Lulu Island Wastewater Treatment Plant


Lulu Island WWTP

The Greater Vancouver Regional District owns and operates 5 WWTP's in the lower mainland including Lulu Island, Annacis Island, Iona Island, Lions Gate and Northwest Langley plants. Two of the facilities are primary plants and 3 are secondary plants, the 5 plants combined treat on average 1230 ML per day.

The Lulu Island plant is now one of the leaders in British Columbia in the area of wastewater treatment. The plant has evolved from its primary beginnings in the early 70's through various upgrades to its present secondary configuration. Lulu's original primary treatment was upgraded in 1999 to a secondary system by the addition of a Trickling Filter/Solids Contact process.

Plant Profile:

- Flow capacity is 155 MLD
- Average flow for 2004 was 79 MLD
- Current population served is 170,000
- 2004 average influent and effluent values:

	Influent	Effluent	Permit
cBOD mg/l	218 mg/L	6 mg/L	45 mg/L
TSS mg/l	206 mg/L	7 mg/L	45 mg/L

Treatment Process:

Pre-treatment:


Clarifiers and Trickling Filters

Raw sewage entering the Lulu Island WWTP first gets screened by three vertical bar screens. The screens can handle 1000 L/s and remove material larger than 12.5 mm. The influent is then pumped up to the six pre-aeration tanks. Grit is removed here with the use of compressed air. The screened material goes to the Burnaby Incinerator and the grit goes to an approved landfill.

Primary Treatment:

70% of TSS and 33% of cBOD is removed in the Primary Sedimentation tanks. The three rectangular tanks have a capacity of 2.5 ML each and remove sludge and scum with a continuous chain and flight system. Scum is screened and sent to the Burnaby Incinerator along with the screened primary sludge

residuals. Primary Effluent, PE, leaves the tank through submerged launderers. The launderers help keep scum from entering the TF/SC process.

TF/SC Process:


Trickling Filter

The first step in the secondary process is the trickling filters. PE is pumped to the top of the trickling filter and is distributed over the plastic media. The process uses a single pass, no recirculation method. The filters are the work horse of this process, with 87% of the soluble carbonaceous Biochemical Oxygen Demand, scBOD, being removed.

The next step is the SC or solids contact. The SC process converts Trickling Filter Effluent, (TFE), carbonaceous Biochemical Oxygen Demand (cBOD) to Suspended Solids, (SS), oxidizes TFE cBOD and flocculates the finely divided TFE SS. Return Secondary Sludge (RSS) is mixed with the TFE to maintain a sufficient concentration of activated sludge in the solids contact tanks. The mixing of these two streams in the contact tanks improves the settling characteristics of the SS in the resulting mixed liquor.

The last step is secondary clarification. The three, 4.2 ML round clarifiers separate the solids in the MLSS. The effluent leaves the clarifiers and proceeds to disinfection. The solids are vacuumed off of the bottom of the tank to be returned to mix with the TFE. The return SS is ~ 5000 mg/L.

Sludge Thickening and Digestion:


Trickling Filter Pumps

The sludge collected from the bottom of the sedimentation tanks is fed to a gravity thickener where solids are increased from less than 1% to 5% solids. Waste secondary solids, WSS, is sent to 1 of 2 Diffused Air Flotation Tanks for thickening. The DAFT's increase the WSS from less than 0.20 % to 4.5 % solids. These two thickened sludge streams are mixed and then fed to the digesters.

Lulu Island utilizes a unique three dimple bottomed anaerobic digester design. This design, along with multiple feed and gas mixing points, assures a very well mixed digester with very little deposition on the digester floor. The methane gas produced from the mesophilic process (38°C) is compressed and used for mixing the digester. Excess gas is burned in two low pressure hot water boilers or flared if not needed. The hot water is used to heat the buildings, the digesters and other plant processes.

De-watering:


Solids Contact Tanks

After 32 days retention time in the digesters(present average), the digested sludge has been reduced from ~ 4.0 % solids to ~ 1.7 % solids. The digested sludge is then fed to centrifuges where the solids are further thickened to ~ 25 %. The de-watered solids are trucked to various sites around BC for land rehabilitation. During 2004, Lulu Island

WWTP produced 7407 metric tonnes of biosolids with most of this going to mine reclamation.

Odour Control Systems:

Odorous air is collected from several points around the plant and is sent to four mixed media biofilters. Areas of concern are solids handling facilities and TF air. In the recent up-grade, equipment hoods and tank covers were incorporated into the design to reduce odours. The Lulu Island WWTP received no odour complaints for the year of 2004.

Disinfection and De-chlorination:


Digester No. 1

Final effluent is disinfected using a 12% sodium hypochlorite solution and de-chlorinated using sulphur dioxide gas. In 2005, the SO2 gaseous system will be replaced by a new liquid sodium bisulphite system.

Plant Staffing:

At the present time the plant is operated using 3 administration personnel, 7 maintenance and 7 operations personnel, working an 8 hour shift each day. 6 operators work a split shift, Sunday to Thursday or Tuesday to Saturday, with all other staff working a regular Monday to Friday shift. The original secondary upgrade plan called for staffing on a 24/7 basis using four shifts. By undertaking an extensive plant review using program de-bugging and optimizing process automation has resulted in lowering staff needs to the present level.

Automation and Control:


Humbolt Centrifuges

The automation degree using a control system throughout the GVRD plants is extensive. Virtually all devices and machines are connected to, and controlled by this system. The entire electrical distribution system is monitored and controlled to such a high degree that the plants will automatically recover after a power failure. The system is comprised of 58 plant operator computers that act as an interface between the operator and the plant floor. More than 150 computer processors are distributed throughout the plants, which contain the logic that makes the plant run. Data acquisition is a key element of this control system. It is through the analysis of this data that plant operations and maintenance staff have applied automation to reduce annual costs by more than a million dollars each and every year.

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