Puyallup River Tributaries Effectiveness Monitoring Quarterly Report: October – December, 2023 (Year 5)

Abstract

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 second quarter (October through December, 2023) 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).

Report Summary

- Ecology collected samples and measurements twice per month at the nine established Boise Creek sites. Two additional sites on the Enumclaw Golf Course were sampled routinely as well. Pussyfoot and Second Creeks remained dry during the month of October and were sampled at downstream locations starting in November. By December all locations were flowing.
- Boise Creek sites Boise_G1 and Boise G2, and Pussyfoot Creek sites Psyft_I2 and Psyft_I3 were the only sites that met water quality criteria for *E. coli* during this period.
- Boise Creek at the golf course (Boise_G1) was the only site that had no exceedance below the minimum dissolved oxygen water quality criteria during this period.

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

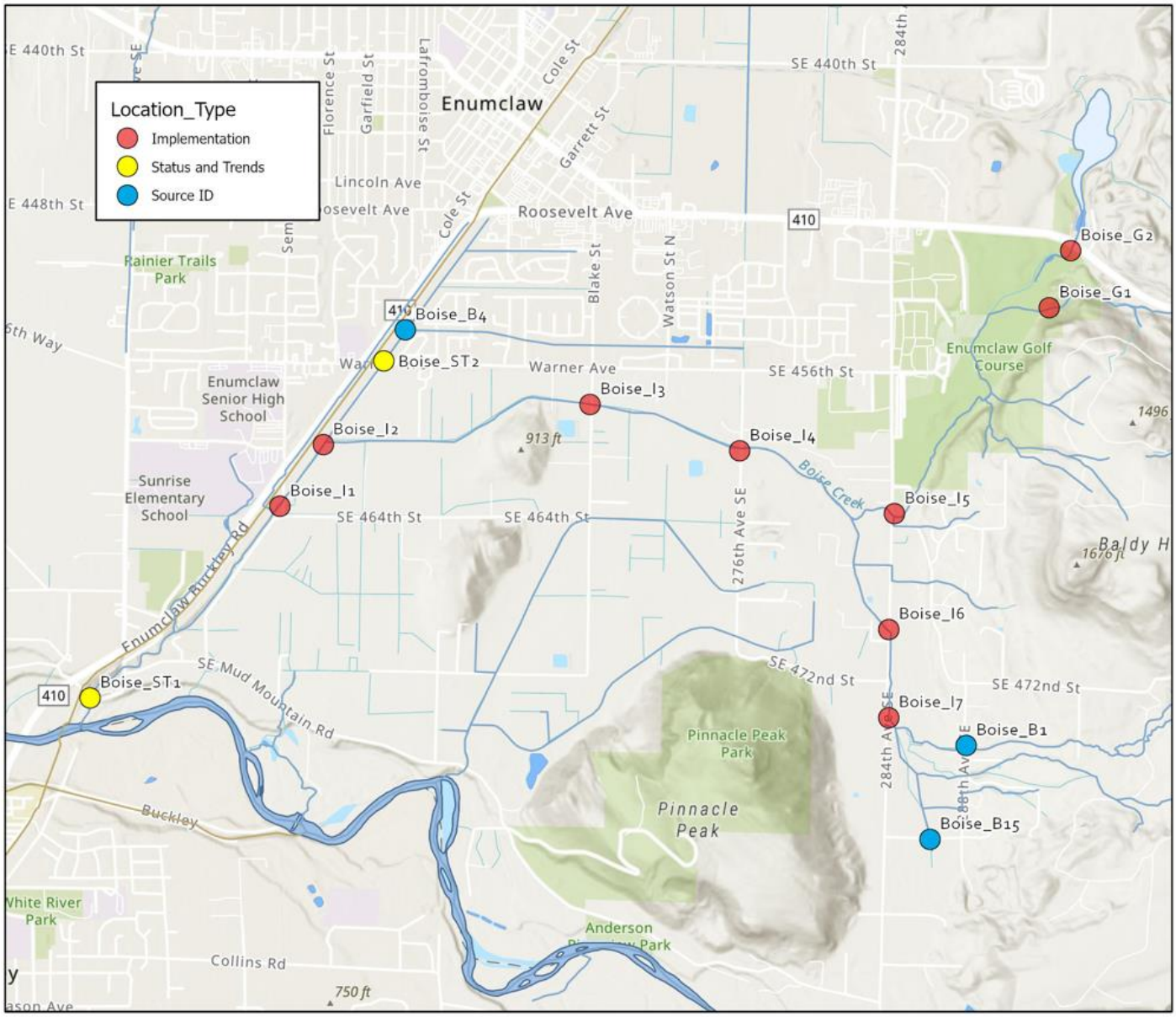

Figure 1. Boise Creek sampling sites during the second quarter of Year 5.

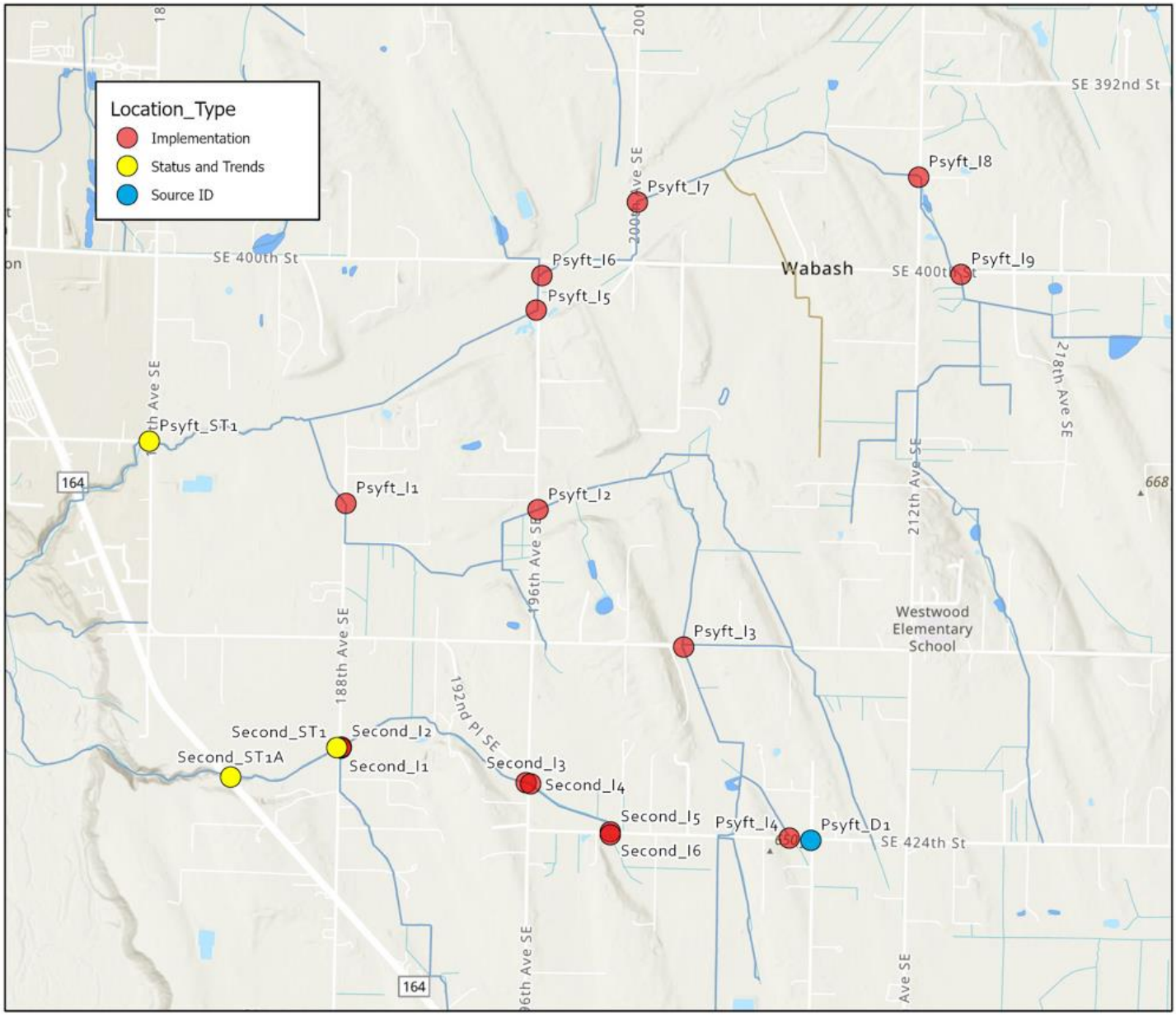

Figure 2. Boise Creek sampling sites during the second quarter of Year 5.

Precipitation and Flow

Based on preliminary data from the Boise Creek USGS stream gage, the months of October and November had significantly lower-than-average flows compared to a typical year, while December had higher-than-average flows, as precipitation greatly increased (Table 1 and Figure 2).

Table 1. Total precipitation and average discharge at Boise Creek at Mud Mountain Road Station.

Month	Total Precipitation (inches)	Average Discharge, CFS *(mean for all years)*
October	4.59	9.05 *(15.72)*
November	6.20	18.57 *(44.14)*
December	10.70	77.25 *(53.51)*

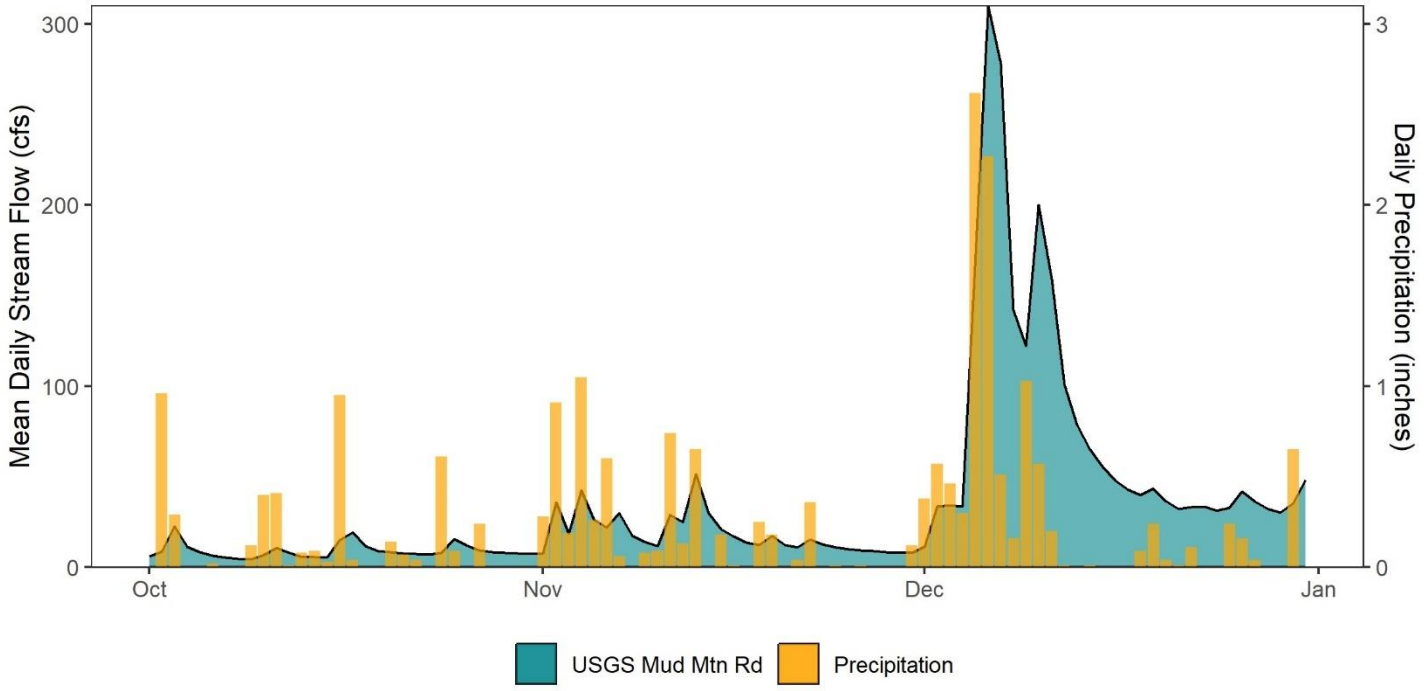

Figure 3. Mean daily stream flow (preliminary data from USGS site 12099600[2]) and daily precipitation (data from King County site 44u[3]) at Boise Creek at Mud Mountain Road station from October 1-December 31, 2023.

[2] https://waterdata.usgs.gov/wa/nwis/uv/?site_no=12099600&PARAmeter_cd=00060,00065
[3] 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. During Quarter 2 of Year 5 none of the sites fully met these targets, and the following narrative will focus on the state water quality standards using *E. coli* mentioned above.

During the second quarter of Year 5 the only sites to meet both components of the water quality criteria for *E. coli* were the two sites located on the Enumclaw Golf Course, Boise_G1 and Boise_G2, and two stations on the south fork of Pussyfoot Creek, Psyft_I2 and Psyft_I3. The two Boise Creek stations are located upstream of almost all developed areas in the Enumclaw plateau (Figure 1). The locations Psyft_I4 and Psyft_I1 are upstream and downstream, respectively, of Psyft_I2 and Psyft_I3. Psyft_I4 did not meet either component of the water quality criteria. This site has lower flows than Psyft_I3, and the decrease in levels at Psyft_I3 may reflect dilution between stations, a sign that flows entering between these sites is likely meeting criteria.

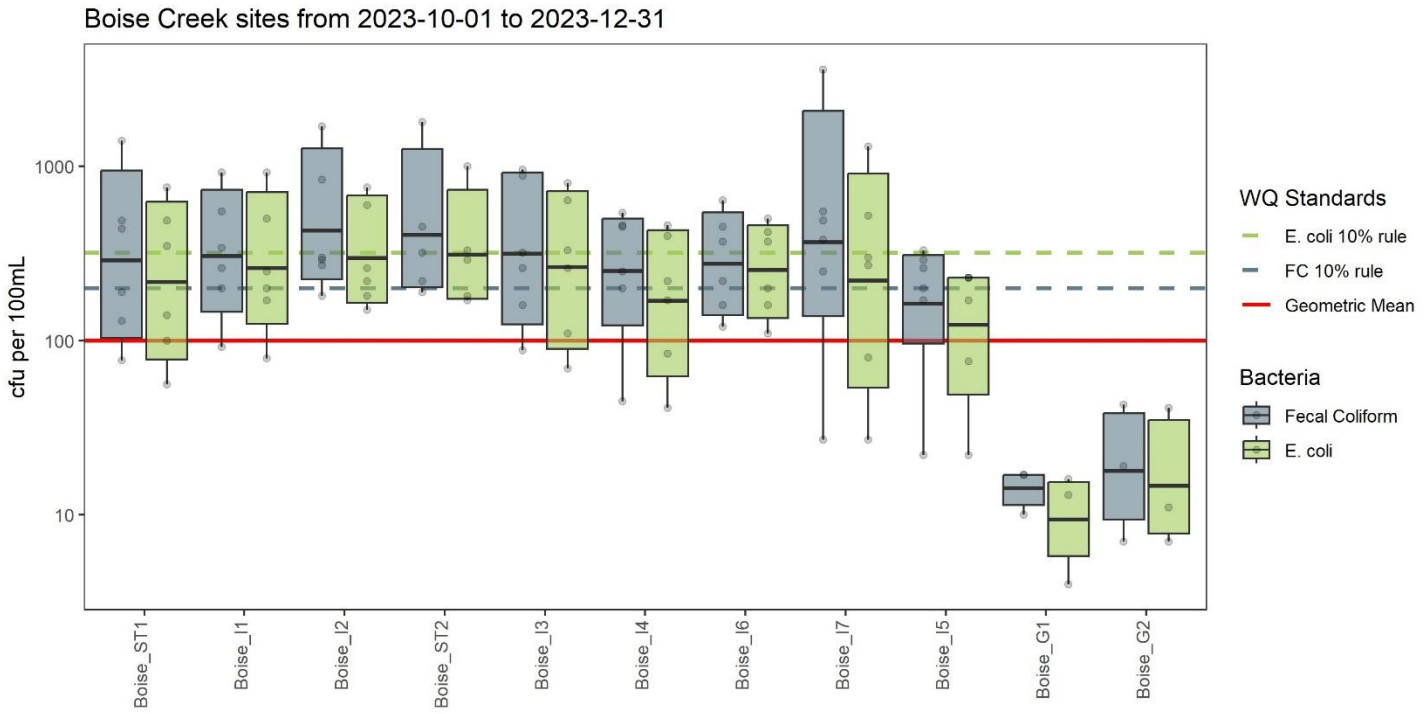

Figure 4. Bacteria levels in Boise Creek from October through December of 2023 with geometric mean (black solid line in boxplot) and 90th percentile (top of colored boxes). Water quality standards displayed as horizontal lines. Sites are ordered from downstream to upstream, left to right.

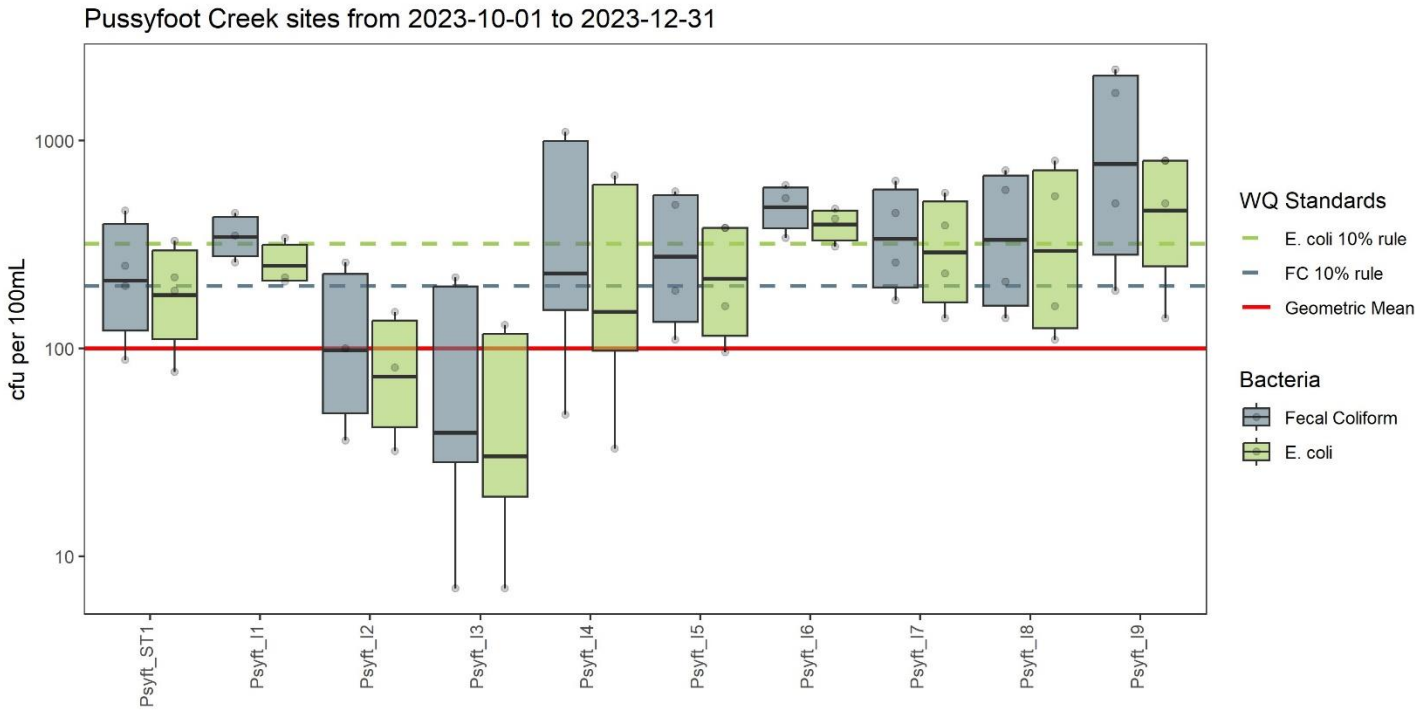

Figure 5. Bacteria levels in Pussyfoot Creek from October through December of 2023 with geometric mean (black solid line in boxplot) and 90th percentile (top of colored boxes). Water quality standards displayed as horizontal lines. Sites are ordered from downstream to upstream, left to right.

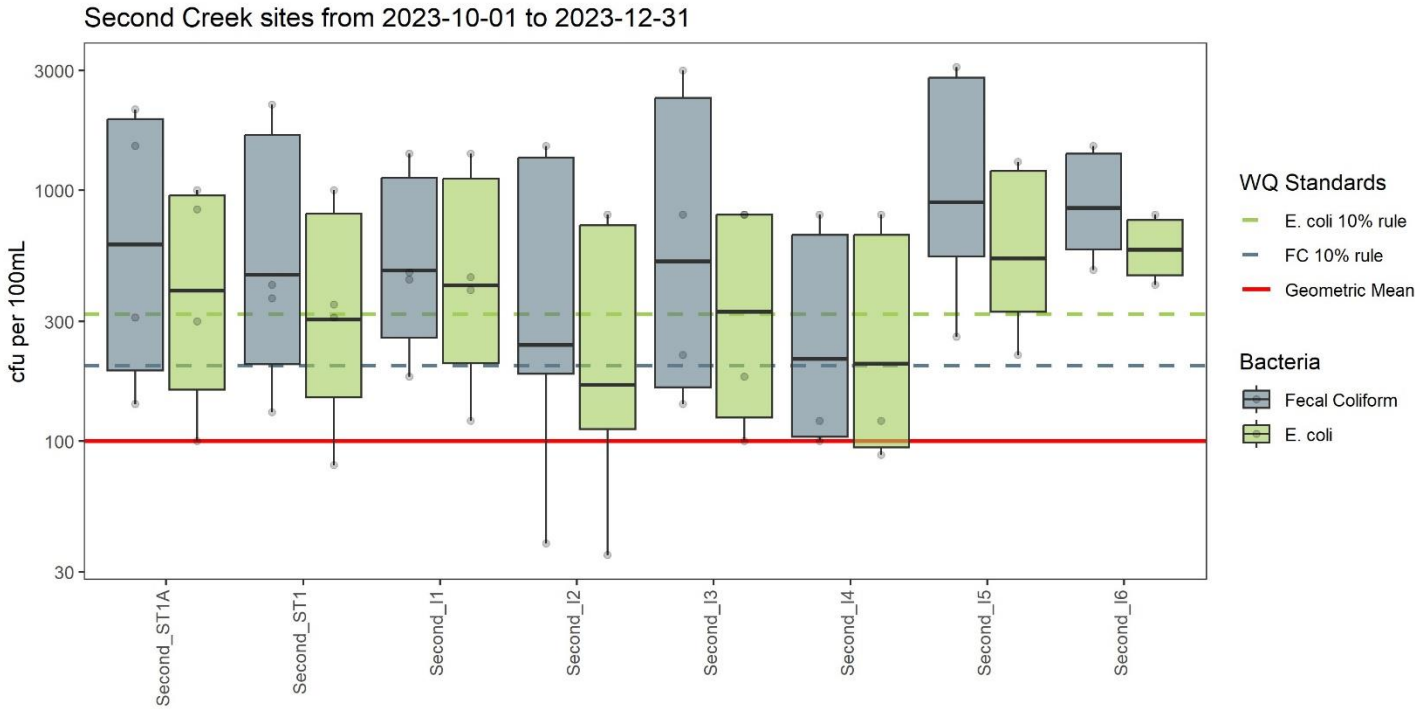

Figure 6. Bacteria levels in Second Creek from October through December of 2023 with geometric mean (black solid line in boxplot) and 90th percentile (top of colored boxes). Water quality standards displayed as horizontal lines. Sites are ordered from downstream to upstream, left to right.

Nutrients

Nutrient data was only collected at the downstream Status and Trends location in the Boise Creek watershed during the month of October, due to stagnant or dry conditions at the other Status and Trends sites. All four locations were sampled beginning in November. Second Creek mostly continues to show the highest concentrations of all nutrient parameters measured, followed by Pussyfoot Creek (Figures 8-10). Boise Creek showed a downward trend of concentrations as the wet season picked up, but with increased flow, loading remains high (Figure 7).

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 4 shows estimated loading rates of OP near the mouth of Boise Creek. Figure 4 also shows the sum of the applicable WLA and LA based on seasonality and flow in the White River. During the sampling event in October the estimated OP load greatly exceeded the allocation. No allocation is in place November through April. 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 4 is an estimate based on a snapshot concentration applied to the entire day, and is not considered a precise assessment of whether or not the applicable WLA is being met.

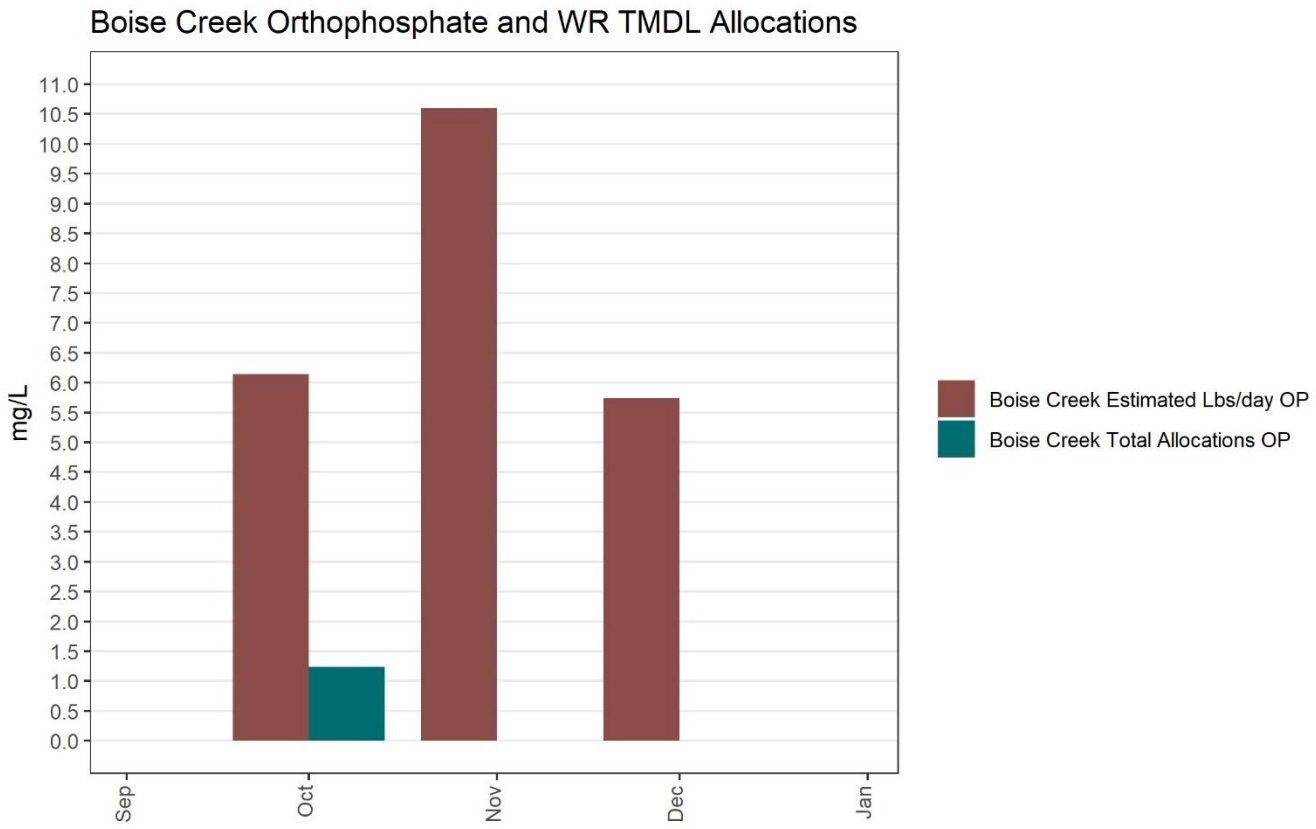

Figure 7. Estimated orthophosphate loading at Boise Creek during the second quarter of Year 5 compared to approximate White River TMDL load allocations for Boise Creek (Gray and Mathieu, 2022).

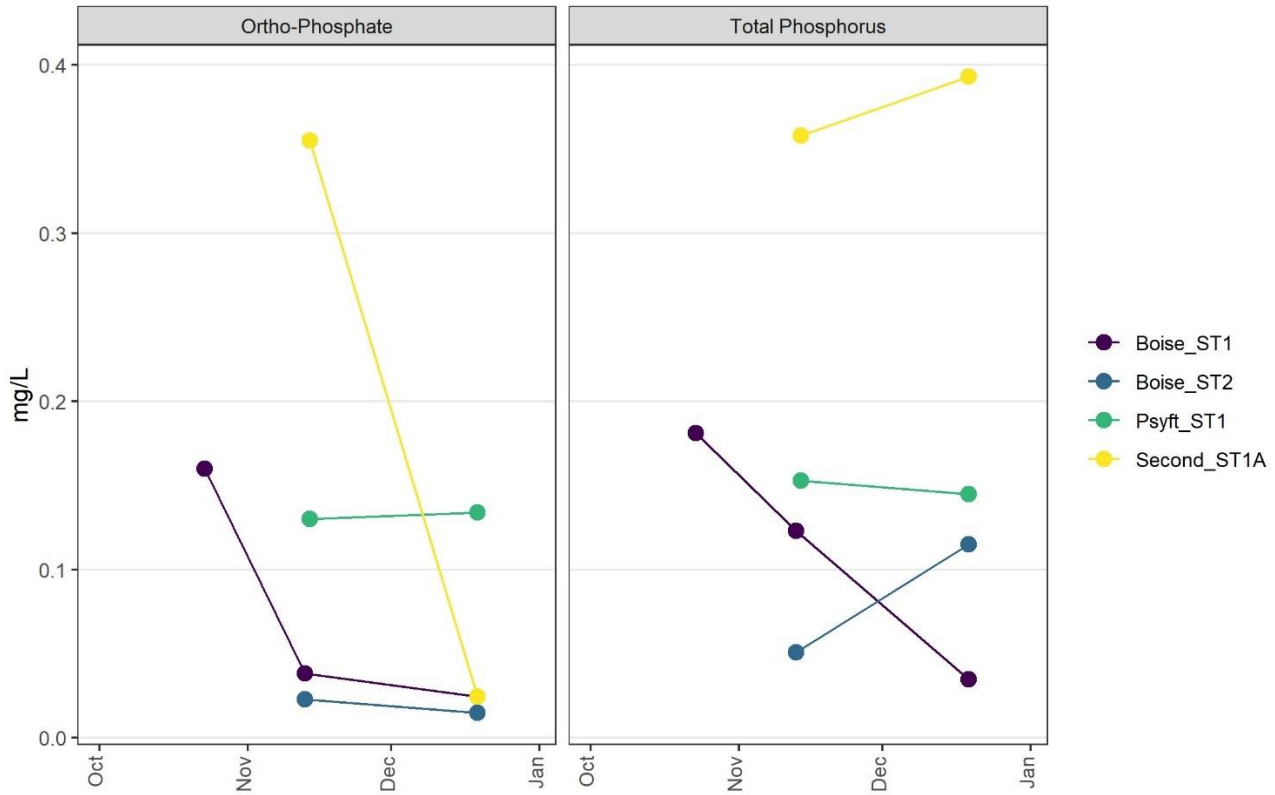

Figure 8. Concentration of monitored phosphorous species over time during the second quarter of Year 5.

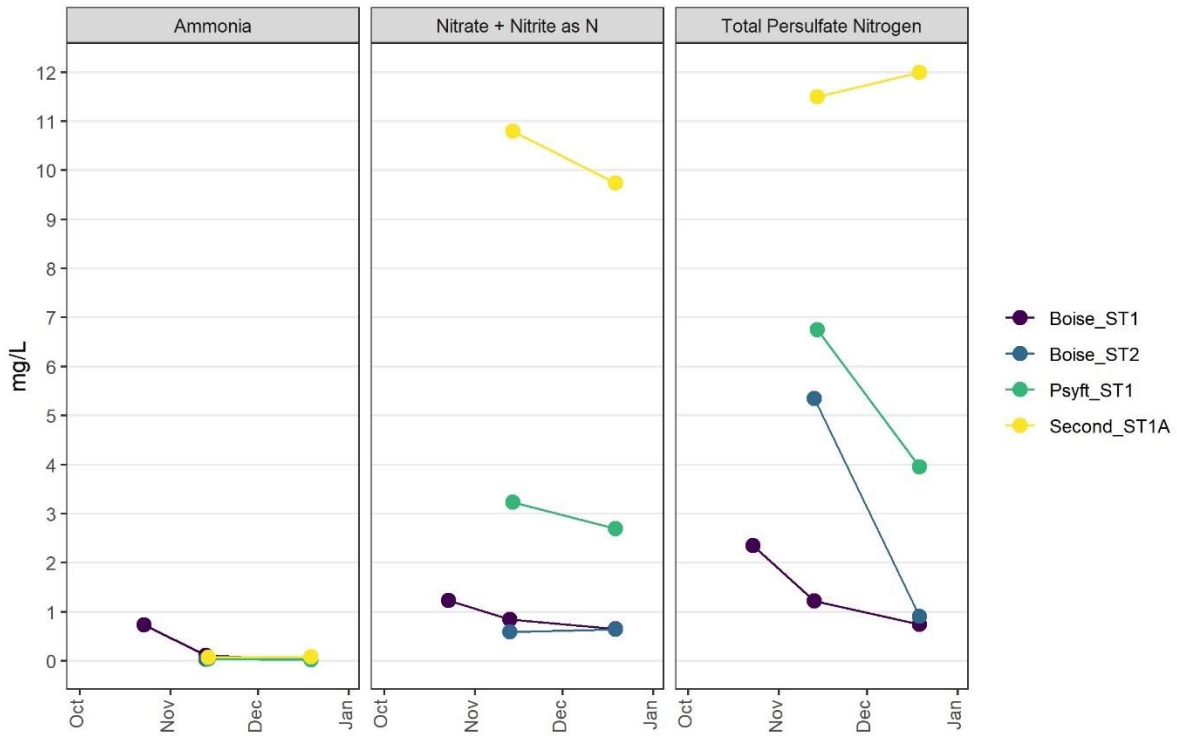

Figure 9. Concentration of monitored nitrogen species over time during the second quarter of Year 5.

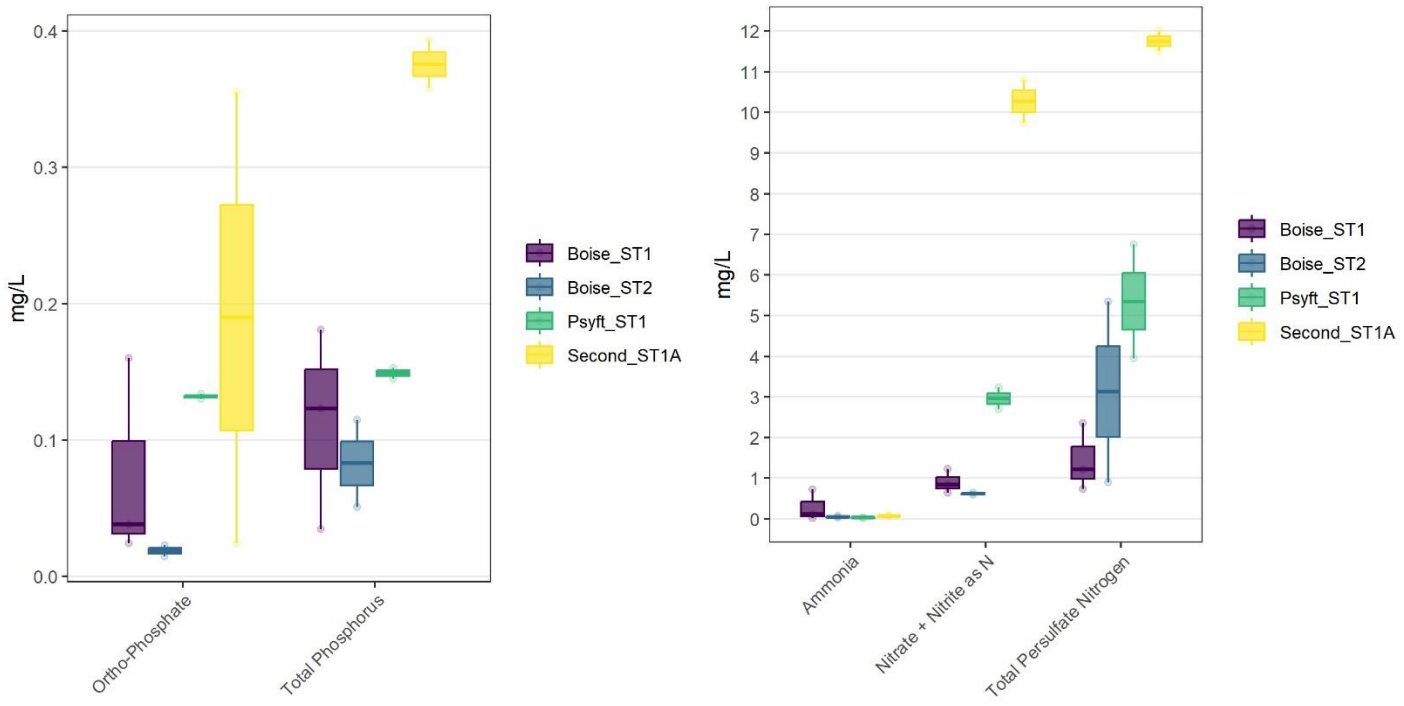

Figure 10. Box plots of phosphorous and nitrogen concentration with the median value represented as a solid line in the boxplot.

Water Quality Measurements

Turbidity

Turbidity continued to increase in Boise Creek downstream of the golf course (Figure 7). At the golf course values ranged from approximately 1-3 NTU, while the next downstream site, Boise_I5, ranged from approximately 2-15 NTU (median value of approximately 12 NTU). The restoration project on the golf course combined with a productive pink salmon run during the fall were likely contributing factors (salmon mobilize sediment while making redds). Pussyfoot creek had its highest turbidity levels at the most upstream site, Psyft_I9 (Figure 8), which also saw the highest levels of bacteria. Conversely, the lowest average turbidity levels observed were at Psyft_I2 and Psyft_I3, which had the lowest levels of bacteria in the Pussyfoot basin. Second Creek had consistently higher turbidity levels at the two most upstream sites, Second_I5 and Second_I6 (Figure 9), which also had the highest average levels of bacteria. On December 5, 2023, Second_I1 also had elevated turbidity (21.4 NTU), which coincided with the single highest level of *E. coli* from any Second Creek station during this period (1400 CFU/100mL).

Dissolved Oxygen

The only implementation station in Boise Creek to meet the dissolved oxygen criteria during all visits was Boise_G1 (Boise Creek at the golf course). Boise_B4, which is a source ID location measured only once during this period, also met the criteria. There were no sites within the Pussyfoot or Second Creek basins that met the criteria during all visits.

Temperature, Specific Conductivity, and pH

Continuous temperature data, which was not collected during this period, 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 stations with discrete measurements above the supplemental spawning criteria for temperature on Boise Creek (13°C 7DADMax, Sept 1-July 1) were Boise_G2 and Boise_ST2. However, neither of these stations are located on the Boise Creek mainstem and are therefor not subject to the supplemental criteria. These sites did not exceed the applicable criteria of 16° C 7DADMax. There were no measurements on either Pussyfoot or Second Creek that exceeded 16° C.

All pH measurements met water quality criteria (6.5 to 8.5 pH units) with the exception of Boise_I7, Psyft_I9, and Psyft_I8, with single instances measuring 6.48, 6.42, and 6.49 pH units, respectively.

Boise_G2, known as Chapel Springs, had consistently elevated specific conductivity, as did Boise_ST2, which drains stormwater from the City of Enumclaw, and to a lesser extent Boise_I6, also known as Beaver Creek. The north fork of the Pussyfoot Creek basin (Psyft_I5 through Psyft_I9) had consistently higher specific conductivity than the south fork (Psyft_I1 through Psyft_I4), and the north fork is also where bacteria levels are consistently higher, compared with the south fork. A clear trend of specific conductivity increasing at upstream sites was observed in the Second Creek basin, with notably higher values observed at Second_I6.

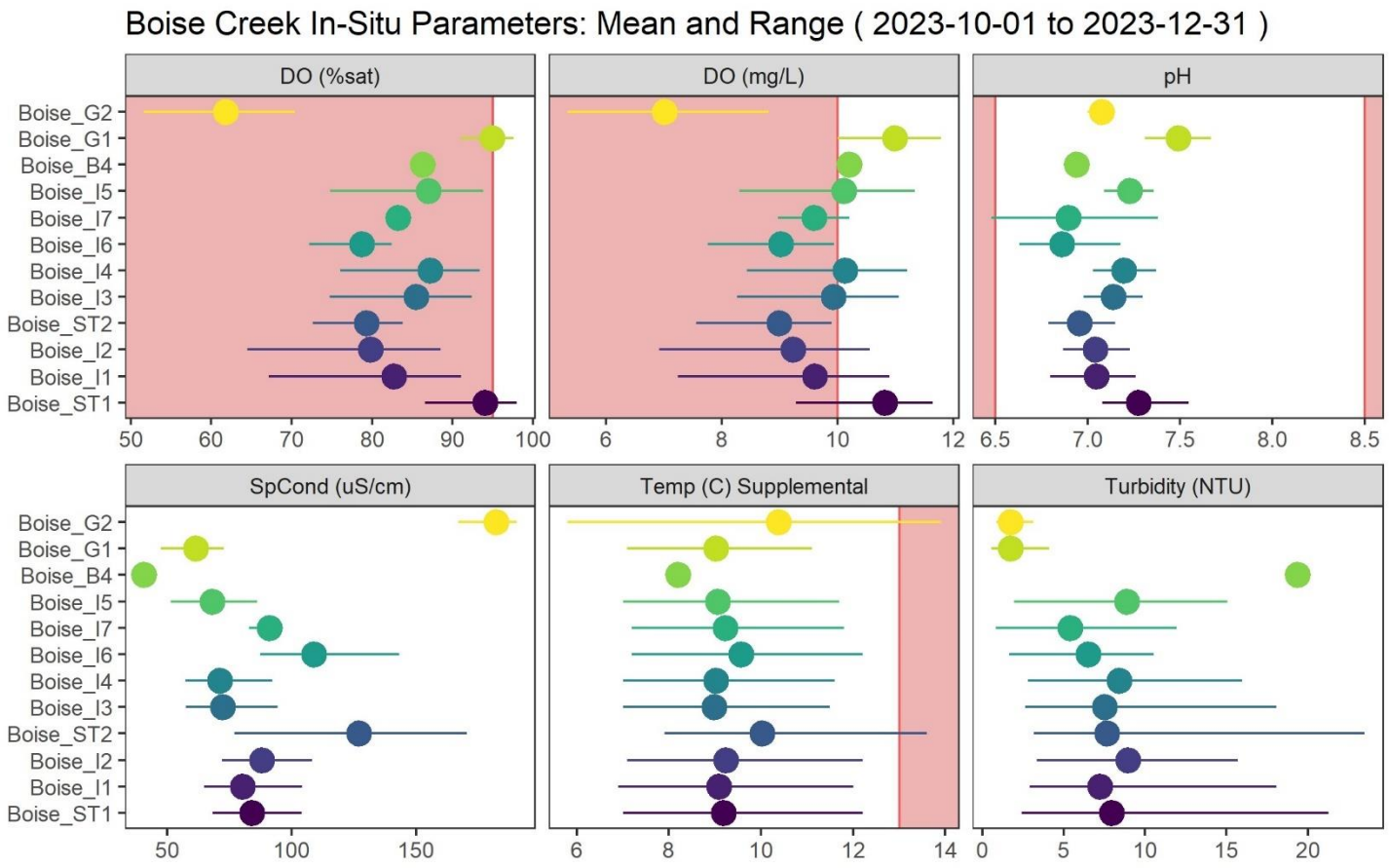

Figure 11. Boise in-situ measurement mean and range by parameter and site during the second quarter of Year 5 with water quality criteria marked in red, where applicable. Note the supplemental spawning criteria for Boise Creek from Sept 1-July 1 (13°C).

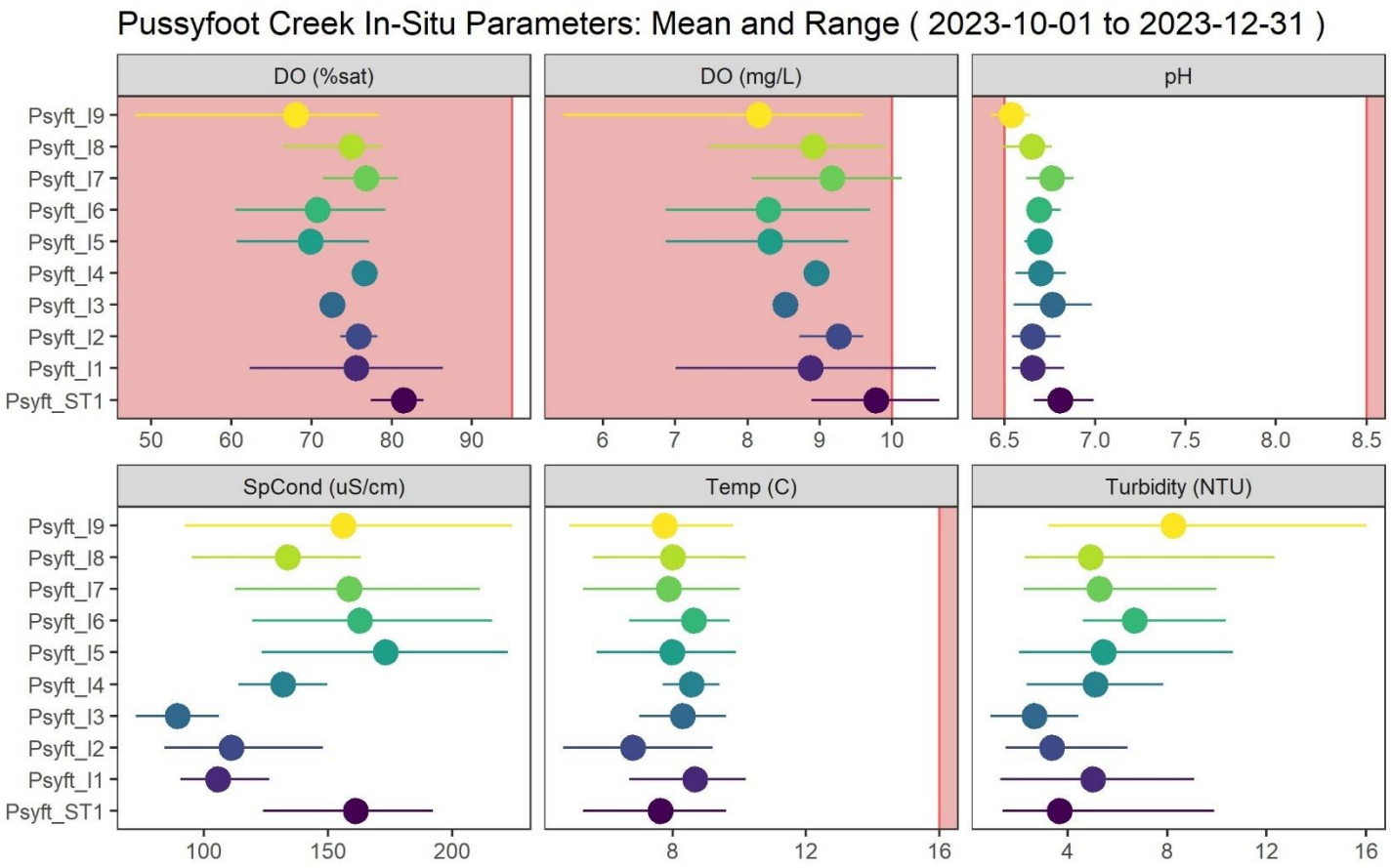

Figure 12. Pussyfoot Creek in-situ measurement mean and range by parameter and site during the second quarter of Year 5 with water quality criteria marked in red, where applicable.

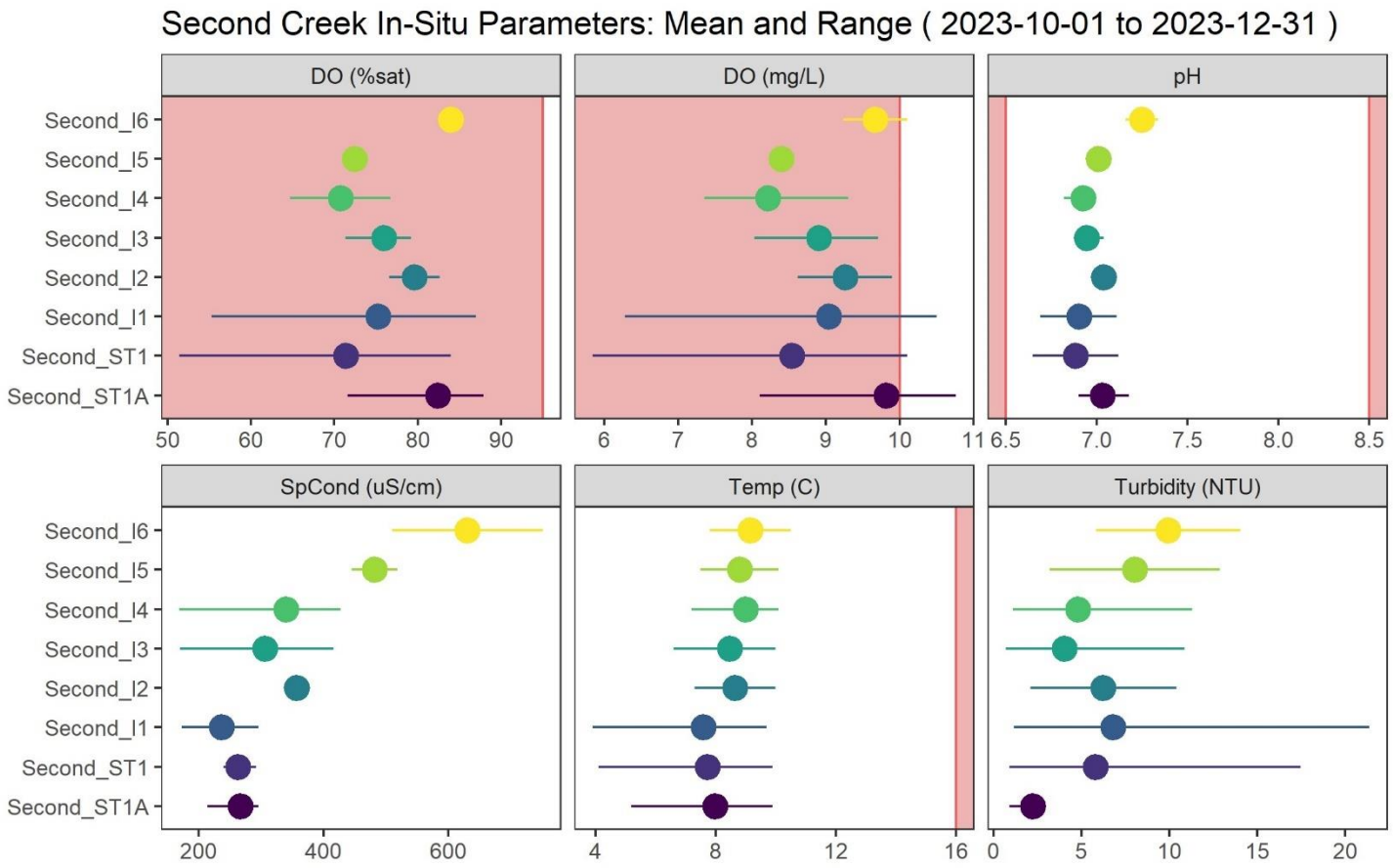

Figure 13. Second Creek in-situ measurement mean and range by parameter and site during the second quarter of Year 5 with water quality criteria marked in red, where applicable.

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. Preliminary results for all sites. Blank cells represent that a sample or measurement was not collected.

Study_Specific_Location_ID	Field_Collection_Start_Date	Field_Collection_Start_Time	Barometric pressure	Temperature, water	Dissolved Oxygen Percent Saturation	Dissolved Oxygen	Conductivity, Specific (at 25 deg C)	pH	Turbidity	E. coli	Fecal Coliform	Ammonia	Nitrate + Nitrite as N	Total Persulfate Nitrogen	Ortho-Phosphate	Total Phosphorus
Boise_ST2	10/10/2023	14:28:00	28.674	13.6	72.6	7.55	97.6	7.15	3.27	1000	1800					
Boise_ST1	10/10/2023	13:35:00	28.76	12.2	86.6	9.28	103.8	7.34	10.3	490	490					
Boise_I1	10/10/2023	13:52:00	28.674	12	67.2	7.24	91.8	7.16	5.72	500	550					
Boise_I3	10/10/2023	14:45:00	28.671	11.5	75.7	8.26	87.8	7.3	7.12	330	320					
Boise_I4	10/10/2023	14:57:00	28.659	11.6	79.2	8.61	86.6	7.37	8.44	170	200					
Boise_I5	10/10/2023	15:48:00	28.636	11.7	79.4	8.61	82	7.36	13.46	230	290					
Boise_G2	10/10/2023	16:14:00	28.6	13.9	51.6	5.33	187	7.08	1.42	7	7					
Boise_G1	10/10/2023	16:24:00	28.6	11.1	90.9	10	72.7	7.67	1.13	16	17					
Boise_I2	10/10/2023	14:10:00	28.674	12.2	64.5	6.92	93.3	7.16	6.34	760	1700					
Boise_I7	10/10/2023	15:26:00	28.624	11.8	82.8	8.97	95.6	7.37	4.52	1300	3600					
Boise_I6	10/10/2023	15:36:00	28.627	12.2	72.2	7.75	116.3	6.99	1.68	370	370					
Boise_B1	10/10/2023	15:10:00								110	160					
Boise_ST1	10/23/2023	13:10:00	29.327	10.9	92.1	10.18	104	7.55	3.46	100	130	0.729	1.23	2.35	0.16	0.181
Boise_I1	10/23/2023	14:00:00	29.226	10.9	71	7.85	104.1	7.26	6.2	170	200					
Boise_I3	10/23/2023	14:55:00	29.221	10.7	74.7	8.28	94.4	7.29	5.68	110	160					
Boise_I4	10/23/2023	15:10:00	29.2	10.8	76	8.43	92.3	7.32	10.43	84	460					
Boise_I5	10/23/2023	15:25:00	29.203	10.7	74.8	8.3	86.1	7.27	11.79	230	260					
Boise_G1	10/23/2023	16:15:00	29.141	10.2	93.9	10.55	72.1	7.67	0.56	4	10					
Boise_G2	10/23/2023	16:30:00	29.15	13	56.6	5.96	190.3	7.14	0.87	41	43					
Boise_I2	10/23/2023	14:20:00	29.229	10.9	67.2	7.42	108.1	7.23	5.82	220	300					
Boise_I6	10/23/2023	15:35:00	29.179	11.7	74.4	8.07	143.2	7.18	6.06	110	120					
Boise_I7	10/23/2023	15:50:00	29.17	10.8	82.6	9.16	94.8	7.38	0.84	520	550					
Boise_ST2	11/7/2023	15:12:00	29.366	10.8	78.3	8.67	170.4	7.06	3.45	170	190					
Psyft_D1	11/7/2023	12:44:00								87	120					
Psyft_ST1	11/7/2023	11:09:00	29.531	9.6	81.3	9.26	192	6.69	1.4							
Psyft_I1	11/7/2023	11:29:00	29.501	10.2	62.3	7.01	126.3	6.54	1.3	340	450					
Second_I1	11/7/2023	11:40:00	29.495	9.7	55.3	6.28	296	6.69	2.31	450	470					
Second_I3	11/7/2023	12:14:00	29.46	10	75	8.47	170.3	6.9	1.38	800	800					
Second_I4	11/7/2023	12:24:00	29.46	9.7	64.7	7.36	169.2	6.82	1.12	120	120					
Psyft_I5	11/7/2023	13:15:00	29.539	9.9	60.7	6.87	222.4	6.61	5.18	380	490					
Psyft_I6	11/7/2023	13:21:00	29.542	9.7	60.5	6.87	215.9	6.62	5.07	470	530					
Psyft_I8	11/7/2023	13:40:00	29.516	10.2	66.5	7.47	152.2	6.62	2.67	540	580					

Boise_I4	11/7/2023	15:00:00	29.335	8.8	89.9	10.43	59.5	7.17	10	400	450					
Boise_I3	11/7/2023	15:05:00	29.354	8.9	88.4	10.25	60.3	7.09	8.12	640	960					
Boise_ST1	11/7/2023	15:22:00	29.472	9.2	98	11.04	72.2	7.41	7.2	140	190					
Boise_I1	11/7/2023	15:30:00	29.386	9	87.5	10.11	68.1	7.1	7.34	200	260					
Psyft_ST1	11/7/2023	11:04:00								220	250					
Boise_I5	11/7/2023	14:35:00								170	200					
Second_ST1	11/7/2023	11:38:00	29.501	9.7	51.4	5.84	275.5	6.65	2.92	350	420					
Second_ST1A	11/7/2023	11:56:00	29.528	9.9	71.6	8.1	268.8	6.9	2.96	1000	1500					
Psyft_I7	11/7/2023	13:30:00	29.542	10	71.4	8.06	210.9	6.72	3.6	390	450					
Psyft_I9	11/7/2023	13:53:00	29.516	9.8	48.1	5.45	223.9	6.42	9.03	800	2200					
Boise_I6	11/7/2023	14:45:00	29.307	9.8	80.8	9.16	117	7	10.49	200	220					
Boise_I2	11/7/2023	15:40:00	29.382	9.2	85.8	9.88	77	7.11	6.76	260	290					
Boise_I7	11/7/2023	14:50:00								80	250					
Boise_ST2	11/13/2023	12:42:00	29.288	9.7	79.4	9.03	161.5	6.94	3.18	180	220	0.03	0.593	5.35	0.0229	0.0509
Boise_ST1	11/13/2023	11:30:00	29.383	8.2	96.3	11.34	68.2	7.17	21.28	350	440	0.115	0.839	1.22	0.0383	0.123
Boise_I1	11/13/2023	12:15:00	29.294	8.1	90.6	10.7	64.8	7.01	18.07	250	340					
Boise_I3	11/13/2023	13:00:00	29.277	8.1	90.6	10.7	57.6	7.05	18.06	260	260					
Boise_I4	11/13/2023	13:30:00	29.259	8.2	92.7	10.92	57.4	7.03	15.94	220	250					
Boise_I5	11/13/2023	14:10:00	29.256	8.1	93.8	11.09	51.5	7.12	15.06	230	330					
Boise_G2	11/13/2023	14:25:00	29.223	8.8	68.5	7.94	184.4	7.09	3.12	11	19					
Boise_G1	11/13/2023	14:35:00	29.221	7.7	97.6	11.63	47.4	7.32	4.12	13	17					
Boise_I2	11/13/2023	12:25:00	29.286	8.3	88.5	10.42	72.1	6.99	15.62	180	270					
Boise_I7	11/13/2023	13:45:00	29.226	8.9	83.1	9.61	89.2	6.51	11.92	300	380					
Boise_I6	11/13/2023	14:00:00	29.238	9.1	80.4	9.29	92.4	6.63	10.52	420	450					
Boise_B15	11/13/2023	13:50:00								800	920					
Psyft_ST1	11/14/2023	10:05:00	29.539	5.3	84	10.65	175.8	6.99	1.58	77	88	0.037	3.23	6.75	0.13	0.153
Second_I1	11/14/2023	10:40:00	29.48	3.9	78.2	10.26	245.8	6.99	1.18	120	180					
Psyft_I2	11/14/2023	12:15:00	29.407	4.7	73.6	9.46	147.8	6.54	1.52	81	100					
Psyft_I5	11/14/2023	12:25:00	29.433	5.7	69.8	8.76	189.5	6.76	2.06	96	110					
Psyft_I8	11/14/2023	13:00:00	29.392	5.6	78.8	9.9	163.2	6.76	2.46	160	210					
Second_I3	11/14/2023	13:55:00	29.368	6.6	79.2	9.71	229	6.91	0.7	180	220					
Second_ST1A	11/14/2023	9:40:00	29.522	5.2	84.7	10.76	295.5	7.15	0.9	100	140	0.066	10.8	11.5	0.355	0.358
Second_ST1	11/14/2023	10:30:00	29.477	4.1	70.6	9.22	239.4	6.89	0.91	80	130					
Psyft_I7	11/14/2023	12:45:00	29.421	5.3	80	10.13	167.4	6.88	2.23	140	170					
Psyft_I9	11/14/2023	13:20:00	29.386	4.9	70.8	9.06	183	6.54	4.71	500	500					
Boise_ST2	12/4/2023	12:42:00	29.144	7.9	82.3	9.78	128.5	6.79	4.86							
Boise_ST1	12/4/2023	11:58:00	29.226	7	95.8	11.64	82.9	7.08	3.06							
Boise_I1	12/4/2023	12:12:00	29.141	6.9	89.1	10.83	77.3	6.8	3.17							
Boise_I3	12/4/2023	12:52:00	29.132	7	91.1	11.06	68.1	6.98	2.65							
Boise_I4	12/4/2023	13:18:00	29.114	7	92.2	11.18	66.4	7.07	2.83							
Boise_I5	12/4/2023	13:54:00	29.082	7	93.4	11.33	58.8	7.09	1.95							
Boise_G2	12/4/2023	14:17:00	29.049	5.8	70.4	8.8	166.7	7	1.5							
Boise_G1	12/4/2023	14:28:00	29.043	7.1	97.2	11.78	53.8	7.31	1.19							
Boise_I2	12/4/2023	12:28:00	29.138	7.1	87.2	10.55	86.8	6.87	3.37							

Boise_I7	12/4/2023	13:36:00	29.079	7.2	83.1	10.02	93.2	6.48	5.5							
Boise_I6	12/4/2023	14:00:00	29.07	7.2	82.4	9.94	97.2	6.63	6.4							
Boise_ST2	12/5/2023	14:44:00								330	450					
Psyft_ST1	12/5/2023	11:52:00	29.406	9.2	77.4	8.89	123.8	6.66	9.89	330	460					
Psyft_I1	12/5/2023	11:59:00	29.362	9.1	78	8.99	90.5	6.59	4.67	210	350					
Second_I1	12/5/2023	12:06:00	29.346	9.7	80.4	9.13	173	6.83	21.36	1400	1400					
Second_I2	12/5/2023	12:07:00	29.346	10	76.6	8.62	372.9	6.97	10.42	800	1500					
Second_I3	12/5/2023	12:40:00	29.299	10	71.3	8.03	409.9	6.93	10.87	800	3000					
Second_I4	12/5/2023	12:41:00	29.311	10.1	70.9	7.98	423.9	6.96	11.3	800	800					
Psyft_I2	12/5/2023	13:35:00	29.343	9.2	75.7	8.72	84.2	6.61	6.4	150	260					
Psyft_I5	12/5/2023	13:40:00	29.374	9.5	71.8	8.21	123.2	6.64	10.64	380	570					
Psyft_I6	12/5/2023	13:42:00	29.374	9.5	72.6	8.28	119.4	6.64	10.37	420	610					
Psyft_I8	12/5/2023	13:55:00	29.354	9.4	75.8	8.67	95.2	6.49	12.31	800	720					
Boise_I5	12/5/2023	14:20:00								76	170					
Boise_I4	12/5/2023	14:35:00								460	540					
Boise_I3	12/5/2023	14:40:00								800	880					
Boise_ST1	12/5/2023	14:50:00								760	1400					
Boise_I1	12/5/2023	14:56:00								920	920					
Second_ST1	12/5/2023	12:05:00	29.346	9.9	79.5	9	246.8	6.88	17.48	1000	2200					
Second_ST1A	12/5/2023	12:22:00	29.374	9.8	85.6	9.7	214.2	6.91	42.49	840	2100					
Second_I5	12/5/2023	12:55:00	29.299	10.1	73.7	8.29	445	6.96	12.88	1300	3100					
Second_I6	12/5/2023	12:56:00	29.311	10.5	82.9	9.24	509.4	7.16	14.03	800	1500					
Psyft_I4	12/5/2023	13:05:00	29.268	9.4	76.8	8.8	113.8	6.56	7.85	680	1100					
Psyft_I3	12/5/2023	13:26:00	29.295	9.6	74.1	8.44	72.6	6.55	4.42	130	220					
Psyft_I7	12/5/2023	13:49:00	29.37	9.4	75.2	8.6	112.5	6.62	9.98	560	640					
Psyft_I9	12/5/2023	14:00:00	29.335	9.6	74.8	8.52	92.4	6.55	16.01	800	1700					
Boise_I6	12/5/2023	14:25:00								500	640					
Boise_I7	12/5/2023	14:28:00								270	490					
Boise_I2	12/5/2023	15:00:00								600	840					
Boise_ST2	12/19/2023	11:40:00	28.776	8.1	83.8	9.9	77	6.84	23.49	290	320	0.064	0.638	0.904	0.0148	0.115
Boise_B4	12/19/2023	11:50:00	28.776	8.2	86.3	10.2	40.6	6.94	19.37	440	480					
Boise_ST1	12/19/2023	10:45:00	28.862	7.6	95.3	11.4	73.2	7.1	2.43	56	77	0.017	0.645	0.739	0.0244	0.0348
Boise_I1	12/19/2023	11:20:00	28.787	7.6	91.1	10.9	75.1	6.96	2.91	79	92					
Boise_I3	12/19/2023	11:56:00	28.772	7.7	92.4	11	66.2	7.14	3.58	69	88					
Boise_I4	12/19/2023	12:02:00	28.752	7.7	93.4	11.2	64.8	7.23	2.96	41	45					
Boise_I5	12/19/2023	12:22:00	28.74	7.8	93.7	11.2	62.4	7.31	2.14	22	22					
Psyft_ST1	12/19/2023	13:15:00	29.039	6.4	83.3	10.3	152.1	6.88	1.86	190	200	0.023	2.69	3.95	0.134	0.145
Psyft_I1	12/19/2023	13:26:00	29	6.7	86.4	10.6	100.1	6.83	9.09	220	260					
Second_I1	12/19/2023	13:36:00	28.996	7.1	87	10.5	234.1	7.11	2.35	400	440					
Second_I2	12/19/2023	13:37:00	28.996	7.3	82.6	9.9	341.7	7.11	2.1	35	39					
Second_I3	12/19/2023	13:50:00	28.957	7.3	78.2	9.4	415.5	7.04	3.24							
Second_I4	12/19/2023	13:53:00	28.953	7.2	76.7	9.3	426.9	7	2.05	88	100					
Psyft_I2	12/19/2023	14:34:00	29.008	6.5	78.2	9.6	101.2	6.81	2.18	32	36					
Psyft_I5	12/19/2023	14:41:00	29.039	6.8	77.2	9.4	157	6.76	3.9	160	190					

Psyft_I6	12/19/2023	14:45:00	29.039	6.7	79.2	9.7	152.5	6.81	4.62	310	340					
Psyft_I8	12/19/2023	14:55:00	29.024	6.8	78.8	9.6	123.6	6.73	2.29	110	140					
Second_I3	12/19/2023	13:56:00								100	140					
Boise_I2	12/19/2023	11:30:00	28.78	7.7	85.7	10.2	90.1	6.89	15.72	150	180					
Boise_I7	12/19/2023	12:08:00	28.728	7.4	84.7	10.2	82.8	6.75	4.27	27	27					
Boise_I6	12/19/2023	12:13:00	28.732	7.4	82.1	9.9	87.4	6.74	4	160	160					
Second_ST1A	12/19/2023	13:02:00	29.016	7	87.9	10.7	288.9	7.18	2.83	300	310	0.08	9.74	12	0.0244	0.393
Second_ST1	12/19/2023	13:35:00	28.992	7.2	84	10.1	292.1	7.12	1.92	310	370					
Second_I5	12/19/2023	14:00:00	28.957	7.5	71.2	8.5	518.2	7.06	3.22	220	260					
Second_I6	12/19/2023	14:04:00	28.957	7.8	85.1	10.1	750.7	7.34	5.84	420	480					
Psyft_I4	12/19/2023	14:10:00	28.921	7.7	76.4	9.1	149.6	6.84	2.36	33	48					
Psyft_I3	12/19/2023	14:20:00	28.957	7	71	8.6	106	6.98	0.89	7	7					
Psyft_I7	12/19/2023	14:48:00	29.035	6.8	80.8	9.9	142.4	6.82	616.34							
Psyft_I9	12/19/2023	15:05:00	29.016	6.7	78.4	9.6	125.3	6.64	3.23	140	190					
Psyft_I7	12/19/2023	14:43:00								230	260					

Table A2. Dates with total daily precipitation of at least 0.1 inches (data from King County site 44u[4]).

Date	Precipitation (inches)
10/2/2023	0.96
10/3/2023	0.29
10/9/2023	0.12
10/10/2023	0.4
10/11/2023	0.41
10/16/2023	0.95
10/20/2023	0.14
10/24/2023	0.61
10/27/2023	0.24
11/1/2023	0.28
11/2/2023	0.91
11/3/2023	0.19
11/4/2023	1.05
11/5/2023	0.26
11/6/2023	0.6
11/11/2023	0.74
11/12/2023	0.13
11/13/2023	0.65
11/15/2023	0.18
11/18/2023	0.25
11/19/2023	0.18
11/22/2023	0.36
11/30/2023	0.12
12/1/2023	0.38
12/2/2023	0.57
12/3/2023	0.46
12/4/2023	0.3
12/5/2023	2.62
12/6/2023	2.27
12/7/2023	0.51
12/8/2023	0.16
12/9/2023	1.03
12/10/2023	0.57
12/11/2023	0.2
12/19/2023	0.24
12/22/2023	0.11
12/25/2023	0.24
12/26/2023	0.16
12/30/2023	0.65

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

Contact information

Water Quality Program

Southwest Regional Office
Author: Julian Sammons
P.O. Box 47600
Olympia, WA 98504-7600
Phone: 360-584-2753

Related Information

- This report is available on the Puyallup Partnership webpage[5].
- Data for this project is available in Ecology's EIM Database,[6] Study ID: EFF_PRT.
- Data is displayed on Puyallup River Tributaries Effectiveness Monitoring StoryMap[7].
- Bacteria data is displayed on Whatcom Conservation District StoryMap[8].

ADA accessibility

The Department of Ecology is committed to providing people with disabilities access to information and services by meeting or exceeding the requirements of the Americans with Disabilities Act (ADA), Section 504 and 508 of the Rehabilitation Act, and Washington State Policy #188.

To request an ADA accommodation, contact Ecology by phone at 360-584-2753 or email at julian.sammons@ecy.wa.gov. For Washington Relay Service or TTY call 711 or 877-833-6341. Visit Ecology's website for more information.

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