

Memorandum

December 15, 2020

TO: Historical Memo

FROM: Carol Nelson, Process Analyst
Samayyah Williams, Process Engineer

SUBJECT: Brightwater Treatment Plant
November 2021 Operating Record

All discharge permit requirements were met in November at the Brightwater Treatment Plant (BWTP). All wastewater received MBR secondary treatment. Effluent BOD and TSS averaged <1.0-mg/L and <2.0-mg/L, respectively, and removals were both $\geq 99\%$. All Fecal Coliform results were less than 1-cfu/100-mL. Effluent pH was maintained between 6.7 and 7.3. Continuous dosing of 59% Magnesium Hydroxide ($Mg(OH)_2$) was required to assure permit compliance for pH. 3000 gallons of 25% Sodium Hydroxide (NaOH) was used for testing and to supplement the dose of $Mg(OH)_2$ this month.

Effluent flow to Puget Sound averaged 21.9-MGD. No reclaimed water was distributed offsite in November. Approximately 0.1-MGD of effluent was recirculated to the Influent via the Influent Pump Station (IPS). Thus, influent flow averaged 22.0-MGD. The max-day influent and effluent flows (both 28.0-MGD) occurred on Nov. 15. Influent flow was often directed to South Plant during wetwell pump downs at the Influent Pump Station (IPS). The monthly total volume directed to South Plant was 6.2 MG. No bypass or overflows resulted from the redirected influent. Membrane capacity was adequate for the influent flow in November with measured capacity ranging between 38-MGD and 45-MGD.

November rainfall totaled 8.7-inches based on local rain gauges. Most rain fell during the first two weeks of the month. The wettest periods occurred between Nov. 11-15 (3.3-inches), Nov. 2-7 (2.3-inches), and Nov. 23-25 (1.4-inches). Precipitation recorded for SeaTac Airport was 10.3-inches, which is 4.0-inches above normal. Local area air temperatures were 2.0°F above normal this month. Membrane effluent temperatures decreased from 66.2°F to 63.5°F during this month.

All permit-required samples were collected and analyzed. Influent sample results for Nov.16 were rejected because of unusually low TSS results; it's likely that the sampling system was plugged.

Influent Pumping: Influent flow was pumped using the two small raw sewage pump sets (RSP). Two RSPs were required when flows exceeded 20-MGD; this occurred on all days for up to 19 hours per day. The IPS wet well was "pumped down" on 22 days in November to remove accumulated grease and rags. During 14 of the pump downs, influent flow was diverted to South Plant for one to three hours. Influent flow was also diverted to South Plant during two other occasions when the RSPs dropped off-line multiple times during windstorm-related power bumps at the IPS (Nov. 9) and when high flows at Hollywood PS presented a danger of surcharging the sewer between Hollywood PS and Woodinville PS. This month all influent screens were available; this helped reduce blinding of the screens during wet well pump downs and higher flow events.

Primary Treatment: Three of five primary clarifiers (PC), (PC-1, PC-2, and PC-4), were in service this month. Solids return flows were directed to primarily to PC-1 this month. Regular cleaning of the primary effluent screens continued. PC-5 was refilled with effluent and monitored to better determine the location

of the intermittent leak; this leak appears to be near the top 10' of the tank wall near the upper sealant joint. This leak results in puddles of water collecting in a below-grade equipment room adjacent to PC-5.

Secondary Treatment: All three aeration basins (AB's) were in service this month. The MLSS averaged 7,860-mg/L and ranged from 6,900 to 8,730 mg/L. The solids retention time (SRT) averaged 23-days. Secondary foam was minimal this month. The SRT and MLSS were maintained primarily by surface wasting over the scum gates; mixed liquor wasting continued this month as a much smaller portion of the total wasting. Wasting was reduced on several days to reduce digester gas production, once as part of a test and other times due to gas-binding of digestion circulation pumps. Aeration blowers were in DO-control mode this month. Aeration air flow averaged 10,900-scfm. On average, DO concentrations were at or above the desired levels.

Total-N removal averaged 25%. Full nitrification was achieved this month while denitrification was minimal. Effluent $\text{NH}_3\text{-N}$ averaged <0.1-mg/L, effluent nitrite/nitrate (NO_2+NO_3) averaged 34-mg/L as N and influent TKN averaged 47-mg/L. The average influent TKN concentration was 15-mg/L lower than October's average and is typical of the concentration in wet weather months.

Alkalinity in the form of a 59% $\text{Mg}(\text{OH})_2$ solution was added to the secondary process to ensure minimum effluent pH limits were met and to achieve complete nitrification. $\text{Mg}(\text{OH})_2$ addition is a full-scale trial to determine any operational benefits and cost-savings compared with using Caustic Soda (25% NaOH) solution. The 59% $\text{Mg}(\text{OH})_2$ solution dose averaged approximately 1,957-gpd or 89 gallons/MG of influent, which is 8% lower than the dose used in October. Plans for improvements to the system include a new control strategy and dilution system downstream of the flow meter. The $\text{Mg}(\text{OH})_2$ pumping system had adequate capacity for the alkalinity demand in November. A total of 3000 gallons of 25% NaOH was used this month, primarily during Nov. 7-8. On those days, staff were concerned about maintaining the effluent pH while there was a low inventory of $\text{Mg}(\text{OH})_2$.

Membrane effluent turbidity averaged 0.02 - 0.04 NTU. Membrane Trains were in "relax" mode and LEAP "low" mode this month because filterability was very good. All cassettes were in service. Approximately 5,540-gallons of 12.5% NaOCl were used for membrane maintenance cleans. Actuators for the backpulse and permeate valves were replaced on Train 4 this month.

Membrane capacity ranged between 38-mgd and 45-mgd this month. This range was well above the range needed to process the influent flow. Permeability continued to be good this month, averaging 9.4 gfd/psi during the peak flow tests. Soluble COD (sCOD) in the mixed liquor, which has been well correlated with permeability, averaged 26-mg/L. The maximum hourly flux during peak flow tests was between 15.9-gpd and 16.4-gpd per ft^2 of membrane surface in November.

Table 1 shows the weekly average trans-membrane pressure (TMP), membrane permeability, and SRT. Peak flow tests were run on two trains per day. Flow setpoints for the peak flow tests are normally adjusted up/down depending on the TMP before backpulse. This month the flow setpoint remained at 4500-gpm. (The rated instantaneous peak hourly flow for one membrane train is 4950-gpm.) TMPs did not drop below -3.0 psi during the peak flow test this month, indicating that the capacity is adequate for the peak hourly design flow. Changes in permeability with time were observed more easily when the peak-flow setpoint was held constant.

Disinfection: Approximately 11,710 gallons of 12.5% NaOCl were used in November for final effluent disinfection and process water at IPS. The hypochlorite effluent disinfection dose averaged 2.5-mg/L as Cl_2 . Hypochlorite was applied through the diffuser. 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 0.08-mg/L and 0.09-mg/L, respectively.

Odor Control: The Odor Control (OC) facilities performed well this month. Repairs were made to the chemical addition systems for the chemical scrubbers. Work that is ongoing includes replacement of two fan motor in the Secondary area and one in the Solids. In the Solids area, the redundant train was in service. In the Secondary Area, three trains were in service until Nov. 22, when another fan motor failed. While the Secondary Control facility is operating with only 2 trains, instead of the normal 3 trains, monitoring of the inlet pressures and odors in the Secondary area continued to ensure minimal fugitive odors. Plans are to replace the third fan motor in December.

Table 1. Trans-membrane pressure, membrane permeability, and SRT.

Parameter	Week ending 11/01	Week ending 11/08	Week ending 11/15	Week ending 11/22	Week ending 11/29
TMP before backpulse, average psi ²	-1.0	-0.9	-1.2	-1.1	-1.2
TMP before backpulse, peak flow test, psi	-1.8	-1.7	-1.9	-1.9	-1.8
Permeability temperature-corrected ¹ , gfd/psi	9.5	9.7	9.0	9.5	9.8
Flow target for peak flow test, gpm	4500	4500	4500	4500	4500
Flow hourly average during peak flow test, gpm	3670	3660	3690	3690	3700
MBR Effluent temperature, degrees F	67.5	66.4	65.2	64.1	63.9
SRT, days	22.1	23.9	24.3	21.5	19.8
MLSS, mg/L	8237	8218	7810	7752	7433

1 Temperature-corrected Permeability based on Peak Flow Test.

2 TMPs during the moderate flow period of the day

Thickening: All three gravity belt thickeners (GBTs) were operated in November. The GBTs thickened approximately 11.0-MG of feed sludge from an average of 1.7% total solids (TS) to 6.7% TS, with an average solids capture of 94.4%. Sludge loading to the thickeners totaled 775 dry tons. The polymer dose for thickening averaged 4.5 pounds active polymer per dry tons solids processed.

Anaerobic Digestion: The digestion process met time and temperature requirements for Class B biosolids production despite declining temperatures in the latter half of November. Digestion has been operating with two active digesters since May 2021 and has converted Digester 3 to operate as the digested sludge storage tank while construction occurs in the actual storage tank. The storage tank is expected to return to service in December 2021.

In the active digesters: the solids retention time averaged 26.8 days (with an additional 13.4 days in the storage tank) and temperature averaged 94.5°F. Minimal operating temperature in Digester 1 and Digester 2 reached 89°F and 82°F, respectfully on Nov 30. The decrease in digester temperatures was due to gas accumulation in the sludge pumps that circulate digested sludge through the heat exchangers. These problems were resolved by flushing of the recirculation pumps to push gas out of the lines, by increasing the speed of the draft tube mixers to help get entrained gas out of solution, and by modulating the heat exchanger bypass valve to improve flow through the exchanger. Volatile solids (VS) destruction averaged 61.4%. The total solids concentration in the active digesters averaged 3.5%, with a VS fraction of 76.7% VS/TS. The average digester VS load was 0.150 lbs-VS/cu-ft./d. Monthly gas production was measured to be 13.2 million ft³ (based on the flow meters).

Dewatering/Biosolids: All biosolids met the requirements for Class B. Dewatering operated 29 days in November, using both Centrifuges 1 and 3. Centrifuge feed averaged 2.7% TS and 78.2 % VS/TS for the month. Centrifuge biosolids product averaged 21.3% TS at 79.5% VS/TS for centrifuge 1 and 21.1% TS at

80.0% VS/TS for centrifuge 3. A total of 292 dry tons of solids were processed (calculated from the feed flow meters and % solids) and 1,280 wet tons (272 dry tons at 21.2% TS) of biosolids cake were produced. A total of 1,321 wet tons (280 dry tons) of biosolids cake were hauled in November. Solids recovery in the dewatering process averaged 95.5%. Polymer dosage averaged 45.4 lbs-active per dry ton produced.