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File: 0473

Town of Pelham
20 Pelham Town Square
Fonthill, ON, L0S 1E0

Attn: Mr. Jason Marr, P.Eng. – Director of Public Works

**Re: Implementation Costs and Effectiveness of Low Impact Development (LID) Practices**
**Meridian Centre Expanded Parking Facility – Fonthill, Town of Pelham**

At the request of the Town of Pelham Upper Canada Consultants has updated the previously prepared parking expansion preliminary concept to reflect current pricing.

The conceptual parking lot is illustrated on Drawing 0473-SSP-BLK4 an provides approximately 174 additional parking spaced to the south east of the existing arena on the block adjacent to Regional Road 54 - Rice Road.

We have provided a baseline construction cost estimate updated to June 2022 with a conventional construction. The baseline construction cost estimate is approximately $970,000 + HST. The use of significant Low Impact Development (LID) measures is expected to increase this base cost by between 20% and 100% to upwards of $2 million dollars.

The proposed parking lot expansion is approximately 7,100 $m^2$ in area and will be comprised of predominantly paved asphalt parking area with concrete walkways with some landscaped areas within curbed islands and around the exterior of the parking area.

The construction of the proposed parking lot expansion will reduce the amount of area in which stormwater flows will be able to infiltrate into the native soils (i.e. pervious area), as compared to the conditions present prior to construction. This reduction in pervious area will result in an overall increase in stormwater volume and flow rate that will be conveyed from the impervious paved areas and be captured into the storm sewer system.

An emerging practice for new and infill developments is Low Impact Development (LID), which aims to explore options to maintain the existing hydrological functions at the source as opposed to downstream end-of-pipe controls. Some examples of LID practices that may be applicable to this area are as follows:

- Soakaway Pits/Infiltration Trenches;
- Vegetated Filter Strips/Enhanced Grassed Swales;
- Bioretention/Biofilters; and,
- Permeable Pavement.

The Ontario Institute of Pedology prepared field mapping in 1981 – 1985 of the soils within the Niagara Region, including the subject property. Based on this mapping, the native soils were identified as primarily silty clay with a thin layer of sandy textures (15 – 40 cm) with an infiltration potential classified as "imperfectly drained" (BVY.C soil classification) with a secondary composition of silty loam with a more substantial sandy layer (40 - 100 cm) with an infiltration potential classified as "well drained" (WSH soil classification). Therefore, infiltration-focused methods such as soakaway pits, bioretention, and permeable pavement may be considered for this area following a more site-specific geotechnical investigation.

The following will provide a brief overview of the applicable alternatives stated above.

**Soakaway Pits/Infiltration Trenches**

These practices promote infiltration of stormwater into the surrounding soils by excavating a pit or trench which is typically lined with a filter cloth, backfilled with coarse granular material and either fed by sheet drainage from the surrounding area or through perforated pipes conveying flows from a storm conveyance system.

In the context of this site, the spacing constraints with the parking area would be more supportive to infiltration trenches along the landscaped strips between the parking area and the driveway aisles/road allowances than any centralized pits.

These practices are only effective in controlling the quantity of stormwater and will not provide significant quality improvements. In fact, as the sole method of controlling stormwater, there is potential for contaminants from the parking area (salt, oil, sediment, etc.) to be directed into the soil and groundwater if the water table is high enough. Therefore, it is recommended to also provide a method of quality improvement to as pre-treatment prior to discharging to an infiltration trench.

Per the Low Impact Development Stormwater Management Planning and Design Guide (LID SWMPD) published by the Ministry of the Environment, Conservation and Parks (MECP) in 2010, these practices have a typical space requirement of 20:1 to 5:1 of the serviced impervious area. The proposed parking lot expansion is comprised of approximately 5,500 $m^2$ of impervious area and therefore approximately 275 $m^2$ to 1,100 $m^2$ of area will need to be designated for the infiltration trenches. There is approximately 1,600 $m^2$ of landscape area available immediately adjacent to the parking lot expansion.

The use of soak away pits/infiltration techniques are not recommended due to the need to implement pre-treatment to ensure contamination of the underlying soils does not occur. The Town has incurred a sunk cost associated with the construction of the existing SWM pond and with associated ongoing maintenance costs. The Town will not be able to realize any of the potential cost savings associated with reduced runoff volumes as the SWM facility and sewers are already constructed.

Without pre-treatment these types of LID's rapidly fill with sediment and overtime lose their ability to function, where they need to be excavated and reconstructed at a significant cost. Budgetary costs associated with capital construction is approximately $375/metre assuming 2m between rows of parking bays.

**UCC does not recommend soakaway pits or infiltration trenches swales be implemented as part of a future parking area.**

**Vegetated Filter Strips/Enhanced Grassed Swales**

These practices provide a vegetated area for stormwater flows to be conveyed through which can provide quality benefits by removing suspended sedimentation and promote infiltration as the flows travel over the pervious area.

Filter strips are typically utilized as a supporting component in the overall stormwater management design and not as a sole controlling practice but have the benefit of being easily implemented where stormwater can be conveyed across the pervious areas. Alternatively, enhanced swales can provide greater quality improvements and even quantity controls with the caveat of requiring more detailed design, maintenance, and space requirements.

Per the LID SWMPD (MECP 2010), these practices have a typical space requirement of 10:1 to 5:1 of the serviced impervious area. Therefore, approximately 550 $m^2$ to 1,100 $m^2$ of area will need to be designated for the filter strips or enhanced swales. There is approximately 1,600 $m^2$ of landscape area available immediately adjacent to the parking lot expansion.

Both practices could be implemented for the proposed parking lot expansion as there are multiple continuous strips of landscape area available at the extents of the parking area. However, grading of the parking lot could be a constraint as stormwater flows from the impervious paved area would need to be conveyed to these landscape areas.

The use of vegetated filter strips/enhanced grasses swales are not recommended due to the need to implement pre-treatment to ensure contamination of the underlying soils does not occur. The Town has incurred a sunk cost associated with the construction of the existing SWM pond and ongoing increased maintenance costs.

This type of LID will reduce the overall available parking spots and the Town will not be able to realize any of the potential cost savings associated with reduced runoff volumes as the SWM facility and sewers are already constructed. Further in our experience this type of installation was installed by the City of St. Catharine's at their Public Works Yard as part of a test program and ultimately removed as maintenance staff are required to perform very labour intensive management to prevent the vegetation from becoming overgrown and encroaching on the parking area. Garbage and debris accumulate within the vegetation and resulted in numerous complains from the public and staff that needed to be removed by hand.

Capital construction costs for budgetary estimates are approximately $150-$300 per metre depending on the intensity of plantings.

**UCC does not recommend significant filter strips or enhanced grassed swales be implemented as part of a future parking area.**

**Bioretention/Biofilters**

These practices can function as a filter to improve stormwater quality and also provide quantity controls by retaining flows and either promoting infiltration, given adequate soil conditions, or conveying flows through a perforated subdrain to a storm sewer conveyance system.

The facilities themselves can be adapted to various situations, such as the landscaped islands within the parking lot and along the exterior curbs of the parking lot to receive and control stormwater flows. Similar to infiltration trenches, additional geotechnical analysis will be required to determine the efficacy of including an infiltration component. It is typically recommended to allocate additional space for a forebay or pre-treatment area to remove heavier sediments that may clog the filtration component.

Per the LID SWMPD (MECP 2010), these practices have a typical space requirement of 15:1 to 5:1 of the serviced impervious area. Therefore, approximately 370 $m^2$ to 1,100 $m^2$ of area will need to be designated for the bioretention areas. There is approximately 1,600 $m^2$ of landscape area available immediately adjacent to the parking lot expansion.

Bioretention and biofilters function similarly to vegetated filter strips combined with infiltration trenches/soakaway pits and have similar drawback and advantages. The Town has incurred a sunk cost associated with the construction of the existing SWM pond and ongoing increased maintenance costs and this type of LID will reduce the overall available parking spots and the Town will not be able to realize any of the potential cost savings associated with reduced runoff volumes as the SWM facility and sewers are already constructed.

Further in our experience this type of installation was installed by the City of St. Catharine's at their Public Works Yard as part of a test program and ultimately removed as maintenance staff are required to perform very labour intensive management to prevent the vegetation from becoming overgrown and encroaching on the parking area. Garbage and debris accumulate within the vegetation and resulted in numerous complains from the public and staff that needed to be removed by hand.

For the purpose of estimating capital construction costs we recommend a range of $375-$525 per metre depending on the significance of the plantings associated with the installation.

**UCC does not recommend significant bioretention or biofilter facilities be implemented as part of a future parking area.**

**Permeable Pavement**

Permeable pavement can be utilized to allow for stormwater flows that would typically run off from the impervious pavement area to drain through the pavement surface to the subgrade as opposed to draining to catch basins or spill ways. From the subgrade infiltration can be promoted, provided adequate soil conditions, or subdrain can be installed to convey flows to a storm sewer conveyance system.

The benefit of this practice is the utilization of the impervious area as a stormwater management facility as opposed to relying on potentially limited landscape areas. However, if applied to the proposed parking lot expansion, consideration will need to be made for the clogging of the permeable surface by sand and sediment as well as the infiltration rates of the native soils.

Per the LID SWMPD (MECP 2010), these practices have a typical space requirement of 1.2:1 to 1:1 of the serviced impervious area. For application in the proposed parking lot expansion, it would be proposed to utilize the entire asphalt parking area and not the concrete walkways for this type of facility, which would fall into the typical space requirement.

*Asphalt*

Permeable asphalt has been installed in the St. Catharine's Public Works Yard as a long tern test for over 10 years. Our understanding is that the asphalt has preformed suitably as would be an acceptable use in this case. However, the underlying stone must be replaced with a thicker layer of clear stone to encourage infiltration and there is a significant price premium to the asphalt. It is recommended that snow clearing be done with a special dedicated vehicle equipped with a plastic/rubber blade in place of typical steel snow clearing blades.

Further periodic pressure washing is recommended to ensure the long term usability of the asphalt as it must remain free-draining to prevent ice accumulation and obliteration of the asphalt during freeze cycles.

This alternative is expected to increase the granular cost by approximately $45,000 and the asphalt cost by $105,000 for a total cost premium of approximately $150,000 or 20% of the project cost. UCC is unable to determine the associated ongoing maintenance costs.

If implemented we would recommend that the asphalt be only placed on the parking stalls and that normal asphalt be used for the drive isles as permeable asphalt is especially susceptible to damage from stationary tire rotations.

*Permeable Paving Stones*

Permeable Paving Stones continue to be the recommended parking solution and we believe that it would be the best use case for implementation in the parking lot expansion, however there is a significant cost associated with it vs. conventional asphalt.

As a light coloured surface there are also significant heat island benefits and associated improved tree and vegetation health.

This alternative is approximately $25/ sq.ft and if implemented over the entire area would have a cost of approximately $1.2 Million, or a project cost increase of approximately $1 Million dollars.

**Current Stormwater Management Design**

Independent of any proposed LID measures for the proposed parking lot expansion, stormwater flows from this area have been allocated to the constructed and approved stormwater management wet pond facility located immediately northwest of the Summersides Boulevard/Wellspring Way roundabout and the associated storm sewer conveyance system.

The facility received an Environmental Compliance Approval from the MECP to provide pre- to post-development peak flow attenuation up to and including the 100-year design storm event and stormwater quality improvements up to MECP Normal levels (70% TSS Removal) for the entire tributary drainage area.

With the construction of this facility, the additional benefit from new LID practices within the relatively small portion of the overall drainage area would be minimal. Most of the practices stated above would only provide benefits if infiltration into the native soils is feasible, which would require additional geotechnical investigations and the others would serve to provide pre-treatment to stormwater flows which will ultimately drain to the storm sewer system and into the constructed wet pond facility anyway.

Because of the in-place implementation the use of LIDs for the expanded parking lot is unlikely to have any measurable impact upon the downstream water quality or quantity and will compound and increase significantly both the initial capital construction costs, approvals timelines and ongoing operation and maintenance costs for the Town of Pelham.

Should you have any questions, concerns or require further information, please contact the undersigned.

Yours very truly,

Adam Keane, P.Eng.

Encl.