November 3, 2015 Project No. 1522372

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CANADA

STORMWATER CONSTRAINTS SUMMARY
PROPOSED PORTAGE PARKWAY WIDENING AND EXTENSION VAUGHAN, ONTARIO

Dear Mr. Keen:

1.0 INTRODUCTION

The following letter report outlines the major stormwater constraints for the proposed Portage Parkway widening and extension. These constraints are taken as storm systems that may be impacted by the proposed reconstruction along Portage Parkway and the proposed extension over Black Creek (the Site). Constraints described below focus on three categories; storm sewers east of Black Creek, storm sewers west of Black Creek and flows in Black Creek pertaining to the proposed crossing.

This report relies on a number of data sources, including:

- Topographic survey information collected by CIMA (June 2015);
- Field investigations by Golder Associates Ltd. surface water specialists (June 2015);
- The Black Creek Optimization Study – Municipal Class Environmental Assessment Master Plan Report (Phases 1 & 2) (AECOM, February 2012);
- The Vaughan Metropolitan Centre (VMC) Municipal Servicing Class Environmental Assessment Master Plan (City of Vaughan, November 2012);
- HEC-RAS Hydraulic modelling for Black Creek provided by the Toronto Region and Conservation Authority (TRCA) (provided by email on June 22, 2015);
- Digital GIS mapping for catch basins and outfalls (City of Vaughan, provided on May 14, 2015);
- Aerial photography (City of Vaughan, 2014); and
- As-Built drawings provided by the City of Vaughan (Various).

2.0 STORMWATER SYSTEM DESCRIPTIONS

2.1 Storm Sewers – East Side

City Storm Sewer System

The storm sewer catchments east of Black Creek, adjacent to the Site, drain to Black Creek largely through two storm sewer systems; one draining the northern portion (and the other draining the southern portion.

- The northern sewer system receives drainage from Talman Court, Macintosh Boulevard, and areas further north. This system is shown discharging to Black Creek through a 2400mm diameter storm outlet from Talman Court approximately 270 m north of the site (GIS Mapping and As-Built E-00950-01).
- The southern sewer system receives drainage from Barnes Court, McLeary Court and Creditstone Road north to Macintosh Boulevard. This system includes a section along Creditstone Road as a 600mm (As-Built 65M-2696-07), shown approximately 2m below the existing grade at the proposed intersection of Portage Parkway and Creditstone Road (As-Built P-00234-05). This southern system is shown discharging to the Black Creek online stormwater pond through an 1800mm diameter storm outlet from Barnes Court, approximately 250 m south of the site (GIS Mapping and As-Built E-01011-01).

The VMC EA document does not suggest any alterations to these systems as part of the proposed redevelopment plans for the area. In addition to the two systems mentioned above, an existing ditch is shown draining an area east of Creditstone Road, crossing under the road immediately north of the proposed intersection of Portage Parkway and Creditstone Road via twin 1000mm diameter CSP pipes (As-Built P-00234-05). Historic As-Built drawings suggests this system used to discharge via a ditch to Black Creek, however aerial photography shows pipe inlets in the ditch west of Creditstone Road leading west, suggesting these flows crossing Creditstone Road are now captured in the Iron Mountain Stormwater System, described below.

Iron Mountain Stormwater System

In addition to the City storm sewers, aerial photography and survey information suggest the presence of a stormwater system on the Iron Mountain property (70 Talman Court, on the east of Black Creek and immediately north of the proposed Portage Parkway extension) that discharges to Black Creek at the location of the proposed crossing. The extent of the system is not known, but it may extend along the length of the south property boundary (approximately 200 m long), and could convey parking lot drainage along the south side of the building, as well as drainage from the area east of the building and from the roof. This system is also assumed to capture flows through in the ditch east of the site, and those flows crossing Creditstone Road via the twin 1000mm diameter CSPs (As-Built P-00234-05), as mentioned above. It is not known what type of stormwater controls are provided, however the City shows a release rate for the Iron Mountain site of 180 L/s/ha, suggesting some storage is provided. The feature in the parking lot south of the existing building is immediately adjacent to the proposed Portage Parkway extension, and could be affected by the proposed works. The proposed designs should maintain the existing functionality of this system.

Electromotion Stormwater System

In addition to the City storm sewers, aerial photography suggests the presence of a stormwater system on the Electromotion property (20 Barnes Court, east of Black Creek and immediately south of the proposed Portage Parkway extension). The absence of noted discharges to Black Creek on City mapping suggest this storm sewer could discharge to the City storm sewer on Barnes Court (although no connections are shown on As-Built P-01011-00), which in turn discharges to the online stormwater pond approximately 250 m downstream

of the site (As-Built E-01011-01). The northern portions of this feature are immediately adjacent to the proposed Portage Parkway extension, and could be affected by the proposed works. The proposed designs should maintain the existing functionality of this system.

400 Creditstone Road Stormwater System

In addition to the City storm sewers, aerial photography suggests the presence of a stormwater system on the 400 Creditstone Road property (east of Black Creek and immediately south of the proposed Portage Parkway extension). The location (away from Black Creek) suggests this storm sewer could discharge to the City storm sewer on Creditstone Road (with a 525mm diameter connection from this location to the Creditstone Road storm sewer shown on As-Built P-00234-05), flowing to Barnes Court and ultimately discharging to the online stormwater pond through a 1800mm diameter storm outlet from Barnes Court, approximately 250 m downstream of the site (GIS Mapping and As-Built E-01011-01). The northern portions of this feature are immediately adjacent to the proposed Portage Parkway extension, and could be affected by the proposed works. The proposed designs should maintain the existing functionality of this system.

2.2 Storm Sewers – West Side

City Storm Sewer System

The storm sewer catchments west of Black Creek, adjacent to the Site, drain to Black Creek largely through a storm sewer system on Portage Parkway and Millway Avenue, with catchment boundaries extending from Highway 7 to the south, Pennsylvania Avenue to the north, Jane Street to the east and Applewood Crescent in the west. GIS mapping from the City of Vaughan shows the system converging to a point on Millway Avenue approximately midway between Portage Parkway and Applemill Road, then running east under the undeveloped lands to discharge into the online stormwater pond 130 m south of the site. The VMC EA document does not suggest any alterations to this system as part of the proposed redevelopment plans for the area. Part of this system runs under Portage Parkway between Edgeley Boulevard and Jane Street and could be affected by the proposed widening of Portage Parkway. The proposed design should maintain the existing functionality of this system. Furthermore, there is a small section of storm sewer between Edgeley Road and Applewood Crescent draining west towards the stormwater pond south of Portage Parkway and adjacent to Highway 400; the portion of this system east of Applewood Crescent may be affected by the proposed widening of Portage Parkway and the proposed design should maintain the existing functionality of this system.

In addition to the sewers along Portage Parkway shown in the mapping, aerial photography also suggests a storm sewer along Jane Street adjacent to the proposed extension. This feature is immediately adjacent to the proposed Portage Parkway extension, and could be affected by the proposed works. The proposed designs should maintain the existing functionality of this system.

7941 Jane Street Storm Sewer

In addition to the City storm sewers, aerial photography and survey information suggest the presence of a stormwater system on the 7941 Jane Street property (west of Black Creek and immediately north of the proposed Portage Parkway extension). This system appears to include at least two manholes on the south side of the property, adjacent to the proposed Portage Parkway extension. GIS mapping from the City of Vaughan shows an outlet approximately 140 m north of the site; this could be the outlet for the stormwater system. This feature is immediately adjacent to the proposed Portage Parkway extension, and could be affected by the proposed works. The proposed designs should maintain the existing functionality of this system.

2.3 Black Creek

Based on the City's Black Creek HEC-RAS modelling figures (shown in the Black Creek Optimization Study), the proposed Portage Parkway crossing is located 100 m upstream of cross-sections 46.23 and 70 m downstream of cross-section 46.24. The cross-sections at this location show a channel with a top width of approximately 80 m and a maximum depth of approximately 5.5 m from the top of the section to the bottom of the channel.

Black Creek Flow

The HEC-RAS model uses steady-state modelling, meaning flow rates are user-defined and assumed to be constant, rather than a flow hydrograph with flow rates that vary as the flood peak moves downstream. The user defined constant flows for this model are considered as the peak flows from the TRCA Visual Otthymo model, which includes the online stormwater pond in order to estimate peak flow mitigation downstream of the pond.

The modelling uses a 1:100 year return period flow of 40.806 m^3/s for Black Creek at the Site, with a Regional storm flow of 108.096 m^3/s.

Black Creek Water Levels and Velocities

The peak water level in the model for the 1:100 year return period flow is 202.01 m at cross-section 46.24 (upstream of the site) and 202.02 m at cross-section 46.23 (downstream of the site). The increase in water level at the downstream section in the model appears to be the result of a decrease in channel velocity between the upstream and downstream sections (from 1.05 m/s at cross-section 46.24 to 0.37 m/s at cross-section 46.23). Bridge designs across Black Creek at this location should take into account the higher water level at the downstream section, as it takes into account the stilling effect from the downstream online stormwater pond. The water surface profile at the Site location is shown on Figure 2.

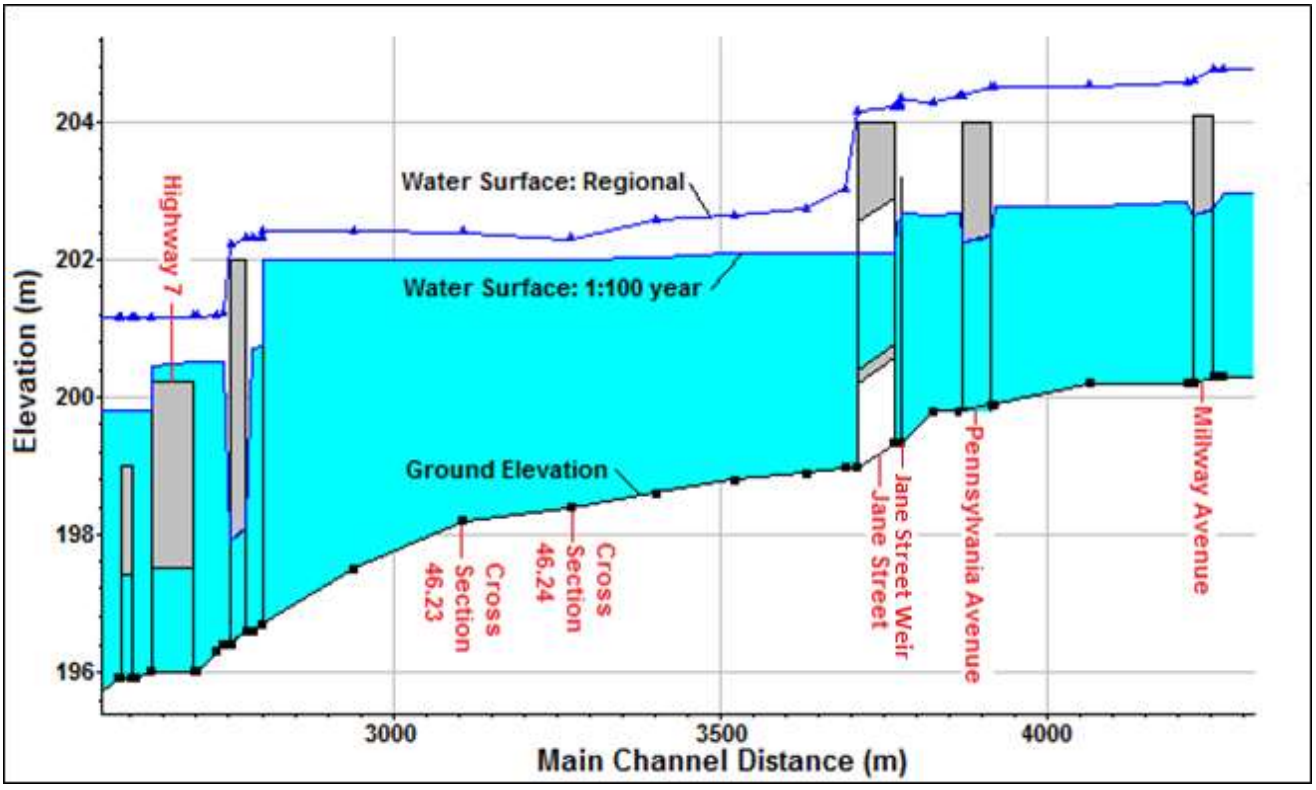

Figure 2: Black Creek HEC-RAS Results between Highway 7 and Millway Avenue

The peak water level in the model for the Regional storm flow is 202.31 m at cross-section 46.24 (upstream of the site) and 202.41 m at cross-section 46.23 (downstream of the site). The increase in water level at the downstream section in the model appears to be the result of a decrease in channel velocity between the upstream and downstream sections (from 2.49 m/s at cross-section 46.24 to 0.86 m/s at cross-section 46.23). As with the 1:100 year return period flow, bridge designs across Black Creek at this location should take into account the higher water level at the downstream section, as it takes into account the stilling effect from the downstream online stormwater pond.

Black Creek Bridge Opening Size

The Black Creek Stormwater Optimization Study describes the next three bridges upstream of the site as follows:

Table 1: Black Creek Bridge Opening Sizes

Location	Dimensions (m) (WxHxL)	# of Barrels / Openings	Total Opening Area (m^2)[1]	Capacity (Storm Event)[2]	
				Full Flow	Maximum
Millway Avenue	4.3 x 2.4 x 30	2	20.64	50-year	100-year
Pennsylvania Avenue	4.3 x 2.4 x 40	2	20.64	25-year	100-year
Jane Street	2.4 x 2.1 x 59	2	12.96	100-year	100-year
	2.4 x 1.2 x 59	1			

Notes:
[1] – Calculated from the opening dimensions
[2] – Taken from "Existing Culvert Inventory and Hydraulic Capacity Information" table on Figure 3 of the Black Creek Stormwater Optimization Study

The HEC-RAS model shows the Millway Avenue and Pennsylvania Avenue culverts surcharging (i.e., upstream water level above upstream culvert obvert) under the 1:100 year peak flow condition and overtopping under the Regional storm flow condition. Although the total opening area at the Jane Street crossing is smaller than the upstream crossings, the Jane Street section has a steeper channel slope, increasing the effective capacity. In addition, an inline weir shown in the model upstream of the Jane Street culverts would likely lead to backwater storage above the weir that would mitigate peak flows reaching the culvert. The existing channel in the location of the proposed Black Creek crossing is not as steep as the Jane Street crossing and is more consistent with the Millway and Pennsylvania crossings. The bridge opening size for the proposed Portage Parkway extension should be approximately sized to provide the same or greater opening areas as the Millway and Pennsylvania crossing in order to match the capacity of upstream culverts. However, the ultimate size will also depend on the proposed crossing material, configuration, length, and inlet and outlet treatments.

3.0 SUMMARY OF CONSTRAINTS

The points summarize the constraints introduced above:

- Widening and roadway construction should ensure that the functionality of the existing adjacent storm sewer systems is maintained;
- The existing regional flow water level for Black Creek through the Site is approximately 202.41 m, and the 1:100 year return period flow through the site is approximately 202.01 m; and
- The bridge opening area over Black Creek should provide a minimum conveyance equal to upstream crossings (i.e., 2 x 4.3 m wide x 2.4 m high) to reduce the risk of capacity reduction upstream.

Yours sincerely,

GOLDER ASSOCIATES LTD.

Christopher Davidson, B.A.Sc., P.Eng
Water Resources Engineer

Doug Kerr, B.E.Sc., P.Eng
Associate, Senior Civil Engineer

CD/DK/wlm/mp

Attachments: Figure 1: Stormwater Constraints

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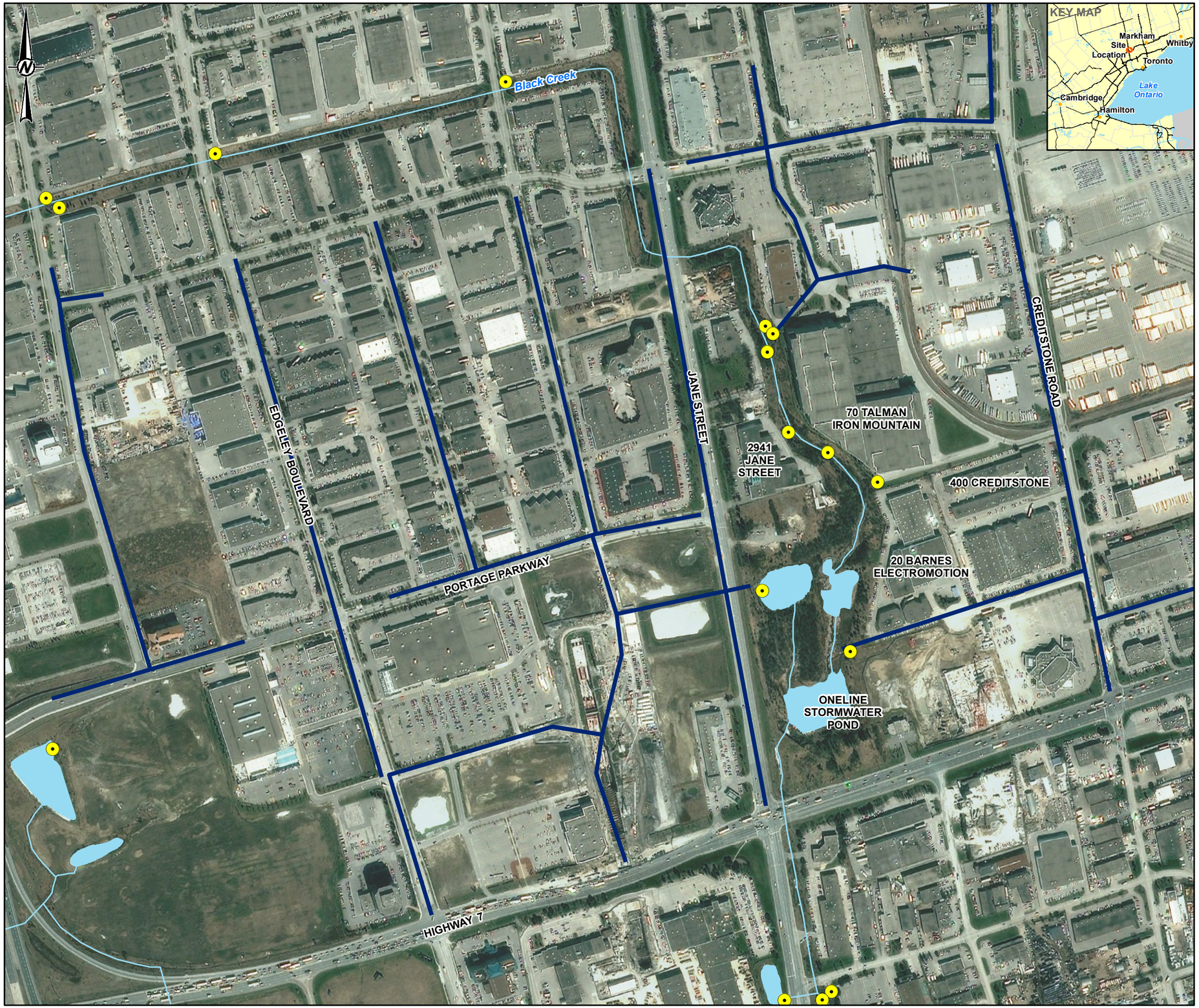

LEGEND

- STORM SEWER OUTLETS
- CITY STORM SEWERS
- WATERCOURSE
- WATERBODY

0 200 400

1:6,000 METRES

REFERENCE(S)

BASE DATA - MNR LIO, OBTAINED 2015
PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM
ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2015
IMAGERY - ESRI WORLD IMAGERY WMS, CNES/AIRBUS DS, 0.5M, 4/22/2013
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17

CLIENT
CITY OF VAUGHAN

PROJECT
VAUGHAN PORTAGE PKWY EA
STORMWATER CONSTRAINTS REPORT

TITLE
STORMWATER CONSTRAINTS

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-11-03
DESIGNED	ME
PREPARED	ME
REVIEWED	CD
APPROVED	DK

PROJECT NO.	CONTROL	REV.	FIGURE
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