

Memorandum

April 12, 2024

TO: Historical Memo

FROM: Andy Strehler, Process Engineer; Rachael Dyda, Process Supervisor; Curtis Steinke, Process Engineer

SUBJECT: South Treatment Plant (STP) DMR Memo
March 2024 Operating Record

STP met its conventional permit limits for secondary effluent. Operation in March 2024 was characterized by lower than normal rainfall and typical temperatures. The plant transitioned to nitrification/denitrification in March. The SVI average for the month was 132 mL/g and varied between 98-172 mL/g. Additional observations include good effluent quality, lower septage loading than in March of previous years, stormwater valved to the influent the entire month and an average of <0.1-mgd of flow from the Brightwater service area.

Climate

March rainfall was considerably lower than normal and average temperatures were the same compared to historical averages. Rainfall (2.36-inches at SeaTac Airport) was almost half the historical average (4.17-inches at SeaTac Airport). The observed daily average high and low air temperatures were 74°F and 28°F. The average monthly maximum and minimum air temperatures were 54.1°F and 40.2°F which are 0.1°F lower and 0.3°F higher than the maximum and minimum long-term averages, respectively. The average wastewater effluent temperature ranged from 56.9°F to 60.9°F throughout the month.

Effluent Quality

Effluent flow averaged 77.6-mgd, which falls within the historical March flow range. Final effluent quality for the month averaged 4-mg/L carbonaceous BOD (CBOD₅), 6-mg/L TSS and 11-mg/L total BOD₅. Respective removals were 98%, 98% and 96%. Maximum weekly average values were 5-mg/L, 6-mg/L and 11-mg/L, respectively. All conventional permit limits for secondary effluent were met.

Offsite Flows and Loads

1.45-MG of septage was received at STP in March, which was approximately 33% lower loading than in March of 2023 and accounted for an estimated 5% of STP's influent solids load for the month. Southern Transfer (aka Allentown) flow averaged 7.7-mgd, with a peak-daily flow estimate of 15.7-mgd on March 01. 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 no flow to STP via the North Creek Pump Station and the York Diversion Gate at Hollywood Pump Station diverted minimal flow on two days. The Port of Seattle sent an estimated 180,000 total pounds of BOD (as deicer) to STP over 19 days in March.

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 76.5-mgd to 112.5-million gallons per day (mgd) with an average of 87.1-mgd. Daily effluent flows ranged from 69.7-mgd to 106.1-mgd with an average flow of 78.0-mgd. Typically, around 6-8-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; recycle of chlorinated secondary effluent was resumed on Mar. 26, adding an estimated 14-mgd additional flow to the influent. The influent loads averaged 67-tons/day CBOD₅, 90-tons/day BOD₅, and 81-tons/day TSS. The average monthly effluent chlorine (Cl₂) at the ETS outfall was <52-ug/L with minimum and maximum daily average values of <50 and 80-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 73-mg/L, resulting in an average TSS removal rate in the primary clarifiers of 68%. Primary effluent CBOD averaged 104-mg/L resulting in an average CBOD removal rate across the primaries of 44%. The hydraulic loading rate (HLR) ranged from 1,104 – 1,623-gpd per ft², with an average of 1,257-gpd per ft².

Secondary Treatment:

All four ATs were in service all month. 23 of 24 secondary clarifiers were in service all month; clarifier 8 was out of service all month due to a leaking collector seal. The POD5 effluent control valve continues to be operated manually. STP operated the secondary process to begin nitrification, by increasing both DO setpoints and solids retention time (SRT) and changing the RAS rates from flow-paced to a fixed flow rate. Settled sewage feed gates were in plug flow mode all month (i.e., AT feed gates open only in Pass-1).

Average MLSS concentration ranged from 2,801 – 3,160-mg/L, with a monthly average concentration of 2,977-mg/L. The solids SRT ranged from 4.5 – 5.6-days, with an average of

5.1-days. The average mixed liquor settling (SVI) was slightly higher in March compared to February, with values ranging from 98 – 172-mL/g, with an average of 132-mL/g. The RAS strategy was operated as a percentage of effluent flow between Mar. 01-18; during this period the RAS flow rates varied between 2.2 to 3.2-mgd per secondary sedimentation tank in service. Between Mar. 19-31 the RAS strategy was switched to a constant 3.0-mgd per clarifier in service.

Aeration tank air use ranged from 54.3 – 86.1-million-ft³/day with an average of 71.0-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 1.4 to 2.0-mgd and averaged 1.66-mgd. DO setpoints in passes 1-4 were at 3.0 mg/L for the entire month. 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 minor total inorganic nitrogen (TIN) removal in early March and transitioned to increased TIN removal by the end of March. South Plant initiated the plan of beginning nitrifying and denitrifying in March in order to meet the WTD bubbled PSNGP annual total inorganic nitrogen action level for 2024. TIN removal averaged 16.6% in February. Effluent ammonia (NH₃) and nitrite plus nitrate (NO₂+NO₃) averaged 23.6-mg/L as N and 4.0-mg/L as N, respectively, resulting in an average effluent TIN of 27.6-mg/L as N. On a mass (as N) basis, the daily average effluent NH₃, NO₂+NO₃, and TIN loads were 15,146-lbs/day, 2,465-lbs/day and 17,611-lbs/day, respectively. The monthly total effluent TIN load for STP in March was 545,938-lbs, which was 57,362-lbs below 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 March averaged 88% and effluent Total-P averaged 0.66-mg/L or 440-lbs/day.

Disinfection

33,110 gallons of 12.5% sodium hypochlorite (NaOCl) were used to disinfect STP's final effluent in March. This resulted in an average dose of 1.8-mg/L as chlorine (Cl₂) based on secondary effluent (POD) flow. Hypochlorite use in March averaged 1,068-gpd, which was slightly lower than February's use (1,103-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 88.5-dry-tons/day (0.408-mgd at 5.22% TS) of co-thickened raw and waste activated sludge (THS) was produced by the DAFTs. This value is approximately 9% below February's average and is likely due to an issue with the THS sampler; during the first part of the month the THS values were unusually low, after repairs to the sampler the %TS values were more typical. There were 4 DAFTs in service (DAFT 2, 3, 4 & 6) all month. All four DAFTs operated with two pressurization units the entire month. 14,850-lbs of polymer (Polydyne WE-1531) were added to DAFT feed sludge in March. The solids loading rate (SLR) averaged 23.9-lbs./d/ft² for the smaller DAFTs and 24.7-lbs./d/ft² for the larger DAFTs. SLR ranged from 20.0-lb/ft²/day to 33.7-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 26.5-days with Digester 5 providing an additional 3.5-days. Volatile solids (VS) reduction through the digestion process averaged 56.9%.

The VS loading rate averaged 0.10-lbs./day/ft³ for the four primary digesters. The VS/TS percent entering and leaving the digestion process averaged 85.2% and 70.7%, respectively. The alkalinity concentrations were in the 6,000 – 7,500-mg/L as calcium carbonate (CaCO₃) for Digesters 1-4. Digester temperatures were in the 98 – 101°F range.

Energy

The gas scrubbing system operated and sold biomethane every day in March. 266,000-therms of scrubbed gas (biomethane) was distributed into PSE's pipeline. 17,455-therms, or approximately 7% of the biogas produced, was flared.

Both Cogen Turbines were available in March. Cogen 1 was operated once for routine PM. Both Cogen 1 & 2 were operated to due to gusty weather, Cogen 1 on Mar. 03 & 11, Cogen 1 on Mar. 11.

The gas fired boiler operated all of March and supplied the plant heat loop. The digester temperature setpoints were fixed at 99°F, and the HRS temperature varied between 135 - 144°F in cascade control based upon digester HRS valve MOV control. The electric boiler in Main Control ran all month to supply heat to the Administration Building and Main Control, this boiler was isolated from the plant heat loop.

Nitrification was resumed in March, and aeration rates were increased to support nitrification. On Mar. 26 RAS return rates were increased and final effluent recycle was resumed to enhance denitrification.

Dewatering/Biosolids

1,122-dry-tons biosolids (5,270-wet-tons at 21.8% TS) were hauled in March. Approximately 71% of the biosolids (based on wet tons) were distributed to Western Washington (WA) forest sites and 29% to Eastern WA agricultural sites. An estimated 61,800-lbs. of active polymer were applied for dewatering biosolids equal to an average dose of 53.4 lb-active/dry ton hauled. The polymer was Polydyne WE1514, a 43% active cationic emulsion solution.

Dewatering operated on 31 days in March. Dewatering operation included night shift shutdowns during the first week of the month to accommodate vacation schedules. During the rest of the month, operation was 24-hour shifts on weekdays and half-day shifts on weekends. Two centrifuges were typically in service during dewatering operations. 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 March. Centrifuges 1, 2 & 3 were in service all month.