Memorandum

February 13, 2024

TO:	Historical Memo
FROM:	Andy Strehler, Process Engineer; Rachael Dyda, Process Supervisor; Curtis Steinke, Process Engineer
SUBJECT:	South Treatment Plant (STP) DMR Memo January 2024 Operating Record

STP met its conventional permit limits for secondary effluent. Operation in January 2024 was characterized by above average rainfall and colder than normal temperatures. The plant was operating to select for phosphate accumulating organisms (PAOs) and did not operate for nitrification/denitrification in January. The RAS chlorination to control filaments at the end of December 2023 broke up filaments, but resulted in SVIs greater than 150 mL/g between Jan. 01 – Jan. 12 (285 – 153 respectively); the SVI decreased throughout the month, ending at 132 mL/g. Additional observations include good effluent quality, slightly lower septage loads, stormwater valved to the influent the entire month and an average of 0.1-mgd of flow from the Brightwater service area. Communication between South Plant's control room and most of the conveyance pump stations were functional January. There are some still some facilities that are missing communication to South Plant and work is ongoing to resolve these issues.

Climate

January temperatures were on average colder than normal and rainfall was higher than normal when compared to historical averages. January had large temperature fluctuations, the first half of the month was colder than normal and the last half was warmer than normal. Rainfall (6.31-inches at SeaTac Airport) was more than the historical average (5.78inches at SeaTac Airport). The observed daily average high and low air temperatures were $61^{\circ}F$ and $15^{\circ}F$. The average monthly maximum and minimum air temperatures were $46.5^{\circ}F$ and $36.7^{\circ}F$ which are $1.5^{\circ}F$ and $1.0^{\circ}F$ lower than the maximum and minimum long-term averages, respectively. The average wastewater effluent temperature decreased from $60.5^{\circ}F$ to $56.5^{\circ}F$ between Jan. 01 - 23, then rose slightly, ending the month at $57.9^{\circ}F$.

Effluent Quality

Effluent flow averaged 95.4-mgd, which falls within the historical January flow range. Final effluent quality for the month averaged 4-mg/L carbonaceous BOD (CBOD₅), 7-mg/L TSS and 7-mg/L total BOD₅. Respective removals were 97%, 96% and 96%. Maximum weekly average values were 5-mg/L, 9-mg/L and 8-mg/L, respectively. All conventional permit limits for secondary effluent were met.

Offsite Flows and Loads

1.55-MG of septage was received at STP in January, which accounted for an estimated 5% of STP's influent solids load and was approximately 30% less than in January of 2023. Southern Transfer (aka Allentown) flow averaged 10.9-mgd, with a peak-daily flow estimate of 22-mgd on Jan. 28. York P.S. flow (i.e., Brightwater based flow) averaged <0.1-mgd, accounting for less than 1% of the monthly flow and TSS loads at STP. Brightwater diverted minimal flow to STP via the North Creek Pump Station and no flow via the York Diversion Gate at Hollywood Pump Station. The Port of Seattle sent an estimated 200,000 total pounds of deicer to STP over 27 days in January.

Sampling and Analyses

All permit-required samples (influent and effluent) were collected and analyzed. The final ETS effluent sample line/sampler was usually chlorinated every fourth day. Influent flow, including recycled flows, ranged from 79.8-mgd to 148.2-million gallons per day (mgd) with an average of 101.8-mgd. Daily effluent flows ranged from 72.3-mgd to 141.1-mgd with an average flow of 95.4-mgd. Typically, around 8-mgd of the total influent flow is from various internal processes and is returned to the influent via the plant sanitary drain system, causing the influent flow to be higher than effluent flow. The measured influent loads averaged 77-tons/day BOD₅, 62-tons/day CBOD₅, and 79-tons/day TSS. The average monthly effluent chlorine (Cl_2) at the ETS outfall was <66-ug/L with minimum and maximum daily average values of <50 and 170-ug/l, respectively. This is well below the permitted max-day limit of 750-ug/L and the monthly average limit of 500-ug/L.

STP Facility Area Status

Primary Treatment: There were 4 north and 8 south primary tanks in service all month. The primary effluent TSS averaged 71-mg/L, resulting in an average TSS removal rate in the primary clarifiers of 63%. Primary effluent CBOD averaged 93-mg/L resulting in an average CBOD removal rate across the primaries of 39%. The hydraulic loading rate (HLR) ranged from 1,152 – 2,138-gpd per ft², with an average of 1,469-gpd per ft².

Secondary Treatment:

All four ATs were in service all month. 22 to 23 of 24 secondary clarifiers were in service all month; clarifier 8 was out of service all month due to a leaking collector seal, and clarifier 22 was out of service between Jan. 13 – 23 due to an over-torque issue with its sludge collector. The POD5 effluent control valve is being operated manually; its automated actuator could not be repaired due to unavailability of replacement parts. STP operated the secondary process to select for PAO population for enhanced secondary settling and high-flow operation. Settled sewage feed gates were in plug flow mode from Jan. 01 – 21 and from Jan. 23 – 25 and Jan. 30 – 31 (i.e., AT feed gates open only in Pass-1). Operation was switched to step feed mode on Jan. 22 and between Jan. 26 – Dec. 12, with gate configuration varying based on plant flow.

MLSS concentration ranged from 2,062 – 2,864-mg/L, with an average of 2,510-mg/L. The solids retention time (SRT) ranged from 2.8 – 4.6-days, with an average of 4.2-days. The average mixed liquor settling (SVI) was much better in January than in December 2023, ranging from 103 – 285-mL/g, with an average of 163-mL/g; SVI values at the end of the month were between 120 – 130 mL/g. The RAS strategy was operated as a percentage of effluent flow all month. RAS flow rates varied between 2.0 to 3.0-mgd per secondary sedimentation tank in service throughout the month. One out of 12 Anaerobic Zone mixers was out of service for most of the month.

Aeration tank air use ranged from 52.1 – 66.5-million-ft³/day with an average of 59.1-million-ft³/day for the month. Wasting rates varied throughout the month in response to changes in flow and in activated sludge inventory. WAS flow rates to the DAFTs varied between 1.6 to 2.7-mgd and averaged 1.8-mgd. DO setpoints in passes 1-4 varied between 2.2 – 2.7 mg/L. DO probe #5, located ½ way down pass 2, was used for control of airflow to passes 1&2 all month, and DO probe #10 was used to control airflow to passes 3&4 all month.

Nutrient Removal and Puget Sound Nutrient (Nitrogen) General Permit (PSNGP)

STP operated the secondary process for minimal nitrogen removal in January. South Plant plans to start nitrifying again in mid-March in order to meet the bubbled PSNGP annual total inorganic nitrogen action level for 2024. Total Inorganic Nitrogen (TIN) removal averaged -12.8% in January. Effluent ammonia (NH₃) and nitrite plus nitrate (NO₂+NO₃) averaged 30.5-mg/L as N and <0.1-mg/L as N, respectively, resulting in an average effluent TIN of 30.6-mg/L as N. On a mass (as N) basis, the daily average effluent NH₃, NO₂+NO₃, and TIN loads were 23,980-lbs/day, <112-lbs/day and 24,091-lbs/day, respectively. The monthly total effluent TIN load for STP in January was 746,833-lbs, which was 125,139-lbs over STP's individual monthly limit, if STP had a monthly limit (calculated using STP's individual action level of 7.34 million lbs/year divided by 366 days and multiplied by # of days per month if WTD had not bubbled and STP had a monthly limit). All permit-required samples (influent and effluent) were collected and analyzed.

Phosphorus (P) removal in January averaged 75% and effluent Total-P averaged 1.05-mg/L or 830-lbs/day.

Disinfection

38,199 gallons of 12.5% sodium hypochlorite (NaOCl) were used to disinfect STP's final effluent in January. This resulted in an average dose of 1.5-mg/L as chlorine (Cl₂) based on secondary effluent (POD) flow. Hypochlorite use in January averaged 1,232-gpd, which was lower than December's use (1,594-gpd) due to lower monthly flow. Dechlorination via sodium bisulfite was not required.

Both the north and south CCCs were in service. A gate between the north and south CCCs near POD4 directed PODs 5&6 effluents to flow down the south CCC while PODs 1-4 effluent flowed down the north CCC.

DAFT

An average of 100.4-dry-tons/day (0.423-mgd at 5.69% TS) of co-thickened raw and waste activated sludge (THS) was produced by the DAFTs. Between Jan. 1 – 16 there were 4 DAFTs in service (DAFT 2, 3, 5 & 6). During this time DAFTs 2 & 3 operated with one pressurization unit and DAFTs 5 & 6 operated with two pressurization units. DAFT 4 was placed back in service on Jan. 17, following repairs to its track system. South Plant operated with 5 DAFTs in service between Jan. 17 – 23; during this time all 5 DAFT units operated with only one pressurization unit. On Jan 24 DAFT 5 was taken out of service to unplug a polymer feed line and to take 3-D images of its interior; it remained out of service the rest of the month. DAFT 6 operated with 2 pressurization units from Jan 24 – 31 while there were only 4 DAFTs in service due to distributing more solids loading to DAFT 6 than the other DAFTs in service. 13,200-lbs of polymer (Polydyne WE-1531) were added to DAFT feed sludge in January. The solids loading rate (SLR) averaged 19.0-lbs./d/ft² for the smaller DAFTs and 25.5-lbs./d/ft² for the larger DAFTs. SLR ranged from 14.4-lb/ft2/day to 42.5-lb/ft² /day throughout the month.

Anaerobic Digestion

Time and temperature requirements for Class B biosolids were met via anaerobic digestion. All five digesters were in service. Digesters 1-4 were the primary digesters, operated in parallel and fed equal amounts of THS. Each discharged to Digester 5, which served as the blending tank before dewatering. Over the month, the primary digester detention time averaged 25.4-days with Digester 5 providing an additional 2.9-days. Volatile solids (VS) reduction through the digestion process averaged 61.3%.

The VS loading rate averaged 0.12-lbs./day/ft³ for the four primary digesters. The VS/TS percent entering and leaving the digestion process averaged 87.2% and 72.4%, respectively. The alkalinity concentrations were in the 7,600 – 9,800-mg/L as calcium carbonate (CaCO₃) for Digesters 1-4. Digester temperatures were in the 98 – 100°F range.

<u>Energy</u>

The gas scrubbing system was off for a period of 50 hours between Jan. 9 - 11 for a scheduled C3 outage to support the heat system project. It was also down on Jan. 12 – 14 due to freezing and low temperatures. Gas scrubbing compressor 3 was down for two days for maintenance work at the end of the month. An estimated 236,849-therms of scrubbed gas (biomethane) was distributed into PSE's pipeline. 60,409-therms, or approximately 21% of the biogas produced, was flared.

Cogen turbine 1 operated for 28.6 hours during the high flow period on Jan. 9 – 10. A total of 99,494-kWh were produced in January. The current peak demand ratchet was set on Dec. 5 at nearly 14,000-kVA.

The boiler operated all of January using the modified HRS temperature control strategy tied to the most open valve operation (MOV) of the digester HRS valves. The digester temperature setpoints were fixed at 99°F, and the HRS temperature varied between 135 - 145°F in cascade control based upon digester HRS valve MOV control.

Dewatering/Biosolids

1,218-dry-tons biosolids (5,586-wet-tons at 21.8% TS) were hauled in January. Approximately 54% of the biosolids (based on wet tons) were distributed to Western Washington (WA) forest sites and 46% to Eastern WA agricultural sites. An estimated 65,700-lbs. of active polymer were applied for dewatering biosolids equal to an average dose of 55.2 lb-active/dry ton hauled. The polymer was Polydyne WE1514, a 43% active cationic emulsion solution.

Dewatering operated on 31 days in January. Dewatering operation was mostly 24-hour shifts on weekdays and half-day shifts on weekends, with two centrifuges typically in operation. Typical centrifuge feed rate ranged between 150 – 230-gpm per each centrifuge in service. Some gas-scrubbing water was sent to the centrate sump to provide struvite control. Centrate was valved to the DAFTs in January. Centrifuges 1 & 2 were in service all month; Centrifuge 3 was placed back in service on January 9 and was in service the rest of the month.