SERVICING & STORMWATER MANAGEMENT REPORT
PROPOSED FOGUANGSHAN TEMPLE

Project No.: CP-17-0503 – 668 Franktown Road, Ottawa, ON

Prepared for:

Bing Professional Engineering Inc.
248 Huntsville Drive, Ottawa, ON K2T 0C3

Prepared by:

McIntosh Perry Consulting Engineers Ltd.
115 Walgreen Road
Carp, ON K0A 1L0

July 30, 2018

McINTOSH PERRY

Executive Summary

Developing a site within the City of Ottawa requires meeting a predefined set of requirements outlined in the City of Ottawa Sewer Design Guidelines (SDG) - 2012 along with meeting the local conservation authority requirements (Rideau Valley Conservation Authority - RVCA) and provincial requirements (Ministry of Environmental and Climate Change – MOECC). Site specific requirements are discussed and outlined in the pre-consultation meeting with the City of Ottawa before the detailed design process is initiated.

This report describes an innovative and cost-efficient design solution for the site servicing (water, sanitary, and storm) and stormwater management (SWM) requirements in order to develop this site. The Rideau Valley Conservation Authority (RVCA) requires the removal of 80% of total suspended solids (TSS) before runoff discharge. Enhanced grassed swales, retention area, level spreader and existing vegetation are proposed to meet the requirements outlined by the RVCA.

Evaluation of the proposed site plan in addition to a review of the site grading and soil characteristics was completed. Our review identified that enhanced grassed swales, retention area and level spreader restricting the flows provided the optimal design solution to meet the stormwater management requirements. During storm events the stormwater will be retained within the enhanced grassed swales and retention area until the storm event subsides and flows reduce. The runoff from the site will drain to the front and back of the limit of development and outlet to the Franktown Road right-of-way and the site behind the development area. These design elements will ensure that water quality and quantity concerns are addressed at all stages of development.

The evaluation of the proposed development, existing site characteristics and surrounding municipal infrastructure suggests that the SWM design elements consisting of enhanced grassed swales, retention areas and level spreaders will not only be a possible design solution to the site constraints but will also contribute to the health of the local watercourse. The proposed septic and well will utilize the existing groundwater and surrounding environment to service the development. Therefore, it is our professional opinion that this site located at 6688 Franktown Road is able to be developed and fully serviced to accommodate the proposed Buddhist Temple.

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1.0 PROJECT DESCRIPTION

1.1 Purpose

McIntosh Perry (MP) has been retained by Bing Professional Engineering Inc. to prepare this Servicing and Stormwater Management Report in support of the Site Plan Control process for the proposed Buddhist Temple located at 6688 Franktown Road within the City of Ottawa.

The purpose of this report is to present a servicing design for the development in accordance with the recommendations and guidelines provided by the City of Ottawa (City), the Rideau Valley Conservation Authority (RVCA) and the Ministry of the Environment and Climate Change (MOECC). This report will address the water, sanitary and stormwater servicing for the development, ensuring that existing and available services will adequately service the proposed development.

1.2 Site Description

The property is located at 6688 Franktown Road. It is described as Part of Lot 19, Concession 3, Geographic Township of Goulbourn, City of Ottawa, Ontario. The land in question covers approximately 39.89 ha, though only 9.38 ha is to be considered the limit of development. The property is located west of the Village of Richmond within the City of Ottawa and is currently undeveloped consisting of tree cover, grass, a gravel drive aisle, a shed and a steel transportation bin.

The proposed development consists of a 2,665 m², one-storey Buddhist Temple and a two-storey 635 m^2 residency building connected by a covered walkway. In addition, the development includes a drive aisle with parking and a dedicated fire route. The existing private approach will be removed and replaced with a new entrance providing 10 parking spaces and landscaped area before a gated entrance to the drive aisle.

Figure 1: Key Map: 6688 Franktown Road, Ottawa

2.0 BACKGROUND STUDIES

Background studies that have been completed for the site include review of a topographical survey of the site, a geotechnical report and a Phase I Environmental Site Assessment (ESA).

A topographic survey of the site was completed by MPSI and can be found under separate cover.

The following reports have previously been completed and are available under separate cover:

- Geotechnical Investigation completed by McIntosh Perry dated July, 2018.
- Phase I ESA completed by McIntosh Perry dated June, 2018.
- Hydrogeological Study completed by McIntosh Perry dated July, 2018.

3.0 PRE-CONSULTATION SUMMARY

City of Ottawa Staff have been pre-consulted regarding this proposed development in person on December 19th, 2017. Specific design parameters to be incorporated within this design include the following:

- Pre-development and post-development flows shall be calculated using a time of concentration (Tc) of 20 minutes and 10 minutes, respectively.
- Control 5 through 100-year post-development flows to the 5 and 100-year pre-development flows with a combined C value to a maximum of 0.50.
- Only the area of development will be considered when determining the pre-development and post-development stormwater flows.

Correspondence with the City and other governing bodies can be found in Appendix 'A'.

4.0 EXISTING SERVICES

The property has not been developed and is within Area D (Rural) of the City of Ottawa Zoning Schedule. There are no underground services that are available to be connected to within the Franktown Road right-of-way though a forcemain running to a pump station in the Village of Richmond is present. Also, overhead utility wires are present along the frontage of the site.

5.0 SERVICING PLAN

5.1 Proposed Servicing Overview

The property will be serviced with a new well and a septic system to provide the required water and sanitary services. The stormwater will be conveyed by means of sheet flow and enhanced grassed swales to storage areas along the southeastern and northwestern limit of the development area prior to its discharge to the rear and front portions of the property.

5.2 Proposed Water Design

A new well will be drilled to the west of the drive aisle approximately half way to where the main parking area begins. The well will provide the proposed development with a domestic water supply. As per the hydrogeological study, the new well will provide sufficient quantity and quality of water for proposed site needs and should not adversely affect groundwater. The building is anticipated to be connected by a 100 mm diameter service that will provide sufficient pressure and flow for the intended use of the development. Service size to be confirmed by mechanical engineer.

For the purpose of this report the gross area of the buildings was used as in the calculations instead of the gross area of the site due to the subject site size. The water demands for the new buildings have been calculated as per the Ottawa Design Guidelines – Water Distribution and are as follows: the average and maximum daily demands are 0.11 L/s and 0.16 L/s respectively. The maximum hourly demand was calculated as 0.29 L/s (Refer to Appendix 'B' for water demand calculations).

The sanitary flows have been calculated using the ultimate usage with the amount of people expected provided by the client, which will be further explored in section 5.3.2. The development is anticipated to hold 5,000 people for a planned duration of one hour. Using the ultimate design flow from the septic design of 40,320 L/day, a time demand interval of eight (8) hours was used to evaluate the required demand to be coordinated with the hydrological assessment to determine the serviceability of the on-site domestic well. The resulting demand is approximately 84 L/min. As per Appendix E of the Hydrological Assessment by McIntosh Perry, available under separate cover, a six (6) hour pump test was preformed pumping 92 L/min for a duration of 6 hours. During this test, less than half a metre drawdown was reported with a positive recharge shown during the test. With the available data, it is anticipated that the well will provide sufficient water to fully service the intended use of the development.

Following Part 3 of the Ontario Building Code (OBC), the required fire protection is 4,500 L/min (See Appendix 'B' for calculation). The required fire protection from the Fire Underwriters Survey (FUS) is 19,000 L/min (provided for information purposes only). Due to the proximity of the nearest fire station (approx. 2km), coordination with Ontario Fire Safety on the location and amount of on-site storage is currently underway.

5.3 Proposed Sanitary Design

A new septic bed located within the northeastern of the site and will be installed and sized to accommodate the development. The septic design will be submitted, under separate cover, to the Ottawa Septic System Office (OSSO) for the required permits and approvals. The septic system is planned to be serviced with a 100 mm diameter PVC lateral from the septic tanks to the proposed buildings.

5.3.1 Interim Facility

Currently the sanitary design flow is calculated to be 9,999 L/day, which takes into consideration the building plumbing as well as the number of attendees and staff expected during occasions provided by the client.

5.3.2 Full Build

Using the information regarding amount of people and the expected participation time provided by the client, the flows were calculated by the septic designer to accommodate the most demanding time. From these calculations a maximum flow of 40,320 L/day was determined. The septic system shown on drawing C103 "*Site Servicing Plan"* represents the layout and components, of the proposed septic design. For more details regarding the proposed septic, see detailed design drawings. The septic application will be included in Appendix C when available.

5.4 Proposed Strom Design

The transition from an undeveloped site covered in vegetation to a fully developed site will increase the amount of stormwater runoff due to an increase in impervious area. To manage the increase in stormwater runoff, enhanced grassed swales have been designed to treat the stormwater for suspended solid removal and convey the flows to retention areas complete with level spreaders. The stormwater will generally sheet flow from the front of the property to the back, with the exception of the northwestern corner that will be conveyed to Franktown Road ditch. The storage during the 5 through 100-year storm events shall be provided within the retention area as well as the enhanced grassed swales. There are two level spreaders proposed to create a non-point source outlet providing the opportunity for the existing vegetation downstream of the outlet to act as a vegetated filter strip for additional stormwater management measures. The combined restricted flows from the level spreaders will not exceed the pre-development flows for the respective storm events. The level spreaders will control the flows until the 100-year storm event subsides while also allowing for an emergency overland flow location. The stormwater management design will be further detailed in Section 6.0.

5.5 Site Utilities

All relevant utility companies (telephone - Bell, gas – Enbridge and hydro – Hydro Ottawa and cable - Rogers) will be contacted prior to construction in order to confirm adequate utility servicing for the site. It is anticipated that the existing overhead wires within the Franktown Road right-of-way will be used for the servicing of the site.

6.0 PROPOSED STORMWATER MANAGEMENT

6.1 Design Criteria and Methodology

Stormwater management for this site will be maintained through positive drainage away from the proposed building and be predominantly conveyed by way of overland sheet flow to the back of the site were an enhanced grassed swale, retention basin and level spreader are proposed to treat the quality of the water as well as restrict the runoff and provide storage for the 5 and 100-year storm events. Similarly, the northwestern portion of the site will sheet flow through an enhanced grassed swale providing treatment and storage before discharging through a level spreader. Two emergency overland flow location have been provided along the frontage to Franktown Road and the rear of the site. The combined restricted flows from the level spreaders

will not exceed the pre-development flows for the respective storm events. The quantitative and qualitative properties of the storm runoff for both the pre- and post-development flows are further detailed below.

Stormwater Best Management Practices (SWM BMP's) will be implemented at the "Lot level", "Conveyance" and "End of Pipe" locations. These concepts will be explained further in Section 6.3. To summarize, roof water will be directed to grass surfaces, where possible, that in turn will be collected into proposed stormwater management swale. The SWM facilities will consist of a swale treating both quality and quantity, with an enhanced level of quality control mandated by the Rideau Valley Conservation Authority (RVCA).

6.2 Runoff Calculations

Runoff calculations presented in this report are derived using the Rational Method, given as:

$$Q = 2.78CIA \text{ (L/s)}$$

Where C = Runoff coefficient

I = Rainfall intensity in mm/hr (City of Ottawa IDF curves)

A = Drainage area in hectares

It is recognized that the rational method tends to overestimate runoff rates. As a by-product of using extremely conservative prediction method, any facilities that are sized using these results are expected to function as intended in real world conditions.

The following coefficients were used to develop an average C for each area:

Table 1: Average Runoff Coefficients (C)

Roofs/Concrete/Asphalt	0.90
Gravel	0.60
Undeveloped and Grass	0.20

As per the City of Ottawa Sewer Design Guidelines, the 5-year balanced 'C' value must be increased by 25% for a 100-year storm event to a maximum of 1.0.

As per the pre-consultation meeting with the City of Ottawa the time of concentration (Tc) used for pre-development and post-development flows shall be calculated using a time of concentration (Tc) of 20 and 10 minutes, respectively.

6.2.1 Pre-Development Drainage

The existing site has been demonstrated as drainage area A1. Drawing CP-17-0503 PRE (Appendix 'D') indicates the limits of the drainage area. The existing site is relatively flat with isolated low points providing poor sheet flow. Generally, the frontage of the property is higher than the rear limit of development. Table 2 demonstrates the existing flow rates in pre-development conditions.

Table 2: Pre-Development Runoff Summary

Area ID	Drainage Area (ha)	Runoff Coefficient (5-year)	Runoff Coefficient (100-year)	T_c (min)	Unrestricted 5-year Peak Flow (L/s)	Unrestricted 100-year Peak Flow (L/s)
A1	9.38	0.21	0.26	20	383	817
Total	9.38				383	817

(See Appendix 'F' for Calculations)

6.2.2 Post-Development Interim Drainage

The interim development includes a 30-space gravel parking area and an interim prayer facility until the full build can be constructed. The existing gravel drive aisle will be upgraded to accommodate heavy duty traffic while removing a graveled portion as outlined on drawing C101 "*Proposed Foguangshan Temple Interim Building*", available with this submission. Table 3 details the post-development runoff generated for the interim development.

Table 3: Interim Facility Post-Development Runoff Summary

Area ID	Drainage Area (ha)	Runoff Coefficient (5-year)	Runoff Coefficient (100-year)	T_c (min)	Unrestricted 5-year Peak Flow (L/s)	Unrestricted 100-year Peak Flow (L/s)
B1	9.38	0.22	0.27	20	394	839
Total	9.38				394	839

(See Appendix 'F' for Calculations)

6.2.3 Post-Development Full Drainage

The post-development drainage plan was designed to retain runoff generated by a 100-year storm event onsite. Stormwater exceeding this amount is directed to the southeast limit of the development as well as the northwestern frontage onto Franktown Road. The proposed drainage and overland flow directions are indicated on drawing CP-17-0503 POST (Appendix 'E'). Table 4 on the following page displays the post-development runoff generated by the proposed site.

Table 4: Post-Development Runoff Summary

Area ID	Drainage Area (ha)	Runoff Coefficient (5-year)	Runoff Coefficient (100-year)	T_c (min)	Unrestricted 5-year Peak Flow (L/s)	Unrestricted 100-year Peak Flow (L/s)
B1	2.35	0.20	0.25	10	136	291
B2	1.18	0.43	0.50	10	147	291
B3	5.85	0.44	0.51	10	746	1473
Total	9.38				1029	2056

(See Appendix 'F' for Calculations)

Runoff from areas B2 and B3 will be restricted before discharging to the front and rear of the limit of development. The total flow leaving the site will be controlled by two level spreaders 37.55m and 49.53m long respectively. Area B2 will be restricted by the 37.55m level spreader restricting the 5-year storm event flows to 41.51 L/s and the 100-year flows to 88.52 L/s. Similarly, drainage area B3 will be restricted by the 49.53m level spreader restricting the 5-year storm event flows to 68.81 L/s and the 100-year flows to 437.19 L/s. The restriction devices will account for the unrestricted flow leaving the site. See Appendix 'F' for calculations. This restriction and quality runoff control will be further detailed in Sections 6.3 and 6.4.

6.3 Quantity Control

The following sections outline the post-development runoff quantity control for the site in both the interim development as well as the planned full development.

6.3.1 Interim Development

As shown in Table 5 below, the overall increase in post-development flows for the interim development do not exceed 4% of the pre-development flows. Therefore, no stormwater management controls have been proposed for the interim building.

Table 5: Interim Facility Pre-Post-Development Runoff Analysis

Peak Flows (L/s)							
5 Year			Percent Difference	100 Year			Percent Difference
Pre.	Post.	Δ		Pre.	Post.	Δ	
Area A1 / B1							
383	394	11	2.87%	817	839	22	2.69%

6.3.2 Full Development

After discussing the stormwater management criteria for the site with City staff, the post-development runoff for this site has been restricted to match the 5 and 100-year pre-development flow rates with a calculated C value of 0.21 and 0.26, respectively (See Appendix 'A' for pre-consultation notes). These values create the following allowable release rates and storage volumes for the development site.

Table 6: Allowable Release Rate

Area ID	Drainage Area (ha)	Runoff Coefficient (5-year)	Runoff Coefficient (100-year)	5-year Flow Rate (L/s)	100-year Flow Rate (L/s)
A1	9.38	0.21	0.26	383	817

(See Appendix 'F' for Calculations)

Reducing site flows will be achieved using flow restriction and will create the need for onsite storage. Runoff from areas B2 and B3 will be restricted as detailed in Table 7.

Table 7: Post-Development Restricted Runoff Calculations

Area ID	Post-Development Unrestricted (L/s)		Post-Development (Restricted) (L/s)		
	5-yr	100-yr	5-yr	100-yr	
B1	136	291	136	291	UNRESTRICTED
B2	147	291	42	89	RESTRICTED
B3	746	1473	69	437	RESTRICTED
Total	**1029**	2056	246	817	

(See Appendix 'F' for Calculations)

Runoff from Area B2 will be restricted at the outlet by a 22.40m level spreader. The level spreader will restrict area B2 to 41.51 L/s for the 5-year storm event creating a water surface elevation (WSEL) of 99.96. The 100-year storm event flows will also be restricted by the level spreader restricting the flows to 88.52 L/s creating a WSEL of 99.97. The storage for this area will be provided within the enhanced grassed swale. Table 8 below details the amount of required and provided storage before discharging to the front of the property.

Table 8: Site Storage Summary

Area	Depth of Ponding (m) for 5-yr storm	5-year required storage (m^3)	5-year available storage (m^3)	Depth of Ponding (m) for 100-yr storm	100-year required storage (m^3)	100-year available storage (m^3)
B2	0.44	69.2	157.8	0.45	128.3	165.3

(See Appendix 'F' for Calculations)

The outlet designs for drainage area B2 detailed on drawing C102 creates surface water within the 0.43 m vertical difference between the outlet (99.95) and the bottom of swale (99.52). It is anticipated that this water will infiltrate through the native loose to compact sand (extending to a depth of 3.4 m to 5.0 m) atop compact to dense sand containing traces of clay, silt and gravel (depths between 4.7 m and 5.7m) due to its anticipated high hydraulic conductivity within a time of 24 hours.

Runoff from Area B3 will be restricted at the outlet by a 49.53m level spreader. The level spreader will restrict area B3 to 68.81 L/s for the 5-year storm event creating a water surface elevation (WSEL) of 99.79. The 100-year storm event flows will also be restricted by the level spreader restricting the flows to 437.19 L/s creating a WSEL of 99.81. The storage for this area will be provided within the retention are as well as within portions of the enhanced grassed swale. Table 9 below details the amount of required and provided storage before discharging to the front of the property.

Table 9: Site Storage Summary

Area	Depth of Ponding (m) for 5-yr storm	5-year required storage (m^3)	5-year available storage (m^3)	Depth of Ponding (m) for 100-yr storm	100-year required storage (m^3)	100-year available storage (m^3)
B3	0.27	602.1	627.8	0.292	662.9	686.7

(See Appendix 'F' for Calculations)

The outlet designs for drainage area B3 detailed on drawing C102 creates surface water within the 0.26m vertical difference between the outlet (99.78) and the bottom of swale (99.52). It is anticipated that this water will infiltrate through the native loose to compact sand (extending to a depth of 3.4 m to 5.0 m) atop compact to dense sand containing traces of clay, silt and gravel (depths between 4.7 m and 5.7m) due to its anticipated high hydraulic conductivity within a time of 24 hours.

6.4 Quality Control

The development of this lot will employ Best Management Practices (BMP's) wherever possible. The intent of implementing stormwater BMP's is to ensure that water quality and quantity concerns are addressed at all stages of development. Lot level BMP's typically include temporary retention of the parking lot runoff, minimizing ground slopes and maximizing landscaped areas. Some of these BMP's cannot be provided for this site due to site constraints and development requirements. From the pre-consultation meeting the Rideau Valley Conservation Authority (RVCA) requires an enhanced level of protection, which stipulates 80% total suspended solid (TSS) removal.

Multiple quality control measures have been proposed within areas B2 and B3 which will be equipped with a retention basin restricting flows from the area. This basin will have minimum slope (0.3%) to increase sediment removal and settling time. The retention areas are equipped with a plunge pool 0.43 m and 0.26 m, respectively, below the bottom of the outlet. The level spreaders proposed for outlets to drainage areas B2 and B3 will act as flow restrictors, causing temporary ponding within the retention basin.

The enhanced grass swales and retention area have a low slope (0.3%) to promote particle settling and allow for infiltration and removal of total suspended solids. It is suggested that the enhanced grassed swale and retention area be evaluated yearly to determine if the amount of suspended solid accumulation requires removal. Table 10 on the following page provides the criteria and proposed conditions the enhanced grassed swale will be subjected to.

Table 10: Enhanced Grassed Swale Requirements

No.	Design Element	Criteria	Proposed Works
1	Drainage Areas	Less than 2 hectares	There is 5.85 ha of the site area draining to the swale with approximately 2 ha of the drainage area contributing to sediment loading.
2	Soils Type	Soil percolation rate should be greater than 15mm/hr	Area is predominantly over loose to compact sand for a depth ranging to 3.4 m to 5.0 m. Based on historical performance, runoff has been known to infiltrate
3	Water Table Depth	The seasonally high-water depth should be greater than 1m below the bottom of the enhanced swales	Groundwater is approximately 0.3 m below ground surface, though the moisture content (24%) of the samples from the Geotechnical investigate show that the soil is not saturated.
4	Bedrock Depth	The depth to bedrock should be greater than 1m below the bottom of the enhanced swales	From the Geotechnical investigation the boreholes report bedrock as close as 4.6m below ground and in some areas 5.7m described good quality limestone bedrock, slightly weathered.
5	Cross-Section	Bottom width: >0.75m Side slopes: 2.5:1 (Typical) Maximum Depth of Flow: <0.5m (Typical) Channel Slope: <4%	Bottom width: 2m Side slopes: 20:1 to 3:1 Max Depth of Flow: 0.45m Channel Slope: 0.3% The ditch matches the criteria set forth by the MOECC.
6	Flow Velocity	Convey the peak flow from a 4-hour 25mm Chicago storm with a velocity <0.5m/s	The velocity within the ditch will be less the 0.5 m/s.
7	Swale Length	>5m	The swale is greater than 5m in length.
8	Permanent Check Dams	To promote infiltration of stormwater and the settling of pollutants, permanent check dames can be constructed at intervals along the swale systems	Permanent flow check dams will be installed within the ditch as required to help treat the stormwater.
9	Major System Events	Grassed swales must be evaluated under major system and minor system events to ensure that swales can convey these storms effectively	The major storm events are anticipated to crest the banks however given the adjacent land use (vegetated and no sediment or erosion concerns), runoff will still ultimately be directed to the intended outlet through a combination of overland sheet flow (where runoff has crested the banks) and concentrated flow (runoff within the banks).

7.0 SEDIMENT EROSION CONTROL

The site-grading contractor is responsible for ensuring sediment control structures are installed in accordance with the Site Grading and Drainage Plan as indicated. Silt fences shall be installed on site before construction or earth-moving operations begin, as shown on the Site Grading and Drainage Plan.

Geosock is to be installed under the grates of all existing structures along the frontage of the site and any new structures immediately upon installation. The Geosock is to be removed only after all areas have been paved and vegetation has been established. Care shall be taken at the removal stage to ensure that any silt that has accumulated is properly handled and disposed of. Removal of silt fences without prior removal of the sediments shall not be permitted.

At the discretion of the project manager, municipal staff or conservation authority, additional silt control devices shall be installed at designated locations.

8.0 SUMMARY

- A new 2665 m^2 single-storey Buddhist Temple will be constructed on the site located at 6688 Franktown Road including a 635 m^2 two-storey residency building.
- A new septic system will be installed to service the site including a 100 mm private service lateral to be coordinated by other as part of the septic application.
- A new well will be drilled on the site including a 100 mm diameter service lateral to the building.
- Stormwater runoff will be directed by overland sheet flow to the front and rear of the limit of development were the outlet will control the quantity and quality of the runoff.
- As discussed with the City of Ottawa staff, the stormwater management design will ensure that the post-development flow rates are restricted to the 5-year and 100-year pre-development flow rate respectively, with a calculated maximum C value of 0.5.
- Storage for the 5- through 100-year storm events will be provided within the retention area and within the enhanced grassed swales.
- The stormwater management design accounts for 80% total suspended solid removal per the Rideau Valley Conservation Authorities requirements.

9.0 RECOMMENDATIONS

Based on the information presented in this report, we recommend that City of Ottawa approve this Servicing and Stormwater Management Report in support of the proposed Bing Professional Engineering Inc. development on Franktown Road.

The sediment and erosion control plan outlined in Section 7.0 and detailed in the Grading and Drainage Plan notes are to be implemented by the contractor.

This report is respectfully being submitted for approval.

Ryan Kennedy, P.Eng.
Practice Area Lead, Land Development
McIntosh Perry Consulting Engineers
T: 613.836.2184 x 2243
E: r.kennedy@mcintoshperry.com

Sean Leflar.
Civil Engineering Technologist, Land Development
McIntosh Perry Consulting Engineers
T: 613.836.2184 x 2252
E: s.leflar@mcintoshperry.com

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10.0 STATEMENT OF LIMITATIONS

This report was produced for the exclusive use of Bing Professional Engineering Inc. The purpose of the report is to assess the existing stormwater management system and provide recommendations and designs for the post-construction scenario that are in compliance with the guidelines and standards from the Ministry of the Environment and Climate Change, City of Ottawa and local approval agencies. McIntosh Perry reviewed the site information and background documents listed in Section 2.0 of this report. While the previous data was reviewed by McIntosh Perry and site visits were performed, no field verification/measures of any information were conducted.

Any use of this review by a third party, or any reliance on decisions made based on it, without a reliance report is the responsibility of such third parties. McIntosh Perry accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions made based on this review.

The findings, conclusions and/or recommendations of this report are only valid as of the date of this report. No assurance is made regarding any changes in conditions subsequent to this date. If additional information is discovered or becomes available at a future date, McIntosh Perry should be requested to re-evaluate the conclusions presented in this report, and provide amendments, if required.

APPENDIX A:
CITY OF OTTAWA PRE-CONSULTATION NOTES

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Requirements

The following is to be brought to a Client Service Centre:

1) Application form for Site Plan Control: Application for New Development, Manager Approval, Public Consultation which can be found at: http://app06.ottawa.ca/online_services/forms/ds/site_plan_control_en.pdf
2) Application Fee Of $23,483.66
   - $21,508.66 for Site Plan Application Type
   - $ 1,000 for Engineering Design Review and Inspection Fee (unless you think should be more)
   - $975 Conservation Authority Fee
3) Plans
   - Street level visualization of the proposed development (.jpg or .pdf format) - optional
   - Survey Plan (2 copies)
   - Site Plan (10 copies)
   - Landscape Plan (10 copies) – prepared by a Landscape Architect
   - Architectural Elevation Drawings – including dimensions & materials (3 copies)
   - Grade Control and Drainage Plan (5 copies)
   - Site Servicing Plan (5 copies)
   - Stormwater Management Plan (5 copies)
   - Erosion and Sediment Control Plan (5 copies)

   All plans and drawings must be produced on A1-sized paper and folded to 21.6 cm x 27.9 cm (8½"x 11"). A scale of 1:200 is recommended for the Site and Landscape Plans.

   Studies
   - Planning Rationale including Design Statement and Integrated Environmental Review Statement (3 copies)
   - Minimum Distance Separation (MDS) (3 copies) – for institutional uses a review of a 2km radius is required.
   - Geotechnical Study (3 copies)
   - Hydrogeological and Terrain Analysis (3 copies)
   - Reasonable Use Assessment (if flows will exceed 10,000 L/d (3 copies)
   - Stormwater Management Brief (3 copies)
   - Environmental Impact Statement (3 copies)
   - Tree Conservation Report (3 copies)
   - Transportation Impact Brief (3 copies)

4) Electronic copies of all required studies and plans must be supplied on a Compact Disk on memory stick in Adobe .pdf format. These documents will be made publicly available on the City's Development Application Search Tool.

Comments

1) For more details on Development Applications can refer to links Development application review process, Guide to Preparing studies and Plans.
2) Recommend that you contact the Ward Councillor, who is Scott Moffatt (scott.moffatt@ottawa.ca or 613-580-2491), neighbours who may be impacted by the

development and the following Community groups, before submitting an application (as they will be circulated when the application is provided):

Country Club Village Community Association
Attn: Denyse MacKenzie
Phone Day: 613-253-0026
denysemackenzie@xplornet.ca
6 Links Drive South
Ashton, Ontario
K0A 1B0

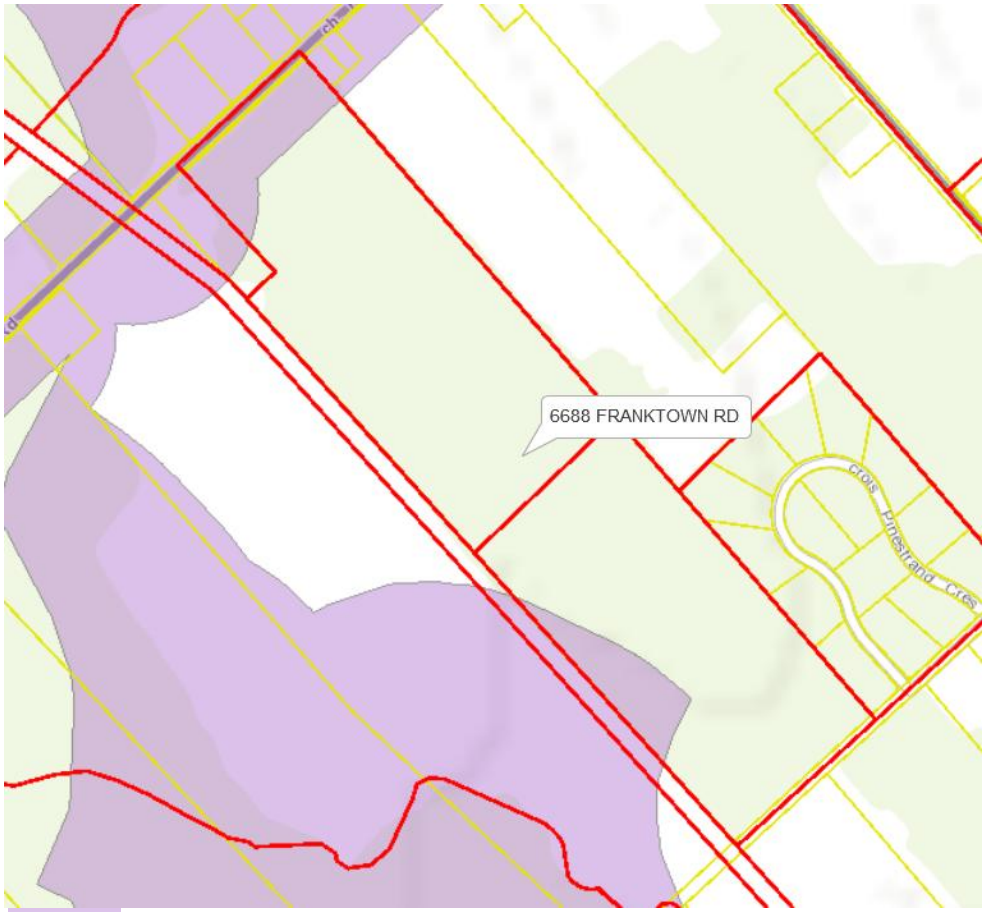
Richmond Village Association
Attn: John Shearer
Phone Day: 613-838-4830
johnshearer@richmondvillage.ca; davidproulx@richmondvillage.ca
208 Cedarstone Street
Richmond, Ontario
K0A 2Z0

3) Comments from Rideau Valley Conservation Authority (RVCA):
   - There is a ditch running along the front of the property, identified as a watercourse, tributary to the Jock River. Development is to be setback 30 metres from the watercourse. Any new crossings/relocation of culverts will be subject to a permit from the RVCA.
   - Additionally, Stormwater Management will need to demonstrate that water quality protection is maintain 80% TSS removal.
   - If the site is to be on Private Services, it may be subject to review and permitting through the Ottawa Septic Office (or MOE based on sizing)
   - Stormwater will need to be controlled post to pre for the 5 year and 100 year events.
   - the proponent will need to provide 80% TSS removal for the proposal.
   - For private on-site wastewater systems, the flows for this type of development often exceed 10,000 L/day and therefore may require approval from Ministry of the Environment and Climate Change (MOECC). If flows are less than 10,000 L per day, the Ottawa Septic System Office (OSSO) would be involved with the review through the RVCA. A permit from the OSSO or an Environmental Compliance Approval (ECA) from MOECC is normally a requirement before completion granting Site Plan Approval, to show that the proposed on-site system is consistent with the site plan.
4) Franktown Road is an arterial road. Per the City's OP a right-of-way protection of 30m is required; i.e. 15m from the existing centreline of the road to the property line.
5) The site access should be designed and implemented in accordance to the City's Private Approach By-law.
6) Depending on the interface be between the Entrance Landscape Courtyard and Franktown Road Right of Way, may want to consider a landscaped buffer between the courtyard and the front property line. The design will need to take into consideration that there is a ditch.
7) If you have any questions regarding the Transportation Impact Brief, please feel free to contact Amira directly @ amira.shehata@ottawa.ca, 613-580-2424 x 27737.
8) Planning Rationale:

- Reference to policies of the Official Plan, particularly policies 3.7.2 – General Rural Area, 3.2 – Natural Environment, 4.6.4 - Scenic Entry Route, and 4.7.5 Protection of Groundwater Resources
- References to Zoning By-law, particularly Rural Exceptions (Section 240) for RI[643r] and RI[644r], Rural Institutional Zone (Sec 223-224), Rural Countryside Zone (Section 227-228), Accessory uses, Buildings and Structures (Section 55), Place of Worship (Section 96), parking, Queuing and Loading Provisions (Section 100-114)

9) Hydrogeological:
   - Must address the fact that the subject site is within a Wellhead Protection Area
   - Will need to drill well and test it as per MOECC guidelines as a minimum (more testing may be required depending on the scope of the project—this should be discussed with the City prior to starting the hydrogeological investigation).
   - Will need to determine how MOECC defines what the City calls an accessory rooming house and what criteria to apply for the Drinking Water System.
   - Will need to include a reasonable use assessment if flows exceed 10,000 L/d.
   - Will want to start discussions with MOECC as soon as possible because it can take up to a year for their approval.
10) Require Permit To Take Water if any water taking exceeds 50,000 litres per day.
11) Not sure if MOECC will need to approve stormwater but most likely will need to approve the sewage system (if the flows >10,000 L/d). Registration with either the MOECC or the City's Health Dept. will be required depending on the category of the Drinking Water System.
12) Site Plan:
   - To show fire route
13) Environmental Impact Statement (EIS)
   - The property is indicated in Schedule L2 as part of our Natural Heritage System due to the significant woodlands which triggers an EIS along with the potential for Endangered and Threatened Species Habitat.
   - The EIS is to conform with the Council-approved guidelines which are available here: http://documents.ottawa.ca/sites/documents.ottawa.ca/files/documents/eis_guidelines2015_en.pdf
   - Consultation with the Ministry of Natural Resources and Forestry very important to ensure all endangered and threatened species are considered and some of these have very particular survey requirements, for example the Whip-poor-will.
   - Should start before the end of June due to seasonal studies being required.
   - The EIS will need to demonstrate that their project will not have a significant negative impact on the significant woodlands and that any endangered and/or threatened species habitat present is protected as per MNRF requirements.
14) Tree Conservation Report (TCR) is required to demonstrate how trees will be retained and incorporated into the landscaping.
   - could be combined with the EIS to simplify the coordination between the EIS and TCR reports.
15) The error in the zoning by-law for exception 643r has been corrected with the removal of the '-h'.
16) It appears that no development buildings are in the area of Archaeological Potential so an Archaeological Resource Assessment will not be required.
17) Will there be a connection between this property and the residential property in the northeast corner from the 6688 Franktown?

18) Design has changed significantly from the Concept Plan provided with the rezoning application, from the pre-consult in June 2005, and the downscaling noted in May of 2016..
    - Appears to be more hardscape and less features protected.
    - More parking (200 spaces)
    - Slightly larger building
    - Less uses? (previously proposed classroom, gift shop, office, main hall, conference room, storage, rooming house, pagoda
    - Private Approach - will it conform to the Private Approach By-law?
    - sculptures



Archaeological potential

APPENDIX B:
EXISTING WATERMAIN FLOW AND FIRE PROTECTION CALCULATIONS

McINTOSH PERRY

McINTOSH PERRY

CP-17-0503 - 6688 FRANKTOWN ROAD - WATER DEMANDS

Project:	6688 FRANKTOWN ROAD
Project No.:	CP-17-0503
Designed By:	SVL
Checked By:	RPK
Date:	07/09/2018
Site Area:	0.33 gross bulding in ha

AVERAGE DAILY DEMAND

DEMAND TYPE	AMOUNT	UNITS
Residential	350	L/c/d
Industrial - Light	35,000	L/gross ha/d
Industrial - Heavy	55,000	L/gross ha/d
Shopping Centres	2,500	L/(1000m² /d
Hospital	900	L/(bed/day)
Schools	70	L/(Student/d)
Trailer Parks no Hook-Ups	340	L/(space/d)
Trailer Park with Hook-Ups	800	L/(space/d)
Campgrounds	225	L/(campsite/d)
Mobile Home Parks	1,000	L/(Space/d)
Motels	150	L/(bed-space/d)
Hotels	225	L/(bed-space/d)
Tourist Commercial	28,000	L/gross ha/d
Other Commercial	*28,000*	*L/gross ha/d*
AVERAGE DAILY DEMAND	0.11	L/s

MAXIMUM DAILY DEMAND

DEMAND TYPE	AMOUNT	UNITS
Residential	2.5 x avg. day	L/c/d
Industrial	1.5 x avg. day	L/gross ha/d
Commercial	1.5 x avg. day	L/gross ha/d
Institutional	*1.5 x avg. day*	*L/gross ha/d*
MAXIMUM DAILY DEMAND	0.16	L/s

MAXIMUM HOUR DEMAND

DEMAND TYPE	AMOUNT	UNITS
Residential	2.2 x max. day	L/c/d
Industrial	1.8 x max. day	L/gross ha/d
Commercial	1.8 x max. day	L/gross ha/d
Institutional	*1.8 x max. day*	*L/gross ha/d*
MAXIMUM HOUR DEMAND	0.29	L/s

WATER DEMAND DESIGN FLOWS PER UNIT COUNT
CITY OF OTTAWA - WATER DISTRIBUTION GUIDELINES, JULY 2010

CP-17-0503 - 6688 FRANKTOWN ROAD - OBC Fire Calculations

Project:	6688 FRANKTOWN ROAD
Project No.:	CP-17-0503
Designed By:	SVL
Checked By:	RPK
Date:	07/09/2018

Ontario 2006 Building Code Compendium (Div. B - Part 3)

Water Supply for Fire-Fighting - Store/Office & Warhouse Building

Building is classified as Group : A2 (from table 3.2.2.55)
Building is of combustible construction with fire separations and fire resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2.
From Div. B A-3.2.5.7. of the Ontario Building Code - 3. Building On-Site Water Supply:

(a) Q = K x V x Stot

where:

Q = minimum supply of water in litres

K = water supply coefficient from Table 1

V = total building volume in cubic metres

Stot = total of spatial coefficient values from the property line exposures on all sides as obtained from the formula:

Stot = 1.0 + [Sside1+Sside2+Sside3+...etc.]

K	18	(from Table 1 pg A-31) (Worst case occupancy {E / F2} 'K' value used)
V	7,951	(Total building volume in m³.)
Stot	1.0	(From figure 1 pg A-32)
Q =	143,120.06 L	

From Figure 1 (A-32)

Snorth	over 10	m	0.0
Seast	over 10	m	0.0
Ssouth	over 10	m	0.0
Swest	over 10	m	0.0

*approximate distances

From Table 2: Required Minimum Water Supply Flow Rate (L/s)

4,500 L/min (if Q > 135,000 L and ≤ 162,000 L)
1189 gpm

McINTOSH PERRY

CP-17-0503 - 6688 FRANKTOWN ROAD - Fire Underwriters Survey (FUS) Fire Calculations

Project:	6688 FRANKTOWN ROAD
Project No.:	CP-17-0503
Designed By:	SVL
Checked By:	RPK
Date:	07/09/2018

From the Fire Underwriters Survey (1999)

From Part II – Guide for Determination of Required Fire Flow Copyright I.S.O.:

F = 220 x C x √A Where:

F = Required fire flow in liters per minute

C = Coefficient related to the type of construction.

A = The total floor area in square meters (including all storey's, but excluding basements at least 50 percent below grade) in the building being considered.

A. Determine The Coefficient Related To The Type Of Construction

The building is considered to be of ordinary construction type. Therefore,

C = 1.50

B. Determine Ground Floor Area

As provided by the Architect:

Floor Area (One Floor) = 3,300.00 m²

A = 3,300.00 m²

This floor area represents the final build-out of the development; as outlined on the Site Plan drawing.

C. Determine Height in Storeys

From Architectural Drawings:

Number of Storeys = 1.00

D. Calculate Required Fire Flow

F = 220 x C x √A

F = 220.00 X 1.50 X √ 3300.00

F = 18,957.06 L/min.

F = 19,000.00 L/min.

E. Determine Increase or Decrease Based on Occupancy

From note 2, Page 18 of the Fire Underwriter Survey:

Combustible - Post Office Storage

No Change

Occupancy Decrease = 0.00 L/min.

F = 19,000.00 L/min.

CP-17-0503 - 6688 FRANKTOWN ROAD - Fire Underwriters Survey (FUS) Fire Calculations

F. Determine the Decrease, if any for Sprinkler Protection

From note 3, Page 18 of the Fire Underwriter Survey:

- The flow requirement may be reduced by up to 50% for complete automatic sprinkler protection depending upon adequacy of the system.
- The credit for the system will be a maximum of 30% for an adequately designed system conforming to NFPA 13 and other NFPA sprinkler standards.
- Additional credit of 10% if water supply is standard for both the system and fire department hose lines
- If sprinkler system is fully supervised system, an additional 10% credit is granted
- The entire building will be installed with a fully automated, standardized with the City of Ottawa Fire Department and fully supervised.
- Therefore the value obtained in Step E is reduced by 0% (The building is not sprinklered)

Reduction = 19,000.00 L/min. X 0%

Reduction = 0.00 L/min.

G. Determine the Total Increase for Exposures

From note 4, Page 18 of the Fire Underwriter Survey:

- There are no existing buildings within 45m.
- Therefore the charge for exposure is 0% of the value obtained in Step E.

Increase = 19,000.00 L/min. X 0%

Increase = 0.00 L/min.

H. Determine the Total Fire Demand

- To the answer obtained in E, substract the value obtained in F and add the value obtained in G
- Fire flow should be no less than 2,000L/min. and the maximum value shoul not exceed 45,000L/min.

F = 19,000.00 L/min. - 0.00 L/min. + 0.00 L/min.
F = 19,000.00 L/min.

Therefore, after rounding to the nearest 1,000 L/min, the total required fire flow for the development is 19000 L/min (5019 GPM).

Table 1					
WATER SUPPLY COEFFICIENT - K					
TYPE OF CONSTRUCTION	Classification by Group or Division in Accordance with Table 3.1.2.1. of the Building Code				
	A-2 B-1 B-2 B-3 C D	A-4 F-3	A-1 A-3	E F-2	F-1
Building is of noncombustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches.	10	12	14	17	23
Building is of noncombustible construction or of heavy timber construction conforming to Article 3.1.4.6. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	16	19	22	27	37
Building is of combustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2.	18	22	25	31	41
Building is of combustible construction. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	23	28	32	39	53
Column 1	2	3	4	5	6

Table 3.2.2.55.
Maximum Building Area, Group D, up to 2 Storeys
Forming Part of Sentence 3.2.2.55.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1 2	1 000 800	1 250 1 000	1 500 1 200
Column 1	2	3	4

Table 2	
OBC Part 3 Buildings	Required Minimum Water Supply Flow Rate (L/min)
One-storey building with building area not exceeding 600 m^2	1800
All other buildings	2700 (if Q ≤ 108,000 L)(1) 3600 (if Q > 108,000 L and ≤ 135,000 L)(1) 4500 (if Q > 135,000 L and ≤ 162,000 L)(1) 5400 (if Q > 162,000 L and ≤ 190,000 L)(1) 6300 (if Q > 190,000 L and ≤ 270,000 L)(1) 9000 (if Q > 270,000 L)(1)

Note to Table 2:
(1) $Q = KVS_{to}$, as referenced in Paragraph 3(a)

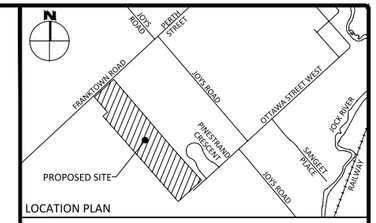
APPENDIX C:
SEPTIC APPLICATION

McINTOSH PERRY

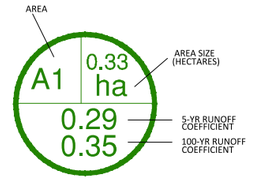
SEPTIC APPLICATION TO BE PROVIDED ONCE AVAILABLE.

APPENDIX D:
PRE-DEVELOPMENT DRAINAGE PLAN

McINTOSH PERRY



LOCATION PLAN



FOR REVIEW ONLY
NOT FOR CONSTRUCTION

No.	Revision/Issue	Date
01	ISSUED FOR REVIEW	JUL. 26, 2018

Check and verify all dimensions before proceeding with the work — Do not scale drawings

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A 1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

Stamp:

Client:
BING PROFESSIONAL ENGINEERING INC.
248 HUNTSVILLE DRIVE
OTTAWA, ON K2T 0C3

Project:
6688 FRANKTOWN ROAD
PROPOSED BUDDHIST TEMPLE
RICHMOND ONTARIO

Drawing Title:
PRE-DEVELOPMENT DRAINAGE AREA PLAN

Scale:	N.T.S
Drawn by:	S.V.L.
Checked By:	R.P.K.
Designed By:	S.V.L.

Project Number: CP-17-0503

Drawing Number: PRE

SHEET 1of 2

FILENAME: H:\01 Project - Proposals\2017 Jobs\CP\CP-17-0503 Bing Proffessional Eng Inc_Proposed Temple SPA_6688 Franktown Road\05 - Civil\15 - Drawing\CP-17-0503_Presentation.dwg
LAST SAVED: Wednesday, July 25, 2018 LAST SAVED BY: s.leflar
LAST PLOTTED: Wednesday, July 25, 2018 AT 11:13AM

APPENDIX E:
POST-DEVELOPMENT DRAINAGE PLAN

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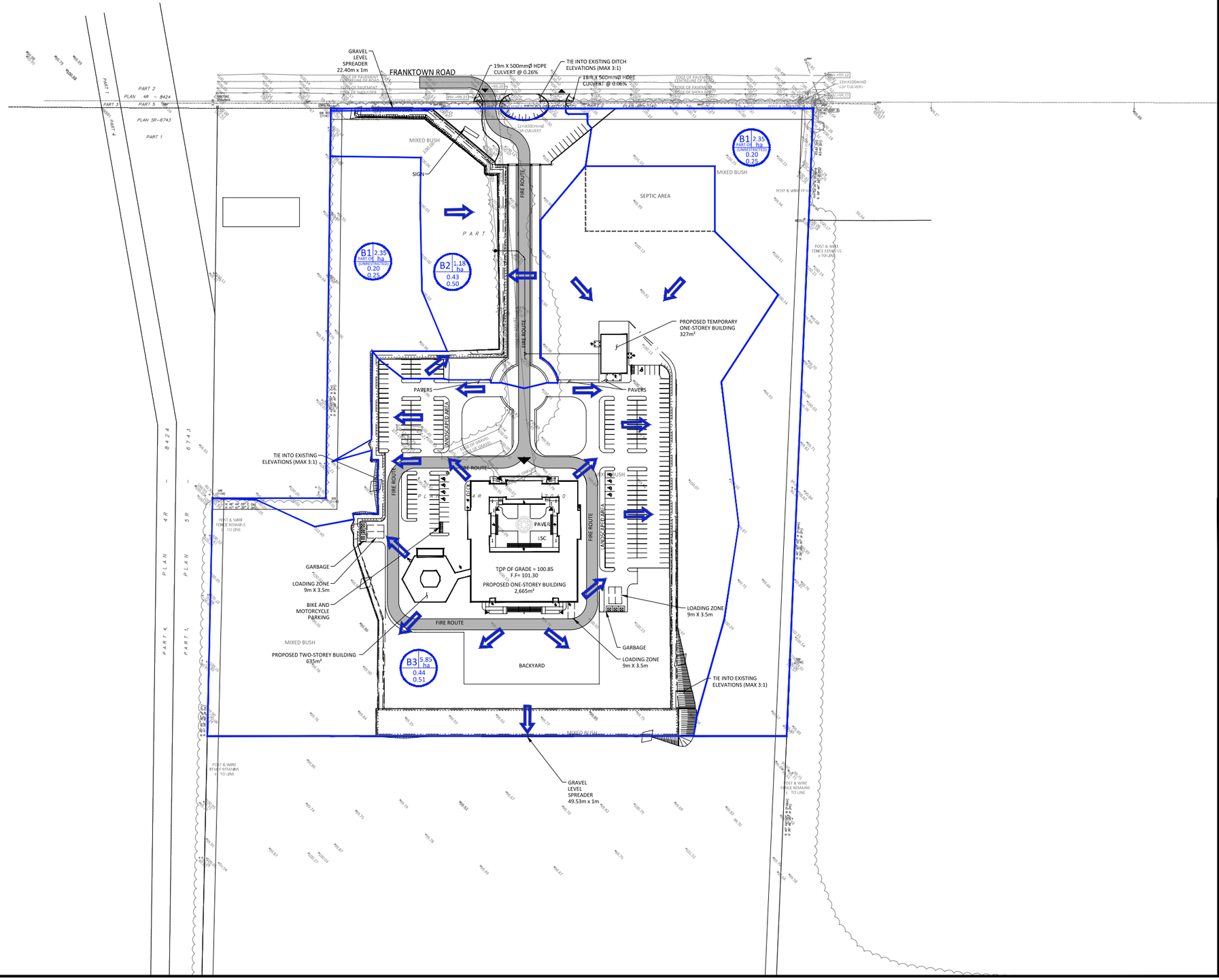

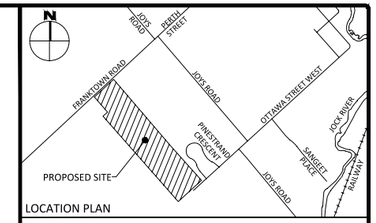

LOCATION PLAN

AREA

B1 | 0.33 ha — AREA SIZE (HECTARES)

0.29 — 5-YR RUNOFF COEFFICIENT

0.35 — 100-YR RUNOFF COEFFICIENT

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No.	Revision/Issue	Date
01	ISSUED FOR REVIEW	JUL. 26, 2018

Check and verify all dimensions before proceeding with the work — Do not scale drawings

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115 Walgreen Road, RR3, Carp, ON K0A 1L0
Tel: 613-836-2184 Fax: 613-836-3742
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Project:
6688 FRANKTOWN ROAD
PROPOSED BUDDHIST TEMPLE
RICHMOND ONTARIO

Drawing Title:
POST-DEVELOPMENT DRAINAGE AREA PLAN

Scale:	N.T.S
Drawn by:	S.V.L.
Checked By:	R.P.K.
Designed By:	S.V.L.

Project Number: CP-17-0503

Drawing Number: SHEET 2of 2 — POST

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LAST SAVED: Wednesday, July 25, 2018 LAST SAVED BY: S.Leffar
LAST PLOTTED: Thursday, July 26, 2018 LAST PLOTTED: —

APPENDIX F:
STORMWATER MANAGEMENT CALCULATIONS

McINTOSH PERRY

CP-17-0503 - 6688 FRANKTOWN ROAD - INTERIM FACILITYY RUNOFF CALCULATIONS

Pre-Development Runoff Coefficient

Area	Drainage Area (ha)	Roof/Asphalt/ Concrete (m^2)	C	Gravel (m^2)	C	Treed/Grass Area (m^2)	C	Average C (5-year)	Average C (100-year)
A1	9.38	0.00	0.90	2072.27	0.60	91764.42	0.20	0.21	0.26

Pre-Development Runoff Calculations

					I (mm/hr)		Q (L/s)	
Area	Drainage Area (ha)	C (5-Yr)	C (100-Yr)	Tc (min)	5-Year	100-Year	5-Year	100-Year
A1	9.38	0.21	0.26	20	70.3	120.0	383	817
Total	9.38						383	817

Post-Development Runoff Coefficient

Area	Drainage Area (ha)	Roof/Asphalt/ Concrete (m^2)	C	Gravel (m^2)	C	Treed/Grass Area (m^2)	C	Average C (5-year)	Average C (100-year)
B1	9.38	553.74	0.90	2567.16	0.60	90715.80	0.20	0.22	0.27

Post-Development Runoff Calculations

					I (mm/hr)		Q (L/s)	
Drainage Area ID	Total Area (ha)	C (5-Yr)	C (100-Yr)	Tc	5-Year	100-Year	5-Year	100-Year
B1	9.38	0.22	0.27	20	70.3	120.0	394	839
Total	9.38						394	839

Post-Development Restricted Runoff Calculations

	Post-Development							
Drainage Area ID	Unrestricted Flow (L/S)		Restricted Flow (L/S)		Storage Required (m^3)		Storage Provided (m^3)	
	5-year	100-Year	5-Year	100-Year	5-Year	100-Year	5-Year	100-Year
B1	394	839	394	839	-	-	-	-
Total	394	839	394	839	-	-	-	-

CP-17-0503 - 6688 FRANKTOWN ROAD - RUNOFF CALCULATIONS

Pre-Development Runoff Coefficient

Area	Drainage Area (ha)	Roof/Asphalt/ Concrete (m^2)	C	Gravel (m^2)	C	Treed/Grass Area (m^2)	C	Average C (5-year)	Average C (100-year)
A1	9.38	0.00	0.90	2072.27	0.60	91764.42	0.20	0.21	0.26

Pre-Development Runoff Calculations

					I (mm/hr)		Q (L/s)	
Area	Drainage Area (ha)	C (5-Yr)	C (100-Yr)	Tc (min)	5-Year	100-Year	5-Year	100-Year
A1	9.38	0.21	0.26	20	70.3	120.0	383	817
Total	9.38						383	817

Post-Development Runoff Coefficient

Area	Drainage Area (ha)	Roof/Asphalt/ Concrete (m^2)	C	Gravel (m^2)	C	Treed/Grass Area (m^2)	C	Average C (5-year)	Average C (100-year)
B1	2.35	0.00	0.90	0.00	0.60	23484.53	0.20	0.20	0.25
B2	1.18	3878.42	0.90	0.00	0.60	7931.15	0.20	0.43	0.50
B3	5.85	20055.214	0.90	0.00	0.60	38487.38	0.20	0.44	0.51

Post-Development Runoff Calculations

					I (mm/hr)		Q (L/s)	
Drainage Area ID	Total Area (ha)	C (5-Yr)	C (100-Yr)	Tc	5-Year	100-Year	5-Year	100-Year
B1	2.35	0.20	0.25	10	104.2	178.6	136	291
B2	1.18	0.43	0.50	10	104.2	178.6	147	291
B3	5.85	0.44	0.51	10	104.2	178.6	746	1473
Total	9.38						1029	2056

Post-Development Restricted Runoff Calculations

	Post-Development							
Drainage Area ID	Unrestricted Flow (L/S)		Restricted Flow (L/S)		Storage Required (m^3)		Storage Provided (m^3)	
	5-year	100-Year	5-Year	100-Year	5-Year	100-Year	5-Year	100-Year
B1	136	291	136	291	-	-	-	-
B2	147	291	42	89	69	128	158	165
B3	746	1473	69	437	602	663	628	687
Total	1029	2056	246	817	671	791	786	852

CP-17-0503 - 6688 FRANKTOWN ROAD - STORAGE REQUIREMENTS

Storage Requirements for Area B2

5-Year Storm Event

Tc (min)	I (mm/hr)	Runoff (L/s) BX	Allowable Outflow (L/s)	Runoff to be Stored (L/s)	Storage Required (m^3)
10	104.2	147	42	106	63
20	70.3	99	42	58	69
30	53.9	76	42	35	62
40	44.2	62	42	21	50
50	37.7	53	42	12	35

Maximum Storage Required 5-year =	69	m^3

100-Year Storm Event

Tc (min)	I (mm/hr)	Runoff (L/s) BX	Allowable Outflow (L/s)	Runoff to be Stored (L/s)	Storage Required (m^3)
10	179	291	89	202	121
20	120	195	89	107	128
30	92	150	89	61	110
40	75	122	89	34	81
50	64	104	89	16	47
60	56	91	89	3	9
70	50	81	89	-7	-31
80	45	73	89	-15	-73
90	41	67	89	-22	-116
100	38	62	89	-27	-161

Maximum Storage Required 100-year =	128	m^3

Storage Occupied In Area B2

5-Year Storm Event

		Water Elev. (m) =		99.96		
Location	Bottom of Swale	INV. (out)	Area (m^2)	Depth (m)	Head (m)	Volume (m^3)
Outlet #1	99.52	99.95	733.8	0.44	0.01	157.8

Storage Available (m^3) = 157.8	*
Storage Required (m^3) = 69.2	

100-YEAR STORM EVENT

		Water Elev. (m) =		99.97		
Location	Bottom of Swale	INV. (out)	Area (m^2)	Depth (m)	Head (m)	Volume (m^3)
Outlet #1	99.52	99.95	757.0	0.45	0.02	165.3

Storage Available (m^3) = 165.3	*
Storage Required (m^3) = 128.3	

*Available Storage calcualted from AutoCAD

CP-17-0503 - 6688 FRANKTOWN ROAD - STORAGE REQUIREMENTS

Storage Requirements for Area B3

5-Year Storm Event

Tc (min)	I (mm/hr)	Runoff (L/s) BX	Allowable Outflow (L/s)	Runoff to be Stored (L/s)	Storage Required (m^3)
20	70.3	503	69	434	521
30	53.9	386	69	317	571
40	44.2	316	69	247	594
50	37.7	270	69	201	602
60	32.9	236	69	167	601

Maximum Storage Required 5-year =	602	m^3

100-Year Storm Event

Tc (min)	I (mm/hr)	Runoff (L/s) BX	Allowable Outflow (L/s)	Runoff to be Stored (L/s)	Storage Required (m^3)
10	179	1473	437	1036	622
20	120	990	437	552	663
30	92	758	437	321	577
40	75	620	437	183	439
50	64	528	437	90	271
60	56	461	437	24	86
70	50	411	437	-26	-111
80	45	371	437	-66	-317
90	41	339	437	-98	-529
100	38	313	437	-124	-747

Maximum Storage Required 100-year =	663	m^3

Storage Occupied In Area B3

5-Year Storm Event

		Water Elev. (m) =		99.79		
Location	Bottom of Swale	INV. (out)	Area (m^2)	Depth (m)	Head (m)	Volume (m^3)
Outlet #2	99.52	99.78	2907.7	0.27	0.01	627.8

Storage Available (m^3) = 627.8 *
Storage Required (m^3) = 602.1

100-YEAR STORM EVENT

		Water Elev. (m) =		99.81		
Location	Bottom of Swale	INV. (out)	Area (m^2)	Depth (m)	Head (m)	Volume (m^3)
Outlet #2	99.52	99.78	2987.3	0.29	0.03	686.7

Storage Available (m^3) = 686.7 *
Storage Required (m^3) = 662.9

*Available Storage calcualted from AutoCAD

B2 - Broad Crested Weir - 5-yr

Project Description

Solve For	Discharge

Input Data

Headwater Elevation		0.01	m
Crest Elevation		0.00	m
Tailwater Elevation		0.00	m
Crest Surface Type	Gravel		
Crest Breadth		1.00	m
Crest Length		22.40	m

Results

Discharge	41.51	L/s
Headwater Height Above Crest	0.01	m
Tailwater Height Above Crest	0.00	m
Weir Coefficient	1.39	SI
Submergence Factor	1.00	
Adjusted Weir Coefficient	1.39	SI
Flow Area	0.27	m²
Velocity	0.15	m/s
Wetted Perimeter	22.42	m
Top Width	22.40	m

B2 -Broad Crested Weir - 100yr

Project Description

Solve For	Crest Length

Input Data

Discharge		88.52	L/s
Headwater Elevation		0.02	m
Crest Elevation		0.00	m
Tailwater Elevation		0.00	m
Crest Surface Type	Gravel		
Crest Breadth		1.00	m

Results

Crest Length	22.40	m
Headwater Height Above Crest	0.02	m
Tailwater Height Above Crest	0.00	m
Weir Coefficient	1.40	SI
Submergence Factor	1.00	
Adjusted Weir Coefficient	1.40	SI
Flow Area	0.45	m²
Velocity	0.20	m/s
Wetted Perimeter	22.44	m
Top Width	22.40	m

B3 -Broad Crested Weir - 5yr

Project Description

Solve For	Discharge

Input Data

Headwater Elevation		0.01	m
Crest Elevation		0.00	m
Tailwater Elevation		0.00	m
Crest Surface Type	Gravel		
Crest Breadth		1.00	m
Crest Length		49.53	m

Results

Discharge	68.81	L/s
Headwater Height Above Crest	0.01	m
Tailwater Height Above Crest	0.00	m
Weir Coefficient	1.39	SI
Submergence Factor	1.00	
Adjusted Weir Coefficient	1.39	SI
Flow Area	0.50	m²
Velocity	0.14	m/s
Wetted Perimeter	49.55	m
Top Width	49.53	m

B3 -Broad Crested Weir - 100yr

Project Description

Solve For	Crest Length

Input Data

Discharge		437.19	L/s
Headwater Elevation		0.03	m
Crest Elevation		0.00	m
Tailwater Elevation		0.00	m
Crest Surface Type	Gravel		
Crest Breadth		1.00	m

Results

Crest Length	49.53	m
Headwater Height Above Crest	0.03	m
Tailwater Height Above Crest	0.00	m
Weir Coefficient	1.41	SI
Submergence Factor	1.00	
Adjusted Weir Coefficient	1.41	SI
Flow Area	1.68	m²
Velocity	0.26	m/s
Wetted Perimeter	49.60	m
Top Width	49.53	m