CONSTRUCTED WETLANDS

Wetland Biofilter System provides year-round, cost effective treatment to over 1.5 million litres of wastewater

Newly completed Wetland Biofilter System.

By Lloyd Rozema, M.Sc., and Andrew Hellebust, P. Eng.

The success of early surface flow treatment wetlands in Canada was limited by hydraulic blockages and oxygen limitation due to freezing. From 1991 to 1996, Dr. Edgar Lemon, with the Friends of Fort George, researched a sub-surface vertical flow constructed wetland treating lagoon effluent at Niagara-on-the-Lake, funded by the Ontario Ministry of Environment (MOE) and the United States Environmental Protection Agency (EPA). This new approach resulted in effective winter treatment due to the fact that water was dosed intermittently just below the surface of the cattails and insulating leaf litter, leaving unsaturated conditions in the root zone between doses and no standing water vulnerable to freezing. Research and development of this technology has continued by Aqua Treatment Technologies Inc., leading to the commercialization of the Wetland Biofilter System (WBS).

The Wetland Biofilter System is providing tertiary treatment for a wide variety of wastewater types, including septic tank effluent, landfill leachate, high strength winery process water, bakery process water, abattoir wastewater, compost leachate from mushroom farms, and recirculated greenhouse irrigation leachate.

Aqua Treatment Technologies Inc. and EcoWerks Technologies Corporation have designed and installed over forty Wetland Biofilter Systems since 1998, 29 of which are operating under MOE Certificates of Approval. In addition, two have been approved by Health Canada for treatment of sanitary sewage on First Nations Reserves, three are operating in pilot stage for treatment of landfill leachate in the United States and four systems do not require Certificates of Approval because they have been designed as closed loop wastewater treatment systems with no discharge to the environment.

The smallest WBS is designed to treat 1,850 L/day of sanitary sewage at a cottage in northern Ontario and the largest is treating 400,000 L/day of greenhouse irrigation leachate at a greenhouse in southern Ontario. In total the WBS has been approved for treatment of over 1.5 million litres of wastewater per day.

The WBS usually consists of three or four cells that operate in series. Each cell is four feet (1.2 m) in depth and filled with layers of gravel, sand and organic media such as wood shavings and planted with nursery grown cattails (Typha sp.). The composition and size of each cell is dependant on treatment goals and wastewater volume. For typical sanitary sewage, a design hydraulic loading rate of 90 L/m^2/day results in tertiary effluent quality.

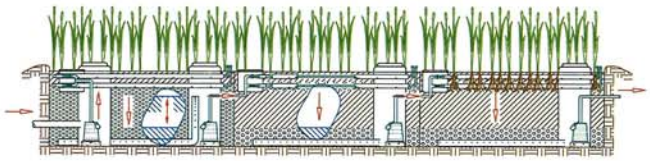
Intermittent (pulse) doses of wastewater slowly percolate down through the cell medium, allowing the system to operate aerobically 12 months of the year as air is drawn down behind the wastewater dose, re-oxygenating the media prior to the next pulse.

Maintenance includes weekly checks of pumps, seasonal switchover between winter (deeper) and summer (shallower) dosing manifolds, and keeping the beds weed free over the first year, totalling approximately one hour per week.

Operational costs are 52 hours/year labour plus electrical costs to power three ½ hp submersible sump pumps. For example, if each pump ran eight hours per day, total electricity cost is approximately: 3 pumps x 12 kWh/d x $0.12/kWh = $4.30/day.

The Wetland Biofilter System has been proven to provide reliable on-site treatment of wastewater year-round. We are currently working on obtaining Certificates of Approvals on four installations for treatment of sanitary sewage, abattoir wastewater and landfill leachate in Ontario. In addition, several installations are in pilot phase for treatment of landfill leachate in the U.S.

Mature Wetland Biofilter System.



Cross section view of typical three cell Wetland

Aqua Treatment Technologies Inc.

MORE INFO? Enter #2032 on Reader Reply Card

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Treatment of abattoir wastewater

CRO Quail Farms, St. Ann's, Ontario

Aqua Treatment Technologies Inc. and EcoWerks Technologies Corporation were retained by CRO Quail Farms Inc. in 2003 to design, permit and install a WBS to treat abattoir wastewater and sanitary sewage from the farm house and employee restrooms. CRO Quail Farms Inc. is a family owned business that breeds, hatches, raises and processes quail. The WBS resulted in considerable cost savings and easier operation by eliminating the need and great expense of trucking wastewater to a privately operated treatment lagoon.

The WBS is designed to treat 18,000 L/day of abattoir wastewater and 2,000 L/day of sanitary sewage. Three cells operate in series, with each cell 10.67 m x 10.67 m in area and 1.2 m in depth. Abattoir wastewater receives primary treatment in a single compartment 391,000 litre storage and flow balancing tank. Sanitary sewage receives primary treatment within a 4,500 L septic tank. Treated water is discharged into 600 metres of shallow buried trench.

Treatment of sanitary sewage at Vineland Estates Winery

Vineland, Ontario

In 2002, AQUA Treatment Technologies Inc. and EcoWerks Technologies Corp. designed, permitted and installed a WBS to treat 13,000 L/day of sanitary sewage from the restaurant and restrooms at Vineland Estates Winery. Tight clays discouraged the use of trenches for disposal, so effluent was treated with ultraviolet light, held in a pond and then used to irrigate lawns, gardens and vineyards. The pond level is managed to ensure adequate winter-time storage capacity. Septic tank effluent is dosed to a three cell WBS, planted with cattails, with a total area of 144 m^2.

After 18 months of monitoring it was found that removal of nitrogen was erratic. Initial high levels of organic matter were likely suppressing nitrification, whereas low levels of carbon at the end of the WBS were limiting denitrification. In an effort to correct this, cell 1 was doubled in size and cell 1 effluent was re-circulated to the flow balancing pump tank. A drastic improvement in nitrification and denitrification was observed within a month, resulting in an average winter-time effluent ammonia concentration of 0.2 mg/L and nitrate levels below 10 mg/L.