# Puyallup River Tributaries Effectiveness Monitoring Quarterly Report: April – June, 2024 (Year 5)

DEPARTMENT OF ECOLOGY
State of Washington

## Background

Year 5 of the 10-Year Puyallup River Tributaries Effectiveness Monitoring project conducted by the Department of Ecology began in July, 2023. This report summarizes bacteria, nutrients, and conventional water quality parameter results from the fourth quarter (April through June) of Year 5. The first, fifth and tenth years of this project include a greater frequency and spatial resolution of data collection; these years are referred to as Implementation years. During the years between Implementation years, referred to as Status and Trends monitoring years, only one downstream site on each of the three tributaries (Boise Creek, Second Creek and Pussyfoot Creek) is routinely monitored, with one additional tributary site on Boise Creek. During the Implementation monitoring, there are nine sites on Boise Creek, eight sites on Second Creek, and ten sites on Pussyfoot Creek. This increase in spatial resolution allows project partners to focus efforts by identifying portions within each watershed where data may suggest pollution sources are entering the stream. More details concerning site locations, sample frequency, methods, etc. are described in the study's Quality Assurance Project Plan[1] (Brownlee 2019). All data can be found on Ecology's Environmental Information Management System (EIM).

## Report Summary

- All sites within the Second Creek watershed failed to meet the numeric criteria for bacteria.
- The tributary to Boise Creek from the City of Enumclaw at 456th St, and Beaver Creek did not meet numeric criteria for bacteria. The two downstream sites on the mainstem of Boise Creek also did not meet the criteria.
- The north fork of Pussyfoot Creek continues to have the highest levels of pollution in that watershed. The south fork has the least-polluted sites, two of which met the numeric criteria for bacteria during this period.
- Second Creek continues to contain the highest level of nutrients of the three streams, followed by Pussyfoot Creek and the tributary at 456th.

[1] https://apps.ecology.wa.gov/publications/SummaryPages/1910040.html

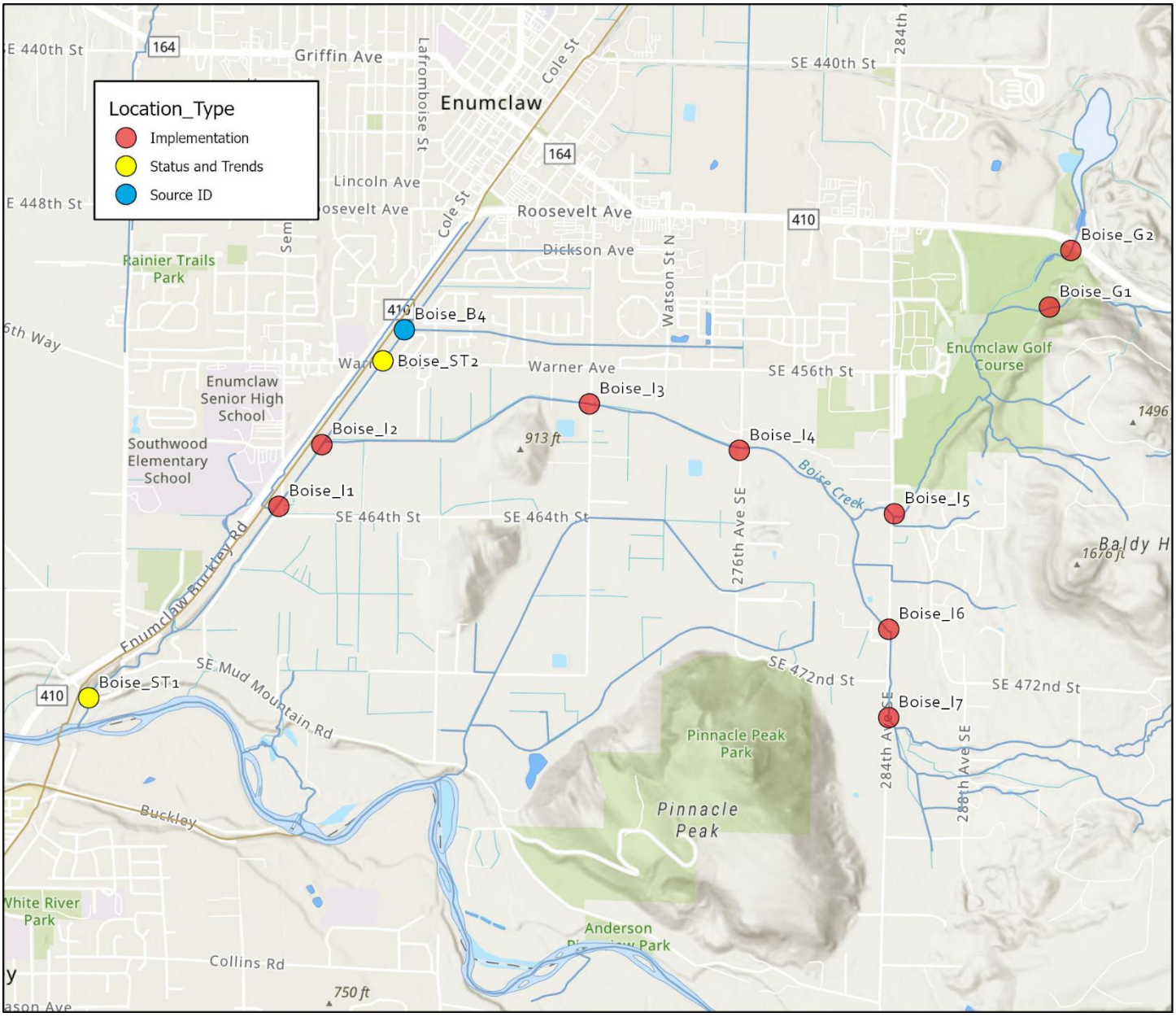


Figure 1. Boise Creek sampling sites during the fourth quarter of Year 5.

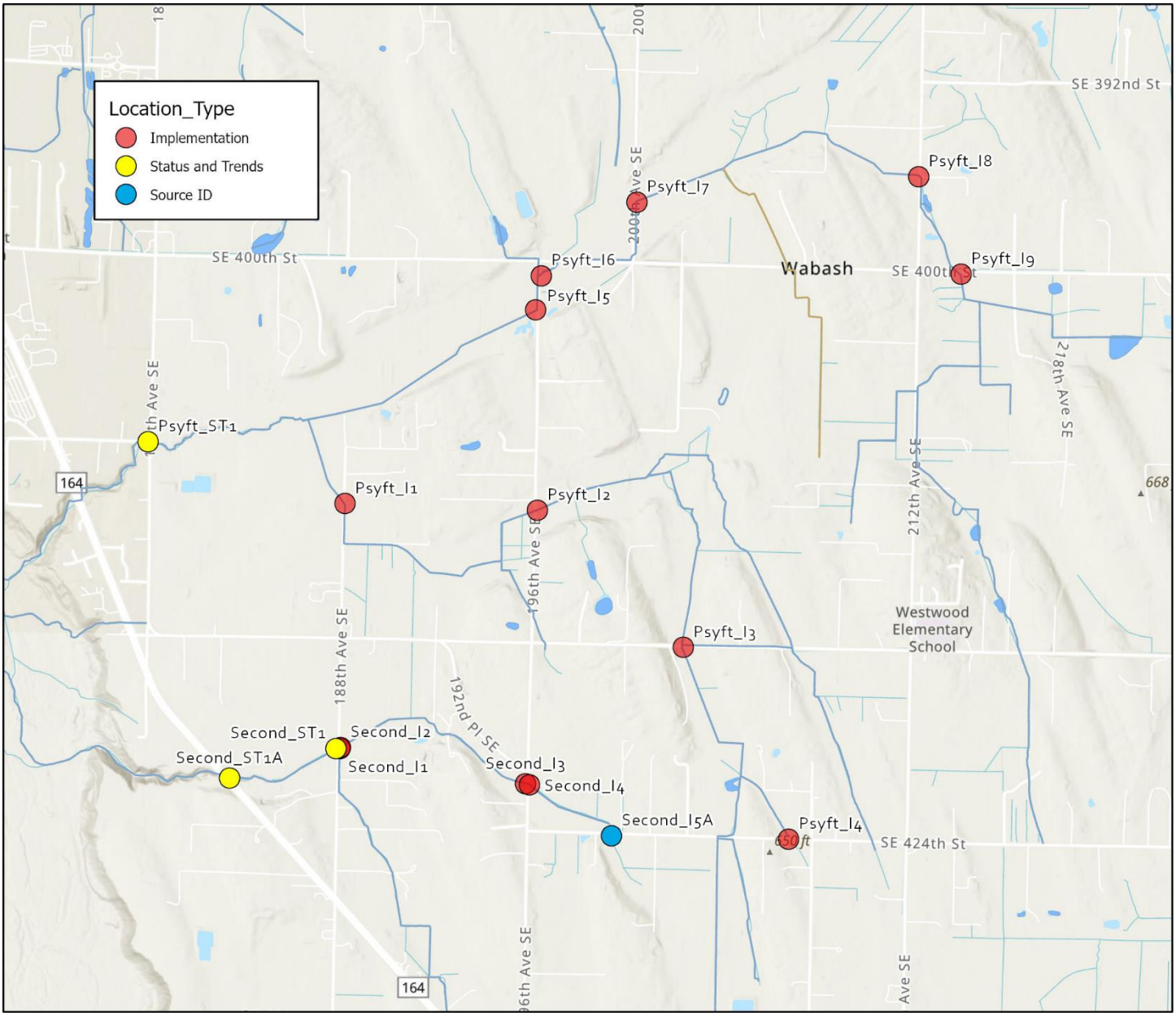


Figure 2. Boise Creek sampling sites during the fourth quarter of Year 5.

# Precipitation and Flow

Based on preliminary data from the Boise Creek USGS stream gage, the months of April and May had significantly lower-than-average flows, while the month of June had slightly above-average flows compared to a typical year (Table 1 and Figure 3).

Table 1. Total precipitation (data from King County site 44u[2]) and average discharge (preliminary data from USGS site 12099600[3]) at Boise Creek at Mud Mountain Road Station.

| Month | Total Precipitation (inches) | Average Discharge, CFS *(mean for all years)* |
|---|---|---|
| April | 3.71 | 22.64 *(41.33)* |
| May | 3.22 | 19.83 *(31.86)* |
| June | 2.85 | 25.14 *(23.87)* |

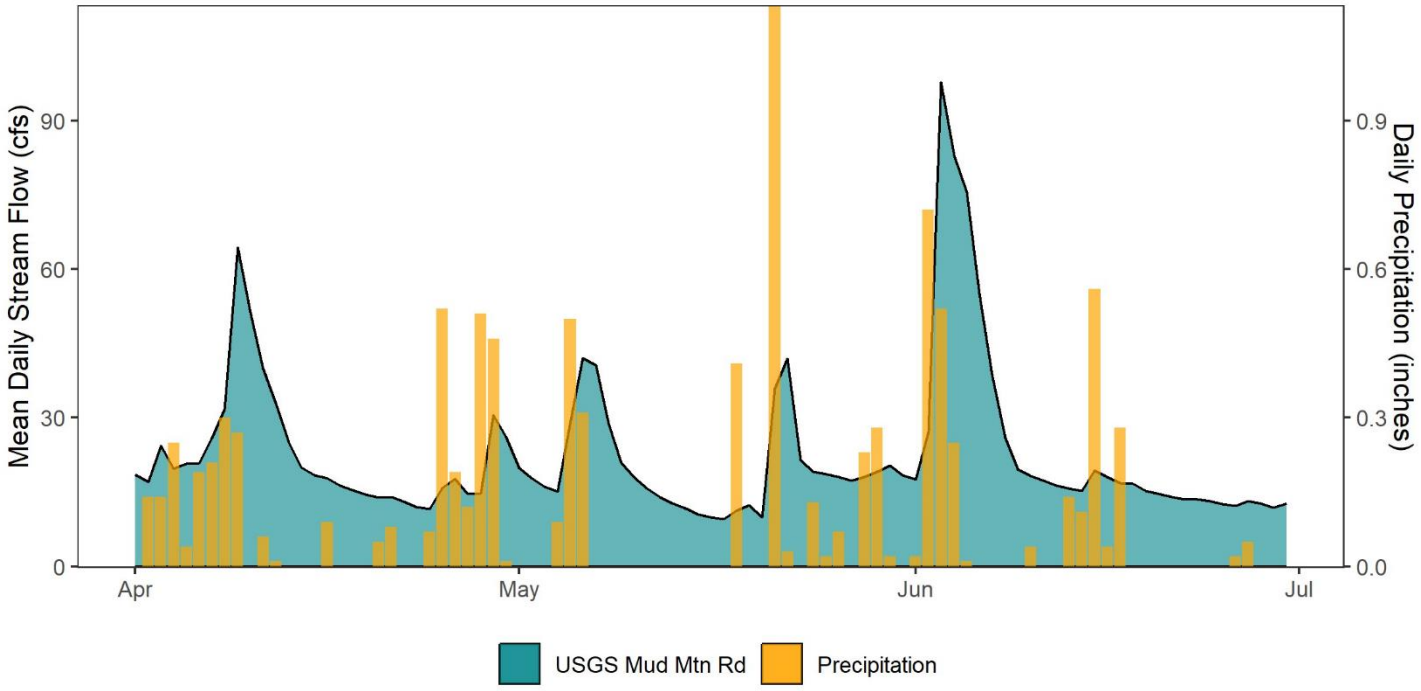


Figure 3. Mean daily stream flow (preliminary data from USGS site 12099600[4]) and daily precipitation (data from King County site 44u[5]) at Boise Creek at Mud Mountain Road station from April 1 – June 30, 2024.

[2] https://green2.kingcounty.gov/hydrology/DataDownload.aspx
[3] https://waterdata.usgs.gov/wa/nwis/uv/?site_no=12099600&PARAmeter_cd=00060,00065
[4] https://waterdata.usgs.gov/wa/nwis/uv/?site_no=12099600&PARAmeter_cd=00060,00065
[5] https://green2.kingcounty.gov/hydrology/DataDownload.aspx

# Bacteria

Bacteria standards state 1) the geometric mean for *E. coli* must not exceed 100 cfu/100mL and 2) no more than 10 percent of all samples (or any single sample when less than ten sample points in an averaging period exist) should exceed 320 cfu/100mL. Figures 4-6 contain box plots of bacteria concentrations for each site during this period.

The Puyallup River Watershed Fecal Coliform TMDL (Mathieu and James, 2011) sets more protective targets, based on the rollback method outlined in Appendix G of that document, using the fecal coliform indicator for the downstream Status and Trends sites on Boise and Pussyfoot creeks. None of the sites that these targets apply to have achieved those targets. The following narrative will focus on the state water quality standards using *E. coli* mentioned above.

During the fourth quarter of Year 5 several sites met the water quality criteria for *E. coli*, while many did not (Figures 4-6). On the mainstem of Boise Creek the only sites that failed to meet the water quality criteria for *E. coli* were the two most-downstream sites: Boise_I1 and Boise_ST1. Tributaries to Boise Creek, including the drainage where Boise_ST2 is located as well as Beaver Creek (Boise_I6 and Boise_I7) also exceeded the criteria. On Pussyfoot Creek the only sites to meet the criteria were Psyft_I1 and Psyft_I2, which are both from the south fork of that drainage. All sites on Second Creek failed to meet the criteria during this period.

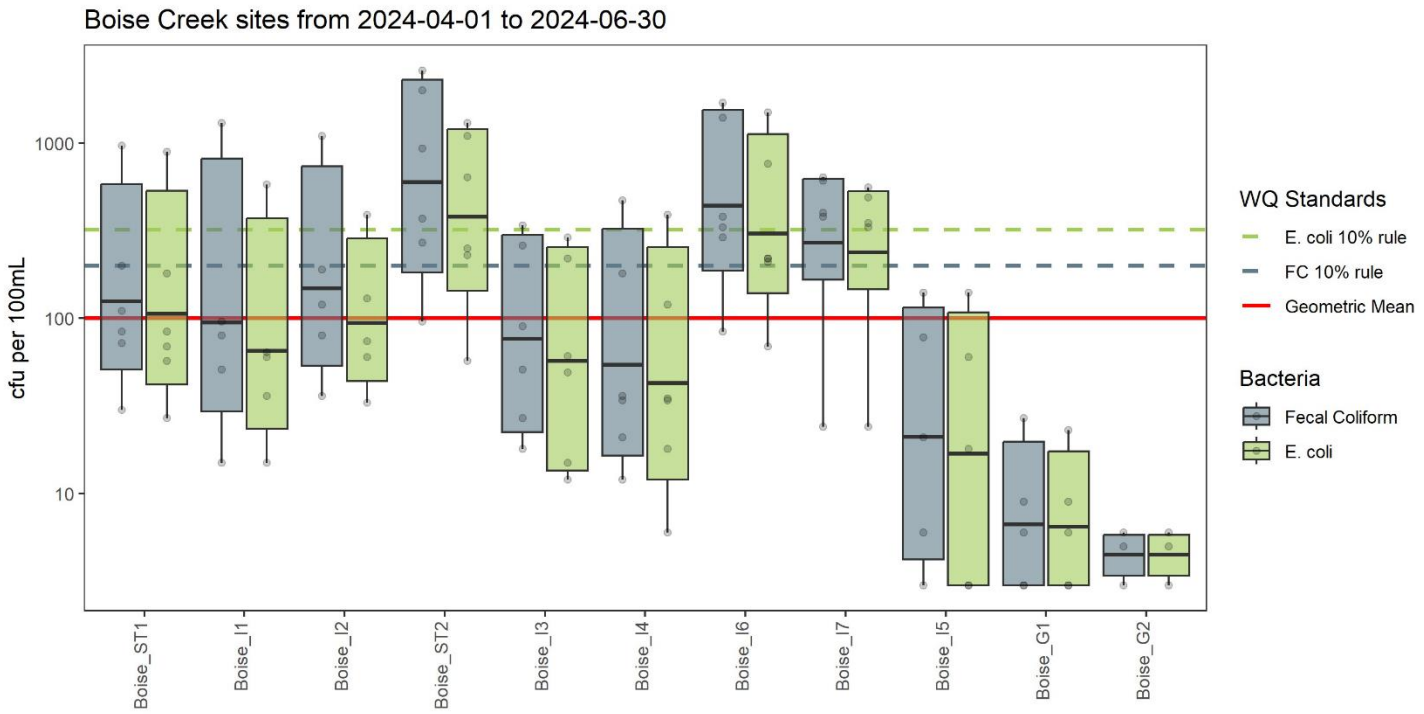


Figure 4. Bacteria levels in Boise Creek from January through March of 2024 with geometric mean (black solid line in boxplot) and 90$^{th}$ percentile (top of colored boxes). Water quality standards displayed as horizontal lines. Sites are ordered from downstream to upstream, left to right.

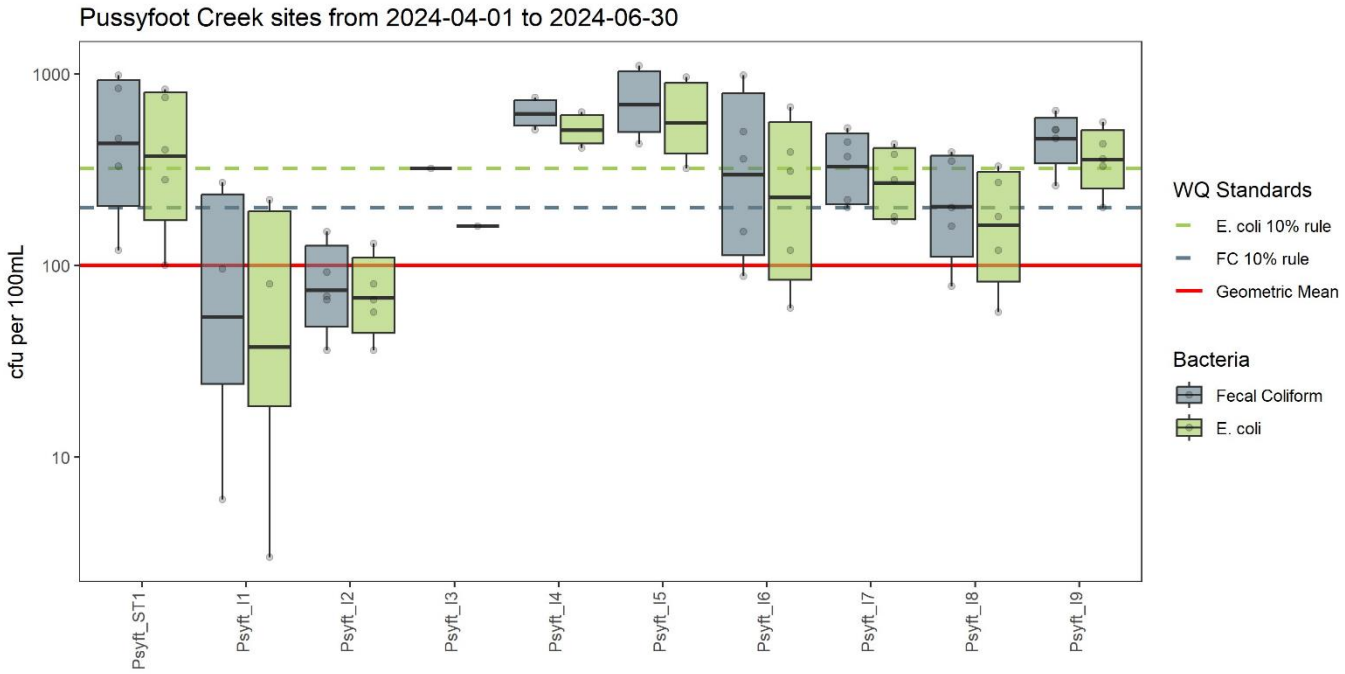


Figure 5. Bacteria levels in Pussyfoot Creek from January through March of 2024 with geometric mean (black solid line in boxplot) and 90th percentile (top of colored boxes). Water quality standards displayed as horizontal lines. Sites are ordered from downstream to upstream, left to right.

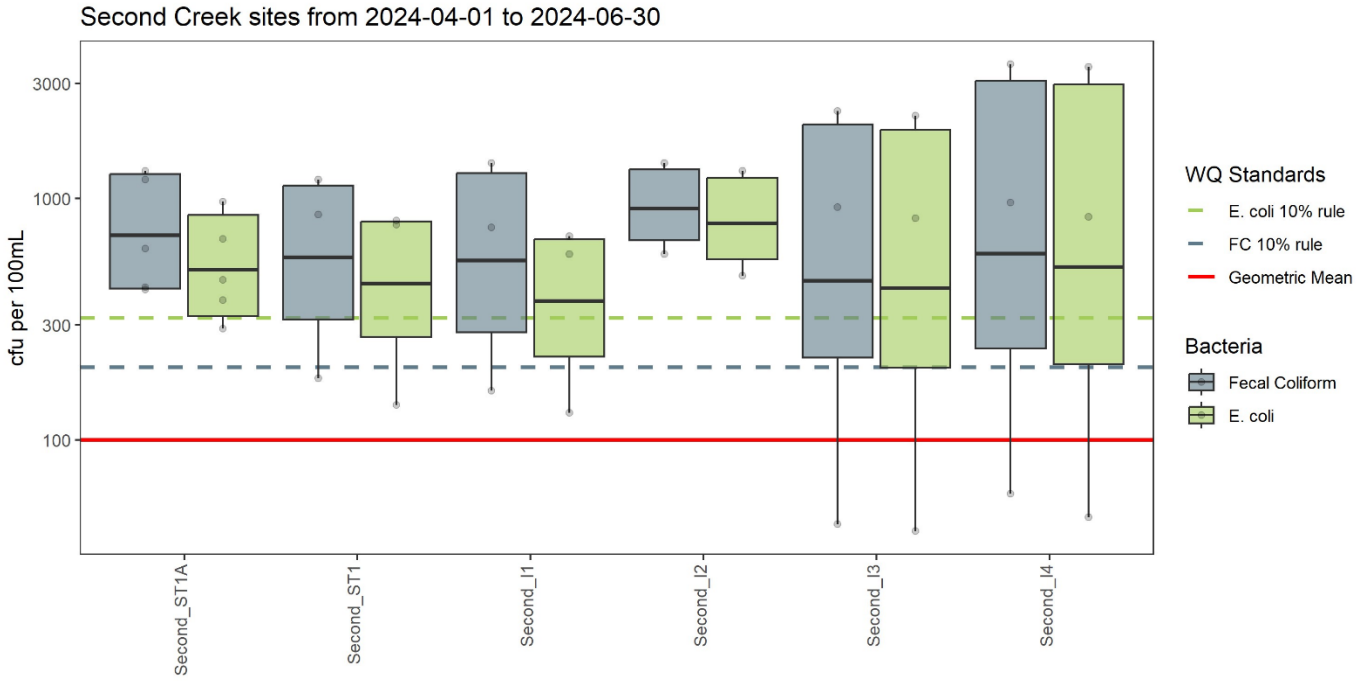


Figure 6. Bacteria levels in Second Creek from January through March of 2024 with geometric mean (black solid line in boxplot) and 90th percentile (top of colored boxes). Water quality standards displayed as horizontal lines. Sites are ordered from downstream to upstream, left to right.

# Nutrients

Second Creek continues to show the highest concentrations of all nutrient parameters, excepting Ammonia, followed by Pussyfoot Creek and the Boise Creek tributary (Boise_ST2), with Boise Creek typically having the lowest concentrations (Figures 8-10).

The Lower White River pH TMDL contains allocations for Soluble Reactive Phosphorous (SRP), with some language specifying load and wasteload allocations (LA and WLA) on Boise Creek. Using USGS stream discharge data for Boise Creek (station 12099600) and orthophosphate (OP) data from this period (OP is the primary constituent of SRP), Figure 7 shows estimated loading rates of OP near the mouth of Boise Creek as well as the sum of the applicable WLA and LA based on seasonality and flow in the White River. The two sampling events that did occur when an allocation was in effect did not result in an estimated load that exceeded the allocation. Please note that the WLA, which is set to point source effluent (Enumclaw WWTP and MS4) cannot be accurately assessed from a downstream site such as Boise_ST1; Figure 7 is an estimate based on a snapshot concentration applied to the entire day, and is not considered an appropriate assessment of whether or not the applicable WLA is being met.

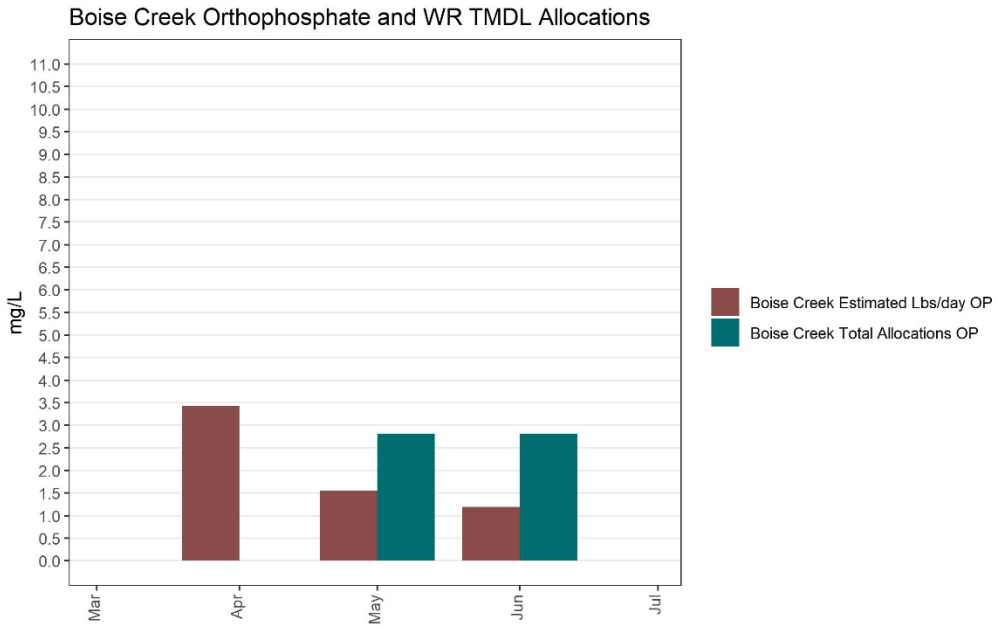


Figure 7. Estimated orthophosphate loading at Boise Creek during the fourth quarter of Year 5 compared to approximate White River TMDL load allocations for Boise Creek (Gray and Mathieu, 2022).

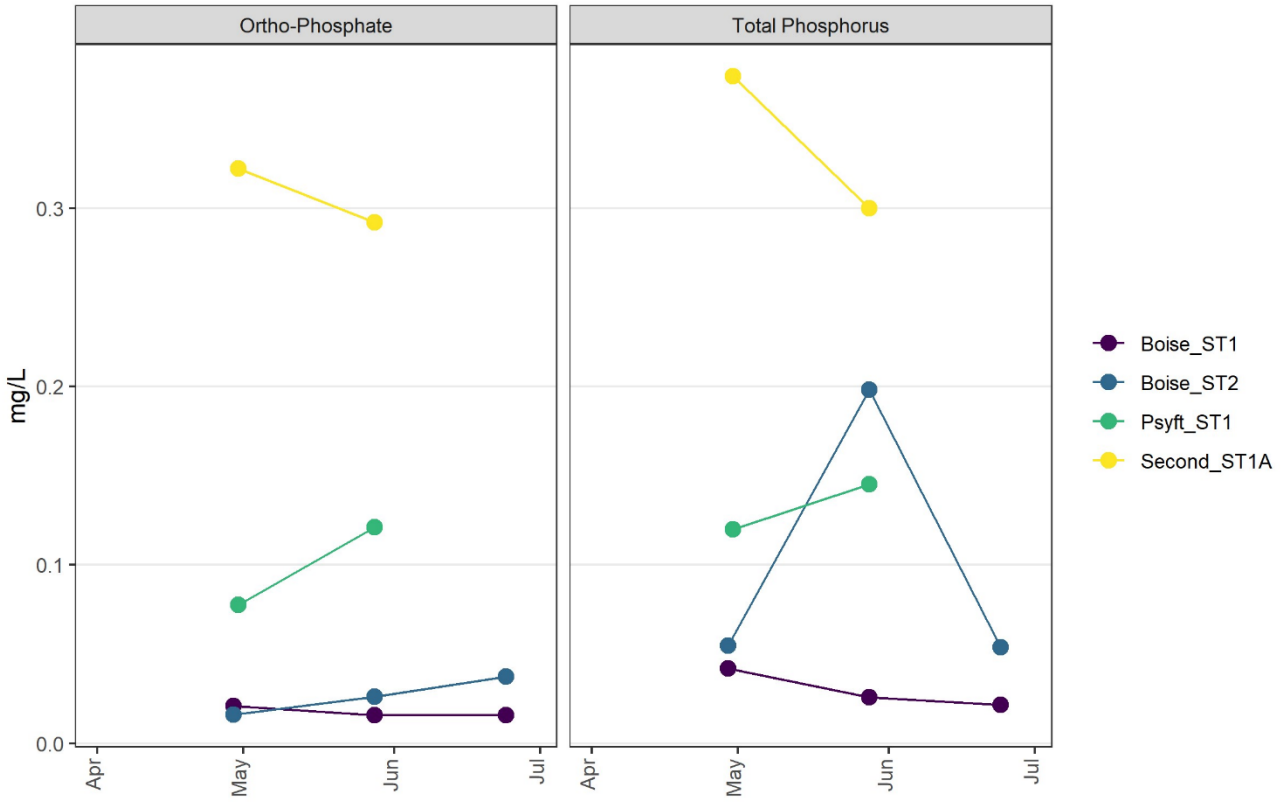


Figure 8. Concentration of monitored phosphorous species over time during the fourth quarter of Year 5.

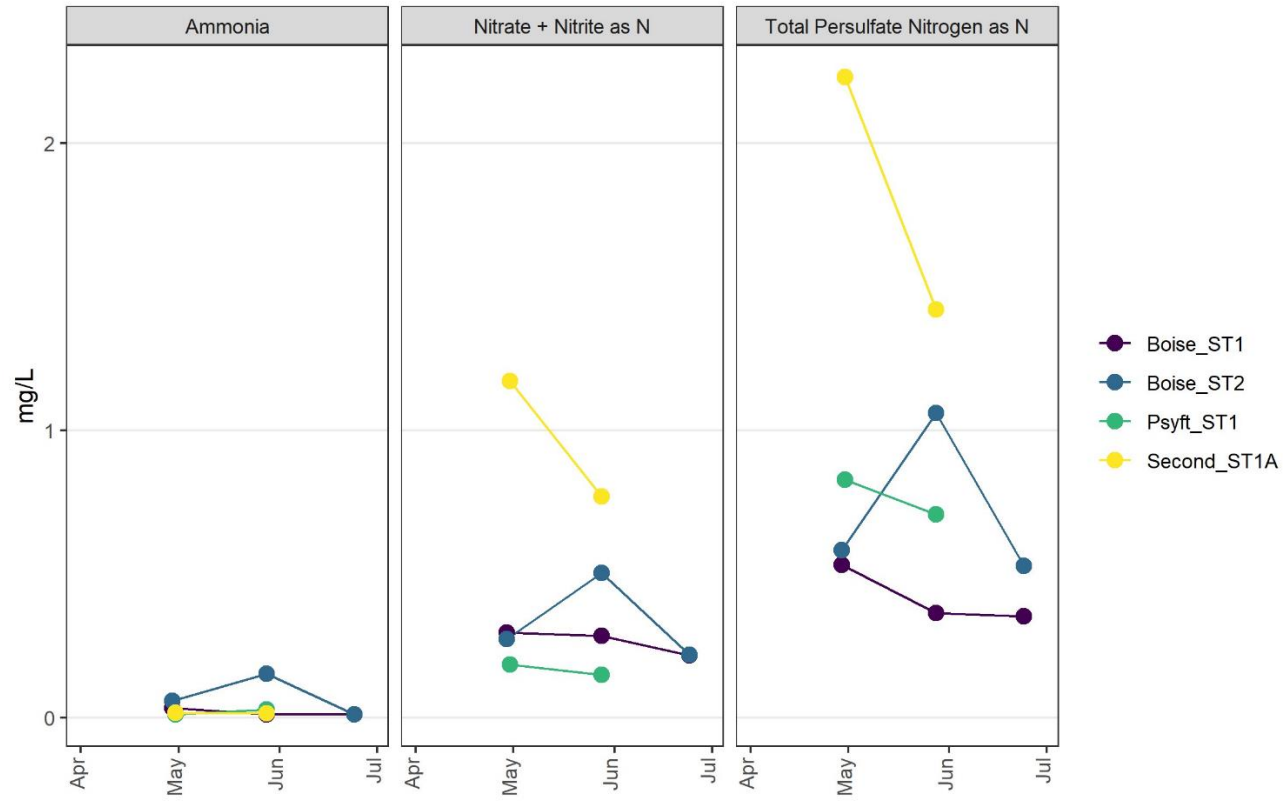


Figure 9. Concentration of monitored nitrogen species over time during the fourth quarter of Year 5.

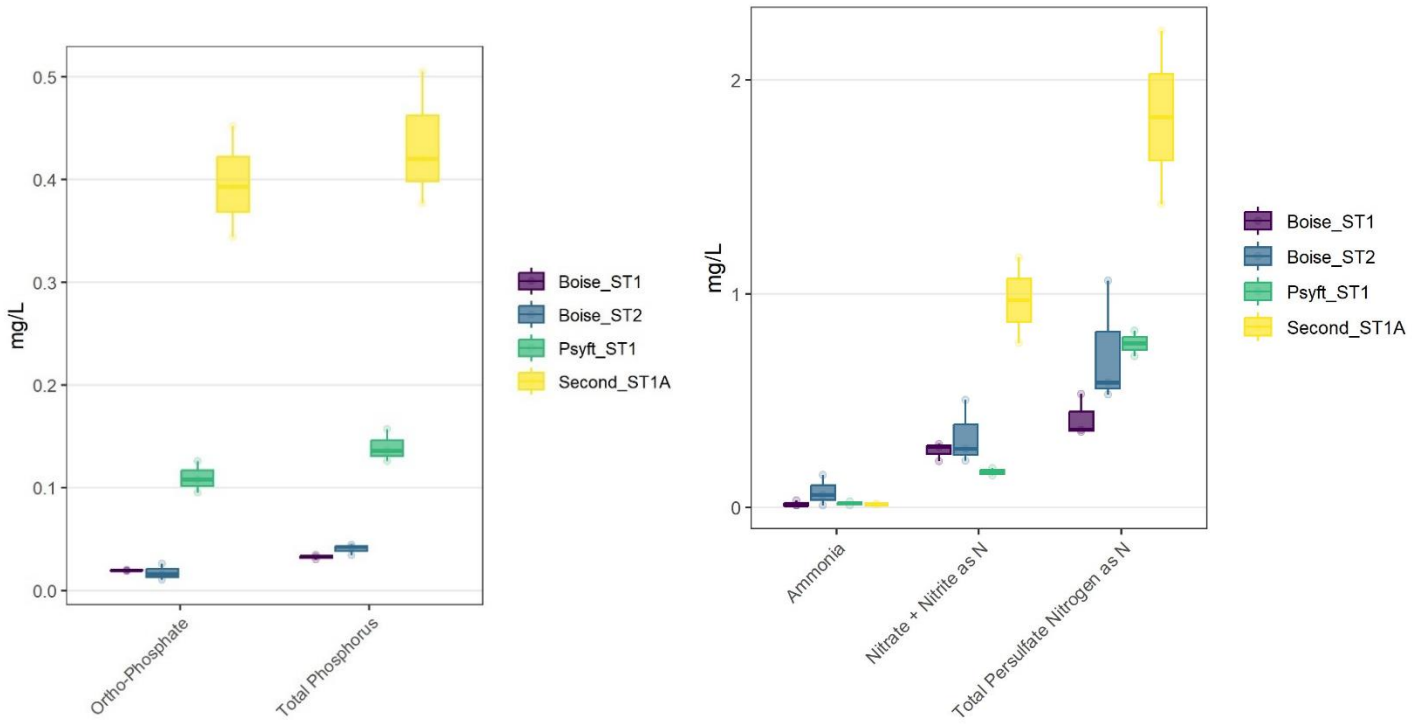


Figure 10. Box plots of phosphorous and nitrogen concentration in the fourth quarter of Year 5 with the median value represented as a solid line in the boxplot.

# Water Quality Measurements

## Turbidity

All sites maintained relatively low levels of turbidity throughout this period (Figures 11-13), except for one visit to Boise_ST2 on May 28 when high levels were observed (63.8 NTU) immediately after a heavy rainfall event. The City of Enumclaw was notified during sampling, and they were able to quickly come out to inspect. They concluded it was likely untreated road surface runoff, due to the acute heavy precipitation event that had just occurred.

## Dissolved Oxygen

On the Boise Creek mainstem there was one site that failed to meet the criteria for dissolved oxygen (10 mg/L or 95% saturation), which was Boise_I2 (Figure 11). This site maintained DO concentrations above 10mg/L but did not maintain 95 percent saturation. The tributary at Boise_ST2, the two sites located on Beaver Creek, as well as the site located on the Chapel Springs tributary within the golf course all failed to meet either part of the criteria on at least one occasion during this period.

Pussyfoot Creek had only two sites meet both parts of the criteria, which were Psyft_I1 and Psyft_I3 (Figure 12). There was only one sample event on Psyft_I3 due to inadeuqate flow in the later portion of this period.

Second Creek had one site meet criteria, which was Second_I2 (Figure 13). There was only one sample event at this location due to inadequate flow later in the period. Periphyton was noted in the lower reaches of Second Creek including Second_I2, which could have affected DO concentrations during midday (increased DO).

## Temperature and pH

Continuous temperature data, which is not collected as part of this study, is needed to properly compare with the temperature criteria. This section will compare discrete measurement data to the 7-day average daily maximum (7DADMax), though this is not a suitable method for assessing a waterbody against the water quality criteria for temperature. The only sites on Boise Creek mainstem to not exceed the supplemental spawning criteria for temperature were Boise_G1 and Boise_I5 (Figure 11). On Pussyfoot Creek, which has no supplemental criteria for temperature, the sites Psyft_I7 and Psyft_I9 were the two sites that failed to stay below the 7DADMax temperature of 16° C (Figure 12). There were no sites on Second Creek with temperatures observed above 16° C (Figure 13).

All pH measurements met water quality criteria (6.5 to 8.5 pH units).


Figure 11. Boise in-situ measurement mean and range by parameter and site during the fourth quarter of Year 5 with water quality criteria marked in red, where applicable. Note the supplemental spawning criteria for Boise Creek from Sept 1-July 1 (13°C).

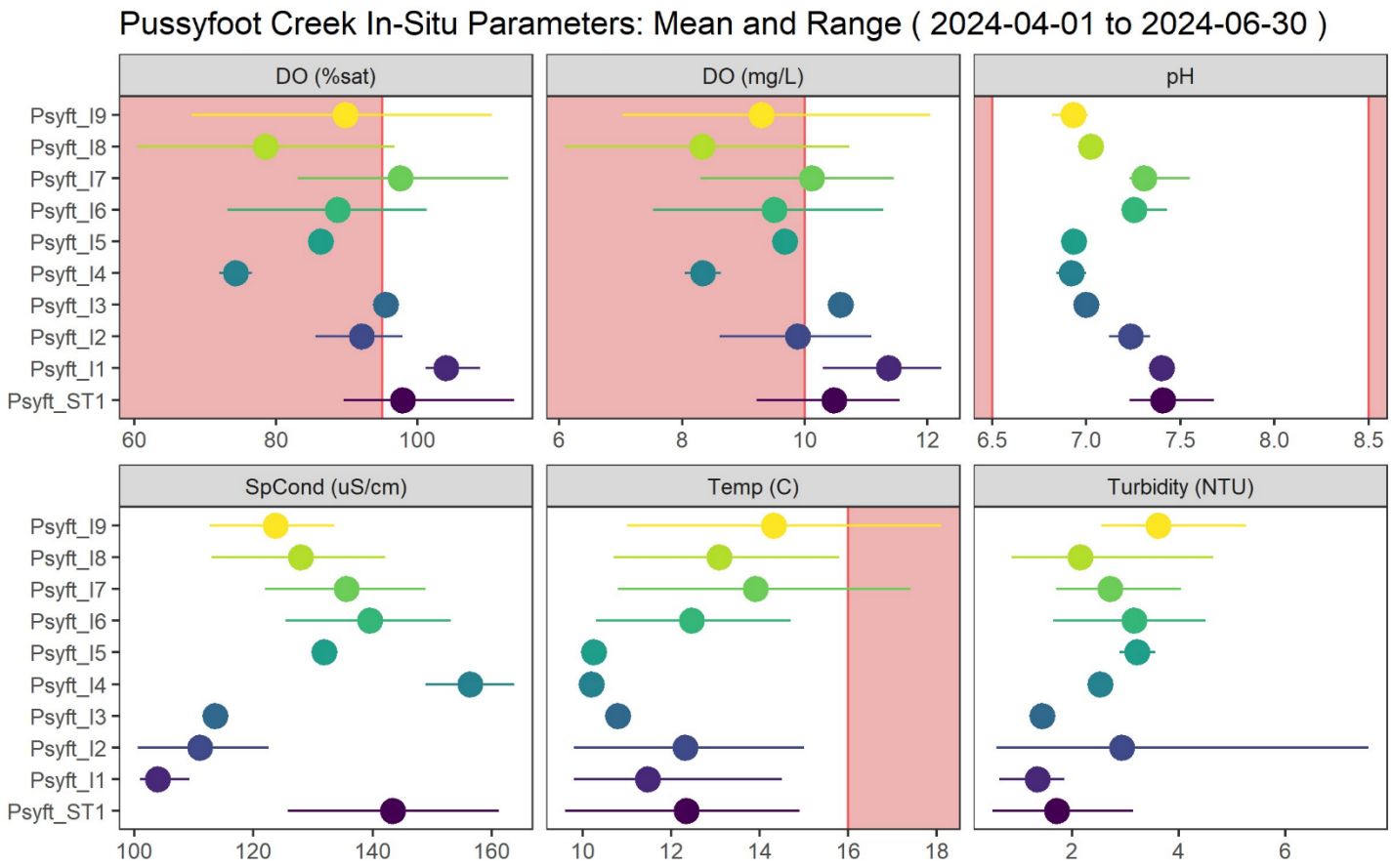


Figure 12. Pussyfoot Creek in-situ measurement mean and range by parameter and site during the fourth quarter of Year 5 with water quality criteria marked in red, where applicable.

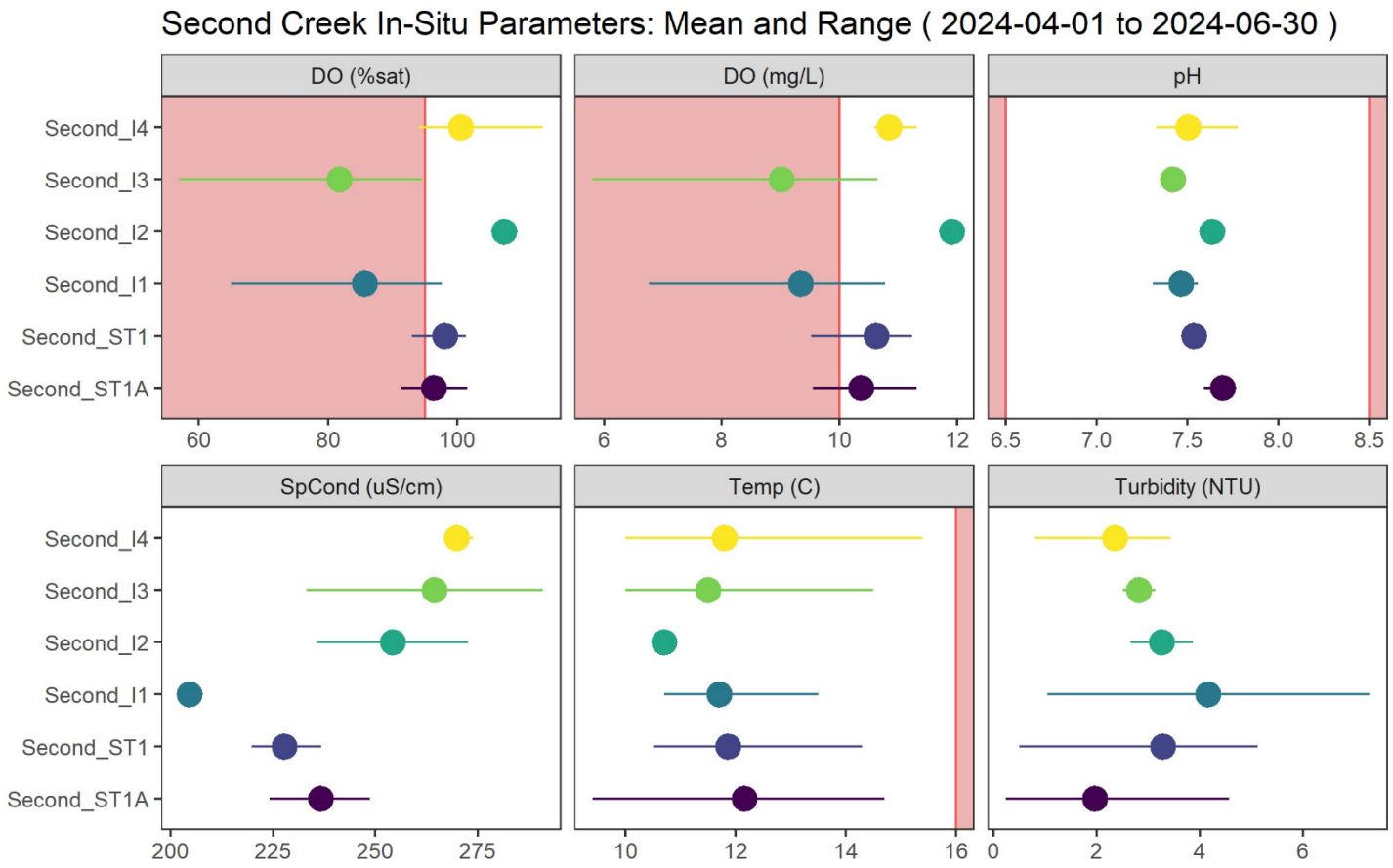


Figure 13. Second Creek in-situ measurement mean and range by parameter and site during the fourth quarter of Year 5 with water quality criteria marked in red, where applicable.

# References

Brownlee, A. 2019. Quality Assurance Project Plan: Puyallup River Tributaries Effectiveness Monitoring. Ecology publication 19-10-040.

Gray, D. and Mathieu, N. 2022. Lower White River pH Total Maximum Daily Load. Washington State Department of Ecology, Olympia, WA. Publication No. 22-10-011. https://apps.ecology.wa.gov/publications/SummaryPages/2210011.html

Mathieu, N. and James, C. 2011. Puyallup River Watershed: Fecal Coliform Total Maximum Daily Load – Water Quality Improvement Report and Implementation Plan. Washington State Department of Ecology, Olympia, WA. Publication No. 11-10-040. https://test-fortress.wa.gov/ecy/publications/SummaryPages/1110040.html

U.S. Geological Survey. Boise Creek at Buckley, WA - Monitoring location 12099600. USGS Water Data for the Nation. https://waterdata.usgs.gov/monitoring-location/12099600/#parameterCode=00060&period=P7D&showMedian=true

Water Quality Program, 2018. Water Quality Program Policy 1-11: Washington's Water Quality Assessment Listing Methodology to Meet Clean Water Act Requirements. Ecology publication 18-10-035. https://fortress.wa.gov/ecy/publications/SummaryPages/1810035.html

Water Quality Standards for Surface Waters of the State of Washington Section 173-201A. https://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A

King County (2023). King County Hydrologic Information Center, 69G - Beaver CR near Boise Confluence Stream Gauge https://green2.kingcounty.gov/hydrology/GaugeMetaData.aspx?G_ID=2166

# Appendix

Table A1. Dates with total daily precipitation of at least 0.1 inches (data from King County site 44u[6]).

| Date | Precip |
|---|---|
| **4/2/2024** | 0.14 |
| **4/3/2024** | 0.14 |
| **4/4/2024** | 0.25 |
| **4/6/2024** | 0.19 |
| **4/7/2024** | 0.21 |
| **4/8/2024** | 0.3 |
| **4/9/2024** | 0.27 |
| **4/25/2024** | 0.52 |
| **4/26/2024** | 0.19 |
| **4/27/2024** | 0.12 |
| **4/28/2024** | 0.51 |
| **4/29/2024** | 0.46 |
| **5/5/2024** | 0.5 |
| **5/6/2024** | 0.31 |
| **5/18/2024** | 0.41 |
| **5/21/2024** | 1.13 |
| **5/24/2024** | 0.13 |
| **5/28/2024** | 0.23 |
| **5/29/2024** | 0.28 |
| **6/2/2024** | 0.72 |
| **6/3/2024** | 0.52 |
| **6/4/2024** | 0.25 |
| **6/13/2024** | 0.14 |
| **6/14/2024** | 0.11 |
| **6/15/2024** | 0.56 |
| **6/17/2024** | 0.28 |

[6] https://green2.kingcounty.gov/hydrology/DataDownload.aspx

# Contact information

### Water Quality Program

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### Related Information

- This report is available on the Puyallup Partnership webpage[7].
- Data for this project is available in Ecology's EIM Database,[8] Study ID: EFF_PRT.
- Data is displayed on Puyallup River Tributaries Effectiveness Monitoring StoryMap[9].
- Bacteria data is displayed on Whatcom Conservation District StoryMap[10].

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[7] https://www.ezview.wa.gov/site/alias__1962/37699/puyallup_river_watershed_improvement_project.aspx
[8]https://apps.ecology.wa.gov/eim/search/Eim/EIMSearchResults.aspx?ResultType=EIMStudyTab&StudyUserIdSearchType=Contains&StudyUserIds=EFF_PRT
[9] https://waecy.maps.arcgis.com/apps/MapSeries/index.html?appid=20f291f848cb48fd8c879704f5464461
[10] https://www.arcgis.com/apps/webappviewer/index.html?id=5395274198aa4365b96fbaf01b4db43b&extent=-13894004.8062%2C6045956.0065%2C-13306968.4289%2C6336110.9659%2C102100