

MEMORANDUM

August 14, 2020

TO: Historical Memo

FM: Peter Carter / Steven Yee

RE: Carnation Wastewater Treatment Plant
July 2020 Process Summary

The Carnation Treatment Plant (CTP) discharged to the Chinook Bend wetland for the entire month of July. All reclaimed water quality requirements were met. Effluent Biochemical Oxygen Demand (BOD₅) and Total Suspended Solids (TSS) averaged <1.1 mg/L and <2.0 mg/L, respectively, and BOD₅ and TSS removals were >99.6% and >99.2% respectively. All permit-required samples were collected and analyzed.

Effluent flow averaged 0.103-MGD. Influent flow averaged 0.106-MGD; influent flow is usually slightly higher than effluent flow due to internal recycle flows. The permeate temperature increased across the month from about 22.7°C to 25.3°C.

The plant operated with one of the two aeration basins in service: Basin-2 from July 1 to July 13 and Basin-1 from July 14 to 31. Since the number of membrane repairs necessary had recently increased, all of the mixed liquor (aka MLSS) that was transferred from Basin-2 to Basin-1 was passed through the 2-mm influent screens in order to filter out any debris that may have accumulated in the MLSS. On July 31, we switched back to Basin-2 due to aeration blower problems on Basin-1.

The MLSS averaged 9040-mg/L. An estimated 7100 dry lbs. of waste sludge and scum were hauled to the South Plant for further treatment.

Flow was cycled through four of the five membrane trains for July; membrane train #2 was taken out of service at the end of June due to a faulty sodium hypochlorite valve (needed for the maintenance clean of the membranes).

Both UV trains were in service the entire month. A communication issue between the PLCs dedicated to the UV control and the plant SCADA system continued into the first week of July; some UV dose numbers were estimated that week.

Total-N removal averaged 91%. Effluent ammonia (NH₃) averaged <0.1-mg/L as N. Effluent nitrite plus nitrate (NO₂+NO₃) averaged 4.9-mg/L as N. Total phosphorus (P) averaged 3.8-mg/L for a total P removal of 56%. N and P analyses were performed the first 3 weeks of July.

Alkalinity was added to the secondary process to maintain the instantaneous effluent pH above pH 6.8. Caustic Soda (25% solution) was the alkalinity source; a total of 268 gallons was used. Effluent alkalinity averaged 106-mg/L (with a range of 99-136) as CaCO₃; influent alkalinity was in the range of 217-272 mg/l as CaCO₃. Alkalinity addition replaces the alkalinity lost during nitrification; the effluent pH would likely fall below the permitted minimum pH 6.0 if alkalinity addition stopped.

Tables 1 and 2 present membrane maintenance cleaning information and membrane performance data, respectively. Average TMPs were in the 1.3 to 1.4 psi range. The control system limits flow through the membranes to keep the TMP <8.0-psi; this protects the membranes' integrity. An estimated 61-gallons of sodium hypochlorite were used for maintenance cleans in July.

Table 1: Membrane Maintenance Cleans Performed July 2020

Week Beginning	Train 1	Train 2	Train 3	Train 4	Train 5
7/1			MC ¹	MC	MC
7/5	MC		MC	MC	MC
7/12	MC		MC	MC	MC
7/19	MC		MC	MC	MC
7/26	MC		MC	MC	

¹ MC refers to a maintenance clean

Table 2: Membrane Performance July 2020

MEMBRANE PARAMETERS	Train 1	Train 2	Train 3	Train 4	Train 5
Permeate Turbidity (NTU)¹					
Average for Month	0.11	-	0.09	0.08	0.12
<i>Design</i>	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Permeate Flow (GPD)²					
Average Daily for Month	29,337	-	28,536	27,664	27,640
<i>AADF (Annual Average Flow) Design</i>	97,500	97,500	97,500	97,500	97,500
Maximum Daily for Month	40,315	-	41,362	36,700	39,417
<i>PDF (Peak Day) Design</i>	165,000	165,000	165,000	165,000	165,000
Permeate Flow Rate (GPM)³					
Average for Month	25	-	24	23	24
Peak Hour for Month	132	-	112	133	132
<i>PHF (Peak Hour) Design</i>	180	180	180	180	180
Instantaneous Flux (GFD⁴)⁵					
Average for Month	7.1	-	7.0	7.1	7.3
Trans-Membrane Pressure (PSI)⁶					
Average for Month	1.2	-	1.4	1.3	1.4
Maximum for Month	3.5	-	2.5	3.6	3.6
<i>(Average/Maximum) Design</i>	2.0/10	2.0/10	2.0/10	2.0/10	2.0/10
Permeate Temperature (°C)⁷					
Minimum for Month	22.5	-	22.5	22.5	22.5
<i>Design</i>	> 12	> 12	> 12	> 12	> 12
Permeability at 20°C (GFD/PSI)⁸					
Average for Month	5.1	-	4.5	4.8	4.7
<i>(Recovery Clean Trigger) Design</i>	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0

¹ Permeate turbidity – indication of membrane integrity.

² Permeate flow – compares operating to design capacity. The design capacity (AADF and PDF) are both based on entire treatment plant flow with four membrane trains available.

³ Permeate flow rate – check of acute operating conditions to confirm peak hour design condition is not being approached. The design capacity (PHF) is based on entire treatment plant flow with five membrane trains available. The average rate is only for when the membrane is operating.

⁴ “GFD” is shorthand for “GPD/Ft²”. GFD is a flux measurement based on the flow (gallons/day) of permeate that passes through a square foot of membrane surface. Each train has one membrane cassette with 12,920 square feet of surface area.

⁵ Instantaneous flux – check of membrane operating flux. Instantaneous differs from net flux in that it does not account for backpulse and/or relax periods (It is therefore always slightly higher). The design condition is based on net flux and therefore not included. The permeate flow design conditions provide the same information since only a single cassette is operating in each membrane train.

⁶ Trans-membrane pressure – provides information related to fouling and biological process operation (MLSS and filterability). The average and maximum TMP are included for reference.

⁷ Permeate temperature – listed since the hydraulic capacity can be reduced when operating below the minimum design temperature (de-rating of membrane capacity).

⁸ Permeability (temperature corrected to 20°C) – parameter assesses fouled condition of membrane. The trigger value listed is from the GE O&M manual.