

# MEMORANDUM

August 13, 2021

TO: Historical Memo

FM: Matt Macdonald

RE: Carnation Wastewater Treatment Plant  
July 2021 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 (BOD<sub>5</sub>) and Total Suspended Solids (TSS) averaged <1.0 mg/L and <2.0 mg/L, respectively, and BOD<sub>5</sub> 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. The day-average permeate temperature ranged from 25.3°C to 26.3°C. All permit-required samples were collected and analyzed.

There was one notable operational event which occurred on July 14. An unexpected City of Carnation cleaning and maintenance operation caused an unusually large amount of grease loading on the plant. Influent screens were blinded by the grease and the influent sampler did not yield a representative sample. As a result, the influent BOD and TSS samples for the day were excluded from reported data, but the required two samples per week were still performed.

Effluent flow averaged 0.099-MGD. Influent flow averaged 0.105-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 maximum daily influent flow of 0.132-MGD occurred on July 30 as a result of an internal plant recycle.

The plant operated with Aeration Basin 1 (AB1) in service the entire month of July. The MLSS averaged 7,900-mg/L. An estimated 6100 dry lbs. of waste sludge and scum were hauled to the South Plant for further treatment.

All five membrane trains and all four UV trains were in service for the duration of the month.

Total-N removal averaged 89%. Effluent ammonia (NH<sub>3</sub>) averaged <0.1-mg/L as N. Effluent nitrite plus nitrate (NO<sub>2</sub>+NO<sub>3</sub>) averaged 7.8-mg/L as N. Effluent total phosphorus (P) averaged 5.1-mg/L for a total P removal of 44%. N and P analyses were performed every Tuesday.

Alkalinity was continuously added to the secondary process to maintain the instantaneous effluent pH above pH 6.9. A total of 425<sup>1</sup> gallons of Caustic Soda (25% NaOH solution) was used for alkalinity adjustment. Effluent alkalinity averaged 103-mg/L (with a range of 72-121) as CaCO<sub>3</sub>; influent alkalinity was in the range of 200-300 mg/l as CaCO<sub>3</sub>. 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. Effluent alkalinity in the second half of the month was in the 72 -107 mg/l as CaCO<sub>3</sub> range

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<sup>1</sup>Calculated by tank level drop

which is somewhat lower than typical. The lower effluent alkalinity was likely a result slightly reduced denitrification performance returning less alkalinity to the process.

Tables 1 and 2 present membrane maintenance cleaning information and membrane performance data, respectively. Average TMPs were in the 1.5 to 1.7 psi range. The control system limits flow through the membranes at a TMP 8.0-psi; this protects the membranes' integrity.

An estimated 76<sup>1</sup>-gallons of sodium hypochlorite was used in July to perform 22 maintenance cleans.

Table 1: Membrane Maintenance Cleans Performed July 2021

Week Beginning	Train 1	Train 2	Train 3	Train 4	Train 5
6/27					MC <sup>2</sup>
7/4	MC	MC	MC	MC	MC
7/11	MC	MC	MC	MC	MC
7/18	MC	MC	MC	MC	MC
7/25	MCx2	MC	MC	MC	MC

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<sup>1</sup> Calculated using tank levels

Table 2: Membrane Performance July 2021

MEMBRANE PARAMETERS	Train 1	Train 2	Train 3	Train 4	Train 5
<b>Permeate Turbidity (NTU)<sup>1</sup></b>					
Average for Month	0.08	0.10	0.10	0.09	0.11
<i>Design</i>	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
<b>Permeate Flow (GPD)<sup>2</sup></b>					
Average Daily for Month	31,230	26,096	25,150	22,993	24,479
<i>AADF (Annual Average Flow) Design</i>	97,500	97,500	97,500	97,500	97,500
Maximum Daily for Month	57,479	48,869	40,683	46,534	40,839
<i>PDF (Peak Day) Design</i>	165,000	165,000	165,000	165,000	165,000
<b>Permeate Flow Rate (GPM)<sup>3</sup></b>					
Average for Month	30	33	27	23	24
Peak Hour for Month	119	121	121	114	115
<i>PHF (Peak Hour) Design</i>	180	180	180	180	180
<b>Instantaneous Flux (GFD<sup>4</sup>)<sup>5</sup></b>					
Average for Month	8.8	8.9	8.9	8.8	9.1
<b>Trans-Membrane Pressure (PSI)<sup>6</sup></b>					
Average for Month	1.6	1.6	1.7	1.5	1.6
Maximum for Month	3.5	3.4	2.6	2.4	2.4
<i>(Average/Maximum) Design</i>	2.0/10	2.0/10	2.0/10	2.0/10	2.0/10
<b>Permeate Temperature (°C)<sup>7</sup></b>					
Minimum for Month	24.7	24.7	24.7	24.7	24.7
<i>Design</i>	> 12	> 12	> 12	> 12	> 12
<b>Permeability at 20°C (GFD/PSI)<sup>8</sup></b>					
Average for Month	4.8	4.9	4.6	5.2	5.1
<i>(Recovery Clean Trigger) Design</i>	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0

<sup>1</sup> Permeate turbidity – indication of membrane integrity.

<sup>2</sup> 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.

<sup>3</sup> 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.

<sup>4</sup> “GFD” is shorthand for “GPD/Ft<sup>2</sup>”. 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.

<sup>5</sup> 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.

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

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

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