Proposed Residential Site Plan Development and
Single Estate Lot
2031818 Ontario Ltd., Town of Caledon

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

October 2017

MAEL Reference 03-141

MASONGSONG ASSOCIATES ENGINEERING LIMITED
ENGINEERING SUSTAINABLE FUTURES

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

PROPOSED RESIDENTIAL SITE PLAN DEVELOPMENT AND SINGLE ESTATE LOT

FOR

2031818 Ontario Ltd.

TOWN OF CALEDON

October 2017

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Masongsong Associates Engineering Limited has been retained by 2031818 Ontario Ltd. to prepare this Functional Servicing and Stormwater Management Report in support of an Official Plan Amendment and Rezoning application for a proposed residential development in the Town of Caledon.

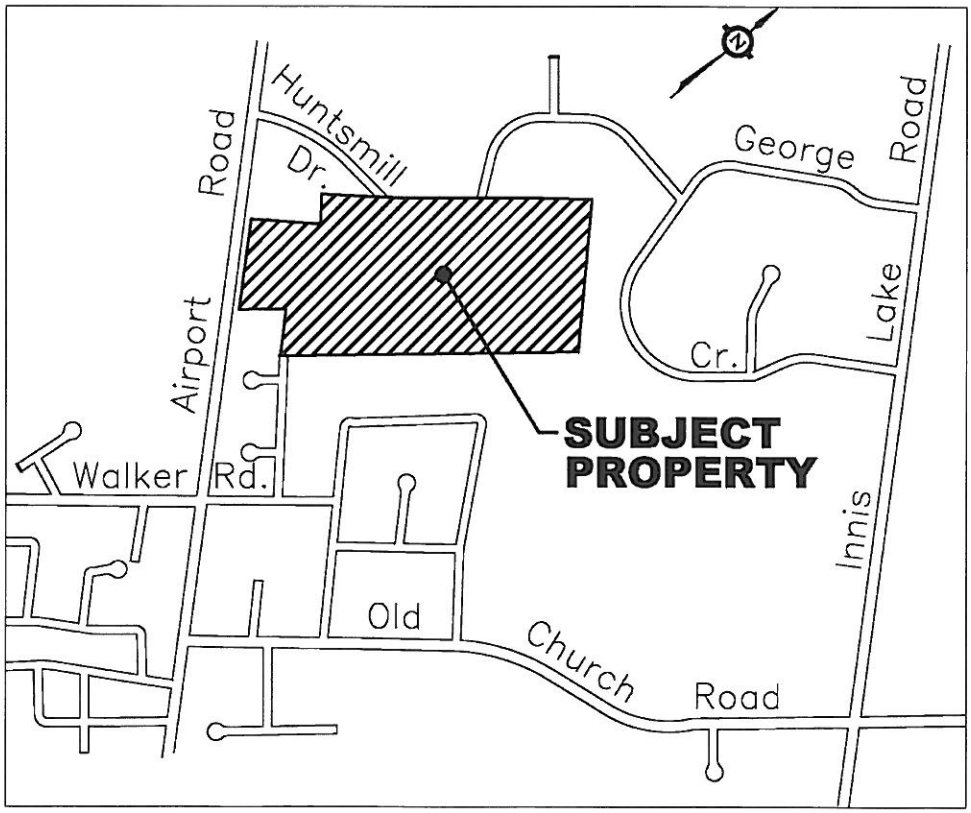
The purpose of this report is to identify the requirements for servicing and stormwater management, and to demonstrate how this site will function within the framework of existing infrastructure.

Preliminary engineering plans are enclosed in the rear Figures Appendix A for reference throughout this report.

1.0 BACKGROUND

The roughly rectangular shaped site comprises an area of approximately 18.85 ha (46.58 acres), located approximately 800m north of Old Church Street on the east side of Airport Road. The legal description of the property is Part of Lot 22 Concession 1 in the Town of Caledon, Region of Peel. A site location plan is illustrated as Figure 1.

Figure 1 *Site Location Plan*



A prominent natural feature, a branch of the Boyce's Creek tributary, traverses the property north to south, effectively "severing" the lands into distinct east and west portions. Other major constraints on the site include a hill landform to the south, a woodlot adjacent to Airport Road and a Locally Significant Wetland (LSW) through the north and central portions of the site. The remaining developable area has been delineated through joint studies by Terraprobe (Geotechnical and Slope Stability analysis), Azimuth Environmental (Natural Environment, features limits) and Masongsong Associates Engineering Limited (floodplain mapping), and it is on this basis that the current site plan concept has been developed.

The subject site is currently zoned as RE (Residential – Estate) and the applicant proposes to rezone the west half of the site to permit a single family type residential development, while retaining a single estate residential lot on the east half of the property.

The subject site was original draft approved in 1986 as an estate residential subdivision with three points of road connections to adjacent subdivisions: McKee Drive to the southwest and northeast, and Huntsmill Drive to the northwest. A copy of the original Draft Plan is enclosed in Appendix A for reference. Although the original Draft Plan approval has since expired, the external road connections, namely McKee Drive, provides the contextual framework on how the subject site has been and is proposed to be serviced by existing infrastructure.

The westerly portion will comprise 21 condominium single family units on a net developable area of approximately 2.33 ha (5.76 acres). Driveway access and municipal servicing for this portion of the site will be via existing McKee Drive to the southwest corner.

The easterly portion will comprise a single estate residential lot serviced with septic, water service connection and soak away pits, situated in the far northeast corner of the site where there is a table-land plateau. Access to the lot will be via a private driveway extended from the current terminus of McKee Drive to the northeast.

The existing adjacent property uses are residential lands. The subject site is bounded to the north and east by estate residential subdivisions and to the south by low-density single-family homes. The westerly limit of the site is bounded by Airport Road.

1.1 Existing Grading and Landform

From the topographic survey, the hill landform near the south central portion of the site has slopes in the range of 20%(5:1) to 33.3%(3:1) and creates two distinct drainage catchment areas: approximately 11.07 ha drains to the Boyce's Creek watercourse, and another portion of approximately 9.39 ha drains in a north to south direction passed the wetland feature and to an existing catchbasin immediately east of the development

driveway.

Due to the significant topographic relief, the site grading constraints for the property will result in having proposed road grades for the residential site plan development reaching the maximum municipal gradients of 5% - 6%.

The latter drainage area of 9.39 ha has been accounted for in the design of the existing Mckee Drive South storm system, and provides the subject site with an existing storm service connection manhole at the property limit. The Mckee Drive storm sewers have been sized for the 2 year storm event (refer to Drainage Plan drawing DR1 for flow calculation and storm design sheet). The site does not receive any significant external drainage and an on-site visit has determined there's an existing ditch inlet catchbasin tied to the Mckee Drive storm sewer and is located within the wetland feature providing an outlet for this drainage area (Refer to Site Picture in Appendix B).

1.2 Existing Infrastructure

As noted above, the **single estate lot east of Boyce's Creek** will be privately serviced with septic, well and soak away pits.

For the proposed **residential site plan west of Boyce's Creek**, the key existing infrastructure which have been reviewed in support of the subject lands include:

Water An existing 300mm diameter watermain is located within the east boulevard of McKee Drive. It is presently stubbed at the terminus of McKee drive with a connection point for the proposed development, and has always been intended to extend into the subject lands.

Sanitary An existing 250mm diameter local sanitary sewer runs within the Mckee Drive subdivision immediately to the south of the subject land. A sanitary manhole approximately 20 m south of the property limit will provide a suitable point of connection for the subject site.

Storm The existing topography can be delineated into 2 catchment areas: approximately 11.07 ha naturally drains to the watercourse, and approximately 9.39 ha of drainage area has been accounted for in the design of McKee Drive subdivision.

There are no other external drainage areas tributary to Mckee Drive south. The existing subdivision storm sewers have been design to accept the 2 year storm event, and it is therefore estimated that the allowable flow from the 9.39 ha of tributary area to the McKee storm system is 257.57 L/s.

2.0 PROPOSED DESIGN CONSIDERATIONS

For reference throughout the following sections on functional design and servicing feasibility, the layout of existing and proposed infrastructure is illustrated on the proposed servicing plan enclosed with this report. (Refer to Drawing Nos. S-1 and S-2 in Appendix A)

Site servicing is largely governed by the overall road network and drainage patterns. The functional design standards considered in the preliminary road design utilizes Town of Caledon and Region of Peel development standards.

2.1 Road Alignment and Lot Grading

Although the subject site is condominium-type tenure, all internal roads will nonetheless design to generally meet the Town of Caledon standard No. 110 Geometric Design Standards for Roads. Based on the relatively steep existing site topography, it is anticipated that residential site plan grading will fall within the split draining, front and back walkout condition categories. There are significant topographic features which may warrant retaining walls at the detailed design stage. In this functional review of grading constraints, areas of notable grading constraints have been highlighted below, and are illustrated on the enclosed Grading Plan (Drawing No. GR1) and Cross Sections Plans (Drawings CS1 and CS2):

- Based on the boundary grading constraints preliminary road profiles developed for the proposed plan indicates road grades approaching 6%.
- Units 7 to 9, at the rear a retaining wall will be required to tie into existing ground elevations.
- At the end of the proposed roadway east of unit 14, a retaining wall will be required to tie into existing ground elevations at the top of the hill side.

The Terraprobe geotechnical report suggests a long-term stable slope incline of 3:1 for any grade alteration of the existing hill. Therefore, all grading into the hilly form must maintain a maximum 3:1 cut slope, and restored with bank stabilization (ground cover) immediately following earth moving activities.

With respect to the single estate lot on the east side of Boyce's Creek, grading will be in accordance with Town of Caledon section 3.12 Residential Lot Drainage and Sodding criteria. As the site will be single custom-designed home, the lot grading will be subject to site plan approval.

2.2 Water Distribution

A new 150mm diameter PVC watermain is proposed to be extended from the existing McKee Drive 300 mm diameter watermain, as a 300mm main would be too large for the condominium residential site. A physical connection can be made with a 300x150 reducer at the property limit, complete with check valve in chamber in accordance with Region of Peel standard drawing number 1-8-2. Internally the 150mm PVC watermain will loop around the condominium roadways and each unit will be supplied with a 19mm diameter Type `K' copper water service connection and meter.

There will be five 5 fire hydrants provided within the proposed site to meet the municipal specified spacing design requirement for fire protection.

As requested by the Region of Peel Water Connection Demand Table in Appendix A stipulates single family complex water demand results required for their use to conduct a site water model analysis.

The single estate lot east of Boyce's Creek will have private water well installed.

For existing and proposed waterman infrastructure layout see Site Servicing Drawings S-1 and S-2.

2.3 Sanitary Sewerage

The receiving sanitary connection point for the subject site is proposed to be the existing 250mm diameter sanitary sewer located within the McKee Drive south roadway. A new 250mm diameter PVC sanitary sewer will be extended and terminated with a sanitary control manhole at the property limit. An internal sanitary sewer system will service the condominium site plan, and the units will be provided with Single Sanitary and Storm Service Connections in Common Trench in accordance with municipal standards.

The proposed development comprises of 21 dwelling units within a 2.33 ha area. The residential density for single family housing is 70 persons/ha therefore the population is estimated at:

Population = 2.33ha x 70 persons/ha
= 163 persons

The sanitary sewage flow estimates are calculated based on the population forecasts

plus extraneous ground water infiltration. Using the above population estimates, the future sanitary sewerage rate from the subject site is calculated as follows.

Proposed Site Design Flow:

Peak Flow Design Parameters

Total Population	= 163 p
Residential Avg. Flow	= 302.8 L/p/d
Peaking Factors	= $1 + 14/(4+(P/1000)^{0.50})$ max 4.0 = 4.0
Site Area	= 2.33 ha
Proposed Manholes	= 18 mh
Manhole Infiltration Rate	= 0.00028 m^3/s/mh*18 mh*1000 L/1 m^3 = 5.04 L/s
Sewer Infiltration Rate	= 0.0002 m^3/s/ha*2.33 ha*1000 L/1 m^3 = 0.466 L/s
Total Infiltration Rate	= 5.51 L/s

Calculation of Peak Design Flow

Design flow, $Q_{SANITARY}$ = average daily flow x peaking factor + infiltration flow
=(163 p x 302.8 L/p/d / 86400 s/d) x 4.00 + 5.51 L/s
=(1.43 L/s x 4.00) + 5.51 L/s
=2.29L/s + 5.51 L/s
=7.8 L/s

The site sewage generation flow rate is calculated to be 7.8 L/s including infiltration. The receiving existing sanitary sewer readily has the available capacity to accommodate the proposed flows.

Refer to Site Servicing Drawings S-1, S-2 and the sanitary sewer design sheet in Appendix A.

3.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

3.1 Development Constraints

The residential development is adjacent to the LSW defined by the Ministry of Nature Resources as the Caledon East Wetland Complex. It proposed to maintain the pre-development wetland tributary area as much as possible by introducing a cut off swale for the site driveway entrance along the north property limit directing stormwater to two storm sewer bypasses and then out to the wetland. The storm sewer by-pass will be sized for the 100 yr storm event (total capture) at the detailed design stage. A second cut off swale is proposed at the rear of units 16 to 20 further contributing to the pre-development storm drainage area to the wetland.

Refer to Pre-Development Plan drawing PRE and Drainage Plan drawing DR1 for the minor 2yr storm event flow calculations. The site plan will be controlled to the 2yr storm event allowable discharge rate of 34.29 L/s. This translates to 13.3% of the total flow 257.57 L/s for the west drainage shed. Through the development proposed site servicing and grading plan the storm flow balance of approximately 223.28 L/s shall be directed to the wetland feature maintaining it. It can be said the proposed site plan development will have a nominal effect to the LSW. Refer to the Water Balance/Erosion Control Section 3.3 it discusses low impact designs (L.I.D.) implemented for the site plan. L.I.D's proposed for the development will provide additional water balance mitigation measures to LSW essentially evening the pre-development condition.

Excluding the pre-development (existing) LSW drainage area from the site will also reduce the land development area required for stormwater management, and in turn reduce the impact to the environmentally sensitive land.

The existing McKee Drive subdivision was designed to accept a drainage area of approximately 9.39 ha from the subject lands at the 2 year storm event rate. As a result of the protected features specifically the Woodlot and Wetland the proposed development drainage area to McKee Drive has been significantly reduced to approximately 1.77 ha. This significant reduction in drainage area provides an opportunity for the residential site plan to control all storm events up to and including the 100 year event down to the 2 year storm release rate.

A Hydrogeological Report by Terraprobe reveals that the groundwater level for borehole 7 is 0.5m below the existing surface at the elevation of 297.70m (Refer to Borehole Logs and Location Plan in Appendix B). The report also reveals for boreholes 8 and 9 located further east along the south hill side where the proposed single family residential site plan will be situated that upon drill completion the boreholes were dry with no water table present. Therefore it is recommended for this development to locate the proposed stormwater management system including LID's within site plan which sits on the south

hillside to avoid the groundwater condition for the LSW. The proposed storm sewers, sanitary sewers and watermain downstream from stormwater management system where the infrastructure will encounter the groundwater condition shall be installed water tight.

3.2 Stormwater Management

Based on reviewing the available information provided by the Town of Caledon, the stormwater management criteria of the residential townhouse site can be summarized as controlling the post-development flow to a maximum pre-development 2 year storm release rate , or a total of $Q_{allowable}$ = **34.29 L/s** (Pre-Development Plan Drawing No. PRE).

3.2.1 Post-Development Discharge

Post development storm drainage areas and composite runoff coefficients were delineated for the site (See Table 2 and Post-Development Plan Drawing No. POST). The calculation of post development peak flows are following.

Table 3.1 *Post Development Peak Flows*

Area type	Hectares	Runoff Coefficient "r"	Area x R
Landscaped	1.0407	0.25	0.2602
Paved	0.2570	0.90	0.2313
Building	0.4749	0.90	0.4274
	SUM = 1.7726		$\sum$ A x R = 0.9189
			AVERAGE R = 0.52

Without any control devices in place, the 100-year post development storm run-off from these areas is calculated as follows:

Q=2.78CIA where

C = 0.52
I_{100} = 196.54 mm/hr (Tc=10.0 minutes)
A = 1.7726 ha

$Q_{100\ POST}$ = (2.78)(0.52)(196.54)(1.7726)
= **503.63 L/s**

Since $Q_{100\ POST}$ is greater than $Q_{Allowable}$, stormwater quantity management control in the form of orifice tube device and on-site storage system is proposed.

3.2.2 Quantity Control

The attached on-site storage calculator sheet Table 4 uses the Mass Rational method to calculate the 100-year storage requirement for the site based on an average weighted run-off coefficient of 0.52.

The stage-discharge-storage relationship is computed iteratively, but only the final solution is presented below.

In order to control the release rate during the 100-year storm, Control MH 6 will be fitted with a 75mm diameter orifice pipe and will discharge **24.96 L/s** based on a high water level of 301.46 m. The required storage is **586.30 m^3**.

The peak controlled discharge of 24.96 L/s is less than the allowable discharge of 34.29 L/s. The required attenuation storage volume is proposed to be accommodated in superpipe storage and storm tank. The volume available **is 598.90 m^3**, which exceeds the required storage of 586.30 m^3. (See Section 1-1 for Stormwater Management System Details on Drawing No. CS2). A summary of post development flows is presented in the following Table 3.2:

Table 3.2 *Controlled Release Rates*

Site Drainage Components	Area (ha)	Q_{100} Post-Development Discharge (L/s)	Controlled Release Rate (L/s)
Control Manhole No. 6	1.7726	503.63	24.96
Totals	**1.7726**	**503.63**	**24.96**

Therefore, superpipe storage, storm tank and orifice pipe design system fulfills site discharge and stormwater attenuation criteria.

3.3 Water Balance/Erosion Control

Generally, all units will implement the low impact design (L.I.D.) rainwater downspout disconnection from the storm sewer. The single family units rear rainwater downspouts will discharge through rain barrel cisterns (second L.I.D. feature) onto grassed areas that lead to the third L.I.D. feature which is an infiltration granular trench. This will improve water balance for the development and reduce runoff to the proposed storm sewer system.

Single family units 1 to 6 and 17 to 21 will not be installed with storm connections since the stormwater system proposed will have water levels that fluctuate due to the orifice design installation. These units will require sump pumps to be installed to discharge

onto grade levels. The remaining single family units 7 to 16 are able to have storm connections since these buildings are located up on the hillside where the major storm high water level in the storm sewer system will not flood the dwellings.

As the stormwater scheme can only manage the single family area and not the proposed driveway as a result of the shallow groundwater table in the LSW, it is recommended that the entrance be installed with a L.I.D. known as porous pavers. In Appendix A the Green Innovations "PG45" product details can be found. Installing the paving grid or approved equivalent for the driveway, it would then be considered a highly porous landscaped entrance feature providing the requisite water quality, balance and erosion criteria for the access maintaining the pre-development state.

The residential site plan area will implement a granular trench L.I.D. at the rear of units 5 to 14 to provide supplementary water balance.

Required 5mm Water Balance/Erosion Control Retention Volume Target

The residential site plan development has a total impermeable area of approximately 7,318 m^2 (See Table 2 and Post Development Plan drawing Post in Appendix A). With an on-site water balance storage of 5mm, yields a volume requirement of:

$$V_{REQUIRED} = 7{,}318\ m^2 \times 0.005\ m$$
$$= 36.6\ m^3$$

Provided Water Balance/Erosion Control Volume

The granular trenches (See infiltration trench in swale detail in Appendix A) are designed with geometry of 0.6 m width, a depth of 1.0 m, and total length of 155.0 m. The trenches run along all rear yards, allowing for seepage and infiltration to safely migrate into naturalized areas. The trenches will yield a volume of.

$$V_{TRENCH} = 0.6\ m \times 1.0\ m \times 155.0\ m \quad (W \times H \times L)$$
$$= 93.0\ m^3$$

Clear stone is recommended in the MOE SWMPP manual to have a porosity of $\rho = 0.40$. Therefore the available storage for the trench is:

$$V_{PROVIDED} = V_{TRENCH} \times \rho$$
$$= 93.0\ m^3 \times 0.40$$
$$= 37.2\ m^3$$

which exceeds the storage required of 36.6 m^3.

The Hydrogeological Report by Terraprobe indicates in-situ soils consist of silty sand with the Infiltration rate ranging from 6.86 mm/hr (or 0.69 cm/hr) to 25.91 mm/hr (or 2.6 cm/hr) based on the Hydrological Soil Properties Classified by Soil Texture Table 3.3.

Table 3.3 *Hydrologic Soil Properties Classified by Soil Texture*

Texture Class	Water Storage Capacity	Infiltration Rate (f)		Soil Group
		In/hr	mm/hr	
Sand	0.35	8.27	210.06	A
Loamy Sand	0.31	2.41	61.21	A
Sandy Loam	0.25	1.02	25.91	A
Loam	0.19	0.52	13.21	B
Silt Loam	0.17	0.27	6.86	B
Sandy Clay Loam	0.14	0.17	4.32	C
Clay Loam	0.14	0.09	2.29	D
Silty Clay Loam	0.11	0.06	1.52	D
Sandy Clay	0.09	0.05	1.27	D
Silty Clay	0.09	0.04	1.02	D
Clay	0.08	0.02	0.51	D

(Source: Stormwater Collection Systems Design Handbook, Mays, 2001)

The infiltration granular trench bottom area is 0.6 m x 155.0 m = 93.0 m^2. Therefore, the drain down time for 29.3 m^3 of stormwater to dissipate into the native ground is:

$$\frac{36.6\ m^3}{93.0\ m^2} = 0.3935m \times \frac{100\ cm}{1\ m} = 39.35\ cm$$

$$39.35\ cm = \frac{1.65\ cm}{hr}\ \text{(Average Infiltration Rate)}$$

$$hr = 23.85$$

Therefore granular trench will provide the requisite water balance/erosion control requirement where over a maximum 48 hour period 5mm of storm runoff detention is achieved through in-situ soil infiltration. The granular infiltration trenches will be proposed at the detailed site servicing and grading design stage.

At the recommendation from the Toronto and Region Conservation Authority an additional LID measure shall be implemented for the site, which is to install 100 gal. (0.38 m^3) Algreen "Barcelona" or approved equivalent rain barrel cisterns for the homeowners gardening and cleaning purposes (Rainwater Harvesting). Each dwelling shall install a minimum of two barrels (0.76 m^3). Therefore with 21 single family homes and two rain barrels installed, this would provide a total of 15.96 m^3 of additional site retention volume to further adhere to site's water balance and erosion control criteria. The pre-fabricated rain barrel devices are commonly and widely available and for Algreen's "Barcelona" rain barrel product details refer to Appendix A.

3.4 Stormwater Quality

The Town of Caledon requires quality control to be implemented for impervious areas. A CONTECH engineered solutions "Stormfilter" SF0820 unit is proposed for the residential site plan to be installed. This unit has been sized to treat the impervious areas based on a minimum 80% TSS removal. CONTECH's Sizing Detailed Report and the treatment device New Jersey State Department certification letter are enclosed in Appendix A.

3.5 Major System Controls

The site plan development proposes on-site stormwater management. Therefore all normal flows up to and including the 100-year post-development major storm is proposed to be captured within the site via pipe & tank storage and discharged at the allowable release rate to the municipal storm sewer system. In an emergency or catastrophic rain event overland flow heads towards Mckee Drive which it will continue conveying southerly as it does in the existing pre-development condition.

3.6 McKee Drive Major Overland Flow Analysis

3.6.1 Pre-development Overland Flow Analysis

In accordance with the Town's current request, the major overland flow was determined using the current Town of Caledon IDF curves for the 100-year storm, being $i_{100} = 4688/(td + 17)^{-0.9624}$. For a time of concentration of 29.54 min (for TC calculation refer to Drainage Plan drawing DR1), i_{100} = 116.38 mm/hr.

Based on the existing area of A = 9.39 ha and C= 0.22, the 100-year peak flow rate at McKee Drive is approximately:

$$Q_{100\ PEAK} = 2.78 \times C \times i_{100} \times A$$
$$= 2.78 \times 0.22 \times 116.38 \times 9.39$$
$$= \mathbf{668.36\ L/s}$$

Accounting for the actual inlet into the minor storm sewer system (minor flow calculation, refer to Drainage Plan drawing DR1), the net drainage remaining as overland flow on the road surface at Section A-A, is:

$$Q_{100\ OVERLAND} = Q_{100\ PEAK} - Q_{\ 2YR\ MINOR}$$
$$= 668.36 - 257.57\ L/s$$
$$= \mathbf{410.79\ L/s\ or\ 0.411\ m^3/s}$$

The generalized channel capacity analysis Section A-A is included in Appendix A allows for separate Manning's *n*-values for the channel (paved roadway) and overbanks (boulevards). For the main channel, comprising asphalt and concrete gutters, the n-value is recommended to be **n=0.013** (Chow, 1959). Similarly, the boulevards are a combination of grass, concrete curbs and

sidewalks, with a composite coefficient of **n=0.020**.

The hydraulic elements are computed at one location of McKee Drive, having longitudinal slope of 2.0% taken from the McKee Drive constructed record drawing. The corresponding cross-sectional analysis at this location yields a road capacity of **7,493 L/s**.

The overland drainage on McKee Drive has been plotted as an overlay on the Section A-A pre-development capacity graph. The high water level of the 100-year overland flow has a depth of **90 mm** which is contained within the main channel and does not breach the crown of the road or street lines.

3.6.2 Post Development Overland Flow Analysis

As noted in this report under section 3.2 Stormwater Management, the residential site plan shall control post development flows (100 year major flows) to a maximum pre-development 2 year storm release rate. Since the site plan will provide its own on-site stormwater management system, while maintaining pre-development flows to McKee Drive subdivision. From the pre-development plan drawing PRE, the area of 1.25 ha can be excluded from the 9.39 ha storm tributary of McKee Drive Subdivision in order to calculate the new major flow to the existing roadway.

Therefore the new major flow is similarly calculated based on the revised area of A = 9.39 ha – 1.25 ha = 8.14 ha and C= 0.22, the 100-year peak flow rate at McKee Drive is approximately:

$$Q_{100\ PEAK} = 2.78 \times C \times i_{100} \times A$$
$$= 2.78 \times 0.22 \times 116.38 \times 8.14$$
$$= \mathbf{579.39\ L/s}$$

Since the actual inlet into the minor storm sewer system is being maintained in the post development scenario. The minor flow calculation from to Drainage Plan drawing DR1 is being carried forward for the purpose of this analysis, the net drainage remaining as overland flow on the road surface, at Section A-A post development, is:

$$Q_{100\ OVERLAND} = Q_{100\ PEAK} - Q_{\ 2YR\ MINOR}$$
$$= 579.39 - 257.57\ L/s$$
$$= \mathbf{321.82\ L/s\ or\ 0.322\ m^3/s}$$

The new overland drainage on McKee Drive has been plotted as an overlay on the Section A-A post development capacity graph. The high water level of the 100-year overland flow has a depth of **75 mm** which is contained within the main channel and does not breach the crown of the road or street lines.

In summary with the addition of residential stormwater managed site plan actually reduces the overland flow from 410.79 L/s down to **321.82 L/s** on McKee Drive's surface conveyance roadway system. The site plan proposal ultimately provides greater overland flow conveyance capacity to the existing roadway system downstream from

the site which in turn provides more of a flood safety cushion to the privately owned lands. Therefore no further overland flow analysis is required.

3.6.3 Post Development Overland Flow Analysis for the cut off swale behind units 16 to 20.

In accordance with the Town's current request, the major overland flow was determined using the current Town of Caledon IDF curves for the 100-year storm, being $i_{100} = 4688/(td + 17)^{-0.9624}$. For a time of concentration of 29.54 min (for TC calculation refer to Drainage Plan drawing DR1), i_{100} = 116.38 mm/hr.

Refer to the proposed grading plan drawing GR1 in Appendix A. Based on the area of A = 0.37 ha and C= 0.22, the 100-year peak flow rate at the end of the cut of swale is approximately:

$$Q_{100\ PEAK} = 2.78 \times C \times i_{100} \times A$$
$$= 2.78 \times 0.22 \times 116.38 \times 0.37$$
$$\mathbf{= 26.34\ L/s}$$

The generalized channel capacity analysis Section B-B is included in Appendix A. For the cut off swale open channel that will be grassed, clean and uniform, the n-value is recommended to be **n=0.020** (Chow, 1959).

The hydraulic elements are computed at the end of the cut off swale location, having longitudinal slope of 5.0% taken from the grading plan. The corresponding cross-sectional analysis at this location yields a channel capacity of **809.7 L/s**.

The overland drainage on the open channel has been plotted as an overlay on the Section B-B cut off swale capacity graph. The high water level of the 100-year overland flow has a depth of **60 mm** and a velocity of **1.0 m/s** which is contained within the main channel and does not breach the crown of the swale at the property line.

3.7 Stormwater Management Residential Estate Lot

The proposed single estate residential lot on the east side of Boyce's Creek will have minimal stormwater management impact on the lands. In consideration of the single-building tenure of the east lot, it is proposed to provide soakaway pits as a lot-level BMP device to receive and intercept roof and driveway discharge. Soakaway pits shall be designed in accordance with the Ministry of Environment SWMPD Manual and lot grading design shall conform to the Town of Caledon criteria.

4.0 EROSION AND SEDIMENT CONTROL

Erosion and sediment control should be implemented for all construction activities within the subject site, and for each consecutive Phase and Stage of Construction, including earthworks, servicing and house building activities. The basic principles considered to minimize erosion and sedimentation and resultant negative environmental impacts include:

- Minimize local disturbance activities (e.g. grading);
- Expose the smallest possible land area to erosion for the shortest possible time;
- Implement erosion and sediment control measures before the outset of construction activities; and,
- Carry out regular inspections of erosion and sediment control measures and repair or maintain as necessary.

The proposed grading, servicing and building construction should be carried out in such a manner that a minimum amount of erosion occurs and such that sedimentation facilities control any erosion that does occur. Erosion and sediment control measures should include but not be limited to the following:

- Temporary off-line siltation control ponds. Current TRCA guidance requires siltation/erosion control for 125 m^3/ha of dry run-off storage for each facility, with a permanent pool of an additional 125 m^3/ha. These ponds are to be located at the low point of the grading, which in this case would be the south end of the proposed driveway.
- Erection of silt fences around all site perimeters. Double-silt fences are to be erected adjacent to the PSW features.
- Provide sediment traps (e.g. rock check dams, straw bales, scour basins) along interceptor swales and points of swale discharge;
- Inlet controls at catchbasins, comprising filter cloth overlain with rip-rap;
- Implement a weekly street sweeping and cleaning program for any mudtracking onto the adjacent municipal roadways;
- Provide gravel "mud mats" at construction vehicle access points to minimize off-site tracking of sediments; and,
- Confine refueling/servicing equipment to areas well away from stormwater minor system or major system elements.

Removal of the erosion and sediment controls should be done once construction is completed and sediment run-off from the construction activities has stabilized. A more detailed Erosion and Sediment Control Report and Plans will be provided at detailed design as part of the Site Alteration permitting and approvals stage.

5.0 RECOMMENDATION AND CONCLUSIONS

The single estate lot on the east side of Boyce's Creek can be privately serviced with septic, well and soak away pits.

It has been demonstrated that the proposed residential site plan development can be accommodated by existing receiving infrastructure on McKee Drive. In summary:

Water The subject site area can be serviced by the existing 300mm diameter main at the current terminus of McKee Drive south of the subject site. A bulk meter at the property line and an internal 150mm diameter watermain is proposed to provide internal site servicing.

Sanitary The total sanitary sewage flow for the residential site plan development is approximately 7.8 L/s. The additional sewerage loading from the subject site is not significant and can be readily accommodated by the existing 250mm sanitary sewer within Mckee Drive. A new 250mm diameter PVC sanitary sewer will be provided with a sanitary control manhole within the private site near the driveway entrance.

Stormwater The residential site plan development will not increase the allowable runoff to the existing municipal storm sewer system. Through the implementation of an orifice pipe design system, superpipe storage & storm tank, oil-grit separator and L.I.D.'s all the Town of Caledon and TRCA's stormwater management water quantity, quality and water balance/erosion control criteria are satisfied.

We trust you will find this submission complete and in order. Should you have any questions, please contact the undersigned.

Respectfully Submitted,

MASONGSONG ASSOCIATES ENGINEERING LIMITED

Professional Engineers
Ontario

Oct. 16/17

Limited Licensee
Name: S O GONZALEZ
Number: 100189895
Category: CIVIL See Limitation
Limitations:
This licence is subject to the limitations as detailed on the certificate
Association of Professional Engineers of Ontario

Steve Omar Gonzalez, LEL, C.E.T.
Sr. Municipal Designer

H:\PROJECTS\03\141\Design\SWM\03-141 FSR_r7.doc

Appendix A

Figures

1986 Draft Plan of Subdivision

McKee Drive Plan and Profile

300mm Feedermain Plan and Profile

Site Servicing S-1 & S-2

Grading Plan and Cross Sections

Drainage, Pre and Post Development Plans

Storm Design Sheets

Green Innovations "PG45" Product Details

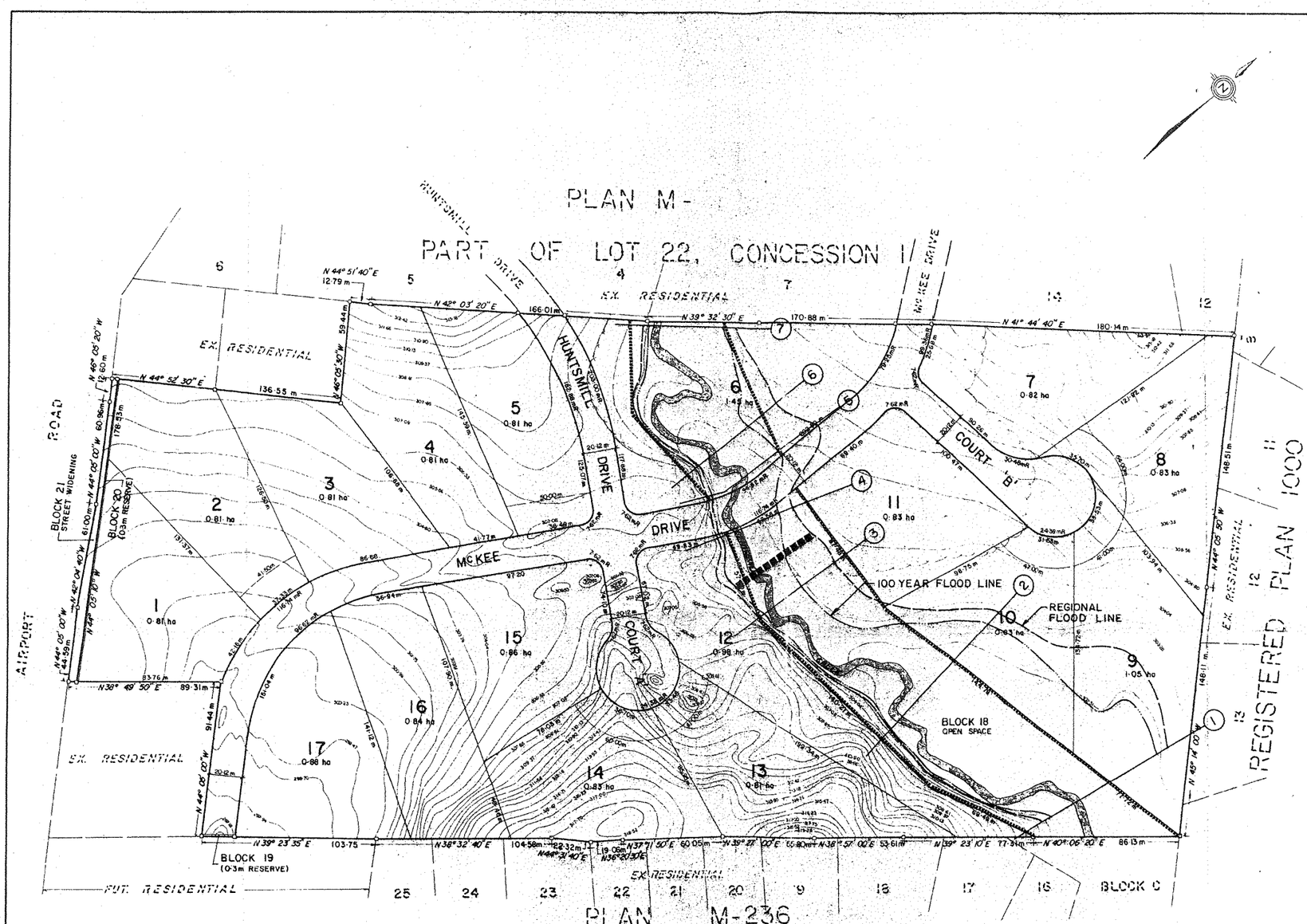
Infiltration Trench in Swale Detail

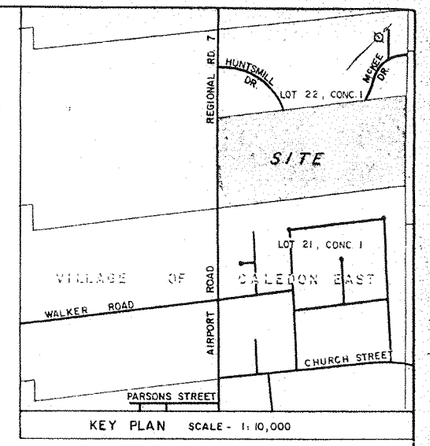
Algreen's "Barcelona" Rain Barrel Product Details

Sanitary Design Sheet, Connection Demand Table and

Corix Watermain Flow Test

Town of Caledon Std. 110, Region of Peel Std. 1-8-2 and 2-4-3





KEY PLAN SCALE - 1: 10,000

DRAFT PLAN OF SUBDIVISION

PART OF LOT 22, CONCESSION I
E.M.R., TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL

OWNER'S AUTHORIZATION

645742 ONTARIO LIMITED,

BEING THE REGISTERED OWNER OF THE SUBJECT LANDS HEREBY AUTHORIZE PAUL THEIL ASSOCIATES LIMITED TO PREPARE AND SUBMIT A DRAFT PLAN OF SUBDIVISION FOR APPROVAL

SIGNED: FRANCIS S.M. HO

DATED: March 8, 1986

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

DATE: March 5, 1986

A. Kikas

ANTON KIKAS LIMITED
ONTARIO LAND SURVEYOR

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 50(2) OF THE PLANNING ACT

(a) AS SHOWN
(b) AS SHOWN
(c) AS SHOWN
(d) SINGLE FAMILY RESIDENTIAL
(e) AS SHOWN
(f) AS SHOWN
(g) AS SHOWN
(h) PIPED WATER AVAILABLE
(i) SILTY SAND
(j) AS SHOWN
(k) PIPED WATER
(l) AS SHOWN AND SEPTIC TANKS

SITE DATA

LOTS 1 TO 17 inclusive		15.06 ha
ROADS		2.14 ha
BLOCK 18 open space		1.70 ha
BLOCK 19	0.3m reserve	.01 ha
BLOCK 20	0.3m reserve	
BLOCK 21 street widening		.09 ha
TOTAL		19.00 ha

LEGEND

SNOW FENCE / STRAW BALES
EROSION CONTROL WORKS
(1) HEC 2 SECTION LOCATION

REVISED: JAN. 13th 1987
SCALE: 1:1250 DATE: FEBRUARY 1986 JOB Nº: 8563

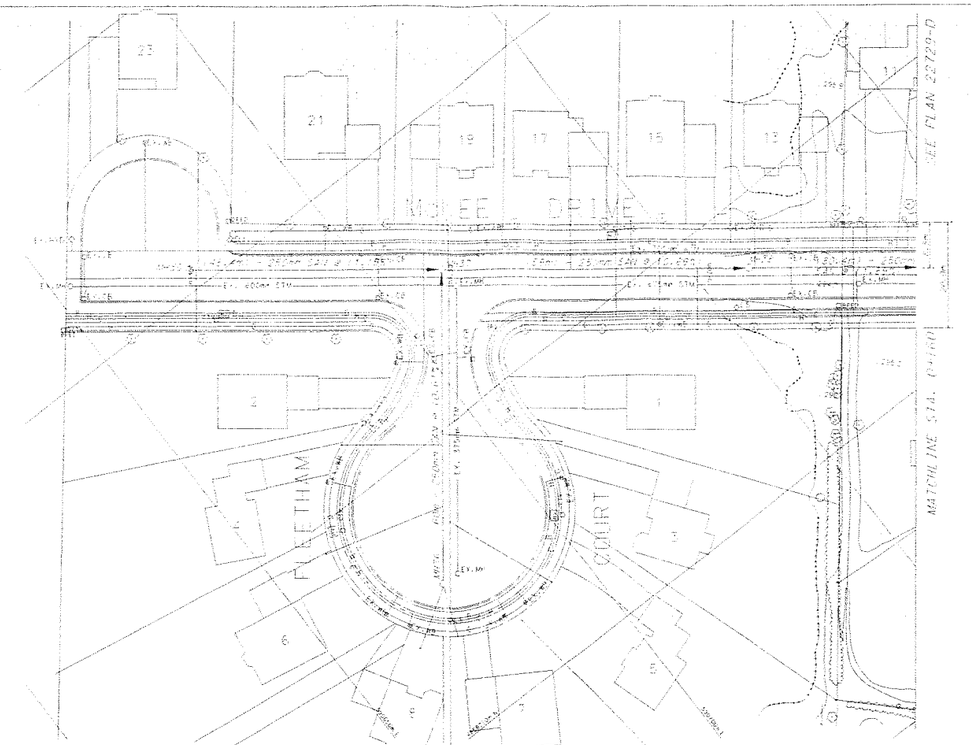
Figure Nº 2

paul theil associates limited
consulting engineers
700 Balmoral Drive, Bramalea, Ontario

NOTES:

1. SAN. CONNECTION FOR Nos. 1, 2, & 3 FLEETHAM COURT ARE INSTALLED UNDER EXISTING STORM.

2. SAN. CONNECTION FOR Nos. 13, 15, 17, 19, 21 AND 22 McKEE DRIVE INSTALLED WITH Y-SAN FROM CREST TO BASEMENT.



PROFILE FOR FLEETHAM COURT

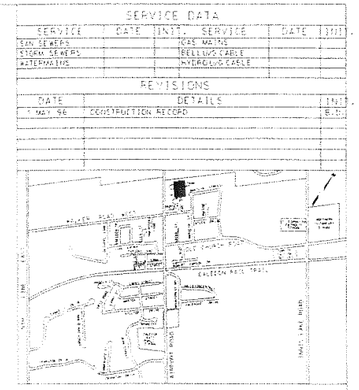
22730-D (04)

SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			HYDRO MAINS		
STORM SEWERS			BELL U/G CABLE		
#2 TERMINALS			HYDRO U/G CABLE		

REVISIONS

DATE	DETAILS	INIT.
1 MAY 96	CONSTRUCTION RECORD	B.D.



KEY PLAN
SCALE - 1:25,000

NOTE:
THE CONSTRUCTION RECORD DATA INCLUDED ON THIS DRAWING WAS A COMPILATION OF ALL SANITARY, STORM, WATERMAIN AND RECONSTRUCTION DRAWINGS FOR THIS AREA. ALL OTHER DRAWINGS FOR THIS AREA HAVE BECOME OBSOLETE.

ALL CONSTRUCTION DATA IS IN BRACKETS ( ).

General Notes

1. All Driveways ASPHALT Unless Otherwise Noted.
2. All Service Locations Are Approximate And Must Be Located Accurately In The Field.
- Denotes Building - Not Located
- Denotes Building Located Type 'B' Reading Unless Otherwise Noted (SAN)

B.M. No. Elev.

The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction Location Of Existing Utilities Approximate Only. To Be Verified In Field By Contractor.

KMK Consultants Limited

Approved by

Director

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING:

THE REGIONAL MUNICIPALITY OF PEEL
TOWN OF CALEDON WORKS DEPT.
BELL TELEPHONE COMPANY
CONSUMERS GAS COMPANY
MINISTRY OF TRANSPORTATION
MINISTRY OF ENVIRONMENT
HYDRO ELECTRIC POWER COMM. OF ONTARIO
ORANGEVILLE CABLE VU LTD.

Region of Peel

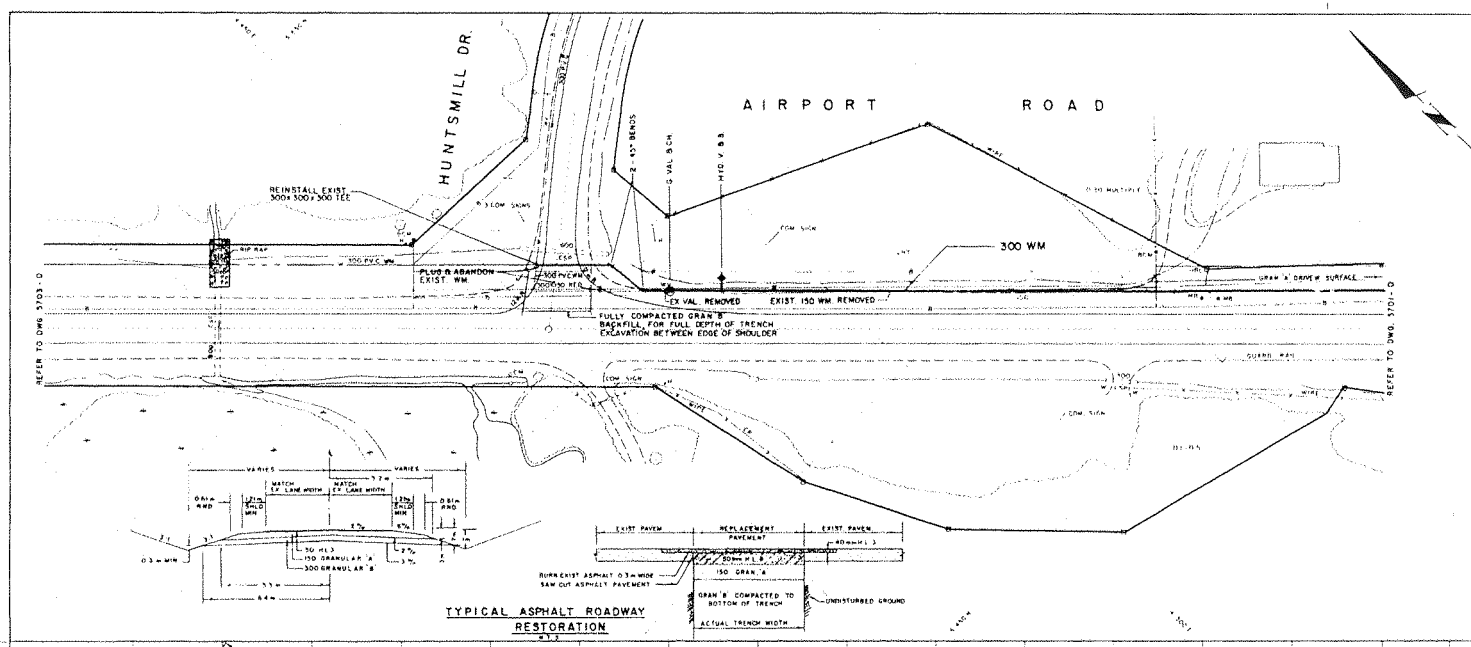
Department of Public Works

CALEDON EAST SANITARY SERVICING

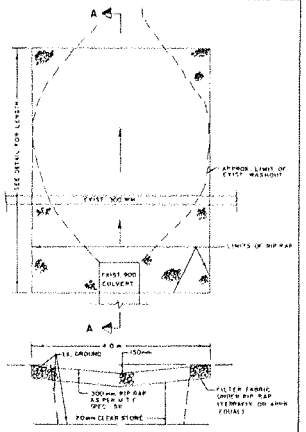
McKEE DR./FLEETHAM CT.
SANITARY SEWERS

STA. 0+160 TO STA. 0+350

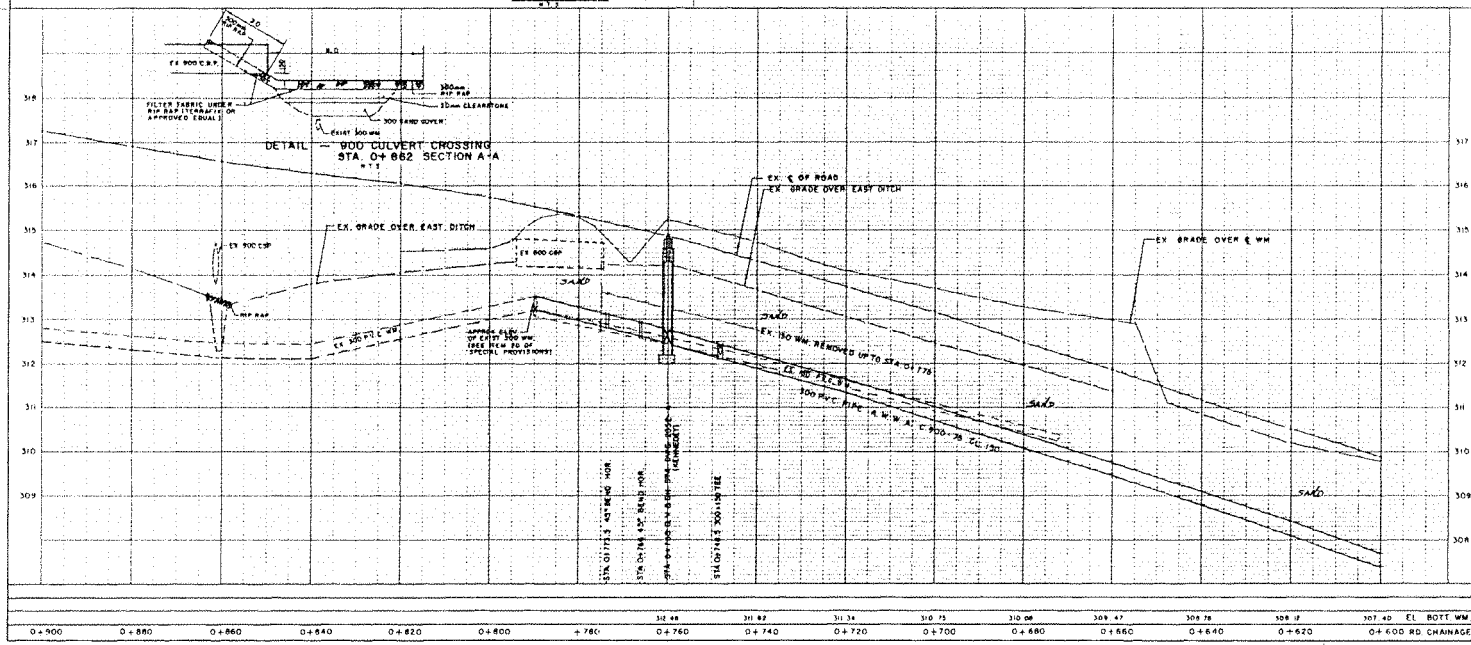
Date:	File Ref: 3707.03-A-125	Project No: 94-2135	
Scale: HOR. 1:1250 VER. 1:250	Drawn By: B.D.	Checked By: M.T.	
CHAINAGE Date: 17 JUNE 94	Sheet: 94 OF 231	Plan No: 22730-D	



TYPICAL ASPHALT ROADWAY RESTORATION



DETAIL — 900 CULVERT CROSSING STA. 0+862



SERVICE DATA

SERVICE	DATE	INIT	SERVICE	DATE	INIT
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL TVP CABLE		
WATERMAINS			HYDRO TVP CABLE		

REVISIONS

DATE	DETAILS	INIT
19.12.1983	AS CONSTRUCTED	I.F.

General Notes

- All Dimensions Shown Unless Otherwise Noted
- All Service Locations Are Approximate And Must Be Located Accurately In Field
- Denotes Building - Not Located
- Denotes Building Located
- Type 'A' Bedding Unless Otherwise Noted (SSM)

B.M. No. Elev.

The Contractor Is Responsible For Locating And Protecting All Existing Utilities Prior To And During Construction Location Of Existing Utilities Approximate Only, To Be Verified In Field By Contractor.

NOTICE TO CONTRACTOR

48 HOURS PRIOR TO COMMENCING WORK NOTIFY THE FOLLOWING:

THE REGIONAL MUNICIPALITY OF PEEL
CITY OF MISSISSAUGA WORKS DEPT.
CITY OF BRAMPTON WORKS DEPT.
TOWN OF CALEDON WORKS DEPT.
BELL TELEPHONE COMPANY
CONSUMERS GAS COMPANY
MINISTRY OF TRANSPORTATION
MINISTRY OF ENVIRONMENT
HYDRO ELECTRIC POWER COMM. OF ONTARIO
HYDRO ELECTRIC COMM. CITY OF MISSISSAUGA
HYDRO ELECTRIC COMM. CITY OF BRAMPTON
HYDRO ELECTRIC COMM. PORT CREDIT
HYDRO ELECTRIC COMM. STREETSVILLE
CABLE TELEVISION

Region of Peel

Department of Public Works

AIRPORT ROAD (REGIONAL ROAD 7)

WALKER RD. TO RESERVOIR (CALEDON EAST)

300 FEEDERMAIN

Sta. 0+600 To Sta. 0+900

Date JUNE 83	Area C-48	Project No. 83-1530
Scale HOR. 1:500 VER. 1:100	Drawn by I. FRANKE	Checked by
	Sheet 3 of 7	Dwg. No. 5702-D

5702-D

E S I D E N T I A L

LOT 15

BLOCK 24

MCKEE DRIVE
(BY REGISTERED PLAN 43M-427)

EX. 150ø WM

BLOCK 20
(0.30 RESERVE)

N39°30'50"E 170.88

LOT 14

EXISTING RESIDENTIAL

N41°43'00"E 180.14

LOT 12

LOT 9

6.0m WIDE GRAVEL DRIVEWAY

WATER WELL

DEVELOPMENT LIMIT

PROP. SEPTIC BED

SOAK AWAY PIT

SOAK AWAY PIT

LOT 11

EXISTING RESIDENTIAL

EXISTING PATHWAY

REGIONAL FLOODLINE

EXISTING FOOTBRIDGE

BOYCE'S CREEK

REGIONAL FLOO

306 307 308 309 310 311 312 313 314 305 304

Project: PROPOSED RESIDENTIAL SITE PLAN & SINGLE ESTATE LOT	Dwg. Title: PROPOSED SERVICING PLAN	MASONGSONG ASSOCIATES 7800 KENNEDY ROAD SUITE 201 MARKHAM, ONTARIO L3R 2C7 T: (905) 944-0162 www.maeng.ca	Scale: 1:1000 / Date: APRIL 2013 / Project Number 03-141 / Drawing No. S-1

AIRPORT ROAD
WIDENING BY INSTRUMENT N° 19464 (ALBION)
(NOT DEDICATED)

MANHOLE

POST & CABLE FENCE

POST & WIRE FENCE

EDGE OF ASPHALT

CENTERLINE OF ASPHALT

LSW BY MNR

CONIFEROUS ROW

LOCAL BENCHMARK
(SPIKE ON HYDRO POLE)
ELEV.=304.883

EX HYDRO POLE

2 BELL BOXES

EX HYDRO POLE

PART 1
PLAN 43R - 1149

STORM SEWER BYPASS

POROUS PAVERS

DEVELOPMENT LIMIT

STORM SEWER BYPASS

DEVELOPMENT LIMIT

INFILTRATION TRENCH
(SEE DETAIL)

DEVELOPMENT LIMIT

LOW CURB SIDEWALK

OPEN SPACE

PROPOSED NEW PATHWAY

EXISTING PATHWAY

TRCA REGIONAL FLOODLINE

BOYCE'S CREEK

VIEWING AREA

LSW BY MNR

EX.DICB

SERVICING FOR COMPLEX AS
PER REGION OF PEEL STD.
DWG. NO. 1-8-2

PART 11
PLAN 43R-18111

PART 12
PLAN 43R-18111

BLOCK 16
(0.30 RESERVE)

BLOCK 18
(WIDENING)

MCKEE DRIVE

EX. 600ø STM

EX. 48.4m-2500ø
SAN @ 1.15%

MH 35

EX. 300ø WM

BLOCK 15

LOT 1

LOT 2

LOT 3

LOT 4

LOT 13

LOT 14

PART 1

PART 2

PART 3

PART 4

PART 5

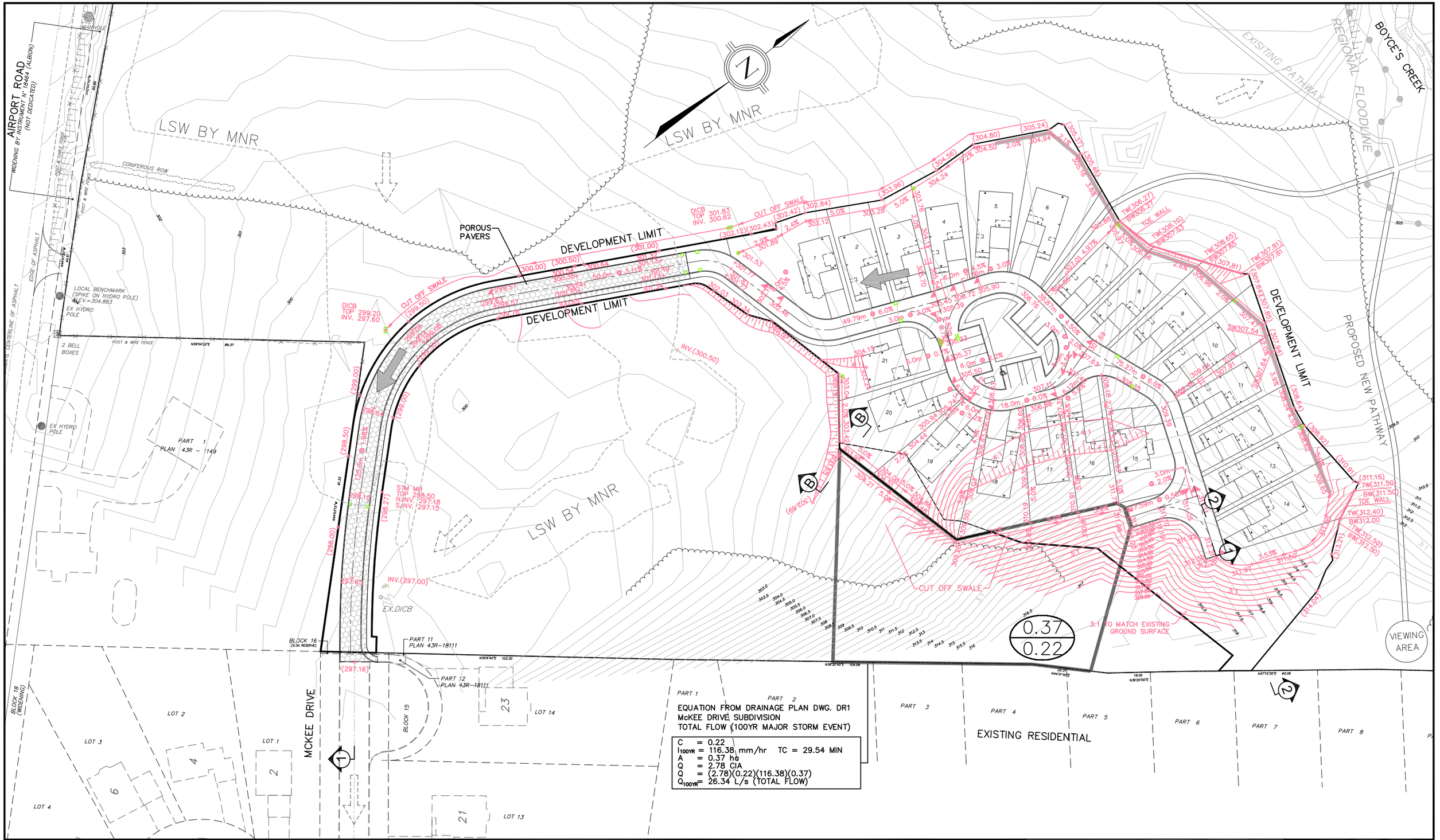
PART 6

PART 7

PART 8

EXISTING RESIDENTIAL

Project: PROPOSED RESIDENTIAL SITE PLAN & SINGLE ESTATE LOT	Dwg. Title: PROPOSED SERVICING PLAN	MASONGSONG ASSOCIATES 7800 KENNEDY ROAD SUITE 201 MARKHAM, ONTARIO L3R 2C7 T: (905) 944-0162 www.maeng.ca	Scale: 1:1000 Project Number 03-141 Date: APRIL 2013 Drawing No. S-2



EQUATION FROM DRAINAGE PLAN DWG. DR1
McKEE DRIVE SUBDIVISION
TOTAL FLOW (100YR MAJOR STORM EVENT)

C	=	0.22	
I_{100YR}	=	116.38 mm/hr	TC = 29.54 MIN
A	=	0.37 ha	
Q	=	2.78 CIA	
Q	=	(2.78)(0.22)(116.38)(0.37)	
Q_{100YR}	=	26.34 L/s (TOTAL FLOW)	

Project:

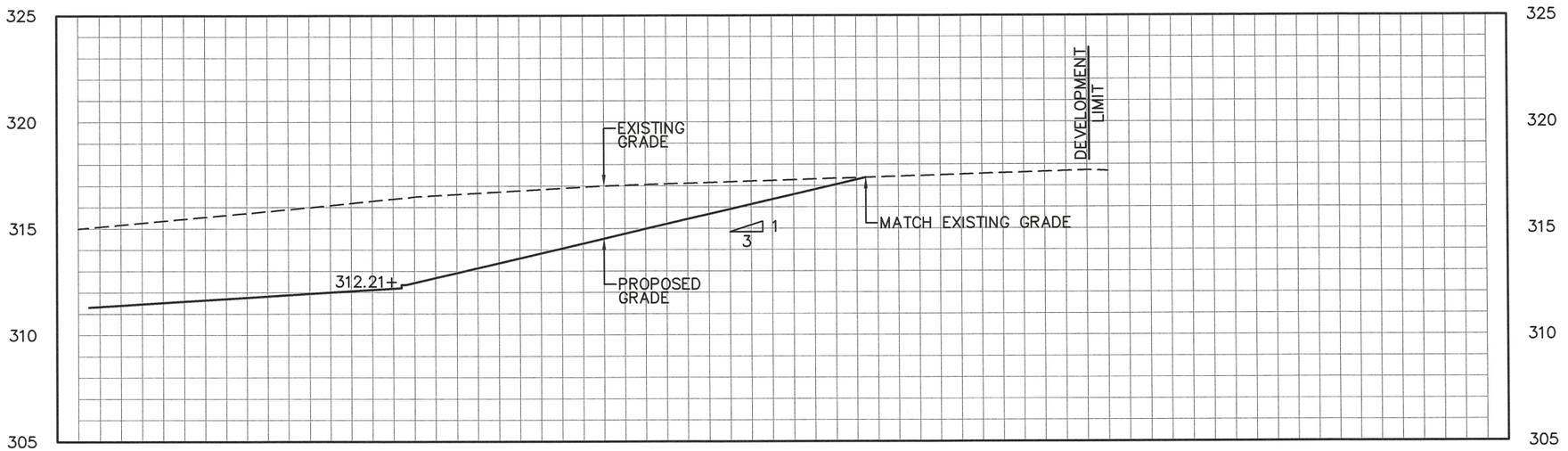
PROPOSED RESIDENTIAL SITE PLAN & SINGLE ESTATE LOT

Dwg.Title:

PROPOSED GRADING PLAN

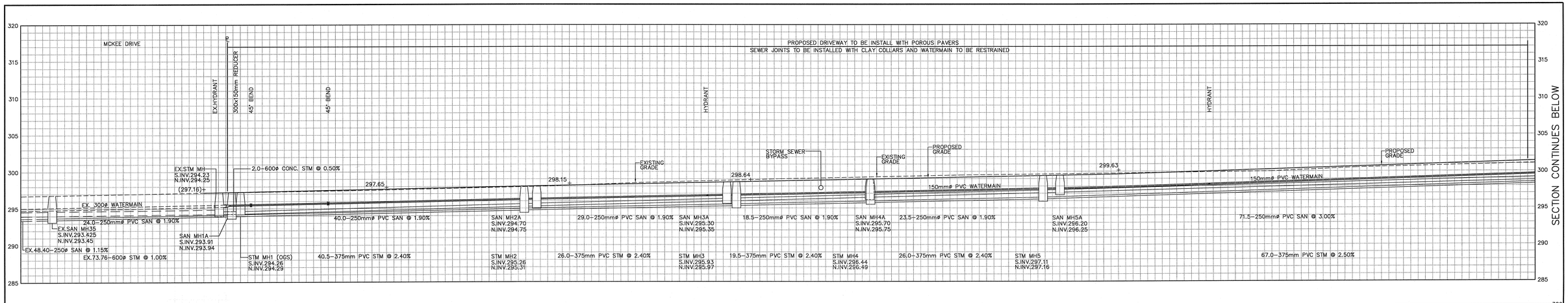
MASONGSONG ASSOCIATES
7800 KENNEDY ROAD
SUITE 201
MARKHAM, ONTARIO
L3R 2C7
T: (905) 944-0162
www.maeng.ca

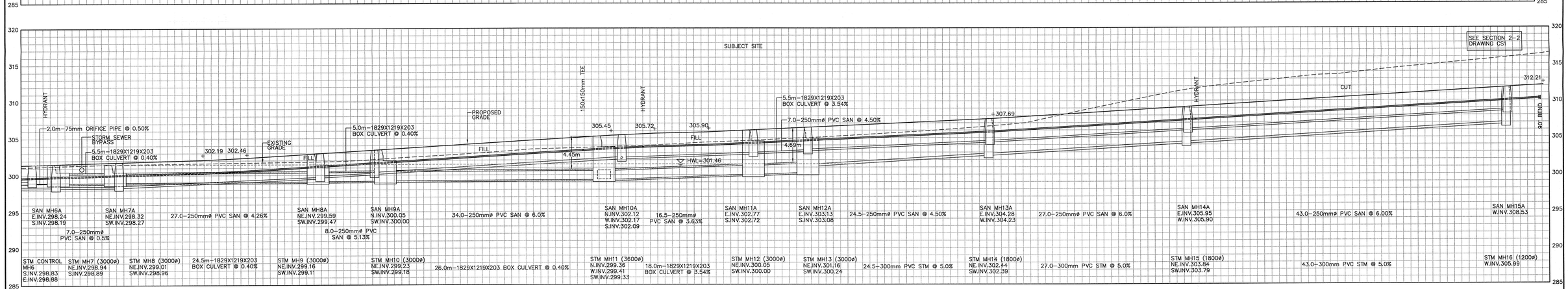
Scale:	Date:
1:1000	APRIL 2013
Project Number	Drawing No.
03-141	GR1



SECTION 2–2
SCALE 1:250

Project: PROPOSED RESIDENTIAL SITE PLAN & SINGLE ESTATE LOT	Dwg.Title: CROSS SECTIONS	MASONGSONG ASSOCIATES 7800 KENNEDY ROAD SUITE 201 MARKHAM, ONTARIO L3R 2C7 T: (905) 944-0162 www.maeng.ca	Scale: 1:250	Date: APRIL 2013
			Project Number 03-141	Drawing No. CS1



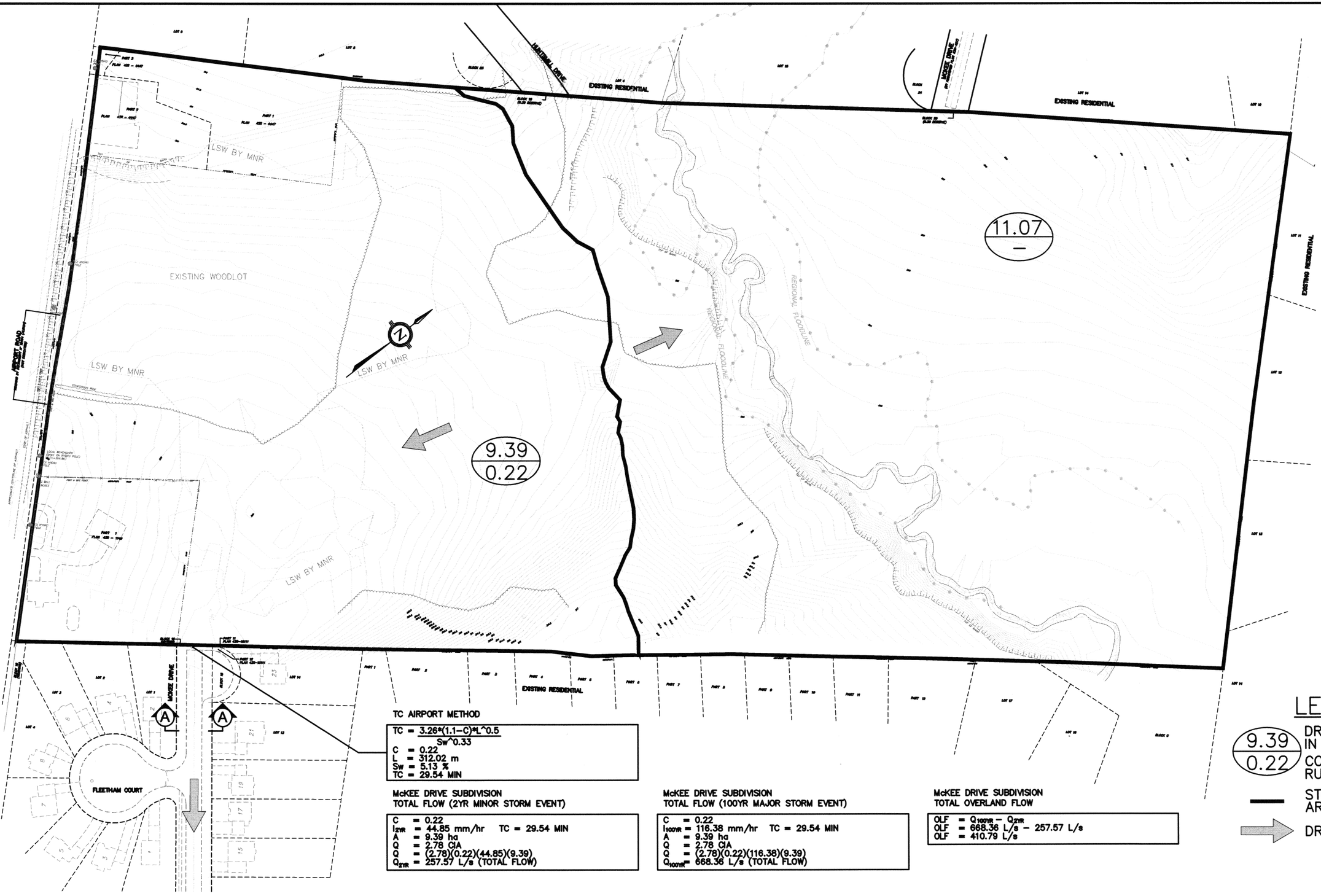


SECTION 1-1

SCALE 1:250

Project: PROPOSED RESIDENTIAL SITE PLAN & SINGLE ESTATE LOT	Dwg.Title: CROSS SECTIONS	MASONGSONG ASSOCIATES	Scale: 1:250
			Date: APRIL 2013
			Project Number: 03-141
			Drawing No.: CS2

7555 KENNEDY ROAD
SUITE 201
MARKHAM, ONTARIO
L3R 2C7
T: (905) 944-0102
www.msong.ca



TC AIRPORT METHOD

$$TC = \frac{3.26*(1.1-C)*L^{0.5}}{Sw^{0.33}}$$

C = 0.22
L = 312.02 m
Sw = 5.13 %
TC = 29.54 MIN

McKEE DRIVE SUBDIVISION
TOTAL FLOW (2YR MINOR STORM EVENT)

C = 0.22
I_{2YR} = 44.85 mm/hr TC = 29.54 MIN
A = 9.39 ha
Q = 2.78 CIA
Q = (2.78)(0.22)(44.85)(9.39)
Q_{2YR} = 257.57 L/s (TOTAL FLOW)

McKEE DRIVE SUBDIVISION
TOTAL FLOW (100YR MAJOR STORM EVENT)

C = 0.22
I_{100YR} = 116.38 mm/hr TC = 29.54 MIN
A = 9.39 ha
Q = 2.78 CIA
Q = (2.78)(0.22)(116.38)(9.39)
Q_{100YR} = 668.36 L/s (TOTAL FLOW)

McKEE DRIVE SUBDIVISION
TOTAL OVERLAND FLOW

OLF = $Q_{100YR} - Q_{2YR}$
OLF = 668.36 L/s – 257.57 L/s
OLF = 410.79 L/s

LEGEND:

9.39 / 0.22 — DRAINAGE AREA IN HECTARES / COMPOSITE RUN OFF COEFFICIENT

STORM DRAINAGE AREA BOUNDARY

DRAINAGE DIRECTION

Project:

PROPOSED RESIDENTIAL SITE PLAN
& SINGLE ESTATE LOT

Dwg.Title:

DRAINAGE PLAN

MASONGSONG ASSOCIATES
7800 KENNEDY ROAD
SUITE 201
MARKHAM, ONTARIO
L3R 2C7
T: (905) 944-0162
www.maeng.ca

Scale:	Date:
1:2000	APRIL 2013
Project Number	Drawing No.
03-141	DR1

TOWN OF CALEDON
ENGINEERING DEPARTMENT

DESIGN STORM:	2 YEAR RETURN
I (2-YEAR):	I = 1070/ (T.C. + 7.85)^0.8759

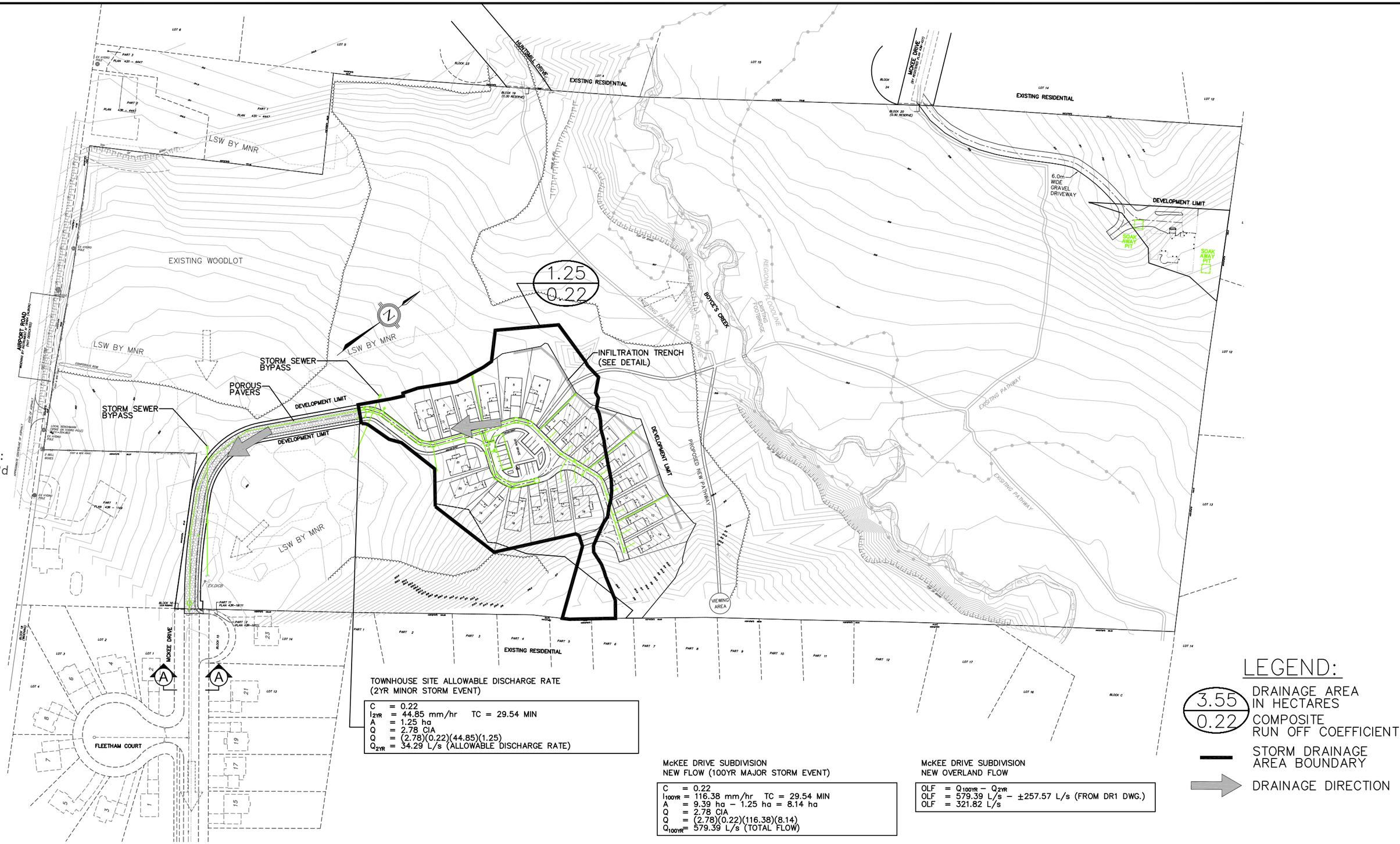
PROPOSED RESIDENTIAL SITE PLAN DEVELOPMENT & SINGLE ESTATE LOT

Masongsong Associates Engineering Limited

PREPARED BY:	SG
CHECKED BY:	AI
FILE No.:	2003-141
DATE	09-Jun-15

STORM SEWER DESIGN SHEET

MANHOLES					A	C	LEG	ACC.	Tc	I	Q_{2yr}	STORM SEWER DESIGN INFORMATION					TIME	Q_{2yr}/Q_{full}
LOCATION	FROM	INVERT	TO	INVERT	area (ha)	runoff coeff.	A x C	A x C	(min)	(2-YR) (mm/hr)	uncontrol (l/s)	size (mm)	slope (%)	length (m)	Q full (l/s)	V full (m/s)	SECT. (min)	Capacity (%)
McKee Drive Service MH	*EX. STM MH*	*294.23*	*EX. STM MH*	*293.49*	*9.39*	*0.22*	*2.07*	*2.07*	*29.54*	*44.85*	*257.60*	*600*	*1.00*	*73.76*	*614*	*2.17*	*0.57*	*42%*



Project:

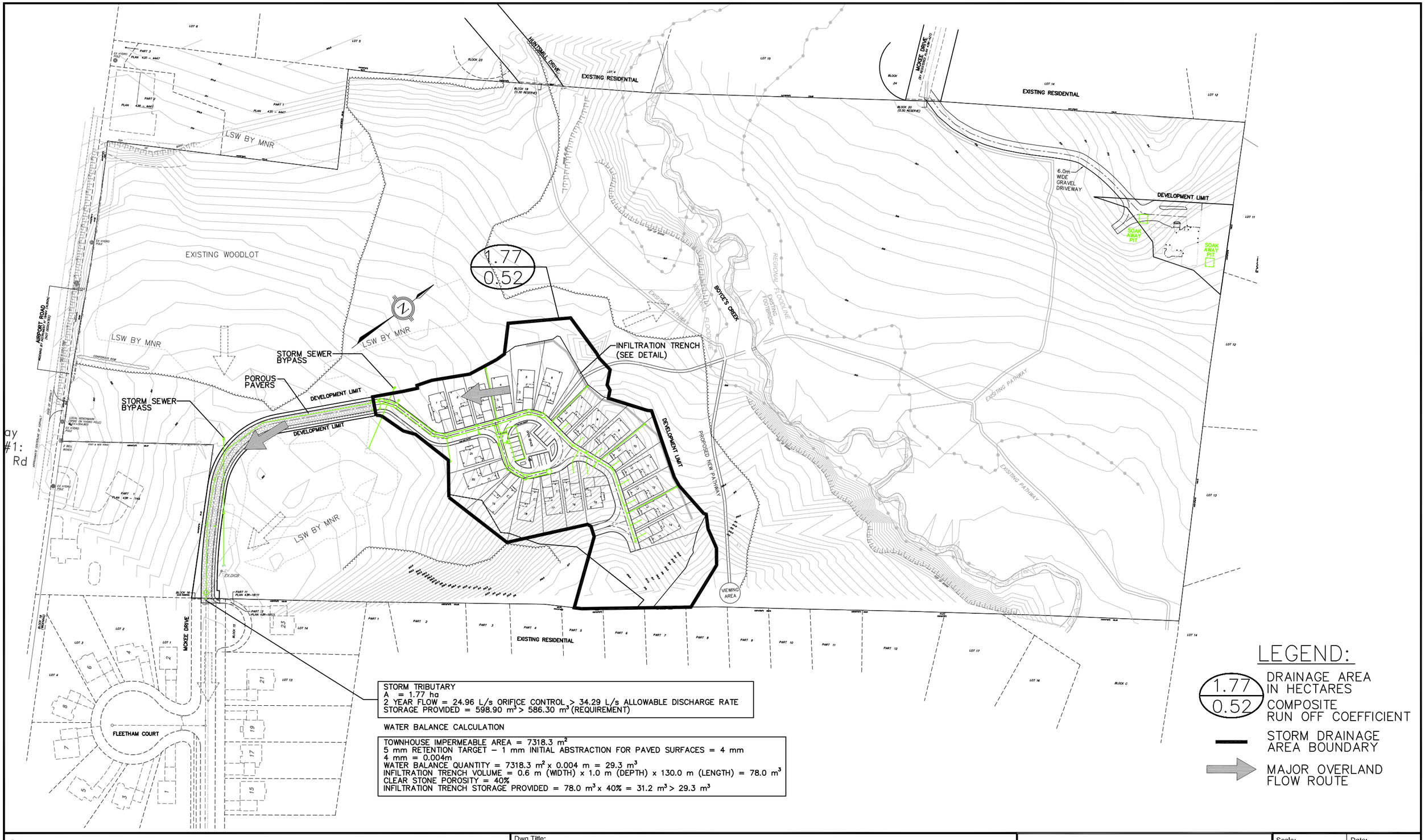
PROPOSED RESIDENTIAL SITE PLAN & SINGLE ESTATE LOT

Dwg.Title:

PRE-DEVELOPMENT PLAN

MASONGSONG ASSOCIATES
7800 KENNEDY ROAD
SUITE 201
MARKHAM, ONTARIO
L3R 2C7
T: (905) 944-0162
www.maeng.ca

Scale:	Date:
1:2000	APRIL 2013
Project Number	Drawing No.
03-141	PRE



ay
#1:
Rd

Project:	Dwg.Title:		Scale:	Date:
PROPOSED RESIDENTIAL SITE PLAN & SINGLE ESTATE LOT	POST DEVELOPMENT PLAN	MASONGSONG ASSOCIATES 7800 KENNEDY ROAD SUITE 201 MARKHAM, ONTARIO L3R 2C7 T: (905) 944-0162 www.maeng.ca	1:2000	APRIL 2013
			Project Number 03-141	Drawing No. POST

AREA I.D.	DRAINAGE PLAN TOTAL AREA SUMMARY (sq.m.)			TOTAL AREA (ha.)	COMPOSITE 'R'
	GRASS ('R'=0.20)	PAVED ('R'=0.90)	BUILDING ('R'=0.90)		
WEST DRAINAGE SHED	91865.08	1289.93	732.89	9.39	0.22

Grassed Area:	9.1865	ha.
Paved Area:	0.1290	ha.
Building Area:	0.0733	ha.
SITE AREA:	9.39	ha.
COMPOSITE 'R' VALUE:	0.22	
Percent Impervious:	2.15%	

Table 1

AREA I.D.	POST-DEVELOPMENT TOTAL AREA SUMMARY (sq.m.)			TOTAL AREA (ha.)	COMPOSITE 'R'
	GRASS ('R'=0.25)	PAVED ('R'=0.90)	BUILDING ('R'=0.90)		
SINGLE FAMILY DEVELOPMENT	10406.57	2569.78	4748.52	1.77	0.52

Grassed Area:	1.0407	**ha.**
Paved Area:	0.2570	**ha.**
Building Area:	0.4749	**ha.**
SITE AREA:	1.77	**ha.**
COMPOSITE 'R' VALUE:	0.52	
Percent Impervious:	41.29%	

Table 2

Table 3 Orifice Sizing Calculation

$$Q = CA(2 \times g \times h)^{0.5}$$

Where:

C =	0.80	*Orifice Coefficient (0.80 Tube, 0.62 Plate)*
A =	0.0044	m^2, *area of orifice(sq.m.)*
g =	9.81	m/s^2, *gravitational constant*
h =	2.54	m, *head = (HWL elevation - springline of orifice)*
d =	**0.075**	**m, orifice diameter**

and:

Invert Elevation =	298.88	m
Springline of Orifice =	298.92	m, *Invert elev + 1/2 of orifice diameter*
HWL Elevation =	301.46	m

Therefore:

Q =	0.0250	m^3/s, Total Flow
	24.96	L/s

Compare:

$Q_{ALLOWABLE}$ =	34.29	L/s

Table 4 100-year Attenuation Volume

On-Site Storage Calculator

CALEDON 100 -Year

Project: SINGLE FAMILY DEV.
Project No.: 03-141
By: S.G.
Date: 27-Mar-13

Location: **SINGLE FAMILY DEVELOPMENT**

A = 1.77 ha.
C = 0.52
Qactual = 0.0250 m^3/s

$$I_{100}=4688/(T_C+17)^{0.9624}$$

t_c (min)	i_{100} (mm/hr)	Q_{100} (m^3/s)	Q_{stored} (m^3/s)	Peak Volume (m^3)	
60	71.685	0.183	0.158	569.934	
61	70.800	0.181	0.156	571.154	
62	69.938	0.179	0.154	572.312	
63	69.096	0.177	0.152	573.410	
64	68.275	0.175	0.150	574.450	
65	67.473	0.173	0.148	575.434	
66	66.691	0.171	0.146	576.364	
67	65.927	0.169	0.144	577.242	
68	65.180	0.167	0.142	578.070	
69	64.451	0.165	0.140	578.848	
70	63.737	0.163	0.138	579.580	
71	63.040	0.161	0.136	580.266	
72	62.358	0.159	0.134	580.908	
73	61.691	0.158	0.133	581.508	
74	61.039	0.156	0.131	582.066	
75	60.400	0.154	0.129	582.584	
76	59.775	0.153	0.128	583.063	
77	59.163	0.151	0.126	583.505	
78	58.563	0.150	0.125	583.910	
79	57.976	0.148	0.123	584.280	
80	57.401	0.147	0.122	584.615	
81	56.837	0.145	0.120	584.918	
82	56.284	0.144	0.119	585.187	
83	55.743	0.143	0.118	585.426	
84	55.211	0.141	0.116	585.634	
85	54.690	0.140	0.115	585.812	
86	54.179	0.139	0.114	585.961	
87	53.678	0.137	0.112	586.082	
88	53.186	0.136	0.111	586.176	
89	52.703	0.135	0.110	586.243	
90	52.229	0.134	0.109	586.285	
91	51.763	0.132	0.107	586.301	***
92	51.306	0.131	0.106	586.292	
93	50.857	0.130	0.105	586.260	
94	50.416	0.129	0.104	586.205	
95	49.983	0.128	0.103	586.127	
96	49.557	0.127	0.102	586.026	
97	49.139	0.126	0.101	585.905	
98	48.727	0.125	0.100	585.762	
99	48.323	0.124	0.099	585.599	
100	47.925	0.123	0.098	585.415	
101	47.534	0.122	0.097	585.212	
102	47.150	0.121	0.096	584.991	

TABLE 5
AVAILABLE STORAGE UNDERGROUND IN SEWERS

FROM	TO	LENGTH BELOW HWL (m)	SIZE (mm)	VOLUME (cu.m.)
MH1	MH2	5.5	1829X1219	12.26
MH2	MH3	24.5	1829X1219	54.62
MH3	MH4	5.0	1829X1219	11.15
MH4	MH5	26.0	1829X1219	57.97
MH5	MH6	18.0	1829X1219	40.13
MH6	MH7	5.5	1829X1219	12.26
MH5	MH10	4.0	1829X1219	8.92
MH10	MH9	18.0	1829X1219	40.13
MH9	MH8	8.5	1829X1219	18.95
MH8	MH11	11.5	1829X1219	25.64
MH10	TANK	3.5	900	2.23
TANK	TANK	1.219 m (HEIGHT)	119.70 m^2 (AREA)	145.91

AVAILABLE STORAGE UNDERGROUND IN MANHOLES
(BELOW ELEVATION of 301.46m HWL) :

MH	HWL ELEV (m)	LOW INVERT ELEV (m)	DIAMETER (m)	VOLUME (cu.m.)
MH1	301.460	298.890	3.00	18.17
MH2	301.460	298.960	3.00	17.67
MH3	301.460	299.080	3.00	16.82
MH4	301.460	299.150	3.00	16.33
MH5	301.460	299.280	3.60	22.19
MH6	301.460	299.430	3.00	14.35
MH7	301.460	300.240	3.00	8.62
MH8	301.460	300.000	3.00	10.32
MH9	301.460	299.810	3.00	11.66
MH10	301.460	299.480	3.60	20.15
MH11	301.460	300.240	3.60	12.42

TOTAL VOLUME AVAILABLE UNDERGROUND IN SEWERS AND MANHOLES (cu.m.) ***598.89***

>586.30 REQUIRED

CONTECH®
ENGINEERED SOLUTIONS

Determining Number of Cartridges for Flow Based Systems

Date **10/12/2017** **Black Cells = Calculation**

Site Information

Project Name	**Proposed Residential Site Plan Development**	
Project Location	**Caledon, ON**	
OGS ID	**SF0820**	
Drainage Area, Ad	**4.37** ac	(1.77 ha)
Impervious Area, Ai	**1.80** ac	
Pervious Area, Ap	**2.57**	
% Impervious	**41%**	
Runoff Coefficient, Rc	**0.51**	
Treatment storm flow rate, Q_{treat}	**0.88** cfs	(25 L/s)
Peak storm flow rate, Q_{peak}	**0.88** cfs	

Filter System

Filtration brand	**StormFilter**	
Cartridge height	**18** in	
Specific Flow Rate	**2.0** gpm/ft^2	
Flow rate per cartridge	**15.0** gpm	

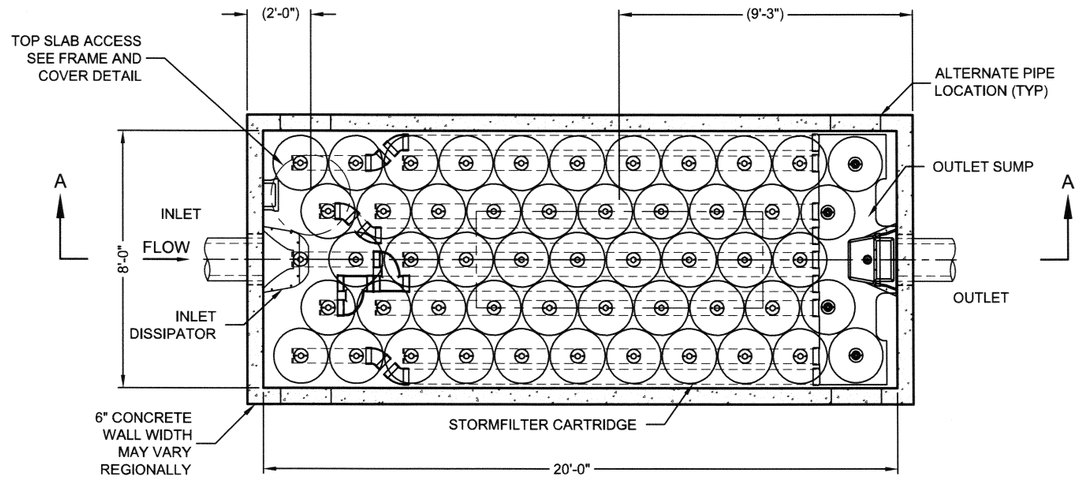
SUMMARY

Treatment Flow Rate, cfs	1.67
Cartridge Flow Rate, gpm	15.0
Sediment Capacity (kg)	815
Number of Cartridges	50
Media Type	Perlite

Event Mean Concentration (EMC)	**150** mg/L	
Annual TSS Removal	**80%**	
Percent Runoff Capture	**90%**	

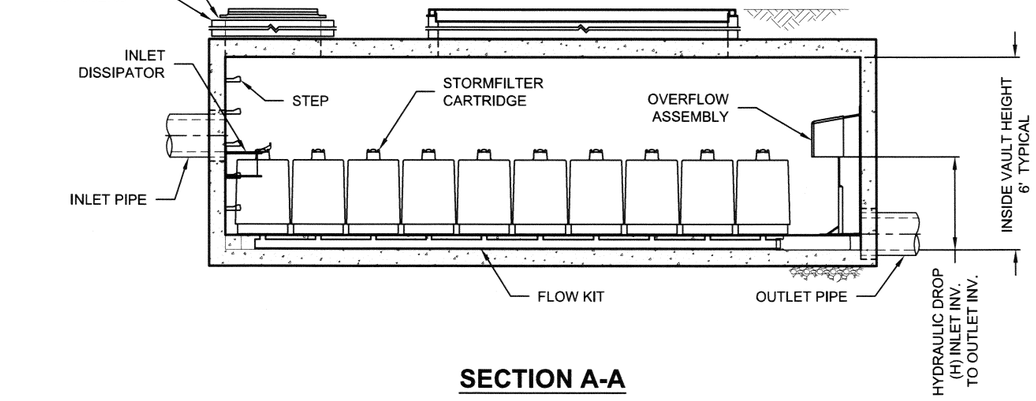
Recommend SF0820 vault

200 Enterprise Drive
Scarborough, ME 04074
Phone 877-907-8676
Fax 207-885-9825

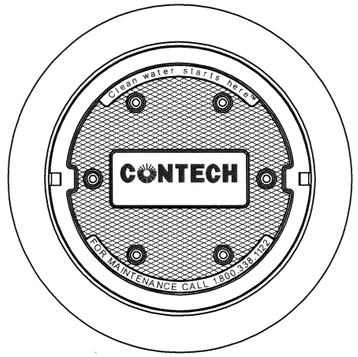


PLAN VIEW

VAULT STYLE: OUTLET SUMP (NIB)



SECTION A-A



FRAME, COVER, AND HATCH

(SIZE AND CONFIGURATION VARY)
N.T.S.

STORMFILTER DESIGN NOTES

STORMFILTER TREATMENTCAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD VAULT STYLE IS SHOWN WITH THE MAXIMUM NUMBER OF CARTRIDGES (51). VAULT STYLE OPTIONS INCLUDE INLET BAY (39), INLET BAY/OUTLET BAY (39), OUTLET BAY (46), INLET BAY/FULL HEIGHT BAFFLE WALL (35),FULL HEIGHT BAFFLE WALL (42).
STORMFILTER 8X20 PEAK HYDRAULIC CAPACITY IS 1.8 CFS. IF THE SITE CONDITIONS EXCEED 1.8 CFS AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27"		18"		LOW DROP	
RECOMMENDED HYDRAULIC DROP (H)	3.05'		2.3'		1.8'	
SPECIFIC FLOW RATE (gpm/sf)	2 gpm/ft²	1 gpm/ft²	2 gpm/ft²	1 gpm/ft²	2 gpm/ft²	1 gpm/ft²
CARTRIDGE FLOW RATE (gpm)	22.5	11.25	15	7.5	10	5

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	*
WATER QUALITY FLOW RATE (cfs)	*
PEAK FLOW RATE (cfs)	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
# OF CARTRIDGES REQUIRED	*
CARTRIDGE FLOW RATE	*
MEDIA TYPE (CSF, PERLITE, ZPG, GAC, PHS)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE #1	*	*	*
INLET PIPE #2	*	*	*
OUTLET PIPE	*	*	*

UPSTREAM RIM ELEVATION	*
DOWNSTREAM RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR SITE SPECIFIC DRAWINGS WITH DETAILED VAULT DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
6. FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 39 SECONDS.
7. SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft).

INSTALLATION NOTES

1. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
2. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER VAULT (LIFTING CLUTCHES PROVIDED).
3. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL VAULT SECTIONS AND ASSEMBLE VAULT.
4. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH OUTLET PIPE INVERT WITH OUTLET BAY FLOOR.
5. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

SF0820
STORMFILTER
STANDARD DETAIL

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
Mail Code 401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

December 14, 2016

Derek M. Berg
Director - Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Laboratory Certification
Stormwater Management StormFilter® (StormFilter) by Contech Engineered Solutions LLC
Off-line Installation

TSS Removal Rate 80%

Dear Mr. Berg:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions LLC has requested a Laboratory Certification for the StormFilter System.

This project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the afore-mentioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the StormFilter System by Contech Engineered Solutions LLC at a TSS removal rate of 80%, when designed, operated and maintained in accordance with the information provided in the Verification Appendix and subject to the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5. The MTFR is calculated based on a verified loading rate of 2.12 gpm/sf of effective filtration treatment area.

2. The StormFilter System shall be installed using the same configuration as the unit tested by NJCAT, and sized in accordance with the criteria specified in item 6 below.

3. This device cannot be used in series with another MTD or a media filter (such as a sand filter), to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual which can be found on-line at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the StormFilter, which is attached to this document. However, it is recommended to review the maintenance website at http://www.conteches.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=2813&PortalId=0&DownloadMethod=attachment for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for a StormFilter System.

   Example: A 0.25 acre impervious site is to be treated to 80% TSS removal using a StormFilter System. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

   The calculation of the minimum number of cartridges for use in the StormFilter System is based upon both the MTFR and the maximum inflow drainage area. It is necessary to calculate the required cartridges using both methods and to rely on the method that results in the highest minimum number of cartridges determined by the two methods.

   Inflow Drainage Area Evaluation:

   The drainage area to the StormFilter System in this example is 0.25 acres. Based upon the information in Table 1 below, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the maximum drainage area:

1. Five (5) 12" cartridges,
2. Three (3) 18" cartridges, or
3. Two (2) 27" cartridges

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was determined based on the following:

time of concentration = 10 minutes
i=3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
c=0.99 (runoff coefficient for impervious)
Q=ciA=0.99x3.2x0.25=0.79 cfs=0.79x448.83 gpm=354.58 gpm

Based on a flow rate of 354.58 gpm, the following minimum number of cartridges are required in a StormFilter System to treat the impervious area without exceeding the MTFR:

1. Thirty-six (36) 12" cartridges,
2. Twenty-four (24) 18" cartridges, or
3. Sixteen (16) 27" cartridges

The MTFR Evaluation results will be used since that method results in the higher minimum number of cartridges determined by the two methods.

The sizing table corresponding to the available system models are noted below:

TABLE 1 STORMFILTER CARTRIDGE HEIGHTS AND NEW JERSEY TREATMENT CAPACITIES

StormFilter Cartridge Heights and New Jersey Treatment Capacities				
StormFilter Cartridge Height	**Filtration Surface Area (sq.ft)**	**MTFR[1] (GPM)**	**Mass Capture Capacity (lbs)**	**Maximum Allowable Inflow Area[2] (acres)**
Low Drop (12")	4.71	10	36.3	0.061
18"	7.07	15	54.5	0.09
27"	10.61	22.5	81.8	0.136

Notes:

1. *MTFR calculated based on 4.72x10-3 cfs/sf (2.12 gpm/sf) of effective filtration treatment area.*
2. *Based upon the equation found in the NJDEP Filter Protocol Maximum Inflow Drainage Area (acres) = weight of TSS before 10% loss in MTFR (lbs)/600 lbs/acre of drainage area annually.*

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of

indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Shashi Nayak of my office at (609) 633-7021.

Sincerely,

James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Shashi Nayak, NJDEP - BNPC

green innovations

PG45 POROUS PAVING GRID GRID

The PG45 Porous Paving Grid System is a versatille solution for driveways, parking areas, walkways, golf cart paths, bicycle lanes and commercial fire lanes.
A great solution for driveable grass areas or stabilizing gravel areas, such as the gravel parking lot shown.

The PG45 Porous Paving Grid is a modular system, manufactured from 100% recycled HDPE.

EPA Map

green innovations

PG45 POROUS PAVING SYSTEM

Create Areas With Grass or Gravel To Prevent Erosion, Ruts, Potholes, Mud and Dust.

Drainage Issues Can Be Solved. Water runs through the system and into the ground and sub-base, reducing or eliminating puddles and muddy areas.

Small rounded studs moulded into the design provides a non-slip surface.

Residential and Commercial Applications

- **Walkways and Driveways**
- **Eliminate Muddy Path Between Houses**
- **Bicycle, Jogging Pathways, Trails**
- **Overflow and Extra Parking Spaces**
- **Laneways and Parking Lots**
- **Fire Lanes For Commercial Projects**
- **RV Parking Pads, Camp Grounds, Parks**
- **Control Mud, Erosion and Drainage in Equestrian Industry**
- **Cart Pathways and Pedestrian Walks on Golf Courses**

www.greeninnovations.co

1-888-725-7524

green innovations

Porous Paving Grid System

green innovations

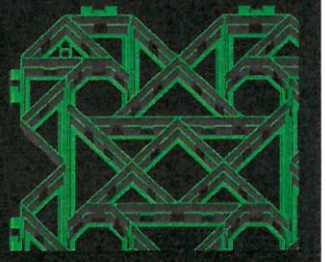
PG-45 POROUS PAVING SYSTEM

PRODUCT FEATURES / DATA

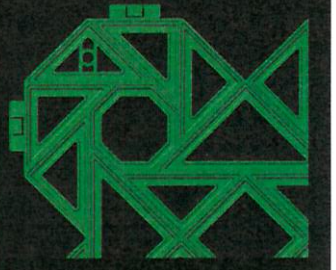
STORM WATER MANAGEMENT SOLUTIONS

The PG-45 Porous Parking Grid is a HDPE plastic grid system that is versatile solution for driveways, parking areas, walkways, golf cart paths, bicycle lanes, fire lanes.

Convenient 24" x 24" x 1 3/4" size makes for fast and easy installation.



Holes in the vertical wall are designed to allow horizontal root growth and improved drainage.



For gravel applications, each grid has two anchor points for placement of the landscape spikes.

RESIDENTIAL

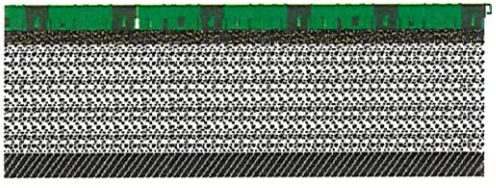
Eliminates muddy pathways around the home. Easy to use and install, makes the PG-45 ideal for use between houses, at the cottage or anywhere erosion and water causes damage to the grass area.

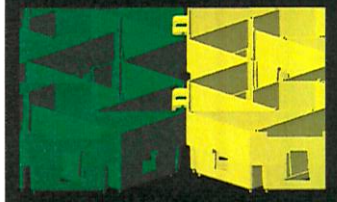
COMMERCIAL

Excavation work in progress for installation of a Fire Lane and access road for heavy trucks.

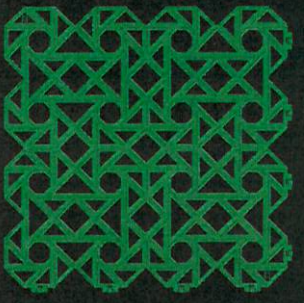
The cells of the grid can be filled with soil and seeded to have a driveable grass area or filled with gravel or decorative stones. The holes between each of the cells of the grid, promoting better growth of grass. Unsightly ruts, mud and pot-holes are eliminated. Storm water seeps back into the ground rather than running into drainage systems.

Recomended Installation





Grids snap and lock together to assure stability. The surface has studs moulded in to provide a non-slip surface.



A unique pattern design for strength and durability, suitable for grass or gravel installations.

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3700 SALEM RD.
PICKERING, ON L1Y 1E8
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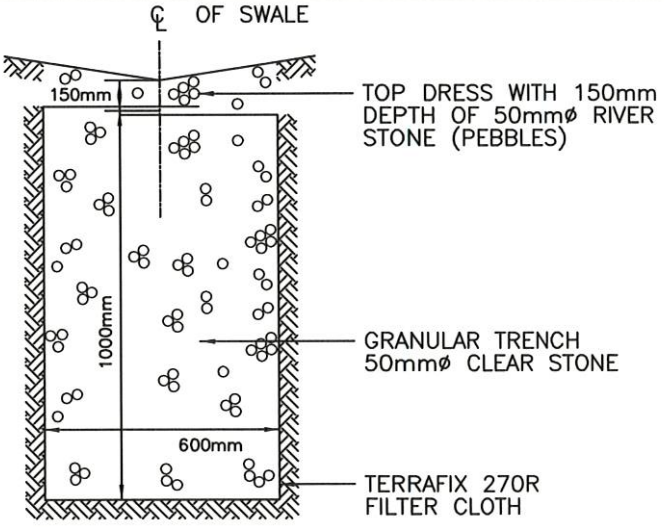


NOTE:

1. TRENCHES SHALL BE INSTALLED AT THE END OF THE DEVELOPMENT CONSTRUCTION.
2. SMEARING OF THE NATIVE MATERIAL AT THE INTERFACE WITH THE TRENCH MUST BE AVOIDED AND/OR CORRECTED BY RAKING/ROTO-TILLING: AND COMPACTION OF THE TRENCH DURING CONSTRUCTION MUST BE MINIMIZED.

INFILTRATION TRENCH IN SWALE DETAIL

N.T.S.

Algreen PRODUCTS

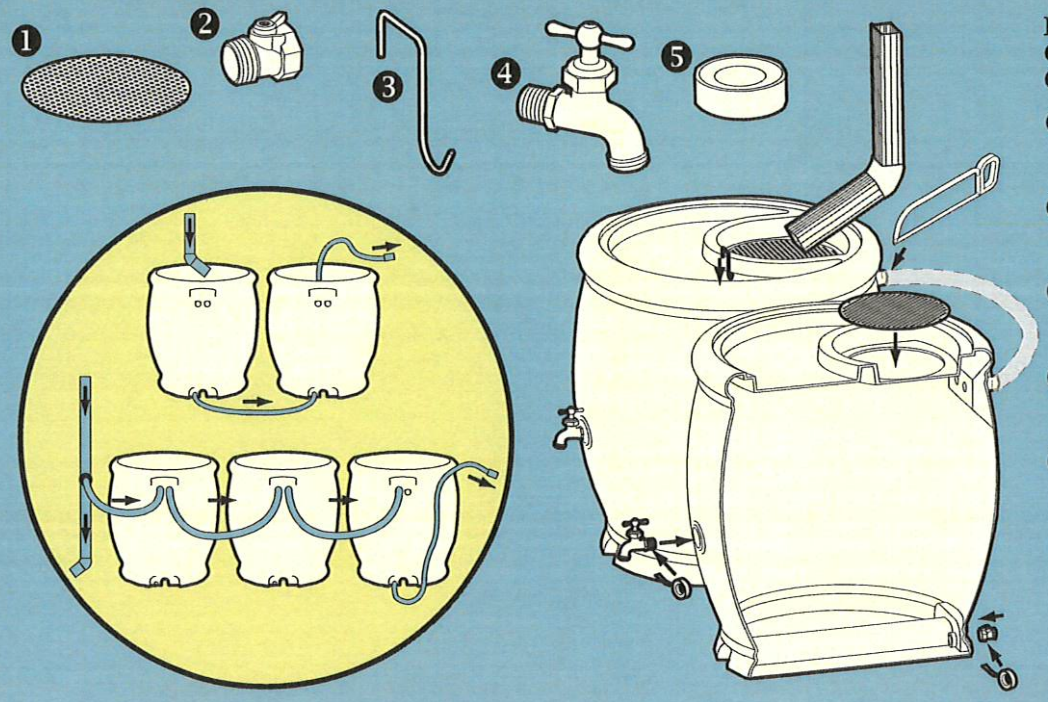
Barcelona

100 Gal. (380 L)

Decorative Rain Barrel with Planter • Citerne pluviale décorative avec jardinière • Barril para agua de lluvia decorativo con macetero

Made in Canada
Fabriqué au Canada
Fabricado en Canadá
ALGREEN PRODUCTS
100 Pinebush Road
Cambridge ON N1R 8J8

0 67151 85301 5



Included Components:
Comprend :
Componentes incluidos:

1. • Corrosion Proof Screen Guard
   • Écran de protection résistant à la corrosion
   • Protector de pantalla anticorrosivo
2. • Nozzle with Shut Off
   • Lance d'arrosage avec dispositif d'arrêt
   • Boquilla con llave de paso
3. • Hook for Optional Garden Hose*
   • Crocher pour tuyau d'arrosage optionnel*
   • Gancho para manguera de jardín opcional*
4. • Spigot
   • Bout mâle
   • Canilla
5. • Teflon Thread Sealing Tape
   • Ruban d'étanchéité fileté en Teflon
   • Cinta selladora de teflón

www.AlgreenProducts.com

PARTNER Carbonfree Carbonfund.org

4 LDPE

Some products may not be exactly as illustrated. *Garden hose not included. Certains produits peuvent ne pas correspondre exactement à l'illustration. *Tuyau d'arrosage non compris. Algunos productos pueden no ser exactamente como aparecen en la ilustración. *Manguera de jardín no incluidos. •Drain barrel in below freezing temperatures •Drain pour citerne pluviale sous le point de congélation •Drene el barril en temperaturas bajo cero

Algreen Rain Barrel Linking Kit

Please read through all instructions before starting.

COMPONENTS:

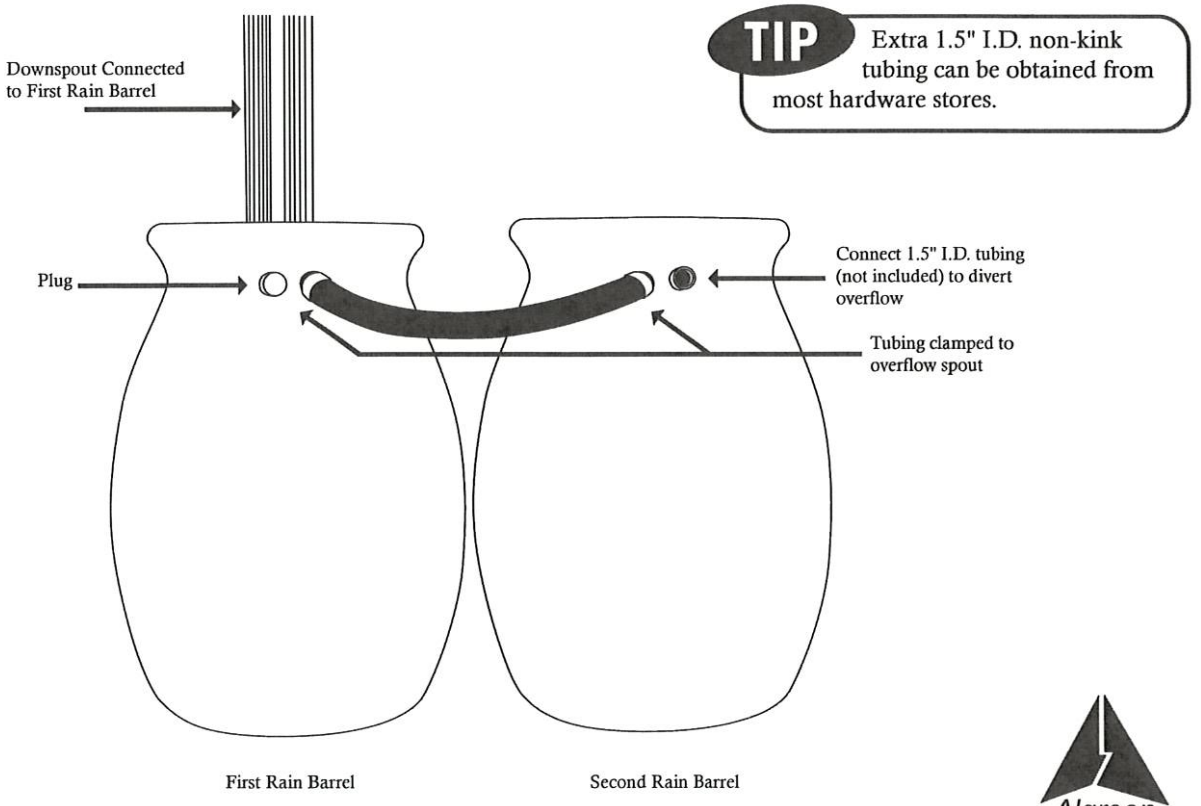
- 1.5" I.D. by 5' non-kink tubing.
- 3 hose clamps
- 1 plug

The rain barrel linking kit allows you to connect multiple rain barrels together in order to increase your water harvesting capacity. Algreen's rain barrel linking kits are designed for rain barrels with 2 overflow spouts at the top. At least one of your rain barrels must have 2 overflow spouts in order to effectively utilize this kit.

Each kit will allow for an addition rain barrel to be linked to a chain of rain barrels. It is important to note that if the initial rain barrel (in the chain) has a second overflow, this overflow must remain blocked. If required, a plug has been provided that can be used to plug the extra overflow.

INSTALLATION INSTRUCTIONS:

1. Use the plug (provided) to block the extra overflow in the first rain barrel. Place the plug over the overflow and tighten the clamp around it to create a water-tight seal.
2. Use a screw-driver to tighten a clamp around one end of the 1.5" tubing over the second overflow (in the first rain barrel).
3. Use a screw-driver to tighten a clamp around the end of the 1.5" tubing over the first overflow (in the second rain barrel).
4. If you have additional linking kits, repeat steps #2 to #3 to add additional rain barrels to the chain.
5. Remember to divert the water from the second overflow (in the second rain barrel) away from your foundation!



Algreen PRODUCTS
100 Pinebush Road
Cambridge Ontario Canada
N1R 8J8
1-800-984-9933

www.algreenproducts.com

Rain Barrels

Cascata 65

EcoCascata 65

Castilla 50

Agua 50

Madison 49

Madison Fountain

Athena 50

Athena 80

Wicker 50

Barcelona 100

Accessories

Barcelona 100

Algreen's 100 gallon Barcelona Rain Barrel provides the decorative appeal and character of a robust urn. This rain barrel features a large planting surface, quality brass spigot, shut-off nozzle valve and dual overflows. A corrosion-proof screen guard and bottom threaded drain to fit standard garden hoses are also included. **Tip:** Combine 2 or more rain barrels with the Algreen Linking Kit

85301 | CharcoalStone
85311 | BrownStone
85001 | Terra Cotta
85231 | TaupeStone

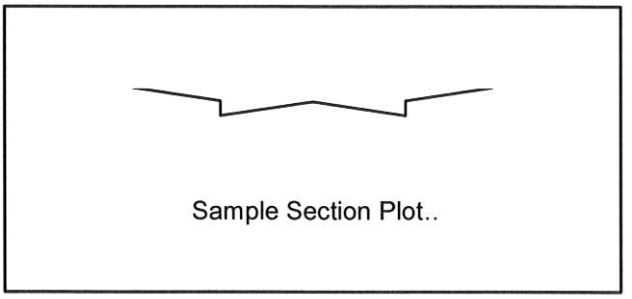
Barcelona | Label & Instructions

Generalized Cross Section Capacity Analysis

SECTION A-A

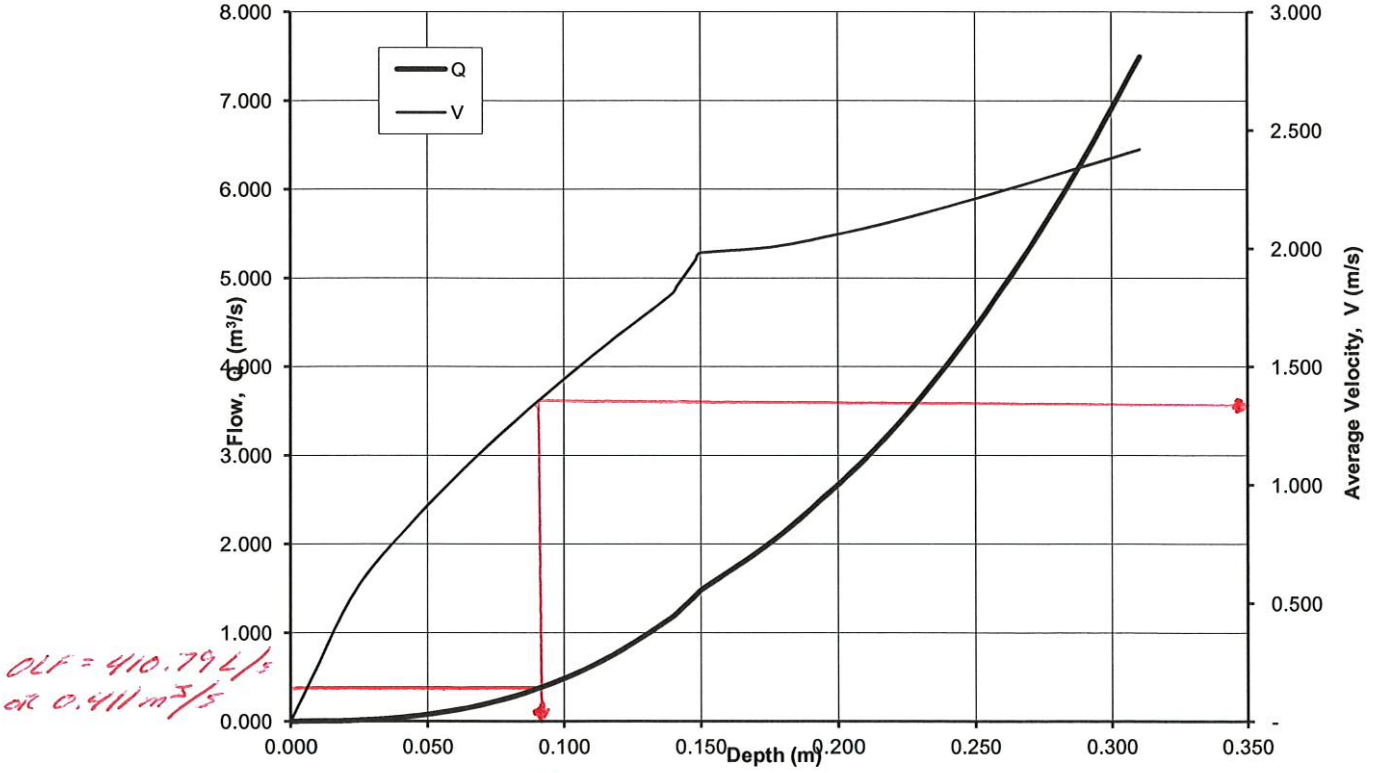
PRE-DEVELOPMENT

Channel Width	20.00	m
Bottom Length	9.30	m
Crossfall:	-0.030	m/m
	0.150	m
Channel Roughness:	0.013	Manning n
Longitudinal Slope:	0.0200	m/m
Side Slope	0.030	m/m
Side Roughness:	0.020	Manning n
Side Slope Length	5.35	m
Graph Exageration:	7.50	Vertical
Max Depth of Flow	310.50	mm
Max Flow	7.4931	m^3/s



Case 1: Crown LOWER than top of Curb

Cross-Section Rating Curve
Flow and Velocity



OLF = 410.79 L/s
or 0.411 m³/s

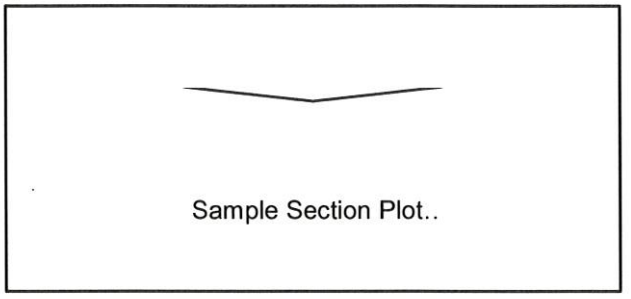
V = 1.55 m/s

D = 0.09 m
or 90 mm

Generalized Cross Section Capacity Analysis

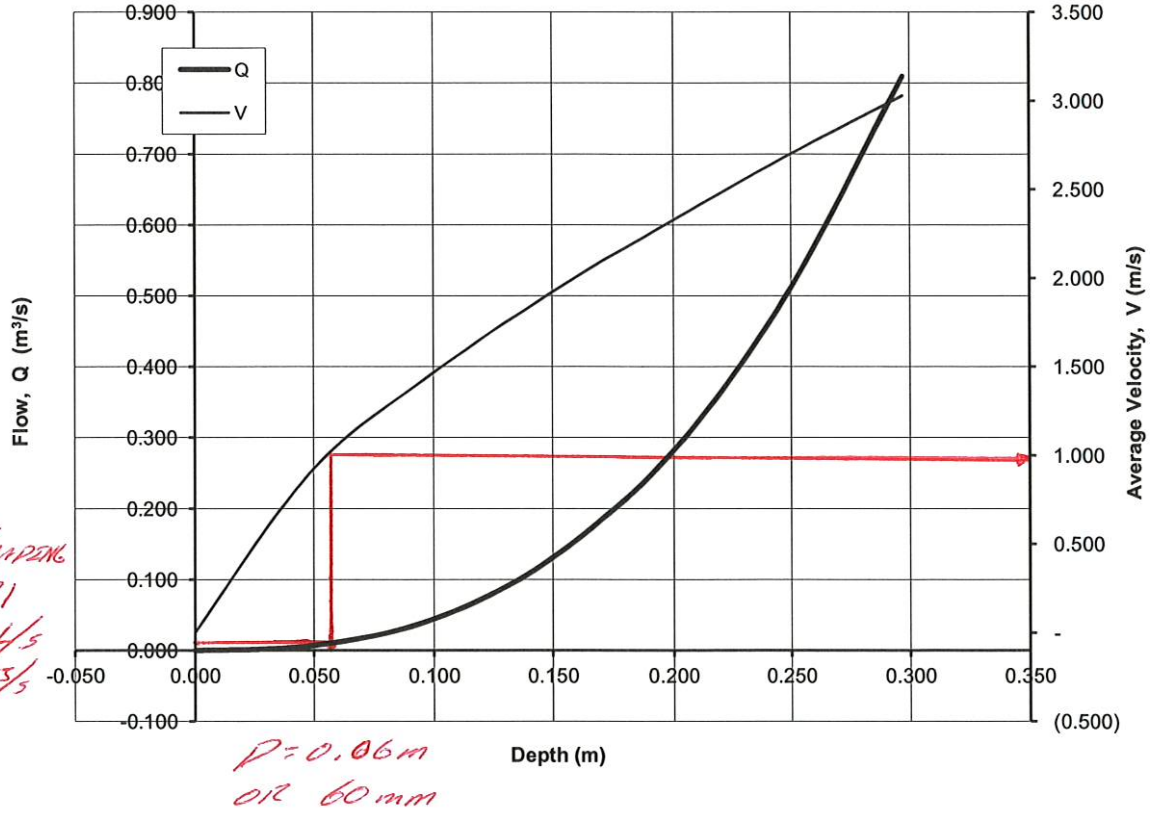
SECTION B-B
CUT OFF SWALE

Channel Width	1.80	m
Bottom Length	0.00	m
Crossfall:	0.000	m/m
	0.000	m
Channel Roughness:	0.020	Manning n
Longitudinal Slope:	0.0500	m/m
Side Slope	0.330	m/m
Side Roughness:	0.020	Manning n
Side Slope Length	0.90	m
Graph Exageration:	7.50	Vertical
Max Depth of Flow	297.00	mm
Max Flow	0.8097	m^3/s



Case 4: Open Channel

Cross-Section Rating Curve
Flow and Velocity



FROM TIME GROUPING PLAN PLATE 6R1
$Q_{100} = 26.34 l/s$
OR $0.026 m^3/s$

$V = 1.0 m/s$

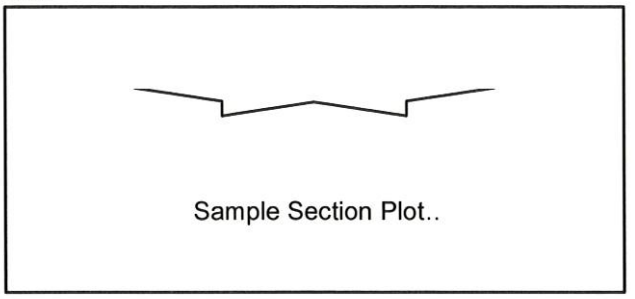
$D = 0.06 m$
OR 60 mm

Generalized Cross Section Capacity Analysis

SECTION A-A

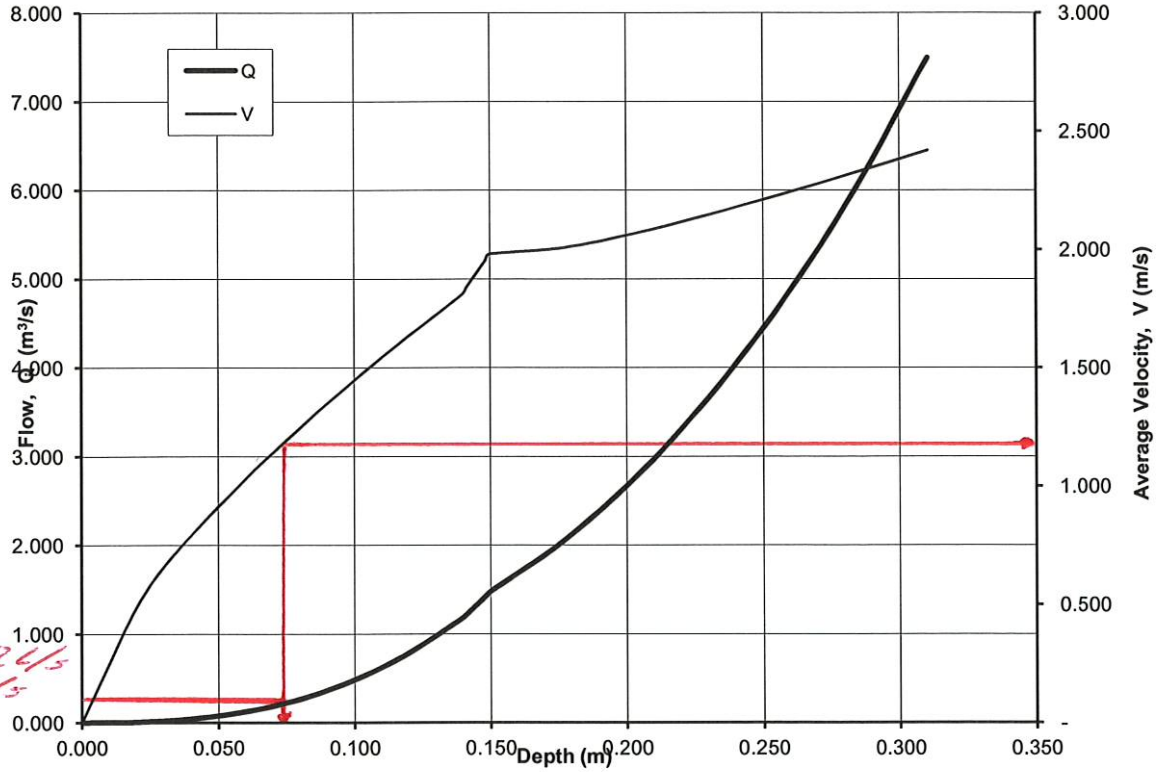
POST DEVELOPMENT

Channel Width	20.00	m
Bottom Length	9.30	m
Crossfall:	-0.030	m/m
	0.150	m
Channel Roughness:	0.013	Manning n
Longitudinal Slope:	0.0200	m/m
Side Slope	0.030	m/m
Side Roughness:	0.020	Manning n
Side Slope Length	5.35	m
Graph Exageration:	7.50	Vertical
Max Depth of Flow	310.50	mm
Max Flow	7.4931	m^3/s



Case 1: Crown LOWER than top of Curb

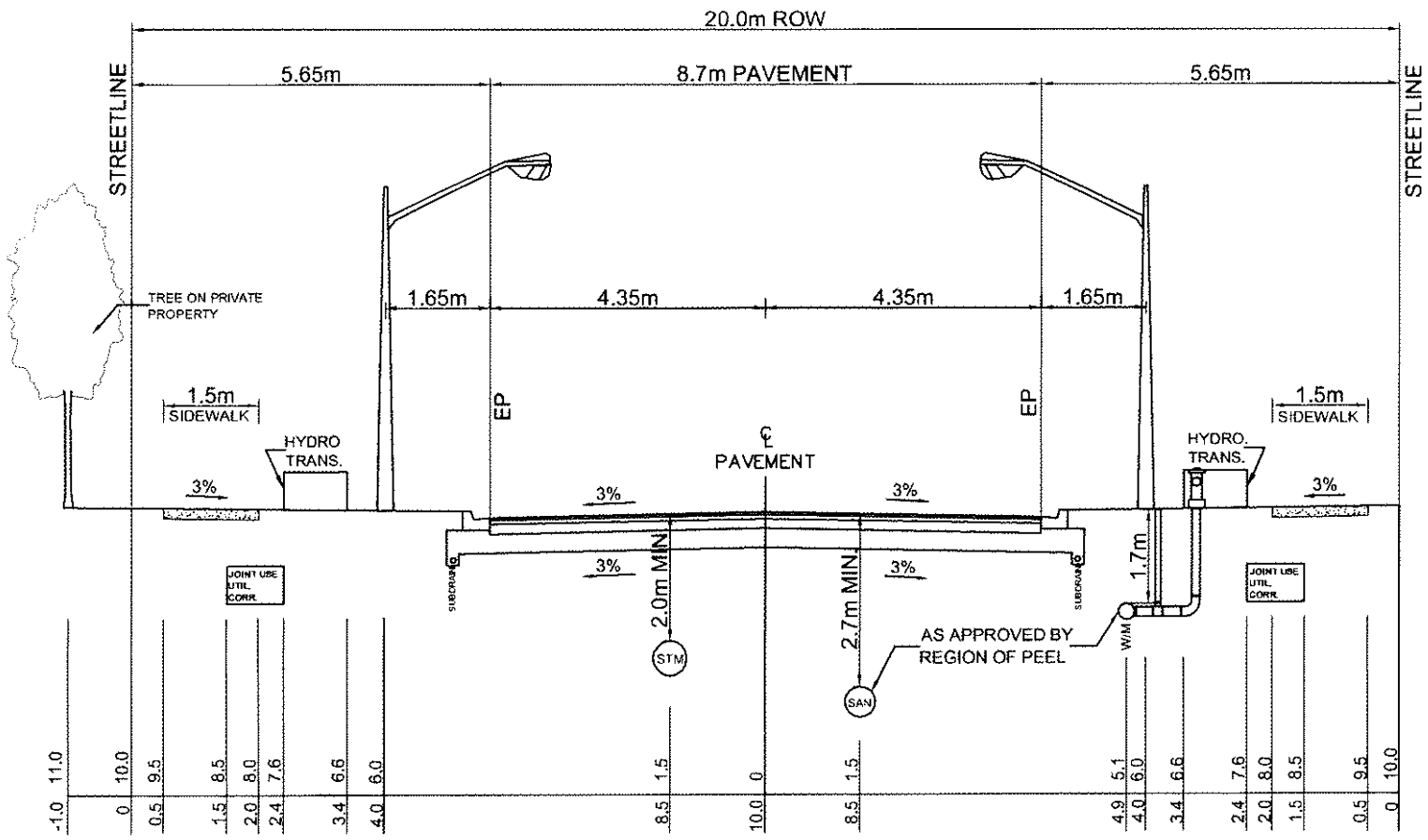
Cross-Section Rating Curve
Flow and Velocity



OUF = 321.82 l/s
OR 0.322 m³/s

D = 0.075 m
OR 75mm

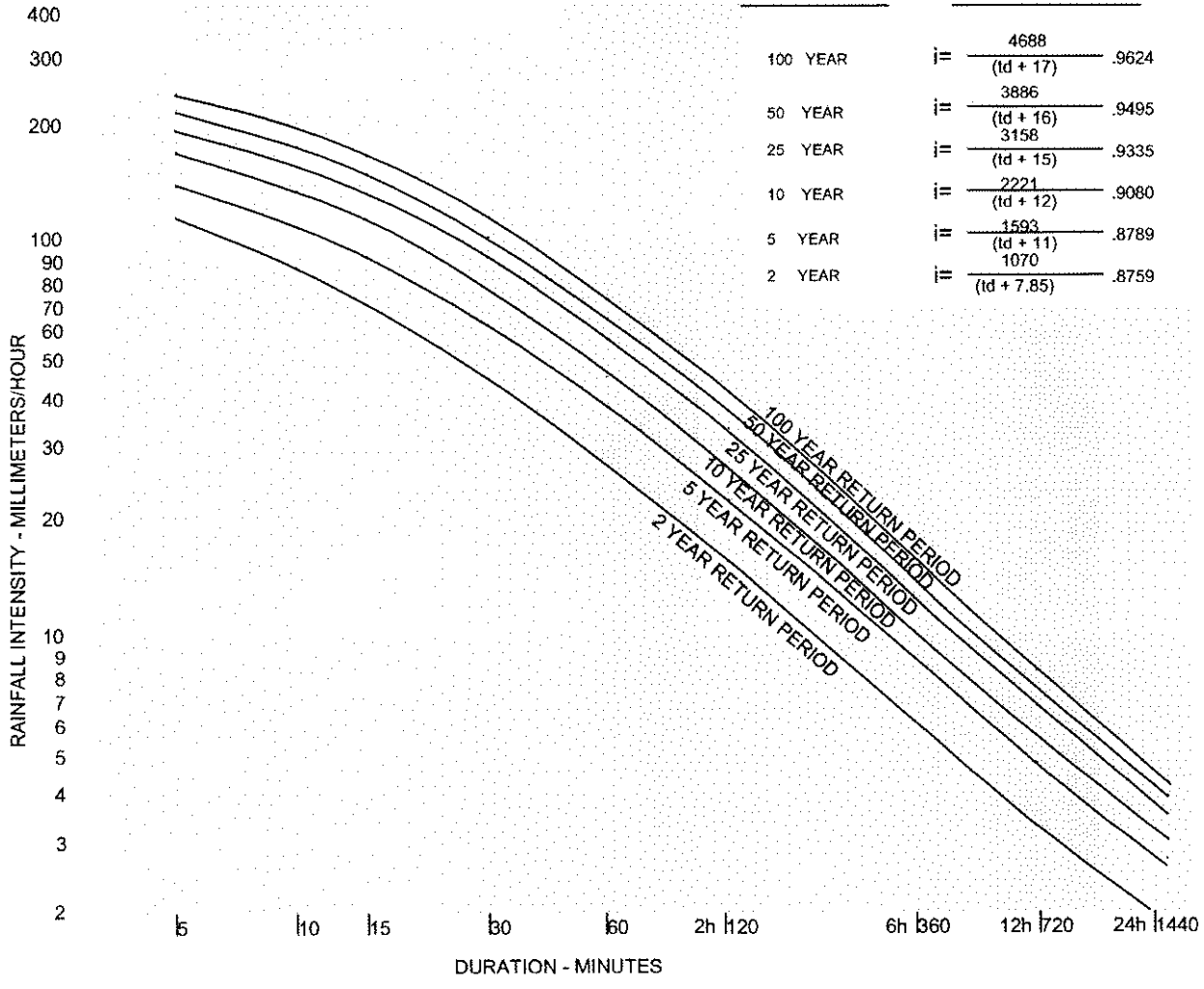
EXISTING McKee Drive



NOTES:

1. UTILITY CORRIDOR TO HAVE A MINIMUM COVER OF 0.9m.
2. WATERMAIN TO HAVE MINIMUM COVER OF 1.7m.
3. THE FOLLOWING IS A MINIMUM ROAD BASE AND WILL REQUIRE A SOILS REPORT VERIFICATION
   - 40mm HL3
   - 65mm HL8
   - 150mm GRANULAR "A"
   - 300mm GRANULAR 'B'
4. THE BOULEVARDS REQUIRE A MINIMUM OF 300mm OF TOPSOIL AND NURSERY SOD
5. TREES TO BE PLACED IN LOCATIONS PER APPROVED LANDSCAPE PLAN
6. STREETLIGHT FIXTURE PER APPROVED TOWN STANDARD.
7. ON A CRESCENT THE WATERMAIN SHALL BE PLACED ON THE OUTSIDE.
8. FULL LENGTH MINIMUM 100MM DIA.SUB-DRAINS C/W FILTERCLOTH SHALL BE INSTALLED TO TOWN OF CALEDON STANDARD NO. 219.
9. SUB-GRADE SHALL BE COMPACTED TO A MINIMUM 95% OF S.P.D. AT OPTIMUM MOISTURE CONTENT.
10. WHERE POSSIBLE MANHOLE LIDS TO BE LOCATED OUT OF TIRE LANE OF TRAFFIC.
11. ESTATE RESIDENTIAL 4.0 METERS LANE WIDTH.

TOWN OF CALEDON						
	4	DIMENSION AND TEXT REVISION		JAN. 09	APR'D: C.C.	DATE: 19/01/00
	3	DIMENSION, LAYOUT REVISION		JULY 08		
	2	DIMENSION EDIT, STD No. 201 NOW 203		JUNE 08	DRAWN: BJM	SCALE: N.T.S.
20.0m LOCAL URBAN/RURAL 9.3m ROADWAY (8.7m PAVEMENT)	1	OFFSETS		APRIL 08	STANDARD No. 203	
	NO.	REVISION	APR'D	DATE		



RETURN PERIOD	EQUATION OF CURVE	
100 YEAR	$i = \frac{4688}{(td + 17)}$	.9624
50 YEAR	$i = \frac{3886}{(td + 16)}$	.9495
25 YEAR	$i = \frac{3158}{(td + 15)}$	.9335
10 YEAR	$i = \frac{2221}{(td + 12)}$	.9080
5 YEAR	$i = \frac{1593}{(td + 11)}$	.8789
2 YEAR	$i = \frac{1070}{(td + 7.85)}$	.8759

INLET TIMES

SUBURBAN RESIDENTIAL	
(ROOF DRAINS UNCONNECTED)	15 min
(ROOF DRAINS CONNECTED)	10 min
SUBURBAN, COMMERCIAL, INDUSTRIAL MULTIPLE FAMILY	10 min
DOWNTOWN COMMERCIAL, HIGH DENSITY APARTMENTS, EXPRESSWAYS	5 min

RUNOFF COEFFICIENT

COMMERCIAL	
- DOWNTOWN & SUBURBAN SHOPPING	0.90
INDUSTRIAL	
- DOWNTOWN	0.90
- SUBURBAN INDUSTRIAL PARKS	0.75
RESIDENTIAL	
- APARTMENTS	0.75
- ROW DWELLINGS	0.70
- DUPLEX DWELLINGS	0.70
- SEMIDETACHED - DOWNTOWN	0.60
- SINGLE FAMILY - DOWNTOWN	0.60
- SEMIDETACHED - SUBURBAN	0.50
- SINGLE FAMILY - SUBURBAN	0.40
SCHOOLS, CHURCHES, HOSPITALS	0.75
PARKS, CEMETERIES, RAIL YARDS	
(OVER 4 Ha)	0.20
(UNDER 4 Ha)	0.25

TOWN OF CALEDON

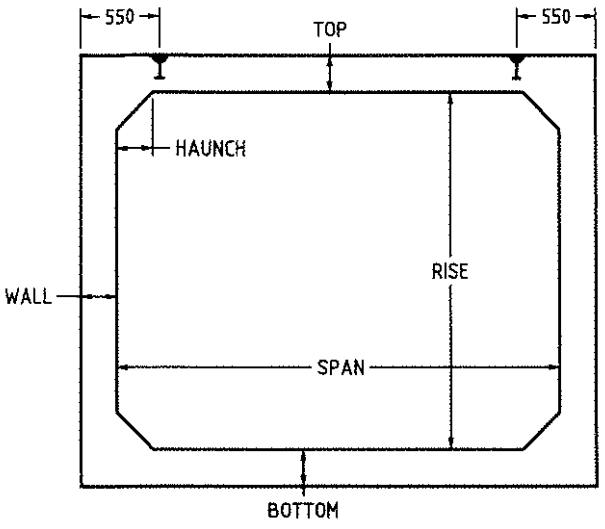
RAINFALL INTENSITY CURVES

NO.	REVISION	APR'D	DATE
1	STANDARD 112.01 NOW 104		JUNE 08

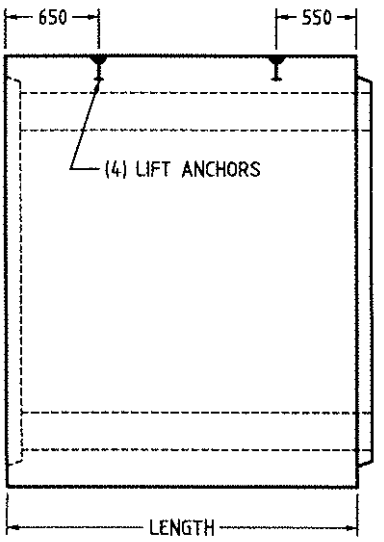
APR'D: C.C. DATE: FEB 2000

DRAWN: BJM SCALE: N.T.S.

STANDARD No. 104



END VIEW



SIDE VIEW

PRECAST BOX CULVERT PARAMETERS (mm)							DESIGN EARTH COVER (m)		SWIFT LIFT ANCHORS
SPAN	RISE	WALL	TOP/BOTTOM	HAUNCH	LENGTH	MASS	OPSS 1821	OHBDC 1991	TON x LENGTH
1800	900	200	200	200	2500	7,922 Kg	0.6 - 5.5	LESS THAN 0.6	4 T x 5.5"
1829	1219	203	203	203	2438	9,004 Kg	0.6 - 5.5	LESS THAN 0.6	4 T x 5.5"
2438	1219	203	203	203	2438	11,126 Kg	0.6 - 3.6	LESS THAN 0.6	4 T x 5.5"
2438	1524	203	203	203	2438	11,883 Kg	0.6 - 3.6	LESS THAN 0.6	4 T x 5.5"
2438	1829	203	203	203	2438	12,615 Kg	0.6 - 3.6	LESS THAN 0.6	4 T x 5.5"
3048	1524	254	254	254	2438	16,738 Kg	0.6 - 3.6	LESS THAN 0.6	8 T x 8.25"
3048	1829	254	254	254	2438	17,690 Kg	0.6 - 3.6	LESS THAN 0.6	8 T x 8.25"
3048	2134	254	254	254	2438	18,617 Kg	0.6 - 3.6	LESS THAN 0.6	8 T x 8.25"
3000	2400	250	250	250	2500	19,082 Kg	0.6 - 3.6	LESS THAN 0.6	8 T x 8.25"

SPECIAL BOX UNITS AND END TREATMENTS AVAILABLE:

- SHORTER LAY LENGTHS
- TEE AND WYE JUNCTIONS
- BENDS AND ELBOWS
- REDUCERS AND INCREASERS
- PLUGS AND CAPS
- RADIUS BOX
- SLOPED AND BEVELLED ENDS
- FLUSH AND EXPOSED MESH ENDS
- DOWELS AND INSERTS
- SCRIBED HOLES
- MAINTENANCE HOLE TEE

GENERAL NOTES:

1. MANUFACTURED IN ACCORDANCE WITH ONTARIO PROVINCIAL STANDARD SPECIFICATION (OPSS) 1821.
2. REFER TO LATEST PRICE LIST FOR PRICING STRUCTURE AND CONDITIONS OF SALE.
3. FOR ALL DESIGN EARTH COVERS NOT SHOWN IN THE ABOVE TABLE, PLEASE CONTACT OUR SALES OR ENGINEERING DEPARTMENT.
4. JOINTING MATERIAL SUCH AS RUBBER GASKETS, AND FILTER FABRIC AVAILABLE UPON REQUEST.
5. ADDITIONAL SIZES OR SPECIAL APPLICATION BOX UNITS ARE AVAILABLE UPON REQUEST.

REV	DESCRIPTION	DATE

CON CAST PIPE
R.R. #3, Guelph, Ontario N1H 6H9
Tel.: (519) 763-8655
Toll Free: (800) 668-7473
Fax: (519) 763-1956

CON CAST PIPE STANDARD DRAWING

PROJECT NAME / DWG TITLE:

PRECAST REINFORCED CONCRETE BOX UNITS SUMMARY OF STANDARD SIZES

SCALE: NTS	DATE: 15 APR 02	DWG NAME: STD_BOX.DGN
DRAWN BY: PI	G:\REGISTRY\ENGINEERING\REFERENCE DOC\BOX\STD_BOX.DGN REV. 000 APRIL 15, 2002	

REGION OF PEEL

SANITARY SEWER DESIGN SHEET
PROPOSED TOWNHOUSE DEVELOPMENT
CALEDON, ONTARIO

LOCATION	MH FROM	TO MH	AREA (ha)	DENSITY (pphe)	POPULATION	CUMULATIVE AREA (ha)	CUMULATIVE POPULATION	1 SEWAGE FLOW (m^3/sec)	2 INFILTRATION FLOW (m^3/sec)	3 FOUNDATION DRAIN (m^3/sec)	TOTAL FLOW 1+2+3 (m^3/sec)	LENGTH (m)	PIPE DIAMETER (mm)	GRADIENT (%)	CAPACITY (m^3/sec)	VELOCITY (m/sec)	DROP IN LOWER M.H. (m)
McKee Drive South	Prop. Service Connection	EX. MH35	2.330	70	163	2.330	163	0.0024	0.004946	-	**0.0073**	24.0	250	1.00	**0.05947**	1.211	
	EX. MH35	EX. MH37	0.620	50	31	2.950	194	0.0028	0.005350	-	**0.0082**	48.4	250	1.15	**0.06377**	1.299	

Plan No. **S-1**

Consultant Masongsong Associates Engineering Limited

Subdivision PROPOSED TOWNHOUSE DEVELOPMENT

Sheet 1 of 1

Project No. **03-141**

Region of Peel
Working for you

Design Criteria:

	(pphe)			
Population Density:		Infiltration:	0.0002	(m^3/sec/ha)
Single family (greater than 10m lots)	50	Infiltration:	0.00028	(m^3/sec/mh)
Single family (less than 10m lots)	70			
Semi-detached	70			
Row dwellings	175			
Aparments	475			

Sewer flow numbers taken from STD.DWG 2-5-2

Date 08-Jun-15 Designed By: S.G.

Checked By: A.I.

Date

Approved

Connection Demand Table

WATER CONNECTION

Connection point [3]	23 McKee Drive South EXISTING FIRE HYDRANT AT THE END OF CUL-DE-SAC (DEAD END)		
Pressure zone of connection point			
Total equivalent population to be serviced [1]		163 PERSONS	
Total lands to be serviced		2.33 ha	
Hydrant flow test			
Hydrant flow test location			
REFER TO WATER CONNECTION POINT ABOVE			
	Pressure (kPa)	Flow (in l/s)	Time
Minimum water pressure	234.42	123.15	8:20AM
Maximum water pressure	606.74	23.25	8:20AM

No.	Water demands		
	Demand type	**Demand**	**Units**
1	Average day flow	0.57	l/s
2	Maximum day flow	1.14	l/s
3	Peak hour flow	1.71	l/s
4	Fire flow [2]	63.33	l/s
Analysis			
5	Maximum day plus fire flow	64.47	l/s

WASTEWATER CONNECTION

Connection point [4]		EX. MH 35	(REFER TO SERVICING PLAN DWG. S-1)
Total equivalent population to be serviced [1]		163 PERSONS	
Total lands to be serviced		2.33 ha	
6	Wastewater sewer effluent (in l/s)	7.8 l/s	(REFER TO SECTION 2.3 SANITARY SEWERAGE IN THE SERVICING AND STORMWATER MANAGEMENT REPORT)

[1] Please refer to design criteria for population equivencies
[2] Please reference the Fire Underwriters Survey Document
[3] Please specify the connection point ID
[4] Please specify the connection point (wastewater line or manhole ID)
Also, the "total equivalent popopulation to be serviced" and the "total lands to be serviced" should reference the connection point. (The FSR should contain one copy of Site Servicing Plan)

Please include the graphs associated with the hydrant flow test information table
Please provide Professional Engineer's signature and stamp on the demand table
All required calculations must be submitted with the demand table submission.

DENSITY POPULATION = 2.33ha x 70 PERSONS/ha
= 163 PERSONS

WATER DEMAND

1. AVG. DAILY FLOW = (302.8 L/p/d x 163 P) / 86400 s/d
= 0.57 l/s

2. MAX. DAY FLOW = 0.57 l/s x 2.0
= 1.14 l/s

3. PEAK HOUR FLOW = 0.57 l/s x 3.0
= 1.71 l/s

corix®
Water Services

10 Estate Drive, Toronto, Ontario M1H 2Z1
Phone: 416.282.1665 Fax: 416.282.7702 Toll Free: 1.888.349.2493
www.corix.com

SITE NAME: Masonsons Gas. DATE: Oct 21/2014

LOCATION: McKee Drive, Caledon ON.

TEST DATA TIME OF TEST: 8:20 am

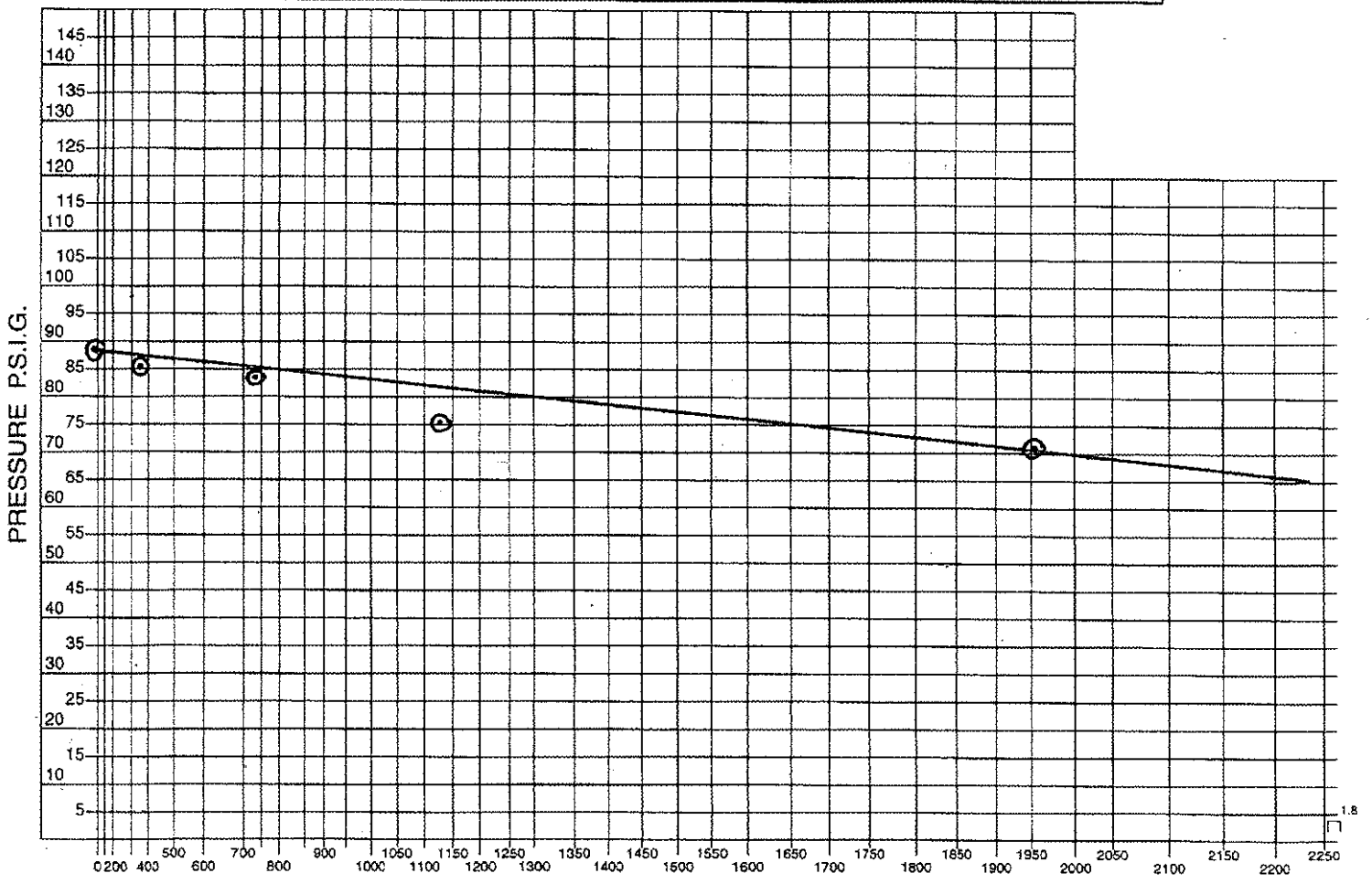
LOCATION OF TEST: (FLOW) 23 McKee Drive, 3Port AVK (Dead end)

(RESIDUAL) 13 McKee Drive, 3Port AVK.

MAIN SIZE: 300 mm P.V.C

STATIC PRESSURE: 88 psi

	NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S. G.P.M.)	RESIDUAL PRESSURE
# 1	1 x 1 1/8"	80	335	85
# 2	1 x 1 3/4"	66	738	83
# 3	1 x 2 1/2"	46	1135	75
# 4	2 x 2 1/2"	34	1952	71



FLOW U.S. G.P.M.

COMMENTS: Performed one complete NFPA 291 flow test.

Authorized Signature _____ Corix Water Services Signature _____

	LOCAL RESIDENTIAL ROADS <1000 ADT	LOCAL INDUSTRIAL ROADS	RESIDENTIAL COLLECTOR ROADS 1000 to 3000 ADT	COLLECTOR ROADS 3000 to 10,000 ADT	ARTERIAL ROADS > 6,000 ADT
DESIGN SPEED	50km/h	50km/h	50km/h	60km/h	70km/h
HORIZONTAL CURVE RADIUS (m)	90.0m	90.0m	130.0m	190.0m	250.0m
CRITICAL CURVE (MINIMUM K) SAG	12	18	18	25	30
CRITICAL CURVE (MINIMUM K) CREST	8	15	15	25	35
STOPPING SIGHT DISTANCE	70.0m	70.0m	95.0m	125.0m	150.0m
ROAD GRADE (MAXIMUM) CUL-DE-SAC (%)	7.00%	4.00%	6.00%	6.00%	6.00%
ROAD GRADE (MINIMUM) INCLUDING CUL-DE-SAC (CURB)	0.75%	0.75%	0.75%	0.75%	0.75%
RADII THROUGH ROADS AT INTERSECTIONS (MAXIMUM)	3.00%	3.00%	3.00%	3.00%	2.00%

NOTES:
1. THIS STANDARD TO BE USED IN CONJUNCTION WITH THE TOWN OF CALEDON ROAD STANDARDS.
2. CHANGES IN VERTICAL ALIGNMENT SHALL NOT EXCEED 1.5% WITHOUT A VERTICAL CURVE.
3. ON CUL-DE-SACS AND ELBOWS, THE CURB LINES ARE TO MAINTAIN A MINIMUM GRADE OF 0.75%.
4. STOPPING SITE DISTANCE AT INTERSECTIONS SHALL CONFORM TO THE ABOVE MINIMUM REQUIRMENTS.

NO.	REVISION	APR'D	DATE
1	ADT Design Minimums		12/01

TOWN OF CALEDON

GEOMETRIC DESIGN STANDARDS FOR ROADS

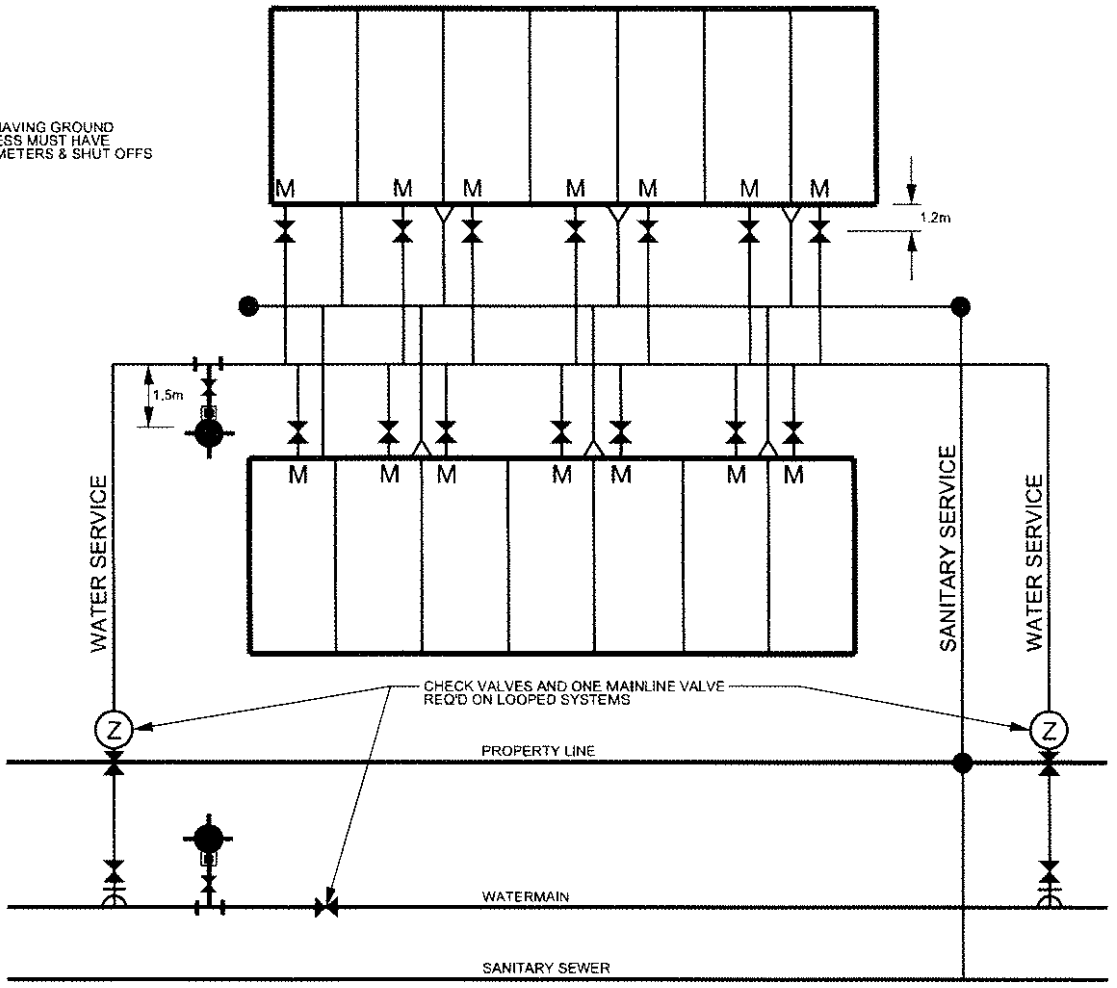
APR'D: | DATE: DATE

DRAWN: DRAWN | SCALE: N.T.S.

STANDARD No. 110

NOTE:

EACH UNIT HAVING GROUND FLOOR ACCESS MUST HAVE INDIVIDUAL METERS & SHUT OFFS



LEGEND

- VALVE & BOX
- (D) DETECTOR CHECK VALVE IN CHAMBER
- (Z) CHECK VALVE IN CHAMBER
- TAPPING SLEEVE & VALVE & BOX
- TEE
- FIRE HYDRANT C/W VALVE & BOX
- DIRECTION OF PUMPER NOZZLE
- (M) METER IN CHAMBER
- M METER
- NON SAMPLING SANITARY MAINTENANCE HOLE

Region of Peel
Working for you

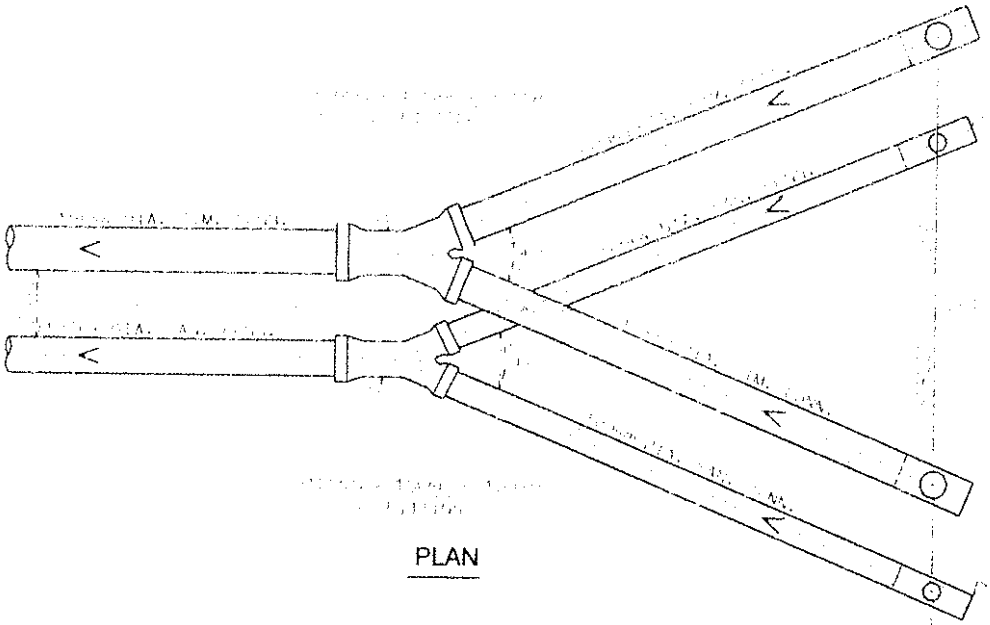
PUBLIC WORKS
STANDARD DRAWING

REV. DATE: NOVEMBER 2011

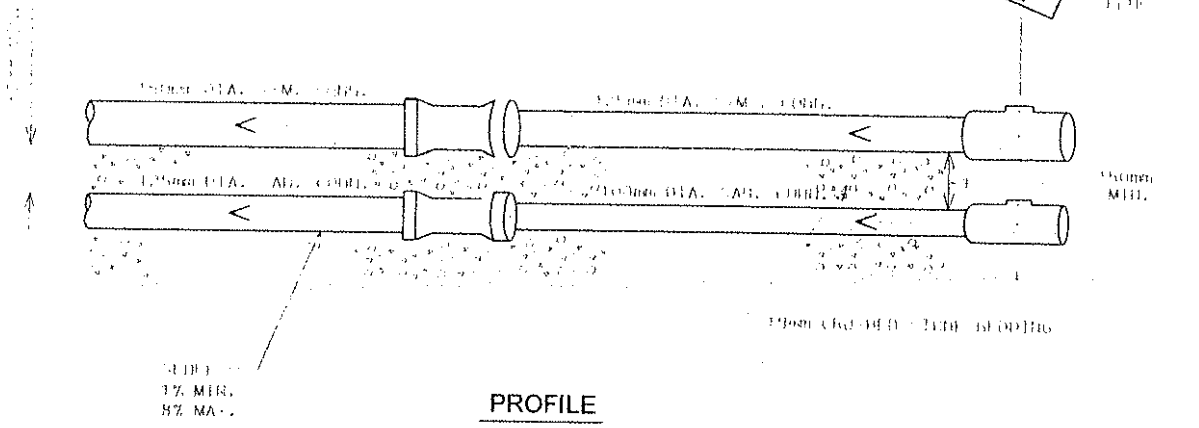
APPROVED BY	DRAWN BY
A.P.	AINLEY GROUP

SERVICING FOR TOWNHOUSE COMPLEX

STD. DWG. NUMBER	SCALE
1-8-2	N.T.S.



PLAN



PROFILE

NOTE

1. MINIMUM TRENCH WIDTH TO BE 900mm.
2. 19mm CRUSHED STONE BEDDING TO BE USED FROM BASE OF EXCAVATION TO SPRING LINE OF UPPER PIPE FROM MAINLINE TO TEST FITTING.
3. 125mm DIA. TEST FITTING TO BE MARKED "SAN".
4. SANITARY CONNECTION PIPE TO BE ANY COLOUR EXCEPT WHITE
5. STORM CONNECTION TO BE ON THE LEFT WHEN FACING THE HOUSE.
6. SANITARY CONNECTION MUST BE SECURELY PLUGGED AT PROPERTY LINE WITH AN APPROVED PLUG.
7. SINGLE SANITARY SERVICE CONNECTIONS SHALL BE 125mm.

Region of Peel
Working for you

PUBLIC WORKS
STANDARD DRAWING

REV. DATE: FEBRUARY 2007

DOUBLE SERVICE CONNECTIONS IN COMMON TRENCH

APPROVED BY	DRAWN BY
D.L.	I.F.
STD. DWG. NUMBER	SCALE
2-4-3	N.T.S.

Appendix B
Hydrogeological Report

Excerpt of Terraprobe Hydrogeological Evaluation Report

Site Picture

Terraprobe

LOG OF BOREHOLE 7

PROJECT: Proposed Residential Subdivision
DATE: 22 January 2001
LOCATION: Caledon East, Ontario
EQUIPMENT: Trackmount 6M2
CLIENT: Valley Grove Investments
ELEVATION DATUM: Geodetic
FILE: 01109

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
298.2	Ground Surface				
0.0 / 298.0	150mm Topsoil				
0.2	Loose wet Brown/Dark Brown **FILL** - Sand trace to some silt, trace clay and organics (DISTURBED NATIVE)		1	SS	6
297.3 / 0.9	Compact wet Brown **SAND** trace silt (Fine to Medium)		2	SS	23
			3	SS	17
295.9 / 2.3	Dense to Very Dense Brown/Grey moist **SILTY SAND** some gravel and clay (TILL)		4	SS	50/8cm
			5	SS	43
			6	SS	50/10cm
293.4 / 4.8	End of Borehole				

ELEVATION SCALE: 298, 297, 296, 295, 294

PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● POCKET PEN. × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30

ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS: ▽

NOTES:
Borehole was caving at 1.4m and water level at 0.5m depth on completion of drilling.

Terraprobe

LOG OF BOREHOLE 8

PROJECT: Proposed Residential Subdivision
LOCATION: Caledon East, Ontario
CLIENT: Valley Grove Investments

DATE: 22 January 2001
EQUIPMENT: Trackmount 6M2
ELEVATION DATUM: Geodetic
FILE: 01109

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
309.0	Ground Surface				
0.0	**350mm Topsoil**		1	SS	4
308.6					
0.4	Loose moist Brown/Dark Brown **FILL -** Sand trace to some silt, trace clay and organics (DISTURBED NATIVE)		2	SS	4
307.5					
1.5	Compact to Dense Brown moist **SILT** trace to some clay & sand **TO** **SANDY SILT** trace to some clay		3	SS	15
			4	SS	26
			5	SS	40
	-- grey, locally very dense		6	SS	89
304.0					
5.0	End of Borehole				

ELEVATION SCALE: 309, 308, 307, 306, 305, 304

PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● POCKET PEN × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS

NOTES:
Borehole was open and dry on completion of drilling. Standpipe dry on January 29, 2001.

Terraprobe

LOG OF BOREHOLE 9

PROJECT: Proposed Residential Subdivision
DATE: 22 January 2001
LOCATION: Caledon East, Ontario
EQUIPMENT: Trackmount 6M2
CLIENT: Valley Grove Investments
ELEVATION DATUM: Geodetic
FILE: 01109

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES
304.8	Ground Surface				
0.0 / 304.4	350mm Topsoil		1	SS	5
0.4 / 304.0	FILL - Sandy Silt to Silty Sand, trace clay & organics (DISTURBED NATIVE)		2	SS	40
0.8 / 303.3	Dense Brown very moist SAND trace silt (Medium to Coarse)		3	SS	43
1.5	Dense to Very Dense Brown/Grey moist		4	SS	73
	SILTY SAND some gravel and clay		5	SS	78
	(TILL)		6	SS	50/13cm
300.1					
4.7	End of Borehole				

ELEVATION SCALE: 304, 303, 302, 301

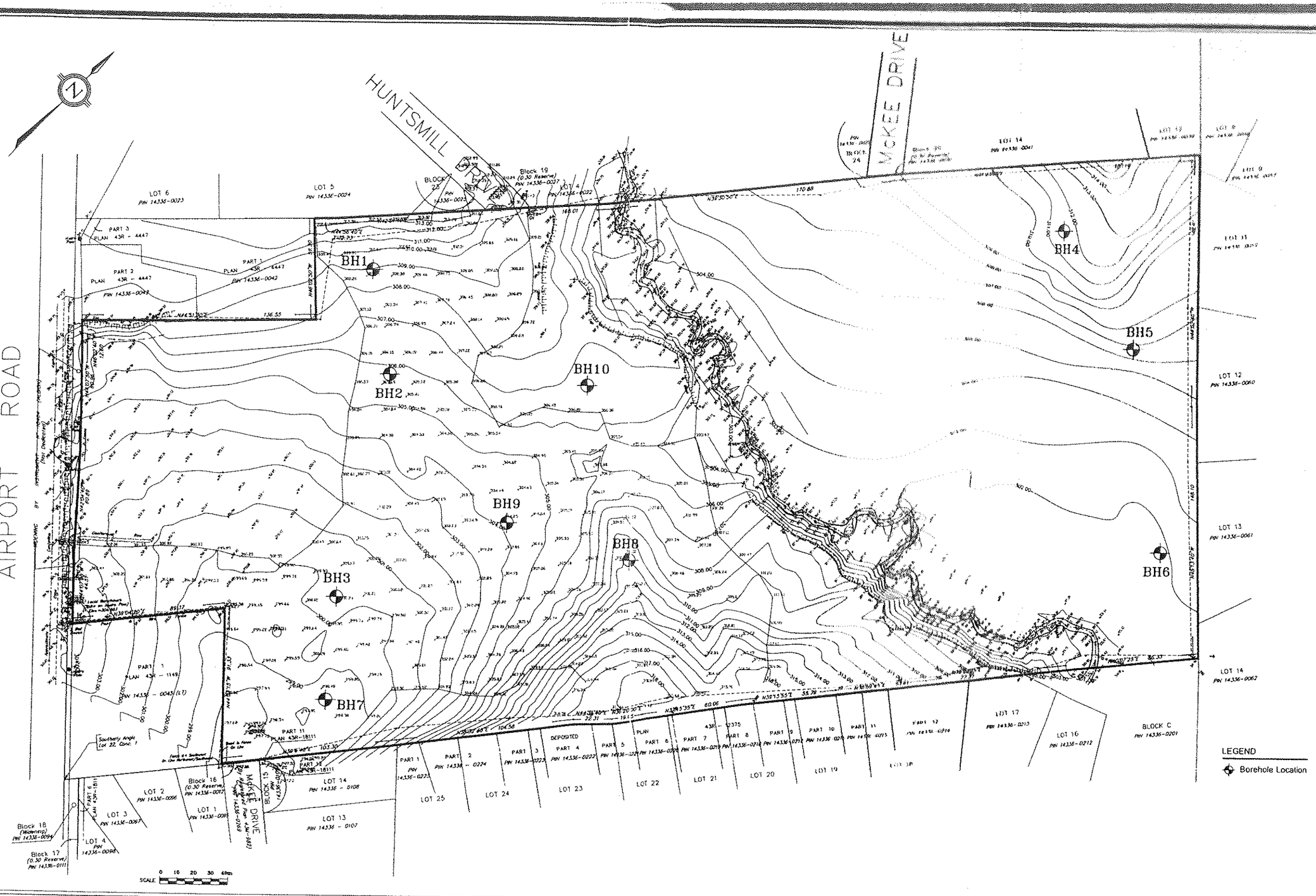
PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● POCKET PEN × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS

NOTES:
Borehole was open and dry on completion of drilling.



BOREHOLE LOCATION PLAN

TERRAPROBE

File No. 1-05-0178

FIGURE 5


05.09.2014