

# Memorandum

January 15, 2019

TO: Historical Memo

FROM: Carol Nelson, Process Analyst  
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SUBJECT: Brightwater Treatment Plant  
December 2018 Operating Record

All discharge permit requirements were met in December 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 <1.3-cfu/100-mL. Effluent pH was maintained between 6.4 and 7.0. Continuous dosing of 25% caustic soda (NaOH) was required to assure permit compliance for pH.

Effluent flow to Puget Sound averaged 17.6-MGD. Influent flow averaged 17.7-MGD. 0.1-MGD effluent was either recycled to the influent pump station (IPS), or used to flush North Creek Pump Station. Effluent was also used to flush primary clarifiers. 1.7-MGD influent was redirected to South Plant to facilitate maintenance on control systems, accommodate constraints on the operating range of the raw sewage pumps (RSPs) and accommodate the decline in membrane capacity, (most of which occurred during the last two weeks of the month). No influent flow was directed to West Point this month.

December rainfall totaled 6.1-inches (local rain gauges). Rainfall at SeaTac Airport totaled 6.1-inches, which is 0.7-inches above normal. Most rain in the Woodinville area fell Dec. 12, 14, 16-18, and 28-29. Local area temperatures were 3.6°F above normal this month. Wastewater effluent temperatures decreased about 3°F in December, from 66°F to 62°F for final effluent, and 64.5°F to 62.2°F for membrane effluent.

All permit-required samples were collected and reported.

**Influent Pumping:** One influent RSP was operated for most flows this month. During Dec. 1-5, flows were limited between 6 PM and 6 AM because of concern with membrane capacity while one air scour blower was out of service. On Dec.10, the RSPs were shutdown for 8 hours for maintenance on the control system servers. On Dec 20, it was decided to only run the RSPs at 87% speed or higher due to concerns with excessive vibration at lower speeds. With this limitation, it was difficult to operate more than one RSP and maintain a flow consistent with the membrane capacity; one RSP has a capacity of 20-21 mgd. Until Dec. 20, two RSPs were used for a few hours each day. Membrane capacity, varying from 18-mgd to 30-mgd, also limited the influent flow this month. There was a steady decline in capacity after Dec. 15, consistent with the declining trend in capacity with wet weather that was observed in 2017. One large RSP was energized this month. Flows were controlled using the North Creek Connector gate. On Dec. 31, flow was also diverted at the Hollywood Diversion structure by lowering the maximum flow from Hollywood P.S. from 13.5-mgd to 7.5-mgd.

**Primary Treatment:** Three of five primary clarifiers (PC) were in service all month. Solids return flows were directed to PC-2 this month. Regular cleaning of the primary screens continued. On Dec.12, influent flow was controlled at 20-21 mgd for 6 hours to test the

Chemically Enhanced Primary Treatment system (CEPT); all of the primary influent flow was directed through PC-4 during this test. BOD removals of 80%, ranging from 77% to 87%, and TSS removals of 91%, ranging from 82% to 94%, were achieved with CEPT. During the CEPT test, the solids return flow was allowed to overflow to the influent sewer although this does not appear to have affected the removal results; the removals were consistent throughout the 3 hour sampling period. All primary effluent was processed through Secondary Treatment.

**Secondary Treatment:** Three aeration basins (AB's) were in service this month. The MLSS averaged 6870-mg/L and ranged from 6,130 to 7,400 mg/L. The solids retention time (SRT) averaged 43-days; however the increase from 24-days occurred all during the last week of the month. Aeration capacity was adequate this month. Overall, aeration capacity continued to increase as a result of dropping wastewater temperature. Staff have begun the process of replacing probes in the ABs with an updated style probe and air clean system. With the ability to achieve DO setpoints, the MLSS was slowly increased to improve mixed liquor filterability. Surface wasting was the primary method to maintain the MLSS and SRT.

Total-N removal averaged 25%. Full nitrification was achieved throughout the month. Effluent  $\text{NH}_3\text{-N}$  averaged <0.1 mg/L for the month. Denitrification was incomplete; effluent nitrite/nitrate ( $\text{NO}_2+\text{NO}_3$ ) averaged 37.4-mg/L as N. Influent TKN averaged 52-mg/L, which is high for the month of December but 7-mg/L lower than November's average.

Continuous dosing of caustic soda to the secondary process was required to ensure minimum effluent pH permit conditions were met, and to achieve complete nitrification. The dose averaged 5196-gpd of 25% NaOH solution or 294 gallons/MG of influent, which is the same dose as needed in November. (Higher caustic doses are required in wet weather because of the lower influent alkalinity that comes with the rain/higher flows, and more complete nitrification due to higher DO concentrations.) The aeration optimization project should reduce the caustic dose by diminishing the nitrogen load to secondary process and/or improving denitrification in the secondary process.

Membrane effluent turbidity averaged 0.04-0.06 NTU. Membrane Trains 1-7 were primarily in "backpulse" mode. The air scour mode was usually 10s-on/10s-off because of declining filterability. One of the five membrane blowers failed Nov. 28, and was returned to service on Dec. 6. Although the plant can operate 10s-on/10s-off with the remaining four blowers, cycling of the blowers and air scour modes produced an unstable aeration supply for short periods of time. Because of high turbidity, additional cassettes in Train 8 were valved out during the last 2 days of the month; 17 of the 20 cassettes for Train 8 are currently in service. Another cassette for Train 8 was replaced with the spare cassette from Train 7; the spare cassette was made available from Pilot testing in Train 7. Train 8 operated in relax mode most of this month. Approximately 5080-gallons of 12.5% sodium hypochlorite ( $\text{NaOCl}$ ) were used for maintenance cleans. An additional 1028-gallons of sodium hypochlorite were used for a recovery clean on Train 4.

Membrane capacity declined from 30-mgd to 18-mgd this month. Capacity declined slowly during the first two weeks from 30-mgd to 28-mgd, and then more rapidly to 18-mgd by the end of the month. As is typical for Brightwater activated sludge, filterability declines are correlated with dropping wastewater temperatures and lower influent alkalinity. The soluble COD of the mixed liquor continued to correlate well with filterability. The maximum hourly average flux during peak flow tests was between 9.3 and 12.8-gfd per  $\text{ft}^2$  of membrane surface in December.

Testing of two higher-density cassettes in Train 7 continued this month. The two cassettes, named Pilot A and Pilot B, both use LEAP aeration for air scour and were originally populated with the plant's 8-year old modules. The spacing for modules in Pilot B are much closer than

the spacing for Pilot A. Pilot A was recently re-configured with new modules designed for higher flux conditions. Performance of the higher-density cassettes, Pilot B, tracked well with the other trains. (Higher-density, higher-flux modules, and LEAP aeration have the potential for reducing membrane energy use while increasing capacity.) Maintenance cleans for Train 7 were performed 3x/week to prevent fouling during the higher flows required for the testing.

The table below shows changes in trans-membrane pressure (TMP), membrane permeability, and MCRT over the month. The rated instantaneous peak hourly flow for one membrane train is 4950-gpm. Peak flow tests were run on two trains per day. Flow setpoints for the peak flow tests were adjusted upwards or downwards depending on the “before-BP” TMP. The initial flow for the peak tests varied between 3500-gpm and 3600-gpm this month.

Parameter	12/3	12/10	12/17	12/24	12/31
TMP before backpulse, average psi <sup>2</sup>	4.0	2.1	4.2	6.1	7.3
TMP before backpulse, peak flow test, psi	7.5	7.2	7.5	8.5	8.7
Permeability temperature-corrected <sup>1</sup> , gfd/psi	1.8	1.9	1.8	1.4	1.2
Flow target for peak flow test, gpm	3600	3600	3600	3540	3500
Flow hourly average during peak flow test, gpm	2800	2860	2770	2490	2160
MB Effluent temperature, degrees F	64.8	64.0	63.6	62.9	62.5
SRT, days	27	19	23	24	114
MLSS, mg/L	7510	7100	7000	6920	6450

1 Temperature-corrected Permeability based on Peak Flow Test.

2 TMPs during the low flow period of the day

**Odor Control:** The Odor Control facilities performed well this month. Work on repairing and tuning chemical supply systems continues. This month, repairs were made to hypochlorite piping systems for distribution to the odor control facilities, the membrane cleaning systems, and the disinfection system piping. The hypochlorite was shutoff to the odor control facilities for 1 day while the repairs were completed.

**Disinfection:** Approximately 13,700 gallons of 12.5% NaOCl were used in December for final effluent disinfection, reclaimed water, and process water at IPS. Hypochlorite effluent disinfection was equal to an average dose of 3.6-mg/L as Cl<sub>2</sub>. Hypochlorite was applied through the diffuser. 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 0.08-mg/L and 0.10-mg/L Cl<sub>2</sub>, respectively.

**Thickening:** All three gravity belt thickeners (GBTs) were rotated in service this month. The GBTs thickened feed sludge from an average of 1.5% total solids (TS) to 6.3% TS, with an average solids capture of 91.3%. Thickened sludge production totaled 666 dry tons. The polymer dose for thickening averaged 7.6 pounds active polymer per dry tons solids processed.

**Anaerobic Digestion:** The digestion process met time and temperature requirements for Class B biosolids production. Digesters 2 and 3 and the blended storage tank were in service in December. In the active digesters, the solids retention time averaged 29.5 days, temperature averaged 99°F, and volatile solids (VS) destruction averaged 63.6%. The total solids concentration in the active digesters averaged 2.84%, with a VS fraction of 81.2% VS/TS. The average digester VS load was 0.13 lbs-VS/cu-ft./d with two digesters in service. Monthly gas production is estimated to be 11.5 million ft<sup>3</sup> (based on biosolids haul data and VS destruction). Digester 1 remained out of service for repairs.

**Dewatering/Biosolids:** 1127 wet tons (230 dry tons at 20.4% TS) of biosolids were produced and 1187 wet tons (242 dry tons) were hauled in December. Solids recovery in the dewatering process averaged 93.3%. Polymer dosage averaged 47.9 lbs-active per dry ton processed. Dewatering operated 30 days in December using both centrifuges (No. 1 and No.3). Centrifuge feed averaged 2.61% TS at 79.8% VS/TS. Biosolids product averaged 20.5% TS at 81.1% VS/TS for centrifuge 1 and 20.3% TS at 81.5% VS/TS for centrifuge 3.