REPORT
10113-5.2.2

NORTH AMERICAN
5705 HAZELDEAN ROAD COMMERCIAL SITE
PHASE 1 & 2
SITE SERVICING BRIEF
SPA D07-12-19-0168

Prepared for North American Development Group
by IBI Group
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1 INTRODUCTION

This servicing brief outlines the proposed municipal site servicing for Phase 1 & 2 of an 8.46 Ha commercial site located on the north side of Hazeldean Road and east of Huntmar Drive as shown on Figure 1.

The subject lands are located within the Kanata West Development Area (KWDA) and therefore are subject to the requirements of the KWDA Master Servicing Reports. Since the first site plan approval in 2010, this brief has been a living document updated to support the various steps of detail design by demonstrating the proposed development can be serviced by the existing municipal infrastructure in accordance with the current City standards and the KWDA Master servicing requirements for water supply, stormwater and wastewater.

The development is a community shopping centre with a mixture of attached and free standing buildings. The total commercial gross floor area for Phases 1 and 2 when fully completed will be approximately 20,007 sm (216,095 sq. ft.), see Master Site Plan A100 in **Appendix A**.

The previous Site Plan Approval D07-12-14-0032 amended the original site plan by adding two buildings, BLDG 1 and BLDG 2 of 1040m^2 and 385m^2 respectively. PAD E was refined to a smaller foot print (from 262 m^2 to 251 m^2).

To address market demands and tenant requirements, the owner is submitting for Site Plan Approval amendment for CRU B-2a (1434 m^2) which will replace two previously planned Box stores, Box B and Box C (1990 m^2 each). In addition, the Owner is applying for approval of PAD B, which has been slightly adjusted from 627 m^2 to 675 m^2, and Box D remains unchanged at 2323 m^2. These adjustments are the subject of this report update. The Master Site Plan A100 in **Appendix A** highlights the location of these buildings. Technical changes, or areas of specific concern to the amendment has been shown in ***bold italics***.

2 WATER SUPPLY

2.1 Existing Conditions

The KWDA Master Servicing Report outlined the proposed trunk watermains within the neighbourhood, see drawing WM-1 of that report. As part of the construction of Huntmar Drive, the proposed 400Ømm watermain was installed and is currently operational.

Phase 1 & 2 of the North American commercial development connects to the Huntmar Road watermain at two locations, with 305 Ømm watermains. These connections create a looped 305 Ømm watermain within Phase 1 & 2. The looping will provide the desired fire protection and offer redundancy within the network. See Drawing C-104 in **Appendix A** for watermain locations. The remainder of the watermains within Phase 1 & 2 of the development are 200 mm in diameter. Water services to the various buildings range from 152 mm to 50 mm in diameter, depending on projected requirement for domestic supply and/or sprinklers. The water services for Pad B and Box D were previously installed and no adjustment is required as part of this SPA amendment. The conversion of Box B/C to CRU B-2a will require a connection to and an extension of the existing water service.

Drawing C-104 illustrates the watermain works for Phase 1 & Phase 2 and Drawing C-105 contains notes and watermain schedules for Phases 1 and 2.

2.2 Design Criteria

2.2.1 Water Demands

Water demands for the commercial buildings in the North American development are based on Table 4.2 of the Ottawa Design Guidelines – Water Distribution. The rate for shopping centers of 2,500 liters per 1000 square meters floor space per day is used. A watermain demand calculation sheet is included in **Appendix A** and the total water demands are summarized as follows:

- Average Day 0.73 L/s
- Maximum Day 1.08 L/s
- Peak Hour 1.95 L/s

2.2.2 System Pressure

The 2010 City of Ottawa Water Distribution Guidelines state that the preferred practice for design of a new distribution system is to have normal operating pressures range between 345 kPa (50 psi) and 552 kPa (80 psi) under maximum daily flow conditions. Other pressure criteria identified in the guidelines are as follows:

Minimum Pressure	Minimum system pressure under peak hour demand conditions shall not be less than 276 kPa (40 psi)
Fire Flow	During the period of maximum day demand, the system pressure shall not be less than 140 kPa (20 psi) during a fire flow event.

Maximum Pressure	Maximum pressure at any point in the distribution system shall not exceed 689 kPa (100 psi). In accordance with the Ontario Building/Plumbing Code, the maximum pressure should not exceed 552 kPa (80 psi). Pressure reduction controls may be required for buildings where it is not possible/feasible to maintain the system pressure below 552 kPa.

2.2.3 Fire Flow Rates

Fire flow demands have been calculated using the Fire Underwriters Survey (FUS) method. For the large building, Box A, a fire flow demand of 15,000 L/min (250 L/s) has been calculated while a demand of 11,700 L/min (195 L/s) has been calculated for Block D and E. It is proposed to use a demand of 250 L/s for all buildings in the development except for Box D and E which will use the 195 L/s flow.

2.2.4 Boundary Conditions

The City of Ottawa has provided hydraulic boundary conditions at Huntmar Road. A copy of the boundary condition is included in **Appendix A** and summarized as follows:

	HUNTMAR ROAD
Max HGL (Basic Day)	161.6 m
Peak Hour	156.5 m
Max Day + Fire (250 L/s Fire Flow)	155.0 m

2.2.5 Hydraulic Model

A computer model for the North American development has been developed using the H2O MAP version 6.0 program produced by MWH Soft Inc. The boundary condition, water demands and fire flow demands are all incorporated in the model.

2.3 Proposed Water Plan

2.3.1 Modeling Results

The hydraulic model was run under basic day, maximum day with fire flows and under peak hour conditions. Water pipes are sized to provide sufficient pressure and to deliver the required fire flows.

Results of the hydraulic model are include in **Appendix A** and summarized as follows:

Scenario	Results
Basic Day (Max HGL) Pressure Range	567.9 to 588.0 kPa
Peak Hour Pressure Range	517.9 to 537.9 kPa
Max Day + 250 L/s Fire Flow Minimum Flow	182.0 L/s

A comparison of the results and design criteria is summarized as follows:

Maximum Pressure	All nodes have pressures exceeding 552 kPa (80 psi) which require pressure reducing control at the building units. The highest pressure is below the maximum allowable value of 689 kPa (100 psi).
Minimum Pressure	All nodes in the model exceed the minimum value of 276 kPa (40 psi).
Fire Flow	Under the fire flow analysis node 40 adjacent to Box D and E has a design fire flow of 182.0 L/s which is marginally under the calculated demand of 195 L/s. Node 40 is a fire hydrant built on a long hydrant lead. Box D and E are also protected by a hydrant at node 34 which has a design fire flow of 338.9 L/s. All other nodes have design flows in excess of the 250 L/s requirement.
Water Age	A water age analysis has been completed under basic day conditions and using the boundary condition at Huntmar road as the origin. The age analysis was run for an eight day period (192 hours) and results are shown in Appendix A, please note that nodes 40 and 70 are fire hydrant nodes and have no water demand. For Pad E and Bldg 2 at node 48 the water age is 66.8 hours or 2.8 days. The actual water age will be the water age at the boundary condition plus the 2.8 days calculated. As the main on Huntmar Drive is a large feeder main it is expected the actual water age will be less than 3 days giving a water age at node 40 less than 6 days which meets the City criteria allowing a maximum water age of 8 days. The longest water age in the model is 72.8 hours (3.0 days) at node 34.

2.3.2 Watermain Layout

The watermain layout for the North American development is shown on Drawing C-104.

3 STORMWATER

3.1 Stormwater Management

The total North American site area is 10.02 Ha, with 8.46 Ha east of Huntmar Drive (Phases 1 and 2) and 1.56 Ha west of Huntmar Drive (future Phase). In accordance with the KWDA MSP the west portion of the site was proposed to outlet to the existing Huntmar Drive storm sewer, which outlets to the existing Levanto Circle trunk storm sewer which discharges to Pond 5 as per KWDA Master Servicing Report. The KWDA MSP also identified the east portion of the North American site outletting to Huntmar Drive and discharging to Pond 5 as noted above. However, during detail design of Phase 1, it has noted excessive grade raise would be required to service the site by gravity to the Huntmar Drive storm sewer. The approved solution was to route the storm sewer for the east portion of the site to Levanto Circle trunk storm sewer through a servicing block, which discharges to Pond 5 as per the KWDA Master Servicing Plan. This route has been coordinated with the adjacent developer, see approved plan and profile drawing 15 from DSEL for Mattamy's Phase 5A for details on the storm sewer within the servicing block, and DSEL Design Brief for Fairwinds Phase 5A (4^{th} submission dated November 13, 2009). These sewers have been constructed and are operational. All drainage directed to these sewers is restricted to a maximum release rate of 85 L/s/ha, which is in accordance with the Master Servicing Report for the KWDA.

3.2 Storm Sewers

The proposed stormwater system is a minor-major storm drainage system, where the minor system is comprised of storm sewers sized to accommodate the City of Ottawa 1:5 year design event. The major system is overland flow routing.

As per the KWDA Master Servicing Plan, the development must limit flow to the storm trunk sewer to 85 L/s/Ha during a 1:5 year rainfall event to provide flood protection for downstream property. In order to control flow into the downstream sewers to meet this criteria, Inlet Control Devices (ICD) and roof drain restrictors are proposed. These flow control devices will restrict flow into the minor system and to the downstream storm sewers, to a maximum of 85 L/s/Ha, or 709.41 L/s for the 8.346 Ha tributary to the Levanto Circle trunk storm sewer for Phase 1 & 2.

The KWDA MSP identified the major storm route for these lands to discharge to Huntmar Drive. As noted earlier, the MSP did not appreciate the volume of fill required to meet this requirement for Phase 1 & 2. Phase 1 & 2 will be designed to accommodate the 100 year event with zero over flow off site, however, should a major event in excess of the 1:100 year event occur, runoff which exceeds the available spare storage would be routed along the parking lot and internal roads to Hazeldean Creek. Figure C-500B in **Appendix B** also illustrates the proposed major storm routing for the site system.

The site plan amendment for proposed CRU B-2a or the subtle adjustment of PAD B does not alter the previously approved major storm routing.

Phase 1 & 2 Minor System

As per the KWDA Master Servicing Plan, the development must limit flow to the storm trunk sewer to 85 L/s/Ha during a 1:5 year rainfall event to provide flood protection for downstream in property. In order to control flow into the downstream sewers to meet this criteria, Inlet Control Devices (ICD) are proposed. Drawing C-500B identifies the storm tributary areas and Drawing C-802 illustrates the ICD's for the various inlets and roof drains for Phase 1 & 2. These ICD's restrict flow into the minor system resulting in ponding as illustrated on Drawing C-402. The modified rational method was used to determine the volume of storage required to capture the 100 year event while limiting the accumulated flow to the downstream storm sewers to a maximum of 85L/s/Ha. For the 8.346 Ha area tributary to the storm sewer, the total allowable flow is 709.41 L/s.

Roof drainage will be restricted to the specified rate for each roof. Detail design of the roof system and flow restrictions is to be completed by the mechanical engineer as part of the building permit works. Roof drain restrictors such as the Watts RD-100 with adjustable Accutrol Weir will be employed to control the runoff from each roof. A copy of RD-100 and weir is included in **Appendix B**.

Approximately 0.05 Ha of grassed side yard (between box A and boulevard, and Pad A and boulevard) will shed uncontrolled runoff to the existing Huntmar Road storm sewer. As this storm sewer is tributary to the sites outlet trunk sewer, the net allowable from the site shall be reduced by 85 L/s/Ha x 0.05 Ha, or 4.25 L/s. To this end the maximum allowable flow from the Phase 1 & 2 onsite sewers is 709.41 L/s – 4.25 L/s = 705.16 L/s.

Based on the proposed ICD's, a total of 705 L/s is being allowed into the system, while a maximum of 2755.81 m^3 of 100year storm storage has been provided as summarized in the table below. The modified rational method analysis is included in **Appendix B** along with the above noted drawings. It can be noted that on site surface storage (roof top, and surface), fully attenuates the 100 year event with zero overflow off site.

The storm sewer design sheets and ICD design sheet for Phase 1 & 2, are also located in **Appendix B** demonstrates the storm sewers have been sized to accommodate the 1:5 year event as per City and MOE requirements

Storm sewers were previously constructed along the frontages of CRU B-2a, Box D and Pad B and service laterals were to be extended from the service stubs to the building. CRU B-2a is a smaller building footprint than the previously intended box stores (Box B and C). The previously constructed services laterals for Box C will be abandoned, and the previously installed services for Box B will be extended to the proposed CRU B-2a. Box D and PAD B will use the previously installed services laterals.

ICD #	TRIB AREA HA	FLOW (L/s)	100 YR. STORAGE (m^3)	5 YR. STORAGE (m^3)
1	0.34	21	154.82	52.03
2	0.097	13	1.35	1.35
3	0.055	13	2.05	2.05
4	0.083	10	0	0
5	0.332	35	118.70	42.38
6	0.149	21	1.87	1.87
7A	0.054	5	0	0
7D	0.028	5	0	0
8A	0.234	18.5	92.29	31.47
8B	0.090	10	23.70	9.19
9	0.12	21	1.87	1.87
11	0.173	18	12.90	9.53

ICD #	TRIB AREA HA	FLOW (L/s)	100 YR. STORAGE (m^3)	5 YR. STORAGE (m^3)
12	0.204	21	82.51	32.17
14	0.272	21	123.67	45.45
15	1.034	43	441.23	193.64
16	0.105	29	18.53	12.96
17	0.709	82	203.43	65.52
18	0.183	21	26.00	9.78
19	0.077	29	29.63	7.96
20	0.64	48	249.78	96.12
21	0.191	10	15.97	15.97
21A	0.027	5	5.17	1.77
22	0.172	12	30.00	21.93
23	0.141	21	46.87	8.62
23B	0.143	3	55.36	26.56
23C	0.218	3	60.59	26.60
24	0.122	35	41.67	6.94
24A	0.020	3	7.44	1.81
25	0.182	27	33.11	8.61
25A	0.028	2	12.12	3.87
26	0.062	5	17.33	7.48
Box A	0.3260	16	125.90	50.55
Box D	***0.232***	***10***	***93.90***	***38.35***
Box E	0.426	20	167.22	67.56
CRU A	0.12	3.5	55.25	23.49
CRU B-1	0.083	2	40.47	17.47
CRU B-2	0.092	2	46.22	20.10
CRU B-2a	***0.149***	***4***	***70.36***	***30.12***
PAD A	0.157	4	75.31	32.37
PAD B	***0.062***	***3***	***24.07***	***9.68***
PAD C	0.062	3	24.07	9.68
PAD D	0.045	3	15.40	5.89
PAD E	0.0251	2	7.94	2.93
PAD F	0.0416	3	13.76	5.19
PAD G	0.049	3	17.37	6.74
BLDG 1	0.1040	2	54.09	23.71
BLDG 2	0.0385	2	14.56	5.80
TOTAL	**8.297**	**705.0**	**2755.81**	**1095.09**
	AVERAGE	**84.97 L/Ha**	**332.14 m^3/Ha**	**131.98 m^3/Ha**

With regards to the previously approved report (file D07-12-14-0102 and D07-12-14-0032), the table below lists the areas impacted by the proposed change. The table also lists new areas and provides the respective 100 year flow and storage values. The net change in flow is -1.5 L/s which as noted above results in a total flow from the site of 705 L/s.

100 YR STORAGE & FLOW COMPARISON –
PREVIOUS REPORT (D07-12-14-0102 and D07-12-14-0032) vs. REVISED REPORT

PREVIOUS				REVISED			
AREA ID	AREA (m^2)	FLOW (L/s)	STORAGE (m^3)	AREA ID	AREA (m^2)	FLOW (L/s)	STORAGE (m^3)
BOX B	1951	8	80.35	CRU B-3	1490	4	70.36
BOX C	1961	8	80.91	BOX D	2320	10	93.90
BOX D	2320	10	93.90	PAD B	620	3	24.07
PAD B	610	3	23.54				
Subtotal: Roofs	**6842**	**29**	**280.7**	**Subtotal: Roofs**	**4730**	**17**	**188.33**
17	681	82	203.43	17	709	82	203.43
22	1016	12	30.00	22	1720	12	30.00
23	1570	21	56.25	23	1410	21	46.87
23C	260	3	45.26	23B	1430	9	55.36
23D	240	3	42.60	23C	2180	9	60.59
24	2060	35	51.08	24	1220	35	41.67
Subtotal: Parking Lot	**5827**	**156**	**747.82**	**Subtotal: Parking Lot**	**8669**	**168**	**437.92**
TOTAL	**12669**	**185**	**1028.52**	**TOTAL**	**13399**	**185**	**626.25**

Previous Report (D07-12-14-0032), Total Flow **706.5 L/s (100 yr)**

Revised Report, Total Flow **705 L/s (100 yr)**

4 WASTEWATER OUTLET

The KWDA Master Servicing Report describes the sanitary servicing strategy for the neighbourhood, see Figure S-1 in the KWDA Master Servicing Report. This study identified a 750Ømm sewer to be constructed within Huntmar Drive, this sewer was constructed as part of the Huntmar Drive works and is currently operational.

The KWDA Master Servicing Report used the standard design flow of 50,000 L/Ha/day as noted in section 4.4.1.2 of the City of Ottawa design guidelines (at that time) to establish the anticipated wastewater flow rate for the proposed development. Based on the limits of Phase 1 & 2 and average design flow of 50,000 L/Ha/day as per the City Guidelines infiltration allowance of 0.28 L/s/Ha, and peak factor of 1.5, the anticipated flow for Phase 1 & 2 of this site is as follows:

Commercial Flow = 8.46 Ha @ 50,000 L/Ha/d = 4.89 L/s

Commercial Peak Factor = 1.5

Peak Flow = 1.5 x 4.89 L/s = 7.335 L/s

Extraneous Flow = 8.45 Ha x 0.28 L/s/Ha = 2.366 L/s

Total Flow = 7.335 L/s + 2.366 L/s = 9.701 L/s

Thus the total peak sanitary flow from Phase 1 & 2 of the North American site used in the design of the downstream sewers was 9.701 L/s.

The sanitary tributary area Drawing C-501B and sanitary sewer design sheet for Phase 1 & 2 are included in **Appendix C**. The sanitary sewer system has been designed in accordance with current City and MOE guidelines. Due to the grade constraints and the existing elevation of the sanitary trunk sewer, the private onsite sewers have an actual velocity of less than the recommended 0.6 m/s self clean velocity. The owner recognizes this and accepts the additional maintenance associated with the proposed sewers.

Based on the proposed usages and City guideline Appendix 4-A Daily Flow for Various Establishments, the following estimates the total sanitary peak flow for phase 1 & 2:

SHOPPING CENTRE RETAIL

BUILDING	FLOOR AREA (SM)
Box A	3287.2
Box E	4180.5
CRU A	1203.2
CRU B1/B2	1699.7
PAD A	1567.2
PAD G	478.4
PAD F	416.3
CRU B-2a	1434.3
BOX D	2322.5
BLDG 1	1040.5
PAD B	675.3
PAD C	627
PAD D	464.5
TOTAL	**19,366.6**

The above are shopping center retail stores which City of Ottawa sewer guideline Appendix 4-A notes as 5 L/d per sm.

19,366.5 x 5L/d per sm = 96,832.5 L/d x 1.5 Peak Factor = **1.68 L/s.**

DRIVE-THRU RESTAURANT

BUILDINGS	SEATS
BLD 2	144
Subtotal Seats	**144**
PAD E	44
Subtotal Seats	**44**
Total Seats	**188**

The above are drive-thru restaurants which Appendix 4-A notes as 125 L/d per seat

188 x 125 L/d per seat = 23,500 L/d x 1.5 Peak Factor = **0.41 L/s**

Phase 1 & 2 area is 8.46 Ha, extraneous flow rate of 0.33 L/s/Ha

8.46Ha x 0.33 L/s/Ha = **2.79 L/s**

Total Peak Flow = retail flow + drive thru flow + extraneous flow = 1.68 + 0.41 + 2.79 = **4.88 L/s**

The total peak sanitary flow when calculated using a usage basis is 4.88 L/s. This is less than the total when using the original design criteria when sizing the downstream sewers which was previously noted as 9.70 L/s.

The above demonstrated that the modification to CRU B-2a and the Pad B does not negatively impact the downstream capacity previously approved for this site. (Box D remains unchanged from original SPA).

Sanitary mains exist along the internal roads abutting CRU B-2a, Box D and PAD B, as illustrated in drawing C-104. Previously constructed service lateral for Box B will be extended to service CRU B-3. Service lateral for Box C will be abandoned. Service laterals previously constructed for PAD B and BOX D are adequate without modification.

5 SEDIMENT & EROSION CONTROL PLAN

The majority of the site has been developed, the sediment and erosion control measures noted within this section deal with the construction of services and parking lot for proposed CRU B-3, PAD B and BOX D.

During construction, existing stream and conveyance system can be exposed to significant sediment loadings. Although construction techniques to reduce unnecessary construction sediment loadings. These will include:

- groundwater in trench will be pumped into a filter mechanism prior to release to the environment;
- seepage barriers will be constructed in any temporary drainage ditches;
- filter cloths will remain on open surface structure such as manholes and catchbasins until structures are commissioned and put into use
- workzone perimeter siltation protection involving a sandbag dyke wrapped in filter cloth, placed at the base of the construction hoarding fence

During construction of municipal services, any trench dewatering using pumps will be discharged into a filter trap made up of geotextile filters and straw bales similar in design to the OPSD 219.240 Dewatering Trap. These will be constructed in a bowl shape with fabric forming the bottom and the straw bales forming the sides. Any pumped groundwater will be filtered prior to release to the existing surface runoff. The contractor will inspect and maintain the filters as needed including sediment removal and disposal and material replacement as needed.

In order to reduce sediment loading to the adjacent lands via overland flow, custom seepage barriers will be installed along the construction limits. All seepage barriers will be inspected and maintained as needed.

All catchbasins, and to a lesser degree manholes, convey surface water to sewers. However, until the surrounding surface has been completed these structures will be covered to prevent sediment from entering the minor storm sewer system. Until the parking lots are asphalted and curbed, all catchbasins and manholes will be constructed with a geotextile filter fabric located between the structure frame and cover. These will stay in place and be maintained during construction of services and the buildings until it is appropriate to remove same.

During construction of any development both imported and native soils are stockpiled. Mitigative measures such as silt fencing and silt bag and proper management (stockpiling within areas with sediment control measures) to prevent these materials entering the sewer system is needed.

During construction of the deeper municipal services, water, sewers and service connections, imported granular bedding materials are temporarily stockpiled on site. These materials are however quickly used up and the works proposed are within the seepage barriers.

Contamination of the environment as a result of stock piling of imported construction materials is generally not a concern. These materials are quickly used and in mitigative measures stated previously, such as and filter fabric in catchbasins and manholes help to manage these concerns.

Parking lot granular materials are not typically stockpiled on site. They are immediately placed in the parking lot and have little opportunity of contamination. Lot grading sometimes generates stockpiles of native materials. However, this is only a temporary event since the materials are quickly moved off site.

The sediment and erosion control plan for Phase 1 & 2 pertaining to CRU B-2a, Box D and Pad B is provided as Drawing C-920 in **Appendix D**.

6 GEOTECHNICAL

Jacques Whitford Ltd. prepared two geotechnical reports (ONO11763) dated November 1, 2004, and ONO11739 dated June 23, 2004 for the subject lands. Paterson Group prepared an updated report dated May 25, 2016 to reflect the proposed revised site plan. A copy of the Paterson report has been provided in **Appendix D**. The report provides recommendations for various site servicing and building construction issues. The recommendations impacting site servicing include, but are not limited to the following, see report for details:

- Permissible grade raise: 1.2m.
- Pavement Structure: The following is the recommended pavement structure.

PAVEMENT STRUCTURE	THICKNESS (mm)	
	CAR PARK AREA	ACCESS LANE & HEAVY TRUCK PARKING (FIRE ROUTE)
Superpave 12.5	50	40
Superpave 19.0		50
Granular “A”	150	150
Granular “B” Type II	300	400

The proposed grading Plan for Phase 1 & 2 C-202 is included in **Appendix D**. The grading plan was prepared with a view to limit grade raise to 1.2m or less.

Infiltration targets for the proposed site were outlined in the KWDA MSP. As indicated in Figure 5.4 of the MSS, attached in **Appendix D**, the soil type within the proposed development area is characterized as clay with low recharge potential. The infiltration target for the area, as identified within the MSP is 50-70mm/year. Phase 1 & 2 consists of approximately 84600m^2 of development, the site is primarily comprised of impervious parking lot and roof surfaces. Pervious areas are provided where possible throughout the site.

In consultation with the MVCA, an infiltration strategy for the site was developed; see approval email from Doug Nuttall in **Appendix D**. The strategy included three sources: natural infiltration from rainfall (20mm/yr), infiltration from irrigation system (20 mm/yr), and infiltration from a dry well supplied by roof runoff. CRU B1/2&2a roofs which total 3134m^2 will provide 9.2 mm/yr for a total of 49.2 mm/yr, which is slightly less than the guideline of 50 to 70 mm/yr.

The location of “dry well” areas which will capture rainfall runoff and retain the water to allow infiltration into the clay subgrade is illustrated on the Grading Plan C-202.

7 RECOMMENDATION

This brief has demonstrated the proposed site plan can be serviced by the existing municipal services, and all existing municipal services have sufficient capacity to accommodate the proposed development. The construction of parking lots, sanitary, storm, and water services to service the proposed CRU B-3, Pad B, Box D can be completed in conformance with the City of Ottawa and MOE standards.

Adherence to the sediment and erosion control plan during construction will minimize harmful impacts on downstream systems.

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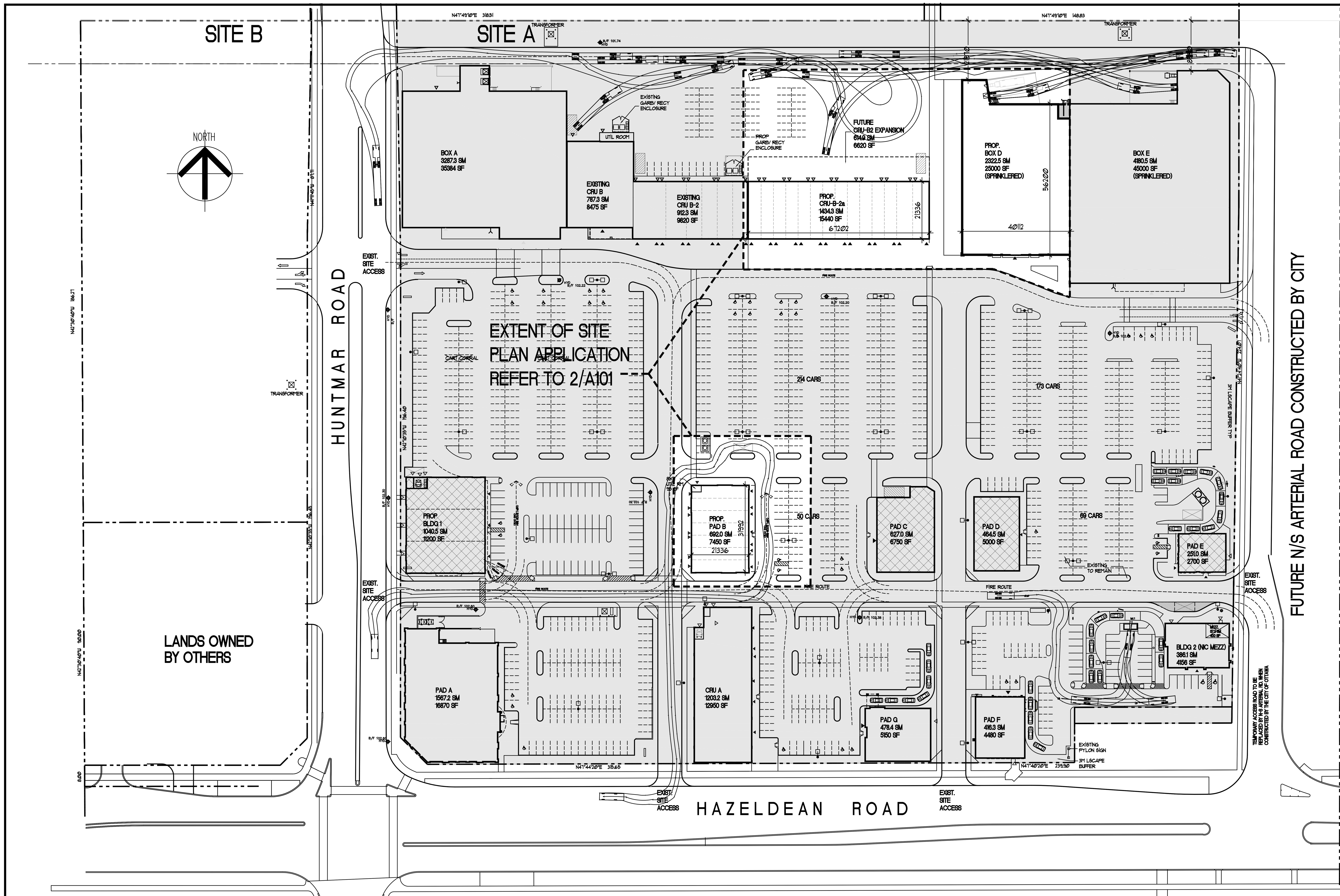
APPENDIX A

- A100 Master Site Plan
- C-104 Phase 1 & 2 General Plan
- C-105 Details Plan Phase 1 & 2
- Watermain Boundary Condition
- Watermain Demand Calculation Sheet
- FUS Fire Flow Calculation
- Water model Schematic and Results



1 A100 SITE PLAN

SCALE 1:800

2 A100 INSET MAP

N.T.S.

LEGEND

- CONCRETE
- SPA APPROVED
- SPA APPROVED NOT CONSTRUCTED
- PROPERTY LINE
- EXIST. CONC. CURB
- PROP. CONC. CURB
- EXIST. PARKING
- PROP. PARKING
- FIRE ROUTE
- MAIN ENTRANCES TO BUILDING (EXACT LOCATION SUBJECT TO TENANT LAYOUTS)
- SIDE/ REAR DOOR LOCATION
- CONC. BOLLARD(REF TO DETAIL)
- FIRE HYDRANT
- LIGHT STANDARD AS PER ELEC. DWGS
- BIKE PARKING AS PER LANDSCAPE DWGS

SITE A

SITE AREA 84596.5 SM 20.9 ACRES
(EXCL. ROAD AND LSCAPE DEDICATION)

COVERAGE 23.7%
(20033 SM)

LOT FRONTAGE		298.605 M
BUILDING FRONTAGE		111.930 M
% OF BUILDING FRONTAGE		40%
EXISTING		
BOX A	3287.3 SM	35384 SF
BOX E	4180.5 SM	45000 SF
PAD A	1567.2 SM	16870 SF
CRU A	1203.2 SM	12950 SF
PAD G	478.4 SM	5150 SF
PAD F	416.3 SM	4480 SF
CRU B/B-2	1699.7 SM	18295 SF
BLDG 2	386.1 SM	4156 SF
-MEZZ	41.9 SM	450 SF
SUB-TOTAL	13260.6 SM	142735 SF
SPA APPROVED (MASTER PLAN)		
PAD B	AREA BELOW	
PAD C	627.0 SM	6750 SF
PAD D	464.5 SM	5000 SF
PAD E	251.0 SM	2700 SF
BOX D	AREA BELOW	
BLDG 1	1040.5 SM	11200 SF
SUB-TOTAL	2383.0 SM	25650 SF
PROPOSED		
BOX D	2322.5 SM	25000 SF
PAD B	692.0 SM	7450 SF
CRU B-2a.	1434.3 SM	15440 SF
SUB-TOTAL	4448.8 SM	47890 SF
TOTAL	20092.4 SM	216275 SF
PARKING		
REQ'D	3.4/100 SM	683 CARS
PROVIDED	5.35/100 SM	1076CARS
	5./1000 SF	
BIKE PARKING		
REQ'D	31 SPACES	
PROVIDED	31 SPACES	

SNOW TO BE REMOVED AND STORED OF SITE.

AM7 (1446)

I ZONING MECHANISMS		II PROVISIONS	PROVIDED
(a) Minimum lot area		600 sm	84596.5 sm
(b) Minimum lot width		18 m	+/- 273 m
(c) Minimum front yard and corner side yard setback	(i) non residential or mixed use buildings	No Minimum	0 m
	(ii) residential use building	3 m	n/a
(d) Minimum interior side yard setback	(i) abutting a residential zone	7.5 m	n/a
	(ii) other cases	No Minimum	n/a
(e) Minimum rear yard setback		10 m	18.53 m
(f) Maximum building height	within 20 m of a residential zone	11 m	10.5 m (box e)
	(ii) other cases	15 m	10.5 m (box e)
(g) N/A			
(h) Maximum FSI	AM7	none	
(i) Minimum req'd with of a landscape buffer of a parking lot	a)abutting a street	3 m	3 m
	b)not abutting a street	3 m	10 m adj to residential zone
Coverage		Max permitted 50 %	23.7 %
Street frontage	If lot is 90 m in width or wider	30 %	40 %
Parking	MIN 3.4/100 SM GLA	683 SPACES	1076 SPACES
Loading (3.5m x 7.0m)		MIN 2	10
Bicycle parking	1/250sm gfa Retail	CRU-B2	10 spaces
		Box D	16 spaces
		Pad B	5 spaces
		Total	31 spaces

SURVEY INFO TAKEN FROM:

TOPOGRAPHIC SURVEY OF PART OF LOTS 27 & 28 CONCESSION 12 Now CITY OF OTTAWA

PREPARED BY:
FIREBALL, NONFAT & WOODLAND LIMITED
ONTARIO LAND SURVEYORS

NO.	BY	DATE	ISSUED
1	AB	03NOV08	FOR SPA
2	AB	12JUN09	FOR SPA
3	AB	14DEC09	FOR SPA
4	AB	25MAR10	FOR SPA
5	CIA	01APR10	FOR SPA
6	AB	28JUL10	FOR SPA
7	AB	09AUG11	REVISED CRU A
8	AB	7DEC11	FOR SPA
9	AB	24FEB12	FOR SPA
10	AB	14NOV12	FOR SPA
11	AB	8JAN13	FOR SPA
12	AB	13MAY13	FOR SPA
13	AB	15MAY14	FOR SPA
14	AB	9.SEP.14	FOR SPA
15	AB	27.OCT.14	EXPANSION
16	AB	3.MAR.16	BLDG 1 AND 2
17	AB	7JUL.17	SPA
18	AB	8SEP.17	SPA
19	AB	3NOV.17	SPA
20	AB	9SEP.19	SPA
21	AB	XXX.19	SPA

VERIFY ALL DIMENSIONS AND CONDITIONS AT THE JOB. DO NOT SCALE PRINTS

PLANS AND SPECIFICATIONS ARE THE PROPERTY OF THE ARCHITECT AND MUST BE RETURNED AT COMPLETION OF THE WORK OR UPON REQUEST

THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS APPROVED AT RIGHT

APPROVED:

DATE:

SCOLER LEE BORENSTEIN + ASSOCIATES ARCHITECTS INC.
STE 900, 60 ST. CLAIR AVE. E TORONTO,ONTARIO M4T 1N5
TEL: (416) 362-7753 FAX: (416) 362-8519

PROJECT

COMMUNITY RETAIL DEVELOPMENT
5705 HAZELDEAN ROAD
WEST KANATA , ONTARIO

DRAWING TITLE

MASTER PLAN

ONTARIO ASSOCIATION OF ARCHITECTS ALLAN MICHAEL BORENSTEIN LICENCE 7172

DRAWN	JL	FOLIO	03007
CHECKED	AB		
DATE	JAN 16	DWG. NO.	A100
SCALE	AS NOTED		

X-REFS:

R-14

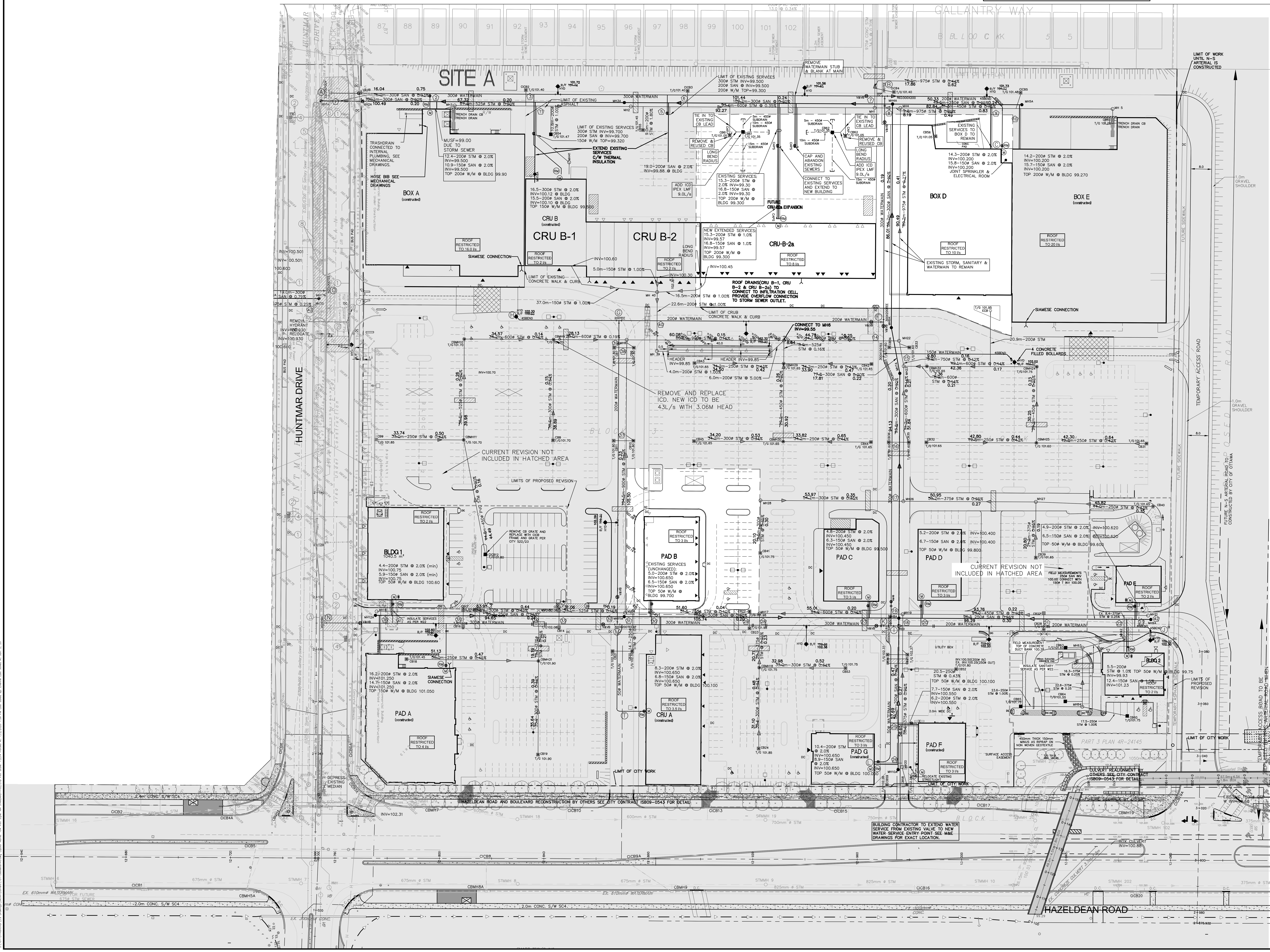
DRAWINGS REVISED: LAST UPDATED:

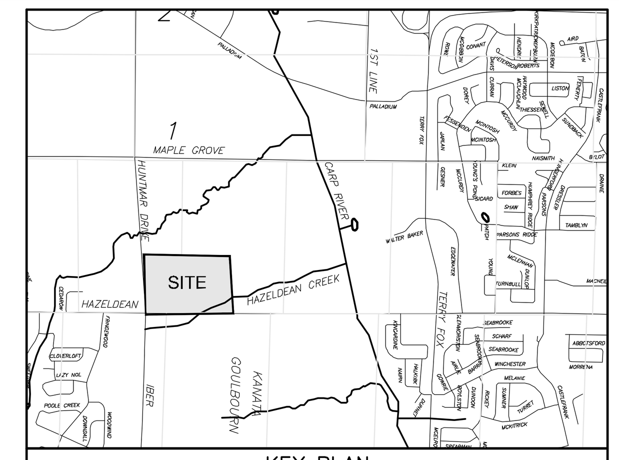
D07-12-19-0009

#18021

REMOVALS

1. SAW CUT AND REMOVE EXISTING BARRIER CURB. REINSTATE WITH DEPRESSED BARRIER CURB AS PER CITY STANDARD SC1.1
2. SAW CUT EXISTING ASPHALT AND REINSTATE ROADWAY TO MATCH EXISTING STRUCTURE AS PER CITY STANDARD R10.
3. SAW CUT EXISTING BARRIER CURB AND REINSTATE BARRIER CURB AND MEDIAN TO MATCH EXISTING.
4. REMOVE EXISTING CURB INLET AND CB AND INSTALL CATCH BASIN AS PER CITY STANDARD S2.
5. SAWCUT EXISTING BARRIER CURB, REMOVED EXISTING MEDIAN, EXCAVATE AND INSTALL GRANULAR ROAD BASE TO MATCH EXISTING, INSTALL NEW BARRIER CURB FOR MEDIAN, REINSTATE ASPHALT TO MATCH EXISTING, COMPLETE WITH STEP JOINT.
6. REMOVED EXISTING CURB INLET CB FRAME AND COVER AND REPLACE WITH STANDARD CB FRAME AND COVER.
7. REMOVED EXISTING HYDRANT, BLANK LEAD AT MAIN AS PER CITY STANDARDS.
8. ADJUST MH TO NEW FINISH GRADE.



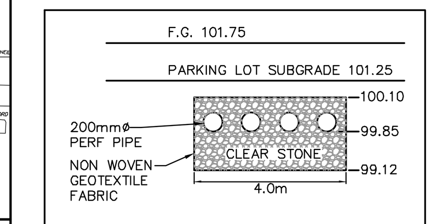


KEY PLAN
N.T.S.

APPROVED ☐ REFUSED ☐

THIS____DAY OF ____________ , 20______

DERRICK MOODIE, MANAGER
DEVELOPMENT REVIEW WEST
PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



SECTION A–A

LEGEND

- MH1 — PROPOSED STORM MANHOLE
- MH1A — PROPOSED SANITARY MANHOLE
- CB — PROPOSED CATCHBASIN
- CBMH — PROPOSED CATCHBASIN MANHOLE
- HYD B/F 92.10 — PROPOSED HYDRANT C/W BOTTOM OF FLANGE
- 250ø STM — STORM SEWER
- 250ø SAN — SANITARY SEWER
- 200ø WATERMAIN — WATERMAIN
- PROPOSED CONCRETEE SIDEWALK
- PROPOSED CONCRETEE CURB
- V&VB — PROPOSED WM VALVE & VALVE BOX
- (M) — PROPOSED WATER METER
- (RM) — PROPOSED REMOTE WATER METER
- SIAMESE CONNECTION
- (B) — WATERMAIN NODE (SEE DWG-105)
- PRESSURE REDUCING VALVE
- (12) — CROSSING (SEE DWG-105)
- SERVICE LATERAL: 200mmø STORM, 150mmø SANITARY, 50mmø WATERMAIN (UNLESS NOTED)
- VERTICAL BEND ON WATERMAIN
- HYDRO TRANSFORMER
- CLAY SEAL AS PER CITY STANDARD S8
- THERMAL INSULATION OVER WATERMAIN AS PER CITY STANDARD W22.
- FIRE ROUTE
- CONCRETE SIDEWALK

NOTE:

SEE DRAWING C-105 FOR NOTES AND DETAILS ON MH SCHEDULES, WATERMAIN SCHEDULE AND CB SCHEDULE.

No.	REVISIONS	By	Date
32	REVISED AS PER CITY COMMENTS	DGY	19:12:20
31	REVISED SPA CRU B-3, PAD B, BOX D	DGY	19:08:29
30	SANITARY OUTLET OVER HYDRO DUTC BANK	DGY	18:07:09
29	FIELD ADJUST MH42 AND SANITARY OUTLET	DGY	18:06:06
28	ISSUED FOR CONSTRUCTION BLDG 2	DGY	18:04:06
27	ISSUED FOR TENDER	DGY	18:01:15
26	REVISED AS PER CITY COMMENTS	DGY	17:11:23
25	ISSUED FOR SPA	DGY	17:11:02
24	REVISED AS PER SITE PLAN	DGY	17:09:08
23	REVISED AS PER SITE PLAN	DGY	17:07:07
22	REVISED AS PER CITY COMMENTS	DGY	17:06:23
21	REVISED BLD 2 & PAD E	DGY	17:02:14
20	REVISED AS PER CITY COMMENTS	DGY	16:08:02
19	SPA BLDG 1 & 2	DGY	16:03:07
18	ISSUED FOR REVIEW	DGY	16:02:19
17	REVISED BLDG 1 & 2	DGY	16:01:21
16	ASBUILT	DGY	15:01:19
15	REVISED AS PER SITE PLAN	DGY	14:11:03
14	SPA	DGY	14:09:09
13	REVISED AS PER SITE PLAN	DGY	14:08:08
12	REVISED AS PER CITY COMMENTS	DGY	14:07:31
11	REVISED DOLLAR & CRUB	DGY	14:06:03
10	REVISED WATER SERVICE FOR PAD F TENDER	DGY	13:02:28
9	ISSUED FOR PAD F TENDER	DGY	13:02:14
8	REVISED FOR PAD F	DGY	12:11:16
7	REVISED FOR PAD F	DGY	12:08.01
6	ADD INFILTRATION CELL BOX C	DGY	12:06:22
5	REVISED SPRINKLER ROOM BOX E	DGY	12:03:09
4	REVISED PER CITY COMMENTS AND PAD E	DGY	12:02:22
3	REVISED FOR BOX E	DGY	12:01:26
2	REVISED SITE PLAN PH1 & PH2	DGY	11:11:24
1	ISSUED FOR APPROVAL	DGY	11:10:27

NORTH AMERICAN
DEVELOPMENT GROUP

IBI GROUP
333 Preston Street
Tower 1, Suite 400
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FAX (613)225–9868

Project Title
5705 HAZELDEAN ROAD
OTTAWA, ONT.

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2019/12/20
PROVINCE OF ONTARIO

N

Drawing Title
GENERAL PLAN OF SERVICES PHASE 1 & 2

Scale 1:500

Design	Date
D.G.Y.	OCTOBER 2011
Drawn	**Checked**
E.H.	D.G.Y.
Project No.	**Drawing No.**
10113	C-104

D07-12-19-0168

PLAN No.: #16044

STORM MANHOLE SCHEDULE

LOCATION	INVERT ELEVATIONS (m)				TOP COVER (m)	MANHOLE TYPE
	NORTH	SOUTH	EAST	WEST		
EX.	EX.97.453	97.410 ~~EX.97.483~~				1800ø
MH 1	97.520 ~~97.556~~		97.580 ~~97.616~~	98.304	101.530	1520X1830
MH 2			98.631	98.716	101.640	1500ø
MH 3			98.850	99.400	102.200	1200ø
MH 4		97.630 ~~97.704~~	98.790 ~~98.855~~	97.620 ~~97.644~~	101.550	1520X1830
MH 5		99.710		99.480 ~~99.465~~	101.790	1200ø
MH 6		98.603	98.250 ~~98.168~~	98.260 ~~98.178~~	101.910	1520X1830
MH 8		98.360 ~~98.334~~	98.350 ~~98.274~~	98.580 ~~98.584~~	101.920	1520X1830
CBMH 9		100.070 ~~100.069~~	98.640 ~~98.637~~	98.860 ~~98.850~~	101.700	1500ø
CBMH 10		99.030 ~~99.040~~	98.910 ~~98.905~~		101.700	1500ø
CBMH 11	99.130 ~~99.117~~	100.080 ~~100.060~~		100.080 ~~100.058~~	101.700	1200ø
MH 14	98.600 ~~98.439~~		98.590 ~~98.589~~	98.900 ~~98.874~~	102.330	1520X1830
MH 15		99.170 ~~99.137~~	98.960 ~~98.927~~	99.190 ~~99.162~~	102.140	1200ø
MH 16			99.480 ~~99.441~~		103.140	1200ø
MH 17		99.020 ~~99.076~~	98.750 ~~98.801~~	98.610 ~~98.641~~	102.010	1220X1220
CBMH 18	99.070 ~~99.128~~	100.200 ~~100.247~~	100.050 ~~100.089~~		101.750	1200ø
MH 19		99.160 ~~99.174~~	99.020 ~~99.049~~	98.860 ~~98.889~~	102.400	1200ø
MH 20	99.320 ~~99.321~~				102.415	1200ø
MH 21				99.230 ~~99.237~~	102.060	1200ø
MH 22	98.000 ~~97.945~~	98.250 ~~98.190~~		98.140 ~~98.080~~	101.750	1520X1830
MH 23	98.260 ~~98.202~~	98.390 ~~98.370~~	98.460 ~~98.400~~		101.705	1220X1220
CBMH 24		98.850 ~~98.850~~	100.016	98.670 ~~98.671~~	101.750	1500ø
CBMH 25	98.92 ~~98.923~~		99.99 ~~100.016~~	100.000 ~~100.016~~	101.600	1200ø
MH 26	98.500 ~~98.442~~		98.750 ~~98.727~~	98.810 ~~98.802~~	101.930	1500ø
MH 27		100.070 ~~100.027~~	100.060 ~~100.011~~	98.89 ~~98.853~~	101.950	1200ø
MH 28		100.190 ~~100.182~~	99.000 ~~98.993~~		102.080	1200ø
CBMH 29	98.617	98.817	100.035 ~~100.053~~	100.040 ~~100.053~~	101.650	1200ø
CBMH 30	98.877		100.050 ~~100.050~~	100.010 ~~100.034~~	101.650	1200ø
CBMH 31	99.210 ~~99.184~~	100.310 ~~100.278~~		99.610 ~~99.575~~	101.900	1200ø
CBMH 32			98.600 ~~98.612~~	98.470 ~~98.412~~	101.650	1200ø
MH 33	EX.99.342	EX.99.342		99.492	±103.070	1520X1830
MH 34	100.360	100.282	99.607	99.678	102.98	1800ø
CBMH35	100.354	100.510			102.650	1200ø
CBMH36	100.850	100.466			102.650	1200ø
BOX MH37	100.475		99.811	99.840	102.890	1520X1830
MH 39	99.96		99.90		101.90	1200ø
MH 40	100.22	100.19	100.22	100.22	102.23	1200ø
MH 41	100.03		100.06		102.00	1200ø
MH 42	99.30	99.90		99.36	102.10	1200ø
MH 63		99.46	99.40	100.13	101.70	1200ø
MH 64	99.52		100.17	100.06	101.60	1200ø

SANITARY MANHOLE SCHEDULE

LOCATION	INVERT ELEVATIONS (m)				TOP COVER (m)	MANHOLE TYPE
	NORTH	SOUTH	EAST	WEST		
MH1A	EX.98.30	EX.98.30	98.92 ~~98.90~~		±102.750	1500ø
MH2A			99.050 ~~99.060~~	99.040 ~~99.049~~	103.030	1200ø
MH3A			99.260 ~~99.270~~	99.250 ~~99.260~~	101.630	1200ø
MH4A		99.550 ~~99.535~~	99.550 ~~99.535~~	99.500 ~~99.475~~	101.500	1200ø*
MH5A				99.670 ~~99.648~~	101.750	1200ø*
MH6A	99.715 ~~99.706~~	99.715 ~~99.716~~			101.790	1200ø*
MH7A	99.750 ~~99.752~~	99.750 ~~99.762~~			101.760	1200ø*
MH8A	99.940 ~~99.949~~	100.050 ~~100.059~~	100.010 ~~100.009~~	100.010 ~~100.009~~	102.420	1200ø
MH9A				100.300 ~~100.250~~	102.090	1200ø
MH10A	100.320 ~~100.290~~				102.430	1200ø
MH11A			100.220 ~~100.219~~	100.280 ~~100.279~~	102.360	1200ø
MH12A			100.510 ~~100.517~~		102.980	1200ø
MH13A			99.216	99.226	102.950	1200ø
MH14A		99.468	99.356	99.366	102.900	1200ø
MH15A	99.884				102.920	1200ø
MH16A			99.477	99.487	102.950	1200ø
MH17A	EX.98.466	EX.98.466		99.066	±103.060	1500ø
MH18A	100.01	100.04			102.06	1200ø

* COMPLETE WITH WATER TIGHT FRAME & COVER

STORM CATCHBASIN SCHEDULE

LOCATION	INVERT ELEVATIONS (m)				TOP COVER (m)
	NORTH	SOUTH	EAST	WEST	
TRENCH DRAIN CB	99.65				101.05
OICB 2		99.92			101.30
OICB 3		100.18			101.40
OICB 4		99.87			101.40
OICB 5		100.02			101.55
CB 6	100.20			100.30	101.80
CB 7			100.40		101.80
CB 8	100.20				101.70
CB 9			100.25		101.85
CB 10	100.20			100.30	101.80
CB 11			100.40		101.80
OICB 12	100.15				101.80
CB 14	100.88				102.08
CB 15		100.78	100.43		102.08
CB 16	100.90				102.08
CB 17		100.80	100.43		102.08
CB 18			99.85		101.45
CB 19	100.45				101.90
CB 20	100.75			100.85	102.32
CB 21			100.95		102.32
CB 22		100.08		100.28	101.98
CB 23	100.68				101.98
CB 24	100.35				101.85
CB 25	100.84			100.94	102.44
CB 26			101.08		102.44
CB 27		100.28		100.18	101.83
CB 28	100.65				101.83
CB 29	99.95			100.50	101.50
CB 30				100.20	101.65
CB 31				100.27	101.65
CB 32			100.18		101.65
CB 33	100.02			100.11	101.60
CB 34			100.19		101.60
CB 35	100.06			100.38	101.60
CB 36			100.39		101.60
CB 39	100.11				101.65
CB 40				100.22	101.65
CB 41	100.25				101.75
CB 42				100.20	101.65
CB 43			100.18		101.65
CB 44				100.27	101.65
CB 45			100.19		101.65
CB 46	100.60				102.65
CB 47			101.15		102.65
CB 48		100.945			102.52
CB 49	101.15		101.05		102.65
CB 50		101.25			102.65
RYCB 51		100.50			102.00
CB 52				100.25	101.80
CB 53				100.26	101.75
CB 54	99.69				101.47
CB 55	99.56				101.45
CB 56	99.80				101.05
TRENCH CB 57	99.81				101.05
CB 58	100.62			100.12	102.26
CB 59			100.90		102.26
CB 60	100.35	REUSE ROTATE EX. CB	100.35	100.01	101.75
CB 61	99.95				101.35
CB 62	99.95				101.35
ECB					101.95
CB63			100.20		101.60
CB64			100.15	99.77	101.55
CB65			100.30		101.75

WATERMAIN SCHEDULE

STATION	DESCRIPTION	FINISHED GRADE(m)	TOP OF WATERMAIN(m)	AS BUILT WATERMAIN(m)
(A) 1+100.0	400x300 TEE	EX.102.60	EX.100.40	EX.100.40
1+111.5	300ø V&VB	103.02	100.620	100.60
1+138.68	SERVICE CONNECTION	102.32	99.920	99.920
1+178.49	SERVICE CONNECTION	101.44	99.040	99.03
1+187.68	HYDRANT&TEE	101.54	99.140	98.99
1+229.57	SERVICE CONNECTION	101.47	99.070	99.02
1+282.18	HYDRANT&TEE	101.58	99.18	99.00
1+305.82	300ø V&VB	101.48	99.080	99.04
(B) 1+312.85	300ø TEE	101.44	99.150	99.08
1+316.27	300x200 REDUCER	101.42	99.020	99.11
1+351.92	HYDRANT&TEE	101.67	99.270	99.21
1+353.96	45° BEND	101.65	99.000	99.20
1+359.52	45° BEND	101.66	98.650	98.94
(C) 1+374.38	200 V&VB	101.90	99.270	99.270
(B) 2+100.00	300ø TEE	101.44	99.150	99.16
2+103.00		101.50	98.950	98.96
2+103.50	VERTICAL BEND	101.51	98.950	98.96
2+103.85	VERTICAL BEND	101.54	99.300	99.26
2+110.00	300ø V&VB	101.60	99.200	99.21
2+125.00		101.60	99.300	99.28
2+175.00		102.22	99.820	99.78
(F) 2+186.56	300X200ø TEE	101.84	99.440	99.440
(F) 3+100.00	300X200ø TEE	101.84	99.440	99.440
3+104.69	200ø V&VB	101.90	99.500	99.48
3+152.61	HYDRANT & TEE	102.15	99.750	99.76
(G) 3+201.33	200ø TEE	101.92	99.520	99.58
(H) 3+240.69	HYDRANT	102.10	99.700	99.72
(F) 4+100.00	300ø TEE	101.84	99.440	99.440
4+101.60	300ø V&VB	101.82	99.460	99.50
4+106.00		101.76	99.800	99.42
4+112.13	300X150ø TEE & HYD	101.85	99.600	99.39
4+114.64	22° BEND	101.87	99.600	99.42
4+123.75	22° BEND	101.73	99.330	99.35
4+167.00		101.87	99.900	99.83
4+207.97	300ø V&VB	102.25	99.850	99.36
4+209.30	VERTICAL BEND	102.25	98.300	98.28
4+209.80	VERTICAL BEND	102.27	98.300	98.300
(I) 4+217.11	300ø TEE	102.38	98.300	98.300
(I) 4+400.00	300ø TEE	102.38	98.300	98.300
4+403.51	300x200 REDUCER	102.38	98.300	98.300
4+411.41	SERVICE CONNECTION	102.24	98.300	98.36
4+416.08	VERTICAL BEND	102.23	98.300	98.38
4+416.58	VERTICAL BEND	102.23	99.830	99.830
4+437.57	HYDRANT&TEE	102.06	99.660	99.65
4+466.57		101.83	99.350	99.350
4+493.33	SERVICE CONNECTION	102.09	99.690	99.68
4+498.37	45° BEND	102.10	99.700	99.69
4+499.78	45° BEND	102.05	99.650	99.70
(J) 4+503.78	HYDRANT	102.20	99.800	99.800
(K) 5+100.00	300ø C/W 50ø SADDLE	102.38	98.300	98.28
5+105.00	45° BEND	102.27	98.300	98.300
5+107.00	45° BEND	102.30	99.900	99.86
5+137.00	SERVICE CONNECTION	102.56	100.160	100.14
(L) 5+154.50	SERVICE CONNECTION	102.48	100.080	100.07
(K) 6+100.00	300ø C/W 50ø SADDLE	102.38	98.300	98.300
6+100.50	VERTICAL BEND	102.26	98.300	98.300
6+102.00	VERTICAL BEND	102.26	99.860	99.860
6+103.50	300ø V&VB	102.25	99.850	99.86
6+106.75	SERVICE CONNECTION	102.26	99.860	99.90
6+130.50	HYDRANT&TEE	102.12	99.720	99.71
6+144.20	VERTICAL BEND	102.07	99.670	99.71
6+145.5	VERTICAL BEND	102.07	98.500	98.55
6+151.5	VERTICAL BEND	102.00	98.500	98.55
6+152.8	VERTICAL BEND	102.00	99.600	99.600
6+187.50	SERVICE CONNECTION	102.20	98.000	98.000
6+189.00	SERVICE CONNECTION	102.20	98.000	98.000
6+201.00	50mmø SADDLE	102.35	99.940	99.93
(M) 6+202.00	300X200 TEE	102.34	99.940	99.93
(M) 10+100.00	50mmø SADDLE	102.35	99.940	99.93
10+110.00		102.42	100.02	100.02
(T) 10+133.00		102.53	100.13	100.13
(G) 7+100.00	200ø TEE	101.92	99.520	99.59
7+106.00		101.94	99.732	99.73
7+127.63		102.01	99.610	99.60
7+177.63	HYDRANT&TEE	102.10	99.700	99.700
7+206.00	200ø V&VB	102.29	99.890	99.89
(M) 7+216.63	300X200 TEE	102.34	99.940	99.95
7+222.13	300ø V&VB	102.22	99.820	99.80
7+243.63	VERTICAL BEND	102.15	99.750	99.750
7+243.89	VERTICAL BEND	102.15	100.024	100.02
7+249.37	VERTICAL BEND	102.17	100.024	100.04
7+249.63	VERTICAL BEND	102.17	99.750	99.750
7+285.88	HYDRANT&TEE	102.46	100.060	100.10
7+308.13	SERVICE CONNECTION	102.87	100.470	100.46
7+314.63	300ø V&VB	103.05	100.650	100.650
(N) 7+328.63	400x300 TEE	EX. 103.10	EX. 100.750	EX. 100.750
(O) 8+100.0	400x300 TEE	EX.102.97	EX.100.71	
8+121.7	300ø V&VB	102.95	100.550	
8+122.7	VERTICAL BEND	102.97	100.570	
8+124.7	VERTICAL BEND	103.00	98.500	
8+127.6	SERVICE CONNECTION	103.00	98.500	
8+130.6	SERVICE CONNECTION	103.07	98.500	
8+133.6	VERTICAL BEND	103.19	98.500	
8+135.6	VERTICAL BEND	103.07	100.670	
8+146.5	VERTICAL BEND	103.00	100.600	
8+147.5	VERTICAL BEND	103.00	99.786	
8+153.0	VERTICAL BEND	103.00	99.786	
8+154.0	VERTICAL BEND	103.00	98.500	
(P) 8+162.9	300x200 CROSS	102.87	98.500	
8+165.9	VERTICAL BEND	102.85	98.500	
8+167.9	VERTICAL BEND	102.79	100.390	
8+185.8	SERVICE CONNECTION	102.68	100.280	
8+191.9	SERVICE CONNECTION	102.74	100.340	
8+202.5	300ø V&VB	102.85	100.450	
(Q) 8+204.1	300ø CAP	102.85	100.450	
(R) 9+100.0	HYDRANT&TEE	103.05	100.650	
9+104.7	200x150 REDUCER	102.85	100.450	
9+141.3	VERTICAL BEND	102.90	98.500	
(P) 9+144.3	300x200 CROSS	102.87	98.500	
9+155.0	VERTICAL BEND	102.90	99.500	
9+157.0	VERTICAL BEND	102.90	100.500	
9+191.0	200x150 REDUCER	102.90	100.500	
9+193.8	SERVICE CONNECTION	102.95	100.550	
(S) 9+196.4	HYDRANT&TEE	103.10	100.700	

CROSSING SCHEDULE

1. 300mmø SAN. 0.730m CLEARANCE UNDER EX.400mmø W/M
2. 200mmø W/M 0.500m CLEARANCE OVER 300mmø STM
3. 300mmø W/M 1.000m CLEARANCE UNDER 200mmø STM; 300mmø SAN. 0.400m CLEARANCE UNDER 200mmø STM

[illegible]

40. 600mmø STM 0.350m CLEARANCE UNDER 200mmø W/M
41. 600mmø STM 0.520m CLEARANCE OVER 200mmø W/M; 200mmø STM 0.850m CLEARANCE OVER 900mmø STM
42. 150mmø SAN 0.650m CLEARANCE OVER 200mmø W/M

DRAWING NOTES

1.0 GENERAL

1.1 CONTRACTOR TO VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.

1.2 DO NOT SCALE DRAWINGS.

1.3 CONTRACTOR TO REPORT ALL DISCOVERIES OF ERRORS, OMISSIONS OR DISCREPANCIES TO THE ARCHITECT OR DESIGN ENGINEER AS APPLICABLE.

1.4 USE ONLY THE LATEST REVISED DRAWINGS OR THOSE THAT ARE MARKED "ISSUED FOR CONSTRUCTION".

1.5 ALL CONSTRUCTION SHALL COMPLY WITH CURRENT CITY OF OTTAWA STANDARDS AND SPECIFICATIONS.

1.6 THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS AND SPECIFICATIONS.

1.7 FOR LEGAL SURVEY INFORMATION REFER TO REGISTERED PLAN.

1.8 ALL IRON WORK ELEVATIONS SHOWN ARE APPROXIMATE AND ARE SUBJECT TO MINOR ADJUSTMENTS AS DETERMINED BY THE ENGINEER.

1.9 ALL CONCRETE CURBS AND SIDEWALKS TO CONFORM TO O.P.S. AND CONSTRUCTED TO CITY STANDARDS. ALL ONSITE CURBS TO BE BARRIER TYPE.

1.10 ALL CONCRETE SHALL BE "NORMAL PORTLAND CEMENT" IN ACCORDANCE WITH O.P.S.S. 1350 AND SHALL ACHIEVE A MINIMUM STRENGTH OF 30MPa AT 28 DAYS.

1.11 ALL CONSTRUCTION TRAFFIC TO ACCESS SITE OFF HUNTMAR OR HAZELDEAN ROAD.

1.12 CONTRACTOR TO PROTECT EXISTING INFRASTRUCTURE AND PROPERTY SUCH AS TREES, PARKING METERS, SIDEWALKS, CURBS, ASPHALT, AND STREET SIGNS FROM DAMAGE DURING CONSTRUCTION. CONTRACTOR TO PAY THE COST TO REINSTATE OR REPLACE ANY DAMAGED INFRASTRUCTURE OR PROPERTY TO THE SATISFACTION OF THE CITY.

1.13 THE POSITION OF POLE LINES, CONDUITS, WATERMAIN, SEWERS, AND OTHER UNDERGROUND AND ABOVEGROUND UTILITIES AND STRUCTURES ARE 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 THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, SHALL PROTECT ALL UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

1.14 CONTRACTOR TO SUPPLY SUITABLE FILL MATERIAL WHERE REQUIRED TO ROUGH GRADE THE SITE.

1.15 CONTRACTOR TO HAUL EXCESS MATERIAL OFFSITE AS NECESSARY TO GRADE SITE TO MEET THE PROPOSED GRADES. ALL EXCESS MATERIAL TO BE HAULED OFFSITE AND DISPOSED OF AT AN APPROVED DUMP SITE. SHOULD THE CONTRACTOR DISCOVER ANY HAZARDOUS MATERIAL, CONTRACTOR IS TO NOTIFY ENGINEER. ENGINEER TO DETERMINE APPROPRIATE DISPOSAL METHOD/LOCATION.

1.16 ALL DISTURBED BOULEVARDS TO BE REINSTATED WITH SOD ON 100mm TOPSOIL.

1.17 UTILITY DUCTS TO BE INSTALLED PRIOR TO ROAD BASE CONSTRUCTION.

2.0 SANITARY

2.1 ALL SANITARY SEWERMAINS TO BE CSA CERTIFIED PVC SDR 35, BELL AND SPIGGOT TYPE. ONLY FACTORY FITTINGS TO BE USED. SEWER TO BE INSTALLED AS PER OSPD 1005.01.

2.2 ALL SANITARY MAINTENANCE HOLES TO BE 1.2m DIAMETER AS PER CITY OF OTTAWA STANDARDS COMPLETE WITH BENCHING, STEPS IF REQUIRED, AND FRAME AND COVER.

2.3 SANITARY MH FRAME AND COVER TO BE CLOSED COVER TYPE, AS PER CITY STANDARD S24.

2.4 SANITARY SEWER LEAKAGE TEST AND CCTV INSPECTION SHALL BE COMPLETED AS PER CITY SPECIFICATIONS PRIOR TO INSTALLATION OF BASE COURSE ASPHALT.

2.5 ANY SANITARY SEWER WITH LESS THAN 1.8m COVER REQUIRES THERMAL INSULATION AS PER CITY OF OTTAWA STANDARD W22, OR AS APPROVED BY THE ENGINEER.

2.6 CONNECTION TO THE EXISTING SANITARY SEWER TO BE INCLUDED IN THE COST FOR SANITARY SEWER INSTALLATION. THIS INCLUDES REINSTATEMENT OF ROAD CUTS TO CITY STANDARDS.

3.0 STORM

3.1 ALL STORM SEWER TO BE CSA CERTIFIED PVC SDR 35 OR CONCRETEE CLASS 100-D, BELL AND SPIGGOT TYPE. ALL STORM SEWERS TO BE INSTALLED PER MANUFACTURER'S INSTRUCTIONS. ONLY FACTORY FITTINGS TO BE USED.

3.2 ALL STORM MAINTENANCE HOLES TO BE SIZED IN WITH THE PLANS AND AS PER CITY OF OTTAWA STANDARDS COMPLETE WITH BENCHING FOR SEWERS 900mm OR GREATER, STEPS IF REQUIRED, AND FRAME AND COVER.

3.3 STORM MH FRAME AND COVERS TO BE OPEN TYPE, AS PER CITY STANDARD S24. CONTRACTOR TO INSTALL FILTER FABRIC UNDER STORM MH COVER UNTIL SODDING IS COMPLETE.

3.4 STORM MAINTENANCE HOLES TO BE AS PER OPSD 701.010, TAPER TOP TYPE COMPLETE WITH 300mm SUMP FOR SEWER LESS THAN 900mmØ. ALL STORM CBMH'S TO BE FLAT TOP TYPE.

3.5 ALL CATCH BASINS TO BE AS PER OPSD 705.010, FRAME & GRATE AS PER 400.02, LEAD TO BE AS PER ITEM 3.1.

3.6 ALL DITCH INLET CB'S TO BE AS PER OPSD 705.030 WITH 3:1 SLOPE. ALL DITCH INLET MANHOLES TO BE TYPE A AS PER OPSD 702.040. ALL DITCH INLET GRADE AS PER OPSD 403.010, LEAD AS PER ITEM 3.1.

3.7 150mm DIAMETER SOCK-WRAPPED PERFORATED PVC SUBDRAINS TO BE INSTALLED AT ALL CBMH'S AND CB'S. SUBDRAINS TO BE 3m LONG (EACH SIDE – CURB INLETS, AND FOUR ORTHOGONALLY OUT – SUMP INLETS) AND DISCHARGE INTO CBMH OR CB.

3.8 STORMWATER ICD'S TO BE INSTALLED IN CB'S PRIOR TO BASE ASPHALT.

3.9 ANY STORM SEWER WITH LESS THAN 1.8m COVER REQUIRES THERMAL INSULATION AS PER CITY OF OTTAWA STANDARD W22, OR AS APPROVED BY THE ENGINEER.

3.10 CONNECTION TO THE EXISTING STORM SEWER TO BE INCLUDED IN THE COST FOR STORM SEWER INSTALLATION. THIS INCLUDES REINSTATEMENT OF ROAD CUT TO CITY STANDARDS.

4.0 WATER

4.1 ALL WATERMAINS TO BE PVC DR 18, WITH MINIMUM COVER OF 2.4m AND INSTALLED PER CITY OF OTTAWA STANDARDS. ALL WATER SERVICES TO BE COPPER OR APPROVED EQUAL WITH MINIMUM COVER OF 2.4 m AND INSTALLED AS PER CITY OF OTTAWA STANDARDS.

4.2 THRUST BLOCKS TO BE INSTALLED AT ALL BENDS, TEES, AND CAPS ALL AS PER OPSD 1103.01 AND 1103.02.

4.3 CONTRACTOR TO CONDUCT PRESSURE AND LEAKAGE TESTING OF ALL WATERMAINS AND DISINFECT AND CHLORINATE ALL WATERMAINS TO THE SATISFACTION OF M.O.E.E. AND THE CITY OF OTTAWA.

4.4 TRACER WIRE TO BE INSTALLED ALONG THE FULL LENGTH OF WATERMAIN AND ATTACHED TO EACH MAIN STOP AS PER MUNICIPAL STANDARDS.

4.5 ALL COMPONENTS OF THE WATER DISTRIBUTION SYSTEM SHALL BE CATHODICALLY PROTECTED AS PER MUNICIPAL STANDARDS.

4.6 ALL VALVES & VALVE BOXES, HYDRANTS, AND HYDRANT VALVES AND ASSEMBLIES SHALL BE INSTALLED AS PER CITY OF OTTAWA STANDARDS.

4.7 ANY WATERMAIN WITH LESS THAN 2.4m COVER REQUIRES THERMAL INSULATION AS PER CITY OF OTTAWA STANDARD W22, OR AS APPROVED BY THE ENGINEER.

4.8 CONTRACTOR IS RESPONSIBLE FOR ACQUIRING THE WATER PERMIT FROM THE CITY OF OTTAWA AND PAYMENT OF ANY FEES ASSOCIATED WITH SECURING THE WATER PERMIT. OWNER IS RESPONSIBLE FOR REIMBURSING THE CONTRACTOR FOR THE ACTUAL COST OF ACQUIRING THE WATER PERMIT.

4.9 CONNECTION TO EXISTING WATERMAIN TO BE CITY FORCES, EXCAVATION AND BACKFILLING AND REINSTATEMENT BY CONTRACTOR, COST TO BE INCLUDING THE COST FOR THE WATERMAIN INSTALLATION. THIS COST INCLUDES REINSTATEMENT OF ROAD CUTS TO CITY STANDARDS.

5.0 ROAD AND WORK IN THE RIGHT OF WAY

5.1 CONTRACTOR TO REINSTATE ROAD CUTS PER CITY OF OTTAWA STANDARD R-10.

5.2 THE CONTRACTOR SHALL PREPARE A TRAFFIC MANAGEMENT PLAN FOR REVIEW AND APPROVAL BY THE CITY OF OTTAWA. CONTRACTOR TO MAINTAIN TRAFFIC FLOW DURING THE ENTIRE CONSTRUCTION PERIOD. MAINTENANCE OF ROAD CUTS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. PROVISION OF FLAGMEN, DETOURS AS NECESSARY, BARRICADES AND SIGNS TO THE FULL SATISFACTION OF THE ENGINEER AND ROAD AUTHORITY SHALL BE THE CONTRACTOR'S RESPONSIBILITY.

5.3 CONTRACTOR TO PREPARE SUBGRADE, INCLUDING PROOFROLLING, TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER PRIOR TO THE COMMENCEMENT OF PLACEMENT OF GRANULAR B MATERIAL.

5.4 FILL TO BE PLACED AND COMPACTED PER THE GEOTECHNICAL REPORT REQUIREMENTS.

5.5 CONTRACTOR TO SUPPLY, PLACE AND COMPACT GRANULAR B MATERIAL IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE GEOTECHNICAL ENGINEER. CONTRACTOR TO PROVIDE ENGINEER WITH SAMPLES OF GRANULAR B MATERIAL FOR TESTING AND CERTIFICATION FROM THE GEOTECHNICAL ENGINEER THAT THE MATERIAL MEETS THE GRADATION REQUIREMENTS SPECIFIED IN THE GEOTECHNICAL REPORT.

5.6 GRANULAR A MATERIAL ONLY TO BE PLACED ONLY UPON APPROVAL BY THE GEOTECHNICAL ENGINEER OF GRANULAR B PLACEMENT.

5.7 CONTRACTOR TO SUPPLY, PLACE AND COMPACT GRANULAR A MATERIAL IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE GEOTECHNICAL ENGINEER. CONTRACTOR TO PROVIDE ENGINEER WITH SAMPLES OF GRANULAR A MATERIAL FOR TESTING AND CERTIFICATION FROM THE GEOTECHNICAL ENGINEER THAT THE MATERIAL MEETS THE GRADATION REQUIREMENTS SPECIFIED IN THE GEOTECHNICAL REPORT.

5.8 ASPHALT MATERIAL TO BE PLACED ONLY UPON APPROVAL BY THE GEOTECHNICAL ENGINEER OF GRANULAR A PLACEMENT.

5.9 CONTRACTOR TO SUPPLY, PLACE AND COMPACT ASPHALT MATERIAL IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE GEOTECHNICAL ENGINEER. CONTRACTOR TO PROVIDE ENGINEER WITH SAMPLES OF ASPHALT MATERIAL FOR TESTING AND CERTIFICATION FROM THE GEOTECHNICAL ENGINEER THAT THE MATERIAL MEETS THE REQUIREMENTS SPECIFIED IN THE GEOTECHNICAL REPORT.

5.10 CONTRACTOR IS RESPONSIBLE FOR ESTABLISHING LINE AND GRADE IN ACCORDANCE WITH THE PLANS, AND FOR PROVIDING THE ENGINEER WITH VERIFICATION PRIOR TO PLACEMENT.

5.11 DITCHES DISTURBED DURING CULVERT INSTALLATION AND GRADING OPERATIONS ARE TO BE REINSTATED TO THEIR ORIGINAL CONDITION AND FLOWLINE GRADES.

5.12 CULVERTS TO CONSIST OF 2.8MM THICKNESS MATERIAL AND BE INSTALLED PER CITY OF OTTAWA STANDARDS.

5.13 CONTRACTOR TO REINSTATE ANY DISTURBED AREA WITHIN EXISTING ROW OR ADJACENT LANDS TO THE BETTER OF IMPORTED SOD ON 100MM TOPSOIL, OR TO MATCH ORIGINAL CONDITION.

5.14 ALL EXCESS MATERIAL TO BE HAULED OFFSITE AND DISPOSED OF AT AN APPROVED DUMP SITE. SHOULD THE CONTRACTOR DISCOVER ANY HAZARDOUS MATERIAL, CONTRACTOR IS TO NOTIFY ENGINEER. ENGINEER TO DETERMINE APPROPRIATE DISPOSAL METHOD/LOCATION.

5.15 PAVEMENT STRUCTURE (MATERIAL TYPES AND THICKNESSES) FOR HEAVY DUTY AND LIGHT DUTY AREAS TO BE AS SPECIFIED IN THE GEOTECHNICAL REPORT AND SHOWN ON THE PLANS.

6.0 SEDIMENT AND EROSION CONTROL

6.1 CONTRACTOR TO IMPLEMENT EROSION AND SEDIMENT CONTROL MEASURES AS IDENTIFIED IN THE EROSION AND SEDIMENT CONTROL PLAN TO THE SATISFACTION OF THE CITY OF OTTAWA, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.). DURING ALL PHASES OF THE SITE PREPARATION AND CONSTRUCTION THE MEASURES ARE TO BE MAINTAINED TO THE SATISFACTION OF THE ENGINEER AND CITY OF OTTAWA IN ACCORDANCE WITH THE BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL. SHOULD ANY ADDITIONAL MEASURES BE REQUIRED TO ADDRESS FIELD CONDITIONS THEY SHALL BE INSTALLED AS DIRECTED BY THE ENGINEER OR THE CITY OF OTTAWA. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.

6.2 ANY GROUND WATER PUMPING IS LIMITED TO 10 000l/d, AND SHALL BE DISCHARGED IN TO AN APPROVED FILTER MECHANISM PRIOR TO RELEASE TO THE ENVIRONMENT.

6.3 SEEPAGE BARRIERS WILL BE CONSTRUCTED IN ANY TEMPORARY DRAINAGE DITCH.

6.4 FILLER CLOTHS WILL BE PLACED ON OPEN INFRASTRUCTURES SUCH AS MANHOLE AND CATCH BASIN UNTIL STRUCTURES ARE COMMISSIONED AND PUT IN USE.

7.0 GEOTECHNICAL.

7.1 FOR DETAILS OF TEST PITS AND VARIOUS CONSTRUCTION REQUIREMENTS SEE GEOTECHNICAL REPORT, GEOTECHNICAL INVESTIGATION PROPOSAL COMMERCIAL DEVELOPMENT HAZELDEAN ROAD AT HUNTMAR DRIVE, OTTAWA ONTARIO, BY PATERSON GROUP DATED FEBRUARY 24, 2012.

7.2 FILL MATERIAL WITHIN THE PARKING LOT AND BUILDING PAD AREAS, AND SUPPORTING BUILDING FOUNDATIONS SHALL BE COMPACTED TO 98% STANDARD MODIFIED PROCTOR DENSITY AND TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER.

7.3 ALL FILL MATERIAL TO BE CERTIFIED AS ACCEPTABLE BY THE GEOTECHNICAL ENGINEER.

7.4 ALL COMPACTION METHODS TO BE PERFORMED TO THE SATISFACTION OF THE GEOTECHNICAL ENGINEER TO INCLUDE BUT NOT BE LIMITED TO THE THICKNESS OF LIFTS, AND COMPACTION EQUIPMENT USED.

7.5 CLAY SEALS TO BE INSTALLED WHERE INDICATED ON THE DRAWINGS OR AS APPROVED AND DIRECTED BY THE GEOTECHNICAL ENGINEER ALL IN ACCORDANCE WITH CITY OF OTTAWA STANDARDS AND SPECIFICATIONS.

7.6 PIPE BEDDING AND BACKFILL SHALL BE COMPLETED IN ACCORDANCE WITH LATEST CITY OF OTTAWA STANDARD, AT A MINIMUM BEDDING FOR SEWER AND WATERMAIN SHALL BE 150mm OPSS GRANULAR A, COMPACTED TO 95% SPMDD AND EXTEND TO SPRINGLINE OF PIPE. COVER MATERIAL SHALL CONSIST OF OPSS GRANULAR A AND SHALL EXTEND FROM SPRINGLINE TO MINIMUM 300mm ABOVE OBVERT OF PIPE, AND COMPACTED TO 95% SPMDD. SEE GEOTECHNICAL REPORT FOR ADDITIONAL DETAILS.

APPROVED ☐ REFUSED ☐

THIS____DAY OF____________, 20______

DERRICK MOODIE, MANAGER
DEVELOPMENT REVIEW WEST
PLANNING, INFRASTRUCTURE AND ECONOMIC DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

No.	REVISIONS	By
24	REVISED AS PER CITY COMMENTS	DGY
23	REVISED SPA DRU B-3, PAD B, BOX D	DGY
22	ISSUED FOR CONSTRUCTION BLDG 2	DGY
21	ISSUED FOR TENDER	DGY
20	REVISED AS PER CITY COMMENTS	DGY
19	ISSUED FOR SPA	DGY
18	REVISED AS PER SITE PLAN	DGY
17	REVISED AS PER CITY COMMENTS	DGY
16	REVISED BLD 2 & PAD E	DGY
15	REVISED AS PER CITY COMMENTS	DGY
14	SPA BLDG 1 & 2	DGY
13	ASBUILT	
12	REVISED AS PER SITE PLAN	DGY
11	SPA	DGY
10	REVISED AS PER SITE PLAN	DGY
9	REVISED AS PER CITY COMMENTS	DGY
8	REVISED DOLLAR & CRUB	DGY
7	ISSUED FOR PAD F TENDER	DGY
6	REVISED FOR PAD F	DGY
5	REVISED SPRINKLER ROOM BOX E	DGY
4	REVISED AS PER CITY COMMENTS AND PAD E	DGY
3	REVISED FOR BOX E	DGY
2	REVISED SITE PLAN PH1 & PH2	DGY
1	ISSUED FOR APPROVAL	DGY

NORTH AMERICAN DEVELOPMENT GROUP

IBI GROUP
333 Preston Street
Tower 1, Suite 400
Ottawa, Ontario
Canada K1S 5N4
Tel (613)225-1311
FAX (613)225-9868

Project Title
5705 HAZELDEAN ROAD
OTTAWA, ONT.

PROFESSIONAL ENGINEER D. G. Yonnoulopoulos 2019/12/20 PROVINCE OF ONTARIO

Drawing Title
SCHEDULES AND NOTES
PHASE 1 & 2

Scale

Design	Date
D.G.Y.	OCTOBER 2011
Drawn E.H.	Checked D.G.Y.
Project No. 10113	Drawing No. C-105

D07-12-19-0168

#16044

Lance Erion

From: Fraser, Mark <Mark.Fraser@ottawa.ca>
Sent: Monday, August 29, 2016 8:19 AM
To: Lance Erion
Cc: Demetrius Yannoulopoulos
Subject: RE: North American Hazeldean & Huntmar Commercial Site
Attachments: CCS_FUSfireflow_2016-08-15.pdf; CCSwater_demand2016-08-12.pdf; Node ID's.pdf; Boundary condition.pdf; BC at 5705 Hazeldean Road.docx

Hi Lance,

Please find attached/below water distribution network boundary conditions for hydraulic analysis as requested based on the provided anticipated water demands and fire flow requirement.

Proposed Water Demands and Fire Flow Requirement:

Proposed Development Location: 5705 Hazeldean Road
Average Daily Demand = 0.73L/s
Max Daily Demand = 1.08 L/s
Peak Hour Demand = 1.95 L/s
Fire Flow = 250 L/s

City of Ottawa Boundary Conditions:

Specified Service Connection Point: Huntmar Drive [Connection 1]
Max HGL = 161.6m
PKHR = 156.5m
MXDY+Fire = 155.0m

Please refer to City of Ottawa, *Ottawa Design Guidelines – Water Distribution*, First Edition, July 2010, WDG001 Clause 4.2.2 for watermain pressure and demand objectives.

Please note that hydraulic modelling software is anticipated. Please include an electronic version of the modelling file with the Site Servicing Report resubmission for review.

These boundary conditions are for current conditions and are based on computer model simulation.

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.*

If you have any questions please let me know.

Regards,

Mark Fraser
Junior Infrastructure Engineer, Suburban Services

PLANNING AND GROWTH MANAGEMENT
URBANISME ET GESTION DE LA CROISSANCE

City of Ottawa | Ville d'Ottawa
Planning, Infrastructure and Economic Development Department
110 Laurier Avenue West. 4th Floor, Ottawa ON, K1P 1J1
Tel:613.580.2424 ext. 27791
Fax: 613-580-2576
Mail: Code 01-14
Email: Mark.Fraser@ottawa.ca

From: Lance Erion [mailto:lerion@IBIGroup.com]
Sent: August 12, 2016 11:56 AM
To: Fraser, Mark
Cc: Demetrius Yannoulopoulos
Subject: North American Hazeldean & Huntmar Commercial Site

We are requesting an update to the attached watermain boundary condition for the commercial site at Hazeldean and Huntmar roads, the calculated water demands are as follows:

Average Day	0.73 l/s
Max Day	1.08
Peak Hour	1.95

A fire flow rate of 250 l/s was used in the analysis.

Regards

Lance Erion P.Eng

Associate
email lerion@IBIGroup.com web www.ibigroup.com

IBI GROUP

IBI GROUP
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

WATERMAIN DEMAND CALCULATION SHEET

PROJECT : NORTH AMERICAN
LOCATION : CITY OF OTTAWA

FILE: 10113.5.7
DATE: 2016-08-29
DESIGN: LE

NODE	RESIDENTIAL						NON-RESIDENTIAL			AVERAGE DAILY DEMAND (l/s)			MAXIMUM DAILY DEMAND (l/s)			MAXIMUM HOURLY DEMAND (l/s)			FIRE DEMAND
	UNITS				GROSS RES. (Ha)	POP'N	COM	IND	INS										
	SF	SD	TH	APT			(m^2)	(Ha)	(Ha)	Res.	Non-res.	Total	Res.	Non-res.	Total	Res.	Non-res.	Total	(l/s)
28						0	3,287			0.00	0.10	0.10	0.00	0.14	0.14	0.00	0.26	0.26	250
30						0	7,813			0.00	0.23	0.23	0.00	0.34	0.34	0.00	0.61	0.61	250
32						0	2,323			0.00	0.07	0.07	0.00	0.10	0.10	0.00	0.18	0.18	250
34						0	4,181			0.00	0.12	0.12	0.00	0.18	0.18	0.00	0.33	0.33	250
42						0	1,092			0.00	0.03	0.03	0.00	0.05	0.05	0.00	0.09	0.09	250
48						0	705			0.00	0.02	0.02	0.00	0.03	0.03	0.00	0.06	0.06	195
54						0	1,830			0.00	0.05	0.05	0.00	0.08	0.08	0.00	0.14	0.14	250
56						0	2,608			0.00	0.08	0.08	0.00	0.11	0.11	0.00	0.20	0.20	250
68						0	1,051			0.00	0.03	0.03	0.00	0.05	0.05	0.00	0.08	0.08	250
TOTALS	**0**	**0**	**0**	**0**	**0**	**0**	**24889**	**0.00**	**0.00**	**0.00**	**0.73**	**0.73**	**0.00**	**1.08**	**1.08**	**0.00**	**1.95**	**1.95**	

ASSUMPTIONS

RESIDENTIAL DENSITIES

- Single Family (SF) 3.4 p/p/u
- Semi Detached (SD) 2.7 p/p/u
- Townhouse (TH) 2.7 p/p/u
- Apartment (APT) 1.8 p/p/u

AVERAGE DAILY DEMAND

- Residential 450 l/cap/day
- Commercia 2,500 l/(1000m^2/d
- Industrial 20,000 l/ha/day
- Institutional 15,000 l/ha/day

MAXIMUM DAILY DEMAND

- Residential 1,125 l/cap/day
- Commercia 3,750 l/(1000m^2/d
- Industrial 30,000 l/ha/day
- Institutional 22,500 l/ha/day

MAXIMUM HOURLY DEMAND

- Residential 2,475 l/cap/day
- Commercia 6,750 l/(1000m^2/d
- Industrial 54,000 l/ha/day
- Institutional 40,500 l/ha/day

FIRE DEMANDS

- SF 100 l/s
- SD 125 l/s
- TH 125 l/s
- APT 170 l/s
- ICI 250 l/s

Fire Flow Requirement from Fire Underwriters Survey

North American - Box A,B,C CRU B-1,B-2

Building Floor Area 9,400 m^2

Fire Flow

$F = 220C\sqrt{A}$

C	0.8		C =	1.5	wood frame
A	9,400	m^2		1.0	ordinary
				0.8	non-combustible
F	17,064	l/min		0.6	fire-resistive
use	17,000	l/min			

Occupancy Adjustment

			-25%	non-combustible
			-15%	limited combustible
Use	0%		0%	combustible
			+15%	free burning
Adjustment	0	l/min	+25%	rapid burning
Fire flow	17,000	l/min		

Sprinkler Adjustment

			-30%	system conforming to NFPA 13
			-50%	complete automatic system
Use	-30%			
Adjustment	-5100	l/min		

Exposure Adjustment

Building Face	Separation	Charge
north	36	5%
east	12	15%
south	90	0%
west	> 45	0%
Total		20%

Separation	Charge
0 to 3m	+25%
3.1 to 10m	+20%
10.1 to 20m	+15%
20.1 to 30m	+10%
30.1 to 45m	+5%

Adjustment 3,400 l/min

Required Fire Flow

Total adjustments	-1,700	l/min
Fire flow	15,300	l/min
Use	**15,000**	**l/min**
	250.0	**l/s**

Fire Flow Requirement from Fire Underwriters Survey

North American - Box D and E

Building Floor Area 5,800 m^2

Fire Flow

$F = 220C\sqrt{A}$

C	0.8		C =	1.5	wood frame
A	5,800	m^2		1.0	ordinary
				0.8	non-combustible
F	13,404	l/min		0.6	fire-resistive
use	13,000	l/min			

Occupancy Adjustment

			-25%	non-combustible
			-15%	limited combustible
Use	0%		0%	combustible
			+15%	free burning
Adjustment	0	l/min	+25%	rapid burning
Fire flow	13,000	l/min		

Sprinkler Adjustment

			-30%	system conforming to NFPA 13
			-50%	complete automatic system
Use	-30%			
Adjustment	-3900	l/min		

Exposure Adjustment

Building Face	Separation	Charge
north	36	5%
east	> 45	0%
south	> 45	0%
west	12	15%
Total		20%

Separation	Charge
0 to 3m	+25%
3.1 to 10m	+20%
10.1 to 20m	+15%
20.1 to 30m	+10%
30.1 to 45m	+5%

Adjustment 2,600 l/min

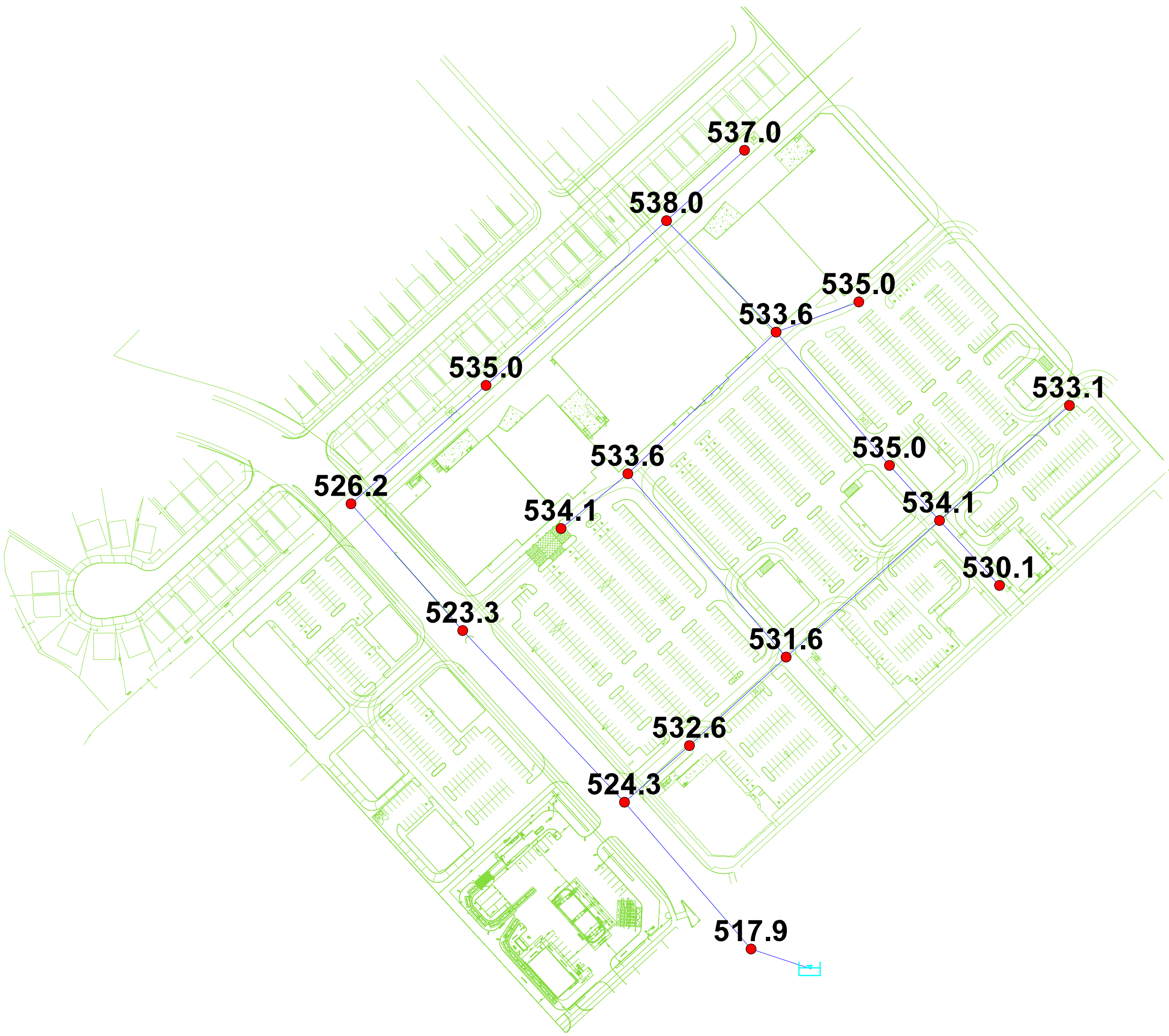
Required Fire Flow

Total adjustments	-1,300	l/min
Fire flow	11,700	l/min
Use	**11,700**	**l/min**
	195.0	**l/s**

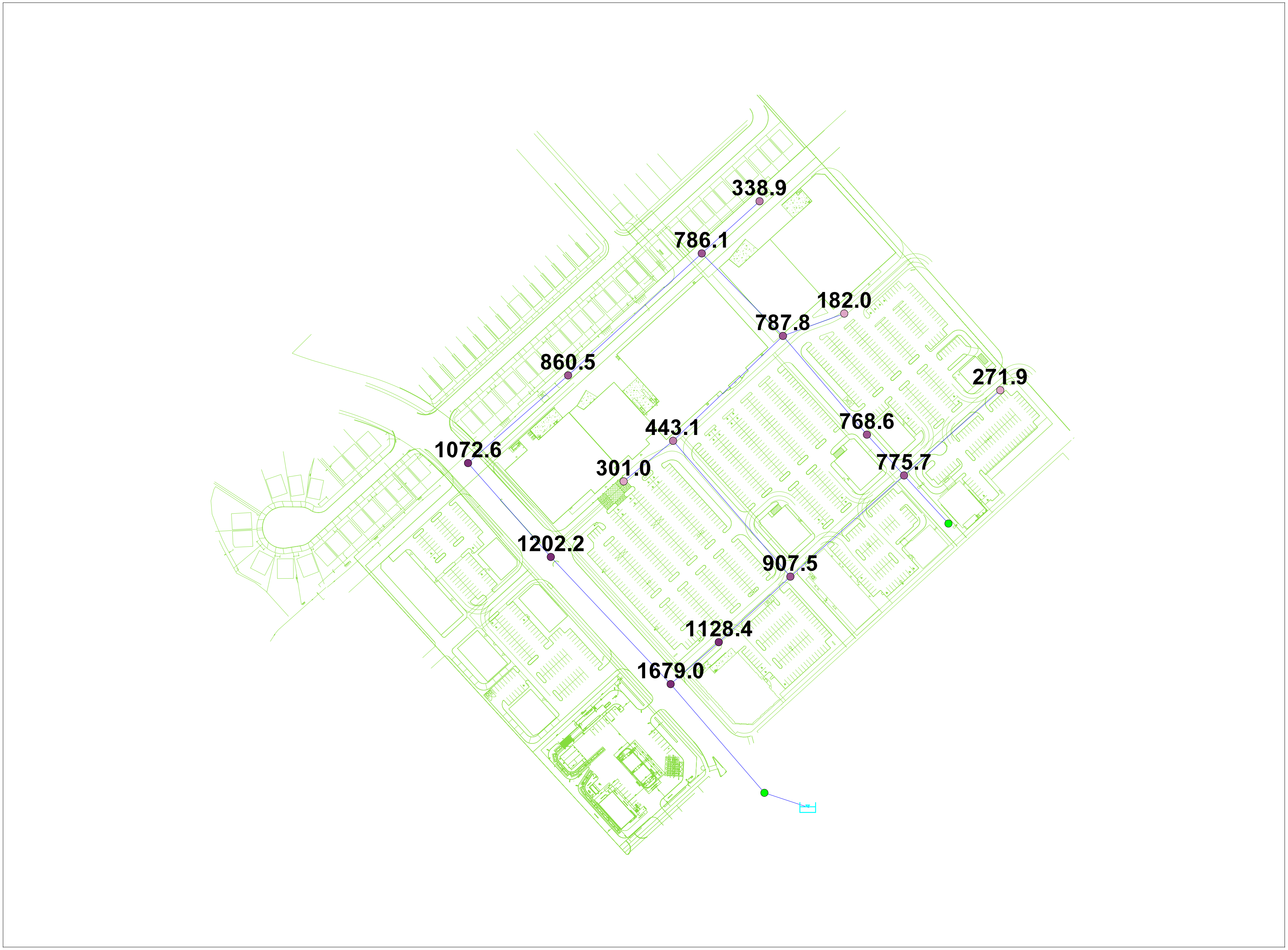
Pipe Sizes and Node ID's

Basic Day (Max HGL) HGL 161.6m - Pressures kPa

Peak Hour HGL 156.5m - Pressures kPa



Max Day + Fire HGL 155.0m - Design Fireflows l/s



Basic Day HGL 161.6m - Water Age

Date: Friday, May 12, 2017

Basic Day (Max HGL) HGL 161.6m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1		18	0.00	103.65	161.60	567.86
2		22	0.00	103.00	161.60	574.23
3		26	0.00	103.10	161.60	573.25
4		28	0.10	102.80	161.60	576.19
5		30	0.23	101.90	161.60	585.01
6		32	0.07	101.60	161.60	587.95
7		34	0.12	101.70	161.60	586.97
8		38	0.00	102.05	161.60	583.54
9		40	0.00	101.90	161.60	585.01
10		42	0.03	101.90	161.60	585.01
11		44	0.00	102.00	161.60	584.03
12		48	0.02	102.10	161.60	583.05
13		54	0.05	102.25	161.60	581.58
14		56	0.05	102.15	161.60	582.56
15		58	0.00	102.05	161.60	583.54
16		68	0.03	102.40	161.60	580.10
17		70	0.00	102.00	161.60	584.03

Peak Hour HGL 156.5m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1		18	0.00	103.65	156.50	517.89
2		22	0.00	103.00	156.50	524.26
3		26	0.00	103.10	156.50	523.28
4		28	0.26	102.80	156.50	526.22
5		30	0.61	101.90	156.50	535.03
6		32	0.18	101.60	156.50	537.97
7		34	0.33	101.70	156.50	536.99
8		38	0.00	102.05	156.50	533.56
9		40	0.00	101.90	156.50	535.03
10		42	0.09	101.90	156.50	535.03
11		44	0.00	102.00	156.50	534.05
12		48	0.06	102.10	156.50	533.07
13		54	0.14	102.25	156.50	531.60
14		56	0.20	102.15	156.50	532.59
15		58	0.00	102.05	156.50	533.56
16		68	0.08	102.40	156.49	530.09
17		70	0.00	102.00	156.50	534.05

Basic Day Water Age HGL 161.6m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)	Water Age (hrs)
1		18	0.00	103.65	161.60	567.86	1.00
2		22	0.00	103.00	161.60	574.23	5.86
3		26	0.00	103.10	161.60	573.25	16.63
4		28	0.10	102.80	161.60	576.19	24.34
5		30	0.23	101.90	161.60	585.01	30.66
6		32	0.07	101.60	161.60	587.95	68.65
7		34	0.12	101.70	161.60	586.97	72.75
8		38	0.00	102.05	161.60	583.54	54.33
9		40	0.00	101.90	161.60	585.01	192.00
10		42	0.03	101.90	161.60	585.01	32.02
11		44	0.00	102.00	161.60	584.03	25.75
12		48	0.02	102.10	161.60	583.05	66.82
13		54	0.05	102.25	161.60	581.58	13.56
14		56	0.05	102.15	161.60	582.56	8.61
15		58	0.00	102.05	161.60	583.54	38.32
16		68	0.03	102.40	161.60	580.10	26.75
17		70	0.00	102.00	161.60	584.03	192.00

Max Day + Fire HGL 155.0m - Fireflow Design Report

		ID	Total Demand (L/s)	Critical Node 1 ID	Critical Node 1 Pressure (kPa)	Critical Node 1 Head (m)	Adjusted Fire-Flow (L/s)	Available Flow @Hydrant (L/s)	Critical Node 2 ID	Critical Node 2 Pressure (kPa)	Critcal Node 2 Head (m)	Adjusted Available Flow (L/s)	Design Flow (L/s)
1		22	250.00	26	497.67	153.79	1,679.03	1,681.37	26	139.01	117.19	1,679.02	1,679.02
2		26	250.00	26	488.36	152.94	1,202.17	1,202.14	26	139.98	117.38	1,202.16	1,202.16
3		28	250.14	28	486.35	152.43	1,072.58	1,072.56	28	139.97	117.08	1,072.58	1,072.58
4		30	250.34	30	481.60	151.05	860.59	860.52	30	139.97	116.18	860.53	860.53
5		32	250.10	34	476.31	150.21	786.15	787.23	34	138.99	115.78	786.15	786.15
6		34	250.18	34	304.33	132.76	338.90	338.90	34	139.96	115.98	338.90	338.90
7		38	250.00	38	473.50	150.37	787.82	787.81	38	139.97	116.33	787.82	787.82
8		40	195.00	40	88.12	110.89	181.99	182.00	40	139.96	116.18	182.00	181.99
9		42	250.05	42	472.67	150.14	768.60	768.60	42	139.97	116.18	768.60	768.60
10		44	250.00	48	471.77	150.14	775.73	776.80	48	138.99	116.18	775.73	775.73
11		48	250.03	48	194.44	121.94	271.94	271.93	48	139.96	116.38	271.93	271.93
12		54	250.08	54	482.15	151.45	907.45	907.44	54	139.97	116.53	907.45	907.45
13		56	250.11	56	494.59	152.62	1,128.41	1,128.39	56	139.98	116.43	1,128.41	1,128.41
14		58	250.00	58	387.52	141.60	443.13	443.13	58	139.96	116.33	443.13	443.13
15		70	250.00	70	250.30	127.54	300.99	300.99	70	139.96	116.28	300.99	300.99

Peak Hour HGL 156.5m - Pipe Report

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/km)
1		23	26	28	88.02	393.00	120.00	1.04	0.01	0.0000	0.000
2		25	28	30	93.58	297.00	120.00	0.78	0.01	0.0000	0.000
3		27	32	30	127.33	297.00	120.00	-0.17	0.00	0.00	0.00
4		29	34	32	54.72	203.00	110.00	-0.33	0.01	0.0000	0.00
5		35	40	38	45.88	155.00	100.00	0.00	0.00	0.00	0.00
6		37	38	42	91.22	297.00	120.00	-0.22	0.00	0.0000	0.000
7		39	42	44	38.75	297.00	120.00	-0.31	0.00	0.00	0.00
8		51	54	56	68.26	297.00	120.00	-0.71	0.01	0.0000	0.000
9		53	56	22	44.95	297.00	120.00	-0.91	0.01	0.0000	0.00
10		67	44	68	46.11	51.00	100.00	0.08	0.04	0.00	0.11
11		69	7000	18	1.00	600.00	120.00	1.95	0.01	0.00	0.00
12		73	38	32	81.43	297.00	120.00	0.34	0.00	0.00	0.00
13		75	58	54	126.28	204.00	110.00	-0.12	0.00	0.0000	0.000
14		77	38	58	106.92	204.00	110.00	-0.12	0.00	0.0000	0.000
15		79	58	70	44.94	204.00	110.00	0.00	0.00	0.00	0.00
16		81	48	44	90.48	204.00	110.00	-0.06	0.00	0.00	0.00
17		83	18	22	101.02	393.00	120.00	1.95	0.02	0.000	0.00
18		85	22	26	122.92	393.00	120.00	1.04	0.01	0.0000	0.000
19		87	44	54	107.07	297.00	120.00	-0.45	0.01	0.0000	0.000

APPENDIX B

- Modified Rational Method design sheets Phase 1 & 2
- DSEL Figure 1
- DSEL email
- DSEL Figure 2
- C-500B Storm Tributary Area Plan Phase 1 & 2
- Storm sewer design sheets Phase 1 & 2
- C-802 Phase 1 & 2 ICD Plan
- C-402 Ponding Plan Phase 1 & 2
- RD-100 & Accutrol Weir Roof Drain
- ICD design sheets Phase 1 & 2

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Ottawa

Manning 0.013 Return Frequency = 5 years

LOCATION			AREA (Ha)														FLOW					SEWER DATA								
			R= 0.25		R= 0.48		R= 0.6		R= 0.66		R= 0.67		R= 0.72		R= 0.9		Indiv.	Accum.	Time of	Rainfall	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
Location	From Node	To Node	A	No.	A	No.	A	No.	A	No.	A	No.	A	No.	A	No.	2.78 AC	2.78 AC	Conc.	Intensity	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min.)	Q/Q full
CORIOLIS COURT(Ph.5A)																														
	13	14			0.19	1							0.29	2			0.83	0.83	15.00	83.56	70	375	375	PVC	0.50	36.5	124	1.12	0.54	0.56
	14	114			0.17	3A							0.16	3B			0.55	1.38	15.54	81.85	113	525	525	CONC	0.20	72.0	192	0.89	1.35	0.59
	114	Ex. 167											0.25	3				1.38	16.89	77.90	108	525	525	CONC	0.50	25.5	304	1.40	0.30	0.35
To GALLANTRY WAY, Pipe Ex. 167 - 115																		1.38	17.20											
HUNTMAR DRIVE																														
	164	165									0.11	25			0.74	22	2.06	2.06	**20.00**	70.25	144	525	525	CONC	0.27	89.5	223	1.03	1.44	0.65
	165	166									0.55	26			0.94	23	3.38	5.43	21.44	67.23	365	975	975	CONC	0.26	120.0	1143	1.53	1.31	0.32
From West of Commercial Block															**3.97**	28	9.93	15.37	22.75	64.74	995									
	166	167									0.48	27			0.64	24	2.50	17.86	22.75	64.74	1156	1050	1050	CONC	0.20	102.6	1221	1.41	1.21	0.95
To GALLANTRY WAY, Pipe Ex. 167 - 115																		17.86	23.96											
GALLANTRY WAY (Ph.5A)																														
Contribution From CORIOLIS COURT, 114 - Ex. 167																	1.38	1.38	17.20											
From Huntmar Drive, 164 - 167																	17.86	19.24	23.96											
	Ex. 167	115															0.00	19.24	23.96	62.60	1205	1050	1050	CONC	0.25	20.0	1365	1.58	0.21	0.88
	115	15											0.16	16			0.32	19.56	24.18	62.24	1218	1200	1200	CONC	0.15	75.5	1510	1.34	0.94	0.81
	15	16											0.47	17			0.94	20.50	25.12	60.71	1245	1200	1200	CONC	0.15	88.0	1510	1.34	1.10	0.82
To KHAMSIN STREET , Pipe 16-18																		20.50	26.22											
Contribution From Future Phase 5B, GALLANTRY WAY																	0.82	0.82	16.29											
Contribution From Storm Easement, Pipe CBMH - 8																	21.64	22.46	18.33											
	8	16			0.28	18							0.09	19A			0.55	23.02	18.33	74.15	1707	975	975	CONC	0.80	31.5	2004	2.68	0.20	0.85
To KHAMSIN STREET , Pipe 16 - 18																		23.02	18.52											
PARK (Block 112)																														
	Cont MH 1	pipe	0.19	6A													0.13	0.13	15.00	83.56	11	300	300	PVC	0.50	8.5	68	0.97	0.15	0.16
To BRIGATINE AVENUE, Pipe 4 - 5																														
KHAMSIN STREET (Ph.5A)																														
Contribution From GALLANTRY WAY, Pipe 15 - 16																	20.50	20.50	26.22											
Contribution From GALLANTRY WAY, Pipe 8 - 16																	23.02	43.52	18.52											
	16	18			0.33	31							0.08	19			0.60	44.12	26.22	59.02	2604	1650	1650	CONC	0.15	66.5	3530	1.65	0.67	0.74
Contribution From Future Phase 5B, GALLANTRY WAY																	1.11	45.23	17.07											
	18	19			0.39	30							0.18	20			0.88	46.11	26.89	58.04	2676	1650	1650	CONC	0.15	62.5	3530	1.65	0.63	0.76
Contribution From Future Phase 5B, BRIGATINE HEIGHTS																	0.72	46.84	17.21											
	19	20											0.17	21			0.34	47.18	27.52	57.15	2696	1650	1650	CONC	0.15	56.5	3530	1.65	0.57	0.76
To BRIGATINE AVENUE , Pipe 20 - 21																		47.18	28.09											

LICENSED PROFESSIONAL ENGINEER
Z. LI
PROVINCE OF ONTARIO

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.76 m/sec

Designed: K.M.	PROJECT: FAIRWINDS SUBDIVISION PHASES 5A, 8		
Checked: Z.L.	LOCATION: City of Ottawa		
Dwg. Reference: Storm Drainage Plan, Dwg No.7-7A	File Ref: 07-308	Date: December, 2009	Sheet No. 1 of 2

STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Ottawa

Manning 0.013 Return Frequency = 5 years

	LOCATION		AREA (Ha)														FLOW					SEWER DATA								
			R= 0.25		R= 0.48		R= 0.6		R= 0.66		R= 0.67		R= 0.72		R= 0.8		Indiv.	Accum.	Time of	Rainfall	Peak Flow	DIA. (mm)	DIA. (mm)	TYPE	SLOPE	LENGTH	CAPACITY	VELOCITY	TIME OF	RATIO
Location	From Node	To Node	A	No.	A	No.	A	No.	A	No.	A	No.	A	No.	A	No.	2.78 AC	2.78 AC	Conc.	Intensity	Q (l/s)	(actual)	(nominal)		(%)	(m)	(l/s)	(m/s)	FLOW (min.)	Q/Q full
BRIGATINE AVENUE (Ph.5A)																														
	1	2											0.13	4			0.26	0.26	15.00	83.56	22	300	300	PVC	0.35	62.5	57	0.81	1.29	0.38
	2	3			0.07	6							0.28	5			0.65	0.91	16.29	79.62	73	450	450	PVC	0.30	70.0	156	0.98	1.19	0.47
	3	4			0.32	15							0.05	7			0.53	1.44	17.48	76.33	110	450	450	PVC	0.40	8.0	180	1.13	0.12	0.61
Contribution From BLOCK 112 (Park), Pipe Cont MH 1 - pipe																	0.13	1.57	15.00											
													0.11	9			0.22	1.79												
	4	5			0.18	14							0.15	8			0.54	2.33	17.59	76.02	177	525	525	CONC	0.50	93.5	304	1.40	1.11	0.58
	5	6											0.02	10			0.04	2.37	18.70	73.23	174	600	600	CONC	0.50	14.5	434	1.54	0.16	0.40
	6	7			0.19	13							0.10	11			0.45	2.83	18.86	72.86	206	600	600	CONC	0.60	43.5	476	1.68	0.43	0.43
	7	20											0.20	12			0.40	3.23	19.29	71.85	232	600	600	CONC	2.50	19.5	971	3.43	0.09	0.24
Contribution From KHAMSIN STREET, Pipe 19 - 20																	47.18	50.40	28.09											
	20	21															0.00	50.40	28.09	56.37	2841	1650	1650	CONC	0.20	20.5	4076	1.91	0.18	0.70
To Pond, Pipe 21 - 22																		50.40	28.27											
STORM SEWER EASEMENT																														
From External					0.17	18A									8.56	29	21.64	21.64	**18.10**											
	CBMH	8															0.00	21.64	18.10	74.72	1617	975	975	CONC	0.70	34.5	1875	2.51	0.23	0.86
To GALLANTRY WAY, Pipe 8 - 16																		21.64	18.33											

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
R = Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min. Velocity = 0.76 m/sec

Designed: K.M.	PROJECT:	**FAIRWINDS SUBDIVISION PHASES 5A, 8**	
Checked: Z.L.	LOCATION:	**City of Ottawa**	
Dwg. Reference: Storm Drainage Plan, Dwg No.7-7A	File Ref: 07-308	Date: December, 2009	Sheet No. 2 of 2

MATTAMY development

DSEL david schaeffer engineering ltd

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Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax. (613) 836-7183
www.DSEL.ca

FAIRWINDS - PHASE 5A AND 8

STORM TRUNK SEWER AND POND

CITY OF OTTAWA

PROJECT No.: 308

May 2010

DRAWN BY: SK

Scale = 1:750

FIGURE - 1

z:\projects\07-308 fairwinds south phase 5\design\c detailed design\c.2 drawings\c.2.1 cad drawings\2010-05-14-stm_trunk_sewer_and_pond\07-308-stm_trunk_sewer.dwg

Demetrius Yannoulopoulos

From: Jennifer Ailey <jailey@dsel.ca>
Sent: Friday, December 09, 2011 3:29 PM
To: Demetrius Yannoulopoulos
Subject: North American - Fairwinds Temporary Pond
Attachments: Figure 2.pdf; 10113Base08-104_Rev2_11-11-24.pdf

<<...>> <<...>>

Hi Demetrius,

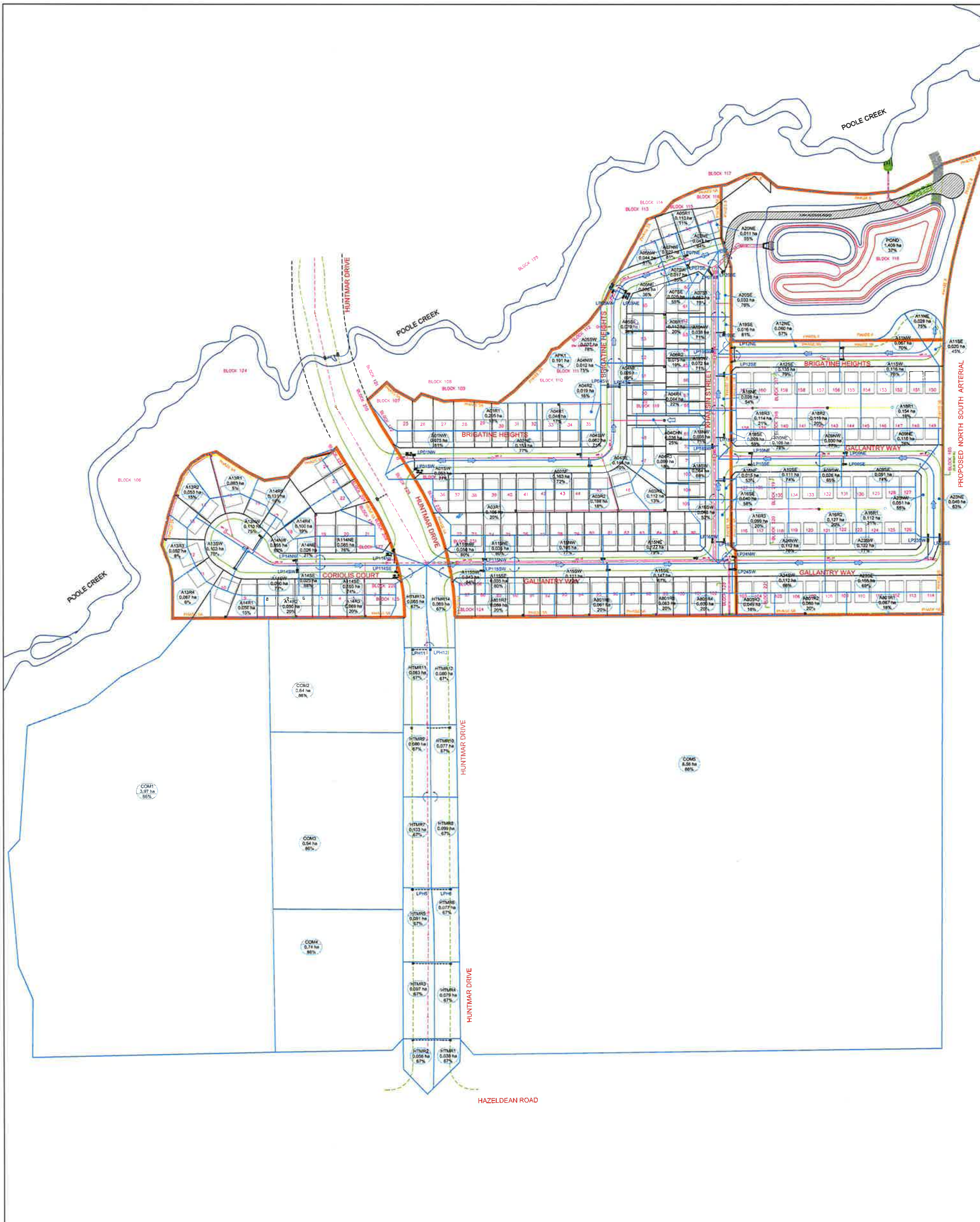
As requested, I have looked at the Stormwater Management Report and Pond Design Brief for Fairwinds Phases 5A and 5B (JFSA, October 2009). Please see attached from this report Figure 2, which shows that Commercial Area (COM5), representing the North American Commercial Lands shown on your current site plan.

This email confirms that those North American Lands are serviced by the Fairwinds Phase 5A Temporary Stormwater Management Pond. Please let me know if you require anything further.

Jen

Jennifer Ailey, P.Eng.
Senior Design Engineer

DSEL
david schaeffer engineering ltd.
120 Iber Road, Unit 203
Stittsville, ON K2S 1E9
Phone: (613) 836-0856 ext. 226
Fax: (613) 836-7183
Cell: (613) 222-6476
Email: jailey@dsel.ca



LEGEND :

- LIMITS OF SUBDIVISION
- MAJOR SYSTEM CATCHMENT BOUNDARY TO LOW POINTS AND OTHER AREAS
- MAJOR SYSTEM FLOW DIRECTION
- FIRST DIRECTION OF EXCESS MAJOR SYSTEM FLOW AT LOW POINT
- LP15NE LOW POINT
- A15NE 0.018 ha 78% — SUB-CATCHMENT ID, SUB-CATCHMENT AREA, TOTAL IMPERVIOUSNESS

SCALE : 0 25 50 75 100 125 150m

J.F. Sabourin & Associates Inc.
WATER RESOURCES AND ENVIRONMENTAL CONSULTANTS
OTTAWA (613) 836-3884
GATINEAU (819) 243-6858

CLIENT :
DSEL
david schaeffer engineering ltd
120 IBER ROAD, SUITE 205
OTTAWA, ONTARIO, K2S 1E3
(613) 836-0856

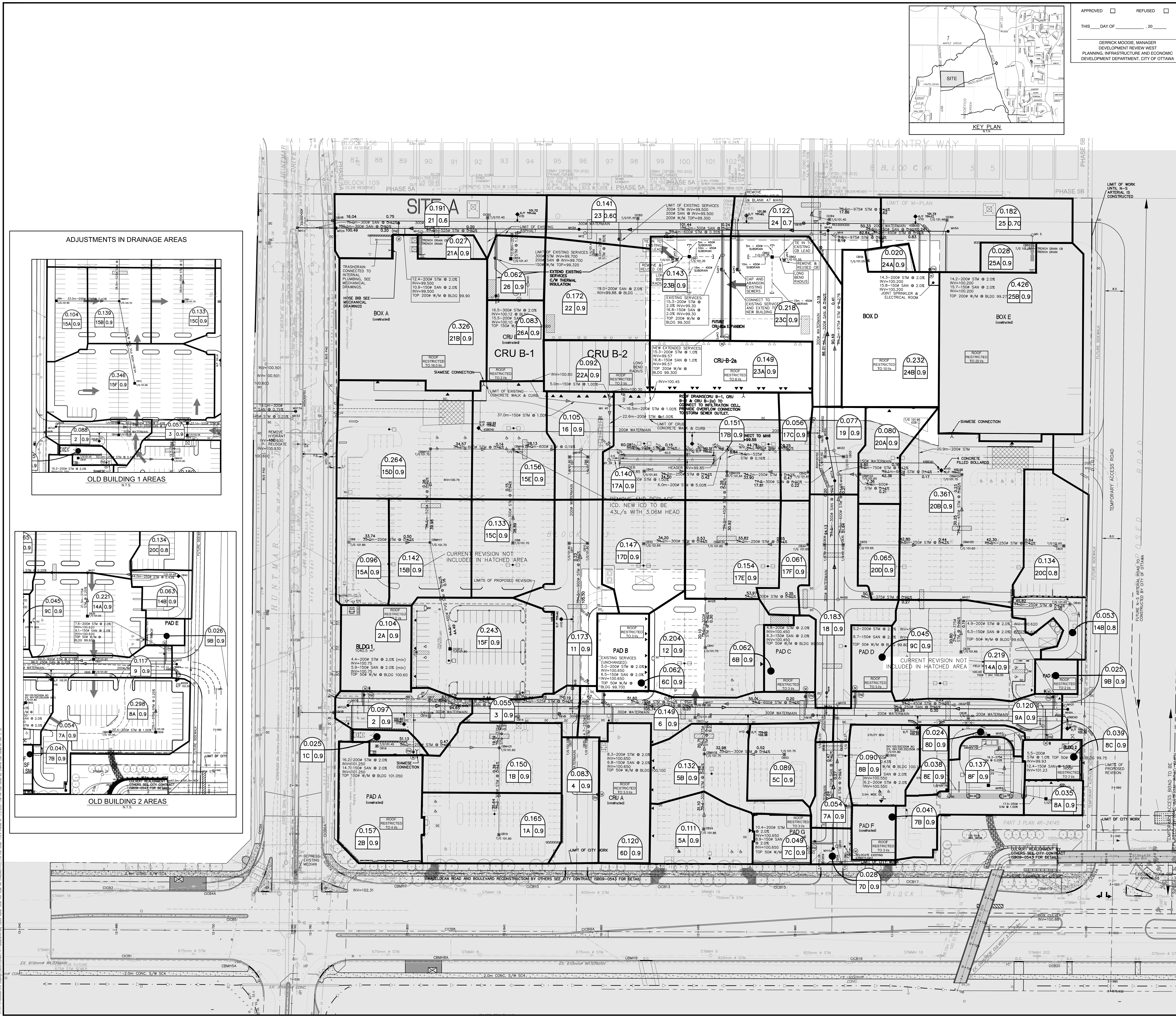
Fairwinds Phases 5A and 5B Proposed Major System

FIGURE 2

DRAWN: LP
VERIFIED: JFS
APPROVED: JFS

DRAWING REF.
677-08\Update 4 (200910)\Design\CAD\JFSA Figures.dwg

DATE: Oct/09
PROJECT No. 677-08



APPROVED ☐ REFUSED ☐

THIS____DAY OF ____________ , 20______

DERRICK MOODIE, MANAGER
DEVELOPMENT REVIEW WEST
PLANNING, INFRASTRUCTURE AND ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

LEGEND

- 0.101 — AREA (ha)
- 0.9 — COEFFICIENT
- 20C — AREA #
- → MAJOR FLOW ROUTE

No.	REVISIONS	By	Date
21	REVISED AS PER CITY COMMENTS	DGY	19:12:20
20	REVISED SPA CRU B-3, PAD B, BOX D	DGY	19:08:29
19	ISSUED FOR CONSTRUCTION BLDG 2	DGY	18:04:06
18	ISSUED FOR TENDER	DGY	18:01:15
17	REVISED AS PER CITY COMMENTS	DGY	17:11:23
16	ISSUED FOR SPA	DGY	17:11:02
15	REVISED AS PER SITE PLAN	DGY	17:07:07
14	REVISED AS PER CITY COMMENTS	DGY	17:06:23
13	REVISED BLD 2 & PAD E	DGY	17:02:14
12	REVISED AS PER CITY COMMENTS	DGY	16:08:02
11	SPA BLDG 1 & 2	DGY	16:03:07
10	REVISED AS PER SITE PLAN	DGY	14:11:03
9	SPA	DGY	14:09:09
8	REVISED AS PER SITE PLAN	DGY	14:08:08
7	REVISED AS PER CITY COMMENTS	DGY	14:07:31
6	REVISED DOLLAR & CRUB	DGY	14:06:03
5	REVISED FOR PAD F	DGY	12:11:16
4	REVISED SPRINKLER ROOM BOX E	DGY	12:03:09
3	REVISED PER CITY COMMENTS AND PAD E	DGY	12:02:22
2	REVISED SITE PLAN PH1 & PH2	DGY	11:11:24
1	ISSUED FOR APPROVAL	DGY	11:10:27

NORTH AMERICAN
DEVELOPMENT GROUP

IBI GROUP
333 Preston Street
Tower 1, Suite 400
Ottawa, Ontario
Canada K1S 5N4
Tel (613)225-1311
FAX (613)225-9868

Project Title
5705 HAZELDEAN ROAD
OTTAWA, ONT.

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2019/12/20
PROVINCE OF ONTARIO

N

Drawing Title
STORM TRIBUTARY AREAS
PHASE 1 & 2

Scale
1:500

Design: D.G.Y.	Date: OCTOBER 2011
Drawn: E.H.	Checked: D.G.Y.
Project No.: 10113	Drawing No.: C-500B

#16044

IBI GROUP

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333 Preston Street - Suite 400
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K1S 5N4

CRU B-1, CRU B-2, Box B roofs directed to infiltration chamber
CRU B-1 CRU B-2 revised October 2014
BUILDINGS 1&2, Pad E revised Feb 2017
BUILDINGS Pad B, and CRU expansion revised April 2019
All sewers are existing, only minor modifications to trib areas to reflect adjustment in buildings

Phase 1 & 2 STORM SEWER DESIGN SHEET

PROJECT: HUNTMAR PLAZA
LOCATION: CITY OF OTTAWA
CLIENT: NORTH AMERICAN

LOCATION				AREA (Ha)								RATIONAL DESIGN FLOW							SEWER DATA						
STREET	AREA	FROM MH	TO MH	C= 0.30	C= 0.50	C= 0.60	C= 0.70	C= 0.80	C= 0.90	INDIV. 2.78AC	ACCUM. 2.78AC	INLET (min.)	TIME IN PIPE	TOTAL (min.)	I (mm/Hr)	PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAP. (L/s)	LENGTH (M)	PIPE (mm)	SLOPE (%)	VEL. (M/s)	AVAIL. CAP. (L/s)	AVAIL. CAP. (%)
East Parking Lot	8A	CB 60	CB62						0.035	0.09	0.09	10.00	0.33	10.33	104.19	9.38		9.38	62.02	24.0	250	1.00	1.224	52.64	84.88%
East Parking Lot	8E	CB 61	CB62						0.038	0.10	0.10	10.00	0.23	10.23	104.19	10.42		10.42	62.02	17.1	250	1.00	1.224	51.60	83.20%
East Parking Lot	8F	CB62	CB63						0.137	0.34	0.53	10.33	0.49	10.82	102.50	54.32		54.32	91.44	23.7	375	0.25	0.802	37.11	40.59%
East Parking Lot	8D	CB63	MH42						0.024	0.06	0.59	10.82	0.47	11.29	100.05	59.03		59.03	91.44	22.4	375	0.25	0.802	32.40	35.44%
East Parking Lot	8B, 8C	MH42	MH21-19						0.000	0.00	0.59	10.82	0.24	11.06	100.05	59.03		59.03	91.44	11.4	375	0.25	0.802	32.40	35.44%
East Parking Lot	9A, 9B, 9C	21	19						0.190	0.48	1.01	11.06	1.93	12.99	98.92	99.91		99.91	132.98	94.0	450	0.20	0.810	33.07	24.87%
East Parking Lot	8C	CB 52	20 - 19						0.090	0.23	0.23	10.00	0.43	10.43	104.19	23.96		23.96	40.69	20.5	250	0.43	0.803	16.72	41.10%
East Parking Lot	7A, 7B, 7C, 7D	20	19						0.172	0.43	0.66	10.43	1.22	11.64	102.00	67.32		67.32	91.44	58.6	375	0.25	0.802	24.12	26.37%
East Parking Lot	6B	19	17						0.062	0.16	1.83	12.99	1.04	14.03	90.66	165.92		165.92	256.26	54.9	600	0.16	0.878	90.34	35.25%
East Parking Lot	5A	CB 24	CBMH18						0.111	0.28	0.28	10.00	0.63	10.63	104.19	29.17		29.17	58.81	30.4	300	0.34	0.806	29.64	50.39%
East Parking Lot	5C	CB 53	CBMH18						0.089	0.22	0.22	10.00	0.68	10.68	104.19	22.92		22.92	58.81	33.0	300	0.34	0.806	35.89	61.02%
East Parking Lot	5B	CBMH18	17						0.132	0.33	0.83	10.68	0.43	11.11	100.72	83.60		83.60	91.44	20.7	375	0.25	0.802	7.83	8.57%
East Parking Lot	4, 6, 6C, 6D	17	14						0.414	1.04	3.70	14.03	1.07	15.10	86.82	321.22		321.22	367.11	51.5	750	0.10	0.805	45.89	12.50%
East Parking Lot	BLDG 1 (2A)	16	15						0.104	0.26	0.26	10.00	0.05	10.05	104.19	27.09	2.00	2.00	48.38	4.4	200	2.00	1.492	46.38	95.87%
East Parking Lot	PAD A (2B)	16	15						0.157	0.39	0.39	10.00	0.18	10.18	104.19	40.64	4.00	4.00	48.38	16.2	200	2.00	1.492	44.38	91.73%
East Parking Lot	2	16	15						0.097	0.24	0.24	10.00	1.12	11.12	104.19	25.01	6.00	31.01	67.64	62.0	300	0.45	0.927	36.63	54.16%
East Parking Lot	1C	CB 18	CBMH31						0.025	0.06	0.06	10.00	1.02	11.02	104.19	6.25		6.25	41.60	50.0	250	0.45	0.821	35.35	84.97%
East Parking Lot	1A	CB 19	CBMH31						0.165	0.41	0.41	10.00	0.74	10.74	104.19	42.72		42.72	58.81	35.9	300	0.34	0.806	16.09	27.36%
East Parking Lot	1B	CBMH31	15						0.150	0.38	0.85	11.02	0.39	11.40	99.12	84.25		84.25	91.44	18.7	375	0.25	0.802	7.18	7.86%
East Parking Lot	3	15	14						0.055	0.14	1.23	11.40	0.69	12.09	97.32	119.70	6.00	125.70	179.44	33.1	525	0.16	0.803	53.73	29.95%
East Parking Lot	11, 16	14	8						0.278	0.70	5.63	15.10	1.92	17.02	83.24	468.63	6.00	474.63	596.93	104.5	900	0.10	0.909	122.30	20.49%
East Parking Lot	15A	CB 9	CBMH11						0.096	0.24	0.24	10.00	0.69	10.69	104.19	25.01		25.01	40.69	33.0	250	0.43	0.803	15.68	38.54%
East Parking Lot	15F	CB 12	CBMH11						0.243	0.61	0.61	10.00	0.92	10.92	104.19	63.56		63.56	132.98	44.8	450	0.20	0.810	69.42	52.21%
East Parking Lot	15B	CBMH11	CBMH10						0.142	0.36	1.21	10.92	0.72	11.64	99.56	120.47		120.47	200.67	38.6	525	0.20	0.898	80.19	39.96%
East Parking Lot	15D	CBMH10	CBMH9						0.264	0.66	1.87	11.64	0.65	12.29	96.27	180.02		180.02	256.26	34.2	600	0.16	0.878	76.23	29.75%
East Parking Lot	15C	CB 8	CBMH9						0.133	0.33	0.33	10.00	0.80	10.80	104.19	34.38		34.38	58.81	38.6	300	0.34	0.806	24.43	41.53%
East Parking Lot	15E	CBMH9	8						0.156	0.39	2.59	12.29	0.49	12.78	93.49	242.13		242.13	279.31	28.0	600	0.19	0.957	37.18	13.31%
East Parking Lot		8	6							0.00	8.22	17.02	0.87	17.89	77.57	637.59	6.00	643.59	755.20	60.2	900	0.16	1.150	111.60	14.78%
East Parking Lot	17F	CB 44	CBMH30						0.061	0.15	0.15	10.00	0.70	10.70	104.19	15.63		15.63	41.14	34.2	250	0.44	0.812	25.52	62.01%
East Parking Lot	17D	CB 45	CBMH30						0.147	0.37	0.37	10.00	0.71	10.71	104.19	38.55		38.55	58.81	34.2	300	0.34	0.806	20.26	34.45%
East Parking Lot	17E	CBMH30	CBMH29						0.155	0.39	0.91	10.71	0.62	11.32	100.60	91.55		91.55	132.98	29.9	450	0.20	0.810	41.43	31.16%
East Parking Lot	17C	CB 42	CBMH29						0.056	0.14	0.14	10.00	0.71	10.71	104.19	14.59		14.59	40.69	34.2	250	0.43	0.803	26.10	64.15%
East Parking Lot	17A	CB 43	CBMH29						0.140	0.35	0.35	10.00	0.71	10.71	104.19	36.47		36.47	40.69	34.2	250	0.43	0.803	4.22	10.37%
East Parking Lot	17B	CBMH29	6						0.151	0.38	1.78	11.32	0.19	11.51	97.69	173.89		173.89	179.44	8.9	525	0.16	0.803	5.54	3.09%
East Parking Lot	22A, 23A, 26A	6	22						0.324	0.81	10.81	23.33	0.57	23.90	63.70	688.58	6.00	694.58	844.51	44.1	900	0.20	1.286	149.92	17.75%
East Parking Lot	20D	CB 32	CBMH25						0.065	0.16	0.16	10.00	0.89	10.89	104.19	16.67		16.67	40.69	42.8	250	0.43	0.803	24.02	59.03%
East Parking Lot	20C	CB 31	CBMH25						0.134	0.34	0.34	10.00	0.89	10.89	104.19	35.43		35.43	40.69	42.8	250	0.43	0.803	5.26	12.93%
East Parking Lot	20B	CBMH25	CBMH24						0.361	0.90	1.40	10.89	0.54	11.43	99.73	139.62		139.62	148.74	29.2	450	0.25	0.906	9.13	6.14%
East Parking Lot		CBMH24	CBMH32							0.00	1.40	11.43	0.86	12.28	97.22	136.11		136.11	239.62	42.1	600	0.14	0.821	103.51	43.20%
East Parking Lot	20A	CBMH32	23						0.080	0.20	1.60	12.28	0.18	12.46	93.52	149.63		149.63	239.62	8.9	600	0.14	0.821	89.99	37.56%
East Parking Lot	14B	CB 40	27					0.053		0.12	0.12	10.00	0.91	10.91	104.19	12.50		12.50	40.69	44.0	250	0.43	0.803	28.19	69.27%

IBI GROUP

IBI Group
333 Preston Street - Suite 400
Ottawa, Ontario
K1S 5N4

CRU B-1, CRU B-2, Box B roofs directed to infiltration chamber
CRU B-1 CRU B-2 revised October 2014
BUILDINGS 1&2, Pad E revised Feb 2017
BUILDINGS Pad B, and CRU expansion revised April 2019
All sewers are existing, only minor modifications to trib areas to reflect adjustment in buildings

Phase 1 & 2 STORM SEWER DESIGN SHEET

PROJECT: HUNTMAR PLAZA
LOCATION: CITY OF OTTAWA
CLIENT: NORTH AMERICAN

LOCATION				AREA (Ha)								RATIONAL DESIGN FLOW							SEWER DATA						
STREET	AREA	FROM MH	TO MH	C= 0.30	C= 0.50	C= 0.60	C= 0.70	C= 0.80	C= 0.90	INDIV. 2.78AC	ACCUM. 2.78AC	INLET (min.)	TIME IN PIPE	TOTAL (min.)	I (mm/Hr)	PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAP. (L/s)	LENGTH (M)	PIPE (mm)	SLOPE (%)	VEL. (M/s)	AVAIL. CAP. (L/s)	AVAIL. CAP. (%)
East Parking Lot	*14A*	*CB 39*	*27*						*0.219*	*0.55*	*0.55*	*10.00*	*0.44*	*10.44*	*104.19*	*57.31*		*57.31*	*91.44*	*21.3*	*375*	*0.25*	*0.802*	*34.13*	*37.33%*
East Parking Lot		*27*	*26*							*0.00*	*0.67*	*10.91*	*1.05*	*11.97*	*99.61*	*66.74*		*66.74*	*91.44*	*50.7*	*375*	*0.25*	*0.802*	*24.70*	*27.01%*
East Parking Lot	*12*	*CB 41*	*28*						*0.204*	*0.51*	*0.51*	*10.00*	*0.40*	*10.40*	*104.19*	*53.14*		*53.14*	*59.69*	*19.5*	*300*	*0.35*	*0.818*	*6.55*	*10.97%*
East Parking Lot		*28*	*26*							*0.00*	*0.51*	*10.40*	*1.12*	*11.51*	*102.14*	*52.09*		*52.09*	*59.69*	*54.7*	*300*	*0.35*	*0.818*	*7.59*	*12.72%*
East Parking Lot	*18*	*26*	*23*						*0.183*	*0.46*	*1.64*	*11.97*	*1.05*	*13.02*	*94.84*	*155.53*		*155.53*	*239.62*	*51.7*	*600*	*0.14*	*0.821*	*84.09*	*35.09%*
East Parking Lot	*19*	*23*	*22*						*0.077*	*0.19*	*3.43*	*13.02*	*0.19*	*13.20*	*90.56*	*310.63*		*310.63*	*402.22*	*9.9*	*750*	*0.12*	*0.882*	*91.59*	*22.77%*
East Parking Lot		*22*	*4*							*0.00*	*14.24*	*23.90*	*0.94*	*24.85*	*62.71*	*892.95*	*6.00*	*898.95*	*1,214.63*	*89.2*	*975*	*0.27*	*1.576*	*315.68*	*25.99%*
East Parking Lot	*24A,24B,25,25A,25B*	*5*	*4*				*0.182*		*0.706*	*2.12*	*2.12*	*10.00*	*0.86*	*10.86*	*104.19*	*220.89*		*220.89*	*257.59*	*81.3*	*450*	*0.75*	*1.569*	*36.70*	*14.25%*
East Parking Lot		*4*	*1*							*0.00*	*16.36*	*24.85*	*0.10*	*24.95*	*61.14*	*1,000.33*	*6.00*	*1006.33*	*1,259.33*	*9.8*	*975*	*0.29*	*1.634*	*253.00*	*20.09%*
East Parking Lot	*21,21A,21B,26*	*3*	*2*			*0.191*			*0.415*	*1.36*	*1.36*	*10.00*	*1.25*	*11.25*	*104.19*	*141.70*		*141.70*	*200.67*	*67.4*	*525*	*0.20*	*0.898*	*58.96*	*29.38%*
East Parking Lot	*22, 23, 23B,23C*	*2*	*1*			*0.141*			*0.533*	*1.57*	*2.93*	*11.25*	*1.20*	*12.45*	*98.02*	*287.20*		*287.20*	*378.84*	*93.4*	*600*	*0.35*	*1.298*	*91.64*	*24.19%*
East Parking Lot	*24*	*1*	*OUT*				*0.122*			*0.24*	*19.53*	*24.95*	*0.14*	*25.08*	*60.98*	*1,191.02*	*6.00*	*1197.02*	*1,550.65*	*16.5*	*975*	*0.44*	*2.012*	*353.64*	*22.81%*

Designed: DY

Checked:

Revision	Date
Revised as per SPA April 2019	Apr 2019
BUILDINGS 1&2, Pad E	Feb 2017
CRU B-1/B-2 revision #2	October 2014
CRU B-1/B-2 revision	July 2014
Pad F revised	Nov 2012
Box C roof directed to infiltration cell	June 2012
2nd submission Ph 2 to City	Feb 27, 2012

Dwg. Reference:	File Ref:	Date:	Sheet No:
10113	10113 - 5.7.1	2011-04-19	1 of 1

Q = 2.78AIC, where:
Q = Peak Flow in Litres per Second (l/s)
A = Area in Hectares (ha.)
I = Rainfall Intensity in Millimeters per Hour (mm/hr)
[I=998.071/(TC+6.053)0.814]

Mannings Coefficient (n) = 0.013

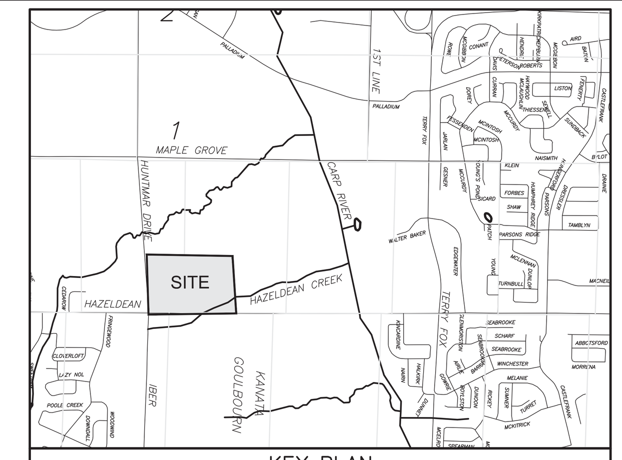
Ponding Data			
Pond ID#	area (sm)	depth (m)	volume (m3)
1A	481.00	0.25	40.08
1B	814.00	0.25	67.83
1C	201.00	0.70	46.90
2A	36.00	0.07	0.84
2B	22.00	0.07	0.51
3A	38.00	0.07	0.89
3B	50.00	0.07	1.17
5A	468.00	0.30	46.80
5B	383.00	0.30	38.30
5C	336.00	0.30	33.60
6A	40.00	0.07	0.93
6B	40.00	0.07	0.93

Ponding Data			
Pond ID#	area (sm)	depth (m)	volume (m3)
8A	794.17	0.30	79.42
8B	284.43	0.25	23.70
8C	127.03	0.25	10.59
8D	68.25	0.10	2.28
9A	40.00	0.07	0.93
9B	40.00	0.07	0.93
11A	150.00	0.15	7.50
11B	108.00	0.15	5.40
12	990.13	0.25	82.51
14A	1343.36	0.25	111.95
14B	140.66	0.25	11.72
15A	296.00	0.15	14.80
15B	1000.00	0.30	100.00
15C	1055.00	0.30	105.50
15D	1000.00	0.30	100.00

Ponding Data			
Pond ID#	area (sm)	depth (m)	volume (m3)
15E	900.00	0.30	90.00
15F	463.98	0.20	30.93
16A	166.37	0.15	8.32
16B	204.14	0.15	10.21
17A	481.30	0.20	32.09
17B	397.16	0.20	26.48
17C	278.03	0.20	18.54
17D	739.91	0.20	49.33
17E	785.48	0.20	52.37
17F	369.62	0.20	24.64
18A	156.00	0.25	13.00
18B	156.00	0.25	13.00

Ponding Data			
Pond ID#	area (sm)	depth (m)	volume (m3)
19A	155.56	0.25	12.96
19B	187.08	0.25	15.59
20A	217.96	0.20	14.53
20D	468.54	0.20	31.24
20B	2029.44	0.25	169.12
20C	523.33	0.20	34.89
21	191.58	0.25	15.97
21A	60.88	0.23	4.67
22	360.00	0.25	30.00
23	562.42	0.25	46.87
23B	535.86	0.30	53.59
23C	558.21	0.30	55.82

Ponding Data			
Pond ID#	area (sm)	depth (m)	volume (m3)
24	489.88	0.25	40.82
24A	74.40	0.30	7.44
25	584.32	0.17	33.11
25A	121.23	0.30	12.12
26	226.00	0.23	17.33



KEY PLAN

N.T.S.

APPROVED ☐ REFUSED ☐

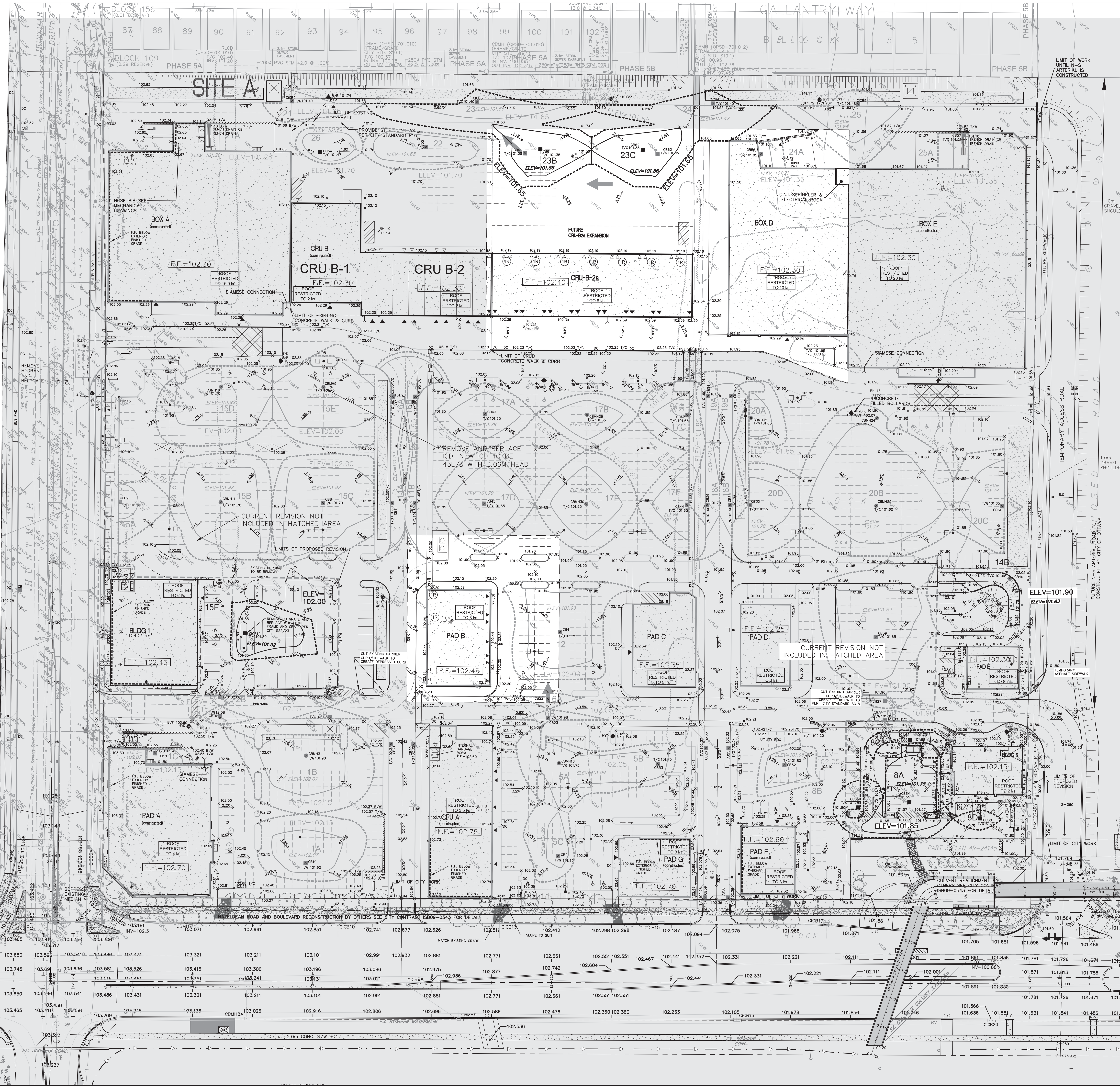
THIS____DAY OF ____________ , 20______

DERRICK MOODIE, MANAGER
DEVELOPMENT REVIEW WEST
PLANNING, INFRASTRUCTURE AND ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

LEGEND:

- ELEV=114.38 — PONDING AREA C/W 100YR PONDING ELEVATION
- ELEV=114.38 — PONDING AREA C/W 5YR PONDING ELEVATION
- MAJOR STORM ROUTE
- 17B — POND AREA
- ROOF TOP STORAGE

5 Year Ponding Data			
Pond ID#	area (sm)	depth (m)	volume (m3)
1A	277.44	0.17	15.72
1B	453.56	0.17	25.70
1C	51.30	0.62	10.60
2A	36.00	0.07	0.84
2B	22.00	0.07	0.51
3A	38.00	0.07	0.89
3B	50.00	0.07	1.17
5A	228.04	0.24	18.24
5B	245.31	0.24	19.62
5C	96.65	0.14	4.51
6A	40.00	0.07	0.93
6B	40.00	0.07	0.93
8A	438.40	0.20	29.23
8B	153.16	0.18	9.19
8C	44.91	0.15	2.25
9A	40.00	0.07	0.93
9B	40.00	0.07	0.93
11A	134.63	0.13	5.83
11B	85.33	0.13	3.70
12	536.13	0.18	32.17
14A	665.69	0.18	39.94
14B	91.87	0.18	5.51
15A	62.14	0.22	1.45
15B	644.98	0.22	47.30
15C	696.50	0.22	51.08
15D	538.48	0.22	39.49
15E	603.30	0.22	44.24
15F	253.74	0.12	10.15
16A	135.45	0.13	5.87
16B	163.52	0.13	7.09
17A	220.60	0.15	11.03
17B	188.99	0.15	9.45
17C	111.16	0.15	5.56
17D	358.98	0.15	17.95
17E	350.76	0.15	17.54
17F	173.44	0.15	8.67
18A	115.03	0.14	5.37
18B	94.54	0.14	4.41
19A	66.62	0.14	3.11
19B	80.81	0.14	3.77
20A	88.84	0.13	3.31
20B	1184.13	0.18	71.05
20C	278.87	0.13	12.08
20D	210.89	0.13	9.14
21	191.58	0.25	15.97
21A	35.32	0.15	1.77
22	286.07	0.23	21.93
23	172.34	0.15	8.62
23B	304.74	0.21	21.33
23C	305.35	0.21	21.37
24	49.05	0.07	1.14
24A	33.91	0.16	1.81
25	234.71	0.11	8.61
25A	58.10	0.20	3.87
26	132.00	0.17	7.48



No.	REVISIONS	By	Date
21	REVISED AS PER CITY COMMENTS	DGY	19:12:20
20	REVISED SPA CRU B-3, PAD B, BOX D	DGY	19:08:29
19	ISSUED FOR CONSTRUCTION BLDG 2	DGY	18:04:06
18	ISSUED FOR TENDER	DGY	18:01:15
17	REVISED AS PER CITY COMMENTS	DGY	17:11:23
16	ISSUED FOR SPA	DGY	17:11:02
15	REVISED AS PER SITE PLAN	DGY	17:07:07
14	REVISED AS PER CITY COMMENTS	DGY	17:06:23
13	REVISED BLD 2 & PAD E	DGY	17:02:14
12	REVISED AS PER CITY COMMENTS	DGY	16:08:02
11	SPA BLDG 1 & 2	DGY	16:03:07
10	REVISED AS PER SITE PLAN	DGY	14:11:03
9	SPA	DGY	14:09:09
8	REVISED AS PER SITE PLAN	DGY	14:08:08
7	REVISED AS PER CITY COMMENTS	DGY	14:07:31
6	REVISED DOLLAR & CRUB	DGY	14:06:03
5	REVISED FOR PAD F	DGY	12:11:16
4	REVISED SPRINKLER ROOM BOX E	DGY	12:03:09
3	REVISED PER CITY COMMENTS AND PAD E	DGY	12:02:22
2	REVISED SITE PLAN PH1 & PH2	DGY	11:11:24
1	ISSUED FOR APPROVAL	DGY	11:10:27

NORTH AMERICAN
DEVELOPMENT GROUP

IBI GROUP
333 Preston Street
Tower 1, Suite 400
Ottawa, Ontario
Canada K1S 5N4
Tel (613)225-1311
FAX (613)225-9868

Project Title

NORTH AMERICAN
HAZELDEAN & HUNTMAR
OTTAWA, ONT.

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2019/12/20
PROVINCE OF ONTARIO

N

Drawing Title

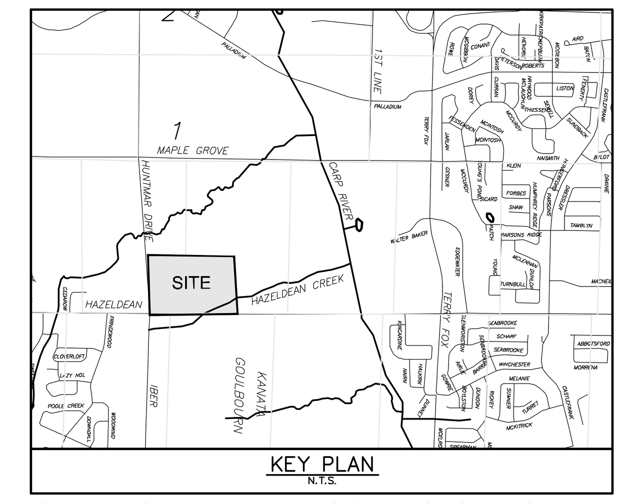
PONDING PLAN
PHASE 1 & 2

Scale: 1:500

Design	Date
D.G.Y.	OCTOBER 2011
Drawn	**Checked**
E.H.	D.G.Y.
Project No.	**Drawing No.**
10113	C-402

D07-12-19-0168

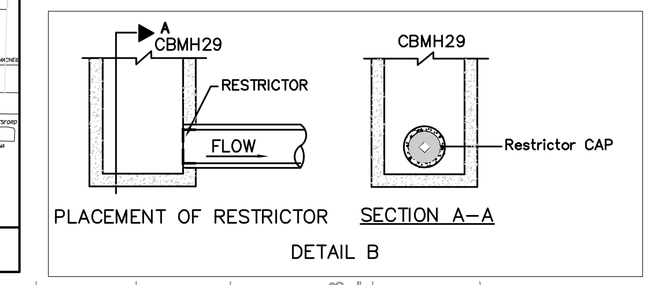
PLAN No.: #16044



APPROVED ☐ REFUSED ☐

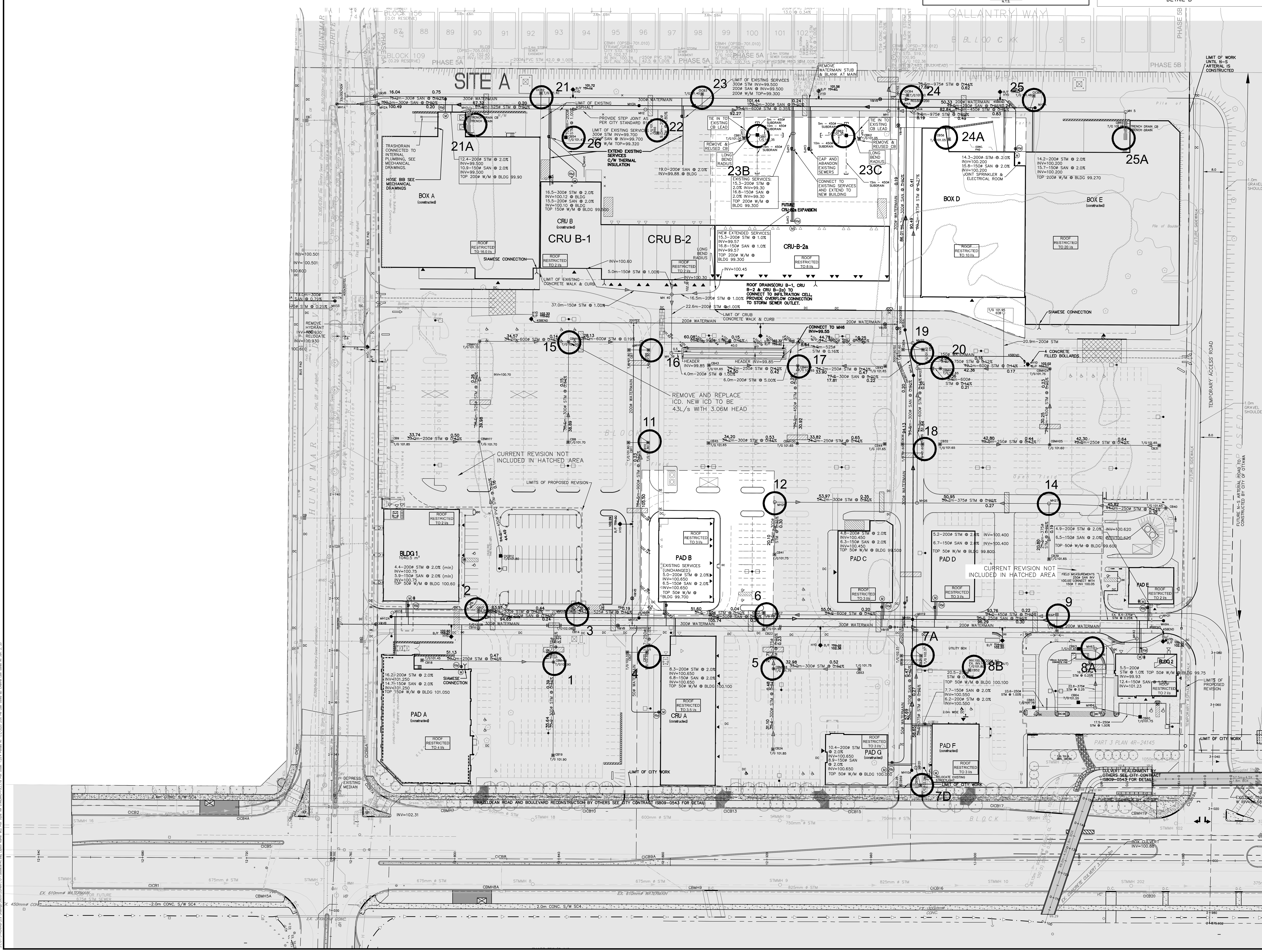
THIS ___ DAY OF ____________, 20____

DERRICK MOODIE, MANAGER
DEVELOPMENT REVIEW WEST
PLANNING, INFRASTRUCTURE AND ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



LEGEND

CB 3 — ICD #



ICD#	ICD TYPE
1	HYDROVEX 125VHV 21.0 l/s @ 2.77m HEAD
2	HYDROVEX 100VHV 13.0 l/s @ 1.62m HEAD
3	HYDROVEX 100VHV 13.0 l/s @ 1.62m HEAD
4	HYDROVEX 100VHV 10.0 l/s @ 1.48m HEAD
5	HYDROVEX 150VHV 35.0 l/s @ 2.73m HEAD
6	21.0 l/s IPEX A
7A	HYDROVEX 75VHV 5.0 l/s @ 1.41m HEAD
7D	HYDROVEX 75VHV 5.0 l/s @ 1.48m HEAD
8A	18.5 l/s IPEX TEMPEST @ 2.25m HEAD
8B	HYDROVEX 100VHV 10.0 l/s @ 1.55m HEAD
9	21.0 l/s IPEX A
11	HYDROVEX 125VHV 18.0 l/s @ 1.63m HEAD
12	21.0 l/s IPEX A
14	HYDROVEX 125VHV 21.0 l/s @ 2.87m HEAD
15	43.0 l/s IPEX TEMPEST @ 3.06m HEAD
16	HYDROVEX 150VHV 29.0 l/s @ 1.62m HEAD
17	HYDROVEX 250VHV 82.0 l/s @ 2.97m HEAD
18	21.0 l/s IPEX A
19	HYDROVEX 150VHV 29.0 l/s @ 1.72m HEAD
20	HYDROVEX 200VHV 48.0 l/s @ 3.14m HEAD
21	HYDROVEX 100VHV 10.0 l/s @ 1.65m HEAD
21A	HYDROVEX 100VHV 5.0 l/s @ 1.45m HEAD
22	HYDROVEX 100VHV 12.0 l/s @ 1.57m HEAD
23	21.0 l/s IPEX A
23B	IPEX LMF 9.0 l/s @ 1.6
23C	IPEX LMF 9.0 l/s @ 1.6
24	HYDROVEX 150VHV 35.0 l/s @ 1.68m HEAD
24A	HYDROVEX 50VHV 3.0 l/s @ 1.44m HEAD
25	HYDROVEX 150VHV 27.0 l/s @ 1.60m HEAD
25A	HYDROVEX 50VHV 2.0 l/s @ 1.42m HEAD
26	HYDROVEX 75VHV 5.0 l/s @ 1.55m HEAD
ROOF DRAINS	ALL ROOF DRAINAGE TO BE CASTROLLED WITH WATTS MODEL RD-100 ROOF DRAIN

No.	REVISIONS	By	Date
22	REVISED AS PER CITY COMMENTS	DGY	19:12:20
21	REVISED SPA CRU B-3, PAD B, BOX D	DGY	19:08:29
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7	REVISED DOLLAR & CRUB	DGY	14:06:03
6	REVISED FOR PAD F	DGY	12:11:16
5	REVISED SPRINKLER ROOM BOX E	DGY	12:03:09
4	REVISED PER CITY COMMENTS AND PAD E	DGY	12:02:22
3	REVISED FOR BOX E	DGY	12:01:26
2	REVISED SITE PLAN PH1 & PH2	DGY	11:11:24
1	ISSUED FOR APPROVAL	DGY	11:10:27

NORTH AMERICAN
DEVELOPMENT GROUP

IBI GROUP
333 Preston Street
Tower 1, Suite 400
Ottawa, Ontario
Canada K1S 5N4
Tel (613)225-1311
FAX (613)225-9868

Project Title
5705 HAZELDEAN ROAD
OTTAWA, ONT.

LICENSED PROFESSIONAL ENGINEER
2019/12/20
PROVINCE OF ONTARIO

Drawing Title
ICD PLAN
PHASE 1 & 2

Scale
1:500

Design	Date
D.G.Y.	OCTOBER 2011
Drawn	Checked
E.H.	D.G.Y.
Project No.	Drawing No.
10113	C-802

#16044

WATTS DRAINAGE	RD-100 Tag: ________	Large Capacity Roof Drain

Components:

SPECIFICATION: Watts Drainage Products RD-100 epoxy coated cast iron roof drain with deep sump, wide serrated flashing flange, flashing clamp device with integral gravel stop and self-locking polyethylene (standard) dome strainer.

Order Code: RD-10☐☐-☐-☐

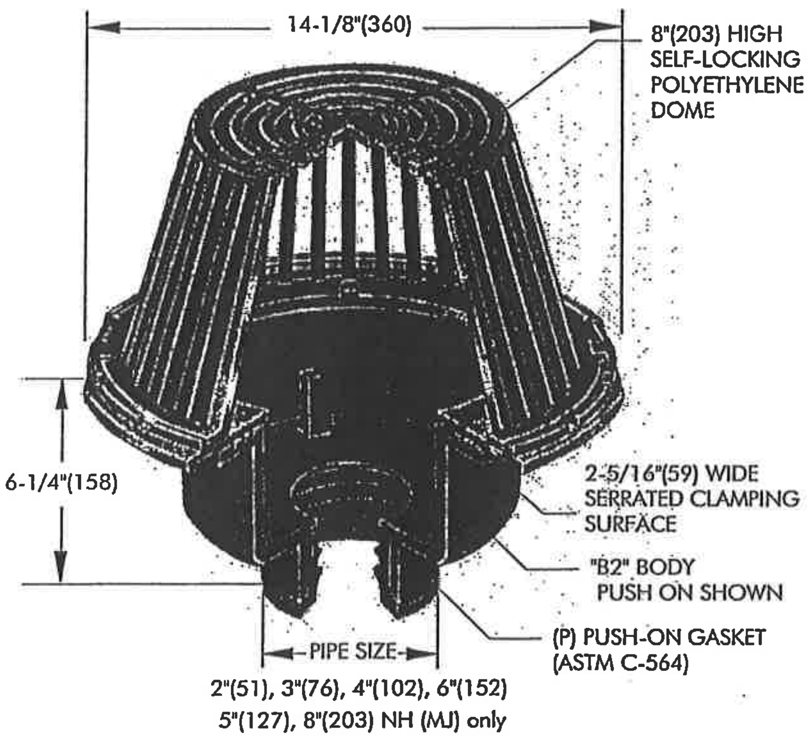
Ex. RD-102P-K

Pipe Sizing (Select One)		
Suffix	Description	
2	2"(51) Pipe Size	☐
3	3"(76) Pipe Size	☐
4	4"(102) Pipe Size	☐
5	5"(127) Pipe Size	☐
6	6"(152) Pipe Size	☐
8	8"(203) Pipe Size	☐

Outlet Type (Select One)		
Suffix	Description	
NH	No Hub (MJ)	☐
P	Push On	☐
T	Threaded Outlet	☐
X	Inside Caulk	☐

Options (Select One or More)		
Suffix	Description	
-A	Accutrol weir (specify # 1-6 slots)	☐
-B	Sump Receiver Flange	☐
-BED	Sump Receiver, Adj Ext., Deck Clamp	☐
-C	Secondary Membrane Clamp	☐
-D	Underdeck Clamp	☐
-E	Adjustable Extension	☐
-GSS	Stainless Steel Ballast Guard	☐
-H	Adj. to 6" IRMA Ballast Guard	☐
-K	Ductile Iron Dome	☐
-K80	Aluminum Dome	☐
-L	Vandal Proof Dome	☐
-R	2" High External Water Dam	☐
-SO	Side Outlet**	☐
-V	Fixed Extension (1-1/2",2",3",4")	☐
-W	Adj. Water Level Regulator	☐
-W-1	Waterproofing Flange	☐
-Z	Extended Integral Wide Flange	☐
-5	Sediment Bucket	☐
-12	Galvanized Dome	☐
-13	All Galvanized	☐
-83	Mesh Covered Dome	☐
-113M	Special Epoxy from 3M Range	☐

Optional Body Material (NH Only)		
Suffix	Description	
-60	PVC Body w/Socket Outlet	☐
-61	ABS Body w/Socket Outlet	☐



Free Area Sq. In.
137

Deck opening: [illegible]
with sump receiver: [illegible]

** Side Outlet (-SO) option only available in 2"(51), 3"(76), 4"(102) pipe sizes.
Underdeck Clamp (-BED and -D options) are not available when -SO is selected.

Job Name ____________________ Contractor ____________________

Job Location ____________________ Contractor's P.O. No. ____________________

Engineer ____________________ Representative ____________________

WATTS Drainage reserves the right to modify or change product design or construction without prior notice and without incurring any obligation to make similar changes and modifications to products previously or subsequently sold. See your WATTS Drainage representative for any clarification. Dimensions are subject to manufacturing tolerances.

WATTS DRAINAGE
CANADA: 5435 North Service Road, Burlington, ON, L7L 5H7 TEL: 905-332-6718 TOLL-FREE: 1-888-208-8927 Website: www.wattsdrainage.ca

CANADA

WATTS® DRAINAGE	Adjustable Accutrol Weir Tag: ____________	Adjustable Flow Control for Roof Drains

ADJUSTABLE ACCUTROL(for Large Sump Roof Drains only)

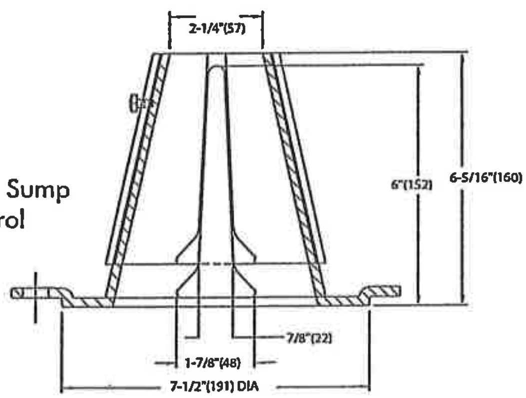
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

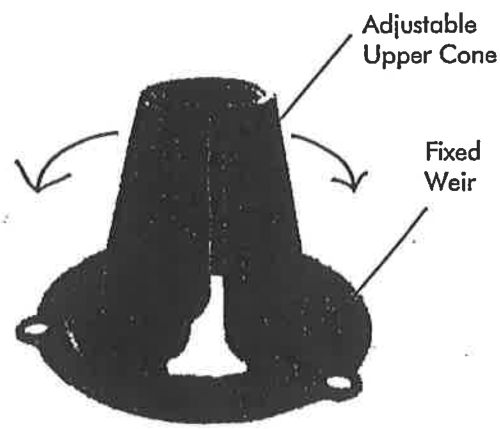
EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2" of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3" of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm(per inch of head) x 2 inches of head] + 2-1/2 gpm(for the third inch of head) = 12-1/2 gpm.

Large Sump Accutrol





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	Head of Water 1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	10	10	10	10	10

Job Name ____________ Contractor ____________

Job Location ____________ Contractor's P.O. No. ____________

Engineer ____________ Representative ____________

CANADA

WATTS DRAINAGE
CANADA: 5435 North Service Road, Burlington, ON, L7L 5H7 TEL: 905-332-6718 TOLL-FREE: 1-888-208-8927 Website: www.wattsdrainage.ca

(Dimension) Denotes Millimeters

IBI GROUP
IBI Group
333 Preston Street - Suite 400
Ottawa, Ontario
K1S 5N4

Denotes Revision 2019-04-02

Phase 1&2 ICD DESIGN SHEET

PROJECT: HUNTMAR PLAZA
LOCATION: CITY OF OTTAWA
CLIENT: NORTH AMERICAN

LOCATION				1:100_{yr} ICD RESTRICTED FLOW																													
LOCATION	ICD #	FROM	TO	INLET (L/s)																			RESTRICTED ROOF FLOW (L/s)									INDIV.	ACCUM.
		MH	MH	2.0	3.0	5.0	9.0	10.0	12.0	13.0	18.0	18.5	21.0	27.0	29.0	30.0	35.0	43.0	48.0	82.0	100.0	130.0	2.0	3.0	3.5	4.0	8.0	10.0	16.0	20.0	25.0	FLOW (L/s)	FLOW (L/s)
East Parking Lot	8A	CB 60	CB 63										1																				18.50	18.50
BLDG 2	ROOF	CB 63	MH 42																				1									2.00	20.50
East Parking Lot	9	21	19											1																			21.00	41.50
Pad E	ROOF	21	19																				1									2.00	43.50
Pad D	ROOF	21	19																					1								3.00	46.50
East Parking Lot	8B	CB 52	20 - 19					1																								10.00	10.00
East Parking Lot	7A	20	19			1																										5.00	15.00
East Parking Lot	7D	20	19			1																										5.00	20.00
Pad F	ROOF	20	19																					1								3.00	23.00
Pad G	ROOF	20	19																					1								3.00	26.00
Pad C	ROOF	19	17																					1								3.00	75.50
East Parking Lot	5	CBMH18	17														1															35.00	35.00
East Parking Lot	6	17	14											1																			21.00	131.50
East Parking Lot	4	17	14					1																								10.00	141.50
Pad B	ROOF	17	14																					1								3.00	144.50
CRU A	ROOF	17	14																						1							3.50	148.00
East Parking Lot	2	16	15							1																						13.00	13.00
Pad A	ROOF	16	15																							1						4.00	17.00
BLDG 1	ROOF	16	15																				1									2.00	19.00
East Parking Lot	1	CBMH31	15											1																			21.00	21.00
East Parking Lot	3	15	14							1																						13.00	53.00
East Parking Lot	11	14	8								1																					18.00	219.00
East Parking Lot	16	14	8												1																	29.00	248.00
East Parking Lot	15	CBMH9	8															1														43.00	43.00
East Parking Lot		8	6																													0.00	291.00
East Parking Lot	17	CBMH29	6																	1												82.00	82.00
East Parking Lot		6	22																													0.00	373.00
East Parking Lot	14	27	26											1																			21.00	21.00
East Parking Lot	12	28	26											1																			21.00	21.00
East Parking Lot	18	26	23											1																			21.00	63.00
East Parking Lot	20	CBMH32	23																1													48.00	48.00
East Parking Lot	19	23	22												1																	29.00	140.00
East Parking Lot		22	4																													0.00	513.00
East Parking Lot	25A	5	4	1																												2.00	2.00
East Parking Lot	25	5	4											1																		27.00	29.00
East Parking Lot	24A	5	4		1																											3.00	32.00
BOX E	ROOF	5	4																											1		20.00	52.00
BOX D	ROOF	5	4																									1				10.00	62.00
East Parking Lot		4	1																													0.00	575.00
East Parking Lot	21	3	2					1																								10.00	10.00
East Parking Lot	21A	3	2			1																										5.00	15.00
BOX A	ROOF	3	2																										1			16.00	31.00
East Parking Lot	26A	3	2			1																										5.00	36.00
CRU B-1	ROOF	3	2																				1									2.00	38.00
CRU B-2	ROOF	3	2																				1									2.00	40.00
~~Box B~~ CRU B-3	ROOF	2	1																							1						4.00	44.00
East Parking Lot	22	2	1						1																							12.00	56.00
East Parking Lot	23	2	1											1																			21.00	77.00
East Parking Lot	23B	2	1		0		1																								9.00	86.00
East Parking Lot	23C	2	1		0		1																								9.00	95.00
~~BOX C~~	~~ROOF~~	~~2~~	~~1~~																								0					0.00	95.00
East Parking Lot	24	1	OUT														1															35.00	705.00

Designed: RM	Revision #6 2019-04-03	
	Revision #5 2017/02/17	
	Revision #4 2016/03/04	
	Revision #3	
Checked: DY	Revision #2	
	Revision #1	
	Revision	
Dwg. Reference: 10113	File Ref: 10113 - 5.7.1	

IBI
333 Preston St
OTTAWA, ONTARIO
K1S 5N4

ONSITE SWM 5yr design
PROJECT: HUNTMAR PLAZA
CITY OF OTTAWA
DEVELOPER : NORTH AMERICAN

JOB #: 10113
DATE: 10/30/2014
DESIGN: DY
Rev#5 BLD 1&2, Pad E

LANDS EAST OF HUNTMAR DR Phase 1 & 2, 5yr design

MAXIMUM ALLOWABLE FLOW - Flow Restricted to 85 l/s/Ha

Time of concentration = 10 minutes

Area (ha) =	**8.297**
C Average =	**0.88**

Intensity - 5 year event storm

10 min Tc	i5yr = 998.071/(T+6.053)^0.814=	**104.2**	mm/hr

Unrestricted Flowrate (Q5)

10 min Tc	Qpre-devo = 2.78*A*Cw*i =	**2114.94** l/s

Restricted Flowrate (Q5)

10 min Tc	Q= 85 l/s/Ha	**705.26** l/s

Intensity - 100 year event storm

10 min Tc	i100yr = 1735.688/(T+6.014)^0.82	**178.6**	mm/hr

Unrestricted Flowrate (Q100)

10 min Tc	Qpost-devo = 2.78*A*Cw*i =	**3624.44** l/s

Restricted Flowrate (Q5)

10 min Tc	Q= 85 l/s/Ha	**705.26** l/s

STORM WATER MANAGEMENT - Post-Development Controlled

(5 year post-development with 100yr inlets)

ROOF AREA # Box A (21B)

3260 sm
5 -YR FLOW
Qp (l/s)

Area(ha)=	0.3260				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			16.00 l/s
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
20	70.3	57.3	16.00	41.3	49.56
22	66.1	54.0	16.00	38.0	50.10
24	62.5	51.0	16.00	35.0	50.42
26	59.3	48.4	16.00	32.4	**50.55**
28	56.5	46.1	16.00	30.1	50.53
30	53.9	44.0	16.00	28.0	50.38
32	51.6	42.1	16.00	26.1	50.10
34	49.5	40.4	16.00	24.4	49.73
36	47.6	38.8	16.00	22.8	49.26
38	45.8	37.4	16.00	21.4	48.71
40	44.2	36.0	16.00	20.0	48.09
42	42.7	34.8	16.00	18.8	47.41

<=== Required volume for roof storage

Req. Storage volume 50.55 m3
Average depth 0.016 m

ROOF AREA # CRU B-3 (23A)

Updated March 2019

1490 sm

5 -YR FLOW

Qp (l/s)

Area(ha)=	0.1490				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			4.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
42	42.7	15.9	4.00	11.9	30.02
44	41.3	15.4	4.00	11.4	30.08
46	40.0	14.9	4.00	10.9	30.11
48	38.8	14.5	4.00	10.5	**30.12** <=== Required volume for roof storage
50	37.7	14.0	4.00	10.0	30.11
52	36.6	13.6	4.00	9.6	30.08
54	35.6	13.3	4.00	9.3	30.04
56	34.7	12.9	4.00	8.9	29.98
58	33.8	12.6	4.00	8.6	29.90
60	32.9	12.3	4.00	8.3	29.81
62	32.2	12.0	4.00	8.0	29.71
64	31.4	11.7	4.00	7.7	29.60

Req. Storage volume 30.12 m3
Average depth 0.020 m

ROOF AREA -- OBSOLETE --

Updated March 2019

0 sm

5 -YR FLOW

Qp (l/s)

Area(ha)=	0.0000				
Cw =	0.00	STORMWATER MANAGEMENT Qm =			0.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
26	59.[illegible]	0.0	0.00	0.0	0.00
28	56.5	0.0	0.00	0.0	0.00
30	53.9	0.0	0.00	0.0	0.00
32	51.6	0.0	0.00	0.0	**0.00** <=== Required volume for roof storage
34	49.5	0.0	0.00	0.0	0.00
36	47.6	0.0	0.00	0.0	0.00
38	45.8	0.0	0.00	0.0	0.00
40	44.2	0.0	0.00	0.0	0.00
42	42.7	0.0	0.00	0.0	0.00
44	41.3	0.0	0.00	0.0	0.00
46	40.0	0.0	0.00	0.0	0.00
48	38.8	0.0	0.00	0.0	0.00

OBSOLETE OBSOLETE

Req. Storage volume 0.00 m3
Average depth #DIV/0! m

ROOF AREA # Box D (24B)

2320 sm

5 -YR FLOW

Qp (l/s)

Area(ha)=	0.2320				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			10.00 l/s
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
24	62.5	36.3	10.00	26.3	37.88
26	59.3	34.4	10.00	24.4	38.14
28	56.5	32.8	10.00	22.8	38.29
30	53.9	31.3	10.00	21.3	**38.35**
32	51.6	30.0	10.00	20.0	38.32
34	49.5	28.7	10.00	18.7	38.22
36	47.6	27.6	10.00	17.6	38.05
38	45.8	26.6	10.00	16.6	37.83
40	44.2	25.6	10.00	15.6	37.55
42	42.7	24.8	10.00	14.8	37.23
44	41.3	24.0	10.00	14.0	36.87
46	40.0	23.2	10.00	13.2	36.47

<=== Required volume for roof storage

Req. Storage volume 38.35 m3
Average depth 0.017 m

ROOF AREA # Box E (25B)

4260 sm

5 -YR FLOW

Qp (l/s)

Area(ha)=	0.4260				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			20.00 l/s
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
22	66.1	70.5	20.00	50.5	66.66
24	62.5	66.7	20.00	46.7	67.19
26	59.3	63.3	20.00	43.3	67.47
28	56.5	60.2	20.00	40.2	**67.56**
30	53.9	57.5	20.00	37.5	67.46
32	51.6	55.0	20.00	35.0	67.21
34	49.5	52.8	20.00	32.8	66.83
36	47.6	50.7	20.00	30.7	66.33
38	45.8	48.8	20.00	28.8	65.73
40	44.2	47.1	20.00	27.1	65.03
42	42.7	45.5	20.00	25.5	64.24
44	41.3	44.0	20.00	24.0	63.38

<=== Required volume for roof storage

Req. Storage volume 67.56 m3
Average depth 0.016 m

ROOF AREA # CRU A (6D)

1200 sm

5 -YR FLOW

Qp (l/s)

Area(ha)=	0.1200					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			3.50 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume	
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)	
39	45.0	13.5	3.50	10.0	23.41	
41	43.4	13.0	3.50	9.5	23.46	
43	42.0	12.6	3.50	9.1	23.48	
45	40.6	12.2	3.50	8.7	**23.49**	<=== Required volume
47	39.4	11.8	3.50	8.3	23.47	for roof storage
49	38.2	11.5	3.50	8.0	23.44	
51	37.1	11.1	3.50	7.6	23.39	
53	36.1	10.8	3.50	7.3	23.33	
55	35.1	10.5	3.50	7.0	23.25	
57	34.2	10.3	3.50	6.8	23.16	
59	33.4	10.0	3.50	6.5	23.06	
61	32.5	9.8	3.50	6.3	22.95	

Req. Storage volume 23.49 m3
Average depth 0.020 m

ROOF AREA # CRU B-2 (22A)

920 sm

5 -YR FLOW

Qp (l/s)

Area(ha)=	0.0920					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			2.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume	
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)	
52	36.6	8.4	2.00	6.4	20.04	
54	35.6	8.2	2.00	6.2	20.07	
56	34.7	8.0	2.00	6.0	20.09	
58	33.8	7.8	2.00	5.8	**20.10**	<=== Required volume
60	32.9	7.6	2.00	5.6	20.10	for roof storage
62	32.2	7.4	2.00	5.4	20.09	
64	31.4	7.2	2.00	5.2	20.08	
66	30.7	7.1	2.00	5.1	20.06	
68	30.0	6.9	2.00	4.9	20.03	
70	29.4	6.8	2.00	4.8	20.00	
72	28.8	6.6	2.00	4.6	19.96	
74	28.2	6.5	2.00	4.5	19.91	

Req. Storage volume 20.10 m3
Average depth 0.022 m

ROOF AREA # CRU B-1 (26A)					
830 sm					
5 -YR FLOW					
Qp (l/s)					
Area(ha)=	0.0830				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			2.00 l/s
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
45	40.6	8.4	2.00	6.4	17.38
47	39.4	8.2	2.00	6.2	17.42
49	38.2	7.9	2.00	5.9	17.45
51	37.1	7.7	2.00	5.7	**17.47** <=== Required volume for roof storage
53	36.1	7.5	2.00	5.5	17.47
55	35.1	7.3	2.00	5.3	17.47
57	34.2	7.1	2.00	5.1	17.46
59	33.4	6.9	2.00	4.9	17.44
61	32.5	6.8	2.00	4.8	17.41
63	31.8	6.6	2.00	4.6	17.38
65	31.0	6.4	2.00	4.4	17.34
67	30.4	6.3	2.00	4.3	17.30

Req. Storage volume 17.47 m3
Average depth 0.021 m

ROOF AREA # Pad A (2B)					
1570 sm					
5 -YR FLOW					
Qp (l/s)					
Area(ha)=	0.1570				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			4.00 l/s
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
45	40.6	16.0	4.00	12.0	32.29
47	39.4	15.5	4.00	11.5	32.34
49	38.2	15.0	4.00	11.0	32.37
51	37.1	14.6	4.00	10.6	**32.37** <=== Required volume for roof storage
53	36.1	14.2	4.00	10.2	32.36
55	35.1	13.8	4.00	9.8	32.33
57	34.2	13.4	4.00	9.4	32.28
59	33.4	13.1	4.00	9.1	32.22
61	32.5	12.8	4.00	8.8	32.15
63	31.8	12.5	4.00	8.5	32.06
65	31.0	12.2	4.00	8.2	31.96
67	30.4	11.9	4.00	7.9	31.85

Req. Storage volume 32.37 m3
Average depth 0.021 m

ROOF AREA # Pad B (6C)

Updated March 2019

620 sm						
5 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.0620					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			3.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume	
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)	
20	70.3	10.9	3.00	7.9	9.48	
22	66.1	10.3	3.00	7.3	9.58	
24	62.5	9.7	3.00	6.7	9.65	
26	59.3	9.2	3.00	6.2	**9.68**	<=== Required volume
28	56.5	8.8	3.00	5.8	9.68	for roof storage
30	53.9	8.4	3.00	5.4	9.66	
32	51.6	8.0	3.00	5.0	9.61	
34	49.5	7.7	3.00	4.7	9.54	
36	47.6	7.4	3.00	4.4	9.46	
38	45.8	7.1	3.00	4.1	9.36	
40	44.2	6.9	3.00	3.9	9.25	
42	42.7	6.6	3.00	3.6	9.12	

Req. Storage volume 9.68 m3
Average depth 0.016 m

ROOF AREA # Pad C (6B)

620 sm						
5 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.0620					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			3.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume	
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)	
20	70.3	10.9	3.00	7.9	9.48	
22	66.1	10.3	3.00	7.3	9.58	
24	62.5	9.7	3.00	6.7	9.65	
26	59.3	9.2	3.00	6.2	**9.68**	<=== Required volume
28	56.5	8.8	3.00	5.8	9.68	for roof storage
30	53.9	8.4	3.00	5.4	9.66	
32	51.6	8.0	3.00	5.0	9.61	
34	49.5	7.7	3.00	4.7	9.54	
36	47.6	7.4	3.00	4.4	9.46	
38	45.8	7.1	3.00	4.1	9.36	
40	44.2	6.9	3.00	3.9	9.25	
42	42.7	6.6	3.00	3.6	9.12	

Req. Storage volume 9.68 m3
Average depth 0.016 m

ROOF AREA # Pad D (9C)

450 sm						
5 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.0450					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			3.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume	
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)	
14	86.9	9.8	3.00	6.8	5.70	
16	80.5	9.1	3.00	6.1	5.82	
18	75.0	8.4	3.00	5.4	5.88	
20	70.3	7.9	3.00	4.9	**5.89**	<=== Required volume
22	66.1	7.4	3.00	4.4	5.87	for roof storage
24	62.5	7.0	3.00	4.0	5.82	
26	59.3	6.7	3.00	3.7	5.74	
28	56.5	6.4	3.00	3.4	5.65	
30	53.9	6.1	3.00	3.1	5.53	
32	51.6	5.8	3.00	2.8	5.40	

Req. Storage volume 5.89 m3
Average depth 0.013 m

ROOF AREA # Pad E (9B)

Updated March 2019

251 sm						
5 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.0251					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			2.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume	
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)	
10	104.2	6.5	2.00	4.5	2.73	
12	94.7	5.9	2.00	3.9	2.84	
14	86.9	5.5	2.00	3.5	2.91	
16	80.5	5.1	2.00	3.1	**2.93**	<=== Required volume
18	75.0	4.7	2.00	2.7	2.92	for roof storage
20	70.3	4.4	2.00	2.4	2.89	
22	66.1	4.2	2.00	2.2	2.84	
24	62.5	3.9	2.00	1.9	2.78	
26	59.3	3.7	2.00	1.7	2.69	

Req. Storage volume 2.93 m3
Average depth 0.012 m

ROOF AREA # Pad F (7B)

Updated Nov/2012

416 sm

5 -YR FLOW

Qp (l/s)

Area(ha)=	0.0416				
Cw =	0.90	STORMWATER MANAGEMENT Qm =		3.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
13	90.6	9.4	3.00	6.4	5.02
15	83.6	8.7	3.00	5.7	5.13
17	77.6	8.1	3.00	5.1	5.18
19	72.5	7.5	3.00	4.5	**5.19** <=== Required volume for roof storage
21	68.1	7.1	3.00	4.1	5.15
23	64.3	6.7	3.00	3.7	5.09
25	60.9	6.3	3.00	3.3	5.01
27	57.9	6.0	3.00	3.0	4.90
29	55.2	5.7	3.00	2.7	4.77
31	52.7	5.5	3.00	2.5	4.63

Req. Storage volume 5.19 m3
Average depth 0.012 m

ROOF AREA # Pad G (7C)

490 sm

5 -YR FLOW

Qp (l/s)

Area(ha)=	0.0490				
Cw =	0.90	STORMWATER MANAGEMENT Qm =		3.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
16	80.5	9.9	3.00	6.9	6.59
18	75.0	9.2	3.00	6.2	6.69
20	70.3	8.6	3.00	5.6	6.74
22	66.1	8.1	3.00	5.1	**6.74** <=== Required volume for roof storage
24	62.5	7.7	3.00	4.7	6.72
26	59.3	7.3	3.00	4.3	6.67
28	56.5	6.9	3.00	3.9	6.60
30	53.9	6.6	3.00	3.6	6.50
32	51.6	6.3	3.00	3.3	6.39
34	49.5	6.1	3.00	3.1	6.26
36	47.6	5.8	3.00	2.8	6.12
38	45.8	5.6	3.00	2.6	5.97

Req. Storage volume 6.74 m3
Average depth 0.014 m

ROOF AREA BLDG 1 (2A)

Updated Feb 2017

1040 sm

5 -YR FLOW

Qp (l/s)

Area(ha)=	0.1040				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			2.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
60	32.9	8.6	2.00	6.6	23.66
62	32.2	8.4	2.00	6.4	23.68
64	31.4	8.2	2.00	6.2	23.70
66	30.7	8.0	2.00	6.0	**23.71**
68	30.0	7.8	2.00	5.8	23.71
70	29.4	7.6	2.00	5.6	23.70
72	28.8	7.5	2.00	5.5	23.69
74	28.2	7.3	2.00	5.3	23.67
76	27.6	7.2	2.00	5.2	23.64
78	27.1	7.0	2.00	5.0	23.61

<=== Required volume for roof storage

Req. Storage volume 23.71 m3
Average depth 0.023 m

ROOF AREA BLDG 2 (8C)

Updated Feb 2017

385 sm

5 -YR FLOW

Qp (l/s)

Area(ha)=	0.0385				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			2.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
20	70.3	6.8	2.00	4.8	5.72
22	66.1	6.4	2.00	4.4	5.77
24	62.5	6.0	2.00	4.0	5.80
26	59.3	5.7	2.00	3.7	**5.80**
28	56.5	5.4	2.00	3.4	5.78
30	53.9	5.2	2.00	3.2	5.75
32	51.6	5.0	2.00	3.0	5.70
34	49.5	4.8	2.00	2.8	5.65
36	47.6	4.6	2.00	2.6	5.58
38	45.8	4.4	2.00	2.4	5.50
40	44.2	4.3	2.00	2.3	5.41
42	42.7	4.1	2.00	2.1	5.32

<=== Required volume for roof storage

Req. Storage volume 5.80 m3
Average depth 0.015 m

PARKING LOT Area #1 (1A, B, C)

3400 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 21 l/s

Area(ha)=	0.3400				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			21.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
14	86.9	74.0	21.00	53.0	44.48
16	80.5	68.4	21.00	47.4	45.55
18	75.0	63.8	21.00	42.8	46.20
20	70.3	59.8	21.00	38.8	46.51
22	66.1	56.3	21.00	35.3	**46.56**
24	62.5	53.2	21.00	32.2	46.37
26	59.3	50.5	21.00	29.5	45.99
28	56.5	48.1	21.00	27.1	45.46
30	53.9	45.9	21.00	24.9	44.78
32	51.6	43.9	21.00	22.9	43.97
33	50.5	43.0	21.00	22.0	43.53

<=== Required volume for storage on-site (22 min: 46.56)

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
18	1.45	0.52
19	1.50	0.54
	Total:	**1.06**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CBMH31 - CB18	50.00	0.25	2.45
CBMH31 - CB19	35.90	0.30	2.54
		Total:	**4.99**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
31	2.17	2.45
	Total:	**2.45**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
1A	277.44	0.17	15.72
1B	453.56	0.17	25.70
1C	51.30	0.62	10.60
		Total:	**52.03**

Overflow from area 2	**3.01**
Total Storage required	**49.57**
Total Surface Storage provided	**52.03**

ICD use Hydrovex 125VHV 21l/s @ 2.77m head, or approved equal

PARKING LOT Area #2						
970 sm						
5 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.0970					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			13.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
7.5	119.6	29.0	13.00	16.0	7.21	
8	116.1	28.2	13.00	15.2	7.29	
8.5	112.9	27.4	13.00	14.4	7.34	
9	109.8	26.6	13.00	13.6	7.37	
9.5	106.9	25.9	13.00	12.9	**7.38**	<=== Required volume
10	104.2	25.3	13.00	12.3	7.37	for storage on-site
10.5	101.6	24.7	13.00	11.7	7.35	
11	99.2	24.1	13.00	11.1	7.31	
11.5	96.9	23.5	13.00	10.5	7.25	
12	94.7	23.0	13.00	10.0	7.19	
12.5	92.6	22.5	13.00	9.5	7.11	

Updated March 2016

Flow restricted to 13 l/s

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
17	1.67	0.60
16	1.25	0.45
	Total:	**1.05**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB16 - CB17	6.00	0.20	0.19
		Total:	**0.19**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
2A	36.00	0.07	0.84
2B	22.00	0.07	0.51
		Total:	**1.35**

Total Storage required	**7.38**
Total Surface Storage provided	**1.35**
Overflow to area 1	**3.01**
Overflow to area 15	**3.01**

ICD use Hydrovex 100VHV 13l/s @ 1.62m head, or approved equal

PARKING LOT Area #3						
550 sm						
5 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.0550					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			13.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
3	166.1	22.9	13.00	9.9	1.77	
3.5	159.0	21.9	13.00	8.9	1.86	
4	152.5	21.0	13.00	8.0	1.92	
4.5	146.6	20.2	13.00	7.2	**1.94**	<=== Required volume for storage on-site
5	141.2	19.4	13.00	6.4	1.93	
5.5	136.2	18.7	13.00	5.7	1.89	
6	131.6	18.1	13.00	5.1	1.84	
6.5	127.3	17.5	13.00	4.5	1.76	
7	123.3	17.0	13.00	4.0	1.67	
7.5	119.6	16.5	13.00	3.5	1.56	
8	116.1	16.0	13.00	3.0	1.43	

Updated March 2016

Flow restricted to 13 l/s

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
14	1.30	0.47
15	1.65	0.59
	Total:	**1.06**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB14 - CB15	6.00	0.20	0.19
		Total:	**0.19**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
3A	38.00	0.07	0.89
3B	50.00	0.07	1.17
		Total:	**2.05**

Overflow from area 4	**3.50**
Total Storage required	**5.43**
Total Surface Storage provided	**2.05**
Overflow to area 15	**3.38**

ICD use Hydrovex 100VHV 13l/s @ 1.50m head, or approved equal

PARKING LOT Area #4

830 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 10 l/s

Area(ha)=	0.0830				
Cw =	0.90	STORMWATER MANAGEMENT Qm =		10.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
8	116.1	24.1	10.00	14.1	6.77
9	109.8	22.8	10.00	12.8	6.91
10	104.2	21.6	10.00	11.6	6.98
11	99.2	20.6	10.00	10.6	**7.00**
12	94.7	19.7	10.00	9.7	6.96
13	90.6	18.8	10.00	8.8	6.88
14	86.9	18.1	10.00	8.1	6.76
15	83.6	17.4	10.00	7.4	6.62
16	80.5	16.7	10.00	6.7	6.44
17	77.6	16.1	10.00	6.1	6.24
18	75.0	15.6	10.00	5.6	6.01

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
20	1.60	0.58
21	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CB21 - CB20	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
		Total:	**0.00**

Total Storage required	**7.00**
Total Surface Storage provided	**0.00**
Overflow to area 3	**3.50**
Overflow to area 6	**3.50**

ICD use Hydrovex 100VHV 10l/s @ 1.48m head, or approved equal

PARKING LOT Area #5 (5A, B, C)						
3320 sm						
5 -YR FLOW			Flow restricted to		35 l/s	
Qp (l/s)						
Area(ha)=	0.3320					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			35.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
4	152.5	126.7	35.00	91.7	22.00	
6	131.6	109.3	35.00	74.3	26.74	
8	116.1	96.5	35.00	61.5	29.50	
10	104.2	86.5	35.00	51.5	30.93	
12	94.7	78.7	35.00	43.7	**31.44**	<=== Required volume
14	86.9	72.2	35.00	37.2	31.26	for storage on-site
16	80.5	66.8	35.00	31.8	30.56	
18	75.0	62.3	35.00	27.3	29.46	
20	70.3	58.4	35.00	23.4	28.03	
22	66.1	54.9	35.00	19.9	26.33	
23	64.3	53.4	35.00	18.4	25.39	

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
24	1.50	0.54
53	1.55	0.56
	Total:	**1.10**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CB24 - CBMH18	30.40	0.30	2.15
CB53 - CBMH18	33.00	0.30	2.33
		Total:	**4.48**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
18	2.07	2.34
	Total:	**2.34**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
5A	228.04	0.24	18.24
5B	245.31	0.24	19.62
5C	96.65	0.14	4.51
		Total:	**42.38**

Overflow from area 6	**7.61**
Total Storage required	**39.05**
Total Surface Storage provided	**42.38**

ICD use Hydrovex 150VHV 35l/s @ 2.73m head, or approved equal

PARKING LOT Area #6

1490 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 21 l/s

Area(ha)=	0.1490				
Cw =	0.90	STORMWATER MANAGEMENT Qm =	21.00 l/s		
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
6	131.6	49.0	21.00	28.0	10.10
7	123.3	46.0	21.00	25.0	10.49
8	116.1	43.3	21.00	22.3	10.70
9	109.8	40.9	21.00	19.9	**10.76**
10	104.2	38.8	21.00	17.8	10.71
11	99.2	37.0	21.00	16.0	10.55
12	94.7	35.3	21.00	14.3	10.30
13	90.6	33.8	21.00	12.8	9.97
14	86.9	32.4	21.00	11.4	9.58
15	83.6	31.1	21.00	10.1	9.13
16	80.5	30.0	21.00	9.0	8.64

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
22	1.60	0.58
23	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB23 - CB22	6.00	0.20	0.19
		Total:	**0.19**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
6A	40.00	0.07	0.93
6B	40.00	0.07	0.93
		Total:	**1.87**

Overflow from area 7A	**2.83**
Overflow from area 4	**3.50**
Total Storage required	**17.09**
Total Surface Storage provided	**1.87**
Overflow to area 5	**7.61**
Overflow to area 12	**7.61**

ICD use Ipex Type A or approved equal

PARKING LOT Area #7A

540 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 5 l/s

Area(ha)=	0.0540				
Cw =	0.90	STORMWATER MANAGEMENT Qm =		5.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
11	99.2	13.4	5.00	8.4	5.55
12	94.7	12.8	5.00	7.8	5.61
13	90.6	12.2	5.00	7.2	5.65
14	86.9	11.7	5.00	6.7	**5.67**
15	83.6	11.3	5.00	6.3	5.66
16	80.5	10.9	5.00	5.9	5.64
17	77.6	10.5	5.00	5.5	5.60
18	75.0	10.1	5.00	5.1	5.54
19	72.5	9.8	5.00	4.8	5.47
20	70.3	9.5	5.00	4.5	5.39
21	68.1	9.2	5.00	4.2	5.30

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
25	1.60	0.58
26	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB26 - CB25	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
		Total:	**0.00**

Total Storage required	**5.67**
Total Surface Storage provided	**0.00**
Overflow to area 9	**2.83**
Overflow to area 6	**2.83**

ICD use Hydrovex 75VHV 5l/s @ 1.41m head, or approved equal

PARKING LOT Area #7D			Updated March 2019			
280 sm						
5 -YR FLOW				Flow restricted to		5 l/s
Qp (l/s)						
Area(ha)=	0.0280					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			5.00 l/s	

Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
4	152.5	10.7	5.00	5.7	1.36	
5	141.2	9.9	5.00	4.9	1.47	
6	131.6	9.2	5.00	4.2	1.52	
7	123.3	8.6	5.00	3.6	**1.53**	<=== Required volume
8	116.1	8.1	5.00	3.1	1.50	for storage on-site
9	109.8	7.7	5.00	2.7	1.45	
10	104.2	7.3	5.00	2.3	1.38	
11	99.2	6.9	5.00	1.9	1.29	
12	94.7	6.6	5.00	1.6	1.18	
13	90.6	6.3	5.00	1.3	1.05	
14	86.9	6.1	5.00	1.1	0.92	

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
58	1.60	0.58
59	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB26 - CB25	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
		Total:	**0.00**

Total Storage required	**1.53**
Total Surface Storage provided	**0.00**
Overflow to Hazeldean Road	**1.53**

ICD use Hydrovex 75VHV 5l/s @ 1.48m head, or approved equal

PARKING LOT Area #8 (A,D,E&F)					
2340 sm					
5 -YR FLOW					
Qp (l/s)					
Area(ha)=	0.2340				
Cw =	0.90	STORMWATER MANAGEMENT Qm =		18.50 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
8	116.1	68.0	18.50	49.5	23.75
10	104.2	61.0	18.50	42.5	25.50
12	94.7	55.4	18.50	36.9	26.60
14	86.9	50.9	18.50	32.4	27.21
16	80.5	47.1	18.50	28.6	**27.46**
18	75.0	43.9	18.50	25.4	27.42
20	70.3	41.1	18.50	22.6	27.16
22	66.1	38.7	18.50	20.2	26.70
24	62.5	36.6	18.50	18.1	26.09
26	59.3	34.7	18.50	16.2	25.34
27	57.9	33.9	18.50	15.4	24.93

Updated Feb 2017

Flow restricted to 18.5 l/s

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
60	1.73	0.62
61	1.81	0.65
62	1.91	0.69
63	2.01	0.72
	Total:	**2.69**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB60 to CB62	24.00	0.25	1.18
CB61 to CB62	17.10	0.25	0.84
CB62 to CB63	22.60	0.38	2.50
		Total:	**4.51**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
8A	438.40	0.20	29.23
8C	44.90	0.15	2.25
		Total:	**31.47**

Overflow from area 9A	**3.85**
Total Storage required	**31.31**
Total Surface Storage provided	**31.47**

ICD use Ipex Tempest 18.5 l/s at 2.25m head or approved equal

PARKING LOT Area #8B						Updated Nov/2012

900 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 10 l/s

Area(ha)=	0.0900				
Cw =	0.90	STORMWATER MANAGEMENT Qm =		10.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
6	131.6	29.6	10.00	19.6	7.07
8	116.1	26.1	10.00	16.1	7.75
10	104.2	23.5	10.00	13.5	8.08
12	94.7	21.3	10.00	11.3	**8.15**
14	86.9	19.6	10.00	9.6	8.04
16	80.5	18.1	10.00	8.1	7.79
18	75.0	16.9	10.00	6.9	7.43
20	70.3	15.8	10.00	5.8	6.98
22	66.1	14.9	10.00	4.9	6.46
24	62.5	14.1	10.00	4.1	5.88
25	60.9	13.7	10.00	3.7	5.57

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
52	1.45	0.52
	Total:	**0.52**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
8B	153.16	0.18	9.19
		Total:	**9.19**

Total Storage required **8.15**
Total Surface Storage provided **9.19**

ICD use Hydrovex 100VHV 10l/s @ 1.55m head, or approved equal

PARKING LOT Area #9A

Updated Feb 2017

1200 sm

5 -YR FLOW

Flow restricted to 21 l/s

Qp (l/s)

Area(ha)=	0.1200				
Cw =	0.90	STORMWATER MANAGEMENT Qm =		21.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
4	152.5	45.8	21.00	24.8	5.95
5	141.2	42.4	21.00	21.4	6.42
6	131.6	39.5	21.00	18.5	6.66
7	123.3	37.0	21.00	16.0	**6.73**
8	116.1	34.9	21.00	13.9	6.65
9	109.8	33.0	21.00	12.0	6.46
10	104.2	31.3	21.00	10.3	6.17
11	99.2	29.8	21.00	8.8	5.80
12	94.7	28.4	21.00	7.4	5.35
13	90.6	27.2	21.00	6.2	4.84
14	86.9	26.1	21.00	5.1	4.28

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
27	1.65	0.59
28	1.30	0.47
	Total:	**1.06**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB28 - CB27	6.00	0.20	0.19
		Total:	**0.19**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
9A	40.00	0.07	0.93
9B	40.00	0.07	0.93
		Total:	**1.87**

Overflow from area 7A	**2.83**
Total Storage required	**9.56**
Total Surface Storage provided	**1.87**
Overflow to area 8A	**3.85**
Overflow to area 14	**3.85**

ICD use Ipex Type A or approved equal

PARKING LOT Area #11						
1730 sm						
5 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.1730					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			18.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
10	104.2	45.1	18.00	27.1	16.26	
11	99.2	42.9	18.00	24.9	16.46	
12	94.7	41.0	18.00	23.0	16.55	
13	90.6	39.2	18.00	21.2	**16.56**	<=== Required volume
14	86.9	37.6	18.00	19.6	16.49	for storage on-site
15	83.6	36.2	18.00	18.2	16.35	
16	80.5	34.8	18.00	16.8	16.15	
17	77.6	33.6	18.00	15.6	15.90	
18	75.0	32.5	18.00	14.5	15.61	
19	72.5	31.4	18.00	13.4	15.27	
20	70.3	30.4	18.00	12.4	14.89	

Flow restricted to 18 l/s

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
10	1.60	0.58
11	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CB11 - CB10	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
11A	134.63	0.13	5.83
11B	85.33	0.13	3.70
		Total:	**9.53**

Total Storage required	**16.56**
Total Surface Storage provided	**9.53**
Overflow to area 16	**7.03**

ICD use Hydrovex 125VHV 18l/s @ 1.63m head, or approved equal

PARKING LOT Area #12

2040 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 21 l/s

Area(ha)=	0.2040	STORMWATER MANAGEMENT Qm =	21.00 l/s		
Cw =	0.90				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
4	152.5	77.8	21.00	56.8	13.64
6	131.6	67.2	21.00	46.2	16.62
8	116.1	59.3	21.00	38.3	18.37
10	104.2	53.2	21.00	32.2	19.31
12	94.7	48.3	21.00	27.3	**19.68**
14	86.9	44.4	21.00	23.4	19.63
16	80.5	41.1	21.00	20.1	19.26
18	75.0	38.3	21.00	17.3	18.65
20	70.3	35.9	21.00	14.9	17.83
22	66.1	33.8	21.00	12.8	16.85
23	64.3	32.8	21.00	11.8	16.30

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
41	1.50	0.54
	Total:	**0.54**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB41 - 28	19.50	0.30	1.38
		Total:	**1.38**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
28	2.56	2.89
	Total:	**2.89**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
12	536.13	0.18	32.17
		Total:	**32.17**

Overflow from area 6	**7.61**
Total Storage required	**27.29**
Total Surface Storage provided	**32.17**

ICD use Ipex Type A or approved equal

PARKING LOT Area #14 (14A,B)

2720 sm

5 -YR FLOW

Qp (l/s)

Updated Feb 2017

Flow restricted to 21 l/s

Area(ha)=	0.2720				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			21.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
10	104.2	70.9	21.00	49.9	29.94
12	94.7	64.4	21.00	43.4	31.28
14	86.9	59.2	21.00	38.2	32.06
16	80.5	54.8	21.00	33.8	32.41
18	75.0	51.0	21.00	30.0	**32.42** <=== Required volume for storage on-site
20	70.3	47.8	21.00	26.8	32.17
22	66.1	45.0	21.00	24.0	31.70
24	62.5	42.6	21.00	21.6	31.05
26	59.3	40.4	21.00	19.4	30.24
28	56.5	38.4	21.00	17.4	29.31
29	55.2	37.6	21.00	16.6	28.80

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
39	1.57	0.57
40	1.45	0.52
	Total:	**1.09**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB40 - 27	44.00	0.25	2.16
CB39 - 27	21.30	0.38	2.35
		Total:	**4.51**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
27	2.57	2.90
	Total:	**2.90**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
14A	665.69	0.18	39.94
14B	91.87	0.18	5.51
		Total:	**45.45**

Overflow from area 9A	**3.85**
Total Storage required	**36.27**
Total Surface Storage provided	**45.45**

ICD use Hydrovex 125VHV 21l/s @ 2.87m head, or approved equal

PARKING LOT Area #15 (15A,B,C,D,E,F)						
10340 sm		Updated Feb 2017				
5 -YR FLOW				Flow restricted to	43 l/s	
Qp (l/s)						
Area(ha)=	1.0340					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			43.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
24	62.5	161.8	43.00	118.8	171.07	
26	59.3	153.5	43.00	110.5	172.43	
28	56.5	146.1	43.00	103.1	173.29	
30	53.9	139.5	43.00	96.5	173.73	
32	51.6	133.5	43.00	90.5	**173.79**	<=== Required volume
34	49.5	128.1	43.00	85.1	173.53	for storage on-site
36	47.6	123.1	43.00	80.1	172.98	
38	45.8	118.5	43.00	75.5	172.17	
40	44.2	114.3	43.00	71.3	171.14	
42	42.7	110.4	43.00	67.4	169.90	
43	42.0	108.6	43.00	65.6	169.21	

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
8	1.50	0.54
9	1.60	0.58
12	1.65	0.59
	Total:	**1.71**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CBMH9 - CBMH10	34.20	0.60	9.67
CBMH10 - CBMH11	38.60	0.53	8.36
CB8 - CBMH11	38.60	0.30	2.73
CB9 - CBMH11	33.00	0.25	1.62
CB12 - CBMH11	44.80	0.45	7.13
		Total:	**29.50**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
9	2.42	2.73
10 (1.5 dia)	2.35	4.15
11	2.14	2.42
	Total:	**9.31**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
15A	62.14	0.07	1.45
15B	644.08	0.22	47.23
15C	696.50	0.22	51.08
15D	538.48	0.22	39.49
15E	603.30	0.22	44.24
15F	253.73	0.12	10.15
		Total:	**193.64**

Overflow from area 2	**3.01**
Overflow from area 3	**3.38**
Total Storage required	**180.18**
Total Surface Storage provided	**193.64**

ICD use IPEX TEMPEST 43l/s @ 3.06m head, or approved equal

PARKING LOT Area #16

1050 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 29 l/s

Area(ha)=	0.1050				
Cw =	0.90	STORMWATER MANAGEMENT Qm =	29.00 l/s		
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
0.5	216.1	56.8	29.00	27.8	0.83
1.5	192.5	50.6	29.00	21.6	1.94
2.5	173.9	45.7	29.00	16.7	2.50
3.5	159.0	41.8	29.00	12.8	**2.68**
4.5	146.6	38.5	29.00	9.5	2.57
5.5	136.2	35.8	29.00	6.8	2.24
6.5	127.3	33.4	29.00	4.4	1.73
7.5	119.6	31.4	29.00	2.4	1.09
8.5	112.9	29.6	29.00	0.6	0.33
9.5	106.9	28.1	29.00	-0.9	-0.52
10.5	101.6	26.7	29.00	-2.3	-1.45

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
6	1.60	0.58
7	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB6 - CB7	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
16A	135.45	0.13	5.87
16B	163.52	0.13	7.09
		Total:	**12.96**

Overflow from area 11	**7.03**
Total Storage required	**9.71**
Total Surface Storage provided	**12.96**

ICD use Hydrovex 150VHV 29l/s @ 1.62m head, or approved equal

PARKING LOT Area #17 (17A,B,C,D,E,F)						Updated March 2019

7090 sm

5 -YR FLOW

Flow restricted to 82 l/s

Qp (l/s)

Area(ha)=	0.7090				
Cw =	0.90	STORMWATER MANAGEMENT Qm =	82.00 l/s		
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
3	166.1	294.6	82.00	212.6	38.27
5	141.2	250.4	82.00	168.4	50.53
7	123.3	218.7	82.00	136.7	57.43
9	109.8	194.8	82.00	112.8	60.89
11	99.2	176.0	82.00	94.0	**62.01**
13	90.6	160.8	82.00	78.8	61.44
15	83.6	148.2	82.00	66.2	59.60
17	77.6	137.7	82.00	55.7	56.78
19	72.5	128.7	82.00	46.7	53.19
21	68.1	120.9	82.00	38.9	48.96
22	66.1	117.3	82.00	35.3	46.65

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
42	1.47	0.53
43	1.45	0.52
44	1.45	0.52
45	1.50	0.54
	Total:	**2.11**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB42 - CBMH29	34.20	0.25	1.68
CB 43 - CBMH29	34.20	0.25	1.68
CBMH29 - CBMH30	38.90	0.45	6.19
CB44 - CBMH30	34.20	0.25	1.68
CB45 - CBMH30	34.20	0.30	2.42
		Total:	**13.64**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
29	2.50	2.83
30	2.34	2.64
	Total:	**5.47**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
17A	220.60	0.14	10.29
17B	188.99	0.14	8.82
17C	111.16	0.14	5.19
17D	358.98	0.14	16.75
17E	350.76	0.14	16.37
17F	173.44	0.14	8.09
		Total:	**65.52**

Total Storage required 62.01
Total Surface Storage provided 65.52

ICD use Hydrovex 250VHV 82l/s @ 2.97m head, or approved equal

PARKING LOT Area #18

1830 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 21 l/s

Area(ha)=	0.1830	STORMWATER MANAGEMENT Qm =			21.00 l/s
Cw =	0.90				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
8	116.1	53.2	21.00	32.2	15.44
9	109.8	50.3	21.00	29.3	15.81
10	104.2	47.7	21.00	26.7	16.02
11	99.2	45.4	21.00	24.4	**16.11**
12	94.7	43.4	21.00	22.4	16.10
13	90.6	41.5	21.00	20.5	15.99
14	86.9	39.8	21.00	18.8	15.80
15	83.6	38.3	21.00	17.3	15.53
16	80.5	36.8	21.00	15.8	15.21
17	77.6	35.5	21.00	14.5	14.82
18	75.0	34.3	21.00	13.3	14.39

<=== Required volume for storage on-site (11 min: 16.11)

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
35	1.60	0.58
36	1.30	0.47
	Total:	**1.04**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CB36 - CB35	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
18A	115.03	0.14	5.37
18B	94.54	0.14	4.41
		Total:	**9.78**

Total Storage required	**16.11**
Total Surface Storage provided	**9.78**
overflow to 19	**6.33**

ICD use Ipex Type A or approved equal

PARKING LOT Area #19

770 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 29 l/s

Area(ha)=	0.0770	STORMWATER MANAGEMENT Qm =			29.00 l/s
Cw =	0.90				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
0.25	223.0	43.0	29.00	14.0	0.21
0.75	209.6	40.4	29.00	11.4	0.51
1.25	197.8	38.1	29.00	9.1	0.68
1.75	187.4	36.1	29.00	7.1	**0.75**
2.25	178.2	34.3	29.00	5.3	0.72
2.75	169.9	32.7	29.00	3.7	0.62
3.25	162.4	31.3	29.00	2.3	0.45
3.75	155.7	30.0	29.00	1.0	0.22
4.25	149.5	28.8	29.00	-0.2	-0.05
4.75	143.8	27.7	29.00	-1.3	-0.37
5.25	138.6	26.7	29.00	-2.3	-0.72

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
33	1.60	0.58
34	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB34 - CB33	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
19A	66.62	0.14	3.11
19B	80.81	0.14	3.77
		Total:	**6.88**

overflow from 18	**6.33**
Total Storage required	**7.08**
Total Storage provided	**7.96**

ICD use Hydrovex 150VHV 29l/s @ 1.72m head, or approved equal

PARKING LOT Area #20 (20A,B,C,D)						
6400 sm						
5 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.6400					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			48.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
9	109.8	175.8	48.00	127.8	69.02	
11	99.2	158.8	48.00	110.8	73.15	
13	90.6	145.1	48.00	97.1	75.76	
15	83.6	133.8	48.00	85.8	77.22	
17	77.6	124.3	48.00	76.3	**77.80**	<=== Required volume
19	72.5	116.1	48.00	68.1	77.67	for storage on-site
21	68.1	109.1	48.00	61.1	76.98	
23	64.3	102.9	48.00	54.9	75.82	
25	60.9	97.5	48.00	49.5	74.27	
27	57.9	92.7	48.00	44.7	72.38	
28	56.5	90.5	48.00	42.5	71.33	

Updated March 2019

Flow restricted to 48 l/s

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
31	1.45	0.52
32	1.45	0.52
	Total:	**0.52**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CBMH32 - CBMH24	42.10	0.60	11.90
CBMH24 - CBMH25	39.00	0.45	6.20
CB32 - CBMH25	42.80	0.25	2.10
CB31 - CBMH25	42.80	0.25	2.10
		Total:	**22.31**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
24	2.59	2.93
25 (1.5m dia)	2.30	4.06
32	2.71	3.06
	Total:	**10.05**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
20A	88.84	0.13	3.85
20B	1184.13	0.18	71.05
20C	278.87	0.13	12.08
20D	210.89	0.13	9.14
		Total:	**96.12**

Total Storage required 77.80
Total Surface Storage provided 96.12

ICD use Hydrovex 200VHV 48l/s @ 3.14m head, or approved equal

PARKING LOT Area #21

1910 sm

5 -YR FLOW

Flow restricted to 10 l/s

Qp (l/s)

Area(ha)=	0.1910				
Cw =	0.60	STORMWATER MANAGEMENT Qm =		10.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
14	86.9	27.7	10.00	17.7	14.86
15	83.6	26.6	10.00	16.6	14.96
16	80.5	25.6	10.00	15.6	15.01
17	77.6	24.7	10.00	14.7	**15.02**
18	75.0	23.9	10.00	13.9	15.00
19	72.5	23.1	10.00	13.1	14.94
20	70.3	22.4	10.00	12.4	14.86
21	68.1	21.7	10.00	11.7	14.75
22	66.1	21.1	10.00	11.1	14.62
23	64.3	20.5	10.00	10.5	14.46
24	62.5	19.9	10.00	9.9	14.29

<=== Required volume for storage on-site (17 min, 15.02)

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
2	1.40	0.50
	Total:	**0.50**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
21	191.58	0.25	15.97
		Total:	**15.97**

Total Storage required **15.02**
Total Surface Storage provided **15.97**

ICD use Hydrovex 100VHV 10l/s @ 1.65m head, or approved equal

PARKING LOT Area #21A					
270 sm					
5 -YR FLOW				Flow restricted to	5 l/s
Qp (l/s)					
Area(ha)=	0.0270				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			5.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
4	152.5	10.3	5.00	5.3	1.27
5	141.2	9.5	5.00	4.5	1.36
6	131.6	8.9	5.00	3.9	1.40
7	123.3	8.3	5.00	3.3	**1.40**
8	116.1	7.8	5.00	2.8	1.37
9	109.8	7.4	5.00	2.4	1.31
10	104.2	7.0	5.00	2.0	1.22
11	99.2	6.7	5.00	1.7	1.12
12	94.7	6.4	5.00	1.4	1.01
13	90.6	6.1	5.00	1.1	0.88
14	86.9	5.9	5.00	0.9	0.73

<=== Required volume for storage on-site (7 min row)

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
1	1.40	0.50
	Total:	**0.50**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

PARKING LOT STORAGE

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
21A	35.32	0.15	1.77
		Total:	**1.77**

Total Storage required **1.40**
Total Surface Storage provided **1.77**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

ICD use Hydrovex 75VHV 5l/s @ 1.45m head, or approved equal

PARKING LOT Area #22							
1720 sm			Updated March 2019				
5 -YR FLOW				Flow restricted to	12 l/s		
Qp (l/s)							
Area(ha)=	0.1720						
Cw =	0.90	STORMWATER MANAGEMENT Qm =			12.00 l/s		
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)		
16	80.5	34.6	12.00	22.6	21.72		
17	77.6	33.4	12.00	21.4	21.83		
18	75.0	32.3	12.00	20.3	21.88		
19	72.5	31.2	12.00	19.2	**21.90**	<===	Required volume
20	70.3	30.2	12.00	18.2	21.88		for storage on-site
21	68.1	29.3	12.00	17.3	21.82		
22	66.1	28.5	12.00	16.5	21.73		
23	64.3	27.7	12.00	15.7	21.62		
24	62.5	26.9	12.00	14.9	21.48		
25	60.9	26.2	12.00	14.2	21.31		
26	59.3	25.5	12.00	13.5	21.12		

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
55	1.26	0.45
	Total:	**0.45**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
22	286.07	0.23	21.93
		Total:	**21.93**

Total Storage required	**21.90**
Total Surface Storage provided	**21.93**

ICD use Hydrovex 100VHV 12l/s @ 1.57m head, or approved equal

PARKING LOT Area #23						
1410 sm						
5 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.1410					
Cw =	0.60	STORMWATER MANAGEMENT Qm =			21.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
2	182.7	43.0	21.00	22.0	2.64	
3	166.1	39.1	21.00	18.1	3.25	
4	152.5	35.9	21.00	14.9	3.57	
5	141.2	33.2	21.00	12.2	**3.66**	<=== Required volume for storage on-site
6	131.6	30.9	21.00	9.9	3.58	
7	123.3	29.0	21.00	8.0	3.36	
8	116.1	27.3	21.00	6.3	3.03	
9	109.8	25.8	21.00	4.8	2.60	
10	104.2	24.5	21.00	3.5	2.10	
11	99.2	23.3	21.00	2.3	1.54	
12	94.7	22.3	21.00	1.3	0.92	

Updated March 2019

Flow restricted to 21 l/s

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
3		
	Total:	**0.00**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
23	172.34	0.15	8.62
		Total:	**8.62**

Overflow form 23B	**2.98**
Total Storage required	**6.65**
Total Surface Storage provided	**8.62**

ICD IPEX type A, or approved equal

PARKING LOT Area #23B						
1430 sm						
5 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.1430					
Cw =	0.90	STORMWATER MANAGEMENT Qm =			9.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
18	75.0	26.8	9.00	17.8	19.25	
19	72.5	25.9	9.00	16.9	19.32	
20	70.3	25.1	9.00	16.1	19.36	
21	68.1	24.4	9.00	15.4	**19.37**	<=== Required volume for storage on-site
22	66.1	23.7	9.00	14.7	19.36	
23	64.3	23.0	9.00	14.0	19.32	
24	62.5	22.4	9.00	13.4	19.26	
25	60.9	21.8	9.00	12.8	19.18	
26	59.3	21.2	9.00	12.2	19.08	
27	57.9	20.7	9.00	11.7	18.97	
28	56.5	20.2	9.00	11.2	18.84	

Updated March 2019

Flow restricted to 9 l/s

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
61	1.26	0.45
	Total:	**0.45**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
Oversized Subdrains	30.00	0.45	4.77
		Total:	**4.77**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
23B	304.74	0.21	21.33
		Total:	**21.33**

Overflow from 23C	**10.17**
Total Storage required	**29.54**
Total Surface Storage provided	**26.56**
Overflow to 23	**2.98**

ICD use Hydrovex 50VHV 3l/s @ 2.1m head, or approved equal

PARKING LOT Area #23C

Updated March 2019

2180 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 9 l/s

Area(ha)=	0.2180	STORMWATER MANAGEMENT Qm =			9.00 l/s
Cw =	0.90				

Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
29	55.2	30.1	9.00	21.1	36.71	
30	53.9	29.4	9.00	20.4	36.75	
31	52.7	28.8	9.00	19.8	36.77	
32	51.6	28.1	9.00	19.1	**36.77**	<=== Required volume
33	50.5	27.6	9.00	18.6	36.75	for storage on-site
34	49.5	27.0	9.00	18.0	36.72	
35	48.5	26.5	9.00	17.5	36.67	
36	47.6	25.9	9.00	16.9	36.61	
37	46.7	25.5	9.00	16.5	36.54	
38	45.8	25.0	9.00	16.0	36.45	
39	45.0	24.5	9.00	15.5	36.35	

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
62	1.26	0.45
	Total:	**0.45**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
Oversized Subdrains	30.00	0.45	4.77
		Total:	**4.77**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
23C	305.35	0.21	21.37
	`		
		Total:	**21.37**

Total Storage required	**36.77**
Total Surface Storage provided	**26.60**
Overflow to 23B	**10.17**

ICD use Hydrovex 50VHV 3l/s @ 2.1m head, or approved equal

PARKING LOT Area #24

Updated March 2019

1220 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 35 l/s

Area(ha)=	0.1220				
Cw =	0.70	STORMWATER MANAGEMENT Qm =			35.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
-1	267.0	63.4	35.00	28.4	-1.70
0	230.5	54.7	35.00	19.7	0.00
1	203.5	48.3	35.00	13.3	0.80
2	182.7	43.4	35.00	8.4	**1.00**
3	166.1	39.4	35.00	4.4	0.80
4	152.5	36.2	35.00	1.2	0.29
5	141.2	33.5	35.00	-1.5	-0.44
6	131.6	31.2	35.00	-3.8	-1.36
7	123.3	29.3	35.00	-5.7	-2.41
8	116.1	27.6	35.00	-7.4	-3.57
9	109.8	26.1	35.00	-8.9	-4.82

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
4	1.53	0.55
	Total:	**0.55**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
24	160.19	0.13	6.94
		Total:	**6.94**

Overflow from 23 **0.00**
Total Storage required **1.00**
Total Surface Storage provided **6.94**

ICD use Hydrovex 150VHV 35l/s @ 1.68m head, or approved equal

PARKING LOT Area #24A

200 sm					
5 -YR FLOW		Flow restricted to		3 l/s	
Qp (l/s)					
Area(ha)=	0.0200				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			3.00 l/s
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
6	131.6	6.6	3.00	3.6	1.29
7	123.3	6.2	3.00	3.2	1.33
8	116.1	5.8	3.00	2.8	1.35
9	109.8	5.5	3.00	2.5	**1.35**
10	104.2	5.2	3.00	2.2	1.33
11	99.2	5.0	3.00	2.0	1.30
12	94.7	4.7	3.00	1.7	1.25
13	90.6	4.5	3.00	1.5	1.20
14	86.9	4.4	3.00	1.4	1.13
15	83.6	4.2	3.00	1.2	1.06
16	80.5	4.0	3.00	1.0	0.99

<=== Required volume for storage on-site (9 min: 1.35)

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
56	1.24	0.45
	Total:	**0.45**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
23C	33.91	0.16	1.81
		Total:	**1.81**

Total Storage required **1.35**
Total Surface Storage provided **1.81**

ICD use Hydrovex 50VHV 3l/s @ 1.44m head, or approved equal

PARKING LOT Area #25

1820 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 27 l/s

Area(ha)=	0.1820	STORMWATER MANAGEMENT Qm =			27.00 l/s
Cw =	0.70				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
3	166.1	58.8	27.00	31.8	5.73
4	152.5	54.0	27.00	27.0	6.48
5	141.2	50.0	27.00	23.0	6.90
6	131.6	46.6	27.00	19.6	**7.06**
7	123.3	43.7	27.00	16.7	7.00
8	116.1	41.1	27.00	14.1	6.78
9	109.8	38.9	27.00	11.9	6.42
10	104.2	36.9	27.00	9.9	5.94
11	99.2	35.1	27.00	8.1	5.37
12	94.7	33.5	27.00	6.5	4.71
13	90.6	32.1	27.00	5.1	3.98

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
5	1.60	0.58
	Total:	**0.58**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

PARKING LOT STORAGE

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
25	234.71	0.11	8.61
		Total:	**8.61**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

Total Storage required **7.06**
Total Surface Storage provided **8.61**

ICD use Hydrovex 150VHV 27l/s @ 1.60m head, or approved equal

PARKING LOT Area #25A

280 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 2 l/s

Area(ha)=	0.0280	STORMWATER MANAGEMENT Qm =			2.00 l/s
Cw =	0.90				
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
14	86.9	6.1	2.00	4.1	3.44
15	83.6	5.9	2.00	3.9	3.47
16	80.5	5.6	2.00	3.6	3.49
17	77.6	5.4	2.00	3.4	**3.51** <=== Required volume for storage on-site
18	75.0	5.3	2.00	3.3	3.51
19	72.5	5.1	2.00	3.1	3.51
20	70.3	4.9	2.00	2.9	3.51
21	68.1	4.8	2.00	2.8	3.49
22	66.1	4.6	2.00	2.6	3.48
23	64.3	4.5	2.00	2.5	3.46
24	62.5	4.4	3.00	1.4	1.99

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
57	1.22	0.44
	Total:	**0.44**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
25A	58.10	0.20	3.87
		Total:	**3.87**

Total Storage required **3.51**
Total Surface Storage provided **3.87**

ICD use Hydrovex 50VHV 2l/s @ 1.42m head, or approved equal

PARKING LOT Area #26

620 sm

5 -YR FLOW

Qp (l/s)

Flow restricted to 5 l/s

Area(ha)=	0.0620				
Cw =	0.90	STORMWATER MANAGEMENT Qm =			5.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
13	90.6	14.1	5.00	9.1	7.07
14	86.9	13.5	5.00	8.5	7.13
15	83.6	13.0	5.00	8.0	7.17
16	80.5	12.5	5.00	7.5	**7.18**
17	77.6	12.0	5.00	7.0	7.18
18	75.0	11.6	5.00	6.6	7.16
19	72.5	11.3	5.00	6.3	7.13
20	70.3	10.9	5.00	5.9	7.08
21	68.1	10.6	5.00	5.6	7.02
22	66.1	10.3	5.00	5.3	6.94
23	64.3	10.0	5.00	5.0	6.86

<=== Required volume for storage on-site (7.18)

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
54	1.34	0.48
	Total:	**0.48**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

PARKING LOT STORAGE

AREA #	AREA (SM)	Depth (m)	Storage (m3)
26	132.00	0.17	7.48
		Total:	**7.48**

Total Storage required 7.18
Total Surface Storage provided 7.48

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

ICD use Hydrovex 75VHV 5l/s @ 1.55m head, or approved equal

Phase 1 & 2 SUMMARY

Total Flow from Roofs=	**82.50 l/s**
Total Roof Area =	**2.012 Ha**
Average roof flow =	**41.00 l/s/Ha**
Volume Stored on Roofs	**349.61 cm**
Total Roof Storage rate	**173.75 cm/Ha**
Total flow from parking lot =	**622.50 l/s**
Total parking Lot area =	**6.285 Ha**
Average parking lot flow =	**99.05 l/s/Ha**
Volume Stored on Parking lot	**745.47 cm**
Total Parking lot Storage rate	**118.61 cm/Ha**
Total flow	**705.00 l/s**
Total area	**8.297 Ha**
Average flow	**84.97 l/s/Ha**
Volume Stored	**1095.09 cm**
Total Storage rate	**131.98 cm/Ha**

IBI	ONSITE SWM 100yr design		PAGE: 1 OF 1
333 Preston St	PROJECT:	HUNTMAR PLAZA	JOB #: 10113
OTTAWA, ONTARIO		CITY OF OTTAWA	DATE: 2019-03
K1S 5N4	DEVELOPER : NORTH AMERICAN		DESIGN: DY
			Rev#6 Box D, Pad B, CRU B-3

LANDS EAST OF HUNTMAR DR Phase 1 & 2, 100 yr design

MAXIMUM ALLOWABLE FLOW - Flow Restricted to 85 l/s/Ha

Time of concentration = 10 minutes

Area (ha) =	**8.297**
C Average =	**0.88**

Intensity - 5 year event storm

10 min Tc	i5yr = 998.071/(T+6.053)^0.814=	**104.2**	mm/hr

Unrestricted Flowrate (Q5)

10 min Tc	Qpre-devo = 2.78*A*Cw*i =	**2114.94** l/s

Restricted Flowrate (Q5)

10 min Tc	Q= 85 l/s/Ha	**705.26** l/s

Intensity - 100 year event storm

10 min Tc	i100yr = 1735.688/(T+6.014)^0.82	**178.6**	mm/hr

Unrestricted Flowrate (Q100)

10 min Tc	Qpost-devo = 2.78*A*Cw*i =	**3624.44** l/s

Restricted Flowrate (Q5)

10 min Tc	Q= 85 l/s/Ha	**705.26** l/s

STORM WATER MANAGEMENT - Post-Development Controlled

(100 year post-development to 85 l/sec/Ha)

ROOF AREA # Box A (21B)

3260 sm

100 -YR FLOW

Qp (l/s)

Area(ha)=	0.3260				
Cw =	1.00	STORMWATER MANAGEMENT Qm =			16.00 l/s
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
42	72.6	65.8	16.00	49.8	125.41
44	70.2	63.6	16.00	47.6	125.67
46	68.0	61.6	16.00	45.6	125.83
48	65.9	59.7	16.00	43.7	**125.90**
50	64.0	58.0	16.00	42.0	125.88
52	62.1	56.3	16.00	40.3	125.79
54	60.4	54.8	16.00	38.8	125.62
56	58.8	53.3	16.00	37.3	125.40
58	57.3	52.0	16.00	36.0	125.11
60	55.9	50.7	16.00	34.7	124.76
62	54.5	49.4	16.00	33.4	124.37
64	53.3	48.3	16.00	32.3	123.92

<=== Required volume for roof storage

Req. Storage volume 125.90 m3

Average depth 0.039 m

ROOF AREA # CRU B-3 (23A)		Updated March 2019			
1490 sm					
100 -YR FLOW					
Qp (l/s)					
Area(ha)=	0.1490				
Cw =	1.00	STORMWATER MANAGEMENT Qm =			4.00 l/s
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
81	44.6	18.5	4.00	14.5	70.28
83	43.7	18.1	4.00	14.1	70.32
85	43.0	17.8	4.00	13.8	70.34
87	42.2	17.5	4.00	13.5	**70.36**
89	41.5	17.2	4.00	13.2	70.36
91	40.8	16.9	4.00	12.9	70.35
93	40.1	16.6	4.00	12.6	70.33
95	39.4	16.3	4.00	12.3	70.31
97	38.8	16.1	4.00	12.1	70.27
99	38.2	15.8	4.00	11.8	70.23
101	37.6	15.6	4.00	11.6	70.17
103	37.0	15.3	4.00	11.3	70.11

<=== Required volume for roof storage

Req. Storage volume 70.36 m3
Average depth 0.047 m

ROOF AREA # --OBSOLETE--		Updated March 2019			
0 sm					
100 -YR FLOW					
Qp (l/s)					
Area(ha)=	0.0000				
Cw =	0.00	STORMWATER MANAGEMENT Qm =			0.00 l/s
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
0	398.6	0.0	0.00	0.0	0.00
2	315.0	0.0	0.00	0.0	0.00
4	262.4	0.0	0.00	0.0	0.00
6	226.0	0.0	0.00	0.0	**0.00**
8	199.2	0.0	0.00	0.0	0.00
10	178.6	0.0	0.00	0.0	0.00
12	162.1	0.0	0.00	0.0	0.00
14	148.7	0.0	0.00	0.0	0.00
16	137.5	0.0	0.00	0.0	0.00
18	128.1	0.0	0.00	0.0	0.00
20	120.0	0.0	0.00	0.0	0.00
22	112.9	0.0	0.00	0.0	0.00

OBSOLETE Reserved for Future Use OBSOLETE

<=== Required volume for roof storage

Req. Storage volume 0.00 m3
Average depth #DIV/0! m

ROOF AREA # Box D (24B)

2320 sm

100 -YR FLOW

Qp (l/s)

Area(ha)=	0.2320					
Cw =	1.00	STORMWATER MANAGEMENT Qm =			10.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume	
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)	
50	64.0	41.2	10.00	31.2	93.74	
52	62.1	40.1	10.00	30.1	93.84	
54	60.4	39.0	10.00	29.0	93.89	
56	58.8	37.9	10.00	27.9	**93.90**	<=== Required volume for roof storage
58	57.3	37.0	10.00	27.0	93.86	
60	55.9	36.0	10.00	26.0	93.78	
62	54.5	35.2	10.00	25.2	93.66	
64	53.3	34.4	10.00	24.4	93.51	
66	52.0	33.6	10.00	23.6	93.33	
68	50.9	32.8	10.00	22.8	93.11	
70	49.8	32.1	10.00	22.1	92.87	
72	48.7	31.4	10.00	21.4	92.60	

Req. Storage volume 93.90 m3
Average depth 0.040 m

ROOF AREA # Box E (25B)

4260 sm

100 -YR FLOW

Qp (l/s)

Area(ha)=	0.4260					
Cw =	1.00	STORMWATER MANAGEMENT Qm =			20.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume	
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)	
44	70.2	83.1	20.00	63.1	166.62	
46	68.0	80.5	20.00	60.5	166.93	
48	65.9	78.0	20.00	58.0	167.13	
50	64.0	75.7	20.00	55.7	**167.22**	<=== Required volume for roof storage
52	62.1	73.6	20.00	53.6	167.21	
54	60.4	71.6	20.00	51.6	167.10	
56	58.8	69.7	20.00	49.7	166.91	
58	57.3	67.9	20.00	47.9	166.64	
60	55.9	66.2	20.00	46.2	166.30	
62	54.5	64.6	20.00	44.6	165.89	
64	53.3	63.1	20.00	43.1	165.42	
66	52.0	61.6	20.00	41.6	164.88	

Req. Storage volume 167.22 m3
Average depth 0.039 m

ROOF AREA # CRU A (6D)

1200 sm

100 -YR FLOW

Qp (l/s)

Area(ha)=	0.1200				
Cw =	1.00	STORMWATER MANAGEMENT Qm =			3.50 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
75	47.3	15.8	3.50	12.3	55.19
77	46.3	15.5	3.50	12.0	55.22
79	45.4	15.2	3.50	11.7	55.24
81	44.6	14.9	3.50	11.4	**55.25**
83	43.7	14.6	3.50	11.1	55.24
85	43.0	14.3	3.50	10.8	55.23
87	42.2	14.1	3.50	10.6	55.21
89	41.5	13.8	3.50	10.3	55.18
91	40.8	13.6	3.50	10.1	55.14
93	40.1	13.4	3.50	9.9	55.09
95	39.4	13.2	3.50	9.7	55.04
97	38.8	12.9	3.50	9.4	54.97

<=== Required volume for roof storage

Req. Storage volume 55.25 m3
Average depth 0.046 m

ROOF AREA # CRU B-2 (22A)

Updated March 2019

920 sm

100 -YR FLOW

Qp (l/s)

Area(ha)=	0.0920				
Cw =	1.00	STORMWATER MANAGEMENT Qm =			2.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
102	37.3	9.5	2.00	7.5	46.19
104	36.8	9.4	2.00	7.4	46.20
106	36.2	9.3	2.00	7.3	46.21
108	35.7	9.1	2.00	7.1	**46.22**
110	35.2	9.0	2.00	7.0	46.22
112	34.7	8.9	2.00	6.9	46.22
114	34.2	8.8	2.00	6.8	46.21
116	33.8	8.6	2.00	6.6	46.21
118	33.3	8.5	2.00	6.5	46.19
120	32.9	8.4	2.00	6.4	46.17
122	32.5	8.3	2.00	6.3	46.15
124	32.1	8.2	2.00	6.2	46.13

<=== Required volume for roof storage

Req. Storage volume 46.22 m3
Average depth 0.050 m

ROOF AREA # CRU B-1 (26A)

830 sm

100 -YR FLOW

Qp (l/s)

Area(ha)=	0.0830					
Cw =	1.00	STORMWATER MANAGEMENT Qm =			2.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume	
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)	
92	40.4	9.3	2.00	7.3	40.44	
94	39.8	9.2	2.00	7.2	40.46	
96	39.1	9.0	2.00	7.0	40.47	
98	38.5	8.9	2.00	6.9	**40.47**	<=== Required volume for roof storage
100	37.9	8.7	2.00	6.7	40.47	
102	37.3	8.6	2.00	6.6	40.47	
104	36.8	8.5	2.00	6.5	40.46	
106	36.2	8.4	2.00	6.4	40.45	
108	35.7	8.2	2.00	6.2	40.43	
110	35.2	8.1	2.00	6.1	40.41	
112	34.7	8.0	2.00	6.0	40.38	
114	34.2	7.9	2.00	5.9	40.36	

Req. Storage volume 40.47 m3
Average depth 0.049 m

ROOF AREA # Pad A (2B)

1570 sm

100 -YR FLOW

Qp (l/s)

Area(ha)=	0.1570					
Cw =	1.00	STORMWATER MANAGEMENT Qm =			4.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume	
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)	
89	41.5	18.1	4.00	14.1	75.28	
91	40.8	17.8	4.00	13.8	75.30	
93	40.1	17.5	4.00	13.5	75.31	
95	39.4	17.2	4.00	13.2	**75.31**	<=== Required volume for roof storage
97	38.8	16.9	4.00	12.9	75.29	
99	38.2	16.7	4.00	12.7	75.27	
101	37.6	16.4	4.00	12.4	75.24	
103	37.0	16.2	4.00	12.2	75.20	
105	36.5	15.9	4.00	11.9	75.16	
107	36.0	15.7	4.00	11.7	75.10	
109	35.5	15.5	4.00	11.5	75.04	
111	35.0	15.3	4.00	11.3	74.97	

Req. Storage volume 75.31 m3
Average depth 0.048 m

ROOF AREA # Pad B (6C)

Updated March 2019

620 sm

100 -YR FLOW

Qp (l/s)

Area(ha)=	0.0620				
Cw =	1.00	STORMWATER MANAGEMENT Qm =		3.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
43	71.4	12.3	3.00	9.3	23.99
45	69.1	11.9	3.00	8.9	24.03
47	66.9	11.5	3.00	8.5	24.06
49	64.9	11.2	3.00	8.2	**24.07**
51	63.0	10.9	3.00	7.9	24.06
53	61.3	10.6	3.00	7.6	24.05
55	59.6	10.3	3.00	7.3	24.01
57	58.1	10.0	3.00	7.0	23.97
59	56.6	9.8	3.00	6.8	23.91
61	55.2	9.5	3.00	6.5	23.85
63	53.9	9.3	3.00	6.3	23.77
65	52.6	9.1	3.00	6.1	23.69

<=== Required volume for roof storage

Req. Storage volume 24.07 m3
Average depth 0.039 m

ROOF AREA # Pad C (6B)

620 sm

100 -YR FLOW

Qp (l/s)

Area(ha)=	0.0620				
Cw =	1.00	STORMWATER MANAGEMENT Qm =		3.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
43	71.4	12.3	3.00	9.3	23.99
45	69.1	11.9	3.00	8.9	24.03
47	66.9	11.5	3.00	8.5	24.06
49	64.9	11.2	3.00	8.2	**24.07**
51	63.0	10.9	3.00	7.9	24.06
53	61.3	10.6	3.00	7.6	24.05
55	59.6	10.3	3.00	7.3	24.01
57	58.1	10.0	3.00	7.0	23.97
59	56.6	9.8	3.00	6.8	23.91
61	55.2	9.5	3.00	6.5	23.85
63	53.9	9.3	3.00	6.3	23.77
65	52.6	9.1	3.00	6.1	23.69

<=== Required volume for roof storage

Req. Storage volume 24.07 m3
Average depth 0.039 m

ROOF AREA # Pad D (9C)

450 sm

100 -YR FLOW

Qp (l/s)

Area(ha)=	0.0450				
Cw =	1.00	STORMWATER MANAGEMENT Qm =		3.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
31	89.8	11.2	3.00	8.2	15.32
33	86.0	10.8	3.00	7.8	15.37
35	82.6	10.3	3.00	7.3	15.39
37	79.4	9.9	3.00	6.9	**15.40**
39	76.5	9.6	3.00	6.6	15.38
41	73.8	9.2	3.00	6.2	15.34
43	71.4	8.9	3.00	5.9	15.29
45	69.1	8.6	3.00	5.6	15.22
47	66.9	8.4	3.00	5.4	15.14
49	64.9	8.1	3.00	5.1	15.05

<=== Required volume for roof storage

Req. Storage volume 15.40 m3
Average depth 0.034 m

ROOF AREA # Pad E (9B)

Updated Feb 2017

251 sm

100 -YR FLOW

Qp (l/s)

Area(ha)=	0.0251				
Cw =	1.00	STORMWATER MANAGEMENT Qm =		2.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
25	103.8	7.2	2.00	5.2	7.87
27	98.7	6.9	2.00	4.9	7.91
29	94.0	6.6	2.00	4.6	7.93
31	89.8	6.3	2.00	4.3	**7.94**
33	86.0	6.0	2.00	4.0	7.93
35	82.6	5.8	2.00	3.8	7.90
37	79.4	5.5	2.00	3.5	7.86
39	76.5	5.3	2.00	3.3	7.81
41	73.8	5.2	2.00	3.2	7.75

<=== Required volume for roof storage

Req. Storage volume 7.94 m3
Average depth 0.032 m

ROOF AREA # Pad F (7B)						
416 sm						
100 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.0416					
Cw =	1.00	STORMWATER MANAGEMENT Qm =			3.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
27	98.7	11.4	3.00	8.4	13.62	
29	94.0	10.9	3.00	7.9	13.70	
31	89.8	10.4	3.00	7.4	13.74	
33	86.0	9.9	3.00	6.9	**13.76**	<=== Required volume
35	82.6	9.6	3.00	6.6	13.76	for roof storage
37	79.4	9.2	3.00	6.2	13.73	
39	76.5	8.8	3.00	5.8	13.69	
41	73.8	8.5	3.00	5.5	13.62	
43	71.4	8.3	3.00	5.3	13.55	
45	69.1	8.0	3.00	5.0	13.46	

Updated Nov/2012

Req. Storage volume 13.76 m3
Average depth 0.033 m

ROOF AREA # Pad G (7C)						
490 sm						
100 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.0490					
Cw =	1.00	STORMWATER MANAGEMENT Qm =			3.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
33	86.0	11.7	3.00	8.7	17.26	
35	82.6	11.2	3.00	8.2	17.32	
37	79.4	10.8	3.00	7.8	17.36	
39	76.5	10.4	3.00	7.4	**17.37**	<=== Required volume
41	73.8	10.1	3.00	7.1	17.36	for roof storage
43	71.4	9.7	3.00	6.7	17.34	
45	69.1	9.4	3.00	6.4	17.30	
47	66.9	9.1	3.00	6.1	17.24	
49	64.9	8.8	3.00	5.8	17.17	
51	63.0	8.6	3.00	5.6	17.09	
53	61.3	8.3	3.00	5.3	17.00	
55	59.6	8.1	3.00	5.1	16.90	

Req. Storage volume 17.37 m3
Average depth 0.035 m

ROOF AREA BLDG 1 (2A)						Updated Feb 2017
1040 sm						
100 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.1040					
Cw =	1.00	STORMWATER MANAGEMENT Qm =			2.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
117	33.6	9.7	2.00	7.7	54.06	
119	33.1	9.6	2.00	7.6	54.07	
121	32.7	9.4	2.00	7.4	54.08	
123	32.3	9.3	2.00	7.3	**54.09**	<=== Required volume
125	31.9	9.2	2.00	7.2	54.09	for roof storage
127	31.5	9.1	2.00	7.1	54.09	
129	31.1	9.0	2.00	7.0	54.08	
131	30.7	8.9	2.00	6.9	54.08	
133	30.4	8.8	2.00	6.8	54.06	
135	30.0	8.7	2.00	6.7	54.05	

Req. Storage volume 54.09 m3
Average depth 0.052 m

ROOF AREA BLDG 2 (8C)						Updated March 2019
385 sm						
100 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.0385					
Cw =	1.00	STORMWATER MANAGEMENT Qm =			2.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
40	75.1	8.0	2.00	6.0	14.50	
42	72.6	7.8	2.00	5.8	14.53	
44	70.2	7.5	2.00	5.5	14.55	
46	68.0	7.3	2.00	5.3	**14.56**	<=== Required volume
48	65.9	7.1	2.00	5.1	14.55	for roof storage
50	64.0	6.8	2.00	4.8	14.54	
52	62.1	6.7	2.00	4.7	14.51	
54	60.4	6.5	2.00	4.5	14.48	
56	58.8	6.3	2.00	4.3	14.44	
58	57.3	6.1	2.00	4.1	14.39	
60	55.9	6.0	2.00	4.0	14.34	
62	54.5	5.8	2.00	3.8	14.28	

Req. Storage volume 14.56 m3
Average depth 0.038 m

PARKING LOT Area #1 (1A,B,C)

3400 sm

100 -YR FLOW

Flow restricted to 21 l/s

Qp (l/s)

Area(ha)=	0.3400				
Cw =	1.00	STORMWATER MANAGEMENT Qm =			21.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
31	89.8	84.9	21.00	63.9	118.86
33	86.0	81.3	21.00	60.3	119.43
35	82.6	78.1	21.00	57.1	119.81
37	79.4	75.1	21.00	54.1	120.02
39	76.5	72.3	21.00	51.3	**120.09**
41	73.8	69.8	21.00	48.8	120.01
43	71.4	67.4	21.00	46.4	119.82
45	69.1	65.3	21.00	44.3	119.52
47	66.9	63.2	21.00	42.2	119.12
49	64.9	61.3	21.00	40.3	118.63
50	64.0	60.4	21.00	39.4	118.35

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
18	1.45	0.52
19	1.50	0.54
	Total:	**1.06**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CBMH31 - CB18	50.00	0.25	2.45
CBMH31 - CB19	35.90	0.30	2.54
		Total:	**4.99**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
31	2.17	2.45
	Total:	**2.45**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
1A	481.00	0.25	40.08
1B	814.00	0.25	67.83
1C	201.00	0.70	46.90
		Total:	**154.82**

Overflow from area 2 **10.96**
Total Storage required **131.04**
Total Surface Storage provided **154.82**

ICD use Hydrovex 125VHV 21l/s @ 2.77m head, or approved equal

PARKING LOT Area #2						
970 sm						
100 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.0970					
Cw =	1.00	STORMWATER MANAGEMENT Qm =			13.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
16.5	135.0	36.4	13.00	23.4	23.18	
17	132.6	35.8	13.00	22.8	23.22	
17.5	130.3	35.1	13.00	22.1	23.25	
18	128.1	34.5	13.00	21.5	23.26	
18.5	125.9	34.0	13.00	21.0	**23.27**	<=== Required volume
19	123.9	33.4	13.00	20.4	23.26	for storage on-site
19.5	121.9	32.9	13.00	19.9	23.24	
20	120.0	32.3	13.00	19.3	23.21	
20.5	118.1	31.8	13.00	18.8	23.18	
21	116.3	31.4	13.00	18.4	23.13	
21.5	114.6	30.9	13.00	17.9	23.08	

Updated March/2012

Flow restricted to 13 l/s

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
17	1.67	0.60
16	1.25	0.45
	Total:	**1.05**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CB16 - CB17	6.00	0.20	0.19
		Total:	**0.19**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
2A	36.00	0.07	0.84
2B	22.00	0.07	0.51
		Total:	**1.35**

Total Storage required	**23.27**
Total Surface Storage provided	**1.35**
Overflow to area 1	**10.96**
Overflow to area 15F	**10.96**

ICD use Hydrovex 100VHV 13l/s @ 1.62m head, or approved equal

PARKING LOT Area #3

Updated March/2012

550 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 13 l/s

Area(ha)=	0.0550	STORMWATER MANAGEMENT Qm =			13.00 l/s
Cw =	1.00				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
9	188.3	28.8	13.00	15.8	8.52
9.5	183.3	28.0	13.00	15.0	8.56
10	178.6	27.3	13.00	14.3	8.58
10.5	174.1	26.6	13.00	13.6	**8.58**
11	169.9	26.0	13.00	13.0	8.57
11.5	165.9	25.4	13.00	12.4	8.53
12	162.1	24.8	13.00	11.8	8.49
12.5	158.5	24.2	13.00	11.2	8.43
13	155.1	23.7	13.00	10.7	8.36
13.5	151.8	23.2	13.00	10.2	8.28
14	148.7	22.7	13.00	9.7	8.18

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
14	1.30	0.47
15	1.65	0.59
	Total:	**1.06**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB14 - CB15	6.00	0.20	0.19
		Total:	**0.19**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
3A	38.00	0.07	0.89
3B	50.00	0.07	1.17
		Total:	**2.05**

Overflow from area 4	**10.61**
Total Storage required	**19.19**
Total Surface Storage provided	**2.05**
Overflow to area 15F	**17.13**

ICD use Hydrovex 100VHV 13l/s @ 1.50m head, or approved equal

PARKING LOT Area #4

830 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 10 l/s

Area(ha)=	0.0830	STORMWATER MANAGEMENT Qm =	10.00 l/s		
Cw =	1.00				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
17	132.6	30.6	10.00	20.6	21.01
18	128.1	29.6	10.00	19.6	21.12
19	123.9	28.6	10.00	18.6	21.18
20	120.0	27.7	10.00	17.7	**21.21**
21	116.3	26.8	10.00	16.8	21.21
22	112.9	26.0	10.00	16.0	21.18
23	109.7	25.3	10.00	15.3	21.12
24	106.7	24.6	10.00	14.6	21.04
25	103.8	24.0	10.00	14.0	20.94
26	101.2	23.3	10.00	13.3	20.82
27	98.7	22.8	10.00	12.8	20.68

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
20	1.60	0.58
21	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB21 - CB20	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
		Total:	**0.00**

Total Storage required	**21.21**
Total Surface Storage provided	**0.00**
Overflow to area 3	**10.61**
Overflow to area 6	**10.61**

ICD use Hydrovex 100VHV 10l/s @ 1.48m head, or approved equal

PARKING LOT Area #5 (5A,B,C)

3320 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 35 l/s

Area(ha)=	0.3320	STORMWATER MANAGEMENT Qm =			35.00 l/s
Cw =	1.00				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
15	142.9	131.9	35.00	96.9	87.20
17	132.6	122.4	35.00	87.4	89.16
19	123.9	114.3	35.00	79.3	90.43
21	116.3	107.3	35.00	72.3	91.15
23	109.7	101.2	35.00	66.2	**91.40** <=== Required volume for storage on-site
25	103.8	95.8	35.00	60.8	91.27
27	98.7	91.1	35.00	56.1	90.82
29	94.0	86.8	35.00	51.8	90.08
31	89.8	82.9	35.00	47.9	89.11
33	86.0	79.4	35.00	44.4	87.92
34	84.3	77.8	35.00	42.8	87.26

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
24	1.50	0.54
53	1.55	0.56
	Total:	**1.10**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CB24 - CBMH18	30.40	0.30	2.15
CB53 - CBMH18	33.00	0.30	2.33
		Total:	**4.48**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
18	2.07	2.34
	Total:	**2.34**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
5A	468.00	0.30	46.80
5B	383.00	0.30	38.30
5C	336.00	0.30	33.60
		Total:	**118.70**

Overflow from area 6 **25.65**
Total Storage required **117.05**
Total Surface Storage provided **118.70**

ICD use Hydrovex 150VHV 35l/s @ 2.73m head, or approved equal

PARKING LOT Area #6

1490 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 21 l/s

Area(ha)=	0.1490	STORMWATER MANAGEMENT Qm =			21.00 l/s
Cw =	1.00				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
15	142.9	59.2	21.00	38.2	34.37
16	137.5	57.0	21.00	36.0	34.54
17	132.6	54.9	21.00	33.9	34.62
18	128.1	53.1	21.00	32.1	**34.62**
19	123.9	51.3	21.00	30.3	34.55
20	120.0	49.7	21.00	28.7	34.42
21	116.3	48.2	21.00	27.2	34.24
22	112.9	46.8	21.00	25.8	34.00
23	109.7	45.4	21.00	24.4	33.72
24	106.7	44.2	21.00	23.2	33.39
25	103.8	43.0	21.00	22.0	33.02

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
22	1.60	0.58
23	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB23 - CB22	6.00	0.20	0.19
		Total:	**0.19**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
6A	40.00	0.07	0.93
6B	40.00	0.07	0.93
		Total:	**1.87**

Overflow from area 7A	**7.95**
Overflow from area 4	**10.61**
Total Storage required	**53.17**
Total Surface Storage provided	**1.87**
Overflow to area 5	**25.65**
Overflow to area 12	**25.65**

ICD use Ipex Type A or approved equal

PARKING LOT Area #7A

540 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 5 l/s

Area(ha)=	0.0540				
Cw =	1.00	STORMWATER MANAGEMENT Qm =			5.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
23	109.7	16.5	5.00	11.5	15.82
24	106.7	16.0	5.00	11.0	15.86
25	103.8	15.6	5.00	10.6	15.88
26	101.2	15.2	5.00	10.2	**15.89**
27	98.7	14.8	5.00	9.8	15.89
28	96.3	14.5	5.00	9.5	15.88
29	94.0	14.1	5.00	9.1	15.86
30	91.9	13.8	5.00	8.8	15.82
31	89.8	13.5	5.00	8.5	15.78
32	87.9	13.2	5.00	8.2	15.73
33	86.0	12.9	5.00	7.9	15.67

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
25	1.60	0.58
26	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB26 - CB25	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
		Total:	**0.00**

Total Storage required	**15.89**
Total Surface Storage provided	**0.00**
Overflow to area 9	**7.95**
Overflow to area 6	**7.95**

ICD use Hydrovex 75VHV 5l/s @ 1.41m head, or approved equal

PARKING LOT Area #7D						
280 sm			Updated March 2019			
100 -YR FLOW				Flow restricted to	5 l/s	
Qp (l/s)						
Area(ha)=	0.0280					
Cw =	1.00	STORMWATER MANAGEMENT Qm =			5.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
11	169.9	13.2	5.00	8.2	5.43	
12	162.1	12.6	5.00	7.6	5.49	
13	155.1	12.1	5.00	7.1	5.52	
14	148.7	11.6	5.00	6.6	**5.52**	<=== Required volume
15	142.9	11.1	5.00	6.1	5.51	for storage on-site
16	137.5	10.7	5.00	5.7	5.48	
17	132.6	10.3	5.00	5.3	5.43	
18	128.1	10.0	5.00	5.0	5.37	
19	123.9	9.6	5.00	4.6	5.29	
20	120.0	9.3	5.00	4.3	5.20	
21	116.3	9.1	5.00	4.1	5.11	

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
58	1.60	0.58
59	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB26 - CB25	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
		Total:	**0.00**

Total Storage required	**5.52**
Total Surface Storage provided	**0.00**
Overflow to Hazeldean Road	**5.52**

ICD use Hydrovex 75VHV 5l/s @ 1.48m head, or approved equal

PARKING LOT Area #8 (A,D,E&F)

Updated Feb 2017

2340 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 18.5 l/s

Area(ha)=	0.2340				
Cw =	1.00	STORMWATER MANAGEMENT Qm =			18.50 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
23	109.7	71.4	18.50	52.9	72.93
25	103.8	67.6	18.50	49.1	73.58
27	98.7	64.2	18.50	45.7	74.00
29	94.0	61.2	18.50	42.7	74.23
31	89.8	58.4	18.50	39.9	**74.28**
33	86.0	56.0	18.50	37.5	74.18
35	82.6	53.7	18.50	35.2	73.96
37	79.4	51.7	18.50	33.2	73.62
39	76.5	49.8	18.50	31.3	73.18
41	73.8	48.0	18.50	29.5	72.64
42	72.6	47.2	18.50	28.7	72.34

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
60	1.73	0.62
61	1.81	0.65
62	1.91	0.69
63	2.01	0.72
	Total:	**2.69**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB60 to CB62	24.00	0.25	1.18
CB61 to CB62	17.10	0.25	0.84
CB62 to CB63	22.60	0.38	2.50
		Total:	**4.51**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
8A	794.30	0.30	79.42
8C	127.00	0.25	10.59
8D	68.25	0.10	2.28
		Total:	**92.29**

Overflow from area 8B	**0.38**
Overflow from area 9	**15.06**
Overflow from area 14	**0.00**
Total Storage required	**89.72**
Total Surface Storage provided	**92.29**

ICD use Ipex TEMPEST 18.5l/s @ 2.25m head or approved equal

PARKING LOT Area #8B

Updated Nov/2012

900 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 10 l/s

Area(ha)=	0.0900	STORMWATER MANAGEMENT Qm =			10.00 l/s
Cw =	1.00				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
16	137.5	34.4	10.00	24.4	23.44
18	128.1	32.0	10.00	22.0	23.81
20	120.0	30.0	10.00	20.0	24.01
22	112.9	28.2	10.00	18.2	**24.08**
24	106.7	26.7	10.00	16.7	24.03
26	101.2	25.3	10.00	15.3	23.89
28	96.3	24.1	10.00	14.1	23.67
30	91.9	23.0	10.00	13.0	23.37
32	87.9	22.0	10.00	12.0	23.02
34	84.3	21.1	10.00	11.1	22.61
35	82.6	20.7	10.00	10.7	22.39

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
52	1.45	0.52
	Total:	**0.52**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
8B	284.43	0.25	23.70
		Total:	**23.70**

Total Storage required	**24.08**
Total Surface Storage provided	**23.70**
Overflow to area 8A	**0.38**

ICD use Hydrovex 100VHV 10l/s @ 1.55m head, or approved equal

PARKING LOT Area #9A							Updated Feb 2017

1200 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 21 l/s

Area(ha)=	0.1200				
Cw =	1.00	STORMWATER MANAGEMENT Qm =		21.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
11	169.9	56.7	21.00	35.7	23.55
12	162.1	54.1	21.00	33.1	23.82
13	155.1	51.7	21.00	30.7	23.98
14	148.7	49.6	21.00	28.6	**24.04**
15	142.9	47.7	21.00	26.7	24.00
16	137.5	45.9	21.00	24.9	23.89
17	132.6	44.2	21.00	23.2	23.71
18	128.1	42.7	21.00	21.7	23.47
19	123.9	41.3	21.00	20.3	23.17
20	120.0	40.0	21.00	19.0	22.82
21	116.3	38.8	21.00	17.8	22.42

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
27	1.65	0.59
28	1.30	0.47
	Total:	**1.06**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CB28 - CB27	6.00	0.20	0.19
		Total:	**0.19**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
9A	40.00	0.07	0.93
9B	40.00	0.07	0.93
		Total:	**1.87**

Overflow from area 7A	**7.95**
Total Storage required	**31.98**
Total Surface Storage provided	**1.87**
Overflow to area 8A	**15.06**
Overflow to area 14	**15.06**

ICD use Ipex Type A or approved equal

PARKING LOT Area #11

1730 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 18 l/s

Area(ha)=	0.1730				
Cw =	1.00	STORMWATER MANAGEMENT Qm =		18.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
21	116.3	55.9	18.00	37.9	47.79
22	112.9	54.3	18.00	36.3	47.90
23	109.7	52.8	18.00	34.8	47.96
24	106.7	51.3	18.00	33.3	**47.96**
25	103.8	49.9	18.00	31.9	47.92
26	101.2	48.7	18.00	30.7	47.83
27	98.7	47.4	18.00	29.4	47.71
28	96.3	46.3	18.00	28.3	47.55
29	94.0	45.2	18.00	27.2	47.35
30	91.9	44.2	18.00	26.2	47.13
31	89.8	43.2	18.00	25.2	46.88

<=== Required volume for storage on-site (Tc = 24 min)

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
10	1.60	0.58
11	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CB11 - CB10	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
11A	150.00	0.15	7.50
11B	108.00	0.15	5.40
		Total:	**12.90**

Total Storage required	**47.96**
Total Surface Storage provided	**12.90**
Overflow to area 16	**35.06**

ICD use Hydrovex 125VHV 18l/s @ 1.63m head, or approved equal

PARKING LOT Area #12

2040 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 21 l/s

Area(ha)=	0.2040				
Cw =	1.00	STORMWATER MANAGEMENT Qm =	21.00 l/s		
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
16	137.5	78.0	21.00	57.0	54.73
18	128.1	72.6	21.00	51.6	55.77
20	120.0	68.0	21.00	47.0	56.43
22	112.9	64.0	21.00	43.0	56.78
24	106.7	60.5	21.00	39.5	**56.88**
26	101.2	57.4	21.00	36.4	56.75
28	96.3	54.6	21.00	33.6	56.45
30	91.9	52.1	21.00	31.1	55.98
32	87.9	49.8	21.00	28.8	55.38
34	84.3	47.8	21.00	26.8	54.65
35	82.6	46.8	21.00	25.8	54.25

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
41	1.50	0.54
	Total:	**0.54**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CB41 - 28	19.50	0.30	1.38
		Total:	**1.38**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
28	2.56	2.89
	Total:	**2.89**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
12	990.13	0.25	82.51
		Total:	**82.51**

Overflow from area 6	**25.65**
Total Storage required	**82.53**
Total Surface Storage provided	**82.51**

ICD use Ipex Type A or approved equal

PARKING LOT Area #14 (14A,B)						Updated Feb 2017
2720 sm						
100 -YR FLOW				Flow restricted to	21 l/s	
Qp (l/s)						

Area(ha)=	0.2720					
Cw =	1.00	STORMWATER MANAGEMENT Qm =			21.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
25	103.8	78.5	21.00	57.5	86.29	
27	98.7	74.6	21.00	53.6	86.84	
29	94.0	71.1	21.00	50.1	87.16	
31	89.8	67.9	21.00	46.9	87.28	
33	86.0	65.1	21.00	44.1	**87.23**	<=== Required volume
35	82.6	62.4	21.00	41.4	87.03	for storage on-site
37	79.4	60.1	21.00	39.1	86.69	
39	76.5	57.9	21.00	36.9	86.24	
41	73.8	55.8	21.00	34.8	85.68	
43	71.4	54.0	21.00	33.0	85.02	
44	70.2	53.1	21.00	32.1	84.66	

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
39	1.57	0.57
40	1.45	0.52
	Total:	**1.09**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CB40 - 27	44.00	0.25	2.16
CB39 - 27	21.30	0.38	2.35
		Total:	**4.51**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
27	2.57	2.90
	Total:	**2.90**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
14A	1343.36	0.25	111.95
14B	140.66	0.25	11.72
		Total:	**123.67**

Overflow from area 9	**15.06**
Total Storage required	**102.29**
Total Surface Storage provided	**123.67**

ICD use Hydrovex 125VHV 21l/s @ 2.87m head, or approved equal

PARKING LOT Area #15 (15A,B,C,D,E,F)

Updated March/2012

10340 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 43 l/s

Area(ha)=	1.0340	STORMWATER MANAGEMENT Qm =			43.00 l/s
Cw =	1.00				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
54	60.4	173.7	43.00	130.7	423.56
56	58.8	169.1	43.00	126.1	423.76
58	57.3	164.8	43.00	121.8	423.78
60	55.9	160.7	43.00	117.7	423.61
62	54.5	156.8	43.00	113.8	**423.28**
64	53.3	153.1	43.00	110.1	422.80
66	52.0	149.6	43.00	106.6	422.17
68	50.9	146.3	43.00	103.3	421.40
70	49.8	143.1	43.00	100.1	420.51
72	48.7	140.1	43.00	97.1	419.50
73	48.2	138.6	43.00	95.6	418.95

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
8	1.50	0.54
9	1.60	0.58
	Total:	**1.12**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CBMH9 - CBMH10	34.20	0.60	9.67
CBMH10 - CBMH11	38.60	0.53	8.36
CB8 - CBMH11	38.60	0.30	2.73
CB9 - CBMH11	33.00	0.25	1.62
		Total:	**22.37**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
9	2.42	2.73
10 (1.5 dia)	2.35	4.15
11	2.14	2.42
	Total:	**9.31**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
15A	296.00	0.15	14.80
15B	1000.00	0.30	100.00
15C	1055.00	0.30	105.50
15D	1000.00	0.30	100.00
15E	900.00	0.30	90.00
15F	463.98	0.20	30.93
		Total:	**441.23**

Overflow from area 2	**10.96**
Overflow from area 3	**17.13**
Total Storage required	**440.42**
Total Storage provided	**441.23**

ICD use IPEX TEMPEST 43l/s @ 3.06m head, or approved equal

PARKING LOT Area #16

1050 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 29 l/s

Area(ha)=	0.1050				
Cw =	1.00	STORMWATER MANAGEMENT Qm =	29.00 l/s		
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
6	226.0	66.0	29.00	37.0	13.31
7	211.7	61.8	29.00	32.8	13.77
8	199.2	58.1	29.00	29.1	13.99
9	188.3	55.0	29.00	26.0	**14.01**
10	178.6	52.1	29.00	23.1	13.87
11	169.9	49.6	29.00	20.6	13.59
12	162.1	47.3	29.00	18.3	13.20
13	155.1	45.3	29.00	16.3	12.70
14	148.7	43.4	29.00	14.4	12.11
15	142.9	41.7	29.00	12.7	11.44
16	137.5	40.2	29.00	11.2	10.70

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
6	1.60	0.58
7	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB6 - CB7	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
16A	166.37	0.15	8.32
16B	204.14	0.15	10.21
		Total:	**18.53**

Overflow from area 15	**0.00**
Overflow from area 11	**35.06**
Total Storage required	**49.07**
Total Surface Storage provided	**18.53**
Overflow to area 17	**30.55**

ICD use Hydrovex 150VHV 29l/s @ 1.62m head, or approved equal

PARKING LOT Area #17 (17 C,D,E,F)					
7090 sm					
100 -YR FLOW					
Qp (l/s)					

Updated March 2019

Flow restricted to 82 l/s

Area(ha)=	0.7090				
Cw =	1.00	STORMWATER MANAGEMENT Qm =			82.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
13	155.1	305.7	82.00	223.7	174.50
15	142.9	281.6	82.00	199.6	179.68
17	132.6	261.4	82.00	179.4	183.00
19	123.9	244.1	82.00	162.1	184.85
21	116.3	229.2	82.00	147.2	**185.50**
23	109.7	216.2	82.00	134.2	185.17
25	103.8	204.7	82.00	122.7	184.03
27	98.7	194.5	82.00	112.5	182.19
29	94.0	185.3	82.00	103.3	179.75
31	89.8	177.1	82.00	95.1	176.80
32	87.9	173.2	82.00	91.2	175.15

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
42	1.47	0.53
43	1.45	0.52
44	1.45	0.52
45	1.50	0.54
	Total:	**2.11**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB42 - CBMH29	34.20	0.25	1.68
CB 43 - CBMH29	34.20	0.25	1.68
CBMH29 - CBMH30	38.90	0.45	6.19
CB44 - CBMH30	34.20	0.25	1.68
CB45 - CBMH30	34.20	0.30	2.42
		Total:	**13.64**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
29	2.50	2.83
30	2.34	2.64
	Total:	**5.47**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
17A	481.30	0.20	32.09
17B	397.16	0.20	26.48
17C	278.03	0.20	18.54
17D	739.91	0.20	49.33
17E	785.48	0.20	52.37
17F	369.62	0.20	24.64
		Total:	**203.43**

Overflow from area 16	**30.55**
Total Storage required	**216.05**
Total Surface Storage provided	**203.43**
Overflow to area 19	**12.62**

ICD use Hydrovex 250VHV 82l/s @ 2.97m head, or approved equal

PARKING LOT Area #18

1830 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 21 l/s

Area(ha)=	0.1830	STORMWATER MANAGEMENT Qm =			21.00 l/s
Cw =	1.00				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
18	128.1	65.2	21.00	44.2	47.69
19	123.9	63.0	21.00	42.0	47.90
20	120.0	61.0	21.00	40.0	48.03
21	116.3	59.2	21.00	38.2	**48.09**
22	112.9	57.4	21.00	36.4	48.08
23	109.7	55.8	21.00	34.8	48.02
24	106.7	54.3	21.00	33.3	47.91
25	103.8	52.8	21.00	31.8	47.75
26	101.2	51.5	21.00	30.5	47.54
27	98.7	50.2	21.00	29.2	47.29
28	96.3	49.0	21.00	28.0	47.00

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
35	1.60	0.58
36	1.30	0.47
	Total:	**1.04**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
CB36 - CB35	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
18A	156.00	0.25	13.00
18B	156.00	0.25	13.00
		Total:	**26.00**

Total Storage required	**48.09**
Total Surface Storage provided	**26.00**
Overflow to area 19	**22.09**

ICD use Ipex Type A or approved equal

PARKING LOT Area #19

770 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 29 l/s

Area(ha)=	0.0770				
Cw =	1.00	STORMWATER MANAGEMENT Qm =			29.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
3	286.0	61.2	29.00	32.2	5.80
4	262.4	56.2	29.00	27.2	6.52
5	242.7	52.0	29.00	23.0	6.89
6	226.0	48.4	29.00	19.4	**6.98**
7	211.7	45.3	29.00	16.3	6.85
8	199.2	42.6	29.00	13.6	6.55
9	188.3	40.3	29.00	11.3	6.10
10	178.6	38.2	29.00	9.2	5.53
11	169.9	36.4	29.00	7.4	4.86
12	162.1	34.7	29.00	5.7	4.11
13	155.1	33.2	29.00	4.2	3.28

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
33	1.60	0.58
34	1.40	0.50
	Total:	**1.08**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CB34 - CB33	8.00	0.20	0.25
		Total:	**0.25**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
19A	155.56	0.25	12.96
19B	187.08	0.25	15.59
		Total:	**28.55**

Overflow from area 18	**22.09**
Overflow from area 17	**12.62**
Total Storage required	**41.68**
Total Storage provided	**29.63**
Overflow to area 20	**12.05**

ICD use Hydrovex 150VHV 29l/s @ 1.72m head, or approved equal

PARKING LOT Area #20 (20A,B,C,D)

6400 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 48 l/s

Area(ha)=	0.6400				
Cw =	1.00	STORMWATER MANAGEMENT Qm =			48.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
25	103.8	184.8	48.00	136.8	205.15
27	98.7	175.5	48.00	127.5	206.61
29	94.0	167.3	48.00	119.3	207.53
31	89.8	159.8	48.00	111.8	207.99
33	86.0	153.1	48.00	105.1	**208.04**
35	82.6	146.9	48.00	98.9	207.74
37	79.4	141.3	48.00	93.3	207.12
39	76.5	136.1	48.00	88.1	206.22
41	73.8	131.4	48.00	83.4	205.07
43	71.4	127.0	48.00	79.0	203.69
44	70.2	124.9	48.00	76.9	202.92

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
31	1.45	0.52
32	1.45	0.52
	Total:	**0.52**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
CBMH32 - CBMH24	42.10	0.60	11.90
CBMH24 - CBMH25	39.00	0.45	6.20
CB32 - CBMH25	42.80	0.25	2.10
CB31 - CBMH25	42.80	0.25	2.10
		Total:	**22.31**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
24	2.59	2.93
25 (1.5m dia)	2.30	4.06
32	2.71	3.06
	Total:	**10.05**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
20A	217.96	0.20	14.53
20B	2029.44	0.25	169.12
20C	523.33	0.20	34.89
20D	468.54	0.20	31.24
		Total:	**249.78**

Overflow from area 19	**12.05**
Total Storage required	**220.09**
Total Surface Storage provided	**249.78**

ICD use Hydrovex 200VHV 48l/s @ 3.14m head, or approved equal

PARKING LOT Area #21

1910 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 10 l/s

Area(ha)=	0.1910	STORMWATER MANAGEMENT Qm =			10.00 l/s
Cw =	0.75				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
32	87.9	35.0	10.00	25.0	48.00
33	86.0	34.3	10.00	24.3	48.04
34	84.3	33.6	10.00	23.6	48.06
35	82.6	32.9	10.00	22.9	**48.06**
36	81.0	32.2	10.00	22.2	48.04
37	79.4	31.6	10.00	21.6	48.01
38	77.9	31.0	10.00	21.0	47.96
39	76.5	30.5	10.00	20.5	47.90
40	75.1	29.9	10.00	19.9	47.82
41	73.8	29.4	10.00	19.4	47.73
42	72.6	28.9	10.00	18.9	47.63

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
2	1.40	0.50
	Total:	**0.50**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
21	191.58	0.25	15.97
		Total:	**15.97**

Total Storage required	**48.06**
Total Surface Storage provided	**15.97**
Overflow to Area 23	**32.09**

ICD use Hydrovex 100VHV 10l/s @ 1.65m head, or approved equal

PARKING LOT Area #21A

270 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 5 l/s

Area(ha)=	0.0270	STORMWATER MANAGEMENT Qm =			5.00 l/s
Cw =	1.00				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
10	178.6	13.4	5.00	8.4	5.04
11	169.9	12.8	5.00	7.8	5.12
12	162.1	12.2	5.00	7.2	5.16
13	155.1	11.6	5.00	6.6	**5.18**
14	148.7	11.2	5.00	6.2	5.18
15	142.9	10.7	5.00	5.7	5.15
16	137.5	10.3	5.00	5.3	5.11
17	132.6	10.0	5.00	5.0	5.05
18	128.1	9.6	5.00	4.6	4.98
19	123.9	9.3	5.00	4.3	4.90
20	120.0	9.0	5.00	4.0	4.80

<=== Required volume for storage on-site (13 min, 5.18)

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
1	1.40	0.50
	Total:	**0.50**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
21A	60.88	0.23	4.67
		Total:	**4.67**

Total Storage required **5.18**
Total Storage provided **5.17**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

ICD use Hydrovex 75VHV 5l/s @ 1.45m head, or approved equal

PARKING LOT Area #22						Updated March 2019

1720 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 12 l/s

Area(ha)=	0.1720				
Cw =	1.00	STORMWATER MANAGEMENT Qm =			12.00 l/s
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
31	89.8	43.0	12.00	31.0	57.57
32	87.9	42.0	12.00	30.0	57.64
33	86.0	41.1	12.00	29.1	57.69
34	84.3	40.3	12.00	28.3	**57.72** <=== Required volume for storage on-site
35	82.6	39.5	12.00	27.5	57.72
36	81.0	38.7	12.00	26.7	57.70
37	79.4	38.0	12.00	26.0	57.66
38	77.9	37.3	12.00	25.3	57.60
39	76.5	36.6	12.00	24.6	57.53
40	75.1	35.9	12.00	23.9	57.44
41	73.8	35.3	12.00	23.3	57.33

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
55	1.26	0.45
	Total:	**0.45**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
22	360.00	0.25	30.00
		Total:	**30.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

Overflow from Area 26	**2.18**
Total Storage required	**59.89**
Total Storage provided	**30.00**

ICD use Hydrovex 100VHV 12l/s @ 1.57m head, or approved equal

PARKING LOT Area #23

Updated March 2019

1410 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 21 l/s

Area(ha)=	0.1410	STORMWATER MANAGEMENT Qm =		21.00 l/s	
Cw =	0.75				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
9	188.3	55.3	21.00	34.3	18.55
10	178.6	52.5	21.00	31.5	18.90
11	169.9	50.0	21.00	29.0	19.11
12	162.1	47.7	21.00	26.7	**19.20**
13	155.1	45.6	21.00	24.6	19.19
14	148.7	43.7	21.00	22.7	19.09
15	142.9	42.0	21.00	21.0	18.91
16	137.5	40.4	21.00	19.4	18.66
17	132.6	39.0	21.00	18.0	18.35
18	128.1	37.7	21.00	16.7	17.99
19	123.9	36.4	21.00	15.4	17.57

<=== Required volume for storage on-site (19.20)

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
3	1.40	0.50
	Total:	**0.50**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
23	562.42	0.25	46.87
		Total:	**46.87**

Overflow from Area 21	**32.09**
Overflow from Area 23B	**23.74**
Total Storage required	**75.04**
Total Surface Storage provided	**46.87**
Overflow to Area 24	**28.17**

ICD IPEX type A, or approved equal

PARKING LOT Area #23B						Updated March 2019	
1430 sm							
100 -YR FLOW				Flow restricted to	9 l/s		
Qp (l/s)							

Area(ha)=	0.1430				
Cw =	1.00	STORMWATER MANAGEMENT Qm =		9.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
35	82.6	32.8	9.00	23.8	50.04
36	81.0	32.2	9.00	23.2	50.08
37	79.4	31.6	9.00	22.6	50.11
38	77.9	31.0	9.00	22.0	**50.12**
39	76.5	30.4	9.00	21.4	50.11
40	75.1	29.9	9.00	20.9	50.10
41	73.8	29.4	9.00	20.4	50.06
42	72.6	28.8	9.00	19.8	50.02
43	71.4	28.4	9.00	19.4	49.96
44	70.2	27.9	9.00	18.9	49.89
45	69.1	27.5	9.00	18.5	49.82

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
Oversized Subdrains	30.00	0.45	4.77
		Total:	**4.77**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
23B	505.86	0.30	50.59
		Total:	**50.59**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

Overflow from area 23C	**28.98**
Total Storage required	**79.10**
Total Surface Storage provided	**55.36**
Overflow to Area 23	**23.74**

ICD use Ipex LMF 9l/s @ 1.6m head, or approved equal

PARKING LOT Area #23C

Updated March 2019

2180 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 9 l/s

Area(ha)=	0.2180				
Cw =	1.00	STORMWATER MANAGEMENT Qm =		9.00 l/s	
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
55	59.6	36.1	9.00	27.1	89.54
56	58.8	35.7	9.00	26.7	89.56
57	58.1	35.2	9.00	26.2	89.57
58	57.3	34.7	9.00	25.7	**89.57**
59	56.6	34.3	9.00	25.3	89.57
60	55.9	33.9	9.00	24.9	89.55
61	55.2	33.5	9.00	24.5	89.52
62	54.5	33.1	9.00	24.1	89.49
63	53.9	32.7	9.00	23.7	89.44
64	53.3	32.3	9.00	23.3	89.39
65	52.6	31.9	9.00	22.9	89.33

<=== Required volume for storage on-site (Tc = 58 min)

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
Oversized Subdrains	30.00	0.45	4.77
		Total:	**4.77**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
23C	558.21	0.30	55.82
		Total:	**55.82**

Total Storage required	**89.57**
Total Surface Storage provided	**60.59**
Overflow to Area 23B	**28.98**

ICD use Ipex LMF 9l/s @ 1.6m head, or approved equal

PARKING LOT Area #24						
1220 sm						
100 -YR FLOW						
Qp (l/s)						
Area(ha)=	0.1220					
Cw =	0.88	STORMWATER MANAGEMENT Qm =			35.00 l/s	
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)	
4	262.4	78.3	35.00	43.3	10.40	
5	242.7	72.4	35.00	37.4	11.23	
6	226.0	67.5	35.00	32.5	11.68	
7	211.7	63.2	35.00	28.2	**11.83**	<=== Required volume
8	199.2	59.5	35.00	24.5	11.74	for storage on-site
9	188.3	56.2	35.00	21.2	11.44	
10	178.6	53.3	35.00	18.3	10.98	
11	169.9	50.7	35.00	15.7	10.37	
12	162.1	48.4	35.00	13.4	9.64	
13	155.1	46.3	35.00	11.3	8.81	
14	148.7	44.4	35.00	9.4	7.89	

Updated March 2019

Flow restricted to 35 l/s

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
4	1.53	0.55
	Total:	**0.55**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
Subdrains	6.00	0.25	0.29
		Total:	**0.29**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate to invert less 0.64m to account for flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
24	489.88	0.25	40.82
		Total:	**40.82**

Overflow from area 23	**28.17**
Overflow from area 25	**0.00**
Total Storage required	**40.00**
Total Surface Storage provided	**41.67**

ICD use Hydrovex 150VHV 35l/s @ 1.68m head, or approved equal

PARKING LOT Area #24A

200 sm

100 -YR FLOW

Flow restricted to 3 l/s

Qp (l/s)

Area(ha)=	0.0200				
Cw =	1.00	STORMWATER MANAGEMENT Qm =	3.00 l/s		
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
13	155.1	8.6	3.00	5.6	4.39
14	148.7	8.3	3.00	5.3	4.43
15	142.9	7.9	3.00	4.9	4.45
16	137.5	7.6	3.00	4.6	**4.46**
17	132.6	7.4	3.00	4.4	4.46
18	128.1	7.1	3.00	4.1	4.45
19	123.9	6.9	3.00	3.9	4.43
20	120.0	6.7	3.00	3.7	4.40
21	116.3	6.5	3.00	3.5	4.37
22	112.9	6.3	3.00	3.3	4.32
23	109.7	6.1	3.00	3.1	4.28

<=== Required volume for storage on-site

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height (m)	Storage (m3)
56	1.24	0.45
	Total:	**0.45**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length (m)	Dia (m)	Storage (m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height (m)	Storage (m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA (SM)	Depth (m)	Storage (m3)
23C	74.40	0.30	7.44
		Total:	**7.44**

Total Storage required **4.46**
Total Surface Storage provided **7.44**

ICD use Hydrovex 50VHV 3l/s @ 1.44m head, or approved equal

PARKING LOT Area #25

1820 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 27 l/s

Area(ha)=	0.1820	STORMWATER MANAGEMENT Qm =			27.00 l/s
Cw =	0.87				
Tc Variable (min)	i (mm/hour)	Qp 2.78 x Area x c x i (l/s)	Qm (l/s)	Qp-Qm (l/s)	Volume (m3)
12	162.1	71.4	27.00	44.4	31.95
13	155.1	68.3	27.00	41.3	32.20
14	148.7	65.5	27.00	38.5	32.31
15	142.9	62.9	27.00	35.9	**32.31** <=== Required volume for storage on-site
16	137.5	60.5	27.00	33.5	32.21
17	132.6	58.4	27.00	31.4	32.01
18	128.1	56.4	27.00	29.4	31.73
19	123.9	54.5	27.00	27.5	31.38
20	120.0	52.8	27.00	25.8	30.96
21	116.3	51.2	27.00	24.2	30.48
22	112.9	49.7	27.00	22.7	29.95

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
5	1.60	0.58
	Total:	**0.58**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
25	584.32	0.17	33.11
		Total:	**33.11**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

Total Storage required **32.31**
Total Surface Storage provided **33.11**

ICD use Hydrovex 150VHV 27l/s @ 1.60m head, or approved equal

PARKING LOT Area #25A

280 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 2 l/s

Area(ha)=	0.0280	STORMWATER MANAGEMENT Qm =			2.00 l/s
Cw =	1.00				
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
30	91.9	7.2	2.00	5.2	9.27
31	89.8	7.0	2.00	5.0	9.29
32	87.9	6.8	2.00	4.8	9.29
33	86.0	6.7	2.00	4.7	**9.30** <=== Required volume for storage on-site
34	84.3	6.6	2.00	4.6	9.30
35	82.6	6.4	2.00	4.4	9.30
36	81.0	6.3	2.00	4.3	9.29
37	79.4	6.2	2.00	4.2	9.28
38	77.9	6.1	2.00	4.1	9.27
39	76.5	6.0	2.00	4.0	9.26
40	75.1	5.8	3.00	2.8	6.84

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
57	1.22	0.44
	Total:	**0.44**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
25A	121.23	0.30	12.12
		Total:	**12.12**

Total Storage required **9.30**
Total Surface Storage provided **12.12**

ICD use Hydrovex 50VHV 2l/s @ 1.42m head, or approved equal

PARKING LOT Area #26

620 sm

100 -YR FLOW

Qp (l/s)

Flow restricted to 5 l/s

Area(ha)=	0.0620				
Cw =	1.00	STORMWATER MANAGEMENT Qm =	5.00 l/s		
Tc Variable	i	Qp 2.78 x Area x c x i	Qm	Qp-Qm	Volume
(min)	(mm/hour)	(l/s)	(l/s)	(l/s)	(m3)
27	98.7	17.0	5.00	12.0	19.45
28	96.3	16.6	5.00	11.6	19.48
29	94.0	16.2	5.00	11.2	19.50
30	91.9	15.8	5.00	10.8	**19.50** <=== Required volume
31	89.8	15.5	5.00	10.5	19.50 for storage on-site
32	87.9	15.1	5.00	10.1	19.48
33	86.0	14.8	5.00	9.8	19.46
34	84.3	14.5	5.00	9.5	19.43
35	82.6	14.2	5.00	9.2	19.39
36	81.0	14.0	5.00	9.0	19.34
37	79.4	13.7	5.00	8.7	19.29

IN-LINE STORAGE (Structure)

0.6m X 0.6m CB		
0.36 m3/m	Height	Storage
	(m)	(m3)
54	1.34	0.48
	Total:	**0.48**

IN-LINE STORAGE (Pipe)

Pipe storage			
Structure to Structure	Length	Dia	Storage
	(m)	(m)	(m3)
		Total:	**0.00**

IN-LINE STORAGE (Structure)

1.2mDia CBMH's		
1.13 m3/m	Height	Storage
	(m)	(m3)
	Total:	**0.00**

PARKING LOT STORAGE 100y Maximum available

AREA #	AREA	Depth	Storage
	(SM)	(m)	(m3)
26	226.00	0.23	17.33
		Total:	**17.33**

Total Storage required	**19.50**
Total Surface Storage provided	**17.33**
Overflow to area 22	**2.18**

CBMH height for storage equals top of grate
to invert less 0.64m to account for
flat top and iron frame/grate

ICD use Hydrovex 75VHV 5l/s @ 1.55m head, or approved equal

Phase 1 & 2 SUMMARY

Total Flow from Roofs=	**82.50 l/s**
Total Roof Area =	**2.012 Ha**
Average roof flow =	**41.00 l/s/Ha**
Volume Stored on Roofs	**845.86 cm**
Total Roof Storage rate	**420.37 cm/Ha**
Total flow from parking lot =	**622.50 l/s**
Total parking Lot area =	**6.285 Ha**
Average parking lot flow =	**99.05 l/s/Ha**
Volume Stored on Parking lot	**1909.95 cm**
Total Parking lot Storage rate	**303.89 cm/Ha**
Total flow	**705.00 l/s**
Total area	**8.297 Ha**
Average flow	**84.97 l/s/Ha**
Volume Stored	**2755.81 cm**
Total Storage rate	**332.14 cm/Ha**

APPENDIX C

- Mattamy Letter and Figure
- C-501B Sanitary Tributary Area Plan Phase 1 & 2
- Sanitary sewer design sheet Phase 1 & 2

Mattamy Homes Limited
Ottawa Division

50 Hines Road, Suite 100, Ottawa, ON K2K 2M5
T (613) 831-4115
www.mattamyhomes.com

June 27, 2017

Mark Fraser
Development Review Services
City of Ottawa
110 Laurier Avenue West, 4th Floor
Ottawa, ON, K1P 1J1

Dear Mr. Fraser,

Re: Fairwinds Temporary Pumping Station

Please accept this letter as confirmation that North American previously purchased 14l/s of capacity at the temporary Mattamy Pump Station on Maple Grove, for Phases 1 and 2 of their development. This letter also confirms that this capacity remains available for North American's use. Note that this 14 l/s is part of the current 92 l/s capacity of the temporary Mattamy Pump Station.

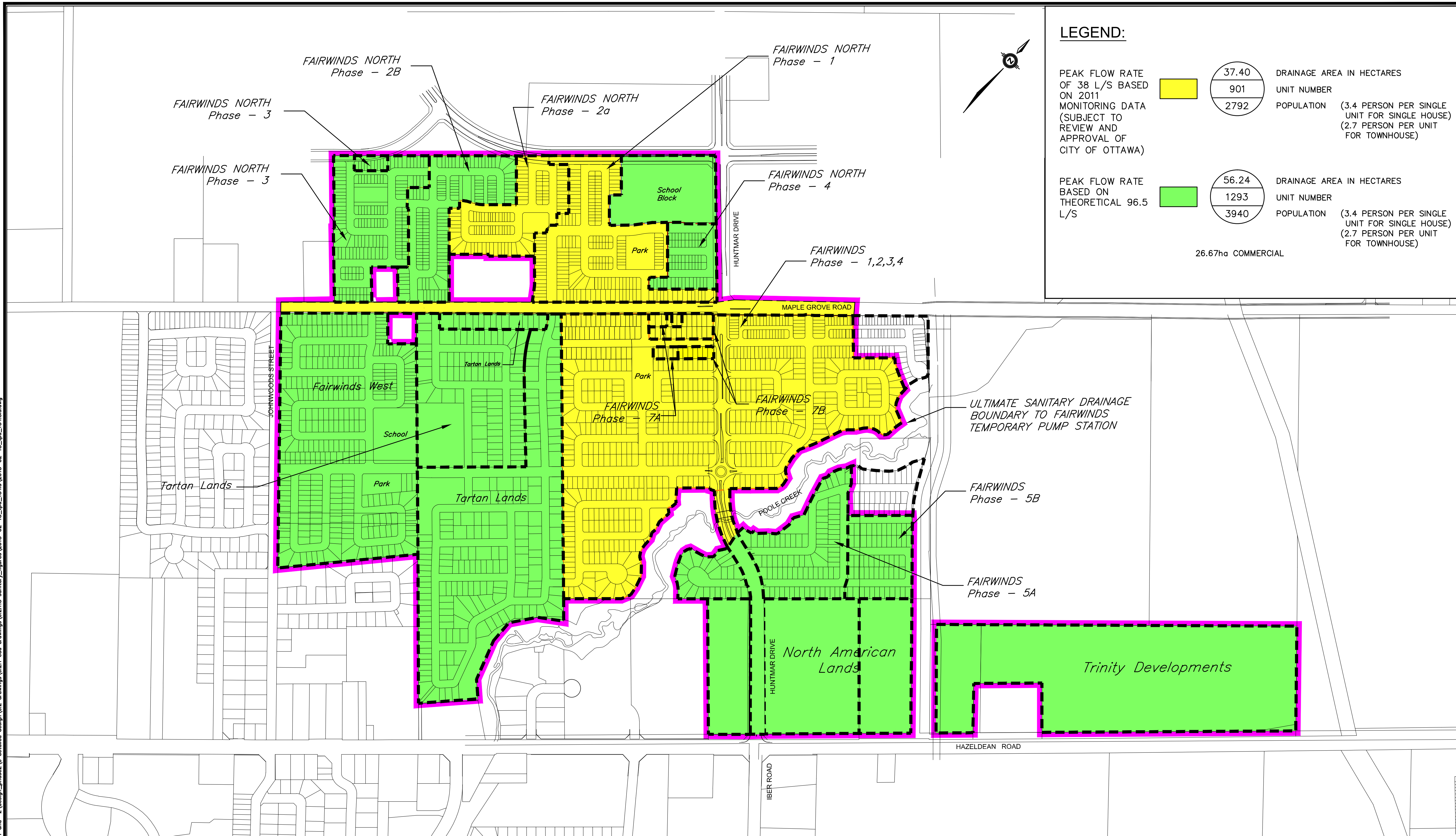
We understand that North American has loaned 1 l/s of their capacity for the Keg Stie Plan (lands previously owned by North American), this will reduce the available capacity for North American's use to 13 l/s for their lands.

If you have any questions, please call the undersigned at (613) 831-5156.

Sincerely,

Kris Haynes
Land Development Manager
Kris.Haynes@mattamycorp.com

Cc: Demetrius Yannoulopoulos



MATTAMY development

DSEL
david schaeffer engineering ltd

120 Iber Road, Unit 203
Stittsville, Ontario, K2S 1E9
Tel. (613) 836-0856
Fax (613) 836-7183
www.DSEL.ca

MATTAMY FAIRWINDS TEMPORARY PUMP STATION ALLOCATION PLAN

DATE: FEBRUARY 13, 2013
SCALE: 1 : 7500
PROJECT No.: 309
FIGURE 1

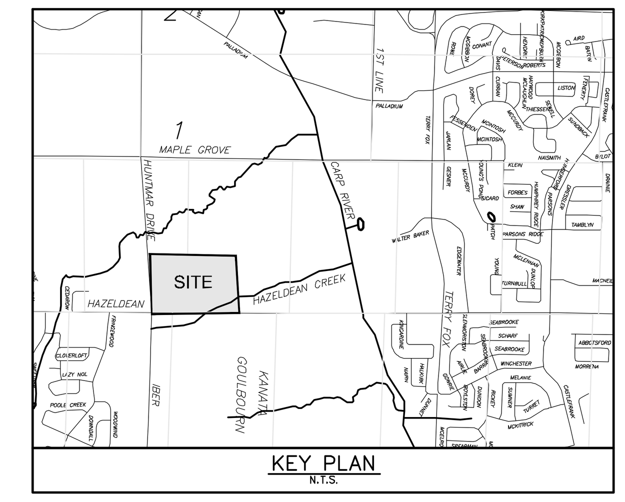
z:\projects\07-309 fairwinds north phase 1 and 2\design_phase2\c detailed design\c.2 drawings\c.2.1 cad drawings\c.2.1.3 sanitary_figures\2013-02-13_tpd_134ls\2013-02-13_tps_134.5ls.dwg

Sanitary Sewer Design Sheet					
Project:	451B	**Where:**	Population (P)		
Location:	Fairwinds Subdivision		Correlation Factor = K =	1	
Revision Date:	13-Feb-13		Average Daily per capita flow Rate =	0.35	(m^3/d cap)
Revised By:	J. Ailey (DSEL)		People per unit = 3.4/single and 2.7/town		
			Infiltration Flow =	0.28	L/s/ha

LOCATION												Total Flow (L/s)	Cumulative Flow (L/s)
Street	Area (Ha)	Cumulative Area (Ha)	Singles	Towns	Units	Population	Cumulative Units	Cumulative Population	Peak Factor	Sewage Flow (L/s)	Infiltration Flow (L/s)		
Existing Development - End of 2011													
Fairwinds Phase 1, 2, 3, 4	24.00	24.0	463	100	563	1845	563	1845					
Fairwinds Phase 7	1.04	25.0	36	0	36	123	599	1968					
Fairwinds North Phase 1	6.29	31.3	11	191	202	554	801	2522					
Fairwinds North Phase 2A	3.08	34.4	0	100	100	270	901	2792					
Infiltration Maple Grove Road	3.02	37.4	0	0	0	0	901	2792					
Monitored Flow Data*													38.0
Fairwinds Phase 5A	5.29	5.3	105	0	105	357	105	357	3.12	4.52	1.48	6.00	6.0
Fairwinds Phase 5B	2.40	7.7	58	0	58	198	163	555	3.12	2.50	0.67	3.18	9.2
Fairwinds North Phase 2B	4.08	11.8	0	141	141	381	304	936	3.12	4.82	1.14	5.96	15.1
Fairwinds North Phase 3	4.22	16.0	0	168	168	454	472	1390	3.12	5.74	1.18	6.93	22.1
Fairwinds North Phase 4	1.50	17.5	0	61	61	165	533	1555	3.12	2.09	0.42	2.51	24.6
Fairwinds North School Block	2.52	20.01								2.19	0.71	2.89	27.5
North American Phase 1										5.70		5.7	5.7
North American Phase 2										8.30		8.3	14.0
Trinity										13.00		13.0	27.0
Fairwinds West	15.72	35.73	249	61	310	1012	843	2567	3.12	12.80	4.40	17.2	71.7
Tartan Lands	20.51	56.24	225	225	450	1373	1293	3940	3.12	17.37	5.74	23.1	94.8
TPS 134.5 L/s Upgrade Total							2194	6732	3.12				**132.8**
Fairwinds Phase 6 (Pond)	1.70	1.7	71	0	71	241	2265	6973	3.10	3.03	0.48	3.5	3.5
Fairwinds Phase 8 (Pond)	1.20	2.9	34	0	34	116	2299	7089	3.10	1.45	0.34	1.8	5.3

Notes:
Peak factors calculated based on total population tributary to the TPS per allocation phase as follows:
Peak Factor for 134.5 L/s based on population of 6732
Peak Factor for remaining allocation based on population of 7062
Tartan unit count provided by IBI - 470 units assuming 50% singles, 25% semi-detached and 25% towns. Average of 3.05 persons / unit.

***Monitored flows based on flow monitoring results submitted to the MOE up to and including the year 2011. Allocation of monitored flows to the pump station will be subject to approval from the City of Ottawa.**



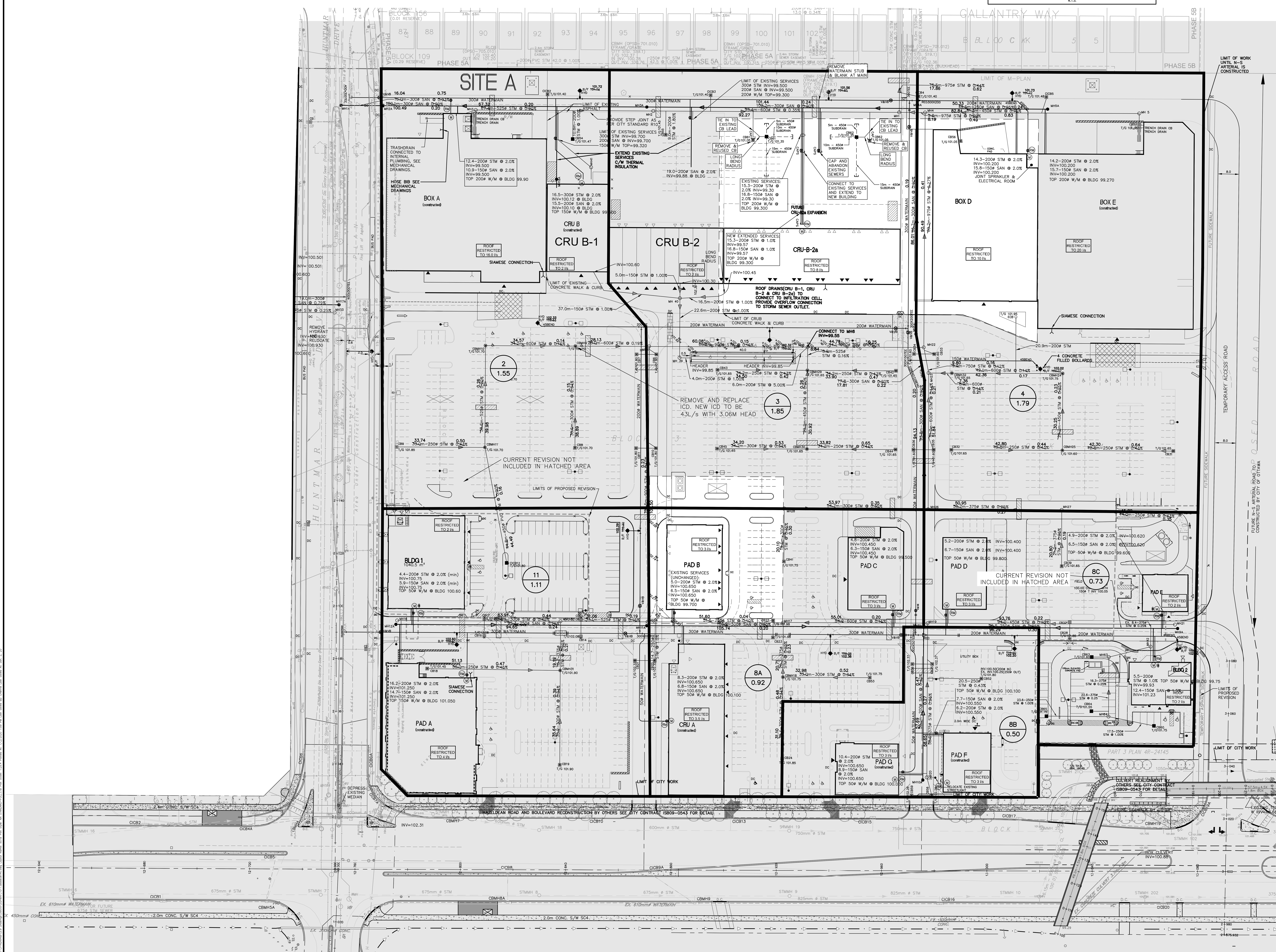
APPROVED ☐ REFUSED ☐

THIS____DAY OF ____________ , 20______

DERRICK MOODIE, MANAGER
DEVELOPMENT REVIEW WEST
PLANNING, INFRASTRUCTURE AND ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

LEGEND

18C — AREA ID NUMBER
0.65 — AREA (ha)



No.	REVISIONS	By	Date
20	REVISED AS PER CITY COMMENTS	DGY	19:12:20
19	REVISED SPA CRU B-3, PAD B, BOX D	DGY	19:08:29
18	ISSUED FOR CONSTRUCTION BLDG 2	DGY	18:04:06
17	ISSUED FOR TENDER	DGY	18:01:15
16	REVISED AS PER CITY COMMENTS	DGY	17:11:23
15	ISSUED FOR SPA	DGY	17:11:02
14	REVISED AS PER SITE PLAN	DGY	17:07:07
13	REVISED AS PER CITY COMMENTS	DGY	17:06:23
12	REVISED BLD 2 & PAD E	DGY	17:02:14
11	REVISED AS PER CITY COMMENTS	DGY	16:08:02
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9	REVISED AS PER SITE PLAN	DGY	14:11:03
8	SPA	DGY	14:09:09
7	REVISED AS PER SITE PLAN	DGY	14:08:08
6	REVISED AS PER CITY COMMENTS	DGY	14:07:31
5	REVISED DOLLAR & CRUB	DGY	14:06:03
4	REVISED FOR PAD F	DGY	12:11:16
3	REVISED SPRINKLER ROOM BOX E	DGY	12:03:09
2	REVISED SITE PLAN PH1 & PH2	DGY	11:11:24
1	ISSUED FOR APPROVAL	DGY	11:10:27

NORTH AMERICAN
DEVELOPMENT GROUP

IBI GROUP
333 Preston Street
Tower 1, Suite 400
Ottawa, Ontario
Canada K1S 5N4
Tel (613)225-1311
FAX (613)225-9868

Project Title

NORTH AMERICAN
HAZELDEAN & HUNTMAR
OTTAWA, ONT.

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2019/12/20
PROVINCE OF ONTARIO

N

Drawing Title

SANITARY TRIBUTARY AREAS PHASE 1 & 2

Scale: 1:500	
Design: D.G.Y.	Date: OCTOBER 2011
Drawn: E.H.	Checked: D.G.Y.
Project No.: 10113	Drawing No.: C-501B

PLAN No.: #16044

IBI GROUP
IBI
333 Preston Street, Suite 400
OTTAWA, ONTARIO
K1S 5N4

Phase 1 & 2 SANITARY SEWER DESIGN SHEET

PROJECT : **Huntmar & Hazeldean**
CITY OF OTTAWA
DEVELOPER : **North American**
All sewers are existing

JOB #: 10113
DATE: Mar 2019
DESIGN: DY

LOCATION			SITE AREA		DESIGN FLOW				EXISTING SEWERS						
Area	FROM MH	TO MH	IND. Area (Ha)	CUMUL. Area (Ha)	PEAK FACT.	DESIGN FLOW (l/s)	INFILT FLOW (l/s)	PEAK FLOW (l/s)	CAPACITY l/s	VELOCITY (full) m/s	LGTH. (m)	PIPE (mm)	GRADE %	VELOCITY (actual) m/s	AVAIL. CAP. (%)
EAST OF HUNTMAR															
11	*12A*	*11A*	*1.11*	*1.11*	*1.50*	*0.64*	*0.31*	*1.27*	*31.01*	*0.61*	*95.3*	*250*	*0.25*	*0.30*	*95.89%*
8A	*11A*	*8A*	*0.92*	*2.03*	*1.50*	*1.17*	*0.57*	*2.33*	*45.09*	*0.62*	*105.2*	*300*	*0.20*	*0.33*	*94.83%*
8B	*10A*	*8A*	*0.50*	*0.50*	*1.50*	*0.29*	*0.14*	*0.57*	*21.63*	*0.67*	*58.1*	*200*	*0.40*	*0.29*	*97.35%*
8C	*9A*	*8A*	*0.73*	*0.73*	*1.50*	*0.42*	*0.20*	*0.84*	*31.01*	*0.61*	*96.5*	*250*	*0.25*	*0.27*	*97.30%*
	8A	*7A*	*0.00*	*3.26*	*1.50*	*1.89*	*0.91*	*3.74*	*45.09*	*0.62*	*93.8*	*300*	*0.20*	*0.37*	*91.70%*
	7A	*6A*	*0.00*	*3.26*	*1.50*	*1.89*	*0.91*	*3.74*	*45.09*	*0.62*	*17.8*	*300*	*0.20*	*0.37*	*91.70%*
	6A	*4A*	*0.00*	*3.26*	*1.50*	*1.89*	*0.91*	*3.74*	*45.09*	*0.62*	*85.7*	*300*	*0.20*	*0.37*	*91.70%*
4	*5A*	*4A*	*1.79*	*1.79*	*1.50*	*1.04*	*0.50*	*2.06*	*31.01*	*0.61*	*49.5*	*250*	*0.25*	*0.35*	*93.37%*
3	*4A*	*3A*	*1.85*	*6.90*	*1.50*	*3.99*	*1.93*	*7.92*	*45.09*	*0.62*	*102.7*	*300*	*0.20*	*0.46*	*82.43%*
2	*3A*	*2A*	*1.55*	*8.45*	*1.50*	*4.89*	*2.37*	*9.70*	*45.09*	*0.62*	*100.1*	*300*	*0.20*	*0.50*	*78.49%*
	2A	*1A*	*0.00*	*8.45*	*1.50*	*4.89*	*2.37*	*9.70*	*97.26*	*1.33*	*16.0*	*300*	*0.93*	*0.85*	*90.03%*

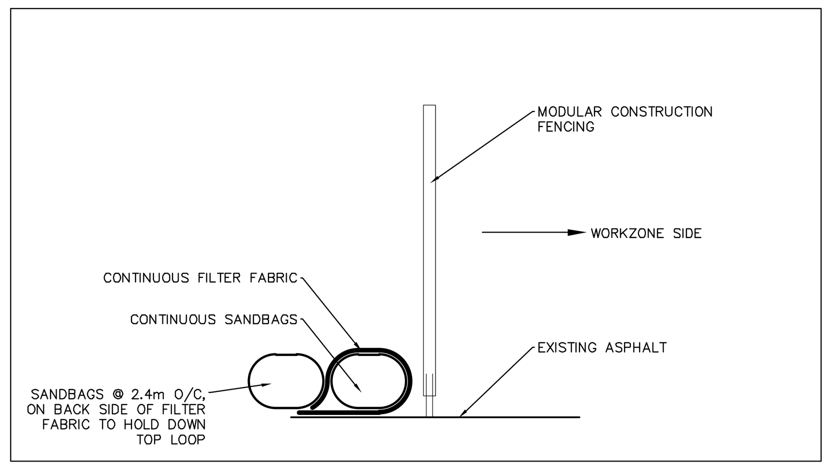
Q = average daily flow (commercial lands) 50000 l/d/Ha
M = Commercial Peaking Factor = 1.5
I = Unit of peak extraneous flow 0.28 l/s/Ha
Q(p) = Peak commercial flow (l/s)
Q(i) = Peak extraneous (infiltration) flow (l/s)

SPECIFY
Coeff. of friction (n) = 0.013

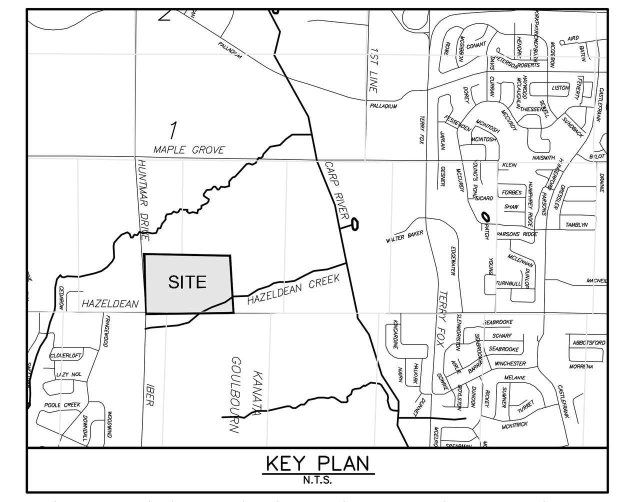
REV. # : 1, Dec, 2011
REV. # : 2, FEB, 2012
REV. # : 3, June, 2014 adjust areas 6 & 7 (CRU B-1/B-2)
REV. # : 4, Aug, 2016 revise area numbers
REV. # : 5, March, 2019 SPA

APPENDIX D

- C-920 Sediment & Erosion Plan Phase 1 & 2
- Paterson Group Report
- C-202 Phase 1 & 2 Grading Plan
- Geotechnical Engineer Memo – Phase 1 & 2 Grading Review
- Figure 5.4 KWDA MSP
- MVCA email



CUSTOM SILT FENCE DETAIL
FOR SITE PERIMETER
LOCATION AS REQUIRED

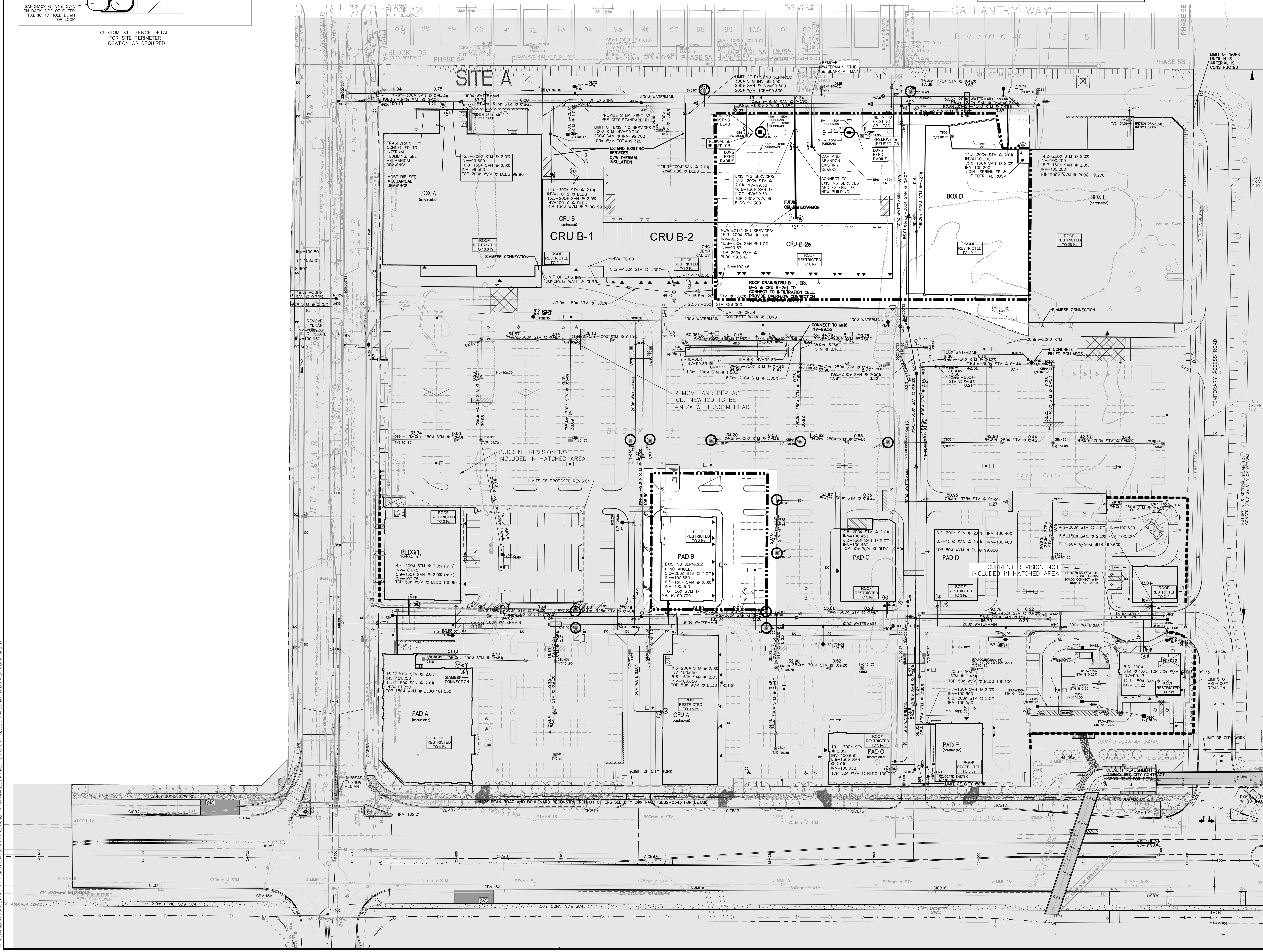


KEY PLAN
N.T.S.

APPROVED ☐ REFUSED ☐

THIS____DAY OF ______________ , 20______

DERRICK MOODIE, MANAGER
DEVELOPMENT REVIEW WEST
PLANNING, INFRASTRUCTURE AND ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



LEGEND

- LIGHT DUTY SILT FENCE AS PER OPSD 219.110
- LIGHT DUTY STRAW BALE BARRIER AS PER OPSD 219.100
- SILT BAG OR APPROVED EQUAL IN EXISTING CICB OR CB
- PERIMETER CONSTRUCTION FENCING C/W CONTINUOUS SEDIMENT CONTROL CONSISTING OF SANDBAGS WRAPPED IN FILTER FABRIC

SEDIMENT AND EROSION CONTROL NOTES.

6.1 CONTRACTOR TO IMPLEMENT EROSION AND SEDIMENT CONTROL MEASURES AS IDENTIFIED IN THE EROSION AND SEDIMENT CONTROL PLAN TO THE SATISFACTION OF THE CITY OF OTTAWA, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.). DURING ALL PHASES OF THE SITE PREPARATION AND CONSTRUCTION THE MEASURES ARE TO BE MAINTAINED TO THE SATISFACTION OF THE ENGINEER AND CITY OF OTTAWA IN ACCORDANCE WITH THE BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL. SHOULD ANY ADDITIONAL MEASURES BE REQUIRED TO ADDRESS FIELD CONDITIONS THEY SHALL BE INSTALLED AS DIRECTED BY THE ENGINEER OR THE CITY OF OTTAWA. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.

6.2 ANY GROUND WATER PUMPING IS LIMITED TO 10 000l/d, AND SHALL BE DISCHARGED IN TO AN APPROVED FILTER MECHANISM PRIOR TO RELEASE TO THE ENVIRONMENT.

6.3 SEEPAGE BARRIERS WILL BE CONSTRUCTED IN ANY TEMPORARY DRAINAGE DITCH.

6.4 FILLER CLOTHS WILL BE PLACED ON OPEN INFRASTRUCTURES SUCH AS MANHOLE AND CATCH BASIN UNTIL STRUCTURES ARE COMMISSIONED AND PUT IN USE.

No.	REVISIONS	By	Date
20	REVISED AS PER CITY COMMENTS	DGY	19:12:20
19	REVISED SPA CRU B-3, PAD B, BOX D	DGY	19:08:29
18	ISSUED FOR CONSTRUCTION BLDG 2	DGY	18:04:06
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6	REVISED AS PER CITY COMMENTS	DGY	14:07:31
5	REVISED DOLLAR & CRUB	DGY	14:06:03
4	REVISED FOR PAD F	DGY	12:11:16
3	REVISED SPRINKLER ROOM BOX E	DGY	12:03:09
2	REVISED PER CITY COMMENTS AND PAD E	DGY	12:02:22
1	ISSUED FOR REVIEW	DGY	11:04:19

NORTH AMERICAN
DEVELOPMENT GROUP

IBI GROUP
333 Preston Street
Tower 1, Suite 400
Ottawa, Ontario
Canada K1S 5N4
Tel (613)225-1311
FAX (613)225-9868

Project Title
5705 HAZELDEAN ROAD
OTTAWA, ONT.

Drawing Title
SEDIMENT AND EROSION CONTROL PLAN
PHASE 1 & 2

Scale
1:500

Design	Date
D.G.Y.	OCTOBER 2008
Drawn	Checked
L.R.	D.G.Y.
Project No.	Drawing No.
10113	C-920

PLAN No.: #16044

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

patersongroup

Geotechnical Investigation

Proposed Commercial Development
5707 Hazeldean Road
Ottawa, Ontario

Prepared For

North American (Goulbourne) Limited Partnership

June 28, 2017

Report: PG1899-2 Revision 1

Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

Table of Contents **Page**

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by North American (Goulbourne) Limited Partnership (North American) to conduct a geotechnical investigation for the commercial development located at the northeast corner of the intersection of Huntmar Drive and Hazeldean Road (5707 Hazeldean Road), in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2).

The objectives of the current investigation were to:

- ❏ Determine the subsoil and groundwater conditions at this site by means of boreholes.
- ❏ Provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject developments as they are understood at the time of writing this report.

2.0 Proposed Development

It is understood that the current phase of the commercial development will consist of several buildings of slab on grade construction. Associated access lanes, parking and landscaped areas are also anticipated.

3.0 Method of Investigation

3.1 Field Investigation

The field program for the current investigation was carried on April 26, 2016. At that time, six (6) boreholes were extended to a maximum depth of 6.4 m. A previous investigation was carried between July 7 and 13, 2009. At that time, eighteen (18) boreholes were extended to a maximum depth of 9.8 m. The test hole locations were distributed across the subject site in a manner to provide general coverage of the proposed buildings. The borehole locations were selected and located in the field by Paterson. The test hole locations are shown on Drawing PG1899-2 - Test Hole Location Plan included in Appendix 2.

The boreholes were put down using a track-mounted auger drill rig operated by a crew of two. All fieldwork was conducted under the full-time supervision of personnel from Paterson's geotechnical division under the direction of a senior engineer. The testing procedure consisted of augering to the required depths at the selected locations and sampling the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using a 50 mm diameter split-spoon (SS) sampler, using 73 mm diameter thin walled (TW) Shelby tubes in conjunction with a piston sampler, or the auger flights. All soil samples were visually inspected and initially classified on site. The split-spoon samples were placed in sealed plastic bags and the Shelby tubes were sealed at both ends on site. All samples were transported to our laboratory for further examination and classification. The depths at which the split-spoon, Shelby tube, and auger samples were recovered from the test holes are shown as SS, TW, and AU, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Undrained shear strength testing was carried out in cohesive soils using a field vane apparatus.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

A flexible standpipe was installed in all boreholes, except BHs 3, 5 and 16, to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

3.2 Field Survey

The test hole locations for the current investigation were determined in the field by Paterson personnel with consideration of existing site features. It should be noted that the ground surface elevations at the borehole locations are referenced to a temporary benchmark (TBM), consisting of the top of a fire hydrant located northeast of CRU A. A geodetic elevation of 102.38 m was provided for the TBM. The borehole locations for the previous investigation were surveyed by Fairhall, Moffatt & Woodland Limited. The locations and ground surface elevation at the borehole locations are presented on Drawing PG1899-2 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

All soil samples recovered from the subject site were examined in our laboratory to review the results of the field logging.

All samples will be stored in the laboratory for a period of one month after issuance of this report. The samples will then be discarded unless otherwise directed.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the samples. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The ground surface at the subject site currently consists of asphaltic concrete and or granular fill, with several commercial buildings constructed during the previous development phases of the subject site. The ground surface at the subject site is relatively flat gradually slopes downward to the south. The subject site is approximately at grade with Huntmar Road and Hazeldean Road.

4.2 Subsurface Profile

Generally, the soil profile at the test holes consists of asphaltic concrete and/or granular fill, such as crushed stone and/or silty sand with gravel and cobbles. Very stiff to stiff brown silty clay crust was encountered below the abovenoted fill layers followed by a firm grey silty clay layer. Practical refusal to dynamic cone penetration testing was completed at BHs 4, 6, 11 and 14, at depths varying between 11 and 15 m. Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profile encountered at each test hole location.

Based on available geological mapping, the subject site consists of interbedded dolostone and limestone of the Gull River formation to depth ranging between 3 to 15 m.

Silty Clay

Two (2) samples of silty clay were subjected to unidimensional consolidation (oedometer) testing. The test results are presented in Subsection 5.3 and the Consolidation Test sheets in Appendix 1. The consolidation test results indicate that the silty clay is overconsolidated with overconsolidation ratios (OCR) for the tested samples varying between 1.9 and 2.1. The OCR is the ratio of the preconsolidation pressure to the effective pressure at the sample depth. This is further discussed in Subsection 5.3.

One (1) silty clay sample was submitted for Atterberg Limits testing. The tested material was classified as inorganic clays of low plasticity (CL). The results are summarized in Table 1 and presented on the Atterberg Limits results sheet in Appendix 1.

Table 1 - Summary of Atterberg Limits Tests					
Sample	**Moisture Content %**	**Liquid Limit %**	**Plastic Limit %**	**Plasticity Index %**	**Classification**
BH 11 TW 2	41.6	30	18	12	CL

4.3 Groundwater

The measured groundwater levels at the borehole locations are presented in Table 2. It should be noted that groundwater readings could be influenced by surface water infiltrating the backfilled boreholes. The groundwater level can also be estimated based on moisture levels and colour of the recovered soil samples. Based on these observations at the borehole locations, the permanent groundwater table is expected to be between 3 and 4 m depth. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

Table 2
Summary of Groundwater Level Readings

Test Hole Number	Ground Elevation, m	Groundwater Levels, m		Recording Date
		Depth	Elevation	
BH1-16	102.08	1.92	100.16	May 3, 2016
BH2-16	102.11	3.62	98.49	May 3, 2016
BH3-16	102.04	2.91	99.13	May 3, 2016
BH4-16	101.83	Dry	n/a	May 3, 2016
BH5-16	101.50	2.20	99.30	May 3, 2016
BH6-16	101.75	3.19	98.56	May 3, 2016
PG1988-1R - February 24, 2012				
BH 1	102.81	1.76	101.05	July 16, 2009
BH 2	102.55	2.28	100.27	July 16, 2009
BH 4	101.98	2.51	99.47	July 16, 2009
BH 6	102.74	1.93	100.81	July 16, 2009
BH 7	102.46	2.03	100.43	July 16, 2009
BH 8	101.92	1.50	100.42	July 16, 2009
BH 9	101.68	1.52	100.16	July 16, 2009

Table 2
Summary of Groundwater Level Readings (continued)

Test Hole Number	Ground Elevation, m	Groundwater Levels, m		Recording Date
		Depth	Elevation	
BH 10	101.54	1.55	99.99	July 16, 2009
BH 11	101.34	1.40	99.94	July 16, 2009
BH 12	101.15	1.42	99.73	July 16, 2009
BH 13	100.95	0.60	100.35	July 16, 2009
BH 14	100.24	0.52	99.72	July 16, 2009
BH 15	100.76	1.61	99.15	July 16, 2009
BH 17	101.55	1.27	100.28	July 16, 2009
BH 18	100.47	1.58	98.89	July 16, 2009

Note:

❏ The ground surface elevations are referenced to a temporary benchmark (TBM), consisting of the top of a fire hydrant to be located northeast of CRU A. A geodetic elevation of 102.38 m was provided for the TBM.

5.0 Discussions

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed commercial development. It is anticipated that all structures will be founded on conventional shallow footings placed on the undisturbed, stiff to very stiff silty clay. However, due to the presence of a silty clay layer, the proposed development will be subjected to grade raise restrictions.

Our permissible grade raise recommendations are discussed in Subsection 5.3. If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil, deleterious fill, such as those containing organic materials, and construction debris should be stripped from under any buildings and other settlement sensitive structures.

Fill Placement

Fill used for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the buildings and paved areas should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, stiff silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, have been removed, in the dry, prior to the placement of concrete for footings.

Footings founded on the silty clay will experience up to 25 mm of total settlement and 15 mm of differential settlement.

Lateral Support

The bearing medium under footing supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to very stiff to stiff silty clay above groundwater table when a plane extending down and out from the bottom edge of the fooring at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

Settlement/Grade Raise

Consideration must be given to potential settlements which could occur due to the presence of the silty clay deposit and the combined loads from the proposed footings, any groundwater lowering effects, and grade raise fill. The foundation loads to be considered for the settlement case are the continuously applied loads which consist of the unfactored dead loads and the portion of the unfactored live load that is considered to be continuously applied.

Generally, the potential long term settlement is evaluated based on the compressibility characteristics of the silty clay. These characteristics are estimated in the laboratory by conducting unidimensional consolidation tests on undisturbed soil samples collected using Shelby tubes in conjunction with a piston sampler. Two (2) site specific consolidation tests are being carried out for this project. The results of the consolidation tests are included in Appendix 1 to the present report.

Value p'_c is the preconsolidation pressure of the sample and p'_o is the effective overburden pressure. The difference between these values is the available preconsolidation. The increase in stress on the soil due to the cumulative effects of the fill surcharge, the footing pressures, the slab loadings and the lowering of the groundwater should not exceed the available preconsolidation if unacceptable settlements are to be avoided.

The values C_{cr} and C_c are the recompression and compression indices, respectively, and are a measure of the compressibility of the soil due to stress increases below and above the preconsolidation pressures. The higher values for the C_c, as compared to the C_{cr}, illustrate the increased settlement potential above, as compared to below, the preconsolidation pressure.

It should be noted that the values of p'_c, p'_o, C_{cr} and C_c are determined using standard engineering practices and are estimates only. In addition, natural variations within the soil deposit would also affect the results. Furthermore, the p'_o parameter is directly influenced by the groundwater level. While the groundwater levels were measured at the time of the fieldwork, the levels vary with time and this has an impact on the available preconsolidation. Lowering the groundwater level increases the p'_o and therefore reduces the available preconsolidation. Unacceptable settlements could be induced by a significant lowering of the groundwater level. The p'_o values for the consolidation tests carried out for the present investigation are based on the long term groundwater level being 0.5 m above the bottom of the silty clay crust. The level of the groundwater level is based on the colour and undrained shear strength profile of the silty clay.

For design purposes, the total and differential settlements associated with the combination of grade raises and footing loading conditions using the bearing resistance values are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed.

Table 3
Summary of Consolidation Test Results

Borehole No.	Sample	Depth (m)	p'_c (kPa)	p'_o (kPa)	C_{cr}	C_c	Q (*)
BH 11	TW 2	4.99	148	70	0.013	0.674	A
BH 18	TW 4	5.07	126	65	0.013	0.466	A

* - Q - Quality assessment of sample - G: Good A: Acceptable P: Likely disturbed

To reduce potential long term liabilities, consideration should be given to provide means to reduce long term groundwater lowering (e.g. clay dykes, restriction on planting around the structures, etc). It should be noted that building on silty clay deposits increases the likelihood of building movements and therefore of cracking. The use of steel reinforcement in foundations placed at key structural locations will tend to reduce foundation cracking as compared to unreinforced foundations.

Based on our laboratory and field testing results, a permissible grade raise restriction of 1.2 m is recommended for the subject site.

If higher grade raises and/or higher loading conditions are required, post construction settlements can be reduced by several methods. The following options can be considered:

- ❑ preloading and surcharging
- ❑ lightweight fill (LWF)

5.4 Design for Earthquakes

The site class for seismic site response is a **Class D** for the foundations considered. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code 2012 (OBC 2012; Table 4.1.8.4 A) for a full discussion of the earthquake design requirements.

5.5 Slab-on-Grade Construction

With the removal of the topsoil layer and fill containing organic matter, within the footprint of the proposed building, the native soil surface will be considered to be an acceptable subgrade on which to commence backfilling for floor slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. It is recommended that the upper 200 mm of sub-floor fill consists of OPSS Granular A crushed stone for slab on grade construction. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

5.6 Pavement Design

For design purposes, the pavement structures presented in the following tables could be used for the design of car only parking areas and access lanes.

Table 4 - Recommended Pavement Structure
Car Only Parking Areas

Thickness mm	Material Description
50	**WEAR COURSE -** Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil or fill.	

Table 5 - Recommended Pavement Structure
Access Lanes, Fire Routes and Heavy Truck Parking Areas

Thickness mm	Material Description
40	**WEAR COURSE -** Superpave 12.5 Asphaltic Concrete
50	**BINDER COURSE -** Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
400	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either in situ soil, fill or OPSS Granular B Type I or II material placed over in situ soil, or fill.	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type I or II material. Weak subgrade conditions may be experienced over service trench fill materials.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable vibratory equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

In areas where silty clay is encountered at subgrade, consideration should be given to installing subdrains during the pavement construction as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for the proposed structures. The system should consist of a 100 mm to 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer or sump pit.

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, such as Miradrain G100N or Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum of 1.5 m of soil cover alone, or a minimum of 0.6 m of soil cover, in conjunction with foundation insulation, should be provided in this regard.

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the structure proper and require additional protection, such as soil cover of 2.1 m or a combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly Type 2 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical side walls.

6.4 Pipe Bedding and Backfill

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material. Where the bedding is located within the firm grey silty clay, the thickness of the bedding material should be increased to a minimum of 300 mm. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of its SPMDD. The bedding material should extent at least to the spring line of the pipe.

The cover material, which should consist of OPSS Granular A, should extend from the spring line of the pipe to at least 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of its SPMDD.

It should generally be possible to re-use the moist (not wet) brown silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet silty clay materials will be difficult to re-use, as the high water contents make compacting impractical without an extensive drying period.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. Generally, the seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the material's SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

The groundwater infiltration into the excavations should be low and controllable with open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

A temporary MOE permit to take water (PTTW) may be required for this project if more than 50,000 L/day is to be pumped during the construction phase. A minimum of 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MOE.

6.6 Winter Construction

The subsoil conditions at this site mostly consist of frost susceptible materials. In presence of water and freezing conditions ice could form within the soil mass. Heaving and settlement upon thawing could occur. Precautions should be taken if winter construction is considered for this project.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

The trench excavations should be carried out in a manner that will avoid the introduction of frozen materials into the trenches. As well, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving as the work takes place. In addition, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The analytical testing results are presented in Table 6 along with industry standards for the applicable threshold values. These results are indicative that Type 10 Portland cement (Type GU, or normal cement) would be appropriate for this site.

Table 6 - Corrosion Potential

Parameter	Laboratory Results	Threshold	Commentary
	BH6 SS2		
Chloride	66 µg/g	Chloride content less than 400 mg/g	Negligible concern
pH	7.5	pH value less than 5.0	Neutral Soil
Resistivity	21.8 ohm.m	Resistivity greater than 1,500 ohm.cm	Moderate Corrosion Potential
Sulphate	251 µg/g	Sulphate value greater than 1 mg/g	Negligible Concern

6.8 Landscaping Considerations

The proposed development is located in a moderate sensitivity area with respect to tree plantings over a silty clay deposit. It is recommended that trees placed within 4 m of the foundation wall should consist of low water demanding trees with shallow roots systems that extend less than 1.5 m below ground surface. Trees placed greater than 4 m from the foundation wall may consist of typical street trees, which are typically moderate water demand species with roots extending to a maximum depth of 2 m below ground surface.

It is well documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils that shrink on drying can result in long-term differential settlements of the structures. Tree varieties that have the most pronounced effect on foundations are seen to consist of poplars, willows and some maples (i.e. Manitoba Maples) and, as such, they should not be considered in the landscaping design.

7.0 Recommendations

It is recommended that the following be carried out once the master plan and site development are determined:

- ❏ Review master grading plan from a geotechnical perspective, once available.
- ❏ Review detailed grading plan(s) from a geotechnical perspective.
- ❏ Observation of all bearing surfaces prior to the placement of concrete.
- ❏ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❏ Observation of all subgrades prior to backfilling and follow-up field density tests to ensure that the specified level of compaction has been achieved.
- ❏ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon request, following the completion of a satisfactory material testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations made in this report are in accordance with our present understanding of the project. The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than North American (Goulbourne) Limited Partnership Limited or their agent(s) are not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng.

LICENSED PROFESSIONAL ENGINEER
June 28, 2017
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

David J. Gilbert, P.Eng.

Report Distribution:

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APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

CONSOLIDATION TESTING RESULTS

ATTERBERG LIMIT TESTING RESULTS

ANALYTICAL TESTING RESULTS

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant. Geodetic elevation = 102.38m.

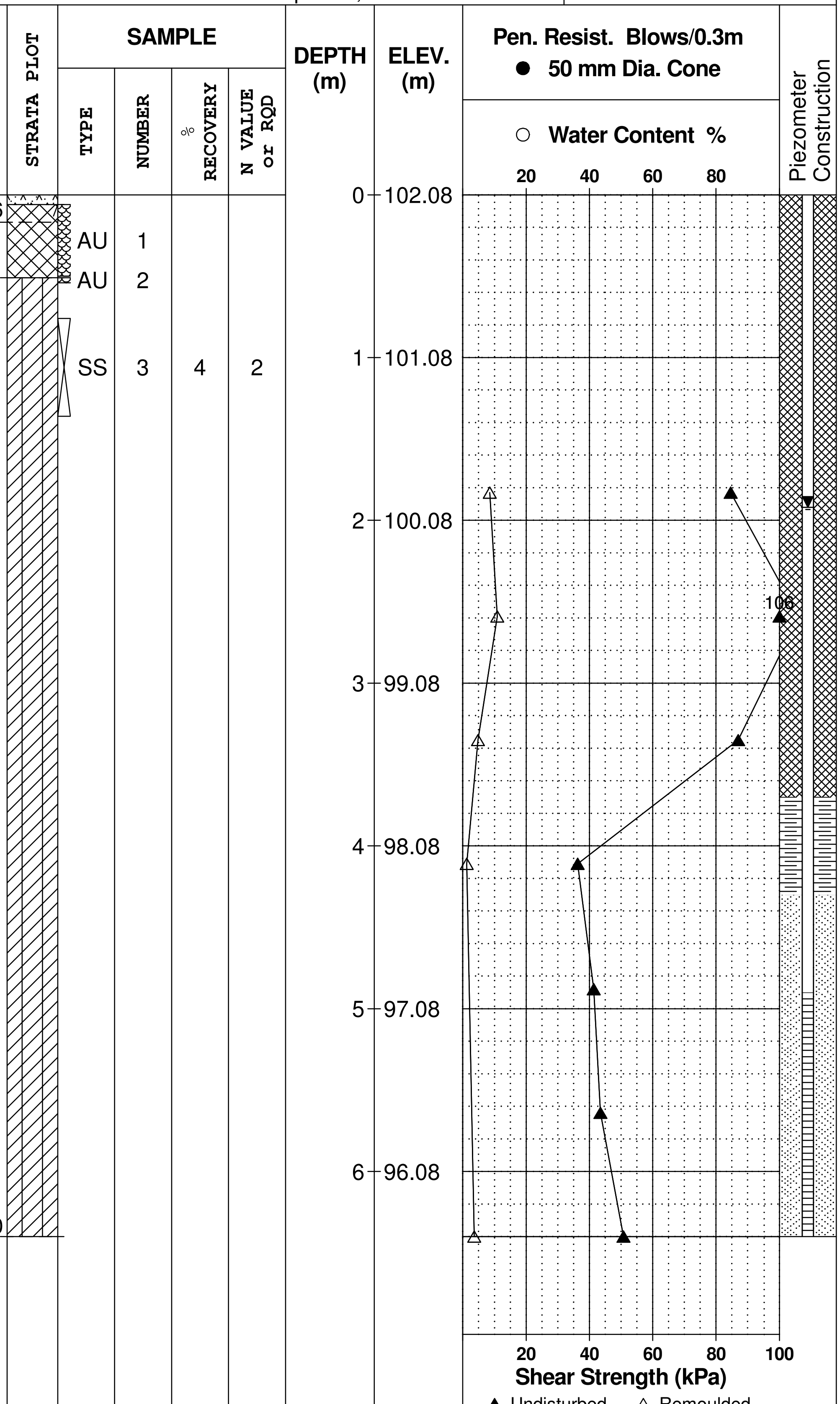
FILE NO. **PG1899**

REMARKS

HOLE NO. **BH 1-16**

BORINGS BY CME 55 Power Auger **DATE** April 26, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.08
Asphaltic concrete 0.06							
FILL: Crushed stone 0.51		AU	1				
		AU	2				
		SS	3	4	2	1	101.08
Very stiff to stiff, brown **SILTY CLAY,** trace sand						2	100.08
						3	99.08
- firm to stiff and grey by 3.8m depth						4	98.08
						5	97.08
6.40						6	96.08
End of Borehole							
(GWL @ 1.92m-May 3, 2016)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant. Geodetic elevation = 102.38m.

REMARKS

BORINGS BY CME 55 Power Auger

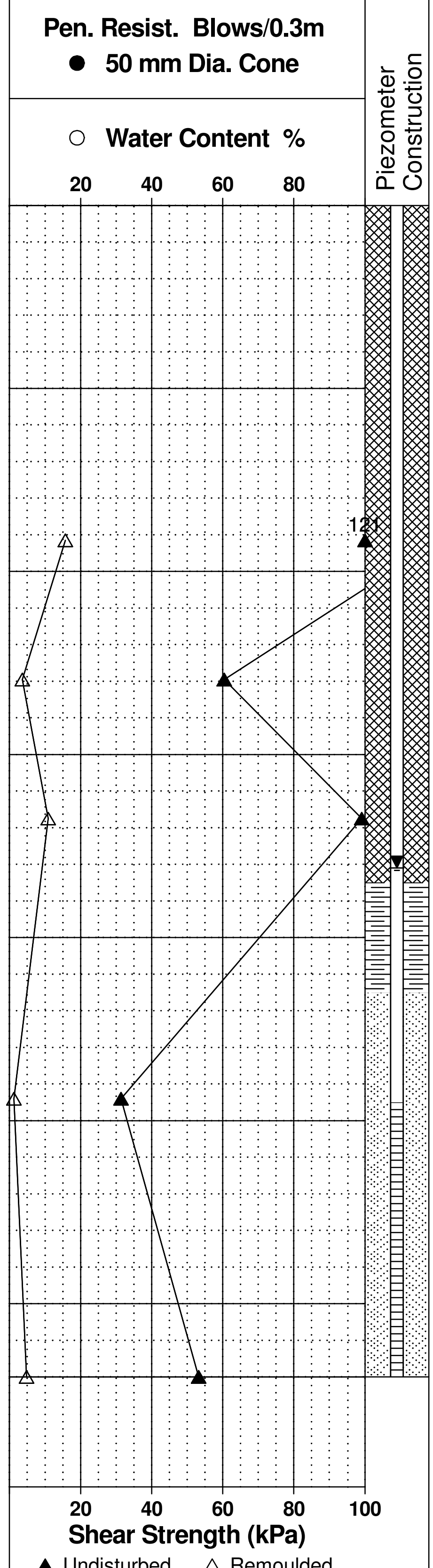
DATE April 26, 2016

FILE NO. PG1899

HOLE NO. BH 2-16

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
Crushed stone	0.15	AU	1		
FILL: Silty sand with gravel and cobbles	0.90				
Very stiff to stiff, brown **SILTY CLAY,** trace sand - firm to stiff and grey by 4.0m depth	6.40	SS	2	46	27
End of Borehole (GWL @ 3.62m-May 3, 2016)					

DEPTH (m)	ELEV. (m)
0	102.11
1	101.11
2	100.11
3	99.11
4	98.11
5	97.11
6	96.11



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant. Geodetic elevation = 102.38m.

FILE NO. PG1899

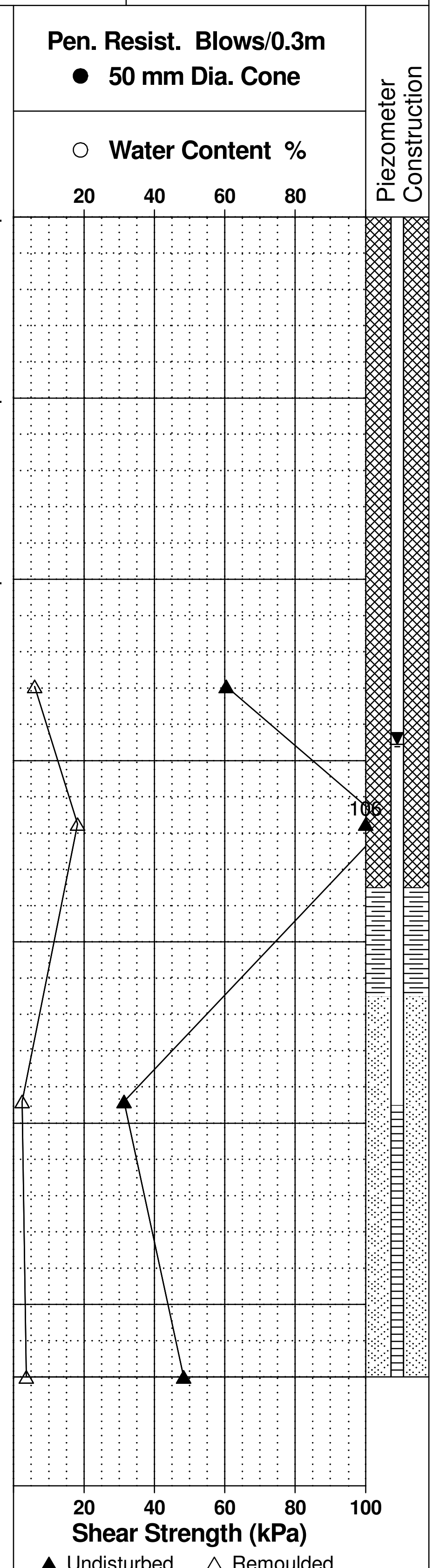
REMARKS

HOLE NO. BH 3-16

BORINGS BY CME 55 Power Auger

DATE April 26, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.04
Crushed stone — 0.15							
FILL: Brown silty sand with gravel and cobbles — 0.85							
		SS	1	42	37	1	101.04
		SS	2	21	5		
						2	100.04
Very stiff to stiff, brown **SILTY CLAY,** trace sand - firm and grey by 4.0m depth						3	99.04
						4	98.04
						5	97.04
						6	96.04
— 6.40 End of Borehole (GWL @ 2.91m-May 3, 2016)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant. Geodetic elevation = 102.38m.

REMARKS

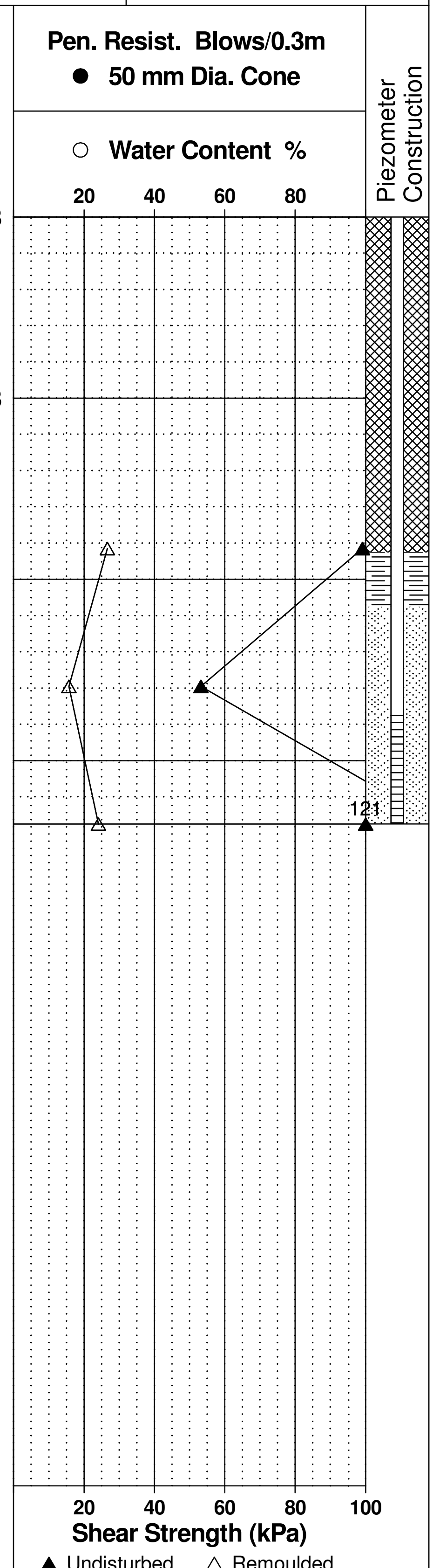
BORINGS BY CME 55 Power Auger

DATE April 26, 2016

FILE NO. PG1899

HOLE NO. BH 4-16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.83
FILL: Brown silty sand with gravel		AU	1				
		SS	2	42	14	1	100.83
1.32							
Stiff to very stiff, brown **SILTY CLAY,** trace sand						2	99.83
						3	98.83
3.35							
End of Borehole							
(BH dry - May 3, 2016)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant. Geodetic elevation = 102.38m.

FILE NO. PG1899

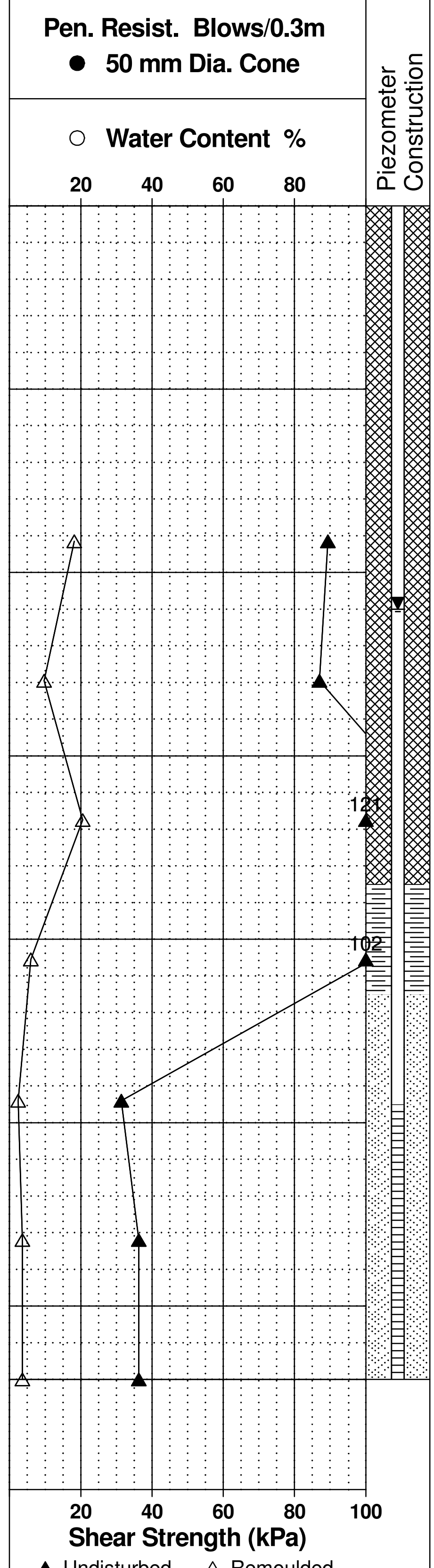
REMARKS

HOLE NO. BH 5-16

BORINGS BY CME 55 Power Auger

DATE April 26, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.50
FILL: Brown silty sand with gravel		AU	1				
0.86		SS	2	42	9	1	100.50
Stiff to very stiff, brown **SILTY CLAY,** trace sand						2	99.50
						3	98.50
- firm and grey by 4.3m depth						4	97.50
						5	96.50
6.40						6	95.50
End of Borehole							
(GWL @ 2.20m-May 3, 2016)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant. Geodetic elevation = 102.38m.

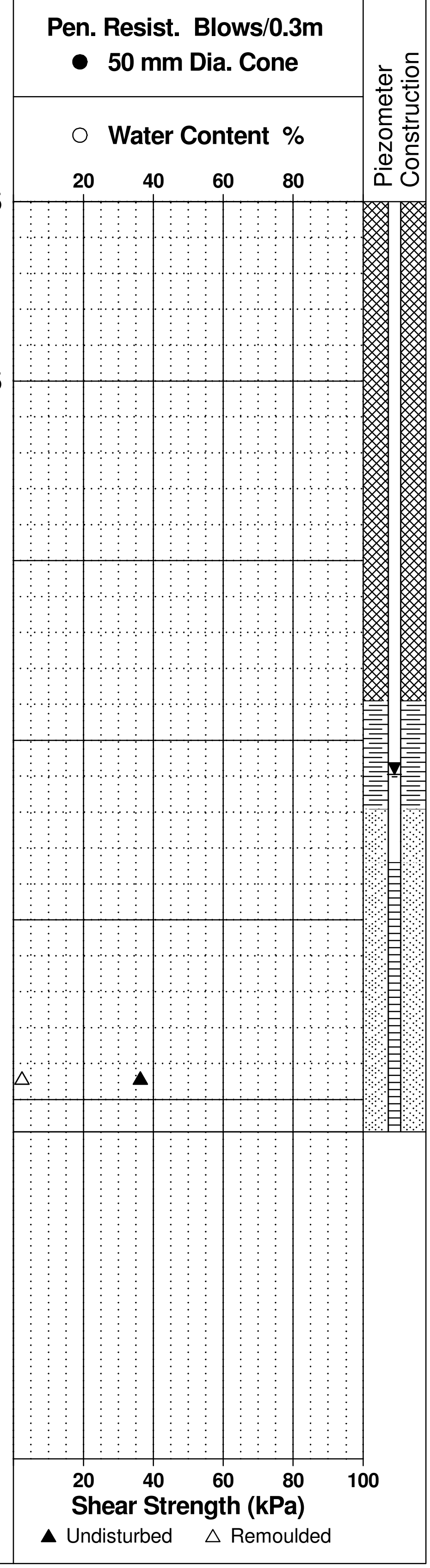
FILE NO. PG1899

REMARKS

HOLE NO. BH 6-16

BORINGS BY CME 55 Power Auger **DATE** April 26, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.75
FILL: Brown silty sand with gravel and cobbles		AU	1				
		SS	2	62	17	1	100.75
1.30							
Very stiff to stiff, brown **SILTY CLAY** with sand		SS	3	67	7	2	99.75
		SS	4	100	4	3	98.75
		SS	5	100	2		
		SS	6	100	2	4	97.75
- firm and grey by 4.5m depth		SS	7	100	P	5	96.75
5.18							
End of Borehole							
(GWL @ 3.19m-May 3, 2016)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Fairhall, Moffatt & Woodland Ltd.

FILE NO. PG1899

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** 13 July 2009

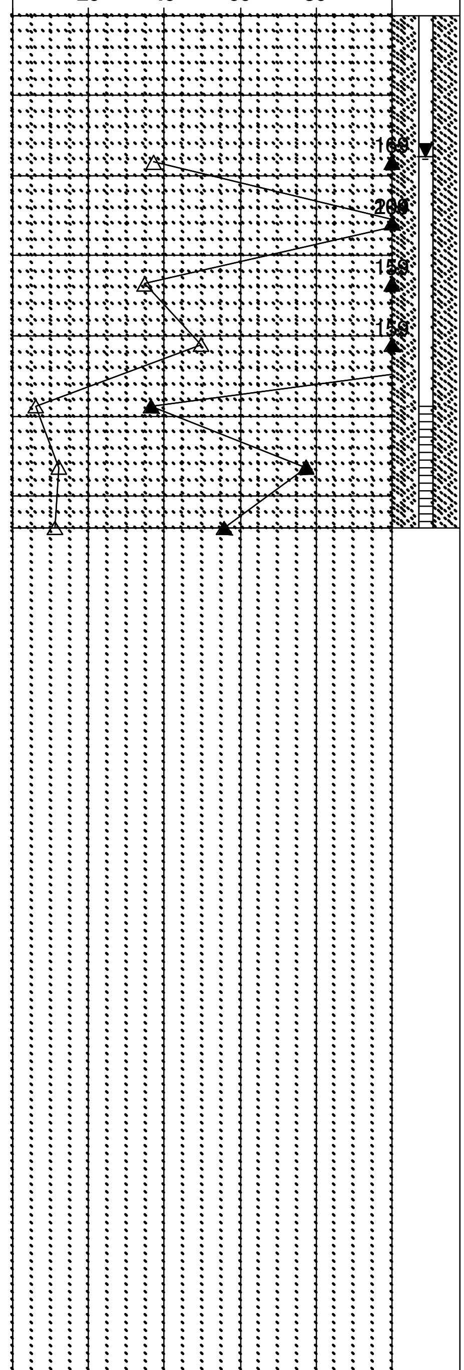
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.81
TOPSOIL 0.13		AU	1				
		SS	2	58	8	1	101.81
Hard to very stiff, brown **SILTY CLAY** , trace sand and sand seams						2	100.81
						3	99.81
						4	98.81
- very stiff to stiff and grey by 2.8m depth						5	97.81
6.40						6	96.81
End of Borehole							
(GWL @ 1.76m-July 16/09)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Fairhall, Moffatt & Woodland Ltd.

REMARKS

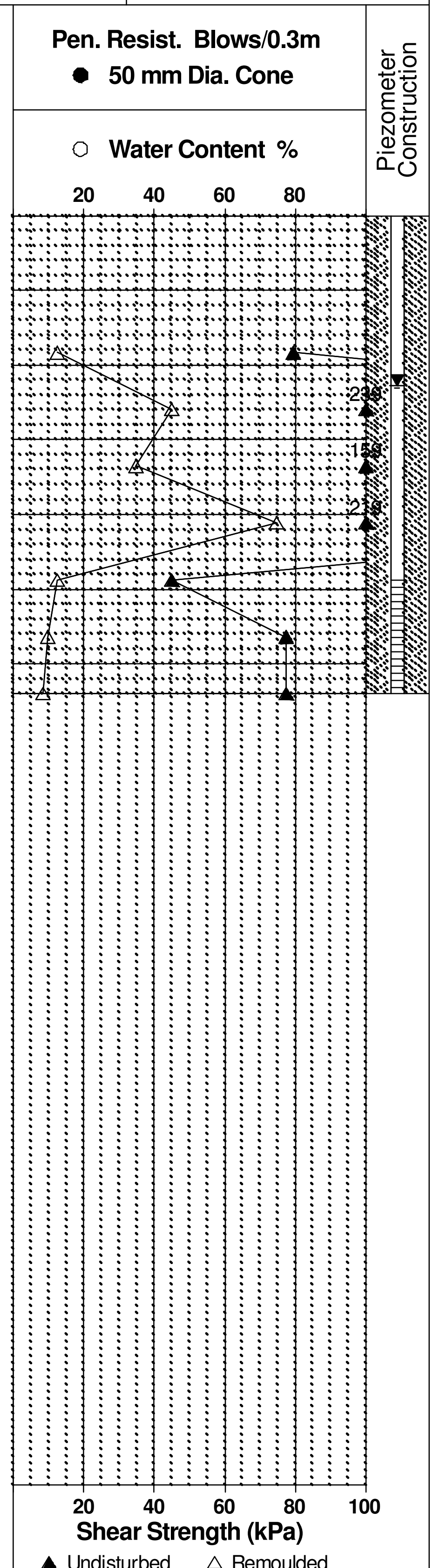
BORINGS BY CME 55 Power Auger

DATE 13 July 2009

FILE NO. PG1899

HOLE NO. BH 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.55
TOPSOIL 0.15							
		SS	1		5	1	101.55
						2	100.55
Hard to very stiff, brown **SILTY CLAY**, trace sand and sand seams						3	99.55
						4	98.55
- firm to stiff and grey by 4.3m depth						5	97.55
6.40						6	96.55
End of Borehole							
(GWL @ 2.28m-July 16/09)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

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REMARKS

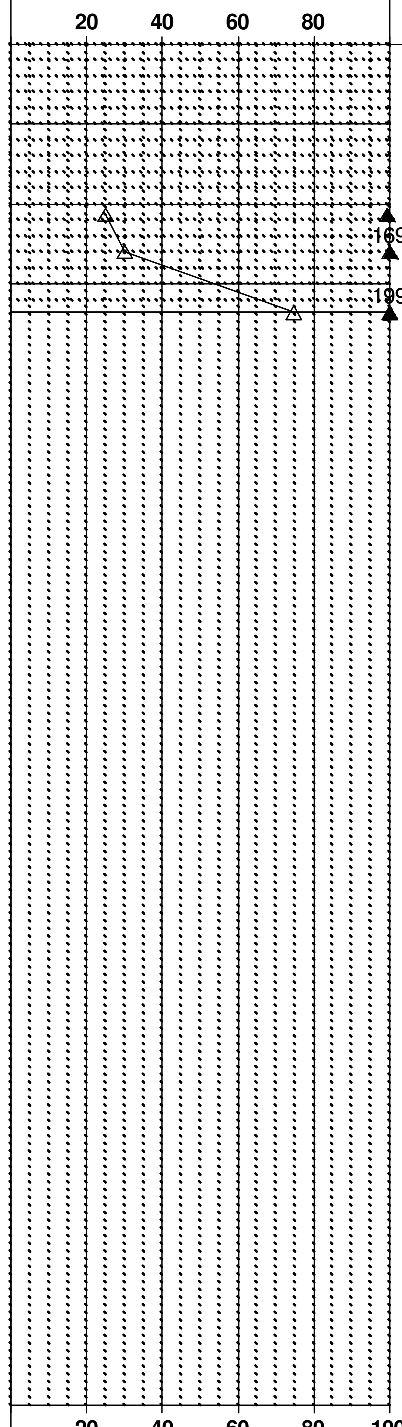
BORINGS BY CME 55 Power Auger

DATE 13 July 2009

FILE NO. PG1899

HOLE NO. BH 3

SOIL DESCRIPTION	Layer bottom depth (m)	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE							0	102.59		
TOPSOIL	0.15									
Brown **CLAYEY SILT**, some sand	0.69		SS	1		8	1	101.59		
Very stiff, brown **SILTY CLAY**	3.35						2	100.59		
							3	99.59		
End of Borehole										



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
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REMARKS

BORINGS BY CME 55 Power Auger

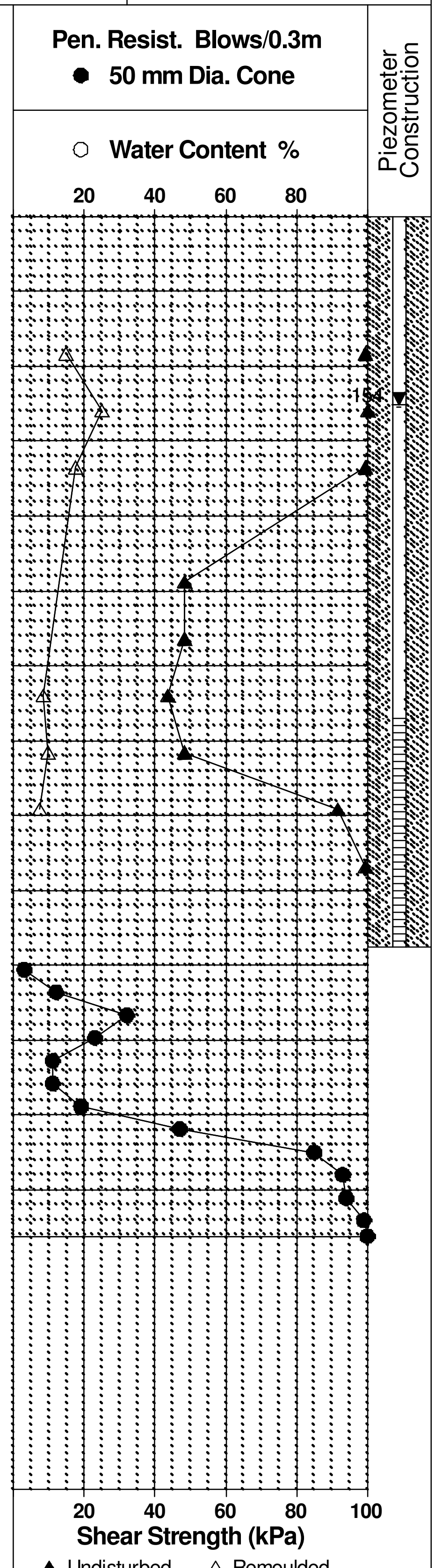
DATE 8 July 2009

FILE NO. PG1899

HOLE NO. BH 4

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
FILL: Silty clay wtih gravel and topsoil	0.91	AU	1		
Very stiff to stiff, brown **SILTY CLAY**, trace sand - grey-brown by 2.0m depth - firm to stiff and grey by 3.7m depth	8.15	SS	2		5
		TW	3	100	
GLACIAL TILL: Stiff, grey clayey silt with sand, gravel , cobbles and boulders, trace clay	9.75	SS	4		2
Dynamic Cone Penetration Test commenced @ 9.75m depth Inferred **GLACIAL TILL**	13.62				
End of Borehole Practical refusal to DCPT @ 13.62m depth (GWL @ 2.51m-July 16/09)					

DEPTH (m)	ELEV. (m)
0	101.98
1	100.98
2	99.98
3	98.98
4	97.98
5	96.98
6	95.98
7	94.98
8	93.98
9	92.98
10	91.98
11	90.98
12	89.98
13	88.98



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
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REMARKS

BORINGS BY CME 55 Power Auger **DATE** 7 July 2009

FILE NO. PG1899

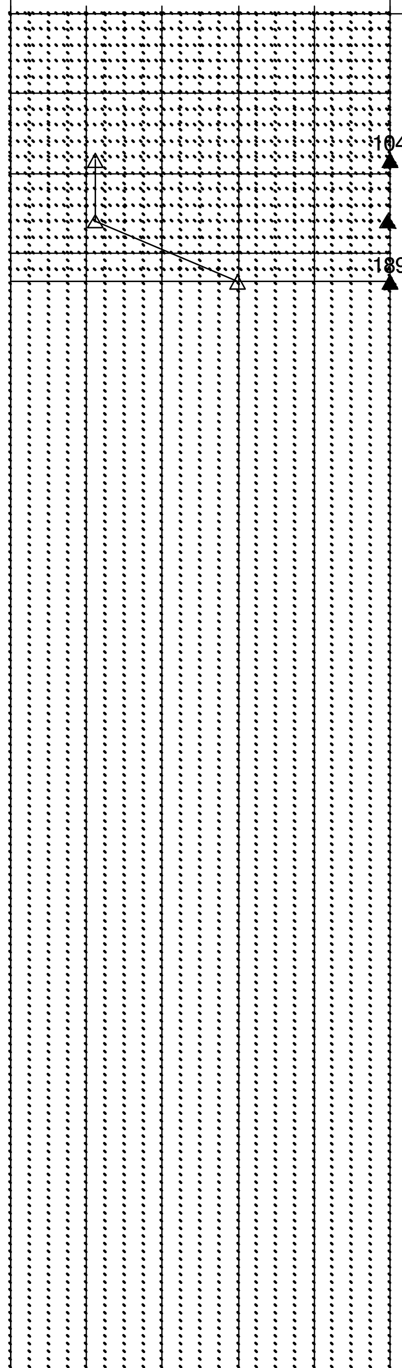
HOLE NO. BH 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.27
TOPSOIL 0.20							
		SS	1		5	1	101.27
Very stiff, brown **SILTY CLAY** with some sand						2	100.27
3.35						3	99.27
End of Borehole							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

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FILE NO. PG1899

REMARKS

HOLE NO. BH 6

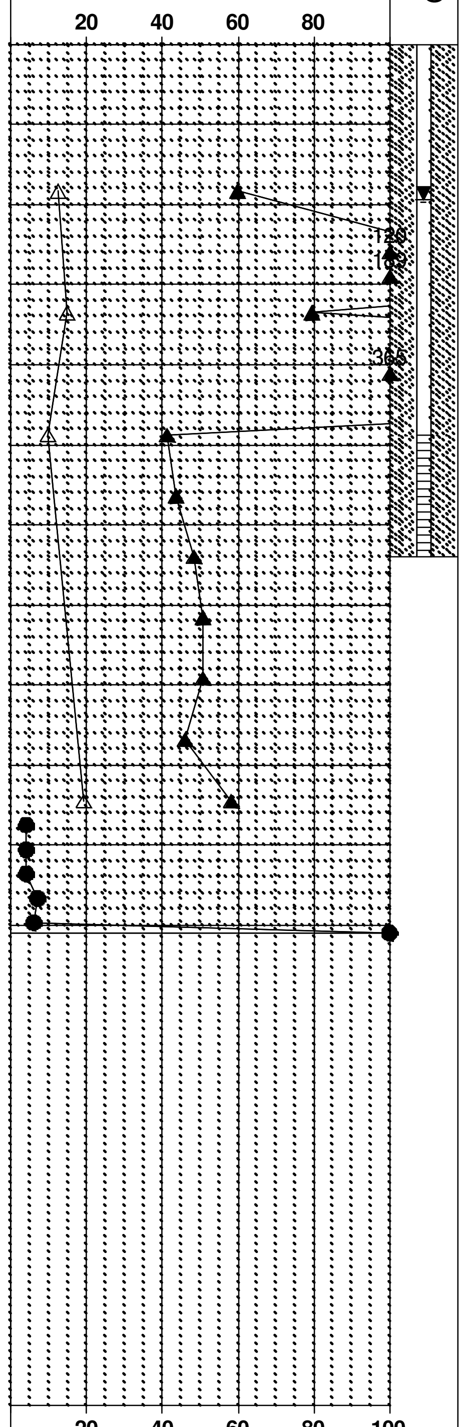
BORINGS BY CME 55 Power Auger **DATE** 7 July 2009

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.74
FILL: Silty sand with gravel 0.30		AU	1				
FILL: Black silty clay with sand 0.53		SS	2	100	4	1	101.74
						2	100.74
Stiff, mottled brown **SILTY CLAY**, some sand seams						3	99.74
- firm to stiff and grey by 3.6m depth						4	98.74
						5	97.74
						6	96.74
						7	95.74
						8	94.74
9.45						9	93.74
Dynamic Cone Penetration Test commenced @ 9.45m depth						10	92.74
11.10						11	91.74
End of Borehole							
Practical refusal to DCPT @ 11.10m depth							
(GWL @ 1.93m-July 16/09)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

Piezometer Construction



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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FILE NO. PG1899

REMARKS

HOLE NO. BH 7

BORINGS BY CME 55 Power Auger

DATE 7 July 2009

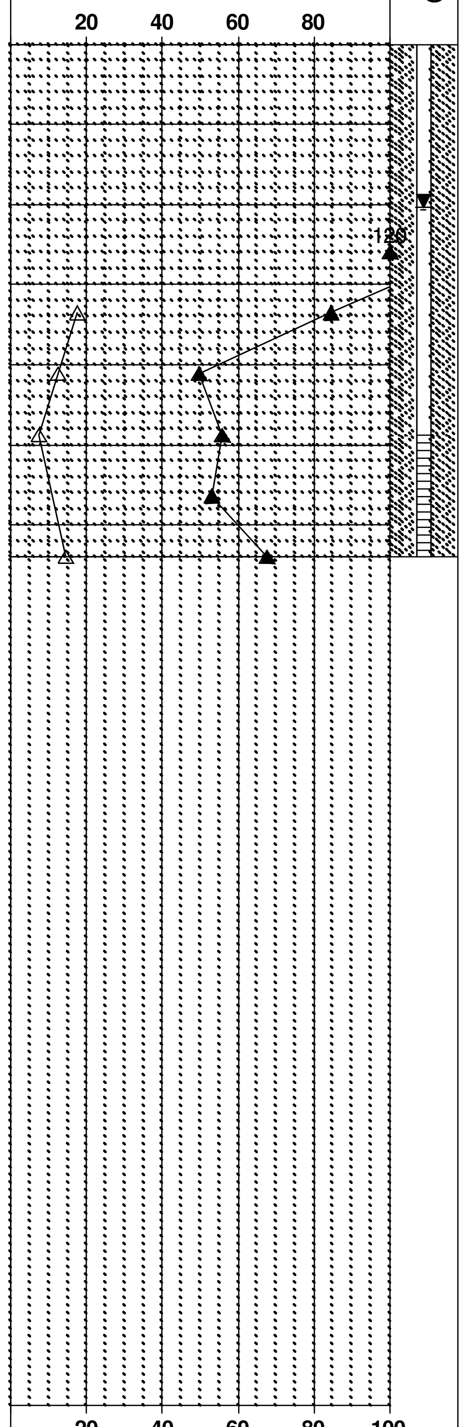
SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.46
FILL: Gravel	0.08	AU	1				
TOPSOIL	0.69						
FILL: Brown silty clay with sand and topsoil	1.45	SS	2	25	7	1	101.46
Very stiff to stiff, grey-brown **SILTY CLAY** with some sand - grey by 3.6m depth	6.40	SS	3	100	2	2	100.46
						3	99.46
						4	98.46
						5	97.46
						6	96.46

End of Borehole

(GWL @ 2.03m-July 16/09)

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

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FILE NO. PG1899

REMARKS

HOLE NO. BH 8

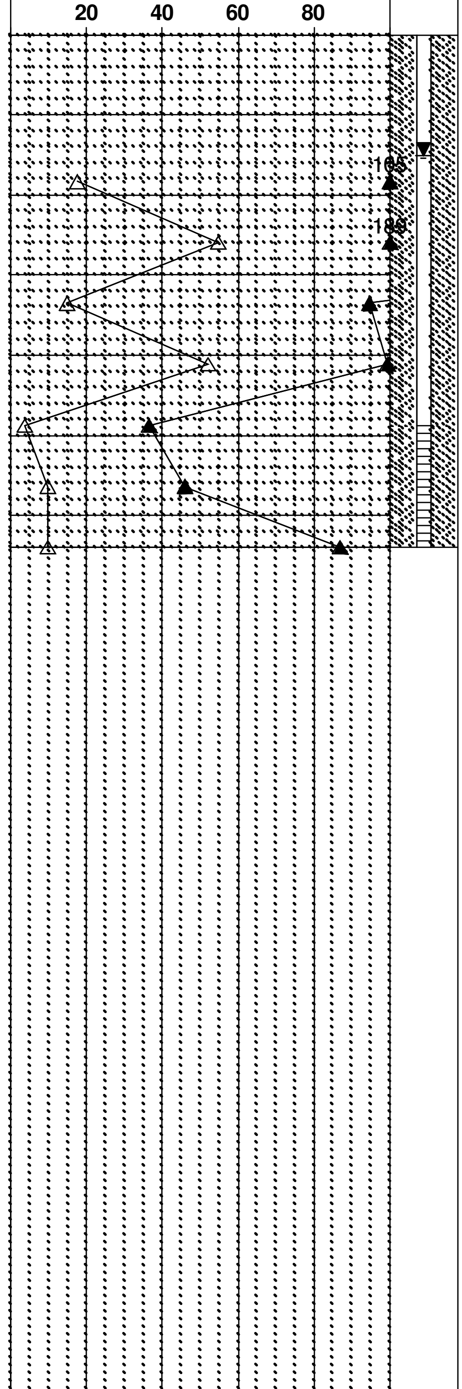
BORINGS BY CME 55 Power Auger **DATE** 9 July 2009

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.30		AU	1			0	101.92
		SS	2		4	1	100.92
						2	99.92
Very stiff to stiff, brown **SILTY CLAY** with some sand						3	98.92
- firm to stiff and grey by 3.6m depth		SS	3	92	P	4	97.92
						5	96.92
6.40						6	95.92
End of Borehole							
(GWL @ 1.50m-July 16/09)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

Piezometer Construction



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
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REMARKS

BORINGS BY CME 55 Power Auger

DATE 9 July 2009

FILE NO. PG1899

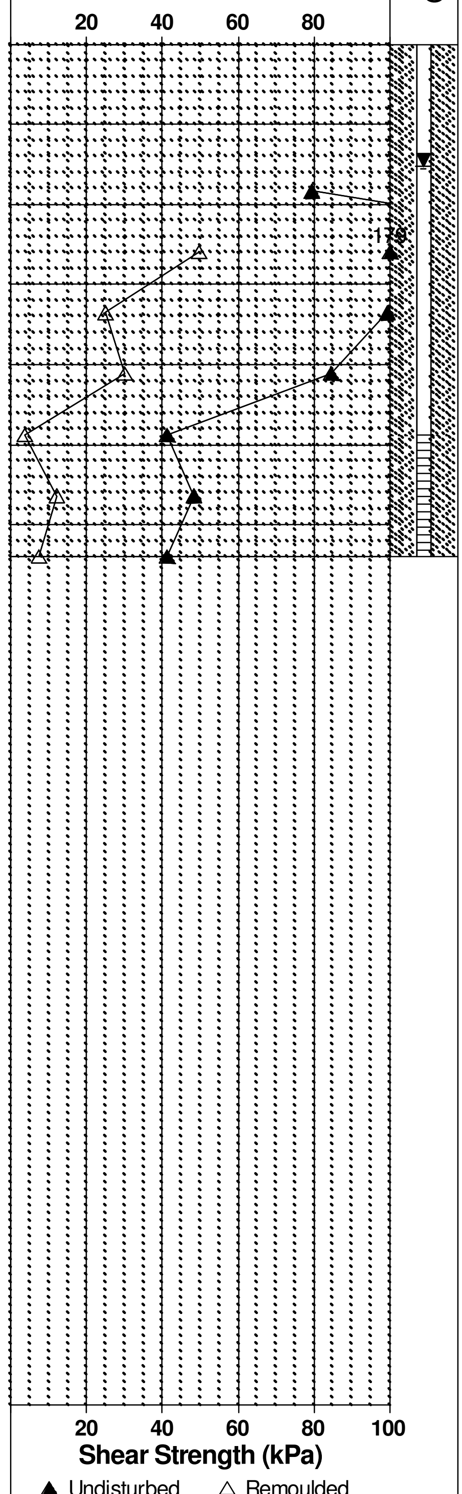
HOLE NO. BH 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.68
TOPSOIL 0.18							
Loose, brown **SILTY SAND**, some clay 0.63		SS	1		4	1	100.68
						2	99.68
Very stiff to stiff, brown **SILTY CLAY**						3	98.68
- firm and grey by 3.6m depth						4	97.68
						5	96.68
						6	95.68
6.40		AU	2				
End of Borehole							
(GWL @ 1.52m-July 16/09)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

Piezometer Construction



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
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REMARKS

BORINGS BY CME 55 Power Auger

DATE 8 July 2009

FILE NO. PG1899

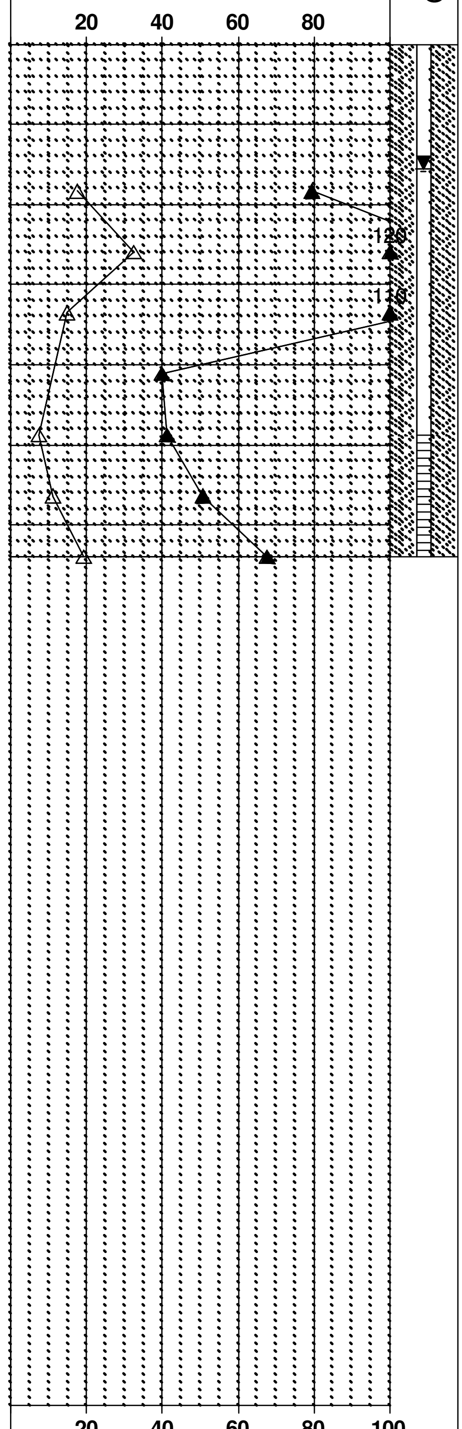
HOLE NO. BH10

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.54
TOPSOIL 0.20		AU	1				
Loose, brown **SANDY SILT** with clay 0.69		SS	2	92	7	1	100.54
Stiff to very stiff, brown **SILTY CLAY**						2	99.54
- grey-brown by 2.0m depth						3	98.54
- firm to stiff and grey by 3.8m depth						4	97.54
						5	96.54
6.40						6	95.54
End of Borehole							
(GWL @ 1.55m-July 16/09)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

Piezometer Construction



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Fairhall, Moffatt & Woodland Ltd.

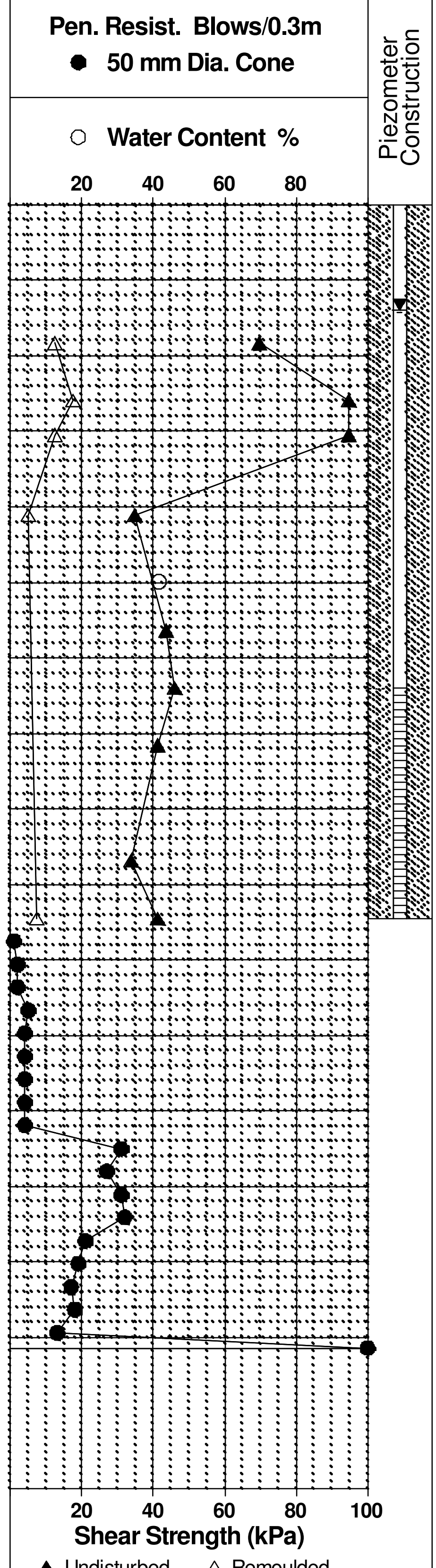
FILE NO. **PG1899**

REMARKS

HOLE NO. **BH11**

BORINGS BY CME 55 Power Auger **DATE** 8 July 2009

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.34
TOPSOIL 0.20							
Loose, brown **SILTY SAND** with some clay 1.45		SS	1	100	4	1	100.34
Stiff, brown **SILTY CLAY** - grey-brown by 2.6m depth - stiff to firm and grey by 3.6m depth						2	99.34
						3	98.34
						4	97.34
		TW	2	100		5	96.34
						6	95.34
						7	94.34
		TW	3	100		8	93.34
9.45						9	92.34
Dynamic Cone Penetration Test commenced @ 9.45m depth Inferred grey **SILTY CLAY** 12.20						10	91.34
						11	90.34
						12	89.34
Inferred **GLACIAL TILL** 15.14						13	88.34
						14	87.34
						15	86.34
End of Borehole Practical refusal to DCPT @ 15.14m depth (GWL @ 1.40m-July 16/09)							



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SOIL PROFILE AND TEST DATA

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Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

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REMARKS

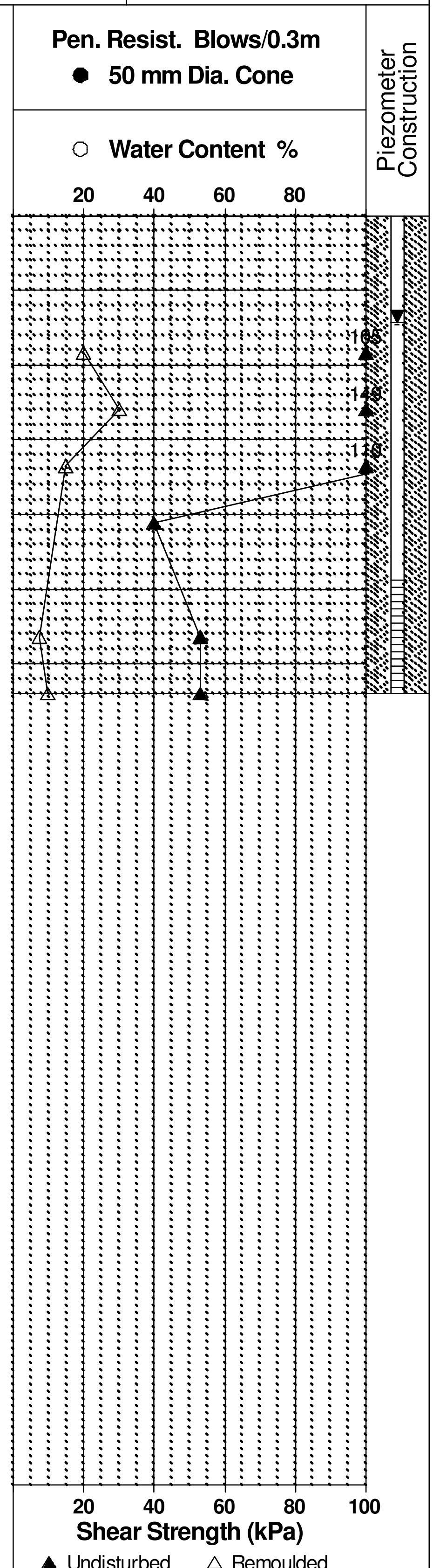
BORINGS BY CME 55 Power Auger

DATE 8 July 2009

FILE NO. PG1899

HOLE NO. BH12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.15
TOPSOIL 0.25							
Loose, brown **SILTY SAND** with clay 0.69		SS	1	75	4	1	100.15
Very stiff to stiff, brown **SILTY CLAY**						2	99.15
- grey-brown by 2.5m depth						3	98.15
- firm and grey by 3.6m depth						4	97.15
		TW	2	100		5	96.15
						6	95.15
6.40		AU	3				
End of Borehole							
(GWL @ 1.42m-July 16/09)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
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REMARKS

BORINGS BY CME 55 Power Auger

DATE 10 July 2009

FILE NO. PG1899

HOLE NO. BH13

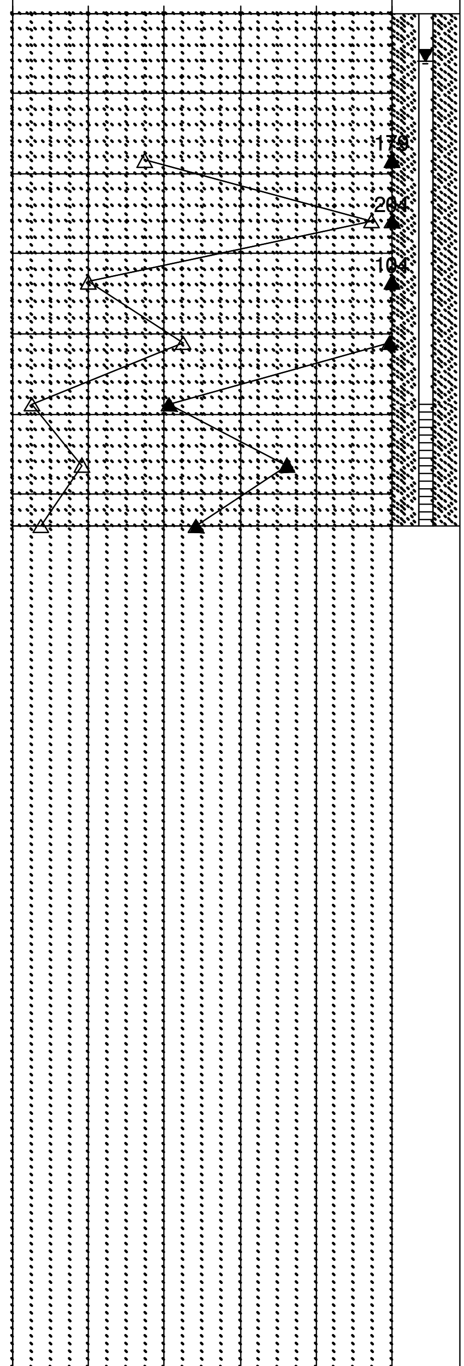
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.95
TOPSOIL 0.23		AU	1				
Very stiff, brown **SILTY CLAY**		SS	2		4	1	99.95
						2	98.95
						3	97.95
- stiff and grey by 3.6m depth						4	96.95
						5	95.95
6.40		AU	3			6	94.95
End of Borehole							
(GWL @ 0.60m-July 16/09)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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REMARKS

BORINGS BY CME 55 Power Auger

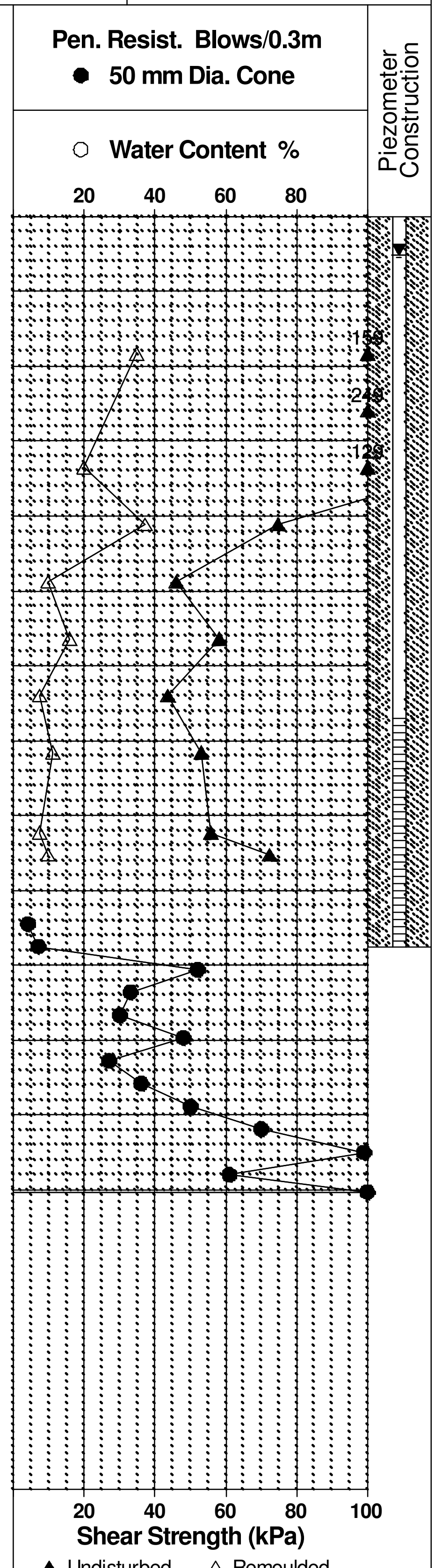
DATE 10 July 2009

FILE NO. PG1899

HOLE NO. BH14

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
GROUND SURFACE					
TOPSOIL 0.15		AU	1		
Very loose, brown **SANDY SILT** with some topsoil 0.23		SS	2		3
Hard to very stiff, brown **SILTY CLAY** with some sand seams - grey-brown by 2.8m depth - stiff and grey by 3.6m depth 8.84					
GLACIAL TILL: Stiff, grey silty clay with sand, gravel, cobbles and boulders 9.75		SS	3		16
Dynamic Cone Penetration Test commenced @ 9.75m depth Inferred **GLACIAL TILL** 13.03					
End of Borehole Practical refusal to DCPT @ 13.03m depth (GWL @ 0.52m-July 16/09)					

DEPTH (m)	ELEV. (m)
0	100.24
1	99.24
2	98.24
3	97.24
4	96.24
5	95.24
6	94.24
7	93.24
8	92.24
9	91.24
10	90.24
11	89.24
12	88.24
13	87.24



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SOIL PROFILE AND TEST DATA

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REMARKS

BORINGS BY CME 55 Power Auger

DATE 10 July 2009

FILE NO. PG1899

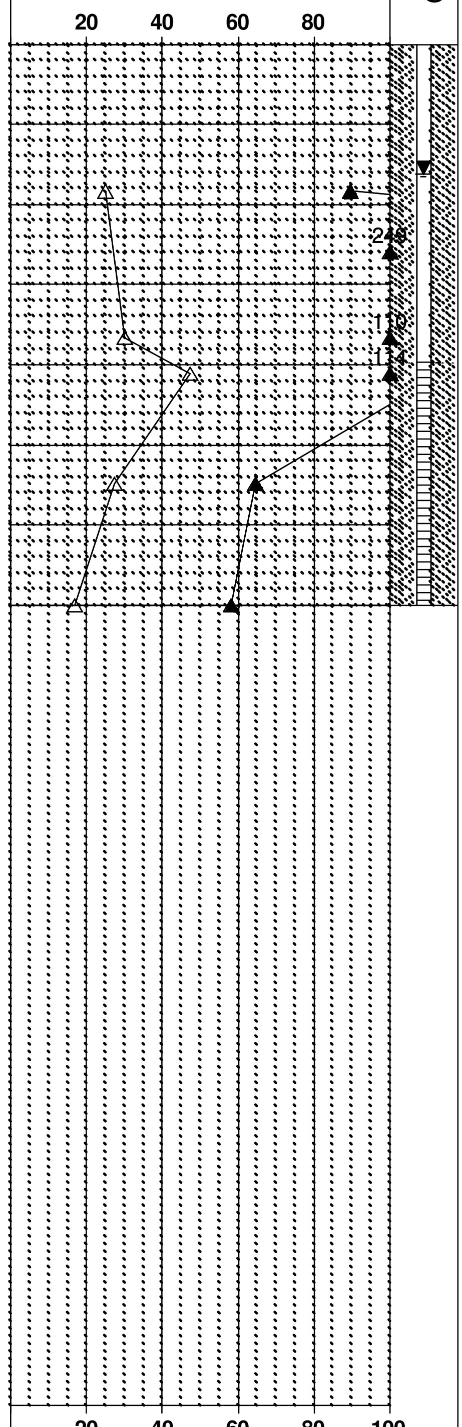
HOLE NO. BH15

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.76
FILL: Grey-brown silty clay with sand, gravel, cobbles and boulders (to 0.60)		AU	1				
		SS	2		5	1	99.76
Hard to very stiff, brown **SILTY CLAY**						2	98.76
- grey-brown by 2.8m depth						3	97.76
- stiff and grey by 4.3m depth						4	96.76
		SS	3	100	2	5	95.76
		TW	4	29		6	94.76
		TW	5	67			
(to 7.01)						7	93.76
End of Borehole							
(GWL @ 1.61m-July 16/09)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

Piezometer Construction



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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REMARKS

BORINGS BY CME 55 Power Auger

DATE 9 July 2009

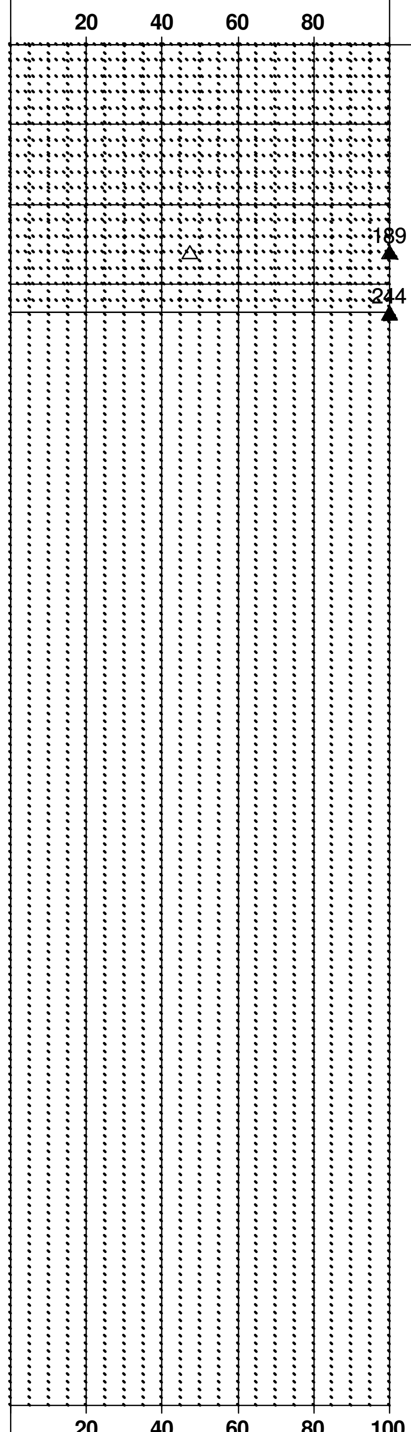
FILE NO. PG1899

HOLE NO. BH16

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.88
FILL: Silty sand with gravel 0.15		AU	1				
TOPSOIL 0.23							
Very stiff to hard, brown **SILTY CLAY**		SS	2	42	7	1	99.88
- grey-brown by 2.8m depth		SS	3	50	4	2	98.88
3.35						3	97.88
End of Borehole							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

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REMARKS

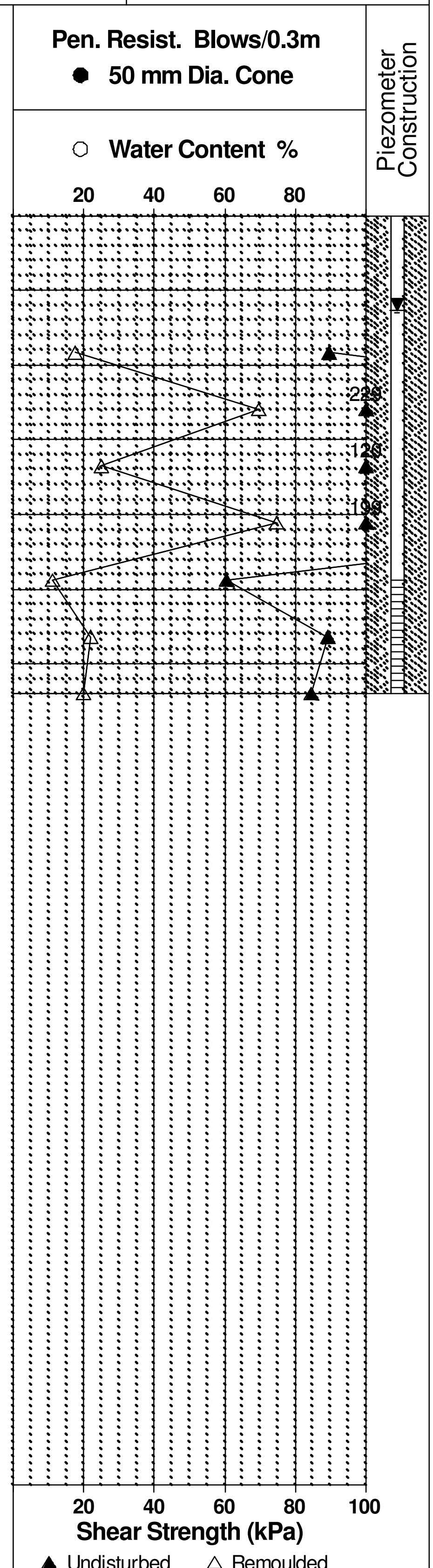
BORINGS BY CME 55 Power Auger

DATE 9 July 2009

FILE NO. PG1899

HOLE NO. BH17

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.55
FILL: Silty clay with gravel 0.08							
TOPSOIL 0.20							
		SS	1			1	100.55
Hard to very stiff, brown **SILTY CLAY** with some sand seams						2	99.55
						3	98.55
						4	97.55
- stiff by 4.3m depth						5	96.55
		AU	2			6	95.55
6.40							
End of Borehole							
(GWL @ 1.27m-July 16/09)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Commercial Development-Hazeldean Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Fairhall, Moffatt & Woodland Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE 13 July 2009

FILE NO. PG1899

HOLE NO. BH18

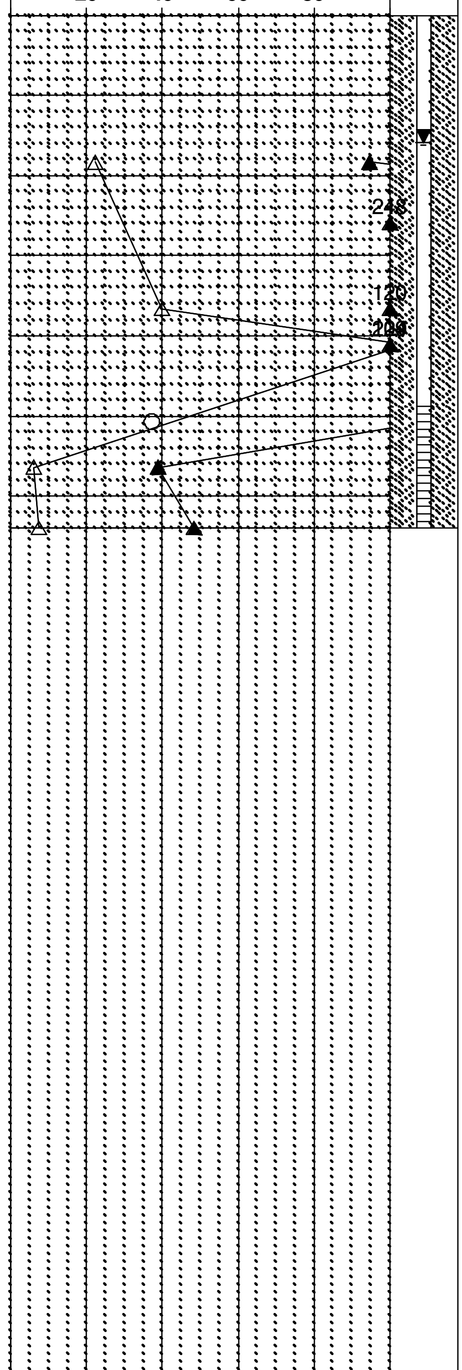
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.47
TOPSOIL 0.20		AU	1				
		SS	2	50	7	1	99.47
Hard to very stiff, brown **SILTY CLAY**						2	98.47
- grey-brown by 2.8m depth						3	97.47
		SS	3			4	96.47
- firm and grey by 3.7m depth		TW	4	100		5	95.47
6.40						6	94.47
End of Borehole							
(GWL @ 1.58m-July 16/09)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation 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 layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
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 the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: 1 < Cc < 3 and Cu > 4
Well-graded sands have: 1 < Cc < 3 and Cu > 6
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay (more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

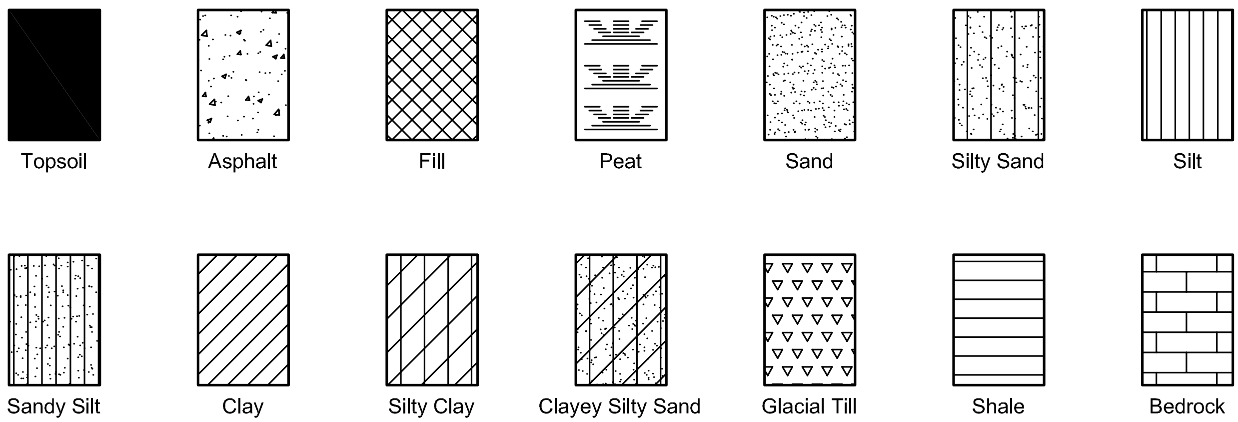
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

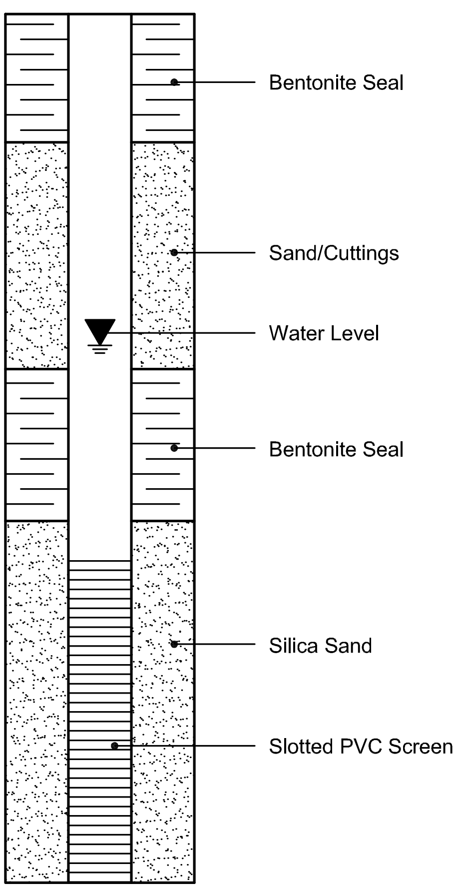
SYMBOLS AND TERMS (continued)

STRATA PLOT

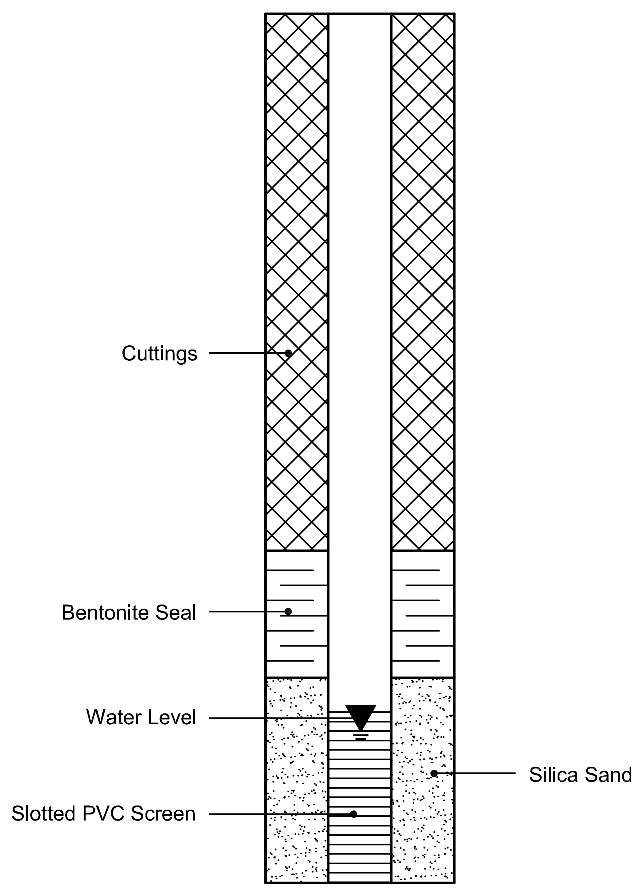


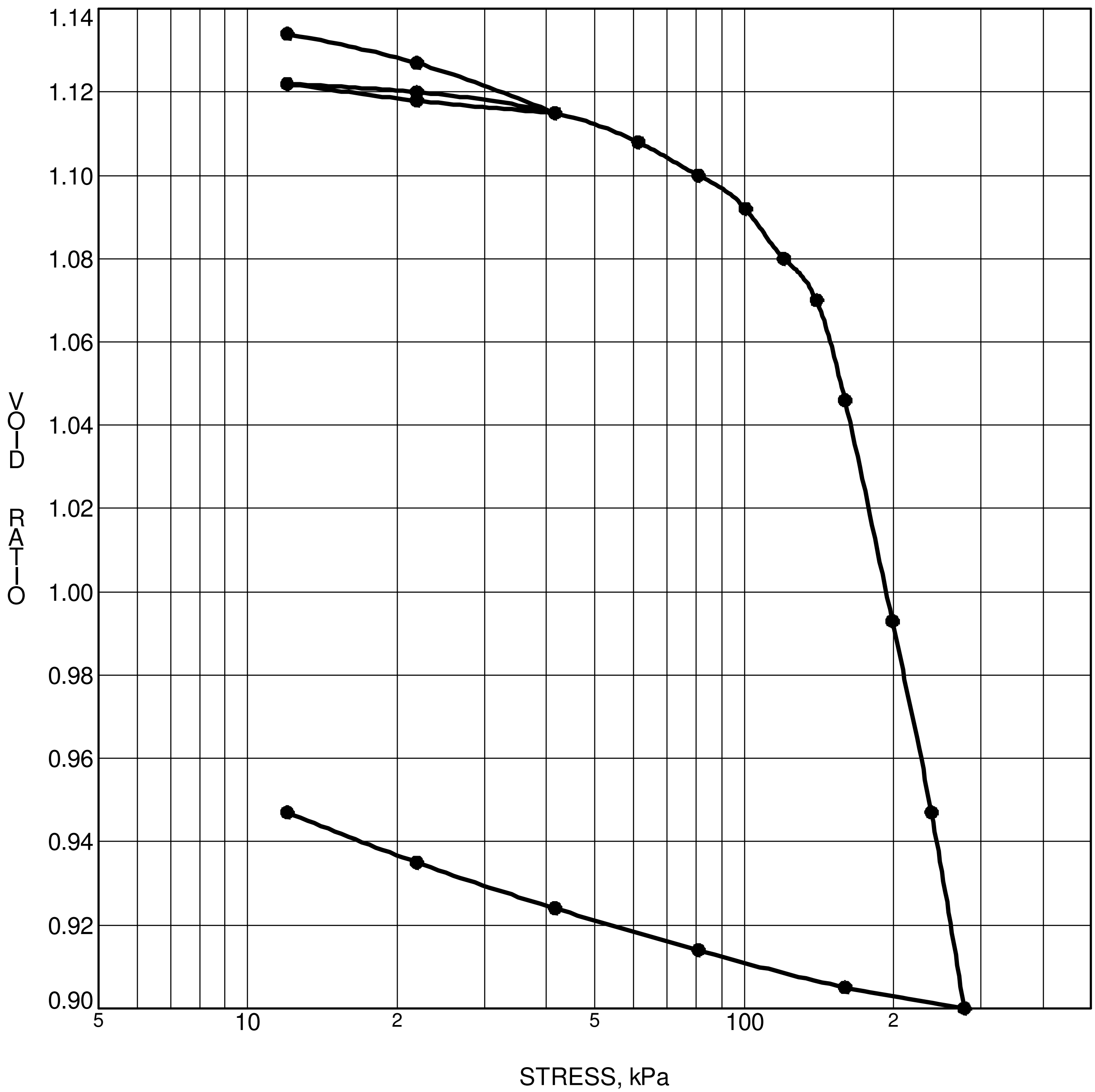
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH11**	p'_o	**70** kPa	Ccr	**0.013**
Sample No.	**TW 2**	p'_c	**148** kPa	Cc	**0.674**
Sample Depth	**4.99** m	OC Ratio	**2.1**	Wo	**41.6** %
Sample Elev.	**96.35** m	Void Ratio	**1.143**	Unit Wt.	**17.7** kN/m^3

CLIENT **Centrecorp Management Services Limited**

FILE NO. **PG1899**

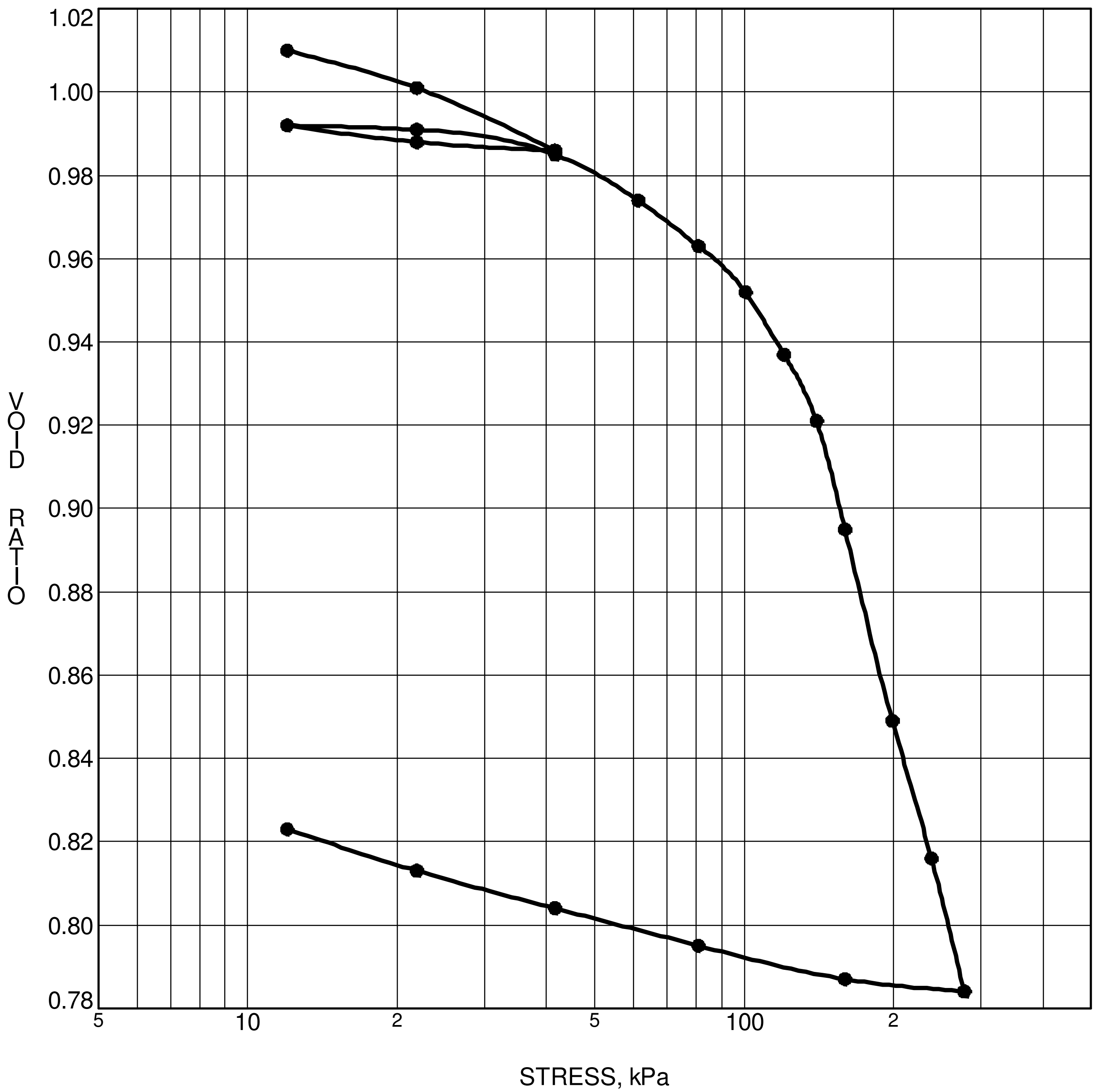
PROJECT **Geotechnical Investigation - Proposed Commercial Development-Hazeldean Road**

DATE **07/17/2009**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

CONSOLIDATION TEST



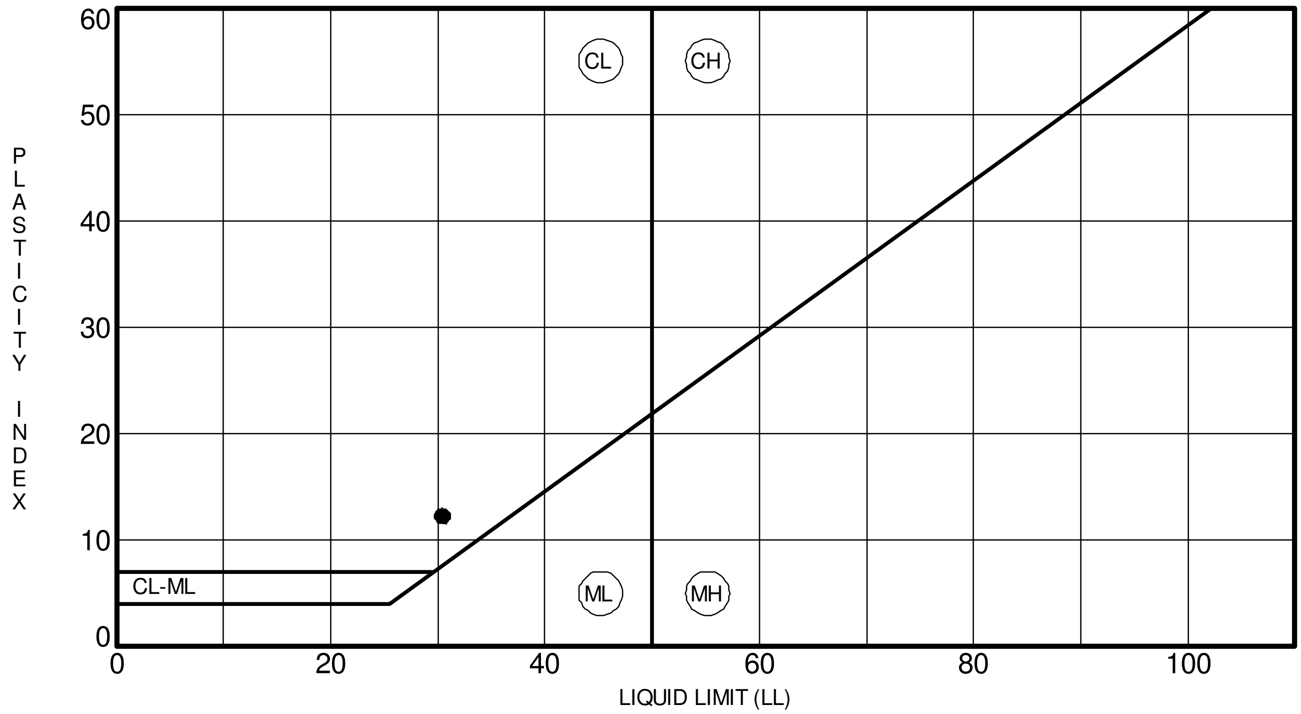
CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH18**	p'_o	**65** kPa	Ccr	**0.013**
Sample No.	**TW 4**	p'_c	**126** kPa	Cc	**0.466**
Sample Depth	**5.07** m	OC Ratio	**1.9**	Wo	**37.2** %
Sample Elev.	**95.40** m	Void Ratio	**1.024**	Unit Wt.	**18.2** kN/m^3

CLIENT	**Centrecorp Management Services Limited**	FILE NO.	**PG1899**
PROJECT	**Geotechnical Investigation - Proposed Commercial Development-Hazeldean Road**	DATE	**07/17/2009**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

CONSOLIDATION TEST



	Specimen Identification	LL	PL	PI	Fines	Classification
●	**BH11**	**30**	**18**	**12**		**CL-Inorganic clays of low plasticity (TW 2)**

CLIENT **Centrecorp Management Services Limited**

PROJECT **Geotechnical Investigation - Proposed Commercial Development-Hazeldean Road**

FILE NO. **PG1899**

DATE **8 Jul 09**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS

PARACEL LABORATORIES LTD.

Order #: 1620196

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 17631

Report Date: 16-May-2016

Order Date: 10-May-2016

Project Description: PG1899

	Client ID:	BH6-SS2	-	-	-
	Sample Date:	26-Apr-16	-	-	-
	Sample ID:	1620196-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	75.5	-	-	-
General Inorganics					
pH	0.05 pH Units	7.50	-	-	-
Resistivity	0.10 Ohm.m	21.8	-	-	-
Anions					
Chloride	5 ug/g dry	66	-	-	-
Sulphate	5 ug/g dry	251	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG1899-2 - TEST HOLE LOCATION PLAN

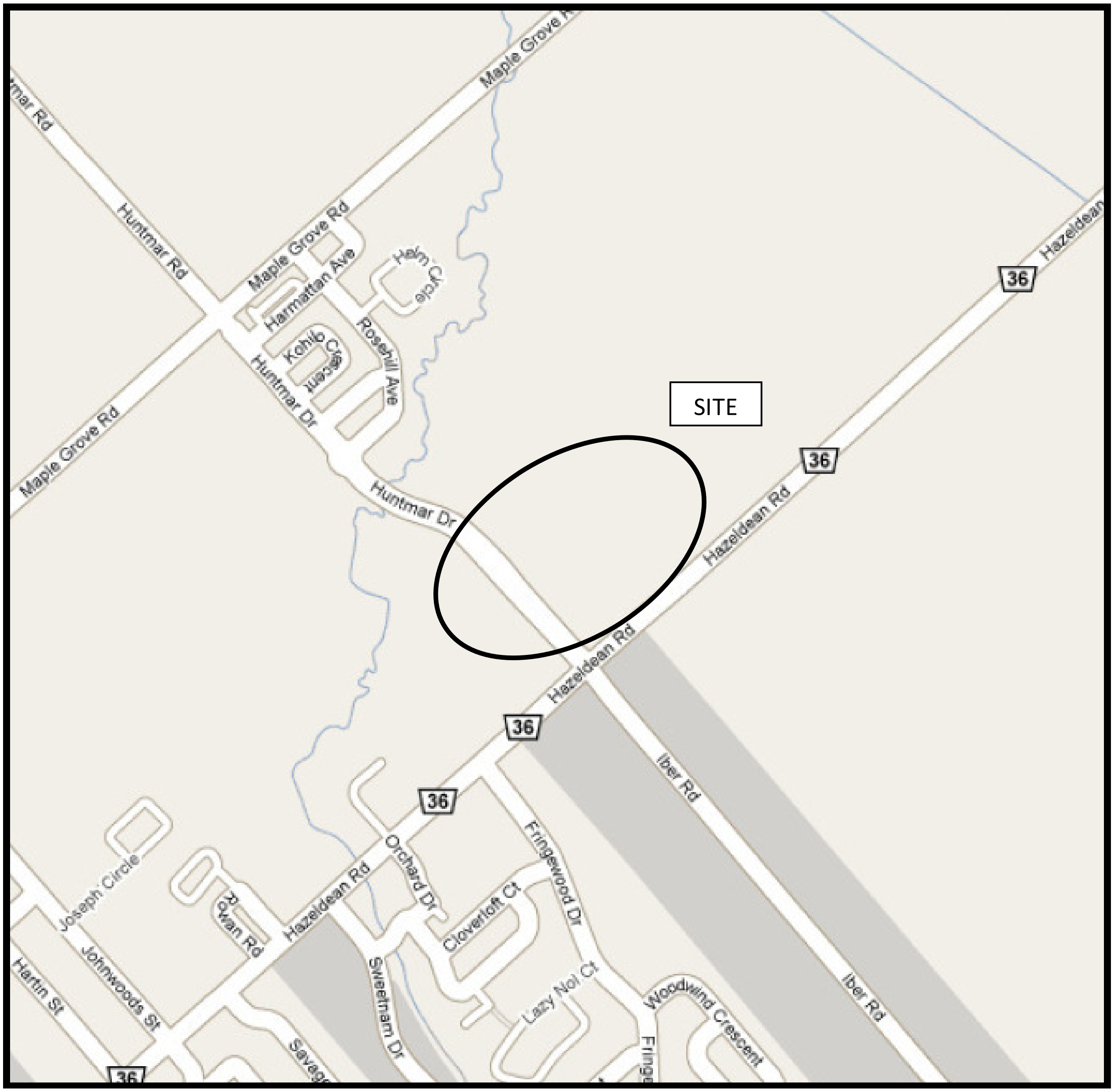
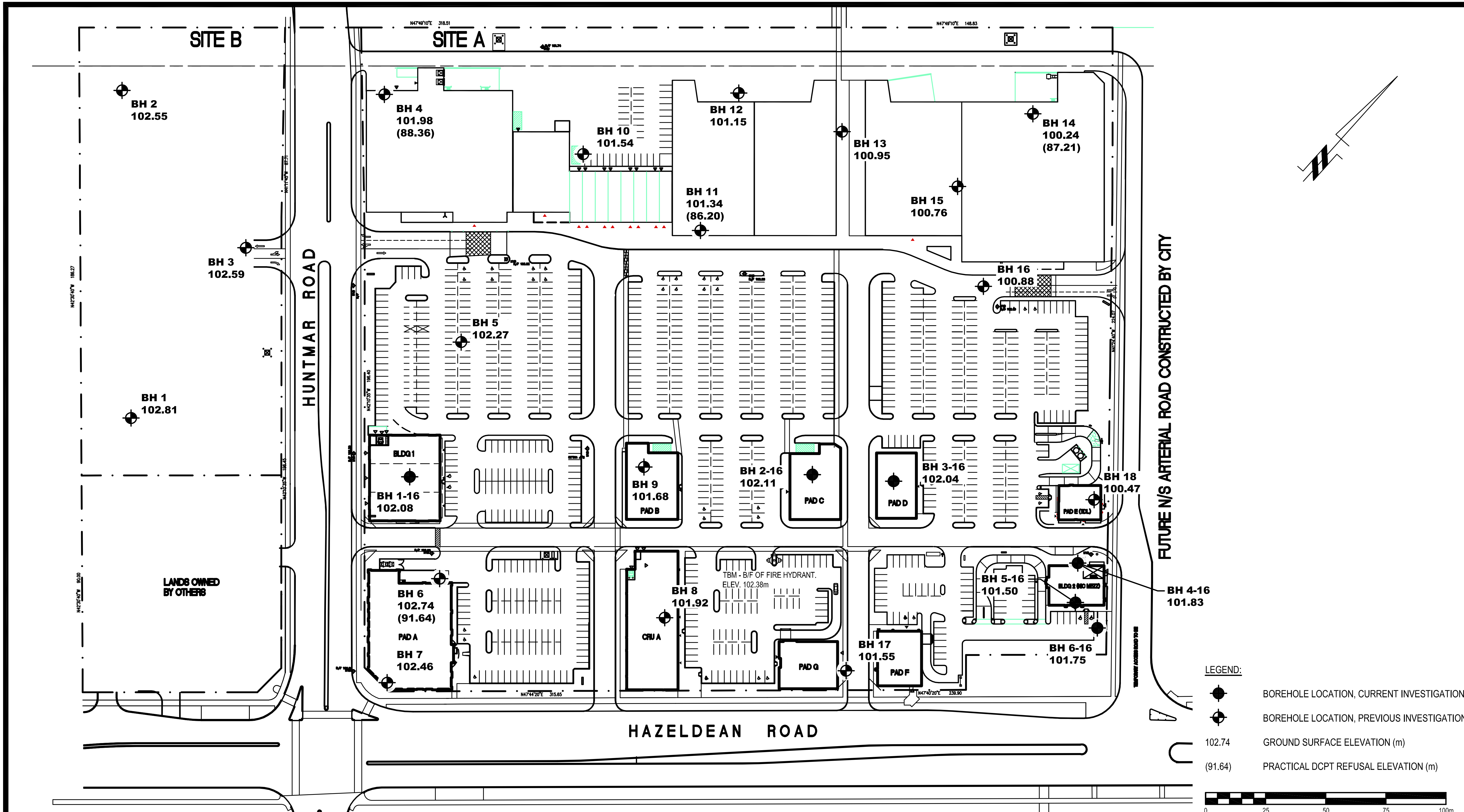


FIGURE 1

KEY PLAN



patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
0	BASE PLAN UPDATED	28/09/2017	DJG

NORTH AMERICAN (GOULBOURNE) LIMITED PARTNERSHIP
GEOTECHNICAL INVESTIGATION
PROP. COMMERICAL DEVELOPMENT - HAZELDEAN ROAD
OTTAWA, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale: 1:1500	Date: 05/2016
Drawn by: MPG	Report No.: PG1899
Checked by: FA	Dwg. No.: PG1899-2
Approved by: DJG	Revision No.: 1

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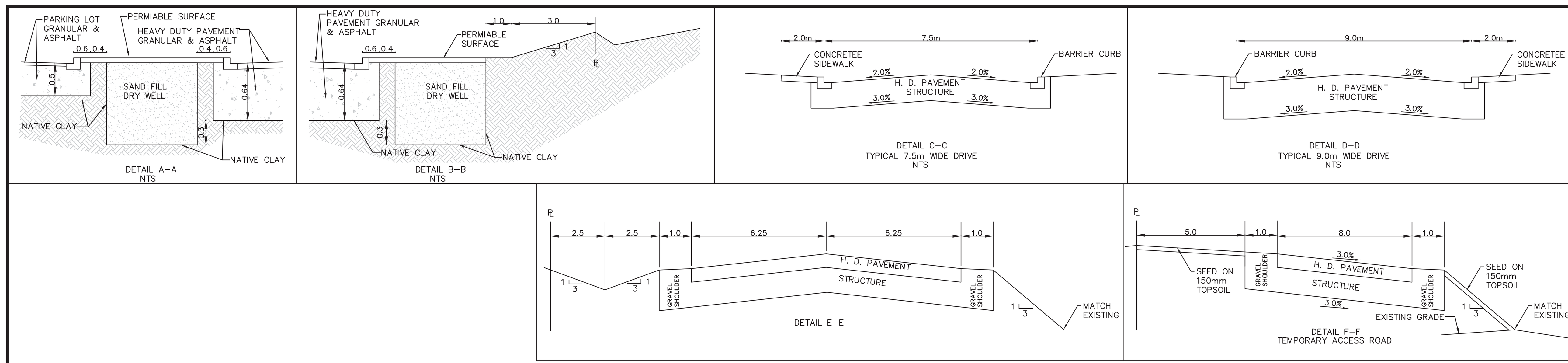
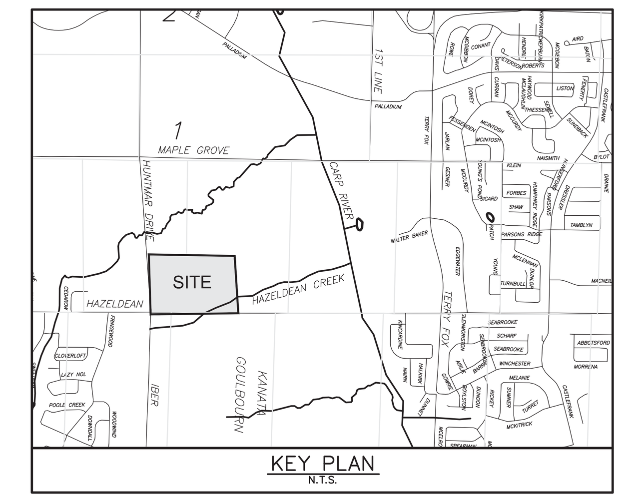




APPROVED ☐ REFUSED ☐

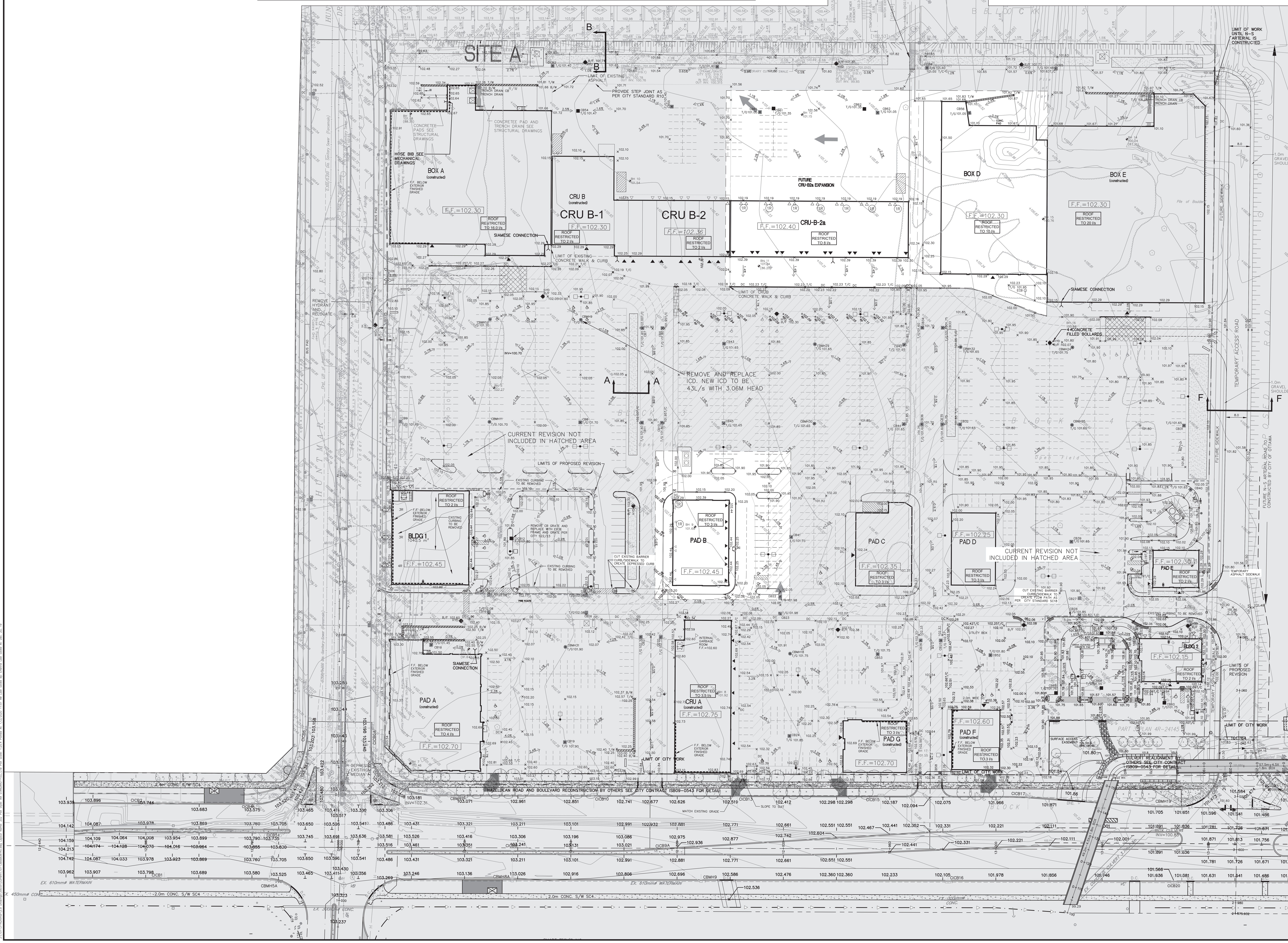
THIS____DAY OF ____________, 20______

DERRICK MOODIE, MANAGER
DEVELOPMENT REVIEW WEST
PLANNING, INFRASTRUCTURE AND ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA

APPROVED ☐ REFUSED ☐

THIS____DAY OF ____________, 20______

DERRICK MOODIE, MANAGER
DEVELOPMENT REVIEW WEST
PLANNING, INFRASTRUCTURE AND ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



LEGEND:

- PROPOSED GRADES
- EXISTING GRADES
- PROPOSED SURFACE FLOW DIRECTION
- CBMH PROPOSED CATCHBASIN MANHOLE
- CB PROPOSED STREET CATCHBASIN
- F.F.=102.30 PROPOSED FINISH FLOOR ELEVATION
- PROPOSED RETAINING WALL
- PROPOSED TERRACING
- HYD B/F 102.10 PROPOSED HYDRANT C/W BOTTOM OF FLANGE
- PROPOSED BARRIER CURB
- MAJOR STORM AND FLOW

PAVEMENT STRUCTURE

HEAVY DUTY AREAS
40mm HL3 ASPHALT SUPERPAVE 12.5
50mm HL8 ASPHALT SUPERPAVE 19.0
150mm GRANULAR A
400mm GRAN B TYPE II

CAR PARK AREAS
50mm HL3 ASPHALT SUPERPAVE 12.5
150mm GRANULAR A
300mm GRAN B TYPE II

CONCRETE PAD

INFILTRATION DRY WELL

BH 11 101.34 (86.20) BORE HOLE LOCATION AND ELEVATION SEE GEOTECHNICAL REPORT FOR DETAILS

CONCRETE SIDEWALK

AS-BUILT PICK UP

No.	REVISIONS	By	Date
27	REVISED AS PER CITY COMMENTS	DGY	19:12:20
26	REVISED SPA CRU B-3, PAD B, BOX D	DGY	19:08:29
25	REVISED REAR DOOR GRADES PER ARCHITECT	DGY	18:06:18
24	ISSUED FOR CONSTRUCTION BLDG 2	DGY	18:04:06
23	ISSUED FOR TENDER	DGY	18:01:15
22	REVISED AS PER CITY COMMENTS	DGY	17:11:23
21	ISSUED FOR SPA	DGY	17:11:02
20	REVISED AS PER SITE PLAN	DGY	17:09:08
19	REVISED AS PER SITE PLAN	DGY	17:07:07
18	REVISED AS PER CITY COMMENTS	DGY	17:06:23
17	REVISED BLD 2 & PAD E	DGY	17:02:14
16	REVISED AS PER CITY COMMENTS	DGY	16:08:05
15	SPA BLDG 1 & 2	DGY	16:03:07
14	REVISED BLDG 1 & 2	DGY	16:01:21
13	REVISED AS PER SITE PLAN	DGY	14:11:03
12	SPA	DGY	14:09:09
11	REVISED AS PER SITE PLAN	DGY	14:08:08
10	REVISED AS PER CITY COMMENTS	DGY	14:07:31
9	REVISED DOLLAR & CRUB	DGY	14:06:03
8	ISSUED FOR PAD F TENDER	DGY	13:02:14
7	REVISED FOR PAD F	DGY	12:11:16
6	REVISED FOR PAD F	DGY	12:08.01
5	REVISED SPRINKLER ROOM BOX E	DGY	12:03:09
4	REVISED PER CITY COMMENTS AND PAD E	DGY	12:02:22
3	REVISED FOR BOX E	DGY	12:01:26
2	REVISED SITE PLAN PH1 & PH2	DGY	11:11:24
1	ISSUED FOR APPROVAL	DGY	11:10:27

NORTH AMERICAN
DEVELOPMENT GROUP

IBI GROUP
333 Preston Street
Tower 1, Suite 400
Ottawa, Ontario
Canada K1S 5N4
Tel (613)225-1311
FAX (613)225-9868

Project Title
5705 HAZELDEAN ROAD
OTTAWA, ONT.

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2019/12/20
PROVINCE OF ONTARIO

N

Drawing Title
GRADING PLAN PHASE 1 & 2

Scale 1:500

Design	D.G.Y.	Date	OCTOBER 2011
Drawn	E.H.	Checked	D.G.Y.
Project No.	10113	Drawing No.	C-202

D07-12-19-0168

PLAN No.: #16044

patersongroup — consulting engineers

memorandum

to: IBI Group - **Mr. Ryan Magladry**- rmagladry@ibigroup.com

re: Grading Plan Review
Proposed North American Commercial Development - Phase 1 and 2
Hazeldean Road - Ottawa

date: April 8, 2019

file: PG1899-MEMO.05 Rev.01

Further to your request and authorization, Paterson Group (Paterson) reviewed the following grading plan prepared by IBI Group for the aforementioned commercial development:

- ❏ Grading Plan - Drawing No. C-202 - Project 10113 - Revision 26 dated March 29, 2019.

The present memo should be read in conjunction with our Report PG1899-2 dated May 25, 2016. Based on our permissible grade raise recommendations for the subject site, the reviewed grading plan is considered to be acceptable from a geotechnical perspective.

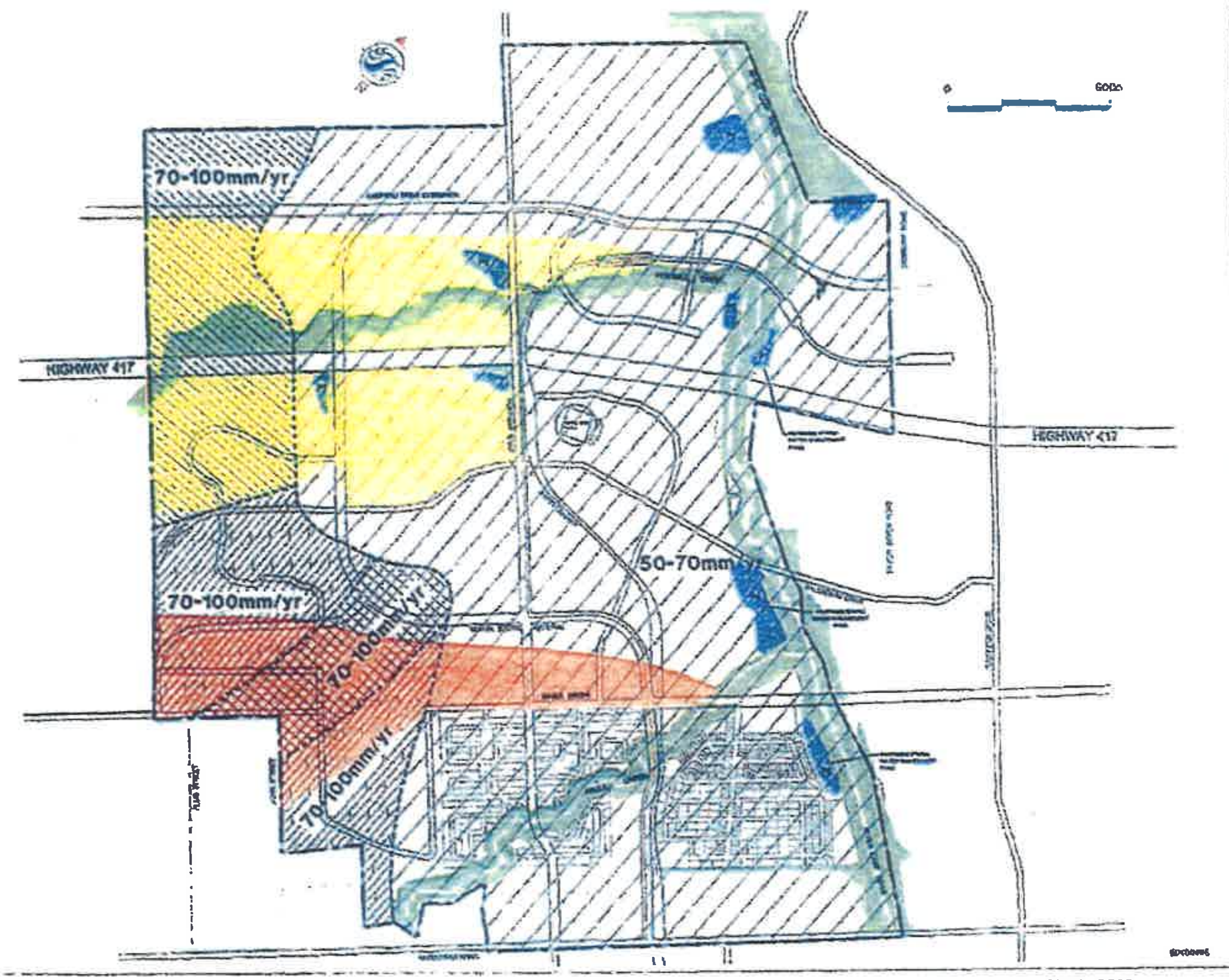
We trust that this information satisfies your immediate requirements.

Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng.

LICENSED PROFESSIONAL ENGINEER
April 8, 2019
F. I. ABOU-SEIDO
100156744
PROVINCE OF ONTARIO

David J. Gilbert, P.Eng.



INFILTRATION TARGETS

	SOIL TYPE	RECHARGE
	FINE SAND	MODERATE
	PALEOZOIC BEDROCK	MODERATE
	TILL	MODERATE
	CLAY	LOW

Kanata-West Concept Plan Boundary

Area Tributary To Feedmill Creek (Existing Conditions)

Area Tributary To Maple Grove Ditch System and Poole Creek (Existing Conditions)

OPEN SPACE

NOTE:
SOIL TYPES AND RECHARGE POTENTIAL FROM CARP RIVER WATERSHED/SUBWATERSHED STUDY BY ROBINSON CONSULTANTS INC. 2004.
TARGET INFILTRATION RATES OBTAINED FROM ENVIRONMENTAL FACT SHEETS FROM 2004 REPORT.

MAY 2006

Stantec CCL/IBI

FIG. 5.4

Demetrius Yannoulopoulos

From: Doug Nuttall <dnuttall@mvc.on.ca>
Sent: Friday, June 22, 2012 9:10 AM
To: Demetrius Yannoulopoulos
Cc: sean.moore@ottawa.ca
Subject: RE: Infiltration augmentation

Sorry about the delay;

MVC is satisfied with this approach. It is reasonable to expect that there will be sufficient infiltration from this facility to supplement the infiltration that will come from the sand beds and irrigation. It would be very interesting to monitor the water flowing into and out of such a facility, and I would ask the consultant, on behalf of the client, if MVC would be able to install monitoring in MH 35? Ideally, we should be monitoring flows in and out of the facility – thus it would be easier for us if the outlet was directed to CBMH 29, rather than directly to the pipe. There should be lots of grade to make that work.

Douglas Nuttall, P.Eng.
Water Resources Engineer
Mississippi Valley Conservation

From: Demetrius Yannoulopoulos
Sent: Tuesday, June 19, 2012 10:03 AM
To: 'Doug Nuttall'
Subject:

Hi Doug
As discussed yesterday, we propose to add a drywell in front of Box C, within in the parking lot area.
The drywell will be a clear stone facility 4m wide by 40m long, and 0.73m clear depth from bottom of perforated pipe. The drywell has a total volume of 116.6m3, with 30% voids in the clear stone there is 35m3 of storage available.
Rainfall from the 5992 m2 roof of Box C will supply the drywell, the roof of Box C has flow restrictors limiting the outflow to 25l/s. The dry well is set up such that if the volume of runoff from the roof exceeds the storage capacity of the dry well excess runoff is discharged to the storm sewer, see attached PDF illustrating the proposed drywell.

Rainfall data (see attached) indicates for the months of March up to and including November, 40 days of 5mm or more rain occurred, and for the same period 22 days of 10mm or more rain occurred. Assuming 80% of rainfall is collected by the roof drains the following volume of rainfall is collected and discharged into the drywell:
5mm, at 80% = 4mm, for 5992m2 roof = 23.96m3, for 40 events = 958.72m3
10mm, at 80%= 8mm (less 4mm from above) = 4mm for 5992m2 roof = 23.96m3, for 22 events = 527.29m3
These events provide a approximately of 1486m3 of rainfall for use by the drywell.
For the 84,600m2 site, this will add approximately 17.56mm/yr of infiltration.

As we had previously discussed the sand well will provide approximately 20mm/yr of infiltration with natural rainfall, and the irrigation system will also supplement with an additional 20mm/yr.
Combining these three the site will have approximately 57mm/yr of infiltration which falls within the 50 to 70mm/yr target for this area.

As you are aware the City is asking us to provide CA acceptance of the infiltration approach. If you are in agreement with the above, it would be greatly appreciated if you could forward me an email indicating MVCA acceptance of the infiltration approach.
If you have any questions, please call or email.
Thx
Demetrius

Demetrius Yannoulopoulos P.Eng.
Associate Director

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Ottawa ON K1S 5N4 Canada

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fax 613 225 9868
cell 613 447 0504
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web www.ibigroup.com