MOOREFIELD PROPERTIES LTD.

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

154 and 164 Cemetery Road, Township of Uxbridge

Project No.: UD16-0349

COLE ENGINEERING

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COLE ENGINEERING GROUP LTD.

HEAD OFFICE
70 Valleywood Drive
Markham, ON CANADA L3R 4T5
T. 905.940.6161 | 416.987.6161
F. 905.940.2064 | www.ColeEngineering.ca

GTA WEST OFFICE
151 Superior Boulevard, Units 1 & 2
Mississauga, ON CANADA L5T 12L1
T. 905.364.6161
F. 905.364.6162

PREPARED BY:

COLE ENGINEERING GROUP LTD.

Leila Zavareh, E.I.T.
Designer
Urban Development (ICI)

CHECKED BY:

COLE ENGINEERING GROUP LTD.

Nav Grewal
Team Leader, Technical Services
Urban Development (ICI)

CHECKED BY:

COLE ENGINEERING GROUP LTD.

LICENSED PROFESSIONAL ENGINEER
C. D. SHENG
100117409
Nov. 24, 2016
PROVINCE OF ONTARIO

Chaodong Sheng, P.Eng.
Senior Water Resources Engineer
Urban Development (ICI)

AUTHORIZED FOR ISSUE BY:

COLE ENGINEERING GROUP LTD.

LICENSED PROFESSIONAL ENGINEER
T. W. WRIGHT
100146459
11/28/16
PROVINCE OF ONTARIO

Tyson Wright, P.Eng.
Vice President
Urban Development (ICI)

Issues and Revisions Registry

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Draft Report	October 2016	For Zoning By-law Amendment
Final Report	November 2016	For Zoning By-law Amendment

Statement of Conditions

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1 Introduction

1.1 Background

Cole Engineering Group Ltd. (Cole Engineering) was retained by Moorefield Properties Ltd. to Prepare a Functional Servicing and Stormwater Management Report in support of Zoning By-law Amendment Application for a proposed residential development at 154 and 164 Cemetery Road, in the Township of Uxbridge (the "Township"), Regional Municipality of Durham (the "Region"). The development comprises 56 townhouses and a three-story apartment building with access on a private road. The purpose of this report is to provide site-specific information for the Township and Region to review with respect to infrastructure required to support the proposed development regarding storm drainage, water supply, and sanitary discharge. More specifically, the report will Present the following:

- Identify sanitary servicing opportunities and constraints, including:
  - Calculate existing and proposed sanitary flows;
  - Review the capacity of the existing sanitary service connections; and,
  - Ensure that there is enough capacity on the receiving Regional sewers to accommodate the additional sanitary flows from the proposed development.
- Evaluate the existing Regional water system, including:
  - Calculate the proposed domestic water and firefighting supply needs; and,
  - Confirm that it has adequate flow to meet the additional required domestic and fire flow demands for the proposed development.
- Evaluate on a Preliminary basis the Stormwater Management (SWM) opportunities and constraints, including:
  - Calculate allowable and proposed runoff rates for the development;
  - Evaluate suitable methods for attenuation and treatment of stormwater runoff;
  - Develop and propose on-site control measures and examine theoretical performance; and,
  - Demonstrate compliance of the proposed stormwater control measures with Township, the conservation authorities, and the Ministries of the Environment and Climate Change (MOECC) and the Ministry of Natural Resources and Forestry (MNRF).

The following documents were reviewed during the Preparation of this report:

- Plan and profile drawing of Cemetery Road, Prepared by Sernas Associates, drawing numbers: P-106 and P-107;
- Plan and profile drawings of Toronto Street from Douglas Road to Cemetery Road Prepared by Totten Sims Hubicki Associates Engineers Architects and Planners, drawing numbers 20330-S7 to S11 and 20330-W1 to W4, dated March 1997;
- Plan and profile drawings of Toronto Street from 6th Concession Road to Cemetery Road Douglas Road Prepared by Chisholm, Fleming and Associates Consulting Engineers drawing Numbers U-06-R-309 to 311, dated January 2010;
- Hydrogeological Investigation Cemetery Road Uxbridge Proposed Development, Prepared by Nobert M. Woerns, dated January 30, 2009; and,
- Stormwater Management Design Brief, Prepared by Sernas Associates, dated February 2009.

1.2 Site Description

The subject site is located at the northwest corner of Cemetery Road and Toronto Street (Hwy No. 47) in the Township of Uxbridge, Regional Municipality of Durham. The existing site is approximately 9.5 ha in size which is occupied by two (2) framed garages, three (3) residential dwellings and a ½ metal clad building. There is a wetland located on the south side of the site, which separates the development into two (2) parcels, north and south. The wetland is classified as a Provincially Significant Wetland. The legal description is as follows: Part of Lots 26 and 27 Concession 6, Township of Uxbridge.

The site is bound by Cemetery Road to the west, Toronto Street to the south, and a residential dwelling to the north. Refer to **Figures FIG 1** and **FIG 2** following the report for location plan and aerial map of the site location.

2 Site Proposal

The proposed development consists of two (2) parcels which are separated by a wetland. The north development (north parcel) is 1.45 ha in size with a total building coverage of approximately 14,550 m^2 composed of 56 townhouse units. The access to the townhouses will be through two (2) private roads (Street A and Street B) from Cemetery Road. The south development (south parcel) is 0.15 ha in size with a total building coverage of 1,462 m^2 composed of a three-story apartment building with 12 units and a parking lot, located on the northwest corner of Cemetery Road and Toronto Street. Refer to **Appendix A** for details.

3 Terms of Reference and Methodology

3.1 Terms of Reference

Design criteria for the municipal services will be in accordance with the Region, Township, and MOECC:

- Post-development peak flows for all events from the site should be controlled to the peak flow resulting from the Pre-development conditions;
- Stormwater should be treated to Enhanced Protection (Level 1) as defined in the MOECC Stormwater Management Planning & Design (SWMPD) Manual (2003); and,
- The Township's intensity-duration-frequency (IDF) data was used for the quantity control analysis.

3.2 Methodology: Stormwater Drainage and Management

The SWM portion of this report demonstrates that the required quality and quantity controls will be achieved as per the provincial, conservation authority and municipal standards. The Preliminary SWM facility design, including on-site SWM storage sizing calculations and Post- to-Pre- peak flow attenuation, water balance and infiltration gallery sizing calculations are provided. The SWM standards applied are summarized below.

Water Quality

As per MOECC SWMPD Manual (2003), Level 1 (enhanced) quality control (i.e. long-term average removal of 80% of the total suspended solids (TSS) on an annual loading basis) shall be achieved.

Water Quantity

Post- to-Pre- peak flow attenuation up to and including 100-year storm shall be achieved. In this case, on-site control is proposed using underground storage (i.e. super pipes). The release rates will be controlled using a flow regulation device (i.e. orifice plate). The Modified Rational Method is applied for sizing the storage volume using the IDF curves specified in the Township standards.

Water Balance

Post- to Pre- water balance shall be achieved as per the Lake Simcoe Region Conservation Authority (LSRCA)'s Stormwater Management Guidelines.

3.3 Methodology: Sanitary Discharge

The sanitary sewage discharge from the proposed site was determined using sanitary sewer design sheets based on Region's Design Standards that consider the land use and building statistics as supplied by the design team. The calculated values provide peak sanitary flow discharge with infiltration considerations.

The estimated sanitary discharge flows from the existing site as well as the proposed site will be calculated based on the criteria shown in **Table 3.1** below.

Table 3.1 Sanitary Flows

Usage	Design Flow	Units	Persons
Existing Residential	364	Litres / person / day	Single Family Dwelling: 3.5 Persons/Unit
Residential	364	Litres / person / day	Townhouses 3.0 Persons/Unit Apartment Building 3.5 Persons/Unit

Based on the calculated peak flows, the adequacy of the existing infrastructure to support the proposed development will be discussed.

3.4 Methodology: Water Usage

The proposed watermain system will be designed in accordance with the following guidelines and standards:

- Region of Durham's Design Specifications, dated April 2014;
- The MOECC Design Guidelines for Drinking-Water Systems, dated 2008; and,
- Fire Underwriters Survey (FUS), Water Supply for Public Fire Protection, dated 1999.

The system design pressure and demand requirements for the subject development are summarized in the **Table 3.2** below.

Table 3.2 Water Supply Design Criteria

Design Criteria	Requirement
Domestic Demand	Average daily demand of 364 litres/capita/day
Residential Population Density	3.0 persons per unit (ppu) for townhouses; 4.5 ppu for apartment (for a conservative design)
Peaking Factor	Maximum Day = 2.75 and Peak Hour = 4.13 for population less than 1,000 for the subject development (MOECC, 2008)
Fire Flow	Calculated as per Water Supply for Public Fire Protection (FUS, 1999)
System Pressure	Minimum Pressure = 275 kPa (40 psi) under normal operating condition Minimum Pressure = 140 kPa (20 psi) during Maximum Day + Fire Flow Maximum Pressure = 700 kPa (100 psi) under any flow scenario
Pipeline Sizing	Minimum size of 150 mm diameter in residential areas; 300 mm diameter in commercial, Industrial and institutional areas.
"C" Factor	C=100 for 150 mm diameter watermain C=110 for 200 to 300 mm diameter watermain C=120 for 350 to 600 mm diameter watermain

The required fire flows of 117 L/s for the townhouse block and 83 L/s for the apartment building were calculated using the FUS 1999 guideline. The details of the fire flow requirement are provided in the **Section 6.2.1**and **Appendix D**.

4 Stormwater Management and Drainage

4.1 Design Criteria

As Previously mentioned, the proposed SWM scheme is proposed to meet the MOECC SWMPD Manual (2003), LSRCA's Technical Guidelines and Township standards. The following design criteria will be applied:

- Quality Control: Level 1 Enhanced Level protection as defined in the MOECC SWMPD Manual (2003);
- Quantity Control: Post- to Pre- peak flow attenuation for the 1:2 year to 1:100 year design storm events. The Township's IDF data to be used for analysis; and,
- Water Balance: Post-development to Pre-development water balance.

4.2 Existing Conditions

Based on the existing topographic information, the site is divided into two (2) sections by a naturally formed wetland. Therefore, the 1.92 ha area north of existing wetland will be referred to as the north residential block, while the 0.15 ha area south of the existing wetland will be referred to as the south apartment block.

The existing north section of the site Predominantly drains from the northwest to the southeast and outlets to an existing wetland to the south of the site. This drainage is conveyed underneath Cemetery Road via an existing box culvert. A small portion of the site (A1 Pre) in the northwest corner of the site drains to the northwest and is part of the Uxbridge Brook watershed. An external drainage from the west conveys through the site and drains to the existing wetland.

The existing south section of the site (south of the wetland) drains radially towards the existing wetland. **Figure DAP-1** in **Appendix B** illustrates the Pre-development drainage area plan.

The majority of the land is open space with scattered buildings. **Table 4.1** below shows the parameters calculation results, including runoff coefficient, as per the existing land use.

Table 4.1 Target Input Parameters

Catchment ID	Drainage Area (ha)	C	Tc (min)
A1 Pre	0.15	0.35	10
A2 Pre	0.48	0.29	10
A3 Pre	1.28	0.29	10
Ext 1	0.49	0.29	10
A4 Pre	0.15	0.25	10

Peak flows calculated for the existing conditions in the north residential block are shown in **Table 4.2** below. The target flows for the Post-development flow rates can be seen in the bottom row. Please note that the area A1 Pre is not included in the target release rates calculations since it outlets to the watercourse to the north instead of the wetland, as the existing conditions. Over-control will be provided to compensate the slight drainage boundary adjustment. The detailed calculations can be found in **Appendix B**.

Table 4.2 Target Peak Flows (North Residential Block)

Catchment ID	Peak Flow Rational Method (L/s)				
	2-Year	5-Year	10-Year	25-Year	100-Year
A1 Pre	11.3	15.8	18.6	22.8	29.6
A2 Pre	29.4	41.0	48.3	59.3	76.9
A3 Pre	80.3	111.9	131.8	161.7	209.8
Ext 1	30.7	42.8	50.5	61.9	80.3
Total	151.8	211.5	249.2	305.7	396.6
Target Release Rates	140.4	195.8	230.6	282.9	367.0

Peak flows calculated for the existing conditions in the south apartment block are shown in **Table 4.3** below. The corresponding detailed calculations can be found in **Appendix B**.

Table 4.3 Target Peak Flows (South Apartment Block)

Catchment ID	Peak Flow Rational Method (L/s)				
	2-Year	5-Year	10-Year	25-Year	100-Year
A4 Pre	8.0	11.1	13.1	16.1	20.9
Target Release Rates	8.0	11.1	13.1	16.1	20.9

4.3 Stormwater Management Scheme

In order to achieve the required quantity controls (i.e. the Post-development flow rates are to be controlled to the corresponding Pre-development levels, established in **Section 4.2**. On-site underground storage using super pipes is proposed. **Figure DAP-2** in **Appendix B** provides the Post-development drainage plan. The drainage characteristics under the Post-development drainage plan are summarized in **Table 4.4** below.

Table 4.4 Post-Development Input Parameters

Catchment ID	Drainage Area (ha)	C	Tc (min)
A1 Post (Controlled Rooftops and Roads – North Block)	1.47	0.63	10
A2 Post (Uncontrolled Back Lots – North Block)	0.21	0.47	10
A3 Post (Uncontrolled Back Lots and Parkette – North Block)	0.23	0.39	10
A4 Post (Uncontrolled Back Lots – South Block)	0.07	0.25	10
A5 Post (Controlled Rooftops and Parking Lot – South Block)	0.08	0.87	10
Ext 1 (External Drainage Area)	0.49	0.29	10

North Residential Block

Under the Post-development conditions for the north residential block, including A1 Post, A2 Post and A3 Post, A2 Post and A3 Post, which have the backyards draining to the watercourse / wetland / parkette, will be draining uncontrolled. Majority of the site (i.e. A1 Post) will be controlled via a proposed super pipe. Other than compensating the flow from A1 Pre, the required storage volume for A1 Post will be further oversized to compensate the uncontrolled flows from A2 Post and A3 Post. A cut-off swale will be installed to redirect the flow from the existing external drainage area (i.e. Ext 1), to the existing wetland. Under the post-development conditions, Ext 1 will not by-pass via the site and its outlet point to the wetland will be slightly moved westerly. The controlled flows from the super pipes will ultimately outlet into the existing wetland, where it will be conveyed further through the existing culvert underneath Cemetery Road.

South Apartment Block

The post-development conditions for the south apartment block are reflected by two (2) drainage areas. A4 Post consists of the uncontrolled landscaped area surrounding the proposed apartment building which drains to the wetland, directly uncontrolled. Catchment A5 Post includes the rooftop of the apartment, as well as the proposed parking lot and a few landscaped areas. This catchment (i.e. A5 Post) will drain to an underground storage system, and then outlet towards the existing wetland. The underground storage system A5 Post will also be oversized to compensate the uncontrolled area (i.e. A4 Post).

4.3.1 Quality Controls

As per MOECC standard, annual 80% TSS removal rate for the entire site is required and will be achieved using an oil / grit separator (OGS), associated with the drainage areas where the backyards draining to the watercourse / wetland without having the runoff mixed with the road flows. As per the most current standard, Jelly-fish style of OGS will be proposed to achieve the 80% TSS removal without providing “treatment train” which is not feasible due to the site constraints. The combination of the proposed quality control measures provides a total annual TSS removal rate of 95% (see **Table 4.5** below for calculation summary). Refer to the detailed water quality calculations in **Appendix B**.

Table 4.5 Quality Control Summary

Surface	Method	Effective TSS Removal	Area North (ha)	Area South (ha)	Total Area (ha)	% Area of Site	Overall TSS Removal
Roof Area	Inherent	100%	0.57	0.03	0.60	29%	29%
Pavement	N/A	80%	0.42	0.05	0.47	23%	18%
Landscape	Inherent	100%	0.93	0.07	1.00	48%	48%
Total	-	-	1.92	0.15	2.07	100%	95%

4.3.2 Quantity Controls

Modified Rational Method was applied to determine the storage volume required during the 2-, 5-, 10-, 25-, and 100-year storm events. A summary of the results for the north residential block is provided in **Table 4.6** below and the detailed calculations are found in **Appendix B**.

Table 4.6 Post-Development Quantity Control as per Criteria – North Residential Block

Storm Event	Target Flow (L/s)	Underground Storage Required (m^3)	Controlled Release Rate (L/s)	Uncontrolled Release Rate (L/s)	Maximum Site Release Rate (L/s)
2-Year	140.4	82.1	64.6	66.7	131.3
5-Year	195.8	117.8	87.0	93.0	180.1
10-Year	230.6	142.1	99.8	109.6	209.4
25-Year	282.9	175.6	115.6	134.5	250.0
100-Year	367.0	229.8	151.9	174.5	326.3

As illustrated in **Table 4.6**, in order to control post-development flows to the corresponding pre-development levels, a 225 mm diameter orifice plate will be installed to control the post-development flows to meet the target release rates for all storms. Refer to **Appendix B** for detailed orifice calculations.

A summary of the Post-development quantity calculations for the south apartment block can be seen in **Table 4.7** below and detailed calculations can be found in **Appendix B**.

Table 4.7 Post-Development Quantity Control as per Criteria – South Apartment Block

Storm Event	Target Flow (L/s)	Underground Storage Required (m^3)	Controlled Release Rate (L/s)	Uncontrolled Release Rate (L/s)	Maximum Site Release Rate (L/s)
2-Year	8.0	5.1	6.4	3.5	9.9
5-Year	11.1	7.7	7.9	4.9	12.8
10-Year	13.1	9.4	8.8	5.8	14.6
25-Year	16.1	12.0	10.0	7.1	17.1
100-Year	20.9	16.6	11.9	9.2	21.1

For the south apartment block, a 75 mm diameter orifice plate (the minimum allowable orifice plate size) will be installed to regulate the post-development flows to meet the target release rates. Please note that the controlled flows are determined by the minimum allowable orifice size in this case, and it consequences that the post-to-pre flow attenuation is not achievable by considering the south apartment block. The post- to pre- flow attenuation will be achieved for the entire site (total of the north block and south block). The north residential block will have to provide further over-controls to compensate the slightly increase of the flows from the south apartment block. **Table 4.8** below compares the total site's target flows to the control release rates, demonstrating that the design criteria has been satisfied. Please note that there are a slight increase of the post-development flow on the 2- to 10-year flows, these increases were caused by the limitation of flow control devise sizing.

Table 4.8 Post-Development Target Flow and Release Rate Comparison

Storm Event	Target Flow Rate			Actual Release Rate		
	North Block (L/s)	South Block (L/s)	Total Site (L/s)	North Block (L/s)	South Block (L/s)	Total Site (L/s)
2-Year	140.4	8.0	**148.4**	131.3	9.9	**141.2**
5-Year	195.8	11.1	**206.9**	180.1	12.8	**192.9**
10-Year	230.6	13.1	**243.7**	209.4	14.6	**224.0**
25-Year	282.9	16.1	**299.0**	250.0	17.1	**267.1**
100-Year	367.0	20.9	**387.9**	326.3	21.1	**347.4**

4.3.3 Underground Storage System

The required underground storage volume for the North Residential Block is calculated as 227.0 m^3, which will be achieved using a combination of 1,800 mm by 900 mm box culvert and 450 mm and 375 mm storm sewer pipes, as well as a series of oversized manholes. The details and sizes of each component can be found in **Appendix B**. The lowest catchbasins will be functioning as the spill route, which regulate the hydraulic grade line and ensure the individual lots will not be impact during 100-year storm while the underground storage is full.

For the south apartment block, the storage volume is provided using a Terrafix Triton S-29 underground storage systems or its equivalent systems. The system will provide a storage volume of 17.8 m^3 for the runoff generated from the parking lot and rooftop. Additional storage system details can be found in **Appendix B** of this report.

4.3.4 Water Balance

The LSRCA's Stormwater Management Guidelines indicate that every effort is to be made to match the post-development infiltration volumes to the pre-development levels on an annual basis. As such, an infiltration storage tank was designed to be located underneath of the parkette in the North Residential Block and was sized to provide adequate volume to achieve post- to pre- water balance. Please note that the required infiltration volume was calculated for the entire site (i.e. north block and south block), and even the infiltration gallery was proposed to be located on the North Residential Block due to the site constraints.

The infiltration gallery was sized to have a storage volume of 119.7 m^3, which will provide approximately 2,440 m^3 infiltration capacity in an average year. The overall annual infiltration capacity was estimated to be 5,838 m^3, which exceeding the existing capacity of 4,922 m^3. Please refer to **Appendix B** for detailed water balance calculations.

4.3.5 Phosphorus Loading Calculations

As the development is part of the Lake Simcoe Watershed, the phosphorus loading resulting from the proposed development must be identified. The phosphorus loading analysis for pre and post-development conditions was completed using the MOECC Lake Simcoe Phosphorous Loading Development Tool. The pre-development conditions were simulated applying a land use type of 'Hay-Pasture', and some scattered residential buildings. The total phosphorus loading under Pre-development conditions is 0.17 kg/year.

The post-development conditions were simulated by applying a land use type of 'High Intensity Development' for the 2.07 ha of lands. The new annual phosphorus loading was estimated to be 2.73 kg. With the proposed Underground storage + Infiltration Trench for the north parcel and the underground storage for the south parcel, the mitigated annual phosphorus loading with Best Management Practices was estimated as 1.16 kg.

Please note that the overall phosphorus loading under post-development conditions is approximately 1.0 kg/year higher than that under the existing conditions. Therefore, additional phosphorus mitigation measures will be required, and will be proposed during detailed design stage.

5 Sanitary Drainage System

5.1 Existing Sanitary Drainage System

According to the plan and profile drawings from the Township and the Region, there is an existing 300 mm diameter sanitary sewer on Toronto Street running along the north side of the street.

No sanitary sewer is present on Cemetery Road with the existing dwellings on the subject site on private sewage.

5.2 Existing Sanitary Flows

According to the reviewed information, the existing site is serviced by private sewage works and there is no municipal sanitary service connection for the existing site.

5.3 Proposed Sanitary Flows

The proposed sanitary discharge flows from the site were calculated based on the proposed building and site statistics, using the criteria listed in **Section 3.3**. Peaking factors were applied using the Harmon Peaking Factor as per the Region standards. The number of proposed residential units were considered in the analysis in order to evaluate the adequacy of the existing municipal infrastructure. The design inputs for the site is shown in **Table 5.1** below.

Table 5.1 Equivalent Population Calculations (Residential)

Unit Size	Number of Units	Persons (ppu)	Total Persons
Townhouses (north parcel)	56	3	168
3-Bedroom Apartment Building (south parcel)	12	3.5	42

The sanitary discharge flow was calculated using the Region's guidelines as detailed in **Section 3.3, Table 3.1**. Based on this criteria, a total design flow of 4.0 L/s was calculated for the proposed development. According to the Region, there is adequate capacity in the existing sanitary sewer to permit the proposed development of consisting of 56 townhouses and 12 apartment building units. Refer to **Appendix C** for correspondence email provide by the Region.

5.4 Proposed Sanitary Connection

5.4.1 Sanitary Sewer Extension

A 300 mm diameter sanitary sewer is proposed to be extended from the intersection of Toronto Street and Cemetery Road, north on Cemetery Road. This sanitary sewer is to be extended to the north limit of the subject property, and will service the proposed developments, north parcel and south parcel. Refer to **Drawing PP-01** in **Appendix E** for the conceptual plan and profile of the sanitary sewer extension.

5.4.2 North Parcel

The proposed condominium townhome development will be serviced by a private sanitary sewer network, consisting of 200 mm diameter sewer within the private road network. The sanitary sewer network will be connected to the Regional 300 mm diameter sanitary sewer, extended north along Cemetery Road. The north parcel will be connected to the extended sewer on Cemetery Road at a single location the intersection of Street B and Cemetery Road. Each townhome will be serviced by a 100 mm diameter sanitary connection, as per municipal standards. Refer to **Drawing GP-01** in **Appendix E** for the proposed servicing layout.

5.4.3 South Parcel

The proposed apartment building will be serviced by a 200 mm diameter sanitary sewer connection which will connect to the Regional 300 mm diameter sanitary sewer, extended north along Cemetery Road. A control maintenance hole will be installed at the property line to service the south parcel. Refer to **Drawing GP-01** in **Appendix E** for the proposed servicing layout.

6 Water Supply System

6.1 Existing Water System

Based on the review of the Region's water supply system, the subject site is located within the pressure Zone 1 of the Uxbridge Water System. The water supply is from two (2) municipal wells (Wells No. 5 and No. 6). The existing Quaker Hill reservoir provides water storage and maintains system pressure for the Zone 1 water system. The reservoir is located at Concession Road 6, south of Bolton Drive. The Top Water Level (TWL) in the existing reservoir is 331 m and Low Water Level (LWL) is assumed 328 m, approximately 0.65 above the bottom of the reservoir.

A 300 mm diameter watermain exists along Toronto Street South on south of Cemetery road, east of the subject site. There is an existing 300 mm diameter watermain with plug located at Toronto Street South and Cemetery Road. This watermain plug will provide water service connection for the proposed development.

In order to confirm the available system head / pressure along the existing pipeline in the vicinity of the site, Cole Engineering performed one (1) fire hydrant flow test near the proposed watermain connection on Toronto Street South and Cemetery Road on September 29, 2016. The detected static pressure was approximately 432 kPa (or 63 psi, corresponding to a system head of 332.4 m). The pressure / system head dropped by approximately 18 m and the system head was reduced to 314 m when the hydrant was flowing at 107 L/s. The hydrant flow test data and results are shown in **Appendix D**.

Based on the fire flow test results, the static hydraulic grade line near the subject site location is equal to approximately 332 m (virtually equal to top water level of the existing reservoir). The fire flow test results and the extrapolated system pressure indicate that the required fire flow rate of 117 L/s would be available in the system near the proposed watermain connection at 35 psi (system head of 313 m). A watermain analysis via a hydraulic model was performed to assess the available system head and pressure within the subject site under the proposed development.

The hydrant test results and the extrapolated system head were used as the system boundary conditions for the hydraulic analysis to estimate the anticipated system pressure within the subject site. The water supply boundary in the hydraulic analysis was modelled as a dummy pump and reservoir at the pressure measurement location of the field test. A dummy pump curve (head vs. flow) was established based on the flow test results and input to the model.

6.2 Proposed Water Servicing Requirements

A total of 56 townhouse units and a three-storey apartment building, located at the southeast corner are to be developed within the subject site.

A proposed 300 mm diameter watermain (east of the subject site) along Cemetery Road will be connected to the existing 300 mm watermain plug at Toronto Street South and Cemetery Road. This proposed 300 mm watermain will be terminated at location near the north boundary of the subject site. The watermain turns into the subject site near the proposed Street A. Based on the proposed layout of the subject site, the proposed townhouse and apartment buildings can be serviced as follows:

- Townhouse Buildings: A domestic flow meter will be installed in the 150 mm domestic watermain and backflow check valve preventer will be installed to the 300 mm fire watermain. The flow meter and the backflow check valve Preventer will be put inside a meter building, as shown in **Drawing GP-01** in **Appendix E**;
- Apartment Building: The 3-storey apartment building is to be serviced by the 150 mm domestic watermain with a connection to the proposed 300 mm watermain along Cemetery Road. Existing hydrant at Toronto Street South and Cemetery Road will provide fire protection coverage to the apartment building; and,
- The proposed water servicing layout is illustrated in **Drawing GP-01** in **Appendix E**.

6.2.1 Estimated Water Demand

The estimated water consumption for the proposed development was calculated based on the occupancy rates shown in **Table 3.2**. It is anticipated that an average daily consumption of approximately 0.9 L/s, a maximum daily consumption of 2.6 L/s, and a peak hourly demand of 3.9 L/s will be required to service the development with domestic water. Refer to detailed calculations located in **Appendix D**. The site development plan is illustrated in **Drawing GP-01** in **Appendix E**.

The required fire flows for the proposed buildings are based on the FUS 1999.

Based on the proposed building and system layout, the fire suppression flow of approximately 83 L/s is required for the proposed apartment building, at the southeast corner of the site.

The townhouse blocks consist of up to six (6) units. It was assumed that the buildings will consist of ordinary construction (brick or other masonry walls, combustible floor and interior), limited combustible occupancies and provision of fire separation (e.g. fire separation to be installed every three (3) units) within the townhouse blocks.

The fire flow on Street B is identified as requiring the critical fire flow - longest distance from fire watermain connection. The required fire flow is estimated at approximately 117 L/s at the three (3) townhouse units (e.g. units 24 to 26) on Street B.

The calculations for the fire flows for these buildings are provided in **Appendix D**.

6.2.2 Proposed System Pressure

The Water CAD hydraulic model was used to estimate the system pressure within the site development. **Appendix D** shows the schematic watermain layouts in the model for the development.

The available system heads at the water supply boundary near Toronto Street South and Cemetery Road in the hydraulic analysis were established from the flow test results for the normal system operating conditions (average day, maximum day, and peak hour) and fire flow conditions. For a conservative design, the system head near the 50% full reservoir water level (e.g. system head approximately 329.5 m) was assumed as the static system head and the reduction of system head or pressure was extrapolated from the hydrant test results and used in the analysis.

The system pressures within the proposed development are between 374 kPa and 395 kPa under the normal operating conditions. **Table 6.1** below summarizes the minimum and maximum estimated system pressures for the proposed development. **Appendix D** illustrates the model outputs for normal demand conditions.

The system was evaluated against the fire flow capacity under the maximum day demand condition to ensure that the minimum pressure of 140 kPa (20 psi) is satisfied. The minimum pressure occurs at the proposed hydrant near townhouse unit 26 on Street B within the subject site, as shown in **Appendix D**. The required fire flow of 117 L/s for the townhouse block on Street B within the subject site was simulated and the minimum system pressure under the fire flow condition is approximately equal to 142 kPa. The hydraulic model outputs under the maximum day plus fire flow conditions are shown in **Appendix D**.

Table 6.1 Proposed System Pressure within Subject Site

Design Condition	Minimum Pressure (kPa)	Maximum Pressure (kPa)
Average Day	378	395
Maximum Day	376	393
Peak Hour	374	391
Maximum Day + Fire Demand*	142	171

*Fire flow of 117 L/s at Townhouse Block on Street

7 Site Grading

7.1 Existing Grades

The site topography for the north parcel generally slopes towards the southeast of the site, where it drains to the existing wetland area. Roadside ditches along the east side of the property abutting Cemetery Road partially drain the site, including the roadway. These drains outlet to the existing wetland, which drains to an existing storm sewer under Cemetery Road.

7.2 Proposed Grades

7.2.1 North Parcel

The proposed grading of the site will match the existing grades where possible and maintain the existing overland flow routes. To the extent practical, site flows will be accommodated by the SWM system up to and including the 100-year storm event. To maintain as much groundwater recharge as possible, clean water (from rear yards and rooftops) from the west units will be permitted to flow overland to the west of the subject site, and infiltrate prior to reaching the western reach of the wetland. Additionally, some grading will be required outside of the settlement area boundary in order to accommodate site topography. Emergency overland flow will be directed via the roadway to the wetland on the south side of the site. For the north and west edge of the property, grading requirements will see a combination of sloping, swales and retaining walls to match into existing topography. The existing ditch along the east edge of the property, adjacent to Cemetery Road, will be realigned and graded to maintain existing flows southerly. Ditch realignment is required in order to permit grading to facilitate the installation of culverts under Streets A and B.

Refer to **Drawing SG-01** in **Appendix E** for proposed Site Grading Plan.

7.2.2 South Parcel

The south parcel is to be graded generally flat, with grading designed to facilitate a driveway connection to Cemetery Road. As the general topography around the parcel is low, the south parcel will be raised and match into existing with sloping.

8 Conclusions and Recommendations

Based on our investigation, we conclude and recommend the following:

Storm Drainage

An underground storage system capable of retaining 233.6 m^3 in conjunction with a 225 mm diameter orifice plate is proposed to control post-development peak flows to the pre-development target for the north residential block. An underground storage tank capable of retaining 17.8 m^3 in conjunction with a 75 mm diameter orifice plate is proposed to control post-development peak flows to the pre-development target for the south apartment block. The water balance requirements can be achieved by the provision of an infiltration storage tank capable of storing 119.7 m^3 of water. The proposed rooftop surfaces along with the OGS unit will be sufficient to provide stormwater quality control, achieving approximately 95% TSS removal. The results of the analysis in this report indicate that the proposed measures will effectively meet the SWM criteria set forth by the LSRCA and the MOECC.

Sanitary Sewers

A total net design flow of 4.0 L/s was calculated for the proposed development (3.3 L/s from the north parcel, and 0.7 L/s from the south parcel). The proposed developments will connect to an extended 300 mm diameter sanitary sewer, from the Cemetery Road and Toronto Street intersection. According to the Region, there is adequate capacity in the existing sanitary sewer to permit the proposed development of 56 townhouse units and 12 apartment units. Refer to **Appendix C** for correspondence email provided by the Region.

Water Supply

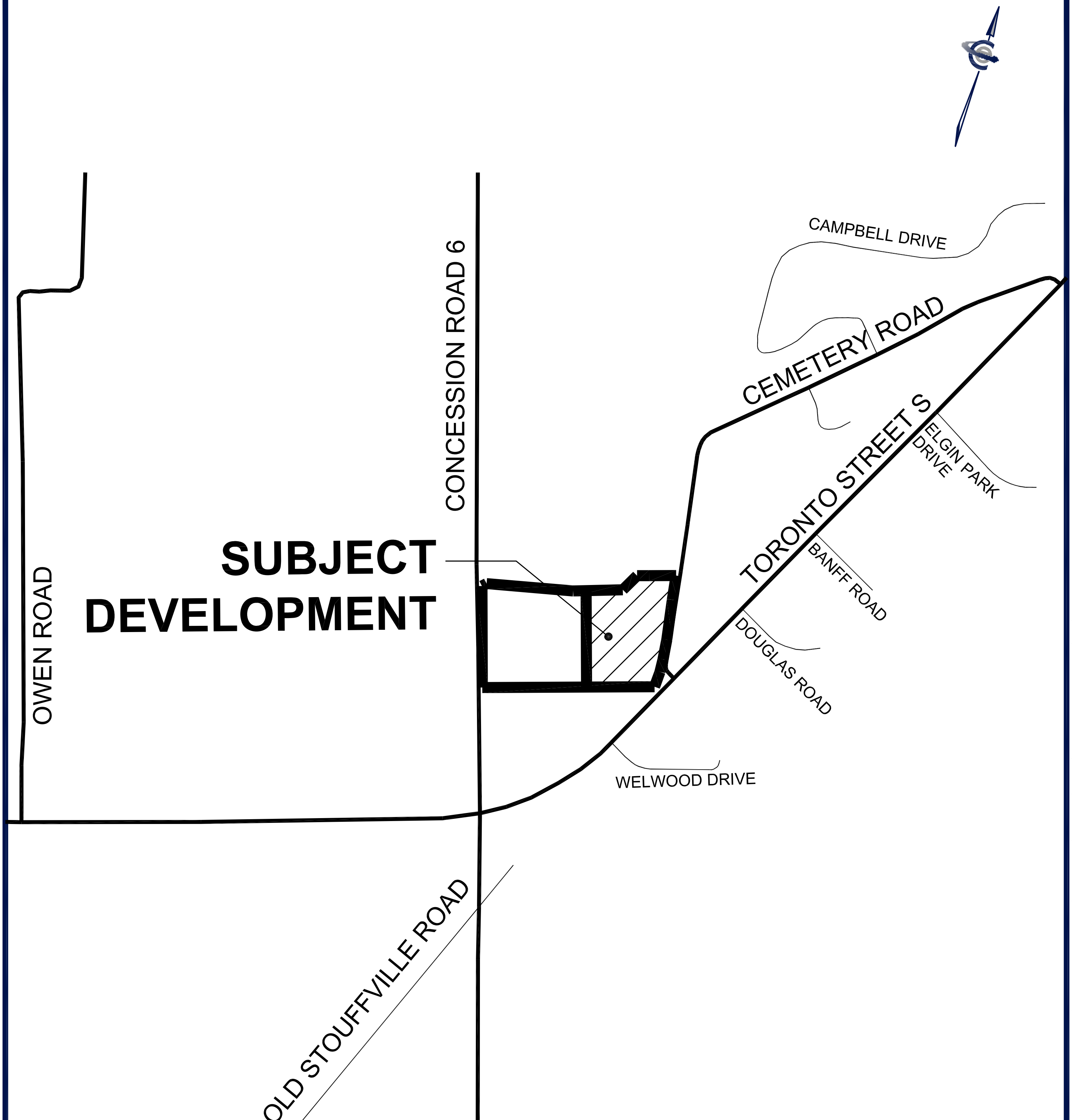
Based on the results of the water system hydraulic analysis, the anticipated system pressures within the subject site meet the Region's pressure requirements between 275 kPa and 700 kPa under the normal operations. The minimum system pressure of 140 kPa under fire flow condition as per the Region's requirement can be maintained within the subject site.

The proposed water supply distribution system, via a connection to the existing 300 mm watermain plug near Toronto Street South and Cemetery Road, is capable of providing adequate flows and pressures to support the proposed development under normal operating and fire conditions.

Frequent water sampling and flushing programs shall be performed at the dead-end watermain location on Cemetery Road (see **Drawing GP-01** for the location) to ensure water quality can be maintained.

Site Grading

The proposed grading of the site will match the existing grades where possible and maintain the existing overland flow routes. To the extent practical, site flows will be accommodated by the SWM system up to and including the 100-year storm event. Emergency overland flow will be directed to the wet land on the south side of the site. To maintain as much groundwater recharge as possible, clean water (from rear yards and rooftops) will be permitted to flow overland to the west of the subject site and infiltrate. Portions of the property, grading requirements will see a combination of sloping, swales and retaining walls to match into existing topography. The existing ditch along the east edge of the property, adjacent to Cemetery Road, will be realigned and graded to maintain existing flows southerly. The south parcel is to be graded generally flat, with grading designed to facilitate a driveway connection to Cemetery Road. As the general topography around the parcel is low, the south parcel will be raised and match into existing with sloping.



COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LOCATION PLAN

154 & 164 CEMETERY ROAD
PART OF LOT 26 AND 27
CONCESSION 2

DATE:	NOV 2016	PROJECT No.	UD16-0349
SCALE:	N.T.S.	FIGURE No.	FIG 1

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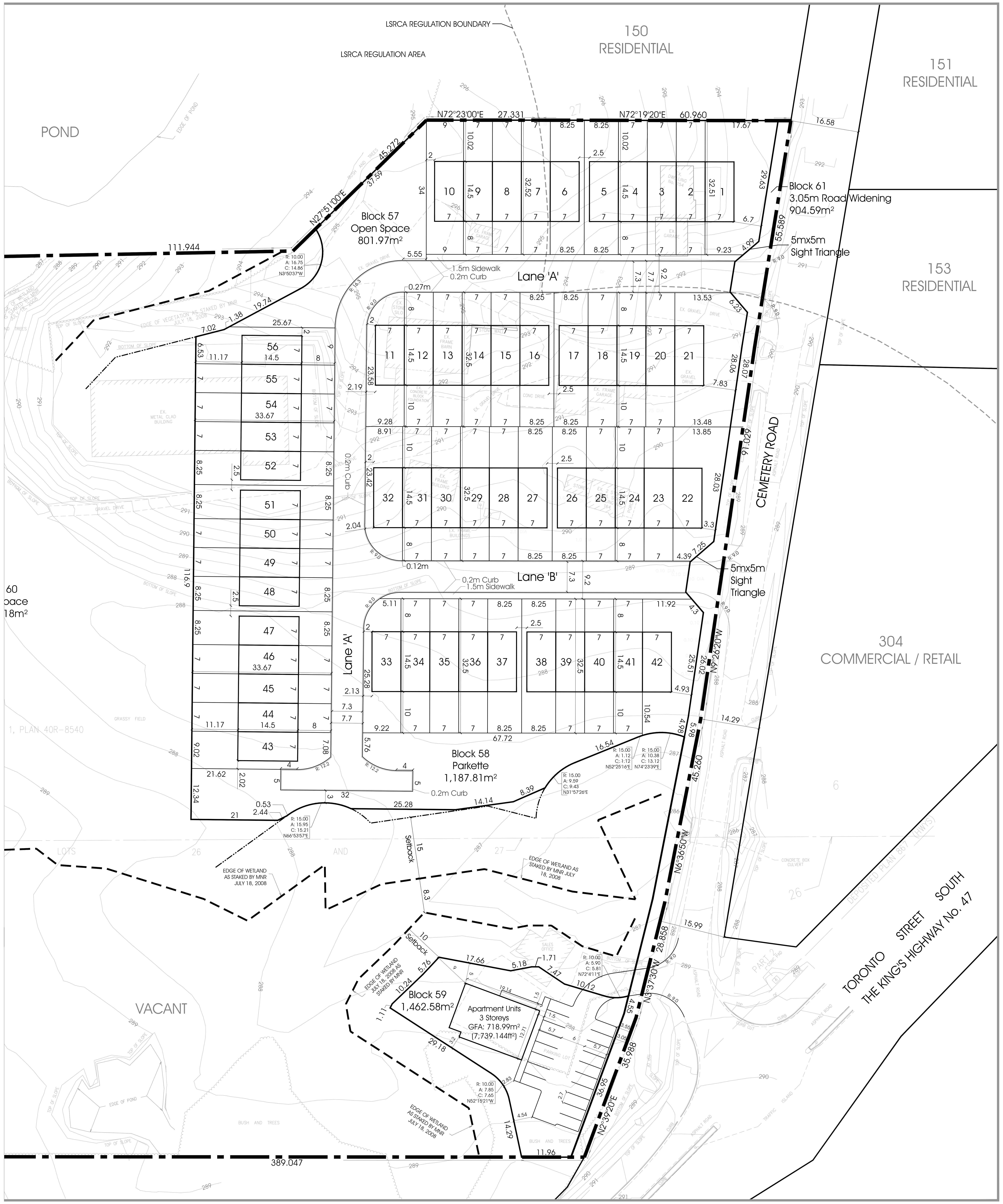
AERIAL PLAN

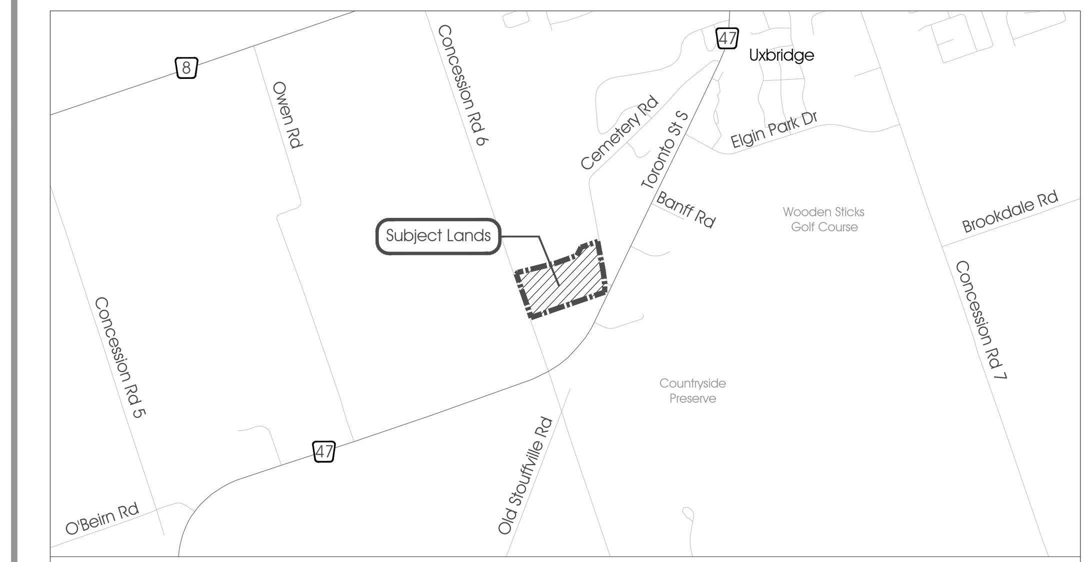
154 & 164 CEMETERY ROAD
PART OF LOT 26 AND 27
CONCESSION 2

DATE:	NOV 2016	PROJECT No.	UD16-0349
SCALE:	N.T.S.	FIGURE No.	FIG 2

File: \\data\shared\2016 Projects\UD\CI\UD16-0349 Oxford_164CemeterySPA_Uxbridge\300-Design-Engineering\305-Reports\FSR-SWM\Figures\UD16-0349 Figures.dwg (AErial Plan)> Nov 28, 2016-2:04pm

APPENDIX A
Background Information





KEY PLAN - Uxbridge

Scale
1:30,000

SCHEDULE OF LAND USE

Proposed Land Use	Lot / Block	Units	m²	ac	ha	%
Townhomes	1-56	56	14,549.16	3.60	1.455	15.2
Common Element	57,58		1,989.79	0.49	0.199	2.1
Apartment Units	59	12	1,462.58	0.36	0.146	1.5
Open Space	60		74,147.18	18.32	7.415	77.5
Road Widening	61		904.59	0.22	0.090	0.9
Lanes 'A' and 'B'	Lanes A & B		2,626.86	0.65	0.263	2.8
Total		68	95,680.16	23.64	9.568	100

LEGEND

- SUBJECT LANDS
- ENVIRONMENTAL CONSTRAINTS
- SETBACKS FROM ENVIRONMENTAL CONSTRAINTS
- LSRCA REGULATION BOUNDARY

No.	REVISION	DATE

Note All dimensions are shown in metres.

Draft Concept Plan

154 & 164 CEMETERY RD
(PT OF LOTS 26 & 27 CONCESSION 6)
TOWNSHIP OF UXBRIDGE
REGIONAL MUNICIPALITY OF DURHAM

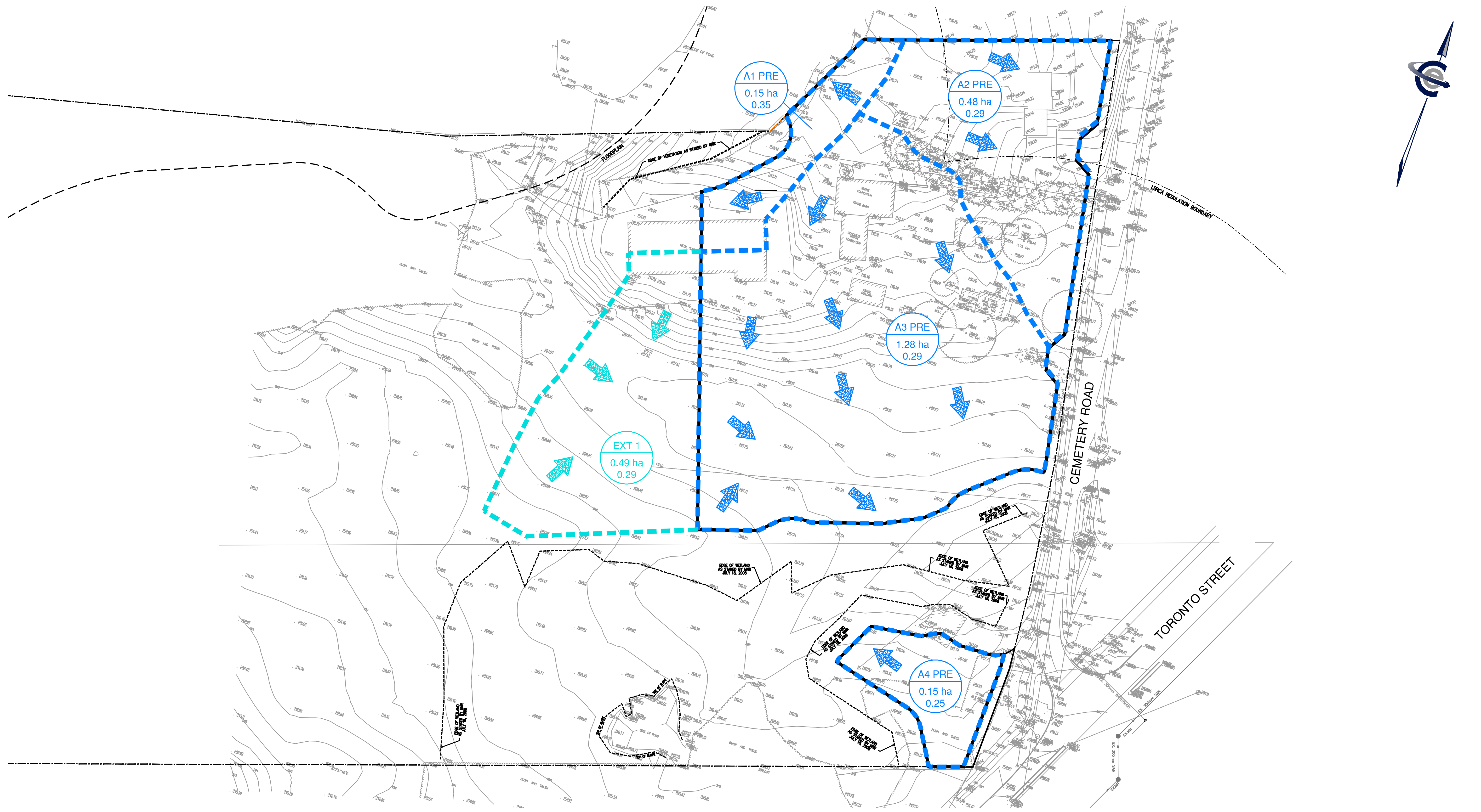
0 5 10 15 20 25m

SEAL

groundswell
URBAN PLANNERS INC.
30 WEST BEAVER CREEK ROAD, UNIT 109
RICHMOND HILL, ONTARIO L4B 3K1
T: 905.597.8204 F: 905.597.8904
groundswellplan.com
GIVING YOU SOMETHING TO BUILD ON.

DESIGN	DRAWN AM
APPROVED BR, MF	DATE OCT. 19, 2016
SCALE	1:500
PROJECT No.	16-18
DRAWING No.	01a

APPENDIX B
Stormwater Data Analysis



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T:416.987.6161 / 905.940.6161 F:905.940.2064

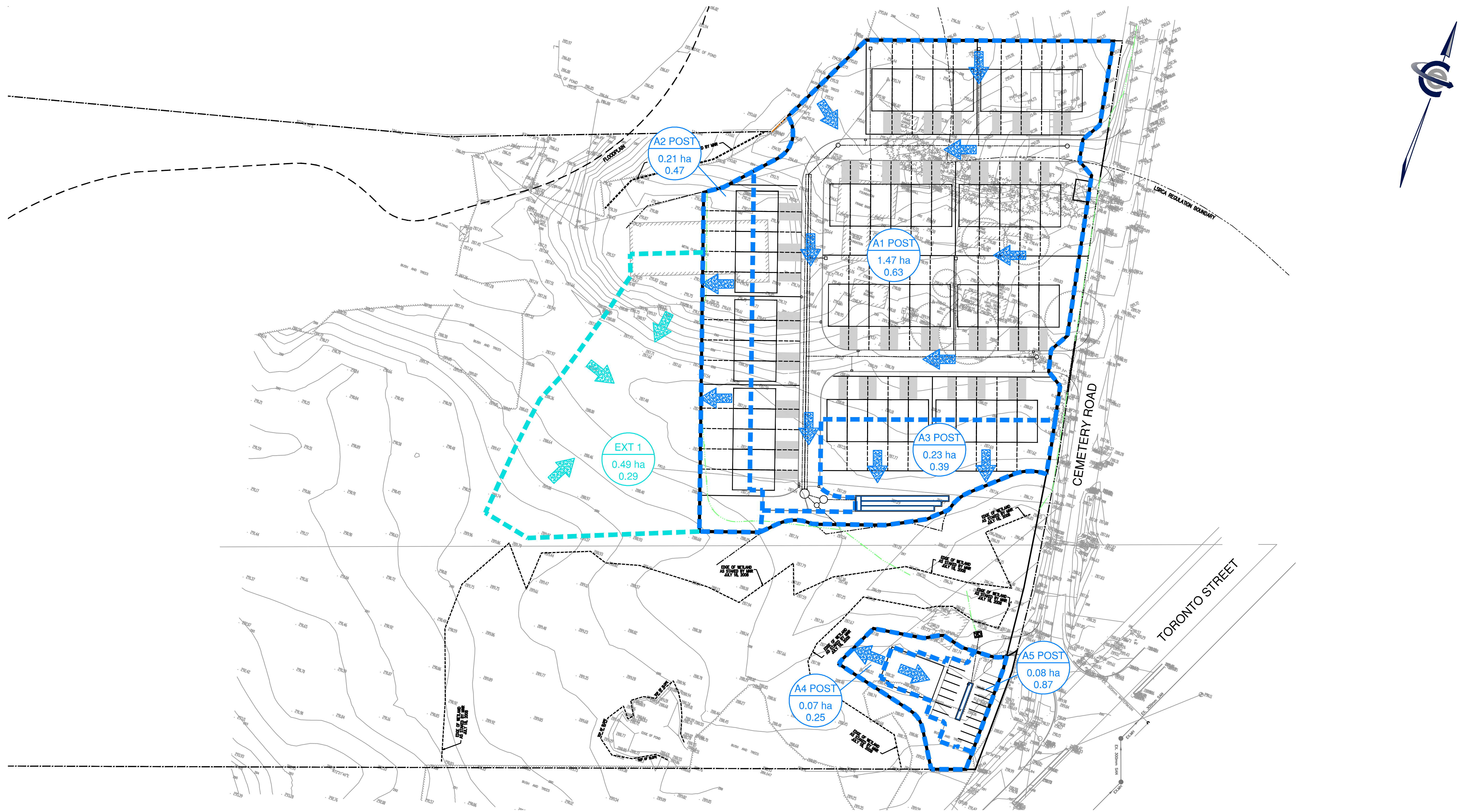
LEGEND

Blue dashed line	INTERNAL DRAINAGE BOUNDARY
Cyan dashed line	EXTERNAL DRAINAGE BOUNDARY
Solid line	RESIDENTIAL BLOCK LIMIT
Dash-dot line	PROPERTY LINE
Dotted line	EDGE OF WETLAND
Arrow	OVERLAND FLOW DIRECTION
A1 POST	CATCHMENT ID
1.47 ha	CATCHMENT AREA
0.63	RUNOFF COEFFICIENT

PRE-DEVELOPMENT DRAINAGE AREA PLAN

OXFORD HOMES
164 CEMETERY ROAD
TOWN OF UXBRIDGE

DATE:	NOVEMBER 2016	PROJECT No.:	UD16-0349
SCALE:	1:1250	FIGURE No.:	DAP-1



COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LEGEND

- INTERNAL DRAINAGE BOUNDARY
- EXTERNAL DRAINAGE BOUNDARY
- RESIDENTIAL BLOCK LIMIT
- PROPERTY LINE
- EDGE OF WETLAND
- OVERLAND FLOW DIRECTION
- A1 POST — CATCHMENT ID
- 1.47 ha — CATCHMENT AREA
- 0.63 — RUNOFF COEFFICIENT

POST-DEVELOPMENT DRAINAGE AREA PLAN

OXFORD HOMES
164 CEMETERY ROAD
TOWN OF UXBRIDGE

DATE:	NOVEMBER 2016	PROJECT No.:	UD16-0349
SCALE:	1:1250	FIGURE No.:	DAP-2

COLE ENGINEERING

Prepared By: Ben Lidbetter, EIT

Post-Development Composite Coefficient (North Residential Block)

164 Cemetery Road

Town of Uxbridge

October 2016

Area A1 Pre

	(ha)	Coefficent
Total Area	0.15	
Impervious Area	0.02	0.90
Landscaped Area	0.13	0.25
Composite "C"		**0.35**

Area A2 Pre

	(ha)	Coefficent
Total Area	0.48	
Impervious Area	0.03	0.90
Landscaped Area	0.45	0.25
Composite "C"		**0.29**

Area A3 Pre

	(ha)	Coefficent
Total Area	1.28	
Impervious Area	0.09	0.90
Landscaped Area	1.19	0.25
Composite "C"		**0.29**

Area Ext 1

	(ha)	Coefficent
Total Area	0.49	
Impervious Area	0.02	0.90
Landscaped Area	0.47	0.25
Composite "C"		**0.29**

COLE ENGINEERING

Prepared By: Ben Lidbetter, EIT

Rational Method Target Flow Calculations (North Residential Block)

164 Cemetery Road
Town of Uxbridge
October 2016

Time of Concentration Calculation

Area	Area (ha)	C	Time of (min)
A1 Pre	0.15	0.35	10
A2 Pre	0.48	0.29	10
A3 Pre	1.28	0.29	10
Ext 1	0.49	0.29	10

Formula:	I = A/(T+B)^C	
	A,B,C	Constants
	T	Time of concentration (h)
	I	Rainfall intensity (mm/h)

Rational Method Calculation

Event 2-Year
IDF Data Set Town of Uxbridge
A = 645.00
B = 5.00
C = 0.786

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	0.15	0.35	0.05	10.00	76.763	0.011	11.3
A2 Pre	0.48	0.29	0.14	10.00	76.763	0.029	29.4
A3 Pre	1.28	0.29	0.38	10.00	76.763	0.080	80.3
Ext 1	0.49	0.29	0.14	10.00	76.763	0.031	30.7
Total						**0.152**	**151.8**
					Target	0.140	140.4

Event 5-Year
IDF Data Set Town of Uxbridge
A = 904.00
B = 5.00
C = 0.788

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	0.15	0.35	0.05	10.00	107.006	0.016	15.8
A2 Pre	0.48	0.29	0.14	10.00	107.006	0.041	41.0
A3 Pre	1.28	0.29	0.38	10.00	107.006	0.112	111.9
Ext 1	0.49	0.29	0.14	10.00	107.006	0.043	42.8
Total						**0.212**	**211.5**
					Target	0.196	195.8

Event 10-Year
IDF Data Set Town of Uxbridge
A = 1065.00
B = 5.00
C = 0.788

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	0.15	0.35	0.05	10.00	126.064	0.019	18.6
A2 Pre	0.48	0.29	0.14	10.00	126.064	0.048	48.3
A3 Pre	1.28	0.29	0.38	10.00	126.064	0.132	131.8
Ext 1	0.49	0.29	0.14	10.00	126.064	0.050	50.5
Total						**0.249**	**249.2**
					Target	0.231	230.6

Rational Method
Target Flow Calculations

164 Cemetery Road
Town of Uxbridge
September 2016

COLE ENGINEERING

Prepared By: Ben Lidbetter, EIT

Event 25-Year
IDF Data Set Town of Uxbridge
A = 1234.00
B = 4.00
C = 0.787

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	0.15	0.35	0.05	10.00	154.637	0.023	22.8
A2 Pre	0.48	0.29	0.14	10.00	154.637	0.059	59.3
A3 Pre	1.28	0.29	0.38	10.00	154.637	0.162	161.7
Ext 1	0.49	0.29	0.14	10.00	154.637	0.062	61.9
Total						**0.306**	**305.7**
					Target	0.283	282.9

Event 100-Year
IDF Data Set Town of Uxbridge
A = 1799.00
B = 5.00
C = 0.810

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	0.15	0.35	0.05	10.00	200.631	0.030	29.6
A2 Pre	0.48	0.29	0.14	10.00	200.631	0.077	76.9
A3 Pre	1.28	0.29	0.38	10.00	200.631	0.210	209.8
Ext 1	0.49	0.29	0.14	10.00	200.631	0.080	80.3
Total						**0.397**	**396.6**
					Target	0.367	367.0

Prepared By: Ben Lidbetter, EIT

Post-Development Composite Coefficient (North Residential Block)

164 Cemetery Road
Town of Uxbridge
October 2016

Area A1 Post

	(ha)	Coefficent
Total Area	1.47	
Impervious Area	0.87	0.90
Landscaped Area	0.60	0.25
Composite "C"		**0.63**

Area A2 Post

	(ha)	Coefficent
Total Area	0.21	
Impervious Area	0.07	0.90
Landscaped Area	0.14	0.25
Composite "C"		**0.47**

Area A3 Post

	(ha)	Coefficent
Total Area	0.23	
Impervious Area	0.05	0.90
Landscaped Area	0.18	0.25
Composite "C"		**0.39**

Prepared By: Ben Lidbetter, EIT

Rational Method Post-Development Flow Calculations (North Residential Block)

164 Cemetery Road
Town of Uxbridge
October 2016

Time of Concentration Calculation

Area	Area (ha)	C	Time of (min)
A1 Post	1.47	0.63	10
A2 Post	0.21	0.47	10
A3 Post	0.23	0.29	10

Formula:	I = A/(T+B)^C	
	A,B,C	Constants
	T	Time of concentration (h)
	I	Rainfall intensity (mm/h)

Rational Method Calculation

Event 2-Year
IDF Data Set Town of Uxbridge
A = 645.00
B = 5.00
C = 0.786

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Post	1.47	0.63	0.93	10.00	76.763	0.199	198.7
A2 Post	0.21	0.47	0.10	10.00	76.763	0.021	21.2
A3 Post	0.23	0.29	0.07	10.00	76.763	0.015	14.6
Total						**0.235**	**234.5**

Event 5-Year
IDF Data Set Town of Uxbridge
A = 904.00
B = 5.00
C = 0.788

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Post	1.47	0.63	0.93	10.00	107.006	0.277	277.0
A2 Post	0.21	0.47	0.10	10.00	107.006	0.029	29.5
A3 Post	0.23	0.29	0.07	10.00	107.006	0.020	20.4
Total						**0.327**	**326.9**

Event 10-Year
IDF Data Set Town of Uxbridge
A = 1065.00
B = 5.00
C = 0.788

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Post	1.47	0.63	0.93	10.00	126.064	0.326	326.3
A2 Post	0.21	0.47	0.10	10.00	126.064	0.035	34.7
A3 Post	0.23	0.29	0.07	10.00	126.064	0.024	24.0
Total						**0.385**	**385.1**

Prepared By: Ben Lidbetter, EIT

Rational Method Post-Development Flow Calculations (North Residential Block)

164 Cemetery Road
Town of Uxbridge
October 2016

Event 25-Year
IDF Data Set Town of Uxbridge
A = 1234.00
B = 4.00
C = 0.787

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Post	1.47	0.63	0.93	10.00	154.637	0.400	400.3
A2 Post	0.21	0.47	0.10	10.00	154.637	0.043	42.6
A3 Post	0.23	0.29	0.07	10.00	154.637	0.029	29.5
Total						**0.472**	**472.4**

Event 100-Year
IDF Data Set Town of Uxbridge
A = 1799.00
B = 5.00
C = 0.810

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Post	1.47	0.63	0.93	10.00	200.631	0.519	519.4
A2 Post	0.21	0.47	0.10	10.00	200.631	0.055	55.3
A3 Post	0.23	0.29	0.07	10.00	200.631	0.038	38.3
Total						**0.613**	**612.9**

Prepared By: Ben Lidbetter, EIT

Modified Rational Method - Two Year Storm
Site Flow and Storage Summary (North Residential Block)

164 Cemetery Road
Town of Uxbridge
October 2016

2-Year Design Storm	
A=	645.00
B=	5.00
C=	0.786
I =	I = A/(T+B)^C

A2 Post & A3 Post Uncontrolled

Drainage Areas	A2 Post, A3 Post & EXT1	
Area	**0.94**	ha
"C" =	**0.33**	
AC (2,3, EXT1) =	**0.31**	
Tc =	**10.0**	min
Time Increment =	**10.0**	min
Max. Uncontrolled Release Rate =	**66.7**	L/s

A1 Post Controlled

Drainage Areas	A1 Post	
Area =	**1.47**	ha
"C" =	**0.63**	
AC1	**0.93**	
Tc =	**10.0**	min
Allowable Release Rate (Full Site) =	**140.4**	L/s
Release Rate =	**64.6**	L/s
Max. Required Storage Volume =	**82.1**	m^3
Max. Uncontrolled Release Rate =	**66.7**	L/s
Controlled Release Rate (From Orifice) =	**64.6**	L/s
Total Release Rate =	**131.3**	L/s

(1) Time (min)	(2) Rainfall Intensity (mm/hr)	(3) Storm Runoff (Uncontrolled) (m^3/s)	(4) Runoff Volume (Uncontrolled) (m^3)	(5) Storm Runoff (A2 Post) (m^3/s)	(6) Runoff Volume (A1 Post) (m^3)	(7) Allowable Released Volume (m^3)	(8) Storage Volume (m^3)
	I = A(T)^B	**(3) = [(2)*AC2,3,EXT1]/360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1]/360**	**(6) = (5)*(1)*60**	**(7) = [(R1) / 1000]*(1)*60**	**(8) = (6)-(7)**
10.0	76.8	0.067	40.0	0.199	119.2	38.7	80.5
20.0	51.4	0.045	53.6	0.133	159.6	77.5	82.1
30.0	39.4	0.034	61.7	0.102	183.8	116.2	67.5
40.0	32.4	0.028	67.6	0.084	201.1	155.0	46.1
50.0	27.6	0.024	72.1	0.072	214.7	193.7	21.0
60.0	24.2	0.021	75.9	0.063	225.9	232.5	0.0
70.0	21.7	0.019	79.1	0.056	235.5	271.2	0.0
80.0	19.6	0.017	82.0	0.051	244.0	310.0	0.0
90.0	18.0	0.016	84.5	0.047	251.5	348.7	0.0
100.0	16.6	0.014	86.8	0.043	258.3	387.4	0.0
110.0	15.5	0.013	88.9	0.040	264.5	426.2	0.0
120.0	14.5	0.013	90.8	0.038	270.3	464.9	0.0
130.0	13.6	0.012	92.6	0.035	275.6	503.7	0.0
140.0	12.9	0.011	94.3	0.033	280.6	542.4	0.0
150.0	12.2	0.011	95.8	0.032	285.3	581.2	0.0
160.0	11.7	0.010	97.3	0.030	289.7	619.9	0.0
170.0	11.1	0.010	98.7	0.029	293.9	658.6	0.0
180.0	10.7	0.009	100.1	0.028	297.9	697.4	0.0
190.0	10.2	0.009	101.3	0.026	301.7	736.1	0.0
200.0	9.8	0.009	102.6	0.025	305.3	774.9	0.0
210.0	9.5	0.008	103.7	0.025	308.8	813.6	0.0
220.0	9.1	0.008	104.9	0.024	312.2	852.4	0.0
230.0	8.8	0.008	105.9	0.023	315.4	891.1	0.0
240.0	8.5	0.007	107.0	0.022	318.5	929.9	0.0
250.0	8.3	0.007	108.0	0.021	321.5	968.6	0.0
260.0	8.0	0.007	109.0	0.021	324.4	1007.3	0.0
270.0	7.8	0.007	109.9	0.020	327.2	1046.1	0.0
280.0	7.6	0.007	110.8	0.020	329.9	1084.8	0.0
290.0	7.4	0.006	111.7	0.019	332.6	1123.6	0.0
300.0	7.2	0.006	112.6	0.019	335.2	1162.3	0.0
310.0	7.0	0.006	113.4	0.018	337.7	1201.1	0.0
320.0	6.8	0.006	114.2	0.018	340.1	1239.8	0.0

COLE ENGINEERING

Prepared By: Ben Lidbetter, EIT

Modified Rational Method - Five Year Storm
Site Flow and Storage Summary (North Residential Block)

164 Cemetery Road
Town of Uxbridge
October 2016

5-Year Design Storm	
A=	904.00
B=	5.00
C=	0.788
I =	I = A/(T+B)^C

A2 Post & A3 Post Uncontrolled

Drainage Areas	A2 Post, A3 Post & EXT1	
Area	**0.94**	ha
"C" =	**0.33**	
AC (2,3, EXT1) =	**0.31**	
Tc =	**10.0**	min
Time Increment =	**10.0**	min
Max. Uncontrolled Release Rate =	**93.0**	L/s

A1 Post Controlled

Drainage Areas	A1 Post	
Area =	**1.47**	ha
"C" =	**0.63**	
AC1	**0.93**	
Tc =	**10.0**	min
Allowable Release Rate (Full Site) =	**195.8**	L/s
Release Rate =	**87.0**	L/s
Max. Required Storage Volume =	**117.8**	m^3
Max. Uncontrolled Release Rate =	**93.0**	L/s
Controlled Release Rate (From Orifice) =	**87.0**	L/s
Total Release Rate =	**180.1**	L/s

(1) Time (min)	(2) Rainfall Intensity (mm/hr)	(3) Storm Runoff (Uncontrolled) (m^3/s)	(4) Runoff Volume (Uncontrolled) (m^3)	(5) Storm Runoff (A2 Post) (m^3/s)	(6) Runoff Volume (A1 Post) (m^3)	(7) Allowable Released Volume (m^3)	(8) Storage Volume (m^3)
	I = A(T)^B	**(3) = [(2)*AC2,3,EXT1]/360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1]/360**	**(6) = (5)*(1)*60**	**(7) = [(R1) / 1000]*(1)*60**	**(8) = (6)-(7)**
10.0	107.0	0.093	55.8	0.277	166.2	52.2	114.0
20.0	71.5	0.062	74.7	0.185	222.2	104.4	117.8
30.0	54.9	0.048	85.9	0.142	255.7	156.6	99.1
40.0	45.0	0.039	94.0	0.117	279.7	208.9	70.9
50.0	38.4	0.033	100.3	0.100	298.5	261.1	37.4
60.0	33.7	0.029	105.5	0.087	314.0	313.3	0.7
70.0	30.1	0.026	109.9	0.078	327.3	365.5	0.0
80.0	27.3	0.024	113.8	0.071	338.9	417.7	0.0
90.0	25.0	0.022	117.3	0.065	349.3	469.9	0.0
100.0	23.1	0.020	120.5	0.060	358.7	522.2	0.0
110.0	21.5	0.019	123.4	0.056	367.2	574.4	0.0
120.0	20.1	0.018	126.0	0.052	375.1	626.6	0.0
130.0	18.9	0.016	128.5	0.049	382.5	678.8	0.0
140.0	17.9	0.016	130.8	0.046	389.4	731.0	0.0
150.0	17.0	0.015	133.0	0.044	395.8	783.2	0.0
160.0	16.2	0.014	135.0	0.042	401.9	835.5	0.0
170.0	15.4	0.013	136.9	0.040	407.7	887.7	0.0
180.0	14.8	0.013	138.8	0.038	413.2	939.9	0.0
190.0	14.2	0.012	140.5	0.037	418.4	992.1	0.0
200.0	13.6	0.012	142.2	0.035	423.4	1044.3	0.0
210.0	13.1	0.011	143.8	0.034	428.2	1096.5	0.0
220.0	12.7	0.011	145.4	0.033	432.8	1148.7	0.0
230.0	12.2	0.011	146.9	0.032	437.2	1201.0	0.0
240.0	11.8	0.010	148.3	0.031	441.5	1253.2	0.0
250.0	11.5	0.010	149.7	0.030	445.6	1305.4	0.0
260.0	11.1	0.010	151.0	0.029	449.6	1357.6	0.0
270.0	10.8	0.009	152.3	0.028	453.5	1409.8	0.0
280.0	10.5	0.009	153.6	0.027	457.2	1462.0	0.0
290.0	10.2	0.009	154.8	0.026	460.9	1514.3	0.0
300.0	10.0	0.009	156.0	0.026	464.4	1566.5	0.0
310.0	9.7	0.008	157.1	0.025	467.8	1618.7	0.0
320.0	9.5	0.008	158.3	0.025	471.2	1670.9	0.0

COLE ENGINEERING

Prepared By: Ben Lidbetter, EIT

Modified Rational Method - Ten Year Storm
Site Flow and Storage Summary (North Residential Block)

164 Cemetery Road
Town of Uxbridge
October 2016

10-Year Design Storm	
A=	1065.00
B=	5.00
C=	0.788
I =	I = A/(T+B)^C

A2 Post & A3 Post Uncontrolled

Drainage Areas	A2 Post, A3 Post & EXT1	
Area	**0.94**	ha
"C" =	**0.33**	
AC (2,3, EXT1) =	**0.31**	
Tc =	**10.0**	min
Time Increment =	**10.0**	min
Max. Uncontrolled Release Rate =	**109.6**	L/s

A1 Post Controlled

Drainage Areas	A1 Post	
Area =	**1.47**	ha
"C" =	**0.63**	
AC1	**0.93**	
Tc =	**10.0**	min
Allowable Release Rate (Full Site) =	**230.6**	L/s
Release Rate =	**99.8**	L/s
Max. Required Storage Volume =	**142.1**	m^3
Max. Uncontrolled Release Rate =	**109.6**	L/s
Controlled Release Rate (From Orifice) =	**99.8**	L/s
Total Release Rate =	**209.4**	L/s

(1) Time (min)	(2) Rainfall Intensity (mm/hr)	(3) Storm Runoff (Uncontrolled) (m^3/s)	(4) Runoff Volume (Uncontrolled) (m^3)	(5) Storm Runoff (A2 Post) (m^3/s)	(6) Runoff Volume (A1 Post) (m^3)	(7) Allowable Released Volume (m^3)	(8) Storage Volume (m^3)
	I = A(T)^B	**(3) = [(2)*AC2,3,EXT1]/360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1]/360**	**(6) = (5)*(1)*60**	**(7) = [(R1) / 1000]*(1)*60**	**(8) = (6)-(7)**
10.0	126.1	0.110	65.8	0.326	195.8	59.9	135.9
20.0	84.3	0.073	88.0	0.218	261.8	119.7	142.1
30.0	64.7	0.056	101.2	0.167	301.3	179.6	121.7
40.0	53.0	0.046	110.7	0.137	329.5	239.5	90.1
50.0	45.3	0.039	118.1	0.117	351.7	299.3	52.3
60.0	39.7	0.035	124.3	0.103	370.0	359.2	10.7
70.0	35.5	0.031	129.5	0.092	385.6	419.1	0.0
80.0	32.1	0.028	134.1	0.083	399.3	478.9	0.0
90.0	29.4	0.026	138.2	0.076	411.5	538.8	0.0
100.0	27.2	0.024	141.9	0.070	422.5	598.7	0.0
110.0	25.3	0.022	145.3	0.066	432.6	658.6	0.0
120.0	23.7	0.021	148.5	0.061	442.0	718.4	0.0
130.0	22.3	0.019	151.4	0.058	450.6	778.3	0.0
140.0	21.1	0.018	154.1	0.055	458.7	838.2	0.0
150.0	20.0	0.017	156.6	0.052	466.3	898.0	0.0
160.0	19.1	0.017	159.1	0.049	473.5	957.9	0.0
170.0	18.2	0.016	161.3	0.047	480.3	1017.8	0.0
180.0	17.4	0.015	163.5	0.045	486.8	1077.6	0.0
190.0	16.7	0.015	165.6	0.043	492.9	1137.5	0.0
200.0	16.1	0.014	167.6	0.042	498.8	1197.4	0.0
210.0	15.5	0.013	169.5	0.040	504.5	1257.2	0.0
220.0	14.9	0.013	171.3	0.039	509.9	1317.1	0.0
230.0	14.4	0.013	173.0	0.037	515.1	1377.0	0.0
240.0	14.0	0.012	174.7	0.036	520.1	1436.8	0.0
250.0	13.5	0.012	176.4	0.035	525.0	1496.7	0.0
260.0	13.1	0.011	177.9	0.034	529.7	1556.6	0.0
270.0	12.7	0.011	179.5	0.033	534.2	1616.5	0.0
280.0	12.4	0.011	180.9	0.032	538.7	1676.3	0.0
290.0	12.1	0.010	182.4	0.031	542.9	1736.2	0.0
300.0	11.7	0.010	183.8	0.030	547.1	1796.1	0.0
310.0	11.4	0.010	185.1	0.030	551.1	1855.9	0.0
320.0	11.2	0.010	186.5	0.029	555.1	1915.8	0.0

Prepared By: Ben Lidbetter, EIT

Modified Rational Method - Twenty-Five Year Storm
Site Flow and Storage Summary (North Residential Block)

164 Cemetery Road
Town of Uxbridge
October 2016

A2 Post & A3 Post Uncontrolled

Drainage Areas	A2 Post, A3 Post & EXT1	
Area	**0.94**	ha
"C" =	**0.33**	
AC (2,3, EXT1) =	**0.31**	
Tc =	**10.0**	min
Time Increment =	**10.0**	min
Max. Uncontrolled Release Rate =	**134.5**	L/s

A1 Post Controlled

Drainage Areas	A1 Post	
Area =	**1.47**	ha
"C" =	**0.63**	
AC1	**0.93**	
Tc =	**10.0**	min
Allowable Release Rate (Full Site) =	**282.9**	L/s
Release Rate =	**115.6**	L/s
Max. Required Storage Volume =	**175.6**	m^3
Max. Uncontrolled Release Rate =	**134.5**	L/s
Controlled Release Rate (From Orifice) =	**115.6**	L/s
Total Release Rate =	**250.0**	L/s

25-Year Design Storm	
A=	1234.00
B=	4.00
C=	0.787
I =	I = A/(T+B)^C

(1) Time (min)	(2) Rainfall Intensity (mm/hr)	(3) Storm Runoff (Uncontrolled) (m^3/s)	(4) Runoff Volume (Uncontrolled) (m^3)	(5) Storm Runoff (A2 Post) (m^3/s)	(6) Runoff Volume (A1 Post) (m^3)	(7) Allowable Released Volume (m^3)	(8) Storage Volume (m^3)
	I = A(T)^B	(3) = [(2)*AC2,3,EXT1]/360	(4) = (3)*(1)*60	(5) = [(2)*AC1]/360	(6) = (5)*(1)*60	(7) = [(R1) / 1000]*(1)*60	(8) = (6)-(7)
10.0	154.6	0.134	80.7	0.400	240.2	69.4	170.8
20.0	101.2	0.088	105.6	0.262	314.3	138.7	175.6
30.0	76.9	0.067	120.4	0.199	358.4	208.1	150.4
40.0	62.8	0.055	131.0	0.163	390.1	277.4	112.7
50.0	53.4	0.046	139.4	0.138	415.1	346.8	68.3
60.0	46.8	0.041	146.4	0.121	435.7	416.1	19.6
70.0	41.7	0.036	152.3	0.108	453.5	485.5	0.0
80.0	37.7	0.033	157.6	0.098	469.0	554.8	0.0
90.0	34.6	0.030	162.2	0.089	483.0	624.2	0.0
100.0	31.9	0.028	166.5	0.083	495.6	693.5	0.0
110.0	29.7	0.026	170.4	0.077	507.2	762.9	0.0
120.0	27.8	0.024	173.9	0.072	517.8	832.2	0.0
130.0	26.1	0.023	177.3	0.068	527.8	901.6	0.0
140.0	24.7	0.021	180.4	0.064	537.1	970.9	0.0
150.0	23.4	0.020	183.3	0.061	545.8	1040.3	0.0
160.0	22.3	0.019	186.1	0.058	554.1	1109.6	0.0
170.0	21.3	0.019	188.8	0.055	561.9	1179.0	0.0
180.0	20.4	0.018	191.3	0.053	569.4	1248.3	0.0
190.0	19.5	0.017	193.6	0.051	576.5	1317.7	0.0
200.0	18.8	0.016	195.9	0.049	583.3	1387.0	0.0
210.0	18.1	0.016	198.1	0.047	589.8	1456.4	0.0
220.0	17.4	0.015	200.2	0.045	596.1	1525.7	0.0
230.0	16.9	0.015	202.3	0.044	602.1	1595.1	0.0
240.0	16.3	0.014	204.2	0.042	608.0	1664.4	0.0
250.0	15.8	0.014	206.1	0.041	613.6	1733.8	0.0
260.0	15.3	0.013	207.9	0.040	619.0	1803.1	0.0
270.0	14.9	0.013	209.7	0.039	624.3	1872.5	0.0
280.0	14.5	0.013	211.4	0.037	629.4	1941.8	0.0
290.0	14.1	0.012	213.1	0.036	634.4	2011.2	0.0
300.0	13.7	0.012	214.7	0.036	639.2	2080.5	0.0
310.0	13.4	0.012	216.3	0.035	643.9	2149.9	0.0
320.0	13.0	0.011	217.8	0.034	648.5	2219.3	0.0

Prepared By: Ben Lidbetter, EIT

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary (North Residential Block)

164 Cemetery Road
Town of Uxbridge
October 2016

A2 Post & A3 Post Uncontrolled

Drainage Areas	A2 Post, A3 Post & EXT1	
Area	**0.94**	ha
"C" =	**0.33**	
AC (2,3, EXT1) =	**0.31**	
Tc =	**10.0**	min
Time Increment =	**10.0**	min
Max. Uncontrolled Release Rate =	**174.5**	L/s

A1 Post Controlled

Drainage Areas	A1 Post	
Area =	**1.47**	ha
"C" =	**0.63**	
AC1	**0.93**	
Tc =	**10.0**	min
Allowable Release Rate (Full Site) =	**367.0**	L/s
Release Rate =	**151.9**	L/s
Max. Required Storage Volume =	**229.8**	m^3
Max. Uncontrolled Release Rate =	**174.5**	L/s
Controlled Release Rate (From Orifice) =	**151.9**	L/s
Total Release Rate =	**326.3**	m^3

100-Year Design Storm

A=	1799.00
B=	5.00
C=	0.810
I =	I = A/(T+B)^C

(1) Time (min)	(2) Rainfall Intensity (mm/hr)	(3) Storm Runoff (Uncontrolled) (m^3/s)	(4) Runoff Volume (Uncontrolled) (m^3)	(5) Storm Runoff (A2 Post) (m^3/s)	(6) Runoff Volume (A1 Post) (m^3)	(7) Allowable Released Volume (m^3)	(8) Storage Volume (m^3)
	I = A(T)^B	**(3) = [(2)*AC2,3,EXT1]/360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1]/360**	**(6) = (5)*(1)*60**	**(7) = [(R1) / 1000]*(1)*60**	**(8) = (6)-(7)**
10.0	200.6	0.174	104.7	0.519	311.6	91.1	220.5
20.0	132.6	0.115	138.4	0.343	412.0	182.2	229.8
30.0	101.0	0.088	158.1	0.261	470.6	273.3	197.3
40.0	82.4	0.072	172.0	0.213	511.9	364.5	147.5
50.0	70.0	0.061	182.7	0.181	543.9	455.6	88.3
60.0	61.2	0.053	191.5	0.158	570.1	546.7	23.4
70.0	54.5	0.047	199.0	0.141	592.3	637.8	0.0
80.0	49.2	0.043	205.5	0.127	611.7	728.9	0.0
90.0	45.0	0.039	211.2	0.116	628.8	820.0	0.0
100.0	41.5	0.036	216.4	0.107	644.3	911.2	0.0
110.0	38.5	0.034	221.2	0.100	658.4	1002.3	0.0
120.0	36.0	0.031	225.5	0.093	671.3	1093.4	0.0
130.0	33.8	0.029	229.5	0.088	683.3	1184.5	0.0
140.0	31.9	0.028	233.3	0.083	694.5	1275.6	0.0
150.0	30.3	0.026	236.8	0.078	705.0	1366.7	0.0
160.0	28.8	0.025	240.1	0.074	714.8	1457.8	0.0
170.0	27.4	0.024	243.3	0.071	724.2	1549.0	0.0
180.0	26.2	0.023	246.2	0.068	733.0	1640.1	0.0
190.0	25.1	0.022	249.1	0.065	741.4	1731.2	0.0
200.0	24.1	0.021	251.8	0.062	749.5	1822.3	0.0
210.0	23.2	0.020	254.3	0.060	757.2	1913.4	0.0
220.0	22.4	0.019	256.8	0.058	764.5	2004.5	0.0
230.0	21.6	0.019	259.2	0.056	771.6	2095.7	0.0
240.0	20.9	0.018	261.5	0.054	778.5	2186.8	0.0
250.0	20.2	0.018	263.7	0.052	785.0	2277.9	0.0
260.0	19.6	0.017	265.8	0.051	791.4	2369.0	0.0
270.0	19.0	0.017	267.9	0.049	797.5	2460.1	0.0
280.0	18.5	0.016	269.9	0.048	803.5	2551.2	0.0
290.0	18.0	0.016	271.8	0.047	809.3	2642.3	0.0
300.0	17.5	0.015	273.7	0.045	814.9	2733.5	0.0
310.0	17.0	0.015	275.6	0.044	820.3	2824.6	0.0
320.0	16.6	0.014	277.3	0.043	825.6	2915.7	0.0

Orifice Control Calculation
(North Residential Block)

164 Cemetery Road
Town of Uxbridge
October 2016

COLE ENGINEERING

Prepared By: Ben Lidbetter, EIT

Orifice Equation

$$Q = C \times A \times \sqrt{2 \times g \times h}$$

Storm Event	Drainage Area ID	Orifice Location	Orifice Coefficient	Diameter of Orifice (mm)	Orifice Invert (m)	Headwater Elevation (m)	Total Head (m)	Area of Orifice (m^2)	Release Rate (L/s)
2-Year	A1 Post	MH6	0.60	250	287.25	287.62	0.25	0.049	64.6
5-Year	A1 Post	MH6	0.60	250	287.25	287.82	0.44	0.049	87.0
10-Year	A1 Post	MH6	0.60	250	287.25	287.96	0.58	0.049	99.8
25-Year	A1 Post	MH6	0.60	250	287.25	288.16	0.79	0.049	115.6
100-Year	A1 Post	MH6	0.60	250	287.25	288.73	1.36	0.049	151.9

System Storage Calculations (North Residential Block)

164 Cemetery Road
Town of Uxbridge
October 2016

Prepared By: Ben Lidbetter, EIT

Pipe Storage

From	To	Type of Pipe	Pipe Length (m)	Pipe Diameter / Span (mm)	Pipe Radius (mm)	Pipe Rise (mm)	Pipe Volume (m^3)
MH5	MH6	Box Culvert	47.4	1800	-	900	76.79
MH3	MH5	Box Culvert	62.6	1800	-	900	101.41
MH4	MH5	Circular	81.6	450	225	-	12.98
MH2	MH3	Circular	14.3	900	450	-	9.10
MH1	MH2	Circular	78.9	375	188	-	8.71

Total Pipe Storage: **209.0** m^3

Manhole Storage

Manhole ID	Manhole Diameter (mm)	Manhole Radius (mm)	Sump Elevation (mm)	Available Storage Depth (mm)	Manhole Volume (m^3)
MH6	2400	1200	287.25	1740	7.87
MH5	2400	1200	287.37	1622	7.34
MH4	1200	600	287.43	1560	1.76
MH3	2400	1200	287.52	1470	6.65
MH2	1200	600	288.11	880	1.00

Total Manhole Storage: **24.6** m^3

Total Provided System Storage: **233.6** m^3
Minimum System Storage Required: **229.8** m^3

Prepared by: Ben Lidbetter, EIT

Stage-Storage Calculation
(North Residential Block)
164 Cemetery Road
Town of Uxbridge
October 2016

Stage-Storage Curve

Elevation (m)	Depth (m)	MH3-MH6 Box Culvert Storage (m^3)	MH4-MH5 Pipe Storage (m^3)	MH2-MH3 Pipe Storage (m^3)	MH1-MH2 Pipe Storage (m^3)	MH6 Storage (m^3)	MH5 Storage (m^3)	MH4 Storage (m^3)	MH3 Storage (m^3)	MH2 Storage (m^3)	Total Storage (m^3)
287.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
287.30	0.05	7.43	0.79	0.20	0.69	0.23	0.00	0.00	0.00	0.00	9.3
287.35	0.10	14.85	2.15	0.55	1.87	0.45	0.00	0.00	0.00	0.00	19.9
287.40	0.15	22.28	3.79	1.00	3.26	0.68	0.14	0.00	0.00	0.00	31.1
287.45	0.20	29.70	5.57	1.51	4.73	0.90	0.37	0.02	0.00	0.00	42.8
287.50	0.25	37.13	7.41	2.06	6.17	1.13	0.59	0.08	0.00	0.00	54.6
287.55	0.30	44.55	9.19	2.65	7.47	1.36	0.82	0.14	0.14	0.00	66.3
287.60	0.35	51.98	10.83	3.27	8.46	1.58	1.05	0.19	0.36	0.00	77.7
287.65	0.40	59.40	12.19	3.91	8.71	1.81	1.27	0.25	0.59	0.00	88.1
287.70	0.45	66.83	12.98	4.55	8.71	2.04	1.50	0.31	0.81	0.00	97.7
287.75	0.50	74.25	12.98	5.19	8.71	2.26	1.73	0.36	1.04	0.00	106.5
287.80	0.55	81.68	12.98	5.82	8.71	2.49	1.95	0.42	1.27	0.00	115.3
287.85	0.60	89.10	12.98	6.44	8.71	2.71	2.18	0.48	1.49	0.00	124.1
287.90	0.65	96.53	12.98	7.04	8.71	2.94	2.40	0.53	1.72	0.00	132.8
287.95	0.70	103.95	12.98	7.59	8.71	3.17	2.63	0.59	1.95	0.00	141.6
288.00	0.75	111.38	12.98	8.10	8.71	3.39	2.86	0.64	2.17	0.00	150.2
288.05	0.80	118.80	12.98	8.54	8.71	3.62	3.08	0.70	2.40	0.00	158.8
288.10	0.85	126.23	12.98	8.90	8.71	3.85	3.31	0.76	2.62	0.00	167.3
288.15	0.90	133.65	12.98	9.10	8.71	4.07	3.54	0.81	2.85	0.05	175.8
288.20	0.95	141.08	12.98	9.10	8.71	4.30	3.76	0.87	3.08	0.10	184.0
288.25	1.00	148.50	12.98	9.10	8.71	4.52	3.99	0.93	3.30	0.16	192.2
288.30	1.05	155.93	12.98	9.10	8.71	4.75	4.21	0.98	3.53	0.21	200.4
288.35	1.10	163.35	12.98	9.10	8.71	4.98	4.44	1.04	3.75	0.27	208.6
288.40	1.15	170.78	12.98	9.10	8.71	5.20	4.67	1.10	3.98	0.33	216.8
288.45	1.20	178.20	12.98	9.10	8.71	5.43	4.89	1.15	4.21	0.38	225.1
288.50	1.25	178.20	12.98	9.10	8.71	5.65	5.12	1.21	4.43	0.44	225.8
288.55	1.30	178.20	12.98	9.10	8.71	5.88	5.34	1.27	4.66	0.50	226.6
288.60	1.35	178.20	12.98	9.10	8.71	6.11	5.57	1.32	4.89	0.55	227.4
288.65	1.40	178.20	12.98	9.10	8.71	6.33	5.80	1.38	5.11	0.61	228.2
288.70	1.45	178.20	12.98	9.10	8.71	6.56	6.02	1.44	5.34	0.67	229.0
288.75	1.50	178.20	12.98	9.10	8.71	6.79	6.25	1.49	5.56	0.72	229.8
288.80	1.55	178.20	12.98	9.10	8.71	7.01	6.48	1.55	5.79	0.78	230.6
288.85	1.60	178.20	12.98	9.10	8.71	7.24	6.70	1.61	6.02	0.84	231.4
288.90	1.65	178.20	12.98	9.10	8.71	7.46	6.93	1.66	6.24	0.89	232.2
288.95	1.70	178.20	12.98	9.10	8.71	7.69	7.15	1.72	6.47	0.95	233.0
288.99	1.74	178.20	12.98	9.10	8.71	7.87	7.34	1.76	6.65	1.00	233.6

COLE ENGINEERING	Infiltration Storage Calculation (North Residential Block)
Prepared by: Ben Lidbetter, EIT	164 Cemetery Road Town of Uxbridge October 2016

Sizing Parameters

Total Linear Length	87.38	m
Volume Per Linear m	1.37	m
Total Volume	119.71	m^3
Footprint	89.94	m^2

COLE ENGINEERING

Prepared By: Ben Lidbetter, EIT

Water Quality Calculations
(Total Site)

164 Cemetery Road

Town of Uxbridge

October 2016

Surface	Method	Effective TSS Removal	Area North (ha)	Area South (ha)	Total Area (ha)	% Area of Site	Overall TSS Removal
Roof Area	Inherent	100%	0.57	0.03	0.60	29%	29%
Pavement	N/A	80%	0.42	0.05	0.47	23%	18%
Landscape	Inherent	100%	0.93	0.07	1.00	48%	48%
Total			1.92	0.15	2.07	100%	95%

COLE ENGINEERING

Prepared By: Ben Lidbetter, EIT

Rational Method Target Flow Calculations (South Apartment Block)

164 Cemetery Road
Town of Uxbridge
October 2016

Time of Concentration Calculation

Area	Area (ha)	C	Time of (min)
A4 Pre	0.15	0.25	10

Formula:	I = A/(T+B)^C	
	A,B,C	Constants
	T	Time of concentration (h)
	I	Rainfall intensity (mm/h)

Rational Method Calculation

Event 2-Year
IDF Data Set Town of Uxbridge
A = 645.00
B = 5.00
C = 0.786

Area	A (ha)	C	AC	Time of (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Pre	0.15	0.25	0.04	10.00	76.763	0.008	8.0

Event 5-Year
IDF Data Set Town of Uxbridge
A = 904.00
B = 5.00
C = 0.788

Area	A (ha)	C	AC	Time of (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Pre	0.15	0.25	0.04	10.00	107.006	0.011	11.1

Event 10-Year
IDF Data Set Town of Uxbridge
A = 1065.00
B = 5.00
C = 0.788

Area	A (ha)	C	AC	Time of (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Pre	0.15	0.25	0.04	10.00	126.064	0.013	13.1

Event 25-Year
IDF Data Set Town of Uxbridge
A = 1234.00
B = 4.00
C = 0.787

Area	A (ha)	C	AC	Time of (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Pre	0.15	0.25	0.04	10.00	154.637	0.016	16.1

Event 100-Year
IDF Data Set Town of Uxbridge
A = 1799.00
B = 5.00
C = 0.810

Area	A (ha)	C	AC	Time of (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Pre	0.15	0.25	0.04	10.00	200.631	0.021	20.9

COLE ENGINEERING

Prepared By: Ben Lidbetter, EIT

Post-Development Composite Coefficient (South Apartment Block)

164 Cemetery Road

Town of Uxbridge

October 2016

Area A4 Post

	(ha)	Coefficent
Total Area	0.066	
Impervious Area	0.000	0.90
Landscaped Area	0.066	0.25
Composite "C"		**0.25**

Area A5 Post

	(ha)	Coefficent
Total Area	0.081	
Impervious Area	0.077	0.90
Landscaped Area	0.004	0.25
Composite "C"		**0.87**

COLE ENGINEERING

Prepared By: Ben Lidbetter, EIT

Rational Method Post-Development Flow Calculations (South Apartment Block)

164 Cemetery Road
Town of Uxbridge
October 2016

Time of Concentration Calculation

Area	Area (ha)	C	Time of (min)
A4 Post	0.07	0.25	10
A5 Post	0.08	0.87	10

Formula: I = A/(T+B)^C

	A,B,C	Constants
	T	Time of concentration (h)
	I	Rainfall intensity (mm/h)

Rational Method Calculation

Event 2-Year
IDF Data Set Town of Uxbridge
A = 645.00
B = 5.00
C = 0.786

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Post	0.07	0.25	0.02	10.00	76.763	0.004	3.5
A5 Post	0.08	0.87	0.07	10.00	76.763	0.015	14.9
Total						**0.018**	**18.4**

Event 5-Year
IDF Data Set Town of Uxbridge
A = 904.00
B = 5.00
C = 0.788

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Post	0.07	0.25	0.02	10.00	107.006	0.005	4.9
A5 Post	0.08	0.87	0.07	10.00	107.006	0.021	20.8
Total						**0.026**	**25.7**

Event 10-Year
IDF Data Set Town of Uxbridge
A = 1065.00
B = 5.00
C = 0.788

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Post	0.07	0.25	0.02	10.00	126.064	0.006	5.8
A5 Post	0.08	0.87	0.07	10.00	126.064	0.025	24.5
Total						**0.030**	**30.3**

COLE ENGINEERING

Prepared By: Ben Lidbetter, EIT

Rational Method Post-Development Flow Calculations (South Apartment Block)

164 Cemetery Road
Town of Uxbridge
October 2016

Event 25-Year
IDF Data Set Town of Uxbridge
A = 1234.00
B = 4.00
C = 0.787

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Post	0.07	0.25	0.02	10.00	154.637	0.007	7.1
A5 Post	0.08	0.87	0.07	10.00	154.637	0.030	30.1
Total						**0.037**	**37.1**

Event 100-Year
IDF Data Set Town of Uxbridge
A = 1799.00
B = 5.00
C = 0.810

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A4 Post	0.07	0.25	0.02	10.00	200.631	0.009	9.2
A5 Post	0.08	0.87	0.07	10.00	200.631	0.039	39.0
Total						**0.048**	**48.2**

COLE ENGINEERING

Prepared By: Ben Lidbetter, EIT

Modified Rational Method - Two Year Storm
Site Flow and Storage Summary (South Apartment Block)

164 Cemetery Road
Town of Uxbridge
October 2016

2-Year Design Storm

A=	645.00
B=	5.00
C=	0.786
I =	I = A/(T+B)^C

A4 Post Uncontrolled

Drainage Areas	A4 Post	
Area	**0.07**	ha
"C" =	**0.25**	
AC (2,3, EXT1) =	**0.02**	
Tc =	**10.0**	min
Time Increment =	**10.0**	min
Max. Uncontrolled Release Rate =	**3.5**	L/s

A5 Post Controlled

Drainage Areas	A5 Post	
Area =	**0.08**	ha
"C" =	**0.87**	
AC1	**0.07**	
Tc =	**10.0**	min
Release Rate (Full Site) =	**9.9**	L/s
Release Rate (R1) =	**6.4**	L/s
Max.Storage =	**5.1**	m^3

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time (min)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (Uncontrolled) (m^3/s)**	**Runoff Volume (Uncontrolled) (m^3)**	**Storm Runoff (A2 Post) (m^3/s)**	**Runoff Volume (A1 Post) (m^3)**	**Allowable Released Volume (m^3)**	**Storage Volume (m^3)**
	I = A(T)^B	**(3) = [(2)*AC2,3,EXT1]/360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1]/360**	**(6) = (5)*(1)*60**	**(7) = [(R1) / 1000]*(1)*60**	**(8) = (6)-(7)**
10.0	76.8	0.004	2.1	0.015	9.0	3.8	5.1
20.0	51.4	0.002	2.8	0.010	12.0	7.6	4.4
30.0	39.4	0.002	3.2	0.008	13.8	11.4	2.4
40.0	32.4	0.001	3.6	0.006	15.1	15.2	0.0
50.0	27.6	0.001	3.8	0.005	16.1	19.1	0.0
60.0	24.2	0.001	4.0	0.005	17.0	22.9	0.0
70.0	21.7	0.001	4.2	0.004	17.7	26.7	0.0
80.0	19.6	0.001	4.3	0.004	18.3	30.5	0.0
90.0	18.0	0.001	4.4	0.003	18.9	34.3	0.0
100.0	16.6	0.001	4.6	0.003	19.4	38.1	0.0
110.0	15.5	0.001	4.7	0.003	19.9	41.9	0.0
120.0	14.5	0.001	4.8	0.003	20.3	45.7	0.0
130.0	13.6	0.001	4.9	0.003	20.7	49.5	0.0
140.0	12.9	0.001	5.0	0.003	21.1	53.4	0.0
150.0	12.2	0.001	5.0	0.002	21.4	57.2	0.0
160.0	11.7	0.001	5.1	0.002	21.8	61.0	0.0
170.0	11.1	0.001	5.2	0.002	22.1	64.8	0.0
180.0	10.7	0.000	5.3	0.002	22.4	68.6	0.0
190.0	10.2	0.000	5.3	0.002	22.7	72.4	0.0
200.0	9.8	0.000	5.4	0.002	22.9	76.2	0.0
210.0	9.5	0.000	5.5	0.002	23.2	80.0	0.0
220.0	9.1	0.000	5.5	0.002	23.4	83.8	0.0
230.0	8.8	0.000	5.6	0.002	23.7	87.6	0.0
240.0	8.5	0.000	5.6	0.002	23.9	91.5	0.0
250.0	8.3	0.000	5.7	0.002	24.1	95.3	0.0
260.0	8.0	0.000	5.7	0.002	24.4	99.1	0.0
270.0	7.8	0.000	5.8	0.002	24.6	102.9	0.0
280.0	7.6	0.000	5.8	0.001	24.8	106.7	0.0
290.0	7.4	0.000	5.9	0.001	25.0	110.5	0.0
300.0	7.2	0.000	5.9	0.001	25.2	114.3	0.0
310.0	7.0	0.000	6.0	0.001	25.4	118.1	0.0
320.0	6.8	0.000	6.0	0.001	25.5	121.9	0.0

Prepared By: Ben Lidbetter, EIT

Modified Rational Method - Five Year Storm
Site Flow and Storage Summary (South Apartment Block)

164 Cemetery Road
Town of Uxbridge
October 2016

A4 Post Uncontrolled

Drainage Areas	A4 Post	
Area	**0.07**	ha
"C" =	**0.25**	
AC (2,3, EXT1) =	**0.02**	
Tc =	**10.0**	min
Time Increment =	**10.0**	min
Max. Uncontrolled Release Rate =	**4.9**	L/s

A5 Post Controlled

Drainage Areas	A5 Post	
Area =	**0.08**	ha
"C" =	**0.87**	
AC1	**0.07**	
Tc =	**10.0**	min
Release Rate (Full Site) =	**12.8**	L/s
Release Rate (R1) =	**7.9**	L/s
Max.Storage =	**7.7**	m^3

5-Year Design Storm	
A=	904.00
B=	5.00
C=	0.788
I =	I = A/(T+B)^C

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time (min)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (Uncontrolled) (m^3/s)**	**Runoff Volume (Uncontrolled) (m^3)**	**Storm Runoff (A2 Post) (m^3/s)**	**Runoff Volume (A1 Post) (m^3)**	**Allowable Released Volume (m^3)**	**Storage Volume (m^3)**
	I = A(T)^B	**(3) = [(2)*AC2,3,EXT1]/360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1]/360**	**(6) = (5)*(1)*60**	**(7) = [(R1) / 1000]*(1)*60**	**(8) = (6)-(7)**
10.0	107.0	0.005	2.9	0.021	12.5	4.8	7.7
20.0	71.5	0.003	3.9	0.014	16.7	9.5	7.2
30.0	54.9	0.003	4.5	0.011	19.2	14.3	4.9
40.0	45.0	0.002	4.9	0.009	21.0	19.0	2.0
50.0	38.4	0.002	5.3	0.007	22.4	23.8	0.0
60.0	33.7	0.002	5.6	0.007	23.6	28.5	0.0
70.0	30.1	0.001	5.8	0.006	24.6	33.3	0.0
80.0	27.3	0.001	6.0	0.005	25.5	38.1	0.0
90.0	25.0	0.001	6.2	0.005	26.2	42.8	0.0
100.0	23.1	0.001	6.3	0.004	26.9	47.6	0.0
110.0	21.5	0.001	6.5	0.004	27.6	52.3	0.0
120.0	20.1	0.001	6.6	0.004	28.2	57.1	0.0
130.0	18.9	0.001	6.8	0.004	28.7	61.8	0.0
140.0	17.9	0.001	6.9	0.003	29.2	66.6	0.0
150.0	17.0	0.001	7.0	0.003	29.7	71.4	0.0
160.0	16.2	0.001	7.1	0.003	30.2	76.1	0.0
170.0	15.4	0.001	7.2	0.003	30.6	80.9	0.0
180.0	14.8	0.001	7.3	0.003	31.0	85.6	0.0
190.0	14.2	0.001	7.4	0.003	31.4	90.4	0.0
200.0	13.6	0.001	7.5	0.003	31.8	95.2	0.0
210.0	13.1	0.001	7.6	0.003	32.2	99.9	0.0
220.0	12.7	0.001	7.7	0.002	32.5	104.7	0.0
230.0	12.2	0.001	7.7	0.002	32.8	109.4	0.0
240.0	11.8	0.001	7.8	0.002	33.2	114.2	0.0
250.0	11.5	0.001	7.9	0.002	33.5	118.9	0.0
260.0	11.1	0.001	7.9	0.002	33.8	123.7	0.0
270.0	10.8	0.000	8.0	0.002	34.1	128.5	0.0
280.0	10.5	0.000	8.1	0.002	34.3	133.2	0.0
290.0	10.2	0.000	8.1	0.002	34.6	138.0	0.0
300.0	10.0	0.000	8.2	0.002	34.9	142.7	0.0
310.0	9.7	0.000	8.3	0.002	35.1	147.5	0.0
320.0	9.5	0.000	8.3	0.002	35.4	152.2	0.0

Prepared By: Ben Lidbetter, EIT

Modified Rational Method - Ten Year Storm
Site Flow and Storage Summary (South Apartment Block)

164 Cemetery Road
Town of Uxbridge
October 2016

A4 Post Uncontrolled

Drainage Areas	A4 Post	
Area	**0.07**	ha
"C" =	**0.25**	
AC (2,3, EXT1) =	**0.02**	
Tc =	**10.0**	min
Time Increment =	**10.0**	min
Max. Uncontrolled Release Rate =	**5.8**	L/s

A5 Post Controlled

Drainage Areas	A5 Post	
Area =	**0.08**	ha
"C" =	**0.87**	
AC1	**0.07**	
Tc =	**10.0**	min
Release Rate (Full Site) =	**14.6**	L/s
Release Rate (R1) =	**8.8**	L/s
Max.Storage =	**9.4**	m^3

10-Year Design Storm	
A=	1065.00
B=	5.00
C=	0.788
I =	I = A/(T+B)^C

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time (min)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (Uncontrolled) (m^3/s)**	**Runoff Volume (Uncontrolled) (m^3)**	**Storm Runoff (A2 Post) (m^3/s)**	**Runoff Volume (A1 Post) (m^3)**	**Allowable Released Volume (m^3)**	**Storage Volume (m^3)**
	I = A(T)^B	**(3) = [(2)*AC2,3,EXT1]/360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1]/360**	**(6) = (5)*(1)*60**	**(7) = [(R1) / 1000]*(1)*60**	**(8) = (6)-(7)**
10.0	126.1	0.006	3.5	0.025	14.7	5.3	9.4
20.0	84.3	0.004	4.6	0.016	19.7	10.6	9.1
30.0	64.7	0.003	5.3	0.013	22.6	15.9	6.7
40.0	53.0	0.002	5.8	0.010	24.7	21.2	3.6
50.0	45.3	0.002	6.2	0.009	26.4	26.5	0.0
60.0	39.7	0.002	6.5	0.008	27.8	31.8	0.0
70.0	35.5	0.002	6.8	0.007	29.0	37.1	0.0
80.0	32.1	0.001	7.1	0.006	30.0	42.4	0.0
90.0	29.4	0.001	7.3	0.006	30.9	47.7	0.0
100.0	27.2	0.001	7.5	0.005	31.7	53.0	0.0
110.0	25.3	0.001	7.6	0.005	32.5	58.3	0.0
120.0	23.7	0.001	7.8	0.005	33.2	63.5	0.0
130.0	22.3	0.001	8.0	0.004	33.8	68.8	0.0
140.0	21.1	0.001	8.1	0.004	34.4	74.1	0.0
150.0	20.0	0.001	8.2	0.004	35.0	79.4	0.0
160.0	19.1	0.001	8.4	0.004	35.6	84.7	0.0
170.0	18.2	0.001	8.5	0.004	36.1	90.0	0.0
180.0	17.4	0.001	8.6	0.003	36.6	95.3	0.0
190.0	16.7	0.001	8.7	0.003	37.0	100.6	0.0
200.0	16.1	0.001	8.8	0.003	37.5	105.9	0.0
210.0	15.5	0.001	8.9	0.003	37.9	111.2	0.0
220.0	14.9	0.001	9.0	0.003	38.3	116.5	0.0
230.0	14.4	0.001	9.1	0.003	38.7	121.8	0.0
240.0	14.0	0.001	9.2	0.003	39.1	127.1	0.0
250.0	13.5	0.001	9.3	0.003	39.4	132.4	0.0
260.0	13.1	0.001	9.4	0.003	39.8	137.7	0.0
270.0	12.7	0.001	9.4	0.002	40.1	143.0	0.0
280.0	12.4	0.001	9.5	0.002	40.4	148.3	0.0
290.0	12.1	0.001	9.6	0.002	40.8	153.6	0.0
300.0	11.7	0.001	9.7	0.002	41.1	158.9	0.0
310.0	11.4	0.001	9.7	0.002	41.4	164.2	0.0
320.0	11.2	0.001	9.8	0.002	41.7	169.5	0.0

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Prepared By: Ben Lidbetter, EIT

Modified Rational Method - Twenty-Five Year Storm
Site Flow and Storage Summary (South Apartment Block)

164 Cemetery Road
Town of Uxbridge
October 2016

A4 Post Uncontrolled

Drainage Areas	A4 Post	
Area	**0.07**	ha
"C" =	**0.25**	
AC (2,3, EXT1) =	**0.02**	
Tc =	**10.0**	min
Time Increment =	**10.0**	min
Max. Uncontrolled Release Rate =	**7.1**	L/s

A5 Post Controlled

Drainage Areas	A5 Post	
Area =	**0.08**	ha
"C" =	**0.87**	
AC1	**0.07**	
Tc =	**10.0**	min
Release Rate (Full Site) =	**17.1**	L/s
Release Rate (R1) =	**10.0**	L/s
Max.Storage =	**12.0**	m^3

25-Year Design Storm	
A=	1234.00
B=	4.00
C=	0.787
I =	I = A/(T+B)^C

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time (min)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (Uncontrolled) (m^3/s)**	**Runoff Volume (Uncontrolled) (m^3)**	**Storm Runoff (A2 Post) (m^3/s)**	**Runoff Volume (A1 Post) (m^3)**	**Allowable Released Volume (m^3)**	**Storage Volume (m^3)**
	I = A(T)^B	**(3) = [(2)*AC2,3,EXT1]/360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1]/360**	**(6) = (5)*(1)*60**	**(7) = [(R1) / 1000]*(1)*60**	**(8) = (6)-(7)**
10.0	154.6	0.007	4.2	0.030	18.0	6.0	12.0
20.0	101.2	0.005	5.6	0.020	23.6	12.1	11.5
30.0	76.9	0.004	6.3	0.015	26.9	18.1	8.8
40.0	62.8	0.003	6.9	0.012	29.3	24.1	5.2
50.0	53.4	0.002	7.3	0.010	31.2	30.1	1.0
60.0	46.8	0.002	7.7	0.009	32.7	36.2	0.0
70.0	41.7	0.002	8.0	0.008	34.1	42.2	0.0
80.0	37.7	0.002	8.3	0.007	35.2	48.2	0.0
90.0	34.6	0.002	8.5	0.007	36.3	54.2	0.0
100.0	31.9	0.001	8.8	0.006	37.2	60.3	0.0
110.0	29.7	0.001	9.0	0.006	38.1	66.3	0.0
120.0	27.8	0.001	9.2	0.005	38.9	72.3	0.0
130.0	26.1	0.001	9.3	0.005	39.6	78.3	0.0
140.0	24.7	0.001	9.5	0.005	40.3	84.4	0.0
150.0	23.4	0.001	9.6	0.005	41.0	90.4	0.0
160.0	22.3	0.001	9.8	0.004	41.6	96.4	0.0
170.0	21.3	0.001	9.9	0.004	42.2	102.4	0.0
180.0	20.4	0.001	10.1	0.004	42.8	108.5	0.0
190.0	19.5	0.001	10.2	0.004	43.3	114.5	0.0
200.0	18.8	0.001	10.3	0.004	43.8	120.5	0.0
210.0	18.1	0.001	10.4	0.004	44.3	126.5	0.0
220.0	17.4	0.001	10.5	0.003	44.8	132.6	0.0
230.0	16.9	0.001	10.6	0.003	45.2	138.6	0.0
240.0	16.3	0.001	10.7	0.003	45.7	144.6	0.0
250.0	15.8	0.001	10.8	0.003	46.1	150.7	0.0
260.0	15.3	0.001	10.9	0.003	46.5	156.7	0.0
270.0	14.9	0.001	11.0	0.003	46.9	162.7	0.0
280.0	14.5	0.001	11.1	0.003	47.3	168.7	0.0
290.0	14.1	0.001	11.2	0.003	47.6	174.8	0.0
300.0	13.7	0.001	11.3	0.003	48.0	180.8	0.0
310.0	13.4	0.001	11.4	0.003	48.4	186.8	0.0
320.0	13.0	0.001	11.5	0.003	48.7	192.8	0.0

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Prepared By: Ben Lidbetter, EIT

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary (South Apartment Block)

164 Cemetery Road
Town of Uxbridge
October 2016

A4 Post Uncontrolled

Drainage Areas	A4 Post	
Area	**0.07**	ha
"C" =	**0.25**	
AC (2,3, EXT1) =	**0.02**	
Tc =	**10.0**	min
Time Increment =	**10.0**	min
Max. Uncontrolled Release Rate =	**9.2**	L/s

A5 Post Controlled

Drainage Areas	A5 Post	
Area =	**0.08**	ha
"C" =	**0.87**	
AC1	**0.07**	
Tc =	**10.0**	min
Release Rate (Full Site) =	**21.1**	L/s
Release Rate (R1) =	**11.9**	L/s
Max.Storage =	**16.6**	m^3

100-Year Design Storm	
A=	1799.00
B=	5.00
C=	0.810
I =	I = A/(T+B)^C

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time (min)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (Uncontrolled) (m^3/s)**	**Runoff Volume (Uncontrolled) (m^3)**	**Storm Runoff (A2 Post) (m^3/s)**	**Runoff Volume (A1 Post) (m^3)**	**Allowable Released Volume (m^3)**	**Storage Volume (m^3)**
	I = A(T)^B	**(3) = [(2)*AC2,3,EXT1]/360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1]/360**	**(6) = (5)*(1)*60**	**(7) = [(R1) / 1000]*(1)*60**	**(8) = (6)-(7)**
10.0	200.6	0.009	5.5	0.039	23.4	7.1	16.3
20.0	132.6	0.006	7.3	0.026	30.9	14.3	16.6
30.0	101.0	0.005	8.3	0.020	35.3	21.4	13.9
40.0	82.4	0.004	9.1	0.016	38.4	28.6	9.8
50.0	70.0	0.003	9.6	0.014	40.8	35.7	5.1
60.0	61.2	0.003	10.1	0.012	42.8	42.9	0.0
70.0	54.5	0.002	10.5	0.011	44.5	50.0	0.0
80.0	49.2	0.002	10.8	0.010	45.9	57.2	0.0
90.0	45.0	0.002	11.1	0.009	47.2	64.3	0.0
100.0	41.5	0.002	11.4	0.008	48.4	71.5	0.0
110.0	38.5	0.002	11.6	0.007	49.4	78.6	0.0
120.0	36.0	0.002	11.9	0.007	50.4	85.8	0.0
130.0	33.8	0.002	12.1	0.007	51.3	92.9	0.0
140.0	31.9	0.001	12.3	0.006	52.2	100.1	0.0
150.0	30.3	0.001	12.5	0.006	52.9	107.2	0.0
160.0	28.8	0.001	12.6	0.006	53.7	114.4	0.0
170.0	27.4	0.001	12.8	0.005	54.4	121.5	0.0
180.0	26.2	0.001	13.0	0.005	55.0	128.7	0.0
190.0	25.1	0.001	13.1	0.005	55.7	135.8	0.0
200.0	24.1	0.001	13.2	0.005	56.3	143.0	0.0
210.0	23.2	0.001	13.4	0.005	56.9	150.1	0.0
220.0	22.4	0.001	13.5	0.004	57.4	157.3	0.0
230.0	21.6	0.001	13.6	0.004	57.9	164.4	0.0
240.0	20.9	0.001	13.8	0.004	58.5	171.6	0.0
250.0	20.2	0.001	13.9	0.004	59.0	178.7	0.0
260.0	19.6	0.001	14.0	0.004	59.4	185.9	0.0
270.0	19.0	0.001	14.1	0.004	59.9	193.0	0.0
280.0	18.5	0.001	14.2	0.004	60.3	200.2	0.0
290.0	18.0	0.001	14.3	0.003	60.8	207.3	0.0
300.0	17.5	0.001	14.4	0.003	61.2	214.5	0.0
310.0	17.0	0.001	14.5	0.003	61.6	221.6	0.0
320.0	16.6	0.001	14.6	0.003	62.0	228.8	0.0

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Orifice Control Calculation (South Apartment Block)

164 Cemetery Road
Town of Uxbridge
October 2016

Orifice Equation

$$Q = C \times A \times \sqrt{2 \times g \times h}$$

Storm Event	Drainage Area ID	Orifice Location	Orifice Coefficient	Diameter of Orifice (mm)	Orifice Invert (m)	Headwater Elevation (m)	Total Head (m)	Area of Orifice (m^2)	Release Rate (L/s)
2-Year	A4 Post	MH7	0.60	75	286.40	286.73	0.29	0.004	6.4
5-Year	A4 Post	MH7	0.60	75	286.40	286.89	0.46	0.004	7.9
10-Year	A4 Post	MH7	0.60	75	286.40	287.00	0.57	0.004	8.8
25-Year	A4 Post	MH7	0.60	75	286.40	287.17	0.73	0.004	10.0
100-Year	A4 Post	MH7	0.60	75	286.40	287.47	1.03	0.004	11.9

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Infiltration Storage Calculation (South Apartment Block)

164 Cemetery Road
Town of Uxbridge
October 2016

Sizing Parameters

Total Linear Length	13.00	m
Volume Per Linear m	1.37	m
Total Volume	17.81	m^3

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164 Cemetery Road, Town of Uxbridge
Tbale 1 of 6: Site Water Balance Calculations (Annual)

Condition	Site Area (ha)	Water Balance Components	Pervious Area Without Infiltration BMP's	Impervious Area Without Infiltration BMP's	Impervious Area With Basic Infiltration BMP's	Pervious Area With Enhanced Infiltration BMP's	Impervious Area With Enhanced Infiltration BMP's	TOTAL SITE VOLUMES Precipitation (m^3)	Evapotranspiration (m^3)	Surplus (m^3)	Runoff (m^3)	Infiltration (m^3)	Percent of Existing Infiltration (%)
		Area (ha)	1.93	0.14	0.00	0.00	0.00						
		HSG	A	n/a	A	A	A						
		Weighted WHC (mm)	100	n/a	50	50	50						
		Infiltration Factor	0.78	0.00	0.70	0.85	0.85						
Existing	**2.07**	Precipitation (mm)	892.0	892.0	892.0	892.0	892.0	18,464	10,689	7,600	2,678	4,922	100.0
		Evapotranspiration (mm)	553.8	0.0	513.5	513.5	513.5						
		Surplus (mm)	329.1	892.0	371.1	371.1	371.1						
		Infiltration (mm)	255.0	0.0	259.8	315.5	315.5						
		Runoff (mm)	74.0	892.0	111.3	55.7	55.7						
		Area (ha)	1.00	1.07	0.00	0.00	0.00						
		HSG	A	n/a	A	A	A						
		Weighted WHC (mm)	50	n/a	50	50	50						
		Infiltration Factor	0.70	0.00	0.85	0.85	0.85						
Proposed (No Infiltration BMP's)	**2.07**	Precipitation (mm)	892.0	892.0	892.0	892.0	892.0	18,464	5,150	13,240	10,634	2,606	52.9
		Evapotranspiration (mm)	513.5	0.0	513.5	513.5	513.5						
		Surplus (mm)	371.1	892.0	371.1	371.1	371.1						
		Infiltration (mm)	259.8	0.0	315.5	315.5	315.5						
		Runoff (mm)	111.3	892.0	55.7	55.7	55.7						
		Area (ha)	1.00	0.53	0.53	0.00	0.00						
		HSG	A	n/a	A	A	A						
		Weighted WHC (mm)	50	n/a	50	50	50						
		Infiltration Factor	0.70	0.00	0.40	0.85	0.85						
Proposed (With Basic Infiltration BMP's)	**2.07**	Precipitation (mm)	892.0	892.0	892.0	892.0	892.0	18,464	7,890	10,461	7,063	3,398	69.0
		Evapotranspiration (mm)	513.5	0.0	513.5	513.5	513.5						
		Surplus (mm)	371.1	892.0	371.1	371.1	371.1						
		Infiltration (mm)	259.8	0.0	148.4	315.5	315.5						
		Runoff (mm)	111.3	892.0	222.7	55.7	55.7						
Proposed (With Enhanced Infiltration BMP's)	**2.07**				**See Table 1.5**						2,440	5,838	119%

Notes:

1. Site water balance calculations based on methodology per *Stormwater Management Planning and Design Manual* (MOE, March 2003).
2. Basic Infiltration BMP's consist of roof runoff directed to pervious areas.
3. Enhanced Infiltration BMP's consist of Basic Infiltration BMP's + roof runoff and pervious runoff from selected areas directed to infiltration trenches.
4. Roof area for infiltration is assumed as 17% of the total area (per medium density residential) to be conservative, and hence, only 71% (2.4 ha of 3.4 ha) of the actual roof drainage area is considered during water balance calculations.

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Table 2 of 6: Water Holding Capacity (WHC) Calculations

Per MOE Methodology (SWM Planning & Design Manual, MOE, March 2003)

Existing Conditions (Pervious Area)	
C	HSG
Agr.	Moderate Rooted Crop
200	WHC (mm)

Proposed Conditions (Pervious Area	
C	HSG
Lawn	Veg. Cover
125	WHC (mm)

Urban Lawns/Shallow Rooted Crops (spinach, beans, beets, carrots)		
Fine Sand	**A**	**50**
	AB	**63**
Fine Sandy Loam	**B**	**75**
	BC	**100**
Silt Loam, Muck	**C**	**125**
Clay Loam	**CD**	**100**
Clay	**D**	**75**
Moderately Rooted Crops (corn and cereal grains)		
Fine Sand	**A**	**75**
	AB	**113**
Fine Sandy Loam	**B**	**150**
	BC	**175**
Silt Loam,Muck	**C**	**200**
Clay Loam	**CD**	**200**
Clay	**D**	**150**
Pasture and Shrubs		
Fine Sand	**A**	**100**
	AB	**125**
Fine Sandy Loam	**B**	**150**
	BC	**200**
Silt Loam, Muck	**C**	**250**
Clay Loam	**CD**	**250**
Clay	**D**	**200**
Mature Forests		
Fine Sand	**A**	**250**
	AB	**275**
Fine Sandy Loam	**B**	**300**
	BC	**350**
Silt Loam, Muck	**C**	**400**
Clay Loam	**CD**	**400**
Clay	**D**	**350**

Table 3.1: Hydrologic Cycle Component Values

	Water Holding Capacity mm	Hydrologic Soil Group	Precipitation mm	Evapo-transpiration mm	Runoff mm	Infiltration* mm
Urban Lawns/Shallow Rooted Crops (spinach, beans, beets, carrots)						
Fine Sand	50	A	940	515	149	276
Fine Sandy Loam	75	B	940	525	187	228
Silt Loam	125	C	940	536	222	182
Clay Loam	100	CD	940	531	245	164
Clay	75	D	940	525	270	145
Moderately Rooted Crops (corn and cereal grains)						
Fine Sand	75	A	940	525	125	291
Fine Sandy Loam	150	B	940	539	160	241
Silt Loam	200	C	940	543	199	199
Clay Loam	200	CD	940	543	218	179
Clay	150	D	940	539	241	160
Pasture and Shrubs						
Fine Sand	100	A	940	531	102	307
Fine Sandy Loam	150	B	940	539	140	261
Silt Loam	250	C	940	546	177	217
Clay Loam	250	CD	940	546	197	197
Clay	200	D	940	543	218	179
Mature Forests						
Fine Sand	250	A	940	546	79	315
Fine Sandy Loam	300	B	940	548	118	274
Silt Loam	400	C	940	550	156	234
Clay Loam	400	CD	940	550	176	215
Clay	350	D	940	549	196	196

Notes: Hydrologic Soil Group A represents soils with low runoff potential and Soil Group D represents soils with high runoff potential. The evapotranspiration values are for mature vegetation. Streamflow is composed of baseflow and runoff.

**This is the total infiltration of which some discharges back to the stream as base flow. The infiltration factor is determined by summing a factor for topography, soils and cover.*

Topography	Flat Land, average slope < 0.6 m/km	0.3
	Rolling Land, average slope 2.8 m to 3.8 m/km	0.2
	Hilly Land, average slope 28 m to 47 m/km	0.1
Soils	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open Sandy loam	0.4
Cover	Cultivated Land	0.1
	Woodland	0.2

Table 3 of 6 : Infiltration Factor Calculations
Per MOE Methodology (SWM Planning & Design Manual, MOE, March 2003)

Topography	
0.3	Flat Land (avg slope < 0.06%)
0.225	0.06% to 0.27%
0.15	Rolling Land (avg slope between 0.28% and 0.38%)
0.125	0.39% to 2.7%
0.1	Hilly Land (avg slope between 2.8% and 4.7%)
Soils	
0.4	HSG A - open sandy loam
0.35	HSG AB
0.3	HSG B
0.27	HSG BC
0.23	HSG C
0.2	HSG CD - medium combinations of clay and loam
0.1	HSG D - tight impervious clay
Cover	
0.1	cultivated land (crops)
0.15	pasture, lawns
0.2	woodland (forest)

Infiltration Factor Calculations

Existing Conditions	
0.125	Topography
0.23	Soils
0.1	Cover
0.46	Total Infiltration Factor (Existing Conditions)
Proposed Conditions	
0.125	Topography
0.23	Soils
0.15	Cover
0.51	Total Infiltration Factor (Proposed Conditions)

Table 4 of 6: Rainfall Analysis

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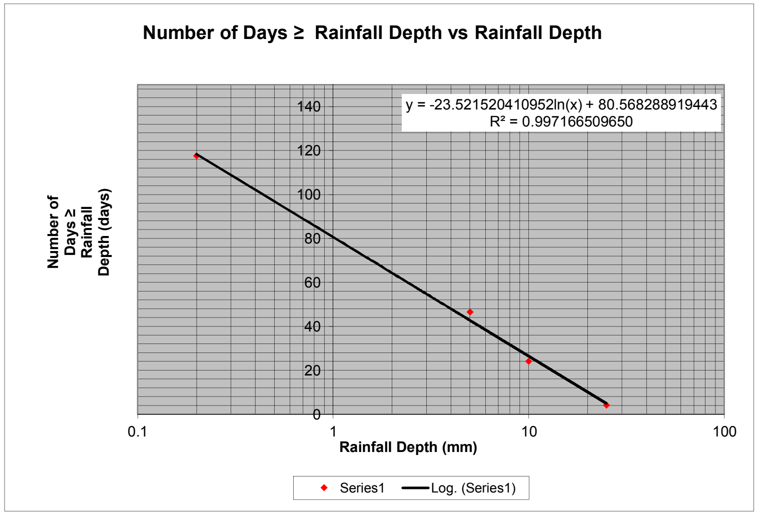


Normal Rainfall Depth (mm)	Normal Days ≥ Rainfall Depth (days)
0.2	117.6
5	46.5
10	24.1
25	4.2

Richmond Hill Climate Normals (1971 - 2000)

735.6	Normal Annual Rainfall Depth (mm)
117.6	Normal Annual Days with Rainfall (≥ 0.2 mm)
892.4	Normal Annual Precipitation Depth (mm)

Simulated Depth (mm)	Simulated Days ≥ Sim Depth (days)	Average Event Depth (mm)	Simulated Days Equal to Avg Depth (days)	Assumed IA (mm)	Runoff (Rain - IA) (mm)	INF Design Storm (mm)	Event Based Maximum Design INF Depth (mm)	Event Based Design INF Depth (mm)	Annual Incremental Design INF Depth (mm)	Annual Cumulative Design INF Depth (mm)	Annual Incremental Total Rain Depth (mm)	Annual Percent of Total Rain (%)	Annual Cumulative Total Rain Depth (mm)	Annual Cumulative Percent of Total Depth (%)
0.2	118.42													
0.5	96.87	0.2 - 0.5	21.55	**5.00**	0.00	**10.00**	5.00	0.00	0.00	0.00		0.000	0.0	0.000
1.5	71.03	1	25.84	5.00	0.00	10.00	5.00	0.00	0.00	0.00	25.84	0.035	25.8	0.035
2.5	59.02	2	12.02	5.00	0.00	10.00	5.00	0.00	0.00	0.00	24.03	0.033	49.9	0.068
3.5	51.10	3	7.91	5.00	0.00	10.00	5.00	0.00	0.00	0.00	23.74	0.032	73.6	0.100
4.5	45.19	4	5.91	5.00	0.00	10.00	5.00	0.00	0.00	0.00	23.65	0.032	97.3	0.132
5.5	40.47	5	4.72	5.00	0.00	10.00	5.00	0.00	0.00	0.00	23.60	0.032	120.9	0.164
6.5	36.54	6	3.93	5.00	1.00	10.00	5.00	1.00	3.93	3.93	23.58	0.032	144.4	0.196
7.5	33.17	7	3.37	5.00	2.00	10.00	5.00	2.00	6.73	10.66	23.56	0.032	168.0	0.228
8.5	30.23	8	2.94	5.00	3.00	10.00	5.00	3.00	8.83	19.49	23.55	0.032	191.6	0.260
9.5	27.61	9	2.62	5.00	4.00	10.00	5.00	4.00	10.46	29.96	23.55	0.032	215.1	0.292
10.5	25.26	10	2.35	5.00	5.00	10.00	5.00	5.00	11.77	41.73	23.54	0.032	238.6	0.324
11.5	23.12	11	2.14	5.00	6.00	10.00	5.00	5.00	10.70	52.43	23.54	0.032	262.2	0.356
12.5	21.16	12	1.96	5.00	7.00	10.00	5.00	5.00	9.81	62.23	23.54	0.032	285.7	0.388
13.5	19.35	13	1.81	5.00	8.00	10.00	5.00	5.00	9.05	71.29	23.53	0.032	309.2	0.420
14.5	17.67	14	1.68	5.00	9.00	10.00	5.00	5.00	8.40	79.69	23.53	0.032	332.8	0.452
15.5	16.10	15	1.57	5.00	10.00	10.00	5.00	5.00	7.84	87.53	23.53	0.032	356.3	0.484
16.5	14.63	16	1.47	5.00	11.00	10.00	5.00	5.00	7.35	94.89	23.53	0.032	379.8	0.516
17.5	13.24	17	1.38	5.00	12.00	10.00	5.00	5.00	6.92	101.81	23.53	0.032	403.4	0.548
18.5	11.94	18	1.31	5.00	13.00	10.00	5.00	5.00	6.54	108.34	23.53	0.032	426.9	0.580
19.5	10.70	19	1.24	5.00	14.00	10.00	5.00	5.00	6.19	114.53	23.53	0.032	450.4	0.612
20.5	9.52	20	1.18	5.00	15.00	10.00	5.00	5.00	5.88	120.41	23.53	0.032	473.9	0.644
21.5	8.40	21	1.12	5.00	16.00	10.00	5.00	5.00	5.60	126.02	23.53	0.032	497.5	0.676
22.5	7.33	22	1.07	5.00	17.00	10.00	5.00	5.00	5.35	131.36	23.53	0.032	521.0	0.708
23.5	6.31	23	1.02	5.00	18.00	10.00	5.00	5.00	5.11	136.48	23.53	0.032	544.5	0.740
24.5	5.33	24	0.98	5.00	19.00	10.00	5.00	5.00	4.90	141.38	23.52	0.032	568.0	0.772
25.5	4.39	25	0.94	5.00	20.00	10.00	5.00	5.00	4.70	146.08	23.52	0.032	591.6	0.804
26.5	3.48	26	0.90	5.00	21.00	10.00	5.00	5.00	4.52	150.61	23.52	0.032	615.1	0.836
27.5	2.61	27	0.87	5.00	22.00	10.00	5.00	5.00	4.36	154.96	23.52	0.032	638.6	0.868
28.5	1.77	28	0.84	5.00	23.00	10.00	5.00	5.00	4.20	159.16	23.52	0.032	662.1	0.900
29	1.36	≥ 29	1.36	5.00	24.00	10.00	5.00	5.00	6.82	165.99	73.46	0.100	735.6	1.000

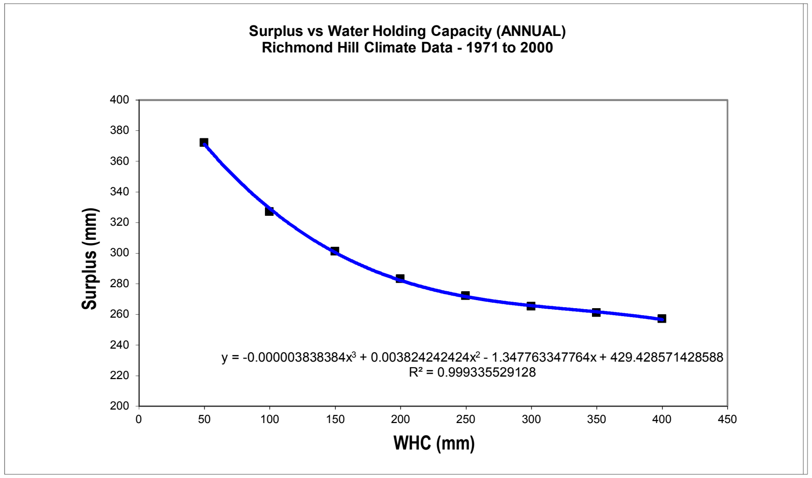
COLE ENGINEERING
File: UD16-0349
October 2016

Table 5 of 6: Surplus and Actual Evapotranspiration vs Water Holding Capacity (WHC) Regression Analysis

AES Water Balance Model Results for a Range of WHC
Richmond Hill Climate Data (1971 - 2000)

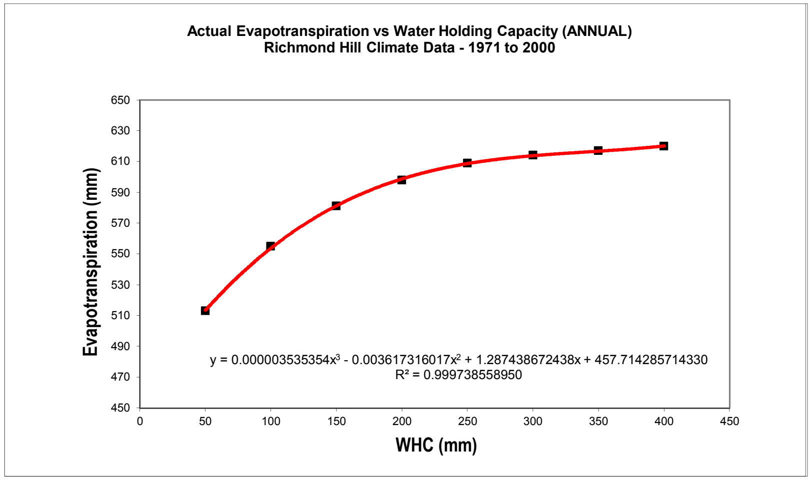
Existing Condition

Trendline			AES Model Results	
Surplus	AE	WHC	Surplus	AE
(mm)	(mm)	(mm)	(mm)	(mm)
371	513	50	372	513
329	554	100	327	555
300	581	150	301	581
282	599	200	283	598
272	609	250	272	609
266	614	300	265	614
262	617	350	261	617
257	620	400	257	620
329.1	553.8	100.00	TOTAL SITE	



Proposed Condition

Trendline			AES Model Results	
Surplus	AE	WHC	Surplus	AE
(mm)	(mm)	(mm)	(mm)	(mm)
371	513	50	372	513
329	554	100	327	555
300	581	150	301	581
282	599	200	283	598
272	609	250	272	609
266	614	300	265	614
262	617	350	261	617
257	620	400	257	620
371.1	513.5	50.00	TOTAL SITE	



164 Cemetery Road, Town of Uxbridge

Table 6 of 6: Infiltration Trench Sizing Calculation

Designed By: Csheng
Checked By: Csheng
Checked By:
File No.: UD16-0349

Total Req'd Annual Infiltration Volume to Achieve Target (m^3)	*Total Actual Annual Infiltration Volume per Design (m^3)*	*Soil Percolation Rate (mm/h)*	*Drainage Area (ha)*	*Maximum Trench Length per Site Plan (m)*	*Composite Imperviousness (%)*	*Retention Time (hr)*	*Total Annual Rainfall Depth (Per 1971-2000 Climate Normals for Pearson Airport) (mm)*	*Total Rainfall Depth Available for Infiltration Per Rainfall Analysis Assuming Ia = 5mm (mm)*	*Annual Rainfall Depth Needed to Achieve Target Infiltration (mm)*	*Req'd Design Storm Depth to Achieve Annual Infiltration Requirements (Assuming Ia=5 mm) (mm)*	*Req'd Event-Based Runoff Volume to be Infiltrated (Based on Req'd Design Storm Depth Assuming Ia = 2.5 mm) (m^3)*	*Infiltration Chamber Volume Provided (m^3)*
1,524	2,440	**60**	**1.47**	**95**	**62**	**48**	**735.6**	**166.0**	8.0	**10.0**	110.3	119.7

Notes:

Infiltration facilities are sized based on the following criteria (SWMPDM, MOE, 2003) and/or assumptions:

(1) Infiltration trench volume should be sized based on the runoff generated by a 4-hr 15-mm event or smaller.

(2) Drainage area should be sufficient to provide req'd runoff quantity.

(3) The maximum allowable depth of the infiltration facility is based on the soil percolation rate and the retention time.

(4) It is feasible to convey the runoff to the infiltration facility.

(5) The seasonal high water table should be at least 1 m below the infiltration trench.

Ontario
MINISTRY OF THE ENVIRONMENT

Database Version: V 1.5 Release Update
Update Date: 16-Jan-12

Project DEVELOPMENT Summary

DEVELOPMENT: 154 and 164 Cemetery Road SPA
Subwatershed: Pefferlaw-Uxbridge Brook

Pre-Development Landuse	Area (ha)	P coeff (kg/ha)	Pload (kg/yr)
Hay-Pasture	1.43	0.06	0.09
Low Intensity Development	0.64	0.13	0.08

Total Pre-Developed Area (ha): **2.07**
Total Pre-Developed Phosphorus Load (kg/yr): **0.17**

POST-DEVELOPMENT EXPORT

Post-Development Landuse	Area (ha)	P coeff (kg/ha)	Best Management Practice applied with Reduction Potential		Pload (kg/yr)
High Intensity - Residential	0.15	1.32	Underground Storage	25%	0.15
High Intensity - Residential	1.92	1.32	Soakaways - Infiltration trenches	60%	1.01

PostDeveloped Area Altered: **2.07**
Total PreDeveloped Area: **2.07**
Unaffected Area: **0**

Pre-Developed Phosphorus EXPORT: **0.17**
Post-Developed EXPORT (without BMP): **2.73**
Post-Developed EXPORT (with BMP): **1.16**
Total Phosphorus Reduction Potential: **-1.0**
(kg/year)

CONSTRUCTION EXPORT

Total Pre-Developed Phosphorus Load (kg/yr):	**0**
Construction Phase Total Load (kg) :	to be determined
Construction Phase Ammortized Annual Load Over 8 years (kg/yr) :	to be determined
Post Development Total Load (kg/yr) :	**1**

Total Load (kg/yr): Post Development + Construction

Conclusion: **Net Reduction in Load**

APPENDIX C
Sanitary Data Analysis

Leila Zavareh

From: Jeff Almeida <Jeff.Almeida@Durham.ca>
Sent: Thursday, November 10, 2016 8:22 AM
To: Leila Zavareh
Subject: RE: Prop. Sanitary Sewer Capacity / Uxbridge

Hi Leila,

I apologize for the delay in our response.

Based on the information provided, we don't foresee any concerns with the existing 300 mm sanitary sewer on Toronto Street to accommodate the increase in flows from 3.5 l/s to 4.5 l/s for the subject lands.

On a side note, the sanitary sewer design that you provided is using a PPU rate of 3 for the semi-detached units. Please note that you should be using a PPU rate of 3.5.

Please note that the above noted comments are preliminary and are subject to change. Additional comments will be provided upon a submission of a development application.

Jeff Almeida
Development Approvals Division
Works Department
Regional Municipality of Durham
605 Rossland Road East
Whitby, ON L1R 1W8
Phone: (905) 668-7711 ext. 3721
Fax: (905) 668-2051

From: Leila Zavareh [mailto:lzavareh@coleengineering.ca]
Sent: November-10-16 8:13 AM
To: Glen Severn
Cc: Jeff Almeida
Subject: RE: Prop. Sanitary Sewer Capacity / Uxbridge

Good morning Glen,

I want to follow up with you regarding sanitary capacity for our site on Cemetery road? Would you be able to provide me with the answer?

Thanks,
Leila

From: Glen Severn [mailto:Glen.Severn@Durham.ca]
Sent: Thursday, October 27, 2016 9:50 AM
To: Leila Zavareh <lzavareh@coleengineering.ca>
Subject: RE: Prop. Sanitary Sewer Capacity / Uxbridge

Thank-you.

From: Leila Zavareh [mailto:lzavareh@coleengineering.ca]
Sent: Thursday, October 27, 2016 9:41 AM
To: Glen Severn
Cc: Jeff Almeida
Subject: RE: Prop. Sanitary Sewer Capacity / Uxbridge

Hi Glen,

We have 12 units and I assumed they are all 3 bedrooms. Please check attached the preliminary sanitary design sheet I have prepared.

Thanks,
Leila

From: Glen Severn [mailto:Glen.Severn@Durham.ca]
Sent: Thursday, October 27, 2016 9:41 AM
To: Leila Zavareh <lzavareh@coleengineering.ca>
Cc: Jeff Almeida <Jeff.Almeida@Durham.ca>
Subject: RE: Prop. Sanitary Sewer Capacity / Uxbridge

Hi Leila,

Jeff has asked me to take a look at your proposal. Could you please provide some information (number and type of units...) on your proposed apartment building to substantiate the 4.5 l/s.

Thanks,
Glen Severn
Engineering Planning & Studies Division
Region of Durham – Works Department
(905) 668-7711 extension 3529

From: Leila Zavareh [mailto:lzavareh@coleengineering.ca]
Sent: October-26-16 12:36 PM
To: Jeff Almeida
Cc: Nav Grewal
Subject: RE: Prop. Sanitary Sewer Capacity / Uxbridge

Hi Jeff,

As we are proposing a three store apartment building in the south side of our site, the total flow for the proposed development will be around 4.5 L/s now. Could you please confirm that the existing 300mm diameter pipe on Toronto Street has the capacity for our design understanding that its first come first serve?

I have attached our conceptual general servicing for your reference.

Best regards,

Leila Zavareh, M.Eng, EIT
Designer, Urban Development

Cole Engineering Group Ltd.
70 Valleywood Dr., Markham, ON L3R 4T5

T. 905-940-6161 Ext 303, Tor. Line: 416-987-6161
F: 905-940-2064
Email: lzavareh@coleengineering.ca
Website: www.ColeEngineering.ca

From: Jeff Almeida [mailto:Jeff.Almeida@Durham.ca]
Sent: Tuesday, September 27, 2016 1:41 PM
To: Leila Zavareh <lzavareh@coleengineering.ca>
Cc: Nav Grewal <NGrewal@coleengineering.ca>
Subject: RE: Prop. Sanitary Sewer Capacity / Uxbridge

Hi Leila,

We have reviewed the preliminary information provided and the 300 mm sanitary sewer on Toronto Street appears to have capacity for the proposal of 3.5 l/s. Please note that sanitary capacity is on a first come first serve basis and is only allocated at the time of signing a development agreement.

We have reviewed the "General Plan" and provide the following comments:

- A separate domestic water service and a separate fire line is required
- A 300 mm watermain is required on Cemetery road and not a 200 mm watermain as shown
- We will not permit a secondary water connection to Street 'A'
- The watermain and sanitary sewer on Cemetery Road must be extended to the north limit of the property

Jeff Almeida
Development Approvals Division
Works Department
Regional Municipality of Durham
605 Rossland Road East
Whitby, ON L1R 1W8
Phone: (905) 668-7711 ext. 3721
Fax: (905) 668-2051

From: Leila Zavareh [mailto:lzavareh@coleengineering.ca]
Sent: September-21-16 2:56 PM
To: Jeff Almeida
Cc: Nav Grewal
Subject: Prop. Sanitary Sewer Capacity / Uxbridge

Hi Jeff,

We are working on a site development project in Township of Uxbridge located at 164 Cemetery Road (Northwest of Cemetery road and Toronto Street) and we need to check if the existing sanitary sewer on Toronto Street has the capacity for our design.

The anticipated sanitary discharge flows for the proposed site were calculated based on the Region of Durham criteria. As per attached table the sanitary peak flow of 3.5 L/s was calculated for the subject site. Could you please confirm that the existing 300mm diameter pipe on Toronto Street has the capacity for our design?

I have attached the schematic servicing drawing and sanitary design sheet for you reference.

Many thanks,

Leila Zavareh, M.Eng, EIT
Designer, Urban Development

Cole Engineering Group Ltd.
70 Valleywood Dr., Markham, ON L3R 4T5
T. 905-940-6161 Ext 303, Tor. Line: 416-987-6161
F: 905-940-2064
Email: lzavareh@coleengineering.ca
Website: www.ColeEngineering.ca

TOWNSHIP OF UXBRIDGE

ENGINEERING AND PUBLIC WORKS DEPARTMENT

COLE ENGINEERING

SANITARY SEWER DESIGN SHEET

RESIDENTIAL DEVELOPMENT

Sheet: 1 of 1
Prepared By: LZ
Date: 27-Oct-16
Project No.: UD16-0349

Residential Population Density:
3 Bedroom Apartment: 3.5 Persons/Unit   Townhouses: 3.0 Persons/Unit
q = average daily flow per person   364   L/d
M = Peaking Factor (Residential)
M = 1 + 14/(4+P^.5)
where P = population in 1000's

Infiltration: 22,500 L/g/h/day

Q (p) = peak population flow (L/s)
Q (I) = peak Infiltration flow (L/s)
Q (C) = peak flow from commercial area (L/s)
Q (d) = Total Peak flow (L/s)   Q(d) = Q(p) + Q(I) + Q(C)

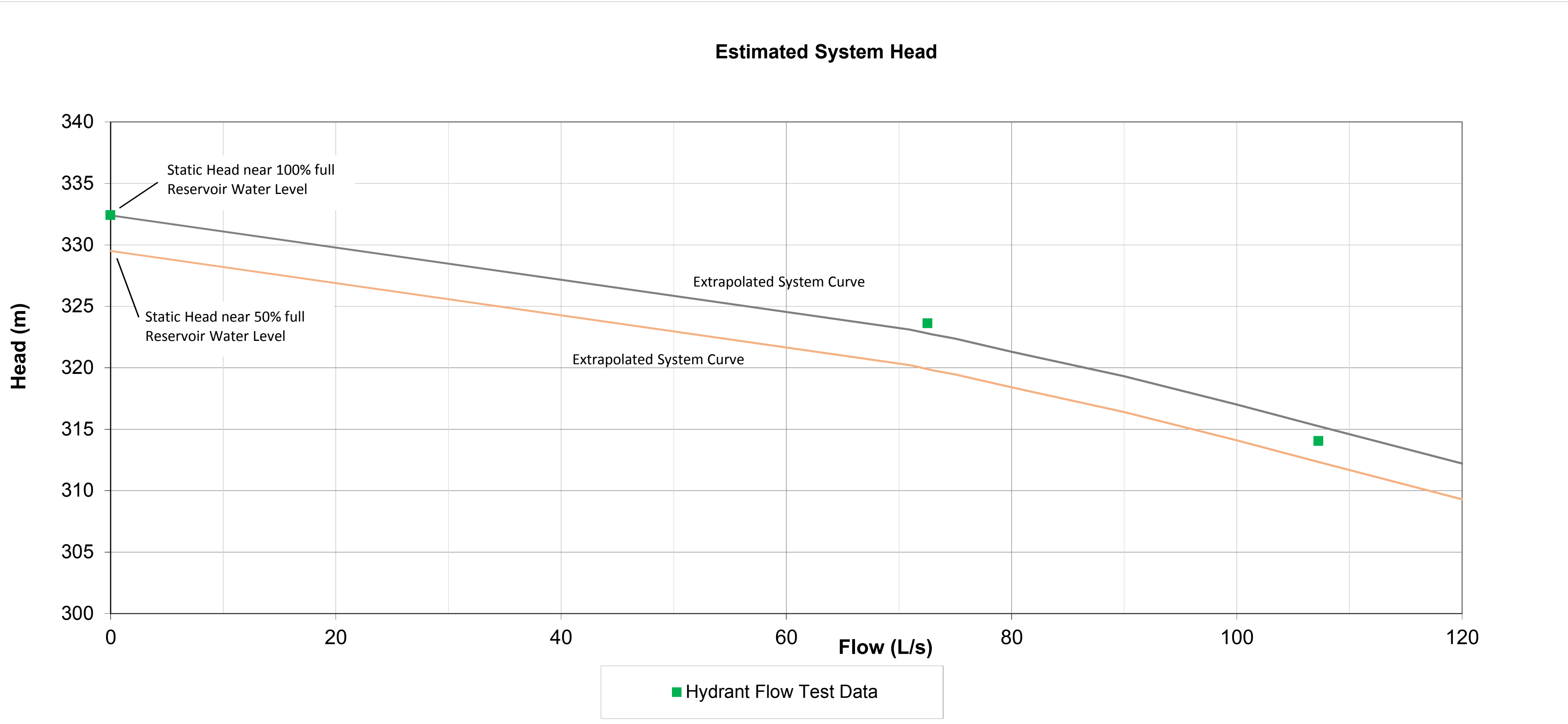
	MANHOLE		RESIDENTIAL											COMMERCIAL		IND. & INST.		Total	SEWER DESIGN								
LOCATION	From MH	To MH	No. of Units	P.P.U.	Pop	Acc Pop	Avg Day Flow (L/s)	Peaking Factor M	Peak Pop. Flow Q(p) (L/s)	Sect Area (ha)	Accum Area (ha)	Infilt. Flow Q(I) (L/s)	Res. Flow (L/s)	Area (ha)	Peak Flow (L/s)	Area (ha)	Peak Flow (L/s)	Peak Flow Q(d) (L/s)	Pipe Diameter (mm)	Pipe Material	Grade (%)	Length (m)	Capacity n=0.013 (L/s)	% of Design Capacity (%)	Full Velocity (m/s)	Actual Velocity (m/s)	Remarks
STREET A	MH1A	MH2A	21	3	63	63	0.27	3.80	1.01	0.71	0.71	0.185	1.2	0.00	0.00	0.00	0.00	1.2	200	PVC	0.93	84.8	31.63	3.8%	1.01	0.48	
STREET A	MH2A	MH3A	0	3	0	63	0.27	3.80	1.01	0.09	0.80	0.208	1.2	0.00	0.00	0.00	0.00	1.2	200	PVC	0.50	14.3	23.19	5.2%	0.74	0.38	
STREET A	MH3A	MH5A	8	3	24	87	0.37	3.80	1.39	0.24	1.04	0.271	1.7	0.00	0.00	0.00	0.00	1.7	200	PVC	0.50	62.7	23.19	7.2%	0.74	0.43	
STREET A	MH4A	MH5A	6	3	18	18	0.08	3.80	0.29	0.24	0.24	0.063	0.4	0.00	0.00	0.00	0.00	0.4	200	PVC	0.45	42.9	22.00	1.6%	0.70	0.24	
STREET B	MH5A	MH6A	21	3	63	168	0.71	3.80	2.69	0.74	2.02	0.526	3.2	0.00	0.00	0.00	0.00	3.2	200	PVC	0.51	80.0	23.42	13.7%	0.75	0.52	
STREET B	MH6A	MH8A	0	3	0	168	0.71	3.80	2.69	0.03	2.05	0.534	3.2	0.00	0.00	0.00	0.00	3.2	200	PVC	0.45	23.4	22.00	14.7%	0.70	0.49	
External Areas																											
Cemetery Road	MH7A	MH8A	0	3	0	0	0.00	3.80	0.00	0.16	0.16	0.042	0.0	0.00	0.00	0.00	0.00	0.0	200	PVC	0.50	14.3	23.19	0.2%	0.74	0.14	
Cemetery Road	MH8A	MH9A	0	3	0	168	0.71	3.80	2.69	0.15	2.36	0.615	3.3	0.00	0.00	0.00	0.00	3.3	200	PVC	0.50	98.3	23.19	14.2%	0.74	0.52	
Cemetery Road	MH9A	MH10A	12	3.5	42	210	0.88	3.80	3.36	0.03	2.39	0.622	4.0	0.00	0.00	0.00	0.00	4.0	200	PVC	0.50	14.9	23.19	17.2%	0.74	0.55	
Toronto Street	MH10A	EXMH	0	3	0	210	0.88	3.80	3.36	0.04	2.43	0.633	4.0	0.00	0.00	0.00	0.00	4.0	200	PVC	0.50	25.5	23.19	17.2%	0.74	0.55	

APPENDIX D
Water Data Analysis

Appendix D-1: Hydrant Flow Test Analysis

Project: UD16-0349, 164 Cemetery Road_ Uxbridge
Date: Oct 24, 2016
File: UD16-0349_hydrant_tests.xls

Test No.	Location for Pressure Measurement	Location for Flow	Date/Time	Elevation	Flow		Pressure			Head (m)	Remark
				(m)	USGPM	L/s	(psi)	(m)	kPa		
	West Side of Toronto Street South in front of	Near ditch at the NE corner of Toronto Street South and	September 29, 2016	288	0	0	63	44	432	332.4	Static
	Elgin Centre Plaza	Cemetery Road	10:00 AM		1150	73	50	35	345	323.6	
					1700	107	36	26	251	314.0	



HYDRANT FLOW TEST FORM

COLE ENGINEERING
Experience Enhancing Excellence

Project No: UD16-0349

Date: Sept. 29, 2016

Site Location: 164 Cemetery Rd. Uxbridge, On.

Hydrants Opened by: Durham Water

Tested By: Gordon H, Mirko S.

1) Required photos:

- [✓] Site Id & Date
- [✓] Condition of Flow Hydrant
- [✓] Location Overview
- [✓] Condition of Residual Hydrant
- [✓] Other

2) Test Data

Time of Test: 1000

Location of Test: (Flow) Near ditch at the NE corner of Cemetery Rd + Toronto St. S

(Residual) West side of Toronto St in front of Elgin Centre plaza.

Main Size: 300mm

Static Pressure: 63psi

	Number of Outlets & Orifice Size	Pitot Pressure	Flow (USGPM)	Residual Pressure
1	1 x 2.5"	48	1150	50
2	2 x 2.5"	26	1700	36
3				
4				

3) Calculations

$Q = 29.83 cd^2\sqrt{p}$

Where c- cofficient of discharge (1 in smooth pipe)
d- pipe diameter (inches)
p- pitot reading (psi)
Q- flow (USGPM)

$Q_1 = (29.83)(0.9)(2.5")^2\sqrt{48}$

$= 1162.51$

$Q_1 = \sim 1150$ USGPM

$Q_t = 2(29.83)(0.9)(2.5")^2\sqrt{26}$

$= 1711.17$

$Q_t = \sim 1700$ USGPM

Appendix D-2: Water Demand Estimation

Project No. UD16-0349

Region Design Criteria

Average Day (Residential)	364	l/capita/day	
Population Density			
Townhouse	3.0	persons/unit	
Apartment	4.5	persons/unit	(For a conservative design)

MOE Design Guideline

Peaking Factor (for population less than 1000)	
Max. Day Demand Factor	2.75
Peak Hour Demand Factor	4.13

Land Use	Type	Area (ha)	Number of Units	Population	Design Flow (L/s)			
					Average Day	Max. Day	Peak Hour	Fire Flow*
Residential	Townhouse	1.5	56	168	0.7	1.9	2.9	**117**
	Apartment	0.2	12	54	0.2	0.6	0.9	**83**
	Total	1.7	68	222	**0.9**	**2.6**	**3.9**	--

Note:
*Required fire flows determined based on the Fire Underwriters Survey (FUS) 1999

Appendix D-3: Fire Flow Estimation for Townhouse Buildings

Based on Part II of Water Supply for Public Fire Protection 1999 (Page 17 to 20 Guide for determination of required fire flow)

Project: UD16-0349
Date: Oct 2016
File: UD16-0349_fire flow estimation.xls

Item A to D, P20) Fire flow rate based on type of construction
Item 1, P17 F1=220C1A^.5 Fire Flow Formula (Rounded off to nearest 1000 L/min)
F1= Required fire Flow (L/min)
A= **606** m^2 Total Floor area at Townhouse units (e.g. units 24 to 26) on Street B
Largest one floor area (m2)
Floor area above (m2)
Floor area below (m2)

	Assume house		Total house
Building	size per unit (ft^2)	# of Unit*	area (ft^2)
Townhouse	2174	3	6523

*Assume fire separation provided in every 3 units

C1 = 1.0 Type of construction (Page 17)
C1=1.5 for wood frame construction (structure essentially all combustible)
C1=1.0 for ordinary construction (brick or other masonry walls, combustibles floor and interior)
C1=0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
C1=0.6 for fire-resistive construction (fully protected frame, floors, roof)
a) fire-resistive construction with vertical opening inadequately protected:
two largest floors plus 50% of each of any floors immediately above up to eight
F1= **5000** L/min
B) fire-resistive construction with vertical opening and exterior communications adequately protected (one hour rating):
one largest floors plus 25% of each of the two immediately adjoining floors

Item E, P20) Determine the increase or decrease for type of occupancies (Do not round off the answer)
Item 2, P18)
F2= F1 * C2 Adjusted Fire Flow rate (L/s)
C2= -15% C2=-25% Non-Combustible, P18
F2= **4250** L/min C2=-15% Limited Combustible, P18

Item F, P20) Determine the decrease for automatic sprinkler system protection and standard design
Item 3, P18) (Do not round off the answer)
F3 = F2 *C3
C3= 0% C3=-50% Complete automatic sprinkler System (50%), P18
F3= **0** L/min C3=-30% Adequately designed system conforming to NFPA 13 and other NFPA Sprinkler standards

Item G, P20) Determine the increase for structure exposure distance, P18 (Do not round off the answer)
Item 4, p18)
F4 = F2 *C4 Exposure to the other buildings,
C4= 75% C4 = 0% if >45 m
F4= **3188** L/min C4 = 25 % (if 0 to 3 m)
C4 = 20 % (if 3 to 10 m)
C4 = 15 % (if 10 to 20 m)
C4 = 10 % (if 20 to 30 m)
C4 = 5 % (if 30 to 45 m)

	Exposure	Percentage
Side	Distance (m)	Charge (%)
North	~18	15
South	~25	10
East	<3	25
West	<3	25
	Total	75

Item H, P20) Adjust the Fire Flow Value
F5= F2+F3+F4
F5= 7438 L/min
F5= 7000 L/min (Rounded off to nearest 1000 L/min)
F5= **117** L/s

Appendix D-3: Fire Flow Estimation for Apartment Building

Based on Part II of Water Supply for Public Fire Protection 1999 (Page 17 to 20 Guide for determination of required fire flow)

Project: UD16-0349
Date: Oct 2016
File: UD16-0349_fire flow estimation.xls

Item A to D, P20) Fire flow rate based on type of construction
Item 1, P17

F1=220C1A^.5		Fire Flow Formula		(Rounded off to nearest 1000 L/min)
F1=		Required fire Flow (L/min)		
A=	**720** m^2	Total Floor area	3-storey apartment building	
		Largest one floor area (m2)		
		Floor area above (m2)		
		Floor area below (m2)		
C1 =	1.0	Type of construction (Page 17)		
		C1=1.5	for wood frame construction (structure essentially all combustible)	
		C1=1.0	for ordinary construction (brick or other masonry walls, combustibles floor and interior)	
		C1=0.8	for non-combustible construction (unprotected metal structural components, masonry or metal walls)	
		C1=0.6	for fire-resistive construction (fully protected frame, floors, roof)	
			a) fire-resistive construction with vertical opening inadequately protected:	
F1=	**6000** L/min		two largest floors plus 50% of each of any floors immediately above up to eight	
			B) fire-resistive construction with vertical opening and exterior communications adequately protected (one hour rating):	
			one largest floors plus 25% of each of the two immediately adjoining floors	

Item E, P20) Determine the increase or decrease for type of occupancies (Do not round off the answer)
Item 2, P18)

F2=	F1 * C2	Adjusted Fire Flow rate (L/s)
C2=	-15%	C2=-25% Non-Combustible, P18
F2=	**5100** L/min	C2=-15% Limited Combustible, P18

Item F, P20) Determine the decrease for automatic sprinkler system protection and standard design
Item 3, P18) (Do not round off the answer)

F3 =	F2 *C3		
C3=	0%	C3=-50%	Complete automatic sprinkler System (50%), P18
F3=	**0** L/min	C3=-30%	Adequately designed system conforming to NFPA 13 and other NFPA Sprinkler standards

Item G, P20) Determine the increase for structure exposure distance, P18 (Do not round off the answer)
Item 4, p18)

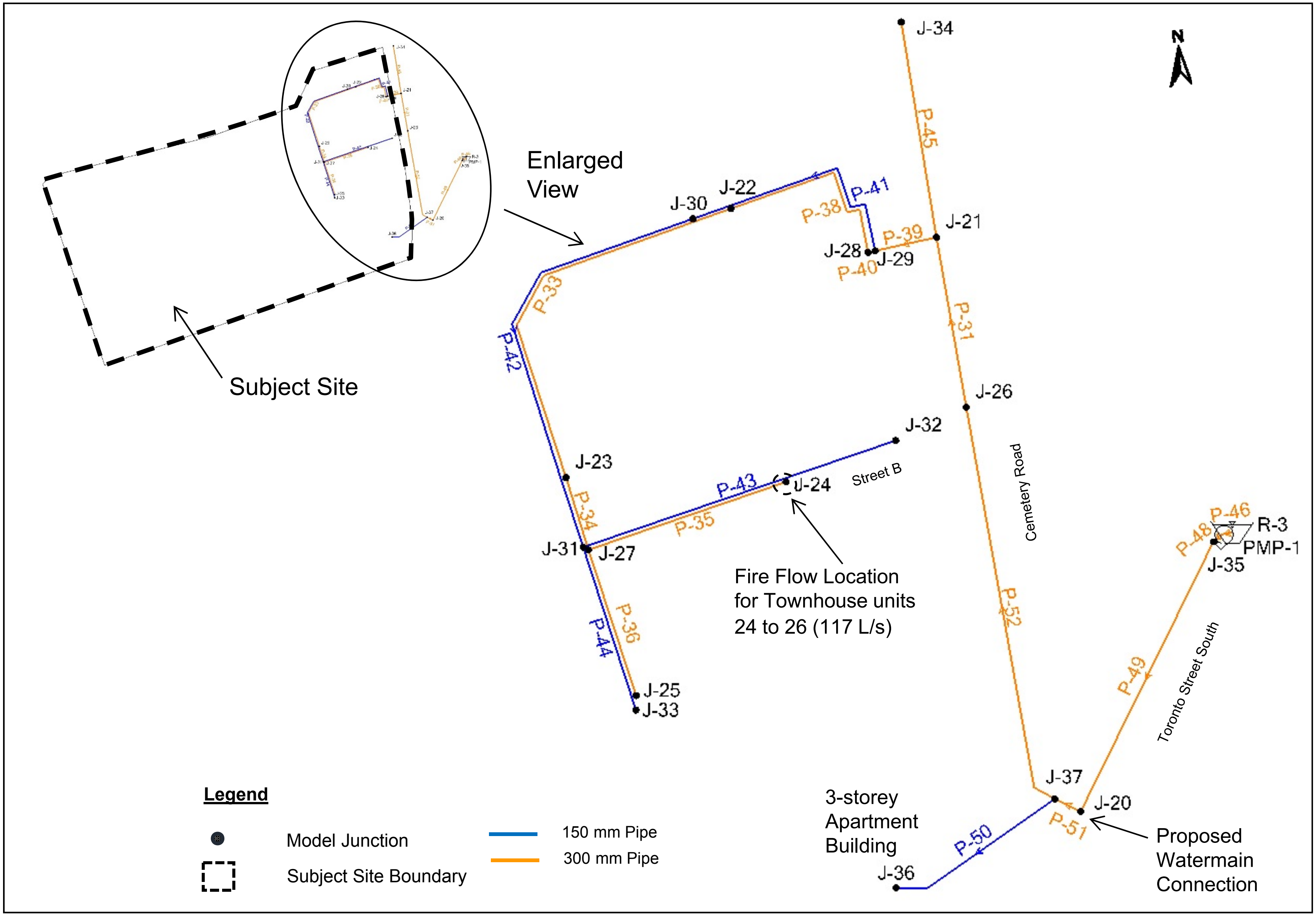
F4 =	F2 *C4	Exposure to the other buildings,
C4=	0%	C4 = 0% if >45 m
F4=	**0** L/min	C4 = 25 % (if 0 to 3 m)
		C4 = 20 % (if 3 to 10 m)
		C4 = 15 % (if 10 to 20 m)
		C4 = 10 % (if 20 to 30 m)
		C4 = 5 % (if 30 to 45 m)

Side	Exposure Distance (m)	Percentage Charge (%)
North	>45	0
South	>45	0
East	>45	0
West	>45	0
	Total	0

Item H, P20) Adjust the Fire Flow Value

F5=	F2+F3+F4	
F5=	5100 L/min	
F5=	5000 L/min	(Rounded off to nearest 1000 L/min)
F5=	**83** L/s	

Appendix D-4: Schematic Model Layout



Appendix D-5: Average Day Hydraulic Model Output					(page 1 of 5)
Junction Nodes within Subject Site					
Label	**Elevation (m)**	**Demand (L/s)**	**Hydraulic Grade (m)**	**Pressure (kPa)**	**Remark**
J-30	290.7	0.4	329.4	378	
J-22	290.7	0.0	329.4	378	
J-28	290.7	0.0	329.4	378	
J-29	290.7	0.0	329.4	378	
J-23	289.6	0.0	329.4	389	
J-31	289.3	0.4	329.4	392	
J-27	289.3	0.0	329.4	392	
J-24	289.2	0.0	329.4	394	
J-33	289.1	0.0	329.4	394	
J-25	289.1	0.0	329.4	394	
J-32	289.0	0.0	329.4	395	
J-36	289.0	0.2	329.4	395	
External Junction Nodes					
J-34	292.3	0.0	329.4	363	
J-21	290.7	0.0	329.4	378	
J-20	290.5	0.0	329.4	380	
J-37	289.5	0.0	329.4	390	
J-26	289.1	0.0	329.4	394	
J-35	288.4	0.0	329.4	401	

Appendix D-5: Max. Day Hydraulic Model Output					(page 2 of 5)
Junction Nodes within Subject Site					
Label	**Elevation (m)**	**Demand (L/s)**	**Hydraulic Grade (m)**	**Pressure (kPa)**	**Remark**
J-30	290.7	1.0	329.1	376	
J-22	290.7	0.0	329.2	376	
J-28	290.7	0.0	329.2	376	
J-29	290.7	0.0	329.2	376	
J-23	289.6	0.0	329.2	387	
J-31	289.3	1.0	329.1	390	
J-27	289.3	0.0	329.2	390	
J-24	289.2	0.0	329.2	391	
J-33	289.1	0.0	329.1	392	
J-25	289.1	0.0	329.2	392	
J-32	289.0	0.0	329.1	393	
J-36	289.0	0.6	329.2	393	
External Junction Nodes					
J-34	292.3	0.0	329.2	361	
J-21	290.7	0.0	329.2	376	
J-20	290.5	0.0	329.2	378	
J-37	289.5	0.0	329.2	388	
J-26	289.1	0.0	329.2	392	
J-35	288.4	0.0	329.2	399	

Appendix D-5: Peak Hour Hydraulic Model Output					(page 3 of 5)
Junction Nodes within Subject Site					
Label	**Elevation (m)**	**Demand (L/s)**	**Hydraulic Grade (m)**	**Pressure (kPa)**	**Remark**
J-30	290.7	1.5	329.0	374	
J-22	290.7	0.0	329.0	375	
J-28	290.7	0.0	329.0	375	
J-29	290.7	0.0	329.0	375	
J-23	289.6	0.0	329.0	385	
J-31	289.3	1.5	328.9	388	
J-27	289.3	0.0	329.0	388	
J-24	289.2	0.0	329.0	390	
J-33	289.1	0.0	328.9	390	
J-25	289.1	0.0	329.0	390	
J-32	289.0	0.0	328.9	391	
J-36	289.0	0.9	329.0	391	
External Junction Nodes					
J-34	292.3	0.0	329.0	359	
J-21	290.7	0.0	329.0	375	
J-20	290.5	0.0	329.0	377	
J-37	289.5	0.0	329.0	386	
J-26	289.1	0.0	329.0	390	
J-35	288.4	0.0	329.0	397	

Appendix D-5: Max. Day plus Fire Hydraulic Model Output					(page 4 of 5)
Junction Nodes within Subject Site					
Label	**Elevation (m)**	**Demand (L/s)**	**Hydraulic Grade (m)**	**Pressure (kPa)**	**Remark**
J-24	289.2	117.0	303.7	142	See Appendix D-4 for fire flow location
J-23	289.6	0.0	304.5	146	
J-27	289.3	0.0	304.3	147	
J-22	290.7	0.0	305.8	148	
J-25	289.1	0.0	304.3	149	
J-28	290.7	0.0	306.5	154	
J-30	290.7	1.0	306.5	154	
J-29	290.7	0.0	306.5	155	
J-31	289.3	1.0	306.5	168	
J-33	289.1	0.0	306.5	170	
J-32	289.0	0.0	306.5	171	
J-36	289.0	0.6	308.6	191	
External Junction Nodes					
J-34	292.3	0.0	306.7	141	
J-21	290.7	0.0	306.7	156	
J-26	289.1	0.0	307.2	178	
J-20	290.5	0.0	308.7	178	
J-37	289.5	0.0	308.6	186	
J-35	288.4	0.0	309.6	208	

Appendix D-5: Max. Day plus Fire Hydraulic Model Pipe Output									(page 5 of 5)
Pipes within Subject Site									
Label	**Length (Scaled) (m)**	**Start Node**	**Stop Node**	**Diameter (mm)**	**Hazen-Williams C**	**Flow (L/s)**	**Velocity (m/s)**	**Headloss (m)**	**Remark**
P-39	17	J-21	J-29	300	110	119	1.7	0.2	
P-33	110	J-22	J-23	300	110	117	1.7	1.3	
P-34	20	J-23	J-27	300	110	117	1.7	0.2	
P-38	55	J-28	J-22	300	110	117	1.7	0.6	
P-40	2	J-29	J-28	300	110	117	1.7	0.0	
P-35	55	J-27	J-24	300	110	117	1.7	0.7	
P-41	68	J-29	J-30	150	100	2	0.1	0.0	
P-42	120	J-30	J-31	150	100	1	0.1	0.0	
P-50	49	J-37	J-36	150	100	1	0.0	0.0	
P-43	87	J-31	J-32	150	100	0	0.0	0.0	
P-44	45	J-31	J-33	150	100	0	0.0	0.0	
P-36	41	J-27	J-25	300	110	0	0.0	0.0	
External Pipes									
P-46	3	R-3	PMP-1	300	110	120	1.7	0.0	
P-48	3	PMP-1	J-35	300	110	120	1.7	0.0	
P-49	80	J-35	J-20	300	110	120	1.7	1.0	
P-51	8	J-20	J-37	300	110	120	1.7	0.1	
P-31	46	J-26	J-21	300	110	119	1.7	0.6	
P-52	108	J-37	J-26	300	110	119	1.7	1.3	
P-45	58	J-21	J-34	300	110	0	0.0	0.0	

APPENDIX E
Engineering Plans

GENERAL NOTES:

1. PRIOR TO STARTING ANY WORKS, THE CONTRACTOR MUST ENSURE THAT ALL NECESSARY APPROVALS ARE IN PLACE FROM THE TOWNSHIP OF UXBRIDGE, REGION OF DURHAM, AND OTHER EXTERNAL AGENCIES, AS REQUIRED.
2. ALL WORK SHALL BE CARRIED OUT IN COMPLIANCE WITH THE APPLICABLE HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.
3. ALL WORK AND MATERIALS TO CONFORM WITH THE CURRENT PROVINCIAL BUILDING CODE, MINISTRY OF THE ENVIRONMENT OF ONTARIO, TOWNSHIP OF UXBRIDGE, REGION OF DURHAM , ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS. LOCAL UTILITY STANDARDS AND MINISTRY OF TRANSPORTATION STANDARDS WILL APPLY WHERE REQUIRED.
4. FOR ALL CONSTRUCTION DETAILS NOT SHOWN ON THE DRAWINGS, REFERENCE SHALL BE MADE TO THE DESIGN STANDARDS OF THE TOWNSHIP OF UXBRIDGE.
5. THE CONTRACTOR IS ADVISED THAT WORKS BY OTHERS MAY BE ONGOING DURING THE PERIOD OF THIS CONTRACT. THE CONTRACTOR SHALL COORDINATE CONSTRUCTION ACTIVITIES WITH ALL OTHER CONTRACTORS AND PREVENT CONSTRUCTION CONFLICTS.
6. THE INFORMATION SHOWN FOR EXISTING UTILITIES WAS PROVIDED BY OTHERS. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UTILITIES DURING CONSTRUCTION. ALL EXISTING UTILITIES MUST BE LOCATED AND VERIFIED BY EACH PROVIDER PRIOR TO COMMENCEMENT OF WORK. ANY VARIANCE IS TO BE REPORTED TO THE ENGINEER 48 HRS PRIOR TO CONSTRUCTION. LOST TIME AND/OR ANY ADDITIONAL WORKS DUE TO FAILURE OF THE CONTRACTOR TO CONFIRM UTILITY LOCATIONS AND NOTIFY THE ENGINEER OF ANY CONFLICTS 48 HRS PRIOR TO CONSTRUCTION WILL BE AT THE CONTRACTORS EXPENSE.
7. THE CONTRACTOR MUST INSTALL ALL SEDIMENT CONTROL DEVICES PRIOR TO THE COMMENCEMENT OF SITE GRADING WORKS. SILT LADEN WATER MUST NOT BE PERMITTED TO ENTER INTO ANY EXISTING CATCH BASINS, INLETTING STRUCTURES, OR WATERCOURSES. ADDITIONAL CONTROLS AS DEEMED REQUIRED BY THE AUTHORITIES AND/OR THE ENGINEER DURING CONSTRUCTION ACTIVITIES SHALL BE PROVIDED BY THE CONTRACTOR. THE CONTRACTOR MUST INSPECT SEDIMENT CONTROLS ON A REGULAR BASIS AND AFTER EVERY RAINFALL EVENT. REPAIRS MUST BE DONE IN A TIMELY MANNER TO PREVENT SEDIMENT FROM ENTERING ANY WATER SYSTEMS. ADDITIONAL SILT FENCING MUST BE AVAILABLE IN CASE IMMEDIATE REPAIR IS REQUIRED.
8. ALL DIMENSIONS, ELEVATIONS AND OTHER INFORMATION SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR 72 HOURS PRIOR TO ANY CONSTRUCTION. ANY DISCREPANCIES FOUND MUST BE REPORTED IMMEDIATELY TO THE ENGINEER.
9. THE CONTRACTOR IS TO PROVIDE A TOTAL OF TWO CCTV CAMERA INSPECTIONS OF ALL SANITARY AND STORM SEWERS, INCLUDING PICTORIAL REPORT, TWO CD COPIES AND ONE VIDEO TAPE IN A FORMAT SATISFACTORY TO THE ENGINEER. ALL SEWERS ARE TO BE FLUSHED PRIOR TO CAMERA INSPECTION.
10. LASER ALIGNMENT CONTROL TO BE UTILIZED ON ALL SEWER INSTALLATIONS.
11. ALL PVC SANITARY SEWERS TO BE MANDREL AND AIR TESTED.
12. ALL PVC STORM SEWERS TO BE MANDREL TESTED. AIR TEST ONLY ON RECOMMENDATION BY SOIL CONSULTANT.

MANHOLES:

1. ALL PRECAST CONCRETE MANHOLES TO MEET M.O.E. SPECIFICATIONS AND CONFORM TO OPSD 701.010, 701.011, 701.012, 701.013 AND 701.014.
2. MANHOLE COVERS TO BE AS PER OPSD 401.010, TYPE 'A'
3. 'MODULOC' OR APPROVED MANHOLES ADJUSTERS SHALL BE USED IN LIEU OF BRICKING.
4. MANHOLE STEPS SHALL BE RECTANGULAR STAINLESS STEEL AS PER OPSD 405.010.
5. SAFETY GRATING SHALL BE PROVIDED, AS PER OPSD 404.020, FOR MANHOLES WITH DEPTH EXCEEDING 5.0m. THE MAXIMUM SPACING BETWEEN SAFETY GRATING SHALL NOT EXCEED 4.5m.
6. BENCHING TO BE PROVIDED AT ALL MANHOLES UNLESS OTHERWISE STATED IN ACCORDANCE WITH OPSD 701.021
7. ALL DROP STRUCTURES TO BE CONSTRUCTED AS PER OPSD 1003.010 AND OPSD 1003.020.

CATCH BASINS:

1. ALL SINGLE AND DOUBLE CATCH BASINS SHALL BE PRECAST AS PER OPSD 705.010 AND 705.020 RESPECTIVELY.
2. ALL CATCH BASIN FRAMES AND COVERS SHALL BE AS PER OPSD 400.020.
3. ALL CATCH BASIN LEADS SHALL BE SDR-35, 250mmØ FOR SINGLE AND 300mmØ FOR DOUBLE WITH A MINIMUM SLOPE OF 1.00% UNLESS OTHERWISE NOTED. CB LEAD INVERT TO BE MINIMUM 1.50m BELOW FINISHED GRADE, UNLESS OTHERWISE NOTED.
4. 'MODULOC' OR APPROVED CATCH BASIN ADJUSTERS SHALL BE USED IN LIEU OF BRICKING.
5. DURING CONSTRUCTION ALL CATCH BASINS SHALL BE EQUIPPED WITH A TEMPORARY SEDIMENT CONTROL DEVICE.

SEWER MATERIALS:

1. ALL SEWERS OF 375mmØ OR SMALLER SHALL BE PVC. ALL SEWERS 450mmØ OR GREATER SHALL BE CONCRETE.
2. POLYVINYL CHLORIDE (PVC) SEWER PIPE TO MEET M.O.E. SPECIFICATIONS, CLASS SDR 35 UNLESS OTHERWISE NOTED. ALL PVC STORM SEWERS SHALL BE WHITE IN COLOUR.
3. ALL CONCRETE SEWER PIPES SHALL BE REINFORCED CLASS 65-D, UNLESS OTHERWISE NOTED; CONFORMING TO CSA-A257.2.
4. THE MINIMUM PIPE SIZE FOR MAINLINE OR BRANCH SANITARY OR STORM SEWERS SHALL BE 200mmØ AND 300mmØ RESPECTIVELY.

SEWER BEDDING:

1. STORM AND SANITARY SEWER BEDDING SHALL BE AS PER OPSD 802.010 CLASS 'B' FOR FLEXIBLE PIPES AND OPSD 802.030, 802.031, 802.032 CLASS 'B' FOR RIGID PIPES UNLESS OTHERWISE SPECIFIED.
2. ALL SERVICES AND STRUCTURES LOCATED IN TRENCH CUT SHALL BE SUPPORTED BY COMPACTED GRANULAR TO UNDISTURBED OR STRUCTURALLY COMPACTED GROUND.

BACKFILL:

1. ALL MANHOLE AND CATCH BASIN EXCAVATIONS SHALL BE BACKFILLED WITH GRANULAR 'B' COMPACTED TO 98% SPMDD AND BE PLACED IN ACCORDANCE WITH THE LATEST REVISION OF THE GEOTECHNICAL REPORT.

WATERMAINS:

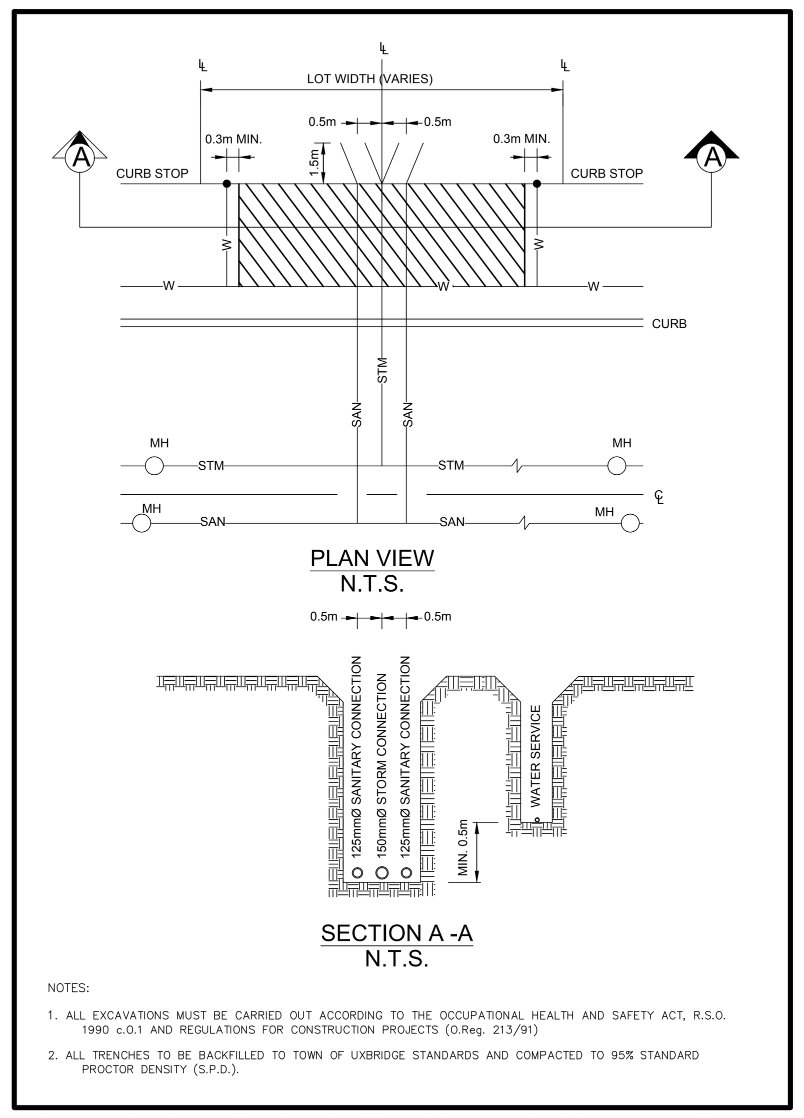
1. ALL WATERMAINS SHALL BE CONSTRUCTED IN ACCORDANCE WITH OPSS 701.
2. WATERMAINS AND APPURTENANCES SHALL BE AS PER TOWNSHIP OF UXBRIDGE SPECIFICATIONS.
3. WATERMAIN SHALL BE POLYVINYL CHLORIDE (PVC) CLASS-150, DR-18 CONFORMING TO APPLICABLE AWWA STANDARDS.
4. ALL WATERMAINS SHALL HAVE A MINIMUM COVER OF 1.80 m.
5. ALL WATERMAIN HORIZONTAL AND VERTICAL BENDS, JOINTS AND PLUGS TO BE MECHANICALLY RESTRAINED. MECHANICAL RESTRAINERS MUST BE INSTALLED ON ALL WATERMAIN BENDS, TEES, AND PLUGS AS PER REGION OF DURHAM STANDARDS.
6. WATERMAINS MUST COMPLY WITH MINIMUM HORIZONTAL AND VERTICAL CLEARANCES IN ACCORDANCE WITH LOCAL PROVINCIAL GUIDELINES AND THE APPLICABLE BUILDING AND PLUMBING CODE. WHERE HORIZONTAL SEPARATIONS CANNOT BE ACHIEVED, APPROVAL FROM THE ENGINEER MUST BE OBTAINED AND A MINIMUM 500mm VERTICAL SEPARATION MUST BE MAINTAINED.
7. ALL WATERMAIN BEDDING COVER AND TRENCH DETAIL SHALL BE AS PER LOCAL MUNICIPAL, REGIONAL OR PROVINCIAL STANDARDS. THE CONTRACTOR SHALL SUBMIT SAMPLES OF BEDDING AND COVER MATERIALS TO THE GEOTECHNICAL ENGINEER AND OBTAIN APPROVAL FOR USE PRIOR TO COMMENCEMENT OF SERVICE INSTALLATION.
8. ALL WATERMAIN AND APPURTENANCES (VALVES, HYDRANTS, FITTINGS, ETC.) SHALL BE INSTALLED WITH CATHODIC PROTECTION AS PER OPSD 1109.011.
9. ALL PVC WATERMAIN SHALL BE INSTALLED COMPLETE WITH #14 GAUGE TRACER WIRE, TERMINATING AT GRADE AT A FIRE HYDRANT OR VALVE LOCATION, AND SHALL BE POSITIVELY CONNECTED TO THE HYDRANT OR VALVE.
10. ALL WATERMAINS SHALL BE HYDROSTATICALLY TESTED IN ACCORDANCE WITH LOCAL MUNICIPAL AND PROVINCIAL GUIDELINES UNLESS OTHERWISE DIRECTED. PROVISIONS FOR FLUSHING WATER LINE PRIOR TO TESTING, ETC. MUST BE PROVIDED. FLUSHING, PRESSURE TESTING, CHLORINATION AND SAMPLING SHALL BE DONE IN ACCORDANCE WITH THE TOWNSHIP OF UXBRIDGE AND REGION OF DURHAM REQUIREMENTS.
11. ALL WATERMAINS SHALL BE BACTERIALOGICALLY TESTED IN ACCORDANCE WITH LOCAL MUNICIPAL AND PROVINCIAL GUIDELINES. ALL CHLORINATED WATER TO BE DISCHARGED AND PRETREATED TO ACCEPTABLE LEVELS PRIOR TO DISCHARGE. ALL DISCHARGED WATER MUST BE CONTROLLED AND TREATED SO AS NOT TO ADVERSELY EFFECT THE ENVIRONMENT. THE LOCAL MUNICIPALITY MAY HAVE SPECIFIC REQUIREMENTS TO BE COMPLIED WITH. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT ALL MUNICIPAL AND/OR PROVINCIAL REQUIREMENTS ARE FOLLOWED.

GRADING AND ROAD PAVEMENTS:

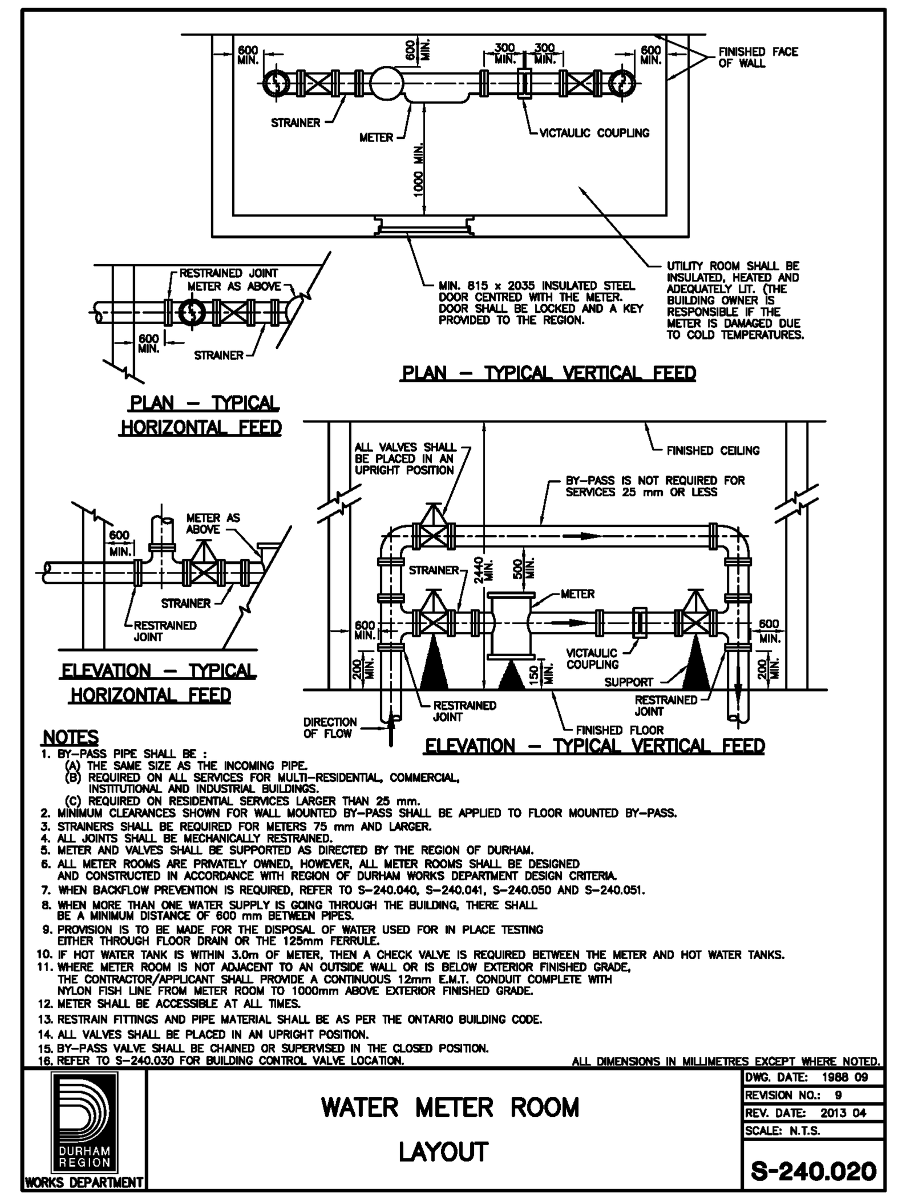
1. ALL EXTERNAL SITE AREAS DISTURBED BY THE ACTIVITIES OF THE CONTRACTOR SHALL BE RESTORED TO EXISTING CONDITION OR BETTER AND TO THE SATISFACTION OF THE TOWN. GRASSED AREAS SHALL BE RESTORED BY PLACING 150mm TOPSOIL AND ACTIVELY GROWING NUMBER 1 NURSERY SOD. ALL BOULEVARDS TO BE TOPSOILED AND SODDED.
2. TOPSOIL IN FILL AREAS TO BE STRIPPED. ALL FILL MATERIAL SHALL BE APPROVED FOR SUITABILITY BY THE GEOTECHNICAL ENGINEER PRIOR TO ANY FILLING OR REUSE OF EXCAVATED MATERIAL. APPROVED FILL MATERIAL SHALL BE COMPACTED TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER.
3. PAVEMENT STRUCTURE TO BE CONSTRUCTED, AS RECOMMENDED BY THE GEOTECHNICAL REPORT AND THE TOWNSHIP OF UXBRIDGE, AS FOLLOWS:

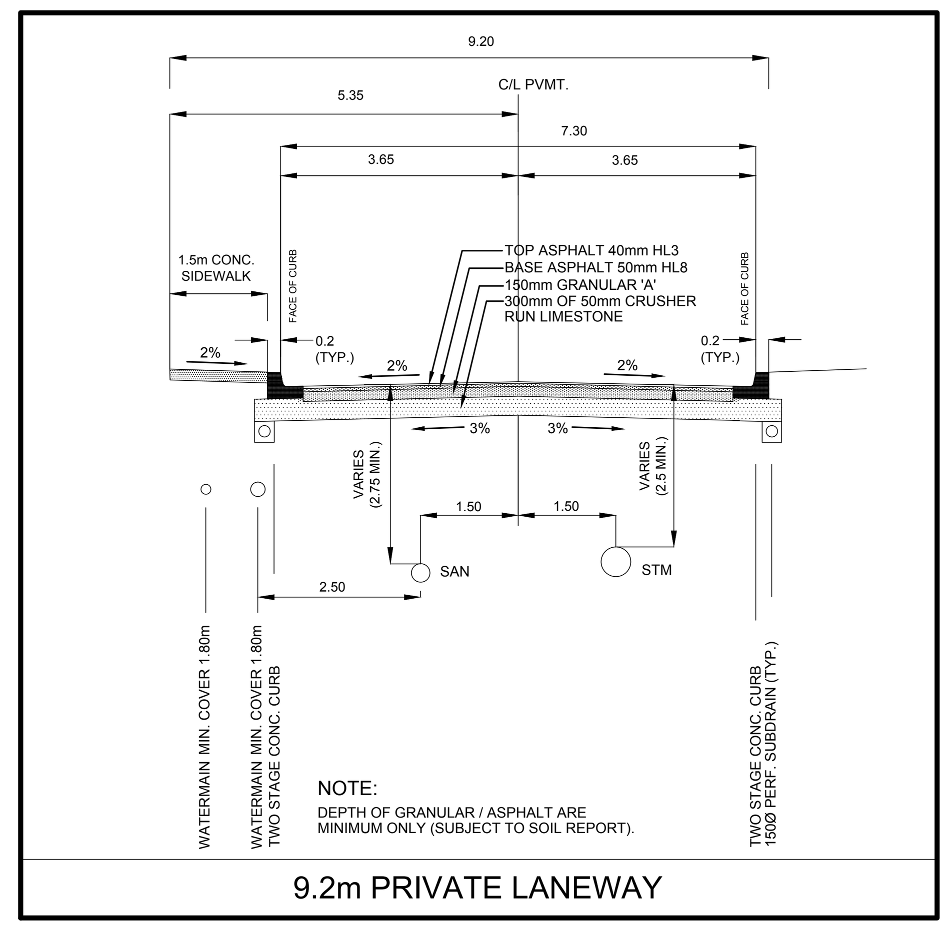
	ALL MULTIPLE FAMILY ROADWAYS
HL3	40mm
HL8	50mm
GRANULAR 'A' BASE	150mm
GRANULAR 'B' SUB-BASE	300mm

4. THE GEOTECHNICAL ENGINEER SHALL VERIFY THE SUITABILITY OF THE ENGINEERED FILL AT SOURCE PRIOR TO HAULING ANY MATERIAL ON SITE.
5. ALL FILL SHALL BE PLACED AND COMPACTED TO 95% STANDARD PROCTOR DENSITY IN MAXIMUM 0.20m LIFTS TO SUBGRADE. FILL SHALL BE COMPACTED TO 98% SPD AS DIRECTED BY THE GEOTECHNICAL ENGINEER.
6. EXISTING BOUNDARY ELEVATION ALONG THE SITE PERIMETER SHALL REMAIN UNDISTURBED. DRAINAGE RECEIVED FROM ADJACENT PROPERTIES SHALL BE ACCOMMODATED AND DRAINAGE FROM THE SUBJECT LANDS SHALL BE SELF-CONTAINED.
7. PAVEMENT GRADES: MIN. 0.5%, MAX. 6.0%
8. DRIVEWAY GRADES: MIN. 1.0%, MAX. 8.0%, 6.0% DESIRABLE
9. BOULEVARD GRADES: MIN. 2.0%, MAX. 5.0%
10. DRAINAGE SWALES: MIN. 2.0%, MAX. 5.0%. SWALES SHALL RANGE IN DEPTH FROM MIN. 250mm TO A MAX. 750mm.
11. YARD SURFACES SHALL HAVE A MINIMUM SLOPE OF 2.0%. YARD SURFACES SHALL HAVE A MAXIMUM SLOPE OF 3:1 TO A MAXIMUM VERTICAL GRADE DIFFERENTIAL OF 1.0m AND 4:1 IF THE VERTICAL GRADE DIFFERENCE EXCEEDS 1.0m. A 1.0m WIDE FLAT AREA IS REQUIRED BETWEEN 3:1 OR 4:1 DOWNWARD SLOPES AT ANY PROPERTY LINE.
12. ALL GRADING TO CONFORM TO TOWNSHIP OF UXBRIDGE STANDARDS AND SPECIFICATIONS AND O.P.S.D.
13. ALL CONSTRUCTION TO BE CARRIED OUT IN ACCORDANCE WITH THE MOST CURRENT DESIGN CRITERIA, STANDARDS, AND SPECIFICATIONS OF THE TOWNSHIP OF UXBRIDGE AND O.P.S.D.
14. THE APPLICANT SHALL CONTACT THE TOWNSHIP OF UXBRIDGE BUILDING SERVICES DIVISION REGARDING ANY PROPOSED RETAINING WALL(S) IN ORDER TO DETERMINE THE REVIEW, CERTIFICATION, PERMIT ISSUANCE, AND INSPECTION PROCESS REQUIRED FOR "DESIGNATED STRUCTURES".

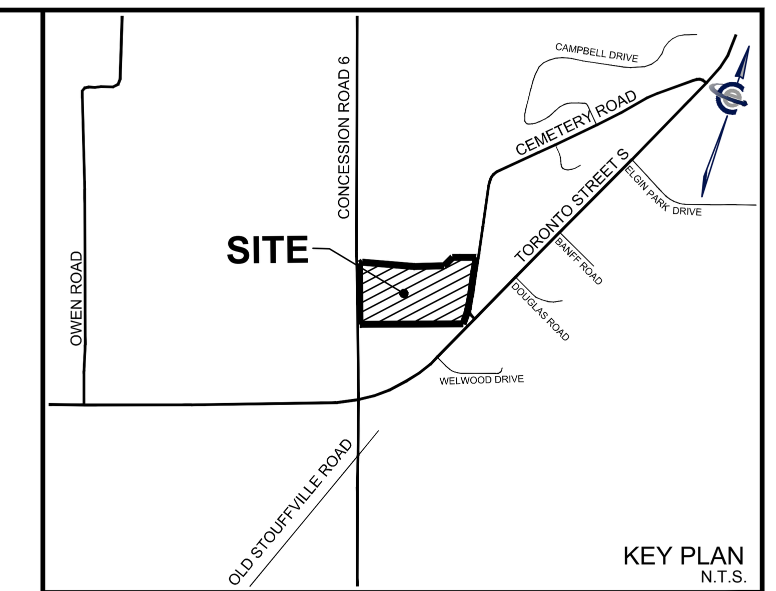


TOWNHOUSE LOT SERVICE CONNECTIONS LAYOUT
N.T.S.





9.2m PRIVATE LANEWAY



KEY PLAN
N.T.S.

LEGEND

LIST OF DRAWINGS
GN-01 (GENERAL NOTES)
GP-01 (GENERAL PLAN OF SERVICES)
SG-01 (SITE GRADING PLAN)
PP-01 (CONCEPT PLAN & PROFILE - CEMETERY ROAD SANITARY SEWER EXTENSION)

No.	Revision	Date	By	Appr'd
3				
2				
1	FIRST SUBMISSION	NOV 24, 2016	NG	TW

BENCHMARK
SOUTHWEST CORNER OF A HYDRO VAULT PAD, LOCATED ON THE EAST SIDE OF CEMETERY ROAD OPPOSITE DWELLING No. 164. ELEVATION = 289.72

LICENSED PROFESSIONAL ENGINEER
T.W. WRIGHT
100146459
2016-11-24
PROVINCE OF ONTARIO

TOWNSHIP OF UXBRIDGE

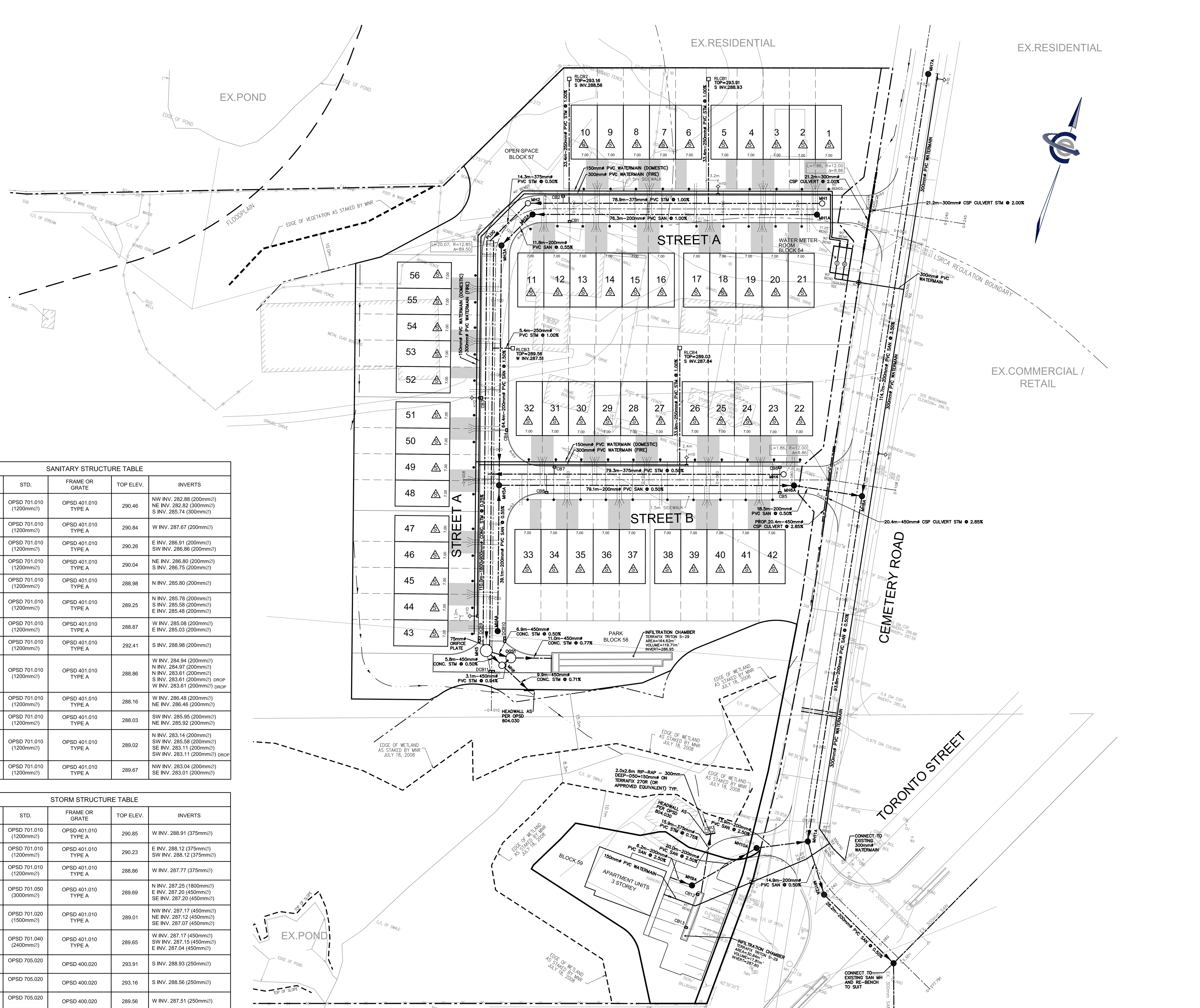
COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

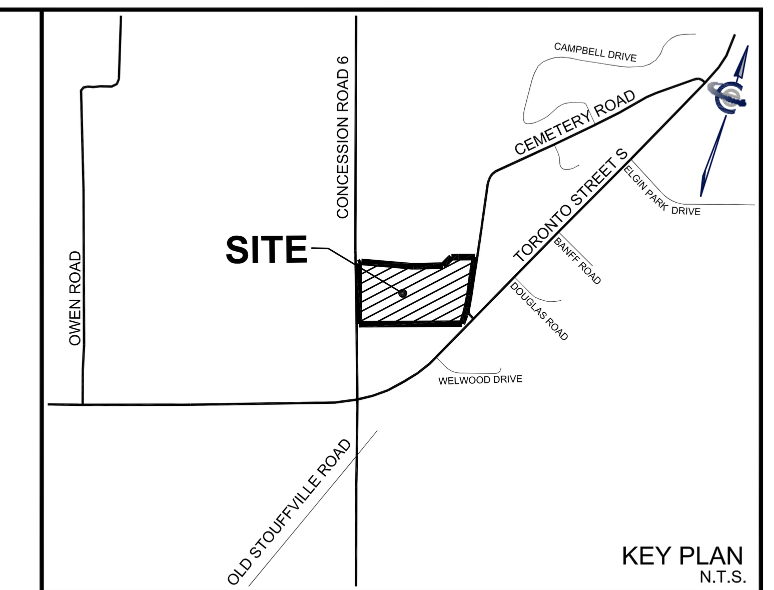
164 CEMETERY ROAD

GENERAL NOTES

Surveyed by: E.R. GARDEN LIMITED	Checked by: N.G	Project No. UD16-0349
Drawn by: Z.K	Approved by: T.W	Drawing No. GN-01
Designed by: L.Z	Date: SEPTEMBER, 2016	Sheet No. 1 OF 4
Scale 1:500 (0m 10m 20m)		

File : \\data\shared\2016 Projects\UD\CI\UD16-0349 Oxford_164CemeterySPA_Uxbridge\400-CAD\402-Design\Sheets\UD16-0349 GN-01.dwg, Date :Nov 24, 2016 - 2:42pm, Edit By : lzovoreh





LEGEND

- PROPERTY BOUNDARY
- EDGE OF WETLAND AS STAKED BY MNR
- PROPOSED DITCH
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- CATCH BASIN
- PROPOSED DOUBLE CATCH BASIN
- PROPOSED VALVE & CHAMBER
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT & VALVE
- PROPOSED WATER METER
- PROPOSED BACKFLOW PREVENTOR
- SUMP PUMP TO GRADE
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EXISTING CATCHBASIN
- EXISTING VALVE & CHAMBER
- EXISTING HYDRANT & VALVE

SANITARY STRUCTURE TABLE

ITEM	STD.	FRAME OR GRATE	TOP ELEV.	INVERTS
EX. MH	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	290.46	NW INV. 282.88 (200mm∅) NE INV. 282.82 (300mm∅) S INV. 285.74 (300mm∅)
MH1A	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	290.84	W INV. 287.67 (200mm∅)
MH2A	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	290.26	E INV. 286.91 (200mm∅) SW INV. 286.86 (200mm∅)
MH3A	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	290.04	NE INV. 286.80 (200mm∅) S INV. 286.75 (200mm∅)
MH4A	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	288.98	N INV. 285.80 (200mm∅)
MH5A	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	289.25	N INV. 285.78 (200mm∅) S INV. 285.58 (200mm∅) E INV. 285.48 (200mm∅)
MH6A	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	288.87	W INV. 285.08 (200mm∅) E INV. 285.03 (200mm∅)
MH7A	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	292.41	S INV. 288.98 (200mm∅)
MH8A	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	288.86	W INV. 284.94 (200mm∅) N INV. 284.97 (200mm∅) N INV. 283.61 (200mm∅) S INV. 283.61 (200mm∅) DROP W INV. 283.61 (200mm∅) DROP
MH9A	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	288.16	W INV. 286.48 (200mm∅) NE INV. 286.46 (200mm∅)
MH10A	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	288.03	SW INV. 285.95 (200mm∅) NE INV. 285.92 (200mm∅)
MH11A	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	289.02	N INV. 283.14 (200mm∅) SW INV. 285.58 (200mm∅) SE INV. 283.11 (200mm∅) SW INV. 283.11 (200mm∅) DROP
MH12A	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	289.67	NW INV. 283.04 (200mm∅) SE INV. 283.01 (200mm∅)

STORM STRUCTURE TABLE

ITEM	STD.	FRAME OR GRATE	TOP ELEV.	INVERTS
MH1	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	290.85	W INV. 288.91 (375mm∅)
MH2	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	290.23	E INV. 288.12 (375mm∅) SW INV. 288.12 (375mm∅)
MH4	OPSD 701.010 (1200mm∅)	OPSD 401.010 TYPE A	288.86	W INV. 287.77 (375mm∅)
MH5	OPSD 701.050 (3000mm∅)	OPSD 401.010 TYPE A	289.69	N INV. 287.25 (1800mm∅) E INV. 287.20 (450mm∅) SE INV. 287.20 (450mm∅)
MH6	OPSD 701.020 (1500mm∅)	OPSD 401.010 TYPE A	289.01	NW INV. 287.17 (450mm∅) NE INV. 287.12 (450mm∅) SE INV. 287.07 (450mm∅)
OGS	OPSD 701.040 (2400mm∅)	OPSD 401.010 TYPE A	289.65	W INV. 287.17 (450mm∅) SW INV. 287.15 (450mm∅) E INV. 287.04 (450mm∅)
RLCB1	OPSD 705.020	OPSD 400.020	293.91	S INV. 288.93 (250mm∅)
RLCB2	OPSD 705.020	OPSD 400.020	293.16	S INV. 288.56 (250mm∅)
RLCB3	OPSD 705.020	OPSD 400.020	289.56	W INV. 287.51 (250mm∅)
RLCB4	OPSD 705.020	OPSD 400.020	289.03	S INV. 287.84 (250mm∅)

LIST OF DRAWINGS

No.	Revision	Date	By	Appr'd
3				
2				
1	FIRST SUBMISSION	NOV 24, 2016	NG	TW

BENCHMARK

SOUTHWEST CORNER OF A HYDRO VAULT PAD, LOCATED ON THE EAST SIDE OF CEMETERY ROAD OPPOSITE DWELLING No. 164. ELEVATION = 289.72

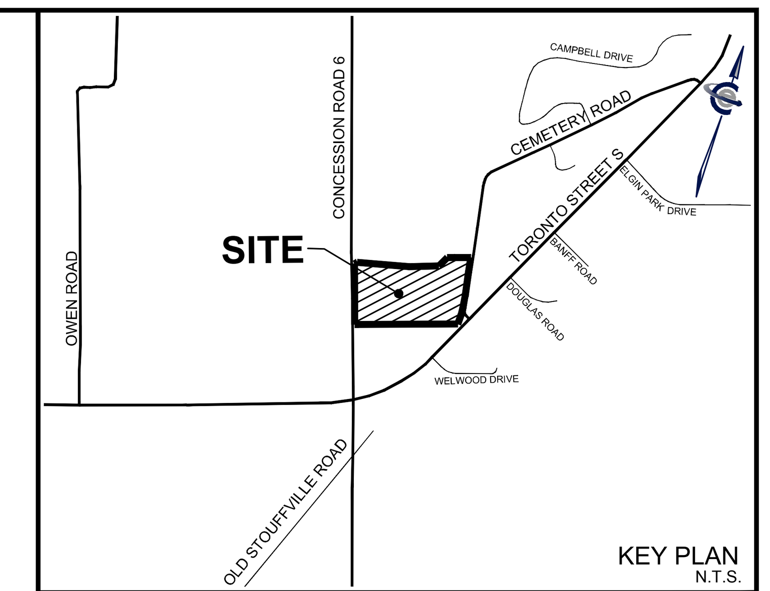
LICENSED PROFESSIONAL ENGINEER T.W. WRIGHT 100146459 2016-11-24 PROVINCE OF ONTARIO

TOWNSHIP OF UXBRIDGE

COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

164 CEMETERY ROAD
GENERAL PLAN OF SERVICES

Surveyed by: E.R. GARDEN LIMITED	Checked by: N.G	Project No. UD16-0349
Drawn by: Z.K	Approved by: T.W	Drawing No. GP-01
Designed by: L.Z	Date: SEPTEMBER, 2016	Sheet No. 2 OF 4
Scale 1:500 (0m 10m 20m)		



LEGEND

	PROPERTY LINE
234	EXISTING CONTOUR
× 233.50EX	EXISTING GRADE
× 234.11	PROPOSED GRADE
× 234.11SW	PROPOSED SWALE GRADE
× 234.11DI	PROPOSED DITCH GRADE
	PROPOSED SLOPE (3:1 MAX.)
	PROPOSED SWALE
	PROPOSED DITCH
S	SPLIT DRAIN LOT
W/U	WALK UP LOT
BS	BACK SPLIT LOT
TR	TRANSITION LOT
F	FRONT DRAIN LOT
	PROPOSED STORM MANHOLE
	PROPOSED SANITARY MANHOLE
	PROPOSED CATCHBASIN
	PROPOSED DOUBLE CATCH BASIN
	PROPOSED VALVE & BOX
	PROPOSED HYDRANT
	SUMP PUMP TO GRADE
	EXISTING STORM MANHOLE
	EXISTING SANITARY MANHOLE
EX.CB.	EXISTING CATCHBASIN
EX.V&C	EXISTING VALVE & CHAMBER
EX.H&V	EXISTING HYDRANT & VALVE

LIST OF DRAWINGS

GN-01 (GENERAL NOTES)
GP-01 (GENERAL PLAN OF SERVICES)
SG-01 (SITE GRADING PLAN)
PP-01 (CONCEPT PLAN & PROFILE - CEMETERY ROAD SANITARY SEWER EXTENSION)

No.	Revision	Date	By	Appr'd
3				
2				
1	FIRST SUBMISSION	NOV 24, 2016	NG	TW

BENCHMARK

SOUTHWEST CORNER OF A HYDRO VAULT PAD, LOCATED ON THE EAST SIDE OF CEMETERY ROAD OPPOSITE DWELLING No. 164. ELEVATION = 289.72

LICENSED PROFESSIONAL ENGINEER
T.W. WRIGHT
100146459
2016-11-24
PROVINCE OF ONTARIO

TOWNSHIP OF UXBRIDGE

COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

164 CEMETERY ROAD

SITE GRADING PLAN

Surveyed by: E.R. GARDEN LIMITED	Checked by: N.G	Project No. UD16-0349
Drawn by: Z.K	Approved by: T.W	
Designed by: L.Z	Date: SEPTEMBER, 2016	Drawing No. SG-01
Scale 1:500 (0m 10m 20m)		Sheet No. 3 OF 4

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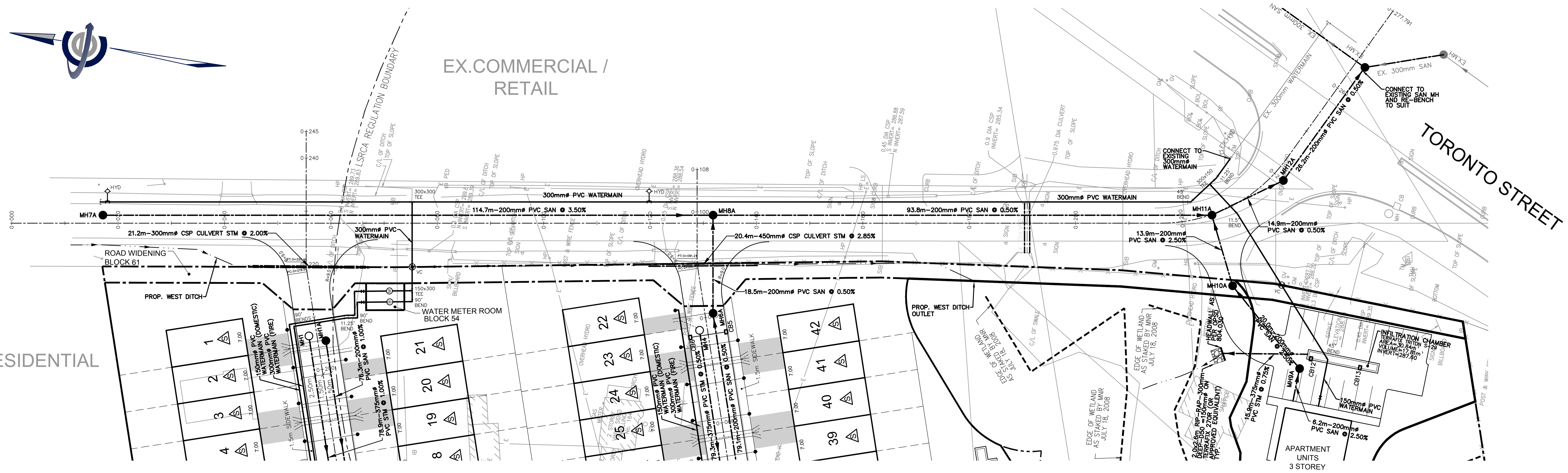
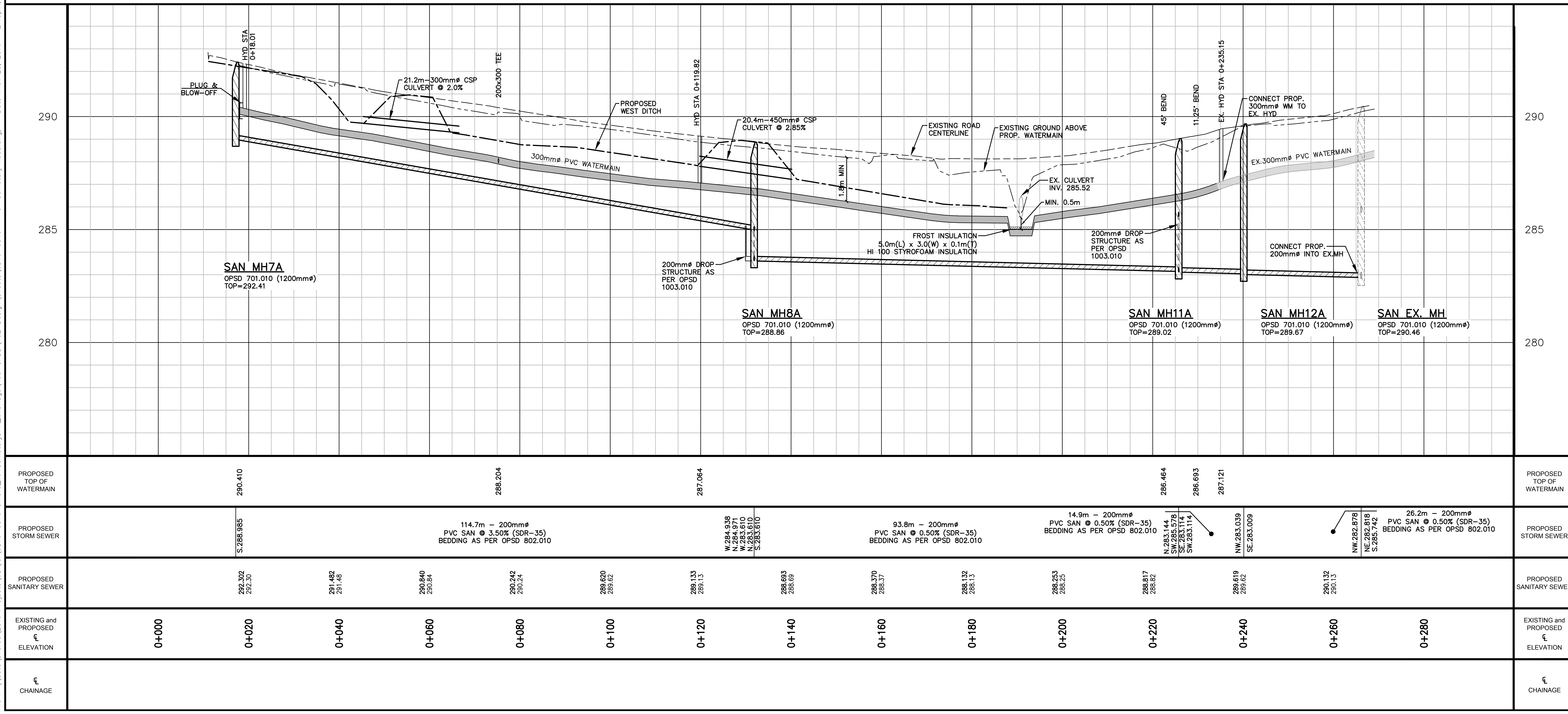
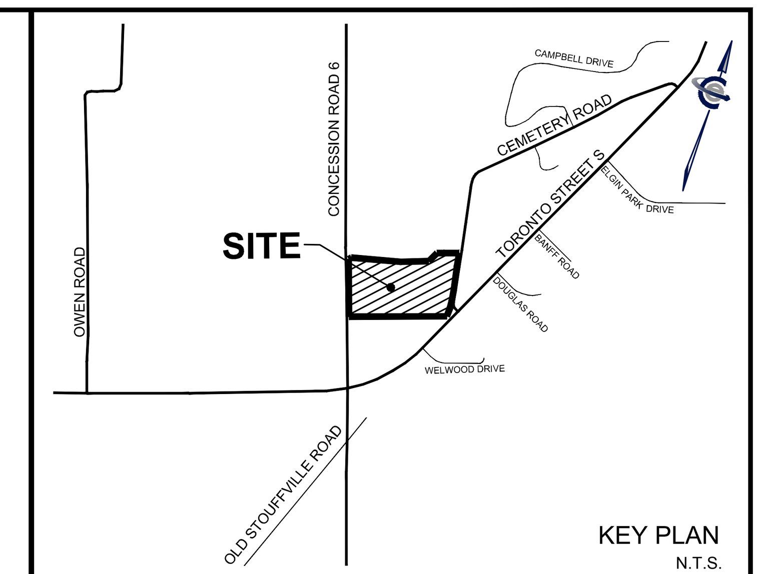


CEMETERY ROAD





KEY PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- PROPOSED SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED WATERMAIN
- PROPOSED SANITARY LATERAL
- PROPOSED STORM LATERAL
- PROPOSED WATER SERVICE
- PROPOSED DITCH
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY MANHOLE
- PROPOSESD CATCH BASIN
- PROPOSED DOUBLE CATCH BASIN
- PROPOSED VALVE & CHAMBER
- PROPOSED VALVE & BOX
- PROPOSED HYDRANT & VALVE
- SUMP PUMP TO GRADE
- EXISTING STORM MANHOLE
- EXISTING SANITARY MANHOLE
- EX.CB. EXISTING CATCHBASIN
- EX.V&C EXISTING VALVE & CHAMBER
- EX.H&V EXISTING HYDRANT & VALVE

LIST OF DRAWINGS

GN-01 (GENERAL NOTES)
GP-01 (GENERAL PLAN OF SERVICES)
SG-01 (SITE GRADING PLAN)
PP-01 (CONCEPT PLAN & PROFILE - CEMETERY ROAD SANITARY SEWER EXTENSION)

No.	Revision	Date	By	Appr'd
4				
3				
2				
1	FIRST SUBMISSION	NOV 24, 2016	N.G.	T.W.

BENCHMARK

SOUTHWEST CORNER OF A HYDRO VAULT PAD, LOCATED ON THE EAST SIDE OF CEMETERY ROAD OPPOSITE DWELLING No. 164. ELEVATION = 289.72

LICENSED PROFESSIONAL ENGINEER T.W. WRIGHT 100146159 2016-11-24 PROVINCE OF ONTARIO

TOWNSHIP OF UXBRIDGE

COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

164 CEMETERY ROAD
CONCEPT PLAN & PROFILE - CEMETERY ROAD SANITARY SEWER EXTENSION
STA.0+000 TO STA. 0+220

Surveyed by: E.R.GARDEN LTD.	Checked by: N.G	Project No. UD16-0349	
Drawn by: Z.K	Approved by: T.W	Drawing No. PP-01	
Designed by: L.Z	Date: SEPTEMBER, 2016	Sheet No. 4 OF 4	
Scale HORIZ. 1:500 VERT. 1:100	0m 10m 20m / 0m 2m 4m		

APPENDIX F

Statement Of Limiting Conditions And Assumptions

Statement of Limiting Conditions and Assumptions

1. This Report/Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner, and its affiliates (the "Intended Users"). No one other than the Intended Users has the right to use and rely on the Work without first obtaining the written authorization of Cole Engineering Group Ltd. (Cole Engineering) and its Owner.
2. Cole Engineering expressly excludes liability to any party except the Intended Users for any use of, and/or reliance upon, the Work.
3. Cole Engineering notes that the following assumptions were made in completing the Work:
   a) the land use description(s) supplied to us are correct;
   b) the surveys and data supplied to Cole Engineering by the Owner are accurate;
   c) market timing, approval delivery and secondary source information is within the control of Parties other than Cole Engineering; and
   d) there are no encroachments, leases, covenants, binding agreements, restrictions, pledges, charges, liens or special assessments outstanding, or encumbrances which would significantly affect the use or servicing.

   Investigations have not been carried out to verify these assumptions. Cole Engineering deems the sources of data and statistical information contained herein to be reliable, but we extend no guarantee of accuracy in these respects.
4. Cole Engineering accepts no responsibility for legal interpretations, questions of survey, opinion of title, hidden or inconspicuous conditions of the property, toxic wastes or contaminated materials, soil or sub-soil conditions, environmental, engineering or other factual and technical matters disclosed by the Owner, the Client, or any public agency, which by their nature, may change the outcome of the Work. Such factors, beyond the scope of this Work, could affect the findings, conclusions and opinions rendered in the Work. We have made disclosure of related potential problems that have come to our attention. Responsibility for diligence with respect to all matters of fact reported herein rests with the Intended Users.
5. Cole Engineering practices engineering in the general areas of infrastructure and transportation. It is not qualified to and is not providing legal or planning advice in this Work.
6. The legal description of the property and the area of the site were based upon surveys and data supplied to us by the Owner. The plans, photographs, and sketches contained in this report are included solely to aide in visualizing the location of the property, the configuration and boundaries of the site, and the relative position of the improvements on the said lands.
7. We have made investigations from secondary sources as documented in the Work, but we have not checked for compliance with by-laws, codes, agency and governmental regulations, etc., unless specifically noted in the Work.
8. Because conditions, including capacity, allocation, economic, social, and political factors change rapidly and, on occasion, without notice or warning, the findings of the Work expressed herein, are as of the date of the Work and cannot necessarily be relied upon as of any other date without subsequent advice from Cole Engineering.
9. The value of proposed improvements should be applied only with regard to the purpose and function of the Work, as outlined in the body of this Work. Any cost estimates set out in the Work are based on construction averages and subject to change.
10. Neither possession of the Work, nor a copy of it, carries the right of publication. All copyright in the Work is reserved to Cole Engineering. The Work shall not be disclosed, produced or reproduced, quoted from, or referred to, in whole or in part, or published in any manner, without the express written consent of Cole Engineering and the Owner.
11. The Work is only valid if it bears the professional engineer's seal and original signature of the author, and if considered in its entirety. Responsibility for unauthorized alteration to the Work is denied.