

MEMORANDUM

January 10, 2018

TO: Historical Memo

FM: Peter Carter / Steven Yee

RE: Carnation Wastewater Treatment Plant
December 2017 Process Summary

The Carnation Treatment Plant (CTP) performed well and met all its permit conditions in December. Class-A Reclaimed Water was applied to the wetland site the entire month. Effluent Biochemical Oxygen Demand (BOD₅) and Total Suspended Solids (TSS) averaged <1.0 mg/L and <2.0 mg/L, respectively. BOD₅ and TSS removals were both >99%. All permit-required samples were collected and analyzed in December.

Effluent flow averaged 0.097-MGD for the month. Influent flow to the CTP averaged slightly higher (0.103-MGD) due to internal recycle flows. The max-day effluent flow was 0.120-MGD on December 8. The permeate temperature decreased from about 65°F to about 59°F across the month.

The plant operated with one of two aeration basins in service (Basin 2). The MLSS averaged 9353-mg/L. An estimated 7500 dry lbs. of waste sludge and scum were hauled to the South Plant for further treatment.

Total-N removal averaged 84%. Effluent ammonia (NH₃) averaged <0.1-mg/L as N. Effluent nitrite plus nitrate (NO₂+NO₃) averaged 9.3-mg/L as N. Total phosphorus (P) removal averaged 65% and effluent P averaged 2.8-mg/L. N and P analyses were performed weekly.

Alkalinity (as 25% sodium hydroxide) was added continuously to Basin 2 to maintain the effluent pH above pH 6.7 at all times; the target pH was pH 7.0. 1036-gallons of 25% sodium hydroxide was added in December. Effluent alkalinity averaged 185-mg/L as CaCO₃; influent alkalinity was in the range of 209-265 mg/l as CaCO₃. (Alkalinity addition is required to replace the alkalinity lost during nitrification; the effluent pH would likely be below the permitted minimum pH 6.0 if alkalinity addition stopped.)

Flow was cycled through all five membrane trains and both UV trains in December. Tables 1 and 2 present membrane maintenance and recovery cleaning information and membrane performance data, respectively. An estimated 253-gallons of 12.5% sodium hypochlorite were used for maintenance and recovery cleans. Average TMPs were in the 1.7-2.7 psi range. The trans-membrane pressures (TMPs) were higher than usual in December. The higher TPMs were likely due to reduced wasting of the foam from the top of the aeration basin. We have returned to increased surface wasting and expect that the average TMPs will gradually decrease. The maximum TMPs were 8.0-psi in a few of the membrane trains during peak flow testing; the control system limits flow to keep the TMP <8.0-psi in order to protect the membranes' integrity.

Table 1: Membrane Maintenance Cleans Performed

Week Beginning:	Train 1	Train 2	Train 3	Train 4	Train 5
12/1					MC ¹
12/3	MC		RC _{hypo} ² MC	RC _{hypo} MC	MC
12/10	MC		MC	MC	RC _{hypo} MC
12/17	MC	MC	MC	MC	MC
12/24	MC	MC	MC	MC	MC

¹ MC refers to a Maintenance Clean

² RC_{hypo} refers to a Sodium Hypochlorite Recovery Clean

Table 2: Membrane Performance December 2017

MEMBRANE PARAMETERS	Train 1	Train 2	Train 3	Train 4	Train 5
Permeate Turbidity (NTU)¹					
Average for Month	0.06	0.06	0.05	0.07	0.07
<i>Design</i>	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Permeate Flow (GPD)²					
Average Daily for Month	21,063	25,302	22,814	20,778	19,168
<i>AADF (Annual Average Flow) Design</i>	97,500	97,500	97,500	97,500	97,500
Maximum Daily for Month	39,687	35,858	37,113	39,322	32,575
<i>PDF (Peak Day) Design</i>	165,000	165,000	165,000	165,000	165,000
Permeate Flow Rate (GPM)³					
Average for Month	15	21	17	17	14
Peak Hour for Month	95	104	155	107	98
<i>PHF (Peak Hour) Design</i>	180	180	180	180	180
Instantaneous Flux (GFD⁴)⁵					
Average for Month	7.2	7.2	7.0	7.1	7.4
Trans-Membrane Pressure (PSI)⁶					
Average for Month	2.7	2.0	1.9	1.7	1.9
Maximum for Month	8.0	6.4	8.0	8.0	5.7
<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	14.4	14.4	14.4	14.4	14.4
<i>Design</i>	> 12	> 12	> 12	> 12	> 12
Permeability at 20°C (GFD/PSI)⁸					
Average for Month	3.6.	4.1	4.2	4.9	4.6
<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.