An aerial view of the containment system under construction.

Article courtesy ADS

The Willoughy Sports Complex in Langley, B.C., hides Canada's largest storm water containment system able to hold 20 million liters of runoff.

CREATIVE Storm Water CONTAINMENT SYSTEM

The modular arch chamber system is made up of over 3,300 segments able to retain over 21 million liters.

Not only does the new Willoughby sports complex in Langley, B.C. have five playing fields, it is also the site for one of the largest underground storm water detention systems ever installed. The system, located under two of those fields, is used to store and treat runoff from roofs and impervious pavement at nearby multi-housing complexes.

In 2017, while developing a storm water management plan for the Yorkson Neighborhood in the Township of Langley, McElhanney Consulting Services was tasked with maintaining the rate of post-development flows into nearby Yorkson Creek at pre-development levels. The required storage volume was calculated to be in excess of 21,000 cubic meters (21 million liters or 5.5 million gallons) of water, making the system the largest in Canada.

Rather than choosing a traditional pond to accommodate this volume, the development owner selected a buried storage system to make better use of the land. Using an underground arch chamber system would enable the owner to meet an obligation to the Township to provide a recreation complex with multi-purpose sports fields.

"This project actually goes back about eight years," explains Raymond Sull, P.Eng., division manager, land development for McElhanney. "In a new neighborhood it is a requirement for the first developer to secure land and construct a detention pond for the entire catchment. As the developer of the Willoughby Town Centre was the first development in the catchment they were ultimately responsible for securing and constructing the detention pond. Initially the developer had difficulty securing sufficient land to construct the detention pond. Therefore, we explored alternative strategies to a conventional detention pond.

"We presented the concept of storing water underground for a smaller and more frequent storm event. And for a larger storm event, five year and above, water would be stored on the surface. Our thinking was that if it's really raining out there, no one is going to be using that field anyway.

"We got close to the approval of a concept with the Township but it was taking too long so the developer decided to proceed with a conventional pond. They managed to secure sufficient land to construct the conventional open pond option while we were working on the detention tank concept.

"A couple of years later," he continues, "we had another developer looking to open up another adjacent catchment that would have about 147 lots. We started discussions with the Township about how to control storm water runoff and they were a little bit more receptive to our plan.

Photos courtesy ADS

The completed field will see sporting activity next year.

The water retention system was laid on a bed of crushed rock on top of geotextile fabric.

"We expanded upon the work we did eight years before and utilized the constructed conventional pond to address the first flush, because after a period of dry weather the roads have a lot of grit and oil on them and the first rainfall washes all that into the storm sewer and there are a lot of contaminants that would flow into the creek. So we were using the pond to manage the storm water for the first flush and during a longer storm event the water would flow into the system under the field. This would prevent any flash flooding and allow a controlled flow of water to drain into the Yorkson Creek.

"The way the concept is designed now is that the system receives water only a couple of times a year, but now during a 100-year event everything will be contained underground as opposed to buying another couple acres of land for a pond. Land these days is getting quite expensive, especially in the Vancouver area. With an underground system, we can get the same land and use it for multiple purposes, such as this sports complex, and the public won't even know there's a detention system underneath."

The goal was to be able to store up to 21,247 m^3 (750,331 ft3 or 5,612,864 gallons) of water. To hold the water, StormTech chambers from Advanced Drainage Systems (ADS) were specified for the job. Each of the company's MC-3500 chambers, without the end caps, measures 2.286m long x 1.956m wide and 1.143m high (90 x 77 x 45 inches) and has an installed volume of 5.06 m^3 (178.7 ft3) of water. In total, 3,312 StormTech chambers were installed in a 130m wide x 160m long (427 x 525 ft.) pit, along with 230m (755 ft.) of 1050 mm (42-inch) diameter SaniTite HP Pipe (also from ADS) as the primary water inlet to the system with a designed rate of 2,650 liters (700 gallons) per second. The outlet flow rate is 1,130 liters (299 gallons) per second.

Installation by Gemco Construction of Langley took approximately 60 work days and was completed in December 2017. "This is a massive underground system," stated Paul Borradaile, project manager for Gemco. "We had to come up with a construction sequence that was a brand new idea because it was such a large system. We did not do what we have done in the past just because everything was so big and on such a large scale. Now, we hope that the lessons learned can give us a competitive edge in future similar projects.

The chambers are designed per industry standards to provide a 75-year service life and rated by CSA for 50 year service life in CSA B184.0. Because of the modular nature of the chambers, the system was able to be installed on a bed of crushed rock in an oval configuration to provide maximum capacity. A layer of geotextile fabric was first laid in the pit and covered by the rock. The geotextile was brought up each wall to cover the chamber, completely enveloping the system.

Included in the system is a StormTech Isolator Row that traps sediment to prevent it from settling at the bottom of the bed. The buildup of sediment in the Isolator Row can be monitored from an Inspection Port, and the Isolator Row can be periodically cleaned out using a typical JET-VAC process from the main inlet manhole.

"We did include the Isolator Row," Hull said. "We had most of the flow going into the open, conventional pond but put in the Isolator Row to manage sediments flowing into the underground system, which the Isolator Row can trap. After entering the Isolator, the water backs up and eventually goes into the main area of the system."

At the western side of the detention system, approximately 365 meters (1,198 feet) of 200 mm diameter (8-inch) perforated HDPE pipe was installed to act as an underdrain for the foundation stone. Cover over the system ranged from 2.5 to 5 meters (8.2 to 16 feet).

"As far as we know, this is the largest underground detention system of its kind in western North America, and we were very proud to be part of the team," said Sull.

During the summer of 2018, the surface of the playing fields was completed with topsoil and natural grass and will be ready for games next year after a full growing season. CCE