Report
Project: 121793-6.2.1

PATHWAYS - BLOCK 232
1055 CEDAR CREEK DRIVE
SERVICING BRIEF

Prepared for Phoenix Homes
by IBI GROUP

December 2020

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1 INTRODUCTION

Block 232 is located in the south portion of the Leitrim Development Area (LDA) and is part of the Pathways at the Findlay Creek subdivision. IBI Group Professional Services Inc. (IBI Group) has been retained to provide professional engineering services for Block 232. The subject site is approximately 1.01 ha and consists of 1 accessory building for solid waste sorting and storage, 5 stacked townhouse buildings, 2 apartment buildings, with a total of 92 units. The site consists of surface level and below grade parking facilities.

Block 232 is bounded by Salamander Way and existing residential area to the North, Pingwi Place to the south, Cedar Creek Drive to the east and existing residential lands and pathway block to the west. Its Civic Address is 1055 Cedar Creek Drive. Refer to key plan on **Figure 1.1** for block location.

Figure 1.1 Site Location

The proposed servicing design conforms to current City of Ottawa and MECP design criteria, and no pre-consultation meetings were requested from the Rideau Valley Conservation Authority (RVCA) or the Ontario Ministry of Environment, Conservation and Parks (MECP).

2 WATER DISTRIBUTION

2.1 Existing Conditions

There is an existing 250mm watermain in Salamander Way to the north of the site, an existing 250mm watermain in Cedar Creek Drive to the east of the site and an existing 250mm Watermain in Pingwi Place. The proposed development was considered in the water model for the Pathways Phase 1 development.

2.2 Design Criteria

2.2.1 Water Demands

Block 232 consists of 56 2-bedroom stacked townhouse units and 36 apartment units, consisting of 12 1-bedroom units and 24 2-bedroom units. Per unit population density and consumption rates are taken from **Tables 4.1** and **4.2** of the Ottawa Design Guidelines – Water Distribution and are summarized as follows:

- 2 Bedroom Units 2.1 person per unit
- 1 Bedroom Units 1.4 person per unit
- Average Day Demand 350 l/cap/day
- Peak Daily Demand 875 l/cap/day
- Peak Hour Demand 1,925 l/cap/day

A water 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 1.91 l/s
- Peak Hour 4.13 l/s

2.2.2 System Pressures

The 2010 City of Ottawa Water Distribution Guidelines states 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 in unoccupied areas 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) in occupied areas. 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 Rate

The site consists of five stacked townhouse blocks and two three storey apartment blocks. A Fire Underwriters Survey (FUS) calculation has been done for building 5 which is the largest stacked townhouse block with the most exposures to adjacent buildings and for Building 4 which is the apartment block with the most exposure to adjacent buildings. The calculations result in a fire flow of 13,000 l/min for both buildings; a copy of the FUS calculation is included in **Appendix A**.

2.2.4 Boundary Conditions

The City of Ottawa has provided hydraulic boundary conditions at the connections to Salamander Way watermain and Cedar Creek Drive. The City has provided existing condition and SUC Zone reconfiguration boundary conditions. The existing condition has the highest maximum HGL value and is used in the analysis to determine maximum pressure while the SUC Zone reconfiguration value has the lower values for peak hour and fire and is used in the analysis. A copy of the Boundary Condition is included in **Appendix A** and summarized as follows:

CRITERIA	HYDRAULIC HEAD	
	CONNECTION 1	CONNECTION 2
Max HGL (Basic Day)	155.6 m	155.6 m
Peak Hour	145.1 m	145.1 m
Max Day + Fire (13,000 l/m)	138.0 m	135.4 m

2.2.5 Hydraulic Model

A computer model for the Block 232 water distribution system has been developed using the InfoWater SA program. The model includes the boundary conditions at Salamander Way watermain and Cedar Creek Drive.

2.3 Proposed Water Plan

2.3.1 Hydraulic Analysis

The hydraulic model was run under basic day conditions with the existing boundary condition to determine the maximum pressure for the site. The minimum pressure for the site is determined in the peak hour analysis using the SUC Zone reconfiguration boundary condition. There are two fire hydrants in the site and they are represented by nodes 50 and 52 in the model; the model was run under the max day plus fire (13,000 l/min) SUC Zone Reconfiguration Boundary condition to determine the design fire flow at the hydrant locations. There are several hydrants on Salamander Way, Cedar Creek Drive and Pingwi Place that are adjacent to the site and provide fire protection for the buildings. In the Pathways Phase 1 hydraulic water model, the mains on the adjacent street were run with a 250 l/s (15,000 l/min) fire demand for the fire flow analysis. Results of the Phase 1 fire flow analysis from the Pathways Phase 1 design brief are included in **Appendix A**. Results of the analysis for the Block 232 site are summarized in Section 2.3.2 and the water model schematic and model results are included in **Appendix A**.

2.3.2 Summary of Results

Results of the hydraulic analysis for Block 232 are summarized as follows:

Pressures (kPa)	
- Basic Day (Max HGL)	526.7 – 546.8
- Peak Hour	423.3 – 443.9

Minimum Fire Flow @ 140 kPa Residual Pressure 423.5 l/s.

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

Maximum Pressure	All nodes have basic day pressure below 552 kPa; therefore, pressure reducing control is not required for this site.
Minimum Pressure	All nodes exceed the minimum requirement of 276 kPa during peak hour conditions.
Fire Flow	The minimum design fire flow with a minimum residual pressure of 140 kPa in the site is 423.5 l/s which exceeds the requirement of 216.7 l/s (13,000 l/min). In the pathways Phase 1 water analysis the design fireflows on Salamander Way, Cedar Creek Drive and Pingwi Place range from 246.8 to 289.2 l/s which exceed the requirement of 216.7 l/s (13,000 l/min).

3 WASTEWATER

3.1 Existing Conditions

The Leitrim Pump Station is the wastewater outlet for all developed lands within the LDA, including the subject property. In 2002, the City constructed the station, associated forcemains and outlet sewers in Bank Street and Conroy Road. Sewage from the LDA outlets to the Conroy Road Trunk Sewer eventually discharging to a sewage treatment plant located near the Ottawa River. The Pathways Phase 1 report prepared by IBI Group dated July 2017 confirmed that the existing 375mm sewer in Kelly Farm Drive has sufficient capacity for the Pathways at Findlay Creek property inclusive of the proposed development.

3.1.1 Verification of Existing Sanitary Sewer Capacity

There is an existing 300mm sanitary sewer in Cedar Creek Drive, which connects to the existing 300mm sanitary sewer in Miikana Road, then to the 375 mm diameter sub-trunk sewer in Kelly Farm Drive. In the previous Pathways Phase 1 report, the design population for Block 232 was 129.6, see **Appendix B**. In the proposed site plan, the total population is 165.6. However, using the new design criteria of 280 liter per capita per day and 0.8 correction factor, the calculated sanitary flow rate is 2.23 l/s, which is less than 2.39 l/s in the Pathway Phase 1 design for Block 232. The block area remains unchanged. Therefore, the existing sanitary sewer has adequate capacity for the subject site, and there will be no negative effect to the downstream sanitary system. Refer to **Appendix B** for the detailed sanitary sewer design sheet.

3.1.2 Sanitary Hydraulic Grade Line

Pathways Phase 1 report indicates that the sanitary hydraulic grade line (HGL) in BLK6117 on Cedar Creek Drive is 94.89, refer to **Appendix B** for the Pathways Phase 1 Sanitary HGL analysis. The sanitary HGL extended through the subject site have been calculated as follows:

LOCATION	MH #	USF ELEV (M)	SANITARY HGL (M)	FREEBOARD (M)
Cedar Creek Drive	BLK6117	-	94.890	-
Block 232	MH 200A	98.420	95.816	2.604
Block 232	MH 215A	98.420	95.957	2.463
Block 232	MH 214A	98.420	96.324	2.108
Block 232	MH 202A	98.420	96.635	1.797
Block 232	MH 201A	98.420	96.964	1.456
Block 232	MH 217A	99.820	97.952	1.487
Block 232	MH 216A	99.170	98.578	0.420
Block 232	MH 204A	98.940	97.012	1.626
Block 232	MH 212A	98.470	97.898	0.560
Block 232	MH 205A	98.470	97.174	0.996
Block 232	MH 210A	98.370	97.495	0.708
Block 232	MH 211A	98.370	97.705	0.515
Block 232	MH 206A	98.920	97.230	1.390
Block 232	MH 209A	98.920	98.173	0.456
Block 232	MH 207A	99.870	98.509	1.062
Block 232	MH 208A	100.620	99.173	1.298

All underside of footing elevations have been designed to provide a minimum of 300mm separation between the greater of governing pipe obvert or governing HGL. A copy of the sanitary HGL analysis for Block 232 is provided in **Appendix B**.

3.2 Proposed Sewers

All on-site sewers have been designed to City of Ottawa and MOE design criteria which include but are not limited to the below listed criteria. A copy of the detailed sanitary tributary area plan 400 and the sanitary sewer design sheets are included in **Appendix B** illustrate the population densities and sewers which provide the necessary outlets.

3.2.1 Design Flow:

Average Residential Flow	-	280 l/cap/day
Peak Residential Factor	-	Harmon Formula
Infiltration Allowance	-	0.33 l/sec/Ha
Minimum Pipe Size	-	200mm diameter

3.2.2 Population Density:

2 Bedroom Units	-	2.1 person/unit
1 Bedroom Units	-	1.4 person/unit
External Low Density Land	-	120 units/gross Ha

4 SITE STORMWATER MANAGEMENT

4.1 Objective

The purpose of this evaluation is to prepare the dual drainage design, including the minor and major system, for the Block 232 development. The design includes the assignment of inlet control devices, on-site storage, maximum depth of surface ponding and hydraulic grade line analysis. The evaluation takes into consideration the City of Ottawa Sewer Design Guidelines (OSDG) (October 2012), the February 2014 Technical Bulletin ISDTB-2014-01, the September 2016 Technical Bulletin PIEDTB-2016-01 and the June 2018 Technical Bulletin ISTB-2018-04.

4.2 Design Criteria

The stormwater system was designed following the principles of dual drainage, making accommodations for both major and minor flow.

Some of the key criteria include the following:

- Design Storm — 1:2 year return (Ottawa)

  (It should be noted that the overall Pathways Site utilized 1:5 year return storm for minor system release from the subject site, further details are provided in Section 4.3 and 4.4.2)
- Rational Method Sewer Sizing
- Initial Time of Concentration — 10 minutes
- Runoff Coefficients
  - Landscaped Areas — C = 0.25
  - Landscaped Area with Pathway — C = 0.50
  - Building and Roof Area — C = 0.90
  - Parking Area and Driveway — C = 0.90
- Pipe Velocities — 0.80 m/s to 3.0 m/s
- Minimum Pipe Size — 250 mm diameter (200 mm CB Leads)

4.3 System Concept

According to the Pathways Phase 1 report prepared by IBI Group dated July 2017, the development of the adjacent downstream properties included the expected stormwater servicing needs of the subject property. The existing storm sewers constructed adjacent to the site were oversized to provide the needed capacity for minor storm runoff from the subject site. Minor storm runoff from the subject site will connect to the existing 600 mmØ sewer stub that connects to the existing 1500mmØ trunk storm sewer in Cedar Creek Drive.

4.3.1 Dual Drainage Design

The dual drainage system proposed for the subject site will accommodate both major and minor stormwater runoff. Minor flow from the subject site will be conveyed through the storm sewer network and discharge into the existing 600 mmØ sewer stub that connects to the existing 1500mm ø trunk storm sewer in Cedar Creek Drive.

The balance of the surface flow not captured by the minor system will be conveyed via the major system. Where possible, storage will be provided in surface sags or low points within the roadway. Storage will also be provided within oversized storm pipes. Once the maximum storage is utilized, the excess flow will cascade to the next downstream street sag. Major flow up to 100-year storm event will be restricted and detained on-site. Emergency overflow will be directed towards Salamander Way and Cedar Creek Drive.

4.3.2 Proposed Minor System

Using the criteria identified in Section 4.2, the proposed on-site storm sewers were sized accordingly. A detailed storm sewer design sheet and the associated storm sewer drainage area plan is included in **Appendix C**. The general plan of services, depicting all on-site storm sewers can be found in **Appendix A**.

The owner of the site will be responsible for regular maintenance of the on-site sewers, catch basins and inlet control devices (ICDs). Maintenance includes but is not limited to the cost of regular cleaning of the structures and ICDs as necessary. The site owner will also be responsible for replacement of damaged or missing catch basin structures, grates or ICDs as needed.

4.4 Stormwater Management

4.4.1 Water Quality Control

The subject site is part of the larger development referred to as the Leitrim Development Area. The stormwater management strategy was outlined in the following reports:

- Addendum to Leitrim Development Area Stormwater Management Environmental Study Report and Pre-Design Volumes 1 and II (IBI Group, July 2005);
- Design Brief and Amendment to MOE Certificate of Approval Findlay Creek Village Stormwater Facility (IBI Group, July 2005);
- Final Serviceability Report Leitrim Development Area City of Ottawa (IBI Group, March 2007).
- 2016 Final Updated Serviceability Report (Class EA OPA76 Areas 8a, 9a and 9b) Leitrim Development Area (IBI Group, September 2016)

The subject site is part of the drainage area which ultimately discharges into the existing Findlay Creek Village Stormwater Facility. The Findlay Creek Village Stormwater Facility was constructed in 2006 and provides water quality control to an Enhanced Level of Protection according to MOE Stormwater Management Planning and Design Guidelines (March 2003).

4.4.2 Water Quantity Control

The subject site will be limited to a maximum minor system release rate of 206 L/s and a maximum major system release rate of 84l/s according to Pathways at Findlay Creek Design Brief dated July, 2017, reference information is provided within Appendix C (Table 4.5 from the Pathways Design Brief). This will be achieved through a combination of inlet control devices (ICD's) at inlet locations, surface storage where possible and underground storage in oversized storm pipes where required.

Surface flows in excess of the site's allowable release rate will be stored on site in strategic surface storage areas or oversized underground pipes and gradually released into the minor system to respect the site's allowable release rate. The maximum surface retention depth located within the developed areas will be limited to 300mm during a 1:100 year event as show on the ponding plan located in **Appendix C** and grading plans located in **Appendix D.** Overland flow routes will be provided in the grading to permit emergency overland flow.

At the south-east corner and two western corner of the site, the opportunity to capture and store runoff is limited due to grading constraints and building geometry. These areas will discharge to Salamander Way, Cedar Creek Drive and Pingwi Place uncontrolled. These locations are generally located at the perimeter of the site where it is necessary to tie into public boulevards and adjacent properties or in areas where ponding stormwater is undesirable.

4.5 Hydrological Evaluation

The hydrological analysis of the proposed dual drainage system was conducted using DDSWMM. This technique offers a single storm event flow generation and routing. Land use, selected modeling routines, and input parameters are discussed in the following sections. A DDSWMM model schematic is provided within Appendix C and model files are included on the CD enclosed in Appendix C. The main hydrological parameters for the subject site are summarized below.

Storms and Drainage Area Parameters

The main hydrology parameters are summarized below and in **Table 4.1**.

- **Design storms:** The site was evaluated using the following storms:
    - 2 year, 3 hour Chicago storm events with a 10 minute time step (for dual drainage evaluation, specifically to confirm no ponding after the storm event);
    - 100 year 3 hour Chicago storm event with a 10 minute time step (to confirm on-site storage requirements); and
    - 100 year 3 hour Chicago storm event + 20% increase in intensity with a 10 minute time step (for a stress test on major flow conveyance as per the City of Ottawa Sewer Design Guidelines).
- **Infiltration:** The selected infiltration losses are consistent with the City of Ottawa Sewer Design Guidelines. The Horton values are as follows: f_o = 76.2 mm/h, f_c = 13.2 mm/h, k = 0.00115 s^{-1}.
- **Area:** Catchment areas are based on the rational method drainage areas with some minor modifications for modelling purposes.
- **Imperviousness:** Imperviousness for the subject site is based on the rational method runoff coefficients as indicated within Drawing 500.
- **Width:** The catchment width was based on the conveyance route length of the drainage area and multiplied by two. The multiplier of two was only used if the drainage area had runoff contribution from both sides of the drainage area.
- **Slope:** The ground slope was based upon the average slope for both impervious and pervious area. Generally, the slope is approximately 2% (0.02 m/m). This assumes a slope of approximately 1% for impervious or road surfaces and 3% for pervious surfaces (lot grading).
- **Detention storage depth:** Detention storage depths of 1.57 mm and 4.67 mm were used for impervious and pervious areas, respectively.
- **Manning's roughness:** Manning's roughness coefficients of 0.013 and 0.25 were used for impervious and pervious areas, respectively.

- **Baseflow:** No baseflow components were assumed for any of the areas contributing runoff to the minor system.

- **Minor system capture:** The minor system capture is based on the ICD design. ICDs are incorporated into the design to maintain the allowable release rate into the existing downstream storm sewer system to protect the minor system from surcharge during infrequent storm events and to utilize the available on-site storage.

  The main hydrological parameters used in the DDSWWM model are summarized in **Table 4.1**. A CD of the model files is provided in **Appendix C**.

- **Major system storage and routing:** The subject site is comprised of parking areas, drive aisle and underground storage within oversized storm pipes. Flow is attenuated within low points with potential overflow cascading to the next segment downstream. The total volume at each low point, up to the overflow depth, is the maximum static storage.

  For areas with ponding, cascading overflow from a low point to a downstream segment utilizes the static storage available plus an additional amount of storage equivalent to the depth required for the flow to cascade over the downstream high point. The attenuation in street sags was evaluated to account for static storage and, if overflow occurs, dynamic storage. Within this report it is referred to as double routing.

  DDSWMM does not have a direct way of coding double routing since it does not allow the user to code dynamic storage over the high point. For this analysis, the method employed is that recommended in the February 2014 City of Ottawa Technical Bulletin (PIEDTB-2016-01). It accounts for overflow from a street segment (regular static storage at a sag) being conveyed to a downstream dummy segment. In other words, a regular low point segment is provided with a downstream dummy segment for further flow attenuation to account for the dynamic ponding during overflow.

  There are no drainage area attributes associated with the dummy segment since it is a segment solely for routing. In addition, there is no inflow to the minor system from these dummy segments. The overflow hydrograph from the upstream catchment is routed in the dummy segment to the next “real” downstream segment. The dummy segments have the following specific characteristics:

  - Segment Length: Equivalent to the length of the maximum static storage from the street segment contributing to it.

  - Road Type: Equivalent to the right-of-way characteristics from the segment contributing to it, but with a longitudinal slope of 0.01% (0.0001 m/m).

  The dummy segments for major system routing have been applied to the analysis of the subject site. The segments are referenced as D1, D2, D3, etc. within the DDSWMM modelling file. The drainage area plan presented in **Drawing 500** does not show the dummy segments, but the DDSWMM output file shows the dummy segments immediately following the corresponding major segment which cascades into that dummy segment.

  Rear yards were considered independently of street segments and rear yard catch basins were incorporated in the DDSWMM model. Simulations were based on the total interception of runoff by the storm inlets. This was done by specifying a one-to-one relationship between approach flow and capture flow. For this particular case, underground storage volumes in rear yards was accounted for as available on-site storage. As per the Technical Bulletin

(PIEDTB-2016-01), the effect of flow attenuation due to surface ponding in rear yards has been accounted for by utilizing a constant slope ditch/swale draining to the street. The ditch/swale has a minimum longitudinal slope of 1.5%, a maximum depth of 600mm, and side slopes of 3 horizontal to 1 vertical.

Table 4.1 DDSWMM Hydrological Parameters

DRAINAGE AREA ID	AREA (HA)	D/S SEGMENT ID	IMP RATIO [Tp (h)]	Segment Length (m)	Subcatchment WIDTH (M)	MINOR SYSTEM RESTRICTION (LPS)	AVAILABLE STATIC PONDING (M^3)
ACB1	0.081	ACB2	1.00	30	60	52	36.03*
ACB2	0.066	ACB3	1.00	35	70		
ACB3	0.037	ACB11	1.00	22	44		
ACB4	0.038	ACB3	1.00	21	42		
ACB5	0.054	ACB4	1.00	21	42	17	1.58
ACB6	0.074	ACB5	1.00	27	54	17	6.39
ACB7	0.100	ACB8	1.00	34	68	58	13.87*
ACB8	0.086	OUT1	1.00	32	64		
UNC_CB9	0.038	OUT3	1.00	22	44	0	0
ACB10	0.029	UN3	0.79	20	40	10	0.78
ACB11	0.119	OUT1	0.43	124	124	27	6.59*
ACB12	0.084	OUT1	0.43	30	60	7	2.30
UN1	0.011	OUT1	0.79	4	8	N/A	0
UN2	0.043	OUT1	0.79	11	22	N/A	0
UN3	0.075	OUT2	0.79	6	12	N/A	0
UN4	0.071	OUT2	0.79	10	20	N/A	0

NOTES:

* Restriction controlled for group of catchments
**Oversized storm pipe storage included as part of the available static storage. For detailed calculations refer to Appendix C

4.6 Results of the Hydrological Evaluation

The allowable release rate for the 1.01 Ha site is 206 L/s of minor flow and 84 L/s of major flow for the 100 year Chicago storm according to the previous Pathways Phase 1 report, See Table 4.5 in **Appendix C** and area HD1 DDSWMM model results. As noted in Section 4.4, a portion of the site will be left to discharge to Salamander Way, Cedar Creek Drive and Pingwi Place uncontrolled. As per the detailed DDSWMM model, these uncontrolled areas contribute 71 L/s of the 84 L/s total major flow released from Block 232 for the 100 year Chicago storm. This is on par with the results from the previous Pathway Phase 1 report. Also, catchment UNC_CB9 is set to full capture due to the parking ramp in this area. The flows for this catchment are accounted for in the total minor flow allowance.

Based on the aforementioned flow allowance, 7 inlet control devices are proposed for all of the surface drainage. For the 100 year Chicago Storm, the sum of all the minor flow rates (**205 l/s**) is less than the maximum allowable flowrate of 206 l/s. Table 4.2 summarizes the ICDs characteristics, refer to **Drawing C-010** for detailed calculations and orifice sizing.

Table 4.2 Summary of ICD

LOCATION	AREA (HA)	RELEASE RATE (L/S)	Head (M)	ICD
ACB1	0.081	52	2.037	Custom IPEX MHF 131 mm Diameter
ACB2	0.066			
ACB3	0.037			
ACB4	0.038			
ACB5	0.054	17	1.42	Custom IPEX MHF 82 mm Diameter
ACB6	0.074	17	1.50	Custom IPEX MHF 81 mm Diameter
ACB7	0.100	58	1.736	Custom IPEX MHF 144 mm Diameter
ACB8	0.086			
UNC_CB9	0.038	17	1.25	Full Capture, No ICD
ACB10	0.029	10	1.45	Custom HYDROVEX 100 VHV-1 restricted at 10 l/s
ACB11	0.119	27	1.48	Standard IPEX MHF 102 mm Diameter
ACB12	0.084	7	1.55	Custom HYDROVEX 75 VHV-1 restricted at 7 l/s
TOTAL	**0.806**	**205**	-	

The below **Table 4.3** and summarizes the minor system capture for each subcatchment on the subject site for the 2 year, 3 hour Chicago storm events. The results demonstrates that there is no ponding on the block where the flow is controlled following the 2 year storm event. The site releases a total of 27 l/s from the uncontrolled areas UN1, UN2, UN3 and UN4.

The release rate for the 2 year design storm is less than the allowable release rate of 205 l/s, at 121 l/s for the minor flow plus 27 l/s totalling 148 l/s. Similarly, the 5 year release rate is 165 l/s for the minor flow and 38 l/s major flow totalling 203 l/s. The table to support these results is provided within Appendix C with the summary of the minor flows for each storm.

Table 4.3 DDSWMM Hydrological Model Results for 2 Year 3 Hour Chicago

DRAINAGE AREA ID	MINOR SYSTEM RESTRICTION (l/s)	AVAILABLE STATIC STORAGE (m3)	MINOR SYSTEM CAPTURE	TOTAL STORAGE USED (m3)	OVERFLOW (l/s)
ACB1	52	36.03*	40	0.01	0**
ACB2					
ACB3					
ACB4					
ACB5	17	1.58	10	0.01	0
ACB6	17	6.39	13	0.01	0
ACB7	58	13.87*	33	0.01	0**
ACB8					
UNC_CB9	0	0.00	7	0	0

DRAINAGE AREA ID	MINOR SYSTEM RESTRICTION (l/s)	AVAILABLE STATIC STORAGE (m3)	MINOR SYSTEM CAPTURE	TOTAL STORAGE USED (m3)	OVERFLOW (l/s)
ACB10	10	0.78	5	0.01	0
ACB11	27	6.59*	10	0	0
ACB12	7	2.30	7	0.01	0
UN1	N/A	0	0	0	2
UN2	N/A	0	0	0	6
UN3	N/A	0	0	0	10
UN4	N/A	0	0	0	10
OUT2	N/A	N/A	N/A	N/A	27

NOTES:

* Restriction controlled for group of catchments
**Oversized storm pipe storage included as part of the available static storage. For detailed calculations refer to Appendix C

The **Table 4.4** and **Table 4.5** below, summarize the cascading overflows for each subcatchment on the subject site for the 100 year 3 hour Chicago storm event and the 100 year Chicago storm increased by 20%, respectively. The cascading overflow is the flow exiting a drainage area when maximum minor system inflow and maximum available ponding has been utilized. The overflow is obtained from the respective DDSWMM output file provided in **Appendix C**, CD model files.

Table 4.4 DDSWMM Hydrological Model Results for 100 Year 3 Hour Chicago

<table>
<tr><th>DRAINAGE AREA ID</th><th>MINOR SYSTEM RESTRICTION (l/s)</th><th>AVAILABLE STATIC STORAGE (m3)</th><th>MINOR SYSTEM CAPTURE</th><th>TOTAL STORAGE USED (m3)</th><th>OVERFLOW (l/s)</th></tr>
<tr><td>ACB1</td><td rowspan="4">52</td><td rowspan="4">36.03*</td><td rowspan="4">52</td><td rowspan="4">32.59</td><td rowspan="4">0**</td></tr>
<tr><td>ACB2</td></tr>
<tr><td>ACB3</td></tr>
<tr><td>ACB4</td></tr>
<tr><td>ACB5</td><td>17</td><td>1.58</td><td>17</td><td>1.58</td><td>7</td></tr>
<tr><td>ACB6</td><td>17</td><td>6.39</td><td>17</td><td>6.39</td><td>2</td></tr>
<tr><td>ACB7</td><td rowspan="2">58</td><td rowspan="2">13.87*</td><td rowspan="2">58</td><td rowspan="2">11.42</td><td rowspan="2">0**</td></tr>
<tr><td>ACB8</td></tr>
<tr><td>UNC_CB9</td><td>0</td><td>0</td><td>17.33</td><td>0</td><td>0</td></tr>
<tr><td>ACB10</td><td>10</td><td>0.78</td><td>10</td><td>0.46</td><td>0</td></tr>
<tr><td>ACB11</td><td>27</td><td>6.59*</td><td>26.99</td><td>2.29</td><td>0</td></tr>
</table>

DRAINAGE AREA ID	MINOR SYSTEM RESTRICTION (l/s)	AVAILABLE STATIC STORAGE (m3)	MINOR SYSTEM CAPTURE	TOTAL STORAGE USED (m3)	OVERFLOW (l/s)
ACB12	7	2.30	7	2.30	15
UN1	N/A	0	0	0	4
UN2	N/A	0	0	0	16
UN3	N/A	0	0	0	25
UN4	N/A	0	0	0	26
OUT2	N/A	N/A	N/A	N/A	84

NOTES:
* Restriction controlled for group of catchments
**Oversized storm pipe storage included as part of the available static storage. For detailed calculations refer to Appendix C

The above results indicate that the major system releases a total of 84 l/s of major flow from the site during the 100 year 3 hour Chicago design storm. This corresponds to the previous analysis presented with the Pathways Design Brief Phase 1, which included an overflow of 84 L/s generated from the site.

Table 4.5 DDSWMM Hydrological Model Results for 100 Year 3 Hour Chicago +20%

DRAINAGE AREA ID	MINOR SYSTEM RESTRICTION (l/s)	AVAILABLE STATIC STORAGE (m3)	MINOR SYSTEM CAPTURE	TOTAL STORAGE USED (m3)	OVERFLOW (l/s)
ACB1 ACB2 ACB3 ACB4	52	36.03*	52	36.03	28**
ACB5	17	1.58	17	1.58	24
ACB6	17	6.39	17	6.39	23
ACB7 ACB8	58	13.87*	58	13.87	0**
UNC_CB9	0	0	21	0	0
ACB10	10	0.78	10	0.78	5
ACB11	27	6.59*	27	6.59	34
ACB12	7	2.30	7	2.30	22
UN1	N/A	0	0	0	5
UN2	N/A	0	0	0	20

DRAINAGE AREA ID	MINOR SYSTEM RESTRICTION (l/s)	AVAILABLE STATIC STORAGE (m3)	MINOR SYSTEM CAPTURE	TOTAL STORAGE USED (m3)	OVERFLOW (l/s)
UN3	N/A	0	0	0	39
UN4	N/A	0	0	0	32
OUT2	N/A	N/A	N/A	N/A	111

The above results indicate that the major system flow from the site is 111 L/s during the 100 year 3 hour Chicago + 20% sensitivity analysis. This is less than the previous analysis within the Pathways Design Brief, which included an overflow of 140 L/s generated from the site.

The following table summarizes the elevation of dynamic ponding, property line elevation and the garage elevations for the street segments during the 100 year storm event increased by 20%.

Table 4.6 Critical Ponding Locations during the Stress Test and Adjacent Property Elevations

<table>
<tr><th rowspan="2">DRAINAGE AREA ID</th><th rowspan="2">STATIC PONDING DEPTH (M)</th><th rowspan="2">MAX. DEPTH (STATIC + DYNAMIC, WHERE APPLICABLE) (M)</th><th rowspan="2">(1) CORRESPONDING ELEVATION (M)</th><th rowspan="2">(2) ADJACENT PROPERTY LINE ELEVATION (M)</th><th rowspan="2">DIFFERENCE (2) – (1)</th><th colspan="2">(3) ADJACENT CRITICAL ELEVATION</th><th rowspan="2">DIFFERENCE (3) – (1)</th></tr>
<tr><th>LOCATION</th><th>(3) ELEVATION (M)</th></tr>
<tr><td>ACB1</td><td>0.15</td><td rowspan="4">0.29</td><td rowspan="4">99.89</td><td>100.95</td><td>1.06</td><td>Property boundary</td><td>100.95</td><td>1.06</td></tr>
<tr><td>ACB2</td><td>0.25</td><td>99.85</td><td>-0.04</td><td>Building envelope</td><td>99.95</td><td>0.06</td></tr>
<tr><td>ACB3</td><td>0.25</td><td>100.10</td><td>0.21</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>ACB4</td><td>0.10</td><td>100.90</td><td>1.01</td><td>Building entrance</td><td>100.95</td><td>1.06</td></tr>
<tr><td>ACB5</td><td>0.12</td><td>0.19</td><td>100.29</td><td>100.45</td><td>0.16</td><td>Building entrance</td><td>100.50</td><td>0.21</td></tr>
<tr><td>ACB6</td><td>0.20</td><td>0.27</td><td>100.47</td><td>100.45</td><td>-0.02</td><td>Building envelope</td><td>100.50</td><td>0.03</td></tr>
<tr><td>ACB7</td><td>0.15</td><td rowspan="2">0.00</td><td rowspan="2">99.84</td><td>100.90</td><td>1.06</td><td>Building envelope</td><td>101.45</td><td>1.61</td></tr>
<tr><td>ACB8</td><td>0.19</td><td>99.95</td><td>0.11</td><td>Building envelope</td><td>100.20</td><td>0.36</td></tr>
<tr><td>UNC_CB9</td><td>0.00</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>ACB10</td><td>0.15</td><td>0.20</td><td>101.00</td><td>101.10</td><td>0.07</td><td>Building envelope</td><td>101.05</td><td>0.10</td></tr>
</table>

DRAINAGE AREA ID	STATIC PONDING DEPTH (M)	MAX. DEPTH (STATIC + DYNAMIC, WHERE APPLICABLE) (M)	(1) CORRESPONDING ELEVATION (M)	(2) ADJACENT PROPERTY LINE ELEVATION (M)	DIFFERENCE (2) – (1)	(3) ADJACENT CRITICAL ELEVATION		DIFFERENCE (3) – (1)
						LOCATION	(3) ELEVATION (M)	
ACB11	0.18	0.28	99.48	99.55	0.07	To Salamander Way	99.48	0
ACB12	0.25	0.35	100.20	100.20	0	Building envelope	100.25	0.05

From the comparison in **Table 4.6**, during the 100 year storm event increased by 20%, the major system encroaches the adjacent property line, but remains below the garage opening at all locations.

4.7 Storm Hydraulic Grade Line

Pathways Phase 1 report indicates that the storm hydraulic grade line (HGL) in MH 6102 on Cedar Creek Drive is 94.89m, refer to **Appendix C** for the Pathways Phase 1 Storm HGL analysis. The storm HGL extended through the subject site have been calculated as follows:

LOCATION	MH #	USF ELEV (M)	STORM HGL (M)	FREEBOARD (M)
Cedar Creek Drive	BLK6117	-	94.890	-
Block 232	MH 200	98.420	94.905	3.515
Block 232	MH 201	98.420	96.689	1.731
Block 232	MH 203	98.420	97.064	1.356
Block 232	MH 204	98.940	97.455	1.485
Block 232	MH 205	98.940	98.099	0.841
Block 232	MH 206	98.920	98.333	0.587
Block 232	MH 207	100.62	98.100	2.520
Block 232	MH 208	100.62	98.132	2.488

All underside of footing elevations have been designed to provide a minimum of 300mm separation between the greater of governing pipe obvert or governing HGL. A copy of the storm HGL analysis for Block 232 is provided in **Appendix C**.

5 SOURCE CONTROLS

5.1 General

On site level or source control management of runoff will be provided to provide quality control for the subject lands. Such controls or mitigative measures are proposed for the development not only for final development but also during construction and build out. Some of these measures are:

- flat lot grading;
- split lot drainage;
- Roof-leaders to vegetated areas;
- vegetation planting; and
- groundwater recharge.

5.2 Lot Grading

There is an elevation difference of approximately 2m from southwest to northeast in Block 232. In accordance with local municipal standards, the parking lots will be graded northeast between 1.5% and 5.0%. Most landscaped area drainage will be directed into a swale drainage system, and connects to the storm sewer system. Typically swales will have slopes larger than 1.5% with subdrains. Copies of the grading plans have been included in **Appendix D.**

5.3 Roof Leaders

This development will consist of stacked homes and apartments. It is proposed that roof leaders from these units be constructed such that runoff is directed to grass areas adjacent to the units. This will promote water quality treatment through settling, absorption, filtration and infiltration and a slow release rate to the conveyance network.

5.4 Vegetation

As with most subdivision agreements, the developer will be required to complete a vegetation and planting program. Vegetation throughout the development including planting along roadsides and within public parks provides opportunities to re-create lost natural habitat.

6 CONVEYANCE CONTROLS

6.1 General

Besides source controls, the development also proposes to use several conveyance control measures to improve runoff quality. These will include:

- flat vegetated swales;
- catchbasin and maintenance hole sumps; and
- pervious rear yard drainage.

6.2 Flat Vegetated Swales

The development will make use of relatively flat vegetated swales where possible to encourage infiltration and runoff treatment.

6.3 Catchbasins

All catchbasins within the development, either rear yard or street, will be constructed with minimum 600 mm deep sumps. These sumps trap pollutants, sand, grit and debris which can be mechanically removed prior to being flushed into the minor pipe system. Both rear yard and street catchbasins will be fabricated to OPSD 705.010 or 705.020. All storm sewer maintenance holes servicing local sewers less than 900 mm diameter shall be constructed with a 300 mm sump as per City standards.

6.4 Pervious Landscaped Area Drainage

Some of the landscaped area swales make use of a filter wrapped perforated drainage pipe constructed below the rear yard swale. This perforated system is designed to provide some ground water recharge and generally reduce both volumetric and pollutant loadings that enter the minor pipe system.

7 SEDIMENT AND EROSION CONTROL PLAN

7.1 General

During construction, existing stream and conveyance systems can be exposed to significant sediment loadings. Although construction is only a temporary situation, it is proposed to introduce a number of mitigative 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;
- bulkhead barriers will be installed at the nearest downstream manhole in each sewer which connects to an existing downstream sewer;
- seepage barriers will be constructed in any temporary drainage ditches; and
- silt sacks will remain on open surface structure such as manholes and catchbasins until these structures are commissioned and put into use.

7.2 Trench Dewatering

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 the 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.

7.3 Bulkhead Barriers

At the first manhole constructed immediately upstream of an existing sewer, a ½ diameter bulkhead will be constructed over the lower half of the outletting sewer. This bulkhead will trap any sediment carrying flows, thus preventing any construction –related contamination of existing sewers. The bulkheads will be inspected and maintained including periodic sediment removal as needed.

7.4 Seepage Barriers

These barriers will consist of both the Light Duty Straw Bale Barrier as per OPSD 219.100 or the Light Duty Silt Fence Barrier as per OPSD 219.110 and will be installed in accordance with the sediment and erosion control drawing. The barriers are typically made of layers of straw bales or geotextile fabric staked in place. All seepage barriers will be inspected and maintained as needed.

7.5 Surface Structure Filters

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 rear yards are sodded or until streets are asphalted and curbed, all catchbasins and manholes will be equipped with geotextile filter socks. These will stay in place and be maintained during construction and build until it is appropriate to remove them.

7.6 Stockpile Management

During construction of any development similar to that being proposed both imported and native soils are stockpiled. Mitigative measures and proper management to prevent these materials entering the sewer systems 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 generally before any catchbasins are installed. Street catchbasins are installed at the time of roadway construction and rearyard catchbasins are usually installed after base course asphalt is placed.

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

The roadway granular materials are not stockpiled on site. They are immediately placed in the roadway 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 construction of this development will involve a substantial rock blasting, breaking and crushing operation. Given the existing topography, a substantial cut and fill operation is require in order to construction a development that meets City Standards. As part of this operation, materials will be manipulated onsite, and provided the sediment and erosion control measures are in place, are generally inconsequential to the surrounding environment.

8 ROADS AND NOISE ATTENUATION

Vehicular access to Block 232 is provided by two private entrances from Pingwi Place and Salamander Way.

There are 130 parking spaces in total, including 28 underground and 102 surface parking spots.

There are no bus routes proposed within Block 232.

Environmental noise has been evaluated by IBI Group, and recommendations are provided under a separate cover.

9 SOILS

Golder Associates Ltd. was retained to prepare a geotechnical investigation for the proposed mixed use development for the Pathways Phase 1. The objectives of the investigation were to prepare a report to:

- Determine the subsoil and groundwater conditions at the site by means of test pits and boreholes and;
- To provide geotechnical recommendations pertaining to design of the proposed development including construction considerations.

The geotechnical report 19131587 was prepared by Golder Associates Ltd. in January 2020. A copy of the report is included in **Appendix D**. The report contains recommendations which include but are not limited to the following:

- The maximum permissible grade raise is 2.5m
- In areas where finished grade exceeds grade raise limits, geotechnical reviews are required
- Fill placed below the foundations to meet OPSS Granular ‘A’ or Granular ‘B’ Type II placed in 300 mm lifts compacted to 98% SPMDD.
- Fill for roads to be suitable native material in 300mm lifts compared to 95% SPMDD

Pavement Structure:

LOCAL ROAD	THICKNESS
Asphaltic Concrete	90mm
OPSS Granular A Base	150mm
OPSS Granular B Type II Subbase	375mm

- Pipe bedding and cover; bedding to be minimum 150 mm OPSS Granular ‘A’ up to spring line of pipe. Cover to be 300 mm OPSS A (PUC and concrete pipes) or sand for concrete pipes. Both bedding and cover to be placed in maximum 225 mm lifts compacted to 95% SPMDD.

In general the grading plan for Block 232 adheres to the grade raise constraints noted above. A copy of the grading plans is included in **Appendix D**. For areas that exceed the grade raise limit a light weight fill program will be in place.

10 RECOMMENDATIONS

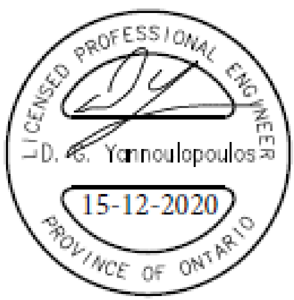
Water, wastewater and stormwater systems required to develop Pathways Block 232 will be designed in accordance with MOE and City of Ottawa's current level of service requirements.

The use of lot level controls, conveyance controls and end of pipe controls outlined in the report will result in effective treatment of surface stormwater runoff from the site. Adherence to the proposed sediment and erosion control plan during construction will minimize harmful impacts on surface water.

Final detail design will be subject to governmental approval prior to construction, including but not limited to the following:

- Block 232 Commence Work Order: City of Ottawa
- Block 232 Watermain Approval: City of Ottawa
- Block 232 Commence Work Order (utilities): City of Ottawa

Report prepared by:



Demetrius Yannoulopoulos, P.Eng.
Director

Ryan Magladry, C.E.T.
Project Manager

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APPENDIX A

APPROVED UNDER SECTION 51 OF THE PLANNING ACT
BY THE CITY OF OTTAWA.

THIS ________ DAY OF ___________________ , _______

STEPHEN WILLIS, GENERAL MANAGER
PLANNING, INFRASTRUCTURE AND ECONOMIC
DEVELOPMENT DEPARTMENT
CITY OF OTTAWA

PLAN 4M-

I CERTIFY THAT THIS PLAN
IS REGISTERED IN THE LAND REGISTRY OFFICE
FOR THE LAND TITLES DIVISION OF OTTAWA-CARLETON NO. 4
AT _ _ _ _ _ O'CLOCK ON THE _ _ _ _ DAY OF _ _ _ _ _ _ _ _ _, _ _ _ _
AND ENTERED IN THE PARCEL REGISTER FOR
PROPERTY IDENTIFIERS _
AND THE RE□UIRED CONSENTS ARE REGISTERED AS
PLAN DOCUMENT NO._ _ _ _ _ _ _ _ _ _ _

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _
LAND REGISTRAR

This □lan com□rises □art of the land identified □y PIN 04328-3631 and all of the land identified □y PIN 04328-3632.

PRELIMINARY PLAN OF SUBDIVISION OF

PART OF LOT 21
CONCESSION 4 (RIDEAU FRONT)

Geogra□hic Townshi□ of Glo□cester

CITY OF OTTAWA

S□r□eyed □y Annis , O'S□lli□an , Volle□ekk Ltd.

Scale 1 : 1000

40 30 20 10 0 20 40 Metres

Metric

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

SURVEYOR'S CERTIFICATE

I CERTIFY THAT :

1. This s□r□ey and □lan are correct and in accordance with the S□r□eys Act, the S□r□eyors Act and the Land Titles Act and the reg□lations made □nder them.
2. The S□r□ey was com□leted on the _ _ _ day of _ _ _ _ _ _ _ _ _ _ ,2018.

_ _ _ _ _ _ _ _ _ _
Date

_ _
Andre Roy
Ontario Land S□r□eyor

OWNER'S CERTIFICATE

THIS IS TO CERTIFY THAT :

1. Lots 1 to 215, □oth incl□si□e, Blocks 216 to 245, □oth incl□si□e, the Streets, namely, □romenade Cedar Creek Dri□e, □romenade D□n Ski□□er Dri□e, □ois Zaatiik Gro□e, r□e Minikan Street, □lace Pingwi Place, □romenade Kelly Farm Dri□e, □oie Salamander Way, □oie S□readwing Way, r□e Rallidale Street and □lacette Viceroy Mews, the Street Widenings, namely, Blocks 246 and 247 and the Reser□es, namely, Blocks 248 to 254, □oth incl□si□e, ha□e □een laid o□t in accordance with o□r instr□ctions.
2. The Streets and Street Widenings are dedicated to City of Ottawa as □□□lic highways.

Dated the _ _ _ _ day
of _ _ _ _ _ _ _ _ _ _ _ _,2018

_ _
Da□id Kardish
Leitrim So□th Holdings Inc.
I ha□e the a□thority to □ind the cor□oration.

NOTES AND LEGEND

—□—	denotes	S□r□ey Mon□ment Planted.
—■—	"	S□r□ey Mon□ment Fo□nd
SIB	"	Standard Iron Bar.
SSIB	"	Short Standard Iron Bar.
CC	"	C□t Cross.
IB	"	Iron Bar.
CLF	"	Chain Link Fence
BF	"	Board Fence
□AOG□	"	Annis, O'S□lli□an, Volle□ekk Ltd.
□P1□	"	Plan 4R-29621
□P2□	"	Plan
P□W	"	Post □ Wire
— OHW —	"	O□erhead Wires

All □lanted s□r□ey mon□ments are IB's □nless otherwise noted.

Distances shown on c□r□ed limits are Arc distances □nless otherwise noted.

Distances shown on this □lan are gro□nd distances and can □e con□erted to grid distances □y m□lti□lying □y the com□ined scale factor of 0.9999xx.

Bearings are grid, deri□ed from Can-Net 2016 Real Time Network GPS o□ser□ations on reference □oints A and B, shown hereon, ha□ing a bearing of Nxx°xx'xx"W and are referenced to Specified Control Points 01919760735 and 01919871649, MTM Zone 9 (76°30' West Longitude) NAD-83 □original□

Coordinates are deri□ed from Can-Net 2016 Real Time Network GPS o□ser□ations referenced to S□ecified Control Points 01919760735 and 01919871649, MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

Coordinate □al□es are to □r□an acc□racy in accordance with O. Reg. 216/10.

. 01919760735	Northing	5026903.34	Easting	376968.72
. 01919871649	Northing	5007189.87	Easting	372435.05
. Point A	Northing		Easting	
. Point B	Northing		Easting	

Ca□tion: Coordinates cannot, in themsel□es, □e □sed to re-esta□lish corners or □o□ndaries shown on this □lan.

REVISION SCHEDULE			
NO.	REVISION	DATE	
1	PLAN PREPARED	MAY. 18, 2017	N
2	BLAIS ROAD REALIGNMENT	JULY 5, 2017	N
3	STREET NAMES REVISED	JULY 18, 2017	N
4	STREET NAMES REVISED	JULY 31, 2017	N
5	REVISED LOTS 110 TO 115	OCT. 6, 2017	DG
6	REVISED BLOCK 251 & ADDED STREET PLACETTE VICEROY MEWS	NOV. 1, 2017	DG
7	ADDED RESERVE BLKS 253 & 254	FEB. 27, 2018	N

11

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Email: Nepean@aovltd.com
Ontario Land Surveyors

Job No. 19429-17 Regional Pt Lts 21 22 C4 RF GL SUB PHI D7 N

SITE INFORMATION :

SITE AREA : 10,061.14 m² = 1.0 ha (2.47 A)
ZONING : R4Z [2370]

PERMITTED USES: - PLANNED UNIT DEVELOPMENT
- APARTMENT DWELLING - LOW RISE, STACKED DWELLING

		REQUIRED :	PROVIDED :
LOT WIDTH (MIN.):	- PLANNED UNIT DEVELOPMENT - APARTMENT DWELLING - LOW RISE, STACKED DWELLING	18.0 m	64.00 m
LOT AREA (MIN.):	- PLANNED UNIT DEVELOPMENT - APARTMENT DWELLING - LOW RISE, STACKED DWELLING	1,400.00 m²	10,061.14 m²
BUILDING HEIGHT (MAX.):	- PLANNED UNIT DEVELOPMENT - APARTMENT DWELLING - LOW RISE, STACKED DWELLING	15.0 m	12.15 m 12.06 m
FRONT YARD (MIN.) : (CEDAR CREEK DRIVE)	- PLANNED UNIT DEVELOPMENT - APARTMENT DWELLING - LOW RISE, STACKED DWELLING	3.0 m	4.44 m
REAR YARD (MIN.) : (PUBLIC WALKWAY)	- PLANNED UNIT DEVELOPMENT - APARTMENT DWELLING - LOW RISE, STACKED DWELLING	6.0 m (1.&12.)	4.50 m
INTERIOR SIDE YARD (MIN.) : (NORTH LINE)	- PLANNED UNIT DEVELOPMENT - APARTMENT DWELLING - LOW RISE, STACKED DWELLING	3.0 m (12.)	6.00 m
CORNER SIDE YARD (MIN.) :	- PLANNED UNIT DEVELOPMENT - APARTMENT DWELLING - LOW RISE, STACKED DWELLING	3.0 m	3.00 m
ACCESSORY BUILDING SIZE (MAX.)		55.0 m²	109.0 m²
ACCESSORY BUILDING HEIGHT (MAX.)		3.6 m	3.5 m
LANDSCAPED AREA OF LOT (MIN.):		30 %	43.39 % (4,365m²)

TOTAL AMENITY AREA REQUIRED : - APARTMENT LOW RISE - 6.0 m² x 36 = 216 m²
COMMUNAL AMENITY AREA REQ'D. (MIN.): 50% of 216 m² = 108 m²
AMENITY AREA PROVIDED : - PRIVATE AMENITY AREA - (BALCONIES & PATIOS) = 251 m²
- COMMUNAL AMENITY AREA - 472 m²
TOTAL AMENITY AREA PROVIDED : 723 m²

APARTMENT BUILDING, TERRA FLATS & BACK to BACK TERRACE HOMES:

BUILDING No. :		BUILDING AREA:	GROSS FLOOR AREA:	No. UNITS:
BUILDING 1 =	BACK to BACK TERRACE HOMES	358.0 m²	1,394.0 m²	12 UNITS
BUILDING 2 =	BACK to BACK TERRACE HOMES	358.0 m²	1,394.0 m²	12 UNITS
BUILDING 3 =	APARTMENT BLDG.	505.0 m²	1,504.0 m²	18 UNITS
BUILDING 4 =	APARTMENT BLDG.	505.0 m²	1,504.0 m²	18 UNITS
BUILDING 5 =	BACK to BACK TERRACE HOMES	358.0 m²	1,394.0 m²	12 UNITS
BUILDING 6 =	BACK to BACK TERRACE HOMES	358.0 m²	1,394.0 m²	12 UNITS
BUILDING 7 =	BACK to BACK TERRACE HOMES	230.0 m²	907.5 m²	8 UNITS
ACCESSORY BUILDING		109.0 m²		
TOTAL =		2,781.0 m²	6,703.5 m	92 UNITS

APARTMENT BUILDINGS = 36 UNITS
BACK to BACK TERRACE HOMES = 56 UNITS
TOTAL = 92 UNITS

PARKING :
PARKING REQUIRED : 1.2 Spaces / (92) d.u. + 0.2 / (92) d.u. (Visitor) = 110.4 + 18.4 = 129 Spaces

PARKING PROVIDED : UNDERGROUND - 2 x 14 Spaces = 28 Spaces
SURFACE 84 Spaces +18Visitor Spaces = 102 Spaces
TOTAL: = 130 Spaces

20 (4 u/g) PARKING SPACES (15.4% total) INDICATED WITH AN * HAVE A WIDTH OF 2.4m as per SECTION 106 (3)(a)

BICYCLE PARKING REQUIRED : 0.5 / d.u.(92) = 46 Spaces
BICYCLE PARKING PROVIDED : 32 (Accessory bldg.) + 26 u/g (13 per apt. bldg) + 4 Surface = 62 spaces

SNOW STORAGE : CLEARED SNOW TO BE REMOVED FROM SITE

LEGEND/ ABBREVIATIONS:

D.C. - DEPRESSED CURB
C.R.W. - CONCRETE RETAINING WALL
B.S. - BUILDING SERVICES LOCATION
- WALL MOUNT LIGHT FIXTURE
- FIRE HYDRANT
L.S. - LIGHT STANDARD
TACTILE WALKING SURFACE INDICATOR
SIAMESE CONNECTIONS
COLOUR PALETTES: REFER TO BUILDING ELEVATIONS

NOTE:
SITE PLAN TO BE READ IN CONJUNCTION WITH :
- SITE SERVICING AND GRADING PLAN PREPARED BY IBI GROUP
- LANDSCAPING PLAN PREPARED BY JAMES B. LENNOX AND ASSOCIATES INC.

BOUNDARIES DERIVED FROM: PLAN 4M -XXX.
PLAN PREPARED BY ANNIS O'SULLIVAN VOLLEBEKK LTD.
DATED XXX. XX, 20XX.

M. David Blakely Architect Inc.
2200 Prince of Wales Dr. Suite 101 Ottawa, Ontario
Phone (613) 226-8811 Fax (613) 226-7942 k2E 6Z9

GENERAL NOTES:
1. THE CONTRACTOR IS RESPONSIBLE FOR CHECKING AND VERIFYING ALL DIMENSIONS, ANY DISCREPANCY MUST BE REPORTED TO M. DAVID BLAKELY ARCHITECT INC.
2. ALL WORK AND MATERIALS TO BE IN COMPLAINCE WITH ALL CODES, REGULATIONS, & BY-LAWS
3. ADDITIONAL DRAWINGS MAY BE ISSUED FOR CLARIFICATION TO ASSIST THE PROPER EXECUTION OF WORK. SUCH DRAWINGS WILL HAVE THE SAME MEANING AND INTENT AS IF THEY WERE INCLUDED WITH THE PLANS IN CONTRACT DOCUMENTS
4. DO NOT SCALE DRAWINGS.
5. THIS DRAWING SHALL NOT BE USED OR COPIED WITHOUT THE AUTHORIZATION OF THE ARCHITECT
6. THIS DRAWING SHALL NOT BE USED FOR PERMIT OR CONSTRUCTION UNLESS THE DRAWING BEARS THE ARCHITECT'S SEAL AND SIGNATURE

OWNER: PHOENIX HOMES
18A BENTLEY AVE.
OTTAWA, ON K2E 6T8
(613) 723-9227

ARCHITECT: M. DAVID BLAKELY ARCHITECT INC.
2200 PRINCE OF WALES DR., SUITE 101
OTTAWA, ON K2E 6Z9
(613) 226-8811

CIVIL ENGINEER: IBI GROUP
333 PRESTON STREET #400
OTTAWA, ON K1S 5N4
(613) 225-1311

LANDSCAPE ARCHITECT: JAMES B. LENNOX AND ASSOCIATES INC.
3332 CARLING AVE.
NEPEAN, ON K2H 5A8
(613) 722-5168

SURVEYOR: ANNIS O'SULLIVAN VOLLEBEKK LTD.
14 CONCOURSE GATE, SUITE 500
NEPEAN, ON K2E 7S6
(613) 727-0850

SEAL

REVISIONS

No.	DATE	DESCRIPTION	INIT.
12.			
11.			
10.			
9.			
8.			
7.			
6.			
5.			
4.	10/08/20	FOR RESUBMISSION	MB
3.	18/11/19	FOR SITE PLAN SUBMISSION	MB
2.	27/06/19	FOR COORDINATION	MB
1.	04/04/19	FOR REVIEW	MB

REVISIONS

No.	DATE	DESCRIPTION	INIT.
24.			
23.			
22.			
21.			
20.			
19.			
18.			
17.			
16.			
15.			
14.			
13.			

A / B | C
A - DETAIL NUMBER
B - SHEET NUMBER (DETAIL REQUIRED)
C - SHEET NUMBER (DETAIL LOCATION)

PROJECT: PATHWAYS | BLOCK 232
PLANNED UNIT DEVELOPMENT
1055 CEDAR CREEK DRIVE
OTTAWA, ONTARIO

CLIENT: PHOENIX HOMES
18A Bentley Ave Ottawa, ON K2E 6T8

DRAWING TITLE: SITE PLAN

DATE: APRIL 2019
SCALE: 1 : 250
SHEET No.: SP1
DRAWN BY: mdb
CHECKED: MDB

D07-12-20-0037

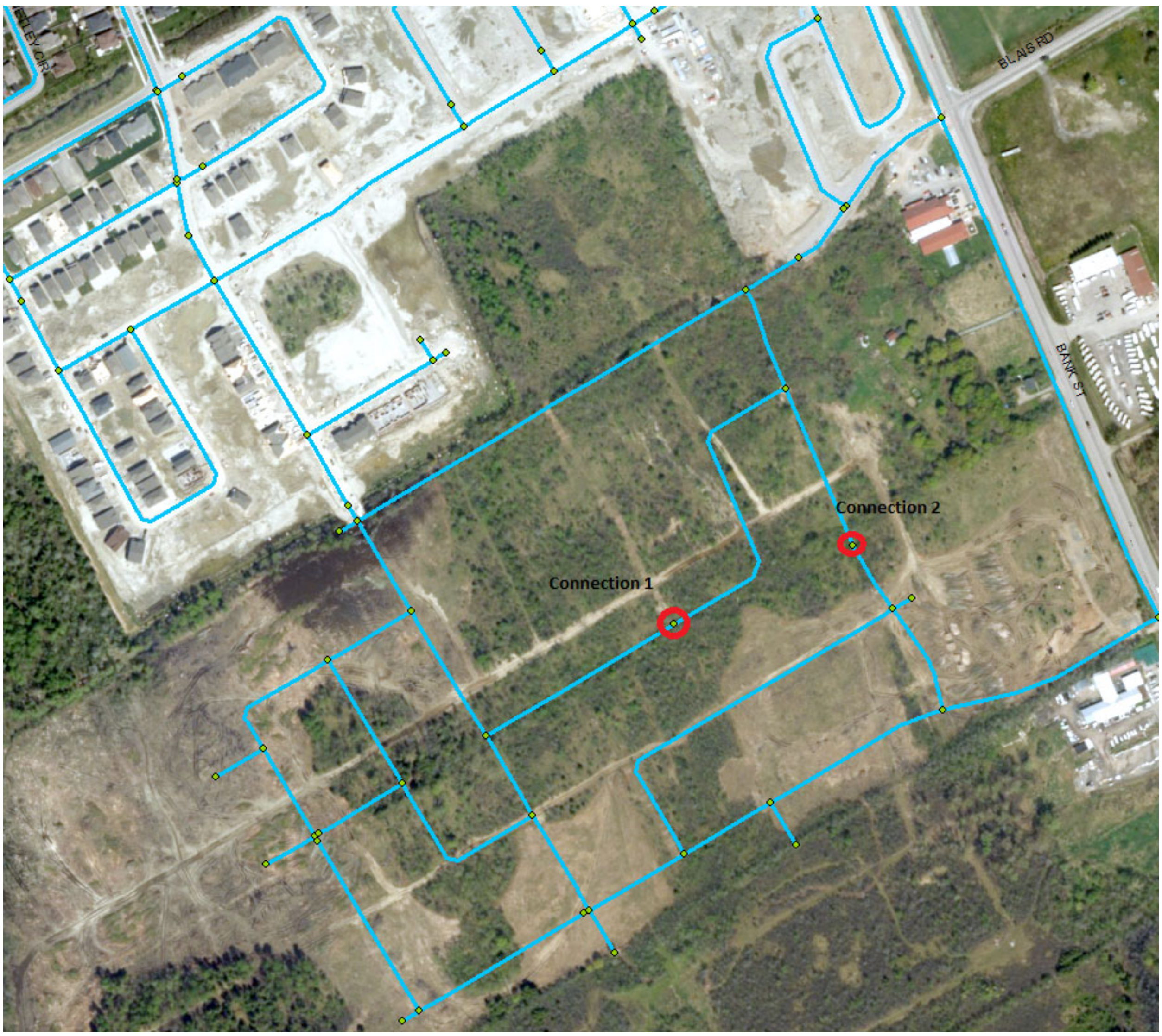
Boundary Conditions for 76 Salamander Way

Information Provided:

Date provided: November 2019

Scenario	Demand	
	L/min	L/s
Average Daily Demand	40.2	0.67
Maximum Daily Demand	100.8	1.68
Peak Hour	221.4	3.69
Fire Flow Demand #1	10000	166.67
Fire Flow Demand #2	13000	216.67

Location:



Results: 2019 Existing Conditions

Connection 1 - Salamander Way

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	155.6	84.8
Peak Hour	145.7	70.7
Max Day plus Fire (10,000 l/min)	147.2	72.9
Max Day plus Fire (13,000 L/min)	143.3	67.3

[1] Ground Elevation = 95.945m

Connection 2 - Cedar Creek

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	155.6	81.0
Peak Hour	145.6	66.8
Max Day plus Fire (10,000 l/min)	144.6	66.7
Max Day plus Fire (13,000 L/min)	140.7	59.7

[1] Ground Elevation = 98.662m

Results: SUC Zone Reconfiguration

Connection 1 - Salamander Way

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.9	72.4
Peak Hour	145.1	69.9
Max Day plus Fire (10,000 l/min)	140.6	63.4
Max Day plus Fire (13,000 L/min)	138.0	59.9

[1] Ground Elevation = 95.945m

Connection 2 - Cedar Creek

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.9	68.5
Peak Hour	145.1	66.0
Max Day plus Fire (10,000 l/min)	138.9	57.2
Max Day plus Fire (13,000 L/min)	135.4	52.3

[1] Ground Elevation = 98.662m

Notes:

1) As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:

a) If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

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.

IBI GROUP
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

WATERMAIN DEMAND CALCULATION SHEET

PROJECT : BLOCK 232 PATHWAYS
LOCATION : CITY OF OTTAWA
DEVELOPER : DCR/PHOENIX GROUP OF COMPANIES

FILE: 121793.5.7
DATE PRINTED: 18-Sep-20
DESIGN: LE

NODE	RESIDENTIAL UNITS				NON-RESIDENTIAL			AVERAGE DAILY DEMAND (l/s)			MAXIMUM DAILY DEMAND (l/s)			MAXIMUM HOURLY DEMAND (l/s)			FIRE DEMAND
	SF	2Bed	1Bed	POP'N	INDTRL (ha.)	COMM. (ha.)	INST. (ha.)	Res.	Non-res.	Total	Res.	Non-res.	Total	Res.	Non-res.	Total	(l/min)
T02		4		8				0.03	0.00	0.03	0.09	0.00	0.09	0.19	0.00	0.19	
T04		4		8				0.03	0.00	0.03	0.09	0.00	0.09	0.19	0.00	0.19	
T06		2		4				0.02	0.00	0.02	0.04	0.00	0.04	0.09	0.00	0.09	
T08		2		4				0.02	0.00	0.02	0.04	0.00	0.04	0.09	0.00	0.09	
T10		4		8				0.03	0.00	0.03	0.09	0.00	0.09	0.19	0.00	0.19	
T12		4		8				0.03	0.00	0.03	0.09	0.00	0.09	0.19	0.00	0.19	
T14		4		8				0.03	0.00	0.03	0.09	0.00	0.09	0.19	0.00	0.19	
T16		4		8				0.03	0.00	0.03	0.09	0.00	0.09	0.19	0.00	0.19	
T18		4		8				0.03	0.00	0.03	0.09	0.00	0.09	0.19	0.00	0.19	
T20		12	6	34				0.14	0.00	0.14	0.34	0.00	0.34	0.75	0.00	0.75	
T24		12	6	34				0.14	0.00	0.14	0.34	0.00	0.34	0.75	0.00	0.75	
T26		2		4				0.02	0.00	0.02	0.04	0.00	0.04	0.09	0.00	0.09	
T28		6		13				0.05	0.00	0.05	0.13	0.00	0.13	0.28	0.00	0.28	
T30		4		8				0.03	0.00	0.03	0.09	0.00	0.09	0.19	0.00	0.19	
T32		2		4				0.02	0.00	0.02	0.04	0.00	0.04	0.09	0.00	0.09	
T34		6		13				0.05	0.00	0.05	0.13	0.00	0.13	0.28	0.00	0.28	
T36		4		8				0.03	0.00	0.03	0.09	0.00	0.09	0.19	0.00	0.19	
T50																	13,000
T52																	13,000
TOTALS		80	12	185						**0.73**			**1.91**			**4.13**	

ASSUMPTIONS

RESIDENTIAL DENSITIES
- Single Family (SF) 3.4 p / p / u
- 2 Bedroom Units 2.1 p / p / u
- 1 Bedroom Units 1.4 p / p / u
-Other 66 u / p / ha

AVG. DAILY DEMAND
- Residential 350 l / cap / day
- ICI 50,000 l / ha / day

MAX. DAILY DEMAND
- Residential 875 l / cap / day
- ICI 75,000 l / ha / day

MAX. HOURLY DEMAND
- Residential 1,925 l / cap / day
- ICI 135,000 l / ha / day

FIRE FLOW
13,000 l / min

Fire Flow Requirement from Fire Underwriters Survey

Block 232 - Building 4

Building Floor Area

width	24.0	m
depth	23.0	m
stories	3	
Area	1,656.0	m^2

$F = 220C\sqrt{A}$

C	1.5		C =	1.5	wood frame
A	1,656	m^2		1.0	ordinary
				0.8	non-combustile
F	13,429	l/min		0.6	fire-resistive
use	13,000	l/min			

Occupancy Adjustment

			-25%	non-combustile
			-15%	limited combustile
Use	-15%		0%	combustile
			+15%	free burning
Adjustment	-1950	l/min	+25%	rapid burning
Fire flow	11,050	l/min		

Sprinkler Adjustment

Use	-30%	
Adjustment	-3315	l/min

Exposure Adjustment

Building Face	Separation (m)	Adjacent Exposed Wall			Exposure Charge *
		Length	Stories	L*H Factor	
north	19.0	15.5	3	47	13%
east	14.0	23.0	3	69	14%
south	27.0	18.0	2	36	8%
west	24.0	22.5	3	68	9%
Total					44%

Adjustment	4,862	l/min
Total adjustments	1,547	l/min
Fire flow	12,597	l/min
Use	**13,000**	**l/min**
	216.7	**l/s**

* Exposure charges from Techinical Bulletin ISTB 2018-02 Appendix H (ISO Method)

Fire Flow Requirement from Fire Underwriters Survey

Block 232 - Building 5

Building Floor Area

width	15.5	m
depth	22.5	m
stories	3	
Area	1,046.3	m^2

F = 220C√A

C	1.5		C =	1.5	wood frame
A	1,046	m^2		1.0	ordinary
				0.8	non-combustile
F	10,674	l/min		0.6	fire-resistive
use	11,000	l/min			

Occupancy Adjustment

			-25%	non-combustile
			-15%	limited combustile
Use	-15%		0%	combustile
			+15%	free burning
Adjustment	-1650	l/min	+25%	rapid burning
Fire flow	9,350	l/min		

Sprinkler Adjustment

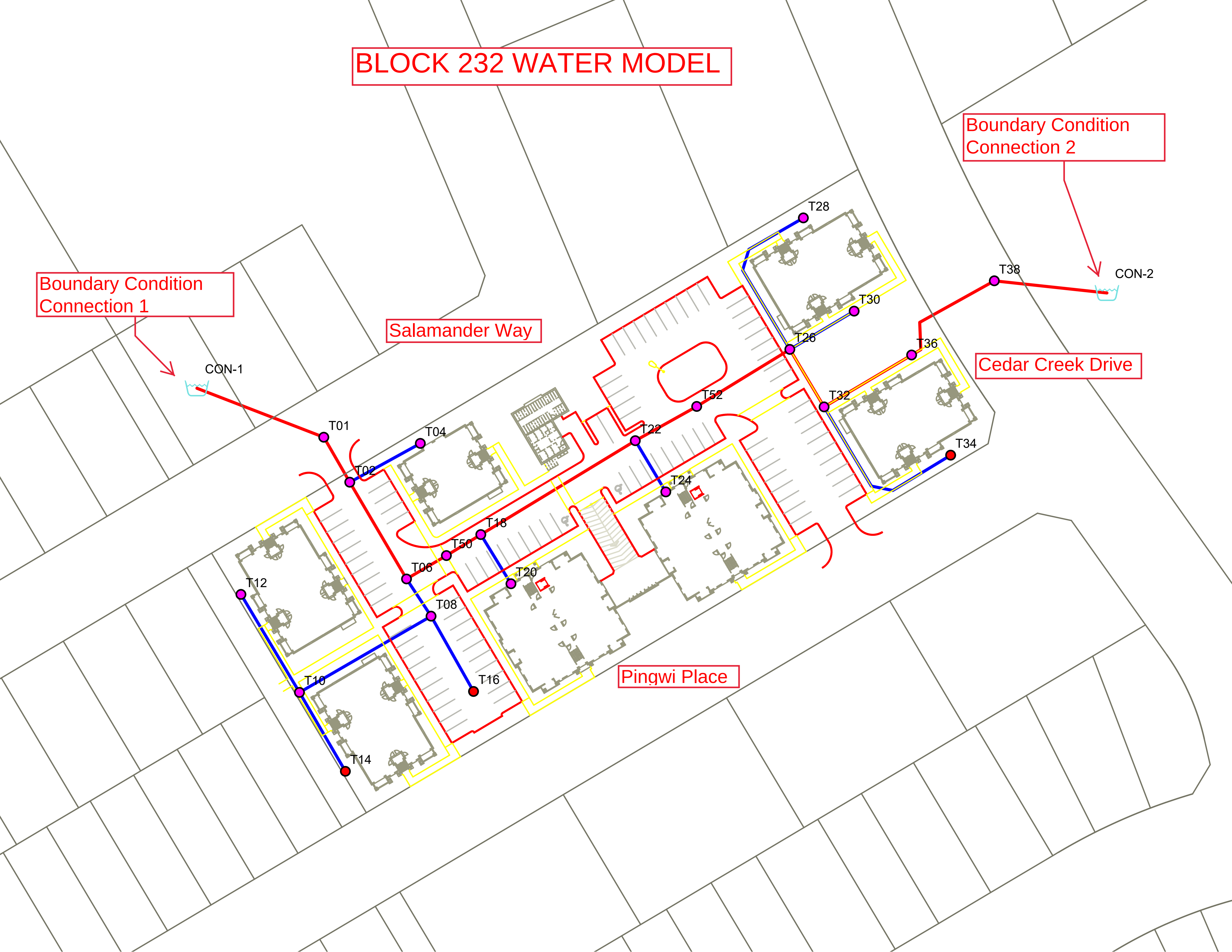
Use	0%	
Adjustment	0	l/min

Exposure Adjustment

Building Face	Separation (m)	Adjacent Exposed Wall			Exposure Charge *
		Length	Stories	L*H Factor	
north	10.5	15.0	3	45	13%
east	24.0	23.0	3	69	9%
south	27.0	18.0	2	36	8%
west	11.0	15.0	2	30	12%
Total					42%

Adjustment	3,927	l/min
Total adjustments	3,927	l/min
Fire flow	13,277	l/min
Use	**13,000**	**l/min**
	216.7	**l/s**

* Exposure charges from Techinical Bulletin ISTB 2018-02 Appendix H (ISO Method)



BLOCK 232 WATER MODEL
Boundary Condition Connection 1
Boundary Condition Connection 2
CON-1
CON-2
Salamander Way
Cedar Creek Drive
Pingwi Place
T01
T02
T04
T06
T08
T10
T12
T14
T16
T18
T20
T22
T24
T26
T28
T30
T32
T34
T36
T38
T50
T52

Basic Day (Max HGL) HGL 155.6m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)	Water Age (hrs)
1	☐	T01	0.17	100.00	155.60	544.84	1.00
2	☐	T02	0.03	99.80	155.60	546.80	2.00
3	☐	T04	0.03	100.15	155.60	543.37	4.98
4	☐	T06	0.01	100.80	155.60	537.00	3.00
5	☐	T08	0.01	100.90	155.60	536.02	4.00
6	☐	T10	0.03	101.00	155.60	535.04	5.87
7	☐	T12	0.03	100.60	155.60	538.96	10.09
8	☐	T14	0.03	101.85	155.60	526.71	9.25
9	☐	T16	0.03	101.90	155.60	526.22	7.20
10	☐	T18	0.03	100.40	155.60	540.92	5.00
11	☐	T20	0.13	100.80	155.60	537.00	6.00
12	☐	T22	0.00	100.40	155.60	540.92	9.42
13	☐	T24	0.13	100.95	155.60	535.53	10.42
14	☐	T26	0.01	100.60	155.60	538.96	4.00
15	☐	T28	0.04	99.95	155.60	545.33	8.90
16	☐	T30	0.03	100.15	155.60	543.37	6.77
17	☐	T32	0.01	100.90	155.60	536.02	3.00
18	☐	T34	0.04	101.65	155.60	528.67	8.04
19	☐	T36	0.03	100.60	155.60	538.96	2.00
20	☐	T38	0.00	100.15	155.60	543.37	1.00
21	☐	T50	0.00	100.50	155.60	539.94	4.00
22	☐	T52	0.00	100.25	155.60	542.39	5.79

Peak Hour HGL 145.1 m - Junction Report

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)	Water Age (hrs)
1	☐	T01	0.91	100.00	145.10	441.94	0.00
2	☐	T02	0.16	99.80	145.10	443.90	0.00
3	☐	T04	0.16	100.15	145.10	440.47	0.00
4	☐	T06	0.08	100.80	145.10	434.09	0.00
5	☐	T08	0.08	100.90	145.10	433.11	0.00
6	☐	T10	0.16	101.00	145.10	432.13	0.00
7	☐	T12	0.16	100.60	145.10	436.04	0.00
8	☐	T14	0.16	101.85	145.10	423.80	0.00
9	☐	T16	0.16	101.90	145.10	423.31	0.00
10	☐	T18	0.16	100.40	145.10	438.01	0.00
11	☐	T20	0.72	100.80	145.10	434.09	0.00
12	☐	T22	0.00	100.40	145.10	438.01	0.00
13	☐	T24	0.72	100.95	145.10	432.62	0.00
14	☐	T26	0.08	100.60	145.10	436.05	0.00
15	☐	T28	0.24	99.95	145.10	442.42	0.00
16	☐	T30	0.16	100.15	145.10	440.46	0.00
17	☐	T32	0.08	100.90	145.10	433.11	0.00
18	☐	T34	0.24	101.65	145.10	425.76	0.00
19	☐	T36	0.16	100.60	145.10	436.06	0.00
20	☐	T38	0.00	100.15	145.10	440.47	0.00
21	☐	T50	0.00	100.50	145.10	437.03	0.00
22	☐	T52	0.00	100.25	145.10	439.48	0.00

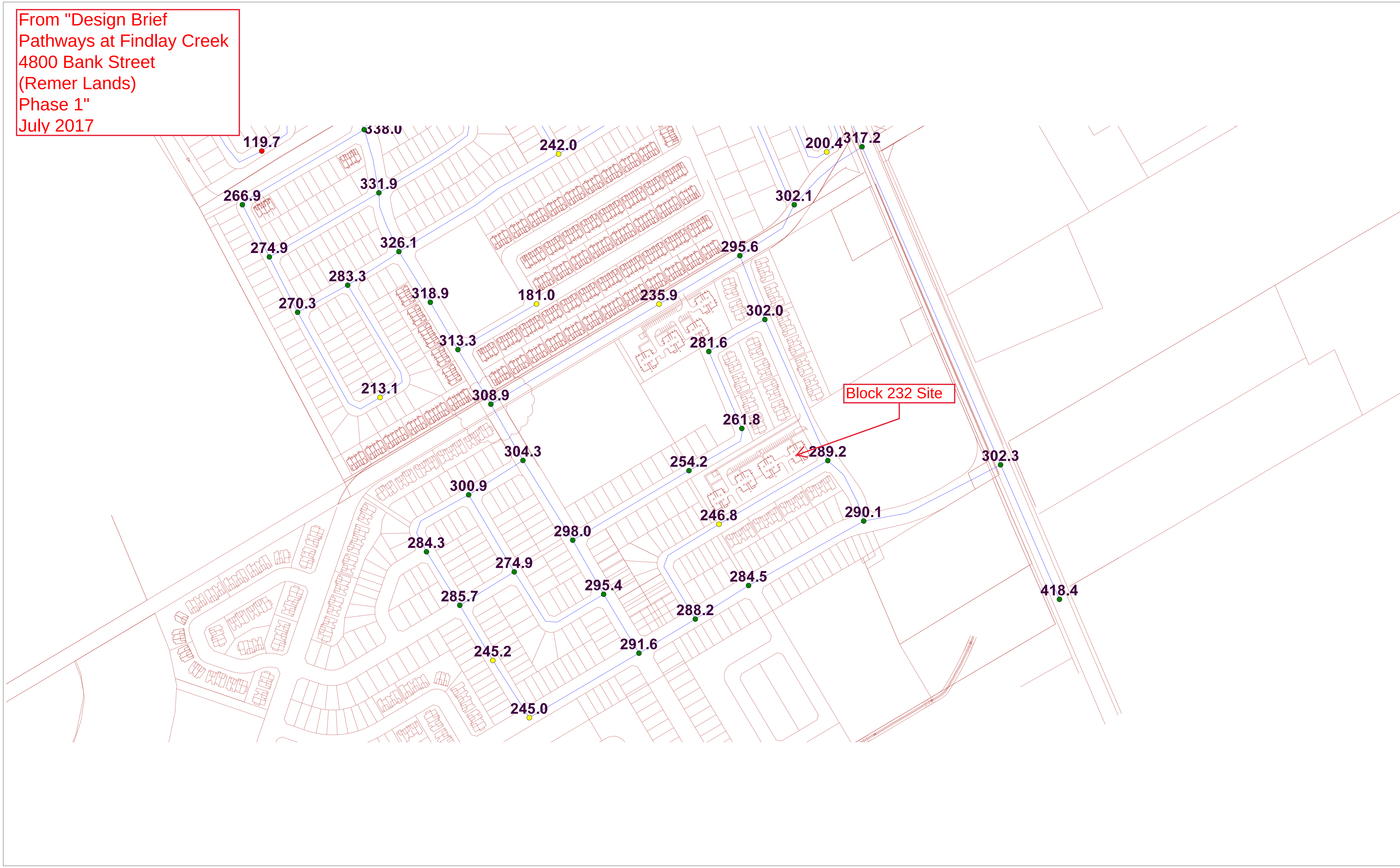
Peak Hour HGL 145.1 m - Pipe Report

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)	HL/1000 (m/k-m)	Status	Flow Reversal Count	Water Age (hrs)
1	☐	P51	T01	T02	10.99	204.00	110.00	2.10	0.06	0.00	0.04	Open	0	0.00
2	☐	P53	T02	T06	23.75	204.00	110.00	1.78	0.05	0.00	0.03	Open	0	0.00
3	☐	P55	T06	T08	9.44	155.00	100.00	0.72	0.04	0.00	0.03	Open	0	0.00
4	☐	P57	T08	T16	18.30	155.00	100.00	0.16	0.01	0.00	0.00	Open	0	0.00
5	☐	P59	T08	T10	32.16	155.00	100.00	0.48	0.03	0.00	0.01	Open	0	0.00
6	☐	P61	T10	T12	24.15	155.00	100.00	0.16	0.01	0.00	0.00	Open	0	0.00
7	☐	P63	T02	T04	17.03	155.00	100.00	0.16	0.01	0.00	0.00	Open	0	0.00
8	☐	P65	T06	T50	9.78	204.00	110.00	0.98	0.03	0.00	0.01	Open	0	0.00
9	☐	P67	T50	T18	8.53	204.00	110.00	0.98	0.03	0.00	0.01	Open	0	0.00
10	☐	P69	T18	T20	12.24	155.00	100.00	0.72	0.04	0.00	0.03	Open	0	0.00
11	☐	P71	T18	T22	38.24	204.00	110.00	0.10	0.00	0.00	0.00	Open	0	0.00
12	☐	P73	T10	T14	19.33	155.00	100.00	0.16	0.01	0.00	0.00	Open	0	0.00
13	☐	P75	T22	T24	12.62	155.00	100.00	0.72	0.04	0.00	0.03	Open	0	0.00
14	☐	P77	T22	T52	14.88	204.00	110.00	-0.62	0.02	0.00	0.01	Open	0	0.00
15	☐	P79	T52	T26	23.10	204.00	110.00	-0.62	0.02	0.00	0.00	Open	0	0.00
16	☐	P81	T26	T30	15.83	155.00	100.00	0.16	0.01	0.00	0.00	Open	0	0.00
17	☐	P83	T26	T28	37.41	155.00	100.00	0.24	0.01	0.00	0.00	Open	0	0.00
18	☐	P85	T26	T32	14.20	204.00	110.00	-1.10	0.03	0.00	0.01	Open	0	0.00
19	☐	P87	T32	T34	38.48	155.00	100.00	0.24	0.01	0.00	0.00	Open	0	0.00
20	☐	P89	T32	T36	21.52	204.00	110.00	-1.42	0.04	0.00	0.02	Open	0	0.00
21	☐	P91	T36	T38	26.09	204.00	110.00	-1.58	0.05	0.00	0.03	Open	0	0.00
22	☐	P93	T38	CON-2	1.00	204.00	110.00	-1.58	0.05	0.00	0.03	Open	0	0.00
23	☐	P95	CON-1	T01	1.00	204.00	110.00	3.01	0.09	0.00	0.08	Open	0	0.00

Max Day + Fire (13,000 l/min) - Fireflow Design Report

		ID	Total Demand (L/s)	Available Flow at Hydrant (L/s)	Critical Node ID	Critical Node Pressure (kPa)	Critical Node Head (m)	Design Flow (L/s)	Design Pressure (kPa)	Design Fire Node Pressure (kPa)
1	☐	T50	216.67	486.27	T50	139.96	114.78	486.28	139.96	139.94
2	☐	T52	216.67	423.46	T52	139.96	114.53	423.46	139.96	139.96

Phase 1 - MXDY + Fire - Design Fireflows (l/s)



Date: Friday, November 18, 2016

Servicing study guidelines for development applications

4. Development Servicing Study Checklist

The following section describes the checklist of the required content of servicing studies. It is expected that the proponent will address each one of the following items for the study to be deemed complete and ready for review by City of Ottawa Infrastructure Approvals staff.

The level of required detail in the Servicing Study will increase depending on the type of application. For example, for Official Plan amendments and re-zoning applications, the main issues will be to determine the capacity requirements for the proposed change in land use and confirm this against the existing capacity constraint, and to define the solutions, phasing of works and the financing of works to address the capacity constraint. For subdivisions and site plans, the above will be required with additional detailed information supporting the servicing within the development boundary.

4.1 General Content

- ☐ Executive Summary (for larger reports only).
- ☒ Date and revision number of the report.
- ☒ Location map and plan showing municipal address, boundary, and layout of proposed development.
- ☒ Plan showing the site and location of all existing services.
- ☐ Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.
- ☐ Summary of Pre-consultation Meetings with City and other approval agencies.
- ☐ Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.
- ☒ Statement of objectives and servicing criteria.
- ☒ Identification of existing and proposed infrastructure available in the immediate area.
- ☒ Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).
- ☒ Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.
- ☐ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.
- ☐ Proposed phasing of the development, if applicable.

☒ Reference to geotechnical studies and recommendations concerning servicing.

☒ All preliminary and formal site plan submissions should have the following information:

- Metric scale
- North arrow (including construction North)
- Key plan
- Name and contact information of applicant and property owner
- Property limits including bearings and dimensions
- Existing and proposed structures and parking areas
- Easements, road widening and rights-of-way
- Adjacent street names

4.2 Development Servicing Report: Water

☐ Confirm consistency with Master Servicing Study, if available

☒ Availability of public infrastructure to service proposed development

☒ Identification of system constraints

☒ Identify boundary conditions

☒ Confirmation of adequate domestic supply and pressure

☒ Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.

☒ Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.

☐ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design

☒ Address reliability requirements such as appropriate location of shut-off valves

☐ Check on the necessity of a pressure zone boundary modification.

☒ Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range

- ☒ Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.
- ☐ Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.
- ☒ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.
- ☐ Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

4.3 Development Servicing Report: Wastewater

- ☒ Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).
- ☐ Confirm consistency with Master Servicing Study and/or justifications for deviations.
- ☐ Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.
- ☒ Description of existing sanitary sewer available for discharge of wastewater from proposed development.
- ☒ Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)
- ☐ Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.
- ☒ Description of proposed sewer network including sewers, pumping stations, and forcemains.
- ☐ Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).
- ☐ Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.
- ☐ Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.
- ☐ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.
- ☒ Special considerations such as contamination, corrosive environment etc.

4.4 Development Servicing Report: Stormwater Checklist

☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)

☐ Analysis of available capacity in existing public infrastructure.

☐ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.

☒ Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.

☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.

☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.

☐ Set-back from private sewage disposal systems.

☐ Watercourse and hazard lands setbacks.

☐ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.

☐ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.

☒ Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).

☐ Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.

☒ Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.

☐ Any proposed diversion of drainage catchment areas from one outlet to another.

☒ Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.

☐ If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100 year return period storm event.

☐ Identification of potential impacts to receiving watercourses

☐ Identification of municipal drains and related approval requirements.

☒ Descriptions of how the conveyance and storage capacity will be achieved for the development.

☒ 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.

- ☐ Inclusion of hydraulic analysis including hydraulic grade line elevations.
- ☒ Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.
- ☐ Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.
- ☐ Identification of fill constraints related to floodplain and geotechnical investigation.

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

- ☐ Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.
- ☐ Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.
- ☐ Changes to Municipal Drains.
- ☐ Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

4.6 Conclusion Checklist

- ☒ Clearly stated conclusions and recommendations
- ☒ Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.
- ☒ All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario

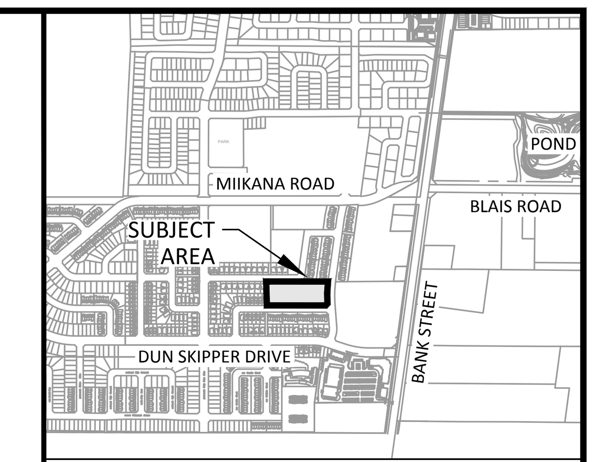
LOCATION	AREA (HA)	RELEASE RATE (L/S)	Head (M)	ICD
MH202	0.081	52	2.037	Custom IPEX MHF 131 mm Diameter
	0.066			
	0.037			
	0.038			
CB5	0.054	17	1.42	Custom IPEX MHF 82 mm Diameter
CB6	0.074	17	1.5	Custom IPEX MHF 81 mm Diameter
CB7	0.1	58	1.736	Custom IPEX MHF 144 mm Diameter
	0.086			
CB9	0.038	17	1.25	NO ICD - unrestricted
CB10	0.029	10	1.45	Custom HYDROVEX 100 VHV-1 restricted at 10 l/s
CB11	0.119	27	1.48	Standard IPEX MHF 102 mm Diameter
CB12	0.084	7	1.55	Custom HYDROVEX 75 VHV-1 restricted at 7 l/s
TOTAL	**0.806**	**205**	-	

STM STRUCTURE TABLE

NAME	RIM ELEV.	INVERT IN	INVERT IN AS–BUILT	INVERT OUT	INVERT OUT AS–BUILT	DESCRIPTION
EXMH6117	99.46	SE93.050 SW94.435		NW93.010		2438mm x 2438mm RECTANGULAG METRIC
MH200	99.62	SW94.467 SE96.290 NW97.359		NE94.467		1200mmø OPSD–701.010 C/W SAFETY LANDING
MH201	100.31	SW96.505		NW96.445		1200mmø OPSD–701.010
MH202	100.02	NW97.708 SW98.517 S98.649		SE97.688		1200mmø OPSD–701.010
MH203	100.38	SW96.930 NW97.603		NE96.835		1200mmø OPSD–701.010
MH204	100.42	SW97.217		NE97.197		1200mmø OPSD–701.010
MH205	100.67	NW97.939 SW98.030		NE97.804		1200mmø OPSD–701.010
MH206	101.06	SW99.341 NW98.438 SE99.356		NE98.279		1200mmø OPSD–701.010
MH207	100.35	NW97.999		SE97.979		1200mmø OPSD–701.010
MH208	99.80	SW98.135		SE98.075		1200mmø OPSD–701.010

SAN STRUCTURE TABLE

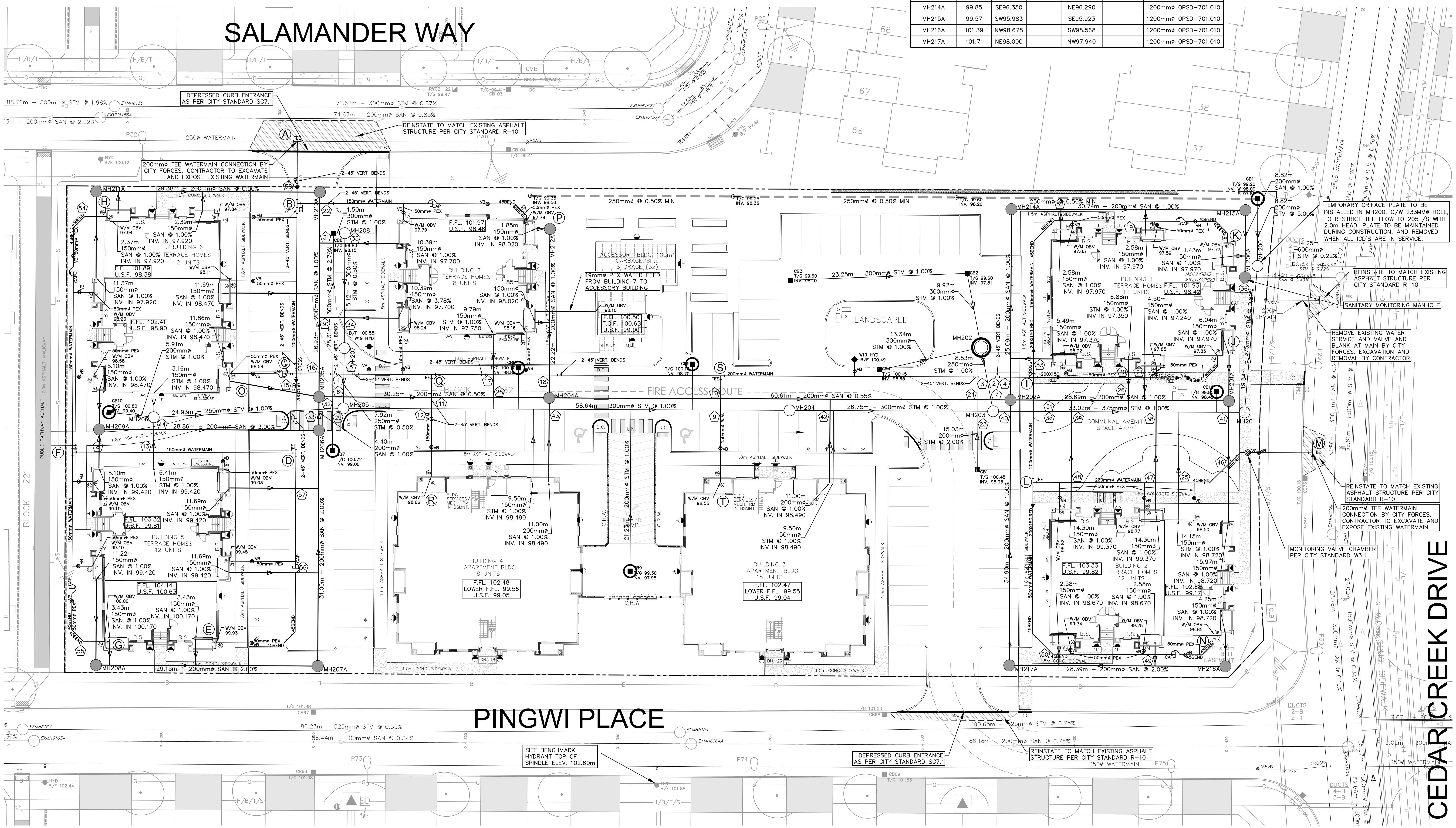
NAME	RIM ELEV.	INVERT IN	INVERT IN AS–BUILT	INVERT OUT	INVERT OUT AS–BUILT	DESCRIPTION
EXMH6117A	99.58	SE93.580 SW95.720		NW93.520		1200mmø OPSD–701.010
MH200A	99.88	NW95.834 SW95.774		NE95.774		1200mmø OPSD–701.010
MH201A	100.20	NW97.910 SE98.560		SW96.948		1200mmø OPSD–701.010
MH202A	100.36	SW96.647 NE96.661 SE97.591		NW96.601		1200mmø OPSD–701.010
MH204A	100.38	SW97.000 SE98.380 NW97.666		NE96.980		1200mmø OPSD–701.010
MH205A	100.67	SE97.172 NW97.212 W98.351		NE97.152		1200mmø OPSD–701.010
MH206A	100.72	SE97.881 SW97.276		NW97.216		1200mmø OPSD–701.010
MH207A	101.89	SW98.561		NW98.501		1200mmø OPSD–701.010
MH208A	102.45	NW99.308		NE99.144		1200mmø OPSD–701.010
MH209A	100.96	SE99.369 NW98.419		NE98.142		1200mmø OPSD–701.010
MH210A	99.85	SW97.541		SE97.481		1200mmø OPSD–701.010
MH211A	100.18	SE97.806		NE97.688		1200mmø OPSD–701.010
MH212A	100.14	SW98.001		SE97.888		1200mmø OPSD–701.010
MH214A	99.85	SE96.350		NE96.290		1200mmø OPSD–701.010
MH215A	99.57	SW95.983		SE95.923		1200mmø OPSD–701.010
MH216A	101.39	NW98.678		SW98.568		1200mmø OPSD–701.010
MH217A	101.71	NE98.000		NW97.940		1200mmø OPSD–701.010



KEY PLAN
N.T.S.

NOTES:

1. SEE DRAWING C-010, C-011 FOR ADDITIONAL DETAILS AND NOTES.
2. SITE BENCHMARK OBTAINED FROM LEGAL SURVEYOR ANNIS O'SULLIVAN VOLLEBEKK LTD. TOP SPINDLE OF HYDRANT ON PINGWI PLACE, ELEV.=102.60m



No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3	REVISED AS PER CITY COMMENTS	DGY	2020:12:14
2	REVISED AS PER CITY COMMENTS	DGY	2020:09:18
1	ISSUED FOR SPA	DGY	2019:12:18

DCR/PHOENIX GROUP OF COMPANIES

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title
1055 CEDAR CREEK DRIVE

LICENSED PROFESSIONAL ENGINEER D. G. Yannoulopoulos 2020/12/14 PROVINCE OF ONTARIO

Drawing Title
SITE SERVICING PLAN

Scale 1:250

Design	Date
RM/WZ	SEPT. 2019
Drawn	**Checked**
DPS/WZ	DGY
Project No.	**Drawing No.**
121793	001

D07-12-20-0037

APPENDIX B

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

SANITARY SEWER DESIGN SHEET

Pathways Block 232
City of Ottawa
Pheonix Homes

LOCATION				RESIDENTIAL										ICI AREAS								INFILTRATION ALLOWANCE			FIXED FLOW (L/s)		TOTAL FLOW	PROPOSED SEWER DESIGN						
				AREA w/ Units (Ha)	UNIT TYPES				AREA w/o Units (Ha)	POPULATION		RES PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha)						ICI PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha)		FLOW (L/s)			(L/s)	CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY	
														INSTITUTIONAL		COMMERCIAL		INDUSTRIAL																
STREET	AREA ID	FROM MH	TO MH		SF	SD	2Bed	1BED		IND	CUM			IND	CUM	IND	CUM	IND	CUM			IND	CUM		IND	CUM							L/s	(%)
		BLD6-A	MH209A				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	4.97	150	1.00	0.871	15.84	99.68%
		BLD5-F	MH209A				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	5.10	150	1.00	0.871	15.84	99.68%
	MH209A	MH209A	MH206A	0.052						0.0	8.4	3.74	0.10	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.05	0.05	0.02	0.00	0.00	0.12	59.26	29.78	200	3.00	1.828	59.15	99.80%
		BLD5-E	MH208A				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	11.09	150	1.00	0.871	15.84	99.68%
		BLD5-D	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	3.43	150	1.00	0.871	15.84	99.68%
		BLD5-C	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	3.43	150	1.00	0.871	15.84	99.68%
	MH208A	MH208A	MH207A	0.032						0.0	12.6	3.72	0.15	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.03	0.03	0.01	0.00	0.00	0.16	48.39	30.31	200	2.00	1.492	48.23	99.66%
		BLD5-B	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	12.69	150	1.00	0.871	15.84	99.68%
		BLD5-A	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	12.69	150	1.00	0.871	15.84	99.68%
	MH207A	MH207A	MH206A	0.078						0.0	21.0	3.70	0.25	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.08	0.11	0.04	0.00	0.00	0.29	48.39	31.00	200	2.00	1.492	48.10	99.40%
		MH206A	MH205A							0.0	29.4	3.68	0.35	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.16	0.05	0.00	0.00	0.40	34.22	4.40	200	1.00	1.055	33.81	98.82%
		BLD6-B	MH211A				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	11.42	150	1.00	0.871	15.84	99.68%
		BLD6-C	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	2.37	150	1.00	0.871	15.84	99.68%
		BLD6-D	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	2.39	150	1.00	0.871	15.84	99.68%
	MH211A	MH211A	MH210A	0.041						0.0	12.6	3.72	0.15	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.04	0.04	0.01	0.00	0.00	0.17	24.19	30.35	200	0.50	0.746	24.03	99.32%
		BLD6-E	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	12.69	150	1.00	0.871	15.84	99.68%
		BLD6-F	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	12.87	150	1.00	0.871	15.84	99.68%
		BLD7-A	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	10.09	150	1.00	0.871	15.84	99.68%
		BLD7-B	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	10.09	150	1.00	0.871	15.84	99.68%
	MH210A	MH210A	MH205A	0.080						0.0	29.4	3.68	0.35	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.08	0.12	0.04	0.00	0.00	0.39	34.22	26.93	200	1.00	1.055	33.83	98.86%
	MH205A	MH205A	MH204A						0.051	3.1	61.9	3.64	0.73	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.05	0.33	0.11	0.00	0.00	0.84	24.19	30.25	200	0.50	0.746	23.36	96.53%
		BLD4	MH204A				12	6		33.6	33.6	3.68	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	15.89	11.00	150	1.00	0.871	15.49	97.48%
		BLD7-D	MH212A				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	2.15	150	1.00	0.871	15.84	99.68%
		BLD7-C	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	2.15	150	1.00	0.871	15.84	99.68%
	MH212A	MH212A	MH204A	0.045						0.0	8.4	3.74	0.10	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.05	0.05	0.01	0.00	0.00	0.12	34.22	22.22	200	1.00	1.055	34.10	99.66%
		BLD3	MAIN				12	6		33.6	33.6	3.68	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	15.89	11.00	150	1.00	0.871	15.49	97.48%
	MH204A	MH204A	MH202A	0.322						0.0	137.5	3.56	1.59	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.32	0.70	0.23	0.00	0.00	1.82	25.38	60.61	200	0.55	0.782	23.56	92.83%
		BLD2-D	MH216A				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.70	0.23	0.00	0.00	0.28	15.89	4.25	150	1.00	0.871	15.61	98.22%
		BLD2-E	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.70	0.23	0.00	0.00	0.28	15.89	2.58	150	1.00	0.871	15.61	98.22%
		BLD2-F	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.70	0.23	0.00	0.00	0.28	15.89	2.58	150	1.00	0.871	15.61	98.22%
	MH216A	MH216A	MH217A	0.037						0.0	12.6	3.72	0.15	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.04	0.74	0.24	0.00	0.00	0.40	48.39	28.39	200	2.00	1.492	47.99	99.18%
	MH217A	MH217A	MH202A						0.064	3.8	16.4	3.71	0.20	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.06	0.80	0.26	0.00	0.00	0.46	34.22	34.90	200	1.00	1.055	33.75	98.65%
		BLD1-E	MH201A				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	6.04	150	1.00	0.871	15.84	99.68%
		BLD1-F	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	4.50	150	1.00	0.871	15.84	99.68%
		BLD2-C	MH201A				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	15.97	150	1.00	0.871	15.84	99.68%
		BLD2-B	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	14.30	150	1.00	0.871	15.84	99.68%
		BLD2-A	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	14.30	150	1.00	0.871	15.84	99.68%
	MH201A	MH201A	MH202A	0.100						0.0	21.0	3.70	0.25	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.10	0.10	0.03	0.00	0.00	0.28	34.22	28.69	200	1.00	1.055	33.93	99.17%
		BLD1-A	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	5.49	150	1.00	0.871	15.84	99.68%
	MH202A	MH202A	MH214A	0.063						0.0	179.1	3.53	2.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.06	0.97	0.32	0.00	0.00	2.37	34.22	25.09	200	1.00	1.055	31.85	93.08%
		BLD1-B	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	2.58	150	1.00	0.871	15.84	99.68%
		BLD1-C	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	2.58	150	1.00	0.871	15.84	99.68%
	MH214A	MH214A	MH215A	0.029						0.0	187.5	3.53	2.14	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.03	0.99	0.33	0.00	0.00	2.47	34.22	30.74	200	1.00	1.055	31.75	92.78%
		BLD1-D	MAIN				2			4.2	4.2	3.76	0.05	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	15.89	1.43	150	1.00	0.871	15.84	99.68%
	MH215A	MH215A	MH200A	0.013						0.0	191.7	3.52	2.19	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.01	1.01	0.33	0.00	0.00	2.52	34.22	8.82	200	1.00	1.055	31.70	92.63%
	MH200A	MH200A	*EXMH6117A*							0.0	191.7	3.52	2.19	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.01	0.33	0.00	0.00	2.52	22.44	12.65	200	0.43	0.692	19.92	88.76%
				0.89	0	0	80	12	0.12	191.7	TRUE											1.01	TRUE											

Design Parameters:

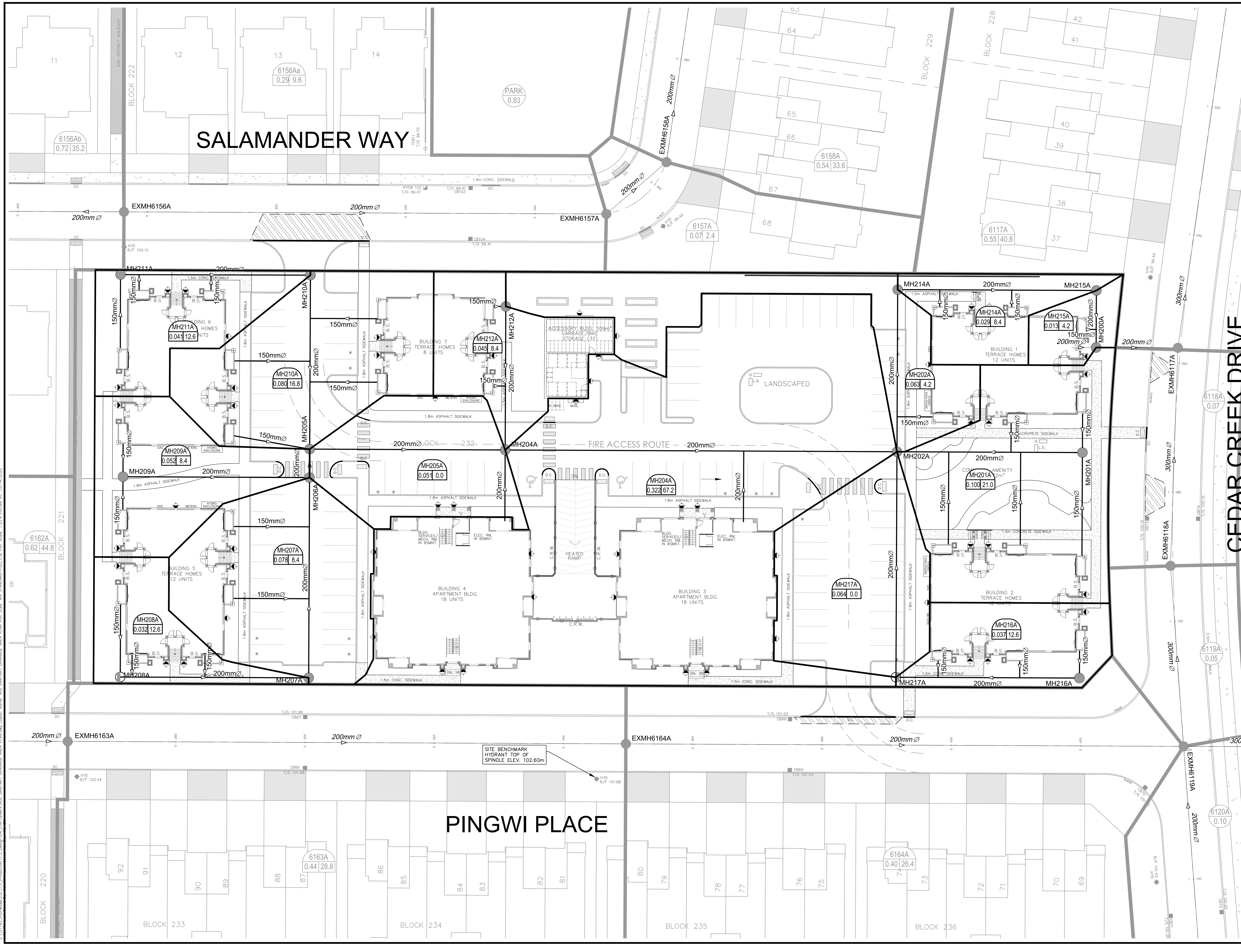
Residential			ICI Areas		
SF	3.4	p/p/u	INST	28,000 L/Ha/day	
2Bed	2.1	p/p/u	COM	28,000 L/Ha/day	
1Bed	1.4	p/p/u	IND	35,000 L/Ha/day	MOE Chart
Other	60	p/p/Ha		17000 L/Ha/day	

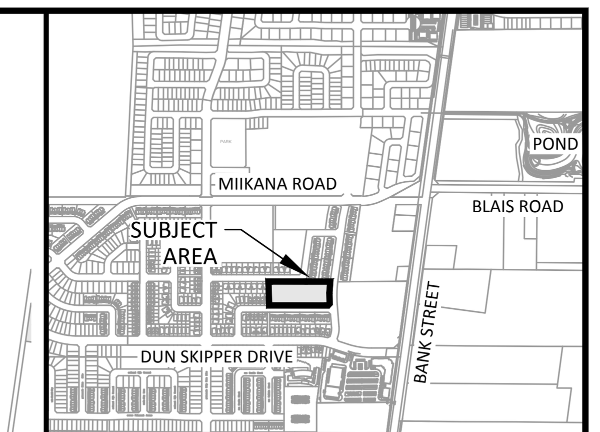
Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day 200 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+(P/1000)^0.5))0.8
   where K = 0.8 Correction Factor
5. Commercial and Institutional Peak Factors based on total area,
   1.5 if greater than 20%, otherwise 1.0

Designed: A.Z.
Checked: R.M.
Dwg. Reference: 121793-400

No.	Revision	Date
1.	Pathways Block 232 Servicing Brief - Submission No. 1	2019-12-13
2.	Pathways Block 232 Servicing Brief - Submission No. 2	2020-09-18

File Reference:	Date:	Sheet No:
121793.6.2.4	2019-12-13	1 of 1





KEY PLAN
N.T.S.

NOTES:

1. SEE DRAWING C-010, C-011 FOR ADDITIONAL DETAILS AND NOTES.
2. SITE BENCHMARK OBTAINED FROM LEGAL SURVEYOR ANNIS O'SULLIVAN VOLLEBEKK LTD. TOP SPINDLE OF HYDRANT ON PINGWI PLACE, ELEV.=102.60m

LEGEND :

6115A / 0.81 43.2 — AREA NUMBER, POPULATION, AREA IN HECTARES

FUTURE FLOW DIRECTION

6115A / 0.81 43.2 — E□ISTING AREA NUMBER, E□ISTING POPULATION, AREA IN HECTARES

E□ISTING FLOW DIRECTION

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3	REVISED AS PER CITY COMMENTS	DGY	2020:12:14
2	REVISED AS PER CITY COMMENTS	DGY	2020:09:18
1	ISSUED FOR SPA	DGY	2019:12:18

DCR/PHOENIX GROUP OF COMPANIES

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

1055 CEDAR CREEK DRIVE

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/12/14
PROVINCE OF ONTARIO

Drawing Title

SANITARY DRAINAGE AREA PLAN

Scale
1:250

Design	RM/WZ	Date	SEPT, 2019
Drawn	DPS/WZ	Checked	DGY
Project No.	121793	Drawing No.	400

D07-12-20-0037

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

LEGEND
Red text High level sanitary sewer

SANITARY SEWER DESIGN SHEET

Remer Lands Phase 1
City of ottawa
Leitrim South Holdings Inc. (Regional Group)

LOCATION				RESIDENTIAL										ICI AREAS							INFILTRATION ALLOWANCE			FIXED FLOW (L/s)		TOTAL FLOW	PROPOSED SEWER DESIGN						
				AREA w/ Units (Ha)	UNIT TYPES				AREA w/o Units (Ha)	POPULATION		PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha)						PEAK FLOW (L/s)	AREA (Ha)		FLOW (L/s)			(L/s)	CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY	
														INSTITUTIONAL		COMMERCIAL		INDUSTRIAL															
STREET	AREA ID	FROM MH	TO MH		SF	SD	TH	APT		IND	CUM			IND	CUM	IND	CUM	IND	CUM		IND	CUM		IND	CUM							L/s	(%)
Dun Skipper Road	6131C	MH6131C	MH6131A	0.45	7					22.4	22.4	4.00	0.36		0.00		0.00		0.00	0.00	0.45	0.45	0.13		0.00	0.49	39.01	43.00	200	1.30	1.203	38.52	98.75%
Dun Skipper Road	6131A	MH6131A	MH6130A	0.49	8					25.6	48.0	4.00	0.78		0.00		0.00		0.00	0.00	0.49	0.94	0.26		0.00	1.04	61.68	86.07	200	3.25	1.902	60.64	98.31%
Minikan Street	6130A	MH6130A	MH6170A	0.48	11					35.2	83.2	4.00	1.35		0.00		0.00		0.00	0.00	0.48	1.42	0.40		0.00	1.75	48.39	83.57	200	2.00	1.492	46.64	96.39%
Minikan Street	6170A	MH6170A	MH6171A	0.64	14					44.8	128.0	4.00	2.07		0.00		0.00		0.00	0.00	0.64	2.06	0.58		0.00	2.65	50.75	84.42	200	2.20	1.565	48.10	94.78%
					DRAFT 2016 UPDATED SERVICEABILITY REPORT																												
Spreadwing Way	EXT5	BLK3171AW	MH6171A	30.52						1388.8	1388.8	3.70	20.84		0.00		0.00		0.00	0.00	30.52	30.52	8.55		0.00	29.38	45.12	43.00	300	0.20	0.618	15.73	34.88%
Spreadwing Way	6171A	MH6171A	MH6183A	0.15						0.0	1516.8	3.68	22.59		0.00		0.00		0.00	0.00	0.15	32.73	9.16		0.00	31.75	45.12	83.61	300	0.20	0.618	13.36	29.62%
Minikan Street	6176A	MH6176A	MH6172A	0.43	6					19.2	19.2	4.00	0.31		0.00		0.00		0.00	0.00	0.43	0.43	0.12		0.00	0.43	29.63	66.50	200	0.75	0.914	29.20	98.54%
					DRAFT 2016 UPDATED SERVICEABILITY REPORT																												
Viceroy Mews	EXT6	BLK6172AW	MH6172A	0.83	13					41.6	41.6	4.00	0.67		0.00		0.00		0.00	0.00	0.83	0.83	0.23		0.00	0.91	20.24	41.50	200	0.35	0.624	19.34	95.52%
Minikan Street	6172A	MH6172A	MH6173A	0.15	2					6.4	67.2	4.00	1.09		0.00		0.00		0.00	0.00	0.15	1.41	0.39		0.00	1.48	20.24	27.99	200	0.35	0.624	18.76	92.67%
Minikan Street	6173A	MH6173A	MH6174A	0.18	2					6.4	73.6	4.00	1.19		0.00		0.00		0.00	0.00	0.18	1.59	0.45		0.00	1.64	20.24	11.54	200	0.35	0.624	18.61	91.91%
Minikan Street	6174A	MH6174A	MH6175B	0.58	11					35.2	108.8	4.00	1.76		0.00		0.00		0.00	0.00	0.58	2.17	0.61		0.00	2.37	20.24	68.80	200	0.35	0.624	17.87	88.29%
Minikan Street		MH6175B	MH6175A							0.0	108.8	4.00	1.76		0.00		0.00		0.00	0.00	0.00	2.17	0.61		0.00	2.37	45.12	6.00	300	0.20	0.618	42.75	94.75%
Zaatiik Grove	6180A	MH6180A	MH6181A	0.48	8					25.6	25.6	4.00	0.41		0.00		0.00		0.00	0.00	0.48	0.48	0.13		0.00	0.55	34.22	58.50	200	1.00	1.055	33.67	98.39%
Zaatiik Grove	6181A	MH6181A	MH6182A	0.22	2					6.4	32.0	4.00	0.52		0.00		0.00		0.00	0.00	0.22	0.70	0.20		0.00	0.71	34.22	11.58	200	1.00	1.055	33.50	97.91%
Zaatiik Grove	6182A	MH6182A	MH6183A	0.48	7					22.4	54.4	4.00	0.88		0.00		0.00		0.00	0.00	0.48	1.18	0.33		0.00	1.21	54.10	74.74	200	2.50	1.668	52.89	97.76%
Zaatiik Grove		MH6183A	MH6175A							0.0	1571.2	3.66	23.33		0.00		0.00		0.00	0.00	0.00	33.91	9.49		0.00	32.82	45.12	118.54	300	0.20	0.618	12.29	27.25%
Zaatiik Grove	6183A	MH6183B	MH6175D	0.67	12					38.4	38.4	4.00	0.62		0.00		0.00		0.00	0.00	0.67	0.67	0.19		0.00	0.81	37.48	103.00	200	1.20	1.156	36.67	97.84%
Zaatiik Grove		MH6175D	MH6175A							0.0	38.4	4.00	0.62		0.00		0.00		0.00	0.00	0.00	0.67	0.19		0.00	0.81	37.48	6.00	200	1.20	1.156	36.67	97.84%
Minikan Street		MH6175A	MH6106A							0.0	1718.4	3.64	25.31		0.00		0.00		0.00	0.00	0.00	36.75	10.29		0.00	35.60	45.12	85.46	300	0.20	0.618	9.51	21.09%
Minikan Street	6175A	MH6175C	MH6106B	0.58	10					32.0	32.0	4.00	0.52		0.00		0.00		0.00	0.00	0.58	0.58	0.16		0.00	0.68	28.63	69.00	200	0.70	0.883	27.95	97.62%
Minikan Street		MH6106B	MH6106A							0.0	32.0	4.00	0.52		0.00		0.00		0.00	0.00	0.00	0.58	0.16		0.00	0.68	28.63	6.00	200	0.70	0.883	27.95	97.62%
Dun Skipper Road	6132Ac	MH6132A	MH6110A	0.53	9					28.8	28.8	4.00	0.47		0.00		0.00		0.00	0.00	0.53	0.53	0.15		0.00	0.62	43.28	85.00	200	1.60	1.335	42.67	98.58%
					DRAFT 2016 UPDATED SERVICEABILITY REPORT																												
Kelly Farm Drive	EXT1		BLK6110AS	1.34						76.8	76.8	4.00	1.24		0.00		0.00		0.00	0.00	1.34	1.34	0.38										
Kelly Farm Drive	6110Aa	BLK6110AS	MH6110A	0.30	4					12.8	89.6	4.00	1.45		0.00		0.00		0.00	0.00	0.30	1.64	0.46		0.00	1.91	72.58	44.00	200	4.50	2.238	70.67	97.37%
Kelly Farm Drive	6110Ab	MH6110A	MH6109A	0.52	8					25.6	144.0	4.00	2.33		0.00		0.00		0.00	0.00	0.52	2.69	0.75		0.00	3.09	59.26	85.00	200	3.00	1.828	56.18	94.79%
Kelly Farm Drive	6109A	MH6109A	MH6108A	0.56	10					32.0	176.0	4.00	2.85		0.00		0.00		0.00	0.00	0.56	3.25	0.91		0.00	3.76	59.26	81.99	200	3.00	1.828	55.50	93.65%
Salamander Way	6156Ab	MH6156A	MH6155A	0.72	11					35.2	35.2	4.00	0.57		0.00		0.00		0.00	0.00	0.72	0.72	0.20		0.00	0.77	50.75	88.13	200	2.20	1.565	49.98	98.48%
Salamander Way	6155A	MH6155A	MH6108A	0.51	8					25.6	60.8	4.00	0.99		0.00		0.00		0.00	0.00	0.51	1.23	0.34		0.00	1.33	50.75	88.25	200	2.20	1.565	49.42	97.38%
Kelly Farm Drive	6108A	MH6108A	MH6107A	0.33	5					16.0	252.8	4.00	4.10		0.00		0.00		0.00	0.00	0.33	4.81	1.35		0.00	5.44	43.28	60.23	200	1.60	1.335	37.84	87.42%
Kelly Farm Drive	6107A	MH6107A	MH6106A	0.18	1					3.2	256.0	4.00	4.15		0.00		0.00		0.00	0.00	0.18	4.99	1.40		0.00	5.55	43.28	58.91	200	1.60	1.335	37.74	87.19%
Kelly Farm Drive	6106A	MH6106A	*EX. MH647A*	0.19						0.0	2006.4	3.58	29.14		0.00		0.00		0.00	0.00	0.19	42.51	11.90		0.00	41.04	45.12	86.86	300	0.20	0.618	4.08	9.04%
					DRAFT 2016 UPDATED SERVICEABILITY REPORT																												
Miikana Road	EXT7	BLK6105AW	*EX. MH647A*	5.74						379.2	379.2	4.00	6.14		0.00		0.00		0.00	0.00	5.74	5.74	1.61		0.00	7.75	20.24	17.00	200	0.35	0.624	12.49	61.71%

Design Parameters:

Residential			ICI Areas			Peak Factor
SF	3.2	p/p/u				
TH/SD	2.4	p/p/u	INST	50,000	L/Ha/day	1.5
APT	1.9	p/p/u	COM	50,000	L/Ha/day	1.5
Other	43	p/p/Ha	IND	35,000	L/Ha/day	MOE Chart
				17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 350 L/day 300 L/day
3. Infiltration allowance: 0.28 L/s/Ha
4. Residential Peaking Factor:
   Harmon Formula = 1+(14/(4+P^0.5))
   where P = population in thousands

Designed: WY

Checked: JM

Dwg. Reference: 501, 501A

No.	Revision	Date
1.	City Submission No. 1	11/23/2016
2.	City Submission No. 2	5/12/2017
3.	City Submission No. 3	7/5/2017
4.	Updated Street Name for MOE Submission	8/3/2017

File Reference:	Date:	Sheet No:
33956.5.7.1	5/10/2017	1 of 2

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

LEGEND
Red text High level sanitary sewer

SANITARY SEWER DESIGN SHEET

Remer Lands Phase 1
City of ottawa
Leitrim South Holdings Inc. (Regional Group)

LOCATION				RESIDENTIAL										ICI AREAS							INFILTRATION ALLOWANCE			FIXED FLOW (L/s)		TOTAL	PROPOSED SEWER DESIGN						
STREET	AREA ID	FROM MH	TO MH	AREA w/ Units (Ha)	UNIT TYPES SF	SD	TH	APT	AREA w/o Units (Ha)	POPULATION IND	CUM	PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha) INSTITUTIONAL IND	CUM	COMMERCIAL IND	CUM	INDUSTRIAL IND	CUM	PEAK FLOW (L/s)	AREA (Ha) IND	CUM	FLOW (L/s)	IND	CUM	FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	DIA (mm)	SLOPE (%)	VELOCITY (full) (m/s)	AVAILABLE CAPACITY L/s	(%)
Dun Skipper Road	6132Aa	MH6132A	MH6133A	0.64	10					32.0	32.0	4.00	0.52		0.00		0.00		0.00	0.00	0.64	0.64	0.18		0.00	0.70	43.28	82.00	200	1.60	1.335	42.58	98.39%
					DRAFT 2016 UPDATED SERVICEABILITY REPORT																												
Street No. 7	EXT2		BLK6133AS						2.88	123.8	123.8	4.00	2.01		0.00		0.00		0.00	0.00	2.88	2.88	0.81										
Street No. 7	6133Ab	BLK6133AS	MH6133A	0.07						0.0	123.8	4.00	2.01		0.00		0.00		0.00	0.00	0.07	2.95	0.83		0.00	2.83	24.19	44.00	200	0.50	0.746	21.36	88.29%
Dun Skipper Road	6133Aa	MH6133A	MH6134A	0.58	10					32.0	187.8	4.00	3.04		0.00		0.00		0.00	0.00	0.58	4.17	1.17		0.00	4.21	37.48	72.14	200	1.20	1.156	33.27	88.76%
Dun Skipper Road	6134A	MH6134A	MH6135A	0.66	12					38.4	226.2	4.00	3.67		0.00		0.00		0.00	0.00	0.66	4.83	1.35		0.00	5.02	28.63	72.09	200	0.70	0.883	23.61	82.47%
Dun Skipper Road	6135A	MH6135A	MH6136A	0.19	3					9.6	235.8	4.00	3.82		0.00		0.00		0.00	0.00	0.19	5.02	1.41		0.00	5.23	28.63	24.81	200	0.70	0.883	23.40	81.74%
					DRAFT 2016 UPDATED SERVICEABILITY REPORT																												
Easement	EXT3	BLK6145A	MH6146A	2.50						250.8	250.8	4.00	4.06		0.00		0.00		0.00	0.00	2.50	2.50	0.70		0.00	4.76	21.64	22.70	200	0.40	0.667	16.88	77.99%
Easement		MH6146A	MH6136A							0.0	250.8	4.00	4.06		0.00		0.00		0.00	0.00	0.00	2.50	0.70		0.00	4.76	21.64	46.46	200	0.40	0.667	16.88	77.99%
					DRAFT 2016 UPDATED SERVICEABILITY REPORT																												
	EXT4	BLK6138A	MH6138A							0.0	0.0	4.00	0.00		0.00	4.07	4.07		0.00	3.53	4.07	4.07	1.14		0.00	4.67	20.24	20.00	200	0.35	0.624	15.57	76.92%
Dun Skipper Road	6138A	MH6138A	MH6137A	0.08						0.0	0.0	4.00	0.00		0.00		4.07		0.00	3.53	0.08	4.15	1.16		0.00	4.69	20.24	32.25	200	0.35	0.624	15.55	76.81%
Dun Skipper Road	6137A	MH6137A	MH6136A	0.10						0.0	0.0	4.00	0.00		0.00		4.07		0.00	3.53	0.10	4.25	1.19		0.00	4.72	20.24	44.44	200	0.35	0.624	15.52	76.67%
Cedar Creek Drive	6136A	MH6136A	MH6121A	0.04						0.0	486.6	3.98	7.85		0.00		4.07		0.00	3.53	0.04	11.81	3.31		0.00	14.69	20.24	28.03	200	0.35	0.624	5.56	27.45%
Cedar Creek Drive	6121A	MH6121A	MH6120A	0.03						0.0	486.6	3.98	7.85		0.00		4.07		0.00	3.53	0.03	11.84	3.32		0.00	14.69	20.24	12.97	200	0.35	0.624	5.55	27.41%
Cedar Creek Drive	6120A	MH6120A	MH6119A	0.10						0.0	486.6	3.98	7.85		0.00		4.07		0.00	3.53	0.10	11.94	3.34		0.00	14.72	20.24	53.29	200	0.35	0.624	5.52	27.27%
Pingwi Place	6132Ab	MH6132A	MH6161A	0.25	3					9.6	9.6	4.00	0.16		0.00		0.00		0.00	0.00	0.25	0.25	0.07		0.00	0.23	56.22	77.03	200	2.70	1.734	56.00	99.60%
Pingwi Place	6161A	MH6161A	MH6162A	0.22	3					9.6	19.2	4.00	0.31		0.00		0.00		0.00	0.00	0.22	0.47	0.13		0.00	0.44	24.19	11.41	200	0.50	0.746	23.75	98.17%
Pingwi Place	6162A	MH6162A	MH6163A	0.62	14					44.8	64.0	4.00	1.04		0.00		0.00		0.00	0.00	0.62	1.09	0.31		0.00	1.34	20.24	74.88	200	0.35	0.624	18.90	93.37%
Pingwi Place	6163A	MH6163A	MH6164A	0.44			12			28.8	92.8	4.00	1.50		0.00		0.00		0.00	0.00	0.44	1.53	0.43		0.00	1.93	20.24	86.35	200	0.35	0.624	18.31	90.46%
Pingwi Place	6164A	MH6164A	MH6119A	0.40			11			26.4	119.2	4.00	1.93		0.00		0.00		0.00	0.00	0.40	1.93	0.54		0.00	2.47	29.63	86.29	200	0.75	0.914	27.16	91.66%
Block 429	COM	BLK6119AE	MH6119A							0.0	0.0	4.00	0.00		0.00	3.01	3.01		0.00	2.61	3.01	3.01	0.84		0.00	3.46	45.12	20.00	300	0.20	0.618	41.66	92.34%
Cedar Creek Drive	6119A	MH6119A	MH6118A	0.05						0.0	605.8	3.93	9.64		0.00		7.08		0.00	6.15	0.05	16.93	4.74		0.00	20.53	45.12	28.01	300	0.20	0.618	24.58	54.49%
Cedar Creek Drive	6118A	MH6118A	MH6117A	0.07						0.0	605.8	3.93	9.64		0.00		7.08		0.00	6.15	0.07	17.00	4.76		0.00	20.55	45.12	33.76	300	0.20	0.618	24.57	54.45%
Block 443	HD1	BLK6117AW	MH6117A	1.03						129.6	129.6	4.00	2.10		0.00		0.00		0.00	0.00	1.03	1.03	0.29		0.00	2.39	20.24	20.00	200	0.35	0.624	17.85	88.20%
Cedar Creek Drive	6117A	MH6117A	MH6116A	0.55			17			40.8	776.2	3.87	12.16		0.00		7.08		0.00	6.15	0.55	18.58	5.20		0.00	23.51	45.12	75.05	300	0.20	0.618	21.60	47.89%
Cedar Creek Drive	6116A	MH6116A	MH6115A	0.52			17			40.8	817.0	3.85	12.76		0.00		7.08		0.00	6.15	0.52	19.10	5.35		0.00	24.25	59.68	67.16	300	0.35	0.818	35.43	59.36%
Salamander Way	6156Aa	MH6156A	MH6157A	0.29	3					9.6	9.6	4.00	0.16		0.00		0.00		0.00	0.00	0.29	0.29	0.08		0.00	0.24	31.55	74.63	200	0.85	0.973	31.31	99.25%
Salamander Way	6157A	MH6157A	MH6158A	0.07			1			2.4	12.0	4.00	0.19		0.00		0.00		0.00	0.00	0.07	0.36	0.10		0.00	0.30	34.22	12.28	200	1.00	1.055	33.92	99.14%
Salamander Way	6158A	MH6158A	MH6153A	0.54			14			33.6	45.6	4.00	0.74		0.00		0.00		0.00	0.00	0.54	0.90	0.25		0.00	0.99	56.22	106.46	200	2.70	1.734	55.23	98.24%
Block 436	PARK	BLK6153C	MH6153A						0.83	0.0	0.0	4.00	0.00		0.00		0.00		0.00	0.00	0.83	0.83	0.23		0.00	0.23	24.19	13.25	200	0.50	0.746	23.96	99.04%
Salamander Way	6153A	MH6153A	MH6154A	0.03						0.0	45.6	4.00	0.74		0.00		0.00		0.00	0.00	0.03	1.76	0.49		0.00	1.23	28.63	10.53	200	0.70	0.883	27.40	95.70%
Salamander Way	6154A	MH6154A	MH6115A	0.13						0.0	45.6	4.00	0.74		0.00		0.00		0.00	0.00	0.13	1.89	0.53		0.00	1.27	24.19	76.18	200	0.50	0.746	22.93	94.76%
Cedar Creek Drive	6115A	MH6115A	MH6101A	0.61			18			43.2	905.8	3.83	14.04		0.00		7.08		0.00	6.15	0.61	21.60	6.05		0.00	26.24	59.68	87.15	300	0.35	0.818	33.44	56.04%
Miikana Road	6101A	MH6101A	MH6102A	0.45			11			26.4	932.2	3.82	14.42		0.00		7.08		0.00	6.15	0.45	22.05	6.17		0.00	26.74	59.68	91.17	300	0.35	0.818	32.94	55.19%
Block 436	HD2	BLK6102AS	MH6102A	0.94						115.2	115.2	4.00	1.87		0.00		0.00		0.00	0.00	0.94	0.94	0.26		0.00	2.13	20.24	20.00	200	0.35	0.624	18.11	89.48%
Miikana Road	6102A	MH6102A	MH6103A	0.23			6			14.4	1061.8	3.78	16.27		0.00		7.08		0.00	6.15	0.23	23.22	6.50		0.00	28.92	59.68	41.44	300	0.35	0.818	30.76	51.54%
Miikana Road	6103A	MH6103A	MH6104A	0.66			18			43.2	1105.0	3.77	16.88		0.00		7.08		0.00	6.15	0.66	23.88	6.69		0.00	29.72	59.68	120.00	300	0.35	0.818	29.97	50.21%
Block 450	INST	BLK6104AS	MH6104A							0.0	0.0	4.00	0.00	2.55	2.55		0.00		0.00	2.21	2.55	2.55	0.71		0.00	2.93	20.24	20.00	200	0.35	0.624	17.32	85.54%
Miikana Road	6104A	MH6104A	MH6105B	0.60			15			36.0	1141.0	3.76	17.39		2.55		7.08		0.00	8.36	0.60	27.03	7.57		0.00	33.32	59.68	114.40	300	0.35	0.818	26.36	44.17%
Miikana Road		MH6105B	*EX. MH647A*							0.0	1141.0	3.76	17.39		2.55		7.08		0.00	8.36	0.00	27.03	7.57		0.00	33.32	45.12	8.00	300	0.20	0.618	11.80	26.15%
Kelly Farm Drive		*EX. MH647A*	*EX. MH742A*	*0.28*			*5*			*12.0*	3538.6	3.38	48.46		2.55		7.08		0.00	8.36	0.28	75.56	21.16		0.00	77.97	101.84	*80.31*	*375*	*0.31*	0.893	23.87	23.43%

Design Parameters:

Residential			ICI Areas			Peak Factor
SF	3.2	p/p/u	INST	50,000	L/Ha/day	1.5
TH/SD	2.4	p/p/u	COM	50,000	L/Ha/day	1.5
APT	1.9	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Other	43	p/p/Ha		17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 350 L/day 300 L/day
3. Infiltration allowance: 0.28 L/s/Ha
4. Residential Peaking Factor:
Harmon Formula = 1+(14/(4+P^0.5))
where P = population in thousands

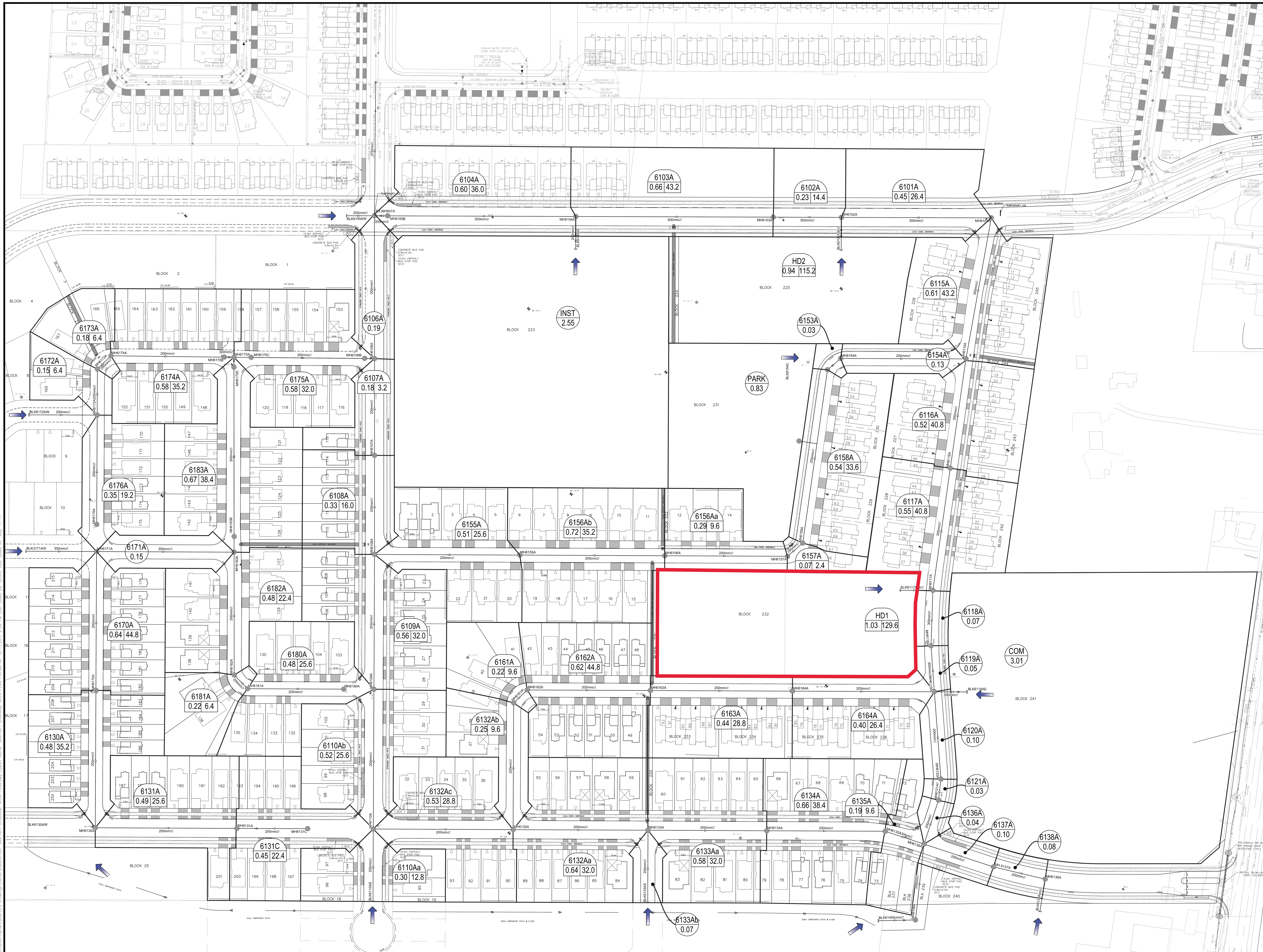
Designed: WY

Checked: JM

Dwg. Reference: 501, 501A

No.	Revision	Date
1.	City Submission No. 1	11/23/2016
2.	City Submission No. 2	5/12/2017
3.	City Submission No. 3	7/5/2017
4.	Updated Street Name for MOE Submission	8/3/2017

File Reference:	Date:	Sheet No:
33956.5.7.1	5/10/2017	2 of 2



REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed ____________________

Date ____________________ 2017

Plan Number ____________________

LEGEND :

6115A	AREA NUMBER
0.81 43.2	POPULATION
	AREA IN HECTARES
➡	FUTURE FLOW DIRECTION

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5	REVISED BLOCK NUMBERS	J.I.M.	2017:08:11
4	RE-SUBMISSION FOR MOECC APPROVAL & REVISED STREET NAMES	J.I.M.	2017:08:02
3	SUBMISSION FOR MOECC APPROVAL	J.I.M.	2017:07:07
2	SUBMISSION No.2 FOR CITY REVIEW	J.I.M.	2017:05:12
1	SUBMISSION No.1 FOR CITY REVIEW	J.I.M.	2016:11:23

LEITRIM SOUTH HOLDINGS INC.

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

pathways at FINDLAY CREEK

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2017/08/02
PROVINCE OF ONTARIO

Drawing Title

SANITARY DRAINAGE AREA PLAN

Scale 1 : 1000

Design	Date
J.I.M.	NOV 2016
Drawn	Checked
D.D.	----
Project No.	Drawing No.
33956	501

D07-16-13-0023

#17367

and trunk storm sewers included in the XPSWMM model have been compared to the USF and the results are presented in **Appendix E** for all storm events listed in **Section 4.9.1.** It should be noted that the establishment of the sanitary scenarios discussed in **Section 4.9.1**, result in slight or negligible difference in the storm HGL.

Table 4.12 Storm Hydraulic Grade Line - Local Sewers within Pathways at Findlay Creek Phase 1 for the 100 Year 3 Hour Chicago and 100 Year 3 Hour Chicago increased by 20% Storm Events

XPSWMM Node	USF (m)	Sanitary Inflow Scenario							
		100 Year 3 Hour Chicago				100 Year 3 Hour Chicago + 20%			
		Option 1		Option 2		Option 1		Option 2	
		HGL (m)*	USF–HGL (m)	HGL (m)†	USF–HGL (m)	HGL (m)*	USF–HGL (m)	HGL (m)†	USF–HGL (m)
BLK6172W	n/a	92.50	n/a	92.50	n/a	92.72	n/a	92.72	n/a
S6176	94.30	92.98	1.32	92.98	1.32	92.98	1.32	92.98	1.32
S6172	93.40	92.47	0.93	92.47	0.93	92.69	0.71	92.69	0.71
S6173	93.30	92.46	0.84	92.46	0.84	92.68	0.62	92.68	0.62
S6174	93.40	92.44	0.96	92.44	0.96	92.66	0.74	92.66	0.74
S6131B	100.90	99.93	0.97	99.93	0.97	99.93	0.97	99.93	0.97
S6131	100.20	99.20	1.00	99.20	1.00	99.20	1.00	99.20	1.00
S6130	97.10	96.38	0.72	96.38	0.72	96.38	0.72	96.38	0.72
S6170	95.70	94.64	1.06	94.64	1.06	94.64	1.06	94.64	1.06
S6180	97.55	96.30	1.25	96.30	1.25	96.30	1.25	96.30	1.25
S6181	97.00	95.86	1.14	95.86	1.14	95.86	1.14	95.86	1.14
S6182	96.85	95.73	1.12	95.73	1.12	95.73	1.12	95.73	1.12
S6132	102.40	101.16	1.24	101.16	1.24	101.16	1.24	101.16	1.24
BLK6110S	102.10	101.60	0.50	101.60	0.50	101.60	0.50	101.60	0.50
S6110	100.55	99.36	1.19	99.36	1.19	99.36	1.19	99.36	1.19
S6109	97.95	96.29	1.66	96.29	1.66	96.29	1.66	96.29	1.66
S6156	98.30	96.97	1.33	96.97	1.33	97.15	1.15	97.15	1.15
S6155	97.25	95.54	1.71	95.54	1.71	95.60	1.65	95.60	1.65
S6108	95.45	93.63	1.82	93.63	1.82	93.78	1.67	93.78	1.67
S6107	93.60	92.77	0.83	92.77	0.83	92.97	0.63	92.97	0.63
BLK6105W	n/a	91.92	n/a	91.92	n/a	92.07	n/a	92.07	n/a
S6132B	102.40	101.40	1.00	101.40	1.00	101.40	1.00	101.40	1.00
BLK6133S	n/a	100.57	n/a	100.57	n/a	100.57	n/a	100.57	n/a
S6133	101.80	100.14	1.66	100.14	1.66	100.14	1.66	100.14	1.66
S6134	100.75	99.23	1.52	99.23	1.52	99.23	1.52	99.23	1.52
S6135	100.20	98.74	1.46	98.74	1.46	98.74	1.46	98.74	1.46
BLK900	n/a	96.06	n/a	96.06	n/a	96.06	n/a	96.06	n/a
S6140	n/a	96.06	n/a	96.06	n/a	96.06	n/a	96.06	n/a

XPSWMM Node	USF (m)	Sanitary Inflow Scenario							
		100 Year 3 Hour Chicago				100 Year 3 Hour Chicago + 20%			
		Option 1		Option 2		Option 1		Option 2	
		HGL (m)*	USF–HGL (m)	HGL (m)†	USF–HGL (m)	HGL (m)*	USF–HGL (m)	HGL (m)†	USF–HGL (m)
S6139	n/a	95.91	n/a	95.91	n/a	95.92	n/a	95.92	n/a
S6138	n/a	95.86	n/a	95.86	n/a	95.86	n/a	95.86	n/a
S6137	n/a	95.80	n/a	95.80	n/a	95.81	n/a	95.81	n/a
BLK6145	100.25	98.80	1.45	98.80	1.45	98.80	1.45	98.80	1.45
S6146	n/a	98.72	n/a	98.72	n/a	98.72	n/a	98.72	n/a
S6136	n/a	95.68	n/a	95.68	n/a	95.68	n/a	95.68	n/a
S6120	n/a	94.85	n/a	94.85	n/a	94.85	n/a	94.85	n/a
S6132A	n/a	101.34	n/a	101.34	n/a	101.37	n/a	101.37	n/a
S6161	100.45	99.16	1.29	99.16	1.29	99.18	1.27	99.18	1.27
S6162	100.30	99.06	1.24	99.06	1.24	99.08	1.22	99.08	1.22
S6163	100.50	98.95	1.55	98.95	1.55	98.98	1.52	98.98	1.52
S6164	99.88	98.76	1.12	98.76	1.12	98.78	1.10	98.78	1.10
S6119	n/a	94.33	n/a	94.33	n/a	94.34	n/a	94.34	n/a
BLK6117B	n/a	94.89	n/a	94.89	n/a	94.89	n/a	94.89	n/a
S6117	n/a	94.11	n/a	94.11	n/a	94.11	n/a	94.11	n/a
S6116	96.03	92.84	3.19	92.84	3.19	92.85	3.18	92.85	3.18
S6156B	98.00	96.77	1.23	96.77	1.23	96.77	1.23	96.77	1.23
S6157	n/a	96.13	n/a	96.13	n/a	96.14	n/a	96.14	n/a
S6158	96.93	95.97	0.96	95.97	0.96	95.97	0.96	95.97	0.96
S6153	94.83	93.02	1.81	93.02	1.81	93.02	1.81	93.02	1.81
S6154	n/a	92.86	n/a	92.86	n/a	92.86	n/a	92.86	n/a
S6115	94.71	92.35	2.36	92.35	2.36	92.35	2.36	92.35	2.36

Notes: * HGL results for Option 1 were taken from the results of the XPSWMM model entitled 34738-20170630-MOE1-3CHI100.out or 34738-20170630-MOE1-3CHI120.out and presented on the CD in **Appendix E**.
† HGL results for Option 2 were taken from the results of the XPSWMM model entitled 34738-20170630-MOE2-3CHI100.out or 34738-20170630-MOE2-3CHI120.out and presented on the CD in **Appendix E**.

IBI GROUP

SANITARY HYDRAULIC GRADE LINE DESIGN SHEET
PATHWAYS BLOCK 232
CITY OF OTTAWA
PHOENIX HOMES

JOB #: 121793 - 6.2
DATE: 2019-12-13
DESIGN: W.Z. & R.M.
CHECKED: D.G.Y.
REV #: -

BLK6117 in Cedar Creek Drive to MH200A

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**BLK6117**	**200A**	
INVERT ELEVATION (m)	95.720	95.774	
OBVERT ELEVATION (m)	95.920	95.974	
DIAMETER (mm)			200
LENGTH (m)			12.7
FLOW (l/s)			2.23
HGL (m) ***	**94.890**	**94.891**	**0.001**
MANHOLE COEF K= 0.75	LOSS (m)	0.000	
TOTAL HGL (m)		**95.816**	
MAX. SURCHARGE (mm)		**-158**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	0.430	0.05	0.68	21.42

HYDRAULIC SLOPE = 7.320 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.104
DESIGN FLOW DEPTH = 0.042

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 0.07 m/s
$HL = K_L * V^2 / 2g$

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**200A**	**215A**	
INVERT ELEVATION (m)	95.834	95.923	
OBVERT ELEVATION (m)	96.034	96.123	
DIAMETER (mm)			200
LENGTH (m)			8.8
FLOW (l/s)			2.22
HGL (m) ***	**95.816**	**95.816**	**0.000**
MANHOLE COEF K= 0.75	LOSS (m)	0.000	
TOTAL HGL (m)		**95.957**	
MAX. SURCHARGE (mm)		**-166**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.05	32.93

HYDRAULIC SLOPE = 1.599 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.067
DESIGN FLOW DEPTH = 0.034

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 0.07 m/s
$HL = K_L * V^2 / 2g$

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**215A**	**214A**	
INVERT ELEVATION (m)	95.983	96.290	
OBVERT ELEVATION (m)	96.183	96.490	
DIAMETER (mm)			200
LENGTH (m)			30.7
FLOW (l/s)			2.17
HGL (m) ***	**95.957**	**95.958**	**0.001**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**96.324**	
MAX. SURCHARGE (mm)		**-166**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.04	32.76

HYDRAULIC SLOPE = 1.194 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.066
DESIGN FLOW DEPTH = 0.034

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.07 m/s
$HL = K_L * V^2 / 2g$

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**214A**	**202A**	
INVERT ELEVATION (m)	96.350	96.601	
OBVERT ELEVATION (m)	96.550	96.801	
DIAMETER (mm)			200
LENGTH (m)			25.1
FLOW (l/s)			2.07
HGL (m) ***	**96.324**	**96.325**	**0.001**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**96.635**	
MAX. SURCHARGE (mm)		**-166**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.04	32.79

HYDRAULIC SLOPE = 1.240 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.063
DESIGN FLOW DEPTH = 0.034

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.07 m/s
$HL = K_L * V^2 / 2g$

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**202A**	**201A**	
INVERT ELEVATION (m)	96.661	96.948	
OBVERT ELEVATION (m)	96.861	97.148	
DIAMETER (mm)			200
LENGTH (m)			28.7
FLOW (l/s)			0.45
HGL (m) ***	**96.635**	**96.635**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**96.964**	
MAX. SURCHARGE (mm)		**-184**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.04	32.79

HYDRAULIC SLOPE = 1.147 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.014
DESIGN FLOW DEPTH = 0.016

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.01 m/s
$HL = K_L * V^2 / 2g$

IBI GROUP

SANITARY HYDRAULIC GRADE LINE DESIGN SHEET
PATHWAYS BLOCK 232
CITY OF OTTAWA
PHOENIX HOMES

JOB #: 121793 - 6.2
DATE: 2019-12-13
DESIGN: W.Z. & R.M.
CHECKED: D.G.Y.
REV #: -

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**202A**	**217A**	
INVERT ELEVATION (m)	97.591	97.940	
OBVERT ELEVATION (m)	97.791	98.140	
DIAMETER (mm)			200
LENGTH (m)			34.9
FLOW (l/s)			0.28
HGL (m) ***	**96.635**	**96.635**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**97.952**	
MAX. SURCHARGE (mm)		**-188**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.04	32.78

HYDRAULIC SLOPE = 3.774 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.009
DESIGN FLOW DEPTH = 0.012

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.01 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**217A**	**216A**	
INVERT ELEVATION (m)	98.000	98.568	
OBVERT ELEVATION (m)	98.200	98.768	
DIAMETER (mm)			200
LENGTH (m)			28.4
FLOW (l/s)			0.27
HGL (m) ***	**97.952**	**97.952**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**98.578**	
MAX. SURCHARGE (mm)		**-190**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	2.000	0.05	1.48	46.37

HYDRAULIC SLOPE = 2.205 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.006
DESIGN FLOW DEPTH = 0.010

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.01 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**202A**	**204A**	
INVERT ELEVATION (m)	96.647	96.980	
OBVERT ELEVATION (m)	96.847	97.180	
DIAMETER (mm)			200
LENGTH (m)			53.3
FLOW (l/s)			1.55
HGL (m) ***	**96.635**	**96.636**	**0.001**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**97.012**	
MAX. SURCHARGE (mm)		**-168**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	0.550	0.05	0.82	25.90

HYDRAULIC SLOPE = 0.707 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.060
DESIGN FLOW DEPTH = 0.032

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.05 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**204A**	**212A**	
INVERT ELEVATION (m)	97.666	97.888	
OBVERT ELEVATION (m)	97.866	98.088	
DIAMETER (mm)			200
LENGTH (m)			22.2
FLOW (l/s)			0.18
HGL (m) ***	**97.012**	**97.012**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**97.898**	
MAX. SURCHARGE (mm)		**-190**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.04	32.77

HYDRAULIC SLOPE = 3.987 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.005
DESIGN FLOW DEPTH = 0.010

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.01 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**204A**	**205A**	
INVERT ELEVATION (m)	97.000	97.152	
OBVERT ELEVATION (m)	97.200	97.352	
DIAMETER (mm)			200
LENGTH (m)			30.3
FLOW (l/s)			0.68
HGL (m) ***	**97.012**	**97.012**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**97.174**	
MAX. SURCHARGE (mm)		**-178**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	0.500	0.05	0.74	23.24

HYDRAULIC SLOPE = 0.536 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.029
DESIGN FLOW DEPTH = 0.022

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.02 m/s
HL = K_L * V^2/ 2g

SANITARY HYDRAULIC GRADE LINE DESIGN SHEET
PATHWAYS BLOCK 232
CITY OF OTTAWA
PHOENIX HOMES

JOB #: 121793 - 6.2
DATE: 2019-12-13
DESIGN: W.Z. & R.M.
CHECKED: D.G.Y.
REV #: -

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**205A**	**210A**	
INVERT ELEVATION (m)	97.212	97.481	
OBVERT ELEVATION (m)	97.412	97.681	
DIAMETER (mm)			200
LENGTH (m)			26.9
FLOW (l/s)			0.36
HGL (m) ***	**97.174**	**97.174**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**97.495**	
MAX. SURCHARGE (mm)		**-186**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.04	32.76

HYDRAULIC SLOPE = 1.192 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.011
DESIGN FLOW DEPTH = 0.014

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.01 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**210A**	**211A**	
INVERT ELEVATION (m)	97.541	97.693	
OBVERT ELEVATION (m)	97.741	97.893	
DIAMETER (mm)			200
LENGTH (m)			30.4
FLOW (l/s)			0.18
HGL (m) ***	**97.495**	**97.495**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**97.705**	
MAX. SURCHARGE (mm)		**-188**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	0.500	0.05	0.74	23.20

HYDRAULIC SLOPE = 0.692 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.008
DESIGN FLOW DEPTH = 0.012

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.01 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**205A**	**206A**	
INVERT ELEVATION (m)	97.172	97.216	
OBVERT ELEVATION (m)	97.372	97.416	
DIAMETER (mm)			200
LENGTH (m)			4.4
FLOW (l/s)			0.35
HGL (m) ***	**97.174**	**97.174**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**97.230**	
MAX. SURCHARGE (mm)		**-186**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.04	32.78

HYDRAULIC SLOPE = 1.273 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.011
DESIGN FLOW DEPTH = 0.014

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.01 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**206A**	**209A**	
INVERT ELEVATION (m)	97.276	98.169	
OBVERT ELEVATION (m)	97.476	98.369	
DIAMETER (mm)			200
LENGTH (m)			29.8
FLOW (l/s)			0.09
HGL (m) ***	**97.230**	**97.230**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**98.173**	
MAX. SURCHARGE (mm)		**-196**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	3.000	0.05	1.81	56.77

HYDRAULIC SLOPE = 3.167 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.002
DESIGN FLOW DEPTH = 0.004

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.00 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**206A**	**207A**	
INVERT ELEVATION (m)	97.881	98.501	
OBVERT ELEVATION (m)	98.081	98.701	
DIAMETER (mm)			200
LENGTH (m)			31.0
FLOW (l/s)			0.23
HGL (m) ***	**97.230**	**97.230**	**0.000**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**98.509**	
MAX. SURCHARGE (mm)		**-192**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	2.000	0.05	1.48	46.36

HYDRAULIC SLOPE = 4.126 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.005
DESIGN FLOW DEPTH = 0.008

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.01 m/s
HL = K_L * V^2/ 2g

IBI GROUP

SANITARY HYDRAULIC GRADE LINE DESIGN SHEET
PATHWAYS BLOCK 232
CITY OF OTTAWA
PHOENIX HOMES

JOB #: 121793 - 6.2
DATE: 2019-12-13
DESIGN: W.Z. & R.M.
CHECKED: D.G.Y.
REV #: -

FRICTION LOSS		FROM MH	TO MH	PIPE ID
Block 232		**207A**	**208A**	
INVERT ELEVATION (m)		98.561	99.167	
OBVERT ELEVATION (m)		98.761	99.367	
DIAMETER (mm)				200
LENGTH (m)				30.3
FLOW (l/s)				0.13
HGL (m)	***	**98.509**	**98.509**	**0.000**
MANHOLE COEF K=	0.05	LOSS (m)	0.000	
TOTAL HGL (m)			99.173	
MAX. SURCHARGE (mm)			-194	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	2.000	0.05	1.48	46.35

HYDRAULIC SLOPE =	2.191 %
DESIGN FLOW TO FULL FLOW RATIO (Q/	0.003
DESIGN FLOW DEPTH =	0.006

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.00 m/s
$HL = K_L * V^2 / 2g$

Cedar Creek Drive Sanitary HGL has no negative impact on the proposed development.

APPENDIX C

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

STORM SEWER DESIGN SHEET

Pathways Block 232
City of Ottawa
Phoenix Homes

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW															SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.25	C= 0.40	C= 0.50	C= 0.57	C= 0.65	C= 0.69	C= 0.70	C= 0.75	C= 0.90	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr) (L/s)	(%)
	CB10	CB10	MH206									0.029		0.06	0.06	10.00	0.09	10.09	76.81	104.19	122.14	178.56	4.64	6.30	7.39	10.80		4.64	34.22	5.91	200			1.00	1.055	29.57	86.43%
		MH206	MH205											0.00	0.06	10.09	0.34	10.43	76.45	103.70	121.56	177.71	4.62	6.27	7.35	10.75		4.62	62.04	24.93	250			1.00	1.224	57.42	92.55%
	CB7	CB7	CB8										0.100	0.25	0.25	10.00	0.20	10.20	76.81	104.19	122.14	178.56	19.22	26.07	30.56	44.68		19.22	168.51	28.31	300			2.79	2.309	149.29	88.60%
	CB8	CB8	MH208										0.086	0.22	0.47	10.20	0.02	10.22	76.03	103.13	120.88	176.71	35.38	47.99	56.26	82.24		35.38	100.88	1.50	300			1.00	1.383	65.50	64.93%
		MH208	MH207											0.00	0.47	10.22	0.26	10.48	75.96	103.03	120.77	176.55	35.35	47.95	56.21	82.16		35.35	71.62	15.12	300			0.50	0.982	36.27	50.64%
		MH207	MH205											0.00	0.47	10.48	0.15	10.63	75.01	101.73	119.24	174.29	34.91	47.34	55.49	81.11		34.91	43.87	7.92	250			0.50	0.866	8.96	20.42%
	CB6	CB6	MAIN										0.074	0.19	0.19	10.00	0.06	10.06	76.81	104.19	122.14	178.56	14.22	19.29	22.61	33.06		14.22	48.39	5.12	200			2.00	1.492	34.17	70.61%
	UNC CB9	CB9	MAIN										0.038	0.10	0.10	10.00	0.34	10.34	76.81	104.19	122.14	178.56	7.30	9.91	11.61	16.98		7.30	34.22	21.23	200			1.00	1.055	26.91	78.66%
	CB5	CB5	MAIN										0.054	0.14	0.14	10.00	0.06	10.06	76.81	104.19	122.14	178.56	10.38	14.08	16.50	24.12		10.38	48.39	5.72	200			2.00	1.492	38.01	78.56%
		MH205	MH204											0.00	0.94	10.63	0.71	11.34	74.46	100.97	118.35	172.98	70.08	95.03	111.38	162.81		70.08	100.88	58.64	300			1.00	1.383	30.80	30.53%
																														0.00							
		MH204	MH203											0.00	0.94	11.34	0.32	11.66	72.02	97.62	114.40	167.18	67.78	91.87	107.67	157.35		67.78	100.88	26.75	300			1.00	1.383	33.10	32.81%
	CB3	CB3	CB2										0.037	0.09	0.09	10.00	0.28	10.28	76.81	104.19	122.14	178.56	7.11	9.65	11.31	16.53		7.11	100.88	23.25	300			1.00	1.383	93.77	92.95%
	CB2	CB2	MH 202										0.066	0.17	0.26	10.28	0.12	10.40	75.75	102.74	120.42	176.04	19.52	26.48	31.03	45.37		19.52	100.88	9.92	300			1.00	1.383	81.36	80.65%
	CB1 & CB4	MH 202	MH203										0.119	0.30	0.56	10.40	0.12	10.52	75.30	102.13	119.71	174.98	41.83	56.73	66.49	97.19		41.83	62.04	8.53	250			1.00	1.224	20.21	32.58%
	CB12	MH203	MH201				0.084							0.12	1.61	11.66	0.34	12.00	70.97	96.17	112.69	164.68	114.49	155.16	181.81	265.69		114.49	182.91	33.02	375			1.00	1.604	68.42	37.40%
		MH201	MH200											0.00	1.61	12.00	0.22	12.23	69.88	94.68	110.94	162.10	112.74	152.75	178.98	261.53		112.74	163.60	19.34	375			0.80	1.435	50.86	31.09%
	CB11	CB11	MH200				0.119							0.17	0.17	10.00	0.06	10.06	76.81	104.19	122.14	178.56	12.70	17.23	20.20	29.54		12.70	76.51	8.82	200			5.00	2.359	63.81	83.40%
		MH200	*EXMH6117*											0.00	1.78	12.23	0.23	12.46	69.19	93.73	109.82	160.46	123.07	166.73	195.35	285.43		123.07	301.81	14.25	600			0.22	1.034	178.74	59.22%
												TOTAL	0.806	1.78	TRUE																						

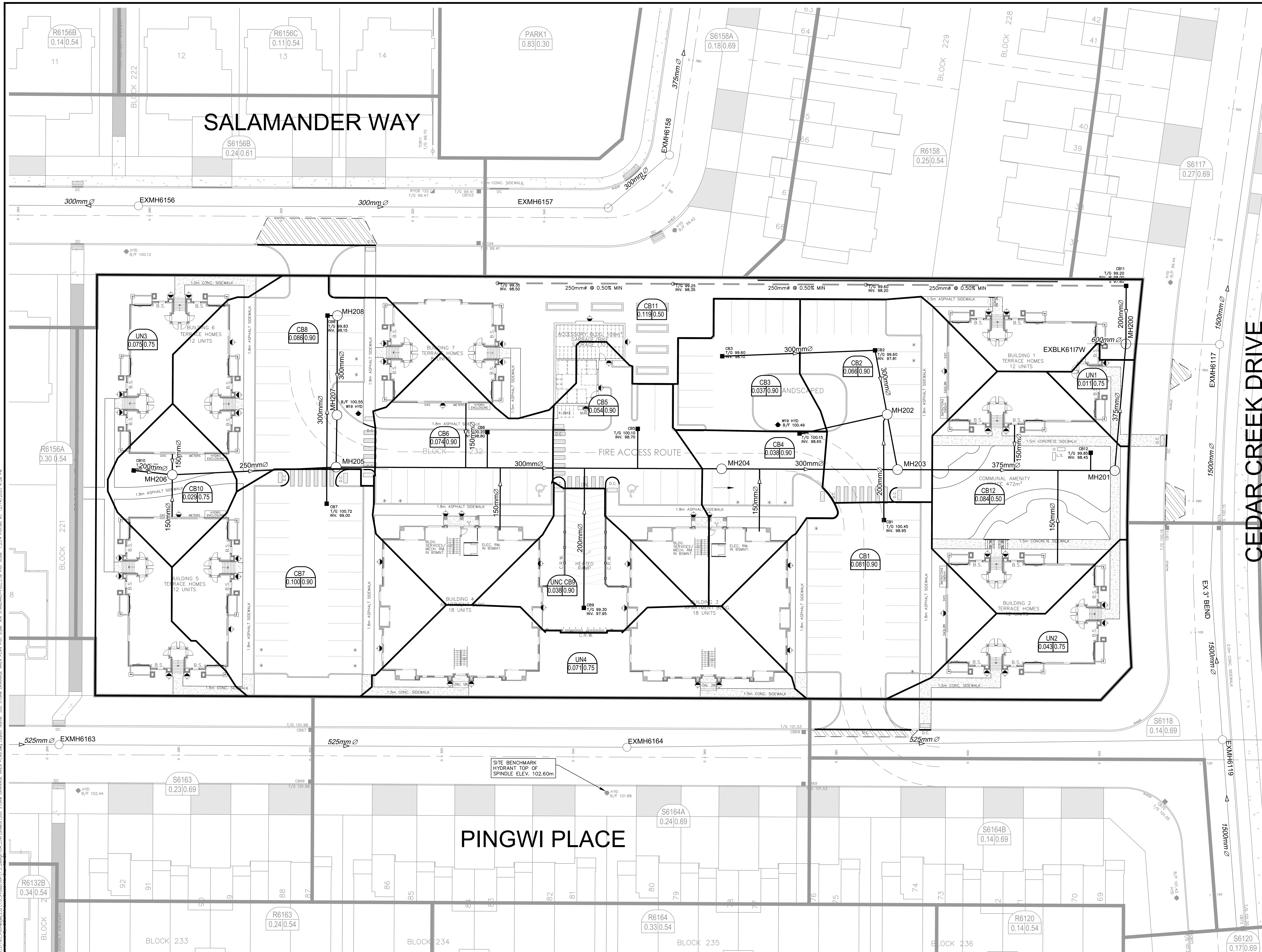
Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

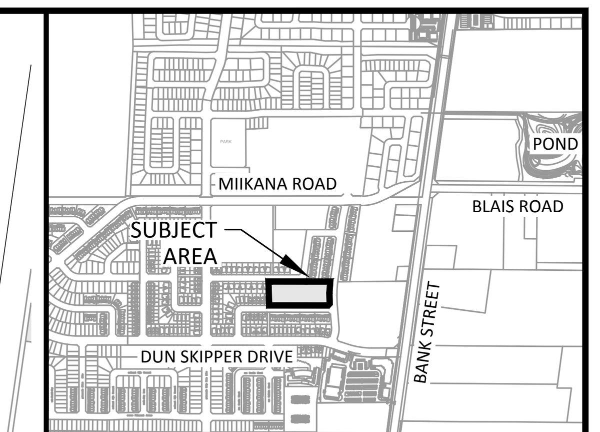
Notes:
1. Mannings coefficient (n) = 0.013

Designed: W.Z.
Checked: R.M.
Dwg. Reference: 121793-500

No.	Revision	Date
1.	Pathways Block 232 Servicing Brief - Submission No. 1	2019-12-13
2.	Pathways Block 232 Servicing Brief - Submission No. 2	2020-09-18

File Reference:	Date:	Sheet No:
121793.6.2.4	2019-12-13	1 of 1





KEY PLAN
N.T.S.

NOTES:
1. SEE DRAWING C-010, C-011 FOR ADDITIONAL DETAILS AND NOTES.
2. SITE BENCHMARK OBTAINED FROM LEGAL SURVEYOR ANNIS O'SULLIVAN VOLLEBEKK LTD. TOP SPINDLE OF HYDRANT ON PINGWI PLACE, ELEV.=102.60m

LEGEND :

6115A 0.81 0.25 — AREA NUMBER, RUNOFF COEFFICIENT, AREA IN HECTARES

FUTURE FLOW DIRECTION

6115A 0.81 0.35 — EXISTING AREA NUMBER, EXISTING RUNOFF COEFFICIENT, AREA IN HECTARES

EXISTING FLOW DIRECTION

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3	REVISED AS PER CITY COMMENTS	DGY	2020:12:14
2	REVISED AS PER CITY COMMENTS	DGY	2020:09:18
1	ISSUED FOR SPA	DGY	2019:12:18

DCR/PHOENIX GROUP OF COMPANIES

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title
1055 CEDAR CREEK DRIVE

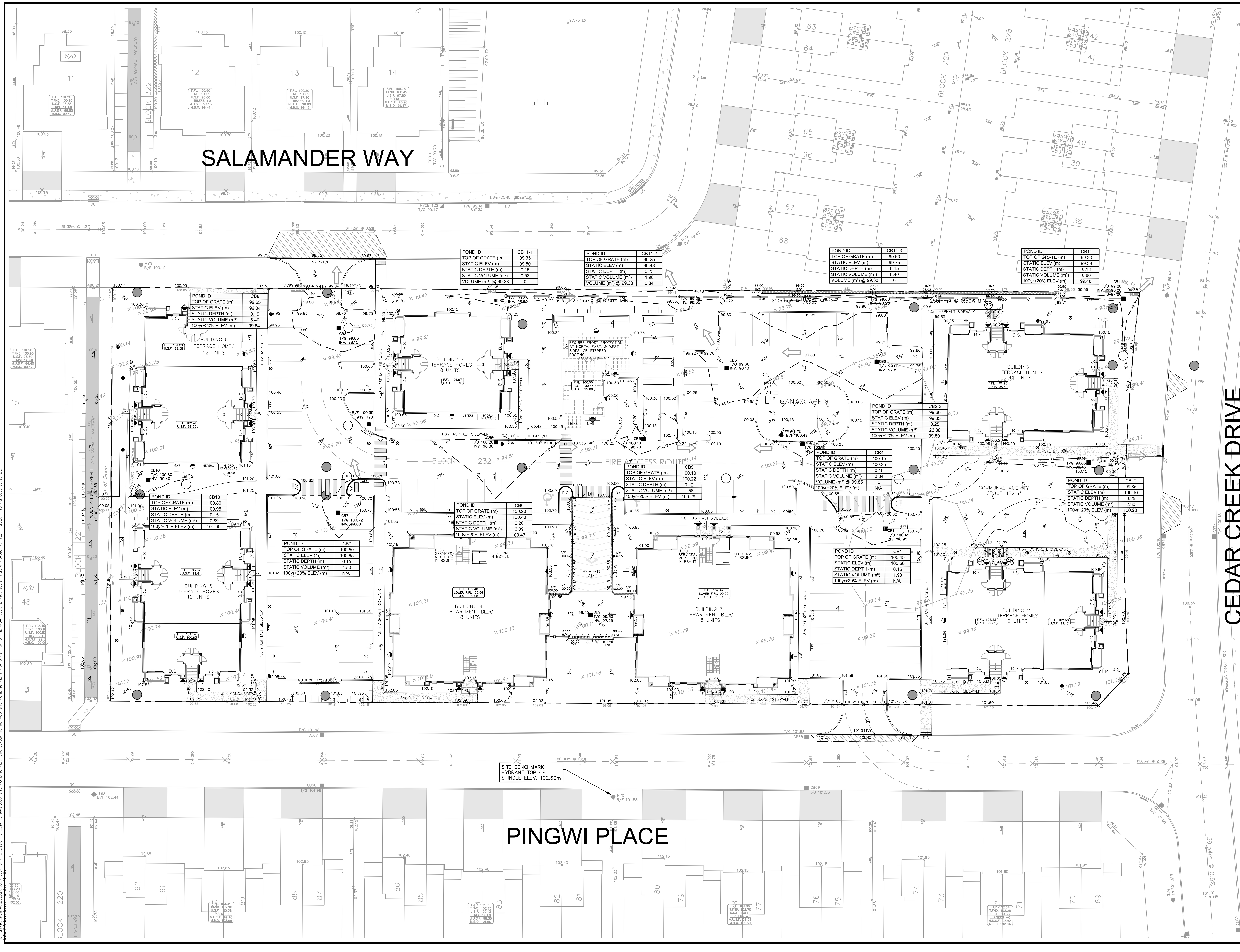
LICENSED PROFESSIONAL ENGINEER D. G. Yannoulopoulos 2020/12/14 PROVINCE OF ONTARIO

Drawing Title
STORM DRAINAGE AREA PLAN

Scale
1:250

Design	Date
RM/WZ	SEPT, 2019
Drawn	Checked
DPS/WZ	DGY
Project No.	Drawing No.
121793	500

D07-12-20-0037



POND ID	CB11-1
TOP OF GRATE (m)	99.35
STATIC ELEV (m)	99.50
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	0.53
VOLUME (m³) @ 99.38	0

POND ID	CB11-2
TOP OF GRATE (m)	99.25
STATIC ELEV (m)	99.48
STATIC DEPTH (m)	0.23
STATIC VOLUME (m³)	1.98
VOLUME (m³) @ 99.38	0.34

POND ID	CB11-3
TOP OF GRATE (m)	99.60
STATIC ELEV (m)	99.75
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	0.40
VOLUME (m³) @ 99.38	0

POND ID	CB11
TOP OF GRATE (m)	99.20
STATIC ELEV (m)	99.38
STATIC DEPTH (m)	0.18
STATIC VOLUME (m³)	0.86
100yr+20% ELEV (m)	99.48

POND ID	CB8
TOP OF GRATE (m)	99.65
STATIC ELEV (m)	99.84
STATIC DEPTH (m)	0.19
STATIC VOLUME (m³)	6.40
100yr+20% ELEV (m)	99.84

POND ID	CB2-3
TOP OF GRATE (m)	99.60
STATIC ELEV (m)	99.85
STATIC DEPTH (m)	0.25
STATIC VOLUME (m³)	26.38
100yr+20% ELEV (m)	99.89

POND ID	CB4
TOP OF GRATE (m)	100.15
STATIC ELEV (m)	100.25
STATIC DEPTH (m)	0.10
STATIC VOLUME (m³)	0.34
VOLUME (m³) @ 99.85	0
100yr+20% ELEV (m)	N/A

POND ID	CB5
TOP OF GRATE (m)	100.10
STATIC ELEV (m)	100.22
STATIC DEPTH (m)	0.12
STATIC VOLUME (m³)	1.58
100yr+20% ELEV (m)	100.29

POND ID	CB12
TOP OF GRATE (m)	99.85
STATIC ELEV (m)	100.10
STATIC DEPTH (m)	0.25
STATIC VOLUME (m³)	2.30
100yr+20% ELEV (m)	100.20

POND ID	CB10
TOP OF GRATE (m)	100.80
STATIC ELEV (m)	100.95
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	0.89
100yr+20% ELEV (m)	101.00

POND ID	CB6
TOP OF GRATE (m)	100.20
STATIC ELEV (m)	100.40
STATIC DEPTH (m)	0.20
STATIC VOLUME (m³)	6.39
100yr+20% ELEV (m)	100.47

POND ID	CB7
TOP OF GRATE (m)	100.50
STATIC ELEV (m)	100.65
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	1.50
100yr+20% ELEV (m)	N/A

POND ID	CB1
TOP OF GRATE (m)	100.45
STATIC ELEV (m)	100.60
STATIC DEPTH (m)	0.15
STATIC VOLUME (m³)	1.93
100yr+20% ELEV (m)	N/A

KEY PLAN
N.T.S.

NOTES:
1. SEE DRAWING C-010, C-011 FOR ADDITIONAL DETAILS AND NOTES.
2. SITE BENCHMARK OBTAINED FROM LEGAL SURVEYOR ANNIS O'SULLIVAN VOLLEBEKK LTD. TOP SPINDLE OF HYDRANT ON PINGWI PLACE, ELEV.=102.60m

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3	REVISED AS PER CITY COMMENTS	DGY	2020:12:14
2	REVISED AS PER CITY COMMENTS	DGY	2020:09:18
1	ISSUED FOR SPA	DGY	2019:12:18

DCR/PHOENIX GROUP OF COMPANIES

IBI GROUP
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Ottawa ON K1S 5N4 Canada
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ibigroup.com

Project Title
1055 CEDAR CREEK DRIVE
CREEK DRIVE

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/12/14
PROVINCE OF ONTARIO

Drawing Title
SITE PONDING PLAN

Scale
1:250

Design	Date
RM/WZ	SEPT. 2019
Drawn	**Checked**
DPS/WZ	DGY
Project No.	**Drawing No.**
121793	600

D07-12-20-0037

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Ottawa, Ontario K1S 5N4 Canada
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LEGEND
Black text 5 year event curve design
Red text 10 year event curve design (Earl Armstrong Road)

STORM SEWER DESIGN SHEET

Pathways at FINDLAY CREEK
City of Ottawa
Leitrim South Holdings Inc. (Regional Group)

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW													SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.15	C= 0.30	C= 0.40	C= 0.54	C= 0.61	C= 0.65	C= 0.69	C= 0.71	C= 0.75	C= 0.80	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (5yr) (L/s)	(%)
	EXT 1			DRAFT 2016 UPDATED SERVICEABILITY REPORT											0.92			11.23																	
Kelly Farm Drive	S6110B	BLK6110S	MH6110					0.33						0.56	1.48	11.23	0.26	11.49	98.12	114.98	168.05	145.17				145.17	214.00	45.00	300			4.50	2.933	68.83	32.16%
Dun Skipper Road	S6132A, R6132D	MH6132	MH6110				0.11	0.21						0.52	0.52	10.00	0.67	10.67	104.19	122.14	178.56	54.31				54.31	231.37	82.00	375			1.60	2.029	177.06	76.53%
Kelly Farm Drive	S6110A	MH6110	MH6109					0.29						0.49	2.49	11.49	0.47	11.96	96.95	113.61	166.03	241.66				241.66	515.17	88.69	450			3.00	3.138	273.51	53.09%
Kelly Farm Drive	R6109	MH6109	MH6108				0.31							0.47	2.96	11.96	0.45	12.41	94.88	111.18	162.45	280.66				280.66	515.17	85.00	450			3.00	3.138	234.51	45.52%
Salamander Way	S6156A, R6156A-B	MH6156	MH6155				0.44	0.21						1.02	1.02	10.00	0.76	10.76	104.19	122.14	178.56	105.93				105.93	142.67	88.69	300			2.00	1.955	36.74	25.75%
Salamander Way	S6155A-B, R6155	MH6155	MH6108				0.54	0.43						1.54	2.56	10.76	0.74	11.50	100.36	117.63	171.93	256.58				256.58	325.82	88.07	450			1.20	1.985	69.25	21.25%
Kelly Farm Drive	S6108A-B,R6108A-B	MH6108	MH6107				0.46	0.36						1.30	6.82	12.41	0.44	12.85	92.99	108.95	159.18	633.76				633.76	1,109.24	79.65	675			1.60	3.003	475.48	42.87%
Kelly Farm Drive	S6107	MH6107	MH6106					0.25						0.42	7.24	12.85	0.23	13.08	91.21	106.86	156.12	660.34				660.34	1,109.24	41.01	675			1.60	3.003	448.90	40.47%
Dun Skipper Road	R6131B	MH6131B	MH6131				0.54							0.81	0.81	10.00	0.49	10.49	104.19	122.14	178.56	84.46				84.46	115.02	46.00	300			1.30	1.576	30.56	26.57%
Dun Skipper Road	S6131A-B	MH6131	MH6130					0.49						0.83	1.64	10.49	0.50	10.98	101.69	119.20	174.23	166.94				166.94	329.75	86.07	375			3.25	2.892	162.81	49.37%
Minikan Street	S6130, R6130	MH6130	MH6170				0.10	0.25						0.57	2.22	10.98	0.52	11.51	99.28	116.35	170.05	219.96				219.96	420.63	80.58	450			2.00	2.562	200.67	47.71%
Minikan Street	S6170, R6170	MH6170	MH6171				0.25	0.36						0.99	3.20	11.51	0.55	12.06	96.86	113.50	165.87	310.08				310.08	441.17	88.94	450			2.20	2.687	131.08	29.71%
	EXT 6			DRAFT 2016 UPDATED SERVICEABILITY REPORT											62.99			24.12																	
Spreadwing Way		BLK3171W	MH6171											0.00	62.99	24.12	0.34	24.46	62.34	72.92	106.33	3,926.53				3,926.53	7,005.73	40.00	2100			0.15	1.959	3079.20	43.95%
Spreadwing Way	S6171, R6171	MH6171	MH6183				0.32	0.15						0.73	66.92	24.46	0.71	25.17	61.77	72.25	105.35	4,134.00				4,134.00	7,005.73	83.00	2100			0.15	1.959	2871.73	40.99%
Zaatiik Grove		MH6180	MH6181											0.00	0.00	10.00	0.74	10.74	104.19	122.14	178.56	0.00				0.00	100.88	61.25	300			1.00	1.383	100.88	100.00%
Zaatiik Grove	S6181, R6181	MH6181	MH6182				0.47	0.29						1.20	1.20	10.74	0.12	10.86	100.45	117.73	172.08	120.27				120.27	182.91	11.82	375			1.00	1.604	62.64	34.25%
Zaatiik Grove	S6182, R6182	MH6182	MH6183				0.31	0.20						0.80	2.00	10.86	0.52	11.38	99.85	117.03	171.05	199.90				199.90	289.21	79.10	375			2.50	2.537	89.31	30.88%
Zaatiik Grove	S6183A-B, R6183	MH6183	MH6175				0.26	0.38						1.03	69.96	25.17	1.01	26.17	60.63	70.91	103.39	4,241.85				4,241.85	7,005.73	118.56	2100			0.15	1.959	2763.88	39.45%
Minikan Street	S6176, R6176A-B	MH6176	MH6172				0.46	0.05						0.78	0.78	10.00	0.83	10.83	104.19	122.14	178.56	80.79				80.79	158.41	69.50	375			0.75	1.389	77.62	49.00%
	EXT 7			DRAFT 2016 UPDATED SERVICEABILITY REPORT											1.50			12.90																	
Viceroy Mews		BLK6172W	MH6172											0.00	1.50	12.90	0.74	13.64	91.02	106.63	155.78	136.64				136.64	200.65	40.00	525			0.20	0.898	64.01	31.90%
Minikan Street	S6172	MH6172	MH6173					0.11						0.19	2.46	13.64	0.53	14.17	88.22	103.33	150.94	217.28				217.28	402.33	27.82	750			0.12	0.882	185.04	45.99%
Minikan Street	S6173, R6173	MH6173	MH6174				0.40	0.31						1.13	3.59	14.17	0.22	14.39	86.34	101.13	147.71	309.91				309.91	402.33	11.80	750			0.12	0.882	92.41	22.97%
Minikan Street		MH6174	MH6175											0.00	3.59	14.39	1.38	15.77	85.58	100.23	146.38	307.16				307.16	402.33	73.12	750			0.12	0.882	95.16	23.65%
Minikan Street	S6175	MH6175	MH6106					0.18						0.31	73.86	26.17	0.78	26.95	59.08	69.10	100.73	4,363.59				4,363.59	7,005.73	91.44	2100			0.15	1.959	2642.14	37.71%
Kelly Farm Drive	S6106, R6106	MH6106	MH6105				0.27	0.24						0.81	81.91	26.95	0.74	27.69	57.95	67.76	98.78	4,746.28				4,746.28	7,005.73	86.86	2100			0.15	1.959	2259.45	32.25%
	EXT 8			DRAFT 2016 UPDATED SERVICEABILITY REPORT											12.34			18.40																	
Miikana Road		BLK6105W	MH6105											0.00	12.34	18.40	0.25	18.65	73.97	86.58	126.36	913.03				913.03	1,575.26	20.00	1200			0.15	1.349	662.23	42.04%
Miikana Road	S6105A-C	MH6105	MH6104							0.48				0.92	95.17	27.69	1.12	28.81	56.91	66.55	97.00	5,416.41				5,416.41	8,166.82	117.89	2400			0.10	1.749	2750.41	33.68%
Block 450	INST	BLK6102S	MH6104									2.55		5.32	5.32	12.00	0.25	12.25	94.70	110.96	162.13	503.47				503.47	636.13	21.00	750			0.30	1.395	132.66	20.85%
Miikana Road	S6104A-B	MH6104	MH6103							0.32				0.61	0.61	0.00	1.14	1.14	230.48	271.61	398.62	141.48				141.48	8,166.82	119.43	2400			0.10	1.749	8025.35	98.27%
Miikana Road	S6103	MH6103	MH6102							0.16				0.31	95.48	28.81	0.40	29.21	55.42	64.79	94.42	5,290.92				5,290.92	8,166.82	42.00	2400			0.10	1.749	2875.90	35.21%
Block 436	HD2	BLK6102S	MH6102										0.94	2.09	2.09	12.00	0.36	12.36	94.70	110.96	162.13	197.97				197.97	286.47	21.00	600			0.20	0.982	88.50	30.89%
Miikana Road	S6102A-B, R6102	MH6102	MH6101				0.12			0.32				0.79	98.36	29.21	0.92	30.13	54.90	64.19	93.54	5,400.36				5,400.36	8,166.82	96.27	2400			0.10	1.749	2766.46	33.87%

Definitions:
Q = 2.78CiA, 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] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

Designed: W.Y.
Checked: J.M.
Dwg. Reference: 500, 500A

No.	Revision	Date
1.	City Submission No. 1	11/23/2016
2.	City Submission No. 2	5/12/2017
3.	City Submission No. 3	7/6/2017
4.	Updated Street Name for MOE Submission	8/3/2017

File Reference:	Date:	Sheet No:
33956.5.7.1	5/10/2017	1 of 2

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

STORM SEWER DESIGN SHEET

Pathways at FINDLAY CREEK
City of Ottawa
Leitrim South Holdings Inc. (Regional Group)

LEGEND
Black text 5 year event curve design
Red text 10 year event curve design (Earl Armstrong Road)

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW													SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.15	C= 0.30	C= 0.40	C= 0.54	C= 0.61	C= 0.65	C= 0.69	C= 0.71	C= 0.75	C= 0.80	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (5yr) (L/s)	(%)
	EXT 2			DRAFT 2016 UPDATED SERVICEABILITY REPORT											4.92			12.88																	
Street No. 7	S6133B	BLK6133S	MH6133					0.20						0.34	5.25	12.88	0.33	13.21	91.10	106.72	155.91	478.64				478.64	1,296.87	47.00	825			0.75	2.350	818.23	63.09%
Dun Skipper Road	S6132B, R6132A, R6132C	MH6132	MH6133				0.70	0.20						1.39	1.39	10.00	1.04	11.04	104.19	122.14	178.56	144.83				144.83	149.72	82.07	375			0.67	1.313	4.89	3.27%
Dun Skipper Road	S6133A, R6133	MH6133	MH6134				0.16	0.30						0.75	7.39	13.21	0.40	13.61	89.81	105.21	153.69	663.99				663.99	1,640.43	71.48	825			1.20	2.973	976.44	59.52%
Dun Skipper Road	R6134	MH6134	MH6135				0.20							0.30	7.69	13.61	0.52	14.13	88.32	103.45	151.12	679.48				679.48	1,580.10	74.61	900			0.70	2.406	900.63	57.00%
Dun Skipper Road	S6135	MH6135	MH6136					0.18						0.31	8.00	14.13	0.20	14.33	86.47	101.28	147.93	691.68				691.68	1,580.10	28.36	900			0.70	2.406	888.43	56.23%
				DRAFT 2016 UPDATED SERVICEABILITY REPORT																															
				DRAFT 2016 UPDATED SERVICEABILITY REPORT																															
	EXT 4	BLK900	MH6140									4.04		8.42	16.42	15.74	0.16	15.90	81.24	95.13	138.90	1,334.13				1,742.71	2,490.17	16.00	1350			0.20	1.685	747.46	30.02%
	EXT 5	BLK900	MH6140									2.06		4.30	4.30	15.74	0.16	15.90	81.24	95.13	138.90		408.58			1,742.71	2,490.17	16.00	1350			0.20	1.685	747.46	30.02%
Dun Skipper Road	S6140A-C	MH6140	MH6139							0.22				0.42	16.84	15.90	0.73	16.63	80.76	94.57	138.07	1,360.38				1,766.55	2,156.55	64.00	1350			0.15	1.460	390.00	18.08%
		MH6140	MH6139											0.00	4.30	15.90	0.73	16.63	80.76	94.57	138.07		406.17			1,766.55	2,156.55	64.00	1350			0.15	1.460	390.00	18.08%
Dun Skipper Road	S6139	MH6139	MH6138							0.08				0.15	17.00	16.63	0.38	17.01	78.64	92.07	134.41	1,336.66				1,732.10	2,156.55	33.27	1350			0.15	1.460	424.45	19.68%
		MH6139	MH6138											0.00	4.30	16.63	0.38	17.01	78.64	92.07	134.41		395.44			1,732.10	2,156.55	33.27	1350			0.15	1.460	424.45	19.68%
Dun Skipper Road	S6138	MH6138	MH6137							0.08				0.15	17.15	17.01	0.38	17.39	77.58	90.83	132.59	1,330.61				1,720.72	2,156.55	33.26	1350			0.15	1.460	435.83	20.21%
		MH6138	MH6137											0.00	4.30	17.01	0.38	17.39	77.58	90.83	132.59		390.11			1,720.72	2,156.55	33.26	1350			0.15	1.460	435.83	20.21%
Dun Skipper Road		MH6137	MH6136											0.00	17.15	17.39	0.46	17.84	76.56	89.62	130.82	1,313.04				1,697.97	2,156.55	39.90	1350			0.15	1.460	458.57	21.26%
		MH6137	MH6136											0.00	4.30	17.39	0.46	17.84	76.56	89.62	130.82		384.93			1,697.97	2,156.55	39.90	1350			0.15	1.460	458.57	21.26%
Temp Ditch		DI 1	BLK6145		6.71									5.60	5.60	49.35	0.01	49.36	38.01	44.39	64.57	212.72				212.72	448.66	1.00	525			1.00	2.008	235.93	52.59%
				DRAFT 2016 UPDATED SERVICEABILITY REPORT																															
Easement	EXT 3	BLK6145	MH6146									2.50		5.21	9.51	12.00	0.26	12.26	94.70	110.96	162.13	900.33				900.33	1,280.55	25.77	975			0.30	1.662	380.22	29.69%
Easement	S6146	MH6146	MH6136					0.21						0.36	9.86	12.26	0.52	12.77	93.61	109.68	160.25	923.30				923.30	1,280.55	51.42	975			0.30	1.662	357.24	27.90%
Cedar Creek Drive		MH6136	BEND6121											0.00	35.01	17.84	0.23	18.08	75.37	88.22	128.77	2,638.86				3,017.79	3,297.98	25.33	1500			0.20	1.808	280.19	8.50%
		BEND6121	MH6120											0.00	35.01	18.08	0.12	18.20	74.77	87.52	127.74	2,618.06				2,993.99	3,297.98	13.56	1500			0.20	1.808	303.99	9.22%
		MH6136	BEND6121											0.00	4.30	17.84	0.23	18.08	75.37	88.22	128.77		378.93			3,017.79	3,297.98	25.33	1500			0.20	1.808	280.19	8.50%
		BEND6121	MH6120											0.00	4.30	18.08	0.12	18.20	74.77	87.52	127.74		375.93			2,993.99	3,297.98	13.56	1500			0.20	1.808	303.99	9.22%
Cedar Creek Drive	S6120, R6120	MH6120	MH6119				0.14			0.17				0.54	35.55	18.08	0.52	18.60	74.77	87.52	127.74	2,658.16				3,034.08	3,297.98	56.40	1500			0.20	1.808	263.90	8.00%
		MH6120	MH6119											0.00	4.30	18.08	0.52	18.60	74.77	87.52	127.74		375.93			3,034.08	3,297.98	56.40	1500			0.20	1.808	263.90	8.00%
Pingwi Place	S6132C, R6132B	MH6132	MH6161				0.34	0.17						0.80	0.80	10.00	0.64	10.64	104.19	122.14	178.56	83.22				83.22	101.94	76.86	250			2.70	2.012	18.72	18.37%
Pingwi Place		MH6161	MH6162											0.00	0.80	10.64	0.12	10.76	100.95	118.32	172.94	80.62				80.62	182.91	11.65	375			1.00	1.604	102.29	55.92%
Pingwi Place	S6162	MH6162	MH6163					0.21						0.36	1.15	10.76	1.39	12.14	100.35	117.62	171.92	115.89				115.89	200.65	74.71	525			0.20	0.898	84.76	42.24%
Pingwi Place	S6163, R6163	MH6163	MH6164				0.24			0.23				0.80	1.96	12.14	1.21	13.36	94.08	110.24	161.07	184.05				184.05	265.43	86.36	525			0.35	1.188	81.37	30.66%
Pingwi Place	S6164A-B, R6164	MH6164	MH6119				0.33			0.38				1.22	3.18	13.36	0.87	14.22	89.27	104.58	152.76	283.94				283.94	388.55	90.57	525			0.75	1.739	104.60	26.92%
Block 429	COM	BLK6119	MH6119									3.01		6.28	6.28	12.00	0.22	12.22	94.70	110.96	162.13	594.30				594.30	844.60	17.00	900			0.20	1.286	250.30	29.64%
Cedar Creek Drive	S6118	MH6119	BEND6118							0.14				0.27	45.27	18.60	0.19	18.79	73.49	86.01	125.53	3,327.09				3,696.53	4,039.18	25.02	1500			0.30	2.214	342.66	8.48%
		BEND6118	MH6117											0.00	45.27	18.79	0.26	19.05	73.03	85.48	124.74	3,306.54				3,673.69	4,039.18	35.20	1500			0.30	2.214	365.50	9.05%
		MH6119	BEND6118											0.00	4.30	18.60	0.19	18.79	73.49	86.01	125.53		369.43			3,696.53	4,039.18	25.02	1500			0.30	2.214	342.66	8.48%
		BEND6118	MH6117											0.00	4.30	18.79	0.26	19.05	73.03	85.48	124.74		367.14			3,673.69	4,039.18	35.20	1500			0.30	2.214	365.50	9.05%
Block 443	HD1	BLK6117W	MH6117										1.02	2.27	2.27	12.00	0.30	12.30	94.70	110.96	162.13	214.82				214.82	320.28	20.00	600			0.25	1.097	105.46	32.93%
Cedar Creek Drive	S6117	MH6117	MH6116							0.27				0.52	48.06	19.05	0.51	19.56	72.41	84.74	123.66	3,479.86				3,843.83	4,362.82	73.12	1500			0.35	2.392	518.99	11.90%
		MH6117	MH6116											0.00	4.30	19.05	0.50	19.56	72.41	84.74	123.66		363.97			3,843.83	4,362.82	72.31	1500			0.35	2.392	518.99	11.90%
Cedar Creek Drive	S6116, R6116A-B	MH6116	MH6115				0.27			0.34				1.06	49.12	19.56	0.41	19.97	71.23	83.36	121.64	3,498.73				3,856.77	5,214.57	69.61	1500			0.50	2.859	1357.80	26.04%
Cedar Creek Drive		MH6116	MH6115											0.00	4.30	19.56	0.40	19.96	71.23	83.36	121.64		358.04			3,856.77	5,214.57	69.28	1500			0.50	2.859	1357.80	26.04%
Salamander Way	S6156B, R6156C	MH6156	MH6157				0.11	0.24						0.57	0.57	10.00	0.93	10.93	104.19	122.14	178.56	59.61				59.61	93.01	71.45	300			0.85	1.275	33.40	35.91%
Salamander Way		MH6157	MH6158											0.00	0.57	10.93	0.15	11.08	99.50	116.62	170.45	56.93				56.93	100.88	12.31	300			1.00	1.383	43.95	43.57%
Salamander Way	S6158A-B, R6158	MH6158	MH6153				0.25			0.35				1.05	1.62	11.08	0.67	11.75	98.80	115.79	169.23	159.94				159.94	300.55	105.99	375			2.70	2.636	140.61	46.78%
Block 438 (Park)	PARK1	BLK6153B	MH6153		0.83									0.69	0.69	11.00	0.16	11.16	99.19	116.25	169.91	68.66				68.66	100.88	13.00	300			1.00	1.383	32.22	31.94%
Salamander Way		MH6153	MH6154											0.00	2.31	11.75	0.13	11.88	95.76	112.22	163.98	221.31				221.31	248.85	11.90	450			0.70	1.516	27.54	11.07%
Salamander Way	S6154, R6154	MH6154	MH6115				0.26			0.16				0.70	3.01	11.88	0.86	12.75	95.20	111.55	163.00	286.37				286.37	452.94	80.33	600			0.50	1.552	166.57	36.78%
Cedar Creek Drive	S6115	MH6115	MH6101							0.33				0.63	52.76	19.97	0.51	20.48	70.32	82.30	120.08	3,710.31				4,063.81	5,214.57	88.17	1500			0.50	2.859	1150.76	22.07%
Cedar Creek Drive		MH6115	MH6101											0.00	4.30	19.96	0.52	20.48	70.33	82.30	120.08		353.50			4,063.81	5,214.57	88.50	1500			0.50	2.859	1150.76	22.07%
Miikana Road	S6101A-B,R6101	MH6101	BLK6101				0.15			0.14				0.49	151.62	30.13	0.23	30.36	53.77	62.86	91.59	8,151.91				8,421.89	12,912.88	38.34	2400			0.25	2.765	4490.99	34.78%
Miikana Road		MH6101	BLK6101											0.00	4.30	30.13	0.23	30.36	53.77	62.86	91.59		269.98			8,421.89	12,912.88	38.34	2400			0.25	2.765	4490.99	34.78%
Dun Skipper culvert				31.15										12.99	12.99	92.20	0.39	92.59	23.84	27.80	40.35	309.73				309.73	452.94	36.00	600			0.50	1.552	143.21	31.62%

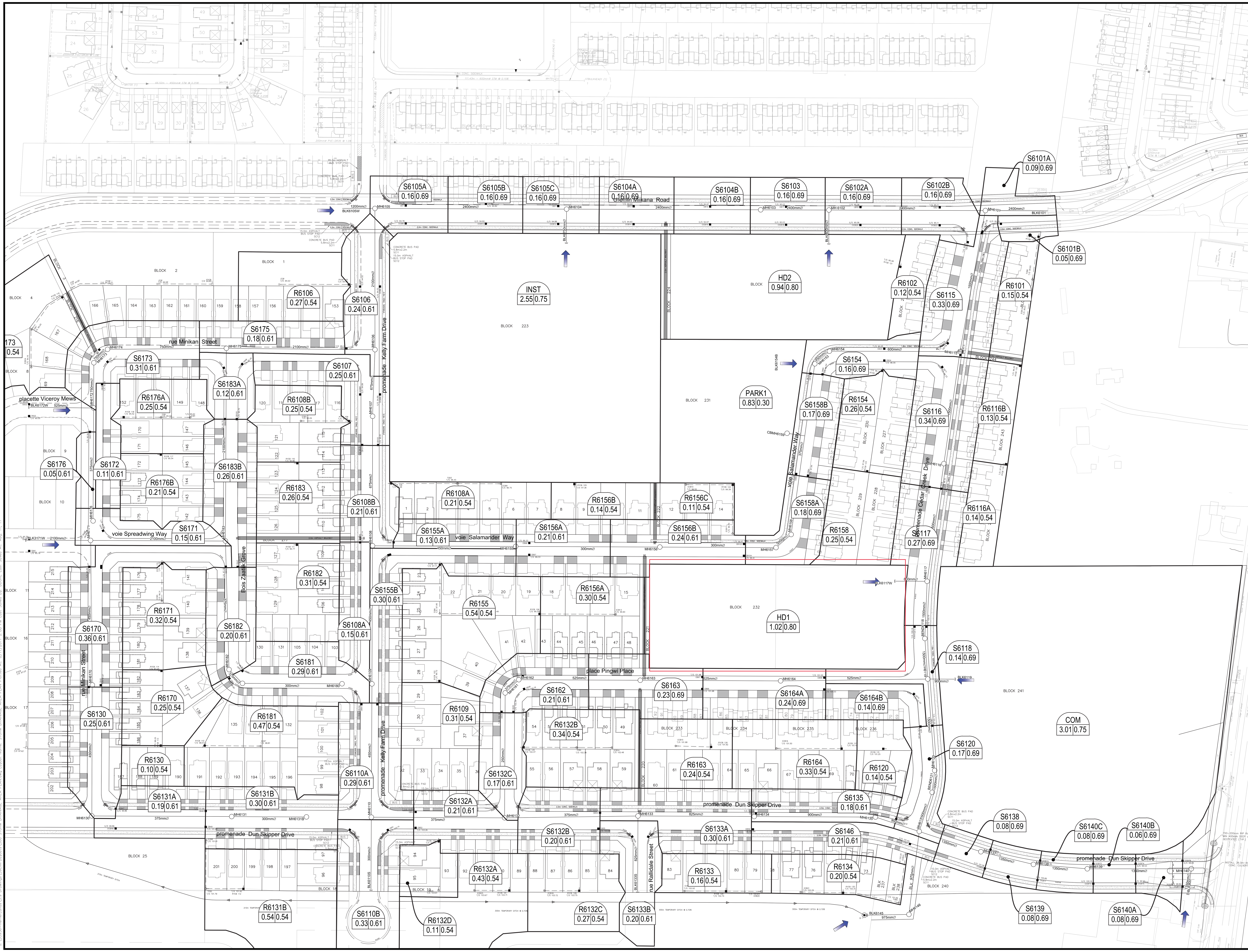
Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

Designed: W.Y.
Checked: J.M.
Dwg. Reference: 500, 500A

No.	Revision	Date
1.	City submission No. 1	11/23/2016
2.	City Submission No. 2	5/12/2017
3.	City Submission No. 3	7/6/2017
4.	Updated Street Name for MOE Submission	8/3/2017

File Reference:	Date:	Sheet No:
33956.5.7.1	5/10/2017	2 of 2



REVIEWED BY
DEVELOPMENT REVIEW SERVICES BRANCH

Signed ____________

Date ____________ 2017

Plan Number ____________

LEGEND :

S168 — AREA NUMBER
0.69 — RUNOFF COEFFICIENT
2.01 — AREA IN HECTARES
➔ FUTURE MINOR FLOW DIRECTION

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5	REVISED BLOCK NUMBERS	J.I.M.	2017:08:11
4	RE-SUBMISSION FOR MOECC APPROVAL & REVISED STREET NAMES	J.I.M.	2017:08:02
3	SUBMISSION FOR MOECC APPROVAL	J.I.M.	2017:07:07
2	SUBMISSION No.2 FOR CITY REVIEW	J.I.M.	2017:05:12
1	SUBMISSION No.1 FOR CITY REVIEW	J.I.M.	2016:11:23

LEITRIM SOUTH HOLDINGS INC.

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

pathways at FINDLAY CREEK

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2017/08/02
PROVINCE OF ONTARIO

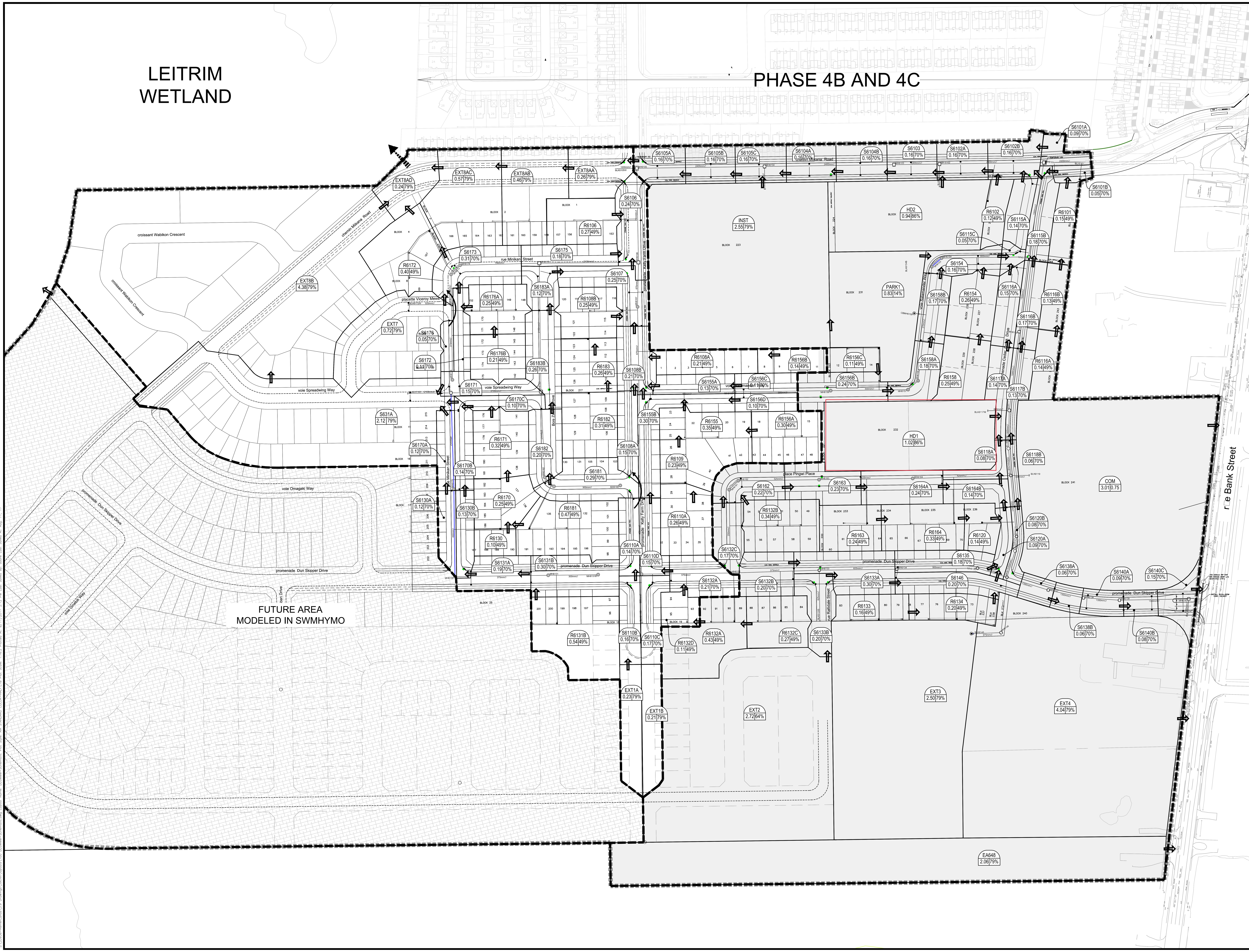
Drawing Title

STORM DRAINAGE AREA PLAN

Scale	1 : 1000
Design: J.I.M.	Date: NOV 2016
Drawn: D.D.	Checked: ----
Project No.: 33956	Drawing No.: 500

D07-16-13-0023

#17367



LEGEND:

- PHASE 1 EAST DRAINAGE AREA MODELED IN DDSWMM
- PHASE 1 WEST DRAINAGE AREA MODELED IN DDSWMM
- FUTURE DRAINAGE AREA MODELED IN DDSWMM
- PHASE 1 DRAINAGE BOUNDARY
- DDSWMM MODELS DRAINAGE BOUNDARIES
- SUBCATCHMENT DRAINAGE BOUNDARY
- S208 — AREA ID
- 71 — Im[illegible]/T[illegible]hr[illegible]
- 0.19 — AREA [illegible]ha[illegible]
- MA[illegible]OR FLOW
- MA[illegible]OR FLOW TO WETLAND

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5	REVISED BLOCK NUMBERS	D.D.	2017:08:11
4	RE-SUBMISSION FOR MOECC APPROVAL & REVISED STREET NAMES	R.B.	2017:08:02
3	SUBMISSION FOR MOECC APPROVAL	R.B.	2017:07:07
2	SUBMISSION NO.2 FOR CITY REVIEW	R.B.	2017:05:12
1	SUBMISSION NO.1 FOR CITY REVIEW	R.B.	2016:11:23

LEITRIM SOUTH HOLDINGS INC.

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Project Title

pathways at FINDLAY CREEK

LICENSED PROFESSIONAL ENGINEER
R.F.D. BROWN
100078940
2017/08/02
PROVINCE OF ONTARIO

N

Drawing Title

DDSWMM SCHEMATIC

Scale
1:1500

Design	Date
R.B.	NOV 2016
Drawn	**Checked**
[illegible]F.	R.B.
Project No.	**Drawing No.**
33956	700

D07-[illegible]

#17367

† Pathways at Findlay Creek Phase 1 West modeled flow is from the DDSWMM output file 33956-PH1W-3CHI2.out, 33956-PH1W-3CHI5.out and 33956-PH1W-3CHI100.out which are all presented on the CD in **Appendix E**.

The assigned size of the inlet control devices (ICDs) for the subject site was optimized using DDSWMM. ICDs are incorporated into the stormwater management design to protect the minor system from surcharge during major storm events. The ICDs used for Phase 1 are provided on **Drawing 010**. It should be noted that due to the increased minor system capture at low points flow, there were a few instances where the flow restriction into the minor system was the capacity of the CB inlet. These include one CB on S6115B, one CB on S6183A, one CB on S6107 (indicated in bold in **Table 4.4**). Calculations demonstrating the capacity of the CBs within a road sag is presented in **Appendix E**. In addition, there are two instances where the CB lead is the restriction for the inflow to the minor system. These include S6115B and S6155B. Calculations supporting the lead size for the inflow restriction are provided in **Appendix E**.

For those areas within Phase 1 which will require a separate site stormwater design and analysis, the following table summarizes the assumed inflow rate and minimum on-site storage required for their design.

Table 4.5 Summary of Minimum On-Site Storage and Minor System Inflow Rate for External Development Lands to Phase 1

Drainage Area		Land Use	IMP Ratio (%)	Minimum On-Site Storage Required (m^3)*	Minor System Inflow Rate (l/s)
Segment ID	Area (ha)				
EXT3	2.50	High Density	79	125.00	469
HD1	1.02	High Density	86	100.00	206
PARK1	0.83	Park	14	150.00	38
HD2	0.94	High Density	86	115.00	190
INST	2.55	School	79	290.00	476
EXT4	4.06	Commercial	79	462.00	760
COM	3.01	Commercial	79	345.00	562

** The on-site storage noted was used to evaluate Phase 1. As a minimum this on-site storage should be provided.*

4.9.3 Simulation Results

Minor system hydrographs generated in DDSWMM were downloaded to the XPSWMM model for hydraulic grade line analysis (refer to **Section 4.10**).

The storage available on-site and its maximum depth and the results of the DDSWMM evaluation for the subject site are presented in **Table 4.6**. Also included in **Table 4.6**, is the duration of ponding and depth of ponding for the 2 year, 5 year, 100 year and July 1, 1979 historical storm events. The ponding plan for the subject site is presented on **Drawing 751**. The DDSWMM output files are presented in **Appendix E**.

Major System Segment HD1

Excerpt from Pathways Phase 1 DDSWMM model results for subject site (100YR 3HR Chicago +20%)

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.004	0.004	0.002	0.000	1.7	0.00
0:30	0.000	0.027	0.027	0.021	0.000	3.5	0.00
0:40	0.000	0.041	0.041	0.038	0.000	4.2	0.00
0:50	0.000	0.098	0.098	0.086	0.000	5.9	0.00
1: 0	0.000	0.474	0.474	0.206	0.000	10.7	66.93
1:10	0.000	0.327	0.327	0.206	0.140	9.3	100.00
1:20	0.000	0.049	0.049	0.206	0.000	4.6	67.61
1:30	0.000	0.079	0.079	0.191	0.000	5.4	0.01
1:40	0.000	0.040	0.040	-0.069	0.000	4.2	0.00
1:50	0.000	0.037	0.037	0.155	0.000	4.0	0.01
2: 0	0.000	0.029	0.029	-0.087	0.000	3.6	0.00
2:10	0.000	0.025	0.025	0.143	0.000	3.4	0.01
2:20	0.000	0.022	0.022	-0.095	0.000	3.3	0.00
2:30	0.000	0.019	0.019	0.137	0.000	3.2	0.01
2:40	0.000	0.018	0.018	-0.099	0.000	3.1	0.00
2:50	0.000	0.016	0.016	0.134	0.000	3.0	0.01
3: 0	0.000	0.000	0.000	-0.111	0.000	0.0	0.00
Maximum	0.000		0.474	0.206	0.140	10.7	100.00
Time (h:min)	0: 0		1: 0	1:10	1:10		

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

33956 Remer Phase 1 - East
DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S6117A

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.001	0.001	0.000	0.000	0.3	0.00
0:30	0.001	0.004	0.004	0.002	0.002	1.6	0.00
0:40	0.001	0.005	0.006	0.003	0.003	1.6	0.00
0:50	0.002	0.012	0.014	0.005	0.007	2.3	0.00
1: 0	0.254	0.063	0.317	0.019	0.277	7.9	0.00
1:10	0.426	0.041	0.467	0.019	0.438	9.2	0.00
1:20	0.030	0.006	0.036	0.019	0.060	3.4	0.00
1:30	0.003	0.010	0.014	0.007	0.010	2.3	0.00
1:40	0.001	0.004	0.005	0.003	0.004	1.6	0.00
1:50	0.001	0.005	0.006	0.003	0.003	1.7	0.00
2: 0	0.001	0.003	0.004	0.002	0.002	1.5	0.00
2:10	0.001	0.003	0.004	0.002	0.002	1.5	0.00
2:20	0.001	0.002	0.003	0.002	0.001	1.2	0.00
2:30	0.001	0.002	0.003	0.001	0.001	1.1	0.00
2:40	0.001	0.002	0.002	0.001	0.001	1.0	0.00
2:50	0.001	0.002	0.002	0.001	0.001	0.9	0.00
3: 0	0.001	0.000	0.001	0.001	0.001	0.2	0.00
Maximum	0.426		0.467	0.019	0.447	9.2	0.00
Time (h:min)	1:10		1:10	1:11	1:11		

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

33956 Remer Phase 1 - East
DUAL DRAINAGE SIMULATION

Major System Segment HD1

Excerpt from Pathways Phase 1 DDSWMM model results for subject site (100 YR 3HR Chicago)

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.001	0.001	0.000	0.000	0.4	0.00
0:30	0.000	0.020	0.020	0.015	0.000	3.2	0.00
0:40	0.000	0.034	0.034	0.031	0.000	3.9	0.00
0:50	0.000	0.080	0.080	0.071	0.000	5.4	0.00
1: 0	0.000	0.382	0.382	0.206	0.000	9.9	41.52
1:10	0.000	0.275	0.275	0.206	0.084	8.7	100.00
1:20	0.000	0.042	0.042	0.206	0.000	4.3	63.50
1:30	0.000	0.064	0.064	0.150	0.000	5.0	0.01
1:40	0.000	0.034	0.034	-0.050	0.000	3.9	0.00
1:50	0.000	0.030	0.030	0.121	0.000	3.7	0.01
2: 0	0.000	0.024	0.024	-0.065	0.000	3.4	0.00
2:10	0.000	0.021	0.021	0.111	0.000	3.2	0.01
2:20	0.000	0.018	0.018	-0.071	0.000	3.1	0.00
2:30	0.000	0.016	0.016	0.107	0.000	3.0	0.01
2:40	0.000	0.015	0.015	-0.075	0.000	2.9	0.00
2:50	0.000	0.013	0.013	0.104	0.000	2.7	0.01
3: 0	0.000	0.000	0.000	-0.084	0.000	0.0	0.00
Maximum	0.000		0.382	0.206	0.084	9.9	100.00
Time (h:min)	0: 0		1: 0	1:10	1:10		

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

33956 Remer Phase 1 - East
DUAL DRAINAGE SIMULATION

MAJOR SYSTEM DETAILED SIMULATION RESULTS

Major System Segment S6117A

Time (hr:min)	U/S Inflow (cms)	Catchment Inflow (cms)	Total Inflow (cms)	Inlet Capture (cms)	Outflow (cms)	Depth at Curb (cm)	Storage (cu.m)
0: 0	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:10	0.000	0.000	0.000	0.000	0.000	0.0	0.00
0:20	0.000	0.000	0.000	0.000	0.000	0.1	0.00
0:30	0.000	0.003	0.004	0.001	0.001	1.4	0.00
0:40	0.001	0.004	0.005	0.002	0.002	1.6	0.00
0:50	0.002	0.010	0.012	0.005	0.006	2.1	0.00
1: 0	0.133	0.050	0.183	0.019	0.150	6.4	0.00
1:10	0.225	0.034	0.259	0.019	0.243	7.3	0.00
1:20	0.015	0.005	0.020	0.016	0.032	2.7	0.00
1:30	0.002	0.008	0.011	0.005	0.007	2.0	0.00
1:40	0.001	0.003	0.004	0.003	0.003	1.5	0.00
1:50	0.001	0.004	0.005	0.002	0.002	1.6	0.00
2: 0	0.001	0.002	0.003	0.002	0.002	1.3	0.00
2:10	0.001	0.002	0.003	0.002	0.001	1.2	0.00
2:20	0.001	0.002	0.003	0.001	0.001	1.0	0.00
2:30	0.001	0.002	0.002	0.001	0.001	0.9	0.00
2:40	0.000	0.002	0.002	0.001	0.001	0.8	0.00
2:50	0.000	0.001	0.002	0.001	0.001	0.8	0.00
3: 0	0.000	0.000	0.000	0.001	0.001	0.2	0.00
Maximum	0.236		0.278	0.019	0.259	7.6	0.00
Time (h:min)	1: 5		1: 5	1: 6	1: 6		

Dual Drainage Storm Water Management Model (DDSWMM 2.1)
IBI Group, Ottawa, Ontario

33956 Remer Phase 1 - East
DUAL DRAINAGE SIMULATION

XPSWMM Node	USF (m)	Finished Grade (m)	Storm Hydraulic Grade Line							
			100 Year 24 Hour SCS Type II				100 Year 24 Hour SCS Type II + 20%			
	Existing	Existing	Sani Inflow Option 1		Sani Inflow Option 2		Sani Inflow Option 1		Sani Inflow Option 2	
	Proposed	*Proposed*	HGL (m)*	USF–HGL (m)	HGL (m)†	USF–HGL (m)	HGL (m)*	USF–HGL (m)	HGL (m)†	USF–HGL (m)
S825	92.80	94.90	90.94	1.86	90.94	1.86	91.00	1.80	91.00	1.80
S840	n/a	n/a	91.17	n/a	91.17	n/a	91.23	n/a	91.24	n/a
P2OUT	n/a	n/a	91.33	n/a	91.33	n/a	91.42	n/a	91.42	n/a
P2	n/a	n/a	91.86	n/a	91.85	n/a	92.10	n/a	92.10	n/a

Notes: * HGL results for Option 1 were taken from the results of the XPSWMM model entitled 34738-20170630-MOE1-24SCS100.out or 34738-20170630-MOE1-24SCS120.out and presented on the CD in **Appendix E**.
† HGL results for Option 2 were taken from the results of the XPSWMM model entitled 34738-20170630-MOE2-24SCS100.out or 34738-20170630-MOE2-24SCS120.out and presented on the CD in **Appendix E**.

The HGL results presented in **Table 4.14** indicate that the minimum 0.3 m clearance between the USF and HGL is maintained along the western trunk storm sewer for both Sanitary Inflow Options 1 and 2 for the 100 year 24 hour SCS Type II and the 100 year 24 hour SCS Type II increased by 20% storm events.

As noted in Section 4.10.1, a tabular summary of the resulting HGL and freeboard for the entire LDA simulated for each storm event, whether presented in the main body of this report or not, is provided on the CD in **Appendix E**.

4.10.4 25% Sediment Accumulation within Submerged Storm Sewers

An evaluation of the hydraulic grade line (HGL) was undertaken assuming that those storm sewer pipes which are permanently submerged have 25% accumulation of sediment. The evaluation was undertaken using the 10 year 3 hour Chicago storm event. The evaluation was undertaken for Sanitary Inflow Option 2. **Tables 4.15 and 4.16** presents the resulting storm HGL for the local storm sewers for the subject site and the south sub-trunk for noted storm event, respectively. The XPSWMM Schematics in **Appendix E** indicates those sewers in the LDA which are permanently submerged. There are no permanently submerged sewers are located within the subject site.

Table 4.15 Storm Hydraulic Grade Line – 25% Submerged Storm Sewers – Phase 1 Pathways at Findlay Creek Local Sewers for the 10 Year 3 Hour Chicago Storm Events – Sanitary Inflow Option 2

XPSWMM Node	USF (m)	Storm Hydraulic Grade Line	
	Existing	100 Year 3 Hour Chicago	
	Proposed	HGL (m)*	USF–HGL (m)
BLK6172W	n/a	92.09	n/a
S6176	94.30	92.98	1.32
S6172	93.40	91.92	1.48
S6173	93.30	91.88	1.42
S6174	93.40	91.83	1.57

XPSWMM Node	USF (m)	Storm Hydraulic Grade Line	
	Existing	100 Year 3 Hour Chicago	
	Proposed	HGL (m)*	USF–HGL (m)
S6131B	100.90	99.93	0.97
S6131	100.20	99.19	1.01
S6130	97.10	96.37	0.73
S6170	95.70	94.62	1.08
S6180	97.55	96.30	1.25
S6181	97.00	95.85	1.15
S6182	96.85	95.70	1.15
S6132	102.40	101.10	1.30
BLK6110S	102.10	101.60	0.50
S6110	100.55	99.33	1.22
S6109	97.95	96.25	1.70
S6156	98.30	96.47	1.83
S6155	97.25	94.90	2.35
S6108	95.45	93.48	1.97
S6107	93.60	92.26	1.34
BLK6105W	n/a	91.28	n/a
S6132B	102.40	101.40	1.00
BLK6133S	n/a	100.57	n/a
S6133	101.80	100.14	1.66
S6134	100.75	99.23	1.52
S6135	100.20	98.73	1.47
BLK900	n/a	96.01	n/a
S6140	n/a	95.99	n/a
S6139	n/a	95.85	n/a
S6138	n/a	95.80	n/a
S6137	n/a	95.75	n/a
BLK6145	100.25	98.80	1.45
S6146	n/a	98.71	n/a
S6136	n/a	95.63	n/a
S6120	n/a	94.81	n/a
S6132A	n/a	101.31	n/a
S6161	100.45	99.13	1.32
S6162	100.30	99.00	1.30
S6163	100.50	98.86	1.64
S6164	99.88	98.64	1.24

XPSWMM Node	USF (m)	Storm Hydraulic Grade Line	
	Existing	100 Year 3 Hour Chicago	
	Proposed	HGL (m)*	USF–HGL (m)
S6119	n/a	94.28	n/a
BLK6117B	n/a	94.89	n/a
S6117	n/a	94.06	n/a
S6116	96.03	92.79	3.24
S6156B	98.00	96.76	1.24
S6157	n/a	96.12	n/a
S6158	96.93	95.96	0.97
S6153	94.83	93.00	1.83
S6154	n/a	92.85	n/a
S6115	94.71	92.27	2.44

Notes: * HGL results for the 10 year 3 hour Chicago storm were taken from the XPSWMM model entitled 34738-20170630-SEDMOE2-3CHI10.out and presented on the CD in **Appendix E**.

Table 4.16 Storm Hydraulic Grade Line – 25% Submerged Storm Sewers – South Sub-Trunk for the 10 Year 3 Hour Chicago Storm Events – Sanitary Inflow Option 2

XPSWMM Node	USF (m)	Finished Grade (m)	Storm Hydraulic Grade Line	
	Existing	Existing	100 Year 3 Hour Chicago	
	Proposed	*Proposed*	HGL (m)*	USF–HGL (m)
S790	91.75	93.80	89.64	2.11
S791C	n/a	94.50	89.49	n/a
S792	92.68	94.53	89.68	3.00
S647	92.68	94.61	90.11	2.57
S649	n/a	95.05	90.60	n/a
S6101	n/a	95.38	90.80	n/a
S6102	93.38	95.25	90.91	2.47
S6103	93.48	95.18	90.96	2.52
S6104	92.98	94.98	91.07	1.91
S6105	92.93	94.95	91.24	1.69
S6106	93.50	95.07	91.49	2.01
S6175	93.65	95.68	91.68	1.97
S6183	94.60	96.75	91.87	2.73
S6171	94.30	96.00	91.98	2.32
BLK3171W	94.50	95.94	92.01	2.49
S631	*93.70*	*95.85*	92.09	1.61
S630	*93.80*	*95.95*	92.25	1.55

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PROJECT:	BLK 232
DATE:	2019-11-19
FILE:	121793 - 6.2.4.
REV #:	-
DESIGNED BY:	RM
CHECKED BY:	RM

UNDERGROUND STORAGE CALCULATIONS - Pathways BLK 232

Pipe Storage MH207

From	To	Length	Diameter	X-sec Area	Volume
CB7	CB8	26.93	300	0.071	1.90
CB8	MH208	1.50	300	0.071	0.11
MH208	Mh207	15.12	300	0.071	1.07
				Total	3.08

Structure Storage MH207

	Base	Top	Height	diameter	X-sec Area	Volume
CB7	99.000	99.83	0.83	600	0.360	0.30
CB8	98.150	99.65	1.50	600	0.360	0.54
MH208	98.075	99.67	1.60	1200	1.131	1.80
MH207	97.979	99.83	1.85	1200	1.131	2.09
					Total	4.74

TOTAL MH207	**7.81**

Pipe Storage MH202

From	To	Length	Diameter	X-sec Area	Volume
CB3	CB2	23.25	300	0.071	1.64
CB2	MH202	9.92	300	0.071	0.70
CB1	MH202	15.03	200	0.031	0.47
CB4	MH202	13.34	300	0.071	0.94
				Total	3.76

Structure Storage MH202

	Base	Top	Height	diameter	X-sec Area	Volume
CB1	98.950	99.90	0.95	600	0.360	0.34
CB2	97.810	99.60	1.79	600	0.360	0.64
CB3	98.100	99.60	1.50	600	0.360	0.54
CB4	98.650	99.90	1.25	600	0.360	0.45
MH202	97.688	99.90	2.21	1500	1.767	3.91
					Total	5.89

TOTAL TO MH 202	**9.65**

Pipe Storage		*CB11*			
From	**To**	**Length**	**Diameter**	**X-sec Area**	**Volume**
ECB 1	TCB 2	26.50	250	0.049	1.30
TCB 2	TCB 3	29.50	250	0.049	1.45
TCB 3	CB11	39.00	250	0.049	1.91
				Total	4.66

Structure Storage			*CB11*			
	Base	**Top**	**Height**	**diameter**	**X-sec Area**	**Volume**
ECB 1	98.350	99.35	1.00	300	0.071	0.07
TCB 2	98.250	99.25	1.00	300	0.071	0.07
TCB 3	98.200	99.38	1.18	300	0.071	0.08
CB11	97.800	99.20	1.40	600	0.360	0.50
					Total	0.73

TOTAL CB11	**5.39**

IBI GROUP

STORM HYDRAULIC GRADE LINE DESIGN SHEET
PATHWAYS BLOCK 232
CITY OF OTTAWA
PHOENIX HOMES

JOB #: 121793 - 6.2
DATE: 2019-12-13
DESIGN: W.Z. & R.M.
CHECKED: D.G.Y.
REV #: -

BLK6117A in Cedar Creek Drive to MH200

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**BLK6117**	**200**	
INVERT ELEVATION (m)	94.435	94.467	
OBVERT ELEVATION (m)	95.035	95.067	
DIAMETER (mm)			600
LENGTH (m)			14.3
FLOW (l/s)			130.92
HGL (m) ***	**94.890**	**94.896**	**0.006**
MANHOLE COEF K= 0.75	LOSS (m)	0.008	
TOTAL HGL (m)		**94.905**	
MAX. SURCHARGE (mm)		**-162**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.6	0.28	1.88	0.220	0.15	1.03	290.82

HYDRAULIC SLOPE = 0.10 %
DESIGN FLOW TO FULL FLOW RATIO (Q 0.450
DESIGN FLOW DEPTH = 0.282

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 0.46 m/s
$HL = K_L * V^2 / 2g$

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**200**	**201**	
INVERT ELEVATION (m)	96.290	96.445	
OBVERT ELEVATION (m)	96.665	96.820	
DIAMETER (mm)			375
LENGTH (m)			19.3
FLOW (l/s)			120.63
HGL (m) ***	**94.905**	**94.996**	**0.092**
MANHOLE COEF K= 0.75	LOSS (m)	0.046	
TOTAL HGL (m)		**96.689**	
MAX. SURCHARGE (mm)		**-131**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.375	0.11	1.18	0.800	0.09	1.42	156.88

HYDRAULIC SLOPE = 9.22 %
DESIGN FLOW TO FULL FLOW RATIO (Q 0.769
DESIGN FLOW DEPTH = 0.244

Head loss in manhole simplified method p. 71 (MWDM)
fig1.7.1, Kratio = 0.75 for 45 bends K_L=0.75
Velocity = Flow / Area = 1.09 m/s
$HL = K_L * V^2 / 2g$

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**201**	**203**	
INVERT ELEVATION (m)	96.505	96.835	
OBVERT ELEVATION (m)	96.880	97.210	
DIAMETER (mm)			375
LENGTH (m)			33.0
FLOW (l/s)			122.71
HGL (m) ***	**96.689**	**96.851**	**0.162**
MANHOLE COEF K= 0.05	LOSS (m)	0.003	
TOTAL HGL (m)		**97.064**	
MAX. SURCHARGE (mm)		**-146**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.375	0.11	1.18	1.000	0.09	1.59	175.16

HYDRAULIC SLOPE = 1.14 %
DESIGN FLOW TO FULL FLOW RATIO (Q 0.701
DESIGN FLOW DEPTH = 0.229

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 1.11 m/s
$HL = K_L * V^2 / 2g$

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**203**	**204**	
INVERT ELEVATION (m)	96.930	97.197	
OBVERT ELEVATION (m)	97.230	97.497	
DIAMETER (mm)			300
LENGTH (m)			26.8
FLOW (l/s)			100.88
HGL (m) ***	**97.064**	**97.355**	**0.291**
MANHOLE COEF K= 0.05	LOSS (m)	0.005	
TOTAL HGL (m)		**97.455**	
MAX. SURCHARGE (mm)		**-42**	

MANNING FORMULA - FLOWING FULL						
DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.3	0.07	0.94	1.000	0.08	1.37	96.56

HYDRAULIC SLOPE = 1.46 %
DESIGN FLOW TO FULL FLOW RATIO (Q 1.045
DESIGN FLOW DEPTH = 0.258

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 1.43 m/s
$HL = K_L * V^2 / 2g$

IBI GROUP

STORM HYDRAULIC GRADE LINE DESIGN SHEET
PATHWAYS BLOCK 232
CITY OF OTTAWA
PHOENIX HOMES

JOB #: 121793 - 6.2
DATE: 2019-12-13
DESIGN: W.Z. & R.M.
CHECKED: D.G.Y.
REV #: -

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**204**	**205**	
INVERT ELEVATION (m)	97.217	97.804	
OBVERT ELEVATION (m)	97.517	98.104	
DIAMETER (mm)			300
LENGTH (m)			58.6
FLOW (l/s)			100.88
HGL (m) ***	**97.455**	**98.094**	**0.639**
MANHOLE COEF K= 0.05	LOSS (m)	0.005	
TOTAL HGL (m)		**98.099**	
MAX. SURCHARGE (mm)		**-5**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.3	0.07	0.94	1.000	0.08	1.37	96.70

HYDRAULIC SLOPE = 1.10 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 1.000
DESIGN FLOW DEPTH = 0.243

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 1.43 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**205**	**206**	
INVERT ELEVATION (m)	98.030	98.279	
OBVERT ELEVATION (m)	98.230	98.479	
DIAMETER (mm)			200
LENGTH (m)			24.9
FLOW (l/s)			5.57
HGL (m) ***	**98.099**	**98.106**	**0.007**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**98.333**	
MAX. SURCHARGE (mm)		**-146**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.2	0.03	0.63	1.000	0.05	1.04	32.76

HYDRAULIC SLOPE = 0.94 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.170
DESIGN FLOW DEPTH = 0.054

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.18 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**205**	**207**	
INVERT ELEVATION (m)	97.939	97.979	
OBVERT ELEVATION (m)	98.189	98.229	
DIAMETER (mm)			250
LENGTH (m)			7.9
FLOW (l/s)			5.57
HGL (m) ***	**98.099**	**98.100**	**0.001**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**98.100**	
MAX. SURCHARGE (mm)		**-129**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.25	0.05	0.79	0.500	0.06	0.86	42.24

HYDRAULIC SLOPE = 0.01 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.132
DESIGN FLOW DEPTH = 0.060

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.11 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**207**	**208**	
INVERT ELEVATION (m)	97.999	98.075	
OBVERT ELEVATION (m)	98.299	98.375	
DIAMETER (mm)			300
LENGTH (m)			15.1
FLOW (l/s)			5.57
HGL (m) ***	**98.100**	**98.100**	**0.001**
MANHOLE COEF K= 0.05	LOSS (m)	0.000	
TOTAL HGL (m)		**98.132**	
MAX. SURCHARGE (mm)		**-243**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.3	0.07	0.94	0.500	0.08	0.97	68.52

HYDRAULIC SLOPE = 0.21 %
DESIGN FLOW TO FULL FLOW RATIO (Q/ 0.081
DESIGN FLOW DEPTH = 0.057

Head loss in manhole simplified method p. 71 (MWDM)
straight through K_L=0.05
Velocity = Flow / Area = 0.08 m/s
HL = K_L * V^2/ 2g

Cedar Creek Drive Storm HGL has no negative impact on the proposed development.

Calculation Sheet: Overflow From Typical Road Ponding Area

User Input Characteristics

Road Cross-Slope	3.0	%
Right-of-Way Cross-Slope	3.5	%
Curb Height	0.15	m
Manning's Roughness for Road	0.013	
Manning's Roughness for Right-Of-Way	0.025	

Note: Overflow calculations performed based on Manning's Equation, where $Q = R_h^{2/3}S^{1/2}A / n$, and:

Q = overflow (m^3/s)

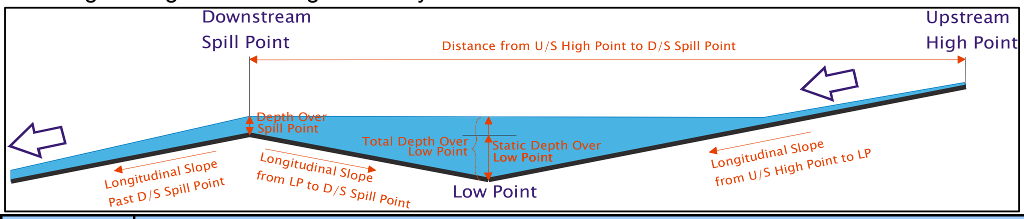
R_h = hydraulic radius

A = area (m^2)

n = Manning's roughness coefficient

S = friction slope (m/m), as simulated in XPSWMM for a range of longitudinal road slopes downstream of the spill point of the road ponding area:

0.50 - 0.74% longitudinal slope = 0.15% friction slope
0.75 - 1.24% longitudinal slope = 0.16% friction slope
1.25 - 3.74% longitudinal slope = 0.17% friction slope
3.75 - 5.00% longitudinal slope = 0.18% friction slope



Depth Over Spill Point (m)	Overflow (m^3/s)											
	0.50% - 0.74% D/S Slope			0.75% - 1.24% D/S Slope			1.25% - 3.74% D/S Slope			3.75% - 5.00% D/S Slope		
	5.5 m Road	8.5 m Road	11.0 m Road	5.5 m Road	8.5 m Road	11.0 m Road	5.5 m Road	8.5 m Road	11.0 m Road	5.5 m Road	8.5 m Road	11.0 m Road
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.015	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
0.020	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
0.025	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.004
0.030	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
0.035	0.008	0.008	0.008	0.008	0.008	0.008	0.009	0.009	0.009	0.009	0.009	0.009
0.040	0.011	0.011	0.011	0.012	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.013
0.045	0.016	0.016	0.016	0.016	0.016	0.016	0.017	0.017	0.017	0.017	0.017	0.017
0.050	0.021	0.021	0.021	0.021	0.021	0.021	0.022	0.022	0.022	0.023	0.023	0.023
0.055	0.027	0.027	0.027	0.028	0.028	0.028	0.029	0.029	0.029	0.029	0.029	0.029
0.060	0.034	0.034	0.034	0.035	0.035	0.035	0.036	0.036	0.036	0.037	0.037	0.037
0.065	0.042	0.042	0.042	0.043	0.043	0.043	0.045	0.045	0.045	0.046	0.046	0.046
0.070	0.051	0.051	0.051	0.053	0.053	0.053	0.054	0.054	0.054	0.056	0.056	0.056
0.075	0.061	0.061	0.061	0.063	0.063	0.063	0.065	0.065	0.065	0.067	0.067	0.067
0.080	0.073	0.073	0.073	0.075	0.075	0.075	0.078	0.078	0.078	0.080	0.080	0.080
0.085	0.087	0.086	0.086	0.090	0.088	0.088	0.093	0.091	0.091	0.096	0.094	0.094
0.090	0.104	0.100	0.100	0.108	0.103	0.103	0.111	0.106	0.106	0.114	0.109	0.109
0.095	0.123	0.115	0.115	0.127	0.119	0.119	0.131	0.123	0.123	0.134	0.126	0.126
0.100	0.142	0.132	0.132	0.147	0.136	0.136	0.151	0.141	0.141	0.156	0.145	0.145
0.105	0.163	0.150	0.150	0.168	0.155	0.155	0.173	0.160	0.160	0.178	0.165	0.165
0.110	0.184	0.170	0.170	0.190	0.176	0.176	0.196	0.181	0.181	0.202	0.187	0.187
0.115	0.207	0.192	0.192	0.214	0.198	0.198	0.220	0.204	0.204	0.226	0.210	0.210
0.120	0.230	0.215	0.215	0.238	0.222	0.222	0.245	0.229	0.229	0.252	0.235	0.235
0.125	0.255	0.240	0.240	0.263	0.247	0.247	0.271	0.255	0.255	0.279	0.262	0.262
0.130	0.280	0.269	0.266	0.290	0.278	0.275	0.299	0.287	0.283	0.307	0.295	0.291
0.135	0.307	0.304	0.294	0.317	0.314	0.304	0.327	0.323	0.313	0.336	0.333	0.322
0.140	0.334	0.340	0.324	0.345	0.351	0.335	0.356	0.362	0.345	0.366	0.372	0.355
0.145	0.363	0.377	0.356	0.375	0.390	0.368	0.386	0.402	0.379	0.397	0.413	0.390
0.150	0.392	0.417	0.390	0.405	0.430	0.402	0.417	0.443	0.415	0.429	0.456	0.427
0.155	0.422	0.458	0.425	0.436	0.473	0.439	0.450	0.487	0.453	0.463	0.501	0.466
0.160	0.454	0.500	0.463	0.469	0.517	0.479	0.483	0.532	0.493	0.497	0.548	0.508
0.165	0.486	0.544	0.503	0.502	0.562	0.520	0.518	0.580	0.536	0.533	0.596	0.552
0.170	0.520	0.590	0.556	0.537	0.610	0.574	0.553	0.629	0.592	0.569	0.647	0.609
0.175	0.555	0.638	0.610	0.573	0.659	0.630	0.590	0.679	0.650	0.607	0.699	0.669
0.180	0.590	0.687	0.667	0.610	0.710	0.689	0.629	0.732	0.710	0.647	0.753	0.731
0.185	0.627	0.738	0.726	0.648	0.763	0.750	0.668	0.786	0.773	0.687	0.809	0.795
0.190	0.665	0.791	0.787	0.687	0.817	0.813	0.708	0.842	0.838	0.729	0.867	0.862
0.195	0.705	0.846	0.851	0.728	0.873	0.879	0.750	0.900	0.906	0.772	0.926	0.932
0.200	0.745	0.902	0.917	0.770	0.931	0.947	0.793	0.960	0.976	0.817	0.988	1.004
0.205	0.787	0.960	0.985	0.813	0.991	1.017	0.838	1.022	1.048	0.862	1.052	1.078
0.210	0.830	1.020	1.055	0.857	1.053	1.089	0.884	1.085	1.123	0.909	1.117	1.155
0.215	0.874	1.081	1.127	0.903	1.117	1.164	0.931	1.151	1.200	0.958	1.184	1.235
0.220	0.920	1.144	1.202	0.950	1.182	1.241	0.979	1.218	1.280	1.008	1.254	1.317
0.225	0.967	1.210	1.279	0.999	1.249	1.321	1.029	1.288	1.362	1.059	1.325	1.401
0.230	1.015	1.277	1.358	1.048	1.318	1.403	1.081	1.359	1.446	1.112	1.398	1.488
0.235	1.065	1.345	1.440	1.100	1.389	1.487	1.133	1.432	1.533	1.166	1.474	1.577
0.240	1.116	1.416	1.523	1.152	1.462	1.573	1.188	1.507	1.622	1.222	1.551	1.669
0.245	1.168	1.488	1.610	1.206	1.537	1.662	1.243	1.584	1.713	1.279	1.630	1.763
0.250	1.222	1.563	1.698	1.262	1.614	1.754	1.300	1.664	1.808	1.338	1.712	1.860
0.255	1.277	1.639	1.789	1.318	1.693	1.847	1.359	1.745	1.904	1.398	1.795	1.959
0.260	1.333	1.717	1.881	1.377	1.773	1.943	1.419	1.828	2.003	1.460	1.881	2.061
0.265	1.391	1.797	1.977	1.437	1.856	2.042	1.481	1.913	2.104	1.524	1.968	2.165
0.270	1.450	1.879	2.074	1.498	1.940	2.142	1.544	2.000	2.208	1.589	2.058	2.272
0.275	1.511	1.962	2.174	1.561	2.027	2.245	1.609	2.089	2.314	1.656	2.150	2.382
0.280	1.574	2.048	2.276	1.625	2.115	2.351	1.675	2.180	2.423	1.724	2.244	2.494
0.285	1.638	2.136	2.381	1.691	2.206	2.459	1.743	2.274	2.535	1.794	2.340	2.608
0.290	1.703	2.225	2.488	1.759	2.298	2.569	1.813	2.369	2.648	1.865	2.438	2.725
0.295	1.770	2.317	2.597	1.828	2.393	2.682	1.884	2.467	2.765	1.939	2.538	2.845
0.300	1.838	2.410	2.708	1.899	2.490	2.797	1.957	2.566	2.883	2.014	2.641	2.967
0.305	1.908	2.506	2.822	1.971	2.588	2.915	2.032	2.668	3.005	2.090	2.745	3.092
0.310	1.980	2.603	2.939	2.045	2.689	3.035	2.108	2.772	3.128	2.169	2.852	3.219
0.315	2.053	2.703	3.057	2.120	2.792	3.157	2.186	2.878	3.255	2.249	2.961	3.349
0.320	2.128	2.805	3.178	2.198	2.897	3.282	2.265	2.986	3.383	2.331	3.072	3.482
0.325	2.204	2.908	3.302	2.277	3.004	3.410	2.347	3.096	3.515	2.415	3.186	3.617
0.330	2.282	3.014	3.427	2.357	3.113	3.540	2.430	3.208	3.649	2.500	3.301	3.755
0.335	2.362	3.121	3.556	2.440	3.224	3.672	2.515	3.323	3.785	2.588	3.419	3.895
0.340	2.443	3.231	3.686	2.524	3.337	3.807	2.601	3.440	3.924	2.677	3.540	4.038
0.345	2.527	3.343	3.819	2.609	3.453	3.945	2.690	3.559	4.066	2.768	3.662	4.184
0.350	2.611	3.457	3.955	2.697	3.570	4.085	2.780	3.680	4.210	2.861	3.787	4.332
0.355	2.698	3.573	4.093	2.786	3.690	4.227	2.872	3.804	4.357	2.955	3.914	4.484
0.360	2.786	3.691	4.233	2.877	3.812	4.372	2.966	3.929	4.507	3.052	4.043	4.637
0.365	2.876	3.811	4.376	2.970	3.936	4.520	3.062	4.057	4.659	3.150	4.175	4.794
0.370	2.968	3.934	4.522	3.065	4.063	4.670	3.159	4.188	4.814	3.251	4.309	4.953
0.375	3.061	4.058	4.669	3.161	4.191	4.823	3.259	4.320	4.971	3.353	4.446	5.115
0.380	3.156	4.185	4.820	3.260	4.322	4.978	3.360	4.455	5.131	3.457	4.584	5.280
0.385	3.253	4.314	4.973	3.360	4.455	5.136	3.463	4.592	5.294	3.564	4.725	5.447
0.390	3.352	4.445	5.128	3.462	4.591	5.296	3.569	4.732	5.459	3.672	4.869	5.617
0.395	3.453	4.578	5.286	3.566	4.728	5.459	3.676	4.874	5.627	3.782	5.015	5.790

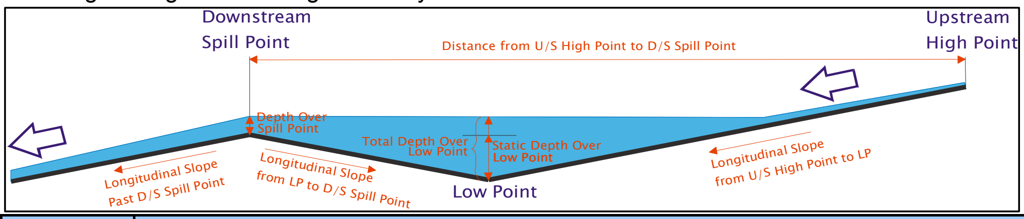
Calculation Sheet: Overflow From Typical Road Ponding Area

User Input Characteristics

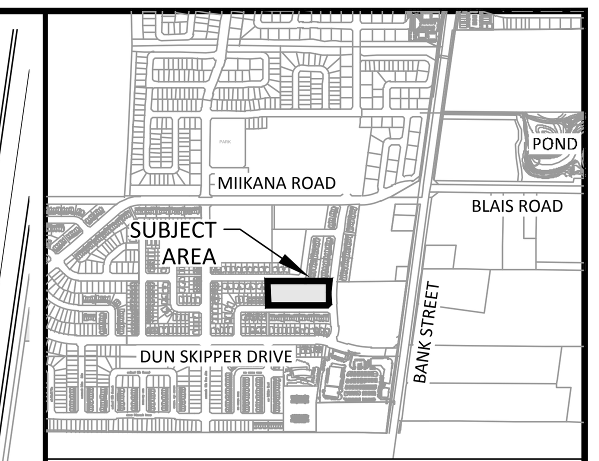
Road Cross-Slope	3.0	%
Right-of-Way Cross-Slope	3.5	%
Curb Height	0.15	m
Manning's Roughness for Road	0.013	
Manning's Roughness for Right-Of-Way	0.025	

Note: Overflow calculations performed based on Manning's Equation, where $Q = R_h^{2/3} S^{1/2} A / n$, and:

Q = overflow (m^3/s)
R_h = hydraulic radius
A = area (m^2)
n = Manning's roughness coefficient
S = friction slope (m/m), as simulated in XPSWMM for a range of longitudinal road slopes downstream of the spill point of the road ponding area:
0.50 - 0.74% longitudinal slope = 0.15% friction slope
0.75 - 1.24% longitudinal slope = 0.16% friction slope
1.25 - 3.74% longitudinal slope = 0.17% friction slope
3.75 - 5.00% longitudinal slope = 0.18% friction slope



Depth Over Spill Point (m)	Overflow (m^3/s)											
	0.50% - 0.74% D/S Slope			0.75% - 1.24% D/S Slope			1.25% - 3.74% D/S Slope			3.75% - 5.00% D/S Slope		
	5.5 m Road	8.5 m Road	11.0 m Road	5.5 m Road	8.5 m Road	11.0 m Road	5.5 m Road	8.5 m Road	11.0 m Road	5.5 m Road	8.5 m Road	11.0 m Road
0.400	3.555	4.713	5.446	3.672	4.868	5.625	3.785	5.018	5.798	3.895	5.163	5.966
0.405	3.659	4.851	5.609	3.780	5.010	5.793	3.896	5.164	5.972	4.009	5.314	6.145
0.410	3.766	4.991	5.775	3.889	5.155	5.964	4.009	5.313	6.148	4.125	5.467	6.326
0.415	3.874	5.133	5.943	4.001	5.301	6.138	4.124	5.465	6.327	4.243	5.623	6.510
0.420	3.984	5.278	6.113	4.114	5.451	6.314	4.241	5.618	6.508	4.364	5.781	6.697
0.425	4.096	5.424	6.287	4.230	5.602	6.493	4.360	5.774	6.693	4.486	5.942	6.887
0.430	4.209	5.573	6.462	4.347	5.756	6.674	4.481	5.933	6.880	4.611	6.105	7.079
0.435	4.325	5.724	6.641	4.467	5.912	6.859	4.604	6.094	7.070	4.738	6.271	7.275
0.440	4.443	5.878	6.822	4.588	6.071	7.046	4.729	6.257	7.262	4.867	6.439	7.473
0.445	4.562	6.034	7.005	4.712	6.231	7.235	4.857	6.423	7.458	4.998	6.609	7.674
0.450	4.684	6.192	7.192	4.837	6.395	7.427	4.986	6.592	7.656	5.131	6.783	7.878
0.455	4.807	6.352	7.380	4.965	6.561	7.623	5.118	6.762	7.857	5.266	6.958	8.085
0.460	4.933	6.515	7.572	5.095	6.729	7.820	5.251	6.936	8.061	5.404	7.137	8.295
0.465	5.060	6.680	7.766	5.226	6.899	8.021	5.387	7.112	8.268	5.543	7.318	8.507
0.470	5.190	6.848	7.963	5.360	7.072	8.224	5.525	7.290	8.477	5.685	7.501	8.723
0.475	5.321	7.018	8.163	5.496	7.248	8.430	5.665	7.471	8.690	5.829	7.687	8.942
0.480	5.455	7.190	8.365	5.634	7.426	8.639	5.807	7.654	8.905	5.976	7.876	9.163
0.485	5.591	7.365	8.570	5.774	7.606	8.851	5.952	7.840	9.123	6.124	8.067	9.388
0.490	5.728	7.542	8.777	5.916	7.789	9.065	6.098	8.029	9.344	6.275	8.261	9.615
0.495	5.868	7.721	8.987	6.061	7.974	9.282	6.247	8.220	9.568	6.428	8.458	9.845
0.500	6.010	7.903	9.201	6.207	8.162	9.502	6.398	8.414	9.795	6.584	8.657	10.079



KEY PLAN
N.T.S.

LEGEND :

ACB2 0.07 1.00	AREA ID IMP. (RUNOFF COEFF.) AREA (ha)
▬ ▪ ▬	LIMIT OF DEVELOPMENT OF SUBJECT PROPERTY
▬	SUBCATCHMENT DRAINAGE BOUNDARY
⇨	MAJOR FLOW
➡	EXTERNAL FLOW

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			
2			
1	ISSUED FOR CITY REVIEW	PD	2020:09

DCR/PHOENIX GROUP OF COMPANIES

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

Project Title

1055 CEDAR CREEK DRIVE

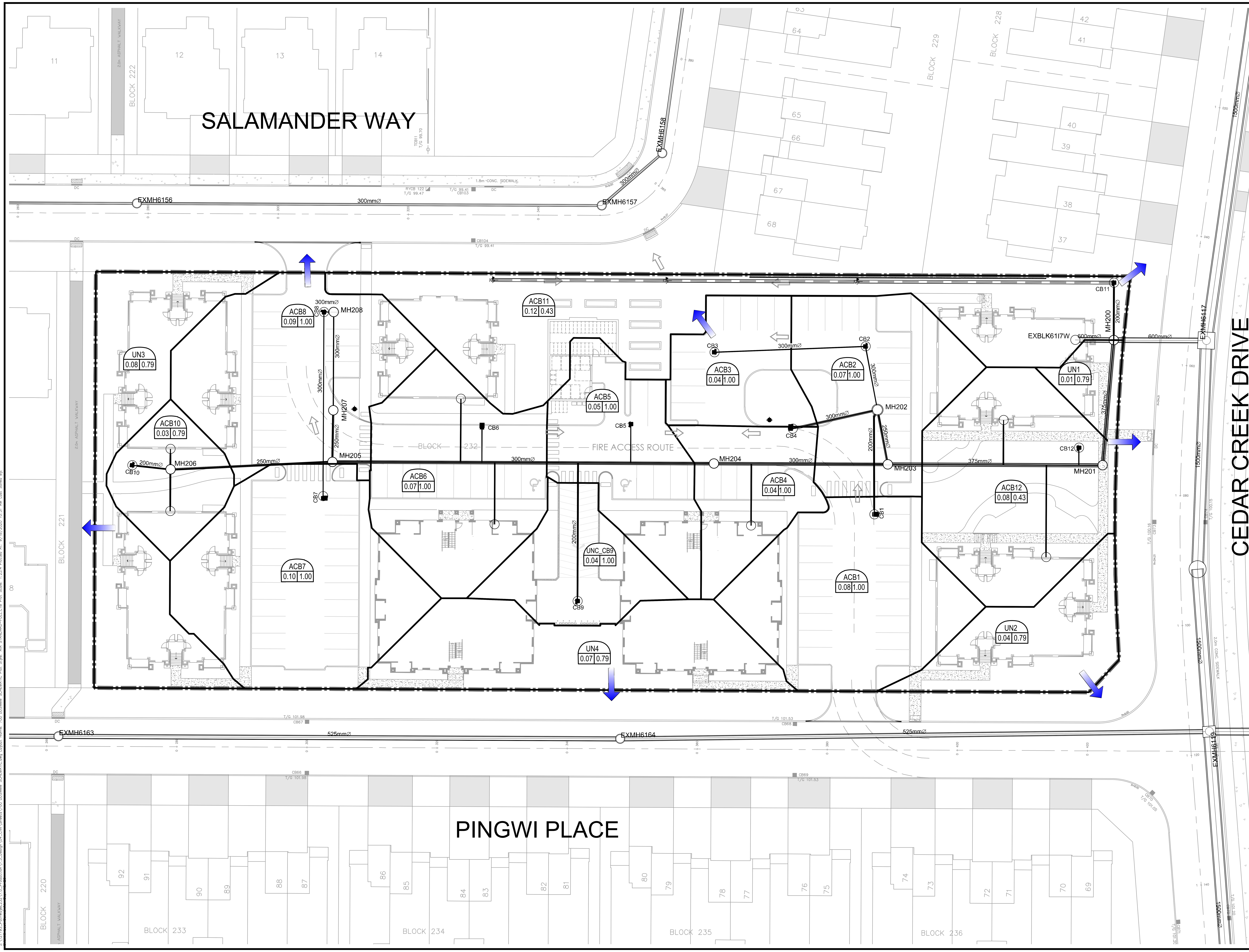
Drawing Title

DDSWMM SCHEMATIC

Scale 1:250

Design PD	Date AUG. 2020
Drawn SF	Checked PD
Project No. 121793	Drawing No. 700

D07-12-20-0037



```
                                 AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                 (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 1:000210         2.00     .622    1.00 57.861      .349     1.704
   OUTFLOW: ID= 2:000154         2.00     .615    1.02 57.861      .346     1.696


 -------------------------------------------------------------------------------
 001:0006-----------------------------------------------------------------------
 *
 *
 *
 *# Area ACB3, ACB2
 *#===========================================================2
 *# CROSS SECTION - OVERFLOW - 1.25% Slope
 *#===========================================================
 *
 --------------------
 | ROUTE CHANNEL    |     Routing time step (min) =  1.00
 |  IN> 01:000210   |     Number of SEGMENTS =  1
 | OUT< 02:000154   |     Slopes (%), CHANNEL=1.2500  FLOODPLAIN=1.2500
 --------------------                 LENGTH =   60.00    (m)

               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00            .22         .0250
                   4.90            .00         .0250
                  10.90            .10         .0250
                  23.90            .15         .0250

   <---------------------------- TRAVEL TIME TABLE -------------------------->
    DEPTH     ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
     (m)       (m)   (cu.m.)   (cu.m.)      (cms)     (m/s)     (min)   (m2/s)
     .008     .008  .154E+00  .810E-03       .000      .112      8.95     .001
     .016     .016  .615E+00  .648E-02       .002      .177      5.64     .003
     .024     .024  .138E+01  .219E-01       .005      .232      4.30     .006
     .032     .032  .246E+01  .518E-01       .012      .281      3.55     .009
     .039     .039  .385E+01  .101E+00       .021      .327      3.06     .013
     .047     .047  .554E+01  .175E+00       .034      .369      2.71     .017
     .055     .055  .754E+01  .278E+00       .051      .409      2.45     .023
     .063     .063  .985E+01  .415E+00       .073      .447      2.24     .028
     .071     .071  .125E+02  .590E+00       .100      .483      2.07     .034
     .079     .079  .154E+02  .810E+00       .133      .518      1.93     .041
     .087     .087  .186E+02  .108E+01       .171      .552      1.81     .048
     .095     .095  .222E+02  .140E+01       .216      .585      1.71     .055
     .103     .103  .260E+02  .178E+01       .258      .594      1.68     .061
     .111     .111  .308E+02  .227E+01       .294      .573      1.75     .063
     .118     .118  .366E+02  .289E+01       .348      .570      1.75     .067
     .126     .126  .435E+02  .367E+01       .419      .577      1.73     .073
     .134     .134  .515E+02  .461E+01       .507      .590      1.69     .079
     .142     .142  .605E+02  .573E+01       .613      .608      1.65     .086
     .150     .150  .705E+02  .705E+01       .738      .628      1.59     .094

  X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
  S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

                                       <---- hydrograph ---->   <-pipe / channel->
                                 AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                 (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 1:000210         2.00     .622    1.00 57.861      .143      .609
   OUTFLOW: ID= 2:000154         2.00     .596    1.03 57.861      .141      .605


 -------------------------------------------------------------------------------
 001:0007-----------------------------------------------------------------------
 *
 *
 *# Area UN3
 *#===========================================================2
 *# CROSS SECTION - PEDESTRIAN PATH CONVEYANCE - 2.0% Slope
 *#===========================================================
 *
 --------------------
 | ROUTE CHANNEL    |     Routing time step (min) =  1.00
 |  IN> 01:000210   |     Number of SEGMENTS =  1
 | OUT< 02:000154   |     Slopes (%), CHANNEL=2.0000  FLOODPLAIN=2.0000
 --------------------                 LENGTH =   60.00    (m)

               <------ DATA FOR SECTION (   1.0) ------>
               Distance      Elevation       Manning
                    .00            .05         .0130
                   2.00            .00         .0130
                   4.00            .05         .0130

   <---------------------------- TRAVEL TIME TABLE -------------------------->
    DEPTH     ELEV   X-VOLUME  S-VOLUME  FLOW RATE  VELOCITY  TRAV.TIME   D x V
     (m)       (m)   (cu.m.)   (cu.m.)      (cms)     (m/s)     (min)   (m2/s)
     .003     .003  .166E-01  .182E-04       .000      .131      7.66     .000
     .005     .005  .665E-01  .146E-03       .000      .207      4.82     .001
     .008     .008  .150E+00  .492E-03       .001      .272      3.68     .002
     .011     .011  .266E+00  .117E-02       .001      .329      3.04     .003
     .013     .013  .416E+00  .228E-02       .003      .382      2.62     .005
     .016     .016  .598E+00  .394E-02       .004      .431      2.32     .007
     .018     .018  .814E+00  .625E-02       .006      .478      2.09     .009
     .021     .021  .106E+01  .933E-02       .009      .522      1.91     .011
     .024     .024  .135E+01  .133E-01       .013      .565      1.77     .013
     .026     .026  .166E+01  .182E-01       .017      .606      1.65     .016
     .029     .029  .201E+01  .243E-01       .022      .646      1.55     .019
     .032     .032  .239E+01  .315E-01       .027      .685      1.46     .022
     .034     .034  .281E+01  .400E-01       .034      .722      1.38     .025
     .037     .037  .326E+01  .500E-01       .041      .759      1.32     .028
     .039     .039  .374E+01  .615E-01       .050      .794      1.26     .031
     .042     .042  .425E+01  .746E-01       .059      .829      1.21     .035
     .045     .045  .480E+01  .895E-01       .069      .863      1.16     .039
     .047     .047  .539E+01  .106E+00       .081      .897      1.11     .042
     .050     .050  .600E+01  .125E+00       .093      .930      1.08     .046

  X-VOLUME= Total X-Section volume over given CHANNEL LENGTH at specified DEPTH.
  S-VOLUME= Volume that can be stored in channel at specified ELEVATION.

      *** WARNING: TRAVEL TIME TABLE was exceeded
                                       <---- hydrograph ---->   <-pipe / channel->
                                 AREA    QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL
                                 (ha)    (cms)   (hrs)   (mm)      (m)      (m/s)
   INFLOW : ID= 1:000210         2.00     .622    1.00 57.861      .050      .924
   OUTFLOW: ID= 2:000154         2.00     .605    1.02 57.861      .050      .930


 -------------------------------------------------------------------------------
 001:0008-----------------------------------------------------------------------
 *
 *
      FINISH
 -------------------------------------------------------------------------------
 *******************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
  001:0007 ROUTE CHANNEL   ->
      *** WARNING: TRAVEL TIME TABLE was exceeded
   Simulation ended on 2020-09-10     at 14:15:44
 ===============================================================================
```

Max flow depth along Pathway Block ~3-4cm for 100 year and Sensitivity Analysis

Velocity x Depth Calculation - Phase 1 Remer East

Iteration equation:

Velocity:

$$v_x = v_{\min} + \frac{Q_x - Q_{\min}}{Q_{\max} - Q_{\min}}(v_{\max} - v_{\min})$$

Depth:

$$d_x = d_{\min} + \frac{Q_x - Q_{\min}}{Q_{\max} - Q_{\min}}(d_{\max} - d_{\min})$$

Including 25l/s from Pathways BLK232

Negligible change less than 1cm.

100 Year 3 Hour Chicago Storm

					SWMHYMO (RPH1Evxd.out)					Calculation Sheet: Overflow for Typical Road Ponding Area					SWMHYMO (RPH1Evxd.out)			Velocity x Depth	Maximum Static Ponding Depth	Total Depth (Dynamic + Static)
Area ID (Dummy Segment, if applicable)	Road ROW Section	Longitudinal Slope (%)	Overflow Flowrate		Flowrate (cms)		Velocity (m/s)			Flowrate (cms)		Dynamic Depth (m)			Dynamic Depth (m)					
			Qx (l/s)	Qx (cms)	Qmin	Qmax	vmin	vmax	vx	Qmin	Qmax	dmin	dmax	dx	dmin	dmax	dx	(m^2/s)	(m)	(m)
S6132B	24	1.40	**58**	0.058	0.051	0.110	0.717	0.867	**0.735**						0.044	0.059	**0.046**	0.034	0	**0.05**
S6133B	18	1.40	**704**	0.704	0.697	0.954	1.376	1.488	**1.379**						0.118	0.133	**0.118**	0.163	0	**0.12**
S6133A	24	0.70	**792**	0.792	0.674	0.893	1.052	1.129	**1.093**						0.133	0.147	**0.141**	0.154	0	**0.14**
S6135	24	1.30	**57**	0.057	0.055	0.100	0.705	0.817	**0.710**						0.048	0.061	**0.049**	0.034	0	**0.05**
S6146	24	1.30	**987**	0.987	0.840	1.098	1.420	1.581	**1.512**						0.133	0.145	**0.140**	0.211	0	**0.14**
S6120A	20	0.50	**132**	0.132	0.105	0.158	0.595	0.660	**0.628**						0.073	0.085	**0.079**	0.050	0	**0.08**
S6120B	20	0.50	**959**	0.959	0.893	1.096	1.114	1.182	**1.136**						0.157	0.169	**0.161**	0.183	0	**0.16**
S6132C	18	0.50	**58**	0.058	0.042	0.078	0.475	0.550	**0.510**						0.052	0.064	**0.058**	0.029	0	**0.06**
S6162(D1)	18	0.50	**27**	0.027	0.020	0.042	0.392	0.475	**0.418**	0.027	0.034	0.055	0.060	**0.055**	N/A	N/A	N/A	0.023	0.21	**0.27**
S6163	18	0.60	**56**	0.056	0.046	0.084	0.520	0.602	**0.542**						0.052	0.064	**0.055**	0.030	0	**0.06**
S6164A	18	2.70	**113**	0.113	0.098	0.177	1.103	1.278	**1.136**						0.052	0.064	**0.054**	0.062	0	**0.05**
S6164B(D2)	18	2.60	**187**	0.187	0.147	0.239	1.202	1.357	**1.269**	0.362	0.402	0.140	0.145	**0.142**	N/A	N/A	N/A	0.180	0.03	**0.17**
S6118A	20	2.00	**193**	0.193	0.129	0.210	1.054	1.191	**1.162**						0.061	0.073	**0.070**	0.082	0	**0.07**
S6118B	20	2.00	**907**	0.907	0.819	1.084	1.674	1.833	**1.727**						0.121	0.133	**0.125**	0.216	0	**0.12**
S6117A	20	2.40	**259**	0.259	0.230	0.347	1.304	1.445	**1.339**						0.073	0.085	**0.076**	0.102	0	**0.08**
S6117B	20	2.40	**889**	0.889	0.677	0.897	1.709	1.833	**1.828**						0.109	0.121	**0.121**	0.220	0	**0.12**
S6116A	20	1.20	**283**	0.283	0.245	0.350	1.022	1.117	**1.056**						0.085	0.097	**0.089**	0.094	0	**0.09**
S6116B	20	1.20	**877**	0.877	0.840	1.098	1.420	1.581	**1.443**						0.133	0.145	**0.135**	0.194	0	**0.13**
S6156B	18	2.70	**95**	0.095	0.045	0.098	0.911	1.103	**1.092**						0.039	0.052	**0.051**	0.056	0	**0.05**
S6158A	18	1.30	**129**	0.129	0.068	0.123	0.765	0.887	**0.900**						0.052	0.064	**0.065**	0.059	0	**0.07**
S6158B	18	0.80	**159**	0.159	0.097	0.157	0.695	0.785	**0.788**						0.064	0.077	**0.077**	0.061	0	**0.08**
S6154(D3)	18	0.60	**179**	0.179	0.136	0.205	0.680	0.754	**0.726**	0.150	0.170	0.105	0.110	**0.112**	N/A	N/A	N/A	0.081	0.1	**0.21**
S6115A	20	0.70	**443**	0.443	0.345	0.493	0.890	0.973	**0.945**						0.103	0.118	**0.113**	0.107	0	**0.11**
S6115B(D4)	20	0.70	**692**	0.692	0.674	0.893	1.052	1.129	**1.058**	0.667	0.726	0.180	0.185	**0.182**	N/A	N/A	N/A	0.193	0.05	**0.23**
S6101B	24	1.00	**59**	0.059	0.036	0.078	0.507	0.613	**0.565**						0.044	0.059	**0.052**	0.030	0	**0.05**
S6101A	24	0.70	**32**	0.032	0.012	0.036	0.387	0.507	**0.487**						0.029	0.044	**0.042**	0.020	0	**0.04**
S6102B(D5)	24	0.60	**858**	0.858	0.827	1.067	1.045	1.107	**1.053**	0.851	0.917	0.195	0.200	**0.196**	N/A	N/A	N/A	0.206	0.13	**0.33**
S6102A(D6)	24	0.70	**727**	0.727	0.674	0.893	1.052	1.129	**1.071**	0.726	0.787	0.185	0.190	**0.185**	N/A	N/A	N/A	0.198	0.1	**0.29**
S6103(D7)	24	0.60	**570**	0.570	0.456	0.624	0.901	0.974	**0.951**	0.556	0.610	0.170	0.175	**0.171**	N/A	N/A	N/A	0.163	0.11	**0.28**
S6104B(D8)	24	0.70	**418**	0.418	0.345	0.493	0.890	0.973	**0.931**	0.390	0.425	0.150	0.155	**0.154**	N/A	N/A	N/A	0.143	0.11	**0.26**
S6104A(D9)	24	0.60	**343**	0.343	0.319	0.456	0.824	0.901	**0.837**	0.3241	0.35584	0.14	0.145	**0.143**	N/A	N/A	N/A	0.120	0.11	**0.25**
S6105C(D10)	24	0.70	**227**	0.227	0.141	0.229	0.711	0.803	**0.801**	0.2148	0.23954	0.12	0.125	**0.122**	N/A	N/A	N/A	0.098	0.1	**0.22**
S6105B(D11)	24	0.60	**123**	0.123	0.072	0.13	0.567	0.658	**0.647**	0.1152	0.13211	0.095	0.1	**0.097**	N/A	N/A	N/A	0.063	0.12	**0.22**
S6105A(D12)	24	0.50	**0**	0											N/A	N/A	N/A		0.11	**0.11**
S6138A	24	1.60	**20**	0.02	0.018	0.054	0.585	0.766	**0.595**						0.029	0.044	**0.030**	0.018	0	**0.03**
S6138B	24	1.60	**31**	0.031	0.018	0.054	0.585	0.766	**0.650**						0.029	0.044	**0.034**	0.022	0	**0.03**
S6140A	24	2.20	**51**	0.051	0.022	0.064	0.686	0.898	**0.832**						0.029	0.044	**0.039**	0.033	0	**0.04**
S6140B	24	2.20	**67**	0.067	0.064	0.138	0.898	1.087	**0.906**						0.044	0.059	**0.045**	0.040	0	**0.04**
S6140C	24	2.20	**91**	0.091	0.064	0.138	0.898	1.087	**0.967**						0.044	0.059	**0.049**	0.048	0	**0.05**
S6115A+S6115B+S6101A+S6101B	24	0.7	**1226**	1.226	1.153	1.516	1.195	1.299	**1.216**	1.202	1.279	0.22	0.225	**0.222**	0.162	0.177	**N/A**	0.269	0.05	**0.27**
S6132B+S6133B	24	1.4	**762**	0.762	0.697	0.954	1.376	1.488	**1.404**						0.118	0.133	**0.122**	0.171	0	**0.12**
S6120A+S6120B	20	0.5	**1091**	1.091	0.893	1.096	1.114	1.182	**1.180**						0.157	0.169	**0.169**	0.199	0	**0.17**
S6116A+S6116B	20	1.2	**1160**	1.160	1.098	1.383	1.581	1.726	**1.613**						0.145	0.157	**0.148**	0.238	0	**0.15**
S6135+S6146	20	1.3	**1044**	1.044	0.84	1.098	1.42	1.581	**1.547**						0.133	0.145	**0.142**	0.220	0	**0.14**
S6118A+S6118B	20	2	**1100**	1.100	1.084	1.417	1.833	2.041	**1.843**						0.133	0.145	**0.134**	0.246	0	**0.13**
S6115C+S6116B	20	1.2	**1301**	1.301	1.098	1.383	1.581	1.726	**1.684**						0.145	0.157	**0.154**	0.259	0	**0.15**
S6117A+S6117B	20	2.4	**1148**	1.148	0.897	1.187	1.833	2.008	**1.984**						0.121	0.133	**0.131**	0.261	0	**0.13**

Note: Flow value is doubled to calculate dynamic depth over half street

Velocity x Depth Calculation - Phase 1 Remer East

Iteration equation:

Velocity:

$$v_x = v_{\min} + \frac{Q_x - Q_{\min}}{Q_{\max} - Q_{\min}} (v_{\max} - v_{\min})$$

Depth:

$$d_x = d_{\min} + \frac{Q_x - Q_{\min}}{Q_{\max} - Q_{\min}} (d_{\max} - d_{\min})$$

Including 39l/s from Pathways BLK232

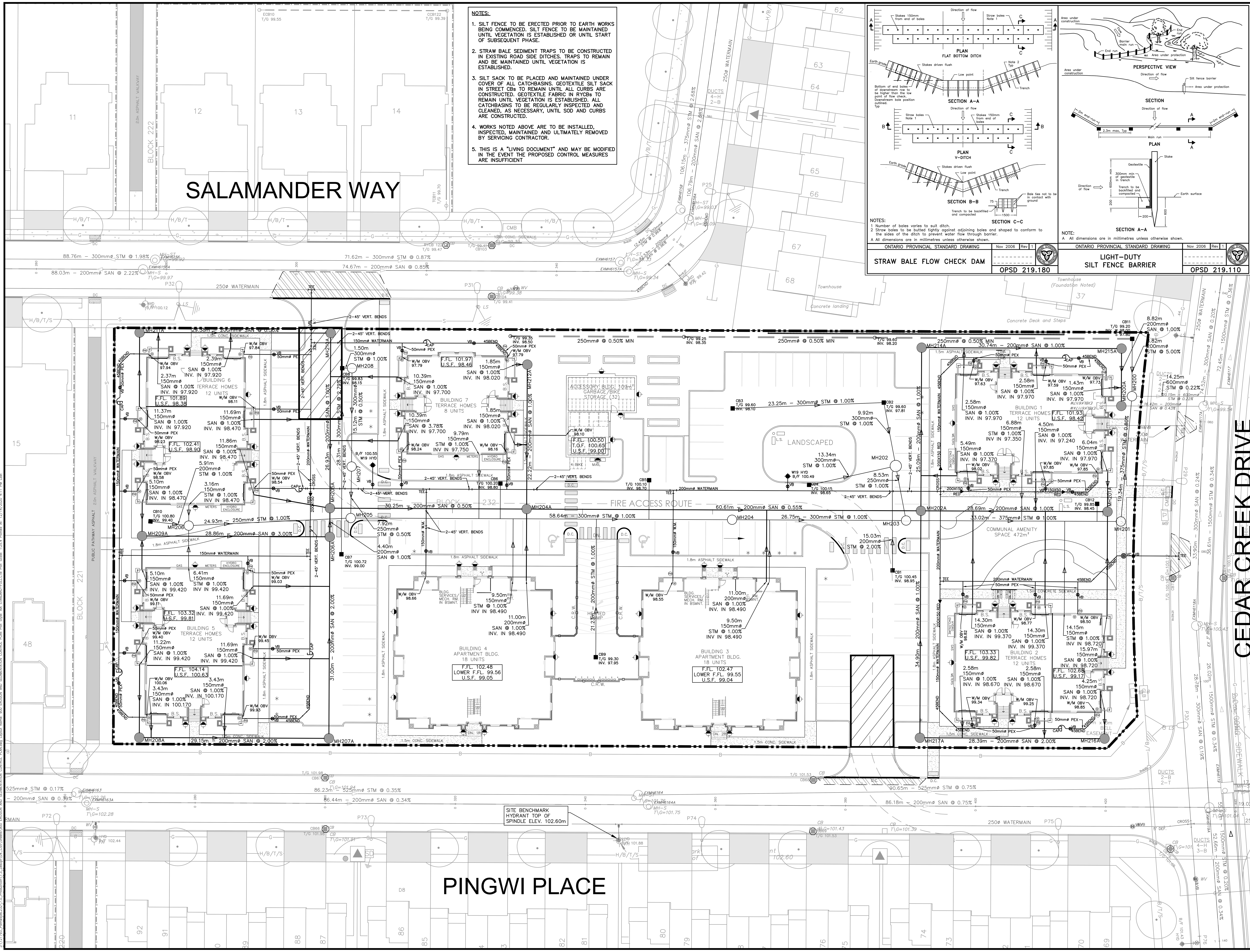
100 Year 3 Hour Chicago Storm + 20%

					SWMHYMO (RPH1Evxd.out)					Calculation Sheet: Overflow for Typical Road Ponding Area					SWMHYMO (RPH1Evxd.out)			Velocity x Depth	Maximum Static Ponding Depth	Total Depth (Dynamic + Static)
Area ID (Dummy Segment, if applicable)	Road ROW Section	Longitudinal Slope (%)	Overflow Flowrate		Flowrate (cms)		Velocity (m/s)			Flowrate (cms)		Dynamic Depth (m)			Dynamic Depth (m)					
			Qx (l/s)	Qx (cms)	Qmin	Qmax	vmin	vmax	vx	Qmin	Qmax	dmin	dmax	dx	dmin	dmax	dx	(m^2/s)	(m)	(m)
S6132B	24	1.40	**76**	0.076	0.051	0.110	0.717	0.867	**0.781**						0.044	0.059	**0.050**	0.039	0	**0.05**
S6133B	18	1.40	**939**	0.939	0.697	0.954	1.376	1.488	**1.481**						0.118	0.133	**0.132**	0.196	0	**0.13**
S6133A	24	0.70	**1068**	1.068	0.893	1.153	1.129	1.195	**1.173**						0.147	0.162	**0.157**	0.184	0	**0.16**
S6135	24	1.30	**73**	0.073	0.055	0.100	0.705	0.817	**0.750**						0.048	0.061	**0.053**	0.040	0	**0.05**
S6146	24	1.30	**1761**	1.761	1.699	2.049	1.831	1.905	**1.844**						0.169	0.182	**0.171**	0.316	0	**0.17**
S6120A	20	0.50	**214**	0.214	0.158	0.226	0.660	0.721	**0.710**						0.085	0.097	**0.095**	0.067	0	**0.09**
S6120B	20	0.50	**1744**	1.744	1.571	1.845	1.263	1.287	**1.278**						0.194	0.206	**0.202**	0.258	0	**0.20**
S6132C	18	0.50	**90**	0.090	0.076	0.124	0.550	0.621	**0.571**						0.064	0.077	**0.068**	0.039	0	**0.07**
S6162(D1)	18	0.50	**84**	0.084	0.076	0.124	0.550	0.621	**0.562**	0.073	0.086	0.080	0.085	**0.084**	N/A	N/A	N/A	0.047	0.21	**0.29**
S6163	18	0.60	**127**	0.127	0.084	0.136	0.602	0.680	**0.667**						0.064	0.077	**0.075**	0.050	0	**0.07**
S6164A	18	2.70	**188**	0.188	0.098	0.177	1.103	1.278	**1.302**						0.052	0.064	**0.066**	0.086	0	**0.07**
S6164B(D2)	18	2.60	**318**	**0.318**	0.289	0.361	1.357	1.504	**1.452**	0.287	0.323	0.130	0.135	**0.178**	N/A	N/A	N/A	0.258	0.03	**0.21**
S6118A	20	2.00	**331**	0.331	0.316	0.452	1.319	1.442	**1.333**						0.085	0.097	**0.086**	0.115	0	**0.09**
S6118B	20	2.00	**1701**	1.701	1.417	1.785	2.041	2.228	**2.185**						0.145	0.157	**0.154**	0.337	0	**0.15**
S6117A	20	2.40	**447**	0.447	0.347	0.495	1.445	1.580	**1.536**						0.085	0.097	**0.093**	0.143	0	**0.09**
S6117B	20	2.40	**1703**	1.703	1.552	1.956	2.236	2.440	**2.312**						0.145	0.157	**0.149**	0.346	0	**0.15**
S6116A	20	1.20	**470**	0.470	0.350	0.479	1.117	1.208	**1.202**						0.097	0.109	**0.108**	0.130	0	**0.11**
S6116B	20	1.20	**1717**	1.717	1.698	2.048	1.831	1.904	**1.835**						0.169	0.182	**0.170**	0.311	0	**0.17**
S6156B	18	2.70	**141**	0.141	0.098	0.177	1.103	1.278	**1.198**						0.052	0.064	**0.0585**	0.070	0	**0.06**
S6158A	18	1.30	**207**	0.207	0.123	0.200	0.887	1.001	**1.011**						0.064	0.077	**0.0782**	0.079	0	**0.08**
S6158B	18	0.80	**234**	0.234	0.157	0.237	0.785	0.870	**0.867**						0.077	0.090	**0.090**	0.078	0	**0.09**
S6154(D3)	18	0.60	**303**	0.303	0.205	0.293	0.754	0.824	**0.832**	0.240	0.269	0.125	0.130	**0.136**	N/A	N/A	N/A	0.113	0.1	**0.24**
S6115A	20	0.70	**688**	0.688	0.674	0.893	1.052	1.129	**1.057**						0.133	0.147	**0.134**	0.142	0	**0.13**
S6115B(D4)	20	0.70	**1600**	1.600	1.516	1.943	1.299	1.397	**1.318**	1.523	1.610	0.240	0.245	**0.244**	N/A	N/A	N/A	0.322	0.05	**0.29**
S6101B	24	1.00	**97**	0.097	0.078	0.141	0.613	0.711	**0.643**						0.059	0.074	**0.064**	0.041	[illegible]	[illegible]
S6101A	24	0.70	**40**	0.040	0.036	0.078	0.507	0.613	**0.517**						0.044	0.059	**0.045**	0.023	[illegible]	[illegible]
S6102B(D5)	24	0.60	**2056**	2.056	1.799	2.240	1.293	1.371	**1.338**	1.977	2.074	0.265	0.270	**0.269**	N/A	N/A	N/A	0.360	[illegible]	[illegible]
S6102A(D6)	24	0.70	**1955**	1.955	1.943	2.420	1.397	1.480	**1.399**	1.881	1.977	0.260	0.265	**0.264**	N/A	N/A	N/A	0.369	[illegible]	[illegible]
S6103(D7)	24	0.60	**1737**	1.737	1.404	1.799	1.202	1.293	**1.279**	1.698	1.789	0.250	0.255	**0.252**	N/A	N/A	N/A	0.322	[illegible]	[illegible]
S6104B(D8)	24	0.70	**1533**	1.533	1.516	1.943	1.299	1.397	**1.303**	1.523	1.610	0.240	0.245	**0.241**	N/A	N/A	N/A	0.313	[illegible]	[illegible]
S6104A(D9)	24	0.60	**1421**	1.421	1.404	1.799	1.202	1.293	**1.206**	1.3582	1.43968	0.23	0.235	**0.234**	N/A	N/A	N/A	0.282	[illegible]	[illegible]
S6105C(D10)	24	0.70	**1352**	1.352	1.153	1.516	1.195	1.299	**1.252**	1.2789	1.35817	0.225	0.23	**0.230**	N/A	N/A	N/A	0.287	[illegible]	[illegible]
S6105B(D11)	24	0.60	**1216**	1.216	1.067	1.404	1.107	1.202	**1.149**	1.2019	1.27892	0.22	0.225	**0.221**	N/A	N/A	N/A	0.254	0.12	**0.34**
S6105A(D12)	24	0.50	**1044**	1.044	0.974	1.281	1.01	1.098	**1.030**	0.9845	1.05473	0.205	0.21	**0.209**	N/A	N/A	N/A	0.216	0.11	**0.32**
S6138A	24	1.60	**25**	0.025	0.018	0.054	0.585	0.766	**0.620**						0.029	0.044	**0.032**	0.020	0	**0.03**
S6138B	24	1.60	**40**	0.04	0.018	0.054	0.585	0.766	**0.696**						0.029	0.044	**0.038**	0.027	0	**0.04**
S6140A	24	2.20	**68**	0.068	0.064	0.138	0.898	1.087	**0.908**						0.044	0.059	**0.045**	0.041	0	**0.04**
S6140B	24	2.20	**91**	0.091	0.064	0.138	0.898	1.087	**0.967**						0.044	0.059	**0.049**	0.048	0	**0.05**
S6140C	24	2.20	**128**	0.128	0.064	0.138	0.898	1.087	**1.061**						0.044	0.059	**0.057**	0.060	0	**0.06**
S6115A+S6115B+S6101A+S6101B	24	0.7	**2425**	2.425	2.42	2.948	1.48	1.553	**1.481**	2.351	2.488	0.285	0.29	**0.288**	N/A	N/A	**N/A**	0.426	0.05	**0.34**
S6132B+S6133B	24	1.4	**1015**	1.015	0.954	1.263	1.488	1.597	**1.510**						0.133	0.147	**0.136**	0.205	0	**0.14**
S6120A+S6120B	20	0.5	**1958**	1.958	1.845	2.146	1.287	1.305	**1.294**						0.206	0.218	**0.211**	0.272	0	**0.21**
S6116A+S6116B	20	1.2	**2187**	2.187	2.048	2.434	1.904	1.957	**1.923**						0.182	0.194	**0.186**	0.358	0	**0.19**
S6135+S6146	20	1.3	**1834**	1.834	1.699	2.049	1.831	1.905	**1.860**						0.169	0.182	**0.174**	0.324	0	**0.17**
S6118A+S6118B	20	2	**2032**	2.032	1.785	2.193	2.228	2.363	**2.310**						0.157	0.169	**0.164**	0.379	0	**0.16**
S6115C+S6116B	20	1.2	**2384**	2.384	2.048	2.434	1.904	1.957	**1.950**						0.182	0.194	**0.192**	0.375	0	**0.19**
S6117A+S6117B	20	2.4	**2150**	2.150	1.956	2.402	2.44	2.589	**2.505**						0.157	0.169	**0.162**	0.406	0	**0.16**

Flow value is doubled to calculate dynamic depth over half street

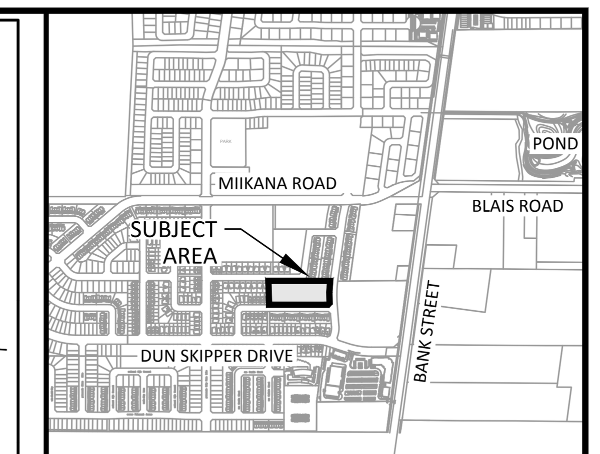
Negligible change less than 1cm.

APPENDIX D



NOTES:

1. SILT FENCE TO BE ERECTED PRIOR TO EARTH WORKS BEING COMMENCED. SILT FENCE TO BE MAINTAINED UNTIL VEGETATION IS ESTABLISHED OR UNTIL START OF SUBSEQUENT PHASE.
2. STRAW BALE SEDIMENT TRAPS TO BE CONSTRUCTED IN EXISTING ROAD SIDE DITCHES. TRAPS TO REMAIN AND BE MAINTAINED UNTIL VEGETATION IS ESTABLISHED.
3. SILT SACK TO BE PLACED AND MAINTAINED UNDER COVER OF ALL CATCHBASINS. GEOTEXTILE SILT SACK IN STREET CBs TO REMAIN UNTIL ALL CURBS ARE CONSTRUCTED. GEOTEXTILE FABRIC IN RYCBs TO REMAIN UNTIL VEGETATION IS ESTABLISHED. ALL CATCHBASINS TO BE REGULARLY INSPECTED AND CLEANED, AS NECESSARY, UNTIL SOD AND CURBS ARE CONSTRUCTED.
4. WORKS NOTED ABOVE ARE TO BE INSTALLED, INSPECTED, MAINTAINED AND ULTIMATELY REMOVED BY SERVICING CONTRACTOR.
5. THIS IS A "LIVING DOCUMENT" AND MAY BE MODIFIED IN THE EVENT THE PROPOSED CONTROL MEASURES ARE INSUFFICIENT



KEY PLAN
N.T.S.

NOTES:
1. SEE DRAWING C-010, C-011 FOR ADDITIONAL DETAILS AND NOTES.
2. SITE BENCHMARK OBTAINED FROM LEGAL SURVEYOR ANNIS O'SULLIVAN VOLLEBEKK LTD. TOP SPINDLE OF HYDRANT ON PINGWI PLACE, ELEV.=102.60m

LEGEND:
- LIGHT DUTY SILT FENCE AS PER OPSD-219.110
- SNOW FENCE
- STRAW BALE CHECK DAM AS PER OPSD-219.180
- ROCK CHECK DAM AS PER OPSD-219.210
- SILT SACK PLACED UNDER EXISTING CB COVER
- TEMPORARY MUD MAT 0.15m THICK 50mm CLEAR STONE ON NON WOVEN FILTER CLOTH (15.0 × 7.0)

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
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6			
5			
4			
3	REVISED AS PER CITY COMMENTS	DGY	2020:12:14
2	REVISED AS PER CITY COMMENTS	DGY	2020:09:18
1	ISSUED FOR SPA	DGY	2019:12:18

DCR/PHOENIX GROUP OF COMPANIES

IBI GROUP
400 – 333 Preston Street
Ottawa ON K1S 5N4 Canada
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ibigroup.com

Project Title
1055 CEDAR CREEK DRIVE

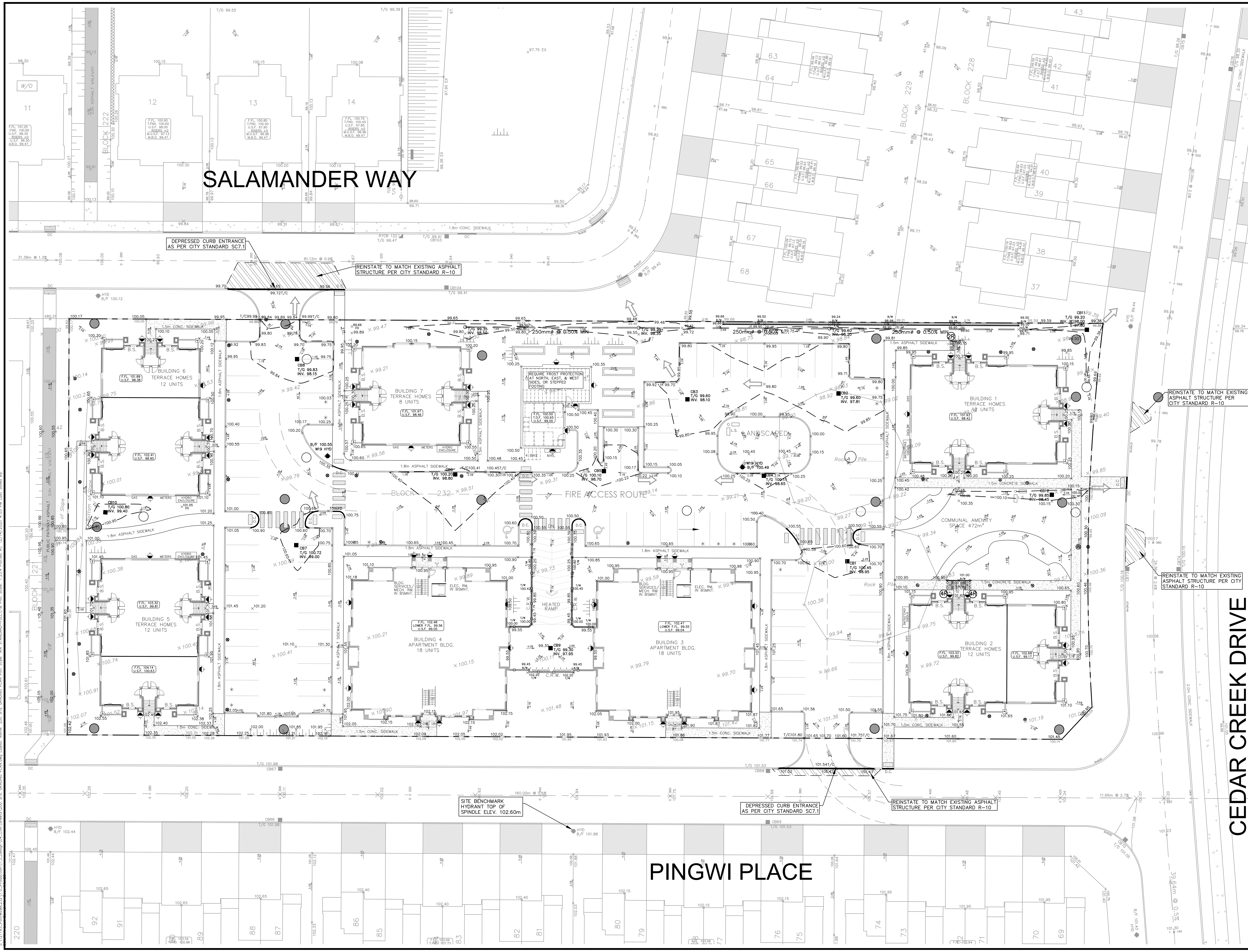
LICENSED PROFESSIONAL ENGINEER D. G. Yannoulopoulos 2020/12/14 PROVINCE OF ONTARIO

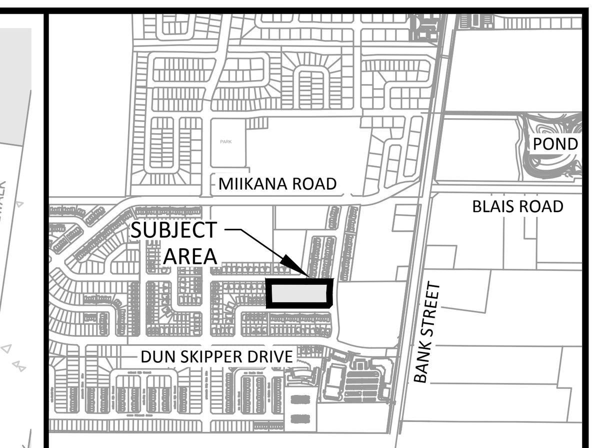
Drawing Title
EROSION AND SEDIMENTATION CONTROL PLAN

Scale
1:250

Design	Date
RM/WZ	SEPT, 2019
Drawn	Checked
DPS/WZ	DGY
Project No.	Drawing No.
121793	900

D07-12-20-0037





KEY PLAN
N.T.S.

NOTES:

1. SEE DRAWING C-010, C-011 FOR ADDITIONAL DETAILS AND NOTES.
2. SITE BENCHMARK OBTAINED FROM LEGAL SURVEYOR ANNIS O'SULLIVAN VOLLEBEKK LTD. TOP SPINDLE OF HYDRANT ON PINGWI PLACE, ELEV.=102.60m

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3	REVISED AS PER CITY COMMENTS	DGY	2020:12:14
2	REVISED AS PER CITY COMMENTS	DGY	2020:09:18
1	ISSUED FOR SPA	DGY	2019:12:18
No.	REVISIONS	By	Date

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Project Title

1055 CEDAR CREEK DRIVE

LICENSED PROFESSIONAL ENGINEER D. G. Yannoulopoulos 2020/12/14 PROVINCE OF ONTARIO

Drawing Title

SITE GRADING PLAN

Scale 1:250

Design	Date
RM/WZ	SEPT, 2019
Drawn	Checked
DPS/WZ	DGY
Project No.	Drawing No.
121793	200

D07-12-20-0037

GOLDER

REPORT

Geotechnical Investigation

Proposed Residential Development

1055 Cedar Creek Drive (BLOCK 232), Ottawa, Ontario

Submitted to:

DCR/Phoenix Group

18A Bentley Ave, Ottawa, ON K2E 6T8

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January 2020

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ATTACHMENTS

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APPENDIX A
Method of Soil Classification and Terms
Lithological and Geotechnical Rock Description Terminology
Record of Boreholes and Test Pits – Previous Investigations by Golder

APPENDIX B
Record of Boreholes – Previous Investigations by others

1.0 INTRODUCTION

This report provides geotechnical design guidance for the proposed residential development to be located on 1055 Cedar Creek Drive (Block 232) in Ottawa, Ontario. The previous investigation report titled: "*Geotechnical Investigation, Proposed Residential Development, Remer and Idone Lands, Ottawa, Ontario, report number 13-1121-0083 (1046), dated January 2017*", which was issued for the entire residential subdivision on the Remer and Idone Lands, was used to prepare this geotechnical report for the proposed development at Block 232.

The purpose of the subsurface investigations was to determine the general soil, bedrock, and groundwater conditions across the site by means of five boreholes and one test pit of previous investigations. Based on an interpretation of the factual information, obtained from the existing subsurface information available for the site from previous investigations, engineering recommendations are provided on the geotechnical design aspects of the proposed development, including construction considerations that could affect design decisions.

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

2.0 DESCRIPTION OF PROJECT AND SITE

Plans are being prepared to develop residential buildings on 1055 Cedar Creek Drive in Ottawa, Ontario (see Key Plan, Figure 1).

The following information is known about the site and the proposed development:

- The site is Block 232 on Subdivision Plan 4M-1617 and measures approximately 165 m by 65 m in plan area.
- The site is bordered by Cedar Creek Drive to the east, by Salamander Way to the north and by Pingwi Place to the south. Some future developments will be constructed on the west side of the proposed development site.
- The site is proposed to be developed into seven multi-storey residential buildings (numbered building 1 to 7, inclusive), one accessory building and associated parking areas.
- Five buildings (including buildings 1, 2, 5, 6, 7) will be 3-storeys in height and will have one level of basement to be located on the northern, eastern and western portions of the site. Two buildings (including buildings 3 and 4) will be located on the southern portion of the site and will be 3-storeys in height and will have one level of underground parking garage.
- Based on the provided architectural drawings, the finished grades rage from about elevations 100.2 to 101.5 m and the underside of the footing elevations for the proposed buildings range between about 98.4 m and 100.6 m.
- The proposed accessory building will be a one storey slab on grade structure and will be located on the northern portion of the site. The top of the slab on grade is understood to be at elevation of 100.5 m.

The approximate locations of the relevant boreholes and test pits from the previous investigations are shown on the Site Plan, Figure 1.

Based on the results of those previous investigations, as well as a review of the published geological mapping, the subsurface conditions across this site are expected to predominantly consist of variable deposits of sands and silts, overlying bouldery glacial till, above bedrock. The bedrock surface is expected to vary at depths of about 3 to 6 m below the existing ground surface. Geological mapping indicates that the bedrock in the area consists of interbedded sandstone and dolomite of the March Formation.

3.0 SUBSURFACE CONDITIONS

3.1 General

Information on the subsurface conditions is provided as follows:

- Record of test pit, borehole, and drillhole sheets of the previous investigations by Golder (2013 and 2016) are provided in Appendix A.
- Record of borehole sheets of the previous investigation by others (2005 and 1990) are provided in Appendix B.

In general, the subsurface conditions at this site consist of topsoil, over variable thickness of sand and silt deposits underlain by glacial till, over dolostone bedrock.

The following sections present a more detailed overview of the subsurface conditions encountered in the boreholes and test pit advanced during the previous investigations. It is assumed in the sections below that the site has not been altered since those investigations were completed (i.e., no stripping, excavation or filling has been carried out on the site).

3.2 Topsoil

Topsoil consisting of silty sand to sandy silt existed at the ground surface at all borehole and test pit locations. The thickness of the topsoil ranged from about 0.2 to 0.3 m.

3.3 Sand and Silt

The topsoil was generally underlain by variable deposits of sand and silt. These deposits predominantly consist of sand, silty sand to sandy silt and silt, with varying amounts of gravel, cobbles and boulders. These deposits extend to depths ranging from about 0.8 to 4.2 m below the ground surface.

SPT "N" values in the sand and silt deposits ranged widely, from 4 to >50 blows per 0.3 m of penetration, indicating a loose to very dense state of packing.

The measured water contents of samples from these deposits vary from 8 to 20 percent.

3.4 Glacial Till

Glacial till exists beneath the sand and silt deposits at all the borehole locations, except at test pit 16-6. The glacial till generally consists of a heterogeneous mixture of gravel, cobbles, and boulders in a matrix of silty sand to sandy silt. The glacial till was not penetrated at the test holes, with the exception of borehole 16-103, but was proven extend to depths ranging between about 2.3 and 6.1 m beneath the existing ground surface prior to encountering refusal to augering or excavating or being terminated. At borehole 16-103, the glacial till extends to a depth of 5.1 m.

SPT "N" values obtained in this deposit were reported to be greater than 50 blows per 0.3 m of penetration, indicating a very dense state of packing. However, some but not all of the "N" values likely reflect the presence of cobbles and boulders within the deposit or the bedrock surface, rather than the actual state of packing of the soil matrix deposit.

The measured water contents of samples of the glacial till ranged from 9 to 16 percent.

3.5 Refusal or Bedrock

Practical refusal to augering or excavating was encountered in all boreholes and test pit (except borehole 16-105) at depths varying between about 2.3 to 6.1 m below the existing ground surface. Refusal may indicate the bedrock surface; however, it could also represent boulders within the glacial till.

Borehole 16-103 was extended into the bedrock to a depth of about 7.0 m using rotary diamond drilling techniques while retrieving NQ sized core.

The following table provides a summary of the ground surface elevation, depth to the bedrock surface, and the elevation of the bedrock surface; elevations are provided in m above sea level (masl).

Borehole / Test Pit Number	Ground Surface Elevation (masl)	Depth to Refusal (m)	Refusal Elevation (masl)
16-6	98.9	4.2	94.7
16-103	98.1	5.1	93.0
16-105	101.5	N/A	N/A
13-5	99.7	6.1	93.6
8	99.0	3.6	95.5
90.6	99.7	2.3	97.4

The bedrock encountered in borehole 16-103 consists of dolostone with shale interbeds. The bedrock is generally slightly weathered to fresh, thinly to medium bedded, and grey in colour.

The Rock Quality Designation (RQD) values measured on the recovered bedrock core samples from borehole 16-103 ranged between 80 and 90 percent, indicating a very good to excellent rock quality.

3.6 Groundwater

The measured groundwater level in the standpipe piezometer installed in borehole 8 was about 3.2 m below the existing ground surface (or about elevation 95.8 m). Test pit 16-6 and borehole 16-105 were noted to be dry upon completion at depths of 4.20 and 5.0 m, respectively.

Groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring.

4.0 DISCUSSION

4.1 General

This section of the report provides engineering recommendations on the geotechnical design aspects of this project based on our interpretation of the test hole information as well as the project requirements, and is subject to the limitations in the “Important Information and Limitations of This Report” attachment which follows the text of this report, but forms an integral part of this document.

4.2 Site Grading

In general, the subsurface conditions at this site consist of topsoil, overlying variable thicknesses of silts and sands, followed by glacial till, which is in turn underlain by bedrock. The depth to refusal varied, ranging from about 2.3 to 6.1 m below the existing ground surface.

From a foundation design perspective, no practical restrictions apply to the thickness of grade raise fill that may be placed within the proposed development. However, grade raises in excess of 4 m should be reviewed and approved.

For predictable performance of the structures, roadways, and site services, preparation for filling of the site should include stripping the existing topsoil. The topsoil is not suitable as general fill and should be stockpiled separately for re-use in landscaping applications only. In areas with no structures, roadways or services, the existing topsoil may be left in place provided some long term settlement of the ground surface following filling can be tolerated.

4.3 Material Reuse

The native soils encountered at this site are not considered to be generally suitable for reuse as structural or engineered fill. Within foundation areas, imported engineered fill should be used.

The silt and sand deposits and glacial till may be suitable for use as controlled fill beneath pavement areas, provided they are not too wet to place and compact. Glacial till encountered below the groundwater may be too wet to feasibly be used as controlled fill. These materials could however be reused in non-structural areas (i.e., landscaping).

4.4 Foundations

The native undisturbed, inorganic overburden soils encountered at the site are considered suitable for supporting the proposed residential buildings. Topsoil and fill (if encountered) would not be considered suitable to support the building foundations and therefore must be removed from underneath the building footings and slabs.

For frost protection purposes, exterior footings for buildings should be founded at least 1.5 m below finished exterior grade. Isolated footings in unheated areas should be provided with at least 1.8 m of soil for frost protection (see Section 5.6 below). Any subexcavation below underside of the footing elevations should be removed and replaced with engineered fill. The engineered fill should consist of Ontario Provincial Standard Specification (OPSS) Granular B Type II, placed in maximum 300 mm thick lifts, and compacted to at least 95 percent of the material’s standard Proctor maximum dry density using suitable vibratory compaction equipment. The engineered fill material must be placed within the full zone of influence of the building foundations. The zone of influence is considered to extend out and down from the edge of the perimeter footings at a slope of 1 horizontal to 1 vertical (1H:1V).

Strip or pad footings, up to 3 m in width, placed on the surface of the native soils or on engineered fill may be designed using a maximum allowable net bearing pressure of 150 kPa at serviceability limit states (SLS) and a factored bearing resistance at ultimate limit states (ULS) of 250 kPa.

The post-construction total and differential settlements of footings sized using the above maximum allowable net bearing pressure should be less than about 25 and 15 mm, respectively, provided that the subgrade at or below founding level is not disturbed by groundwater inflow or construction traffic.

The overburden materials on this site, in particular the glacial till deposit, contain cobbles and boulders. Any cobbles or boulders in footing areas which are loosened by the excavation process should be removed (and not pushed back into place) and the cavity filled with lean concrete. Otherwise, recompression of the disturbed soils could lead to larger than expected post-construction settlements.

There may be portions of the site where the shallow sand and silt deposits will be exposed at footing/subgrade level. Prior to construction of footings or the placement of engineered fill within these areas, the surface of the native sandy and silty materials should be proof rolled to provide surficial densification of any loose or disturbed material.

4.5 Seismic Design

The seismic design provisions of the 2012 Ontario Building Code (OBC) depend, in part, on the shear wave velocity of the upper 30 m of soil and/or bedrock below founding level. Based on the 2012 OBC methodology, this site can be assigned a Site Class of D.

More favourable Site Class values could potentially be assigned for portions of the site if shear wave velocity testing were carried out.

The soils at this site are not considered liquefiable under earthquake loadings.

4.6 Frost Protection

The native subgrade soils on this site are considered to be highly frost susceptible. Therefore, all exterior perimeter foundation elements or foundation elements in unheated areas should be provided with a minimum of 1.5 m of earth cover for frost protection purposes. Isolated, unheated exterior footings adjacent to surfaces which are cleared of snow cover during winter months should be provided with a minimum of 1.8 m of earth cover. Insulation could be provided as an alternative to earth cover for frost protection. Golder can provide further details if required.

4.7 Excavations for Basements and Underground Parking Garages

Based on the provided preliminary drawings, the underside of the footing elevations for the proposed buildings will range between about 98.4 m and 100.6 m. Therefore, the excavations for the underground levels (i.e., basements or underground parking garages) will be through the topsoil and into the underlying sand and silt deposits and/or glacial till. Bedrock excavation is not anticipated for the basements or underground parking excavations.

No unusual problems are anticipated in excavating the overburden materials using conventional hydraulic excavating equipment, recognizing that large boulders (which may be nested) will likely be encountered in the glacial till. Boulders larger than 0.3 m in size should be removed from the excavation side slopes, for worker safety.

Based on the measured groundwater levels in the previous investigations, excavations to the underside of footing depth are not expected to extend below groundwater level. However, perched water or seasonal fluctuations in groundwater level should be anticipated. It is considered that it should generally be possible to handle the groundwater inflow into the excavations by pumping from well filtered sumps in the floor of the excavations. Where the subgrade is found to be wet and sensitive to disturbance, consideration should be given to placing a mud slab of lean concrete over the subgrade (following inspection and approval by geotechnical personnel), or a 150 mm thick layer of OPSS Granular A underlain by a non-woven geotextile, to protect the subgrade from construction traffic.

In accordance with the Occupational Health and Safety Act (OHSA) of Ontario, the overburden materials above the groundwater table (or where the groundwater level is lowered below the floor of the excavation) would generally be classified as a Type 3 soil and therefore, the side slopes should be stable in the short term at 1 horizontal to 1 vertical. Boulders larger than 0.3 m in diameter should be removed from the excavation side slopes for worker safety.

Under the new regulations, a Permit-To-Take-Water (PTTW) is required from the Ministry of the Environment and Climate Change (MOECC) if a volume of water greater than 400,000 litres per day is pumped from the excavations. If the volume of water to be pumped will be less than 400,000 litres per day, but more than 50,000 litres per day, the water taking will not require a PTTW, but will need to be registered in the Environmental Activity and Sector Registry (EASR) as a prescribed activity.

It is understood that a Category 3 Permit-To-Take-Water (PTTW) has been obtained from the Ministry of the Environment and Climate Change (MOECC) for this development and no further registration would be required.

4.8 Basement and Underground Parking Floor Slabs

In preparation for the construction of the basement and underground parking floor slabs, all loose, wet, and disturbed material should be removed from beneath the floor slabs. Provision should be made for at least 200 mm of 19 mm crushed clear stone to form the base of the floor slabs. The underslab fill should be compacted to at least 95 percent of the material’s standard Proctor maximum dry density using suitable compaction equipment.

To prevent hydrostatic pressure build up beneath the basement and underground parking floor slabs, it is suggested that the granular base for the floor slabs be positively drained. This could be achieved by providing a hydraulic link between the underfloor fill material and the exterior drainage system.

A geotextile should be provided between the clear stone underslab fill and the subgrade soil (which will likely consist of the finer sand and silt deposits), to avoid loss of fine soil particles from the subgrade soil into the voids in the clear stone and ultimately into the drainage system. The geotextile should consist of a Class II non-woven geotextile with a Filtration Opening Size (FOS) not exceeding 100 microns, in accordance with OPSS 1860.

4.9 Slab on Grade (For Accessory Building)

Conventional slab on grade construction can be used for the proposed accessory building.

For predicable performance of the slab, all topsoil beneath the proposed floor slab should be removed. Once removed, proof-rolling of the existing subgrade materials is recommended to provide surficial densification of the existing subgrade materials and to identify any isolated areas of soft or loose soils which would need replacing.

Provision should be made for at least 150 mm of OPSS Granular A to form the base for the floor slab. Any bulk fill required to raise the grade to the underside of the Granular A should consist of OPSS Granular B Type II. The underslab fill should be placed in maximum 300 mm thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.

4.10 Basement Walls and Foundation Wall Backfill

The soils at this site are frost susceptible and should not be used as backfill directly against exterior, unheated, or well insulated foundation elements. To avoid problems with frost adhesion and heaving, these foundation elements should either be backfilled with non-frost susceptible sand or sand and gravel conforming to the requirements for OPSS Granular B Type I or, alternatively, a bond break such as the Platon system sheeting could be placed against the foundation walls.

Drainage of the wall backfill should be provided by means of a perforated pipe subdrain in a surround of 19 mm clear stone, fully wrapped in geotextile, which leads by gravity drainage to a positive outlet, such as an adjacent storm sewer or sump pit. Conventional damp proofing of the basement walls is appropriate with the above design approach.

Basement walls made within open cut excavations, backfilled with granular material, and effectively drained as described above should be designed to resist lateral earth pressures calculated using a triangular distribution of the stress with a magnitude of:

$$\sigma_h(z) = K_o (\gamma z + q)$$

Where:

- $\sigma_h(z)$ = Lateral earth pressure on the wall at depth z, kilopascals
- K_o = At-rest earth pressure coefficient, use 0.5
- γ = Unit weight of retained soil, 21.5 kilonewtons per cubic metre
- z = Depth below top of wall, m
- q = Uniform surcharge at ground surface behind the wall to account for traffic, equipment, or stockpiled soil (use 12 kilopascals as a minimum)

The lateral earth pressure equation given above is in an unfactored format and will need to be factored for Limit States Design purposes.

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

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

Where:

- K_{AE} = The seismic earth pressure coefficient, use 0.8 for a non-yielding wall
- Ka = Active earth pressure coefficient, use 0.34
- H = The total depth to the bottom of the foundation wall, m

4.11 Site Servicing

Excavations for the installation of site services will be made through the topsoil, silt and sand deposits, glacial till and bedrock. Based on the anticipated groundwater levels at this site, the excavations for site servicing may extend near or just below the groundwater level.

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

Excavation side slopes above the water table should be stable in short term at 1H:1V (i.e., for Type 3 soils per OSHA of Ontario). Excavation side slopes below groundwater level will need to be at 3H:1V (i.e., Type 4 soils).

The stand up time for exposed side slopes will be extremely short and the subgrade will be disturbed if left exposed for any length of time. Construction of site services should be planned to be carried out in short sections, which can be fully completed in a minimal amount of time. The rate of groundwater inflow from the overburden could be significant. Based on past experience on the adjacent sites and particularly where the excavations are deeper and/or where the overburden is coarser, some pre-drainage of the overburden will be required. For example, several sumps could be constructed, and pre-pumping of the overburden carried out.

Alternatively, excavations within the overburden soils could also be carried out within a fully braced steel trench box, which would minimize the width of the excavation. The use of a trench box will not, however, eliminate the potential for disturbance outside the trench box limits.

Some groundwater inflow through the overburden into the service excavations should be expected. However, it should be possible to handle the groundwater inflow by pumping from well filtered sumps in the excavations, provided that multiple suitably sized pumps are used.

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

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

It should generally be possible to re-use the overburden soils as trench backfill. Material from below the water table may be re-used provided that it can be adequately placed and compacted.

Some of the overburden materials below the water table may be too wet to compact. Where that is the case, these materials should be wasted (and drier materials imported) or these materials should be placed only in the lower portions of the trench, recognizing that some future ground settlement over the trenches will likely occur.

In that case, it would also be prudent to delay final paving for as long as practical and significant padding of the roadways may be required in these areas prior to final paving.

Boulders larger than 300 mm in diameter will also interfere with the backfill compaction and should be removed from the excavated material prior to re-use as backfill.

Where the trench will be covered with hard surfaced areas, the type of native material placed in the frost zone (between subgrade level and 1.8 m depth) should match the soil exposed on the trench walls for frost heave compatibility. Trench backfill should be placed in maximum 300 mm thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable compaction equipment.

4.12 Pavement Design

In preparation for pavement construction, all topsoil should be removed from all pavement areas.

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

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

The pavement structure for local roads or parking lots, which will not experience bus or truck traffic (other than school bus and garbage collection), should consist of:

Pavement Component	Thickness (millim)
Asphaltic Concrete	90
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	375

The pavement structure for collector roadways which will experience bus and/or truck traffic should consist of:

Pavement Component	Thickness (millim)
Asphaltic Concrete	90
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	450

If any of the roadways would be categorized as 'collector' roadways and/or will experience bus or truck traffic (other than school buses, garbage trucks, moving trucks, etc.), then additional pavement design recommendations will need to be provided.

The granular base and subbase materials should be uniformly compacted to at least 100 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment. The asphaltic concrete should be compacted in accordance with Table 10 of OPSS 310. The composition of the asphaltic concrete pavement should be as follows:

- Superpave 12.5 mm Surface Course – 40 mm
- Superpave 19 mm Base Course – 50 mm

The asphaltic cement should consist of PG 58-34 and the design of the mixes should be based on a Traffic Category B for local roads and Category D for collector roads.

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

4.13 Tree Planting Restrictions

Silty clay soils in the Ottawa area are highly sensitive to water depletion by trees of high water demand during periods of dry weather. When trees draw water from the silty clay, the silty clay undergoes shrinkage which can result in settlement of adjacent structures.

Based on the results of the previous investigations, no silty clay encountered within the referenced boreholes and test pit locations. No restrictions on the types or sizes of trees that may be planted or tree to foundation setback distances need to be considered for this development.

4.14 Corrosion and Cement Type

No chemical analyses on soil samples were performed as part of the current investigation. It is recommended to carry out chemical analysis related to potential corrosion of exposed buried ferrous elements and potential sulphate attack on buried concrete elements on a few selected soil samples retrieved from the founding level of the proposed buildings foundations, during the construction phase. The results can be obtained quickly without significantly interrupting the construction schedule and additional instructions on the cement type and corrosion potential can be provided accordingly.

5.0 IMPACTS TO ADJACENT PROPERTIES OR INFRASTRUCTURE

Based on the information available to Golder at the time of this report, excavations for foundations or services at this site will not be within the zone of influence (defined within a line drawn from the existing underside of foundation or utility invert at an angle of 1 horizontal to 1 vertical) of existing structures or utilities. The planned excavations should therefore not have an impact on adjacent properties or utilities.

6.0 ADDITIONAL CONSIDERATIONS

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

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

The test pits excavated and backfilled during the previous investigations constitute zones of disturbance to the native soils. The presence of the backfill materials could affect the performance of surface structures or other settlement-sensitive facilities should they be constructed above the zone of influence of those locations. In such cases, the excavated soil should be removed and replaced with engineered fill.

Golder Associates should be retained to review the final drawings and specifications for this project prior to tendering to ensure that the guidelines in this report have been adequately interpreted.

7.0 CLOSURE

We trust that this report meets your current requirements. If you have any questions, or if we may be of further assistance, please contact the undersigned.

Signature Page

Golder Associates Ltd.

Ali Ghirian, P.Eng.
Geotechnical Engineer

Bill Cavers, P.Eng.
Associate, Senior Geotechnical Engineer

AG/WC/hdw

https://golderassociates.sharepoint.com/sites/116382/project files/6 deliverables/19131587-1000-001-r-rev0-dcr phoenix 1055 cedar creek geotechnical investigation-dec 2019.docx

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

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

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

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

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

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

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

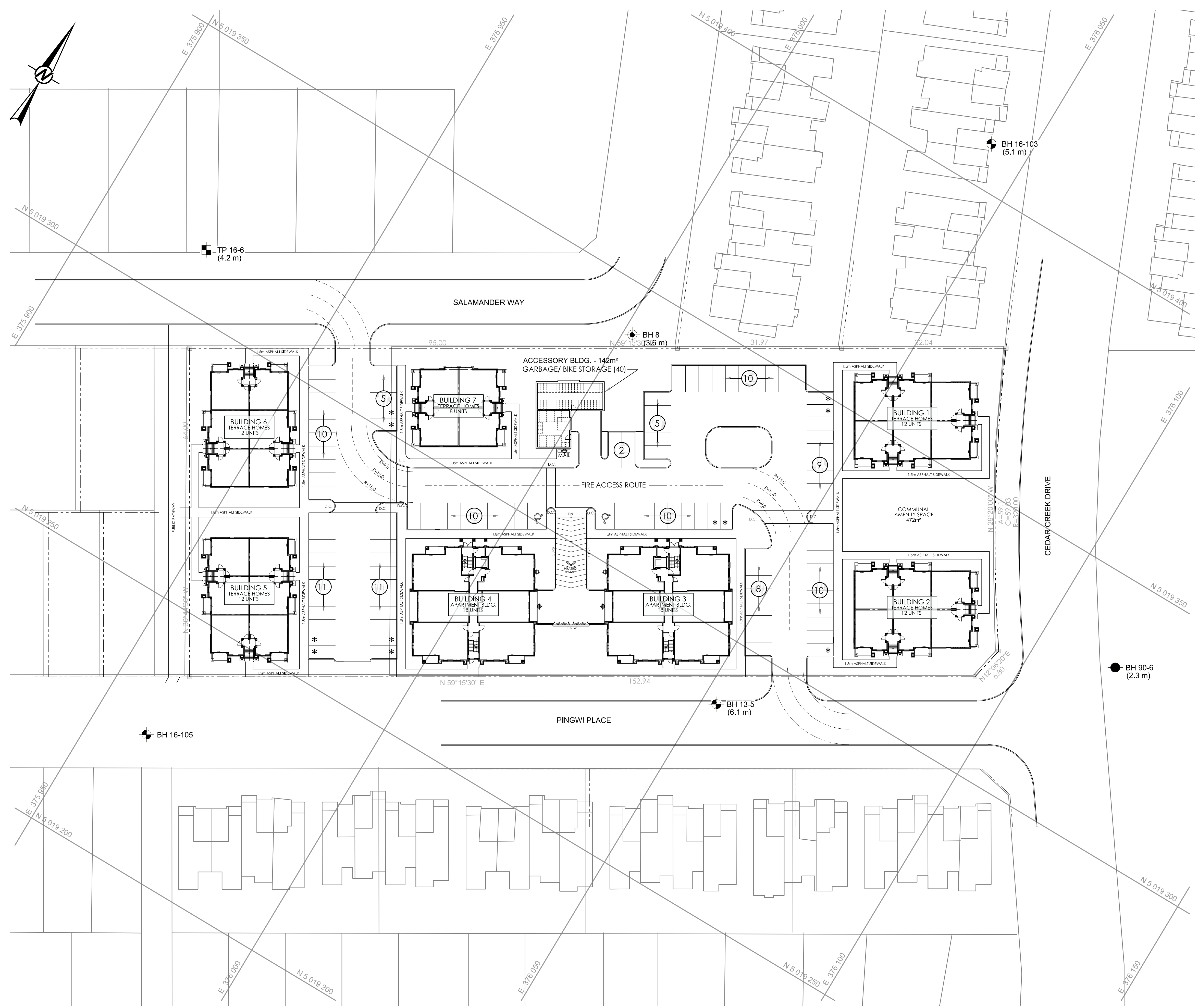
Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater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

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

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

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

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



KEY MAP

SCALE: 1:50,000 m

LEGEND

- APPROXIMATE BOREHOLE LOCATION - PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD., REPORT NO. 13-1121-0083
- APPROXIMATE TEST PIT LOCATION - PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD., REPORT NO. 13-1121-0083
- APPROXIMATE BOREHOLE LOCATION - PREVIOUS INVESTIGATION BY JACQUES WHITFORD, REPORT NO. 30227-1
- APPROXIMATE BOREHOLE LOCATION - PREVIOUS INVESTIGATION BY JDP, REPORT NO. PG0627
- (2.3 m) DEPTH TO REFUSAL

REFERENCE(S)

1. BASE PLANS PROVIDED IN DIGITAL FORMAT BY DCR PHOENIX GROUP, DRAWING NOS. Block 232_2019_06_27 (2) (1).pdf, RECEIVED ON NOV. 15, 2019
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83 CSRS, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

CLIENT
DCR PHOENIX GROUP

PROJECT
GEOTECHNICAL INVESTIGATION
1055 CEDAR CREEK DRIVE (BLOCK 232),
OTTAWA, ONTARIO

TITLE
SITE PLAN

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-20
DESIGNED	AG
PREPARED	ZS
REVIEWED	AG
APPROVED	WC

PROJECT NO.	CONTROL	REV.	FIGURE
19131587	0001	A	1

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

APPENDIX A

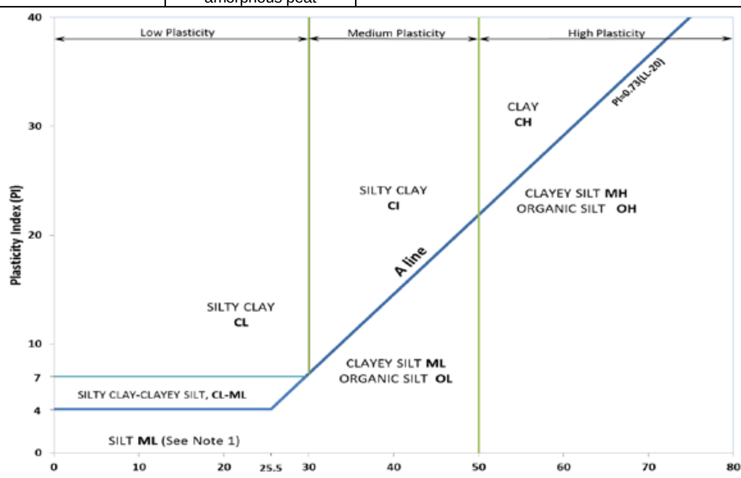
Method of Soil Classification and Terms
Lithological and Geotechnical Rock Description Terminology
Record of Boreholes and Test Pits – Previous Investigations by Golder

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators: Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)	Organic Content	USCS Group Symbol	Primary Name
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% **(see Note 2)**	CL	SILTY CLAY
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)
An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.
2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma$ - u)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c′	effective cohesion
c_u, s_u	undrained shear strength (ϕ = 0 analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$
2 shear strength = (compressive strength)/2

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERINGS STATE

Fresh: no visible sign of rock material weathering.

Faintly weathered: weathering limited to the surface of major discontinuities.

Slightly weathered: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

Moderately weathered: weathering extends throughout the rock mass but the rock material is not friable.

Highly weathered: weathering extends throughout rock mass and the rock material is partly friable.

Completely weathered: rock is wholly decomposed and in a friable condition but the rock and structure are preserved.

BEDDING THICKNESS

Description	Bedding Plane Spacing
Very thickly bedded	Greater than 2 m
Thickly bedded	0.6 m to 2 m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	Less than 6 mm

JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	Greater than 3 m
Wide	1 m to 3 m
Moderately close	0.3 m to 1 m
Close	50 mm to 300 mm
Very close	Less than 50 mm

GRAIN SIZE

Term	Size*
Very Coarse Grained	Greater than 60 mm
Coarse Grained	2 mm to 60 mm
Medium Grained	60 microns to 2 mm
Fine Grained	2 microns to 60 microns
Very Fine Grained	Less than 2 microns

Note: * Grains greater than 60 microns diameter are visible to the naked eye.

CORE CONDITION

Total Core Recovery (TCR)
The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

Solid Core Recovery (SCR)
The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

Rock Quality Designation (RQD)
The percentage of solid drill core, greater than 100 mm length, as measured along the centerline axis of the core, relative to the length of the total core run. RQD varies from 0% for completely broken core to 100% for core in solid segments.

DISCONTINUITY DATA

Fracture Index
A count of the number of naturally occuring discontinuities (physical separations) in the rock core. Mechanically induced breaks caused by drilling are not included.

Dip with Respect to Core Axis
The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90^{o} angle is horizontal.

Description and Notes
An abbreviation description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes and mechanically separated bedding or foliation surfaces. Additional information concerning the nature of fracture surfaces and infillings are also noted.

Abbreviations

JN	Joint	PL	Planar
FLT	Fault	CU	Curved
SH	Shear	UN	Undulating
VN	Vein	IR	Irregular
FR	Fracture	K	Slickensided
SY	Stylolite	PO	Polished
BD	Bedding	SM	Smooth
FO	Foliation	SR	Slightly Rough
CO	Contact	RO	Rough
AXJ	Axial Joint	VR	Very Rough
KV	Karstic Void		
MB	Mechanical Break		

TABLE 1 (Continued)

RECORD OF TEST PITS AND HAND AUGERHOLES

Test Pit Number (Elevation m)	Depth (m)	Description
16-6	0.00 – 0.19	TOPSOIL – (ML) sandy SILT; dark brown; moist
(98.93 m)	0.19 – 2.30	(SM) SILTY SAND, some gravel; brown; non-cohesive, moist
	2.30 – 4.20	(SP) SAND, some non-plastic fines and gravel; brown, contains cobbles and boulders up to 1.0 metres in diameter; non-cohesive, moist
	4.20	End of Test Pit – Refusal to excavating on probable bedrock

Note: Test pit dry upon completion.

Sample No.	Depth (m)
1	0.19 – 1.10
2	1.10 – 2.30
3	2.30 – 4.20

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-103

LOCATION: See Site Plan

BORING DATE: October 5, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.30m	WATER CONTENT PERCENT (W)	ADDITIONAL LAB. TESTING
		GROUND SURFACE	98.05					
0	Power Auger, 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; dark brown; moist	0.00					
		(SM/ML) SILTY SAND to sandy SILT, some gravel; brown; non-cohesive, dry, loose to very dense	0.17	1	SS	4	~20	
1				2	SS	>50	~9	
				3	SS	100	~9	
2		(SM) SILTY SAND, some gravel; brown to grey brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, dry to moist, very dense	95.76 / 2.29	4	SS	>50	~9	
3				5	SS	>50	~10	MH
4				6	SS	59	~12	
				7	SS	>50		
5	Rotary Drill, NQ Core	Fresh, thinly to medium bedded, grey, fine grained DOLOSTONE BEDROCK, with shale interbeds	92.95 / 5.10	C1	RC	DD		
6				C2	RC	DD		
7		End of Borehole	91.04 / 7.01					
8								
9								
10								

Column headings also include: DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20, 40, 60, 80); SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○); HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8}, 10^{-6}, 10^{-4}, 10^{-2}); WATER CONTENT PERCENT Wp —○W— Wl (20, 40, 60, 80); STRATA PLOT; PIEZOMETER OR STANDPIPE INSTALLATION.

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

RECORD OF DRILLHOLE: 16-103

PROJECT: 13-1121-0083-1046

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: October 5, 2016

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-850

DRILLING CONTRACTOR: CCC

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate, BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage, PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular, PO- Polished, K - Slickensided, SM- Smooth, Ro - Rough, MB- Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH COLOUR % RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	B Angle	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jcon	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.
		BEDROCK SURFACE		92.95															
6	Rotary Drill NQ Core	Fresh, thinly to medium bedded, grey, fine grained DOLOSTONE BEDROCK, with shale interbeds		5.10	1	30													
					2	40													
7				91.04 7.01															
		End of Drillhole																	
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

PROJECT: 13-1121-0083-1046

RECORD OF BOREHOLE: 16-105

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: October 5, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}); WATER CONTENT PERCENT Wp ⊢ ○W ⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		101.46							
0	Power Auger 200 mm Diam. (Hollow Stem)	TOPSOIL - (ML) sandy SILT; dark brown; moist		0.00							
		(SM/ML) SAND and SILT, trace gravel; grey brown; non-cohesive, moist, loose		101.28 / 0.18	1	SS	6				
		(SM) SILTY SAND, some gravel; brown, contains cobbles and boulders (GLACIAL TILL); non-cohesive, dry to moist, very dense		100.70 / 0.76							
1					2	SS	76				
					3	SS	>50				
2					4	SS	>50				
3					5	SS	>50				
4					6	SS	>50				
					7	SS	>50				
5		End of Borehole		96.43 / 5.03							
											Open borehole dry upon completion of drilling
6											
7											
8											
9											
10											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: KM

CHECKED: CK

RECORD OF BOREHOLE: 13-5

PROJECT: 13-1121-0083

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 26 & 27, 2013

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE – DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.30m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-8} 10^{-6} 10^{-4} 10^{-2}); WATER CONTENT PERCENT Wp ⊢ ○W ⊣ Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		99.74							
0	Power Auger, 200 mm Diam. (Hollow Stem)	TOPSOIL		0.00							
		Brown SILTY SAND		99.46 / 0.28	1	50 DO	8				
1		Dense to very dense brown SILTY SAND, trace gravel and clay, with cobbles and boulders (GLACIAL TILL)		98.98 / 0.76	2	50 DO	49		○		
					3	50 DO	>50				
2	Wash Boring, HQ Core	BOULDER		97.89 / 1.85	4	NQ RC	DD				
		Very dense brown SILTY SAND, trace gravel and clay, with cobbles and boulders (GLACIAL TILL)		97.55 / 2.19	5	50 DO	>50				
3					6	50 DO	>50				
4		Very dense SANDY SILT, trace gravel and clay, with cobbles and boulders (GLACIAL TILL)		95.93 / 3.81	7	50 DO	>50				
5		BOULDER		95.17 / 4.57	8	NQ RC	DD				
		Very dense grey SILTY SAND, some gravel, trace clay, with cobbles and boulders (GLACIAL TILL)		94.63 / 5.11	9	50 DO	>100				
6		End of Borehole Auger Refusal		93.64 / 6.10							
7											
8											
9											
10											

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: ALB

CHECKED: PAS

APPENDIX B

Record of Boreholes – Previous Investigations by others

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Proposed Development, Bank Street at Blais Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis O'Sullivan Vollebekk Surveying.

REMARKS

BORINGS BY CME 55 Power Auger

DATE 20 JUL 05

FILE NO. PG0627

HOLE NO. BH 8

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	99.03
TOPSOIL 0.15							
Compact, brown SILTY fine SAND 0.76		AU	1				
GLACIAL TILL: Very dense, brown silty fine sand with gravel, cobbles and boulders		SS	2	47	79+	1	98.03
		SS	3	67	50+	2	97.03
		SS	4	78	50+	3	96.03
3.56		SS	5	33	77+		
End of Borehole							
Practical refusal to augering @ 3.56m depth							
(GWL @ 3.18m-Sep. 6/05)							

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

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

90-6

CLIENT Ship & Krakow Architects

LOCATION Leitrim, Ontario

DATES: BORING 90-06-27 WATER LEVEL

PROJECT No. 30067

BOREHOLE No. 90-6

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.70	Ground Surface						
	99.4	Dark brown, TOPSOIL and ROOTMAT						
	98.1	Brown and grey, fine to medium, SAND, trace silt						
	97.4	Very dense, brown, silty sand, some gravel and rock fragments at top of bedrock, TILL			SS	1	250	*
		End of Borehole (Bedrock)						

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

* Split spoon refusal

UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

△ Pocket Penetrometer Test

□ Field Vane Test

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