2017	0.36	mg/L	234	mg/L	115	cs1000 mL	0.48	mg/L	0.27	mg/L	1.04	mg/L	1.31	mg/L	0.022	mg/L	4	mg/L
10/19/2017	0.40	mg/L	590	9.04	mg/L	127	cs1000 mL	0.2	mg/L	0.48	mg/L	10.6	mg/L	0.023	mg/L	4	mg/L	
11/15/2017	0.48	mg/L	395	12.30	mg/L	28.2	cs1000 mL	0.3	mg/L	7.33	pH units	10.6	mg/L	0.055	mg/L	4	mg/L	
2018																		
4/24/2018	0.54	mg/L	286	9.60	mg/L	12.1	cs1000 mL	0.2	mg/L	8.68	pH units	5.5	mg/L	0.015	mg/L	4	mg/L	
5/30/2018	0.48	mg/L	1070	mg/L														
5/30/2018	0.40	mg/L	104	6.08	mg/L	201	cs1000 mL											

02-WCH Tributary Sampling Data 2007-2018

Date	Staff Gauge Reading	Ammonia	Chloride	Conductivity	DO	E. coli	Fecal Coliform	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	TKN	Total Nitrogen	Total Phosphorus	Laboratory Detection Limit			
																Expected Outlier or Equipment Failure	TSS		
5/26/2007		0.348	mg/L		9.55	mg/L	9.8	csd100 mL			8.24	pH units	13.8	°C	0.084	mg/L	4	mg/L	
6/20/2007		0.21	mg/L	143	µS/cm	9.1	mg/L	0.1	mg/L		7.03	pH units	16.8	°C	0.034	mg/L	4	mg/L	
8/2/2007		0.349	mg/L	143.6	µS/cm	8.94	30.5	csd100 mL			6.75	pH units	17.9	°C	0.08	mg/L	4	mg/L	
8/22/2007		0.355	mg/L	154.5	µS/cm	10.64	18.5	csd100 mL			6.18	pH units	12.4	°C	0.033	mg/L	10	mg/L	
1/6/2008		0.107	mg/L															mg/L	
5/29/2008		0.1	mg/L	152.5	µS/cm	10.27	24	csd100 mL			6.68	pH units	12.6	°C	0.023	mg/L	4	mg/L	
6/5/2008															0.01	mg/L	4	mg/L	
7/9/2008																			
8/24/2008				6.34	µS/cm	8.87	24.6	csd100 mL			7.04	pH units	20.9	°C					
				131	µS/cm						6.39	pH units	20.8	°C					
5/25/2010		0.1	mg/L	144.8	µS/cm	10.85	15.1	csd100 mL			6.39	pH units	16	°C	0.5	mg/L		mg/L	
7/25/2010		0.1	mg/L	152.2	µS/cm	7.13	38.8	csd100 mL			7.12	pH units	18.7	°C	0.033	mg/L	4	mg/L	
9/22/2010		0.2	mg/L	152.2	µS/cm		6.3	csd100 mL			7.58	pH units	13.3	°C	0.5	mg/L	4	mg/L	
10/20/2010		0.17	mg/L	154.5	µS/cm		7.3	csd100 mL			7.58	pH units	13.3	°C	0.5	mg/L	4	mg/L	
11/8/2010		0.2	mg/L	154.5	µS/cm		2	csd100 mL			7.58	pH units	13.3	°C	0.5	mg/L	4	mg/L	
11/8/2010		0.2	mg/L	154.5	µS/cm						7.58	pH units	13.3	°C	0.5	mg/L	4	mg/L	
3/30/2011		0.2	mg/L	92.2	µS/cm	13.84	mg/L	1	csd100 mL		6.99	pH units	5.2	°C	0.5	mg/L	4	mg/L	
5/2/2011		0.346	mg/L	95.2	µS/cm	11.6	53.7	csd100 mL			6.94	pH units	13.1	°C	0.5	mg/L	4	mg/L	
8/4/2011		0.2	mg/L	150.4	µS/cm	10.23	23.3	csd100 mL			6.89	pH units	16.9	°C	0.5	mg/L	4	mg/L	
8/16/2011															0.021	mg/L	4	mg/L	
9/14/2011		0.2	mg/L	120.3	µS/cm	9.52	27.5	csd100 mL			6.84	pH units	17.7	°C	0.5	mg/L	4	mg/L	
10/4/2011		0.2	mg/L	71.6	µS/cm	9.59	mg/L				7	pH units			0.016	mg/L	4	mg/L	
11/7/2011		0.2	mg/L	121	µS/cm	11.89	4.1	csd100 mL			6.84	pH units	5.4	°C	0.5	mg/L	4	mg/L	
12/20/2011		0.2	mg/L	89.1	µS/cm	13.66	2	csd100 mL			6.5	pH units	2.7	°C	0.5	mg/L	4	mg/L	
3/28/2012		0.88	mg/L	100.3	µS/cm	12.23	mg/L				6.66	pH units	5.2	°C	0.5	mg/L	5	mg/L	
4/26/2012		0.05	mg/L		82.5	µS/cm	10.93	18.3	csd100 mL		6.75	pH units	10.8	°C	0.5	mg/L	5	mg/L	
8/2/2012		0.05	mg/L	141.5	µS/cm	9.2	17.1	csd100 mL			6.42	pH units	17.8	°C	0.5	mg/L	5	mg/L	
8/27/2012		0.05	mg/L	144.7	µS/cm	9.39	mg/L	18.3	csd100 mL		6.71	pH units	16.7	°C	0.5	mg/L	5	mg/L	
9/18/2012		1.56	mg/L	147.5	µS/cm	10.3	mg/L				6.69	pH units	12.7	°C	0.5	mg/L	5	mg/L	
10/5/2012		0.60	mg/L	120.4	µS/cm	9.92	mg/L	1	csd100 mL		6.47	pH units	9.6	°C	0.5	mg/L	5	mg/L	
4/4/2013		1.28	0.2	mg/L	74	mg/L	14	mg/L			6.49	pH units	5.8	°C	0.5	mg/L	6	mg/L	
5/6/2013		0.76	0.2	mg/L	109.4	µS/cm	10.10	mg/L	12.2	csd100 mL	1	csd100 mL			0.05	mg/L	6	mg/L	
6/20/2013		0.2	mg/L	109.4	µS/cm	10.10	mg/L	12.2	csd100 mL	7	csd100 mL				0.06	mg/L	6	mg/L	
7/16/2013		0.61	0.2	mg/L	130.7	µS/cm	12.58	mg/L	0.47	mg/L	6.39	pH units	21.2	°C	0.018	mg/L	6	mg/L	
8/16/2013		0.59	0.2	mg/L	109.4	µS/cm	9.43	mg/L	0.3	mg/L	6.58	pH units	20.2	°C	0.02	mg/L	6	mg/L	
9/16/2013		0.55	0.2	mg/L	103.5	µS/cm	14.40	mg/L	0.49	mg/L	6.69	pH units	24.3	°C	0.02	mg/L	6	mg/L	
10/26/2013		0.58	0.2	mg/L	94.6	µS/cm	10.86	mg/L	0.49	mg/L	6.26	pH units	11.5	°C	0.5	mg/L	6	mg/L	
4/14/2014		0.2	mg/L	21	mg/L	33	mg/L	18	mg/L	142.5	µS/cm	13.02	mg/L	1	csd100 mL	2	csd100 mL	0.2	mg/L
5/9/2014		0.88	0.2	mg/L	26	mg/L	110.2	mg/L	1	csd100 mL	2	csd100 mL	1	csd100 mL	2	csd100 mL	0.2	mg/L	
6/12/2014		0.66	0.2	mg/L	34	mg/L	90.7	µS/cm	11.00	mg/L	3.1	csd100 mL	1	csd100 mL	2	csd100 mL	0.2	mg/L	
7/14/2014		0.54	0.2	mg/L	37	mg/L	104.8	µS/cm	10.17	mg/L	8.6	mg/L	236	csd100 mL	2	csd100 mL	0.48	mg/L	
8/22/2014		0.51	0.2	mg/L	40	mg/L	106.9	µS/cm	11.00	mg/L	108	mg/L	108	csd100 mL	8	csd100 mL	0.58	mg/L	
9/18/2014		0.48	0.2	mg/L	38	mg/L	96.6	µS/cm	11.92	mg/L	8.5	mg/L	13.4	csd100 mL	0.6	mg/L	0.62	mg/L	
11/5/2014		0.90	0.2	mg/L	26	mg/L	68.8	µS/cm	12.44	mg/L	4.1	csd100 mL	2	csd100 mL	0.26	mg/L	0.2	mg/L	
4/3/2015		1.48	0.2	mg/L	18	mg/L	142.5	µS/cm	13.02	mg/L	1	csd100 mL	2	csd100 mL	0.2	mg/L	0.2	mg/L	
5/7/2015		0.89	0.2	mg/L	33	mg/L	131.5	µS/cm	10.72	mg/L	5.2	mg/L	35.9	csd100 mL	40	csd100 mL	0.67	mg/L	
7/16/2015		0.60	0.2	mg/L	42	mg/L	146.2	µS/cm	10.72	mg/L	35.9	csd100 mL	40	csd100 mL	6	csd100 mL	0.64	mg/L	
8/6/2015		0.57	0.2	mg/L	45	mg/L	157.1	µS/cm	6.89	mg/L	16	mg/L	29.2	csd100 mL	15	csd100 mL	0.61	mg/L	
8/27/2015		0.52	0.2	mg/L	46	mg/L	96.6	µS/cm	9.31	mg/L	13.4	csd100 mL	5	csd100 mL	0.64	mg/L	0.64	mg/L	
9/24/2015		0.50	0.2	mg/L	46	mg/L	150	µS/cm	8.70	mg/L	13.4	csd100 mL	5	csd100 mL	0.64	mg/L	0.64	mg/L	
11/5/2015		0.56	0.2	mg/L	41	mg/L	130.4	µS/cm			3	csd100 mL	3	csd100 mL	0.46	mg/L	0.2	mg/L	
4/21/2016		1.52	0.2	mg/L	27	mg/L	127	µS/cm			1	csd100 mL	5	csd100 mL	0.23	mg/L	0.2	mg/L	
6/2/2016		1.70	0.2	mg/L	40	mg/L	137.9	µS/cm	6.71	mg/L	19.9	csd100 mL	5	csd100 mL	0.33	mg/L	0.2	mg/L	
7/27/2016		2.40	0.2	mg/L	47	mg/L	179.9	µS/cm	6.03	mg/L	17.3	csd100 mL	33	csd100 mL	0.02	mg/L	0.2	mg/L	
7/28/2016		1.45	0.2	mg/L	50	mg/L	198.6	µS/cm	6.44	mg/L	43.2	csd100 mL	36	csd100 mL	0.5	mg/L	0.2	mg/L	
8/26/2016		1.60	0.2	mg/L	47	mg/L	183.7	µS/cm	6.48	mg/L	82	csd100 mL	30	csd100 mL	0.31	mg/L	0.2	mg/L	
9/26/2016		2.80	0.2	mg/L	48	mg/L	183.7	µS/cm	7.24	mg/L	36.8	csd100 mL	289	csd100 mL	0.32	mg/L	0.2	mg/L	
10/9/2016		2.00	0.2	mg/L	49	mg/L	167.7	µS/cm	6.54	mg/L	37.7	csd100 mL	34	csd100 mL	0.37	mg/L	0.2	mg/L	
5/4/2017		2.09	0.2	mg/L	24	mg/L	87.4	µS/cm	9.15	mg/L	52.9	csd100 mL	32	csd100 mL	0.2	mg/L	0.2	mg/L	
6/14/2017		1.65	0.2	mg/L	39	mg/L	146.6	µS/cm	7.34	mg/L	6.3	csd100 mL	13	csd100 mL	0.37	mg/L	0.2	mg/L	
7/8/2017		1.39	0.2	mg/L	51	mg/L	194.2	µS/cm	8.21	mg/L	32.7	csd100 mL	24	csd100 mL	0.62	mg/L	0.2	mg/L	
8/22/2017		1.22	0.2	mg/L	50	mg/L					37.9	csd100 mL	39	csd100 mL	0.44	mg/L	0.2	mg/L	
10/9/2017		0.80	0.2	mg/L	51	mg/L					29.5	csd100 mL	23	csd100 mL	0.66	mg/L	0.2	mg/L	
11/15/2017		1.02	0.2	mg/L	29	mg/L	146	µS/cm	9.70	mg/L	161	csd100 mL	394	csd100 mL	0.59	mg/L	0.2	mg/L	
4/24/2018		1.30	0.2	mg/L	27	mg/L	111.9	µS/cm	10.90	mg/L	8.5	csd100 mL	11	csd100 mL	0.22	mg/L	0.2	mg/L	
5/30/2018		0.83	0.82	mg/L	45	mg/L	178	µS/cm	7.91	mg/L	28.8	csd100 mL	2	csd100 mL	0.54	mg/L	0.2	mg/L	
7/12/2018		0.90	0.2	mg/L	57	mg/L	190.8	µS/cm	10.83	mg/L	1.17	mg/L	7.15	pH units	18.5	°C	0.38	mg/L	
8/16/2018		1.25	0.2	mg/L	27	mg/L	117.1	µS/cm	12.67	mg/L	66.3	csd100 mL	44	csd100 mL	0.23	mg/L	0.2	mg/L	
9/6/2018		0.75	0.2	mg/L	47	mg/L	89.8	µS/cm	12.20	mg/L	60.1	csd100 mL	61	csd100 mL	0.65	mg/L	0.2	mg/L	
10/07/2018		1.60	0.2	mg/L	25	mg/L	108.6	µS/cm	10.20	mg/L	20.1	csd100 mL	15	csd100 mL	0.23	mg/L	0.2	mg/L	
10/31/2018		1.90	0.2	mg/L	23	mg/L	103.7	µS/cm	15.21	mg/L	16	csd100 mL	15	csd100 mL	0.2	mg/L	0.2	mg/L	
10/31/2018											6.58	pH units	6.2	°C	0.83	mg/L	4	mg/L	
10/31/2018											6.66	pH units	11.9	°C	1.85	mg/L	2.07	mg/L	
10/31/2018											5.63	pH units	16.4	°C	1.43	mg/L	2.89	mg/L	
10/31/2018											7.15	pH units	18.5	°C	0.717	mg/L	1.89	mg/L	
10/31/2018											6.98	pH units	20.9	°C	0.2	mg/L	0.23	mg/L	
10/31/2018											7.01	pH units	20.9	°C	1.41	mg/L	2.06	mg/L	
10/31/2018											6.50	pH units	15.7	°C	0.788	mg/L	1.02	mg/L	
10/31/2018											6.58	pH units	6.2	°C	0.83	mg/L	0.83	mg/L	
10/31/2018											6.58	pH units	6.2	°C	0.83	mg/L	0.83	mg/L	
10/31/2018																			

12-PEN Tributary Sampling Data 2007-2018

Staff Gauge Reading												Laboratory Detection Limit				
												Expected Outlier or Equipment Failure				
Date	Ammonia	Chloride	Conductivity	DO	E. coli	Fecal Coliform	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	TKN	Total Nitrogen	Total Phosphorus	TSS	
2007																
5/20/2007				8.54	mg/L 2	csd1000 mL				7.28	pH units 17.8 °C	0.637	mg/L	mg/L 0.017	4	
6/26/2007	0.1	mg/L	133	µS/cm 18.5	mg/L	csd1000 mL				7.08	pH units 24.5 °C	0.723	mg/L	mg/L 0.025	4	
8/22/2007	0.307	mg/L	139.4	µS/cm 50.4	mg/L	csd1000 mL				7.01	pH units 21.5 °C	0.766	mg/L	mg/L 0.019	4	
8/22/2007	0.1	mg/L	137.5	µS/cm 9.85	mg/L	csd1000 mL				6.54	pH units 13.6 °C	1.13	mg/L	mg/L 0.025	4	
2008																
1/6/2008	0.176	mg/L			72.2	csd1000 mL								mg/L 0.035	4	
5/29/2008	0.115	mg/L	144.2	µS/cm 9.18	mg/L	csd1000 mL				6.91	pH units 16.1 °C	0.523	mg/L	mg/L 0.016	4	
No Data																
6/12/2008			0.13	µS/cm 7.04	mg/L	csd1000 mL				7.04	pH units 24.5 °C					
7/9/2008			142	µS/cm	69.7	csd1000 mL				7.04	pH units 20.9 °C					
8/2/2008										7.04	pH units 20.9 °C					
2010																
5/25/2010	0.1	mg/L	127.6	µS/cm 9.32	mg/L 16.1	csd1000 mL				6.98	pH units 21.5 °C	0.5	mg/L	mg/L 0.028	4	
7/12/2010	0.4	mg/L	131.6	µS/cm 8.14	mg/L 146	csd1000 mL				7.02	pH units 21.3 °C	0.5	mg/L	mg/L 0.041	4	
9/22/2010	0.2	mg/L	134.6	µS/cm	2	csd1000 mL				7.58	pH units 14.7 °C	0.5	mg/L	mg/L 0.015	4	
10/20/2010	0.2	mg/L			154.1	csd1000 mL				7.58	pH units 14.7 °C	0.5	mg/L	mg/L 0.043	4	
11/30/2010	0.2	mg/L	0.13	µS/cm	3.1	csd1000 mL					3.8 °C	0.5	mg/L	mg/L 0.03	4	
2011																
3/20/2011	0.2	mg/L	126.9	µS/cm 12.79	mg/L 1	csd1000 mL				7.04	pH units 6.4 °C	0.5	mg/L	mg/L 0.01	4	
5/2/2011	0.49	mg/L	140.7	µS/cm	24.1	csd1000 mL				7.19	pH units 15.2 °C	0.5	mg/L	mg/L 0.013	4	
8/4/2011	0.2	mg/L	142.3	µS/cm 9.28	mg/L 107.6	csd1000 mL				7.15	pH units 21.1 °C	0.5	mg/L	mg/L 0.07	4	
8/16/2011	0.2	mg/L	136.3	µS/cm 9.24	mg/L	csd1000 mL				7	pH units	0.5	mg/L	mg/L 0.01	4	
9/14/2011	0.2	mg/L	134.1	µS/cm 8.78	mg/L 44.1	csd1000 mL				7.09	pH units 20.7 °C	0.5	mg/L	mg/L 0.01	4	
10/4/2011	0.2	mg/L	138	µS/cm 9.34	mg/L	csd1000 mL				7	pH units	0.5	mg/L	mg/L 0.013	4	
11/7/2011	0.2	mg/L	123.9	µS/cm 11.36	mg/L 5.2	csd1000 mL				7.13	pH units 8 °C	0.5	mg/L	mg/L 0.01	4	
12/20/2011	0.2	mg/L	128.8	µS/cm 12.56	mg/L 12.2	csd1000 mL				7.32	pH units 4 °C	0.5	mg/L	mg/L 0.01	4	
2012																
3/28/2012	0.59	mg/L	123.8	µS/cm 11.13	mg/L 36.9	csd1000 mL				6.8	pH units 7.5 °C	0.5	mg/L	mg/L 0.01	5	
4/26/2012	0.60	mg/L	116.1	µS/cm 10.04	mg/L 29.5	csd1000 mL				6.84	pH units 13.5 °C	0.5	mg/L	mg/L 0.01	5	
8/2/2012	0.35	mg/L	143.9	µS/cm 8.67	mg/L 365.4	csd1000 mL				6.73	pH units 21.6 °C	0.5	mg/L	mg/L 0.01	5	
8/27/2012	0.06	mg/L	131.7	µS/cm 8.45	mg/L 172.3	csd1000 mL				6.88	pH units 19.1 °C	0.5	mg/L	mg/L 0.01	5	
9/18/2012	1.00	mg/L	130.4	µS/cm 9.32	mg/L 52	csd1000 mL				6.89	pH units 14.3 °C	0.5	mg/L	mg/L 0.01	5	
10/25/2012	0.25	mg/L	115.3	µS/cm 10.22	mg/L 10.8	csd1000 mL				6.17	pH units 10 °C	0.5	mg/L	mg/L 0.01	5	
2013																
4/4/2013	0.82	mg/L 24	mg/L 118.2	µS/cm 12.06	mg/L 2	csd1000 mL 1			0.5	mg/L	5.3 °C	0.5	mg/L	mg/L 0.05	6	
5/2/2013	0.2	mg/L	131.1	µS/cm 8.73	mg/L 41	csd1000 mL				6.52	pH units 13.7 °C	0.5	mg/L	mg/L 0.03	6	
5/28/2013	0.58	mg/L	139	µS/cm 11.24	mg/L 17	csd1000 mL				6.44	pH units 13.8 °C	0.5	mg/L	mg/L 0.03	6	
7/12/2013	0.59	mg/L	132.7	µS/cm 11.24	mg/L 139	csd1000 mL			0.2	mg/L	24.2 °C	0.5	mg/L	mg/L 0.051	6	
8/16/2013	0.46	mg/L	113.2	µS/cm 8.98	mg/L 16.1	csd1000 mL			0.2	mg/L	18 °C	0.5	mg/L	mg/L 0.02	6	
9/12/2013	0.35	mg/L	104.7	µS/cm 14.06	mg/L 24.6	csd1000 mL			0.2	mg/L	6.69	pH units 11 °C	0.5	mg/L	mg/L 0.029	6
10/28/2013	0.26	mg/L	89.1	µS/cm 11.15	mg/L 13.1	csd1000 mL			0.2	mg/L	8 °C	0.5	mg/L	mg/L 0.029	6	
2014																
4/13/2014	0.96	mg/L 28	mg/L 80	µS/cm	2	csd1000 mL			0.2	mg/L	14.6 °C	0.2	mg/L	mg/L 0.042	4	
5/12/2014	0.74	mg/L 33	mg/L 147.4	µS/cm 10.36	mg/L 4.1	csd1000 mL			0.2	mg/L	13.8 °C	0.2	mg/L	mg/L 0.026	4	
6/11/2014	0.54	mg/L 34	mg/L 97	µS/cm 10.09	mg/L 66.3	csd1000 mL			0.2	mg/L	18.1 °C	0.2	mg/L	mg/L 0.03	4	
7/14/2014	0.58	mg/L 32	mg/L 97.3	µS/cm 9.21	mg/L 22.8	csd1000 mL			0.2	mg/L	22.6 °C	0.2	mg/L	mg/L 0.17	4	
8/22/2014	0.40	mg/L 32	mg/L 97	µS/cm 10.36	mg/L 27.5	csd1000 mL			0.22	mg/L	18.5 °C	0.2	mg/L	mg/L 0.012	4	
9/18/2014	0.58	mg/L 33	mg/L 90.5	µS/cm 11.26	mg/L 37.3	csd1000 mL			0.2	mg/L	6.94	pH units 11.9 °C	0.2	mg/L	mg/L 0.01	4
11/5/2014	1.56	mg/L 31	mg/L 84.3	µS/cm 11.62	mg/L 25.6	csd1000 mL			0.2	mg/L	6.92	pH units 9.6 °C	0.2	mg/L	mg/L 0.01	4
2015																
4/13/2015	2.16	mg/L 35	mg/L 95.7	µS/cm 12.61	mg/L 3.1	csd1000 mL			0.2	mg/L	9.2 °C	0.2	mg/L	mg/L 0.01	4	
5/7/2015	1.18	mg/L	153.9	µS/cm 9.39	mg/L 42.6	csd1000 mL			0.2	mg/L	18.6 °C	0.2	mg/L	mg/L 0.013	4	
7/16/2015	0.41	mg/L 39	mg/L 154.5	µS/cm 6.01	mg/L 43.2	csd1000 mL			0.2	mg/L	20 °C	0.817	mg/L	mg/L 0.022	4	
8/6/2015	0.27	mg/L 38	mg/L 156.9	µS/cm 5.08	mg/L 48	csd1000 mL			0.2	mg/L	19.7 °C	1.26	mg/L	mg/L 0.046	4	
8/27/2015	0.26	mg/L 38	mg/L 164	µS/cm 4.37	mg/L 133	csd1000 mL			0.2	mg/L	21.5 °C	0.692	mg/L	mg/L 0.023	7	
9/14/2015	0.17	mg/L 38	mg/L 140.3	µS/cm 5.01	mg/L 63.1	csd1000 mL			0.2	mg/L	6.96	pH units 14.4 °C	0.2	mg/L	mg/L 0.029	4
11/5/2015	0.27	mg/L 37	mg/L 123.7	µS/cm	37.9	csd1000 mL			0.2	mg/L	11.1 °C	0.327	mg/L	mg/L 0.014	4	
2016																
4/21/2016	0.58	mg/L 43	mg/L 199	µS/cm	3.1	csd1000 mL			0.2	mg/L	13.62 °C	0.2	mg/L	mg/L 0.012	4	
6/2/2016	0.69	mg/L 46	mg/L 171.3	µS/cm 4.17	mg/L 236	csd1000 mL			0.2	mg/L	6.79	pH units 13.2 °C	0.5	mg/L	mg/L 0.043	4
6/27/2016	2.45	mg/L 42	mg/L 102.1	µS/cm 1.80	mg/L 276	csd1000 mL			0.2	mg/L	6.54	pH units 10.8 °C	0.654	mg/L	mg/L 0.07	4
8/2/2016	0.2	mg/L 44	mg/L 202.3	µS/cm 1.61	mg/L 249	csd1000 mL			0.2	mg/L	6.42	pH units 10.7 °C	0.77	mg/L	mg/L 0.42	4
8/25/2016	2.30	mg/L 39	mg/L 146	µS/cm 1.99	mg/L 65	csd1000 mL			0.2	mg/L	6.48	pH units 13.7 °C	0.54	mg/L	mg/L 0.181	5
9/22/2016	0.40	mg/L 31	mg/L 146	µS/cm 1.39	mg/L 79.4	csd1000 mL			0.2	mg/L	6.68	pH units 13.7 °C	0.519	mg/L	mg/L 0.03	4
10/19/2016	0.50	mg/L 39	mg/L 141.6	µS/cm 3.49	mg/L 336	csd1000 mL			0.2	mg/L	6.30	pH units 13.5 °C	1.03	mg/L	mg/L 0.073	4
2017																
5/4/2017	1.18	mg/L 46	mg/L 167.7	µS/cm 7.98	mg/L 5.2	csd1000 mL			0.2	mg/L	15.7 °C	0.576	mg/L	mg/L 0.020	4	
6/14/2017	0.98	mg/L 45	mg/L 191.8	µS/cm 5.75	mg/L 130	csd1000 mL			0.2	mg/L	6.90	pH units 22.5 °C	0.2	mg/L	mg/L 0.011	4
7/6/2017	1.30	mg/L 44	mg/L 192	µS/cm 4.68	mg/L 41.9	csd1000 mL			0.2	mg/L	6.79	pH units 21.8 °C	0.2	mg/L	mg/L 0.014	4
8/22/2017	1.47	mg/L 43	mg/L		61.3	csd1000 mL			0.2	mg/L	6.20	pH units	0.2	mg/L	mg/L 0.011	4
9/7/2017	na	mg/L 42	mg/L	7.21	mg/L 62.4	csd1000 mL			0.2	mg/L	11.4 °C	0.2	mg/L	mg/L 0.014	4	
10/19/2017	2.54	mg/L 42	mg/L 134	µS/cm	81.6	csd1000 mL			0.2	mg/L	6.20	pH units	0.2	mg/L	mg/L 0.022	4
11/15/2017	1.28	mg/L 47	mg/L 127.5	µS/cm 17.13	mg/L 3.6	csd1000 mL			0.2	mg/L	6.53	pH units 5.4 °C	0.428	mg/L	mg/L 0.043	4
2018																
4/24/2018	0.95	mg/L 44	mg/L 181.9	µS/cm 10.51	mg/L 1	csd1000 mL			0.2	mg/L	6.65	pH units 12.3 °C	0.696	mg/L	mg/L 0.011	4
5/30/2018	0.80	mg/L 42	mg/L 184.2	µS/cm 8.06	mg/L 50	csd1000 mL			0.2	mg/L	6.40	pH units 19.2 °C	0.789	mg/L	mg/L 0.014	4
7/12/2018	0.30	mg/L 43	mg/L 169.3	µS/cm 12.16	mg/L 61.3	csd1000 mL			0.4	mg/L	7.44	pH units 20.7 °C	0.922	mg/L	mg/L 0.018	4
8/16/2018	0.50	mg/L 39	mg/L 171.7	µS/cm 11.39	mg/L 104	csd1000 mL			0.2	mg/L	6.62	pH units 22.4 °C	0.2	mg/L	mg/L 0.016	4
9/6/2018	0.35	mg/L 41	mg/L 186.1	µS/cm 11.30	mg/L 65	csd1000 mL			0.2	mg/L	7.70	pH units 22.2 °C	0.7	mg/L	mg/L 0.010	4
10/07/2018	0.70	mg/L 42	mg/L													

Attachment B:

Groundwater Sampling Data, 2013 through 2018

09-PEN Groundwater Sampling Data 2013-2015

09-PEN Groundwater Sampling Data 2013-2015													
Date	Water Level Depth	Ammonia	Chloride	Conductivity	DO	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	TKN	Laboratory Detection Limit	
												Expected Outlier or Equipment Failure	
2013													
4/4/2013			410					0.9	mg/L			0.5	mg/L
7/17/2013	2.92	0.4	227	780	12.25	mg/L	0.67	mg/L	0.2	mg/L	6.53	pH units	23.1
8/16/2013	2.97	0.2	235	741	7.56	mg/L	1.14	mg/L	0.2	mg/L	6.42	pH units	18.3
9/10/2013	3.27	0.2	266	716	12.81	mg/L	0.2	mg/L	0.2	mg/L	6.51	pH units	17.4
10/28/2013	3.22	0.1	150	439	10.42	mg/L	0.2	mg/L	0.2	mg/L	6.65	pH units	13
2014													
4/14/2014	2.53	0.2	333	860		2.03	mg/L	0.2	mg/L	6.37	pH units	15	°C
5/8/2014	2.65	0.2	401	1369	10.46	mg/L	2.75	mg/L	0.2	mg/L	6.73	pH units	12
6/11/2014	3.13	0.2	443	902	9.86	mg/L	1.56	mg/L	0.2	mg/L	6.78	pH units	16.2
7/14/2014	3.20	0.2	425	922	9.68	mg/L	0.56	mg/L	0.2	mg/L	6.79	pH units	20.2
8/12/2014	3.31	0.2	248	595	10.36	mg/L	0.2	mg/L	0.2	mg/L	7.09	pH units	19
9/18/2014	3.28	0.2	124	356	10.83	mg/L	0.2	mg/L	0.2	mg/L	6.90	pH units	15.8
11/5/2014	3.01	0.2	220	474	10.98	mg/L	3.36	mg/L	0.2	mg/L	6.92	pH units	12.9
2015													
4/13/2015	2.38	0.2	211	728	11.27	mg/L	1.32	mg/L	0.2	mg/L	6.96	pH units	10.2
5/7/2015	2.90	0.2	163	598	10.44	mg/L	1.83	mg/L	0.2	mg/L	14.1	°C	°C
7/16/2015	3.08	0.2	260	801	6.03	mg/L	2.58	mg/L	0.2	mg/L	6.94	pH units	16.8
8/6/2015	3.24	0.2	249	770	6.72	mg/L	0.45	mg/L	0.2	mg/L	6.95	pH units	17.5
8/27/2015	3.28	0.2	130	484.5	6.24	mg/L	0.2	mg/L	0.2	mg/L	6.84	pH units	18.8
9/24/2015	3.38	0.2	94	366.6	6.54	mg/L	0.2	mg/L	0.2	mg/L	6.97	pH units	18.8
11/5/2015	3.10	0.2	96	378.4		mg/L	0.2	mg/L	0.2	mg/L	6.89	pH units	16.8
											0.283	mg/L	0.28
													mg/L

Estimated Quantity of Fish and Fishery Products	Laboratory Detection Limit

CN	Total Nitrogen		Total Phosphorus, Unfiltered
	expected (water or equipment residue)		
	mg/L	0.5	mg/L
	mg/L	7.27	mg/L
	mg/L	4.07	mg/L
	mg/L	0.2	mg/L
	mg/L	0.2	mg/L
	mg/L	4.61	mg/L
	mg/L	3.17	mg/L
	mg/L	0.2	mg/L
	mg/L	1.46	mg/L
	mg/L	0.2	mg/L
	mg/L	1.48	mg/L
	mg/L	0.2	mg/L
	mg/L		
	mg/L	0.2	mg/L
	mg/L		
	mg/L		
	mg/L	0.79	mg/L
	mg/L	1.03	mg/L
	mg/L	3.12	mg/L
	mg/L	1.61	mg/L
	mg/L	3.71	mg/L
	mg/L	4.38	mg/L
	mg/L	0.75	mg/L
	mg/L	1.79	mg/L
	mg/L	0.5	mg/L
	mg/L	0.2	mg/L
	mg/L	3.27	mg/L
	mg/L	0.66	mg/L
	mg/L	1.11	mg/L
	mg/L	1.56	mg/L
	mg/L		
	mg/L	1.94	mg/L
	mg/L	2.13	mg/L
	mg/L	3.45	mg/L
	mg/L		
	mg/L	1.72	mg/L
	mg/L		0.27

Laboratory Detection Limit	
Expected Outlier or Equipment Failure	

Laboratory Detection Limit	
Expected Outlier or Equipment Failure	

01-WCH Groundwater Sampling Data 2013-2018

Date	Water Level Depth	Ammonia	Chloride	Conductivity	DO	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	Total Alkalinity	Total Dissolved Solids	TKN	Total Nitrogen	Laboratory Detection Limit	
															Expected Outlier or Equipment Failure	
4/4/2013								2013								
7/17/2013	1.95	0.4	mg/L	55	mg/L	259	µS/cm	10.72	mg/L	0.2	mg/L	0.2	mg/L	5.67	pH units	14.5 °C
8/16/2013	1.76	0.2	mg/L	68	mg/L	247	µS/cm	6.82	mg/L	2.41	mg/L	0.2	mg/L	5.58	pH units	12.6 °C
9/17/2013	1.80	0.2	mg/L	76	mg/L	243	µS/cm	10.63	mg/L	0.2	mg/L	2.33	mg/L	5.58	pH units	13.6 °C
10/28/2013	1.56	0.1	mg/L	61	mg/L	198.3	µS/cm	2.71	mg/L	0.2	mg/L	0.2	mg/L	5.88	pH units	11.4 °C
4/4/2014	1.12	0.2	mg/L	67	mg/L	250	µS/cm									
5/6/2014	1.43	0.2	mg/L	49	mg/L	206.2	µS/cm	7.17	mg/L	1.77	mg/L	0.2	mg/L	1.77	mg/L	1.77
6/11/2014	1.51	0.2	mg/L	40	mg/L	118.7	µS/cm	8.21	mg/L	1.92	mg/L	0.2	mg/L	5.83	pH units	10.9 °C
7/14/2014	1.47	0.2	mg/L	41	mg/L	119.2	µS/cm	7.47	mg/L	1.85	mg/L	0.2	mg/L	5.95	pH units	13 °C
8/2/2014	1.86	0.2	mg/L	41	mg/L	116.4	µS/cm	7.58	mg/L	1.74	mg/L	0.2	mg/L	6.00	pH units	13.9 °C
9/18/2014	1.82	0.2	mg/L	42	mg/L	114.9	µS/cm	6.02	mg/L	1.85	mg/L	0.2	mg/L	6.03	pH units	12.8 °C
11/9/2014	1.31	0.2	mg/L	93	mg/L	116.4	µS/cm	4.63	mg/L	1.8	mg/L	0.2	mg/L	5.91	pH units	12.8 °C
4/19/2015	0.92	0.2	mg/L	104	mg/L	419	µS/cm	5.75	mg/L	1.8	mg/L	0.2	mg/L	5.34	pH units	9.7 °C
5/7/2015	1.04	0.2	mg/L	72	mg/L	277	µS/cm	5.39	mg/L	1.75	mg/L	0.2	mg/L	1.75	mg/L	1.75
7/19/2015	1.75	0.2	mg/L	58	mg/L	185.4	µS/cm	5.58	mg/L	1.54	mg/L	0.2	mg/L	5.79	pH units	11.5 °C
8/6/2015	2.94	0.2	mg/L	61	mg/L	200.1	µS/cm	4.45	mg/L	1.57	mg/L	0.2	mg/L	5.73	pH units	12.5 °C
8/27/2015	2.90	0.2	mg/L	51	mg/L	173	µS/cm	3.22	mg/L	1.4	mg/L	0.2	mg/L	5.65	pH units	12.8 °C
9/24/2015	1.99	0.2	mg/L	37	mg/L	141.8	µS/cm	3.11	mg/L	1.3	mg/L	0.2	mg/L	6.02	pH units	13.2 °C
11/5/2015	1.57	0.2	mg/L	39	mg/L	145.6	µS/cm		mg/L	0.2	mg/L	0.2	mg/L	5.95	pH units	12.1 °C
4/21/2016	2.24	0.2	mg/L	79	mg/L	370	µS/cm		mg/L	2.35	mg/L	0.2	mg/L	5.79	pH units	10.55 °C
6/2/2016	2.30	0.2	mg/L	26	mg/L	109.2	µS/cm	4.96	mg/L	1.6	mg/L	0.2	mg/L	6.54	pH units	11.3 °C
6/27/2016	2.35	0.2	mg/L	61	mg/L	208.5	µS/cm	1.67	mg/L	0.2	mg/L	0.2	mg/L	6.01	pH units	18 °C
7/28/2016	2.98	0.36	mg/L	74	mg/L	287.9	µS/cm	1.99	mg/L	0.2	mg/L	0.2	mg/L	6.15	pH units	25 °C
8/25/2016	3.30	0.26	mg/L	86	mg/L	345.6	µS/cm	2.68	mg/L	0.2	mg/L	0.2	mg/L	6.55	pH units	24 °C
9/22/2016	2.82	0.2	mg/L	114	mg/L	418.8	µS/cm	2.79	mg/L	0.2	mg/L	0.2	mg/L	6.67	pH units	20.5 °C
10/19/2016	3.13	0.2	mg/L	73	mg/L	233	µS/cm	3.57	mg/L	0.2	mg/L	0.2	mg/L	6.45	pH units	12.6 °C
5/4/2017	1.79	0.2	mg/L	57	mg/L	186	µS/cm	5.98	mg/L	0.93	mg/L	0.2	mg/L	7.04	pH units	13.1 °C
6/13/2017	2.80	0.2	mg/L	34	mg/L	139.1	µS/cm	4.38	mg/L	1.21	mg/L	0.2	mg/L	6.83	pH units	14.7 °C
7/6/2017	2.09	0.2	mg/L	37	mg/L	148.2	µS/cm	4.36	mg/L	0.99	mg/L	0.2	mg/L	6.32	pH units	17 °C
8/22/2017	2.30	0.2	mg/L	31	mg/L					1.13	mg/L	0.2	mg/L			
9/7/2017	1.74	0.2	mg/L	34	mg/L					0.55	mg/L	0.2	mg/L	0.55	mg/L	
10/19/2017	2.30	0.2	mg/L	33	mg/L	148	µS/cm	8.05	mg/L	1.39	mg/L	0.2	mg/L	6.45	pH units	14.8 °C
11/15/2017	1.77	0.2	mg/L	60	mg/L	710	µS/cm	2.51	mg/L	0.44	mg/L	0.2	mg/L	6.46	pH units	11.7 °C
4/24/2018	1.90	0.2	mg/L	34	mg/L	105.2	µS/cm	4.55	mg/L	0.59	mg/L	0.2	mg/L	7.34	pH units	9 °C
5/30/2018	2.20	0.2	mg/L	22	mg/L	123	µS/cm	4.84	mg/L	1.28	mg/L	0.2	mg/L	6.11	pH units	11.3 °C
7/12/2018	4.18	0.21	mg/L	21	mg/L	100.9	µS/cm	10.95	mg/L	1.09	mg/L	0.2	mg/L	7.82	pH units	17 °C
8/19/2018	1.90	0.2	mg/L	22	mg/L	132.6	µS/cm	7.61	mg/L	1.22	mg/L	0.2	mg/L	6.32	pH units	17.2 °C
9/5/2018	4.00	0.2	mg/L	29	mg/L	162.5	µS/cm	10.39	mg/L	0.69	mg/L	0.2	mg/L	6.27	pH units	20.3 °C
10/10/2018	1.70	0.2	mg/L	26	mg/L	143	µS/cm	4.80	mg/L	1.02	mg/L	0.2	mg/L	6.50	pH units	15.4 °C
10/31/2018	1.83	0.2	mg/L	25	mg/L	135.8	µS/cm	5.25	mg/L	1.01	mg/L	0.2	mg/L	5.90	pH units	11.9 °C
5/4/2019	1.79	0.2	mg/L	57	mg/L	186	µS/cm	5.98	mg/L	0.93	mg/L	0.2	mg/L	7.04	pH units	13.1 °C
6/13/2019	2.80	0.2	mg/L	34	mg/L	139.1	µS/cm	4.38	mg/L	1.21	mg/L	0.2	mg/L	6.83	pH units	14.7 °C
7/6/2019	2.09	0.2	mg/L	37	mg/L	148.2	µS/cm	4.36	mg/L	0.99	mg/L	0.2	mg/L	6.32	pH units	17 °C
8/22/2019	2.30	0.2	mg/L	31	mg/L					1.13	mg/L	0.2	mg/L			
9/7/2019	1.74	0.2	mg/L	34	mg/L					0.55	mg/L	0.2	mg/L	0.55	mg/L	
10/19/2019	2.30	0.2	mg/L	33	mg/L	148	µS/cm	8.05	mg/L	1.39	mg/L	0.2	mg/L	6.45	pH units	14.8 °C
11/15/2019	1.77	0.2	mg/L	60	mg/L	710	µS/cm	2.51	mg/L	0.44	mg/L	0.2	mg/L	6.46	pH units	11.7 °C
4/24/2018	1.90	0.2	mg/L	34	mg/L	105.2	µS/cm	4.55	mg/L	0.59	mg/L	0.2	mg/L	7.34	pH units	9 °C
5/30/2018	2.20	0.2	mg/L	22	mg/L	123	µS/cm	4.84	mg/L	1.28	mg/L	0.2	mg/L	6.11	pH units	11.3 °C
7/12/2018	4.18	0.21	mg/L	21	mg/L	100.9	µS/cm	10.95	mg/L	1.09	mg/L	0.2	mg/L	7.82	pH units	17 °C
8/19/2018	1.90	0.2	mg/L	22	mg/L	132.6	µS/cm	7.61	mg/L	1.22	mg/L	0.2	mg/L	6.32	pH units	17.2 °C
9/5/2018	4.00	0.2	mg/L	29	mg/L	162.5	µS/cm	10.39	mg/L	0.69	mg/L	0.2	mg/L	6.27	pH units	20.3 °C
10/10/2018	1.70	0.2	mg/L	26	mg/L	143	µS/cm	4.80	mg/L	1.02	mg/L	0.2	mg/L	6.50	pH units	15.4 °C
10/31/2018	1.83	0.2	mg/L	25	mg/L	135.8	µS/cm	5.25	mg/L	1.01	mg/L	0.2	mg/L	5.90	pH units	11.9 °C
5/4/2019	1.79	0.2	mg/L	57	mg/L	186	µS/cm	5.98	mg/L	0.93	mg/L	0.2	mg/L	7.04	pH units	13.1 °C
6/13/2019	2.80	0.2	mg/L	34	mg/L	139.1	µS/cm	4.38	mg/L	1.21	mg/L	0.2	mg/L	6.83	pH units	14.7 °C
7/6/2019	2.09	0.2	mg/L	37	mg/L	148.2	µS/cm	4.36	mg/L	0.99	mg/L	0.2	mg/L	6.32	pH units	17 °C
8/22/2019	2.30	0.2	mg/L	31	mg/L					1.13	mg/L	0.2	mg/L			
9/7/2019	1.74	0.2	mg/L	34	mg/L					0.55	mg/L	0.2	mg/L	0.55	mg/L	
10/19/2019	2.30	0.2	mg/L	33	mg/L	148	µS/cm	8.05	mg/L	1.39	mg/L	0.2	mg/L	6.45	pH units	14.8 °C
11/15/2019	1.77	0.2	mg/L	60	mg/L	710	µS/cm	2.51	mg/L	0.44	mg/L	0.2	mg/L	6.46	pH units	11.7 °C
4/24/2018	1.90	0.2	mg/L	34	mg/L	105.2	µS/cm	4.55	mg/L	0.59	mg/L	0.2	mg/L	7.34	pH units	9 °C
5/30/2018	2.20	0.2	mg/L	22	mg/L	123	µS/cm	4.84	mg/L	1.28	mg/L	0.2	mg/L	6.11	pH units	11.3 °C
7/12/2018	4.18	0.21	mg/L	21	mg/L	100.9	µS/cm	10.95	mg/L	1.09	mg/L	0.2	mg/L	7.82	pH units	17 °C
8/19/2018	1.90	0.2	mg/L	22	mg/L	132.6	µS/cm	7.61	mg/L	1.22	mg/L	0.2	mg/L	6.32	pH units	17.2 °C
9/5/2018	4.00	0.2	mg/L	29	mg/L	162.5	µS/cm	10.39	mg/L	0.69	mg/L	0.2	mg/L	6.27	pH units	20.3 °C
10/10/2018	1.70	0.2	mg/L	26	mg/L	143	µS/cm	4.80	mg/L	1.02	mg/L	0.2	mg/L	6.50	pH units	15.4 °C
10/31/2018	1.83	0.2	mg/L	25	mg/L	135.8	µS/cm	5.25	mg/L	1.01	mg/L	0.2	mg/L	5.90	pH units	11.9 °C
5/4/2019	1.79	0.2	mg/L	57	mg/L	186	µS/cm	5.98	mg/L	0.93	mg/L	0.2	mg/L	7.04	pH units	13.1 °C
6/13/2019	2.80	0.2	mg/L	34	mg/L	139.1	µS/cm	4.38	mg/L	1.21	mg/L	0.2	mg/L	6.83	pH units	14.7 °C
7/6/2019	2.09	0.2	mg/L	37	mg/L	148.2	µS/cm	4.36	mg/L	0.						

12-PEN Groundwater Sampling Data 2013-2018

Date	Water Level Depth	Ammonia	Chloride	Conductivity	DO	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	Total Alkalinity	Total Dissolved Solids	TKN	Total Nitrogen	Total Phosphorus, Unfiltered															
Laboratory Detection Limit Expected Outlier or Equipment Failure																														
2013																														
4/4/2013								0.5	mg/L	6.43	pH units		0.5	mg/L	0.5	mg/L														
7/17/2013	2.00	0.4	mg/L	42	mg/L	171.9	µS/cm	3.61	mg/L																					
8/6/2013	2.43	0.2	mg/L	42	mg/L	144.2	µS/cm	2.29	mg/L																					
9/17/2013	3.02	0.2	mg/L	39	mg/L	134.5	µS/cm	3.03	mg/L																					
10/28/2013	3.32	0.1	mg/L	37	mg/L	111.7	µS/cm	2.43	mg/L																					
2014																														
4/14/2014	1.86	0.2	mg/L	39	mg/L	160	µS/cm																							
5/6/2014	1.32	0.2	mg/L	33	mg/L	143.9	µS/cm	2.45	mg/L																					
6/11/2014	2.27	0.2	mg/L	31	mg/L	87	µS/cm	2.85	mg/L																					
7/14/2014	2.70	0.2	mg/L	30	mg/L	88	µS/cm	2.50	mg/L																					
8/20/2014	3.10	0.2	mg/L	35	mg/L	94.4	µS/cm	2.48	mg/L																					
9/18/2014	3.28	0.2	mg/L	35	mg/L	94.8	µS/cm	2.72	mg/L																					
11/9/2014	2.20	0.2	mg/L	33	mg/L	109.4	µS/cm	2.26	mg/L																					
2015																														
4/19/2015	1.10	0.2	mg/L	34	mg/L	148.5	µS/cm	2.91	mg/L																					
5/7/2015	1.62	0.2	mg/L	35	mg/L	143.3	µS/cm	3.69	mg/L																					
7/19/2015	2.21	0.2	mg/L	34	mg/L	120.1	µS/cm	3.50	mg/L																					
8/6/2015	2.70	0.2	mg/L	33	mg/L	118.1	µS/cm																							
8/27/2015	3.04	0.2	mg/L	34	mg/L	118	µS/cm	1.16	mg/L																					
9/24/2015	3.42	0.2	mg/L	35	mg/L	123.7	µS/cm	2.70	mg/L																					
11/5/2015	3.03	0.2	mg/L	36	mg/L	127.6	µS/cm																							
2016																														
4/21/2016	2.06	0.2	mg/L	43	mg/L	200	µS/cm																							
6/2/2016	2.02	0.2	mg/L	45	mg/L	143	µS/cm	3.47	mg/L																					
6/27/2016	1.91	0.2	mg/L	46	mg/L	163.5	µS/cm	2.15	mg/L																					
7/28/2016	1.35	0.21	mg/L	47	mg/L	189.5	µS/cm	2.41	mg/L																					
8/25/2016	2.40	0.23	mg/L	40	mg/L	162.5	µS/cm	2.20	mg/L																					
9/22/2016	2.43	0.26	mg/L	36	mg/L	135.4	µS/cm	2.27	mg/L																					
10/19/2016	3.17	0.2	mg/L	44	mg/L	164.9	µS/cm	1.88	mg/L																					
2017																														
5/4/2017	1.45	0.2	mg/L	47	mg/L	139.2	µS/cm	2.85	mg/L																					
6/13/2017	1.56	0.2	mg/L	47	mg/L	143.5	µS/cm	2.31	mg/L																					
7/6/2017	1.89	0.2	mg/L	46	mg/L	148.3	µS/cm	2.42	mg/L																					
8/22/2017	2.16	0.2	mg/L	45	mg/L																									
9/27/2017	2.16	0.2	mg/L	42	mg/L																									
10/19/2017	2.25	0.2	mg/L	43	mg/L	144	µS/cm	3.35	mg/L																					
11/15/2017	1.73	0.2	mg/L	48	mg/L	146.7	µS/cm	1.91	mg/L																					
2018																														
4/24/2018	1.47	0.2	mg/L	57	mg/L	211.7	µS/cm	3.24	mg/L																					
5/30/2018	1.92	0.2	mg/L	56	mg/L	298	µS/cm	4.06	mg/L																					
7/12/2018	2.71	0.2	mg/L	58	mg/L	164.8	µS/cm	6.67	mg/L																					
8/16/2018	2.50	0.2	mg/L	58	mg/L	227.2	µS/cm	8.12	mg/L																					
9/6/2018	2.80	0.2	mg/L	63	mg/L	238.8	µS/cm	4.60	mg/L																					
10/10/2018	2.00	0.2	mg/L	66	mg/L	248.4	µS/cm	3.07	mg/L																					
10/31/2018	1.95	0.2	mg/L	70	mg/L	271.4	µS/cm	3.45	mg/L																					

Laboratory Detection Limit

Date	Water Level Depth	Ammonia	Chloride	Conductivity	DO	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	Total Alkalinity	Total Dissolved Solids	TKN	Total Nitrogen	Total Phosphorus, Unfiltered	expected Cooler or equipment failure
2013																
4/4/2013			350 mg/L					0.5 mg/L	5.78	pH units	16.9 °C			0.5 mg/L		
7/17/2013	1.45	0.4 mg/L	314 mg/L	1004 µS/cm	3.34 mg/L	0.2 mg/L	0.2 mg/L	0.4 mg/L	5.78	pH units	16.9 °C			0.5 mg/L	0.2 mg/L	
8/16/2013	1.36	0.2 mg/L	334 mg/L	916 µS/cm	2.38 mg/L	5.05 mg/L	1 mg/L	5.05 mg/L	5.68	pH units	15.4 °C			0.5 mg/L	5.05 mg/L	
9/17/2013	1.40	0.2 mg/L	373 mg/L	960 µS/cm	3.01 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.49	pH units	14 °C			0.5 mg/L	0.2 mg/L	
10/29/2013	1.46	0.1 mg/L	378 mg/L	850 µS/cm	3.00 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.74	pH units	13.2 °C			0.5 mg/L	0.2 mg/L	
2014																
4/14/2014	0.80	0.2 mg/L	282 mg/L	960 µS/cm		0.2 mg/L	0.2 mg/L	0.2 mg/L		8.2 °C				0.2 mg/L	0.2 mg/L	
5/6/2014	1.00	0.2 mg/L	287 mg/L	947 µS/cm	4.98 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.94	pH units	10.4 °C			0.2 mg/L	0.2 mg/L	
6/11/2014	1.10	0.2 mg/L	296 mg/L	609 µS/cm	5.36 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.92	pH units	13.9 °C			0.2 mg/L	0.2 mg/L	
7/14/2014	1.21	0.2 mg/L	275 mg/L	589 µS/cm	4.29 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.96	pH units	14.5 °C			0.2 mg/L	0.2 mg/L	
8/2/2014	1.39	0.2 mg/L	270 mg/L	577 µS/cm	3.43 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.79	pH units	15.8 °C			0.2 mg/L	0.2 mg/L	
9/19/2014	1.17	0.2 mg/L	269 mg/L	565 µS/cm	3.83 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.00	pH units	14.6 °C			0.2 mg/L	0.2 mg/L	
11/5/2014	0.85	0.2 mg/L	315 mg/L	647 µS/cm	6.70 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.07	pH units	12.3 °C			0.2 mg/L	0.2 mg/L	
2015																
4/13/2015	0.50	0.2 mg/L	104 mg/L	490 µS/cm	7.17 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.54	pH units	8.3 °C			0.2 mg/L	0.2 mg/L	
5/1/2015	0.95	0.2 mg/L	107 mg/L	443 µS/cm	5.89 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L		13 °C				0.087 mg/L	0.7 mg/L	
7/12/2015	0.40	0.2 mg/L	138 mg/L	443 µS/cm	3.38 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.03	pH units	12.4 °C			0.81 mg/L	0.81 mg/L	
8/6/2015	1.17	0.2 mg/L	210 mg/L	603 µS/cm	4.41 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.89	pH units	14.2 °C			0.869 mg/L	0.87 mg/L	
8/27/2015	1.61	0.2 mg/L	222 mg/L	660 µS/cm	4.53 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.93	pH units	15 °C			0.495 mg/L	0.5 mg/L	
9/24/2015	1.85	0.2 mg/L	241 mg/L	683 µS/cm	1.77 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.98	pH units	15.2 °C			0.635 mg/L	0.64 mg/L	
11/9/2015	1.30	0.2 mg/L	277 mg/L	797 µS/cm		0.2 mg/L	0.2 mg/L	0.2 mg/L	5.83	pH units	13.9 °C			0.481 mg/L	0.48 mg/L	
2016																
4/21/2016	1.14	0.2 mg/L	357 mg/L	1351 µS/cm		0.2 mg/L	0.2 mg/L	0.2 mg/L	5.60	pH units	10.79 °C			0.2 mg/L	0.2 mg/L	
6/2/2016	0.73	0.2 mg/L	458 mg/L	1303 µS/cm	4.27 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.81	pH units	11.1 °C			1.05 mg/L	1.05 mg/L	
7/27/2016	1.45	0.22 mg/L	586 mg/L	1637 µS/cm	2.52 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.77	pH units	15.6 °C			1.07 mg/L	1.29 mg/L	
7/28/2016	1.89	0.51 mg/L	571 mg/L	1710 µS/cm	3.85 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.81	pH units	16.8 °C			4.41 mg/L	4.32 mg/L	
8/25/2016	1.86	0.2 mg/L	506 mg/L	1543 µS/cm	4.03 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	4.64	pH units	17 °C			2.00 mg/L	2.00 mg/L	
9/22/2016	2.54	0.2 mg/L	487 mg/L	1432 µS/cm	4.42 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.91	pH units	16.1 °C			0.241 mg/L	0.24 mg/L	
10/19/2016	1.80	0.2 mg/L	483 mg/L	1385 µS/cm	6.12 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.97	pH units	15.2 °C			1.19 mg/L	0.747 mg/L	
2017																
5/4/2017	1.00	0.2 mg/L	653 mg/L	1615 µS/cm	3.72 mg/L	0.25 mg/L	0.2 mg/L	0.2 mg/L	5.80	pH units	9.5 °C	10 mg CaCO3/L	1200 mg/L	0.785 mg/L	1.03 mg/L	3.57 mg/L
6/15/2017	1.10	0.2 mg/L	781 mg/L	2025 µS/cm	3.85 mg/L	0.29 mg/L	0.2 mg/L	0.25 mg/L	5.74	pH units	12 °C	8 mg CaCO3/L	1420 mg/L	0.94 mg/L	0.63 mg/L	6.08 mg/L
7/6/2017	1.05	0.2 mg/L	822 mg/L	2045 µS/cm	3.10 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.70	pH units	13.9 °C	11 mg CaCO3/L	1380 mg/L	0.82 mg/L	4.96 mg/L	
8/23/2017	1.14	0.36 mg/L	864 mg/L		0.2 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L				10 mg CaCO3/L	161 mg/L	1.74 mg/L	2 mg/L	4.19 mg/L
9/27/2017	1.11	0.2 mg/L	925 mg/L		0.26 mg/L	0.26 mg/L	0.2 mg/L	0.26 mg/L				10 mg CaCO3/L	1260 mg/L	0.894 mg/L	1.25 mg/L	2.01 mg/L
10/12/2017	1.15	0.22 mg/L	761 mg/L	1015 µS/cm	3.56 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.53	pH units	15.6 °C	11 mg CaCO3/L	1300 mg/L	0.685 mg/L	0.88 mg/L	1.54 mg/L
11/5/2017	1.04	0.2 mg/L	754 mg/L	1960 µS/cm	6.27 mg/L	0.23 mg/L	0.2 mg/L	0.23 mg/L	5.87	pH units	12.7 °C	9 mg CaCO3/L	1340 mg/L	0.655 mg/L	0.88 mg/L	2.17 mg/L
2018																
4/24/2018	0.92	0.2 mg/L	643 mg/L	2116 µS/cm	4.49 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.28	pH units	9.8 °C	7 mg CaCO3/L	1240 mg/L	1.14 mg/L	1.14 mg/L	6.86 mg/L
5/30/2018	1.10	0.24 mg/L	636 mg/L	2105 µS/cm	4.47 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	4.57	pH units	12.3 °C	9 mg CaCO3/L	1170 mg/L	1.35 mg/L	1.59 mg/L	0.993 mg/L
7/12/2018	1.15	0.2 mg/L	652 mg/L	2132 µS/cm	8.00 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.77	pH units	14.1 °C	10 mg CaCO3/L	1190 mg/L	1.89 mg/L	1.89 mg/L	4.07 mg/L
8/16/2018	1.20	0.2 mg/L	717 mg/L	2167 µS/cm	5.70 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.06	pH units	16.7 °C	5 mg CaCO3/L	1230 mg/L	1.25 mg/L	1.25 mg/L	1.06 mg/L
9/5/2018	1.10	0.2 mg/L	677 mg/L	1968 µS/cm	5.50 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.90	pH units	17.5 °C	9 mg CaCO3/L	1300 mg/L	1.08 mg/L	1.08 mg/L	0.443 mg/L
10/10/2018	1.20	0.2 mg/L	691 mg/L	2120 µS/cm	3.90 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.95	pH units	16.5 °C	7 mg CaCO3/L	1180 mg/L	0.83 mg/L	0.83 mg/L	4.37 mg/L
10/31/2018	0.76	0.2 mg/L	663 mg/L	2218 µS/cm	6.32 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	5.45	pH units	12.5 °C	10 mg CaCO3/L	1230 mg/L	1.02 mg/L	1.59 mg/L	

01-XWB Groundwater Sampling Data 2013-2018

01-XWB Groundwater Sampling Data 2013-2018															Laboratory Detection Limit	
															Expected Outlier or Equipment Failure	
Date	Water Level Depth	Ammonia	Chloride	Conductivity	DO	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	Total Alkalinity	Total Dissolved Solids	TKN	Total Nitrogen	Total Phosphorus, Unfiltered	
2013																
4/4/2013			17	mg/L				0.9	mg/L				0.5	mg/L	0.9	
7/17/2013	2.75	0.4	mg/L	98.7	µS/cm	1.27	mg/L	1.27	mg/L	5.55	°C		0.5	mg/L	1.27	
8/16/2013	2.78	0.2	mg/L	83.9	µS/cm	0.79	mg/L	0.79	mg/L	5.48	°C		0.5	mg/L	0.79	
9/17/2013	3.05	0.2	mg/L	99.8	µS/cm	1.1	mg/L	1.1	mg/L	5.57	°C		0.5	mg/L	1.1	
10/28/2013	2.94	0.1	mg/L	91.8	µS/cm	1.56	mg/L	1.56	mg/L	5.68	°C		0.5	mg/L	1.56	
2014																
4/4/2014	2.08	0.2	mg/L	60	µS/cm	0.46	mg/L	0.46	mg/L	10.7	°C		0.2	mg/L	0.46	
5/8/2014	2.33	0.2	mg/L	112.5	µS/cm	1.41	mg/L	1.41	mg/L	5.88	°C		0.2	mg/L	1.41	
6/12/2014	2.72	0.2	mg/L	60.1	µS/cm	1.14	mg/L	0.2	mg/L	5.80	°C		0.2	mg/L	1.14	
7/14/2014	3.03	0.2	mg/L	61.1	µS/cm	0.96	mg/L	0.96	mg/L	5.90	°C		0.2	mg/L	0.96	
8/2/2014	3.28	0.2	mg/L	72.1	µS/cm	1.34	mg/L	1.34	mg/L	5.85	°C		0.2	mg/L	1.34	
9/18/2014	3.28	0.2	mg/L	20	µS/cm	1.3	mg/L	1.3	mg/L	5.81	°C		0.2	mg/L	1.3	
11/5/2014	2.65	0.2	mg/L	82.6	µS/cm	0.2	mg/L	0.2	mg/L	5.89	°C		0.2	mg/L	1.14	
2015																
4/13/2015	2.10	0.2	mg/L	102.2	µS/cm	1.2	mg/L	1.2	mg/L	6.08	°C		0.2	mg/L	1.2	
5/7/2015	2.52	0.2	mg/L	81.8	µS/cm	3.55	mg/L	1.12	mg/L	10.8	°C		0.288	mg/L	1.42	
7/16/2015	2.91	0.2	mg/L	78.9	µS/cm	2.63	mg/L	0.75	mg/L	5.59	°C		0.554	mg/L	1.3	
8/6/2015	3.03	0.2	mg/L	103.6	µS/cm	2.91	mg/L	1.06	mg/L	5.84	°C		0.593	mg/L	1.65	
8/27/2015	3.01	0.2	mg/L	103.6	µS/cm	2.78	mg/L	1.38	mg/L	5.61	°C		0.396	mg/L	1.76	
9/4/2015	3.08	0.2	mg/L	105	µS/cm	2.85	mg/L	1.42	mg/L	5.75	°C		0.2	mg/L	1.42	
11/5/2015	2.80	0.2	mg/L	90.5	µS/cm	1	mg/L	1	mg/L	5.79	°C		0.167	mg/L	1.77	
2016																
4/21/2016	2.31	0.2	mg/L	109	µS/cm	1.95	mg/L	1.95	mg/L	5.54	°C		0.538	mg/L	2.39	
6/27/2016	2.51	0.2	mg/L	100.5	µS/cm	3.51	mg/L	1.38	mg/L	6.07	°C		0.678	mg/L	2.06	
7/28/2016	2.64	0.2	mg/L	111.3	µS/cm	3.42	mg/L	1.4	mg/L	5.92	°C		2.31	mg/L	3.71	
8/29/2016	2.92	0.2	mg/L	111.2	µS/cm	4.20	mg/L	1.43	mg/L	6.22	°C		2.74	mg/L	4.17	
8/29/2016	3.00	0.2	mg/L	122.3	µS/cm	3.50	mg/L	1.41	mg/L	5.88	°C		5.20	mg/L	6.61	
9/22/2016	3.00	0.2	mg/L	119.7	µS/cm	2.63	mg/L	1.51	mg/L	5.67	°C		1.08	mg/L	0.408	
10/19/2016	3.00	0.2	mg/L	121	µS/cm	3.71	mg/L	1.56	mg/L	5.98	°C		0.48	mg/L	2.04	
2017																
5/4/2017	2.03	0.2	mg/L	71.6	µS/cm	1.03	mg/L	1.03	mg/L	5.78	°C	8	mg CaCO3/L	69.3	mg/L	
6/15/2017	2.30	0.2	mg/L	68.5	µS/cm	0.67	mg/L	0.67	mg/L	6.30	°C	5	mg CaCO3/L	70.6	mg/L	
7/6/2017	2.75	0.2	mg/L	66.5	µS/cm	2.06	mg/L	0.35	mg/L	16.5	°C	8	mg CaCO3/L	65.3	mg/L	
8/22/2017	3.12	0.2	mg/L			0.24	mg/L	0.24	mg/L			9	mg CaCO3/L	67.1	mg/L	
9/7/2017	3.10	0.2	mg/L	26	mg/L	1.35	mg/L	1.35	mg/L			7	mg CaCO3/L	92	mg/L	
10/19/2017	2.40	0.2	mg/L	96	µS/cm	3.33	mg/L	1.51	mg/L	5.67	°C	6	mg CaCO3/L	84	mg/L	
11/15/2017	2.46	0.2	mg/L	100.3	µS/cm	2.34	mg/L	0.98	mg/L	6.14	°C	6	mg CaCO3/L	88.2	mg/L	
2018																
4/24/2018	2.18	0.2	mg/L	85.8	µS/cm	5.90	mg/L	0.86	mg/L	8.60	°C	11	mg CaCO3/L	93.9	mg/L	
5/30/2018	2.49	0.2	mg/L	95.55	µS/cm	3.68	mg/L	1.05	mg/L	5.44	°C	7	mg CaCO3/L	90	mg/L	
7/12/2018	2.70	0.2	mg/L	101.6	µS/cm	9.68	mg/L	1.31	mg/L	7.26	°C	5	mg CaCO3/L	118	mg/L	
8/16/2018	2.20	0.2	mg/L	134.2	µS/cm	13.05	mg/L	1.46	mg/L	7.04	°C	5	mg CaCO3/L	110	mg/L	
9/6/2018	2.70	0.2	mg/L	123.4	µS/cm	5.50	mg/L	1.32	mg/L	7.46	°C	5	mg CaCO3/L	110	mg/L	
10/10/2018	2.30	0.2	mg/L	45.4	µS/cm	4.86	mg/L	0.28	mg/L	18.5	°C	5	mg CaCO3/L	50	mg/L	
10/31/2018	2.56	0.2	mg/L	42.1	µS/cm	5.54	mg/L	0.46	mg/L	5.95	°C	5	mg CaCO3/L	40	mg/L	
										13.2	°C		0.705	mg/L	0.342	

Laboratory Detection Limit

Date	Water Level Depth	Ammonia	Chloride	Conductivity	DO	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	Total Alkalinity	Total Dissolved Solids	TKN	Total Nitrogen	Total Phosphorus, Unfiltered	expected Cooler or equipment failure
2013																
4/4/2013			86 mg/L		4.23 mg/L	mg/L		0.5 mg/L	6.08	pH units			0.7 mg/L	0.2 mg/L		
7/17/2013	2.32	0.4 mg/L	90 mg/L	426 µS/cm		mg/L	0.2 mg/L	0.2 mg/L	6.08	pH units	17.7 °C		0.5 mg/L	0.2 mg/L		
8/16/2013	2.50	0.2 mg/L	200 mg/L	464 µS/cm	2.61 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.51	pH units	17.1 °C		0.5 mg/L	0.2 mg/L		
9/10/2013	2.75	0.2 mg/L	133 mg/L	436 µS/cm	2.83 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.63	pH units	17.4 °C		0.5 mg/L	0.2 mg/L		
10/29/2013	2.89	0.1 mg/L	135 mg/L	406 µS/cm	2.71 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.61	pH units	13.5 °C		0.5 mg/L	0.2 mg/L		
2014																
4/14/2014	1.83	0.2 mg/L	209 mg/L	720 µS/cm		0.2 mg/L	0.2 mg/L	0.2 mg/L	7.45	pH units	7.4 °C		0.2 mg/L	0.2 mg/L		
5/6/2014	2.13	0.2 mg/L	304 mg/L	880 µS/cm	8.13 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	7.35	pH units	8.8 °C		0.2 mg/L	0.2 mg/L		
6/11/2014	2.46	0.2 mg/L	76 mg/L	519 µS/cm	8.13 mg/L	0.5 mg/L	0.2 mg/L	0.5 mg/L	7.60	pH units	11.5 °C		0.2 mg/L	0.5 mg/L		
7/14/2014	2.66	0.2 mg/L	196 mg/L	472 µS/cm	2.98 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.92	pH units	15.8 °C		0.2 mg/L	0.2 mg/L		
7/14/2014	2.78	0.2 mg/L	264 mg/L	571 µS/cm	2.87 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.69	pH units	17.5 °C		0.2 mg/L	0.2 mg/L		
8/27/2014	2.91	0.2 mg/L	118 mg/L	315 µS/cm	2.98 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.78	pH units	16.9 °C		0.2 mg/L	0.2 mg/L		
9/19/2014	2.91	0.2 mg/L	143 mg/L	385 µS/cm	2.45 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.91	pH units	13.8 °C		0.2 mg/L	0.2 mg/L		
11/5/2014	2.51	0.2 mg/L											0.2 mg/L	0.2 mg/L		
2015																
4/13/2015	1.89	0.2 mg/L	113 mg/L	423 µS/cm	8.75 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	7.75	pH units	5.6 °C		0.2 mg/L	0.2 mg/L		
5/13/2015	2.22	0.2 mg/L	211 mg/L	680 µS/cm	7.60 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.73	pH units	10.9 °C		0.438 mg/L	0.44 mg/L		
7/2/2015	2.40	0.2 mg/L	279 mg/L	856 µS/cm	2.57 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.70	pH units	14.4 °C		0.498 mg/L	0.498 mg/L		
8/6/2015	2.77	0.2 mg/L	181 mg/L	579 µS/cm	1.73 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.70	pH units	16.2 °C		0.633 mg/L	0.63 mg/L		
8/27/2015	2.86	0.2 mg/L	212 mg/L	695 µS/cm	2.04 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	6.72	pH units	17.5 °C		0.396 mg/L	0.4 mg/L		
9/24/2015	2.89	0.2 mg/L	202 mg/L	681 µS/cm	2.09 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	7.49	pH units	17.7 °C		0.393 mg/L	0.39 mg/L		
11/9/2015	2.80	0.2 mg/L	140 mg/L	523 µS/cm		0.2 mg/L	0.2 mg/L	0.2 mg/L	7.02	pH units	15.2 °C		0.679 mg/L	0.68 mg/L		
2016																
4/21/2016	2.45	0.2 mg/L	282 mg/L	1090 µS/cm		0.2 mg/L	0.2 mg/L	0.2 mg/L	6.80	pH units	7.36 °C		1.14 mg/L	mg/L	0.568 mg/L	
6/2/2016	2.80	0.2 mg/L	239 mg/L	752 µS/cm	3.46 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	7.70	pH units	10.5 °C		0.608 mg/L	0.61 mg/L	0.63 mg/L	
7/27/2016	2.96	0.2 mg/L	227 mg/L	736 µS/cm	2.61 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	8.63	pH units	14.3 °C		1.58 mg/L	1.58 mg/L	1.320 mg/L	
7/28/2016	3.80	0.2 mg/L	212 mg/L	736 µS/cm	2.37 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	8.27	pH units	17.1 °C		1.47 mg/L	1.47 mg/L	0.825 mg/L	
8/25/2016	3.20	0.2 mg/L	152 mg/L	631 µS/cm	3.10 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	7.99	pH units	18.6 °C		3.3 mg/L	3.3 mg/L	1.200 mg/L	
9/22/2016	2.90	0.2 mg/L	127 mg/L	552 µS/cm	3.38 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	7.93	pH units	18.4 °C		0.589 mg/L	0.59 mg/L	0.391 mg/L	
10/19/2016	2.80	0.2 mg/L	121 mg/L	487.4 µS/cm	1.91 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	8.50	pH units	16.9 °C		0.662 mg/L	0.66 mg/L	0.119 mg/L	
2017																
5/4/2017	2.00	0.2 mg/L	81 mg/L	346.1 µS/cm	6.23 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	8.88	pH units	8.5 °C	37 mg CaCO3/L	199 mg/L	1.79 mg/L	0.79 mg/L	1.260 mg/L
6/15/2017	2.15	0.2 mg/L	178 mg/L	540 µS/cm	6.35 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	8.15	pH units	11.6 °C	32 mg CaCO3/L	344 mg/L	0.887 mg/L	0.89 mg/L	0.836 mg/L
7/6/2017	2.37	0.2 mg/L	155 mg/L	763.07 µS/cm	3.40 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	9.18	pH units	13.4 °C	64 mg CaCO3/L	407 mg/L	1.27 mg/L	1.37 mg/L	0.463 mg/L
8/22/2017	2.55	0.2 mg/L	214 mg/L	mg/L		0.2 mg/L	0.2 mg/L	0.2 mg/L				77 mg CaCO3/L	389 mg/L	1.39 mg/L	1.39 mg/L	0.856 mg/L
9/27/2017	3.67	0.2 mg/L	308 mg/L			0.2 mg/L	0.2 mg/L	0.2 mg/L				66 mg CaCO3/L	291 mg/L	0.881 mg/L	0.88 mg/L	0.629 mg/L
10/12/2017	2.79	0.2 mg/L	216 mg/L	641 µS/cm	3.30 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	7.70	pH units	16.1 °C	60 mg CaCO3/L	471 mg/L	0.541 mg/L	0.54 mg/L	0.534 mg/L
11/5/2017	2.38	0.2 mg/L	146 mg/L	551 µS/cm	1.65 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	8.35	pH units	13.3 °C	74 mg CaCO3/L	374 mg/L	0.655 mg/L	0.66 mg/L	0.344 mg/L
2018																
4/24/2018	2.05	0.2 mg/L	83 mg/L	353.6 mg/L	9.62 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	9.75	pH units	8.5 °C	32 mg CaCO3/L	210 mg/L	1.68 mg/L	1.68 mg/L	0.800 mg/L
5/30/2018	2.60	0.2 mg/L	275 mg/L	1030 µS/cm	5.20 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	8.55	pH units	11.1 °C	56 mg CaCO3/L	638 mg/L	1.54 mg/L	1.54 mg/L	1.050 mg/L
7/12/2018	2.91	0.2 mg/L	232 mg/L	727 µS/cm	8.90 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	9.50	pH units	15.3 °C	72 mg CaCO3/L	510 mg/L	3.03 mg/L	3.03 mg/L	1.430 mg/L
8/16/2018	1.18	0.2 mg/L	156 mg/L	508 µS/cm	5.28 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	7.88	pH units	19.3 °C	72 mg CaCO3/L	366 mg/L	2.93 mg/L	2.93 mg/L	1.060 mg/L
9/5/2018	1.80	0.2 mg/L	91 mg/L	426.8 mg/L	4.15 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	8.75	pH units	20.1 °C	71 mg CaCO3/L	268 mg/L	1.14 mg/L	1.14 mg/L	0.355 mg/L
10/10/2018	2.50	0.2 mg/L	216 mg/L	600 mg/L	6.00 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	7.69	pH units	18.2 °C	81 mg CaCO3/L	468 mg/L	1.39 mg/L	1.39 mg/L	0.435 mg/L
10/31/2018	2.43	0.2 mg/L	101 mg/L	536 µS/cm	4.80 mg/L	0.2 mg/L	0.2 mg/L	0.2 mg/L	7.42	pH units	14 °C	82 mg CaCO3/L	286 mg/L	1.54 mg/L	1.54 mg/L	0.316 mg/L

02-WCH Groundwater Sampling Data 2013-2018

02-WCH Groundwater Sampling Data 2013-2018															Laboratory Detection Limit	
															Expected Outlier or Equipment Failure	
Date	Water Level Depth	Ammonia	Chloride	Conductivity	DO	Nitrate	Nitrite	Nitrate/Nitrite	pH	Temperature	Total Alkalinity	Total Dissolved Solids	TKN	Total Nitrogen	Total Phosphorus, Unfiltered	
4/4/2013	1.80	0.4	59	mg/L				2013						0.5		
7/17/2013	1.86	0.2	25	mg/L	4.96	mg/L	0.2	mg/L	5.57	pH units				2.38		
8/19/2013	1.88	0.2	24	mg/L	5.25	mg/L	0.2	mg/L	5.68	pH units	19.2			0.2		
9/17/2013	1.90	0.2	26	mg/L	4.98	mg/L	0.2	mg/L	5.31	pH units	17.1			0.5		
10/28/2013	1.93	0.1	10	mg/L	40.9	µS/cm	0.2	mg/L	5.81	pH units	15.2			0.2		
								2014						0.5		
4/14/2014	1.44	0.2	41	mg/L	150	µS/cm	0.2	mg/L						0.2		
5/8/2014	1.83	0.2	35	mg/L	140.6	µS/cm	0.2	mg/L	5.89	pH units	10.3			0.2		
6/17/2014	2.13	0.2	71	mg/L	161.8	µS/cm	0.2	mg/L	5.85	pH units	13.2			0.2		
7/14/2014	2.46	0.2	33	mg/L	88.5	µS/cm	0.2	mg/L	6.26	pH units	17.3			0.2		
8/12/2014	3.10	0.2	22	mg/L	9.53	mg/L	0.2	mg/L	6.37	pH units	17.7			0.2		
9/18/2014	2.86	0.2	21	mg/L	63.2	µS/cm	0.2	mg/L	6.22	pH units	15.8			0.2		
11/5/2014	1.90	0.2	43	mg/L	222	µS/cm	0.2	mg/L	5.79	pH units	11.2			0.2		
					6.80	mg/L	1.49							1.49		
4/13/2015	1.40	0.2	99	mg/L	356	µS/cm	0.2	mg/L	5.84	pH units	6			0.2		
5/7/2015	1.01	0.2	44	mg/L	161.8	µS/cm	0.2	mg/L	5.30	pH units	11.7			0.478		
7/16/2015	2.03	0.2	128	mg/L	384.2	µS/cm	0.2	mg/L	5.30	pH units	15.4			0.455		
8/6/2015	2.74	0.2	42	mg/L	6.26	mg/L	0.2	mg/L	5.95	pH units	16.3			0.633		
8/27/2015	4.02	0.2	37	mg/L			0.2	mg/L						0.396		
9/24/2015		0.2	46	mg/L		0.64								0.37		
11/5/2015	2.00	0.2	31	mg/L	128.7	µS/cm	0.2	mg/L	5.50	pH units	12.6			0.503		
								2016								
4/21/2016									5.89	pH units	11.72					
6/27/2016																
7/28/2016	3.73				278.5	µS/cm			6.55	pH units	21.2					
8/25/2016	3.45	2.61	23	mg/L	4.45	mg/L	0.2	mg/L	6.14	pH units	22.3			12.7		
9/22/2016	3.28	2.12	23	mg/L	195.3	µS/cm	0.2	mg/L	6.07	pH units	20			15		
10/19/2016	2.56	2.16	21	mg/L	210.9	µS/cm	0.2	mg/L	6.42	pH units	21.9			4.1		
	2.21	1.73	22	mg/L	130.2	µS/cm	0.2	mg/L	6.24	pH units	16			5.46		
								2017								
5/4/2017	2.75															
6/15/2017	2.23															
7/6/2017	3.41															
8/22/2017	n/a															
9/27/2017	4.43															
10/19/2017	4.75															
11/15/2017	4.48	0.62	11	mg/L	114.7	µS/cm	0.2	mg/L	6.29	pH units	9.5			4.9		
					6.55	mg/L	0.2	mg/L						4.28		
														mg/L		
4/24/2018																
5/30/2018	3.30	0.2	28	mg/L		0.2	mg/L	0.2	mg/L			24	mg CaCO3/L	269	mg/L	
7/12/2018	3.41	0.2	50	mg/L		0.2	mg/L	0.2	mg/L			14	mg CaCO3/L	146	mg/L	
8/16/2018	4.70	0.38	35	mg/L	12.75	mg/L	0.2	mg/L	6.90	pH units	19.4			2.71	mg/L	
9/6/2018	5.70	0.26	36	mg/L	161.1	µS/cm	0.2	mg/L	7.08	pH units	19.9			3.82	mg/L	
10/10/2018	2.70	0.2	23	mg/L	11.00	mg/L	0.2	mg/L	6.54	pH units	16.9			2.12	mg/L	
10/31/2018	2.42	0.2	24	mg/L	115.6	µS/cm	0.2	mg/L	6.53	pH units	9.4			6.58	mg/L	
					10.10	mg/L	0.2	mg/L				10	mg CaCO3/L	92.6	mg/L	
														0.91	mg/L	
														0.913	mg/L	
														0.177	mg/L	

Well Recharge Insufficient for Sampling

Well Recharge Insufficient for Sampling

	Laboratory Detection Limit
	Expected Outlier or Equipment Failure

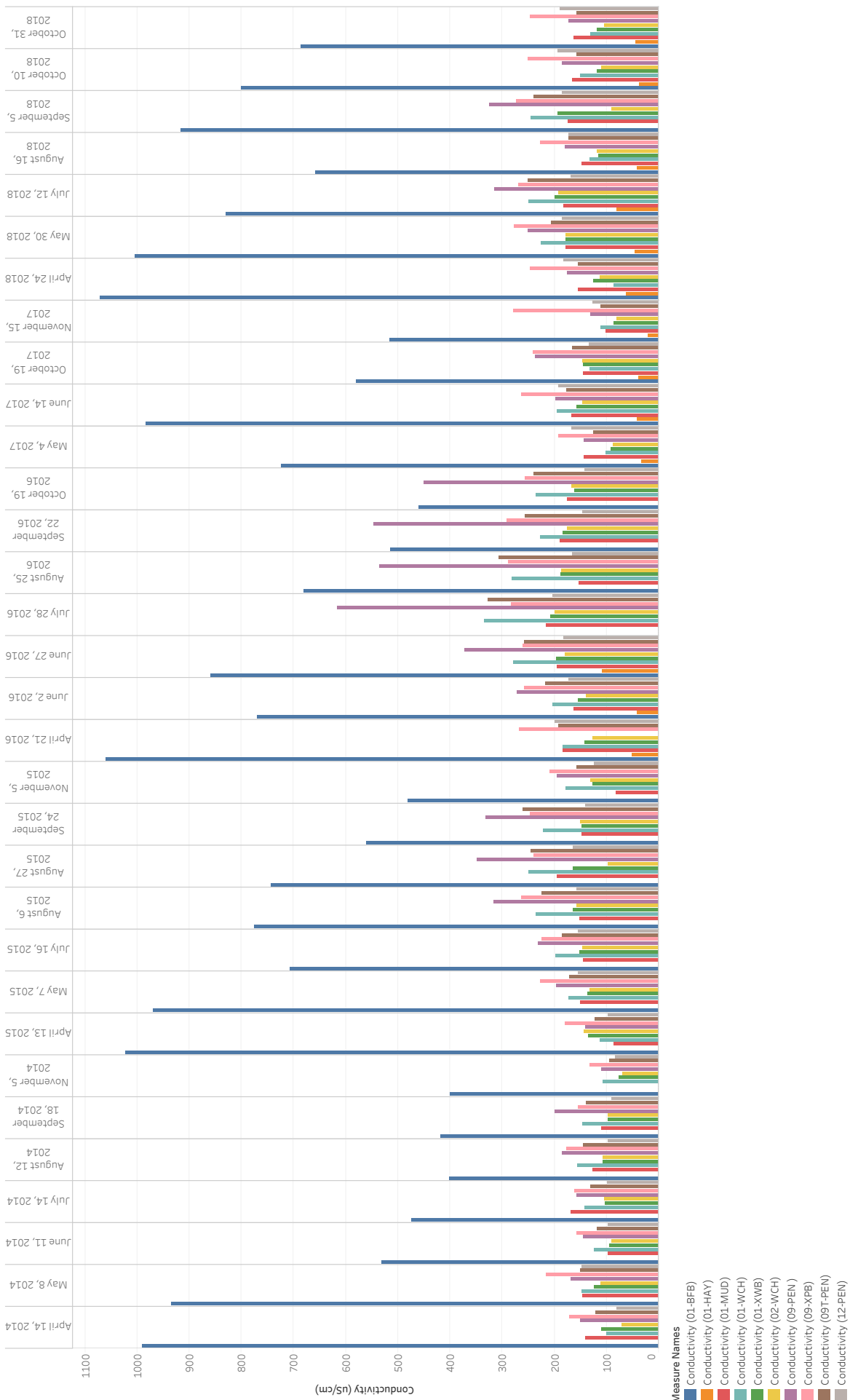
	Laboratory Detection Limit
	Expected Outlier or Equipment Failure

Attachment C:

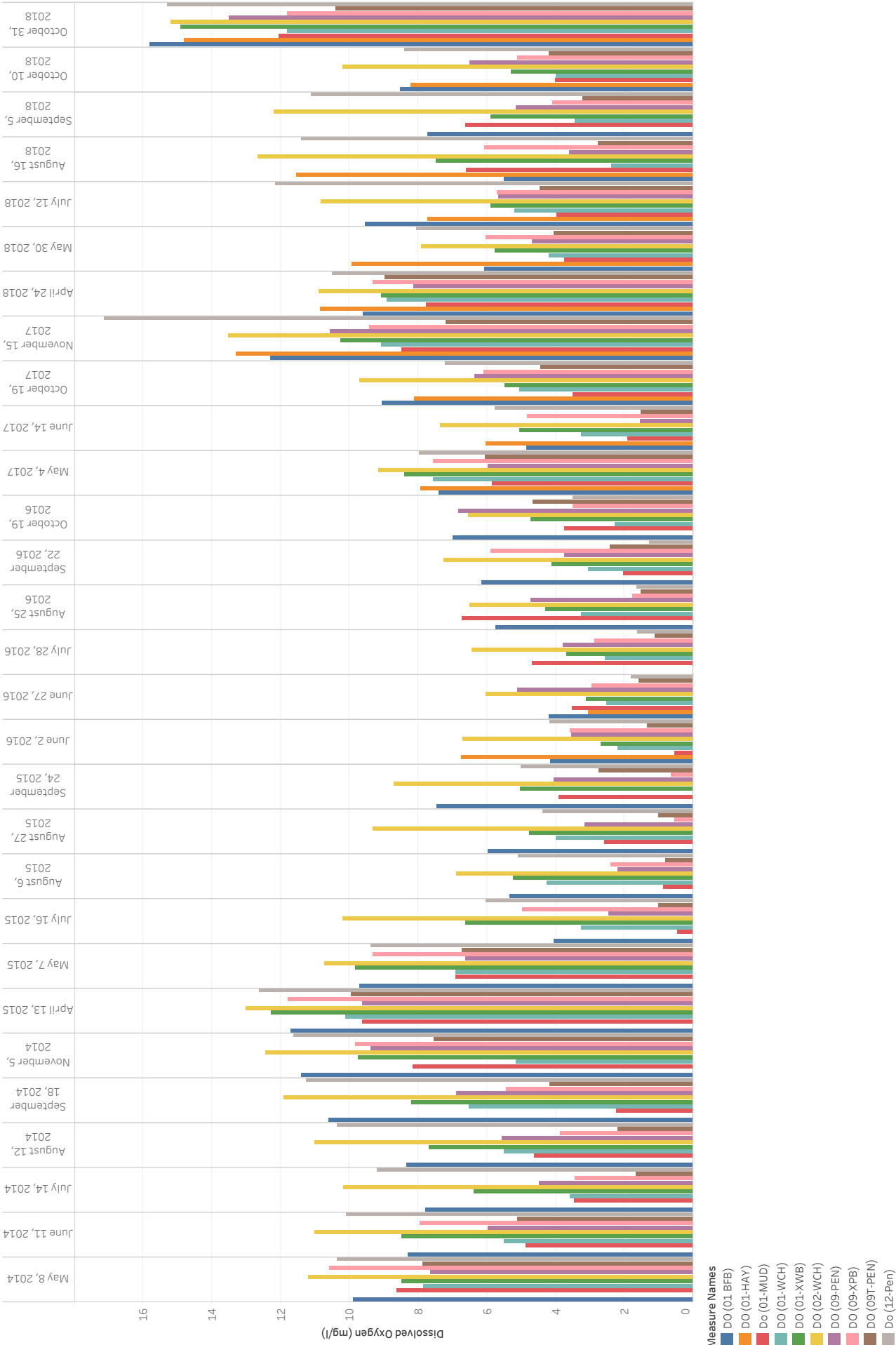
Select Tributary Graphs, 2014 through 2018

*(Note: Graphs abbreviated to show recent data from
2014 through 2018 for enhanced readability and identification of trends)*

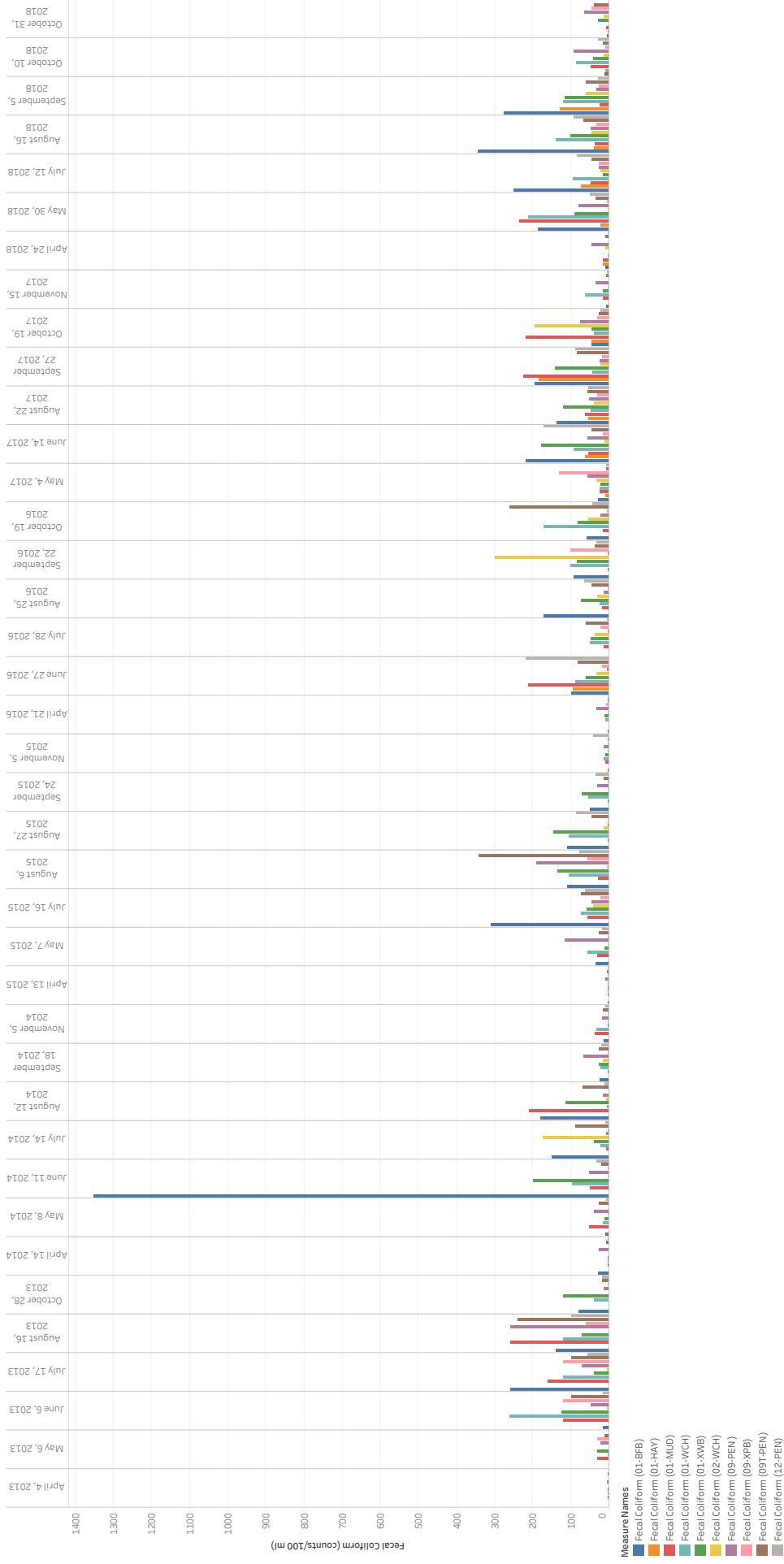
Tributary Conductivity, 2014-2018

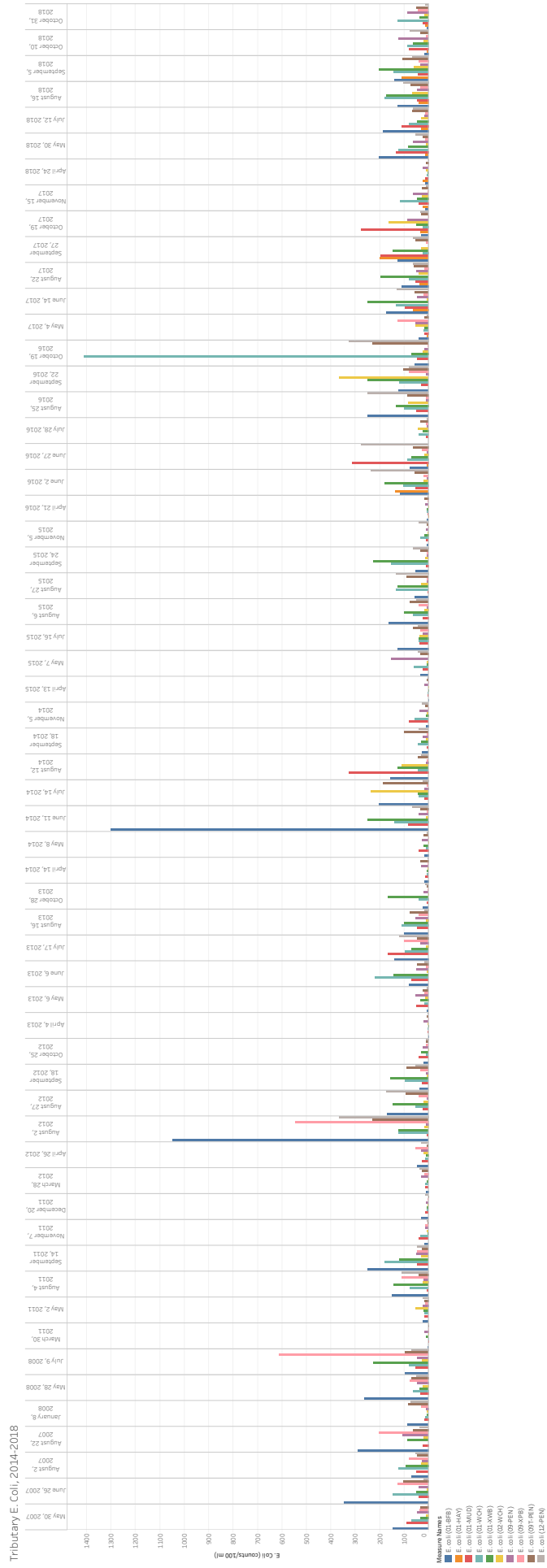


Tributary Dissolved Oxygen, 2014-2018

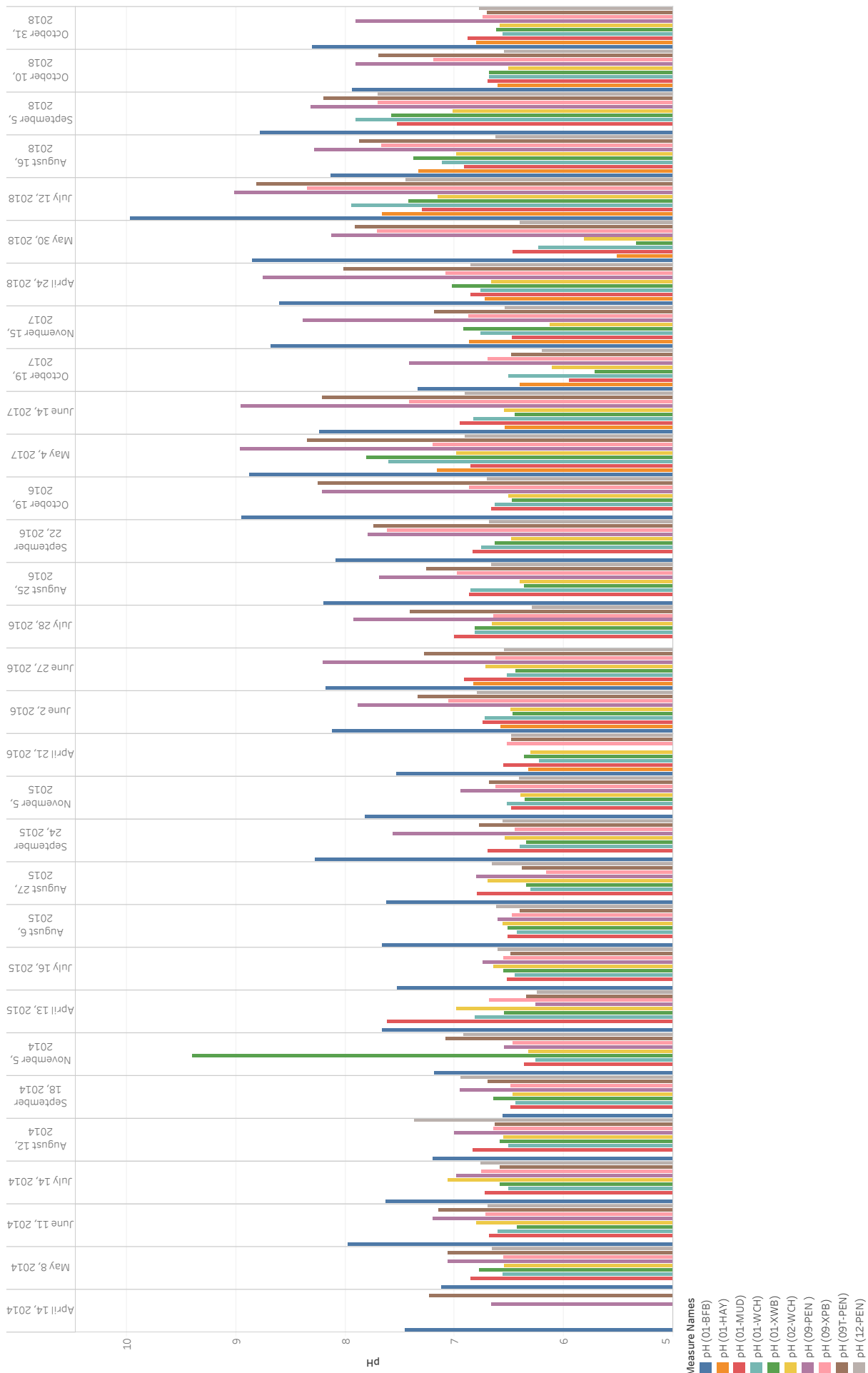


Tributary Fecal Coliform, 2014-2018

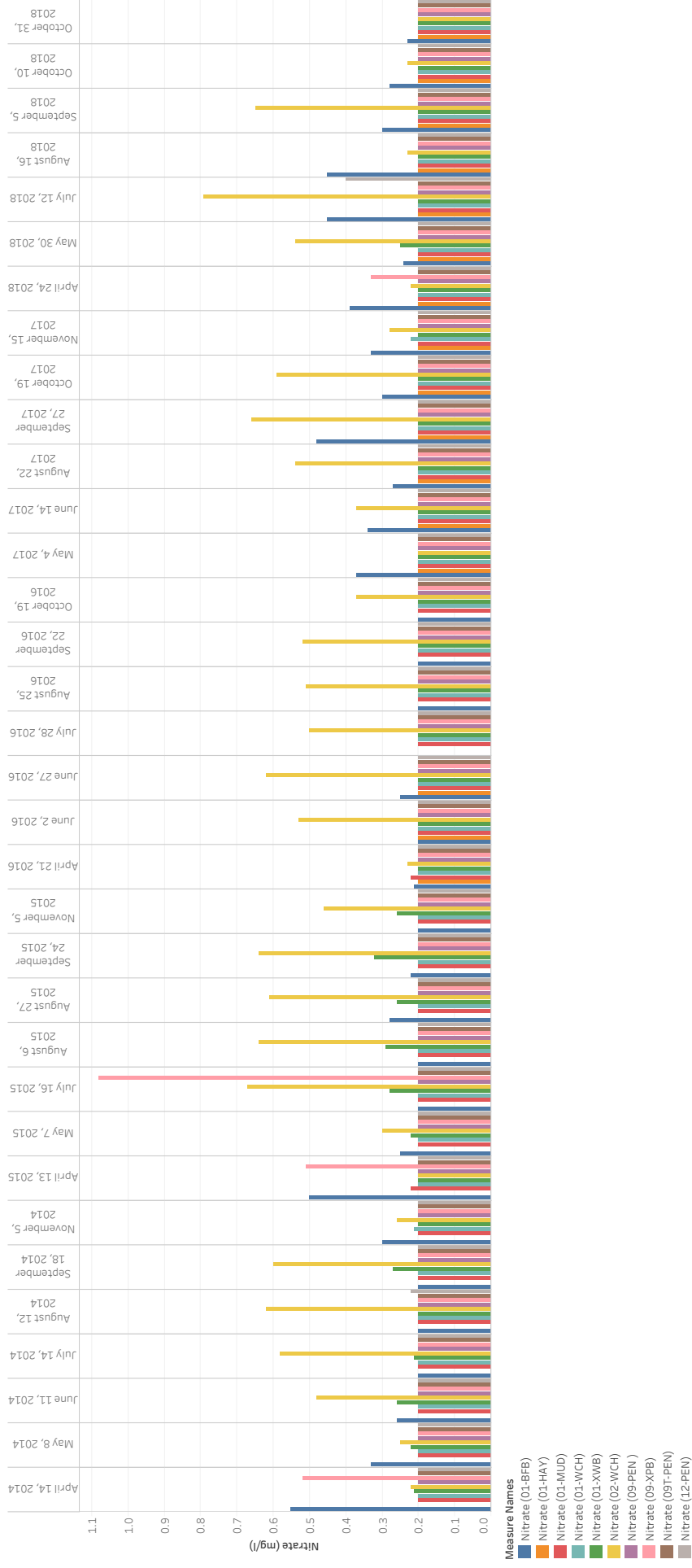




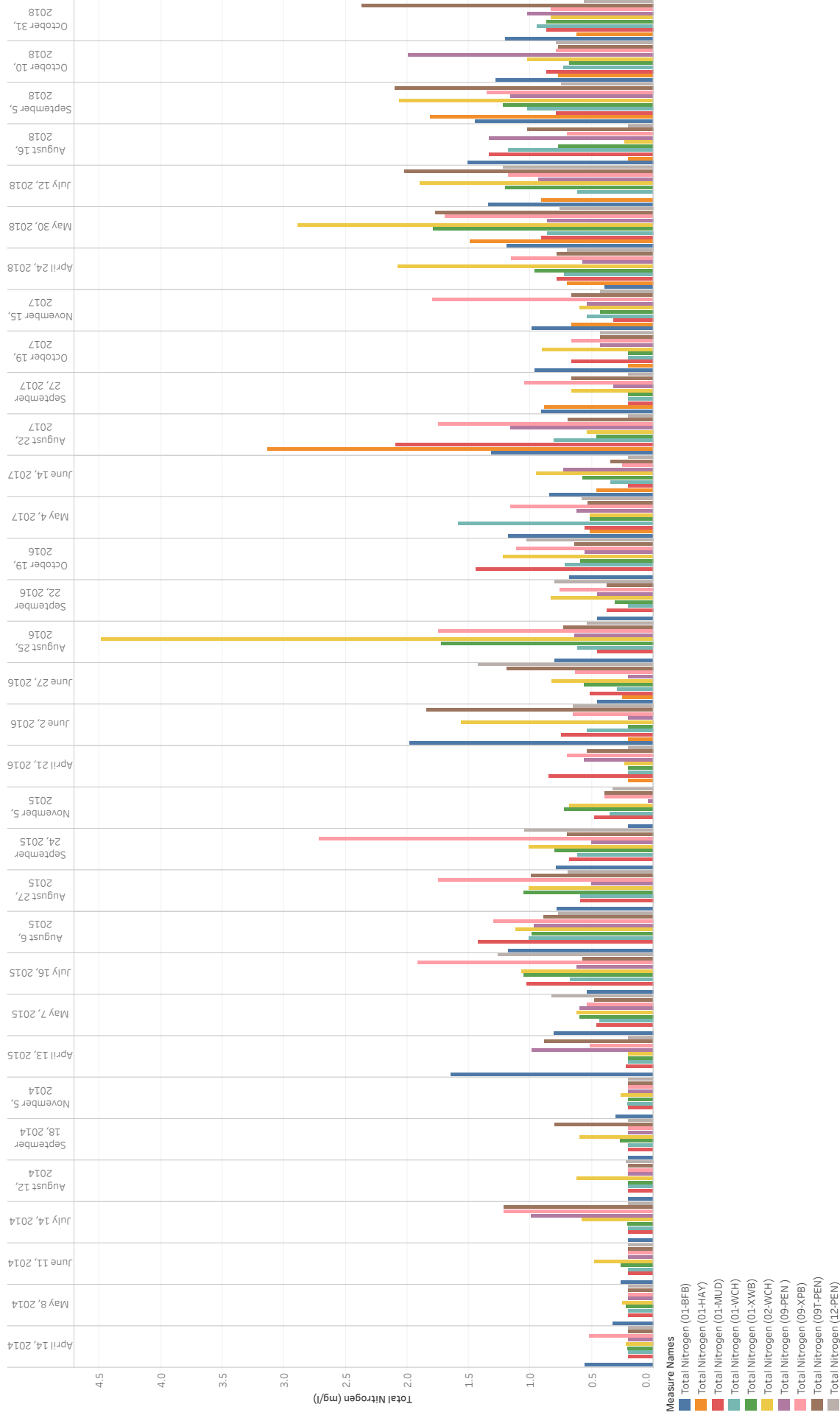
Tributary pH, 2014-2018



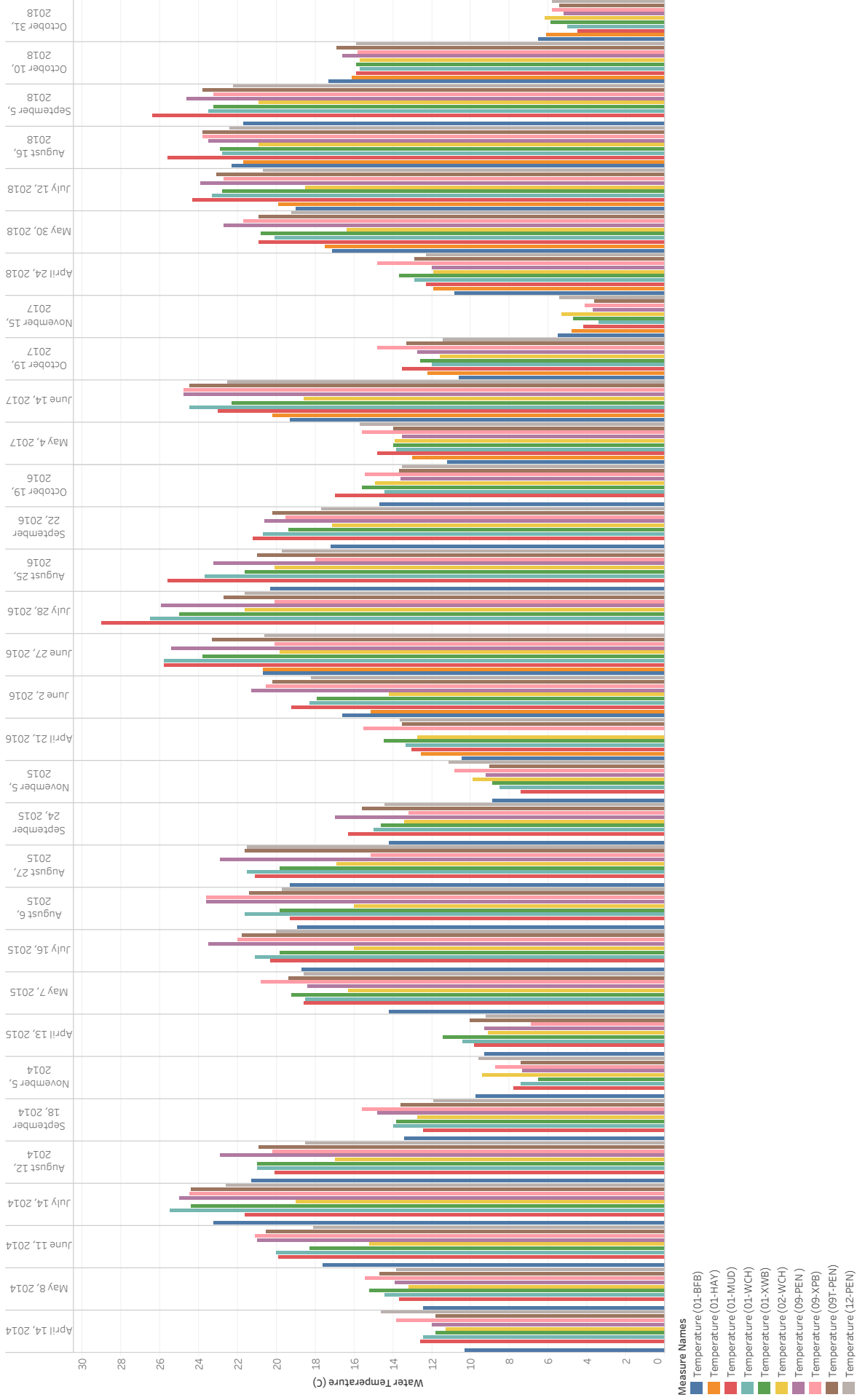
Tributary Nitrate, 2014-2018



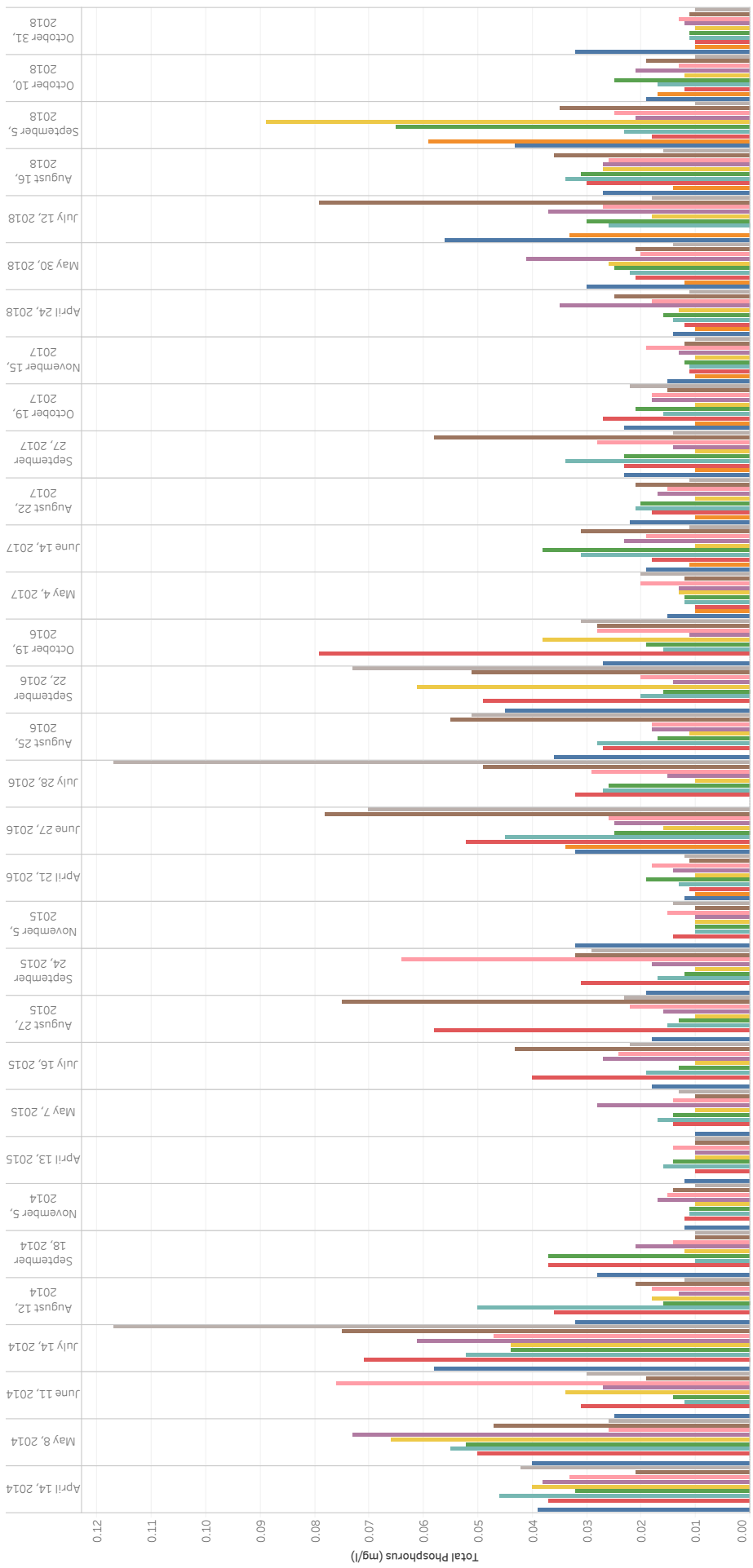
Tributary Total Nitrogen, 2014-2018



Tributary Temperature, 2014-2018



Tributary Phosphorus, 2014-2018

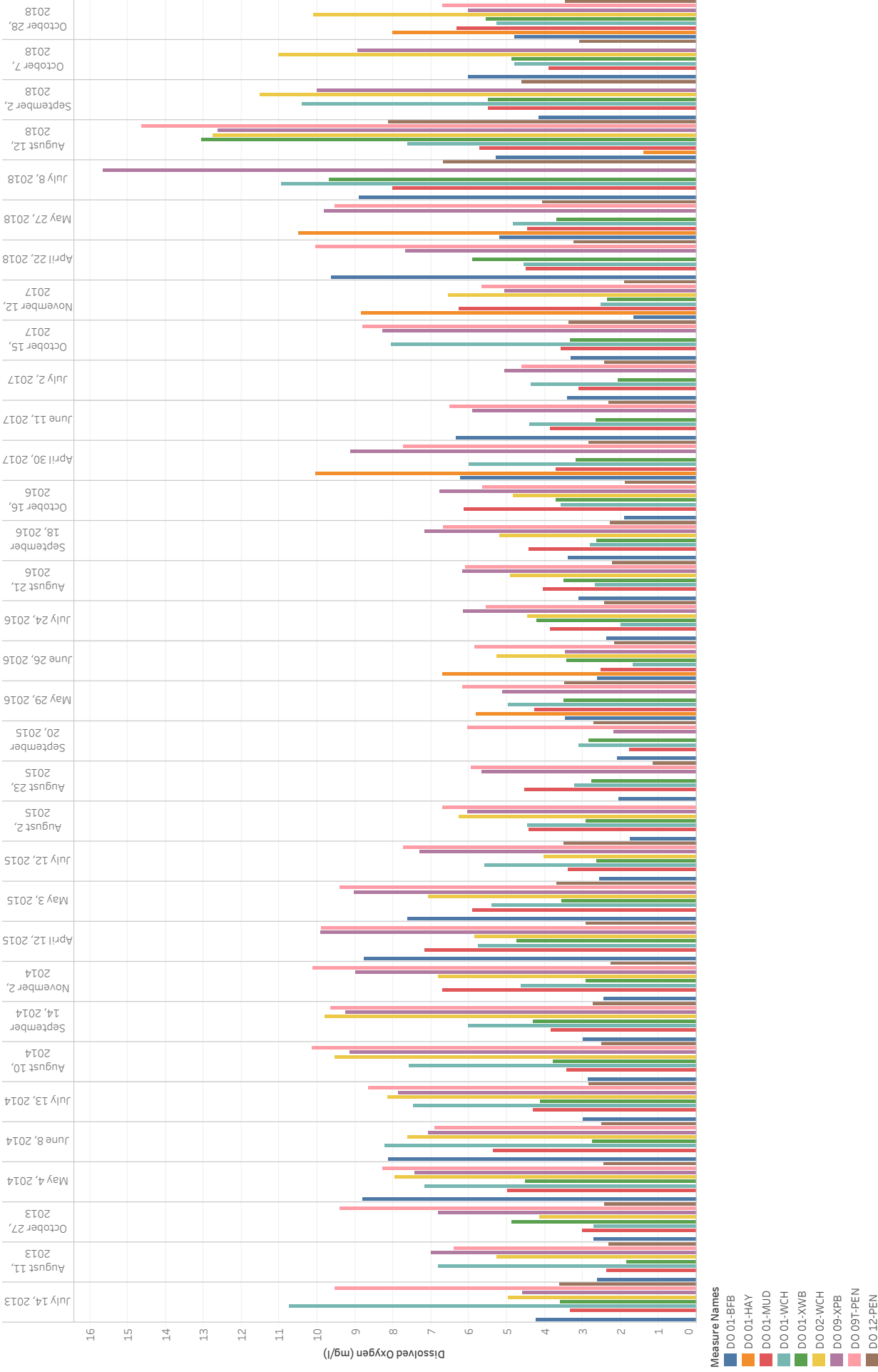


Note: Outliers from the following stations and sampling events have been removed:
02-WCH, 8/6/2015
09-PEN, 8/6/2015
09T-PEN, 6/2/2016

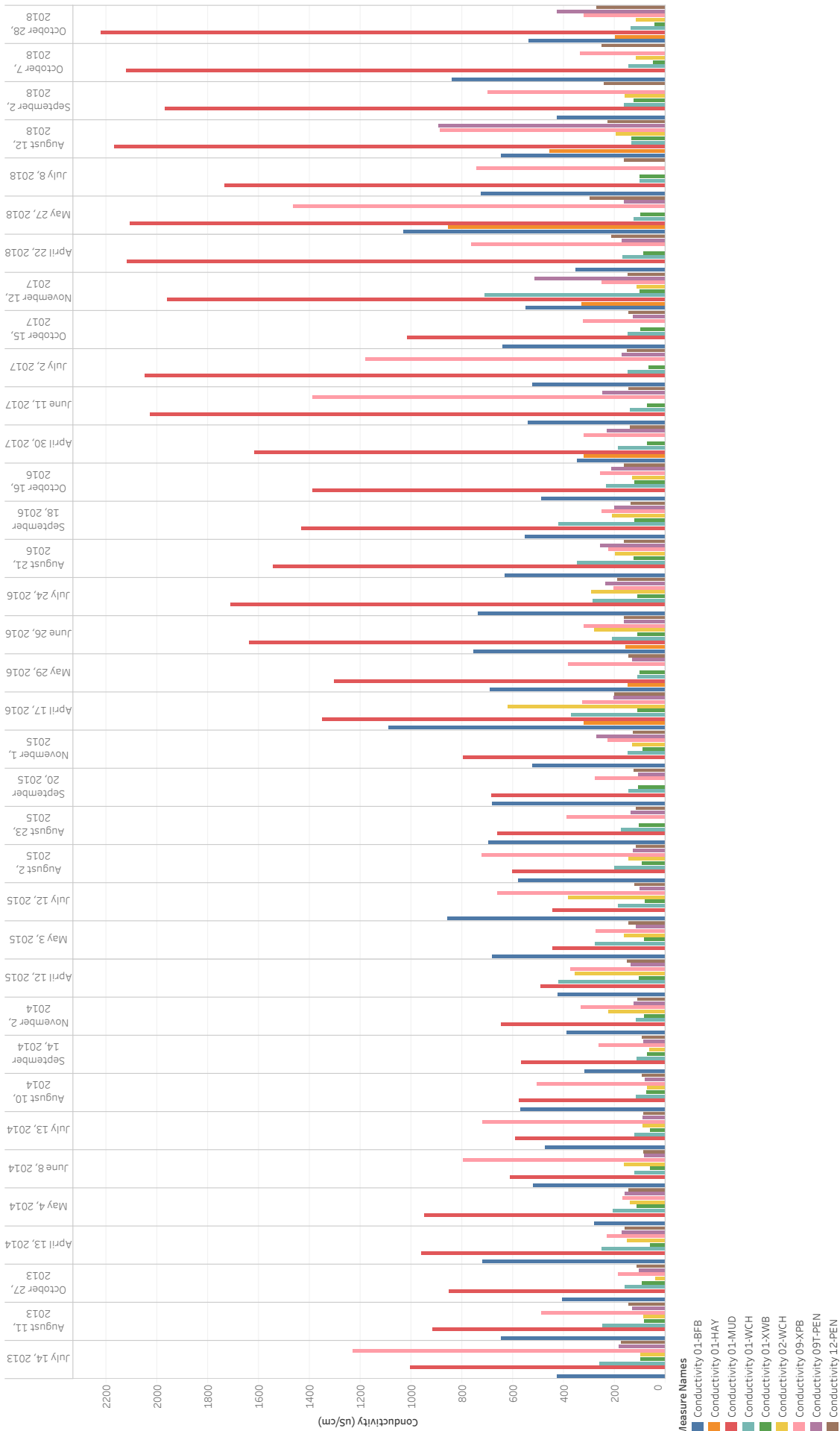
Attachment D:

Select Groundwater Graphs, 2013 through 2018

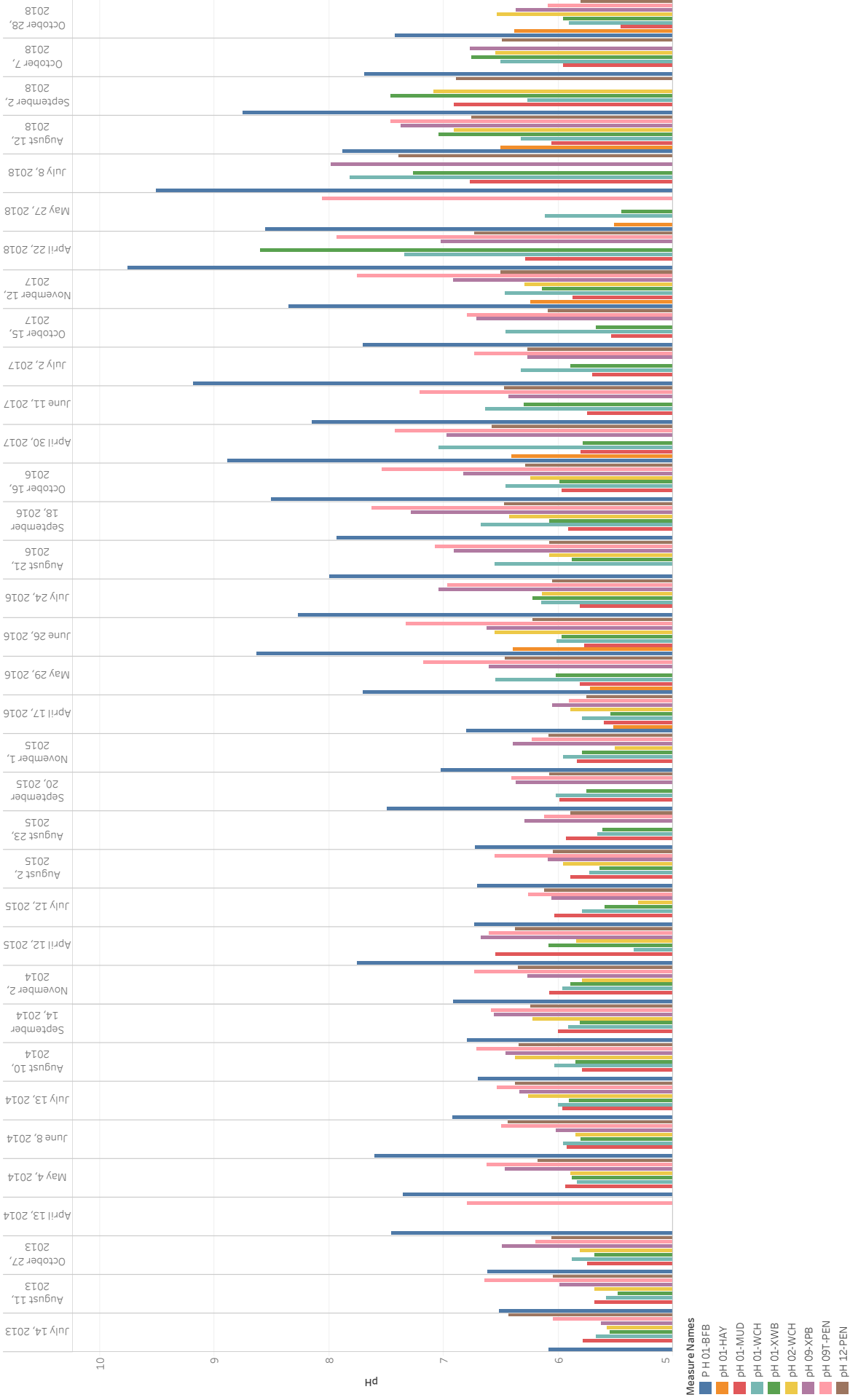
Groundwater Dissolved Oxygen, 2013-2018



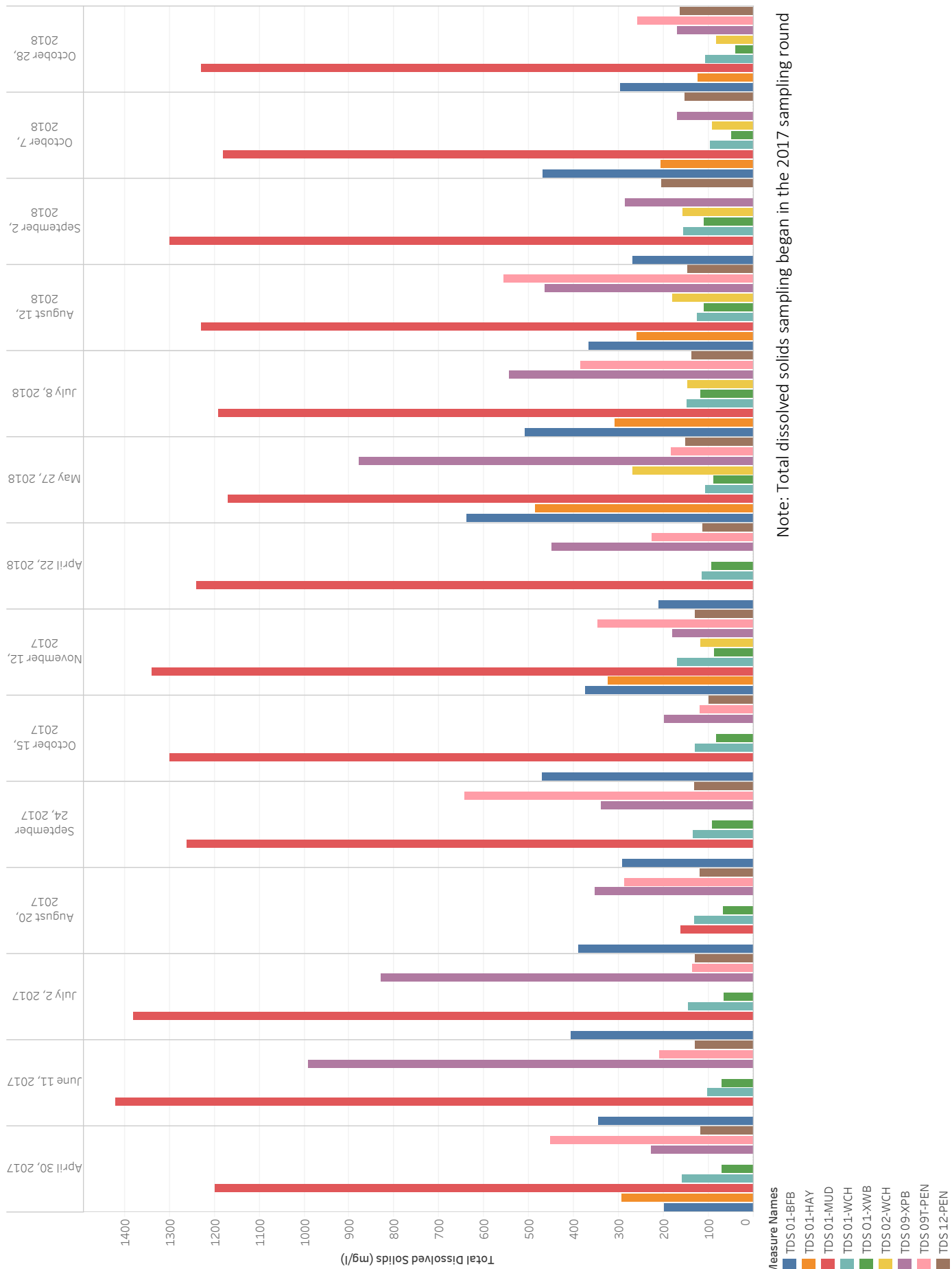
Groundwater Conductivity, 2013-2018



Groundwater pH, 2013-2018

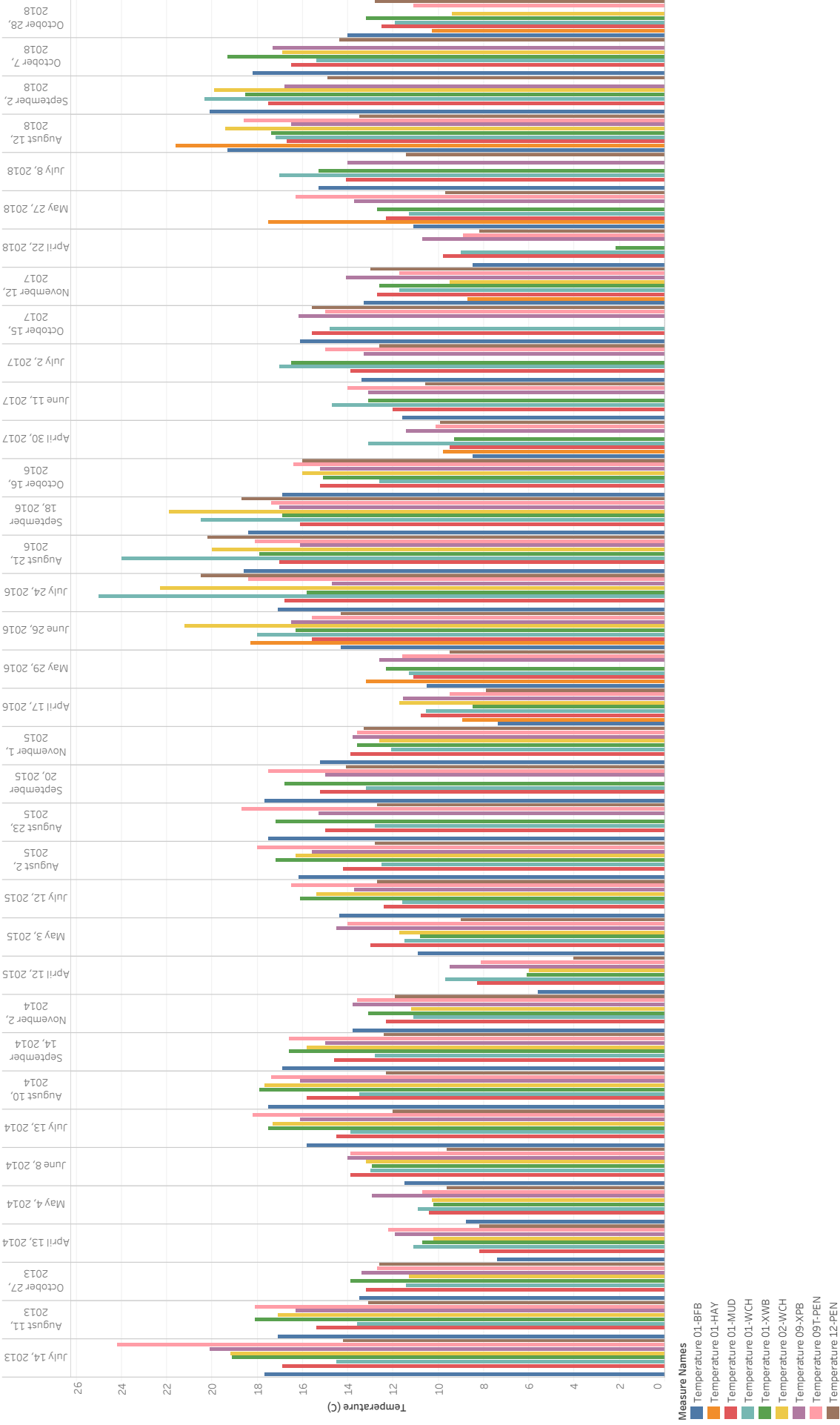


Groundwater Total Dissolved Solids, 2017-2018

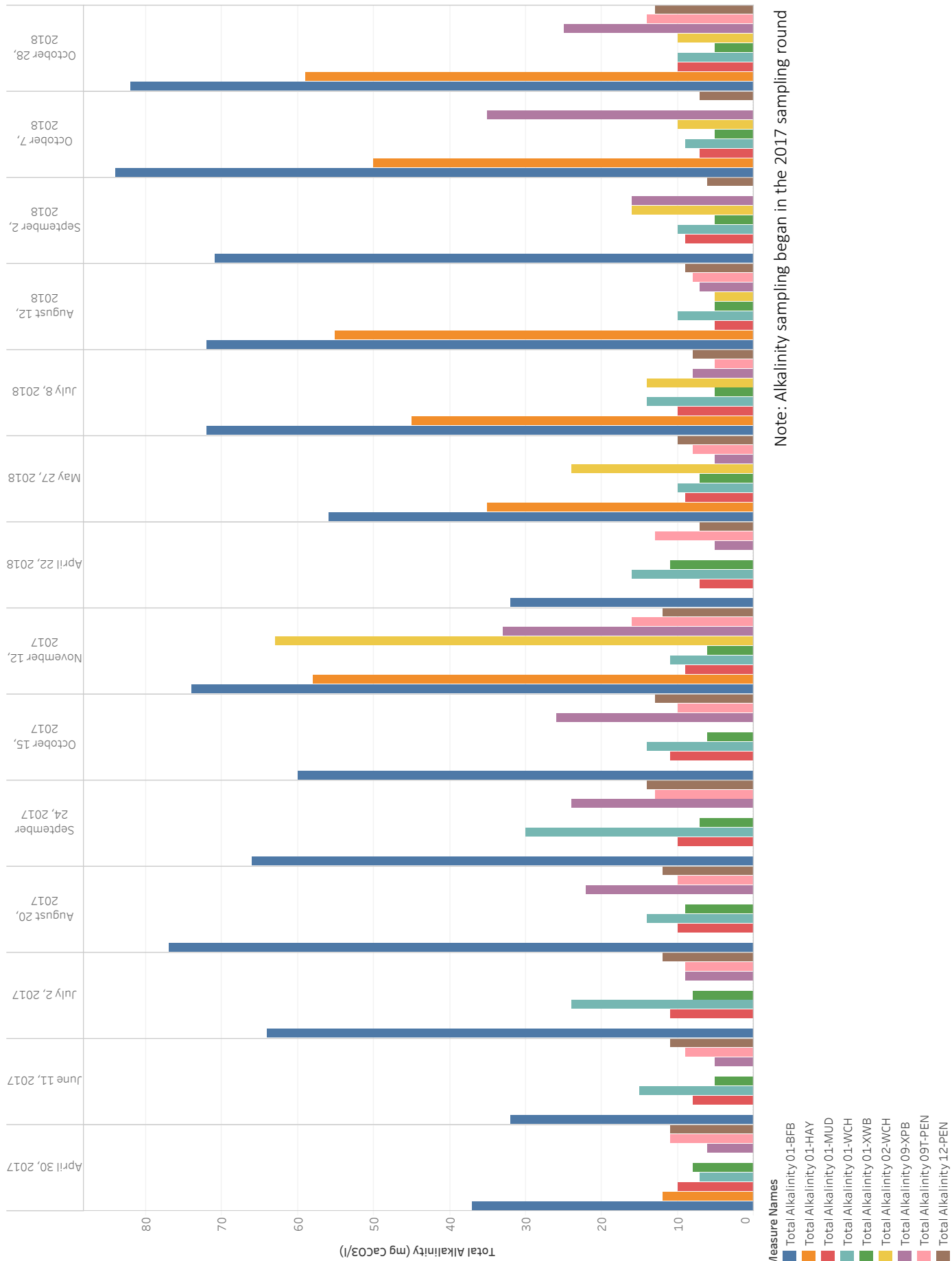


Note: Total dissolved solids sampling began in the 2017 sampling round

Groundwater Temperature, 2013-2018

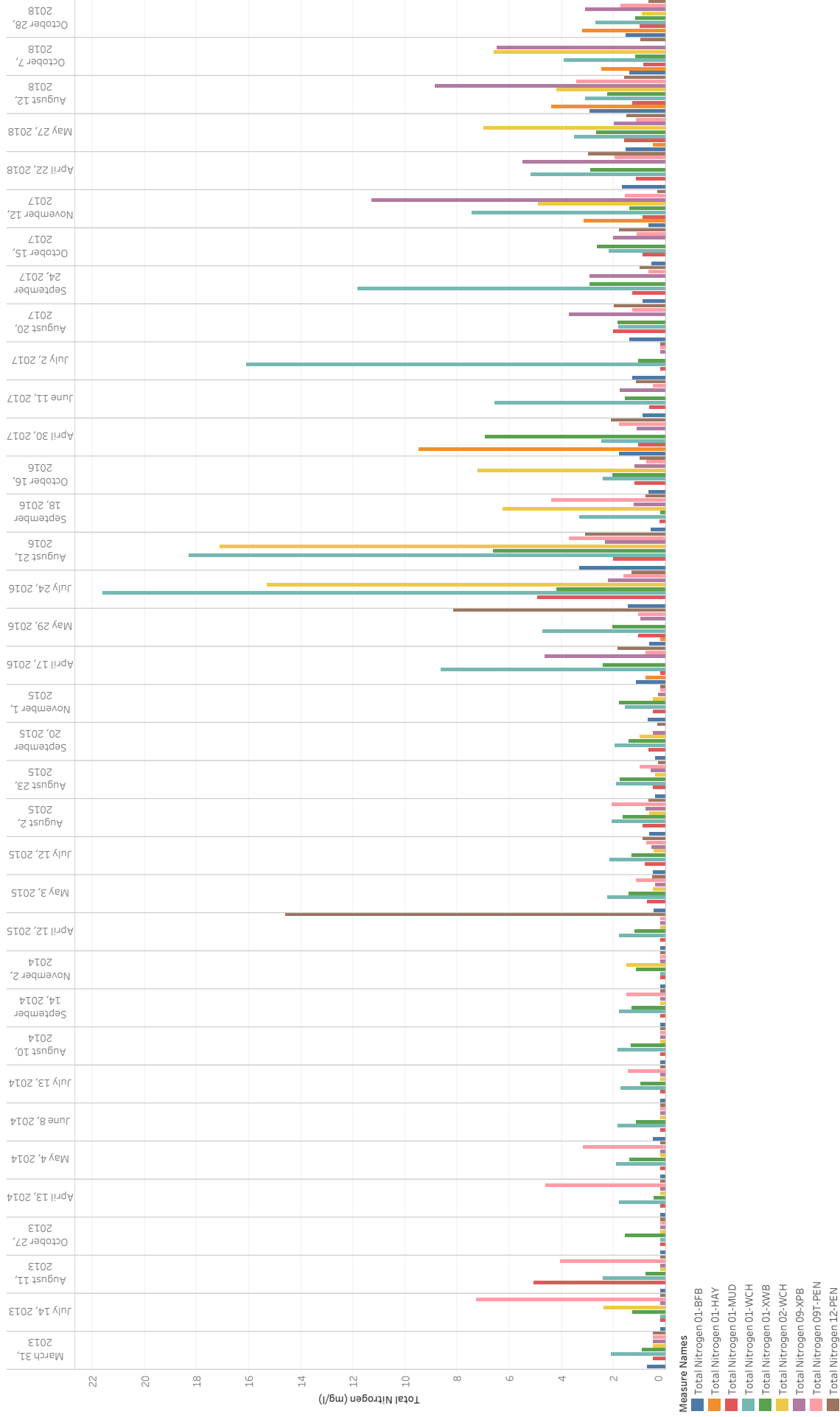


Groundwater Alkalinity, 2017-2018

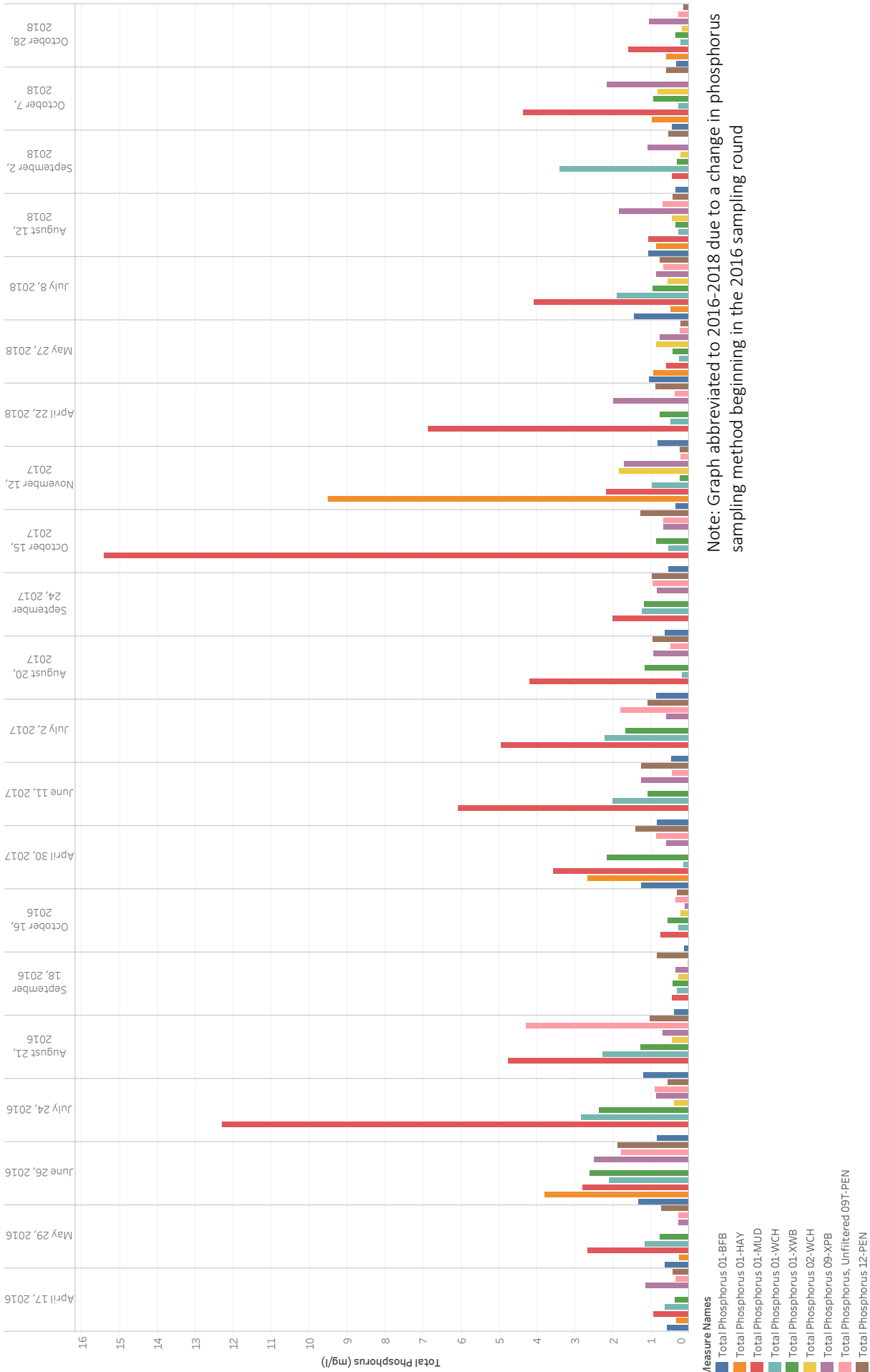


Note: Alkalinity sampling began in the 2017 sampling round

Groundwater Total Nitrogen, 2013-2018



Groundwater Total Phosphorus, 2016-2018

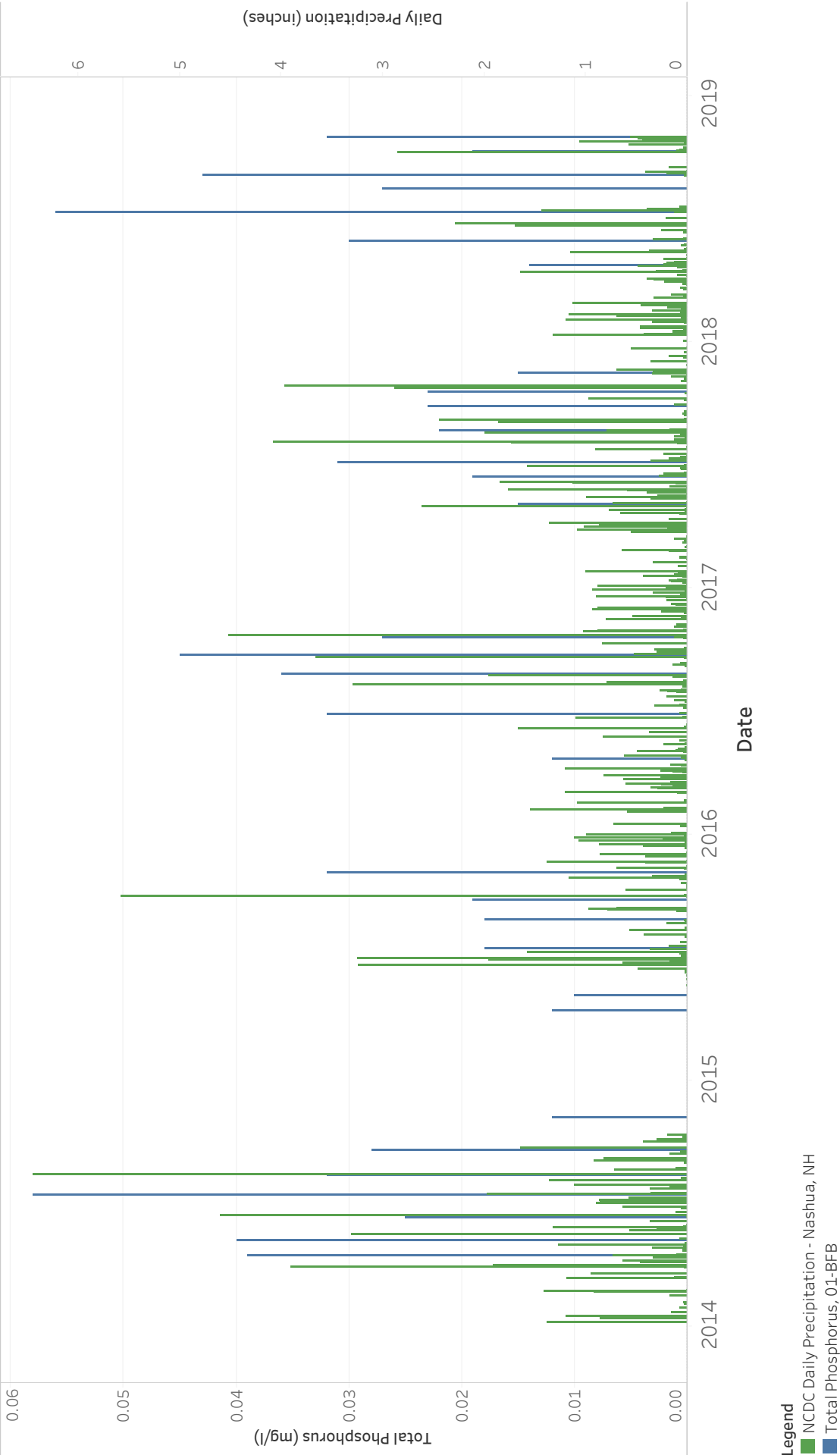


Note: Graph abbreviated to 2016-2018 due to a change in phosphorus sampling method beginning in the 2016 sampling round

Attachment E:

Precipitation vs. Phosphorus Graphs, 2014-2018

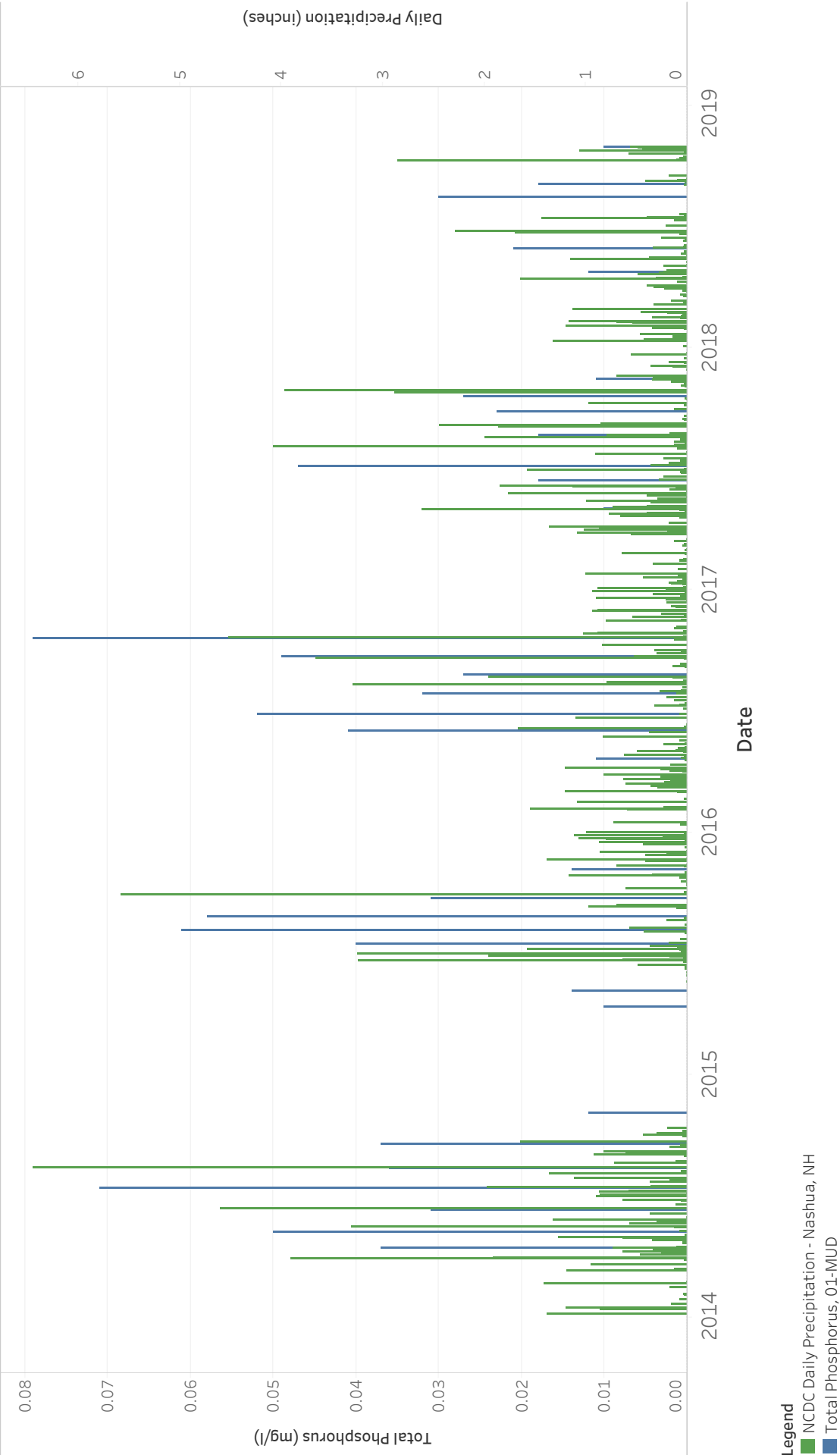
01-BFB: Total Phosphorus vs. Daily Rainfall, 2014-2018



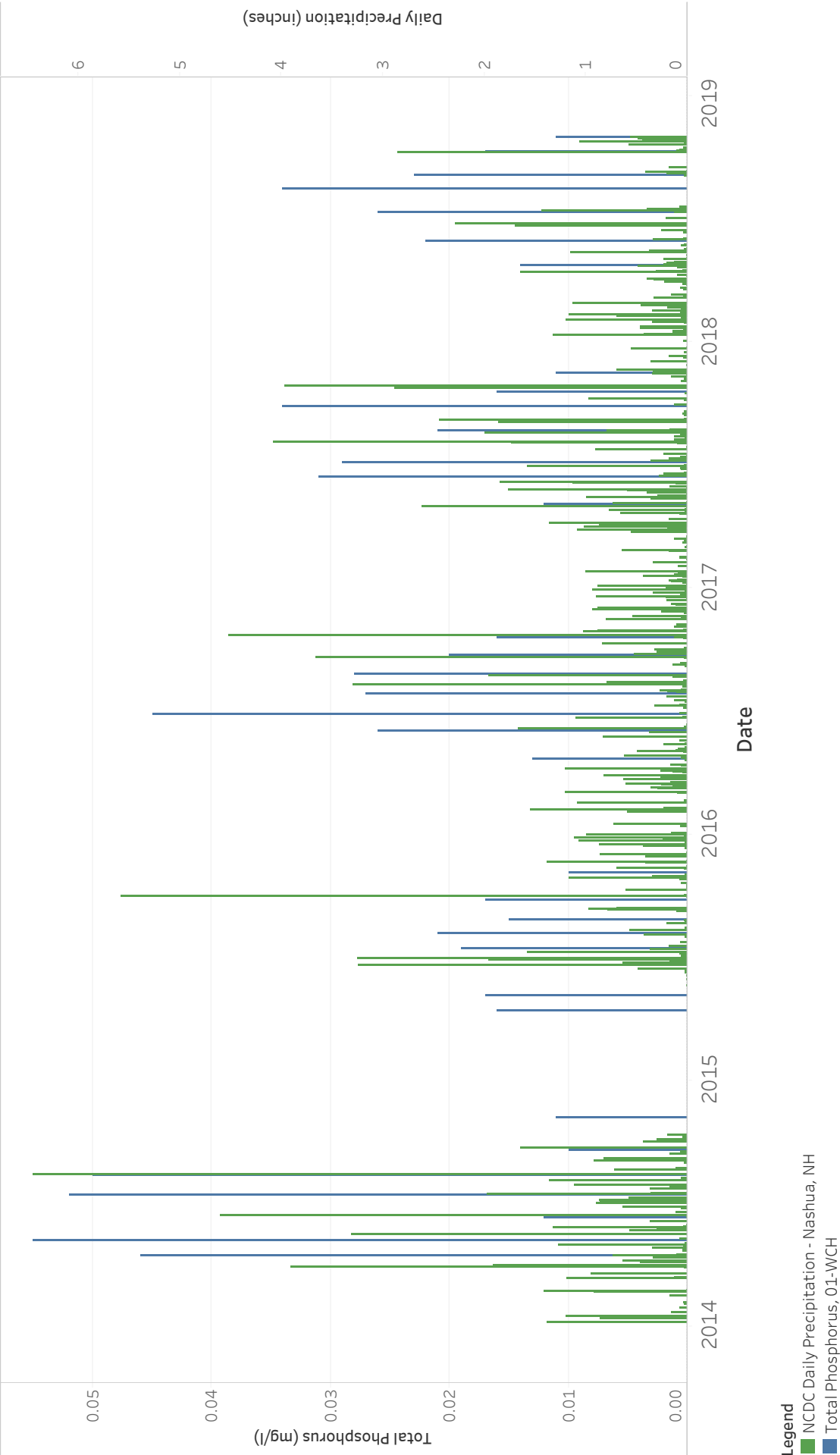
01-HAY: Total Phosphorus vs. Daily Rainfall, 2016-2018



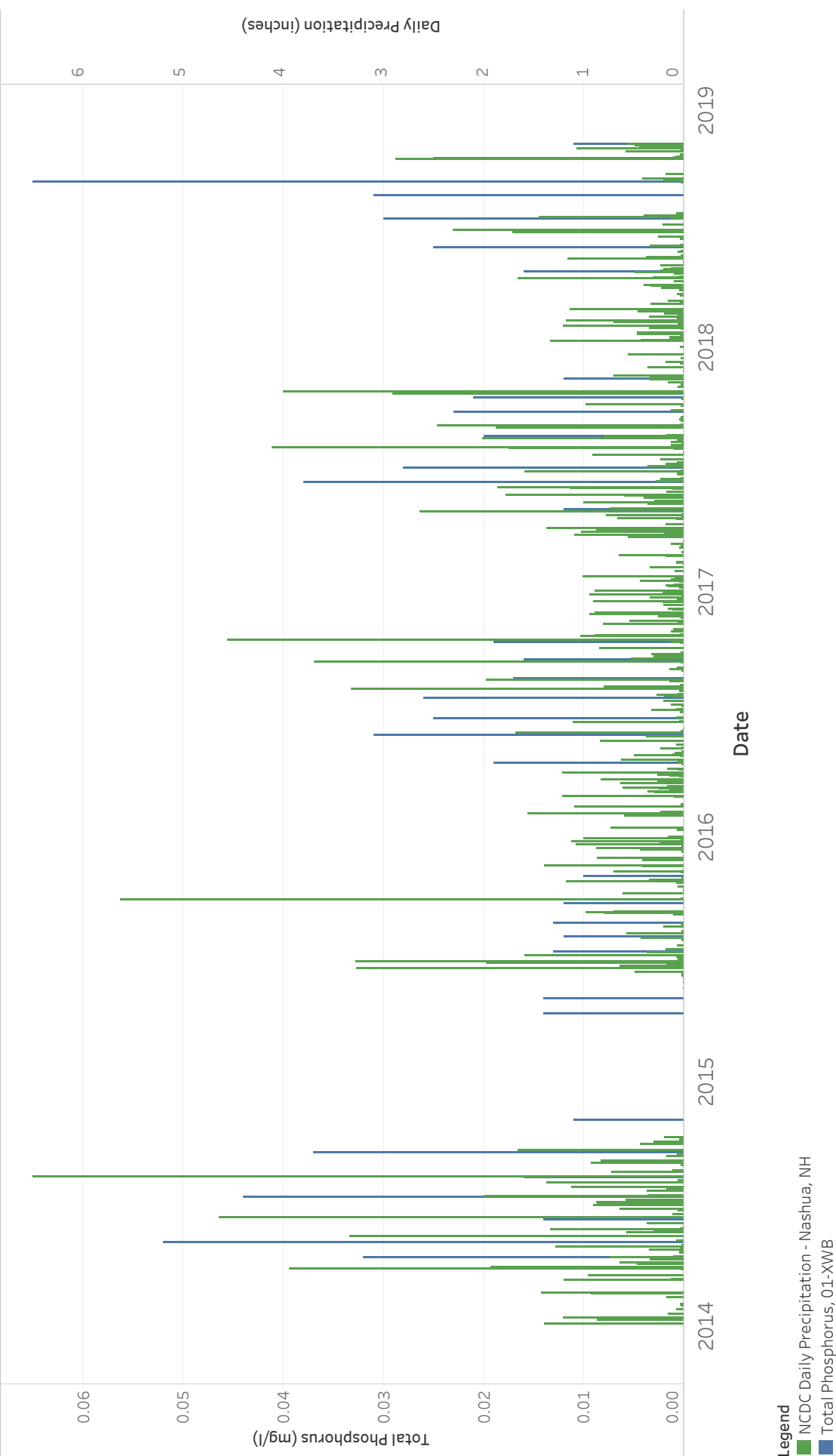
01-MUD: Total Phosphorus vs. Daily Rainfall, 2014-2018



01-WCH: Total Phosphorus vs. Daily Rainfall, 2014-2018



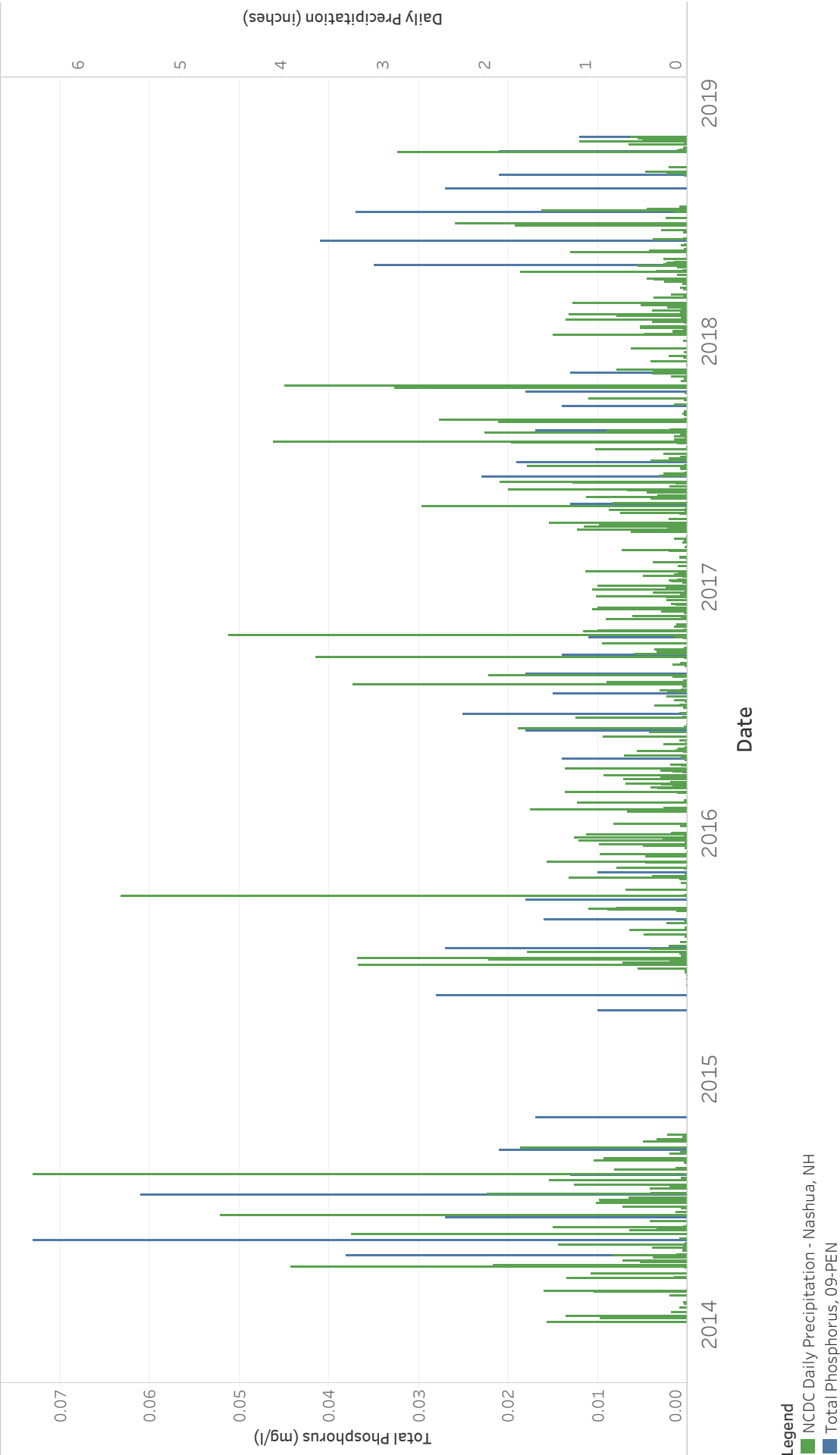
01-XWB: Total Phosphorus vs. Daily Rainfall, 2014-2018



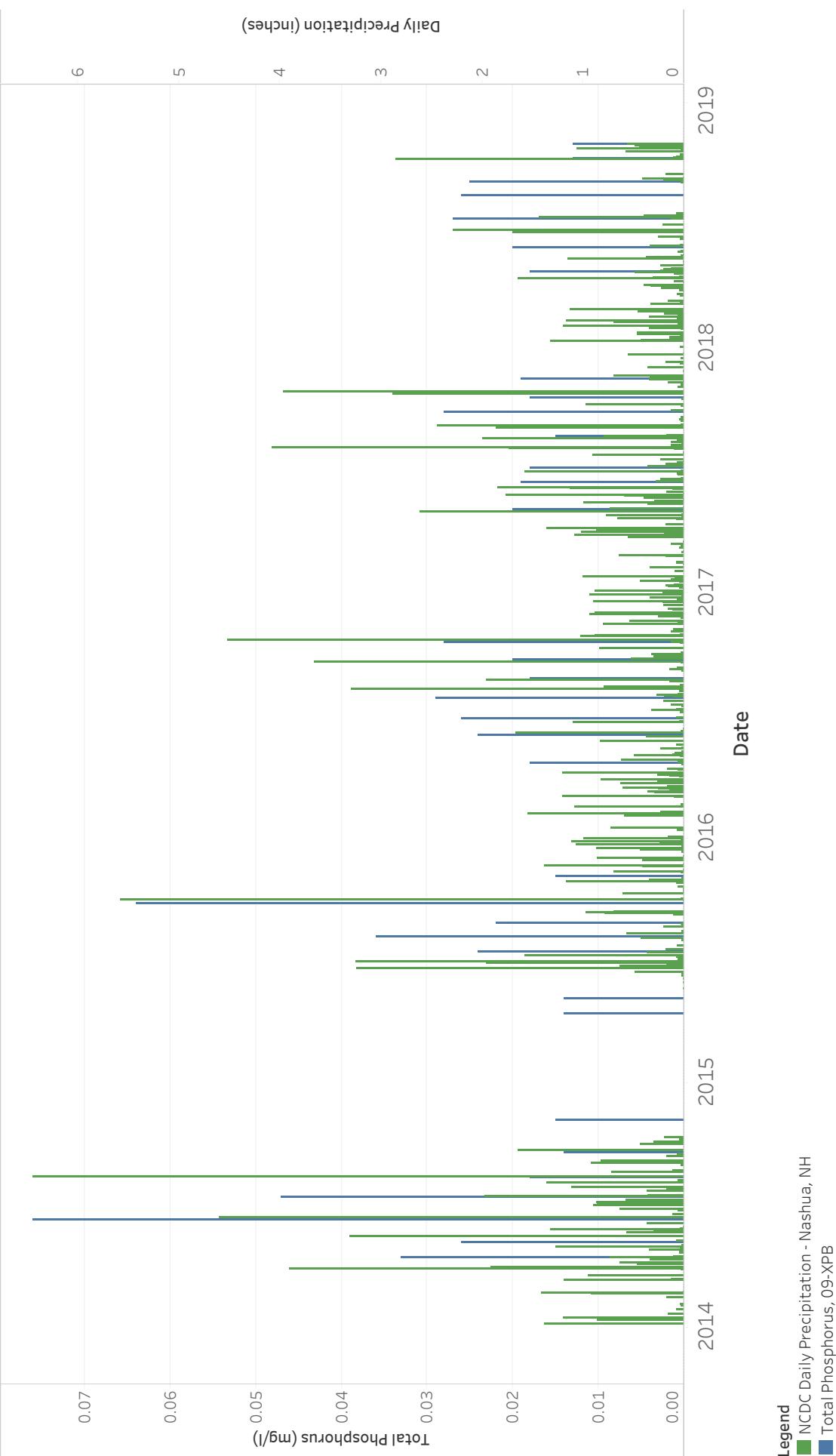
02-WCH: Total Phosphorus vs. Daily Rainfall, 2014-2018



09-PEN: Total Phosphorus vs. Daily Rainfall, 2014-2018



09-XPB: Total Phosphorus vs. Daily Rainfall, 2014-2018



09T-PEN: Total Phosphorus vs. Daily Rainfall, 2014-2018



12-PEN: Total Phosphorus vs. Daily Rainfall, 2014-2018

