Proposed Townhouse Development and Single Estate Lot
2031818 Ontario Ltd. • Town of Caledon

Functional Servicing and Stormwater Management Report

October 2013

MASONGSONG ASSOCIATES ENGINEERING LIMITED
Consulting Engineers • Planners • Project Managers

MAEL Project 03-141

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

PROPOSED TOWNHOUSE DEVELOPMENT AND SINGLE ESTATE LOT

FOR

2031818 Ontario Ltd.

TOWN OF CALEDON

October 2013

Prepared by:

MASONGSONG ASSOCIATES ENGINEERING LIMITED
7800 Kennedy Road, Suite #201
Markham, Ontario • L3R 2C7
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Project No: MAE 2003-141

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.

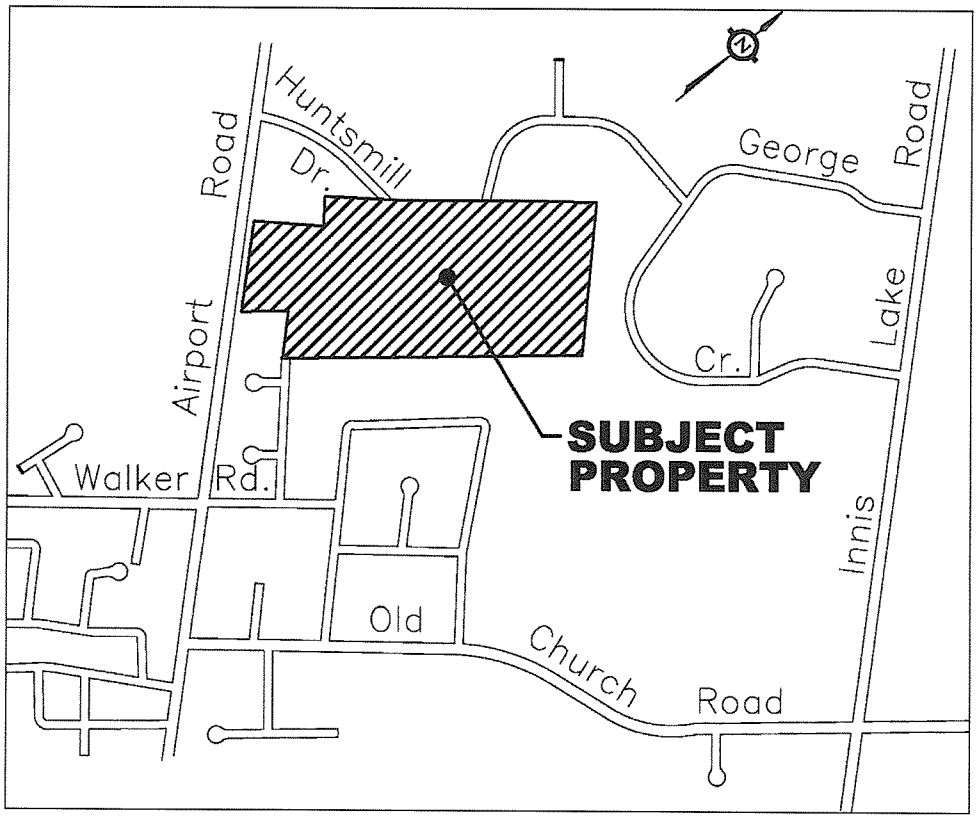
The purpose of this report is to identify the requirements for servicing and stormwater management, and to demonstrate how this site will function within the framework of existing infrastructure.

Preliminary engineering plans are enclosed in the rear Figures Appendix 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 Boise 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 Provincially Significant Wetlands (PSWs) throughout 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 cluster-townhouse 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 25 condominium townhouse units on a net developable area of approximately 2.5 ha (6.2 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, privately serviced (septic, well 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 Boise Creek watercourse, and another portion of approximately 7.77 ha drains in a north to south direction to a

wetland feature 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 townhouse development reaching the maximum municipal gradients of 5% - 6%.

The latter drainage area of 7.77 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.

1.2 Existing Infrastructure

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

For the proposed **townhouse site west of Boise 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 7.77 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 7.77 ha of tributary area to the McKee storm system is 378.11 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 a condominium-type tenure, all internal roads will nonetheless be designed to generally meet the Town of Caledon standard No. 101 Geometric Design Standards for Roads. Based on the relatively steep existing site topography, it is anticipated that townhouse building block grading will fall within the front, split draining and 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 Plan (Drawing CS1):

- Based on the boundary grading constraints preliminary road profiles developed for the proposed plan indicates road grades approaching 5%.
- At the end of the proposed roadway east of Building 4, a retaining wall will be required to tie into existing ground elevations at the top of the hill side.
- Building 6, near the end of the road, will require a 3:1 slope to match 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 Boise Creek, grading will be in accordance with Town of Caledon section 3.12 Residential Lot Drainage and Sodding criteria. As the site will be a 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 townhouse site. A physical connection can be made with a 300x150 reducer at the property limit, complete with a bulk meter chamber in accordance with Region of Peel standards. 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.

There will be six 6 fire hydrants provided within the proposed site to meet the Region's specified spacing design requirement for fire protection.

The single estate lot east of Boise Creek will have a private water well installed. It is not intended to extend the municipal water main system under the creek to service a single lot.

For existing and proposed waterman infrastructure layout see Site Servicing Drawings SS-1 and SS-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 townhouses, and the units will be provided with Double 'Y' Sanitary and Storm Service Connections in Common Trench in accordance with Region of Peel Standard 2-4-3.

Based on the development area of 2.5 ha and 25 townhouse units, the site sewage generation flow rate is calculated to be 14.1 L/s including infiltration. The receiving existing sanitary sewer readily has the available capacity to accommodate the proposed flows.

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

3.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

3.1 Development Constraints

The townhouse development is adjacent to the Centreville PSW. 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 a storm sewer bypass 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.

Excluding the pre-development (existing) PSW 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 7.77 ha from the subject lands at the 2 year storm event rate. As a result of the protected features (Woodlot and Wetland) and the much reduced developable area, the proposed development drainage area to McKee Drive has been significantly reduced to 2.5 ha. The new site area would therefore meet discharge requirements as it is approximately one-third of the original subdivision design tributary area.

This significant reduction in drainage area provides an opportunity for the townhouse site to release allowable flow at a greater than 2-year release rate, yet remain under the original allowable design flow of the receiving storm system. Based on a review of the various storm intensities, it is proposed to control all storm events up to and including the 100 year event to the 5 year release rate. The effect of utilizing the available capacity of the existing system would again result in a lesser stormwater management footprint impact on the site.

3.2 Stormwater Management

Stormwater management criteria can be summarized as controlling the all storm runoff up to and including the 100 year storm event to the 5 year release rate. Storm runoff in excess of the 5 year release rate must detained onsite. In consideration of the BMP selection criteria, an appropriate form of stormwater facility would be a **Wet Pond**. A wet pond is a highly compatible form of stormwater *quality treatment* facility. A Wet Pond is also excellent for providing quantity and erosion control attenuation.

Preliminary pond modeling and sizing has been carried forward on the basis of providing erosion, quality and quantity control up to the 100-year storm event.

3.3.1 Preliminary Hydrologic Modelling

The pond block sizing requirement for various rain events was modeled using Visual OTTHYMO 2.3 for both pre- and post-development conditions, with the hydrologic input taken from the City's criteria. A VO2 schematic and preliminary model output for both pre and post-development scenarios are included in the Appendix B. A summary of the modeling results are presented below.

The pre-development level peak for each storm event (25mm, 5 year and 100 year) received at the stormwater pond block are summarized in the following Table 3.1.

Table 3.1 Pre-Development Runoff

		4hr Chicago	3hr Chicago		3hr SCS	
		25mm	5 Year	100 Year	5 Year	100 Year
Peak Flow	m3/s	0.019	0.103	0.284	0.103	0.459
Runoff Volume	mm	5.018	17.336	46.721	16.215	76.987

Note: Shaded cell denotes 5 year pre-development flow rate for pond site area to be 103 L/s. The Pond orifice design in the post development scenario will be set to discharge at this release rate for the 100 year event.

In the post development scenario, the tributary area to the pond is the same area (2.66 ha), but with the increase in imperviousness, will require quantity attenuation to meet the pre-development levels. The post-development flows are similarly modeled and summarized in the following Table 3.2.

Table 3.2 Post-Development Runoff

		4hr Chicago	3hr Chicago		3hr SCS	
		25mm	5 Year	100 Year	5 Year	100 Year
Peak Flow	m3/s	0.125	0.471	1.028	0.623	1.374
Runoff Volume	mm	13.26	32.21	69.14	30.64	103.58

As a result of the post-development increase in flows, preliminary volumetric sizing for the post- to pre-development attenuation results in a peak volume of approximately 707 m^3. (See Summary of Flows Sheet in Appendix B for Volume Quantity)

3.3.2 Preliminary Pond Geometry

A Pond Design parameter sheet is attached to this report, indicating forebay design

details and the MOE Water Quality Storage requirements. The following is a summary of the preliminary wet pond geometry design which confirms the adequacy of the available pond block area. Detailed pond design will be carried out during detailed design.

Wet Pond Forebay	Forebay Length	62 m	
	Forebay Width	3 m	
	Maximum depth	0.8 m	
	Forebay Volume	50 m^3	
	Forebay Area	232 m^2	
Pond Volumes	Permanent Pool	266 m^3	
	Extended Detention	219 m^3	
	100-yr Attenuation	707 m^3	
	Max. Fluctuation	0.91 m	(for storms up to 100 yr)
	Required Footprint	0.11 ha	

The provided Stormwater Management Pond area is approximately 0.16 ha, which will sufficiently accommodate a wet pond facility and appurtenant operational features such as a forebay cleanout reserve area, and embankment sloping as required to match into existing grades. These design features, including a detailed emergent planting plan, will be incorporated in the detailed design stage.

3.3 Water Balance

The first flush runoff retention storage is calculated as follows.

Storage required = Total Work Area x 5mm
= 24,957 sq.m. x (5mm x (1m/1000mm))
= 124.8 m^3

Based on the above storage calculation a suitable configuration of infiltration trenches located at each rearlot catchbasin will provide 125.2 m^3 of storage. Complete ***retention*** of the frequent storm event is possible as the proposed sub drain outlet is set above the 5mm base storage. Details of the storage function and alignment will be determined at the detailed Site Plan stage in conjunction with the servicing and building design. However, it is determined functionally that there is sufficient area and grading accommodations around the perimeter of the site to incorporate infiltration trenches in the final design.

3.4 Stormwater Management Residential Estate Lot

The proposed single estate residential lot on the east side of Boise 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. 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. RECOMMENDATIONS AND CONCLUSIONS

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

It has been demonstrated that the proposed condominium townhouse 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 subdivision is approximately 14.1 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.

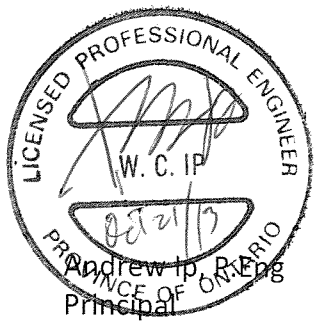
Stormwater An end-of-pipe stormwater management wet pond is proposed as an efficient facility for stormwater quality and quantity control, meeting MOE Enhanced (Level 1) standards. Preliminary modeling and sizing confirms that the designated Pond area is adequate to accommodate a wet pond facility. Detailed pond design, including detailed pond landscaping, will be undertaken with the detailed engineering design. The proposed pond discharge will be connected to the existing storm sewer system within McKee Drive, which has been designed to accommodate the subject site.

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

Steve Omar Gonzalez, C.E.T.
Senior Design Technologist



Andrew Ip, P.Eng
Principal

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Appendix A

Figures

1986 Draft Plan of Subdivision

McKee Drive Plan and Profile

300mm Feedermain Plan and Profile

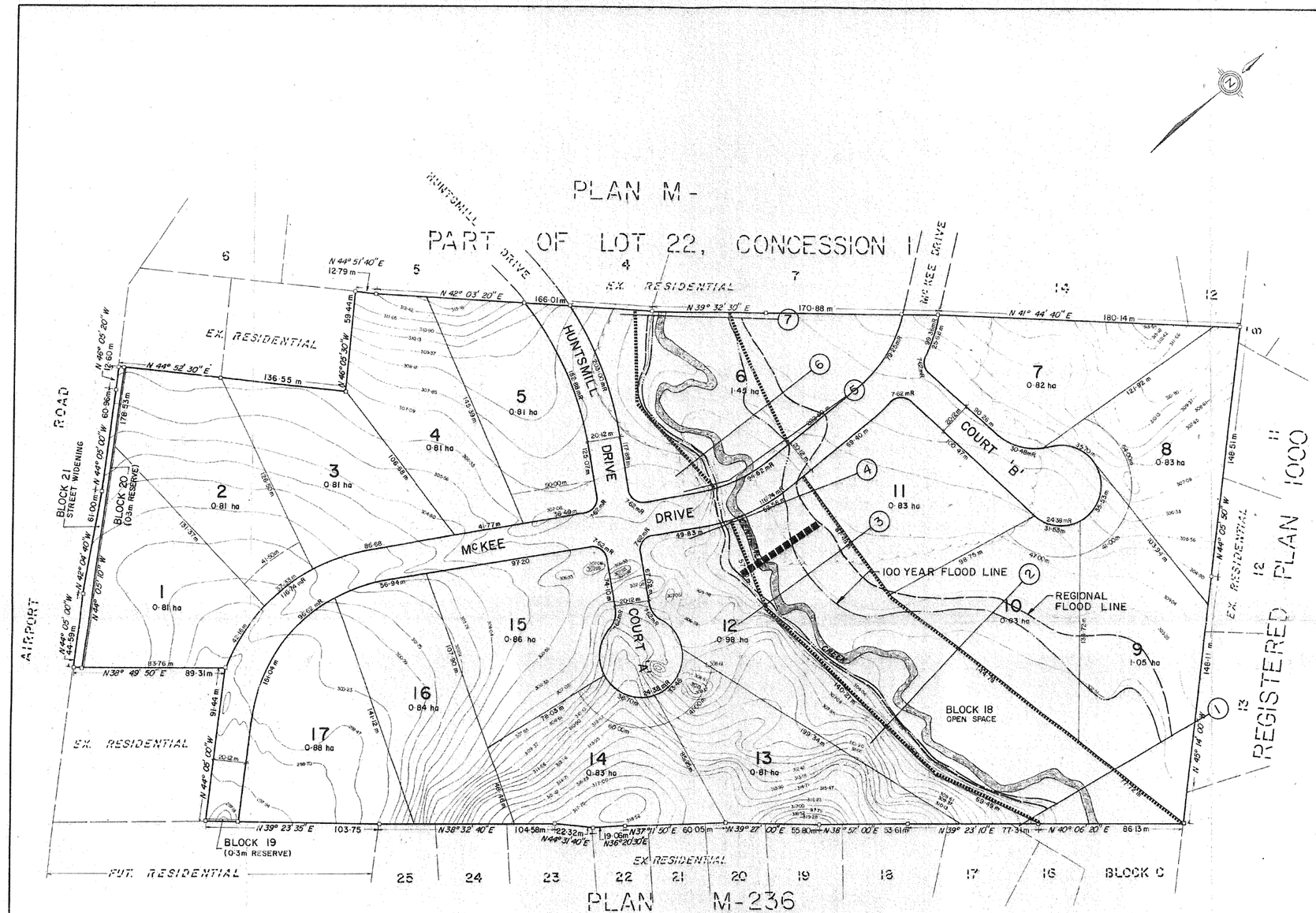
Site Servicing S-1 & S-2

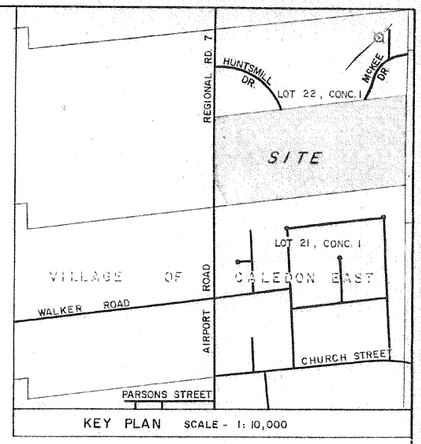
Grading Plan and Cross Sections

Drainage, Pre and Post Development Plans

Sanitary and Storm Design Sheets

Town of Caledon Std. 101 and Region of Peel Std. 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

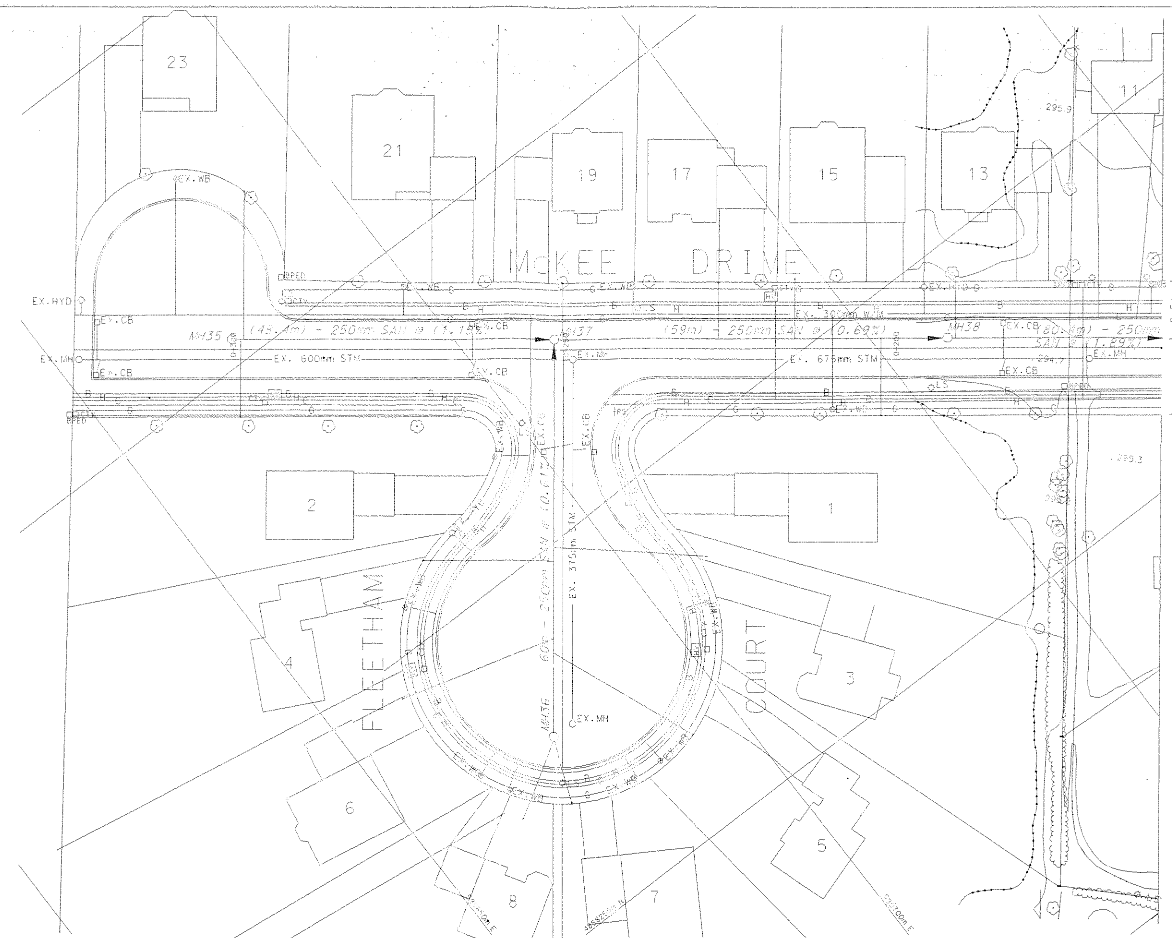
LEGEND

SNOW FENCE / STRAW BALES
EROSION CONTROL WORKS
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

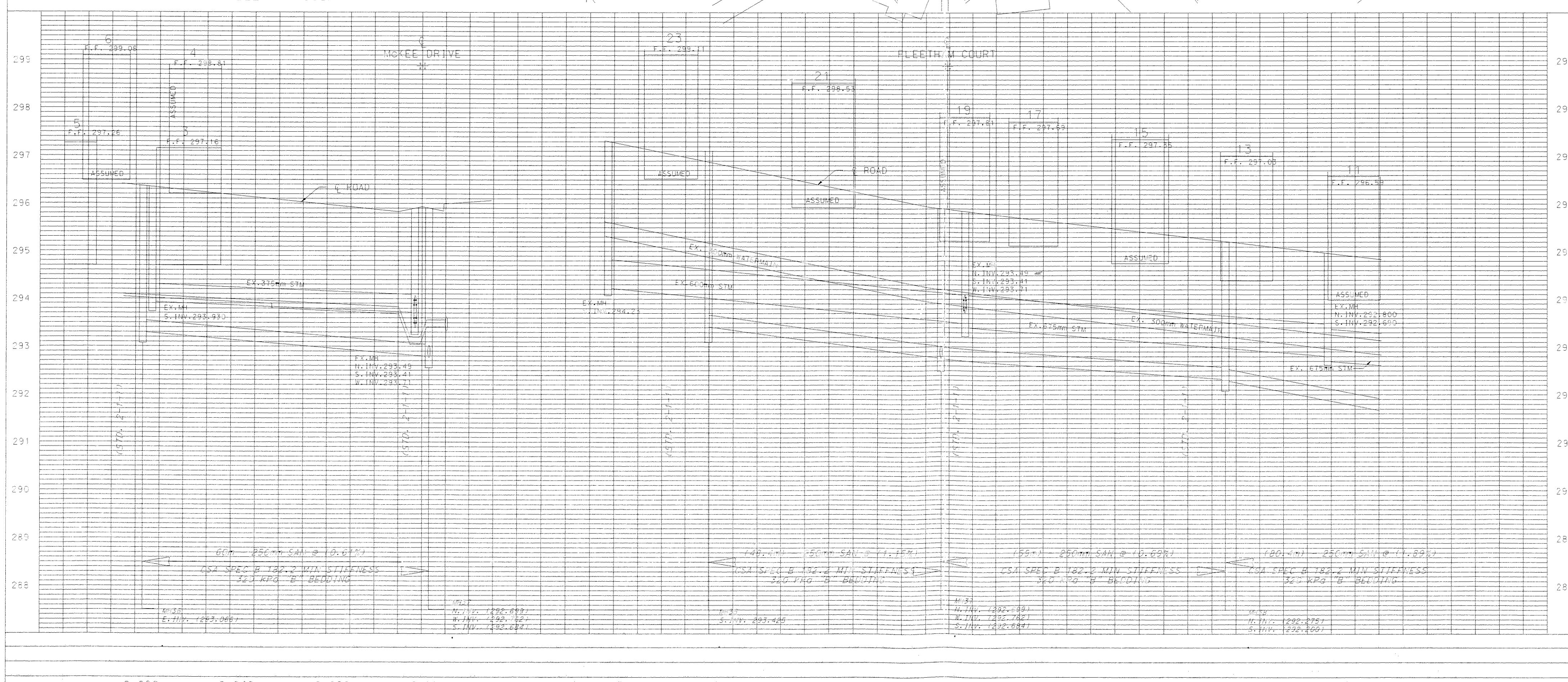


NOTE:

1. SAN. CONNECTION FOR No. 1, 2, 3 AND 5 FLEETHAM COURT WAS INSTALLED UNDER EXISTING STORM.

2. SAN. CONNECTION FOR No. 13, 15, 17, 19, 21 AND 23 WAS INSTALLED MIN. 1.3m FROM OBVERT TO BASEMENT.

PROFILE FOR FLEETHAM COURT

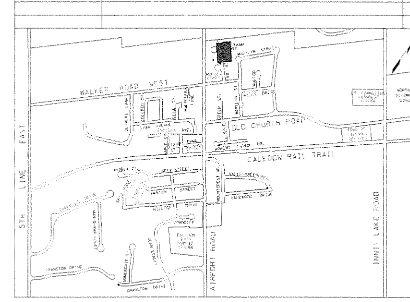


SERVICE DATA

SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			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

- All Driveways ASPHALT Unless Otherwise Noted.
- All Service Locations Are Approximate And Must Be Located Accurately In The Field
- Denotes Building - Not Located
- Denotes Building Located
- Type 'B' Bedding 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
Brampton • Kitchener • Cobalt

Approved by

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

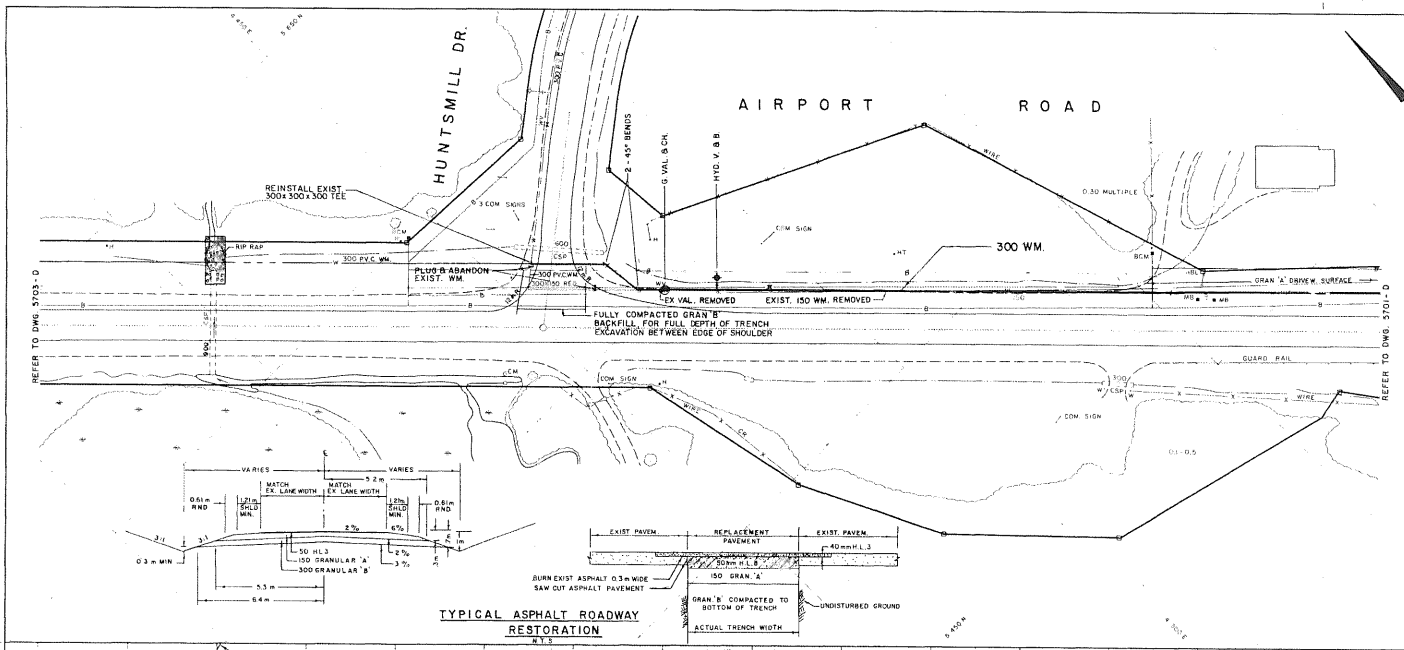
CALEDON EAST SANITARY SERVICING

McKEE DR./FLEETHAM CT.
SANITARY SEWERS

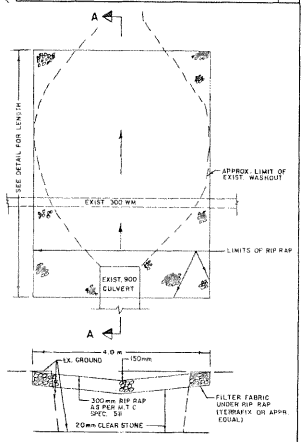
STA. 0+160 TO STA. 0+350

Lots:	File Ref: 1707.03-A-121	Project No. 94-2135
Scale: Hor. 1:500 Ver. 1:50	Drawn by G.D.	Checked by M.T.
Date: 17 JUNE 94	Sheet: 94 OF 231	Plan No. 22730-D

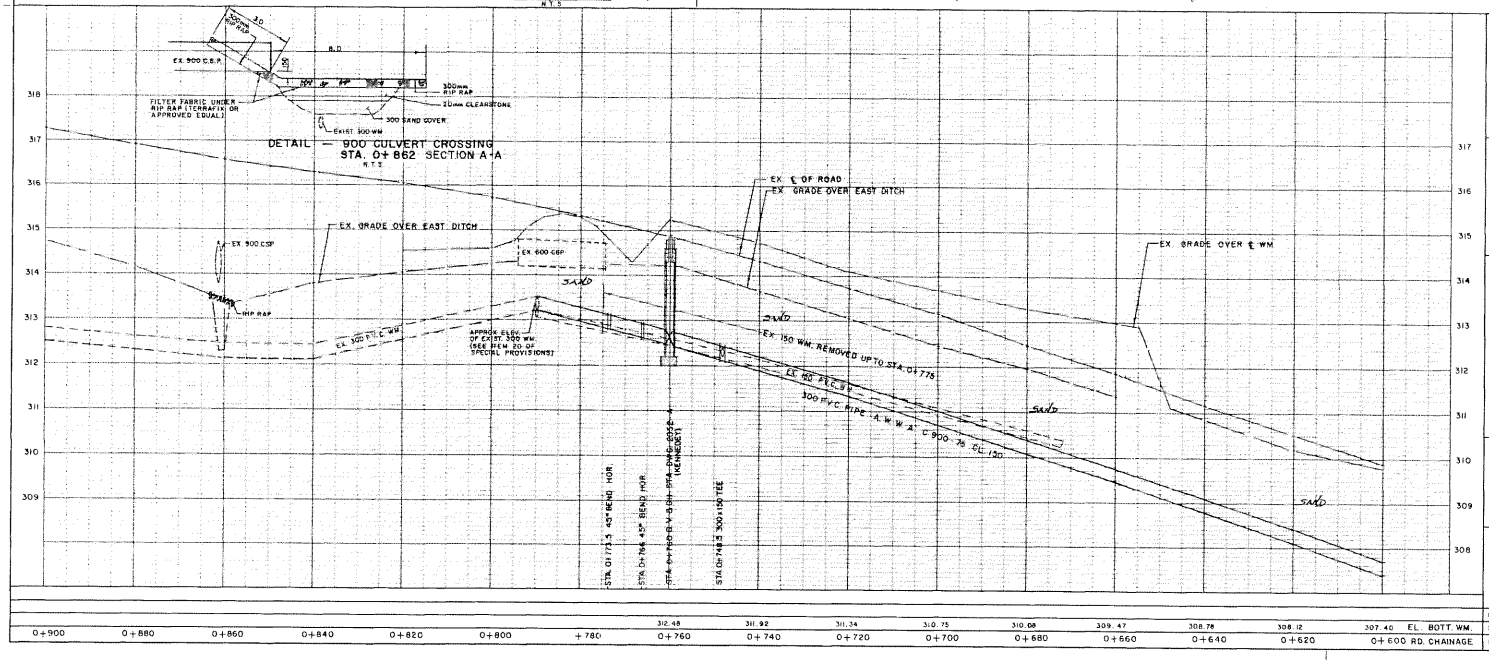
22730-D (94)



TYPICAL ASPHALT ROADWAY RESTORATION
N.T.S.



DETAIL — 900 CULVERT CROSSING
STA. 0+862
N.T.S.



DETAIL — 900 CULVERT CROSSING
STA. 0+862 SECTION A-A
N.T.S.

0+900	0+880	0+860	0+840	0+820	0+800	+780	312.48 0+760	311.92 0+740	311.34 0+720	310.75 0+700	310.08 0+680	309.47 0+660	308.78 0+640	308.12 0+620	307.40 EL. BOTT. WM. 0+600 RD. CHAINAGE

SERVICE DATA					
SERVICE	DATE	INIT.	SERVICE	DATE	INIT.
SAN SEWERS			GAS MAINS		
STORM SEWERS			BELL U/G CABLE		
WATERMAINS			HYDRO U/G CABLE		

REVISIONS		
DATE	DETAILS	INIT
19.12.1983	AS CONSTRUCTED	I.F.

General Notes

- All Driveways Gravel 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 (S.B.N.)

B.M. No. Elev.

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

Designed By — Drawn By — Checked By — Approved By

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.
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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

Lots	Area C - 48		Project No. 83-1530
Scale Hor. 1:500 Ver. 1:50	Drawn by I. FRANKE	Checked by	
Date JUNE 83	Sheet 3 of 7		Plan No. 5702 - D

5702 - D

E S I D E N T I A L

LOT 15

BLOCK 24

MICKEE DRIVE
(BY REGISTERED PLAN 43M-427)

EX. 150ø WM

LOT 14

EXISTING RESIDENTIAL

LOT 12

LOT 9

N39°30'50"E 170.88

BLOCK 20
(0.30 RESERVE)

N41°47'00"E 190.14

6.0m WIDE GRAVEL DRIVEWAY

WATER WELL

DEVELOPMENT LIMIT

PROP. SEPTIC BED

SOAK AWAY PIT

SOAK AWAY PIT

LOT 11

EXISTING RESIDENTIAL

BOYCE'S CREEK

304 305 306 307 308 309 310 311 312 313 314

Project:

PROPOSED TOWNHOUSE DEVELOPMENT
& SINGLE ESTATE LOT

Dwg.Title:

PROPOSED SERVICING PLAN

MASONGSONG ASSOCIATES
ENGINEERING LIMITED
Consulting Engineers • Planners • Project Managers
7800 Kennedy Road • Suite 201 • Markham, Ontario • L3R 2C7
Tel:(905) 944-0162 • Fax:(905) 944-0165 • E-mail: maeng@maeng.ca

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

AIRPORT ROAD
WIDENING BY INSTRUMENT N° 18464 (ALBION)
(NOT DEDICATED)
MANHOLE
CONIFEROUS ROW
EDGE OF ASPHALT
CENTERLINE OF ASPHALT
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
DEVELOPMENT LIMIT
DEVELOPMENT LIMIT
INFILTRATION TRENCH
BUILDING 1
BUILDING 2
BUILDING 3
BUILDING 4
BUILDING 5
BUILDING 6
DEVELOPMENT LIMIT
BOYCE'S CREEK
INFILTRATION TRENCH
PSW
MNR
BLOCK 18
(0.30 WIDENING)
PART 11
PLAN 43R-18111
PART 12
PLAN 43R-18111
DEVELOPMENT LIMIT
BLOCK 18
(WIDENING)
LOT 2
LOT 3
LOT 1
LOT 4
MCKEE DRIVE
EX. MH
EX. 600ø STM
EX. 48.4m-250ø
SAN @ 1.15%
MH 35
EX. 300ø WM
BLOCK 15
LOT 14
LOT 13
PART 1
PART 2
PART 3
PART 4
PART 5
PART 6
PART 7
PART 8
EXISTING RESIDENTIAL

Project:
PROPOSED TOWNHOUSE DEVELOPMENT
& SINGLE ESTATE LOT

Dwg.Title:
PROPOSED SERVICING PLAN

MASONGSONG ASSOCIATES
ENGINEERING LIMITED
Consulting Engineers • Planners • Project Managers
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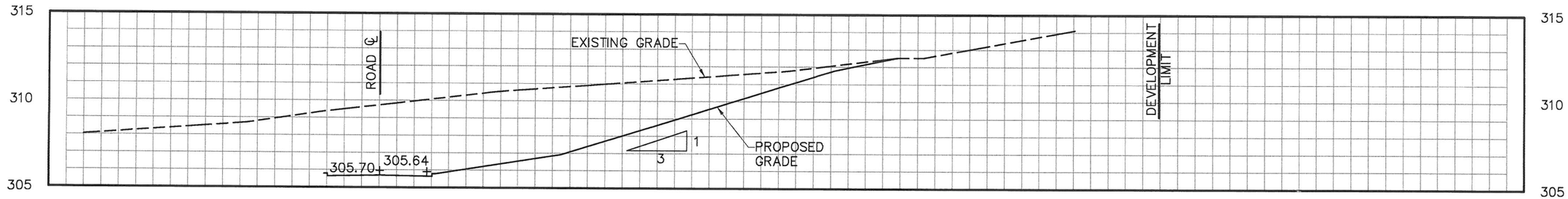
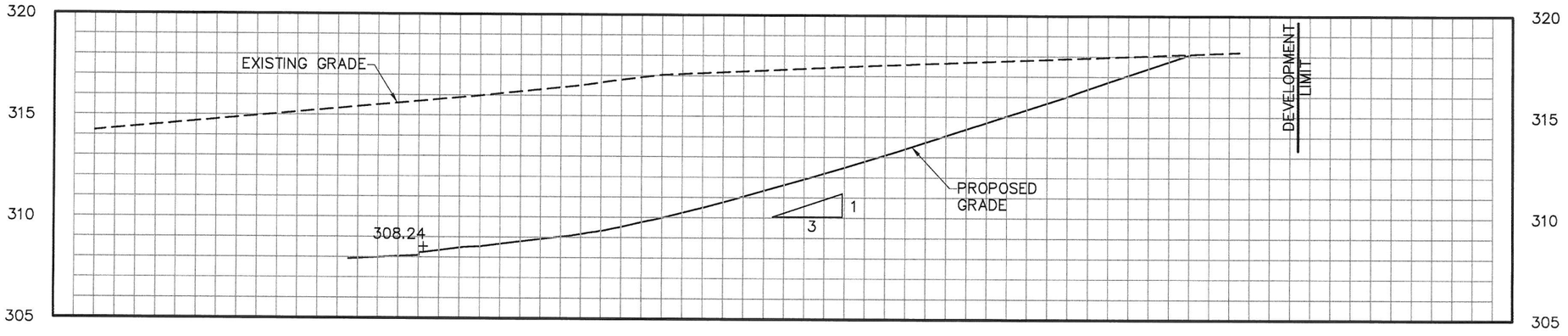
Scale:	Date:
1:1000	APRIL 2013
Project Number	Drawing No.
03-141	S-2

AIRPORT ROAD
WIDENING BY INSTRUMENT N° 18464 (ALBION)
(NOT DEDICATED)
MANHOLE
CONIFEROUS ROW
EDGE OF ASPHALT
CENTRELINE OF ASPHALT
LOCAL BENCHMARK
(SPIKE ON HYDRO POLE)
ELEV.=304.883
EX HYDRO POLE
2 BELL BOXES
EX HYDRO POLE
PART 1
PLAN 43R – 1149
BOYCE'S CREEK
DEVELOPMENT LIMIT
CUT OFF SWALE
BUILDING 1
BUILDING 2
BUILDING 3
BUILDING 4
BUILDING 5
BUILDING 6
TOE WALL
3:1 TO MATCH EXISTING GROUND SURFACE
EXISTING RESIDENTIAL
BLOCK 16 (0.3m RESERVE)
PART 11 PLAN 43R–18111
PART 12 PLAN 43R–18111
BLOCK 15
BLOCK 18 (WIDENING)
MCKEE DRIVE
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

Project: PROPOSED TOWNHOUSE DEVELOPMENT & SINGLE ESTATE LOT	Dwg.Title: PROPOSED GRADING PLAN	MASONGSONG ASSOCIATES ENGINEERING LIMITED Consulting Engineers • Planners • Project Managers 7800 Kennedy Road • Suite 201 • Markham, Ontario • L3R 2C7 Tel:(905) 944-0162 • Fax:(905) 944-0165 • E-mail: maeng@maeng.ca	Scale: 1:1000 Project Number 03-141	Date: APRIL 2013 Drawing No. GR1



SECTION 1–1
SCALE 1:250



SECTION 2–2
SCALE 1:250

Project:

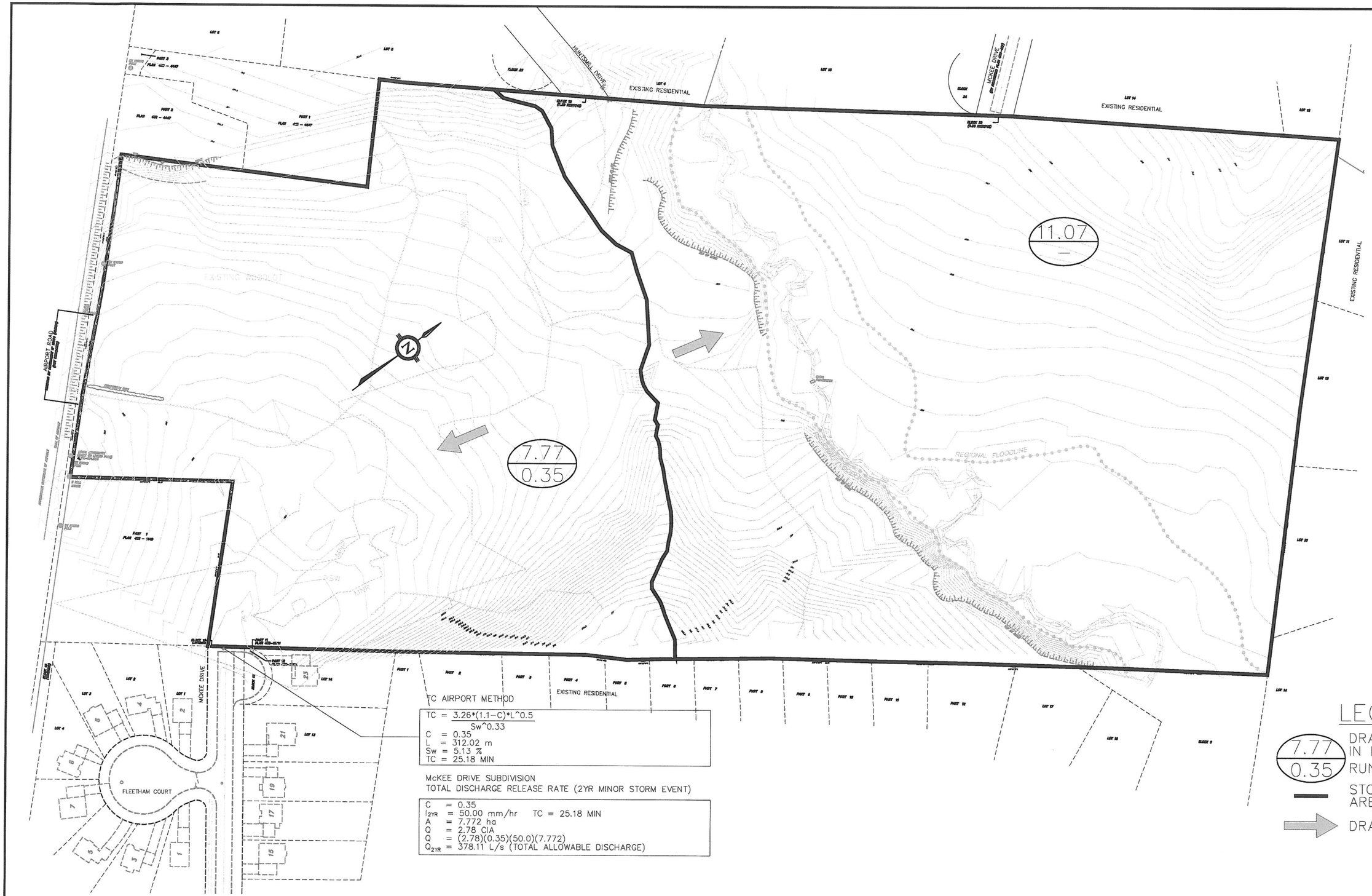
PROPOSED TOWNHOUSE DEVELOPMENT & SINGLE ESTATE LOT

Dwg.Title:

CROSS SECTIONS

MASONGSONG ASSOCIATES ENGINEERING LIMITED
Consulting Engineers • Planners • Project Managers
7800 Kennedy Road • Suite 201 • Markham, Ontario • L3R 2C7
Tel:(905) 944-0162 • Fax:(905) 944-0165 • E-mail: maeng@maeng.ca

Scale:	Date:
1:250	APRIL 2013
Project Number	Drawing No.
03-141	CS1



TC AIRPORT METHOD

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

C = 0.35
L = 312.02 m
Sw = 5.13 %
TC = 25.18 MIN

McKEE DRIVE SUBDIVISION
TOTAL DISCHARGE RELEASE RATE (2YR MINOR STORM EVENT)

C = 0.35
I_{2YR} = 50.00 mm/hr TC = 25.18 MIN
A = 7.772 ha
Q = 2.78 CIA
Q = (2.78)(0.35)(50.0)(7.772)
Q_{2YR} = 378.11 L/s (TOTAL ALLOWABLE DISCHARGE)

LEGEND:

7.77 / 0.35 — DRAINAGE AREA IN HECTARES / RUN OFF COEFFICIENT

STORM DRAINAGE AREA BOUNDARY

DRAINAGE DIRECTION

Project:

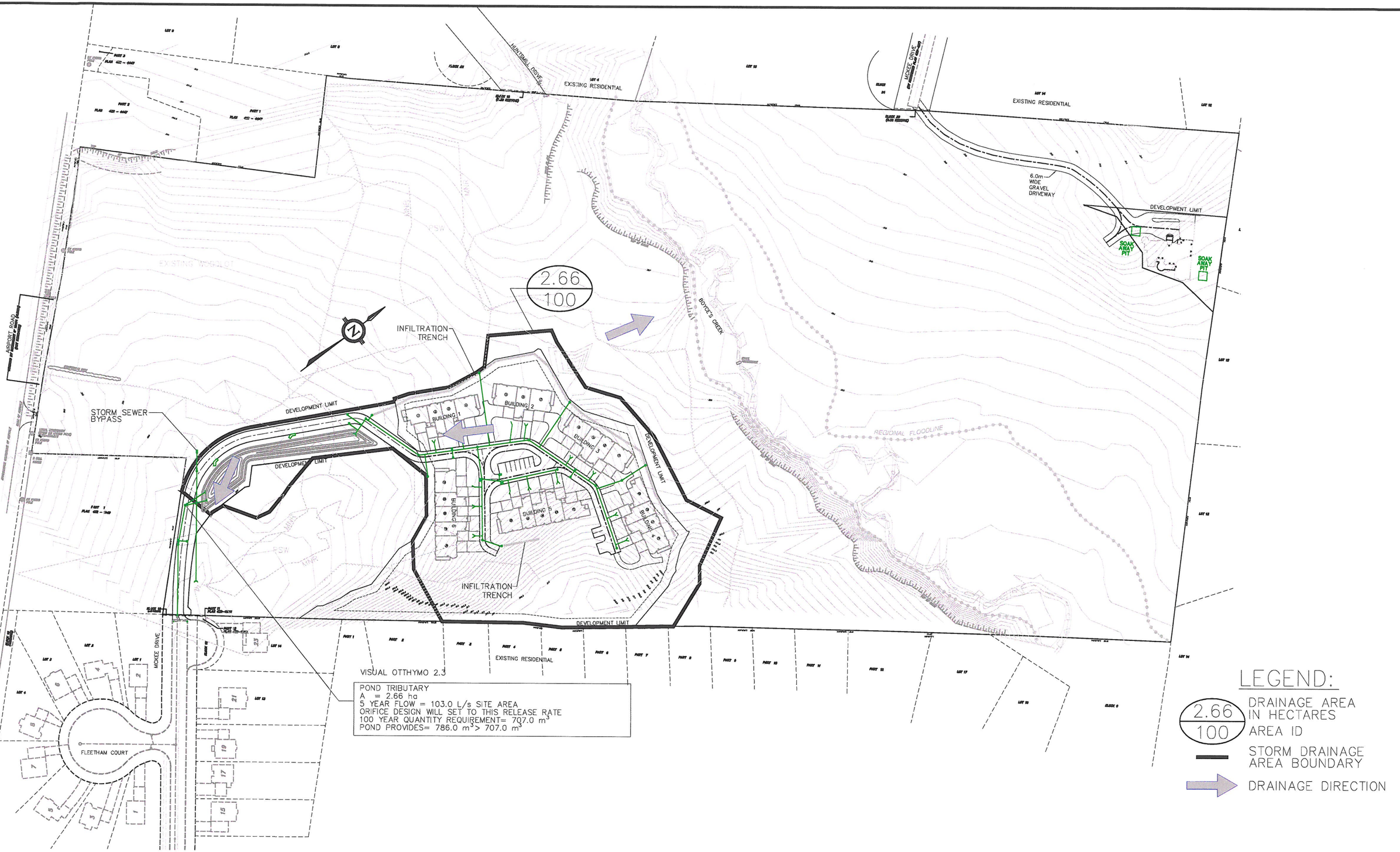
PROPOSED TOWNHOUSE DEVELOPMENT & SINGLE ESTATE LOT

Dwg.Title:

DRAINAGE PLAN

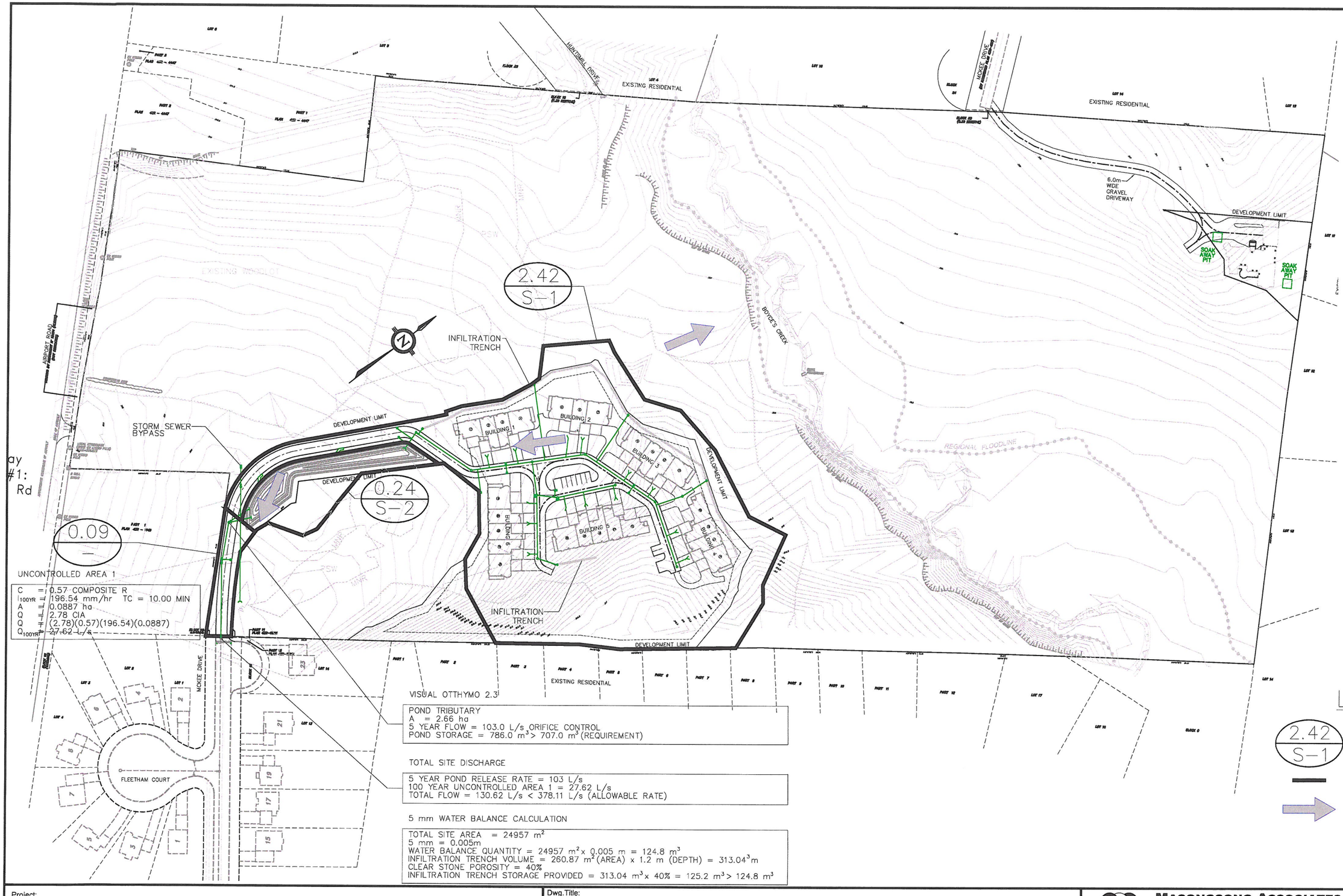
MASONGSONG ASSOCIATES ENGINEERING LIMITED
Consulting Engineers • Planners • Project Managers
7800 Kennedy Road • Suite 201 • Markham, Ontario • L3R 2C7
Tel:(905) 944-0162 • Fax:(905) 944-0165 • E-mail: maeng@maeng.ca

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



ay
#1:
Rd

Project: PROPOSED TOWNHOUSE DEVELOPMENT & SINGLE ESTATE LOT	Dwg.Title: PROPOSED PRE-DEVELOPMENT PLAN	MASONGSONG ASSOCIATES ENGINEERING LIMITED Consulting Engineers • Planners • Project Managers 7800 Kennedy Road • Suite 201 • Markham, Ontario • L3R 2C7 Tel:(905) 944-0162 • Fax:(905) 944-0165 • E-mail: maeng@maeng.ca	Scale: 1:2000 Project Number 03-141	Date: APRIL 2013 Drawing No. PRE



Project:

PROPOSED TOWNHOUSE DEVELOPMENT & SINGLE ESTATE LOT

Dwg.Title:

POST DEVELOPMENT PLAN

MASONGSONG ASSOCIATES ENGINEERING LIMITED
Consulting Engineers • Planners • Project Managers
7800 Kennedy Road • Suite 201 • Markham, Ontario • L3R 2C7
Tel:(905) 944-0162 • Fax:(905) 944-0165 • E-mail: maeng@maeng.ca

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

REGION OF PEEL

SANITARY SEWER DESIGN SHEET
PROPOSED TOWNHOUSE DEVELOPMENT
CALEDON, ONTARIO

LOCATION	MH FROM	TO MH	AREA (ha)	DENSITY (ppha)	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 MH	EXTERNAL	EX. MH35	2.500	175	438	2.500	438	0.0130	0.001060	-	**0.0141**	24.0	250	1.00	**0.05947**	1.211	
	EX. MH35	EX. MH37	0.620	50	31	3.120	469	0.0130	0.001184	-	**0.0142**	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:

Population Density:	(ppha)	Infiltration:	0.0002	(m^3/sec/ha)
Single family (greater than 10m lots)	50			
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 21-Oct-13 Designed By: S.G.
Checked By: A.I.

Date

Approved

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

TOWN OF CALEDON
ENGINEERING DEPARTMENT

PROPOSED TOWNHOUSE DEVELOPMENT
SINGLE ESTATE LOT

Masongsong Associates
Engineering Limited

PREPARED BY:	SG
CHECKED BY:	AI
FILE No.:	2003-141
DATE	01-Apr-13

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	7.77	0.35	2.72	2.72	25.18	50.00	378.11	600	1.00	73.76	614	2.17	0.57	62%

AREA I.D.	POST-DEVELOPMENT TOTAL AREA SUMMARY (sq.m.)		TOTAL AREA (ha.)	COMPOSITE 'R'
	GRASS ('R'=0.25)	PAVED ('R'=0.90)		
S-1 TH DEVELOPMENT	15610.12	8588.74	2.4199	0.48
S-2 POND	2418.15	0	0.2418	0.25
UNCONTROLLED AREA 1	457.29	430.02	0.0887	0.57

AREA TO BE CONTROLLED

Grassed Area:	1.8028	ha.
Paved Area:	0.8589	ha.
SITE AREA:	2.6617	ha.
COMPOSITE 'R' VALUE:	0.460	
Percent Impervious:	32.27%	

Table 1

	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
ESIGN SPEED	50km/h	50km/h	50km/h	60km/h	70km/h
IORIZONTAL URVE ADIUS (m)	90.0m	90.0m	130.0m	190.0m	250.0m
ERTICAL URVE MINIMUM K) AG	12	18	18	25	30
ERTICAL URVE MINIMUM K) REST	8	15	15	25	35
TOPPING IGHT DISTANCE	70.0m	70.0m	95.0m	125.0m	150.0m
OAD GRADE MAXIMUM) CUL-DE-SAC %)	7.00%	4.00%	6.00%	6.00%	6.00%
OAD GRADE MINIMUM) INCLUDING UL-DE-SAC URB)	0.75%	0.75%	0.75%	0.75%	0.75%
RADE HROUGH OADS NTERSECTIONS 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

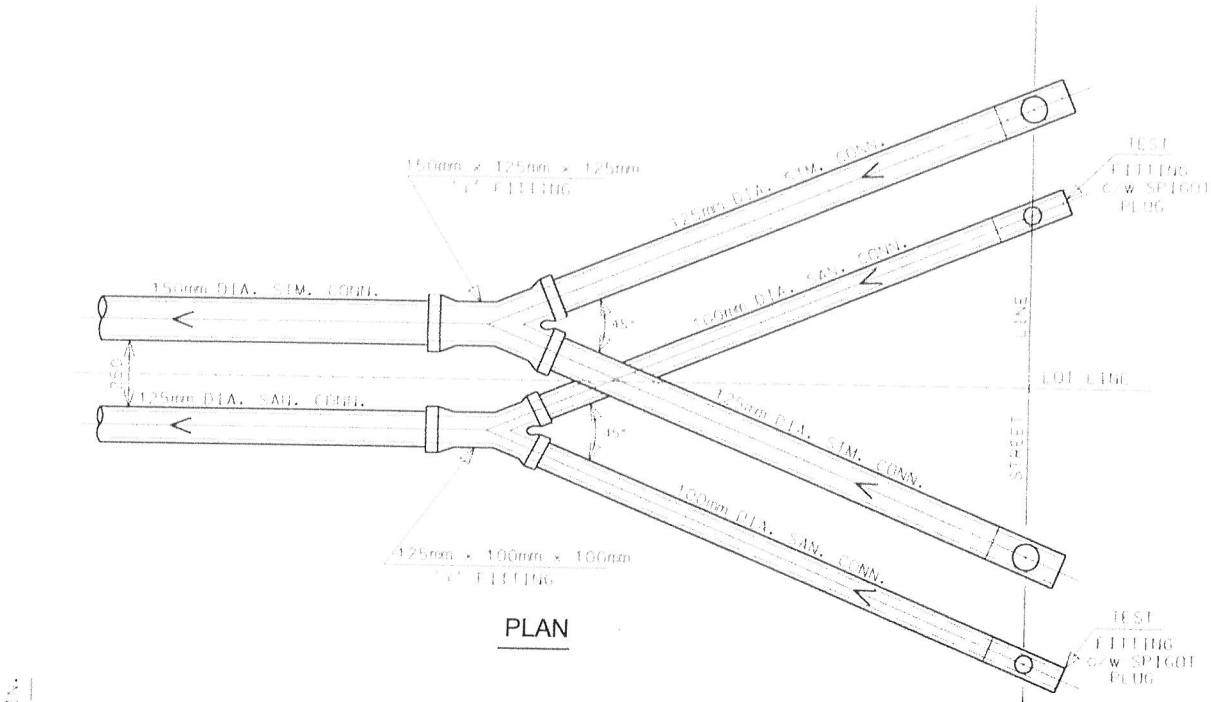
TOWN OF CALEDON

GEOMETRIC DESIGN STANDARDS FOR ROADS

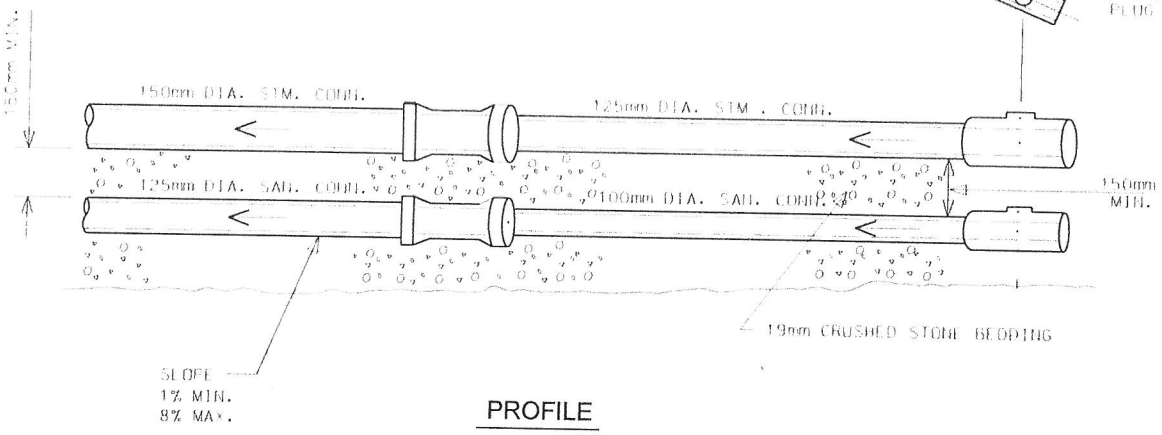
APR'D: | DATE: DATE

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

STANDARD No. 110



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

Calculations

Figure 1 and 2, VO2 Schematic Pre and Post Development Condition

VO2 output results for Pre and Post Scenario

SWM Design Parameter Calculation Sheet

Figure 1.0: VO2 Schematic for the Theoretical Pre-Development Condition

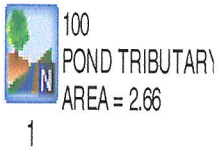
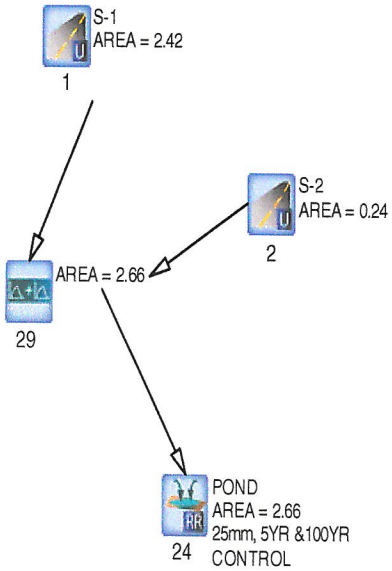


Figure 2.0: VO2 Schematic for the Theoretical Post-Development Condition



```
==========================================================================================================================

       V    V   I    SSSSS  U   U    A    L
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```


***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 2.3.2\voin.dat
Output filename: H:\PROJECTS\03\141\Design\SWM Model\03-141SWMModel\Pond-pre-cond.out
Summary filename: H:\PROJECTS\03\141\Design\SWM Model\03-141SWMModel\Pond-pre-cond.sum

DATE: 4/9/2013 TIME: 10:02:14 AM

USER:

COMMENTS: Pre - Development

****
** SIMULATION NUMBER: 1 **
****

READ STORM | Ptotal= 46.99 mm | Filename: H:\PROJECTS\03\141\Design\SWM Model\03-141SWMModel\Rain Files\3HR-Chicago\R5YR.stm
Comments: 3 Hour Chicago Distribution Design Storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	3.90	1.00	10.08	1.83	16.31	2.67	4.73
.33	4.41	1.17	15.37	2.00	10.77	2.83	4.18
.50	5.10	1.33	32.79	2.17	8.09	3.00	3.75
.67	6.07	1.50	103.04	2.33	6.51		
.83	7.55	1.67	33.80	2.50	5.47		

CALIB
NASHYD (0001) | ID= 1 DT=10.0 min | Area (ha)= 2.66 Curve Number (CN)= 81.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= .45

Unit Hyd Qpeak (cms)= .226

PEAK FLOW (cms)= .103 (i) *
TIME TO PEAK (hrs)= 2.000
RUNOFF VOLUME (mm)= 17.336 *
TOTAL RAINFALL (mm)= 46.987
RUNOFF COEFFICIENT = .369

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

****
** SIMULATION NUMBER: 2 **
****

READ STORM | Ptotal= 86.13 mm | Filename: H:\PROJECTS\03\141\Design\SWM Model\03-141SWMModel\Rain Files\3HR-Chicago\R100YR.stm
Comments: 3 Hour Chicago Distribution Design Storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	6.61	1.00	18.78	1.83	31.44	2.67	8.17
.33	7.57	1.17	29.53	2.00	20.17	2.83	7.13
.50	8.89	1.33	63.97	2.17	14.76	3.00	6.33
.67	10.77	1.50	181.81	2.33	11.62		
.83	13.70	1.67	65.94	2.50	9.59		

CALIB
NASHYD (0001)
ID= 1 DT=10.0 min

Area (ha)= 2.66 Curve Number (CN)= 81.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= .45

Unit Hyd Qpeak (cms)= .226

PEAK FLOW (cms)= .284 (i)
TIME TO PEAK (hrs)= 1.833
RUNOFF VOLUME (mm)= 46.721
TOTAL RAINFALL (mm)= 86.130
RUNOFF COEFFICIENT = .542

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

****
** SIMULATION NUMBER: 3 **
****

READ STORM
Ptotal= 45.26 mm

Filename: H:\PROJECTS\03\141\Design\SWM Mo
del\03-141SWMModel\Rain Files\3HR-SCS\
5year-3HR-SCS.txt
Comments: 5 year, 3 hour SCS Type II storm - Toron

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	3.61	1.00	6.56	1.83	10.50	2.67	4.59
.33	4.27	1.17	10.01	2.00	9.19	2.83	3.28
.50	4.27	1.33	17.72	2.17	7.38	3.00	3.28
.67	5.25	1.50	140.47	2.33	4.92		
.83	6.56	1.67	25.76	2.50	3.94		

CALIB
NASHYD (0001)
ID= 1 DT=10.0 min

Area (ha)= 2.66 Curve Number (CN)= 81.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= .45

Unit Hyd Qpeak (cms)= .226

PEAK FLOW (cms)= .103 (i)
TIME TO PEAK (hrs)= 1.833
RUNOFF VOLUME (mm)= 16.215
TOTAL RAINFALL (mm)= 45.260
RUNOFF COEFFICIENT = .358

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

****
** SIMULATION NUMBER: 4 **
****

READ STORM
Ptotal=121.50 mm

Filename: H:\PROJECTS\03\141\Design\SWM Mo
del\03-141SWMModel\Rain Files\3HR-SCS\
100year-3HR-SCS.txt
Comments: 100 year, 3 hour SCS Type II storm - Tor

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	7.29	1.00	29.16	1.83	43.74	2.67	14.58
.33	7.29	1.17	58.32	2.00	36.45	2.83	7.29
.50	14.58	1.33	145.80	2.17	21.87	3.00	7.29
.67	14.58	1.50	218.70	2.33	14.58		
.83	14.58	1.67	58.32	2.50	14.58		

```
--------------------
| CALIB            |
| NASHYD    (0001) |   Area     (ha)=   2.66   Curve Number    (CN)= 81.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .45

     Unit Hyd Qpeak  (cms)=    .226

     PEAK FLOW       (cms)=    .459 (i)
     TIME TO PEAK    (hrs)=   1.833
     RUNOFF VOLUME    (mm)=  76.987
     TOTAL RAINFALL   (mm)= 121.500
     RUNOFF COEFFICIENT   =    .634

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
  ***************************
  ** SIMULATION NUMBER:   5 **
  ***************************


--------------------
|    READ STORM    |    Filename: H:\PROJECTS\03\141\Design\SWM Mo
|                  |              del\03-141SWMModel\Rain Files\25mmYR.stm
| Ptotal= 24.99 mm |    Comments: 25mm Rainfall 4 hour chicago storm
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	2.07	1.17	5.70	2.17	5.19	3.17	2.80
.33	2.27	1.33	10.77	2.33	4.47	3.33	2.62
.50	2.52	1.50	50.21	2.50	3.95	3.50	2.48
.67	2.88	1.67	13.37	2.67	3.56	3.67	2.35
.83	3.38	1.83	8.29	2.83	3.25	3.83	2.23
1.00	4.18	2.00	6.30	3.00	3.01	4.00	2.14

```
--------------------
| CALIB            |
| NASHYD    (0001) |   Area     (ha)=   2.66   Curve Number    (CN)= 81.0
|ID= 1 DT=10.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .45

     Unit Hyd Qpeak  (cms)=    .226

     PEAK FLOW       (cms)=    .019 (i)
     TIME TO PEAK    (hrs)=   2.000
     RUNOFF VOLUME    (mm)=   5.018
     TOTAL RAINFALL   (mm)=  24.995
     RUNOFF COEFFICIENT   =    .201

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

 FINISH
================================================================================
```

```
 V    V   I    SSSSS  U   U    A    L
 V    V   I    SS     U   U   A A   L
  V  V    I     SS    U   U  AAAAA  L
  V  V    I      SS   U   U  A   A  L
   VV     I    SSSSS  UUUUU  A   A  LLLLL

  OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO
 O   O    T      T    H   H   Y Y   MM MM  O   O
 O   O    T      T    H   H    Y    M   M  O   O
  OOO     T      T    H   H    Y    M   M   OOO
```


***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 2.3.2\voin.dat
Output filename: H:\PROJECTS\03\141\Design\SWM Model\03-141SWMModel\Pond post cond.out
Summary filename: H:\PROJECTS\03\141\Design\SWM Model\03-141SWMModel\Pond post cond.sum

DATE: 4/11/2013 TIME: 10:20:33 AM

USER:

COMMENTS: Post Development

****
** SIMULATION NUMBER: 1 **
****

READ STORM	Filename: H:\PROJECTS\03\141\Design\SWM Model\03-141SWMModel\Rain Files\3HR-Chicago\R5YR.stm
Ptotal= 46.99 mm	Comments: 3 Hour Chicago Distribution Design Storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	3.90	1.00	10.08	1.83	16.31	2.67	4.73
.33	4.41	1.17	15.37	2.00	10.77	2.83	4.18
.50	5.10	1.33	32.79	2.17	8.09	3.00	3.75
.67	6.07	1.50	103.04	2.33	6.51		
.83	7.55	1.67	33.80	2.50	5.47		

CALIB STANDHYD (0001) ID= 1 DT=10.0 min	Area (ha)= 2.42 Total Imp(%)= 40.00 Dir. Conn.(%)= 35.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.97	1.45	
Dep. Storage	(mm)=	1.00	6.82	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	127.00	308.57	
Mannings n	=	.013	.013	
Max.Eff.Inten.	(mm/hr)=	103.04	71.65	
over	(min)	10.00	10.00	
Storage Coeff.	(min)=	2.37 (ii)	7.03 (ii)	
Unit Hyd. Tpeak	(min)=	10.00	10.00	
Unit Hyd. peak	(cms)=	.17	.13	
				TOTALS
PEAK FLOW	(cms)=	.24	.23	.468 (iii)
TIME TO PEAK	(hrs)=	1.50	1.50	1.50
RUNOFF VOLUME	(mm)=	45.99	25.92	32.94
TOTAL RAINFALL	(mm)=	46.99	46.99	46.99
RUNOFF COEFFICIENT	=	.98	.55	.70

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

```
            CN* =  91.0     Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

CALIB STANDHYD (0002) ID= 1 DT=10.0 min	Area (ha)= .24	Total Imp(%)= 1.00	Dir. Conn.(%)= 1.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.00	.24	
Dep. Storage	(mm)=	1.00	6.82	
Average Slope	(%)=	.50	.50	
Length	(m)=	40.00	105.00	
Mannings n	=	.240	.250	
Max.Eff.Inten.	(mm/hr)=	103.04	33.97	
over	(min)	10.00	40.00	
Storage Coeff.	(min)=	10.31 (ii)	39.71 (ii)	
Unit Hyd. Tpeak	(min)=	10.00	40.00	
Unit Hyd. peak	(cms)=	.11	.03	
				TOTALS
PEAK FLOW	(cms)=	.00	.01	.011 (iii)
TIME TO PEAK	(hrs)=	1.50	2.00	2.00
RUNOFF VOLUME	(mm)=	45.99	24.71	24.82
TOTAL RAINFALL	(mm)=	46.99	46.99	46.99
RUNOFF COEFFICIENT	=	.98	.53	.53

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  91.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

ADD HYD (0029) 1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0001):	2.42	.468	1.50	32.94
+ ID2= 2 (0002):	.24	.011	2.00	24.82
ID = 3 (0029):	2.66	.471	1.50	32.21

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0024)
IN= 2---> OUT= 1
DT= 10.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.0000	.0000	.4810	.5040
.0570	.2620	.7400	.6000
.1200	.3270	.8980	.6540
.3200	.4360	1.0940	.7180

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0029)	2.660	.471 *	1.50	32.21 *
OUTFLOW: ID= 1 (0024)	2.660	.016	3.17	31.77

PEAK FLOW REDUCTION [Qout/Qin](%)= 3.48
TIME SHIFT OF PEAK FLOW (min)=100.00
MAXIMUM STORAGE USED (ha.m.)= .0755

```
  **************************
  ** SIMULATION NUMBER:   2 **
  **************************
```

READ STORM | Ptotal= 86.13 mm

Filename: H:\PROJECTS\03\141\Design\SWM Model\03-141SWMModel\Rain Files\3HR-Chicago\R100YR.stm
Comments: 3 Hour Chicago Distribution Design Storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	6.61	1.00	18.78	1.83	31.44	2.67	8.17
.33	7.57	1.17	29.53	2.00	20.17	2.83	7.13
.50	8.89	1.33	63.97	2.17	14.76	3.00	6.33
.67	10.77	1.50	181.81	2.33	11.62		
.83	13.70	1.67	65.94	2.50	9.59		

CALIB
STANDHYD (0001)
ID= 1 DT=10.0 min

Area (ha)= 2.42
Total Imp(%)= 40.00 Dir. Conn.(%)= 35.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.97	1.45	
Dep. Storage	(mm)=	1.00	6.82	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	127.00	308.57	
Mannings n	=	.013	.013	
Max.Eff.Inten.	(mm/hr)=	181.81	164.00	
over	(min)	10.00	10.00	
Storage Coeff.	(min)=	1.89 (ii)	5.23 (ii)	
Unit Hyd. Tpeak	(min)=	10.00	10.00	
Unit Hyd. peak	(cms)=	.17	.14	
				TOTALS
PEAK FLOW	(cms)=	.43	.59	1.013 (iii)
TIME TO PEAK	(hrs)=	1.50	1.50	1.50
RUNOFF VOLUME	(mm)=	85.13	61.86	70.00
TOTAL RAINFALL	(mm)=	86.13	86.13	86.13
RUNOFF COEFFICIENT	=	.99	.72	.81

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 91.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0002)
ID= 1 DT=10.0 min

Area (ha)= .24
Total Imp(%)= 1.00 Dir. Conn.(%)= 1.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.00	.24	
Dep. Storage	(mm)=	1.00	6.82	
Average Slope	(%)=	.50	.50	
Length	(m)=	40.00	105.00	
Mannings n	=	.240	.250	
Max.Eff.Inten.	(mm/hr)=	181.81	103.70	
over	(min)	10.00	30.00	
Storage Coeff.	(min)=	8.22 (ii)	27.03 (ii)	
Unit Hyd. Tpeak	(min)=	10.00	30.00	
Unit Hyd. peak	(cms)=	.12	.04	
				TOTALS
PEAK FLOW	(cms)=	.00	.04	.036 (iii)
TIME TO PEAK	(hrs)=	1.50	1.83	1.83
RUNOFF VOLUME	(mm)=	85.13	60.23	60.40
TOTAL RAINFALL	(mm)=	86.13	86.13	86.13
RUNOFF COEFFICIENT	=	.99	.70	.70

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 91.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0029)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0001):	2.42	1.013	1.50	70.00

```
      + ID2= 2 (0002):      .24     .036     1.83     60.40
        ============================================
        ID = 3 (0029):     2.66   1.028     1.50     69.14

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR (0024) |
| IN= 2---> OUT= 1 |
| DT= 10.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |    (cms)     (ha.m.)
                          .0000       .0000   |     .4810       .5040
                          .0570       .2620   |     .7400       .6000
                          .1200       .3270   |     .8980       .6540
                          .3200       .4360   |    1.0940       .7180

                                  AREA      QPEAK       TPEAK       R.V.
                                  (ha)      (cms)       (hrs)       (mm)
    INFLOW : ID= 2 (0029)        2.660     1.028 *      1.50       69.14 *
    OUTFLOW: ID= 1 (0024)        2.660      .035        3.00       68.70

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.45
                TIME SHIFT OF PEAK FLOW          (min)= 90.00
                MAXIMUM  STORAGE   USED        (ha.m.)=   .1632

--------------------------------------------------------------------------------
  ***************************
  ** SIMULATION NUMBER:   3 **
  ***************************


--------------------
|    READ STORM    |    Filename: H:\PROJECTS\03\141\Design\SWM Mo
|                  |              del\03-141SWMModel\Rain Files\3HR-SCS\
|                  |              5year-3HR-SCS.txt
| Ptotal= 45.26 mm |    Comments: 5 year, 3 hour SCS Type II storm - Toron
--------------------
                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .17    3.61 |  1.00    6.56 |  1.83   10.50 |  2.67    4.59
                 .33    4.27 |  1.17   10.01 |  2.00    9.19 |  2.83    3.28
                 .50    4.27 |  1.33   17.72 |  2.17    7.38 |  3.00    3.28
                 .67    5.25 |  1.50  140.47 |  2.33    4.92 |
                 .83    6.56 |  1.67   25.76 |  2.50    3.94 |

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| STANDHYD  (0001) |   Area     (ha)=   2.42
|ID= 1 DT=10.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  35.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=        .97          1.45
     Dep. Storage      (mm)=       1.00          6.82
     Average Slope      (%)=       2.00          2.00
     Length             (m)=     127.00        308.57
     Mannings n            =       .013          .013

     Max.Eff.Inten.(mm/hr)=     140.47         90.66
               over (min)        10.00         10.00
     Storage Coeff.  (min)=       2.09 (ii)     6.33 (ii)
     Unit Hyd. Tpeak (min)=      10.00         10.00
     Unit Hyd. peak  (cms)=        .17           .13
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .33           .29        .620 (iii)
     TIME TO PEAK    (hrs)=       1.50          1.50         1.50
     RUNOFF VOLUME    (mm)=      44.26         24.42        31.37
     TOTAL RAINFALL   (mm)=      45.26         45.26        45.26
     RUNOFF COEFFICIENT   =        .98           .54          .69

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  91.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD  (0002) |   Area     (ha)=    .24
```

|ID= 1 DT=10.0 min | Total Imp(%)= 1.00 Dir. Conn.(%)= 1.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	.00	.24
Dep. Storage	(mm)=	1.00	6.82
Average Slope	(%)=	.50	.50
Length	(m)=	40.00	105.00
Mannings n	=	.240	.250
Max.Eff.Inten.	(mm/hr)=	140.47	35.81
over	(min)	10.00	40.00
Storage Coeff.	(min)=	9.11 (ii)	37.90 (ii)
Unit Hyd. Tpeak	(min)=	10.00	40.00
Unit Hyd. peak	(cms)=	.11	.03

				TOTALS
PEAK FLOW	(cms)=	.00	.01	.012 (iii)
TIME TO PEAK	(hrs)=	1.50	2.00	2.00
RUNOFF VOLUME	(mm)=	44.26	23.24	23.36
TOTAL RAINFALL	(mm)=	45.26	45.26	45.26
RUNOFF COEFFICIENT	=	.98	.51	.52

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 91.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0029)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0001):	2.42	.620	1.50	31.37
+ ID2= 2 (0002):	.24	.012	2.00	23.36
ID = 3 (0029):	2.66	.623	1.50	30.64

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0024)
IN= 2---> OUT= 1
DT= 10.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.0000	.0000	.4810	.5040
.0570	.2620	.7400	.6000
.1200	.3270	.8980	.6540
.3200	.4360	1.0940	.7180

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0029)	2.660	.623	1.50	30.64
OUTFLOW: ID= 1 (0024)	2.660	.016	3.17	30.21

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.50
TIME SHIFT OF PEAK FLOW (min)=100.00
MAXIMUM STORAGE USED (ha.m.)= .0719

****
** SIMULATION NUMBER: 4 **
****

READ STORM
Ptotal=121.50 mm

Filename: H:\PROJECTS\03\141\Design\SWM Model\03-141SWMModel\Rain Files\3HR-SCS\100year-3HR-SCS.txt
Comments: 100 year, 3 hour SCS Type II storm - Tor

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	7.29	1.00	29.16	1.83	43.74	2.67	14.58
.33	7.29	1.17	58.32	2.00	36.45	2.83	7.29
.50	14.58	1.33	145.80	2.17	21.87	3.00	7.29
.67	14.58	1.50	218.70	2.33	14.58		
.83	14.58	1.67	58.32	2.50	14.58		

```
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   2.42
|ID= 1 DT=10.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  35.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=        .97          1.45
     Dep. Storage      (mm)=       1.00          6.82
     Average Slope      (%)=       2.00          2.00
     Length             (m)=     127.00        308.57
     Mannings n            =       .013          .013

     Max.Eff.Inten.(mm/hr)=     218.70        217.84
               over (min)        10.00         10.00
     Storage Coeff.  (min)=       1.75 (ii)     4.74 (ii)
     Unit Hyd. Tpeak (min)=      10.00         10.00
     Unit Hyd. peak  (cms)=        .17           .15
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .51           .83        1.342 (iii)
     TIME TO PEAK    (hrs)=       1.50          1.50         1.50
     RUNOFF VOLUME    (mm)=     120.50         95.90       104.51
     TOTAL RAINFALL   (mm)=     121.50        121.50       121.50
     RUNOFF COEFFICIENT    =        .99           .79          .86

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  91.0     Ia = Dep. Storage   (Above)
      (ii) TIME STEP (DT)  SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------
| CALIB            |
| STANDHYD  (0002) |   Area    (ha)=    .24
|ID= 1 DT=10.0 min |   Total Imp(%)=   1.00   Dir. Conn.(%)=   1.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=        .00           .24
     Dep. Storage      (mm)=       1.00          6.82
     Average Slope      (%)=        .50           .50
     Length             (m)=      40.00        105.00
     Mannings n            =       .240          .250

     Max.Eff.Inten.(mm/hr)=     218.70        156.12
               over (min)        10.00         30.00
     Storage Coeff.  (min)=       7.63 (ii)    23.61 (ii)
     Unit Hyd. Tpeak (min)=      10.00         30.00
     Unit Hyd. peak  (cms)=        .12           .04
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .00           .06          .058 (iii)
     TIME TO PEAK    (hrs)=       1.50          1.83         1.83
     RUNOFF VOLUME    (mm)=     120.50         94.07        94.26
     TOTAL RAINFALL   (mm)=     121.50        121.50       121.50
     RUNOFF COEFFICIENT    =        .99           .77          .78

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  91.0     Ia = Dep. Storage   (Above)
      (ii) TIME STEP (DT)  SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------
| ADD HYD   (0029) |
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
          ID1= 1 (0001):     2.42     1.342      1.50    104.51
        + ID2= 2 (0002):      .24      .058      1.83     94.26
          ================================================
          ID = 3 (0029):     2.66     1.374      1.50    103.58

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------
```

| RESERVOIR (0024) |
| IN= 2---> OUT= 1 |
| DT= 10.0 min |

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
.0000	.0000	.4810	.5040
.0570	.2620	.7400	.6000
.1200	.3270	.8980	.6540
.3200	.4360	1.0940	.7180

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0029)	2.660	1.374	1.50	103.58
OUTFLOW: ID= 1 (0024)	2.660	.053	3.00	103.15

PEAK FLOW REDUCTION [Qout/Qin](%)= 3.87
TIME SHIFT OF PEAK FLOW (min)= 90.00
MAXIMUM STORAGE USED (ha.m.)= .2444

****
** SIMULATION NUMBER: 5 **
****

| READ STORM | Ptotal= 24.99 mm |

Filename: H:\PROJECTS\03\141\Design\SWM Mo
del\03-141SWMModel\Rain Files\25mmYR.stm
Comments: 25mm Rainfall 4 hour chicago storm

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.17	2.07	1.17	5.70	2.17	5.19	3.17	2.80
.33	2.27	1.33	10.77	2.33	4.47	3.33	2.62
.50	2.52	1.50	50.21	2.50	3.95	3.50	2.48
.67	2.88	1.67	13.37	2.67	3.56	3.67	2.35
.83	3.38	1.83	8.29	2.83	3.25	3.83	2.23
1.00	4.18	2.00	6.30	3.00	3.01	4.00	2.14

| CALIB STANDHYD (0001) ID= 1 DT=10.0 min |

Area (ha)= 2.42
Total Imp(%)= 40.00 Dir. Conn.(%)= 35.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.97	1.45	
Dep. Storage	(mm)=	1.00	6.82	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	127.00	308.57	
Mannings n	=	.013	.013	
Max.Eff.Inten.	(mm/hr)=	50.21	12.47	
over	(min)	10.00	20.00	
Storage Coeff.	(min)=	3.15 (ii)	12.54 (ii)	
Unit Hyd. Tpeak	(min)=	10.00	20.00	
Unit Hyd. peak	(cms)=	.16	.07	
				TOTALS
PEAK FLOW	(cms)=	.11	.03	.125 (iii)
TIME TO PEAK	(hrs)=	1.50	1.67	1.50
RUNOFF VOLUME	(mm)=	23.99	8.34	13.82
TOTAL RAINFALL	(mm)=	24.99	24.99	24.99
RUNOFF COEFFICIENT	=	.96	.33	.55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 91.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB STANDHYD (0002) ID= 1 DT=10.0 min |

Area (ha)= .24
Total Imp(%)= 1.00 Dir. Conn.(%)= 1.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	.00	.24
Dep. Storage	(mm)=	1.00	6.82
Average Slope	(%)=	.50	.50
Length	(m)=	40.00	105.00
Mannings n	=	.240	.250

Max.Eff.Inten.(mm/hr)=	31.79	4.68	
over (min)	20.00	90.00	
Storage Coeff. (min)=	16.51 (ii)	81.45 (ii)	
Unit Hyd. Tpeak (min)=	20.00	90.00	
Unit Hyd. peak (cms)=	.06	.01	
			TOTALS
PEAK FLOW (cms)=	.00	.00	.001 (iii)
TIME TO PEAK (hrs)=	1.67	3.33	3.33
RUNOFF VOLUME (mm)=	23.99	7.63	7.60
TOTAL RAINFALL (mm)=	24.99	24.99	24.99
RUNOFF COEFFICIENT =	.96	.31	.30

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 91.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0029)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0001):		2.42	.125	1.50	13.82
+ ID2= 2 (0002):		.24	.001	3.33	7.60
ID = 3 (0029):		2.66	.125	1.50	13.26

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR (0024)				
IN= 2---> OUT= 1				
DT= 10.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	.0000	.0000	.4810	.5040
	.0570	.2620	.7400	.6000
	.1200	.3270	.8980	.6540
	.3200	.4360	1.0940	.7180

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0029)	2.660	.125	1.50	13.26
OUTFLOW: ID= 1 (0024)	2.660	.006	4.17	12.82

PEAK FLOW REDUCTION [Qout/Qin](%)= 5.05
TIME SHIFT OF PEAK FLOW (min)=160.00
MAXIMUM STORAGE USED (ha.m.)= .0291

FINISH

==========

Summary of Flows

CHICAGO- 4HR Results

Table 1 - Total Runoff Volumes and Peak flow for Predevelopment Scenario

		Using 3hr Chicago		Using 3hr SCS		
		5 Year	100 Year	5 Year	100 Year	25mm Water Quality (4hr Chicago)
Peak Flow	m3/s	0.103	0.284	0.103	0.459	0.019
Runoff Volume	mm	17.336	46.721	16.215	76.987	5.018
	m3	461.1	1242.8	431.3	2047.9	133.5
Pond Tributary Area	ha	2.66				

Table 2 - Total Runoff Volumes and Peak flow for Postdevelopment Scenario

		UNCONTROLLED				
		5 Year	100 Year	5 Year	100 Year	25mm Water Quality (4hr Chicago)
Peak Flow	m3/s	0.471	1.028	0.623	1.374	0.125
Runoff Volume	mm	32.21	69.14	30.64	103.58	13.26
	m3	856.8	1839.1	815.0	2755.2	352.7
Pond Tributary Area	ha	2.66				

Table 3 - Preliminary Estimation of SWM Pond Volume Required

		5 Year	100 Year	5 Year	100 Year	25mm Water Quality (4hr)
Volume Required	m3	395.6	596.3	383.7	707.4	219.2

Design Parameters

Water Quality Storage Requirements (MOE SWMPP Table 3.2)

Pond Catchment Area	2.66 ha	Water Quality Storage (Select the greater of the two values)			
Level 1	140 m3/ha	Interpolated from Table 3.2 (MOE SWMPP)	*106.40*	m3	
Extended	40 m3/ha	25 mm Event From OTTHYMO	*219.24*	m3	
% imperviousness	32.27 %				
	SAY 35.0 %	Permanent Volume Required	*266.00*	m3	

Settling Calculations

$$Dist = \sqrt{\frac{r \times Q_p}{V_s}}$$

MOE SWMPP Equation 4.5

Dist	6	Minimum Forebay length	m
r	2	Length to width ratio	-
Qp	0.0472	Peak flow rate from the pond during design quality storm	m3/s
Vs	0.003	settling velocity	m/s

Dispersion Length

$$Dist = \frac{8Q}{dV_f}$$

MOE SWMPP Equation 4.6

	2	Minimum Width		m
Dist	18	Minimum Dispersion Length		m
Q	0.33	Maximum Inlet Flow Rate	(5 year Storm)	m3/s
d	0.29	Depth of the Permanent Pool		m
Vf	0.5	Desired Velocity in the Forebay		m/s

Design Quality Storm

$$i_{25} = 43C + 5.9$$

MOE SWMPP Equation 3.7

A	2.66	Area	ha
C	0.3227	Runoff Coefficient	
i	19.7761	Intensity	mm/hr
Qp	0.05	m3/s	m3/s

Flow Velocity Check

Qd	0.33	Inlet Flow Rate	m3/s
A	0.87	Crossectional Area	m2
Vfb	0.376	Average Flow Velocity	m/s

Forebay Dimensions

33	Average Side Slope	%
65.00	Top Length	m
59.00	Bottom Length	m
4.00	Average Top Width	m
2.00	Bottom Width	m
0.29	Average Depth of Forebay Pool	m
50.22	Total Volume of Forebay Pool	m3

Forebay Cleanout Frequency

Ac	2.66	Contributing Area	(ha)
Ds	0.29	Maximum Sediment Depth	(m)
Vsf	50.22	Maximum Sediment Volume	(m3)
a	35%	Impervious Level	%
da	0.6	Annual Sediment Loading	(m3/ha/yr) (Table 6.3 MOE Manual)
Fs	31.5	Forebay Cleanout Frequency	(years)
	80%	Target Maintenance TSS Removal Efficiency	

Stage-Storage-Discharge Curve - Pond

[Stage] Elevation	Sec Area	Avg Area	Sec Volume	[Storage] Cumulative Volume	Fluctuation Volume	Stage Active -Elev-	Active Storage	Component Discharge Orifice 0.10	Orifice 0.20	Weir 1 0.000	[Discharge] TOTAL Pond Discharge	Description
m	m^2	m^2	m^3	m^3	m^3	m	ha.m	m^3/s	m^3/s	m^3/s	m^3/s	
296.73	31.77											
297.23	96.94	64.36	32.18	32.18								
297.73	298.30	197.62	98.81	130.99								
298.02	***488.49***	======= *PWL* =======		***266.00***	**0.00**	**0.000**	**0.000**	**0.000**			**0.000**	***Orifice Equation Used***
298.23	625.68	461.99	231.00	361.98	95.98	0.208	0.010	0.010			0.010	Q = 0.62 x A x (2gH)^0.5
298.38	730.20	677.94	101.69	463.67	197.67	0.358	0.020	0.013	0.000		0.013	
298.73	974.85	852.53	298.38	762.06	496.06	0.708	0.050	0.018	0.073		0.091	
298.93	1,119.89	1,047.37	209.47	971.53	705.53	0.908	0.071	0.021	0.082		0.103	
299.00	1,171.23	1,145.56	80.19	1,051.72	785.72	0.978	0.079				0.000	
Interpolated Values												
298.38					***219.24***						*0.013*	***Quality Storm***
298.93					***707.37***						*0.103*	***100 Year***
FREE BOARD		0.07 m										

STORAGE REQUIRED

Storm Event	Pre-devel. Peak Flows	Post-Devel. Controlled Peak Flows	Volume Required [OTTHYMO]
	m^3/s	m^3/s	m^3
3hr Chicago			
5 year	0.103		396
100 year	0.284	0.103	596
3hr SCS			
5 year	0.103		384
100 year	0.459	0.103	707

Denotes 5 year allowable release rate 103 L/s

100 year storage quantity required is 707 cu.m.

FOREBAY VOLUME

Elevation	Sec Area	Avg Area	Volume	Total
297.73	111.84			
298.02	231.86	171.85	50.22	50.22

25 mm Pond Orifice Calculation for 12 hr or Greater Detention Time

Project: Lexus-Bayview Developments, Townhouse Development and Single Lot
Ref: 03-141

C	0.62000		Extended Quality Volume:	219	m^3
Orifice	0.10000	m	Initial Head:	0.31	m
Area	0.00785	m^2	Detention:	10.00	hrs
				600.00	min

FALLING HEAD EQUATION

Time (min)	Head (m)	Q (m3/s)	Volume (m3)	Declining Volume Start	Declining Volume End
0	0.3078	0.0120	3.59	219.24	215.65
5	0.3027	0.0119	3.56	215.65	212.09
10	0.2977	0.0118	3.53	212.09	208.56
15	0.2928	0.0117	3.50	208.56	205.06
20	0.2879	0.0116	3.47	205.06	201.58
25	0.2830	0.0115	3.44	201.58	198.14
30	0.2781	0.0114	3.41	198.14	194.73
		-- BREAK --			
580	0.0004	0.0004	0.13	0.30	0.17
585	0.0002	0.0003	0.10	0.17	0.07
590	0.0001	0.0002	0.06	0.07	0.00
595	0.0000	0.0001	0.02	0.00	(0.01)
600	(0.0000)	#NUM!	#NUM!	(0.01)	#NUM!
605	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
610	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
615	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
620	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
625	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
630	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
635	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
640	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
645	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
650	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
655	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
660	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
665	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
670	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
675	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
680	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
685	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
690	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
695	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
700	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
705	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
710	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
715	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
720	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
725	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!

Appendix C

Geotechnical Report

Excerpt of Terraprobe Soil Investigation Report

Runoff Curve Numbers

Top of Page

The following table of runoff curve numbers (CN) has been condensed from Tables 2-2(a-d) of SCS (1986), which is an exhaustive listing of runoff curve numbers. The hydrologic soil group refers to the infiltration potential of the soil after prolonged wetting.

Group A Soils: High infiltration (low runoff). Sand, loamy sand, or sandy loam. Infiltration rate > 0.3 inch/hr when wet.

Group B Soils: Moderate infiltration (moderate runoff). Silt loam or loam. Infiltration rate 0.15 to 0.3 inch/hr when wet.

Group C Soils: Low infiltration (moderate to high runoff). Sandy clay loam. Infiltration rate 0.05 to 0.15 inch/hr when wet.

Group D Soils: Very low infiltration (high runoff). Clay loam, silty clay loam, sandy clay, silty clay, or clay. Infiltration rate 0 to 0.05 inch/hr when wet.

SCS.

TABLE
Runoff curve numbers for selected agricultural, suburban, and urban land uses (antecedent moisture condition II, $I_a = 0.2S$)

Land Use Description		Hydrologic Soil Group			
		A	B	C	D
Cultivated land1: without conservation treatment		72	(81)	88	91
with conservation treatment		62	71	78	81
Pasture or range land: poor condition		68	79	86	89
good condition		39	61	74	80
Meadow: good condition		30	58	71	78
Wood or forest land: thin stand, poor cover, no mulch		45	66	77	83
good cover2		25	55	70	77
Open Spaces, lawns, parks, golf courses, cemeteries, etc.					
good condition: grass cover on 75% or more of the area		39	61	74	80
fair condition: grass cover on 50% to 75% of the area		49	69	79	84
Commercial and business areas (85% impervious)		89	92	94	95
Industrial districts (72% impervious)		81	88	91	93
Residential3:					
Average lot size	Average % impervious4				
1/8 acre or less	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
Paved parking lots, roofs, driveways, etc.5		98	98	98	98
Streets and roads:					
paved with curbs and storm sewers5		98	98	98	98
gravel		76	85	89	91
dirt		72	82	87	89

Terraprobe

LOG OF BOREHOLE 3

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

DATE: 19 January 2001
EQUIPMENT: Trackmount 6M2
ELEVATION DATUM: Geodetic
FILE: 01109

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES
300.2 / 0.0	Ground Surface			
299.8 / 0.4	**400mm Topsoil**	1	SS	8
299.4 / 0.8	**FILL -** Sandy Silt to Silty Sand, trace clay & organics (DISTURBED NATIVE) Compact Brown wet	2	SS	15
		3	SS	23
	-- grey	4	SS	16
	SILT trace to some clay & sand **TO** **SANDY SILT** trace to some clay	5	SS	24
		6	SS	19
294.1 / 6.1	-- coarse sand and gravel Dense to Very Dense Grey wet **SILTY SAND** trace clay **TO** **SAND** trace to some silt, trace clay	7	SS	50/15cm
		8	SS	88
292.1 / 8.1	End of Borehole			

PENETRATION RESISTANCE PLOT
SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● POCKET PEN. × LAB VANE

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

ORGANIC VAPOUR (ppm)

STANDPIPE INSTALLATION OR REMARKS

NOTES:
Borehole was open and water level at 1.2m depth on completion of drilling. Water level in standpipe at 0.1m depth 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 (TILL)		5	SS	78
300.1			6	SS	50/13cm
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

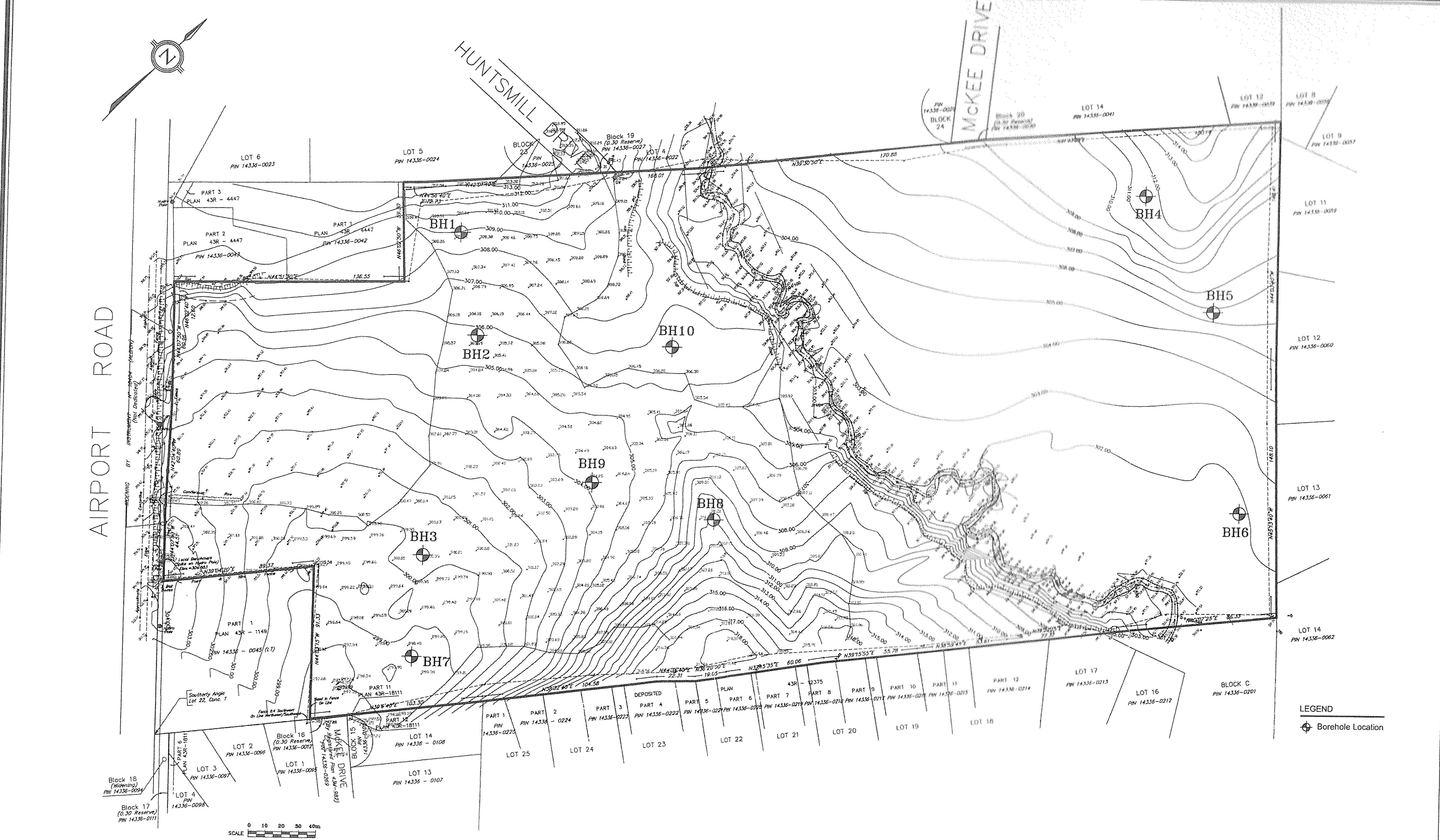
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

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

Municipal and Development Engineering

Water Resources Engineering

Planning

Project Management

MASONGSONG ASSOCIATES ENGINEERING LIMITED
Consulting Engineers • Planners • Project Managers

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