FUNCTIONAL SERVICING AND
STORMWATER MANAGEMENT REPORT
REACH STREET LANDS
VENETIAN GROUP LTD.
TOWNSHIP OF UXBRIDGE

Prepared for:	Venetian Group Ltd. 110 Konrad Crescent, Unit 6 Markham, Ontario L3R 9X2
Prepared by:	Sabourin Kimble & Associates Ltd. 110 Old Kingston Road Ajax, Ontario L1T 2Z9
Project No.:	17:386:P1
Date:	April, 2018

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1. INTRODUCTION

Sabourin Kimble & Associates Ltd. have been retained by Venetian Group Ltd. to carry out a Functional Servicing Report (FSR) in support of the redevelopment of the lands at 231 to 249 Reach Street in the Township of Uxbridge. The subject site is located on the north side of Reach Street just east of Coral Creek Crescent/Testa Road, as shown in Figure 1.0.

The purpose of this FSR is to provide municipal servicing and stormwater management information to address site grading, storm drainage, sanitary drainage, water supply and stormwater management for the proposed development.

STUDY AREA

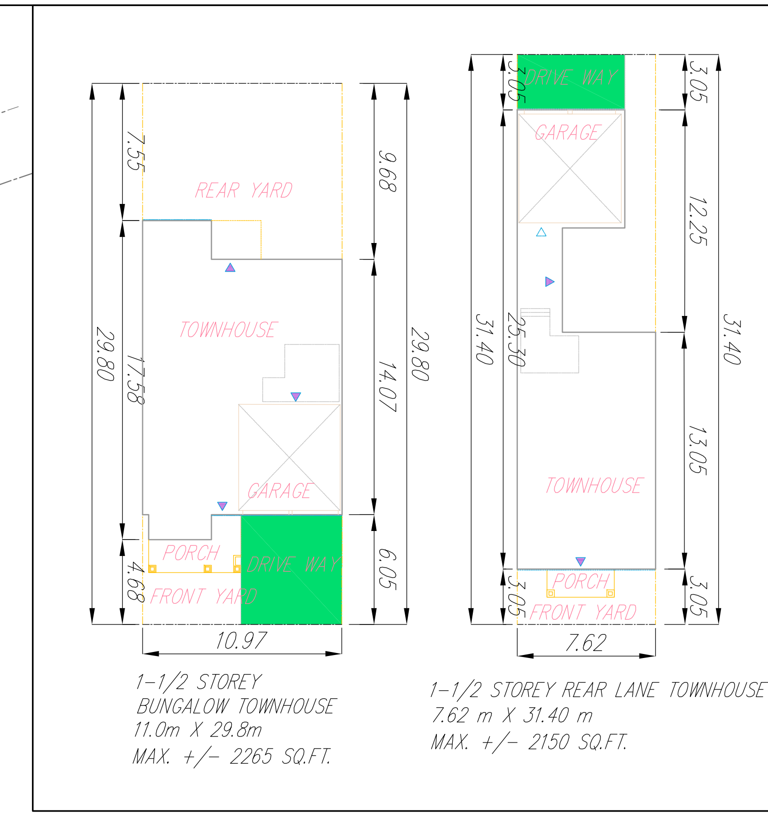
SABOURIN KIMBLE
& ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NO.
17:386	1

2. DEVELOPMENT CONCEPT

As shown in Figure 2, the proposed development contemplates the redevelopment of six (6) existing single family residential units (231, 235, 237, 241, 245 and 249 Reach Street) into a 61 unit townhouse development. The proposed townhouse units will be a bungalow style with the garage at grade and various types of amenity areas. The units around the perimeter (blocks 1 through 7) will front onto the interior road with the garage facing the road. Interior blocks 8 and 9 will front onto one interior road with the garage at the rear fronting another interior road. Blocks 10 through 12 will front onto Reach Street with the garage in the rear fronting onto an interior road.

There are two (2) woodlot areas that will be protected and preserved as identified through an Environmental Impact Study prepared by Beacon Environmental Limited.



SCALE 1:1250

DEVELOPMENT CONCEPT

SABOURIN KIMBLE & ASSOCIATES LTD.
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PROJECT NUMBER	FIGURE NO.
17:386	2

CAD FILE: P:\17\386\Drawing Files\Phase I\Figures\386 Fig 2 - Development Concept.dwg

3. MUNICIPAL SERVICES

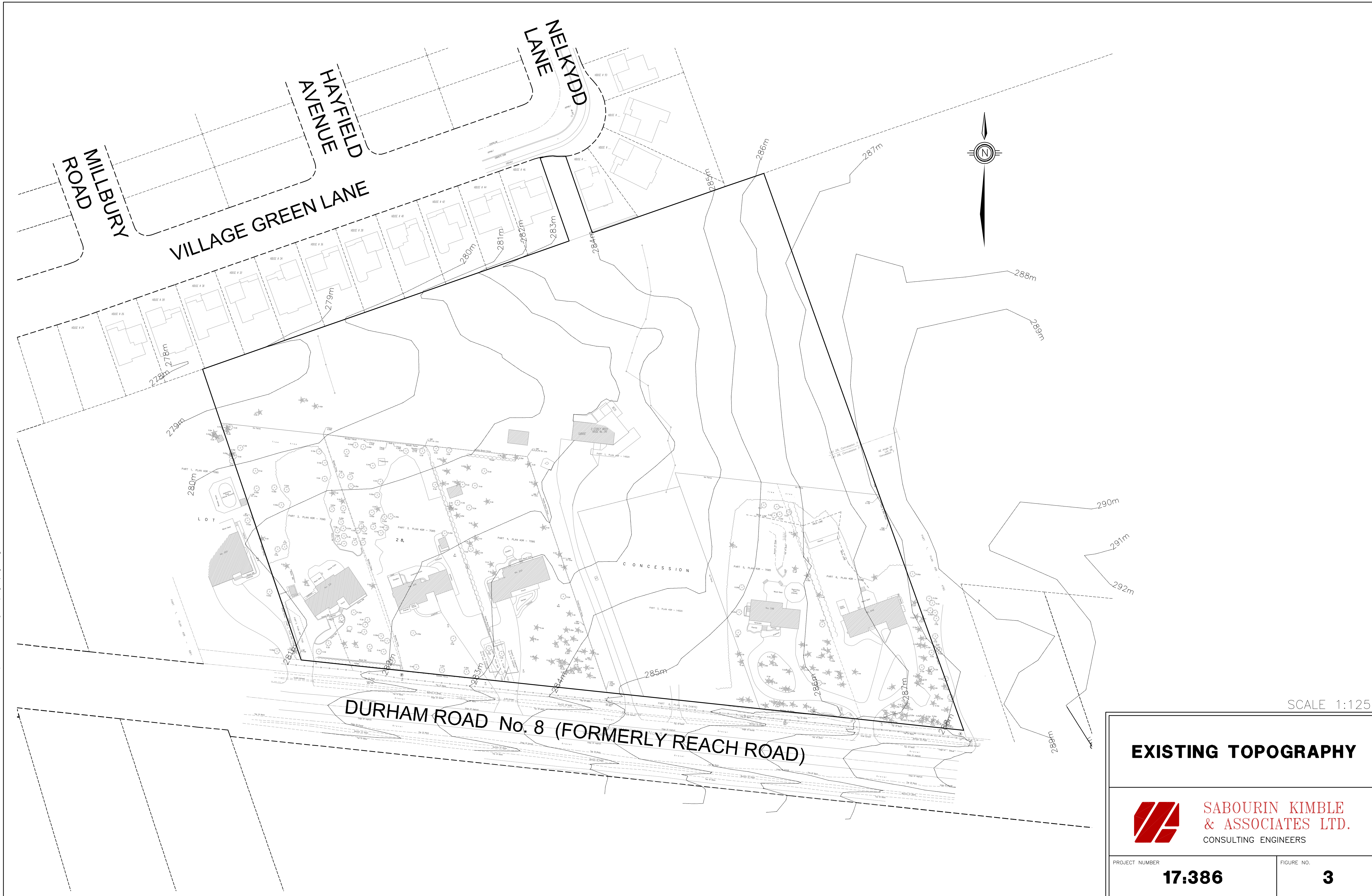
3.1 Site Grading

3.1.1 Existing Conditions

As shown in Figure 3, the entire subject site has a grade separation of approximately nine (9) metres from the southeast to northwest limits of the site. The existing residential lots are all lower than the centre-line grades of Reach Street. Surface runoff from Reach Street is separated from the drainage on the lots by an existing ditch flowing in a westerly direction along the north boulevard. Small portions of the boulevard flow into the lots and overland toward the northwest. Ultimately, overland drainage is conveyed to the rear lot lines of the subdivision to the north and is taken into the storm drainage system of the residential lots fronting onto Village Green Lane.

3.1.2 Proposed Grading

As shown in Figure 4 (back pocket) specific grading is required to support the development concept. As required by the Region of Durham, property line grades have been established as 0.3 metres above the existing centre-line of road grade for Reach Street to allow for future urbanization. This requirement, along with the desired unit types influences the grading of Street A. The remaining interior roads have been graded to collect at a low point adjacent to the proposed woodlot at the northwest limit of the site. The capacity of the downstream storm drainage system is limited and as such, it is proposed to capture all overland flows in this location and convey them to the outlet via the storm sewer system. Further details are provided in the following sections of this report. Based on the development concept and the proposed road grades, finished floor elevations have been established resulting in a varying number of risers throughout the proposed development. The Architect for the subject site (Hunt Design Associates Inc.) will ultimately adjust the number of risers and unit mix to reflect the ultimate grading of the site.



EXISTING TOPOGRAPHY

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NO.
17:386	3

The interior road and units have been graded to contain the majority of the drainage within the site. The coverage on the site is quite extensive and as a result, a number of retaining walls are required to match existing grades at the western woodlot and the existing lots along the north limit. Anticipated top of wall and bottom of wall elevations have been shown on the grading plan. Similar grading challenges have been identified along the limit of the woodlot to the east. It is proposed to match proposed lot grades to existing grades with 3:1 sloping located within the buffer of the woodlot.

3.2 Storm Drainage

3.2.1 Existing Conditions

As outlined in Section 3.1.1, the entire site contributes overland drainage to the existing storm sewer system on Village Green Lane via a rear yard catchbasin located at the northwest limit of the site. In addition to the 3.62 hectares of drainage area from the subject site, an external area of 1.44 hectares to the east of the site also contributes overland drainage to the outlet. Refer to the storm drainage plan provided in Appendix A.

In the storm sewer design for the Estates of Avonlea subdivision to the north, an allowance for uncontrolled flow of approximately 0.38 hectares at a runoff coefficient of 0.35 from the subject site was provided for in the Village Green Lane storm sewer. Refer to the Burnside storm drainage plan in Appendix A (total drainage area 0.58 ha at 0.35). That development has also sized the municipal storm sewers and communal Stormwater Management Pond to accommodate the site using a runoff coefficient of 0.45 and an overall area of 1.65 ha. A servicing block at the northeast corner of the site connects to Village Green Lane. The allowable storm discharge from the site is 221 l/s and 414 l/s for the 5 year and 100 year storms respectively as shown on the Avonlea Estates storm drainage plan (Appendix A). Therefore, adequate stormwater management controls must be implemented on the subject site to meet the downstream capacity constraints. The details of those controls are outlined in the following sections.

3.2.2 Proposed Storm Servicing

As shown in Figure 5 (back pocket) the entire site will be serviced by a storm sewer system which outlets to the existing 525mm diameter storm sewer on Nelkydd Lane. The internal storm sewers have been sized to convey the 5 year and 100 year storm flows to the outlet of the site. A runoff coefficient of 0.75 for the multi-family residential portion of the site and 0.25 for the remaining open space plus the external drainage area was applied as per the Township of Uxbridge design criteria. The site storm drainage will be controlled to a maximum flow of 221 l/s for the 5 year storm and 414 l/s for the 100 year storm as per the requirements of the downstream storm drainage system. Details of the stormwater management controls are provided in Section 4.0 of this report.

Overland drainage from the rear yards of blocks 1, 2, and 3 plus 75% of the roof area from Block 3 will discharge to the existing woodlot at the northwest corner and outlet to the existing rear yard catchbasin within the downstream subdivision. The combined coverage and drainage area is equal to that anticipated in the Village Green Lane design as outlined in the supporting design calculations (Appendix A).

A preliminary storm sewer design sheet and storm drainage plan have been provided in Appendix A.

3.3 Sanitary Drainage

As shown in Figure 5, the entire site will be serviced internally by 200mm diameter sanitary sewers which will flow by gravity and outlet to the existing 200mm diameter sanitary sewer on Nelkydd Lane. The resulting peak sanitary flow is 2.98 l/s with a contributing population of 183 persons. The downstream sanitary sewer provided a capacity allowance of 1.65 l/s with a population of 77 persons. Review of the existing downstream system identified a maximum residual capacity of 2.35 l/s at existing manhole 17-17. The residual capacity within the system will accommodate the additional flow generated from the proposed development. A preliminary sanitary sewer design sheet and assessment of downstream residual capacity is provided in Appendix B.

3.4 Water Supply

As shown in Figure 5, the subject site will be serviced with a private domestic watermain and a private fire main from the existing Region of Durham watermain located on Village Green Lane. These private watermains will be distributed through a proposed mechanical room designed to Region of Durham standards which will house a domestic water meter and a double check valve assembly on the fire main. The fire main will extend through the site to strategic hydrant locations to provide adequate fire protection for the site. Individual domestic connections will be provided to each unit.

4. STORMWATER MANAGEMENT

4.1 Stormwater Management Criteria

4.1.1 Overall Stormwater Management Criteria

The stormwater management approach for the site must meet the overall stormwater management criteria as established by the Lake Simcoe Region Conservation Authority and Township of Uxbridge as summarized in Table 1.

TABLE 1
Overall Stormwater Management Criteria

Control	Criteria
Water Quality	Enhanced fisheries protection as outlined in the MOE Stormwater Management Practices Planning and Design Manual. Minimize phosphorous loading according to the Lake Simcoe Protection Plan.
Erosion Control	Detention of the 25mm 4 hour Chicago storm runoff for a minimum of 24 hours.
Water Quantity	Control post development flows to pre-development levels for the 2 through 100 year storms.
Water Balance	Maintain the pre-development water balance under post development conditions.

Given the existence of the downstream stormwater management facility, water quantity controls to meet the restrictions of the downstream receiving sewers will be required.

4.1.2 LID Guidelines

In April 2015, LSRCA published the Lake Simcoe Watershed LID SWM Guidelines for Municipalities. The main objective of the guideline is to identify minimal impact design standard approaches for Low Impact Development stormwater management techniques. Much of the document is focused on better site design techniques to control and reduce runoff volume from any given development site. A number of stormwater volume reduction performance goals are identified in the document with the following goal outlined for new development:

For new, nonlinear developments that create more than 0.5 hectares of new impervious surface on sites without restrictions, stormwater runoff volumes will be controlled and the post-construction runoff volume shall be retained on site from runoff of the first 25 mm of rainfall from all impervious surfaces on the site.

4.2 Stormwater Management Concept

The stormwater management approach has been developed to reflect the LID Guidelines and the infiltration capacity of the site and provide infiltration capacity for the 25mm storm runoff volume from impervious surfaces. It is proposed that these works will adequately address the overall stormwater management criteria for water quality control and erosion control as outlined in Table 1. Additional water quantity storage will be provided to adequately address the limited capacity of the downstream receiving system.

Infiltration galleries combined with perforated storm sewers plus rear yard infiltration swales will provide sufficient infiltration capacity as shown in Figure 6 (back pocket). Four (4) distinct infiltration systems will be provided throughout the site. Rear yard LID areas 1 and 2 will overflow into the perforated storm sewer system for additional controls. Rear yard LID area 3 will outlet to the existing woodlot when the infiltration capacity is reached. The internal perforated pipe system is completely linked and dendritic in nature to provide adequate infiltration capacity for the remainder of the site. The infiltration capabilities of the granular cisterns will be supplemented by extra depth topsoil (0.3 m minimum) on all lawn and landscaped areas.

Flows in excess of the 25mm runoff event up to the 100 year storm event will be controlled for water quantity purposes by orifice plates located in the downstream most manhole. The water quantity storage volume will be provided in a portion of the contributing storm sewer system plus a centralized open bottom underground stacked storage system (Stormchamber) located at the site outlet.

Allowable release rates, post development flows and runoff volumes have been evaluated at the site outlet. The technical details of the proposed stormwater management system are provided in the following sections.

4.3 Supporting Study

In April, 2018, Palmer Environmental Consulting Group Inc. completed a detailed hydrogeologic investigation on the site which included six (6) boreholes with three (3) monitoring wells. Boreholes were drilled to depths of up to 8.0 metres. Through the monitoring period the boreholes and monitoring wells remained dry. The report estimated that based on surrounding well records, the groundwater level would be in the order of 13.0 metres below grade. The monitoring is on-going and will be updated as the development process proceeds. These ground water elevations were considered to be stable winter conditions. The report identified that seasonal variations of 1-2 metres may be expected.

A representative percolation rate was determined empirically based on the geometric mean of hydraulic conductivity valuations for two (2) locations within the site. The resulting representative infiltration rate was determined to be 72 mm/hr and was subject to a safety factor of 2.5. Therefore, a percolation rate of 28.8 mm/hr was utilized in the preliminary design of the LID system. As the design process advances and elevation/location details for each LID are verified, in-situ field percolation rate tests will be conducted.

4.4 Stormwater Quality/LID Controls

Water quality and infiltration facilities have been provided in four (4) distinct systems as shown in Figure 6. Runoff from 75% of the roof area within rear yard LID areas 1 through 3 will be directed to the surface at the rear of each housing unit. This runoff will combine with overland flow from the rear yards and discharge to swales located along rear property line. The flow from the swales will be captured by rear yard catchbasins and discharged into a granular trench located beneath the swale. The granular trenches have been designed with sufficient storage volume to accommodate the equivalent of 25mm of runoff from the contributing roof areas.

Sufficient contact area has been provided to accommodate draindown of the storage volume within a 24 hour period. An overflow outlet will be provided on each granular gallery should they become full. Rear yard LID areas 1 and 2 will overflow into the storm sewer system within the road for further water quantity control. Rear yard LID area 3 will overflow into the woodlot located at the northwest limit of the site. A detail of the rear yard LID system is provided in Figure 6.

The remainder of the site will contribute runoff to an internal perforated storm sewer and centralized storage facility with sufficient granular storage capacity to accommodate 25mm of runoff from the remaining roof areas and all of the surface impervious areas (roadways and driveways). Granular galleries will be provided at the bottom of the perforated sewers and under the centralized storage area. The galleries are proposed in a dendritic fashion following the storm sewer routing such that continuous storage volume is always available. It is proposed that the remaining front roof areas (25%) of the units adjacent to rear yard LID's 1 through 3 (75% to the rear yard LID's) plus 100% of the remaining roof areas be directly connected to the perforated storm sewer system. Road drainage will be captured via catchbasins in a conventional manner with pre-treatment of the flows with localized goss traps in the catchbasins or centralized oil/grit separators. The granular galleries under the roadway have been designed with sufficient contact area to ensure a draindown time of 24 hours. The draindown time of the granular under the centralized open bottom facility is in the order of 42 hours. A detail of the perforated storm sewer granular galleries is provided in Figure 6.
The contributing drainage areas and corresponding storage volumes are summarized in Table 2.

TABLE 2 WATER QUALITY/INFILTRATION VOLUMES				
Drainage Area	**Total Contributing Drainage Area (ha)**	**Total Impervious Area (ha)**	**Required Storage Volume (m^3)**	**Storage Volume Provided (m^3)**
*Rear Yard LID 1	0.14	0.06	13.8	17.1
**Rear Yard LID 2	0.35	0.18	44.7	47.0
Rear Yard LID 3	0.14	0.07	17.2	19.7
Perforated Storm Sewers &Central Facility	1.93	1.57	383.4	391.6

**External area contributing to the LID but not included in the calculation is 1.0 ha from outside of subject property.*
***External area contributing to the LID but not included in the calculation is 0.83 ha of woodlot from within subject site and 0.44 ha from outside of the subject site.*

Calculations in support of the water quality/infiltration design are enclosed in Appendix C.

4.5 Stormwater Quantity Controls

It is assumed that the water quality/infiltration works provided will adequately address all water quality and erosion control requirements for the site. Any flow in excess of these systems will be conveyed by the storm sewers to water quantity control orifice plates located in manhole 24. Any major system flows remaining on the surface will collect at the centralized low point, be captured into the storm sewer system and will also be conveyed to manhole 24. A 222mm and 318mm diameter orifice plate combination will control the discharge from the developed area such that post development flows meet the 5 year storm flow target of 221 l/s and the 100 year storm flow target of 414 l/s. The orifice plate controls result in a maximum 100 year storm storage volume of 575 cubic metres at a maximum ponding elevation of 279.55 metres. The storage volume will be provided within 900mm diameter storm sewers within the development and in a Stormchamber open bottom stacked storage system located at the north limit of the site. The resultant storage volume and ponding elevations for each return period storm are summarized in Table 3.

TABLE 3 WATER QUANTITY STORAGE VOLUMES				
Storm	**Maximum Water Surface Elevation (m)**	**Storage Volume in Storm Sewer System (m^3)**	**Storage Volume in Stormchamber System (m^3)**	**Total Storage Volume (m^3)**
5 year	278.6	87.6	222.4	310
100 year	279.55	177.8	397.2	575

Calculations in support of the water quantity control system are enclosed in Appendix D.

5. EROSION AND SEDIMENTATION CONTROL MEASURES

During construction of any portion of the subject lands adequate erosion and sedimentation controls must be implemented to safeguard them against potential impacts. In support of the detailed design for any development proposal, a comprehensive construction erosion and sedimentation control plan should be prepared. This plan should detail the works proposed to control erosion on-site and sediment transport from the site to match or exceed current Municipal and Provincial standards. Works such as sediment control fencing, controlled stripping/earthworks practices, undisturbed buffers, filter strips, catchbasin silt sacks and catchbasin/storm sewer sediment traps should be implemented. Specific sedimentation control measures must be designed to safeguard the infiltration facilities from plugging with construction sediment. In support of the erosion and sedimentation control, a construction implementation plan and maintenance protocol should also be established.

The design of the sediment control plan, construction implementation plan and maintenance protocol should be completed in accordance with the Township of Uxbridge guidelines and the Greater Golden Horseshoe Conservation Authorities Erosion and Sediment Control Guideline for Urban Construction.

Sedimentation control practices will be implemented for all construction activities within the Study Area, including tree removal, topsoil stripping, underground sewer construction, road construction and house construction. Sedimentation control measures are to be installed and operational prior to any construction activity, and are to remain in place until such time as the residential dwellings are constructed and the lot grading complete with established sod.

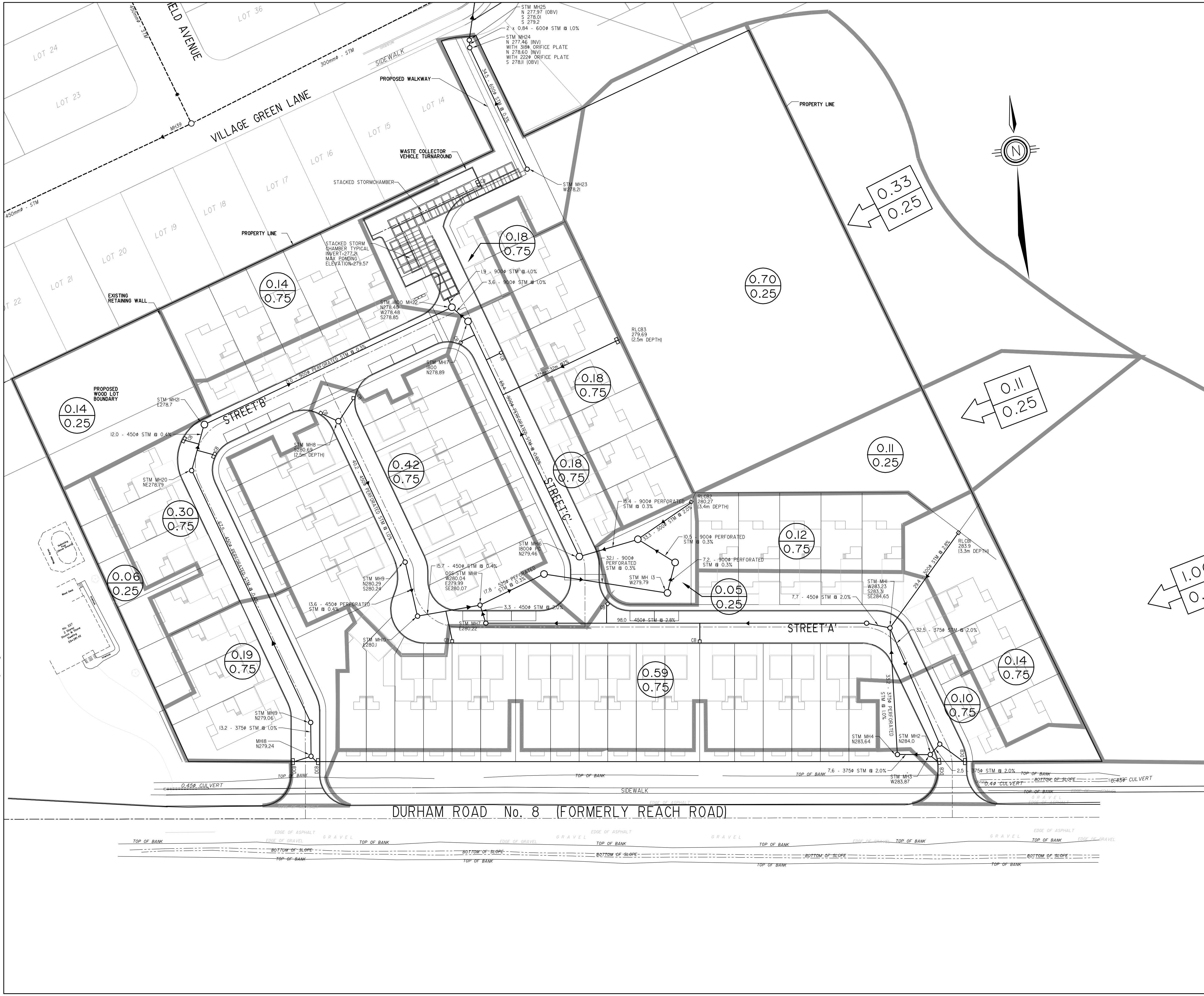
6. CONCLUSIONS

Based on the findings of this Functional Servicing Report, the following conclusions were reached:

- The subject lands should be developed as townhouse residential land use.
- The style of development requires specific grading that may be accommodated on this site.
- There is sufficient capacity in the downstream sanitary sewers and water supply to adequately service the proposed development.
- The proposed infiltration works and the existing soil characteristics provide sufficient capacity to retain and infiltrate the runoff volume from a 25mm design storm over the contributing impervious area.
- The water quantity storage system provided will control post development flows to specific flow targets at the site outlet.

APPENDIX A

Storm Sewer Design



LEGEND

- 0.99 / 0.45 – AREA IN HECTARES – RUNOFF COEFFICIENT
- STORM DRAINAGE BOUNDARY
- EXTERNAL DRAINAGE AREA 0.11 / 0.25 – AREA IN HECTARES – RUNOFF COEFFICIENT
- DIRECTION OF SEWER FLOW PROPOSED

STORM DRAINAGE

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NO.
17:386	STM

CAD FILE: P:\17\386\Drawing Files\Phase 1\Figures\386 Base - Servicing.dwg

STORM SEWER DESIGN SHEET
5 YEAR, 25 YEAR, AND 100 YEAR STORMS
TOWNSHIP OF UXBRIDGE

STREET	Upstream MH	Downstream MH	A at R=0.25 (ha) *"Parks"*	A at R=0.45 (ha) *"Single-Fam"*	A at R=0.75 (ha) *"Townhouses"*	A at R=0.85 (ha) *"Paved Areas"*	A x R this section (ha)	Acc. AR (ha)	t (min)	I (5yr) (mm/hr)	Q (5yr) (l/s)	I (25yr) (mm/hr)	Q (25yr) (l/s)	I (100yr) (mm/hr)	Q (100yr) (l/s)	Pipe	Pipe (mm)	Grade (%)	Capacity (l/s)	Velocity (m/s)	Length (m)	Time (min)	Total Time (min)	Downstream Invert	Upstream Invert	% Capacity
Street A	1 (SE)	1 (W)			0.1		0.075	0.075	10.00	107.01	22.29	154.64	32.22	200.63	41.80	METRIC	300	1.00	96.70	1.37	32.5	0.40	10.40		0.33	23.1%
Street A	RLCB1	1 (W)	1		0.14		0.355	0.355	10.00	107.01	105.52	154.64	152.49	200.63	197.85	METRIC	300	2.80	161.81	2.29	30.0	0.22	10.22		0.84	65.2%
Street A	1 (W)	11			0.59		0.443	0.873	10.40	104.83	254.07	151.28	366.65	196.44	476.10	IMPERIAL	450	2.80	497.70	3.03	105.0	0.58	10.97		2.94	51.0%
Street A	8	11			0.42		0.315	0.315	10.00	107.01	93.63	154.64	135.31	200.63	175.55	IMPERIAL	450	0.40	188.11	1.15	72.0	1.05	11.05		0.29	49.8%
Street B	18	19			0.19		0.143	0.143	10.00	107.01	42.36	154.64	61.21	200.63	79.42	IMPERIAL	450	0.40	188.11	1.15	30.0	0.44	10.44		0.12	22.5%
Street B	19	22			0.30		0.225	0.368	10.44	104.62	106.80	150.95	154.09	196.02	200.11	IMPERIAL	900	0.30	1034.42	1.58	133.0	1.41	11.84		0.40	10.3%
Street C	RLCB2	11	0.27		0.12		0.158	0.158	10.00	107.01	46.82	154.64	67.65	200.63	87.78	METRIC	300	2.00	136.76	1.93	40.0	0.34	10.34		0.80	34.2%
Street C	RLCB3	11	1.03		0.18		0.393	0.393	10.00	107.01	116.67	154.64	168.60	200.63	218.74	METRIC	300	2.00	136.76	1.93	32.0	0.28	10.28		0.64	85.3%
Street C	11	22			0.18		0.135	1.873	10.97	101.83	529.69	146.67	762.90	190.67	991.76	IMPERIAL	900	0.84	1730.92	2.64	73.0	0.46	11.43		0.61	30.6%
Street C	22	24			0.18		0.135	2.375	11.84	97.66	644.32	140.29	925.54	182.65	1204.99	IMPERIAL	900	1.00	1888.59	2.88	40.0	0.23	12.08		0.40	34.1%

PROJECT :	Reach Street
PROJECT NUMBER :	17:386
CLIENT :	
DATE :	Novemeber 2017

NOTES

Town IDF Curve:

$$I_{5YR} = \frac{904}{(t+5)^{0.7880}}$$

$$I_{25YR} = \frac{1234}{(t+4)^{0.787}}$$

$$I_{100YR} = \frac{1799}{(t+5)^{0.810}}$$

Regional IDF Curve:

$$I_{10YR} = \frac{3454}{(t+20)}$$

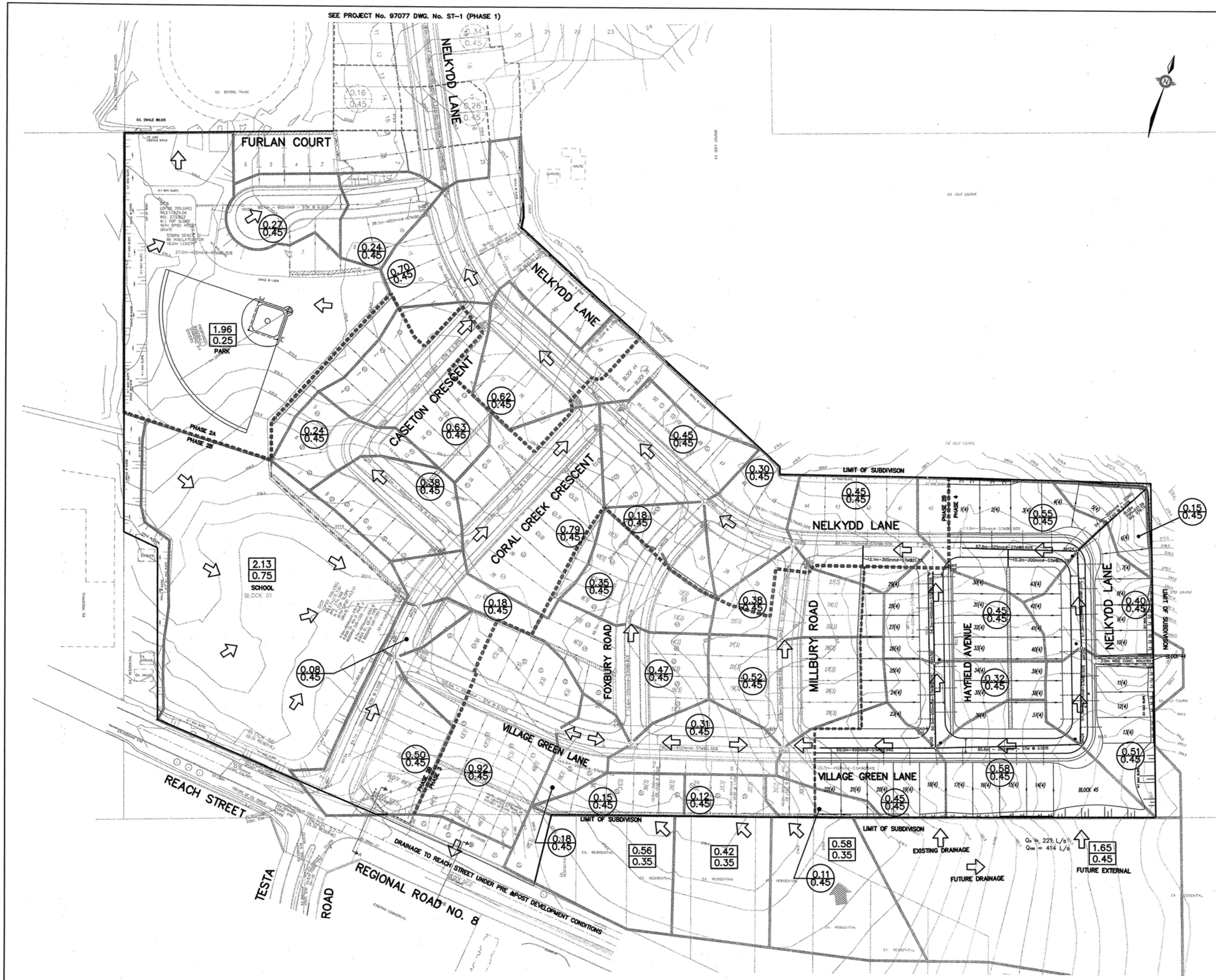
$$I_{25YR} = \frac{3454}{(t+20)} \times 1.1$$

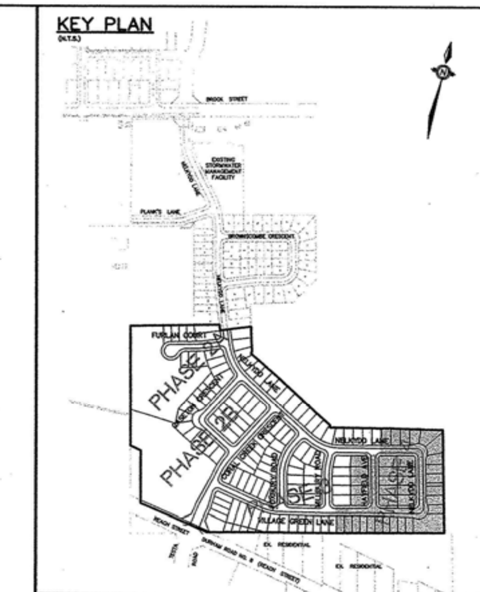
$$I_{100YR} = \frac{3454}{(t+20)} \times 1.25$$

Designed: KLD

Checked: AK

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS





ESTATES OF AVONLEA
PHASE 4

LEGEND

PROPOSED STORM SERVICE

0.35 — DRAINAGE AREA (Ha)
0.45 — RUNOFF COEFFICIENT

0.87 — EXTERNAL DRAINAGE AREA (Ha)
0.45 — EXTERNAL RUNOFF COEFFICIENT

⇨ MAJOR SYSTEM

⊘ UNITS WITH WEEPING TILE SUMP AND SUMP PUMP DISCHRGING TO SPLASHPAD IN SIDEYARD

ISSUED FOR CONSTRUCTION

NOTE:
ORIFICE PLATES TO BE INSTALLED ON ALL STREET CATCHBASIN LEADS IN PHASES 2,3 &4. ORIFICE PLATES TO BE SCEPTER TYPE 'A' OR APPROVED EQUAL. REFER TO DETAIL ON DRAWING CD-1.

NO.	REVISION	DATE	BY	APPROVED
4.	PHASE 4 FINAL SUBMISSION	07/09	E.G.	
3.	PHASE 4 THIRD SUBMISSION	06/09	F.W.	
2.	PHASE 4 SECOND SUBMISSION	03/09	F.W.	
1.	PHASE 4 FIRST SUBMISSION	01/09	F.W.	

REVISIONS

ACCEPTED TO BE IN GENERAL CONFORMANCE WITH THE TOWNSHIP OF UXBRIDGE STANDARDS. THIS ACCEPTANCE IS NOT TO BE CONSTRUED AS VERIFICATION OF ENGINEERING CONTENT.
AECOM Canada Ltd
DATE: Aug 11, 2009

CORPORATION OF THE TOWNSHIP OF UXBRIDGE

CORAL CREEK HOMES

STORM DRAINAGE PLAN

18T-99009

BURNSIDE

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web www.rjburnside.com

LICENSED PROFESSIONAL ENGINEER — Jul 29/09 — E. GROSKOPFS — PROVINCE OF ONTARIO

SCALE:	1:1000	PROJECT NO. PTB-11727
DRAWN BY:	F.W.	DRAWING NO.
DESIGNED BY:	F.W.	ST-1
CHECKED BY:	E.G.	
DATE:	JUNE 2009	

Xref \\Brampton\AdeptWork\Shared Work Areas\11727.1 Avonlea Phase 4\11727_PH4_GNBASE
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Xref \\Brampton\AdeptWork\Shared Work Areas\11727.1 Avonlea Phase 4\68253-S-PH-4_1-MAR-20-2008-DWG_1

TOWNSHIP OF UXBRIDGE

STORM SEWER DESIGN SHEET - MINOR SYSTEM

CORAL CREEK HOMES - PHASE 4

CALCULATED BY: F.W. DATE: JUNE 2009
CHECKED BY: E.G. DATE: JUNE 2009
PROJECT NO.: 02-3956 SHEET 1 OF 3

STREET	UP STREAM		DOWN STREAM		SECTION			CUMULATIVE	INTENSITY	FLOW	PIPE					CONC.	TOTAL
					AREA	COEFF.	AxR	AxR	Is	Q5	LENGTH	SIZE	GRADE	CAP.	VEL.	TIME	TIME
	MH	INVERT	MH	INVERT	(ha)				(mm/s)	(l/s)	(m)	(mm)	(%)	(l/s)	(m/s)	(min.)	(min.)
																	10.00
* Nelkydd Lane	FUT	279.19	26	277.320	1.65	0.45	0.743	0.743	107.01	221	196.7	525	0.40	284	1.27	2.58	12.58
Nelkydd Lane	26	277.290	25	276.430	0.51	0.45	0.230	0.972	94.42	255	57.3	525	1.50	549	2.46	0.39	12.97
Nelkydd Lane	25	276.400	24	275.710	0.40	0.45	0.180	1.152	92.81	297	57.3	525	1.20	491	2.20	0.43	13.40
																	10.00
	RLCB4	276.120	24	275.850	0.15	0.45	0.068	0.068	107.01	20	54.4	300	0.50	71	0.98	0.93	10.93
Nelkydd Lane	24	275.620	23	274.854	0.55	0.45	0.248	1.467	91.08	371	85.6	525	0.90	426	1.90	0.75	13.40
																	10.00
Village Green Lane	26	277.920	39	275.350	0.58	0.45	0.261	0.261	107.01	78	85.6	300	3.00	175	2.39	0.60	10.60
Hayfield Avenue	39	275.250	38	274.950	0.32	0.45	0.144	0.405	103.77	117	50.3	450	0.60	230	1.40	0.60	11.19
Hayfield Avenue	38	274.920	23	274.712	0.45	0.45	0.203	0.608	100.74	170	68.7	600	0.30	351	1.20	0.95	12.15
																	13.40
Nelkydd Lane	23	274.562	22	274.151	0.45	0.45	0.203	2.277	91.08	576	82.4	750	0.50	820	1.80	0.76	14.17
																	10.00
					0.15	0.45	0.068	0.068									
	RLCB3		42		0.56	0.35	0.196	0.264	107.01	78	40.0	300	1.00	101	1.38	0.48	10.48
					0.12	0.45	0.054	0.054									
	RLCB2		42		0.42	0.35	0.147	0.201	107.01	60	40.0	300	1.00	101	1.38	0.48	10.48
Village Green Lane	42	275.385	43	274.790	0.31	0.45	0.140	0.604	104.37	175	90.1	450	0.66	242	1.47	1.02	11.50
																	10.00
					0.11	0.45	0.050	0.050									
	RLCB1		43		0.58	0.35	0.203	0.253	107.01	75	40.0	300	1.00	101	1.38	0.48	10.48
Village Green Lane	39	275.710	43	274.863	0.19	0.45	0.086	0.338	104.37	98	90.0	450	0.94	288	1.76	0.85	11.34
Millbury Road	43	274.595	37	274.448	0.52	0.45	0.234	1.176	100.05	327	63.9	750	0.23	557	1.22	0.87	12.37
Millbury Road	37	274.294	22	274.150	0.38	0.45	0.171	1.347	95.31	357	57.3	750	0.25	582	1.28	0.75	13.12
																	14.17
Nelkydd Lane	22	273.807	21	273.630	0.30	0.45	0.135	3.759	88.21	921	59.0	1050	0.30	1560	1.75	0.56	14.73
																	10.00
Foxbury Road	42	275.450	36	274.864	0.47	0.45	0.212	0.212	107.01	63	72.6	375	0.81	164	1.44	0.84	10.84
Foxbury Road	36	274.784	35	274.550	0.35	0.45	0.158	0.369	102.51	105	46.7	375	0.50	129	1.14	0.69	11.52
Foxbury Road	35	274.408	21	274.210	0.18	0.45	0.081	0.450	99.15	124	39.6	450	0.50	210	1.28	0.52	12.04

R = 0.45 (Single Family-Urban) / 0.75 (Townhouses & School)
Is = 904/(T+5)^0.788 Rational Formula Q=2.78AIR Limit of flow velocity = 0.75m/s < V < 4.5m/s

*Allowable Peak Flow From 241 Reach Street

Printed on: 6/29/2009

H:\dwg\PBJOB\2002\Pb02-3956 \Design\11727 STM & SAN Phase 4 - Submission 3.xls

		TOWNSHIP OF UXBRIDGE			CALCULATED BY:	F.W.	DATE:	JUNE 2009
		STORM SEWER DESIGN SHEET - 100-YEAR			CHECKED BY:	E.G.	DATE:	JUNE 2009
		CORAL CREEK HOMES - PHASE 4			PROJECT NO.:	02-3956	SHEET	1 OF 3

STREET	UP STREAM		DOWN STREAM		SECTION			CUMULATIVE	INTENSITY	FLOW	PIPE					CONC.	TOTAL
					AREA	COEFF.	AxR	AxR	I_{100}	Q_{100}	LENGTH	SIZE	GRADE	CAP.	VEL.	TIME	TIME
	MH	INVERT	MH	INVERT	(ha)				(mm/s)	(l/s)	(m)	(mm)	(%)	(l/s)	(m/s)	(min.)	(min.)
																	10.00
* Nelkydd Lane	FUT	279.190	26	277.320	1.65	0.56	0.928	0.928	200.63	517	196.7	525	0.40	284	1.27	2.58	12.58
Nelkydd Lane	26	277.290	25	276.430	0.51	0.56	0.287	1.215	176.41	595	57.3	525	1.50	549	2.46	0.39	12.97
Nelkydd Lane	25	276.400	24	275.710	0.40	0.56	0.225	1.440	173.32	693	57.3	525	1.20	491	2.20	0.43	13.40
																	10.00
	RLCB4	276.120	24	275.850	0.15	0.56	0.084	0.084	200.63	47	54.4	300	0.50	71	0.98	0.93	10.93
Nelkydd Lane	24	275.620	23	274.854	0.55	0.56	0.309	1.834	170.00	866	85.6	525	0.90	426	1.90	0.75	13.40
																	10.00
Village Green Lane	26	277.920	39	275.350	0.58	0.56	0.326	0.326	200.63	182	85.6	300	3.00	175	2.39	0.60	10.60
Hayfield Avenue	39	275.250	38	274.950	0.32	0.56	0.180	0.506	194.40	273	50.3	450	0.60	230	1.40	0.60	11.19
Hayfield Avenue	38	274.920	23	274.712	0.45	0.56	0.253	0.759	188.57	398	68.7	600	0.30	351	1.20	0.95	12.15
																	13.40
Nelkydd Lane	23	274.562	22	274.151	0.45	0.45	0.203	2.796	170.00	1320	82.4	750	0.50	820	1.80	0.76	14.17
																	10.00
					0.15	0.45	0.068	0.068									
	RLCB3		42		0.56	0.35	0.196	0.264	200.63	147	40.0	300	1.00	101	1.38	0.48	10.48
					0.12	0.45	0.054	0.054									
	RLCB2		42		0.42	0.35	0.147	0.201	200.63	112	40.0	300	1.00	101	1.38	0.48	10.48
Village Green Lane	42	275.385	43	274.790	0.31	0.45	0.140	0.604	195.55	328	90.1	450	0.66	242	1.47	1.02	11.50
																	10.00
					0.11	0.56	0.062	0.062									
	RLCB1		43		0.58	0.44	0.254	0.316	200.63	176	40.0	300	1.00	101	1.38	0.48	10.48
Village Green Lane	39	275.710	43	274.863	0.19	0.56	0.107	0.423	195.55	230	90.0	450	0.94	288	1.76	0.85	11.34
Millbury Road	43	274.595	37	274.448	0.52	0.45	0.234	1.261	187.23	656	63.9	750	0.23	557	1.22	0.87	12.37
Millbury Road	37	274.294	22	274.150	0.38	0.45	0.171	1.432	178.12	708	57.3	750	0.25	582	1.28	0.75	13.12
																	14.17
Nelkydd Lane	22	273.807	21	273.630	0.30	0.45	0.135	4.362	164.49	1993	59.0	1050	0.30	1560	1.75	0.56	14.73
																	10.00
Foxbury Road	42	275.450	36	274.864	0.47	0.45	0.212	0.212	200.63	118	72.6	375	0.81	164	1.44	0.84	10.84
Foxbury Road	36	274.784	35	274.550	0.35	0.45	0.158	0.369	191.97	197	46.7	375	0.50	129	1.14	0.69	11.52
Foxbury Road	35	274.408	21	274.210	0.18	0.45	0.081	0.450	185.50	232	39.6	450	0.50	210	1.28	0.52	12.04

R = 0.45 (Single Family-Urban) / 0.75 (Townhouses & School)

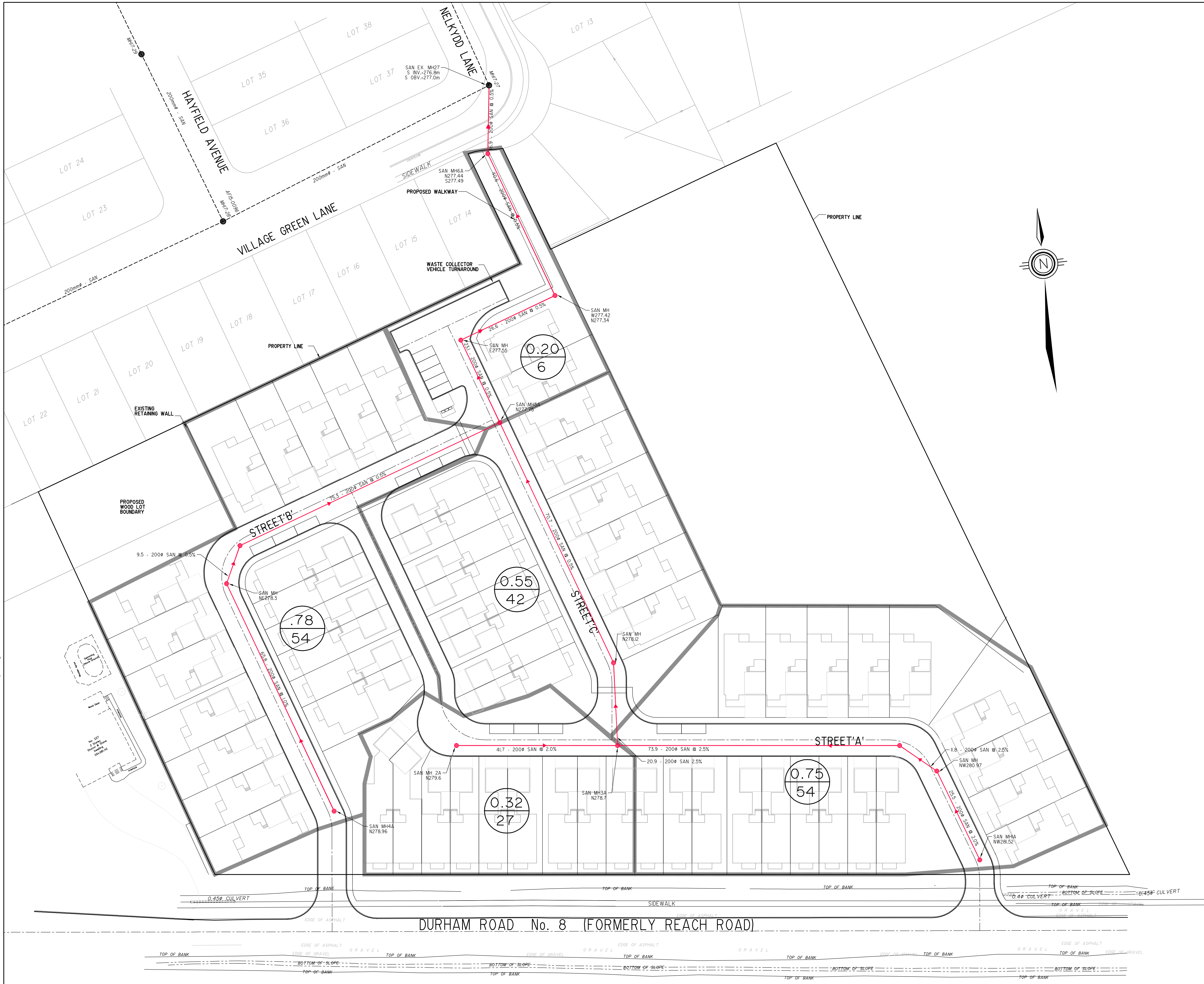
I_{100} = 1799/(T+5)^0.810 Rational Formula Q=2.78AIR

Limit of flow velocity = 0.75m/s < V < 4.5m/s

*Allowable Peak Flow From 241 Reach Street

APPENDIX B

Sanitary Sewer Design



LEGEND

0.20	- AREA IN HECTARES
6	- POPULATION
	- SANITARY DRAINAGE BOUNDARY
	- DIRECTION OF SEWER FLOW PROPOSED

SCALE 1:1000

SANITARY DRAINAGE PLAN

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NO.
17:386	SAN

CAD FILE: P:\17\386\Drawing Files\Phase 1\Figures\386 Base - Servicing.dwg

241 Reach St
17:386

Uxbridge

November 2017

Unit Type:	Persons per unit
S - Single Family Dwelli	3.50
T- Townhouse Unit	3.00
A - Apartment Unit	N/A

NOTES

P.F. = 1 + 14 / (4 + (pop) ^ 0.5) MAX 3.8 MIN 1.5

Q residentia 364 l/p/d (For local sewer sizing)
Q residentia 364 l/p/d (For trunk sewer sizing)
Q infiltratior 22,500 l/ha/d (0.26 l/s/ha)
Q institutior 112,000 l/ha/d (1.3 l/s/ha)
Q commerci 180,000 l/ha/d (2.08 l/s/ha)

Designed B KLD
Checked By AK

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

SANITARY SEWER DESIGN

			TOTAL DESIGN AREA		RESIDENTIAL												COMMERCIAL AND INSTITUTIONAL								TOTAL FLOWS	PIPE DESIGN							
					Residential Area		Known Lot Fabric				Unknown Lot Fabric		Cummulative Flows																				
Location	Upstream Manhole	Downstream Manhole	Section Area (ha)	Cummulative Area (ha)	Section Area (ha)	Cummulative Area (ha)	Unit Type (S, T or A)	Unit Count	Density Per Unit (Type A)	Section Population (P/1000)			Cummulative Population (P/1000)	Peak Factor	Residential Flow (l/s)	Infiltration Flow (l/s)	Institutional Section Area (ha)	Cummulative Institutional Area (ha)	Cummulative Institutional Flow (l/s)	Commercial Section Area (ha)	Cummulative Commercial Area (ha)	Floor Space Index	Cummulative Floor Area (ha)	Cummulative Commercial Flow (l/s)	Cummulative Design Flow (l/s)	Metric or Imperial Pipe Size	Pipe Size (mm)	Grade (%)	Capacity (l/s)	Velocity (m/s)	Length (m)	% Capacity	
NORTH OF COLIN SANITARY DRAINAGE																																	
Street A	1A	3A	0.75	0.75	0.75	0.75	T	18	3.0	0.054	N/A	0.000	0.054	3.800	0.86	0.20		0.000	0.00		0.000	1.000	0.000	0.00	1.06	METRIC	200	2.50	51.86	1.65	111.2	2.0%	
Street A	2A	3A	0.32	0.32	0.32	0.32	T	9	3.0	0.027	N/A	0.000	0.027	3.800	0.43	0.08		0.000	0.00		0.000	1.000	0.000	0.00	0.52	METRIC	200	2.00	46.38	1.48	41.7	1.1%	
Street B	4A	5A	0.78	0.78	0.78	0.78	T	18	3.0	0.054	N/A	0.000	0.054	3.800	0.86	0.20		0.000	0.00		0.000	1.000	0.000	0.00	1.07	METRIC	200	0.50	23.19	0.74	150.6	4.6%	
Street C	3A	5A	0.55	1.62	0.55	1.62	T	14	3.0	0.042	N/A	0.000	0.123	3.800	1.97	0.42		0.000	0.00		0.000	1.000	0.000	0.00	2.39	METRIC	200	0.50	23.19	0.74	91.6	10.3%	
Street C	5A	17-27	0.20	0.20	0.2	0.20	T	2	3.0	0.006	N/A	0.000	0.183	3.800	2.93	0.05		0.000	0.00		0.000	1.000	0.000	0.00	2.98	METRIC	200	0.50	23.19	0.74	107.2	12.9%	
									Total population=	0.183																							

Governing Flow on Nelkydd Lane between MH 17-17 to MH 23-13 (As per Durham San Design Sheet Project # PB02-3956 Date: Jan 2009)

Current Sanitary Design for Estates of Avonlea:

Governing Sections Cumulative Design Flow occurs between MH 17-17 to MH 23-13 = 21.84 L/s

Capacity between MH 17-17 to MH 23-13 = 24.19 L/s

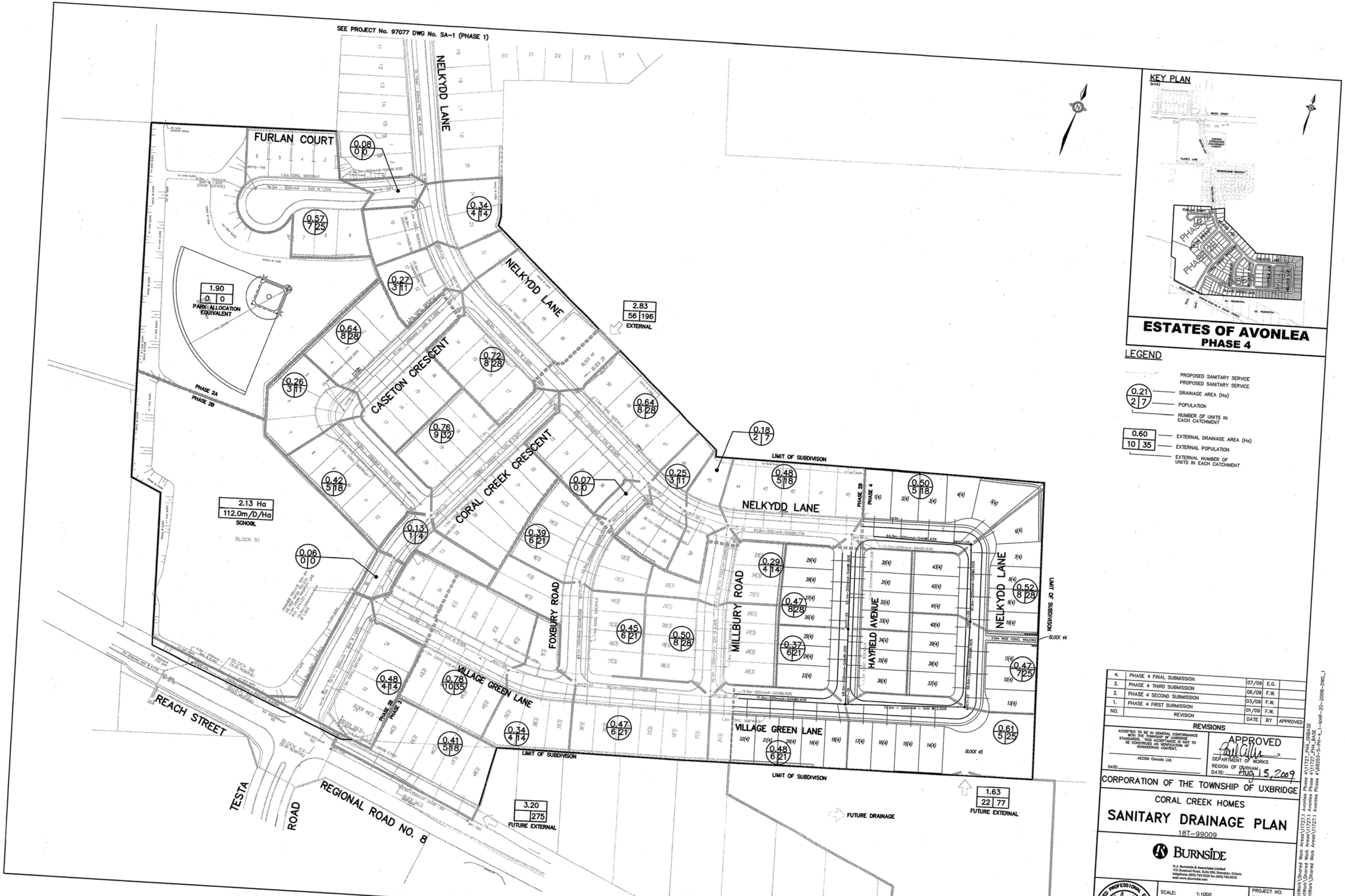
Design Flow Allocated for Future Development on Nelkydd at MH 17-27= 1.65 L/s

Current available capacity at MH 17-17= 4.00 L/s

Proposed Sanitary Design for Estates of Avonlea:

Proposed Future Development Design Flow to Nelkydd= 2.98 L/s

Proposed Development Design Flow at Governing MH 17-17 = 23.17 L/s **Therefore, Proposed Design Flow is less than capacity.**



SEE PROJECT No. 97077 DWG No. SA-1 (PHASE 1)
FURLAN COURT
NELKYDD LANE
CASETON CRESCENT
CORAL CREEK CRESCENT
FOXBURY ROAD
MILLBURY ROAD
HAYFIELD AVENUE
VILLAGE GREEN LANE
REACH STREET
TESTA ROAD
REGIONAL ROAD NO. 8
PARK ALLOCATION EQUIVALENT
2.13 Ha
112.0m/D/Ha
SCHOOL
BLOCK 51
PHASE 2A
PHASE 2B
PHASE 3
PHASE 4
LIMIT OF SUBDIVISON
2.83
56 196
EXTERNAL
3.20
275
FUTURE EXTERNAL
1.63
22 77
FUTURE EXTERNAL
FUTURE DRAINAGE
BLOCK 44
BLOCK 45
KEY PLAN
ESTATES OF AVONLEA
PHASE 4
LEGEND
PROPOSED SANITARY SERVICE
PROPOSED SANITARY SERVICE
DRAINAGE AREA (Ha)
POPULATION
NUMBER OF UNITS IN EACH CATCHMENT
EXTERNAL DRAINAGE AREA (Ha)
EXTERNAL POPULATION
EXTERNAL NUMBER OF UNITS IN EACH CATCHMENT
4. PHASE 4 FINAL SUBMISSION 07/09 E.G.
3. PHASE 4 THIRD SUBMISSION 06/09 F.W.
2. PHASE 4 SECOND SUBMISSION 03/09 F.W.
1. PHASE 4 FIRST SUBMISSION 01/09 F.W.
NO. REVISION DATE BY APPROVED
REVISIONS
APPROVED
DEPARTMENT OF WORKS
REGION OF DURHAM
DATE: Aug 13, 2009
CORPORATION OF THE TOWNSHIP OF UXBRIDGE
CORAL CREEK HOMES
SANITARY DRAINAGE PLAN
18T-99009
BURNSIDE
SCALE: 1:1000
PROJECT NO.
PTR-11727

STREET	UP STREAM		DOWN STREAM		SECTION 3.5 p/unit			CUMULATIVE		M	POPULATION FLOW	INFIL. 0.26	INSTITUTIONAL		CUM. FLOW	PIPE					
	MH	INVERT	MH	INVERT	POP.	UNITS	AREA	POP.	AREA (ha)		(l/s)	(l/s/ha)	AREA (ha)	FLOW (l/s)	(l/s)	LENGTH (m)	SIZE (mm)	GRADE (%)	CAP. (l/s)	VEL. (m/s)	TYPE
* Future Nelkydd	FUT	277.250	17-27	276.840	77	22	1.63	77	1.63	3.80	1.23	0.42			1.65	87.5	200	0.50	24.19	0.75	DR-35
Nelkydd Lane	17-27	276.810	17-26	276.240	25	7	0.47	102	2.10	3.80	1.62	0.55			2.17	56.6	200	1.00	34.22	1.06	DR-35
Nelkydd Lane	17-26	276.210	17-25	275.950	28	8	0.52	130	2.62	3.80	2.07	0.68			2.75	51.9	200	0.50	24.19	0.75	DR-35
Nelkydd Lane	17-25	275.870	17-24	274.577	18	5	0.50	147	3.12	3.80	2.35	0.81			3.16	79.6	200	1.63	43.68	1.35	DR-35
Village Green Lane	17-27	277.780	17-28	275.790	18	5	0.61	18	0.61	3.80	0.28	0.16			0.44	79.5	200	2.50	54.10	1.67	DR-35
Hayfield Avenue	17-28	275.610	17-29	275.110	21	6	0.37	39	0.98	3.80	0.61	0.25			0.87	49.5	200	1.00	34.22	1.06	DR-35
Hayfield Avenue	17-29	275.080	17-24	274.450	28	8	0.47	67	1.45	3.80	1.06	0.38			1.44	63.5	200	1.00	34.22	1.06	DR-35
Nelkydd Lane	17-24	274.300	17-23	273.662	18	5	0.48	231	5.05	3.80	3.69	1.31			5.00	82.8	200	0.77	30.02	0.93	DR-35
Village Green Lane	17-28	276.040	17-30	275.210	21	6	0.48	21	0.48	3.80	0.34	0.12			0.46	90.0	200	0.92	32.82	1.01	DR-35
Millbury Road	17-30	275.030	17-31	274.727	28	8	0.50	49	0.98	3.80	0.78	0.25			1.04	60.7	200	0.50	24.19	0.75	DR-35
Millbury Road	17-31	274.677	17-23	274.407	14	4	0.29	63	1.27	3.80	1.01	0.33			1.34	54.1	200	0.50	24.19	0.75	DR-35
Nelkydd Lane	17-23	273.541	17-22	273.390	7	2	0.18	301	6.50	3.80	4.80	1.69			6.49	30.3	200	0.50	24.19	0.75	DR-35
Nelkydd Lane	17-22	273.321	17-21	273.170	11	3	0.25	312	6.75	3.80	4.97	1.76			6.73	30.3	200	0.50	24.19	0.75	DR-35
Village Green Lane	17-30'	275.662	17-34	274.761	21	6	0.49	21	0.49	3.80	0.34	0.13			0.46	90.1	200	1.00	34.22	1.06	DR-35
Foxbury Road	17-34	274.661	17-33	273.970	21	6	0.45	42	0.94	3.80	0.67	0.24			0.91	69.1	200	1.00	34.22	1.06	DR-35
Foxbury Road	17-33	273.868	17-32	273.640	21	6	0.39	63	1.33	3.80	1.01	0.35			1.35	45.5	200	0.50	24.24	0.75	DR-35
Foxbury Road	17-32	273.609	17-21	273.410	0	0	0.07	63	1.40	3.80	1.01	0.36			1.37	36.1	200	0.55	25.38	0.78	DR-35

average Flow = 364 l/p/d <u>or</u> 0.0042 l/p/s

infiltration = 22.5c.m./ha/d <u>or</u> 0.26 l/ha/s

single family - 60 p/ha <u>or</u> 3.5 p/unit

school - 112 c.m./gross ha / day incl. infil. and peaking effect

DESIGN BY:	F.W.	DATE:	JAN. 2009
CHECKED BY:	E.G.	DATE:	JAN. 2009
PROJECT #:	PB02-3956	SHEET:	1 OF 3

SANITARY SEWER DESIGN SHEET

MUNICIPALITY OF DURHAM

ESTATES OF AVONLEA - PHASE 4

*Allowable Peak Flow From 241 Reach Street

STREET	UP STREAM MH	UP STREAM INVERT	DOWN STREAM MH	DOWN STREAM INVERT	SECTION 3.5 p/unit POP.	SECTION UNITS	SECTION AREA	CUMULATIVE POP.	CUMULATIVE AREA (ha)	M	POPULATION FLOW (l/s)	INFIL. 0.26 (l/s/ha)	INSTITUTIONAL AREA (ha)	INSTITUTIONAL FLOW (l/s)	CUM. FLOW (l/s)	PIPE LENGTH (m)	PIPE SIZE (mm)	PIPE GRADE (%)	PIPE CAP. (l/s)	PIPE VEL. (m/s)	PIPE TYPE
Nelkydd Lane	17-21	273.159	17-20	272.733	28	8	0.64	403	8.79	3.80	6.42	2.29			8.71	85.2	200	0.50	24.19	0.7461	DR-35
Village Green Lane	17-34'	274.868	17-35	274.410	14	4	0.34	14	0.34	3.80	0.22	0.09			0.31	45.8	200	1.00	34.22	1.06	DR-35
Village Green Lane	17-35	274.380	17-13	273.872	35	10	0.78	49	1.12	3.80	0.78	0.29			1.07	101.5	200	0.50	24.19	0.75	DR-35
SCHOOL	School		17-13		0	0	0.00	0	0.00	3.80	0.00	0.00	2.13	2.76	2.76	12.3	200	1.00	34.22	1.06	DR-35
Coral Creek Cresent	16-155	275.122	17-13	274.000	14	4	0.48	14	0.48	3.80	0.22	0.12			0.35	70.1	200	1.60	43.28	1.33	DR-35
Coral Creek Cresent	17-13	273.812	17-14	273.654	0	0	0.06	63	1.66	3.80	1.01	0.43	2.13	2.76	4.20	31.5	200	0.50	24.24	0.75	DR-35
Coral Creek Cresent	17-14	273.624	17-15	273.436	4	1	0.13	67	1.79	3.80	1.06	0.47	2.13	2.76	4.29	37.6	200	0.50	24.19	0.75	DR-35
Coral Creek Cresent	17-15	273.406	17-20	272.812	32	9	0.76	98	2.55	3.80	1.56	0.66	2.13	2.76	4.99	118.8	200	0.50	24.19	0.75	DR-35
Block 52	External		17-20		196	56	2.83	196	2.83	3.80	3.13	0.74			3.86						
Nelkydd Lane	17-20	272.752	17-19	272.287	28	8	0.72	725	14.89	3.80	11.56	3.87	2.13	2.76	18.20	93.0	200	0.50	24.19	0.75	DR-35
Caseton Cresent	17-16	274.300	16-156	273.635	18	5	0.42	18	0.42	3.80	0.28	0.11			0.39	66.5	200	1.00	34.22	1.06	DR-35
Caseton Cresent	16-156	273.572	16-157	273.350	11	3	0.26	28	0.68	3.80	0.45	0.18			0.62	22.1	200	1.00	34.28	1.06	DR-35
Caseton Cresent	16-157	273.321	17-19	272.347	28	8	0.64	56	1.32	3.80	0.89	0.34			1.24	97.4	200	1.00	34.22	1.06	DR-35
Nelkydd Lane	17-19	272.257	17-18	272.072	11	3	0.27	791	16.48	3.80	12.62	4.28	2.13	2.76	19.67	37.0	200	0.50	24.19	0.75	DR-35
Nelkydd Lane	17-18	272.042	17-17	271.848	14	4	0.34	805	16.82	3.80	12.85	4.37	2.13	2.76	19.98	38.8	200	0.50	24.19	0.75	DR-35
PARK	PARK		16-159		0	0	1.90	0	1.90	3.80	0.00	0.49			0.49						
Furlan Court	16-159	273.334	16-158	272.461	25	7	0.57	25	2.47	3.80	0.40	0.64			1.04	87.3	200	1.00	34.22	1.06	DR-35
Furlan Court	16-158	272.431	17-17	272.068	0	0	0.08	25	2.55	3.80	0.40	0.66			1.06	36.3	200	1.00	34.22	1.06	DR-35
* *NELKYDD LANE*	*17-17*	*271.818*	*23-13*	271.268	*35*	*10*	*0.91*	*865*	20.28	*3.80*	*13.81*	*5.27*	*2.13*	*2.76*	*21.84*	*110.0*	*200*	*0.50*	*24.19*	*0.75*	*DR-35*

average Flow = 364 l/p/d or 0.0042 l/p/s

infiltration = 22.5c.m./ha/d or 0.26 l/ha/s

single family - 60 p/ha or 3.5 p/unit

school - 112 c.m./gross ha / day incl. infil. and peaking effect

DESIGN BY:	F.W.	DATE:	JAN. 2003
CHECKED BY:	E.G.	DATE:	JAN. 2009
PROJECT #:	PB02-3956	SHEET:	2 OF 3

SANITARY SEWER DESIGN SHEET

MUNICIPALITY OF DURHAM

ESTATES OF AVONLEA - PHASE 4

*Limiting Sewer Capacity at End of Development Phase

Printed on: 3/31/2009

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STREET	UP STREAM		DOWN STREAM		SECTION 3.5 p/unit			CUMULATIVE		M	POPULATION FLOW (l/s)	INFIL. 0.26 (l/s/ha)	INSTITUTIONAL		CUM. FLOW (l/s)	PIPE					
	MH	INVERT	MH	INVERT	POP.	UNITS	AREA	POP.	AREA (ha)				AREA (ha)	FLOW (l/s)		LENGTH (m)	SIZE (mm)	GRADE (%)	CAP. (l/s)	VEL. (m/s)	TYPE
BROWNSCOMBE	*23-11*		*23-12*		*21*	*6*	*0.49*	*21*	*0.49*	*3.80*	*0.34*	*0.13*			*0.46*	*63.9*	*200*	*1.00*	*34.22*	*1.0551*	*DR-35*
BROWNSCOMBE	*23-12*		*23-13*		*11*	*3*	*0.30*	*32*	*0.79*	*3.80*	*0.50*	*0.21*			*0.71*	*66.1*	*200*	*0.50*	*24.19*	*0.75*	*DR-35*
NELKYDD LANE	*23-13*		*23-7*		*39*	*11*	*0.75*	*935*	*21.82*	*3.80*	*14.92*	*5.67*	*2.13*	*2.76*	*23.36*	*93.1*	*200*	*0.60*	*26.50*	*0.82*	*DR-35*
BROWNSCOMBE	*23-11A*		*23-10*		*7*	*2*	*0.17*	*7*	*0.17*	*3.80*	*0.11*	*0.04*			*0.16*	*22.2*	*200*	*1.00*	*34.22*	*1.06*	*DR-35*
BROWNSCOMBE	*23-10*		*23-9*		*28*	*8*	*0.66*	*35*	*0.83*	*3.80*	*0.56*	*0.22*			*0.77*	*64.7*	*200*	*0.50*	*24.19*	*0.75*	*DR-35*
BROWNSCOMBE	*23-9*		*23-8*		*18*	*5*	*0.45*	*53*	*1.28*	*3.80*	*0.84*	*0.33*			*1.17*	*57.0*	*200*	*0.50*	*24.19*	*0.75*	*DR-35*
BROWNSCOMBE	*23-8*		*23-7*		*25*	*7*	*0.56*	*77*	*1.84*	*3.80*	*1.23*	*0.48*			*1.71*	*90.1*	*200*	*1.30*	*39.01*	*1.20*	*DR-35*
NELKYDD LANE	*23-7*		*23-6*		*7*	*2*	*0.21*	*1019*	*23.87*	*FALSE*	*0.00*	*6.21*	*2.13*	*2.76*	*8.97*	*52.7*	*200*	*0.50*	*24.19*	*0.75*	*DR-35*
NELKYDD LANE	*23-6*		*22-215*		*0*	*0*	*0.24*	*1019*	*24.11*	*FALSE*	*0.00*	*6.27*	*2.13*	*2.76*	*9.03*	*110.0*	*200*	*0.50*	*24.19*	*0.75*	*DR-35*
NELKYDD LANE	*22-215*		*22-214*		*0*	*0*	*0.11*	*1019*	*24.22*	*FALSE*	*0.00*	*6.30*	*4.37*	*5.66*	*11.96*	*58.7*	*200*	*1.55*	*42.60*	*1.31*	*DR-35*
NELKYDD LANE	*22-214*		*22-213*		*0*	*0*	*0.10*	*1019*	*24.32*	*FALSE*	*0.00*	*6.32*	*4.37*	*5.66*	*11.99*	*52.3*	*200*	*0.60*	*26.50*	*0.82*	*DR-35*
Reach Street	200	278.223	100	277.218	293	5	3.61	293	*3.61*	3.80	4.67	0.94			5.61	100.5	250	1.00	62.04	1.22	DR-35
Reach Street	100	277.118	EX 16-BB	277.058	0	0	0.00	293	*3.61*	3.80	4.67	0.94			5.61	3.0	250	2.00	87.74	1.73	DR-35

DESIGN BY:	F.W.	DATE:	JAN. 2009
CHECKED BY:	E.G.	DATE:	JAN. 2009
PROJECT #:	PB02-3956	SHEET:	3 OF 3

average Flow = 364 l/p/d or 0.0042 l/p/s

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single family - 60 p/ha or 3.5 p/unit

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SANITARY SEWER DESIGN SHEET

MUNICIPALITY OF DURHAM

ESTATES OF AVONLEA - PHASE 4

APPENDIX C

LID Design

Site Description

Total Site Area	**3.5908**	Ha

General Infiltration Requirements

Total Impervious Ground Surface Area	7778.8	m^2
Total Roof Area	10563.8	m^2
Total Site Impervious Area	18342.6	m^2

Storm to Infiltrate	25	mm
Total Site Volume to Infiltrate	**459**	m^3

Proposed Infiltration

LID Unit	**Down- stream LID Unit**	**Contact Area** m^2	**Depth** m	**Proposed LID Infiltration Volume** m^3	**Drain Down Time** Hours
Rear Yard LID#1	Perf Pipe#3	62.0	0.7	17.1	24.0
Rear Yard LID#2	Perf Pipe#5	170.0	0.7	47.0	24.0
Rear Yard LID#3	na	71.3	0.7	19.7	24.0
Perf Pipe#1	Perf Pipe#3	80.4	0.7	22.2	24.0
Perf Pipe#2	Perf Pipe#3	77.8	0.7	21.5	24.0
Perf Pipe#3	Perf Pipe#4	115.5	0.7	31.9	24.0
Perf Pipe#4	Perf Pipe#5	435.0	0.7	120.3	24.0
Perf Pipe#5	STM Chamber	103.0	0.7	28.5	24.0
Perf Pipe#6	Perf Pipe#7	101.0	0.7	27.9	24.0
Perf Pipe#7	STM Chamber	106.0	0.7	29.3	24.0
STM Chamber	na	229.0	1.2	109.9	41.7
			TOTAL	**475**	

Cumulative Infiltration Volumes

LID Unit	**Down- stream LID Unit**	**Required Infiltration Volume/Reach** m^3	Cummulative Infiltration Required m^3	**Infiltration Available per Reach** m^3	Cummulative Infiltration Available m^3	**Available Volume Infiltrated per Reach** m^3
Rear Yard LID#1	Perf Pipe#3	13.8	13.8	17.1	17.1	**13.8**
Rear Yard LID#2	Perf Pipe#5	44.7	44.7	47.0	47.0	**44.7**
Rear Yard LID#3	na	17.2	17.2	19.7	19.7	**17.2**
Perf Pipe#1	Perf Pipe#3	75.9	75.9	22.2	22.2	**22.2**
Perf Pipe#2	Perf Pipe#3	16.0	16.0	21.5	21.5	**16.0**
Perf Pipe#3	Perf Pipe#4	139.5	231.3	31.9	75.7	**31.9**
Perf Pipe#4	Perf Pipe#5	0.0	231.3	120.3	195.9	**120.3**
Perf Pipe#5	STM Chamber	41.2	272.5	28.5	224.4	**28.5**
Perf Pipe#6	Perf Pipe#7	60.0	60.0	27.9	27.9	**27.9**
Perf Pipe#7	STM Chamber	34.5	94.5	29.3	57.2	**29.3**
STM Chamber	na	16.4	383.4	109.9	391.6	**107.3**
Sum of Column=		**459**		**475**		**459**

Infiltration Summary

Total Site Volume Required to Infiltrate	459	m^3
Infiltration Volume Provided	475	m^3
Infiltration Volume Achieved	459	m^3
Remaining Volume Required	**0.0**	$\mathbf{m^3}$

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REAR YARD LID#1

Infiltration Requirements

Total area of imperviousness	550.0	m^2
Volume to infiltrate:	25.0	mm
Target Volume to be infiltrated:	13.8	m^3

Maximum clearstone depth: $$d = \frac{PT}{1000}$$

Where

P=	28.8	percolation rate of native soil (mm/h)
T=	24.0	detention time (24 hours)

d= 0.69

$$A = \frac{1000\ V}{Pnt}$$

Where

	A=		Bottom area of trench (m^2)
	V=	13.8	runoff volume to be infiltrated (m^3)
P=K/f.s.	**P=**	28.8	percolation rate of native soil (mm/h)
K = 72mm/hr infiltration rate	**n=**	0.4	porosity of storage media (0.4 for clear stone)
f.s.= 2.5	**t=**	24.0	detention time (24 hours)

$$A = \frac{(1000)(12.5)}{(12.0)(0.4)(72.0)}$$

A= 49.7

Area Available for Infiltration

Contact Area	**62.00**	**m^2**
Depth of clearstone	0.69	m
Trench Volume	**42.85**	**m^3**
Void ratio	0.4	
Total LID Infiltration Volume Available	**17.14**	**m^3**

Total Imperviousness to be infiltrated in downstream LID	**0.00**	**m^3**

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REAR YARD LID#2

Infiltration Requirements

Total area of imperviousness	1786.2	m^2
Volume to infiltrate:	25.0	mm
Target Volume to be infiltrated:	44.7	m^3

Maximum clearstone depth: $$d = \frac{PT}{1000}$$

Where **P=** 28.8 percolation rate of native soil (mm/h)

T= 24.0 detention time (24 hours)

d= 0.69

$$A = \frac{1000\,V}{Pnt}$$

Where **A=** Bottom area of trench (m^2)

V= 44.7 runoff volume to be infiltrated (m^3)

P=K/f.s. **P=** 28.8 percolation rate of native soil (mm/h)

K = 72mm/hr infiltration rate **n=** 0.4 porosity of storage media (0.4 for clear stone)

f.s.= 2.5 **t=** 24.0 detention time (24 hours)

$$A = \frac{(1000)(12.5)}{(12.0)(0.4)(72.0)}$$

A= 161.5

Area Available for Infiltration

Contact Area	**170.00**	**m^2**
Depth of clearstone	0.69	m
Trench Volume	**117.50**	**m^3**
Void ratio	0.4	
Total LID Infiltration Volume Available	**47.00**	**m^3**

Total Imperviousness to be infiltrated in downstream LID	**0.00**	**m^3**

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REAR YARD LID#3
Infiltration Requirements

Total area of imperviousness	686.9	m^2
Volume to infiltrate:	25.0	mm
Target Volume to be infiltrated:	17.2	m^3

Maximum clearstone depth: $$d = \frac{PT}{1000}$$

Where
P= 28.8 percolation rate of native soil (mm/h)
T= 24.0 detention time (24 hours)

d= 0.69

$$A = \frac{1000\ V}{Pnt}$$

Where
A= Bottom area of trench (m^2)
V= 17.2 runoff volume to be infiltrated (m^3)
P=K/f.s. **P=** 28.8 percolation rate of native soil (mm/h)
K = 72mm/hr infiltration rate **n=** 0.4 porosity of storage media (0.4 for clear stone)
f.s.= 2.5 **t=** 24.0 detention time (24 hours)

$$A = \frac{(1000)(12.5)}{(12.0)(0.4)(72.0)}$$

A= 62.1

Area Available for Infiltration

Contact Area	**71.30**	**m^2**
Depth of clearstone	0.69	m
Trench Volume	**49.28**	**m^3**
Void ratio	0.4	
Total LID Infiltration Volume Available	**19.71**	**m^3**

Total Imperviousness to be infiltrated in downstream LID	**0.00**	**m^3**

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Perforated Pipe #1
Infiltration Requirements

Total area of imperviousness	3035.4	m^2
Volume to infiltrate:	25.0	mm
Target Volume to be infiltrated:	75.9	m^3

Maximum clearstone depth: $d = \frac{PT}{1000}$

Where	P=	28.8	percolation rate of native soil (mm/h)
	T=	24.0	detention time (24 hours)
	d=	0.69	

$$A = \frac{1000\,V}{Pnt}$$

Where	A=		Bottom area of trench (m^2)
	V=	75.9	runoff volume to be infiltrated (m^3)
P=K/f.s.	P=	28.8	percolation rate of native soil (mm/h)
K = 72mm/hr infiltration rate	n=	0.4	porosity of storage media (0.4 for clear stone)
f.s.= 2.5	t=	24.0	detention time (24 hours)

$$A = \frac{(1000)(12.5)}{(12.0)(0.4)(72.0)}$$

A= 274.5

Area Available for Infiltration

Contact Area	**80.40**	**m^2**
Depth of clearstone	0.69	m
Trench Volume	**55.57**	**m^3**
Void ratio	0.4	
Total LID Infiltration Volume Available	**22.23**	**m^3**

Total Imperviousness to be infiltrated in downstream LID	**53.66**	**m^3**

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Perforated Pipe #2
Infiltration Requirements

Total area of imperviousness	639.2	m^2
Volume to infiltrate:	25.0	mm
Target Volume to be infiltrated:	16.0	m^3

Maximum clearstone depth: $$d = \frac{PT}{1000}$$

Where
P= 28.8 percolation rate of native soil (mm/h)
T= 24.0 detention time (24 hours)

d= 0.69

$$A = \frac{1000\,V}{Pnt}$$

Where
A= Bottom area of trench (m^2)
V= 16.0 runoff volume to be infiltrated (m^3)

P=K/f.s. — **P=** 28.8 percolation rate of native soil (mm/h)
K = 72mm/hr infiltration rate — **n=** 0.4 porosity of storage media (0.4 for clear stone)
f.s.= 2.5 — **t=** 24.0 detention time (24 hours)

$$A = \frac{(1000)(12.5)}{(12.0)(0.4)(72.0)}$$

A= 57.8

Area Available for Infiltration

Contact Area	**77.80**	**m^2**
Depth of clearstone	0.69	m
Trench Volume	**53.78**	**m^3**
Void ratio	0.4	
Total LID Infiltration Volume Available	**21.51**	**m^3**

Total Imperviousness to be infiltrated in downstream LID	**0.00**	**m^3**

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Perforated Pipe #3

Infiltration Requirements

Volume to be infiltrated from Upstream Source:	**53.7**	**m^3**
Total area of imperviousness	5578.1	m^2
Volume to infiltrate:	25.0	mm
Volume to be infiltrated:	139.5	m^3
Total Target Volume Required for LID Infiltration:	**193.1**	**m^3**

Maximum clearstone depth: $$d = \frac{PT}{1000}$$

Where	**P=**	28.8	percolation rate of native soil (mm/h)
	T=	24.0	detention time (24 hours)
	d=	0.69	

$$A = \frac{1000\,V}{Pnt}$$

Where	**A=**		Bottom area of trench (m^2)
	V=	193.1	runoff volume to be infiltrated (m^3)
P=K/f.s.	**P=**	28.8	percolation rate of native soil (mm/h)
K = 72mm/hr infiltration rate	**n=**	0.4	porosity of storage media (0.4 for clear stone)
f.s.= 2.5	**t=**	24.0	detention time (24 hours)

$$A = \frac{(1000)(12.5)}{(12.0)(0.4)(72.0)}$$

A= 698.5

Area Available for Infiltration

Contact Area	**115.50**	**m^2**
Depth of clearstone	0.69	m
Trench Volume	**79.83**	**m^3**
Void ratio	0.4	
Total LID Infiltration Volume Available	**31.93**	**m^3**

Total Imperviousness to be infiltrated in downstream LID	**161.18**	**m^3**

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Perforated Pipe #4
Infiltration Requirements

Volume to be infiltrated from Upstream Source:	**161.2**	**m^3**
Total area of imperviousness	0.0	m^2
Volume to infiltrate:	25.0	mm
Volume to be infiltrated:	0.0	m^3
Total Target Volume Required for LID Infiltration:	**161.2**	**m^3**

Maximum clearstone depth: $$d = \frac{PT}{1000}$$

Where	**P=**	28.8	percolation rate of native soil (mm/h)
	T=	24.0	detention time (24 hours)
	d=	0.69	

$$A = \frac{1000\ V}{Pnt}$$

Where	**A=**		Bottom area of trench (m^2)
	V=	161.2	runoff volume to be infiltrated (m^3)
P=K/f.s.	**P=**	28.8	percolation rate of native soil (mm/h)
K = 72mm/hr infiltration rate	**n=**	0.4	porosity of storage media (0.4 for clear stone)
f.s.= 2.5	**t=**	24.0	detention time (24 hours)

$$A = \frac{(1000)(12.5)}{(12.0)(0.4)(72.0)}$$

A= 583.0

Area Available for Infiltration

Contact Area	**435.00**	**m^2**
Depth of clearstone	0.69	m
Trench Volume	**300.67**	**m^3**
Void ratio	0.4	
Total LID Infiltration Volume Available	**120.27**	**m^3**

Total Imperviousness to be infiltrated in downstream LID	**40.91**	**m^3**

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Perforated Pipe #5
Infiltration Requirements

Volume to be infiltrated from Upstream Source:	**40.9**	**m^3**
Total area of imperviousness	1646.6	m^2
Volume to infiltrate:	25.0	mm
Volume to be infiltrated:	41.2	m^3
Total Target Volume Required for LID Infiltration:	**82.1**	**m^3**

Maximum clearstone depth: $$d = \frac{PT}{1000}$$

Where **P=** 28.8 percolation rate of native soil (mm/h)
T= 24.0 detention time (24 hours)

d= 0.69

$$A = \frac{1000\ V}{Pnt}$$

Where
A= Bottom area of trench (m^2)
V= 82.1 runoff volume to be infiltrated (m^3)
P=K/f.s. **P=** 28.8 percolation rate of native soil (mm/h)
K = 72mm/hr infiltration rate **n=** 0.4 porosity of storage media (0.4 for clear stone)
f.s.= 2.5 **t=** 24.0 detention time (24 hours)

$$A = \frac{(1000)(12.5)}{(12.0)(0.4)(72.0)}$$

A= 296.8

Area Available for Infiltration

Contact Area	**103.00**	**m^2**
Depth of clearstone	0.69	m
Trench Volume	**71.19**	**m^3**
Void ratio	0.4	
Total LID Infiltration Volume Available	**28.48**	**m^3**

Total Imperviousness to be infiltrated in downstream LID	**53.59**	**m^3**

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Perforated Pipe #6
Infiltration Requirements

Total area of imperviousness	2400.8	m^2
Volume to infiltrate:	25.0	mm
Volume to be infiltrated:	60.0	m^3
Total Target Volume Required for LID Infiltration:	**60.0**	**m^3**

Maximum clearstone depth: $$d = \frac{PT}{1000}$$

Where
P= 28.8 percolation rate of native soil (mm/h)
T= 24.0 detention time (24 hours)

d= 0.69

$$A = \frac{1000\ V}{Pnt}$$

Where
A= Bottom area of trench (m^2)
V= 60.0 runoff volume to be infiltrated (m^3)
P=K/f.s. **P=** 28.8 percolation rate of native soil (mm/h)
K = 72mm/hr infiltration rate **n=** 0.4 porosity of storage media (0.4 for clear stone)
f.s.= 2.5 **t=** 24.0 detention time (24 hours)

$$A = \frac{(1000)(12.5)}{(12.0)(0.4)(72.0)}$$

A= 217.1

Area Available for Infiltration

Contact Area	**101.00**	**m^2**
Depth of clearstone	0.69	m
Trench Volume	**69.81**	**m^3**
Void ratio	0.4	
Total LID Infiltration Volume Available	**27.92**	**m^3**

Total Imperviousness to be infiltrated in downstream LID	**32.10**	**m^3**

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Perforated Pipe #7
Infiltration Requirements

Volume to be infiltrated from Upstream Source:	**32.10**	**m^3**
Total area of imperviousness	1381.0	m^2
Volume to infiltrate:	25.0	mm
Volume to be infiltrated:	34.5	m^3
Total Target Volume Required for LID Infiltration:	**66.6**	**m^3**

Maximum clearstone depth: $$d = \frac{PT}{1000}$$

Where
P= 28.8 percolation rate of native soil (mm/h)
T= 24.0 detention time (24 hours)

d= 0.69

$$A = \frac{1000\,V}{Pnt}$$

Where
A= Bottom area of trench (m^2)
V= 66.6 runoff volume to be infiltrated (m^3)
P=K/f.s. **P=** 28.8 percolation rate of native soil (mm/h)
K = 72mm/hr infiltration rate **n=** 0.4 porosity of storage media (0.4 for clear stone)
f.s.= 2.5 **t=** 24.0 detention time (24 hours)

$$A = \frac{(1000)(12.5)}{(12.0)(0.4)(72.0)}$$

A= 241.0

Area Available for Infiltration

Contact Area	**106.00**	**m^2**
Depth of clearstone	0.69	m
Trench Volume	**73.27**	**m^3**
Void ratio	0.4	
Total LID Infiltration Volume Available	**29.31**	**m^3**

Total Imperviousness to be infiltrated in downstream LID	**37.31**	**m^3**

SABOURIN KIMBLE
& ASSOCIATES LTD.
CONSULTING ENGINEERS

Storm Chamber
Infiltration Requirements

Volume to be infiltrated from Upstream Source:	**90.91**	**m^3**
Total area of imperviousness	654.0	m^2
Volume to infiltrate:	25.0	mm
Volume to be infiltrated:	16.4	m^3
Total Target Volume Required for LID Infiltration:	**107.3**	**m^3**

Drain Down Time: $$T = \frac{1000d}{P}$$

Where	**P=**	28.8	percolation rate of native soil (mm/h)
	d=	1.2	(m)
	T=	41.67	detention time (Hours)

P=K/f.s.
K = 72mm/hr infiltration rate
f.s.= 2.5

Area Available for Infiltration

Contact Area	**229.00**	**m^2**
Depth of clearstone	1.20	m
Trench Volume	**274.80**	**m^3**
Void ratio	0.4	
Total LID Infiltration Volume Available	**109.92**	**m^3**

Total Imperviousness to be infiltrated in downstream LID	**0.00**	**m^3**

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

APPENDIX D

Water Quantity Control Design

WOODLOT DRAINAGE TO THE ESTATES OF AVONLEA

Town of Uxbridge
4/9/2018

Existing Drainage Conditions to External Lands	**Area (Ha)**	**Runoff Coefficient**	**AR**
Drainage Area to Village Green Lane Accounted For By R.J, Burnside	0.58	0.35	**0.203**
Area of R.J. Burnsides AR Estimate Which is Applicable to The Site Area	0.38	0.35	**0.133**

Refer to Storm Drainage Plan in Appendix A, Drawing No ST - 1 by R.J. Burnside & Associates Limited

Proposed Drainage to External Lands	**Area (Ha)**	**Runoff Coefficient**	**AR**
Pervious runnoff	0.27	0.25	0.067
Impervious runnoff	0.07	0.90	0.062
Total Area	0.34	Total AR=	**0.129**

Therefore, proposed AR is less than the original Estimate from R.J. Burnside & Associates.

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STORM STORAGE QUANTITY REQUIREMENTS
Town of Uxbridge
4/9/2018

Storm Intensity Curve	2-year	5-year	25-year	100-year
A	645.0	904.000	1234	1799
B	5	5.0	4	5
C	0.786	0.788	0.787	0.81
Intensity (mm/hr)	76.76	107.01	154.64	200.63

Time of Concentration = 10.000 min

Proposed

	Area (ha)	Runoff Coefficient
Development Capture	2.4256	0.75
Preserved Woodlot	0.81	0.25
External Area	1.44	0.25
Total Capture Area	**4.68**	**0.51**

Storm Intensity Curve	2-year	5-year	25-year	100-year
Proposed Uncontrolled Flow (m^3/s)	0.51	0.71	1.02	1.33

	5 yr (m3/s)	100 yr (m3/s)
Allowable Target Discharge	**0.221**	**0.414**

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STORM STORAGE QUANTITY REQUIREMENTS

100-YEAR POST To 100-YEAR TARGET
Town of Uxbridge
4/9/2018

ENTRY TIME: 7.0 min
TIME STEP 0.5 min

100 yr Post Storm - 100 yr Allowable Discharge					
TIME	INTENSITY (mm/hr)	PEAK DISCHARGE (m^3/s)	RUNOFF VOLUME (m^3)	RELEASE VOLUME (m^3)	STORAGE VOLUME (m^3)
7.0	240.4	1.592	668.6	173.9	494.7
7.5	232.6	1.540	693.1	186.3	506.8
8.0	225.3	1.492	716.1	198.7	517.4
8.5	218.5	1.447	738.0	211.1	526.9
9.0	212.2	1.405	758.7	223.6	535.2
9.5	206.2	1.366	778.4	236.0	542.4
10.0	200.6	1.329	797.2	248.4	548.8
10.5	195.4	1.294	815.1	260.8	554.3
11.0	190.4	1.261	832.3	273.2	559.0
11.5	185.7	1.230	848.7	285.7	563.0
12.0	181.3	1.201	864.4	298.1	566.3
12.5	177.1	1.173	879.5	310.5	569.0
13.0	173.1	1.146	894.1	322.9	571.2
13.5	169.3	1.121	908.1	335.3	572.7
14.0	165.7	1.097	921.6	347.8	573.8
14.5	162.2	1.074	934.6	360.2	574.5
15.0	158.9	1.052	947.2	372.6	574.6
15.5	155.8	1.032	959.4	385.0	574.4
16.0	152.8	1.012	971.2	397.4	573.8
16.5	149.9	0.993	982.7	409.9	572.8
17.0	147.1	0.974	993.8	422.3	571.5

THEREFORE THE MAXIMUM VOLUME REQUIRED = 575 m^3
TIME DURATION REQUIRED TO OBTAIN MAXIMUM STORAGE = 15 min

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

STORM STORAGE QUANTITY REQUIREMENTS
5-YEAR POST To 5-YEAR TARGET
Town of Uxbridge
4/9/2018

ENTRY TIME: 10.0 min
TIME STEP 0.5 min

5 yr Post Storm - 5 yr Allowable Discharge					
TIME	INTENSITY (mm/hr)	PEAK DISCHARGE (m^3/s)	RUNOFF VOLUME (m^3)	RELEASE VOLUME (m^3)	STORAGE VOLUME (m^3)
10.0	107.0	0.709	425.2	132.6	292.6
10.5	104.3	0.691	435.1	139.2	295.8
11.0	101.7	0.674	444.5	145.9	298.7
11.5	99.3	0.657	453.6	152.5	301.1
12.0	97.0	0.642	462.3	159.1	303.2
12.5	94.8	0.628	470.7	165.8	304.9
13.0	92.7	0.614	478.8	172.4	306.4
13.5	90.7	0.601	486.6	179.0	307.6
14.0	88.8	0.588	494.1	185.6	308.5
14.5	87.0	0.576	501.4	192.3	309.1
15.0	85.3	0.565	508.4	198.9	309.5
15.5	83.7	0.554	515.2	205.5	309.7
16.0	82.1	0.544	521.9	212.2	309.7
16.5	80.6	0.534	528.3	218.8	309.5
17.0	79.1	0.524	534.5	225.4	309.1
17.5	77.7	0.515	540.6	232.1	308.5
18.0	76.4	0.506	546.5	238.7	307.8
18.5	75.1	0.497	552.2	245.3	306.9
19.0	73.9	0.489	557.8	251.9	305.9
19.5	72.7	0.481	563.3	258.6	304.7
20.0	71.5	0.474	568.6	265.2	303.4

THEREFORE THE MAXIMUM VOLUME REQUIRED = 310 m^3
TIME DURATION REQUIRED TO OBTAIN MAXIMUM STORAGE = 15.5 min

SABOURIN KIMBLE
& ASSOCIATES LTD.
CONSULTING ENGINEERS

STORM STORAGE QUANTITY REQUIREMENTS

17:386
241 Reach St. Uxbridge
Quantity Control Analysis Approach Summary

In order to control the proposed sites storm water quantity as per required, three systems will be used in conjunction:

- A combined stacked StormChamber system to store the majority of the quantity as per required.
- The poposed storm sewer system and over-sized pipes for additional storage.
- Orifice plates on the downstream manhole to restrict the flow to the allowable release rate and backup the excess flow into the upstream storage system (previous systems mentioned).

SABOURIN KIMBLE
& ASSOCIATES LTD.
CONSULTING ENGINEERS

17:386
241 Reach St. Uxbridge
Quantity Control Analysis

Quantity Control Requirement

MAXIMUM VOLUME REQUIRED		
100 yr Post Storm - 100 yr Allowable Discharge	575	m3
5 yr Post Storm - 5 yr Allowable Discharge	310	m3
Max storage Required=	**575**	**m3**

Proposed Quantity Control Measures

Storm Water Top Storage Elevation = 279.57 m (With no development Sump-Pumps)

Storm Chamber Storage		
Total Base Chamber Storage	300	m3
Base Storage Infiltration Quantity	99.779	m3
Total Top Chamber Storage	200.8	m3
Storm Chamber Quantity Control Storage	**401**	**m3**

System storage to Max ponding elevation= 279.57 in order to prevent required sumpumps

Maintenance Hole Storage																
Manhole Number	**MH24**	**MH23**	**MH22**	**MH21**	**MH20**	**MH19**	**MH18**	**MH17**	**MH16**	**MH15**	**MH14**	**MH13**	**MH12**	**MH11**	**MH10**	**MH7**
Manhole Diameter (mm)	1200	1200	1800	1800	1200	1200	1200	1800	1800	1800	1800	1800	1800	1200	1200	1200
Lowest Obvert Elevation (m)	277.97	278.15	278.40	278.70	278.79	279.06	279.24	278.49	279.46	279.59	279.67	279.77	279.89	279.99	280.10	280.22
Pipe Diameter (m)	0.600	0.600	0.900	0.900	0.450	0.450	0.375	0.900	0.900	0.900	0.900	0.900	0.900	0.525	0.450	0.450
Lowest Invert Elevation (m)	277.37	277.55	277.50	277.80	278.34	278.61	278.87	277.59	278.56	278.69	278.77	278.87	278.99	279.47	279.65	279.77
Depth of Storage (m)	2.2	2.0	2.1	1.8	1.2	1.0	0.7	2.0	1.0	0.9	0.8	0.7	0.6	0.1	-0.1	-0.2
Storage Volume (m^3)	**2.49**	**2.28**	**5.26**	**4.50**	**1.39**	**1.09**	**0.80**	**5.04**	**2.57**	**2.24**	**2.03**	**1.78**	**1.48**	**0.12**	**-0.09**	**-0.23**

Total Manhole Storage available = 33.06 m^3

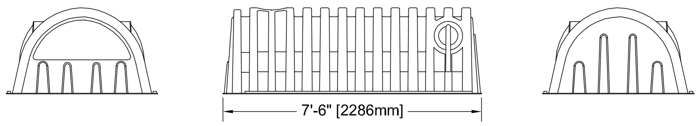
Pipe Storage																	
MH ID	**Diameter**	**D (m)**	**DS Obv**	**DS Inv**	**Raw Depth**	**Depth**	**US obv**	**US Inv**	**Raw Depth**	**Depth**	**Avg Depth**	**r**	**h**	**Theta (rad)**	**Area at Depth**	**Pipe Length**	**Volume**
24-23	600	0.600	278.050	277.45	0.600	0.600	278.150	277.55	0.600	0.600	0.600	0.000	0.000	0.000	0.283	34.7	9.81
22-21	**900**	0.900	278.480	277.58	0.900	0.900	278.700	277.80	0.900	0.900	0.900	0.000	0.000	0.000	0.636	70.0	44.53
21-20	375	0.375	278.750	278.38	0.375	0.375	278.790	278.42	0.375	0.375	0.375	0.000	0.000	0.000	0.110	12.0	1.33
20-19	375	0.375	278.840	278.47	0.375	0.375	279.060	278.69	0.375	0.375	0.375	0.000	0.000	0.000	0.110	67.5	7.46
19-18	375	0.375	279.110	278.74	0.375	0.375	279.240	278.87	0.375	0.375	0.375	0.000	0.000	0.000	0.110	13.2	1.46
22-17	750	0.750	278.450	277.70	0.750	0.750	278.490	277.74	0.750	0.750	0.750	0.000	0.000	0.000	0.442	3.6	1.59
17-16	**900**	0.900	278.540	277.64	0.900	0.900	279.460	278.56	0.900	0.900	0.900	0.000	0.000	0.000	0.636	69.4	44.15
16-15 (Possible Granular Storage)	**900**	0.900	279.540	278.64	0.900	0.900	279.590	278.69	0.880	0.880	0.890	0.440	0.010	0.422	0.635	15.4	9.78
15-14 (Possible Granular Storage)	**900**	0.900	279.640	278.74	0.830	0.830	279.670	278.77	0.800	0.800	0.815	0.365	0.085	1.249	0.606	10.5	6.36
14-13 (Possible Granular Storage)	**900**	0.900	279.720	278.82	0.750	0.750	279.740	278.84	0.730	0.730	0.740	0.290	0.160	1.741	0.560	7.2	4.03
13-12	**900**	0.900	279.790	278.89	0.680	0.680	279.890	278.99	0.580	0.580	0.630	0.180	0.270	2.319	0.476	32.1	15.27
12-11 (Possible Granular Storage)	525	0.525	279.940	279.42	0.155	0.155	280.890	279.99	-0.420	0.000	0.077	0.185	0.077	1.577	0.020	17.8	0.35

Total Pipe Storage Available = 146.11 m^3

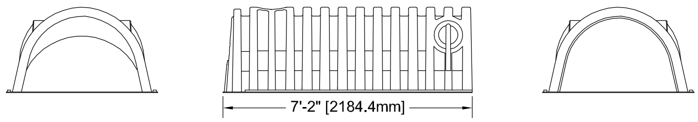
Summary of Quantity Control Measures

Quantity Control Required	**574.6**	**m3**

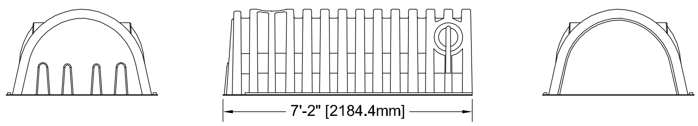
Proposed Storm Chamber Storage	400.7	m3
Proposed Manhole Storage	33.06	m3
Proposed Pipe Storage	146.11	m3
Total Proposed Storage Volume	**579.90**	**m3**



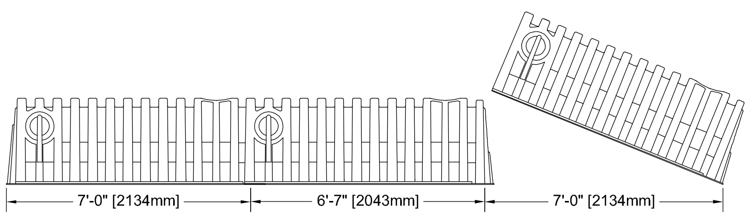
START CHAMBER CONFIGURATION
START MODEL IS CLOSED AT THE SIDE PORTAL END AND PARTIALLY OPEN AT THE TOP PORTAL END



MIDDLE CHAMBER CONFIGURATION
MIDDLE MODEL IS COMPLETELY OPEN AT THE SIDE PORTAL END AND PARTIALLY OPEN AT THE TOP PORTAL END



END CHAMBER CONFIGURATION
END MODEL IS COMPLETELY OPEN AT THE SIDE PORTAL END AND COMPLETLY CLOSED AT THE TOP PORTAL END

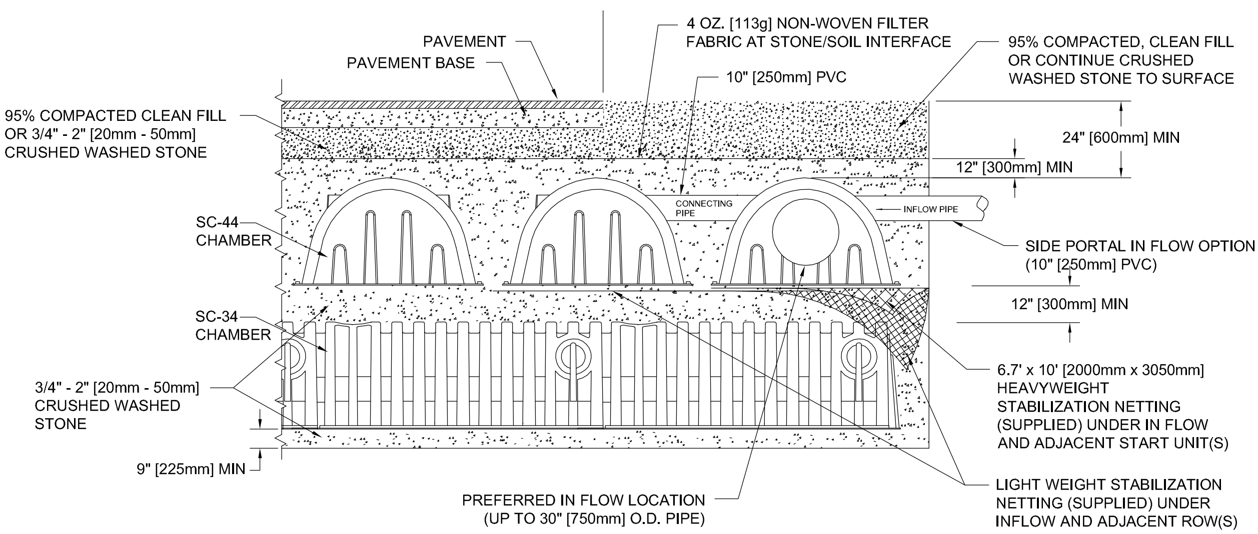


LAY-UP LENGTHS

NOTE:
1. Start chambers (closed at the side portal end) are placed at the inflow end of the rows.
2. Begin placements with Start chambers and end rows with End chambers.
3. Place first rib of next chamber in the row over last rib of previous chamber.

RECOMMENDED STACKED INSTALLATION OF STORMCHAMBER® SC-44 FOR STORMWATER MANAGEMENT (PROVIDED AS AN ILLUSTRATED EXAMPLE ONLY)

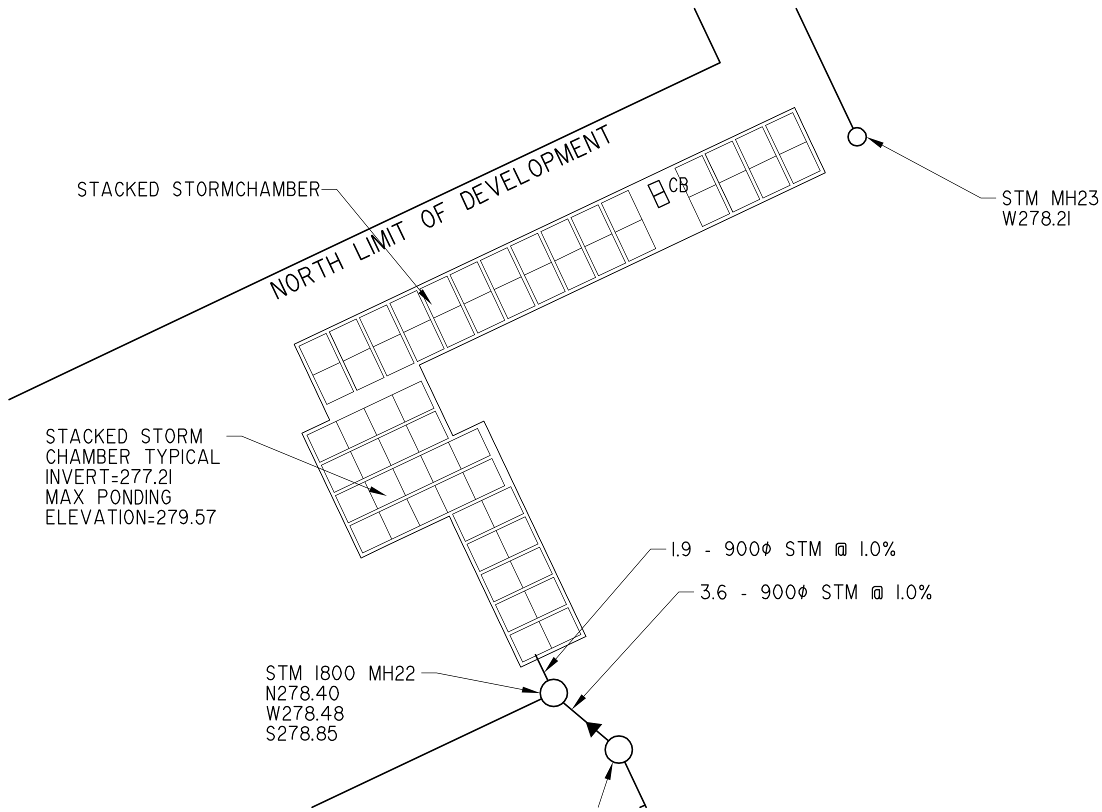
FOR PAVED AREAS
FOR UNPAVED AREAS



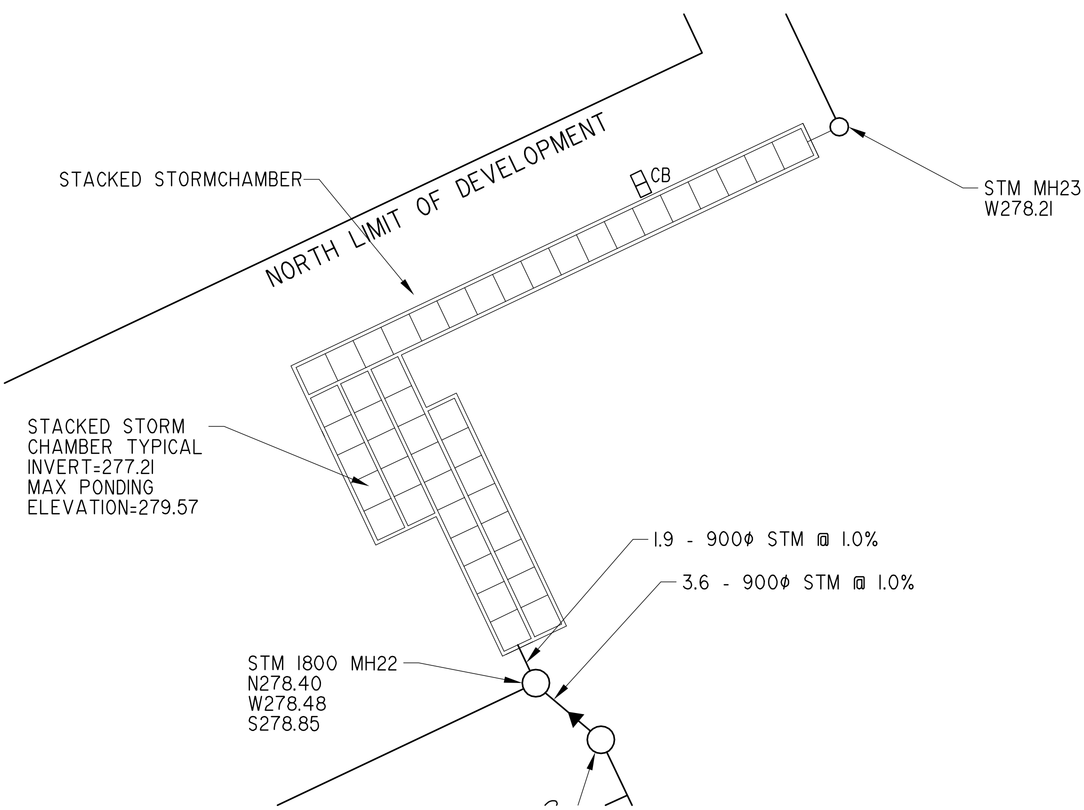
SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

STORMCHAMBER® DESIGN DETAILS SHEET FOR SC-44 CHAMBER

FIGURE No.



UPPER STORMCHAMBER CONFIGURATION



BOTTOM STORMCHAMBER CONFIGURATION

SABOURIN KIMBLE
& ASSOCIATES LTD.
CONSULTING ENGINEERS

STORMCHAMBER CONFIGURATION

FIGURE No.

Project: Venetian, Uxbridge
Engineer:
Location: 241 Reach St, Uxbridge
Date: 29-Mar-18

STORMCHAMBER®
by Hydrologic Solutions

Choose a Chamber Model	**SC-44**
Choose a Units System	**Metric**

If you have any Questions or Concerns Contact us at
info@stormchambers.com

Total Number of Chambers	**46**
Void Space in Stone (%)	**40%**
Elevation of Stone Base (meters)	**276**
Stone Above Chambers (mm)	**300**
Stone Below Chambers (mm)	**1200**
Space Between Rows (mm)	**230**
Total Number of Rows	**5**

☑ Inclue Perimeter Stone in Calculations

StormChamber Staged Storage

Height of System (mm)	Incremental Single Chamber (cubic meters)	Incremental Total Chambers (cubic meters)	Incremental Stone (cubic meters)	Incremental Ch & St (cubic meters)	Cumulative Ch & St (cubic meters)	Elevation (meters)
2617.00	0.000	0.000	2.112	2.112	299.712	278.617
2591.60	0.000	0.000	2.112	2.112	297.600	278.592
2566.20	0.000	0.000	2.112	2.112	295.488	278.566
2540.80	0.000	0.000	2.112	2.112	293.376	278.541
2515.40	0.000	0.000	2.112	2.112	291.264	278.515
2490.00	0.000	0.000	2.112	2.112	289.152	278.490
2464.60	0.000	0.000	2.112	2.112	287.040	278.465
2439.20	0.000	0.000	2.112	2.112	284.928	278.439
2413.80	0.000	0.000	2.112	2.112	282.816	278.414
2388.40	0.000	0.000	2.112	2.112	280.704	278.388
2363.00	0.000	0.000	2.112	2.112	278.592	278.363
2337.60	0.000	0.000	1.713	1.713	276.480	278.338
2317.00	0.009	0.414	1.946	2.360	274.767	278.317
2291.60	0.021	0.966	1.726	2.692	272.407	278.292
2266.20	0.028	1.288	1.597	2.885	269.715	278.266
2240.80	0.033	1.518	1.505	3.023	266.830	278.241
2215.40	0.038	1.748	1.413	3.161	263.807	278.215
2190.00	0.042	1.932	1.339	3.271	260.646	278.190
2164.60	0.046	2.116	1.266	3.382	257.375	278.165
2139.20	0.049	2.254	1.210	3.464	253.993	278.139
2113.80	0.052	2.392	1.155	3.547	250.529	278.114
2088.40	0.055	2.530	1.100	3.630	246.982	278.088
2063.00	0.057	2.622	1.063	3.685	243.352	278.063
2037.60	0.060	2.760	1.008	3.768	239.667	278.038
2012.20	0.062	2.852	0.971	3.823	235.899	278.012
1986.80	0.064	2.944	0.934	3.878	232.076	277.987
1961.40	0.066	3.036	0.898	3.934	228.198	277.961
1936.00	0.067	3.082	0.879	3.961	224.264	277.936
1910.60	0.069	3.174	0.842	4.016	220.303	277.911
1885.20	0.070	3.220	0.824	4.044	216.287	277.885
1859.80	0.071	3.266	0.806	4.072	212.243	277.860
1834.40	0.073	3.358	0.769	4.127	208.171	277.834
1809.00	0.074	3.404	0.750	4.154	204.044	277.809
1783.60	0.075	3.450	0.732	4.182	199.890	277.784
1758.20	0.076	3.496	0.714	4.210	195.708	277.758
1732.80	0.076	3.496	0.714	4.210	191.498	277.733
1707.40	0.077	3.542	0.695	4.237	187.288	277.707
1682.00	0.078	3.588	0.677	4.265	183.051	277.682
1656.60	0.078	3.588	0.677	4.265	178.786	277.657
1631.20	0.079	3.634	0.658	4.292	174.521	277.631
1605.80	0.079	3.634	0.658	4.292	170.229	277.606
1580.40	0.080	3.680	0.640	4.320	165.937	277.580
1555.00	0.080	3.680	0.640	4.320	161.617	277.555
1529.60	0.081	3.726	0.622	4.348	157.297	277.530
1504.20	0.081	3.726	0.622	4.348	152.949	277.504
1478.80	0.082	3.772	0.603	4.375	148.601	277.479
1453.40	0.082	3.772	0.603	4.375	144.226	277.453
1428.00	0.083	3.818	0.585	4.403	139.851	277.428
1402.60	0.083	3.818	0.585	4.403	135.448	277.403
1377.20	0.084	3.864	0.566	4.430	131.045	277.377
1351.80	0.084	3.864	0.566	4.430	126.615	277.352
1326.40	0.085	3.910	0.548	4.458	122.185	277.326
1301.00	0.086	3.956	0.530	4.486	117.727	277.301
1275.60	0.086	3.956	0.530	4.486	113.241	277.276
1250.20	0.087	4.002	0.511	4.513	108.755	277.250
1224.80	0.087	4.002	0.461	4.463	104.242	277.225
1200.00	0.000	0.000	2.112	2.112	99.779	277.200
1174.60	0.000	0.000	2.112	2.112	97.667	277.175
1149.20	0.000	0.000	2.112	2.112	95.555	277.149
1123.80	0.000	0.000	2.112	2.112	93.443	277.124
1098.40	0.000	0.000	2.112	2.112	91.331	277.098
1073.00	0.000	0.000	2.112	2.112	89.219	277.073
1047.60	0.000	0.000	2.112	2.112	87.107	277.048
1022.20	0.000	0.000	2.112	2.112	84.995	277.022
996.80	0.000	0.000	2.112	2.112	82.883	276.997
971.40	0.000	0.000	2.112	2.112	80.771	276.971
946.00	0.000	0.000	2.112	2.112	78.659	276.946
920.60	0.000	0.000	2.112	2.112	76.547	276.921
895.20	0.000	0.000	2.112	2.112	74.435	276.895
869.80	0.000	0.000	2.112	2.112	72.323	276.870
844.40	0.000	0.000	2.112	2.112	70.211	276.844
819.00	0.000	0.000	2.112	2.112	68.099	276.819
793.60	0.000	0.000	2.112	2.112	65.987	276.794
768.20	0.000	0.000	2.112	2.112	63.875	276.768
742.80	0.000	0.000	2.112	2.112	61.763	276.743

717.40	0.000	0.000	2.112	2.112	59.651	276.717
692.00	0.000	0.000	2.112	2.112	57.539	276.692
666.60	0.000	0.000	2.112	2.112	55.427	276.667
641.20	0.000	0.000	2.112	2.112	53.315	276.641
615.80	0.000	0.000	2.112	2.112	51.203	276.616
590.40	0.000	0.000	2.112	2.112	49.091	276.590
565.00	0.000	0.000	2.112	2.112	46.979	276.565
539.60	0.000	0.000	2.112	2.112	44.867	276.540
514.20	0.000	0.000	2.112	2.112	42.755	276.514
488.80	0.000	0.000	2.112	2.112	40.643	276.489
463.40	0.000	0.000	2.112	2.112	38.531	276.463
438.00	0.000	0.000	2.112	2.112	36.419	276.438
412.60	0.000	0.000	2.112	2.112	34.307	276.413
387.20	0.000	0.000	2.112	2.112	32.195	276.387
361.80	0.000	0.000	2.112	2.112	30.083	276.362
336.40	0.000	0.000	2.112	2.112	27.971	276.336
311.00	0.000	0.000	2.112	2.112	25.859	276.311
285.60	0.000	0.000	2.112	2.112	23.747	276.286
260.20	0.000	0.000	2.112	2.112	21.635	276.260
234.80	0.000	0.000	2.112	2.112	19.523	276.235
209.40	0.000	0.000	2.112	2.112	17.411	276.209
184.00	0.000	0.000	2.112	2.112	15.299	276.184
158.60	0.000	0.000	2.112	2.112	13.187	276.159
133.20	0.000	0.000	2.112	2.112	11.075	276.133
107.80	0.000	0.000	2.112	2.112	8.963	276.108
82.40	0.000	0.000	2.112	2.112	6.851	276.082
57.00	0.000	0.000	2.112	2.112	4.739	276.057
31.60	0.000	0.000	2.112	2.112	2.627	276.032
6.20	0.000	0.000	0.515	0.515	0.515	276.006
0.00	0.000	0.000	0.000	0.000	0.000	0.000

Project: Venetian, Uxbridge
Engineer:
Location: 241 Reach St, Uxbridge
Date: 29-Mar-18

STORMCHAMBER® by Hydrologic Solutions

Choose a Chamber Model	SC-44
Choose a Units System	Metric

If you have any Questions or Concerns Contact us at
info@stormchambers.com

Total Number of Chambers	46
Void Space in Stone (%)	40%
Elevation of Stone Base (meters)	277.21
Stone Above Chambers (mm)	300
Stone Below Chambers (mm)	0
Space Between Rows (mm)	230
Total Number of Rows	5

☑ Inclue Perimeter Stone in Calculations

StormChamber Staged Storage

Height of System (mm)	Incremental Single Chamber (cubic meters)	Incremental Total Chambers (cubic meters)	Incremental Stone (cubic meters)	Incremental Ch & St (cubic meters)	Cumulative Ch & St (cubic meters)	Elevation (meters)
1417.00	0.000	0.000	2.112	2.112	199.933	278.627
1391.60	0.000	0.000	2.112	2.112	197.821	278.602
1366.20	0.000	0.000	2.112	2.112	195.709	278.576
1340.80	0.000	0.000	2.112	2.112	193.597	278.551
1315.40	0.000	0.000	2.112	2.112	191.485	278.525
1290.00	0.000	0.000	2.112	2.112	189.373	278.500
1264.60	0.000	0.000	2.112	2.112	187.261	278.475
1239.20	0.000	0.000	2.112	2.112	185.149	278.449
1213.80	0.000	0.000	2.112	2.112	183.037	278.424
1188.40	0.000	0.000	2.112	2.112	180.925	278.398
1163.00	0.000	0.000	2.112	2.112	178.813	278.373
1137.60	0.000	0.000	1.713	1.713	176.701	278.348
1117.00	0.009	0.414	1.946	2.360	174.988	278.327
1091.60	0.021	0.966	1.726	2.692	172.628	278.302
1066.20	0.028	1.288	1.597	2.885	169.936	278.276
1040.80	0.033	1.518	1.505	3.023	167.051	278.251
1015.40	0.038	1.748	1.413	3.161	164.028	278.225
990.00	0.042	1.932	1.339	3.271	160.867	278.200
964.60	0.046	2.116	1.266	3.382	157.596	278.175
939.20	0.049	2.254	1.210	3.464	154.214	278.149
913.80	0.052	2.392	1.155	3.547	150.750	278.124
888.40	0.055	2.530	1.100	3.630	147.203	278.098
863.00	0.057	2.622	1.063	3.685	143.573	278.073
837.60	0.060	2.760	1.008	3.768	139.888	278.048
812.20	0.062	2.852	0.971	3.823	136.120	278.022
786.80	0.064	2.944	0.934	3.878	132.297	277.997
761.40	0.066	3.036	0.898	3.934	128.419	277.971
736.00	0.067	3.082	0.879	3.961	124.485	277.946
710.60	0.069	3.174	0.842	4.016	120.524	277.921
685.20	0.070	3.220	0.824	4.044	116.508	277.895
659.80	0.071	3.266	0.806	4.072	112.464	277.870
634.40	0.073	3.358	0.769	4.127	108.392	277.844
609.00	0.074	3.404	0.750	4.154	104.265	277.819
583.60	0.075	3.450	0.732	4.182	100.111	277.794
558.20	0.076	3.496	0.714	4.210	95.929	277.768
532.80	0.076	3.496	0.714	4.210	91.719	277.743
507.40	0.077	3.542	0.695	4.237	87.509	277.717
482.00	0.078	3.588	0.677	4.265	83.272	277.692
456.60	0.078	3.588	0.677	4.265	79.007	277.667
431.20	0.079	3.634	0.658	4.292	74.742	277.641
405.80	0.079	3.634	0.658	4.292	70.450	277.616
380.40	0.080	3.680	0.640	4.320	66.158	277.590
355.00	0.080	3.680	0.640	4.320	61.838	277.565
329.60	0.081	3.726	0.622	4.348	57.518	277.540
304.20	0.081	3.726	0.622	4.348	53.170	277.514
278.80	0.082	3.772	0.603	4.375	48.822	277.489
253.40	0.082	3.772	0.603	4.375	44.447	277.463
228.00	0.083	3.818	0.585	4.403	40.072	277.438
202.60	0.083	3.818	0.585	4.403	35.669	277.413
177.20	0.084	3.864	0.566	4.430	31.266	277.387
151.80	0.084	3.864	0.566	4.430	26.836	277.362
126.40	0.085	3.910	0.548	4.458	22.406	277.336
101.00	0.086	3.956	0.530	4.486	17.948	277.311
75.60	0.086	3.956	0.530	4.486	13.462	277.286
50.20	0.087	4.002	0.511	4.513	8.976	277.260
24.80	0.087	4.002	0.461	4.463	4.463	277.235
0.00	0.000	0.000	0.000	0.000	0.000	0.000

Project: Venetian, Uxbridge
Engineer:
Location: 241 Reach St, Uxbridge
Date: Feb 16/18

Choose a Chamber Model	SC-44
Choose a Units System	Metric

If you have any Questions or Concerns Contact us at
info@stormchambers.com

Total Number of Chambers	58
Void Space in Stone (%)	40%
Elevation of Stone Base (meters)	278.63
Stone Above Chambers (mm)	300
Stone Below Chambers (mm)	0
Space Between Rows (mm)	230
Total Number of Rows	23

☑ Inclue Perimeter Stone in Calculations

StormChamber Staged Storage

Height of System (mm)	Incremental Single Chamber (cubic meters)	Incremental Total Chambers (cubic meters)	Incremental Stone (cubic meters)	Incremental Ch & St (cubic meters)	Cumulative Ch & St (cubic meters)	Elevation (meters)
1417.00	0.000	0.000	2.833	2.833	261.645	280.047
1391.60	0.000	0.000	2.833	2.833	258.812	280.022
1366.20	0.000	0.000	2.833	2.833	255.979	279.996
1340.80	0.000	0.000	2.833	2.833	253.146	279.971
1315.40	0.000	0.000	2.833	2.833	250.313	279.945
1290.00	0.000	0.000	2.833	2.833	247.480	279.920
1264.60	0.000	0.000	2.833	2.833	244.647	279.895
1239.20	0.000	0.000	2.833	2.833	241.814	279.869
1213.80	0.000	0.000	2.833	2.833	238.981	279.844
1188.40	0.000	0.000	2.833	2.833	236.148	279.818
1163.00	0.000	0.000	2.833	2.833	233.315	279.793
1137.60	0.000	0.000	2.298	2.298	230.482	279.768
1117.00	0.009	0.522	2.626	3.148	228.184	279.747
1091.60	0.021	1.218	2.347	3.565	225.036	279.722
1066.20	0.028	1.624	2.185	3.809	221.471	279.696
1040.80	0.033	1.914	2.069	3.983	217.662	279.671
1015.40	0.038	2.204	1.953	4.157	213.679	279.645
990.00	0.042	2.436	1.860	4.296	209.522	279.620
964.60	0.046	2.668	1.767	4.435	205.226	279.595
939.20	0.049	2.842	1.698	4.540	200.791	279.569
913.80	0.052	3.016	1.628	4.644	196.251	279.544
888.40	0.055	3.190	1.559	4.749	191.607	279.518
863.00	0.057	3.306	1.512	4.818	186.858	279.493
837.60	0.060	3.480	1.443	4.923	182.040	279.468
812.20	0.062	3.596	1.396	4.992	177.117	279.442
786.80	0.064	3.712	1.350	5.062	172.125	279.417
761.40	0.066	3.828	1.303	5.131	167.063	279.391
736.00	0.067	3.886	1.280	5.166	161.932	279.366
710.60	0.069	4.002	1.234	5.236	156.766	279.341
685.20	0.070	4.060	1.211	5.271	151.530	279.315
659.80	0.071	4.118	1.187	5.305	146.259	279.290
634.40	0.073	4.234	1.141	5.375	140.954	279.264
609.00	0.074	4.292	1.118	5.410	135.579	279.239
583.60	0.075	4.350	1.095	5.445	130.169	279.214
558.20	0.076	4.408	1.071	5.479	124.724	279.188
532.80	0.076	4.408	1.071	5.479	119.245	279.163
507.40	0.077	4.466	1.048	5.514	113.766	279.137
482.00	0.078	4.524	1.025	5.549	108.252	279.112
456.60	0.078	4.524	1.025	5.549	102.703	279.087
431.20	0.079	4.582	1.002	5.584	97.154	279.061
405.80	0.079	4.582	1.002	5.584	91.570	279.036
380.40	0.080	4.640	0.979	5.619	85.986	279.010
355.00	0.080	4.640	0.979	5.619	80.367	278.985
329.60	0.081	4.698	0.955	5.653	74.748	278.960
304.20	0.081	4.698	0.955	5.653	69.095	278.934
278.80	0.082	4.756	0.932	5.688	63.442	278.909
253.40	0.082	4.756	0.932	5.688	57.754	278.883
228.00	0.083	4.814	0.909	5.723	52.066	278.858
202.60	0.083	4.814	0.909	5.723	46.343	278.833
177.20	0.084	4.872	0.886	5.758	40.620	278.807
151.80	0.084	4.872	0.886	5.758	34.862	278.782
126.40	0.085	4.930	0.863	5.793	29.104	278.756
101.00	0.086	4.988	0.839	5.827	23.311	278.731
75.60	0.086	4.988	0.839	5.827	17.484	278.706
50.20	0.087	5.046	0.816	5.862	11.657	278.680
24.80	0.087	5.046	0.749	5.795	5.795	278.655
0.00	0.000	0.000	0.000	0.000	0.000	0.000

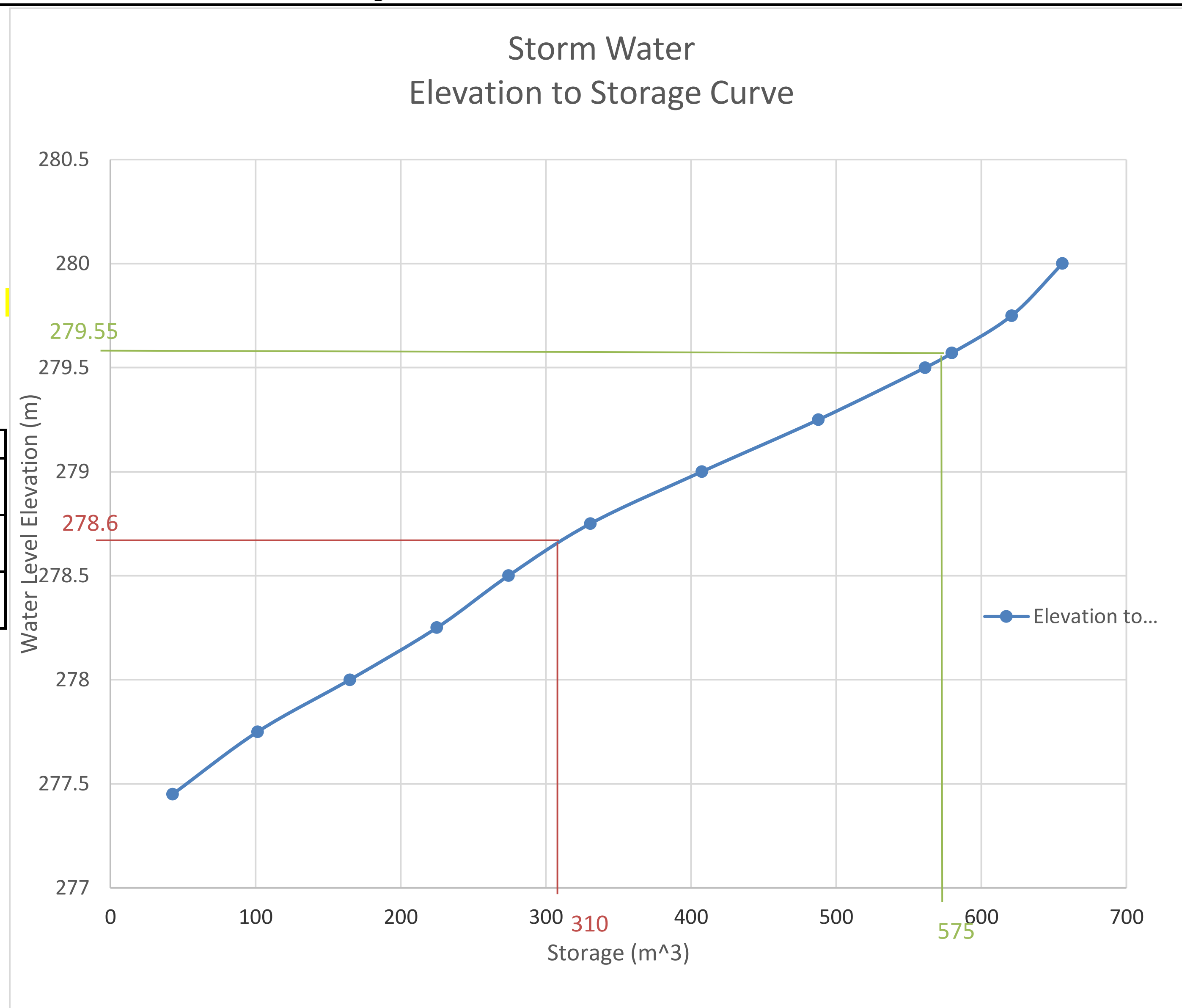
17:386
241 Reach St. Uxbridge
Quantity Control Analysis

Elevation to Storage Curve

Elevation (m)	Storage (m^3)
277.45	43
277.75	102
278	165
278.25	225
278.5	274.3
278.75	330.7
279	407.6
279.25	487.9
279.5	561.5
279.57	579.9
279.75	621
280	656

Orifice Control Measures

	Quanitiy (m^3)	Elevation of Ponding (m)
5 Year Storm Release	310	278.60
100 Year Storm Release	575	279.55



5 YEAR STORM VERTICAL ORIFICE PLATE

Req. Flow	**0.221**	m^3/s	**Input Variables**
H_{max}	278.60	m	
Pipe Invert (Orifice #1 Inv)	277.45	m	
C	0.63		
Head	0.99	m	
Orifice #1 Diameter	**318**	**mm**	

$$Q = CA\sqrt{2gh}$$

Q = (0.630) (0.079) (2 x 9.81 x 0.99 m)

Q = 0.221 m^3/s

100 YEAR STORM VERTICAL ORIFICE PLATE

Flow Released through 5 Year control Orfice at 100 Year Ponding Elevation:

H_{max}	279.55	m
Pipe Invert (Orifice #1 Inv)	277.45	m
C	0.63	
Head	1.94	m
Diameter	**318**	**mm**

$$Q = CA\sqrt{2gh}$$

Q = (0.630) (0.079) (2 x 9.81 x 1.94 m)

Q = 0.309 m^3/s

Required Total Out Flow	0.414	m^3/s
5 Year Control Orifice Flow	0.309	m^3/s
Remaining 100 Year Control Orifice Flow	0.105	m^3/s
Orifice #2 Inv	278.60	m
Head	0.95	m
Orifice #2 Diameter	**222**	**mm**

Q = (0.630) (0.039) (2 x 9.81 x 0.95 m)

Q = 0.105 m^3/s

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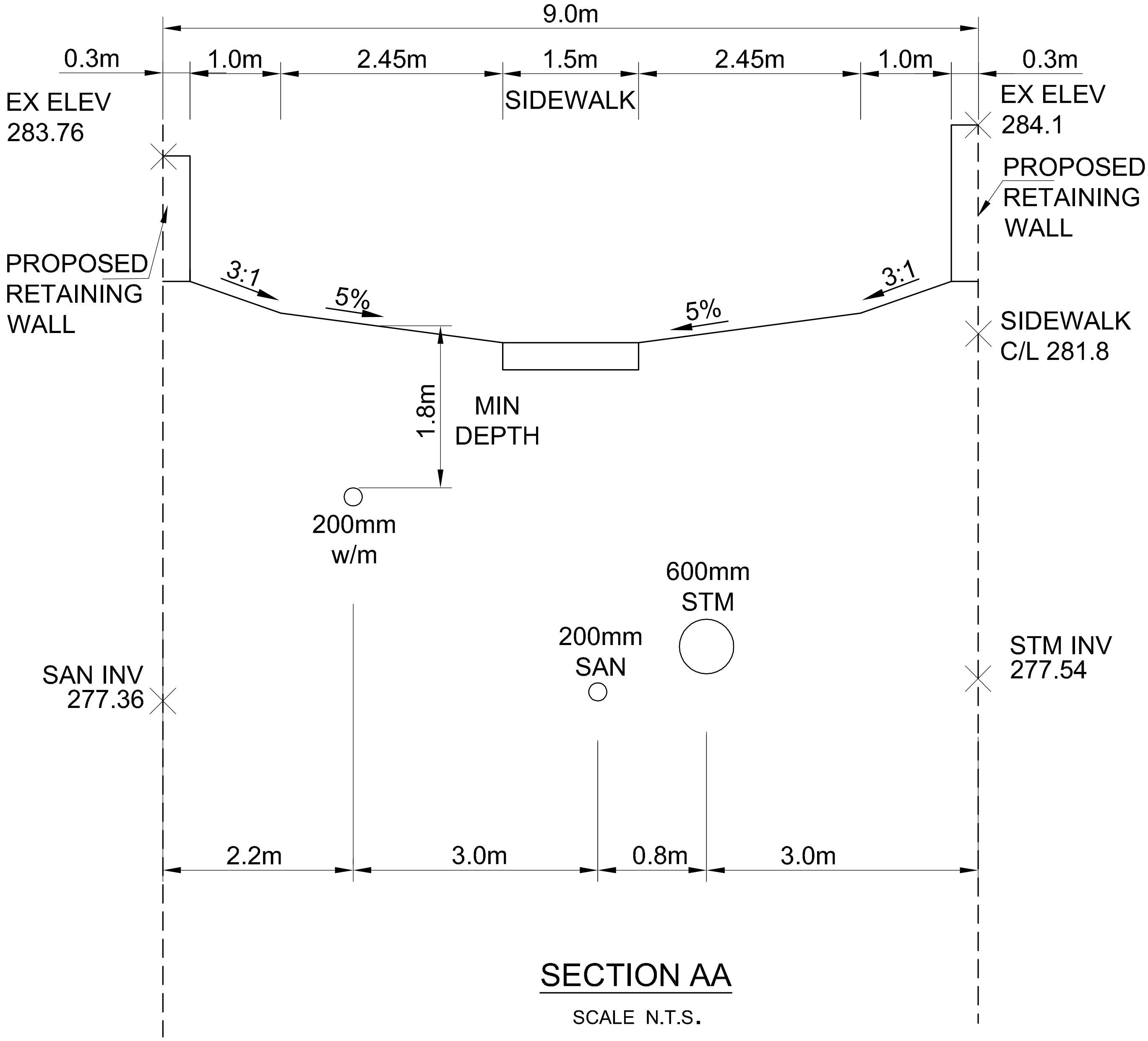
CONSULTING ENGINEERS



SECTION AA

SCALE N.T.S.

SABOURIN KIMBLE
& ASSOCIATES LTD.
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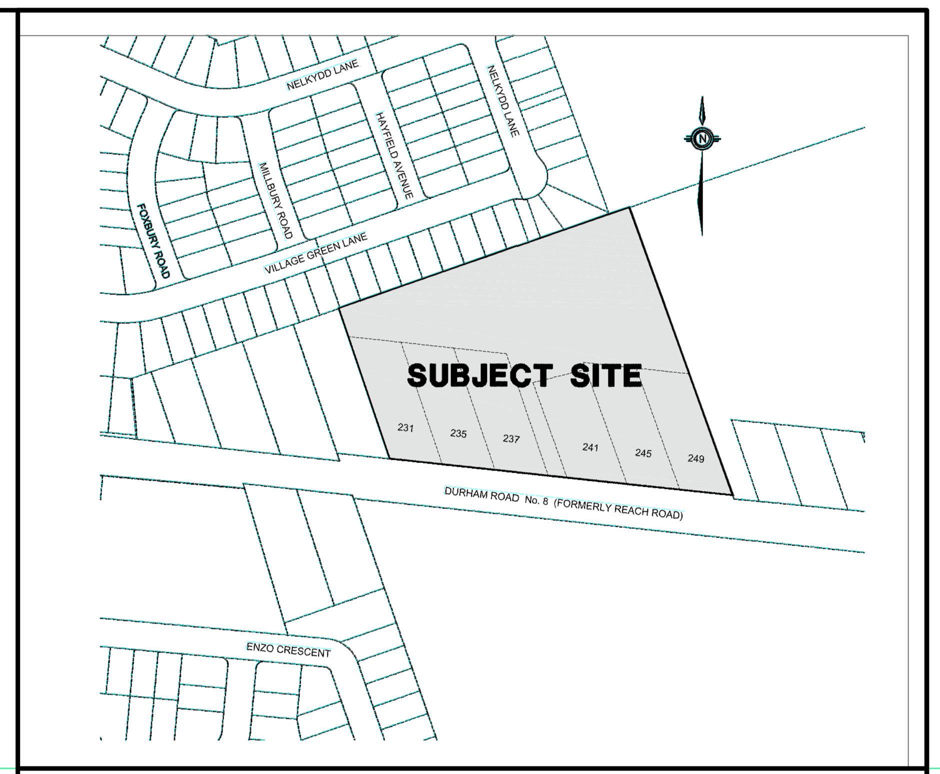
EASEMENT CROSS SECTION A-A

FIGURE No.

AA



KEYMAP N.T.S.

LEGEND:

- SWALE GRADE
- SWALE DRAINAGE
- PROPOSED GRADE
- EXISTING GRADE
- EXISTING CONTOURS
- PROPOSED 3:1 SLOPE

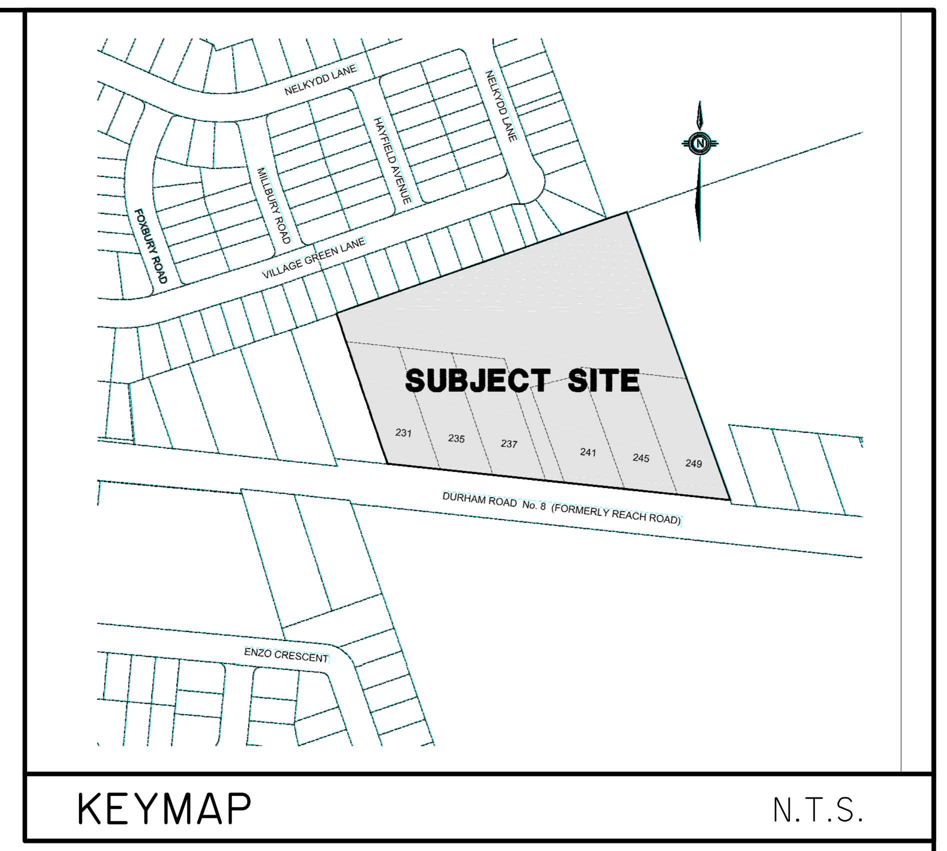
SCALE 1:500

PROPOSED GRADING

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

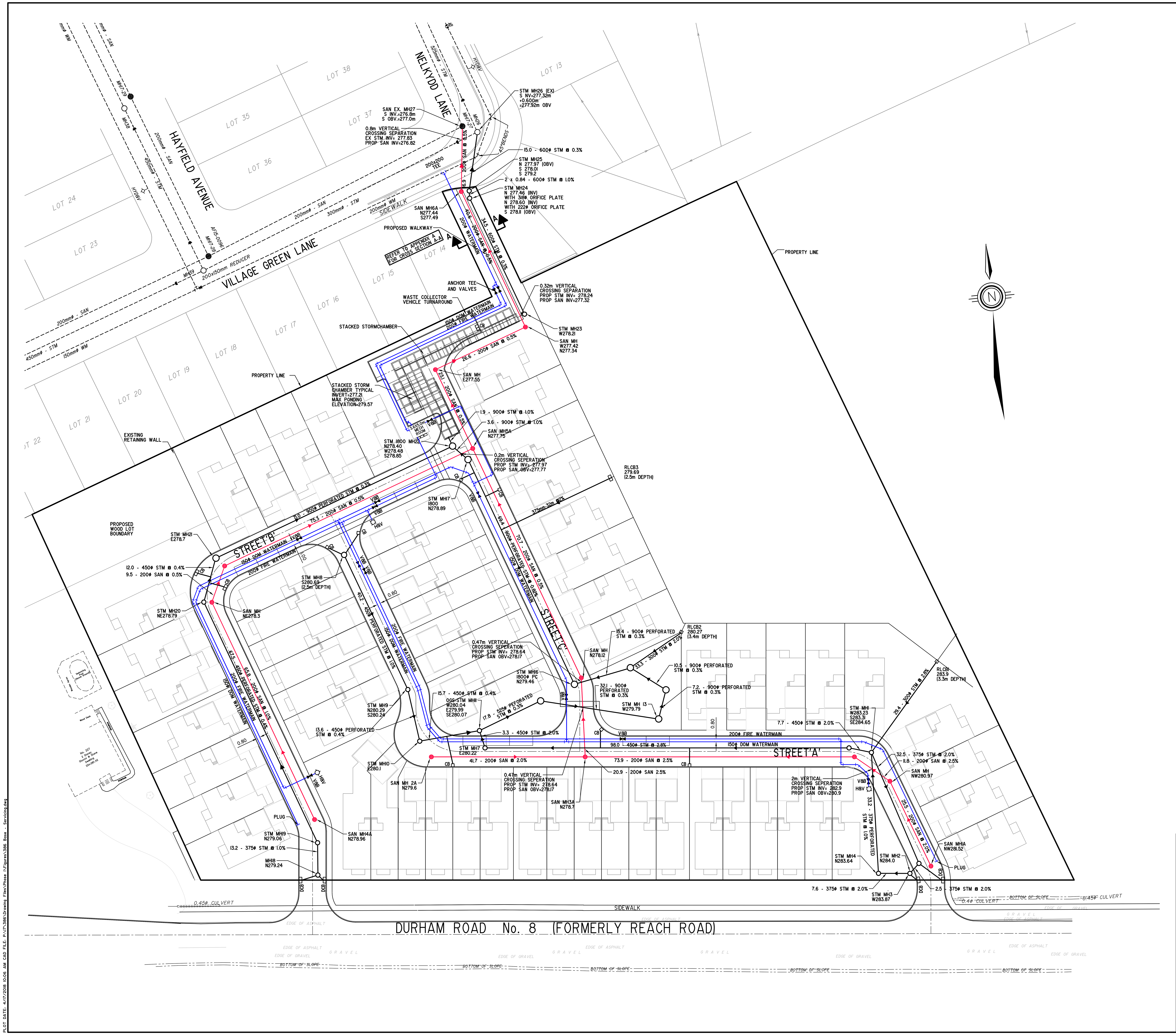
PROJECT NUMBER	FIGURE NUMBER
17:386	4

PLOT DATE: 4/17/2018 8:23 AM CAD FILE: P:\17\386\Drawing Files\Phase 1\Figures\386 Base - Grading.dwg



LEGEND:

- PROPOSED STORM SEWER FLOW DIRECTION
- PROPOSED SANITARY SEWER FLOW DIRECTION
- PROPOSED WATERMAIN
- PROPOSED HYDRANT AND VALVE
- PROPOSED VALVE AND BOX
- PROPOSED SANITARY MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED CATCHBASIN



SCALE 1:500

PROPOSED SERVICING

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
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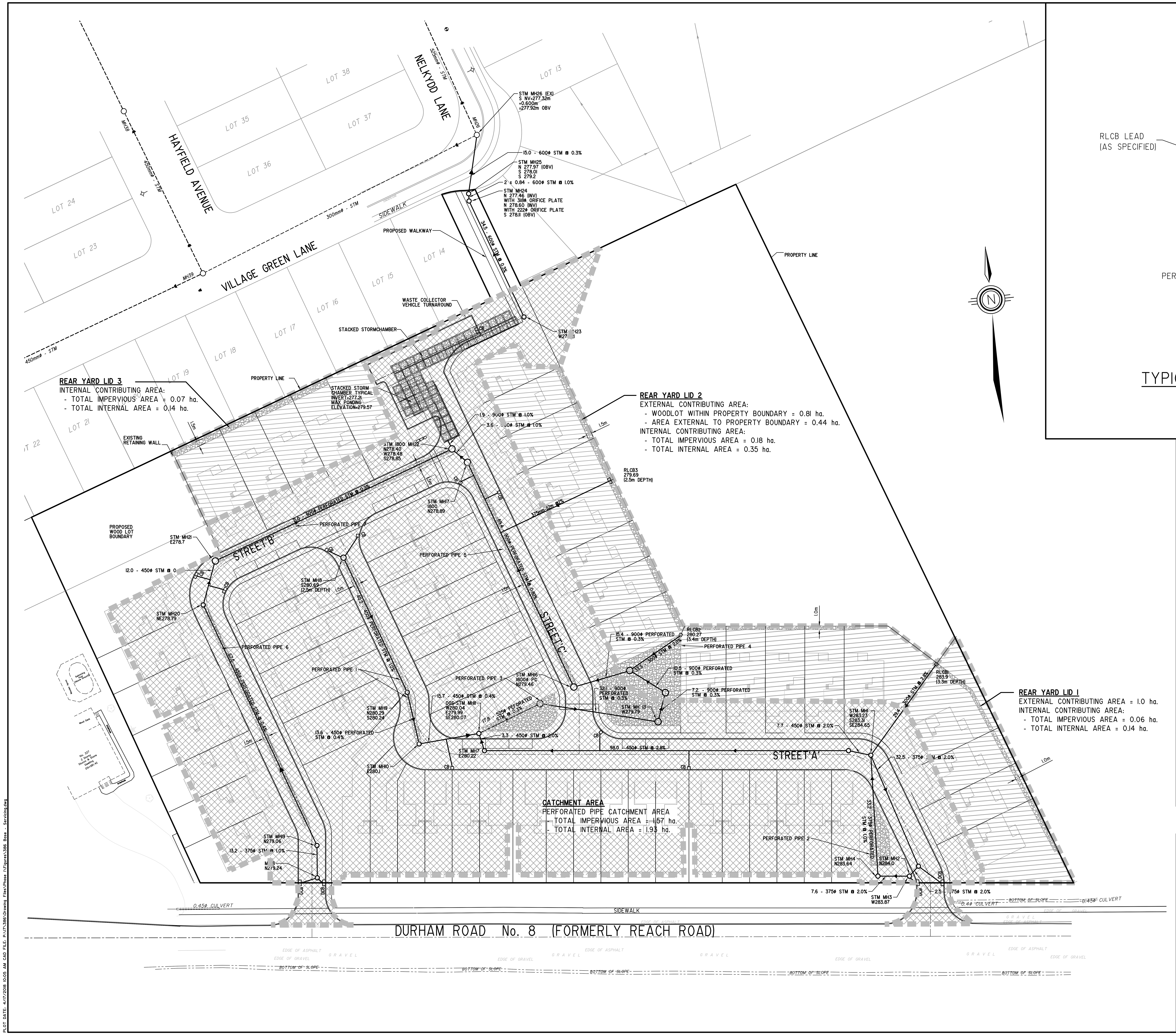
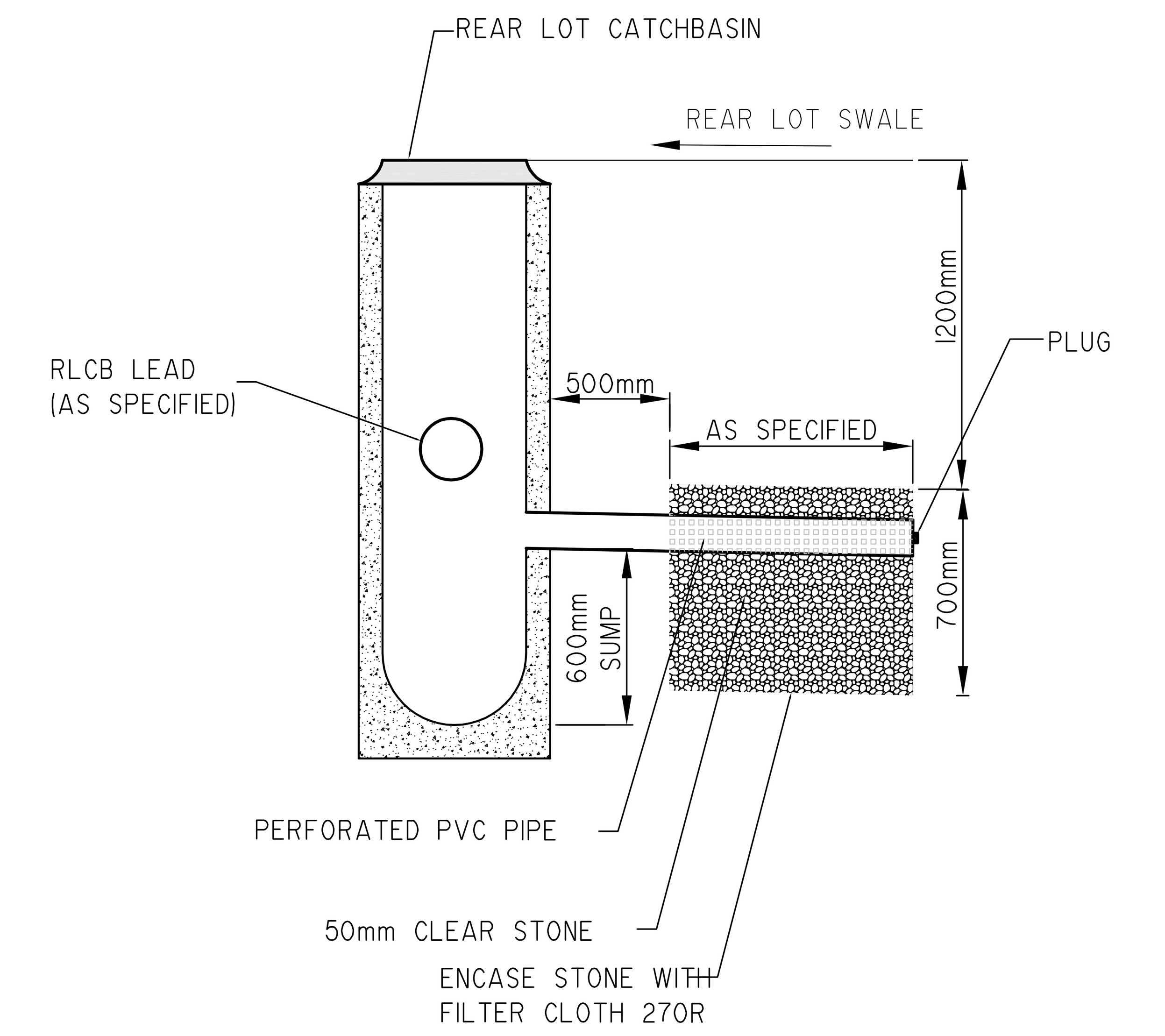
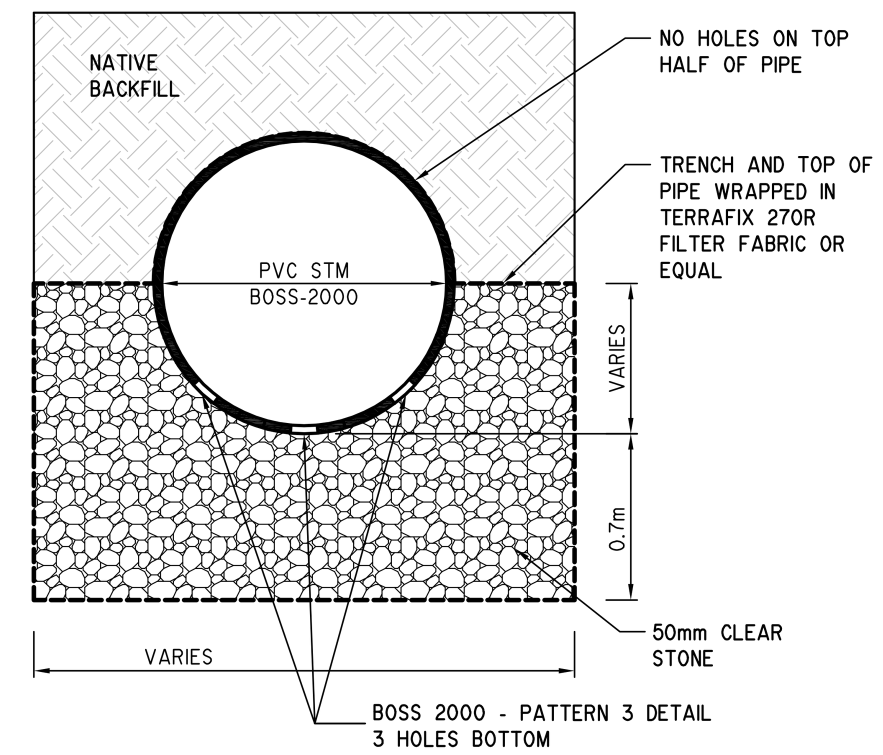




TYPICAL PERVIOUS RLCB

NTS



PERFORATED PIPE TYPICAL DETAIL

N.T.S.

LEGEND

- LID CAPTURE BOUNDARY
- DIRECTION OF SEWER FLOW PROPOSED

SCALE 1:500

PROPOSED LID WORKS

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
17:386	6