Memorandum

October 15, 2018

TO: Historical Memo

FROM: Rick Butler, Process Control Supervisor

SUBJECT: South Treatment Plant at Renton (STP)
September 2018 Operating Record

STP met all of its conventional permit limits for secondary effluent in September 2018. Flow averaged 55-mgd. The max-day flow was 62-mgd (September 14). Final effluent quality averaged 4-mg/L carbonaceous BOD ($cBOD_5$), 6-mg/L TSS and 10-mg/L total BOD_5. Respective removals were 99%, 98% and 98%. All flows received secondary treatment.

September was dry and warm, with a rainfall total of 1.04-inches. The historic average rainfall for September is 1.50-inches and the record rainfall is 6.17-inches (2013). Air temperatures were around 0°F and 2°F warmer than normal, respectively, with average daily high and low temperatures of 70.5°F and 55°F. Wastewater temperature dropped slightly across September from 74°F to 72.5°F.

Offsite Flows and Loads: 2.29-MG of septage was received in September, accounting for 8% of STP's influent solids load. The Southern Transfer, aka Allentown, averaged 3.6-mgd. Sewage from the Brightwater (BW) service area accounted for <1% of STP's influent load. BW-based flows (via York P.S.) averaged 0.4-mgd. York's max-day flow was 1.3-mgd. Deicer was discharged to STP on seven days but at very low loads (270-lbs/d BOD average).

On Sept. 16, the STP received a sizable load of palm oil (a grease-like substance) from a local industry. Most of the palm oil was removed at STP's headworks or captured in a dedicated primary clarifier tank. The remaining palm oil had a limited impact to the rest of the plant, though biogas production was temporarily much higher in the anaerobic digesters. All permit or specification requirements for final effluent, reclaimed water, biosolids and scrubbed gas quality were met during and after the spill

Sampling and Analyses: All permit-required samples (influent and effluent) were collected and analyzed. The final ETS effluent sample line/sampler was chlorinated every other day. Effluent chlorine (Cl_2) at the ETS outfall was monitored using two on-line analyzers; the outfall Cl_2 level was below the 0.75-mg/L daily average and 0.5-mg/L monthly average limits. The measured influent loads were 210,000-lbs/day for BOD, 131,000-lbs/day for CBOD and

166,000-lbs/day for TSS. Recent months' loads and plant mass balances suggest that September's influent BOD and TSS loads may be closer to 160,000-lbs/day.

STP Facilities Status: STP was in summer operating mode in September. Numerous process tanks were out of service for scheduled summer PMs. Offsite RW application occurred every day. The secondary process was nitrifying. Process heat was provided by the boiler. The gas scrubbing system was in operation all month at near full capacity; parts of the scrubbing system were occasionally out of service to install new water separators. All scrubbed gas was injected into the PSE pipeline for RINs sales.

8 of 12 primary sedimentation tanks, 4 of 4 aeration tanks, 16-19 of 24 secondary clarifiers, and 1-2 of 2 chlorine contact channels (Cl_2CC) were in service essentially all month. The 4 southwest primaries were out of service for scheduled PM's. POD6 (Clarifiers 21-24) was out of service for scheduled PMs and to install new diffusers in the MLSS channel. POD2 (Clarifiers 5-8) returned to service late in the month. The south Cl_2CC returned to service Sept. 20 after being out of service most of the summer.

Five of six DAFTs (one large and four small) were in service all month. DAFT6 returned to service Sept. 14; DAFT5 then went out of service for scheduled repairs. All five anaerobic digesters were in service all month. Dewatering operated every day but two; centrate was valved to the DAFTs. On September 30, STP operated with 8 of 12 primary tanks, 4 of 4 aeration tanks, 19 of 24 secondary clarifiers, 2 of 2 chlorine contact channels, 5 of 6 DAFTs and 5 of 5 digesters.

Secondary Treatment: The secondary process was operated in plug flow mode with a ½-pass un-aerated zone in Pass-1. The system was operated to nitrify all month. The secondary system's solids retention time (SRT) was around 6-7 days most of the month. The MLSS concentration was about 2500-2800 mg/L over the month. The secondary process was operated to achieve greater nitrification (i.e., NH3 conversion to NO_2+NO_3) in the second half of the month, e.g., via higher operating D.O.'s.

The RAS return rate was set at a constant rate of 90% output for each RAS pump. This provided a total RAS flow of 85-mgd (16 clarifiers) and an average RAS return rate of 150%. The instantaneous RAS return was as high as 250-300% during breakfast hours. When POD2 returned to service on Sept. 25, the total RAS flow was about 100-mgd with an RAS return of about 200%. The constant, high RAS flow was chosen to improve denitrification and to buffer the low effluent pH of the day – which was associated with the breakfast hours.

Daily aeration tank air use averaged 90 million-ft3/day, ranging from 68 to 110 million-ft3/day. The range in aeration rates was primarily due to the mid-month change in aeration DOs to further lower the effluent NH3. As expected, aeration rates increased substantially with the higher DOs and the resulting higher levels of nitrification (i.e., oxidation of NH3 to

NO2+NO3). Aeration rates during the first two weeks averaged near 80 million-ft3/day while aeration rates during the last week of September averaged near 105 million-ft3/day.

Nitrogen (N) and phosphorus (P) removals averaged 55% and 44%, respectively, in September. Effluent ammonia (NH_3-N) and nitrate + nitrite (NO_2+NO_3) averaged 8-mg/L and 17-mg/L, respectively, in September. However, effluent NH3-N averaged 12-mg/L and 4-mg/L during the first and second halves of the month, respectively. Though greater NH_3 was converted to NO_2+NO_3 during the second half of the month, no additional nitrogen was removed as the effluent NO_2+NO_3 increased a similar amount as the NH3-N dropped. Effluent total-P averaged 4.9-mg/L, which is similar to July's average.

Influent alkalinity was usually 100,000-120,000 lbs/day as $CaCO_3$. Effluent alkalinity was usually 50,000-60,000 lbs/day (110-130-mg/L) early in the month when effluent NH_3 averaged 12-mg/L. Effluent alkalinity dropped to 25,000-35,000 lbs/day (65-75 mg/L) late in the month when effluent NH_3 averaged closer to 4-mg/L. Minimum effluent pH values occurred in late September; they were near pH 6.2.

Disinfection: 37,960 gallons of 12.5% sodium hypochlorite (NaOCl) were used to disinfect STP's final effluent in September. This resulted in an average dose of 2.8-mg/L as Cl_2 based on effluent flow. Historically, the Cl_2 disinfection dose has been near 1.5-2.0 mg/L in winter and 2.0-3.0 mg/L in summer.

Hypochlorite doses in the first half of the month was very different than doses in the second half. During the first half of the month, daily hypochlorite use was in the 900-1100 gpd range (2.0-2.4 mg/L dose based on effluent flow). During the second half, daily hypochlorite use was usually in the 1400-1700 gpd range (3.0-4.0 mg/L based on effluent flow). This difference in dosing was due to the much lower effluent NH_3 levels in the second half of the month, and the liklihood that the effluent NH_3 was essentially zero for some period of the day.

The north Cl_2CC was in service all of September, and the south Cl_2CC returned to service Sept. 20. The "West" dosing system applies hypochlorite to the north Cl_2CC, while the "east" system doses the south Cl_2CC. RAS chlorination (for SVI control) was not practiced in September. Pre-chlorination (for odor control of the influent wastewater) was practiced on one day. The CCC, ETS effluent pipeline, and ETS outfall structure were usually disinfected with a slug dose of hypochlorite every two weeks.

DAFT: An average of 80 dry tons/day of thickened raw sludge (THS) was fed to the digesters. THS flow averaged 0.35-mgd with a solids concentration of 5.5% TS. 41,850-lbs/month of polymer were added to 167-dry tons/day of DAFT feed sludge for an average polymer dose of 3.0 lb-active/dry ton feed. Polydyne polymer WE-1531 was used in September.

Five of six DAFTs (one large and four small) were in service. DAFT5 (large) went out of service mid-month when it was replaced with DAFT6 (large). Through Sept. 23, the solids loading rate (SLR) for the small and large DAFTs averaged 26 - 27 lbs./day solids per ft^2 using one fizz system per DAFT. One Sept. 24, the SLR to DAFT6 was increased to 40-45 lbs./day solids per ft^2 (with two fizz systems) in order to test its capacity. The corresponding SLR for the smaller DAFTs then averaged 15.5 lbs./day solids per ft^2 (with one fizz system).

Anaerobic Digestion: Time and temperature requirements for Class B biosolids were met via digestion. All four primary digesters and the fifth "blending" digester were in service all month. Volatile solids (VS) and total solids (TS) reductions averaged 63.5% and 56%, respectively. The detention time averaged 34-days; 3 of those days were provided by Digester 5. Digester temperatures were in the 96-102°F range. The VS/TS content entering and leaving the digesters averaged 88.8% and 74.3%, respectively. Digester alkalinity levels were usually in the 6500-7000 mg/L range. All primary digesters were operating in parallel and fed equal amounts of THS. The digester VS loading rate averaged 0.10-lbs./day.

The gas and pumped mixing systems for all digesters operated in a "normal" mode. The digesters did experience some gas binding issues in September, issues which may be related to the palm oil spill. Some additional accumulation of scum/sludge was also seen on the digester covers; air-spargers were available to control that accumulation.

Dewatering/Biosolids: 4949 wet tons of biosolids (1101-dry tons @ 22.2%TS) were beneficially reused in September. All of the biosolids were applied to Eastern WA. agricultural sites. Digested sludge production was closer to 1078 dry tons as the digester inventory decreased by 23 dry tons across the month.

49,050 lbs.-active polymer were used for biosolids dewatering, resulting in an average polymer dose of 44.6 lb.-active/dry ton hauled. The applied polymer was Polydyne WE586, a 41.5% cationic emulsion solution. Centrifuge feed rates were usually 150-gpm in the first half of the month and 170-gpm during the second half.