Summerland Wastewater Treatment Facility


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Summerland is located in the beautiful Okanagan Valley centrally located to Kelowna and Penticton. It is home to the Kettle Valley steam Train, Ornamental Garden, Pacific Agri-Food Research Center, spectacular beaches, estate/cottage wineries and old English theme shops.

The Summerland WWTP was commissioned in 1998 by Reid and Crowther. The plant is based on a 5-stage bardenpho facility (Enhanced Biological Nutrient Control); it is used to remove both nitrogen and phosphorus as it primary objective. Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) are removed.


Bioreactor

The collection system currently has 2011 connections and is feed primarily by 5 lift stations located throughout the municipality. Summerland has approximately 55 kilometers of Sewer lines and over 700 manhole covers.


Blowers

Process

1. **Headworks**

- Removal of influent material by a mechanical screen (6mm), with a parallel manual screen.
- This material is forwarded to the compactor then removed offsite.
- Both screens are sized for a peak capacity of 18 ML/day.

2. **Primary Clarifier/Fermenter**

- Separation of settable solids and floating material, the sludge/scum is directed to the sludge vault.
- Sludge thickening/fermentation takes place; the volatile fatty acids, (VFA's), from the supernatant are added downstream.
- The design peak hourly is 10 ML/day.

3. **Bioreactor**

- Nitrogenous compounds such as ammonia must be removed to protect the receiving waters, these compounds provide a nutrient source for plants, algae and can be toxic to fish. This is done by a 2-step process nitrification/denitrification.
- Nitrification is the conversion of ammonia to nitrate; this is felicitated by microorganisms (Nitro somas and Nitrobactor) called autotrophs. The reaction occurs with the presence of free oxygen (Aerobic Cells)
- Reaction: NH3 (Ammonia) NO2- (Nitrite) NO3- (Nitrate)

- Denitrification is the process in which microorganisms reduce nitrate (NO_3^-) to nitrogen gas (N_2) this is done be heterotrophic organisms that metabolize complex organic compounds. This reaction is done primary is the absence of oxygen (Pre-Denite/Anoxic Zones).
- Reaction: NO_3^- (Nitrate) N_2 (Nitrogen gas)
- Phosphorus such as Ortho P also provides a food source to algae that can cause taste and odors in drinking waters.
- Phosphorus removal in SWWTP is done by a modified process of biological phosphorus removal and chemical addition. Biological P removal is done first in the anaerobic cell (VFA addition) where in the absence of dissolved oxygen and nitrite, microorganisms release the phosphorus from their cell membrane this release can now be captured and wasted. They are then introduced to the aerobic zone and placed with oxygen and food, since they are now lacking phosphorus from there cell structure the first thing the organisms need is to obtain phosphorus. Chemical addition is done by the use of Aluminum Sulfate which flocculates/coagulates the phosphorus and creates larger particles that settle in the waste sludge (Secondary clarifiers) or is captured in the filter.
- Carbonaceous biological oxygen demand and total suspended solids removal is not specifically targeted due to the longer retention times required in the *EBNR* process.

a) Pre- Denite cell

- Removal of nitrate and oxygen from the primary effluent and return activated sludge, (RAS). The combination of activated sludge and biodegradable carbon in the primary effluent depletes the free and nitrate bound oxygen.

b) Anaerobic cell

- VFA rich supernatant from the primary is added here to provide a soluble carbon source.
- The VFA addition triggers the release of phosphorus and this allows for removal beyond normal biological requirements.
- Cell Volume 173m3, Retention Time 0.9 hr.

c) Anoxic cell 1 & 2

- Cell 1 receives a convergent flow, (return), from the following three locations: the anaerobic cell, recycled aerobic mixed liquor, and primary effluent. The mixed liquor is pumped at a constant rate, (8 times the influent flow), so as to allow for the completion of the denitrification stage in the two stage nitrogen removal process.
- Cell Volume 185m3 each, Retention time 4.0 hr

d) Aerobic cell 1 & 2, (two trains)

- Continuous aeration provides the free residual dissolved oxygen required to complete the nitrification stage in the nitrogen removal process. In addition, the complete oxidation of the remaining soluble and colloidal carbon occurs.
- Sludge is wasted from a common channel, (located downstream from the aerobic cells), at the end of the bioreactor in order to maintain an accurate sludge age, adequate mixed liquor suspended solids, (MLSS), and to remove the phosphorus rich microorganisms.

- Supplementary alum is added to the bioreactor effluent to assist in flocculation and phosphorus removal.
- Cell Volume 322m3, Retention Time 7 hr.

4. Secondary Clarifier

- Separation of mixed liquor from the bioreactor into treated wastewater and flocculated/settled biological solids occurs in the secondary clarifier. The settled sludge is returned to the anaerobic zone and the clarified effluent overflows to the filter system.
- Peak flow 10 ML/day

5. Dual Media Filter

- Secondary clarified effluent flows to the dual media filter, (anthracite and sand); where additional suspended solids are removed. This subsequent removal of solids accounts for an additional removal of particulate phosphorus that typically ranges from 5 to 10 mg/l or another 5% that is not discharged. The backwash water is returned to headworks and it is treated again. The effluent from the filter is well below 5 NTU allowing for the use of Ultraviolet, (UV), for the purposes of disinfection.
- Peak Overflow 234 m3/m2/d

6. Ultra Violet (U.V)

- The disinfection/sterilization of the final effluent is done by means of UV radiation. The UV radiation penetrates the cell walls of microorganisms and damages the DNA causing microbial inactivation. A noted advantage of UV disinfection is the absence of chemical residual in the effluent. A disadvantage to the UV process is the UV radiation rays cannot penetrate with turbidity over 5 NTU.
- 192 lamps for a Peak flow of 10 ML/day.

7. Dissolved Air Floatation, (DAFT), Sludge Thickening

- The Biological Nutrient Removal process consumes suspended and dissolved solids including excess phosphorus that is removed.
- The WAS is mixed with pressurized air saturated recycled effluent. The fine bubbles carry the WAS to the surface thickening and allowing the water to drain from the floating sludge which in turn is then skimmed to the sludge vault. The clarified underflow is returned to the process for further removal of any re-released phosphorus.
- Peak loading rate 6 kg/m2/h

Plant Permit


Barscreen

The plant's permit are as follows:

- Biochemical Oxygen Demand (BOD5): Less than <10 mg/l
- Total Suspended Solids (TSS): Less than <10 mg/l
- Total Phosphorus: Annual Average <0.25 mg/l
- Total Nitrogen: Less than < 6.0 mg/l
- Feacal Coliforms: Annual Average 50 CFU/100 ml
- Flow: For 2003 flow not to exceed 3300 m3/day

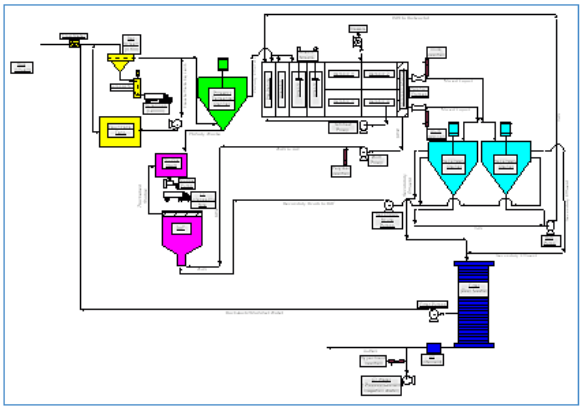
Plant Effluent Flow

2000		**2001**		**2002**	
EFFLUENT		**EFFLUENT**		**EFFLUENT**	
Month	**cu meters**	**Month**	**cu meters**	**Month**	**cu meters**
Jan	48413.9	Jan	48457.37	Jan	43231.36
Feb	44504.63	Feb	44391.47	Feb	39290.02
Mar	46911.98	Mar	50708.12	Mar	44191.54
Apr	46718.5	Apr	51637.15	Apr	43414.26
May	50537.56	May	53997.12	May	44099.79
Jun	50662.3	Jun	52017.47	Jun	43101.69
Jul	55259.02	Jul	55043.12	Jul	44477.66
Aug	55233.77	Aug	51733.95	Aug	40336.34
Sep	49573.17	Sep	44300.5	Sep	32428.57
Oct	48600.85	Oct	43099.2	Oct	26672.14
Nov	45612.79	Nov	40768.37	Nov	921.25
Dec	47667.78	Dec	42480.59	Dec	1079.95
Total:	**589696.25**	**Total:**	**578634.43**	**Total:**	**403244.57**

Plant Performance
External Lab results

		Influent					Effluent						
Year	Avg	BOD	ORG-N	TN	TP	pH	BOD	TSS	TP	TN	pH	Total Coliforms	Faecal Coliforms
2000	Avg/yr	126	1.61	42.60	6.95	7.44	< 10	4	0.33	3.66	6.95	1085	28
2001	Avg/yr	142	1.01	39.22	6.49	7.47	< 10	3	0.28	4.78	7.15	39	1
2002	Avg/yr	83	0.99	26.96	4.26	6.94	< 10	1	0.24	4.78	7.01	116	1

Process Flow Schematic



Points of Interest

- 2 full time staff (Tresa Daoust and Kevin McLuskey) with 3 additional operators for support staff.
- Entire process and lift station controlled by SCADA system
- Waste sludge is composted at local area landfill.
- C3 (effluent) water irrigates plant site, Hypochlorite disenfection.
- Generator at plant site can run all process needs.
- Generators at all lift stations.
- Lift stations all have lead/lag dry centrifical pumps.
- 1 mobile Gorman lift station.
- Aeration zone, air supplied with 3 Hoffman blowers with fine air diffusers
- Ferric chloride addition at lift stations to prevent odors.
- Foul air is removed from all buildings to the boifilter.

Written by Kevin McLuskey