

# Memorandum

February 13, 2023

TO: Historical Memo

FROM: Carol Nelson, Process Analyst  
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SUBJECT: Brightwater Treatment Plant  
January 2023 Operating Record

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All discharge permit requirements were met in January at the Brightwater Treatment Plant (BWTP). All wastewater received Membrane Bioreactor (MBR) secondary treatment. Effluent BOD and TSS averaged <1.2-mg/L and <2.1-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 6.6 and 7.5. Continuous dosing of 59% Magnesium Hydroxide ( $\text{Mg}(\text{OH})_2$ ) was required to ensure permit compliance for pH. 25% Sodium Hydroxide was used on two days to supplement the  $\text{Mg}(\text{OH})_2$  dose.

Effluent flow to Puget Sound averaged 21.8-MGD. No reclaimed water was distributed offsite in January. Influent flow also averaged 21.8-MGD. Influent flow was often directed to South Plant during wet well pump downs at the Influent Pump Station (IPS). Between Jan. 2 and Jan. 3, 5.8-MG of influent flow was directed to South Plant to maintain effluent pH while the inventory of  $\text{Mg}(\text{OH})_2$  was low. The monthly total volume directed to South Plant was 8.1-MG. No bypass or overflows resulted from the redirected influent. Membrane capacity was adequate for the influent flow in January with measured capacity ranging between 39-MGD and 45-MGD.

January rainfall totaled 5.1-inches based on local rain gauges. The wettest periods occurred between Jan. 7-9 (1.2-inches) and Jan. 12-13 (1.2-inches). The max-day influent and effluent flows, 24.9-MGD and 25.0-MGD, respectively, occurred on Jan. 13. Precipitation recorded for SeaTac Airport was 3.1-inches of rain, which is 2.7-inches below normal. Local area air temperatures were 0.7°F above normal this month. Membrane effluent temperatures were fairly constant (within 1°F) and averaged 59.4°F.

All permit-required samples were collected and analyzed. No blending events occurred this month. The modified influent sampler is performing more reliably than the previous configuration.

**Influent Pumping:** Influent flow was pumped using the small raw sewage pump sets (RSP). Two pump sets were required for an average of 11 hours per day, with one exception; on Jan. 2, influent flow was restricted to 21-MGD so that only one RSP was in service. This restriction facilitated maintaining effluent pH while the  $\text{Mg}(\text{OH})_2$  inventory was low. The IPS wet well was “pumped down” on 20 days in January to remove accumulated grease and rags. An average of 0.3-MGD of influent was directed to South Plant daily via the Brightwater diversion structure and the North Creek Pump Station (NCPS).

**Primary Treatment:** Three of five primary clarifiers (PC) were in service during the month of January: PC-2, PC-3 and PC-4. Solids return flows were directed to PC-2. Regular cleaning of the primary effluent screens continued. PC-5 remains out of service because of an apparent leak near the top of the tank wall. This leak results in puddles of water collecting in an equipment room adjacent to PC-5.

**Secondary Treatment:** Three aeration basins (AB's) were in service this month. Aeration basins continued to operate in the "zone-DO" control mode this month, which is part of the Brightwater Aeration Basin Optimization (BWABO) project. DO setpoints were reduced by 0.2mg/L on Jan. 4 and Jan.18 to determine if denitrification could be improved during the wet weather season. DO concentrations were at or above the setpoints. During the morning hours of most days, the air demand was lower than the minimum air flow for the current blower configuration. Plans for tuning the system include installation of a blow-off valve, which will improve DO control by allowing a lower minimum air flow to the basins. Aeration air flow for the month averaged 10,670-scfm to all three basins. The MLSS and SRT averaged 9,380-mg/L and 26 days, respectively. Secondary foam was present but minimal this month. The MLSS was maintained both by surface wasting and mixed liquor wasting.

Full nitrification was achieved this month and denitrification was incomplete. Effluent nitrite/nitrate (NO<sub>2</sub>+NO<sub>3</sub>) and ammonia averaged 32.5-mg/L and less than 0.09-mg/L as N, respectively. January's total effluent nitrogen loading, (TIN, lb/month), was higher than December's because of the higher flows. Influent concentrations for total Kjeldahl nitrogen (TKN) and TIN were reduced compared to the previous months. December influent characteristics were typical of wet weather conditions. Results for November, December, and January are summarized in Table 1.

Table 1. Influent and Effluent TKN and TIN concentrations and loading.

	Days in Month	Influent				Effluent				Total N Removal <sup>1</sup>
		Influent TKN, mg/L	Influent TIN, mg/L	Influent Flow, (MGD)	Influent TKN, lbs per day	Effluent TKN, mg/L	Effluent TIN, mg/L	Effluent Flow, (MGD)	Effluent TIN, lbs per day	
Nov	30	70.6	33.9	13.2	7,772	1.3	33.6	10.0	2,834	50%
Dec	31	49.2	31.9	18.2	7,456	1.1	37.1	17.8	5,260	23%
Jan	31	47.8	32.5	21.8	8,686	1.3	32.6	21.8	5,936	29%

<sup>1</sup> Total Nitrogen Removal (TN) is equal to [Influent TKN-(Effluent TKN + Effluent NO<sub>2</sub>+NO<sub>3</sub>)]/Influent TKN and assumes that the Influent NO<sub>2</sub>+NO<sub>3</sub> is very low. TKN is equal Organic Nitrogen + Ammonia.

Alkalinity in the form of a 59% Mg(OH)<sub>2</sub> solution was added to the secondary process to ensure minimum effluent pH limits were met and to achieve complete nitrification. The 59% Mg(OH)<sub>2</sub> solution dose averaged approximately 2,264-gpd or 104 gallons/MG of influent. The membrane effluent pH meter was calibrated twice this month. Due to a low inventory of Mg(OH)<sub>2</sub> on Jan.2 and Jan.3, a total of 1340 gallons of 25% Sodium Hydroxide (NaOH) was added for alkalinity in January.

Membrane effluent turbidity averaged 0.03 - 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 2,540-gallons of 12.5% NaOCl were used for membrane maintenance cleans. An additional 810-gallons of 12.5% NaOCl were used for the recovery clean of Train 1.

Membrane capacity ranged between 39-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 9.3 gfd/psi during the peak flow tests. Soluble COD (sCOD) in the mixed liquor, which has been well correlated with permeability, decreased to an average of 40-mg/L. The maximum hourly flux during peak flow tests was between 16.0-gpd and 16.4-gpd per ft<sup>2</sup> of membrane surface.

Table 2 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 (changes in permeability with time are easily observed when the peak-flow setpoint is held constant); 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, indicating that the capacity was adequate for the peak hourly design flow for the month. Plans are in place to have the membrane vendor add options for the automated peak flow tests that will help reduce wear on the membrane fibers.

Table 2. Trans-membrane pressure, membrane permeability, and SRT.

Parameter	Week ending 1/2	Week ending 1/9	Week ending 1/16	Week ending 1/23	Week ending 1/30
TMP before backpulse, average psi <sup>2</sup>	-1.3	-1.2	-1.4	-1.2	-1.2
TMP before backpulse, peak flow test, psi	-2.2	-2.0	-2.0	-2.0	-1.9
Permeability temperature-corrected <sup>1</sup> , gfd/psi	8.7	9.1	9.4	9.5	9.8
Flow target for peak flow test, gpm	4500	4500	4500	4500	4500
Flow hourly average during peak flow test, gpm	3680	3690	3690	3670	3670
MBR Effluent temperature, degrees F	58.2	59.7	59.6	59.2	59.5
SRT, days	33	30	24	28	20
MLSS, mg/L	8290	8970	9565	9410	9605
ML soluble COD, mg/L	69	54	45	30	33

<sup>1</sup> Temperature-corrected Permeability based on Peak Flow Test.

<sup>2</sup> TMPs during the moderate flow period of the day

**Disinfection:** Approximately 9,660 gallons of 12.5% sodium hypochlorite (NaOCl) was used in January for final effluent disinfection. The NaOCl effluent disinfection dose averaged 2.0-mg/L as Cl<sub>2</sub>. Effluent Cl<sub>2</sub> residual at the outfall (aka Point Wells) met both the monthly and max-weekly permit limits. The monthly average and maximum weekly residuals were 0.07-mg/L and 0.08-mg/L, respectively. Staff began replacing the effluent disinfection pumps to improve reliability.

**Odor Control:** The Odor Control (OC) facilities performed well during most of the month. All odor control areas had the design-specified number of trains in service; three each for Secondary and Solids and four for Headworks. Air balancing work in all three areas began in January. Repairs to metering pumps and minor chemical leaks are ongoing.

**Thickening:** All three gravity belt thickeners (GBTs) were operated in January. The GBTs thickened approximately 13.3 MG of feed sludge from an average of 1.3% total solids (TS) to 6.4% TS, with an average solids capture of 94.1%. Sludge loading to the thickeners totaled 742 dry tons. The polymer dose for thickening averaged 5.2 pounds active polymer per dry tons solids processed.

**Anaerobic Digestion:** The digestion process met time and temperature requirements for Class B biosolids production and operated with all three active digesters during the month of January. In the active digesters, the solids retention time averaged 37.0 days, temperature averaged 99.1°F, and volatile solids (VS) destruction averaged 60.3%. The total solids concentration in the active digesters averaged 2.3% with a VS fraction of 80.9% VS/TS. The average digester VS load was 0.10 lbs-VS/cu-ft./d. Monthly gas production totaled 11.9 million ft<sup>3</sup> (based on the waste gas burner and boiler flow meters). Observations of volatile acid (VA) concentrations and digester gas composition indicated stable digestion. In January, VA concentrations were less than 60 mg/L and digester gas methane concentrations were between 56% and 60%.

**Dewatering/Biosolids:** All biosolids met the requirements for Class B. Dewatering operated 25 days in January, using both Centrifuges 1 and 3. Centrifuge feed averaged 2.0% TS and 80.6% VS/TS for the month. Centrifuge biosolids product averaged 20.9% TS at 83.0% VS/TS for centrifuge 1 and 20.6% TS at 82.9% VS/TS for centrifuge 3. A total of 223 dry tons of solids were processed (according to the feed flow meters and % solids) and 1,019 wet tons (212 dry tons at 20.8% TS) of biosolids cake were produced. A total of 1,032 wet tons (215 dry tons) of biosolids cake were hauled in January. Solids recovery in the dewatering process averaged 94.8%. Polymer dosage averaged 73.5 lbs-active per dry ton produced.