

MEMORANDUM

April 13, 2021

TO: Historical Memo

FM: Matt Macdonald

RE: Carnation Wastewater Treatment Plant
March 2021 Process Summary

The Carnation Treatment Plant (CTP) discharged to the Chinook Bend wetland for the entire month of March. 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 >99.7% and >99.4%, respectively. The max daily total coliform grab for the month was <1.0-cfu/100-mL. All permit-required samples were collected and analyzed. The permeate temperature ranged from 15.8°C to 18.0°C.

Effluent flow averaged 0.101-MGD. Influent flow averaged 0.107-MGD; influent flow is slightly higher than effluent flow due to internal recycle flows. The influent flow meter continued to report artificially high flow totals for the duration of the month. In response, daily influent flow totals were estimated by summing the measured effluent flow and an estimate of the internal recycle and wasted activated sludge.

The plant operated with Aeration Basin 2 (AB2) in service until March 31 when AB1 was put in service. The MLSS averaged 8,600-mg/L. An estimated 7600 dry lbs. of waste sludge and scum were hauled to the South Plant for further treatment. Hauled solids were likely underestimated slightly as the majority of wasting this month came from scum.

All five membrane trains were in service for the month. Due to poorer filterability, there were multiple events where membrane trains went into TMP (trans-membrane pressure) control and ultimately shutdown. UV train 1A remained out of service in March; the remaining UV trains ran for the duration of the month.

On March 22, the influent sampling point was moved downstream of the influent screens to improve sampling reliability by eliminating the potential for rag accumulation in the sampler line.

Total-N removal averaged 89%. Effluent ammonia (NH₃) averaged <0.1-mg/L as N. Effluent nitrite plus nitrate (NO₂+NO₃) averaged 7.0-mg/L as N. Effluent total phosphorus (P) averaged 2.5-mg/L for a total P removal of 67%. N and P analyses were performed every Tuesday.

Alkalinity was continuously added to the secondary process to maintain the instantaneous effluent pH above pH 7.2. Caustic Soda (25% NaOH solution) was the alkalinity source; a total of 409¹ gallons was used. Effluent alkalinity averaged 106-mg/L (with a range of 97-115) as CaCO₃; influent alkalinity was in the range of 209-281 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.

¹Calculated by tank level drop

Tables 1 and 2 present membrane maintenance cleaning information and membrane performance data, respectively. Average TMPs were in the 2.4 to 5.0 psi range. The control system limits flow through the membranes to keep the TMP <8.0-psi; this protects the membranes' integrity.

An estimated 110¹-gallons of sodium hypochlorite was used in March. Approximately 44-gallons were for a recovery clean on train 1 (March 24); the remaining 66-gallons were used for the 30 maintenance cleans in March. Additional maintenance cleans were performed this month due to trains going into TMP control. The membrane clean cycle was set to twice per week as of March 22.

Table 1: Membrane Maintenance Cleans Performed March 2021

Week Beginning	Train 1	Train 2	Train 3	Train 4	Train 5
1/31	MC ²	MC	MC	MC	MC
3/7	MC	MC	MC	MC	MC
3/14	MC	MC	MC	MC	MC
3/21	MC x3	MC x2	MC x3	MC x2	MCx2
3/28	MC	MC	MC	MC	MC

¹ Calculated using tank level drop across the month

² MC refers to a maintenance clean

Table 2: Membrane Performance March 2021

MEMBRANE PARAMETERS	Train 1	Train 2	Train 3	Train 4	Train 5
Permeate Turbidity (NTU)¹					
Average for Month	0.10	0.09	0.08	0.07	0.11
<i>Design</i>	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Permeate Flow (GPD)²					
Average Daily for Month	21,077	29,353	23,429	26,815	23,657
<i>AADF (Annual Average Flow) Design</i>	97,500	97,500	97,500	97,500	97,500
Maximum Daily for Month	39,778	59,872	44,823	69,361	54,778
<i>PDF (Peak Day) Design</i>	165,000	165,000	165,000	165,000	165,000
Permeate Flow Rate (GPM)³					
Average for Month	24	33	24	29	28
Peak Hour for Month	142	140	131	140	140
<i>PHF (Peak Hour) Design</i>	180	180	180	180	180
Instantaneous Flux (GFD⁴)⁵					
Average for Month	8.3	8.0	8.1	8.2	8.3
Trans-Membrane Pressure (PSI)⁶					
Average for Month	5.0	2.4	3.1	2.4	3.6
Maximum for Month	8	8	8	8	8
<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	15.0	15.0	15.0	15.0	15.0
<i>Design</i>	> 12	> 12	> 12	> 12	> 12
Permeability at 20°C (GFD/PSI)⁸					
Average for Month	2.6	4.0	3.2	4.0	3.2
<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.