



FCM Sustainability Community Awards 2010 Winner — Water City of Edmonton, Alberta Population: 782,439



Kennedale End-of-Pipe Constructed Wetland



The wetland also provides walking trails and restored wildlife habitat.
Photo credit: City of Edmonton

Summary

The City of Edmonton built its first end-of-pipe treatment wetland as a flagship project of the city's Stormwater Quality Strategy (SWQS), taking advantage of available city-owned land and of green infrastructure funding that saw the federal and provincial orders of government both match the municipal contribution to project costs. In consultation with numerous stakeholders, the city managed the project, contracting external expertise for the construction. The engineered wetland is located at Edmonton's largest stormwater outflow and uses natural ecological processes to reduce contaminants entering the North Saskatchewan River, thereby improving watershed health. The Kennedale wetland will treat about 70 per cent of the city's annual stormwater volume, removing about 1,100 kilograms (44 per cent) of total suspended solids daily. The project also improves the biodiversity and aesthetics of a former gravel pit, and demonstrates to the public the importance of natural wetlands.

Background

Situated along the banks of the North Saskatchewan River, Edmonton is home to nearly 800,000 people. The city's wastewater and storm drainage system operates under the provisions of the Alberta Environmental Protection and Enhancement Act, including a stipulation requiring a comprehensive SWQS and a plan for implementing the strategy. By June 2008 the SWQS and implementation plan were in place, and a key action item was to build wetlands to treat the flow from major storm outfalls, thereby reducing stormwater pollutant loadings to the North Saskatchewan River.

The Kennedale trunk sewer is the largest of Edmonton's four main storm outfalls. The city's motives for undertaking this particular project included the availability of land on a former gravel pit in Hermitage Park for situating the constructed wetland, and an opportunity to improve aesthetics and user amenities in that park through the expansion of natural habitat. A CAMRIF (Canada Alberta Municipal Rural Infrastructure Funding) grant provided additional incentive for early design and construction of the facility.

The city has monitored watershed health for more than 10 years through its annual Environmental Monitoring Program, which has demonstrated that the storm sewer system contributes more than 80 per cent of the suspended solids discharged into the river. Edmonton's existing stormwater management system includes dry ponds, wet ponds, and constructed wetlands built primarily for flood prevention, but also providing partial treatment as a secondary benefit. The Kennedale facility is Edmonton's first constructed wetland built exclusively to protect the river by treating stormwater.

Project Development

A series of consultant investigations and design studies demonstrated that an end-of-pipe treatment wetland for the Kennedale basin would be the most cost-effective and beneficial means of reducing annual sediment loadings into the river. In March 2007, the Kennedale project was given conditional approval to receive CAMRIF funding; a step that coincided with the start of detailed site planning and design.

Staff from many civic departments — including Parks, Community Services, Corporate Properties, Office of Natural Areas, Planning and Development, Drainage Services, Transportation, and the Edmonton Waste Management Centre — collaborated on the planning and design process. This internal collaboration was needed to optimize the design from the viewpoint of land-use zoning, treatment and operational efficiencies, constructability of the facility, and needs of park users.

Externally, numerous consulting firms were retained to provide engineering and landscape architecture design services. Membership in the Alberta Low-Impact Development Partnership allowed the city to learn from the experiences of other municipalities. Value engineering sessions were held to share ideas and preliminary design concepts. Alberta Environment, as the provincial regulator, was an active stakeholder and participant in a series of project meetings and in the value engineering sessions. Two open houses informed the public of the design and provided citizens with a forum for discussion. Federal government scientists conducted a full environmental assessment, reviewing and approving the project and recommending many environmental mitigation measures.

Project Implementation

Development of both the SWQS and a total loading plan for the city set the stage for the Kennedale project, providing a new framework for managing cumulative impacts on the watershed. In the context of the Province of Alberta's Water for Life Strategy, annual pollutant load management was introduced into Edmonton's Approval to Operate starting in 2005. This stipulation means that any additional pollutant loading from new development must be offset with net reductions in annual loading through measures such as stormwater treatment.

Edmonton has already had 13 other constructed wetlands, typically about one to two hectares in size, located at the upstream reaches of urban storm basins and serving individual developments. The Kennedale project was Edmonton's first end-of-pipe treatment wetland and, in comparison, was planned to occupy five hectares and to receive continuous low flows from the 7,250-hectare Kennedale storm basin. Although few other North American municipalities have attempted them, end-of-pipe treatment wetlands are an innovative and cost-effective way to treat stormwater runoff from older, built-out communities. They provide a better system, in terms of both pollutant removal and cost, than the alternative: a network of oil and grit separators. Constructed wetlands do not require chemicals for treatment; rather, they rely on natural ecological processes to remove suspended solids, bacteria, and nutrients. As natural infrastructure, the wetland is expected to operate indefinitely.

The city hired a private contractor to construct the wetland, and an independent environmental engineering firm to conduct regular environmental audits of the site during construction. Implementation of the \$7.5 million project began with dewatering an existing five-metre-deep pond on the site of the former gravel pit and refilling it with clay to support wetland vegetation. The contractor installed a clay and bentonite liner to separate the wetland from the water table. Two stormwater treatment units were installed to provide treatment for flows beyond the capacity of the wetland. Storm lines, service manholes, inlet and outlet structures, a diversion chamber, and a concrete weir inside the existing storm tunnel were also constructed. A flow control chamber regulates flows into the wetland and into the two stormwater treatment units. A discharge control chamber regulates the depth of the wetland, which is connected into the existing trunk that discharges into the river. Electrical controls automate the operation of the sluice gates.

To restore the 10-hectare disturbed area, the construction team reused excavated slurry material from the pit, mixing it with stripped topsoil and imported compost from the Edmonton Waste Management Centre. Landscaping of the wetland and upland areas used topsoil, seed, and vegetation from an existing natural wetland. Finally, in September 2009, gravel trails, viewing decks, a paved access road, and interpretive educational signs were installed on the site, completing the construction and landscaping phase.

Throughout the construction phase, monthly meetings were held to review progress, to conduct environmental audits meant to limit erosion and sediment transport, and to develop a long-term monitoring program to assess the treatment efficiency of the wetland. As of spring 2010, the monitoring system was tracking levels of suspended solids and other water quality parameters such as total phosphorous, ammonia, *E. coli*, and various metals.

Edmonton has shared its knowledge and experience with other municipalities through participation at several stormwater-related seminars and through involvement in numerous FCM programs, including the Sustainable Communities Conference, the Sustainable Communities Mission, and a Capacity Building Program Consultation Workshop in March 2007.

Results

- The Kennedale wetland treats about 70 per cent of the annual volume of stormwater running through Edmonton's largest sewer trunk before discharge into the river. The wetland is expected to remove about 1,100 kilograms daily (roughly 44 per cent) of suspended solids.
- The daily rate of sediment removal offsets the equivalent of about 1,700 hectares of new land development (about four to five years of future urban growth). The wetland will allow the city to grow and develop without compromising local watershed health or violating the city's Total Loading Plan.
- The wetland improves local air quality by sequestering carbon dioxide in its vegetation. It also contributes to reducing the urban "heat island" effect.
- The site provides additional habitat for bird, amphibian, and aquatic species in the city. Bird-watching opportunities have been enhanced in the nearby stretch of the North Saskatchewan River Valley.
- Citizens have benefited from more attractive green space in Hermitage Park, including gravel walking trails around the outer perimeter of the riverbank and two timber river overlooks.

Lessons Learned

- INVOLVE STAKEHOLDERS AS EARLY AS POSSIBLE. Communication with internal staff in other civic departments is just as essential as the development of close working relationships with provincial regulatory officials. In the Kennedale wetland project, the value engineering sessions (discussing risk, constructability, and operability) were crucial in gathering input and support from all stakeholders during the design phase.
- BUILDING PUBLIC SUPPORT THROUGH ENGAGEMENT IS CRITICAL. End-of-pipe wetland facilities are usually sited on or near park space visited by many citizens. Leonora Lumabi, project manager for the Kennedale wetland, notes that "with the threat of global warming in the public consciousness, highlighting the environmental benefits of the project is an effective way to garner support."
- CONVERTING A LARGE EXISTING WATER BODY INTO A SHALLOW CONSTRUCTED WETLAND IS COSTLY. High cost is especially true for a facility located in the lowest reaches of a basin (as end-of-pipe systems normally are) because of the large quantity of groundwater that seeps in during construction. This course of action is likely not one that Edmonton would take in attempting future projects.
- ALLOW SUFFICIENT TIME. "Allowing at least two years for gathering necessary environmental

permits and approvals before construction,” Ms. Lumabi says, “would allow more time for ... assessing all possible risks. Costs can be controlled in the planning stage more effectively than during the construction stage.”

- **INSTALL REAL-TIME, AUTOMATED CONTROLS.** Small rainfall events can deliver high storm flows into the treatment facility in a matter of minutes. Regulated flows can maintain the treatment efficiency of the facility.

Related and Future Initiatives

The Kennedale wetland is a cornerstone project of Edmonton’s SWQS. Other components of the strategy include construction of a low-flow diversion structure to move additional stormwater to the local wastewater treatment plant during dry weather, and a program to encourage low-impact development (LID) practices, such as rain gardens and bioswales, which can reduce impacts on the watershed. In 2010, the city will be undertaking a study to develop LID design criteria and manuals related to infill and new urban land development.

As part of the SWQS, planning and preliminary design are also underway for a second end-of-pipe constructed wetland in Government House Park. This new facility will treat diverted storm flows from the Groat Road storm trunk sewer. Several civic departments are collaborating on possible stormwater reuse opportunities at a golf course located near the planned treatment site.

Partners and Collaboration

Alberta Environment
EPCOR Water
North Saskatchewan Watershed Alliance
Alberta Low Impact Development Partnership
Western Canada Water
Alberta Capital Region Wastewater Commission
Federation of Canadian Municipalities
Norellco Contractors Ltd. (construction contractor)
Golder Associates (environmental engineering consultant)

Contact Information

John Hodgson, Manager, Drainage Services
City of Edmonton, Alta.
780-496-5658
john.hodgson@edmonton.ca