

Wastewater Process Information

CSO (Combined Sewer Overflow) Reduction

Prior to the construction of the first wastewater treatment plant in 1948, storm water and sanitary sewage were conveyed from Mount Vernon to the Skagit River in the same pipes. The legacy of this old sewer system was the occasional overflow of untreated combined, sewage to the river during certain storm events, when the treatment plant capacity was exceeded.

In 1996, the City of Mount Vernon signed an Order on Consent with the Washington State Department of Ecology mandating the reduction of untreated CSO overflows to not more than one per year by 2015. In 1995 an engineering study revealed that an average annual CSO, or baseline before construction of control devices, would be 116.5 Million Gallons, for an average annual rainfall of 31.95 inches. In 1997, Mount Vernon completed construction of a CSO interceptor, similar to a 1.1 Million Gallon underground storage tank, which reduced the average annual CSO flow to approximately 11 Million Gallons and from more than 100 events per year to 8. The interceptor, a 60" diameter pipe, which includes a system of baffles, valves and weirs for control, allows the storage of storm flows until they can be treated by the wastewater treatment plant. In 2003, the City of Mount Vernon adopted a Comprehensive Sewer Plan and began pre-design work which outlines solutions for achieving the 2015 goal.

In October 2009, the City of Mount Vernon completed the Phase 1 Wastewater Treatment Plant Upgrade; designed by HDR Engineering Inc. and constructed by McClure and Sons Inc. This first phase, of potential multiple phases, included: Influent Pump Station Improvements, a Pre-treatment Building, two Primary Clarifiers, Aeration Basin Modifications, two Secondary Clarifiers, UV (Ultraviolet Violet) Disinfection and a Biofilter Odor Control system. The project cost \$38.5 Million and took 2 ½ years to complete.

The Peak Flow Capacity was increased from 12 MGD to 16.5 MGD. The additional hydraulic capacity, as well as provisions for CSO storage, should enable Mount Vernon to meet the (DOE) Order on Consent by 2010. If additional flow capacity becomes necessary to reach this goal, WWTP Phase 2 Upgrade Plans call for the construction of two High Rate Clarification Units (HRC's) by 2014.

Treatment Plant Process

1. To begin the process, coarse debris is removed by a mechanical bar screen and deposited into a washer-compactor where organic materials are removed. Then, wastewater is pumped up from an influent sewer located 25 feet below the ground.
2. The next treatment step is accomplished in the Pretreatment Building where fine debris is removed by perforated plate screens then washed and dewatered in washer-compactors. Inorganic material (sand, silt, etc.) is removed in circular grit basins which utilize a vortex action to keep organic material suspended while allowing inorganic material to sink. A constant flow of grit slurry is pumped to cyclone grit classifiers where the grit is dewatered. The grit and screenings are deposited into bags which are disposed of by the Mount Vernon Solid Waste Utility.
3. Two Primary Clarifiers provide the next step in treatment by allowing solids to settle out of the wastewater and the floatable material to rise to the top. The solids material (primary sludged), which is collected at the bottom of the tank, and the scum which is skimmed off of the top are pumped to facility's Anaerobic Digester.
4. Wastewater then flows to the Aeration Basins. During this part of the treatment process, air is blown into the aeration basins from large multi-stage, centrifugal blowers. Oxygen from the air is required for microorganisms to grow and consume waste matter that wasn't removed by the primary clarifiers. This mass of microorganisms is known as activated sludge.

Ammonia, a byproduct of aerobic metabolism, is also a pollutant which can be toxic to fish and cause oxygen depletion in the receiving stream. The 2009, Phase 1 WWTP Upgrade included modifications to the activated sludge process to convert ammonia to nitrate and then to remove most of the nitrate

utilizing a mechanically mixed cell in the absence of dissolved oxygen. In this cell, called an anoxic cell, a type of bacteria called facultative use the oxygen from the nitrate molecule and release nitrogen as a gas. An additional benefit is the reduction of nutrients that enter the receiving stream.

The conversion of ammonia nitrogen to nitrate nitrogen results in an acidic condition which lowers pH. Because of Mount Vernon's Discharge Permit pH limits and the activated sludge organisms' preference for a neutral pH, 25% caustic soda or sodium hydroxide is fed to the aeration basins.

5. Treated wastewater and activated sludge are separated in the facility's three secondary clarifiers. Some of the sludge, known as return activated sludge, is mixed with flow entering the aeration basins. Since the microorganisms are continually growing and multiplying, excess activated sludge is removed and pumped to a dissolved air flotation thickener (DAFT).
6. The flow leaving the secondary clarifiers, referred to as secondary effluent, then enters the UV disinfection facility. The flow is disinfected in the few seconds it takes to flow through one or two channels containing 88 horizontal, high pressure, low intensity UV lamps each. UV works by destroying the DNA of disease causing organisms.
7. Treatment plant effluent flows through an outfall pipeline to the Skagit River. Under normal conditions, this highly treated wastewater can use the force of gravity to reach its destination. During periods of high river levels, however, the effluent is pumped to the river.

Solids Handling

1. De-gritted primary sludge is concentrated in the bottom of the plant's Primary Clarifiers. The thickened sludge is removed from the bottom of the tanks and pumped to an anaerobic digester. Overflow from this process returns to the facility's influent pump station or another tank known as a Supernatant Tank for further thickening.
2. Waste organisms from the Activated Sludge Process are pumped to the dissolved air flotation thickener (DAFT) on a daily basis. The waste activated sludge flow is injected with tiny bubbles which lift and thicken the sludge, causing a "sludge blanket" to form on top of the DAFT. After the blanket is skimmed off, this sludge is also pumped into the anaerobic digester.
3. Under controlled conditions, the solids are allowed to decompose in the anaerobic digester. Methane gas, a by-product, is collected and burned in a boiler to provide hot water for heating the plant buildings. This hot water is also used to maintain the temperature of the anaerobic digester at 98 degrees Fahrenheit. Excess gas, less than 50%, is diverted to a gas flare, where it is burned.
4. The anaerobically digested sludge is thickened to 14 -16% solids using two Belt Filter Presses. The Biosolids produced by Mount Vernon are below regulatory limits for metals and toxins and certified as (Class B). They are transported to Eastern Washington and recycled as a soil amendment to grow dry land grain crops.