Water Quality Monitoring Report: Columbia County Soil and Water Conservation District Water Quality Trend Monitoring Program 2017

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PROJECT OVERVIEW

Introduction

This monitoring program was established with the goal of creating a long-term trend monitoring network to characterize ambient water quality conditions for temperature, bacteria, and turbidity in the Clatskanie River, Beaver Creek, Milton Creek, and Scappoose River watersheds (Figure 1). The Oregon Department of Environmental Quality (ODEQ) will use these data to assess whether the Clatskanie River, Beaver Creek, Milton Creek, and Scappoose River watersheds are meeting water quality criteria for beneficial uses. The Columbia Soil and Water Conservation District (CSWCD), the Lower Columbia River Watershed Council, and the Scappoose Bay Watershed Council will use the long-term trend data as a baseline watershed condition for water quality and complement future monitoring data focused on restoration effectiveness.

Site Seclection

Monitored watersheds were selected based on areas of interest identified by the CSWCD. Specific sampling sites for continuous water temperature and grab sample turbidity were selected based on three factors: HUC 12 boundary, the presence of legacy ODEQ monitoring, and TMDL limited water bodies. HUC 12 boundaries divide the river or creek into discrete monitoring reaches to better define the water body to being monitored. Sampling defined reaches of the water body can identify landscape factors influencing water temperature. *E. coli* sampling was conducted in the lowest reaches of the watersheds to highlight both areas commonly accessed by humans for recreation (near urban centers) and to evaluate the cumulative condition of the water quality within in each watershed. When possible, sampling locations were also chosen based on prior ODEQ sampling sites nearby. Continuing to monitor ODEQ sampling sites augments existing monitoring data on previously TMDL limited water bodies and can help inform if changes have occurred over time. Alternatively, monitoring stations located in non TMDL limited waters were selected to help monitor if conditions in the watershed were unchanged.

The 13 monitoring sites chosen through this selection process provided a comprehensive overview of the four watersheds (Figure 2, Table 1). By monitoring the major tributary confluences, the CSWCD can observe differences and make comparisons of water quality conditions from the headwaters to the lower reaches. Overtime, this will allow the CSWCD to identify problem areas and assess where further monitoring and possible restoration activities are needed throughout the watersheds. Detailed monitoring site descriptions can be found in Appendix A.

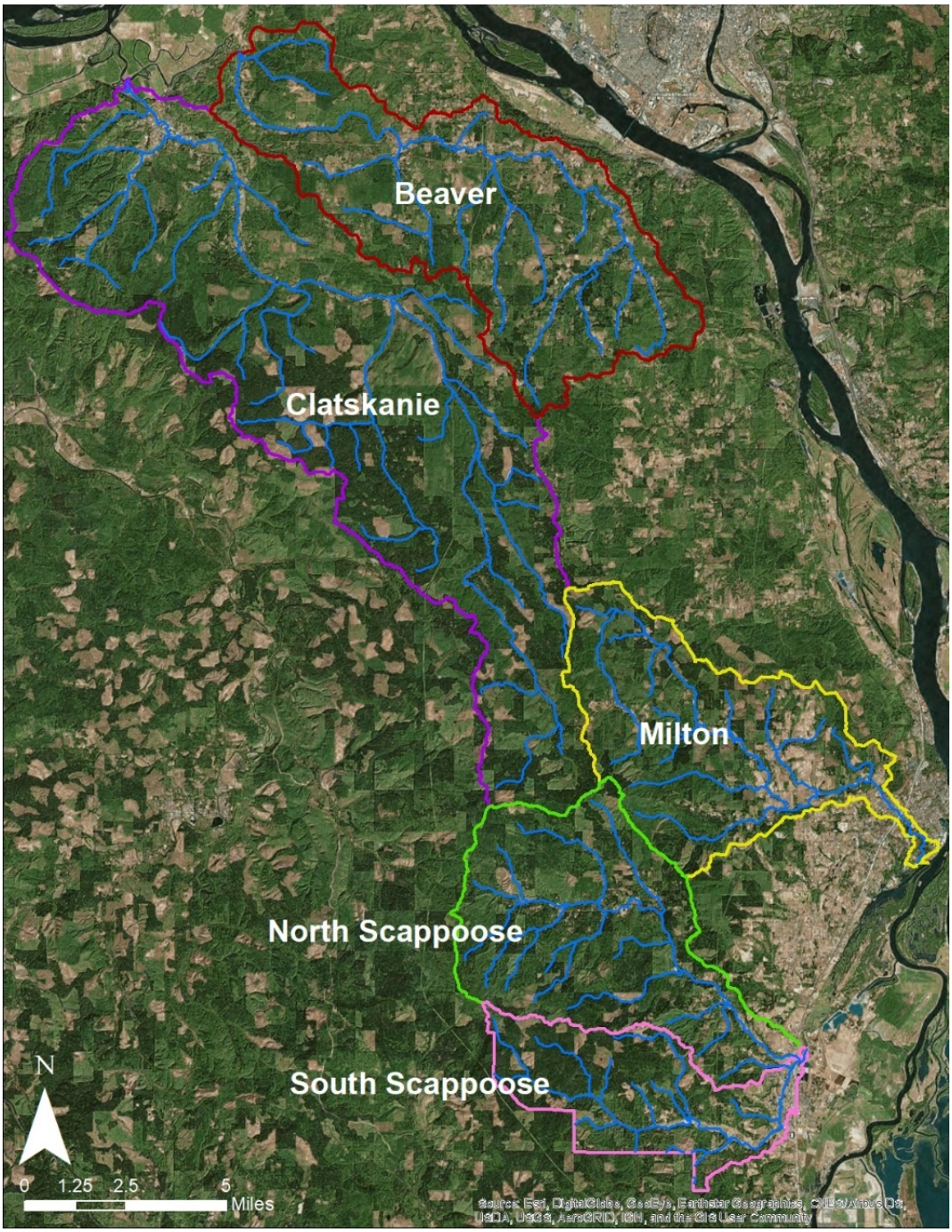

Figure 1: The Clatskanie River, Beaver Creek, Milton and Scappoose River watersheds are in Columbia County, Oregon, USA.

Table 1: Sampling Station Descriptions, Locations, and Parameters

ODEQ LASAR Station Number	Station Description	Latitude	Longitude	Parameter
	Clatskanie Watershed			
23539	Little Clatskanie River at Apiary Road	45.987971	-123.039261	Temperature
n/a	Headwaters Clatskanie River at Apiary Road	45.988035	-123.040453	Temperature
n/a	Clatskanie River upstream of Carcus Creek	46.040538	-123.080797	Temperature, E. Coli, Turbidity
23537	Carcus Creek at mouth (Clatskanie River tributary, River Mile 11.2)	46.040955	-123.084107	Temperature
34152	Clatskanie River above Keystone Creek (Columbia)	46.086429	-123.164433	Temperature
25603	Clatskanie River at RR Bridge	46.112284	-123.211451	Temperature, E. Coli, Turbidity
	Beaver Creek Watershed			
23535	Girt Creek at Beaver Spring Road (Beaver Creek tributary River Mile 16.6)	46.064726	-122.964486	Temperature, E. Coli, Turbidity
23526	Beaver Creek at Beaver Falls Road (Tidewater, upstream of Stewart Creek)	46.1193	-123.1628	Temperature, E. Coli, Turbidity
	Milton Creek Watershed			
n/a	Cox Creek South Of Yankton School (Yankton)	45.859126	-122.879343	Temperature, E. Coli, Turbidity
n/a	Milton Creek at Boise Cascade (River Mile 0.8)	45.8478	-122.8102	Temperature, E. Coli, Turbidity
	North Scappoose Creek			
n/a	North Scappoose Creek below Alder Creek	45.820583	-122.945106	Temperature, E. Coli, Turbidity
23566	Scappoose Creek - North Scappoose Creek at Hwy 30	45.7713	-122.8789	Temperature, E. Coli, Turbidity
	South Scappoose Creek			
23579	Scappoose Creek - South Scappoose Creek at Bankston Road	45.7456	-122.947	Temperature, E. Coli, Turbidity
n/a	Scappoose Creek - South Scappoose Creek at Hwy 30	45.7662	-122.8785	Temperature, E. Coli, Turbidity

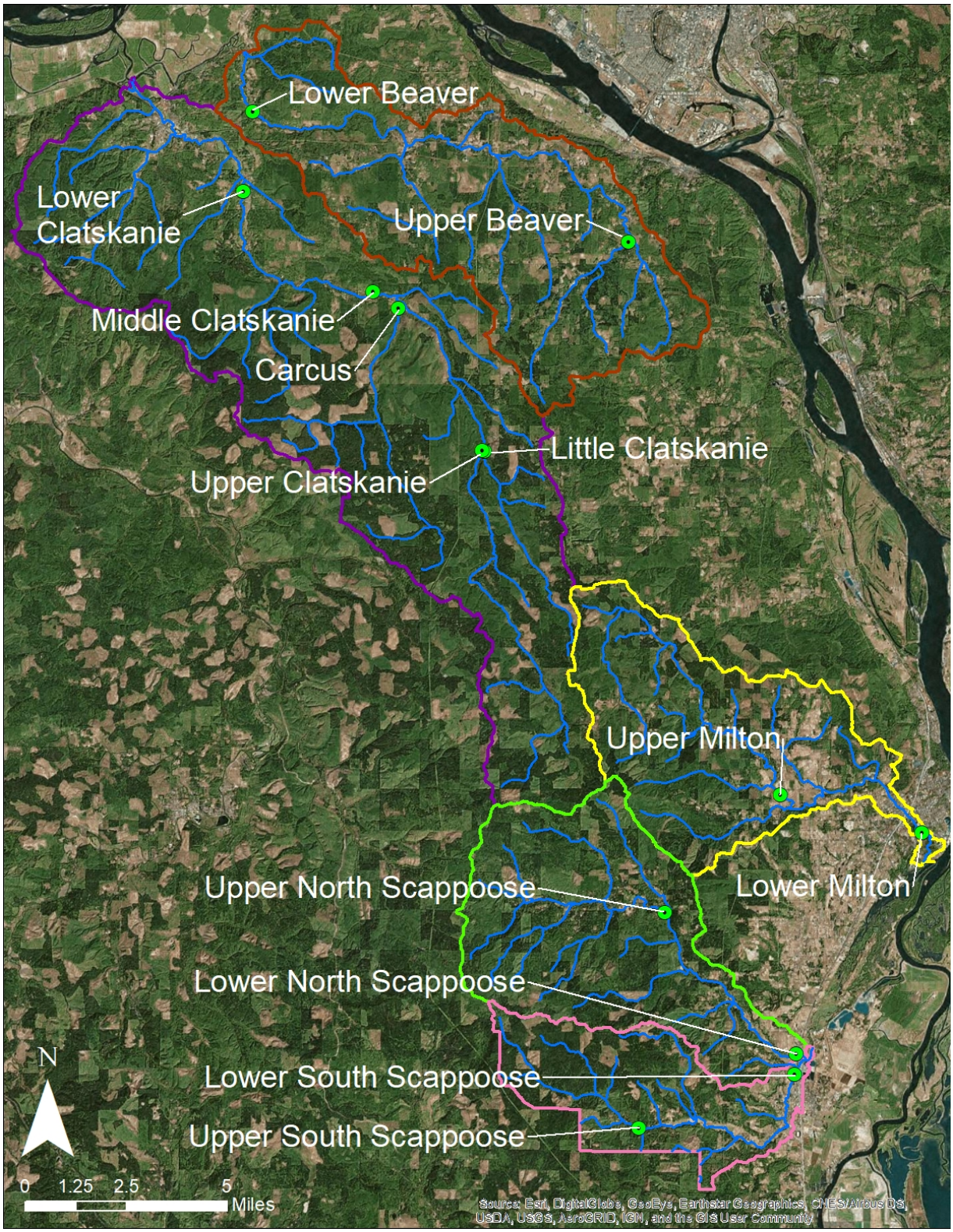

Figure 2: Map of water quality monitoring site locations

Watershed Descriptions

The Clatskanie River is approximately 26 miles in length and enters the Columbia River at river mile 50. The Clatskanie watershed is approximately 61,508 acres with 86% of landcover characterized as evergreen forest, shrub/scrub, or mixed forest and 6% of the landcover is characterized as developed (USGS 2012). The city of Clatskanie is at the confluence of Clatskanie and Columbia Rivers and in 2013 had a population of 1,745.

Beaver Creek is approximately 19 miles in length and enters the Columbia River at same location as the Clatskanie River at river mile 50. The Beaver Creek watershed is approximately 31,228 acres with 81% of landcover characterized as evergreen forest, shrub/scrub, or mixed forest and 8% of the landcover characterized as developed (USGS 2012).

The Scappoose Bay watershed contains Milton Creek, North Scappoose Creek, and South Scappoose Creek sub-watersheds. Milton Creek is approximately 20 miles in length and enters near the mouth of the Scappoose River. The Milton Creek watershed is approximately 20,674 acres with 81% of landcover characterized as evergreen forest, shrub/scrub, or mixed forest and 9% of the landcover characterized as developed (USGS 2012). The North Scappoose Creek and South Scappoose Creek are both 12 miles in length and enter the Columbia River via Scappoose Creek at Columbia River mile 86. The North Scappoose watershed is 20,555 acres which is predominately forested (91%) and 5% of the landcover characterized developed (USGS 2012). The South Scappoose Creek watershed is 17,388 acres with 83% of landcover characterized by evergreen forest, shrub/scrub, or mixed forest and 11% of the landcover characterized as developed (USGS 2012). Due to tidal influences, Scappoose Creek is not included in this study.

MONITORING METHODS

Water Quality Parameters

Water quality monitoring was conducted following the methods and quality assurance protocols laid out by the Oregon Department of Environmental Quality (ODEQ) for measuring water temperature, bacteria, and turbidity (ODEQ 2003). See Table 2 for specifics on equipment used and accuracy ranges of each parameter measured. Data loggers were deployed in July 2017 and water quality data and continuous water temperature collected monthly (approximately every 4 weeks) thereafter. Gaps in the monthly and/or continuous monitoring data during the study period occurred periodically due to technical difficulties and/or extreme weather events. All site location data was collected for mapping using a Ashtech Promark 220 GPS Unit.

Water Quality Data Analysis

Water quality data was summarized and compared to standard parameter ranges for ideal salmonid habitat as defined by the ODEQ, OWEB, and Environmental Protection Agency (EPA) (EPA 2001, OWEB 2001, ODEQ 2003). See Table 3 for a summary of the standard parameter ranges for salmonid habitat and general stream water quality used in this analysis. Data were summarized by sampling location and watershed. All water quality data analysis was conducted using R 3.4.1 and Microsoft Excel Software. Maps were prepared using ESRI ArcGIS Version 10.5.1.

Table 2: Water quality parameters measured, equipment used and accuracy standards (ODEQ A level data quality standards) (OWEB 2001).

Water Quality Parameter	Equipment	Accuracy
***E. coli* Bacteria Counts**	Lab Analysis	(+/-) 0.5 log (MPN/100ml)
Turbidity	Hach Turbidity Meter	(+/-) 5% of standard value (NTU)
Stream Water Temperature	HOBO Data Logger and NIST Digital Thermometer	(+/-) 0.5 °C

Table 3: Summary of standard parameter ranges for salmonid habitat and general stream water quality (EPA 2001, OWEB 2001, ODEQ 2003, UWE 2006).

Parameters	Need	Acceptable Range	Source
***E. coli* Bacteria**	**General**	<406 MPN/100ml (DEQ) or <235 MPN/100ml (EPA)	DEQ regulatory standards (OAR 340-041), EPA recommended Criteria
Turbidity	**Salmon Habitat**	<10 NTU	University of Wisconsin Extension 2006
Temperature	**Salmon Habitat: Year-round**	18°C 7-day moving average maximum (7dMAM)	DEQ regulatory standards for salmonid rearing habitat
Temperature	**Salmon Habitat: Healthy Adult**	7.2-15.6°C (>25 °C Lethal)	OWEB Water Quality Technical Manual
Temperature	**Salmon Habitat: Healthy Juvenile**	12.2-13.9°C (>25 °C Lethal)	OWEB Water Quality Technical Manual

WATER QUALITY MONITORING RESULTS

Clatskanie Watershed

Between July and October Upper Clatskanie and Carcus Creek 7-day average maximum temperatures (7dMAM) remained below the 18°C temperature threshold (year-round salmon rearing habitat maximum, Figure 3). In Little Clatskanie Creek and Middle Clatskanie temperatures exceeded 18°C in late July- Early August. The Lower mainstem Clatskanie river was only monitored from mid-August to early October and exceeded 18°C during August and early September (Figure 3). On average monthly temperatures for Carcus Creek, Little Clatskanie Creek, Upper Clatskanie, and Mid-Clatskanie River remained below 18°C during July-October (Figure 4).

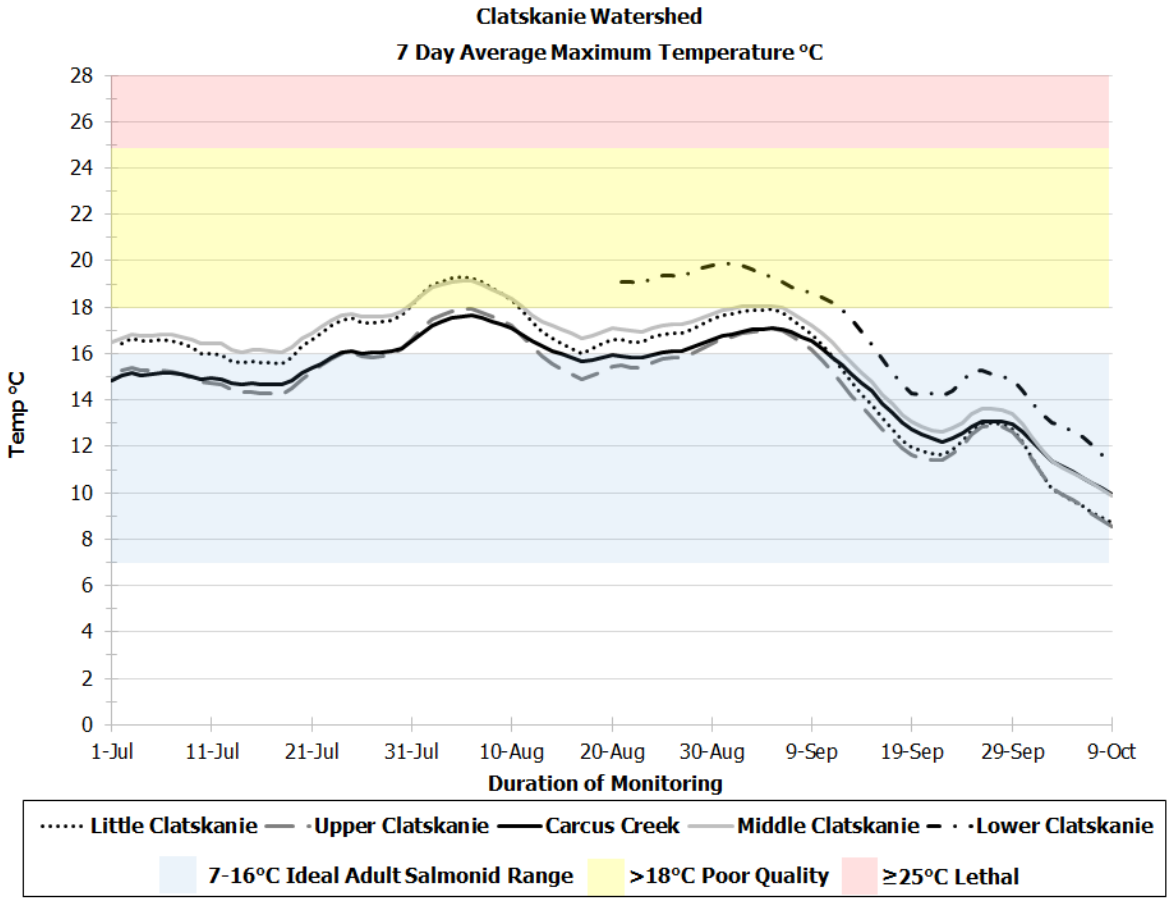

Figure 3: Clatskanie Watershed 7-day average maximum temperatures (7dMAM) from July to October 2017. See Table 3 for details on salmonid temperature thresholds.

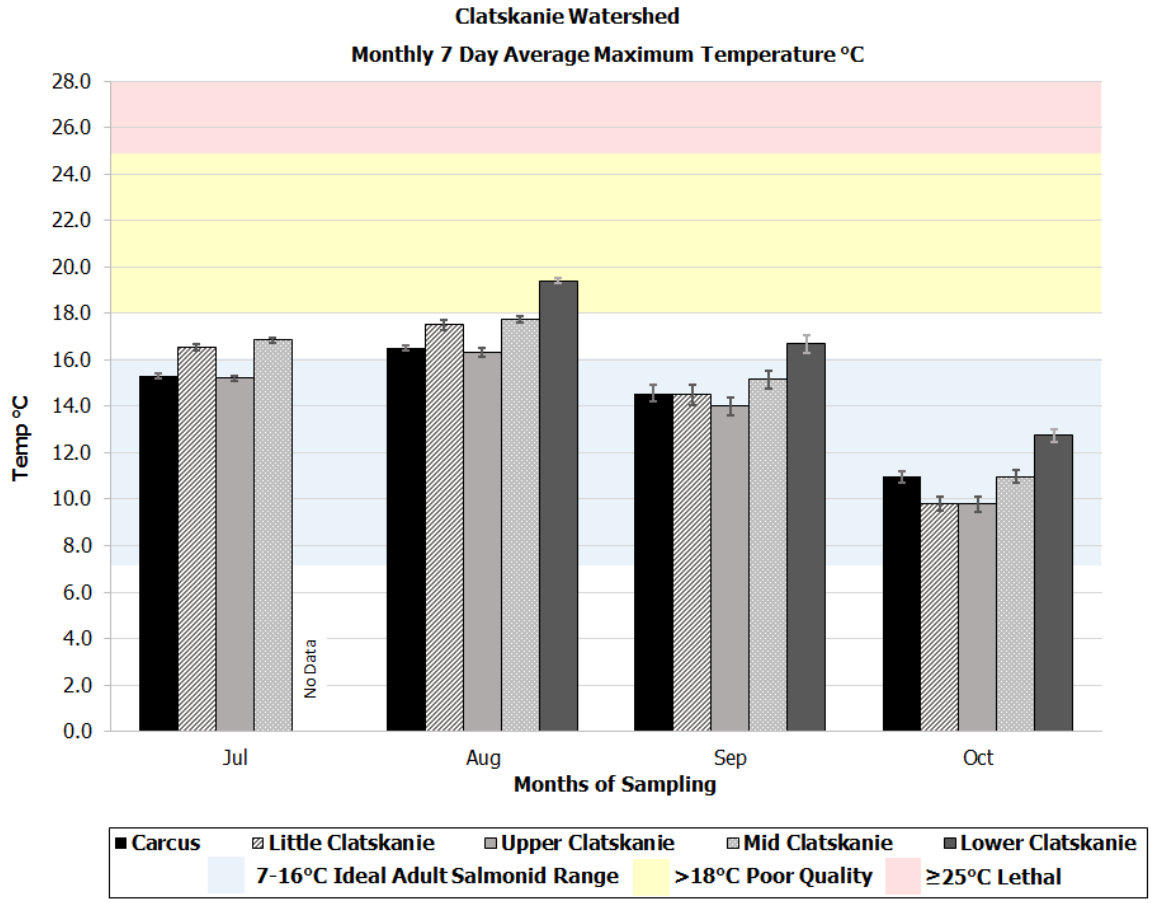

Figure 4: Clatskanie Watershed monthly mean 7-day average maximum temperatures (7dMAM) from July to October 2017. See Table 3 for details on salmonid temperature thresholds.

Carcus Creek, Little Clatskanie Creek, Upper Clatskanie, Mid-Clatskanie, and Lower Clatskanie River sampling locations had relatively low (< 4 NTUs) turbidity levels recorded between July and October 2017 (Figure 5). Across all sampling events Upper Clatskanie Creek showed elevated turbidity levels relative to the other sample locations, except Little Clatskanie Creek in September which also exhibited an elevated turbidity relative to the other sites monitored (Figure 5). All sites remained below the 10 NTU salmon habitat turbidity threshold during the study period.

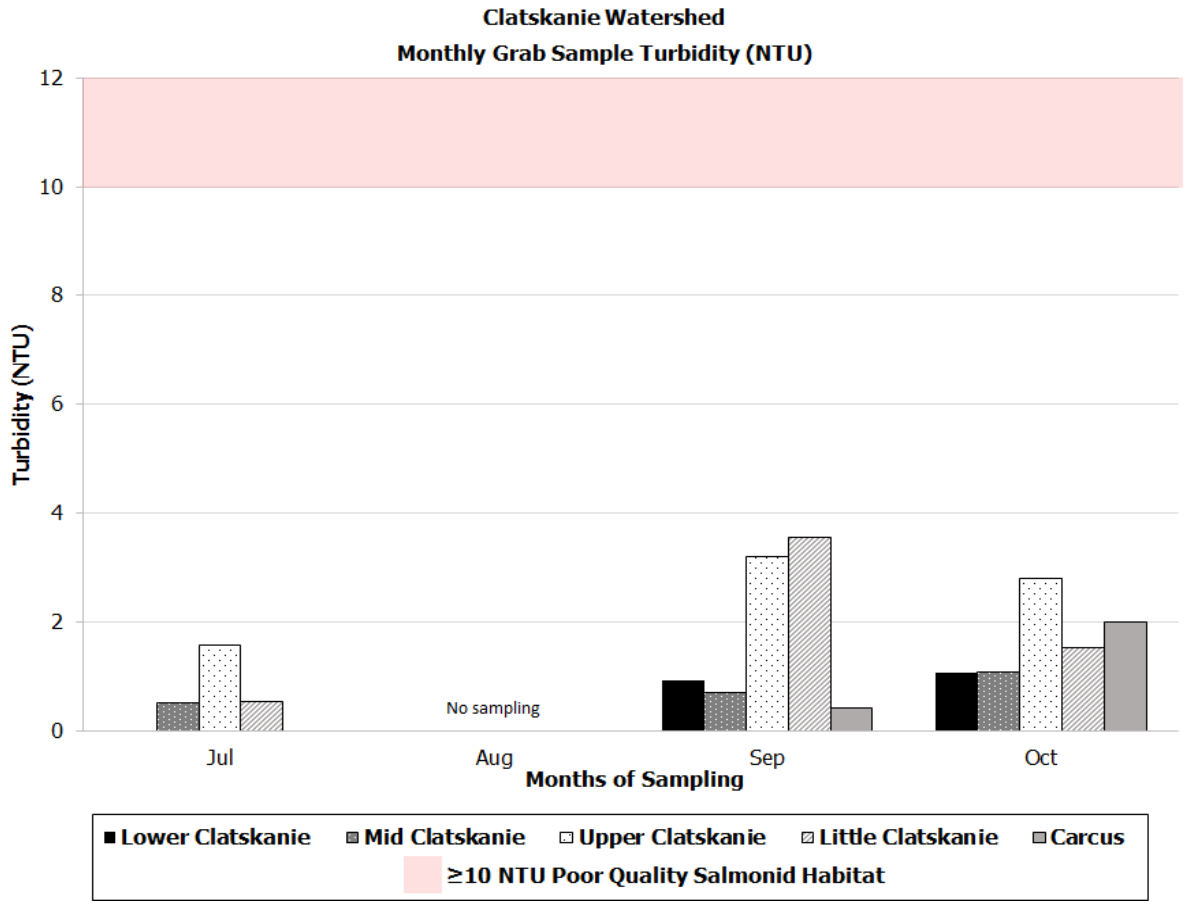

Figure 5: Clatskanie Watershed monthly grab sample turbidity (NTU) data from July to October 2017. See Table 3 for details on salmon habitat turbidity threshold.

Stream sampling of *E. coli* bacteria levels in the Clatskanie Watershed were only collected in Lower Clatskanie Creek during September and October 2017 and exhibited low *E. coli* levels (<100 MPN/100 ml) during these sampling events (Figure 6).

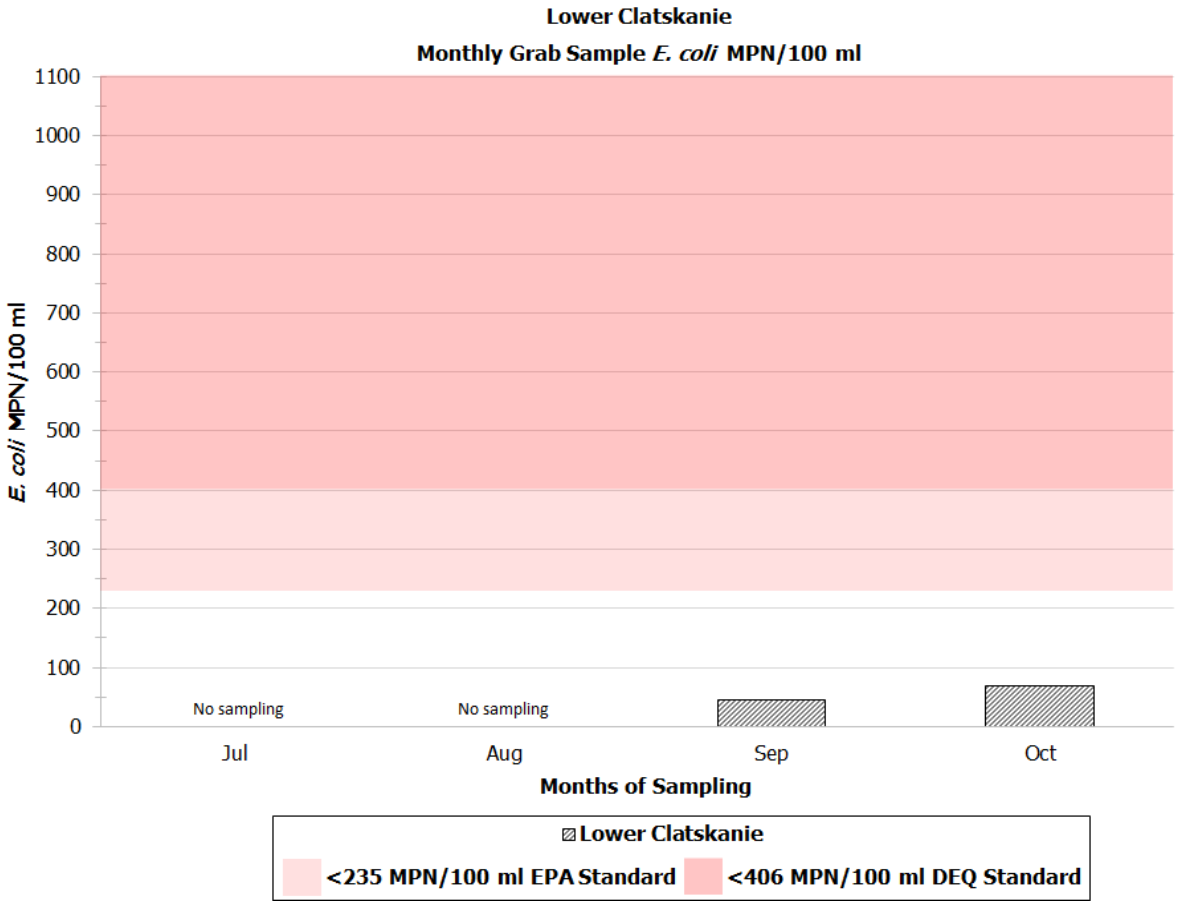

Figure 6: Clatskanie Watershed monthly grab sample *E. coli* bacteria data from July to October 2017. See Table 3 for details on *E. coli* bacteria thresholds.

Beaver Creek Watershed

Between July and August Lower Beaver Creek 7dMAM consistently remained above the 18°C temperature, however temperatures dropped down below the 18°C temperature threshold in September and October 2017 (Figure 7). Upper Beaver Creek exhibited periods of > 18°C in August but generally maintained temperatures below 18°C during the July through October study period (Figure 7). Monthly average maximum temperatures followed similar trends with Lower Beaver Creek with average temperatures falling between 18-20°C in July and August and then dropping below 18°C in September and October (Figure 8). Average monthly temperatures for Upper Beaver Creek only exceeded 18°C in August (Figure 8).

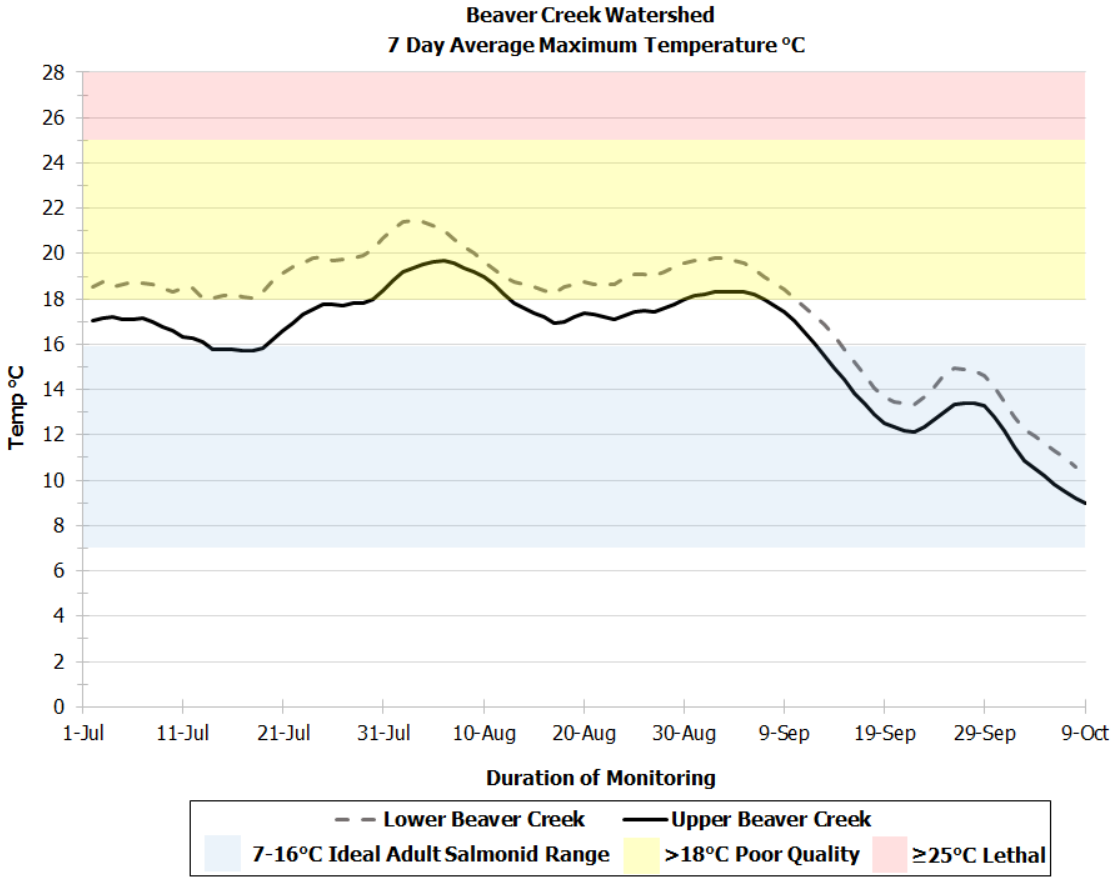

Figure 7. Beaver Creek Watershed 7-day average maximum temperatures (7dMAM) from July to October 2017. See Table 3 for details on salmonid temperature thresholds.

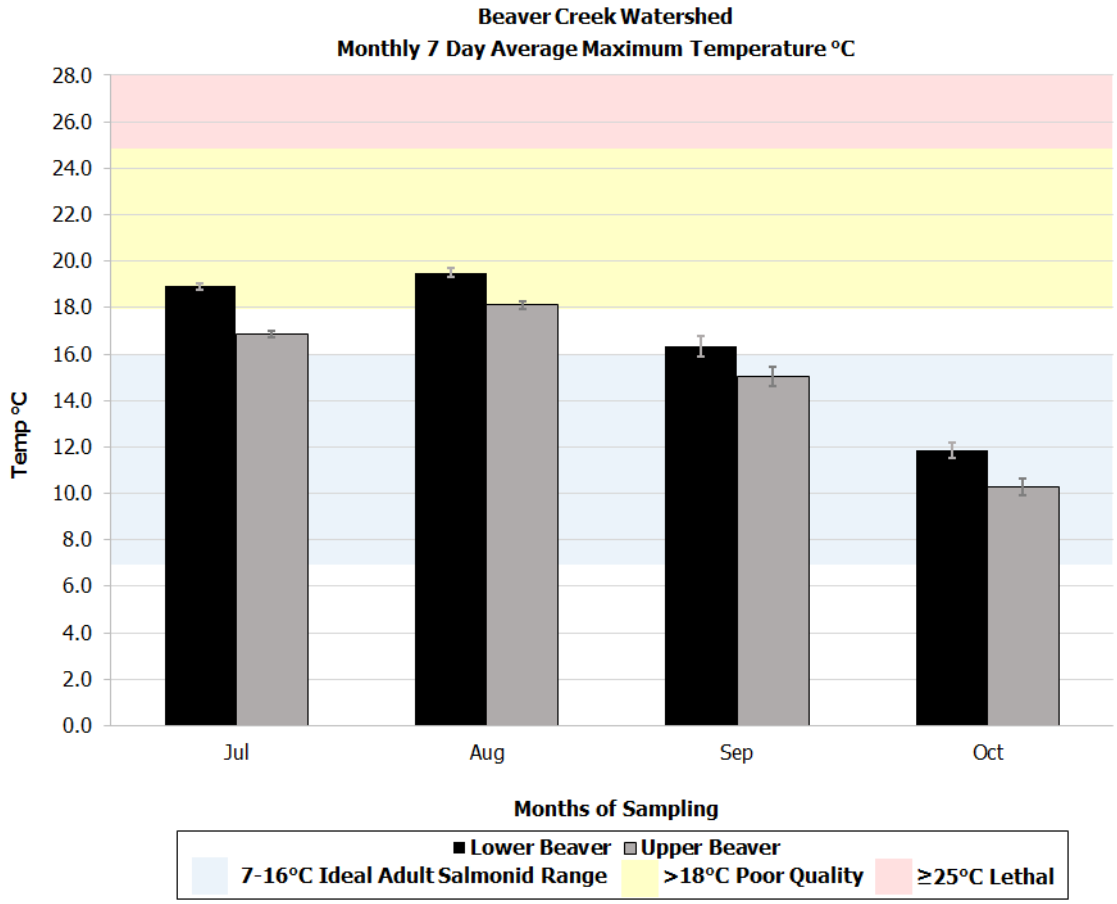

Figure 8. Beaver Creek Watershed monthly mean 7-day average maximum temperatures (7dMAM) from July to October 2017. See Table 3 for details on salmonid temperature thresholds.

Lower Beaver Creek turbidity consistently had lower turbidity than Upper Beaver Creek. Upper Beaver Creek exhibited elevated turbidity levels throughout the study period, with >10 NTU turbidity observed in September (Figure 9).

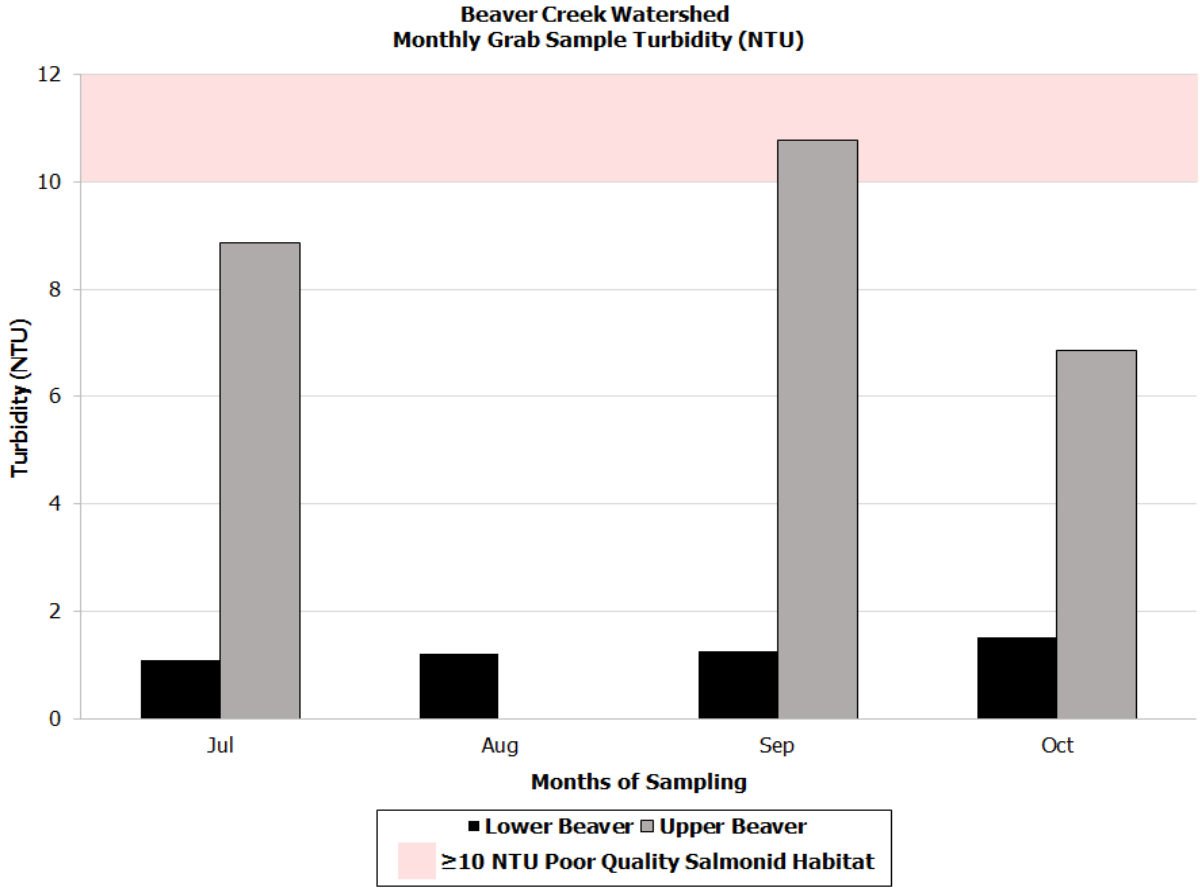

Figure 9: Beaver Creek Watershed monthly grab sample turbidity (NTU) data from July to October 2017. See Table 3 for details on salmon habitat turbidity threshold.

E. coli bacteria levels in the Beaver Creek Watershed were only collected in Lower Beaver Creek and exhibited low *E. coli* levels throughout the study period, however the October sample was elevated beyond the EPA health standard <235 MPN/100 ml (Figure 10).

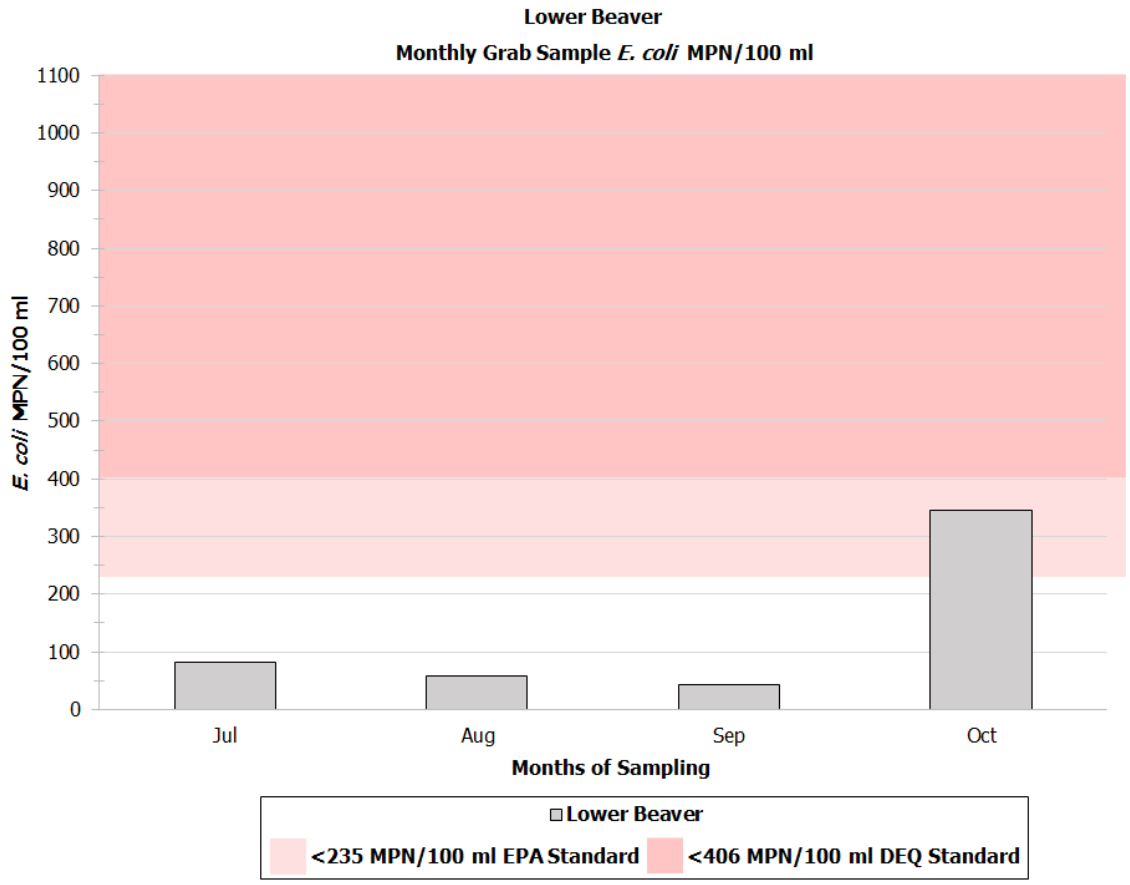

Figure 10. Beaver Creek Watershed monthly grab sample *E. coli* bacteria data from July to October 2017. See Table 3 for details on *E. coli* bacteria thresholds.

Scappoose Bay Watershed

Milton Creek

Lower Milton Creek maintained temperatures >18°C (poor quality) during July, August, and early September. Additionally, temperatures exceeded 25°C (lethal) during the first week of August. Upper Milton Creek also exhibited periods of >18°C in July and August (Figure 12).

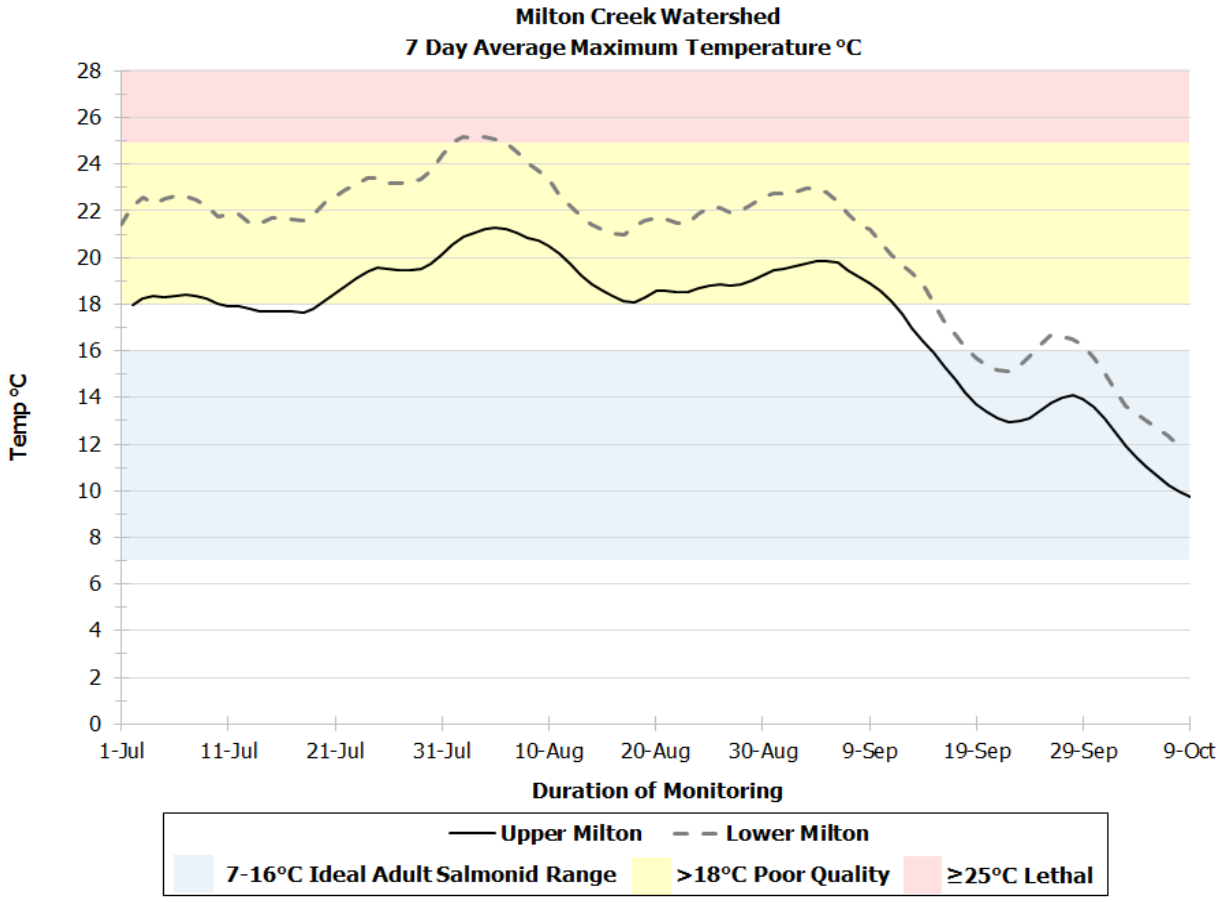

Figure 11. Milton Creek Watershed 7-day average maximum temperatures (7dMAM) from July to October 2017. See Table 3 for details on salmonid temperature thresholds.

On average monthly average maximum stream temperatures were >18°C (poor quality) during July, August, and early September. Upper Milton Creek also exhibited periods of >18°C in July and August (Figure 12).

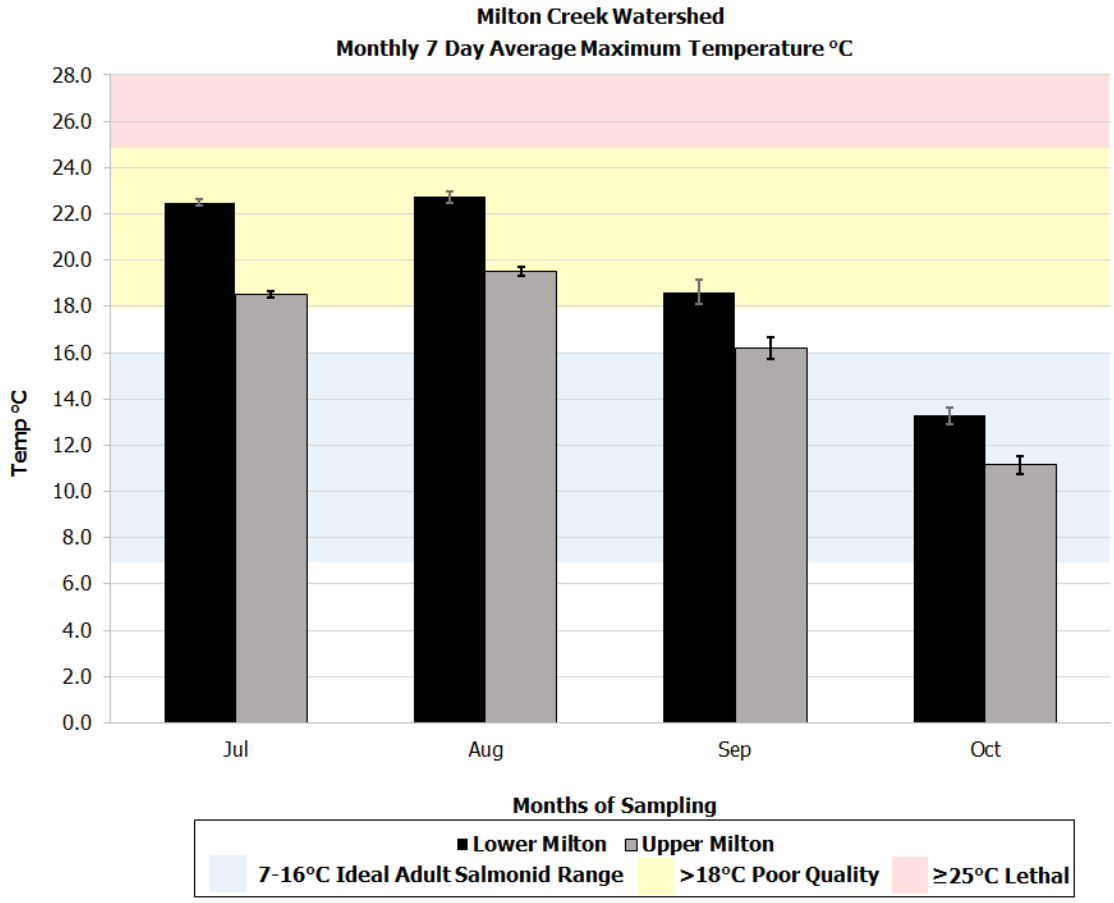

Figure 12. Milton Creek Watershed monthly mean 7-day average maximum temperatures (7dMAM) from July to October 2017. See Table 3 for details on salmonid temperature thresholds.

Lower Milton Creek turbidity was consistently lower than Upper Milton Creek which exhibited generally elevated turbidity levels throughout the study period, with levels near >10 NTU turbidity observed in September (Figure 13).

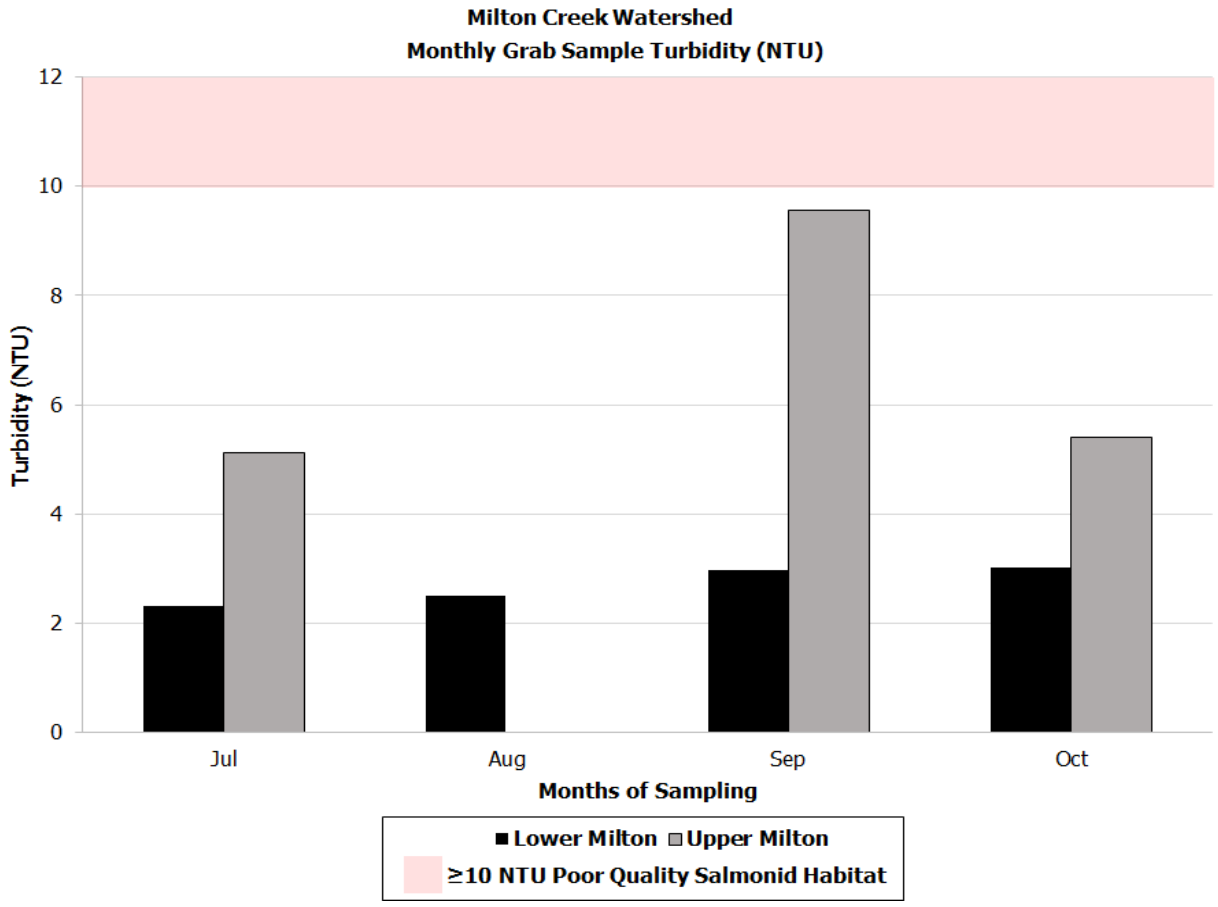

Figure 13. Milton Creek Watershed monthly grab sample turbidity (NTU) data from July to October 2017. See Table 3 for details on salmon habitat turbidity threshold.

Lower Milton Creek generally exhibited elevated *E. coli* levels throughout the study period; in July and October levels exceeded the EPA health standard <235 MPN/100 ml in addition to the DEQ health standard <406 MPN/100 ml in September. Levels were low in August, however as these are only monthly grab samples it is hard to assess if this is a true representation of the water quality for this entire month (Figure 14).

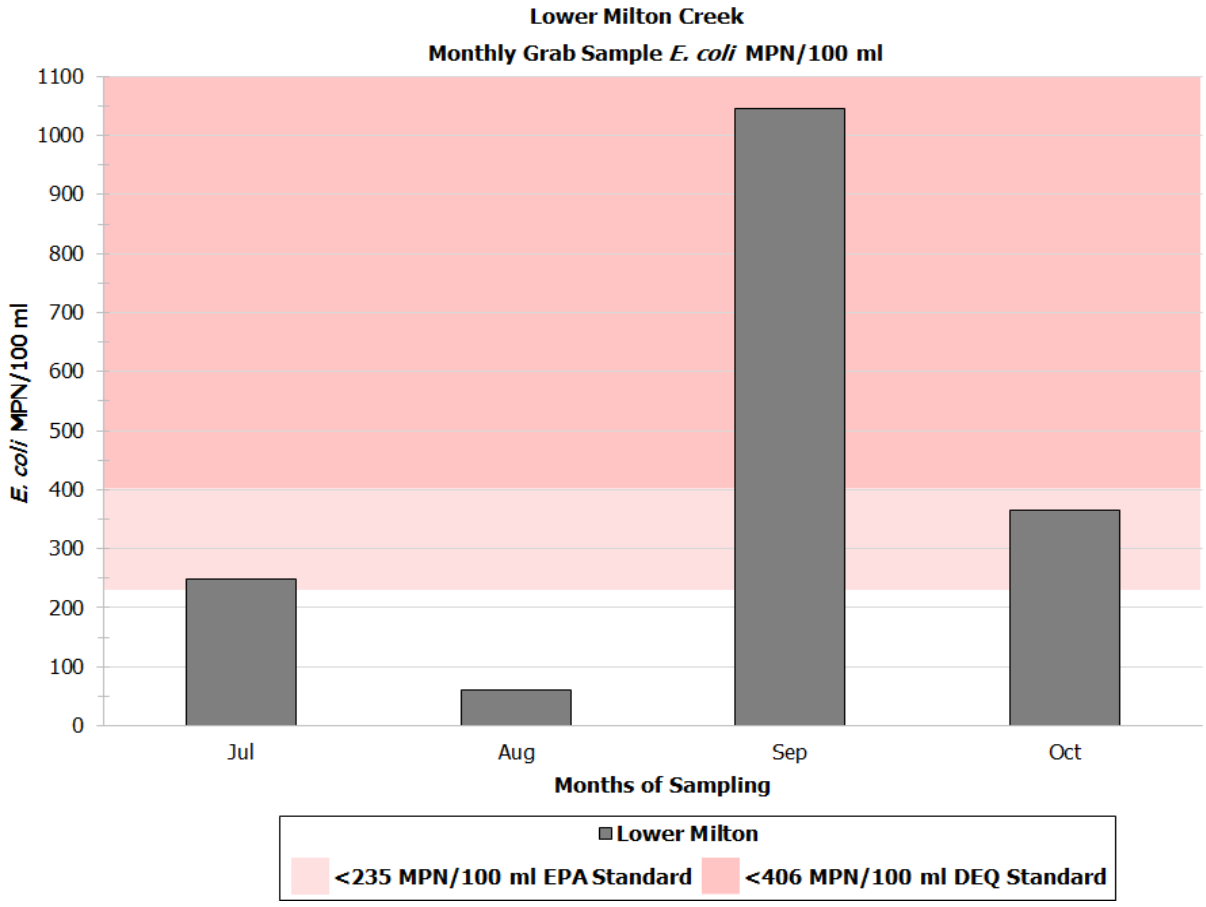

Figure 14. Beaver Creek Watershed monthly grab sample *E. coli* bacteria data from July to October 2017. See Table 3 for details on *E. coli* bacteria thresholds.

North Scappoose Creek

Lower North Scappoose Creek maintained temps >18°C (poor quality) during July and August, however these temperatures dropped down below 18°C in September and October. Upper North Scappoose also exhibited periods of >18°C in July and August, but dropped below 18°C in early September and October (Figure 15).

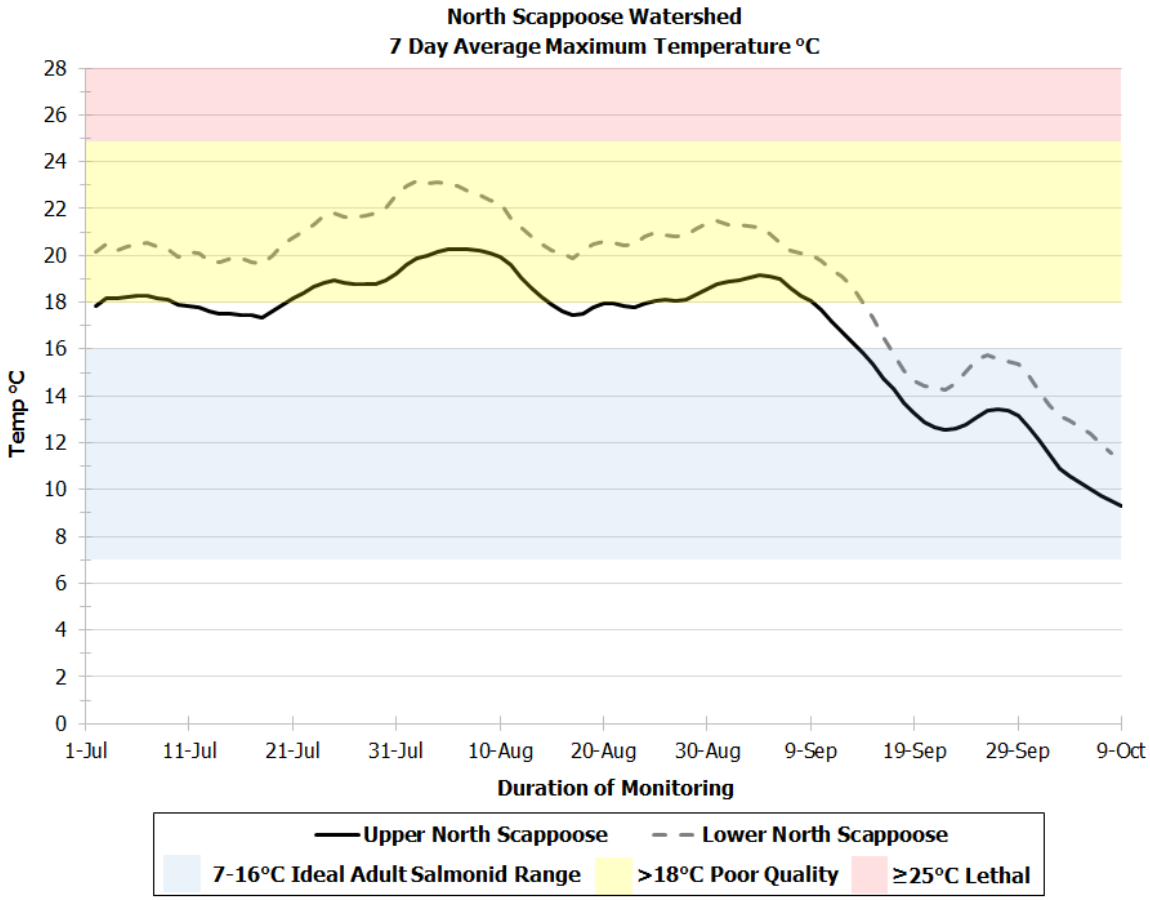

Figure 15. North Scapoose Creek Watershed 7-day average maximum temperatures (7dMAM) from July to October 2017. See Table 3 for details on salmonid temperature thresholds.

On average monthly maximum stream temperatures in both Lower and Upper North Scappoose Creek exceeded 18°C during July and August and remained below 18°C in September and October (Figure 16).

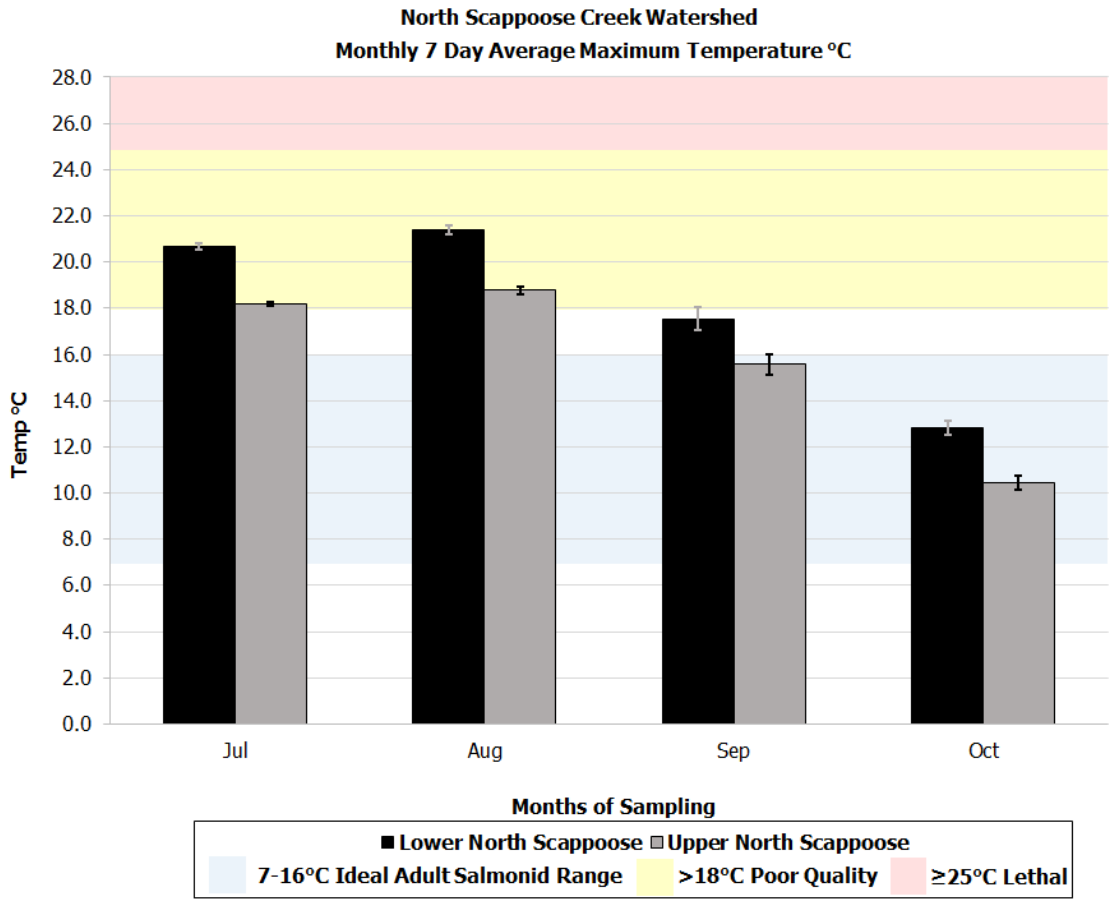

Figure 16. North Scappoose Watershed monthly mean 7-day average maximum temperatures (7dMAM) from July to October 2017. See Table 3 for details on salmonid temperature thresholds.

Lower North Scappoose Creek turbidity was consistently lower than Upper North Scappoose Creek. Both Lower and Upper North Scappoose River turbidity levels were well below the 10 NTU turbidity threshold for poor water quality (Figure 17).

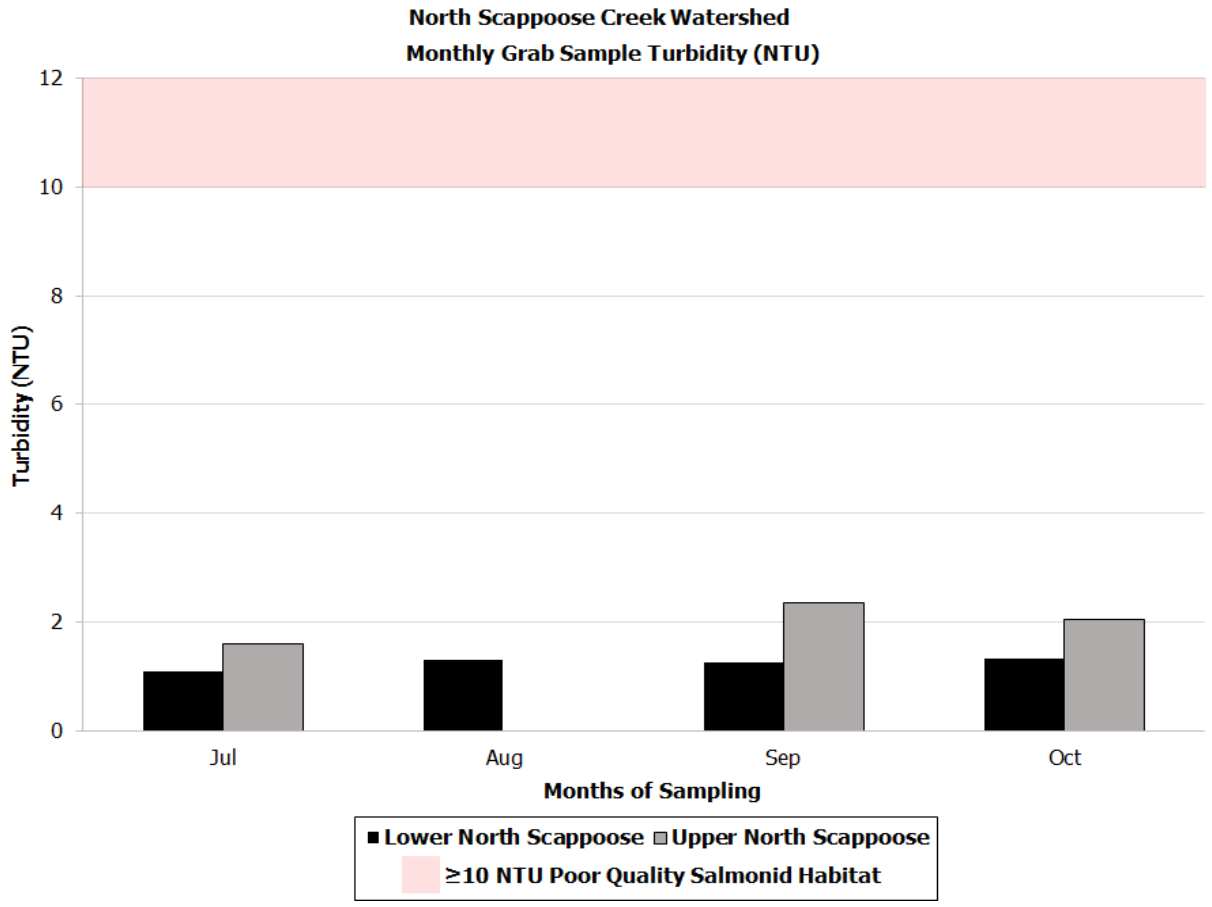

Figure 17. North Scappoose Watershed monthly grab sample turbidity (NTU) data from July to October 2017. See Table 3 for details on salmon habitat turbidity threshold.

Lower North Scappoose Creek exhibited low *E. coli* levels (<235 MPN/100 ml) in July, August, and October. Elevated levels (>235 MPN/100 ml) of *E. coli* were observed in September, exceeding the EPA health standard (Figure 18).

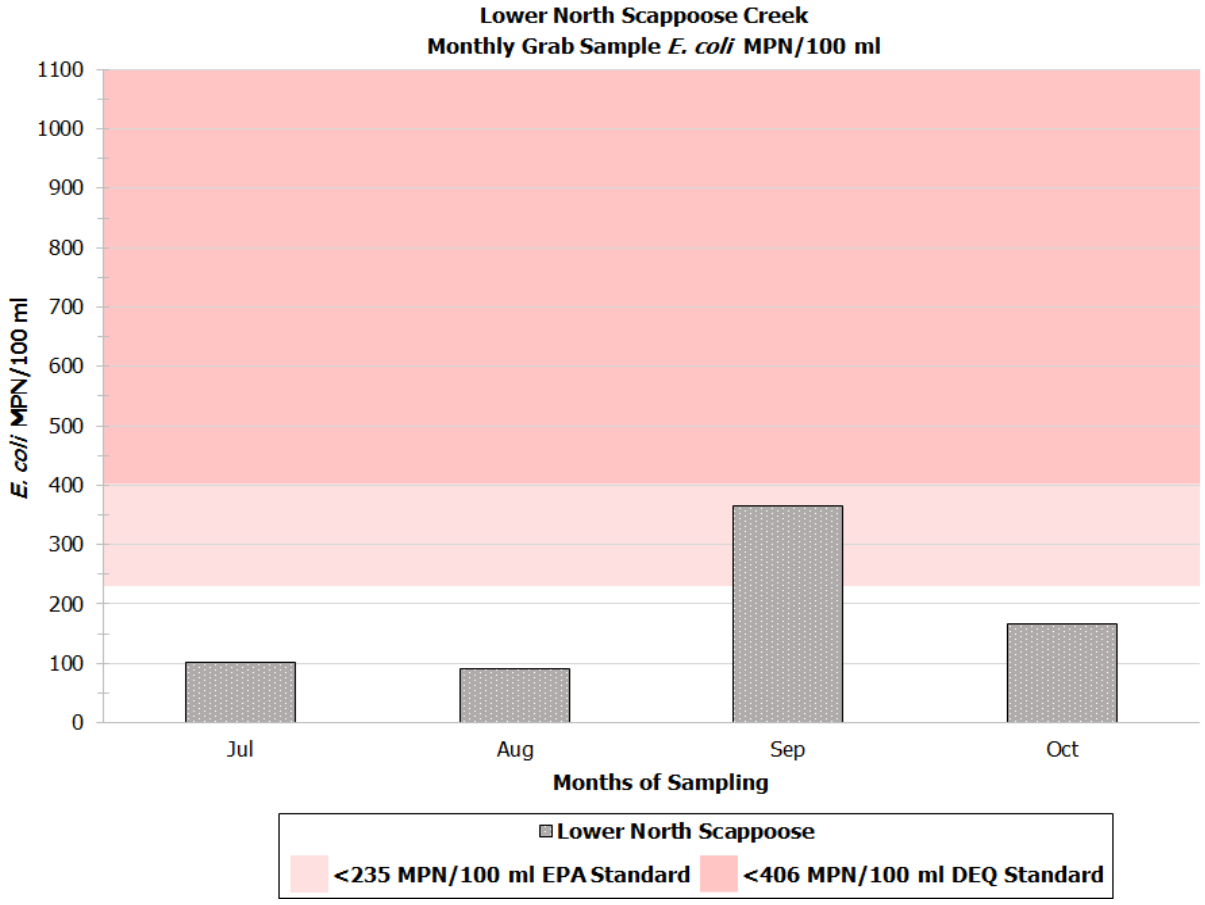

Figure 18. North Scappoose Watershed monthly grab sample *E. coli* bacteria data from July to October 2017. See Table 3 for details on *E. coli* bacteria thresholds.

South Scappoose Creek

Lower South Scappoose Creek maintained temps >18°C (poor quality) during July and August, however these temperatures dropped below 18°C in September and October. Upper Scappoose River exhibited a period of >18°C during the first week of August but generally maintained temperatures <18°C during the study Period (July-October) (Figure 19).

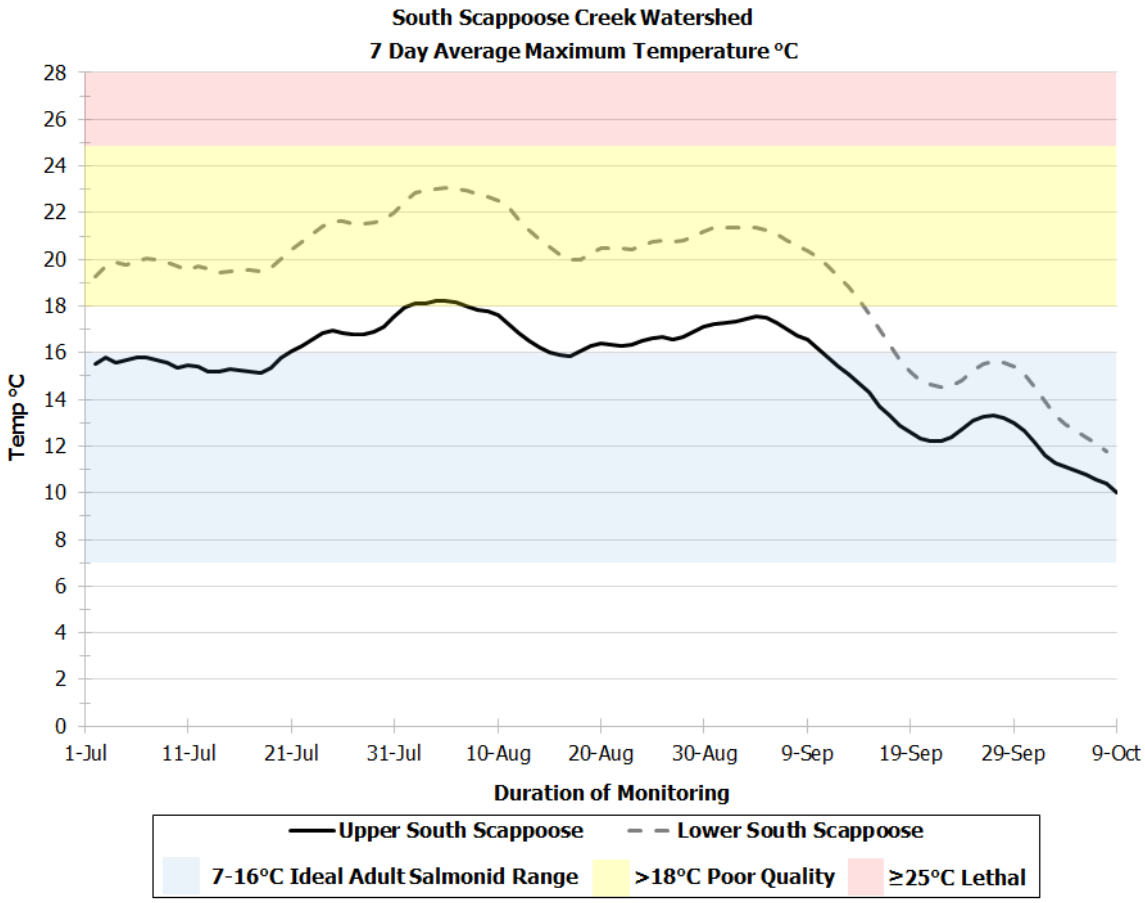

Figure 19 South Scapoose Creek Watershed 7-day average maximum temperatures (7dMAM) from July to October 2017. See Table 3 for details on salmonid temperature thresholds.

On average maximum stream temperatures in Lower North Scappoose Creek exceeded 18°C during July and August and remained below 18°C in September and October. Average maximum stream temperatures in Upper South Scappoose river remained below the 18°C threshold for the entire study period (July-October) (Figure 20).

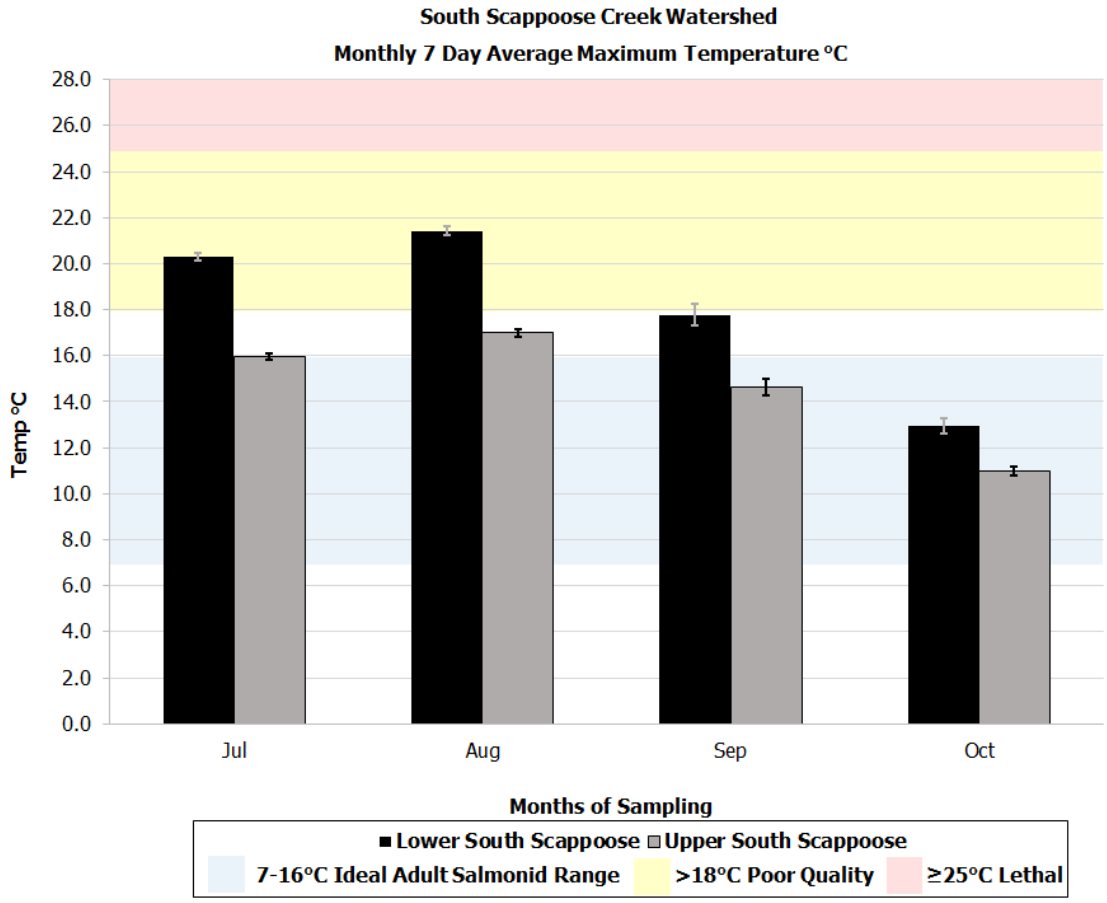

Figure 20 South Scappoose Watershed monthly mean 7-day average maximum temperatures (7dMAM) from July to October 2017. See Table 3 for details on salmonid temperature thresholds.

Lower South Scappoose Creek turbidity was consistently higher compared to the Upper South Scappoose River, with levels in the Lower South Scappoose river nearing 10 NTU turbidity in September (Figure 21).

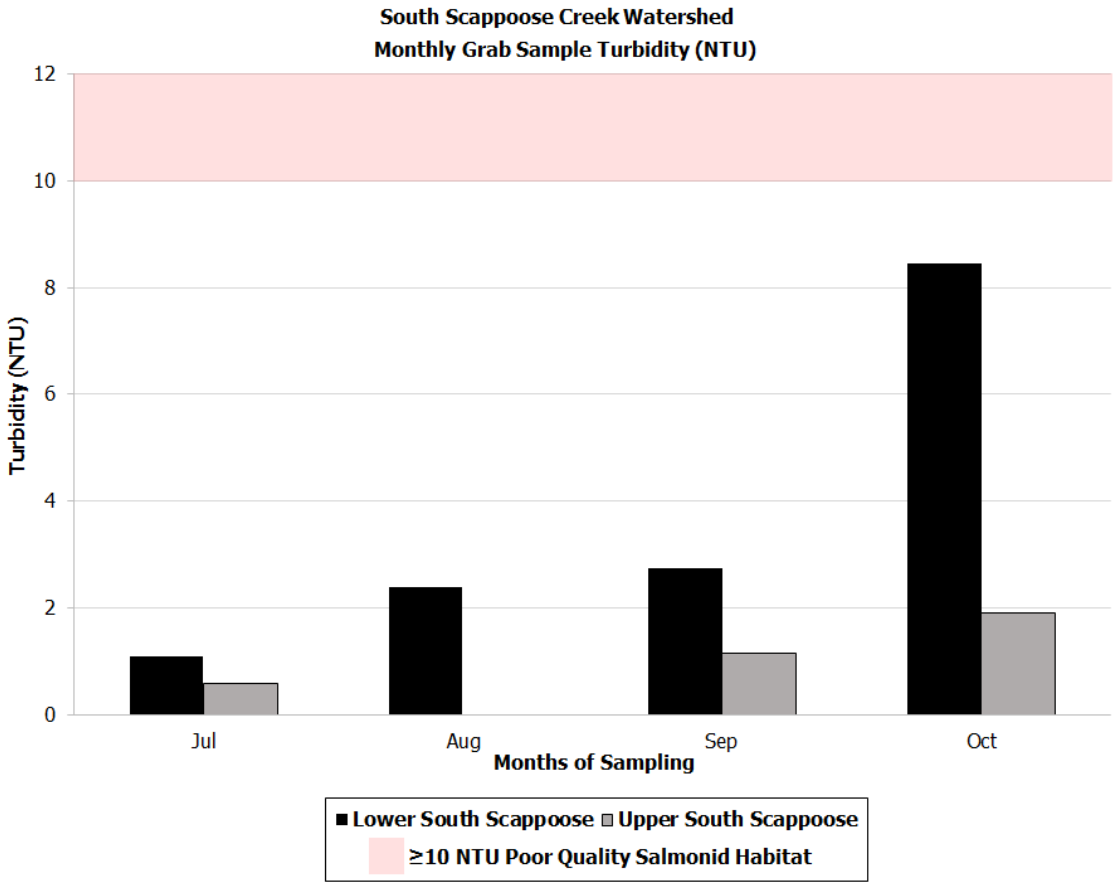

Figure 21. South Scappoose Watershed monthly grab sample turbidity (NTU) data from July to October 2017. See Table 3 for details on salmon habitat turbidity threshold.

Lower South Scappoose River generally exhibited elevated *E. coli* levels throughout the study period; in July and September levels exceeded the EPA health standard <235 MPN/100 ml (Figure 22).

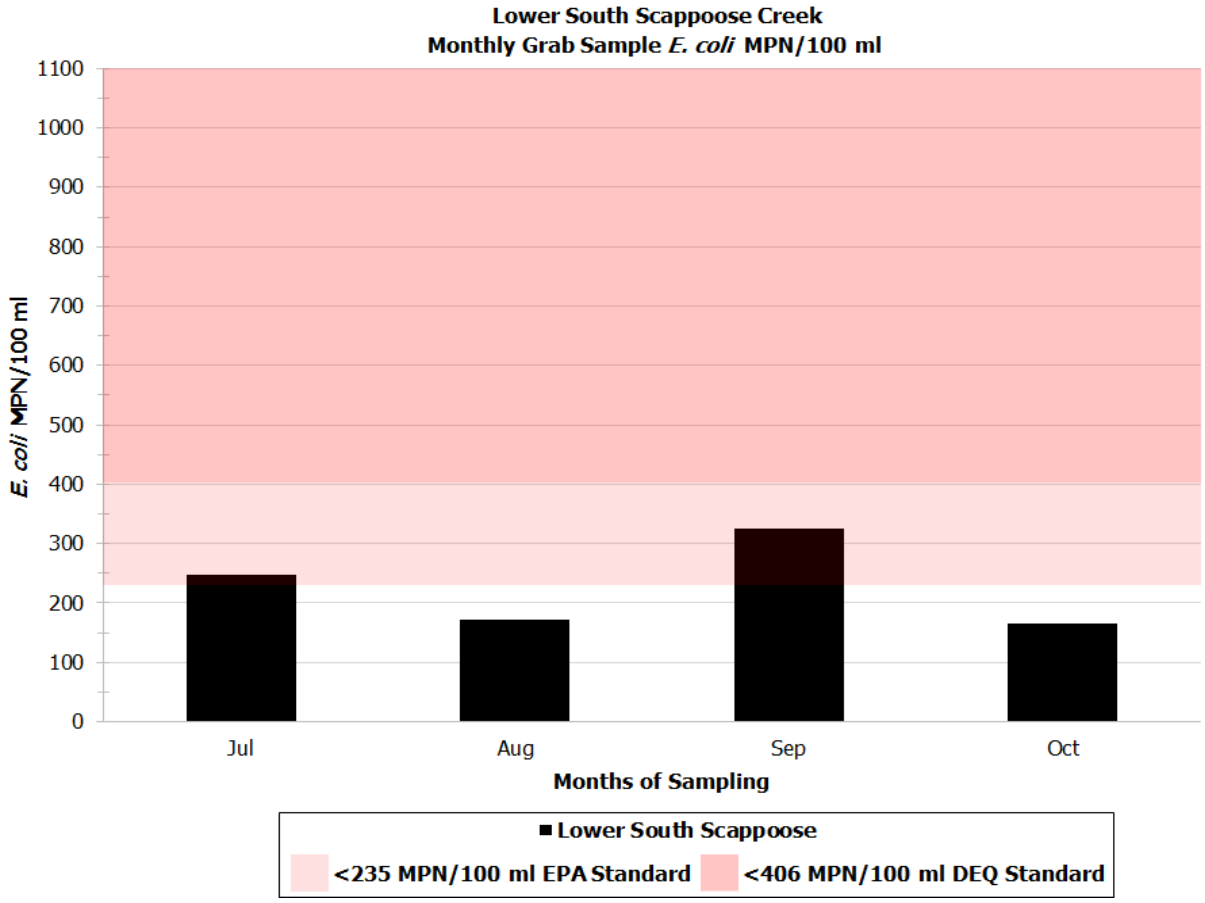

Figure 22. South Scappoose Watershed monthly grab sample *E. coli* bacteria data from July to October 2017. See Table 3 for details on *E. coli* bacteria thresholds.

WATER QUALITY RESULTS SUMMARY

During the study period (July-October) the warmest average temperatures were recorded in the main stem (lower watershed) sampling locations, while the head water sampling locations generally remained below 18°C. The coolest average maximum temperatures were found in the Beaver, Clatskanie, and South Scappoose head waters. Beaver and Clatskanie maintained the cooler average maximum temperatures in the the lower main stem. Milton, North and South Scappoose Watersheds generally exhibited overall warmer average maximum temperature in main stems (Figure 23).

For Turbidity, the highest turbidities were recorded in the head waters of Beaver Creek and Milton Creek. For main stem sites, South Scappoose Creek consistently had higher turbidity than most of other head water sites. (Figure 24).

Across all the sites *E. coli* levels were greatest in September and lowest in August. Milton Creek generally had the greatest counts of *E. coli*, while Lower Beaver and Lower Clatskanie had the lowest *E. coli* levels.

In July, Lower Milton and Lower South Scapposse exceeded the EPA health health standard. In August not sites exceeded established health levels. Lower Milton had exceeded the DEQ standard by for E. Coli by double while Lower North and South Scappoose creeks exceeded the EPA health standard threshold in September. October saw a recudtion in E. Coli levels, but Lower Milton still exceeded the EPA health standard threshold. Lower Beaver Creek exceeded the EPA health standard threshold in October (Figure 25).

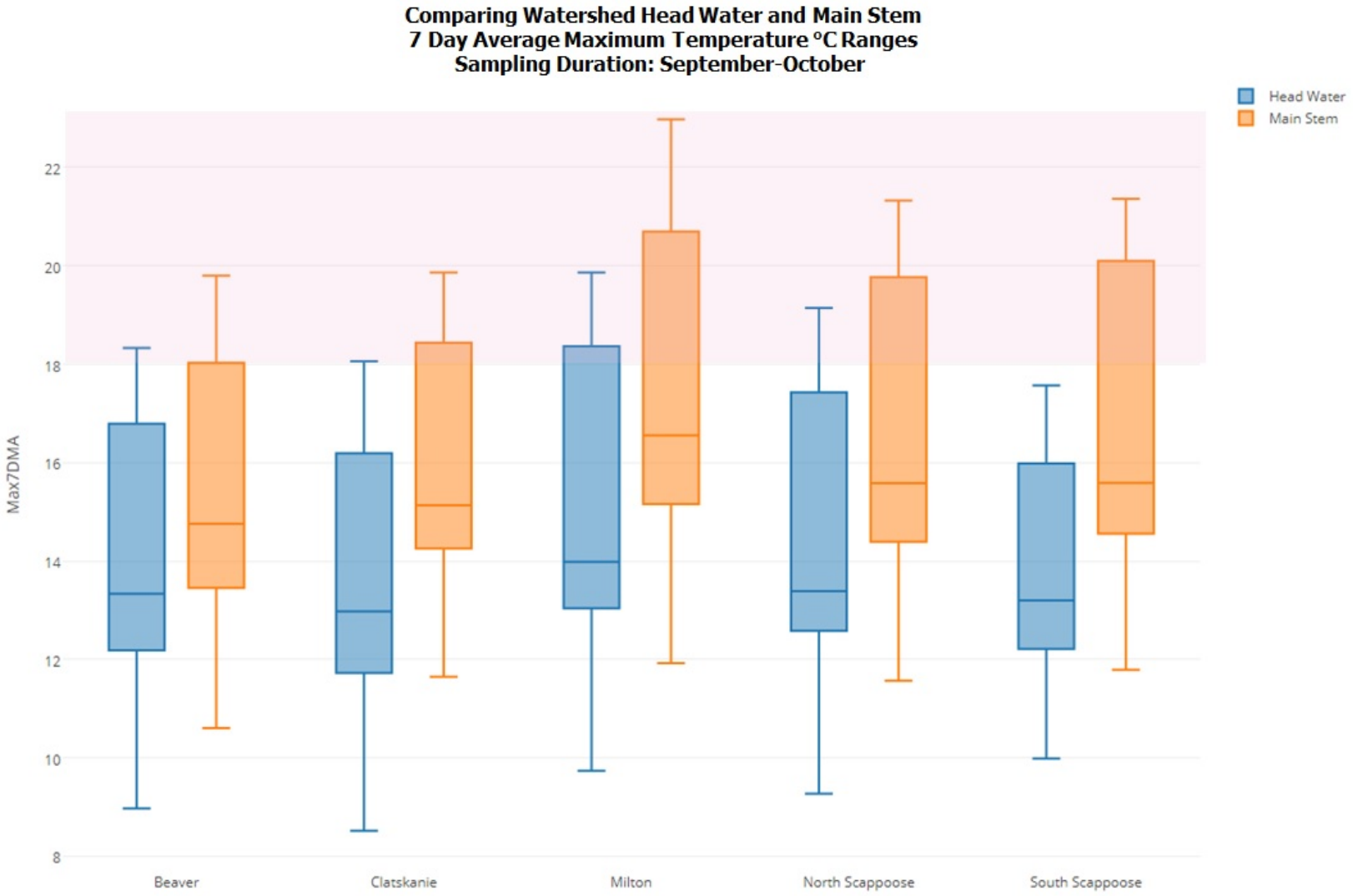

Figure 23. Comparison of 7 day average maximum temperature ranges for watershed head waters and lower mainstem sites

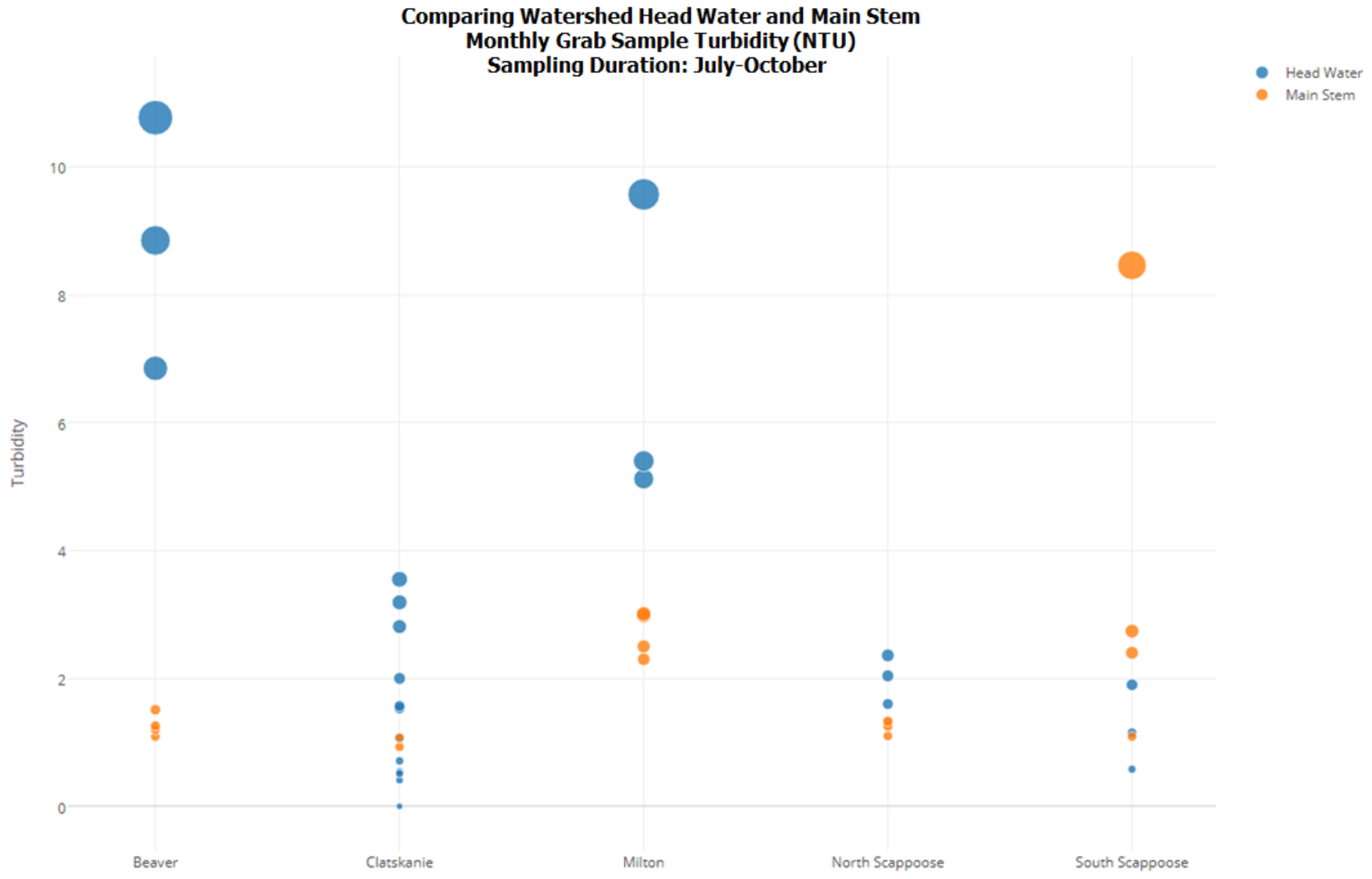

Figure 24. Monthly turbidity sampling in July through October in the headwater and mainstem for all monitored watersheds

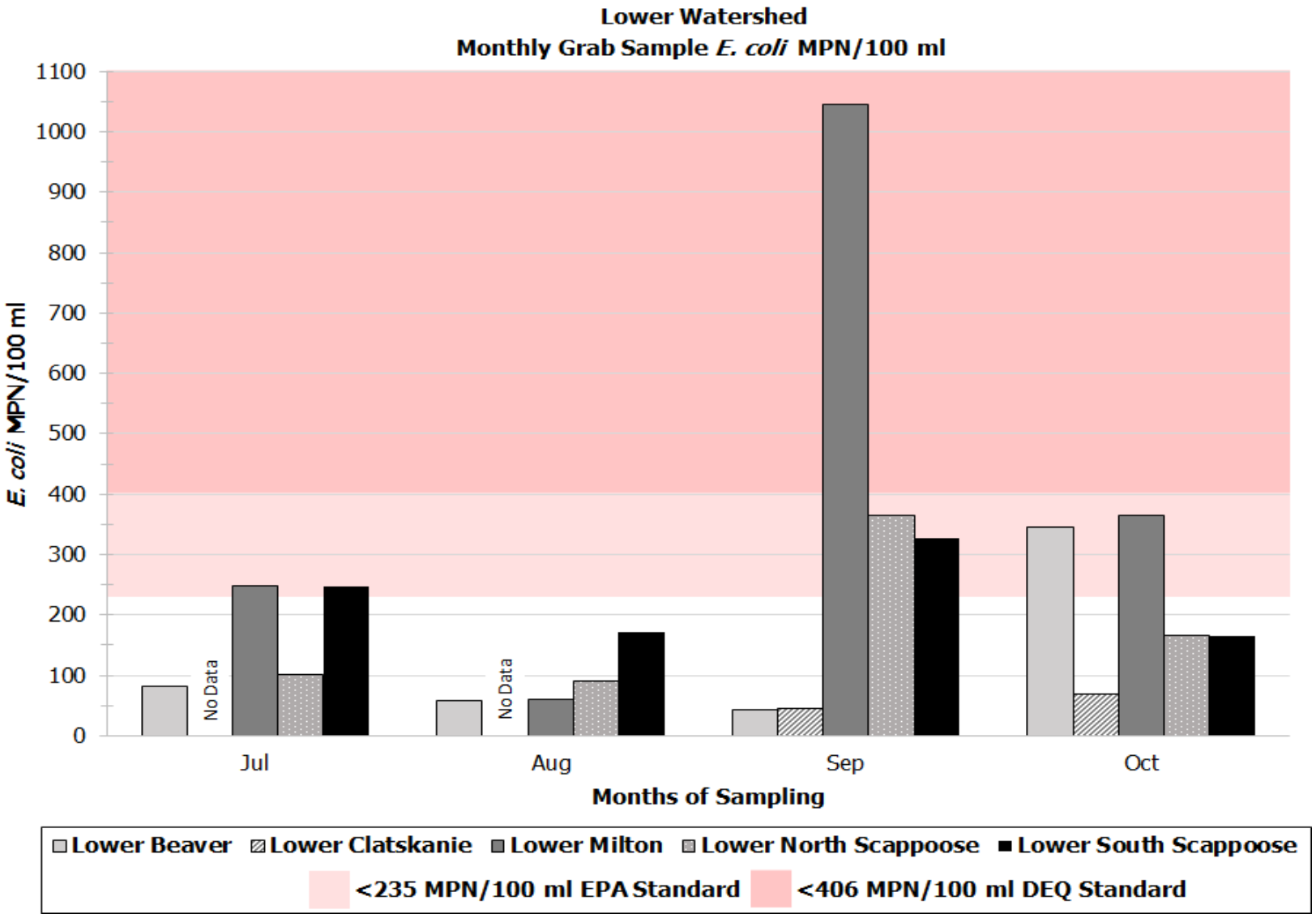

Figure 25. Monthly comparison of E. Coli results between monitored watersheds from July through October

CONCLUSIONS AND RECOMMENDATIONS

Trends in water quality metrics were evident through the initial period of study. Upper watershed monitoring sites generally exhibited lower average maximum water temperatures than monitoring sites located lower in the watershed. The opposite trend occurred in turbidity with head water sites generally having higher turbidity than lower watershed sites. With apparent trends, the next step is to identify potential drivers that could be contributing to increased temperature and turbidity. For *E. Coli*, some watersheds had elevated counts which could be an indicator of potential issues. For watersheds with higher *E. Coli* counts, monitoring in the both the upper and lower watershed should be considered to better identify the sources and areas where the contamination is occurring. Overall initial monitoring efforts have been successful in capturing water quality trends within watersheds and continued monitoring will show if these water trends persist through time or different trends emerge.

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APPENDICES

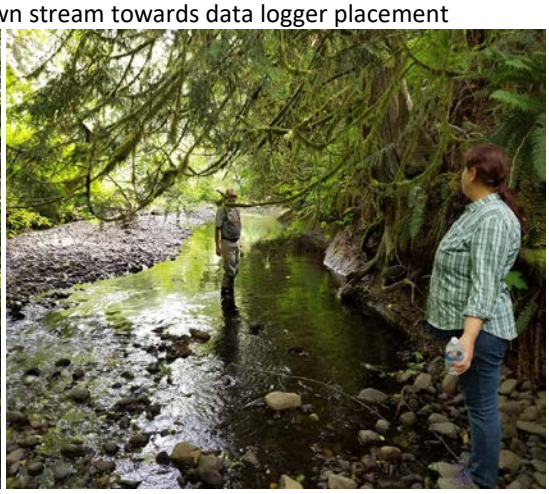
Appendix A: Monitoring Site Locations and Descriptions

Clatskanie Watershed						
Site Code	**Site Name**	**Description**	**GPS Coordinates**	**Logger Serial Number**	**Installed Date/Time**	**Installed Temp °C**
LC	Lower Clatskanie	Data: Bacteria, Temp/WL, Turbidity	Lat: 46.080002 Long: -123.166841	20112654	8/17/2017 15:30	19.8
Site Code	**Site Name**	**Description**	**GPS Coordinates**	**Logger Serial Number**	**Installed Date/Time**	**Installed Temp °C**
MC	Middle Clatskanie	Data: Temp/WL, Turbidity Private property (must notify owner ahead of time) off of Swedetown road, walk through field behind the home, then cross through an old gate to access river. Data logger placed near an undercut bank with some overhanging roots	Lat: 46.045193 Long: -123.095813	20112657	6/28/2017 15:28	14.6

Location Image: River access just beyond old fence gate, near bank root overhang

Site Code	Site Name	Description	GPS Coordinates	Logger Serial Number	Installed Date/Time	Installed Temp °C
CAR	Carcus	Data: Temp/WL, Turbidity Stream accessed via private drive off Swedetown Rd, data logger placed a few meters upstream of the bridge (to be out of way of impending construction).	Lat: 46.038533 Long: -123.085543	20112662	6/28/2017 15:54	14.1

Location: Looking up stream at bridge, looking down stream towards data logger placement



Matt standing near data logger placement location, under vine maple (flagged with pink tape)

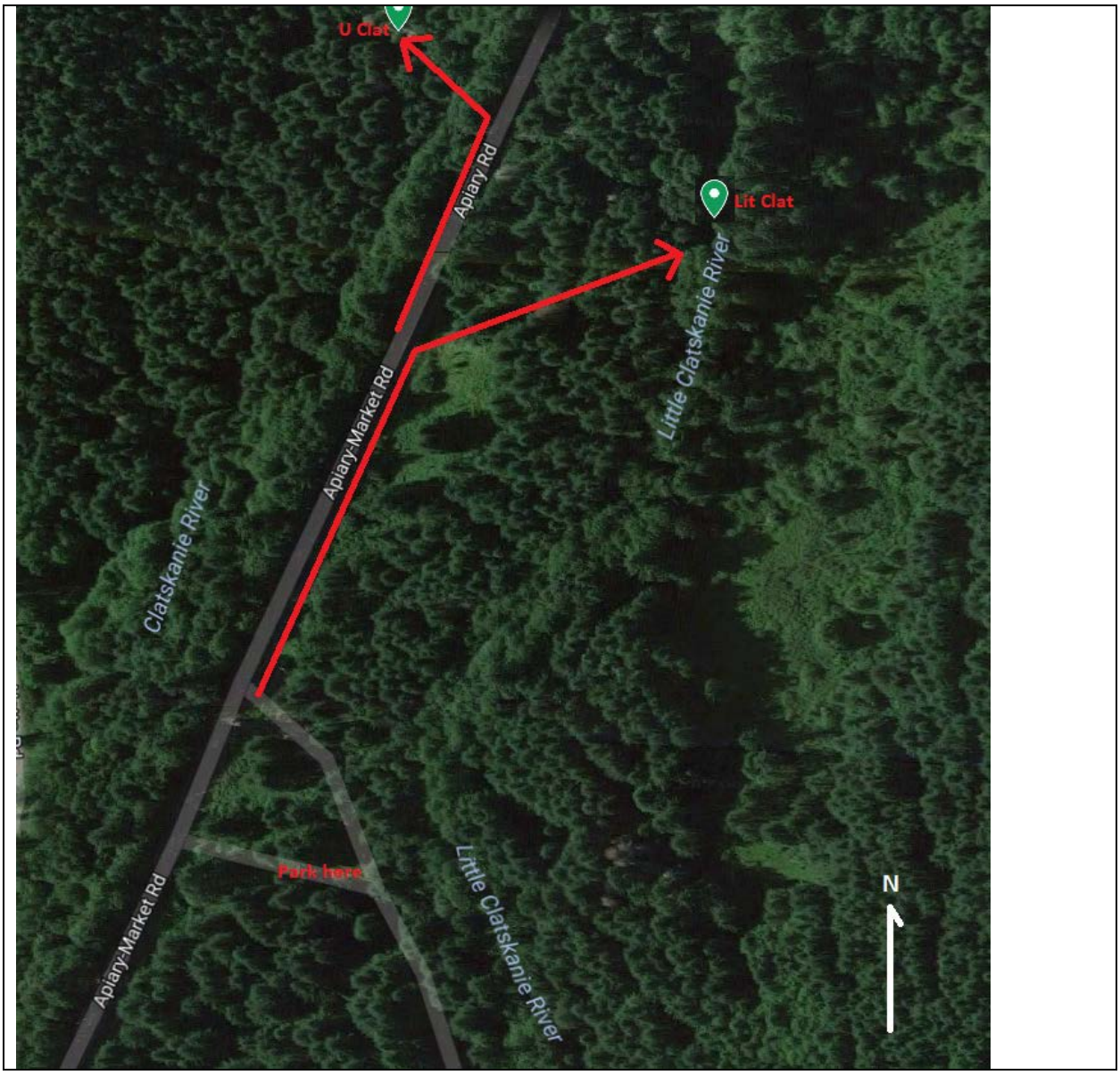
Site Code	Site Name	Description	GPS Coordinates	Logger Serial Number	Installed Date/Time	Installed Temp °C
UC	Upper Clatskanie	Data: Temp/WL, Turbidity Just north of LC location on the other side of the Apiary road. Steep descent from road to stream. Data logger near large rock on road side of river bank.	Lat: 45.987717 Long: -123.040371	20112651	6/29/2017 11:43	12.8

Location images: Data logger located near large rock along the river bank

Site Code	Site Name	Description	GPS Coordinates	Logger Serial Number	Installed Date/Time	Installed Temp °C
LitC	Little Clatskanie	Data: Temp/WL, Turbidity Park at pull out for logging road (on little Clat side of the road) along Apiary Market Rd and then access river via grassy opening along right side of road side north of car pull out, follow pink flagging to data logger location (downstream of large data logger housing)	Lat: 45.987598 Long: -123.038492	20112659	6/29/2017 11:23	12.7

Location Images:
Grassy opening along right side of road side north of car pull out, data logger is located near flagging next to salmon berry shrub and cedar stump

Map of Upper Clat and Lit Clat locations along Apiary Market Rd


U Clat
Apiary Rd
Lit Clat
Little Clatskanie River
Apiary-Market Rd
Clatskanie River
Park here
Little Clatskanie River
Apiary-Market Rd
N

Beaver Creek Watershed						
Site Code	**Site Name**	**Description**	**GPS Coordinates**	**Logger Serial Number**	**Installed Date/Time**	**Installed Temp °C**
LB	Lower Beaver	Pull out before the bridge at Beaver Falls Rd, data logger placed at the end of a rock pile just upstream of the bridge (large currant shrub on shore).	Lat: 46.108942 Long: -123.158919	20112663	6/29/2017 10:09	14.3

Location images: Park on side of the road and access stream on upstream side of bridge, data logger placed at the end of a rock pile just upstream of the bridge (large currant shrub on shore). Large rock near data logger placement marked with a black X.

Site Code	Site Name	Description	GPS Coordinates	Logger Serial Number	Installed Date/Time	Installed Temp °C
UB	Upper Beaver UB	Data: Temp/WL, Turbidity Park just past bridge on Fernhill Road (near 73723 Fern Hill Rd), and walk down on the upstream side of the bridge through the large reed canarygrass patch. Located upstream of bridge, under a large currant shrub with pink flagging marking its location	Lat: 46.062373 Long: -122.965167	20112653	6/29/2017 10:44	14.0

Location images: Park just past bridge on Fernhill Road (near 73723 Fern Hill Rd Rainier, Oregon), and walk down on the upstream side of the bridge through the large reed canarygrass patch.

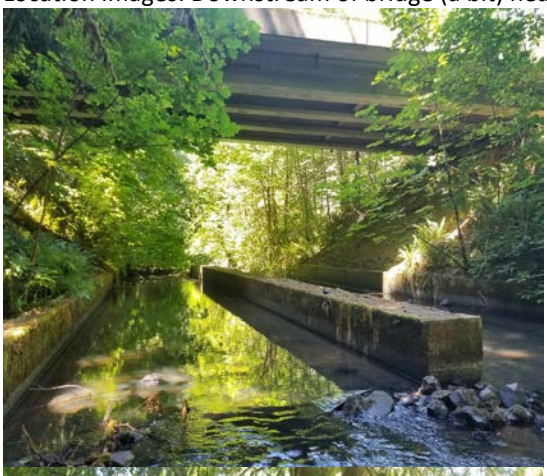
Data logger located under Currant shrub on far side of stream.

Scappoose Bay Watershed: Lower Milton Creek						
Site Code	**Site Name**	**Description**	**GPS Coordinates**	**Logger Serial Number**	**Installed Date/Time**	**Installed Temp °C**
LM	Lower Milton	Data: Bacteria, Temp/WL, Turbidity Located in McCormick Park on the downstream side of the Old Portland Road Bridge - under woody debris	Lat: 45.850289 Long: -122.816039	20112656	6/28/2017 11:28	16.3

Location Image (looking down from the bridge, Matt is bending over data logger placement):

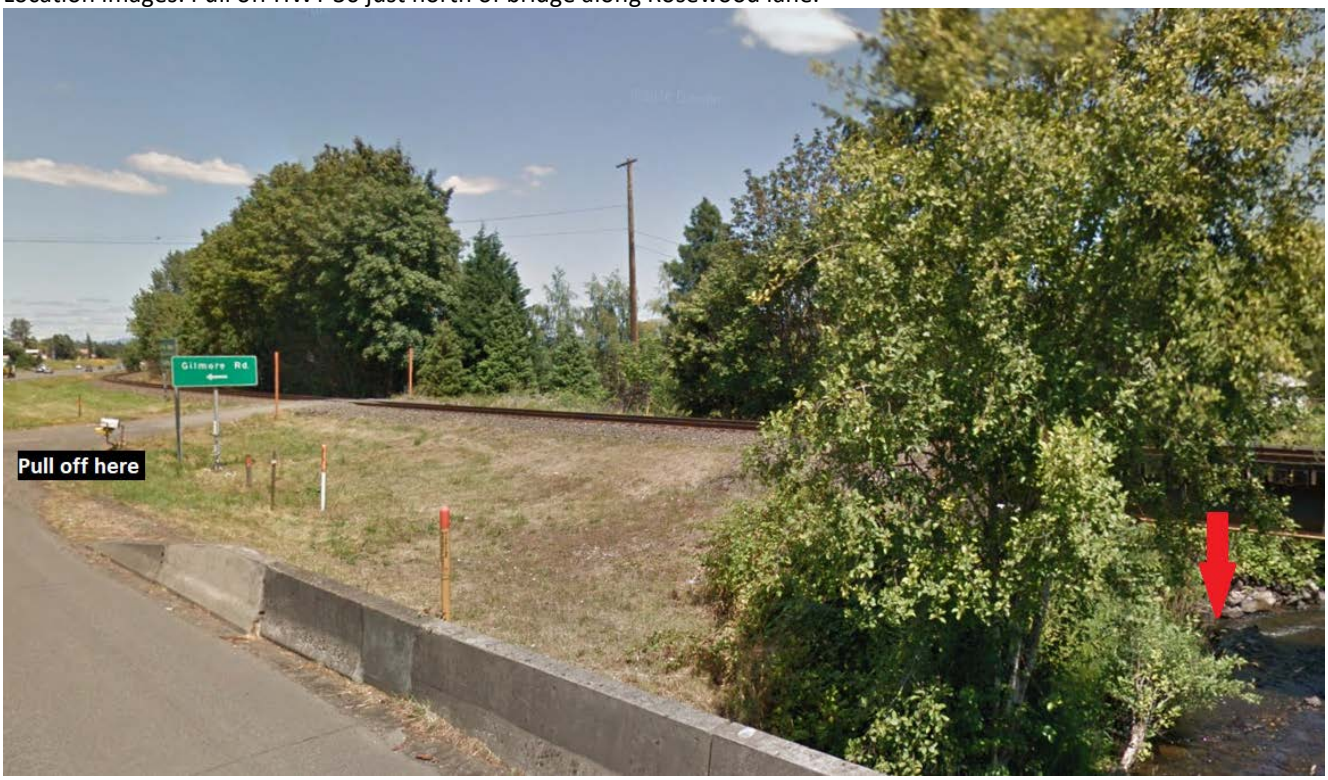
Site Code	Site Name	Description	GPS Coordinates	Logger Serial Number	Installed Date/Time	Installed Temp °C
UM	Upper Milton	Data: Temp/WL, Turbidity Downstream side of W. Kappler Rd bridge (very steep), data logger located downstream of bridge under flagged cedar tree.	Lat: 45.864193 Long: -122.886893	20112650	6/29/2017 12:58	15.4

Location images: Downstream of bridge (a bit) near the north stream bank under flagged cedar tree in pool



Scappoose Bay Watershed: North Scappoose Creek						
Site Code	**Site Name**	**Description**	**GPS Coordinates**	**Logger Serial Number**	**Installed Date/Time**	**Installed Temp °C**
LNS	Lower North Scappoose	Data: Bacteria, Temp/WL, Turbidity Pull off HWY 30 just north of bridge along Rosewood lane. Enter stream on the north bank at the railroad bridge (large patch of reed canarygrass) crossing. Data logger tided to old piling (flagged) on north bank of stream under railroad bridge.	Lat: 45.771786	20112652	6/29/2017 14:19	17.2

Location images: Pull off HWY 30 just north of bridge along Rosewood lane.



Enter stream on the north bank at the railroad bridge (large patch of reed canarygrass) crossing. Data logger tided to old piling on north bank of stream under railroad bridge.

Site Code	Site Name	Description	GPS Coordinates	Logger Serial Number	Installed Date/Time	Installed Temp °C
UNS	Upper North Scappoose	Data: Temp/WL, Turbidity Pull off close to the bridge crossing river near 30161 Scappoose Vernonia Hwy. Descend on the upstream side of the bridge on the North bank. Data logger placed on North bank under maple tree (flagged).	Lat: 45.823753 Long: -122.946923	20112655	6/29/2017 13:37	14.4

Location images: Descend on the upstream side of the bridge on the North bank. Data logger placed on North bank under maple tree (flagged).

Scappoose Bay Watershed: South Scappoose Creek						
Site Code	**Site Name**	**Description**	**GPS Coordinates**	**Logger Serial Number**	**Installed Date/Time**	**Installed Temp °C**
LSS	Lower South Scappoose	Data: Bacteria, Temp/WL, Turbidity Park at the CZ trail area just off HWY 30, then decent on the south side of the bridge on the upstream side. Data logger tied to piling under bridge on south bank. Piling flagged.	Lat: 45.762739 Long: -122.880973	20112658	6/29/2017 13:59	16.3

Location images:

Site Code	Site Name	Description	GPS Coordinates	Logger Serial Number	Installed Date/Time	Installed Temp °C
USS	Upper South Scappoose	Data: Temp/WL, Turbidity Pull off on the south side of the bridge on Otto Miller Rd just past the Dutch Canyon Rd turn off (see image). Data logger located downstream of bridge under an alder tree (flagged).	Lat: 45.744219 Long: -122.961964	20112664	6/29/2017 14:44	13.7

Location images: Pull off on the south side of the bridge on Otto Miller Rd just past the Dutch Canyon Rd turn off

Data logger located downstream of bridge under an alder tree (flagged)