

Memorandum

August 15, 2024

TO: Historical Memo

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

SUBJECT: Brightwater Treatment Plant
July 2024 Operating Record

All discharge permit requirements were met in July at the Brightwater Treatment Plant (BWTP). All wastewater received Membrane Bioreactor (MBR) secondary treatment. Effluent BOD and TSS averaged <1.5-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 7.2 and 7.6. Continuous dosing of 59% Magnesium Hydroxide [Mg(OH)₂] was required to ensure permit compliance for pH. Sodium Hydroxide [NaOH] added alkalinity on 12 days to ensure that the NaOH dosing pumps were available and for 2 days when the Mg(OH)₂ pumps were out of service for a secondary system outage.

Effluent flow to Puget Sound averaged 12.6-MGD. Reclaimed water distributed to customer sites averaged 0.6-MGD this month. Influent flow averaged 13.3-MGD. Approximately 0.1-MGD of treated effluent was used for treatment plant and Influent Pump Station (IPS) processes. RW drain water sent to South Plant via York Pump station totaled approximately 0.5-MG. To reduce the solids loading to Brightwater, approximately of 95.1-MG of raw sewage was directed to West Point. The influent flow reduction helped maintain digester health while one digester remains out of service for maintenance. No bypass or overflows resulted from the redirected influent. No raw sewage was directed to South Plant this month due to a major maintenance project occurring there.

A total of 0.4-inches of rainfall was measured in July based on local rain gauges. Rain fell on only two days, July 1 and July 29. Precipitation recorded for SeaTac Airport was 0.2-inches of rain, below the normal rainfall of 0.6-inches. Local area air temperatures averaged 69.8 °F, which is 2.7 °F above normal.

All permit-required samples were collected and analyzed. No blending events occurred this month.

Influent Pumping: Influent was pumped using the small raw sewage pump sets (RSP) every day this month. Two pump sets were required for an average of 1 hour per day on three days. The IPS wet well was “pumped down” on 19 days in July to remove accumulated grease and rags. Maximum influent flow was restricted to 26-MGD this month to accommodate having one aeration basin (AB) out of service.

Primary Treatment: Three of five primary clarifiers (PC) were in service in June. PC-2, PC-3, and PC-4 were in service the entire month. Solids return flows were directed to PC-2. Regular cleaning of the primary effluent screens continued.

Secondary Treatment: Two aeration basins were in service this month. AB#2 remained out of service to facilitate repair of the wash-down system, scum gates, upper walls, and underside of the deck at the north end of the basin damaged in the August 2023 fire. As part of the Brightwater Aeration Basin Optimization (BWABO) project, testing of some components of the classifying selector equipment continued this month. Operation of the

selector will facilitate improved control of the solids retention time (SRT) and removal of foaming sludge as the secondary process moves towards a low DO and simultaneous nitrification/denitrification (SND) processes.

The new selector feed pumps, new wasting pumps, secondary scum gates, and selector scum gates were operated and tested this month. Surface wasting was accomplished using the selector feed pumps in “wasting mode” on 24 days in July. From July 23 to July 29, the classifying selector was in service and the new selector wasting pumps were used for surface wasting. Tuning of the control of the scum gates, selector feed pumps and selector scum gate continued this month. Filamentous growth increased this month but did not result in problems with wasting or maintaining flow through the basins. The monthly MLSS and SRT averaged 7728-mg/L and 17 days, respectively.

Aeration basins continued to operate in “zone-DO” control mode. Aeration air flow averaged 11,460-scfm total to all basins. The blow-off valve installed in May continued to work well in July by enabling smoother transitions when the number of blowers required by the DO control strategy decreased or increased. The improved blower control should improve denitrification once the process stabilizes. DO setpoints were not changed this month; lowering setpoints will be tried after the side stream selector operation is fully operational and foam is reduced.

Total Kjeldahl nitrogen (TKN) and total inorganic nitrogen (TIN) concentrations for May, June, and July are summarized below in Table 1. Full nitrification was achieved during most days this month, while denitrification was incomplete, in part because of higher sustained DO concentrations. Effluent nitrite/nitrate (NO₂+NO₃) and ammonia averaged 42.4-mg/L and 0.2-mg/L as N, respectively. Influent TKN and TIN in July were higher than in June and May, which is typical for dry weather conditions when the sewage is not diluted by infiltration. Total nitrogen removal was similar to June’s. Total effluent TIN loading was lower because of the reduced flows and increased distribution of reclaimed water.

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

	Days in Month	Influent				Effluent				Total N Removal ¹
		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	
May	31	57.1	38.6	18.4	8,754	2.1	36.9	18.0	5,610	33.4%
June	30	59.3	38.5	18.5	9,140	2.7	39.3	17.9	5,927	30.8%
July	31	64.8	39.9	13.3	7,213	2.1	42.6	12.6	4,454	31.4%

¹ Total Nitrogen Removal (TN) is equal to [Influent TKN-(Effluent TKN + Effluent NO₂+NO₃)]/Influent TKN and assumes that the Influent NO₂+NO₃ is very low. TKN is Organic Nitrogen + Ammonia.

Alkalinity in the form of a 59% Mg(OH)₂ solution was added to the secondary process to ensure minimum effluent pH limits were met and to achieve complete nitrification. The 59% Mg(OH)₂ solution dose averaged approximately 1,800-gpd or 135-gallons/MG of influent. An additional 3,830 gallons of 25% NaOH was also used for alkalinity addition in July. 700 gallons of this addition occurred by gravity flow with the suction and discharge of the NaOH pumps left open and the dosing pumps off. Leaving the pumps valved in facilitated availability of the NaOH pumping in the event that the demand quickly increases due to low influent alkalinity, higher ammonia loading from the solids area, or low Mg(OH)₂ inventory. An additional 3,130 gallons of 25% NaOH was added when the east return active sludge (RAS) channel was taken out of service on July 30-Aug.1 for contractor work for the BWABO project. The Mg(OH)₂ solution is discharged to the east RAS channel while the NaOH solution is discharged to the west RAS channel; when the east channel is out of service, NaOH dosing simplifies the alkalinity addition process.

Membrane effluent turbidity averaged 0.02 - 0.06 NTU. Membrane Trains were in “relax” mode and LEAP “low” mode this month because filterability was very good. Approximately 4,000-gallons of 12.5% NaOCl were used for membrane maintenance cleans. An additional 640-gallons were used for a recovery clean on Train 2.

Membrane capacity was above the range needed to process the average influent flow. Plans are in place to rebuild the effluent check valves for all trains in the coming year to prevent the effluent pumps from shutting down. Soluble COD (sCOD) in the mixed liquor averaged 31-mg/L; this parameter has been well correlated with permeability (lower sCOD is correlated with higher permeability). The maximum hourly flux during peak flow tests was between 16.4-gpd and 17.4-gpd per ft² of membrane surface.

Table 2 shows the weekly average trans-membrane pressure (TMP), membrane permeability, and SRT. Flow setpoints for the peak flow tests are increased or decreased depending on the TMP before backpulse and anticipated influent flow. The rated instantaneous peak hourly flow for one membrane train is 4,950-gpm. The peak flow setpoint was 4,700-gpm throughout this month. Results from peak flow tests are used to calculate the capacity of the membrane trains. These results help staff anticipate the need for storage in the influent structure, diverting flow to other treatment plants, or chemically enhanced primary treatment. All peak flow tests were run with trains in backpulse mode.

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

Parameter	Week ending 7/1	Week ending 7/8	Week ending 7/15	Week ending 7/22	Week ending 7/29
TMP before backpulse, average psi ²	-1.0	-0.9	-0.9	-0.8	-0.9
TMP before backpulse, peak flow test, psi	-1.9	-1.9	-1.7	-1.9	-1.8
Permeability temperature-corrected ¹ , gfd/psi	9.0	8.7	9.7	8.6	9.3
Flow target for peak flow test, gpm ³	4700	4700	4700	4700	4700
Flow hourly average during peak flow test, gpm	3900	3890	3858	3852	3850
MBR Effluent temperature, degrees F	67.7	68.8	70.4	71.1	70.9
SRT, days	15.5	17.5	18.0	17.9	15.9
MLSS, mg/L	7575	7770	7764	7736	7560
ML soluble COD, mg/L	32	37	33	32	27

1 Temperature-corrected Permeability based on Peak Flow Test.

2 TMPs during the moderate flow period of the day

3 Flow target is the instantaneous flow, the hourly flow takes into account time the train is not in production.

Disinfection: Approximately 4,930 gallons of 12.5% NaOCl was used in July for final effluent disinfection. The NaOCl effluent disinfection dose averaged 1.8-mg/L as Cl₂. The monthly average and maximum weekly effluent Cl₂ residual at the outfall (aka Point Wells) were both 0.03-mg/L; both met both the monthly and max-weekly permit limits.

Odor Control: All odor control areas except for Secondary had the design-specified number of trains in service; four for Headworks and three for Solids. For Secondary, all four trains were in service starting May 31st to provide maintenance air for workers entering Aeration Basin 2 to perform repair work. Inspection of the main odor control ductwork for Headworks is ongoing.

Thickening: All three gravity belt thickeners (GBTs) operated in July. The GBTs thickened approximately 11.0 MG of feed sludge from an average of 1.5% total solids (TS) to 6.1% TS, with an average solids capture of 91.5%. Sludge loading to the thickeners totaled 678 dry tons. The polymer dose for thickening averaged 4.9

pounds active polymer per dry tons solids processed. The thickening and swing polymer blending units operated normally during the month.

Anaerobic Digestion: The digestion process met time and temperature requirements for Class B biosolids for the month and operated with two active digesters. Digester 1 was purged on July 18th and the stress crack in Mixer 1 flange was repaired on the 25th. The temperature and solids retention time (SRT) for the two digesters averaged 99°F and 29.8 days respectively. Volatile solids (VS) destruction averaged 61.4% for the month. Total solids (%TS) continued to remain elevated in Digester 2. Digester 2 and 3 total solids averaged 3.3% and 3.6%, respectively; VS averaged 74.3% and 74.7%, respectively.

The average digester VS load for the two active digesters was 0.12 lbs-VS/cu-ft./d. Approximately 11.2 million ft³ (MMCF) of digester gas was produced in July, using the gas flow meters to the flares and the boilers. Volatile acid (VA) concentrations in the two active digesters and the DSST remained below 100 mg/L (concentrations less than 500 mg/L are ideal); and digester gas was comprised of approximately 59% methane.

Dewatering/Biosolids: Dewatering operated 26 days in July, using both centrifuges. Centrifuge feed averaged 2.3% TS and 81.3% VS/TS for the month. Centrifuge biosolids product for Centrifuge 1 averaged 21.5% TS at 82.9% VS/TS and product for Centrifuge 3 averaged 20.9% TS at 81.9% VS/TS. A total of 313 dry tons of solids were processed (according to the feed flow meters and % solids) and 1,350 wet tons (290 dry tons at 21.4% TS) of biosolids cake were produced. A total of 1,419 wet tons (304 dry tons) of biosolids cake were hauled in July. Solids recovery in the dewatering process averaged 94.6%. Polymer dosage averaged 47.4 lbs-active per dry ton produced. The dewatering polymer unit operated normally during the month. Plans to replace all three skid units (thickening, dewatering, and the swing unit) are ongoing.