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Dual Use Stormwater Storage Facility / Sports Field

Prepared for: The Canadian Consulting Engineering Awards 2020

Submitted by: McElhanney

Category: Water Resources

1. 75-WORD SUMMARY

Qualico required a stormwater storage system to accommodate runoff for a 56-hectare catchment. McElhanney's non-traditional solution is one of the largest underground stormwater storage systems in North America and the system's ability to overcome typical project complexities impressed the client. Combining the facilities and placing the system underground allowed McElhanney to deliver Qualico added project benefits such as using less land, providing reduced long-term maintenance costs, benefits to the environment, and increased safety for residents.

Figure 1: Before and after. Upon completion, this is now one of the largest underground stormwater detention systems in North America.

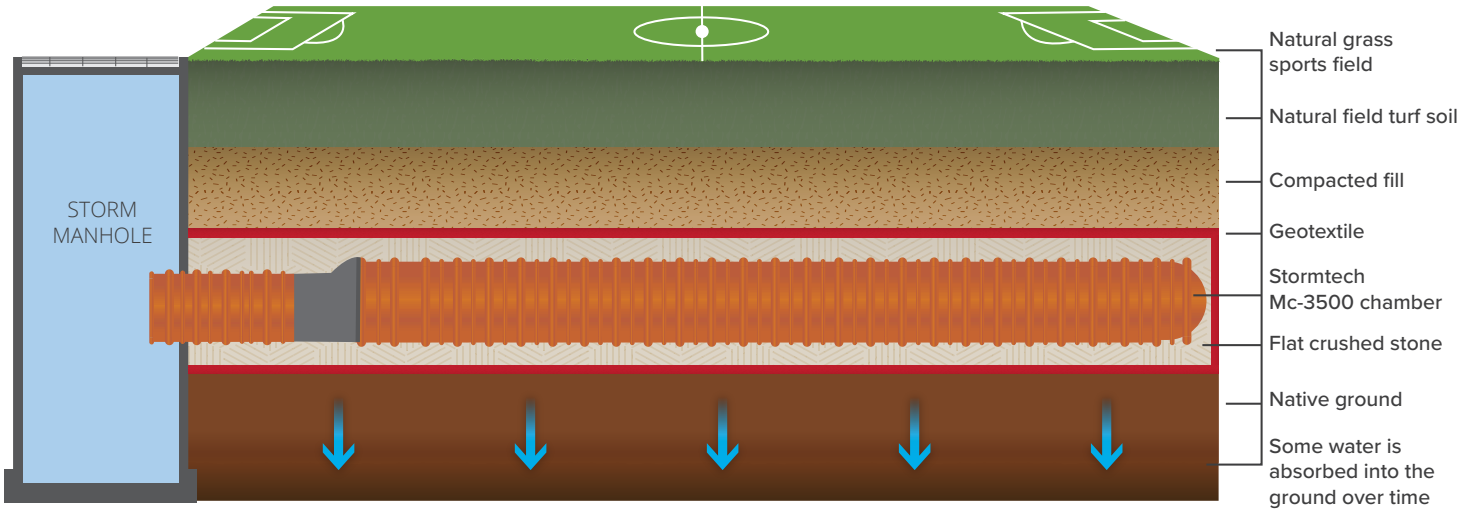

Figure 2: Cross-section of the underground storage facility. A variety of materials were used to make the underground storage tanks viable beneath the natural grass sports fields.

Figure 3: Langley, BC. The Yorkson neighbourhood is located in the Township of Langley, British Columbia on the west coast of Canada.

2. PROJECT HIGHLIGHTS

Innovation

To move forward with the second phase of construction for approximately 450 new homes in the Yorkson neighbourhood of Langley, BC, Qualico Developments needed to find a way to manage stormwater flows generated by the 56 hectare development. Qualico retained McElhanney to assess potential stormwater storage options to keep this large, new community safe and operational, particularly during significant rainfall events.

Ponds are typically used for detaining stormwater as they hold a large volume of water while gradually releasing the water back into the ground. In order for a stormwater pond to be effective, it must be located at the low point of the drainage area, limiting options for the pond's location. McElhanney considered both constructing a new pond or expanding the existing pond which served the previous phase of the Yorkson neighbourhood.

However, landowners did not want to sell the land required to build a new pond or expand the existing pond – plus, even if they did, Qualico would have had to pay well above market value to acquire the land (see ***B in Figure 5a***). Conscious of Qualico's budget, McElhanney set out to find a financially viable solution.

When reviewing plans for the area, McElhanney discovered the Township of Langley had secured land for a nearby community park (Yorkson Green) including two natural grass soccer fields – a feature which ignited McElhanney's design inspiration (see ***item 4 in Figure 5a***). The stormwater storage system and the proposed natural sports fields could be integrated into the same footprint – the team would design an underground storage system to be placed beneath the sports fields.

With a capacity of 21,200m^3, the result was a non-traditional and sustainable approach to stormwater storage that is the largest of its kind in Canada and is one of the top five largest in North America.

While the use of underground stormwater storage tanks is not a new concept, it had never been done to this magnitude in Canada. Incorporating a stormwater storage facility below a sports field was an innovative way to utilize the same area for public spaces without limiting either facility.

When presented with challenges such as sediment buildup, McElhanney used the site's unique proximity to the existing pond to Qualico's advantage and designed the facility to use the pond as a first screen for sediments (see ***Complexity*** section for more). To our knowledge, this is the first time a pond has worked in unison with an underground facility.

Complexity

A dual-use facility with underground stormwater storage tanks located below a field was a major departure from standard industry practice. To succeed, McElhanney's design had to address flooding, usability of the field, sediment buildup, and field elevation.

Containment required - To avoid surface flooding, the system was designed to contain a 100-year 24-hour storm with larger storm events conveyed via the spillway within the flow control manhole (see ***Figure 5b***). Alongside single event computer modelling, McElhanney ran continuous simulations to confirm that the performance of the proposed system would not impact the field's surface.

Blockage mitigated - Sediment buildup leading to blockage was a major concern as blockages would lead to reduced storage volume and long-term maintenance issues (see ***F in Figure 5b***). Therefore, McElhanney utilized flow diversion manholes to direct initial surface runoff and smaller storm events to an existing storage pond, allowing for sediment and debris to be collected by the pond before entering the underground system. Only during significant events would flows directly enter the tank system below the fields (see ***Figure 5a***).

Unusual shape - Although the fields can accommodate 21,200m^3 of stormwater, their oval shape and 2.4m elevation difference made it challenging to accommodate an efficient underground system (see ***G in Figure 5b***). Due to these constraints, McElhanney used easy-to-maintain, cost-efficient, and non-concrete stormwater chambers which offered a higher volume of storage per square metre, flexible configuration, and the ability to withstand significant bury-depth loading (see ***Figure 4***). The selected product also prolonged water flow from the storage tanks to ensure nearby Yorkson Creek did not run dry in warmer months (see ***A in Figure 5a***).

What is a 100-year 24-hour storm event?

A one percent chance of a major storm in a given location during any given year. Statistically, resulting in one storm every 100 years.

Figure 4: Conserving land. The storage facility was placed below ground as a tank system, leaving space for more development and amenities in the neighbourhood.

Figure 5a: Key Issues Part 1

Key Issues

- **A** **Yorkson Creek** – Salmon rely on the creek for spawning habitat.
- **B** **Proposed Land for Phase 2 -** Landowners unwilling to sell the land needed for proposed Phase 2 pond.
- **C** **Existing Pond** – Not large enough to support Phase 2.
- **D** **Community** – To proceed with Phase 2, 21,200m^3 of stormwater storage was required.

Figure 5b: Key Issues Part 2

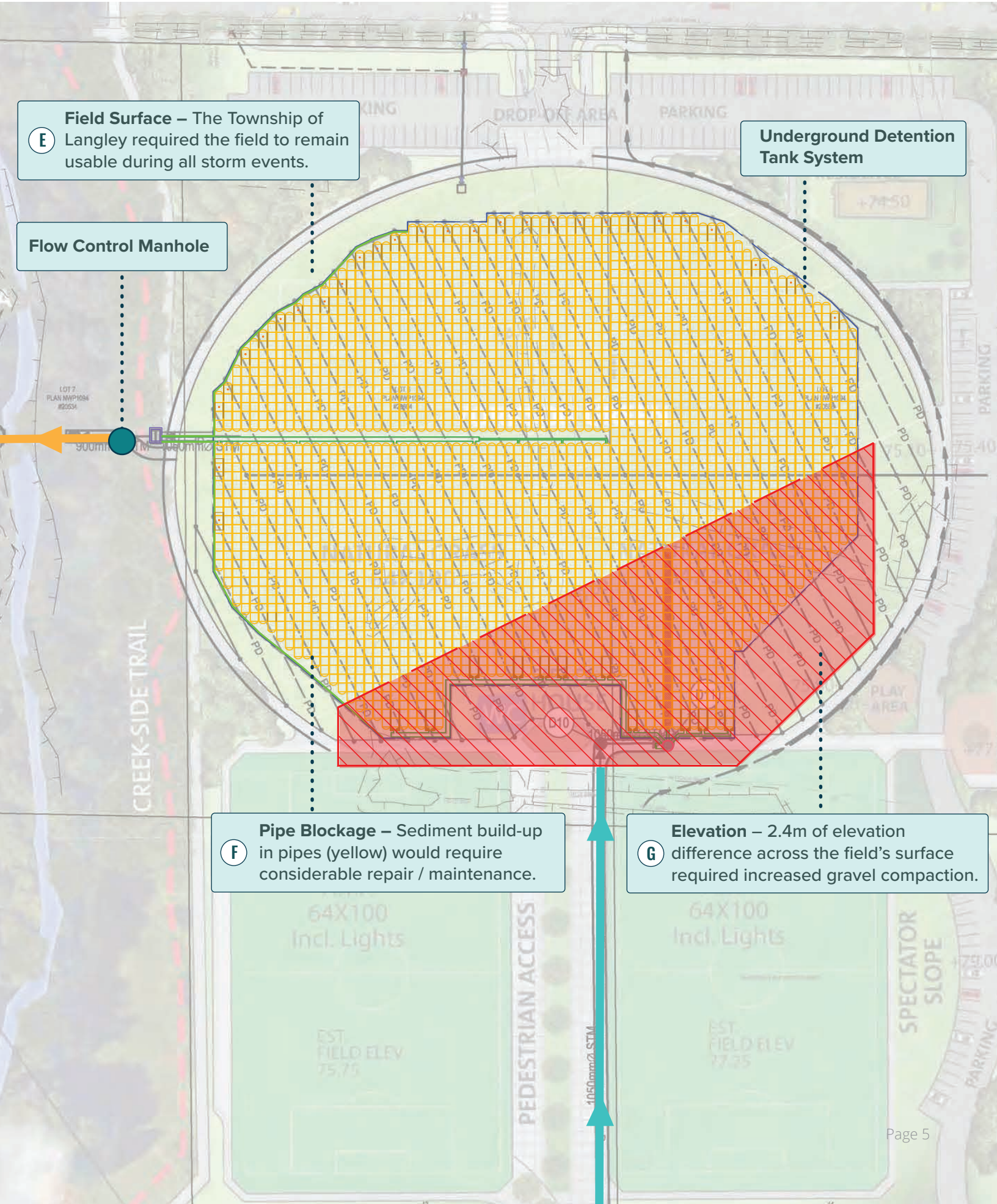

Figure 6: Dual use. The stormwater detention system is hidden underneath the new natural grass field which can fit two standard soccer fields.

Social and/or Economic Benefits

Cost savings - As the stormwater facility and park are maintained by the Township of Langley and funded through tax revenue, combining two facilities into one reduced maintenance costs incurred by the Township and taxpayers. Merging the facilities saved the Township approximately $1M in construction costs, as the fee for developing the soccer fields was absorbed into the cost of the stormwater facility. By integrating the natural fields and the facility, the fields were also open to the public earlier than planned.

Increased opportunity for revenue - While land for a traditional stormwater pond is single-use, McElhanney's efficient dual-use system offered the Township earlier access to the soccer fields, and the revenue generated from them. By eliminating the need for a separate parcel of land, the previous pond location can now be developed for other revenue generating purposes such as residential or recreation facilities (see ***B in Figure 5a***).

Exceptional safety - Although effective, traditional ponds can pose a threat to public health and safety. Ponds are a breeding ground for pesky, and potentially disease-carrying, mosquitoes. If not properly maintained, ponds can also pose severe risks to curious trespassers; for example, in the winter the ponds can masquerade as inviting ice skating rinks, but the ice is rarely thick enough to support a person's weight. Similarly, children may see a pond as a swimming hole on a hot summer day, but the water is not safe for swimming. Placing the stormwater storage system underground eliminated these potential threats to the community.

Environmental Benefits

Cooler water for salmon - As water from the underground storage system is released, a significant volume flows downstream into Yorkson Creek, an important area for salmon-spawning (see ***A in Figure 5a***). Development in salmon-spawning areas is always a risk. However, the underground system is better than traditional ponds because the underground facility detains water at a cooler temperature than an exposed pond. This is critical because as it is released, warmer water temperatures can be detrimental to salmon.

More oxygen for salmon - The development of algae on traditional stormwater ponds threatens salmon. As water sits stagnant in ponds, exposed to sunlight, algae can develop on the water's surface. Dependent on oxygen for its survival, algae depletes the amount of oxygen in the water, resulting in potentially deadly conditions for salmon, who rely on this vital element for survival. By placing the storage facility underground, out of the sun, algae are unable to form.

Limited earthworks - To reduce the volume of native and brought-in earthworks required to grade the fields' 2.4m elevation difference, McElhanney designed the fields to slope in the same direction as the natural grade (see ***G in Figure 5b***). This reduced required materials and emissions from trucks carrying materials to the site.

Efficient land use - With a limited supply of land, it is crucial to think creatively about how to maximize available land. Combining more facilities and uses in less land has the potential to achieve the same benefits with less impact, as this project demonstrates.

Figure 7: Yorkson Creek. The creek, which runs adjacent to the new storage facility, is an important local salmon spawning habitat.

Meeting Client's Needs

When a conventional stormwater pond was rendered impractical due to property ownership, Qualico made it clear that they were still eager to deliver the stormwater project by Summer 2018 to avoid carrying costs associated with the new development. McElhanney got creative and began looking for land elsewhere.

When McElhanney first developed the idea of placing the stormwater storage facility under the soccer fields, they reached out to the park's land owner: the Township of Langley. The Township agreed to allow the stormwater storage facility to be built under their fields on one condition: the facility could not impact the use of the field. Initially envisioned to only accommodate smaller, more frequent storm events (larger five year storm events would have sat on the fields' surface), McElhanney ran simulations and used the existing pond to collect smaller rainfall events (described in ***Complexity*** section), ensuring the fields' surface would not be compromised (see ***Figure 8***).

McElhanney's sustainable and non-traditional approach exceeded Qualico's expectations. The stormwater storage facility was delivered on-time and, by meeting the Township's requirements for land use, McElhanney helped Qualico save $6M by not having to secure land for a conventional pond. Qualico's portion of the land originally proposed for the pond, can now be used for more housing and amenity opportunities in the neighbourhood.

Figure 8: Finished product. The stormwater facility was delivered on time and the field was immediately used by members of the community.