Site Servicing & Stormwater Management Brief

Canadian Tire Store No. 442

2501 Greenbank Rd.

Ottawa, Ontario

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1.0 INTRODUCTION

Parsons Inc. was retained by Canadian Tire Real Estate Limited to provide engineering services for a proposed expansion to their existing store #442 located at 2501 Greenbank Road in Ottawa, Ontario.

The proposed expansion involves an additional retail and warehouse area on the south-east side of the existing store, relocation of the garden centre, new seasonal soil compound and new e-commerce parking spaces. The expansion will impact only a certain part of the total site. The impacted site area is estimated at 0.20 ha.

The proposed work will require modifications to the existing storm sewer and the removal of the garden centre on the south-east side of the existing store. The new garden centre, e-commerce parking spaces and the new seasonal soil compound will be integrated within the existing parking lot area. The existing loading dock layout will also be modified.

2.0 PURPOSE

This brief summarizes the impact of the proposed expansion on the existing site servicing, grading and drainage design. The erosion and sediment control measures to be undertaken during construction are also described.

Stormwater management items addressed include the following:

- Comparison between the existing and proposed runoff and storage from the site.

3.0 EXISTING CONDITIONS

Design of the initial site was made by Bronte Engineering Limited in 2000. An expansion to the south-east of the original store was previously designed in 2006 by Delcan (now Parsons Inc.). Improvements to stormwater management of the site was also made in 2014 by Novatech Engineering Consultants Ltd. to mitigate flooding onsite and to provide additional stormwater storage. New storm chambers were installed under the existing parking lot on the south-west side of the property along Greenbank Rd to capture the 5-yr storm event while any event over the 5-yr storm is stored as surface ponding in the parking lot area. Novatech's report is attached to this brief in Appendix E.

The runoff from all drainage areas is captured through the existing storm structures. The site stormwater discharge point is located on the south corner of the property. Site stormwater is exiting the site through a 180mm x 180mm diamond shape orifice ICD plate. As per Novatech report & plan in 2014, a check valve (flap gate) was proposed on the 300mm inlet pipe to prevent municipal storm sewer back flow on site. It is also worth noting that no major overland drainage route is defined for this site. Approximately 0.5m of water will accumulate over the existing catch basins in the parking lot before water starts to spill to the public right-of-way.

4.0 PROPOSED DEVELOPMENT

As shown on the Architectural Site Plan, the proposed development will consist of the addition of a retail and warehouse area on the south-east side of the existing store, relocation of the garden centre, new seasonal soil compound and new e-commerce parking spaces. Modification to the existing loading dock layout is also proposed as part of this project.

The existing garden centre will be relocated to accommodate the building expansion. Existing catch basins and storm sewers, including a connection to the roof drains, located under the existing garden centre will be removed. The existing roof drain system will be rerouted internally to merge with the proposed roof drain connection for the building expansion. This new roof drain leader will be connected to the existing storm maintenance hole (ex. MH-15A) near the new building expansion. Roof drains on the building expansion will be controlled to attenuate peak flows. No grading modification are anticipated within the existing parking lot area to accommodate the new garden centre, soil compound and e-commerce parking spaces. However, a new grass swale is proposed south of the building expansion to capture any water runoff coming from the back of sidewalk along Strandherd Dr. All of the remaining site will remain in its existing condition.

5.0 STORMWATER MANAGEMENT PLAN

As mentioned earlier, only a small portion of the existing site is impacted by the new building expansion. The estimated area impacted by the proposed works is 0.20 ha. The following table illustrates the comparison between the existing and proposed runoff coefficient of the impacted area using the following runoff coefficients:

- Landscaped surfaces (grass, trees, shrubs, etc.) C = 0.20
- Impervious surfaces (asphalt, concrete, pavers, rooftops, etc.) C = 0.90

Table 1 : Comparison Between Existing and Proposed Runoff Coefficient

	Existing Condition		Proposed Expansion	
	Area (ha)	Runoff Coefficient	Area (ha)	Runoff Coefficient
Landscape Areas	0.02	0.20	0.02	0.20
Impervious Areas (asphalt, concrete)	0.18	0.90	0.06	0.90
Building Area (roof)	-	0.90	0.12	0.90
Total	**0.20**	**0.83**	**0.20**	**0.83**

As shown in the previous table, the proposed building expansion is replacing impervious areas. Thus, the post-development runoff coefficient is the same as existing condition. No additional runoff is generated by the store expansion.

Additionally, controlled roof drains are proposed for the new building area. Therefore, any stormwater storage lost within the existing garden centre area will be compensated by rooftop storage. According to Figure 7 in Novatech's report, only a minimal amount of storage (±5m³) was proposed for existing CB-14 within the garden centre area for a 100-yr storm event. The new controlled roof drains will provide **20.7m³** and **45.6m³** for the 5-yr and 100-yr storm events respectively. New controlled roof drains calculations are shown in **Appendix B**. The new roof drains will also attenuate the peak flows, which will greatly reduce the amount of flow reaching existing MH-15A. The following table illustrates the significant improvement in terms of storage and peak flow between existing and proposed conditions.

Table 2 : Comparison Between Existing and Proposed Storage & Peak Flows

	Existing Condition*	Proposed Expansion
Garden Centre Area/Building Expansion – 5-yr Storage	n/a	20.7 m³
Garden Centre Area/Building Expansion – 100-yr Storage	± 5 m³	45.6 m³
5-yr Peak Flow at MH-15A	69.73 L/s	30.01 L/s
5-yr Pipe Capacity between MH-15A and CBMH-13	95% Full	41% Full

**Values taken from Novatech's report*

As shown in the previous table, the future conditions represent a significant improvement from the existing conditions and pipe capacity issues within the subject site will be mitigated due to the additional storage provided on the new building roof. Storm sewer design sheets are shown in **Appendix A**.

The remainder of the site will stay to existing conditions. As mentioned earlier, existing underground storm chambers located at the south-west end of the parking lot provide storage for minor rainfall events (5-yr and under) while additional storage is provided on the parking lot surface for events greater than the 5-yr storm event. Site discharge is controlled by an ICD diamond shape orifice 180mm x 180mm located in existing MH-16. A flap gate was also installed on the 300mm storm sewer pipe that outlet the site to prevent overflow from municipal storm sewer on site, see **Drawing C102** for more details. Stormwater quality control for this site is achieved via the existing Kennedy Burnett storm sewer management pond, therefore no additional treatment is required.

6.0 STORM SEWERS AND SWM SYSTEM

An existing storm sewer at the south side of the building needs to be removed due to the new building footprint. A new swale with a perforated subdrain on the south side of the new building addition will be added as well as a new rear yard catch basin to receive the subdrain and the swale. New storm sewer pipe and a storm sewer maintenance hole will also be added before re-connecting to an existing storm maintenance hole in the parking lot.

As previously mentioned, and existing roof drain connection will need to be removed to accommodate the proposed building expansion. The existing roof drain system will be connected internally to the proposed roof drain connection. The new roof drain connection will provide flow control on the roof and will be connected to an existing storm sewer maintenance hole (ex. MH-15A) in the parking lot. Details about the proposed roof drains are presented in **Appendix B**

Storm sewer pipe sizing is presented in **Appendix A**. Details including pipe lengths, sizes, materials, inverts elevations and structure types are shown on **Drawing C102**.

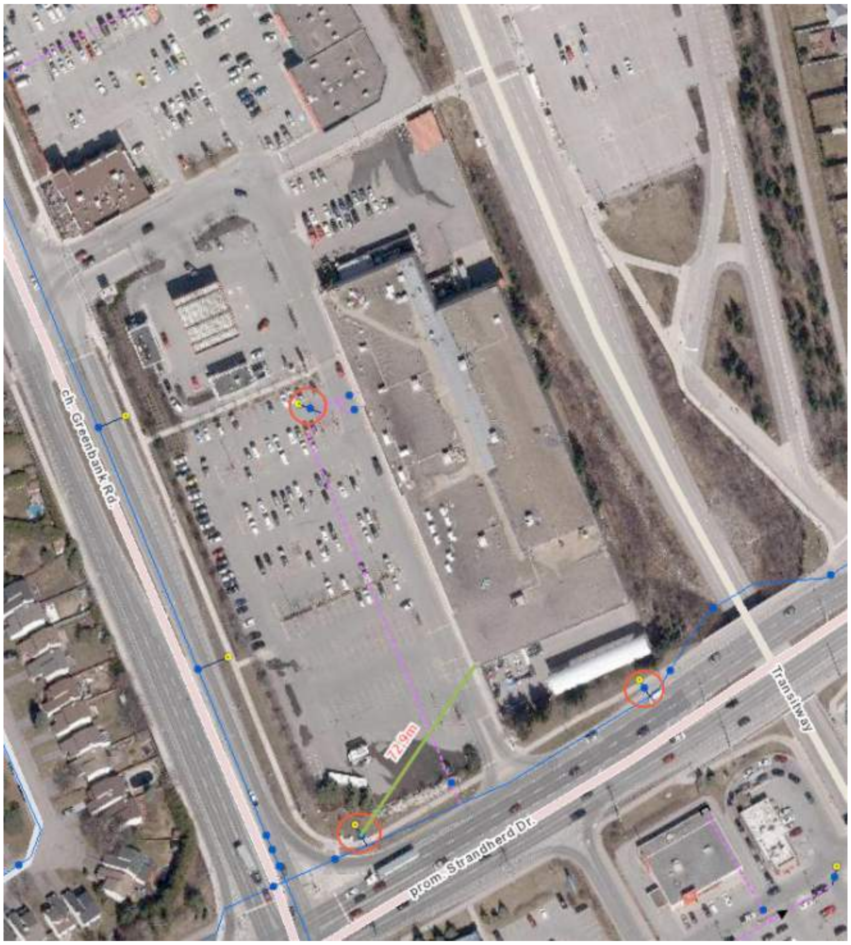
7.0 SANITARY SEWER

The building addition will be serviced internally from the existing building sanitary system. The peak sanitary flow for the building with the addition of the new expansion is calculated to be **1.98 L/s**, including infiltration. The increased sanitary load calculations can be found in **Appendix C**. The assessment of the existing sanitary service connection shows that the capacity is adequate for the expanded building. The Sanitary Sewer Computation Sheet is included in **Appendix A**. Details concerning the existing pipe lengths and locations are shown on the site servicing plan.

8.0 WATER SERVICING

Water servicing and fire protection for the proposed building addition will be provided by the existing building service. The existing 200mm service connection, off the existing 400mm watermain on Standherd Dr. will provide both the domestic and sprinkler demands. The exterior fire protection will be provided by a combination of three existing fire hydrants around the site, all located withing 75m of the buidling as shown on the figure below.

Figure 1 : Fire Hydrant Locations



The water demands for the existing and proposed building are listed in **Table 3**. The fire flow was calculated using the Fire Underwriters Survey (FUS, 2020) method. As the table below indicates, the fire flow demand will remain the same after the proposed store addition and the average daily demand will also remain under 50m^3/day (0.59L/s). Therefore, no modification to the existing on-site water service and exterior fire protection is required. Calculation details can be found in **Appendix C** and the boundary conditions received from the City are shown in **Appendix D**. Details regarding the existing watermain service connection pipe size and location are shown on **Drawing C102.**

Table 3 : Building Water Demands and Fire Flow

	Average Daily Demand (L/s)	Max Daily Demand (L/s)	Peak Hourly Demand (L/s)	Fire Flow Demand (L/s)	Max Daily + Fire Flow Demand (L/s)
Existing Store	0.28	0.42	0.75	150	150.42
Proposed Store	0.31	0.47	0.84	150	150.47

9.0 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

To mitigate the impacts due to erosion and sedimentation during construction, erosion and sediment control measures shall be installed and maintained throughout the duration of construction.

Measures shall only be removed once the construction activities are complete, and the site has stabilized.

The measures will include:

- Siltsack® shall be installed between the frame and cover of existing and new catchbasins and maintenance holes, to minimize sediments entering the storm drainage system.
- Light Duty Silt Fence Barriers placed around the perimeter of the site where necessary, installed and maintained according to OPSS 577 and OPSD 219.110.

10.0 CONCLUSIONS

No additional stormwater management is required for this site as the building expansion does not generate additional runoff. Minimal modifications to the existing storm sewer are required due to the new building footprint. The new roof drains on the building expansion will provide additional storage and will attenuate the peak flows compared to existing condition. The existing underground storm chambers located at the south-west end of the parking will provide storage for minor storm events (5yr and under) while major storm event will pond on the existing parking lot surface. No on-site stormwater treatment is required as the required treatment is achieved via the existing Kennedy Burnett Pond located downstream from our site.

The water servicing of the building addition will be provided from the existing building plumbing system and the existing 200mm service. The proposed building fire flow was estimated at 150 L/s which is the same as the existing building fire flow and the average daily demand is under 50m^3/day. Thus, no modification to the existing water servicing and exterior fire protection is required.

The sanitary servicing of the building addition will be provided from the existing building plumbing system. The peak sanitary flow for the proposed building, including infiltration, is calculated to be 1.98 L/s. The existing building sanitary service connection is adequate to carry the additional sanitary load.

Erosion and sediment control measures will minimize downstream impacts due to construction activities.

We look forward to receiving approval of this brief and the appended plans from the City of Ottawa in order to proceed with construction of the site.

Parsons Inc.

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Reviewed by:

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Mathew

Appendix A : Storm and Sanitary Sewer Computation Forms

STORM SEWER COMPUTATION FORM

Rational Method

Q = 2.78*A*I*R

Q = Flow (L/sec)
A = Area (ha)
I = Rainfall Intensity (mm/h)
R = Ave. Runoff Coefficient

City of Ottawa IDF Curve - 5-y

I_5 = 998.071/(Tc+6.053) ^ 0.814

Minimum Time of Conc. Tc = **10 min**

Manning's n = **0.013**

Drainage Area	From	To	Area	Runoff Parameters					Roof Flow	Peak Flow	Pipe Dia.		Slope	Length	Capacity	Velocity		Time of Flow	Q(d) / Q(f)	REMARKS
			(ha)	Runoff Coeff. R	Indiv. 2.78AR	Accum. 2.78AR	Time of Conc. (min)	Rainfall Intensity (mm/hr)	Q (L/sec)	Q (L/sec)	nom. (mm)	actual (mm)	(%)	(m)	full (L/sec)	full (m/sec)	actual (m/sec)	(min)		
New Swale	RYCB-2	MHST-1	0.075	0.20	0.04	0.04	10.00	104.19		4.34	250	254	2.00	8.6	87.74	1.73	0.80	0.08	0.05	
	MHST-1	*EX MH-15A*	-	-	-	0.04	10.08	103.77		4.34	250	254	2.00	17.6	87.74	1.73	0.80	0.17	0.05	
New + Existing Roof	Roof Connection	*EX MH-15A*	-	-	-	-	-	-	25.72	25.72	300	305	2.00	6.4	142.67	1.96	1.21	0.05	0.18	21 L/s for existing roof. Per Novatech's report p.126
	EX MH-15A	*EX CBMH-13*	-	-	-	0.04	10.25	102.89	25.72	30.01	*300*	*305*	*0.53*	*51.2*	*73.44*	*1.01*	*0.81*	*0.85*	*0.41*	

Note:

Design: B. Villeneuve
Check: M. Theiner

Date: 2023-08--14

Project: Canadian Tire Store # 442
Building Expansion
2501 Greenbank Rd, Nepean, Ontario
Client: Canadian Tire Real Estate

STORM SEWER COMPUTATION FORM

Rational Method

Q = 2.78*A*I*R

Q = Flow (L/sec)
A = Area (ha)
I = Rainfall Intensity (mm/h)
R = Ave. Runoff Coefficient

City of Ottawa IDF Curve - 100-y

I_{100} = 1735.688/(Tc+6.014) ^ 0.820

Minimum Time of Conc. Tc = **10 min**

Manning's n = **0.013**

Drainage Area	**From**	**To**	**Area**	**Runoff Parameters**					**Roof Flow Q**	**Peak Flow Q**	**Pipe Dia.**		**Slope**	**Length**	**Capacity**	**Velocity**		**Time of Flow**	**Q(d) / Q(f)**	**REMARKS**
			(ha)	**Runoff Coeff. R**	**Indiv. 2.78AR**	**Accum. 2.78AR**	**Time of Conc.** (min)	**Rainfall Intensity** (mm/hr)	(L/sec)	(L/sec)	nom. (mm)	actual (mm)	(%)	(m)	full (L/sec)	full (m/sec)	actual (m/sec)	(min)		
New Swale	RYCB-2	MHST-1	0.075	0.25	0.05	0.05	10.00	178.56		9.31	250	254	2.00	8.6	87.74	1.73	0.97	0.08	0.11	
	MHST-1	*EX MH-15A*	-	-	-	0.05	10.08	177.83		9.31	250	254	2.00	17.6	87.74	1.73	0.97	0.17	0.11	
New + Existing Roof	Roof Connection	*EX MH-15A*	-	-	-	-	-	-	31.14	31.14	300	305	2.00	6.4	142.67	1.96	1.31	0.05	0.22	25 L/s for existing roof. Estimate based on existing Stage-Discharge Curv
	EX MH-15A	*EX CBMH-13*	-	-	-	0.05	10.25	176.31	31.14	40.33	*300*	*305*	*0.53*	*51.2*	*73.443*	*1.0065*	*0.87569*	*0.85*	*0.55*	

Note:

Design: B. Villeneuve
Check: M. Theiner

Date: 2023-08--14

Project: Canadian Tire Store # 442
Building Expansion
2501 Greenbank Rd, Nepean, Ontario
Client: Canadian Tire Real Estate

SANITARY SEWER DESIGN SHEET

Drainage Area	From	To	Peak Flow Q (L/sec)	Sewer Data										REMARKS
				Type of Pipe	Pipe Dia.		Slope	Length	Capacity	Velocity		Time of Flow	Q(d) / Q(f)	
					nom. (mm)	actual (mm)	(%)	(m)	full (L/sec)	full (m/sec)	actual (m/sec)	(min)		
	CTC Site	*Public San Sewer*	1.98	PVC	200	203.2	0.5	150.0	24.2	0.75	0.40	6.21	0.08	

Manning's n = **0.013**

Design:	B. Villeneuve	**Project Name:**	Barrhaven Canadian Tire
Check:	M. Theiner	**Parsons Project #:**	478461
Date:	March, 2023	**Client:**	Canadian Tire Realty
		Client Project #:	

Appendix B : Roof Drains Calculations and Specifications

Table 1 - Storage Volumes (5-Year and 100-Year Storm Events)

Storage Requirement for New Roof Area

C_{AVG} = 0.90 (2-year)
C_{AVG} = 1.00 (100-year)
Time Interval = 5 (mins)
Drainage Area = 0.040 (hectares) per drain
400 (sqm)

Zurn Z105 Control-Flo Single Notch
Number of Drains = 3
Total Release Rate 5 year = **4.72 L/s**
Total Release Rate 100 year = **6.14 L/s**

Release Rate = **1.57** (L/sec) per drain
Return Period = 5 (years)
IDF Parameters, A = 998.071 , B = 0.814
$I = A/(T_c+6.199)$^B

Release Rate = **2.05** (L/sec) per drain
Return Period = 100 (years)
IDF Parameters, A = 1735.688 , B = 0.820
$I = A/(T_c+6.014)$^B

Duration (min)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	-	-	-	-	-	-	-	-	-	-
5	141.2	14.1	1.6	12.6	3.8	242.7	27.0	2.0	24.9	7.5
10	104.2	10.4	1.6	8.9	5.3	178.6	19.9	2.0	17.8	10.7
15	83.6	8.4	1.6	6.8	6.1	142.9	15.9	2.0	13.8	12.5
20	70.3	7.0	1.6	5.5	6.5	120.0	13.3	2.0	11.3	13.5
25	60.9	6.1	1.6	4.5	6.8	103.8	11.5	2.0	9.5	14.2
30	53.9	5.4	1.6	3.8	6.9	91.9	10.2	2.0	8.2	14.7
35	48.5	4.9	1.6	3.3	6.9	82.6	9.2	2.0	7.1	15.0
40	44.2	4.4	1.6	2.8	6.8	75.1	8.4	2.0	6.3	15.1
45	40.6	4.1	1.6	2.5	6.7	69.1	7.7	2.0	5.6	15.2
50	37.7	3.8	1.6	2.2	6.6	64.0	7.1	2.0	5.1	15.2
55	35.1	3.5	1.6	1.9	6.4	59.6	6.6	2.0	4.6	15.1
60	32.9	3.3	1.6	1.7	6.2	55.9	6.2	2.0	4.2	15.0
65	31.0	3.1	1.6	1.5	6.0	52.6	5.9	2.0	3.8	14.8
70	29.4	2.9	1.6	1.4	5.7	49.8	5.5	2.0	3.5	14.7
75	27.9	2.8	1.6	1.2	5.5	47.3	5.3	2.0	3.2	14.4
80	26.6	2.7	1.6	1.1	5.2	45.0	5.0	2.0	3.0	14.2
85	25.4	2.5	1.6	1.0	4.9	43.0	4.8	2.0	2.7	13.9
90	24.3	2.4	1.6	0.9	4.6	41.1	4.6	2.0	2.5	13.6
95	23.3	2.3	1.6	0.8	4.3	39.4	4.4	2.0	2.3	13.3
100	22.4	2.2	1.6	0.7	4.0	37.9	4.2	2.0	2.2	13.0
105	21.6	2.2	1.6	0.6	3.7	36.5	4.1	2.0	2.0	12.7
110	20.8	2.1	1.6	0.5	3.4	35.2	3.9	2.0	1.9	12.3
115	20.1	2.0	1.6	0.4	3.0	34.0	3.8	2.0	1.7	12.0
120	19.5	1.9	1.6	0.4	2.7	32.9	3.7	2.0	1.6	11.6
Max Storage (m^3) per drain=					**6.9**					**15.2**
Average Ponding Depth (mm)					**17.2**					**38.0**
Maximum Ponding Depth (mm)					**105.2**					**136.9**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I_5 = A/(Tc+6.053)^B$ & $I_{100} = A/(Tc+6.014)^B$
3) Release Rate = LESSER of Min (Release Rate, Peak Flow) - Minus 100 Year Flow Of Uncontroled Areas OR Pipe Outlet Capacity
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration

ZURN CANADA

SPECIFICATION DRAINAGE

Control-Flo
Roof Drainage System

www.zurn.com

Control-Flo...Today’s Successful Answer to More

THE ZURN “CONTROL-FLO CONCEPT”

Originally, Zurn introduced the scientifically-advanced “Control-Flo” drainage principle for dead-level roofs. Today, after thousands of successful applications in modern, large dead-level roof areas, Zurn engineers have adapted the comprehensive “Control-Flo” data to **sloped roof** areas.

WHAT IS “CONTROL-FLO”?

It is an advanced method of removing rain water off dead-level or sloped roofs. As contrasted with conventional drainage practices, which attempt to drain off storm water as quickly as it falls on the roof’s surface, “Control-Flo” drains the roof at a controlled rate. Excess water accumulates on the roof under controlled conditions...then drains off at a lower rate after a storm abates.

CUTS DRAINAGE COSTS

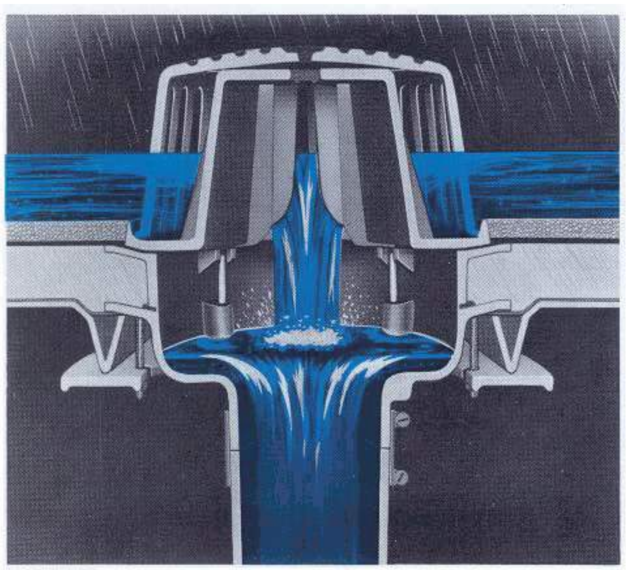
Fewer roof drains, smaller diameter piping, smaller sewer sizes, and lower installation costs are possible with a “Control-Flo” drainage system because roof areas are utilized as temporary storage reservoirs.

REDUCES PROBABILITY OF STORM DAMAGE

Lightens load on combination sewers by reducing rate of water drained from roof tops during severe storms thereby reducing probability of flooded sewers, and consequent backflow into basements and other low areas.

THANKS TO EXCLUSIVE ZURN “AQUA-WEIR” ACTION

Key to successful “Control-Flo” drainage is a unique scientifically-designed weir containing accurately calibrated notches with sides formed by parabolic curves which provide flow rates directly proportional to the head. Shape and size of notches are based on predetermined flow rates, and all factors involved in roof drainage to assure permanent regulation of drainage flow rates for specific geographic locations and rainfall intensities.

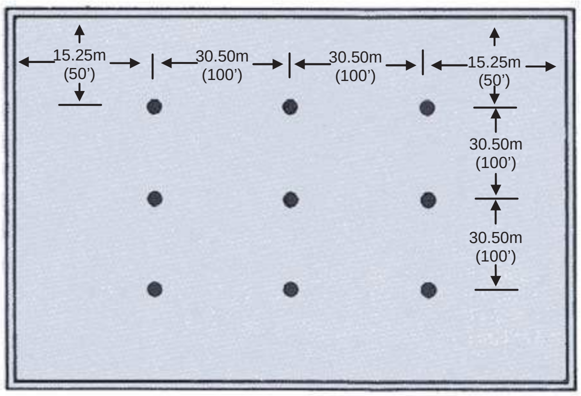


DEFINITION

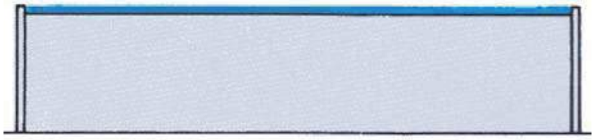
DEAD LEVEL ROOFS

DIAGRAM “A”

A dead-level roof for purposes of applying the Zurn “Control-Flo” drainage principle is one which has been designed for zero slope across its entire surface. Measurements shown are for maximum distances.



(Plan View)



(Section View)

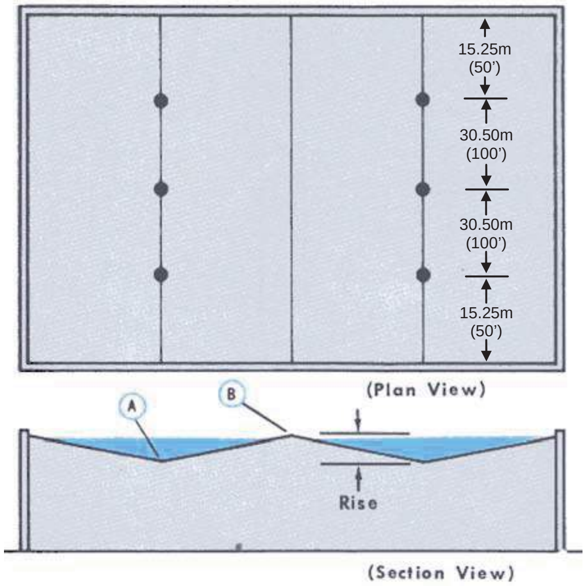
SLOPED ROOFS

DIAGRAM “B”

A sloped roof is one designed commonly with a shallow slope. The Zurn “Control-Flo” drainage system can be applied to any slope which results in a total rise up to 152mm (6”).

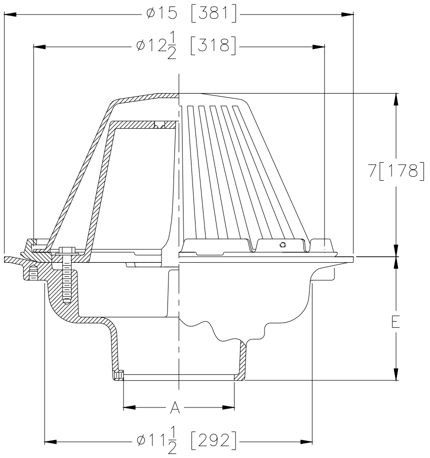
The total rise of a roof as calculated for “Control-Flo” application is defined as the vertical increase in height in inches, from the low point or valley of a sloping roof (A) to the top of the sloping section (B). (Example: a roof that slopes 3mm (1/8”) per foot having a 7.25m (24’) span would have a rise of 7.25m x 3mm or 76mm (24’ x 1/8” or 3”)).

Measurements shown are for maximum distances.



Economical Roof Drainage Installations

SPECIFICATION DATA



ENGINEERING SPECIFICATION: ZURN Z-105 "Control-Flo" roof drain for dead -level or sloped roof construction, Dura-Coated cast iron body. "Control-Flo" weir shall be linear functioning with integral membrane flashing clamp/ gravel guard and Poly-Dome. All data shall be verified proportional to flow rates.

ROOF DESIGN RECOMMENDATIONS

Basic roofing design should incorporate protection that will prevent roof overloading by installing adequate over-flow scuppers in parapet walls.

GENERAL INFORMATION

The “Control-Flo” roof drainage data is tabulated for four areas (232.25m^2 (2500 sq. ft.), 464.502m^2 (5000 sq. ft.), 696.75m^2 (7500 sq. ft.), 929m^2 (10,000 sq. ft.) notch areas ratings) for each locality. For each notch area rating the maximum discharge in L.P.M. (G.P.M.) - draindown in hours, and maximum water depth at the drain in inches for a dead level roof — 51mm (2 inch) rise — 102mm (4 inch) rise and 152mm (6 inch) rise—are tabulated. The rise is the total change in elevation from the valley to the peak. Values for areas, rise or combination thereof other than those listed, can be arrived at by extrapolation. All data listed is based on the fifty-year return frequency storm. In other words the maximum conditions as listed will occur on the average of once every fifty years.

NOTE: The tabulated “Control-Flo” data enables the individual engineer to select his own design limiting condition. The limiting condition can be draindown time, roof load factor, or maximum water depth at the drain. If draindown time is the limiting factor because of possible freezing conditions, it must be recognized that the maximum time listed will occur on the average of once every 50 years and would most likely be during a heavy summer thunder storm. Average winter draindown times would be much shorter in duration than those listed.

GENERAL RECOMMENDATIONS

On sloping roofs, we recommend a design depth referred to as an equivalent depth. An equivalent depth is the depth of water attained at the drains that results in the same roof stresses as those realized on a dead-level roof. In all cases this equivalent depth is almost equal to that attained by using the same notch area rating for the different rises to 152mm (6”). With the same depth of water at the drain the roof stresses will decrease with increasing total rise. Therefore, it would be possible to have a depth in excess of 152mm (6”) at the drain on a sloping roof without exceeding stresses normally encountered in a 152mm (6”) depth on a dead-level roof. However, it is recommended that scuppers be placed to limit the maximum water depth on any roof to 152mm (6”) to prevent the overflow of the weirs on the drains and consequent overloading of drain piping. In the few cases where the data shows a flow rate in excess of 136 L.P.M. (30 G.P.M.) if all drains and drain lines are sized according to recommendations, and the one storm in fifty years occurs, the only consequence will be a brief flow through the scuppers or over-flow drains.

NOTE: An equivalent depth is that depth of water attained at the drains at the lowest line or valley of the roof with all other conditions such as notch area and rainfall intensity being equal. For Toronto, Ontario a notch area rating of 464.50m^2 (5,000 sq. ft.) results in a 74mm (2.9 inch) depth on a dead level roof for a 50-year storm. For the same notch area and conditions, equivalent depths for a 51mm (2”), 102mm (4”) and 152mm (6”) rise respectively on a sloped roof would be 86mm (3.4”), 104mm (4.1”) and 124mm (4.9”). Roof stresses will be approximately equal in all cases.

Control-Flo Drain Selection Is Quick and Easy...

The exclusive Zurn “Selecta-Drain” Chart (pages 8—11) tabulates selection data for 34 localities in Canada. Proper use of this chart constitutes your best assurance of sure, safe, economical application of Zurn “Control-Flo” systems for your specific geographical area. If the “Selecta-Drain Chart does not cover your specific design criteria, contact Zurn Industries Limited, Mississauga, Ontario, for additional data for your locality. Listed below is additional information pertinent to proper engineering of the “Control-Flo” system.

ROOF USED AS TEMPORARY RETENTION

The key to economical “Control-Flo” is the utilization of large roof areas to temporarily store the maximum amount of water without overloading average roofs or creating excessive draindown time during periods of heavy rainfall. The data shown in the “Selecta-Drain” Chart enables the engineer to select notch area ratings from 232.25 m^2 (2,500 ft.^{2}) to 929m^2 (10,000 ft.^{2}) and to accurately predict all other design factors such as maximum roof load, L.P.M. (G.P.M.) discharge, draindown time and water depth at the drain. Obviously, as design factors permit the notch area rating to increase the resulting money saved in being able to use small leaders and drain lines will also increase.

ROOF LOADING AND RUN-OFF RATES

The four values listed in the “Selecta-Drain” Chart for notch area ratings for different localities will normally span the range of good design. If areas per notch below 232.25m^2 (2,500 ft.^{2}) are used considerable economy of the “Control-Flo” concept is being lost. The area per notch is limited to 929m^2 (10,000 ft.^{2}) to keep the draindown time within reasonable limits. Extensive studies show that stresses due to water load on a sloping roof for any fixed set of conditions are very nearly the same as those on a dead-level roof. A sloping roof tends to concentrate more water in the valleys and increase the water depth at this point. The greater depth around the drain leads to a faster run-off rate, particularly a faster early run -off rate. As a result, the total volume of water stored on the roof is less, and the total load on the sloping roof is less. By using the same area on the sloping roof as on the dead-level roof the increase in roof stresses due to increased water depth in the valleys is offset by the decrease in the total load due to less water stored. The net result of the maximum roof stress is approximately the same for any single span rise and fixed set of conditions. A fixed set of conditions, would be the same notch area, the same frequency store, and the same locality.

SPECIAL CONSIDERATIONS FOR STRUCTURAL SAFETY: Normal practice of roof design is based on 18kg (40 lbs.) per 929 cm^2 (sq ft.). (Subject to local codes and by-laws.) Thus it is extremely important that design is in accordance with normal load factors so deflection will be slight enough in any bay to prevent progressive deflection which could cause water depths to load the roof beyond its design limits.

ADDITIONAL NOTCH RATINGS

The ‘Selecta-Drain” Chart along with Tables I and II enables the engineer to select “Control-Flo” Drains and drain pipe sizes for most Canadian applications. These calculations are computed for a proportional flow weir that is sized to give a flow of 23 L.P.M. (5 G.P.M.) per inch of head. The 23 L.P.M. (5 G.P.M.) per inch of head notch opening is selected as the bases of design as it offers the most economical installation as applied to actual rainfall experienced in Canada.
Should you require design criteria for locations outside of Canada or for special project applications please contact Zurn Industries Limited, Mississauga, Ontario.

LEADER AND DRAIN PIPE SIZING

Since all data in the “Selecta-Drain” Chart is based on the 50-year-storm it is possible to exceed the water depth listed in these charts if a 100-year or 1000-year storm would occur. Therefore, for good design it is recommended that scuppers or other methods be used to limit water depth to the design depth and tables I and II be used to size the leaders and drain pipes. If the roof is capable of supporting more water than the design depth it is permissible to locate the scuppers or other overflow means at a height that will allow a greater water depth on the roof. However, in this case the leader and drain pipes should be sized to handle the higher flow rates possible based on a flow rate of 23 L.P.M. (5 G.P.M.) per inch of depth at the drain.

PROPER DRAIN LOCATION

The following good design practice is recommended for selecting the proper number of “Control-Flo” drains for a given area. **On dead-level roofs**, drains should be located no further than 15.25m (50 feet) from edge of roof and no further than 30.50m (100 feet) between drains. See diagram “A” page 2. **On sloping roofs**, drains should be located in the valleys at a distance no greater than 15.25m (50 feet) from each end of the valleys and no further than 30.50m (100 feet) between drains. See diagram “B” page 2. Compliance with these recommendations will assure good run off regardless of wind direction.

Saves Specification Time, Assures Proper Application

QUICK, EASY SELECTION

Using the "Selecta-Drain" Chart (pages 9—13) in combination with the steps and examples appearing below, should save you countless hours in engineering specification time. This vast compilation of data is related to the proper selection of drains for 34 cities. All cities in alphabetical order by province. If a specific city does not appear in the tabulation, chooses the city nearest your area and select the proper drain using these factors.

3 EASY STEPS…

AND 3 TYPICAL EXAMPLES FOR APPLICATION OF SURE, SCIENTIFIC CONTROL OF DRAINAGE FROM DEAD-LEVEL AND SLOPING ROOFS WITH THE ZURN CONCEPT.

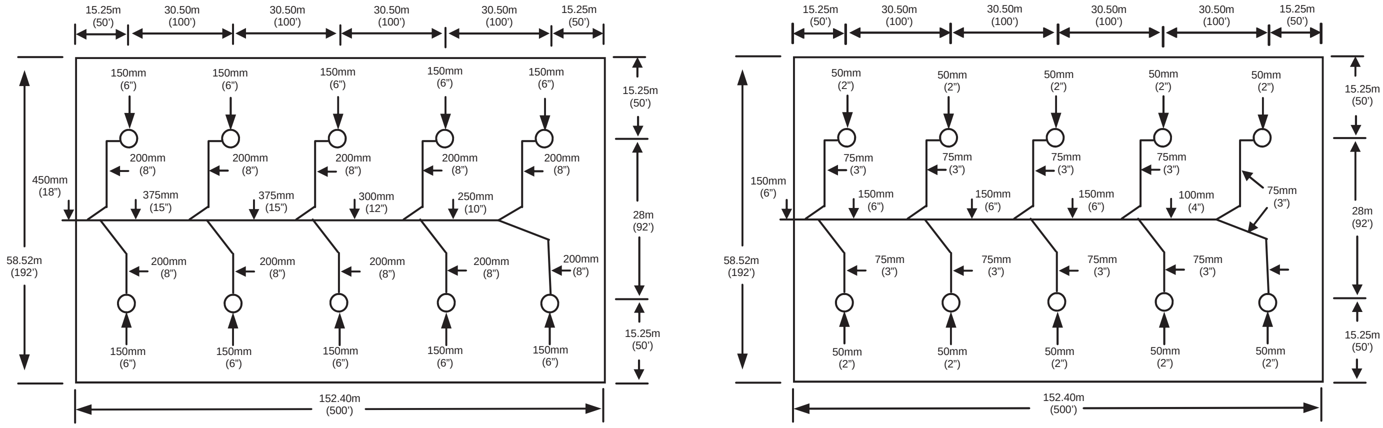
NOTE: Where roof area to be drained is adjacent to one or more vertical walls projecting above the roof, then a percentage of the of the wall(s) must be added to the roof area in determining total roof area to be drained.

TORONTO, ONTARIO		DEAD-LEVEL ROOF	102mm (4 INCH) SLOPE	152mm (6 INCH) SLOPE
1	Determine total roof area or individual areas when roof is divided by expansion joints or peaks in the case of sloping roof.	Roof Area: 56.52m x 152.40m = 8918.40m^2 (192ft x 500ft = 96,000 sq. ft.) (See Z105 layout bottom of this page.)	3 Individual Roof Areas: 19.50m x 152.40m = 2972.80m^2 (64ft x 500ft = 32,000 sq. ft.) Valleys 152.40m (500ft) long 3 x 2972.80 = 8918.40m^2 (3 x 32,000 = 96,000 sq. ft.)	2 Individual Roof Areas: 29.87m x 152.40m = 4552m^2 (98ft x 500ft = 49,000 sq. ft.) Valleys 152.40m (500ft) long 2 x 4552 = 9104m^2 (2 x 49,000 = 98,000 sq. ft.)
2	Divide roof area or individual areas by Zurn Notch Area Rating selected to obtain the total number of notches required.	Zurn Notch Area Rating selected for Toronto = 464.50m^2 (5,000 sq. ft.) from "Selecta-Drain Chart, page 11. Total Roof Area = 8918.40m^2 (96,000 sq. ft.) Entire roof. 464.50m^2 (5,000 sq. ft.) notch area = 19.2 notches—USE 20.	Zurn Notch Area Rating selected for Toronto = 464.50m^2 (5,000 sq. ft.) from "Selecta-Drain Chart, page 11. Total Roof Area = 2972.80m^2 (32,000 sq. ft.) Each area. 464.50m^2 (5,000 sq. ft.) notch area = 6.4 notches—USE 7 PER AREA.	Zurn Notch Area Rating selected for Toronto = 464.50m^2 (5,000 sq. ft.) from "Selecta-Drain Chart, page 11. Total Roof Area = 4552m^2 (49,000 sq. ft.) Each area. 464.50m^2 (5,000 sq. ft.) notch area = 9.8 notches—USE 10 PER AREA.
3	Determine total number of drains required by not exceeding maximum spacing dimensions in the preceding instructions. See Diagrams "A" or "B", page 2. Divide total number of notches required to determine the number of notches per drain. Note maximum water depth at drain and use this dimension to determine scupper height. Maximum scupper height to be used is 152mm (6"). *Use this flow rate to size leaders and drain lines.*	*10 drains required. All drains must have two notches each for a total of 20 notches. Flow rate is 66 L.P.M. (14.5 G.P.M.) per notch. Size leaders for 2 notch weirs for a flow rate of 66 L.P.M. (14.5 G.P.M.) 50 mm (two inch) pipe size leaders required. Maximum water depth and scupper height is 74mm (2.9"). Requires 19 hours draindown time maximum. For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7.	**5 drains per area required located in the valleys 15.25m (50ft.) from each end with 3 in the middle at 30.50m (100ft.) spacings. Two drains on ends with two notches—3 drains in middle on notch each for a total of 7 notches. Maximum flow rate 93 L.P.M. (20.5 G.P.M.) per notch. Leader size 50mm (2") for single notch weirs—75mm (3") notch weirs. Maximum water depth and scupper height is 104mm (4.1"). Requires 11 hours draindown time maximum. For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7.	**5 drains per area required located in the valleys 15.25m (50ft.) from each end with 3 in the middle at 30.50m (100ft.) spacing in the middle. 10 notches are required therefore all drains must have two notches. Flow rate is 111 L.P.M. (24.5 G.P.M.) per notch. Size all leaders for 2 notch weirs. 75mm (3") pipe size required. Maximum water depth and scupper height is 124mm (4.9"). Requires 9 hours draindown time maximum. For drain, vertical and horizontal pipe sizing data see Tables I and II on page 6 and 7.

*See Diagram "A" page 2 for recommended drain placement.
**See Diagram "B" page 2 for recommended drain placement.

DEAD LEVEL ROOF

6mm (1/4") PER FT. SLOPE STORM DRAIN



CONVENTIONAL — "UNCONTROLLED" — RUN OFF

"CONTROL-FLO" — RUN OFF

Select The Proper Vertical Drain Leaders

ROOF DRAINAGE DATA

The flow rate for any design condition can be easily read from the data contained on the following pages; the tabulations shown below (and on the opposite page) can be used to simplify selection of drain line sizes.

TABLE 1 - SUGGESTED RELATION OF DRAIN OUTLET AND VERTICAL LEADER SIZE TO ZURN CONTROL-FLO ROOF DRAINS (BASED ON NATIONAL PLUMBING CODE ASA -A40.8 DATA ON VERTICAL LEADERS).

No. of Notches in Drain	**Max. Flow per Notch in L.P.M. (G.P.M.)**		
	Pipe Size		
	50mm (2”)	75mm (3”)	100mm (4”)
1	136* (30*)	—	—
2	68 (15)	136* (30*)	—
3	45 (10)	136* (30*)	—
4	—	105 (23)	136* (30*)
5	—	82 (18)	136* (30*)
6	—	68 (15)	136* (30*)

*Maximum flow obtainable from 1 notch with 152mm (6”) water depth at drain.

Table 1 should be used to select **vertical drain** leaders which at the same time establishes the drain outlet size. This table illustrates the minimum flow per notch in L.P.M. (G.P.M.) Since the Z-105 drain is available with a minimum of one and a maximum of six notches, calculations have already been a made and are listed in this table for any quantity of weir notch openings established in your design. It was determined ten drains with two notches each weir would be required in the Dead-Level Roof example on page 5. A 66 L.P.M. (14.5 G.P.M.) discharge per notch flow rate was also established.

Once this design criteria has been determined it will be the key to the proper selection of all drain outlet sizes, vertical and horizontal storm drain sizes in Table I and II. Enter the column “Number of Notches in Drain”, Table I, read down the column to the figure 2 which indicates two notches in weir, then read across until you reach a figure equal to or closest figure in excess of 66 L.P.M. (14.5 G.P.M.) You will find fifteen in the column under 50mm (2”) which represents the pipe size. Therefore all drain outlets and vertical leaders are 50mm (2”) size.

Let us digress for a moment assuming a specific structure requires a total of six drains each containing a weir with a different number of notches. One with 1, one with 2, etc. Table 1 discloses the pipe size for one notch is 50mm (2”), two notch is 50mm (2”), three notch is 75mm (3”), four notch is 75mm (3”), five notch is 75mm (3”) and six notch is 75mm (3”) as they all equal or closely exceed the 66 L.P.M. (14.5 G.P.M.) design.

NOTE: Although pipe size calculations should be based on accumulated flow rate, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

TABLE II should be used to select **horizontal** storm drain piping. Use the same flow rate 66 L.P.M. (14.5 G.P.M.) used to establish the vertical leaders to size the storm drainage system and main storm drain. Let us assume the ten drains each with two notch weirs were actually on the roof in two separate lines of five drains each and joined at a common point before leaving the building. Since Table II includes 3mm (1/8”), 6mm (1/4”) and 13mm (1/2”) per foot slope, let **us use 6mm (1/4”) as our basis for selection** which will take us to the centre section. Starting with the first of five drains we enter the extreme left column in Table II and read down to the figure 2 since this drain has two notches in weir, read across horizontally and the size of first section of horizontal storm drain is 75mm (3”) between 1st and 2nd drain, return to left hand column proceed reading down until you reach figure 4 then read across horizontally and the pipe size will be 100mm (4”) between 2nd and 3rd drain, 100mm (4”) between 3rd and 4th and 125mm (5”) (if available) between 4th and 5th. If not available use 150mm (6”). (You may be tempted to use 100mm (4”) since the capacity is close. We recommend you go to the larger size.) Pipe size leaving 5th drain would be 150mm (6”). The same sizing would hold true for the second line of five drains. Since both columns of five drains each are being joined together before leaving the building there will be total of twenty notches discharging into the main building storm sewer. Enter left hand column Table II, read down until you reach the figure twenty, then read across horizontally to the 6mm (1/4”) per 305mm (1’) slope column and you will see a 150mm (6”) storm drain will handle the job adequately. The same procedure should be followed for sloped roof installations. The above method of sizing was done to better acquaint you with Table II and its use. The more economical and practical way of laying out and installing this same job is illustrated in the control-flo layout shown on bottom of page 5.

NOTE: Although pipe size calculations should be based on accumulated flow rates, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

Select Proper Horizontal Storm Drain Piping

Table II — SUGGESTED RELATION OF HORIZONTAL STORM DRAIN SIZE TO ZURN CONTROL-FLO ROOF DRAINAGE

Total No. of Notches Discharging to Storm Drain	MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.)								MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.)							MAX. FLOW PER NOTCH IN L.P.M. (G.P.M.)						
	Storm Drain Size 3mm (1/8”) per 305mm (1’) Slope								Storm Drain Size 6mm (1/4”) per 305mm (1’) Slope							Storm Drain Size 13mm (1/2”) per 305mm (1’) Slope						
	75 (3”)	100 (4”)	125 (5”)	150 (6”)	200 (8”)	250 (10”)	300 (12”)	375 (15”)	75 (3”)	100 (4”)	125 (5”)	150 (6”)	200 (8”)	250 (10”)	300 (12”)	75 (3”)	100 (4”)	125 (5”)	150 (6”)	200 (8”)	250 (10”)	300 (12”)
1	136* (30*)	—	—	—	—	—	—	—	136* (30*)	—	—	—	—	—	—	136* (30*)	—	—	—	—	—	—
2	77 (17)	136* (30*)	—	—	—	—	—	—	109 (24)	136* (30*)	—	—	—	—	—	136* (30*)	—	—	—	—	—	—
3	50 (11)	118 (26)	136* (30*)	—	—	—	—	—	73 (16)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	—
4	36 (8)	86 (19)	136* (30*)	—	—	—	—	—	55 (12)	127 (28)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—	—	—	—	—
5	—	65 (15)	127* (28*)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	59 (13)	136* (30*)	—	—	—	—	—
6	—	59 (13)	105 (23)	136* (30*)	—	—	—	—	—	82 (18)	136* (30*)	—	—	—	—	50 (11)	118 (26)	136* (30*)	—	—	—	—
7	—	50 (11)	91 (20)	136* (30*)	—	—	—	—	—	73 (16)	127 (28)	136* (30*)	—	—	—	—	100 (22)	136* (30*)	—	—	—	—
8	—	—	77 (17)	127 (28)	136* (30*)	—	—	—	—	64 (14)	114 (25)	136* (30*)	—	—	—	—	86 (19)	136* (30*)	—	—	—	—
9	—	—	68 (15)	114 (25)	136* (30*)	—	—	—	—	55 (12)	100 (22)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—	—	—	—
10	—	—	64 (14)	100 (22)	136* (30*)	—	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	68 (15)	123 (27)	136* (30*)	—	—	—
11	—	—	55 (12)	91 (20)	136* (30*)	—	—	—	—	—	82 (18)	132 (29)	136* (30*)	—	—	—	64 (14)	114 (25)	136* (30*)	—	—	—
12	—	—	—	82 (18)	136* (30*)	—	—	—	—	—	73 (16)	118 (26)	136* (30*)	—	—	—	59 (13)	105 (23)	136* (30*)	—	—	—
13	—	—	—	77 (17)	136* (30*)	—	—	—	—	—	68 (15)	109 (24)	136* (30*)	—	—	—	55 (12)	95 (21)	136* (30*)	—	—	—
14	—	—	—	73 (16)	136* (30*)	—	—	—	—	—	64 (14)	100 (22)	136* (30*)	—	—	—	—	86 (19)	136* (30*)	—	—	—
15	—	—	—	68 (15)	136* (30*)	—	—	—	—	—	59 (13)	95 (21)	136* (30*)	—	—	—	—	82 (18)	132 (29)	136* (30*)	—	—
16	—	—	—	64 (14)	136* (30*)	—	—	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	77 (17)	123 (27)	136* (30*)	—	—
17	—	—	—	59 (13)	127 (28)	136* (30*)	—	—	—	—	—	82 (18)	136* (30*)	—	—	—	—	73 (16)	118 (26)	136* (30*)	—	—
18	—	—	—	55 (12)	118 (26)	136* (30*)	—	—	—	—	—	77 (17)	136* (30*)	—	—	—	—	68 (15)	109 (24)	136* (30*)	—	—
19	—	—	—	—	114 (25)	136* (30*)	—	—	—	—	—	73 (16)	136* (30*)	—	—	—	—	64 (14)	105 (23)	136* (30*)	—	—
20	—	—	—	—	109 (24)	136* (30*)	—	—	—	—	—	68 (15)	136* (30*)	—	—	—	—	59 (13)	100 (22)	136* (30*)	—	—
23	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	—	64 (14)	132 (29)	136* (30*)	—	—	—	55 (12)	86 (19)	136* (30*)	—	—
25	—	—	—	—	86 (19)	136* (30*)	—	—	—	—	—	59 (13)	123 (27)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—	—
30	—	—	—	—	73 (16)	127 (28)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	64 (14)	136* (30*)	—	—
35	—	—	—	—	59 (13)	109 (24)	136* (30*)	—	—	—	—	—	86 (19)	136* (30*)	—	—	—	—	55 (12)	123 (27)	136* (30*)	—
40	—	—	—	—	55 (12)	95 (21)	136* (30*)	—	—	—	—	—	77 (17)	136* (30*)	—	—	—	—	—	105 (23)	136* (30*)	—
45	—	—	—	—	—	86 (19)	136* (30*)	—	—	—	—	—	68 (15)	123 (27)	136* (30*)	—	—	—	—	95 (21)	136* (30*)	—
50	—	—	—	—	—	77 (17)	123 (27)	136* (30*)	—	—	—	—	59 (13)	109 (24)	136* (30*)	—	—	—	—	86 (19)	136* (30*)	—
55	—	—	—	—	—	68 (15)	114 (25)	136* (30*)	—	—	—	—	—	100 (22)	136* (30*)	—	—	—	—	77 (17)	136* (30*)	—
60	—	—	—	—	—	64 (14)	105 (23)	136* (30*)	—	—	—	—	—	91 (20)	136* (30*)	—	—	—	—	68 (15)	127 (28)	136* (30*)
65	—	—	—	—	—	59 (13)	95 (21)	136* (30*)	—	—	—	—	—	82 (18)	136* (30*)	—	—	—	—	64 (14)	118 (26)	136* (30*)
70	—	—	—	—	—	55 (12)	91 (20)	136* (30*)	—	—	—	—	—	77 (17)	127 (28)	—	—	—	—	59 (13)	109 (24)	136* (30*)

*Maximum flow obtainable from 1 notch with 152mm (6”) water depth at drain.

TABLE III - TO BE USED WHEN ROOF STORM WATER RUN OFF AND OTHER SURFACE WATER RUN OFF IS BEING CONSOLIDATED INTO ONE COMMON MAIN HORIZONTAL STORM SEWER.

Flow capacity of vertical leaders litres per minute (gallons per minute)

Pipe Size	Maximum Capacity L.P.M. (G.P.M.)
50mm (2”)	136 (30)
75mm (3”)	409 (90)
100mm (4”)	864 (190)
†125mm (5”)	1582 (348)
150mm (6”)	2550 (561)

†In some areas 125mm (5”) drainage pipe may not be available.

Flow capacity of horizontal storm sewers litres per minute (gallons per minute).

Pipe Size	Slope per 305mm (1’0”)		
	3mm (1/8”)	6mm (1/4”)	13mm (1/2”)
75mm (3”)	163 (36)	232 (51)	327 (72)
100mm (4”)	355 (78)	505 (111)	714 (157)
†125mm (5”)	646 (142)	914 (201)	1291 (284)
150mm (6”)	1050 (231)	1487 (327)	2100 (462)
200mm (8”)	2264 (498)	3205 (705)	4528 (996)
250mm (10”)	4100 (902)	5796 (1275)	8201 (1804)
300mm (12”)	6669 (1467)	9437 (2076)	13338 (2934)
375mm (15”)	12120 (2666)	17157 (3774)	24239 (5332)

Note: Although pipe size calculations should be based on accumulated flow rate, local by-laws should be referred to for minimum pipe size requirements and roof drain spacing.

SCUPPER AND OVERFLOW DRAINS

Roofing members and understructures, weakened by seepage and rot resulting from improper drainage and roof construction can give away under the weight of rapidly accumulated water during flash storms. Thus, it is recommended, and often required by building codes, to install scuppers and overflow drains in parapet-type roofs. Properly selected and sized scuppers and overflow drains are vital to a well-engineered drainage system to prevent excessive loading, erosion, seepage and rotting.

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2”) RISE			102mm (4”) RISE			152mm (6”) RISE		
			L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Calgary, Alberta	232 (2,500)	4.7 (10.4)	45.5 (10)	**7**	51 (2)	57 (12.5)	**6**	63.5 (2.5)	72.5 (16)	**4**	81.5 (3.2)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	66 (14.5)	**14**	73.5 (2.9)	82 (18)	**9**	91.5 (3.6)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**28**	68.5 (2.7)	72.5 (16)	**22**	81.5 (3.2)	88.5 (19.5)	**15**	99 (3.9)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	6.8 (15.1)	66 (14.5)	**38**	73.5 (2.9)	77.5 (17)	**31**	86.5 (3.4)	93 (20.5)	**22**	104 (4.1)	109 (24)	**17**	122 (4.8)
Edmonton, Alberta	232 (2,500)	4.5 (9.9)	43 (9.5)	**7**	48.5 (1.9)	57 (12.5)	**6**	63.5 (2.5)	72.5 (16)	**4**	81.5 (3.2)	82 (18)	**3**	91.5 (3.6)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**14.5**	76 (3)	84 (18.5)	**9.5**	94 (3.7)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	6.6 (14.5)	63.5 (14)	**28**	71 (2.8)	75 (16.5)	**24**	84 (3.3)	97.5 (21.5)	**16**	104 (4.1)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3.0)	79.5 (17.5)	**32**	89 (3.5)	100 (22)	**22**	112 (4.4)	113.5 (25)	**18**	127 (5.0)
Penticton, British Columbia	232 (2,500)	3.8 (8.3)	36.5 (8)	**6**	40.5 (1.6)	38.5 (8.5)	**4**	43 (1.7)	52.5 (11.5)	**3**	58.5 (2.3)	61.5 (13.5)	**2.3**	68.5 (2.7)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	**13**	43 (1.7)	41 (9)	**9**	45.5 (1.8)	57 (12.5)	**6**	63.5 (2.5)	68 (15)	**5**	76 (3)
	697 (7,500)	4.2 (9.3)	41 (9)	**21**	45.5 (1.8)	43 (9.5)	**14.5**	48.5 (1.9)	61.5 (13.5)	**10.5**	68.5 (2.7)	72.5 (16)	**8**	81.5 (3.2)
	929 (10,000)	4.2 (9.3)	41 (9)	**27**	45.5 (1.8)	45.5 (10)	**20**	51 (2)	63.5 (14)	**14**	71 (2.8)	75 (16.5)	**11**	84 (3.3)
Vancouver, British Columbia	232 (2,500)	3.3 (7.3)	32 (7)	**5.5**	35.5 (1.4)	38.5 (8.5)	**4**	43 (1.7)	47.5 (10.5)	**2.8**	53.5 (2.1)	57 (12.5)	**2**	63.5 (2.5)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	**13**	43 (1.7)	45.5 (10)	**10**	51 (2)	57 (12.5)	**6**	63.5 (2.5)	68 (15)	**5**	76 (3)
	697 (7,500)	4.5 (9.9)	43 (9.5)	**22**	48.5 (1.9)	50 (11)	**17**	56 (2.2)	63.5 (14)	**11**	71 (2.8)	75 (16.5)	**8.5**	84 (3.3)
	929 (10,000)	4.9 (10.9)	47.5 (10.5)	**30**	53.5 (2.1)	54.5 (12)	**24**	61 (2.4)	68 (15)	**15**	76 (3)	79.5 (17.5)	**12**	89 (3.5)
Victoria, British Columbia	232 (2,500)	3.3 (7.3)	32 (7)	**5.5**	35.5 (1.4)	38.5 (8.5)	**4**	43 (1.7)	43 (9.5)	**2.5**	48.5 (1.9)	54.5 (12)	**2**	61 (2.4)
	465 (5,000)	4.0 (8.8)	38.5 (8.5)	**13**	43 (1.7)	45.5 (10)	**10**	51 (2)	54.5 (12)	**6**	61 (2.4)	68 (15)	**5**	76 (3)
	697 (7,500)	4.5 (9.9)	43 (9.5)	**22**	48.5 (1.9)	50 (11)	**16**	56 (2.2)	59 (13)	**10**	66 (2.6)	75 (16.5)	**8**	84 (3.3)
	929 (10,000)	4.7 (10.4)	45.5 (10)	**30**	51 (2)	54.5 (12)	**23**	61 (2.4)	63.5 (14)	**14**	71 (2.8)	79.5 (17.5)	**12**	89 (3.5)
Brandon, Manitoba	232 (2,500)	5.9 (13)	57 (12.5)	**8**	63.5 (2.5)	68 (15)	**7**	76 (3)	82 (18)	**4.5**	91.5 (3.6)	92.5 (21)	**3.5**	106.5 (4.2)
	465 (5,000)	7.3 (16.1)	73 (16)	**20**	81.5 (3.2)	84 (18.5)	**17**	94 (3.7)	97.5 (21.5)	**11**	109 (4.3)	113.5 (25)	**8.5**	127 (5)
	697 (7,500)	8.3 (18.2)	79.5 (17.5)	**32**	89 (3.5)	93 (20.5)	**27**	104 (4.1)	107 (23.5)	**19**	119.5 (4.7)	125 (27.5)	**15**	139.5 (5.5)
	929 (10,000)	9.0 (19.8)	86.5 (19)	**43**	96.5 (3.8)	100 (22)	**38**	112 (4.4)	113.5 (25)	**26**	127 (5.0)	132 (29)	**21**	147.5 (5.8)
Winnipeg, Manitoba	232 (2,500)	4.7 (10.4)	45.5 (10)	**7**	51 (2)	57 (12.5)	**6**	63.5 (2.5)	75 (16.5)	**4**	84 (3.3)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**15**	76 (3)	84 (18.5)	**10**	94 (3.7)	100 (22)	**7.5**	112 (4.4)
	697 (7,500)	6.6 (14.5)	63.5 (14)	**28**	71 (2.8)	75 (16.5)	**24**	84 (3.3)	93 (20.5)	**16**	104 (4.1)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	**39**	76 (3)	82 (18)	**32**	91.5 (3.6)	97.5 (21.5)	**22**	109 (4.3)	113.5 (25)	**17**	127 (5.0)
Campbellton, New Brunswick	232 (2,500)	6.4 (14)	62 (13.5)	**9**	68.5 (2.7)	70.5 (15.5)	**7**	78.5 (3.1)	79.5 (17.5)	**4.5**	89 (3.5)	91 (20)	**3.5**	101.5 (4.0)
	465 (5,000)	9.0 (19.8)	86.5 (19)	**22**	96.5 (3.8)	91 (20)	**18**	101.5 (4)	102.5 (22.5)	**12**	115 (4.5)	113.5 (25)	**9**	127 (5.0)
	697 (7,500)	10.4 (22.9)	100 (22)	**35**	112 (4.4)	102.5 (22.5)	**28**	114.5 (4.5)	118 (26)	**20**	132 (5.2)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	11.3 (25)	109 (24)	**47**	122 (4.8)	111.5 (24.5)	**40**	124.5 (4.9)	127.5 (28)	**29**	142 (5.6)	141 (31)	**22**	157.5 (6.2)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT)	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
	NOTCH AREA RATING		L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Chatham, New Brunswick	232 (2,500)	4.5 (9.9)	43 (9.5)	**7**	48.5 (1.9)	52.5 (11.5)	**5.5**	58.5 (2.3)	63.5 (14)	**3.5**	71 (2.8)	77.5 (17)	**2.9**	86.5 (3.4)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	63.5 (14)	**13**	71 (2.8)	77.5 (17)	**9**	86.5 (3.4)	91 (20)	**7**	101.5 (4.0)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**27**	68.5 (2.7)	68 (15)	**22**	76 (3)	84 (18.5)	**14**	94 (3.7)	102.5 (22.5)	**12**	114.5 (4.5)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**37**	71 (2.8)	75 (16.5)	**30**	84 (3.3)	91 (20)	**20**	101.5 (4.0)	107 (23.5)	**16**	119.5 (4.7)
Moncton, New Brunswick	232 (2,500)	4.3 (9.4)	41 (9)	**7**	45.5 (1.8)	54.5 (12)	**6**	61 (2.4)	63.5 (14)	**3.5**	71 (2.8)	72.5 (16)	**2.7**	81.5 (3.2)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**14**	76 (3)	82 (18)	**9**	91.5 (3.6)	93 (20.5)	**7**	104 (4.1)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	79.5 (17.5)	**24**	89 (3.5)	93 (20.5)	**16**	104 (4.1)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	7.5 (16.6)	73.5 (16)	**39**	81.5 (3.2)	84 (18.5)	**34**	94 (3.7)	100 (22)	**23**	112 (4.4)	113.5 (25)	**17**	127 (5.0)
Saint John, New Brunswick	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	57 (12.5)	**6**	63.5 (2.5)	75 (16.5)	**4**	84 (3.3)	86.5 (19)	**3**	96.5 (3.8)
	465 (5,000)	7.5 (16.6)	72.5 (16)	**20**	81.5 (3.2)	79.5 (17.5)	**16**	89 (3.5)	95.5 (21)	**11**	106.5 (4.2)	104.5 (23)	**8**	117 (4.6)
	697 (7,500)	8.7 (19.2)	84 (18.5)	**32**	94 (3.7)	93 (20.5)	**27**	104 (4.1)	107 (23.5)	**19**	119.5 (4.7)	118 (26)	**13.5**	132 (5.2)
	929 (10,000)	9.7 (21.3)	93 (20.5)	**44**	104 (4.1)	104.5 (23)	**38**	117 (4.6)	113.5 (25)	**27**	127 (5.0)	127.5 (28)	**20**	142 (5.6)
Gander, Newfoundland	232 (2,500)	3.5 (7.8)	34 (7.5)	**5.5**	38 (1.5)	45.5 (10)	**5**	51 (2.0)	57 (12.5)	**3.5**	63.5 (2.5)	68 (15)	**2.5**	76 (3.0)
	465 (5,000)	4.7 (10.4)	45.5 (10)	**15**	51 (2.0)	57 (12.5)	**12**	63.5 (2.5)	72.5 (16)	**8**	81.5 (3.2)	82 (18)	**6.5**	91.5 (3.6)
	697 (7,500)	5.7 (12.5)	54.5 (12)	**25**	61 (2.4)	63.5 (14)	**21**	71 (2.8)	79.5 (17.5)	**13.5**	89 (3.5)	93 (20.5)	**11**	104 (4.1)
	929 (10,000)	6.1 (13.5)	59 (13)	**35**	66 (2.6)	70.5 (15.5)	**29**	78.5 (3.1)	84 (18.5)	**19**	94 (3.7)	100 (22)	**15**	112 (4.4)
St. Andrews, Newfoundland	232 (2,500)	3.5 (7.8)	34 (7.5)	**5.5**	38 (1.5)	45.5 (10)	**5**	51 (2.0)	59 (13)	**3.5**	66 (2.6)	63.5 (14)	**2.5**	71 (2.8)
	465 (5,000)	5.2 (11.4)	47.5 (10.5)	**15**	53.5 (2.1)	59 (13)	**13**	66 (2.6)	72.5 (16)	**8**	81.5 (3.2)	79.5 (17.5)	**6**	89 (3.5)
	697 (7,500)	5.9 (13)	57 (12.5)	**26**	63.5 (2.5)	66 (14.5)	**21**	73.5 (2.9)	82 (18)	**14**	91.5 (3.6)	88.5 (19.5)	**10**	99 (3.9)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**36**	71 (2.8)	72.5 (16)	**30**	81.5 (3.2)	86.5 (19)	**20**	96.5 (3.8)	95.5 (21)	**14.5**	106.5 (4.2)
St. John's, Newfoundland	232 (2,500)	5.9 (13)	57 (12.5)	**8**	63.5 (2.6)	68 (15)	**7**	76 (3.0)	77.5 (17)	**4.5**	86.5 (3.4)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	8.5 (18.7)	82 (18)	**21**	91.5 (3.6)	91 (20)	**18**	101 (4.0)	100 (22)	**11**	112 (4.4)	113.5 (25)	**9**	127 (5.0)
	697 (7,500)	10.6 (23.4)	102.5 (22.5)	**34**	114.5 (4.5)	109 (24)	**29**	122 (4.8)	122.5 (27)	**21**	137 (5.4)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	11.8 (26)	113.5 (25)	**48**	127 (5.0)	129.5 (28.5)	**43**	145 (5.7)	143 (31.5)	**33**	160 (6.3)	150 (33)	**24**	167.5 (6.6)
Torbay, Newfoundland	232 (2,500)	4.9 (10.9)	47.5 (10.5)	**7.5**	53.5 (2.1)	61.5 (13.5)	**6.5**	68.5 (2.7)	75 (16.5)	**4**	84 (3.3)	84 (18.5)	**3**	94 (3.7)
	465 (5,000)	6.4 (14)	61.5 (13.5)	**18**	68.5 (2.7)	75 (16.5)	**15.5**	84 (3.3)	88.5 (19.5)	**10**	99 (3.9)	102.5 (22.5)	**8**	114.5 (4.5)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	**29**	78.5 (3.1)	84 (18.5)	**25**	94 (3.7)	100 (22)	**17.5**	112 (4.4)	113.5 (25)	**13**	127 (5)
	929 (10,000)	8.0 (17.7)	77.5 (17)	**40**	86.5 (3.4)	88.5 (19.5)	**34**	99 (3.9)	107 (23.5)	**24**	119.5 (4.7)	122.5 (27)	**19**	137 (5.4)
Halifax, Nova Scotia	232 (2,500)	5.9 (13)	57 (12.5)	**8**	63.5 (2.5)	68 (15)	**7**	76 (3.0)	77.5 (17)	**4.5**	86.5 (3.4)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	8.5 (18.7)	82 (18)	**21**	91.5 (3.6)	91 (20)	**18**	101.5 (4.0)	100 (22)	**11**	112 (4.4)	113.5 (25)	**9**	127 (5.0)
	697 (7,500)	10.6 (23.4)	102.5 (22.5)	**34**	114.5 (4.5)	109 (24)	**29**	122 (4.8)	122.5 (27)	**21**	137 (5.4)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	11.8 (26)	113.5 (25)	**48**	127 (5.0)	129.5 (28.5)	**43**	145 (5.7)	143 (31.5)	**33**	160 (6.3)	150 (33)	**24**	167.5 (6.6)

Selecta-Drain Chart

ZURN®

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2”) RISE			102mm (4”) RISE			152mm (6”) RISE		
			L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Sydney, Nova Scotia	232 (2,500)	4.3 (9.4)	41 (9)	**6.5**	45.5 (1.8)	45.5 (10)	**5**	51 (2.0)	57 (12.5)	**3.5**	6.5 (2.5)	68 (15)	**2.5**	76 (3)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	59 (13)	**13**	66 (2.6)	75 (16.5)	**8**	84 (3.3)	84 (18.5)	**6.5**	94 (3.7)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**28**	68.5 (2.7)	68 (15)	**22**	76 (3)	84 (18.5)	**14**	94 (3.7)	97.5 (21.5)	**11**	109 (4.3)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3)	75 (16.5)	**30**	84 (3.3)	91 (20)	**20**	101.5 (4)	104.5 (23)	**16**	117 (4.6)
Yarmouth, Nova Scotia	232 (2,500)	6.4 (14)	61.5 (13.5)	**9**	68.5 (2.7)	70.5 (15.5)	**7.5**	78.5 (3.1)	82 (18)	**4.5**	91.5 (3.6)	91 (20)	**3.5**	101.5 (4)
	465 (5,000)	8.3 (18.2)	79.5 (17.5)	**21**	89 (3.5)	88.5 (19.5)	**18**	99 (3.9)	104.5 (23)	**12**	117 (4.6)	116 (25.5)	**9**	129.5 (5.1)
	697 (7,500)	9.4 (20.8)	91 (20)	**34**	101.5 (4)	102.5 (22.5)	**29**	114.5 (4.5)	118 (26)	**21**	132 (5.2)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	10.4 (22.9)	100 (22)	**45**	112 (4.4)	109 (24)	**41**	122 (4.8)	129.5 (28.5)	**29**	145 (5.7)	141 (31)	**22**	157.5 (6.2)
Thunder Bay, Ontario	232 (2,500)	4.9 (10.9)	47.5 (10.5)	**7.5**	53.5 (2.1)	61.5 (13.5)	**6.5**	68.5 (2.7)	75 (16.5)	**4**	84 (3.3)	88.5 (19.5)	**3.5**	91.5 (3.6)
	465 (5,000)	6.1 (13.5)	59 (13)	**18**	66 (2.6)	72.5 (16)	**15**	81.5 (3.2)	86.5 (19)	**9.5**	96.5 (3.8)	102.5 (22.5)	**7.5**	114.5 (4.5)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	77.5 (17)	**24**	86.5 (3.4)	93 (20.5)	**16**	104 (4.1)	109 (24)	**13**	122 (4.8)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3)	84 (18.5)	**33**	94 (3.7)	97.5 (21.5)	**22**	109 (4.3)	116 (25.5)	**18**	129.5 (5.1)
Guelph, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	63.5 (14)	**7**	71 (2.8)	86.5 (19)	**5**	96.5 (3.8)	100 (22)	**3.7**	112 (4.4)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	75 (16.5)	**15.5**	84 (3.3)	97.5 (21.5)	**11**	109 (4.3)	116 (25.5)	**9**	129.5 (5.1)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	**29**	78.5 (3.1)	82 (18)	**25**	91.5 (3.6)	104.5 (23)	**18**	117 (4.6)	125 (27.5)	**14**	139.5 (5.5)
	929 (10,000)	8.0 (17.7)	77.5 (17)	**40**	86.5 (3.4)	84 (18.5)	**34**	94 (3.7)	109 (24)	**26**	122 (4.8)	132 (29)	**20**	147.5 (5.8)
Hamilton, Ontario	232 (2,500)	5.9 (13)	57 (12.5)	**8.5**	63.5 (2.5)	72.5 (16)	**7.5**	81.5 (3.2)	93 (20.5)	**5**	104 (4.1)	109 (24)	**4**	122 (4.8)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	79.5 (17.5)	**16**	89 (3.5)	104.5 (23)	**12**	117 (4.6)	122.5 (27)	**9**	137 (5.4)
	697 (7,500)	6.8 (15.1)	66 (14.5)	**28**	73.5 (2.9)	84 (18.5)	**26**	94 (3.7)	111.5 (24.5)	**20**	124.5 (4.9)	127.5 (28)	**15**	142 (5.6)
	929 (10,000)	7.1 (15.6)	68 (15)	**39**	76 (3)	86.5 (19)	**34**	96.5 (3.8)	116 (25.5)	**27**	129.5 (5.1)	134 (29.5)	**21**	150 (5.9)
Kingston, Ontario	232 (2,500)	6.4 (14)	61.5 (13.5)	**9**	68.5 (2.7)	77.5 (17)	**8**	86.5 (3.4)	91 (20)	**5**	101.5 (4)	109 (24)	**4**	122 (4.8)
	465 (5,000)	7.5 (16.6)	72.5 (16)	**20**	81.5 (3.2)	86.5 (19)	**18**	96.5 (3.8)	104.5 (23)	**12**	117 (4.6)	122.5 (27)	**9.5**	137 (5.4)
	697 (7,500)	8.5 (18.7)	82 (18)	**31**	91.5 (3.6)	93 (20.5)	**28**	104 (4.1)	111.5 (24.5)	**20**	124.5 (4.9)	132 (29)	**15**	147.5 (5.8)
	929 (10,000)	8.7 (19.2)	86.5 (19)	**42**	96.5 (3.8)	97.5 (21.5)	**38**	109 (4.3)	116 (25.5)	**27**	129.5 (5.1)	68 (15)	**21**	152.5 (6)
London, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	**8.5**	66 (2.6)	72.5 (16)	**7.5**	81.5 (3.2)	88.5 (19.5)	**5**	99 (3.9)	107 (23.5)	**4**	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	**20**	76 (3)	84 (18.5)	**17**	94 (3.7)	102.5 (22.5)	**12**	114.5 (4.5)	122.5 (27)	**9.5**	137 (5.4)
	697 (7,500)	8.0 (17.7)	77.5 (17)	**30**	86.5 (3.4)	88.5 (19.5)	**27**	99 (3.9)	109 (24)	**19**	122 (4.8)	129.5 (28.5)	**15**	145 (5.7)
	929 (10,000)	8.5 (18.7)	82 (18)	**41**	91.5 (3.6)	91 (20)	**36**	101.5 (4)	113.5 (25)	**27**	127 (5)	134 (29.5)	**21**	150 (5.9)
North Bay, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	68 (15)	**7**	76 (3)	86.5 (19)	**5**	96.5 (3.8)	100 (22)	**3.8**	112 (4.4)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	79.5 (17.5)	**16**	89 (3.5)	97.5 (21.5)	**11**	109 (4.3)	113.5 (25)	**9**	127 (5)
	697 (7,500)	7.5 (16.6)	72.5 (16)	**30**	81.5 (3.2)	86.5 (19)	**26**	96.5 (3.8)	107 (23.5)	**19**	119.5 (4.7)	122.5 (27)	**14**	137 (5.4)
	929 (10,000)	8.3 (18.2)	77.5 (17)	**40**	86.5 (3.4)	93 (20.5)	**36**	104 (4.1)	111.5 (24.5)	**26**	124.5 (4.9)	127.5 (28)	**20**	142 (5.6)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT)	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
	NOTCH AREA RATING		L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Ottawa, Ontario	232 (2,500)	4.7 (10.4)	45.5 (10)	**7**	51 (2)	59 (13)	**6.5**	66 (2.6)	77.5 (17)	**4.5**	86.5 (3.4)	86.5 (19)	**3.2**	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	68 (15)	**14**	76 (3)	86.5 (19)	**10**	96.5 (3.8)	100 (22)	**7.5**	112 (4.4)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**27**	68.5 (2.7)	75 (16.5)	**23**	84 (3.3)	93 (20.5)	**16**	104 (4.1)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**36**	71 (2.8)	79.5 (17.5)	**32**	89 (3.5)	97.5 (21.5)	**22**	109 (4.3)	113.5 (25)	**18**	127 (5)
St. Thomas, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	68 (15)	**7**	76 (3.0)	86.5 (19)	**5**	96.5 (3.8)	104.5 (23)	**4**	117 (4.6)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	77.5 (17)	**16**	86.5 (3.4)	97.5 (21.5)	**11**	109 (4.3)	118 (26)	**9**	132 (5.2)
	697 (7,500)	7.1 (16.6)	68 (15)	**29**	76 (3.0)	82 (18)	**26**	91.5 (3.6)	102.5 (22.5)	**18**	114.5 (4.5)	125 (27.5)	**15**	139.5 (5.5)
	929 (10,000)	7.5 (16.6)	72.5 (16)	**40**	81.5 (3.2)	86.5 (19)	**34**	96.5 (3.8)	107 (23.5)	**24**	119.5 (4.7)	132 (29)	**20**	147.5 (5.8)
Timmins, Ontario	232 (2,500)	4.3 (9.4)	41 (9)	**7**	45.5 (1.8)	57 (12.5)	**6**	63.5 (2.5)	72.5 (16)	**4**	81.5 (3.2)	86.5 (19)	**3.3**	96.5 (3.8)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	63.5 (14)	**14**	71 (2.8)	82 (18)	**9**	91.5 (3.6)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	**27**	68.5 (2.7)	70.5 (15.5)	**22**	78.5 (3.1)	86.5 (19)	**15**	96.5 (3.8)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	6.6 (14.6)	63.5 (14)	**36**	71 (2.8)	72.5 (16)	**30**	81.5 (3.2)	91 (20)	**21**	101.5 (4.0)	109 (24)	**17**	122 (4.8)
Toronto, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	**8**	61 (2.4)	66 (14.5)	**7**	73.5 (2.9)	82 (18)	**4.5**	91.5 (3.6)	97.5 (21.5)	**3.5**	109 (4.3)
	465 (5,000)	6.8 (15.1)	66 (14.5)	**19**	73.5 (2.9)	77.5 (17)	**16**	86.5 (3.4)	93 (20.5)	**11**	104 (4.1)	111.5 (24.5)	**9**	124.5 (4.9)
	697 (7,500)	8.0 (17.7)	77.5 (17)	**30**	86.5 (3.4)	84 (18.5)	**26**	94 (3.7)	100 (22)	**18**	112 (4.4)	120.5 (26.5)	**14**	134.5 (5.3)
	929 (10,000)	8.7 (19.2)	82 (18)	**42**	91.5 (3.6)	86.5 (19)	**34**	96.5 (3.8)	104.5 (23)	**24**	117 (4.6)	127.5 (28)	**20**	142 (5.6)
Windsor, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	**8.5**	66 (2.6)	70.5 (15.5)	**7.5**	78.5 (3.1)	84 (18.5)	**4.5**	94 (3.7)	107 (23.5)	**4**	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	**20**	76 (3.0)	79.5 (17.5)	**16**	89 (3.5)	97.5 (21.5)	**11**	109 (4.3)	118 (26)	**9**	132 (5.2)
	697 (7,500)	8.0 (17.7)	77.5 (17)	**30**	86.5 (3.4)	86.5 (19)	**26**	96.5 (3.8)	107 (23.5)	**18**	119.5 (4.7)	125 (27.5)	**15**	139.5 (5.5)
	929 (10,000)	8.7 (19.2)	82 (18)	**42**	91.5 (3.6)	91 (20)	**36**	101.5 (4.0)	113.5 (25)	**26**	127 (5.0)	129.5 (28.5)	**20**	145 (5.7)
Charlottetown, Prince Edward Island	232 (2,500)	4.9 (10.9)	47.5 (10.5)	**7.5**	53.5 (2.1)	57 (12.5)	**6**	63.5 (2.5)	68 (15)	**3.8**	76 (3.0)	79.5 (17.5)	**3**	89 (3.5)
	465 (5,000)	6.6 (14.6)	63.5 (14)	**19**	71 (2.8)	75 (16.5)	**15.5**	84 (3.3)	88.5 (19.5)	**10**	99 (3.9)	100 (22)	**7.5**	112 (4.4)
	697 (7,500)	7.8 (17.2)	75 (16.5)	**31**	84 (3.3)	86.5 (19)	**26**	96.5 (3.8)	102.5 (22.5)	**18**	114.5 (4.5)	113.5 (25)	**13**	127 (5.0)
	929 (10,000)	8.7 (19.2)	84 (18.5)	**42**	94 (3.7)	97.5 (21.5)	**37**	106.5 (4.2)	111.5 (24.5)	**26**	124.5 (4.9)	125 (27.5)	**20**	139.5 (5.5)
Montreal, Quebec	232 (2,500)	5.2 (11.4)	50 (11)	**7.5**	56 (2.2)	61.5 (13.5)	**7**	68.5 (2.7)	79.5 (17.5)	**4.5**	89 (3.5)	97.5 (21.5)	**3.5**	109 (4.36)
	465 (5,000)	5.9 (13)	57 (12.5)	**17**	63.5 (2.5)	70.5 (15.5)	**15**	78.5 (3.1)	88.5 (19.5)	**10**	99 (3.9)	109 (24)	**8**	122 (4.8)
	697 (7,500)	6.1 (13.5)	59 (13)	**27**	66 (2.6)	72.5 (16)	**23**	81.5 (3.2)	93 (20.5)	**16**	104 (4.1)	113.5 (25)	**13**	127 (5.0)
	929 (10,000)	6.4 (14)	61.5 (13.5)	**36**	68.5 (2.7)	77.5 (17)	**31**	86.5 (3.4)	95.5 (21)	**22**	106.5 (4.2)	120.5 (26.5)	**19**	134.5 (5.3)
Quebec City, Quebec	232 (2,500)	5.4 (12)	52.5 (11.5)	**8**	58.5 (2.3)	63.5 (14)	**7**	71 (2.8)	79.5 (17.5)	**4.5**	89 (3.5)	97.5 (21.5)	**3.5**	109 (4.3)
	465 (5,000)	6.4 (14)	61.5 (13.5)	**18**	68.5 (2.7)	70.5 (15.5)	**15**	78.5 (3.1)	84 (18.5)	**10**	94 (3.7)	104.5 (23)	**8**	117 (4.6)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	72.5 (16)	**23**	81.5 (3.2)	86.5 (19)	**15**	96.5 (3.8)	107 (23.5)	**12**	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	**37**	76 (3.0)	77.5 (17)	**31**	86.5 (3.4)	88.5 (19.5)	**20**	99 (3.9)	109 (24)	**17**	122 (4.8)

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT)	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
	NOTCH AREA RATING		L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	**Draindown Time Hrs.**	mm (in.) Water Depth
Regina, Saskatchewan	232 (2,500)	4.5 (9.9)	43 (9.5)	**7**	48.5 (1.9)	54.5 (12)	**6**	61 (2.4)	72.5 (16)	**4**	81.5 (3.2)	79.5 (17.5)	**3**	89 (3.5)
	465 (5,000)	6.4 (14)	61.5 (13.5)	**18**	68.5 (2.7)	68 (15)	**14**	76 (3.0)	86.5 (19)	**10**	96.5 (3.8)	97.5 (21.5)	**7.5**	109 (4.3)
	697 (7,500)	7.3 (16.1)	70.5 (15.5)	**29**	78.5 (3.1)	77.5 (17)	**24**	86.5 (3.4)	100 (22)	**17**	112 (4.4)	109 (24)	**12**	122 (4.8)
	929 (10,000)	8.3 (18.2)	79.5 (17.5)	**40**	89 (3.5)	82 (18)	**32**	91.5 (3.6)	104.5 (23)	**24**	117 (4.6)	118 (26)	**18**	132 (5.2)
Saskatoon, Saskatchewan	232 (2,500)	4.0 (8.8)	38.5 (8.5)	**6**	43 (1.7)	57 (12.5)	**6**	63.5 (2.5)	66 (14.5)	**3.8**	73.5 (2.9)	77.5 (17)	**2.8**	86.5 (3.4)
	465 (5,000)	5.7 (12.5)	54.5 (12)	**16**	61 (2.4)	68 (15)	**14.5**	76 (3.0)	82 (18)	**9**	91.5 (3.6)	95.5 (21)	**7**	106.5 (4.2)
	697 (7,500)	6.6 (14.6)	63.5 (14)	**28**	71 (2.8)	75 (16.5)	**24**	84 (3.3)	91 (20)	**16**	101.5 (4.0)	104.5 (23)	**12**	117 (4.6)
	929 (10,000)	7.1 (15.6)	68 (15)	**38**	76 (3.0)	82 (18)	**32**	91.5 (3.6)	97.5 (21.5)	**22**	109 (4.3)	113.5 (25)	**18**	127 (5.0)

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Appendix C : Sanitary Load and Fire Flow

SANITARY DESIGN FLOWS

Area	WAREHOUSE					OFFICE					AUTOMOTIVE SERVICE CENTRE				COMMERCIAL/RETAIL			TOTAL	INFILTRATION			Total
	Site Area (ha)	Warehouse Area (m^2)	Capita ($1/90m^2$)	Peak Factor	Peak Flow (L/s)	Site Area (ha)	Office Area (m^2)	Capita ($1/25m^2$)	Peak Factor	Peak Flow (L/s)	Number of Bays	Capita	Peak Factor	Peak Flow (L/s)	Retail Area (m^2)	Peak Factor	Peak Flow (L/s)	Peak Flow (L/s)	Site Areas (ha)	Infiltration Allowance (L/s/ha)	Infilt. Flow (L/s)	Total Peak Flow (L/s)
Existing Store (C.T. Store # 442)																			3.03	0.33	1.00	1.00
Retail															5,181	1.5	0.22	0.22				0.22
Office							460	18	1.5	0.02								0.02				0.02
Warehouse		3,116	35	1.5	0.05													0.05				0.05
Automotive Service Centre											15	18	1.5	0.02				0.02				0.02
Corner Store															107	1.5	0.005	0.00				0.00
Car Wash																		0.63				0.63
																					Total	**1.94**
Proposed Expansion (C.T. Store # 442)																			3.03	0.33	1.00	1.00
Retail															5,832	1.5	0.25	0.25				0.25
Office							411	16	1.5	0.02								0.02				0.02
Warehouse		3,675	41	1.5	0.05													0.05				0.05
Automotive Service Centre											15	18	1.5	0.02				0.02				0.02
Corner Store															107	1.5	0.005	0.00				0.00
Car Wash																		0.63				0.63
																					Total	**1.98**

Design:	BV	**Project:**	Barrhaven Canadian Tire Ottawa, Ontario
Check :	MT	**Location:**	2501 Greenbank Rd Ottawa, Ontario
Dwg reference:		**Project # :** **Date:** **Sheet:**	478461 March, 2023 1 of 1

Average Daily Demands

(Based on City of Ottawa *Sewer Design Guidelines 2012* and *MOE Water Design Guidelines*)

Average Residential Daily Flow =	280	L/p/d
Institutional Flow =	28,000	L/ha/d
Commercial Flow =	28,000	L/ha/d
Light Industrial Flow =	35,000	L/ha/d
Heavy Industrial Flow =	55,000	L/ha/d
Hotel Daily Flow =	225	L/bed/d
Office/Warehouse Daily Flow =	75	L/empl/d
Shopping Centres =	2,500	L/(1000m^2/d)

Peak Factors

Commercial =	1.5	if commercial contribution > 20%, otherwise	1.0
Institutional =	1.5	if institutional contribution > 20%, otherwise	1.0
Industrial =		per Appendix 4-B.0 Graph	
Residential :		Harmon Equatio 1 + (14/(4+(Capita/1000) ^ 0.5))*8	
		min = 2	max = 4

Infiltration allowance (dry weather)	0.05	L/s/ha
Infiltration allowance (wet weather)	0.28	L/s/ha
I/I (total)	0.33	L/s/ha

Population Densities

Average suburban residential dev.	60	p/ha
Single family	3.4	p./unit
Semi-detached	2.7	p./unit
Duplex	2.3	p./unit
Townhouse	2.7	p./unit
Appartment average	1.8	p./unit
Bachelor	1.4	p./unit
1 Bedroom	1.4	p./unit
2 Bedrooms	2.1	p./unit
3 Bedrooms	3.1	p./unit
Hotel room, 18 m2	1	p./unit
Restaurant, 1 m2	1	p./unit
Office	1	p/25m^2
Warehouse	1	p/90m^2
Automotive Service Centre, per bay	1	p/bay (plus management)
Car wash	40gallons per wash, 4mins wash, 10GPM, .0.63L/s	

Canadian Tire Barrhaven - Estimated Water Demands

Area	Units	Population	Gross Floor Area (m2)	Average Daily Demand (ADD) (L/s)	Maximum Daily Demand (MDD) (L/s)	Peak Hourly Demand (PHD) (L/s)	Fire Flow (FF) (L/s)	MDD + FF (L/s)
Existing Canadian Tire Store								
Shopping Centre			9,565	0.28	0.42	0.75	150	150.42
Proposed Canadian Tire Store								
Shopping Centre			10,726	0.31	0.47	0.84	150	150.47

Average Daily Demand

Based on Ottawa Design Guidelines - Water Distribution, 2010 and MOE Design Guidelines for Drinking-Water Systems, 2008

Average Residential Daily Flow = 350 L/p/d
Institutional Flow = 28,000 L/gross ha/d
Commercial Flow = 28,000 L/gross ha/d
Light Industrial Flow = 35,000 L/gross ha/d
Heavy Industrial Flow = 55,000 L/gross ha/d
Hotel Daily Flow = 225 L/bed/d
Office/Warehouse Daily Flow = 75 L/person/d
Office/Warehouse Daily Flow = 8.06 L/m2/day
Restaurant (Ordinary not 24 Hours) = 125 L/seat/d
Restaurant (24 Hours) = 200 L/seat/d
Shopping Centres = 2,500 L/(1000m^2/d)
Amenity Area = 5 L/m2/d

Maximum Daily Demand

Residential = 2.5 x Average Daily Demand
4.9 x Average Daily Demand **
Industrial = 1.5 x Average Daily Demand
Commercial = 1.5 x Average Daily Demand
Institutional = 1.5 x Average Daily Demand

Peak Hourly Demand

Residential = 2.2 x Maximum Daily Demand
7.4 x Maximum Daily Demand **
Industrial = 1.8 x Maximum Daily Demand
Commercial = 1.8 x Maximum Daily Demand
Institutional = 1.8 x Maximum Daily Demand

Canadian Tire Barrhaven - Fire Demand Calculations

													Required Fire Demand	
Building	Type of Construction C	Total Floor Area (m2) A	Fire Flow (min. 2,000) (L/min) F	Adjusted (nearest 1,000) (L/min)	Occupancy Factor O	Reduction / Increase due to Occupancy	Fire Flow with Occupancy (min. 2,000) (L/min)	Sprinklers Factor S	Reduction due to Sprinklers (L/min)	Exposure Factor % E	Increase due to Exposure (L/min)	Fire Flow (L/min)	Roof Contribution (L/min) R	Adjusted to the nearest 1000 (min. 2,000, max. 45,000) (L/min) F	Minimum 33 (L/s)
Existing CT	0.8	9,565	17,213	17,000	0%	0	17,000	50%	8,500	0%	0	9,000	0	9,000	150
Proposed CT	0.8	10,726	18,228	18,000	0%	0	18,000	50%	9,000	0%	0	9,000	0	9,000	150

Reference: <u>References</u>

Water Supply for Public Fire Protection , 2020 by Fire Underwriters Survey (FUS) and
Ottawa Design Guidelines - Water Distribution, July 2010 and subsequent Technical Bulletins

C Type of Construction

Wood Frame (Type V)	1.5
Mass Timber (Type IV-A) - Encapsulated Mass Timber	0.8
Mass Timber (Type IV-B) - Rated Mass Timber	0.9
Mass Timber (Type IV-C) - Ordinary Mass Timber	1.0
Mass Timber (Type IV-D) - Unrated Mass Timber	1.5
Ordinary Construction (Type III also known as joisted masonry)	1.0
Non-Combustible Construction (Type II - minimum 1 hour fire resistance rating)	0.8
Fire resistive Construction (Type I - minimum 2 hour fire resistance rating)	0.6

A Total Effective Floor Area (m^2)

Buildings Classified with a Construction Coefficient from 1.0 to 1.5

100% of all Floor Areas

Buildings Classified with a Construction Coefficient below 1.0

Vertical Openings Unprotected
- Two (2) Largest Adjoining Floor Areas
- Additional Floors (up to eight (8)) at 50%

Vertical Openings Properly Protected
- Single Largest Floor
- Additional Two (2) Adjoining Floors at 25%

High One Storey Building

When a building has a large single storey space exceeding 3m in height, the number of storeys to be used in determining the total effective area depends upon the use being made of the building.

Subdividing Buildings (Vertical Firewalls)

Minimum two (2) hour fire resistance rating and meets National Building Code requirements.

- Up to 10% can be applied if there is severe risk of fire on the exposed side of the firewall due to hazard conditions.
- An exposure charge of up to 10% can be applied if there are unprotected openings in the firewall

Basement

Basement floor excluded when it is at least 50% below grade.

Open Parking Garages

Use the area of the largest floor.

O Occupancy

Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

- Table 3 provides recommended Occupancy and Contents Adjustment Factors for Example Major Occupancies from the National Building Code of Canada.
- Adjustment factors should be adjusted accordingly to the specific fore loading and situation that exists in the subject building.
- Values can be interpolated from the examples given considering fire loading and expected combustibility of contents if the subject building is not listed.
- Values can be modified by up to 10% (+/-) depending on the extent to which the fire loading is unusual for the building.
- Buildings with multiple major occupancies should use the most restrictive factor or interpolate based on the percentage of each occupancy and its associated fire loading.

Table 3 Values for Subject Building

Group:	F
Division:	3
Description of Occupancy:	Storage Garage including Open Air Parking Garage
Occupancy and Contents:	Combustible
Adjustment Factor:	0%

R Roof

Shake Roof	2,000 to 4,000 L/min	additional should be added to the fire flow
Wood Shingle	2,000 to 4,000 L/min	additional should be added to the fire flow

F Fire Flow (L/Min)

220*C*(A^0.5)

S Sprinklers

	Complete Coverage	Partial Coverage
Automatic Sprinklers NFPA Standards	30%	30% * x%
Standard Water Supply	10%	10% * x%
Full Supervision	10%	10% * x%

(x%: percentage of total protected floor area)

Additional Reductions for Community Level Automatic Sprinkler Protection of Area

Buildings located within communities or subdivisions that are completely sprinkler protected may apply up to a maximum additional 25% reduction in required fire flows beyond the normal maximum of 50% reduction for sprinkler protection of an individual building.

Adjustment of Sprinkler Reductions for Community Level Oversight of Sprinkler Maintenance, Testing, and Water Supply Requirements

The reduction in required fire flow for sprinkler protection may be reduced of eliminated if:

- The community does not have a Fire Prevention Program that provides a system of ensuring that the fire sprinkler systems are inspected, tested, and maintained in accordance with NFPA 25
- The community does not maintain the pressure and flow rate requirements for fire sprinkler installations, or otherwise allows the flow rates and pressure levels that were available during sprinkler system design to significantly degrade, increasing the probability of inadequate water supply for effective sprinkler operation.

E Exposure

The maximum exposure adjustment that can be applied to a building is 75% when summing the percentages of all sides of the building.

Separation Distance (m)	Maximum Exposure Adjustment	N	E	S	W
0 to 3	25%				
3.1 to 10	20%				
10.1 to 20	15%				
20.1 to 30	10%				
Greater than 30	0%				

Table 6: Exposure Adjustment Charges for Subject Building Considering Construction Type of Exposed Building Face

Distance to the Exposure (m)	Length-Height Factor of Exposing Building Face	Type V	Type III-IV[2]	Type III-IV[3]	Type I-II[2]	Type I-II[3]
0 to 3	0-20	20%	15%	5%	10%	0%
	21-40	21%	16%	6%	11%	1%
	41-60	22%	17%	7%	12%	2%
	61-80	23%	18%	8%	13%	3%
	81-100	24%	19%	9%	14%	4%
	Over 100	25%	20%	10%	15%	5%
3.1 to 10	0-20	15%	10%	3%	6%	0%
	21-40	16%	11%	4%	7%	0%
	41-60	17%	12%	5%	8%	1%
	61-80	18%	13%	6%	9%	2%
	81-100	19%	14%	7%	10%	3%
	Over 100	20%	15%	8%	11%	4%
10.1 to 20	0-20	10%	5%	0%	3%	0%
	21-40	11%	6%	1%	4%	0%
	41-60	12%	7%	2%	5%	0%
	61-80	13%	8%	3%	6%	1%
	81-100	14%	9%	4%	7%	2%
	Over 100	15%	10%	5%	8%	3%
20.1 to 30	0-20	0%	0%	0%	0%	0%
	21-40	2%	1%	0%	0%	0%
	41-60	4%	2%	0%	1%	0%
	61-80	6%	3%	1%	2%	0%
	81-100	8%	4%	2%	3%	0%
	Over 100	10%	5%	3%	4%	0%
Over 30m	All Sizes	0%	0%	0%	0%	0%

[2] with unprotected openings

[3] without unprotected openings

Automatic Sprinkler Protection in Exposed Buildings

- If the exposed building is fully protected with an automatic sprinkler system (see note Recognition of Automatic Sprinkler), the exposure adjustment charge determined from Table 6 may be reduced by up to 50% of the value determined.

Automatic Sprinkler Protection in both Subject and Exposed Buildings

- If both the subject building and the exposed building are fully protected with automatic sprinkler systems (see note Recognition of Automatic Sprinkler), no exposure adjustment charge should be applied.

Exposure Protection of Area Between Subject and Exposed Buildings

- If the exposed building is fully protected with an automatic sprinkler system (see note Recognition of Automatic Sprinkler), and the area between the buildings is protected with an exterior automatic sprinkler system, no exposure adjustment charge should be applied.

Reduction of Exposure Charge for Type V Buildings

- If the exposed building face of a Type V building has an exterior cladding assembly with a minimum 1 hour fire resistive rating, then the exposure charge may be treated as a Type III/IV building for the purposes of looking up the appropriate exposure charge in Table 6.

Appendix D : Site Boundary Condition

Boundary Conditions
2501 Greenbank Road

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	19	0.31
Maximum Daily Demand	28	0.47
Peak Hour	50	0.84
Fire Flow Demand #1	9,000	150.00

Location

Results

Existing Conditions (Pressure Zone 3SW)

Connection 1 – Strandherd Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.8	80.0
Peak Hour	143.7	61.4
Max Day plus Fire Flow	133.8	47.3

[1] Ground Elevation = 100.5 m

Future Conditions (Pressure Zone SUC)

Connection 1 – Strandherd Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.9	65.9
Peak Hour	144.4	62.4
Max Day plus Fire Flow	145.1	63.3

[1] Ground Elevation = 101.2 m

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Appendix E : Stormwater Management Improvements Report Novatech Engineering Consultants Ltd.

CANADIAN TIRE – BARRHAVEN

STORMWATER MANAGEMENT IMPROVEMENTS REPORT

Prepared by:

NOVATECH ENGINEERING CONSULTANTS LTD.
240 Michael Cowpland Dr. - Suite 200
Ottawa, Ontario
K2M 1P6

File No.: 113199
Report Reference No.: R-2014-072

May 28, 2014

NOVATECH
ENGINEERING
CONSULTANTS LTD.

May 28, 2014

Keller Engineering Associates Inc.
1390 Prince of Wales Drive, Suite 107
Ottawa, ON, K2C 3N6

Attention: Mr. Adam Archambault

Dear Sir:

Reference: **Canadian Tire – Barrhaven Ontario**
Stormwater Management Improvements Report
Our File No.: 113199

Enclosed herein is the Stormwater Management Improvements Report for improving the stormwater management strategy for the existing Canadian Tire in Barrhaven Ontario. This report is submitted to review the existing conditions and presents a stormwater management strategy for mitigating the existing flooding issues for the site.

Trusting this report is adequate for your purposes. Should you have any questions, or require additional information, please contact us.

Yours truly,

NOVATECH ENGINEERING CONSULTANTS LTD.

Michael Petepiece, P.Eng.
Project Manager

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   (Delcan, March, 2006)
5) General Plan of Services for Village Square Plaza
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7) Plan and Profiles for Greenbank Road
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2) 113199-STM-Existing (existing storm sewer network)
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1.0 INTRODUCTION

This report outlines proposed improvements to the existing storm drainage infrastructure at the Canadian Tire retail centre and gas bar in Barrhaven, Ontario to reduce the frequency and extent of surface flooding during moderate to large storm events. This report identifies the primary causes of flooding, and illustrates the extent of flooding under existing conditions (based on model results) for various design rainfall events.

1.1 Location

The Canadian Tire site is located in Barrhaven (Ottawa), Ontario northwest of the intersection of Strandherd Drive and Greenbank Road, as shown in **Figure 1** below. The site shares an entrance off of Greenbank Road with Village Square Plaza, an existing retail plaza to the north of the Canadian Tire. An OC Transpo Transitway bounds the site to the east.

Figure 1: Aerial Photo of the Canadian Tire Site (Google, 2013)

1.2 Phasing

The current Canadian Tire site was developed in three phases, as outlined in the design reports prepared for each phase:

- Canadian Tire Building and Parking Lot *(Bronte Engineering Limited, February 2000)*
- Canadian Tire Gas Bar *(Trow Associates Inc., February 2003)*
- South Extension of the Existing Canadian Tire Building *(Delcan, March 2006)*

The initial site was designed in 2000 by Bronte Engineering Limited and has been modified twice to account for the development of the Gas Bar and expansion of the existing Canadian Tire building to the south. The original storm sewer design was modified to accommodate construction of the Canadian Tire Gas Bar (2003) and south extension (2006), but pipe sizes and slopes for both phases are similar to those specified in the original design by Bronte Engineering Limited.

The construction of the Gas Bar included removing storm sewers underneath the footprint of the Gas Bar to make room for the gas pumps, the underground fuel tanks, the car wash and the kiosk. The catchbasin manholes were relocated and a new sewer system was installed.

The construction of Strandherd Drive east of Greenbank Road provided the opportunity to expand the Canadian Tire building footprint to the south. The building expansion included extending the outlet pipe for the roof drains and relocating the existing catchbasins and catchbasins manholes within the footprint of the expansion.

2.0 SWM CRITERIA

The proposed storm drainage improvements to alleviate the existing surface flooding will adhere to the stormwater management criteria previously established in the following documents:

- Canadian Tire – Stormwater Management Report
  (Bronte Engineering Limited, February 18, 2000)
- Village Square Plaza – Stormwater Management Report
  (Cumming Cockburn Limited, March 5, 2001)
- Village Square Plaza Expansion – Stormwater Management Report
  (Novatech Engineering Consultants Limited (February 18, 2010)
- City of Ottawa Sewer Design Guidelines (October 2012)

2.1 Allowable Release Rate

Based on the storm sewer design sheets provided in the Stormwater Management Report for Village Square Plaza (**Appendix B**), the Canadian Tire site was allocated a release rate of 160L/s. The outlet manhole from the Canadian Tire Site (MH 16) includes a diamond shaped 180mm x 180mm orifice plate installed in a slide gate as shown in **Figure 2a**. The 375mm outlet pipe downstream of the orifice plate is sloped at 0.5% and connects to a catchbasin manhole installed on Greenbank Road. The rating curve for this orifice (**Figure 2b)**, indicates that the depth of water in the manhole with the orifice plate (MH16) will need to be at the ground surface to achieve a release rate of 160L/s.

Figure 2a: Gate/Orifice in MH16

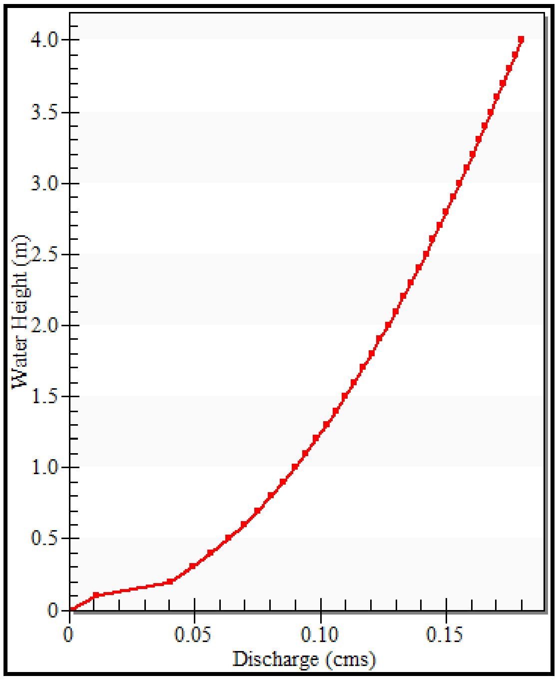


Figure 2b: Rating Curve for orifice in MH16

3.0 EXISTING CONDITIONS

The existing storm sewer network for the Canadian Tire site is shown on the Drawing 113199-STM-Existing.

3.1 Video Inspection Report

The video inspection completed by Multi-Drain Inspection Services (Multi-Drain) on October 23, 2013 did not reveal any significant problems with the storm sewers. In one instance there was a crack in the sewer, but this would only cause minor inflows/infiltration to or from the system.

Multi-Drain did notice the presence of oil sheen in the catchbasins and storm sewers near the Gas Bar. Further investigation by Terrapex Environmental Ltd. did not find any evidence of oil or sheen in the catchbasins and there were no obvious concerns with the stormceptor. At this time Terrapex Environmental Ltd. is not recommending any additional work since there does not appear to be any ongoing concern.

Pipe sizes and lengths were confirmed by Multi-Drain in the field and were consistent with the design drawings and survey completed by Fairhall Moffatt & Woodland Ltd. (October 17, 2013). Invert elevations of the storm sewers were provided by Multi-Drain Inspection Services to Fairhall Moffatt & Woodland Ltd. to develop an as-built drawing, which has been attached to this report.

3.2 Bronte Engineering Limited SWM Report

The stormwater management report for the original Canadian Tire (Bronte Engineering Limited, February 18, 2000) provided only a hydrologic analysis and did not include a hydraulic analysis of the sewer system. The hydrologic analysis from this report is summarized below:

- Allowable peak flow rate from the site (Rational Method):
    - 5-year = 151.8 L/s
    - 100-year = 248.7 L/s
- Controlled flow rate from the site (OTTHYMO model results):
    - 5-year = 144.6 L/s
    - 100-year = 147.2 L/s
- Depth of ponding in the parking lot:
    - 5-year = 0.19m (99.70m (elevation)
    - 100-year = 0.29m (99.80m elevation)

The building roof was designed to provide 836m^3 of storage with outflows controlled using eleven (11) ZURN type roof drains, which restrict flows to 21L/s at a head of 0.125m.

The parking lot was designed to provide 600m^3 of storage at a maximum ponding elevation of 99.80m, with outflows controlled using a 180mm x 180mm orifice plate located on the upstream side of the manhole at the southwest corner of the site (MH16).

3.3 Village Square Plaza

The Village Square Plaza was developed subsequent to the Canadian Tire site. The 1:1000 mapping provided by the City of Ottawa (2009) indicates that the parking lot of the Village Square Plaza is at least 1.0m higher than the Canadian Tire site.

The storm drainage area plan for Village Square Plaza allocated an area of approximately 0.30 ha to the Canadian Tire storm sewers (shown in blue on **Figure 3**). Based on a field review of existing conditions, several of the catchbasins in the Village Square parking lot are on a continuous grade, which significantly limits their effectiveness in capturing storm runoff. This results in a larger contributing area from the Village Square Plaza parking lot to the Canadian Tire site at the south entrance from Greenbank Road (i.e. CBMH6). Based on site visits and a review of the 1:1000 topographic mapping, the extra contributing drainage area from the Village Square Plaza is approximately 0.26 ha (shown in red on **Figure 3**), which is almost double what was previously allocated.

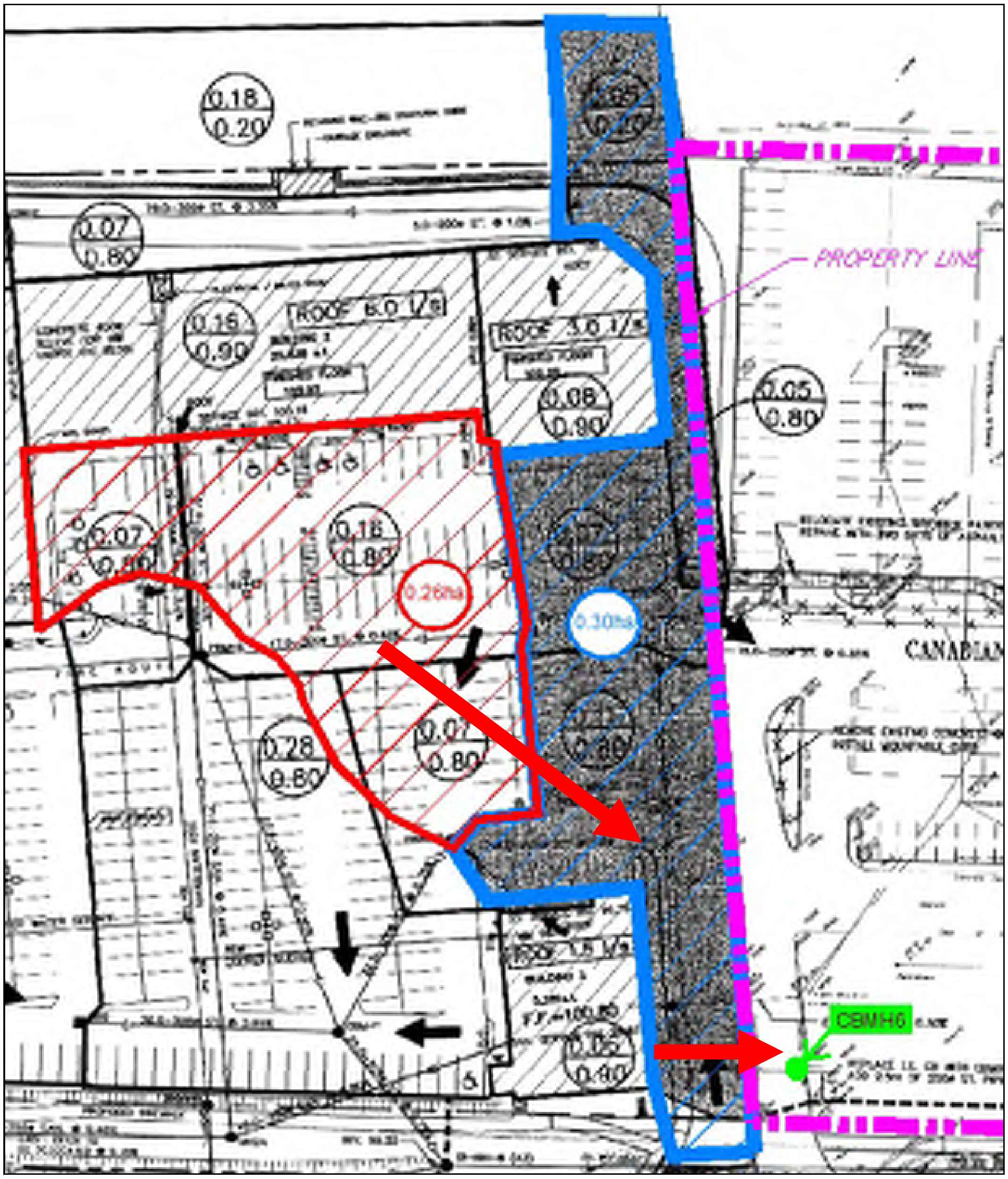


Figure 3: Drainage Area from Village Square Plaza to CBMH6

The storm sewer system on the Canadian Tire site is undersized (based on current City standards) and the additional runoff from the Village Square Plaza further reduces the level of service provided by the existing storm sewers.

3.4 Greenbank Road

The east portion of Greenbank Road drains into a roadside ditch, which flows into a ditch inlet catchbasin (DICB) north of the south entrance from Greenbank Road to the Canadian Tire site. As shown in **Figure 4**, there is a portion of Greenbank Road (approximately 0.07 ha) that drains into the Canadian Tire storm sewer system as the elevation of Greenbank Road is higher than the private entrance and a portion of Greenbank Road has roadside curbs.

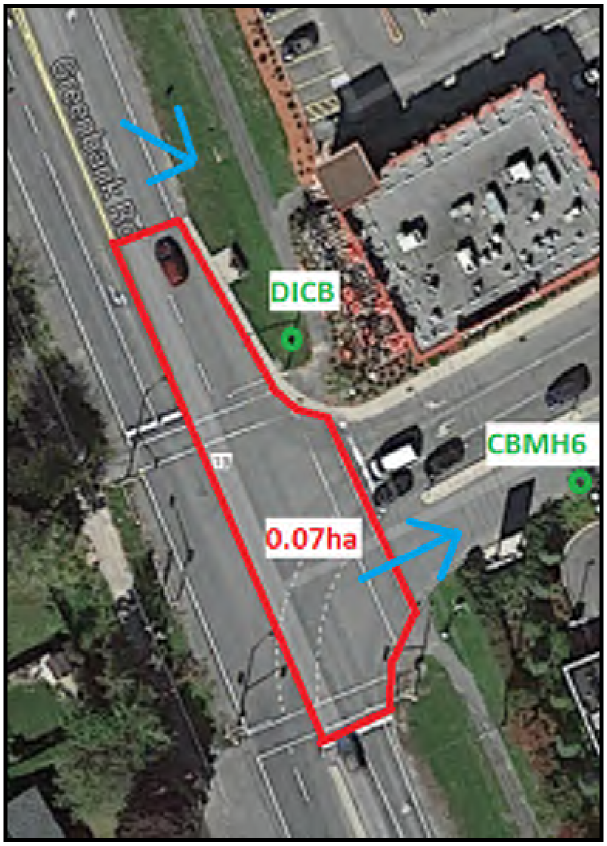


Figure 4: Drainage Area from Greenbank Road to CBMH6 (Google, 2014)

4.0 HYDROLOGIC AND HYDRAULIC MODELING

The City of Ottawa Sewer Design Guidelines (October 2012) require the use of a dynamic hydrologic/hydraulic model to evaluate stormwater management retrofits of existing infrastructure.

The existing Canadian Tire storm drainage system and the proposed modifications were modeled using Autodesk Storm and Sanitary Analysis (Autodesk SSA). The capabilities of the software are summarized in the *Autodesk Storm and Sanitary Analysis 2013 – Technical Capabilities and Functionalities* bulletin provided in **Appendix D.**

4.1 Model Development

The Autodesk SSA models account for both minor and major system flows, including the routing of flows through the storm sewer network (minor system), and overland between catchbasins (major system).

4.1.1 Subcatchments / Storm Sewers

Model parameters for the subcatchments and storm sewers were developed using the following sources:

- Detailed topographic survey by Fairhall Moffatt & Woodland Ltd. (October 17, 2013);
- 1:1000 mapping from the City of Ottawa (2009);
- Aerial photos from GeoOttawa (2011) and Google Maps (2013);
- Inverts and pipe sizes provided by Multi-Drain Inspection Services (October 23, 2013);
- Storm sewer design sheets and plan and profile drawings for Greenbank Road and Strandherd Drive (2001);

4.1.2 Infiltration

Infiltration losses were modeled using Horton's equation, which defines the infiltration capacity of the soil over the duration of a precipitation event using a decay function that ranges from an initial maximum infiltration rate to a minimum rate as the storm progresses. The default values from the City of Ottawa Sewer Design Guidelines (October 2012) were used for all catchments.

Horton's Equation:
$f(t) = fc + (fo – fc)e^{-k(t)}$

Initial infiltration rate: fo = 76.2 mm/hr
Final infiltration rate: fc = 13.2 mm/hr
Decay Coefficient: k = 4.14/hr

4.1.3 Depression Storage

Building rooftops are assumed to provide no depression storage (all rainfall converted to runoff). The default values for depression storage from the City of Ottawa Sewer Design Guidelines (October 2012) were used for all other catchments.

- Depression Storage (pervious areas): 4.67 mm
- Depression Storage (impervious areas): 1.57 mm

4.1.4 Equivalent Width

The 'equivalent width' parameter is calculated by dividing the flow length by the catchment area, as described in the City of Ottawa Sewer Design Guidelines (October 2012).

4.1.5 Major & Minor System Networks

Inlets to the storm sewer network were modeled as storage nodes. The stage-storage curves include the storage volume within the structure (pipe invert to top of grate), as well as the storage above the structure (surface ponding).

Storm sewer (pipe) data includes length, diameter, slope, inlet and outlet elevations, Manning's Roughness, and inlet/outlet losses through manholes.

Overland flow paths between storm inlets are represented as open channels. Cross-sections and elevations for the overland flow network are based on the topographic data.

4.1.6 Modeling Files / Schematic

The Autodesk Storm and Sanitary Analysis modeling files and schematics are provided in **Appendix D**. Digital copies of the modeling files and model output for all storm events are provided on the enclosed CD.

4.2 Design Storms

The hydrologic analysis was completed using a wide range and variety of synthetic design storms and historical storms. The IDF parameters used to generate the design storms were taken from the City of Ottawa Sewer Design Guidelines (October 2012).

3 Hour Storm Distributions:	24 Hour Storm Distributions:
2-year 3hr Chicago	2-year 24hr Chicago
5-year 3hr Chicago	5-year 24hr Chicago
10-year 3hr Chicago	10-year 24hr Chicago
25-year 3hr Chicago	25-year 24hr Chicago
50-year 3hr Chicago	50-year 24hr Chicago
100-year 3hr Chicago	100-year 24hr Chicago
100-year 3hr Chicago (+20%)	100-year 24hr Chicago (+20%)

Historical Storms:
July 1, 1979
August 4, 1988
August 8, 1996
July 19, 2013 (used for calibration purposes)

5.0 EXISTING CONDITIONS MODEL

An existing conditions model of the Canadian Tire site was developed to simulate the minor and major drainage systems. In order to accurately evaluate hydraulic conditions in the on-site storm sewers, the following external drainage areas were also included in the model:

- Village Square Plaza / Plaza Expansion: Buildings and parking lots (including storage and controlled release rates), drainage areas tributary to the Canadian Tire site;
- Greenbank Road / Strandherd Drive: Upstream/downstream drainage areas, storm sewer network and major system overland flow routes.

For areas where as-built information was not available, design elevations from the original SWM reports and drawings were used. The model subdivides the site into subcatchments which represent the area tributary to each inlet to the storm sewer system as shown on the Drawing 113199-SWM. An overview of the modeling parameters for each subcatchment is provided in **Table 1**. Supporting calculations are provided in **Appendix C**.

Table 1: Hydrologic Modeling Parameters

Catchment ID	Area (ha)	Runoff Coefficient C	Percent Impervious (%)	Equivalent Width (m)	Avg. Slope (%)
External Drainage Areas					
Greenbank Road (A3)	0.440	0.70	71%	34	1.00%
Greenbank Road (A3 - A2)	0.275	0.70	71%	31	1.00%
Greenbank Road (A2 - A1)	0.450	0.70	71%	35	1.00%
Greenbank Road (A1 – A)	0.770	0.70	71%	39	1.00%
Greenbank Road (A – B)	0.424	0.71	73%	53	1.00%
Strandherd Drive (B – C)	1.150	0.70	71%	58	1.00%

Catchment ID	Area (ha)	Runoff Coefficient C	Percent Impervious (%)	Equivalent Width (m)	Avg. Slope (%)
Greenbank Road (C – D)	1.174	0.54	48%	117	1.00%
Greenbank Road (D – E)	0.498	0.65	64%	62	1.00%
Village Square (Buildings)	0.660	0.90	100%	138	2.45%
Village Square (Parking)	1.209	0.90	100%	139	1.50%
Village Square Expansion (Buildings)	0.221	0.90	100%	82	1.50%
Village Square Expansion (Parking)	0.521	0.90	100%	163	0.91%
Canadian Tire Site					
EX-1 (Village Square)	0.178	0.90	100%	27	2.77%
Greenbank Road	0.070	0.90	100%	16	1.33%
CBMH6	0.440	0.88	97%	70	1.84%
CB1	0.123	0.78	83%	47	1.38%
CBMH2	0.131	0.80	86%	33	4.26%
CB3	0.160	0.90	100%	40	3.76%
PUMPS	0.037	0.90	100%	22	1.50%
GAS BAR	0.013	0.90	100%	19	1.50%
CAR WASH	0.011	0.90	100%	18	1.50%
CBMH102	0.059	0.90	100%	20	1.52%
CBMH101	0.106	0.90	100%	31	1.45%
GB-CB3	0.068	0.90	100%	13	1.36%
CBMH104	0.010	0.90	100%	11	0.64%
CBMH103	0.022	0.90	100%	24	2.96%
GB-CB1	0.010	0.90	100%	9	1.52%
GB-CB4	0.008	0.90	100%	7	0.40%
GB-CB2	0.012	0.90	100%	6	0.37%
CBMH105	0.028	0.20	0%	16	0.40%
CBMH106	0.011	0.20	0%	6	0.78%
CBMH10	0.331	0.87	96%	60	1.02%
CBMH11	0.247	0.89	99%	44	1.17%
CBMH12	0.323	0.87	96%	60	1.33%
CBMH13	0.229	0.78	83%	55	1.54%
CB14	0.133	0.90	100%	78	1.05%
CBMH15	0.079	0.90	100%	29	0.65%
BLDG	0.786	0.90	100%	138	1.50%

5.1 Model Calibration (July 19th, 2013 Storm Event)

The existing conditions model was calibrated using rainfall data from the July 19th, 2013 storm event collected by the Walter Baker City of Ottawa Rain Gauge. Rainfall intensities for this storm event are shown in **Figure 5**.

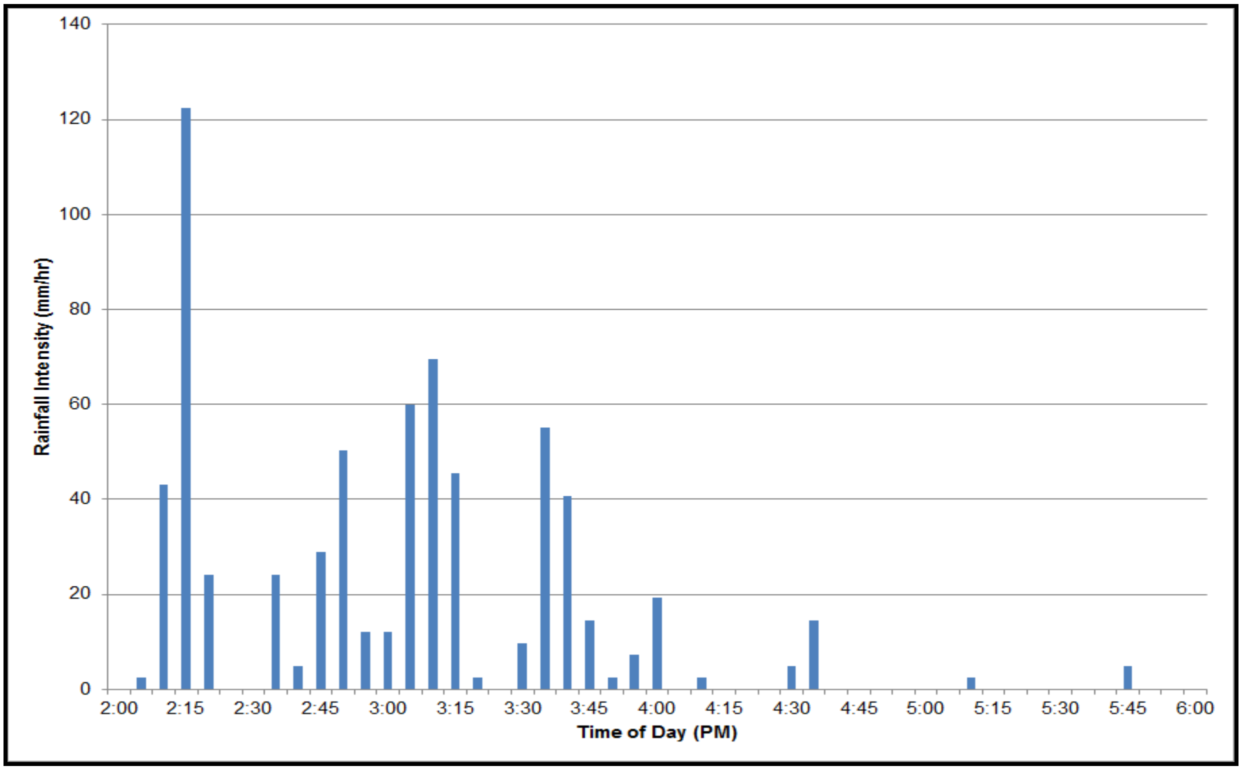


Figure 5: Rainfall Intensity (mm/hr) - July 19th, 2013 Event (Walter Baker Rain Gauge)

The July 19th, 2013 storm event had a peak intensity of 122 mm/hr and produced 56.6mm of rainfall at the Walter Baker rain gauge over approximately four (4) hours. This storm event can be categorized between a 1:5 year and 1:10 year return period.

Calibration of the existing conditions model was based on the observed extent of surface ponding following this event. The following photo (**Figure 6**) was taken at approximately 4:00pm on July 19th, 2013 from the car wash at the Canadian Tire Gas Bar. Through discussions with Canadian Tire Staff, this event resulted in approximately 15 - 20mm of water ponding in the parking lot for roughly 6 - 8 hours.

Figure 6: Extent of Flooding on July 19th, 2013

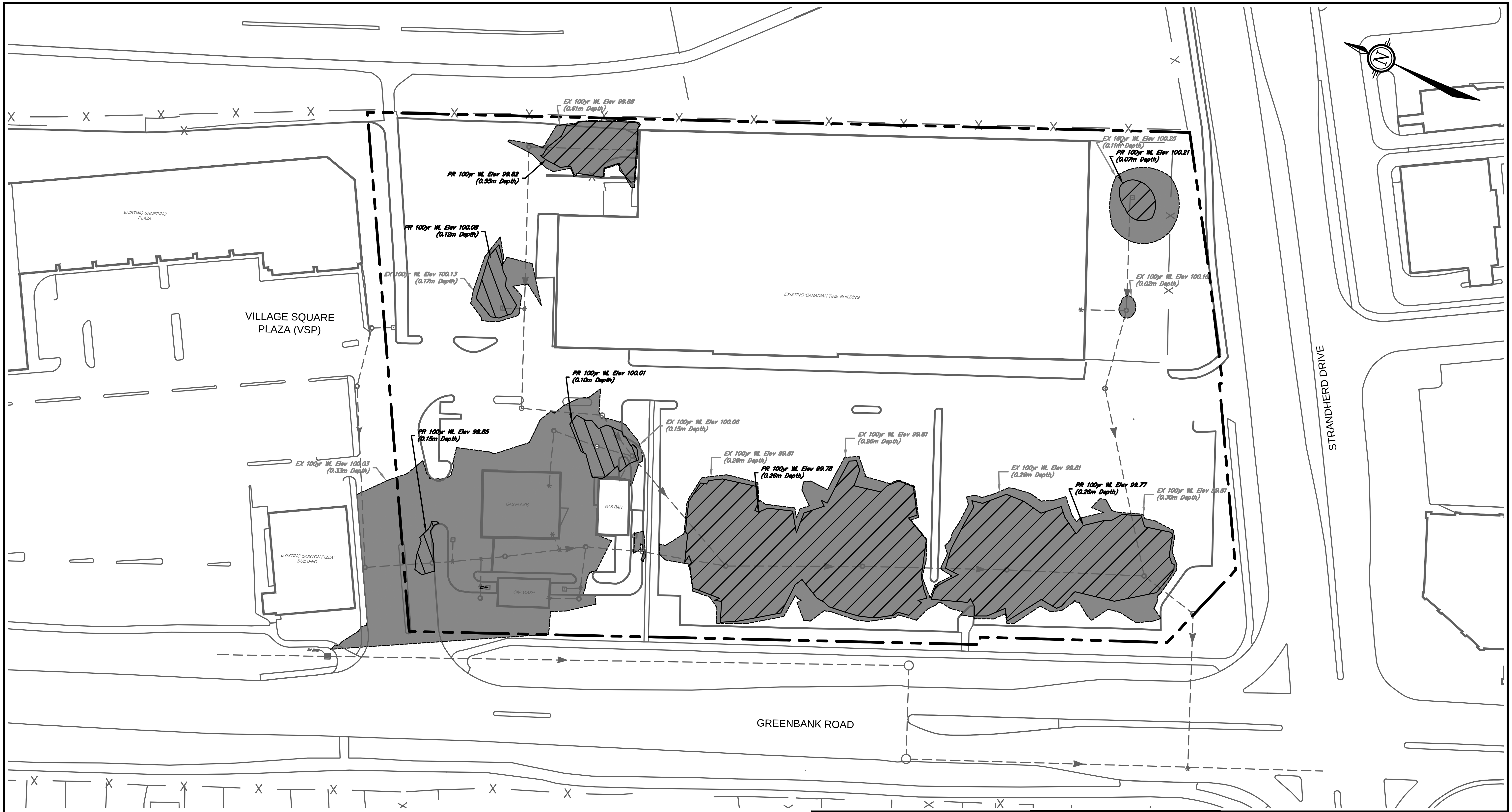
Using the July 19th, 2013 rainfall data, the model parameters were adjusted to produce ponding depths generally consistent with what is shown in **Figure 6**. It should be noted that the model reports a significantly shorter duration of ponding, which may be a result of an obstruction in one or more of the storm sewer inlets or outlets, or due to elevated water levels in the outlet storm sewers on Greenbank Road.

5.2 Model Results (Existing Conditions)

Following calibration of the existing conditions model, the performance of the existing Canadian Tire storm drainage system was evaluated using a range of synthetic design storms and historical storm events. The model results confirm that the storm sewer system is undersized and that portions of the site will experience surface flooding during relatively minor sstorm events. Ponding depths over each catchbasin (existing conditions) for the various storm events and distributions are summarized in Tables D1 – D3 in **Appendix D**. The extent of ponding under existing and proposed conditions for the 100-year storm event is shown on **Figure 7**.

The main Canadian Tire parking lot (CBMHs 10-13) is expected to experience approximately 0.14m of ponding overtop of the catchbasins during a 2-year storm event. The depth of ponding increases to 0.30m during a 100-year storm event, which is the maximum amount of ponding allowed for safe passage, as per the City of Ottawa Sewer Design Guidelines (October, 2012). When the system was stress tested by increasing 100-year peak flows and rainfall volumes by 20% there is 0.34m of ponding in the parking lot.

The catchbasin at the Gas Bar entrance from Greenbank Road (CBMH 6) experiences frequent flooding and greater ponding depths for a given storm event when compared with the main parking lot.



LEGEND

- - -▶- - EXISTING STORM SEWER WITH FLOW DIRECTION
⊡ EXISTING CATCH BASIN MANHOLE
○ EXISTING MANHOLE
□ EXISTING CATCH BASIN
—— EXISTING CURB
▬▬ PROPERTY LINE
▩ 100-YEAR PONDING LIMITS (EXISTING)
▨ 100-YEAR PONDING LIMITS (PROPOSED)

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SCALE
1:1000

1:1000
0 10 20 30 40

CANADIAN TIRE
BARRHAVEN

EXISTING AND PROPOSED
100-YEAR PONDING LIMITS

MAY 2014 113199 FIGURE 7

M:\2013\113199\CAD\Design\113199-SWM.dwg, PONDING, May 29, 2014 - 12:55pm, cstang

SHT11X17.DWG - 279mmX432mm

5.3 Identification of the Primary Causes of Flooding

The frequent surface flooding in the vicinity of the Gas Bar (CBMH 6) is due to several factors: The storm sewers in the vicinity of the gas bar were intended to surcharge to the ground surface. Storm runoff would be routed through the on-site sewers and back out onto the parking lot surface through the grates of the catchbasin manholes in the main parking lot (CBMH10-13). However, the original design report did not evaluate the hydraulics of the system. A review of the existing storm sewer system revealed significant deficiencies in both the size and configuration of the storm sewers connecting the gas bar to the main parking lot, which prevents the system from operating as intended.

Storm sewers are typically designed to convey the 5-year post-development peak flows. Based on current City of Ottawa Standards, almost all of the on-site storm sewers are significantly undersized (refer to the storm sewer design sheets provided in **Appendix B)**. While this may have been intentional (the storm system was intended to be restricted by the orifice in MH16 and to back up onto the surface through the grates of the catchbasins in the main parking lot), the ability of the sewers to internally convey runoff between the gas bar and the main parking lot was overlooked.

This issue is compounded by the additional runoff from the Village Square Plaza parking lot and Greenbank Road that was not accounted for in the original design, resulting in a larger volume of runoff entering the Canadian Tire site than was originally intended. There is also no defined major system (overland flow) outlet for the site, so the depth of water in the parking lots can exceed 0.30m during larger storm events.

6.0 PROPOSED SWM IMPROVEMENTS

The proposed improvements to the existing storm drainage system include:

1) The installation of a new 600mm storm sewer along the western boundary of the site to supplement the conveyance capacity of the existing storm sewer network connecting the gas bar and the main parking lot.
2) The installation of an underground storage system beneath the main parking lot consisting of two (2) rows of StormTech MC-3500 (or approved equivalent) infiltration chambers.
3) The installation of a check valve at the storm outlet to prevent inflows from the off-site storm sewers into the proposed underground storage system.

The proposed underground storage system (Drawing 113199-STM) represents a balance between cost and level of service. This configuration provides sufficient underground storage for runoff from a 5-year event (approx. 500 m^3). Runoff from larger storms will exceed the available underground storage and begin to accumulate on the parking lot surface as per the original design intent.

6.1 Model Results (Proposed Improvements)

The model results indicate that the proposed works will significantly improve the capacity of the internal storm drainage network and reduce the frequency of surface flooding on the site. There will be no ponding in the main parking area during the 5-year storm event. The extent of ponding during the 100-year storm event (maximum depth of approximately 0.26 m) is shown on **Figure 7**.

6.2 Design Details

Infiltration Chambers

The proposed infiltration chambers (StormTech MC-3500) have been designed to provide the as much storage as possible while maintaining adequate clearance from the granular material in the parking lot. Details and design specifications are shown on Drawings 113199-STM and 113199-ND:

1. Provide a 300mm (minimum) clearstone base (50mm dia. D_{50}) and 150mm perforated subdrain pipe beneath the infiltration chambers.
2. Backfill the space surrounding the infiltration chambers with clean, crushed angular stone (19mm – 51mm) to a minimum depth of 305mm above the infiltration chambers
3. A non-woven geotextile (ADS 601 or approved equivalent) is to be wrapped around the perimeter of the stone fill to prevent soil movement into the storage area.
4. Provide a minimum 610mm of clearance from the top of the infiltration chambers to the base of asphalt.
5. The bottom of the first row of the storage chambers is to be underlain with a geotextile liner or flooring to allow for flushing of accumulated sediment.

Supporting calculations for the StormTech MC-3500 infiltration chambers are provided in **Appendix E**. Approved equivalent infiltration chambers can be specified, provided they meet the following standards:

1. The chambers must meet the requirements of CSA B184.0-11, “General Requirements and Methods of Testing for Polymeric Subsurface Stormwater Management Structures”

2. The chambers must meet the requirements of CBSA B184.2-11 for “Polypropylene (PP) Chambers”

600mm Storm Sewer

The proposed 600mm storm sewer from the south entrance from Greenbank Road to the infiltration chambers will alleviate the flooding at the south entrance, which will prevent the car wash from flooding during frequent events. The installation of this storm sewer will be within the property limits for the existing Canadian Tire, but will require the removal and installation of vegetation such as trees and bushes as shown on the Drawing 113199-TCP.

Check Valve

A check valve (flap gate) is to be installed on the 300mm pipe entering MH16 to prevent flows from the off-site storm sewers from entering the underground storage chambers.

Utilities

The location of existing utilities shown on the Drawing 113199-STM is based on the available design drawings. While there are no apparent conflicts based on the current layout, utility locates are to be performed in advance of construction. If any conflicts with existing utilities are identified, the layout of the proposed storm sewers and infiltration chambers will be adjusted accordingly.

Landscaping

The proposed 600mm storm sewer will be routed along the western property limit parallel to Greenbank Road in order to minimize disruption to the Gas Bar and carwash. The proposed sewer will require the removal of existing trees and shrubs along the property line.

The proposed landscaping plan (Drawing 113199-L) replaces the vegetation that will be removed during construction with vegetation of equivalent size. All large trees will be placed at least 1.5m from the proposed storm sewer.

Construction

A pre-construction meeting will be held with representatives from Keller Engineering, Novatech Engineering, and the contractor to go over the installation procedure. It is anticipated that construction will take approximately two (2) to three (3) weeks to complete.

7.0 WATER QUALITY

The Canadian Tire storm sewers are tributary to the Kennedy-Burnett Stormwater Management Facility, which provides water quality treatment before outletting into the Jock River. For the Gas Bar, two (2) existing stormceptors (STC-750) have been installed to capture any spillage from the gas pumps before outletting into the storm sewer system.

8.0 EMERGENCY OVERLAND DRAINAGE

The main Canadian Tire parking lot does not have a defined overland drainage route. The lowest spill elevation is along the west side of the site and is approximately 0.50m higher than the elevations of the catchbasins within the parking lot. The lowest point of the Canadian Tire building is the entrance to the garage, which is 0.80m higher than the elevations of the catchbasin within the parking lot.

The overland flow route for the Gas Bar is via Greenbank Road, which is sloped south to Strandherd Drive and eventually the Kennedy Burnett Stormwater Management Facility.

9.0 GEOTECHNICAL INVESTIGATION

The following geotechnical reports, provided in **Appendix A,** were reviewed to determine the soil type, depth of bedrock and groundwater elevations.

1. Geotechnical Investigation, Proposed Commercial Development, 1581 Greenbank Road (i.e. Village Square Plaza Expansion), Ottawa, Ontario

   Golder and Associates, December 2009 – Report Number 09-1121-1036

2. Geotechnical Investigation – Canadian Tire Real Estate Limited, Proposed Store #442 Barrhaven, Ontario

   Jacques, Whitford & Associates Limited, January 31, 2000

Based on the geotechnical report (Golder and Associates) for the expansion to Village Square Plaza, the soil type between 0.5 and 3.5m below grade is on average sandy silt (glacial till), which has a low hydraulic conductivity (10^{-7} m/s) and percolation rate (25mm/hr). Bedrock elevations were observed to be below 3.5m.

The geotechnical report (Jaques Whitford & Associates) for the Canadian Tire was completed before the building and parking lot were built. In general, the underlying soil was predominantly glacial till (consisting of a heterogeneous mixture of silt, sand and gravel) with layers of silty clay. Bedrock in the location of the proposed works is on average 3m from the ground surface with no groundwater levels observed in the boreholes.

10.0 EROSION & SEDIMENT CONTROL REQUIREMENTS

The erosion and sediment control requirements that will be implemented during construction are as follows.

Temporary and permanent erosion and sediment control measures are to be implemented prior to, during and after construction; and should be inspected regularly.

To prevent surface erosion, sediment and debris from entering the storm system during construction, the following erosion and sediment control measures should be implemented during construction in accordance with the "Guidelines on Erosion and Sediment Control for Urban Construction Sites" (Government of Ontario, May 1987):

- Filter socks (i.e. Filtrexx or approved equivalent) should be placed around the grates of all area drains and remain in place until the asphalt has been reestablished and construction is complete;
- Street sweeping and cleaning should be performed on all roads adjacent to active construction on a regular basis; and,
- Stockpiles should not be located overtop of maintenance holes, storm inlets or utility accesses. Stockpile locations should not block any overland drainage paths.

Permanent erosion and sediment control measures will consist of re-establishing the asphalt and re-planting all disturbed vegetation areas.

11.0 CONCLUSIONS AND RECOMMENDATIONS

This report provides an overview of the existing storm drainage system and identifies the probable causes for the existing flooding issues at the Canadian Tire in Barrhaven (Ottawa), Ontario. The proposed modifications to the existing system will improve the capacity of the on-site sewers and provide additional underground storage.

Existing Conditions

- The existing design did not account for the conveyance of stormwater (i.e. hydraulics) within the site, as such the storm sewers are undersized to convey peak flows to the main parking lot for storage.
- The main parking lot has been sized to provide sufficient surface storage.
- Ponding in the parking lot experienced during storm events equal to or greater than the 2-year storm event prevents stormwater from being conveyed from the south entrance from Greenbank Road; therefore, significant ponding occurs at the south entrance from Greenbank Road.

- The Hydraulic Grade Line in the 600mm storm sewer along Greenbank Road prevents the site from draining during storm events greater than the 2-year storm event, which causes backflows into the Canadian Tire storm sewer system.

Proposed Modifications

- Improve the conveyance capacity of the on-site storm sewers by installing a new 600mm pipe from the Gas Bar entrance to the underground storage system.
- Provide underground storage chambers (i.e. StormTech MC-3500 or approved equivalent) beneath the parking lot to store the 5-year storm event underground.

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Michael Petepiece, P.Eng.
Project Manager

Appendix A:

Geotechnical Reports

A1 – Geotechnical Investigation – Canadian Tire Real Estate Limited, Proposed Store #442 Barrhaven, Ontario, *Jacques, Whitford & Associates Limited, January 31, 2000*

A2 – Geotechnical Investigation, Proposed Commercial Development, 1581 Greenbank Road (i.e. Village Square Plaza Expansion), Ottawa, Ontario, *Golder and Associates, December 2009*

CANADIAN TIRE REAL ESTATE LIMITED

GEOTECHNICAL INVESTIGATION

PROPOSED STORE #442
BARRHAVEN
NEPEAN, ONTARIO

Box # 351201125
File # 19248

PROJECT NO. 11297

GEOTECHNICAL REPORT TO

CANADIAN TIRE REAL ESTATE LIMITED

ON

PROPOSED STORE #442
BARRHAVEN

NEPEAN, ONTARIO

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January 31, 2000

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for proposed Canadian Tire Store #442, located at the intersection of Greenbank Road and Strandherd Road in Nepean, Ontario. The investigation was carried out in accordance with our proposal dated January 11, 2000. Authorization to carry out this investigation was provided by Mr. Martin Toomes of Canadian Tire Real Estate Limited.

This report has been prepared specifically and solely for the proposed development described herein. It contains all of our findings and includes geotechnical recommendations for the design and construction of the proposed building, gas bar, pylon signs and pavement areas.

2.0 PROPOSED DEVELOPMENT

The proposed store development site is located at the northeast corner of Greenbank Road and Strandherd Road in the community of Barrhaven. The site location is shown on Drawing No. 11297-1 provided in Appendix 1.

It is understood that the development will consist of a *Canadian Tire Retail and Automotive Centre - Prototype 'B'* facility, which includes a single-storey slab-on-grade structure with a footprint of 7,432 m^2, a gas bar with a small booth like building, underground storage tanks and overhead canopy, pylon signs and parking for approximately 400 passenger vehicles. The proposed development will also include underground service connections.

The building will not have a basement. The floor loading will principally consist of storage racks with a total floor load of less than 14.4 kPa (300 psf). The finished floor elevation was identified on the Site Plan provided by Bronte Engineering Limited (Drawing No. A01A) as being 100.50 m, geodetic. Column loads have not yet been established, however, it is likely that they will not exceed 900 kN (200 kips).

It is understood that the building will include 15 garage bays which will be equipped with hydraulic lifts. The foundations for the lifts have been assumed to be within 3.0 m of the finished floor elevation.

A below grade truck ramp will be built at the northeast corner of the building to facilitate loading and unloading of merchandise.

3.0 SCOPE OF WORK

The scope of work for this investigation included the following:

1. A drilling investigation consisting of thirty six (36) boreholes located as follows:
    - 18 within the pavement areas
    - 16 within the building footprint
    - 2 at pylon sign locations
2. Laboratory testing of collected soil samples, including:
    - grain-size distribution
    - Atterberg limits
    - moisture content
    - pH, sulphate, and resistivity
3. Preparation of a Geotechnical Report including the following:
    - Borehole Location Plan
    - Borehole Records
    - description of the soil conditions and groundwater levels at the site
    - geotechnical design parameters for foundations and slabs-on-grade
    - pavement structure recommendations
    - general site development recommendations

The investigation and reporting was carried out in accordance with the Canadian Tire document entitled *Investigation of Soils Conditions: Standard Canadian Tire Requirements.*

This geotechnical investigation was carried out in conjunction with a Phase I and Phase II Environmental Site Assessments. The results of the environmental site assessment work are described in a separate report.

A geotechnical investigation was carried out at this site by Jacques Whitford Limited in 1990 for a proposed Canadian Tire development. The development proposed in 1990 was a smaller development with a different building footprint. The investigation carried out in 1990 consisted of 13 test pits. The results of that investigation are presented in Jacques Whitford Report No. 10161 and were considered during the preparation of this document.

4.0 METHOD OF INVESTIGATION

4.1 Field Investigation

A total of thirty six (36) boreholes were drilled between January 19 and 25, 2000, at the locations shown on Drawing No. 11297-2, Appendix 1. The boreholes were drilled using a track-mounted CME-55 drill rig, suitably equipped for soil and bedrock sampling.

Prior to the commencement of the drilling investigation, Jacques Whitford carried out the following activities:

- Site inspection by a geotechnical engineer to assess the surficial site conditions.
- Layout of the borehole locations relative to the property boundary by a land surveyor.
- "Clearance to dig" from the appropriate utility agencies.

All foundation boreholes (18 for the building, and 2 for the pylon signs) were advanced to auger refusal on inferred bedrock. Split-spoon samples were collected at regular depth intervals while conducting standard penetration tests (SPT). All recovered samples were stored in moisture-proof bags and were returned to our laboratory for detailed classification and testing.

All pavement boreholes (16 in total) were drilled to a depth of 10 feet (3 m) or auger refusal. Split-spoon samples were collected at regular depth intervals while conducting standard penetration tests (SPT). All recovered samples were stored in moisture-proof bags and were returned to our laboratory for detailed classification and testing.

Standpipes were installed within 14 of the boreholes and groundwater levels within the standpipes were measured on January 28, 2000.

4.2 Survey

Ground surface elevation at each of the borehole locations was surveyed relative to a local geodetic benchmark established by the land surveyors (Annis, O'Sullivan, Vollebekk Ltd.). Annis, O'Sullivan Vollebekk Ltd. was retained by Jacques Whitford to lay out the borehole locations and carry out the elevation survey. Ground surface elevations at the borehole locations are indicated on the Borehole Records and on the Borehole Location Plan.

4.3 Laboratory Testing

All samples returned to the laboratory were subjected to detailed visual classification by a geotechnical engineer. Selected samples were tested for moisture content, Atterberg limits and grain-size distribution. Three soil samples were submitted to Paracel Laboratories in Ottawa, Ontario, for pH, water soluble sulphate and resistivity testing. Samples remaining after testing will be stored for a period of three months after issuance of this report. Samples will then be discarded unless we are otherwise directed.

5.0 RESULTS OF INVESTIGATION

5.1 Surface Conditions

The site is currently undeveloped. The majority of the site has never been developed but may have been cultivated, the exception being an area of approximately 2,000 m^2, at the south end of the site fronting onto Strandherd Road, which was formerly the site of a residence with a footprint of approximately 225 m^2. The home was demolished in the 1980's, however, the old foundations walls and basement slab are still in place. The basement has been in-filled with soil and debris such as concrete and brick. The ground surrounding the former residence is raised above the surrounding natural grades by up to 900 mm.

The site topography is rolling with high points being located in the southwest and northwest corners. Existing ground surface elevations across the site vary by up to 4 m, including a variation of up to 1.8 m within the proposed building footprint.

The majority of the site is vegetated with wild grass and brush. Two tree lines are present; one along the northern property line and a second following a ditch which extends north-south through the middle of the site. The trees are typically in the range of 8 to 12 m tall. Cattails are present in the low lying area immediately east of the former residential development.

A shallow ditch passes through the middle of the site from north to south. The depth of the ditch is generally no greater than 500 mm. Surface drainage is generally poor and toward the low lying areas on site.

General site features and the proposed development area are shown in Drawing 11297-2 in Appendix 2.

5.2 Subsurface Profile

The subsurface conditions observed in the boreholes are presented in detail on the Borehole Records provided in Appendix 2. An explanation of the symbols and terms used to describe the Borehole Records is also provided.

In general, the observed stratigraphy consisted of a surficial organic layer (topsoil) overlying glacial till, overlying bedrock. A layer of silty clay/clayey silt was present in low-lying areas. Fill was present in the area of the former residential development. At the time of this investigation, frost had penetrated the ground to a depth of 500 to 600 mm, making it impossible to determine the relative compactness (loose, compact, dense, etc.) of the surficial soils.

The soil strata encountered are described in the following sections.

5.2.1 Topsoil

A layer of dark brown topsoil was encountered immediately beneath the surficial vegetation throughout the entire site, except the footprint of the former residence. Elsewhere, the thickness of the topsoil layer, varied from 50 mm to 380 mm, with an average of 260 mm. The upper portion of the topsoil layer contained many rootlings. No assessment of the quality of the topsoil material was carried out. The topsoil layer was frozen at the time of this investigation

5.2.2 Fill

Fill material was encountered within the upper 1.5 m of Borehole BH00-24, located within the footprint of the former residence. The fill consisted of sandy silt with occasional pieces of brick and concrete. A hard object was encountered at a depth of 1.2 m, however, the fill was generally in a loose state. Debris such as concrete and brick were visible at ground surface despite partial snow cover at the time of the investigation.

5.2.3 Silty Clay / Clayey Silt

A deposit of silty clay/clayey silt was encountered beneath the topsoil in approximately half of the boreholes; those situated within the low-lying area extending diagonally across the site from the northwest to southeast corner. The thickness of the silty clay/clayey silt deposit, where encountered, varied from approximately 500 mm to 2.5 m. The silty clay/clayey silt was brown in colour. Pocket penetrometer tests were carried out on selected samples indicated that the undrained shear strength of the material typically varied form 75 kPa to 110 kPa, indicating a very stiff to stiff consistency.

The moisture content of the eleven samples tested ranged from 33 % to 40 % with an average of 36 %. Atterberg limit testing indicated that the sample tested had a liquid limit of 42 % and a plastic limit of 23 %.

5.2.4 Glacial Till

A glacial till deposit was encountered in all boreholes either directly beneath the topsoil or beneath the silty clay/clayey silt. The glacial till consists of a heterogeneous mixture of silt, sand and gravel with occasional cobbles and boulders. Grain-size analysis testing carried out on samples of the glacial till indicate that it typically contains between 7 and 22 % gravel, 45 to 51 % sand, 33 to 42 % silt and clay size particles. Standard Penetration Test N-values indicated that the till was typically compact to dense, however, zones with loose or very dense glacial till were also encountered. The moisture content of the fourteen till samples tested ranged from 6 % to 15 %, with an average of 8.5 %.

5.3 Bedrock

Bedrock was inferred by auger refusal in 24 of the 36 boreholes at depths ranging from 900 mm to over 6.7 m. In all but 8 borehole locations, bedrock was greater than 3 m below existing grade. It is noted that *Geological Survey of Canada* maps indicate that a fault line is situated in close proximity to the site and extends from the northwest to the southeast - likely following the edge of the high ground located in the northeast corner of the site.

5.4 Groundwater

Groundwater levels were measured in the standpipes on January 25, 2000. The groundwater levels varied from 1.3 m to 4.3 m below ground surface. Fluctuations in the groundwater level due to seasonal variations or in response to a particular precipitation event should be anticipated.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 Geotechnical Assessment

Conventional spread footings placed on native silty clay/clayey silt or glacial till or placed on structural fill overlying these native soils are recommended as the most suitable foundation system for support of the proposed building.

Significant site grading work will be required due to the large variation in existing ground surface elevations across the site. Preliminary site plans indicate a finished floor elevation of 100.50 m. Significant site preparation should also be expected in the area of the former residential development. Backfill in this area is generally in a loose state and not suitable beneath foundations, slabs-on-grade or pavement structures. In addition, trees will need to be removed from the tree lined ditch and the ditch will need to be filled.

The following sections outline our recommendations for the design of the proposed building, gas bar, pylon signs and parking areas.

6.2 Site Grading and Preparation

Beneath Spread Footings

Spread footings must be placed on suitable native soils or structural fill overlying suitable native soils. Therfore, it will be necessary to sub-excavate the following materials from beneath the spread footings:

- Surficial vegetation and organic soils
- Existing fill and other deleterious material from the former residential development

The horizontal limits of the sub-excavation are defined by an imaginary line extending away from the outside edge of the footing at an angle of one horizontal to one vertical (1:1) down to the suitable native soil. It is noted that site preparation beneath footings will extend to approximately 1.8 m below existing grades at some locations.

Structural fill may be used to raise the grades to the underside of footing elevation. Structural Fill for use beneath spread footings should consist of clean granular material such as OPSS Granular A, or Granular B Type I or II.

Beneath Slabs-on-Grade

In order to limit settlements to tolerable levels and to provide uniform support to the floor slab, the following materials should be removed from beneath slabs-on-grade:

- Surficial vegetation and organic soils
- Former foundations, foundation walls and other debris
- Other deleterious material

Existing granular fill may remain in place beneath the proposed floor slab areas provided it is surface compacted to the satisfaction of qualified geotechnical personnel. Any soft areas identified during the surface compaction will need to be sub-excavated and replaced with structural fill.

Structural Fill for use beneath slabs-on-grade should consist of clean granular material such as OPSS Granular A or Granular B, Type I or II.

Beneath Pavement Areas

In order to limit differential settlements and frost heave, the following materials should be removed from beneath all pavement areas:

- Surficial vegetation and organic soils
- Former foundations, foundation walls and concrete slabs located within 1.2 m of finished grade
- Other deleterious material

Existing granular fill may remain in place beneath the proposed pavement areas provided it is surface compacted to the satisfaction of qualified geotechnical personnel. Any soft areas identified during the surface compaction will need to be sub-excavated and replaced with subgrade fill.

Subgrade fill in parking areas, if required, should consist of materials meeting the requirements of OPSS Select Subgrade Material (SSM).

Reuse of Site-Generated Material

Site generated material may be used as subgrade fill beneath pavement areas provided it is free of organic matter and provided that an adequate degree of field compaction can be achieved. The native silty clay/clayey silt and glacial till both have a high silt content, making them very sensitive to changes in moisture content. All or a portion of the site generated material may be unsuitable for re-use depending on the weather conditions and in-situ moisture content at the time of construction.

General Site Preparation

All structural fill and subgrade fill materials should be tested and approved by a geotechnical engineer prior to delivery to the site. Fill should be placed in lifts no thicker than 300 mm and compacted using suitable compaction equipment.

Structural Fill should be compacted to at least 98% Standard Proctor maximum dry density (SPMDD). The degree of compaction may be reduced to 95% SPMDD for subgrade fill in parking areas. Where subgrade fill is dissimilar to the existing material on site, the edges of the existing fill should be graded to slope no steeper than 5 horizontal to 1 vertical prior to placing the new subgrade fill in order to limit the effects of differential frost movements.

Earth removal should be inspected by a geotechnical engineer to ensure that all unsuitable materials are removed prior to placement of Structural/Subgrade Fill. Inspection and testing services will also be required to ensure that all fill is placed and compacted to the required degree.

It is noted that the existing site drainage is relatively poor and that the ground water level is quite high within the low-lying parts of the site. Temporary ditching during construction on site should be considered.

The soils at this site are susceptible to disturbance from traffic and weather conditions. Site preparation work should be scheduled such that approved subgrades are quickly covered with pavement or underslab granulars. Construction traffic should be restricted to haul roads across the site.

6.3 Spread Footings

Footings placed on undisturbed native soil or on structural fill placed on native soils may be designed using an allowable bearing pressure of 150 kPa. A factor of safety of 3 has been utilized in the analysis for allowable bearing pressure.

The total and differential settlements associated with the recommended bearing pressure and maximum foundation loads will be less than 25 mm and 19 mm, respectively.

All perimeter footings and interior footings located within 1 m distance from the exterior walls will require a minimum soil cover of 1.5 m for protection against frost action. Footings in unheated areas or exterior footings for signs, canopies, etc. should be founded at least 1.8 m below exterior grade to protect against frost action.

The base of all footing excavations should be inspected by a geotechnical engineer prior to placing concrete to confirm the above design pressure and to ensure there is no loose material left over the prepared subgrade surface. Any loose or disturbed material identified during the inspection will need to be removed and disposed of. Where construction is undertaken during winter conditions, footing subgrades should be protected from freezing and foundation walls and columns should be protected against heave due to soil adfreeze.

It is noted that the native soils at this site are sensitive to disturbance from water or construction activity. The contractor is responsible for maintaining the founding soils in an undisturbed state. A mud slab may be required at some locations.

6.4 Slab-on-Grade

A conventional slab-on-grade unit is suitable for the support of floor loads of up to 300 psf (14.4 kPa) provided the site is prepared as outlined in Section 6.2. A layer of free draining granular material such as clean crushed stone at least 200 mm in thickness should be placed immediately beneath the floor slab for levelling and support purposes. This material should be compacted to at least 100% SPMDD.

The floor slab constructed as recommended above may be designed using a soil modulus of subgrade reaction, k, of 40 MPa/m. Settlements of the floor slab are expected to be less than 5 mm.

The slab-on-grade unit should float independently of all load-bearing walls and columns in order to allow minor movements to take place without cracking the slab.

A perimeter drainage system for the proposed building is not required provided exterior grades are 150 mm lower than the finished floor elevation. It is recommended that the exterior grades be sloped downward away from the building.

Where construction is undertaken during winter conditions, floor slab subgrades should be protected from freezing. Alternatively, the floor slab subgrade should be completely thawed, then proof rolled prior to placing concrete.

Exterior slabs-on-grade, including the truck ramp and at the gas bar, should be protected from frost action with either 50 mm of polystyrene insulation or at least 1 m of underlying non-frost susceptible soil fill. The insulation or the fill should extend out beyond the limit of the slab by at least 1 m.

6.5 Underground Tank Installations

The design of underground tank installations should account for buoyancy forces. For design purposes, the groundwater table should be assumed to be at the ground surface and the tank should be assumed to be empty. A concrete slab with anchors may be used to counteract the buoyancy forces.

Granular bedding and backfill materials should be placed and compacted in accordance with the tank installation specifications.

6.6 Below-Grade Truck Ramp / Retaining Walls

It is understood that a below-grade truck ramp will be constructed in the northeast corner of the building as part of the proposed receiving area. It is recommended that the ramp be constructed with a concrete base pad. Consideration should also be given to placing concrete pads to support semi-trailer jack legs at specific truck parking areas.

Where concrete pads are placed, some deterioration of the asphalt abutting the concrete should be anticipated as a result of the differential behaviour of each in response to frost heave and temperature change. The concrete pads should have a minimum thickness of 200 mm.

Generally, concrete parking areas or pads do not need underslab gravels. However, in the area of the below-grade truck ramp, it is recommended that the following granular thicknesses be used for drainage purposes:

OPSS Granular A	150 mm
OPSS Granular B, Type I	250 mm

The granulars should be connected to a perimeter drainage system, with a frost free outlet, provided around the ramp.

The grade change between the below-grade ramp and the adjacent areas will likely be constructed with a small retaining structure.

To prevent hydrostatic pressure buildup, backfill against retaining structures should consist of free draining granular materials. The granular materials must be at least 0.9 m wide and be connected to a drainage system at the base of the wall.

The earth pressures recommended below are based on the assumption that a permanent horizontal back slope will be utilized behind the retaining wall. In order to use the coefficients of pressures for the granular materials, the granular backfill must be provided within a wedge extending from the base of the wall at 45 degrees (or smaller) to the horizontal. If a smaller wedge is used, the coefficients of earth pressures of the materials outside the backfill wedge must be used for lateral pressure design calculations.

For retaining walls that are designed to allow rotation, active earth pressure may be used for design. For rigidly tied structures, the at rest pressure should be used for design, unless the wall can deflect enough (approximately 0.05% of the wall height) to establish the active pressure.

Lateral earth pressures may be calculated using the following parameters:

Parameters	Granular A	Granular B, Type I	Native Glacial Till	Native Silty Clay
Unit Weight (kN/m^3)	22.5	21.0	21.0	17.0
Angle of Internal Friction, ϕ	35°	30°	32°	27°
Coeff. of Active Earth Pressure, K_a	0.27	0.33	0.31	0.37
Coeff. of Earth Pressure at Rest, K_o	0.43	0.50	0.47	0.55

The bearing surface preparation comments provided in Sections 6.2 above are applicable to foundations for retaining walls. Retaining wall foundations can be design as conventional spread footings as described in Section 6.3 above. The underside of the retaining walls should be provided with a minimum of 1.8 m of soil cover or equivalent insulation for frost protection.

Sliding resistance can be calculated using the following unfactored friction coefficients:

Condition	Unfactored Friction Coefficient
Between Concrete and Structural Fill	0.55
Between Concrete and Native Glacial Till	0.45
Between Concrete and Native Silty Clay/Clayey Silt	0.38

A minimum factor of safety of 1.5 should be used to assess stability with respect to sliding.

6.7 Excavation and Backfilling

Temporary excavations for footings or services in the fill or native silty clay/clayey silt should be supported or be no steeper than 1 horizontal to 1 vertical from the base of the excavation as per the requirement of the current version of the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. Temporary excavations in the native glacial till may be supported or be no steeper than 1 horizontal to 1 vertical from 1.2 m above the base of the excavation. Difficulties may be encountered during excavation in the glacial till due to the presence of boulders.

Excavations into the bedrock, if required, will require rock breaking techniques. These excavations may be carried out with near vertical slopes, however, any loose rock should be scaled from the face of the excavation.

Groundwater levels at the time of the investigation varied from 1.3 m to over 4 m below ground surface. It was noted that cattails were observed in the low-lying part of the site adjacent to Strandherd Road. Groundwater will likely be encountered during excavations for footings and services throughout parts of the site. Surface water may be encountered in low-lying parts of the site in the spring. It is expected that groundwater may be controlled by sump and pumping methods. It is the responsibility of the contractor to protect the bearing surface from being disturbed due to infiltration.

Foundation backfill should consist of free draining granular materials placed and compacted in lifts. Care should be taken immediately adjacent to walls to avoid over compaction of the soil resulting in damage to the walls.

Backfill under structures sensitive to movement, such as sidewalks and curbs, should incorporate appropriate frost tapers to reduce potential frost heave damage.

Bedding for utilities should be placed in accordance with the pipe design requirements. It is recommended that a minimum of 300 mm of OPSS Granular A be placed below the pipe invert as bedding material. Bedding material should also be placed around the pipe with a minimum of 300 mm vertical cover. These materials should be compacted to at least 95% of SPMDD.

Backfill for service trenches in landscaped areas may consist of excavated material replaced and compacted in lifts. Where the service trenches extend below paved areas, the trench should be backfilled with OPSS Granular B material from the top of the pipe cover to within 1.6 m of the proposed pavement surface, placed in lifts and compacted to at least 95% of SPMDD. The material used within the upper 1.6 m and below the subgrade line should be similar to that exposed in the trench walls to prevent differential frost heave, placed in lifts and compacted to at least 95% of SPMDD.

Catchbasins and manholes should be backfilled with compacted granular materials. A 3H:1V frost taper should be built within the upper 1.2 m. Joints between manhole and catchbasin sections should be wrapped with a non-woven geotextile.

6.8 Pavement Structure Recommendations

It has been assumed that the parking areas will be used mostly by passenger vehicles, and the access roads will be used by delivery trucks and fire vehicles.

The subgrade in paved areas should be prepared as described in Section 6.2 above. The following minimum pavement structures are recommended:

	Parking Areas	Access Roads
Asphalt Surface Course	38 mm	38 mm
Asphalt Binder Course	50 mm	75 mm
Granular A	150 mm	150 mm
Granular B Type I	250 mm	300 mm

It is noted that the asphalt thicknesses match the Canadian Tire standard but the thickness of the pavement granulars is greater than the official Canadian Tire standard pavement structure. This is recommended in order to minimize the effects of differential frost heave associated with the variability of the subgrade soils (silty clay/clayey silt and glacial till) which are moderately frost susceptible.

It is estimated that the service life prior to major rehabilitation for the above pavement structures is 20 years provided they are properly maintained. The pavement surface and the underlying subgrade should be graded to direct runoff water towards suitable drainage. "Stub drains" should be placed on the subgrade level around all catch basins to promote drainage and reduce potential frost heaving of the pavement structure around the catch basins.

All granular materials should be tested and approved by a geotechnical engineer prior to delivery to the site. Both base and subbase materials should be compacted to at least 100% SPMDD. Asphalt should be compacted to at least 97% Marshall bulk density.

It is recommended that the lateral extent of the subbase and base layers not be terminated in a vertical fashion immediately behind the curb line. A taper with a grade of 5 horizontal to 1 vertical is recommended in the subgrade line to minimize differential frost heave problems under sidewalks.

6.9 Earthquake Considerations

As outlined in the National Building Code of Canada (NBCC), 1990, buildings and their foundations must be designed to resist a minimum earthquake force. The NBCC formula for obtaining the minimum earthquake force is dependent upon several factors, including the Foundation Factor. The recommended Foundation Factor, F, is 1.0 for the soils encountered at this site.

6.10 Cement Type and Corrosion Potential

Three representative soil samples were submitted to Paracel Laboratories in Ottawa, Ontario, for pH, water -soluble sulphate and resistivity testing. The test results will be summarized in a separate letter detailing the degree of sulphate attack expected for concrete in contact with the site soils and groundwater. The pH level and resistivity will provide an indication of the level of potential attack on buried steel objects such as reinforcing steel.

7.0 CLOSURE

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review our recommendations when the drawings and specifications are complete.

A soil investigation is a limited sampling of a site. The conclusions given herein are based on information gathered at the specific borehole locations and can only be extrapolated to an undefined limited area around these locations. The extent of the limited area depends on the soil and groundwater conditions, as well as the history of the site reflecting natural, construction, and other activities. Should any conditions at the site be encountered which differ from those at the borehole locations, we request that we be notified immediately in order to assess the additional information and its effects on the above conclusions.

We trust the information presented herein meets your present requirements. Should you have any questions or require additional information, please do not hesitate to contact us.

Yours very truly,

JACQUES, WHITFORD & ASSOCIATES LIMITED

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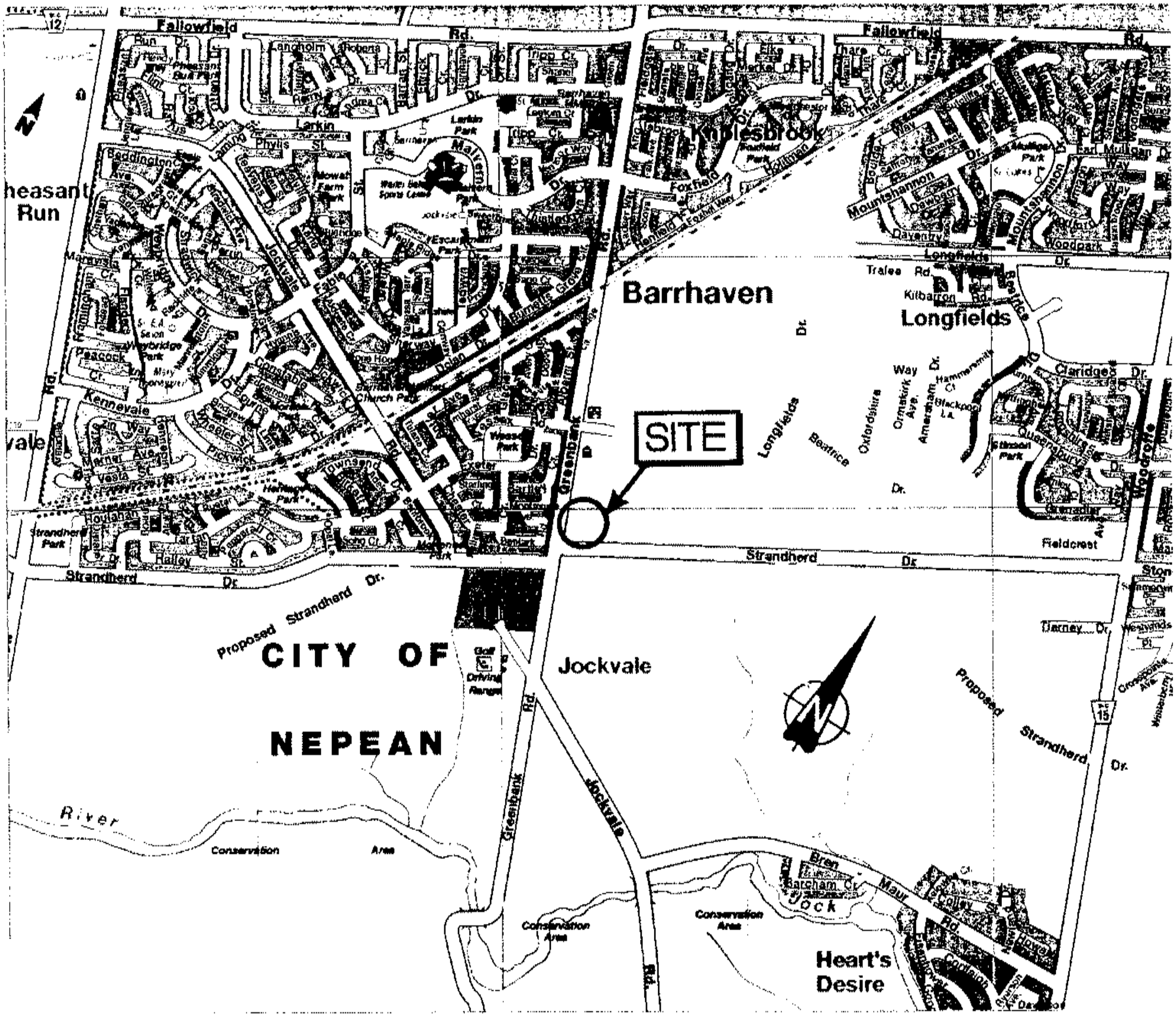
P:\2000\10000\11297\Geotech\11297 Geo Rep.wpd

APPENDIX 1



KEY PLAN

1 : 25 000

Reference: MapArt

PROJECT No. 11297

DRAWING No.

APPENDIX 2

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil - mixture of soil and humus capable of supporting good vegetative growth
Peat - fibrous aggregate of visible and invisible fragments of decayed organic matter
Till - unstratified glacial deposit which may range from clay to boulders
Fill - any materials below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated - having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured - having cracks, and hence a blocky structure
Varved - composed of regular alternating layers of silt and clay
Stratified - composed of alternating successions of different soil types, e.g. silt and sand
Layer - >75 mm
Seam - 2 mm to 75 mm
Parting - < 2 mm
Well Graded - having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Uniformly Graded - predominantly of one grain size

Terminology describing soils on the basis of grain size and plasticity is based on the Unified Soil Classification System (USCS) (ASTM D-2488). The classification excludes particles larger than 76 mm (3 inches). This system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%

The standard terminology to describe cohesionless soils includes the compactness (formerly "relative density"), as determined by laboratory test or by the Standard Penetration Test 'N' - value.

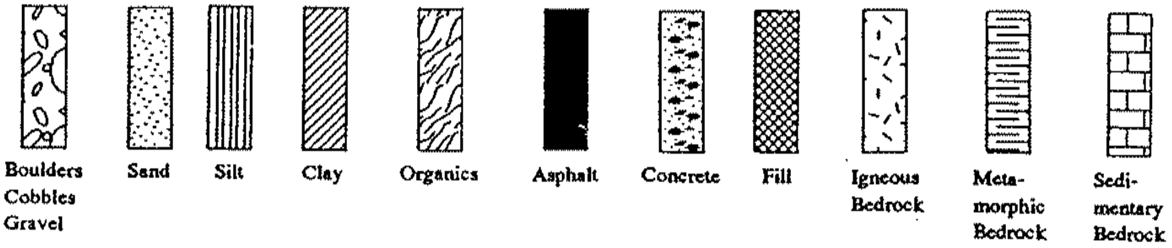
Relative Density	'N' Value	Compactness %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Moderate	-	Weathering extends throughout rock mass. Rock is not friable.
High	-	Weathering extends throughout rock mass. Rock is friable.

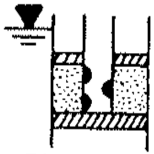
STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



WATER LEVEL MEASUREMENT

Borehole or
Standpipe



Piezometer

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
PS	Piston sample
BS	Bulk sample
WS	Wash sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond drilling bits.

N - VALUE

Numbers in this column are the results of the Standard Penetration Test: the number of blows of a 140 pound (64 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil. For split spoon samples where insufficient penetration was achieved and 'N' values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75).

OTHER TESTS

S	Sieve analysis
G_s	Specific gravity of soil particles
k	Permeability (cm/sec)
⊤↓	Single packer permeability test; test interval from depth shown to bottom of borehole
⌶	Double packer permeability test; test interval as indicated
○↓	Falling head permeability test using casing
▽↓	Falling head permeability test using well point or piezometer
H	Hydrometer analysis
γ	Unit weight
C	Consolidation
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct shear
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$; the index corrected to a reference diameter of 50 mm)

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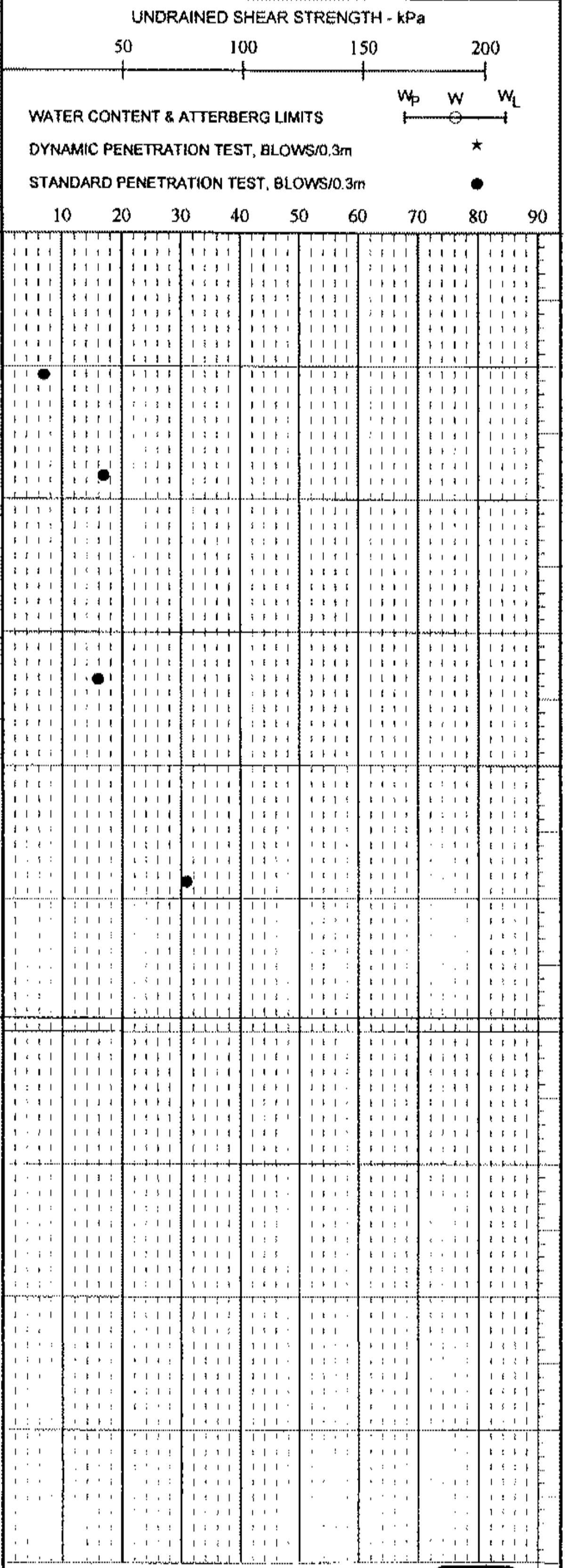
BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**
BOREHOLE No. **BH 00-1**
LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**
PROJECT No. **11297**
DATES: BORING **00-01-24**
WATER LEVEL **00-01-28**
DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	101.07							
	100.8	300 mm TOPSOIL						
1	99.6	Loose, brown silty sand, some clay, trace gravel, occasional cobbles, occasional boulders: TILL			SS	1	480	7
2		Compact to dense, brown silty sand, trace gravel, occasional cobbles and boulders: TILL			SS	2	540	17
3					SS	3	520	16
4				▼				
5					SS	4	550	31
	95.2				SS	5	310	50/ 100
6		End of Borehole - standpipe installed						
7								
8								
9								
10								



▽ Inferred Groundwater Level
▼ Groundwater Level Measured in Standpipe

▫ Field Vane Test, kPa
▫ Remoulded Vane Test, kPa
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT Canadian Tire Real Estate Limited

LOCATION Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON

DATES: BORING 00-01-24

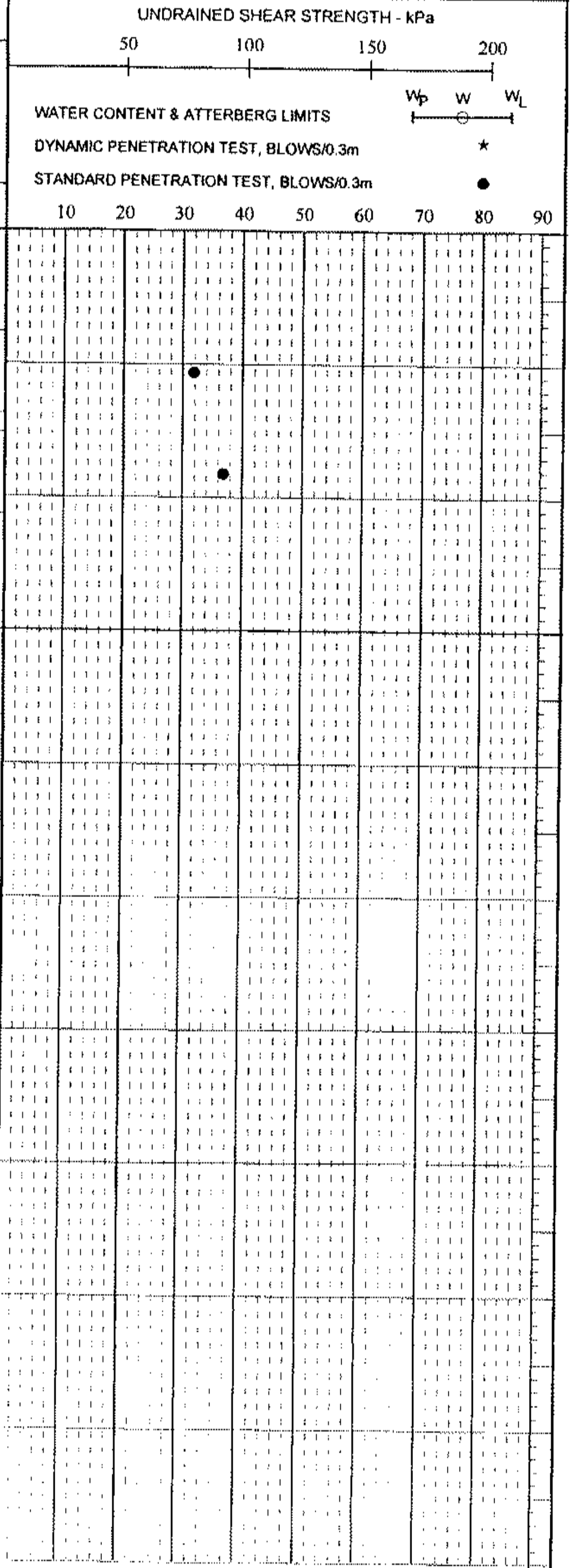
WATER LEVEL

BOREHOLE No. BH 00-2

PROJECT No. 11297

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	100.22							
	99.9	300 mm TOPSOIL						
		Dense, brown silty sand, trace gravel, occasional cobbles, occasional boulders: TILL						
1					SS	1	320	32
2					SS	2	560	37
3	97.2	End of Borehole Auger Refusal on Inferred Bedrock						
4								
5								
6								
7								
8								
9								
10								



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

▫ Remoulded Vane Test, kPa

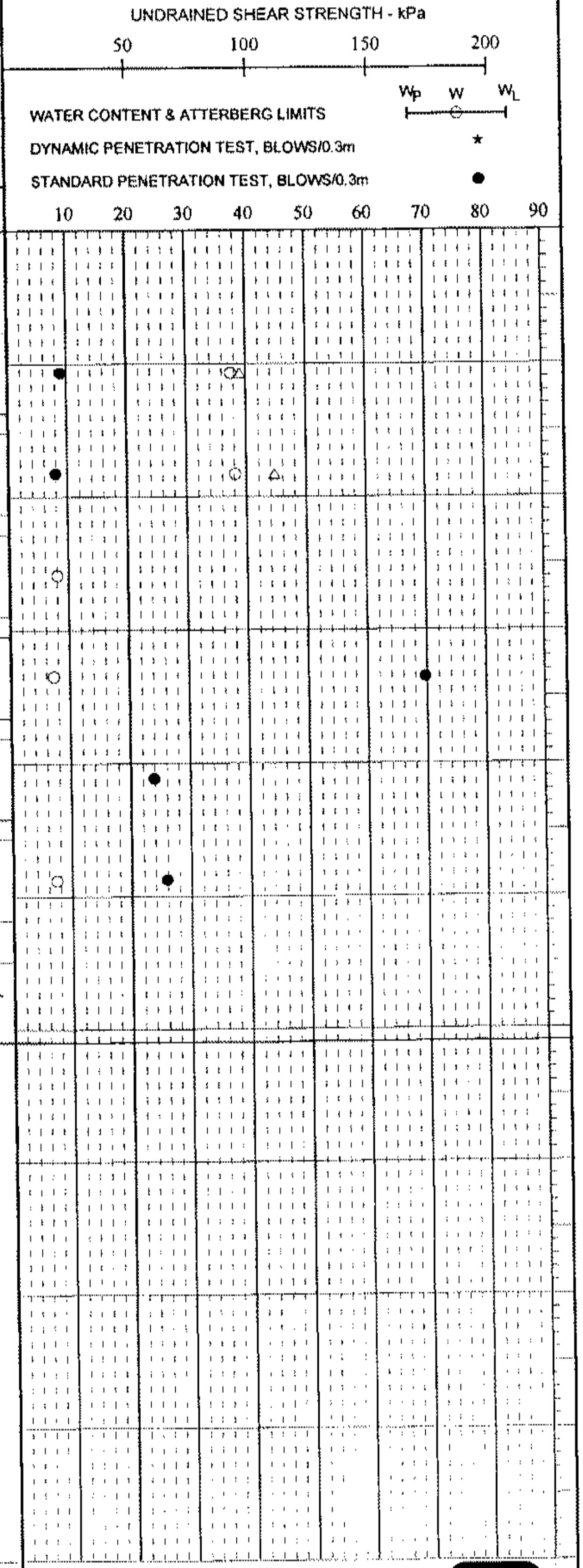
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**
BOREHOLE No. **BH 00-3**
LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**
PROJECT No. **11297**
DATES: BORING **00-01-20**
WATER LEVEL
DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.65					
	99.3	325 mm TOPSOIL				
		Very stiff to stiff, brownish grey SILTY CLAY				
1			SS	1	610	9
			SS	2	610	8
2	97.5	Compact to very dense, grey sand and silt, trace to some gravel, occasional boulders: TILL				
			SS	3	300	* ref
3			SS	4	610	70
4			SS	5	610	24
5			SS	6	610	26
			SS	7	200	* ref
6	93.6	End of Borehole Auger Refusal on Inferred Bedrock * ref = split spoon refusal				
7						
8						
9						
10						



▽ Inferred Groundwater Level
▼ Groundwater Level Measured in Standpipe

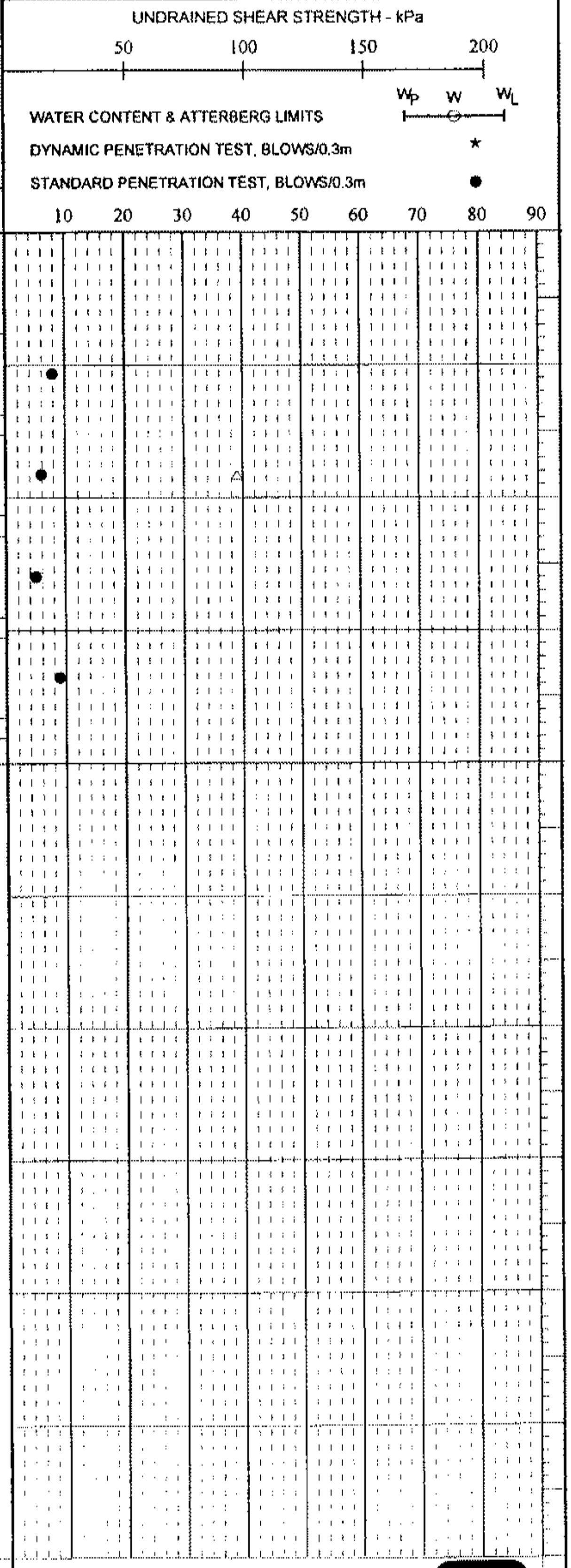
□ Field Vane Test, kPa
□ Remoulded Vane Test, kPa
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**
BOREHOLE No. **BH 00-4**
LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**
PROJECT No. **11297**
DATES: BORING **00-01-20**
WATER LEVEL **00-01-28**
DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.57							
	99.3	200 mm TOPSOIL						
		Very stiff to stiff, brown SILTY CLAY						
1					SS	1	610	8
				▼				
					SS	2	610	6
2	97.3	Loose, brownish grey silt and sand, trace gravel: TILL						
					SS	3	610	5
3					SS	4	610	9
					SS	5	50	* ref
4	95.6	End of Borehole Auger Refusal on Inferred Bedrock - standpipe installed * ref = split spoon refusal						
5								
6								
7								
8								
9								
10								



▽ Inferred Groundwater Level
▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa
⁞ Remoulded Vane Test, kPa
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT: Canadian Tire Real Estate Limited

LOCATION: Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON

DATES: BORING 00-01-20

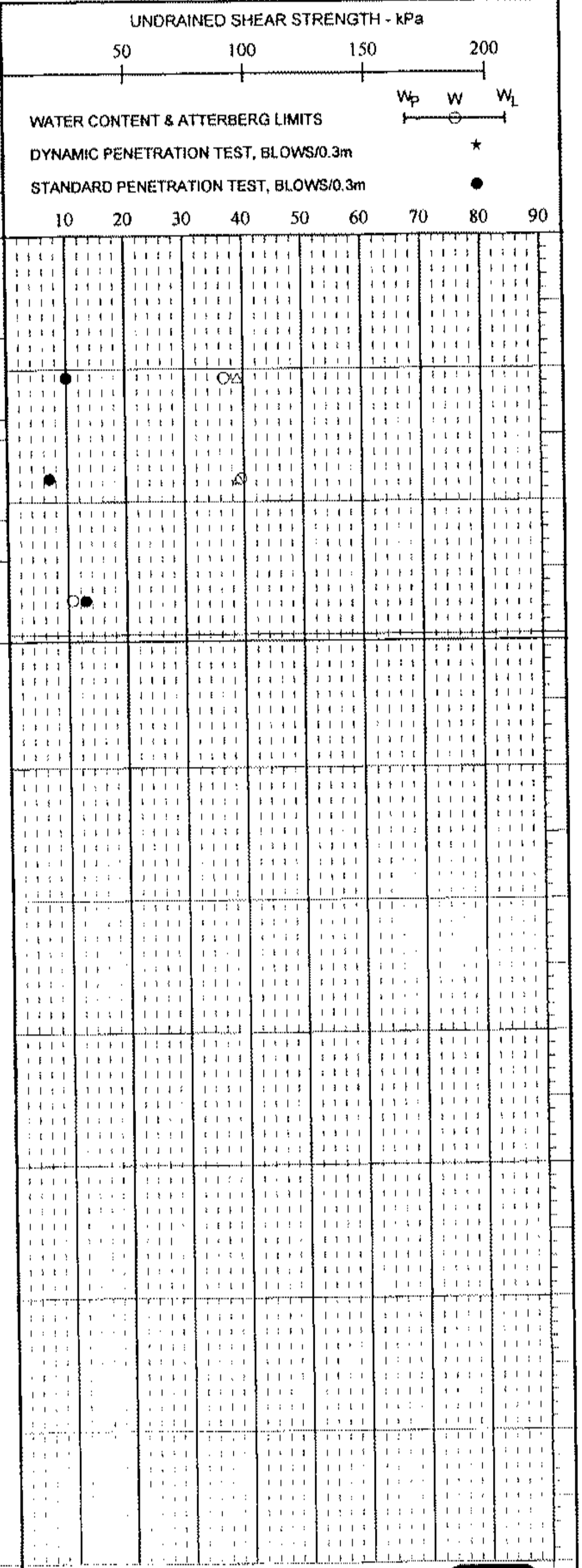
WATER LEVEL

BOREHOLE No. BH 00-5

PROJECT No. 11297

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.48	230 mm TOPSOIL					
	99.2	Very stiff to stiff, brown SILTY CLAY					
1				SS	1	610	10
				SS	2	530	7
2	97.5	Compact, brownish grey sand and silt, trace gravel, occasional boulders: TILL	∇				
				SS	3	510	13
3	96.4	End of Borehole					
4							
5							
6							
7							
8							
9							
10							



∇ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

▫ Field Vane Test, kPa

▫ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

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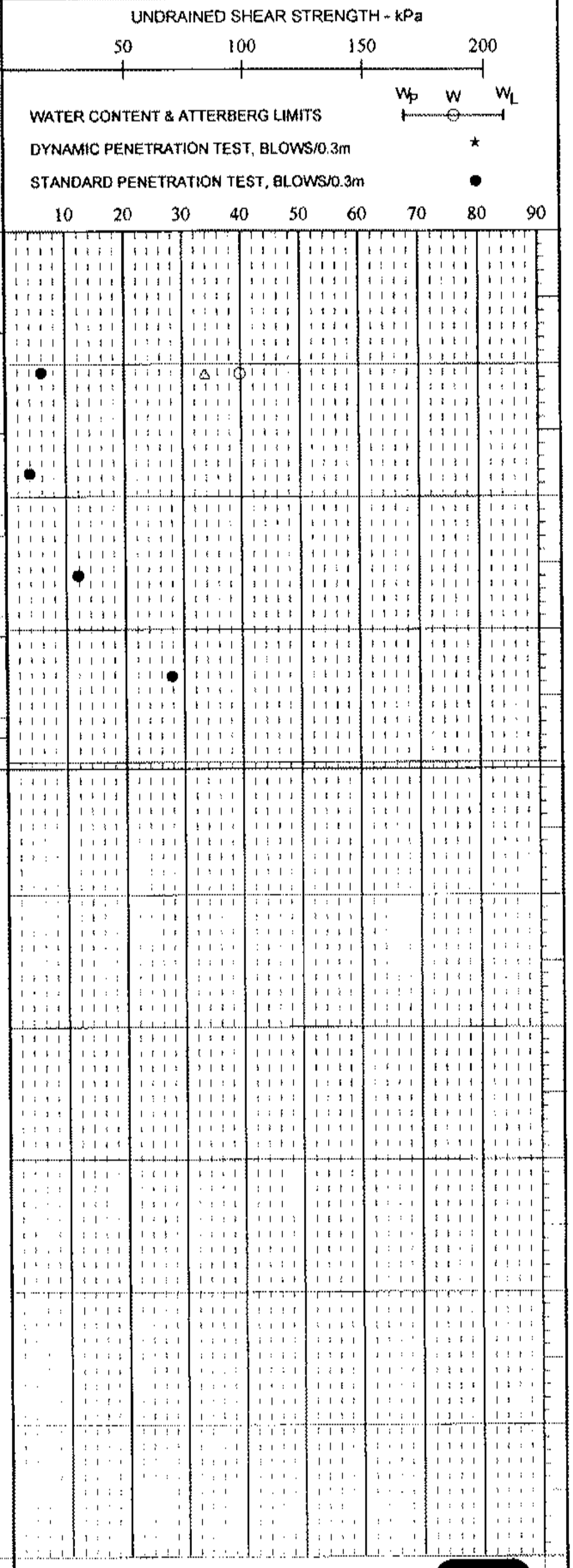
BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**
BOREHOLE No. **BH 00-6**
LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**
PROJECT No. **11297**
DATES: BORING **00-01-20**
WATER LEVEL
DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.55							
	99.5	50 mm TOPSOIL Stiff, brown SILTY CLAY						
1					SS	1	610	6
	97.9	Loose to compact, grey sandy silt, trace gravel: TILL		∇	SS	2	80	4
2								
					SS	3	330	12
3								
					SS	4	530	28
4	95.5				SS	5	150	* ref
		End of Borehole Auger Refusal on Inferred Bedrock - standpipe installed * ref = split spoon refusal - standpipe blocked @ surface						
5								
6								
7								
8								
9								
10								



∇ Inferred Groundwater Level
▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa
□ Remoulded Vane Test, kPa
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

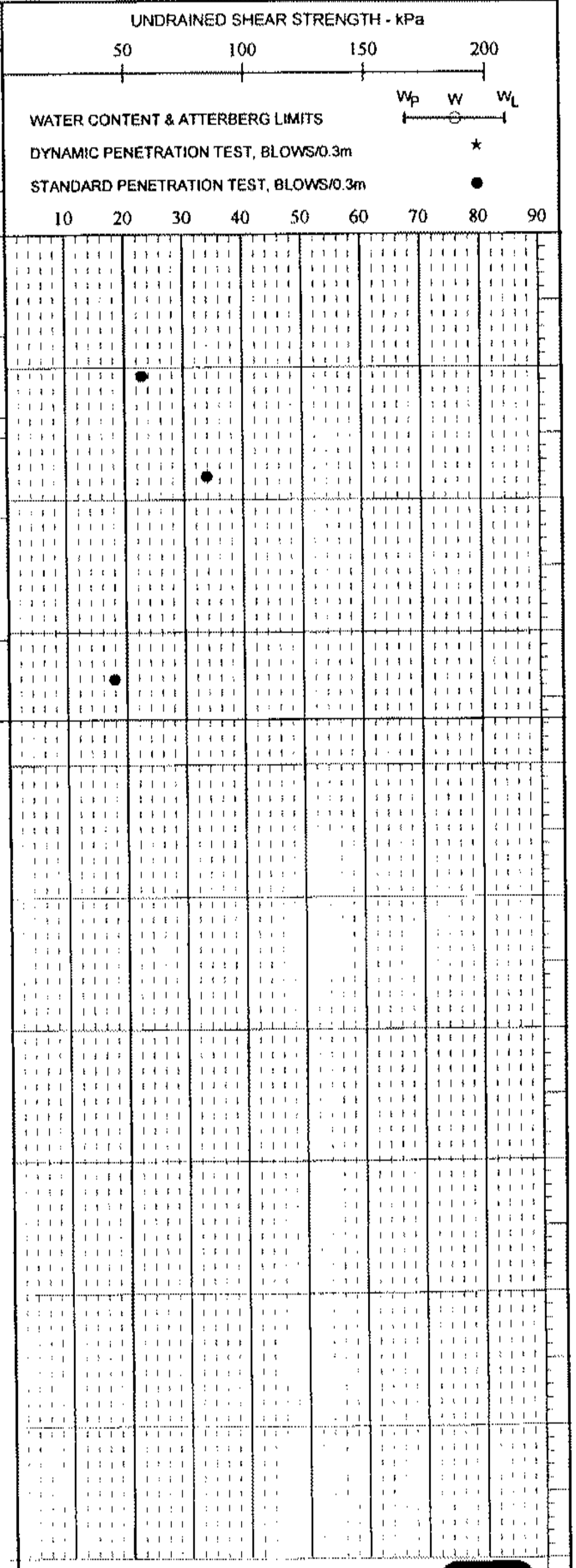
DATES: BORING **00-01-25** WATER LEVEL

BOREHOLE No. **BH 00-7**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	101.48							
	101.2	225 mm TOPSOIL						
		Compact to dense, brown silty sand, trace gravel: TILL						
1					SS	1	600	23
2					SS	2	600	34
3					SS	3	600	18
	97.8	End of Borehole						
4								
5								
6								
7								
8								
9								
10								



⩝ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

◘ Field Vane Test, kPa

▢ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

DATES: BORING **00-01-24**

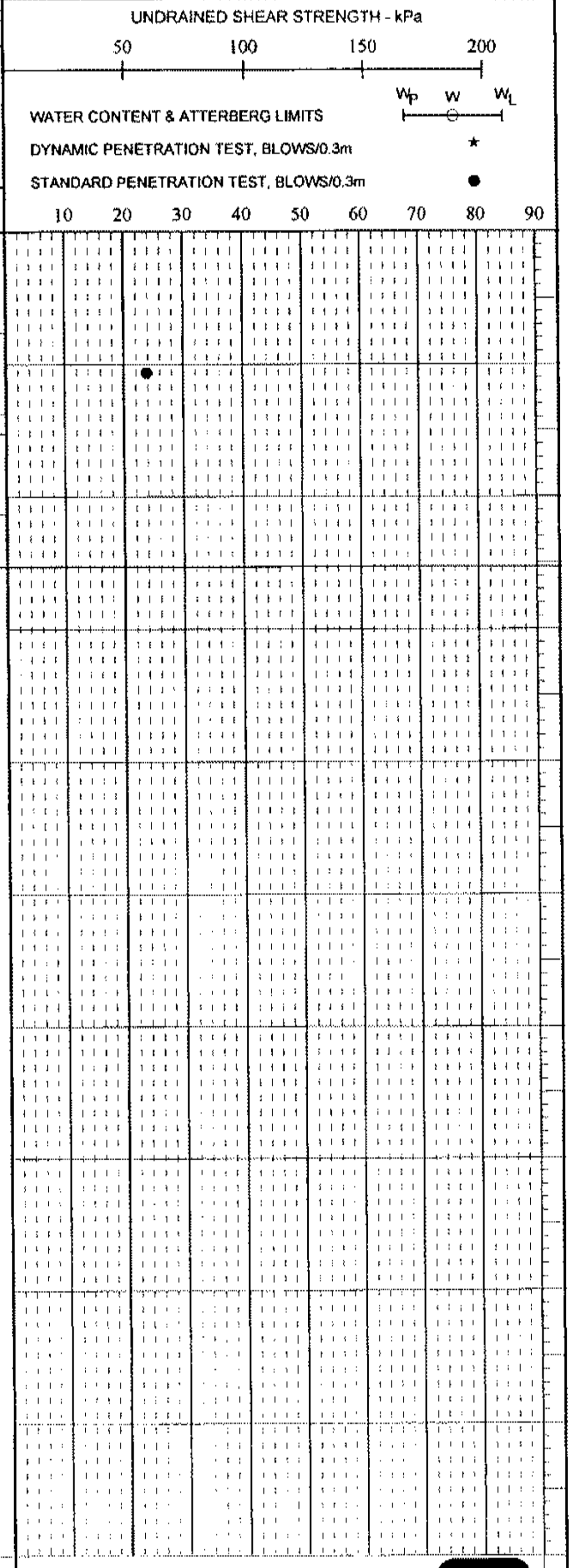
WATER LEVEL

BOREHOLE No. **BH 00-8**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	100.41	355 mm TOPSOIL				
	100.1	Compact to very dense, brown silty sand, trace gravel: TILL				
1			SS	1	600	24
2			SS	2	540	65/ 130
	97.9	End of Borehole Auger Refusal on Inferred Bedrock				



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

▯ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

BOREHOLE No. **BH 00-9**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

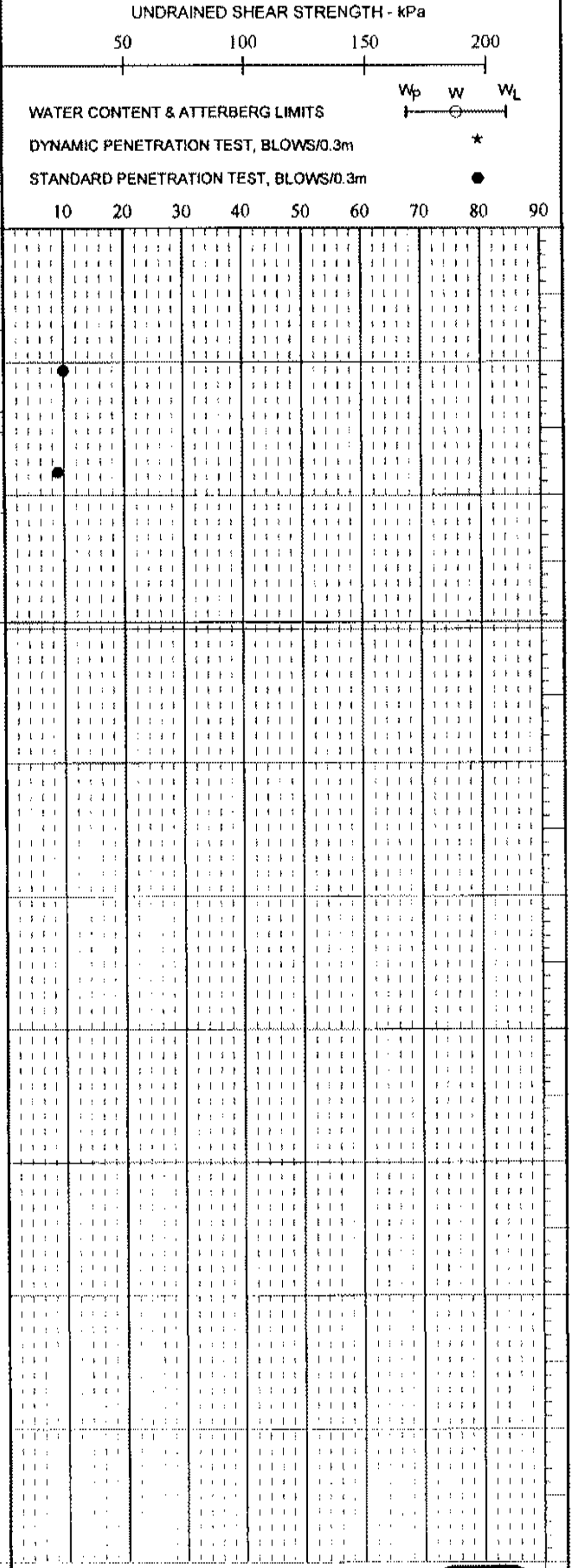
PROJECT No. **11297**

DATES: BORING **00-01-24**

WATER LEVEL **00-01-28**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.63						
	99.3	330 mm TOPSOIL					
1	98.1	Very stiff, brown SILTY CLAY	▼	SS	1	600	10
2	96.7	Loose, brown clayey silt, some sand, occasional cobbles, occasional boulders, occasional sand seams: TILL		SS	2	600	9
3		End of Borehole Auger Refusal on Inferred Bedrock - standpipe installed					
4							
5							
6							
7							
8							
9							
10							



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

◘ Field Vane Test, kPa

▫ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

DATES: BORING **00-01-24**

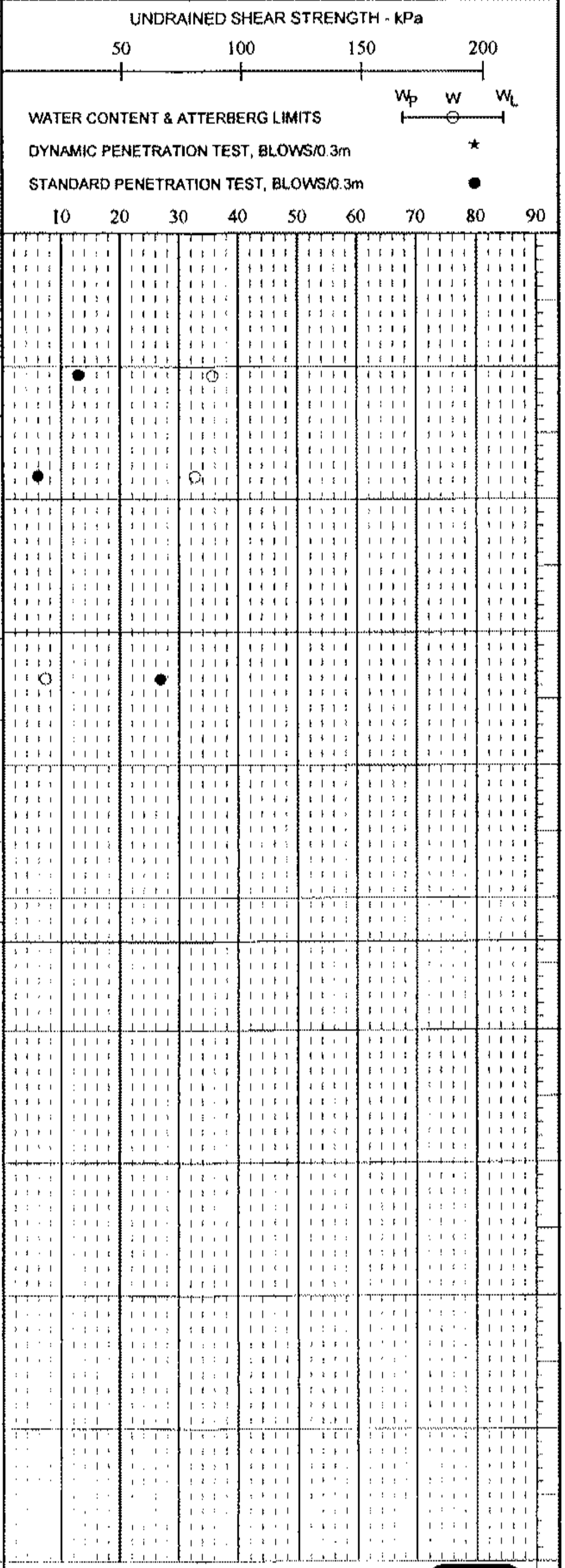
WATER LEVEL

BOREHOLE No. **BH 00-10**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
	99.37					
0	99.0	355 mm TOPSOIL				
1	97.8	Stiff, brown CLAYEY SILT, trace sand	SS	1	600	13
2	96.6	Loose, brown clayey silt with sand, trace gravel: TILL	SS	2	600	6
3		Compact to dense, brown silty sand, some gravel: TILL	SS	3	300	27
4						
5	94.0		SS	4	310	50/ 130
6		End of Borehole Auger Refusal on Inferred Bedrock				
7						
8						
9						
10						



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

○ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

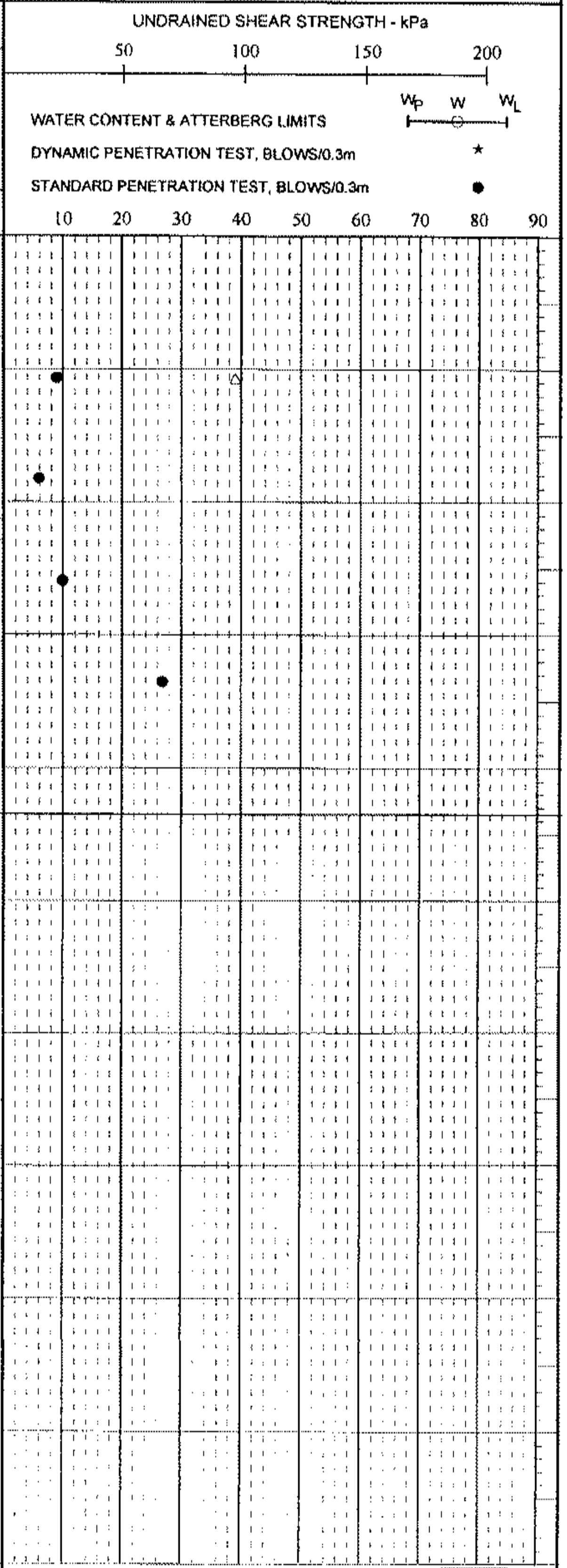
DATES: BORING **00-01-20** WATER LEVEL

BOREHOLE No. **BH 00-11**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.43	355 mm TOPSOIL						
	99.1	Stiff, brown SILTY CLAY						
1					SS	1	610	9
					SS	2	610	6
2	97.5	Compact, brownish grey sandy silt, trace gravel, occasional boulders: TILL						
					SS	3	460	10
3					SS	4	560	27
4					SS	5	510	* ref
	95.1	End of Borehole Auger Refusal on Inferred Bedrock * ref = split spoon refusal						
5								
6								
7								
8								
9								
10								



Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

◘ Field Vane Test, kPa

☐ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

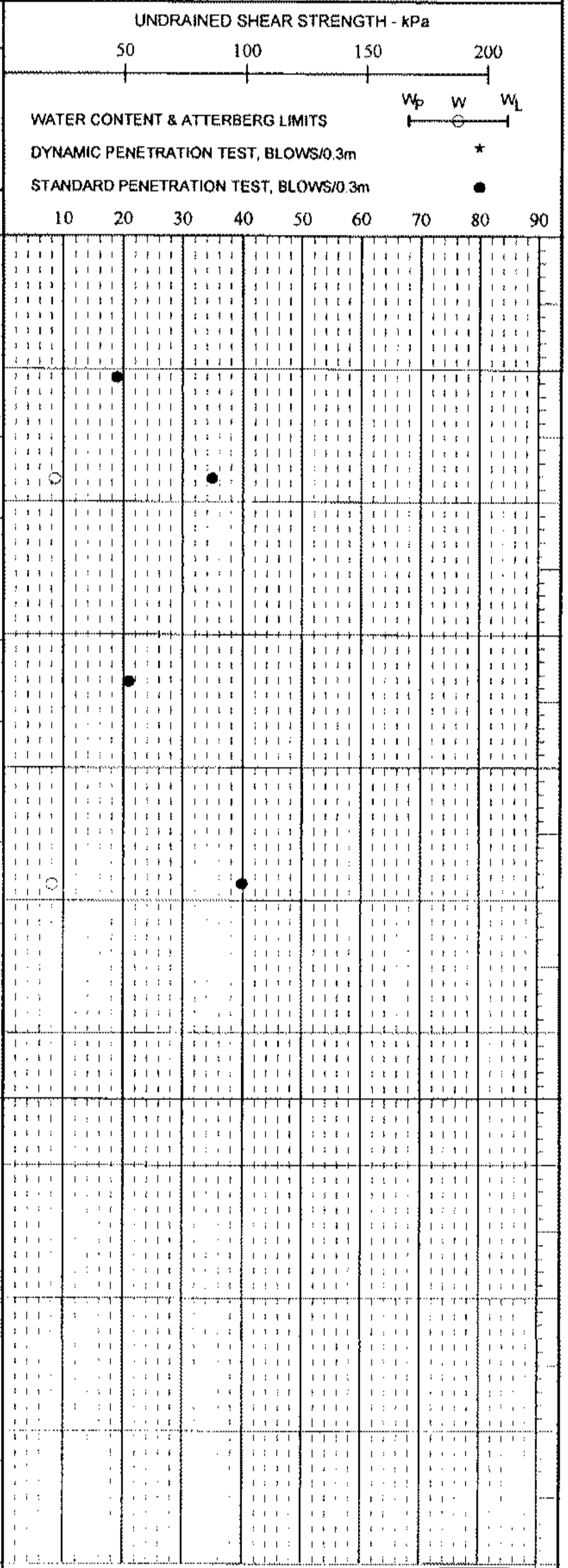
JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**
LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**
DATES: BORING **00-01-24** WATER LEVEL **00-01-28**
BOREHOLE No. **BH 00-12**
PROJECT No. **11297**
DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION
0	100.46	
	100.2	300 mm TOPSOIL
		Compact to dense, brown silty sand, trace to some gravel: TILL
6	94.4	Fractured BEDROCK
	94.0	End of Borehole - standpipe installed

TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
SS	1	600	19
SS	2	470	35
SS	3	600	21
SS	4	600	40
SS	5	80	116/200



▽ Inferred Groundwater Level
▼ Groundwater Level Measured in Standpipe

◘ Field Vane Test, kPa
☐ Remoulded Vane Test, kPa
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

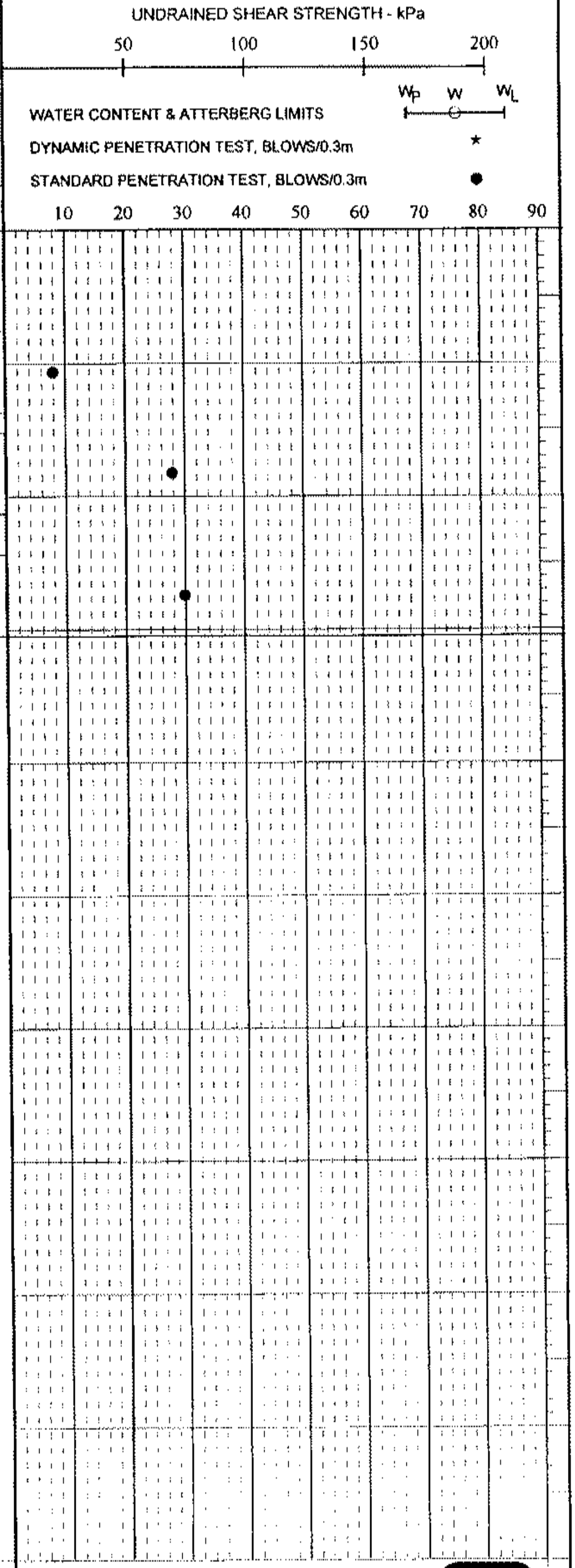
DATES: BORING **00-01-19** WATER LEVEL

BOREHOLE No. **BH 00-13**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.39	330 mm TOPSOIL						
	99.1	Stiff, brown SILTY CLAY to CLAYEY SILT						
1					SS	1	610	8
	97.5				SS	2	460	28
2		Compact, grey sandy silt, trace gravel: TILL						
					SS	3	610	30
3	96.3	End of Borehole						
4								
5								
6								
7								
8								
9								
10								



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

BOREHOLE No. **BH 00-14**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

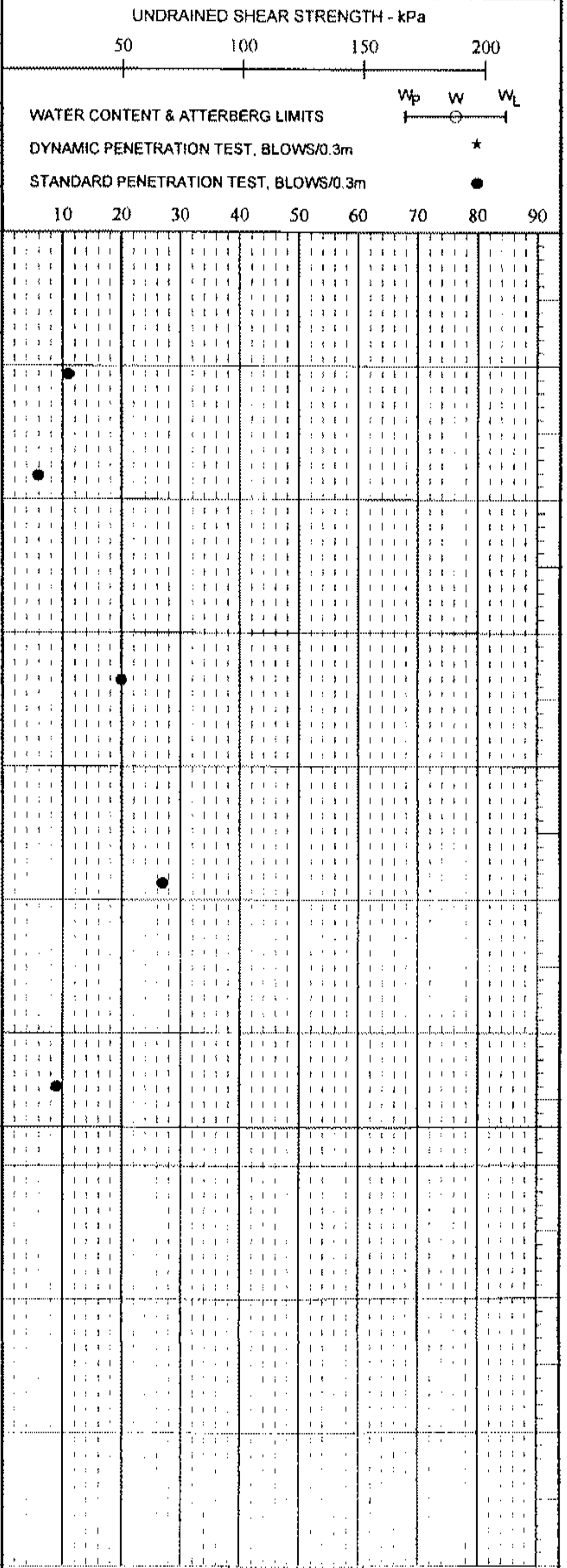
PROJECT No. **11297**

DATES: BORING **00-01-25**

WATER LEVEL

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.84					
	99.5	275 mm TOPSOIL				
		Stiff, brown CLAYEY SILT				
1			SS	1	600	11
2			SS	2	600	6
	97.6	Compact, brown silty sand, trace to some gravel: TILL				
3			SS	3	280	20
4						
5			SS	4	590	27
6			SS	5	40	9
	93.1	- loose				
7		End of Borehole				
8						
9						
10						



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

▢ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

BOREHOLE No. **BH 00-15**

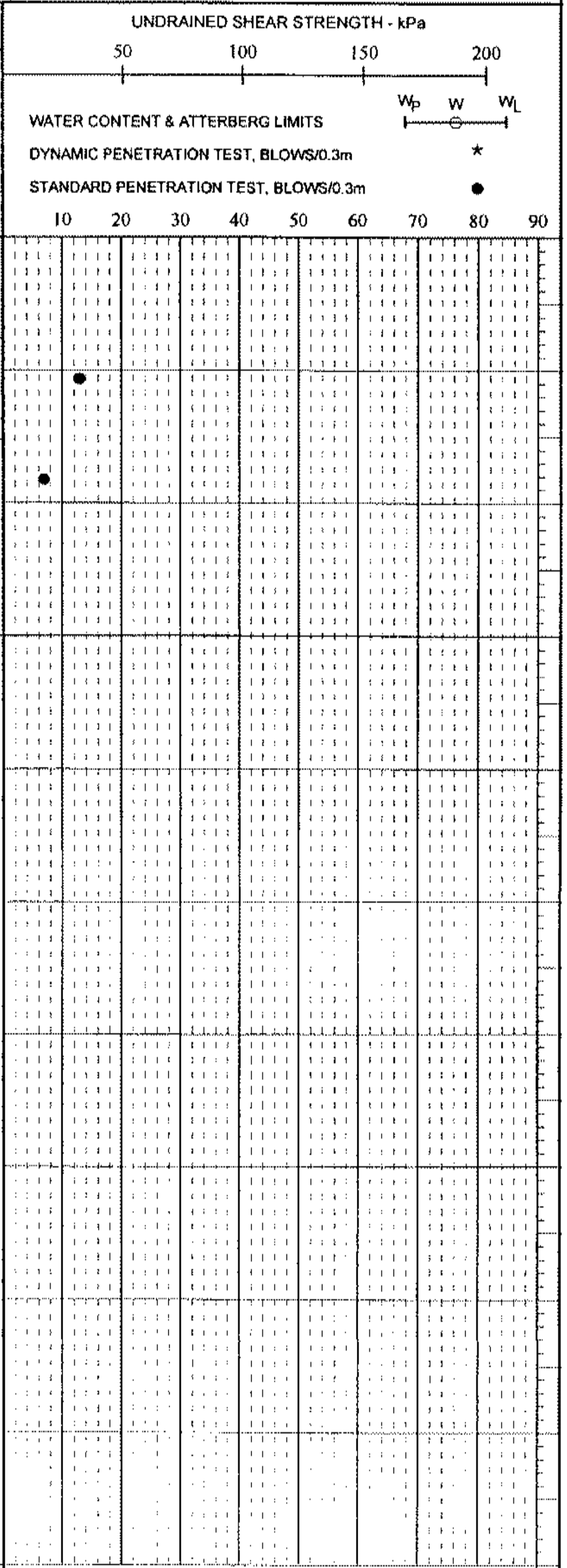
LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

PROJECT No. **11297**

DATES: BORING **00-01-24** WATER LEVEL

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.40							
	99.1	275 mm TOPSOIL						
		Stiff, brown CLAYEY SILT with sand seams						
1					SS	1	600	13
2					SS	2	600	7
3	96.4	End of Borehole Auger Refusal on Inferred Bedrock						
4								
5								
6								
7								
8								
9								
10								



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

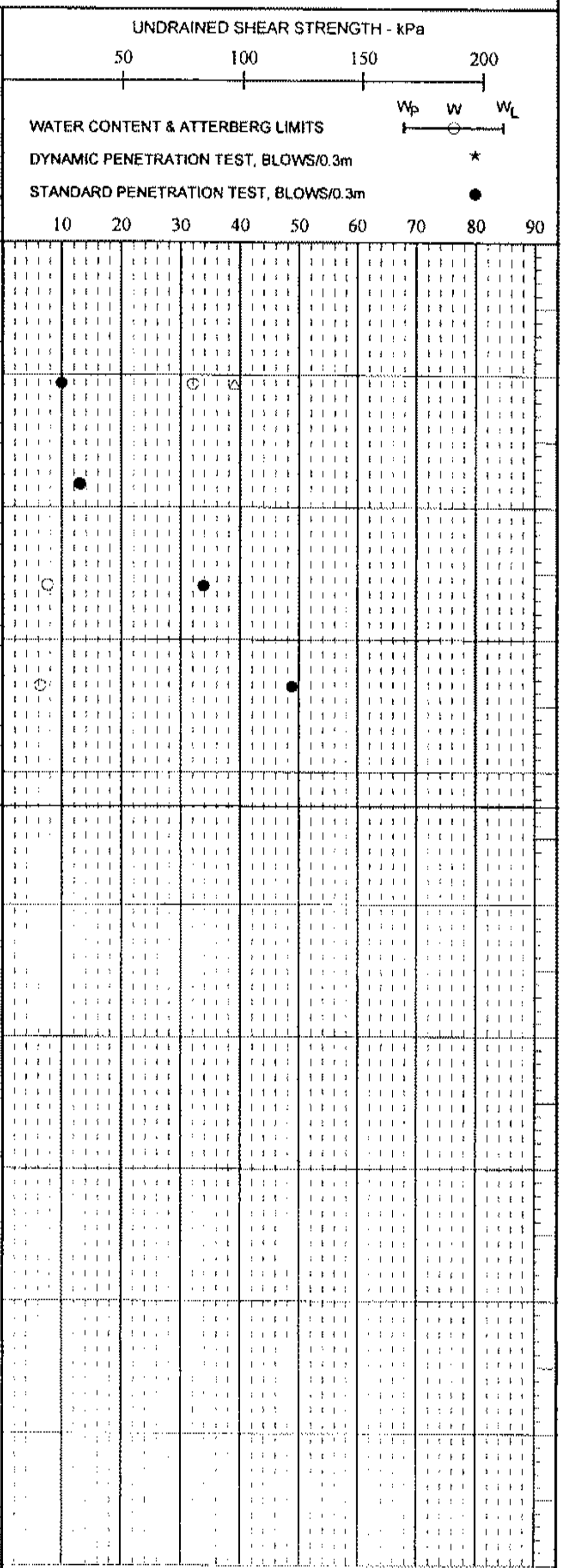
DATES: BORING **00-01-19** WATER LEVEL **00-01-28**

BOREHOLE No. **BH 00-16**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL	TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.38						
	99.2	200 mm TOPSOIL					
		Stiff, brown CLAYEY SILT to SILTY CLAY					
1				SS	1	610	10
	97.8	Compact to dense, grey sand and silt with gravel: TILL					
2				SS	2	610	13
				SS	3	610	34
3			▼				
				SS	4	510	49
4				SS	5	360	* ref
	95.1	End of Borehole					
5		Auger Refusal on Inferred Bedrock					
		- standpipe installed					
6		* ref = split spoon refusal					
7							
8							
9							
10							



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

☐ Field Vane Test, kPa

▢ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

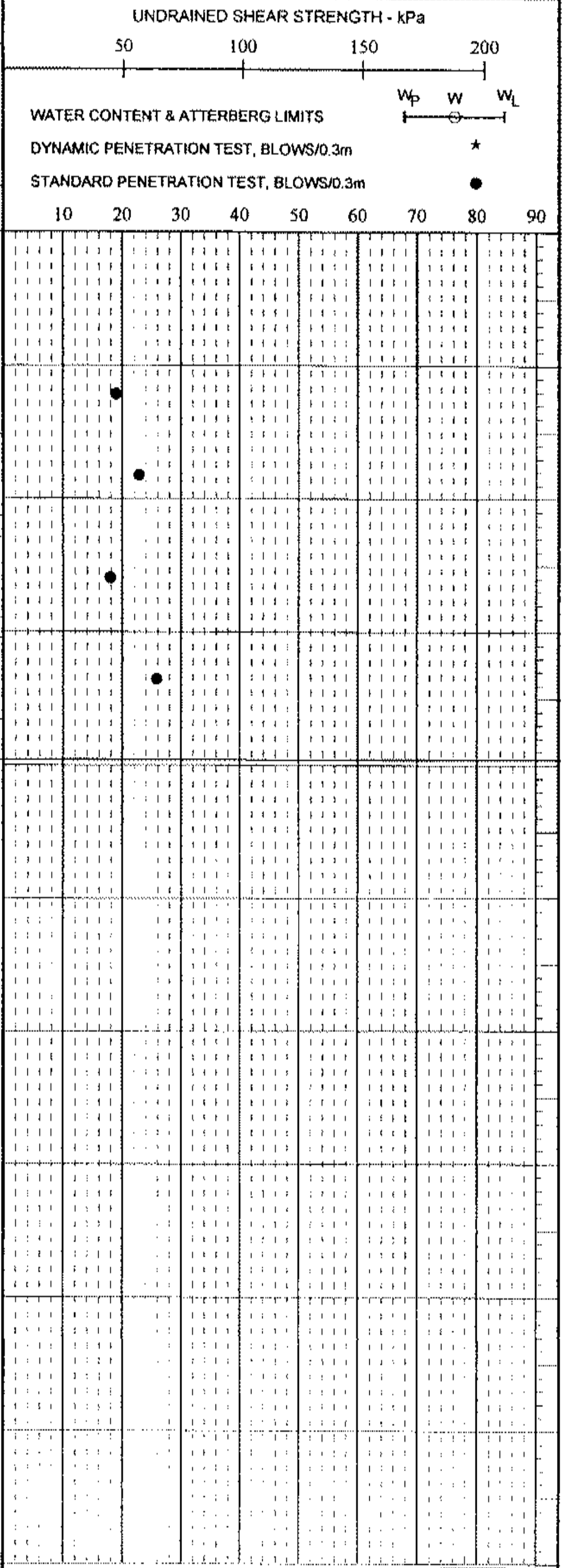
DATES: BORING **00-01-19** WATER LEVEL

BOREHOLE No. **BH 00-17**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.42					
	99.2	250 mm TOPSOIL				
		Stiff, brown CLAYEY SILT to SILTY CLAY				
1	98.3	Compact, brownish grey sand and silt, trace gravel: TILL	SS	1	460	19
2			SS	2	360	23
			SS	3	30	18
3			SS	4	610	26
4	95.5	End of Borehole Auger Refusal on Inferred Bedrock				
5						
6						
7						
8						
9						
10						



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

◻ Field Vane Test, kPa

◻ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

BOREHOLE No. **BH 00-18**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

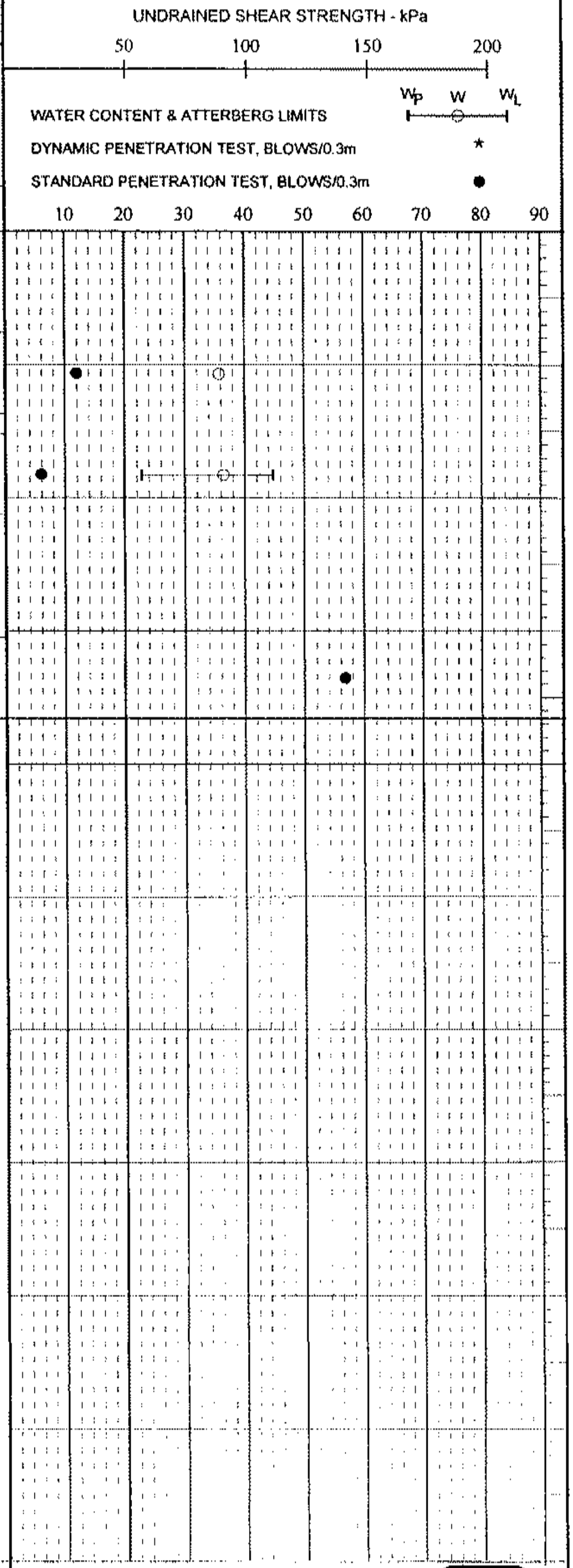
PROJECT No. **11297**

DATES: BORING **00-01-25**

WATER LEVEL

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.94							
	99.7	250 mm TOPSOIL						
1		Very stiff to stiff, brown SILTY CLAY			SS	1	600	12
2					SS	2	600	6
	97.5	Very dense, brown silty sand, trace gravel: TILL						
3					SS	3	0	57
	96.3	End of Borehole - standpipe installed - standpipe dry to 2.9 m						
4								
5								
6								
7								
8								
9								
10								



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

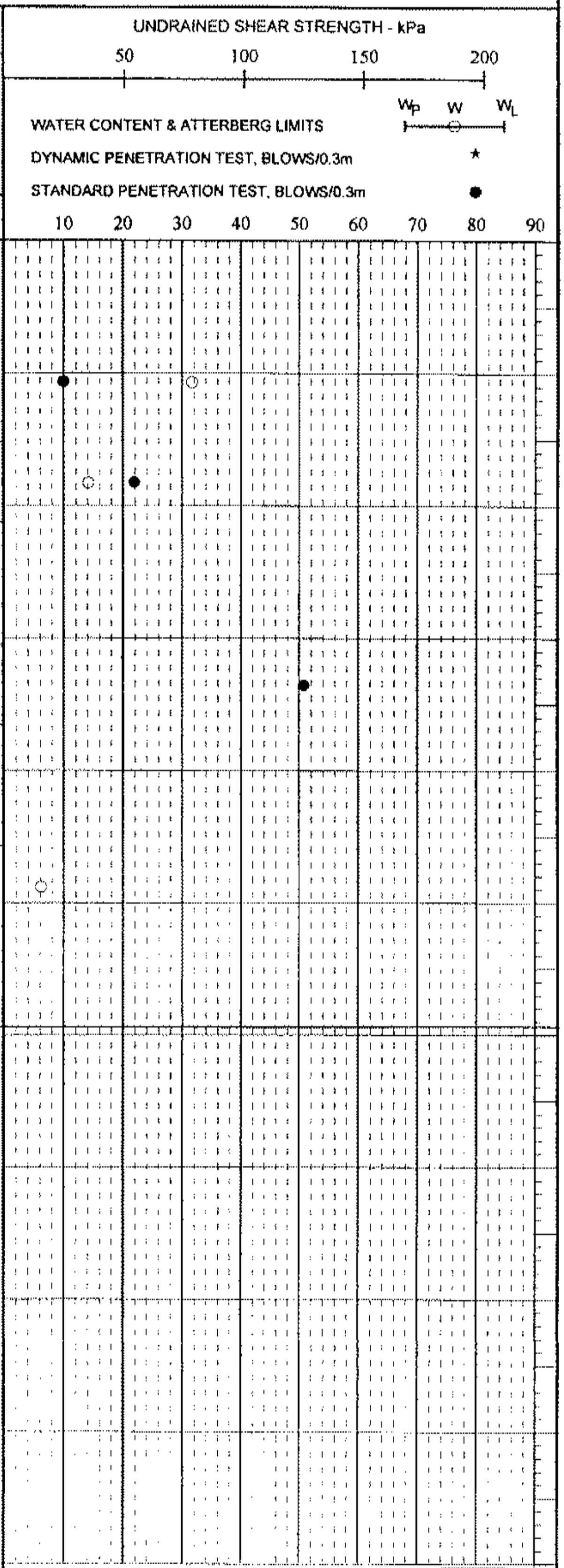
JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**
LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**
DATES: BORING **00-01-25** WATER LEVEL **00-01-28**

BOREHOLE No. **BH 00-19**
PROJECT No. **11297**
DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.64							
	99.4	225 mm TOPSOIL						
		Very stiff, brown SILTY CLAY						
1					SS	1	600	10
	98.1	Compact to very dense, brown silty sand, some clay, some gravel: TILL						
2					SS	2	580	22
				▼				
3					SS	3	600	51
	96.2	Very dense, grey sand, some silt, some gravel: TILL						
5					SS	4	210	50/ 50
6	93.7	End of Borehole Auger Refusal on Inferred Bedrock - standpipe installed						



▽ Inferred Groundwater Level
▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa
◻ Remoulded Vane Test, kPa
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

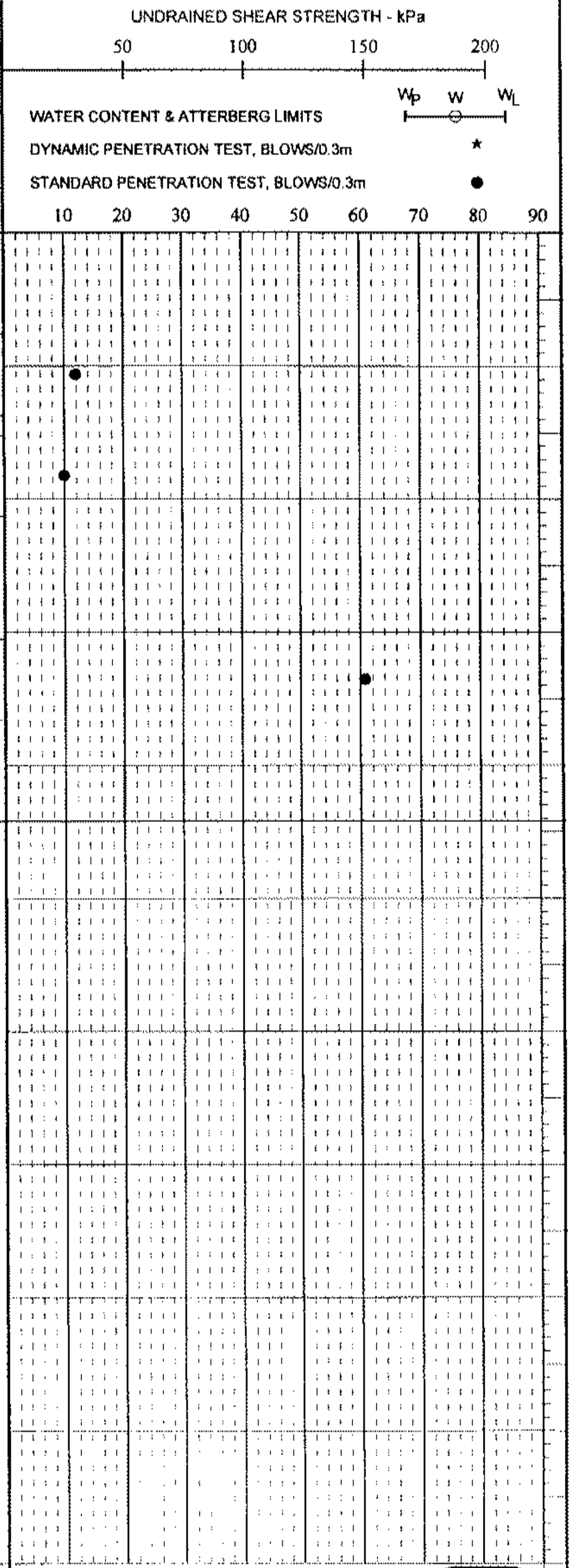
DATES: BORING **00-01-25** WATER LEVEL

BOREHOLE No. **BH 00-20**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.54							
	99.2	380 mm TOPSOIL						
1		Very stiff, brown CLAYEY SILT, trace sand			SS	1	600	12
2					SS	2	600	10
3	96.5	Very dense, brown silty sand, some gravel: TILL			SS	3	600	61
4	95.1	End of Borehole Auger Refusal on Inferred Bedrock						
5								
6								
7								
8								
9								
10								



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

▢ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

BOREHOLE No. **BH 00-21**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

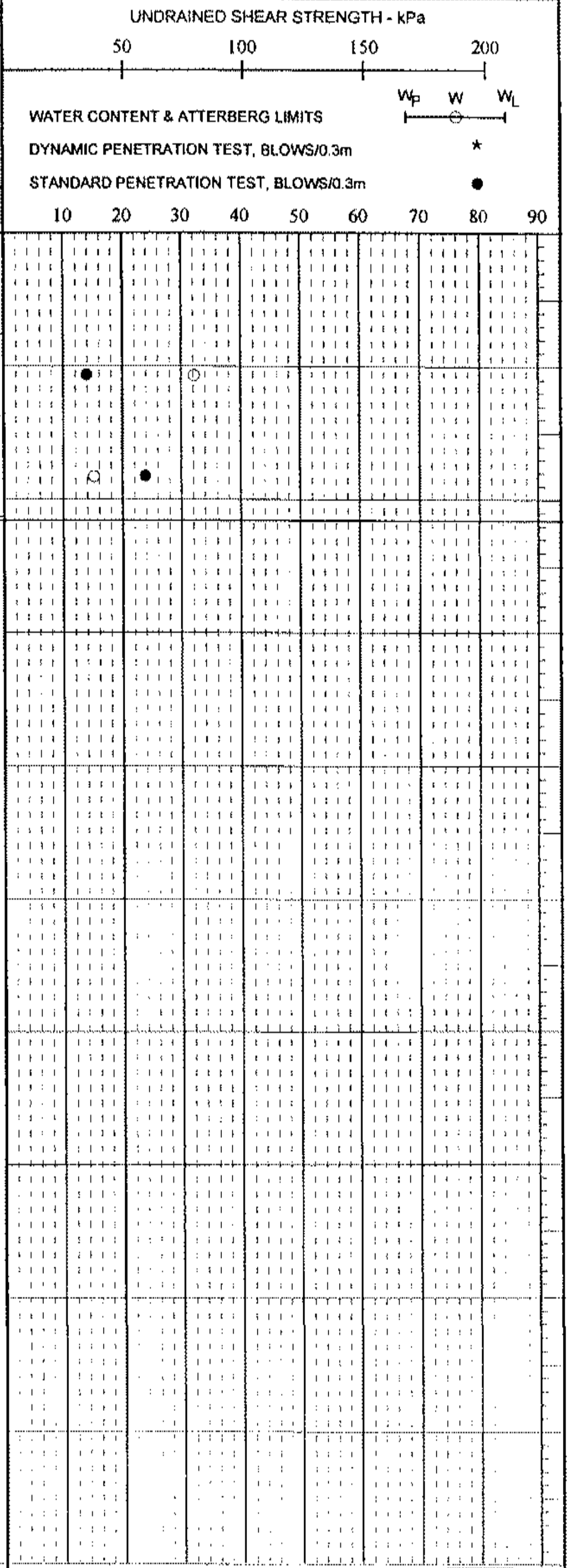
PROJECT No. **11297**

DATES: BORING **00-01-24**

WATER LEVEL **00-01-28**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.41							
	99.1	300 mm TOPSOIL						
		Very stiff, brown CLAYEY SILT						
1				▼	SS	1	600	14
	97.6	Compact, brown silty sand with clay, trace gravel: TILL			SS	2	600	24
2	97.3	End of Borehole Auger Refusal on Inferred Bedrock - standpipe installed						
3								
4								
5								
6								
7								
8								
9								
10								



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

▫ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

DATES: BORING **00-01-19**

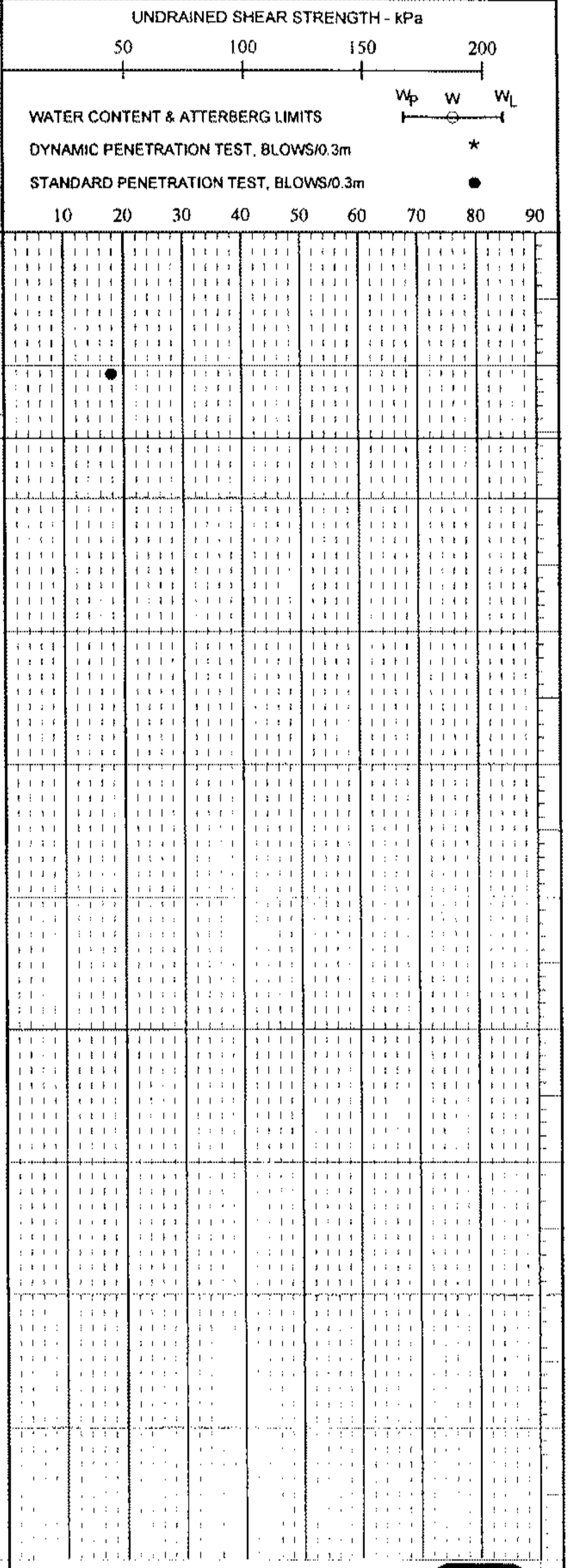
WATER LEVEL

BOREHOLE No. **BH 00-22**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.46							
	99.2	225 mm TOPSOIL						
		Compact, brown sand and silt, trace gravel: TILL						
1					SS	1	610	18
	97.9							
		End of Borehole Auger Refusal on Inferred Bedrock						
2								
3								
4								
5								
6								
7								
8								
9								
10								



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

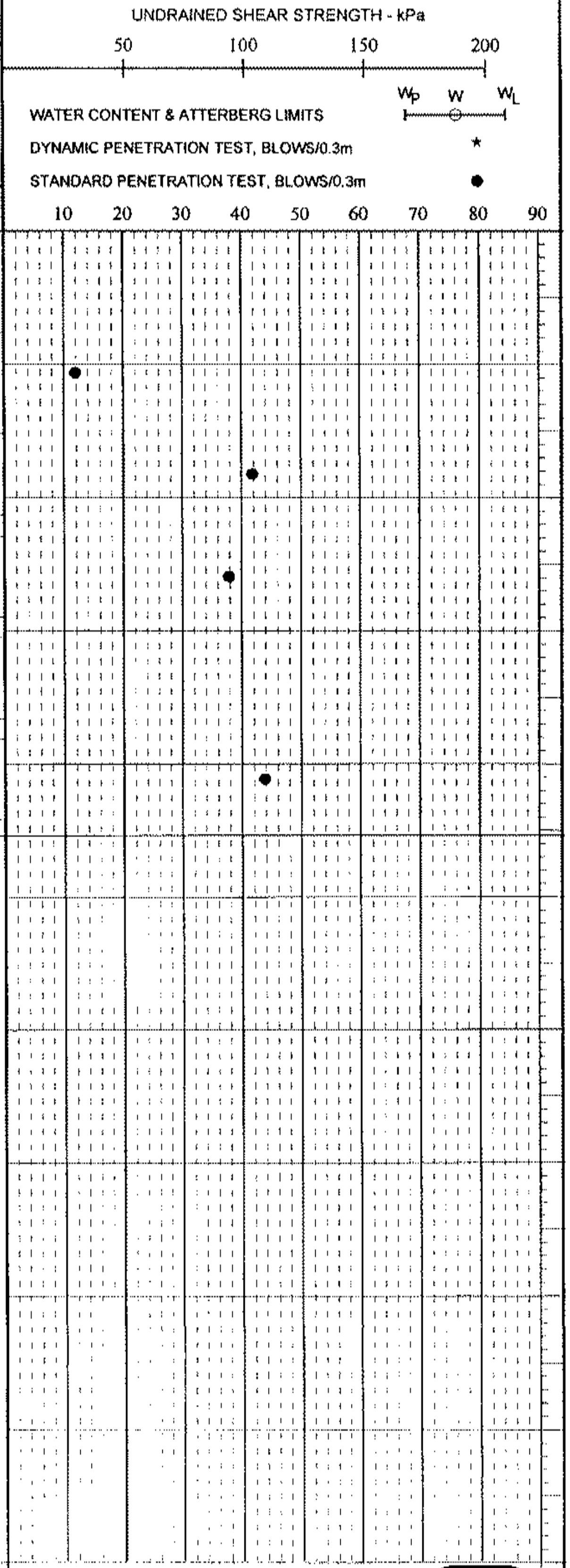
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**　BOREHOLE No. **BH 00-23**
LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**　PROJECT No. **11297**
DATES: BORING **00-01-19**　WATER LEVEL **00-01-28**　DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	100.13	75 mm TOPSOIL						
	99.4	Stiff, brown SILTY CLAY to CLAYEY SILT			SS	1	560	12
	98.6	Dense, brownish grey sand and silt, trace to some gravel: TILL			SS	2	610	42
					SS	3	610	38
				▼	SS	4	610	* ref
					SS	5	510	44
	95.6	End of Borehole Auger Refusal on Inferred Bedrock - standpipe installed * ref = split spoon refusal						



▽ Inferred Groundwater Level
▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa
□ Remoulded Vane Test, kPa
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

BOREHOLE No. **BH 00-24**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

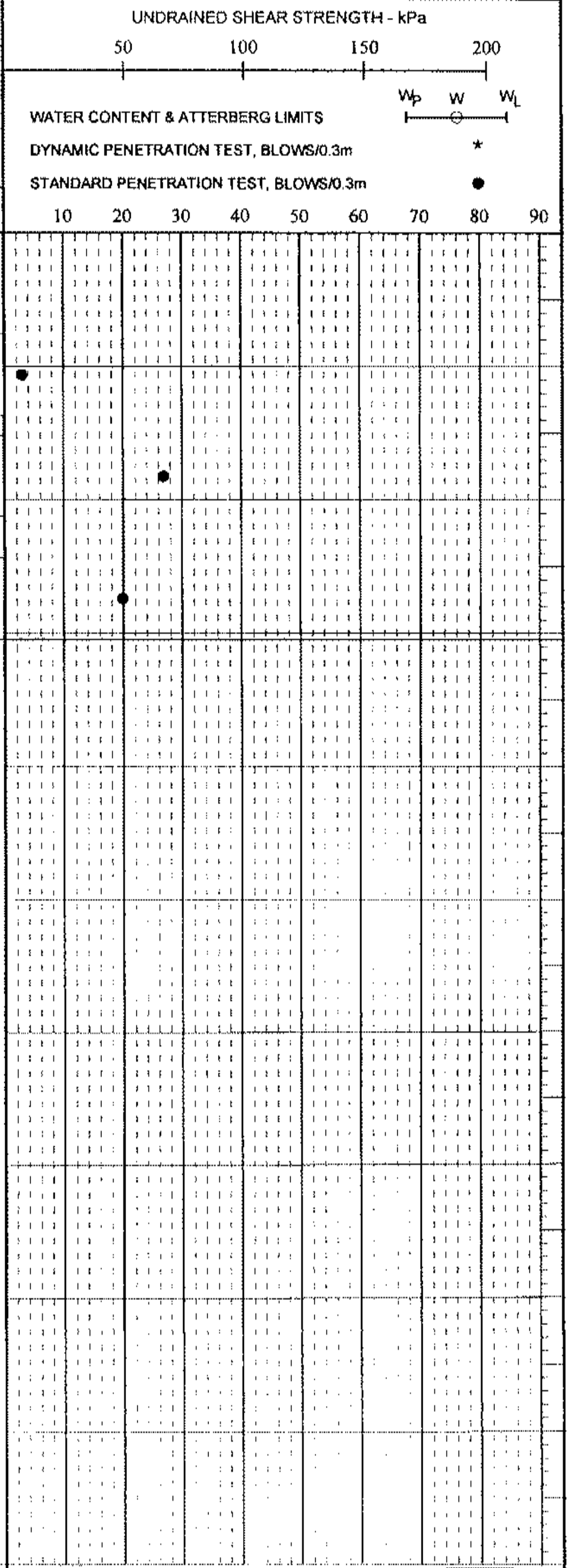
PROJECT No. **11297**

DATES: BORING **00-01-20**

WATER LEVEL

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.85	Loose, dark brown sandy silt, occasional brick fragments: FILL				
1			SS	1	510	3
	98.3	- boulders or debris @ 1.2 m				
		Compact, brownish grey sand and silt, trace gravel: TILL	SS	2	510	27
2						
			SS	3	610	20
3	96.8	End of Borehole				



∇ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

▢ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

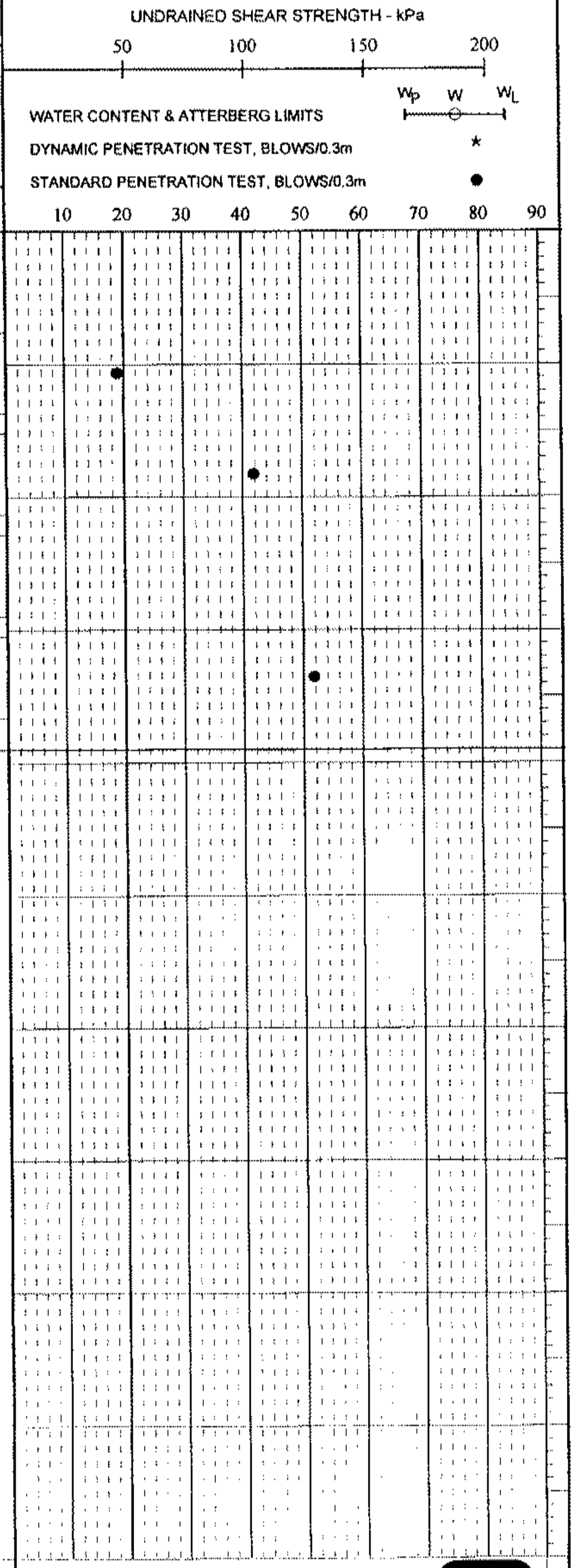
DATES: BORING **00-01-20** WATER LEVEL **00-01-28**

BOREHOLE No. **BH 00-25**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	100.18							
	100.1	50 mm TOPSOIL						
		Compact to dense, brownish grey sand and silt, trace to some gravel, occasional boulders: TILL						
1					SS	1	510	19
2					SS	2	-	42
					SS	3	360	* ref
3				▼	SS	4	610	52
	96.3							
4		End of Borehole Auger Refusal on Inferred Bedrock - standpipe installed						
5								
6								
7								
8								
9								
10								



☒ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

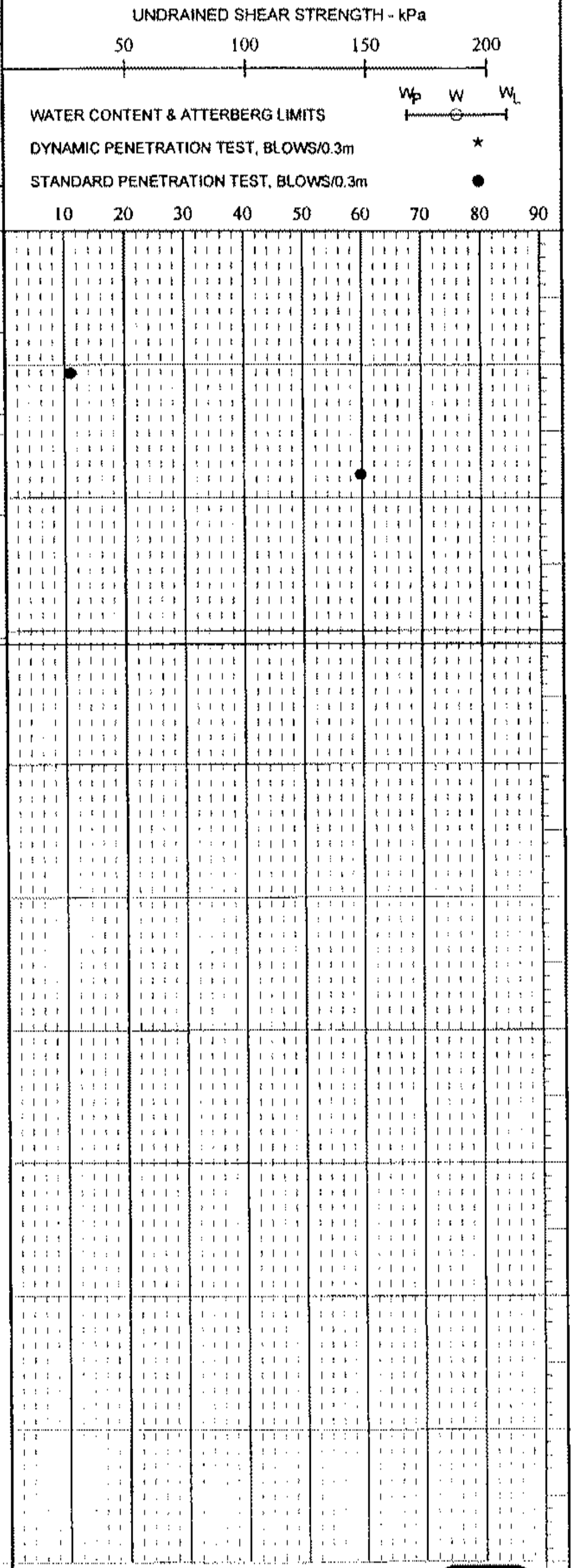
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT Canadian Tire Real Estate Limited
LOCATION Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON
DATES: BORING 00-01-25 WATER LEVEL
BOREHOLE No. BH 00-26
PROJECT No. 11297
DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.57					
	99.4	200 mm TOPSOIL				
		Brown, silty sand, trace gravel: TILL				
1		- clayey	SS	1	510	11
2			SS	2	590	60
3	96.5		SS	3	80	* ref
		End of Borehole Auger Refusal on Inferred Boulders - standpipe installed * ref = split spoon refusal - standpipe dry to 3.0 m				



▽ Inferred Groundwater Level
▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa
□ Remoulded Vane Test, kPa
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

DATES: BORING **00-01-24**

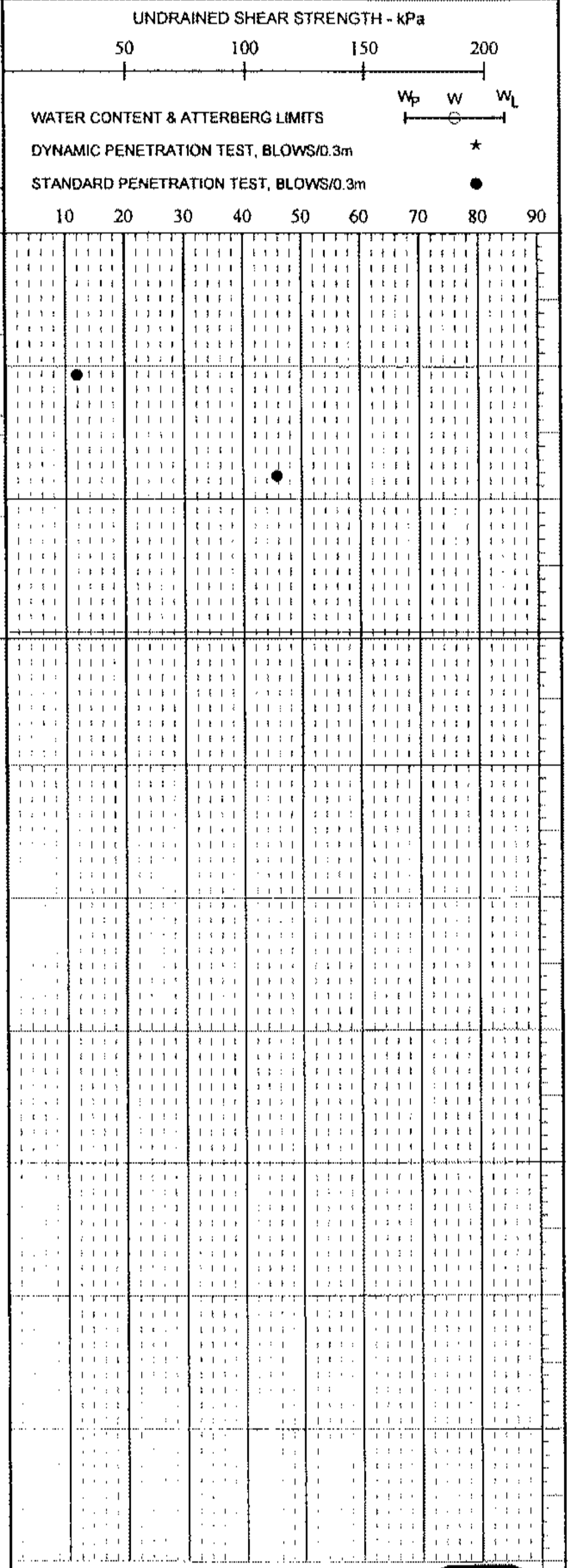
WATER LEVEL

BOREHOLE No. **BH 00-27**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.46							
	99.2	250 mm TOPSOIL						
		Stiff, brown CLAYEY SILT						
1					SS	1	580	12
	97.9	Dense, brown silty sand, some clay with sand seams: TILL						
2					SS	2	600	46
3	96.4	End of Borehole						



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

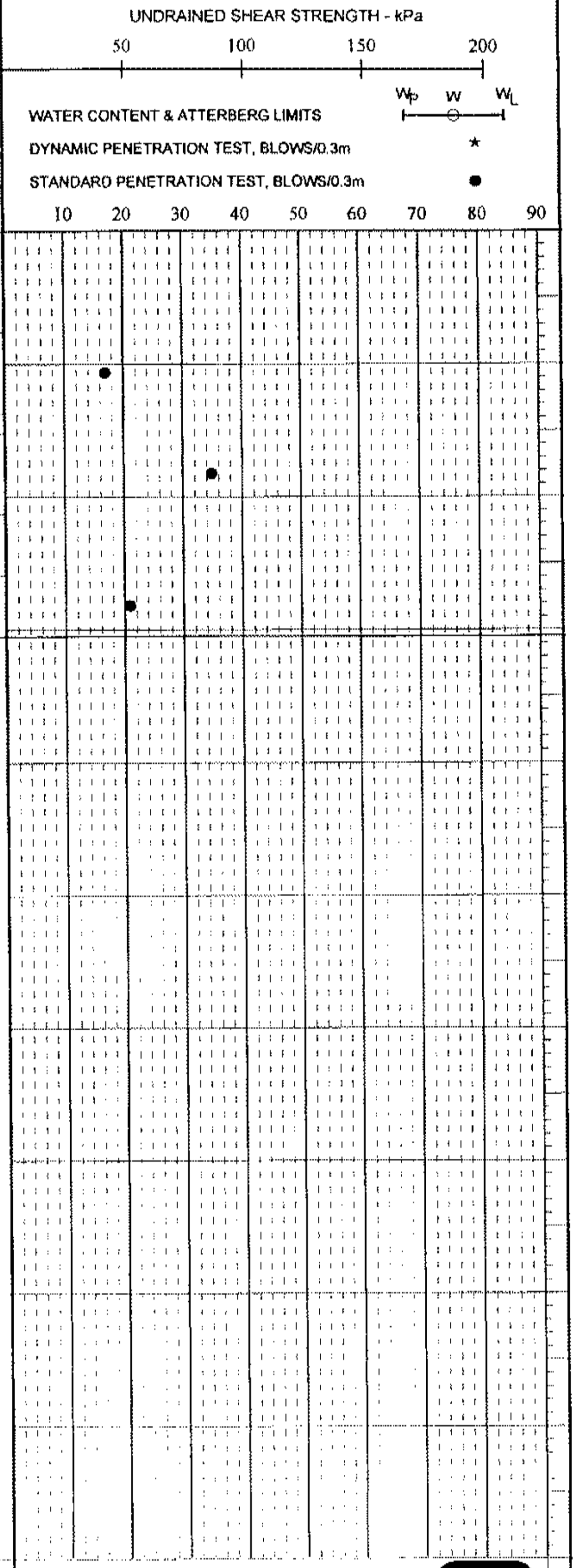
DATES: BORING **00-01-19** WATER LEVEL

BOREHOLE No. **BH 00-28**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES			
					TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	100.08							
	99.9	225 mm TOPSOIL						
		Compact to dense, brownish grey sand and silt, trace to some gravel: TILL						
1					SS	1	610	17
2					SS	2	560	35
3	97.0				SS	3	610	21
		End of Borehole						
4								
5								
6								
7								
8								
9								
10								



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

BOREHOLE No. **BH 00-29**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

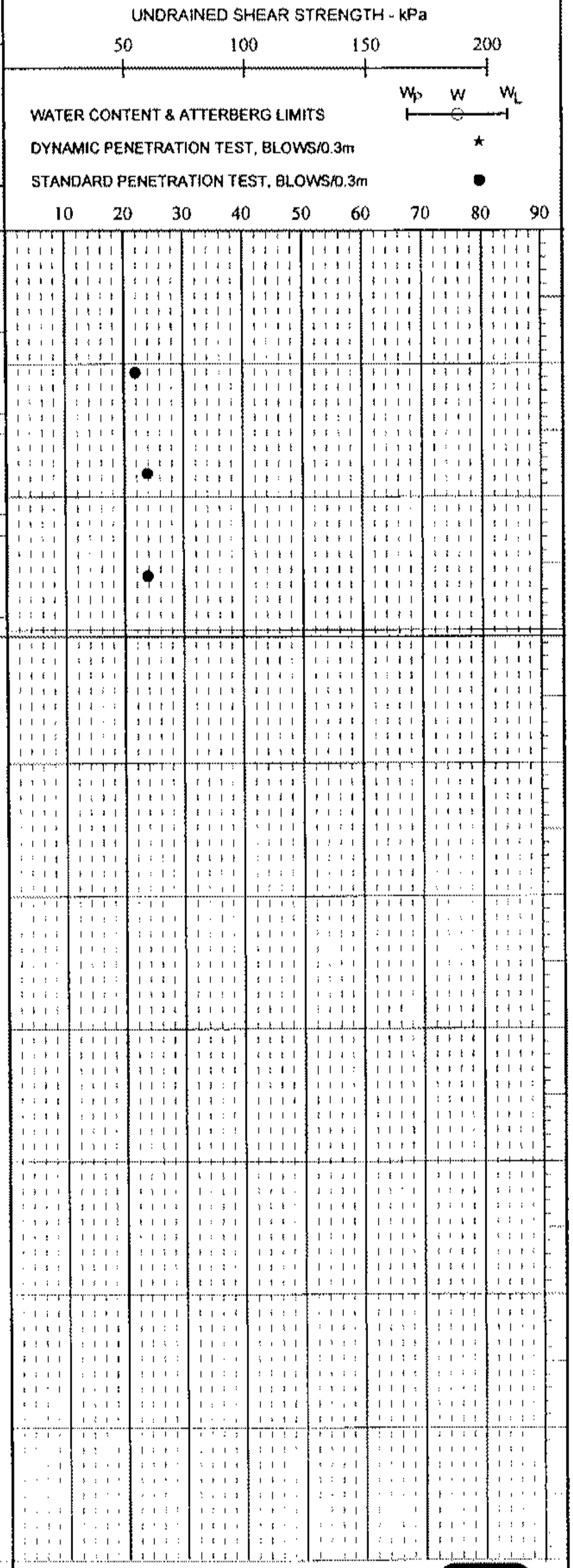
PROJECT No. **11297**

DATES: BORING **00-01-19**

WATER LEVEL

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	100.00							
	99.7	325 mm TOPSOIL						
		Compact to dense, brown, sandy silt, trace gravel, occasional boulders: TILL						
1					SS	1	450	22
2					SS	2	510	24
					SS	3	610	24
3	97.0	End of Borehole						
4								
5								
6								
7								
8								
9								
10								



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

◘ Field Vane Test, kPa

☐ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT Canadian Tire Real Estate Limited

LOCATION Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON

DATES: BORING 00-01-30

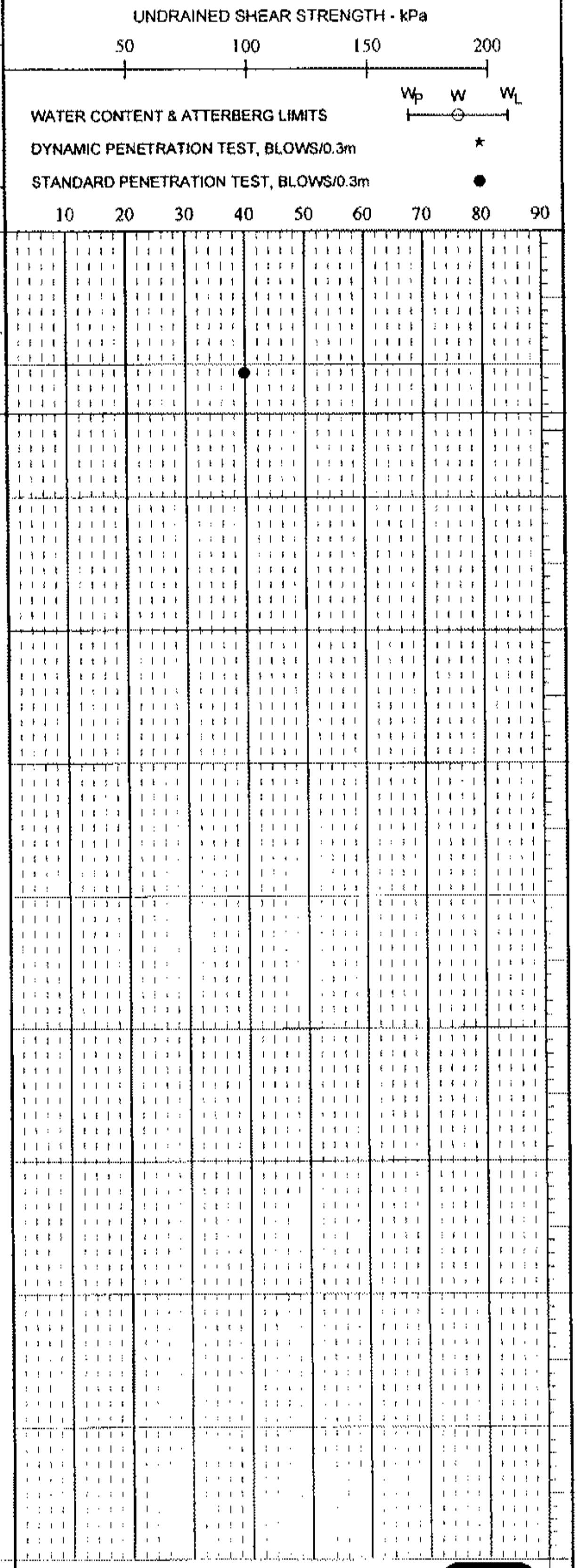
WATER LEVEL

BOREHOLE No. BH 00-30

PROJECT No. 11297

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.60							
	99.3	350 mm TOPSOIL						
1	98.2	Dense, brown sandy silt, trace gravel: TILL			SS	1	470	40
2		End of Borehole Auger Refusal on Inferred Boulders						
3								
4								
5								
6								
7								
8								
9								
10								



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

☐ Remoulded Vane Test, kPa

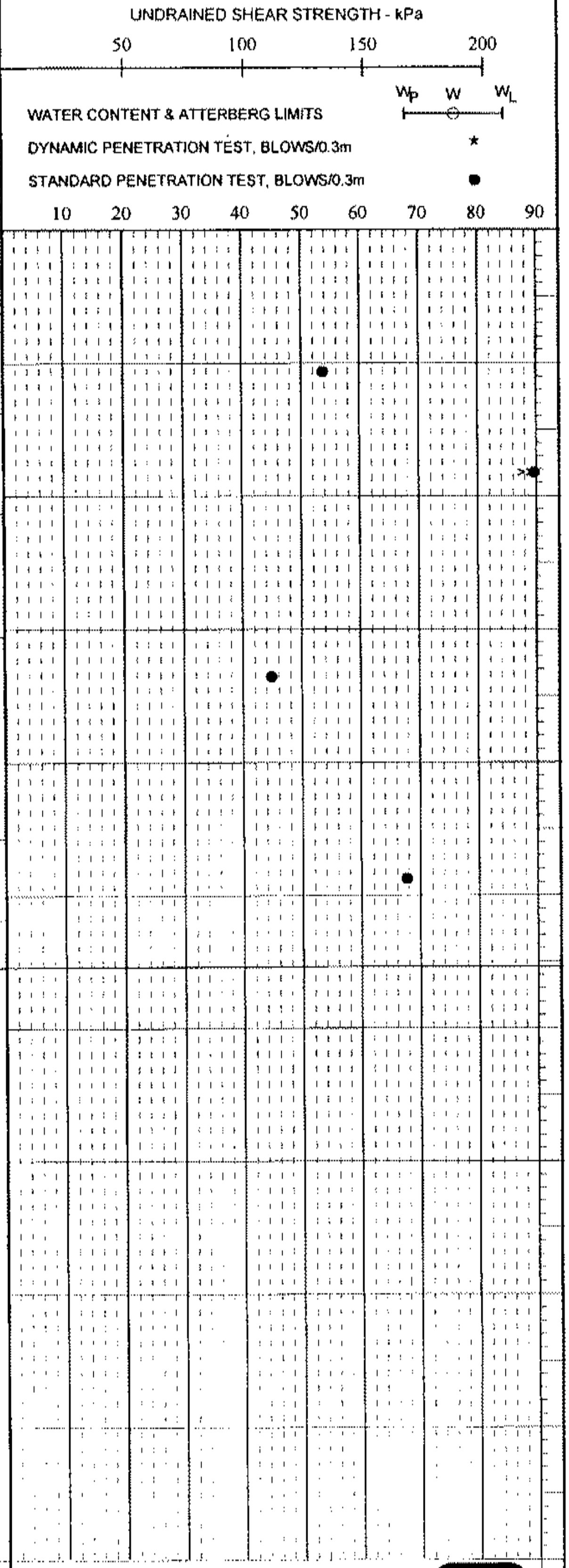
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**
BOREHOLE No. **BH 00-31**
LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**
PROJECT No. **11297**
DATES: BORING **00-01-25** WATER LEVEL **00-01-28**
DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.66						
	99.4	225 mm TOPSOIL					
		Dense to very dense, brown silty sand, some gravel, occasional cobbles, occasional boulders: TILL					
1				SS	1	200	54
2				SS	2	600	108
3			▼				
3.5				SS	3	590	45
5				SS	4	420	68
5.5	94.1	End of Borehole Auger Refusal on Inferred Bedrock - standpipe installed					



▽ Inferred Groundwater Level
▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa
▨ Remoulded Vane Test, kPa
△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

DATES: BORING **00-01-24**

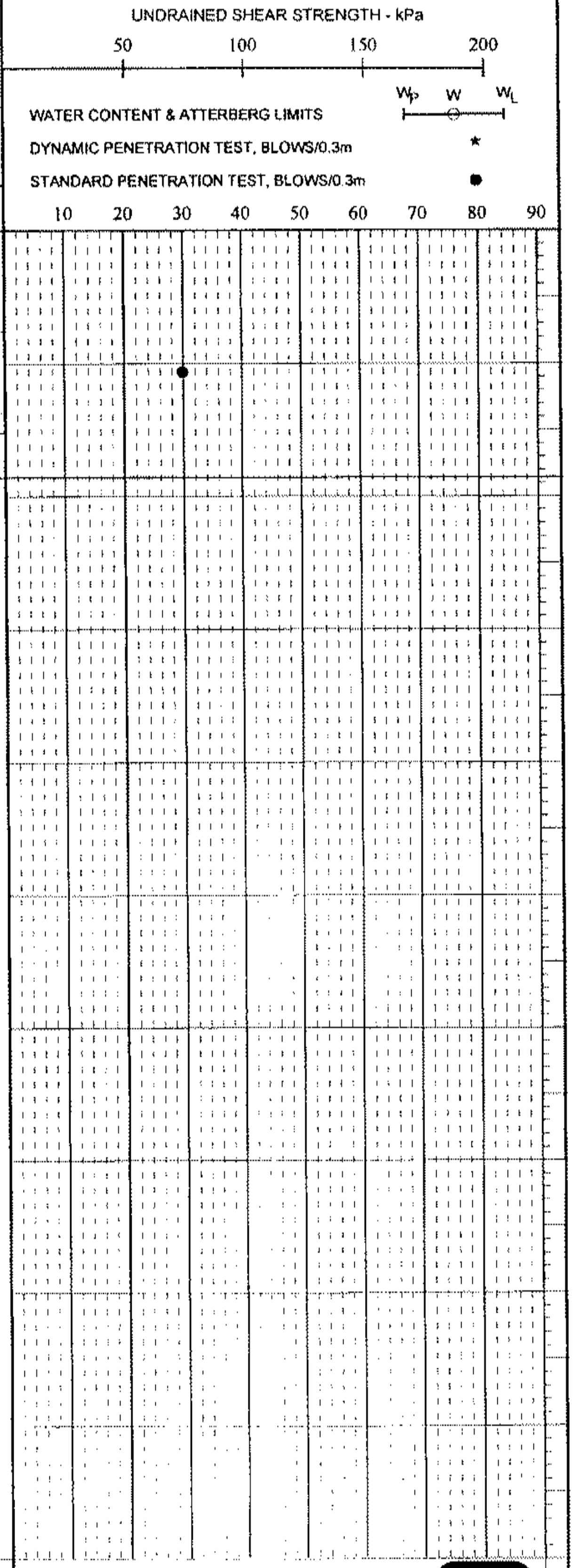
WATER LEVEL

BOREHOLE No. **BH 00-32**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.85							
	99.6	250 mm TOPSOIL						
		Compact to dense, brown silty sand, trace gravel: TILL						
1					SS	1	600	30
					SS	2	280	50/ 100
2	98.0	End of Borehole Auger Refusal on Inferred Bedrock - standpipe installed						
3								
4								
5								
6								
7								
8								
9								
10								



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

BOREHOLE No. **BH 00-33**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

PROJECT No. **11297**

DATES: BORING **00-01-19**

WATER LEVEL

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	100.54							
	100.3	200 mm TOPSOIL						
	99.6	Dense, brown sand and silt, trace gravel: TILL			SS	1	80	* ref
1		End of Borehole Auger Refusal on Inferred Bedrock * ref = split spoon refusal						
2								
3								
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P w W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

DATES: BORING **00-01-34**

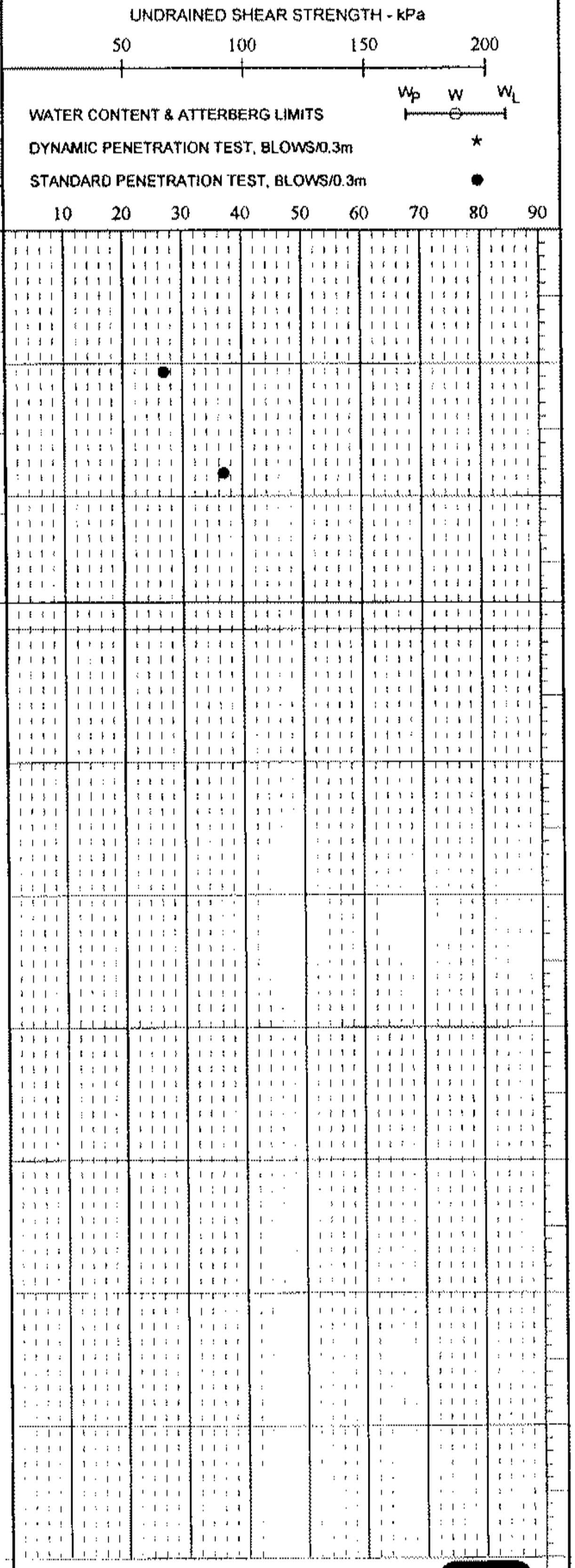
WATER LEVEL

BOREHOLE No. **BH 00-34**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	99.63	350 mm TOPSOIL						
	99.3	Compact to dense, brown silty sand, trace gravel, trace clay: TILL						
1					SS	1	550	27
2					SS	2	600	37
	96.8	End of Borehole Auger Refusal on Inferred Bedrock						
3								
4								
5								
6								
7								
8								
9								
10								



☒ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

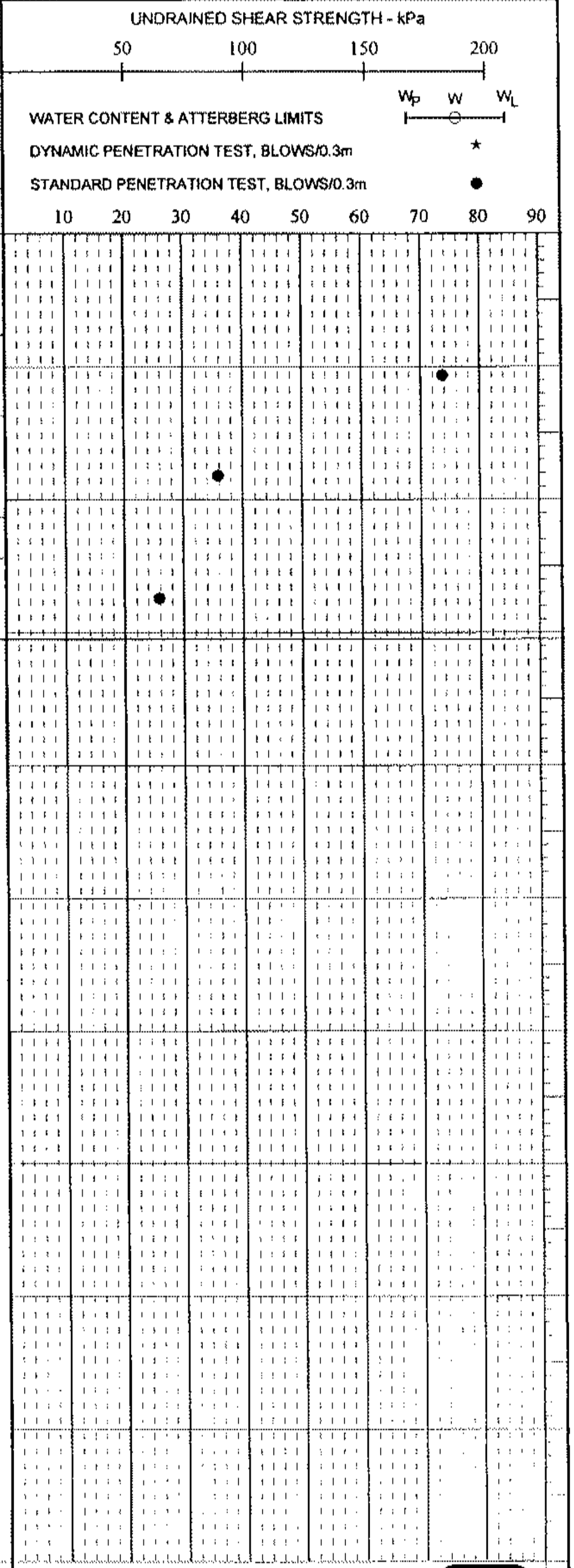
DATES: BORING **00-01-24** WATER LEVEL

BOREHOLE No. **BH 00-35**

PROJECT No. **11297**

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	100.30					
	100.0	275 mm TOPSOIL				
		Very dense to compact, brown silty sand, trace gravel, occasional cobbles boulders: TILL				
1			SS	1	520	74
2			SS	2	580	36
			SS	3	600	26
3	97.3	End of Borehole				



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

CLIENT **Canadian Tire Real Estate Limited**

BOREHOLE No. **BH 00-36**

LOCATION **Proposed Canadian Tire Store #442 Barrhaven, Nepean, ON**

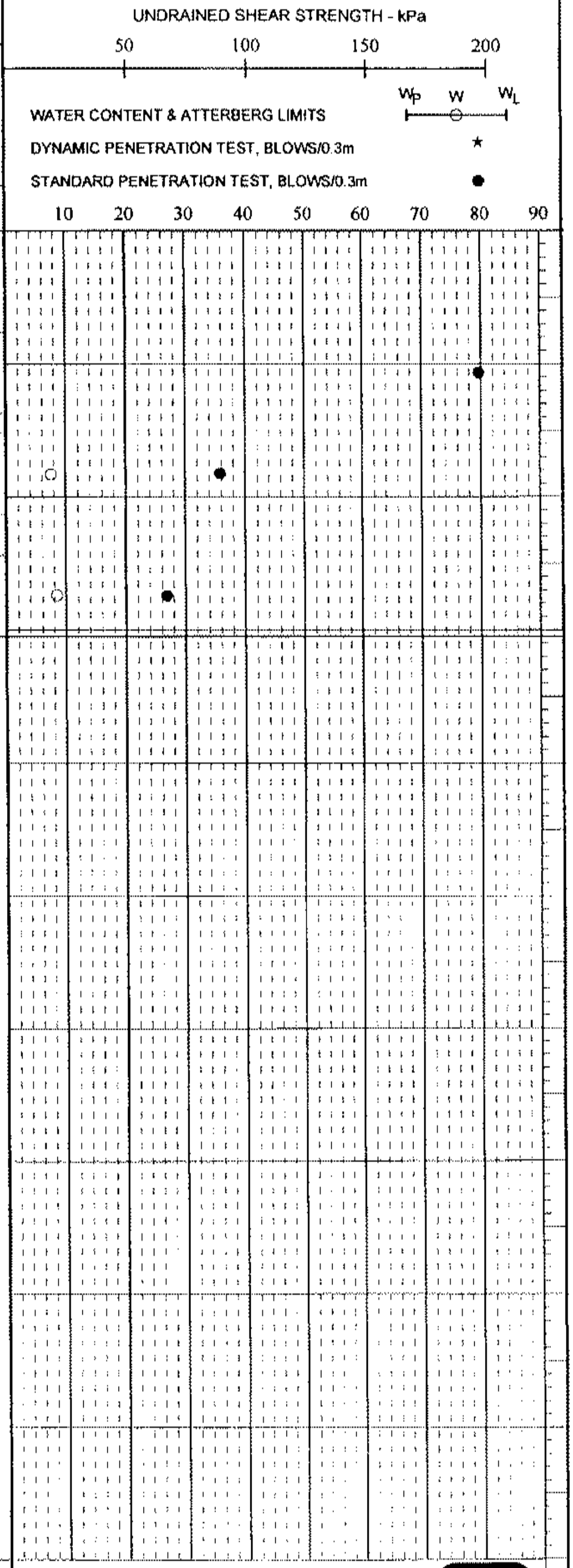
PROJECT No. **11297**

DATES: BORING **00-01-19**

WATER LEVEL

DATUM **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	100.18							
	100.0	200 mm TOPSOIL						
		Compact to very dense, brownish grey sand and silt, some gravel, occasional boulders: TILL						
1					SS	1	610	80
2					SS	2	610	36
					SS	3	610	27
3	97.1	End of Borehole						



▽ Inferred Groundwater Level

▼ Groundwater Level Measured in Standpipe

□ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

December 2009

REPORT

REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
1581 GREENBANK ROAD
OTTAWA, ONTARIO

Submitted to:

ECL Developments Ltd.
5955 Airport Road, Suite 200
Mississauga, Ontario
L4V 1R9

Report Number: 09-1121-1036

Distribution:

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APPENDIX A
NBCC Seismic Site Class Testing Results
1581 Greenbank Road, Ottawa, Ontario

APPENDIX B
Results of Chemical Analysis
EXOVA Accutest Report No. 2927582

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed commercial development located at 1581 Greenbank Road in Ottawa, Ontario.

The purpose of this geotechnical investigation was to determine the general soil, and groundwater conditions on this site by means of eight test pits. Based on an interpretation of the factual information obtained, engineering guidelines are provided on the geotechnical design aspects of the project, including construction considerations which could affect design decisions.

The reader is referred to the "Important Information and Limitations of This Report" which follows the text but forms an integral part of this document.

2.0 DESCRIPTION OF PROJECT AND SITE

The proposed commercial development is located at 1581 Greenbank Road in Ottawa, Ontario (see Key Plan, Figure 1). The site is located south of Berrigan Drive on the east side of Greenbank Road adjacent to an existing church. The site is currently undeveloped and mostly grass covered with the exception of the eastern portion which is forested.

It is understood that the commercial development will be a 'campus' style layout consisting of two separate buildings (i.e., CRU 1 and 3) occupying the 'L' shaped site. Building CRU 1 measures about 59 by 26 metres and is proposed for the eastern portion of the site adjacent to Berrigan Drive. Building CRU 3 measures about 17 by 51 metres and is proposed for the western portion of the site along Greenbank Road. It is also understood that the buildings will consist of one storey slab-on-grade (i.e., no basement) structures. At-grade parking is proposed around the buildings as well as a drive through lane adjacent to building CRU 3.

Published geological maps and previous experience in the area indicate that the subsurface conditions should consist of glacial till underlain by March formation sandstone and/or dolostone bedrock. The depth to the bedrock surface is indicated to be between ground surface and 5 metres depth.

3.0 PROCEDURE

The field work for this investigation was carried out on October 28, 2009. At that time, eight test pits (numbered 09-1 to 09-8, inclusive) were put down at the approximate locations shown on the Site Plan, Figure 2. The test pits were excavated using a rubber tired backhoe supplied and operated by a local excavating contractor.

The test pits were excavated to depths ranging from about 1.0 to 4.8 metres below the existing ground surface. The groundwater seepage conditions were observed in the open test pits and the test pits were loosely backfilled upon completion of excavating and sampling.

Standpipes were sealed into test pits 09-2 and 09-4 to allow subsequent measurement of the groundwater level.

The field work was supervised by an experienced technician from our staff who located the test pits, directed the excavation operations, logged the test pits and samples, directed the in situ testing, and took custody of the soil samples retrieved.

On completion of the excavation operations, samples of the soils encountered in the test pits were transported to our laboratory for examination by the project engineer and for laboratory testing. One sample of soil was submitted to Exova Accutest Laboratories Ltd. for chemical analysis related to potential corrosion of buried steel elements and potential sulphate attack on buried concrete elements.

The groundwater levels in the standpipes were measured on November 12, 2009.

The test pit locations were selected by Golder Associates and picketed in the field in relation to existing site features. Golder Associates subsequently surveyed the borehole elevations and locations using a Trimble R8 Global Positioning System (GPS) which are reference to Geodetic datum.

To support the selection of an appropriate seismic site response classification, the shear wave velocity (Vs) of the soils was measured on October 20, 2009 by Golder Associates personnel using the Multichannel Analysis of Surface Waves (MASW) method. The MASW testing was carried out at two locations as shown on Figure 2 (i.e., one in the area of CRU 1 and one in the area of CRU 3). At each location a series of 24 low frequency (4.5 Hertz) geophones were laid out at 2 metre intervals. A seismic weight drop of 45 kilograms was used as the seismic source for this investigation. The seismic source location was offset at a distance of 20 and 10 metres from the end and collinear with the geophone array.

4.0 SUBSURFACE CONDITIONS

The subsurface conditions encountered in the test pits are shown on the Record of Test Pits, Table 1. The results of the MASW testing are provided in a memo in Appendix A. The results of the basic chemical analysis on a soil sample from test pit 09-1 are provided in Appendix B.

The following provides a summary of the subsurface conditions at the site.

Approximately 100 to 400 millimetres of topsoil was encountered at the ground surface at the majority of the test pit locations, although fill material was encountered at the ground surface at test pits 09-5, 09-7 and 09-8. The thickness of the fill material at these locations was about 0.8, 0.8, and 0.2 metres, respectively. The fill material consists of topsoil and silty sand with varying amounts of gravel and/or organic matter. Traces of asphalt, metal and plastic were also encountered in the fill material at test pit 09-7. Topsoil was encountered beneath the fill material at test pits 09-7 and 09-8 with thicknesses of about 200 and 170 millimetres, respectively.

The topsoil is generally underlain by a deposit of sand, silty sand and/or sandy silt which varies in thickness from about 0.2 to 0.6 metres.

Glacial till underlies the fill material at test pit 09-5 and the sand, silty sand and/or sandy silt deposits at all other test pit locations, with the exception of test pit 09-8. The glacial till was proven to depths between about 1.8 and 4.8 metres below the existing ground surface. The glacial till is a heterogeneous mixture of gravel, cobbles, and boulders in a matrix of sandy silt.

Weathered and fractured sandstone bedrock with soil infilled seams was encountered beneath the glacial till at test pit 09-6 and the silty sand at test pit 09-8. The weathered bedrock was excavated to a depth of about 4.3 metres at test pit 09-6 where the test pit was terminated and 1.0 metre at test pits 09-8 where practical refusal to excavating was encountered on sandstone bedrock.

At the remaining test pit locations practical refusal to excavating on probable bedrock was encountered between about 1.8 and 4.8 metres depth.

No groundwater was observed in any of the test pits during the short time they remained open. The standpipes installed in test pits 09-2 and 09-4 were dry when measured on November 12, 2009.

It should be noted that groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring.

5.0 DISCUSSION

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of this project based on our interpretation of the borehole information and project requirements, and subject to the limitations in the "Important Information and Limitations of This Report" attachment which follows the text of this report.

5.2 Foundation Excavations

The foundation excavations as well as the site service trenches will extend through topsoil, fill material, sandy deposits, glacial till and weathered bedrock (i.e., within the eastern portion of the site in the area of CRU 1).

No unusual problems are anticipated in excavating in the overburden using conventional large hydraulic excavating equipment, recognizing that cobbles and boulders will be encountered within the glacial till. Boulders larger than 0.3 metres in size should be removed from the excavation side slopes. If required in the eastern portion of the site, mechanical methods of rock removal (such as hoe ramming) can likely be carried out for depths of about one metre, however, this work may be slow and tedious.

The Occupational Health and Safety Act (OHSA) of Ontario indicate that side slopes in the overburden should be sloped at a minimum of 1 horizontal to 1 vertical (i.e., Type 3 soils).

Some groundwater inflow into the excavations could potentially be expected. However, it should be possible to handle the groundwater inflow by pumping from well filtered sumps established in the floor of the excavations.

5.3 Site Grading

The subsurface conditions on this site consist of a limited amount fill material overlying sandy deposits, glacial till and bedrock.

For these subsurface conditions, no restrictions apply to the height of grade raise fill which may be placed on the site from a foundation design perspective.

5.4 Foundations

The subsurface conditions on the site generally consist of a discontinuous layer of fill material overlying sandy deposits and/or glacial till with the probable bedrock surface between about 1.0 and 4.8 metres depth.

It is understood that the finished floor elevations of the buildings and exterior grading have yet to be determined. Therefore it has been assumed that the exterior footings will be founded at least 1.5 metres below the finished exterior grade and the interior footings will be founded directly beneath the slab.

The existing topsoil and fill materials present on this site are not suitable for the support of the footings, or the slab, and should be removed from within the building footprints. The footings should then be founded on/within the sandy deposits, glacial till, or bedrock.

The net bearing resistance at Serviceability Limit States (SLS) for spread footing foundations founded within sandy deposits or glacial till may be taken as 150 kilopascals and the factored bearing resistance at Ultimate Limit States (ULS) may be taken as 250 kilopascals, irrespective of footing size. An SLS net bearing resistance of 250 kilopascals and a factored ULS bearing resistance of 500 kilopascals may be used for spread footing foundations founded on or within the weathered bedrock.

The post construction total and differential settlements of footings sized using the above SLS net bearing resistance values should be less than about 25 and 15 millimetres, respectively, provided that the soil at or below founding level is not disturbed during construction.

Footings on the unweathered bedrock may be sized using a ULS factored bearing resistance of 1000 kilopascals. Provided the bedrock surface is acceptably cleaned of soil or loose bedrock, the settlement of footings at the corresponding service (un-factored) load levels will be less than 25 millimetres and therefore Serviceability Limit States (SLS) need not be considered in the foundation design.

For foundations where the bedrock is shallow, two options may be considered for foundation design:

Option 1: Found the footings directly on the bedrock, and provide at least 1.5 metres of earth cover for frost protection purposes; or,

Option 2: Where 1.5 metres of earth cover cannot be provided without removing bedrock and/or extensively raising the surrounding grade, the required frost protection can be achieved by insulating the footing bearing surfaces with high density rigid insulation as shown on Figure 3.

Where the bearing surface will be insulated (Option 2), the design parameters for the footings will depend on the type of insulation used. The contact pressure on the insulation placed under the footings should not exceed about 35 percent of the insulation's quoted compressive strength due to the time dependant creep characteristics of this material. Further guidelines on foundation insulation are provided in Section 5.7 of this report

Where the subgrade at footing level changes from overburden to bedrock (i.e., in the area of CRU 1), differential settlement will result at this transition due to the different settlement properties of these materials. To limit the differential settlement, the bedrock adjacent to the transition should be removed for a distance of at least 2 metres back and to a depth of about 0.5 metres (see Figure 4). The width of bedrock removal should be at least equal to the footing width plus 0.5 metres. The excavation should then be filled to the underside of footing level with nominally compacted OPSS Granular A or Granular B Type II. The intent of this transition detail is to limit the severity of this differential settlement and avoid cracking of the structure. The structural engineering consultant should be contacted for input on this issue.

As mentioned above, all existing fill material must be removed from within the zone of influence of the new foundations. The zone of influence is considered to extend out and down from the edge of the footings at a slope of 1 horizontal to 1 vertical. If the resulting excavation of the fill removal leaves the native subgrade level below the proposed underside of footing level the grade should be raised within the zone of influence of the foundations, with Ontario Provincial Standard Specification (OPSS) Granular B Type II. The Granular B Type II should be placed in the maximum 300 millimetre thick lifts and compacted to at least 95 percent standard Proctor maximum dry density using suitable vibratory compaction equipment. The foundation design parameters for the sandy soils and glacial till can be used for this design option, as given above.

5.5 Seismic Design

The seismic design provisions of the 2006 Ontario Building Code (OBC) depend, in part, on the shear wave velocity of the upper 30 metres of soil and/or rock below founding level. The results of the MASW shear wave velocity testing are provided in Appendix A and indicate average shear wave velocities of 1158 and 1275 metres per second for this site. Although these values are greater than 760 metres per second the 2006 OBC indicates that a Site Class B can only be applied if there is no more than 3 metres of soil between the rock surface and the bottom of the spread footing foundations. Therefore, depending on the founding elevations of the proposed footings (i.e., whether or not there is less than 3 meters of soil beneath the footings and the bedrock surface) a site classification of either Site Class B or C may apply. Specifically, for building CRU 1 a Site Class B designation can only be used if the underside of footing level is no higher than elevation 103.5 metres. For building CRU 3 a Site Class B designation can only be used if the underside of footing level is no higher than elevation 101.6 metres.

5.6 Slab on Grade

The existing topsoil and fill material (where present) should be removed from within the proposed building area for predictable performance of the slab. Provision should be made for at least 150 millimetres of OPSS Granular A to form the base for the floor slab. Any bulk fill required to raise the grade to the underside of the granular base should consist of OPSS Granular B Type II. The underslab fill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

5.7 Frost Protection

All exterior foundation elements or foundation elements in unheated areas should be provided with a minimum of 1.5 metres of earth cover for frost protection purposes. Isolated foundations or foundations in unheated areas which are adjacent to surfaces which are cleared of snow cover during winter months should be provided with a minimum of 1.8 metres of earth cover.

Insulation of the bearing surface with high density insulation could be considered as an alternative to earth cover for frost protection. A typical detail for footing insulation is shown on Figure 3. A typical detail for insulation of the footings in a loading dock area (if required) is provided on Figure 5, which is intended to avoid excessive differential heaving of the pavement surface above the edge of the insulation. A similar detail for a loading dock retaining wall footing is provided on Figure 6.

In preparation for the insulation, a levelling mat consisting of 25 millimetres of concrete/mortar sand or lean concrete should be placed on the approved bearing surface. Care must be taken to ensure that the insulation is not damaged during construction. Joints should be carefully lap jointed and glued where and if possible. Footings may then be constructed on the insulation.

The bearing pressure on the insulation placed under the footings should not exceed about 35 percent of the insulation's quoted compressive strength due to the time dependant creep characteristics of this material. For example, the resistance for several strengths of insulation are:

Insulation Type	SLS Resistance (kilopascals)	ULS Factored Resistance (kilopascals)
Dow SM	65	100
Dow High Load 40	90	135
Dow High Load 60	145	205
Dow High Load 100	240	340

The insulation which projects beyond the edge of the footings can consist of Dow SM or equivalent, except beneath pavements where HI 60 should be used beyond the footing.

5.8 Foundation Wall Backfill

The soils at this site are highly frost susceptible and, as such, should not be used as backfill against exterior, unheated or well insulated foundation elements. To avoid problems with frost adhesion and heaving, these foundation elements should be backfilled with non-frost susceptible sand or sand and gravel conforming to the requirements for OPSS Granular B Type I.

In areas where pavement or other hard surfacing will abut the building, differential frost heaving could occur between the granular fill and the adjacent areas. To reduce this differential heaving, the backfill adjacent to the wall should be provided with frost tapers. The frost taper should be brought up to pavement subgrade level from 1.5 metres below finished exterior grade at a slope of 3 horizontal to 1 vertical, or flatter, away from the wall. The granular fill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment.

The pavement could be expected to perform better in the long term if the granular backfill against the foundation walls is drained by means of a perforated pipe subdrain in a surround of 19 millimetre clear stone, fully wrapped in geotextile, which leads by gravity drainage to an adjacent storm sewer or ditch.

5.9 Retaining Wall

If a retaining wall is to be constructed on the site it is suggested that frost protection be provided by insulating the bearing surface, as indicated on Figure 6. Bearing resistance values provided in Section 5.4 may be used for the retaining wall footings.

The retaining wall should be designed to resist lateral earth pressures calculated using a triangular distribution of the stress, which may be determined as follows:

$$\sigma_h(z) = K_a\,(\gamma\, z + q)$$

Where: $\sigma_h(z)$ = The lateral earth pressure at depth 'z' (kPa);

z = The depth below the top of the wall (m);

K_a = The active pressure coefficient, use 0.32;

γ = The unit weight of the backfill soil (kN/m^3) use 21.5 kilonewtons per cubic metre; and,

q = The surcharge due to live loads on the ground surface above the wall (kPa).

The value of the surcharge due to live loading (q) should consider the potential traffic loading above the wall and also the potential construction loads from equipment or materials. A value of no less than 15 kilopascals could be reasonable.

These lateral earth pressures would increase under seismic loading conditions. The earthquake-induced dynamic pressure distribution, which is to be added to the static earth pressure distribution, is a linear distribution with maximum pressure at the top of the wall and minimum pressure at its toe (i.e., an inverted triangular pressure distribution). The *combined* pressure distribution (static plus seismic) may be determined as follows:

$$\sigma_h(z) = K_a \gamma z + (K_{AE} - K_a) \gamma (H-z)$$

Where: K_{AE} = The seismic earth pressure coefficient; and,

H = The total height of the wall (m).

If the wall is to be designed in accordance with the current version of the Ontario Building Code, a value of 0.45 should be used.

All of the above lateral earth pressure equations and parameters are given in an unfactored format.

The above seismic design parameters are consistent with the wall being an unrestrained structure. For a retaining wall to be considered as an unrestrained structure under seismic conditions, the wall should be capable of displacing 100 millimetres outward under seismic conditions.

The resistance to sliding across the concrete and sand/glacial till interface for the retaining wall should be calculated using an unfactored friction angle of 25 degrees. An unfactored friction angle of 30 degrees may be used to calculate the sliding resistance across the concrete and bedrock interface.

Geotechnical resistance factors should be applied to these values in calculating the resistance to sliding for the retaining wall. If the bearing surface will be insulated, then the sliding resistance across the interface between the insulation and the subgrade can be calculated using a friction angle of 25 degrees (unfactored).

5.10 Site Servicing

5.10.1 Excavations

The excavation for site services will extend through topsoil, fill material, sandy deposits, glacial till, and possibly into the bedrock (on the eastern portion of the site).

No unusual problems are anticipated in excavating in the overburden using conventional large hydraulic excavating equipment, recognizing that boulders will be encountered within the glacial till. Boulders larger than 0.3 metres in size should be removed from the excavation side slopes.

The Occupational Health and Safety Act (OHSA) of Ontario indicate that side slopes in the overburden should be sloped at a minimum of 1 horizontal to 1 vertical (i.e., Type 3 soils). Alternatively, the excavations for site services could be carried out within a fully braced, steel trench box.

Some groundwater inflow into the trenches could potentially be expected. However, it should be possible to handle the groundwater inflow by pumping from well filtered sumps in the excavations.

If required, it is expected that the bedrock removal for this project will be carried out using drill and blast techniques. Mechanical methods of rock removal (such as hoe ramming) can likely be carried out for depths of about one metre; however, this work would likely be slow and tedious.

Near vertical trench walls in the bedrock should stand unsupported for the construction period.

If blasting is used it should be controlled to limit the peak particle velocities at all adjacent structures or services such that blast induced damage will be avoided. This will require blast designs by a specialist in this field.

A pre-blast survey should be carried out of all of the surrounding structures. Selected existing interior and exterior cracks in the structures should be identified during the pre-blast survey and should be monitored for lateral or shear movements by means of pins, glass plate telltales and/or movement telltales.

The contractor should be limited to only small controlled shots. The following frequency dependent peak vibration limits at the nearest structures and services are suggested.

Frequency Range (Hertz)	**Vibration Limits (millimetres/second)**
< 10	5
10 to 40	5 to 50 (sliding scale)
> 40	50

These limits should be practical and achievable on this project. Blasting will probably generate vibrations in excess of 40 Hertz at the closest structures. The majority of structures and their components have natural frequencies in the range of 4 to 24 Hertz.

It is recommended that the monitoring of ground vibration intensities (peak ground vibrations and accelerations) from the blasting operations be carried out both in the ground adjacent to the closest structures and within the structures themselves.

5.10.2 Bedding and Backfill

At least 150 millimetres of OPSS Granular A should be used as pipe bedding for sewer and water pipes. Where unavoidable disturbance to the subgrade surface does occur, it may be necessary to place a sub-bedding layer consisting of 300 millimetres of compacted OPSS Granular B Type II beneath the Granular A or to thicken the Granular A bedding. The bedding material should in all cases extend to the spring line of the pipe and should be compacted to at least 95 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment. The use of clear crushed stone as a bedding layer should not be permitted anywhere on this project since fine particles from the sandy backfill materials could potentially migrate into the voids in the clear crushed stone and cause loss of lateral pipe support.

Cover material, from spring line of the pipe to at least 300 millimetres above the top of pipe, should consist of OPSS Granular A or Granular B Type I with a maximum particle size of 25 millimetres. The cover material should be compacted to at least 95 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment.

It should generally be possible to re-use the sandy soils and glacial till as trench backfill. Where the trench will be covered with hard surfaced areas, the type of native material placed in the frost zone (between subgrade level and 1.8 metres depth) should match the soil exposed on the trench walls for frost heave compatibility. Trench backfill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the standard Proctor maximum dry density using suitable compaction equipment.

Well fractured or well broken bedrock will be acceptable as backfill for the lower portion of the service trenches in areas where the excavation is in rock. The rock fill, however, should only be placed from at least 300 millimetres above the pipes to minimize damage due to impact or point load. The rock fill should be limited to a maximum of 300 millimetres in size.

5.11 Pavement Design

In preparation for pavement construction, all unsuitable material (e.g., topsoil and fill materials containing organic or deleterious material) should be excavated from all pavement areas.

Those portions of the fill material not containing organic matter may be left in place provided that some long term settlement of the pavement surface can be tolerated. However, the surface of the fill material at subgrade level should be proof rolled with a heavy smooth drum vibratory roller under the supervision of qualified geotechnical personnel to compact the existing fill and to identify soft areas requiring sub-excavation and replacement with more suitable fill.

Sections requiring grade raising to proposed subgrade level should then be filled using acceptable (compactable and inorganic) earth borrow or OPSS Select Subgrade Material. These materials should be placed in maximum 300-millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable compaction equipment.

The surface of the subgrade or fill should be crowned to promote drainage of the pavement granular structure. Perforated pipe subdrains should be provided at subgrade level extending from the catch basins for a distance of at least 3 metres in four orthogonal directions, or longitudinally where parallel to a curb.

The pavement structure for car parking areas should consist of:

Pavement Component	Thickness (millimetres)
Asphaltic Concrete	50
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	300

The pavement structure for the drive through lane, access roadways and truck traffic areas should consist of:

Pavement Component	Thickness (millimetres)
Asphaltic Concrete	90
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	300

The granular base and subbase materials should be uniformly compacted to at least 100 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment. The asphaltic concrete should be compacted in accordance with Table 9 of OPSS 310.

The composition of the asphaltic concrete pavement in car parking areas should be as follows:

Superpave 12.5 – 50 millimetres

The composition of the asphaltic concrete pavement in access roadways and truck traffic areas should be as follows:

Superpave 12.5 – 40 millimetres

Superpave 19.0 – 50 millimetres

The above pavement designs are based on the assumption that the pavement subgrade has been acceptably prepared (i.e., where the trench backfill and grade raise fill have been adequately compacted to the required density and the subgrade surface not disturbed by construction operations or precipitation). Depending on the actual conditions of the pavement subgrade at the time of construction, it could be necessary to increase the thickness of the subbase and/or to place a woven geotextile beneath the granular materials.

The asphalt cement should consist of PG 58-28 and the design of the mixes should be based on a Traffic Category B.

5.12 Corrosion and Cement Type

One sample of soil from borehole 05-2 was submitted to Accutest Laboratories Ltd. for chemical analysis related to potential corrosion of buried ferrous elements or sulphate attack on buried concrete elements. The results of the testing are provided in Appendix B. The results indicate that concrete made with Type GU Portland cement should be acceptable for substructures. The results also indicate a potential for corrosion of exposed ferrous metal.

5.13 Test Pits

Where the test pits for this investigation have been excavated within the zone of influence of the proposed building footprints or adjacent to the building footprints, the disturbed backfill soils in the test pits are unsuitable vertical or lateral support of foundations or floor slabs. Foundations or floor slabs supported on the backfill soils could experience unacceptable settlements. The backfill materials should therefore be removed and replaced with compacted engineered fill. The engineered fill material used within the test pits should consist of OPSS Granular B Type II or Granular A. These materials should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the standard Proctor maximum dry density using suitable compaction equipment. At test pit locations which are beneath future paved or hard surface areas, the backfill materials should be removed and recompacted with native soil, acceptable earth borrow or engineered fill. These materials should also be placed in maximum 300 millimetre thick lifts and compacted to at least 95 percent of the standard Proctor maximum dry density using suitable compaction equipment.

6.0 ADDITIONAL CONSIDERATIONS

The soils at this site are sensitive to disturbance from ponded water, construction traffic and frost.

All footing and subgrade areas should be inspected by experienced geotechnical personnel prior to filling or concreting to ensure that soil having adequate bearing capacity has been reached and that the bearing surfaces have been properly prepared. The placing and compaction of any engineered fill as well as sewer bedding and backfill should be inspected to ensure that the materials used conform to the specifications from both a grading and compaction point of view.

Any boulders loosened in footing excavations should be removed then filled with compacted engineered fill or with lean concrete.

At the time of the writing of this report, only preliminary details for the proposed subdivision were available. Golder Associates should be retained to review the final grading plan and specifications for this project prior to construction to ensure that the guidelines in this report have been adequately interpreted.

The groundwater level monitoring devices (i.e., standpipe piezometers or wells) installed at the site will require decommissioning at the time of construction in accordance with Ontario Regulation 128/03. However, it is expected that most of the wells will either be destroyed during construction or can be more economically abandoned as part of the construction contract. If that is not the case or is not considered feasible, abandonment of the monitoring wells can be carried out separately.

Yours truly,

GOLDER ASSOCIATES LTD.

S.A. Trickey, EIT

Terry J. Nicholas, P.Eng.
Principal

SAT/TJN/cg

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IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

TABLE 1

RECORD OF TEST PITS

Test Pit Number (Elevation)	Depth (metres)	DESCRIPTION
09-1	0.00 – 0.30	TOPSOIL
(102.54 m)	0.30 – 0.60	Red brown SAND, trace to some gravel, trace silt
	0.60 – 3.90	Grey brown SANDY SILT, some gravel, with cobbles and boulders (GLACIAL TILL)
	3.90	Refusal to excavating, Possible Bedrock
		Note: Test pit dry upon completion.

Sample	Depth (m)
1	0.1 – 0.2
2	0.4 – 0.5
3	1.50

09-2	0.00 – 0.40	TOPSOIL
(102.95 m)	0.40 – 0.75	Red brown SAND, some gravel, trace to some silt, with rootlets
	0.75 – 3.80	Grey brown SANDY SILT, some gravel, with cobbles and boulders (GLACIAL TILL)
	3.80	Refusal to excavating, Possible Bedrock
		Note: Test pit dry upon completion.

Sample	Depth (m)
1	0.5 – 0.7

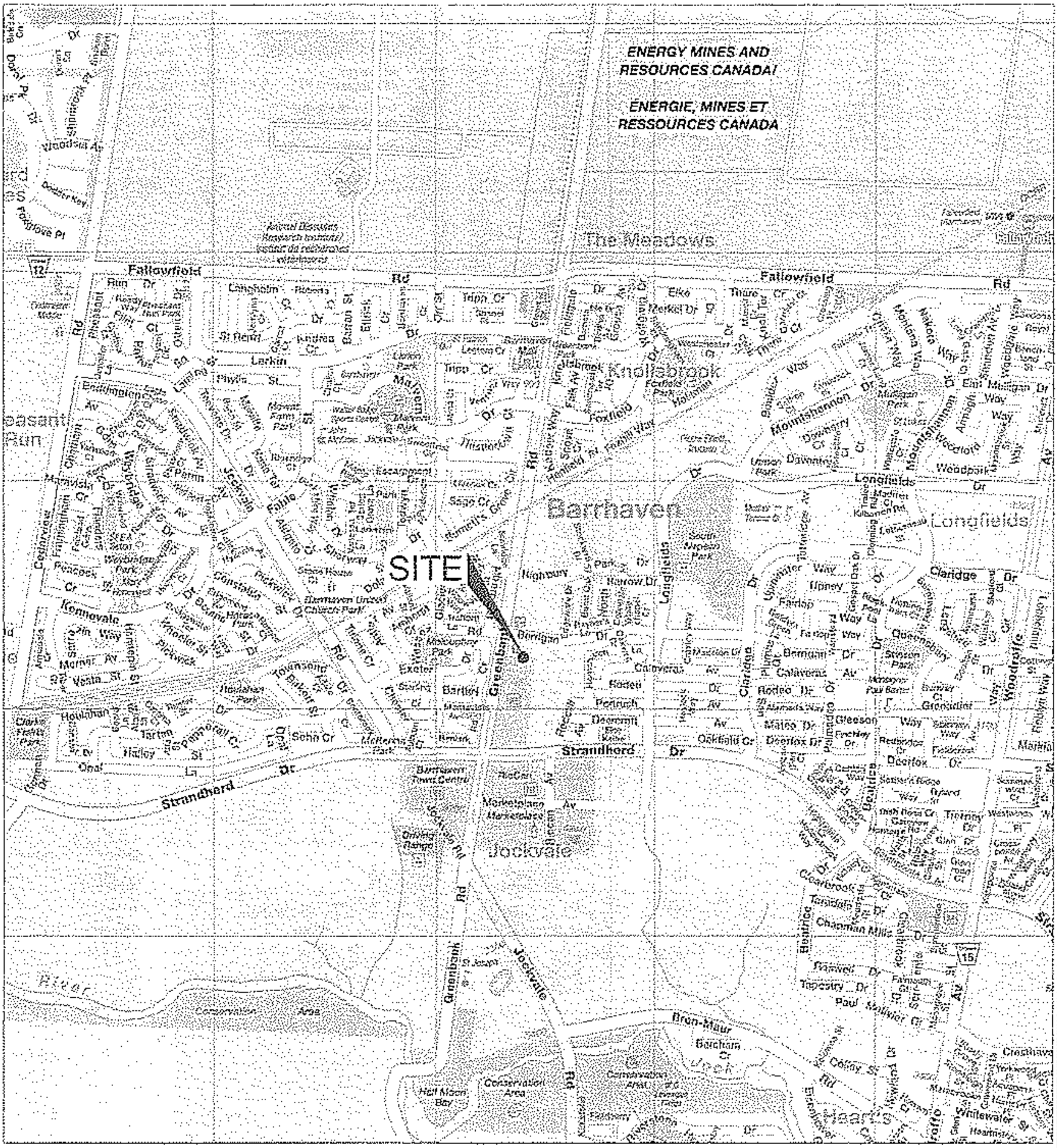
Test Pit Number (Elevation)	Depth (metres)	DESCRIPTION
09-3	0.00 – 0.25	TOPSOIL
(104.36 m)	0.25 – 0.45	Red brown SAND, trace to some gravel, trace silt
	0.45 – 4.75	Grey brown SANDY SILT, some gravel, with cobbles and boulders (GLACIAL TILL)
	4.75	Refusal to excavating, Possible Bedrock
		Note: Test pit dry upon completion.
09-4	0.00 – 0.30	TOPSOIL
(104.26 m)	0.30 – 0.55	Red brown SAND, some gravel, with cobbles
	0.55 – 3.25	Grey brown SANDY SILT, some gravel, with cobbles and boulders (GLACIAL TILL)
	3.25	Refusal to excavating, Possible Bedrock
		Note: Test pit dry upon completion. 50 mm diameter PVC standpipe installed at 3.25 m depth.

Sample	Depth (m)
1	1.80

Test Pit Number (Elevation)	Depth (metres)	DESCRIPTION
09-5	0.00 – 0.10	Topsoil (FILL)
(103.65 m)	0.10 – 0.75	Dark brown silty sand, with gravel and organic matter (FILL)
	0.75 – 2.15	Grey brown SANDY SILT, some gravel, with cobbles and boulders (GLACIAL TILL)
	2.15	Refusal to excavating, Possible Bedrock
		Note: Test pit dry upon completion.

Sample	Depth (m)
1	0.30 – 0.50

Test Pit Number (Elevation)	Depth (metres)	DESCRIPTION
09-6	0.00 – 0.20	TOPSOIL
(104.12 m)	0.20 – 0.80	Red brown to grey brown SILTY SAND to SANDY SILT, some gravel
	0.80 – 3.60	Grey brown SANDY SILT, some gravel, with cobbles and boulders (GLACIAL TILL)
	3.60 – 4.25	Fractured and weathered SANDSTONE BEDROCK, with soil infilled seams
	4.25	End of test pit
		Note: Test pit dry upon completion.
09-7	0.00 – 0.10	Topsoil (FILL)
(103.43 m)	0.10 – 0.82	Brown silty sand, with gravel, organic matter, asphalt, metal and plastic (FILL)
	0.82 – 1.02	TOPSOIL
	1.02 – 1.55	Red brown SAND, some gravel, with boulders
	1.55 – 1.83	Grey brown SANDY SILT, some gravel, with cobbles (GLACIAL TILL)
	1.83	Refusal to excavating, Possible Bedrock
		Note: Test pit dry upon completion.
09-8	0.00 – 0.15	Grey brown silty sand, with organic matter (FILL)
(103.89 m)	0.15 – 0.32	TOPSOIL
	0.32 – 0.62	Red brown to yellow brown SILTY SAND, some gravel, with cobbles
	0.62 – 0.95	Weathered SANDSTONE BEDROCK, with clayey silt infilled seams
	0.95	Refusal to excavating, SANDSTONE BEDROCK
		Note: Test pit dry upon completion.



N
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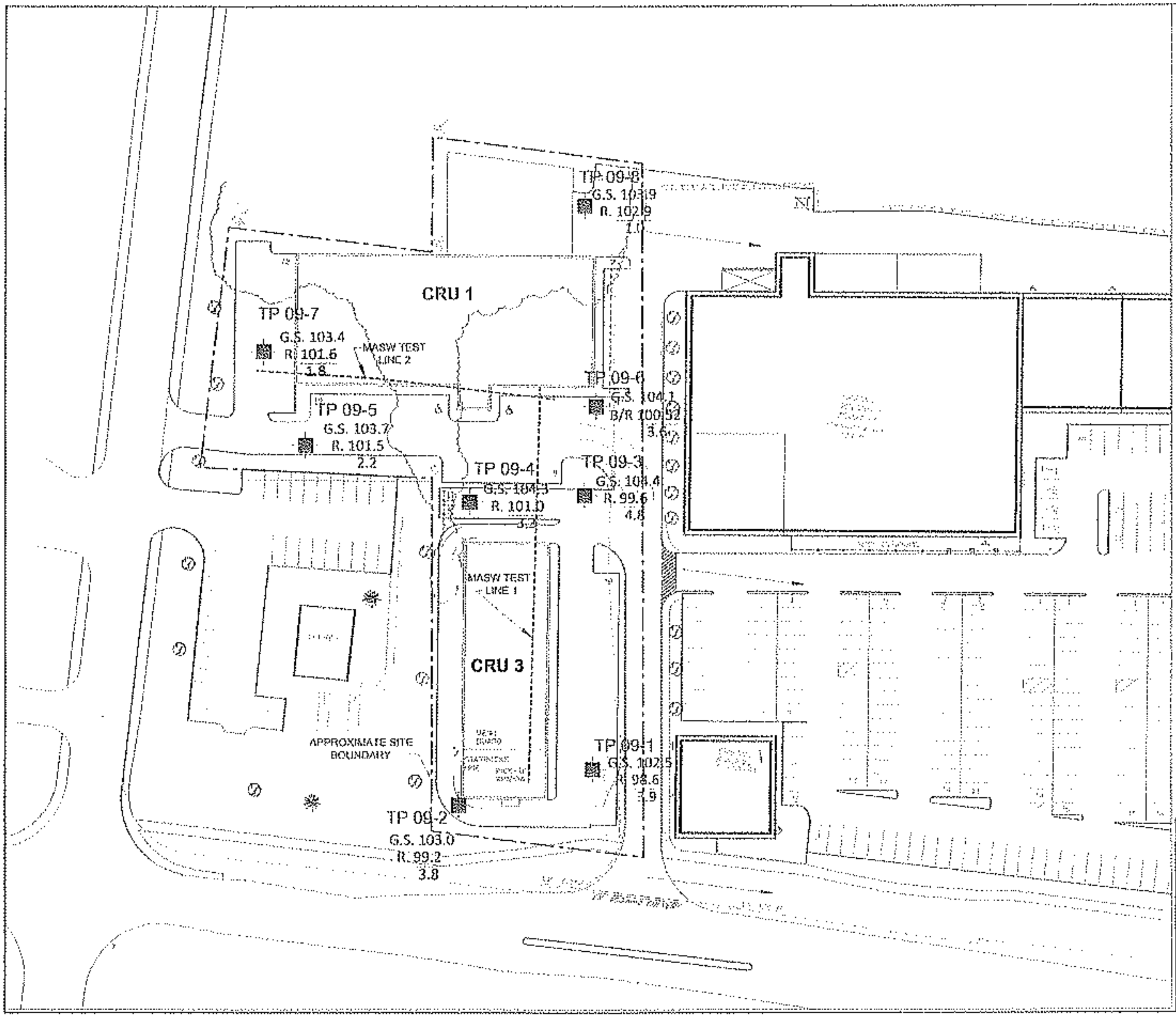
NOTE

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT No. 09-1121-1036

Golder Associates
Ottawa, Ontario, Canada

SCALE	1:25,000	TITLE	KEY PLAN
DATE	17 NOV. 09		
DESIGN			
CAD	A.B.D.		
FILE No 0911211036-01.dwg	CHECK		1581 GREENBANK ROAD OTTAWA, ONTARIO
PROJECT No 09-1121-1036 REV.	REVIEW		FIGURE 1

PLOT DATE: December 4, 2009
FILENAME: N:\Active\2009\1121 -- Geotechnical\09-1121-1036 1581 Greenbank Road Ottawa\ACAD\0911211036-01.dwg



LEGEND

▨ TP 09-10	APPROXIMATE TEST PIT LOCATION IN PLAN
G.S. 103.4	GROUND SURFACE ELEVATION,metres
B/R 100.52	BEDROCK SURFACE, metres
3.6	DEPTH TO BEDROCK, metres
R. 99.6	REFUSAL ELEVATION, metres
4.8	DEPTH TO REFUSAL, metres
-------	APPROXIMATE LOCATION OF MASW TEST LINE

REFERENCE

BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY ECL DEVELOPMENT LTD.

NOTE

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT No.09-1121-1036

15 0 15

SCALE 1:760 METRES

GEOTECHNICAL INVESTIGATION
1581 GREENBANK ROAD
OTTAWA, ONTARIO

SITE PLAN

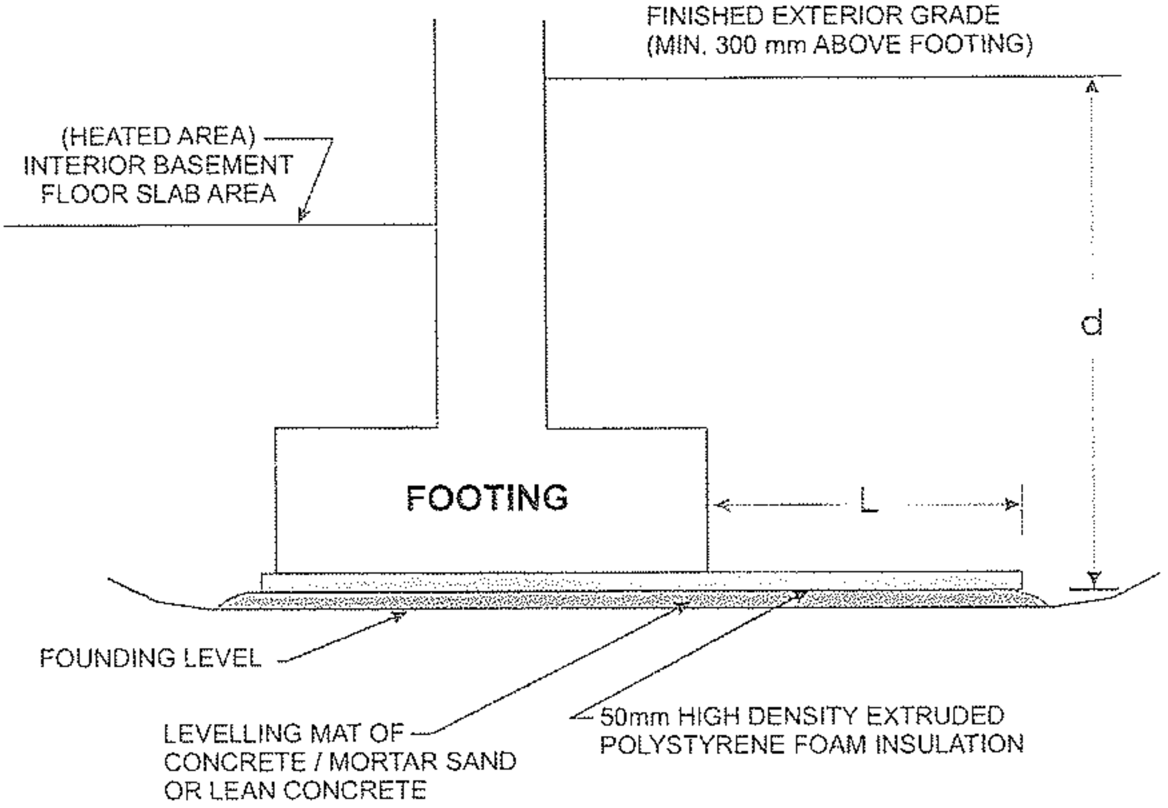
Golder Associates

2

PLOT DATE: December 4, 2009
FILENAME: N:\Active\2009\1121 - Geotechnical\09-1121-1036 1581 Greenbank Road Ottawa\CADD\091121036-02.dwg

TYPICAL FOOTING INSULATION DETAIL

FIGURE 3



LEGEND

d	THICKNESS OF EARTH COVER ABOVE BOTTOM OF INSULATION
L	PROJECTED LENGTH OF INSULATION

NOTES

1) INSULATION JOINTS TO BE GLUED AND / OR LAPPED
2) FOR ADEQUATE FROST PROTECTION $d + L \geq 1.5$ m
3) FOR $d \geq 0.9$ m, INSULATION THICKNESS OF 25 mm IS ADEQUATE
4) ALLOWLABLE BEARING PRESSURE FOR FOOTING DESIGN DEPENDS ON INSULATION TYPE
5) FOR ISOLATED UNHEATED FOUNDATIONS, ADDITIONAL DETAILS ARE REQUIRED

Date: DECEMBER 2009

Project 09-1121-1036

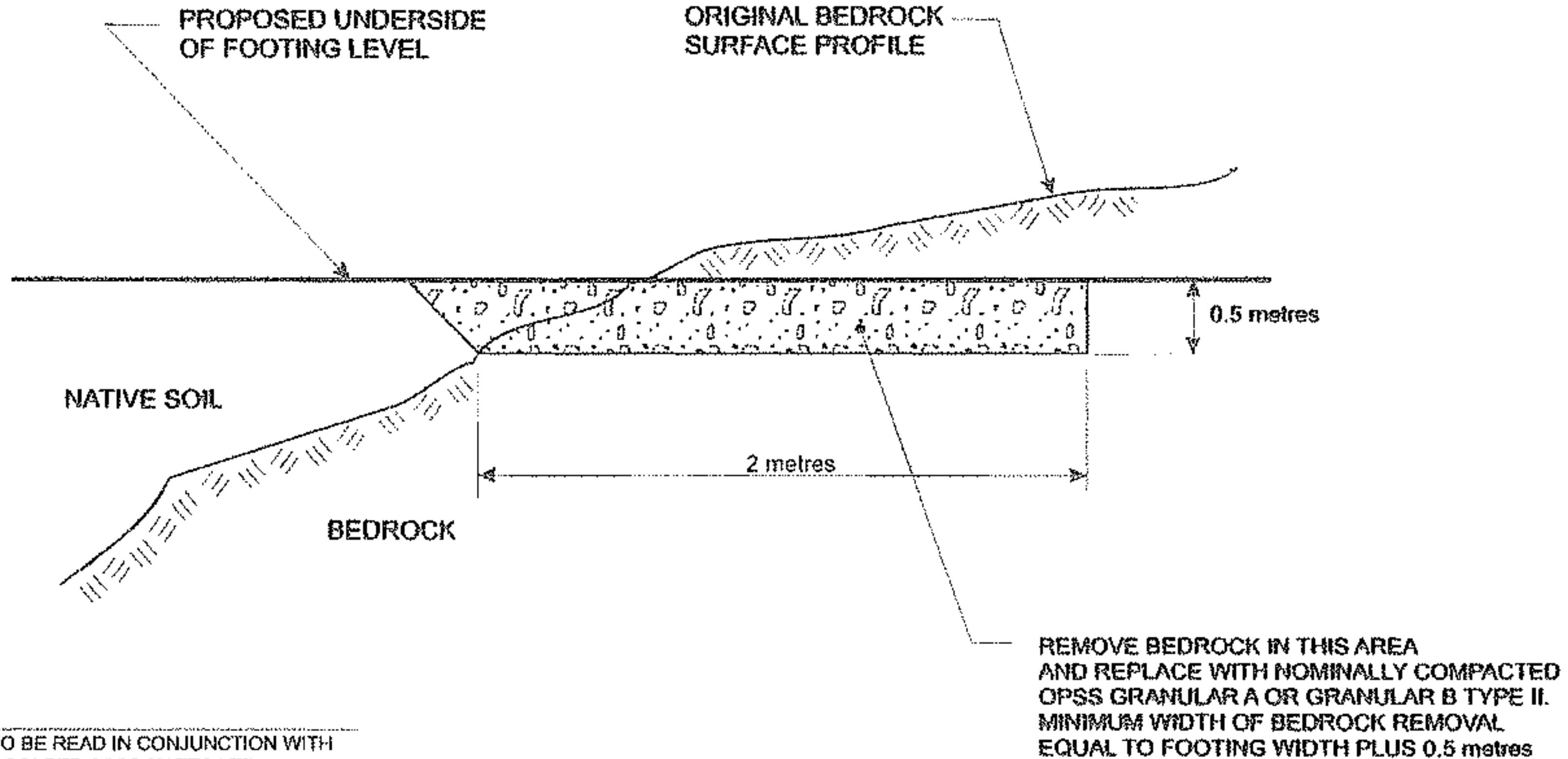
Golder Associates

Drawn: J M

Chkd: SAT

Drawing File: 09-1121-1036-03.cdr

PLOT DATE: December 4, 2009
FILENAME: N:\Active\2009\1121 - Geotechnical\09-1121-1036 1581 Greenbank Road Ottawa\ACAD\0911211036-04.dwg



NOTE
THIS FIGURE IS TO BE READ IN CONJUNCTION WITH
ACCOMPANYING GOLDER ASSOCIATES LTD.
REPORT No. 09-1121-1036

N.T.S.

1581 GREENBANK ROAD
OTTAWA, ONTARIO

FOOTING TRANSITION DETAIL BEDROCK TO OVERBURDEN

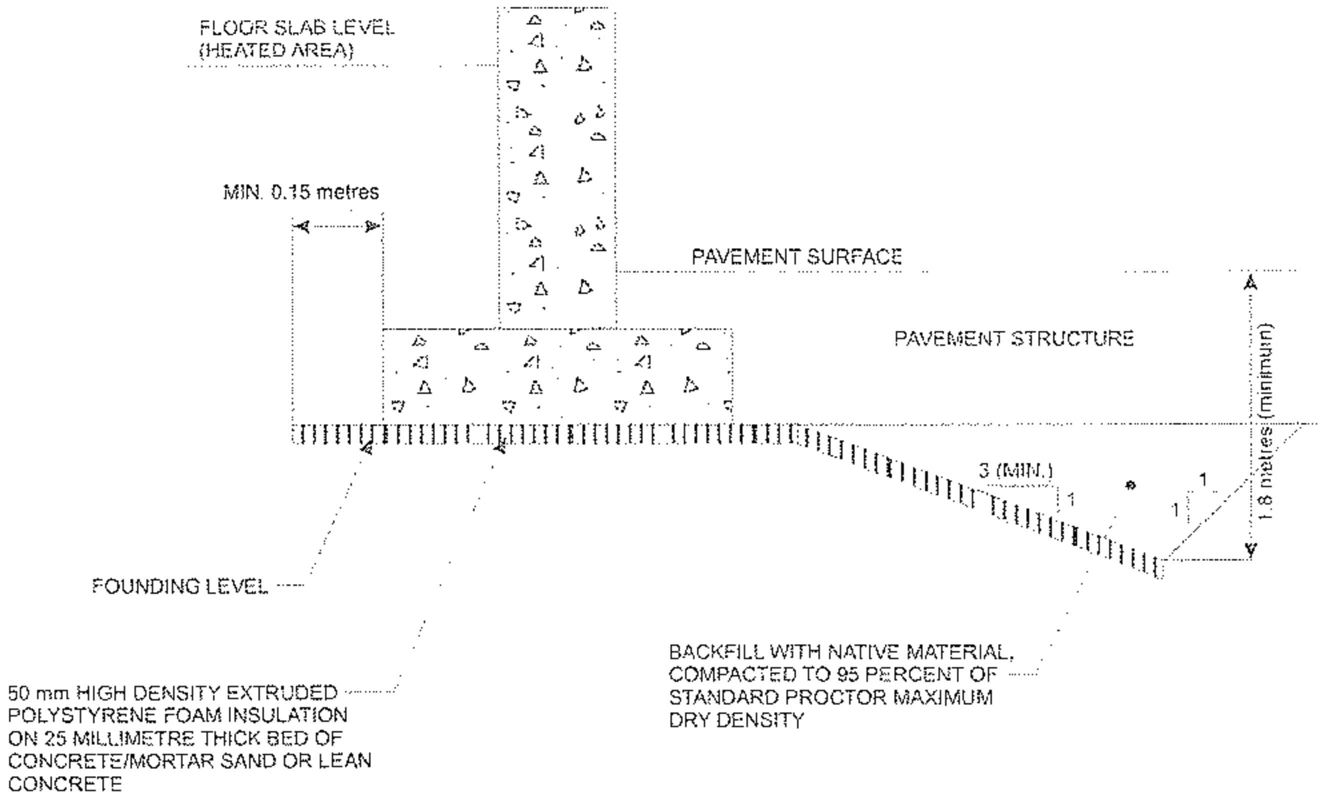
FIGURE 4

Golder Associates
Ottawa Ontario, Canada

PROJECT No. 09-1121-1036   DATE Dec. 4, 2009   CAD A.B.O.

TYPICAL FOOTING INSULATION DETAIL FOR LOADING DOCK AREA

FIGURE 5



NOTES

1) INSULATION JOINTS TO BE GLUED AND/OR LAP JOINTED

2) ALLOWABLE BEARING PRESSURE FOR FOOTING DESIGN IS DEPENDANT ON INSULATION TYPE - SEE TEXT

Date DECEMBER 2009

Project 09-1121-1036

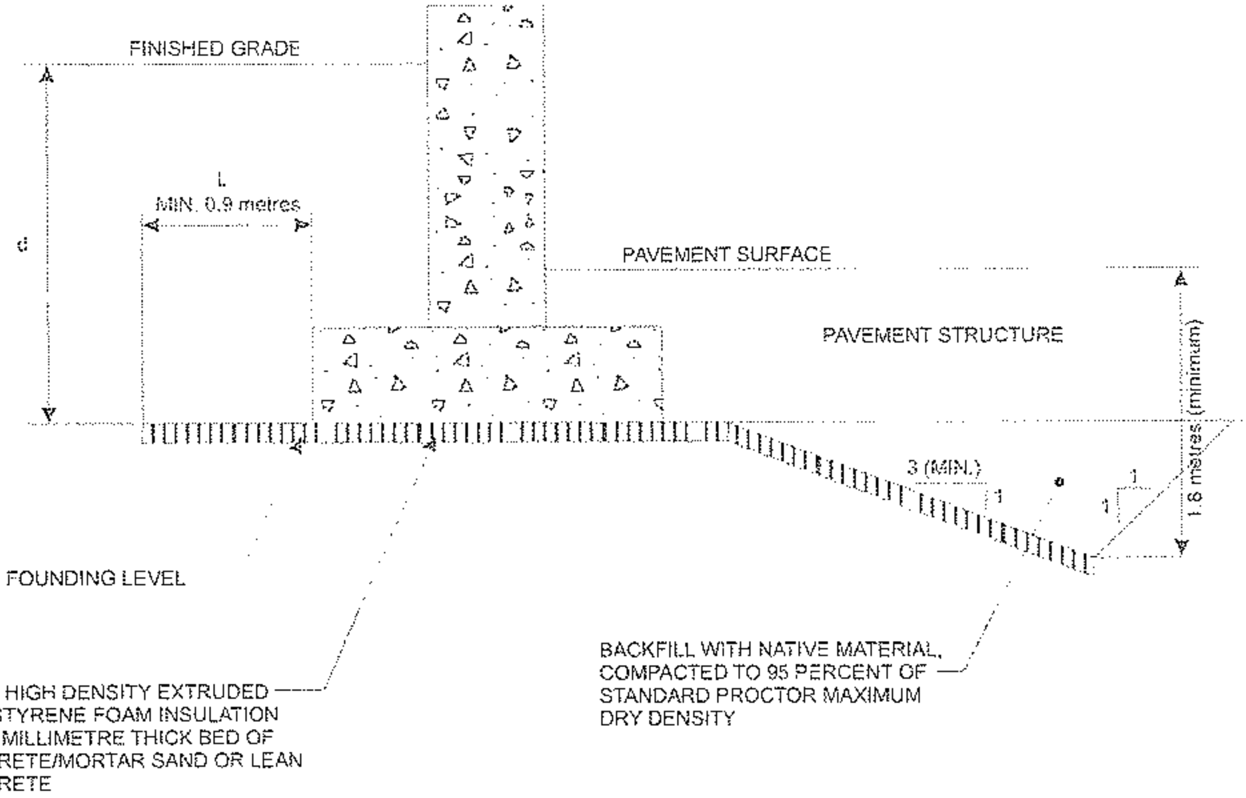
Golder Associates

Drawn MIC

Chkd SAT

TYPICAL FOOTING INSULATION DETAIL FOR LOADING DOCK RETAINING WALL

FIGURE 6



LEGEND

d THICKNESS OF EARTH COVER ABOVE BOTTOM OF INSULATION
L PROJECTED LENGTH OF INSULATION

NOTES

1) INSULATION JOINTS TO BE GLUED AND/OR LAPPED
2) FOR ADEQUATE FROST PROTECTION d + L ≥ 1.8 metres
3) ALLOWABLE BEARING PRESSURE FOR FOOTING DESIGN IS DEPENDANT ON INSULATION TYPE - SEE TEXT

Date: DECEMBER 2009
Project: 09-1121-1036

Golder Associates

Drawn: MIC
Chkd:

APPENDIX A

NBCC Seismic Site Class Testing Results
1581 Greenbank Road, Ottawa, Ontario

Golder Associates

TECHNICAL MEMORANDUM

DATE December 1, 2009 **DOCUMENT No.** 09-1121-1036

TO Susan Trickey
Golder Associates Ltd.

CC Michael Snow

FROM Christopher Phillips **EMAIL** cphillips@golder.com

NBCC SEISMIC SITE CLASS TESTING RESULTS – 1581 GREENBANK ROAD, OTTAWA, ONTARIO

This technical memorandum presents the processing and results of the Multichannel Analysis of Surface Waves (MASW) test performed for the purpose of National Building Code of Canada seismic site classification at 1581 Greenbank Road, Ottawa, Ontario. The geophysical testing was performed by Golder personnel on October 20, 2009.

Methodology

The Multichannel Analysis of Surface Waves (MASW) method measures variations in surface wave velocity with increasing distance and wavelength and can be used to infer the rock/soil types, stratigraphy and soil conditions.

A typical MASW survey requires a seismic source, to generate surface-waves, and a minimum of two geophone receivers, to measure the ground response at some distance from the source. Surface waves are a special type of seismic wave whose propagation is confined to the near surface medium.

The depth of penetration of a surface-wave into a medium is directly proportional to its wavelength. In a non-homogeneous medium surface-waves are dispersive, i.e., each wavelength has a characteristic velocity owing to the subsurface heterogeneities within the depth interval that particular wavelength of surface-wave propagates through. The relationship between surface-wave velocity and wavelength is used to obtain the shear-wave velocity and attenuation profile of the medium with increasing depth.

The seismic source used can be either active or passive, depending on the application and location of the survey. Examples of active sources include explosives, weight-drops, sledge hammer and vibrating pads. Examples of passive sources are road traffic, micro-tremors and water-wave action (in near-shore environments).

The geophone receivers measure the wave-train associated with the surface wave travelling from a seismic source at different distances from the source.

The participation of surface-waves with different wavelengths can be determined from the wave-train by transforming the wave-train results into the frequency domain. The surface-wave velocity profile with respect to wavelength (called the 'dispersion curve') is determined by the delay in wave propagation measured between the geophone receivers. The dispersion curve is then matched to a theoretical dispersion curve using an iterative forward-modelling procedure. The result is a shear-wave velocity profile of the tested medium with depth, which can be used to estimate the dynamic shear modulus of the medium as a function of depth.

Field Work

The MASW field work was conducted on October 20, 2009, by personnel from the Golder Mississauga office. Two MASW perpendicular lines were undertaken. MASW line 1 was set up nearly east-west and MASW line 2 nearly north-south. For each MASW line, a series of 24 low frequency (4.5 Hz) geophones were laid out at 2 metre intervals. A seismic weight drop of 45 kg and a sledge hammer were used as seismic sources for this investigation. Seismic records were collected with seismic sources located 20 and 10 metres from the end and collinear with the geophone array. An example of an active seismic record collected is shown in Figure 1 (below).

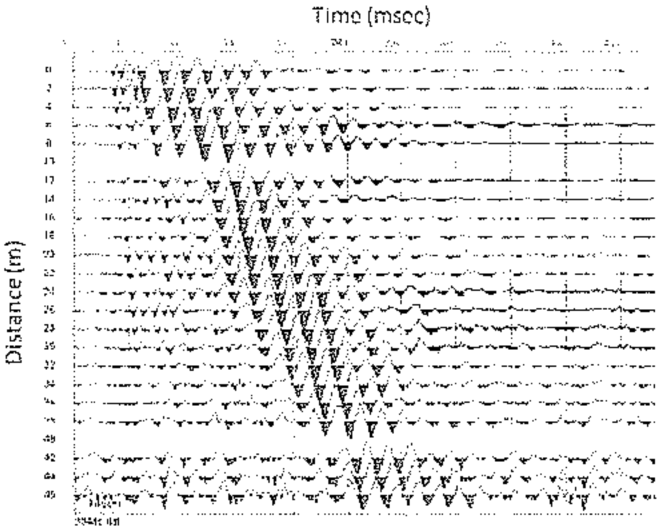


Figure 1: Typical seismic record collected at the site.

Data Processing

Processing of the MASW test results consisted of the following main steps:

1. Transformation of the time domain data into the frequency domain using a Fast-Fourier Transform (FFT) for each source location;

2. Calculation of the phase for each frequency component;

3. Linear regression to calculate phase velocity for each frequency component;

4. Filtering of the calculated phase velocities based on the Pearson correlation coefficient (r2) between the data and the linear regression best fit line used to calculate phase velocity;

5. Generation of the dispersion curve by combining calculated phase velocities for each shot location of a single MASW test; and

6. Generation of the stiffness profile, through forward iterative modelling and matching of model data to the field collected dispersion curve.

Processing of the MASW data was completed using the SWAN software package (GeoStudi Astier). The calculated phase velocities for each seismic shot point for a given test were combined and the dispersion curve generated by choosing the minimum phase velocity calculated for each frequency component as shown on Figure 2. Shear wave velocity profiles were generated through inverse modelling to best fit the calculated dispersion curves.

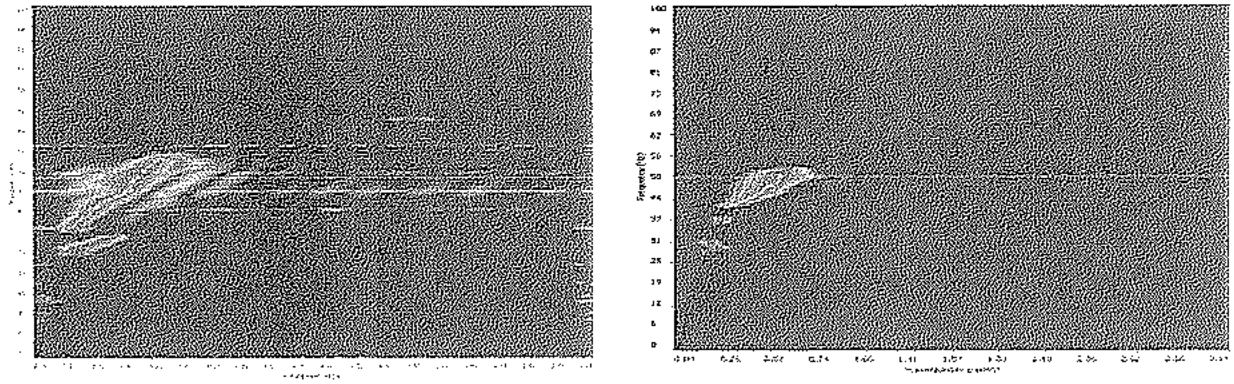


Figure 2: MASW Line 1(left) and MASW Line 2 (right) Dispersion Curve Picks (Yellow Dots)

The minimum measured surface wave frequency with sufficient signal-to-noise ratio to accurately measure phase velocity was approximately 35 Hz at MASW Line 1 and 40 Hz at MASW Line 2.

Results

The MASW test results are presented in Figure 3, which presents the calculated shear wave velocity profiles measured from the field testing. These results have been inferred using a seismic weight drop located at 10 metres from the first geophone. The field collected dispersion curves are compared with the model generated dispersion curves on Figure 4. There is a good correlation between the field collected and model calculated dispersion curves, with a root mean squared error of 4.5% for MASW Line 1 and 1.7% for MASW Line 2. The two shear wave velocity depth profiles indicate variations in shear wave velocity within the overburden ranging from 380 m/s to about 600 m/s. On both MASW lines, a sharp increase in velocity occurs at approximately 4 metre depth from about 400-450 m/s to 1200-1350 m/s. Along MASW Line 1 another large increase in shear wave velocity ranging from 1185 m/s to 1700 m/s is observed at about 8 metre depth. A similar increase from 1350 m/s to 1750 m/s is observed along MASW Line 2 at about 7 metre depth.

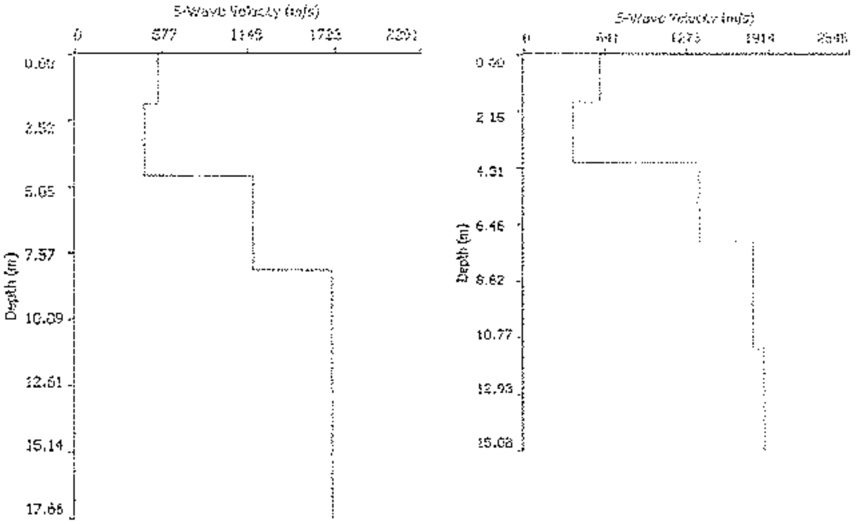


Figure 3: MASW Line 1 (left) and Line 2 (right) Modelled Shear Wave Velocity Depth Profile

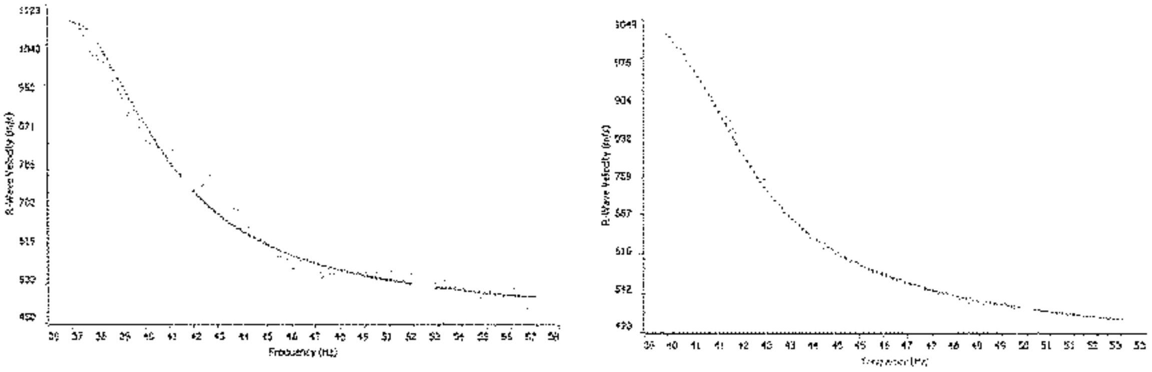


Figure 4: Comparison of Field vs. Modelled Data for MASW Line 1(left) and Line 2 (right) (Red Line is Field Data)

To calculate the average shear wave velocity as required by the National Building Code of Canada, 2005 (NBCC2005), the results were modelled to 30 metres below ground surface. The limited low frequency content of the dispersion curve did not permit to sufficiently resolve shear-wave velocities at depth below 17 metres along MASW Line 1 and 15 metres along MASW Line 2. Therefore the average velocity was calculated assuming that the velocity from the maximum resolved depth to a depth of 30 metres was constant and equal to the velocity of the bedrock. The average shear velocity was found to be 1158 m/s along MASW Line 1 (Table 1) and 1275 m/s along MASW Line 2 (Table 2).

Table 1: Shear Wave Velocity Profile for MASW Line 1

Model Layer (mbgs)		**Layer Thickness (m)**	**Shear Wave Velocity (m/s)**	**Shear Wave Travel Time Through Layer (s)**
Top	**Bottom**			
0.00	1.87	1.87	548	0.003412
1.85	4.64	2.79	454	0.006145
4.42	8.19	3.77	1185	0.003181
7.93	13.02	5.09	1700	0.002994
12.70	30.00	17.30	1700	0.010176
			Vs Average to 30 mbgs (m/s)	**1158**

Table 2: Shear Wave Velocity Profile for MASW Line 2

Model Layer (mbgs)		**Layer Thickness (m)**	**Shear Wave Velocity (m/s)**	**Shear Wave Travel Time Through Layer (s)**
Top	**Bottom**			
0.00	1.79	1.79	604	0.002964
1.79	4.10	2.31	386	0.005984
4.10	7.08	2.98	1358	0.002194
7.08	11.13	4.05	1773	0.002284
11.13	30.00	18.87	1869	0.010096
			Vs Average to 30 mbgs (m/s)	**1275**

Closure

We trust that this letter report meets your needs at the present time. If you have any questions or require clarification, please contact the undersigned at your convenience.

PROFESSIONAL GEOSCIENTISTS ONTARIO
CHRISTOPHER R. PHILLIPS
PRACTISING MEMBER
1503

Christopher Phillips, M.Sc., P.Geo
Senior Geophysicist - Associate

SS/CRP/crp

c:_current projects\09-1121-1036 masw greenbank\09-1121-1036 tech memo masw greenbank december 1_2009.docx

APPENDIX B

Results of Chemical Analysis
EXOVA Accutest Report No. 2927582

EXOVA ACCUTEST

REPORT OF ANALYSIS

Exova
Accutest

Client: Golder Associates Ltd. (Ottawa)
32 Steacie Drive
Kanata, ON
K2K 2A9
Attention: Ms. Susan Trickey

Report Number: 2927582
Date: 2009-11-13
Date Submitted: 2009-11-09

Project: 09-1121-1036

P.O. Number:
Matrix: Soil

Chain of Custody Number: 92362

		LAB ID:	758155					GUIDELINE		
		Sample Date:	2009-10-28							
		Sample ID:	TP 09-1 SA#3							
PARAMETER	UNITS	MRL						TYPE	LIMIT	UNITS
Chloride	%	0.002	0.020							
Electrical Conductivity	mS/cm	0.05	0.28							
pH			8.9							
Resistivity	ohm-cm	1	3850							
Sulphate	%	0.01	0.01							

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

APPROVAL:
Ewan McRobbie
Inorganic Lab Supervisor

Appendix B:

Storm Sewer Design Sheets

B1 – Existing Conditions Storm Sewer Design Sheet

B2 – Proposed 600mm Storm Sewer Design Sheet

B3 – Village Square Plaza Storm Sewer Design Sheet for Greenbank Road and Strandherd Drive

CANADIAN TIRE - BARRHAVEN, ONTARIO

STORM SEWER DESIGN SHEET

JOB# 113199

EXISTING CONDITIONS

***Reproduced from design by Bronte Engineering (February 1, 2000)**

NOVATECH
ENGINEERING
CONSULTANTS LTD.

LOCATION			AREA (ha)			FLOW					SEWER DATA								
Catchment ID	From Node	To Node	Area (ha)	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Conc.	Intensity (mm/hr)	Peak Flow (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
Sub-CB1	CB1	CBMH2	0.123	0.78	0.10	0.267	0.267	10.00	104.19	27.79	0.203	200	PVC	0.22	27.9	16.0	0.49	0.94	173%
Sub-CBMH2	CBMH2	CB3 Junction	0.131	0.80	0.10	0.291	0.558	10.94	99.47	55.51	0.305	300	PVC	0.35	43.3	59.6	0.82	0.88	93%
Sub-CB3	CB3	CB3 Junction	0.160	0.90	0.14	0.400	0.400	10.00	104.19	41.71	0.254	250	PVC	0.94	6.4	60.1	1.19	0.09	69%
	CB3 Junction	MH107	0.000	0.00	0.00	0.000	0.958	10.94	99.47	95.33	0.305	300	PVC	0.38	26.6	62.1	0.85	0.52	153%
	MH107	MH108	0.000	0.00	0.00	0.000	0.958	11.46	97.06	93.02	0.305	300	PVC	0.32	21.6	57.0	0.78	0.46	163%
	MH108	CBMH101	0.000	0.00	0.00	0.000	0.958	11.92	95.03	91.08	0.305	300	PVC	-0.30	13.6	NA	NA	NA	NA
Sub-Pumps (East Section)	Gas Pumps (East Section)	CBMH102	0.019	0.90	0.02	0.048	0.048	10.00	104.19	4.95	0.152	150	PVC	2.50	14.8	25.1	1.38	0.18	20%
Sub-CBMH102	CBMH102	Stormceptor 1	0.059	0.90	0.05	0.148	0.195	10.18	103.26	20.15	0.305	300	PVC	0.24	12.3	49.4	0.68	0.30	41%
Sub-Gas Bar	Gas Bar	CBMH101	0.013	0.90	0.01	0.033	0.033	10.00	104.19	3.39	0.203	200	PVC	1.01	6.9	34.4	1.06	0.11	10%
	Stormceptor 1	CBMH101	0.000	0.00	0.00	0.000	1.186	11.92	95.03	112.71	0.305	300	PVC	1.53	9.8	124.7	1.71	0.10	90%
Sub-CBMH101	CBMH101	CBMH10	0.106	0.90	0.10	0.265	1.451	12.02	94.62	137.32	0.305	300	PVC	0.21	38.5	46.2	0.63	1.01	297%

CANADIAN TIRE - BARRHAVEN, ONTARIO

STORM SEWER DESIGN SHEET

JOB# 113199

EXISTING CONDITIONS

***Reproduced from design by Bronte Engineering (February 1, 2000)**

NOVATECH ENGINEERING CONSULTANTS LTD.

LOCATION			AREA (ha)			FLOW					SEWER DATA								
Catchment ID	From Node	To Node	Area (ha)	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Conc.	Intensity (mm/hr)	Peak Flow (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
Sub-CBMH6, EX-1	CBMH6	GB-CB3 Junction	0.618	0.88	0.54	1.512	1.512	10.00	104.19	157.53	0.305	300	PVC	0.74	5.4	86.7	1.19	0.08	182%
Sub-GB-CB3	GB-CB3	GB-CB3 Junction	0.068	0.90	0.06	0.170	0.170	10.00	104.19	17.73	0.203	200	PVC	0.95	5.3	33.3	1.03	0.09	53%
	GB-CB3 Junction	CBMH106 Junction	0.000	0.00	0.00	0.000	1.682	10.09	103.74	174.49	0.305	300	PVC	0.74	5.4	86.7	1.19	0.08	201%
Sub-CBMH106	CBMH106	GB-CB4 Junction	0.011	0.20	0.00	0.006	0.006	10.16	103.35	0.63	0.203	200	PVC	3.25	3.1	61.6	1.90	0.03	1%
Sub-GB-CB4	GB-CB4	GB-CB4 Junction	0.008	0.90	0.01	0.020	0.020	10.00	104.19	2.09	0.203	200	PVC	0.69	1.5	28.4	0.88	0.03	7%
	GB-CB4 Junction	CBMH106 Junction	0.000	0.00	0.00	0.000	0.026	10.19	103.21	2.70	0.203	200	PVC	3.24	7.4	61.5	1.90	0.07	4%
	CBMH 106 Junction	CBMH104	0.000	0.00	0.00	0.000	1.708	10.25	102.87	175.72	0.305	300	PVC	0.62	6.4	79.4	1.09	0.10	221%
Sub-CBMH104	CBMH104	CBMH104 Junction	0.010	0.90	0.01	0.025	1.733	10.35	102.37	177.42	0.305	300	PVC	0.27	14.7	52.4	0.72	0.34	339%
Sub-Pumps (West Section)	Gas Pumps (West Section)	CBMH104 Junction	0.019	0.90	0.02	0.048	0.048	10.00	104.19	4.95	0.152	150	PVC	0.88	4.5	14.9	0.82	0.09	33%
	CB104 Junction	CBMH103	0.000	0.00	0.00	0.000	1.781	10.69	100.67	179.26	0.305	300	PVC	0.29	7.0	54.3	0.74	0.16	330%

CANADIAN TIRE - BARRHAVEN, ONTARIO

STORM SEWER DESIGN SHEET

JOB# 113199

EXISTING CONDITIONS

***Reproduced from design by Bronte Engineering (February 1, 2000)**

LOCATION			AREA (ha)			FLOW					SEWER DATA								
Catchment ID	From Node	To Node	Area (ha)	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Conc.	Intensity (mm/hr)	Peak Flow (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
Sub-Car Wash	Car Wash	CBMH105	0.011	0.90	0.01	0.028	0.028	10.00	104.19	2.87	0.203	200	PVC	1.00	8.0	34.2	1.05	0.13	8%
Sub-CBMH105	CBMH105	GB-CB2 Junction	0.028	0.20	0.01	0.016	0.043	10.13	103.53	4.46	0.203	200	PVC	2.02	3.0	48.6	1.50	0.03	9%
Sub-GB-CB2	GB-CB2	GB-CB2 Junction	0.012	0.90	0.01	0.030	0.030	10.00	104.19	3.13	0.203	200	PVC	1.03	4.8	34.7	1.07	0.07	9%
	GB-CB2 Junction	CBMH103	0.000	0.00	0.00	0.000	0.073	10.16	103.36	7.56	0.203	200	PVC	1.98	11.1	48.1	1.48	0.12	16%
Sub-CBMH103	CBMH103	GB-CB1 Junction	0.022	0.90	0.02	0.055	1.909	10.85	99.91	190.71	0.305	300	PVC	-0.15	12.9	NA	NA	NA	NA
Sub-GB-CB1	GB-CB1	GB-CB1 Junction	0.010	0.90	0.01	0.025	0.025	10.00	104.19	2.61	0.203	200	PVC	0.98	4.1	33.8	1.04	0.07	8%
	GB-CB1 Junction	Stormceptor 2	0.000	0.00	0.00	0.000	1.934	10.85	99.91	193.21	0.305	300	PVC	0.00	2.4	NA	NA	NA	NA
	Stormceptor 2	CBMH10	0.000	0.00	0.00	0.000	1.934	10.85	99.91	193.21	0.305	300	PVC	0.44	22.5	66.9	0.92	0.41	289%
Sub-CBMH10	CBMH10	CBMH11	0.331	0.87	0.29	0.801	4.186	11.26	97.98	410.12	0.305	300	PVC	0.41	36.5	64.5	0.88	0.69	635%
Sub-CBMH11	CBMH11	CBMH12	0.247	0.89	0.22	0.611	4.797	11.95	94.92	455.33	0.305	300	PVC	0.39	38.6	62.9	0.86	0.75	723%
Sub-CBMH12	CBMH12	CBMH13	0.323	0.87	0.28	0.781	5.578	12.69	91.84	512.27	0.305	300	PVC	0.38	36.7	62.1	0.85	0.72	824%

CANADIAN TIRE - BARRHAVEN, ONTARIO

STORM SEWER DESIGN SHEET

JOB# 113199

EXISTING CONDITIONS

***Reproduced from design by Bronte Engineering (February 1, 2000)**

NOVATECH
ENGINEERING
CONSULTANTS LTD.

LOCATION			AREA (ha)			FLOW					SEWER DATA								
Catchment ID	From Node	To Node	Area (ha)	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Conc.	Intensity (mm/hr)	Peak Flow (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
Sub-CB14	CB14	CBMH15	0.133	0.78	0.10	0.288	0.288	10.00	104.19	30.05	0.254	250	PVC	0.99	30.2	61.7	1.22	0.41	49%
Sub-CDN Tire Building	CDN Tire Building	CBMH15	0.786	0.90	0.71	*Controlled Flow from Rooftop = 21L/s				21.00	0.305	300	PVC	0.82	12.2	91.3	1.25	0.16	23%
Sub-CBMH15	CBMH15	MH15A	0.079	0.90	0.07	0.198	0.486	10.41	102.06	70.61	0.305	300	PVC	0.51	21.6	72.0	0.99	0.36	98%
	MH15A	CBMH13	0.000	0.00	0.00	0.000	0.486	10.78	100.25	69.73	0.305	300	PVC	0.53	51.2	73.4	1.01	0.85	95%
Sub-CBMH13	CBMH13	MH16	0.229	0.78	0.18	0.497	6.561	13.41	89.07	605.35	0.305	300	PVC	0.48	16.5	69.8	0.96	0.29	867%
	MH16	Connection on Greenbank Rd	0.000	0.00	0.00	0.000	6.561	13.70	88.01	598.42	0.381	375	PVC	0.51	41.5	130.5	1.14	0.60	458%

Q = 2.78 AIC, where
Q= Peak Flow in Litres per Second (L/s)
A= Area in hectares (ha)
I= Rainfall Intensity (mm/hr), 5 year storm
C= Runoff Coefficient

Consultant:	**Novatech Engineering Conusltants Ltd.**	
Date:	February 1, 2000	
Design By:	Bronte Engineering	
Client:	**Dwg. Reference:**	**Reproduced by:**
Canadian Tire Barrhaven, Ontario	113199-STM-Existing	Conrad Stang

CANADIAN TIRE - BARRHAVEN, ONTARIO

STORM SEWER DESIGN SHEET

PROPOSED 600mm STORM SEWER

JOB# 113199

NOVATECH ENGINEERING CONSULTANTS LTD.

LOCATION			AREA (ha)			FLOW					SEWER DATA								
Catchment ID	From Node	To Node	Area (ha)	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Conc.	Intensity (mm/hr)	Peak Flow (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
EX-1 / CBMH6	CBMH6	STM-1	0.688	0.89	0.61	1.697	1.697	10.00	104.19	176.81	0.610	600	Conc	0.20	20.9	286.3	0.98	0.36	62%
	STM-1	STM-2	-	-	0.00	0.000	1.697	10.36	102.35	173.69	0.610	600	Conc	0.20	54.9	286.3	0.98	0.93	61%
	STM-2	STM-3	-	-	0.00	0.000	1.697	11.29	97.85	166.04	0.610	600	Conc	0.20	16.9	286.3	0.98	0.29	58%

Q = 2.78 AIC, where
Q= Peak Flow in Litres per Second (L/s)
A= Area in hectares (ha)
I= Rainfall Intensity (mm/hr), 5 year storm
C= Runoff Coefficient

Consultant:	**Novatech Engineering Conusltants Ltd.**	
Date:	May 28, 2014	
Design By:	Conrad Stang	
Client:	**Dwg. Reference:**	**Checked By:**
Canadian Tire Barrhaven, Ontario	113199-SWM / 113199-GP	Mike Petepiece

CANADIAN TIRE - BARRHAVEN

STORM SEWER DESIGN SHEET

JOB# 113199

GREENBANK ROAD AND STRANDHERD DRIVE

***Reproduced from Village Square Mall by Cumming Cockburn Ltd. (March 6, 2001)**

NOVATECH ENGINEERING CONSULTANTS LTD.

LOCATION			AREA (ha)			FLOW							SEWER DATA								
Street	From	To	Area	C	AC	Indiv	Accum	Time of	Time	Intensity	Peak Flow (L/sec)		Dia. (m)	Dia.	Type	Slope	Length	Capacity	Velocity	Flow Time	Ratio
	Node	Node	(ha)		(ha)	2.78 AC	2.78 AC	Conc.	(min)	mm/hr	Qindiv	Qtotal	Actual	(mm)		(%)	(m)	(L/s)	(m/s)	(min)	Q/Q full
MH A - (OSD from Village Square Plaza + 50% of Greenbank Road											**377.98**										
50% of Greenbank Road	MH A	MH B	0.770	0.60	0.46	1.284	1.284	30.29	0.65	49.80	63.96	441.94	0.610	600	Conc	0.87	79.7	597.1	2.05	0.65	74%
OSD (Canadian Tire Site)											**160.00**										
50% of Greenbank Road	MH B	MH C	0.424	0.71	0.30	0.837	2.121	30.94	0.38	49.04	41.04	642.01	0.610	600	Conc	0.82	45.5	579.7	1.99	0.38	111%
			0.717	0.67	0.48	1.335	1.335														
			0.294	0.74	0.22	0.605	0.605														
			0.462	0.79	0.36	1.015	1.015														
	MH C	MH D	0.228	0.75	0.17	0.475	5.552	31.32	0.95	48.61	166.73	807.82	0.610	600	Conc	1.56	102.6	799.6	2.74	0.62	101%
			0.484	0.20	0.10	0.269	0.269														
	MH D	MH E	0.498	0.65	0.32	0.900	6.721	32.27	0.47	47.56	55.60	857.62	0.610	600	Conc	1.80	83.2	858.9	2.94	0.47	100%

CANADIAN TIRE - BARRHAVEN

STORM SEWER DESIGN SHEET

JOB# 113199

GREENBANK ROAD AND STRANDHERD DRIVE

***Reproduced from Village Square Mall by Cumming Cockburn Ltd. (March 6, 2001)**

LOCATION			AREA (ha)			FLOW							SEWER DATA								
Street	From	To	Area	C	AC	Indiv	Accum	Time of	Time	Intensity	Peak Flow (L/sec)		Dia. (m)	Dia.	Type	Slope	Length	Capacity	Velocity	Flow Time	Ratio
	Node	Node	(ha)		(ha)	2.78 AC	2.78 AC	Conc.	(min)	mm/hr	Qindiv	Qtotal	Actual	(mm)		(%)	(m)	(L/s)	(m/s)	(min)	Q/Q full
Res. Dev. 2.78AC = 75.862, tc = 40.4 min							75.862	40.40													
	MH E	MH F	0.378	0.47	0.18	0.494	83.076	40.40	0.89	40.39	19.95	3,893.79	1.829	1805	Conc	0.12	85.0	4,153.0	1.58	0.90	94%
			0.392	0.47	0.18	0.512	0.512														
			0.130	0.71	0.09	0.257	0.257														
	MH F	MH G	0.280	0.51	0.14	0.397	84.242	41.29	2.20	39.76	46.35	3,887.40	1.829	1805	Conc	0.10	195.0	3,791.1	1.44	2.25	103%
			0.632	0.31	0.20	0.545	0.545														
			0.209	0.53	0.11	0.308	0.308														
	MH G	MH H	0.457	0.71	0.32	0.902	85.997	43.29	0.41	38.29	67.18	3,830.53	1.829	1805	Conc	0.13	40.0	4,322.6	1.65	0.41	89%
2.78AR = 2.44						2.440	2.440														
2.78AR = 1.87						1.870	1.870														
OSD First City											**220.00**										
	MH H	MH I	0.280	0.67	0.19	0.522	90.828	43.90	1.6	38.03	183.73	4,211.87	1.829	1805	Conc	0.15	170.0	4,643.2	1.77	1.60	91%

CANADIAN TIRE - BARRHAVEN

STORM SEWER DESIGN SHEET

JOB# 113199

GREENBANK ROAD AND STRANDHERD DRIVE

***Reproduced from Village Square Mall by Cumming Cockburn Ltd. (March 6, 2001)**

LOCATION			**AREA (ha)**			**FLOW**							**SEWER DATA**								
Street	From	To	Area	C	AC	Indiv	Accum	Time of	Time	Intensity	Peak Flow (L/sec)		Dia. (m)	Dia.	Type	Slope	Length	Capacity	Velocity	Flow Time	Ratio
	Node	Node	(ha)		(ha)	2.78 AC	2.78 AC	Conc.	(min)	mm/hr	Qindiv	Qtotal	Actual	(mm)		(%)	(m)	(L/s)	(m/s)	(min)	Q/Q full

Q = 2.78 AIC, where
Q= Peak Flow in Litres per Second (l/s)
A= Area in hectares (ha)
I= Rainfall Intensity (mm/hr), 5 year storm
C= Runoff Coefficient

Consultant:	**Novatech Engineering Conusltants Ltd.**	
Date:	March 6, 2001	
Design By:	Cumming Cockburn Ltd.	
Client:	**Dwg. Reference:**	**Reproduced by:**
Canadian Tire - Barrhaven		Conrad Stang

Appendix C:

Stormwater Management Calculations

C1 – Catchment Parameters

C2 – Storage Curves

C3 – Rooftop Stage-Discharge Curve

Canadian Tire - Barrhaven
Catchment Parameters

Catchment ID	Area (ha)	Runoff Coef.	% Imp.	No. Depression	Flow Length (m)	Equiv. Width (m)	Slope (%)
External Catchments							
Greenbank Road to MH A3	0.440	0.70	71%	0%	130	34	1.00%
Greenbank Road MH A3 to MH A2	0.275	0.70	71%	0%	90	31	1.00%
Greenbank Road MH A2 to MH A1	0.450	0.70	71%	0%	130	35	1.00%
Greenbank Road MH A1 to MH A	0.770	0.70	71%	0%	200	39	1.00%
Greenbank Road MH A to MH B	0.424	0.71	73%	0%	80	53	1.00%
Strandherd Drive MH B to MH C	1.150	0.70	71%	0%	200	58	1.00%
Greenbank Road MH C to MH D	1.174	0.54	48%	0%	100	117	1.00%
Greenbank Road MH D to MH E	0.498	0.65	64%	0%	80	62	1.00%
Village Square Plaza - Buildings	0.660	0.90	100%	100%	48	138	2.45%
Village Square Plaza - Parking Lot	1.209	0.90	100%	0%	87	139	1.50%
Village Square Plaza Expansion - Buildings	0.221	0.90	100%	100%	27	82	1.50%
Village Square Plaza Expansion - Parking Lot	0.521	0.90	100%	0%	32	163	0.91%
Canadian Tire Site							
EX-1 (Village Square Plaza)	0.178	0.90	100%	0%	65	27	2.77%
Greenbank Road	0.070	0.90	100%	0%	45	16	1.33%
CBMH6	0.440	0.88	97%	0%	63	70	1.84%
CB1	0.123	0.78	83%	0%	26	47	1.38%
CBMH2	0.131	0.80	86%	0%	40	33	4.26%
CB3	0.160	0.90	100%	0%	40	40	3.76%
PUMPS	0.037	0.90	100%	100%	17	22	1.50%
GAS BAR	0.013	0.90	100%	100%	7	19	1.50%
CAR WASH	0.011	0.90	100%	100%	6	18	1.50%
CBMH102	0.059	0.90	100%	0%	29	20	1.52%
CBMH101	0.106	0.90	100%	0%	34	31	1.45%
GB-CB3	0.068	0.90	100%	0%	51	13	1.36%
CBMH104	0.010	0.90	100%	0%	9	11	0.64%
CBMH103	0.022	0.90	100%	0%	9	24	2.96%
GB-CB1	0.010	0.90	100%	0%	11	9	1.52%
GB-CB4	0.008	0.90	100%	0%	11	7	0.40%
GB-CB2	0.012	0.90	100%	0%	20	6	0.37%
CBMH105	0.028	0.20	0%	0%	18	16	0.40%
CBMH106	0.011	0.20	0%	0%	17	6	0.78%
CBMH10	0.331	0.87	96%	0%	55	60	1.02%
CBMH11	0.247	0.89	99%	0%	56	44	1.17%
CBMH12	0.323	0.87	96%	0%	54	60	1.33%
CBMH13	0.229	0.78	83%	0%	42	55	1.54%
CB14	0.133	0.90	100%	0%	17	78	1.05%
CBMH15	0.079	0.90	100%	0%	27	29	0.65%
BLDG	0.786	0.90	100%	100%	57	138	1.50%

Prepared by Novatech Engineering Consulting Ltd.
Date: 28/05/2014

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CBMH10

Stage (m)	Depth (m)	Area (m2)
97.5	0.00	0.36
99.52	2.02	0.36
99.60	2.10	299
99.70	2.20	832
99.80	2.30	1191
99.90	2.40	1495

Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.50	99.52	2.02	0.36

CBMH11

Stage (m)	Depth (m)	Area (m2)
97.34	0.00	0.36
99.55	2.21	0.36
99.60	2.26	191
99.70	2.36	825
99.80	2.46	1510
99.90	2.56	1784

Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.34	99.55	2.21	0.36

CBMH12

Stage (m)	Depth (m)	Area (m2)
97.19	0.00	0.36
99.52	2.33	0.36
99.60	2.41	326
99.70	2.51	757
99.80	2.61	1261
99.90	2.71	1796

Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.19	99.52	2.33	0.36

CBMH13

Stage (m)	Depth (m)	Area (m2)
97.05	0.00	0.36
99.51	2.46	0.36
99.60	2.55	269
99.70	2.65	532
99.80	2.75	828
99.90	2.85	1122

Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.05	99.51	2.46	0.36

CB3

Stage (m)	Depth (m)	Area (m2)
97.96	0.00	0.36
99.96	2.00	0.36
100.10	2.14	440
100.20	2.24	804

Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.96	99.96	2.00	0.36

CB1

Stage (m)	Depth (m)	Area (m2)
98.14	0.00	0.36
99.27	1.13	0.36
99.50	1.36	172
99.60	1.46	218
99.70	1.56	263
99.80	1.66	367
99.90	1.76	515
100.00	1.86	663
100.10	1.96	804
100.20	2.06	926

Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
98.14	99.27	1.13	0.36

CBMH6

Stage (m)	Depth (m)	Area (m2)
97.78	0.00	0.36
99.70	1.92	0.36
99.90	2.12	240
100.00	2.22	360
100.10	2.32	480

Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.78	99.70	1.92	0.36

CBMH15

Stage (m)	Depth (m)	Area (m2)
97.45	0.00	0.36
100.14	2.69	0.36
100.24	2.79	225

Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.45	100.14	2.69	0.36

Canadian Tire - Barrhaven
Storage Node - Storage Curves

CB14

Stage (m)	Depth (m)	Area (m2)	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.75	0.00	0.36	97.75	100.14	2.39	0.36
100.14	2.39	0.36				
100.24	2.49	225				

CBMH102

Stage (m)	Depth (m)	Area (m2)	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.89	0.00	0.36	97.89	99.99	2.10	0.36
99.99	2.10	0.36				
100.10	2.21	400				

GB-CB3

Stage (m)	Depth (m)	Area (m2)	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.87	0.00	0.36	97.87	99.83	1.96	0.36
99.83	1.96	0.36				
99.85	1.98	25				

CBMH101

Stage (m)	Depth (m)	Area (m2)	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.68	0.00	0.36	97.68	99.91	2.23	0.36
99.91	2.23	0.36				
100.00	2.32	50				

GB-CB1

Stage (m)	Depth (m)	Area (m2)	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.68	0.00	0.36	97.68	99.88	2.20	0.36
99.88	2.20	0.36				
99.95	2.27	25				

CBMH103

Stage (m)	Depth (m)	Area (m2)	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.62	0.00	0.36	97.62	99.92	2.30	0.36
99.92	2.30	0.36				
99.95	2.33	25				

GB-CB2

Stage (m)	Depth (m)	Area (m2)	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.89	0.00	0.36	97.89	100.08	2.19	0.36
100.08	2.19	0.36				
100.10	2.21	25				

GB-CB4

Stage (m)	Depth (m)	Area (m2)	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.95	0.08	0.36	97.95	100.07	2.12	0.36
100.07	2.20	0.36				
100.10	2.23	25				

CBMH104

Stage (m)	Depth (m)	Area (m2)	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
97.69	0.00	0.36	97.69	100.01	2.32	0.36
100.01	2.32	0.36				
100.10	2.41	100				

STOR-VSP-PARKING

Stage (m)	Depth (m)	Area (m2)	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
99.17	0.00	0.36	99.17	100.45	1.28	0.36
100.45	1.28	0.36				
100.60	1.43	300				

STOR-VSP-EXP-PARKING (CB1+SUPERPIPE)

Stage (m)	Depth (m)	Area (m2)	Volume (m3)	Invert Elev. (m)	Rim Elev. (m)	Depth (m)	Area (m2)
101.50	0.00	0.36	169.5	101.50	103.20	1.70	0.36
103.20	1.70	199.0	169.5				
103.40	1.90	36.0	193.0				

Values Taken from
Canadian Tire - Stormwater Management Report
Bronte Engineering (February 2000)

ZURN Z1055 ERC "Control-Flo"
11 Roof Drains
20.79 L/s @ depth of 125mm

Height (mm)	Outflow (m^3/s)	Storage (m^3)
0	0	0
25	0.00416	167
50	0.00832	335
75	0.01247	502
100	0.01663	669
125	0.02079	836

Appendix D:

Autodesk Storm and Sanitary Analysis Model

D1 – Autodesk SSA Hydrologic / Hydraulic Modeling Capabilities

Existing Conditions Model

D2 – Existing Conditions Results Tables

D3 – Existing Conditions Model Schematic

D4 – Existing Conditions Input/Output Data (100-yr 3hr Chicago Storm)

Proposed Conditions Model

D5 – Proposed Conditions Results Tables

D6 – Proposed Conditions Model Schematic

D7 – Proposed Conditions Input/Output Data (100-yr 3hr Chicago Storm)

Autodesk Storm and Sanitary Analysis Hydrologic / Hydraulic Modeling Capabilities

Hydrologic Modeling Capabilities

Autodesk Storm and Sanitary Analysis accounts for various hydrologic processes that produce runoff from urban areas, including:

- Time-varying rainfall
- Evaporation of standing surface water
- Snow accumulation and melting
- Rainfall interception from depression storage
- Infiltration of rainfall into unsaturated soil layers
- Percolation of infiltrated water into groundwater layers
- Interflow between groundwater and the drainage system
- Nonlinear reservoir routing of overland flow

Spatial variability in all of these processes was achieved by dividing the study area into a collection of smaller, homogeneous subcatchment areas, each containing its own fraction of pervious and impervious sub-areas. Overland flow was routed between sub-areas, between subcatchments, and/or between entry points of a drainage system.

Hydraulic Modeling Capabilities

Autodesk Storm and Sanitary Analysis contains a flexible set of hydraulic modeling capabilities used to help route runoff and external inflows through the drainage system network of pipes, channels, storage/treatment units, and diversion structures. The software can simultaneously simulate dual drainage networks (stormwater sewer network and city streets as separate but connected conveyance pathways) and inlet capacity. It can quickly determine the amount of stormwater flow that is intercepted by the stormwater network inlets and the amount of stormwater flow that bypasses and is then routed further downstream to other inlets.

Canadian Tire - Barrhaven, Ontario
Ponding Depths - Existing Conditions

Storage Node ID	Rim Elev. (m)	Ponding Depth (m) - 3-hour Chicago Storm						
		2-year	5-year	10-year	25-year	50-year	100-year	100-year +20%
CB1	99.27	0.42	0.48	0.50	0.54	0.57	0.61	0.68
CB14	100.14	0.00	0.00	0.04	0.07	0.09	0.11	0.14
CB3	99.96	0.00	0.06	0.10	0.13	0.15	0.17	0.20
CBMH10	99.52	0.18	0.21	0.23	0.25	0.27	0.29	0.33
CBMH101	99.91	0.00	0.03	0.08	0.11	0.13	0.15	0.18
CBMH102	99.99	0.00	0.00	0.01	0.04	0.06	0.08	0.11
CBMH103	99.92	0.00	0.00	0.00	0.03	0.04	0.07	0.10
CBMH104	100.01	0.00	0.00	0.00	0.00	0.00	0.02	0.04
CBMH11	99.55	0.14	0.18	0.20	0.22	0.24	0.26	0.30
CBMH12	99.52	0.09	0.16	0.21	0.25	0.27	0.29	0.33
CBMH13	99.51	0.01	0.16	0.22	0.26	0.28	0.30	0.34
CBMH15	100.14	0.00	0.00	0.00	0.00	0.00	0.02	0.05
CBMH6	99.70	0.21	0.26	0.28	0.30	0.31	0.33	0.35
GB-CB1	99.88	0.00	0.00	0.00	0.00	0.01	0.03	0.06
GB-CB2	100.08	0.00	0.00	0.00	0.00	0.00	0.00	0.01
GB-CB3	99.83	0.08	0.13	0.15	0.17	0.18	0.20	0.22
GB-CB4	100.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Storage Node ID	Rim Elev. (m)	Ponding Depth (m) - 24-hour Chicago Storm						
		2-year	5-year	10-year	25-year	50-year	100-year	100-year +20%
CB1	99.27	0.41	0.48	0.51	0.55	0.58	0.61	0.68
CB14	100.14	0.00	0.00	0.00	0.00	0.01	0.11	0.14
CB3	99.96	0.00	0.00	0.02	0.07	0.10	0.17	0.20
CBMH10	99.52	0.17	0.21	0.23	0.25	0.27	0.29	0.33
CBMH101	99.91	0.00	0.00	0.00	0.04	0.07	0.15	0.18
CBMH102	99.99	0.00	0.00	0.00	0.00	0.00	0.07	0.10
CBMH103	99.92	0.00	0.00	0.00	0.00	0.01	0.07	0.10
CBMH104	100.01	0.00	0.00	0.00	0.00	0.00	0.02	0.04
CBMH11	99.55	0.14	0.18	0.20	0.22	0.24	0.26	0.30
CBMH12	99.52	0.04	0.13	0.20	0.25	0.27	0.29	0.33
CBMH13	99.51	0.00	0.12	0.21	0.26	0.28	0.30	0.34
CBMH15	100.14	0.00	0.00	0.00	0.00	0.00	0.02	0.06
CBMH6	99.70	0.21	0.24	0.26	0.27	0.28	0.33	0.35
GB-CB1	99.88	0.00	0.00	0.00	0.00	0.00	0.03	0.06
GB-CB2	100.08	0.00	0.00	0.00	0.00	0.00	0.00	0.01
GB-CB3	99.83	0.08	0.11	0.13	0.14	0.15	0.20	0.22
GB-CB4	100.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Prepared by Novatech Engineering Consultants Ltd.
Date: 29/05/2014

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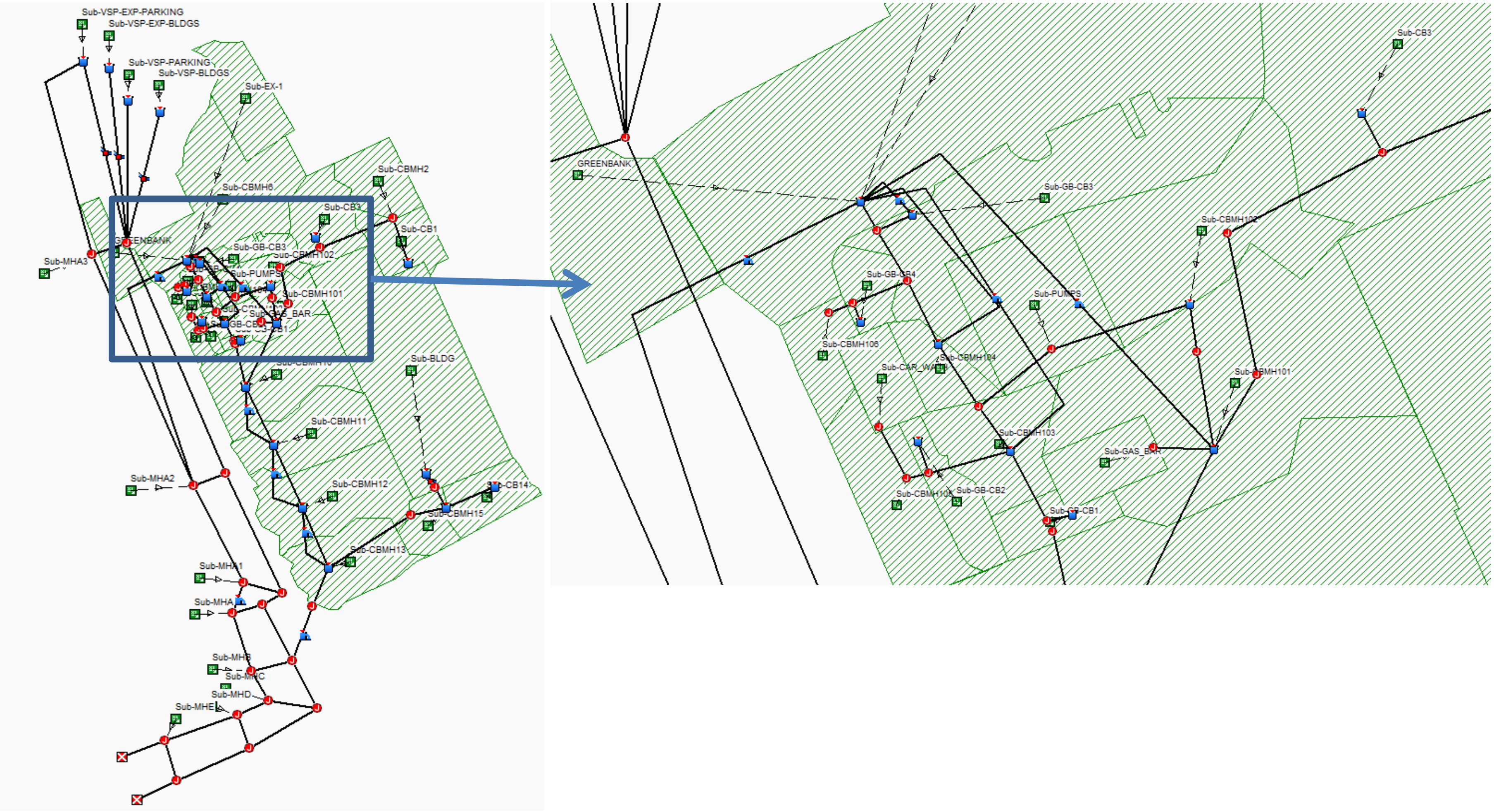
Canadian Tire - Barrhaven, Ontario
Ponding Depths - Existing Conditions

Storage Node ID	Rim Elev. (m)	Ponding Depth (m)- Historical Storms			
		July 19th, 2013	July 1st, 1979	August 4th, 1988	August 8th, 1996
CB1	99.27	0.57	0.71	0.67	0.57
CB14	100.14	0.00	0.05	0.07	0.02
CB3	99.96	0.02	0.14	0.13	0.09
CBMH10	99.52	0.23	0.33	0.29	0.22
CBMH101	99.91	0.00	0.10	0.12	0.06
CBMH102	99.99	0.00	0.03	0.05	0.00
CBMH103	99.92	0.00	0.04	0.06	0.00
CBMH104	100.01	0.00	0.00	0.00	0.00
CBMH11	99.55	0.19	0.30	0.26	0.19
CBMH12	99.52	0.15	0.33	0.28	0.19
CBMH13	99.51	0.14	0.34	0.29	0.20
CBMH15	100.14	0.00	0.00	0.02	0.00
CBMH6	99.70	0.25	0.30	0.31	0.28
GB-CB1	99.88	0.00	0.02	0.04	0.00
GB-CB2	100.08	0.00	0.00	0.00	0.00
GB-CB3	99.83	0.12	0.17	0.18	0.15
GB-CB4	100.07	0.00	0.00	0.00	0.00

Canadian Tire - Barrhaven
SSA Model Schematic - Existing Conditions
Subcatchments



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Date: 29/05/2014

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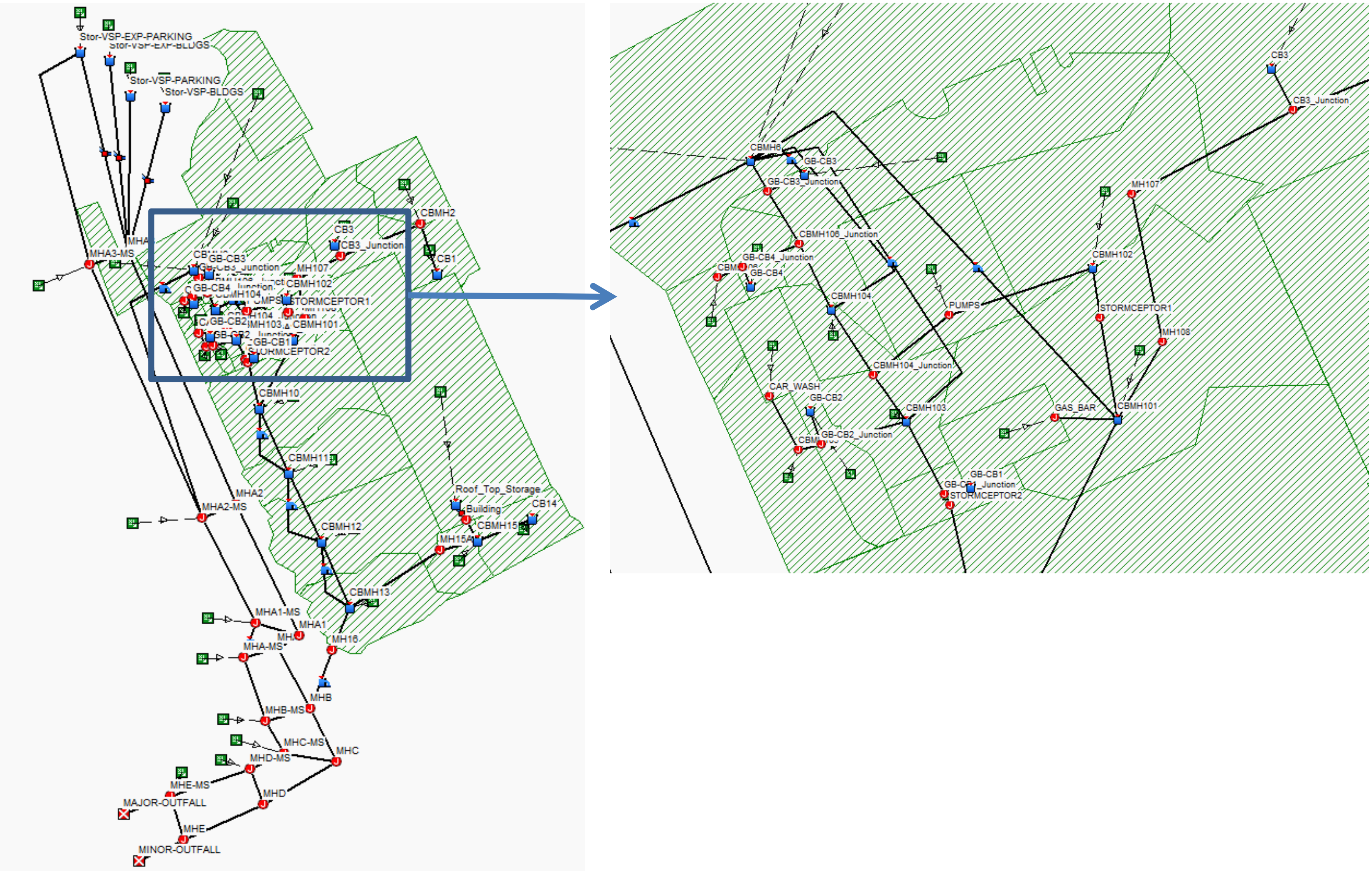
Canadian Tire - Barrhaven
SSA Model Schematic - Existing Conditions
Nodes



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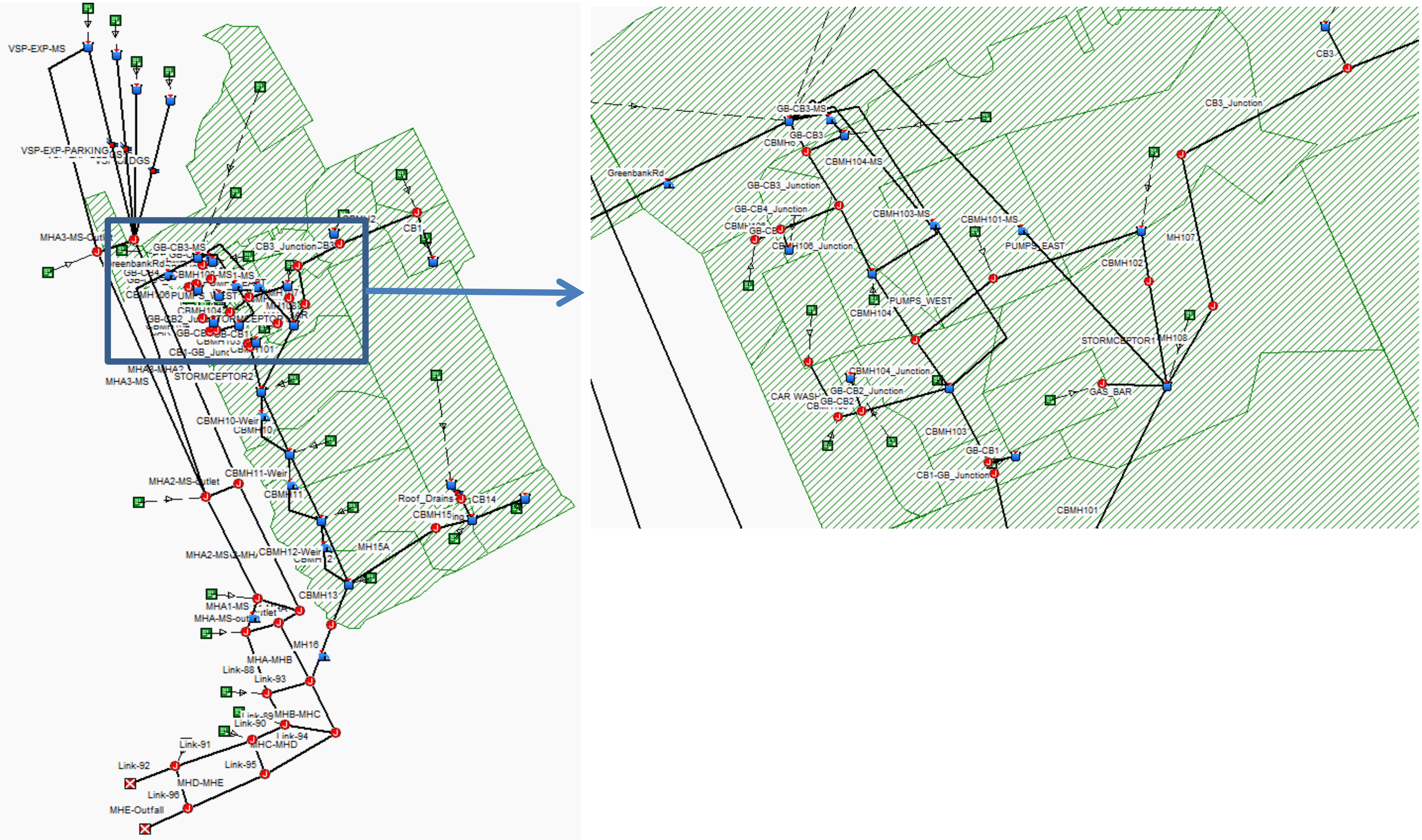
Canadian Tire - Barrhaven
SSA Model Schematic - Existing Conditions
Links



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Date: 29/05/2014

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Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Existing Conditions

Pipes

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset
					(m)	(m)	(m)	(m)	(m)
1	Building		Building	CBMH15	10.30	97.55	0.00	97.45	0.00
2	CAR WASH		CAR_WASH	CBMH105	8.00	97.98	0.00	97.90	0.00
3	CB1		CB1	CBMH2	27.92	98.14	0.00	98.08	0.03
4	CB14		CB14	CBMH15	30.20	97.75	0.00	97.45	0.00
5	CB1-GB_Junction		GB-CB1_Junction	STORMCEPTOR2	2.42	97.64	0.00	97.64	0.00
6	CB3		CB3	CB3_Junction	6.44	97.96	0.00	97.90	0.00
7	CB3_Junction		CB3_Junction	MH107	26.64	97.90	0.00	97.80	0.04
8	CBMH10		CBMH10	CBMH11	36.49	97.50	0.00	97.35	0.01
9	CBMH101		CBMH101	CBMH10	38.53	97.68	0.00	97.60	0.10
10	CBMH102		CBMH102	STORMCEPTOR1	12.32	97.89	0.00	97.86	0.03
11	CBMH103		CBMH103	GB-CB1_Junction	12.86	97.62	0.00	97.64	0.00
12	CBMH104		CBMH104	CBMH104_Junction	14.67	97.69	0.00	97.65	0.00
13	CBMH104_Junction		CBMH104_Junction	CBMH103	7.00	97.65	0.00	97.63	0.01
14	CBMH105		CBMH105	GB-CB2_Junction	3.00	97.90	0.00	97.84	0.00
15	CBMH106		CBMH106	GB-CB4_Junction	3.11	98.04	0.00	97.94	0.00
16	CBMH106_Junction		CBMH106_Junction	CBMH104	6.44	97.70	0.00	97.66	-0.03
17	CBMH11		CBMH11	CBMH12	38.60	97.34	0.00	97.19	0.00
18	CBMH12		CBMH12	CBMH13	36.67	97.19	0.00	97.05	0.00
19	CBMH13		CBMH13	MH16	16.50	97.07	0.02	96.99	0.00
20	CBMH15		CBMH15	MH15A	21.60	97.45	0.00	97.34	0.01
21	CBMH2		CBMH2	CB3_Junction	43.34	98.05	0.00	97.90	0.00
22	CBMH6		CBMH6	GB-CB3_Junction	5.41	97.78	0.00	97.74	0.00
23	GAS_BAR		GAS_BAR	CBMH101	6.90	97.75	0.00	97.68	0.00
24	GB-CB1		GB-CB1	GB-CB1_Junction	4.13	97.68	0.00	97.64	0.00
25	GB-CB2		GB-CB2	GB-CB2_Junction	4.80	97.89	0.00	97.84	0.00
26	GB-CB2_Junction		GB-CB2_Junction	CBMH103	11.10	97.84	0.00	97.62	0.00
27	GB-CB3		GB-CB3	GB-CB3_Junction	5.30	97.87	0.00	97.82	0.08
28	GB-CB3_Junction		GB-CB3_Junction	CBMH106_Junction	7.73	97.76	0.02	97.70	0.00
29	GB-CB4		GB-CB4	GB-CB4_Junction	1.45	97.95	0.00	97.94	0.00
30	GB-CB4_Junction		GB-CB4_Junction	CBMH106_Junction	7.41	97.94	0.00	97.70	0.00
31	Link-93		MHB-MS	MHB	10.00	97.70	0.00	97.60	1.18
32	Link-94		MHC-MS	MHC	10.00	97.60	0.00	97.50	1.58
33	Link-95		MHD-MS	MHD	10.00	95.40	0.00	95.30	1.00
34	Link-96		MHE-MS	MHE	10.00	95.05	0.00	94.95	2.15
35	MH107		MH107	MH108	21.63	97.76	0.00	97.69	0.04
36	MH108		MH108	CBMH101	13.56	97.65	0.00	97.69	0.01
37	MH15A		MH15A	CBMH13	51.23	97.33	0.00	97.06	0.01
38	MHA1-MHA		MHA1	MHA	25.00	97.72	0.00	97.12	0.00
39	MHA1-MS-outlet		MHA1-MS	MHA1	10.00	98.00	0.00	97.90	0.18

Prepared by Novatech Engineering Consultants Ltd.
Date: 29/05/2014

Pipes

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset
					(m)	(m)	(m)	(m)	(m)
40	MHA2-MHA1		MHA2	MHA1	72.00	97.82	0.00	97.72	0.00
41	MHA2-MS-outlet		MHA2-MS	MHA2	10.00	98.40	0.00	98.30	0.48
42	MHA3-MHA2		MHA3	MHA2	105.00	97.97	0.00	97.82	0.00
43	MHA3-MS-Outlet		MHA3-MS	MHA3	10.00	100.03	0.00	99.93	1.96
44	MHA-MHB		MHA	MHB	79.70	97.12	0.00	96.42	0.00
45	MHA-MS-outlet		MHA-MS	MHA	10.00	98.00	0.00	97.90	0.78
46	MHB-MHC		MHB	MHC	45.50	96.42	0.00	96.05	0.13
47	MHC-MHD		MHC	MHD	102.60	95.92	0.00	94.32	0.02
48	MHD-MHE		MHD	MHE	83.20	94.30	0.00	92.80	0.00
49	MHE-Outfall		MHE	MINOR-OUTFALL	5.00	92.80	0.00	92.71	0.00
50	PUMPS_EAST		PUMPS	CBMH102	14.80	98.26	0.57	97.89	0.00
51	PUMPS_WEST		PUMPS	CBMH104_Junction	4.50	97.69	0.00	97.65	0.00
52	STORMCEPTOR1		STORMCEPTOR1	CBMH101	9.80	97.83	0.00	97.68	0.00
53	STORMCEPTOR2		STORMCEPTOR2	CBMH10	22.52	97.64	0.00	97.54	0.04
54	VSP-PARKING		Stor-VSP-PARKING	MHA3	25.00	99.17	0.00	98.98	1.01

Pipes

SN	Element ID	Total Drop (m)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (mm)	Pipe Width (mm)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses
1	Building	0.10	0.9700	CIRCULAR	300.000	300.00	0.0130	0.5000	0.8000	0.0000
2	CAR WASH	0.08	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
3	CB1	0.06	0.2100	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
4	CB14	0.30	0.9900	CIRCULAR	250.000	250.00	0.0130	0.5000	0.5000	0.0000
5	CB1-GB_Junction	0.00	0.0000	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
6	CB3	0.06	0.9300	CIRCULAR	250.000	250.00	0.0130	0.5000	0.8000	0.0000
7	CB3_Junction	0.10	0.3800	CIRCULAR	300.000	300.00	0.0130	0.5000	0.8000	0.0000
8	CBMH10	0.15	0.4100	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
9	CBMH101	0.08	0.2100	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
10	CBMH102	0.03	0.2400	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
11	CBMH103	-0.02	-0.1600	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
12	CBMH104	0.04	0.2700	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
13	CBMH104_Junction	0.02	0.2900	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
14	CBMH105	0.06	2.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
15	CBMH106	0.10	3.2200	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
16	CBMH106_Junction	0.04	0.6200	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
17	CBMH11	0.15	0.3900	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
18	CBMH12	0.14	0.3800	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
19	CBMH13	0.08	0.4800	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
20	CBMH15	0.11	0.5100	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
21	CBMH2	0.15	0.3500	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
22	CBMH6	0.04	0.7400	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
23	GAS_BAR	0.07	1.0100	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
24	GB-CB1	0.04	0.9700	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
25	GB-CB2	0.05	1.0400	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
26	GB-CB2_Junction	0.22	1.9800	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
27	GB-CB3	0.05	0.9400	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
28	GB-CB3_Junction	0.06	0.7800	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
29	GB-CB4	0.01	0.6900	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
30	GB-CB4_Junction	0.24	3.2400	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
31	Link-93	0.10	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
32	Link-94	0.10	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
33	Link-95	0.10	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
34	Link-96	0.10	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
35	MH107	0.07	0.3200	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
36	MH108	-0.04	-0.2900	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
37	MH15A	0.27	0.5300	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
38	MHA1-MHA	0.60	2.4000	CIRCULAR	600.000	600.00	0.0130	0.5000	0.8000	0.0000
39	MHA1-MS-outlet	0.10	1.0000	CIRCULAR	250.000	250.00	0.0130	0.5000	0.8000	0.0000

Pipes

SN	Element ID	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses
		(m)	(%)		(mm)	(mm)				
40	MHA2-MHA1	0.10	0.1400	CIRCULAR	600.000	600.00	0.0130	0.5000	0.8000	0.0000
41	MHA2-MS-outlet	0.10	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
42	MHA3-MHA2	0.15	0.1400	CIRCULAR	600.000	600.00	0.0130	0.5000	0.5000	0.0000
43	MHA3-MS-Outlet	0.10	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
44	MHA-MHB	0.70	0.8800	CIRCULAR	600.000	600.00	0.0130	0.5000	0.5000	0.0000
45	MHA-MS-outlet	0.10	1.0000	CIRCULAR	250.000	250.00	0.0130	0.5000	0.8000	0.0000
46	MHB-MHC	0.37	0.8100	CIRCULAR	600.000	600.00	0.0130	0.5000	0.8000	0.0000
47	MHC-MHD	1.60	1.5600	CIRCULAR	600.000	600.00	0.0130	0.5000	0.5000	0.0000
48	MHD-MHE	1.50	1.8000	CIRCULAR	600.000	600.00	0.0130	0.5000	0.5000	0.0000
49	MHE-Outfall	0.09	1.8000	CIRCULAR	600.000	600.00	0.0130	0.5000	0.5000	0.0000
50	PUMPS_EAST	0.37	2.5000	CIRCULAR	150.000	150.00	0.0130	0.5000	0.8000	0.0000
51	PUMPS_WEST	0.04	0.8900	CIRCULAR	150.000	150.00	0.0130	0.5000	0.8000	0.0000
52	STORMCEPTOR1	0.15	1.5300	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
53	STORMCEPTOR2	0.10	0.4400	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
54	VSP-PARKING	0.19	0.7600	CIRCULAR	530.000	530.00	0.0130	0.5000	0.8000	0.0000

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Existing Conditions

Pipes

SN	Element ID	Initial Flow (lps)	Flap Gate	Lengthening Factor	Peak Flow (lps)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (m/sec)	Travel Time (min)	Design Flow Capacity (lps)	Max Flow / Design Flow Ratio
1	Building	0.00	NO	1.00	10.450	0 03:10	0.70	0.25	95.29	0.11
2	CAR WASH	0.00	NO	1.00	5.660	0 01:14	0.41	0.33	32.80	0.17
3	CB1	0.00	NO	1.00	43.350	0 04:55	1.38	0.34	15.21	2.85
4	CB14	0.00	NO	1.00	44.550	0 01:12	0.91	0.55	59.27	0.75
5	CB1-GB_Junction	0.00	NO	1.00	60.320	0 01:14	0.85	0.05	10.85	5.56
6	CB3	0.00	NO	1.00	45.670	0 01:34	0.93	0.12	57.40	0.80
7	CB3_Junction	0.00	NO	1.00	44.020	0 04:55	0.66	0.67	59.25	0.74
8	CBMH10	0.00	NO	1.00	76.890	0 04:32	1.09	0.56	62.00	1.24
9	CBMH101	0.00	NO	1.00	79.530	0 01:14	1.13	0.57	44.07	1.80
10	CBMH102	0.00	NO	1.00	24.660	0 01:12	0.37	0.55	47.72	0.52
11	CBMH103	0.00	NO	1.00	57.000	0 01:20	0.81	0.26	38.14	1.49
12	CBMH104	0.00	NO	1.00	53.820	0 01:05	0.76	0.32	50.50	1.07
13	CBMH104_Junction	0.00	NO	1.00	48.820	0 01:05	0.69	0.17	51.69	0.94
14	CBMH105	0.00	NO	1.00	10.410	0 01:20	0.41	0.12	46.39	0.22
15	CBMH106	0.00	NO	1.00	2.400	0 01:20	0.16	0.32	58.82	0.04
16	CBMH106_Junction	0.00	NO	1.00	63.140	0 01:05	0.89	0.12	38.11	1.66
17	CBMH11	0.00	NO	1.00	93.640	0 04:18	1.32	0.49	60.28	1.55
18	CBMH12	0.00	NO	1.00	99.860	0 04:04	1.41	0.43	59.75	1.67
19	CBMH13	0.00	NO	1.00	133.690	0 01:55	1.89	0.15	67.34	1.99
20	CBMH15	0.00	NO	1.00	70.220	0 01:14	0.99	0.36	69.01	1.02
21	CBMH2	0.00	NO	1.00	43.360	0 04:55	0.61	1.18	56.89	0.76
22	CBMH6	0.00	NO	1.00	52.840	0 01:02	0.75	0.12	83.15	0.64
23	GAS_BAR	0.00	NO	1.00	6.570	0 01:13	0.37	0.31	33.04	0.20
24	GB-CB1	0.00	NO	1.00	5.100	0 04:33	0.16	0.43	32.28	0.16
25	GB-CB2	0.00	NO	1.00	5.800	0 01:20	0.31	0.26	33.48	0.17
26	GB-CB2_Junction	0.00	NO	1.00	15.850	0 01:20	0.50	0.37	46.18	0.34
27	GB-CB3	0.00	NO	1.00	17.690	0 01:05	0.56	0.16	31.86	0.56
28	GB-CB3_Junction	0.00	NO	1.00	68.360	0 01:05	0.97	0.13	85.20	0.80
29	GB-CB4	0.00	NO	1.00	5.020	0 01:05	0.35	0.07	27.24	0.18
30	GB-CB4_Junction	0.00	NO	1.00	6.430	0 01:20	0.20	0.62	59.03	0.11
31	Link-93	0.00	NO	1.00	139.260	0 01:13	2.22	0.08	65.60	2.12
32	Link-94	0.00	NO	1.00	181.200	0 01:14	2.88	0.06	65.60	2.76
33	Link-95	0.00	NO	1.00	180.500	0 01:13	2.87	0.06	65.60	2.75
34	Link-96	0.00	NO	1.00	183.630	0 01:23	2.92	0.06	65.60	2.80
35	MH107	0.00	NO	1.00	44.040	0 04:55	0.62	0.58	55.01	0.80
36	MH108	0.00	NO	1.00	44.080	0 04:55	0.62	0.36	52.52	0.84
37	MH15A	0.00	NO	1.00	70.180	0 01:14	0.99	0.86	70.21	1.00
38	MHA1-MHA	0.00	NO	1.00	511.560	0 01:12	1.98	0.21	951.28	0.54
39	MHA1-MS-outlet	0.00	NO	1.00	155.310	0 01:49	1.58	0.11	118.94	1.31

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Existing Conditions

Pipes

SN	Element ID	Initial Flow (lps)	Flap Gate	Lengthening Factor	Peak Flow (lps)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (m/sec)	Travel Time (min)	Design Flow Capacity (lps)	Max Flow / Design Flow Ratio
40	MHA2-MHA1	0.00	NO	1.00	508.170	0 01:12	1.80	0.67	228.84	2.22
41	MHA2-MS-outlet	0.00	NO	1.00	91.540	0 01:46	1.46	0.11	65.60	1.40
42	MHA3-MHA2	0.00	NO	1.00	418.260	0 01:12	1.48	1.18	232.09	1.80
43	MHA3-MS-Outlet	0.00	NO	1.00	91.580	0 01:13	1.48	0.11	65.60	1.40
44	MHA-MHB	0.00	NO	1.00	654.570	0 01:13	2.32	0.57	575.47	1.14
45	MHA-MS-outlet	0.00	NO	1.00	172.840	0 01:13	1.76	0.09	118.94	1.45
46	MHB-MHC	0.00	NO	1.00	787.630	0 01:13	2.79	0.27	553.73	1.42
47	MHC-MHD	0.00	NO	1.00	747.910	0 01:14	2.68	0.64	766.81	0.98
48	MHD-MHE	0.00	NO	1.00	869.400	0 01:45	3.07	0.45	824.49	1.05
49	MHE-Outfall	0.00	NO	1.00	1049.650	0 01:22	3.71	0.02	823.83	1.27
50	PUMPS_EAST	0.00	NO	1.00	9.760	0 01:05	0.55	0.45	24.08	0.41
51	PUMPS_WEST	0.00	NO	1.00	16.840	0 01:12	0.95	0.08	14.36	1.17
52	STORMCEPTOR1	0.00	NO	1.00	24.650	0 01:12	0.35	0.47	119.64	0.21
53	STORMCEPTOR2	0.00	NO	1.00	60.230	0 01:14	0.85	0.44	64.44	0.93
54	VSP-PARKING	0.00	NO	1.00	450.330	0 01:13	2.08	0.20	374.94	1.20

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Existing Conditions

Pipes

SN	Element ID	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (m)	Froude Number	Reported Condition
1	Building	1.00	241.00	0.30	0.77	SURCHARGED
2	CAR WASH	1.00	244.00	0.20	0.04	SURCHARGED
3	CB1	1.00	239.00	0.20	0.06	SURCHARGED
4	CB14	1.00	229.00	0.25	0.02	SURCHARGED
5	CB1-GB_Junction	1.00	255.00	0.30	0.10	SURCHARGED
6	CB3	1.00	243.00	0.25	0.05	SURCHARGED
7	CB3_Junction	1.00	243.00	0.30	0.11	SURCHARGED
8	CBMH10	1.00	265.00	0.30	0.31	SURCHARGED
9	CBMH101	1.00	253.00	0.30	0.11	SURCHARGED
10	CBMH102	1.00	243.00	0.30	0.05	SURCHARGED
11	CBMH103	1.00	256.00	0.30	0.01	SURCHARGED
12	CBMH104	1.00	254.00	0.30	0.17	SURCHARGED
13	CBMH104_Junction	1.00	256.00	0.30	0.02	SURCHARGED
14	CBMH105	1.00	248.00	0.20	0.03	SURCHARGED
15	CBMH106	1.00	244.00	0.20	0.00	SURCHARGED
16	CBMH106_Junction	1.00	253.00	0.30	0.14	SURCHARGED
17	CBMH11	1.00	271.00	0.30	0.26	SURCHARGED
18	CBMH12	1.00	275.00	0.30	0.01	SURCHARGED
19	CBMH13	1.00	278.00	0.30	0.69	SURCHARGED
20	CBMH15	1.00	249.00	0.30	0.73	SURCHARGED
21	CBMH2	1.00	239.00	0.30	0.05	SURCHARGED
22	CBMH6	1.00	250.00	0.30	0.02	SURCHARGED
23	GAS_BAR	1.00	255.00	0.20	0.01	SURCHARGED
24	GB-CB1	1.00	260.00	0.20	0.00	SURCHARGED
25	GB-CB2	1.00	248.00	0.20	0.02	SURCHARGED
26	GB-CB2_Junction	1.00	250.00	0.20	0.00	SURCHARGED
27	GB-CB3	1.00	250.00	0.20	0.12	SURCHARGED
28	GB-CB3_Junction	1.00	251.00	0.30	0.17	SURCHARGED
29	GB-CB4	1.00	246.00	0.20	0.03	SURCHARGED
30	GB-CB4_Junction	1.00	247.00	0.20	0.00	SURCHARGED
31	Link-93	1.00	37.00	0.20	0.42	SURCHARGED
32	Link-94	1.00	37.00	0.20	0.74	SURCHARGED
33	Link-95	1.00	40.00	0.20	0.44	SURCHARGED
34	Link-96	1.00	32.00	0.20	0.41	SURCHARGED
35	MH107	1.00	249.00	0.30	0.09	SURCHARGED
36	MH108	1.00	253.00	0.30	0.01	SURCHARGED
37	MH15A	1.00	257.00	0.30	0.54	SURCHARGED
38	MHA1-MHA	1.00	38.00	0.60	1.43	SURCHARGED
39	MHA1-MS-outlet	1.00	39.00	0.25	0.48	SURCHARGED

Prepared by Novatech Engineering Consultants Ltd.
Date: 29/05/2014

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Pipes

SN	Element ID	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (m)	Froude Number	Reported Condition
40	MHA2-MHA1	1.00	38.00	0.60	0.63	SURCHARGED
41	MHA2-MS-outlet	1.00	39.00	0.20	0.38	SURCHARGED
42	MHA3-MHA2	1.00	39.00	0.60	0.39	SURCHARGED
43	MHA3-MS-Outlet	1.00	21.00	0.20	0.66	SURCHARGED
44	MHA-MHB	1.00	42.00	0.60	0.74	SURCHARGED
45	MHA-MS-outlet	1.00	38.00	0.25	0.65	SURCHARGED
46	MHB-MHC	1.00	42.00	0.60	1.12	SURCHARGED
47	MHC-MHD	1.00	43.00	0.60	1.57	SURCHARGED
48	MHD-MHE	1.00	45.00	0.60	1.46	SURCHARGED
49	MHE-Outfall	1.00	39.00	0.60	1.47	SURCHARGED
50	PUMPS_EAST	1.00	236.00	0.15	0.00	SURCHARGED
51	PUMPS_WEST	1.00	269.00	0.15	0.01	SURCHARGED
52	STORMCEPTOR1	1.00	246.00	0.30	0.01	SURCHARGED
53	STORMCEPTOR2	1.00	255.00	0.30	0.27	SURCHARGED
54	VSP-PARKING	1.00	30.00	0.52	0.53	SURCHARGED

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Existing Conditions

Channels

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop
					(m)	(m)	(m)	(m)	(m)	(m)
1	CBMH104-MS		CBMH104	CBMH6	30.00	100.01	2.32	99.70	1.92	0.31
2	Link-88		MHA-MS	MHB-MS	79.70	99.40	1.40	99.10	1.40	0.30
3	Link-89		MHB-MS	MHC-MS	45.50	99.10	1.40	99.00	1.40	0.10
4	Link-90		MHC-MS	MHD-MS	102.60	99.00	1.40	96.80	1.40	2.20
5	Link-91		MHD-MS	MHE-MS	83.20	96.80	1.40	96.45	1.40	0.35
6	Link-92		MHE-MS	MAJOR-OUTFALL	5.00	96.45	1.40	96.40	0.00	0.05
7	MHA2-MS		MHA2-MS	MHA1-MS	72.00	99.80	1.40	99.40	1.40	0.40
8	MHA3-MS		MHA3-MS	MHA2-MS	105.00	100.43	0.40	99.80	1.40	0.63
9	VSP-EXP-MS		Stor-VSP-EXP-PARKING	MHA3-MS	100.00	101.03	-0.47	100.43	0.40	0.60

Prepared by Novatech Engineering Consultants Ltd.
Date: 29/05/2014

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Channels

SN	Element ID	Average Slope (%)	Channel Type	Channel Height (m)	Channel Width (m)	Left Overbank Manning's Roughness	Channel Manning's Roughness	Right Overbank Manning's Roughness	Entrance Losses
1	CBMH104-MS	1.0300	Rectangular	0.150	5.00	0.0000	0.0130	0.0000	0.0000
2	Link-88	0.3800	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
3	Link-89	0.2200	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
4	Link-90	2.1400	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
5	Link-91	0.4200	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
6	Link-92	1.0000	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
7	MHA2-MS	0.5600	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
8	MHA3-MS	0.6000	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
9	VSP-EXP-MS	0.6000	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000

Channels

SN	Element ID	Exit/Bend Losses	Additional Losses	Initial Flow (lps)	Flap Gate	Lengthening Factor	Peak Flow (lps)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (m/sec)
1	CBMH104-MS	0.0000	0.0000	0.00	NO	1.00	29.480	0 01:19	0.07
2	Link-88	0.0000	0.0000	0.00	NO	1.00	968.630	0 01:21	0.70
3	Link-89	0.0000	0.0000	0.00	NO	1.00	960.110	0 01:22	0.69
4	Link-90	0.0000	0.0000	0.00	NO	1.00	1071.460	0 01:22	1.00
5	Link-91	0.0000	0.0000	0.00	NO	1.00	1106.570	0 01:23	0.82
6	Link-92	0.0000	0.0000	0.00	NO	1.00	1013.150	0 01:23	1.03
7	MHA2-MS	0.0000	0.0000	0.00	NO	1.00	757.780	0 01:21	0.38
8	MHA3-MS	0.0000	0.0000	0.00	NO	1.00	365.990	0 01:20	0.46
9	VSP-EXP-MS	0.0000	0.0000	0.00	NO	1.00	257.740	0 01:19	0.56

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Existing Conditions

Channels

SN	Element ID	Travel Time (min)	Design Flow Capacity (lps)	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (m)	Froude Number	Reported Condition
1	CBMH104-MS	7.14	1592.65	0.02	0.59	0.00	0.09	0.00	Calculated
2	Link-88	1.90	3957.79	0.24	0.47	0.00	0.07	0.01	Calculated
3	Link-89	1.10	3024.23	0.32	0.46	0.00	0.07	0.01	Calculated
4	Link-90	1.71	9446.23	0.11	0.36	0.00	0.05	0.02	Calculated
5	Link-91	1.69	4184.01	0.26	0.45	0.00	0.07	0.02	Calculated
6	Link-92	0.08	6450.91	0.16	0.33	0.00	0.05	0.02	Calculated
7	MHA2-MS	3.16	4808.22	0.16	0.66	0.00	0.10	0.00	Calculated
8	MHA3-MS	3.80	4996.85	0.07	0.27	0.00	0.04	0.01	Calculated
9	VSP-EXP-MS	2.98	6672.87	0.04	0.17	0.00	0.03	0.25	Calculated

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Outfalls

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (m)	Boundary Type	Flap Gate	Fixed Water Elevation (m)	Peak Inflow (lps)	Peak Lateral Inflow (lps)	Maximum HGL Depth Attained (m)	Maximum HGL Elevation Attained (m)
1	MAJOR-OUTFALL	363838.47	5014746.14		96.40	NORMAL	NO		1013.15	0.00	0.05	96.45
2	MINOR-OUTFALL	363846.42	5014722.00		92.71	NORMAL	NO		1049.65	0.00	0.60	93.31

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Existing Conditions

Storage Nodes

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (m)	Max (Rim) Elevation (m)	Max (Rim) Offset (m)	Initial Water Elevation (m)	Initial Water Depth (m)	Ponded Area (m²)	Evaporation Loss
1	CB1	363992.84	5015025.02	Rim_Elev.=99.27	98.14	100.20	2.06	98.14	0.00	0.00	0.00
2	CB14	364039.79	5014898.48	RimElev=100.14	97.75	100.28	2.53	97.75	0.00	0.00	0.00
3	CB3	363942.55	5015039.63	Rim_Elev.=99.96	97.96	100.20	2.24	97.96	0.00	0.00	0.00
4	CBMH10	363905.17	5014955.34	Rim_Elev.=99.52	97.50	99.90	2.40	97.50	0.00	0.00	0.00
5	CBMH101	363922.05	5014991.14	RimElev=99.91	97.68	100.28	2.60	97.68	0.00	0.00	0.00
6	CBMH102	363918.74	5015012.07	RimElev=99.99	97.89	100.10	2.21	97.89	0.00	0.00	0.00
7	CBMH103	363893.95	5014990.86	RimElev=99.92	97.62	100.28	2.66	97.62	0.00	0.00	0.00
8	CBMH104	363884.04	5015006.29	RimElev=100.01	97.69	100.28	2.59	97.69	0.00	0.00	0.00
9	CBMH11	363920.16	5014922.25	Rim_Elev.=99.55	97.34	99.90	2.56	97.34	0.00	0.00	0.00
10	CBMH12	363935.85	5014886.83	Rim_Elev.=99.52	97.19	99.90	2.71	97.19	0.00	0.00	0.00
11	CBMH13	363949.90	5014852.95	Rim_Elev.=99.51	97.05	99.90	2.85	97.05	0.00	0.00	0.00
12	CBMH15	364013.16	5014886.92	RimElev=100.14	97.45	100.28	2.83	97.45	0.00	0.00	0.00
13	CBMH6	363873.37	5015026.81	RimElev=99.70	97.78	100.28	2.50	97.78	0.00	0.00	0.00
14	GB-CB1	363902.61	5014981.67	RimElev=99.88	97.68	99.95	2.27	97.68	0.00	0.00	0.00
15	GB-CB2	363881.26	5014992.34	RimElev=100.08	97.89	100.10	2.21	97.89	0.00	0.00	0.00
16	GB-CB3	363880.48	5015024.91	RimElev=99.83	97.87	100.28	2.41	97.87	0.00	0.00	0.00
17	GB-CB4	363873.35	5015009.56	RimElev=100.07	97.95	100.10	2.15	97.95	0.00	0.00	0.00
18	Roof_Top_Storage	364002.26	5014906.16		110.35	110.50	0.15	110.35	0.00	0.00	0.00
19	Stor-VSP-BLDGS	363858.99	5015110.67		110.00	110.15	0.15	0.00	-110.00	0.00	0.00
20	Stor-VSP-EXP-BLDGS	363831.65	5015134.93		110.00	110.15	0.15	0.00	-110.00	0.00	0.00
21	Stor-VSP-EXP-PARKING	363817.40	5015139.16	RimElev=103.2	101.50	103.50	2.00	101.50	0.00	0.00	0.00
22	Stor-VSP-PARKING	363841.76	5015117.02	RimElev=100.6	99.17	100.90	1.73	99.17	0.00	0.00	0.00

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Date: 29/05/2014

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Existing Conditions

Storage Nodes

SN	Element ID	Peak Inflow (lps)	Peak Lateral Inflow (lps)	Peak Outflow (lps)	Peak Exfiltration Flow Rate (cmm)	Maximum HGL Elevation Attained (m)	Maximum HGL Depth Attained (m)	Average HGL Elevation Attained (m)	Average HGL Depth Attained (m)	Time of Maximum HGL Occurrence (days hh:mm)	Total Exfiltration Volume (1000-m³)	Total Flooded Volume (ha-mm)	Total Time Flooded (minutes)	Total Retention Time (seconds)
1	CB1	96.26	58.73	43.35	0.00	99.89	1.75	98.41	0.27	0 01:53	0.00	0.00	0.00	0.00
2	CB14	66.15	66.15	44.55	0.00	100.25	2.50	98.04	0.29	0 01:21	0.00	0.00	0.00	0.00
3	CB3	81.51	79.53	45.67	0.00	100.13	2.17	98.25	0.29	0 01:22	0.00	0.00	0.00	0.00
4	CBMH10	299.75	162.38	148.15	0.00	99.81	2.31	97.87	0.37	0 01:52	0.00	0.00	0.00	0.00
5	CBMH101	98.06	52.71	79.53	0.00	100.06	2.38	98.02	0.34	0 01:20	0.00	0.00	0.00	0.00
6	CBMH102	34.81	29.41	29.63	0.00	100.07	2.18	98.19	0.30	0 01:21	0.00	0.00	0.00	0.00
7	CBMH103	66.32	11.00	57.00	0.00	99.99	2.37	97.99	0.37	0 01:20	0.00	0.00	0.00	0.00
8	CBMH104	64.40	5.12	53.82	0.00	100.04	2.35	98.03	0.34	0 01:20	0.00	0.00	0.00	0.00
9	CBMH11	265.74	121.82	116.42	0.00	99.81	2.47	97.73	0.39	0 01:52	0.00	0.00	0.00	0.00
10	CBMH12	251.67	158.68	105.28	0.00	99.81	2.62	97.59	0.40	0 01:52	0.00	0.00	0.00	0.00
11	CBMH13	238.19	107.55	133.69	0.00	99.81	2.76	97.51	0.46	0 01:52	0.00	0.00	0.00	0.00
12	CBMH15	80.32	38.95	70.22	0.00	100.16	2.71	97.82	0.37	0 01:20	0.00	0.00	0.00	0.00
13	CBMH6	346.23	339.56	298.90	0.00	100.04	2.26	98.11	0.33	0 01:20	0.00	0.00	0.00	0.00
14	GB-CB1	5.72	4.76	5.10	0.00	99.92	2.24	98.02	0.34	0 01:20	0.00	0.00	0.00	0.00
15	GB-CB2	5.99	5.79	5.80	0.00	100.04	2.15	98.19	0.30	0 01:20	0.00	0.00	0.00	0.00
16	GB-CB3	71.84	33.67	52.11	0.00	100.04	2.17	98.18	0.31	0 01:20	0.00	0.00	0.00	0.00
17	GB-CB4	6.03	4.18	4.40	0.00	100.04	2.09	98.24	0.29	0 01:20	0.00	0.00	0.00	0.00
18	Roof_Top_Storage	389.31	389.31	10.33	0.00	110.41	0.06	110.38	0.03	0 03:10	0.00	0.00	0.00	0.00
19	Stor-VSP-BLDGS	327.06	327.06	8.70	0.00	110.06	0.06	110.03	0.03	0 03:10	0.00	0.00	0.00	0.00
20	Stor-VSP-EXP-BLDGS	109.61	109.61	2.40	0.00	110.06	0.06	110.03	0.03	0 03:10	0.00	0.00	0.00	0.00
21	Stor-VSP-EXP-PARKING	258.30	258.30	258.03	0.00	101.52	0.02	101.50	0.00	0 01:19	0.00	0.00	0.00	0.00
22	Stor-VSP-PARKING	597.47	597.47	450.33	0.00	100.78	1.61	99.20	0.03	0 01:21	0.00	0.00	0.00	0.00

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Date: 29/05/2014

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Existing Conditions

Junctions

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover
					(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m²)	(mm)
1	Building	364007.28	5014898.03		97.55	110.50	12.95	97.55	0.00	110.50	0.00	0.00	0.00
2	CAR_WASH	363875.86	5014994.35		97.98	102.00	4.02	97.98	0.00	102.00	0.00	0.00	3820.00
3	CB3_Junction	363945.46	5015033.83		97.90	100.19	2.29	97.90	0.00	100.26	0.07	0.00	1990.00
4	CBMH104_Junction	363889.72	5014997.27		97.65	100.13	2.48	97.65	0.00	100.26	0.13	0.00	2180.00
5	CBMH105	363879.76	5014986.94		97.90	100.10	2.20	97.90	0.00	100.28	0.18	0.00	2000.00
6	CBMH106	363868.95	5015010.82		98.04	100.04	2.00	98.04	0.00	100.28	0.24	0.00	1800.00
7	CBMH106_Junction	363879.90	5015015.38		97.70	100.00	2.30	97.70	0.00	100.28	0.28	0.00	2000.00
8	CBMH2	363984.85	5015050.36		98.05	99.83	1.78	98.05	0.00	100.28	0.45	0.00	1480.00
9	GAS_BAR	363913.82	5014991.46		97.75	102.00	4.25	97.75	0.00	102.00	0.00	0.00	4050.00
10	GB-CB1_Junction	363899.07	5014980.75		97.64	100.00	2.36	97.64	0.00	100.28	0.28	0.00	2060.00
11	GB-CB2_Junction	363882.77	5014987.69		97.84	100.09	2.25	97.84	0.00	100.28	0.19	0.00	2050.00
12	GB-CB3_Junction	363875.67	5015022.64		97.74	99.89	2.15	97.74	0.00	100.28	0.39	0.00	1830.00
13	GB-CB4_Junction	363872.34	5015012.20		97.94	100.12	2.18	97.94	0.00	100.28	0.16	0.00	1980.00
14	MH107	363923.98	5015022.26		97.76	100.12	2.36	97.76	0.00	100.26	0.14	0.00	2020.00
15	MH108	363928.11	5015001.88		97.65	100.08	2.43	97.65	0.00	100.28	0.20	0.00	2090.00
16	MH15A	363994.52	5014882.33	RimElev=100.26	97.33	100.26	2.93	97.33	0.00	100.28	0.02	0.00	2620.00
17	MH16	363941.36	5014830.92		96.99	99.85	2.86	96.99	0.00	100.28	0.43	0.00	0.00
18	MHA	363914.34	5014832.07	RimElev=99.4	97.12	99.40	2.28	97.12	0.00	99.70	0.30	0.00	1250.00
19	MHA1	363925.15	5014838.47	RimElev=99.40	97.72	99.40	1.68	97.72	0.00	99.70	0.30	0.00	1080.00
20	MHA1-MS	363903.84	5014844.49		98.00	99.40	1.40	98.00	0.00	99.70	0.30	0.00	0.00
21	MHA2	363894.31	5014906.11	RimElev=99.80	97.82	99.80	1.98	97.82	0.00	100.10	0.30	0.00	1300.00
22	MHA2-MS	363877.34	5014898.97		98.40	99.80	1.40	98.40	0.00	99.95	0.15	0.00	0.00
23	MHA3	363840.90	5015036.07	RimElev=100.43	97.97	100.43	2.46	97.97	0.00	100.73	0.30	0.00	0.00
24	MHA3-MS	363822.26	5015029.87		100.03	100.43	0.40	100.03	0.00	100.58	0.15	0.00	0.00
25	MHA-MS	363897.95	5014827.12		98.00	99.40	1.40	98.00	0.00	99.55	0.15	0.00	0.00
26	MHB	363930.48	5014800.49	RimElev=99.10	96.42	99.10	2.68	96.42	0.00	99.40	0.30	0.00	0.00
27	MHB-MS	363908.55	5014794.14		97.70	99.10	1.40	97.70	0.00	99.25	0.15	0.00	0.00
28	MHC	363943.72	5014773.43	RimElev=99.00	95.92	99.00	3.08	95.92	0.00	99.30	0.30	0.00	1300.00
29	MHC-MS	363917.68	5014777.65		97.60	99.00	1.40	97.60	0.00	99.15	0.15	0.00	0.00
30	MHD	363907.43	5014751.05	RimElev=96.80	94.30	96.80	2.50	94.30	0.00	97.10	0.30	0.00	1300.00
31	MHD-MS	363900.89	5014769.41		95.40	96.80	1.40	95.40	0.00	96.95	0.15	0.00	0.00
32	MHE	363868.07	5014732.76	RimElev=96.45	92.80	96.45	3.65	92.80	0.00	96.75	0.30	0.00	1300.00
33	MHE-MS	363861.73	5014755.27		95.05	96.45	1.40	95.05	0.00	96.60	0.15	0.00	0.00
34	PUMPS	363899.74	5015005.54		97.69	105.00	7.31	97.69	0.00	105.00	0.00	0.00	6590.00
35	STORMCEPTOR1	363919.72	5015005.14		97.83	99.94	2.11	97.83	0.00	100.28	0.34	0.00	1780.00
36	STORMCEPTOR2	363899.85	5014979.33		97.64	99.96	2.32	97.64	0.00	100.28	0.32	0.00	2020.00

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Existing Conditions

Junctions

SN	Element ID	Peak Inflow (lps)	Peak Lateral Inflow (lps)	Maximum HGL Elevation Attained (m)	Maximum HGL Depth Attained (m)	Maximum Surcharge Depth Attained (m)	Minimum Freeboard Attained (m)	Average HGL Elevation Attained (m)	Average HGL Depth Attained (m)	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ha-mm)	Total Time Flooded (minutes)
1	Building	10.33	0.00	100.16	2.61	0.00	10.34	97.90	0.35	0 01:20	0 00:00	0.00	0.00
2	CAR_WASH	5.49	5.49	100.05	2.07	0.00	1.95	98.26	0.28	0 01:19	0 00:00	0.00	0.00
3	CB3_Junction	45.67	0.00	100.12	2.22	0.00	0.07	98.20	0.30	0 01:19	0 00:00	0.00	0.00
4	CBMH104_Junction	53.82	0.00	100.02	2.37	0.00	0.11	98.00	0.35	0 01:20	0 00:00	0.00	0.00
5	CBMH105	10.45	5.00	100.04	2.14	0.00	0.06	98.20	0.30	0 01:20	0 00:00	0.00	0.00
6	CBMH106	2.41	2.41	100.04	2.00	0.00	0.00	98.31	0.27	0 01:20	0 00:00	0.00	0.00
7	CBMH106_Junction	68.36	0.00	100.04	2.34	0.04	0.00	98.04	0.34	0 01:20	0 00:00	0.00	0.00
8	CBMH2	63.12	63.12	100.16	2.11	0.33	0.00	98.33	0.28	0 01:19	0 00:00	0.00	0.00
9	GAS_BAR	6.42	6.42	100.07	2.32	0.00	1.93	98.07	0.32	0 01:19	0 00:00	0.00	0.00
10	GB-CB1_Junction	60.56	0.00	99.92	2.28	0.00	0.08	97.99	0.35	0 01:20	0 00:00	0.00	0.00
11	GB-CB2_Junction	15.89	0.00	100.03	2.19	0.00	0.06	98.15	0.31	0 01:20	0 00:00	0.00	0.00
12	GB-CB3_Junction	68.56	0.00	100.04	2.30	0.15	0.00	98.09	0.35	0 01:20	0 00:00	0.00	0.00
13	GB-CB4_Junction	6.46	0.00	100.04	2.10	0.00	0.08	98.23	0.29	0 01:20	0 00:00	0.00	0.00
14	MH107	44.02	0.00	100.09	2.33	0.00	0.03	98.09	0.33	0 01:20	0 00:00	0.00	0.00
15	MH108	44.04	0.00	100.08	2.43	0.00	0.00	98.03	0.38	0 01:20	0 00:00	0.00	0.00
16	MH15A	70.22	0.00	100.01	2.68	0.00	0.25	97.72	0.39	0 01:20	0 00:00	0.00	0.00
17	MH16	133.69	0.00	99.65	2.66	0.00	0.20	97.38	0.39	0 01:14	0 00:00	0.00	0.00
18	MHA	669.31	0.00	99.42	2.30	0.02	0.00	97.21	0.09	0 01:21	0 00:00	0.00	0.00
19	MHA1	597.71	0.00	99.63	1.91	0.23	0.00	97.79	0.07	0 01:21	0 00:00	0.00	0.00
20	MHA1-MS	899.75	174.48	99.67	1.67	0.12	0.00	98.03	0.03	0 01:21	0 00:00	0.00	0.00
21	MHA2	508.24	0.00	99.94	2.12	0.14	0.00	97.94	0.12	0 01:21	0 00:00	0.00	0.00
22	MHA2-MS	791.50	111.26	99.85	1.45	0.00	0.95	98.43	0.03	0 01:21	0 00:00	0.00	0.00
23	MHA3	544.24	0.00	100.67	2.70	0.24	0.00	98.08	0.11	0 01:13	0 00:00	0.00	0.00
24	MHA3-MS	420.95	163.21	100.46	0.43	0.00	0.12	100.05	0.02	0 01:20	0 00:00	0.00	0.00
25	MHA-MS	1036.21	270.65	99.46	1.46	0.00	0.09	98.03	0.03	0 01:21	0 00:00	0.00	0.00
26	MHB	887.98	0.00	99.12	2.70	0.02	0.00	96.55	0.13	0 01:14	0 00:00	0.00	0.00
27	MHB-MS	1081.90	169.58	99.18	1.48	0.00	0.07	97.73	0.03	0 01:22	0 00:00	0.00	0.00
28	MHC	968.14	0.00	98.84	2.92	0.00	0.16	96.03	0.11	0 01:14	0 00:00	0.00	0.00
29	MHC-MS	1223.52	399.19	99.04	1.44	0.00	0.11	97.64	0.04	0 01:22	0 00:00	0.00	0.00
30	MHD	869.19	0.00	96.40	2.10	0.00	0.40	94.40	0.10	0 01:14	0 00:00	0.00	0.00
31	MHD-MS	1260.76	324.00	96.87	1.47	0.00	0.08	95.44	0.04	0 01:23	0 00:00	0.00	0.00
32	MHE	1049.66	0.00	94.16	1.36	0.00	2.29	92.91	0.11	0 01:22	0 00:00	0.00	0.00
33	MHE-MS	1196.72	179.10	96.50	1.45	0.00	0.10	95.08	0.03	0 01:23	0 00:00	0.00	0.00
34	PUMPS	18.38	18.38	100.09	2.40	0.00	4.91	98.03	0.34	0 01:19	0 00:00	0.00	0.00
35	STORMCEPTOR1	24.66	0.00	100.06	2.23	0.12	0.00	98.14	0.31	0 01:20	0 00:00	0.00	0.00
36	STORMCEPTOR2	60.32	0.00	99.87	2.23	0.00	0.09	97.98	0.34	0 01:21	0 00:00	0.00	0.00

Canadian Tire (Barrhaven, Ontario)
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Weirs

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	From (Inlet) Node Invert Elevation (m)	To (Outlet) Node Invert Elevation (m)	Type	Flap Gate	Crest Elevation (m)	Crest Offset (m)	Length (m)	Weir Total Height (m)	Discharge Coefficient	Peak Flow (lps)
1	CBMH101-MS		CBMH101	CBMH6	97.68	97.78	SIDE FLOW	NO	100.11	2.43	5.00	0.17	0.61	0.00
2	CBMH103-MS		CBMH103	CBMH6	97.62	97.78	SIDE FLOW	NO	100.11	2.49	5.00	0.17	0.61	0.00
3	CBMH10-Weir		CBMH10	CBMH11	97.50	97.34	RECTANGULAR	NO	99.59	2.09	6.00	0.30	1.84	142.32
4	CBMH11-Weir		CBMH11	CBMH12	97.34	97.19	RECTANGULAR	NO	99.71	2.37	6.00	0.30	1.84	96.51
5	CBMH12-Weir		CBMH12	CBMH13	97.19	97.05	RECTANGULAR	NO	99.61	2.42	6.00	0.30	1.84	102.42
6	GB-CB3-MS		GB-CB3	CBMH6	97.87	97.78	SIDE FLOW	NO	98.85	0.98	3.00	0.30	0.61	52.11
7	GreenbankRd		CBMH6	MHA2-MS	97.78	98.40	SIDE FLOW	NO	99.88	2.10	10.00	0.30	0.61	279.67
8	MHA1-MS		MHA1-MS	MHA-MS	98.00	98.00	SIDE FLOW	NO	99.40	1.40	20.00	0.15	0.61	825.74

Prepared by Novatech Engineering Consultants Ltd.
Date: 29/05/2014

Outlets

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	From (Inlet) Node Invert Elevation (m)	To (Outlet) Node Invert Elevation (m)	Crest Elevation (m)	Crest Height (m)	Outlet Type	Outlet Reference	Flap Gate	Peak Flow (lps)	Time of Peak Flow Occurrence (days hh:mm)
1	Roof_Drains		Roof_Top_Storage	Building	110.35	97.55	110.35	0.00	Rating Curve Table	Depth Above Inlet	NO	10.330	0 03:10
2	VSP-BLDGS		Stor-VSP-BLDGS	MHA3	110.00	97.97	110.00	0.00	Rating Curve Table	Depth Above Inlet	NO	8.700	0 03:10
3	VSP-EXP-BLDGS		Stor-VSP-EXP-BLDGS	MHA3	110.00	97.97	110.00	0.00	Rating Curve Table	Depth Above Inlet	NO	2.400	0 03:10
4	VSP-EXP-PARKING		Stor-VSP-EXP-PARKING	MHA3	101.50	97.97	101.50	0.00	Rating Curve Table	Depth Above Inlet	NO	0.290	0 01:19

Orifices

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	From (Inlet) Node Invert Elevation (m)	To (Outlet) Node Invert Elevation (m)	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (mm)	Rectangular Orifice Height (m)	Rectangular Orifice Width (m)	Orifice Invert Elevation (m)	Orifice Invert Offset (m)	Orifice Coefficient	Peak Flow (lps)	Time of Peak Flow Occurrence (days hh:mm)
1	MH16		MH16	MHB	96.99	96.42	SIDE	RECT_CLOSED	NO		0.18	0.18	96.99	0.00	0.6260	133.690	0 01:55

Rain Gauges

SN	Element ID	Description	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period	Rainfall Depth	Rainfall Distribution
									(years)	(mm)	
1	1		Time Series	C-3hr-100yr	Cumulative	mm				0	

Canadian Tire (Barrhaven, Ontario)
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Subbasins

SN	Element ID	Description	Area (ha)	Drainage Node ID	Max Infiltration Rate (mm/hr)	Min Infiltration Rate (mm/hr)	Drying Time (days)	Decay Constant (1/hrs)	Max Volume (mm)	Average Slope (%)	Equivalent Width (m)	Impervious Area (%)	Impervious Area No Depression (%)	Impervious Area Depression Depth (mm)
1	GREENBANK		0.07	CBMH6	76.2000	13.2000	7.00	4.1400	0.00	1.3300	16.00	100.00	0.00	1.5700
2	Sub-BLDG		0.79	Roof_Top_Storage	76.2000	13.2000	7.00	4.1400	0.00	1.5000	138.00	100.00	100.00	1.5700
3	Sub-CAR_WASH		0.01	CAR_WASH	76.2000	13.2000	7.00	4.1400	0.00	1.5000	18.00	100.00	100.00	1.5700
4	Sub-CB1		0.12	CB1	76.2000	13.2000	7.00	4.1400	0.00	1.3800	47.00	83.00	0.00	1.5700
5	Sub-CB14		0.13	CB14	76.2000	13.2000	7.00	4.1400	0.00	1.0500	78.00	100.00	0.00	1.5700
6	Sub-CB3		0.16	CB3	76.2000	13.2000	7.00	4.1400	0.00	3.7600	40.00	100.00	0.00	1.5700
7	Sub-CBMH10		0.33	CBMH10	76.2000	13.2000	7.00	4.1400	0.00	1.0200	60.00	96.00	0.00	1.5700
8	Sub-CBMH101		0.11	CBMH101	76.2000	13.2000	7.00	4.1400	0.00	1.4500	31.00	100.00	0.00	1.5700
9	Sub-CBMH102		0.06	CBMH102	76.2000	13.2000	7.00	4.1400	0.00	1.5200	20.00	100.00	0.00	1.5700
10	Sub-CBMH103		0.02	CBMH103	76.2000	13.2000	7.00	4.1400	0.00	2.9600	24.00	100.00	0.00	1.5700
11	Sub-CBMH104		0.01	CBMH104	76.2000	13.2000	7.00	4.1400	0.00	0.6400	11.00	100.00	0.00	1.5700
12	Sub-CBMH105		0.03	CBMH105	76.2000	13.2000	7.00	4.1400	0.00	0.4000	16.00	0.00	0.00	1.5700
13	Sub-CBMH106		0.01	CBMH106	76.2000	13.2000	7.00	4.1400	0.00	0.7800	6.00	0.00	0.00	1.5700
14	Sub-CBMH11		0.25	CBMH11	76.2000	13.2000	7.00	4.1400	0.00	1.1700	44.00	99.00	0.00	1.5700
15	Sub-CBMH12		0.32	CBMH12	76.2000	13.2000	7.00	4.1400	0.00	1.3300	60.00	96.00	0.00	1.5700
16	Sub-CBMH13		0.23	CBMH13	76.2000	13.2000	7.00	4.1400	0.00	1.5400	55.00	83.00	0.00	1.5700
17	Sub-CBMH15		0.08	CBMH15	76.2000	13.2000	7.00	4.1400	0.00	0.6500	29.00	100.00	0.00	1.5700
18	Sub-CBMH2		0.13	CBMH2	76.2000	13.2000	7.00	4.1400	0.00	4.2600	33.00	86.00	0.00	1.5700
19	Sub-CBMH6		0.44	CBMH6	76.2000	13.2000	7.00	4.1400	0.00	1.8400	70.00	97.00	0.00	1.5700
20	Sub-EX-1		0.18	CBMH6	76.2000	13.2000	7.00	4.1400	0.00	2.7700	27.00	100.00	0.00	1.5700
21	Sub-GAS_BAR		0.01	GAS_BAR	76.2000	13.2000	7.00	4.1400	0.00	1.5000	19.00	100.00	100.00	1.5700
22	Sub-GB-CB1		0.01	GB-CB1	76.2000	13.2000	7.00	4.1400	0.00	1.5200	9.00	100.00	0.00	1.5700
23	Sub-GB-CB2		0.01	GB-CB2	76.2000	13.2000	7.00	4.1400	0.00	0.3700	6.00	100.00	0.00	1.5700
24	Sub-GB-CB3		0.07	GB-CB3	76.2000	13.2000	7.00	4.1400	0.00	1.3600	13.00	100.00	0.00	1.5700
25	Sub-GB-CB4		0.01	GB-CB4	76.2000	13.2000	7.00	4.1400	0.00	0.4000	7.00	100.00	0.00	1.5700
26	Sub-MHA		0.77	MHA-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	39.00	71.00	0.00	1.5700
27	Sub-MHA1		0.45	MHA1-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	35.00	71.00	0.00	1.5700
28	Sub-MHA2		0.28	MHA2-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	31.00	71.00	0.00	1.5700
29	Sub-MHA3		0.44	MHA3-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	34.00	71.00	0.00	1.5700
30	Sub-MHB		0.42	MHB-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	53.00	73.00	0.00	1.5700
31	Sub-MHC		1.15	MHC-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	58.00	70.00	0.00	1.5700
32	Sub-MHD		1.17	MHD-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	117.00	48.00	0.00	1.5700
33	Sub-MHE		0.50	MHE-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	62.00	64.00	0.00	1.5700
34	Sub-PUMPS		0.04	PUMPS	76.2000	13.2000	7.00	4.1400	0.00	1.5000	22.00	100.00	100.00	1.5700
35	Sub-VSP-BLDGS		0.66	Stor-VSP-BLDGS	76.2000	13.2000	7.00	4.1400	0.00	1.5000	138.00	100.00	100.00	1.5700
36	Sub-VSP-EXP-BLDGS		0.22	Stor-VSP-EXP-BLDGS	76.2000	13.2000	7.00	4.1400	0.00	1.5000	82.00	100.00	100.00	1.5700
37	Sub-VSP-EXP-PARKING		0.52	Stor-VSP-EXP-PARKING	76.2000	13.2000	7.00	4.1400	0.00	0.9100	163.00	100.00	0.00	1.5700
38	Sub-VSP-PARKING		1.21	Stor-VSP-PARKING	76.2000	13.2000	7.00	4.1400	0.00	2.4500	139.00	100.00	0.00	1.5700

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Subbasins

SN	Element ID	Impervious Area Manning's Roughness	Pervious Area Depression Depth (mm)	Pervious Area Manning's Roughness	Curb & Gutter Length (m)	Rain Gage ID	Total Precipitation (mm)	Total Runon (mm)	Total Evaporation (mm)	Total Infiltration (mm)	Total Runoff (mm)	Peak Runoff (lps)	Time of Concentration (days hh:mm:ss)
1	GREENBANK	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.14	34.69	0 00:05:07
2	Sub-BLDG	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	71.71	389.33	0 00:05:47
3	Sub-CAR_WASH	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	71.77	5.49	0 00:01:31
4	Sub-CB1	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	7.3620	63.07	58.74	0 00:10:54
5	Sub-CB14	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.17	66.15	0 00:03:07
6	Sub-CB3	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.16	79.53	0 00:03:33
7	Sub-CBMH10	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	1.7220	68.48	162.40	0 00:11:39
8	Sub-CBMH101	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.15	52.71	0 00:04:18
9	Sub-CBMH102	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.16	29.41	0 00:03:53
10	Sub-CBMH103	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.20	11.00	0 00:01:35
11	Sub-CBMH104	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.18	5.12	0 00:02:31
12	Sub-CBMH105	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	46.3580	25.32	5.00	0 00:24:58
13	Sub-CBMH106	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	45.6380	26.04	2.41	0 00:21:20
14	Sub-CBMH11	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.4280	69.72	121.83	0 00:08:25
15	Sub-CBMH12	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	1.7200	68.48	158.69	0 00:10:36
16	Sub-CBMH13	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	7.4110	63.01	107.58	0 00:13:56
17	Sub-CBMH15	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.15	38.95	0 00:04:45
18	Sub-CBMH2	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	6.0390	64.35	63.13	0 00:09:15
19	Sub-CBMH6	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	1.2880	68.90	216.83	0 00:09:49
20	Sub-EX-1	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.14	88.05	0 00:05:14
21	Sub-GAS_BAR	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	71.77	6.42	0 00:01:37
22	Sub-GB-CB1	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.19	4.76	0 00:02:06
23	Sub-GB-CB2	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.15	5.79	0 00:04:37
24	Sub-GB-CB3	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.14	33.67	0 00:05:39
25	Sub-GB-CB4	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.17	4.18	0 00:03:23
26	Sub-MHA	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	14.2320	56.33	270.80	0 00:49:50
27	Sub-MHA1	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	13.7280	56.84	174.56	0 00:29:51
28	Sub-MHA2	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	13.3820	57.20	111.31	0 00:23:54
29	Sub-MHA3	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	13.7350	56.83	163.28	0 00:38:40
30	Sub-MHB	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	12.3320	58.22	169.65	0 00:28:09
31	Sub-MHC	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	14.7750	55.80	399.40	0 00:50:40
32	Sub-MHD	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	25.3070	45.62	324.20	0 00:42:26
33	Sub-MHE	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	16.7370	53.95	179.19	0 00:31:46
34	Sub-PUMPS	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	71.75	18.38	0 00:02:47
35	Sub-VSP-BLDGS	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	71.71	327.06	0 00:05:12
36	Sub-VSP-EXP-BLDGS	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	71.73	109.61	0 00:03:41
37	Sub-VSP-EXP-PARKING	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.15	258.30	0 00:04:45
38	Sub-VSP-PARKING	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.13	597.50	0 00:06:26

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Date: 29/05/2014

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Canadian Tire - Barrhaven, Ontario
Dynamic Ponding Depths - Proposed Conditions

Storage Node ID	Rim Elev. (m)	Ponding Depth (m) - 3-hour Chicago Storm						
		2-year	5-year	10-year	25-year	50-year	100-year	100-year +20%
CB1	99.27	0.04	0.19	0.38	0.46	0.51	0.55	0.62
CB14	100.14	0.00	0.00	0.00	0.00	0.03	0.07	0.11
CB3	99.96	0.00	0.00	0.00	0.05	0.09	0.12	0.17
CBMH10	99.52	0.00	0.00	0.12	0.18	0.22	0.26	0.31
CBMH101	99.91	0.00	0.00	0.00	0.00	0.03	0.10	0.14
CBMH102	99.99	0.00	0.00	0.00	0.00	0.00	0.02	0.07
CBMH103	99.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBMH104	100.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBMH11	99.55	0.00	0.00	0.09	0.15	0.19	0.23	0.28
CBMH12	99.52	0.00	0.00	0.11	0.18	0.22	0.25	0.31
CBMH13	99.51	0.00	0.00	0.12	0.19	0.23	0.26	0.32
CBMH15	100.14	0.00	0.00	0.00	0.00	0.00	0.00	0.03
CBMH6	99.70	0.00	0.00	0.00	0.01	0.06	0.15	0.24
GB-CB1	99.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GB-CB2	100.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GB-CB3	99.83	0.00	0.00	0.00	0.00	0.00	0.02	0.11
GB-CB4	100.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Storage Node ID	Rim Elev. (m)	Ponding Depth (m) - 24-hour Chicago Storm						
		2-year	5-year	10-year	25-year	50-year	100-year	100-year +20%
CB1	99.27	0.00	0.10	0.35	0.45	0.50	0.55	0.63
CB14	100.14	0.00	0.00	0.00	0.00	0.00	0.07	0.11
CB3	99.96	0.00	0.00	0.00	0.01	0.05	0.12	0.17
CBMH10	99.52	0.00	0.00	0.11	0.19	0.22	0.26	0.32
CBMH101	99.91	0.00	0.00	0.00	0.00	0.00	0.10	0.14
CBMH102	99.99	0.00	0.00	0.00	0.00	0.00	0.02	0.06
CBMH103	99.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBMH104	100.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CBMH11	99.55	0.00	0.00	0.08	0.16	0.19	0.23	0.29
CBMH12	99.52	0.00	0.00	0.11	0.18	0.22	0.25	0.32
CBMH13	99.51	0.00	0.00	0.11	0.19	0.23	0.26	0.33
CBMH15	100.14	0.00	0.00	0.00	0.00	0.00	0.00	0.03
CBMH6	99.70	0.00	0.00	0.00	0.06	0.12	0.15	0.23
GB-CB1	99.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GB-CB2	100.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GB-CB3	99.83	0.00	0.00	0.00	0.00	0.00	0.02	0.10
GB-CB4	100.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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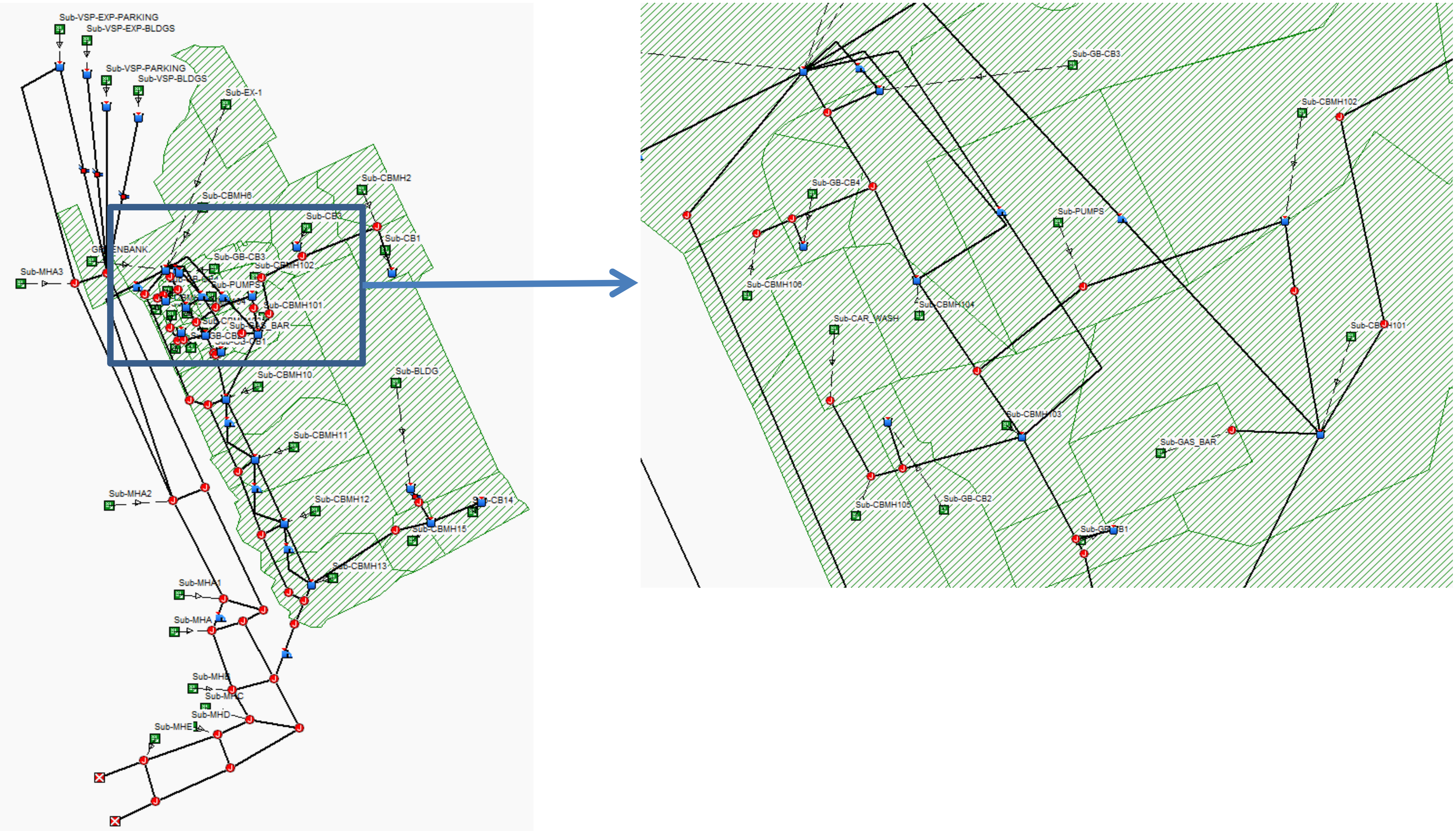
Date: 29/05/2014

Canadian Tire - Barrhaven, Ontario
Dynamic Ponding Depths - Proposed Conditions

Storage Node ID	Rim Elev. (m)	Ponding Depth (m)- Historical Storms			
		July 19th, 2013	July 1st, 1979	August 4th, 1988	August 8th, 1996
CB1	99.27	0.33	0.60	0.52	0.39
CB14	100.14	0.00	0.04	0.07	0.00
CB3	99.96	0.00	0.10	0.11	0.00
CBMH10	99.52	0.10	0.32	0.27	0.15
CBMH101	99.91	0.00	0.06	0.11	0.00
CBMH102	99.99	0.00	0.00	0.03	0.00
CBMH103	99.92	0.00	0.00	0.00	0.00
CBMH104	100.01	0.00	0.00	0.00	0.00
CBMH11	99.55	0.07	0.29	0.24	0.12
CBMH12	99.52	0.10	0.32	0.27	0.15
CBMH13	99.51	0.08	0.33	0.28	0.16
CBMH15	100.14	0.00	0.00	0.01	0.00
CBMH6	99.70	0.00	0.18	0.21	0.00
GB-CB1	99.88	0.00	0.00	0.00	0.00
GB-CB2	100.08	0.00	0.00	0.00	0.00
GB-CB3	99.83	0.00	0.05	0.08	0.00
GB-CB4	100.07	0.00	0.00	0.00	0.00

Canadian Tire - Barrhaven
SSA Model Schematic - Proposed Conditions
Subcatchments



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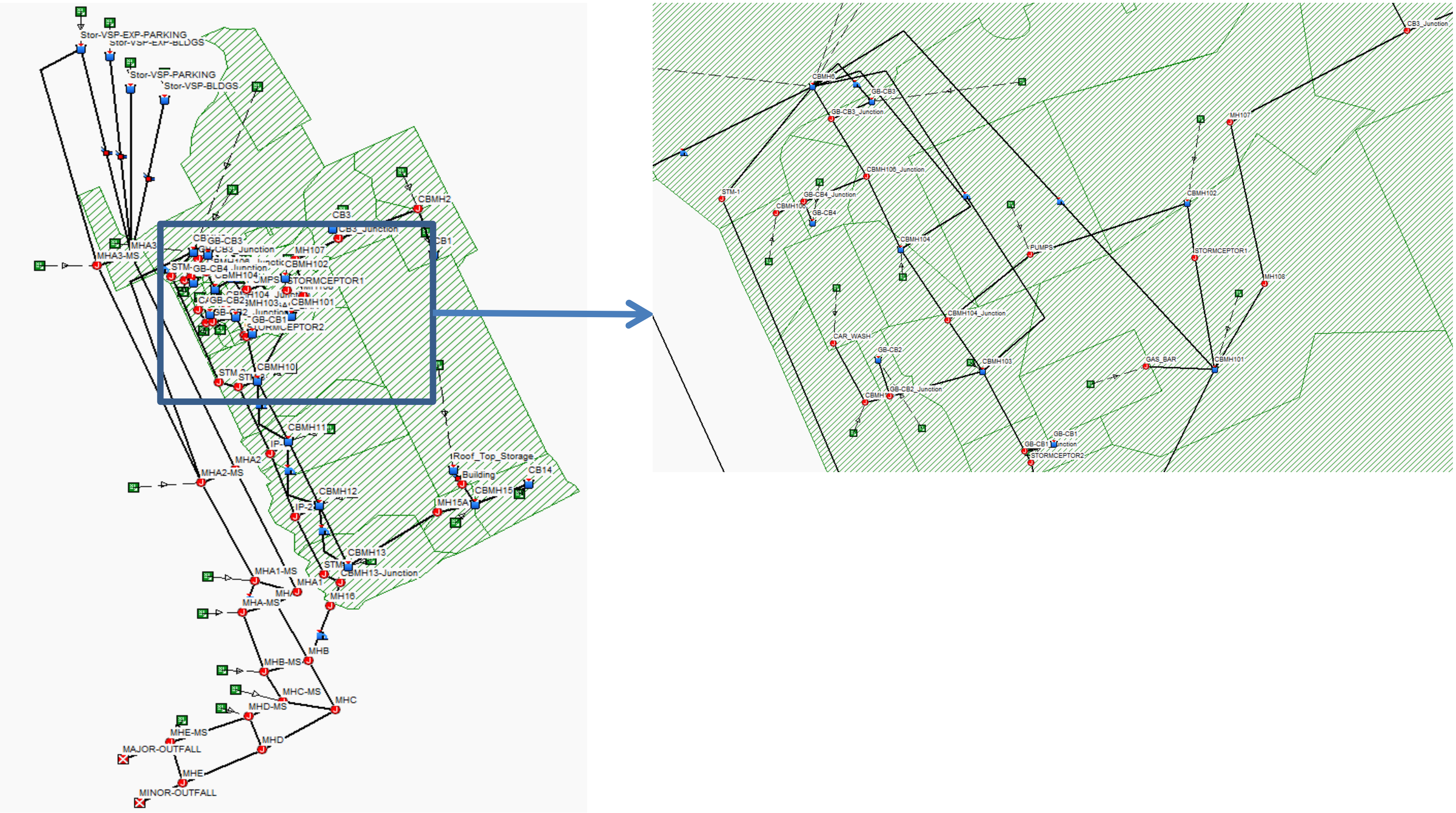
Canadian Tire - Barrhaven
SSA Model Schematic - Proposed Conditions
Nodes



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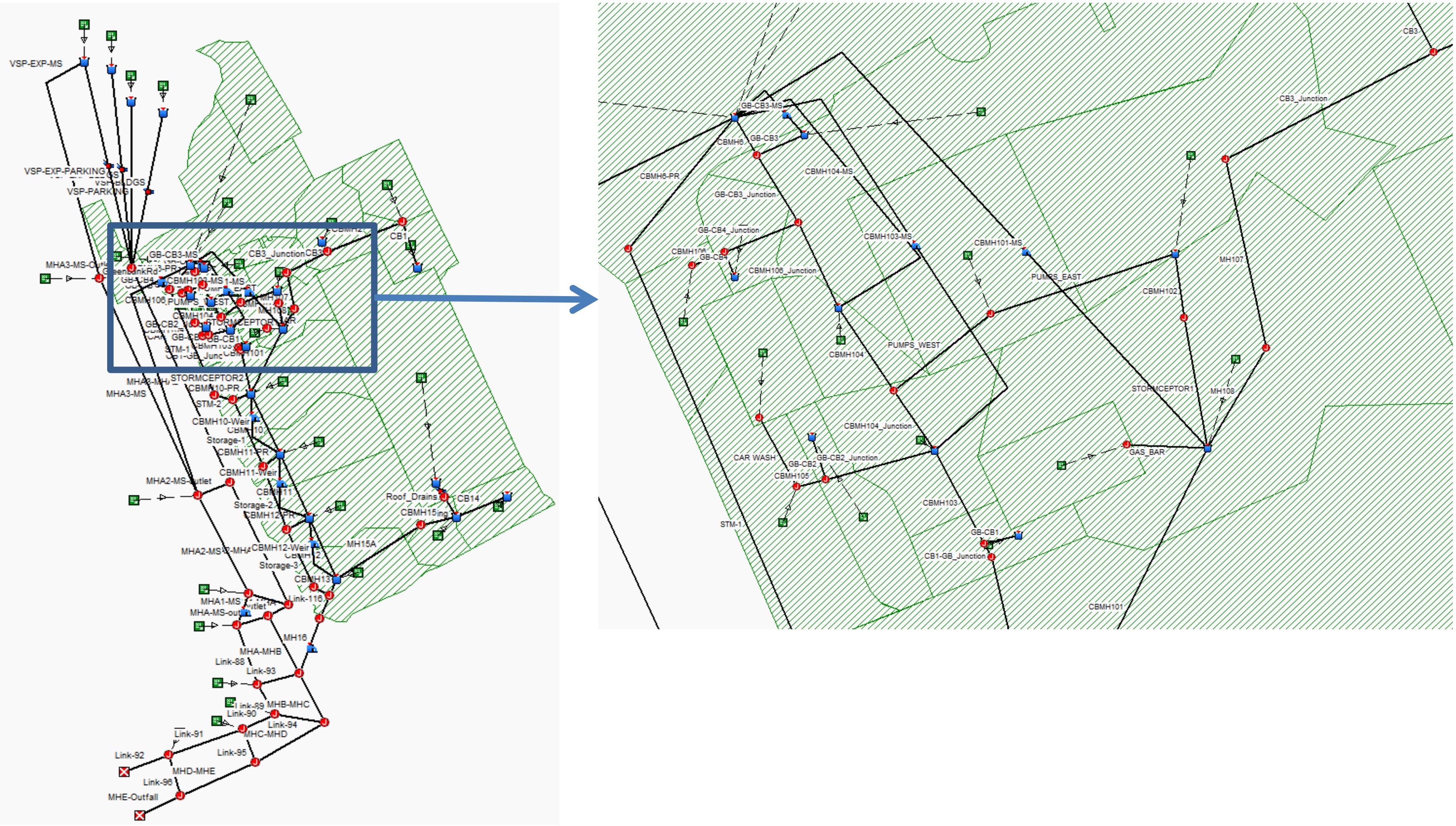
Canadian Tire - Barrhaven
SSA Model Schematic - Proposed Conditions
Links



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Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Pipes

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SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset
					(m)	(m)	(m)	(m)	(m)
1	Building		Building	CBMH15	10.30	97.55	0.00	97.45	0.00
2	CAR WASH		CAR_WASH	CBMH105	8.00	97.98	0.00	97.90	0.00
3	CB1		CB1	CBMH2	27.92	98.14	0.00	98.08	0.03
4	CB14		CB14	CBMH15	30.20	97.75	0.00	97.45	0.00
5	CB1-GB_Junction		GB-CB1_Junction	STORMCEPTOR2	2.42	97.64	0.00	97.64	0.00
6	CB3		CB3	CB3_Junction	6.44	97.96	0.00	97.90	0.00
7	CB3_Junction		CB3_Junction	MH107	26.64	97.90	0.00	97.80	0.04
8	CBMH10		CBMH10	CBMH11	36.49	97.50	0.00	97.35	0.01
9	CBMH101		CBMH101	CBMH10	38.53	97.68	0.00	97.60	0.10
10	CBMH102		CBMH102	STORMCEPTOR1	12.32	97.89	0.00	97.86	0.03
11	CBMH103		CBMH103	GB-CB1_Junction	12.86	97.62	0.00	97.64	0.00
12	CBMH104		CBMH104	CBMH104_Junction	14.67	97.69	0.00	97.65	0.00
13	CBMH104_Junction		CBMH104_Junction	CBMH103	7.00	97.65	0.00	97.63	0.01
14	CBMH105		CBMH105	GB-CB2_Junction	3.00	97.90	0.00	97.84	0.00
15	CBMH106		CBMH106	GB-CB4_Junction	3.11	98.04	0.00	97.94	0.00
16	CBMH106_Junction		CBMH106_Junction	CBMH104	6.44	97.70	0.00	97.66	-0.03
17	CBMH10-PR		CBMH10	STM-3	4.40	97.62	0.12	97.60	0.00
18	CBMH11		CBMH11	CBMH12	38.60	97.34	0.00	97.19	0.00
19	CBMH11-PR		CBMH11	IP-1	4.50	97.55	0.21	97.53	0.00
20	CBMH12		CBMH12	CBMH13	36.67	97.19	0.00	97.05	0.00
21	CBMH12-PR		CBMH12	IP-2	4.90	97.47	0.28	97.45	0.00
22	CBMH13		CBMH13	CBMH13-Junction	2.60	97.07	0.02	97.06	0.00
23	CBMH15		CBMH15	MH15A	21.60	97.45	0.00	97.34	0.01
24	CBMH2		CBMH2	CB3_Junction	43.34	98.05	0.00	97.90	0.00
25	CBMH6		CBMH6	GB-CB3_Junction	5.41	97.78	0.00	97.74	0.00
26	CBMH6-PR		CBMH6	STM-1	20.90	97.78	0.00	97.74	0.00
27	GAS_BAR		GAS_BAR	CBMH101	6.90	97.75	0.00	97.68	0.00
28	GB-CB1		GB-CB1	GB-CB1_Junction	4.13	97.68	0.00	97.64	0.00
29	GB-CB2		GB-CB2	GB-CB2_Junction	4.80	97.89	0.00	97.84	0.00
30	GB-CB2_Junction		GB-CB2_Junction	CBMH103	11.10	97.84	0.00	97.62	0.00
31	GB-CB3		GB-CB3	GB-CB3_Junction	5.30	97.87	0.00	97.82	0.08
32	GB-CB3_Junction		GB-CB3_Junction	CBMH106_Junction	7.73	97.76	0.02	97.70	0.00
33	GB-CB4		GB-CB4	GB-CB4_Junction	1.45	97.95	0.00	97.94	0.00
34	GB-CB4_Junction		GB-CB4_Junction	CBMH106_Junction	7.41	97.94	0.00	97.70	0.00
35	Link-116		CBMH13-Junction	MH16	13.90	97.06	0.00	96.99	0.00
36	Link-93		MHB-MS	MHB	10.00	97.70	0.00	97.60	1.18
37	Link-94		MHC-MS	MHC	10.00	97.60	0.00	97.50	1.58
38	Link-95		MHD-MS	MHD	10.00	95.40	0.00	95.30	1.00
39	Link-96		MHE-MS	MHE	10.00	95.05	0.00	94.95	2.15

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Date: 29/05/2014

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Pipes

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	Length (m)	Inlet Invert Elevation (m)	Inlet Invert Offset (m)	Outlet Invert Elevation (m)	Outlet Invert Offset (m)
40	MH107		MH107	MH108	21.63	97.76	0.00	97.69	0.04
41	MH108		MH108	CBMH101	13.56	97.65	0.00	97.69	0.01
42	MH15A		MH15A	CBMH13	51.23	97.33	0.00	97.06	0.01
43	MHA1-MHA		MHA1	MHA	25.00	97.72	0.00	97.12	0.00
44	MHA1-MS-outlet		MHA1-MS	MHA1	10.00	98.00	0.00	97.90	0.18
45	MHA2-MHA1		MHA2	MHA1	72.00	97.82	0.00	97.72	0.00
46	MHA2-MS-outlet		MHA2-MS	MHA2	10.00	98.40	0.00	98.30	0.48
47	MHA3-MHA2		MHA3	MHA2	105.00	97.97	0.00	97.82	0.00
48	MHA3-MS-Outlet		MHA3-MS	MHA3	10.00	100.03	0.00	99.93	1.96
49	MHA-MHB		MHA	MHB	79.70	97.12	0.00	96.42	0.00
50	MHA-MS-outlet		MHA-MS	MHA	10.00	98.00	0.00	97.90	0.78
51	MHB-MHC		MHB	MHC	45.50	96.42	0.00	96.05	0.13
52	MHC-MHD		MHC	MHD	102.60	95.92	0.00	94.32	0.02
53	MHD-MHE		MHD	MHE	83.20	94.30	0.00	92.80	0.00
54	MHE-Outfall		MHE	MINOR-OUTFALL	5.00	92.80	0.00	92.71	0.00
55	PUMPS_EAST		PUMPS	CBMH102	14.80	98.26	0.57	97.89	0.00
56	PUMPS_WEST		PUMPS	CBMH104_Junction	4.50	97.69	0.00	97.65	0.00
57	STM-1		STM-1	STM-2	54.90	97.74	0.00	97.63	0.00
58	STM-2		STM-2	STM-3	16.90	97.63	0.00	97.60	0.00
59	STM-4		STM-4	CBMH13-Junction	3.60	97.08	0.00	97.06	0.00
60	Storage-1		STM-3	IP-1	36.49	97.60	0.00	97.53	0.00
61	Storage-2		IP-1	IP-2	38.60	97.53	0.00	97.45	0.00
62	Storage-3		IP-2	STM-4	36.67	97.45	0.00	97.38	0.30
63	STORMCEPTOR1		STORMCEPTOR1	CBMH101	9.80	97.83	0.00	97.68	0.00
64	STORMCEPTOR2		STORMCEPTOR2	CBMH10	22.52	97.64	0.00	97.54	0.04
65	VSP-PARKING		Stor-VSP-PARKING	MHA3	25.00	99.17	0.00	98.98	1.01

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Pipes

SN	Element ID	Total Drop (m)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (mm)	Pipe Width (mm)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses
1	Building	0.10	0.9700	CIRCULAR	300.000	300.00	0.0130	0.5000	0.8000	0.0000
2	CAR WASH	0.08	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
3	CB1	0.06	0.2100	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
4	CB14	0.30	0.9900	CIRCULAR	250.000	250.00	0.0130	0.5000	0.5000	0.0000
5	CB1-GB_Junction	0.00	0.0000	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
6	CB3	0.06	0.9300	CIRCULAR	250.000	250.00	0.0130	0.5000	0.8000	0.0000
7	CB3_Junction	0.10	0.3800	CIRCULAR	300.000	300.00	0.0130	0.5000	0.8000	0.0000
8	CBMH10	0.15	0.4100	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
9	CBMH101	0.08	0.2100	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
10	CBMH102	0.03	0.2400	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
11	CBMH103	-0.02	-0.1600	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
12	CBMH104	0.04	0.2700	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
13	CBMH104_Junction	0.02	0.2900	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
14	CBMH105	0.06	2.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
15	CBMH106	0.10	3.2200	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
16	CBMH106_Junction	0.04	0.6200	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
17	CBMH10-PR	0.02	0.4500	CIRCULAR	600.000	600.00	0.0130	0.5000	0.8000	0.0000
18	CBMH11	0.15	0.3900	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
19	CBMH11-PR	0.02	0.4400	CIRCULAR	300.000	300.00	0.0130	0.5000	0.7000	0.0000
20	CBMH12	0.14	0.3800	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
21	CBMH12-PR	0.02	0.4100	CIRCULAR	300.000	300.00	0.0130	0.5000	0.7000	0.0000
22	CBMH13	0.01	0.3800	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
23	CBMH15	0.11	0.5100	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
24	CBMH2	0.15	0.3500	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
25	CBMH6	0.04	0.7400	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
26	CBMH6-PR	0.04	0.1900	CIRCULAR	600.000	600.00	0.0130	0.5000	0.6000	0.0000
27	GAS_BAR	0.07	1.0100	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
28	GB-CB1	0.04	0.9700	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
29	GB-CB2	0.05	1.0400	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
30	GB-CB2_Junction	0.22	1.9800	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
31	GB-CB3	0.05	0.9400	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
32	GB-CB3_Junction	0.06	0.7800	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
33	GB-CB4	0.01	0.6900	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
34	GB-CB4_Junction	0.24	3.2400	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
35	Link-116	0.07	0.5000	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
36	Link-93	0.10	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
37	Link-94	0.10	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
38	Link-95	0.10	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
39	Link-96	0.10	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000

Prepared by Novatech Engineering Consultants Ltd.
Date: 29/05/2014

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Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Pipes

SN	Element ID	Total Drop (m)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (mm)	Pipe Width (mm)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses
40	MH107	0.07	0.3200	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
41	MH108	-0.04	-0.2900	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
42	MH15A	0.27	0.5300	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
43	MHA1-MHA	0.60	2.4000	CIRCULAR	600.000	600.00	0.0130	0.5000	0.8000	0.0000
44	MHA1-MS-outlet	0.10	1.0000	CIRCULAR	250.000	250.00	0.0130	0.5000	0.8000	0.0000
45	MHA2-MHA1	0.10	0.1400	CIRCULAR	600.000	600.00	0.0130	0.5000	0.8000	0.0000
46	MHA2-MS-outlet	0.10	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
47	MHA3-MHA2	0.15	0.1400	CIRCULAR	600.000	600.00	0.0130	0.5000	0.5000	0.0000
48	MHA3-MS-Outlet	0.10	1.0000	CIRCULAR	200.000	200.00	0.0130	0.5000	0.8000	0.0000
49	MHA-MHB	0.70	0.8800	CIRCULAR	600.000	600.00	0.0130	0.5000	0.5000	0.0000
50	MHA-MS-outlet	0.10	1.0000	CIRCULAR	250.000	250.00	0.0130	0.5000	0.8000	0.0000
51	MHB-MHC	0.37	0.8100	CIRCULAR	600.000	600.00	0.0130	0.5000	0.8000	0.0000
52	MHC-MHD	1.60	1.5600	CIRCULAR	600.000	600.00	0.0130	0.5000	0.5000	0.0000
53	MHD-MHE	1.50	1.8000	CIRCULAR	600.000	600.00	0.0130	0.5000	0.5000	0.0000
54	MHE-Outfall	0.09	1.8000	CIRCULAR	600.000	600.00	0.0130	0.5000	0.5000	0.0000
55	PUMPS_EAST	0.37	2.5000	CIRCULAR	150.000	150.00	0.0130	0.5000	0.8000	0.0000
56	PUMPS_WEST	0.04	0.8900	CIRCULAR	150.000	150.00	0.0130	0.5000	0.8000	0.0000
57	STM-1	0.11	0.2000	CIRCULAR	600.000	600.00	0.0130	0.5000	0.6000	0.0000
58	STM-2	0.03	0.1800	CIRCULAR	600.000	600.00	0.0130	0.5000	0.8000	0.0000
59	STM-4	0.02	0.5600	CIRCULAR	300.000	300.00	0.0130	0.5000	0.7000	0.0000
60	Storage-1	0.07	0.1900	Rectangular	1750.000	1270.00	0.0130	0.5000	0.5000	0.0000
61	Storage-2	0.08	0.2100	Rectangular	1750.000	1270.00	0.0130	0.5000	0.5000	0.0000
62	Storage-3	0.07	0.1900	Rectangular	1750.000	1270.00	0.0130	0.5000	0.6000	0.0000
63	STORMCEPTOR1	0.15	1.5300	CIRCULAR	300.000	300.00	0.0130	0.5000	0.6000	0.0000
64	STORMCEPTOR2	0.10	0.4400	CIRCULAR	300.000	300.00	0.0130	0.5000	0.5000	0.0000
65	VSP-PARKING	0.19	0.7600	CIRCULAR	530.000	530.00	0.0130	0.5000	0.8000	0.0000

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Pipes

SN	Element ID	Initial Flow (lps)	Flap Gate	Lengthening Factor	Peak Flow (lps)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (m/sec)	Travel Time (min)	Design Flow Capacity (lps)	Max Flow / Design Flow Ratio
1	Building	0.00	NO	1.00	10.450	0 03:09	0.68	0.25	95.29	0.11
2	CAR WASH	0.00	NO	1.00	6.160	0 01:11	0.54	0.25	32.80	0.19
3	CB1	0.00	NO	1.00	38.960	0 01:18	1.24	0.38	15.21	2.56
4	CB14	0.00	NO	1.00	54.370	0 01:16	1.11	0.45	59.27	0.92
5	CB1-GB_Junction	0.00	NO	1.00	62.590	0 01:17	0.89	0.05	10.85	5.77
6	CB3	0.00	NO	1.00	66.200	0 01:12	1.35	0.08	57.40	1.15
7	CB3_Junction	0.00	NO	1.00	87.320	0 01:12	1.24	0.36	59.25	1.47
8	CBMH10	0.00	NO	1.00	38.960	0 01:18	0.78	0.78	62.00	0.63
9	CBMH101	0.00	NO	1.00	123.240	0 01:14	1.74	0.37	44.07	2.80
10	CBMH102	0.00	NO	1.00	23.130	0 01:19	0.49	0.42	47.72	0.48
11	CBMH103	0.00	NO	1.00	62.880	0 01:17	0.89	0.24	38.14	1.65
12	CBMH104	0.00	NO	1.00	27.210	0 01:18	0.42	0.58	50.50	0.54
13	CBMH104_Junction	0.00	NO	1.00	52.580	0 01:16	0.74	0.16	51.69	1.02
14	CBMH105	0.00	NO	1.00	10.550	0 01:19	0.48	0.10	46.39	0.23
15	CBMH106	0.00	NO	1.00	6.610	0 01:11	0.31	0.17	58.82	0.11
16	CBMH106_Junction	0.00	NO	1.00	30.290	0 01:18	0.44	0.24	38.11	0.79
17	CBMH10-PR	0.00	NO	1.00	346.910	0 01:17	1.23	0.06	413.99	0.84
18	CBMH11	0.00	NO	1.00	42.640	0 01:18	0.74	0.87	60.28	0.71
19	CBMH11-PR	0.00	NO	1.00	104.400	0 01:17	1.48	0.05	64.47	1.62
20	CBMH12	0.00	NO	1.00	41.170	0 00:46	0.61	1.00	59.75	0.69
21	CBMH12-PR	0.00	NO	1.00	125.400	0 01:17	1.77	0.05	61.78	2.03
22	CBMH13	0.00	YES	1.00	131.360	0 01:17	1.86	0.02	59.97	2.19
23	CBMH15	0.00	NO	1.00	79.110	0 01:16	1.12	0.32	69.01	1.15
24	CBMH2	0.00	NO	1.00	43.600	0 01:11	0.62	1.17	56.89	0.77
25	CBMH6	0.00	NO	1.00	20.920	0 01:03	0.50	0.18	83.15	0.25
26	CBMH6-PR	0.00	NO	1.00	323.250	0 01:17	1.14	0.31	268.63	1.20
27	GAS_BAR	0.00	NO	1.00	6.540	0 01:18	0.37	0.31	33.04	0.20
28	GB-CB1	0.00	NO	1.00	6.770	0 01:18	0.22	0.31	32.28	0.21
29	GB-CB2	0.00	NO	1.00	6.470	0 01:11	0.40	0.20	33.48	0.19
30	GB-CB2_Junction	0.00	NO	1.00	15.700	0 01:19	0.50	0.37	46.18	0.34
31	GB-CB3	0.00	NO	1.00	25.220	0 01:13	0.80	0.11	31.86	0.79
32	GB-CB3_Junction	0.00	NO	1.00	31.000	0 01:12	0.56	0.23	85.20	0.36
33	GB-CB4	0.00	NO	1.00	5.760	0 01:12	0.47	0.05	27.24	0.21
34	GB-CB4_Junction	0.00	NO	1.00	10.260	0 01:11	0.33	0.37	59.03	0.17
35	Link-116	0.00	YES	1.00	132.600	0 01:56	1.88	0.12	68.63	1.93
36	Link-93	0.00	NO	1.00	139.260	0 01:46	2.22	0.08	65.60	2.12
37	Link-94	0.00	NO	1.00	180.730	0 01:14	2.88	0.06	65.60	2.76
38	Link-95	0.00	NO	1.00	180.510	0 01:13	2.87	0.06	65.60	2.75
39	Link-96	0.00	NO	1.00	182.970	0 01:23	2.91	0.06	65.60	2.79

Prepared by Novatech Engineering Consultants Ltd.
Date: 29/05/2014

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Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Pipes

SN	Element ID	Initial Flow (lps)	Flap Gate	Lengthening Factor	Peak Flow (lps)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (m/sec)	Travel Time (min)	Design Flow Capacity (lps)	Max Flow / Design Flow Ratio
40	MH107	0.00	NO	1.00	87.300	0 01:12	1.24	0.29	55.01	1.59
41	MH108	0.00	NO	1.00	87.270	0 01:12	1.23	0.18	52.52	1.66
42	MH15A	0.00	NO	1.00	79.070	0 01:16	1.12	0.76	70.21	1.13
43	MHA1-MHA	0.00	NO	1.00	529.100	0 01:13	1.94	0.21	951.28	0.56
44	MHA1-MS-outlet	0.00	NO	1.00	158.770	0 01:46	1.62	0.10	118.94	1.33
45	MHA2-MHA1	0.00	NO	1.00	510.100	0 01:12	1.81	0.66	228.84	2.23
46	MHA2-MS-outlet	0.00	NO	1.00	84.350	0 01:12	1.34	0.12	65.60	1.29
47	MHA3-MHA2	0.00	NO	1.00	427.120	0 01:12	1.51	1.16	232.09	1.84
48	MHA3-MS-Outlet	0.00	NO	1.00	91.640	0 01:13	1.48	0.11	65.60	1.40
49	MHA-MHB	0.00	NO	1.00	662.250	0 01:13	2.34	0.57	575.47	1.15
50	MHA-MS-outlet	0.00	NO	1.00	176.760	0 01:13	1.80	0.09	118.94	1.49
51	MHB-MHC	0.00	NO	1.00	741.510	0 01:14	2.62	0.29	553.73	1.34
52	MHC-MHD	0.00	NO	1.00	744.010	0 01:22	2.67	0.64	766.81	0.97
53	MHD-MHE	0.00	NO	1.00	868.170	0 01:43	3.07	0.45	824.49	1.05
54	MHE-Outfall	0.00	NO	1.00	1047.070	0 01:23	3.70	0.02	823.83	1.27
55	PUMPS_EAST	0.00	NO	1.00	15.880	0 01:11	0.90	0.27	24.08	0.66
56	PUMPS_WEST	0.00	NO	1.00	30.740	0 01:13	1.74	0.04	14.36	2.14
57	STM-1	0.00	NO	1.00	323.490	0 01:17	1.14	0.80	274.86	1.18
58	STM-2	0.00	NO	1.00	323.520	0 01:17	1.14	0.25	258.71	1.25
59	STM-4	0.00	NO	1.00	97.230	0 01:14	1.38	0.04	72.08	1.35
60	Storage-1	0.00	NO	1.00	512.920	0 01:17	0.34	1.79	7645.71	0.07
61	Storage-2	0.00	NO	1.00	289.910	0 01:17	0.28	2.30	7947.07	0.04
62	Storage-3	0.00	NO	1.00	106.810	0 01:13	0.18	3.40	7626.92	0.01
63	STORMCEPTOR1	0.00	NO	1.00	23.180	0 01:18	0.33	0.49	119.64	0.19
64	STORMCEPTOR2	0.00	NO	1.00	62.130	0 01:17	0.88	0.43	64.44	0.96
65	VSP-PARKING	0.00	NO	1.00	457.220	0 01:13	2.11	0.20	374.94	1.22

Pipes

SN	Element ID	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (m)	Froude Number	Reported Condition
1	Building	1.00	285.00	0.30	0.74	SURCHARGED
2	CAR WASH	1.00	245.00	0.20	0.05	SURCHARGED
3	CB1	1.00	233.00	0.20	0.07	SURCHARGED
4	CB14	1.00	264.00	0.25	0.02	SURCHARGED
5	CB1-GB_Junction	1.00	273.00	0.30	0.10	SURCHARGED
6	CB3	1.00	246.00	0.25	0.05	SURCHARGED
7	CB3_Junction	1.00	247.00	0.30	0.11	SURCHARGED
8	CBMH10	1.00	295.00	0.30	0.28	SURCHARGED
9	CBMH101	1.00	270.00	0.30	0.12	SURCHARGED
10	CBMH102	1.00	245.00	0.30	0.06	SURCHARGED
11	CBMH103	1.00	274.00	0.30	0.02	SURCHARGED
12	CBMH104	1.00	268.00	0.30	0.16	SURCHARGED
13	CBMH104_Junction	1.00	274.00	0.30	0.02	SURCHARGED
14	CBMH105	1.00	253.00	0.20	0.04	SURCHARGED
15	CBMH106	1.00	239.00	0.20	0.00	SURCHARGED
16	CBMH106_Junction	1.00	267.00	0.30	0.14	SURCHARGED
17	CBMH10-PR	1.00	240.00	0.60	0.03	SURCHARGED
18	CBMH11	1.00	324.00	0.30	0.24	SURCHARGED
19	CBMH11-PR	1.00	285.00	0.30	0.02	SURCHARGED
20	CBMH12	1.00	345.00	0.30	0.01	SURCHARGED
21	CBMH12-PR	1.00	296.00	0.30	0.02	SURCHARGED
22	CBMH13	1.00	352.00	0.30	0.53	SURCHARGED
23	CBMH15	1.00	300.00	0.30	0.71	SURCHARGED
24	CBMH2	1.00	232.00	0.30	0.05	SURCHARGED
25	CBMH6	1.00	256.00	0.30	0.02	SURCHARGED
26	CBMH6-PR	1.00	228.00	0.60	0.09	SURCHARGED
27	GAS_BAR	1.00	276.00	0.20	0.01	SURCHARGED
28	GB-CB1	1.00	284.00	0.20	0.00	SURCHARGED
29	GB-CB2	1.00	254.00	0.20	0.03	SURCHARGED
30	GB-CB2_Junction	1.00	260.00	0.20	0.00	SURCHARGED
31	GB-CB3	1.00	257.00	0.20	0.13	SURCHARGED
32	GB-CB3_Junction	1.00	258.00	0.30	0.16	SURCHARGED
33	GB-CB4	1.00	248.00	0.20	0.04	SURCHARGED
34	GB-CB4_Junction	1.00	249.00	0.20	0.00	SURCHARGED
35	Link-116	1.00	352.00	0.30	0.67	SURCHARGED
36	Link-93	1.00	34.00	0.20	0.44	SURCHARGED
37	Link-94	1.00	35.00	0.20	0.77	SURCHARGED
38	Link-95	1.00	39.00	0.20	0.47	SURCHARGED
39	Link-96	1.00	30.00	0.20	0.43	SURCHARGED

Pipes

SN	Element ID	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (m)	Froude Number	Reported Condition
40	MH107	1.00	263.00	0.30	0.09	SURCHARGED
41	MH108	1.00	270.00	0.30	0.01	SURCHARGED
42	MH15A	1.00	318.00	0.30	0.45	SURCHARGED
43	MHA1-MHA	1.00	35.00	0.60	1.44	SURCHARGED
44	MHA1-MS-outlet	1.00	36.00	0.25	0.51	SURCHARGED
45	MHA2-MHA1	1.00	35.00	0.60	0.63	SURCHARGED
46	MHA2-MS-outlet	1.00	36.00	0.20	0.41	SURCHARGED
47	MHA3-MHA2	1.00	37.00	0.60	0.39	SURCHARGED
48	MHA3-MS-Outlet	1.00	21.00	0.20	0.69	SURCHARGED
49	MHA-MHB	1.00	39.00	0.60	0.72	SURCHARGED
50	MHA-MS-outlet	1.00	35.00	0.25	0.68	SURCHARGED
51	MHB-MHC	1.00	39.00	0.60	1.12	SURCHARGED
52	MHC-MHD	1.00	40.00	0.60	1.58	SURCHARGED
53	MHD-MHE	1.00	43.00	0.60	1.46	SURCHARGED
54	MHE-Outfall	1.00	37.00	0.60	1.47	SURCHARGED
55	PUMPS_EAST	1.00	226.00	0.15	0.00	SURCHARGED
56	PUMPS_WEST	1.00	297.00	0.15	0.02	SURCHARGED
57	STM-1	1.00	230.00	0.60	0.06	SURCHARGED
58	STM-2	1.00	239.00	0.60	0.10	SURCHARGED
59	STM-4	1.00	352.00	0.30	0.00	SURCHARGED
60	Storage-1	1.00	159.00	1.75	0.06	SURCHARGED
61	Storage-2	1.00	161.00	1.75	0.04	SURCHARGED
62	Storage-3	1.00	165.00	1.75	0.11	SURCHARGED
63	STORMCEPTOR1	1.00	251.00	0.30	0.01	SURCHARGED
64	STORMCEPTOR2	1.00	273.00	0.30	0.24	SURCHARGED
65	VSP-PARKING	1.00	30.00	0.52	0.55	SURCHARGED

Channels

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop
					(m)	(m)	(m)	(m)	(m)	(m)
1	CBMH104-MS		CBMH104	CBMH6	30.00	100.01	2.32	99.70	1.92	0.31
2	Link-88		MHA-MS	MHB-MS	79.70	99.40	1.40	99.10	1.40	0.30
3	Link-89		MHB-MS	MHC-MS	45.50	99.10	1.40	99.00	1.40	0.10
4	Link-90		MHC-MS	MHD-MS	102.60	99.00	1.40	96.80	1.40	2.20
5	Link-91		MHD-MS	MHE-MS	83.20	96.80	1.40	96.45	1.40	0.35
6	Link-92		MHE-MS	MAJOR-OUTFALL	5.00	96.45	1.40	96.40	0.00	0.05
7	MHA2-MS		MHA2-MS	MHA1-MS	72.00	99.80	1.40	99.40	1.40	0.40
8	MHA3-MS		MHA3-MS	MHA2-MS	105.00	100.43	0.40	99.80	1.40	0.63
9	VSP-EXP-MS		Stor-VSP-EXP-PARKING	MHA3-MS	100.00	101.03	-0.47	100.43	0.40	0.60

Channels

SN	Element ID	Average Slope (%)	Channel Type	Channel Height (m)	Channel Width (m)	Left Overbank Manning's Roughness	Channel Manning's Roughness	Right Overbank Manning's Roughness	Entrance Losses
1	CBMH104-MS	1.0300	Rectangular	0.150	5.00	0.0000	0.0130	0.0000	0.0000
2	Link-88	0.3800	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
3	Link-89	0.2200	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
4	Link-90	2.1400	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
5	Link-91	0.4200	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
6	Link-92	1.0000	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
7	MHA2-MS	0.5600	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
8	MHA3-MS	0.6000	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000
9	VSP-EXP-MS	0.6000	Rectangular	0.150	20.00	0.0000	0.0130	0.0000	0.0000

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Channels

SN	Element ID	Exit/Bend Losses	Additional Losses	Initial Flow (lps)	Flap Gate	Lengthening Factor	Peak Flow (lps)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (m/sec)
1	CBMH104-MS	0.0000	0.0000	0.00	NO	1.00	0.000	0 00:00	0.00
2	Link-88	0.0000	0.0000	0.00	NO	1.00	683.170	0 01:21	0.61
3	Link-89	0.0000	0.0000	0.00	NO	1.00	666.490	0 01:23	0.60
4	Link-90	0.0000	0.0000	0.00	NO	1.00	767.140	0 01:22	0.87
5	Link-91	0.0000	0.0000	0.00	NO	1.00	799.000	0 01:24	0.73
6	Link-92	0.0000	0.0000	0.00	NO	1.00	703.430	0 01:23	0.89
7	MHA2-MS	0.0000	0.0000	0.00	NO	1.00	474.110	0 01:21	0.29
8	MHA3-MS	0.0000	0.0000	0.00	NO	1.00	362.250	0 01:20	0.54
9	VSP-EXP-MS	0.0000	0.0000	0.00	NO	1.00	257.720	0 01:20	0.57

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Channels

SN	Element ID	Travel Time (min)	Design Flow Capacity (lps)	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (m)	Froude Number	Reported Condition
1	CBMH104-MS		1592.65	0.00	0.50	0.00	0.08	0.00	Calculated
2	Link-88	2.18	3957.79	0.17	0.38	0.00	0.06	0.01	Calculated
3	Link-89	1.26	3024.23	0.22	0.37	0.00	0.06	0.01	Calculated
4	Link-90	1.97	9446.23	0.08	0.29	0.00	0.04	0.01	Calculated
5	Link-91	1.90	4184.01	0.19	0.37	0.00	0.06	0.01	Calculated
6	Link-92	0.09	6450.91	0.11	0.26	0.00	0.04	0.01	Calculated
7	MHA2-MS	4.14	4808.22	0.10	0.62	0.00	0.09	0.00	Calculated
8	MHA3-MS	3.24	4996.85	0.07	0.23	0.00	0.03	0.01	Calculated
9	VSP-EXP-MS	2.92	6672.87	0.04	0.17	0.00	0.03	0.26	Calculated

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Outfalls

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (m)	Boundary Type	Flap Gate	Fixed Water Elevation (m)	Peak Inflow (lps)	Peak Lateral Inflow (lps)	Maximum HGL Depth Attained (m)	Maximum HGL Elevation Attained (m)
1	MAJOR-OUTFALL	363838.47	5014746.14		96.40	NORMAL	NO		703.43	0.00	0.04	96.44
2	MINOR-OUTFALL	363846.42	5014722.00		92.71	NORMAL	NO		1047.07	0.00	0.60	93.31

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Date: 29/05/2014

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Storage Nodes

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (m)	Max (Rim) Elevation (m)	Max (Rim) Offset (m)	Initial Water Elevation (m)	Initial Water Depth (m)	Ponded Area (m^2)	Evaporation Loss
1	CB1	363992.84	5015025.02	Rim_Elev.=99.27	98.14	100.20	2.06	98.14	0.00	0.00	0.00
2	CB14	364039.79	5014898.48	RimElev=100.14	97.75	100.28	2.53	97.75	0.00	0.00	0.00
3	CB3	363942.55	5015039.63	Rim_Elev.=99.96	97.96	100.20	2.24	97.96	0.00	0.00	0.00
4	CBMH10	363905.17	5014955.34	Rim_Elev.=99.52	97.50	99.90	2.40	97.50	0.00	0.00	0.00
5	CBMH101	363922.05	5014991.14	RimElev=99.91	97.68	100.28	2.60	97.68	0.00	0.00	0.00
6	CBMH102	363918.74	5015012.07	RimElev=99.99	97.89	100.10	2.21	97.89	0.00	0.00	0.00
7	CBMH103	363893.95	5014990.86	RimElev=99.92	97.62	100.28	2.66	97.62	0.00	0.00	0.00
8	CBMH104	363884.04	5015006.29	RimElev=100.01	97.69	100.28	2.59	97.69	0.00	0.00	0.00
9	CBMH11	363920.16	5014922.25	Rim_Elev.=99.55	97.34	99.90	2.56	97.34	0.00	0.00	0.00
10	CBMH12	363935.85	5014886.83	Rim_Elev.=99.52	97.19	99.90	2.71	97.19	0.00	0.00	0.00
11	CBMH13	363949.90	5014852.95	Rim_Elev.=99.51	97.05	99.90	2.85	97.05	0.00	0.00	0.00
12	CBMH15	364013.16	5014886.92	RimElev=100.14	97.45	100.28	2.83	97.45	0.00	0.00	0.00
13	CBMH6	363873.37	5015026.81	RimElev=99.70	97.78	100.28	2.50	97.78	0.00	0.00	0.00
14	GB-CB1	363902.61	5014981.67	RimElev=99.88	97.68	99.95	2.27	97.68	0.00	0.00	0.00
15	GB-CB2	363881.26	5014992.34	RimElev=100.08	97.89	100.10	2.21	97.89	0.00	0.00	0.00
16	GB-CB3	363880.48	5015024.91	RimElev=99.83	97.87	100.28	2.41	97.87	0.00	0.00	0.00
17	GB-CB4	363873.35	5015009.56	RimElev=100.07	97.95	100.10	2.15	97.95	0.00	0.00	0.00
18	Roof_Top_Storage	364002.26	5014906.16		110.35	110.50	0.15	110.35	0.00	0.00	0.00
19	Stor-VSP-BLDGS	363858.99	5015110.67		110.00	110.15	0.15	0.00	-110.00	0.00	0.00
20	Stor-VSP-EXP-BLDGS	363831.65	5015134.93		110.00	110.15	0.15	0.00	-110.00	0.00	0.00
21	Stor-VSP-EXP-PARKING	363817.40	5015139.16	RimElev=103.2	101.50	103.50	2.00	101.50	0.00	0.00	0.00
22	Stor-VSP-PARKING	363841.76	5015117.02	RimElev=100.6	99.17	100.90	1.73	99.17	0.00	0.00	0.00

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Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Storage Nodes

SN	Element ID	Peak Inflow (lps)	Peak Lateral Inflow (lps)	Peak Outflow (lps)	Peak Exfiltration Flow Rate (cmm)	Maximum HGL Elevation Attained (m)	Maximum HGL Depth Attained (m)	Average HGL Elevation Attained (m)	Average HGL Depth Attained (m)	Time of Maximum HGL Occurrence (days hh:mm)	Total Exfiltration Volume (1000-m³)	Total Flooded Volume (ha-mm)	Total Time Flooded (minutes)	Total Retention Time (seconds)
1	CB1	97.22	58.73	29.96	0.00	99.82	1.68	98.36	0.22	0 01:58	0.00	0.00	0.00	0.00
2	CB14	66.15	66.15	54.37	0.00	100.21	2.46	98.02	0.27	0 01:21	0.00	0.00	0.00	0.00
3	CB3	79.53	79.53	66.20	0.00	100.08	2.12	98.20	0.24	0 01:22	0.00	0.00	0.00	0.00
4	CBMH10	522.20	162.38	346.91	0.00	99.78	2.28	97.82	0.32	0 01:51	0.00	0.00	0.00	0.00
5	CBMH101	144.87	52.71	123.24	0.00	100.01	2.33	97.97	0.29	0 01:20	0.00	0.00	0.00	0.00
6	CBMH102	30.38	29.41	26.93	0.00	100.01	2.12	98.14	0.25	0 01:20	0.00	0.00	0.00	0.00
7	CBMH103	72.15	11.00	62.88	0.00	99.82	2.20	97.93	0.31	0 01:22	0.00	0.00	0.00	0.00
8	CBMH104	35.42	5.12	27.21	0.00	99.85	2.16	97.97	0.28	0 01:21	0.00	0.00	0.00	0.00
9	CBMH11	240.58	121.82	142.90	0.00	99.78	2.44	97.69	0.35	0 01:51	0.00	0.00	0.00	0.00
10	CBMH12	216.76	158.68	167.18	0.00	99.77	2.58	97.58	0.39	0 01:51	0.00	0.00	0.00	0.00
11	CBMH13	185.64	107.55	160.49	0.00	99.77	2.72	97.52	0.47	0 01:51	0.00	0.00	0.00	0.00
12	CBMH15	97.47	38.95	79.11	0.00	100.12	2.67	97.82	0.37	0 01:20	0.00	0.00	0.00	0.00
13	CBMH6	411.55	339.56	343.88	0.00	99.85	2.07	98.04	0.26	0 01:21	0.00	0.00	0.00	0.00
14	GB-CB1	11.53	4.76	4.40	0.00	99.78	2.10	97.96	0.28	0 01:23	0.00	0.00	0.00	0.00
15	GB-CB2	10.31	5.79	5.70	0.00	99.86	1.97	98.13	0.24	0 01:20	0.00	0.00	0.00	0.00
16	GB-CB3	41.97	33.67	66.40	0.00	99.85	1.98	98.12	0.25	0 01:21	0.00	0.00	0.00	0.00
17	GB-CB4	9.73	4.18	5.17	0.00	99.85	1.90	98.18	0.23	0 01:21	0.00	0.00	0.00	0.00
18	Roof_Top_Storage	389.31	389.31	10.33	0.00	110.41	0.06	110.38	0.03	0 03:10	0.00	0.00	0.00	0.00
19	Stor-VSP-BLDGS	327.06	327.06	8.70	0.00	110.06	0.06	110.03	0.03	0 03:10	0.00	0.00	0.00	0.00
20	Stor-VSP-EXP-BLDGS	109.61	109.61	2.40	0.00	110.06	0.06	110.03	0.03	0 03:10	0.00	0.00	0.00	0.00
21	Stor-VSP-EXP-PARKING	258.30	258.30	258.01	0.00	101.52	0.02	101.50	0.00	0 01:19	0.00	0.00	0.00	0.00
22	Stor-VSP-PARKING	597.46	597.46	457.22	0.00	100.77	1.60	99.20	0.03	0 01:21	0.00	0.00	0.00	0.00

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Date: 29/05/2014

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Junctions

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover
					(m)	(m)	(m)	(m)	(m)	(m)	(m)	(m²)	(mm)
1	Building	364007.28	5014898.03		97.55	110.50	12.95	97.55	0.00	110.50	0.00	0.00	0.00
2	CAR_WASH	363875.86	5014994.35		97.98	102.00	4.02	97.98	0.00	102.00	0.00	0.00	3820.00
3	CB3_Junction	363945.46	5015033.83		97.90	100.19	2.29	97.90	0.00	100.26	0.07	0.00	1990.00
4	CBMH104_Junction	363889.72	5014997.27		97.65	100.13	2.48	97.65	0.00	100.26	0.13	0.00	2180.00
5	CBMH105	363879.76	5014986.94		97.90	100.10	2.20	97.90	0.00	100.28	0.18	0.00	2000.00
6	CBMH106	363868.95	5015010.82		98.04	100.04	2.00	98.04	0.00	100.28	0.24	0.00	1800.00
7	CBMH106_Junction	363879.90	5015015.38		97.70	100.00	2.30	97.70	0.00	100.28	0.28	0.00	2000.00
8	CBMH13-Junction	363946.30	5014843.70		97.06	99.60	2.54	97.06	0.00	99.90	0.30	0.00	2240.00
9	CBMH2	363984.85	5015050.36		98.05	99.83	1.78	98.05	0.00	100.28	0.45	0.00	1480.00
10	GAS_BAR	363913.82	5014991.46		97.75	102.00	4.25	97.75	0.00	102.00	0.00	0.00	4050.00
11	GB-CB1_Junction	363899.07	5014980.75		97.64	100.00	2.36	97.64	0.00	100.28	0.28	0.00	2060.00
12	GB-CB2_Junction	363882.77	5014987.69		97.84	100.09	2.25	97.84	0.00	100.28	0.19	0.00	2050.00
13	GB-CB3_Junction	363875.67	5015022.64		97.74	99.89	2.15	97.74	0.00	100.28	0.39	0.00	1830.00
14	GB-CB4_Junction	363872.34	5015012.20		97.94	100.12	2.18	97.94	0.00	100.28	0.16	0.00	1980.00
15	IP-1	363911.39	5014915.08		97.53	99.55	2.02	97.53	0.00	99.90	0.35	0.00	272.00
16	IP-2	363924.21	5014879.75		97.45	99.52	2.07	97.45	0.00	99.90	0.38	0.00	322.00
17	MH107	363923.98	5015022.26		97.76	100.12	2.36	97.76	0.00	100.26	0.14	0.00	2020.00
18	MH108	363928.11	5015001.88		97.65	100.08	2.43	97.65	0.00	100.28	0.20	0.00	2090.00
19	MH15A	363994.52	5014882.33	RimElev=100.26	97.33	100.26	2.93	97.33	0.00	100.28	0.02	0.00	2620.00
20	MH16	363941.36	5014830.92		96.99	99.85	2.86	96.99	0.00	100.28	0.43	0.00	0.00
21	MHA	363914.34	5014832.07	RimElev=99.4	97.12	99.40	2.28	97.12	0.00	99.70	0.30	0.00	1250.00
22	MHA1	363925.15	5014838.47	RimElev=99.40	97.72	99.40	1.68	97.72	0.00	99.70	0.30	0.00	1080.00
23	MHA1-MS	363903.84	5014844.49		98.00	99.40	1.40	98.00	0.00	99.70	0.30	0.00	0.00
24	MHA2	363894.31	5014906.11	RimElev=99.80	97.82	99.80	1.98	97.82	0.00	100.10	0.30	0.00	1300.00
25	MHA2-MS	363877.34	5014898.97		98.40	99.80	1.40	98.40	0.00	99.95	0.15	0.00	0.00
26	MHA3	363842.23	5015024.59	RimElev=100.43	97.97	100.43	2.46	97.97	0.00	100.73	0.30	0.00	0.00
27	MHA3-MS	363825.51	5015018.81		100.03	100.43	0.40	100.03	0.00	100.58	0.15	0.00	0.00
28	MHA-MS	363897.95	5014827.12		98.00	99.40	1.40	98.00	0.00	99.55	0.15	0.00	0.00
29	MHB	363930.48	5014800.49	RimElev=99.10	96.42	99.10	2.68	96.42	0.00	99.40	0.30	0.00	0.00
30	MHB-MS	363908.55	5014794.14		97.70	99.10	1.40	97.70	0.00	99.25	0.15	0.00	0.00
31	MHC	363943.72	5014773.43	RimElev=99.00	95.92	99.00	3.08	95.92	0.00	99.30	0.30	0.00	1300.00
32	MHC-MS	363917.68	5014777.65		97.60	99.00	1.40	97.60	0.00	99.15	0.15	0.00	0.00
33	MHD	363907.43	5014751.05	RimElev=96.80	94.30	96.80	2.50	94.30	0.00	97.10	0.30	0.00	1300.00
34	MHD-MS	363900.89	5014769.41		95.40	96.80	1.40	95.40	0.00	96.95	0.15	0.00	0.00
35	MHE	363868.07	5014732.76	RimElev=96.45	92.80	96.45	3.65	92.80	0.00	96.75	0.30	0.00	1300.00
36	MHE-MS	363861.73	5014755.27		95.05	96.45	1.40	95.05	0.00	96.60	0.15	0.00	0.00
37	PUMPS	363899.74	5015005.54		97.69	105.00	7.31	97.69	0.00	105.00	0.00	0.00	6590.00
38	STM-1	363862.41	5015012.61		97.74	99.81	2.07	97.74	0.00	100.28	0.47	0.00	1470.00
39	STM-2	363886.23	5014954.35		97.63	99.75	2.12	97.63	0.00	100.26	0.51	0.00	1520.00
40	STM-3	363895.98	5014951.63		97.60	99.52	1.92	97.60	0.00	99.90	0.38	0.00	172.00
41	STM-4	363938.10	5014848.37		97.08	99.51	2.43	97.08	0.00	99.90	0.39	0.00	382.00
42	STORMCEPTOR1	363919.72	5015005.14		97.83	99.94	2.11	97.83	0.00	100.28	0.34	0.00	1780.00
43	STORMCEPTOR2	363899.85	5014979.33		97.64	99.96	2.32	97.64	0.00	100.28	0.32	0.00	2020.00

Prepared by Novatech Engineering Consultants Ltd.
Date: 29/05/2014

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Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Junctions

SN	Element ID	Peak Inflow (lps)	Peak Lateral Inflow (lps)	Maximum HGL Elevation Attained (m)	Maximum HGL Depth Attained (m)	Maximum Surcharge Depth Attained (m)	Minimum Freeboard Attained (m)	Average HGL Elevation Attained (m)	Average HGL Depth Attained (m)	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ha-mm)	Total Time Flooded (minutes)
1	Building	10.33	0.00	100.13	2.58	0.00	10.37	97.89	0.34	0 01:20	0 00:00	0.00	0.00
2	CAR_WASH	9.63	5.49	99.87	1.89	0.00	2.13	98.21	0.23	0 01:20	0 00:00	0.00	0.00
3	CB3_Junction	87.40	0.00	100.08	2.18	0.00	0.11	98.15	0.25	0 01:19	0 00:00	0.00	0.00
4	CBMH104_Junction	52.82	0.00	99.84	2.19	0.00	0.29	97.94	0.29	0 01:22	0 00:00	0.00	0.00
5	CBMH105	10.59	5.00	99.87	1.97	0.00	0.23	98.14	0.24	0 01:20	0 00:00	0.00	0.00
6	CBMH106	6.62	2.41	99.85	1.81	0.00	0.19	98.25	0.21	0 01:21	0 00:00	0.00	0.00
7	CBMH106_Junction	31.00	0.00	99.85	2.15	0.00	0.15	97.98	0.28	0 01:21	0 00:00	0.00	0.00
8	CBMH13-Junction	133.04	0.00	99.76	2.70	0.16	0.00	97.50	0.44	0 01:43	0 00:00	0.00	0.00
9	CBMH2	63.12	63.12	100.11	2.06	0.28	0.00	98.28	0.23	0 01:19	0 00:00	0.00	0.00
10	GAS_BAR	6.42	6.42	100.01	2.26	0.00	1.99	98.02	0.27	0 01:20	0 00:00	0.00	0.00
11	GB-CB1_Junction	63.44	0.00	99.79	2.15	0.00	0.21	97.93	0.29	0 01:51	0 00:00	0.00	0.00
12	GB-CB2_Junction	15.86	0.00	99.86	2.02	0.00	0.23	98.09	0.25	0 01:20	0 00:00	0.00	0.00
13	GB-CB3_Junction	31.14	0.00	99.85	2.11	0.00	0.04	98.03	0.29	0 01:21	0 00:00	0.00	0.00
14	GB-CB4_Junction	10.26	0.00	99.85	1.91	0.00	0.27	98.17	0.23	0 01:21	0 00:00	0.00	0.00
15	IP-1	727.58	0.00	99.79	2.26	0.24	0.00	97.84	0.31	0 01:55	0 00:00	0.00	0.00
16	IP-2	484.86	0.00	99.79	2.34	0.27	0.00	97.78	0.33	0 01:58	0 00:00	0.00	0.00
17	MH107	87.32	0.00	100.05	2.29	0.00	0.07	98.04	0.28	0 01:20	0 00:00	0.00	0.00
18	MH108	87.30	0.00	100.02	2.37	0.00	0.06	97.98	0.33	0 01:20	0 00:00	0.00	0.00
19	MH15A	79.11	0.00	99.96	2.63	0.00	0.30	97.72	0.39	0 01:20	0 00:00	0.00	0.00
20	MH16	132.60	0.00	99.59	2.60	0.00	0.26	97.38	0.39	0 01:41	0 00:00	0.00	0.00
21	MHA	691.37	0.00	99.37	2.25	0.00	0.03	97.20	0.08	0 01:22	0 00:00	0.00	0.00
22	MHA1	602.51	0.00	99.56	1.84	0.16	0.00	97.78	0.06	0 01:22	0 00:00	0.00	0.00
23	MHA1-MS	629.74	174.46	99.56	1.56	0.01	0.00	98.03	0.03	0 01:22	0 00:00	0.00	0.00
24	MHA2	510.18	0.00	99.90	2.08	0.10	0.00	97.94	0.12	0 01:22	0 00:00	0.00	0.00
25	MHA2-MS	504.95	111.25	99.84	1.44	0.00	0.96	98.43	0.03	0 01:21	0 00:00	0.00	0.00
26	MHA3	551.22	0.00	100.57	2.60	0.14	0.00	98.08	0.11	0 01:13	0 00:00	0.00	0.00
27	MHA3-MS	420.91	163.19	100.46	0.43	0.00	0.12	100.05	0.02	0 01:20	0 00:00	0.00	0.00
28	MHA-MS	769.70	270.62	99.45	1.45	0.00	0.10	98.03	0.03	0 01:21	0 00:00	0.00	0.00
29	MHB	852.95	0.00	98.86	2.44	0.00	0.24	96.55	0.13	0 01:25	0 00:00	0.00	0.00
30	MHB-MS	792.97	169.56	99.16	1.46	0.00	0.09	97.73	0.03	0 01:23	0 00:00	0.00	0.00
31	MHC	922.04	0.00	98.60	2.68	0.00	0.40	96.03	0.11	0 01:14	0 00:00	0.00	0.00
32	MHC-MS	920.14	399.13	99.03	1.43	0.00	0.12	97.64	0.04	0 01:22	0 00:00	0.00	0.00
33	MHD	867.93	0.00	96.33	2.03	0.00	0.47	94.40	0.10	0 01:13	0 00:00	0.00	0.00
34	MHD-MS	958.06	323.95	96.86	1.46	0.00	0.09	95.44	0.04	0 01:23	0 00:00	0.00	0.00
35	MHE	1047.08	0.00	94.15	1.35	0.00	2.30	92.92	0.12	0 01:23	0 00:00	0.00	0.00
36	MHE-MS	886.36	179.07	96.49	1.44	0.00	0.11	95.08	0.03	0 01:23	0 00:00	0.00	0.00
37	PUMPS	32.09	18.38	100.00	2.31	0.00	5.00	97.97	0.28	0 01:19	0 00:00	0.00	0.00
38	STM-1	323.25	0.00	99.81	2.07	0.00	0.00	98.01	0.27	0 01:22	0 00:00	0.00	0.00
39	STM-2	323.49	0.00	99.79	2.16	0.04	0.00	97.92	0.29	0 01:49	0 00:00	0.00	0.00
40	STM-3	675.57	0.00	99.79	2.19	0.27	0.00	97.89	0.29	0 01:49	0 00:00	0.00	0.00
41	STM-4	175.65	0.00	99.79	2.71	0.28	0.00	97.51	0.43	0 01:54	0 00:00	0.00	0.00
42	STORMCEPTOR1	23.13	0.00	100.01	2.18	0.07	0.00	98.09	0.26	0 01:20	0 00:00	0.00	0.00
43	STORMCEPTOR2	62.59	0.00	99.79	2.15	0.00	0.17	97.93	0.29	0 01:54	0 00:00	0.00	0.00

Prepared by Novatech Engineering Consultants Ltd.
Date: 29/05/2014

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Weirs

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	From (Inlet) Node Invert Elevation (m)	To (Outlet) Node Invert Elevation (m)	Type	Flap Gate	Crest Elevation (m)	Crest Offset (m)	Length (m)	Weir Total Height (m)	Discharge Coefficient	Peak Flow (lps)
1	CBMH101-MS		CBMH101	CBMH6	97.68	97.78	SIDE FLOW	NO	100.11	2.43	5.00	0.17	0.61	0.00
2	CBMH103-MS		CBMH103	CBMH6	97.62	97.78	SIDE FLOW	NO	100.11	2.49	5.00	0.17	0.61	0.00
3	CBMH10-Weir		CBMH10	CBMH11	97.50	97.34	RECTANGULAR	NO	99.59	2.09	6.00	0.30	1.84	107.56
4	CBMH11-Weir		CBMH11	CBMH12	97.34	97.19	RECTANGULAR	NO	99.71	2.37	6.00	0.30	1.84	49.13
5	CBMH12-Weir		CBMH12	CBMH13	97.19	97.05	RECTANGULAR	NO	99.61	2.42	6.00	0.30	1.84	40.70
6	GB-CB3-MS		GB-CB3	CBMH6	97.87	97.78	SIDE FLOW	NO	98.85	0.98	3.00	0.30	0.61	58.78
7	GreenbankRd		CBMH6	MHA2-MS	97.78	98.40	SIDE FLOW	NO	99.88	2.10	10.00	0.30	0.61	0.00
8	MHA1-MS		MHA1-MS	MHA-MS	98.00	98.00	SIDE FLOW	NO	99.40	1.40	20.00	0.15	0.61	565.81

Outlets

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	From (Inlet) Node Invert Elevation (m)	To (Outlet) Node Invert Elevation (m)	Crest Elevation (m)	Crest Height (m)	Outlet Type	Outlet Reference	Flap Gate	Peak Flow (lps)	Time of Peak Flow Occurrence (days hh:mm)
1	Roof_Drains		Roof_Top_Storage	Building	110.35	97.55	110.35	0.00	Rating Curve Table	Depth Above Inlet	NO	10.330	0 03:10
2	VSP-BLDGS		Stor-VSP-BLDGS	MHA3	110.00	97.97	110.00	0.00	Rating Curve Table	Depth Above Inlet	NO	8.700	0 03:10
3	VSP-EXP-BLDGS		Stor-VSP-EXP-BLDGS	MHA3	110.00	97.97	110.00	0.00	Rating Curve Table	Depth Above Inlet	NO	2.400	0 03:10
4	VSP-EXP-PARKING		Stor-VSP-EXP-PARKING	MHA3	101.50	97.97	101.50	0.00	Rating Curve Table	Depth Above Inlet	NO	0.290	0 01:20

Orifices

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	From (Inlet) Node Invert Elevation (m)	To (Outlet) Node Invert Elevation (m)	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (mm)	Rectangular Orifice Height (m)	Rectangular Orifice Width (m)	Orifice Invert Elevation (m)	Orifice Invert Offset (m)	Orifice Coefficient	Peak Flow (lps)	Time of Peak Flow Occurrence (days hh:mm)
1	MH16		MH16	MHB	96.99	96.42	SIDE	RECT_CLOSED	NO		0.18	0.18	96.99	0.00	0.6260	132.590	0 01:55

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Rain Gauges

SN	Element ID	Description	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (mm)	Rainfall Distribution
1	1		Time Series	C-3hr-100yr	Cumulative	mm				0	

Prepared by Novatech Engineering Consultants Ltd.
Date: 29/05/2014
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Subbasins

SN	Element ID	Description	Area	Drainage Node ID	Max Infiltration Rate	Min Infiltration Rate	Drying Time	Decay Constant	Max Volume	Average Slope	Equivalent Width	Impervious Area	Impervious Area No Depression	Impervious Area Depression Depth
			(ha)		(mm/hr)	(mm/hr)	(days)	(1/hrs)	(mm)	(%)	(m)	(%)	(%)	(mm)
1	GREENBANK		0.07	CBMH6	76.2000	13.2000	7.00	4.1400	0.00	1.3300	16.00	100.00	0.00	1.5700
2	Sub-BLDG		0.79	Roof_Top_Storage	76.2000	13.2000	7.00	4.1400	0.00	1.5000	138.00	100.00	100.00	1.5700
3	Sub-CAR_WASH		0.01	CAR_WASH	76.2000	13.2000	7.00	4.1400	0.00	1.5000	18.00	100.00	100.00	1.5700
4	Sub-CB1		0.12	CB1	76.2000	13.2000	7.00	4.1400	0.00	1.3800	47.00	83.00	0.00	1.5700
5	Sub-CB14		0.13	CB14	76.2000	13.2000	7.00	4.1400	0.00	1.0500	78.00	100.00	0.00	1.5700
6	Sub-CB3		0.16	CB3	76.2000	13.2000	7.00	4.1400	0.00	3.7600	40.00	100.00	0.00	1.5700
7	Sub-CBMH10		0.33	CBMH10	76.2000	13.2000	7.00	4.1400	0.00	1.0200	60.00	96.00	0.00	1.5700
8	Sub-CBMH101		0.11	CBMH101	76.2000	13.2000	7.00	4.1400	0.00	1.4500	31.00	100.00	0.00	1.5700
9	Sub-CBMH102		0.06	CBMH102	76.2000	13.2000	7.00	4.1400	0.00	1.5200	20.00	100.00	0.00	1.5700
10	Sub-CBMH103		0.02	CBMH103	76.2000	13.2000	7.00	4.1400	0.00	2.9600	24.00	100.00	0.00	1.5700
11	Sub-CBMH104		0.01	CBMH104	76.2000	13.2000	7.00	4.1400	0.00	0.6400	11.00	100.00	0.00	1.5700
12	Sub-CBMH105		0.03	CBMH105	76.2000	13.2000	7.00	4.1400	0.00	0.4000	16.00	0.00	0.00	1.5700
13	Sub-CBMH106		0.01	CBMH106	76.2000	13.2000	7.00	4.1400	0.00	0.7800	6.00	0.00	0.00	1.5700
14	Sub-CBMH11		0.25	CBMH11	76.2000	13.2000	7.00	4.1400	0.00	1.1700	44.00	99.00	0.00	1.5700
15	Sub-CBMH12		0.32	CBMH12	76.2000	13.2000	7.00	4.1400	0.00	1.3300	60.00	96.00	0.00	1.5700
16	Sub-CBMH13		0.23	CBMH13	76.2000	13.2000	7.00	4.1400	0.00	1.5400	55.00	83.00	0.00	1.5700
17	Sub-CBMH15		0.08	CBMH15	76.2000	13.2000	7.00	4.1400	0.00	0.6500	29.00	100.00	0.00	1.5700
18	Sub-CBMH2		0.13	CBMH2	76.2000	13.2000	7.00	4.1400	0.00	4.2600	33.00	86.00	0.00	1.5700
19	Sub-CBMH6		0.44	CBMH6	76.2000	13.2000	7.00	4.1400	0.00	1.8400	70.00	97.00	0.00	1.5700
20	Sub-EX-1		0.18	CBMH6	76.2000	13.2000	7.00	4.1400	0.00	2.7700	27.00	100.00	0.00	1.5700
21	Sub-GAS_BAR		0.01	GAS_BAR	76.2000	13.2000	7.00	4.1400	0.00	1.5000	19.00	100.00	100.00	1.5700
22	Sub-GB-CB1		0.01	GB-CB1	76.2000	13.2000	7.00	4.1400	0.00	1.5200	9.00	100.00	0.00	1.5700
23	Sub-GB-CB2		0.01	GB-CB2	76.2000	13.2000	7.00	4.1400	0.00	0.3700	6.00	100.00	0.00	1.5700
24	Sub-GB-CB3		0.07	GB-CB3	76.2000	13.2000	7.00	4.1400	0.00	1.3600	13.00	100.00	0.00	1.5700
25	Sub-GB-CB4		0.01	GB-CB4	76.2000	13.2000	7.00	4.1400	0.00	0.4000	7.00	100.00	0.00	1.5700
26	Sub-MHA		0.77	MHA-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	39.00	71.00	0.00	1.5700
27	Sub-MHA1		0.45	MHA1-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	35.00	71.00	0.00	1.5700
28	Sub-MHA2		0.28	MHA2-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	31.00	71.00	0.00	1.5700
29	Sub-MHA3		0.44	MHA3-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	34.00	71.00	0.00	1.5700
30	Sub-MHB		0.42	MHB-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	53.00	73.00	0.00	1.5700
31	Sub-MHC		1.15	MHC-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	58.00	70.00	0.00	1.5700
32	Sub-MHD		1.17	MHD-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	117.00	48.00	0.00	1.5700
33	Sub-MHE		0.50	MHE-MS	76.2000	13.2000	7.00	4.1400	0.00	1.0000	62.00	64.00	0.00	1.5700
34	Sub-PUMPS		0.04	PUMPS	76.2000	13.2000	7.00	4.1400	0.00	1.5000	22.00	100.00	100.00	1.5700
35	Sub-VSP-BLDGS		0.66	Stor-VSP-BLDGS	76.2000	13.2000	7.00	4.1400	0.00	1.5000	138.00	100.00	100.00	1.5700
36	Sub-VSP-EXP-BLDGS		0.22	Stor-VSP-EXP-BLDGS	76.2000	13.2000	7.00	4.1400	0.00	1.5000	82.00	100.00	100.00	1.5700
37	Sub-VSP-EXP-PARKING		0.52	Stor-VSP-EXP-PARKING	76.2000	13.2000	7.00	4.1400	0.00	0.9100	163.00	100.00	0.00	1.5700
38	Sub-VSP-PARKING		1.21	Stor-VSP-PARKING	76.2000	13.2000	7.00	4.1400	0.00	2.4500	139.00	100.00	0.00	1.5700

Canadian Tire (Barrhaven, Ontario)
100-year 3hr Chicago Storm - Proposed Conditions

Subbasins

SN	Element ID	Impervious Area Manning's Roughness	Pervious Area Depression Depth (mm)	Pervious Area Manning's Roughness	Curb & Gutter Length (m)	Rain Gage ID	Total Precipitation (mm)	Total Runon (mm)	Total Evaporation (mm)	Total Infiltration (mm)	Total Runoff (mm)	Peak Runoff (lps)	Time of Concentration (days hh:mm:ss)
1	GREENBANK	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.14	34.69	0 00:05:07
2	Sub-BLDG	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	71.71	389.33	0 00:05:47
3	Sub-CAR_WASH	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	71.77	5.49	0 00:01:31
4	Sub-CB1	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	7.3620	63.07	58.74	0 00:10:54
5	Sub-CB14	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.17	66.15	0 00:03:07
6	Sub-CB3	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.16	79.53	0 00:03:33
7	Sub-CBMH10	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	1.7220	68.48	162.40	0 00:11:39
8	Sub-CBMH101	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.15	52.71	0 00:04:18
9	Sub-CBMH102	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.16	29.41	0 00:03:53
10	Sub-CBMH103	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.20	11.00	0 00:01:35
11	Sub-CBMH104	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.18	5.12	0 00:02:31
12	Sub-CBMH105	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	46.3580	25.32	5.00	0 00:24:58
13	Sub-CBMH106	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	45.6380	26.04	2.41	0 00:21:20
14	Sub-CBMH11	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.4280	69.72	121.83	0 00:08:25
15	Sub-CBMH12	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	1.7200	68.48	158.69	0 00:10:36
16	Sub-CBMH13	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	7.4110	63.01	107.58	0 00:13:56
17	Sub-CBMH15	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.15	38.95	0 00:04:45
18	Sub-CBMH2	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	6.0390	64.35	63.13	0 00:09:15
19	Sub-CBMH6	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	1.2880	68.90	216.83	0 00:09:49
20	Sub-EX-1	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.14	88.05	0 00:05:14
21	Sub-GAS_BAR	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	71.77	6.42	0 00:01:37
22	Sub-GB-CB1	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.19	4.76	0 00:02:06
23	Sub-GB-CB2	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.15	5.79	0 00:04:37
24	Sub-GB-CB3	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.14	33.67	0 00:05:39
25	Sub-GB-CB4	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.17	4.18	0 00:03:23
26	Sub-MHA	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	14.2320	56.33	270.80	0 00:49:50
27	Sub-MHA1	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	13.7280	56.84	174.56	0 00:29:51
28	Sub-MHA2	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	13.3820	57.20	111.31	0 00:23:54
29	Sub-MHA3	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	13.7350	56.83	163.28	0 00:38:40
30	Sub-MHB	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	12.3320	58.22	169.65	0 00:28:09
31	Sub-MHC	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	14.7750	55.80	399.40	0 00:50:40
32	Sub-MHD	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	25.3070	45.62	324.20	0 00:42:26
33	Sub-MHE	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	16.7370	53.95	179.19	0 00:31:46
34	Sub-PUMPS	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	71.75	18.38	0 00:02:47
35	Sub-VSP-BLDGS	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	71.71	327.06	0 00:05:12
36	Sub-VSP-EXP-BLDGS	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	71.73	109.61	0 00:03:41
37	Sub-VSP-EXP-PARKING	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.15	258.30	0 00:04:45
38	Sub-VSP-PARKING	0.0130	4.6700	0.2500	0.00	1	71.65	0.00	0.0000	0.0000	70.13	597.50	0 00:06:26

Prepared by Novatech Engineering Consultants Ltd.
Date: 29/05/2014

Appendix E:

StormTech MC-3500 Infiltration Chambers

E1 – MC-3500 Site Calculator Results for 5-year 3hr Chicago Storm

StormTech
Detention • Retention • Recharge
Subsurface Stormwater Management℠

MC-3500 Site Calculator

Project Information:

Project Name: Canadian Tire Barrhaven - 5yr Event
Location: Barrhaven (Ottawa), Ontario
Date: 28-May-14
Engineer: Conrad Stang
StormTech RPM:

System Requirements

Units		Metric	
Required Storage Volume		505	cubic meters
Stone Porosity (Industry Standard = 40%)		40	%
Stone Above Chambers	(305 mm min.)	305	mm
Stone Foundation Depth	(229 mm min.)	300	mm
Average Cover over Chambers	(610 mm min.)	1000	mm
Bed size controlled by WIDTH or LENGTH?		LENGTH	
Limiting WIDTH or LENGTH dimension		107	meters
Storage Volume per Chamber		5.2	cubic meters
Storage Volume per End Cap		1.3	cubic meters

System Sizing

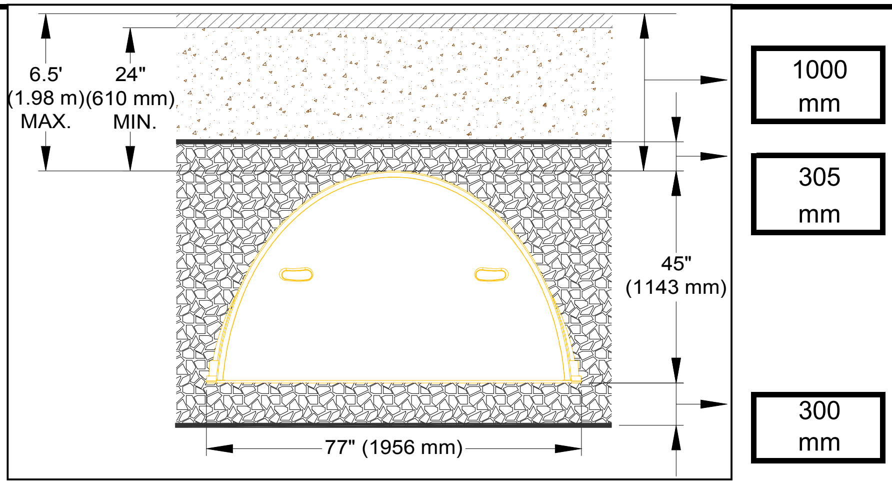
Number of Chambers Required	96	each
Number of End Caps Required	4	each
Bed Size (including perimeter stone)	504	square meters
Stone Required (including perimeter stone)	963	metric tonnes
Volume of Excavation	1232	cubic meters
Non-woven Filter Fabric Required (20% Safety Factor)	1676	square meters
Length of Isolator Row	106.2	meters
Non-woven Isolator Row Fabric (20% Safety Factor)	505	square meters
Woven Isolator Row Fabric (20% Safety Factor)	640	square meters
Installed Storage Volume	504	cubic meters

Controlled by Length

Maximum Length = 107 meters

2	rows of	48	chambers
0	row of	0	chambers

Maximum Length = 106.2 meters
Maximum Width = 4.7 meters



Appendix F:

External Drawings

1) Detailed Topographic Survey
   (Fairhall Moffatt & Woodland Ltd. October 17, 2013)

2) Servicing and Grading Plan for Proposed Canadian Tire
   (Bronte Engineering Limited, February, 2000)

3) Servicing Plan for Canadian Tire Gas Bar
   (Trow Associates Inc., February, 2003)

4) Site Servicing and Grading Plan for South Expansion to Canadian Tire
   (Delcan, March, 2006)

5) General Plan of Services for Village Square Plaza
   (Cumming Cockburn Limited, December 2000)

6) Site Servicing Plan for Village Square Plaza Expansion
   (Novatech Engineering Consultants Ltd., December 2010)

7) Plan and Profiles for Greenbank Road
   (Regional Municipality of Ottawa-Carleton, July 1990)

8) Strandherd Drive Road Reconstruction
   (McCormick Rankin Consulting Engineers, May 1992)

Internal Drawings:

1) 113199-SWM (storm drainage area plan)

2) 113199-STM-Existing (existing storm sewer network)

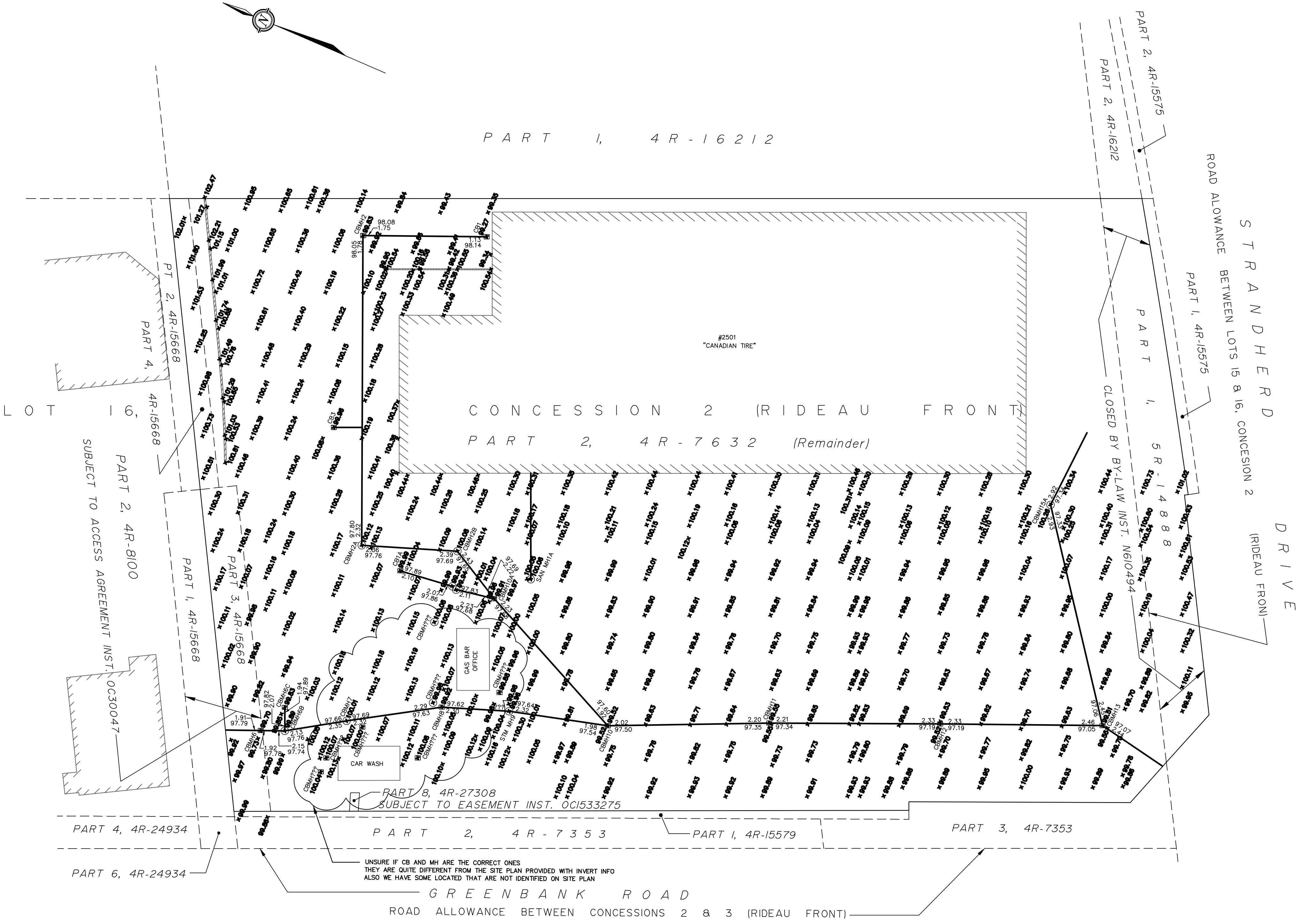
3) 113199-GP (proposed general plan of services)

4) 113199-DET (notes and details)

5) 113199-TCP (tree conservation plan)

6) 113199-L (landscape plan)

METRIC
DISTANCES AND ELEVATIONS SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048



UNSURE IF CB AND MH ARE THE CORRECT ONES
THEY ARE QUITE DIFFERENT FROM THE SITE PLAN PROVIDED WITH INVERT INFO
ALSO WE HAVE SOME LOCATED THAT ARE NOT IDENTIFIED ON SITE PLAN

PLAN SHOWING ELEVATIONS ON
PART OF LOT 16
CONCESSION 2 (RIDEAU FRONT)
CITY OF OTTAWA

SCALE 1 : 500
0 10 20 50 metres

FAIRHALL, MOFFATT & WOODLAND LIMITED
ONTARIO LAND SURVEYORS

ELEVATION NOTES

1. ELEVATIONS SHOWN HEREON ARE REFERRED TO GEODETIC DATUM.
2. ELEVATIONS FOR MANHOLE COVERS AND CATCH BASINS HAVE TO BE INDEPENDENTLY CONFIRMED BEFORE THEY CAN BE ACCEPTED FOR FINAL DESIGN OR CONSTRUCTION PURPOSES.
3. IT IS THE RESPONSIBILITY OF THE USER OF THIS INFORMATION TO VERIFY THAT THE JOB BENCHMARKS HAVE NOT BEEN ALTERED OR DISTURBED AND THAT THEIR RELATIVE ELEVATION AND DESCRIPTION AGREE WITH THE INFORMATION SHOWN ON THIS DRAWING.

UTILITY NOTES

1. THIS DRAWING CANNOT BE ACCEPTED AS ACKNOWLEDGING ANY UNDERGROUND UTILITIES AND IT WILL BE THE RESPONSIBILITY OF THE USER TO CONTACT THE RESPECTIVE UTILITY AUTHORITIES FOR CONFIRMATION OR LOCATION.
2. BEFORE ANY WORK INVOLVING PROBING, EXCAVATING, ETC., A FIELD LOCATION OF UNDERGROUND PLANT BY THE PERTINENT UTILITY AUTHORITY IS MANDATORY.

NOTES

1. THE SURVEY REPRESENTED BY THIS PLAN WAS COMPLETED ON OCTOBER 17, 2013.

LEGEND

▥ – CATCH BASIN
○ – MANHOLE

THIS IS NOT A VALID COPY UNLESS EMBOSSED WITH SEAL

Fairhall
Moffatt &
Woodland
LIMITED
ONTARIO LAND SURVEYORS
OTTAWA
Surveying and Land Information Services
100–600 TERRY FOX DRIVE, KANATA, ONTARIO K2L 4B6
TEL: (613) 591–2580 FAX: (613) 591–1495
www.fmw.on.ca

JOB No.
S42400

E 363958
N 5014962

REFERENCE No.
130 – 2 (RF) NP

S:\JOBS\
s424_topo.dwg (KG)

STRANDHERD ROAD

1. THE CITY OF NEPEAN WILL RECONSTRUCT STRANDHERD ROAD AS A FOUR LANE URBAN SECTION FROM THE EXISTING URBAN SECTION EASTWARD IN THE YEAR 2000. THE WORKS MAY INCLUDE THE ENTRANCE TO THE CTREL STORE. NOTWITHSTANDING THE WORKS ASSOCIATED WITH THE ENTRANCE ROAD SHALL BE ITEMIZED PRICE AS PART OF THIS CONTRACT. THE CONTRACTOR SHALL CO-ORDINATE WITH THE CITY OF NEPEAN FORCES WITH RESPECT TO SCHEDULING OF THE WORKS ON SITE AS WELL AS WITHIN STRANDHERD ROAD TO ENSURE CONFORMABILITY.

2. THE FINAL DESIGN FOR STRANDHERD ROAD WILL BE PROVIDED BY CTREL TO THE CONTRACTOR WHEN AVAILABLE FROM THE CITY OF NEPEAN.

GREENBANK ROAD

1. THE REGION OF OTTAWA-CARLETON REQUIRES THAT CTREL CONSTRUCT GREENBANK ROAD FROM STRANDHERD ROAD NORTHWARD INCLUDING TURNING LANES ALONG THE FRONTAGE OF THE PROPOSED DEVELOPMENT. THE WORKS WILL INCLUDE A SIGNALIZED INTERSECTION AT THE PROPOSED CTREL ENTRANCE. THE DESIGN OF THE PROPOSED ROADWORKS, PRESENTLY UNDER DESIGN BY DELCAN, WILL BE TENDERED AND CONSTRUCTED BY CTREL AS PHASE II TENDER IN THE YEAR 2000. THE CONTRACTOR SHALL CO-ORDINATE WITH THE REGION AND THE RESPECTIVE CONTRACTOR FOR THE CONSTRUCTION OF GREENBANK "WORKS" TO ENSURE THE PROPER CONFORMABILITY.

2. FINAL DESIGN DRAWINGS AND SPECIFICATIONS OF THE PROPOSED WORKS WILL BE PROVIDED BY CTREL FROM DELCAN TO THE CONTRACTOR WHEN APPROVED BY THE REGION.

SANITARY SEWERS

MH1A
TOP 100.10
E INV. 98.458
S INV. 95.032

MH2A
TOP 99.85
N INV. 97.925
S INV. 97.895

MH3A
TOP 100.75
N INV. 97.52
S INV. 97.52

STORM SEWERS

CB1
TOP 99.25
N INV 97.88

CBMH2
TOP 99.60
S INV 97.84
W INV 97.81

CB3
TOP 99.61
S INV 97.75

CBMH4
TOP 99.60
W INV 97.56
E INV 97.56
S INV 97.53

CBMH5
TOP 99.72
W INV 97.74

CB6
TOP 99.72
E INV 97.86
W INV 97.66

CB7
TOP 99.67
S INV 97.60

CBMH9
TOP 99.77
N INV 97.50
W INV 97.50
S INV 97.47

MH9 STORMCEPTOR
TOP 99.95
N INV 97.41
S INV 97.35

CBMH10
TOP 99.51
NE INV 97.34
W INV 97.29
S INV 97.29

CBMH11
TOP 99.51
N INV 97.18
S INV 97.15

CBMH12
TOP 99.51
N INV 97.03
S INV 97.02

CBMH13
TOP 99.51
E INV 96.92
N INV 96.92
S INV 96.89

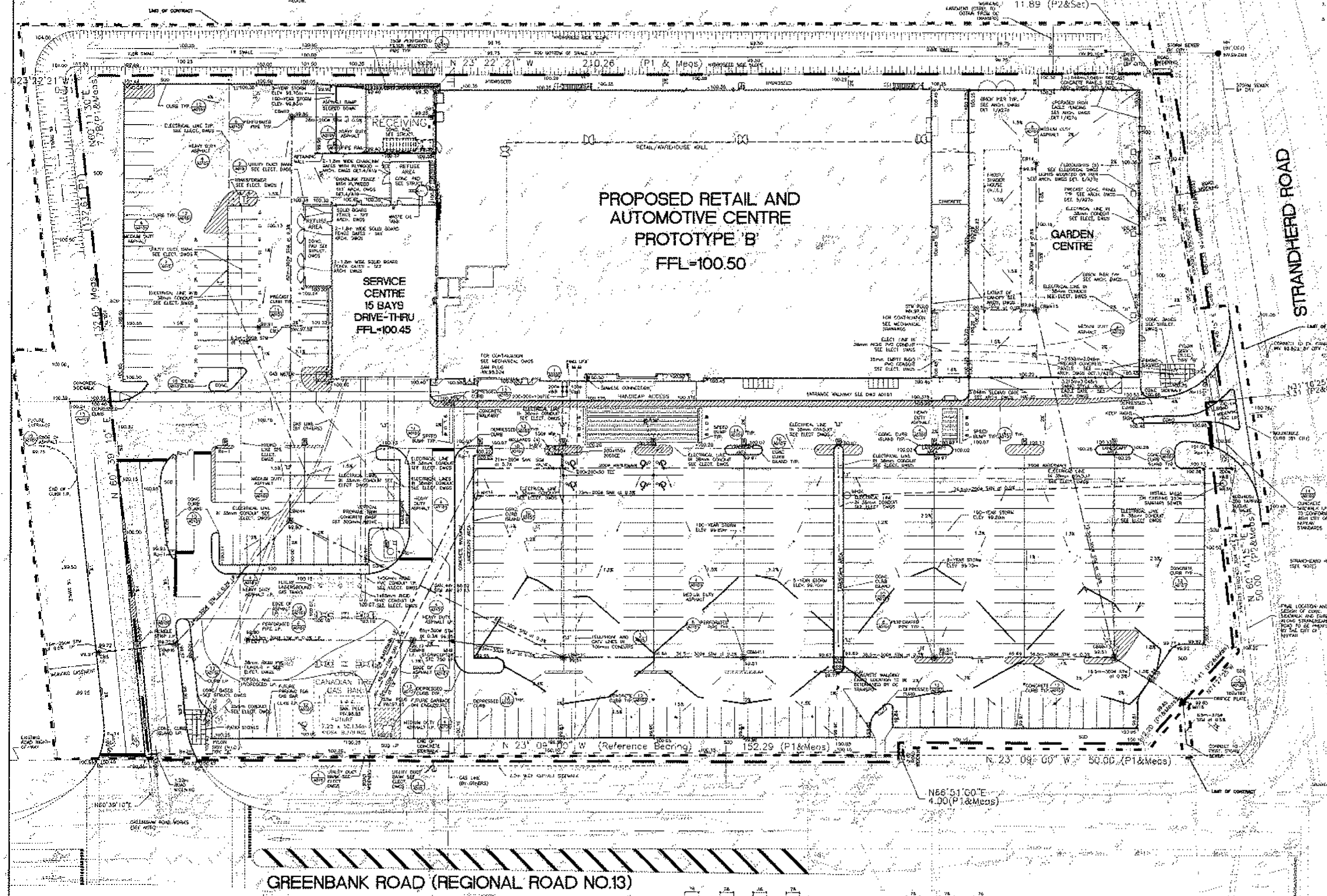
CBMH14
TOP 99.94
W INV 97.43

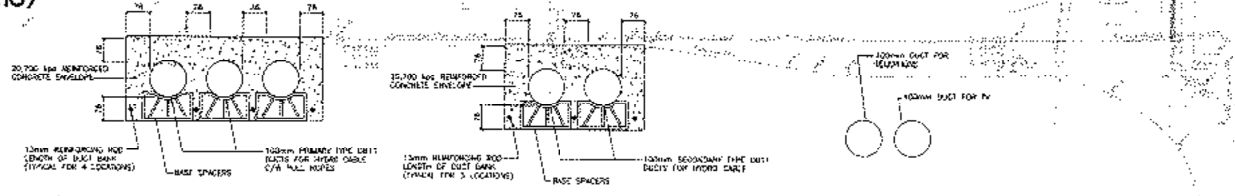
CBMH15
TOP 99.94
N INV 97.31
W INV 97.31
E INV 97.28

MH16 OFFICE
TOP 99.38
N INV 96.84
W INV 96.84

5-YEAR STORM ELEV. 99.70m

100-YEAR STORM ELEV. 99.90m





1 A01S ELECTRICAL DUCT BANK SCALE N.T.S.

2 A01S ELECTRICAL DUCT BANK SCALE N.T.S.

3 A01S TELEPHONE AND CABLE CONDUITS SCALE N.T.S.

GENERAL

1. ALL ELEVATIONS AND INVERTS MUST BE VERIFIED PRIOR TO CONSTRUCTION. IF THERE IS ANY DISCREPANCY THE CONTRACTOR IS TO NOTIFY THE ENGINEER PROMPTLY.
2. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UTILITIES DURING CONSTRUCTION GAS, HYDRO, TELEPHONE OR ANY OTHER UTILITIES THAT MAY EXIST ON THE SITE OR WITHIN THE STREETLINES AND MUST BE LOCATED BY ITS OWN UTILITIES AND VERIFIED PRIOR TO CONSTRUCTION.
3. TOPSOIL IN FILL AREA TO BE STRIPPED AND CLEAN FILL TO BE PLACED AND COMPACTED TO 95% STANDARD PROCTOR DENSITY.
4. ALL GRADES TO BE WITHIN 3:1 MAX. SLOPE AT PROPERTY LINE AND WITHIN THE SITE.
5. ALL UNDERGROUND SERVICES MATERIALS AND INSTALLATIONS TO BE IN ACCORDANCE WITH THE LATEST STANDARDS AND CODES OF THE MUNICIPALITY.
6. ALL DISTURBED AREAS TO BE RESTORED TO ORIGINAL CONDITION OR BETTER UNLESS OTHERWISE SPECIFIED.
7. ALL SANITARY, STORM SEWER AND WATERMAIN ON PRIVATE PROPERTY IS TO BE DONE IN ACCORDANCE WITH THE ONTARIO BUILDING CODE.
8. CONTRACTOR SHALL CO-ORDINATE WITH CITY AND PUC FORCES WITH RESPECT TO WORK BY OTHERS.

STORM SEWERS

1. ALL STORM SEWER MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND CITY OF NEPEAN STANDARDS.
2. ALL CATCHBASINS SHALL BE PRECAST AND CONFORM TO OPSD 705.02
3. ALL CATCHBASIN LEAD CONNECTIONS TO BE MADE WITH FACTORY TEES
4. ALL CATCHBASIN MANHOLES AND MANHOLES SHALL BE PRECAST AND CONFORM TO OPSD 701.01 AND 701.03.
5. ALL CATCHBASIN MANHOLES, CATCHBASINS AND MANHOLES TO HAVE A MINIMUM 0.6m SUMP AND TOP AS PER OPSD UNLESS OTHERWISE NOTED
6. THE CATCHBASIN FRAME AND GRATE SHALL CONFORM TO OPSD 400.02.
7. STORM SEWER 450Ø AND SMALLER SHALL BE PVC SDR 35 WITH TYPE "B" BEDDING THROUGHOUT EXCEPT AT RISERS, UNLESS OTHERWISE NOTED, AS PER ONTARIO PROVINCIAL STANDARD SPECIFICATIONS.
8. STORM SEWER 600Ø AND LARGER SHALL BE CONCRETE CLASS 4 WITH TYPE "B" BEDDING.
9. ALL CATCHBASINS CONSTRUCTED IN FILL AREAS TO BE SUPPORTED ON 17 MPa CONCRETE TO SOLID GROUND.
10. PROVIDE 100mm PE FILTER WRAPPED DRAINAGE PIPE OFFSET 1.0mm TYPICAL AROUND ALL CATCHBASINS, CATCHBASIN MANHOLES AND MANHOLES AT A DEPTH OF 1.0m.
11. MH9 SHALL BE A STC 750 OIL/GRIT INTERCEPTOR AS MANUFACTURED BY "STORMCEPTOR"

SANITARY SEWERS

1. ALL SANITARY SEWER MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO CURRENT MUNICIPAL STANDARDS AND SPECIFICATIONS, AND OPSD.
2. SANITARY SEWERS AND CONNECTIONS 150Ø AND SMALLER TO BE PVC SDR 28.
3. SANITARY SEWERS AND CONNECTIONS 200Ø AND LARGER TO BE PVC SDR 35 ASTM D3034-81 WITH TYPE "B" BEDDING THROUGHOUT EXCEPT AT RISERS, UNLESS OTHERWISE NOTED
4. ALL MANHOLES SHALL BE PRECAST AND CONFORM TO O.P.S.D. 701.01 AND 701.03 AND FRAME AND COVER SHALL CONFORM TO 401.01 TYPE A

WATERMAINS

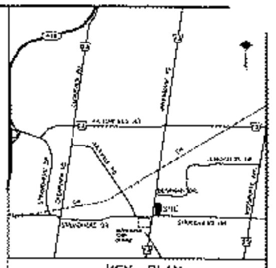
1. ALL WATERMAINS AND WATER SERVICE MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO CURRENT SPECIFICATIONS FOR THE RMOC
2. WATERMAIN MUST HAVE A MINIMUM VERTICAL CLEARANCE OF 0.15m OVER AND 0.50m UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING
3. WATERMAINS AND/OR WATER SERVICE ARE TO HAVE A MINIMUM COVER OF 2.4m WITH A MINIMUM HORIZONTAL SPACING OF 2.0m FROM THEMSELVES AND OTHER UTILITIES, AS PER RMOC DETAIL #SD-36
4. WATERMAINS TO BE INSTALLED TO GRADE AS SHOWN, COPY OF GRADE SHEET MUST BE SUPPLIED TO INSPECTION PRIOR TO COMMENCEMENT OF WORK WHERE REQUESTED BY THE INSPECTOR.
5. PROVISIONS FOR FLUSHING THE LINES PRIOR TO TESTING ETC. MUST BE PROVIDED WITH AT LEAST A 50Ø OUTLET ON A 100Ø AND LARGER PIPES. COPPER LINES ARE TO HAVE FLUSHING POINTS AT THE END, SAME SIZE AS THE LINES. THEY MUST ALSO BE HOSED OR PIPED TO ALLOW THE WATER TO DRAIN ONTO A PARKING LOT, SODDED AREA OR DITCH. FLUSHING OUTLET TO BE 100Ø OR A HYDRANT.
6. ALL CURB STOPS TO BE 1.5m OFF THE FACE OF THE BUILDING UNLESS OTHERWISE NOTED.
7. ALL WATERPIPE SHALL BE PVC CONFORMING TO A.W.W.A. STD. C-900 AND SHALL MEET AND/OR EXCEED O.P.S.S. 701.053 AND 1841, WITH CAST IRON FITTINGS.
8. ALL VALVES TO OPEN COUNTER-CLOCKWISE AND COMPLY WITH A.W.W.A. SPEC C-500. VALVE BOXES TO BE "FERGUSON" 260mm TYPE AS PER RMOC DETAIL #SD-24
9. FIRE HYDRANTS TO BE "CENTURY" MODEL BY CANADA VALVE LIMITED OR CONCORD CHANGLE. CENTROMON OR McAVITY M67 C DIA. PVC CONNECTION TO WATERMAIN. TWO 65mm NOZZLES AT 180° AND ONE 100mm STEAMER CONNECTION ON THE FRONT SIDE OF THE HYDRANT C/W GATE VALVE AND BOX, AS PER RMOC DETAIL #SD-16.
10. THRUST BLOCKS TO BE PLACED AS DIRECTED AND POURED WITH 25 MPa CONCRETE TO PROVIDE A MINIMUM 0.40m² EFFECTIVE BEARING AREA TO UNDISTURBED NATIVE SOIL (AT ALL ENDS, BENDS, FITTINGS AND TEES FOR NON-RESTRAINED WATER PIPE), PER MODIFIED O.P.S.D. 1103.01.

PARKING AREAS AND ROADWORKS

1. MEDIUM DUTY PAVEMENT FOR PARKING AREAS SHALL CONSIST OF 350mm OPSS GRANULAR B TYPE I SUBBASE MATERIAL, 150mm OPSS GRANULAR A BASE COURSE MATERIAL, 50mm HL8 BASE COURSE ASPHALT AND 30mm HL3 SURFACE COURSE ASPHALT.
2. HEAVY DUTY ASPHALT PAVEMENT WHERE SHOWN ON DRAWING A01S SHALL CONSIST OF 350mm OPSS GRANULAR B TYPE I SUBBASE, 150mm OPSS GRANULAR A BASE COURSE MATERIAL, 75mm HL8 BASE COURSE ASPHALT AND 30mm HL3 SURFACE COURSE ASPHALT

ELECTRICAL – PHASE I

1. THE CONTRACTOR SHALL EXCAVATE AND BACKFILL ALL UTILITY (HYDRO, TELEPHONE, CABLE TV) TRENCHES FOR LIGHT STANDARD LINES, TRANSFORMER VAULT, AND FOR PYLON SIGN LINES AS PART OF PHASE I TENDER SITE WORKS.
2. THE CONSTRUCTION OF ALL LIGHT STANDARD BASES AND PYLON SIGN BASES SHALL BE PART OF PHASE I SITE WORKS.
3. THE SUPPLY AND INSTALLATION OF ALL UNDERGROUND UTILITY CABLES INCLUDING BEDDING, DUCTS, DUCT BANKS AND COVER MATERIAL SHALL BE CONSTRUCTED AS PART OF PHASE II WORKS TO BE TENDERED SEPARATELY BY CTREL. THE SUPPLY AND INSTALLATION OF THE HYDRO TRANSFORMER AND ITS BASE SHALL BE PART OF PHASE I WORKS.
4. THE CONTRACTOR SHALL COORDINATE WITH THE ELECTRICAL DRAWINGS AND SPECIFICATIONS TO ENSURE CONFORMITY WITH THE "WORKS"



KEY PLAN
N.T.S.

PART OF
LOT 16, AND PART
OF ROAD ALLOWANCE
BETWEEN LOTS 16 AND 15
CONCESSION 2
(RIDEAU FRONT)
IN THE
TOWNSHIP OF NEPEAN
NOW THE
CITY OF NEPEAN
REGIONAL MUNICIPALITY OF
OTTAWA–CARLTON

SITE INFORMATION SHOWN ON THIS PLAN HAS BEEN TAKEN FROM TOPOGRAPHIC SURVEY DWG. REF. No. 5-216-98 DATED JUNE 22, 1998 PREPARED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD., ONTARIO LAND SURVEYORS.

BEARINGS ARE ASTRONOMIC DERIVED FROM THE EASTERLY LIMIT OF GREENBANK ROAD SHOWN TO BE N 23°09'00" W ON REFERENCE PLAN 4R-2632

LEGEND

H&V = HYDRANT & VALVE
V&B = VALVE & BOX
V&C = VALVE & CHAMBER
MH = MANHOLE
CBMH = CATCH BASIN MANHOLE
CB = CATCH BASIN
DCB = DOUBLE CATCH BASIN
BOREHOLE
EXISTING CURB
EXISTING ANCHOR
EXISTING OVERHEAD WIRES
EXISTING MANHOLE
EXISTING CATCH BASIN
SURVEY MARKER
EXISTING ELEVATION
PROPOSED CURB
F.L. PROPOSED FLOOD LIGHT
L.S. PROPOSED LIGHT STANDARD
SIAMESE WATER CONNECTION
·201.25 PROPOSED ELEVATION
·201.40TC PROPOSED ELEV. TOP OF CURB
·202.05 EXISTING ELEVATION TO REMAIN
DRAINAGE FLOW
WORKING EASEMENT
CTREL PROPERTY LINE
LIMIT OF CONTRACT
HEAVY DUTY ASPHALT
NO PARKING/FIRE ROUTE SIGN
Ra-1 STOP SIGN
T TRANSFORMER
ELECTRICAL LINE
UTILITY DUCT BANK
EXISTING R.O.W.
DO NOT ENTER SIGN
DC DEPRESSED CURB
I.P. ITEMIZED PRICE
LIMIT OF ITEMIZED PRICE

FEB.24/00		ISSUED FOR SITE PLAN AGREEMENT	JW
FEB.18/00		ISSUED FOR BUILDING PERMIT	JW
FEB.08/00		ISSUED FOR [illegible]	JW
FEB.01/00	2	ISSUED FOR ADDENDUM No.2	JW
JAN.27/00	1	ISSUED FOR PHASE 1 TENDER	JW
JAN.17/00		RE-ISSUED FOR SITE PLAN APPROVAL	JW
DEC.10/99		RE-ISSUED FOR SITE PLAN APPROVAL	JW
NOV.26/99		RE-ISSUED FOR SITE PLAN APPROVAL	JW
OCT.6/99		ISSUED FOR SITE PLAN APPROVAL	JW
DATE	REV.	DESCRIPTION	DWN BY

REVISION RECORD

BARRHAVEN
STORE No.
442

STAMP

NORTH ARROW

CANADIAN TIRE REAL ESTATE LIMITED

CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND BE RESPONSIBLE FOR SAME, REPORTING ANY DISCREPANCIES BEFORE COMMENCING WORK.
LATEST APPROVED DRAWING ONLY TO BE USED FOR CONSTRUCTION.
PRINTS ARE NOT TO BE SCALED.

PROJECT
PROPOSED
CANADIAN TIRE STORE

DRAWING TITLE
SERVICING AND
GRADING PLAN

DRAWING No.
A01S

SCALE 1:500
JOB No. 98 3430
FILE NAME SITE
PLOT DATE FEBRUARY 18, 2000

BEL
BRONTE ENGINEERING LIMITED
2330 WYECROFT ROAD UNIT A1
OAKVILLE, ONTARIO L6L 6M1
TEL. (905) 827-6128
FAX. (905) 847-3112

NOTES

1. ALL MATERIALS AND CONSTRUCTION METHODS TO BE IN ACCORDANCE WITH THE CITY OF OTTAWA STANDARD SPECIFICATIONS AND DRAWINGS.
2. CONTRACTOR TO BE RESPONSIBLE FOR OBTAINING ALL PERMITS REQUIRED AND BEAR COST OF THE SAME INCLUDING ENTRY PERMIT AND ASSOCIATED COSTS.
3. CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF EXISTING SERVICES PRIOR TO ANY CONSTRUCTION.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING LOCATES FROM ALL UTILITY COMPANIES TO LOCATE EXISTING UTILITIES PRIOR TO EXCAVATION.
5. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL EXCAVATION, BACKFILL, REINSTATEMENT OF ALL AREAS DISTURBED DURING CONSTRUCTION AND ALL ASSOCIATED WORKS TO THE SATISFACTION OF THE ENGINEER AND THE CITY OF OTTAWA.
6. ALL COSTS AND ASSOCIATED CITY OF OTTAWA FEES TO BE RESPONSIBILITY OF CONTRACTOR. EXCAVATION, BACKFILL AND RELATED WORKS TO BE RESPONSIBILITY OF THE CONTRACTOR.
7. PROVIDE THERMAL INSULATION FOR WATER MAINS AT OPEN STRUCTURES IN ACCORDANCE WITH CITY STD. W 22.
8. WATER SERVICES [illegible] SHALL BE INSTALLED AS PER [illegible].
9. WATER METER TO BE INSTALLED IN ACCORDANCE WITH CITY OF OTTAWA SPECIFICATIONS.
10. [illegible]
11. SANITARY MANHOLES SHALL BE 1200 mm DIAMETER IN ACCORDANCE WITH OPSD-701.01.
12. CATCH BASINS SHALL BE IN ACCORDANCE WITH OPSD-705.01 COMPLETE WITH FRAME AND GRATE AS PER OPSD [illegible].
13. EXCESS EXCAVATED MATERIAL SHALL BE REMOVED FROM THE SITE.
14. FOR THE ENTIRE CONSTRUCTION PERIOD MAINTAIN A FILTER FABRIC AROUND ALL CATCH BASIN AND MANHOLE TOPS.
15. GRANULAR "A" SHALL BE PLACED TO A MINIMUM THICKNESS OF 300 mm AROUND ALL STRUCTURES WITHIN PAVEMENT AREA.
16. SEWER TRENCH SHALL CONSIST OF A CLASS "B" BEDDING CONSISTING OF 150 mm OF GRANULAR "A" BEDDING AND BACKFILLED WITH GRANULAR "A" TO 300mm OVER SEWER. COMPACTION SHALL BE A MINIMUM OF 95% STANDARD PROCTOR DENSITY AS PER CITY [illegible].
17. ALL GRANULAR FOR ROADS SHALL BE COMPACTED TO A MINIMUM OF 98% STANDARD PROCTOR DENSITY.
18. ALL NECESSARY CLEARING AND GRUBBING SHALL BE COMPLETED BY THE CONTRACTOR. REVIEW WITH ARCHITECT PRIOR TO CUTTING.
19. SEWERS SHALL BE VIDEO INSPECTED AFTER CONSTRUCTION.
20. [illegible] COURSE OF ASPHALT TO BE PLACED AFTER A VIDEO INSPECTION OF SEWERS & RESULTING REPAIRS ARE CARRIED OUT.
21. SUB-EXCAVATE SOFT AREAS & FILL WITH GRANULAR "B" COMPACTED IN [illegible] LAYERS.
22. ALL MANHOLE & CATCHBASIN EXCAVATIONS TO BE BACKFILLED WITH GRANULAR "B" COMPACTED TO 95% STANDARD PROCTOR DENSITY.
23. CONTRACTOR IS RESPONSIBLE FOR COORDINATION OF THEIR ACTIVITIES WITH OTHERS ON SITE.
24. PROVIDE THERMAL INSULATION [illegible] WIDTH OVER SEWERS IN AREAS WHERE COVER IS LESS THAN 1.82 METRES.
25. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING AS-BUILT INFORMATION.
26. ALL GRANULAR BASE COURSE MATERIALS TO BE COMPACTED TO MINIMUM 98% STANDARD PROCTOR DENSITY.
27. THE CONTRACTOR SHALL BE RESPONSIBLE FOR [illegible] ALL CONNECTIONS INTO THE EXISTING SEWERS AND CATCHBASINS (AS PER REQUIREMENTS OF THE CITY OF OTTAWA).
28. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE LANDSCAPE, ARCHITECTURAL, MECHANICAL, ELECTRICAL, STRUCTURAL DRAWINGS.
29. ALL ROADWAY REINSTATEMENT SHALL CONFORM TO THE CITY OF OTTAWA SPECIFICATIONS.
30. ALL DISTURBED AREAS TO BE REINSTATED TO THE SATISFACTION OF THE CITY OF OTTAWA.
31. CONTRACTOR WILL BE RESPONSIBLE FOR THE HORIZONTAL AND VERTICAL LAYOUT OF SERVICES, ROADS, CURBING, ELECTRICAL, ETC.
32. CURBING IS TO BE 150mm ABOVE ASPHALT UNLESS OTHERWISE INDICATED BY GRADE.
33. ALL WATERMAINS AND APPURTENANCES SHALL HAVE CATHODIC PROTECTION IN ACCORDANCE WITH THE CITY OF OTTAWA SPECIFICATIONS [illegible].
34. ALL WATERMAINS SHALL BE INSTALLED WITH A MINIMUM OF 2.4m COVER FROM FINISHED GRADE. HYDRANTS TO BE AS PER W19.
35. CONTRACTOR TO SUPPLY SHOP DRAWINGS FOR REVIEW & APPROVAL OF MANHOLES THAT EXCEED THE RECOMMENDED OPSD STANDARDS.
36. ALL CONCRETE SEWER PIPES TO BE C.S.A. SPECIFICATIONS A257-[illegible] OR LATEST AMENDMENT UNLESS OTHERWISE NOTED.
37. CONTRACTOR SHALL BE RESPONSIBLE FOR CONNECTION TO EXIST. MANHOLES AND FOR [illegible].
38. ALL POLYVINYLCHLORIDE (PVC) SANITARY SEWER PIPES SHALL MEET CURRENT ABS SPECIFICATIONS AND CITY OF OTTAWA STANDARDS.
39. [illegible] LATEST AMENDMENT UNLESS OTHERWISE NOTED.
40. ALL MANHOLES AND CATCHBASINS SHALL BE ADJUSTED TO FINAL GRADES.

WATERMAIN SCHEDULE
50mm WATER SERVICE

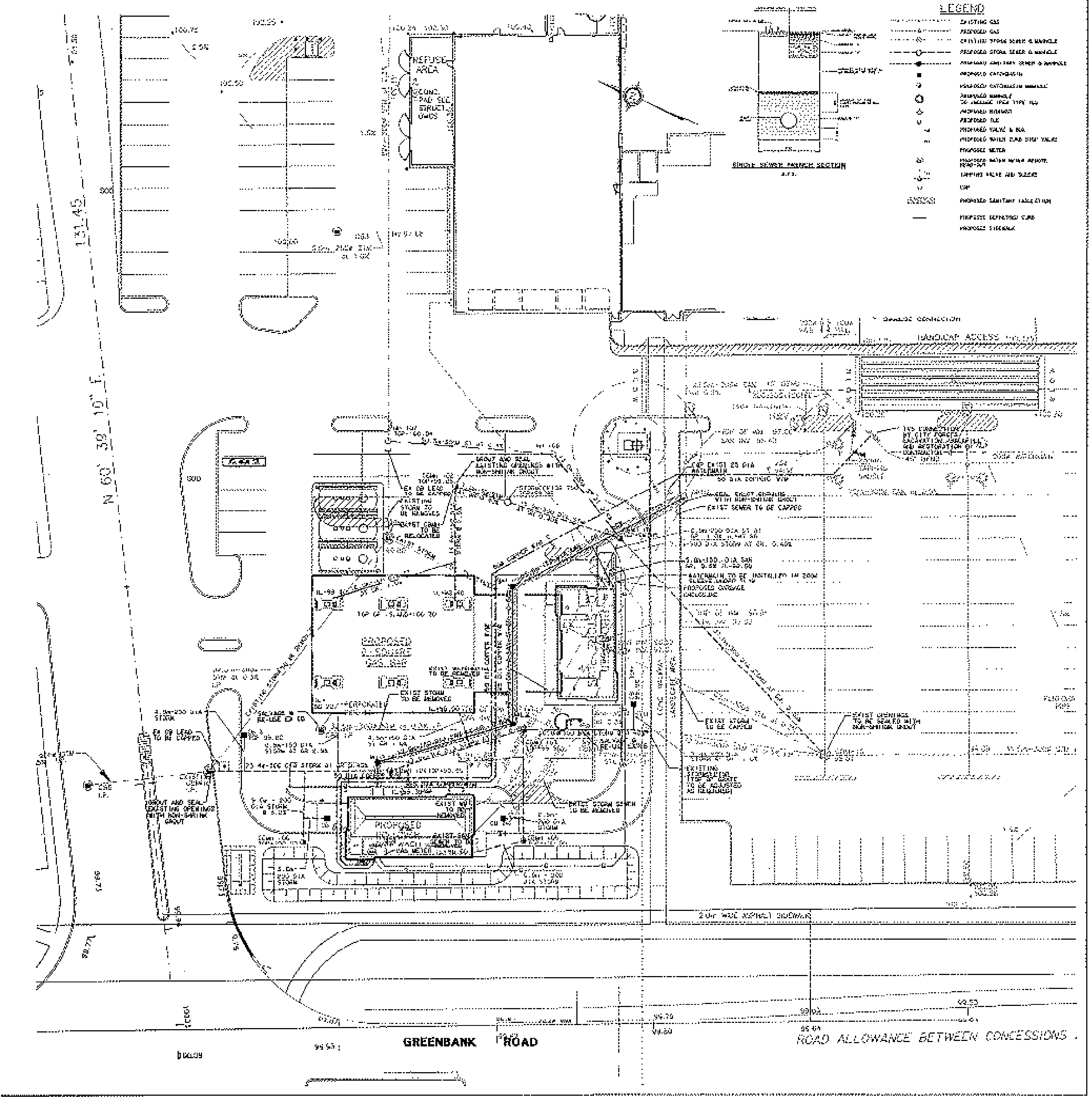
STATION	DESCRIPTION	PROPOSED ELEVATION	TOP OF WATERMAIN
0+00.0	50x200 TAPPING SADDLE VALVE & BOX	100.15	97.75
0+002.8		100.12	97.72
0+030		100.00	97.60
0+060		100.10	97.70
0+090		99.95	97.45
0+116.2	BLDG.(CAR WASH)	100.15	97.75

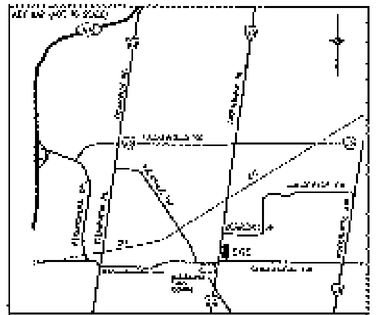
WATERMAIN SCHEDULE
25mm WATER SERVICE

STATION	DESCRIPTION	PROPOSED ELEVATION	TOP OF WATERMAIN
0+000	BLDG.(C-STORE)	100.00	97.60
0+015		100.04	97.64
0+030		99.95	97.55
0+045		99.95	97.55
0+060		100.12	97.72
0+075		100.12	97.72
0+074.7	BLDG.(CAR WASH)	100.15	97.75

CATCHBASIN & MANHOLE SCHEDULE

	ELEVATIONS					
STRUCTURE	GRATE	EAST INVERT	WEST INVERT	SOUTH INVERT	NORTH INVERT	REMARKS
EX MH 1A	100.15	98.41	98.41	98.41		EXISTING
MH 1	100.05	98.04	98.04			1800 DIA
MH 2	98.56	98.59	98.88			1800 DIA
MH 3	98.98	98.76	99.36			1200 DIA
CB1	99.80		98.70			
CB2	100.05	98.60				
CB3	99.85		98.20			
CB4	100.05		98.55			
CBMH 6	99.74		97.89	97.89		EXISTING
CBMH 10	99.61			97.68		EXISTING
CBMH 101	99.85	97.75	97.85	97.72	97.75	1800 DIA
CBMH 102	99.85		97.92	97.04		1800 DIA
CBMH 103	99.40		98.28	97.74	97.74	1200 DIA
CBMH 104	99.35	97.80	97.80			1800 DIA
CBMH 105	100.00		98.55			1200 DIA
CBMH 106	100.00	98.50				1200 DIA
STORMCEPTOR	99.75			97.66	97.68	EXISTING STC 750
STORMCEPTOR	99.52	99.30		97.81	97.61	STC 750
MH 107	100.04			97.97	97.49	1200 DIA
MH 108	100.05		97.85	97.81		1200 DIA





Conforms to
City of Ottawa Standards
Conforme aux standards
de la Ville d'Ottawa
Plan # 13603
Date: 24/6/05
Ottawa

REVISIONS

M. A. ANSARI
LICENSED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

Trow Associates Inc.
154 Colonnade Road South, Ottawa, Ontario K2E 7J5
Tel: (613) 225-9940
Fax: (613) 225-7337

PROPOSED
GAS BAR
CANADIAN TIRE PETROLEUM

SITE SERVICING PLAN

GREENBANK ROAD & [illegible]
BARRHAVEN – ONTARIO

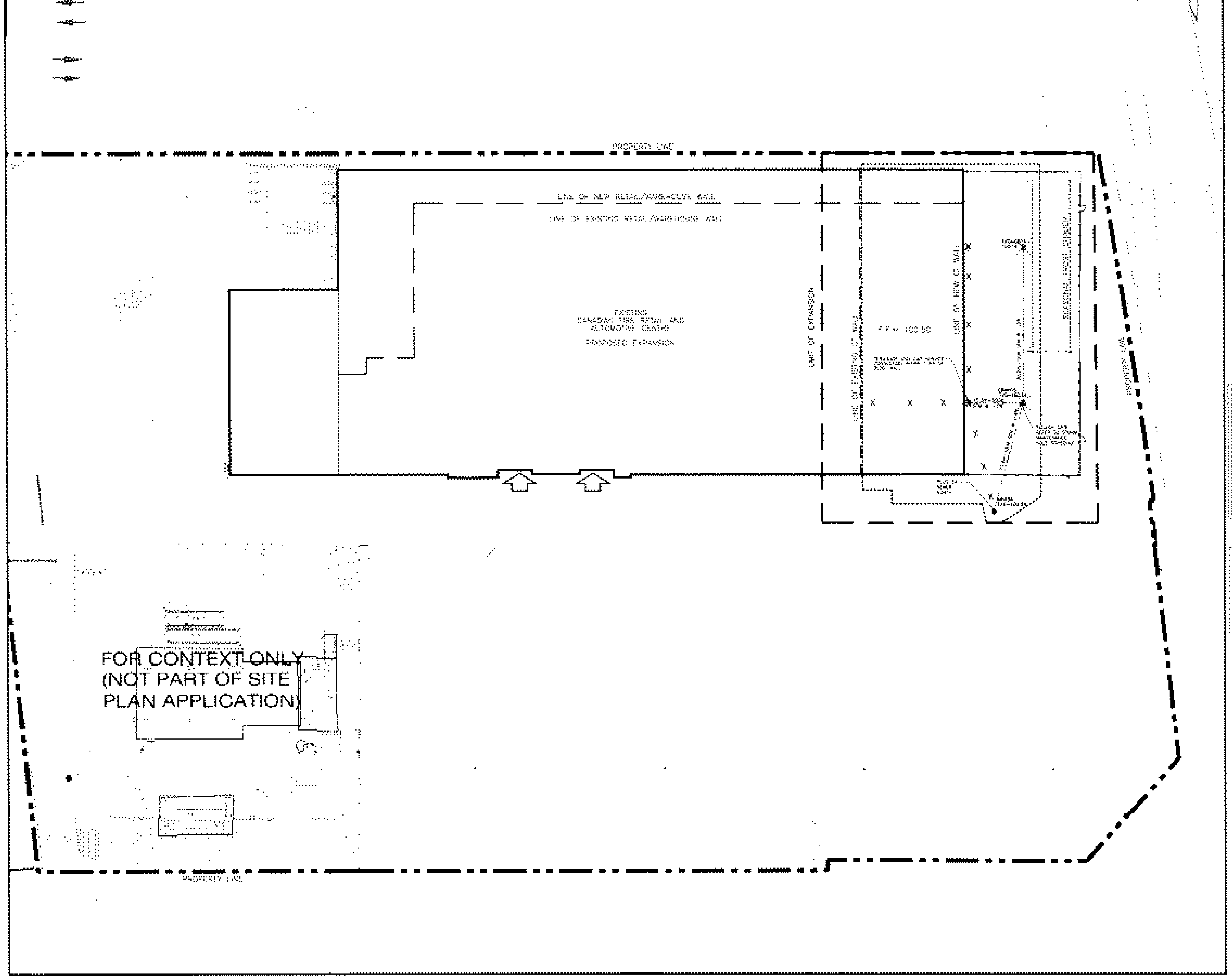
PART OF LOT 10 AND PART OF ROAD ALLOWANCE BETWEEN LOTS 10 and 11 CONCESSION 2 (RIDEAU FRONT) IN THE TOWNSHIP OF NEPEAN NOW IN THE CITY OF NEPEAN REGIONAL MUNICIPALITY OF OTTAWA-CARLETON

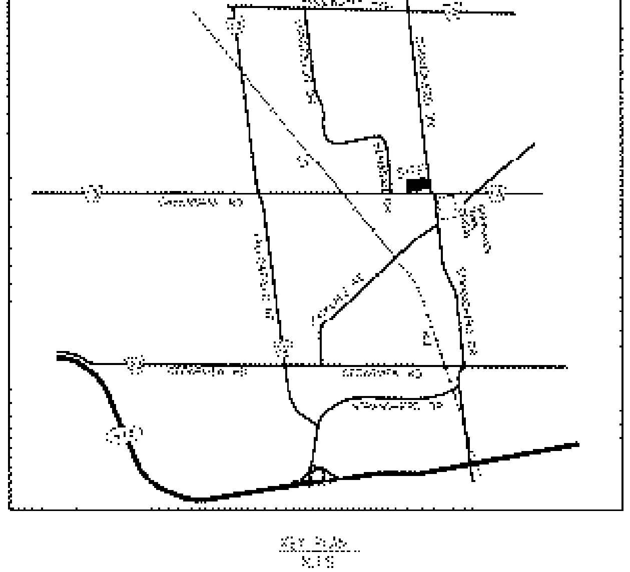
1:200	FEB 2003
M.M.R.	0
442P	SS-1

Contractor must check and verify all dimensions and be responsible for the same, reporting any discrepancies to CANADIAN TIRE PETROLEUM before commencing work.

PRINTS ARE NOT TO BE SCALED.

All dimensions are in metres unless otherwise specified. To convert METRES to FEET divide dimension by 0.3048



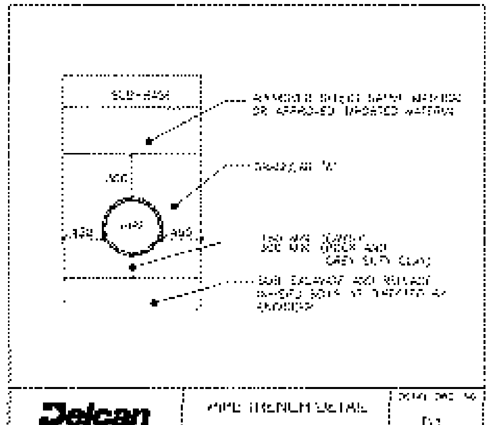

KEY PLAN
N.T.S.

STORM MAINTENANCE HOLE SCHEDULE

STORM PIPING SCHEDULE

NOTES: GENERAL

NOTES: SEWER


PIPE TRENCH DETAIL

D1

REVISION RECORD

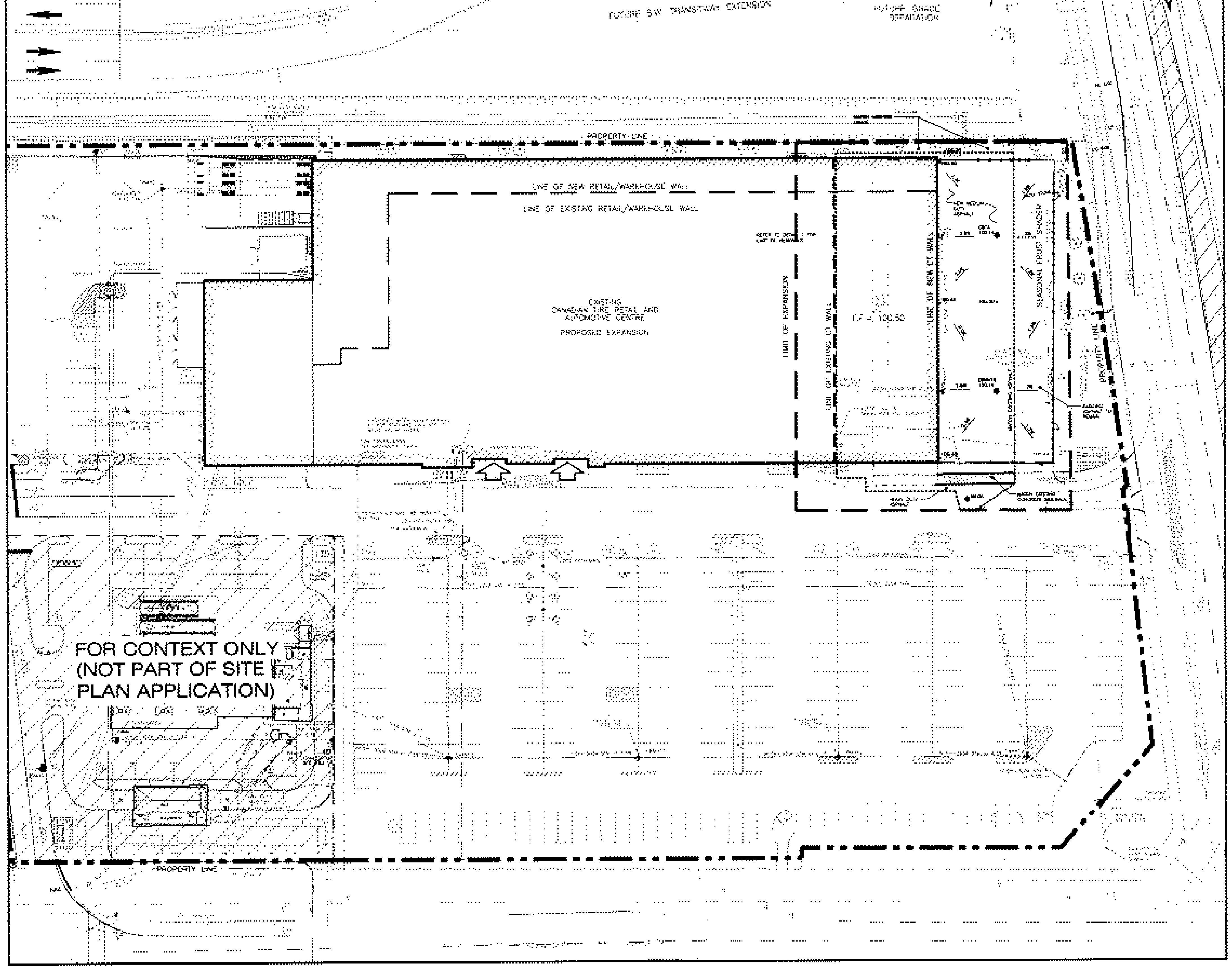
TURNER FLEISCHER

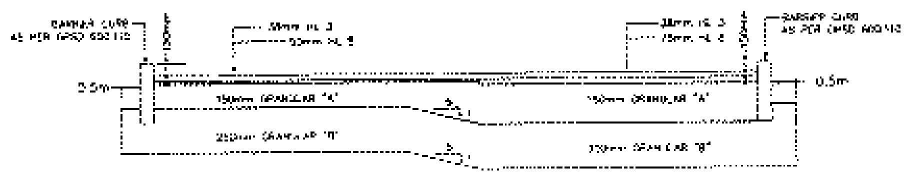
Delcan

BARRHAVEN
STORE No 442

CANADIAN TIRE REAL ESTATE LTD

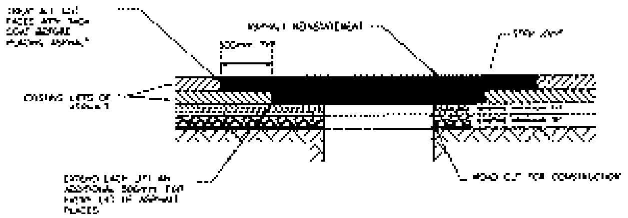
RETAIL STORE AND SERVICE CENTRE # 442
2501 GREENBANK RD
BARRHAVEN, ONTARIO



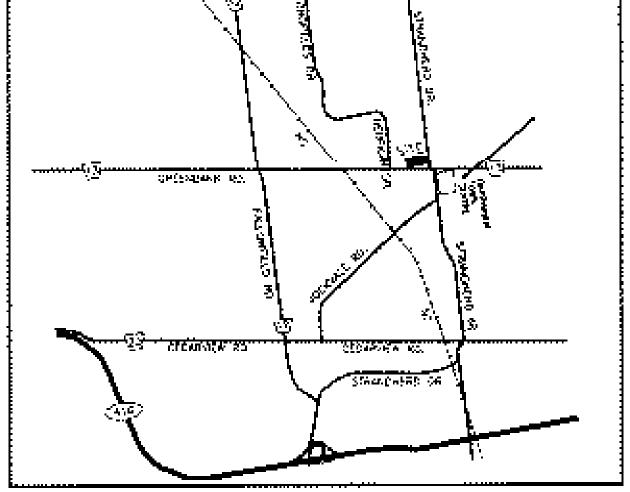


PARKING AREAS (MEDIUM DUTY)

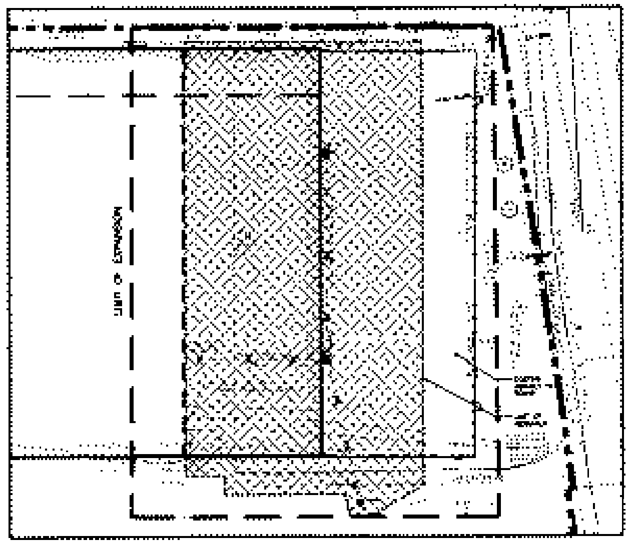
MAJOR ACCESS ROUTES (HEAVY DUTY)



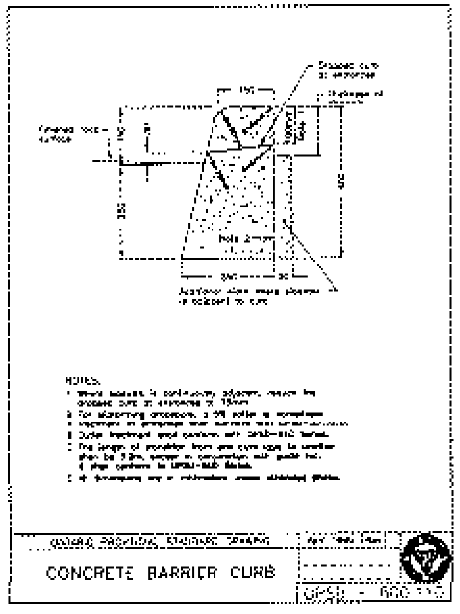
EXISTING ROAD PAVEMENT REINSTATEMENT DETAIL



KEY PLAN
N.T.S.



REMOVAL DETAIL
SCALE = 1:400



CONCRETE BARRIER CURB

APPLICANT:
KATHLEEN FREEMAN
CANADIAN TIRE REAL ESTATE LIMITED
2180 YONGE STREET
P.O. BOX 770, STATION K
TORONTO, ONTARIO
M4P 2V8

LEGEND

APPROVED [✓] REFUSED ☐
KAREN P. CURRIE
Manager
Development Approvals

Reviewed by
Infrastructure Approvals Divn.
2006/06/25
#13603

REVISION RECORD

TURNER FLEISCHER
ARCHITECTS INC.

TORONTO :
67 Lesmill Road
Toronto, Ontario M3B 2T8
Tel : 416-425-2222
Fax: 416-425-6717

DELCAN

BARRHAVEN
STORE No.
442

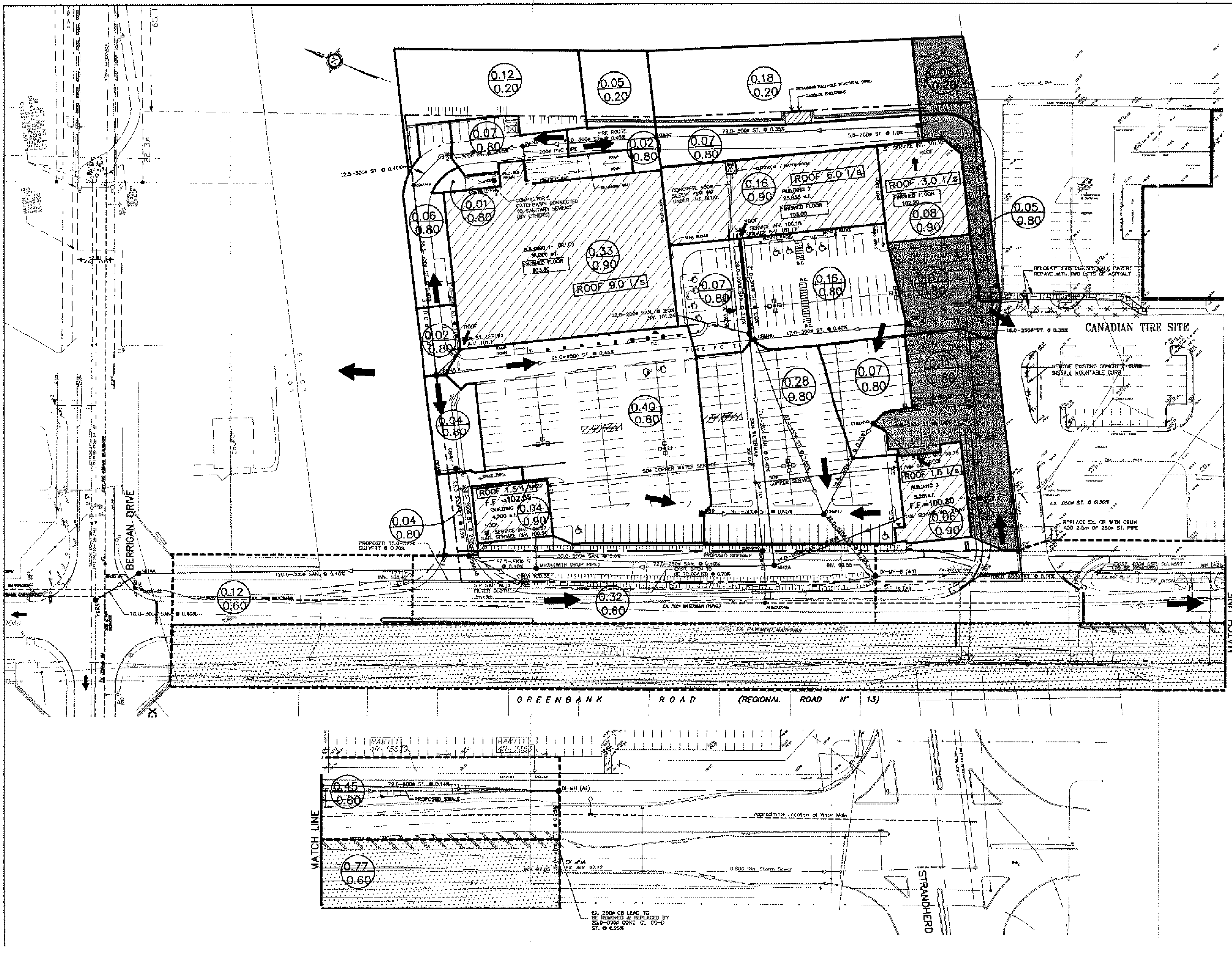
CANADIAN TIRE REAL ESTATE LTD.

RETAIL STORE AND SERVICE CENTRE # 442
2501 GREENBANK RD
BARRHAVEN, ONTARIO

GRADING PLAN

GR1

D07-12-06-0085



NO.	DATE	BY	REVISION
0.	00:12:15		ISSUED FOR APPROVAL
1.	01:01:22		REVISED AS PER CITY AND ARCHITECT
2.	01:01:30		REVISED FOR SWM
3.	01:01:31		REVISED AS PER ARCHITECT
4.	01:02:28		REVISED PER ARCH. & CTC ENTRANCE

LEGEND :

0.28	AREA IN HECTARES
0.80	RUN OFF COEFFICIENT
➡	MAJOR FLOW

THE LOCATION OF UTILITIES IS APPROXIMATE ONLY, AND THE EXACT LOCATION SHOULD BE DETERMINED BY CONSULTING THE MUNICIPAL AUTHORITIES AND UTILITY COMPANIES CONCERNED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ADEQUATE PROTECTION FROM DAMAGE DURING CONSTRUCTION.

CITY OF NEPEAN
PUBLIC WORKS DEPARTMENT

Cumming Cockburn Limited
Consulting Engineers, Planners, and Environmental Scientists

REGISTERED PROFESSIONAL ENGINEER
R.W. WINGATE
01:02:05
PROVINCE OF ONTARIO

VILLAGE SQUARE MALL
WESTEINDE DEVELOPMENTS LTD.

STORM DRAINAGE AREA PLAN

SCALE: 1:500
DRAWN: M.M. DATE: DECEMBER '00
DESIGN: K. HOTOVEC DATE: DECEMBER '00
CHECKED: R.W.W DATE: DECEMBER '00

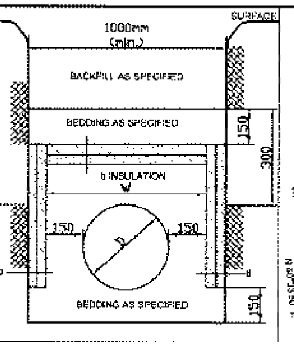
PROJECT NO. 3333-LD
DRAWING NO. 500

b = THICKNESS OF INSULATION (mm)
h = DEPTH OF COVER
W = D + 300 (1000 min.)
W = WIDTH OF INSULATION (mm)
D = O.D OF PIPE (mm)

COVER (mm)	INSULATION THICKNESS (mm)
1500-1200	75
1200-900	100
900-600	125

NOTES:

1. INSULATE ALL SEWER PIPES THAT HAVE LESS THAN 1.5m COVER WITH EXPANDED POLYSTYRENE INSULATION AS SHOWN.
2. THE THICKNESS OF INSULATION SHALL BE THE EQUIVALENT OF 25mm FOR EVERY 300mm REDUCTION IN THE REQUIRED DEPTH OF COVER (SEE TABLE)



TYPICAL INSULATION DETAIL

N.T.S.

ROOF DRAIN TABLE - BUILDING 'A', 'B', 'C'

AREA ID *	ROOF DRAIN No.	ROOF DRAINS OPENING	1:5 YEAR RELEASE RATE	APPROX. 5 YR PONDING DEPTH	1:100 YEAR RELEASE RATE	APPROX. 100 YR PONDING DEPTH
(A-2) BLDG 'A' & 'B'	RD 1, RD 2 & RD 3	1/2 OPEN	2.85 L/s	0.08 m	4.50 L/s	0.15 m
(A-3) BLDG 'C'	RD 1	1/4 OPEN	0.95 L/s	0.11 m	1.14 L/s	0.16 m

* REFER TO STORMWATER MANAGEMENT PLAN (102076-SWM) FOR DRAINAGE AREA ID
** ALL PROPOSED ROOF DRAINS TO BE WATTS ACCUTROL ADJUSTABLE FLOW CONTROL ROOF DRAINS

CRITICAL PIPE CROSSING TABLE

①	250mmØ STM INV=101.30	200mmØ SAN OBV=100.72	0.58m± CLEARANCE
②	250mmØ STM INV=101.00	150mmØ STM OBV=100.75	0.25m± CLEARANCE
③	150mmØ STM INV=100.65	200mmØ SAN OBV=100.10	0.55m± CLEARANCE
④	200mmØ STM INV=101.03	200mmØ SAN OBV=99.64	1.39m± CLEARANCE

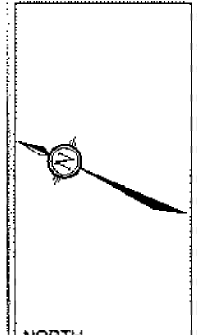
150mmØ WATERMAIN TABLE

STATION	SURFACE ELEVATION	TOP OF WATERMAIN ELEVATION	DESCRIPTION
0+000.0	102.70±	100.30± *	CONNECT TO EXISTING 406Ø WATERMAIN
0+009.7	102.70	100.35	150mmØ V&VB
0+025.0	102.90	100.50	-
0+050.0	103.23	100.83	-
0+062.9	103.23	100.80	CROSS BELOW STM (STM INV=101.31)
0+071.7	103.28	100.88	150mmØ x 150mmØ x 150mmØ TEE
0+075	103.35	100.95	-
0+080.9	103.45	101.05	CROSS ABOVE SAN (SAN OBV=100.48)
0+081.3	103.45	101.05	45° H. BEND
0+084.8	103.50	101.10	CROSS ABOVE STM (STM OBV=100.72)
0+088.3	103.45	101.10	45° H. BEND
0+100	103.61	101.14	-
0+114.0	103.42	101.02	CROSS BELOW STM (STM INV=101.55)
0+123.4	103.40	101.00	45° H. BEND
0+125	103.50	101.00	-
0+127.2	103.40	101.00	45° H. BEND
0+143.3	103.25	100.85	45° H. BEND
0+144.3	103.25	100.85	45° H. BEND
0+145.3	103.40	100.85	CAP 1.0m FROM BUILDING FACE

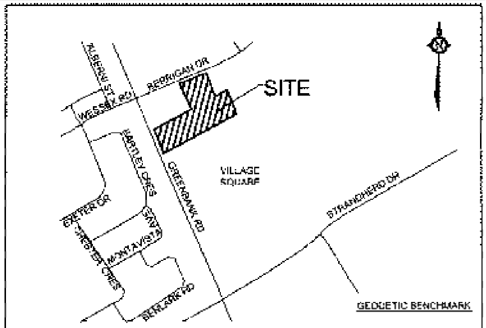
150mmØ HYDRANT LEAD

STATION	SURFACE ELEVATION	TOP OF WATERMAIN ELEVATION	DESCRIPTION
2+000.0	103.45	101.06	150mmØ x 150mmØ x 150mmØ TEE
2+001.8	103.45	101.05	V&VB
2+004.6	103.52	101.06	CROSS ABOVE STM (STM OBV=100.72)
2+007.4	103.65	101.06	HYDRANT

* EXACT DEPTH OF EXISTING WATERMAIN TO BE DETERMINED AT TIME OF EXCAVATION. PROVIDE THERMAL INSULATION AS PER CITY OF OTTAWA DETAILS W22 WHERE COVER IS LESS THAN 2.4m.



NORTH



KEY PLAN
N.T.S.

50mmØ SERVICE TO 'C'

STATION	SURFACE ELEVATION	TOP OF WATERMAIN ELEVATION	DESCRIPTION
1+000.0	103.45	100.85	CAP 1.0m FROM BUILDING FACE
1+001.4	103.24	100.84	45° H. BEND
1+003.2	103.23	100.83	45° H. BEND
1+020.7	103.43	101.03	45° H. BEND
1+024.8	103.60	101.03	45° H. BEND
1+025	103.60	101.03	-
1+031.4	103.42	101.02	CROSS BELOW STM (STM INV=101.48)
1+050	103.56	101.15	-
1+059.8	103.56	101.15	45° H. BEND
1+064.4	103.50	101.10	CROSSING ABOVE STM (STM OBV=100.73)
1+069.7	103.45	101.05	CROSSING ABOVE SAN (SAN OBV=100.47)
1+075.3	103.30	100.90	45° H. BEND
1+089.1	102.99	100.59	CROSSING BELOW STM (STM INV=101.13)
1+100	103.17	100.77	-
1+102.9	103.17	100.77	SP
1+103.9	103.25	100.85	CAP 1.0m FROM BUILDING FACE

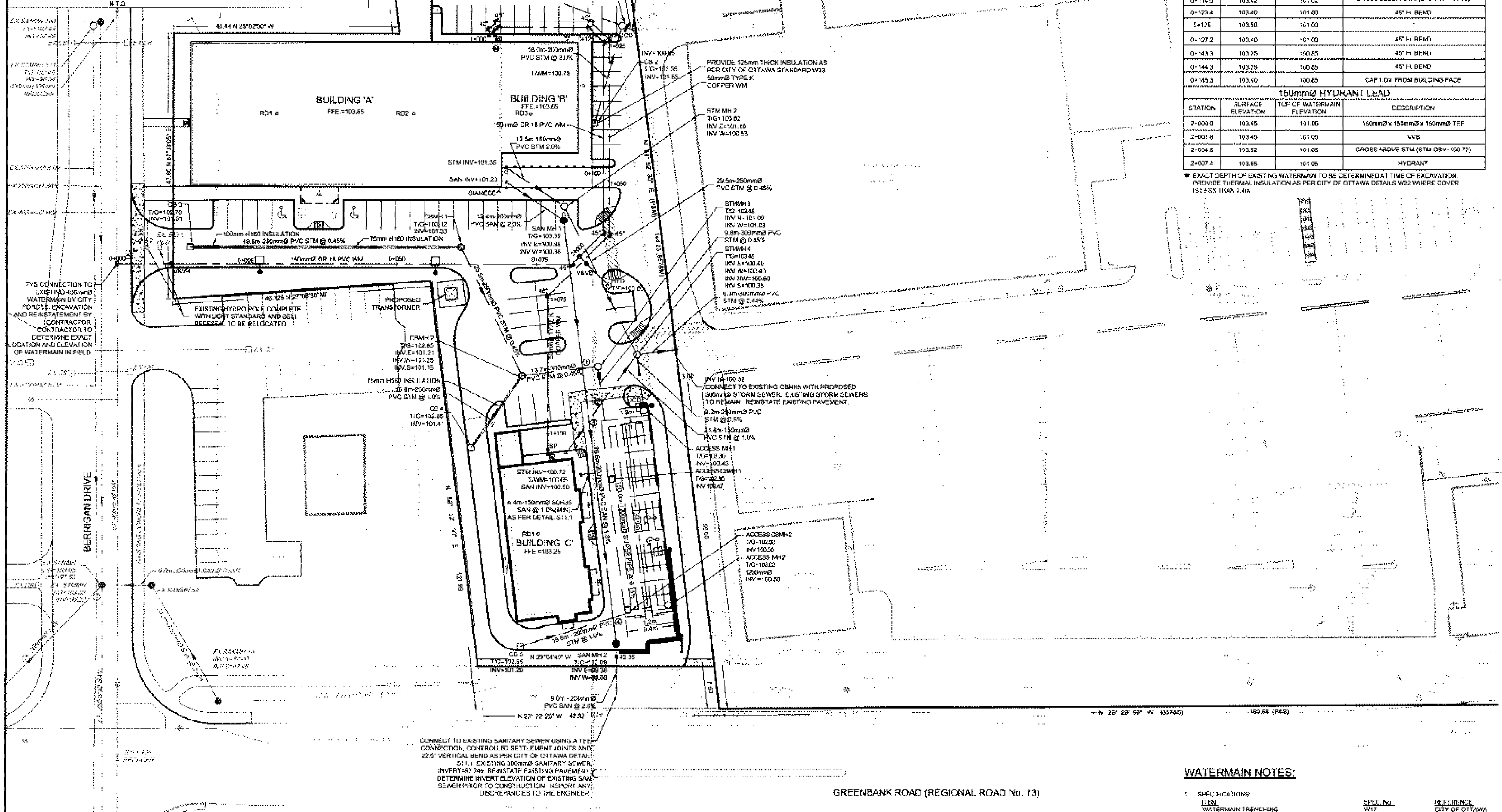
* PROVIDE THERMAL INSULATION AS PER CITY OF OTTAWA DETAILS W22 WHERE COVER IS LESS THAN 2.4m

INLET CONTROL DEVICE DATA - STM MH 1

DESIGN EVENT	HYDROVEX MODEL	DIAMETER OF OUTLET PIPE (mm)	DESIGN FLOW (L/s)	DESIGN HEAD (m)	VOLUME (m3)
1:5 YR	75-VHV-1	250	5.80	2.30	7.6
1:100 YR	75-VHV-1	250	6.00	2.40	21.3

INLET CONTROL DEVICE DATA - ACCESS MH 1

DESIGN EVENT	HYDROVEX MODEL	DIAMETER OF OUTLET PIPE (mm)	DESIGN FLOW (L/s)	DESIGN HEAD (m)	VOLUME (m3)
1:5 YR	75-VHV-1	250	4.50	0.83	82.6
1:100 YR	75-VHV-1	250	5.42	1.28	168.6



WATERMAIN NOTES:

1. SPECIFICATIONS:

ITEM	SPEC. No.	REFERENCE
WATERMAIN TRENCHING	W17	CITY OF OTTAWA
THERMAL INSULATION IN SHALLOW TRENCHES	W22	CITY OF OTTAWA
WATERMAIN CROSSING BELOW SEWER	W25	CITY OF OTTAWA
HYDRANT LOCATION	W18	CITY OF OTTAWA
HYDRANT INSTALLATION	W19	CITY OF OTTAWA
THERMAL INSULATION AT OPEN STRUCTURES	W23	CITY OF OTTAWA
WATERMAIN	PVC DR 18 TYPE K COPPER	

2. SUPPLY AND CONSTRUCT ALL WATERMAINS AND APPURTENANCES IN ACCORDANCE WITH THE CITY OF OTTAWA STANDARDS AND SPECIFICATIONS. EXCAVATION, INSTALLATION, BACKFILL AND RESTORATION OF ALL WATERMAINS BY THE CONTRACTOR. CONNECTIONS AND SHUT-OFFS AT THE MAIN AND CHLORINATION OF THE WATER SYSTEM SHALL BE PERFORMED BY CITY OFFICIALS
3. WATERMAIN SHALL BE MINIMUM 2.4m DEPTH BELOW GRADE UNLESS OTHERWISE INDICATED
4. PROVIDE MINIMUM 0.25m CLEARANCE BETWEEN OUTSIDE OF PIPES AT ALL CROSSINGS
5. WATER SERVICE IS TO BE CONSTRUCTED TO WITHIN 1.0m OF FOUNDATION WALL AND CAPPED, UNLESS OTHERWISE INDICATED

GENERAL NOTES:

1. COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS
2. DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THIS DRAWING.
3. OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM THE CITY OF OTTAWA BEFORE COMMENCING CONSTRUCTION
4. BEFORE COMMENCING CONSTRUCTION OBTAIN AND PROVIDE PROOF OF COMPREHENSIVE, ALL RISK AND OPERATIONAL LIABILITY INSURANCE FOR $2,000,000.00. INSURANCE POLICY TO NAME OWNERS, ENGINEERS AND ARCHITECTS AS CO-INSURED.
5. RESTORE ALL DISTURBED AREAS ON-SITE AND OFF-SITE, INCLUDING TRENCHES AND SURFACES ON PUBLIC ROAD ALLOWANCES TO EXISTING CONDITIONS OR BETTER TO THE SATISFACTION OF THE CITY OF OTTAWA AND ENGINEER
6. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL, ORGANIC MATERIAL AND DEBRIS UNLESS OTHERWISE INSTRUCTED BY ENGINEER. EXCAVATE AND REMOVE FROM SITE ANY CONTAMINATED MATERIAL. ALL CONTAMINATED MATERIAL SHALL BE DISPOSED OF AT A LICENSED LANDFILL FACILITY.
7. ALL ELEVATIONS ARE GEODETIC
8. REFER TO GEOTECHNICAL REPORT(No. 09-1121-0006, DATED DECEMBER 2009) PREPARED BY GOLDER ASSOCIATES FOR SUBSURFACE CONDITIONS, CONSTRUCTION RECOMMENDATIONS, AND GEOTECHNICAL INSPECTION REQUIREMENTS. THE GEOTECHNICAL CONSULTANT IS TO REVIEW ON-SITE CONDITIONS AFTER EXCAVATION PRIOR TO PLACEMENT OF THE GRANULAR MATERIAL.
9. REFER TO ARCHITECT'S AND LANDSCAPE ARCHITECT'S DRAWINGS FOR BUILDING AND HARDSURFACE AREAS AND DIMENSIONS
10. REFER TO STORMWATER MANAGEMENT REPORT (R-2010-073) PREPARED BY NOVATECH ENGINEERING CONSULTANTS LTD.
11. SAW CUT AND KEY GRIND ASPHALT AT ALL ROAD CUTS AND ASPHALT TIE IN POINTS AS PER CITY OF OTTAWA STANDARDS (R10).
12. PROVIDE LINE/PARKING PAINTING.

SEWER NOTES:

1. SPECIFICATIONS

ITEM	SPEC. No.	REFERENCE
CATCHBASIN (600x600mm)	705.010	OPSD
STORM / SANITARY MANHOLE (1200Ø)	701.010	OPSD
STORM MANHOLE (2400Ø)	701.060 & 701.061	OPSD
CB, FRAME & COVER	400.020	OPSD
STORM / SANITARY MH FRAME & COVER	401.010	OPSD
SEWER TRENCH	S6, S7	CITY OF OTTAWA

STORM SEWER	PVC DR 35, CONC CLASS 65D
SANITARY SEWER	PVC DR 35
SUPER PIPE	ALUMINIZED STEEL TYPE 2 2.0mm THICKNESS (ULTRA FLO OR EQUIVALENT)

2. SERVICES ARE TO BE CONSTRUCTED TO 1.0m FROM FACE OF BUILDING AT A MINIMUM SLOPE OF 1.0%
3. PIPE BEDDING, COVER AND BACKFILL ARE TO BE COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY. THE USE OF CLEAR CRUSHED STONE AS A BEDDING LAYER SHALL NOT BE PERMITTED.
4. FLEXIBLE CONNECTIONS ARE REQUIRED FOR CONNECTING PIPES TO MANHOLES (FOR EXAMPLE KOR-N-SEAL, PSX: POSITIVE SEAL AND DURASEAL). THE CONCRETE CRADLE FOR THE PIPE CAN BE ELIMINATED
5. THE OWNER SHALL REQUIRE THAT THE SITE SERVICING CONTRACTOR PERFORM FIELD TESTS FOR QUALITY CONTROL OF ALL SANITARY SEWERS. LEAKAGE TESTING SHALL BE COMPLETED IN ACCORDANCE WITH OPSS 410.07.16, 410.07.16.04 AND 407.07.24. DYE TESTING IS TO BE COMPLETED ON ALL SANITARY SERVICES TO CONFIRM PROPER CONNECTION TO THE SANITARY SEWER MAIN. THE FIELD TESTS SHALL BE PERFORMED IN THE PRESENCE OF A CERTIFIED PROFESSIONAL ENGINEER WHO SHALL SUBMIT A CERTIFIED COPY OF THE TEST RESULTS.
6. STORM MANHOLES AND CBMHS ARE TO HAVE 300mm SUMPS UNLESS OTHERWISE INDICATED.
7. CONTRACTOR TO TELEVISE (CCTV) ALL PROPOSED SEWERS, 200mmØ OR GREATER PRIOR TO BASE COURSE ASPHALT. UPON COMPLETION OF CONTRACT, THE CONTRACTOR IS RESPONSIBLE TO FLUSH AND CLEAN ALL SEWERS & APPURTENANCES

LEGEND

DC	PROPOSED DEPRESSED CURB
200mmØ	PROPOSED WATERMAIN AND DIAMETER
V&VB	PROPOSED VALVE & VALVE BOX
SP	PROPOSED STAND POST
HYD	PROPOSED HYDRANT C/W VALVE & LEAD
BEND	PROPOSED BEND AND THRUSTBLOCK 11.25°, 22.5°, 45° or TEE
Y	PROPOSED SIAMESE CONNECTION
[	PROPOSED CAP

LEGEND

SAN MH	PROPOSED SANITARY MANHOLE & SEWER
STM MH	PROPOSED STORM MANHOLE & SEWER
➡	DIRECTION OF FLOW
CB 1	PROPOSED CATCHBASIN C/W CATCHBASIN LEAD
CBMH	PROPOSED CATCHBASIN MH
RD	PROPOSED ROOF DRAIN
ICD	PROPOSED INLET CONTROL DEVICE
▽	PROPOSED BUILDING ENTRANCE

LEGEND

▨	PROPOSED 75mm INSULATION
▨	PROPOSED 100mm INSULATION
▬	PROPOSED RETAINING WALL
═	PROPOSED PYLON SIGN
●	PROPOSED WATER METER
●	PROPOSED REMOTE METER
	EXISTING STORM MANHOLE & SEWER
○	*EXISTING SANITARY MANHOLE & SEWER*

LEGEND

EXISTING CATCHBASIN C/W CATCHBASIN LEAD
EXISTING CATCHBASIN MH
EXISTING LIGHT STANDARD
EXISTING WATERMAIN
EXISTING VALVE & VALVE BOX
EXISTING HYDRANT C/W VALVE & LEAD

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

Owner:
ECL Developments Limited
5935 Airport Road, Suite 810
Mississauga, ON, L4T 1V2

No.	REVISION	DATE	BY	No.	REVISION	DATE	BY
				8.	RE-ISSUED FOR SITE PLAN APPROVAL	DEC 15/10	MS
				7.	ISSUED FOR COORDINATION	DEC 2/10	MS
				6.	ISSUED FOR REVIEW AND COORDINATION	NOV 25/10	MS
				5.	ISSUED FOR MOE APPROVAL	SEPT 13/10	MS
				4.	REVISED PER CITY COMMENTS	AUG 20/10	MS
				3.	ISSUED FOR COORDINATION	AUG 17/10	MS
10.	RE-ISSUED FOR SITE PLAN APPROVAL	FEB 16/11	MS	2.	ISSUED FOR SITE PLAN APPLICATION	JUNE 8/10	MS
9.	ISSUED FOR REVIEW AND COORDINATION	FEB 16/11	MS	1.	ISSUED FOR REVIEW	JAN 14/09	MS

SCALE
1:400
1:400
0 4 8 12 16

DESIGN CJO
CHECKED MS
DRAWN CJO
CHECKED MS
APPROVED MS

FOR REVIEW ONLY

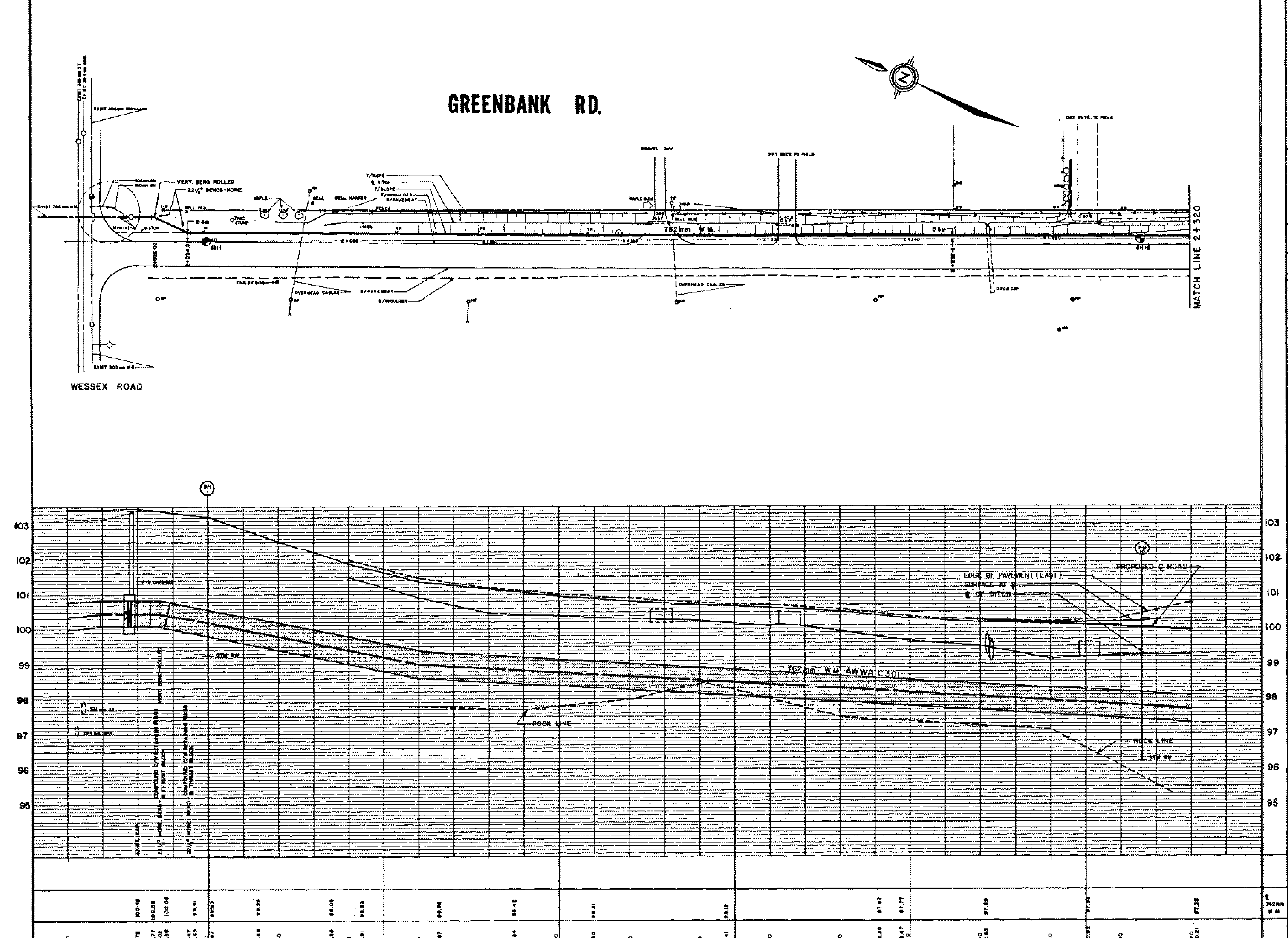
M. SAVIC
100102651

NOVATECH
ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email novainfo@novatech-eng.com

LOCATION
CITY OF OTTAWA
VILLAGE SQUARE PLAZA
1481 GREENBANK ROAD

DRAWING NAME
GENERAL PLAN OF SERVICES

PROJECT No. 102076
REV REV # 10
DRAWING No. 102076-GP



REGIONAL MUNICIPALITY
OF
OTTAWA-CARLETON

ENVIRONMENTAL SERVICES
DEPARTMENT

R. DENHAM, P.Eng
ENVIRONMENTAL SERVICES COMMISSIONER

Approved by:
Manager of Design & Construction
Date 7/3/91

R. O'KEEFE
PROVINCE OF ONTARIO

Project Officer | Date JUL. 90

Drawn by: M. LAHEY M. GLEASON | Date JUL. 90

Notes

1. RMOC FORCES WILL CONNECT TO EXIST. WATERMAINS.
2. LOCATION & GRADE OF EXIST 762mm WM. IS TO BE DETERMINED IN THE FIELD BY THE CONTRACTOR.
3. DETAILED SURVEY PLOTTED PER FIELD BOOK No 757, RECORDED BY B. ALBERTY, JUN. 90 ALSO DWG. No 3754.
4. ALL SEWER & UTILITY LOCATIONS TO BE VERIFIED BY THE CONTRACTOR PRIOR TO ORDERING PIPE.
5. FIRE HYDRANT STATION: INCLUDES ALL PIPE AND APPURTENANCES FROM TEE TO HYDRANT, EXCAVATION, BACKFILL, CULVERT PIPE, RAMPING, GRADING, ETC.

AS BUILT - 18/05/91 - REF. FIELD BOOKS # 757A & B FOR INFORMATION.

No.	Revision	Date
2	AS BUILT - F.B. NO'S 757 A&B/807	18/05/91
1	PROF 762mm W.M. M.A.O	FEB. 91

Scales
HORIZ. 1:500
VERT. 1:50

Project Title
GREENBANK RD

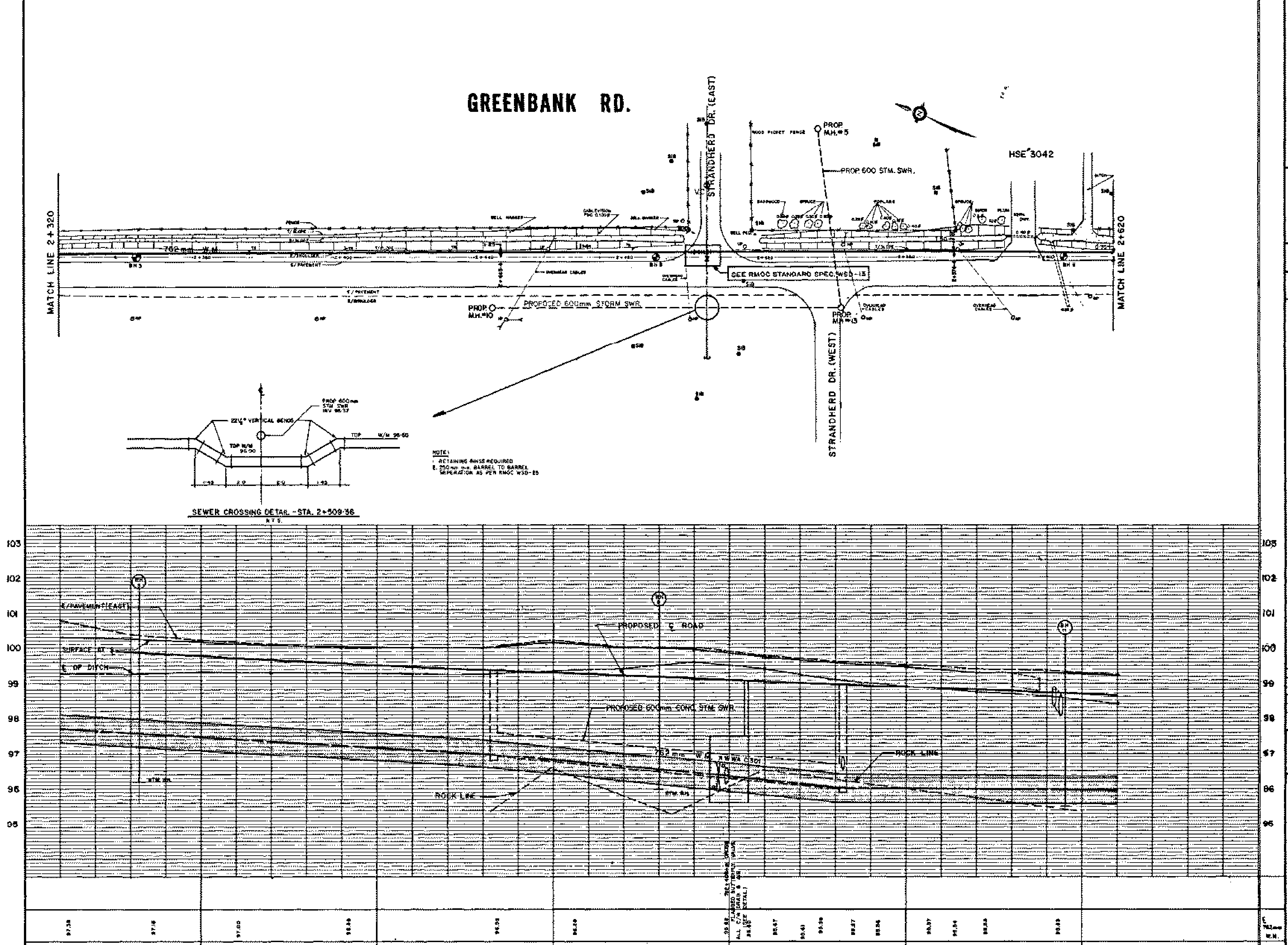
WESSEX RD.
TO
400m SOUTH
OF STRANDHERD

762mm Ø WM.

8259

Drawing No.: 4160

Sht. No.:



REGIONAL MUNICIPALITY
OF
OTTAWA-CARLETON

ENVIRONMENTAL SERVICES
DEPARTMENT

R DENHAM, P Eng.
ENVIRONMENTAL SERVICES COMMISSIONER

Approved by:
Manager of Design & Construction
Date 7/03/91

L. F. B. O'KEEFE

Project Officer
Date JUL 90

Drawn by: M. LAKEY M. GLEASON
Date JUL 90

Notes
SEE "NOTES" SHEET No. 1

No.	Revision	Date
2	AS BUILT-F/B.NO.757A88 ADT	16/09/91
1	PROP. 762mm W.M. M.A.G.	FEB. 91

Scales
HORIZ. 1:500
VERT. 1:50

Project Title
GREENBANK RD

WESSEX RD.
TO
400m SOUTH
OF STRANDHERD

762mm Ø WM.

8359

D07-12-60311

NO	REVISIONS	BY	DATE
1	REVISED PER NEW ARCHITECT PLAN		

Cumming Cockburn Limited

R.W. WINGATE

GREENBANK ROAD MODIFICATIONS AT VILLAGE SQUARE ENTRANCE

PLAN & PROFILE
CL BERRIGAN 0+000 TO 0+250

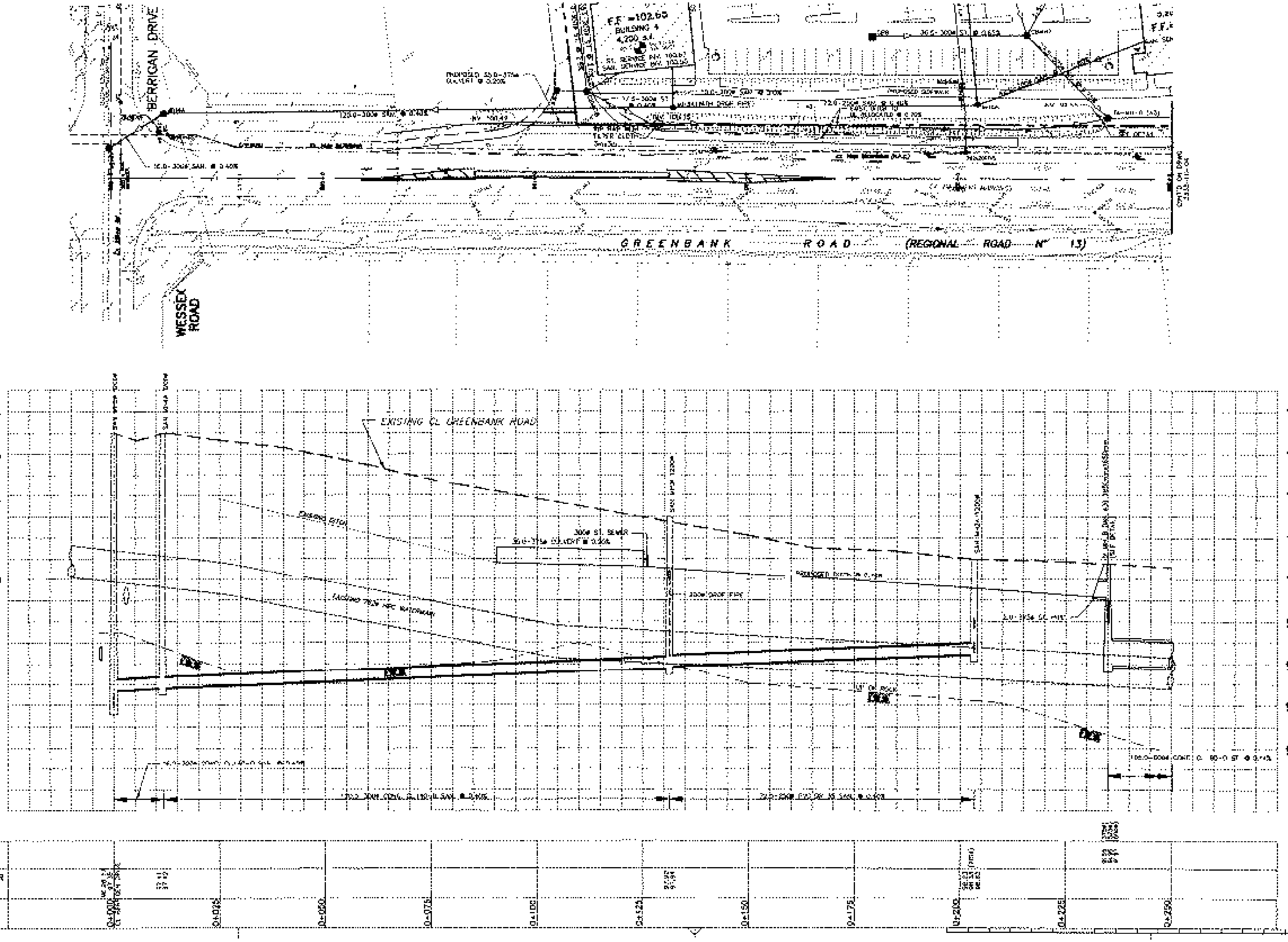
R. D. HEWITT, P.ENG.

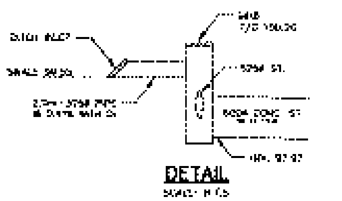
V.K. SAHNI, P.ENG.

Ottawa

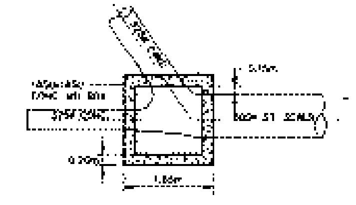
CONTRACT NO.

DWG. NO.
3333-LD-03





DETAIL



CONCRETE DI-MH-B BOX DETAIL

EXHIBIT "J"

D07-12-60311

APPROVED ☒ REFUSED ☐

JOHN L. MOSER
Director of Planning and Infrastructure Approvals
DATE Mar 21, 2014

SP 60 - 211

Cumming Cockburn Limited
Consulting Engineers, Planners and Environmental Scientists

R.W. WINGATE

NO.	REVISIONS	BY	DATE
1.	REVISED PER NEW ARCHITECT PLAN		01-03-08

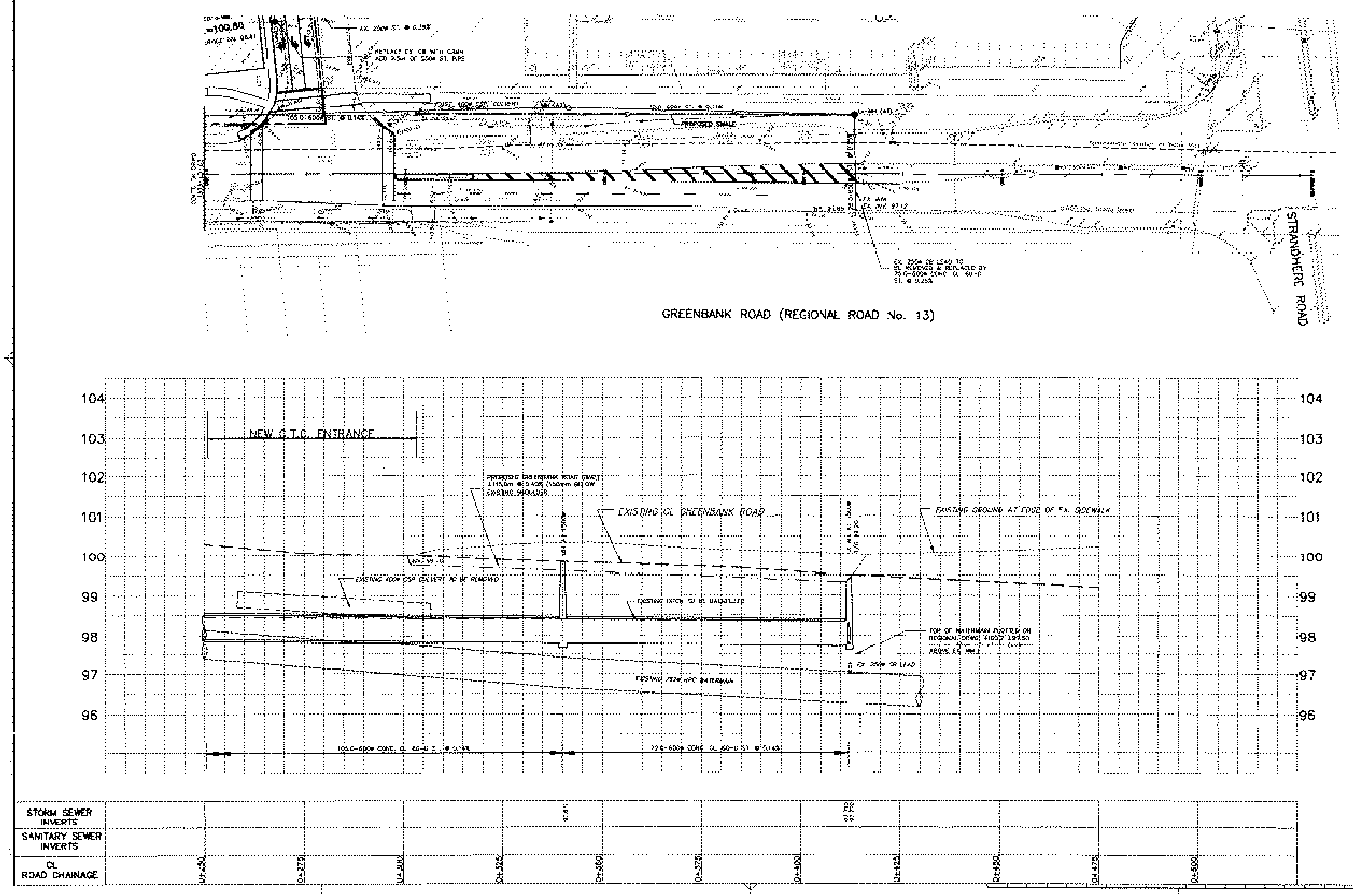
NOTE:

GREENBANK ROAD MODIFICATIONS AT VILLAGE SQUARE ENTRANCE

PLAN & PROFILE
0+250 TO CL STRANDHERD 0+528.03

R. D. HEWITT, P.ENG.
V.K. SAHNI, P.ENG.

Ottawa
CONTRACT NO.
DWG. NO.
3333-LD-04
SCALE HORIZONTAL



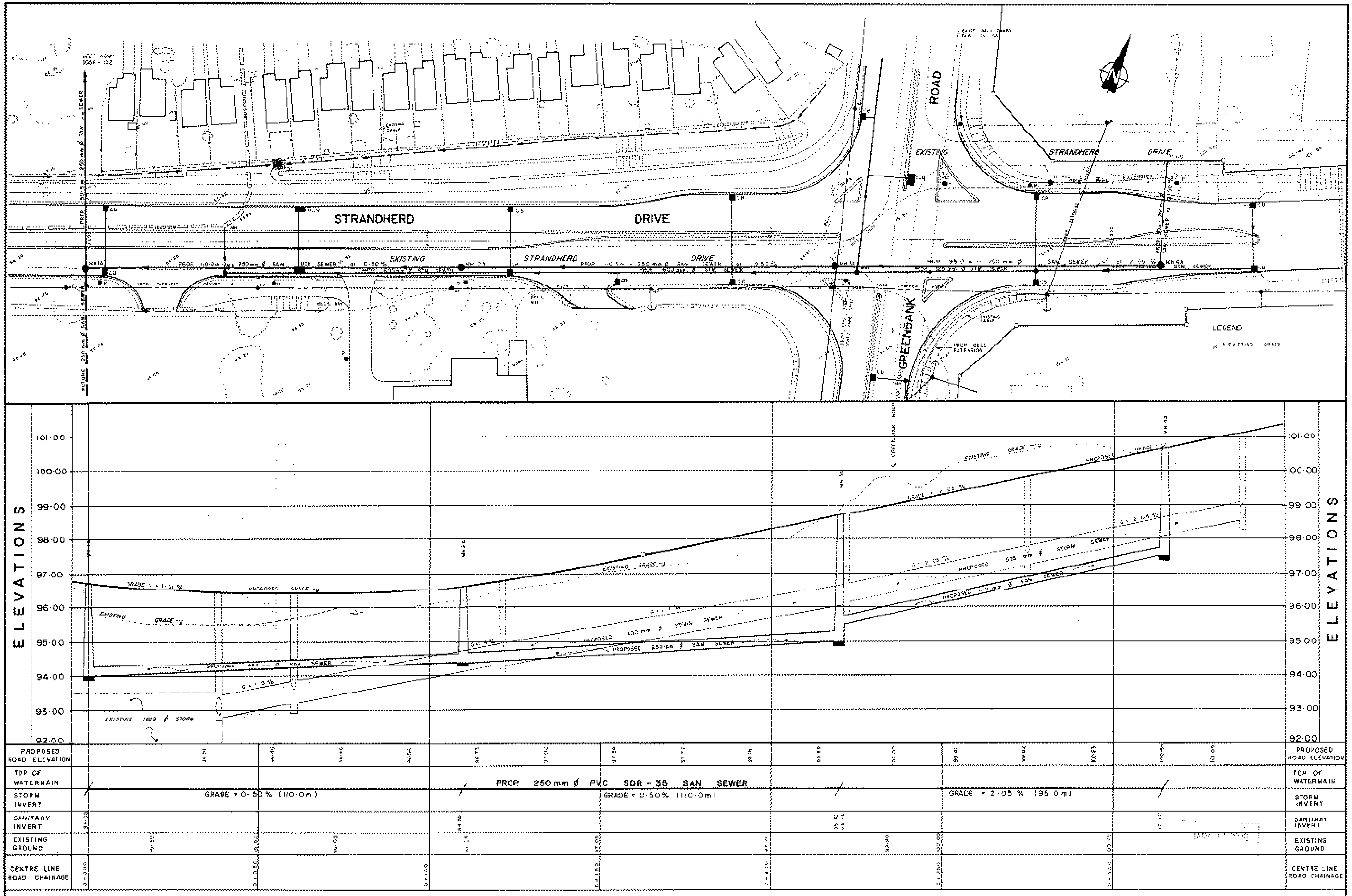
SCHEDULE "K"
D07-01-60211

APPROVED ☒ ~~REFUSED~~ ☐
JOHN L. MOSER
Director of Planning
and Infrastructure Approvals
Mar 21, 2001

EARTH EXCAVATION
ROCK EXCAVATION
EARTH FILL

D07-12-60211

SP 60 - 211



NO	DATE	REVISIONS	BY	NO	DATE	REVISIONS	BY

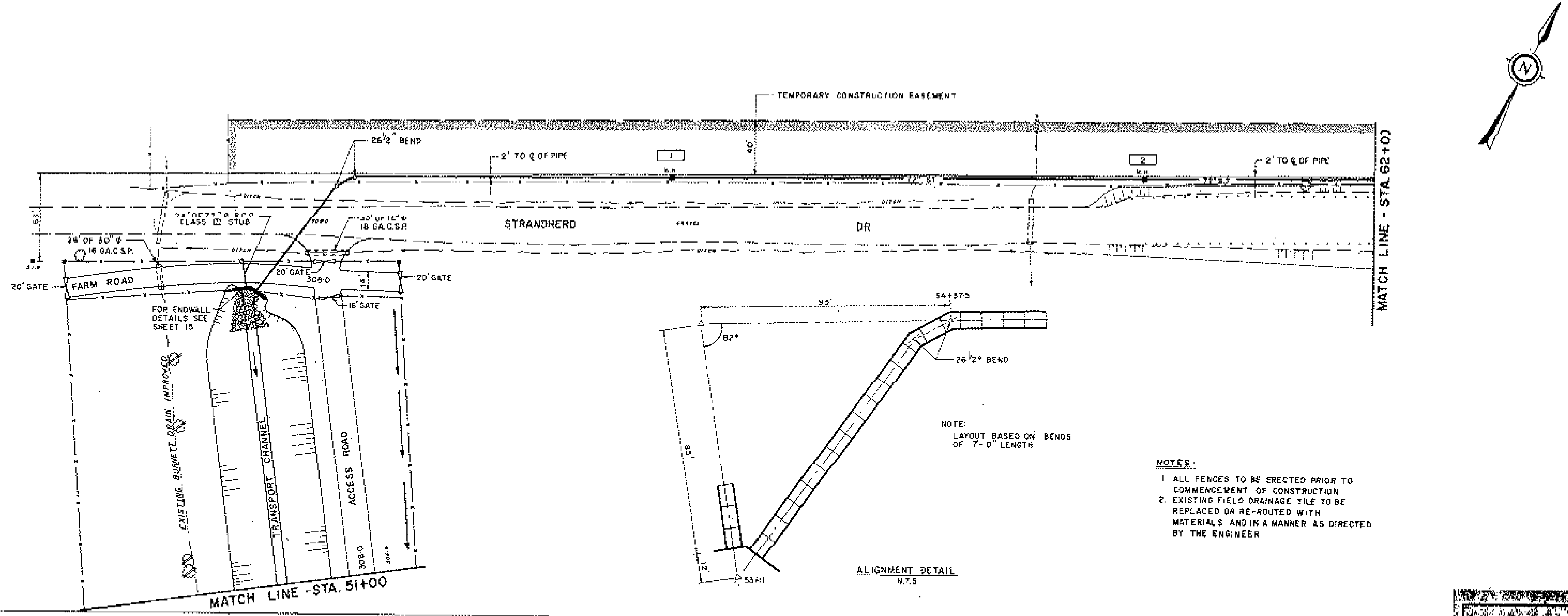
D. NARAINE

Cecil D. Naraine
Associates Limited
CONSULTING ENGINEERS

STRANDHERD DRIVE RECONSTRUCTION
PAUL ANKA LANDS
CITY OF NEPEAN

SANITARY SEWER
MH No 1A TO MH No 4A

DRWG. NO. 3056 – 101

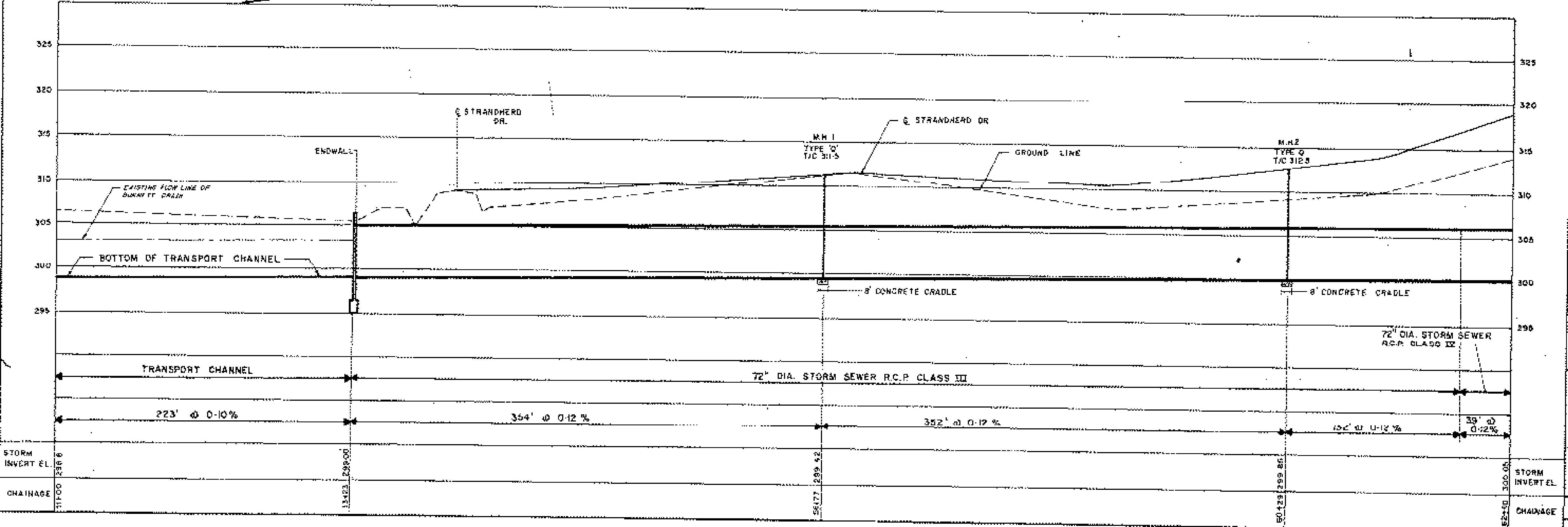


NOTE:
LAYOUT BASED ON BENDS OF 7'-0" LENGTH

ALIGNMENT DETAIL
N.T.S

NOTES:
1. ALL FENCES TO BE ERECTED PRIOR TO COMMENCEMENT OF CONSTRUCTION
2. EXISTING FIELD DRAINAGE TILE TO BE REPLACED OR RE-ROUTED WITH MATERIALS AND IN A MANNER AS DIRECTED BY THE ENGINEER

AS BUILT



NO	Revision	By	Date

H. L. K

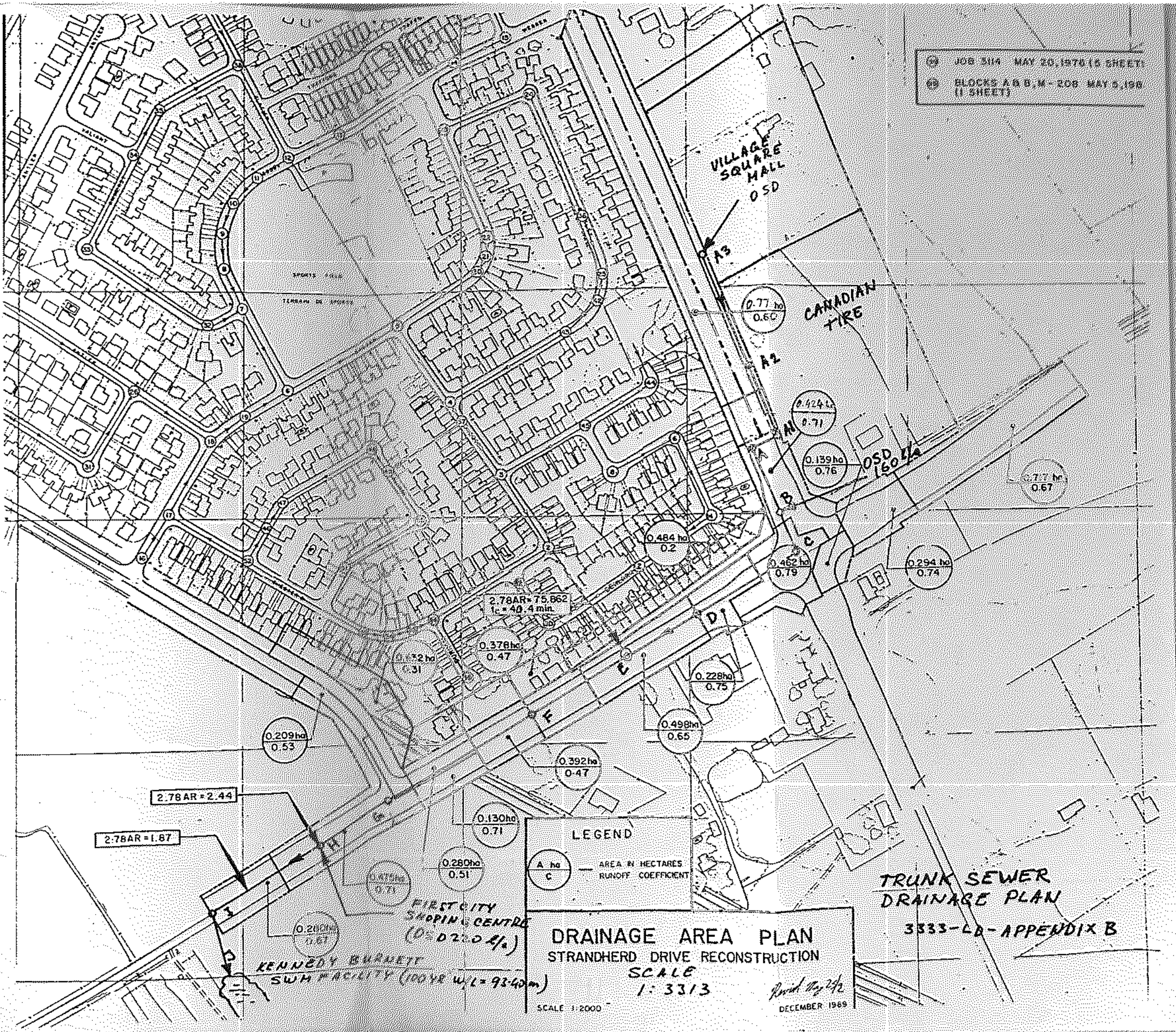
TOWNSHIP OF NEPEAN
WORKS DEPARTMENT

GREATER BARRHAVEN
TRUNK SEWERS
CONTRACT NO 4
KENNEDY-BURNETT DRAIN OUTLET

STRANDHERD DRIVE
PLAN AND PROFILE
STA 51+00 TO STA 62+00

DeLeuw Cather
CONSULTING ENGINEERS & PLANNERS

Designed by	Checked by	Drawn by	Checked by
J S W	H V M	D F M, W S	R O P



LEGEND

A ha / C	AREA IN HECTARES RUNOFF COEFFICIENT

DRAINAGE AREA PLAN

STRANDHERD DRIVE RECONSTRUCTION

SCALE
1: 3313

SCALE 1:2000

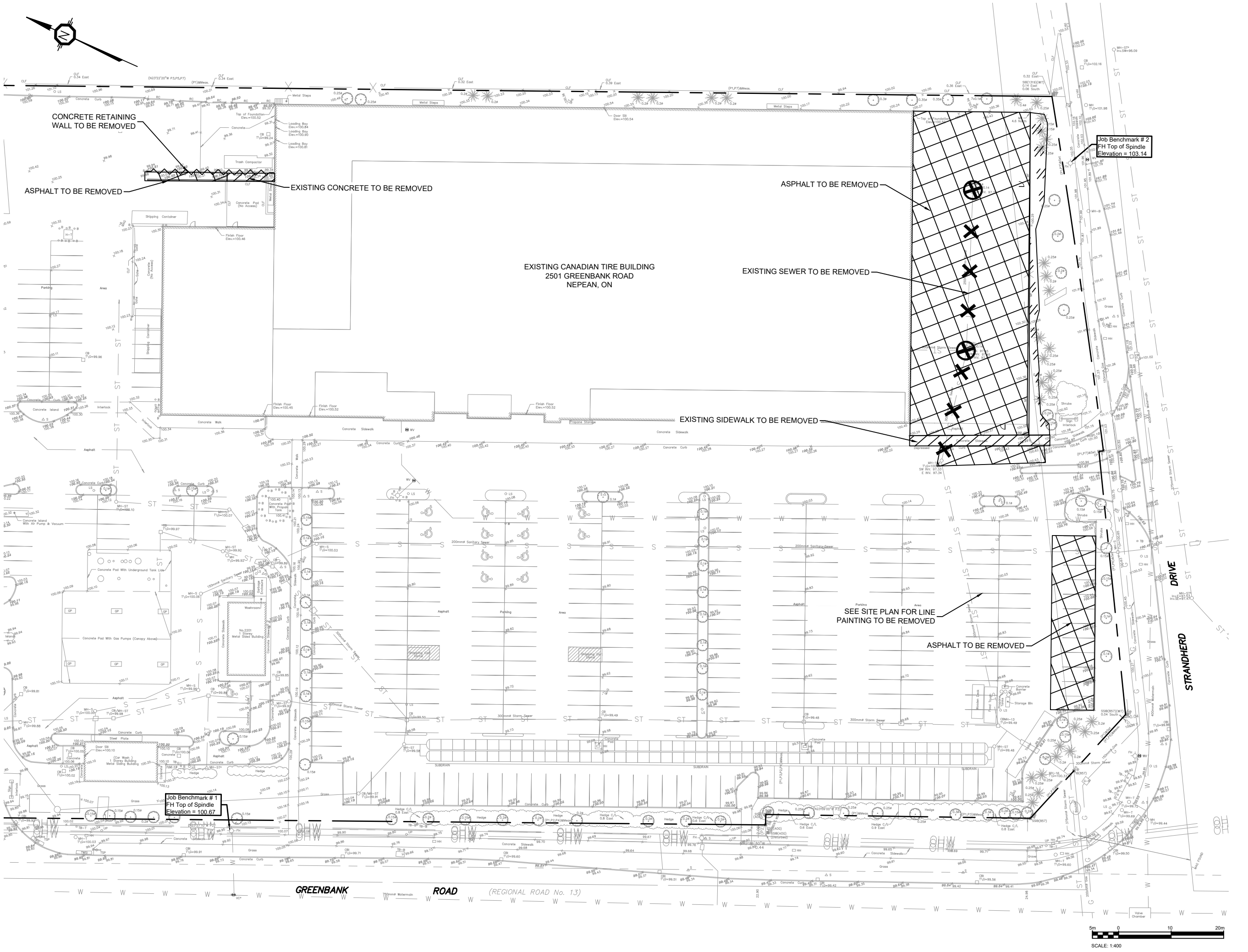
DECEMBER 1989

Revised May 24/2

TRUNK SEWER
DRAINAGE PLAN

3333-LD-APPENDIX B

DRAWINGS



LEGEND:

— - —	EXISTING PROPERTY LINE
⊗	STRUCTURE TO BE REMOVED
× × ×	SEWER TO BE REMOVED
⊠	ASPHALT REMOVAL
▨	LANDSCAPE REMOVAL
▨	CONCRETE REMOVAL
﹏	EXISTING CURB/RETAINING WALL REMOVAL

NOTES: REMOVALS AND DEMOLITION

1. PRE-REMOVAL, THE CONTRACTOR MUST VISIT THE PREMISES IN ORDER TO BE FULLY AWARE OF EXISTING CONDITIONS ON SITE, INCLUDING ALL ELEMENTS TO BE REMOVED AND DEMOLISHED. NO CLAIM WILL BE ACCEPTED DUE TO A POOR EVALUATION OF THE WORK TO BE COMPLETED.
2. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND THE REQUEST FOR INTERRUPTION OF PUBLIC UTILITY SERVICES, SUCH AS GAS, TELEPHONE, POWER, CABLE, SEWERS, WATERMAIN, ETC. BEFORE PROCEEDING WITH WORK, COORDINATE WITH ALL APPLICABLE UTILITY COMPANIES.
3. FIRE HYDRANTS TO BE TAGGED AND BAGGED AND/OR PROTECTED AS INDICATED ON DRAWING.
4. CURB, ASPHALT, SIDEWALK, AND GRANULAR BASE TO BE EXCAVATED WITHIN LIMITS OF DEMOLITION REMOVAL. THE CONTRACTOR MUST CARRY OUT NECESSARY SAW CUTS.
5. SEWER / WATERMAIN PIPES TO BE ABANDONED MUST BE CUT, FILL WITH UNSHRINKABLE CONCRETE CONFORMING TO OPSS 1359, AND CAPPED.
6. REMOVE AND DISPOSE SEWERS AS INDICATED. PLUG ANY SERVICE LATERALS TO BE ABANDONED.
7. THE CONTRACTOR MUST ENTIRELY REMOVE THE DEMOLITION WRECKAGE FROM THE CONSTRUCTION SITE OFFSITE IN ACCORDANCE WITH THE REQUIREMENTS OF THE MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE (MOECC).
   a. THE CONTRACTOR MUST DISCARD RECYCLABLE DEMOLITION MATERIALS IN COLLABORATION WITH A REGIONAL RECYCLING COMPANY.
   b. ALL OTHER DEMOLITION MATERIALS MUST BE DISPOSED OFF-SITE AT AUTHORIZED LICENSED LANDFILLS AND IN CONFORMITY WITH THE APPLICABLE LAWS AND REGULATIONS. THE CONTRACTOR MUST BE ABLE TO PROVIDE, UPON REQUEST, COPIES OF THE DISPOSAL TICKETS TO THE OWNER'S REPRESENTATIVE.
8. SURFACES AND WORKS LOCATED OUTSIDE OF THE CONSTRUCTION WORK LIMIT MUST BE REINSTATED AS THEY WERE BEFORE BEGINNING OF WORK. CONTRACTOR IS RESPONSIBLE TO MAKE GOOD ON ANY DAMAGES TO EXISTING CURB AND ASPHALT NOT SCHEDULED FOR REMOVAL.
9. ALL MATERIALS, PRODUCTS AND OTHERS COMING FROM THE DEMOLITION BELONG TO THE CONTRACTOR, UNLESS SPECIFIED OTHERWISE.
10. THE CONTRACTOR MUST COMPLETE ALL REMOVALS AS SHOWN ON THE DRAWINGS AND AS REQUIRED TO MAKE THE WORK COMPLETE.
11. THE CONTRACTOR MUST PROTECT AND MAINTAIN IN SERVICE THE EXISTING WORKS WHICH MUST REMAIN IN PLACE. IF THEY ARE DAMAGED, THE CONTRACTOR MUST IMMEDIATELY MAKE THE REPLACEMENTS AND NECESSARY REPAIRS TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE AND WITHOUT ADDITIONAL EXPENSE TO THE OWNER.
12. THE CONTRACTOR MUST NOT PERFORM ANY TREE CUTTING DURING THE CORE MIGRATORY BIRDS NESTING PERIOD, WHICH IS APRIL 15 TO AUGUST 15.

NOTES: GENERAL

1. THE CONTRACTOR MUST CONFORM TO ALL LAWS, CODES, ORDINANCES, AND REGULATIONS ADOPTED BY FEDERAL, PROVINCIAL OR MUNICIPAL GOVERNMENT COUNCILS AND GOVERNMENT AGENCIES, APPLYING TO WORK TO BE CARRIED OUT. WHEREVER STANDARDS, LAWS AND/OR REGULATIONS ARE MENTIONED THEY REFER TO THEIR CURRENT VERSIONS, MODIFICATIONS INCLUDED.
2. ALL MATERIALS AND CONSTRUCTION METHODS SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND DRAWINGS (OPSS AND OPSD), THE ONTARIO MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE, THE ONTARIO MINISTRY OF NATURAL RESOURCES, APPLICABLE CONSERVATION AUTHORITIES, THE MUNICIPAL STANDARD SPECIFICATIONS AND DRAWINGS, AND ALL OTHER GOVERNING AUTHORITIES AS THEY APPLY, UNLESS OTHERWISE INDICATED.
3. ALL MATERIAL SUPPLIED AND PLACED FOR PARKING LOT AND ACCESS ROAD CONSTRUCTION SHALL BE TO OPSS STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE NOTED. CONSTRUCTION TO OPSS 206, 310 & 314. MATERIALS TO OPSS 1001, 1003 & 1010.
4. THE LOCATION OF EXISTING UNDERGROUND MUNICIPAL SERVICES AND PUBLIC UTILITIES AS SHOWN ON THE PLANS ARE APPROXIMATE. THE CONTRACTOR MUST DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES (ON-SITE AND OFF-SITE) PRIOR TO ANY EXCAVATION WORK. DAMAGE TO ANY EXISTING SERVICES AND/OR EXISTING UTILITIES DURING CONSTRUCTION, WHETHER OR NOT SHOWN ON THE DRAWINGS MUST BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
5. THE CONTRACTOR SHALL DETERMINE THE EXACT INVERT (GEODETIC ELEVATION), DIAMETER AND CONSTRUCTION MATERIAL OF THE EXISTING CONDUITS AT THE PROPOSED CONNECTIONS. THEY SHALL ALSO CARRY OUT, IF NECESSARY, EXPLORATORY DIGS IN ORDER TO DETERMINE THE EXACT LOCATION AND INVERTS OF EXISTING DUCK BANKS. THIS INFORMATION SHALL IMMEDIATELY BE PROVIDED TO THE CONSULTANT PRIOR TO START UNDERTAKING ANY MUNICIPAL SERVICES WORK AND A 48 HOUR PERIOD MUST BE ALLOCATED TO THE CONSULTANT FOR DESIGN REVIEW.
6. AT PROPOSED UTILITY CONNECTION POINTS AND CROSSINGS (I.E. STORM SEWER, SANITARY SEWER, WATER, ETC.) THE CONTRACTOR SHALL DETERMINE THE PRECISE LOCATION AND DEPTH OF EXISTING UTILITIES AND REPORT ANY DISCREPANCIES OR CONFLICTS TO THE ENGINEER BEFORE COMMENCING WORK.
7. CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT FOR CONSTRUCTION PURPOSES.
8. THE CONTRACTOR IS RESPONSIBLE FOR THE COORDINATION OF ALL WORK AND ACTIVITIES WITH OTHERS TRADES AND CONTRACTORS.
9. THE CONTRACTOR IS THE ONLY PERSON IN CHARGE OF SAFETY ON THE BUILDING SITE. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ADEQUATE PROTECTION OF THE WORKERS, OTHER PERSONNEL AND THE GENERAL PUBLIC, PROTECTION OF MATERIALS, AS WELL AS MAINTAINING IN GOOD CONDITION THE COMPLETED WORKS AND WORKS TO BE COMPLETED. THE CONTRACTOR MUST PROVIDE AT ANY TIME:
   a. A SUFFICIENT NUMBER OF FENCES, BARRIERS, POSTERS, GUARDS AND OTHERS TO ENSURE SAFETY;
   b. NECESSARY CONVENIENCES FOR THE COMPLETION OF WORK SUCH AS HEATING, LIGHTING, VENTILATION ETC.
10. CONTRACTOR IS RESPONSIBLE TO OBTAIN THE VARIOUS PERMITS/APPROVALS REQUIRED TO COMPLETE ALL THE WORKS AND ACTIVITIES AND BEAR COST OF THE SAME, SUCH AS BUT NOT LIMITED TO; ROAD CUT PERMITS, SEWER PERMITS, WATER PERMIT, ETC. AND THEIR ASSOCIATED COSTS.
11. ALL ELEVATIONS ARE GEODETIC AND UTILIZE METRIC UNITS.
12. JOB BENCH MARK - CONFIRM WITH PARSONS PRIOR TO UTILIZATION. THE CONTRACTOR MUST MAINTAIN BENCHMARKS AND LANDMARK REFERENCES AS IS. OTHERWISE THESE REFERENCES WILL BE REPOSITIONED BY A CERTIFIED LAND SURVEYOR AT THE CONTRACTOR'S EXPENSE.
13. ALL GROUND SURFACES SHALL BE EVENLY GRADED WITHOUT PONDING AREAS AND LOW POINTS EXCEPT WHERE APPROVED SWALE OR CATCH BASIN OUTLETS ARE PROVIDED.
14. IF GROUNDWATER IS ENCOUNTERED DURING CONSTRUCTION, DEWATERING OF EXCAVATIONS COULD BE REQUIRED. IT IS ASSUMED THAT GROUNDWATER MAY BE CONTROLLED BY SUMP AND PUMPING METHODS. THE CONTRACTOR SHALL OBTAIN A PERMIT TO TAKE WATER IF SITE CONDITIONS REQUIRE TAKING MORE THAN A TOTAL OF 400 000 L/DAY.
15. STRIP AND REMOVE ALL TOPSOIL FROM IMPROVED AREAS. SITE PREPARATION INCLUDES CLEARING, GRUBBING, STRIPPING OF TOPSOIL, DEMOLITION, REMOVAL OF UNSUITABLE MATERIALS, CUT, FILL AND ROUGH GRADING OF ALL AREAS TO RECEIVE FINISHED SURFACES.
16. ABUTTING PROPERTY GRADE TO BE MATCHED.
17. ALL EDGES OF DISTURBED PAVEMENT SHALL BE SAW CUT TO FORM A NEAT AND STRAIGHT LINE PRIOR TO PLACING NEW PAVEMENT. PAVEMENT REINSTATEMENT SHALL BE WITH STEP JOINTS OF 300mm WIDTH MINIMUM.
18. CURBS TO BE BARRIER, CONSTRUCTED AS PER OPSD 600.110, EXCEPT WHERE INDICATED OTHERWISE. ELEVATION AT TOP OF CONCRETE CURBS TO BE 150 mm ABOVE THE ASPHALT, UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
19. DEPRESSED CURBS TO BE MOUNTABLE, CONSTRUCTED AS PER OPSD 600.100.
20. LIGHT DUTY AND HEAVY DUTY ASPHALT PAVEMENTS TO BE CONSTRUCTED AS PER TABLE ON DRAWING C103.
21. TRANSITION BETWEEN EXISTING AND PROPOSED PAVEMENT SHALL BE CONSTRUCTED AS PER DETAIL D2 ON DRAWING C103 AND TRENCHES AS PER DETAIL R10 ON DRAWING C104.
22. RESTORE PAVEMENT STRUCTURE AND SURFACES ON EXISTING ROADS TO A CONDITION AT LEAST EQUAL TO ORIGINAL AND TO THE SATISFACTION OF THE MUNICIPAL AUTHORITIES.
23. CLEANLINESS ON THE SITE, INCLUDES THE CONTRACTOR SHALL CLEAN ROADWAYS AT HIS OWN COST AS DIRECTED BY THE OWNER'S REPRESENTATIVE, MATERIALS AND EQUIPMENT MUST BE LAID OUT IN AN ORGANIZED AND SAFE MANNER, AND ALL MATERIAL, EQUIPMENT AND TEMPORARY STRUCTURES WHICH ARE NO LONGER NECESSARY FOR THE EXECUTION OF THE CONTRACT MUST BE REMOVED FROM THE SITE.
24. CONTRACTOR TO ENSURE MITIGATION MEASURES ARE IMPLEMENTED TO REDUCED THE RISK OF GROUND CONTAMINATION FROM PETROLEUM PRODUCTS.
25. THE CONTRACTOR MUST ENSURE THE FOLLOWING MEASURES ARE IMPLEMENTED REGARDING THE HANDLING OF CONCRETE:
   a. CONCRETE SHOULD EITHER BE MIXED AWAY FROM THE SITE OR SHOULD BE PREPARED ON PAVED SURFACES IF ONLY SMALL QUANTITIES ARE REQUIRED (I.E. MINOR REPAIRS);
   b. EXCESS CONCRETE MUST BE DISPOSED OFF-SITE AT A LOCATION THAT MEETS ALL REGULATORY REQUIREMENTS;
   c. THE WASHING OF CONCRETE TRUCKS AND OTHER EQUIPMENT USED FOR MIXING CONCRETE SHOULD NOT BE CARRIED OUT WITHIN 30 METERS OF A WATERCOURSE OR WETLAND AND SHOULD TAKE PLACE OUTSIDE OF THE WORK SITE;
   d. ALL CONCRETE TRUCKS SHOULD COLLECT THEIR WASH WATER AND RECYCLE IT BACK INTO THEIR TRUCKS FOR DISPOSAL OFF-SITE AT A LOCATION MEETING ALL REGULATORY REQUIREMENTS.
26. THE CONTRACTOR SHALL ENSURE THAT ALL EXCAVATED SURPLUS MATERIALS THAT WILL BE REQUIRED TO BE DISPOSED OFFSITE BE STOCKPILED TEMPORALLY FOR SAMPLING PRIOR BEING LOADED OFFSITE.
27. MINIMIZE DISTURBANCE TO EXISTING VEGETATION DURING THE EXECUTION OF ALL WORKS.
28. TRENCHING, BACKFILLING AND COMPACTING MUST CONFORM TO OPSS 401.
29. DEWATERING OF PIPELINE, UTILITY AND ASSOCIATED STRUCTURE EXCAVATIONS TO BE COMPLETED AS PER OPSS 517.
30. THE CONTRACTOR MUST CONTROL SURFACE RUNOFF FROM PRECIPITATION DURING CONSTRUCTION.
31. FOR ALL GEOTECHNICAL WORK, CONTRACTOR TO REFER TO "GEOTECHNICAL INVESTIGATION, CANADIAN TIRE STORE #442, GREENBANK ROAD, NEPEAN, ONTARIO, BY JACQUES, WHITOFRD AND ASSOCIATES LIMITED. DATED JANUARY 31, 2000.
32. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL UNLESS OTHERWISE DIRECTED FROM THE ENGINEER. EXCAVATE AND REMOVE ALL ORGANIC MATERIAL AND DEBRIS LOCATED WITHIN THE PROPOSED BUILDING, PARKING AND ROADWAY LOCATIONS.
33. THE CONTRACTOR IS RESPONSIBLE FOR ALL EXCAVATION, BACKFILL AND REINSTATEMENT OFF ALL AREAS DISTURBED DURING CONSTRUCTION TO EXISTING CONDITIONS OR BETTER AND ALL ASSOCIATED WORKS TO THE SATISFACTION OF THE CONSULTANT AND MUNICIPAL AUTHORITIES. ASPHALT REINSTATEMENT MUST BE IN ACCORDANCE WITH OPSS 310. LANDSCAPE AREAS TO BE REINSTATED WITH 150 mm OF TOPSOIL AND SOD IN ACCORDANCE WITH OPSS 802 AND OPSS 803.
34. DURING THE CONSTRUCTION PERIOD THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING TEMPORARY TRAFFIC SIGNAGE, INCLUDING TRAFFIC SIGNS, TRAFFIC MARKINGS AND TEMPORARY TRAFFIC LIGHTS, AND FLAGMEN, AS REQUIRED BY THE OWNER, THE CONSULTANT, THE MUNICIPALITY, THE MTO, AND OTHER GOVERNING AUTHORITIES.
35. CONSTRUCT SIDEWALK EXPANSION JOINTS & CONTROL JOINTS AS PER OPSD 310.020.
36. CONSTRUCT CONCRETE SIDEWALK AS PER OPSD 310.020 AND OPSS 351. TACTILE WALKING SURFACE INDICATORS PER OPSS 351.
37. DISPOSE OF CONTAMINATED MATERIALS AT APPROPRIATE OFF-SITE FACILITY THAT MEETS ALL REGULATORY REQUIREMENTS.
38. BE PREPARED TO INTERCEPT, CLEAN UP, AND DISPOSE OF SPILLS OR RELEASES THAT MAY OCCUR WHETHER ON LAND OR WATER. MAINTAIN MATERIALS AND EQUIPMENT REQUIRED FOR CLEANUP OF SPILLS OR RELEASES READILY ACCESSIBLE ON SITE.
39. PROMPTLY REPORT SPILLS AND RELEASES POTENTIALLY CAUSING DAMAGE TO ENVIRONMENT TO: AUTHORITY HAVING JURISDICTION OR INTEREST IN SPILL OR RELEASE INCLUDING CONSERVATION AUTHORITY, WATER SUPPLY AUTHORITIES, DRAINAGE AUTHORITY, ROAD AUTHORITY, AND FIRE DEPARTMENT.
40. DECONTAMINATE EQUIPMENT AFTER WORKING IN POTENTIALLY CONTAMINATED WORK AREAS AND PRIOR TO SUBSEQUENT WORK OR TRAVEL ON CLEAN AREAS.
41. DO NOT DISCHARGE DECONTAMINATED WATER, OR SURFACE WATER RUNOFF, OR GROUNDWATER WHICH MAY HAVE COME IN CONTACT WITH POTENTIALLY CONTAMINATED MATERIAL, OFF SITE OR TO MUNICIPAL SEWERS.
42. CONTRACTOR NEEDS TO SUBMIT A TRAFFIC MANAGEMENT PLAN FOR APPROVAL ONE (1) WEEK PRIOR TO ANY WORK WITHIN THE ROW LIMITS TO MEET THE REQUIREMENTS OF MTO BOOK 7. THE CONTRACTOR WILL BE REQUIRED TO IMPLEMENT ALL REQUIREMENTS OF THE MTO BOOK 7.
43. TOWN PUBLIC WORKS DEPARTMENT TO BE CONTACTED MINIMUM 7 DAYS PRIOR TO PLANNED DATE FOR CONNECTION TO EXISTING STORM SEWERS, SANITARY SEWERS, AND WATERMAIN. CONNECTION TO EXISTING TO TAKE PLACE IN THE PRESENCE OF APPROPRIATE MUNICIPALITY OF CASSELMAN STAFF.

TURNER FLEISCHER

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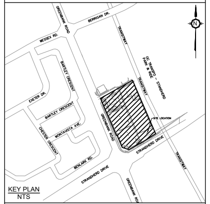

KEY PLAN
NTS

PARSONS

1223 MICHAEL STREET, SUITE 100, OTTAWA, ONTARIO K1J 7T2
Tel: 613-738-4160 Fax: 613-739-7105

TOPOGRAPHIC INFORMATION & BENCHMARK

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#	DATE	DESCRIPTION	BY
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1	2023-05-18	ISSUED FOR SITE PLAN APPLICATION	PC

BARRHAVEN
STORE No.
442

PROJECT

2501 GREENBANK RD
CANADIAN TIRE STORE EXPANSION

BARRHAVEN, ONTARIO

DRAWING

REMOVAL PLAN

PROJECT NO.
478461

PROJECT DATE
2022-09-23

DRAWN BY
BV

CHECKED BY
MT

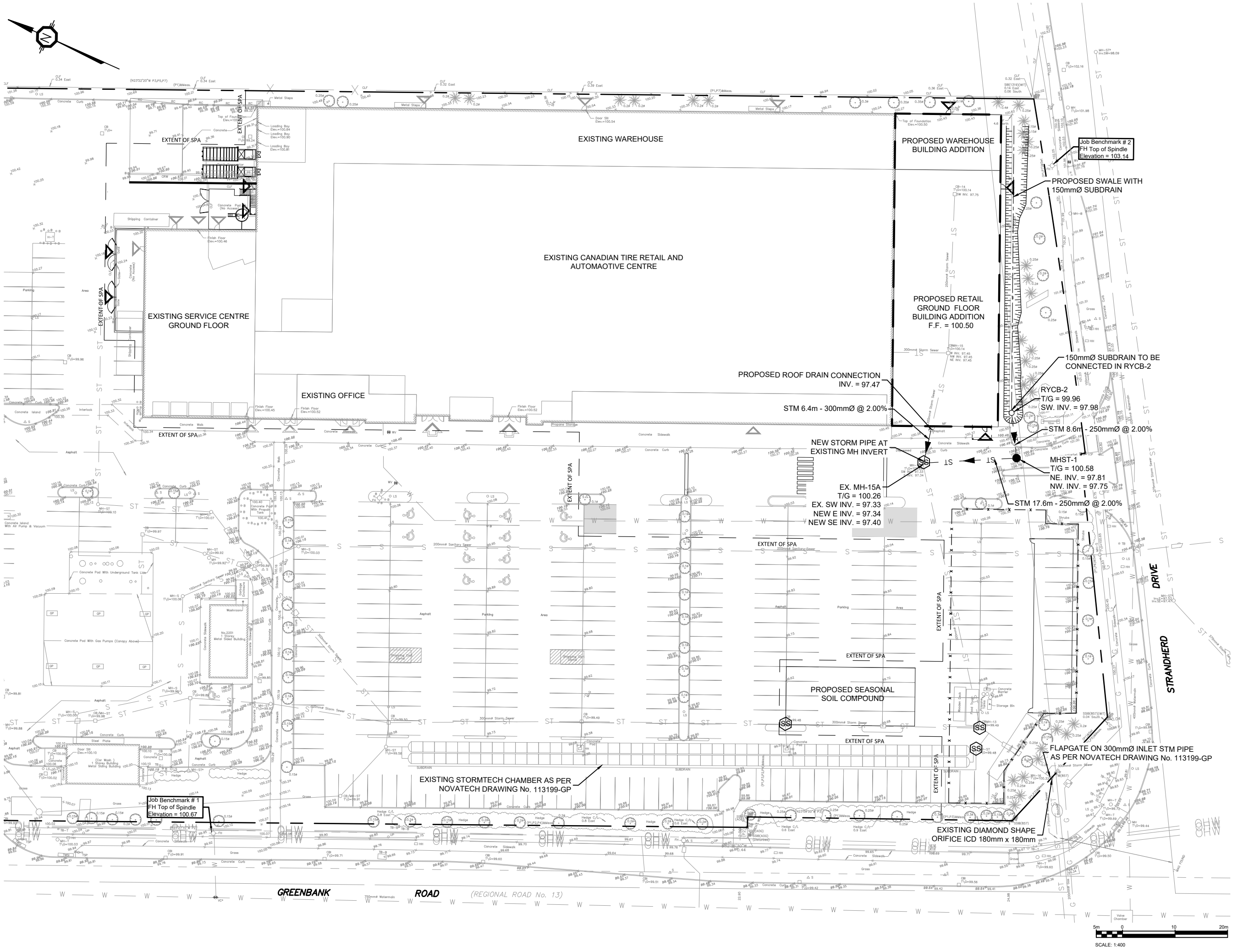
SCALE
As indicated

B. VILLENEUVE
100553987
2023-10-26

DRAWING NO.
C101

REV.

#19006 D07-12-23-0064



LEGEND:

— — —	EXISTING PROPERTY LINE
— W — W —	EXISTING WATERMAIN
⊗	EXISTING V&VB
⊕ FH	EXISTING FIRE HYDRANT
☐	EXISTING CATCH BASIN
— S — S —○	EXISTING SANITARY SEWER AND MAINTENANCE HOLE
— ST — ST —○	EXISTING STORM SEWER AND MAINTENANCE HOLE
—► ST — ST●	PROPOSED STORM SEWER AND MAINTENANCE HOLE
○	PROPOSED REAR YARD CATCH BASIN
— · — · —	PROPOSED CENTERLINE SWALE WITH SUBDRAIN 150mmØ
DC	PROPOSED DEPRESSED CONCRETE CURB
— — —	PROPOSED BUILDING ADDITION OUTLINE
SS	SILT SACK PER DETAIL D1

NOTES: SEWER

1. CONTRACTOR TO CONFIRM ELEVATION OF EXISTING STORM AND SANITARY SEWERS AT PROPOSED CONNECTION POINTS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE COMMENCING ANY WORK.
2. ALL WORK SHALL BE PERFORMED, AS APPLICABLE IN ACCORDANCE WITH OPSS 407, AND 410.
3. PIPE MATERIAL TO BE PVC SDR-35 AND CONFORMING TO OPSS 1841, UNLESS INDICATED OTHERWISE. PVC SEWERS TO BE INSTALLED PER OPSD 802.010 (MODIFIED). BEDDING AND COVER MATERIALS TO BE OPSS 1010 GRANULAR 'A' CRUSHER-RUN LIMESTONE BEDDING COMPACTED TO 95% SPMDD.
4. ALL SEWERS WITH LESS THAN 1.5 METERS OF COVER ARE SUBJECTED TO INSULATION
5. PIPE BACKFILL MATERIAL TO BE APPROVED NATIVE MATERIAL OR SELECT SUBGRADE MATERIAL IN CONFORMANCE WITH OPSS 212.
6. ALL MAINTENANCE HOLES AND CATCH BASIN MAINTENANCE HOLES TO BE 1200mmØ AS PER OPSD 701.010, UNLESS INDICATED OTHERWISE. MAINTENANCE HOLES AND CATCH BASIN MAINTENANCE HOLES TO BE INSTALLED PER OPSS 407.
7. ALL CATCH BASINS TO BE 600x600mm AS PER OPSD 705.010, UNLESS INDICATED OTHERWISE. CATCH BASINS TO BE INSTALLED PER OPSS 407.
8. EXCAVATING, BACKFILLING, AND COMPACTING REQUIRED FOR MAINTENANCE HOLES, CATCH BASIN MAINTENANCE HOLES, AND CATCH BASINS TO BE COMPLETED AS PER OPSS 402. THEY ARE TO BE BACKFILLED WITH OPSS GRANULAR 'B' COMPACTED TO 98% SPMDD. JOINTS BETWEEN SECTIONS TO BE WRAPPED WITH NON-WOVEN GEOTEXTILE.
9. FOR STORM STRUCTURES: CAST IRON CATCH BASIN MAINTENANCE HOLE COVER AS PER OPSD 401.010 TYPE 'B' AND CAST IRON CATCH BASIN COVER AS PER OPSD 400.020.
10. THE CONTRACTOR IS RESPONSIBLE FOR MAKING OR ARRANGING ALL CONNECTIONS TO THE EXISTING SEWERS AS PER MUNICIPAL REQUIREMENTS. PRIOR TO CONNECTION, THE CONTRACTOR MUST PROVIDE, TO THE CONSULTANT / ENGINEER AND THE CITY FOR APPROVAL, ALL TEST RESULTS PERFORMED ON THE INTERNAL SERVICES.
11. ADVISE THE CITY PUBLIC WORKS AT LEAST 72 HOURS IN ADVANCE BEFORE ANY CONNECTION TO THE TOWN SERVICES. CO-ORDINATE WITH TOWN AS REQUIRED.
12. TERMINATE AND PLUG ALL SERVICE CONNECTIONS AT 1.0 m FROM EDGE OF THE BUILDING.
13. ALL SEWERS TO BE C.C.T.V. INSPECTED BY THE CONTRACTOR AS PER OPSS 409. TWO COPIES OF THE INSPECTION REPORT MUST BE PROVIDED TO THE CONSULTANT AND THE C.C.T.V. INSPECTION IN DVD FORMAT ONLY.
14. SUBDRAIN KNOCKOUT (KO) WILL BE PRE-MANUFACTURED WITH CATCH BASINS AND MAINTENANCE HOLES.
15. EXISTING STORMTECH CHAMBERS LOCATED ON THE SOUTH WEST END OF THE PARKING LOT, PARALLEL TO GREENBANK (SEE PLAN C102), TO BE KEPT AND PROTECT, FREE OF ANY CONSTRUCTION DEBRIS OR ANY OTHER DAMAGES DURING CONSTRUCTION.

EROSION AND SEDIMENT CONTROL MEASURES:

- CONTRACTOR IS RESPONSIBLE FOR ALL INSTALLATION, MONITORING, REPAIR AND REMOVAL OF ALL EROSION AND SEDIMENT CONTROL FEATURES. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURE MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
- SEDIMENT AND EROSION CONTROL PLAN OBJECTIVES:
- PREVENT SOIL EROSION. THIS CAN RESULT FROM STREAMING RAIN WATER OR WIND EROSION DURING CONSTRUCTION,
- PREVENT SEDIMENT DEPOSITS IN THE SEWER PIPES AND NEARBY COLLECTING STREAMS (AS APPLICABLE),
- PREVENT AIR POLLUTION FROM PARTICULATE MATTER AND DUST.

1. PRIOR TO START OF CONSTRUCTION:

PRIOR TO THE REMOVAL OF ANY VEGETATIVE COVER, MOVING OF SOIL AND CONSTRUCTION:

- INSTALL SILT FENCE (AS PER OPSD 219.110) ALONG DITCHES IMMEDIATELY DOWNSTREAM FROM AREAS TO BE DISTURBED.
- INSTALL FILTER CLOTH ON DOWNSTREAM MANHOLE COVERS.
- INSTALL SILTSACK FILTERS IN ALL CONCRETE CATCH BASINS STRUCTURES.
- INSPECT MEASURES IMMEDIATELY AFTER INSTALLATION.
- THE CONTRACTOR MUST SET UP THE MEASURES INDICATED ON THE PLAN, INSPECT THEM FREQUENTLY AND CLEAN AND REPAIR OR REPLACE THE DETERIORATED STRUCTURES. AT THE END OF THE CONSTRUCTION PERIOD, THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL OF THE TEMPORARY STRUCTURES AND RECONDITIONING THE AFFECTED AREAS

2. DURING CONSTRUCTION:

- SEDIMENT AND EROSION CONTROL MEASURES TO BE CONSTRUCTED AS PER OPSS 805.
- WHEN SEDIMENT AND EROSION CONTROL MEASURES MUST BE REMOVED TO COMPLETE A PORTION OF THE WORK, THE SAME MEASURES MUST BE REINSTATED UPON THE WORK'S COMPLETION.
- WORK TO BE DONE IN THE VICINITY OF MAJOR WATERWAYS TO BE CARRIED OUT FROM JULY AND SEPTEMBER ONLY.
- MINIMIZE THE EXTENT OF DISTURBED AREAS AND THE DURATION OF EXPOSURE.
- PROTECT DISTURBED AREAS FROM RUNOFF.
- PROVIDE TEMPORARY COVER SUCH AS SEEDING OR MULCHING IF DISTURBED AREA WILL NOT BE REHABILITATED SHORTLY.
- INSPECT STRAW BALE FLOW CHECK DAMS, SILT FENCES, SILT SACKS, AND CATCH BASIN SUMPS REGULARLY AND AFTER EVERY MAJOR STORM EVENT. CLEAN AND REPAIR WHEN NECESSARY.
- PLAN TO BE REVIEWED AND REVISED AS REQUIRED DURING CONSTRUCTION.
- EROSION CONTROL FENCING TO BE ALSO INSTALLED AROUND THE BASE OF ALL STOCKPILES.
- DO NOT LOCATE TOPSOIL PILES AND EXCAVATION MATERIAL CLOSER THAN 2.5m FROM ANY PAVED SURFACE, OR ONE WHICH IS TO BE PAVED BEFORE THE PILE IS REMOVED. ALL TOPSOIL PILES ARE TO BE SEEDED IF THEY ARE TO REMAIN ON SITE LONG ENOUGH FOR SEEDS TO GROW (LONGER THAN 30 DAYS). WHEN STORING SOIL ON SITE IN PILES THE CONTRACTOR MUST COVER EACH PILE WITH TARPS, STRAW OR A GEOTEXTILE FABRIC TO AVOID FINE PARTICLE TRANSPORT BY WIND AND/OR STREAMING RAIN WATER.
- CONTROL WIND-BLOWN DUST OFF SITE TO ACCEPTABLE LEVELS BY SEEDING TOPSOIL PILES AND OTHER AREAS TEMPORARILY (PROVIDE WATERING AS REQUIRED). FOR DUST CONTROL, CONTRACTOR TO APPLY CALCIUM CHLORIDE (TYPE I – OPSS 2501 AND CAN/CGSB-15-1) AND WATER WITH EQUIPMENT APPROVED BY THE OWNER'S REPRESENTATIVE AT RATE IN
- ACCORDANCE TO OPSS 506 WHEN DIRECTED BY OWNER'S REPRESENTATIVE.
- ALL EROSION CONTROL STRUCTURE TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN STABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER. SEDIMENT CAPTURE SILT SACKS MUST BE MAINTAINED AND CANNOT BE REMOVED UNTIL ALL LANDSCAPING AREAS ARE COMPLETED.
- NO ALTERNATE METHODS OF EROSION PROTECTION SHALL BE PERMITTED UNLESS APPROVES BY THIS CONSULTING ENGINEER AND THE TOWN DEPARTMENT OF PUBLIC WORKS.
- CONTRACTOR RESPONSIBLE FOR MUNICIPAL ROADWAY AND SIDEWALK TO BE CLEANED OF ALL SEDIMENT FROM VEHICULAR TRACKING ETC. AT THE END OF EACH WORK DAY.
- DURING WET CONDITIONS, TIRES OF ALL VEHICLES/EQUIPMENT LEAVING THE SITE ARE TO BE SCRAPED.
- ANY MUD/MATERIAL TRACKED ONTO THE ROAD SHALL BE REMOVED IMMEDIATELY BY HAND OR RUBBER TIRE LOADER.
- TAKE ALL NECESSARY STEPS TO PREVENT BUILDING MATERIAL, CONSTRUCTION DEBRIS OR WASTE BEING SPILLED OR TRACKED ONTO ABUTTING PROPERTIES OR PUBLIC STREETS DURING CONSTRUCTION AND PROCEED IMMEDIATELY TO CLEAN UP ANY AREAS SO AFFECTED.
- PROVIDE GRAVEL ENTRANCE WHEREVER EQUIPMENT LEAVES THE SITE TO PROVIDE MUD TRACKING ONTO PAVED SURFACES. GRAVEL BED SHALL BE A MINIMUM OF 10m LONG, 4m WIDE, AND 0.15m DEEP AND SHALL CONSIST OF COARSE MATERIAL. MAINTAIN GRAVEL ENTRANCE IN CLEAN CONDITION.

3. AFTER CONSTRUCTION:

- PROVIDE PERMANENT COVER CONSISTING OF TOPSOIL AND SEED TO DISTURBED AREAS.
- ALL SEDIMENT AND EROSION CONTROL MEASURES TO BE REMOVED BY THE CONTRACTOR FOLLOWING THE COMPLETION OF WORK AND AFTER DISTURBED AREAS HAVE BEEN REHABILITATED AND STABILIZED, THIS INCLUDES REMOVE STRAW BALE FLOW CHECK DAMS, SILT FENCES AND FILTER CLOTHS ON CATCH BASINS AND MANHOLE COVERS.
- INSPECT AND CLEAN CATCH BASIN SUMPS AND STORM SEWERS.

STORM SEWER STRUCTURE TABLE

STRUCTURE No.	STRUCTURE DETAILS	ELEVATIONS (m)	NORTHING	EASTING
MHST-1	CONCRETE MANHOLE 1200mm OPSD 701.010	T/G = 100.58 INV NE = 97.81 INV NW = 97.75	5014866.96	363999.18
RYCB-2	RYCB 375mm CITY OF OTTAWA S31	T/G = 99.96 INV SW = 97.98	5014871.28	364006.61
EX. MH-15A	EXISTING STRUCTURE	EX T/G = 100.26 EX INV SW = 97.33 NEW INV E = 97.34 NEW INV SE = 97.40	5014882.64	363991.18

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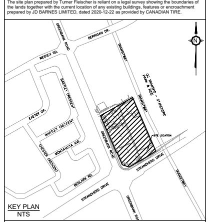

KEY PLAN
NTS

PARSONS
1223 MICHAEL STREET, SUITE 100, OTTAWA, ONTARIO K1J 7T2
Tel: 613-738-4160 Fax: 613-739-7105

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#	DATE	DESCRIPTION	BY
2	2023-10-26	RE-ISSUED FOR SITE PLAN APPLICATION	MT
1	2023-05-18	ISSUED FOR SITE PLAN APPLICATION	PC

BARRHAVEN
STORE No.
442

PROJECT
2501 GREENBANK RD
CANADIAN TIRE STORE EXPANSION
BARRHAVEN, ONTARIO

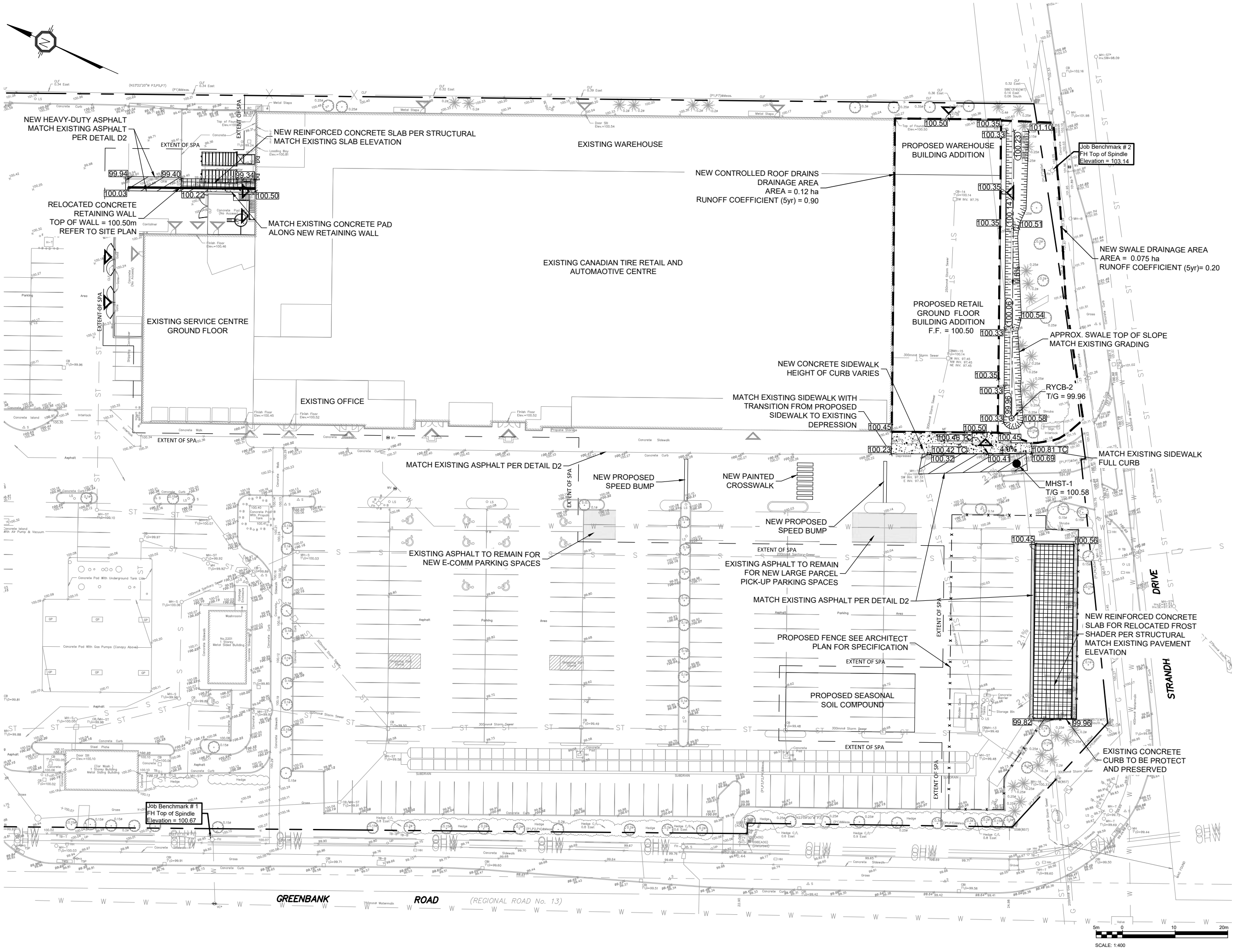
DRAWING
SITE SERVICING &
EROSION/SEDIMENT CONTROL PLAN

PROJECT NO.
478461
PROJECT DATE
2022-09-23
DRAWN BY
BV
CHECKED BY
MT
SCALE
As indicated

B. VILLENEUVE
100553987
2023-10-26

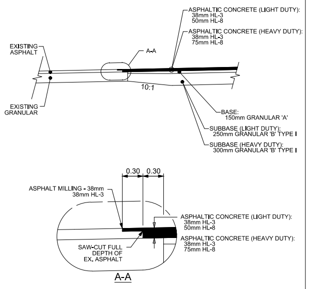
DRAWING NO.
C102
REV.

#19006 D07-12-23-0064



LEGEND:

— — —	EXISTING PROPERTY LINE
┬┬┬┬	TERRACE (3:1 MAX)
— · — · —	PROPOSED CENTERLINE SWALE WITH SUBDRAIN 150mmØ
99.99	EXISTING GRADE
99.99	PROPOSED GRADE
99.99 TC	PROPOSED GRADE TOP OF CURB
99.99	PROPOSED SWALE CENTERLINE GRADE
9.9%	PROPOSED SLOPE DIRECTION AND PERCENTAGE
▒	PROPOSED LIGHT DUTY PAVEMENT
▨	PROPOSED HEAVY DUTY PAVEMENT
⁘	PROPOSED CONCRETE SIDEWALK
▦	PROPOSED REINFORCED CONCRETE SLAB PER STRUCTURAL
— x — x —	PROPOSED FENCE SEE ARCHITECT PLAN



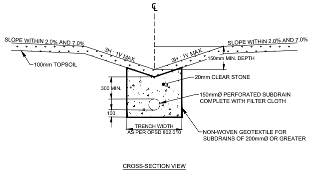
A-A

NEW TO EXISTING PAVEMENT PERPENDICULAR TRANSITION TREATMENT

N.T.S.

PARSONS

D2



CROSS-SECTION VIEW

NOTE :

1. ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. APPROVED NON-WOVEN CLASS 1 GEOTEXTILE SHALL BE USED.
3. LONGITUDINAL SLOPE OF SWALES/DITCHES 0.5% MINIMUM WITH 1% OR GREATER PREFERRED.
4. PERFORATED SUBDRAIN TO BE INSTALLED AT MINIMUM 0.5% SLOPE

SWALE WITH SUBDRAIN

N.T.S.

PARSONS

D3

PAVEMENT STRUCTURES

MATERIAL	LIGHT DUTY	HEAVY DUTY	COMPACTION
Asphaltic Concrete Surface Course: HL3	38 mm	38 mm	> 97%
Asphaltic Concrete Binder Course: HL8	50 mm	75 mm	> 97%
Granular Base: OPSS 1010 Granular A (crushed limestone)	150 mm	150 mm	100%
Granular Sub-base: OPSS 1010 Granular B, Type I	250 mm	300 mm	100%

FROM: GEOTECHNICAL INVESTIGATION, PROPOSED BUILDING STORE #442, GREENBANK ROAD, NEPEAN, ONTARIO, BY JACQUES, WHITFORD LIMITED. DATED JANUARY 31, 2000
*MINIMUM PAVEMENT COMPACTION BASED ON MARSHALL BULK DENSITY TEST
**BASED ON STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD)

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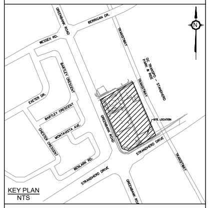

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BARRHAVEN, ONTARIO

DRAWING
GRADING PLAN

PROJECT NO.
478461
PROJECT DATE
2022-09-23
DRAWN BY
BV
CHECKED BY
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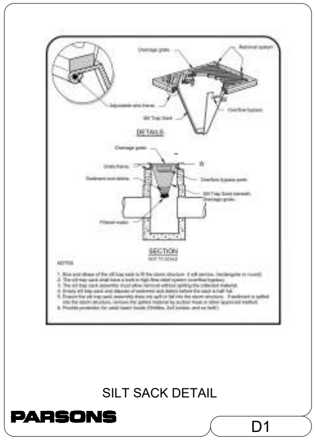
SCALE
As indicated

B. VILLENEUVE
100553987
2023-10-26

DRAWING NO.
C103
REV.

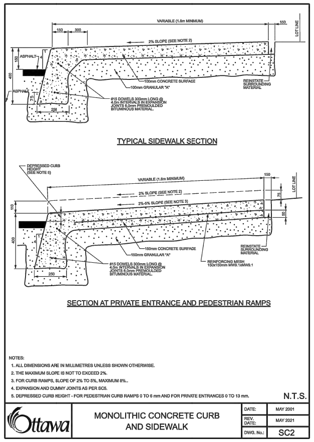
#19006 D07-12-23-0064



SILT SACK DETAIL

PARSONS

D1



TYPICAL SIDEWALK SECTION

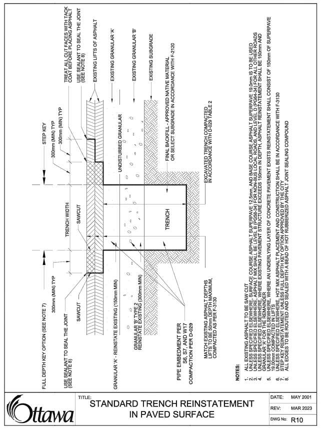
SECTION AT PRIVATE ENTRANCE AND PEDESTRIAN RAMPS

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
2. THE MAXIMUM SLOPE IS NOT TO EXCEED 2%.
3. FOR CURB RAMPS, SLOPE OF 2% TO 5%, MAXIMUM 8%..
4. EXPANSION AND DUMMY JOINTS AS PER SC5.
5. DEPRESSED CURB HEIGHT - FOR PEDESTRIAN CURB RAMPS 0 TO 6 mm AND FOR PRIVATE ENTRANCES 0 TO 13 mm.

N.T.S.

MONOLITHIC CONCRETE CURB AND SIDEWALK

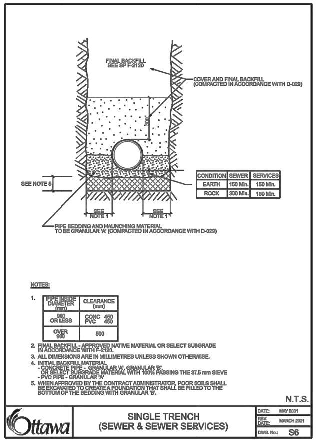
DATE: MAY 2001
REV. DATE: MAY 2021
DWG. No.: SC2



NOTES:
1. ALL EXISTING ASPHALT TO BE SAW CUT
2. UNLESS SPECIFIED ELSEWHERE, SURFACE COURSE ASPHALT SUPERPAVE 12.5mm, AND BASE COURSE ASPHALT SUPERPAVE 19.0mm IS TO BE USED
3. UNLESS SPECIFIED ELSEWHERE, ASPHALT MIX SHALL BE LEVEL B (PG58-34) FOR NON-BUS LOCAL ROADS, AND LEVEL D (PG64-34) FOR ALL OTHER ROADS
4. UNLESS SPECIFIED ELSEWHERE, WHERE EXISTING PAVEMENT STRUCTURE EXCEEDS 150mm IN DEPTH, ASPHALT REINSTATEMENT SHALL BE 150mm AND GRANULAR 'A' FOR THE REMAINDER
5. UNLESS SPECIFIED ELSEWHERE, WHERE AN UNDERLYING LAYER OF CONCRETE PAVEMENT EXISTS REINSTATEMENT SHALL CONSIST OF 150mm OF SUPERPAVE 19.00mm COMPACTED IN LIFTS
6. UNLESS SPECIFIED ELSEWHERE, HOT MIX ASPHALT PLACEMENT AND CONSTRUCTION SHALL BE IN ACCORDANCE WITH F-3130
7. STEP KEY REINSTATEMENT UNLESS FULL DEPTH KEY OPTION APPROVED BY THE CITY
8. ALL EDGES TO BE ROUTED AND SEALED WITH A BEAD OF HOT RUBBERIZED ASPHALT JOINT SEALING COMPOUND

TITLE: STANDARD TRENCH REINSTATEMENT IN PAVED SURFACE

DATE: MAY 2001
REV: MAR 2023
DWG No: R10



CONDITION	SEWER	SERVICES
EARTH	150 Min.	150 Min.
ROCK	300 Min.	150 Min.

NOTES:

1.

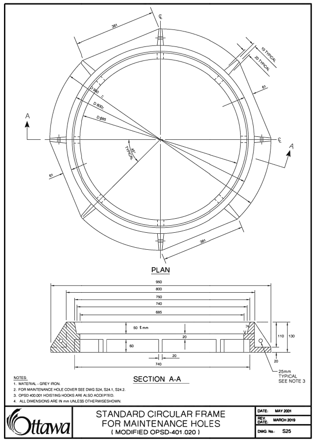
PIPE INSIDE DIAMETER (mm)	CLEARANCE (mm)
900 OR LESS	CONC 450 PVC 450
OVER 900	500

2. FINAL BACKFILL - APPROVED NATIVE MATERIAL OR SELECT SUBGRADE IN ACCORDANCE WITH F-2120.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
4. INITIAL BACKFILL MATERIAL
   - CONCRETE PIPE - GRANULAR 'A', GRANULAR 'B', OR SELECT SUBGRADE MATERIAL WITH 100% PASSING THE 37.5 mm SIEVE
   - PVC PIPE - GRANULAR 'A'
5. WHEN APPROVED BY THE CONTRACT ADMINISTRATOR, POOR SOILS SHALL BE EXCAVATED TO CREATE A FOUNDATION THAT SHALL BE FILLED TO THE BOTTOM OF THE BEDDING WITH GRANULAR 'B'.

N.T.S.

SINGLE TRENCH (SEWER & SEWER SERVICES)

DATE: MAY 2001
REV. DATE: MARCH 2021
DWG. No.: S6

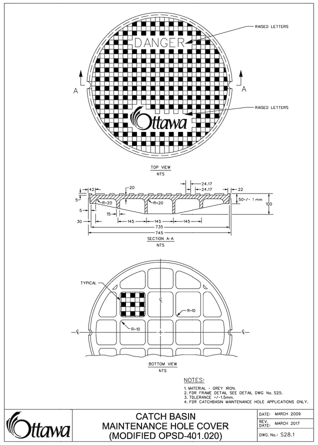


SECTION A-A

NOTES:
1. MATERIAL - GREY IRON.
2. FOR MAINTENANCE HOLE COVER SEE DWG S24, S24.1, S24.2.
3. OPSD 400.001 HOISTING HOOKS ARE ALSO ACCEPTED.
4. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISESHOWN.

STANDARD CIRCULAR FRAME FOR MAINTENANCE HOLES (MODIFIED OPSD-401.020)

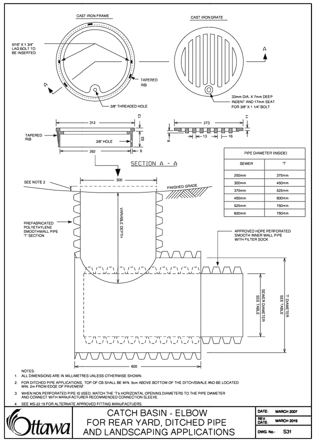
DATE: MAY 2001
REV. DATE: MARCH 2019
DWG. No.: S25



NOTES:
1. MATERIAL - GREY IRON.
2. FOR FRAME DETAIL SEE DETAIL DWG No. S25.
3. TOLERANCE +/-1.5mm.
4. FOR CATCHBASIN MAINTENANCE HOLE APPLICATIONS ONLY.

CATCH BASIN MAINTENANCE HOLE COVER (MODIFIED OPSD-401.020)

DATE: MARCH 2009
REV. DATE: MARCH 2017
DWG. No.: S28.1

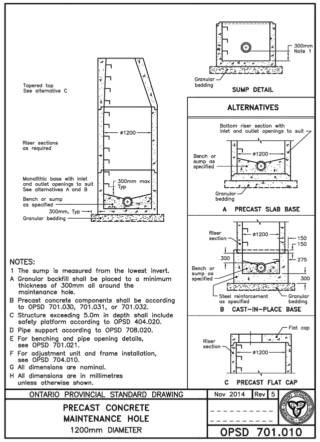


PIPE DIAMETER (INSIDE)	
SEWER	'T'
250mm	375mm
300mm	450mm
375mm	525mm
450mm	600mm
525mm	750mm
600mm	750mm

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
2. FOR DITCHED PIPE APPLICATIONS, TOP OF CB SHALL BE MIN. 5cm ABOVE BOTTOM OF THE DITCH/SWALE AND BE LOCATED MIN. 2m FROM EDGE OF PAVEMENT.
3. WHEN NON PERFORATED PIPE IS USED, MATCH THE 'T's HORIZONTAL OPENING DIAMETERS TO THE PIPE DIAMETER AND CONNECT WITH MANUFACTURER RECOMMENDED CONNECTION SLEEVE.
4. SEE MS-22.15 FOR ALTERNATE APPROVED FITTING MANUFACTUERS.

CATCH BASIN - ELBOW FOR REAR YARD, DITCHED PIPE AND LANDSCAPING APPLICATIONS

DATE: MARCH 2007
REV. DATE: MARCH 2019
DWG. No.: S31



NOTES:
1 The sump is measured from the lowest invert.
A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
B Precast concrete components shall be according to OPSD 701.030, 701.031, or 701.032.
C Structure exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.
D Pipe support according to OPSD 708.020.
E For benching and pipe opening details, see OPSD 701.021.
F For adjustment unit and frame installation, see OPSD 704.010.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

Nov 2014 Rev 5

PRECAST CONCRETE MAINTENANCE HOLE 1200mm DIAMETER

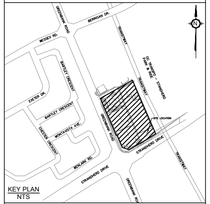
OPSD 701.010

TURNER FLEISCHER

Turner Fleischer Architects Inc.

67 Lesmill Road
Toronto, ON, M3B 2T8
T 416 425 2222
turnerfleischer.com

The site plan prepared by Turner Fleischer is reliant on a legal survey showing the boundaries of the lands together with the current location of any existing buildings, features or encroachment prepared by JD BARNES LIMITED, dated 2020-12-22 as provided by CANADIAN TIRE.



KEY PLAN
NTS

PARSONS

1223 MICHAEL STREET, SUITE 100, OTTAWA, ONTARIO K1J 7T2
Tel: 613-738-4160 Fax: 613-739-7105

TOPOGRAPHIC INFORMATION & BENCHMARK

SURVEY COMPLETED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD. ON NOVEMBER 9TH, 2022. ELEVATIONS SHOWN ARE GEODETIC AND ARE REFERRED TO THE CGVD28 GEODETIC DATUM, DERIVED FROM CONTROL MONUMENT NO. 019680071 HAVING AN ELEVATION OF 99.742m.

#	DATE	DESCRIPTION	BY
2	2023-10-26	RE-ISSUED FOR SITE PLAN APPLICATION	MT
1	2023-05-18	ISSUED FOR SITE PLAN APPLICATION	PC

BARRHAVEN
STORE No.
442

PROJECT
2501 GREENBANK RD
CANADIAN TIRE STORE EXPANSION
BARRHAVEN, ONTARIO

DRAWING
DETAILS

PROJECT NO. 478461
PROJECT DATE 2022-09-23
DRAWN BY BV
CHECKED BY MT
SCALE As indicated

B. VILLENEUVE
100553987
2023-10-26

N

DRAWING NO. C104
REV.

#19006 D07-12-23-0064