425 King Street East
Cobourg ON

Functional Servicing and
Stormwater Management Report

Mason Homes

65 Sunray Street Whitby Ontario L1N 8Y3 Canada | 11192099 | Report No 1 | May 2019

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1. Introduction

1.1 Project Background

GHD Limited was retained by Mason Homes to provide engineering services related to the proposed development of 425 King Street East, a 1.58 ha site consisting of 5 townhouse blocks in the Town of Cobourg. The proposed development is bound by King Street East to the north, and residential properties to the south, east and west, as shown on **Figure 1 – Site Location Plan**. This report will investigate the stormwater, sanitary and water servicing requirements for the development of the subject property.

Currently the site consists of an open grass field and an abandoned asphalt driveway. The site drains in a north eastern to south westerly direction towards the drainage ditch along the southern property line, where it is conveyed to the Brook Street South roadside ditch. In general, the residential properties to the east of the development fronting onto Orchard Avenue drain in a rear to front fashion, where it is conveyed east to Coverdale Avenue. The lots fronting onto King Street East are split draining with a portion of the lot draining onto King Street East right of way, and the remainder draining to Orchard Avenue. However, a 0.74 ha external drainage area consisting of the rear yards of the properties immediately east of the subject property will drain through the property, as illustrated on **Figure 2 – Pre-Development Site Drainage Plan**.

The following reports and documents have been utilized in the preparation of this report:

- "Technical and Engineering Guidelines for Stormwater Management Submission" prepared by Ganaraska Region Conservation Authority, dated December 2014
- "Functional Servicing Report" prepared by Engage Engineering Ltd, dated February 2018
- "Addendum to Stormwater Management Report" prepared by MMK Engineering Inc., dated April 2010
- "Coverdale Avenue Storm Sewer and Roadway Improvements Drainage Plan" and "Storm Sewer Design Chart", prepared by Totten Sims Hubicki Associates, dated July 2005
- "King Street East / Coverdale Trunk Storm Sewer Analysis" prepared by GHD Limited., dated April 2019

0 10 20 30m
SCALE 1:1000 AT ORIGINAL SIZE

N

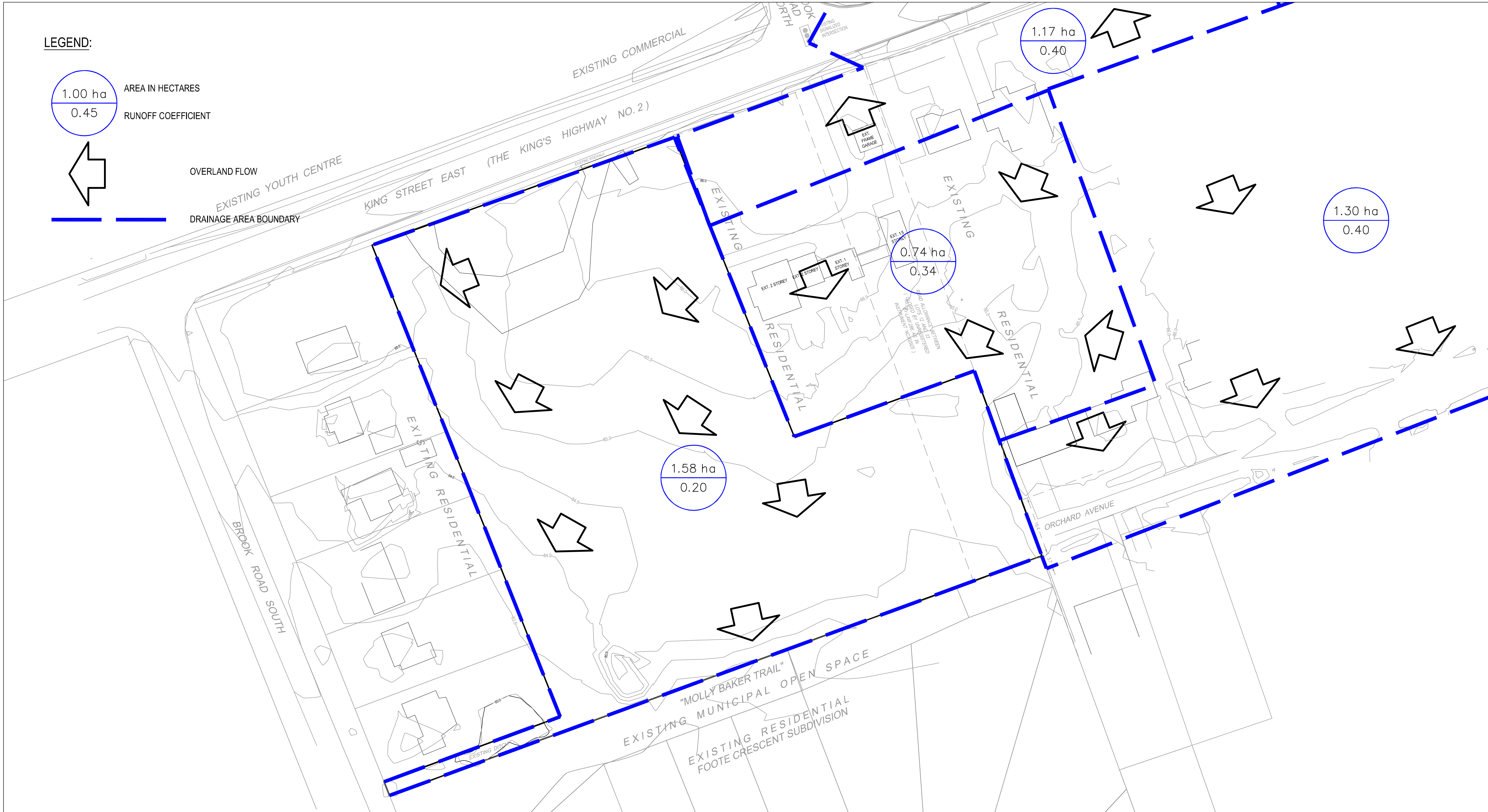
GHD

Mason Homes
425 King Street East
Sewer Analysis
Site Location Plan

Job Number 11192099
Revision A
Date March 2019

Figure 1

65 Sunray Street, Whitby Ontario L1N 8Y3 T 1 905 686 6402 F 1 905 432 7877 E ytomail@ghd.com W www.ghd.com



0 10 20 30m
SCALE 1:1000 AT ORIGINAL SIZE

N

GHD

Mason Homes
425 King Street East
Sewer Analysis

Pre-Development Site Drainage Plan

Job Number	11192099
Revision	A
Date	April 2019

Figure 2

65 Sunray Street, Whitby Ontario L1N 8Y3 **T** 1 905 686 6402 **F** 1 905 432 7877 **E** ytomail@ghd.com **W** www.ghd.com

Plot Date: 17 April 2019 - 8:28 AM Plotted by: Ryan Brockie Cad File No: G:\111\11192099\Technical\Water Resources\Letter\Figures\Figure 2 - Pre-Development Site Drainage Plan.dwg

2. Site Servicing

2.1 Storm Sewer Servicing

The post development drainage pattern is shown in **Figure 3**. A storm sewer system is proposed to capture and intercept runoff generated by the internal and external drainage area of 1.85 ha. The minor system is sized to capture and convey the 5 year storm event to the underground storage facility. Major system flows (rainfall events exceeding the 5 year storm) are to be conveyed overland through the road network to a local low point, where they will be captured and conveyed into the underground storage facility. Foundation drainage will be provided through sump pump connections to avoid basement flooding. This will avoid hydraulic grade line issues with the foundation drainage due to the shallow storm system and the underground storage system. A typical sump connection detail is shown in **Figure 4**.

Once flows are captured, they are to be stored onsite and discharged through a proposed sewer within the Orchard Avenue right of way, where flows will be conveyed to the existing 1650 mm concrete sewer within the Coverdale Avenue right of way as illustrated on **Drawing 11192099-SS1**. Flows will then follow the existing drainage pattern, continuing south and ultimately discharging to Lake Ontario.

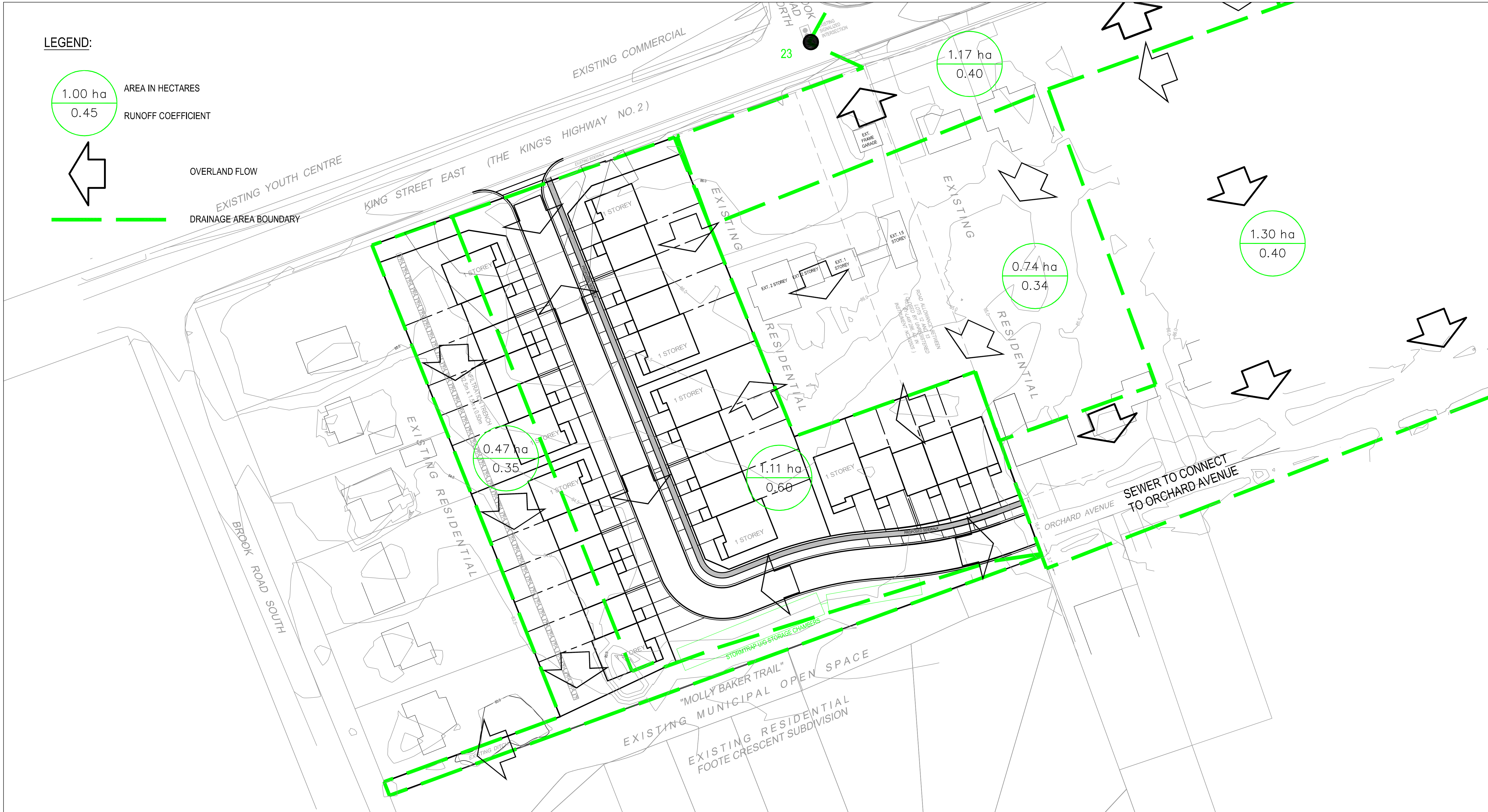
Flows directed toward Coverdale Avenue are highly controlled to due to flow constraints downstream. The discharge could be conveyed by a 200 mm diameter outlet pipe within the Orchard Avenue right of way. However, the Town of Cobourg has requested that the proposed storm sewer be sized to convey future flows from the existing tributary drainage area. As this would allow the future reconstruction of Orchard Avenue as an urban cross section. The pipe has been over sized for the future developments requirements. The pipe has been oversized from the required 200 mm to as big as a 600 mm along Orchard Avenue, as such, Development Charge credits may be applicable, the sizing is as illustrated on **Drawing 1192099-SS1**. Storm sewer design sheets are attached in **Appendix A**.

2.2 Sanitary Sewer Servicing

It is proposed to service the subject development through a 200 mm PVC sanitary sewer. The proposed 200 mm PVC sanitary sewer will connect into the existing 300 mm sanitary sewer with the King Street East right of way via doghouse method. Where flows are conveyed west to the sanitary trunk sewer on Brook Road South and will continue south. Due to grading constraints, a leg of the proposed sanitary sewer will connect into the existing 200 mm PVC sanitary sewer within the Orchard Avenue right of way at MH88, as illustrated on **Drawing 11192099-SS1**. Flows will then continue east towards the existing 200 mm PVC sanitary sewer within the Coverdale Avenue right of way. Each unit will be serviced through a typical 100 mm PVC sanitary sewer service connection.

2.3 Watermain Servicing

The development is proposed to be serviced through a 200 mm PVC watermain. It is proposed to connect into the existing 200 mm PVC watermain in the Orchard Avenue right of way and the 400mm watermain on King Street East, as illustrated on **Drawing 11192099-SS1**. Each unit will be serviced through a typical 19 mm type ‘K’ copper domestic watermain service connection.



0 10 20 30m

SCALE 1:1000 AT ORIGINAL SIZE

N

GHD

Mason Homes
425 King Street East
Sewer Analysis

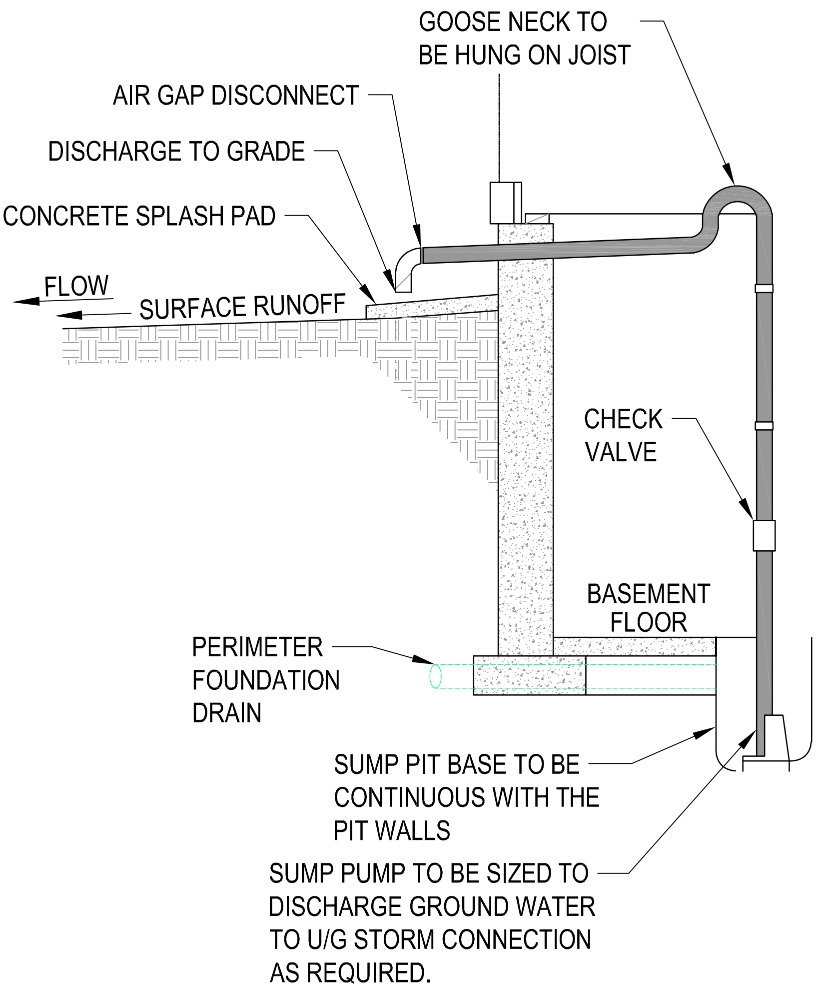
Post-Development Site Drainage Plan

Job Number	11192099
Revision	A
Date	April 2019

Figure 3

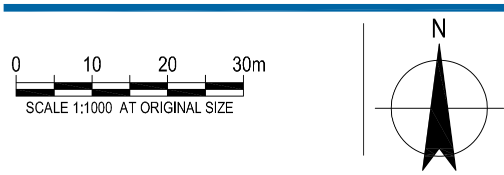
65 Sunray Street, Whitby Ontario L1N 8Y3 **T** 1 905 686 6402 **F** 1 905 432 7877 **E** ytomail@ghd.com **W** www.ghd.com

Plot Date: 14 May 2019 - 4:23 PM Plotted by: Ryan Brockie Cad File No: G:\111\11192099\Technical\Water Resources\Reports\Figures\Figure 2 - Pre-Development Site Drainage Plan.dwg



SUMP PUMP DISCHARGE TO GRADE

N.T.S.



Mason Homes
425 King Street East
Sewer Analysis
Sump Pump Detail

Job Number	11192099
Revision	A
Date	March 2019

Figure 4

65 Sunray Street, Whitby Ontario L1N 8Y3 **T** 1 905 686 6402 **F** 1 905 432 7877 **E** ytomail@ghd.com **W** www.ghd.com

Plot Date: 10 May 2019 - 8:35 AM Plotted by: Ryan Brockie Cad File No: G:\111\11192099\Technical\Water Resources\Reports\Figures\Figures 4&5.dwg

3. Stormwater Management

3.1 Stormwater Management Criteria

Based on criteria from the Town of Cobourg and Ganaraska Region Conservation Authority (GRCA), the stormwater management (SWM) controls that will be required for the proposed development are as follows:

- Quantity Control — Drainage directed eastwards to the Coverdale Avenue Trunk Storm Sewer must not impact downstream properties
- Quality Control — An “Enhanced” level of protection
- Erosion Control — Not required for this development

In order to ensure the above criteria are achieved, the following measures will be implemented:

3.2 Quantity Control

3.2.1 Runoff Coefficient

The typical Runoff Coefficient for townhouse units as per GRCA and Town of Cobourg criteria is 0.65. However in discussion with both the GRCA and the Town, it was agreed to calculate the runoff coefficient for this development from first principles. This calculation is shown in **Appendix B** and the runoff coefficients used are shown in **Figure 3**.

3.2.2 Coverdale Avenue

The natural drainage direction for the subject property is westerly towards Brook Road South. A topographic survey of the existing Brook Road South ditch and culvert system was completed, it was found that there is capacity issues in pre-development conditions. Therefore, it was suggested to investigate the possibility of directing the subdivision flows eastwards to Coverdale Avenue, where a large trunk storm sewer conveys flows to Lake Ontario. To that end, an analysis of the King Street East and Coverdale Avenue trunk storm sewer was performed under a separate cover, the “King Street East / Coverdale Trunk Storm Sewer Analysis” prepared by GHD, dated April 2019. It is understood that the Town of Cobourg and GRCA are in general agreement with the findings of the study. This analysis is attached as **Appendix C**. Since the proposed development flows are not tributary to this sewer, the subject property must discharge at a flow rate that does not cause an adverse impact to any properties serviced by the existing Coverdale Avenue trunk storm sewer.

Manhole 17 adjacent to Coverdale Park was determined to be the most sensitive location in this system. A 750 mm overflow outlet to Coverdale Park has been provided at the obvert of the trunk storm sewer at Manhole 17. Downstream of this location a small tributary makes its way through the park and private property before rejoining Brook Creek. Therefore, this was determined to be the crucial location in the system. The hydraulic grade line in the trunk sewer at this location controls the flow rate through Coverdale Park and private property. As such, an increase to the hydraulic grade line will cause a higher flow rate to discharge to Coverdale Park from the outlet pipe. A discharge from the proposed development was applied and the resultant hydraulic grade line traced through trunk storm sewer. The release rate from the development to the Coverdale Sewer was selected such that there was no increase in the calculated hydraulic grade line at Manhole 17. This release rate was found to be 0.020 m^3/s.

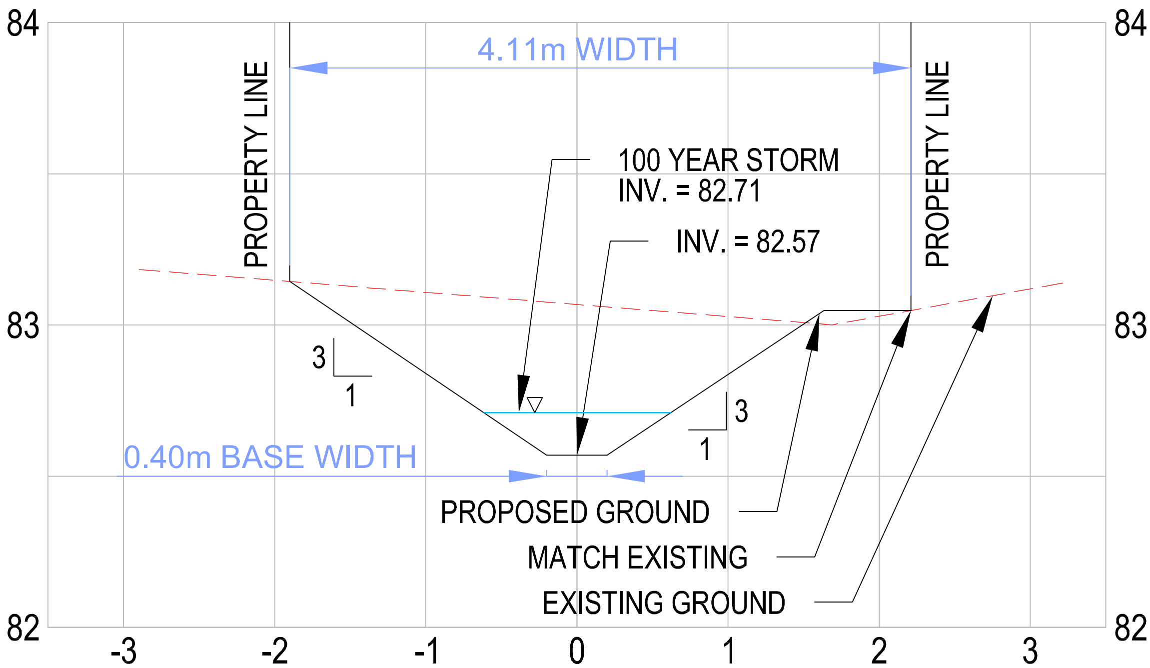
As shown on the Post Development drainage area plan, a total of 1.85 ha of drainage area will be collected by the storm sewer system and therefore on site storage must be provided to attenuate these flows.

Using the modified rational method, the total storage volume required to attenuate the 100-year post-development peak flow is found to be 555 m^3. It is proposed to provide the onsite storage volume in the form of an underground chamber system and the proposed storm sewers and manhole structures. SingleTrap storage chambers, manufactured by StormTrap, are proposed. The SingleTrap chambers provide a footprint of which 88% of its area is available for storage. As such, a foot print area of 349 m^2 with a storage depth of 1.65 m will provide 507 m^3 of storage. As proposed the storm sewers will provide 32 m^3 of storage and manhole structures are proposed to provide 16 m^3 of storage volume. Given this, a total of 555 m^3 of onsite storage volume is available. This, in conjunction with an 85 mm plate orifice located at the downstream outlet of MH5, will control the post-development peak flows such that the 100-year post-development controlled flow rate will not exceed 0.020 m^3/s. Storage calculations can be found in **Appendix B**.

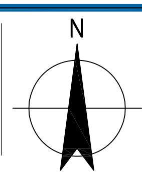
Lastly, the exact location of the underground SingleTrap storage chambers will be determined through detailed engineering design wherein appropriate setbacks to the southern Tree Protection Zone identified in the May 2019 Tree Inventory & Preservation Plan will be confirmed to ensure the least disruption to the existing trees as possible.

3.2.3 Brook Road South

The current property is an open grassed field with an abandoned asphalt driveway. This 2.32 ha drainage area currently drains southwest towards Brook Road South. Upon development, approximately half the rooftops and the rear yards of the western flankage of lots on Orchard Avenue will not be captured in the storm sewer system but will continue to drain towards Brook Road South. A total of 0.47 ha of drainage area is proposed to continue draining towards Brook Street South, where it will follow the existing drainage pattern. Using the rational method, pre development and the uncontrolled post-development peak flows are determined for the 2 through 100-year storm events. The results are as summarized below in **Table 3.1**, supporting calculations are provided in **Appendix B**.



SECTION B-B
H 1:50
V 1:25



Mason Homes
425 King Street East
Sewer Analysis
Typical Channel Section

Job Number	11192099
Revision	A
Date	March 2019

Figure 5

65 Sunray Street, Whitby Ontario L1N 8Y3 **T** 1 905 686 6402 **F** 1 905 432 7877 **E** ytomail@ghd.com **W** www.ghd.com

Plot Date: 9 May 2019 - 5:11 PM Plotted by: Ryan Brockie Cad File No: G:\111\11192099\Technical\Water Resources\Reports\Figures\Figures 4&5.dwg

Table 3.1 Pre and Post Development Flows Brook Road

Return Period (year)	Pre-Development Flows (m^3/s)	Uncontrolled Post-Development Flows (m^3/s)
2	0.102	0.029
5	0.128	0.036
10	0.147	0.042
25	0.190	0.054
50	0.196	0.056
100	0.209	0.059

As demonstrated above, there is a reduction in flows being directed towards Brook Road South in post-development conditions. As such, no quantity controls are required for draining the rear yards to the southwest, where they will continue to follow the existing drainage pattern. The letter "Infiltration Assessment" was prepared by GHD Ltd, dated April 29, 2019, attached as **Appendix E**, in order to determine the suitability of the soil to provide infiltration. It was found that the soil has is in fact suitable, with an infiltration rate ranging from 12 to 15 mm/hr. As such, an infiltration gallery is proposed along the rear yards of Blocks 4 and 5. The infiltration gallery is sized to infiltrate the runoff generated by the 25 mm storm event, resulting in a required infiltration volume of 47 m^3. The gallery is proposed to be 125.0 m long, 1.90 m wide and 0.50 m deep, providing a total volume of 47 m^3. Supporting calculations are provided in **Appendix B**.

Runoff in excess of the 25 mm storm will continue southwest, where a trapezoidal channel will convey up to and including the 100 year storm flows to the Brook Road South road side ditch. The channel is proposed to have a longitudinal slope of 0.5%, a 0.4 m bottom width, 3:1 side slopes that tie into the adjacent grades and a flow depth of 0.14 m, as illustrated on **Figure 5 – Typical Channel Cross Section**. Supporting conveyance capacity calculations are provided in **Appendix B**. **Figure 5** depicts the channel cross section.

3.3 Quality Control

As per the Ministry of the Environment Guidelines, 'Enhanced Level' of protection is required for the development. As such, a long term T.S.S. removal rate of 80% is required. Additionally, extended detention for downstream erosion control is not required to be implemented on site due to the receiving storm sewer system discharging directly into Lake Ontario.

For the proposed development, a treatment train approach has been taken to provide quality control. An oil and grit separator is proposed to provide treatment prior to the drainage entering the StormTrap chambers, as illustrated on **Drawings 11192099-SS1**. A Stormceptor EF8 Unit, or approved equal, is proposed, removing 63% of total suspended solids before entering the chamber system. Sizing calculations for the OGS unit has been provided in **Appendix D**. Furthermore, the SingleTrap chambers allow infiltration to occur below the chamber, which will further increase the quality of the effluent stormwater. Additionally, rear yard infiltration has been proposed for the lots on the western flankage of Orchard Avenue.

3.4 Erosion and Sediment Controls during Construction

During construction, there is potential for sediment laden runoff to leave the site and enter the municipal right of ways. As such, prior to works involving grading activities occurring, the following erosion control practices are to be implemented:

- Silt fence installed along the perimeter of the site
- "Mud-Mat" on the access used during construction
- Catch basin filters installed on existing catchbasins within the municipal right of way
- Good engineering and housekeeping practices

Details for erosion and sedimentation control during construction is subject to Town approval during detailed design.

4. Conclusions

The preceding Functional Servicing and Stormwater Management Report demonstrates the criteria pertaining to site servicing, stormwater management, quantity, quality and erosion controls are met as per Town of Cobourg and Ganaraska Region Conservation Authority guidelines.

The site can be serviced as follows:

- Storm sewers will be provided for the minor system flows. Major system flows will be conveyed by the roadway to an onsite storage system. The majority of storm drainage from the site will be discharged to the Coverdale trunk storm sewer.
- Sanitary servicing will be provided through connection points on King Street East and Orchard Avenue.
- Water servicing will be provided with connection points on King Street East and Orchard Avenue providing continuous looping.
- Quantity controls are proposed in order to attenuate the post-development peak flows to the target flow rate of 0.020 m^3/s to the Coverdale Avenue sewer.
- The target flow rate will necessitate 555 m^3 of onsite storage provided in the form of SingleTrap stormwater detention units, storm sewers and manhole structures.
- An 85 mm plate orifice is proposed at the downstream invert of MH5 in conjunction with the storage chambers to control flows to be less than or equal to the target flow rate 0.020 m^3/s.
- An enhanced level of treatment is provided through a combination of a Stormceptor EF8 unit and infiltration methods.
- Extended detention for downstream erosion control is not necessary, as the receiving storm sewer system discharges directly to Lake Ontario.

All of Which is Respectfully Submitted,

GHD

Ryan Brockie, E.I.T.
Water Resources

LICENSED PROFESSIONAL ENGINEER
K. L. EDGINGTON
May 23 2019
PROVINCE OF ONTARIO

Karen Edgington, P.Eng
Water Resources Group Manager

Appendix A
Design Sheets

65 Sunray St.
Whitby, Ontario
L1N 8Y3
905-686-6402

Town of Cobourg
STORM SEWER DESIGN SHEET

Project Name: **425 King Street East**
Project No. **11192099**

PREPARED BY: M.B.
CHECKED BY: G.B.
DATE: 15-May-2019

15 MINUTE ENTRY TIME
5yr-Design Storm

Street	From MH	To MH	A Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall (mm/hr)	Q Peak Flow (l/s)	Pipe Diameter (mm)	Design Slope (%)	Length (m)	Capacity (l/s)	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks
ORCHARD AVENUE	CBMH1	MH1	0.23	0.65	0.424	0.424	15.00	79.48	34	375	0.30	47.1	100	No	0.88	0.89	15.89	
ORCHARD AVENUE	RYCB1	MH1	0.17	0.65	0.311	0.311	15.00	79.48	25	300	0.50	44.3	71	No	0.98	0.76	15.76	
ORCHARD AVENUE	MH1	MH2	0.22	0.65	0.403	1.138	15.89	77.26	88	525	0.30	52.0	246	No	1.10	0.79	16.68	
ORCHARD AVENUE	MH2	CBMH2	0.07	0.65	0.121	1.259	16.68	75.39	95	600	0.30	20.3	351	No	1.20	0.28	16.96	
ORCHARD AVENUE	MH4	MH3	0.19	0.65	0.347	0.347	16.96	74.75	26	375	0.30	40.6	100	No	0.88	0.77	17.73	
ORCHARD AVENUE	RYCB2	MH3	0.90	0.65	1.626	1.626	15.00	79.48	129	375	0.50	40.5	129	No	1.13	0.60	15.60	
ORCHARD AVENUE	MH3	CBMH2	0.06	0.65	0.116	2.089	17.73	73.04	153	450	0.30	36.5	163	No	0.99	0.61	18.35	
ORCHARD AVENUE	CBMH2	STC1	0.00	0.65	0.000	3.348	18.35	71.74	240	750	0.30	4.9	636	No	1.39	0.06	18.40	
ORCHARD AVENUE	STC1	SC N	0.00	0.65		3.348	18.40	71.62	240	750	0.30	2.5	636	No	1.39	0.03	18.43	
ORCHARD AVENUE	SC E	MH5	0.00	0.65			15.00	79.48	7	300	0.30	4.0	55	No	0.76	0.09	15.09	
ORCHARD AVENUE	MH5	MH6	0.00	0.65			15.09	79.25	7	300	0.30	66.1	55	No	0.76	1.45	16.54	
ORCHARD AVENUE	MH6	MH7	0.50	0.65	0.904	0.904	16.54	75.72	75	450	0.30	35.4	163	No	0.99	0.59	17.13	
ORCHARD AVENUE	MH7	MH8	0.50	0.65	0.904	1.807	17.13	74.36	141	525	0.30	96.2	246	No	1.10	1.46	18.59	
ORCHARD AVENUE	MH8	MH9	0.50	0.65	0.904	2.711	18.59	71.23	200	600	0.30	20.8	351	No	1.20	0.29	18.88	
ORCHARD AVENUE	Ex.MH18	MH9	0.50	0.65	0.904	0.904	18.59	71.23	64	1650	1.00	13.1	9,509	No	4.31	0.05	18.64	
ORCHARD AVENUE	MH9	Ex.MH12	0.50	0.65	0.904	4.518	18.88	70.64	326	1650	1.00	50.9	9,509	No	4.31	0.20	19.08	

Runoff Coefficients

0.20	Parks-Cemeteries-Playground	0.70	Schools & Churches
0.50	Single Family Residential	0.80	Industrial Areas
0.55	Semi-Detached Residential	0.90	Commercial Areas
0.65	Townhouses	0.90	Heavily Developed Areas
0.70	High Density Residential		

5yr: I = 2464 / (T + 16)
n = 0.013

Date	Submission
15-May-2019	FUNCTIONAL

65 Sunray St.
Whitby, Ontario
L1N 8Y3
905-686-6402

Town of Cobourg
STORM SEWER DESIGN SHEET

Project Name: **425 King Street East**
Project No. **11192099**

PREPARED BY: M.B.
CHECKED BY: G.B.
DATE: 15-May-2019

15 MINUTE ENTRY TIME
100yr-Design Storm

Street	From MH	To MH	A Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall (mm/hr)	Q Peak Flow (l/s)	Pipe Diameter (mm)	Design Slope (%)	Length (m)	Capacity (l/s)	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks
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ORCHARD AVENUE	RYCB1	MH1	0.17	0.65	0.311	0.311	15.00	129.95	40	300	0.50	44.3	71	No	0.98	0.76	15.76	
ORCHARD AVENUE	MH1	MH2	0.22	0.65	0.403	1.138	15.89	127.31	145	525	0.30	52.0	246	No	1.10	0.79	16.68	
ORCHARD AVENUE	MH2	CBMH2	0.07	0.65	0.121	1.259	16.68	125.06	157	600	0.30	20.3	351	No	1.20	0.28	16.96	
ORCHARD AVENUE	MH4	MH3	0.19	0.65	0.347	0.347	16.96	124.28	43	375	0.30	40.6	100	No	0.88	0.77	17.73	
ORCHARD AVENUE	RYCB2	MH3	0.90	0.65	1.626	1.626	15.00	129.95	211	375	0.50	40.5	129	Yes	1.13	0.60	15.60	
ORCHARD AVENUE	MH3	CBMH2	0.06	0.65	0.116	2.089	17.73	122.19	255	450	0.30	36.5	163	Yes	0.99	0.61	18.35	
ORCHARD AVENUE	CBMH2	STC1	0.00	0.65	0.000	3.348	18.35	120.57	404	750	0.30	4.9	636	No	1.39	0.06	18.40	
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ORCHARD AVENUE	SC E	MH5	0.00	0.65			15.00	129.95	20	300	0.30	4.0	55	No	0.76	0.09	15.09	
ORCHARD AVENUE	MH5	MH6	0.00	0.65			15.09	129.68	20	300	0.30	66.1	55	No	0.76	1.45	16.54	
ORCHARD AVENUE	MH6	MH7	0.50	0.65	0.904	0.904	16.54	125.46	133	450	0.30	35.4	163	No	0.99	0.59	17.13	
ORCHARD AVENUE	MH7	MH8	0.50	0.65	0.904	1.807	17.13	123.81	244	525	0.30	96.2	246	No	1.10	1.46	18.59	
ORCHARD AVENUE	MH8	MH9	0.50	0.65	0.904	2.711	18.59	119.93	345	600	0.30	20.8	351	No	1.20	0.29	18.88	
ORCHARD AVENUE	Ex.MH18	MH9	0.50	0.65	0.904	0.904	18.59	119.93	108	1650	1.00	13.1	9,509	No	4.31	0.05	18.64	
ORCHARD AVENUE	MH9	Ex.MH12	0.50	0.65	0.904	4.518	18.88	119.20	558	1650	1.00	50.9	9,509	No	4.31	0.20	19.08	

Runoff Coefficients

0.20	Parks-Cemeteries-Playground	0.70	Schools & Churches
0.50	Single Family Residential	0.80	Industrial Areas
0.55	Semi-Detached Residential	0.90	Commercial Areas
0.65	Townhouses	0.90	Heavily Developed Areas
0.70	High Density Residential		

5yr: I = 2464 / (T + 16)
n = 0.013

Date	Submission
15-May-2019	FUNCTIONAL

Appendix B
Stormwater Managment Calculations

Project Name	Cobourg King Street East Sewer Analysis
Project No.	11192099
Subject	Runoff Coefficient

Total Area 15799 m2

Proposed Site

	Area (m2)	C	AC
Block 1	702	0.90	632
Block 2	718	0.90	647
Block 3	669	0.90	602
Block 4	442	0.90	398
Block 5	442	0.90	398
Sidewalk	309	0.90	278
Drive Aisle	2077	0.90	1869
Driveway	1495	0.90	1346
Landscape	5215	0.20	1043
Sum	**12069**		**7212**
Composite 'C'		**0.60**	

External Drainage Area

	Area (m2)	C	AC
Impervious Surface	1510	0.90	1359
Pervious Surface	5840	0.20	1168
Sum	**7350**		**2527**
Composite 'C'		**0.34**	

Entire Drainage Area

	Area (m2)	C	AC
Site	12069	0.60	7212
External Area	7350	0.34	2527
Sum	**19419**		**9739**
Composite 'C'		**0.50**	

Drainage Area to Brook Road

	Area (m2)	C	AC
Impervious Surface	792	0.90	713
Pervious Surface	2938	0.20	588
Sum	**3730**		**1300**
Composite 'C'		**0.35**	

Project Name	Cobourg King Street East Sewer Analysis
Project No.	11192099
Subject	Pre-Development Release Rate (to Brook Street South)

Utilizing the rational method, the allowable release rate can be determined:

Q = C I A where,

Q = Allowable Release Rate (m^3/s)
C = Runoff Coefficient = 0.25
I = Intensity (mm/hr)
A = Area (ha) = 2.32

The Intensity for Cobourg can be calculated as:

I = a / (b + t)^c where,

		2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
I =	Intensity (mm/hr)						
a =	Constant =	1778	2464	2819	3886	4750	5588
b =	Constant =	13	16	16	18	24	28
c =	Constant =	1	1	1	1	1	1
t =	Time of Concentration (min) =	15	15	15	15	15	15
I =	Intensity (mm/hr)	63.50	79.48	90.94	117.76	121.79	129.95
Q =	**Allowable Release Rate (m^3/s)**	**0.102**	**0.128**	**0.147**	**0.190**	**0.196**	**0.209**

CALCULATIONS

Prepared by R.B.
Checked by K.E.

Project Name	Cobourg King Street East Sewer Analysis
Project No.	11192099
Subject	Post Development Uncontrolled Release Rate (to Brook Street South)

Utilizing the rational method, the post development release rate can be determined:

Q = C I A where,

Q = Flow rate (cms)
C = Runoff Coefficient
I = Intensity (mm/hr)
A = Area (ha)

The Intensity foı Cobourg can be calculated as:

I = a / (b + t)^c where,

		2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
I =	Intensity (mm/hr)						
a =	Constant =	1778	2464	2819	3886	4750	5588
b =	Constant =	13	16	16	18	24	28
c =	Constant =	1	1	1	1	1	1
t =	Time of Concentration (min) =	15	15	15	15	15	15
I =		63.50	79.48	90.94	117.76	121.79	129.95

Based on the proposed land use the post development flow rates are:

Area ID	Area Description	Area (ha)	Runoff Coefficient	Flow Rates (m^3/s)					
				2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
101	Site + External Drainage Area	0.47	0.35	0.029	0.036	0.042	0.054	0.056	0.059
Total		0.47	0.35	0.029	0.036	0.042	0.054	0.056	0.059

CALCULATIONS

Prepared by R.B.
Checked by K.E.

Project Name	Cobourg King Street East Sewer Analysis
Project No.	11192099
Subject	Post Development Uncontrolled Release Rate (to Coverdale Avenue)

Utilizing the rational method, the post development release rate can be determined:

Q = C I A where,

Q = Flow rate (cms)
C = Runoff Coefficient
I = Intensity (mm/hr)
A = Area (ha)

The Intensity foı Cobourg can be calculated as:

I = a / (b + t)^c where,

I =	Intensity (mm/hr)	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
a =	Constant =	1778	2464	2819	3886	4750	5588
b =	Constant =	13	16	16	18	24	28
c =	Constant =	1	1	1	1	1	1
t =	Time of Concentration (min) =	15	15	15	15	15	15
I =		63.50	79.48	90.94	117.76	121.79	129.95

Based on the proposed land use the post development flow rates are:

Area ID	Area Description	Area (ha)	Runoff Coefficient	Flow Rates (m^3/s)					
				2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
101	Site + External Drainage Area	1.85	0.50	0.163	0.204	0.234	0.303	0.313	0.334
Total		1.85	0.50	0.163	0.204	0.234	0.303	0.313	0.334

CALCULATIONS

Prepared by R.B.
Checked by K.E.

Project Name	Cobourg King Street East Sewer Analysis
Project No.	11192099
Subject	Modified Rational Storage Calculations

100 Year

Catchment ID =	101	
Time of Concentration (t_c) =	15	minutes
Time Step (t_1) =	10	minutes
Runoff Coefficient (C) =	0.50	
Catchment Area (A) =	1.85	ha

Target Release Rate (Q_o) =	0.020	m^3/s

Time $t = t_c + t_1$ (min.)	Intensity $I=a/(t_c+b)^c$ (mm/hr)	Runoff Q=CIA (m^3/s)	Storage Rate $Q_s = Q - Q_o$ (m^3/s)	Required Storage $V = Q_s\ t$ (m^3)
15	130	0.334	0.314	283
25	105	0.271	0.251	376
35	89	0.228	0.208	437
45	77	0.197	0.177	477
55	67	0.173	0.153	505
65	60	0.154	0.134	524
75	54	0.139	0.119	537
85	49	0.127	0.107	546
95	45	0.117	0.097	551
105	42	0.108	0.088	554
115	39	0.100	0.080	555
125	37	0.094	0.074	554
135	34	0.088	0.068	551
145	32	0.083	0.063	548
155	31	0.078	0.058	544
165	29	0.074	0.054	539
175	28	0.071	0.051	533
185	26	0.067	0.047	526
195	25	0.064	0.044	519
205	24	0.062	0.042	512
215	23	0.059	0.039	504
225	22	0.057	0.037	496
235	21	0.055	0.035	488
245	20	0.053	0.033	479
255	20	0.051	0.031	470
265	19	0.049	0.029	461
275	18	0.047	0.027	452
285	18	0.046	0.026	442
295	17	0.044	0.024	433
305	17	0.043	0.023	423

100 Year Storage Required =	555	m^3

Project Na	Cobourg King Street East Sewer Analysis
Project No.	11192099
Subject	Pipe/Manhole Storage

Pipe Storage

From	To	Size (mm)	Length (m)	Volume (m3)
CBMH1	MH1	375	47.13	5.21
MH1	MH2	525	51.99	11.25
MH2	CBMH2	600	20.32	5.75
MH4	MH3	375	40.55	4.48
MH3	CBMH2	450	36.48	5.80
Sum				**32.49**

Manhole Storage

Structure	MH Depth (m)	Diameter (m)	Volume (m3)
CBMH1	1.09	1.2	0.93
MH1	2.12	1.2	3.53
MH2	2.08	1.2	3.40
CBMH2	2.22	1.2	3.87
MH3	1.95	1.2	2.99
MH4	1.39	1.2	1.52
Sum			**16.24**

Total Storage 48.72

CALCULATIONS

Prepared by R.B.
Checked by K.E.

Project Name	Cobourg King Street East Sewer Analysis
Project No.	11192099
Subject	Orifice Calculations

Controlled Site Area =	1.85	ha
Qo - Allowable Orifice Release Rate =	**0.020**	**m^3/s**

Catchment ID =	Site	
Orifice Location =	MH5	
Orifice Type =	Orifice Plate	
Invert Elevation =	82.91	m
Diameter of Orifice =	**85**	**mm**
Area of Orifice (A)=	0.006	m^2
Orifice Coefficient (C_d) =	0.620	

Calculation of Head

Water Elevation =	84.56	m
Upstream Head[a], H =	1.608	m

$$Q_A = C_d A (2 g h)^{1/2}$$

Actual Controlled Discharge, Q_A=	**0.020**	**m^3/s**

[a]Head is based on depth of water above orifice midpoint

[b]Velocity based on orifice area @ orifice face not Vena Contracta

CALCULATIONS

Prepared by R.B.
Checked by K.E.

Project Name	425 King Street East - Cobourg
Project No.	11192099
Subject	CBMH 1 Capacity

Contributing drainage area =	0.23	ha
Max allowable ponding above grate =	0.15	m
Peak Flow (100 year storm) entering grate =	0.06	m^3/s
Assume % Loss due to Grating =	50	%
Surface area of grate =	0.72	m^2
1 x 600mmx600mm CBMH 1 x 600x600mm CB (O.P.S.D. 705.010)		
Use orifice equation to determine inflow at a ponding depth of	0.15	**m**

Orifice Calculation to Determine Inlet Capacity:

Q =	0.06	m^3/s
C =	0.62	
A =	0.36	m^2
h =	0.15	m
g =	9.81	m/s^2

$Q = C \times A \times (2gh)^{1/2}$

$Q = 0.383$ m^3/s

$Q_{50\%} = 0.191$ m^3/s Inlet Capacity Assuming 50% Blockage

$Q_{Major} = Q_{100}$

$= 0.055$ m^3/s < 0.191 m^3/s

Calculation to Determine Required Headwater Above Pipe at Max Flow:

Pipe Diameter =	375	mm
Q =	0.06	m^3/s
C =	0.62	
A =	0.11	m^2
g =	9.81	m/s^2

$h = Q^2 / (C^2 \times A^2 \times 2g)$

$h = 0.04$ m

Calculation to Determine Pipe Capacity:

Capacity of 375 mm dia. Pipe @ 0.3 % Slope

C =	0.62	
A =	0.11	m^2
n =	0.01	
S =	0.30	%
R =	0.09	

$Q = (1.0 \times A \times R^{2/3} \times S^{1/2}) / R$

$Q = 0.09024$ m^3/s > 0.055 m^3/s (PEAK FLOW)

CALCULATIONS

Prepared by R.B.
Checked by K.E.

Project Name	425 King Street East - Cobourg
Project No.	11192099
Subject	CBMH 2 Capacity

Contributing drainage area =	0.37	ha
Max allowable ponding above grate =	0.30	m
Peak Flow (100 year storm) entering grate =	0.09	m^3/s
Assume % Loss due to Grating =	50	%
Surface area of grate =	0.72	m^2
1 x 600x600mm CB & 600x600mm CBMH (O.P.S.D. 705.010)		
Use orifice equation to determine inflow at a ponding depth of	0.3	**m**

Orifice Calculation to Determine Inlet Capacity:

Q =	0.09	m^3/s
C =	0.62	
A =	0.36	m^2
h =	0.30	m
g =	9.81	m/s^2

$Q = C \times A \times (2gh)^{1/2}$

$Q = 0.542$ m^3/s

$Q_{50\%} = 0.271$ m^3/s Inlet Capacity Assuming 50% Blockage

$Q_{Major} = Q_{100}$

$= 0.087$ m^3/s < 0.271 m^3/s

Calculation to Determine Required Headwater Above Pipe at Max Flow:

Pipe Diameter =	750	mm
Q =	0.09	m^3/s
C =	0.62	
A =	0.46	m^2
g =	9.81	m/s^2

$h = Q^2 / (C^2 \times A^2 \times 2g)$

$h = 0.00$ m

Calculation to Determine Pipe Capacity:

Capacity of 750 mm dia. Pipe @ 0.3 % Slope

C =	0.62	
A =	0.46	m^2
n =	0.01	
S =	0.30	%
R =	0.19	

$Q = (1.0 \times A \times R^{2/3} \times S^{1/2}) / R$

$Q = 0.63581$ m^3/s > 0.087 m^3/s (PEAK FLOW)

CALCULATIONS

Prepared by R.B.
Checked by K.E.

Project Name	425 King Street East - Cobourg
Project No.	11192099
Subject	MH4 - CB Capacity

Contributing drainage area =	0.19	ha
Max allowable ponding above grate =	0.07	m
Peak Flow (100 year storm) entering grate =	0.04	m^3/s
Assume % Loss due to Grating =	50	%
2 x 600x600mm CB (O.P.S.D. 705.010) Surface area of grate =	0.72	m^2

Use orifice equation to determine inflow at a ponding depth of 0.07 **m**

Orifice Calculation to Determine Inlet Capacity:

Q =	0.04	m^3/s
C =	0.62	
A =	0.36	m^2
h =	0.07	m
g =	9.81	m/s^2

$Q = C \times A \times (2gh)^{1/2}$

$Q = 0.262$ m^3/s

$Q_{50\%} = 0.131$ m^3/s Inlet Capacity Assuming 50% Blockage

$Q_{Major} = Q_{100}$

$= 0.043$ m^3/s $<$ 0.131 m^3/s

Calculation to Determine Required Headwater Above Pipe at Max Flow:

Pipe Diameter =	375	mm
Q =	0.04	m^3/s
C =	0.62	
A =	0.11	m^2
g =	9.81	m/s^2

$h = Q^2 / (C^2 \times A^2 \times 2g)$

$h = 0.02$ m

Calculation to Determine Pipe Capacity:

Capacity of 375 mm dia. Pipe @ 0.3 % Slope

C =	0.62	
A =	0.11	m^2
n =	0.01	
S =	0.30	%
R =	0.09	

$Q = (1.0 \times A \times R^{2/3} \times S^{1/2}) / R$

$Q = 0.09024$ m^3/s $>$ 0.043 m^3/s (PEAK FLOW)

CALCULATIONS

Prepared by R.B.
Checked by K.E.

Project Name	425 King Street East - Cobourg
Project No.	11192099
Subject	RYCB1 Capacity

Contributing drainage area =	0.17	ha
Max allowable ponding above grate =	0.30	m
Peak Flow (100 year storm) entering grate =	0.04	m^3/s
Assume % Loss due to Grating =	50	%
600x600mm CB (O.P.S.D. 705.010) Surface area of grate =	0.36	m^2

Use orifice equation to determine inflow at a ponding depth of 0.3 **m**

Orifice Calculation to Determine Inlet Capacity:

Q =	0.04	m^3/s
C =	0.62	
A =	0.18	m^2
h =	0.30	m
g =	9.81	m/s^2

$Q = C \times A \times (2gh)^{1/2}$

$Q = 0.135$ m^3/s

$Q_{50\%} = 0.068$ m^3/s Inlet Capacity Assuming 50% Blockage

$Q_{Major} = Q_{100}$

$= 0.040$ m^3/s < 0.068 m^3/s

Calculation to Determine Required Headwater Above Pipe at Max Flow:

Pipe Diameter =	300	mm
Q =	0.04	m^3/s
C =	0.62	
A =	0.07	m^2
g =	9.81	m/s^2

$h = Q^2 / (C^2 \times A^2 \times 2g)$

$h = 0.04$ m

Calculation to Determine Pipe Capacity:

Capacity of 300 mm dia. Pipe @ 0.5 % Slope

C =	0.62	
A =	0.07	m^2
n =	0.01	
S =	0.50	%
R =	0.07	

$Q = (1.0 \times A \times R^{2/3} \times S^{1/2}) / R$

$Q = 0.06795$ m^3/s > 0.040 m^3/s (PEAK FLOW)

CALCULATIONS

Prepared by R.B.
Checked by K.E.

Project Name	425 King Street East - Cobourg
Project No.	11192099
Subject	RYCB2 Capacity

Contributing drainage area =	0.9	ha
Max allowable ponding above grate =	0.19	m
Peak Flow (100 year storm) entering grate =	0.21	m^3/s
Assume % Loss due to Grating =	50	%
600x600mm CB (O.P.S.D. 400.120) Surface area of grate =	0.36	m^2

Use orifice equation to determine inflow at a ponding depth of 0.19 **m**

Orifice Calculation to Determine Inlet Capacity:

Q =	0.21	m^3/s
C =	0.62	
A =	0.18	m^2
h =	0.19	m
g =	9.81	m/s^2

$Q = C \times A \times (2gh)^{1/2}$

$Q = 0.215$ m^3/s

**the catchbasin grate as per OPSD 400.120, will not clog as it is rasied.

$Q_{Major} = Q_{100}$

$= 0.211$ m^3/s < 0.215 m^3/s

Calculation to Determine Required Headwater Above Pipe at Max Flow:

Pipe Diameter =	375	mm
Q =	0.21	m^3/s
C =	0.62	
A =	0.11	m^2
g =	9.81	m/s^2

$h = Q^2 / (C^2 \times A^2 \times 2g)$

$h = 0.53$ m

Calculation to Determine Pipe Capacity:

Capacity of 375 mm dia. Pipe @ 0.5 % Slope

C =	0.62	
A =	0.11	m^2
n =	0.01	
S =	0.50	%
R =	0.09	

$Q = (1.0 \times A \times R^{2/3} \times S^{1/2}) / R$

$Q = 0.1165$ m^3/s < 0.211 m^3/s (PEAK FLOW)

CALCULATIONS

Prepared by R.B.
Checked by K.E.

Project Name	425 King St East
Project No.	11192099
Subject	Infiltration Trench Characteristics

Equation 4.2: Maximum Allowable Infiltration Trench Depth (MOE SWMP Manual, 2003)

$d = PT / 1000\ V_r$

P =	Percolation Rate	12	mm/hr
T =	Drawdown time	48	hr
Vr =	Void Ratio	0.4	(assumed for clear stone)
d =	Maximum allowable depth	0.576	m

Equation 4.3: Infiltration Trench Bottom Area (MOE SWMP Manual, 2003)

A=1000 V / Pn t

A =	Area (ha)	0.47	ha	
C =	Runoff Coefficient	0.40		
XIMP =	% Impervious	0.3		
d =	Depth of Runoff Infiltrated	10.0	mm	C * 25mm
V =	Runoff Volume infiltrated	47.0	m^3	
P =	Percolation Rate	12	mm/hr	
n =	Porosity of the Storage Media	0.4	(assumed for clear stone)	
t =	Retention time (24 to 48 hrs)	48	hours	
A =	Bottom Area	204	m^2	
L=	Proposed Length	125	m	
W=	Proposed Width	1.90	m	
D =	Proposed Depth	0.5	m	
A =	Proposed Area	237.5	m^2	
V =	Propopsed Storage Volume (L x W x D x n)	47.5	m^3	

Project Name	425 King Street East Cobourg
Project No.	11192099
Subject	Channel Design A-A

Flow Parameters

	A	B	C
5 yr	2464	16	1
100 yr	5588	28	1

tc = 15 mins
Area = 0.47 ha
C = 0.35

$$i = \frac{A}{(t_c + B)^C} \qquad Q = \frac{1}{360} CiA$$

$i_5 =$ 79.48 mm/hr $i_{100} =$ 129.9535 mm/hr

$Q_5 =$ 0.036 $Q_{100} =$ 0.059

$Q_{major} =$ 0.059 m3/s

Channel Parameters

Max. Depth	y =	0.20	m
Side Slope	z =	3	:1
Bottom Width	b =	0.4	m
Rough. Coef.	n =	0.035	
Channel Slope	s =	0.005	m/m

$$Q_{cap} = \frac{1}{n} A R^{2/3} S^{1/2}$$

$$A = y(b + yz) \quad P = b + 2\sqrt{y^2(1 + z^2)} \quad R = \frac{A}{P}$$

A = 0.2 m2
P = 1.66 m
R = 0.12 m

$Q_{cap} =$ 0.098 m3/s

Flow Depth 0.14 m

Therefore, the channel as proposed channel has capacity to convey the major flows from the adjoining site

Project Name	425 King Street East Cobourg
Project No.	11192099
Subject	Channel Design B-B

Flow Parameters

	A	B	C
5 yr	2464	16	1
100 yr	5588	28	1

tc = 15 mins
Area = 0.47 ha
C = 0.35

$$i = \frac{A}{(t_c + B)^C} \qquad Q = \frac{1}{360} CiA$$

$i_5 =$ 79.48 mm/hr $\qquad i_{100} =$ 129.9535 mm/hr

$Q_5 =$ 0.036 $\qquad Q_{100} =$ 0.059

$Q_{major} =$ 0.059 m3/s

Channel Parameters

Max. Depth	y =	0.48	m
Side Slope	z =	3	:1
Bottom Width	b =	0.4	m
Rough. Coef.	n =	0.035	
Channel Slope	s =	0.005	m/m

$$Q_{cap} = \frac{1}{n} AR^{2/3} S^{1/2}$$

$$A = y(b + yz) \qquad P = b + 2\sqrt{y^2(1 + z^2)} \qquad R = \frac{A}{P}$$

A = 0.8832 m2
P = 3.44 m
R = 0.26 m

$Q_{cap} =$ 0.721 m3/s

Flow Depth 0.14 m

Therefore, the channel as proposed channel has capacity to convey the major flows from the adjoining site

Appendix **C**

King Street East/Coverdal Trunk Storm Sewer Analysis

April 18, 2019 Reference No. 11192099

Terry Hoekstra
Town of Cobourg
740 Division Street, Building 7
Cobourg, ON K9A 0H6

Dear Mr. Hoekstra:

Re: King Street East / Coverdale Trunk Storm Sewer Analysis
425 King Street East
Town of Cobourg

This analysis has been prepared to investigate the capacity of the existing trunk storm sewer system on King Street East and Coverdale Avenue in the Town of Cobourg. It is proposed to provide a storm outlet to this trunk storm system for a development located at 425 King Street East which currently drains westward to Brook Road South. It is therefore important to understand if this sewer has capacity to accept additional flows.

1.1 Existing Site

The site is locally known as 425 King Street East in the Town of Cobourg. The site is bound to the north by King Street East, and residential properties to the east, west and south. The site is approximately 1.58ha, consisting of an asphalt surface and an open grassed field, as shown on **Figure 1 – Site Location Plan**. Presently, the property drains in a north eastern to a south westerly direction towards a drainage ditch along the southern property limit, where it is conveyed west to the Brook Road South roadside ditch. An additional drainage area of approximately 0.74ha external to the site flows through the subject property, towards the drainage ditch adjacent to the southern property line. In general, the residential properties to the east of the development fronting onto Orchard Avenue will drain in a rear to front fashion, where it is conveyed east to Coverdale Avenue. Lots fronting onto King Street East are split draining, with a portion of the lot draining into the King Street East right of way and the remaining draining to Orchard Avenue as well. However, the rear yards of the lots immediately east of the development drain through the subject property, as illustrated on **Figure 2 – Pre-Development Site Drainage Plan**.

1.2 Existing Coverdale Avenue Trunk Sewer

As part of the design of the trunk storm sewer by Totten Sims Hubicki Associates in 2005, storm sewer design sheets and a drainage area plan was prepared. This information along with plan/profile drawings for Coverdale Avenue was provided to GHD Ltd. by the Town of Cobourg, has been appended to this letter. This documentation formed the basis of the current analysis of the existing storm sewer and its capacity. Further to the information provided, an overall drainage plan has been prepared by this office, to illustrate the updated drainage areas. The overall area drainage plan is depicted in drawing **11192099-ODA1**.

GHD
65 Sunray Street Whitby Ontario L1N 8Y3 Canada
T 905 686 6402 **F** 905 432 7877 **W** www.ghd.com

0 10 20 30m
SCALE 1:1000 AT ORIGINAL SIZE

N

GHD

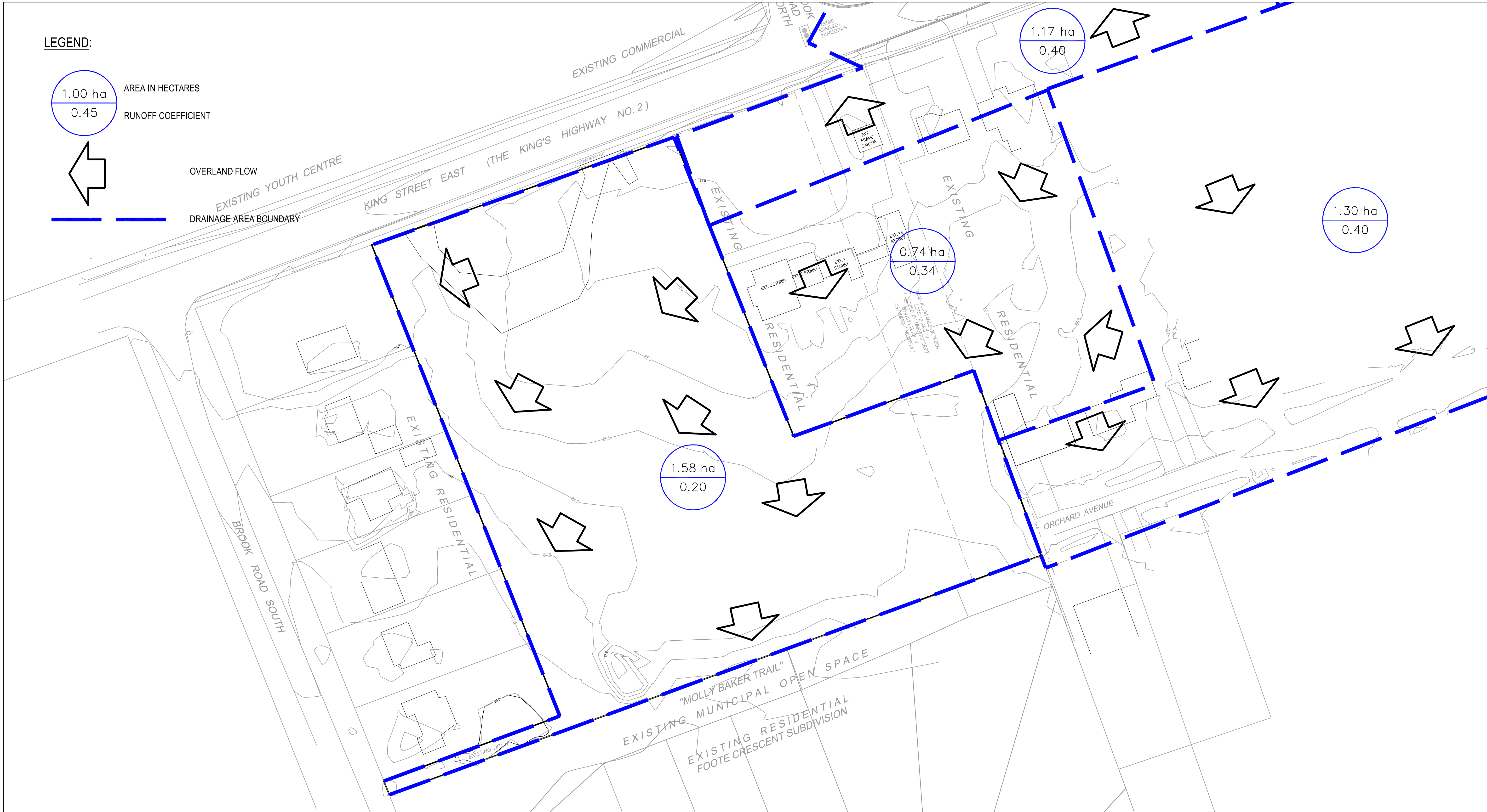
Mason Homes
425 King Street East
Sewer Analysis
Site Location Plan

Job Number	11192099
Revision	A
Date	March 2019

Figure 1

65 Sunray Street, Whitby Ontario L1N 8Y3 **T** 1 905 686 6402 **F** 1 905 432 7877 **E** ytomail@ghd.com **W** www.ghd.com

Plot Date: 14 March 2019 - 11:39 AM Plotted by: Ryan Brockie Cad File No: C:\Users\rbrockie\Desktop\11192099\Letter\Figures\Figure 1 - Site Location Plan.dwg



0 10 20 30m
SCALE 1:1000 AT ORIGINAL SIZE

N

GHD

Mason Homes
425 King Street East
Sewer Analysis

Pre-Development Site Drainage Plan

Job Number	11192099
Revision	A
Date	April 2019

Figure 2

65 Sunray Street, Whitby Ontario L1N 8Y3 **T** 1 905 686 6402 **F** 1 905 432 7877 **E** ytomail@ghd.com **W** www.ghd.com

Plot Date: 17 April 2019 - 8:28 AM Plotted by: Ryan Brockie Cad File No: G:\111\11192099\Technical\Water Resources\Letter\Figures\Figure 2 - Pre-Development Site Drainage Plan.dwg

A rational method calculation was performed to estimate the capacity of the existing storm sewer during the 5 year and 100 year storm events. Runoff coefficients for the existing drainage areas are as taken from the TSH design sheet. The Yarnell storm IDF curve was used. Additionally, 100 year storm HGL calculations were performed using the rational method. Storm sewer design sheets for the existing 5 year, 100 year and 100 year HGL are appended to this letter.

The storm design sheets prepared by Totten Sims Hubicki have been updated as follows for the existing development:

1. Manhole 27 to 26 – TSH area of 59.51 ha, C 0.45, Tc 29.15min. This area has now been split into the basin north of the Railway, East Village Phase 5 Tributary to the SWM pond and future development.
   a. North Basin is 38.27 ha, assumed runoff coefficient 0.47, plus future development 2.68 ha for a total of 40.95ha , C of 0.46, Tc = 37mins.
   b. East Village Phase 5 - Engage Engineering is responsible for the detailed design of the Gates of Camelot Phase 2 subdivision, which is to be constructed north of King Street East and discharge into the King Street east storm sewer. Engage has provided GHD Ltd. with the maximum allowable post-development release rate for the Gates of Camelot Phase 2 stormwater management facility. The stormwater management facility will control flows entering the King Street East storm sewer to a maximum flow rate of 148L/s during the 100 year storm event. The flows from the stormwater management facilities for the proposed site and Gates of Camelot Phases 1 & 2 are modelled to discharge at a constant flow rate in the storm sewer design sheet prepared by this office. The constant flows from these catchments are carried throughout the peak flow calculations for the storm sewer system and are not calculated using the rational method. The post development drainage plan received from Engage and email detailing flows are appended to this brief.
2. Manhole 231 to 23 TSH area of 9.45 ha, C 0.39, Tc 40.60min
   a. The Gates of Camelot Phase 1 subdivision, which was constructed north of King Street East and is tributary to the trunk storm sewer, has a stormwater management facility in place to limit post development flow rates to the sewer system to be less than 0.446 m^3/s as per the TSH design sheet. The flow rates discharging from the stormwater management facility in the Gates of Camelot Phase 1 subdivision are obtained from “Addendum to Stormwater Management Report” prepared by MMK Engineering Inc. dated April 2010 for the 5 and 100 year storm events, they are 193L/s and 373L/s respectively. The constant flows from these catchments are carried throughout the peak flow calculations for the storm sewer system and are not calculated using the rational method. The Tc used for this area matches the previously used 40.6 minutes from the TSH sheet. Outflows from the stormwater pond peak at 2.20 hours so this Tc is conservative.
   b. Brook Road North Catchment matches TSH 5.09 ha, C 0.4, Tc 15 min
3. King Street East Manhole 231 to 23 TSH area of 9.45 ha, C 0.39, Tc 40.60min – additional drainage from lots on south frontage of King St added drainage area now 1.17 ha
4. Orchard Avenue West MH 201 to 20 TSH area of 0.53 ha, C 0.40 Tc 17.15 drainage area has been increased to 1.30 ha

All other drainage basins are assumed to match the TSH Sheet.

At MH 17 a sewer overflow from the trunk system, a 750mm diameter pipe, outlets to Coverdale Park. The overflow pipe is placed at the obvert of the trunk sewer such that water will release from the sewer system upon surcharge of the trunk sewer. The ditch in the park continues south westerly to Brook Road South. Therefore, MH 17 is found to be the most sensitive to a hydraulic grade line increase as an increase in the hydraulic grade line at this location will result in more flows being sent to the ditch. As such, the 100-year post-development flow rate from the subject property discharging through Orchard Avenue to the existing storm sewer system is to be controlled such that the hydraulic grade line does not increase at MH 17. This in turn ensures flows discharging to the existing watercourse will continue at pre-development levels in post-development conditions.

1.3 Proposed Site

The proposed development at 425 King Street East was the subject of a previously submitted FSSR for the subdivision by Engage Engineering Ltd. submitted February 2018. At this time GHD has been employed by the owner Mason Homes to complete the FSSR as well as this analysis. In the previously submitted report, post development runoff and storage was calculated based on assumed runoff coefficients. In this particular development lots are larger than typical, therefore it was agreed at the meeting March 11, 2019 between the Town of Cobourg, GRCA, Mason Homes and GHD, that the runoff coefficient for this development could be calculated from first principals. The impervious and pervious areas were measured, and the appropriate runoff coefficients were applied to each, from that a total composite runoff coefficient for the drainage area was obtained, including the external drainage area. Table 1 below details the results of the first principle measurement and calculation.

Table 1 Site Composite Runoff Coefficient

	Area (m^2)	Runoff Coefficient (C)	A▪C
Pervious	5215	0.20	1043
Impervious	6855	0.90	6169
External Drainage	7350	0.34	2527
Total	19419	**0.50**	9739

As noted above, in existing conditions site drainage is directed west towards Brook Road South, including the external drainage area. In post-development conditions, it is proposed to capture and convey 1.95ha of drainage from the subject site through Orchard Avenue towards the Coverdale Avenue storm sewer. The runoff from the existing lots fronting King Street East and Orchard Avenue will continue to follow the existing drainage pattern.

1.4 Coverdale Avenue Trunk Sewer – Including 425 King Street

Using the Rational Method, the peak flow and capacity for the trunk storm sewers was determined. The storm design sheets previously prepared by TSH provided the initial times of concentration throughout the system. These values were used as they were deemed to be more conservative than those determined in the hydraulic modeling in “Addendum to Stormwater Management Report” prepared by MMK Engineering Inc. dated April 2010. Additionally, the Rational Method hydraulic gradeline analysis assumes 100% capture of the 100 year storm event by the minor storm system, providing an increased level of conservatism. It is understood that, in general, flows in excess of the 25 year storm event will not enter the minor storm sewer system and be conveyed overland. Through the analysis, it is found that the maximum allowable discharge rate from the subject property to the storm sewer, such that no increase to the hydraulic grade line occurs at MH 17, is 0.013m^3/s. The results of the 100 year hydraulic grade line analysis for the existing and proposed conditions are summarized below in Table 2.

Table 2 100 Year Hydraulic Grade Line

Manhole		Hydraulic Grade Line Existing Conditions		Hydraulic Grade Line Proposed Conditions	
Lower	Upper	Lower	Upper	Lower	Upper
100	1	77.63	78.03	77.63	78.03
1	4	78.50	79.33	78.50	79.33
4	7	79.33	80.34	79.33	80.34
7	9	80.34	80.50	80.34	80.50
9	10	80.53	80.76	80.53	80.76
10	16	80.90	80.97	80.90	80.97
16	**17**	81.13	**81.70**	81.13	**81.70**
17	18	**81.75**	81.81	**81.75**	81.81
18	19	81.85	82.17	81.85	82.17
19	20	82.21	82.84	82.21	82.84
20	21	82.92	83.49	82.93	83.50
21	22	83.99	84.36	84.00	84.37
22	23	84.34	84.80	84.35	84.81
21	24	83.67	84.31	83.68	84.32
24	25	84.38	84.96	84.39	84.97
25	26	85.00	86.66	85.01	86.67

As shown above, by limiting the discharge to the existing storm sewer to 0.013m^3/s there is no increase to the hydraulic gradeline at MH 17. Furthermore, it is shown that there is no appreciable impact on the hydraulic grade line throughout the system. The runoff coefficient for the entire 1.95ha drainage area discharging to Orchard Avenue is found to be 0.50, using the rational method, a post-development peak flow is calculated. With the post-development flow being higher than the target flow rate of 0.013m^3/s, onsite controls are required in order to attenuate flows to meet the target flow rate. Using the modified rational method, the volume required to attenuate post-development flow to 0.013m^3/s is 305m^3. The volume is proposed to be provided in the form of underground storage. The onsite storage in conjunction with an orifice will control flows discharging to the existing storm sewer to the target flow rate of $0.013m^3/s$ during the 100 year storm event, ensuring there is no adverse impacts to the existing hydraulic grade line.

1.5 Conclusions

The preceding letter/report outlines the proposed outfall design for the development of 425 King Street and its impact on the Coverdale Avenue trunk storm sewer. The analysis of the Coverdale Avenue storm sewer found that if there is negligible impact on the trunk sewer if the proposed development controls post-development peak flows to $0.013m^3/s$. A Functional Servicing and Stormwater Management Report will follow this analysis shortly, detailing how the proposed controls will be implemented within the development in accordance with these findings.

Should you have any questions or require additional information, please do not hesitate to contact our office.

Sincerely,

GHD

Ryan Brockie, E.I.T.
Water Resources

LICENSED PROFESSIONAL ENGINEER
K. L. EDGINGTON
04/22/2019
PROVINCE OF ONTARIO

Karen Edgington, P.Eng.
Water Resources Group Manager

KE/RB/mp

Encl.

cc: Mason Homes; Attn: Ashley Mason
GRCA; Attn: Leslie Benson

LEGEND:

RUNOFF COEFFICIENT 0.45 / AREA IN HECTARES 1.00 ha / MANHOLE NUMBER 23	
	OVERLAND FLOW
	DRAINAGE AREA BOUNDARY
● 27	EXISTING STORM MANHOLE

No.	Revision	Drawn	Job Manager	Project Director	Date

Drawing Revisions

Note: * indicates signatures on original issue of drawing or last revision of drawing

N

0 40 80 120 160 200
SCALE 1:4000 AT ORIGINAL SIZE

GHD
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Client **MASON HOMES**

Project **425 KING STREET EAST TRUNK SEWER ANALYSIS**

Title **TRUNK SEWER OVERALL DRAINAGE AREA PLAN**

Scale	AS SHOWN	**DO NOT SCALE**
Drawn	R.B.	
Designer	R.B.	
Drafting Check	K.E.	
Design Check	K.E.	
Approved (Project Director)	K.E.	
Date	APRIL 2019	

This Drawing must not be used for Construction unless signed as Approved

Drawing No. **11192099-ODA1**

Original Size **Arch D**

Rev. **A**

Plot Date: 18 April 2019 - 2:01 PM Plotted by: Ryan Brockie Cad File No: G:\111\11192099\Technical\Water Resources\Letter\Figures\Figure 3 - Overall Drainage Plan.dwg

Project Name	Cobourg King Street East Sewer Analysis
Project No.	11192099
Subject	Runoff Coefficient

Total Area 15799 m2

Proposed Site

	Area (m2)	C	AC
Block 1	702	0.90	632
Block 2	718	0.90	647
Block 3	669	0.90	602
Block 4	442	0.90	398
Block 5	442	0.90	398
Sidewalk	309	0.90	278
Drive Aisle	2077	0.90	1869
Driveway	1495	0.90	1346
Landscape	5215	0.20	1043
Sum	**12069**		**7212**
Composite 'C'		**0.60**	

External Drainage Area

	Area (m2)	C	AC
Impervious Surface	1510	0.90	1359
Pervious Surface	5840	0.20	1168
Sum	**7350**		**2527**
Composite 'C'		**0.34**	

Entire Drainage Area

	Area (m2)	C	AC
Site	12069	0.60	7212
External Area	7350	0.34	2527
Sum	**19419**		**9739**
Composite 'C'		**0.50**	

Drainage Area to Brook Road

	Area (m2)	C	AC
Impervious Surface	792	0.90	713
Pervious Surface	2938	0.20	588
Sum	**3730**		**1300**
Composite 'C'		**0.35**	

CALCULATIONS

Prepared by R.B.
Checked by K.E.

Project Name	Cobourg King Street East Sewer Analysis
Project No.	11192099
Subject	Post Development Uncontrolled Release Rate

Utilizing the rational method, the post development release rate can be determined:

Q = C I A where,

Q = Flow rate (cms)
C = Runoff Coefficient
I = Intensity (mm/hr)
A = Area (ha)

The Intensity foı Cobourg can be calculated as:

I = a / (b + t)^c where,

		2 Year	5 Year	10 Year	25 Year	25 Year	100 Year
I =	Intensity (mm/hr)						
a =	Constant =	1778	2464	2819	3886	4750	5588
b =	Constant =	13	16	16	18	24	28
c =	Constant =	1	1	1	1	1	1
t =	Time of Concentration (min) =	15	15	15	15	15	15
I =		63.50	79.48	90.94	117.76	121.79	129.95

Based on the proposed land use the post development flow rates are:

Area ID	Area Description	Area (ha)	Runoff Coefficient	Flow Rates (m^3/s)					
				2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
101	Site + External Drainage Area	1.95	0.50	0.172	0.215	0.246	0.319	0.330	0.352
Total		1.95	0.50	0.172	0.215	0.246	0.319	0.330	0.352

CALCULATIONS

Prepared by R.B.
Checked by K.E.

Project Name	Cobourg King Street East Sewer Analysis
Project No.	11192099
Subject	Modified Rational Storage Calculations

100 Year

Catchment ID =	101	
Time of Concentration (t_c) =	15	minutes
Time Step (t_1) =	5	minutes
Runoff Coefficient (C) =	0.50	
Catchment Area (A) =	1.95	ha

Target Release Rate (Q_o) =	0.013	m^3/s

Time $t = t_c + t_1$ (min.)	Intensity $I=a/(t_c+b)^c$ (mm/hr)	Runoff Q=CIA (m^3/s)	Storage Rate $Q_s = Q - Q_o$ (m^3/s)	Required Storage $V = Q_s\,t$ (m^3)
15	130	0.352	0.339	305
20	116	0.315	0.302	363
25	105	0.286	0.273	409
30	96	0.261	0.248	446
35	89	0.240	0.227	477
40	82	0.223	0.210	503
45	77	0.207	0.194	525
50	72	0.194	0.181	543

100 Year Storage Required =	305	m^3

65 Sunray St.
Whitby, Ontario
L1N 8Y3
905-686-6402

Town of Cobourg
PRE-DEVELOPMENT STORM SEWER DESIGN SHEET

PREPARED BY: R.B.
CHECKED BY: K.E.
DATE: 15-Mar-19

Project Name: **Cobourg King Street East Sewer Analysis**
Project No. **11192099**

15 MINUTE ENTRY TIME
5yr-Design Storm

Street	From MH	To MH	A Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall (mm/hr)	Q Peak Flow (l/s)	Pipe Diameter (mm)	Design Slope (%)	Length (m)	Capacity (l/s)	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks
Future Basin North of King	27	26	39.97	0.47	52.225	52.225	29.15	54.57	2,850	1500	0.45	1.0	4,947	No	2.71	0.01	29.16	
East Village	27	26	11.80	0.40			29.15	54.57	50	1500	0.45	1.0	4,947	No	2.71	0.01	29.16	East Village Controlled Flow
King Street East	26	25	3.09	0.40	3.436	55.661	29.16	54.57	3,087	1500	0.45	288.0	4,947	No	2.71	1.77	30.93	
	25	24	1.53	0.40	1.701	57.362	30.93	52.51	3,062	1500	0.50	100.0	5,215	No	2.86	0.58	31.51	
	24	21	1.67	0.40	1.857	59.219	31.51	51.86	3,121	1500	0.56	107.0	5,519	No	3.03	0.59	32.10	
Brook Road North	231	23	12.10	0.40			40.60	43.53	193	750	0.79	14.0	1,032	No	2.26	0.10	40.70	Gates of Camelot Phase 1 Controlled Flow
	231	23	5.09	0.40	5.660	5.660	15.00	79.48	450	750	0.79	14.0	1,032	No	2.26	0.10	15.10	
King Street East	23	22	1.17	0.40	1.301	6.961	40.70	43.46	496	750	0.50	70.0	821	No	1.80	0.65	41.35	Inclding external drainage area see Figure 2
	22	21	1.03	0.40	1.145	8.106	41.35	42.97	541	825	0.56	79.0	1,121	No	2.03	0.65	42.00	
Coverdale Avenue	21	20	1.35	0.40	1.501	68.827	42.00	42.49	3,167	1650	0.59	143.0	7,304	No	3.31	0.72	42.72	
Orchard Avenue West	201	20	1.30	0.40	1.446	1.446	17.15	74.33	107	525	1.00	1.0	449	No	2.01	0.01	17.16	Inclding external drainage area see Figure 2
Orchard Avenue East	202	20	1.30	0.40	1.446	1.446	15.81	77.46	112	375	1.00	1.0	183	No	1.60	0.01	15.82	
Coverdale Avenue	20	19	1.42	0.40	1.579	73.297	42.72	41.96	3,319	1650	0.60	143.0	7,365	No	3.34	0.71	43.43	
Hamilton Avenue West	191	19	0.58	0.40	0.645	0.645	17.08	74.49	48	300	0.50	1.0	71	No	0.98	0.02	17.10	
Hamilton Avenue East	192	19	12.69	0.40	14.111	14.111	21.52	65.67	927	750	1.40	1.0	1,374	No	3.01	0.01	21.53	
CoverdaleAvenue	19	18	0.79	0.40	0.878	88.932	43.43	41.46	3,930	1800	0.60	83.0	9,289	No	3.54	0.39	43.82	
	18	17	0.00	0.40		88.932	43.82	41.19	3,906	1800	0.54	16.0	8,812	No	3.35	0.08	43.90	
Coverdale Avenue	17	16	0.63	0.40	0.701	89.632	43.90	41.13	3,930	1800	0.28	147.5	6,345	No	2.42	1.02	44.92	
Springbrook Road	163	161	1.20	0.40	1.334	1.334	15.00	79.48	106	375	1.00	110.0	183	No	1.60	1.14	16.14	
	164	161	1.20	0.40	1.334	1.334	15.00	79.48	106	375	1.00	85.0	183	No	1.60	0.88	15.88	
	161	16	0.00	0.40		2.669	15.88	77.28	206	450	1.00	110.0	297	No	1.81	1.01	16.89	
Coverdale Avenue	16	10	0.99	0.40	1.101	93.402	44.92	40.45	4,021	1800	0.37	19.0	7,294	No	2.78	0.11	45.03	
	10	9	0.62	0.40	0.689	94.092	45.03	40.37	4,042	1800	0.23	55.5	5,751	No	2.19	0.42	45.46	
Gardiner Crescent	91	9	1.05	0.40	1.168	1.168	15.00	79.48	93	300	1.00	95.0	101	No	1.38	1.15	16.15	
Coverdale Avenue	9	7	0.60	0.40	0.667	95.926	45.46	40.09	4,089	1800	0.86	18.5	11,121	No	4.23	0.07	45.53	
	7	4	0.36	0.40	0.400	96.327	45.53	40.05	4,101	1800	0.86	115.0	11,121	No	4.23	0.45	45.98	
Gardiner Crescent	41	4	1.20	0.40	1.334	1.334	15.00	79.48	106	375	1.00	90.0	183	No	1.60	0.93	15.93	
Springbrook Road	43	42	1.30	0.40	1.446	1.446	15.00	79.48	115	375	1.00	65.0	183	No	1.60	0.68	15.68	
	42	4	0.55	0.40	0.612	2.057	15.68	77.79	160	375	1.00	105.5	183	No	1.60	1.10	16.77	

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Town of Cobourg
PRE-DEVELOPMENT STORM SEWER DESIGN SHEET

Project Name: **Cobourg King Street East Sewer Analysis**
Project No. **11192099**

PREPARED BY: R.B.
CHECKED BY: K.E.
DATE: 15-Mar-19

15 MINUTE ENTRY TIME
5yr-Design Storm

Street	From MH	To MH	A Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall (mm/hr)	Q Peak Flow (l/s)	Pipe Diameter (mm)	Design Slope (%)	Length (m)	Capacity (l/s)	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks
Coverdale Avenue	4	1	0.50	0.40	0.556	100.274	45.98	39.75	4,229	1800	0.82	100.0	10,859	No	4.13	0.40	46.38	
Lakeshore Road West	111	1	0.50	0.40	0.556	0.556	15.00	79.48	44	300	1.00	60.0	101	No	1.38	0.72	15.72	
Lakeshore Road East	112	1	1.17	0.40	1.301	1.301	15.00	79.48	103	375	1.00	75.0	183	No	1.60	0.78	15.78	
Existing Outlet - Coverdale	1	100	0.00	0.40		102.131	46.38	39.50	4,277	1800	0.47	85.2	8,221	No	3.13	0.45	46.84	

Runoff Coefficients

0.20	Parks-Cemeteries-Playground	0.70	Schools & Churches
0.50	Single Family Residential	0.80	Industrial Areas
0.55	Semi-Detached Residential	0.90	Commercial Areas
0.65	Townhouses	0.90	Heavily Developed Areas
0.70	High Density Residential		

Gates of Camelot Phase 1 - 5 Year Discharge Rate 373 L/s
East Village - 5 Year Discharge Rate 50 L/s

5yr: I = 2464 / (T + 16)
n = 0.013

Date	Submission
5-Mar-19	1st Submission

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Town of Cobourg
PRE-DEVELOPMENT STORM SEWER DESIGN SHEET

Project Name: **Cobourg King Street East Sewer Analysis**
Project No. **11192099**

PREPARED BY: R.B.
CHECKED BY: K.E.
DATE: 15-Mar-19

15 MINUTE ENTRY TIME
100yr-Design Storm

Street	From MH	To MH	A Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall (mm/hr)	Q Peak Flow (l/s)	Pipe Diameter (mm)	Design Slope (%)	Length (m)	Capacity (l/s)	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks
Future Basin North of King	27	26	39.97	0.47	52.225	52.225	29.15	97.78	5,106	1500	0.45	1.0	4,947	Yes	2.71	0.01	29.16	
East Village	27	26	11.80				29.15	97.78	148	1500	0.45	1.0	4,947	No	2.71	0.01	29.16	East Village Controlled Flow
King Street East	26	25	3.09	0.40	3.436	55.661	29.16	97.77	5,590	1500	0.45	288.0	4,947	Yes	2.71	1.77	30.93	
	25	24	1.53	0.40	1.701	57.362	30.93	94.83	5,588	1500	0.50	100.0	5,215	Yes	2.86	0.58	31.51	
	24	21	1.67	0.40	1.857	59.219	31.51	93.90	5,709	1500	0.56	107.0	5,519	Yes	3.03	0.59	32.10	
Brook Road North	231	23	12.10	0.40			40.60	81.46	373	750	0.79	14.0	1,032	No	2.26	0.10	40.70	Gates of Camelot Phase 1 Controlled Flow
	231	23	5.09	0.40	5.660	5.660	15.00	129.95	736	750	0.79	14.0	1,032	No	2.26	0.10	15.10	
King Street East	23	22	1.17	0.40	1.301	6.961	40.70	81.34	939	750	0.50	70.0	821	Yes	1.80	0.65	41.35	
	22	21	1.03	0.40	1.145	8.106	41.35	80.58	1,026	825	0.56	79.0	1,121	No	2.03	0.65	42.00	
Coverdale Avenue	21	20	1.35	0.40	1.501	68.827	42.00	79.83	6,016	1650	0.59	143.0	7,304	No	3.31	0.72	42.72	
Orchard Avenue West	201	20	1.30	0.40	1.446	1.446	17.15	123.77	179	525	1.00	1.0	449	No	2.01	0.01	17.16	Including external drainage area see Figure 2
Orchard Avenue East	202	20	1.30	0.40	1.446	1.446	15.81	127.55	184	375	1.00	1.0	183	Yes	1.60	0.01	15.82	
Coverdale Avenue	20	19	1.42	0.40	1.579	73.297	42.72	79.02	6,313	1650	0.60	143.0	7,365	No	3.34	0.71	43.43	
Hamilton Avenue West	191	19	0.58	0.40	0.645	0.645	17.08	123.96	80	300	0.50	1.0	71	Yes	0.98	0.02	17.10	
Hamilton Avenue East	192	19	12.69	0.40	14.111	14.111	21.52	112.84	1,592	750	1.40	1.0	1,374	Yes	3.01	0.01	21.53	
CoverdaleAvenue	19	18	0.79	0.40	0.878	88.932	43.43	78.23	7,478	1800	0.60	83.0	9,289	No	3.54	0.39	43.82	
	18	17	0.00	0.40		88.932	43.82	77.80	7,440	1800	0.54	16.0	8,812	No	3.35	0.08	43.90	
	17	16	0.63	0.40	0.701	89.632	43.90	77.72	7,487	1800	0.28	147.5	6,345	Yes	2.42	1.02	44.92	
Springbrook Road	163	161	1.20	0.40	1.334	1.334	15.00	129.95	173	375	1.00	110.0	183	No	1.60	1.14	16.14	
	164	161	1.20	0.40	1.334	1.334	15.00	129.95	173	375	1.00	85.0	183	No	1.60	0.88	15.88	
	161	16	0.00	0.40		2.669	15.88	127.34	340	450	1.00	110.0	297	Yes	1.81	1.01	16.89	
Coverdale Avenue	16	10	0.99	0.40	1.101	93.402	44.92	76.63	7,679	1800	0.37	19.0	7,294	Yes	2.78	0.11	45.03	
	10	9	0.62	0.40	0.689	94.092	45.03	76.51	7,720	1800	0.23	55.5	5,751	Yes	2.19	0.42	45.46	
Gardiner Crescent	91	9	1.05	0.40	1.168	1.168	15.00	129.95	152	300	1.00	95.0	101	Yes	1.38	1.15	16.15	
Coverdale Avenue	9	7	0.60	0.40	0.667	95.926	45.46	76.07	7,818	1800	0.86	18.5	11,121	No	4.23	0.07	45.53	
	7	4	0.36	0.40	0.400	96.327	45.53	76.00	7,842	1800	0.86	115.0	11,121	No	4.23	0.45	45.98	
Gardiner Crescent	41	4	1.20	0.40	1.334	1.334	15.00	129.95	173	375	1.00	90.0	183	No	1.60	0.93	15.93	
Springbrook Road	43	42	1.30	0.40	1.446	1.446	15.00	129.95	188	375	1.00	65.0	183	Yes	1.60	0.68	15.68	
	42	4	0.55	0.40	0.612	2.057	15.68	127.94	263	375	1.00	105.5	183	Yes	1.60	1.10	16.77	

65 Sunray St.
Whitby, Ontario
L1N 8Y3
905-686-6402

Town of Cobourg
PRE-DEVELOPMENT STORM SEWER DESIGN SHEET

Project Name: **Cobourg King Street East Sewer Analysis**
Project No. **11192099**

PREPARED BY: R.B.
CHECKED BY: K.E.
DATE: 15-Mar-19

15 MINUTE ENTRY TIME
100yr-Design Storm

Street	From MH	To MH	A Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall (mm/hr)	Q Peak Flow (l/s)	Pipe Diameter (mm)	Design Slope (%)	Length (m)	Capacity (l/s)	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks
Coverdale Avenue	4	1	0.50	0.40	0.556	100.274	45.98	75.53	8,095	1800	0.82	100.0	10,859	No	4.13	0.40	46.38	
Lakeshore Road West	111	1	0.50	0.40	0.556	0.556	15.00	129.95	72	300	1.00	60.0	101	No	1.38	0.72	15.72	
Lakeshore Road East	112	1	1.17	0.40	1.301	1.301	15.00	129.95	169	375	1.00	75.0	183	No	1.60	0.78	15.78	
Existing Outlet - Coverdale	1	100	0.00	0.40		102.131	46.38	75.12	8,193	1800	0.47	85.2	8,221	No	3.13	0.45	46.84	

Runoff Coefficients

0.20	Parks-Cemeteries-Playground	0.70	Schools & Churches
0.50	Single Family Residential	0.80	Industrial Areas
0.55	Semi-Detached Residential	0.90	Commercial Areas
0.65	Townhouses	0.90	Heavily Developed Areas
0.70	High Density Residential		

Gates of Camelot Phase 1 - 100 Year Discharge Rate 373 L/s
East Village - 100 Year Discharge Rate 148 L/s

100yr: I = 5588 / (T + 28)
n = 0.013

Date	Submission
5-Mar-19	1st Submission

110 Scotia Ct, Unit 41
Whitby, Ontario
L1N 8Y7
905-686-6402

MUNICIPALITY OF CLARINGTON
100 YEAR PRE-DEVELOPMENT STORM HYDRAULIC GRADE LINE CALCULATIONS

PREPARED BY: R.B.
CHECKED BY: K.E.
DATE: 43539

Project Name: Cobourg King Street East Sewer Analysis
Project No. 11192099

			PROPOSED PIPE									MANHOLE LOSSES @ D/S MANHOLE											HGL Elevation		EGL Elevation		Surcharge	
STREET NAME	From MH	To MH	Bend Angle in D/S MH	Box Culvert? (Y/N)	Size mm	Length m	Slope %	Lower Inv. m	Upper Inv. m	Lower Obv. m	Upper Obv. m	Flow cms	Pipe Capacity cms	% Capacity	Frict'n Slope %	Frict'n Loss m	Vel. in m/s	Vel. out m/s	$v_i^2/2g$ m	$kv_o^2/2g$ m	$v_o^2/2g - v_{lat}^2/2g$ m	D/S MH Losses m	Lower m	Upper m	Lower m	Upper m	Lower m	Upper m
Existing Outlet - Coverdale	100	1	0	N	1800	85.2	0.47	75.800	76.200	77.629	78.029	8.193	8.221	99.7%	0.47	0.398	3.12	3.13	0.496	0.050	0.003	0.053	77.63	78.03	77.632	78.523	0.00	0.00
0	1	4	0	N	1800	100.0	0.82	76.670	77.500	78.499	79.329	8.095	10.859	74.5%	0.46	0.456	3.08	3.12	0.484	0.050	0.012	0.061	78.50	79.33	78.572	79.438	0.00	0.00
0	4	7	0	N	1800	115.0	0.86	77.500	78.510	79.329	80.339	7.841	11.121	70.5%	0.43	0.492	2.99	3.08	0.454	0.048	0.030	0.078	79.33	80.34	79.487	80.275	0.00	0.00
0	7	9	0	N	1800	18.5	0.86	78.510	78.670	80.339	80.499	7.818	11.121	70.3%	0.43	0.079	2.98	2.99	0.452	0.045	0.003	0.048	80.34	80.50	80.320	80.869	0.00	0.00
	9	10	0	N	1800	55.5	0.23	78.700	78.830	80.529	80.659	7.720	5.751	134.2%	0.41	0.230	2.94	2.98	0.440	0.045	0.011	0.056	80.53	80.76	80.914	81.199	0.00	0.10
Coverdale Avenue	10	16	45	N	1800	19.0	0.37	78.850	78.920	80.679	80.749	7.678	7.294	105.3%	0.41	0.078	2.92	2.94	0.436	0.132	0.005	0.137	80.90	80.97	81.331	81.409	0.22	0.22
0	16	17	45	N	1800	147.5	0.28	78.950	79.370	80.779	81.199	7.487	6.345	118.0%	0.39	0.575	2.85	2.92	0.414	0.131	0.021	0.152	81.13	81.70	81.540	82.115	0.35	0.50
0	17	18	0	N	1800	16.0	0.54	79.400	79.486	81.229	81.315	7.440	8.812	84.4%	0.38	0.062	2.83	2.85	0.409	0.041	0.005	0.047	81.75	81.81	82.156	82.218	0.52	0.49
0	18	19	0	N	1800	83.0	0.60	79.516	80.014	81.345	81.843	7.478	9.289	80.5%	0.39	0.323	2.85	2.83	0.413	0.041	-0.004	0.037	81.85	82.17	82.258	82.581	0.50	0.32
0	19	20	0	N	1650	143.0	0.60	80.044	80.902	81.721	82.579	6.313	7.365	85.7%	0.44	0.630	2.86	2.85	0.417	0.041	-0.004	0.037	82.21	82.84	82.623	83.253	0.48	0.26
Coverdale Avenue	20	21	0	N	1650	143.0	0.59	80.932	81.776	82.609	83.453	6.015	7.304	82.4%	0.40	0.572	2.73	2.86	0.379	0.042	0.038	0.080	82.92	83.49	83.294	83.867	0.31	0.04
	21	22	90	N	825	79.0	0.56	81.806	82.249	82.644	83.087	1.026	1.121	91.6%	0.47	0.371	1.86	2.73	0.176	0.303	0.202	0.505	83.99	84.36	84.170	84.541	1.35	1.28
King Street East	22	23	0	N	750	70.0	0.50	82.279	82.629	83.041	83.391	0.939	0.821	114.4%	0.65	0.458	2.06	1.86	0.216	0.018	-0.040	-0.022	84.34	84.80	84.558	85.016	1.30	1.41
	21	24	90	N	1500	107.0	0.56	81.806	82.405	83.330	83.929	5.709	5.519	103.4%	0.60	0.641	3.13	2.73	0.499	0.303	-0.121	0.182	83.67	84.31	84.170	84.811	0.34	0.38
	24	25	0	N	1500	100.0	0.50	82.435	82.935	83.959	84.459	5.588	5.215	107.2%	0.57	0.574	3.06	3.13	0.478	0.050	0.021	0.071	84.38	84.96	84.861	85.435	0.42	0.50
King Street East	25	26	0	N	1500	288.0	0.45	82.965	84.261	84.489	85.785	5.590	4.947	113.0%	0.57	1.655	3.06	3.06	0.479	0.048	0.000	0.047	85.00	86.66	85.483	87.137	0.51	0.87

GHD

65 Sunray St.
Whitby, Ontario
L1N 8Y3
905-686-6402

Town of Cobourg
POST-DEVELOPMENT STORM SEWER DESIGN SHEET

Project Name: **Cobourg King Street East Sewer Analysis**
Project No. **11192099**

PREPARED BY: R.B.
CHECKED BY: K.E.
DATE: 15-Mar-19

15 MINUTE ENTRY TIME
5yr-Design Storm

Street	From MH	To MH	A Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall (mm/hr)	Q Peak Flow (l/s)	Pipe Diameter (mm)	Design Slope (%)	Length (m)	Capacity (l/s)	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks
Future Basin North of King	27	26	38.27	0.47	50.004	50.004	29.15	54.57	2,729	1500	0.45	1.0	4,947	No	2.71	0.01	29.16	
	27	26	2.68	0.40	2.980	2.980	29.15	54.57	163	1500	0.45	1.0	4,947	No	2.71	0.01	29.16	
East Village	27	26	11.80	0.40			29.15	54.57	50	1500	0.45	1.0	4,947	No	2.71	0.01	29.16	East Village Controlled Flow
King Street East	26	25	3.09	0.40	3.436	53.440	29.16	54.57	2,966	1500	0.45	288.0	4,947	No	2.71	1.77	30.93	
	25	24	1.53	0.40	1.701	55.141	30.93	52.51	2,945	1500	0.50	100.0	5,215	No	2.86	0.58	31.51	
	24	21	1.67	0.40	1.857	56.998	31.51	51.86	3,006	1500	0.56	107.0	5,519	No	3.03	0.59	32.10	
Brook Road North	231	23	12.10	0.40			40.60	43.53	193	750	0.79	14.0	1,032	No	2.26	0.10	40.70	Gates of Camelot Phase 1 Controlled Flow
	231	23	5.09	0.40	5.660	5.660	15.00	79.48	450	750	0.79	14.0	1,032	No	2.26	0.10	15.10	
King Street East	23	22	1.17	0.40	1.301	6.961	40.70	43.46	496	750	0.50	70.0	821	No	1.80	0.65	41.35	Inclding external drainage area see Figure 2
	22	21	1.03	0.40	1.145	8.106	41.35	42.97	541	825	0.56	79.0	1,121	No	2.03	0.65	42.00	
Coverdale Avenue	21	20	1.35	0.40	1.501	66.606	42.00	42.49	3,073	1650	0.59	143.0	7,304	No	3.31	0.72	42.72	
Proposed Development	**SITE**	**201**	**1.95**	**0.50**			**15.00**	**79.48**	**9**	**525**	**1.00**	**1.0**	**449**	**No**	**2.01**	**0.01**	**15.01**	425 King Street East Controlled Flows
Orchard Avenue West	201	20	1.30	0.40	1.446	1.446	17.15	74.33	116	525	1.00	1.0	449	No	2.01	0.01	17.16	Inclding external drainage area see Figure 2
Orchard Avenue East	202	20	1.30	0.40	1.446	1.446	15.81	77.46	112	375	1.00	1.0	183	No	1.60	0.01	15.82	
Coverdale Avenue	20	19	1.42	0.40	1.579	71.076	42.72	41.96	3,235	1650	0.60	143.0	7,365	No	3.34	0.71	43.43	
Hamilton Avenue West	191	19	0.58	0.40	0.645	0.645	17.08	74.49	48	300	0.50	1.0	71	No	0.98	0.02	17.10	
Hamilton Avenue East	192	19	12.69	0.40	14.111	14.111	21.52	65.67	927	750	1.40	1.0	1,374	No	3.01	0.01	21.53	
CoverdaleAvenue	19	18	0.79	0.40	0.878	86.711	43.43	41.46	3,847	1800	0.60	83.0	9,289	No	3.54	0.39	43.82	
	18	17	0.00	0.40		86.711	43.82	41.19	3,824	1800	0.54	16.0	8,812	No	3.35	0.08	43.90	
Coverdale Avenue	17	16	0.63	0.40	0.701	87.411	43.90	41.13	3,848	1800	0.28	147.5	6,345	No	2.42	1.02	44.92	
Springbrook Road	163	161	1.20	0.40	1.334	1.334	15.00	79.48	106	375	1.00	110.0	183	No	1.60	1.14	16.14	
	164	161	1.20	0.40	1.334	1.334	15.00	79.48	106	375	1.00	85.0	183	No	1.60	0.88	15.88	
	161	16	0.00	0.40		2.669	15.88	77.28	206	450	1.00	110.0	297	No	1.81	1.01	16.89	
Coverdale Avenue	16	10	0.99	0.40	1.101	91.181	44.92	40.45	3,940	1800	0.37	19.0	7,294	No	2.78	0.11	45.03	
	10	9	0.62	0.40	0.689	91.870	45.03	40.37	3,961	1800	0.23	55.5	5,751	No	2.19	0.42	45.46	
Gardiner Crescent	91	9	1.05	0.40	1.168	1.168	15.00	79.48	93	300	1.00	95.0	101	No	1.38	1.15	16.15	
Coverdale Avenue	9	7	0.60	0.40	0.667	93.705	45.46	40.09	4,009	1800	0.86	18.5	11,121	No	4.23	0.07	45.53	
	7	4	0.36	0.40	0.400	94.106	45.53	40.05	4,021	1800	0.86	115.0	11,121	No	4.23	0.45	45.98	
Gardiner Crescent	41	4	1.20	0.40	1.334	1.334	15.00	79.48	106	375	1.00	90.0	183	No	1.60	0.93	15.93	

65 Sunray St.
Whitby, Ontario
L1N 8Y3
905-686-6402

Town of Cobourg
POST-DEVELOPMENT STORM SEWER DESIGN SHEET

PREPARED BY: R.B.
CHECKED BY: K.E.
DATE: 15-Mar-19

Project Name: **Cobourg King Street East Sewer Analysis**
Project No. **11192099**

15 MINUTE ENTRY TIME
5yr-Design Storm

Street	From MH	To MH	A Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall (mm/hr)	Q Peak Flow (l/s)	Pipe Diameter (mm)	Design Slope (%)	Length (m)	Capacity (l/s)	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks
Springbrook Road	43	42	1.30	0.40	1.446	1.446	15.00	79.48	115	375	1.00	65.0	183	No	1.60	0.68	15.68	
	42	4	0.55	0.40	0.612	2.057	15.68	77.79	160	375	1.00	105.5	183	No	1.60	1.10	16.77	
Coverdale Avenue	4	1	0.50	0.40	0.556	98.053	45.98	39.75	4,150	1800	0.82	100.0	10,859	No	4.13	0.40	46.38	
Lakeshore Road West	111	1	0.50	0.40	0.556	0.556	15.00	79.48	44	300	1.00	60.0	101	No	1.38	0.72	15.72	
Lakeshore Road East	112	1	1.17	0.40	1.301	1.301	15.00	79.48	103	375	1.00	75.0	183	No	1.60	0.78	15.78	
Existing Outlet - Coverdale	1	100	0.00	0.40		99.910	46.38	39.50	4,198	1800	0.47	85.2	8,221	No	3.13	0.45	46.84	

Runoff Coefficients

0.20	Parks-Cemeteries-Playground	0.70	Schools & Churches
0.50	Single Family Residential	0.80	Industrial Areas
0.55	Semi-Detached Residential	0.90	Commercial Areas
0.65	Townhouses	0.90	Heavily Developed Areas
0.70	High Density Residential		

Gates of Camelot Phase 1 - 5 Year Discharge Rate 373 L/s
East Village - 5 Year Discharge Rate 50 L/s
Subject Property Controlled Discharge Rate 9 L/s
5yr: I = 2464 / (T + 16)
n = 0.013

Date	Submission
5-Mar-19	1st Submission

65 Sunray St.
Whitby, Ontario
L1N 8Y3
905-686-6402

Town of Cobourg
POST-DEVELOPMENT STORM SEWER DESIGN SHEET

Project Name: **Cobourg King Street East Sewer Analysis**
Project No. **11192099**

PREPARED BY: R.B.
CHECKED BY: K.E.
DATE: 15-Mar-19

15 MINUTE ENTRY TIME
100yr-Design Storm

Street	From MH	To MH	A Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall (mm/hr)	Q Peak Flow (l/s)	Pipe Diameter (mm)	Design Slope (%)	Length (m)	Capacity (l/s)	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks
Future Basin North of King	27	26	38.27	0.47	50.004	50.004	29.15	97.78	4,889	1500	0.45	1.0	4,947	No	2.71	0.01	29.16	
	27	26	2.68	0.40	2.980	2.980	29.15	97.78	291	1500	0.45	1.0	4,947	No	2.71	0.01	29.16	
East Village	27	26	11.80	0.40			29.15	97.78	148	1500	0.45	1.0	4,947	No	2.71	0.01	29.16	East Village Controlled Flow
King Street East	26	25	3.09	0.40	3.436	53.440	29.16	97.77	5,373	1500	0.45	288.0	4,947	Yes	2.71	1.77	30.93	
	25	24	1.53	0.40	1.701	55.141	30.93	94.83	5,377	1500	0.50	100.0	5,215	Yes	2.86	0.58	31.51	
	24	21	1.67	0.40	1.857	56.998	31.51	93.90	5,500	1500	0.56	107.0	5,519	No	3.03	0.59	32.10	
Brook Road North	231	23	12.10	0.40			40.60	81.46	373	750	0.79	14.0	1,032	No	2.26	0.10	40.70	Gates of Camelot Phase 1 Controlled Flow
	231	23	5.09	0.40	5.660	5.660	15.00	129.95	736	750	0.79	14.0	1,032	No	2.26	0.10	15.10	
King Street East	23	22	1.17	0.40	1.301	6.961	40.70	81.34	939	750	0.50	70.0	821	Yes	1.80	0.65	41.35	
	22	21	1.03	0.40	1.145	8.106	41.35	80.58	1,026	825	0.56	79.0	1,121	No	2.03	0.65	42.00	
Coverdale Avenue	21	20	1.35	0.40	1.501	66.606	42.00	79.83	5,838	1650	0.59	143.0	7,304	No	3.31	0.72	42.72	
Proposed Development	**SITE**	**201**	**1.95**	**0.50**			**15.00**	129.95	**20**	**525**	**1.00**	**1.0**	**449**	**No**	**2.01**	**0.01**		425 King Street East Controlled Flows
Orchard Avenue West	201	20	1.30	0.40	1.446	1.446	17.15	123.77	199	525	1.00	1.0	449	No	2.01	0.01	17.16	Including external drainage area see Figure 2
Orchard Avenue East	202	20	1.30	0.40	1.446	1.446	15.81	127.55	184	375	1.00	1.0	183	Yes	1.60	0.01	15.82	
Coverdale Avenue	20	19	1.42	0.40	1.579	71.076	42.72	79.02	6,157	1650	0.60	143.0	7,365	No	3.34	0.71	43.43	
Hamilton Avenue West	191	19	0.58	0.40	0.645	0.645	17.08	123.96	80	300	0.50	1.0	71	Yes	0.98	0.02	17.10	
Hamilton Avenue East	192	19	12.69	0.40	14.111	14.111	21.52	112.84	1,592	750	1.40	1.0	1,374	Yes	3.01	0.01	21.53	
CoverdaleAvenue	19	18	0.79	0.40	0.878	86.711	43.43	78.23	7,324	1800	0.60	83.0	9,289	No	3.54	0.39	43.82	
	18	17	0.00	0.40		86.711	43.82	77.80	7,287	1800	0.54	16.0	8,812	No	3.35	0.08	43.90	
Coverdale Avenue	17	16	0.63	0.40	0.701	87.411	43.90	77.72	7,334	1800	0.28	147.5	6,345	Yes	2.42	1.02	44.92	
Springbrook Road	163	161	1.20	0.40	1.334	1.334	15.00	129.95	173	375	1.00	110.0	183	No	1.60	1.14	16.14	
	164	161	1.20	0.40	1.334	1.334	15.00	129.95	173	375	1.00	85.0	183	No	1.60	0.88	15.88	
	161	16	0.00	0.40		2.669	15.88	127.34	340	450	1.00	110.0	297	Yes	1.81	1.01	16.89	
Coverdale Avenue	16	10	0.99	0.40	1.101	91.181	44.92	76.63	7,528	1800	0.37	19.0	7,294	Yes	2.78	0.11	45.03	
	10	9	0.62	0.40	0.689	91.870	45.03	76.51	7,570	1800	0.23	55.5	5,751	Yes	2.19	0.42	45.46	
Gardiner Crescent	91	9	1.05	0.40	1.168	1.168	15.00	129.95	152	300	1.00	95.0	101	Yes	1.38	1.15	16.15	
Coverdale Avenue	9	7	0.60	0.40	0.667	93.705	45.46	76.07	7,669	1800	0.86	18.5	11,121	No	4.23	0.07	45.53	
	7	4	0.36	0.40	0.400	94.106	45.53	76.00	7,693	1800	0.86	115.0	11,121	No	4.23	0.45	45.98	
Gardiner Crescent	41	4	1.20	0.40	1.334	1.334	15.00	129.95	173	375	1.00	90.0	183	No	1.60	0.93	15.93	

65 Sunray St.
Whitby, Ontario
L1N 8Y3
905-686-6402

Town of Cobourg
POST-DEVELOPMENT STORM SEWER DESIGN SHEET

Project Name: **Cobourg King Street East Sewer Analysis**
Project No. **11192099**

PREPARED BY: R.B.
CHECKED BY: K.E.
DATE: 15-Mar-19

15 MINUTE ENTRY TIME
100yr-Design Storm

Street	From MH	To MH	A Area (ha)	R Runoff Coeff.	2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall (mm/hr)	Q Peak Flow (l/s)	Pipe Diameter (mm)	Design Slope (%)	Length (m)	Capacity (l/s)	Capacity Problem	Velocity (m/s)	Time in Section (min)	Total Time (min)	Remarks
Springbrook Road	43	42	1.30	0.40	1.446	1.446	15.00	129.95	188	375	1.00	65.0	183	Yes	1.60	0.68	15.68	
	42	4	0.55	0.40	0.612	2.057	15.68	127.94	263	375	1.00	105.5	183	Yes	1.60	1.10	16.77	
Coverdale Avenue	4	1	0.50	0.40	0.556	98.053	45.98	75.53	7,947	1800	0.82	100.0	10,859	No	4.13	0.40	46.38	
Lakeshore Road West	111	1	0.50	0.40	0.556	0.556	15.00	129.95	72	300	1.00	60.0	101	No	1.38	0.72	15.72	
Lakeshore Road East	112	1	1.17	0.40	1.301	1.301	15.00	129.95	169	375	1.00	75.0	183	No	1.60	0.78	15.78	
Existing Outlet - Coverdale	1	100	0.00	0.40		99.910	46.38	75.12	8,047	1800	0.47	85.2	8,221	No	3.13	0.45	46.84	

Runoff Coefficients

0.20	Parks-Cemeteries-Playground	0.70	Schools & Churches
0.50	Single Family Residential	0.80	Industrial Areas
0.55	Semi-Detached Residential	0.90	Commercial Areas
0.65	Townhouses	0.90	Heavily Developed Areas
0.70	High Density Residential		

Gates of Camelot Phase 1 - 100 Year Discharge Rate 373 L/s
East Village - 100 Year Discharge Rate 148 L/s
Subject Property Discharge Rate 20 L/s
100yr: I = 5588 / (T + 28)
n = 0.013

Date	Submission
5-Mar-19	1st Submission

110 Scotia Ct, Unit 41
Whitby, Ontario
L1N 8Y7
905-686-6402

MUNICIPALITY OF CLARINGTON
100 YEAR POST-DEVELOPMENT STORM HYDRAULIC GRADE LINE CALCULATIONS

PREPARED BY: R.B.
CHECKED BY: K.E.
DATE: 43539

Project Name: Cobourg King Street East Sewer Analysis
Project No. 11192099

			PROPOSED PIPE									MANHOLE LOSSES @ D/S MANHOLE											HGL Elevation		EGL Elevation		Surcharge	
STREET NAME	From MH	To MH	Bend Angle in D/S MH	Box Culvert? (Y/N)	Size mm	Length m	Slope %	Lower Inv. m	Upper Inv. m	Lower Obv. m	Upper Obv. m	Flow cms	Pipe Capacity cms	% Capacity	Frict'n Slope %	Frict'n Loss m	Vel. in m/s	Vel. out m/s	$v_i^2/2g$ m	$kv_o^2/2g$ m	$v_o^2/2g - v_{lat}^2/2g$ m	D/S MH Losses m	Lower m	Upper m	Lower m	Upper m	Lower m	Upper m
Existing Outlet - Coverdale	100	1	0	N	1800	85.2	0.47	75.800	76.200	77.629	78.029	8.047	8.221	97.9%	0.45	0.384	3.06	3.13	0.478	0.050	0.021	0.071	77.63	78.03	77.650	78.491	0.00	0.00
0	1	4	0	N	1800	100.0	0.82	76.670	77.500	78.499	79.329	7.947	10.859	73.2%	0.44	0.439	3.03	3.06	0.467	0.048	0.012	0.060	78.50	79.33	78.539	79.405	0.00	0.00
0	4	7	0	N	1800	115.0	0.86	77.500	78.510	79.329	80.339	7.693	11.121	69.2%	0.41	0.473	2.93	3.03	0.437	0.047	0.029	0.076	79.33	80.34	79.451	80.239	0.00	0.00
0	7	9	0	N	1800	18.5	0.86	78.510	78.670	80.339	80.499	7.669	11.121	69.0%	0.41	0.076	2.92	2.93	0.434	0.044	0.003	0.046	80.34	80.50	80.283	80.849	0.00	0.00
	9	10	0	N	1800	55.5	0.23	78.700	78.830	80.529	80.659	7.570	5.751	131.6%	0.40	0.221	2.88	2.92	0.423	0.043	0.011	0.055	80.53	80.75	80.892	81.173	0.00	0.09
Coverdale Avenue	10	16	45	N	1800	19.0	0.37	78.850	78.920	80.679	80.749	7.528	7.294	103.2%	0.39	0.075	2.87	2.88	0.419	0.127	0.005	0.132	80.88	80.96	81.300	81.375	0.20	0.21
0	16	17	45	N	1800	147.5	0.28	78.950	79.370	80.779	81.199	7.334	6.345	115.6%	0.37	0.552	2.79	2.87	0.397	0.126	0.021	0.147	81.10	81.66	81.501	82.053	0.32	0.46
0	17	18	0	N	1800	16.0	0.54	79.400	79.486	81.229	81.315	7.287	8.812	82.7%	0.37	0.059	2.77	2.79	0.392	0.040	0.005	0.045	81.70	81.76	82.092	82.151	0.47	0.44
0	18	19	0	N	1800	83.0	0.60	79.516	80.014	81.345	81.843	7.324	9.289	78.9%	0.37	0.310	2.79	2.77	0.396	0.039	-0.004	0.035	81.79	82.10	82.191	82.500	0.45	0.26
0	19	20	0	N	1650	143.0	0.60	80.044	80.902	81.721	82.579	6.157	7.365	83.6%	0.42	0.600	2.79	2.79	0.397	0.040	0.000	0.039	82.14	82.74	82.540	83.140	0.42	0.16
Coverdale Avenue	20	21	0	N	1650	143.0	0.59	80.932	81.776	82.609	83.453	5.838	7.304	79.9%	0.38	0.539	2.65	2.79	0.357	0.040	0.040	0.080	82.82	83.45	83.179	83.718	0.21	0.00
	21	22	90	N	825	79.0	0.56	81.806	82.249	82.644	83.087	1.026	1.121	91.6%	0.47	0.371	1.86	2.65	0.176	0.285	0.180	0.466	83.83	84.20	84.004	84.375	1.18	1.11
King Street East	22	23	0	N	750	70.0	0.50	82.279	82.629	83.041	83.391	0.939	0.821	114.4%	0.65	0.458	2.06	1.86	0.216	0.018	-0.040	-0.022	84.18	84.63	84.392	84.850	1.14	1.24
	21	24	90	N	1500	107.0	0.56	81.806	82.405	83.330	83.929	5.500	5.519	99.7%	0.56	0.595	3.02	2.65	0.463	0.285	-0.107	0.179	83.54	84.14	84.004	84.599	0.21	0.21
	24	25	0	N	1500	100.0	0.50	82.435	82.935	83.959	84.459	5.377	5.215	103.1%	0.53	0.532	2.95	3.02	0.443	0.046	0.021	0.067	84.20	84.73	84.645	85.177	0.24	0.27
King Street East	25	26	0	N	1500	288.0	0.45	82.965	84.261	84.489	85.785	5.373	4.947	108.6%	0.53	1.529	2.95	2.95	0.442	0.044	0.001	0.045	84.78	86.31	85.221	86.750	0.29	0.52

TOTTEN SIMS HUBICKI ASSOCIATES
STORM SEWER DESIGN CHART
YARNELL 5 YEAR STORM

Project Description : ULTIMATE SYSTEM
COVERDALE AVENUE
Project Number : 12-29292-03

Date : 07 18 2005
Prepared By : G.J.W.

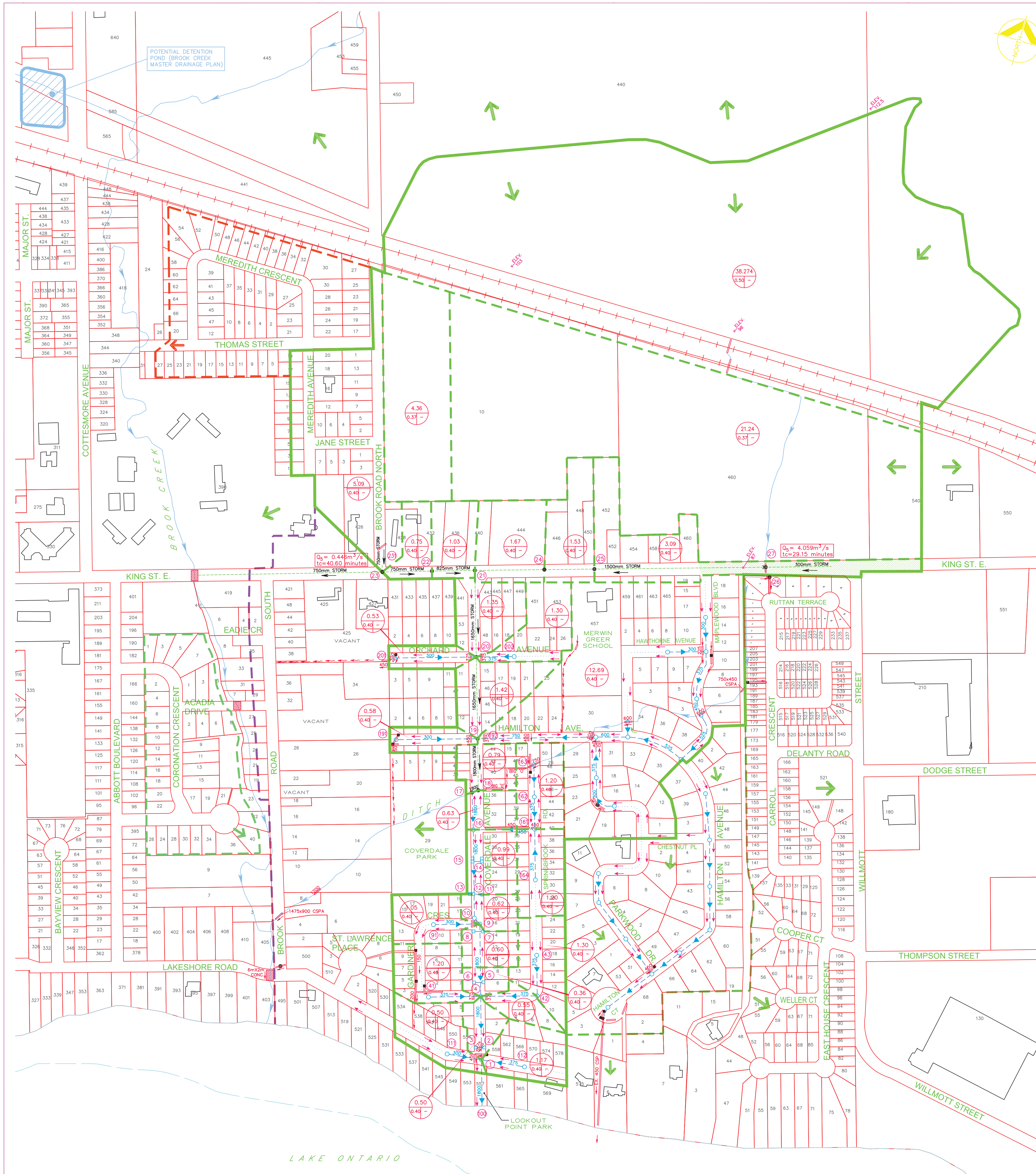
LOCATION	MANHOLE FROM	MANHOLE TO	LENGTH (m)	AREA (ha)	RUNOFF COEF.	A X R INCR.	A X R TOTAL	MAXIMUM T of C (min)	INTENSITY (mm/hr)	TOT. AREA FLOW (cms)	TOT. CONT. FLOW (cms)	DESIGN FLOW (cms)	SEWER SLOPE (%)	SIZE (mm)	CAPACITY (cms)	FLOW CAPACITY RATIO	VELOCITY FULL (m/s)	VELOCITY ACTUAL (m/s)	TRAVEL TIME (min)	PIPE TYPE
FUTURE BASIN NORTH OF KING	27	26	1.0	59.51	.450	26.78	26.78	29.15	54.57	4.059	.000	4.059	.45	1500	4.742	.856	2.68	3.02	.01	C.P.
EXISTING KING STREET EAST	26	25	288.0	3.09	.400	1.24	28.02	29.16	54.56	4.246	.000	4.246	.45	1500	4.742	.895	2.68	3.04	1.58	C.P.
	25	24	100.0	1.53	.400	.61	28.63	30.74	52.72	4.192	.000	4.192	.50	1500	4.998	.839	2.83	3.17	.53	C.P.
	24	21	107.0	1.67	.400	.67	29.30	31.26	52.13	4.242	.000	4.242	.56	1500	5.290	.802	2.99	3.33	.54	C.P.
FUTURE BROOK ROAD NORTH	231	23	14.0	9.45	.390	3.69	3.69	40.60	43.53	.446	.000	.446	.79	750	.989	.450	2.24	2.19	.11	C.P.
EXISTING KING STREET EAST	23	22	70.0	.75	.400	.30	3.99	40.71	43.45	.481	.000	.481	.50	750	.787	.611	1.78	1.87	.62	C.P.
	22	21	79.0	1.03	.400	.41	4.40	41.33	42.98	.525	.000	.525	.56	825	1.074	.489	2.01	2.00	.66	C.P.
EXISTING COVERDALE AVENUE	21	20	143.0	1.35	.400	.54	34.23	41.99	42.49	4.040	.000	4.040	.59	1650	7.001	.577	3.27	3.40	.70	C.P.
FUTURE ORCHARD AVENUE WEST	201	20	1.0	.53	.400	.21	.21	17.15	74.32	.044	.000	.044	.50	300	.068	.640	.97	1.03	.02	P.V.C
FUTURE ORCHARD AVENUE EAST	202	20	1.0	1.30	.400	.52	.52	15.81	77.45	.112	.000	.112	1.00	375	.175	.638	1.59	1.69	.01	P.V.C
EXISTING COVERDALE AVENUE	20	19	158.8	1.42	.400	.57	35.53	42.69	41.98	4.144	.000	4.144	.60	1650	7.060	.587	3.30	3.44	.77	C.P.
FUTURE HAMILTON AVENUE WES	191	19	1.0	.58	.400	.23	.23	17.08	74.48	.048	.000	.048	.50	300	.068	.702	.97	1.05	.02	P.V.C
FUTURE HAMILTON AVENUE EAS	192	19	1.0	12.69	.400	5.08	5.08	21.52	65.67	.926	.000	.926	1.40	750	1.317	.703	2.98	3.23	.01	C.P.
EXISTING COVERDALE AVENUE	19	18	83.0	.79	.400	.32	41.16	43.46	41.44	4.737	.000	4.737	.60	1800	8.904	.532	3.50	3.56	.39	C.P.
	18	17	16.0	.00	.400	.00	41.16	43.85	41.17	4.707	.000	4.707	.54	1800	8.447	.557	3.32	3.41	.08	C.P.
PROPOSED COVERDALE AVENUE	17	16	60.0	.63	.400	.25	41.41	43.92	41.12	4.729	.000	4.729	.29	1800	6.190	.764	2.43	2.68	.37	C.P.
FUTURE SPRINGBROOK ROAD -	163	161	110.0	1.20	.400	.48	.48	15.00	79.48	.106	.000	.106	1.00	375	.175	.604	1.59	1.67	1.10	P.V.C
FUTURE SPRINGBROOK ROAD -	164	161	85.0	1.20	.400	.48	.48	15.00	79.48	.106	.000	.106	1.00	375	.175	.604	1.59	1.67	.85	P.V.C
FUTURE EASEMENT - SPRINGBR	161	16	110.0	.00	.400	.00	.96	16.10	76.75	.205	.000	.205	1.00	450	.285	.718	1.79	1.95	.94	P.V.C
PROPOSED COVERDALE AVENUE	16	15	46.5	.00	.400	.00	42.37	44.30	40.86	4.809	.000	4.809	.29	1800	6.190	.777	2.43	2.69	.29	C.P.
	15	13	59.0	.99	.400	.40	42.76	44.59	40.67	4.831	.000	4.831	.29	1800	6.190	.780	2.43	2.69	.37	C.P.
	13	10	36.0	.62	.400	.25	43.01	44.95	40.42	4.830	.000	4.830	.29	1800	6.190	.780	2.43	2.69	.22	C.P.
	10	9	17.5	.00	.400	.00	43.01	45.17	40.28	4.812	.000	4.812	.34	1800	6.703	.718	2.63	2.87	.10	C.P.

STORM SEWER DESIGN CHART
YARNELL 5 YEAR STORM

Project Description : ULTIMATE SYSTEM
COVERDALE AVENUE
Project Number : 12-29292-03

Date : 07 18 2005
Prepared By : G.J.W.

LOCATION	MANHOLE FROM	MANHOLE TO	LENGTH (m)	AREA (ha)	RUNOFF COEF.	A X R INCR.	A X R TOTAL	MAXIMUM T of C (min)	INTENSITY (mm/hr)	TOT. AREA FLOW (cms)	TOT. CONT. FLOW (cms)	DESIGN FLOW (cms)	SEWER SLOPE (%)	SIZE (mm)	CAPACITY (cms)	FLOW CAPACITY RATIO	VELOCITY FULL (m/s)	VELOCITY ACTUAL (m/s)	TRAVEL TIME (min)	PIPE TYPE
FUTURE GARDINER CRES. N TO	91	9	95.0	1.05	.400	.42	.42	15.00	79.48	.093	.000	.093	1.00	300	.097	.959	1.37	1.56	1.02	P.V.C
PROPOSED COVERDALE AVENUE	9	7	18.5	.60	.400	.24	43.67	45.28	40.21	4.878	.000	4.878	.60	1800	8.904	.548	3.50	3.58	.09	C.P.
	7	4	115.0	.36	.400	.14	43.82	45.36	40.15	4.887	.000	4.887	.60	1800	8.904	.549	3.50	3.58	.53	C.P.
FUTURE GARDINER CRES. S TO	41	4	90.0	1.20	.400	.48	.48	15.00	79.48	.106	.000	.106	1.00	375	.175	.604	1.59	1.67	.90	P.V.C
FUTURE SPRINGBROOK ROAD TO	43	42	65.0	1.30	.400	.52	.52	15.00	79.48	.115	.000	.115	1.00	375	.175	.655	1.59	1.70	.64	P.V.C
	42	4	105.5	.55	.400	.22	.74	15.64	77.87	.160	.000	.160	1.00	375	.175	.913	1.59	1.80	.98	P.V.C
PROPOSED COVERDALE AVENUE	4	1	100.0	.50	.400	.20	45.24	45.90	39.81	5.002	.000	5.002	.60	1800	8.904	.562	3.50	3.61	.46	C.P.
FUTURE LAKESHORE ROAD W TO	111	1	60.0	.50	.400	.20	.20	15.00	79.48	.044	.000	.044	1.00	300	.097	.457	1.37	1.34	.75	P.V.C
FUTURE LAKESHORE ROAD E TO	112	1	75.0	1.17	.400	.47	.47	15.00	79.48	.103	.000	.103	1.00	375	.175	.589	1.59	1.66	.76	P.V.C
PROPOSED OUTLET - COVERDAL	1	100	85.2	.00	.400	.00	45.90	46.36	39.51	5.038	.000	5.038	.47	1800	7.880	.639	3.10	3.29	.43	C.P.



LEGEND

- 375 — EXISTING CULVERT
- 1500 — EXISTING STORM SEWER
- EXISTING MANHOLE
- EXISTING CATCH BASIN
- 450 — PROPOSED STORM SEWER
- 1 — STRUCTURE NUMBER
- DRAINAGE AREA BOUNDARY KING ST./COVERDALE AVE. SEWERS
- SUBDRAINAGE AREA BOUNDARIES:
  - HAMILTON AVENUE
  - BROOK CREEK (EAST SIDE)
  - MEREDITH CRES./THOMAS ST.
  - CORONATION CRES./ACADIA DR.
- FLOW DIRECTION
- BASEMENT DRAIN HEADER SYSTEM
- 0.50 — DRAINAGE AREA (ha)
- —
- 0.40 — RUNOFF COEFFECIENT

NOTE :

IT IS THE RESPONSIBILITY OF THE CONTRACTORS TO INFORM THEMSELVES OF THE EXACT LOCATION OF, AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES, SERVICES AND STRUCTURES WHETHER ABOVE GROUND OR BELOW GRADE BEFORE COMMENCING THE WORK. SUCH INFORMATION IS NOT NECESSARILY SHOWN ON THE DRAWING, AND WHERE SHOWN, THE ACCURACY CANNOT BE GUARANTEED.

WITH THE SOLE EXCEPTION OF THE BENCHMARK(S) SPECIFICALLY DESCRIBED FOR THIS PROJECT, NO ELEVATION INDICATED OR ASSUMED HEREON IS TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

No.	DATE	BY	ISSUES / REVISIONS

LICENSED PROFESSIONAL ENGINEER
G. J. WATSON
PROVINCE OF ONTARIO

TSH engineers architects planners
513 Division Street
Cobourg, Ontario
K9A 5G6
TEL: 905-372-2121
FAX: 905-372-3621
E-mail cobourg@tsh.ca
www.tsh.ca

ALL DIMENSIONS AND INFORMATION SHALL BE CHECKED AND VERIFIED ON THE JOB AND ANY DISCREPANCIES MUST BE REPORTED TO THE CONSULTANT BEFORE COMMENCING THE WORK. DRAWINGS ARE NOT TO BE SCALED.

CLIENT:

THE CORPORATION OF THE TOWN OF COBOURG

VICTORIA HALL

55 KING STREET WEST
COBOURG, ONTARIO
K9A 2M2

PROJECT:

COVERDALE AVENUE STORM SEWER AND ROADWAY IMPROVEMENTS

LAKE ONTARIO TO 105m SOUTH OF HAMILTON AVE.

DRAWING:

COVERDALE AVENUE TRUNK STORM SEWER

DRAINAGE AREA PLAN

DRAWN BY:	CHECKED BY:	PROJECT No. :
J. BEAVAN	G. J. WATSON	12-29292-03
DESIGNED BY:	APPROVED BY:	DRAWING No.
R. LARONDE	W. WILCOX	SD-1
SCALE:	DATE:	
1:2500	JUNE 2005	

Ryan Brockie

From:	Jason Armstrong <jason@engageeng.ca>
Sent:	Thursday, April 11, 2019 8:41 AM
To:	Ryan Brockie
Cc:	Karen Edgington; Brad Parsons
Subject:	RE: Gates of Camelot Phase II - Post Development Flow Rates
Attachments:	TSH Coverdale Storm Sewer Design Sheets.pdf; TSH Coverdale Storm Sewer Drainage Areas.pdf; 4 - 18041-Post DA.pdf

Hi Ryan,

I've attached our Post-development drainage area for the site.

Flows from PR1 will be controlled to a maximum 5-yr release of 0.148m^3/sec.

Flows from PXT2 & PXT3 will be conveyed through the site directly into the storm sewer.

I've also attached some older information the Town had provided to us from the original TSH review.

Hope this helps if you have any questions feel free to give me a call.

Thanks,

Jason Armstrong
Engage Engineering Ltd.
P: 705.755.0427 x203 C: 705.760.1006

From: Ryan.Brockie@ghd.com <Ryan.Brockie@ghd.com>
Sent: April 5, 2019 3:42 PM
To: Jason Armstrong <jason@engageeng.ca>
Cc: Karen Edgington <Karen.Edgington@ghd.com>
Subject: Gates of Camelot Phase II - Post Development Flow Rates

Hi Jason,

Further to our conversation, I am looking for the ultimate post-development flow rates that will discharge to the King Street East sewer from the "Gates of Camelot – Phase II" lands, I have attached a screen grab of the area for reference. Based on the information we have been provided by the Town of Cobourg, it is approximately 13.5ha.

Any information on the drainage areas and design flows for the future subdivision would be greatly appreciated.

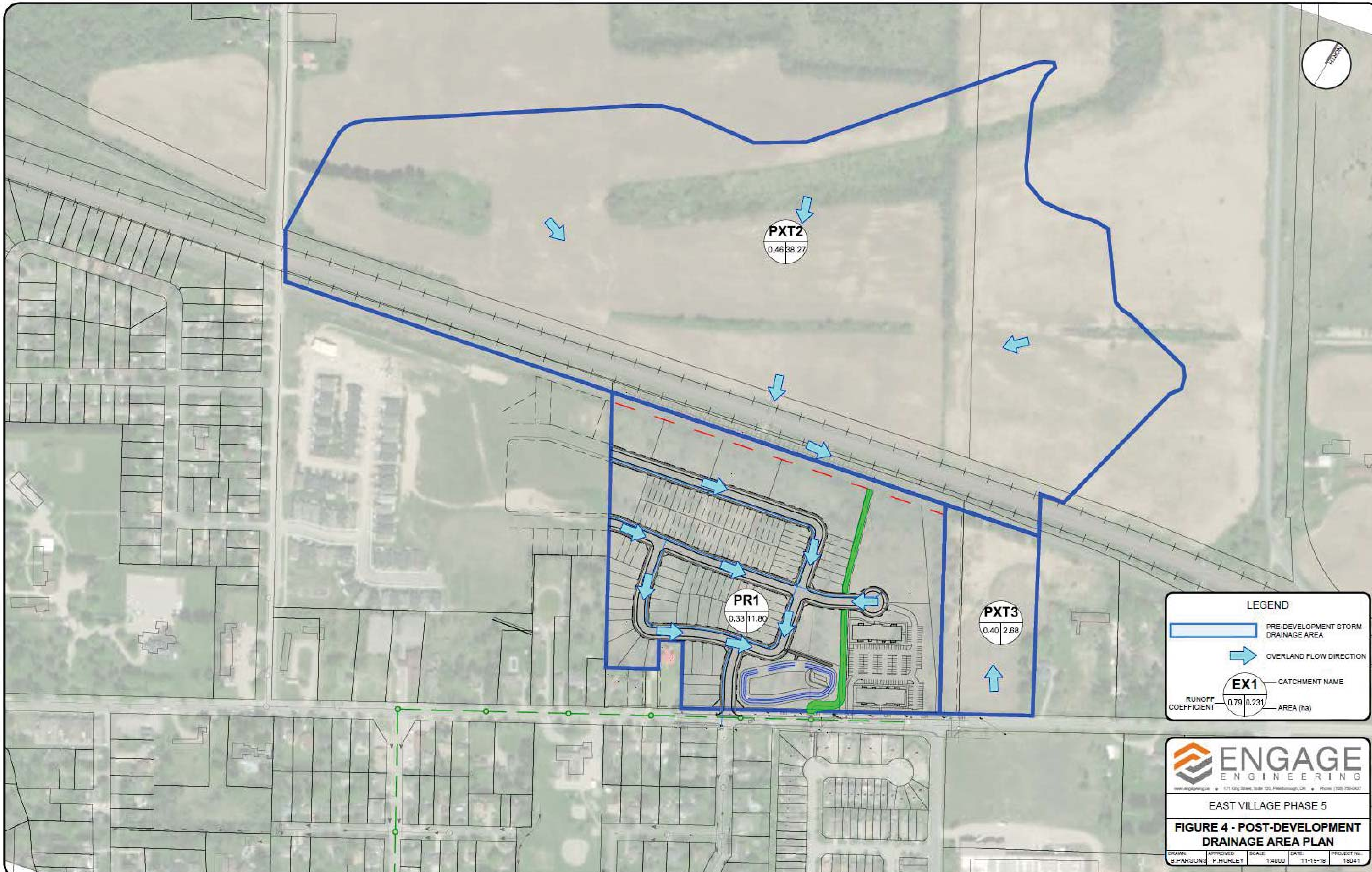
Thank you,
Ryan

Ryan Brockie
Water Resources, EIT

GHD
T: + 1 905 215 0545 | V: 886545 | E: ryan.brockie@ghd.com
65 Sunray Street Whitby ON L1N 8Y3 | www.ghd.com

WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION

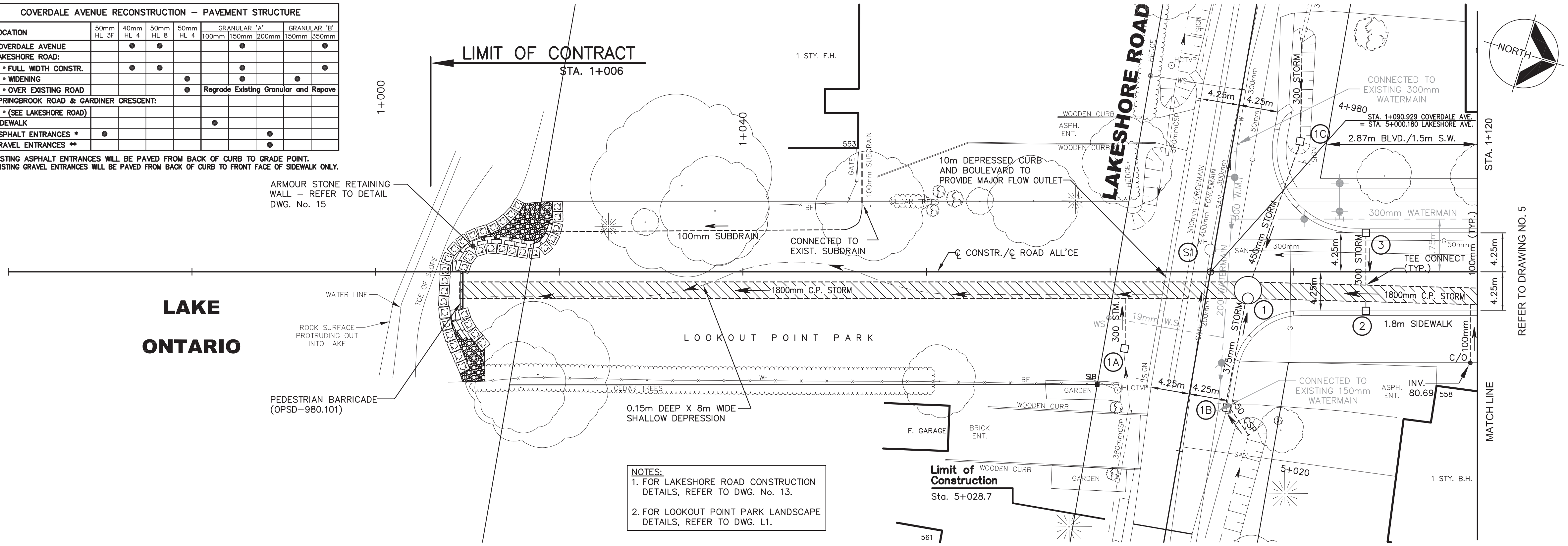
Please consider our environment before printing this email



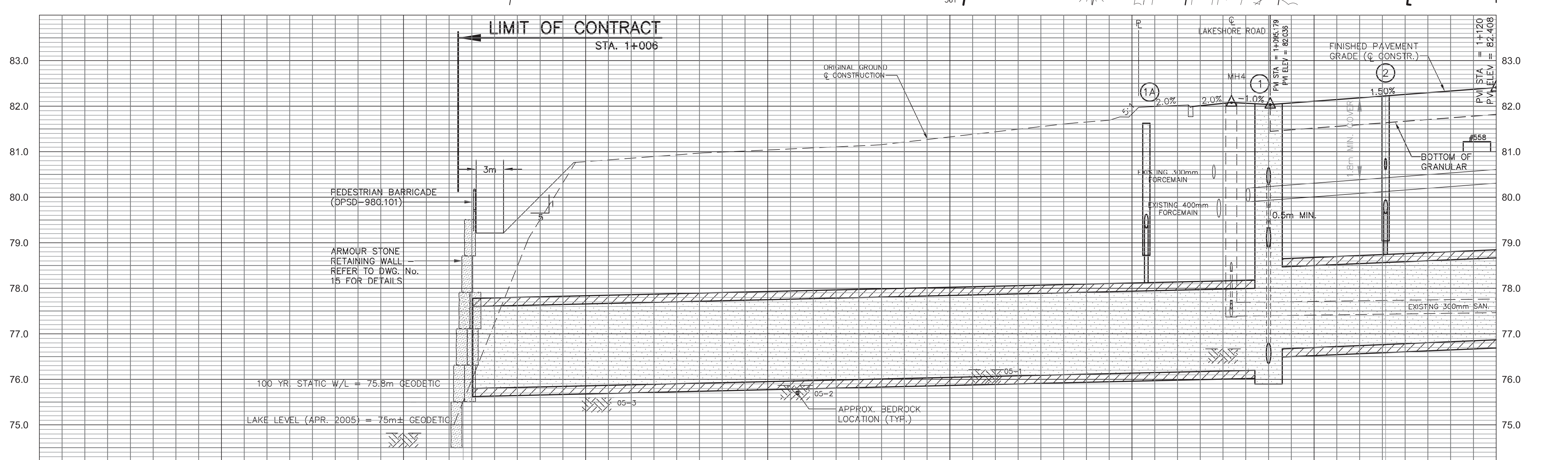
S:\01 - Projects\18000\18041 East Village Phase 5\02 Design\Drawings\Current Drawings\18041-DA1.dwg PRINTED: Nov 30, 2018

COVERDALE AVENUE RECONSTRUCTION – PAVEMENT STRUCTURE									
LOCATION	50mm HL 3F	40mm HL 4	50mm HL 8	50mm HL 4	GRANULAR 'A' 100mm	GRANULAR 'A' 150mm	GRANULAR 'A' 200mm	GRANULAR 'B' 150mm	GRANULAR 'B' 350mm
COVERDALE AVENUE		●	●			●			●
LAKESHORE ROAD:									
• FULL WIDTH CONSTR.		●	●			●			●
• WIDENING				●		●		●	
• OVER EXISTING ROAD				●	Regrade Existing Granular and Repave				
SPRINGBROOK ROAD & GARDINER CRESCENT:									
• (SEE LAKESHORE ROAD)									
SIDEWALK					●				
ASPHALT ENTRANCES *	●						●		
GRAVEL ENTRANCES **							●		

* EXISTING ASPHALT ENTRANCES WILL BE PAVED FROM BACK OF CURB TO GRADE POINT.
** EXISTING GRAVEL ENTRANCES WILL BE PAVED FROM BACK OF CURB TO FRONT FACE OF SIDEWALK ONLY.



NOTES:
1. FOR LAKESHORE ROAD CONSTRUCTION DETAILS, REFER TO DWG. No. 13.
2. FOR LOOKOUT POINT PARK LANDSCAPE DETAILS, REFER TO DWG. L1.



PROPOSED ROAD GRADE	75.51	80.78	81.04	81.32	81.76	82.078	82.108	82.408			
STORM SEWER LENGTH, SIZE AND GRADE	87.4m OF 1800mm C.P. @ 0.46%	101.5m OF 1800mm C.P. @ 0.82%									
STORM SEWER INVERT	75.800	DROP W. 76.350 W. 78.890 S. 78.200 N. 78.670 E. 80.275 DROP E. 76.350									
CHAINAGE	0+960	0+980	1+000	1+007.6	1+020	1+040	1+060	1+080	1+090.929	1+095	1+100	1+120

LEGEND

- STM. — EXISTING STORM SEWER
- SAN. — EXISTING SANITARY SEWER
- WM — EXISTING WATERMAIN
- G — EXISTING GAS MAIN
- B — EXISTING BURIED BELL CABLE
- CTV — EXISTING BURIED CTV CABLE
- H — EXISTING BURIED HYDRO CABLE
- 300mm — AS CONSTRUCTED STORM SEWER
- AS CONSTRUCTED STORM SERVICE
- AS CONSTRUCTED WATER SERVICE
- AS CONSTRUCTED WATERMAIN
- CURB & GUTTER
- DROP CURB
- SIDEWALK

B.M. 101 ELEV.81.458
N. & W. IN N. FACE OF HBP/CTV, S. SIDE OF LAKESHORE ROAD, 1st. POLE W. OF COVERDALE AVE.
Sta. 4+978.72, O/S 7.95m Rt.

NOTE :

IT IS THE RESPONSIBILITY OF THE CONTRACTORS TO INFORM THEMSELVES OF THE EXACT LOCATION OF, AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES, SERVICES AND STRUCTURES WHETHER ABOVE GROUND OR BELOW GRADE BEFORE COMMENCING THE WORK. SUCH INFORMATION IS NOT NECESSARILY SHOWN ON THE DRAWING, AND WHERE SHOWN, THE ACCURACY CANNOT BE GUARANTEED.

WITH THE SOLE EXCEPTION OF THE BENCHMARK(S) SPECIFICALLY DESCRIBED FOR THIS PROJECT, NO ELEVATION INDICATED OR ASSUMED HEREON IS TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

No.	DATE	BY	ISSUES / REVISIONS
3	04/17/07	S.M.	AS CONSTRUCTED DETAILS ADDED
2	09/30/05	J.B.	ISSUED FOR CONSTRUCTION
1	08/25/05	J.B.	ISSUED FOR TENDER/APPROVALS

TSH engineers architects planners
513 Division Street
Cobourg, Ontario
K9A 5G6
TEL: 905-372-2121
FAX: 905-372-3621
E-mail cobourg@tsh.ca
www.tsh.ca
Totten Sims Hubicki Associates (1997) Limited

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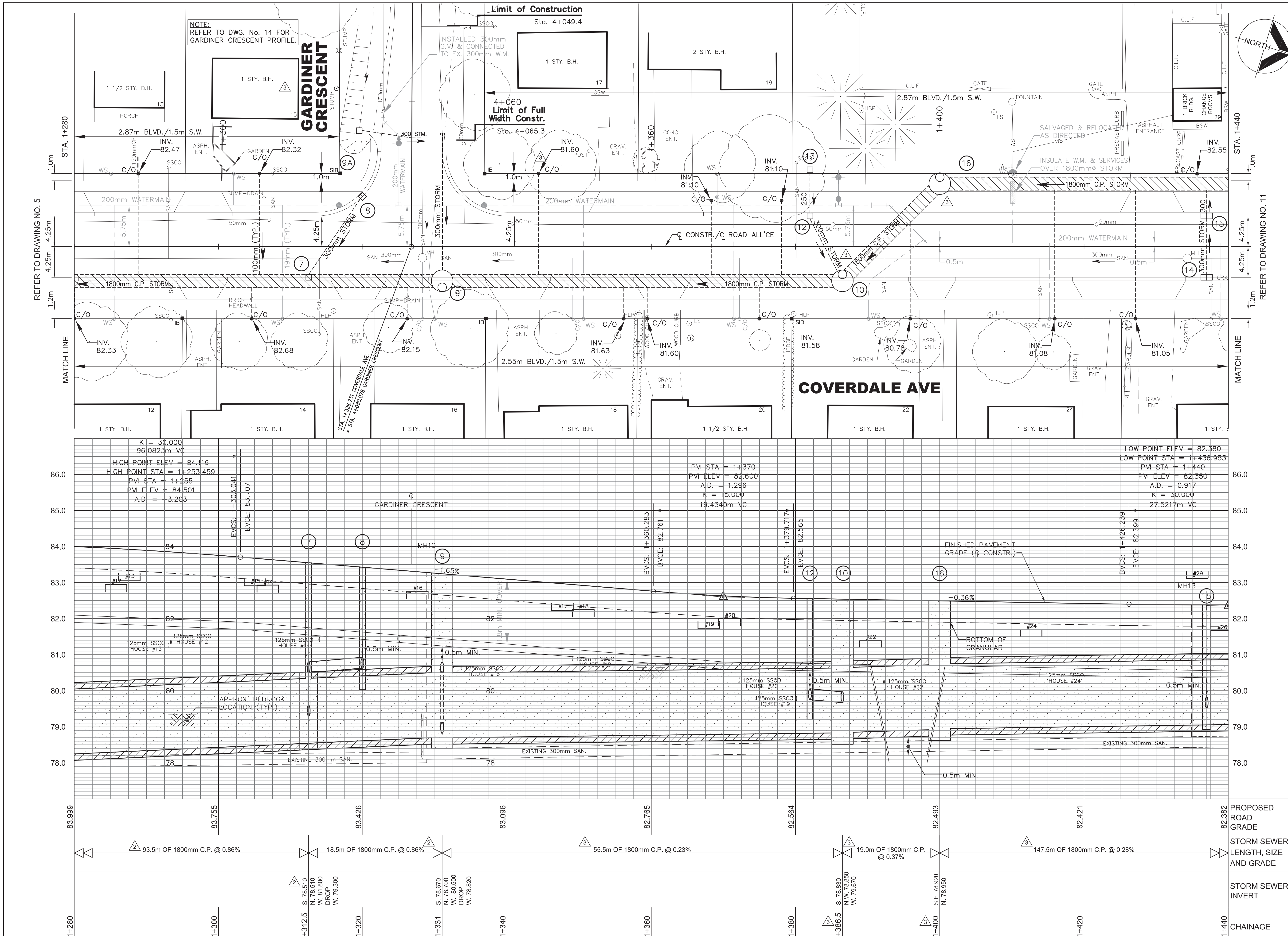
CLIENT:
THE CORPORATION OF THE TOWN OF COBOURG
PUBLIC WORKS DIVISION
ENGINEERING DEPARTMENT
VICTORIA HALL
55 KING STREET WEST
COBOURG, ONTARIO
K9A 2M2

PROJECT:
COVERDALE AVENUE RECONSTRUCTION
LAKE ONTARIO TO 105m SOUTH OF HAMILTON AVENUE

CONTRACT No. CO-05-25

DRAWING:
NEW CONSTRUCTION AND STORM SEWERS STA. 1+000 TO STA. 1+120 AS CONSTRUCTED

DRAWN BY:	CHECKED BY:	PROJECT No.:
J. BEAVAN	G.J. WATSON	12-29292-03
DESIGNED BY: J. BEAVAN G. J. WATSON	APPROVED BY: W. WILCOX	DRAWING No. 2
SCALE: HORZ. 1:250 VERT. 1:50	DATE: AUGUST 2005	



LEGEND

STM.	EXISTING STORM SEWER
SAN.	EXISTING SANITARY SEWER
WM.	EXISTING WATERMAIN
G	EXISTING GAS MAIN
B	EXISTING BURIED BELL CABLE
CTV	EXISTING BURIED CTV CABLE
H	EXISTING BURIED HYDRO CABLE
300mm	AS CONSTRUCTED STORM SEWER
	AS CONSTRUCTED STORM SERVICE
	AS CONSTRUCTED WATER SERVICE
	AS CONSTRUCTED WATERMAIN
	CURB & GUTTER
	DROP CURB
	SIDEWALK

B.M. 102 ELEV.84.016
R.R. SPIKE IN W. FACE OF HLP, E. SIDE OF COVERDALE AVE., BETWEEN Hs. #16 & Hs. #14. Sta. 1+315.97 O/S 8.90m Rt.

NOTE :

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No.	DATE	BY	ISSUES / REVISIONS
4	04/17/07	S.M.	AS CONSTRUCTED DETAILS ADDED
3	05/30/06	J.B.	STORM SEWER REVISED
2	09/30/05	J.B.	ISSUED FOR CONSTRUCTION
1	08/25/05	J.B.	ISSUED FOR TENDER/APPROVALS

TSH engineers architects planners
513 Division Street
Cobourg, Ontario
K9A 5G6
TEL: 905-372-2121
FAX: 905-372-3621
E-mail cobourg@tsh.ca
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CLIENT:

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PUBLIC WORKS DIVISION
ENGINEERING DEPARTMENT
VICTORIA HALL
55 KING STREET WEST
COBOURG, ONTARIO
K9A 2M2

PROJECT:

COVERDALE AVENUE RECONSTRUCTION

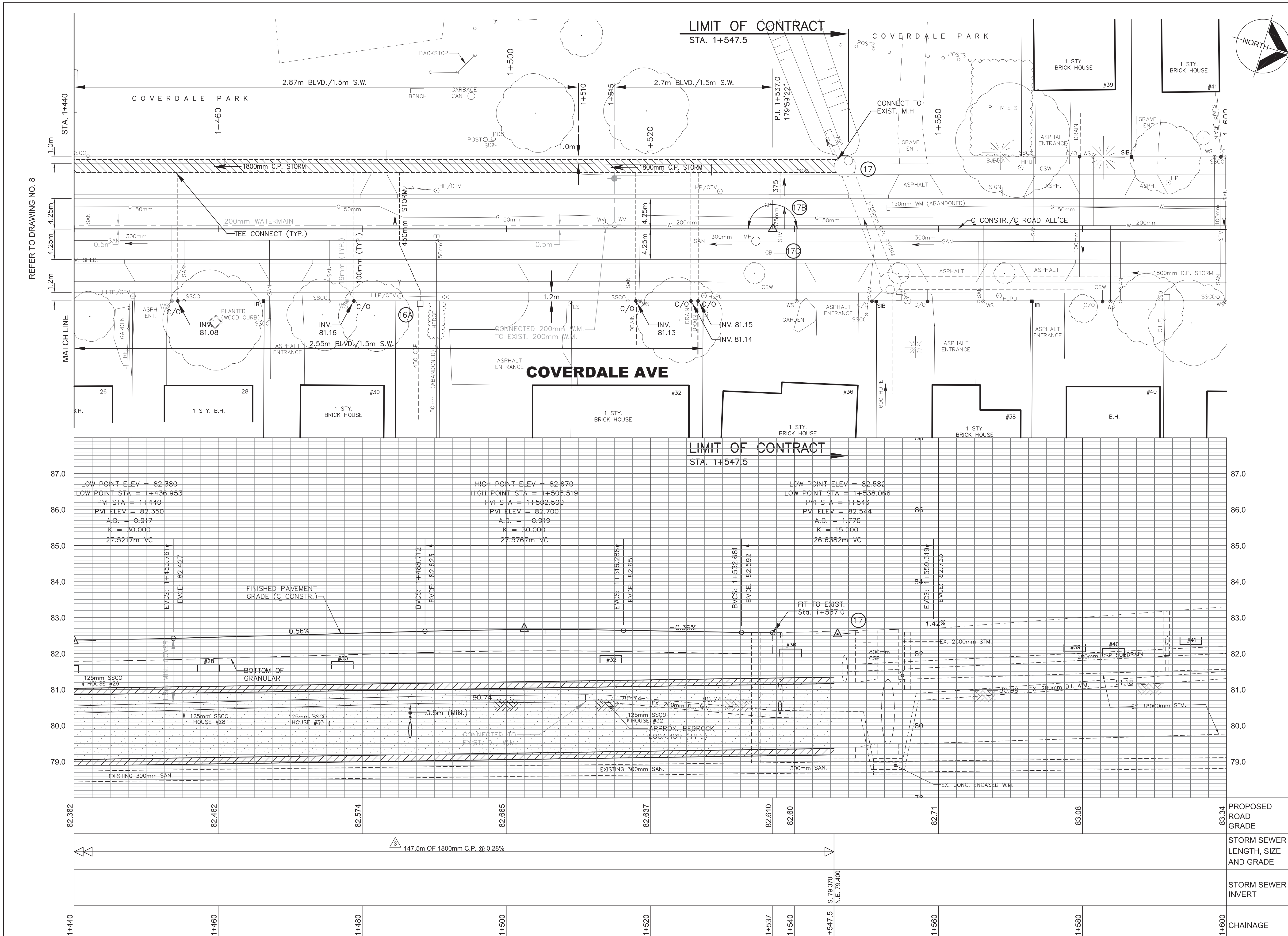
LAKE ONTARIO TO 105m SOUTH OF HAMILTON AVENUE

CONTRACT No. CO-05-25

DRAWING:

NEW CONSTRUCTION AND STORM SEWERS STA. 1+280 TO STA. 1+440 AS CONSTRUCTED

DRAWN BY:	CHECKED BY:	PROJECT No. :
J. BEAVAN	G.J. WATSON	12-29292-03
DESIGNED BY: J. BEAVAN, G. J. WATSON	APPROVED BY: W. WILCOX	DRAWING No. 8
SCALE: HORZ. 1:500 VERT. 1:100	DATE: AUGUST 2005	



LEGEND

STM.	EXISTING STORM SEWER
SAN.	EXISTING SANITARY SEWER
WM.	EXISTING WATERMAIN
G	EXISTING GAS MAIN
B	EXISTING BURIED BELL CABLE
CTV	EXISTING BURIED CTV CABLE
H	EXISTING BURIED HYDRO CABLE
300mm	AS CONSTRUCTED STORM SEWER
	AS CONSTRUCTED STORM SERVICE
	AS CONSTRUCTED WATER SERVICE
	AS CONSTRUCTED WATERMAIN
	CURB & GUTTER
	DROP CURB
	SIDEWALK

B.M. 102 ELEV.84.016
R.R. SPIKE IN W. FACE OF HLP, E. SIDE OF COVERDALE AVE., BETWEEN Hs. #16 & Hs. #14.
Sta. 1+315.97 O/S 8.90m Rt.

NOTE :

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No.	DATE	BY	ISSUES / REVISIONS
4	04/17/07	S.M.	AS CONSTRUCTED DETAILS ADDED
3	05/30/06	J.B.	STORM REVISED / MH#16 DELETED
2	09/30/05	J.B.	ISSUED FOR CONSTRUCTION
1	08/25/05	J.B.	ISSUED FOR TENDER/APPROVALS

TSH engineers architects planners
Totten Sims Hubicki Associates (1997) Limited
513 Division Street
Cobourg, Ontario
K9A 5G6
TEL: 905-372-2121
FAX: 905-372-3621
E-mail cobourg@tsh.ca
www.tsh.ca

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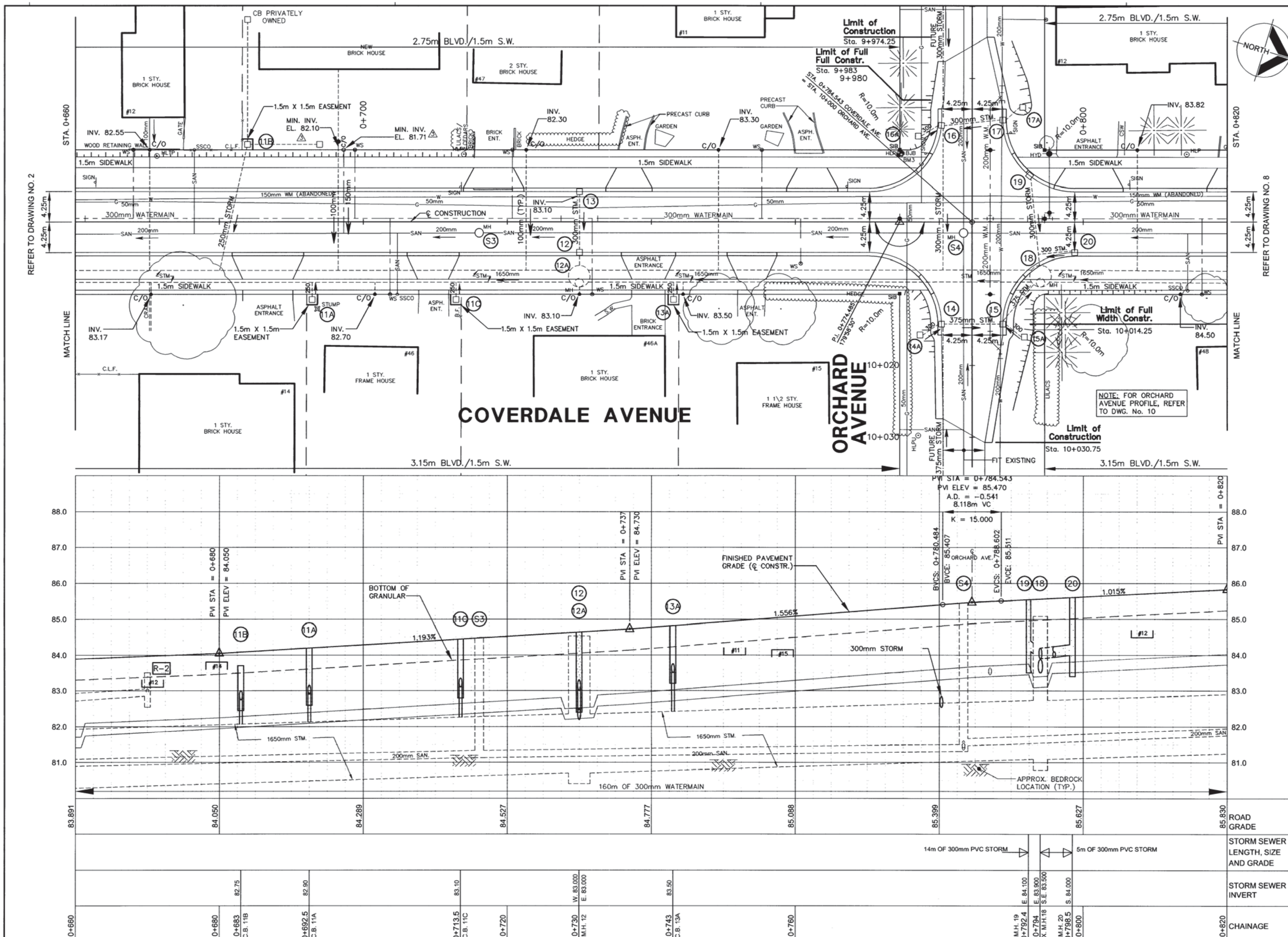
PUBLIC WORKS DIVISION
ENGINEERING DEPARTMENT
VICTORIA HALL
55 KING STREET WEST
COBOURG, ONTARIO
K9A 2M2

PROJECT:
COVERDALE AVENUE RECONSTRUCTION
LAKE ONTARIO TO 105m SOUTH OF HAMILTON AVENUE

CONTRACT No. CO-05-25

DRAWING:
NEW CONSTRUCTION AND STORM SEWERS STA. 1+440 TO STA. 1+600 AS CONSTRUCTED

DRAWN BY:	CHECKED BY:	PROJECT No. :
J. BEAVAN	G.J. WATSON	12-29292-03
DESIGNED BY: J. BEAVAN, G. J. WATSON	APPROVED BY: W. WILCOX	DRAWING No. 11
SCALE: HORZ. 1:500, VERT. 1:100	DATE: AUGUST 2005	



LEGEND

STM	STORM SEWER
SAN	SANITARY SEWER
W	WATERMAIN
G	GAS MAIN
B	BURIED BELL CABLE
CTV	BURIED CTV CABLE
H	BURIED HYDRO CABLE
300mm	STORM SEWER AS CONSTRUCTED
200mm	WATERMAIN AS CONSTRUCTED
	CURB & GUTTER
	DROP CURB
100mm PVC C/O	BASEMENT DRAINS W/ CLEAN-OUT (REFER TO S-303 MOD.)

B.M.3 ELEV. 83.789
N&W IN EAST FACE OF HLP AT SOUTH-WEST CORNER OF COVERDALE AVENUE AND ORCHARD AVENUE.
STA. 0+774.52, O/S 9.56m Lt.

NOTE:

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No.	DATE	BY	ISSUES / REVISIONS
4	07.22.04	A.D.O.	AS CONSTRUCTED DETAILS ADDED
3	10.17.03	J.B.	STORM & SANITARY SERVICE ADDED (0+697)
2	10.09.03	J.B.	ISSUED FOR CONSTRUCTION
1	9.19.03	J.B.	ISSUED FOR TENDER

LICENSED PROFESSIONAL ENGINEER
W. WILCOX
PROVINCE OF ONTARIO

TSH engineers architects planners
513 Division Street
Cobourg, Ontario
K9A 5G6
TEL: 905-372-2121
FAX: 905-372-3621
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CLIENT:

THE CORPORATION OF THE TOWN OF COBOURG

VICTORIA HALL
55 KING STREET WEST
COBOURG, ONTARIO
K9A 2M2

PROJECT:

COVERDALE AVENUE RECONSTRUCTION

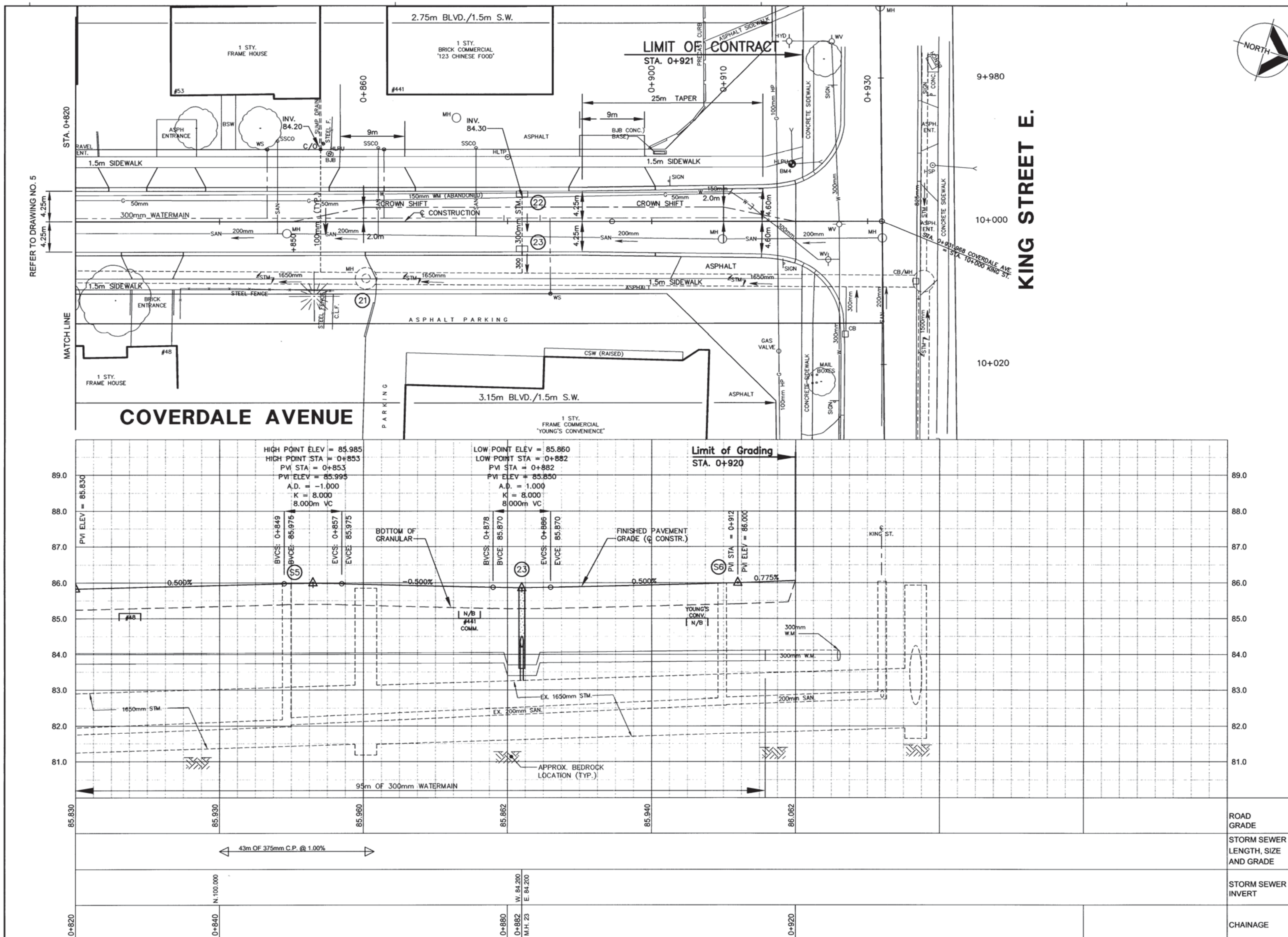
KING STREET TO 130m SOUTH OF HAMILTON AVENUE

CONTRACT No. 2-03-03

DRAWING:

NEW CONSTRUCTION AND STORM SEWERS AS CONSTRUCTED STA. 0+660 TO STA. 0+820

DRAWN BY:	CHECKED BY:	PROJECT No. :
J. BEAVAN	R.P. LARONDE	12-29292
DESIGNED BY: R.P. LARONDE	APPROVED BY: W. WILCOX	DRAWING No. 5
SCALE: HORZ. 1:250 VERT. 1:50	DATE: SEPTEMBER 2003	



LEGEND

STM	STORM SEWER
SAN	SANITARY SEWER
W	WATERMAIN
G	GAS MAIN
B	BURIED BELL CABLE
CTV	BURIED CTV CABLE
H	BURIED HYDRO CABLE
300mm	STORM SEWER AS CONSTRUCTED
200mm	WATERMAIN AS CONSTRUCTED
	CURB & GUTTER
	DROP CURB
100mm PVC C/O	BASEMENT DRAINS W/ CLEAN-OUT (REFER TO S-303 MOD.)

B.M.4 ELEV. 86.490
N&W IN EAST FACE OF HLPU AT SOUTH-WEST CORNER OF COVERDALE AVENUE AND KING STREET EAST.
STA. 0+919.48, O/S 8.02m Lt.

NOTE :

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No.	DATE	BY	ISSUES / REVISIONS
3	07.22.04	A.D.O.	AS CONSTRUCTED DETAILS ADDED
2	10.09.03	J.B.	ISSUED FOR CONSTRUCTION
1	9.19.03	J.B.	ISSUED FOR TENDER

LICENSED PROFESSIONAL ENGINEER
W. WILCOX
PROVINCE OF ONTARIO

TSH engineers architects planners
513 Division Street
Cobourg, Ontario
K9A 5G6
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FAX: 905-372-3621
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CLIENT:
THE CORPORATION OF THE TOWN OF COBOURG
VICTORIA HALL
55 KING STREET WEST
COBOURG, ONTARIO
K9A 2M2

PROJECT:
COVERDALE AVENUE RECONSTRUCTION
KING STREET TO 130m
SOUTH OF HAMILTON AVENUE

CONTRACT No. 2-03-03

DRAWING:
NEW CONSTRUCTION AND STORM SEWERS AS CONSTRUCTED STA. 0+820 TO STA. 0+921

DRAWN BY:	CHECKED BY:	PROJECT No. :
J. BEAVAN	R.P. LARONDE	12-29292
DESIGNED BY: R.P. LARONDE	APPROVED BY: W. WILCOX	DRAWING No. 8
SCALE: HORZ. 1:250 VERT. 1:50	DATE: SEPTEMBER 2003	

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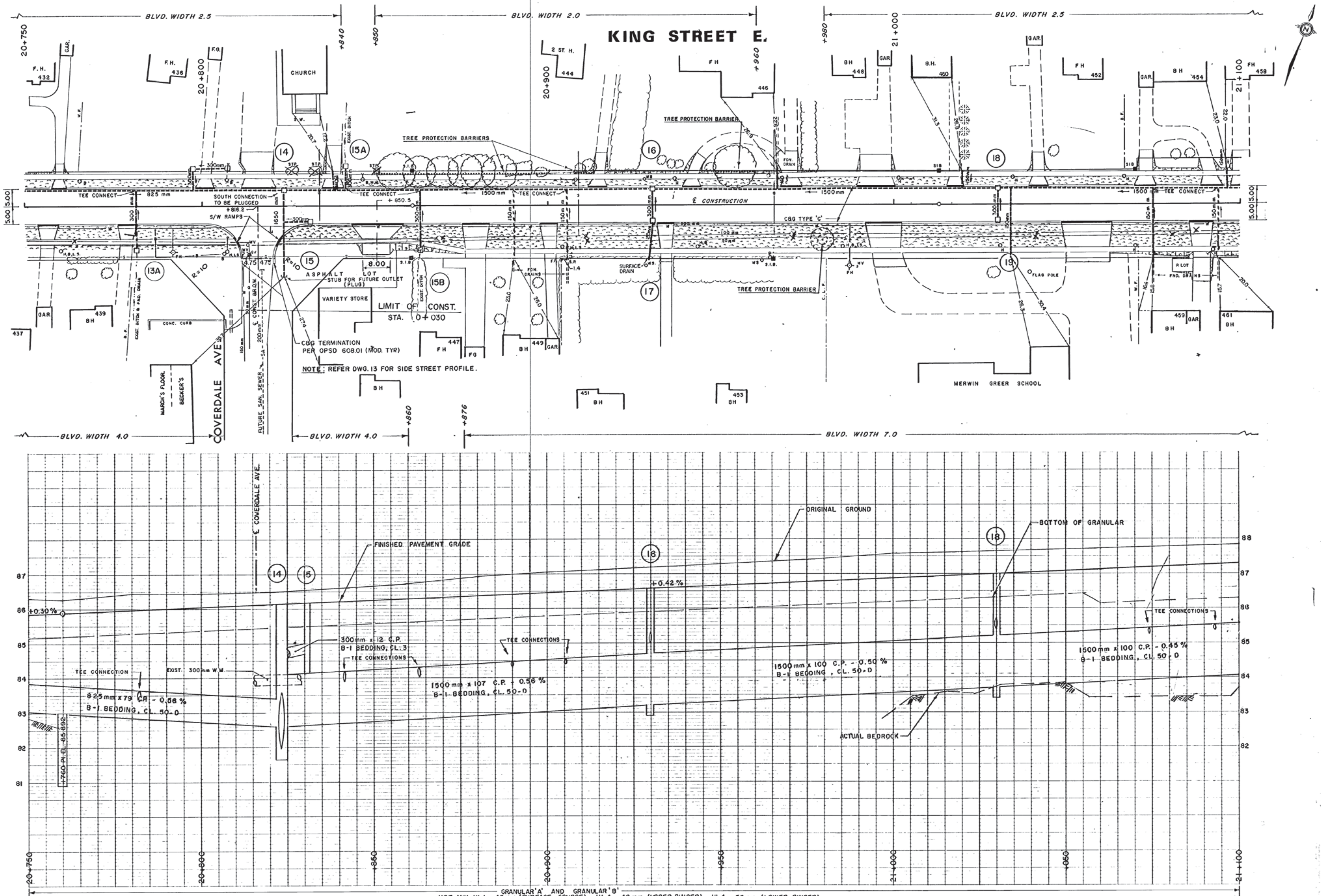


totten sims hubicki associates

ENGINEERS ARCHITECTS AND PLANNERS

COBOURG WHITBY KINGSTON TORONTO BRACEBRIDGE OTTAWA SIMCOE

No.	DATE	BY	REVISIONS
1	OCT./89	P.C.	AS CONSTRUCTED DETAILS ADDED

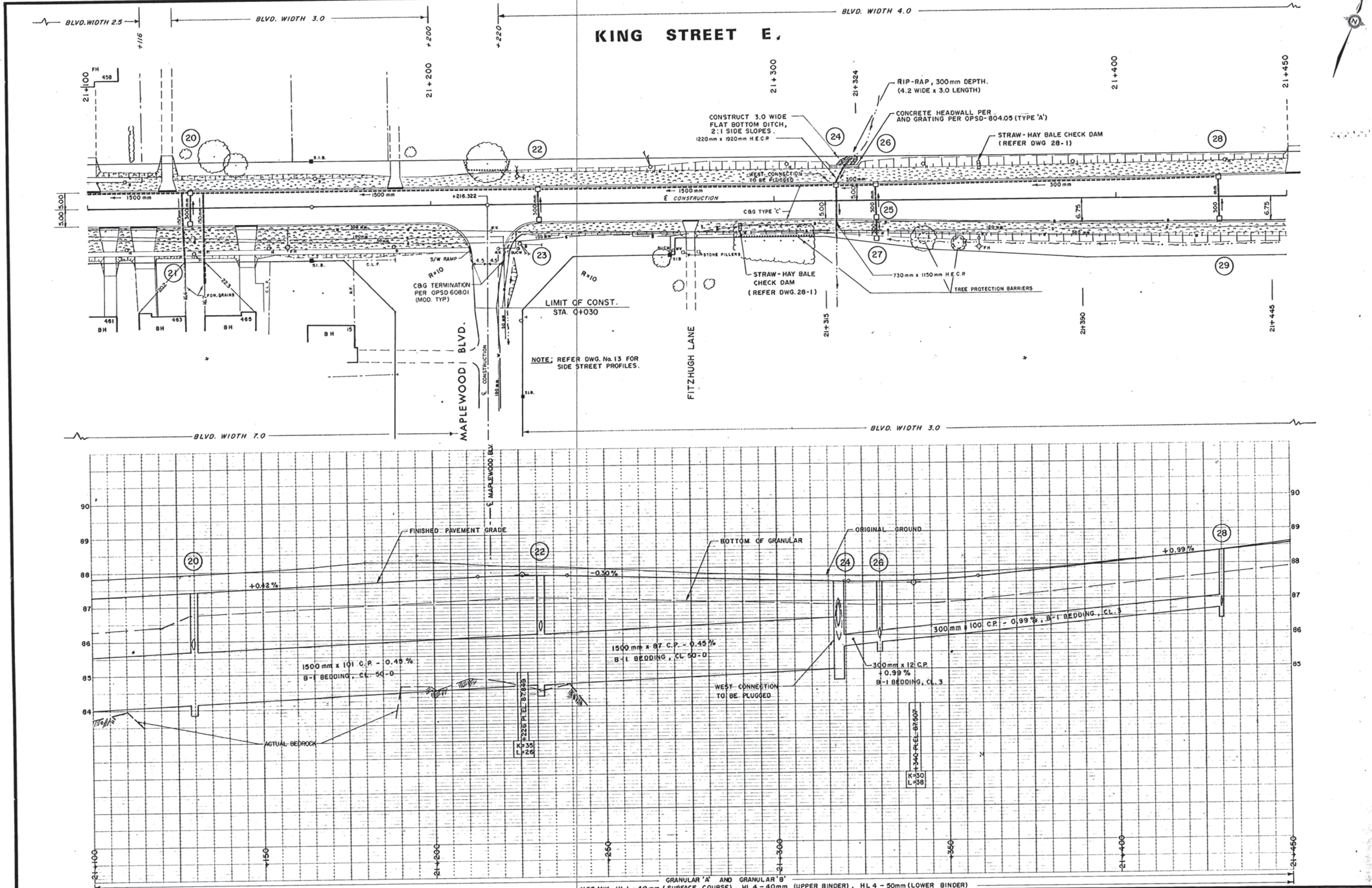
DESIGNED: R. P. L.
DRAWN: J. R. M.
CHECKED: R. P. L.
APPROVED: H. D. G.
SCALE: 1:500 HOR. 1:50 VERT.

TOWN OF COBOURG

KING STREET EAST – HIGHWAY NO. 2

STREET CONSTRUCTION AND STORM SEWERS

DATE: FEB, 1988
PROJECT: 7294
DRAWING: 6



totten sims hubicki associates

ENGINEERS ARCHITECTS AND PLANNERS

COBOURG WHITBY KINGSTON TORONTO BRACEBRIDGE OTTAWA SIMCOE

No.	DATE	BY	REVISIONS
1	OCT./89	P.C.	AS CONSTRUCTED DETAILS ADDED

DESIGNED: R. P. L.
DRAWN: J. R. M.
CHECKED: R. P. L.
APPROVED: H. D. G.
SCALE: 1:500 HOR. 1:50 VERT.

TOWN OF COBOURG

KING STREET EAST — HIGHWAY NO. 2

STREET CONSTRUCTION AND STORM SEWERS

DATE: FEB, 1988
PROJECT: 7294
DRAWING: 8

Appendix **D**

Stormceptor Design Breif

Detailed Stormceptor Sizing Report – 425 King Street East

Project Information & Location			
Project Name	425 King Street East	**Project Number**	11192099
City	Cobourg	**State/ Province**	Ontario
Country	Canada	**Date**	3/18/2019
Designer Information		**EOR Information (optional)**	
Name	Ryan Brockie	**Name**	
Company	GHD Ltd.	**Company**	
Phone #	905-215-0545	**Phone #**	
Email	ryan.brockie@ghd.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	
Recommended Stormceptor Model	EF8
TSS Removal (%) Provided	63
Particle Size Distribution (PSD)	CA ETV
Rainfall Station	TORONTO CENTRAL

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

EF Sizing Summary	
EF Model	**% TSS Removal Provided**
EF4	53
EF6	59
EF8	63
EF10	65
EF12	67
Parallel Units / MAX	Custom

For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

OVERVIEW

Stormceptor ® EF is a continuation and evolution of the most globally recognized oil-grit separator (OGS) stormwater treatment technology - **Stormceptor ®.** Also known as a hydrodynamic separator, the enhanced flow Stormceptor EF is a high performing oil-grit separator that effectively removes a wide variety of pollutants from stormwater and snowmelt runoff at higher flow rates as compared to the original Stormceptor. Stormceptor EF captures and retains sediment (TSS), free oils, gross pollutants and other pollutants that attach to particles, such as nutrients and metals. Stormceptor EF's patent-pending treatment and scour prevention technology and internal bypass ensures sediment is retained during all rainfall events.

Sizing Methodology

Stormceptor ® EF and Stormceptor ® EFO are sized using local historical rainfall data for the site of interest, specific site parameters, and a performance curve for TSS removal derived from third-party testing conducted in accordance with the Canadian Environmental Technology Verification (ETV) Program's Procedure for Laboratory Testing of Oil Grit Separators. Every Stormceptor unit is designed to achieve the specified target TSS removal, however, for sites where oil/fuel capture and retention is an additional specified water quality objective Stormceptor EFO is the proper selection. The sizing methodology includes various considerations, including:

- Site parameters
- Local historical rainfall data
- Capture of the Canadian ETV particle size distribution
- Requirements for oil/fuel capture and retention
- Performance results from third-party testing and verification

Hydrology Analysis

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour).
Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station

State/Province	Ontario	**Total Number of Rainfall Events**	2719
Rainfall Station Name	TORONTO CENTRAL	**Total Rainfall (mm)**	13185.4
Station ID #	0100	**Average Annual Rainfall (mm)**	732.5
Coordinates	43°37'N, 79°23'W	**Total Evaporation (mm)**	565.8
Elevation (ft)	328	**Total Infiltration (mm)**	7435.1
Years of Rainfall Data	18	**Total Rainfall that is Runoff (mm)**	5184.5

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

ONLINE APPLICATION

Stormceptor EF's internal bypass and patent-pending scour prevention technology has demonstrated very effective retention of pollutants in third-party testing and verification following the Canadian ETV's **Procedure for Laboratory Testing of Oil-Grit Separators.** Sediment scour prevention demonstrated an effluent concentration of less than 10 mg/L for sediment particles ranging from 1 to 1,000 microns, even during peak influent flow rates associated with infrequent high intensity storm events. While Stormceptor EF will capture oil, only the Stormceptor EFO configuration has been third-party tested and verified to retain greater than 99% of captured oil. Based on these verified performance attributes, the most efficient and widely accepted application of Stormceptor EF is an online configuration, which allows all upstream conveyance flows to enter and exit the unit. The online application eliminates the need for costly additional bypass structures, piping and installation expense.

FLOW ENTRANCE OPTIONS

Single Inlet Pipe – A common design which includes one inlet pipe and one outlet pipe. A 90-degree (maximum) bend is also accepted with this configuration.

Inlet Grate – Allows surface runoff to enter the unit from grade. The inlet grate option can also be used in conjunction with one inlet pipe or multiple inlet pipes. A removable flow deflector is added in the Stormceptor EF4/EFO4.

Maximum Pipe Diameter		
Model	Inlet (in/mm)	Outlet (in/mm)
EF4 / EFO4	24 / 610	24 / 610
EF6 / EFO6	36 / 915	36 / 915
EF8 / EFO8	48 / 1220	48 / 1220
EF10 / EFO10	72 / 1828	72 / 1828
EF12 / EFO12	72 / 1828	72 / 1828

Multiple Inlet Pipe – Allows for multiple inlet pipes of various diameters to enter the unit.

Maximum Pipe Diameter		
Model	Inlet (in/mm)	Outlet (in/mm)
EF4 / EFO4	18 / 457	24 / 610
EF6 / EFO6	30 / 762	36 / 915
EF8 / EFO8	42 / 1067	48 / 1220
EF10 / EFO10	60 / 1524	72 / 1828
EF12 / EFO12	60 / 1524	72 / 1828

Drainage Area	
Total Area (ha)	1.85
Imperviousness %	43.0

Up Stream Storage	
Storage (ha-m)	**Discharge (cms)**
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Design Details	
Stormceptor Inlet Invert Elev (m)	
Stormceptor Outlet Invert Elev (m)	
Stormceptor Rim Elev (m)	
Normal Water Level Elevation (m)	
Pipe Diameter (mm)	
Pipe Material	
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	No

Water Quality Objective	
TSS Removal (%)	60.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

CA ETV

Particle Diameter (microns)	Distribution %	Specific Gravity
2.0	5.0	2.65
5.0	5.0	2.65
8.0	10.0	2.65
20.0	15.0	2.65
50.0	10.0	2.65
75.0	5.0	2.65
100.0	10.0	2.65
150.0	15.0	2.65
250.0	15.0	2.65
500.0	5.0	2.65
1000.0	5.0	2.65

Site Name	

Site Details

Drainage Area

Total Area (ha)	1.85
Imperviousness %	43.0

Infiltration Parameters

Horton's equation is used to estimate infiltration

Max. Infiltration Rate (mm/hr)	61.98
Min. Infiltration Rate (mm/hr)	10.16
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Surface Characteristics

Width (m)	272.00
Slope %	2
Impervious Depression Storage (mm)	0.508
Pervious Depression Storage (mm)	5.08
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Evaporation

Daily Evaporation Rate (mm/day)	2.54

Dry Weather Flow

Dry Weather Flow (L/s)	0

Maintenance Frequency

Maintenance Frequency (months) >	12

Winter Months

Winter Infiltration	0

TSS Loading Parameters	
TSS Loading Function	

Buildup/Wash-off Parameters	
Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

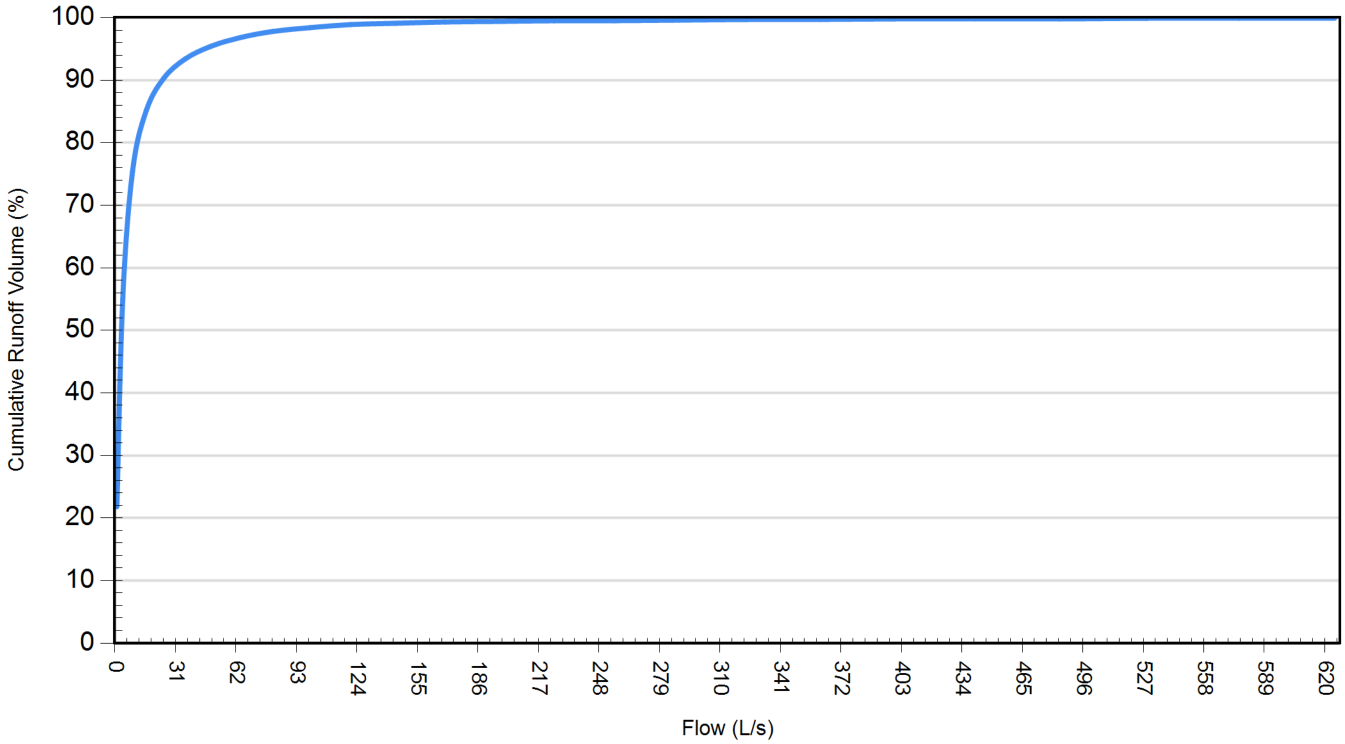
TSS Availability Parameters	
Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

Cumulative Runoff Volume by Runoff Rate

Runoff Rate (L/s)	Runoff Volume (m^3)	Volume Over (m^3)	Cumulative Runoff Volume (%)
1	21039	75675	21.8
4	53170	43545	55.0
9	72943	23776	75.4
16	82346	14374	85.1
25	87313	9409	90.3
36	90315	6407	93.4
49	92283	4440	95.4
64	93647	3076	96.8
81	94582	2142	97.8
100	95205	1519	98.4
121	95615	1109	98.9
144	95889	835	99.1
169	96031	692	99.3
196	96120	603	99.4
225	96198	525	99.5
256	96276	448	99.5
289	96355	369	99.6
324	96405	319	99.7
361	96449	274	99.7
400	96485	238	99.8
441	96522	201	99.8
484	96561	163	99.8
529	96595	128	99.9
576	96624	100	99.9
625	96653	71	99.9

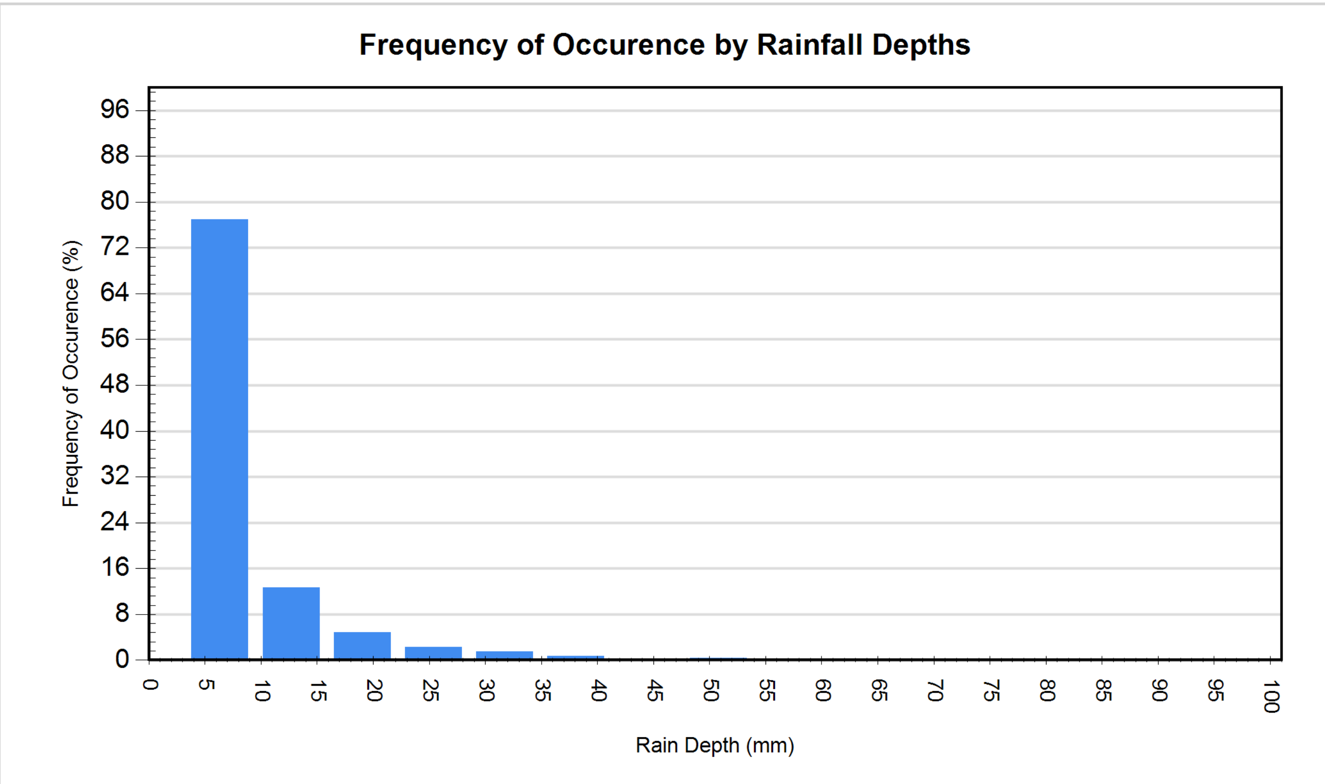
Cumulative Runoff Volume by Runoff Rate

For area: 1.85(ha), imperviousness: 43.0%, rainfall station: TORONTO CENTRAL



Rainfall Event Analysis

Rainfall Depth (mm)	No. of Events	Percentage of Total Events (%)	Total Volume (mm)	Percentage of Annual Volume (%)
6.35	2091	76.9	3344	25.4
12.70	345	12.7	3201	24.3
19.05	131	4.8	2062	15.6
25.40	63	2.3	1358	10.3
31.75	42	1.5	1185	9.0
38.10	20	0.7	678	5.1
44.45	9	0.3	377	2.9
50.80	11	0.4	521	4.0
57.15	3	0.1	159	1.2
63.50	1	0.0	61	0.5
69.85	0	0.0	0	0.0
76.20	1	0.0	73	0.6
82.55	1	0.0	80	0.6
88.90	1	0.0	85	0.6
95.25	0	0.0	0	0.0
101.60	0	0.0	0	0.0



STANDARD SPECIFICATION FOR
"OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREAMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, designing, maintaining, and constructing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV). Work includes supply and installation of concrete bases, precast sections, and the appropriate precast section with OGS internal components correctly installed within the system, watertight sealed to the precast concrete prior to arrival to the project site.

1.2 REFERENCE STANDARDS

1.2.1 For Canadian projects only, the following reference standards apply:

CAN/CSA-A257.4-14: Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Fittings Using Rubber Gaskets
CAN/CSA-A257.4-14: Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings
CAN/CSA-S6-00: Canadian Highway Bridge Design Code

1.2.2 For ALL projects, the following reference standards apply:

ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 891: Standard Practice for Installation of Underground Precast Concrete Utility Structures
ASTM D2563: Standard Practice for Classification of Visual Defects in Reinforced Plastics

1.3 SHOP DRAWINGS

1.3.1 Shop drawings shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail the precast concrete components and OGS internal components prior to shipment, including the sequence for installation.

1.3.2 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record. Any and all changes to project cost estimates, bonding amounts, plan check fees for revision of approved documents, or design impacts due to regulatory requirements as a result of a product substitution shall be coordinated by the Contractor with the Engineer of Record.

1.4 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

1.4.1 OGS internal components supplied by the Manufacturer for attachment to the precast concrete vessel shall be pre-fabricated, bolted to the precast and watertight sealed to the precast vessel surface prior to site delivery to ensure Manufacturer's internal assembly process and quality control processes are fully adhered to, and to prevent materials damage on site.

1.4.2 Follow all instructions including the sequence for installation in the shop drawings during installation.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The OGS vessel shall be cylindrical and constructed from precast concrete riser and slab components.

2.1.2 The precast concrete OGS internal components shall include a fiberglass insert bolted and watertight sealed inside the precast concrete vessel, prior to site delivery. Primary internal components that are to be anchored and watertight sealed to the precast concrete vessel shall be done so only by the Manufacturer prior to arrival at the job site to ensure product quality.

2.1.3 The OGS shall be allowed to be specified and have the ability to function as a 240-degree bend structure in the stormwater drainage system, or as a junction structure.

2.1.4 The OGS to be specified shall have the capability to accept influent flow from an inlet grate and an inlet pipe.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be designed and manufactured to meet highway loading conditions per State/Provincial or local requirements.

2.3 GASKETS

Only profile neoprene or nitrile rubber gaskets that are oil resistant shall be accepted. For Canadian projects only, gaskets shall be in accordance to CSA A257.4-14. Mastic sealants, butyl tape/rope or Conseal CS-101 alone are not acceptable gasket materials.

2.4 JOINTS

The concrete joints shall be watertight and meet the design criteria according to ASTM C-990. For projects where joints require gaskets, the concrete joints shall be watertight and oil resistant and meet the design criteria according to ASTM C-443. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

2.5 FRAMES AND COVERS

Frames and covers shall be manufactured in accordance with State/Provincial or local requirements for inspection and maintenance access purposes. A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS manufacturer's product name to properly identify this asset's purpose is for stormwater quality treatment.

2.6 PRECAST CONCRETE

All precast concrete components shall conform to the appropriate CSA or ASTM specifications.

2.7 FIBERGLASS

The fiberglass portion of the OGS device shall be constructed in accordance with ASTM D2563, and in accordance with the PS15-69 manufacturing standard, and shall only be installed, bolted and watertight sealed to the precast concrete by the Manufacturer prior to arrival at the project site to ensure product quality.

2.8 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a fiberglass insert for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The total sediment storage capacity shall be a minimum 40 ft^3 (1.1 m^3). The total petroleum hydrocarbon storage capacity shall be a minimum 50 gallons (189 liters). The access opening to the sump of the OGS device for periodic inspection and maintenance purposes shall be a minimum 16 inches (406 mm) in diameter.

2.9 LADDERS

Ladder rungs shall be provided upon request or to comply with State/Provincial or local requirements.

2.10 INSPECTION

All precast concrete sections shall be level and inspected to ensure dimensions, appearance, integrity of internal components, and quality of the product meets State/Provincial or local specifications and associated standards.

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 HYDROLOGY AND RUNOFF VOLUME

The OGS device shall be engineered, designed and sized to treat a minimum of 90 percent of the average annual runoff volume, unless otherwise stated by the Engineer of Record, using historical rainfall data. Rainfall data sets should be comprised of a minimum 15-years of rainfall data or a longer continuous period if available for a given location, but in all cases a minimum 5-year period of rainfall data.

3.3 ANNUAL (TSS) SEDIMIMENT LOAD AND STORAGE CAPACITY

The OGS device shall be capable of removing and have sufficient storage capacity for the calculated annual total suspended solids (TSS) mass load and volume without scouring previously captured pollutants prior to maintenance being required. The annual (TSS) sediment load and volume transported from the drainage area should be calculated and compared to the OGS device's available storage capacity by the specifying Engineer to ensure adequate capacity between maintenance cycles. Sediment loadings shall be determined by land use and defined as a minimum of 450 kg (992 lb) of sediment (TSS) per impervious hectare of drainage area per year, or greater based on land use, as noted in Table 1 below.

Annual sediment volume calculations shall be performed using the projected average annual treated runoff volume, a typical sediment bulk density of 1602 kg/m^3 (100 lbs/ft^3) and an assumed Event Mean Concentration (EMC) of 125 mg/L TSS in the runoff, or as otherwise determined by the Engineer of Record.

Example calculation for a 1.3-hectares parking lot site:

- 1.28 meters of rainfall depth, per year

- 1.3 hectares of 100% impervious drainage area
- EMC of 125 mg/L TSS in runoff
- Treatment of 90% of the average annual runoff volume
- Target average annual TSS removal rate of 60% by OGS

Annual Runoff Volume:

- 1.28 m rain depth x 1.3 ha x 10,000 m^2/ha= 16,640 m^3 of runoff volume
- 16,640 m^3 x 1000 L/m^3 = 16,640,000 L of runoff volume
- 16,640,000 L x 0.90 = 14,976,000 L to be treated by OGS unit

Annual Sediment Mass and Sediment Volume Load Calculation:

- 14,976,000 L x 125 mg/L x kg/1,000,000 mg = 1,872 kg annual sediment mass
- 1,872 kg x m^3/1602 kg = 1.17 m^3 annual sediment volume
- 1.17 m^3 x 60% TSS removal rate by OGS = 0.70 m^3 minimum expected annual storage requirement in OGS

As a guideline, the U.S. EPA has determined typical annual sediment loads per drainage area for various sites by land use (see Table 1). Certain States, Provinces and local jurisdictions have also established such guidelines.

Table 1 – Annual Mass Sediment Loading by Land Use

	Commercial	Parking Lot	Residential			Highways	Industrial	Shopping Center
			High	Med.	Low			
(lbs/acre/yr)	1,000	400	420	250	10	880	500	440
(kg/hectare/yr)	1,124	450	472	281	11	989	562	494

Source: U.S. EPA Stormwater Best Management Practice Design Guide Volume 1, Appendix D, Table D-1, Burton and Pitt 2002

3.4 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in Table 2, Section 3.5, and based on third-party performance testing conducted in accordance with the Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. Sizing shall be determined using historical rainfall data (as specified in Section 3.2) and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 3.3.

3.4.1 The Peclet Number is not an approved method or model for calculating TSS removal, sizing, or scaling OGS devices.

3.4.2 If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates:

- Canadian ETV or ISO 14034 ETV Verification Statement which verifies third-party performance testing conducted in accordance with the **Procedure for Laboratory Testing of Oil-Grit Separators**
- Equal or better sediment (TSS) removal of the PSD specified in Table 2 at equivalent surface loading rates, as compared to the OGS device specified herein.
- Equal or greater sediment storage capacity, as compared to the OGS device specified herein.
- Supporting documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.5 PARTICLE SIZE DISTRIBUTION (PSD) FOR SIZING

The OGS device shall be sized to achieve the Engineer-specified average annual percent sediment (TSS) removal based solely on the test sediment used in the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** This test sediment is comprised of inorganic ground silica with a specific gravity of 2.65, uniformly mixed, and containing a broad range of particle sizes as specified in Table 2. No alternative PSDs or deviations from Table 2 shall be accepted.

Table 2
Canadian ETV Program Procedure for Laboratory Testing of Oil-Grit Separators
Particle Size Distribution (PSD) of Test Sediment

Particle Diameter (Microns)	% by Mass of All Particles	Specific Gravity
1000	5%	2.65
500	5%	2.65
250	15%	2.65
150	15%	2.65
100	10%	2.65
75	5%	2.65
50	10%	2.65
20	15%	2.65
8	10%	2.65
5	5%	2.65
2	5%	2.65

3.6 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. This scour testing is conducted with the device pre-loaded with test sediment comprised of the particle size distribution (PSD) illustrated in Table 2.

3.6.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

Data generated from laboratory scour testing performed with an OGS device pre-loaded with a coarser PSD than in Table 2 (i.e. the coarser PSD has no particles in the 1-micron to 50-micron size range, or the D_{50} of the test sediment exceeds 75 microns) shall not be acceptable for the determination of the device's suitability for on-line installation.

3.7 DESIGN ACCOUNTING FOR BYPASS

3.7.1 The OGS device shall be specified to achieve the TSS removal performance and water quality objectives without washout of previously captured pollutants. The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. To ensure this is achieved, there are two design options with associated requirements:

3.7.1.1 The OGS device shall be placed **off-line** with an upstream diversion structure (typically in an upstream manhole) that only allows the water quality volume to be diverted to the OGS device, and excessive flows diverted downstream around the OGS device to prevent high flow washout of pollutants previously captured. This design typically incorporates a triangular layout including an upstream bypass manhole with an appropriately engineered weir wall, the OGS device, and a downstream junction manhole, which is connected to both the OGS device and bypass structure. In this case with an external bypass required, the OGS device manufacturer must provide calculations and designs for all structures, piping and any other required material applicable to the proper functioning of the system, stamped by a Professional Engineer.

3.7.1.2 Alternatively, OGS devices in compliance with Section 3.6 shall be acceptable for an **on-line** design configuration, thereby eliminating the requirement for an upstream bypass manhole and downstream junction manhole.

3.7.2 The OGS device shall also have sufficient hydraulic conveyance capacity to convey the peak storm event, in accordance with hydraulic conditions per the Engineer of Record. If an alternate OGS device is proposed, supporting documentation shall be submitted that demonstrates equal or better hydraulic conveyance capacity as compared to the OGS device specified herein. This documentation shall be signed and sealed by a local registered Professional Engineer. All costs associated with preparing and certifying this documentation shall be born solely by the Contractor.

3.8 <u>PETROLEUM HYDROCARBONS AND FLOATABLES STORAGE CAPACITY</u>

Petroleum hydrocarbons and floatables storage capacity in the OGS device shall be a minimum 50 gallons (189 Liters), or more as specified.

3.8.1 The OGS device shall have gasketed precast concrete joints that are watertight, and oil resistant and meet the design criteria according to ASTM C-443 to provide safe oil and other hydrocarbon materials storage and ground water protection. Mastic sealants or butyl tape/rope alone are not an acceptable alternative.

3.9 <u>SURFACE LOADING RATE SCALING OF DIFFERENT MODEL SIZES</u>

The reference device for scaling shall be an OGS device that has been third-party tested in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. Other model sizes of the tested device shall only be scaled such that the claimed TSS removal efficiency of the scaled device shall be no greater than the TSS removal efficiency of the tested device at identical **surface loading rates** (flow rate divided by settling surface area). The depth of other model sizes of the tested device shall be scaled in accordance with the depth scaling provisions within Section 6.0 of the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

3.9.1 The Peclet Number and volumetric scaling are not approved methods for scaling OGS devices.

PART 4 – INSPECTION & MAINTENANCE

The OGS manufacturer shall provide an Owner's Manual upon request.

4.1 A Quality Assurance Plan that provides inspection and maintenance for a minimum of 5 years shall be included with the OGS stormwater quality device, and written into the Environmental Compliance Approval (ECA) or the appropriate State/Provincial or local approval document.

4.2 OGS device inspection shall include determination of sediment depth and presence of petroleum hydrocarbons and floatables below the insert. Inspection shall be easily conducted from finished grade through a Frame and Cover of at least 22 inch (560 mm) in diameter.

4.3 Inspection and pollutant removal from below the OGS's insert shall be conducted as a periodic maintenance practice using a standard maintenance truck and vacuum apparatus, and shall be easily conducted from finished grade through a Frame and Cover of at least 22-inches (560 mm) in diameter, and through an access opening to the OGS device's sump with a minimum 16-inches diameter (406 mm).

4.4 No confined space for sediment removal or inspection of internal components shall be required for normal operation, annual inspection or maintenance activity.

PART 5 – EXECUTION

5.1 PRECAST CONCRETE INSTALLATION

The installation of the precast concrete OGS stormwater quality treatment device shall conform to ASTM C 891, ASTM C 478, ASTM C 443, CAN/CSA-A257.4-14, CAN/CSA-A257.4-14, CAN/CSA-S6-00 and all highway, State/Provincial, or local specifications for the construction of manholes. Selected sections of a general specification that are applicable are summarized below. The Contractor shall furnish all labor, equipment and materials necessary to offload, assemble as needed the OGS internal components as specified in the Shop Drawings.

5.2 EXCAVATION

5.2.1 Excavation for the installation of the OGS stormwater quality treatment device shall conform to highway, State/Provincial or local specifications. Topsoil that is removed during the excavation for the OGS stormwater quality treatment device shall be stockpiled in designated areas and not be mixed with subsoil or other materials. Topsoil stockpiles and the general site preparation for the installation of the OGS stormwater quality device shall conform to highway, State/Provincial or local specifications.

5.2.2 The OGS device shall not be installed on frozen ground. Excavation shall extend a minimum of 12 inch (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

5.2.3 In areas with a high water table, continuous dewatering shall be provided to ensure that the excavation is stable and free of water.

5.3 BACKFILLING

Backfill material shall conform to highway, State/Provincial or local specifications. Backfill material shall be placed in uniform layers not exceeding 12 inches (300 mm) in depth and compacted to highway, State/Provincial or local specifications.

5.4 OGS WATER QUALITY DEVICE CONSTRUCTION SEQUENCE

5.4.1 The precast concrete OGS stormwater quality treatment device is installed and leveled in sections in the following sequence:

- aggregate base
- base slab, or base
- riser section(s) (if required)
- riser section w/ pre-installed fiberglass insert
- upper riser section(s)
- internal OGS device components
- connect inlet and outlet pipes
- riser section, top slab and/or transition (if required)
- frame and access cover

5.4.2 The precast concrete base shall be placed level at the specified grade. The entire base shall be in contact with the underlying compacted granular material. Subsequent sections, complete with oil resistant, watertight joint seals, shall be installed in accordance with the precast concrete manufacturer's recommendations.

5.4.3 Adjustment of the OGS stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections.

Damaged sections and gaskets shall be repaired or replaced as necessary. Once the OGS stormwater quality treatment device has been constructed, any lift holes must be plugged with mortar.

5.5 DROP PIPE AND OIL INSPECTION PIPE

Once the upper precast concrete riser has been attached to the lower precast concrete riser section, the OGS device Drop Pipe and Oil Inspection Pipe must be attached, and watertight sealed to the fiberglass insert using Sikaflex 1a. Installation instructions and required materials shall be provided by the OGS manufacturer.

5.6 INLET AND OUTLET PIPES

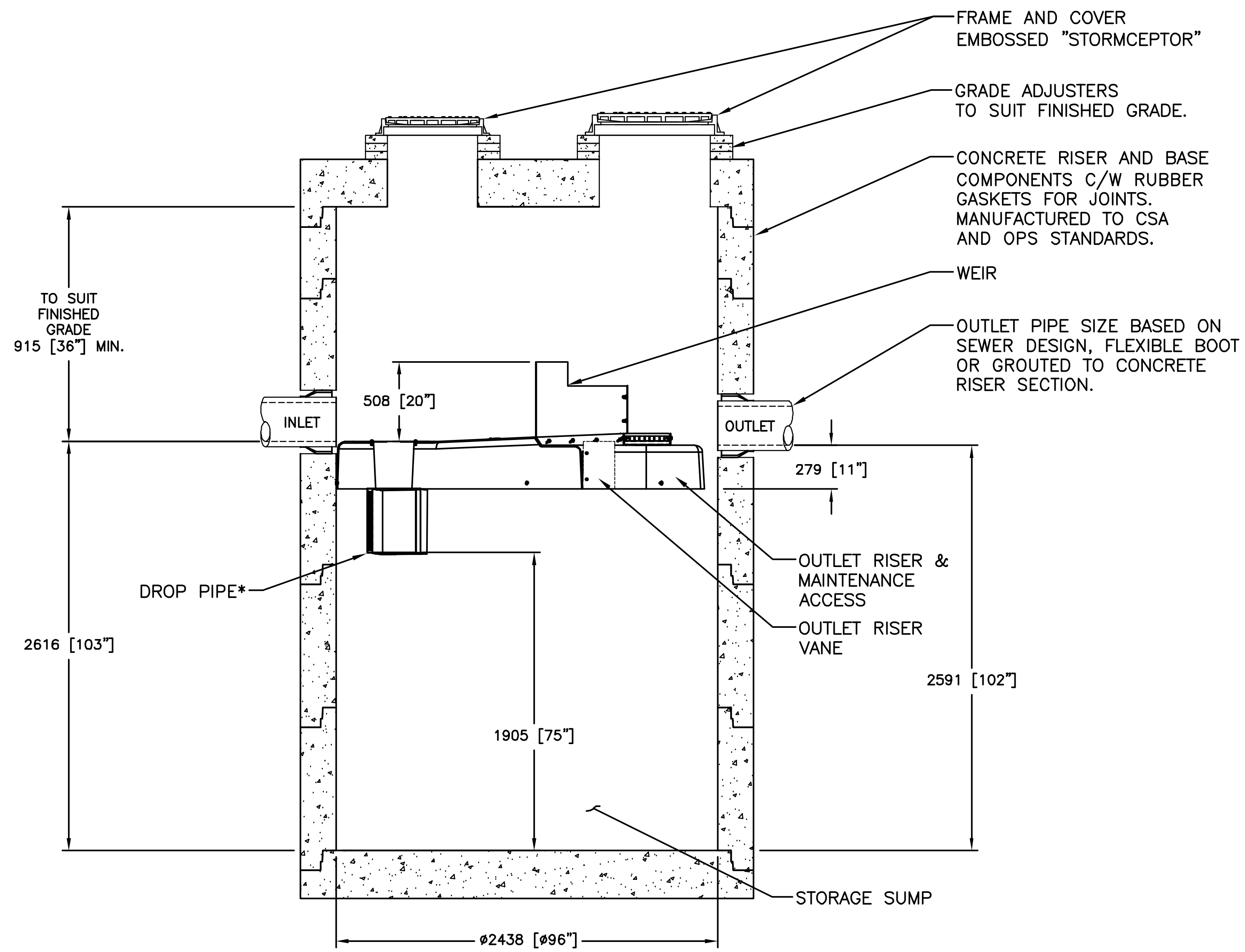
Inlet and outlet pipes shall be securely set using grout or approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight. Non-secure inlets and outlets will result in improper performance.

5.7 FRAME AND COVER OR FRAME AND GRATE INSTALLATION

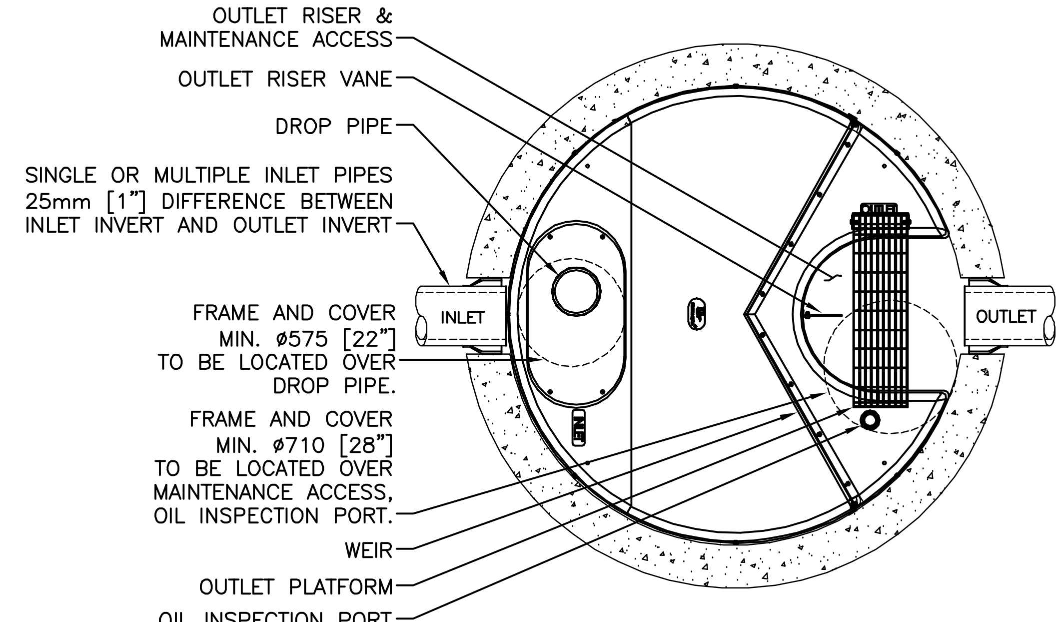
Precast concrete adjustment units shall be installed to set the frame and cover/grate at the required elevation. The adjustment units shall be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover/grate should be set in a full bed of mortar at the elevation specified.

5.7.1 A minimum of one cover, at least 22-inch (560 mm) in diameter, shall be clearly embossed with the OGS device brand or product name to properly identify this asset’s purpose is for stormwater quality treatment.

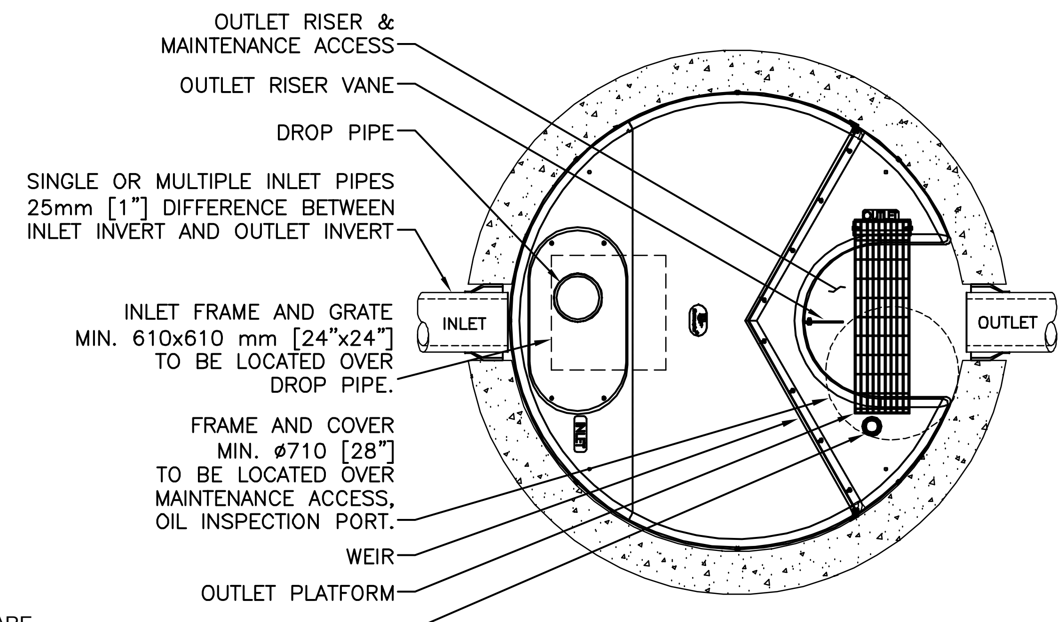
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF8 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO8 (OIL CAPTURE CONFIGURATION).

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EF8
STRUCTURE ID	*
WATER QUALITY FLOW RATE (L/s)	*
PEAK FLOW RATE (L/s)	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
DRAINAGE AREA (HA)	*
DRAINAGE AREA IMPERVIOUSNESS (%)	*

PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

MARK	DATE	REVISION DESCRIPTION	BY
0	5/26/17	INITIAL RELEASE	JSK
1	6/8/18	OUTLET PLATFORM	JSK
####	####	####	####
####	####	####	####
####	####	####	####

Stormceptor® EF

SCALE = NTS

imbrium

DATE: 5/26/2017
DESIGNED: JSK | DRAWN: JSK
CHECKED: BSF | APPROVED: *
PROJECT No.: EF8 | SEQUENCE No.: *
SHEET: 1 OF 1

I:\IMBRIUM\PRODUCTS\STORMCEPTOR EF\40 DRAWINGS & DETAILS\STANDARD DETAILS\EF8-DETAIL.DWG 10/19/2018 8:35 AM

Appendix E

Infiltration Asessment

29 April 2019 Reference No. 11139281-44

Mason Homes Limited
70 Innovator Avenue, Unit #1
Stouffville, Ontario
L4A 0Y2

Dear Ashley Mason:

Re: Infiltration Assessment, Mason Homes
425 King Street East, Cobourg Ontario

1. Introduction

This letter report presents an infiltration assessment of shallow soils located at 425 King Street East in Cobourg. Mason Homes requested information on the infiltration rate of the underlying soil for storm water management. This was carried out at the south central area of the site where an infiltration gallery was proposed and at the eastern boundary of Block 2 where further on site infiltration may be utilized.

2. Soil Classification

On March 13, 2019 GHD observed the advancement of three (3) test holes at 425 King Street East in order to access soil conditions at the site. Test holes were excavated by Behan along the southern portion of the property in the area of the proposed storm water management infiltration gallery and along the eastern boundary where further infiltration measures may be required. The test holes were excavated to a depth of 2.3 metres at the locations shown on Figure 1 and the elevations were estimated using the contours on the site plan.

All the holes encountered a layer of topsoil/earth fill ranging in depths of 0.3 to 0.6 metres. Underlying the topsoil/earth fill was a layer of silty clay, described as firm to stiff and in a moist condition which extended to depths of 1.2 to 1.5 metres. Underlying the silty clay was a layer of sandy silt few clay till, described as compact and in a moist condition. One (1) sample of the silty clay and one (1) sample of the sandy silt few clay were submitted for grain size analysis and the results indicate a composition of 0% gravel, 19% sand, 38% silt and 43% clay sized particles for the silty clay and the gradation of 14% gravel, 26% sand, 50% silt and 10% clay for the sandy silt few clay till. All test holes were terminated within the sandy silt till at a depth of 2.3 m. In test hole TP-3 in the area of the infiltration gallery water seepage was observed at a 2.2 m depth while at test holes TP-1 and TP-2, the test holes were dry at the completion of the excavation.

GHD
347 Pido Road Unit 29 Peterborough Ontario K9J 6X7 Canada
T 705 749 3317 **F** 705 749 9248 **W** www.ghd.com
SMQ ISO 9001:2008

3. Infiltration Testing

Infiltration testing was conducted at all three (3) test pits. Locations of the test pits is shown on the Test Hole Location Plan, Figure 2. Tests were carried out at two depths in each test hole. Infiltration rates are provided in Table 3.1 based on the results of the infiltration testing, our observations and the soils data and are uncorrected as per Table C2 of the TRCA Low Impact Development Stormwater Management Planning and Design Guide.

Table 3.1 Infiltration Testing

Infiltration Location	Depth of Test (m)	Field Saturated Hydraulic Conductivity (cm/sec)	Percolation Time (minutes/cm)	Infiltration Rate (mm/hour)
TP-1	0.9 – 1.2	10^{-05} to 10^{-06}	40	15
TP-1	1.8 – 2.1	10^{-11} to 10^{-12}	100	6
TP-2	0.9 – 1.2	10^{-05} to 10^{-06}	40	15
TP-2	1.8 – 2.1	10^{-06} to 10^{-07}	50	12
TP-3	0.9 – 1.2	10^{-05} to 10^{-06}	40	15
TP-3	1.8 – 2.1	10^{-06} to 10^{-07}	50	12

4. Summary and Conclusions

The results of the excavated test holes, grain size analysis and the infiltration testing indicates that the native soil profile is a silty clay layer overlying a sandy silt till soil. In the infiltration gallery, the shallow soil had an average infiltration rate of 15 mm/hr and the lower layer had an infiltration rate of 12 mm/hr. The consistency of the soil, gradation and infiltration measured relates to a factor of safety from Appendix C of the Low Impact Storm Water Management Planning and Design Guide of 2.5.

We trust this letter report meets with your immediate requirements. Should you have any questions please contact our office.

Sincerely, GHD.

Steve Gagne H.B.Sc.

Andy Fawcett, P.Eng.

LICENSED PROFESSIONAL ENGINEER
29 April 2019
A. F. FAWCETT
PROVINCE OF ONTARIO

gvb/sg/nm/1

Encl.
Test Hole Location Plan
Test Hole Logs
Laboratory Tests

Enclosures

Figure 1
Location Plan

Source: Site Plan from drawing titled "Development Site Plan, 425 King Street, East", dated February 7, 2018, by RFA Planning Consultant Inc. as provided by Client.

0 10 20 30m

Coordinate System:
WGS 1984 UTM Zone 17T

N

GHD

MASON HOMES
425 KING STREET EAST, COBOURG, ON
INFILTRATION ASSESSMENT

TEST HOLE LOCATION PLAN

11139281-44

Apr 22, 2019

FIGURE 1

CAD File: I:\Geo-Logic General\2017\Projects\B - Testing and Inspections\11139281 Andy Fawcett General Number\44 Mason, King Street, Cobourg\AutoCAD\11139281-44, 19-04-22, Test Hole Location Plan, ss.dwg

Attachment A
Test Pit Logs

REFERENCE No.: 11139281-44

ENCLOSURE No.:

TEST PIT No.:	TP-1	TEST PIT REPORT
ELEVATION:	Existing Grade	Page: 1 of 1

CLIENT: Mason Homes

PROJECT: Mason Homes, King St E, Cobourg

LOGGED BY: K. Geraldi

DATE: 13 March 2019

EXCAVATION COMPANY: Client

METHOD: Backhoe

NOTES:

LEGEND

- GS - GRAB SAMPLE
- ▼ - WATER LEVEL

UTM: 17T 0728950E 4871785N

Shear test (Cu) △ Field; Sensitivity (S) □ Lab; ○ Water content (%); w_p w_l Atterberg limits (%); 10 20 30 40 50 60 70 80 90

m Below Existing Grade	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Vapours (ppm)	COMMENTS
0.0	GROUND SURFACE				
	TOPSOIL (300 mm)	GS-1	--	--	
0.30	**SILTY CLAY** - Brown Silty Clay with Sand, Moist, Compact	GS-2	--	--	GS-2: 0% Gravel, 19% Sand, 81% Silt/Clay
1.22	**TILL** - Brown Silty Sand With Clay, Gravel, Moist, Compact	GS-3	--	--	
1.83	END OF TEST PIT				No Groundwater Seepage Encountered

Depth scale: ft 1–7; m 0.5, 1.0, 1.5, 2.0

REFERENCE No.: 11139281-44

ENCLOSURE No.:

GHD	**TEST PIT No.:** TP-2 **ELEVATION:** Existing Grade	**TEST PIT REPORT** Page: 1 of 1

CLIENT: Mason Homes

PROJECT: Mason Homes, King St E, Cobourg

LOGGED BY: K. Geraldi

DATE: 13 March 2019

EXCAVATION COMPANY: Client

METHOD: Backhoe

NOTES:

LEGEND

▨ GS - GRAB SAMPLE

▼ - WATER LEVEL

UTM: 17T 0728973E 4871739N

Depth (ft)	Depth (m)	m Below Existing Grade	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Vapours (ppm)	COMMENTS
		0.0	GROUND SURFACE				
			TOPSOIL Topsoil and Earth Fill	GS-1	--	--	
2		0.61	**SILTY CLAY** - Brown Silty Clay With Sand and Gravel, Moist, Compact	GS-2	--	--	
4		1.22	**TILL** - Brown Silty Sand With Clay, Gravel and Cobbles, Moist, Compact	GS-3	--	--	GS-3: 18% Gravel 44% Sand 38% Silt/Clay
6		1.83	END OF TEST PIT				No Groundwater Seepage Encountered

Depth scale: ft 1, 2, 3, 4, 5, 6, 7; m 0.5, 1.0, 1.5, 2.0

Shear test (Cu) / Sensitivity (S): △ Field □ Lab

○ Water content (%)

w_p w_l Atterberg limits (%)

10 20 30 40 50 60 70 80 90

TEST PIT LOG ENVIRO 11139281-44, 19-03-14, TEST PIT LOGS, KG.GPJ GEOLOGIC.GDT 8/5/19

REFERENCE No.: 11139281-44

ENCLOSURE No.:

TEST PIT No.: TP-3

ELEVATION: Existing Grade

TEST PIT REPORT

Page: 1 of 1

CLIENT: Mason Homes

PROJECT: Mason Homes, King St E, Cobourg

LOGGED BY: K. Geraldi

DATE: 13 March 2019

EXCAVATION COMPANY: Client

METHOD: Backhoe

NOTES:

LEGEND

▨ GS - GRAB SAMPLE

▼ - WATER LEVEL

UTM: 17T 0728940E 4871725N

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
w_p w_l Atterberg limits (%)

Depth (ft)	Depth (m)	m Below Existing Grade	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Moisture Content (%)	Vapours (ppm)	COMMENTS
		0.0	GROUND SURFACE				
			TOPSOIL Topsoil and Earth Fill	GS-1	--	--	
2		0.61	**SILTY CLAY** - Brown Silty Clay With Sand and Gravel, Moist, Compact	GS-2	--	--	Seepage Encountered at 1.2m
5		1.52	**TILL** - Brown Silty Sand With Clay, Gravel and Cobbles, Moist, Compact	GS-3	--	--	
6		1.83	END OF TEST PIT				

Depth scale: ft 1, 2, 3, 4, 5, 6, 7; m 0.5, 1.0, 1.5, 2.0. Shear test scale: 10 20 30 40 50 60 70 80 90

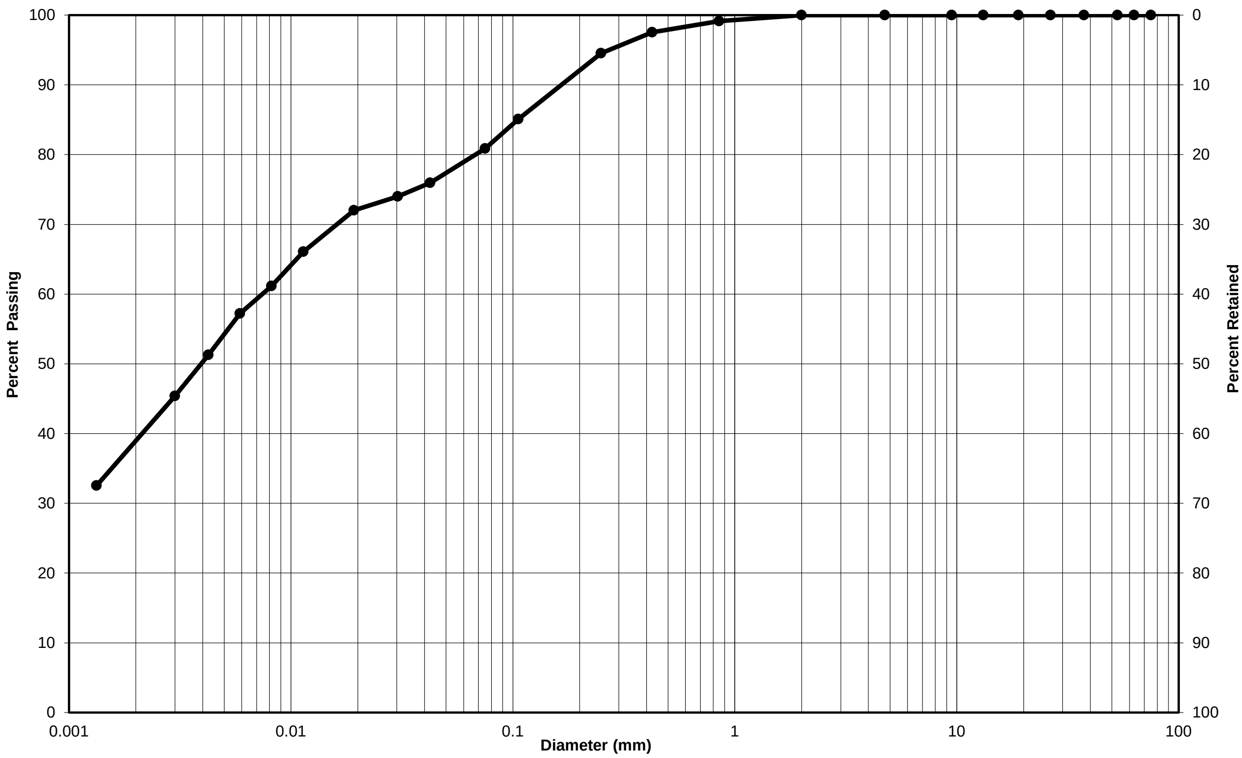
TEST PIT LOG ENVIRO 11139281-44, 19-03-14, TEST PIT LOGS, KG.GPJ GEOLOGIC.GDT 8/5/19

Attachment B
Laboratory Data

Particle-Size Analysis of Soils (Geotechnical)
(USCS) (ASTM D422)

Client:	Mason Homes	**Lab no.:**	SS-19-11
Project/Site:	King Street E., Cobourg	**Project no.:**	11139281-44

Borehole no.:	TP-1	Sample no.:	GS-2
Depth:	2'	Enclosure:	



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

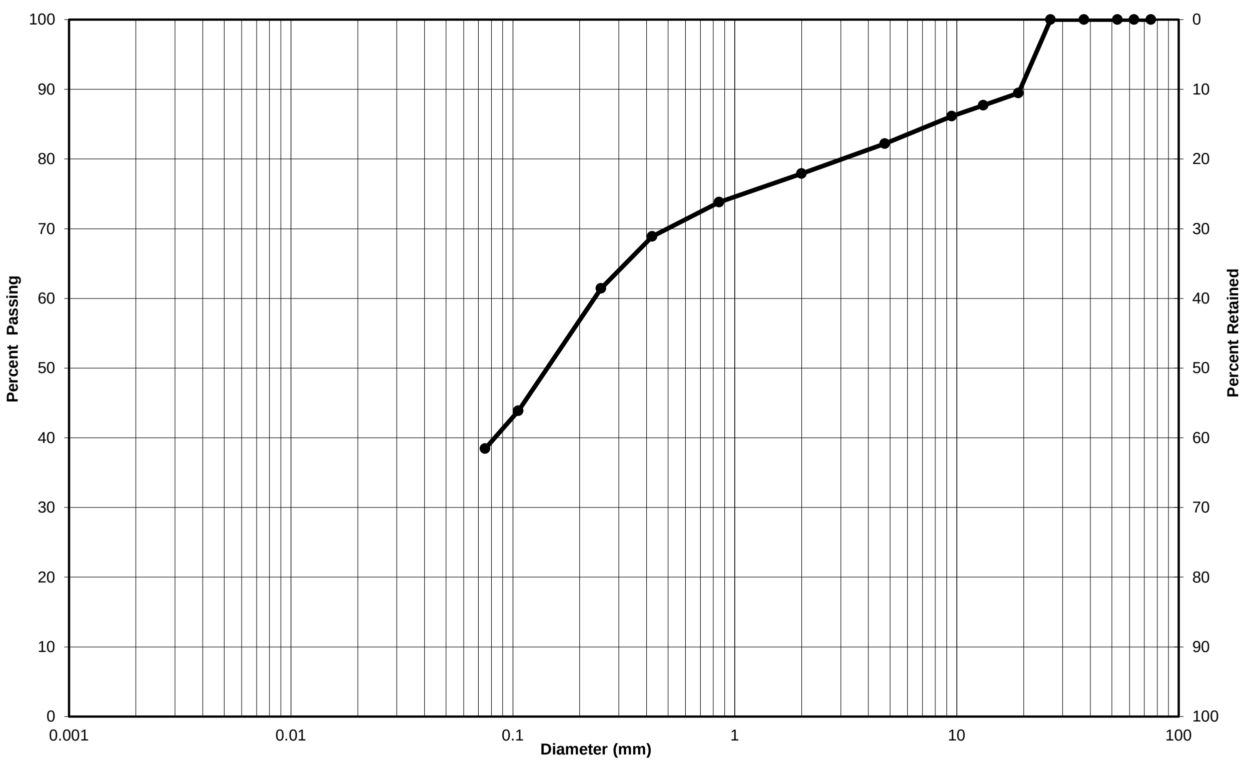
Soil Description	Gravel	Sand	Clay & Silt
	0	19	81

Remarks:

Performed by:	J. Sullivan	**Date:**	March 22, 2019
Verified by:		**Date:**	March 22, 2019

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Mason Homes	**Lab no.:**	SS-19-11
Project/Site:	King Street E, Cobourg	**Project no.:**	11139281-44
Borehole no.:	TP-2	Sample no.:	GS-3
Depth:	6'	Enclosure:	



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel	Sand	Clay & Silt
	18	44	38

Remarks:

Performed by:	J. Sullivan	**Date:**	March 22, 2019
Verified by:		**Date:**	March 22, 2019

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