Memorandum

November 20, 2017

TO: Historical Memo

FROM: Carol Nelson
Peter Carter

SUBJECT: Brightwater Treatment Plant
October 2017 Operating Record

All discharge permit requirements were met in October at the Brightwater Treatment Plant (BWTP). All wastewater received secondary membrane filtration. Effluent BOD and TSS averaged <1.2-mg/L and <2.0-mg/L, respectively, and removals were both > 99%. All results for Fecal Coliform were 0-cfu/100-mL. Effluent pH was maintained between 6.4 and 7.2. Continuous dosing of caustic soda (25% NaOH) was required to assure permit compliance for pH.

Effluent flow to Puget Sound averaged 13.6-MGD. Distribution of Class-A reclaimed water (RW) to permitted sites totaled 1.74-mg, and ended on Oct 9. In addition, 0.12-MGD of RW was sent to South Plant (via York P.S.) due to RW quality diverts to drain and for flushing purposes. 3.1-MGD of raw sewage was redirected to South Plant to facilitate repairs to an aeration basin (AB) and process recovery. Thus, effluent flow would have averaged closer to 16.9-MGD after taking into account RW flows and redirected raw sewage flows. Plant effluent was used to flush North Creek PS twice and York pump station once to reduce odors. Effluent was also used to test the pumps at York at a high flow rate.

Influent flow to the BWTP averaged 14.7-MGD, which includes 0.55-MGD of recirculated effluent to the influent pump station (IPS). During the first 10 days of the month, influent flow was restricted to <14-MGD because one AB was out of service all month. The maximum influent flow setpoint was gradually increased from 14-MGD to 24-MGD after all three aeration basins were back in service.

Weather in October was more typical of fall weather; it was cooler and wetter than the unusually warm and dry September. Rainfall totaled 4.4-inches this month (local rain gauges). Rainfall at SeaTac Airport was recorded as 4.8 inches, 1.3-inches above normal.

All permit-required samples were collected and reported. Though influent TSS and BOD values on Oct 1, 2, 14, and 15, and the influent TSS on Oct. 16, were reported, they could be considered suspect with respect to whether they are representative.

Influent Pumping: From Oct. 1 to Oct. 11, influent flow was operated in a very tight range of 12-mgd to 14-mgd. The maximum flow of 14-MGD was required to accommodate work in the ABs. The minimum flow of 12-MGD was required to keep the RSPs running continuously. Recirculation of effluent was required during the morning hours of most days this month in order to assure a minimum influent flow of 12-MGD. After Oct. 11 when AB3 returned to service, the maximum influent flow was gradually increased to 24-MGD by Oct 25. Influent flows in excess of the maximum influent pumping rate were directed to South Plant via the North Creek P.S by throttling the North Creek Connector Gate. No flow was directed to West Point this month.

During periods of low influent flow, grease tended to accumulate in the IPS wet well and at the influent screens. The influent channel for Screen No. 2 was cleaned twice this month.

Primary Treatment: Three of five primary clarifiers were in service all month; Primary Clarifiers 2 and 3 remained out of service. Primary effluent screens were cleaned twice in October.

Secondary Treatment: Two of the three ABs were in service until Oct 11 when AB3 returned to service. As with AB1 and AB2, the aeration piping was replaced for AB3 and sprays were installed for scum and foam control. The new aeration piping should be more resistant to the high temperatures generated by the aeration blowers. In addition to the piping work, O&M staff installed new diffuser membranes in the first aeration zone and thoroughly cleaned the inside of the diffuser piping that was contaminated with mixed liquor from previous breaks in the aeration piping. One result of this work is that the air flow required to meet the DO setpoint was reduced in AB3. In addition, this allowed staff to direct a greater proportion of secondary influent flow to AB3, and thereby decreasing the load on AB1 and AB2 where the DO concentrations tended to be lower. Installation of the new spray system for each AB and the secondary scum channel is now complete. Staff will continue to fine tune the operation of these sprays over the coming months as the characteristics of the foam and scum change. AB1and AB2's repairs were completed in August and September.

The MLSS and mean cell residence time (MCRT) averaged 5540-mg/L and approximately 70-days, respectively. The MCRT was excessively long because wasting was decreased to build the mass of MLSS needed when AB3 returned to service. Higher MLSS concentrations are required for good filterability and full nitrification in the winter, when influent flows are higher and the wastewater temperature is lower. The MLSS concentration was near 6500-mg/L by the end of the month. Even with the increasing MCRT and MLSS, DO concentrations in the second aerated zone were maintained at or above the desired setpoint of 1.4-mg/L.

Full nitrification was achieved all month, while denitrification was incomplete. Effluent ammonia-nitrogen (NH_3-N) averaged <0.10-mg/L while nitrite/nitrate (NO_2+NO_3) averaged 39-mg/L as N. Total-N removal only averaged 33%

Continuous doses of caustic soda to the secondary process were required to ensure minimum effluent pH permit conditions were met, and to achieve complete nitrification. The dose averaged 4153-gpd of 25% NaOH solution, or 282 gallons/MG of influent. This dose is very similar to the dose in September. Influent alkalinity averaged 210-mg/L as $CaCO_3$ in October. The lower caustic use in September and October appear to be due primarily to the lower rate of biosolids dewatering: centrate carries a high caustic demand when it is nitrified.

MLSS filterability was adequate for October flows. Membrane capacity ranged from 28 to 41 MGD this month. The maximum flux was 12-gfd (i.e., gallons per day per square foot of membrane surface) at the beginning of the month, 18-gfd during the fourth week of the month but 12-gfd by Oct. 31. The table below shows the variations in trans-membrane pressure (TMP), membrane permeability, and MCRT over the month. The design instantaneous peak hourly flow rating for one membrane train varied between 4700-gpm and 4950-gpm this month.

Effluent turbidity of membrane trains ranged from 0.05-NTU to 0.07-NTU. The membranes were primarily in "backpulse" mode this month. Membrane air scour operated in 10-sec ON/30-sec OFF mode during most of the month; 10s/10s mode was used during peak flow tests. Approximately 3544-gallons of 12.5% sodium hypochlorite (NaOCl) were used for weekly maintenance cleans this month.

Parameter	10/2	10/9	10/16	10/23	10/30
TMP before backpulse, average psi	0.8	1.2	0.8	0.8	1.2
TMP before backpulse, peak flow test, psi	8	8	8	8	8
Permeability temperature-corrected[1], gfd/psi	1.4	1.4	1.5	1.9	2.1
Flow target for peak flow test, gpm	4950	4950	4700	4700	4800
Flow average during peak flow test, gpm	2710	2580	2760	3430	3800
ME temperature, degrees F	71.4	70.7	69.8	68.8	68.6
MLSS, mg/l	4490	5210	4920	5393	6453
MCRT, days	24	27	>100	>100	33

1 Temperature-corrected Permeability based on Peak Flow Test.

Odor Control: The Odor Control facilities performed well this month. The injection points for caustic soda and sodium hypochlorite were physically lowered in the chemical scrubbers to improve the performance and reliability of the system; the chemical scrubbers were each shutdown for one day to allow for this work. Staff continued to make repairs to leaks in the chemical transfer piping; the system was returned to normal operation at the end of the month.

Disinfection: Approximately 18,300 gallons of 12.5% NaOCl was used for final effluent disinfection, reclaimed water disinfection, and process water at IPS. This is equal to an average dose of 5.6-mg/L as Cl_2. (It's worth noting that the dose for recirculation and other process water uses dropped notably after the distribution of reclaimed water stopped October 9.) Hypochlorite was applied through the backup diffuser since the "water champ" mixer was still out of service. Effluent Cl_2 residual at the outfall (aka Point Wells) met both the monthly and max-weekly permit limits. The monthly average and maximum weekly residuals were 0.12-mg/L Cl_2 and 0.14-mg/L Cl_2, respectively.

Thickening: Thickening performed well in October. All three gravity belt thickeners (GBTs) were rotated in service this month. The GBT sludge feed was thickened from an average of 1.64% total solids (TS) to 5.79% TS, with an average solids capture of 90.6% Thickened sludge production totaled 450 dry tons. The polymer dose for thickening averaged 8.7 pounds active polymer per dry tons solids processed.

Anaerobic Digestion: The digestion process met time and temperature requirements for Class B biosolids. All three digesters and the blended storage tank were in service. In the three active digesters, the solids retention time averaged 46.2-days, temperature averaged 99°F, and volatile solids (VS) destruction averaged 65.8%. The total solids concentration in the active digesters averaged 2.27%, with a volatile solids (VS) fraction of 79.5 % VS/TS. The digester VS load averaged 0.071 lbs-VS/cu-ft./d. Monthly gas production is estimated to be 7.8 million ft^3 (based on an estimated 245 tons of VS destroyed).

Dewatering/Biosolids: 180 dry tons of solids were processed through dewatering in October. Solids recovery in the process averaged 92.8%. 778 wet tons (168 dry tons) of biosolids were produced and 771 wet tons (165 dry tons @ 21.4%TS) were hauled; the difference was stored in the storage hoppers. Polymer dosage averaged 59.6 lbs.-active per dry ton processed. Dewatering operated 28 days in October using both centrifuges (No. 1 and No.3). Centrifuge feed averaged 2.21% TS at 78.6% VS/TS. Centrifuge 1 biosolids averaged 21.6% TS at 81.3% VS/TS. Centrifuge 3 biosolids averaged 21.2% TS at 81.4% VS/TS. The dewatering strategy generally continues to be: operate mostly during day shift and only one centrifuge at a time to avoid sending a large ammonia return load to the secondary process (via the centrate).