

2016 Annual Wastewater Treatment Report

Resort Municipality of Whistler Wastewater Treatment Plant



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1 Background

1.1 Discharge Monitoring Frequency

Monitoring samples are collected at the WWTP and analyzed daily, bi-weekly, weekly, monthly, and semi-annually. Samples monitored at each given frequency are outlined below.

Daily

- Total Suspended Solids (TSS)
- Orthophosphate (PO₄-P)

Bi-Weekly

- Chemical Oxygen Demand (COD)
- Fecal Coliforms (from May 15 – September 15)

Weekly

- Five Day Carbonaceous Biochemical Oxygen Demand (cBOD₅)
- Total Phosphorous (TP)
- Total Kjeldahl Nitrogen (TKN)
- Nitrate + Nitrite (N+N)

Monthly

- Total Metals

Semi-Annually

- Fish Bioassay 96 hour LT50 (Rainbow Trout)

1.2 Permit Excursions

The WWTP tracks and monitors the number of permit excursions that occur during the year (Fig. 1). In 2016, the WWTP had two permit excursions, both for PO₄-P loading, which are discussed further in this report.

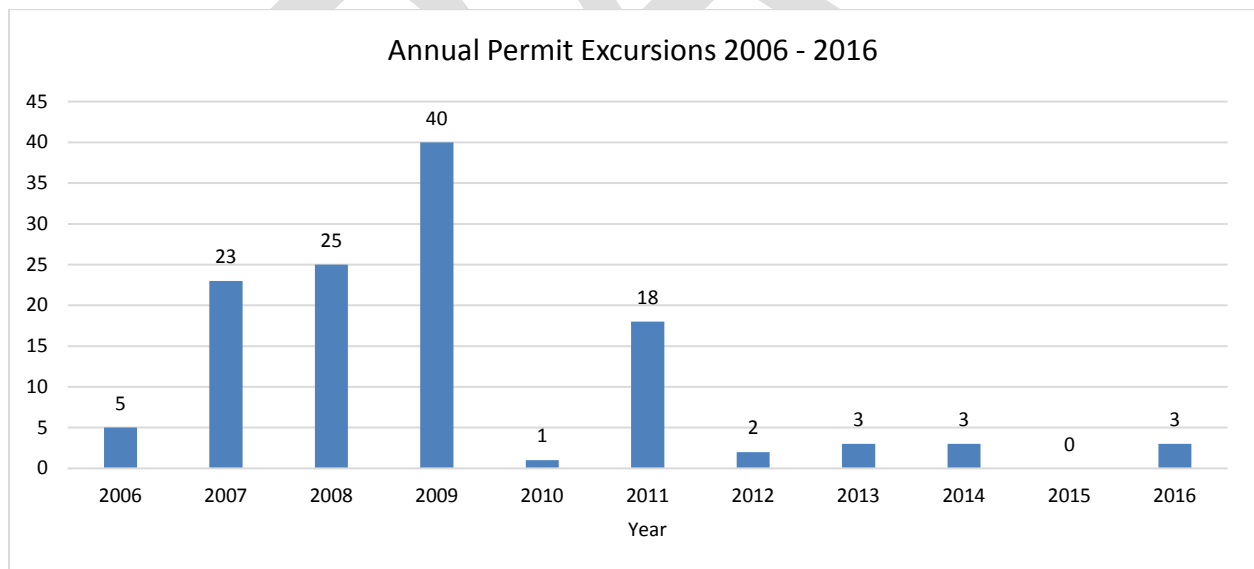


Figure 1. Number of permit excursions occurring by year since 2006.

1.3 General Permit Requirements

Table 1. List of General Permit Requirements.

General Requirement	Quantity
Volume of effluent that bypassed the WWTP*	0
Number of emergency shutdowns during the year	0
Number of trucks turned away due to hazardous waste	0
Number of achievements to report regarding source control and water conservation programs	0

*The raw sewage bypass line was removed in 2010

1.4 Outfall Inspection

The final effluent outfall was inspected by Cascade Environmental Resource Group in 2010.

1.5 Website

Monitoring data is posted on a quarterly basis to The Resort Municipality of Whistler’s website at <http://www.whistler.ca/wastewater-treatment-plant>

1.6 Facility Staffing

The Resort Municipality of Whistler Waste Water Treatment Plan facility staff qualifications meet and/or exceeded 2016 EOCP requirements (Table 2).

Staff qualifications met permit requirements in 2016

Table 2. Facility staff certification list.

Name	Position	Certification
Michael Day, P. Eng.	Utilities Manager	APEGBC Professional Engineer
Trish Browning	Supervisor	Environmental Engineering Technologist EOCP Level I Municipal Wastewater Treatment
Doug Brereton	Operator 4	EOCP Level IV Municipal Wastewater Treatment
Elizabeth Toole	Operator 3	EOCP Level III Municipal Wastewater Treatment
Hamish (Ty) MacFayden	Operator 3	EOCP Level III Municipal Wastewater Treatment
Wendy Linton	Operator 2	EOCP Level II Municipal Wastewater Treatment
Kristy Koehle	Operator 1	EOCP Level I Municipal Wastewater Treatment
Paul Kozin	Operator 1	EOCP Level I Municipal Wastewater Treatment
Neil Kearns	Lab Technician	EOCP Level II Municipal Wastewater Treatment
Bruce Eckersley	Millwright	Red Seal Certified Millwright

2 Discharge Discussion and Analysis

2.1 Discharge Volume

In 2016, as in previous years, the effluent discharge volume from the WWTP was substantially below the maximum allowable discharge volume for the dry season of 16,000 m³/day. The WWTP was also substantially below the 25,000 m³/day maximum allowable discharge volume for the wet season (Fig. 2). The average discharge volume was 9,738 m³/day during the dry season, and 11,369 m³/day during the wet season.

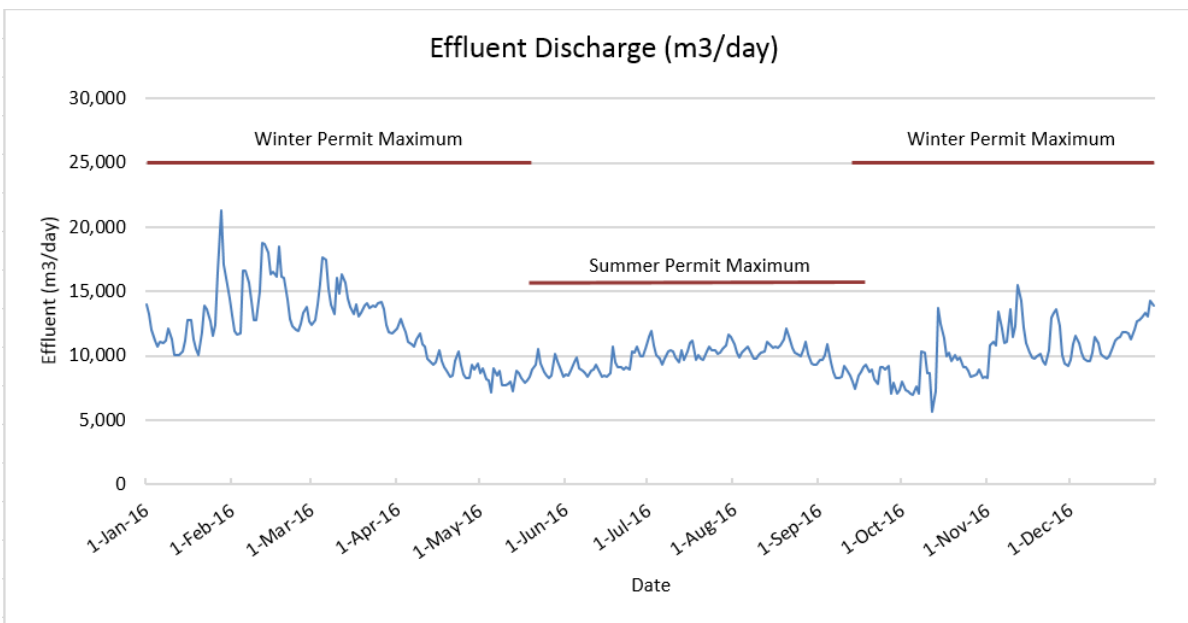


Figure 2. Whistler Waste Water Treatment Facility daily effluent discharge volume (mg/L) 2016.

Table 3. Maximum daily discharge (m3) wet and dry values by year 2004-2016

Year	Max Discharge Dry	Max Discharge Wet	Month Max Discharge Dry	Month Max Discharge Wet
2004	12,238	13,720	August	December
2005	11,402	17,174	July	January
2006	13,742	19,731	July	December
2007	13,991	24,247	August	March
2008	12,891	17,568	August	December
2009	11,623	17,859	June	April
2010	12,891	22,855	August	January
2011	12,153	19,472	July	January
2012	13,397	20,575	June	January
2013	12,525	19,351	June	March
2014	11,646	25,070	August	December
2015	11,447	25,019	August	February
2016	12,119	21,284	August	January

2.2 Orthophosphate as Phosphorous PO4-P

The Whistler WWTP experienced a major failure of its internal recycle pump and pump rail in the active bioreactor train, which ultimately resulted in three PO4-P exceedances in 2016; the PO4-P loading was 41.47 kg from July 15th – August 14th, and 42.645 kg from August 15th – September 14th. There was also a daily discharge concentration of 1.88 mg/L on October 12th.

The internal recycle pump had a mechanical failure on August 12th, and the resulting attempt at replacing the pump caused the pump rail to break off from the wall of the bioreactor. A rental pump was ordered on August 13th, however consistent and reliable operation of the temporary rental pump was not achieved until August 25th. Once the internal recycle was restored, PO4-P treatment was greatly improved.

The operations staff attempted to treat the excess PO4-P with aluminum sulphate, but it was not enough to counteract the amount of PO4-P discharging from the bioreactor.

Results are displayed in Figure 3 and Figure 4.

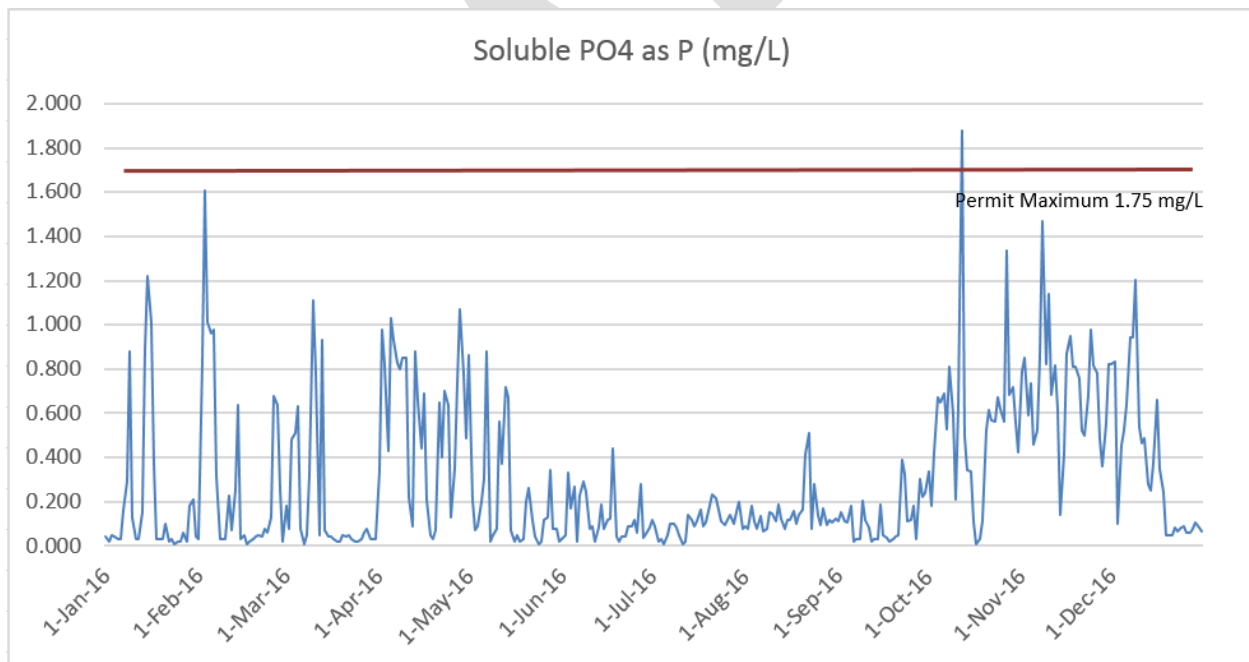


Figure 3. Whistler Waste Water Treatment Facility daily orthophosphate discharge concentrations (mg/L) 2016.

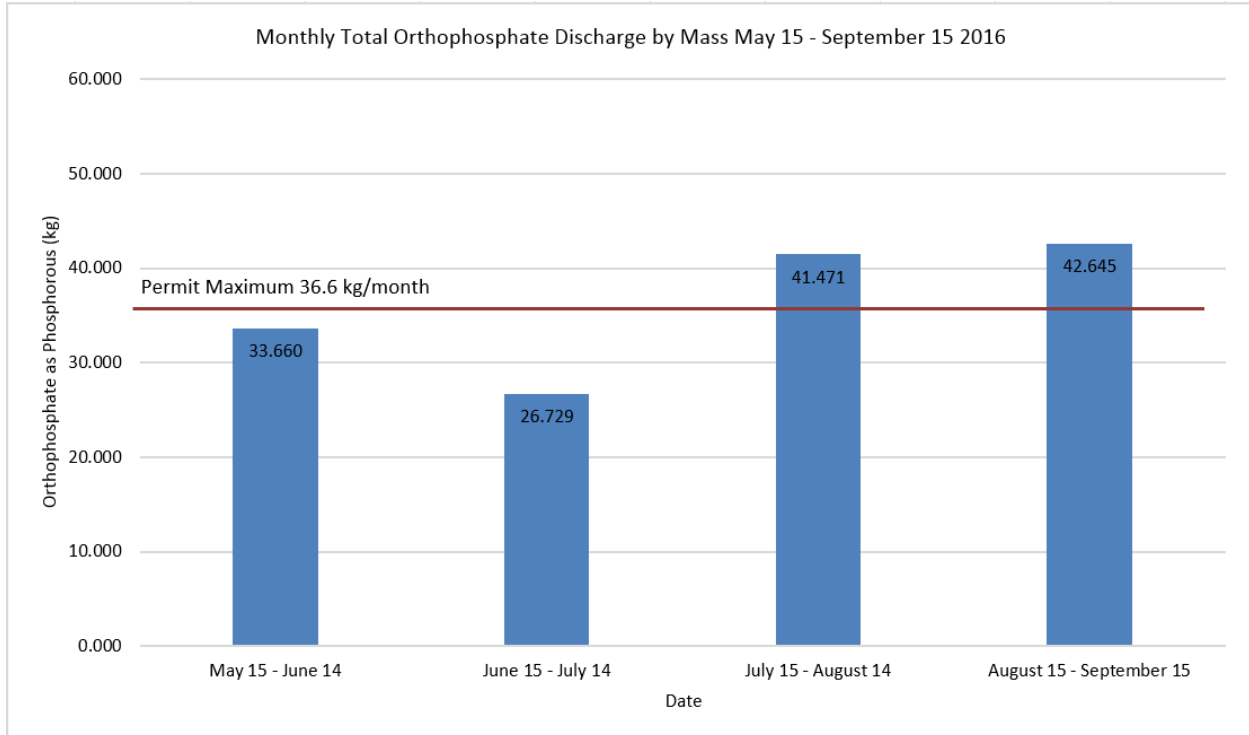


Figure 4. Whistler Waste Water Treatment Facility total orthophosphate discharge (kg) by month May 15 – Sept 15 2016.

2.3 Total Phosphorous

As per the Operational Certificate, the WWTP submits weekly final effluent samples to a certified laboratory for total phosphorous analysis (Fig. 5).

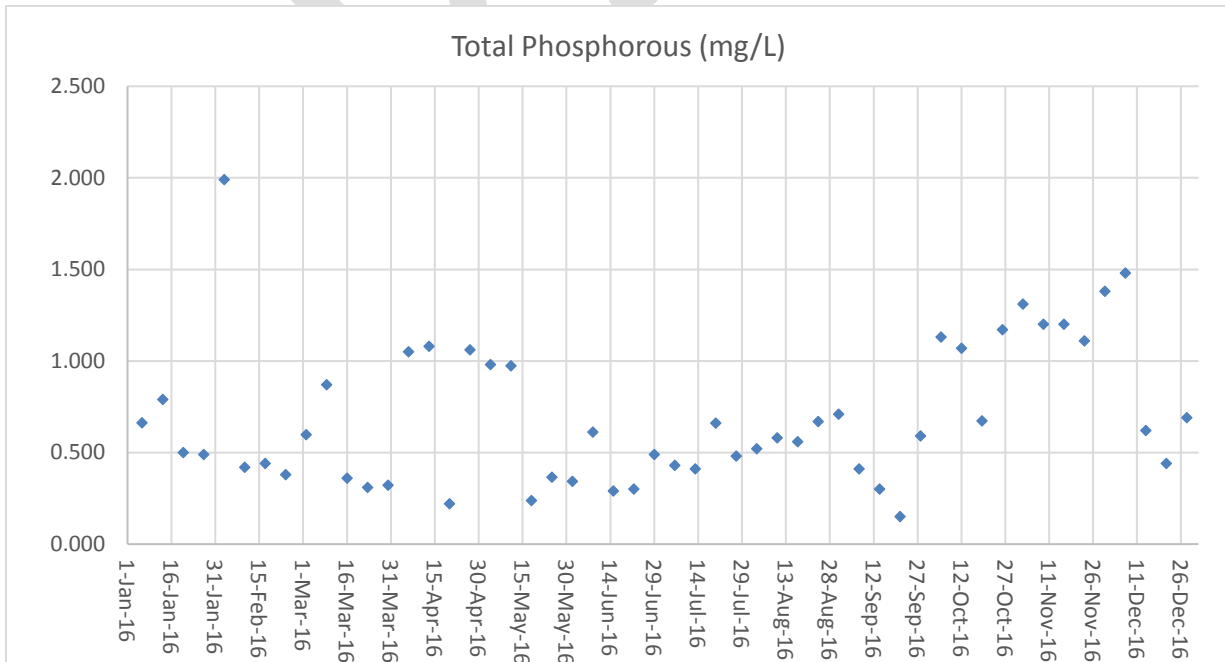


Figure 5. Whistler Waste Water Treatment Facility weekly total phosphorous in effluent (mg/L) 2016.

2.4 Total Suspended Solids

Total Suspended solids concentrations were within allowable levels in 2016 (Fig. 6).

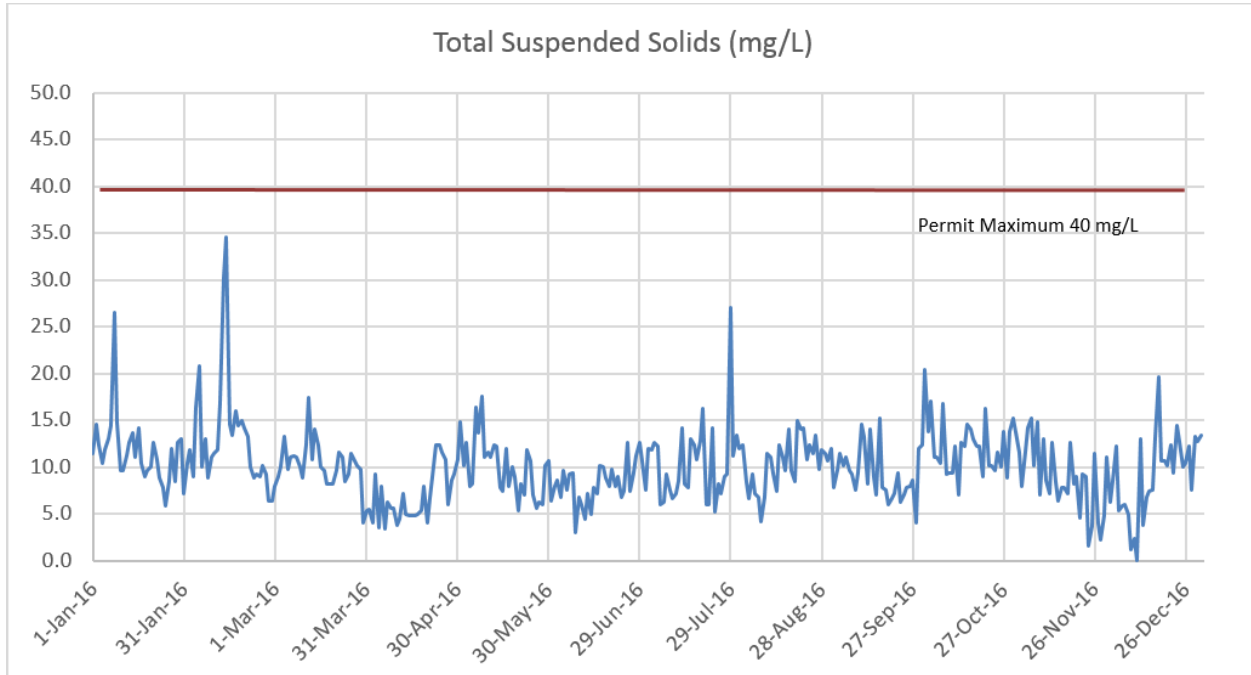


Figure 6. Whistler Waste Water Facility daily total suspended solids (mg/L) 2016

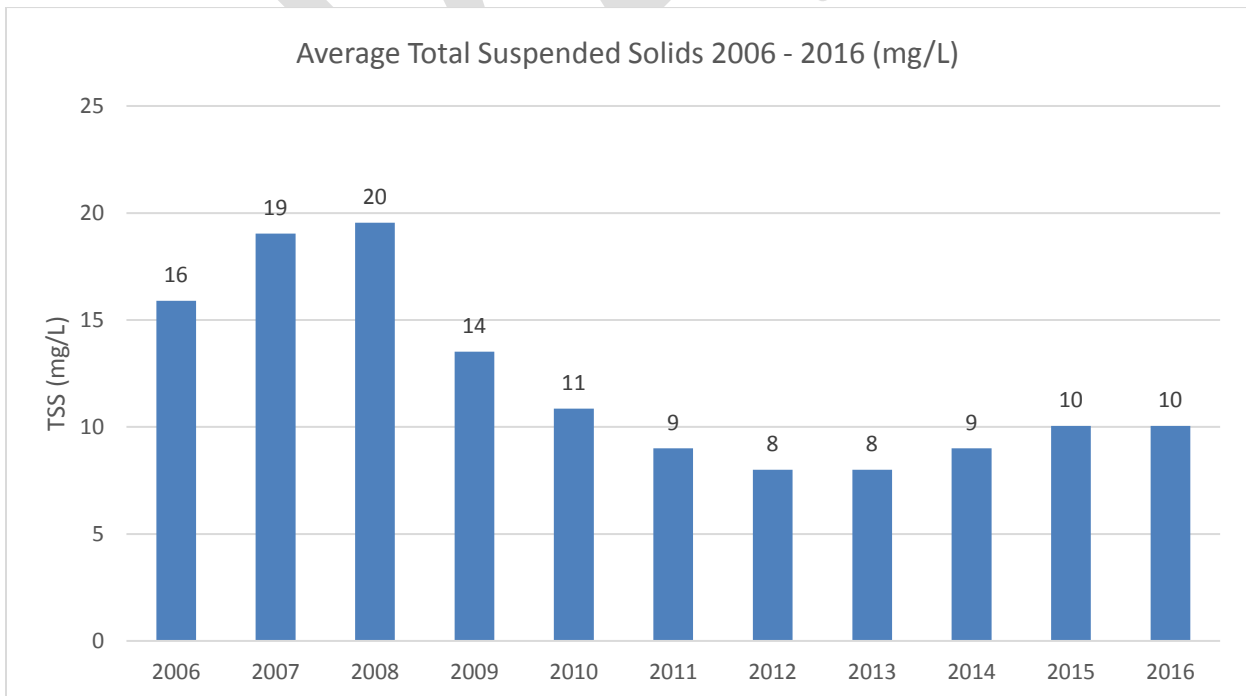


Figure 7. Whistler Waste Water Facility annual average suspended solids (mg/L) 2005 - 2016.

2.5 Carbonaceous Biochemical Oxygen Demand

Carbonaceous biochemical oxygen demand testing requirements outlined in the operational certificate were met in 2016.

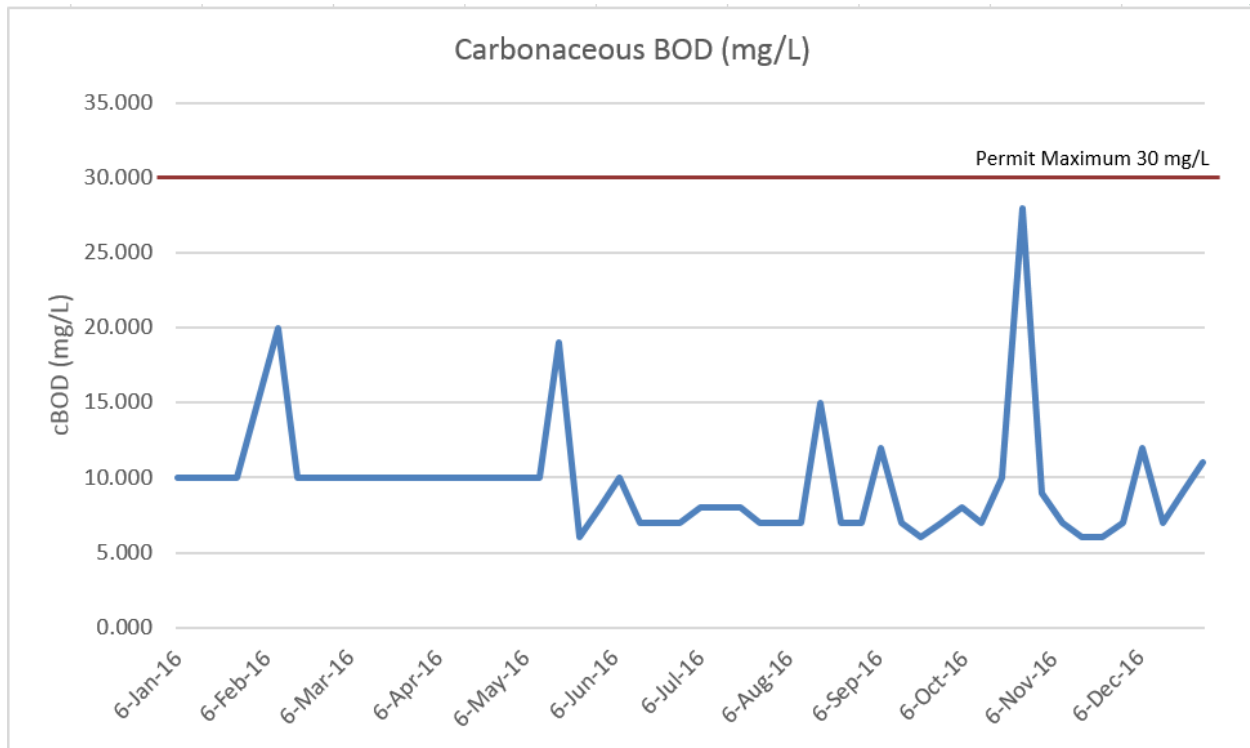


Figure 8. Whistler Waste Water Treatment Facility weekly carbonaceous BOD (mg/L) 2016.

2.6 Effluent Disinfection

As per the Operational Certificate, the WWTP disinfected the effluent with UV from May 15 to October 15. Bi-weekly final effluent samples were submitted to a certified laboratory for fecal coliform analysis throughout the disinfection period in order to verify the effectiveness of the UV disinfection. There were two elevated fecal coliform results in August, and September 2016. These results are thought to be due to cross contamination during sampling; the results are not thought to be a result of the effectiveness of the UV disinfection. (Fig. 9). Note: results determined to be less than detection limit are shown on the graph as the laboratory detection limit of 2.0 cfu/ 100 mL.

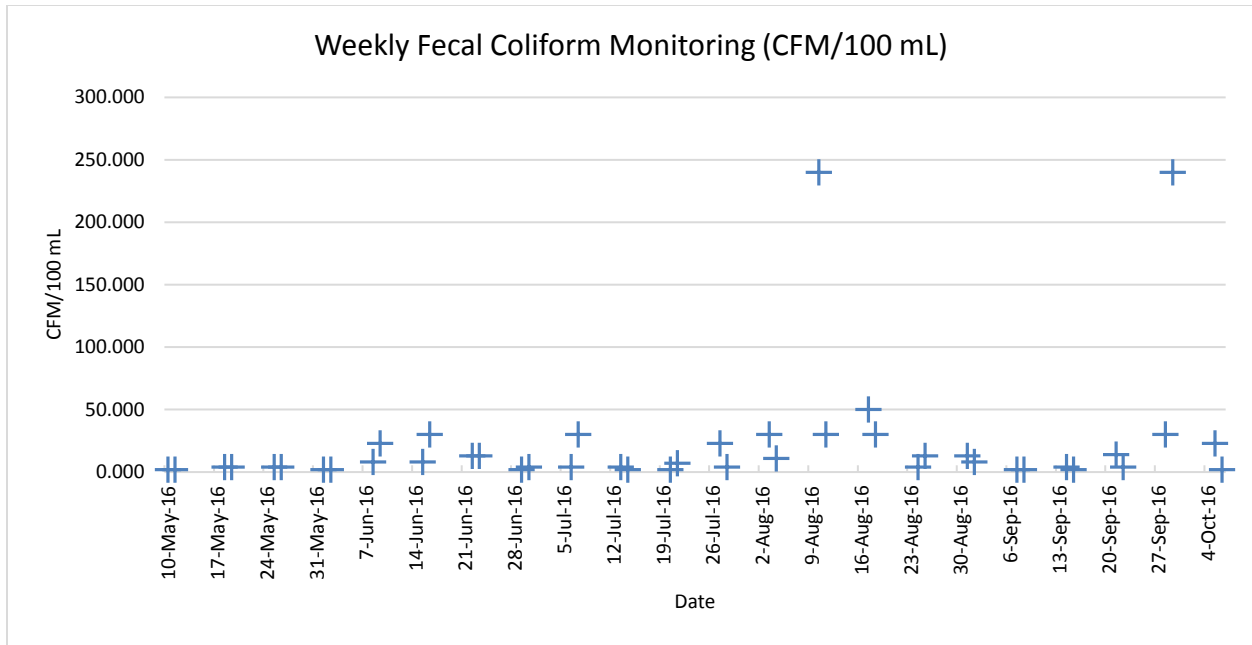


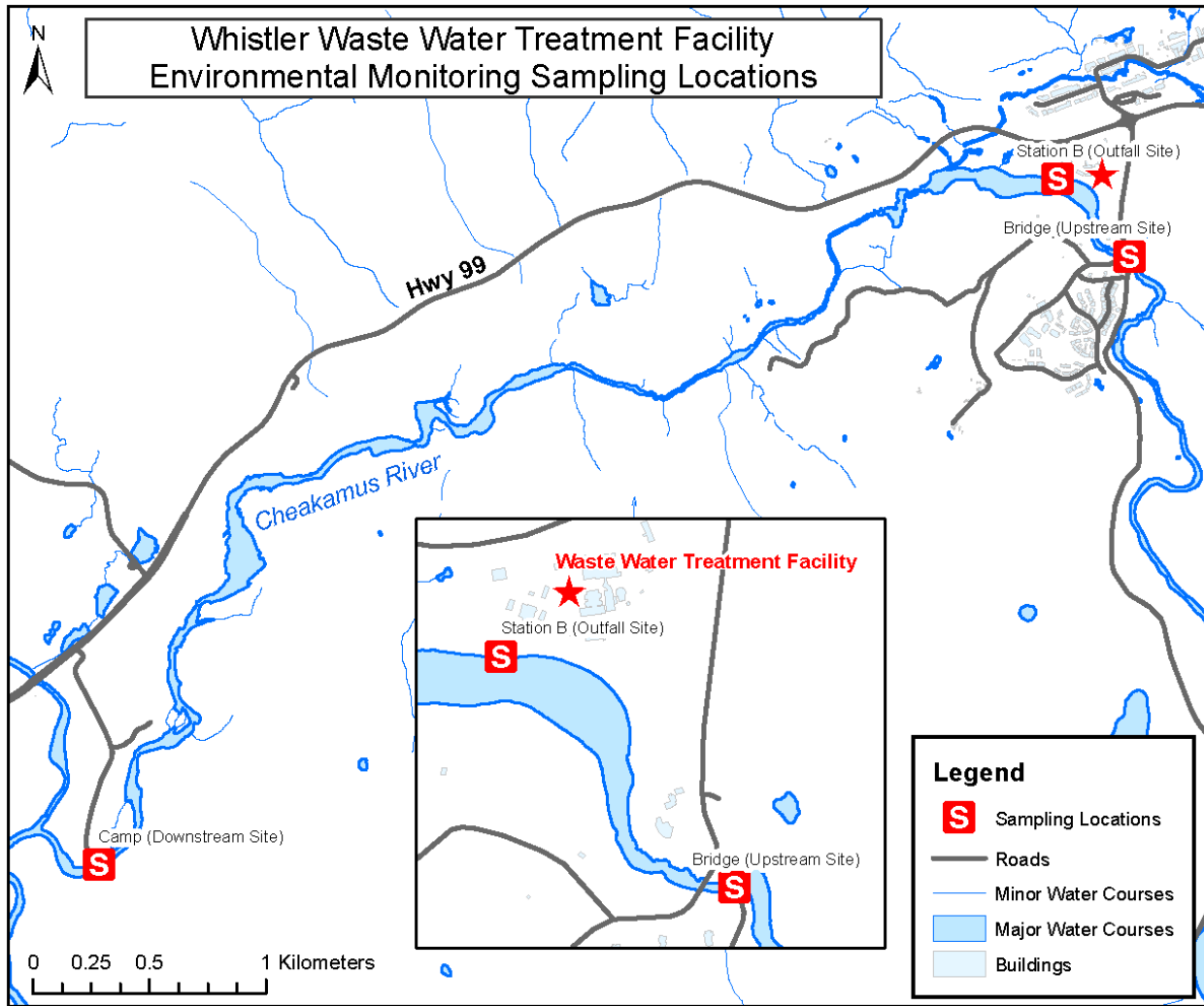
Figure 9. Whistler Waste water Treatment Facility weekly fecal coliform (CFM/mL) 2016.

2.7 Effluent Toxicity

The two LC50 toxicity tests performed as required by the operating permit resulted in 100% of rainbow trout fry surviving in raw (100% concentration) effluent for 96 hours.

3 Receiving Environment Monitoring

The receiving environment for the final effluent of the WWTP is routinely sampled once per month by WWTP staff, and the samples are submitted to a certified laboratory. This provides an accurate representation of conditions in the receiving environment throughout the year. The plant operating permit requires the RMOW monitor two sampling stations, with samples taken three times per year. As in the past few years, the RMOW maintained a more stringent monitoring program in 2016, sampling in three locations every month of the year. The results presented below that were determined to be less than detection limit are shown on the graphs at laboratory detection limit. The monitored parameters pH, turbidity, conductivity, PO₄-P, NO₂ + NO₃, total ammonia (NH₃), and total metals concentrations are compared at three sampling locations (Upstream, Outfall, Downstream) (Map. 1). The upstream sampling location (Bridge) is located approximately 100 meters above the outfall (Station B) and the downstream sampling location (Camp) is located approximately 4 kilometers downstream of the outfall.



Map 1. Whistler Waste Water Treatment Facility environmental monitoring sampling locations

3.1 pH in Receiving Environment

The WWTP had very little impact on the pH in the receiving environment. The average pH in 2016 at all sampling locations was 7.28, which is quite close to the previous year’s average of 7.37.

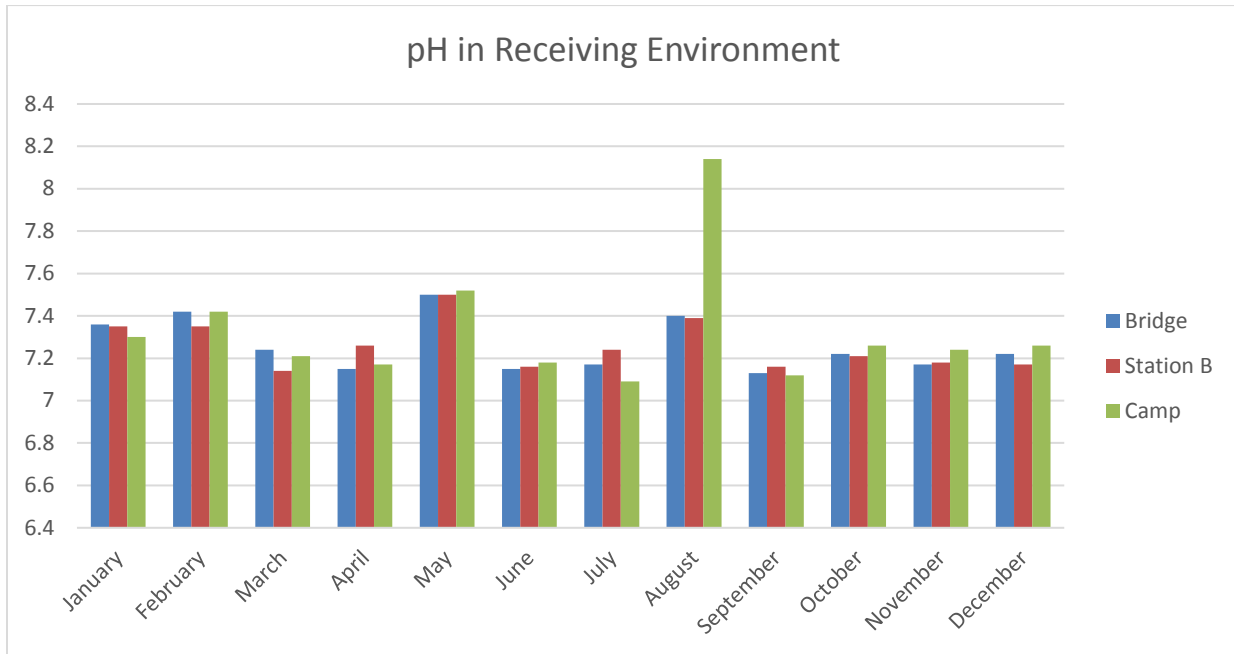


Figure 10. Whistler Waste Water Treatment Facility pH monitoring in receiving environment 2016.

3.2 Conductivity in Receiving Environment

The WWTP did seem to cause an increase in conductance in the receiving environment, as it has in years previous. As in 2014, the increase was more pronounced during the winter months associated with lower river flows. The WWTP had a smaller influence on conductance during the summer months. In each month, the observed increase in conductance had started to dissipate before the downstream sampling location.

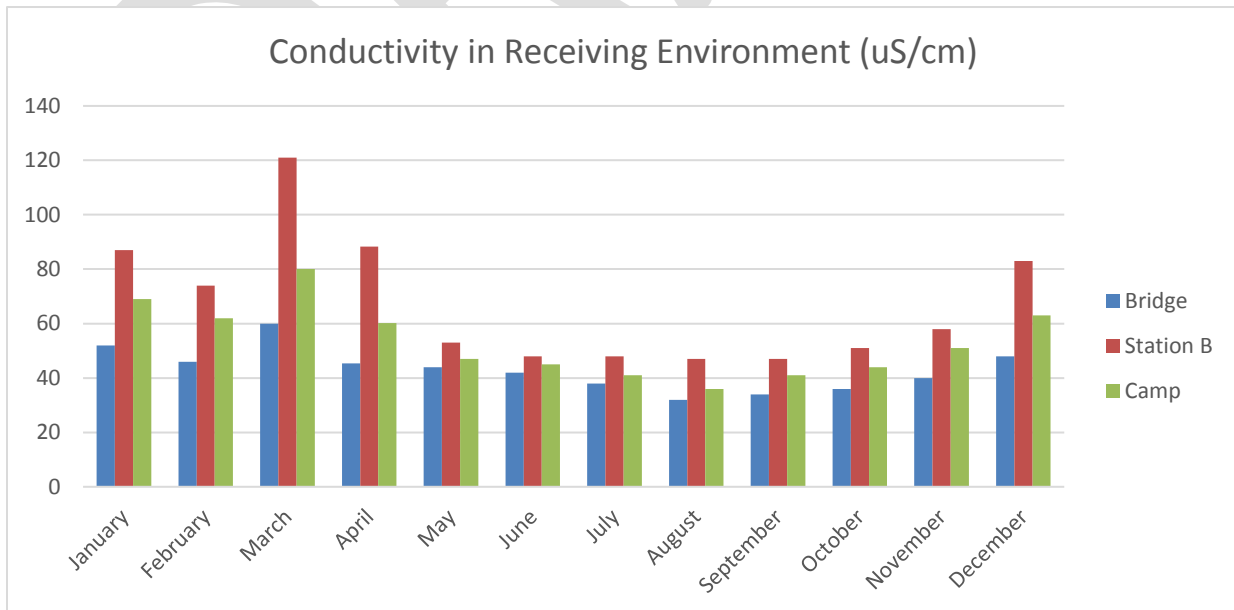


Figure 11. Whistler Waste Water Treatment Facility conductivity monitoring ($\mu\text{S}/\text{cm}$) in receiving environment 2016.

3.3 Turbidity in Receiving Environment

As in 2015, the WWTP effluent had a negligible effect on the turbidity of the receiving environment in 2016. In each month, all three sampling locations were within 1.0 NTU of each other.

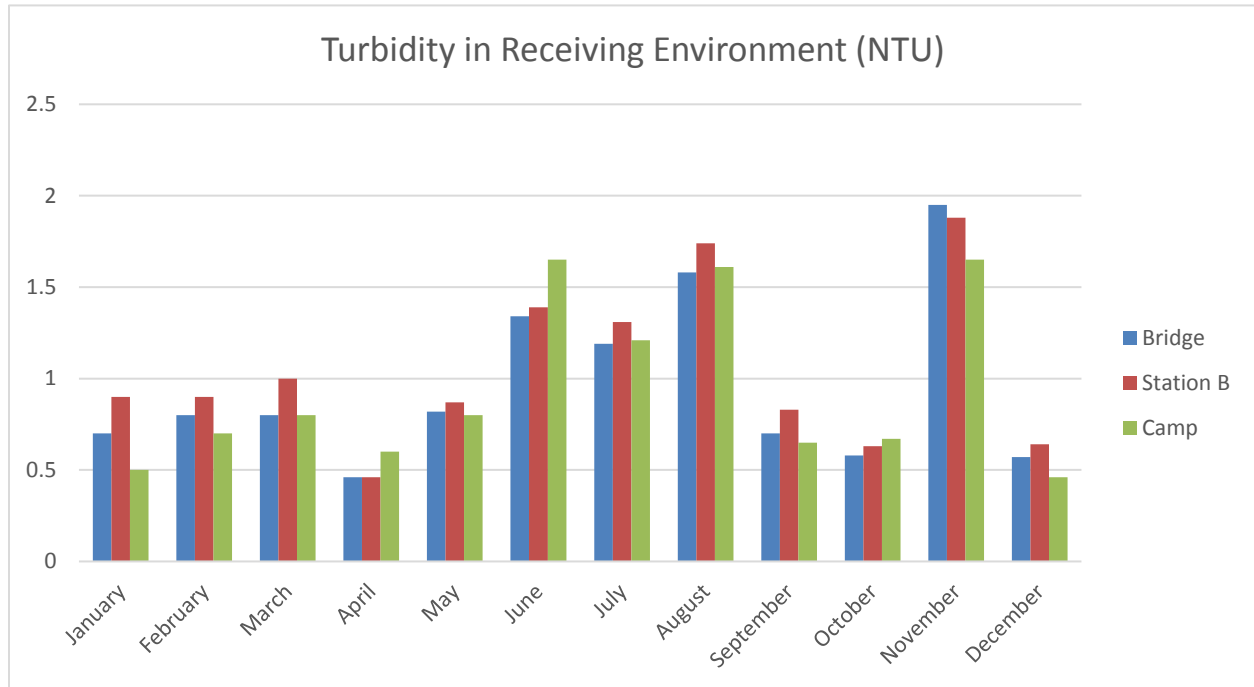


Figure 12. Whistler Waste Water Treatment Facility turbidity monitoring (NTU) in receiving environment 2016.

3.4 Orthophosphate (PO4-P) in Receiving Environment

The majority of PO4-P values in the receiving environment in 2016 were below the laboratory detection limit of 0.01 mg/L. In May, both the upstream and downstream sampling locations were elevated, but the Station B result is below detection limit. It is not thought that the final effluent caused these elevated results.

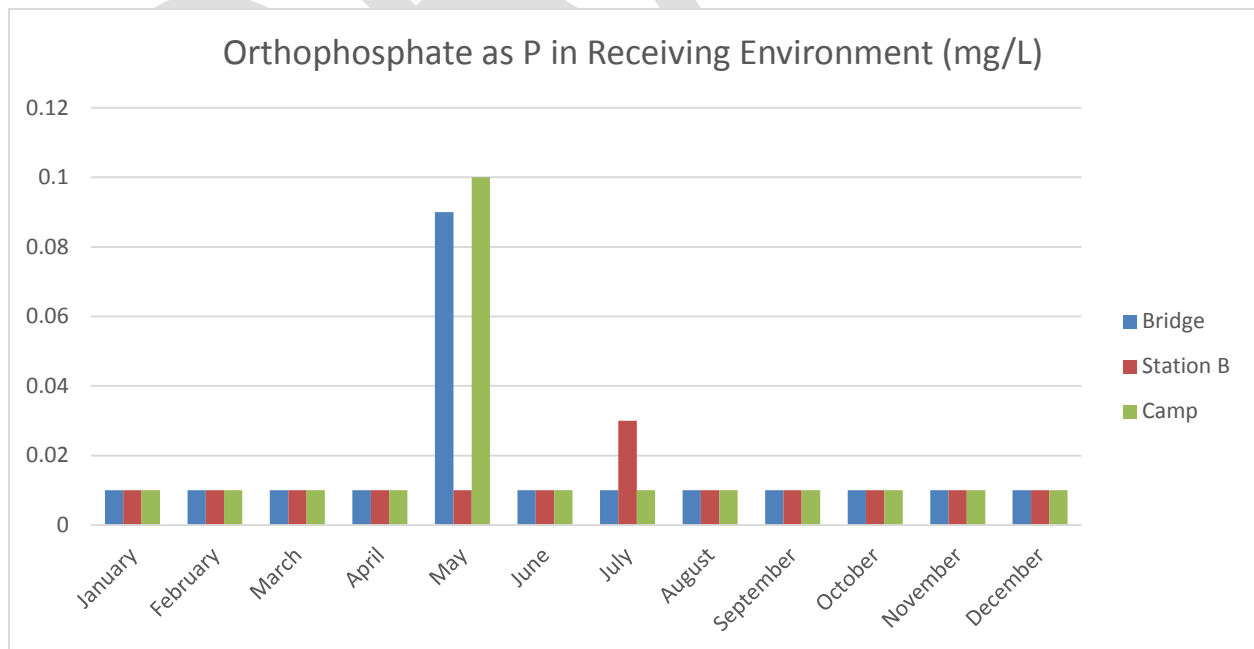


Figure 13. Whistler Waste Water Treatment Facility orthophosphate monitoring (mg/L) in receiving environment 2016.

3.5 Ammonia (NH₃-N) in Receiving Environment

The NH₃ levels at the Station B Outfall sampling location were only slightly higher than the receiving environment background levels in January, February, March and October of 2016. In each month that the Station B ammonia was higher than the upstream ammonia, the levels had dropped to background levels at the downstream sampling location. November was an anomaly, with both the upstream and downstream samples testing significantly higher than the Station B outfall. The upstream and downstream samples were still below 0.7 mg/L.

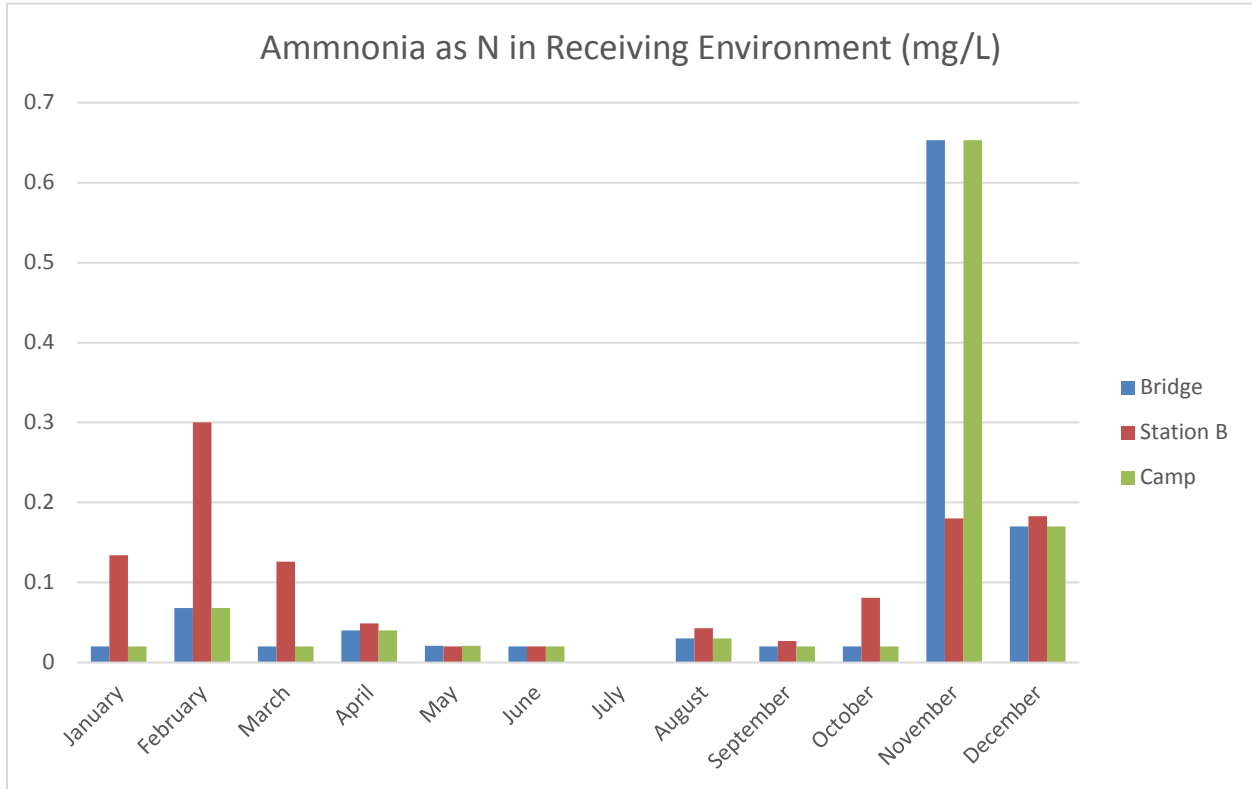


Figure 14. Whistler Waste Water Treatment Facility ammonia monitoring (mg/L) in receiving environment 2016.

3.6 Nitrate + Nitrite (N+N) in Receiving Environment

In 2016, there was elevated levels of nitrate and nitrite at the outfall sampling location in every month. These spikes did show significant dissipation at the downstream Camp sampling location, almost returning to background levels. During the summer sampling events, the effects on the receiving environment were reduced. This was consistent with last year’s monitoring.

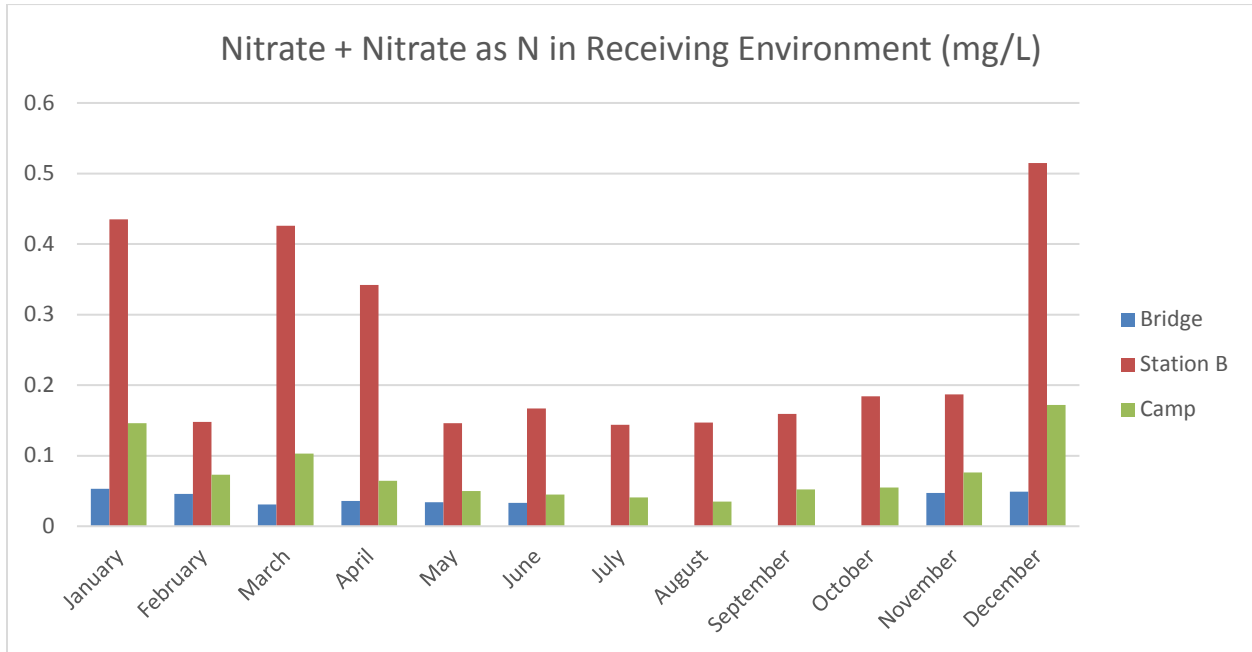


Figure 15. Whistler Waste Water Treatment Facility nitrogen monitoring (mg/L) in receiving environment 2016.

4 Conclusion

In the opinion of RMOW staff, this report fulfills the reporting requirements for the Operational Certificate ME-01452. If you have any questions, please contact either Trish Browning at 604-935-8386, or Chris Wike at 604-935-8315.

5 Appendix A – Waste Water Treatment Facility Data Table

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
1-Jan-16	13,957	11.4		0.040	0.558		
2-Jan-16	13,270	14.6		0.020	0.265		
3-Jan-16	12,021	12.4		0.050	0.601		
4-Jan-16	11,151	10.4		0.040	0.446		
5-Jan-16	10,718	11.8		0.030	0.322		
6-Jan-16	11,130	13.0	<10	0.030	0.334	0.662	
7-Jan-16	11,025	14.4		0.160	1.764		
8-Jan-16	11,191	26.5		0.290	3.245		
9-Jan-16	12,124	14.8		0.880	10.669		
10-Jan-16	11,276	9.6		0.130	1.466		
11-Jan-16	10,061	9.6		0.030	0.302		
12-Jan-16	10,023	11.2		0.030	0.301		
13-Jan-16	10,095	12.6	<10	0.150	1.514	0.790	
14-Jan-16	10,321	13.6		0.880	9.082		
15-Jan-16	11,155	11.0		1.220	13.609		
16-Jan-16	12,753	14.2		1.010	12.880		
17-Jan-16	12,743	10.4		0.380	4.842		
18-Jan-16	11,250	9.0		0.030	0.338		
19-Jan-16	10,500	9.6		0.030	0.315		
20-Jan-16	10,050	10.0	<10	0.030	0.302	0.500	
21-Jan-16	11,840	12.6		0.100	1.184		
22-Jan-16	13,869	10.8		0.020	0.277		
23-Jan-16	13,596	8.8		0.030	0.408		
24-Jan-16	12,710	7.8		0.010	0.127		
25-Jan-16	11,552	5.8		0.020	0.231		
26-Jan-16	12,442	8.4		0.020	0.249		
27-Jan-16	16,382	12.0	<10	0.060	0.983	0.490	
28-Jan-16	21,284	8.4		0.020	0.426		
29-Jan-16	17,080	12.6		0.180	3.074		
30-Jan-16	16,087	13.0		0.210	3.378		
31-Jan-16	14,428	7.2		0.040	0.577		

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
1-Feb-16	13,182	10.4		0.030	0.395		
2-Feb-16	11,922	11.8		0.830	9.895		
3-Feb-16	11,634	9.0	15.000	1.610	18.731	1.990	
4-Feb-16	11,777	16.2		1.010	11.895		
5-Feb-16	16,659	20.8		0.960	15.993		
6-Feb-16	16,644	10.0		0.980	16.311		
7-Feb-16	15,701	13.0		0.320	5.024		
8-Feb-16	14,250	8.8		0.030	0.428		
9-Feb-16	12,777	11.0		0.030	0.383		
10-Feb-16	12,733	11.4	20.000	0.030	0.382	0.420	
11-Feb-16	14,998	11.8		0.230	3.450		
12-Feb-16	18,798	16.8		0.070	1.316		
13-Feb-16	18,643	30.2		0.250	4.661		
14-Feb-16	18,007	34.6		0.640	11.524		
15-Feb-16	16,352	14.6		0.030	0.491		
16-Feb-16	16,502	13.4		0.050	0.825		
17-Feb-16	16,169	16.0	<10	0.010	0.162	0.440	
18-Feb-16	18,525	14.4		0.020	0.371		
19-Feb-16	16,148	15.0		0.030	0.484		
20-Feb-16	16,019	14.2		0.040	0.641		
21-Feb-16	14,400	13.2		0.050	0.720		
22-Feb-16	12,870	10.0		0.040	0.515		
23-Feb-16	12,323	8.8		0.080	0.986		
24-Feb-16	11,991	9.2	<10	0.060	0.719	0.379	
25-Feb-16	11,925	9.0		0.130	1.550		
26-Feb-16	12,530	10.2		0.680	8.520		
27-Feb-16	13,358	9.2		0.640	8.549		
28-Feb-16	13,799	6.4		0.260	3.588		
29-Feb-16	12,710	6.4		0.020	0.254		

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
1-Mar-16	12,428	8.0		0.180	2.237		
2-Mar-16	12,752	9.0	<10	0.080	1.020	0.599	
3-Mar-16	14,032	10.0		0.480	6.735		
4-Mar-16	15,624	13.2		0.510	7.968		
5-Mar-16	17,686	9.8		0.630	11.142		
6-Mar-16	17,467	11.0		0.080	1.397		
7-Mar-16	15,213	11.2		0.010	0.152		
8-Mar-16	13,990	11.0		0.050	0.700		
9-Mar-16	13,224	10.0	<10	0.320	4.232	0.870	
10-Mar-16	16,007	8.8		1.110	17.768		
11-Mar-16	14,867	12.4		0.790	11.745		
12-Mar-16	16,362	17.4		0.050	0.818		
13-Mar-16	15,693	10.8		0.930	14.594		
14-Mar-16	14,437	14.0		0.070	1.011		
15-Mar-16	13,761	12.4		0.040	0.550		
16-Mar-16	13,244	10.0	<10	0.040	0.530	0.360	
17-Mar-16	13,949	9.6		0.030	0.418		
18-Mar-16	13,018	8.2		0.020	0.260		
19-Mar-16	13,369	8.2		0.020	0.267		
20-Mar-16	13,876	8.2		0.050	0.694		
21-Mar-16	14,038	9.6		0.040	0.562		
22-Mar-16	13,744	11.6		0.050	0.687		
23-Mar-16	13,871	11.0	<10	0.030	0.416	0.310	
24-Mar-16	13,767	8.4		0.020	0.275		
25-Mar-16	14,101	9.2		0.020	0.282		
26-Mar-16	14,168	11.4		0.030	0.425		
27-Mar-16	13,627	10.6		0.060	0.818		
28-Mar-16	12,428	10.2		0.080	0.994		
29-Mar-16	11,846	9.8		0.030	0.355		
30-Mar-16	11,725	4.0	<10	0.030	0.352	0.321	
31-Mar-16	11,886	5.4		0.030	0.357		

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
1-Apr-16	12,069	5.5		0.340	4.103		
2-Apr-16	12,891	4.0		0.980	12.633		
3-Apr-16	12,335	9.2		0.820	10.115		
4-Apr-16	11,832	3.5		0.430	5.088		
5-Apr-16	11,070	8.0		1.030	11.402		
6-Apr-16	10,937	3.4	<10	0.930	10.171	1.050	
7-Apr-16	10,697	6.2		0.830	8.879		
8-Apr-16	11,233	5.6		0.800	8.986		
9-Apr-16	11,753	5.6		0.850	9.990		
10-Apr-16	10,929	3.8		0.850	9.290		
11-Apr-16	10,677	4.4		0.220	2.349		
12-Apr-16	9,776	7.2		0.090	0.880		
13-Apr-16	9,496	5.0	<10	0.880	8.356	1.080	
14-Apr-16	9,306	4.8		0.660	6.142		
15-Apr-16	9,484	4.8		0.440	4.173		
16-Apr-16	10,464	4.8		0.690	7.220		
17-Apr-16	9,569	5.0		0.210	2.009		
18-Apr-16	9,130	5.4		0.050	0.457		
19-Apr-16	8,845	8.0		0.030	0.265		
20-Apr-16	8,343	4.0	<10	0.070	0.584	0.220	
21-Apr-16	8,460	6.6		0.650	5.499		
22-Apr-16	9,546	10.0		0.400	3.819		
23-Apr-16	10,322	12.4		0.700	7.225		
24-Apr-16	9,345	12.4		0.640	5.981		
25-Apr-16	8,564	11.6		0.130	1.113		
26-Apr-16	8,313	10.8		0.350	2.910		
27-Apr-16	8,310	6.0	<10	0.730	6.066	1.060	
28-Apr-16	9,275	8.6		1.070	9.924		
29-Apr-16	8,922	9.2		0.780	6.959		
30-Apr-16	9,370	10.8		0.490	4.591		

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
1-May-16	8,670	14.8		0.860	7.456		
2-May-16	8,989	10.2		0.210	1.888		
3-May-16	8,167	12.6		0.070	0.572		
4-May-16	8,058	8.0	<10	0.090	0.725	0.980	
5-May-16	7,138	8.2		0.200	1.428		
6-May-16	9,067	16.4		0.300	2.720		
7-May-16	8,453	13.6		0.880	7.439		
8-May-16	8,825	17.6		0.020	0.177		
9-May-16	7,746	11.0		0.050	0.387		
10-May-16	7,713	11.6		0.080	0.617		1.999
11-May-16	7,765	11.0	<10	0.560	4.348	0.974	1.999
12-May-16	8,015	12.4		0.370	2.966		
13-May-16	7,204	12.2		0.720	5.187		
14-May-16	8,853	7.8		0.670	5.932		
15-May-16	8,619	7.4		0.070	0.603		
16-May-16	8,240	12.0		0.020	0.165		
17-May-16	7,927	8.0		0.050	0.396		
18-May-16	8,112	10.0	19.000	0.020	0.162	0.237	4.000
19-May-16	8,328	9.0		0.030	0.250		4.000
20-May-16	8,911	5.4		0.200	1.782		
21-May-16	9,348	8.2		0.260	2.431		
22-May-16	10,524	7.0		0.120	1.263		
23-May-16	9,352	11.8		0.040	0.374		
24-May-16	8,768	10.6		0.010	0.088		
25-May-16	8,422	7.0	6.000	0.020	0.168	0.366	4.000
26-May-16	8,251	5.6		0.121	0.994		4.000
27-May-16	8,447	6.2		0.130	1.101		
28-May-16	10,100	6.0		0.345	3.487		
29-May-16	9,579	10.2		0.080	0.766		
30-May-16	9,121	10.6		0.080	0.730		
31-May-16	8,368	6.4		0.020	0.167		

Date	Effluent (m3/day)	Total Suspend ed Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorus (mg/L)	Fecal Coliform (cfu/100mL)
1-Jun-16	8,579	8.0	8.000	0.030	0.257	0.342	<2
2-Jun-16	8,469	8.6		0.050	0.423		<2
3-Jun-16	8,803	6.8		0.332	2.925		
4-Jun-16	9,445	9.6		0.173	1.631		
5-Jun-16	9,867	7.6		0.270	2.668		
6-Jun-16	8,983	9.2		0.020	0.180		
7-Jun-16	8,815	9.4		0.230	2.027		
8-Jun-16	8,645	3.0	10.000	0.290	2.507	0.611	8.000
9-Jun-16	8,391	6.8		0.248	2.077		23.000
10-Jun-16	8,868	6.0		0.078	0.693		
11-Jun-16	8,974	4.4		0.091	0.818		
12-Jun-16	9,290	7.2		0.020	0.186		
13-Jun-16	8,958	5.0		0.085	0.759		
14-Jun-16	8,367	7.8		0.189	1.581		
15-Jun-16	8,417	7.2	7.000	0.080	0.673	0.290	8.000
16-Jun-16	8,360	10.2		0.120	1.003		30.000
17-Jun-16	8,632	10.0		0.124	1.068		
18-Jun-16	10,691	8.8		0.440	4.701		
19-Jun-16	9,481	8.0		0.040	0.379		
20-Jun-16	9,070	9.8		0.020	0.181		
21-Jun-16	9,104	8.0		0.040	0.364		
22-Jun-16	8,936	9.0	7.000	0.040	0.357	0.300	13.000
23-Jun-16	9,122	6.8		0.088	0.802		13.000
24-Jun-16	8,931	7.4		0.091	0.815		
25-Jun-16	10,321	12.6		0.121	1.244		
26-Jun-16	10,279	7.4		0.059	0.603		
27-Jun-16	10,690	9.4		0.280	2.993		
28-Jun-16	9,924	11.2		0.036	0.356		
29-Jun-16	9,946	12.6	7.000	0.055	0.551	0.490	<2
30-Jun-16	10,521	10.6		0.081	0.857		4.000

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
1-Jul-16	11,451	7.6		0.117	1.343		
2-Jul-16	11,928	12.0		0.088	1.049		
3-Jul-16	10,809	11.8		0.020	0.216		
4-Jul-16	10,064	12.6		0.030	0.302		
5-Jul-16	9,743	12.2		0.010	0.097		
6-Jul-16	9,312	6.0	8.000	0.050	0.466	0.430	4.000
7-Jul-16	9,788	6.2		0.098	0.956		30.000
8-Jul-16	10,295	9.2		0.101	1.040		
9-Jul-16	10,430	7.6		0.085	0.883		
10-Jul-16	10,300	6.6		0.050	0.515		
11-Jul-16	9,828	7.2		0.010	0.098		
12-Jul-16	9,523	8.4		0.020	0.190		
13-Jul-16	10,396	14.2	8.000	0.143	1.490	0.410	4.000
14-Jul-16	9,680	8.2		0.117	1.135		2.000
15-Jul-16	10,346	7.8		0.088	0.910		
16-Jul-16	10,972	13.0		0.111	1.215		
17-Jul-16	11,185	12.4		0.163	1.822		
18-Jul-16	9,716	10.8		0.088	0.855		
19-Jul-16	10,060	12.8		0.107	1.081		
20-Jul-16	9,789	16.2	8.000	0.182	1.786		2.000
21-Jul-16	9,667	6.0		0.235	2.267	0.660	7.000
22-Jul-16	10,296	6.0		0.218	2.247		
23-Jul-16	10,697	14.2		0.166	1.777		
24-Jul-16	10,396	5.2		0.114	1.185		
25-Jul-16	10,392	8.2		0.094	0.982		
26-Jul-16	10,158	7.2		0.121	1.224		
27-Jul-16	10,206	9.0	7.000	0.143	1.463	0.480	23.000
28-Jul-16	10,489	9.2		0.101	1.059		4.000
29-Jul-16	10,767	27.0		0.153	1.648		
30-Jul-16	11,629	11.2		0.199	2.311		
31-Jul-16	11,430	13.4		0.078	0.894		

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
1-Aug-16	10,927	12.0		0.091	0.997		
2-Aug-16	10,199	12.4		0.078	0.797		
3-Aug-16	9,826	8.4	7.000	0.182	1.792	0.520	30.000
4-Aug-16	10,242	6.6		0.114	1.168		11.000
5-Aug-16	10,547	9.2		0.075	0.790		
6-Aug-16	10,721	7.2		0.137	1.467		
7-Aug-16	10,375	6.8		0.065	0.676		
8-Aug-16	9,739	4.2		0.078	0.761		
9-Aug-16	9,804	6.8		0.153	1.501		
10-Aug-16	10,016	11.4	7.000	0.147	1.468	0.580	240.000
11-Aug-16	10,205	11.0		0.114	1.163		30.000
12-Aug-16	10,359	9.4		0.186	1.923		
13-Aug-16	11,071	7.4		0.124	1.370		
14-Aug-16	10,906	12.4		0.080	0.872		
15-Aug-16	10,586	11.0		0.120	1.270		
16-Aug-16	10,689	9.6		0.120	1.283		
17-Aug-16	10,626	14.0	15.000	0.160	1.700	0.560	50.000
18-Aug-16	10,767	9.6		0.100	1.077		30.000
19-Aug-16	11,233	8.4		0.140	1.573		
20-Aug-16	12,119	15.0		0.166	2.013		
21-Aug-16	11,516	14.0		0.410	4.722		
22-Aug-16	10,644	14.2		0.510	5.428		
23-Aug-16	10,231	10.8		0.080	0.818		
24-Aug-16	10,152	12.4	7.000	0.280	2.843	0.670	4.000
25-Aug-16	9,981	11.4		0.140	1.397		13.000
26-Aug-16	10,381	13.4		0.097	1.007		
27-Aug-16	11,082	9.8		0.169	1.877		
28-Aug-16	10,101	11.8		0.094	0.954		
29-Aug-16	9,429	11.4		0.121	1.136		
30-Aug-16	9,296	10.6		0.104	0.969		
31-Aug-16	9,301	12.0	7.000	0.124	1.151	0.710	13.000

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
1-Sep-16	9,717	7.8		0.111	1.076		8.000
2-Sep-16	9,659	9.6		0.153	1.479		
3-Sep-16	10,061	11.4		0.114	1.147		
4-Sep-16	10,912	10.2		0.104	1.137		
5-Sep-16	9,512	11.0		0.180	1.712		
6-Sep-16	8,720	9.6		0.020	0.174		
7-Sep-16	8,303	9.2	12.000	0.030	0.249	0.410	<2
8-Sep-16	8,296	7.6		0.030	0.249		2.000
9-Sep-16	8,374	9.4		0.205	1.718		
10-Sep-16	9,171	14.6		0.121	1.105		
11-Sep-16	8,956	13.3		0.081	0.729		
12-Sep-16	8,460	8.2		0.020	0.169		
13-Sep-16	8,034	14.0		0.030	0.241		
14-Sep-16	7,451	9.0	7.000	0.032	0.238	0.300	4.000
15-Sep-16	8,468	7.0		0.186	1.572		<2
16-Sep-16	8,728	15.2		0.049	0.426		
17-Sep-16	9,136	7.8		0.039	0.357		
18-Sep-16	9,271	7.6		0.020	0.185		
19-Sep-16	8,752	6.0		0.030	0.263		
20-Sep-16	8,954	6.6		0.040	0.358		
21-Sep-16	8,222	7.2	6.000	0.050	0.411	0.150	14.000
22-Sep-16	7,841	9.4		0.390	3.058		4.000
23-Sep-16	9,161	6.2		0.326	2.984		
24-Sep-16	9,156	7.0		0.114	1.044		
25-Sep-16	8,894	7.8		0.120	1.067		
26-Sep-16	9,224	8.0		0.180	1.660		
27-Sep-16	7,052	8.6		0.030	0.212		
28-Sep-16	7,928	4.0	7.000	0.300	2.378	0.590	30.000
29-Sep-16	7,063	12.0		0.221	1.564		240.000
30-Sep-16	7,290	12.4		0.240	1.750		

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
1-Oct-16	7,956	20.4		0.340	2.705		
2-Oct-16	7,367	13.8		0.180	1.326		
3-Oct-16	7,276	17.0		0.420	3.056		
4-Oct-16	7,080	11.0		0.670	4.744		
5-Oct-16	6,931	11.0	8.000	0.650	4.505	1.130	23.000
6-Oct-16	7,571	10.4		0.690	5.224		2.000
7-Oct-16	7,023	16.8		0.530	3.722		
8-Oct-16	10,365	9.2		0.810	8.396		
9-Oct-16	10,203	9.4		0.599	6.115		
10-Oct-16	8,643	9.4		0.210	1.815		
11-Oct-16	8,679	12.2		0.620	5.381		
12-Oct-16	5,663	7.0	7.000	1.880	10.647	1.070	13.000
13-Oct-16	7,226	12.6		0.502	3.625		
14-Oct-16	13,676	12.2		0.342	4.677		
15-Oct-16	12,458	14.6		0.339	4.220		
16-Oct-16	11,376	14.0		0.110	1.251		
17-Oct-16	9,993	13.0		0.010	0.100		
18-Oct-16	10,220	12.2		0.030	0.307		
19-Oct-16	9,629	12.2	10.000	0.110	1.059	0.673	
20-Oct-16	10,073	9.0		0.520	5.238		
21-Oct-16	9,669	16.2		0.616	5.953		
22-Oct-16	9,826	10.2		0.570	5.601		
23-Oct-16	9,086	10.2		0.560	5.088		
24-Oct-16	9,091	9.6		0.670	6.091		
25-Oct-16	8,823	11.6		0.620	5.470		
26-Oct-16	8,397	10.0	28.000	0.560	4.702	1.170	
27-Oct-16	8,438	13.8		1.336	11.269		
28-Oct-16	8,599	8.8		0.684	5.882		
29-Oct-16	8,930	13.8		0.717	6.399		
30-Oct-16	8,302	15.2		0.560	4.649		
31-Oct-16	8,410	13.8		0.423	3.561		

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
1-Nov-16	8,279	11.6		0.790	6.540		
2-Nov-16	10,839	8.0	9.000	0.850	9.213	1.310	
3-Nov-16	11,062	11.6		0.590	6.527		
4-Nov-16	10,760	14.2		0.736	7.921		
5-Nov-16	13,415	15.2		0.459	6.161		
6-Nov-16	12,160	10.2		0.520	6.323		
7-Nov-16	10,982	14.8		0.850	9.335		
8-Nov-16	11,127	7.0		1.470	16.357		
9-Nov-16	13,630	13.0	7.000	0.820	11.177	1.200	
10-Nov-16	11,467	8.6		1.140	13.073		
11-Nov-16	12,347	7.2		0.684	8.446		
12-Nov-16	15,465	12.6		0.814	12.594		
13-Nov-16	14,241	8.4		0.619	8.814		
14-Nov-16	12,213	6.4		0.140	1.710		
15-Nov-16	10,958	7.8		0.410	4.493		
16-Nov-16	10,274	7.8	6.000	0.870	8.938	1.200	
17-Nov-16	9,841	7.2		0.950	9.349		
18-Nov-16	9,798	12.6		0.810	7.936		
19-Nov-16	9,976	8.2		0.810	8.081		
20-Nov-16	10,145	9.0		0.760	7.710		
21-Nov-16	9,554	4.6		0.520	4.968		
22-Nov-16	9,292	9.2		0.500	4.646		
23-Nov-16	10,398	9.0	6.000	0.680	7.071	1.110	
24-Nov-16	12,959	1.6		0.980	12.700		
25-Nov-16	13,309	3.6		0.814	10.838		
26-Nov-16	13,638	11.4		0.782	10.662		
27-Nov-16	12,258	4.0		0.489	5.989		
28-Nov-16	10,039	2.2		0.358	3.597		
29-Nov-16	9,395	4.8		0.550	5.167		
30-Nov-16	9,162	11.0	7.000	0.820	7.513	1.380	

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
1-Dec-16	9,662	6.2		0.820	7.923		
2-Dec-16	10,860	8.4		0.834	9.056		
3-Dec-16	11,570	12.2		0.098	1.131		
4-Dec-16	10,970	5.4		0.450	4.937		
5-Dec-16	10,252	5.8		0.520	5.331		
6-Dec-16	9,783	6.0		0.640	6.261		
7-Dec-16	9,589	5.0	12.000	0.941	9.027	1.480	
8-Dec-16	9,538	1.2		0.945	9.010		
9-Dec-16	10,256	2.4		1.205	12.361		
10-Dec-16	11,415			0.537	6.135		
11-Dec-16	11,019	13.0		0.466	5.133		
12-Dec-16	10,147	3.8		0.489	4.958		
13-Dec-16	9,924	6.8		0.280	2.779		
14-Dec-16	9,792	7.4	7.000	0.250	2.448	0.620	
15-Dec-16	9,959	7.6		0.370	3.685		
16-Dec-16	10,447	13.0		0.661	6.908		
17-Dec-16	11,138	19.6		0.350	3.898		
18-Dec-16	11,363	10.6		0.244	2.776		
19-Dec-16	11,443	10.6		0.050	0.572		
20-Dec-16	11,859	10.2		0.050	0.593		
21-Dec-16	11,807	12.4	9.000	0.050	0.590	0.440	
22-Dec-16	11,770	9.4		0.085	0.997		
23-Dec-16	11,227	14.4		0.068	0.768		
24-Dec-16	12,023	12.8		0.081	0.979		
25-Dec-16	12,695	10.0		0.088	1.116		
26-Dec-16	12,818	10.4		0.062	0.793		
27-Dec-16	13,000	12.2		0.059	0.762		
28-Dec-16	13,341	7.6	11.000	0.078	1.043	0.690	
29-Dec-16	13,049	13.2		0.104	1.360		
30-Dec-16	14,241	12.8		0.081	1.160		
31-Dec-16	13,879	13.4		0.065	0.904		

6 Appendix B – Environmental Monitoring Site Data Table

		January	February	March	April	May	June	July	August	September	October	November	December
Bridge Upstream Sample Site													
Nitrate as N	mg/L	0.053	0.046	0.031	0.036	0.034	0.033	0.018	0.01	<0.010	0.017	0.047	0.049
Nitrite as N	mg/L	<0.010	<0.010	<0.005	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phosphate, Ortho as P	mg/L	<0.01	<0.01	<0.01	<0.010	0.09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia as N, Total	mg/L	0.042	<0.020	<0.020	0.04	<0.020	<0.020		0.043	0.054	0.038	<0.020	0.181
Turbidity	NTU	0.7	0.8	0.8	0.46	0.82	1.34	1.19	1.58	0.7	0.58	1.95	0.57
pH	pH units	7.36	7.42	7.24	7.15	7.5	7.15	7.17	7.4	7.13	7.22	7.17	7.22
Conductivity (EC)	uS/cm	52	46	60	45.4	44	42	38	32	34	36	40	48
Nitrate+Nitrite as N	mg/L	0.053	0.046	0.031	0.0356	0.034	0.033	<0.020	<0.020	<0.020	<0.020	0.047	0.049
Station B Outfall Sample Site													
Nitrate as N	mg/L	0.408	0.102	0.371	0.33	0.146	0.167	0.144	0.147	0.159	0.184	0.187	0.497
Nitrite as N	mg/L	0.028	0.046	0.054	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.019
Phosphate, Ortho as P	mg/L	<0.01	<0.01	<0.01	<0.010	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia as N, Total	mg/L	0.134	0.3	0.126	0.049	<0.020	<0.020		0.043	0.027	0.081	0.18	0.183
Turbidity	NTU	0.9	0.9	1	0.46	0.87	1.39	1.31	1.74	0.83	0.63	1.88	0.64
pH	pH units	7.35	7.35	7.14	7.26	7.5	7.16	7.24	7.39	7.16	7.21	7.18	7.17
Conductivity (EC)	uS/cm	87	74	121	88.3	53	48	48	47	47	51	58	83
Nitrate+Nitrite as N	mg/L	0.435	0.148	0.426	0.342	0.146	0.167	0.144	0.147	0.159	0.184	0.187	0.515
Camp Downstream Sample Site													
Nitrate as N	mg/L	0.146	0.073	0.097	0.065	0.05	0.045	0.041	0.035	0.052	0.055	0.076	0.172
Nitrite as N	mg/L	<0.010	<0.010	0.006	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Phosphate, Ortho as P	mg/L	<0.01	<0.01	<0.01	<0.010	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia as N, Total	mg/L	<0.020	0.068	<0.020	0.04	0.021	<0.020		0.03	0.02	0.02	0.653	0.17
Turbidity	NTU	0.5	0.7	0.8	0.6	0.8	1.65	1.21	1.61	0.65	0.67	1.65	0.46
pH	pH units	7.3	7.42	7.21	7.17	7.52	7.18	7.09	8.14	7.12	7.26	7.24	7.26
Conductivity (EC)	uS/cm	69	62	80	60.2	47	45	41	36	41	44	51	63
Nitrate+Nitrite as N	mg/L	0.146	0.073	0.103	0.0646	0.05	0.045	0.041	0.035	0.052	0.055	0.076	0.172