



City of Enderby Water Treatment Plant

The City of Enderby is located in the beautiful North Okanagan with a population of 3200 residents. The central location between Vernon and Salmon Arm allows easy access to various leisure activities; that includes swimming, golfing and camping during the summer months and in winter skiing, ice fishing and snowmobiling.



Enderby Water Treatment Plant

The city provides services for 3200+ residents with 1300+ water and sewer connections. The primary drinking water supply is provided by the Shuswap River with secondary sources coming from Shuswap Well located near the river and Brash Creek.

Enderby Water System Overview

- Treatment plant online 1997
- Class II Water treatment facility/Class III Water Distribution System
- 1300+ services
- Fresh water sources Brash Creek, Shuswap Well and Shuswap River
- Brash Creek and Shuswap Well supply capacity 3820 m³/day (Approx 1 M gal/day)
- Peak flows of 3500 m³/day (0.92 M gallon/day)
- Typical Summer Avg. 110m³/hr (29062 gal/hr), Typical Winter 70m³/hr (18494 gal/hr).
- 2 Reservoirs total capacity of 2400 m³ (634,000 gallons)
- Yearly Avg. Consumption 728643 m³/yr (192 M gal/yr)
- 3 booster stations
- 4 pressure zones

Brash Creek and Shuswap Well water, receive treatment by gas chlorine disinfection, however the piping is in place to feed this water in the future to the W.T.P for U.V treatment.



Shuswap River Intake

Water Treatment Plant Overview

- High rate filtration (total detention time 20.3 minutes)
- Intake, transfer pumps and well located at Shuswap River provide primary settling for W.T.P.
- Inline Static mixer: where PAC, pre-chlorination, soda ash and alum can be applied.
- Influent Mixing Chamber: coagulation and flocculation takes place.
- Up Flow Clarifier (based on principle of contact flocculation) where the floc is captured in the media.
- Polishing Filter (2 parallel): dual media filter (sand and anthracite).
- Hydraulic loading Roughing filter 9.92 USGPM/ft² and Polishing filter 3.6 USGPM/ft² per side

- Contact Chamber: post-chlorination is applied
- Wet Well: where two 60 HP pumps move the water to reservoirs.
- Total Plant Supply Capacity 3850 m³/day
- Total Hydraulic Capacity 12000 m³/day
- Filter Backwash cycle uses 72 m³ (1,538 USGPM @ 15-22 psi)
- Rinse to Waste 13.2 m³

W.T.P. Process Description

Facility consists of three major sections

Plant is fully automatic

1. Raw Water Feed (Shuswap River)
 - Raw water intake chamber and screens
 - Raw water pumps
 - Static Mixer
 - Chemical Feed Units (PAC, Soda Ash, Pre-Chlorine & Alum)
 - Inlet Valve
 - Flocculation chamber
2. Adsorption Clarifier
 - Clarifier (upflow roughing filter) non-buoyant media.
 - Air Scour system
 - Flush System
3. Filter Operation including Water Effluent
 - Filter: dual-media (inverted sand/anthracite bed)
 - Air Scour system
 - Backwash system
 - Rinse to Waste system (de-chlorination using SO₂)

Clarifier (Upflow Roughing Filter)

Clarifier is an upflow, solids contact, roughing filter that operates on the principle of absorption. The primary function of the clarifier is to reduce the solids loading applied to the filter and extent filter runs.



Backwash Control Valves

- Water enters the plant through a flow meter, rate of flow valve, static mixer then isolating valve.
- Water and chemicals are mixed in the static mixer when it then enters the flocculation chamber.
- Water is forced/displaced by raw water; up the media bed from the flocculation chamber into the media where contact flocculation occurs, the granular media retains the floc.

- When the media becomes saturated with flocculated particles, the pressure differential loss of head switch closes the butterfly transfer valves and starts a backwash and air scour (12" of head loss).

Operation

Media Saturation

- Measured by pressure differential loss of head switch 12" of water column, enters backwash cycle
1. Transfer valves close and blowers turn on assisted by an air scour. Fluidizes the bed until air and water reach the flood probes.
 2. Blower off and media settles
 3. Blower on
 4. Rinsed with raw water
 5. Transfer valves open

The air scour use 21.2 m³ (5601 gal) to clean the clarifier and under normal condition runs 1/day.

Polishing Filter (dual-media)

Polishing filters are a dual-media filter (silica sand and anthracite) and operates on gravity. Water is gravity feed through the media into an underdrain (slotted laterals) system surrounded by gravel then continues to an external manifold where it enters the contact chamber.



Filtered Water Pumps

Operation

Effluent filter water is controlled by a level control valve, which maintains filter level at a set point above the filter bed. After a period dependent on incoming water quality (turbidity). The filter becomes saturated (removed solids) and a backwash is needed.

1. Backwash is initiated by the loss of head switch (automatic)

600 mm (0.9 psi) water column

2. During backwash cycle, raw water is throttled by ½ normal plant flow.

Controlled by low flow pilot and solenoid control valve. At this time transfer valve (1 or 2) being backwashed is closed

3. Filter air scour (automatic position)

Filter is lowered through waste valve until low-level probe is out of the water.

4. Air Scour

Prior to finishing air scour blower turns off and backwash is started

5. During backwash: water from distribution system is routed back up the underdrain system and fluidizes the media

Controlled by backwash rate of flow and solenoid valves (1266 GPM)

6. Backwash water is carried over wastewater trough and de-chlorinated.

Controlled by panel mounted backwash timer

7. Before filter is in service, Rinse to waste effluent is directed to waste. The purpose of the rinse to waste is to flush the media before going back online.

Controlled by rinse to waste timer

The backwash cycle use 72 m3 and the Rinse to waste 13.2 m3 for a total 85.2m3 (22509 gal). Under normal condition will backwash 1 filter/day.

Alarms

Main alarm conditions will shut down affected components in the plant until reset.

High Turbidity Alarm

- Plant stop

Clarifier Flood

- Raw water off
- Treated water on

Low Filter

- Treated water off
- Raw water on

W.T.P System Performance

Raw Water			Filtered Water				Waste Water					
pH	Temp	Turbidity	pH	Temp	Turbidity	Cl2 Total	Cl2 Free	pH	Temp	D.O.	Cl2 Total	Cl2 Free
-log H+	Celsius	NTU	-log H+	Celsius	NTU	mg/l	mg/l	-log H+	Celsius	NTU	mg/l	mg/l
8.33	12.4	2.53	8.23	12.7	0.39	.930	0.78	7.4	11.9	7.8	0.01	0.00

**All numbers based on yearly average.*

Future Upgrades

We are currently at stage one of four system upgrades, the overall process of providing a multi-barrier protection of the potable water systems and protect the public health for the next twenty years. Stage 2 of the upgrade process is slated to start 2002 includes:

Stage 2

- Improve Shuswap intake to reduce sand.
- Upgrade backwash piping to use clearwell water instead of high-pressurized distribution water (this will eliminate using reservoir water during high demands and provide energy savings to the city).
- Change primary disinfection to Ultra Violet light while using chlorine as a secondary disinfection barrier against possible regrowth. The other two water sources Brash Creek and Shuswap Well will be rerouted to the W.T.P to use U.V. This will give a four-log reduction in giardia and cryptosporidium.
- Additional 60 Hp distribution pump (pumping from clearwell to distribution system and reservoirs).

Stage 3

- 2nd Water treatment plant, additional production capacity 4300 m³/day (8000 m³/day total).
- Additional U.V systems.
- Expansion of the clearwell by 206 m³ .

Stage 4

- 3rd Water treatment plant.
- Building expansion (already constructed with tear away walls).
- 4th distribution pump.
- Additional backwash/wastewater settling tank.

Thanks to Kevin McLuskey, Water Quality Technician