

About CH2M HILL

As a global leader in full-service engineering, procurement, construction, and operations for government, civil, industrial, and energy clients, CH2M HILL seeks to be the industry leader by successfully delivering challenging projects, enabling our clients to build a better world. With over 25,000 employees worldwide, we provide innovative, practical, sustainable solutions—helping clients develop and manage infrastructure and facilities that improve efficiency, safety, and quality of life. CH2M HILL is an industry-leading program management, construction management, and design firm as ranked by *Engineering News-Record* (2008). The firm was selected as one of *Canada's Top 100 Employers* (2009 and 2010) and *Financial Post's Ten Best Companies to Work For* (2009)



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Natural Treatment Systems for
Wastewater and Stormwater Polishing



Brighton's 6-hectare Municipal Wastewater Treatment Wetland



Viewing Platform at the Brighton Wetland

Natural Treatment Systems Augment Existing Wastewater Treatment Plants

There is a growing need to provide cost effective methods for upgrading existing wastewater treatment plants (WWTP). In our current economic climate wholesale replacement of facilities can be financially onerous, even with infrastructure grants that become available from time to time. Communities will continue to expand with resulting need for increased wastewater treatment that could trigger changes to the discharge criteria. This could include a reduction in discharge permit limits requiring a higher level of treatment or an increase in the range of parameters that may not have been a part of the original permit when the existing system was commissioned. Adding capacity to an existing system can be cost effective and provide the needed short or long-term upgrades required to bring a system back into compliance or to ensure that the system that is nearing its capacity does not go out of compliance.

Short or Long-Term Solutions

What do you do with a lagoon or package WWTP system that is still functional but is not performing well (occasionally or regularly exceeds parameters) or is nearing its design capacity? There are several options that can be considered.

- Decommission the existing system and build a new WWTP utilizing some of the existing lagoon or WWTP for biosolids management. This will be the long-term solution presented to towns and municipalities in many cases and is a valid approach assuming funding can be made available.
- Maintain the existing capacity of the existing WWTP by adding a side-stream treatment system such as a membrane bio-reactor (MBR) to treat a portion of the flow to blend with the WWTP effluent to allow it to remain in compliance. This is a good short-term solution for space restrained sites and can be a good long-term solution since they are often modular and treatment capacity can be increased by adding additional units.
- Add a natural treatment system like a constructed wetland to increase the design capacity as a short term solution. This allows a municipality time to set aside tax dollars for a conventional WWTP to be constructed in the future. The capacity afforded by the wetland also provides a long-term solution with additional capacity integrated into the capacity of the new WWTP once constructed. In some cases, the wetland becomes a complete long-term solution and no additional capacity may be required. The treatment wetland will require availability of sufficient land.

Wetlands Are Low Cost and Sustainable

Natural treatment systems require fewer operational personnel, consume less energy, have lower operating and capital costs and produce fewer residuals than most conventional "concrete and steel" approaches. While natural systems require more land than conventional approaches, they create valuable wildlife habitat and opportunities for passive public recreation. A more sustainable approach, natural systems are distinguished by their reliance on renewable sources of energy – solar radiation, wind, gravity, and storage of energy in biological and chemical forms.

A Case History - Brighton, ON

The Municipality of Brighton is located along the north shore of Lake Ontario and has a lagoon system that was approaching its rated capacity. In 1998, CH2M HILL began discussions with the Municipality while they were already in the process of considering a proposed upgrade of their 2-cell lagoon to a conventional activated sludge wastewater treatment plant (WWTP) system. The cost for the facility was in the \$10M to \$15M range (1998 dollars). There were concerns about the proposed approach (that included funding this large cost by a relatively small community), the impacts of a new outfall pipe and diffuser on an adjacent Class 1 wetland, and the potential negative impact of untreated contaminants on the local fishing industry.

During a presentation to the Municipal council, CH2M HILL provided background information and our history of designing natural treatment systems to demonstrate that constructing a wetland was a viable solution. The wetland was to provide a short-term (3 to 5 year) remedy for a rapid population increase based on 25 year planning predictions by the Municipality. It would also provide long-term capacity that could be added to any WWTP upgrades using conventional technology. Even without providing treatment capacity, substituting the wetland for a required \$1-2M outfall pipe provided an immediate cost benefit.

In 1999, the Municipality opted to construct a 6 hectare treatment wetland on land that they already owned, at a cost of about \$0.5M (considerably less than the cost of a conventional treatment system and about 1/3 the cost of the outfall pipe alone). The wetland increased the rated capacity of the existing lagoon system from 3,864 m³/d to 4,600 m³/d.

Since the construction of the wetland, the Municipality has experienced lower than anticipated growth rate and a much lower than anticipated increase in hydraulic and contaminant loading. Installing water meters in all homes helped to reduce the water consumption and subsequent discharge to the WWTP. The wetland system has kept the Town in compliance with their Certificate of Approval (C of A) permit limits.



ICI Canada Inc. Pond and Treatment Wetland System for Gypsum Stack Seepage and Site Stormwater Polishing

In addition, the wetland has further reduced the loading to Presqu'île Bay over the past 10 years (5-7 years longer life than originally anticipated and still going strong) by up to about 20 T/year of combined 5-day biochemical oxygen demand (BOD⁵), total suspended solids, total phosphorus, and nitrogen.

Review of the monitoring data shows trends in the concentrations of the contaminants of concern that appear to be seasonal/wildlife-related and operational changes that can impact a wetland system. These include reduced nitrogen removal efficiency during the winter months, little change in treatment efficiency of the wetland even after almost total removal of standing wetland vegetation by muskrats for hut and feeding mound construction, and no reduced efficiency at low wetland water levels during re-vegetation periods. All these components and more are taken into consideration when designing a wetland system.

The wetland has proven itself to be a reliable and cost-effective component of the Brighton wastewater treatment system that will continue to serve this community for many years to come.



Least Bittern