REPORT
Project: 124219-6.4.3

DESIGN BRIEF
475 WANAKI DRIVE
WATERIDGE VILLAGE AT ROCKCLIFFE
PHASE 2B BLOCK 1

Prepared for Uniform Urban Developments
by IBI GROUP
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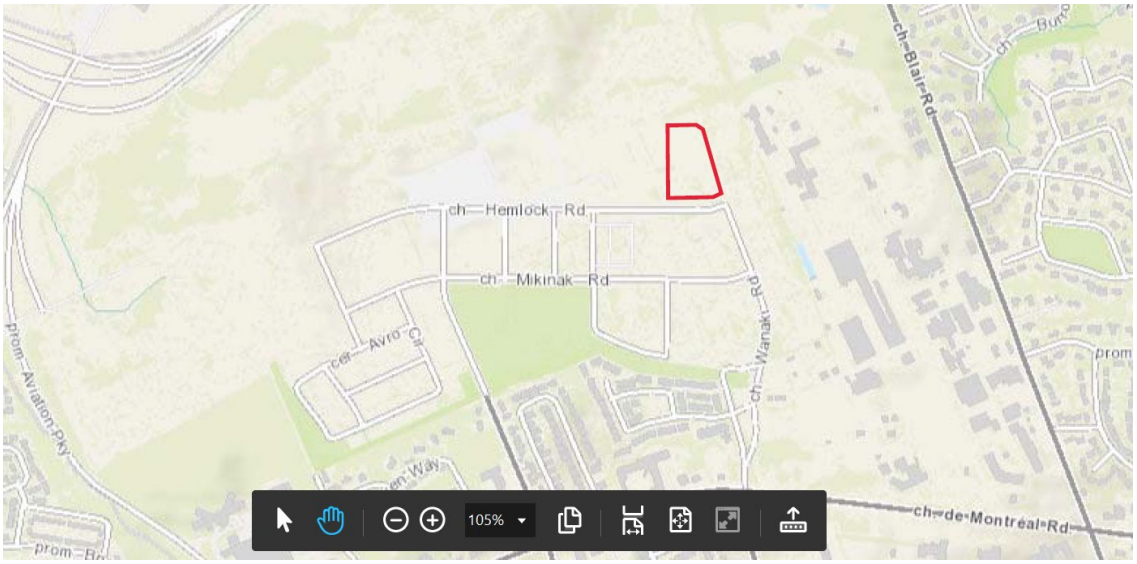
1 Introduction

In 2011, Canada Lands Company (CLC), bought and took ownership of about 125 ha of the former CFB Rockcliffe air base site. The acquisition of the decommissioned base by CLC offers the opportunity today to reconnect this site back into the urban fabric of the City and create a highly desirable mixed-use community for approximately 10,000 residents. CLC completed a Community Design Plan (CDP) in 2015. In support of the CDP, there were numerous supporting documents including the "Former CFB Rockcliffe Master Servicing Study" (MSS), August 2015, prepared by IBI Group. That report provided a plan for provision of major infrastructure needed to support the proposed development of the Wateridge Village.

CLC plans to develop the Wateridge Village property in several phases. Phases 1A and 1B have already been constructed, which cover about 35 ha. Phase 2B is currently under development. The Phase 2B registered 4M plan is provided in **Appendix A.** This phase covers about 10 ha and includes 12 blocks. Block 1 is located in the east portion of the Wateridge Village Phase 2B. IBI Group Professional Services Inc. (IBI Group) has been retained by Uniform Urban Developments to provide professional engineering services for Block 1. The subject site is approximately 1.05 ha and consists of 5 apartment buildings, 3 garbage buildings and an amenity building, with a total of 120 units. The site consists of surface visitor level and below grade parking facilities. Additionally, the Wateridge Village concept Phasing plan and Architectural Site Plan have also been provided in **Appendix A.**

Block 1 is bounded by Tawadina Road to the North, Hemlock Road and existing Phase 1B to the south, Wanaki Road to the east and Pimiwidon Street to the west. Its Civic Address is 475 Wanaki Road. 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

Phase 2B of Wateridge Village at Rockcliffe will be serviced with potable water from the City of Ottawa's Montreal Road Pressure Zone (Zone MONT). An existing 406 mm diameter watermain on Montreal road will supply Phase 2B with connections at Codd's Road and Burma Road. As part of the Phase 1 water plan, two 400 mm mains were extended northward along Codd's Road and Wanaki Road. A copy of the recommended water plan for Phase 2B is included in **Appendix B**

There is an existing 400mm watermain in Tawadina Road to the north of Block 1, an existing 300mm watermain in Hemlock Road to the south of the site, and an existing 200mm Watermain in Pimiwidon Street. Two watermain connections are proposed at Hemlock Road and Pimiwidon Street to provide water service for Block 1. Refer to the General Plan of Services included in **Appendix B** for the detailed water distribution plan for Block 1.

2.2 Design Criteria

2.2.1 Water Demands

Block 1 consists of 120 apartment 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:

- Average Unit Population 2.6 person per unit (Provided by the Architect)
- 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 B** and the total water demands are summarized as follows:

- Average Day 1.28 l/s
- Maximum Day 3.19 l/s
- Peak Hour 7.02 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 three storey apartment blocks. A Fire Underwriters Survey (FUS) calculation has been done for all building blocks. Building 2 is the largest apartment block with the most exposures to adjacent buildings. The calculations result in a fire flow of 12,000 l/min for this building; a copy of the FUS calculation is included in **Appendix B**. The fire flow calculation are summaries in the table below:

Block	Fire Flow Demand (L/min)	Fire Hydrant(s) within 75m	Fire Hydrant(s) within 150m	Available Fire Flow per Table 18.5.4.3 of ISTB 2018-02 (L/min)
Block 1	10,000	3	7	43529
Block 2	12,000	6	3	45423
Block 3	12,000	4	6	45422
Block 4	11,000	4	3	34067
Block 5	11,000	5	5	47315

There are 6 existing fire hydrants located in the perimeter streets of the subject site (including two fire hydrants in Pimiwidon Street, one in Hemlock Road, two in Wanaki Road and one in Tawadina Road), and another 4 hydrants located within 150m range of the site. Refer to general plan of services in **Appendix A** for detailed locations of the fire hydrants.

2.2.4 Boundary Conditions

The City of Ottawa has provided two hydraulic boundary conditions at Pimiwidon Street and Hemlock Road. The boundary conditions are based on current pump operation in Zone Mont.

A copy of the Boundary Condition is included in **Appendix B** and summarized as follows:

CRITERIA	HYDRAULIC HEAD	
	Pimiwidon Street	Hemlock Road
Max HGL (Basic Day)	147.0 m	147.0 m
Peak Hour	146.7 m	146.7 m
Max Day + Fire (12,000 l/m)	142.0 m	144.5 m

2.2.5 Hydraulic Model

A computer model for the Block 1 water distribution system has been developed using the InfoWater SA program. The model incorporates the boundary conditions at Pimiwidon Street and Hemlock Road. Basic day (max HGL) and peak hour scenarios were run using the HGLs discussed in **Section 2.2.4**.

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. There is a total of 6 fire hydrants on Tawadina Road,

Hemlock Road, Wanaki Road and Pimiwidon Street that are adjacent to the site and provide fire protection for the buildings. In the Wateridge Phase 2B Block 1 hydraulic water model, the mains on the adjacent street were run with a 200 l/s (12,000 l/min) fire demand for the fire flow analysis. Results of the analysis for the Block 1 site are summarized in **Section 2.3.2** and the water model schematic and model results are included in **Appendix B**.

2.3.2 Summary of Results

Results of the hydraulic analysis for Block 1 are summarized as follows:

Pressures (kPa)
- Basic Day (Max HGL) 511.5 – 520.3
- Peak Hour 508.5 – 517.4

Minimum Fire Flow @ 140 kPa Residual Pressure 721.8 L/s.

13A 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 721.8 l/s which exceeds the requirement of 200 l/s (12,000 l/min). In the Wateridge Phase 2B Block 1 water analysis, the design fire flows on Tawadina Road, Hemlock Road, Wanaki Road and Pimiwidon Street range from 721.8 to 3425.9 l/s which exceed the requirement of 200 l/s (12,000 l/min).

3 Wastewater Disposal

3.1 Existing Conditions

Canada Lands Company completed a Community Design Plan (CDP) in 2015. To support that plan, a number of technical reports were prepared including the 'Former CFB Rockcliffe Master Servicing Study, August 2015 (MSS). That report recommended that the existing combined sewers on the subject site be abandoned in favour of dedicated sanitary and storm sewer systems.

In particular, the MSS recommended that future wastewater flow from Phase 2B be directed to the Codd's Road Shaft. Accordingly, wastewater flows from the subject site will be designed to outlet to that location. The previous Phase 1A design included the new connection to that shaft and the proposed Phase 2B sanitary sewers will connect to the Phase 1B system. The sanitary sewers in Phase 2B were oversized to provide capacity for Future Phase 2C and 2D connection. A copy of Phase 2B sanitary drainage area plan and design sheet are included in **Appendix C**.

3.2 Verification of Existing Sanitary Sewer Capacity

There is an existing 250mm sanitary sewer in Pimiwidon Street, which connects to the existing 250mm sanitary sewer in Hemlock Road. In the previous Wateridge Phase 2B report, the design population for Block 1 was 253.8 which assumed semi detached and townhouse units at a population density of 2.7p/u and a total peak flow in Pimiwidon Street from MH317A to MH316A of 3.69L/s, see **Appendix C**. In the proposed site plan, the total design population of 315.0 is based on the Architectural review for the 120 unit development of an average occupancy of 2.6 p/u, higher than the City design guideline of 1.8 p/u used for subdivision design. The result is a peak flow from the development of 3.88 L/s, and a peak flow in Pimiwidon Street, from MH317A to MH316A of 4.35 L/s. The net increase in design flow from the approved sewer design sheet to the proposed site plan is 0.66L/s. The receiving sewer in Pimiwidon will have a residual capacity of 37.27 L/s. The Wateridge Phase 2B design sheet indicates that there is a residual capacity in all downstream sewers of greater than 10L/s. The slight variation in design flow from the subject development will have a negligible impact on downstream infrastructure. Refer to **Appendix C** for the detailed sanitary sewer design sheet for Block 1.

3.3 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 sheet are included in **Appendix C** illustrate the population densities and sewers which provide the necessary outlets.

3.3.1 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 (150mm for building service)

3.3.2 Population Density:

Single Family	-	3.4 person/unit
Townhouse Units	-	2.7 person/unit
Apartment Units	-	1.8 person/unit
External Low-Density Land	-	120 units/gross Ha
Phase 2B Block 1 Units	-	2.6 person/unit (Provided by the Architect)

4 Stormwater Management

4.1 Existing Conditions

CLC completed the servicing report, “Former CFB Rockcliffe Master Servicing Study” in 2015. That report recommended a preferred Stormwater Management Plan for the Wateridge Village at Rockcliffe site. The report recommended construction of two stormwater ponds and related appurtenances to service the CLC property; the Western Stormwater Management Facility and the Eastern Stormwater Management Facility. The Eastern Pond is proposed to provide management of flows from most of Phase 1 and 2 of the CLC property. Therefore, the Eastern pond construction was included as part of the development of Phase 1A and the facility was put into service in 2017.

The MSS Report also recommends a series of local and trunk storm sewers to collect runoff from Phases 1 and 2 and route those flows to the Eastern Facility. The Phase 1 design followed the recommendations of the MSS report, including construction of the large diameter sewers, which outlet to the Eastern Stormwater Management Facility; the Eastern Stormwater Management Facility and outlet to the Ottawa River. The Phase 2B storm sewers connect to the downstream Phase 1 sewer system. A copy of storm drainage area plan and storm sewer design sheet are included in **Appendix D**.

4.2 Objective

The purpose of this evaluation is to prepare the dual drainage design, including the minor and major system, for the Block 1 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.

4.3 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)
- Rational Method Sewer Sizing
- Initial Time of Concentration — 10 minutes
- Runoff Coefficients
  - Landscaped Areas — C = 0.25
  - Landscaped Area with Pathway/Roof — C = 0.50 - 0.65
  - 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
150 mm Building Services)

- Minimal allowable slopes

DIAMETER (MM)	SLOPE (%)
250	0.43
300	0.34
375	0.25
450	0.20
525	0.16
600	0.13
675	0.11

- Minimum depth of cover of 2.0 m
- 100-year Hydraulic Grade Line (HGL) separation to be greater than 0.30 m from the underside of footings

4.4 System Concept

According to the Wateridge Phase 2B report prepared by IBI Group dated April 2019, 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 in Pimiwidon Drive.

4.4.1 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 in Pimiwidon 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 in underground storage tank. 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 Wanaki Road and Hemlock Road.

4.4.2 Proposed Minor System

Using the criteria identified in Section 4.3, 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 D**. 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.

4.5 Stormwater Management

Wateridge Phase 2B is part of the larger development referred to as the Former CFB Rockcliffe. The stormwater management strategy was outlined in the "Former CFB Rockcliffe Master Servicing Study" (MSS) (IBI Group, August 2015). Phase 2B is located between Hemlock Road and Tawadina Road (refer to **Figure 1.7**). As part of the Phase 2B development, the design of downstream Phase 2A has been completed.

The subject site is part of the drainage area that ultimately discharges to the Eastern SWM Facility. The trunk storm sewer to the pond and the pond itself were constructed as part of Wateridge Phase 1A.

4.5.1 Water Quality Control

The design takes into consideration the August 2015 MSS, the "Design Brief Wateridge Village at Rockcliffe Phase 1B" (IBI Group, June 2017), the "Design Brief Wateridge Village at Rockcliffe Phase 1A" (IBI Group, April 2016), the City of Ottawa Sewer Design Guidelines (OSDG) (October 2012), and the February 2014 Technical Bulletin ISDTB-2014-01.

Any runoff from the site, as with all future developments in Wateridge Village at Rockcliffe, will have end of pipe quality treatment. Any impacts to receiving watercourses will therefore be mitigated. There are no municipal drains in the vicinity of the subject development and there are no drainage catchment diversions proposed by the current development.

Because the site is located well above the receiving waters of the Ottawa River, there will be no 1:100 year water levels in that watercourse that will impact the site development.

4.5.2 Water Quantity Control

The subject site will be limited to a maximum minor system release rate of 310 L/s according to Wateridge Phase 2B Design Brief dated April 2019. In the Phase 2B subdivision stormwater management system design, the development blocks are subjected to minor system inflow restriction with major flow cascading to a street segment. The restricted rated were provided in Table 5-2, which is included in **Appendix D**. This will be achieved through a combination of inlet control devices (ICD's) at inlet locations, surface storage where possible and underground storage where required.

Surface flows in excess of the site's allowable release rate will be stored on site in strategic surface storage areas or oversize storm 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 D** and grading plans located in **Appendix E.** Overland flow routes will be provided in the grading to permit emergency overland flow.

Along the perimeter of the site, the opportunity to capture and store runoff is limited due to grading constraints and building geometry. These areas will discharge to Tawadina Road, Hemlock Road, Wanaki Road and Pimiwidon Street uncontrolled. These locations are 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.

Based on the proposed site plan, the total uncontrolled area has been calculated to be (0.08+0.05 +0.05+0.08+0.09) 0.35 ha. Refer to Drawing 500 in **Appendix D** for the detailed storm drainage area plan for the site.

Based on a 1:100 year event, the flow from the 0.34 Ha uncontrolled area can be determined as:

$\mathbf{Q_{uncontrolled}}$ = **2.78** x **C** x $\mathbf{i_{100yr}}$ x **A** where:

C = Average runoff coefficient = 0.75

$\mathbf{i_{100yr}}$ = Intensity of 100-year storm event (mm/hr)

= $1735.688 \times (T_c + 6.014)^{0.820}$ =178.56 mm/hr; where T_c = 10 minutes

A = Uncontrolled Area = 0.35 Ha

Therefore, the uncontrolled release rate can be determined as:

$\mathbf{Q_{uncontrolled}}$ = **2.78** x **C** x $\mathbf{i_{100yr}}$ x **A**

= 2.78 x 0.75 x 178.56 x 0.35

= 130.30 L/s

For the depressed driveways to underground garages, runoff will discharge into the storm sewer system unrestricted. The unrestricted flow rate from these areas has been calculated using the same methods as the uncontrolled areas above. The calculated unrestricted flows from the 3 depressed driveways is 107.22 L/s (44.68+ 31.27+31.27). The maximum allowable release rate from the remainder of the site can then be determined as:

$\mathbf{Q_{max\ allowable}}$ = $\mathbf{Q_{restricted} - Q_{uncontrolled} - Q_{unrestricted}}$

= 310.00 L/s – 130.30 L/s – 107.22 L/s

= **72.48 L/s**

Based on the previously noted factors, the rest of the site will be limited to 72.48 l/s discharging rate with inlet control devices. The following table identifies the ICD information for each drainage area and corresponding storage requirements as noted in the modified rational method calculations included in **Appendix D**. The total flow through all ICDs is 70.00 L/s, which is less than maximum allowable rate 72.48 L/s.

DRAINAGE AREA	ICD RESTRICTED FLOW (L/s)	100 YEAR STORAGE REQUIRED (m^3)	SURFACE STORAGE PROVIDED (m^3)
MH 5	15.00	5.53	12.53
CB 106 & 105	20.00	16.75	30.15
CB 102	20.00	11.23	29.18
CB 101	15.00	8.87	22.83
TOTAL	**70.00**	**42.38**	**94.69**

No surface ponding will occur in hard surfaces such as parking areas and driveways during a 2-year storm event. For the only surface parking lot located in the northeast corner of the site, the total flow generated in a 2-year event is 2.14 m^3 at 50% of the proposed release rate. The underground storage provided in storm pipes and structures is 3.94 m^3, which exceeds the required storage volume of the 2-year storm event. The tables below provide the detailed calculation for the 2-year event in the parking lot drainage area using 50% reduction in release rate. It should be noted, that underground storage is not accounted for in the 100 year stormwater calculations as there is adequate surface ponding for retention, thus the modified rational calculations do not include a 50% reduction to the release rate.

Drainage Area	***CB101***				
Area (Ha)	0.100				
C =	0.50	Restricted Flow 0.5 Q_r (L/s)=		7.50	50% of 15.0 L/s

2-Year Ponding					
T_c ***Variable*** ***(min)***	***i_{2yr}*** ***(mm/hour)***	***Peak Flow*** ***$Q_p=2.78xCi_{2yr}A$*** ***(L/s)***	***Q_r*** ***(L/s)***	***Q_p-Q_r*** ***(L/s)***	***Volume*** ***2yr*** ***(m^3)***
5	103.57	14.40	7.50	6.90	2.07
6	96.64	13.43	7.50	5.93	2.14
7	90.66	12.60	7.50	5.10	**2.14**
8	85.46	11.88	7.50	4.38	2.10
9	80.87	11.24	7.50	3.74	2.02

	Storage (m^3)				
	Overflow	**Required**	**Surface**	**Sub-surface**	**Balance**
	0.00	2.14	16.10	3.94	0.00

UNDERGROUND STORAGE CALCULATIONS

Pipe Storage	***CB 101***				
From	**To**	**Length**	**Diameter**	**X-sec Area**	**Volume**
ECB	CB 101	16.93	200	0.031	0.53
CB 101	MH 9	6.03	200	0.031	0.19
				Total	0.72

Structure Storage	***CB 101***					
	Base	**Top**	**Height**	**diameter**	**X-sec Area**	**Volume**
ECB	92.800	93.80	1.00	300	0.071	0.07
CB 101	92.550	93.95	1.40	600	0.360	0.50
MH 9	91.760	94.10	2.34	1200	1.131	2.65
					Total	3.22
		TOTAL STORAGE		**3.94**		

4.5.3 Storm Hydraulic Grade Line

Wateridge Phase 2B report indicates that the 100 year plus 20% storm hydraulic grade line (HGL) in MH 317 In Pimiwidon Street is 91.18, refer to **Appendix D** for the Wateridge Phase 2B HGL analysis. The HGL extended through the subject site have been calculated as follows:

LOCATION	MH #	USF ELEV (M)	STORM HGL (M)	FREEBOARD (M)
Pimiwidon Street	MH317	-	91.18	-
Block 1	MH 1	93.40	91.21	2.19
Block 1	MH 2	93.90	91.24	2.66
Block 1	MH 3	93.35	91.39	1.96
Block 1	MH 4	94.00	91.53	2.47
Block 1	MH 5	93.30	91.89	1.41

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 1 is provided in **Appendix D**.

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

In accordance with local municipal standards, the parking lot, pathways and the depressed driveways will be graded northeast between 0.5% and 6.0%. Most landscaped area drainage will be directed into a swale drainage system and connects to the storm sewer system. Typical swales will have slopes larger than 2.0%, or 1.5% with subdrains. Copies of the grading plans have been included in **Appendix E.**

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. The Phase 2B LID requirements indicate that all landscaped areas shall be prepared with amended topsoil prior to placing sod.

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 required 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 1 is provided by four private entrances. Two entrances are from Pimiwidon Street and the other two will be from Wanaki Road.

There are 178 parking spaces in total, including 112 underground, 43 exterior and 23 visitor parking spots. Four layby parking spots are provided on Hemlock Road.

There are no bus routes proposed within Block 1.

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

9 Geotechnical Considerations

Alston Associates, the geotechnical division of Terrapex, was retained to prepare a geotechnical investigation report for Phase 2B in the Wateridge Village by Rockcliffe Development. The objectives of the investigation are 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 report No. CO682.00 was prepared by Alston Associates in February 2019. The report recommendations were based on the findings and observations from several boreholes and test pits. Among other items, the report recommendations deal with:

- Site grading;
- Foundation Design;
- Pavement Structure;
- Sewer and Watermain Construction;
- Groundwater Control;
- Grade raises

In general, the grading plan for Block 1 adheres to the grade raise constraints noted above. A copy of the grading plans is included in **Appendix E**. For areas that exceed the grade raise limit a light weight fill program will be in place. A copy of the detailed geotechnical report is included in **Appendix E**.

Additionally, Paterson Group has been retained by Uniform to review the recommendations and design of the subject site, its memorandum of review is also included in **Appendix E**.

10 Approvals and Permit Requirements

10.1 City of Ottawa

The City of Ottawa reviews all development documents including this report and working drawings. Upon completion, the City will approve the local watermains under Permit NO. 008-202, submit the sewer ECA application to the province, and eventually issue a Commence Work Notification.

10.2 Province of Ontario

The Ministry of Environment, Conservation and Parks (MECP) Environmental Compliance Approval is not required for the subject development. A Permit To Take Water for the subject site has been provided by the MECP. The permit, number 0565-A5AMP8, expires on December 31, 2025.

10.3 Conservation Authority

Since no watercourses are impacted by the proposed development, no permits will be required from the local Conservation Authority (Rideau Valley Conservation Authority).

10.4 Federal Government

There are no federal permits, authorizations or approvals needed for this development.

11 Conclusions and Recommendations

Water, wastewater and stormwater systems required to develop 475 Wanaki Drive will be designed in accordance with MECP and City of Ottawa's current level of service requirements.

The use of lot level control 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:

- Site Plan Approval: City of Ottawa
- Water Data Card: City of Ottawa

Report Prepared by:

IBI GROUP

Demetrius Yannoulopoulos, P.Eng.
Director

Ryan Magladry, C.E.T.
Project Designer

J:\124219_WateridgeP2B\6.0_Technical\6.04_Civil\03_Tech-Reports\Sent to CLC Review_June 2020\CTR_Design Brief Block 1_2020-06-09.docx\

APPENDIX A

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

THIS 25 DAY OF February, 2020

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

PLAN 4M- 1651

I CERTIFY THAT THIS PLAN
IS REGISTERED IN THE LAND REGISTRY OFFICE
FOR THE LAND TITLES DIVISION OF OTTAWA-CARLETON NO. 4
AT 11:36 O'CLOCK ON THE 3rd DAY OF March 2020
AND ENTERED IN THE PARCEL REGISTER FOR
PROPERTY IDENTIFIERS 04273-0590, 04273-0618 AND 04273-0619

AND THE REQUIRED CONSENTS ARE REGISTERED AS
PLAN DOCUMENT NO. OC2197707

C. Holloway
REPRESENTATIVE FOR LAND REGISTRAR

This plan comprises all of PIN 04273-0618 and 04273-0619 and part of PIN 04273-0590.

Blocks 1 to 16, both inclusive, rue Bareille-Snow Street, chemin Codd's Road, rue Michael Stoqua Street, rue Moses Tennisco Street, rue Pimiwidon Street, chemin Tawadina Road, chemin Wanaki Road and rue Wigwas Street are subject to easement Inst. OC1771382.

Part of Blocks 8, 11, 12 and 15, Part of rue Bareille-Snow Street, Part of rue Michael Stoqua Street and Part of chemin Tawadina Road are subject to easement Inst. OC1755037.

Blocks 2, 3, 5, 6, 9 and 13 and Part of Blocks 1, 4, 7, 8, 10, 11, 12, 14, 15 and 16, Part of rue Bareille-Snow Street, Part of rue Michael Stoqua Street, Part of rue Moses Tennisco Street, Part of rue Pimiwidon Street, Part of chemin Tawadina Road, Part of chemin Wanaki Road and Part of rue Wigwas Street are subject to easement Inst. OC1755039.

Part of Block 1 is subject to easement Inst. OC1876722.

Part of Block 1 is subject to easement Inst. OC1877278.

Part of Block 14 is subject to easement Inst. OC1874459.

Part of Blocks 1, 4, 7, 10, 11, 12, 14, 16, chemin Wanaki Road, rue Pimiwidon Street, rue Wigwas Street, rue Moses Tennisco Street, rue Michael Stoqua Street, rue Bareille-Snow Street and chemin Codd's Road are subject to easement Inst. OC2090069.

PLAN OF SUBDIVISION OF

PART OF LOTS 22 And 23
CONCESSION 1 (OTTAWA FRONT)
Geographic Township of Gloucester
And
BLOCKS 27 And 28
REGISTERED PLAN 4M-1581
CITY OF OTTAWA

Surveyed by Annis , O'Sullivan , Vollebekk Ltd.

Scale 1 : 1250

50 37.5 25 12.5 0 25 50 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 survey and plan are correct and in accordance with the Surveys Act, the Surveyors Act and the Land Titles Act and the regulations made under them.
2. The survey was completed on the 15th day of November, 2019.

FEB 7, 2020
Date

E. H. Herweyer
Ontario Land Surveyor

OWNER'S CERTIFICATE

THIS IS TO CERTIFY THAT :

1. Blocks 1 to 12, both inclusive, and the Streets, namely, rue Bareille-Snow Street, chemin Codd's Road, rue Michael Stoqua Street, rue Moses Tennisco Street, rue Pimiwidon Street, chemin Tawadina Road, chemin Wanaki Road and rue Wigwas Street and the Reserves, namely, Blocks 13, 14, 15 and 16 have been laid out in accordance with our instructions.
2. The Streets are dedicated to City of Ottawa as public highways.

Dated the 5TH day of February 2020

Tara Dinsmore, Vice President,
Real Estate (National Capital Region, Atlantic and Acquisitions)
Canada Lands Company CLC Limited
I have the authority to bind the corporation.

Dated the 5TH day of February 2020

Chris Millen, Acting Senior Director
Real Estate (National Capital Region, Atlantic and Acquisitions)
Canada Lands Company CLC Limited
I have the authority to bind the corporation.

NOTES AND LEGEND

—□—	denotes	Survey Monument Planted.
—■—	"	Survey Monument Found
SIB	"	Standard Iron Bar.
SSIB	"	Short Standard Iron Bar.
CC	"	Cut Cross.
IB	"	Iron Bar.
CLF	"	Chain Link Fence
BF	"	Board Fence
(AOG)	"	Annis, O'Sullivan, Vollebekk Ltd.
(P1)	"	Registered Plan 4M-1581
(P2)	"	(AOG) Plan, December 11, 2017

All found survey monuments are (AOG), unless otherwise noted.

All planted survey monuments are SSIB's unless otherwise noted.

Distances shown on curved limits are Arc distances unless otherwise noted.

Distances shown on this plan are ground distances and can be converted to grid distances by multiplying by the combined scale factor of 0.999947.

Bearings are grid, derived from Can-Net 2016 Real Time Network GPS observations on reference points A and B, shown hereon, having a bearing of N 90°00'00" W and are referenced to Specified Control Points 01919680105 and 01919834761, MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

Coordinates are derived from Can-Net 2016 Real Time Network GPS observations referenced to Specified Control Points 01919680105 and 0198434761, MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

Coordinate values are to urban accuracy in accordance with O. Reg. 216/10.

. 01919680105	Northing	5024915.16	Easting	373971.65
. 01919834761	Northing	5036178.12	Easting	374436.11
. Point A	Northing	5035324.64	Easting	372560.98
. Point B	Northing	5035324.64	Easting	373122.90

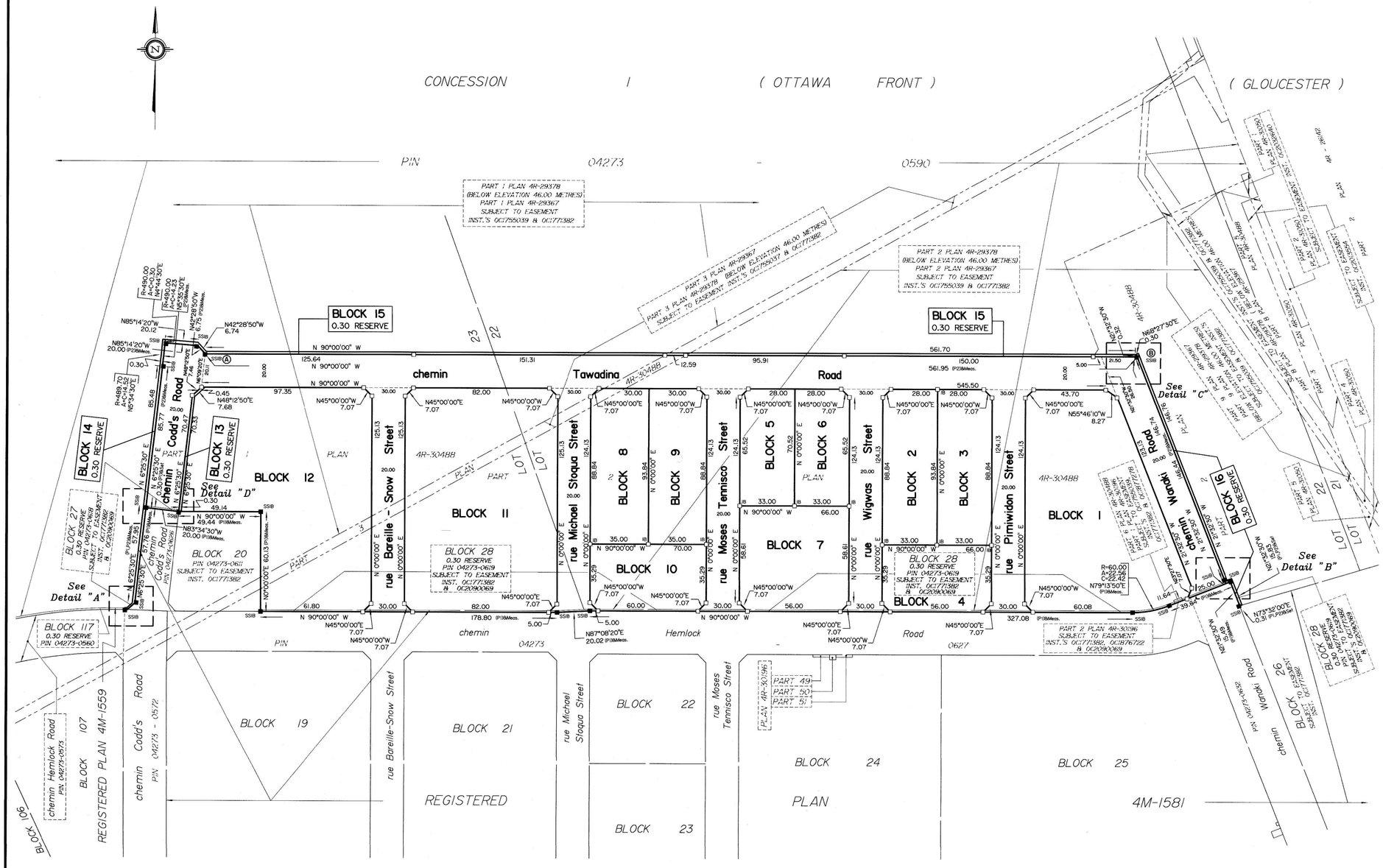
Caution: Coordinates cannot, in themselves, be used to re-establish corners or boundaries shown on this plan.

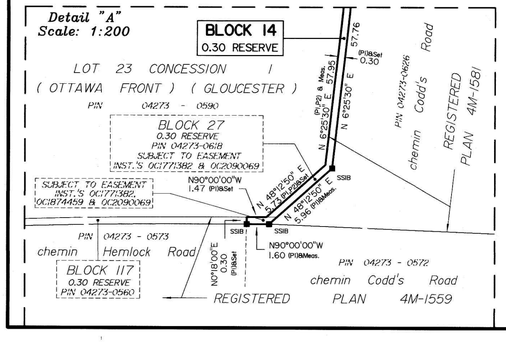
ELEVATION NOTES

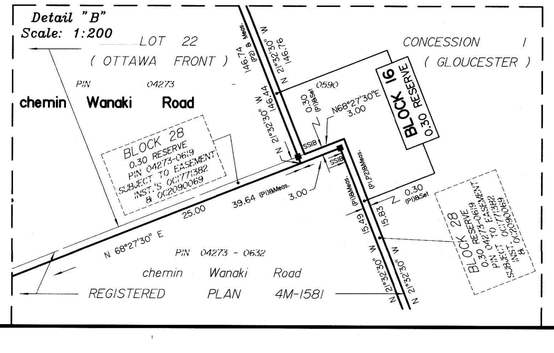
1. Elevations are geodetic, referred to City of Ottawa Vertical Bench Mark No. 396 (01919680138), having an elevation of 95.06 metres.

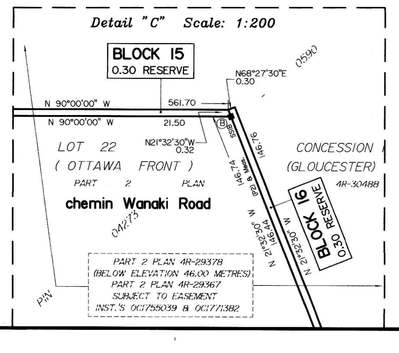
ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Email: Nepean@aovltd.com

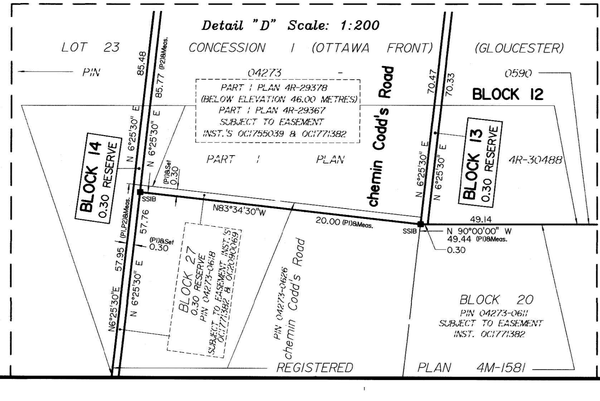
Ontario Land Surveyors — Job No. 18904-18 CLC Pl Lts 22 23 CI OF GL SUB 2B F — N

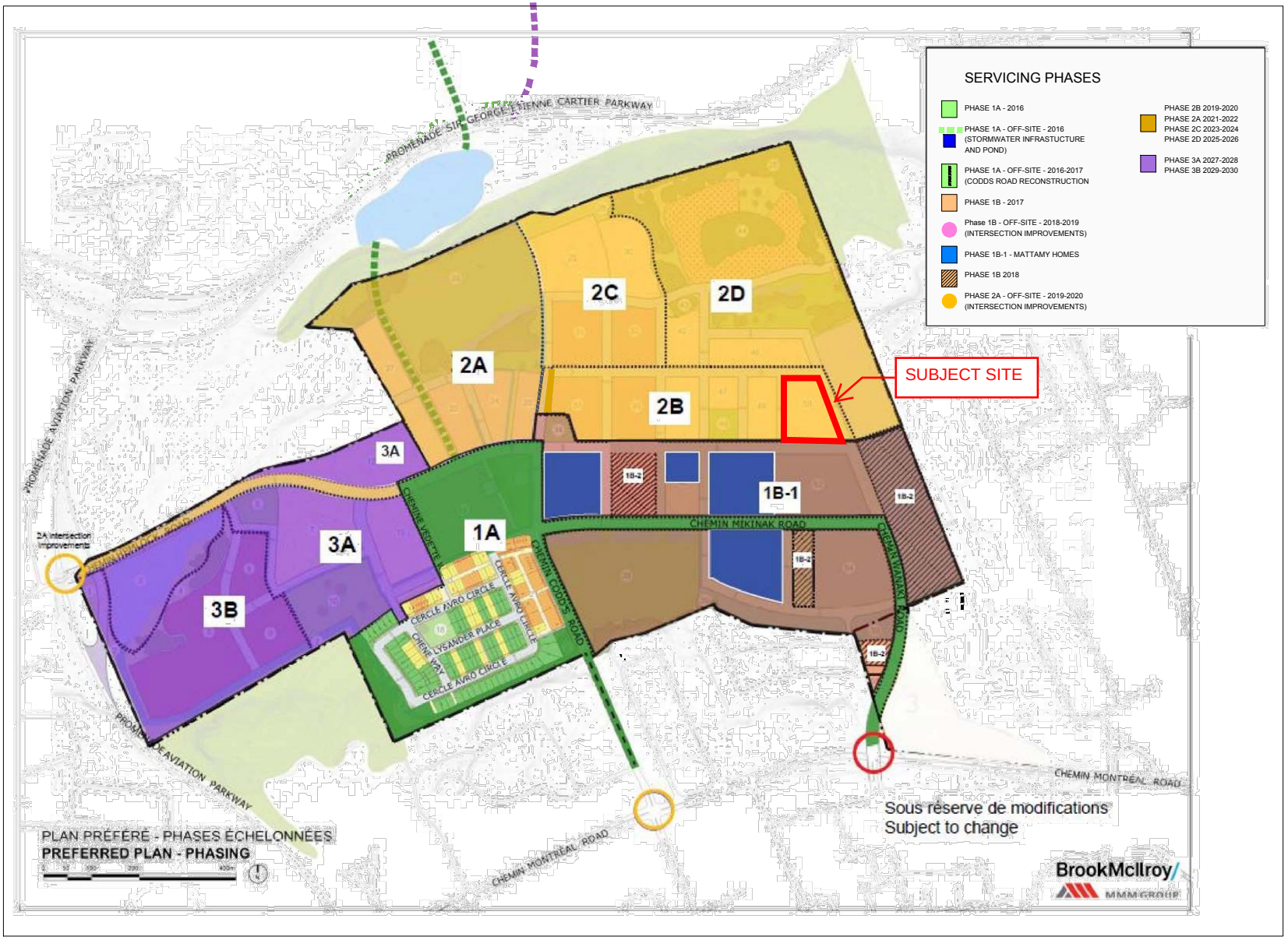






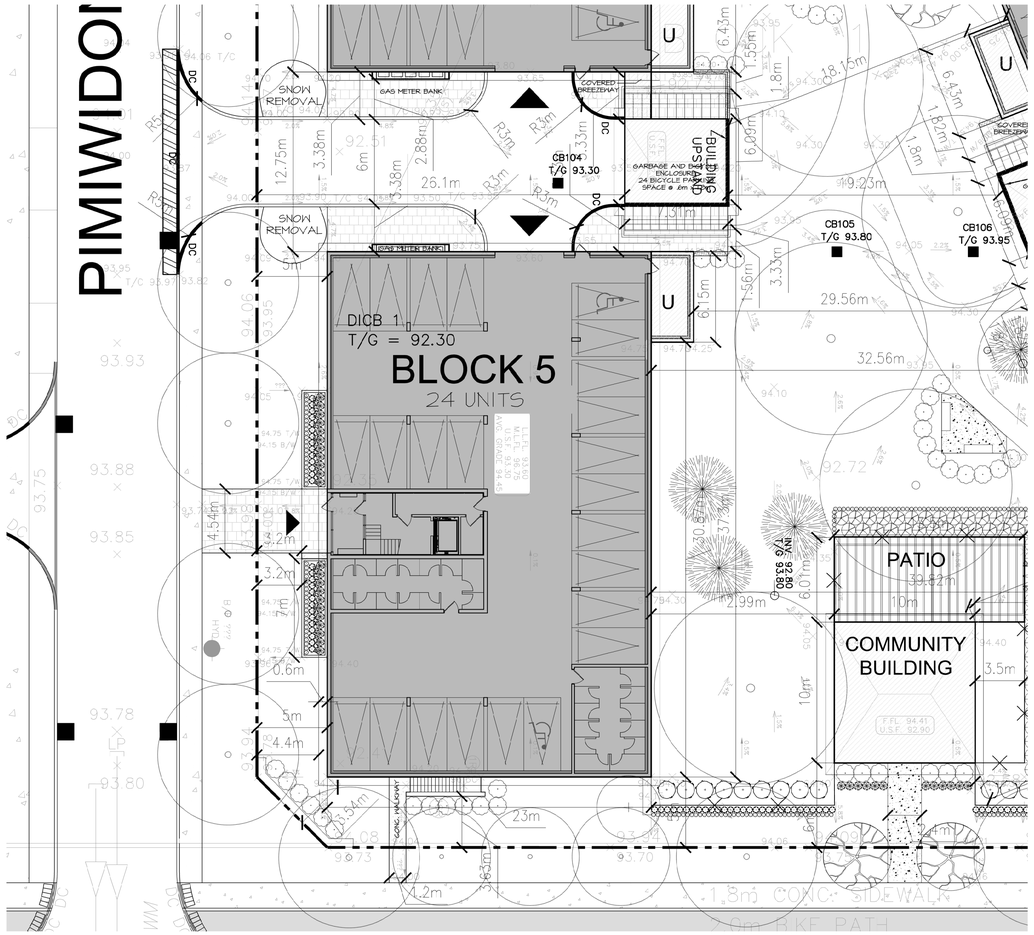


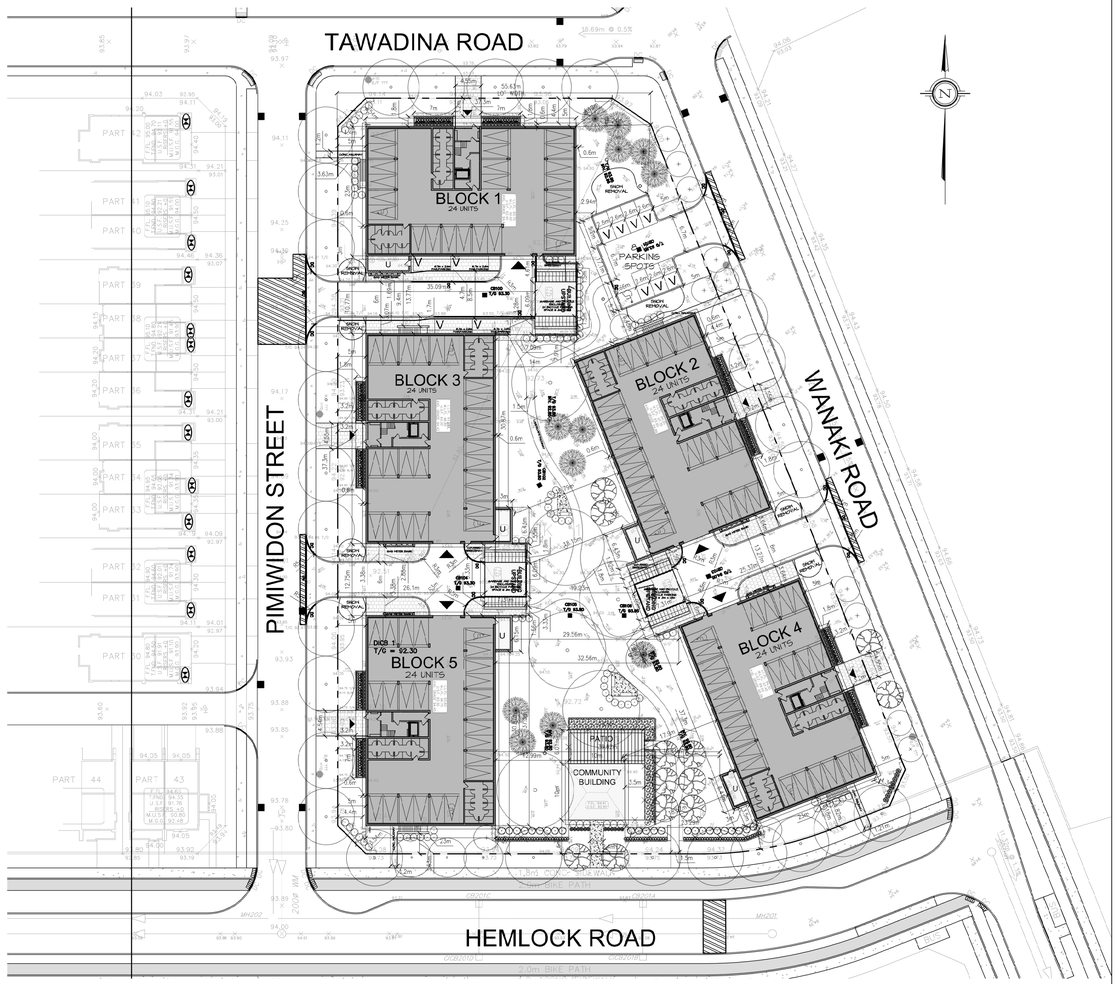




J: \118863_wtridge2o2b\5.9 drawings\59civil\current\Design Brief\Figure 1.7–Development Phasing.dwg Layout Name: Figure 1.7

Scale	Project Title	Drawing Title	Sheet No.
NTS	DESIGN BRIEF WATERIDGE VILLAGE AT ROCKCLIFFE PHASE 2B	DEVELOPMENT PHASING PLAN	FIGURE 1.7





SITE DATA

SITE STATISTICS (NUMBER OF UNITS & GROSS BUILDING AREA)

BLOCK 1	24 UNITS	932.5m²
BLOCK 2	24 UNITS	928.5m²
BLOCK 3	24 UNITS	928.5m²
BLOCK 4	24 UNITS	884m²
BLOCK 5	24 UNITS	884m²
COMMUNITY BLDG.	100m²	
TOTAL	120 UNITS	4,657.5m²

LOT COVERAGE

TOTAL LOT AREA: 10,541m²
TOTAL GROSS BUILDING AREA: 4,657.5m²
TOTAL LOT COVERAGE 44.2%

TOTAL HARD SURFACE AREA: 1,680m²
TOTAL LOT COVERAGE 15.9%

TOTAL LANDSCAPE AREA: 4,454m²
TOTAL LOT COVERAGE 41%

APPROVAL SIGNATURE

APPROVED ☐ REFUSED ☐

DATE _____

_____
DERRICK MOODIE, ACTING MANAGER, DEVELOPMENT REVIEW, SUBURBAN SERVICES

SITE DATA - CONTINUED

COMMUNITY BUILDING

HEIGHT 5m

AMENITY AREA:

6,238m² TOTAL AMENITY AREA:
86.4m² PRIVATE BALCONIES IN UNITS +
100m² COMMUNITY BUILDING +
116m² COMMUNITY BUILDING PATIO +
4,938m² TOTAL EXTERIOR LANDSCAPE AREA (SEATING, PATHWAY, LAWN)

SURVEY INFORMATION

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
ONTARIO LAND SURVEYORS
14 CONCOURSE GATE, SUITE 500
NEPEAN, ON K2E 7S6

CONTACT:
ANDREW BROXHAM
TEL. 613-727-4953

PLAN OF SUBDIVISION OF
PART OF LOTS 22 And 23 CONCESSION I
GEOGRAPHIC TOWNSHIP OF GLOUCESTER
AND
BLOCKS 27 And 28
REGISTERED PLAN 4M-1581
CITY OF OTTAWA

GRAPHIC SCALE 1 : 500

5m 10m 20m 50m

SITE STATISTICS

PLANNED UNIT DEVELOPMENT ZONING MECHANISM

ZONING: R5Y - RESIDENTIAL FIFTH DENSITY ZONE EXCEPTION [2312]

DWELLING TYPE: RUD - 120 APARTMENT UNITS		REQUIRED	PROPOSED
MIN. WIDTH OF PRIVATE DRIVEWAY		6.0m	6.0m
MIN. SEPARATION AREA BETWEEN BUILDINGS		3.0m MIN.	3.33m MIN.
SETBACKS	FRONT YARD - TAWADINA RD.	5m	5m
	INTERIOR SIDE YARD	5m	N/A
	CORNER SIDE YARD - PIMIWIDON ST. AND WANAKI RD.	5m	5m
	REAR YARD - HEMLOCK RD.	5m	5m
MIN. LOT WIDTH		N/A	55.63m
MIN. LOT AREA		1400m²	10541m²
MAX. BUILDING HEIGHT		16m	14.6m

CONSULTANTS

ARCHITECT
HOBIN ARCHITECTURE INC.
63 PAMILLA STREET,
OTTAWA, ON K1S 3K7

CONTACT:
BILL RITCEY
TEL. 613-236-7200
FAX. 613-265-2005

SITE SERVICES & GRADING
IBI GROUP, OTTAWA
333 PRESTON STREET, SUITE 400
OTTAWA, ON K1S 5N4

CONTACT:
RYAN MAGLADERY
TEL. 613 225 1311 EXT. 6406
FAX. 613 225 9868

GEOTECHNICAL
PATERSON GROUP CONSULTING ENGINEERS.
154 COLONNADE ROAD SOUTH,
OTTAWA, ON K2E 7J5

CONTACT:
DAVID GILBERT
TEL. 613-226-7381
FAX. 613-226-6344

LANDSCAPE ARCHITECT
LASHLEY + ASSOCIATES CORP./
450 GLADSTONE AVE. SUITE 202,
OTTAWA, ON K1Y 3E6

CONTACT:
DAVID LASHLEY
TEL. 613-233-8579
FAX. 613-233-4051

PARKING REQUIREMENTS - RESIDENTS

(PARKING PROVISIONS 2008-250 SECTION 106)

RESIDENTS REQUIRE
54 RESIDENT SPACES
[120. (120-12)x0.5]

10.8 VISITORS (0.1x108)

63 SPACES

BICYCLE
0.5 x 120 UNITS = 60 SPACES

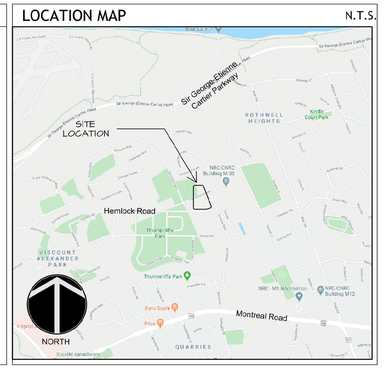
PROVIDED
120 RESIDENT SPACES
10 of which are B.F.
@ 2.4mx5.2m /w 1.5m access isle

12 VISITORS
7 @ 2.6mx5.2m
1 B.F. @ 3.66mx5.2m
4 @ 2.6mx6.7m

132 TOTAL

BICYCLE
60 OUTDOOR SPACES
@ .6m x 1.8m

LOCATION MAP N.T.S.



no.	date	revision

It is the responsibility of the appropriate contractor to check and verify all dimensions on site and report all errors and/or omissions to the architect.

All contractors must comply with all pertinent codes and by-laws.

Do not scale drawings.

This drawing may not be used for construction until signed.

uniform URBAN DEVELOPMENTS

Hobin Architecture Incorporated
63 Pamilla Street
Ottawa, Ontario
Canada K1S 3K7
T: 613-238-7200
F: 613-235-2005
E: mail@hobinarc.com
hobinarc.com

HOBIN ARCHITECTURE

project title
WATERIDGE FLATS
BLOCK 5
STYLE A, PEAKED ROOF
TAWADINA ROAD, OTTAWA, ONTARIO

drawing title
SITE PLAN

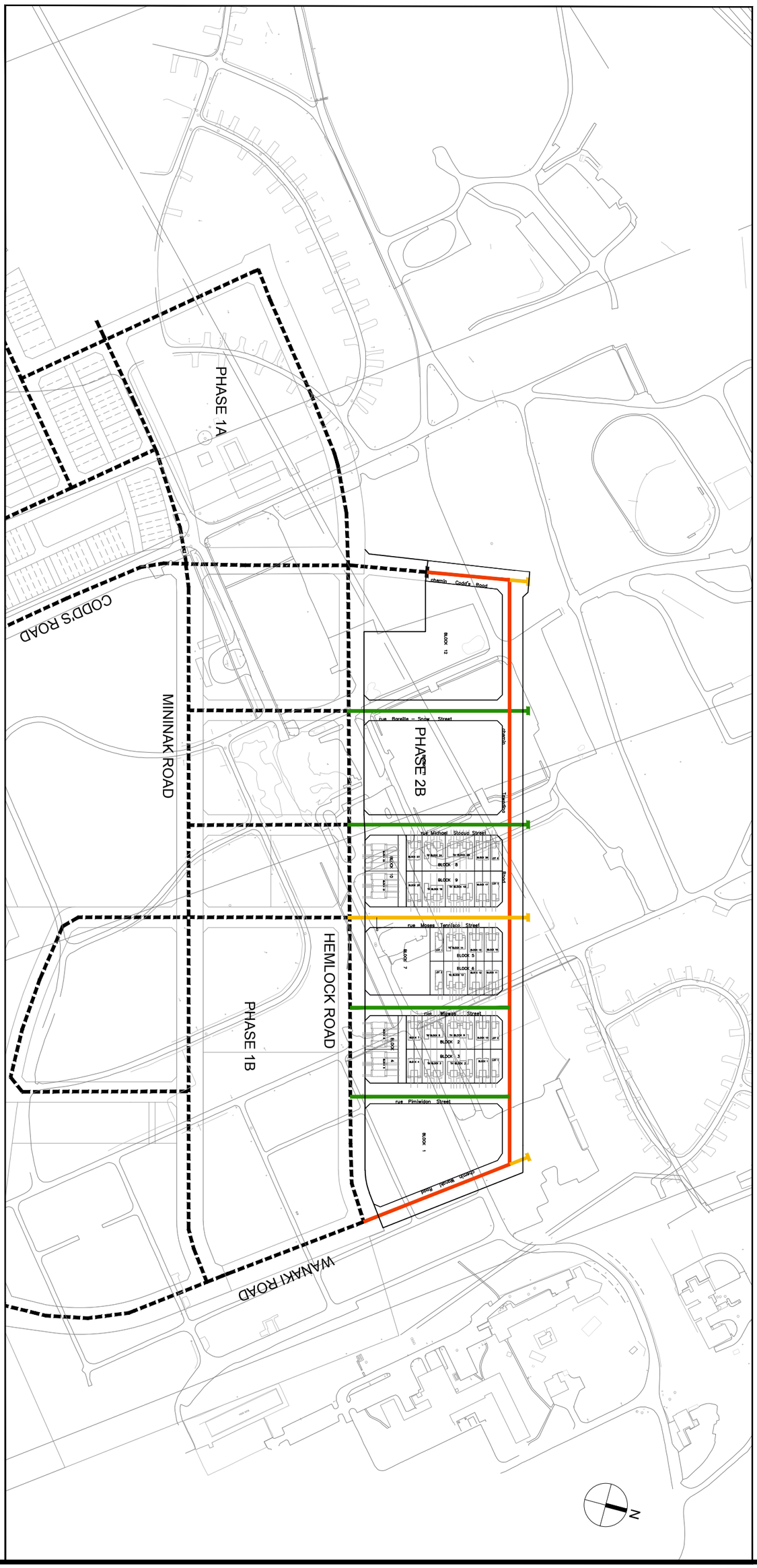
drawn	date	scale
HL	JUN/20	1:500

ONTARIO ASSOCIATION OF ARCHITECTS
CARL J. HOBIN
LICENCE
3049

project 2012
drawing no. SP-1
revision no.

D07.12.15.0149 #17076

APPENDIX B



Sheet No.

FIGURE 2.1

Drawing Title

RECOMMENDED
WATER PLAN

Project Title

DESIGN BRIEF
WATERIDGE VILLAGE
AT ROCKCLIFFE
PHASE 2B

Scale

IBI

Amy Zhuang

From: Fraser, Mark <Mark.Fraser@ottawa.ca>
Sent: Monday, April 27, 2020 3:02 PM
To: Amy Zhuang
Cc: Ryan Magladry; Lance Erion
Subject: RE: Water Boundary Condition Request - Wateridge Phase 2B Block 1
Attachments: Wateridge Phase 2B Block 1 April 2020.pdf

Hi Amy,

Please find below updated boundary conditions, HGL, for hydraulic analysis at **BLOCK 1 within Wateridge Village-Phase 2B** (zone MONT) assumed to be **connected to the 305mm dia. watermain on Hemlock Road and the 203mm dia. watermain on Pimiwidon Street** (see attached PDF for locations). The City water model was updated to included the Phase 2B watermains.

Water Demands:
Type of Development: Residential [BLOCK 1]
Average Day Demand = 1.28 L/s
Maximum Day Demand = 3.19 L/s
Peak Hour Demand = 7.02 L/s
Fire Flow Demand = 12,000 L/min

Existing Conditions based on current pump operations:
Minimum HGL = 146.7m
Maximum HGL = 147.0m
Max Day + FireFlow (200L/s) = 144.5m, on Hemlock Road
Max Day + FireFlow (200L/s) = 142.0m, on Pimiwidon Street

Please note the following:

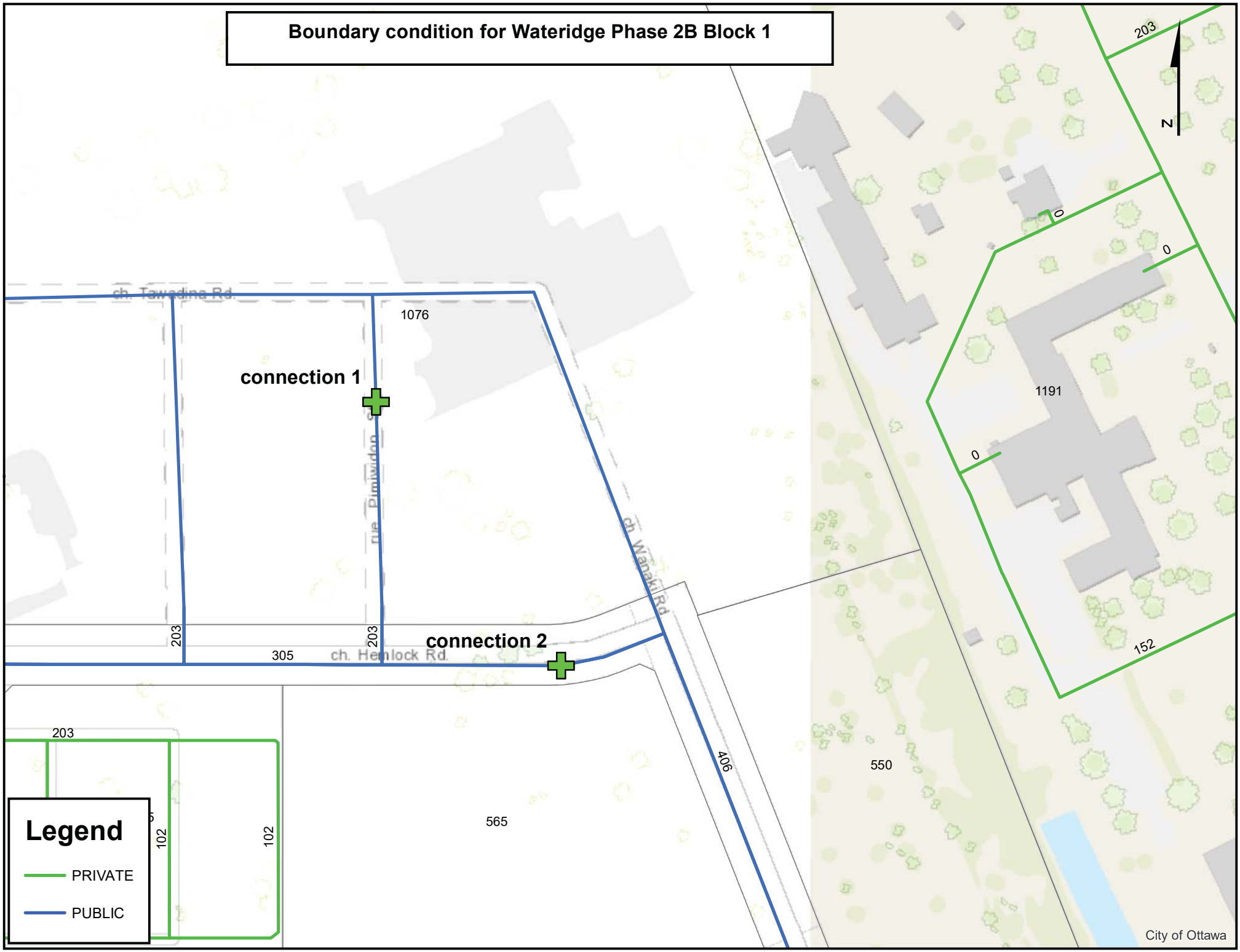
- *Boundary conditions provided above are for existing conditions. Upgrades to the Montreal and Brittany pump stations are currently being planned to support the CFB Rockcliffe development. The City plans to control the discharge HGL to 143.0m. Furthermore, the current plan is to use a different pumping strategy that will try to maintain a constant HGL of 143.0m even during peak hour and/or fire flow conditions.*

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

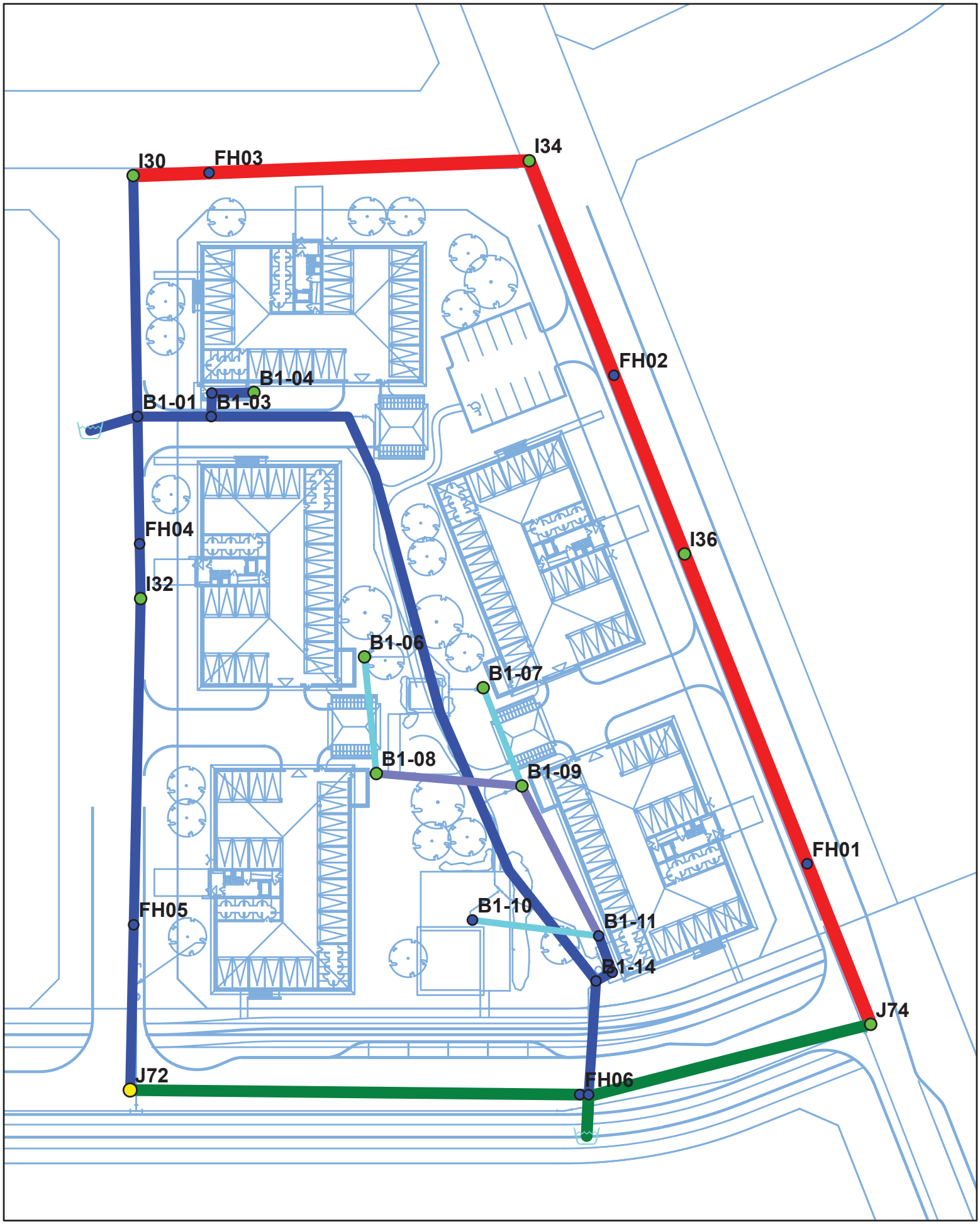
Disclaimer: *The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.*

Regards,

Mark Fraser, P. Eng.
Project Manager, Planning Services
Development Review Central Branch
City of Ottawa | Ville d'Ottawa
Planning, Infrastructure and Economic Development Department
110 Laurier Avenue West. 4th Floor, Ottawa ON, K1P 1J1
Tel:613.580.2424 ext. 27791
Fax: 613-580-2576
Mail: Code 01-14

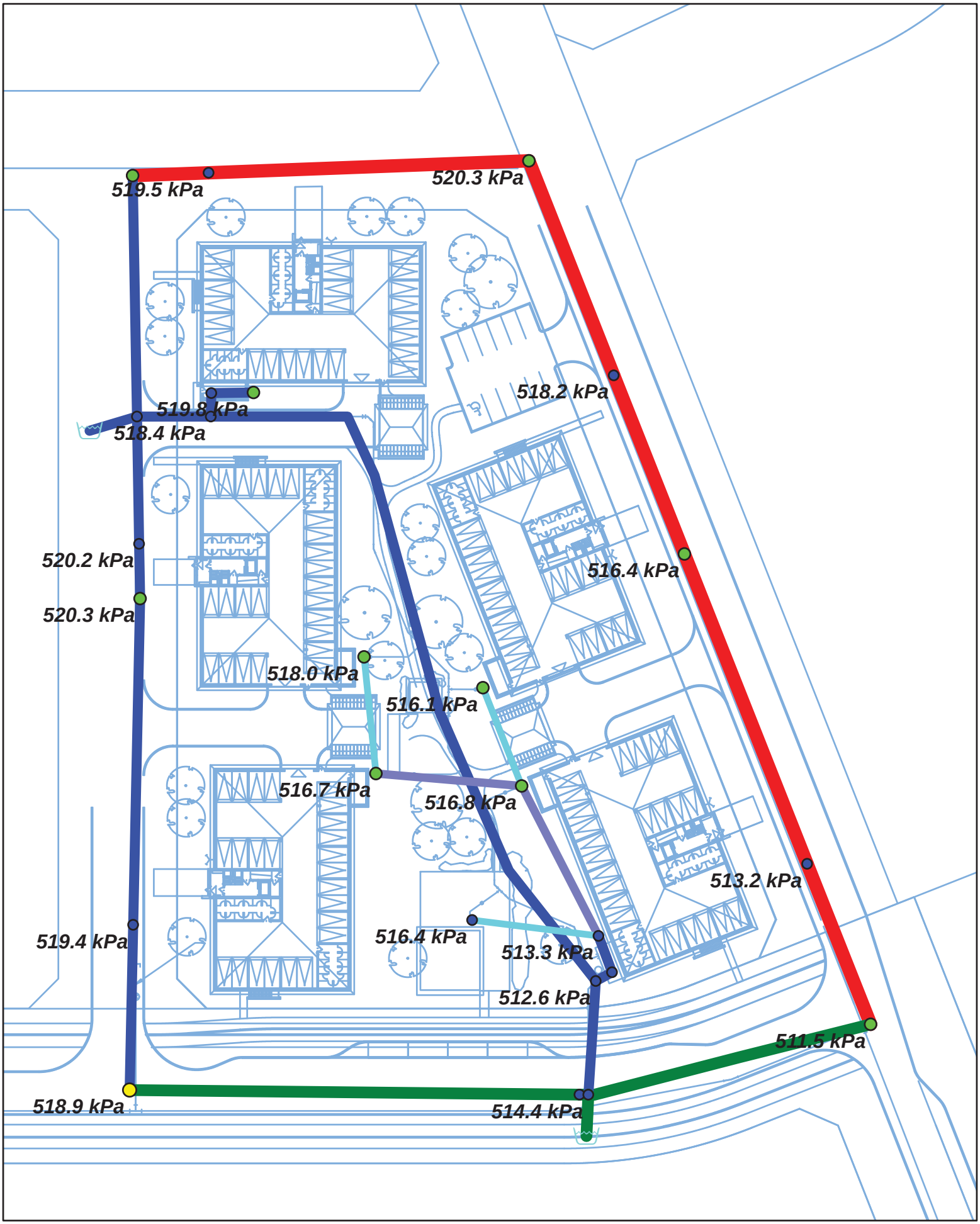

Boundary condition for Wateridge Phase 2B Block 1
ch. Tawadina Rd.
1076
connection 1
rue Pimiwidon
ch. Wanaki Rd.
203
203
305
ch. Hemlock Rd.
connection 2
203
102
102
565
406
550
1191
0
0
0
203
152
N
Legend
PRIVATE
PUBLIC
City of Ottawa

Phase 2B Block 1 Junction ID



Date: 2020-04-28

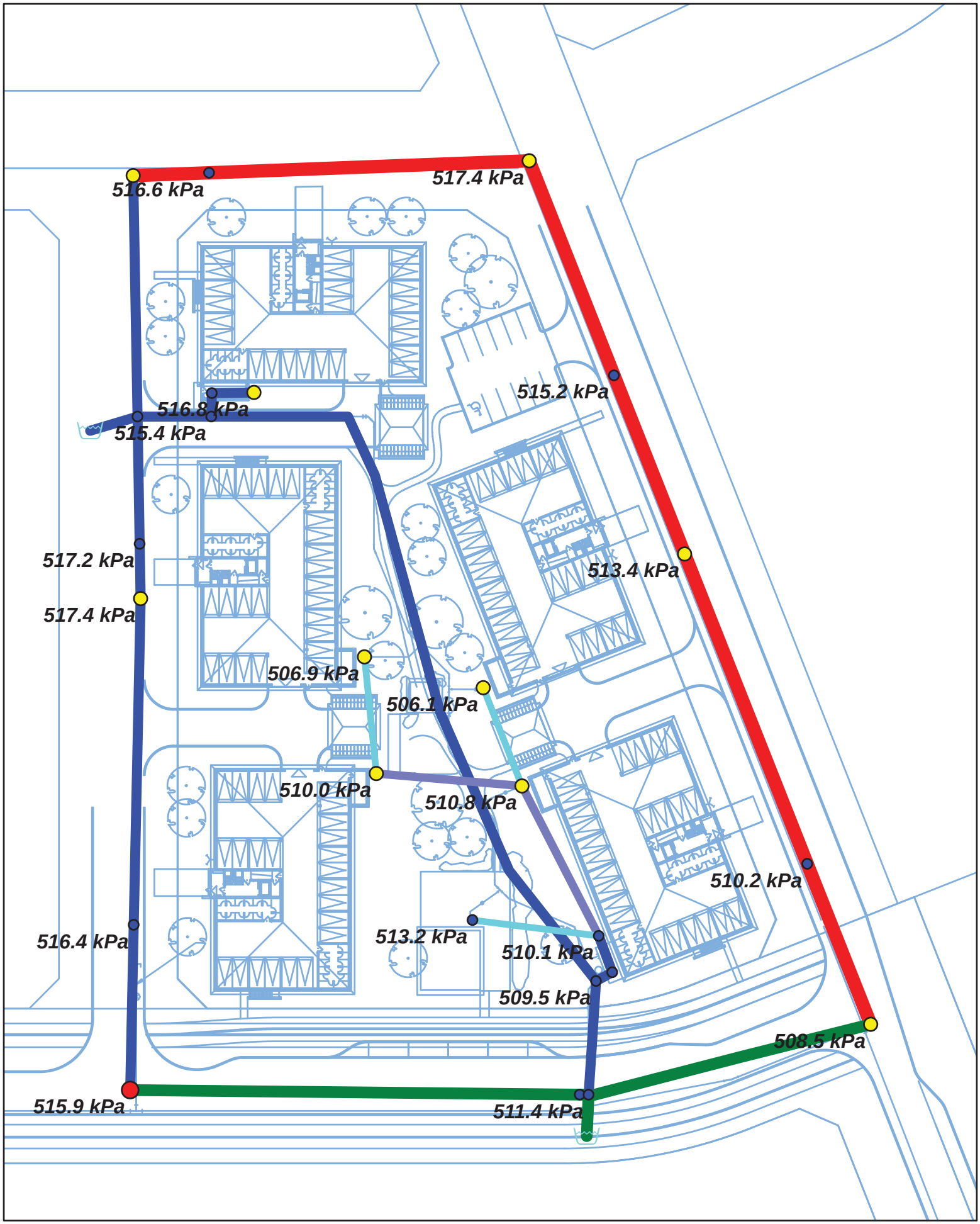
Phase 2B Block 1 Basic Day (Max HGL) Pressures



Date: 2020-04-28

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1	☐	B1-01	0.00	93.94	147.00	519.92
2	☐	B1-02	0.00	94.20	147.00	517.40
3	☐	B1-03	0.00	94.10	147.00	518.38
4	☐	B1-04	0.26	93.95	147.00	519.84
5	☐	B1-06	0.26	94.10	146.96	518.00
6	☐	B1-07	0.26	94.30	146.97	516.09
7	☐	B1-08	0.26	94.25	146.98	516.73
8	☐	B1-09	0.26	94.25	146.99	516.77
9	☐	B1-10	0.00	94.30	147.00	516.41
10	☐	B1-11	0.00	94.62	147.00	513.27
11	☐	B1-12	0.00	94.73	147.00	512.20
12	☐	B1-13	0.00	94.51	147.00	514.37
13	☐	B1-14	0.00	94.69	147.00	512.58
14	☐	FH01	0.00	94.63	147.00	513.19
15	☐	FH02	0.00	94.12	147.00	518.20
16	☐	FH03	0.00	93.98	147.00	519.54
17	☐	FH04	0.00	93.91	147.00	520.21
18	☐	FH05	0.00	94.00	147.00	519.36
19	☐	FH06	0.00	94.50	147.00	514.46
20	☐	I30	0.28	94.00	147.00	519.36
21	☐	I32	0.23	93.90	147.00	520.34
22	☐	I34	0.23	93.90	147.00	520.34
23	☐	I36	0.28	94.30	147.00	516.42
24	☐	J72	1.45	94.05	147.00	518.87
25	☐	J74	0.52	94.80	147.00	511.52

Phase 2B Block 1 Peak Hour Pressures

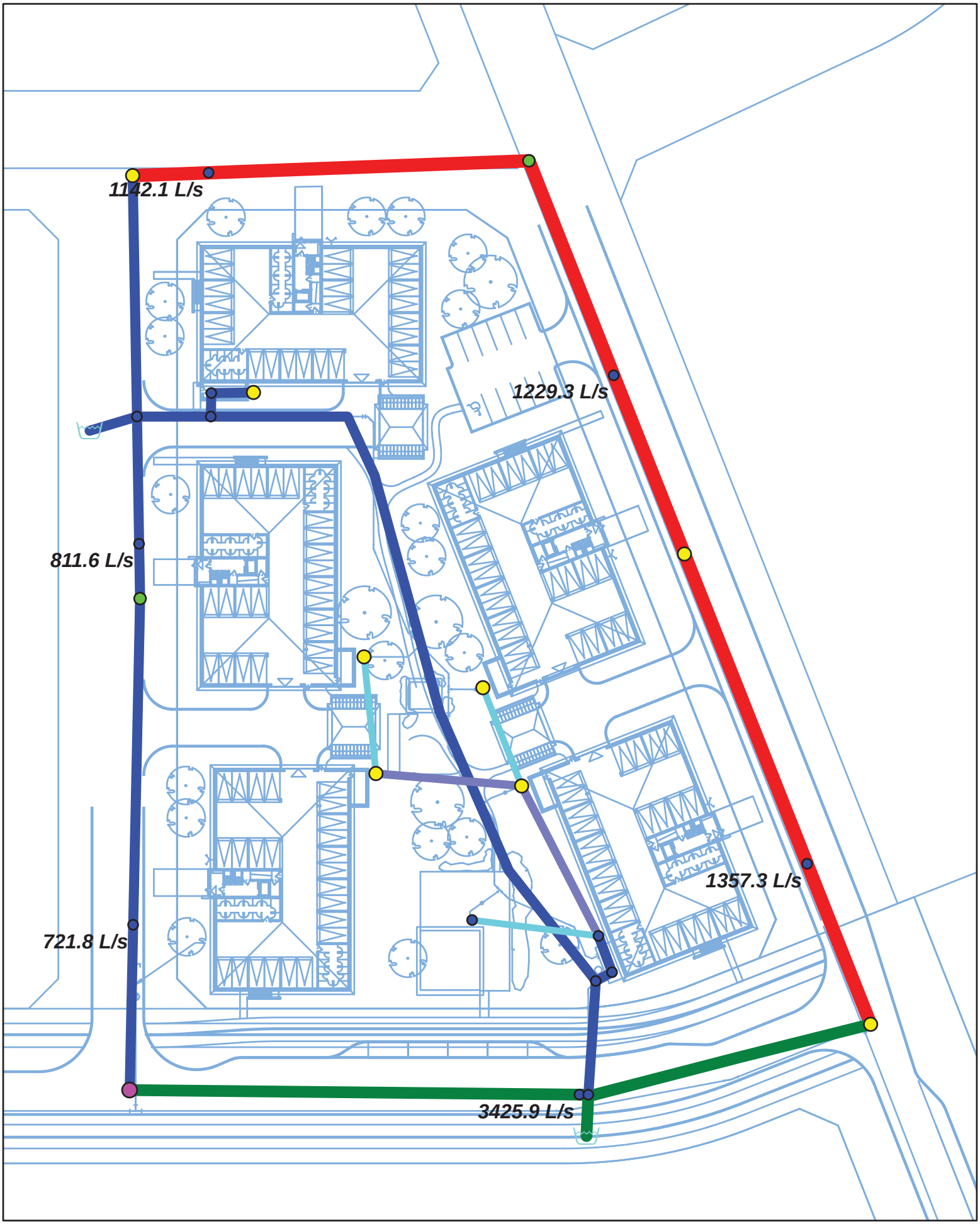


Date: 2020-04-28

Phase 2B Block 1 Peak Hour Pressures

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1	☐	B1-01	0.00	93.94	146.70	516.95
2	☐	B1-02	0.00	94.20	146.69	514.39
3	☐	B1-03	0.00	94.10	146.69	515.37
4	☐	B1-04	1.40	93.95	146.69	516.83
5	☐	B1-06	1.40	94.10	145.83	506.93
6	☐	B1-07	1.40	94.30	145.95	506.13
7	☐	B1-08	1.40	94.25	146.30	510.04
8	☐	B1-09	1.40	94.25	146.37	510.75
9	☐	B1-10	0.00	94.30	146.67	513.20
10	☐	B1-11	0.00	94.62	146.67	510.06
11	☐	B1-12	0.00	94.73	146.68	509.06
12	☐	B1-13	0.00	94.51	146.70	511.42
13	☐	B1-14	0.00	94.69	146.68	509.49
14	☐	FH01	0.00	94.63	146.70	510.22
15	☐	FH02	0.00	94.12	146.70	515.23
16	☐	FH03	0.00	93.98	146.70	516.57
17	☐	FH04	0.00	93.91	146.70	517.23
18	☐	FH05	0.00	94.00	146.69	516.37
19	☐	FH06	0.00	94.50	146.70	511.50
20	☐	I30	1.54	94.00	146.70	516.38
21	☐	I32	1.28	93.90	146.70	517.35
22	☐	I34	1.28	93.90	146.70	517.36
23	☐	I36	1.54	94.30	146.70	513.45
24	☐	J72	7.99	94.05	146.69	515.87
25	☐	J74	1.41	94.80	146.70	508.55

Phase 2B Block 1 Max Day + Fire Design Fireflows



Date: 2020-04-28

Test Report Print Title

		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)
1	☐	FH01	200.00	1,357.31	FH01	139.97	108.91	1,357.32	139.96
2	☐	FH02	200.00	1,229.24	FH02	139.97	108.40	1,229.25	139.96
3	☐	FH03	200.00	1,142.08	FH03	139.97	108.26	1,142.09	139.96
4	☐	FH04	200.00	811.63	FH04	139.96	108.20	811.63	139.96
5	☐	FH05	200.00	721.80	FH05	139.96	108.28	721.80	139.96
6	☐	FH06	200.00	3,425.65	FH06	140.01	108.79	3,425.88	139.96

WATERAIN SCHEDULE

	Station	Description	Finished Grade	Top of Waterain	As Built Waterain
A	0+000.00	TEE	94.181	91.781	
	0+006.91	VB	94.246	91.846	
	0+012.85	45° BEND	94.192	91.792	
	0+013.57	45° BEND	94.176	91.776	
B	0+014.01	CAP	94.248	91.848	
C	0+000.00	CAP	94.143	91.743	
	0+000.44	45° BEND	94.016	91.616	
	0+001.16	45° BEND	93.959	91.559	
	0+010.79	V BEND	93.571	91.171	
	0+011.29	V BEND	93.550	91.448	
	0+020.81	V BEND	93.594	91.448	
	0+021.31	V BEND	93.608	91.208	
	0+022.32	45° BEND	93.635	91.235	
	0+024.09	45° BEND	93.670	91.270	
	0+045.40	22.5° BEND	93.977	91.577	
	0+064.05	SERVICE TEE 50mm	94.110	91.710	
	0+068.89	22.5° BEND	94.236	91.836	
	0+071.66	SERVICE TEE 50mm	94.229	91.829	
	0+075.89	22.5° BEND	94.192	91.792	
	0+076.29	V BEND	94.185	91.785	
	0+076.79	V BEND	94.177	90.764	
	0+078.58	V BEND	94.147	90.764	
	0+079.08	V BEND	94.138	91.738	
	0+086.11	SERVICE TEE 50mm	94.107	91.707	
	0+092.28	22.5° BEND	94.149	91.749	
	0+106.72	45° BEND	94.016	91.616	
	0+111.42	SERVICE TEE 19mm	94.090	91.690	
	0+112.42	45° BEND	94.106	91.706	
	0+116.64	45° BEND	94.095	91.695	
	0+117.81	45° BEND	94.137	91.737	
	0+121.24	22.5° BEND	94.313	91.913	
	0+121.99	45° BEND	94.353	91.953	
D	0+122.28	CAP	94.432	92.032	
E	0+000.00	CAP	94.887	92.487	
	0+000.75	22.5° BEND	94.855	92.455	
	0+002.04	45° BEND	94.801	92.401	
	0+009.17	VB	94.338	91.938	
F	0+026.37	TVS	94.118	91.718	

CROSSING SCHEDULE

1	525 mm ø STM	0.270 m	CLEARANCE OVER	250 mm ø	SAN
2	200 mm ø W/M	1.222 m	CLEARANCE OVER	200 mm ø	SAN
3	200 mm ø W/M	0.310 m	CLEARANCE OVER	525 mm ø	STM
4	150 mm ø SAN	0.261 m	CLEARANCE OVER	525 mm ø	STM
5	150 mm ø SAN	0.261 m	CLEARANCE OVER	150 mm ø	W/M
6	150 mm ø STM	0.492 m	CLEARANCE OVER	150 mm ø	W/M
7	300 mm ø STM	0.250 m	CLEARANCE OVER	150 mm ø	W/M
8	200 mm ø STM	0.769 m	CLEARANCE OVER	150 mm ø	W/M
9	150 mm ø STM	1.333 m	CLEARANCE OVER	200 mm ø	SAN
10	150 mm ø SAN	0.480 m	CLEARANCE OVER	300 mm ø	STM
11	150 mm ø STM	0.468 m	CLEARANCE OVER	150 mm ø	W/M
12	150 mm ø SAN	0.408 m	CLEARANCE OVER	150 mm ø	W/M
13	150 mm ø W/M	0.250 m	CLEARANCE OVER	300 mm ø	STM
14	200 mm ø STM	0.833 m	CLEARANCE OVER	150 mm ø	W/M
15	300 mm ø STM	0.329 m	CLEARANCE OVER	200 mm ø	SAN
16	150 mm ø SAN	0.333 m	CLEARANCE OVER	300 mm ø	STM
17	150 mm ø STM	0.839 m	CLEARANCE OVER	200 mm ø	SAN
18	150 mm ø SAN	0.396 m	CLEARANCE OVER	150 mm ø	W/M
19	150 mm ø STM	0.471 m	CLEARANCE OVER	150 mm ø	W/M
20	150 mm ø W/M	0.370 m	CLEARANCE OVER	450 mm ø	STM
21	150 mm ø W/M	1.412 m	CLEARANCE OVER	250 mm ø	SAN
22	200 mm ø STM	1.191 m	CLEARANCE OVER	150 mm ø	W/M
23	200 mm ø W/M	0.587 m	CLEARANCE OVER	150 mm ø	W/M

Stm STRUCTURE TABLE

NAME	RIM ELEV.	INVERT IN	INVERT IN AS-BUILT	INVERT OUT	INVERT OUT AS-BUILT	DESCRIPTION
MH1	94.19	E90.670		W90.650		1200ø OPSD 701.010
MH2	93.57	S90.832 N91.012		W90.727		1200ø OPSD 701.010
MH3	94.11	SE90.919		N90.889		1200ø OPSD 701.010
MH4	93.95	S91.048		NW90.943		1200ø OPSD 701.010
MH5	93.96			N91.163		1200ø OPSD 701.010
MH6	93.67	NW91.854		E91.724		1200ø OPSD 701.010
MH7	94.18	SE92.598		W91.415		1200ø OPSD 701.010
MH8	93.62	E91.700		S91.033		1200ø OPSD 701.010
MH9	94.06	NE92.493		W91.763		1200ø OPSD 701.010
MH317B	91.84	E90.622				1500ø OPSD 701.011

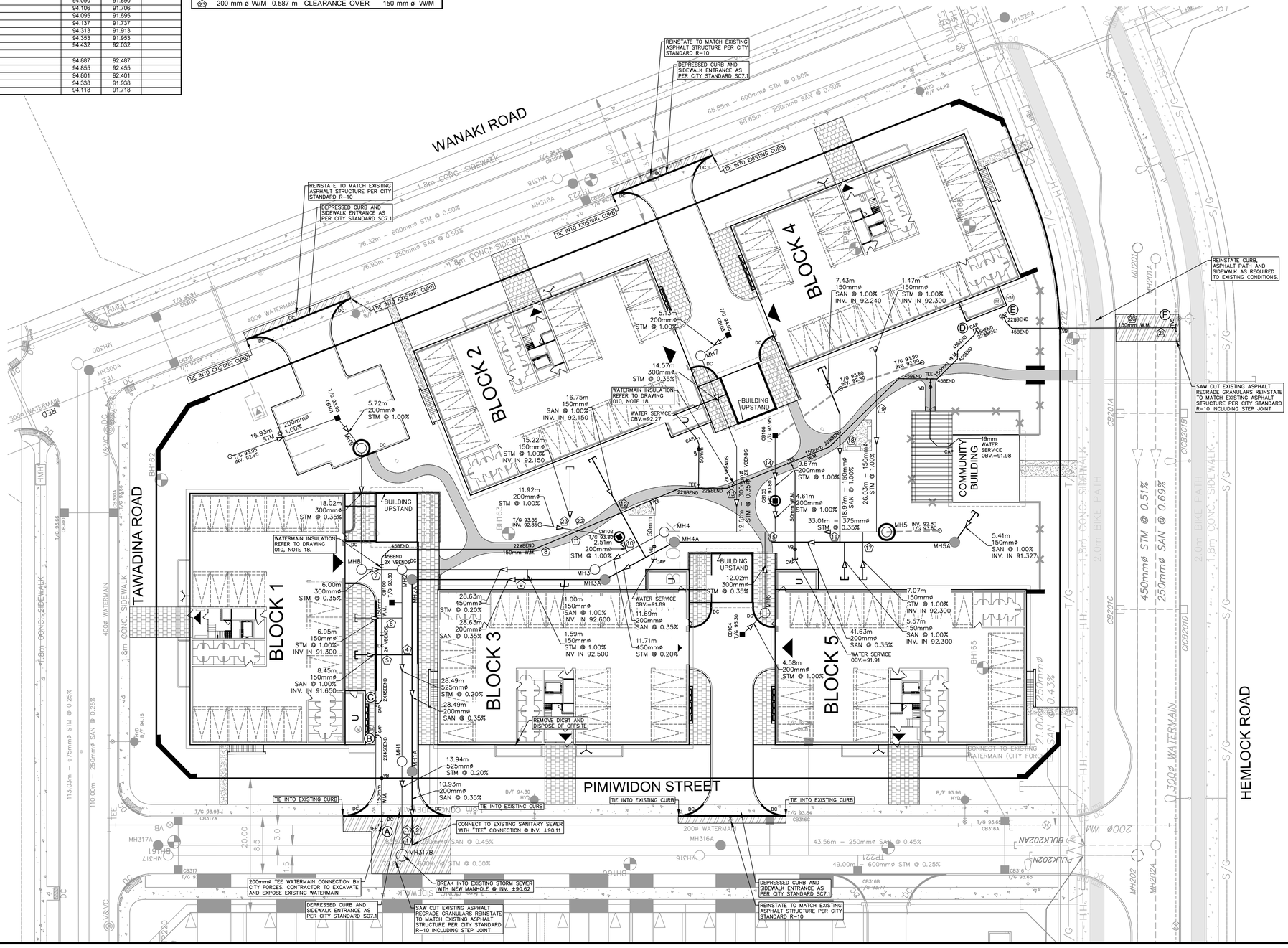
San STRUCTURE TABLE

NAME	RIM ELEV.	INVERT IN	INVERT IN AS-BUILT	INVERT OUT	INVERT OUT AS-BUILT	DESCRIPTION
MH1A	94.22	E90.736		W90.146		1200ø OPSD 701.010
MH2A	93.59	S90.896		W90.836		1200ø OPSD 701.010
MH3A	94.25	SE91.026		N90.996		1200ø OPSD 701.010
MH4A	94.08	S91.097		NW91.067		1200ø OPSD 701.010
MH5A	93.92	SE91.273		N91.243		1200ø OPSD 701.010

CBS STRUCTURE TABLE

NAME	RIM ELEV.	INVERT IN	INVERT OUT	DESCRIPTION
CB100	93.30		S91.90	OPSD 705.010
CB101	93.95	NW92.63	SW92.55	OPSD 705.010
CB102	93.80		W92.40	OPSD 705.010
CB103	94.05		NW92.65	OPSD 705.010
CB104	93.30		SE91.90	OPSD 705.010
CB105	93.80	E92.45	W92.43	OPSD 705.010
CB106	93.95		W92.55	OPSD 705.010

LOCATION	RELEASE RATE (L/s)	HEAD (m)	ICD
MH 5	15.00	2.54	Custom IPEX MHF 60 mm Diameter
CB 105	20.00	1.57	Custom IPEX MHF 78 mm Diameter
CB 102	20.00	1.60	Custom IPEX MHF 77 mm Diameter
MH 9	15.00	1.50	Custom IPEX MHF 68 mm Diameter
TOTAL	**70.00**	-	



No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			
2	ISSUED TO CLC FOR REVIEW	DGY	2020.06.09
1	ISSUED TO CLIENT FOR REVIEW	DGY	2020.05.07

uniform URBAN DEVELOPMENTS

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

Project Title
WATERIDGE VILLAGE
PHASE 2B - BLOCK 1
475 WANAKI ROAD

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/06/09
PROVINCE OF ONTARIO

Drawing Title
GENERAL PLAN
OF SERVICES

Scale
1 : 300

Design	Date
AZ/RM	APRIL 2020
Drawn	Checked
MM/EH	DGY
Project No.	Drawing No.
124219	001

CITY PLAN No.####
CITY FILE No. ####

IBI GROUP
333 PRESTON STREET
OTTAWA, ONTARIO
K1S 5N4

WATERMAIN DEMAND CALCULATION SHEET

PROJECT : WATERIDGE PHASE 2B BLOCK 1
CLIENT : UNIFORM DEVELOPMENTS

FILE: 124219
DATE PRINTED: 17-Apr-20
DESIGN: W.Z.
PAGE: 1 OF 1

NODE	RESIDENTIAL				NON-RESIDENTIAL (ICI)			AVERAGE DAILY DEMAND (l/s)			MAXIMUM DAILY DEMAND (l/s)			MAXIMUM HOURLY DEMAND (l/s)			FIRE DEMAND (l/min)
	SINGLE FAMILY UNITS	TOWN HOUSE UNITS	MEDIUM DENSITY UNITS	POPULATION	INDUST. (ha)	COMM. (ha)	INSTIT. (ha)	RESIDENTIAL	ICI	TOTAL	RESIDENTIAL	ICI	TOTAL	RESIDENTIAL	ICI	TOTAL	
Block 1			24	63.0				0.26		0.26	0.64		0.64	1.40		1.40	12,000
Block 2			24	63.0				0.26		0.26	0.64		0.64	1.40		1.40	
Block 3			24	63.0				0.26		0.26	0.64		0.64	1.40		1.40	
Block 4			24	63.0				0.26		0.26	0.64		0.64	1.40		1.40	
Block 5			24	63.0				0.26		0.26	0.64		0.64	1.40		1.40	
Total			120	315.0				1.28		1.28	3.19		3.19	7.02		7.02	

POPULATION DENSITY

Single Family 3.4 persons/unit

Semi Detached & Townhouse 2.7 persons/unit

Medium Density 1.8 persons/unit

WATER DEMAND RATES

Residential 350 l/cap/day

Commercial Shopping Center 2,500 L/(1000m2)/day

PEAKING FACTORS

Maximum Daily
Residential 2.5 x avg. day
Commercial 1.5 x avg. day

Maximum Hourly
Residential 2.2 x avg. day
Commercial 1.8 x avg. day

FIRE DEMANDS

Single Family 10,000 l/min (166.7 l/s)

Semi Detached & Townhouse 10,000 l/min (166.7 l/s)

Medium Density 15,000 l/min (250 l/s)

NOTE

Population information provided by the Architect. (Average 2.6 persons/unit)

Fire Flow Requirement from Fire Underwriters Survey - Wateridge Phase 2B Block 1

Building - Block 1

Floor Area of Largest building	887	m^2
Storeys	3	
Total Floor Area	2,662	m^2

$F = 220C\sqrt{A}$

C	1.0	C =	1.5	wood frame
A	2,662 m^2		1.0	ordinary
			0.8	non-combustible
F	11,350 l/min		0.6	fire-resistive
use	11,000 l/min			

Occupancy Adjustment

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

Sprinkler Adjustment

		-30%	system conforming to NFPA 13
		-50%	complete automatic system
Use	0%		
Adjustment	0 l/min		

Exposure Adjustment

Building Face	Separation (m)	Adjacent Exposed Wall			Exposure Charge *
		Length	Stories	L*H Factor	
north	>45	12.0	2	24	0%
east	>45	12.0	2	24	0%
south	13.8	12.2	3	37	11%
west	>45	12.0	2	24	0%
Total					11%

Adjustment	1,029	l/min
Total adjustments	1,029	l/min
Fire flow	10,379	l/min
Use	**10,000**	**l/min**
	167	**l/s**

Fire Flow Requirement from Fire Underwriters Survey - Wateridge Phase 2B Block 1

Building - Block 2

Floor Area of Largest building	883	m^2
Storeys	3	
Total Floor Area	2,649	m^2

$F = 220C\sqrt{A}$

C	1.0		C =	1.5 wood frame
A	2,649	m^2		1.0 ordinary
				0.8 non-combustible
F	11,323	l/min		0.6 fire-resistive
use	11,000	l/min		

Occupancy Adjustment

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

Sprinkler Adjustment

		-30%	system conforming to NFPA 13
		-50%	complete automatic system
Use	0%		
Adjustment	0 l/min		

Exposure Adjustment

Building Face	Separation (m)	Adjacent Exposed Wall			Exposure Charge *
		Length	Stories	L*H Factor	
north	16.6	12.2	3	37	11%
east	>45	12.0	2	24	0%
south	14.2	12.2	3	37	11%
west	16.0	12.2	3	37	11%
Total					33%

Adjustment	3,086	l/min
Total adjustments	3,086	l/min
Fire flow	12,436	l/min
Use	**12,000**	**l/min**
	200	**l/s**

Fire Flow Requirement from Fire Underwriters Survey - Wateridge Phase 2B Block 1

Building - Block 3

Floor Area of Largest building	883	m^2
Storeys	3	
Total Floor Area	2,648	m^2

$F = 220C\sqrt{A}$

C	1.0		C =	1.5 wood frame
A	2,648 m^2			1.0 ordinary
				0.8 non-combustible
F	11,320 l/min			0.6 fire-resistive
use	11,000 l/min			

Occupancy Adjustment

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

Sprinkler Adjustment

		-30%	system conforming to NFPA 13
		-50%	complete automatic system
Use	0%		
Adjustment	0 l/min		

Exposure Adjustment

Building Face	Separation (m)	Adjacent Exposed Wall			Exposure Charge *
		Length	Stories	L*H Factor	
north	13.8	12.2	3	37	11%
east	16.0	12.2	3	37	11%
south	13.8	12.2	3	37	11%
west	>45	12.0	2	24	0%
Total					33%

Adjustment	3,086	l/min
Total adjustments	3,086	l/min
Fire flow	12,436	l/min
Use	**12,000**	**l/min**
	200	**l/s**

Fire Flow Requirement from Fire Underwriters Survey - Wateridge Phase 2B Block 1

Building - Block 4

Floor Area of Largest building	882	m^2
Storeys	3	
Total Floor Area	2,647	m^2

F = 220C√A

C	1.0		C =	1.5 wood frame
A	2,647	m^2		1.0 ordinary
				0.8 non-combustible
F	11,319	l/min		0.6 fire-resistive
use	11,000	l/min		

Occupancy Adjustment

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

Sprinkler Adjustment

		-30%	system conforming to NFPA 13
		-50%	complete automatic system
Use	0%		
Adjustment	0 l/min		

Exposure Adjustment

Building Face	Separation (m)	Adjacent Exposed Wall			Exposure Charge *
		Length	Stories	L*H Factor	
north	14.2	12.2	3	37	11%
east	>45	12.0	2	24	0%
south	>45	12.0	2	24	0%
west	19.9	12.2	3	37	11%
Total					22%

Adjustment	2,057	l/min
Total adjustments	2,057	l/min
Fire flow	11,407	l/min
Use	**11,000**	**l/min**
	183	**l/s**

Fire Flow Requirement from Fire Underwriters Survey - Wateridge Phase 2B Block 1

Building - Block 5

Floor Area of Largest building	883	m^2
Storeys	3	
Total Floor Area	2,648	m^2

$F = 220C\sqrt{A}$

C	1.0		C =	1.5 wood frame
A	2,648	m^2		1.0 ordinary
				0.8 non-combustible
F	11,320	l/min		0.6 fire-resistive
use	11,000	l/min		

Occupancy Adjustment

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

Sprinkler Adjustment

		-30%	system conforming to NFPA 13
		-50%	complete automatic system
Use	0%		
Adjustment	0 l/min		

Exposure Adjustment

Building Face	Separation (m)	Adjacent Exposed Wall			Exposure Charge *
		Length	Stories	L*H Factor	
north	13.8	12.2	3	37	11%
east	11.7	12.0	2	24	10%
south	>45	12.0	2	24	0%
west	>45	12.0	2	24	0%
Total					21%

Adjustment	1,964	l/min
Total adjustments	1,964	l/min
Fire flow	11,314	l/min
Use	**11,000**	**l/min**
	183	**l/s**

APPENDIX C

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

Wateridge Phase 2B Block 1
City of Ottawa
Uniform Developments

LOCATION				RESIDENTIAL										ICI AREAS								INFILTRATION ALLOWANCE			FIXED FLOW (L/s)		TOTAL FLOW	PROPOSED SEWER DESIGN						
				AREA	UNIT TYPES				AREA	POPULATION		RES	PEAK	AREA (Ha)						ICI	PEAK	AREA (Ha)		FLOW				CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
STREET	AREA ID	FROM MH	TO MH	w/ Units (Ha)	SF	SD	TH	APT	w/o Units (Ha)	IND	CUM	PEAK FACTOR	FLOW (L/s)	INSTITUTIONAL IND	INSTITUTIONAL CUM	COMMERCIAL IND	COMMERCIAL CUM	INDUSTRIAL IND	INDUSTRIAL CUM	PEAK FACTOR	FLOW (L/s)	IND	CUM	(L/s)	IND	CUM	(L/s)	(L/s)	(m)	(mm)	(%)	(full) (m/s)	L/s	(%)
Block 1		MH 5A	MH 4A	0.51				48		126.0	126.0	3.57	1.46	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.51	0.51	0.17	0.00	0.00	1.63	20.24	41.63	200	0.35	0.624	18.62	91.96%
		MH 4A	MH 3A	0.15				24		63.0	189.0	3.53	2.16	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.15	0.66	0.22	0.00	0.00	2.38	20.24	11.69	200	0.35	0.624	17.87	88.26%
		MH 3A	MH 2A	0.15				24		63.0	252.0	3.49	2.85	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.15	0.80	0.27	0.00	0.00	3.11	20.24	28.63	200	0.35	0.624	17.13	84.62%
		MH 2A	MH 1A	0.25				24		63.0	315.0	3.46	3.53	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.25	1.05	0.35	0.00	0.00	3.88	20.24	28.49	200	0.35	0.624	16.37	80.86%
Pimiwidon Street		MH 1A	*EX. MAIN*							0.0	315.0	3.46	3.53	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.05	0.35	0.00	0.00	3.88	20.24	10.93	200	0.35	0.624	16.37	80.86%
				1.05				120		315.0	TRUE																							
Pimiwidon Street		MH317A	MH316A	0.45	1		10			30.4	345.4	3.44	3.85	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.45	1.50	0.50	0.00	0.00	4.35	41.62	83.50	250	0.45	0.821	37.27	89.55%

Design Parameters:

Residential			ICI Areas			
SF	3.4	p/p/u	INST	28,000	L/Ha/day	
TH/SD	2.7	p/p/u	COM	28,000	L/Ha/day	
APT	1.8	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Other	60	p/p/Ha		17000	L/Ha/day	
Block 1	2.63	p/p/u				
(Provided by Architect)						

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

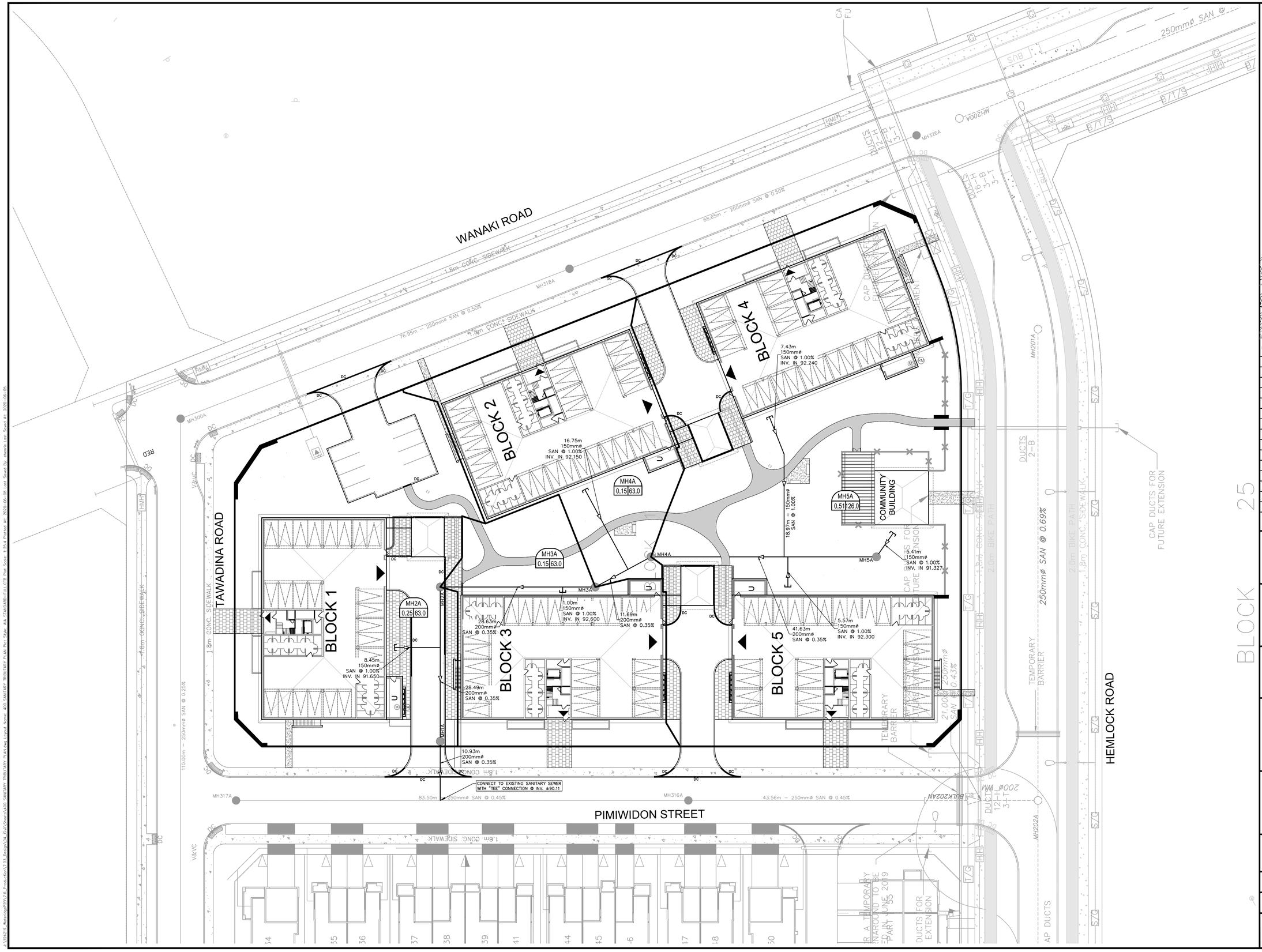
Designed: W.Z.
R.M.

Checked: D.G.Y.

Dwg. Reference: 124219-400

No.	Revision	Date
1.	Servicing Brief - Issued to Client for Review	2020-04-17
2	Servicing Brief - Issued to CLC for Review	2020-06-09

File Reference:		Date:	Sheet No:
124219-6.4.4		2020-06-09	1 of 1



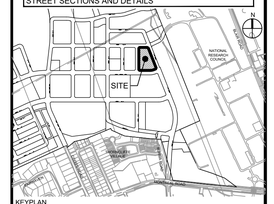
LEGEND

SANITARY TRIBUTARY OUTLINE

AREA IDENTIFICATION
POPULATION
AREA IN HECTARES

POPULATION:
STACKED TOWNHOUSE = 1.8 PPU

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEYPLAN
N.T.S.

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			
2	ISSUED TO CLC FOR REVIEW	DGY	2020:06:09
1	ISSUED TO CLIENT FOR REVIEW	DGY	2020:05:07

uniform URBAN DEVELOPMENTS

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

Project Title
WATERIDGE VILLAGE
PHASE 2B - BLOCK 1
475 WANAKI ROAD

LICENSED PROFESSIONAL ENGINEER
D. K. Yannoulopoulos
2020/06/09
PROVINCE OF ONTARIO

N

Drawing Title
SANITARY TRIBUTARY
PLAN

Scale
1 : 300

Design	Date
AZ/RM	APRIL 2020
Drawn	Checked
MM/EH	DGY
Project No.	Drawing No.
124219	400

CITY FILE No. ####

CITY PLAN No.####

25

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

LEGEND
MH231A Existing infrastructure (shown for information only)

SANITARY SEWER DESIGN SHEET

Wateridge at Rockcliffe - Phase 2B
City of Ottawa
Canada Lands Company

LOCATION				RESIDENTIAL										ICI AREAS								INFILTRATION ALLOWANCE			FIXED FLOW (L/s)		TOTAL FLOW	PROPOSED SEWER DESIGN						
				AREA	UNIT TYPES				AREA	POPULATION		RES	PEAK	AREA (Ha)						ICI	PEAK	AREA (Ha)		FLOW				CAPACITY	LENGTH	DIA	SLOPE	VELOCITY	AVAILABLE CAPACITY	
STREET	AREA ID	FROM MH	TO MH	w/ Units (Ha)	SF	SD / TH/F	TH/S	APT	w/o Units (Ha)	IND	CUM	PEAK FACTOR	FLOW (L/s)	INSTITUTIONAL IND	INSTITUTIONAL CUM	COMMERCIAL IND	COMMERCIAL CUM	INDUSTRIAL IND	INDUSTRIAL CUM	PEAK FACTOR	FLOW (L/s)	IND	CUM	(L/s)	IND	CUM	(L/s)	(L/s)	(m)	(mm)	(%)	(full) (m/s)	L/s	(%)
Pimiwidon Street	MH317-1, MH317-2	MH317A	MH316A	1.50	1	104				284.2	284.2	3.47	3.20	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.50	1.50	0.50	0.00	0.00	3.69	41.62	83.50	250	0.45	0.821	37.93	91.13%
Pimiwidon Street	MH316A	MH316A	BULK202AN	0.16		1				2.7	286.9	3.47	3.23	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.16	1.66	0.55	0.00	0.00	3.77	41.62	43.56	250	0.45	0.821	37.84	90.93%
Pimiwidon Street	-	*BULK202AN*	*MH202A*							*0.0*	*286.9*	*3.47*	*3.23*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*1.66*	*0.55*	*0.00*	*0.00*	*3.77*	*40.68*	*21.00*	*250*	*0.43*	*0.803*	*36.91*	*90.72%*
Wigwas Street	MH315A	MH315A	MH314A	0.79	2	18				55.4	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.79	0.79	0.26	0.00	0.00	0.92	50.02	113.00	250	0.65	0.987	49.10	98.17%
Wigwas Street	MH314A	MH314A	BULK203AN	0.06						0.0	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.06	0.85	0.28	0.00	0.00	0.93	80.17	15.00	250	1.67	1.582	79.24	98.83%
Wigwas Street	-	*BULK203AN*	*MH203A*							*0.0*	*55.4*	*3.64*	*0.65*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*0.85*	*0.28*	*0.00*	*0.00*	*0.93*	*80.17*	*21.00*	*250*	*1.67*	*1.582*	*79.24*	*98.83%*
Moses Tennisco Street	MH313A	MH313A	MH312A	0.66	2	16				50.0	50.0	3.65	0.59	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.66	0.66	0.22	0.00	0.00	0.81	75.98	78.00	250	1.50	1.500	75.17	98.93%
Moses Tennisco Street	MH312A, PARK	MH312A	BULK204AN	0.21		2				5.4	55.4	3.64	0.65	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.21	0.87	0.29	0.00	0.00	0.94	89.90	48.98	250	2.10	1.774	88.96	98.95%
Park	PARK	MH350A	pipe	0.42						0.0	0.0	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.42	0.42	0.14	0.00	0.00	0.14	48.39	11.00	200	2.00	1.492	48.25	99.71%
Moses Tennisco Street	-	*BULK204AN*	*MH204A*							*0.0*	*55.4*	*3.64*	*0.65*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*0.87*	*0.29*	*0.00*	*0.00*	*0.94*	*89.90*	*21.00*	*250*	*2.10*	*1.774*	*88.96*	*98.95%*
Michael Stoqua Street	MH311A	MH311A	MH310A	0.44	1	9				27.7	27.7	3.69	0.33	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.44	0.44	0.15	0.00	0.00	0.48	70.74	78.00	250	1.30	1.396	70.26	99.33%
Michael Stoqua Street	MH310A	MH310A	BULK205AN	0.21		2				5.4	33.1	3.68	0.39	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.21	0.65	0.21	0.00	0.00	0.61	66.24	48.95	250	1.14	1.307	65.63	99.08%
Michael Stoqua Street	-	*BULK205AN*	*MH205A*							*0.0*	*33.1*	*3.68*	*0.39*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*0.65*	*0.21*	*0.00*	*0.00*	*0.61*	*66.24*	*21.00*	*250*	*1.14*	*1.307*	*65.63*	*99.08%*
Wanaki Road	MH200A	MH200A	MH318A							0.0	0.0	3.80	0.00	0.00	0.00	1.01	1.01	0.00	0.00	1.50	0.49	1.01	1.01	0.33	0.00	0.00	0.82	43.91	68.65	250	0.50	0.867	43.09	98.12%
Wanaki Road	MH318A	MH318A	MH300A							0.0	0.0	3.80	0.00	0.00	0.00	0.95	1.96	0.00	0.00	1.50	0.95	0.95	1.96	0.65	0.00	0.00	1.60	43.87	76.95	250	0.50	0.866	42.27	96.35%
Tawadina Road	MH300A	MH300A	MH301A	0.47		15				40.5	40.5	3.67	0.48	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.47	2.43	0.80	0.00	0.00	2.24	31.02	110.00	250	0.25	0.612	28.78	92.79%
Tawadina Road	MH301A	MH301A	MH302A	0.54		14				37.8	78.3	3.62	0.92	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.54	2.97	0.98	0.00	0.00	2.85	58.86	110.00	250	0.90	1.162	56.00	95.16%
Tawadina Road	MH302A	MH302A	MH303A	0.26		2				5.4	83.7	3.61	0.98	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.26	3.23	1.07	0.00	0.00	3.00	73.41	112.50	250	1.40	1.449	70.41	95.92%
Tawadina Road	MH303A	MH303A	MH304A	0.21						0.0	83.7	3.61	0.98	0.00	0.00	0.00	1.96	0.00	0.00	1.50	0.95	0.21	3.44	1.14	0.00	0.00	3.07	31.02	111.99	250	0.25	0.612	27.95	90.11%
Tawadina Road	MH305A	MH305A	MH304A	0.24						0.0	0.0	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.24	0.24	0.08	0.00	0.00	0.08	50.02	111.50	250	0.65	0.987	49.94	99.84%
Bareille-Snow Street	EXT-1	BULK304AN	MH304A	7.35				905		1629.0	1629.0	3.12	16.49	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	7.35	7.35	2.43	0.00	0.00	18.91	31.02	20.00	250	0.25	0.612	12.11	39.04%
Bareille-Snow Street	MH304A-1, MH304A-2	MH304A	MH308A	1.47				190		342.0	2054.7	3.06	20.38	0.00	0.00	0.00	1.96	0.00	0.00	1.00	0.64	1.47	12.50	4.13	0.00	0.00	25.14	31.02	119.13	250	0.25	0.612	5.87	18.94%
Bareille-Snow Street	MH308A	MH308A	BULK206AN	0.07						0.0	2054.7	3.06	20.38	0.00	0.00	0.00	1.96	0.00	0.00	1.00	0.64	0.07	12.57	4.15	0.00	0.00	25.17	88.83	17.00	250	2.05	1.753	63.66	71.67%
Bareille-Snow Street		BULK206AN	MH206A							0.0	2054.7	3.06	20.38	0.00	0.00	0.00	1.96	0.00	0.00	1.00	0.64	0.00	12.57	4.15	0.00	0.00	25.17	88.83	21.00	250	2.05	1.753	63.66	71.67%
Codd's Road	MH340A	MH340A	BLK231AN	1.78				278		500.4	500.4	3.38	5.48	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.78	1.78	0.59	0.00	0.00	6.07	75.98	70.00	250	1.50	1.500	69.91	92.01%
Codd's Road	*MH231A*	*BULK176AN*								*0.0*	*500.4*	*3.38*	*5.48*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*1.00*	*0.00*	*0.00*	*1.78*	*0.59*	*0.00*	*0.00*	*6.07*	*83.92*	*50.22*	*250*	*1.83*	*1.656*	*77.86*	*92.77%*

Design Parameters:

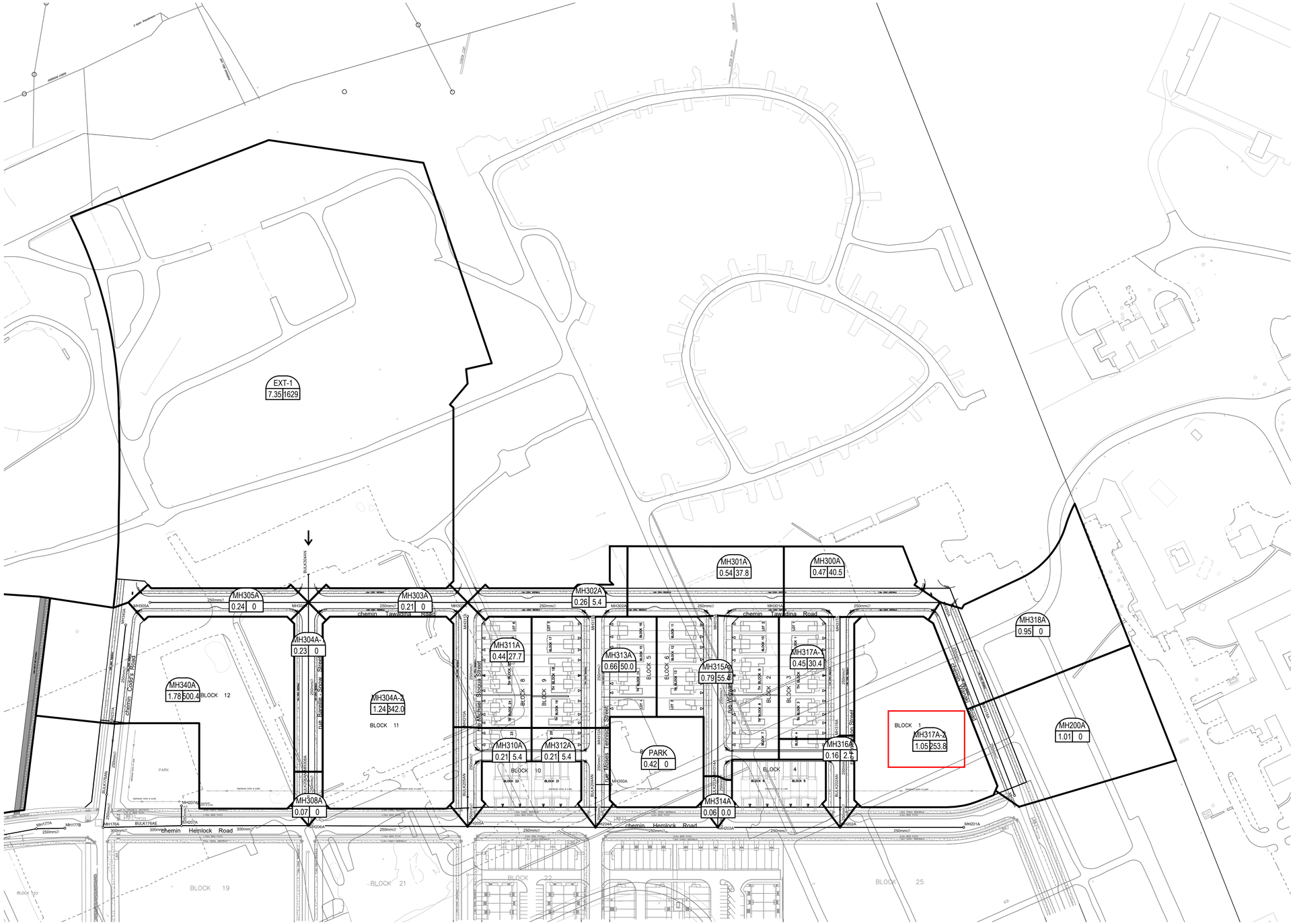
Residential			ICI Areas			
SF	3.4	p/p/u				
TH/F/SD	2.7	p/p/u	INST	28,000	L/Ha/day	
TH/S	2.3	p/p/u	COM	28,000	L/Ha/day	
APT	1.8	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Other	60	p/p/Ha		17000	L/Ha/day	

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

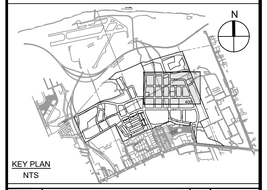
Designed: KH
Checked: JIM
Dwg. Reference: 118863-400

No.	Revision	Date
1	Submission No. 1 for City Review	2018-12-20
2	Submission No. 2 for City Review	2019-03-15
3	MECP Submission	2019-04-17

File Reference: 118863.5.7.1
Date: 2019-04-17
Sheet No: 1 of 1



SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEY PLAN
NTS

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3	MECP SUBMISSION	J.I.M.	2019/04/17
2	SUBMISSION NO. 2 FOR CITY REVIEW	J.I.M.	2019/03/15
1	SUBMISSION NO. 1 FOR CITY REVIEW	J.I.M.	2018/12/20

CANADA LANDS COMPANY
SOCIÉTÉ IMMOBILIÈRE DU CANADA
30 Metcalfe Street Suite 601
Ottawa, On K1P 5L4
613 998 7777

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

Project Title

WATERIDGE VILLAGE AT ROCKCLIFFE

PHASE 2B

LICENSED PROFESSIONAL ENGINEER
J. I. MOFFATT
2019/04/17
PROVINCE OF ONTARIO

N

Drawing Title

SANITARY DRAINAGE AREA PLAN

Scale: 1:1500

Design	Date
K.H./S.T.	DECEMBER 2018
Drawn	Checked
M.M.	J.I.M.
Project No.	Drawing No.
118863	400

D07-16-15-0003

#17063

APPENDIX D

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

Wateridge Phase 2B Block 1
City of Ottawa
Uniform Developments

LOCATION				AREA (Ha)									RATIONAL DESIGN FLOW												SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.25	C= 0.50	C= 0.57	C= 0.65	C= 0.70	C= 0.76	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)	(%)
Block 1	CB 106	CB 106	CB 105			0.11						0.15	0.15	10.00	0.15	10.15	76.81	104.19	122.14	178.56	11.74	15.93	18.68	27.30		11.74	34.22	9.67	200			1.00	1.055	22.47	65.68%
	CB 105	CB 105	MAIN			0.05						0.07	0.22	10.15	0.07	10.23	76.22	103.39	121.20	177.17	16.95	22.99	26.95	39.40	20.00	20.00	34.22	4.61	200			1.00	1.055	14.22	41.55%
	CB 104	CB 104	MH 6								0.07	0.18	0.18	10.00	0.07	10.07	76.81	104.19	122.14	178.56	13.45	18.25	21.39	31.27	31.27	31.27	34.22	4.58	200			1.00	1.055	2.95	8.61%
		MH 6	MAIN									0.00	0.18	10.07	0.24	10.32	76.53	103.81	121.69	177.90	13.40	18.18	21.31	31.16	31.27	31.27	59.68	12.02	300			0.35	0.818	28.41	47.61%
	CB 103	CB 103	MH 7								0.07	0.18	0.18	10.00	0.08	10.08	76.81	104.19	122.14	178.56	13.45	18.25	21.39	31.27	31.27	31.27	34.22	5.13	200			1.00	1.055	2.95	8.61%
		MH 7	BEND									0.00	0.18	10.08	0.30	10.38	76.50	103.77	121.64	177.82	13.40	18.17	21.30	31.14	31.27	31.27	59.68	14.57	300			0.35	0.818	28.41	47.61%
		BEND	MAIN									0.00	0.18	10.38	0.26	10.63	75.38	102.24	119.84	175.18	13.20	17.91	20.99	30.68	31.27	31.27	59.68	12.61	300			0.35	0.818	28.41	47.61%
	MH 5	MH 5	MH 4				0.07					0.11	0.68	10.63	0.58	11.21	74.45	100.95	118.33	172.96	50.91	69.03	80.91	118.26	97.54	97.54	108.21	33.01	375			0.35	0.949	10.67	9.86%
	CB 102	CB 102	MAIN			0.13						0.18	0.18	10.00	0.04	10.04	76.81	104.19	122.14	178.56	13.88	18.83	22.07	32.27	20.00	20.00	34.22	2.51	200			1.00	1.055	14.22	41.55%
		MH 4	MH 3									0.00	0.86	11.21	0.24	11.46	72.44	98.19	115.07	168.17	62.62	84.88	99.47	145.38	117.54	117.54	133.02	11.71	450			0.20	0.810	15.48	11.63%
		MH 3	MH 2									0.00	0.86	11.46	0.59	12.04	71.63	97.09	113.77	166.27	61.93	83.93	98.35	143.73	117.54	117.54	133.02	28.63	450			0.20	0.810	15.48	11.63%
	CB 101	CB 101	MH 9			0.10						0.14	0.14	10.00	0.09	10.09	76.81	104.19	122.14	178.56	10.68	14.48	16.98	24.82	15.00	15.00	34.22	5.72	200			1.00	1.055	19.22	56.16%
		MH 9	MH 8									0.00	0.14	10.09	0.37	10.46	76.46	103.72	121.58	177.74	10.63	14.42	16.90	24.71	15.00	15.00	59.68	18.02	300			0.35	0.818	44.68	74.87%
		MH 8	MH 2									0.00	0.14	10.46	0.12	10.58	75.09	101.84	119.37	174.48	10.44	14.16	16.59	24.25	15.00	15.00	59.68	6.00	300			0.35	0.818	44.68	74.87%
	CB 100	CB 100	MAIN								0.10	0.25	0.25	10.00	0.01	10.01	76.81	104.19	122.14	178.56	19.22	26.07	30.56	44.68	44.68	44.68	59.26	1.50	200			3.00	1.828	14.58	24.61%
		MH 2	MH 1									0.00	1.25	12.04	0.53	12.57	69.76	94.51	110.74	161.81	87.45	118.48	138.82	202.85	177.22	177.22	200.65	28.49	525			0.20	0.898	23.43	11.68%
Pimiwidon Street		MH 1	MH317B									0.00	1.25	12.57	0.26	12.83	68.16	92.32	108.16	158.02	85.45	115.73	135.59	198.11	177.22	177.22	200.65	13.94	525			0.20	0.898	23.43	11.68%
						0.39	0.07				0.24	1.25	TRUE																				
												0.70	Area to Storm Sewer																				
												0.35	Area Uncontrolled offsite																				
												1.05	Total Site Area																				
												0.64	Average C (To Storm Sewer)																				
												0.68	Average C (Site)																				

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 0.013

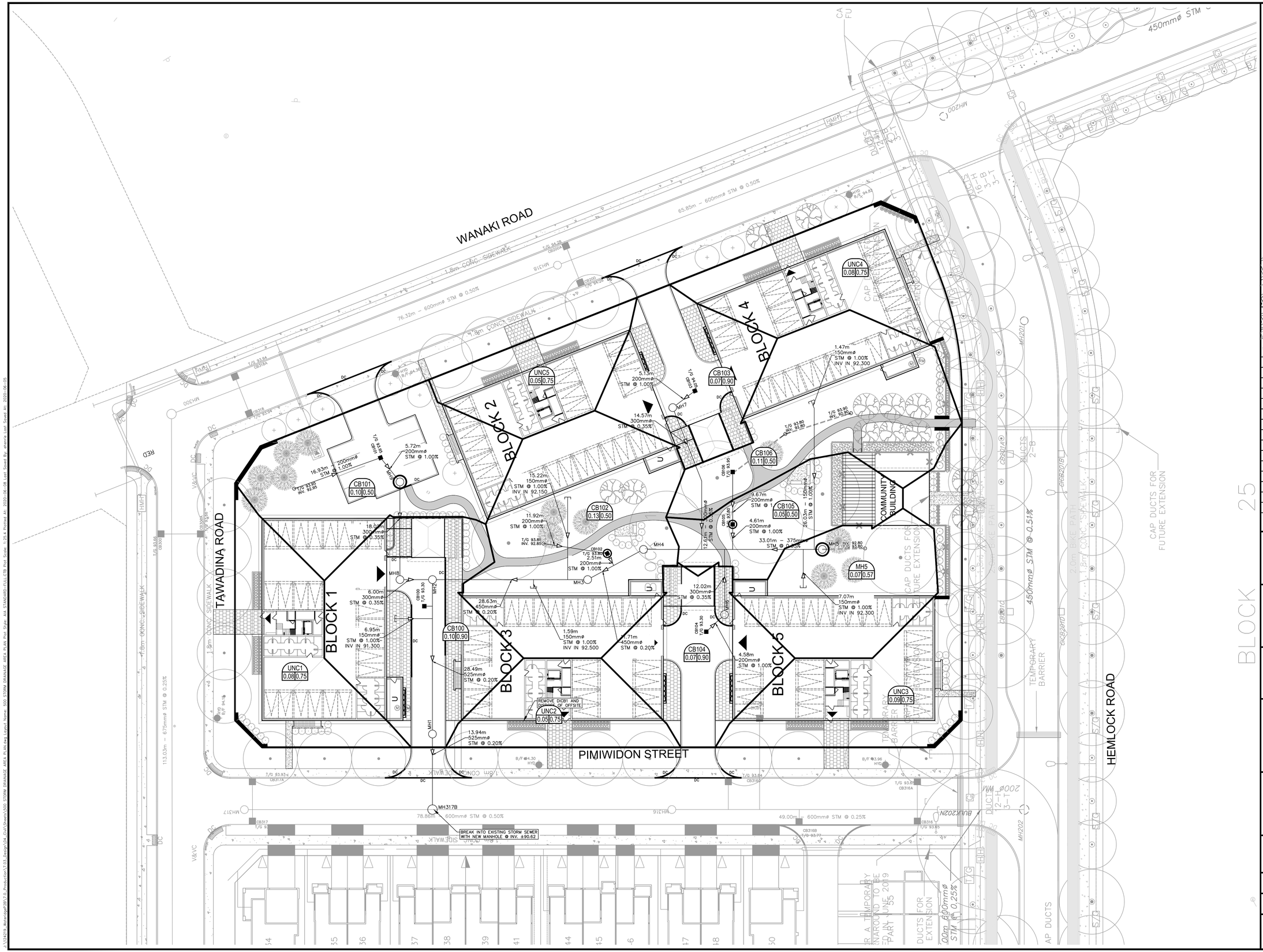
Designed: W.Z.
R.M.

Checked: D.G.Y.

Dwg. Reference: 124219-500

No.	Revision	Date
1.	Servicing Brief - Issued to Client for Review	2020-04-17
2	Servicing Brief - Issued to CLC for Review	2020-06-09

File Reference:	Date:	Sheet No:
124219-6.4.4	2020-06-09	1 of 1

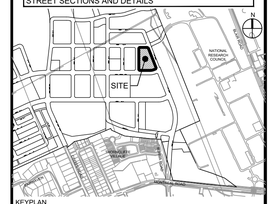


LEGEND

STORM TRIBUTARY OUTLINE

MH5 .07 0.57 — AREA NUMBER / COEFFICIENT / AREA (ha)

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEYPLAN N.T.S.

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			
2	ISSUED TO CLC FOR REVIEW	DGY	2020/06/09
1	ISSUED TO CLIENT FOR REVIEW	DGY	2020/05/07

BLOCK 25

uniform URBAN DEVELOPMENTS

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

Project Title
WATERIDGE VILLAGE
PHASE 2B - BLOCK 1
475 WANAKI ROAD

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/06/09
PROVINCE OF ONTARIO

N

Drawing Title
STORM DRAINAGE
AREA PLAN

Scale
1 : 300

Design	Date
AZ/RM	APRIL 2020
Drawn	Checked
MM/EH	DGY
Project No.	Drawing No.
124219	500

CITY FILE No. #### CITY PLAN No.####

WANAKI ROAD

TAWADINA ROAD

HEMLOCK ROAD

PIMIWIDON STREET

BLOCK 1

BLOCK 2

BLOCK 3

BLOCK 4

BLOCK 5

COMMUNITY BUILDING

POND ID	MH 9
TOP OF GRATE (m)	93.95
STATIC ELEV (m)	94.15
STATIC DEPTH (m)	0.20
STATIC VOLUME (m³)	22.83
2 YEAR VOLUME (m³)	0.42
2 YEAR DEPTH (m)	0.05
5 YEAR VOLUME (m³)	1.49
5 YEAR DEPTH (m)	0.08
100 YEAR VOLUME (m³)	8.87
100 YEAR DEPTH (m)	0.15

POND ID	CB 105
TOP OF GRATE (m)	93.80
STATIC ELEV (m)	94.10
STATIC DEPTH (m)	0.30
STATIC VOLUME (m³)	30.15
2 YEAR VOLUME (m³)	1.26
2 YEAR DEPTH (m)	0.09
5 YEAR VOLUME (m³)	3.42
5 YEAR DEPTH (m)	0.12
100 YEAR VOLUME (m³)	16.75
100 YEAR DEPTH (m)	0.21

POND ID	CB 102
TOP OF GRATE (m)	93.80
STATIC ELEV (m)	94.10
STATIC DEPTH (m)	0.30
STATIC VOLUME (m³)	29.18
2 YEAR VOLUME (m³)	0.49
2 YEAR DEPTH (m)	0.08
5 YEAR VOLUME (m³)	1.81
5 YEAR DEPTH (m)	0.12
100 YEAR VOLUME (m³)	11.23
100 YEAR DEPTH (m)	0.22

POND ID	MH 5
TOP OF GRATE (m)	93.80
STATIC ELEV (m)	94.06
STATIC DEPTH (m)	0.26
STATIC VOLUME (m³)	12.53
2 YEAR VOLUME (m³)	0.09
2 YEAR DEPTH (m)	0.05
5 YEAR VOLUME (m³)	0.63
5 YEAR DEPTH (m)	0.10
100 YEAR VOLUME (m³)	5.53
100 YEAR DEPTH (m)	0.20

REINSTATE TO MATCH EXISTING ASPHALT STRUCTURE PER CITY STANDARD R-10

DEPRESSED CURB AND SIDEWALK ENTRANCE AS PER CITY STANDARD SC7.1

TIE INTO EXISTING CURB

REINSTATE CURB, ASPHALT PATH AND SIDEWALK AS REQUIRED TO EXISTING CONDITIONS.

SAW CUT EXISTING ASPHALT REGRADE GRANULARS REINSTATE TO MATCH EXISTING ASPHALT STRUCTURE PER CITY STANDARD R-10 INCLUDING STEP JOINT

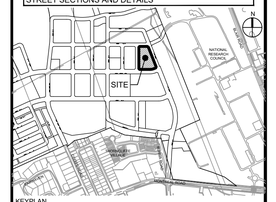
Pond Staging Schematic

LEGEND :

STATIC MAXIMUM PONDING LIMIT
100 YEAR PONDING LIMIT
5 YEAR PONDING LIMIT
2 YEAR PONDING LIMIT
PONDING ELEVATION

EMERGENCY OVERLAND FLOW ROUTE

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEYPLAN
N.T.S.

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			
2	ISSUED TO CLC FOR REVIEW	DGY	2020/06/09
1	ISSUED TO CLIENT FOR REVIEW	DGY	2020/05/07

uniform URBAN DEVELOPMENTS

IBI GROUP
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Ottawa ON K1S 5N4 Canada
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Project Title
WATERIDGE VILLAGE
PHASE 2B - BLOCK 1
475 WANAKI ROAD

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/06/09
PROVINCE OF ONTARIO

N

Drawing Title
PONDING PLAN

Scale
1 : 300

Design	Date
AZ/RM	APRIL 2020
Drawn	Checked
MM/EH	DGY
Project No.	Drawing No.
124219	600

CITY FILE No. #### CITY PLAN No.####

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

PROJECT: Wateridge Block 1
DATE: 2020-06-09
FILE: 124219-6.4.4
REV #: 1
DESIGNED BY: W.Z.
CHECKED BY: D.G.Y. & R.M.

STORMWATER MANAGEMENT

Formulas and Descriptions

i_{2yr} = 1:2 year Intensity = $732.951 / (T_c+6.199)^{0.810}$
i_{5yr} = 1:5 year Intensity = $998.071 / (T_c+6.053)^{0.814}$
i_{100yr} = 1:100 year Intensity = $1735.688 / (T_c+6.014)^{0.820}$
T_c = Time of Concentration (min)
C = Average Runoff Coefficient
A = Area (Ha)
Q = Flow = 2.78CiA (L/s)

Maximum Allowable Release Rate

Restricted Flowrate (Based on IBI Report Dated 2019-04)

A_{site} =	1.054	Ha
$Q_{restricted}$ =	310.00	L/s

Uncontrolled Offsite Release ($Q_{uncontrolled} = 2.78*C*i_{100yr}*A_{uncontrolled}$)

C =	0.75	
T_c =	10	min
i_{100yr} =	178.56	mm/hr
$A_{uncontrolled}$ =	0.35	Ha
$Q_{uncontrolled}$ =	130.30	L/s

Unrestricted Release CB103 ($Q_{unrestricted} = 2.78*C*i_{100yr}*A_{uncontrolled}$)

C =	0.9	
T_c =	10	min
i_{100yr} =	178.56	mm/hr
$A_{uncontrolled}$ =	0.07	Ha
$Q_{uncontrolled}$ =	31.27	L/s

Unrestricted Release CB100 ($Q_{unrestricted} = 2.78*C*i_{100yr}*A_{uncontrolled}$)

C =	0.9	
T_c =	10	min
i_{100yr} =	178.56	mm/hr
$A_{uncontrolled}$ =	0.10	Ha
$Q_{uncontrolled}$ =	44.68	L/s

Unrestricted Release CB104 ($Q_{unrestricted} = 2.78*C*i_{100yr}*A_{uncontrolled}$)

C =	0.9	
T_c =	10	min
i_{100yr} =	178.56	mm/hr
$A_{uncontrolled}$ =	0.07	Ha
$Q_{uncontrolled}$ =	31.27	L/s

Maximum Allowable Release Rate ($Q_{max\ allowable} = Q_{restricted} - Q_{uncontrolled} - Q_{unrestricted}$)

$Q_{max\ allowable}$ =	72.48	L/s

MODIFIED RATIONAL METHOD (100-Year, 5-Year & 2-Year Ponding)

Drainage Area	MH 5
Area (Ha)	0.070
C =	0.68
Restricted Flow Q_r (L/s)=	15.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 100yr (m^3)
6	226.01	30.08	15.00	15.08	5.43
7	211.67	28.17	15.00	13.17	5.53
8	199.20	26.51	15.00	11.51	**5.53**
9	188.25	25.06	15.00	10.06	5.43
10	178.56	23.77	15.00	8.77	5.26

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	5.53	12.53	0	0.00

overflows to: CB105

Drainage Area	MH 5
Area (Ha)	0.070
C =	0.57
Restricted Flow Q_r (L/s)=	15.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 5yr (m^3)
0	230.48	25.57	15.00	10.57	0.00
1	203.51	22.57	15.00	7.57	0.45
2	182.69	20.26	15.00	5.26	**0.63**
3	166.09	18.42	15.00	3.42	0.62
4	152.51	16.92	15.00	1.92	0.46

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.63	12.53	0	0.00

overflows to: CB105

Drainage Area	MH 5
Area (Ha)	0.070
C =	0.57
Restricted Flow Q_r (L/s)=	15.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 2yr (m^3)
-1	192.83	21.39	15.00	6.39	-0.38
0	167.22	18.55	15.00	3.55	0.00
1	148.14	16.43	15.00	1.43	**0.09**
2	133.33	14.79	15.00	-0.21	-0.03
3	121.46	13.47	15.00	-1.53	-0.27

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.09	12.53	0	0.00

overflows to: CB105

Drainage Area	CB105
Area (Ha)	0.160
C =	0.60
Restricted Flow Q_r (L/s)=	20.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 100yr (m^3)
8	199.20	53.16	20.00	33.16	15.92
10	178.56	47.65	20.00	27.65	16.59
12	162.13	43.27	20.00	23.27	**16.75**
14	148.72	39.69	20.00	19.69	16.54
16	137.55	36.71	20.00	16.71	16.04

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	16.75	30.15	0	0.00

overflows to: CB 102

Drainage Area	CB105
Area (Ha)	0.160
C =	0.50
Restricted Flow Q_r (L/s)=	20.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 5yr (m^3)
1	203.51	45.26	20.00	25.26	1.52
3	166.09	36.94	20.00	16.94	3.05
5	141.18	31.40	20.00	11.40	**3.42**
7	123.30	27.42	20.00	7.42	3.12
9	109.79	24.42	20.00	4.42	2.39

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	3.42	30.15	0	0.00

overflows to: CB 102

Drainage Area	CB105
Area (Ha)	0.160
C =	0.50
Restricted Flow Q_r (L/s)=	20.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 2yr (m^3)
1	148.14	32.95	20.00	12.95	0.78
2	133.33	29.65	20.00	9.65	1.16
3	121.46	27.01	20.00	7.01	**1.26**
4	111.72	24.85	20.00	4.85	1.16
5	103.57	23.03	20.00	3.03	0.91

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.26	30.15	0	0.00

overflows to: CB 102

Drainage Area	CB 102
Area (Ha)	0.130
C =	0.60
Restricted Flow Q_r (L/s)=	20.00

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 100yr (m^3)
6	226.01	49.01	20.00	29.01	10.44
8	199.20	43.19	20.00	23.19	11.13
10	178.56	38.72	20.00	18.72	**11.23**
12	162.13	35.16	20.00	15.16	10.91
14	148.72	32.25	20.00	12.25	10.29

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	11.23	29.18	0	0.00

overflows to: Hemlock Road

Drainage Area	CB 102
Area (Ha)	0.130
C =	0.50
Restricted Flow Q_r (L/s)=	20.00

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 5yr (m^3)
0	230.48	41.65	20.00	21.65	0.00
2	182.69	33.01	20.00	13.01	1.56
4	152.51	27.56	20.00	7.56	**1.81**
6	131.57	23.77	20.00	3.77	1.36
8	116.11	20.98	20.00	0.98	0.47

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.81	29.18	0	0.00

overflows to: Hemlock Road

Drainage Area	CB 102
Area (Ha)	0.130
C =	0.50
Restricted Flow Q_r (L/s)=	20.00

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 2yr (m^3)
0	167.22	30.22	20.00	10.22	0.00
1	148.14	26.77	20.00	6.77	0.41
2	133.33	24.09	20.00	4.09	**0.49**
3	121.46	21.95	20.00	1.95	0.35
4	111.72	20.19	20.00	0.19	0.05

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.49	29.18	0	0.00

overflows to: Hemlock Road

Drainage Area	MH 9				
Area (Ha)	0.100				
C =	0.60	Restricted Flow Q_r (L/s)=	15.00		

100-Year Ponding

T_c Variable (min)	i_{100yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{100yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 100yr (m^3)
6	226.01	37.70	15.00	22.70	8.17
8	199.20	33.23	15.00	18.23	8.75
10	178.56	29.78	15.00	14.78	**8.87**
12	162.13	27.04	15.00	12.04	8.67
14	148.72	24.81	15.00	9.81	8.24

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	8.87	22.83	0	0.00

overflows to: Wanaki Road

Drainage Area	MH 9				
Area (Ha)	0.100				
C =	0.50	Restricted Flow Q_r (L/s)=	15.00		

5-Year Ponding

T_c Variable (min)	i_{5yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{5yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 5yr (m^3)
0	230.48	32.04	15.00	17.04	0.00
2	182.69	25.39	15.00	10.39	1.25
4	152.51	21.20	15.00	6.20	**1.49**
6	131.57	18.29	15.00	3.29	1.18
8	116.11	16.14	15.00	1.14	0.55

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	1.49	22.83	0	0.00

overflows to: Wanaki Road

Drainage Area	MH 9				
Area (Ha)	0.100				
C =	0.50	Restricted Flow Q_r (L/s)=	15.00		

2-Year Ponding

T_c Variable (min)	i_{2yr} (mm/hour)	Peak Flow $Q_p = 2.78xCi_{2yr}A$ (L/s)	Q_r (L/s)	$Q_p - Q_r$ (L/s)	Volume 2yr (m^3)
0	167.22	23.24	15.00	8.24	0.00
1	148.14	20.59	15.00	5.59	0.34
2	133.33	18.53	15.00	3.53	**0.42**
3	121.46	16.88	15.00	1.88	0.34
4	111.72	15.53	15.00	0.53	0.13

Storage (m^3)

Overflow	Required	Surface	Sub-surface	Balance
0.00	0.42	22.83	0	0.00

overflows to: Wanaki Road

	Area	Flow
Buildings	0.460	70.00
Uncontrolled	0.35	237.52
	0.810	**307.52**
Allowable		**310.00**
		TRUE

2.48 Residual

IBI GROUP

STORM HYDRAULIC GRADE LINE DESIGN SHEET
WATERIDGE PHASE 2B BLOCK 1
CITY OF OTTAWA
UNIFORM DEVELOPMENTS

JOB #: 24219 - 6.4.4
DATE: 2020-04-17
DESIGN: W.Z.
CHECKED: D.G.Y.
REV #: -

MH 317B in Pimiwidon Street to MH 1

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**317B**	**1**	
INVERT ELEVATION (m)	90.622	90.650	
OBVERT ELEVATION (m)	91.147	91.175	
DIAMETER (mm)			525
LENGTH (m)			13.9
FLOW (l/s)			130.92
HGL (m) ***	**91.180**	**91.193**	**0.013**
MANHOLE COEF K= 0.75	LOSS (m)	0.014	
TOTAL HGL (m)		**91.207**	
MAX. SURCHARGE (mm)		**32**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.525	0.22	1.65	0.200	0.13	0.89	192.65

HYDRAULIC SLOPE = 0.19 %
DESIGN FLOW TO FULL FLOW RATIO (Q_i) 0.680
DESIGN FLOW DEPTH = 0.315

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 = 0.61 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**1**	**2**	
INVERT ELEVATION (m)	90.670	90.725	
OBVERT ELEVATION (m)	91.195	91.250	
DIAMETER (mm)			525
LENGTH (m)			27.6
FLOW (l/s)			120.63
HGL (m) ***	**91.207**	**91.229**	**0.022**
MANHOLE COEF K= 0.75	LOSS (m)	0.012	
TOTAL HGL (m)		**91.241**	
MAX. SURCHARGE (mm)		**-9**	

MANNING FORMULA - FLOWING FULL

DIA (m)	Area (m2)	Perim. (m)	Slope (%)	Hyd.R. (m)	Vel. (m/s)	Q (l/s)
0.525	0.22	1.65	0.200	0.13	0.89	191.95

HYDRAULIC SLOPE = 0.12 %
DESIGN FLOW TO FULL FLOW RATIO (Q_i) 0.628
DESIGN FLOW DEPTH = 0.299

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 = 0.56 m/s
HL = K_L * V^2/ 2g

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**2**	**3**	
INVERT ELEVATION (m)	90.905	90.978	
OBVERT ELEVATION (m)	91.280	91.353	
DIAMETER (mm)			375
LENGTH (m)			29.3
FLOW (l/s)			122.71
HGL (m) ***	**91.241**	**91.384**	**0.144**
MANHOLE COEF K= 0.05	LOSS (m)	0.003	
TOTAL HGL (m)		**91.387**	
MAX. SURCHARGE (mm)		**34**	

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	0.250	0.09	0.79	87.50

HYDRAULIC SLOPE = 0.50 %
DESIGN FLOW TO FULL FLOW RATIO (Q_i) 1.402
DESIGN FLOW DEPTH = 0.375

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	**3**	**4**	
INVERT ELEVATION (m)	91.183	91.234	
OBVERT ELEVATION (m)	91.483	91.534	
DIAMETER (mm)			300
LENGTH (m)			14.3
FLOW (l/s)			100.88
HGL (m) ***	**91.387**	**91.543**	**0.156**
MANHOLE COEF K= 0.05	LOSS (m)	0.005	
TOTAL HGL (m)		**91.549**	
MAX. SURCHARGE (mm)		**15**	

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	0.350	0.08	0.82	57.66

HYDRAULIC SLOPE = 1.13 %
DESIGN FLOW TO FULL FLOW RATIO (Q_i) 1.750
DESIGN FLOW DEPTH = 0.300

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

STORM HYDRAULIC GRADE LINE DESIGN SHEET
WATERIDGE PHASE 2B BLOCK 1
CITY OF OTTAWA
UNIFORM DEVELOPMENTS

JOB #: 24219 - 6.4.4
DATE: 2020-04-17
DESIGN: W.Z.
CHECKED: D.G.Y.
REV #: -

FRICTION LOSS	FROM MH	TO MH	PIPE ID
Block 232	**4**	**5**	
INVERT ELEVATION (m)	91.264	91.364	
OBVERT ELEVATION (m)	91.564	91.664	
DIAMETER (mm)			300
LENGTH (m)			28.6
FLOW (l/s)			100.88
HGL (m) ***	**91.549**	**91.860**	**0.311**
MANHOLE COEF K= 0.05	LOSS (m)	0.005	
TOTAL HGL (m)		**91.865**	
MAX. SURCHARGE (mm)		**201**	

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	0.350	0.08	0.81	57.20

HYDRAULIC SLOPE = 1.11 %
DESIGN FLOW TO FULL FLOW RATIO (Q_i) 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
$HL = K_L * V^2/ 2g$

Pimiwidon Street Storm HGL has no negative impact on the proposed development.

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

LEGEND

Black text	5 year event curve design
Blue text	100 year event curve design
MH206	Existing infrastructure (shown for information only)

STORM SEWER DESIGN SHEET

Wateridge at Rockcliffe - Phase 2B
City of Ottawa
Canada Lands Company

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW													SEWER DATA									
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.30	C= 0.40	C= 0.49	C= 0.57	C= 0.65	C= 0.66	C= 0.70	C= 0.73	C= 0.80	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)	(%)
Pimiwidon Street	S317A, B317	MH317	MH316							0.09			1.05	2.50	2.50	10.00	0.85	10.85	76.81	104.19	122.14	178.56		260.52				260.52	452.94	78.86	600			0.50	1.552	192.43	42.48%
Pimiwidon Street	S316A-B	MH316	BLK202N							0.33				0.61	3.11	10.85	0.74	11.59	73.70	99.92	117.11	171.17		310.34				310.34	320.28	49.00	600			0.25	1.097	9.94	3.10%
Pimiwidon Street		*BULK202N*	*MH202*											0.00	3.11	11.59	0.24	11.83	71.19	96.48	113.06	165.21		299.64				299.64	320.28	*16.00*	*600*			*0.25*	1.097	20.64	6.44%
Wigwas Street	S315, S315A-B, R315	MH315	MH314				0.41			0.31				1.13	1.13	10.00	0.99	10.99	76.81	104.19	122.14	178.56		117.46				117.46	141.68	73.88	375			0.60	1.243	24.23	17.10%
Wigwas Street	S314A-B	MH314	BULK203N							0.44				0.81	1.93	10.99	0.48	11.47	73.20	99.24	116.30	169.98		191.98				191.98	310.53	54.00	450			1.09	1.891	118.55	38.18%
Wigwas Street		*BULK203N*	*MH203*											0.00	1.93	11.47	0.18	11.64	71.60	97.04	113.71	166.18		187.73				187.73	247.07	*16.00*	*450*			*0.69*	1.505	59.34	24.02%
Moses Tennisco St	S313, R313	MH313	MH312				0.31			0.11				0.62	0.62	10.00	0.80	10.80	76.81	104.19	122.14	178.56		65.03				65.03	112.79	73.88	300			1.25	1.546	47.76	42.35%
Moses Tennisco St	S312A-C	MH312	BULK204N							0.45				0.83	1.45	10.80	0.37	11.17	73.88	100.17	117.40	171.59		145.22				145.22	400.16	54.00	450			1.81	2.437	254.94	63.71%
Park Block 7	P312	CBMH350	pipe	0.42										0.23	0.23	10.00	0.13	10.13	76.81	104.19	122.14	178.56		24.33				24.33	87.74	13.50	250			2.00	1.731	63.40	72.27%
Moses Tennisco St		*BULK204N*	*MH204*											0.00	1.68	11.17	0.11	11.28	72.60	98.41	115.33	168.56		165.66				165.66	400.16	*16.00*	*450*			*1.81*	2.437	234.50	58.60%
Michael Stoqua St	S311, S311A, R311	MH311	MH310				0.45			0.22				1.02	1.02	10.00	0.81	10.81	76.81	104.19	122.14	178.56		105.93				105.93	173.52	73.88	375			0.90	1.522	67.60	38.96%
Michael Stoqua St	S310A-B	MH310	BLK205N							0.37				0.68	1.70	10.81	0.53	11.34	73.83	100.11	117.33	171.49		169.73				169.73	279.02	53.99	450			0.88	1.700	109.29	39.17%
Michael Stoqua St		*BLK205N*	*MH205*											0.00	1.70	11.34	0.16	11.50	72.02	97.62	114.40	167.18		165.51				165.51	279.02	*16.00*	*450*			*0.88*	*1.700*	*113.50*	*40.68%*
Bareille-Snow St	S309, B309	MH309	MH308								0.10		1.24	2.95	2.95	10.00	0.74	10.74	76.81	104.19	122.14	178.56		307.62				307.62	375.37	74.73	525			0.70	1.680	67.76	18.05%
Bareille-Snow St	S308, S308A	MH308	BULK206N								0.25			0.49	3.44	10.74	0.32	11.06	74.07	100.43	117.71	172.05		345.38				345.38	536.52	46.47	525			1.43	2.401	191.14	35.63%
Bareille-Snow St		*BULK206N*	*MH206*											0.00	3.44	11.06	0.12	11.19	72.95	98.89	115.90	169.38		340.07				340.07	536.52	*17.50*	*525*			*1.43*	2.401	196.45	36.62%
Wanaki Road	B200, S200A	MH326	MH318								0.15		1.57	3.78	3.78	10.00	0.71	10.71	76.81	104.19	122.14	178.56		394.22				394.22	452.94	65.85	600			0.50	1.552	58.72	12.96%
Wanaki Road	S318	MH318	MH300								0.13			0.25	4.04	10.71	0.82	11.53	74.19	100.60	117.91	172.34		406.08				406.08	452.94	76.32	600			0.50	1.552	46.87	10.35%
Tawadina Road	S300, S300A	MH300	MH301								0.19			0.37	4.41	11.53	1.59	13.11	71.40	96.77	113.39	165.71		426.38				426.38	438.47	113.03	675			0.25	1.187	12.09	2.76%
Tawadina Road	S301, S301A	MH301	MH302								0.17			0.33	4.74	13.11	0.86	13.97	66.61	90.19	105.66	154.35		427.25				427.25	788.75	110.00	675			0.81	2.135	361.51	45.83%
Tawadina Road	S302, S302A	MH302	MH303								0.28			0.54	5.28	13.97	0.69	14.66	64.30	87.03	101.94	148.89		459.70				459.70	1,004.08	111.92	675			1.31	2.718	544.38	54.22%
Tawadina Road	S303	MH303	MH304								0.18			0.35	5.63	14.66	1.55	16.21	62.58	84.68	99.17	144.83		476.92				476.92	580.71	118.37	750			0.25	1.273	103.79	17.87%
Tawadina Road	S304, S304A	MH304	MH305								0.23			0.45	6.08	16.21	1.57	17.78	59.06	79.85	93.49	136.49		485.46				485.46	580.71	120.00	750			0.25	1.273	95.25	16.40%
Codd's Road	S340, B340, B340A	MH305	MH231								0.17		2.02	4.82	10.90	17.78	0.49	18.27	55.90	75.54	88.42	129.06		823.59				823.59	1,324.21	85.55	750			1.30	2.904	500.62	37.81%
Codd's Road	S231	MH231	*MH176*								0.12			0.23	11.14	18.27	0.45	18.72	54.99	74.29	86.96	126.92		827.38				827.38	1,218.10	71.97	750			1.10	2.671	390.72	32.08%
Block 1	-	DICB1	Pipe	1.05										0.58	0.58	61.68	0.20	61.88	24.06	32.28	37.67	54.75				31.97		31.97	62.04	14.59	250			1.00	1.224	30.07	48.47%
Block 11	-	DICB3	Pipe	1.24										0.69	0.69	81.62	0.19	81.81	19.53	26.16	30.52	44.31				30.55		30.55	62.04	13.63	250			1.00	1.224	31.49	50.76%
Block 12	-	DICB4	Pipe	1.24										0.69	0.69	80.96	0.23	81.19	19.65	26.32	30.70	44.58				30.74		30.74	60.47	16.78	250			0.95	1.193	29.73	49.17%
Block 8	-	DICB5	Pipe	0.66										0.37	0.37	28.47	0.15	28.62	41.47	55.87	65.32	95.20				34.93		34.93	62.04	11.20	250			1.00	1.224	27.11	43.69%

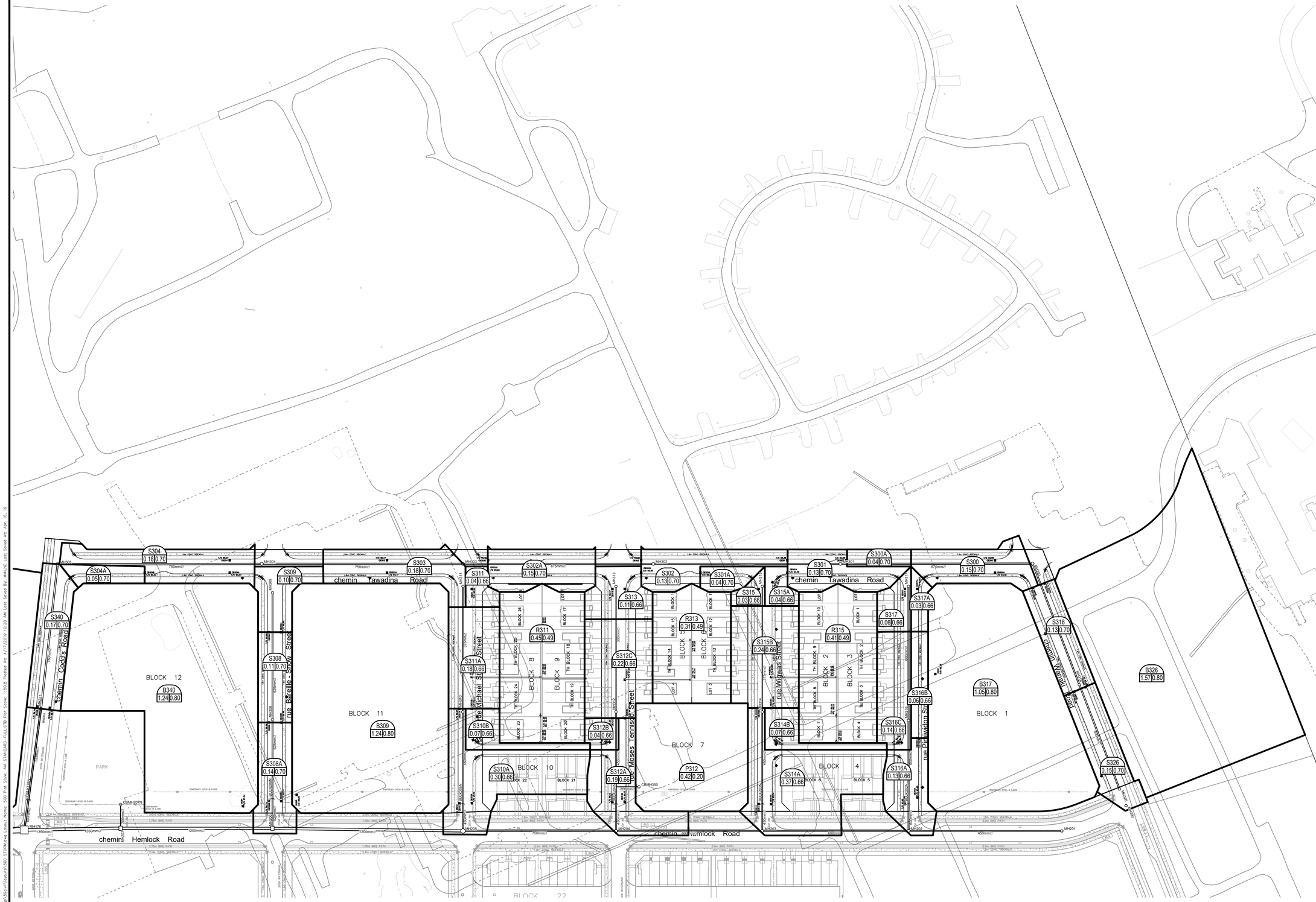
Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820]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

Notes:
1. Mannings coefficient (n) = 0.013

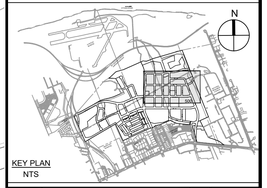
Designed: KH
Checked: JIM
Dwg. Reference: 118863-500

No.	Revision	Date
1	Submission No. 1 for City Review	2018-12-20
2	Submission No. 2 for City Review	2019-03-15
3	MECP Submission	2019-04-17

File Reference: 118863.5.7.1
Date: 2019-04-17
Sheet No: 1 of 1



SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEY PLAN
NTS

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3	MECP SUBMISSION	J.I.M.	2019:04:17
2	SUBMISSION NO. 2 FOR CITY REVIEW	J.I.M.	2019:03:15
1	SUBMISSION NO. 1 FOR CITY REVIEW	J.I.M.	2018:12:20

CANADA LANDS COMPANY
SOCIÉTÉ IMMOBILIÈRE DU CANADA
30 Metcalfe Street Suite 601
Ottawa, On K1P 5L4
613 998 7777

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

Project Title

WATERIDGE VILLAGE AT ROCKCLIFFE

PHASE 2B

PROFESSIONAL ENGINEER
J. I. MOFFATT
2019/04/17
PROVINCE OF ONTARIO

N

Drawing Title

STORM DRAINAGE AREA PLAN

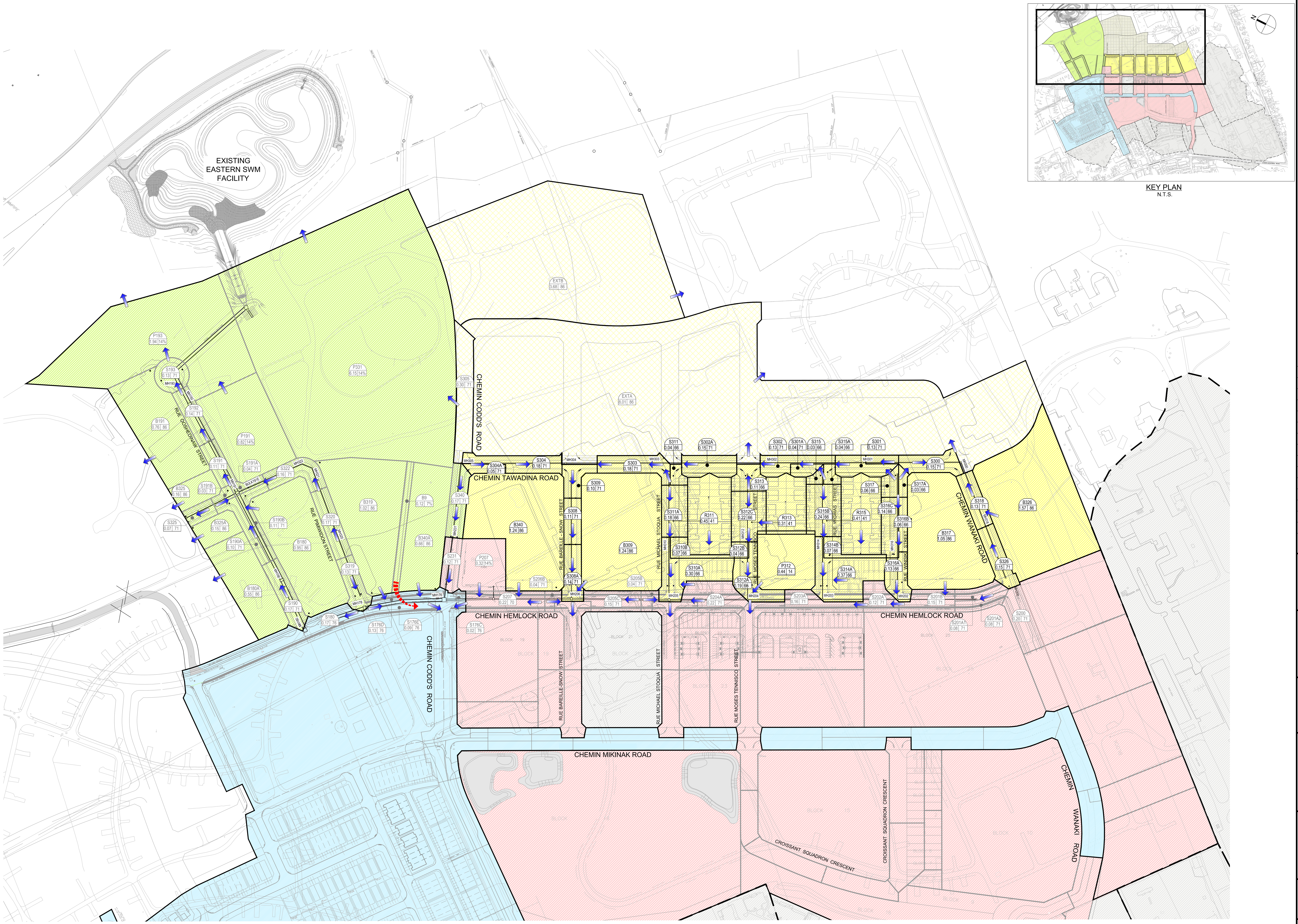
Scale
1:1000

Design	Date
K.H./S.T.	DECEMBER 2018
Drawn	Checked
M.M.	J.I.M.
Project No.	Drawing No.
118863	500

D07-16-15-0003

#17063

J:\118863_Wridge\428\0.9 Drawings\5\Civil\Layouts\500 STORM.dwg Layout: Name: 500 Plot Style: AIA STANDARD-FULL.CTB Plot Scale: 1:50.8 Plotted At: 4/17/2019 10:20 AM Last Saved By: MMUNE Last Saved At: Apr. 16, 19



LEGEND:

- PHASE 2B DRAINAGE AREA
- PHASE 2A DRAINAGE AREA (FUTURE)
- PHASE 2C 2D DRAINAGE AREA (FUTURE)
- PHASE 1B DRAINAGE AREA (EXISTING)
- PHASE 1A DRAINAGE AREA (EXISTING)
- EXTERNAL DRAINAGE AREA
- S318 – AREA ID; 71 – Imp.(%); 0.13 – AREA (ha)
- MAJOR FLOW
- TOTAL FLOW
- MH136 – MANHOLE ID

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8			
7			
6			
5			
4			
3	MECP SUBMISSION	P.S.	2019:04:17
2	SUBMISSION No.2 FOR CITY REVIEW	P.S.	2019:03:15
1	SUBMISSION No.1 FOR CITY REVIEW	P.S.	2018:12:20

CANADA LANDS COMPANY
SOCIÉTÉ IMMOBILIÈRE DU CANADA
30 Metcalfe Street Suite 601
Ottawa, On K1P 5L4
613 998 7777

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

Project Title

WATERIDGE VILLAGE AT ROCKCLIFFE
PHASE 2B

M.S. BLACK 100101736 2019/04/17

Drawing Title

DDSWMM MODEL SCHEMATIC

Scale	1:2000
Design: M.B	Date: DEC. 2018
Drawn: S.V.	Checked: P.S.
Project No.: 118863	Drawing No.: 750

D07-16-15-0003

#17063

DRAINAGE AREA ID	AREA (HA)	D/S SEGMENT ID	XPSWMM NODE ID	IMP RATIO [TP (H)]	SEGMENT LENGTH (M)	SUBCATCHMENT WIDTH (M)	AVAILABLE STATIC PONDING (M^3)
B325A	0.151	DNCC[6]	MH325	0.86	51	102	0[1]
S325	0.072	DNCC[6]	MH325	0.71	36	72	0
B325	0.16	DNCC[6]	MH325	0.86	54	107	0[1]
B191	0.761	DESWM2[5]	MH191	0.86	134	268	0[1]
P331	6.15	ESWM1[5]	EXSTMH	0.14	320	640	0
B9	0.12	S176D	MH305	0.07	151	302	0[1]
Future Phases 2C and 2D							
S305	0.3	P331	MH305	0.71	161	321	7.50[1]
EXTA	8.01	DEDP[2]	EXSTMH	0.86	901	1802	200.25[1]
EXTB	3.68	DEDP[2]	EXSTMH	0.86	414	828	0
Relevant Existing Phases 1A and 1B							
S201A1	0.08	S201B	MH201	0.71	63	63	0
S201A2	0.08	S201B	MH201	0.71	63	63	0
S201B	0.15	S202A	MH202	0.86	65	65	21.20
S202A	0.12	S203A	MH202	0.71	41	41	0
S203A	0.16	DS212	MH203	0.71	90	90	0
S204A	0.22	DS210[4]	MH204	0.71	58	115	0
S205B	0.0379	DS210[4]	MH205	0.71	13	26	0
S205C	0.148	DS208[4]	MH205	0.71	58	58	0
P207	0.32	S207	MH207	0.14	36	72	0
S231	0.22	DS142[4]	MH231	0.71	61	61	0
S207	0.22	DS142[4]	MH207	0.71	90	90	0
S176D	0.13	DS142[4]	MH176	0.76	95	95	2.60
S176E	0.09	DS142[4]	MH176	0.76	80	80	0
S206B	0.0382	DS208[4]	MH206	0.71	11	22	0
S176C	0.05	DS142[4]	MH176	0.76	40	40	1.14
S180	0.16	DNCC[6]	MH180	0.76	68	68	0

(1) Assumed ponding volume
(2) Future dry pond; major flow from a portion of EXTB will cascade north per MSS
(3) Adjustment to drainage area at interface of Phase 2B
(4) Existing Phase 1B
(5) North towards existing SWM facility
(6) West to external

Table 5-3 Minor Flow Capture

DRAINAGE AREA ID	CONTINUOUS/ SAG[1],[2]	ROAD TYPE	MINOR SYSTEM DESIGN TARGET	GENERATED FLOW ON INDIVIDUAL SEGMENT (DDSWMM SIMULATION) (L/S)	ICD (L/S)	NOTE
Phase 2B						
B326	Block	N/A	5	318	318	Minor system restriction for future development block

DRAINAGE AREA ID	CONTINUOUS/ SAG[1],[2]	ROAD TYPE	MINOR SYSTEM DESIGN TARGET	GENERATED FLOW ON INDIVIDUAL SEGMENT (DDSWMM SIMULATION) (L/S)	ICD (L/S)	NOTE
S326	Continuous	20m Row, 8.5m asphalt	5	29	12	
S318	Continuous	20m Row, 8.5m asphalt	5	24	25	
S317A	Sag	20m Row, 8.5m asphalt	5	6	19	
S300	Sag	20m Row, 8.5m asphalt	5	29	38	
S317	Sag	20m Row, 8.5m asphalt	5	10	19	
S301	Continuous	20m Row, 8.5m asphalt	5	25	12	
S315A	Sag	20m Row, 8.5m asphalt	5	7	19	
S315	Sag	20m Row, 8.5m asphalt	5	5	6	
S302	Continuous	20m Row, 8.5m asphalt	5	24	12	
S313	Sag	20m Row, 8.5m asphalt	5	19	25	
B317	Block	N/A	5	214	310	Minor system restriction for future development block
S316B	Continuous	20m Row, 8.5m asphalt	5	11	6	
S316A	Sag	20m Row, 8.5m asphalt	5	24	38	
R315	Rear Yard	N/A	5	46	56	
S315B	Continuous	20m Row, 8.5m asphalt	5	40	12	
S314B	Sag	20m Row, 8.5m asphalt	5	12	44	
S314A	Sag	20m Row, 8.5m asphalt	5	65	107	
R313	Rear Yard	N/A	5	32	39	
P312	Park	N/A	5	19	24	
S312B	Sag	20m Row, 8.5m asphalt	5	6	44	
S312A	Sag	20m Row, 8.5m asphalt	5	35	172	
R311	Rear Yard	N/A	5	49	56	
S311A	Continuous	20m Row, 8.5m asphalt	5	32	12	
S310B	Sag	20m Row, 8.5m asphalt	5	12	86	

HGL

XPSWMM NODE ID	PROPOSED GROUND ELEVATION (M)	USF (M)	100 YEAR 3 HOUR CHICAGO		100 YEAR 3 HOUR CHICAGO + 20%		100 YEAR 24 HOUR SCS TYPE II		JULY 1 1979		AUGUST 1988		AUGUST 1996	
			HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)	HGL (M)	USF - HGL (M)
Phase 2B														
MH317	94.08	91.88	91.16	0.72	91.18	0.70	91.14	0.74	91.15	0.73	91.14	0.74	91.11	0.77
MH316	94.09	91.89	90.96	0.93	90.96	0.93	90.94	0.95	90.95	0.94	90.94	0.95	90.92	0.97
MH315	93.39	91.36	90.27	1.09	90.29	1.07	90.24	1.12	90.24	1.12	90.28	1.08	90.22	1.14
MH314	93.00	91.16	89.90	1.26	89.91	1.25	89.90	1.26	89.91	1.25	89.91	1.25	89.89	1.27
MH313	92.62	90.71	89.34	1.37	89.35	1.36	89.34	1.37	89.34	1.37	89.34	1.37	89.33	1.38
MH312	91.36	89.68	88.41	1.27	88.42	1.26	88.41	1.27	88.41	1.27	88.42	1.26	88.38	1.30
MH311	90.69	88.49	87.38	1.11	87.44	1.05	87.33	1.16	87.34	1.15	87.39	1.10	87.34	1.15
MH310	90.04	87.84	86.94	0.90	87.25	0.59	86.83	1.01	86.84	1.00	86.85	0.99	86.80	1.04
MH309	90.15	87.95	87.29	0.66	87.32	0.63	87.18	0.77	87.19	0.76	87.19	0.76	87.11	0.84
MH308	89.68	87.48	86.65	0.83	86.65	0.83	86.59	0.89	86.61	0.87	86.61	0.87	86.56	0.92
MH326	94.76	92.56	91.33	1.23	91.33	1.23	91.32	1.24	91.32	1.24	91.32	1.24	91.33	1.24
MH318	94.40	92.20	91.03	1.17	91.03	1.17	91.00	1.20	91.00	1.20	91.00	1.20	91.00	1.20
MH300	94.00	91.80	90.71	1.09	90.70	1.10	90.67	1.13	90.68	1.12	90.68	1.12	90.68	1.12
MH301	93.73	91.53	90.20	1.33	90.21	1.32	90.20	1.33	90.20	1.33	90.20	1.33	90.20	1.33
MH302	92.80	90.60	88.63	1.97	88.63	1.97	88.63	1.97	88.63	1.97	88.63	1.97	88.63	1.97
MH303	90.67	88.47	87.69	0.78	87.85	0.62	87.59	0.88	87.68	0.79	87.66	0.81	87.62	0.85
MH304	90.30	88.10	87.32	0.78	87.44	0.66	87.27	0.83	87.32	0.78	87.31	0.79	87.29	0.81
MH305	91.00	88.80	86.81	1.99	86.91	1.89	86.70	2.10	86.79	2.01	86.72	2.08	86.71	2.09
Phase 2A														
MH319	88.81	86.61	86.21	0.40	86.58	0.03	85.82	0.79	85.83	0.78	85.92	0.69	85.77	0.84
MH320	88.77	86.57	85.16	1.41	85.23	1.34	85.09	1.48	85.09	1.48	85.11	1.46	85.08	1.49
MH321	87.67	85.47	84.46	1.01	84.51	0.96	84.40	1.07	84.40	1.07	84.42	1.05	84.39	1.08
MH322	87.50	85.30	84.15	1.15	84.19	1.11	84.11	1.19	84.11	1.19	84.12	1.18	84.10	1.20
MH323	86.57	84.37	83.19	1.18	83.28	1.09	83.11	1.26	83.11	1.26	83.13	1.24	83.09	1.28
MH325	86.19	83.99	83.14	0.85	83.14	0.85	83.13	0.86	83.13	0.86	83.13	0.86	83.13	0.86
Existing Phase 1B Trunk														
MH201	94.29	91.89	90.72	1.17	90.73	1.16	90.72	1.17	90.72	1.17	90.72	1.17	90.71	1.18
MH202	93.91	91.51	90.42	1.09	90.43	1.08	90.41	1.10	90.41	1.10	90.41	1.10	90.39	1.12
MH203	92.38	89.98	88.65	1.33	88.68	1.30	88.63	1.35	88.63	1.35	88.64	1.34	88.60	1.38
MH204	90.40	88.00	87.07	0.93	87.10	0.90	87.05	0.95	87.06	0.94	87.06	0.94	87.02	0.98
MH205	89.35	86.95	85.80	1.15	85.85	1.10	85.77	1.18	85.78	1.17	85.79	1.16	85.72	1.23
MH206	89.10	86.70	85.59	1.11	85.62	1.08	85.56	1.14	85.57	1.13	85.57	1.13	85.52	1.18
MH207	88.53	86.13	84.60	1.53	84.63	1.50	84.58	1.55	84.58	1.55	84.59	1.54	84.54	1.59
MH231	89.81	87.41	85.81	1.59	85.83	1.58	85.70	1.70	85.80	1.61	85.74	1.67	85.70	1.70
Existing Phase 1A Trunk														
MH176	88.03	85.63	83.77	1.86	83.86	1.77	83.67	1.96	83.75	1.88	83.72	1.91	83.48	2.15
MH178	89.00	86.60	83.41	3.19	83.48	3.12	83.32	3.28	83.40	3.20	83.37	3.23	83.16	3.44
MH180	88.23	N/A	82.21	N/A	82.69	N/A	81.93	N/A	82.20	N/A	82.07	N/A	81.46	N/A
MH190	86.96	N/A	81.91	N/A	82.16	N/A	81.65	N/A	81.90	N/A	81.78	N/A	81.22	N/A
MH191	86.36	N/A	81.68	N/A	81.88	N/A	81.43	N/A	81.67	N/A	81.55	N/A	81.06	N/A
MH192	85.76	N/A	81.41	N/A	81.60	N/A	81.21	N/A	81.41	N/A	81.30	N/A	80.89	N/A
MH193	84.99	N/A	81.09	N/A	81.24	N/A	80.91	N/A	81.08	N/A	80.99	N/A	80.60	N/A
MH194	82.05	N/A	80.44	N/A	80.53	N/A	80.34	N/A	80.45	N/A	80.39	N/A	80.12	N/A

APPENDIX E

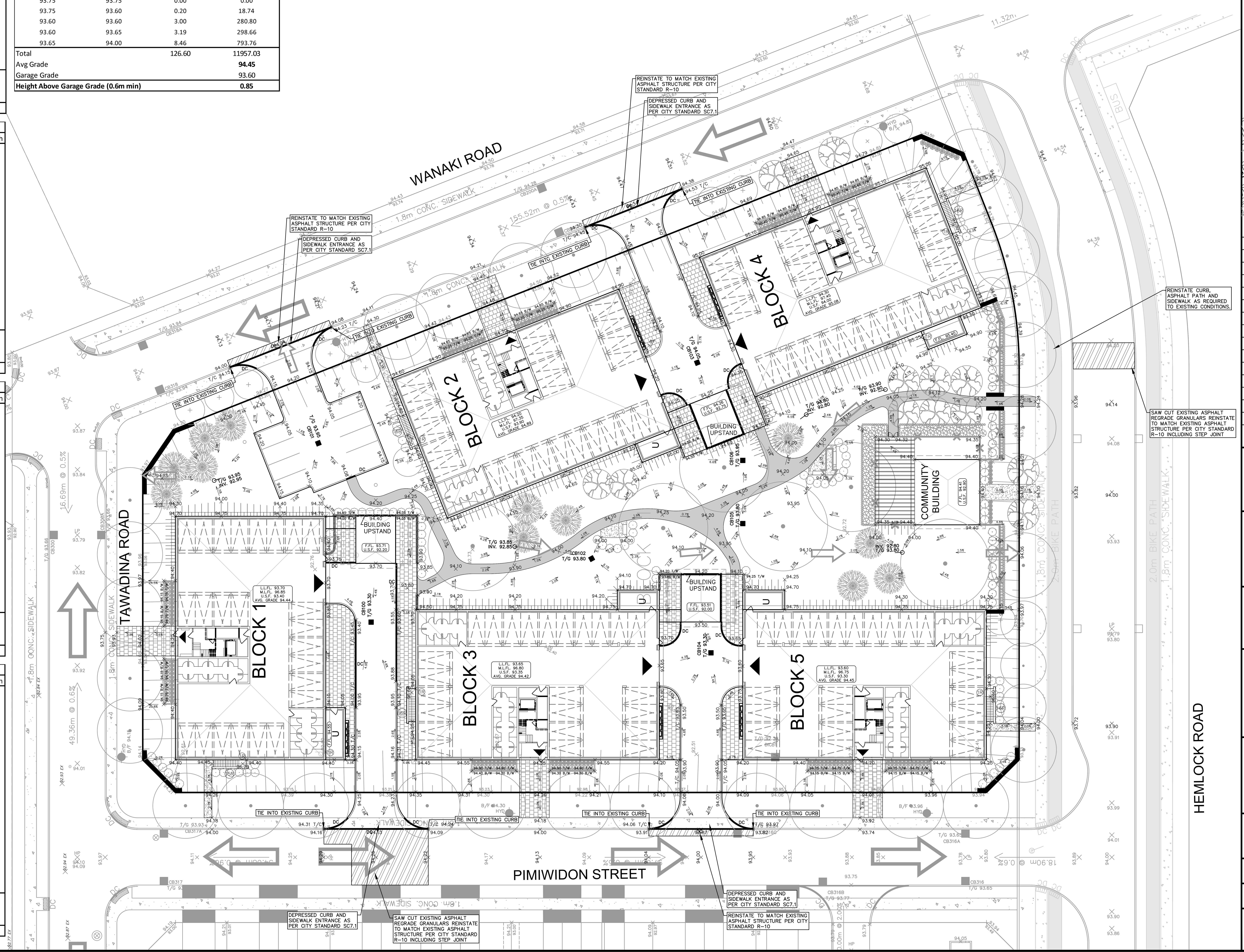
AVERAGE GRADE CALCULATION BLOCK 1			
Start Grade (m)	End Grade (m)	Length (m)	Avg Grade X Length
94.75	94.75	6.99	662.30
94.75	94.75	9.00	852.75
94.75	94.70	6.99	662.13
94.70	94.40	5.58	527.59
94.40	93.75	1.43	134.53
93.75	93.70	0.20	18.75
93.70	93.70	3.00	281.10
93.70	93.70	3.00	281.10
93.70	93.85	0.20	18.76
93.85	94.10	15.89	1493.26
94.10	94.05	3.00	282.23
94.05	94.35	8.00	753.60
94.35	94.40	1.70	160.44
94.40	94.40	13.40	1264.96
94.40	94.40	10.90	1028.96
94.40	94.75	8.50	803.89
94.75	94.75	7.00	663.25
94.75	94.20	4.00	377.90
94.20	94.75	0.95	89.75
94.75	94.75	7.00	663.25
94.75	94.75	9.85	933.29
Total		126.58	11953.77
Avg Grade			**94.44**
Garage Grade			93.70
Height Above Garage Grade (0.6m min)			**0.74**

AVERAGE GRADE CALCULATION BLOCK 2			
Start Grade (m)	End Grade (m)	Length (m)	Avg Grade X Length
94.60	95.25	8.50	806.86
95.25	95.25	7.00	666.75
95.25	94.70	3.86	366.60
94.70	95.25	1.09	103.52
95.25	95.25	7.00	666.75
95.25	94.90	9.85	936.49
94.90	94.35	11.15	1055.07
94.35	94.20	3.21	302.62
94.20	94.20	3.00	282.60
94.20	94.50	8.65	816.13
94.50	95.00	6.43	609.24
95.00	95.25	3.00	285.38
95.25	95.25	11.36	1082.04
95.25	95.00	10.00	951.25
95.00	94.80	9.50	901.55
94.80	94.90	6.06	574.79
94.90	94.90	6.04	573.20
94.90	94.60	10.90	1032.78
Total		126.60	12013.62
Avg Grade			**94.89**
Garage Grade			94.20
Height Above Garage Grade (0.6m min)			**0.69**

AVERAGE GRADE CALCULATION BLOCK 3			
Start Grade (m)	End Grade (m)	Length (m)	Avg Grade X Length
93.70	94.50	0.36	33.88
94.50	94.75	5.85	553.56
94.75	94.75	9.00	852.75
94.75	94.75	15.66	1483.79
94.75	94.70	3.00	284.18
94.70	94.70	6.28	594.72
94.70	93.80	0.15	14.14
93.80	93.70	8.42	789.38
93.70	93.65	0.20	18.74
93.65	93.65	2.95	276.27
93.65	93.80	3.28	307.42
93.80	94.20	11.16	1049.04
94.20	94.90	9.85	931.32
94.90	94.90	7.00	664.30
94.90	94.35	1.51	142.88
94.35	94.90	3.44	325.51
94.90	94.90	7.00	664.30
94.90	94.45	8.50	804.74
94.45	94.05	10.90	1027.33
94.05	93.70	12.10	1135.89
Total		126.61	11954.09
Avg Grade			**94.42**
Garage Grade			93.65
Height Above Garage Grade (0.6m min)			**0.77**

AVERAGE GRADE CALCULATION BLOCK 4			
Start Grade (m)	End Grade (m)	Length (m)	Avg Grade X Length
95.00	95.45	9.85	937.97
95.45	95.45	7.00	668.15
95.45	94.90	1.09	103.74
94.90	95.45	3.86	367.38
95.45	95.45	7.00	668.15
95.45	95.05	8.50	809.63
95.05	95.00	10.90	1035.77
95.00	95.30	12.10	1151.32
95.30	95.30	3.51	334.50
95.30	94.90	3.00	285.30
94.90	94.90	6.43	610.21
94.90	95.25	2.99	284.27
95.25	95.25	5.24	499.11
95.25	95.25	6.00	571.50
95.25	95.25	15.82	1506.86
95.25	94.47	0.30	28.46
94.47	94.30	8.65	816.43
94.30	94.30	3.00	282.90
94.30	94.45	0.22	20.76
94.45	95.00	11.14	1055.24
Total		126.60	12037.63
Avg Grade			**95.08**
Garage Grade			94.30
Height Above Garage Grade (0.6m min)			**0.78**

AVERAGE GRADE CALCULATION BLOCK 5			
Start Grade (m)	End Grade (m)	Length (m)	Avg Grade X Length
94.00	94.70	0.29	27.36
94.70	94.70	6.13	580.51
94.70	94.75	3.00	284.18
94.75	94.75	17.88	1694.13
94.75	94.75	12.99	1230.80
94.75	94.30	12.10	1143.75
94.30	94.25	10.90	1027.60
94.25	94.75	8.50	803.25
94.75	94.75	7.00	663.25
94.75	94.20	3.85	363.73
94.20	94.75	1.10	103.92
94.75	94.75	7.00	663.25
94.75	94.20	9.85	930.58
94.20	93.75	11.16	1048.76
93.75	93.75	0.00	0.00
93.75	93.60	0.20	18.74
93.60	93.60	3.00	280.80
93.60	93.65	3.19	298.66
93.65	94.00	8.46	793.76
Total		126.60	11957.03
Avg Grade			**94.45**
Garage Grade			93.60
Height Above Garage Grade (0.6m min)			**0.85**



SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS

KEYPLAN
N.T.S.

No.	REVISIONS	By	Date
14			
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2	ISSUED TO CLC FOR REVIEW	DGY	2020:06:09
1	ISSUED TO CLIENT FOR REVIEW	DGY	2020:05:07

uniform
URBAN DEVELOPMENTS

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

Project Title

WATERIDGE VILLAGE
PHASE 2B - BLOCK 1
475 WANAKI ROAD

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/06/09
PROVINCE OF ONTARIO

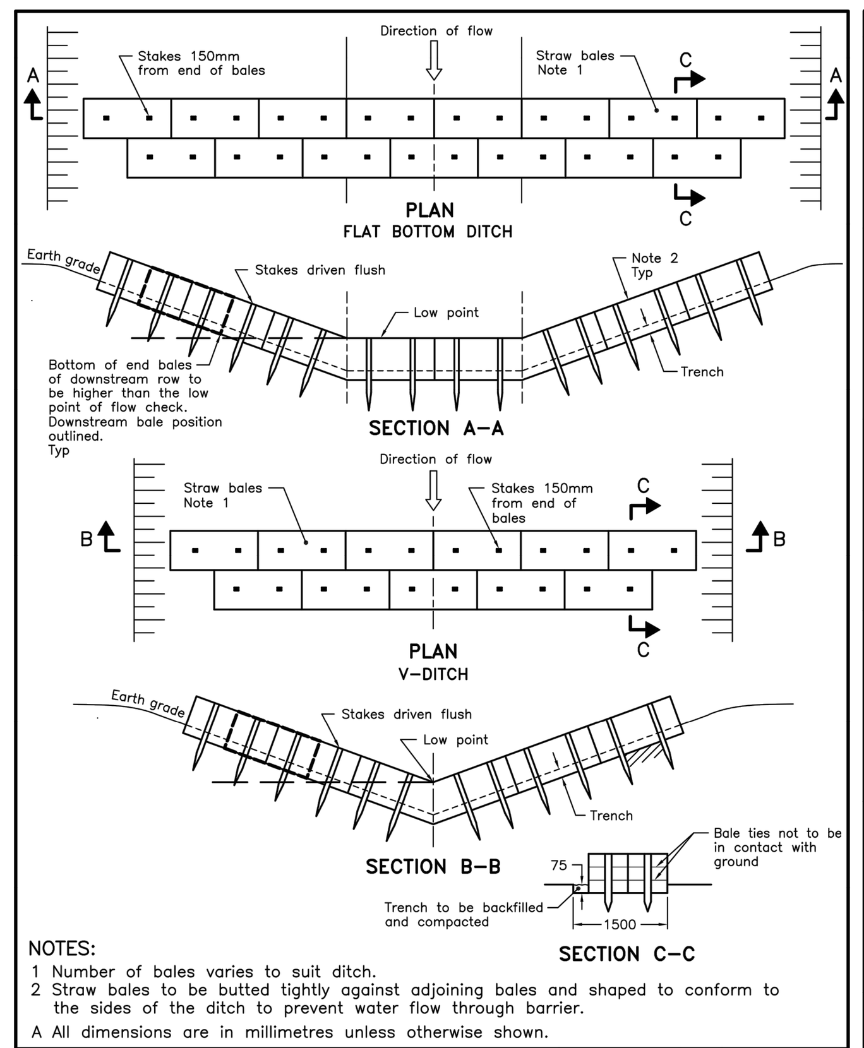
Drawing Title

GRADING PLAN

Scale 1 : 300

Design	Date
AZ/RM	APRIL 2020
Drawn	Checked
MM/EH	DGY
Project No.	Drawing No.
124219	200

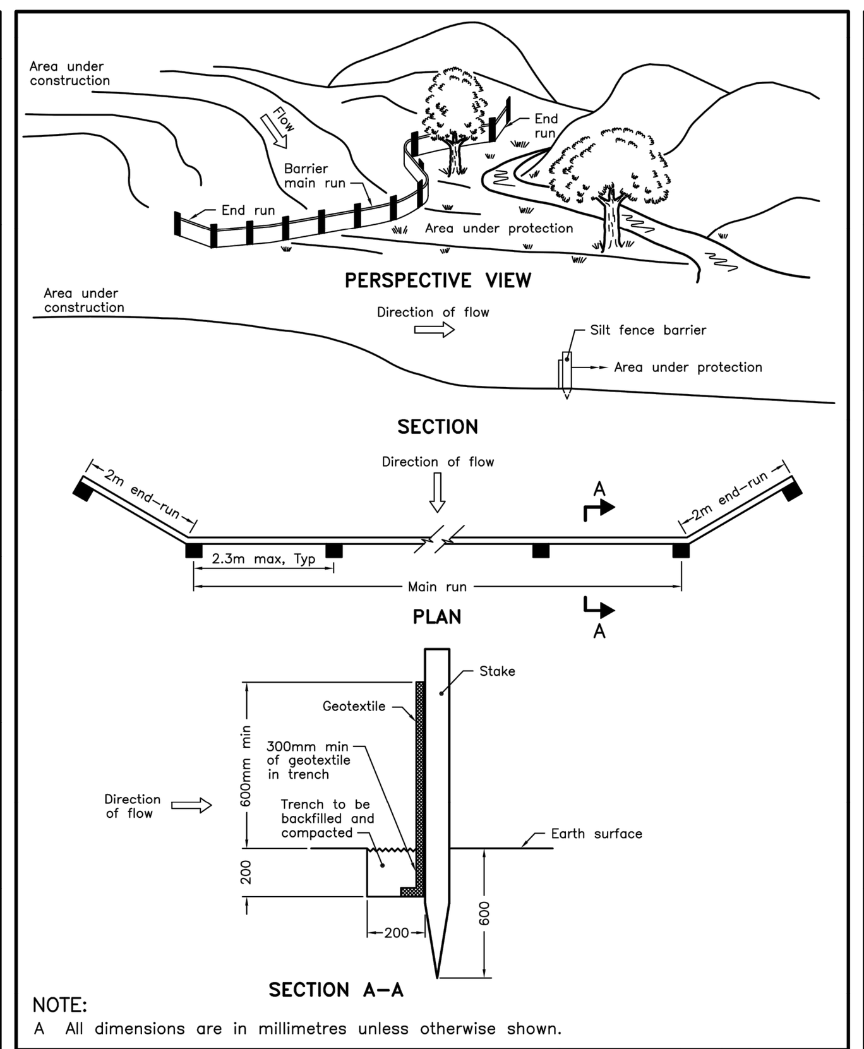
CITY PLAN No. ####
CITY FILE No. ####



ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2006 | Rev 1

STRAW BALE FLOW CHECK DAM

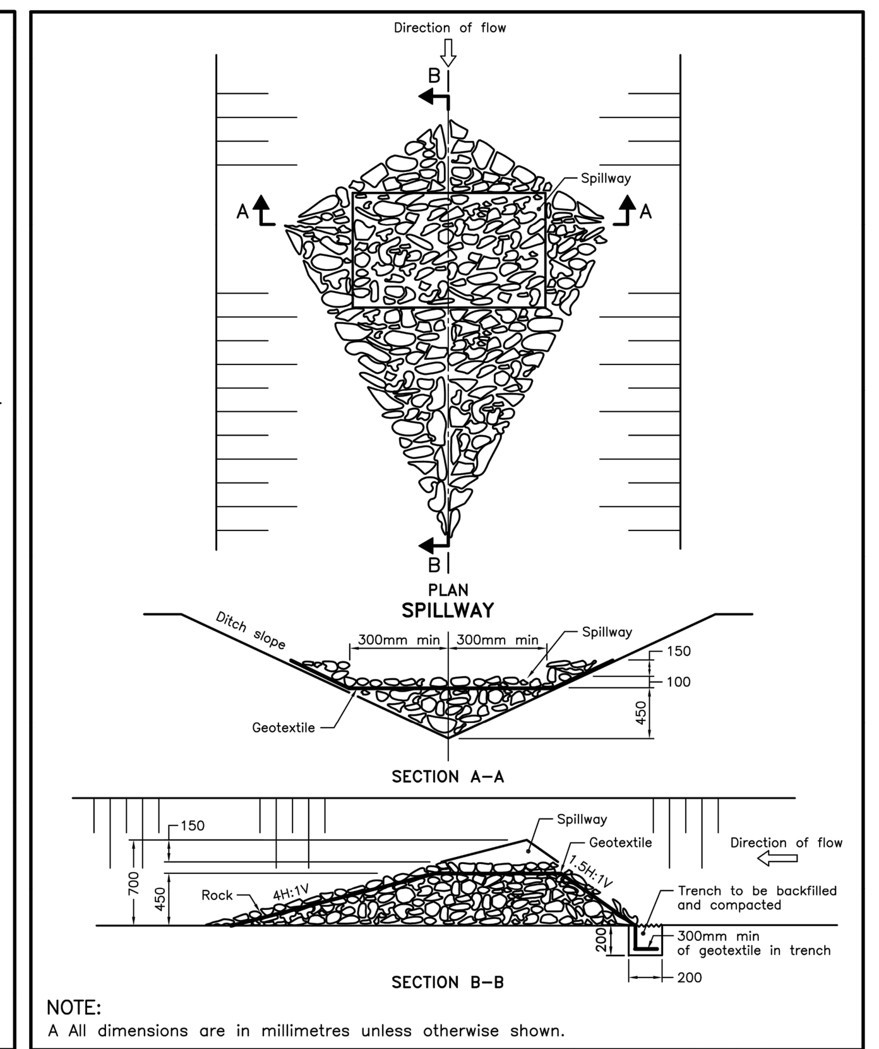
OPSD 219.180



ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2006 | Rev 1

LIGHT-DUTY SILT FENCE BARRIER

OPSD 219.110



ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2006 | Rev 1

ROCK FLOW CHECK DAM
V-DITCH

OPSD 219.210

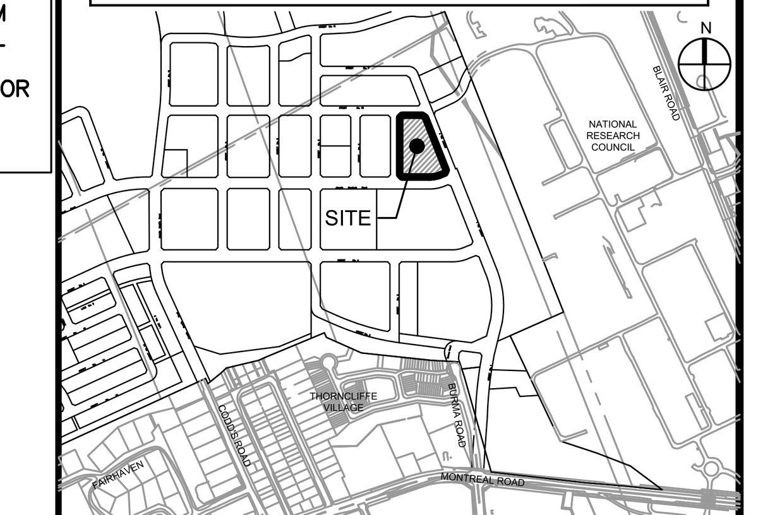
NOTES:

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. CONTRACTOR TO PROVIDE DETAILS ON LOCATION(S) AND DESIGN OF DEWATERING TRAP(S) PRIOR TO COMMENCING WORK. CONTRACTOR ALSO RESPONSIBLE FOR MAINTAINING TRAP(S) AND ADJUSTING SIZE(S) IF DEEMED REQUIRED BY THE ENGINEER DURING CONSTRUCTION.
5. CONTRACTOR TO PROTECT EXISTING CATCHBASINS WITH FILTER CLOTH UNDER THE COVERS TO TRAP SEDIMENTATION. REFER TO IDENTIFIED STRUCTURES.
6. ALL DISTURBED AREA TO BE REVEGETATED AS SOON AS POSSIBLE.
7. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED WEEKLY OR IMMEDIATELY FOLLOWING A STORM EVENT. ANY DAMAGED CONTROL MEASURE SHALL BE REPAIRED IMMEDIATELY. CONTRACTOR TO BE RESPONSIBLE FOR PROTECTING EROSION AND SEDIMENT CONTROL MEASURES DURING CONSTRUCTION.
8. ALL SEDIMENT DEPOSITS SHALL BE REMOVED FROM SITE AND DISPOSED OF AT APPROPRIATE DISPOSAL FACILITY, OR SHALL BE TESTED BY GEOTECHNICAL ENGINEER WHO MAY PROVIDE RECOMMENDATIONS FOR MATERIALS TO BE USED ONSITE PRIOR TO LANDSCAPING.

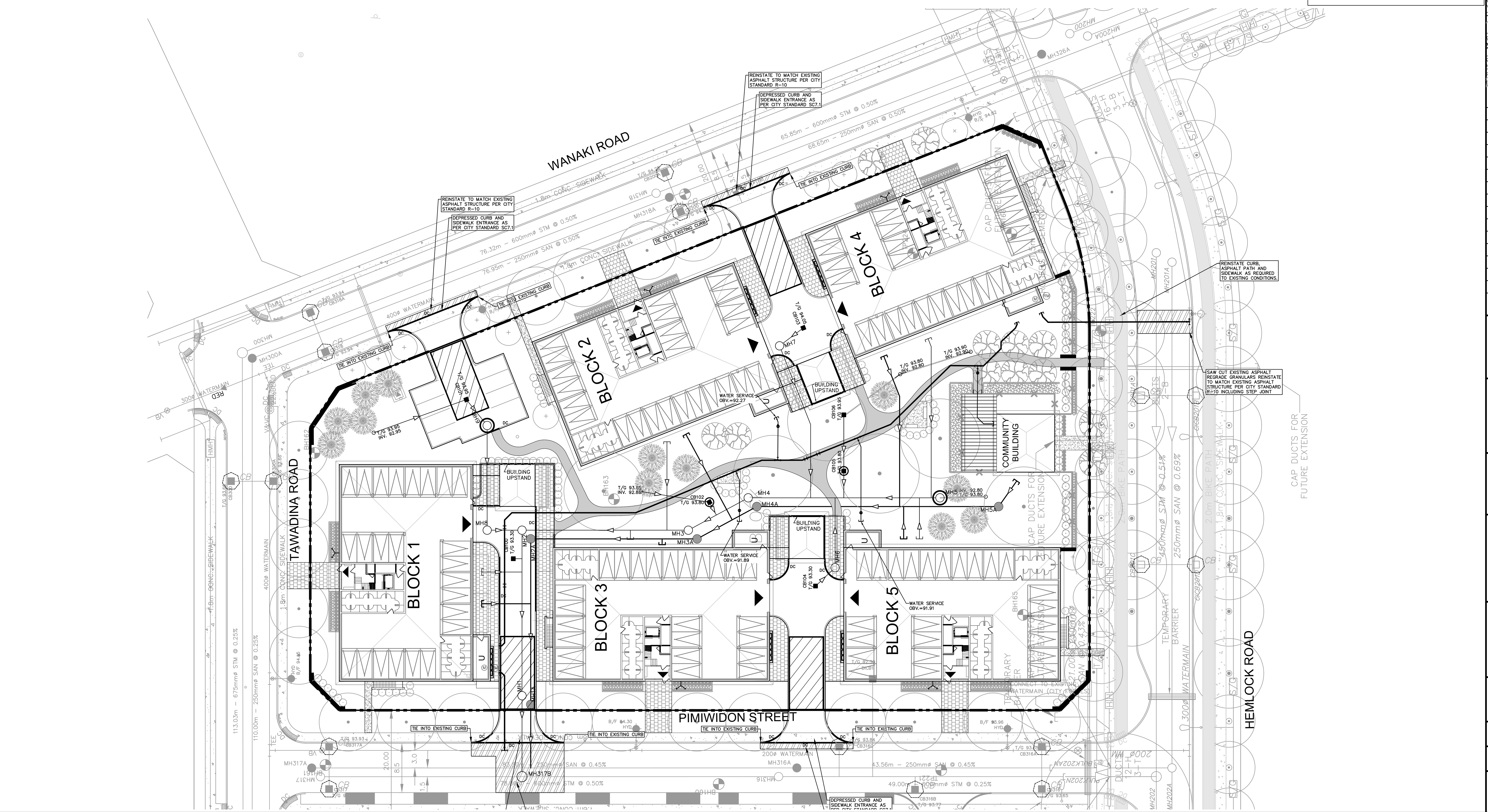
LEGEND

- HEAVY DUTY SILT FENCE
- SNOW FENCE
- STRAW BALE CHECK DAM
- STRAW BALE CHECK DAM WITH FILTER CLOTH
- ROCK CHECK DAM
- SEDIMENT SACK PLACED UNDER EXISTING CB COVER
- TEMPORARY MUD MAT 0.15m THICK 50mm CLEAR STONE ON NON WOVEN FILTER CLOTH (15.0 × 7.0)

SEE 010, 011, 012 FOR NOTES, LEGEND, CB TABLE, STREET SECTIONS AND DETAILS



KEYPLAN
N.T.S.



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Project Title

WATERIDGE VILLAGE
PHASE 2B - BLOCK 1
475 WANAKI ROAD

LICENSED PROFESSIONAL ENGINEER
D. G. Yannoulopoulos
2020/06/09
PROVINCE OF ONTARIO

Drawing Title

EROSION
SEDIMENT PLAN

Scale	1 : 400
Design: AZ/RM	Date: APRIL 2020
Drawn: MM/EH	Checked: DGY
Project No.: 124219	Drawing No.: 900

CITY PLAN No. ####

CITY FILE No. ####

patersongroup **memorandum**

consulting engineers

re: **Geotechnical Design Summary Details**
Proposed Wateridge Village Development - Phase 2B
Block 1 - 475 Wanaki Road - Ottawa

to: Uniform Development - **Mr. Annibale Ferro** - aferro@uniformdevelopments.com
date: April 20, 2020
file: PG3704-MEMO.12

Further to your request and authorization, Paterson Group (Paterson) prepared the current memorandum to provide the geotechnical design summary details for Phase 2B within Block 1 at Wateridge Village residential development. The following memorandum should be read in conjunction with Paterson Letter Report PG3704-LET.03 dated November 5, 2019.

Relevant design information is presented in Table 1 - Summary of Design Details for the subject blocks and lots. The relevant design and inspection information includes the following:

- ❏ Legal lot/block number and street name
- ❏ Existing grade elevation
- ❏ Proposed finished grade elevation
- ❏ Maximum allowable grade raise
- ❏ Bearing resistance values
- ❏ Proposed USF elevation
- ❏ Lightweight fill (LWF) recommendations
- ❏ Seismic site class

Grading Plan Review

Paterson reviewed the following grading plan prepared by IBI Group for Phase 2B within Block 1 of the aforementioned residential development:

- ❏ Grading Plan - Drawing No. 200 - Project No. 124219 dated April 8, 2020.

Based on our review of the above noted grading plan, the proposed grades within Phase 2B are considered acceptable from a geotechnical perspective. Some minor grading exceedances were noted based on our permissible grade raise recommendation provided in Report PG3704-LET.03 dated November 5, 2019. However, no lightweight fill is required due to these minor exceedances based on further analysis completed for the permissible grade raise review for the subject blocks. Table 1 attached to this memo presents our summary of design details for the current phase.

Bearing Resistance Values for Foundation Design

It should also be noted that based on the grading plan provided, the design underside of footing elevations, it is anticipated that several townhouse blocks will require engineered fill below footings.

Based on the provided grading plan, the design underside of footing elevation for several of the subject blocks is anticipated to require an engineered fill pad to be placed over an approved bearing medium. Engineered fill below footings should consist of OPSS Granular A or Granular B Type II crushed stone. The engineered fill should be placed in a maximum 300 mm thick loose lifts and compacted to a minimum 98% of the material's SMPDD in dry and above freezing temperatures. The material placement and compaction should be reviewed and approved by Paterson at the time of construction. Footings placed over a minimum 500 mm thick layer of engineered fill placed over a proof-rolled, compact silty sand bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **225 kPa**.

Footings placed on an approved fill/engineered fill pad or on an undisturbed, compact silty sand bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **225 kPa**.

For building footprints where the existing fill, free of significant amounts of organics and over-sized boulders/concrete pieces, is encountered, the following procedure is recommended:

- ❏ The existing fill should be sub-excavated to a minimum 500 mm depth below the underside of the floor slab. The excavated fill, free of significant amounts of organics and over-sized boulders can be re-compacted in maximum 225 mm thick lifts using a large vibratory roller making several passes. The re-compaction effort should be carried out under dry conditions and above freezing temperatures and be supervised by Paterson.
- ❏ Where the existing fill is encountered below underside of footing, it is recommended to remove the existing fill material extending at least 500 mm below the underside of footing. The approved fill subgrade, free of significant amounts of organics and over-sized boulders, should be proof-rolled by a large vibratory roller making several passes. Any poor performing areas should be sub-excavated and reinstated with engineered fill, such as OPSS Granular A or Granular B Type II, placed in maximum 300 mm thick loose lifts and compacted to 98% of the material's SPMDD. The proof rolling effort should be carried out under dry conditions and above freezing temperatures and be supervised by Paterson.
- ❏ The sub-excavated area below the underside of footing elevation should be backfilled with engineered fill, such as OPSS Granular A or Granular B Type II,

placed in maximum 300 mm thick loose lifts and compacted to 98% of the material's SPMDD.

A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS. The bearing resistance value at SLS given for footings placed on a soil bearing surface will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively.

Frost Protection for Footings

Based on our grading plan review, soil cover above the design underside of footing level does not provide sufficient frost protection. Therefore, a rigid insulation is recommended to be placed below footings for areas where soil cover of less than 1.5 m is present. Based on our review, the perimeter footings should be placed over a 50 mm thick layer of HL-60 or SR.P 600 rigid insulation. A SM rigid insulation should extend at least 1.2 m horizontally beyond the exterior side of the footing face and at least 600 mm horizontally beyond the interior side of the footing face. The rigid insulation thickness should be increased to 100 mm thick at the garage entrance.

We trust that the current submission meets your immediate requirements.

Best Regards,

Paterson Group Inc.

David J. Gilbert, P.Eng.

Table 1 - Summary of Grading Design Details - Wateridge Village - Phase 2B

Legal Lot/ Block Number	Underside of Footing Elevation (m)	Original GS (m)	Proposed GS (m)	Bearing Capacity - SLS (kPa)	Seismic Site Class	Permissible Grade Raise (m)	Above Permissible Grade Raise (m)	Engineered Fill Thickness Below Footings (m)	LWF Required (m)
Block 1 - north	93.40	92.70	94.40	100-150	C	2.00	n/a	1.00	n/a
Block 1 - east	93.40	92.70	94.40	100-150	C	2.00	n/a	1.00	n/a
Block 1 - south	93.40	92.80	94.40	100-150	C	2.00	n/a	0.90	n/a
Block 1 - west	93.40	92.80	94.40	100-150	C	2.00	n/a	0.90	n/a
Block 2 - north	93.85	92.50	94.75	100-150	C	2.00	0.25	1.65	n/a
Block 2 - east	93.85	92.80	94.85	100-150	C	2.00	0.05	1.35	n/a
Block 2 - south	93.85	92.50	94.85	100-150	C	2.00	0.35	1.65	n/a
Block 2 - west	93.85	92.50	94.75	100-150	C	2.00	0.25	1.65	n/a
Block 3 - north	93.35	92.70	94.35	100-150	C	2.00	n/a	0.95	n/a
Block 3 - east	93.35	92.60	94.35	100-150	C	2.00	n/a	1.05	n/a
Block 3 - south	93.35	92.80	94.35	100-150	C	2.00	n/a	0.85	n/a
Block 3 - west	93.35	93.00	94.35	100-150	C	2.00	n/a	0.65	n/a
Block 4 - north	93.95	93.20	94.85	100-150	C	2.00	n/a	1.05	n/a
Block 4 - east	93.95	93.60	94.95	100-150	C	2.00	n/a	0.65	n/a
Block 4 - south	93.95	93.40	94.95	100-150	C	2.00	n/a	0.85	n/a
Block 4 - west	93.95	93.20	94.95	100-150	C	2.00	n/a	1.05	n/a
Block 5 - north	93.20	93.40	94.20	100-150	C	2.00	n/a	n/a	n/a
Block 5 - east	93.20	93.40	94.20	100-150	C	2.00	n/a	n/a	n/a
Block 5 - south	93.20	93.40	94.20	100-150	C	2.00	n/a	n/a	n/a
Block 5 - west	93.20	93.60	94.20	100-150	C	2.00	n/a	n/a	n/a

IBI Grading Plans Reviewed: Grading Plan - Wateridge Village - Project 124219 - Drawing No. 200 - dated April 8, 2020.

Bearing Capacity can be increased to 150 kPa through the bearing surface improvement recommendations noted in Memo Report PG3704-MEMO.12

GEOTECHNICAL INVESTIGATION REPORT
PROPOSED MIXED-USE DEVELOPMENT
PHASE 2A & 2B
WATERIDGE VILLAGE
OTTAWA, ONTARIO

Report Ref. No. CO682.00
February 5, 2019

Prepared For:
Canada Lands Company CLC Limited
100 Queen Street , Unit 1050
Ottawa, ON
K1P 1J9

Prepared By:
Alston Associates
A division of Terrapex Environmental Ltd.

Distribution:

Digital Copy	-	Canada Lands Company CLC Limited

20 Gurdwara Road, Unit 1
Ottawa, Ontario
K2E 8B3

telephone: (613) 745-6471
fax: (613) 745-0796
e-mail: alston.associates@alston.ca

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1 INTRODUCTION

Alston Associates (**AA**), the geotechnical division of Terrapex Environmental Ltd. (**Terrapex**) has been retained by Canada Lands Company CLC Limited (CLC) to carry out a geotechnical investigation for the proposed mixed-use development of Wateridge Village (Phase 2A and 2B) located at the property of the former Canadian Forces Base (CFB) Rockcliffe in the City of Ottawa, Ontario. Authorization to proceed with this study was given by Mr. Jean Lachance of CLC.

We understand that CLC is seeking approval to develop the land at Wateridge Village referred to as Phase 2A and 2B Lands and construct Parks 1 and 7 including road improvements to existing infrastructure along Hemlock Road.

The Phase 2 (A and B) area is located north of Registered Plans of Subdivisions 4M-1559 and 4M-1581 in Wateridge Village, as shown on Drawing 2 attached in Appendix B of this report. Drawing 2 also shows the proposed land use of the property sub-divided into blocks according to the type of development. According to the proposed development plan, the site is scheduled for a mixed use residential development which would include the following:

- Phase 2A will contain three low to mid-rise mixed use Blocks (8, 10 and 11), one low to mid-rise residential Block (13), one low-rise residential Block (12), Park 1 (Block 9), and Hemlock Road west of Codd's Road.
- Phase 2B will contain two mid-rise mixed use Blocks (6 and 7), four low to mid-rise residential Blocks (1, 2, 4 and 5), and Park 9 (Block 3).

A grading plan dated December 2018 was prepared by IBI Group; attached in Appendix B as Drawings 7, 8, and 9. Drawings 7 and 8 shows the building locations and finish floor and foundation elevations on Blocks 2, 4, and 5. Details regarding building locations and design and municipal infrastructure on the remaining blocks were not available at the time of the investigation, and accordingly the recommendations provided in this report are considered to be preliminary in nature, subject for review and revision upon completion of proposed plans.

The purpose of this investigation was to characterize the subsurface soil and groundwater conditions, to determine the engineering properties of the various soil deposits underlying the site, and to provide geotechnical engineering recommendations pertaining to the proposed development.

The investigation included evaluation of the pavement of the old Hemlock Road to assess the condition of the pavement structure and to provide recommendations for improvements/repairs prior to use for construction traffic, transit vehicles and public access.

This report presents the results of the investigation performed in accordance with the general terms of reference outlined above and is intended for the guidance of the client and the design architects or engineers only. It is assumed that the design will be in accordance with the applicable building codes and standards.

2 BACKGROUND

A number of geotechnical and hydrogeological investigations were completed at the former CFB Rockcliffe property for CLC and documented in the following reports; copies of which were *provided to us by CLC:*

- *"Geotechnical Investigation Phase 1B Development – Site Servicing, Wateridge Village at Rockcliffe, Ottawa, Ontario", dated November 2016 (DST File No: IN-SO-026755);*
- *"Geotechnical Investigation Phase 1A Development – Site Servicing, Former CFB Rockcliffe Development, Ottawa, Ontario", dated November 2015 (DST File No: OE-OT- 015358);*
- *"Final Geotechnical Investigation for Subdivision Approval, Former CFB Rockcliffe Development, Ottawa, Ontario", dated September 2015 (DST File No: OE-OT-015358);*
- *"Preliminary Geotechnical and Hydrogeological Investigation Proposed Stormwater Management Pond, CLC Rockcliff Lands Hemlock Road and Aviation Parkway, Ottawa, Ontario", dated May 2015 (Golder Associates File No: 1521309);*
- *"Geotechnical Investigation Report for Preliminary Assessment for Building Foundation, Services Installation and Grade Raise Analysis Mapping – Phase 1 Development, Former CFB Rockcliffe, Ottawa, Ontario", dated April 2014 (DST File No: GS-OT-015358);*
- *"Hydrogeological Report - Stormwater Management Support Studies, Former CFB Rockcliffe, Ottawa, Ontario, dated October 2013" (DST File No: OE-OT- 017184);*
- *"Preliminary Geotechnical Investigation, Rockcliffe Redevelopment Program", dated March 2006 (DST File No.: OGO6562).*

The previous borehole and test pit locations in the Phase 2 development area were extracted from the above referenced reports; shown on Drawing 4 attached in Appendix B of this report. The logs of the previous boreholes and test pits are also attached in Appendix D.

According to the previous borehole and test pit findings, topsoil up to about 200 mm in depth is present across the site. Asphaltic concrete, with a thickness of about 100 mm, is present on existing roads and driveways. Fill material consisting of various silty sand, sand and gravel or clay is present in various areas of the site, with thickness ranging from approximately 0.5 to 4.3 m.

Grey silty clay is the dominant native overburden type in the central and southern portion of the site. The clay layer extends from near surface to a depth of more than 6 m in the south and thins out to the northeast and north where it overlies silty till deposits at depths of 1 to 2 m. The northern and eastern portions of the site are generally underlain by till material consisting of grey compact silt, sand and minor gravel. Where encountered during previous drilling, the till is 1 to 3 m thick.

Boreholes drilled into the bedrock typically encountered horizontally bedded, grey limestone with minor narrow shale bedding, interpreted to be of the Ottawa Group. The bedrock surface is generally unweathered or has a narrow weathering zone, less than one metre thick.

The applicable information from the previous geotechnical investigations are discussed and applied to the comments and recommendations presented in this report.

3 FIELDWORK

The fieldwork for this investigation was carried out during the period between November 13 and 20, and December 14, 2018. It consisted of sixty seven (67) boreholes and twenty four (24) exploratory test pits, advanced by drilling and excavation contractors commissioned by **AA**. The number and location of the boreholes were chosen by **AA** and reviewed by IBI Group and CLC to provide general coverage of the site for the proposed development. The locations of the test pits were chosen by **AA** to provide general coverage between the boreholes to confirm the depth of bedrock. The locations of the boreholes and test pits are shown on Drawing 3; enclosed in Appendix B of this report.

The boreholes; designated as BH101 through BH129, BH131, BH133 through BH150, BH152 through BH167, and BH173 through BH175, were advanced to depths ranging from 0.6 to 4.58 m below ground surface (mbgs). Eight (8) of the boreholes; MW111, MW124, MW125, MW142, MW142, MW152, MW158, and MNW166, were instrumented with monitoring wells to determine the long term groundwater table at the site.

The exploratory test pits (designated as TP201 through TP224) were extended to depths ranging from 0.4 to 4.4 mbgs to confirm the existence and depth of the bedrock.

The ground surface elevations at the locations of the boreholes and test pits were established by **AA** using Topcon Hiper V GNSS Receiver and Trimble R10 GNSS Receiver respectively.

Standard penetration tests were carried out in the course of advancing the boreholes to take representative soil samples and to measure penetration index values (N-values) to characterize the condition of the various soil materials. The number of blows of the striking hammer required to drive the split spoon sampler to 300 mm depth was recorded and these are presented on the logs as penetration index values. Results of SPT are shown on the borehole log sheets in Appendix C of this report.

Groundwater level observations were made in the boreholes and test pits upon completion of each of their advancement, and in the monitoring wells on December 17, 2018. The results of the groundwater measurements are discussed in Section 4.5 of this report.

The fieldwork for this project was carried out under the supervision of an experienced geotechnical technician from this office who laid out the positions of the boreholes and test pits in the field; arranged locates of buried services; effected the drilling, test pit excavation, sampling and in situ testing; observed groundwater conditions; and prepared field borehole and test pit log sheets.

4 LABORATORY TESTS

The soil samples retained from the split spoon sampler were properly sealed, labelled and brought to our laboratory. They were visually classified and water content tests were conducted on all soil samples retained from Boreholes BH101, BH102, BH107, BH 114, BH118, MW124, MW125, BH140, NW142, MW147, MW152, BH154, BH157, BH164, and BH167. The results of the classification, water contents, and Standard Penetration Tests are presented on the borehole logs sheets attached in Appendix C of this report.

Grain-size analyses were carried out on twelve (12) soil samples; Atterberg Limits test was performed on two. The results of these tests are presented as Figures E-1 through E-14 in Appendix E.

In addition, four (4) soil samples were submitted to an analytical laboratory for chemical analyses for pH and soluble sulphate tests. The results of these tests are enclosed in Appendix F; discussed in Section 6.13 of this report.

5 SITE AND SUBSURFACE CONDITIONS

Full details of the subsurface and groundwater conditions at the site are given on the borehole Log sheets attached in Appendix C of this report.

The following paragraphs present a description of the site and a commentary on the engineering properties of the various soil materials contacted in the boreholes.

It should be noted that the boundaries of soil types indicated on the borehole logs are inferred from non-continuous soil sampling and observations made during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design, and therefore, should not be construed as exact planes of geological change.

5.1 Site Description

The subject site is located at the former CFB Rockcliffe property in the City of Ottawa. The former CFB Rockcliffe property is approximately 310 acres; bounded by Aviation Parkway to the west, Sir George Etienne Cartier Parkway to the North, the National Research Council of Canada campus to the east, and existing residential communities and Montfort Hospital to the south. It is bounded by two bedrock escarpments at the south and north boundaries. The Rockcliffe Airport is also located in the vicinity of the site, just north of Sir George Etienne Cartier Parkway.

Our investigation was limited to Phase 2A and 2B including Hemlock Road (west of Codd's Road). The former CFB Rockcliffe property and Phase 2 development area are shown in Drawing 1, attached in Appendix B.

Phase 2A is situated north of Hemlock Road, west of Codd's Road, east of vacant NCC lands, and south of Sir George Etienne Cartier Parkway. It has been divided into Blocks 8 through 13 including Street No. 3, Street No.4, and Hemlock Road. The north escarpment is located along the north boundary of Phase 2A. The slope of the escarpment is almost vertical with exposed bedrock. There is a storm management pond at the bottom of the escarpment.

There are several old pathways, roadways and driveways traversing throughout Phase 2A from past land use, and new storm and sewer lines have been installed along the alignment of the proposed Street No. 4 and east towards the storm sewer outfall. Stockpiles of fill material from previous phases and ongoing construction activities are located in and around Block 12, within the northern half of Block 8, and scattered throughout the north area of Block 9. The remainder of Phase 2A is covered with light to moderate vegetation with mature trees predominately outlining the perimeters of the blocks, and scattered throughout Block 9 (Proposed Park1). The ground surface topography of phase 2A slopes down from south to north and from east to west, the ground surface elevations at the borehole and test pit locations ranged between 77.25 at Test Pit TP208 to 89.57 m at Borehole BH120.

Phase 2B is situated north of Hemlock Road, east of Codd's Road, west of National Research Council of Canada campus, and south of Wanaki Road. It has been divided into Blocks 1 through 7 including Wanaki Road, Street No. 1, Street No. 2, Moses Tennisco Street, Michael Stoqua Street, Bareille-Snow Street, and Codd's Road.

There are several old pathways, roadways and driveways traversing through Phase 2B from past land use. Stockpiles of fill, topsoil and blast rock material from previous phases and ongoing construction activities are located in and around Block 4, northern half of Block 1, northern half of Block 6 and northeast portion of Block 7. Blast rock and fill material are also present along the north edge of Hemlock Road. The remainder of Phase 2B is covered with light vegetation and mature trees predominately outlining the perimeters of the blocks. The ground surface topography is relatively flat with a gradual slope down from east to west and south to north. The ground surface elevations at the borehole and test pit locations ranged between 88.14 m at Borehole BH140 to 93.99 m at Test Pit TP221.

5.2 Asphaltic Concrete Pavement

Boreholes BH101, BH102, BH103, BH104, BH105, BH107, BH108, BH115, BH121, BH138, BH141, BH144, BH 155, BH162, and BH167 were advanced through the asphaltic concrete pavement. They revealed that the thickness of the asphaltic concrete ranges from approximately 40 to 140 mm.

5.3 Granular Base Course

The base course supporting the asphaltic concrete consists of sandy gravel to gravelly sand. The thickness of this granular soil ranges from approximately 200 to 250 mm.

Penetration resistance of the base course material measured N-values ranging from 19 to 25, indicating its compactness condition is compact. The water content of the tested samples of the granular base from Boreholes BH107 and BH167 was about 5% by weight; being damp in appearance.

Sieve grain size analysis was carried out on one (1) sample of granular base course obtained from Borehole BH102 at 0.2 mbgs (Sample 1A). The test revealed that the soil has 70% sand, 28% gravel, and 2% silt and clay. The result of the grain size analysis is shown as Figure E-1 in Appendix E.

5.4 Topsoil

Topsoil was encountered in Boreholes BH114, BH118, BH131, BH134, BH143, BH145, BH146, BH147, BH150, BH153, BH158, BH159, BH155, BH160, BH164, BH165, BH166 and BH167. The thickness of the topsoil at the boreholes varies between approximately 50 and 250 mm.

It should be noted that the topsoil thickness will vary between boreholes. Thicker topsoil than that found in the boreholes may be present in places.

5.5 Fill Material

Fill material is present in all boreholes below the pavement granular base, the topsoil, or surficial

vegetation with the exception of Boreholes BH118, BH127, BH131, BH146, BH147, and BH150. The fill consists of various gravelly sand to sandy gravel, silty sand to sandy silt with trace of gravel, and clayey silt soils; extending to approximate depths ranging from 0.3 to 2.7 mbgs. The fill contains traces of organic, rootlet, and rock fragment. At the location of Boreholes BH114, BH116, BH118, BH120, BH153, and BH154, the fill material contains trace cinder. At the location of Boreholes BH137, BH139, BH142, BH143, BH148, BH153, BH161, and BH174, the fill contains trace to some brick pieces.

SPT carried out in the silty, sandy, and gravelly fill material measured N-values ranging from 3 to 50/25 mm penetration; indicating very loose to very dense compactness condition; generally being compact. The higher N-values are likely due to the split spoon sampler striking boulders or construction rubble. SPT carried out in the clayey silt fill material measured N-values ranging from 3 to 36; indicating soft to hard consistency; generally being firm.

The fill material is generally brown to dark brown in color and damp to moist in appearance. The water content of the tested fill samples from Boreholes BH101, BH102, BH107, BH114, BH118, MW124, MW125, BH140, NW142, MW147, MW152, BH154, BH157, BH164, and BH167 ranges from 5 to 37% by weight.

5.6 Native Soils

5.6.1 Silty Sand to Sand with trace silt

Silty sand to sand with trace silt soils are present below the fill material in Boreholes BH127, BH131, BH140, BH149, BH152, BH153, BH156, BH157, BH160, BH162, BH163, BH164, BH166 and underneath a clayey silt deposit in Borehole MW147. The sandy soils contain variable proportions of silt classifying the soil as sand with trace to some silt and silty sand.

The silty sand to sand unit is generally brown in colour. The water content of the tested sand samples from Boreholes BH140, BH147, BH154, BH157, and BH164 ranges from approximately 7 to 22% by weight; generally being moist in appearance.

Penetration resistance in the silty sand to sand units provided N-values ranging from 4 to 50/75 mm penetration, indicating loose to very dense compactness condition.

Sieve grain size analysis was carried out on five (5) representative samples of the sandy soils. The results of the grain size analysis are enclosed in Appendix E as Figures E-2 to E-6 and summarized below.

Borehole Number	Sample Depth (mbgs) and No.	Sample Description	Gravel %	Sand %	Silt %	Clay %
BH104	1.5 (Sample 3)	Silty Sand, some gravel	13	66	21	
BH140	1.5 (Sample 3)	Sand, trace silt, trace gravel	3	51	2	
BH149	0.76 (Sample 2A)	Silty Sand, trace gravel	7	63	30	
BH158	1.5 (Sample 3)	Sand, some gravel, trace silt	15	81	4	
BH163	2.28 (Sample 4)	Sand, some silt, trace gravel	5	76	19	

Based on the results of the grain size analysis, the coefficient of permeability (K) of the sand soils range from 10^{-2} cm/sec to 10^{-4} cm/sec; medium to high permeability.

5.6.2 Silt with trace sand to sandy silt

Silt with trace sand to sandy silt soils are present below the fill material in Boreholes BH101 through BH105, BH112, BH113, BH116, BH118, BH120, BH124, BH126, BH134, BH136, BH137, BH145, BH146, BH150, BH151, BH154, BH155, BH164, and BH173. This unit contains variable proportions of sand classifying the soil as silt with trace sand to sandy silt.

The sandy silt to silt unit is generally brown in colour. The water content of the tested silt samples from Boreholes BH101, BH124, BH152, and BH164 ranges from approximately 4 to 20% by weight; generally being damp to moist in appearance.

Penetration resistance in the silt unit provided N-values ranging from 11 to 50/25 mm penetration, indicating compact to very dense compactness condition.

Sieve and hydrometer grain size analyses were carried out on three (3) samples of silt soil obtained from Boreholes BH112, BH120, and BH152. The test results are enclosed in Appendix E as Figures E-7 to E-9, and summarized below.

Borehole Number	Sample Depth (mbgs) and No.	Sample Description	Gravel %	Sand %	Silt %	Clay %
BH112	0.76 (Sample 2)	Silt, some clay, trace sand, trace gravel	3	8	73	16
BH120	0.76 (Sample 2)	Silt, some sand, trace clay	0	20	71	9
BH152	2.28 (Sample 4)	Silt, some sand, some clay	0	18	65	14

Based on the results of the grain size analysis, the K values of the silt soils range from 10^{-5} cm/sec to less than 10^{-6} cm/sec; low permeability.

5.6.3 Clay and Silt

A deposit of silt and clay to clayey silt ranging in thickness from 0.5 to 2 m is present below the fill material in Boreholes BH104, BH106, BH125, BH133, BH134, BH138, BH141, BH147, BH150, BH151, BH163, and BH173.

The clay and silt unit is generally brown in colour. The water content of the tested clay and silt samples ranges from approximately 11 to 36% by weight; generally being moist to wet in appearance.

Penetration resistance in the clay and silt soil measured N-values ranging from 5 to 28, indicating firm to very stiff consistencies.

Sieve and hydrometer grain size analyses were carried out on three (3) samples of clay and silt soils; Atterberg Limits test on two (2). The test results are enclosed in Appendix E as Figures E-10 through E-14, and summarized below.

Borehole No.	Sample Depth (mbgs) and No.	Sample Description	Gravel %	Sand %	Silt %	Clay %	Liquid Limit	Plasticity Index	Soil Classification
BH104	0.76 (Sample 2)	Clay and Silt, trace sand	0	2	42	56	-	-	-
BH125	1.5 (Sample 3)	Clay and Silt, trace sand	0	1	45	54	58	34	Inorganic clays of high plasticity
BH134	0.8 (Sample 2)	Clay and Silt, trace sand	0	4	37	59	53	28	Inorganic clays of high plasticity

The soil classification was based on the plasticity chart as shown on Figure 3.1 of the CFEM, 4th Edition.

Based on the results of the grain size analysis, the K values of the clay and silt soil is less than 10^{-7} cm/sec; very low relative permeability.

5.6.4 Gravelly Sand

A gravelly sand deposit is present in Borehole BH107; positioned at an approximate depth of 1.8 mbgs and extending to the bedrock at 2.2 mbgs.

SPT in the gravelly sand unit had N-value of 75/254 mm penetration, indicating very dense compactness condition. It is greyish brown in colour and has a moist appearance.

5.7 Bedrock

Bedrock was encountered in all boreholes and test pits with the exception of Boreholes BH101, BH102, and BH103 at approximate depths ranging from 0.6 to 4.58 mbgs, corresponding to approximate elevations of 79.51 m to 91.57 m. The bedrock was proven by auger refusal and test pits and was not cored. The test pits confirmed that refusal to further advancement of the boreholes was due to bedrock and not large boulders or buried concrete slabs. The depth and elevation of the bedrock encountered in the test pits is tabulated in the table below.

Test Pit No.	Ground Elevation (m)	Depth of Bedrock (mbgs)	Elevation of Bedrock (m)
TP201	74.35	1.42	72.93
TP202	76.71	1.15	75.56
TP203	85.48	1.64	83.84
TP204	86.64	1.84	84.80
TP205	85.81	1.64	84.17
TP206	84.13	1.60	82.53
TP207	82.29	0.64	81.65
TP208	77.25	0.98	76.27
TP209	83.71	1.70	82.01
TP210	88.84	1.60	87.24
TP211	89.64	1.35	88.29
TP212	89.04	1.07	87.97
TP213	88.05	0.78	87.27

TP214	88.28	1.30	86.98
TP215	88.88	0.76	88.12
TP216	89.75	1.60	88.15
TP217	8.84	2.13	86.71
TP218	90.64	1.41	89.23
TP219	91.02	1.12	89.90
TP220	93.92	0.92	93.00
TP221	93.99	0.38	93.61
TP222	93.61	0.90	92.71
TP223	93.58	4.40	89.18
TP224	93.56	4.12	89.44

Based on the ground surface elevations, the surface of the rock dips down from the east to the west and from the central section of the site toward the north and south.

The bedrock at the base of all test pits with the exceptions of Test Pits TP221 and TP222 consists of grey limestone. The bedrock at the base of Test Pits TP221 and TP222 consists of shale.

Review of available geological mapping and previous geotechnical investigations indicates that the bedrock is of the Ottawa Formation, consisting of limestone with some shale bedding and some sandstone in the basal part. According to the previous investigations at the site, the rock is classified to be strong to very strong.

5.8 Groundwater

Groundwater level and cave-in of the unlined side walls of the boreholes were measured during the course of the borehole drilling and upon completion of the boreholes; shown on the individual borehole logs. All boreholes were open and dry upon completion with the exception of the ones listed in the following table:

Borehole No.	Groundwater Depth (m)	Cave-in Level (mbgs)
BH107	Dry	1.8
BH108	Dry	1.5
BH110	Dry	0.9
BH133	Dry	1.8
BH134	0.9	Open
BH139	Dry	1.1
BH140	Dry	2.8
BH148	Dry	1.9
BH154	3.0	Open
BH157	1.96	Open
BH174	Dry	0.6

Groundwater conditions exposed in the test pit excavations were also observed. All test pits remained dry upon completion of excavation.

Groundwater levels in the monitoring wells were measured on December 17, 2018. The results of the groundwater measurement are shown in the following table.

Borehole No.	Ground Elevation (m)	Bottom of the Monitoring Well Depth (m)	Bottom of the Monitoring Well Elevation (m)	Groundwater Depth (mbgs)	Groundwater Elevation (mbgs)
MW111	86.96	2.6	84.36	Dry	-
MW124	90.15	1.7	88.45	Dry	-
MW125	82.65	2.4	80.25	0.25	82.40
MW142	89.85	1.8	88.05	Dry	-
MW147	90.91	2.2	88.71	Dry	-
MW152	92.98	3.0	89.98	Dry	-
MW158	92.86	3.0	89.86	2.25	90.61
MW166	93.54	4.1	89.44	2.55	90.99

It should be noted that groundwater levels are subject to seasonal fluctuations. A higher groundwater level condition will likely develop in the spring and following significant rainfall events.

6 DISCUSSION AND RECOMMENDATIONS

The following discussions and recommendations are based on the factual data obtained from the boreholes and test pits advanced at the site by **AA** and are intended for use by the client and design architects and engineers only.

Contractors bidding on this project or conducting work associated with this project should make their own interpretation of the factual data and/or carry out their own investigations.

On the basis of our fieldwork, laboratory tests and other pertinent information supplied by the client, the following comments and recommendations are made.

6.1 Site Grading

The proposed grading plan prepared and provided for our use by IBI Group and dated December 2018 is included in Appendix B as Drawings 7, 8, and 9.

Based on the proposed grading plan, there will be some modifications to the site grading. The grade will be raised/cut by a maximum of 1m. Given the subsurface conditions at the site; i.e. shallow bedrock, and the absence of thick layers of soft clay, grade raise will not cause any settlement of the subsoil.

6.2 Engineered Fill

The following recommendations regarding construction of engineered fill should be adhered to during the construction stage:

- All surface vegetation, organic materials, softened and disturbed soils must be removed, and the exposed subgrade soils proof-rolled with an inspection by the Geotechnical Engineer prior to any fill placement.
- In the event that the fill will be used to support structures, the existing fill must be removed in its

entirety prior to placement of new fill.

- Soils used as engineered fill should be free of organics and/or other unsuitable material. The engineered fill must be placed in lifts not exceeding 200 mm in thickness and compacted to at least 98% Standard Proctor maximum Dry Density (SPMDD).
- Engineered fill operations should be monitored and compaction tests should be performed on a full-time basis by a qualified engineering technician supervised by the project engineer.
- The boundaries of the engineered fill must be clearly and accurately laid out in the field by qualified surveyors prior to the commencement of engineered fill construction. The top of the engineered fill should extend a minimum of 2.5 m beyond the envelope of the proposed structures. Where the depth of engineered fill exceeds 1.5 m, this horizontal distance of 2.5 m beyond the perimeter of the structure should be increased by at least 1 m for each 1.5 m depth of fill. The edges of the engineered fill should be sloped at a maximum of 3 horizontal to 1 vertical in order to avoid weakening of the engineered fill edges due to slope movement.
- Due to the potential detrimental effects of differential settlement between the engineered fill and the native soils, any buildings where footings are to be placed engineered fill or partly on engineered fill and partly on native soils should include steel reinforcement. The foundation walls of house foundations supported on engineered fill should be reinforced to bridge localized soft spots and zones of non-uniform compaction, and to minimize structural distress due to differential settlement of the engineered fill.
- The engineered fill operation should take place in favorable climatic conditions. If the work is carried out in months where freezing temperatures may occur, all frost affected material must be removed prior to the placement of frost-free fill.
- If unusual soil conditions become apparent during construction, due to subsurface groundwater influences, our office should be contacted in order to assess the conditions and recommend appropriate remedial measures.

6.3 Excavation

Based on the borehole findings, excavation for foundations, potential basements, sewer trenches and utilities will be carried out through fill material, sandy, silty, and clayey native soils, and bedrock. Excavation of the soil strata is not expected to pose any difficulty and can be carried out with heavy hydraulic excavators.

Significant bedrock excavation is anticipated across the site. According to the rock core data from the previous investigations, the bedrock generally consists of strong to very strong limestone with interbedded shale of variable bed thicknesses and depth across the site.

Bedrock excavation is expected to be carried out using line drilling and blasting, hoe ramming or both. Provision should be made in the excavation contract to include the use of these techniques for excavation in bedrock.

Any blasting should be carried out in accordance with City of Ottawa Special Provision S.P. No: F-1201 and under the supervision of a blasting specialist engineer. Vibration monitoring of the blasting operation should be carried out to ensure that the blasting meets the limiting vibration criteria at all times.

The contractor should submit a complete and detailed blasting design and monitoring proposal

prepared by a blasting/vibrations specialist prior to commencing blasting. This would have to be reviewed and accepted in relation to the requirements of the blasting specifications. Vibration monitoring of the blasting should be carried out to ensure that the blasting meets the limiting vibration criteria at all times. A pre-blast condition survey should be carried out of surrounding structures and utilities located within 100 m of the excavation site. The condition survey should also include the National Research Council's Montreal Road Campus located east of the subject site.

All excavations must be carried out in accordance with Occupational Health and Safety Act (OHSA). With respect to OHSA, the near surface fill, compact sandy silt to silt and sand to silty sand, and firm clay and silt soils are expected to conform to Type 3 soils. The dense to very dense sandy silt to silt and sand to silty sand, and stiff to very stiff clay and silt soils can be classified as Type 2 soils. The bedrock is classified as Type 1 soil.

Temporary excavations for slopes in Type 3 soil should not exceed 1.0 horizontal to 1.0 vertical. In the event very loose and/or soft soils are encountered at shallow depths or within zones of persistent seepage, it will be necessary to flatten the side slopes as necessary to achieve stable conditions. In wet sandy soils it may be necessary to slope the excavation at inclinations from 1.0 vertical to 2.0 horizontal to 1.0 vertical to 3.0 horizontal. Excavations in Type 2 soil may be cut with vertical side-walls within the lower 1.2 m height of excavation and 1.0 horizontal to 1.0 vertical above this height. Excavations in the bedrock may be cut with vertical side-walls.

For excavations through multiple soil types, the side slope geometry is governed by the soil with the highest number designation. Excavation side-slopes should not be unduly left exposed to inclement weather. Excavation slopes consisting of sandy soils will be prone to gullying in periods of wet weather, unless the slopes are properly sheeted with tarpaulins.

It should be noted that the on-site fill material may contain boulders, cobbles and remnants of former buildings in the form of buried concrete. Provisions must be made in the excavation and foundation installation contracts for the removal of possible boulders and concrete.

Where workers must enter excavations extending deeper than 1.2 m below grade, the excavation side-walls must be suitably sloped and/or braced in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects.

It is anticipated that sufficient space will be available to slope the sidewalls of the basement excavation; as such it will not be necessary to shore the basement excavation walls.

6.4 Reuse of On-site Excavated Soil as a Compacted Backfill

On-site excavated inorganic native soils are considered suitable for reuse as backfill material within the roadways and pipeline trench excavations, provided their water content is within 2% of their optimum water contents (OWC) as determined by Standard Proctor test, and the materials are effectively compacted with heavy compaction rollers.

While the quality of the native soils are considered suitable for backfilling; the moisture content of the soils and the lift thickness for compaction must be properly controlled during the backfilling. Alternatively, imported suitable material should be used.

Measured water content ranges from approximately 4 to 36% within the native soils and from 5 to 37% within the fill material; generally being close to the wet side of the material's OWC. On-site native soils that are wetter than their OWC should be dried sufficiently prior to use as backfill in order to achieve the specified degree of compaction. Spreading the material in a wide area and air drying will be required to achieve the specified compaction of the native material. Thorough vertical mixing of the excavated soils will be required to provide a material that can be adequately compacted.

The spoil resulting from excavation through the bedrock will contain a large amount of hard rock slabs which will be virtually impossible to compact. Bedrock crushed on-site can be used as granular material provided that it conforms to OPSS gradation requirements and physical properties.

6.5 Groundwater Control

Based on observations made during drilling of the boreholes and excavation of the test pits, close examination of the soil samples extracted from the boreholes, and groundwater measurements made in the monitoring wells, significant groundwater problems are not anticipated within the presumed excavation depths throughout majority of the site with the exception of the area encompassing Blocks 1 and 2 in the easternmost section of the site. Groundwater is present in sand soil in this section of the site. Active dewatering of the sand layers will be required in the event that the excavation is extended below the water table; it is anticipated that dewatering will be possible using a series of filter sump pumps in the base of the excavation.

In the reminder of the site, some seepage of groundwater from localized permeable layers may occur during construction. It will be possible to remove any such seepage using submersible pumps.

Dewatering can be carried out using existing Permit to Take Water (PTTW) obtained by CLC from the MOECP.

Surface water should be directed away from open excavations.

6.6 Residential and Mixed-Use Buildings

6.6.1 Foundation Design

According to the proposed grading plan; shown on Drawing 7 attached in Appendix B, the proposed buildings on Blocks 2, 4, and 5 will be constructed over a single level basement. Details regarding the remaining blocks were not available at the time of the investigation, and accordingly the recommendations provided in this report are considered to be preliminary in nature, subject for review and revision upon completion of proposed plans. Additional boreholes may have to be advanced by the builders at the site once the details of the proposed buildings are finalized.

Conventionally, footing foundations of heated and unheated buildings are positioned at depths of 1.5 m and 1.8 m respectively below exterior grade in the Ottawa area, in order to provide protection to the foundation soil from freezing temperatures.

The foundations for the mid-rise buildings should be installed on the bedrock.

It is not recommended to install the foundations of the proposed low-rise buildings on the fill material. Based on the borehole findings, the bearing stratum should consist of the bedrock or native soil. The native soil throughout the site is considered suitable for the support of low rise building foundations. Locally, it will be necessary to deepen the foundations where the native soil is less competent in strength.

It should also be noted that intact bedrock will not be subjected to frost heave, and provided that footings are extended to non-fractured intact rock, the minimum founding depth of 1.8 m would not apply, and the footings may be placed at shallower depths.

Foundations may be constructed on engineered fill provided that the existing fill is removed in its entirety and the engineered fill is constructed in accordance with recommendations provided in Section 6.2 of this report.

Conventional spread and strip footings may be used to support the proposed buildings.

Foundations installed on the native soil or certified engineered fill may be designed based on bearing resistance of 100 KPa at Serviceability Limit States (SLS), and factored geotechnical bearing resistances at Ultimate Limit States (ULS) of 150 kPa.

The geotechnical bearing resistances recommended above are for vertical loads (no inclination) and no eccentricity. The total and differential settlements of spread footing foundations founded on the native soil designed in accordance with the recommendations provided in this report should not exceed the conventional limits of 25 mm and 19 mm respectively.

Foundations installed on the bedrock may be designed for a factored bearing resistance at Ultimate Limit States of 1 MPa (ULS). The serviceability limit state is not applicable as bedrock will not undergo settlement.

Due to variations in the consistency of the founding soils and/or loosening caused by to excavating disturbance and/or seasonal frost effects, all footing subgrade must be evaluated by the Geotechnical Engineer prior to placing formwork and foundation concrete to ensure that the soil exposed at the excavation base is consistent with the design geotechnical bearing resistance.

In the event necessary, the stepping of the footings at different elevations should be carried out at an angle no steeper than 2 horizontal (clear horizontal distance between footings) to 1 vertical (difference in elevation) on the native soil and 1 horizontal to 1 vertical on the bedrock. No individual footing step should be greater than 0.6 m.

Rainwater or groundwater seepage entering the foundation excavations must be pumped away (not allowed to pond). The foundation subgrade soils should be protected from freezing, inundation and equipment traffic at all times. If unstable subgrade conditions develop, **AA** should be contacted in order to assess the conditions and make appropriate recommendations.

The native soils and rock tend to weather and deteriorate rapidly on exposure to atmosphere or surface water, so construction scheduling should consider the amount of excavation left exposed to the elements, during foundation preparation. **AA** recommends that footings placed on the exposed soil should be poured on the same day as they are excavated, after removal of all unsuitable founding materials and approval of the bearing surface. Alternatively, a concrete mud slab could be used to

protect a bearing surface where footing construction is to be delayed.

In the absence of a significant clay soil at this site, a tree planting restriction does not apply for the development.

6.6.2 Concrete Slab-on-Grade

For building(s) without basement construction, the subgrade supporting the ground floor slab will in general consist of engineered fill or native soil which is adequate to support a slab-on-grade construction. Subgrade preparation should include the removal of surface vegetation, organic materials, weak and softened soils. After removal of all unsuitable materials, the subgrade should then be proof-rolled with heavy rubber tired equipment and adjudged as satisfactory before preparing the granular base course. The proof-rolling operation should be witnessed by the Geotechnical Engineer. Any soft or unsuitable subgrade areas which deflect significantly should be sub-excavated and replaced with suitable engineered fill material compacted to at least 98% of SPMDD.

For building(s) that include a single level basement, the basement floor slabs will rest on the native soil or bedrock; suitable for slab-on-grade construction. Subgrade preparation should include the removal of any disturbed soils, followed by proof-rolling to confirm the subgrade conditions. Any unsuitable subgrade areas which deflect significantly should be sub-excavated and replaced with suitable engineered fill material compacted to at least 98% of its SPMDD.

Where new fill is required to raise the grade, the excavated earth fill and native sandy silty clay material from the site or similar clean imported fill material may be used, free from topsoil, organic or deleterious matter, provided the material is placed in large areas where it can be compacted with a heavy vibratory roller. The fill material should not be frozen and should not be too dry or too wet for efficient compaction (moisture content at optimum or 2% greater than optimum). The fill placement should not be performed during winter months when freezing temperatures occur persistently or intermittently. All fill placed below the slab on grade areas of the buildings must be placed in thin lifts of 200 mm thickness or less, and compacted to a minimum of 98% of SPMDD.

Provided the subgrade, under-floor fill and granular base are prepared in accordance with the above recommendations, the Modulus of Subgrade Reaction (ks) for floor slab design will be 25,000 kPa/m.

It is recommended that a combined moisture barrier and a leveling course, having a minimum thickness of 150 mm and comprised of free draining material be provided as a base for the slab-on-grade. For building(s) without basement construction, either Granular "A" or 20 mm crusher run limestone may be used. For building(s) with basement construction, 20 mm clear crushed limestone is recommended as the base course. The Granular "A" should be compacted to 100% of its SPMDD; the 20 mm clear stone must be compacted by vibration to a dense state.

For building(s) containing a basement level, an exterior perimeter drainage system, consisting of 100 mm diameter weeping tile wrapped in filter fabric and covered with a minimum 150 mm clear crushed stone should be placed along the exterior foundation walls, below the level of the granular base of the floor slab. The weeping tiles must be connected to a positive frost free outlet from which the water can be removed, or connected to a sump located in the basement. The water from the sump must be pumped out to a suitable discharge point. The installation of the perimeter drains as well as the outlet

must conform to the applicable plumbing code requirements.

For building(s) without basement construction, perimeter drainage at the foundation level is not required provided the finished floor surface is at least 150 mm above the prevailing grade and the surrounding surfaces slope away from the buildings.

For building(s) with basement construction, the basement wall backfill for a minimum lateral distance of 0.6 m out from the wall should consist of free-draining granular material such as OPSS Granular "B" Type I. The native soil may be used to backfill excavations along foundation walls provided that prefabricated drainage sheets must be placed continuously against the walls. Damp-proofing must be applied to the exterior basement walls.

The soils at this site are susceptible to frost effects which would have the potential to deform hard landscaping adjacent to the building. At locations where proposed building is expected to have flush entrances, care must be taken in detailing the exterior slabs / sidewalks, providing insulation / drainage / non-frost susceptible backfill to maintain the flush threshold during freezing weather conditions.

6.7 Park 1: North Community Park

It is understood that the north Community Park will be located on Block 9 along the northern border of the site and occupy an area of 10.34 hectares. It will partially front onto Codd's Road on the east and local roads on the west and south sides. It will overlook the Ottawa River on the north side.

The topography of the park area is not level; generally sloping down from south to north. It contains steep ridges and some significant tree and vegetation groupings along the northern and southern boundaries.

The park will serve as the primary passive-recreational space for the community and contain a multi-use pathway system, a community building, look-out area with water feature, outdoor amphitheatre, shade structure, playground, splash pad, open space free play area, toboggan hill, and community gathering area. The approximate locations of the proposed features are shown on the Parks Master Plan drawing prepared by MMM Group Limited and provided for our use by CLC; shown on Drawing 5 attached in Appendix B.

According to the proposed grading plan, there will be some minor modifications to the park grades.

6.7.1 Community Building

It is anticipated that the proposed community building will be a 3,000 ft^2, single storey above grade structure: constructed on the west side of the park.

The subsurface conditions for the proposed building are represented by Borehole BH127. The borehole reveals that bedrock is situated at an approximate depth of 1.5 mbgs.

Conventional spread and wall footings may be used to support the proposed building. Footing foundations which rest on the bedrock may be designed to apply a factored bearing resistance at Ultimate Limit States of 1 MPa (ULS). The serviceability limit state is not applicable as bedrock will not

undergo settlement.

The subgrade supporting the floor slab of the community building will consist of native silty sand soil.

Subgrade preparation should include the removal of surface vegetation, organic materials, weak and softened soils. After removal of all unsuitable materials, the subgrade should then be proof-rolled with heavy rubber tired equipment and adjudged as satisfactory before preparing the granular base course. The proof-rolling operation should be witnessed by geotechnical staff. Any soft or unsuitable subgrade areas should be sub-excavated and replaced with suitable approved compacted backfill; placed in maximum lifts of 200 mm and compacted to at least 98% of SPMDD.

Where new fill is required to raise the grade, the excavated earth fill and native sand and silt material from the site or similar clean imported fill material free from topsoil, organic or deleterious matter, may be used, provided the material is placed in large areas where it can be compacted with a heavy vibratory roller. The fill material should not be frozen and should not be too dry or too wet for efficient compaction (moisture content at optimum or 2% greater than optimum). The fill placement should not be performed during winter months when freezing temperatures occur persistently or intermittently. All fill placed below the slab on grade areas of the buildings must be placed in thin lifts of 150 mm thickness or less, and compacted to a minimum of 98% of SPMDD.

It is recommended that a combined moisture barrier and a levelling course, with a minimum thickness of 150 mm and comprised of free draining material be provided as a base for the slab-on-grade, either Granular "A" or 20 mm crusher run limestone may be used and compacted to 100% of its SPMDD.

Perimeter drainage at the foundation level is not required provided the finished floor surface is at least 150 mm above the prevailing grade and the surrounding surfaces slope away from the building at a gradient of at least 2 percent.

The rock tends to weather and deteriorate rapidly on exposure to atmosphere or surface water, so construction scheduling should consider the amount of excavation left exposed to the elements, during foundation preparation. **AA** recommends that footings placed on the exposed bedrock should be poured on the same day as they are excavated, after removal of all unsuitable founding materials and approval of the bearing surface. Alternatively, a concrete mud slab could be used to protect a bearing surface where footing construction is to be delayed.

6.7.2 Look-Out Area

We understand that it is proposed to construct a look-out area with a prominent water feature along the northern boundary to optimize the views to the Ottawa River.

Test Pit (TP208) was advanced in the proposed look-out area and revealed that the stratigraphy in this area consists of fill material extending to an approximate depth of 1.7 mbgs, followed by the bedrock.

Conventional spread and strip footings founded on the bedrock may be used to support the proposed structure. It is recommended that the foundation is designed and prepared in accordance with the recommendations provided in section 6.7.1 of this report.

Due to the proximity of the proposed lookout structure to the crest of the escarpment at the northern

boundary of the park, a slope stability analysis must be carried out based on the profile of the existing slope and subsurface soil and groundwater data collected from the current and previous investigations. The proposed structure must be set a safe distance from the crest of the escarpment.

6.7.3 Shade Structure

Borehole BH128 which was advanced in the proposed shade structure area revealed that the soil stratigraphy consists of fill; extending to an approximate depth of 1 mbgs, followed by bedrock.

Conventional spread and strip footings founded on the bedrock may be used to support the proposed structure. It is recommended that the foundation is designed and prepared in accordance with the recommendations provided in section 6.7.1 of this report.

The subgrade supporting the floor slab of the shade structure will consist of fill soil. It is recommended that the subgrade is prepared in accordance with the recommendations provided in section 6.7.1 of this report.

It is recommended that a combined moisture barrier and a levelling course, with a minimum thickness of 150 mm and comprised of free draining material be provided as a base for the slab-on-grade, either Granular "A" or 20 mm crusher run limestone may be used and compacted to 100% of its SPMDD. The granular material must be adequately drained to minimize frost heave or be provided with insulation.

Uplift resistance should be considered for the design of the canopy structure which is subject to wind uplift forces. The uplift resistance should be provided using the dead weight of the foundation as well the soil weight above the footing of the canopy structures. For design purposes, the unit weight of concrete may be taken as 24 kN/m3 and the backfill placed above the footings is 20 kN/m^3. If increased uplift capacities are required, this may be achieved by increasing the weight (size) of the foundation, or alternatively, with the use of rock anchors.

6.7.4 Playground

It is expected that the playground structures will be lightly loaded frame structures, which will probably be supported on a set of foundations.

Borehole BH129 which was advanced in vicinity of the proposed playgroundand revealed that the soil stratigraphy consists of fill extending to an approximate depth of 1.5 mbgs, followed by bedrock.

Conventional spread and strip footings founded on the bedrock may be used to support the proposed structure. It is recommended that the foundation is designed and prepared in accordance with the recommendations provided in section 6.7.1 of this report.

The site preparation should consist of removing the existing topsoil layer and profiling the subgrade to the design grades to provide efficient drainage. The fill should provide a satisfactory subgrade to support the playing field.

If any unsuitable fill is contacted at subgrade elevation, this should be removed to contact the underlying competent native sand and silt (till) soil. The sub-excavation should be upfilled with suitable selected fill material (reuse of site excavated soil) and compacted to a dry density of not less than 95% of the materials SPMDD. Construction of turf and the site subgrade systems should be carried out to

meet the design requirements of the artificial turf supplier.

6.7.5 Splash Pad

It is anticipated that the splash pad will consist of concrete slab on grade. It is recommended that the subgrade is prepared in accordance with the recommendations provided for in section 6.7.1 of this report.

Once the subgrade soils have been improved, it is recommended that a minimum 300 mm thick levelling granular base course (Granular A or 20 mm crusher run limestone) is constructed to provide uniform support to the concrete slab.

Sub-drains are recommended to prevent accumulation of water within the granular material, to intercept excess subsurface moisture and minimize subgrade softening. The invert of sub-drains should be maintained at least 0.3 m below subgrade level.

The foundation soils should be insulated from freezing conditions in order to mitigate movement of the foundation soils as a result of the freeze-thaw cycle.

A styrofoam insulating layer (about 150 mm thick) may be placed to rest on the granular base layer under the concrete slab extending a minimum of 1.8 m beyond the outside limit of the floor slab and is placed at a slight slope grading away from the structure to encourage drainage.

The insulation should be protected against degradation by sunlight and damage from surface traffic (with about 200 mm thick overlay layer consisting of granular material, topsoil or sod).

6.8 Park 7: East Parkette

It is understood that the East Parkette will be located on Block 3 and occupy 0.40 hectares. The park will front onto Hemlock Road on the south, residential block on the north, and local roads on the east and west sides. The topography of the park area is relatively flat and contains little vegetation.

The park will serve as the primary passive-recreational space for the local residents and contain a shade structure, splash pad, and playground in the southern portion, a community gathering area in the central portion, and a free play area in the north end of the park. The approximate locations of the proposed features are shown on the Parks Master Plan drawing prepared by MMM Group Limited and provided for use by CLC; shown on Drawing 6 attached in Appendix B.

According to the proposed grading plan, there will be some minor modifications to the park grade.

Boreholes BH153 and BH154 and Test Pit TP219 were advanced in the park area. They revealed that fill is present in this area; extending to approximate depths ranging from 1.1 to 1.6 mbgs, followed by compact silty sand, and underlain by bedrock at approximate depths ranging from 1.1 to 3.2 mbgs.

The recommendations provided for construction of the shade structure, splash pad, and playground in sections 6.7.3 through 6.7.5 of this report apply to the proposed features in this park.

6.9 Service Trenches

Based on the proposed site grades, sewer pipes and water mains will be supported on the bedrock or undisturbed native sandy and silty soils which are considered suitable for supporting water mains, sewer pipes, manholes, catch basins and other related structures

The type of bedding depends mainly on the strength of the subgrade immediately below the invert levels.

Normal Class 'B' bedding is recommended for underground utilities. Granular 'A' or 19 mm crusher-run limestone can be used as bedding material; all granular materials should meet OPS 1010 specifications. The bedding material should be compacted to a minimum of 95% SPMD. Bedding details should follow the applicable governing design detail (i.e. City of Ottawa, OPSD). Trenches dug for these purposes should not be unduly left exposed to inclement weather.

Pipe bedding and backfill for flexible pipes should be undertaken in accordance with OPSD 802.010. Pipe embedment and cover for rigid pipes should be undertaken in accordance with OPSD 802.030.

If unsuitable bedding conditions occur, careful preparation and strengthening of the trench bases prior to sewer installation will be required. The subgrade may be strengthened by placing a thick mat consisting of 50 mm crusher-run limestone. Field conditions will determine the depth of stone required. Geotextiles and/or geogrids may be helpful and these options should be reviewed by **AA** on a case by case basis.

Sand cover material should be placed as backfill to at least 300 mm above the top of pipes. Placement of additional granular material (thickness dictated by the type of compaction equipment) as required or use of smaller compaction equipment for the first few lifts of native material above the pipe will probably be necessary to prevent damage to the pipe during the trench backfill compaction.

It is recommended that service trenches be backfilled with on-site native materials such that at least 95% of SPMDD is obtained in the lower zone of the trench and 98% of SPMDD for the upper 1000 mm.

Impermeable clay should be provided across the entire width of the service trenches. It is recommended that the seals be at least 1.0 m in length along the trench (in accordance with the city of Ottawa Standard S8). The seals should be constructed at intervals no greater than 100 m along all sewer installations.

In areas of narrow trenches or confined spaces such as around manholes, catch basins, etc., the use of aggregate fill such as Granular 'B' Type I (OPSS 1010) is required if there is to be post-construction grade integrity.

6.10 Pavement Design

6.10.1 On-Grade Construction

Based on the existing topography of the site and the proposed grades, re-grading of the subgrade will be required. It is anticipated that the sub-grade material for the pavement will generally comprise of engineered fill.

The subgrade should be thoroughly proof-rolled and re-compacted to ensure uniformity in subgrade strength and support. Lift thicknesses should not exceed 200 mm in a loose state and the excavated site material should be compacted using heavy vibratory rollers. As an alternative, if suitable on-site native material is not available, the upper part of the subgrade could be improved by placing imported granular material.

If construction is carried out in inclement weather, there is a likelihood that some amount of road sub-base supplement will be required (i.e. some sub-excavation followed by granular replacement).

Given the frost susceptibility and drainage characteristics of the subgrade soils, the pavement design presented below is recommended.

Recommended Asphaltic Concrete Pavement Structure Design
(Minimum Component Thicknesses)

Pavement Layer	Compaction Requirements	Light Duty Pavement Local Residential Routes	Heavy Duty Pavement Transit Routes
Surface Course	as per OPSS 310	40 mm Superpave 12.5 Level B Asphalt (PG58-34)	40 mm Superpave 12.5 Level D Asphalt (PG64-34)
Binder Course	as per OPSS 310	50 mm Superpave 19 mm Level B Asphalt (PG58-34)	100 mm Superpave 19 mm Level D Asphalt (PG64-34)
Granular Base	100% SPMDD	150 mm Granular 'A' (OPSS 1010) Pit Run or 19 mm Crusher Run Limestone	150 mm Granular 'A' (OPSS 1010) Pit Run or 19 mm Crusher Run Limestone
Granular Sub-Base	100% SPMDD	450 mm Granular 'B' Type II (OPSS 1010)	600 mm Granular 'B' Type II (OPSS 1010)

The subgrade must be compacted to at least 98% of SPMDD for at least the upper 600 mm and 95% below this level. The granular base and sub-base materials should be compacted to a minimum of 100% SPMDD.

The long-term performance of the proposed pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as practically possible when fill is placed and that the subgrade is not disturbed and weakened after it is exposed.

Control of surface water is a significant factor in achieving good pavement life. Grading adjacent to the pavement areas must be designed so that water is not allowed to pond adjacent to the outside edges of the pavement or curb. In addition, the need for adequate drainage cannot be over-emphasized. The subgrade must be free of depressions and sloped (preferably at a minimum gradient of three percent) to provide effective drainage toward subgrade drains. Continuous sub-drains are recommended to intercept excess subsurface moisture at the curb lines and catch basins. The invert of sub-drains should be maintained at least 0.3 m below subgrade level.

Additional comments on the construction of pavement areas are as follows:

- As part of the subgrade preparation, the proposed pavement areas should be stripped of vegetation, topsoil, unsuitable earth fill and other obvious objectionable material. The subgrade should be properly shaped and sloped as required, and then proof-rolled. Loose/soft or spongy subgrade areas should be sub-excavated and replaced with suitable approved material compacted to at least 98% of SPMDD.
- Where new fill is needed to increase the grade or replace disturbed portions of the subgrade, excavated inorganic soils or similar clean imported fill materials may be used, provided their moisture content is maintained within 2 % of the soil's optimum moisture content. All fill must be placed and compacted to not less than 98% of SPMDD.
- For fine-grained soils, as encountered at the site, the degree of compaction specification alone cannot ensure distress free subgrade. Proof-rolling must be carried out and witnessed by **AA** personnel for final recommendations of sub-base thicknesses.
- In the event that pavement construction takes place in the spring thaw, the late fall, or following periods of significant rainfall, it should be anticipated that an increase in thickness of the granular sub-base layer will be required to compensate for reduced subgrade strength.

6.10.2 Above Parking Garage Roof

The pavement above the parking garage roof slab may be comprised of a minimum of 75 mm thick layer of granular 'A' topped with asphaltic concrete having a minimum thickness of 80 mm (40 mm HL8 and 40 mm HL3). The asphaltic concrete materials should be rolled and compacted in accordance with OPSS 310 requirements.

The gradation and physical properties of HL-3 and HL-8 asphaltic concrete, and Granular 'A' shall conform to the OPSS standards.

The critical section of pavement will be at the transition between the pavement on grade and the pavement above the garage roof slab. In order to alleviate the detrimental effects of dynamic loading / settlement / pavement depression in the backfill to the rigid garage roof structure, it is recommended that an approach type slab be constructed at the entrance/exit points, by extending the granular sub-base to greater depths along the exterior garage wall.

The granular courses of the pavement should be placed in lifts not exceeding 150 mm thick and be compacted to a minimum of 100% SPMDD.

6.11 Pavement Assessment: Old Hemlock Road

Evaluation of the existing pavement along old Hemlock Road was undertaken to assess the condition of the pavement structure and to provide recommendations for improvements/repairs prior to its use for construction traffic, transit vehicles and public access.

At the time of this investigation the road surface was covered with snow. As such, our visual examination of the pavement was limited to the visible sections of the road. It revealed that the pavement is generally in poor to fair condition with few areas of settlement and localized cracking.

Boreholes BH101, BH102, BH103, and BH167 were advanced along old Hemlock Road and extended to

depths ranging from 0.8 to 1.8 mbgs to determine the thickness and composition of the pavement structures as well as the compactness condition/ consistency of the underlying subgrade.

The boreholes revealed that the thickness of the asphaltic concrete is about 140 mm. The base course supporting the asphaltic concrete consists of gravelly sand to sandy gravel. The thickness of this granular soil ranges from approximately 200 to 250 mm. Based on SPT results, it is inferred that the granular materials have been moderately to well compacted. The underlying subgrade soil consist of compact sandy silt to silty sand fill materials.

Test Pits TP201 and TP202 which were advanced immediately adjacent to Hemlock Road, revealed that the bedrock is situated at approximate depths of 1.4 and 1.1 mbgs respectively.

Sieve grain size analysis was carried out on one (1) sample of granular base course obtained from Borehole BH102 at 0.2 mbgs (Sample 1A). The test revealed that the soil has 70% sand, 28% gravel, and 2% silt and clay. The result of the grain size analysis is shown as Figure E-1 in Appendix D.

The condition of the existing pavement along old Hemlock Road is satisfactory for its temporary use for construction traffic. However, the thickness of the existing base course is not sufficient for long term use as a permanent public road. The proposed grading plan provided for our use by IBI Group does not include the Hemlock Road extension. However, we understand that it is not planned to change the grade of the current roadway. The provided recommendations are considered to be preliminary in nature, subject for review and revision upon completion of proposed grading plans.

The following recommendations are provided for preparation of the subgrade soils.

- *Remove existing granular materials and stockpile selected materials which may be reused as granular sub-base;*
- *Lower the subgrade to design elevation and shape to promote drainage.*
- *In the event that soft and/or organic fill materials are contacted at subgrade elevation, these should be removed and replaced with a suitable native or imported soil which is compacted to 98% of the material's SPMDD.*
- *Densely compact the subgrade to improve the condition of the disturbed layers and fill materials and to ensure uniformity in subgrade strength and support.*
- *If construction is carried out in inclement weather, there is a likelihood that some amount of pavement sub-base supplement will be required (i.e. some sub-excavation followed by granular replacement). In such instances, it will be necessary to ensure that granular materials are properly drained by lowering the subdrains.*

6.12 Lateral Earth Pressure

Parameters used in the determination of earth pressure acting on temporary shoring and basement walls are defined below.

Soil Parameters

Parameter	Definition	Units
Φ'	angle of internal friction	degrees
γ	bulk unit weight of soil	kN/m^3
K_a	active earth pressure coefficient (Rankine)	dimensionless
K_o	at-rest earth pressure coefficient (Rankine)	dimensionless
K_p	passive earth pressure coefficient (Rankine)	dimensionless

The appropriate un-factored values for use in the design of structures subject to unbalanced earth pressures at this site are tabulated as follows:

Soil Parameter Values

Soil	Parameter				
	Φ'	Y	K_a	K_p	K_0
Fill Material	28°	18	0.36	2.77	0.53
Silty Sand to Sand	compact - 32°	19.0	0.31	3.25	0.47
Silt to Sandy Silt	dense to very dense - 36°	19.0	0.26	3.85	0.41
Clay and Silt	30°	20	0.33	3.00	0.5
Bedrock	36°	25	0.26	3.85	0.41

Walls or bracings subject to unbalanced earth pressures must be designed to resist a pressure that can be calculated based on the following formula:

$P = K (\gamma h + q)$

Where **P** = lateral pressure in kPa acting at a depth h (m) below ground surface

K = applicable lateral earth pressure coefficient

γ = bulk unit weight of backfill (kN/m^3)

q = the complete surcharge loading (kPa)

This equation assumes that free-draining backfill and positive drainage is provided to ensure that there is no hydrostatic pressure acting in conjunction with the earth pressure.

The coefficient of earth pressure at rest (K_o) should be used in the calculation of the earth pressure on the basement walls.

Resistance to sliding of earth retaining structures is developed by friction between the base of the footing and the soil. This friction (R) depends on the normal load on the soil contact (N) and the frictional resistance of the soil (tan Φ') expressed as: R = N tan Φ'. This is an ultimate resistance value and does not contain a factor of safety.

6.13 Earthquake Design Parameters

The 2012 Ontario Building Code (OBC) stipulates the methodology for earthquake design analysis, as set out in Subsection 4.1.8.7. The determination of the type of analysis is predicated on the importance of the structure, the spectral response acceleration and the site classification.

The parameters for determination of the Site Classification for Seismic Site Response are set out in Table 4.1.8.4.A of the 2012 OBC. The classification is based on the determination of the average shear wave velocity in the top 30 metres of the site stratigraphy, where shear wave velocity (vs) measurements have been taken. In the absence of such measurements, the classification is estimated on the basis of empirical analysis of undrained shear strength or penetration resistance. The applicable penetration resistance is that which has been corrected to a rod energy efficiency of 60% of the theoretical maximum or the (N_{60}) value.

Based on the current and previous borehole and test pit information, the subsurface stratigraphy generally comprises surficial topsoil and asphaltic concrete pavement, underlain by fill material, followed by various native soils consisting of silty sand to sand, sandy silt to silt, and clay and silt soils, underlain by limestone bedrock at shallow depths. Based on the above, the site designation for seismic analysis is estimated to be Class B according to Table 4.1.8.4.A from the quoted code.

The site specific 5% damped spectral acceleration coefficients, and the peak ground acceleration factors are provided in the 2012 Ontario Building Code - Supplementary Standards SB-1 (September 14, 2012), Table 1.2, location Ottawa, Ontario.

6.14 Chemical Characterization of Subsurface Soil

Four (4) soil samples obtained from Boreholes BH108, BH127, BH153, and BH156 were submitted to Maxxam Analytics Inc. for pH index test, water-soluble sulphate, and chloride content to determine the potential of attacking the subsurface concrete and corrosion of steel pipelines. The test results are summarized below:

Soil Parameter	BH108: 0.76 mbgs (Sample 2)	BH127: 0.76 mbgs (Sample 2)	BH153: 1.5 mbgs (Sample 3)	BH156: mbgs (Sample)
pH	7.58	7.54	7.66	7.77
Water-soluble Sulphate (%)	0.0098	0.0026	ND	ND
Chloride (%)	ND*	ND	ND	ND

*ND: Not Detected

The pH of the tested samples indicates a slight alkalinity. The concentration of water-soluble sulphate content of the tested samples is below the CSA Standard of 0.1% water-soluble sulphate (Table 12 of CSA A23.1, Requirements for Concrete Subjected to Sulphate Attack). Special concrete mixes against sulphate attack is therefore not required for the sub-surface concrete of the proposed buildings. The chloride content was not detected in the tested samples. .

The Certificate of Analysis provided by the analytical chemical testing laboratory is contained in Appendix G of this report.

7 LIMITATIONS OF REPORT

The Limitations of Report, as quoted in Appendix 'A', are an integral part of this report.

Yours respectfully

alston associates
A division of Terrapex Environmental Ltd.

Rachel Herzog, CET
Geotechnical Technician

Shabnam Aziznejad, M.A.Sc.
Geotechnical Engineering Trainee

LICENSED PROFESSIONAL ENGINEER
V. NERSESIAN
90770705
Feb. 4
2019
PROVINCE OF ONTARIO

Vic Nersesian, P. Eng.
Vice President, Geotechnical Services

APPENDIX A

LIMITATIONS OF REPORT

limitations of report

The conclusions and recommendations in this report are based on information determined at the inspection locations. Soil and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the soil investigation.

The design recommendations given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with details of alignment and elevations stated in the report. Since all details of the design may not be known to us, in our analysis certain assumptions had to be made as set out in this report. The actual conditions may, however, vary from those assumed, in which case changes and modifications may be required to our recommendations.

This report was prepared for Canada Lands Company CLC Limited by Alston Associates. The material in it reflects Alston Associates judgement in light of the information available to it at the time of preparation. Any use which a Third Party makes of this report, or any reliance on decisions which the Third Party may make based on it, are the sole responsibility of such Third Parties.

We recommend, therefore, that we be retained during the final design stage to review the design drawings and to verify that they are consistent with our recommendations or the assumptions made in our analysis. We recommend also that we be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the test holes. In cases where these recommendations are not followed, the company's responsibility is limited to accurately interpreting the conditions encountered at the test holes, only.

The comments given in this report on potential construction problems and possible methods are intended for the guidance of the design engineer, only. The number of inspection locations may not be sufficient to determine all the factors that may affect construction methods and costs. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work.

APPENDIX B

DRAWING 1: SITE LOCATION
DRAWING 2: PROPOSED DEVELOPMENT PLAN
DRAWING 3: BOREHOLE AND TEST PIT LOCATION PLAN
DRAWING 4: PREVIOUS BOREHOLE AND TEST PIT LOCATION PLAN
DRAWING 5: PROPOSED PARK 1
DRAWING 6: PROPOSED PARK 7
DRAWING 7: PROPOSED GRADING PLAN – PART OF PHASE 2B
DRAWING 8: PROPOSED GRADING PLAN – PARTS OF PHASE 2A&2B
DRAWING 9: PROPOSED GRADING PLAN – PART OF PHASE 2A

TERRAPEX

SITE LOCATION

WATERIDGE VILLIAGE
OTTAWA, ONTARIO

CLIENT

Canada Lands Company
Société immobilière du Canada

LEGEND

- FORMER CFB ROCKCLIFFE
- PHASE 2A AND 2B DEVELOPMENT

0 250m 500m
(APPROXIMATE)

SOURCE: VUMAP FIRST BASE SOLUTIONS, 2017 IMAGERY AND PREFERRED PLAN - LAND USE BY MMM GROUP AND MELOSHE & ASSOCIATES, OCTOBER 2015.

PROJECT #	CO682.00
SCALE	AS SHOWN
DATE	DECEMBER 2018
DRAWN	SK/SF
CHECKED	
DRAWING #	DRAWING 1

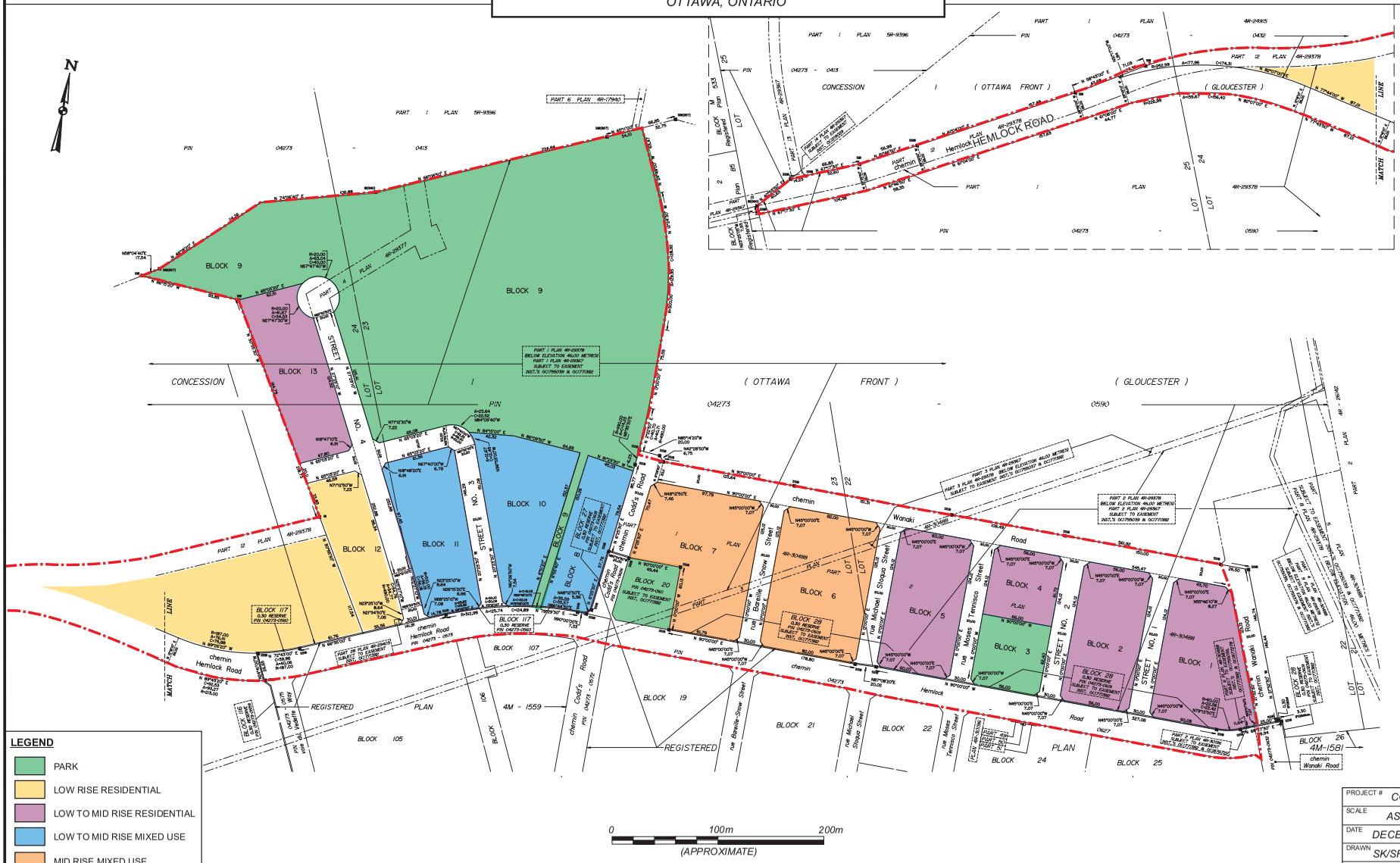
TERRAPEX

PROPOSED DEVELOPMENT PLAN

WATERIDGE VILLIAGE
OTTAWA, ONTARIO

CLIENT

Canada Lands Company
Société immobilière du Canada



LEGEND

- PARK
- LOW RISE RESIDENTIAL
- LOW TO MID RISE RESIDENTIAL
- LOW TO MID RISE MIXED USE
- MID RISE MIXED USE
- APPROXIMATE LOCATION OF INVESTIGATIONS

SOURCE: VUMAP FIRST BASE SOLUTIONS, 2017 IMAGERY AND DRAFT PLAN OF SUBDIVISION PREPARED BY ANNIS , O'SULLIVAN , VOLLEBEKK LTD., JANUARY 11, 2016.

PROJECT #	CO682.00
SCALE	AS SHOWN
DATE	DECEMBER 2018
DRAWN	SK/SF
CHECKED	
DRAWING #	DRAWING 2

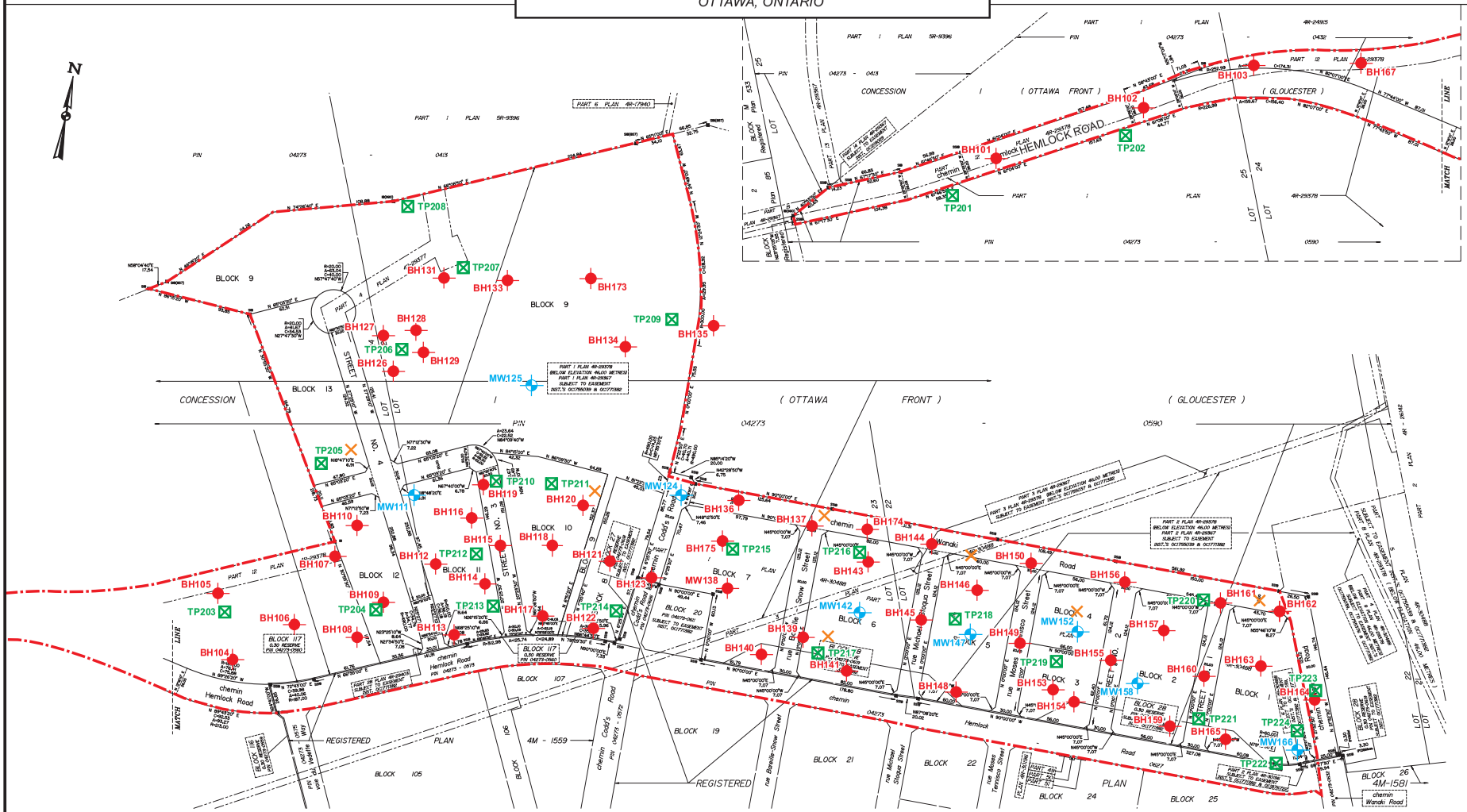
TERRAPEX

BOREHOLE AND TEST PIT LOCATION PLAN

WATERIDGE VILLIAGE
OTTAWA, ONTARIO

CLIENT

Canada Lands Company
Société immobilière du Canada



LEGEND

- STOCKPILE LOCATION (APPROXIMATE)
- TEST PIT LOCATION
- BOREHOLE WITH MONITORING WELL
- BOREHOLE LOCATION
- APPROXIMATE LOCATION OF INVESTIGATIONS

SOURCE: VUMAP FIRST BASE SOLUTIONS, 2017 IMAGERY AND DRAFT PLAN OF SUBDIVISION PREPARED BY ANNIS , O'SULLIVAN , VOLLEBEKK LTD., JANUARY 11, 2016.

PROJECT #	CO682.00
SCALE	AS SHOWN
DATE	DECEMBER 2018
DRAWN	SK/SF
CHECKED	
DRAWING #	DRAWING 3

TERRAPEX

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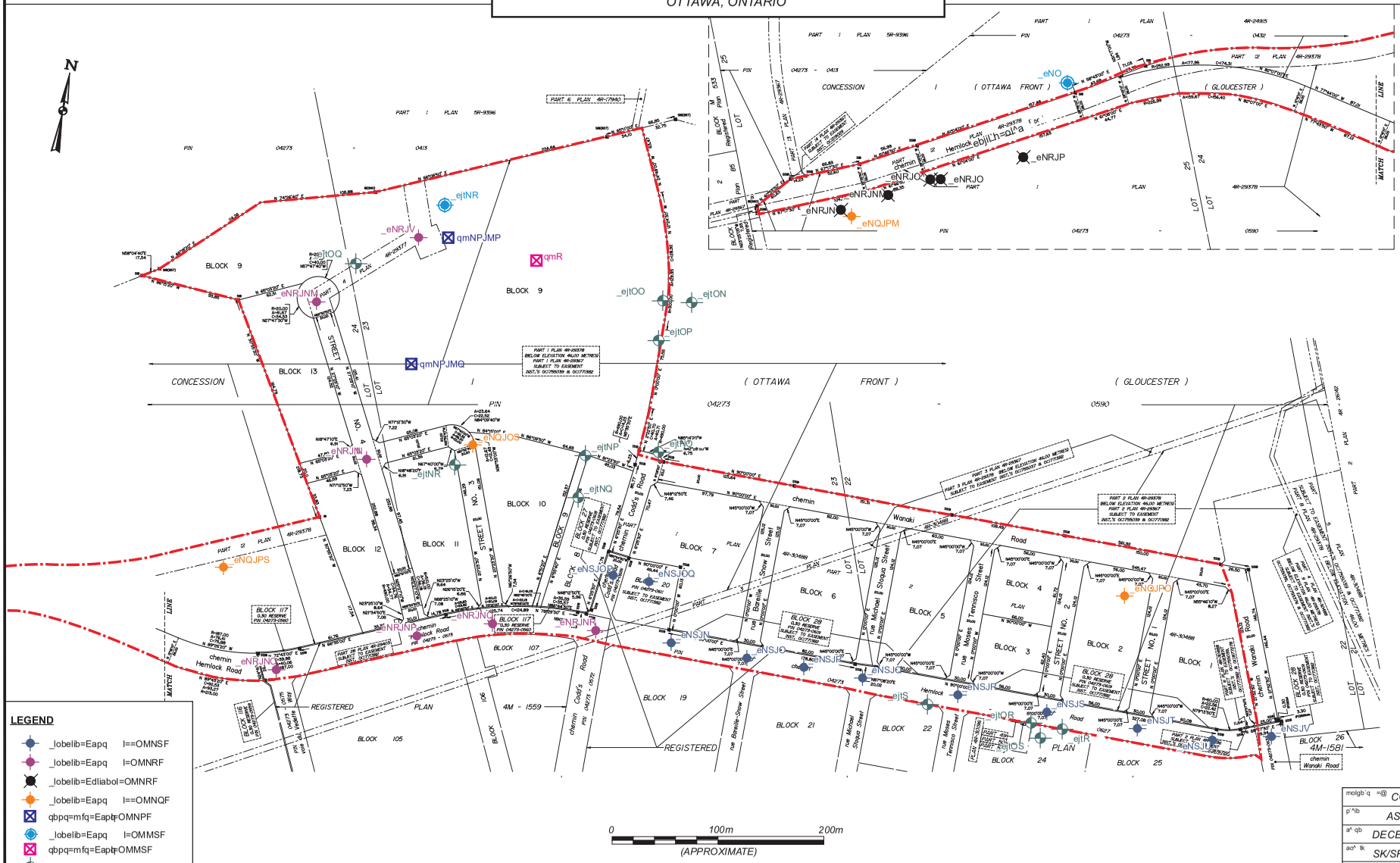
WATERIDGE VILLIAGE
OTTAWA, ONTARIO

CLIENT

Canada Lands Company
Société immobilière du Canada



LEGEND

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molgb`q =@	CO682.00
p^lb	AS SHOWN
a^ qb	DECEMBER 2018
ao^ lk	SK/SF
ao^ tfkd=@	DRAWING 4

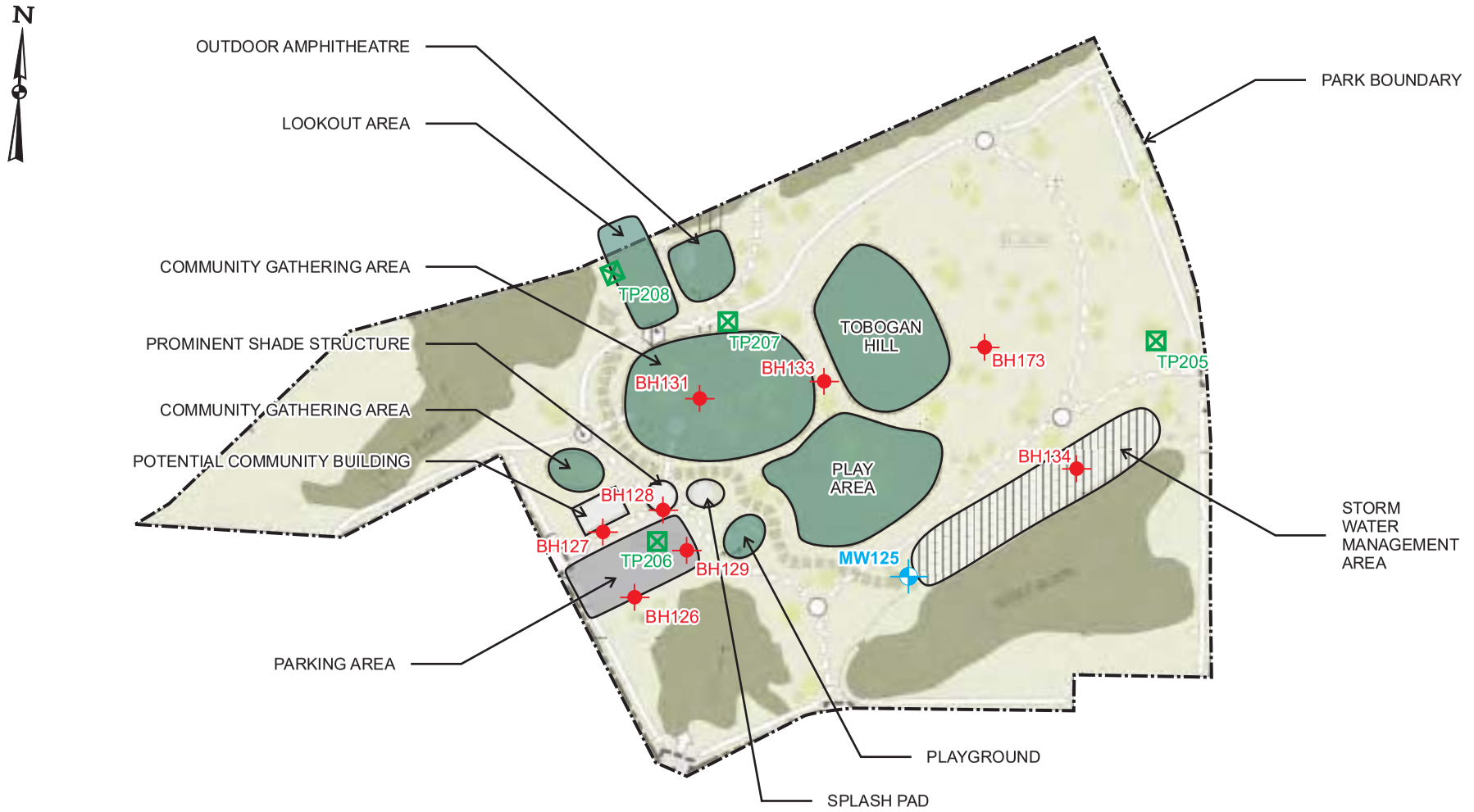
TERRAPEX

PROPOSED PARK 1: NORTH COMMUNITY PARK

WATERIDGE VILLIAGE
OTTAWA, ONTARIO

CLIENT

Canada Lands Company
Société immobilière du Canada



LEGEND

- BOREHOLE WITH MONITORING WELL
- BOREHOLE LOCATION
- TEST PIT LOCATION

0 — 100m — 200m
(APPROXIMATE)

SOURCE: PARKS MASTER PLAN, FORMER CFB ROCKCLIFFE REDEVELOPMENT, PREPARED BY MMM GROUP LIMITED.

PROJECT #	CO682.00
SCALE	AS SHOWN
DATE	DECEMBER 2018
DRAWN	SF/SK
CHECKED	
DRAWING #	DRAWING 5

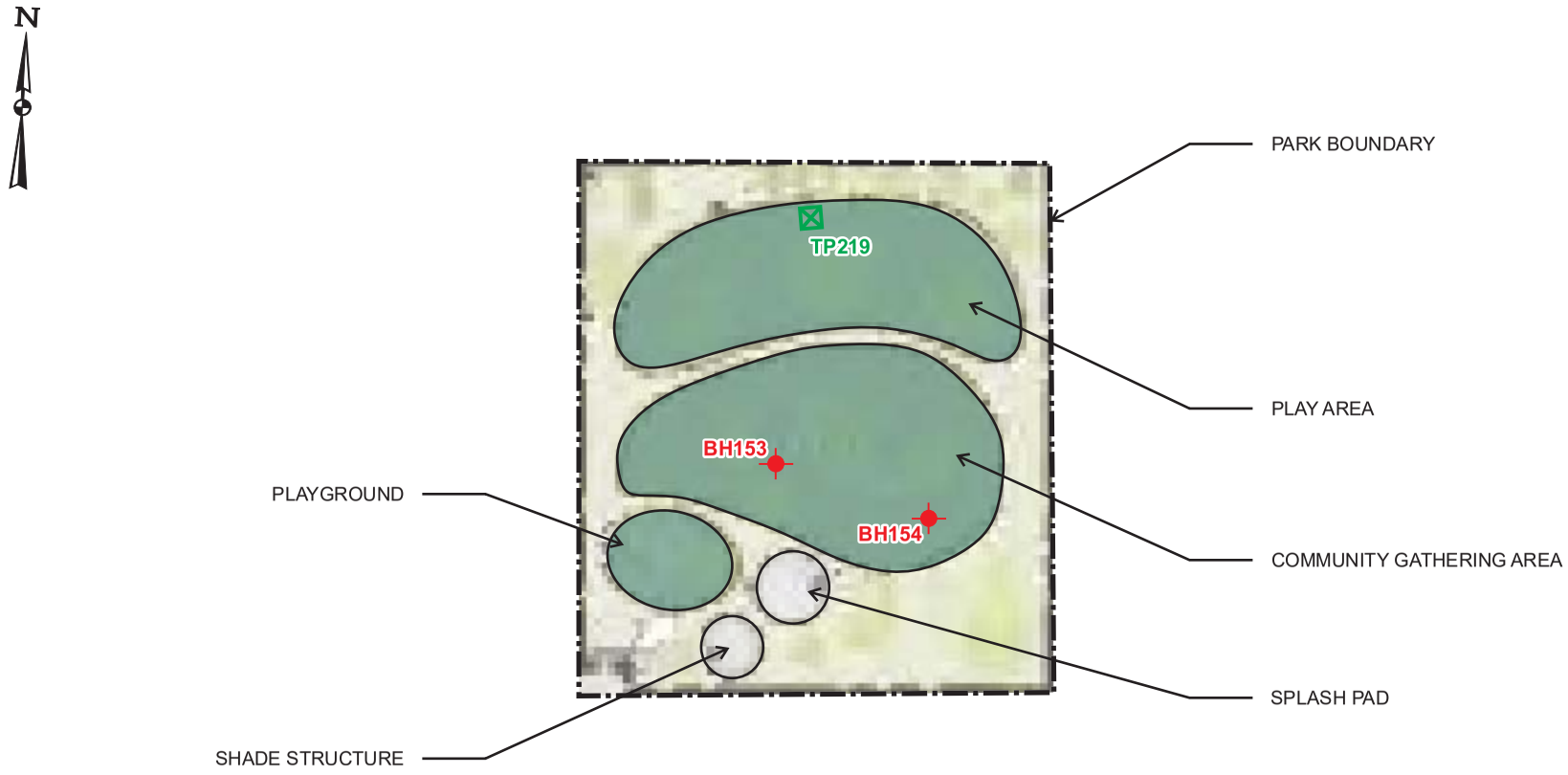
TERRAPEX

PROPOSED PARK 7: EAST PARKETTE

WATERIDGE VILLIAGE
OTTAWA, ONTARIO

CLIENT

Canada Lands Company
Société immobilière du Canada



LEGEND

- BOREHOLE LOCATION
- TEST PIT LOCATION

0 30m 60m
(APPROXIMATE)

SOURCE: PARKS MASTER PLAN, FORMER CFB ROCKCLIFFE REDEVELOPMENT, PREPARED BY MMM GROUP LIMITED.

PROJECT #	CO682.00
SCALE	AS SHOWN
DATE	DECEMBER 2018
DRAWN	SF/SK
CHECKED	
DRAWING #	DRAWING 6

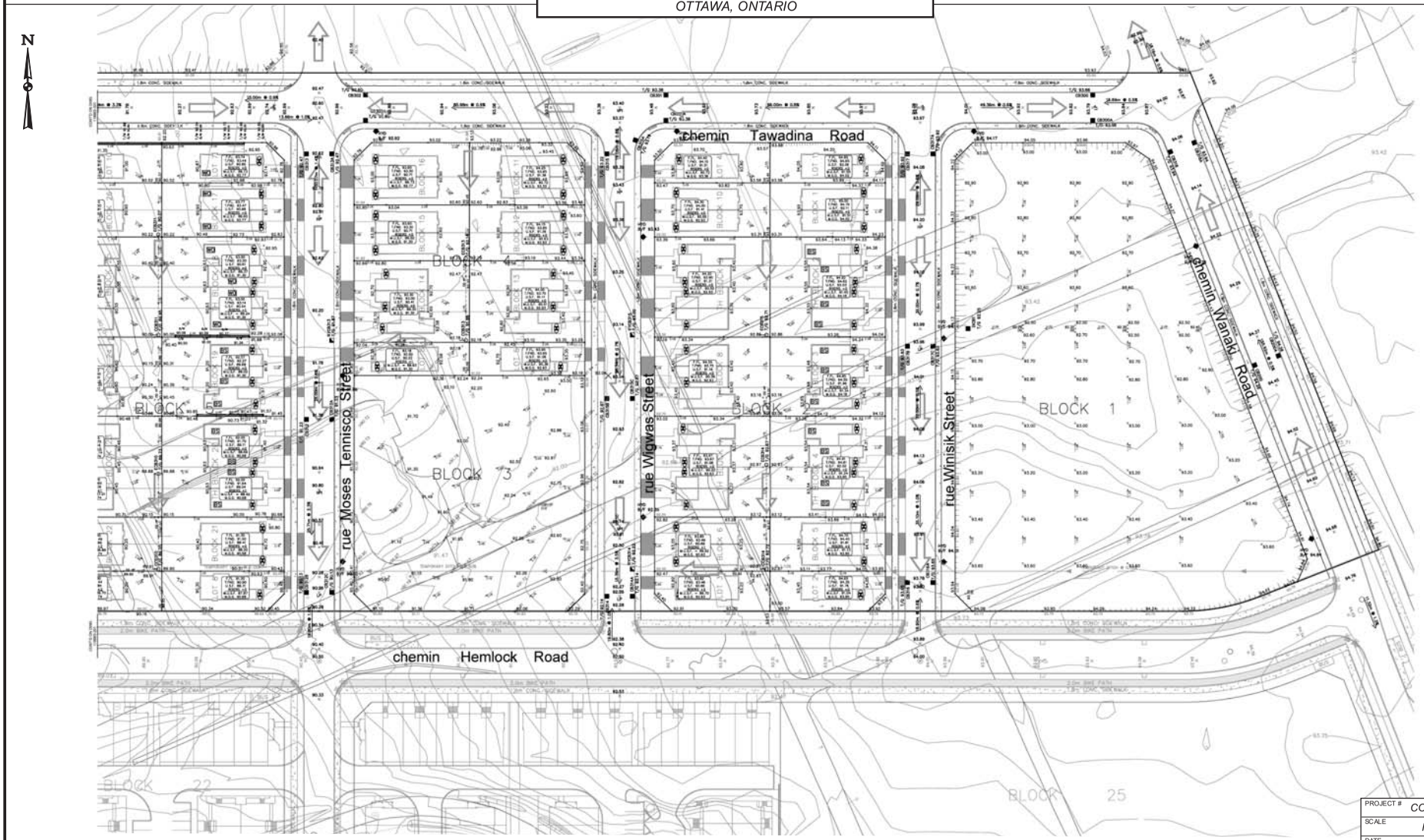
TERRAPEX

PROPOSED GRADING PLAN
PART OF PHASE 2B

WATERIDGE VILLIAGE
OTTAWA, ONTARIO

CLIENT

Canada Lands Company
Société immobilière du Canada



SOURCE: IBI GROUP, GRADING PLAN, DRAWING #200, DECEMBER 2018.

PROJECT #	CO682.00
SCALE	N.T.S
DATE	DECEMBER 2018
DRAWN	SK
CHECKED	
DRAWING #	DRAWING 7

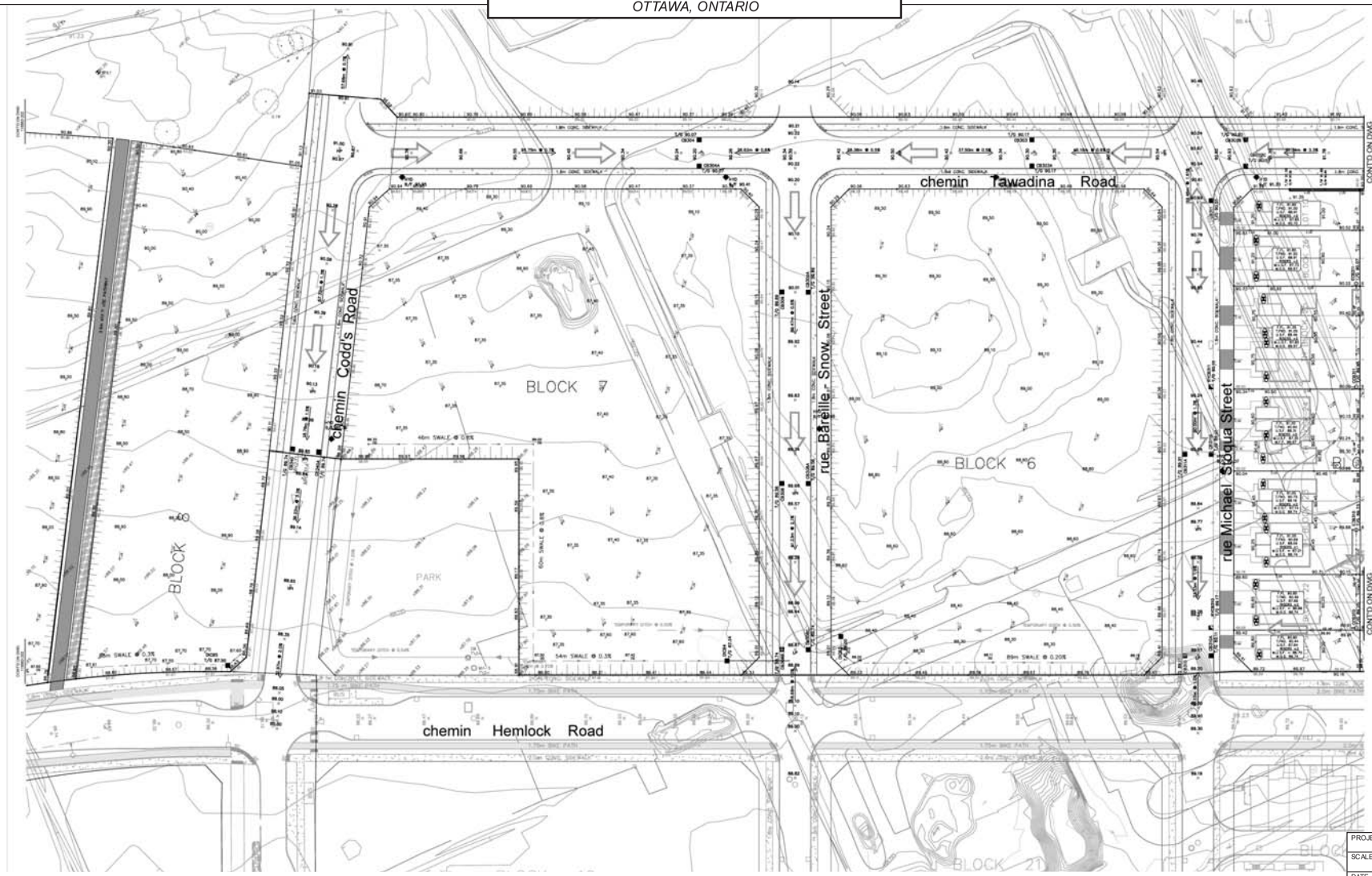
TERRAPEX

PROPOSED GRADING PLAN
PART OF PHASE 2A AND 2B

WATERIDGE VILLIAGE
OTTAWA, ONTARIO

CLIENT

Canada Lands Company
Société immobilière du Canada



PROJECT #	CO682.00
SCALE	N.T.S
DATE	DECEMBER 2018
DRAWN	SK
CHECKED	
DRAWING #	DRAWING 8

SOURCE: IBI GROUP, GRADING PLAN-PHASE 2A & 2B, DRAWING #201, DECEMBER 2018.

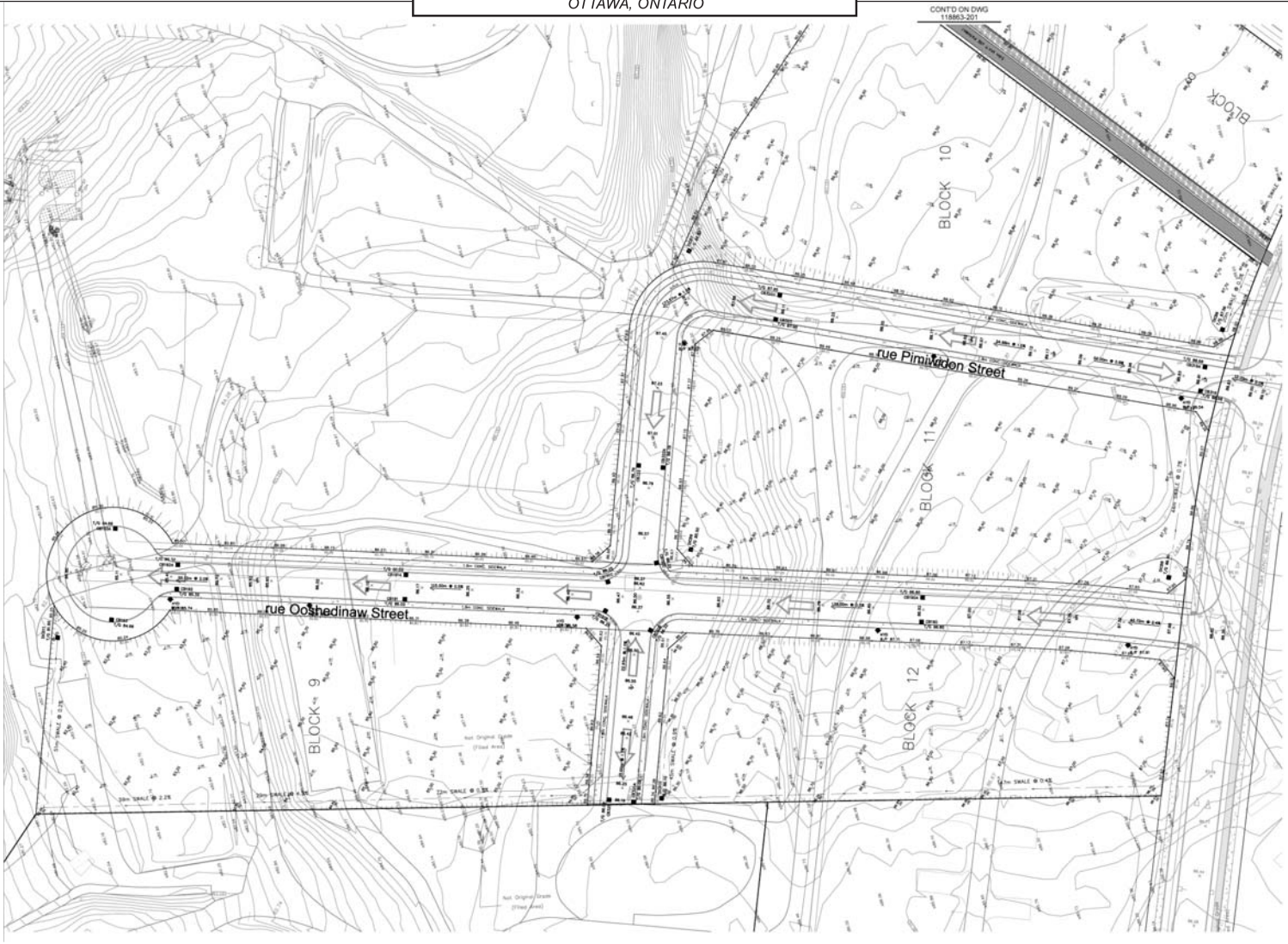
TERRAPEX

PROPOSED GRADING PLAN
PART OF PHASE 2A

WATERIDGE VILLIAGE
OTTAWA, ONTARIO

CLIENT

Canada Lands Company
Société immobilière du Canada



SOURCE: IBI GROUP, GRADING PLAN-PHASE 2A & 2B, DRAWING #202, DECEMBER 2018.

PROJECT #	CO682.00
SCALE	N.T.S
DATE	DECEMBER 2018
DRAWN	SK
CHECKED	
DRAWING #	DRAWING 9

APPENDIX C
BOREHOLE AND TEST PIT LOG SHEETS

CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 101**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 74.486	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033319	EASTING: 449635	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (140 mm)	0								Borehole open and dry on completion.
		GRANULAR BASE (250 mm)	0.25	74.25		6	1A				
		compact, damp, brown/dark brown sand, some silt, trace gravel (FILL)			25	15	1B		25		
		compact, wet, brown silt, trace sand, trace gravel (FILL)	0.5	74			1C				
			0.75	73.75							
		compact, damp, dark brown SANDY SILT, trace rock fragments	1	73.5	25	5	2		25		
			1.25	73.25							
		END OF BOREHOLE									

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LOGGED BY: RH | DRILLING DATE: November 20, 2018

REVIEWED BY: VN | Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 102**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 77.596	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033372	EASTING: 449737	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (140 mm)	0	77.5							Borehole open and dry on completion.
		GRANULAR BASE (250 mm)	0.25	77.25			1A				
		compact, damp, brown/dark brown silty sand, some gravel (FILL)	0.5	77	20		1B		20		
		loose, moist, brown silt, some sand, traces of gravel and organics (FILL)	0.75	76.75		6	2A				
		compact, damp, brown SANDY SILT, trace rock fragments	1	76.5	13		2B		13		
		END OF BOREHOLE	1.25	76.25							

Shear Strength (kPa): 40 80 120 160
N-Value (Blows/300mm): 20 40 60 80
Water Content (%): 20 40 60 80

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REVIEWED BY: VN	Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 103**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 83.885	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033431	EASTING: 449858	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (130 mm)	0	83.75							Borehole open and dry on completion.
		GRANULAR BASE (200 mm)	0.25				1A				
		compact, damp, brown, sandy silt, traces of gravel and clay (FILL)	0.5	83.5	19		1B		19		
			0.75	83.25							
		compact, damp, light brown layered SANDY SILT trace gravel, occassional oxidized layers.	1	83	23		2		23		
			1.25	82.75							
		END OF BOREHOLE									

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REVIEWED BY: VN	Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 104**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 84.343	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033420	EASTING: 450076	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (50 mm)	0	84.25							Borehole open and dry on completion.
		compact, damp, brown/grey silt, traces of clay, sand and gravel (FILL)	0.25 / 0.5	84 / 83.75	12		1		12		
		compact, damp, grey CLAYEY SILT	0.75 / 1 / 1.25	83.5 / 83.25 / 83	14		2		14		
		very dense, damp, brown SANDY SILT, trace gravel	1.5 / 1.75	82.75 / 82.5	50/127		3		50/ 127		Auger refusal at 1.85 m bgs.
		END OF BOREHOLE									

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REVIEWED BY: VN	Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 105**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 85.658	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033479	EASTING: 450064	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		loose, moist, brown silty sand, traces of gravel, clay, and topsoil (FILL)	0	85.5	5		1		5		Borehole open and dry on completion.
			0.25	85.25							
			0.5	85							
			0.75	84.75							
			1		10		2		10		
			1.25	84.5							
		hard, damp, light brown/brown SANDY SILT some clay, trace rock fragments	1.5	84.25							Auger refusal at 1.80 m bgs.
			1.75	84	50/100		3		50/100		
		END OF BOREHOLE									

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LOGGED BY: RH	DRILLING DATE: November 20, 2018
REVIEWED BY: VN	Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 106**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 85.125	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033459	EASTING: 450127	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact, moist, grey gravelly sand (FILL)	0	85			1A				Borehole open and dry on completion.
		very stiff, moist, brown CLAYEY SILT trace gravel, sand, and organics, occassional oxidized pockets	0.25	84.75	16		1B		16		
			0.5	84.5							Difficult to auger from 0.61 m bgs to refusal.
		rock fragments	0.75	84.25	50/75		2		50/75		Auger refusal at 1 m bgs.
			1								
		END OF BOREHOLE									

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LOGGED BY: RH	DRILLING DATE: November 19, 2018
REVIEWED BY: VN	Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 107**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 86.700	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033520	EASTING: 450148	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (100 mm)	0	86.5							Borehole caved-in at 1.8 m bgs and dry on completion.
		dense, damp, grey/brown gravelly sand, some silt (FILL)	0.25	86.25	33	5	1		33		
		soft, wet, dark brown/black clayey silt (FILL)	0.5	86		30	2A				
		soft, moist, greyish blue clayey silt, trace sand (FILL)	0.75	85.75	4		2B		4		
		dense, moist, greyish blue sandy silt, trace gravel (FILL)	1	85.5		17	3A		75/254		
		very dense, greyish brown, moist GRAVELLY SAND, trace rock fragments	1.25	85.25	75/254	2	3B				Auger refusal at 2.20 m bgs.
			1.5	85							
			1.75	84.75							
			2								
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 108**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 86.302	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033465	EASTING: 450175	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (40 mm)	0	86.25							Boreohle caved-in at 1.50 m bgs and dry on completion.
		compact, damp, brown gravelly sand (FILL)	0.25 / 0.5	86 / 85.75	10		1		10		
		firm, moist, dark brown clayey silt, trace sand, trace to some gravel, trace organics (FILL)	0.75 / 1 / 1.25	85.5 / 85.25 / 85	8		2		8		
		compact to very dense, moist, brown sandy silt, some gravel (FILL)	1.5 / 1.75	84.75 / 84.5	62/203		3		62/203		Auger refusal at 1.90 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 109**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 87.338	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033491	EASTING: 450202	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		soft, moist, dark brown, clayey silt traces of sand, gravel, and organics (FILL)	0	87.25	50/125		1		50/125		Borehole open and dy on completion.
			0.25	87							Rock in spoon tip at 0.3 m bgs
			0.5	86.75							
			0.75	86.5			2A				
			1	86.25	40				40		Difficult augering from 1.0 m bgs to refusal.
			1.25	86			2B				
			1.5	85.75							Relocated drill 1 m S to avoid rocks.
		dense to compact, damp, light brown silty sand, some clay, trace gravel (FILL)	1.75	85.5	23		3		23		
		-----	2	85.25							
		rock fragments	2.25	85							
			2.5	84.75	64		4		64		Auger refusal at 2.9 m bgs.
			2.75	84.5							
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 110**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 86.374	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033554	EASTING: 450130	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		FROZEN GROUND	0	86.25							Borehole caved-in at 0.91 m bgs and dry on completion.
		very dense, damp, grey gravel, some sand (FILL)	0.25	86	80		1A		80		
			0.5	85.75			1B				
		compact, damp to wet, brown sandy silt, some gravel, trace organics trace oxidization (FILL)	0.75	85.5			2A				
			1	85.25	31				31		Auger refusal at 1.40 m bgs.
		compact to very dense, moist to wet, dark brown, silty gravel, trace sand, trace organics and rock fragments (FILL)	1.25				2B				
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: MW111**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 86.960	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033607	EASTING: 450217	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		soft, moist, grey clayey silt, organic layers (FILL)	0	86.75	3		1		3		Monitoring well was dry on December 17, 2018.
		some sand trace asphalt	0.25	86.5							Bentonite
			0.5	86.25							
			0.75	86	4		2		4		
			1	85.75							sand
			1.25	85.5							
		limestone fragments, trace sand (FILL)	1.5	85.25	26		3		26		sand and screen
			1.75	85							
			2	84.75							Auger refusal at 2.7 m bgs.
			2.25	84.5	61/228		4		61/228		
		END OF BOREHOLE	2.5								

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 112**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.479	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033534	EASTING: 450242	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		FROZEN GROUND	0								borehole open and dry on completion.
		dense, moist, brown sand and gravel, trace organics (FILL)	0.25	88.25			1A				
			0.5	88	36		1B		36		
		very dense, damp, light brown SANDY SILT trace organics	0.75	87.75							
		rock fragments occassional oxidized pockets	1	87.5	58/228		2		58/228		Auger refusal at 1.2 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 113**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 87.861	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033488	EASTING: 450267	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact, damp, dark brown sandy gravel mixed with organics (FILL)	0 0.25	87.75 87.5	10		1		10		Borehole open and dry on completion.
		very dense, damp, brown silty sand, large gravel (FILL)	0.5 0.75 1	87.25 87	50/75		2		50/75		Difficult augering to 0.76 m to refusal at 1.0 m bgs
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 114**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.305	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033521	EASTING: 450284	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
	TOPSOIL (250 mm)	0	88.25	12	21	1A		12		Borehole open and dry on completion.
	compact, damp to dry, brown/dark brown sand some silt, trace rootlets, trace gravel, trace cinder (FILL)	0.25	88		11	1B				
		0.5	87.75							
		0.75	87.5							
	dense to compact damp light brown mixed dark brown SANDY SILT trace gravel, trace organics	1	87.25	46	7	2		46		
		1.25	87							
		1.5	86.75							
		1.75	86.5	13	4	3		13		Auger refusal at 2.1 m bgs.
		2	86.25							
	END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 115**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.154	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033555	EASTING: 450293	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (40 mm)	0	89							Borehole open and dry on completion. Relocated drill 1 m N, confirmed bedrock depth of 1.0 m bgs.
		dense, damp, brown gravelly sand, trace asphalt (FILL)	0.25	88.75	44		1		44		
		very dense, damp, brown sandy silt, traces of gravel and rock fragments (FILL)	0.5	88.5	50/100		2		50/100		Auger refusal at 1.0 m bgs.
		END OF BOREHOLE	0.75 / 1	88.25							

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 116**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.153	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033580	EASTING: 450267	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		stiff, moist-wet, grey clayey silt (FILL)	0	89	9		1A		9		Borehole open and dry on completion.
		loose, moist, brown/dark brown sandy silt, traces of organics and cinder (FILL)	0.25 / 0.5	88.75			1B				
		very dense, damp, light brown SANDY SILT occassional oxidized pockets	0.75 / 1	88.5 / 88.25	75/228		2		75/ 228		Auger refusal at 1.44 m bgs.
		END OF BOREHOLE	1.25	88 / 87.75							

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 117**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.021	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033498	EASTING: 450350	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact, moist, brown mixed grey sandy silt, traces of clay and gravel (FILL)	0	88							Borehole open and dry on completion.
			0.25	87.75	12		1A		12		
		loose, moist, dark brown/black sandy silt, some organics (FILL)	0.5	87.5			1B				
			0.75	87.25							Auger refusal at 1.23 m bgs.
		firm, moist, brownish grey clayey silt, trace sand (FILL)	1	87	10		2		10		
		END OF BOREHOLE									

Shear Strength (kPa): 40 80 120 160
N-Value (Blows/300mm): 20 40 60 80
Water Content (%): 20 40 60 80

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 118**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.079	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033567	EASTING: 450340	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (200 mm)	0	88		37	1A				Borehole open and dry on completion.
		loose, moist, dark brown sandy silt, traces of cinder and rootlet (FILL)	0.25	87.75	5		1B		5		
		dense, moist brown with grey mottling SANDY SILT, some clay, trace gravel occassional oxidized pockets	0.5	87.5							
			0.75	87.25	50/50	12	2		50/50		Auger refusal at 0.96 m bgs.
		END OF BOREHOLE									

Shear Strength (kPa) ● 40 80 120 160
N-Value (Blows/300mm) ▲ 20 40 60 80
Water Content (%) PL W.C. LL 20 40 60 80

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 119**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.530	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033613	EASTING: 450267	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		very dense, moist, dark brown sand and gravel, large rock in spoon (FILL)	0 0.25 0.5	88.5 88.25 88	90 ▲		1		90		Borehole open and dry on completion. Auger refusal at 0.65 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 120**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.574	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033596	EASTING: 450340	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact, moist, dark brown/brown gravelly sand, traces of cinder and rootlets (FILL)	0	89.5	13		1A		13		Borehole open and dry on completion.
			0.25	89.25							
		very dense, damp, light brown SILT some sand, trace clay	0.5	89			1B				
			0.75	88.75							
			1	88.5	100/280		2		100/280		Auger refusal at 1.20 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 121**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.554	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033556	EASTING: 450408	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT (N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (75 mm)	0	88.5							Borehole open and dry on completion.
		compact, moist to wet, dark brown sandy gravel, trace asphalt (FILL)	0.25	88.25	14 ▲		1		14		
			0.5	88							Auger refusal at 0.80 m bgs.
			0.75								
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Split Spoon Sampling		**BH No.: 122**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.020	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033509	EASTING: 450395	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT (N)	Well Construction	REMARKS
		moist, dark brown/black silt, some sand, some gravel (FILL)	0 0.25 0.5	88 87.75 87.5							Borehole open and dry on completion.
		greyish blue, moist, hard clayey silt, trace sand, trace gravel (FILL)	0.75 1 1.25 1.5	87.25 87 86.75 86.5	36		1		36		Auger refusal at 1.52 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 123**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.589	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033559	EASTING: 450433	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		loose, moist, brown sandy silt, some gravel, trace clay (FILL)	0 0.25 0.5 0.75	88.5 88.25 88 87.75	8 50/25		1 2		8 50/25		Borehole open and dry on completion. Auger refusal at 0.94 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: MW124**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 90.147	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033631	EASTING: 450454	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact, damp to moist, dark brown silty sand, some gravel, trace organics (FILL)	0 0.25 0.5 0.75	90 89.75 89.5 89.25	24	13 27	1 2A		24		Monitoring well was dry on Decemebr 17, 2018. Bentonite
		compact to dense light brown SANDY SILT moist ----- wet	1 1.25 1.5	89 88.75 88.5	20 50/25	8 20	2B 3		20 50/25		sand sand and screen Auger refusal at 1.70 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: MW125**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 82.655	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033720	EASTING: 450286	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
▽		stiff, moist, dark brown/grey clayey silt, traces of topsoil, gravel and rootlets (FILL)	0	82.5	12	33	1		12		Groundwater was measured at 0.25 mbgs on December 17, 2018. Bentonite
			0.25	82.25							
			0.5	82							sand
			0.75	81.75	9	34	2		9		
			1	81.5							
		firm, moist, grey layered CLAY and SILT trace sand occassional oxidized layers	1.25	81.25							
			1.5	81							
			1.75	80.75	9	36	3		9		sand and screen
			2	80.5							
		----- coarse sand seam	2.25	80.25	50/50	11	4		50/50		Auger refusal at 2.46 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 126**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 84.434	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033711	EASTING: 450163	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact, moist, brown gravelly sand, trace rock fragments (FILL)	0 – 0.25 – 0.5	84.25 – 84	12		1		12		Borehole open and dry on completion.
		compact, dry, brown SANDY SILT occassional oxidized layers trace rock fragments	0.75 – 1 – 1.25 – 1.5	83.75 – 83.5 – 83.25 – 83	25		2		25		
					50/125		3		50/125		Auger refusal at 1.65 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 127**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 84.156	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033735	EASTING: 450159	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		brown, moist compact to dense SILTY SAND some rock fragments	0 0.25 0.5 0.75 1 1.25 1.5	84 83.75 83.5 83.25 83 82.75	19 74/50		1 2		19 74/50		Borehole open and dry on completion. Difficult augering between the depths of 0.76 and 1.52 m bgs. Auger refusal at 1.52 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 128**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 84.086	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033735	EASTING: 450193	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		FROZEN GROUND	0	84							Borehole open and dry on completion.
		compact, moist, brown silty sand, trace gravel (FILL)	0.25	83.75	15		1		15		
		----- rock fragments	0.5	83.5							
			0.75	83.25	50/75		2		50/75		Auger refusal at 1.0 m bgs.
		END OF BOREHOLE	1								

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 129**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 84.313	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033718	EASTING: 450203	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact, moist, brown silty sand, trace gravel (FILL) ----- rock fragments	0	84.25							Borehole open and dry on completion.
			0.25	84	10		1		10		
			0.5	83.75							
			0.75	83.5	50/50		2		50/50		
			1	83.25							
			1.25	83							Auger refusal at 1.52 m bgs.
			1.5								
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 131**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 83.039	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033795	EASTING: 450201	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (50 mm)	0	83	40 80 120 160 / 20 40 60 80	20 40 60 80					Borehole open and dry on completion.
		compact ----- dense — moist SILTY SAND — brown ----- light brown	0.25	82.75	12		1		12		
			0.5	82.5							
			0.75	82.25	50/75		2		50/75		
			1	82							
			1.25	81.75							Auger refusal at 1.52 m bgs.
			1.5								
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 133**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 81.775	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033799	EASTING: 450270	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		FROZEN GROUND	0	81.75							Borehole caved-in at 1.83 m bgs and dry on completion.
		compact, moist, brown gravel, trace sand (FILL)	0.25	81.5	25		1		25		
			0.5	81.25							
		firm, moist, dark brown clayey silt, traces of sand, gravel, and organics (FILL)	0.75	81			2A		8		
			1	80.75	8						
			1.25	80.5			2B				
		stiff, moist greyish brown CLAYEY SILT trace gravel trace sand	1.5	80.25							
			1.75	80	17		3		17		
			2	79.75							Auger refusal at 2.28 m bgs.
			2.25	79.5	50/25		4		50/25		
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Split Spoon Sampling		**BH No.: 134**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 82.819	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033758	EASTING: 450381	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (150 mm)	0	82.75			1A				On completion of the borehole water was at 0.91 m bgs.
		brownish orange, moist, loose sand some silt trace organics (FILL)	0.25	82.5	6		1B		6		
			0.5	82.25			2C				
		light brown -----	0.75	82							
▼		stiff, moist CLAY and SILT trace sand	1	81.75	13		2		13		
		greyish brown	1.25	81.5							
			1.5	81.25							Difficult augering between the depths of 1.8 m to refusal.
			1.75	81	11		3A		11		Auger refusal at 2.13 m bgs.
		brown, wet, loose SILT, some sand, some gravel	2	80.75			3B				
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Holow Stem Auger & Split Spoon		**BH No.: 135**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 84.928	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033790	EASTING: 450447	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		very dense, moist, brown gravelly sand, some silt (FILL)	0 0.25 0.5	84.75 84.5 84.25	50		1		50		Borehole open and dry on completion. Auger refusal at 0.70 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Split Spoon Sampling		**BH No.: 136**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.202	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033634	EASTING: 450509	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		very dense, moist, dark brown and black, gravelly sand, trace asphalt pieces (FILL)	0	89			1A				Borehole open and dry on completion.
		very stiff, damp, dark brown clayey silt, some gravel (FILL)	0.25		29		1B		29		
			0.5	88.75			1C				
		very dense, damp. light brown SANDY SILT	0.75	88.5	50/75		2		50/75		
			1	88.25							Auger refusal at 1.37 m bgs.
			1.25	88							
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 137**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.668	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033622	EASTING: 450581	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact, moist-wet, light brown/brown/grey silty sand to sand, some gravel, trace brick, trace concrete, black organics (FILL)	0 0.25 0.5 0.75 1	89.5 89.25 89 88.75	17 7		1 2A		17 7		Borehole open and dry on completion.
		----- compact, damp, light brown SANDY SILT rock fragments	1.25 1.5 1.75	88.5 88.25 88	62/203		2B 3		62/203		Auger refusal at 1.87 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 138**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.510	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033554	EASTING: 450509	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (75 mm)	0	88.5							Borehole open and dry on completion.
		damp, brown gravelly sand (FILL)	0.25	88.25	50		1		50		
			0.5	88							
		hard, moist, brown CLAYEY SILT, some sand, some gravel	0.75	87.75							
			1	87.5	53/254		2		53/254		
			1.25	87.25							Auger refusal at 1.37 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 139**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.520	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033537	EASTING: 450577	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact to dense, damp, brown/grey gravelly sand, traces of brick and concrete (FILL)	0	89.5	30		1		30		Borehole caved-in at 1.10 m bgs and dry on completion.
		----- metal fragments	0.25	89.25							
			0.5	89							
			0.75	88.75							
			1	88.5	15		2		15		
			1.25	88.25							
		no recovery	1.5	88	50/25		3		50/25		Auger refusal at 1.70 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 140**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.144	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033503	EASTING: 450549	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
	compact, damp, brown/grey gravelly sand, trace organics (FILL)	0	88	15	3	1A				Borehole caved-in at 2.85 m bgs and dry on completion.
		0.25			19	1B		15		
	stiff, moist, brown clayey silt, some sand, trace gravel (FILL)	0.5	87.75							
		0.75	87.5							
	stiff, moist, greyish brown clayey silt, some sand, trace large gravel	1	87.25	18	9	2		18		
		1.25	87							
		1.5	86.75							
	compact	1.75	86.5	15	16	3		15		
	brown	2	86.25							Difficult augering at 2.13 m bgs due to large gravel.
	SAND trace gravel trace silt occassional oxidized pockets	2.25	86							
	dense some gravel	2.5	85.75	36	10	4		36		
		2.75	85.5							
	greyish brown	3	85.25							
		3.25	85	50/75	7	5		50/75		Auger refusal at 3.27 m bgs.
	END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon	**BH No.: 141**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.613
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033512	EASTING: 450627
		PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (75 mm)	0	88.5							Borehole open and dry on completion.
		stiff, damp, dark brown/grey/black clayey silt, some sand, some gravel, trace construction debris, trace rock fragments (FILL)	0.25	88.25	14		1		14		
			0.5	88							
			0.75	87.75							
			1	87.5	13		2		13		
			1.25	87.25							
		very stiff, moist, greyish brown CLAYEY SILT some sand, trace gravel	1.5	87							
			1.75	86.75	28		3		28		
			2	86.5							
		no recovery	2.25	86.25	50/50		4		50/50		Auger refusal at 2.46 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: MW142**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.848	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033561	EASTING: 450629	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (100 mm)	0	89.75		11	1A				Borehole open and dry on completion. Monitoring well was dry on December 17, 2018.
		brownish grey some black	0.25	89.5	30	14	1B		30		bentonite
		compact	0.5	89.25							
		-----	0.75	89							sand
		moist gravelly sand trace brick, trace concrete (FILL) grey	1	88.75	9	11	2		9		
		loose	1.25	88.5							Sand and screen
		-----	1.5	88.25	50/25	10	3		50/25		Auger refusal at 1.82 m bgs.
		compact rock fragments	1.75								
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 143**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.890	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033592	EASTING: 450632	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact, damp, brown sandy silt trace clay trace brick trace concrete (FILL)	0	89.75	30		1		30		Borehole open and dry on completion.
		some brick trace limestone fragments	0.25	89.5							
			0.5	89.25							
			0.75	89							
			1	88.75	19		2		19		
			1.25	88.5							
			1.5	88.25	50/75		3		50/75		Auger refusal at 1.75 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 144**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.929	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033618	EASTING: 450674	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (75 mm)	0								Borehole open and dry on completion.
		compact, moist, brown gravelly sand (FILL)		88.75			1A				
		stiff, moist, brown/grey/black clayey silt, some sand, trace gravel	0.25		20		1B		20		Difficult augering between 0.91 to refusal.
			0.5	88.5			1C				
		very dense, damp, light brown sandy silt, trace rock fragments (FILL)	0.75	88.25	50/50		2		50/50		Auger refusal at 1.22 m bgs.
			1	88							
				87.75							
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 145**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.052	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033556	EASTING: 450688	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (75 mm)	0	89			1A				Borehole open and dry on completion.
		compact, damp, brown gravelly sand (FILL)	0.25	88.75	15		1B		15		
		compact, moist, brown sand, some silt, trace gravel (FILL)	0.5	88.5							
		very dense, damp, light brown SANDY SILT, trace rock fragments	0.75	88.25			2A		62		Auger refusal at 1.20 m bgs.
		END OF BOREHOLE	1	88	62		2B				

N-Value (Blows/300mm) scale: 20 40 60 80

Shear Strength (kPa) scale: 40 80 120 160

Water Content (%) scale: 20 40 60 80

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 146**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 91.105	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033589	EASTING: 450737	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (220 mm)	0	91			1A				Borehole open and dry on completion.
			0.25	90.75	5		1B		5		
		compact, damp, light brown SANDY SILT trace gravel trace sand trace rock fragments	0.5	90.5							
			0.75	90.25							
			1	90	19		2		19		
			1.25	89.75							
			1.5	89.5	50/125		3		50/125		Auger refusal at 1.83 m bgs.
			1.75								
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: MW147**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 90.903	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033552	EASTING: 450735	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (100 mm)	0	90.75	10	42	1		10		Monitoring well was dry on December 17, 2018.
		stiff, damp, dark brown CLAYEY SILT some organics	0.25	90.5							bentonite
		----- some sand	0.5	90.25		17	2A				
			0.75	90	21				21		
		compact, damp to moist, light brown SILTY SAND	1	89.75		9	2B				sand
			1.25	89.5							
			1.5	89.25	65/228	10	3		65/228		sand and screen
		compact, moist, light brown SAND, some gravel trace rock fragments	1.75	89							Auger refusal at 2.26 m bgs.
			2	88.75							
		END OF BOREHOLE	2.25								

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 148**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 90.484	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033518	EASTING: 450732	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		trace organics	0	90.25	20		1		20		Borehole caved-in at 1.92 m bgs and dry on completion.
		-----	0.25	90							
		compact, moist, brown gravelly sand (FILL)	0.5	89.75							
			0.75	89.5	11		2		11		
			1	89.25							
			1.25	89							
			1.5	88.75	6		3		6		
		----- ----- brick fragments wet	1.75	88.5							
		-----	2	88.25	50/50		4		50/50		Auger refusal at 2.44 m bgs.
		rock fragments	2.25								
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 149**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 90.842	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033548	EASTING: 450777	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact, damp, dark brown/brown gravelly sand (FILL)	0	90.75	28		1		28		Borehole open and dry on completion.
		compact, wet, brown/light grey SILTY SAND trace gravel occassional oxidization ----- rock fragments	0.25	90.5							
			0.5	90.25							
			0.75	90							
			1	89.75	27		2		27		Auger refusal at 1.52 m bgs.
			1.25	89.5							
			1.5								
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 150**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 91.981	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033616	EASTING: 450777	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (100 mm)	0	91.75	5		1A				Borehole open and dry on completion.
		firm, damp to moist, dark brown mottled light brown and grey CLAYEY SILT, some sand, trace gravel	0.25				1B		5		
			0.5	91.5							
			0.75	91.25							
			1	91	21		2		21		
		damp	1.25	90.75							
		compact light brown SANDY SILT trace gravel occassional oxidized layers	1.5	90.5							
		----- moist	1.75	90.25	75/228		3A		75/228		
							3B				Auger refusal at 2.13 m bgs.
			2	90							
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: MW152**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 92.984	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033581	EASTING: 450800	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		soft, moist, grey/brown clayey silt (FILL)	0 – 1	92.75 – 92	5, 4	30, 37	1, 2		5, 4		Monitoring well was dry on December 17. 2018. bentonite sand
		compact, damp, light brown silty sand to sand, some silt, trace organics (FILL)	1 – 2	92 – 91	15	17	3		15		
		hard, damp, light brown SILT, some clay some sand	2 – 3	91 – 90	58	8	4		58		sand and screen Auger refusal at 3.05 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 153**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 91.642	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033530	EASTING: 450814	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (130 mm)	0	91.5	9		1A		9		Borehole open and dry on completion.
		loose to compact, damp to moist, light brown to black silty sand to sandy silt traces of clay, gravel cinder, and brick (FILL)	0.25	91.25			1B				
			0.5	91							
			0.75	90.75							
			1		23		2A		23		
				90.5							
		compact, damp, dark brownish purple sand, trace silt (FILL)	1.25	90.25			2B				
			1.5								Auger refusal at 1.90 m bgs.
		compact, wet, light brown SILTY SAND, some gravel	1.75	90	58/228		3		58/228		
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 154**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 92.331	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033510	EASTING: 450847	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		dark brown, damp, compact sand, traces of gravel, silt, organics, and cinder (FILL)	0	92.25							Borehole open and water was measured at 3 m bgs on completion.
		-----	0.25	92	15	13	1		15		
		silty sand	0.5	91.75							
			0.75	91.5							
			1	91.25	8	10	2		8		
			1.25	91							
			1.5	90.75							
		some gravel moist light brown	1.75	90.5	10	9	3		10		
			2	90.25							
		----- SILTY SAND -----	2.25	90							
		oxidized fissures wet light grey	2.5	89.75	3	22	4		3		Auger refusal at 3.25 m bgs.
▼		----- -----	2.75	89.5							
		limestone fragments grey	3	89.25	50/152	10	5		50/152		
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 155**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 92.475	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033574	EASTING: 450848	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHATLIC CONCRETE (50 mm)	0				1A				Borehole open and dry on completion.
		dense, damp, grey/brown silty sand, some gravel (FILL)	0.25	92.25	48		1B		48		
			0.5	92							
			0.75	91.75							
		loose, dark brown sandy silt, trace gravel (FILL) moist	1	91.5	4		2		4		
			1.25	91.25							
		----- wet	1.5	91							
		very dense, damp, light brown SANDY SILT	1.75	90.75	54/203		3A		54/203		Auger refusal at 1.83 m bs.
							3B				
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 156**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 92.393	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033617	EASTING: 450865	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (50 mm)	0	92.25							Borehole open and dry on completion.
		compact, damp, grey gravelly sand (FILL)	0.25	92	26		1		26		
			0.5	91.75							
			0.75	91.5	50		2		50		
		very dense, moist to damp, light brown SANDY SILT	1	91.25							
			1.25	91							Auger refusal at 1.5 m bgs.
			1.5		63/228				63/228		
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 157**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 92.883	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033575	EASTING: 450903	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
	moist dark brown loose silty sand some organics (FILL)	0 – 1.5	92.75 – 91.5	9, 6	11, 13	1, 2		9, 6		Borehole open and groundwater was measured at 1.96 m bgs on completion.
▼	wet greyish black	1.5 – 2.25	91.25 – 90.5	3, 50/75	24, 22	3, 4		3, 50/75		Auger refusal at 2.49 m bgs.
	dense, wet, dark grey SAND, some gravel, trace silt									
	END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: MW158**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 92.863	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033524	EASTING: 450883	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
	TOPSOIL (120 mm)	0	92.75	9		1A		9		Groundwater was measured at 2.25 mbgs on December 17, 2018.
	loose, damp to moist, brown silty sand, trace gravel, trace organics (FILL)	0.25	92.5			1B				bentonite
		0.5	92.25							
		0.75	92							
		1	91.75	8		2		8		sand
		1.25	91.5							
		1.5	91.25							
	compact moist to wet light brown SAND, some gravel trace silt	1.75	91	17		3		17		sand and screen
		2	90.75							
		2.25	90.5							
	----- wet silt seam ----- trace rock fragments	2.5	90.25	20		4		20		Auger refusal at 3.0 m bgs.
		2.75	90							
		3		50/50		5		50/50		
	END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 159**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 93.789	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033511	EASTING: 450926	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (120 mm)	0	93.75			1A				Borehole open and dry on completion.
		compact, moist, brown sandy silt, trace to some gravel, trace organics (FILL)	0.25	93.5	17		1B		17		
			0.5	93.25							
			0.75	93							
		compact, damp, light brown gravelly sand, some silt, occassional topsoil pockets (FILL)	1	92.75	11		2		11		
			1.25	92.5							
			1.5	92.25							
			1.75	92	9		3		9		
			2	91.75							
			2.25	91.5							
		compact, damp, light grey rock fragments, trace to some sand	2.5	91.25	27		4		27		Auger refusal at 2.75 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 160**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 92.688	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033545	EASTING: 450952	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (110 mm)	0	92.5	3		1A				Borehole open and dry on completion.
		loose, moist, light brown silty sand, trace organics	0.25				1B		3		
			0.5	92.25							
			0.75	92							
		light brown	1	91.75	19		2		19		Difficult augering from 1.22 m bgs to refusal.
		compact moist layered SILTY SAND trace gravel occassional oxidization	1.25	91.5							
		----- -----	1.5	91.25							
			1.75	91							
		trace rootlets light grey	2	90.75	24		3		24		Auger refusal at 2.26 m bgs.
			2.25	90.5							
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 161**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 93.073	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033617	EASTING: 450956	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact, moist, brown/dark brown/grey sandy silt, some clay, trace topsoil (FILL)	0	93	13		1A		13		Borehole open and dry on completion.
			0.25	92.75			1B				
			0.5	92.5							Relocated drill 3.0 m E, encountered refusal at 0.76 m bgs.
		moist ----- very dense brown trace black gravelly sand trace brick (FILL) wet	0.75	92.25	50/25mm		2		50/25mm		
			1	92							
			1.25	91.75							Auger refusal at 1.52 m bgs.
			1.5								
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 162**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 93.146	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033612	EASTING: 451005	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (45 mm)	0	93			1A				Borehole open and dry on completion.
		compact, moist, light brown silty sand (FILL)	0.25	92.75	13		1B		13		
			0.5	92.5			1C				
			0.75	92.25							
		moist	1	92	17		2		17		
		compact, light grey SILTY SAND occassional oxidization	1.25	91.75							
			1.5	91.5							
		-----	1.75	91.25	16		3		16		
		wet	2	91							Auger refusal at 2.44 m bgs.
		----- trace rock fragments	2.25	90.75							
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 163**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 93.488	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033562	EASTING: 451001	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		loose, moist, grey mixed dark brown clayey silt, trace topsoil, trace gravel (FILL)	0	93.25	3		1		3		Borehole open and dry on completion.
			0.25	93							
			0.5	92.75			2A				
			0.75	92.5	11		2B		11		
			1	92.25							
		---- moist	1.25	92							
		trace large gravel	1.5	91.75	37		3		37		
		compact light brown/light grey SAND some silt trace gravel occassional oxidized pockets	1.75	91.5							
		-----	2	91.25							
			2.25	91	16		4		16		
		wet	2.5	90.75							
			2.75	90.5							
		very dense, moist, grey CLAYEY SILT, with SILTY SAND trace rock fragments	3	90.25	66/165		5A		66/165		
			3.25	90			5B				Auger refusal at 3.83.
			3.5	89.75							
		END OF BOREHOLE	3.75		50/12		6		50/12		

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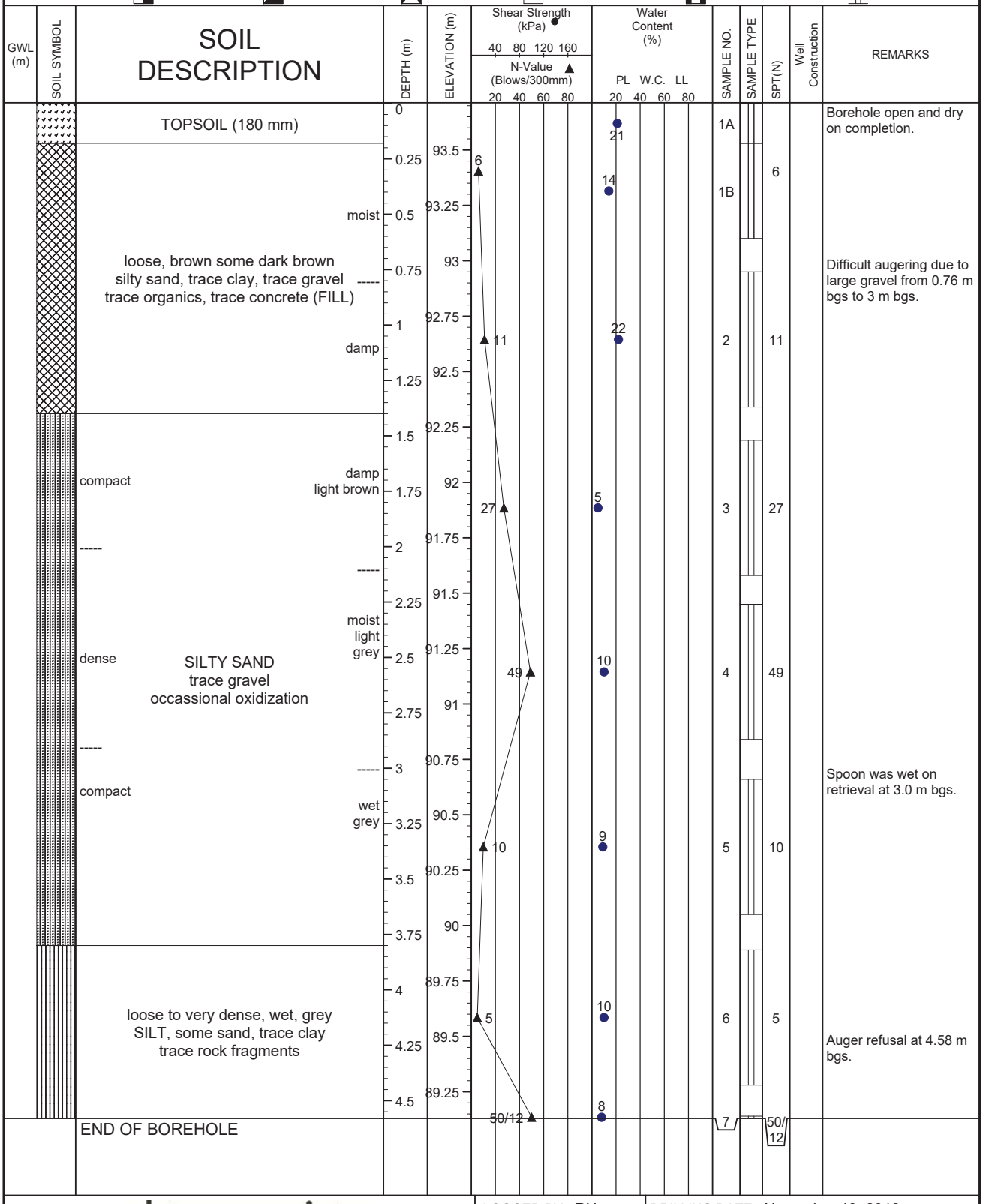
CLIENT: Canada Lands Company CLC Limited	METHOD: Split Spoon Sampling		**BH No.: 164**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 93.710	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033541	EASTING: 451053	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON



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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: 165**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 93.845	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033495	EASTING: 450981	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (240 mm)	0	93.75	6		1A		6		Borehole open and dry on completion.
			0.25	93.5			1B				
		loose to compact moist light brown mixed dark brown silty sand some rock fragments trace organics (FILL)	0.5	93.25							
			0.75	93							
			1	92.75	7		2		7		
			1.25	92.5							
			1.5	92.25							
			1.75	92	12		3		12		
			2	91.75							Auger refusal at 2.27 m bgs.
			2.25		50/12		4		50/12		
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: MW166**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 93.540	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033505	EASTING: 451043	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		TOPSOIL (125 mm)	0	93.5			1A				Groundwater was measured at 2.55 mbgs on December 17, 2018.
		loose, moist, brown/dark brown silty sand, trace clay, trace gravel trace organics (FILL)	0.25	93.25	7		1B		7		
			0.5	93							Bentonite
			0.75	92.75							
			1	92.5	14		2		14		sand
			1.25	92.25							sand and screen
			1.5	92							
		loose, moist, light brown SILTY SAND trace gravel, trace oxidized pockets with sand seams	1.75	91.75	5		3		5		
			2	91.5							
			2.25	91.25							
▼			2.5	91	4		4		4		Spoon wet on retrieval at 2.26 m bgs.
		light brown	2.75	90.75							
		-----	3	90.5							
		loose wet SILTY SAND	3.25	90.25	6		5		6		
		light grey	3.5	90							
		----- trace rock fragments	3.75	89.75							Auger refusal at 4.13 m bgs.
			4	89.5	56/165		6		56/165		
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: BH167**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 85.033	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033449	EASTING: 449942	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		ASPHALTIC CONCRETE (140 mm)	0	85		5	1A				Borehole open and dry on completion.
		GRANULAR BASE (200 mm)	0.25	84.75	21	5	1B		21		
		compact, damp, dark brown/brown silty sandy clay, trace gravel (FILL)	0.5	84.5			1C				
			0.75	84.25							
		dense, damp, light brown sandy silt, trace clay occassional oxidized pockets (FILL)	1	84	35	13	2		35		
			1.25	83.75							
		very dense, damp, greyish black, rock fragments, trace silty sand	1.5	83.5	50/50	9	3		50/50		Auger refusal at 1.72 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: BH173**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 82.718	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033814	EASTING: 450338	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		loose, moist, brown gravelly sand (FILL)	0	82.5	6		1A		6		Borehole open and dry on completion.
		loose, moist, brown silty sand, trace gravel (FILL)	0.5	82.25			1B				
			0.75	82							
			1	81.75	6		2A				
		firm, moist, grey CLAYEY SILT	1.25	81.5			2B		6		
			1.5	81.25							
			1.75	81	6		3		6		
			2	80.75							
▼		loose to compact, wet, brown SANDY SILT, trace gravel occassional oxidized pockets	2.25	80.5							
			2.5	80.25	18		4		18		Auger refusal at 2.72 m bgs.
				80							
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon		**BH No.: BH174**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.668	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033626	EASTING: 450620	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) / N-Value (Blows/300mm)	Water Content (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		dense dry ----- brownish red ----- sand and gravel, trace to some brick fragments (FILL) compact moist ----- metal fragments trace rock fragments	0 0.25 0.5 0.75 1 1.25 1.5	89.5 89.25 89 88.75 88.5 88.25	53 17 50/75		1 2 3		53 17 50/75		Borehole caved-in at 0.61 m bgs and dry on completion. Auger refusal at 1.60 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Hollow Stem Auger & Split Spoon	**BH No.: BH175**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.961
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033593	EASTING: 450502
		PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	Shear Strength (kPa) 40 80 120 160 / N-Value (Blows/300mm) 20 40 60 80	Water Content (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	SPT(N)	Well Construction	REMARKS
		compact, moist, brown/grey sandy gravel (FILL)	0 0.25 0.5	88.75 88.5	20		1		20		Borehole open and dry on completion. Auger refusal at 0.61 m bgs.
		END OF BOREHOLE									

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CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 201**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 74.347	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033269	EASTING: 449596	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was dry and open.								74.25
0.25						damp, dark brown, TOPSOIL trace shale fragments				74
0.5										73.75
0.75						damp, brown SANDY SILT trace clay trace to some shale fragments				73.5
1										73.25
1.25		Refusal @ 1.42 m bgs on Limestone Bedrock (weathered at surfac)								73
						END OF TEST PIT				

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DRILLING DATE: December 14,

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 202**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 76.706	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033347	EASTING: 449742	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL 20	W.C. 40 60	LL 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was dry and open.						damp, dark brown TOPSOIL				76.5
0.25								moist, brownish orange, sand some silt trace gravel (FILL)				76.25
0.5								damp, brown SANDY SILT trace clay, trace gravel, trace limestone and shale fragments				76
0.75												75.75
1		Refusal @ 1.15 m bgs on Limestone Bedrock (weathered at surfac)						END OF TEST PIT				

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DRILLING DATE: December 14,

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 203**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 85.485	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033460	EASTING: 450060	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was dry and open.								
0.25						damp, dark brown TOPSOIL trace rootlets				85.25
0.5										85
0.75						damp, brown SANDY SILT some rootlets				84.75
1										84.5
1.25						damp, brown GRAVELLY SAND some shale fragments				84.25
1.5		Refusal @ 1.64 m bgs on Limestone Bedrock								84
						END OF TEST PIT				

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CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 204**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 86.640	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033484	EASTING: 450194	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone ▲ Tip Resistance (kg/cm 2) 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was dry and open.				damp, dark brown sand and gravel (FILL)				86.5
0.25										86.25
0.5						damp, brown sandy silt some gravel (FILL)				86
0.75										85.75
1										85.5
1.25						moist light brown mixed grey silty sand, some clay trace limestone fragments (FILL)				85.25
1.5										85
1.75		Refusal @ 1.84 m bgs on Limestone Bedrock				END OF TEST PIT				

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CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 205**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 85.810	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033606	EASTING: 450123	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone / Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was dry and open.				moist, grey gravel some to trace sand (FILL)				85.75
0.25										85.5
0.5						damp, dark brown topsoil, trace rootlets (FILL)				85.25
0.75										85
1										84.75
1.25						damp, brown SANDY SILT trace clay, trace gravel				84.5
1.5		Refusal @ 1.64 m bgs on Limestone Bedrock								84.25
						END OF TEST PIT				

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CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 206**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 84.13	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033719	EASTING: 450179	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was dry and open.				moist, dark brown TOPSOIL some gravel				84
0.25						moist, brown SILTY SAND trace organics				83.75
0.5										83.5
0.75										83.25
1						damp, greyish brown SANDY SILT trace gravel				83
1.25		Refusal @ 1.60 m bgs on Limestone bedrock with thinnly bedded shale layers								82.75
1.5						END OF TEST PIT				

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CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 207**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 82.29	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033801	EASTING: 450221	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was dry and open.				moist, brown SILTY SAND some gravel trace limestone fragments				82.25
0.25										82
0.5		Refusal @ 0.64 m bgs on Limestone Bedrock (weathered at surface)				END OF TEST PIT				81.75

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DRILLING DATE: December 14,

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 208**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 77.25	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033847	EASTING: 450162	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was dry and open.				moist, dark brown to brown sandy TOPSOIL trace rootlets				77.25
0.25										77
0.5						damp, greyish brown CLAYEY SILT				76.75
0.75		Refusal @ 0.98 m bgs on Limestone bedrock with thinnly bedded shale layers								76.5
						END OF TEST PIT				

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CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 209**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 83.71	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033788	EASTING: 450415	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone ▲ Tip Resistance (kg/cm 2) 50 100 150 200	PL 20	W.C. 40 60	LL 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion water was entering the test pit from an old subdrain at 1.5 m bgs.						limestone fragments, trace sand (FILL)				83.5
0.25								damp, brown sand, trace silt (FILL)				83.25
0.5								moist, light brown sandy silt some gravel (FILL)				83
0.75												82.75
1								wet, greyish brown sandy clayey silt (FILL)				82.5
1.25												82.25
1.5		Refusal @ 1.70 m bgs on Limestone Bedrock						END OF TEST PIT				

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DRILLING DATE: December 14,

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 210**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.84	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033616	EASTING: 450282	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was dry and open.				damp, grey crusher run limestone (FILL)				88.75
0.25										88.5
0.5						Asphaltic concrete				88.25
0.75						moist, dark brown organic layer, trace to some sand trace rootlets (FILL)				88
1						damp, light brown SANDY SILT some gravel				87.75
1.25										87.5
1.5		Refusal @ 1.60 m bgs on Limestone Bedrock								87.25
						END OF TEST PIT				

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CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 211**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.64	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033621	EASTING: 450332	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was caving in between 0.8- 1.35 m bgs.				damp, dark brown TOPSOIL				89.5
0.25						moist, brownish orange SILTY SAND some shale fragments trace organics				89.25
0.5										89
0.75										88.75
1						damp, light brown SANDY SILT some limestone fragments trace large gravel				88.5
1.25		Refusal @ 1.35 m bgs on Limestone Bedrock				END OF TEST PIT				

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CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 212**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.04	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033549	EASTING: 450275	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was caving in between 0.18- 0.4 m bgs.				asphaltic concrete				89
0.25						damp, grey sand and gravel (FILL)				88.75
0.5						damp, brown GRAVELLY SAND trace cobbles trace shale fragments				88.5
0.75										88.25
1		Refusal @ 1.07 m bgs on Limestone Bedrock				END OF TEST PIT				88

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REVIEWED BY: VN | Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 213**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.05	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033505	EASTING: 450298	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit remained open and dry.								88
0.25						moist, dark brown TOPSOIL some sand				87.75
0.5		Refusal @ 0.78 m bgs on Limestone Bedrock (fractured at surface)								87.5
0.75						END OF TEST PIT				

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LOGGED BY: RH
REVIEWED BY: VN
DRILLING DATE: December 14,

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 214**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.26	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033519	EASTING: 450408	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was open and dry.				damp, brownish grey gravelly silt, some sand (FILL)				88.25
0.25						damp, light brownish orange sandy silt trace to some topsoil (FILL)				88
0.5										87.75
0.75						moist, grey SANDY SILT some to trace clay trace large gravel				87.5
1										87.25
1.25		Refusal @ 1.30 m bgs on Limestone Bedrock				END OF TEST PIT				87

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LOGGED BY: RH	DRILLING DATE: December 14,
REVIEWED BY: VN	Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 215**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.88	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033591	EASTING: 450502	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone ○ Tip Resistance (kg/cm 2) 50 100 150 200 ▲	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was caving in at 0.224-0.52 m bgs.				asphaltic concrete				88.75
0.25						damp, grey crusher run limestone (FILL)				
0.5						moist, brown SANDY SILT some organics				88.5
0.75						light brown SANDY SILT trace gravel				88.25
1		Refusal @ 1.03 m bgs on Limestone Bedrock				Limestone Bedrock (fractured at surface)				88
						END OF TEST PIT				

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LOGGED BY: RH
REVIEWED BY: VN
DRILLING DATE: December 14,

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 216**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 89.75	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033608	EASTING: 450616	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was caving in between 0.0 and 1.60 m bgs.								89.75
0.25										89.5
0.5										89.25
0.75						damp brown to greyish brown sand, some gravel trace brick, trace rebar trace blast rock, trace concrete (FILL)				89
1										88.75
1.25										88.5
1.5		Refusal @ 1.60 m bgs on Limestone Bedrock								88.25
						END OF TEST PIT				

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REVIEWED BY: VN	Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 217**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 88.84	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033511	EASTING: 450595	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was open and dry.				asphaltic concrete damp, brown sand and gravel (FILL)				88.75
0.25						moist, dark brown organic layer (FILL)				88.5
0.5										88.25
0.75						moist, brownish orange sandy silt trace to some boulders (FILL)				88
1										87.75
1.25										87.5
1.5										87.25
1.75						moist, greyish brown SANDY SILT some gravel trace clay				87
2										86.75
2.25		Refusal @ 2.31 m bgs on Limestone Bedrock				END OF TEST PIT				

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LOGGED BY: RH | DRILLING DATE: December 14,
REVIEWED BY: VN | Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 218**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 90.64	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033539	EASTING: 450711	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was open and dry.				moist, dark brown TOPSOIL				90.5
0.25						damp, greyish brown gravel and sand trace limestone fragments trace rebar (FILL)				90.25
0.5										90
0.75						moist orange brown SAND some silt some gravel trace boulders				89.75
1										89.5
1.25		Refusal @ 1.41 m bgs on Limestone Bedrock (fractured at surface)								89.25
						END OF TEST PIT				

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REVIEWED BY: VN
DRILLING DATE: December 14,

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 219**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 91.02	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033540	EASTING: 450809	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was open and dry.								91
0.25						moist, dark brown sand, some silt trace gravel trace brick trace shale fragments trace metal (FILL)				90.75
0.5										90.5
0.75										90.25
1		Refusal @ 1.12 m bgs on Limestone Bedrock (fractured at surface)				damp, orange brown SAND, some to trace gravel trace limestone fragments				90
						END OF TEST PIT				

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REVIEWED BY: VN | Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 220**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 92.92	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033616	EASTING: 450929	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) 50 100 150 200 ▲	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was open and dry.				moist, dark brown TOPSOIL				92.75
0.25						damp, light orange brown SAND, some silt, some gravel				
0.5						damp, greyish brown SANDY SILT trace organics				92.5
0.75		Refusal @ 0.92 m bgs on Limestone Bedrock with thinnly bedded shale layers				damp, light brown SANDY SILT				92.25
						END OF TEST PIT				92

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CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 221**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 93.99	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033510	EASTING: 450942	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL W.C. LL 20 40 60 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was open and dry.				moist, dark brown TOPSOIL				
0.25		Refusal @ 0.38 m bgs on Shale Bedrock				moist, greyish brown clayey silt (FILL)				93.75
						END OF TEST PIT				

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DRILLING DATE: December 14,

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 222**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 93.61	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033482	EASTING: 451019	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) ● 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) ▲ 50 100 150 200	PL 20	W.C. 40 60	LL 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was open and dry.										93.5
0.25								moist, dark brown sandy silt, some organics trace shale fragments (FILL)				93.25
0.5												93
0.75		Refusal @ 0.90 m bgs on Shale Bedrock										92.75
								END OF TEST PIT				

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REVIEWED BY: VN | Page 1 of 1

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 223**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 93.58	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033541	EASTING: 451053	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) 40 80 120 160 / Static Cone Tip Resistance (kg/cm 2) 50 100 150 200	PL 20	W.C. 40 60	LL 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was open and water was filtering in at base of excavation.						moist, dark brown TOPSOIL				93.5
0.25												93.25
0.5								damp, brown sandy silt trace clay trace gravel trace metal (FILL)				93
0.75												92.75
1												92.5
1.25												92.25
1.5												92
1.75												91.75
2								moist brown SANDY SILT trace to some gravel				91.5
2.25												91.25
2.5												91
2.75												90.75
3								moist grey SANDY SILT (TILL)				90.5
3.25												90.25
3.5												90
3.75								moist grey SANDY SILT some to trace clay some large cobbles trace boulders (TILL)				89.75
4												89.5
4.25		Refusal @ 4.40 m bgs on Limestone Bedrock										89.25
								END OF TEST PIT				

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DRILLING DATE: December 14,

CLIENT: Canada Lands Company CLC Limited	METHOD: Excavator		**TP No.: 224**
PROJECT: Wateridge Village	PROJECT ENGINEER: VN	ELEV. (m) 93.56	
LOCATION: Rockcliffe, Ottawa	NORTHING: 5033508	EASTING: 451041	PROJECT NO.: CO682.00

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON

DEPTH (m)	INSTRUMENTATION DATA	REMARKS	Shear Strength (kPa) 40 80 120 160 / Static Cone / Tip Resistance (kg/cm 2) 50 100 150 200	PL 20	W.C. 40 60	LL 80	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO.	SPT(N)	ELEVATION (m)
0		On completion the test pit was open and dry.						Asphaltic concrete				93.5
0.25								damp, grey, sand and gravel (FILL)				93.25
0.5								moist brown sand, some silt some gravel trace shale and limestone fragments (FILL)				93
0.75												92.75
1												92.5
1.25												92.25
1.5												92
1.75												91.75
2												91.5
2.25								moist, blackish brown organic layer (FILL)				91.25
2.5								moist, light brown SILTY SAND trace gravel				91
2.75												90.75
3								moist greyish brown SANDY SILT trace clay trace gravel				90.5
3.25												90.25
3.5												90
3.75												89.75
4		Refusal @ 4.12 m bgs on Limestone Bedrock										89.5
								END OF TEST PIT				

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REVIEWED BY: VN |

APPENDIX D

PREVIOUS BOREHOLE AND TEST PIT LOG SHEETS

LOG OF BOREHOLE BH16-01

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **87.71 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 26, 2016**
COORDINATES: **5035157.53** m N, **372599.17** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) / SPT (N) Blows/0.3m / DCPT	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
					TOPSOIL - grass 180 mm thick					
					FILL - SAND AND GRAVEL - trace silt, asphalt fragments, brown, loose	SS1		4		
	87									Standpipe piezometer 20 mm diameter installed as shown
1.0					CLAY - silty, brown, stiff	SS2		10		
					CLAY - silty, grey, stiff to very stiff	SS3		11		Groundwater level is 2.0 m (Elev. 85.71 m), on Sept. 8, 2016
2.0	86					SS4		8		
	85				TILL - sand, some clay and silt, trace of gravel, grey, loose	SS5		10		
3.0										
	84					SS6		8		9 70 (21)
4.0					End of Borehole at 4.4 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
	83									
5.0										
	82									
6.0										
	81									
7.0										
	80									

DST consulting engineers
DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-02

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **88.05 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 26, 2016**
COORDINATES: **5035157.52** m N, **372671.86** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
	88				ASPHALT - 250 mm thick					
					FILL - SAND AND GRAVEL - trace clay and silt, brown, compact	SS1		28		37 57 (6)
1.0	87		●			SS2		18		
					FILL - GRAVELLY SAND - trace clay and silt, brown, compact to dense	SS3		10		22 65 (13)
2.0	86									
						SS4		37		29 60 (11)
3.0	85		●			SS5		16		
						SS6		50+		
4.0	84				End of Borehole at 4.0 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
5.0	83									
6.0	82									
7.0	81									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

DST consulting engineers
DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-03

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **88.25 metres**

Drilling Data
METHOD: **Hollow Stem Auger / NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **September 16, 2016**
COORDINATES: **5035157.56** m N, **372725.95** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88				ASPHALT - 75 mm thick					
					FILL - SAND AND GRAVEL - trace of clay, brown, compact	SS1		29		
1.0	87					SS2		10		
2.0	86					SS3		26		
						SS4		16		
3.0	85				TILL - Clay, some sand, trace of gravel, grey, hard	SS5		50+		
					LIMESTONE BEDROCK - Light grey					
4.0	84				RC1 = 0.61 m TCR = 87% RQD = 56%	RC1				Possible 50 mm thick clay seam at 4.4 m
5.0	83				RC2 = 1.55 m TCR = 95% RQD = 95%	RC2				
6.0	82				RC3 = 0.46 m TCR = 100% RQD = 47%	RC3				
					End of Borehole at 6.1 m					
7.0	81									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-04

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **88.52 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **September 2, 2016**
COORDINATES: **5035156.93** m N, **372783.61** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88				ASPHALT - 75 mm thick					
					FILL - SAND AND GRAVEL - brown, compact	SS1		13		
1.0	87				CLAY - silty, trace of sand and gravel, brown (possible fill), stiff to very stiff	SS2		14		
2.0						SS3		20		
	86				TILL - sand, gravelly, trace clay, brown, compact	SS4		25		
2.7					End of Borehole at 2.7 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
3.0	85									
4.0	84									
5.0	83									
6.0	82									
7.0	81									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-05

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **90.01 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 29, 2016**
COORDINATES: **5035156.92** m N, **372873.6** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ (20 40 60 80) SPT (N) □ Blows/0.3m DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
					TOPSOIL - 230 mm thick					
1.0	89		●		FILL - SAND - some gravel, trace silt, possible cobbles and boulders, brown, very loose to dense	SS1		5		
						SS2		30		
2.0	88		●			SS3		37		12 81 (7)
					End of Borehole at 2.1 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
3.0	87									
4.0	86									
5.0	85									
6.0	84									
7.0	83									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

DST consulting engineers
DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-06

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **92.09 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **September 2, 2016**
COORDINATES: **5035156.35** m N, **372959.35** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
	92				TOPSOIL - 50 mm thick ASPHALT - 180 mm thick	SS1		17		
1.0	91				FILL - SAND - some gravel, trace silt, possible cobbles and boulders, light brown, compact to very dense	SS2		55		
						SS3		51		
2.0	90					SS4		35		15 76 (9)
3.0	89				TILL - Clay, silty, some gravel, trace of sand, brown, hard	SS5		38		
						SS6		50+		
4.0	88				End of Borehole at 4.0 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
5.0	87									
6.0	86									
7.0	85									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

DST consulting engineers
DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-07

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **93.45 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **September 1, 2016**
COORDINATES: **5035156.4** m N, **373046.35** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	93				TOPSOIL - 25 mm thick					
					FILL - SAND - gravelly, trace clay and silt, possible cobbles and boulders, light brown to grey, compact to very dense	SS1		24		32 62 (6)
1.0	92					SS2		75		
2.0	91					SS3		28		
						SS4		98		
3.0	90					SS5		50+		
					End of Borehole at 3.1 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
4.0	89									
5.0	88									
6.0	87									
7.0	86									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

DST consulting engineers
DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-08

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **93.58 metres**

Drilling Data
METHOD: **Hollow Stem Auger / NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **August 29, 2016**
COORDINATES: **5035156.34** m N, **373117.37** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	93				TOPSOIL - 180 mm thick					
					FILL - SAND AND GRAVEL - silty, brown, compact	SS1		11		
1.0						SS2		50+		
	92				LIMESTONE BEDROCK - Light grey					
					RC1 = 1.55 m TCR = 98% RQD = 71%	RC1				
2.0										
	91									
3.0					RC2 = 1.55 m TCR = 100% RQD = 83%	RC2				
	90									
4.0										
	89				RC3 = 1.55 m TCR = 93% RQD = 84%	RC3				
5.0										
	88				End of Borehole at 5.6 m					
6.0										
	87									
7.0										
	86									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

DST consulting engineers
DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-09

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **93.39 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 29, 2016**
COORDINATES: **5035170.89** m N, **373171.56** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ (20 40 60 80) SPT (N) □ Blows/0.3m DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	93				TOPSOIL - 150 mm thick					
					FILL - SAND - gravelly, some clay and silt, brown, compact to very dense	SS1		10		
1.0	92					SS2		31		32 38 (30)
						SS3		50+		
2.0	91				End of Borehole at 1.8 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
3.0	90									
4.0	89									
5.0	88									
6.0	87									
7.0	86									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

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DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-23

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **88.26 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE:
COORDINATES: **5035209.85** m N, **372533.31** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88				ASPHALT - 75 mm thick					
					FILL - SAND AND GRAVEL - some clay, trace organics, possible cobbles and boulders, brown, compact to very dense	SS1		10		
1.0	87					SS2		59		
2.0	86					SS3		27		
						SS4		54		
3.0	85				End of Borehole at 2.9 m Split Spoon Sampler and Auger Refusal on Inferred Bedrock					
4.0	84									
5.0	83									
6.0	82									
7.0	81									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

DST consulting engineers
DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH16-24

DST REF. No.: **IN-SO-026755**
CLIENT: **Canada Lands Company**
PROJECT: **Site Servicing Phase 1B**
LOCATION: **Wateridge Village, Ottawa, Ontario**
SURFACE ELEV.: **88.28 metres**

Drilling Data
METHOD: **Hollow Stem Auger / NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **August 26, 2016**
COORDINATES: **5035209.64** m N, **372567.49** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ / SPT (N) □ Blows/0.3m / DCPT ◆	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	88				ASPHALT - 75 mm thick FILL - SAND AND GRAVEL - brown, loose	SS1		7		
1.0	87					SS2		10		
						SS3		50+		
2.0	86				LIMESTONE BEDROCK - light grey RC1 = 0.94 m TCR = 84% RQD = 64%	RC1				
3.0	85				RC2 = 1.75 m TCR = 97% RQD = 85%	RC2				
4.0	84				End of Borehole at 4.2 m					
5.0	83									
6.0	82									
7.0	81									

BOREHOLE (STANDARD) PHASE 1B BOREHOLES V1.3.GPJ DST_MIN.GDT 10-24-16

DST consulting engineers
DST Consulting Engineers
Email: thunderbay@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thick Wall Tube
- Bentonite
- Sand

LOG OF BOREHOLE BH15-09

DST REF. No.: **OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION: **Former CFB Rockliffe, Ottawa, Ontario,**
SURFACE ELEVATION: 81.20 metres

Drilling Data
METHOD: **Hollow Stem Auger/Core Barrel/NQ**
DIAMETER: **200 mm**
DATE: **26 August 2015**
COORDINATES: **5033823.631** m N, **450194.353** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE / RQD	VANE (kPa) × 20 40 60 80; SPT (N) □ Blows/0.3m DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
	81				CRUSHED GRAVEL.					
1.0	80				SAND, topsoil, dry, brown.	SS1				
2.0	79				Limestone, grey, highly fractured and weathered from top to 2.2 m deep. Sub vertical fracture from top to 1.60 m, oxydized	RC1		41		TCR = 83%
3.0	78				Shale, black with thin limestone partings, become grey at 4.14 m. Highly fractured from 3.22 to 4.16 m	RC2		49		TCR = 92%
4.0	77				Limestone, dark grey, biomicrite with black shale partings from 4.49 m to 5.38 m and from 5.38 to 5.63 m	RC3		82		TCR = 100%
5.0	76									
6.0	75					RC4		100		TCR = 100%
7.0	74				Black shale, highly fractured					
8.0	73				Limestone, dark grey, biomicrite	RC5		43		TCR = 100%
9.0	72				Limestone grey, cristaline with sub-vertical joint 15 degree with core axis from 8.96 to 9.32 m	RC6		92		TCR = 96%
10.0	71				Shale,black					
11.0	70				Limestone, green/grey, cristaline, highly fractured from 14.1 to 14.5 m	RC7		100		TCR = 100%
12.0	69					RC8		100		TCR = 100%
13.0	68									
14.0	67					RC9		75		TCR = 100%
15.0	66				Shale, black with calcite inclusions from 16.5 to 17.4 m. Sub-vertical joint 20 degree with core axis from 16.8 to 17.0 m with thin < 1mm calcite filling. LIMSTONE interbeds from 19.3 to 20.7 m and from 21.8 to 22.1 m. Horizontal joints @ 22.4, 23.0 and 23.3 m. Highly fractured from 23.3 to 23.5 m.	RC10		90		TCR = 100%
16.0	65									
17.0	64					RC11		66		TCR = 93%
18.0	63									
19.0	62					RC12		78		TCR = 100%
20.0	61					RC13		100		TCR = 100%
21.0	60									
22.0	59					RC14		93		TCR = 100%
23.0	58					RC15		75		TCR = 98%

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 29/9/15

DST consulting engineers
DST Consulting Engineers Inc.
203 - 2150 THURSTON DRIVE
OTTAWA, ONTARIO, K1G 5T9
PH: (613)748-1415
FX: (613)748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand
- Slough

ENCLOSURE 11

LOG OF BOREHOLE BH15-09

DST REF. No.: **OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION: **Former CFB Rockliffe, Ottawa, Ontario,**
SURFACE ELEVATION: 81.20 metres

Drilling Data
METHOD: **Hollow Stem Auger/Core Barrel/NQ**
DIAMETER: **200 mm**
DATE: **26 August 2015**
COORDINATES: **5033823.631** m N, **450194.353** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE / RQD	VANE (kPa) × 20 40 60 80; SPT (N) □ Blows/0.3m DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
25.0	57				Sandstone/dolomite, grey. Sub-vertical joint 30 degree with core axis from 26.1 to 26.33 m with calcite filling < 1 mm. Horizontal joint at 26.42, 26.57, 26.62,26.64. Shale interbeds, black from 26.9 to 27.0 and from 27.8 to 28.3 m. Sub-vertical joint 20 degree with core axis from 29.7 to 29.9 and from 31.3 to 31.5 m with thin < 1 mm calcite filling. Horizontal joints @ 31.7, 31.8, 31.9, 31.2, 32.1, 32.4, 32.7 and 32.9 m.	RC16		33		TCR = 100%
26.0	56					RC17		86		TCR = 100%
27.0	55					RC18		95		TCR = 100%
28.0	54					RC19		84		TCR = 100%
29.0	53					RC20		79		TCR = 100%
30.0	52					RC21		73		TCR = 100%
31.0	51									
32.0	50									
33.0	49									
34.0	48				Sandstone interbedded with black shale. Sub-vertical joints 20 degree with core axis from 33.3 to 33.4 and from 33.6 to 33.8 m no filling.	RC22		56		TCR = 100%
35.0	47					RC23		100		TCR = 100%
36.0	46				End of Borehole at 35.1 m.					
37.0	45									
38.0	44									
39.0	43									
40.0	42									
41.0	41									
42.0	40									
43.0	39									
44.0	38									
45.0	37									
46.0	36									
47.0	35									
	34									

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 29/9/15

DST consulting engineers
DST Consulting Engineers Inc.
203 - 2150 THURSTON DRIVE
OTTAWA, ONTARIO, K1G 5T9
PH: (613)748-1415
FX: (613)748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

Auger Sample
Split Spoon Sample
Bulk Sample
Rock Core
Hiller Peat Sampler
70mm Thin Wall Tube
Bentonite
Sand
Slough

ENCLOSURE 12

LOG OF BOREHOLE BH15-10

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 83.46 metres

Drilling Data
METHOD: **Hollow Stem Auger/ NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **August 21, 2015**
COORDINATES: **5033743.938** m N, **450109.419** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	83				ASPHALT ~ 50 mm					- 19 mm diameter standpipe piezometer installed as shown
					FILL - SAND AND GRAVEL - grey, compact	SS1		24		
1.0					FILL - SILT AND GRAVEL - sandy, brown and dark brown, very dense 75 mm thick gravel seam at 0.9 m	SS2		83		
	82				LIMESTONE BEDROCK - Grey to dark grey					
2.0					RC1 - 1.14 m, TCR = 80%, SCR = 67%, RQD = 33%	RC1				
	81									
3.0										
	80				RC2 - 1.73 m, TCR = 78%, SCR = 71%, RQD = 57%	RC2				
4.0										
	79	▼								- Groundwater level is 4.62 m (Elev. 78.8 m) on October 1, 2015
5.0					RC3 - 1.50 m, TCR = 100%, SCR = 81%, RQD = 81%	RC3				
	78									
6.0										
	77				RC4 - 1.45 m, TCR = 97%, SCR = 84%, RQD = 93%	RC4				
7.0										
	76				RC5 - 0.25 m, TCR = 100%, SCR = 100%, RQD = 92%	RC5				
8.0					End of Borehole at 7.4 m.					
	75									
9.0										
	74									
10.0										
	73									
11.0										
	72									

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/26/15

DST consulting engineers
DST Consulting Engineers Inc.
203 - 2150 THURSTON DRIVE
OTTAWA, ONTARIO, K1G 5T9
PH: (613)748-1415
FX: (613)748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 13

LOG OF BOREHOLE BH15-11

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 85.34 metres

Drilling Data
METHOD: **Hollow Stem Auger/ NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **August 21, 2015**
COORDINATES: **5033606.53** m N, **450180.104** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × (20 40 60 80) SPT (N) □ Blows/0.3m DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	85				TOPSOIL ~ 150 mm					
					FILL - SAND AND GRAVEL - silty, grey, compact			16		
1.0	84				TOPSOIL ~ 50 mm			11		
					SAND AND GRAVEL - Silty, grey					
2.0	83				LIMESTONE BEDROCK - Grey to dark grey RC1 - 1.21 m, TCR = 93%, SCR = 90%, RQD = 65%	RC1				
3.0	82				RC2 - 1.53 m, TCR = 99%, SCR = 90%, RQD = 86%	RC2				
4.0	81				SHALE BEDROCK - Black LIMESTONE BEDROCK - Grey to dark grey RC3 - 1.50 m, TCR = 95%, SCR = 93%, RQD = 87%	RC3				
5.0	80									
6.0	79				SHALE BEDROCK - Black RC4 - 1.55 m, TCR = 100%, SCR = 100%, RQD = 97%	RC4				
7.0	78				LIMESTONE BEDROCK - Grey to dark grey RC5 - 1.12 m, TCR = 97%, SCR = 97%, RQD = 97%	RC5				
8.0	77				End of Borehole at 8.3 m.					
9.0	76									
10.0	75									
11.0	74									

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/26/15

DST consulting engineers
DST Consulting Engineers Inc.
203 - 2150 THURSTON DRIVE
OTTAWA, ONTARIO, K1G 5T9
PH: (613)748-1415
FX: (613)748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 14

LOG OF BOREHOLE BH15-12

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 84.55 metres

Drilling Data
METHOD: **Hollow Stem Auger/ NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **August 21, 2015**
COORDINATES: **5033393.443** m N, **450130.224** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × (20 40 60 80) SPT (N) □ Blows/0.3m DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	84				TOPSOIL ~ 180 mm					
					FILL - CLAY - silty, brown, firm	SS1		7		
1.0					CLAY - Silty, brown, firm to stiff	SS2		12		
	83					SS3		7		
2.0					TILL - Sand, silty, some clay and gravel, brown and grey, compact					
	82					SS4		24		
3.0					LIMESTONE BEDROCK - Grey to dark grey					
	81				RC1 = 1.2 m, TCR = 100%, SCR = 98%, RQD = 81%	RC1				
4.0					RC2 = 1.47 m, TCR = 93%, SCR = 86%, RQD = 29%					
	80									
5.0						RC2				
	79									
6.0					RC3 = 0.43 m, TCR = 100%, SCR = 65%, RQD = 100%	RC3				
	78				End of Borehole at 6.1 m.					
7.0										
	77									
8.0										
	76									
9.0										
	75									
10.0										
	74									
11.0										
	73									

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/26/15

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DST Consulting Engineers Inc.
203 - 2150 THURSTON DRIVE
OTTAWA, ONTARIO, K1G 5T9
PH: (613)748-1415
FX: (613)748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 15

LOG OF BOREHOLE BH15-13

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 86.64 metres

Drilling Data
METHOD: **Hollow Stem Auger/ NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **August 21, 2015**
COORDINATES: **5033444.108** m N, **450254.911** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 20 40 60 80 / SPT (N) □ Blows/0.3m / DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	86				ASPHALT ~ 50 mm					
					FILL - SAND AND GRAVEL - silty, some brick pieces, brown, very dense - boulder from 0.6 to 0.8 m	SS1		63		
1.0	85				FILL - SAND - silty, some gravel, trace clay, brown, compact	SS2		15		
2.0	84					SS3		50+		
3.0					LIMESTONE BEDROCK - Grey to dark grey RC1 = 1.48 m, TCR = 89%, SCR = 77%, RQD = 84%	RC1				
4.0	83									
5.0	82				RC2 = 1.55 m, TCR = 98%, SCR = 88%, RQD = 77%	RC2				
6.0	81									
7.0	80				RC3 = 1.52 m, TCR = 100%, SCR = 100%, RQD = 99%	RC3				
8.0	79				RC4 = 1.50 m, TCR = 98%, SCR = 98%, RQD = 93%	RC4				
9.0	78				RC5 = 1.12 m, TCR = 100%, SCR = 88%, RQD = 88%	RC5				
10.0	77				End of Borehole at 9.9 m.					
11.0	76									
	75									

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/26/15

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PH: (613)748-1415
FX: (613)748-1356
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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 16

LOG OF BOREHOLE BH15-14

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 87.77 metres

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **200 mm**
DATE: **August 21, 2015**
COORDINATES: **5033470.374** m N, **450323.531** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × (20 40 60 80) SPT (N) □ Blows/0.3m DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	87				TOPSOIL ~ 75 mm					
					FILL - SAND AND GRAVEL - silty, brown ~ 100 mm	SS1		6		
1.0					ORGANIC SAND - Silty, some roots and rootlets, black	SS2		50+		
	86				CLAY - Silty, some sand and gravel, brown					
2.0					End of Borehole at 1.1 m. Auger Refusal					
	85									
3.0										
	84									
4.0										
	83									
5.0										
	82									
6.0										
	81									
7.0										
	80									
8.0										
	79									
9.0										
	78									
10.0										
	77									
11.0										
	76									

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/26/15

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203 - 2150 THURSTON DRIVE
OTTAWA, ONTARIO, K1G 5T9
PH: (613)748-1415
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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 17

LOG OF BOREHOLE BH15-15

DST REF. No.:**OE-OT-015358**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Phase 1A Development - Site Servicing**
LOCATION:**Former CFB Rockliffe, Ottawa Ontario**
SURFACE ELEVATION: 87.76 metres

Drilling Data
METHOD: **Hollow Stem Auger/ NQ Size Core Barrel**
DIAMETER: **200 mm**
DATE: **August 26, 2015**
COORDINATES: **5033477.421** m N, **450420.068** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 20 40 60 80; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	87				ASPHALT ~ 150 mm					- 19 mm diameter standpipe piezometer installed as shown
					FILL - SAND - silty, brown, loose	SS1		5		
1.0					CLAY - Silty, brown, stiff	SS2		13		
	86				TILL - Sand, silty, some gravel, grey, compact	SS3		50		
2.0					LIMESTONE BEDROCK - Grey to dark grey RC1 - 0.78 m, TCR = 100%, SCR = 78%, RQD = 50%	RC1				
	85									
3.0										- Groundwater level is 3.27 m (Elev. 84.5 m) on October 1, 2015
	84				RC2 - 1.45 m, TCR = 98%, SCR = 98%, RQD = 88%	RC2				
4.0										
	83									
5.0					RC3 - 1.60 m, TCR = 92%, SCR = 92%, RQD = 81%	RC4				
	82									
6.0										
	81				RC4 - 1.52 m, TCR = 97%, SCR = 95%, RQD = 89%	RC3				
7.0										
	80				RC5 - 0.59 m, TCR = 95%, SCR = 95%, RQD = 69%	RC5				
8.0					End of Borehole at 8.0 m.					
	79									
9.0										
	78									
10.0										
	77									
11.0										
	76									

BOREHOLE (STANDARD) - OTTAWA PROJECT.GPJ DST_MIN.GDT 11/26/15

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PH: (613)748-1415
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SAMPLE TYPE LEGEND

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- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 18

PROJECT: 1521309

RECORD OF BOREHOLE: 15-1

SHEET 1 OF 1

LOCATION: N 5034902.3 ;E 371648.9

BORING DATE: January 26, 2015

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: SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊖ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s: WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		71.35							
0		TOPSOIL - (SM) SILTY SAND; dark brown; moist		0.00 / 71.10							
		(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, very stiff to stiff, w>PL		0.25	1	SS	14				
1					2	SS	9				
					3	SS	6				Native Backfill
2											
	Power Auger 200 mm Diam. (Hollow Stem)				4	SS	4				
3				68.00							
		(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm to stiff		3.35	5	SS	2				
4											Bentonite Seal
											Silica Sand
					6	SS	WH				Standpipe
5											Cave
				65.56							
		End of Borehole		5.79							
6											W.L. in Standpipe at Elev. 69.16 m on February 4, 2015
7											
8											
9											
10											

MIS-BHS 001 1521309.GPJ GAL-MIS.GDT 04/16/15 JM

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: PAH
CHECKED: SD

PROJECT: 1521309

RECORD OF BOREHOLE: 15-2

SHEET 1 OF 1

LOCATION: N 5034949.1 ;E 371734.0

BORING DATE: January 26, 2015

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	SAMPLES: TYPE	SAMPLES: 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^{-6} 10^{-5} 10^{-4} 10^{-3})	WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		73.05									
0	PA (HS)	TOPSOIL		0.00	1	SS	>50						
		End of Borehole Auger Refusal		72.75 0.30									
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: PAH
CHECKED: SD

MIS-BHS 001 1521309.GPJ GAL-MIS.GDT 04/16/15 JM

PROJECT: 1521309

RECORD OF BOREHOLE: 15-3

SHEET 1 OF 2

LOCATION: N 5034983.6 ;E 371807.7

BORING DATE: January 28, 2015

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 - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ⊢ ○ W ⊣ Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		76.24							
0	Power Auger 200 mm Diam. (Hollow Stem)	FILL/TOPSOIL - (SM) SILTY SAND, some gravel; dark brown; moist		0.00 / 75.94	1	SS	19				Bentonite Seal
		(SM/GM) SILTY SAND and GRAVEL; brown; non-cohesive, moist, compact to dense		0.30	2	SS	31				
1				74.89							
2	Rotary Drill NQ Core	Fresh, thinly to medium bedded, grey to dark grey DOLOSTONE BEDROCK, with shale and sandstone interbeds		1.35	C1	NQ RC	DD				
3											Bentonite Seal
					C2	NQ RC	DD				
4											
5					C3	NQ RC	DD				Silica Sand
6											32 mm Diam. PVC #10 Slot Screen
					C4	NQ RC	DD				
7											
8					C5	NQ RC	DD				Silica Sand
											Bentonite Seal
9					C6	NQ RC	DD				Silica Sand
				66.46							
10		End of Borehole		9.78							W.L. in Screen at Elev. 73.47 m on February 4, 2015

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: PAH
CHECKED: SD

MIS-BHS 001 1521309.GPJ GAL-MIS.GDT 04/16/15 JM

PROJECT: 1521309

RECORD OF PROBEHOLE: 15-10

SHEET 1 OF 1

LOCATION: N 5034922.7 ;E 371689.0

BORING DATE: January 29, 2015

DATUM: Geodetic

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: 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^{-6} 10^{-5} 10^{-4} 10^{-3})	WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	DCPT	GROUND SURFACE		71.81									
		Unsampled Overburden		0.00									
1													
2													
3													
4													
5													
6													
7													
				64.19									
		End of Borehole Dynamic Cone Penetration Test Refusal		7.62									
8													
9													
10													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: PAH
CHECKED: SD

MIS-BHS 001 1521309.GPJ GAL-MIS.GDT 04/16/15 JM

LOG OF BOREHOLE BH14-26

DST REF. No.: **OE-OT-015358**
CLIENT: **Canada Lands Company**
PROJECT: **Former CFB Rockcliffe**
LOCATION: **Ottawa, Ontario**
SURFACE ELEV.: **86.27 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **80 mm ID**
DATE: **March 3, 2014**
COORDINATES: **5033642.48** m N, **450271.46** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ (20 40 60 80) SPT (N) □ Blows/0.3m DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	86				TOPSOIL - with grass and roots					
					ASPHALT - 50 mm	AS1				
1.0	85				SAND & GRAVEL	SS2		7		
					SAND - some silt to silty, some gravel, trace clay and roots, occasional cobbles, brown, loose	SS3		100+		
2.0	84				End of Borehole at 1.7 m Auger Refusal					
3.0	83									
4.0	82									
5.0	81									
6.0	80									
7.0	79									
8.0	78									
9.0	77									
10.0	76									
11.0	75									
12.0	74									
13.0	73									
14.0	72									
15.0	71									
16.0	70									
17.0	69									
18.0	68									
19.0	67									

BOREHOLE (STANDARD) - OTTAWA GS-OT-015358 ROCKCLIFFE PHASE I.GPJ DST_MIN.GDT 4/11/14

DST consulting engineers
DST Consulting Engineers Inc.
203 - 2150 THURSTON DRIVE
OTTAWA, ONTARIO, K1G 5T9
PH: (613)748-1415
FX: (613)748-1356
Email: ottawa@dstgroup.com
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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 1

LOG OF BOREHOLE BH14-32

DST REF. No.: **OE-OT-015358**
CLIENT: **Canada Lands Company**
PROJECT: **Former CFB Rockcliffe**
LOCATION: **Ottawa, Ontario**
SURFACE ELEV.: **92.85 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **80 mm ID**
DATE: **March 5, 2014**
COORDINATES: **5033592.04** m N, **450910.85** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ (20 40 60 80) SPT (N) □ Blows/0.3m DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	92				TOPSOIL - with grass and roots	AS1				29 66 (5)
1.0	92				SAND - Gravelly, trace silt, clay and roots, occasional cobbles, grey, loose to compact	SS2		14		
2.0	91					SS3		6		
3.0	90				End of Borehole at 2.1 m Auger Refusal					
4.0	89									
5.0	88									
6.0	87									
7.0	86									
8.0	85									
9.0	84									
10.0	83									
11.0	82									
12.0	81									
13.0	80									
14.0	79									
15.0	78									
16.0	77									
17.0	76									
18.0	75									
19.0	74									
	73									

BOREHOLE (STANDARD) - OTTAWA GS-OT-015358 ROCKCLIFFE PHASE I.GPJ DST_MIN.GDT 4/11/14

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OTTAWA, ONTARIO, K1G 5T9
PH: (613)748-1415
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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 7

LOG OF BOREHOLE BH14-36

DST REF. No.: **OE-OT-015358**
CLIENT: **Canada Lands Company**
PROJECT: **Former CFB Rockcliffe**
LOCATION: **Ottawa, Ontario**
SURFACE ELEV.: **85.57 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **80 mm ID**
DATE: **February 26, 2014**
COORDINATES: **5033475.8** m N, **450066.74** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80; SPT (N) □ Blows/0.3m DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	85				TOPSOIL - with grass and roots	AS1				
1.0	84				SAND & GRAVEL - with clay, some silt,	SS2		6		25 71 (4)
						SS3		12		
2.0	83				SAND - with clay, some gravel, trace silt and roots, loose to compact	SS4		50+		
3.0	82				End of Borehole at 1.8 m Auger Refusal					
4.0	81									
5.0	80									
6.0	79									
7.0	78									
8.0	77									
9.0	76									
10.0	75									
11.0	74									
12.0	73									
13.0	72									
14.0	71									
15.0	70									
16.0	69									
17.0	68									
18.0	67									
19.0	66									

BOREHOLE (STANDARD) - OTTAWA GS-OT-015358 ROCKCLIFFE PHASE I.GPJ DST_MIN.GDT 4/11/14

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203 - 2150 THURSTON DRIVE
OTTAWA, ONTARIO, K1G 5T9
PH: (613)748-1415
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SAMPLE TYPE LEGEND

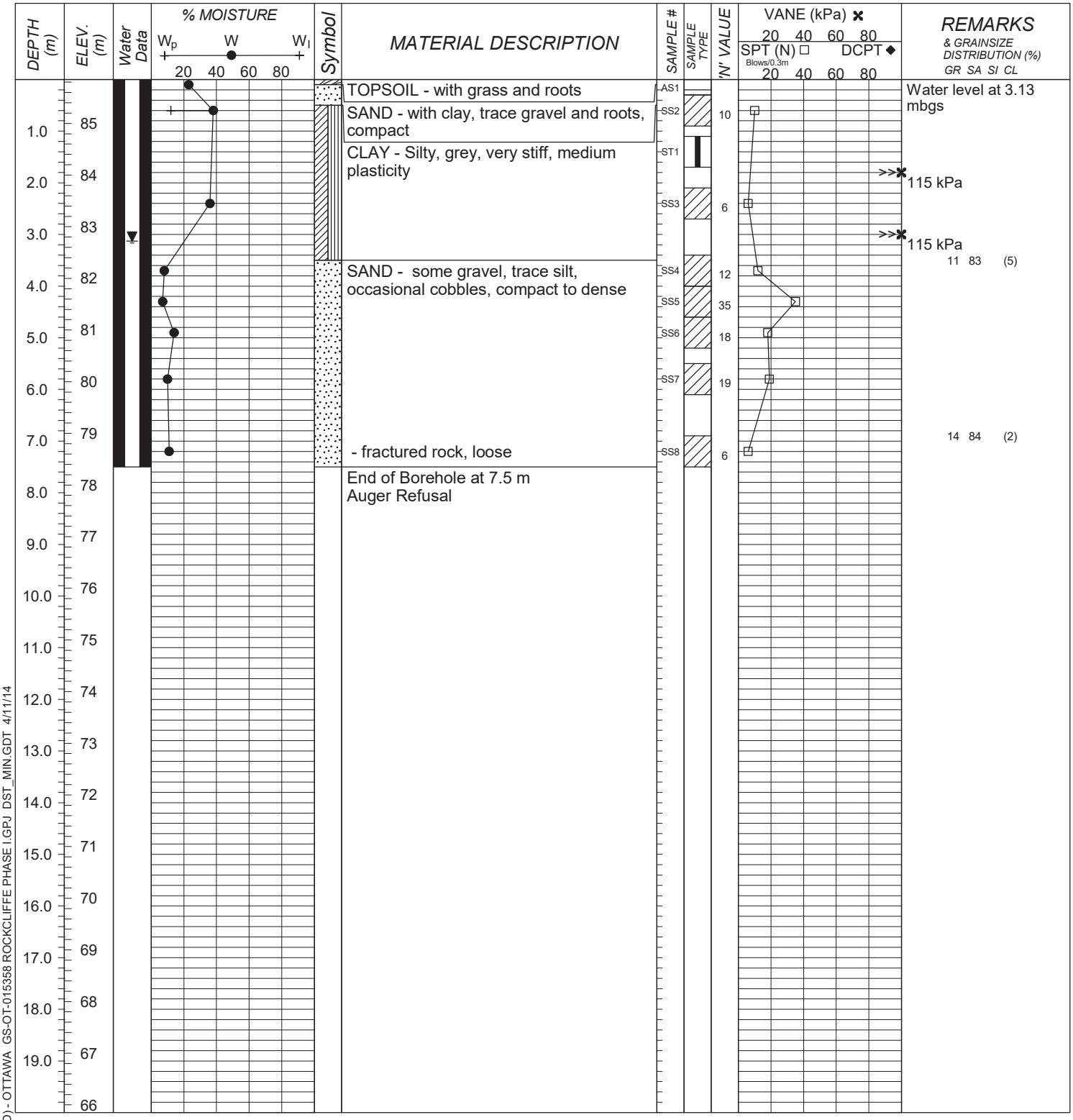
- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 11

LOG OF BOREHOLE BH14-30

DST REF. No.: **OE-OT-015358**
CLIENT: **Canada Lands Company**
PROJECT: **Former CFB Rockcliffe**
LOCATION: **Ottawa, Ontario**
SURFACE ELEV.: **85.85 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
DIAMETER: **80 mm ID**
DATE: **February 24, 2014**
COORDINATES: **5033327.89** m N, **450239.28** m E



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203 - 2150 THURSTON DRIVE
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SAMPLE TYPE LEGEND

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- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- 70mm Thin Wall Tube
- Bentonite
- Sand

ENCLOSURE 5

LOG OF TESTPIT TP13-03

DST REF. No.: **OE-OT-017184**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Stormwater Management Plan**
LOCATION: **Former CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **77.73 metres**

Testpit Data
METHOD: **Excavator**
DATE: **9/6/2013**
COORDINATES: **5033845.5** m N, **450226** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (Wp, W, Wl; 20 40 60 80)	Symbol	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ 20 40 60 80 / CPT (kPa) ◆ 300 600 900 1200	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0					FILL - SAND & GRAVEL - some roots, cobbles and boulders, dark brown					
0.2										
0.4					FILL - SAND - trace gravel and silt, light brown					
0.6					FILL - SAND - Gravelly, light brown					
0.8	77									
1.0					CLAY - Silty, stiff	1				
1.2										
1.4										
1.6									>>✱	130+ kPa
1.8	76									
2.0						2				
2.2					End of Testpit at 2.1 m Refusal					
2.4										
2.6										
2.8	75									
3.0						3				
3.2										
3.4										
3.6										
3.8	74									
4.0						4				
4.2										
4.4										
4.6										
4.8	73									

TESTPIT (STANDARD) - OTTAWA OE-OT-017184 CFB ROCKCLIFFE.GPJ DST_MIN.GDT 10/17/13

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FX: (613)748-1356
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SAMPLE TYPE LEGEND

Bulk Sample

ENCLOSURE 3

LOG OF TESTPIT TP13-04

DST REF. No.: **OE-OT-017184**
CLIENT: **Canada Lands Company (CLC)**
PROJECT: **Stormwater Management Plan**
LOCATION: **Former CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **84.31 metres**

Testpit Data
METHOD: **Excavator**
DATE: **9/6/2013**
COORDINATES: **5033718.5** m N, **450202.2** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	DEPTH(m)	SAMPLE TYPE	'N' VALUE	VANE (kPa) ✖ (20 40 60 80) / CPT (kPa) ◆ (300 600 900 1200)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0					FILL - SAND & GRAVEL - trace roots and silt, some cobbles, dark brown					
0.2	84									
0.4										
0.6					FILL - SAND - some silt, boulders and cobbles, grey					
0.8										
1.0						1				
1.2					SILT - Sandy, trace gravel					
1.4	83									
1.6										
1.8					End of Testpit at 1.8 m Refusal					
2.0						2				
2.2										
2.4	82									
2.6										
2.8										
3.0						3				
3.2										
3.4	81									
3.6										
3.8										
4.0						4				
4.2										
4.4	80									
4.6										
4.8										

TESTPIT (STANDARD) - OTTAWA OE-OT-017184 CFB ROCKCLIFFE.GPJ DST_MIN.GDT 10/17/13

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FX: (613)748-1356
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SAMPLE TYPE LEGEND

Bulk Sample

ENCLOSURE 4

LOG OF BOREHOLE BH12

DST REF. No.: **OG06562**
CLIENT: **Canada Lands Company**
PROJECT: **Preliminary Geotechnical Investigation**
LOCATION: **CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **76.39 m (Geodetic)**

Drilling Data
METHOD: **CME 75 Drill Rig**
DIAMETER: **200 mm**

DATE: **August 15 2006**

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE TYPE	'N' VALUE	VANE DATA (KPA)× 100 200 300 400; SPT (N)□ DCPT◆ 10 20 30 40	REMARKS
0	76				GRASS COVER					Standpipe installed to 3.1 m depth.
					SAND - silty, some gravel, trace boulders, very dense, brown to reddish orange (till)					
			●			SS1		100	>>□	
1										Groundwater level recorded at 1.8 m depth on August 24, 2006.
	75									
					BEDROCK - grey fossiliferous limestone bedrock with narrow horizons of black shale noted at ~ 90 degrees to core axis					Auger refusal at 1.5 m depth.
2										
						CR2				Recovery 98% RQD 87%
	74									
3										
					End of borehole at 3.1 m depth.					
	73									
4										
	72									

BOREHOLE (STANDARD) OG06562.GPJ DST_MIN.GDT 10/3/06

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PH: (613)748-1415
FX: (613)748-1356
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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Thin Wall Tube
- Rock Core
- Side Sampler
- Grab Sample
- Ponar Sample

APPENDIX D

LOG OF BOREHOLE / MONITORING WELL BHMW15 OB

DST REF. No.: **OG06562**
CLIENT: **Canada Lands Company**
PROJECT: **Preliminary Geotechnical Investigation**
LOCATION: **CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **76.22 m (Geodetic)**

Drilling Data
METHOD: **CME 75 Drill Rig**
DIAMETER: **200 mm**

DATE: **August 08 2006**

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE Wp W Wl (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE TYPE	'N' VALUE	VANE DATA (KPA)× 100 200 300 400; SPT (N)□ DCPT◆ 10 20 30 40	REMARKS
0	76				GRASS COVER					Well tag A019081
					CLAY - trace silt, olive grey, stiff					
1	75					SS1		13		Standpipe with a diametre of 20 mm installed to 3.4 m depth.
2	74					SS2		100	>>□	
					CLAY - silty, some sand and fragments of limestone, olive grey (till)					
					BEDROCK - possible weathered limestone bedrock	SS3		100	>>□	Groundwater level recorded at 3.2 m depth on August 24, 2006.
3	73				End of borehole at 3.4 m depth due to possible bedrock.					Auger refusal at 3.4 m depth.
4	72									

BOREHOLE (STANDARD) OG06562.GPJ DST_MIN.GDT 10/3/06

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SAMPLE TYPE LEGEND

Auger Sample
Split Spoon Sample
Thin Wall Tube
Rock Core
Side Sampler
Grab Sample
Ponar Sample

APPENDIX D

LOG OF BOREHOLE / MONITORING WELL BHMW15 BR

DST REF. No.: **OG06562**
CLIENT: **Canada Lands Company**
PROJECT: **Preliminary Geotechnical Investigation**
LOCATION: **CFB Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **76.22 m (Geodetic)**

Drilling Data
METHOD: **CME 75 Drill Rig**
DIAMETER: **200 mm**

DATE: **August 09 2006**

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE NUMBER	SAMPLE TYPE	'N' VALUE	VANE DATA (KPA)× 100 200 300 400; SPT (N)□ DCPT◆ 10 20 30 40	REMARKS
0	76									Auger advanced to 3.5 m depth.
1	75									Standpipe with a diametre of 20 mm installed to 15.8 m depth.
2	74									
3	73									
4	72				BEDROCK - dark grey shale and limestone bedrock, elongated fragments in a grey clay matrix, lower contact at ~ 80 degrees to core axis	CR1				Auger refusal at 3.5 m depth. Recovery 93% RQD 80%
5	71				BEDROCK - grey fossiliferous limestone bedrock with noted at ~ 90 degrees to core axis, narrow horizons of shale parting throughout, pyrite noted					
6	70					CR2				Recovery 97% RQD 80%
7	69					CR3				Recovery 98% RQD 92%
8	68									
9	67					CR4				Recovery 98% RQD 85%
10	66									
11	65					CR5				Recovery 98% RQD 92%
12	64					CR6				Recovery 97% RQD 87%
13	63									
14	62					CR7				Recovery 95% RQD 92%
15	61					CR8				Recovery 97% RQD 95%
16	60				End of borehole at 15.8 m depth.					
17	59									Groundwater level recorded at 5.5 m depth on August 24, 2006.
18	58									
19	57									

BOREHOLE (STANDARD) OG06562.GPJ DST_MIN.GDT 10/3/06

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PH: (613)748-1415
FX: (613)748-1356
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Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Thin Wall Tube
- Rock Core
- Side Sampler
- Grab Sample
- Ponar Sample

APPENDIX D

LOG OF BOREHOLE / MONITORING WELL BHMW5

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 45 Trailer Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **October 27 2004**

CCGD *		SAMPLES			SUBSURFACE PROFILE				
○ RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
		SS1		27		FILL - sand and gravel, compact to very dense, light brown	0.5			36 mm concrete slab
		SS2		>100			1.0			Groundwater level observed 2.7 m below grade on November 25, 2004.
		SS3		>100		- sand, silty, trace brick cinders, very dense, brownish grey	1.5			
		SS4		>100		TILL - sand, silty, trace clay and gravel, very dense to compact with depth, light brown	2.0			
		SS5		78			2.5			
		SS6		33			3.0			
		SS7		27			3.5			
	10						4.0			
						End of borehole at 4.3 m depth.				

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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW6

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 11 2004**

CCGD *		SAMPLES			SUBSURFACE PROFILE					REMARKS
○ RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	
						SURFACE				
						GRASS COVER				
	0	SS1		9		FILL - sand, silty, some gravel, trace clay, loose to compact, dark brown	0.5			Groundwater level observed 3.2 m below grade on November 25, 2004.
	0	SS2		21		- sand, some gravel, compact, orange brown	1.0			
	0	SS3		16		CLAY - silty, trace sand, very stiff to hard, brownish grey with limonite staining	1.5			
	0	SS4		48		- olive grey	2.0			
						- boulders	2.5			
	0	SS5		22		SAND - silty, some clay, compact to very dense, light brown	3.0			SS6: Insufficient sample recovery to collect duplicate fraction for CCGD
		SS6		89			3.5			
						End of borehole at 3.7 m depth.				

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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

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LOG OF BOREHOLE / MONITORING WELL BHMW12

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 15 2004**

CCGD *		SAMPLES			SUBSURFACE PROFILE					
○ RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
○	0	SS1		9		GRASS COVER FILL - sand, silty, loose, black - sand, silty, some gravel, very dense, light brown	0.5			Groundwater level observed 4.3 m below grade on November 25, 2004.
○	0	SS2		89			1.0			
		SS3		>100		BEDROCK - Limestone with silty sand seems throughout	1.5			
		RC1					2.0			Recovery = 97% RQD = 58%
							2.5			
							3.0			Recovery = 83% RQD = 30%
		RC2					3.5			
							4.0			
							4.5			
		RC3					5.0			Recovery = 100% RQD = 91%
							5.5			
							6.0			
		RC4					6.5			Recovery = 100% RQD = 80%
		RC5					7.0			Recovery = 100% RQD = 38%
							7.5			
		RC6					8.0			Recovery = 87% RQD = 77%
							8.5			
		RC7					9.0			Recovery = 82% RQD = 82%
						End of borehole at 9.5 m depth.				

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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW13

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 15 2004**

CCGD *		SAMPLES			SUBSURFACE PROFILE					
○ RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
○	0	SS1		6		GRASS COVER FILL - sand,silty, some gravel, trace of clay, loose, brown	0.5			Groundwater level observed 4.8 m below grade on November 25, 2004.
○	0	SS2		29		- sand, silty, gravel, compact, brown	1.0			
		SS3		17			1.5			
		SS4		100		- sand, silty, trace gravel and clay, loose to very dense, brown	2.0			
		RC1				BEDROCK- limestone, grey, fossiliferous, bedding noted at ~90° to core axis, surface highly weathered with limonite staining, narrow black shale horizons throughout	2.5			Recovery = 100% RQD = 65%
		RC2					3.5			Recovery = 85% RQD = 52%
		RC3					5.0			Recovery = 97% RQD = 70%
		RC4					6.0			
						End of borehole at 6.3 m depth.				

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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Poner Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW14

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 16 2004**

CCGD *	PPM	SAMPLES No.	Type	SPT N-Value	SYMBL	SUBSURFACE PROFILE MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
○ RKI EAGLE (PPM) 20 40 60 80 □ MINIRAE (PPM) 5 10 15 20						SURFACE				
	0	SS1		4		FILL - sand, silty, some gravel, loose to very dense, brown to reddish-brown	0.5			Groundwater level observed 4.3 m below grade on November 25, 2004.
	0	SS2		>100			1.0			Split spoon refusal at 1.0 m Auger from 1.0 to 1.5m
		SS3				SILT- light brown	1.5			
		RC1				BEDROCK - limestone, grey to dark grey, fossiliferous, bedding at 90° to core axis	2.0			Recovery = 100% RQD = 77%
		RC2					3.5			Recovery = 89% RQD = 70%
		RC3					5.0			Recovery = 98% RQD = 70%
		RC4					6.0			Recovery = 94% RQD = 94%
						End of borehole at 6.2 m depth.				

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FX: (613)748-1356
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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW15

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 16 2004**

CCGD *		SAMPLES			SUBSURFACE PROFILE					
○ RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
	0	SS1		15		GRASS COVER FILL - silty, trace gravel, compact to very loose, brown	0.5			Groundwater level observed 3.5 m below grade on November 25, 2004.
	0	SS2		8			1.0			
	0	SS3		8			1.5			
	0	SS4		2		- trace clay	2.0			Strong petroleum hydrocarbon odour noted at approximately 2.7 m
	0	SS5		10		TILL - clay, silty, compact, dark grey	2.5			
	0	SS6		>100			3.0			
	0	RC1				BEDROCK - limestone, grey, fossiliferous, bedding at ~90° to core axis with narrow black shale horizons	3.5			
							4.0			Recovery = 100% RQD = 69%
		RC2					4.5			
							5.0			Recovery = 100% RQD = 86%
		RC3					5.5			
							6.0			Recovery = 100% RQD = 51%
						End of borehole at 6.1 m depth.				

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SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW21

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 18 2004**

CCGD * (○ RKI EAGLE (PPM) 20 40 60 80; □ MINIRAE (PPM) 5 10 15 20)	PPM	SAMPLES No.	Type	SPT N-Value	SYMBL	SUBSURFACE PROFILE MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
						ASPHALT - ~100 mm thick				
		SS1		11		FILL - sand, some silt trace gravel compact to loose, brown	0.5			Groundwater level observed 2.8 m below grade on November 26, 2004.
○	0	SS2		6			1.0			
○	0	SS3		2		TILL - sand, silty, trace gravel, very loose to very dense, grey	1.5			
○	0	SS4		>100			2.0			Brick noted at 0.9 m depth
		RC1				BEDROCK - limestone, grey, fossiliferous with narrow black shale horizons, bedding at ~90° to core axis	2.5			Recovery = 100% RQD = 92%
		RC2					3.5			Recovery = 100% RQD = 49%
							4.0			
							4.5			
		RC3					5.0			
							5.5			Recovery = 100% RQD = 81%
							6.0			
						End of borehole at 6.3 m depth.				

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FX: (613)748-1356
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SAMPLE TYPE LEGEND

Auger Sample; Rock Core; Ponar Sample; Split Spoon Sample; Side Sampler; Thin Wall Tube; Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW22

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 18 2004**

CCGD *		SAMPLES			SUBSURFACE PROFILE					
○ RKI EAGLE (PPM) 20 40 60 80 □ MINIRAE (PPM) 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
						GRASS COVER				
						FILL - sand, silty, some gravel, loose				
○	0	SS1		6		CLAY- silty, firm	0.5			Groundwater level observed 2.0 m below grade on November 26, 2004.
○	0	SS2		9		TILL - silt, sandy, some gravel, reddish seams, loose to very dense, with depth, grey	1.0			
		SS3		23			1.5			
		SS4		>100			2.0			
		RC1				BEDROCK - limestone, dark grey, fossiliferous with narrow black shale horizon bedding noted at ~90° to core axis	2.5			Recovery = 100% RQD = 29%
		RC2					3.0			
							3.5			Recovery = 86% RQD = 68%
							4.0			
							4.5			
		RC3				- fault gouge at 4.6 m, limonite staining noted along fault face	5.0			Recovery = 100% RQD = 77%
							5.5			
		RC4					6.0			Recovery = 100% RQD = 93%
						End of Borehole at 6.3 m depth.				

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OTTAWA, ONTARIO, K1G 5T9
PH: (613)748-1415
FX: (613)748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

* - Catalytic Combustible Gas Detector

SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW23

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 22 2004**

CCGD *		SAMPLES			SUBSURFACE PROFILE					
○ RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
○	0	SS1		7		GRASS COVER FILL - sand, silty, organics, loose, black				
○	0	SS2		11		SAND- some silt, trace gravel, loose to compact, reddish seams throughout, light brown matrix	0.5 1.0			
○	0	SS3		7			1.5			Groundwater level observed 1.4 m below grade on November 26, 2004.
○	35	SS4		20			2.0			
○	0	SS5		>100		BEDROCK - limestone, grey, bedding at ~90° to core axis	2.5			
		RC1					3.0 3.5			Recovery = 100% RQD = 77%
		RC2					4.0 4.5 5.0			Recovery = 100% RQD = 79%
						End of borehole at 6.0 m depth.	5.5			

GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/06

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* - Catalytic Combustible Gas Detector

SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Ponar Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW24

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 55 Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **November 23 2004**

CCGD *		SAMPLES			SUBSURFACE PROFILE					
○ RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
		SS1		8		GRASS COVER FILL - sand, silty, some gravel, rootlets, loose	0.5			
		SS2		11			1.0			
○	0	SS3		>100		SILT - some sand, gravel, light brown, very dense	1.5			
		RC1				BEDROCK - limestone, grey, highly fractured, fossiferous with narrow black shale horizons, bedding at ~90° to core axis	2.0			Recovery = 73% RQD = 8%
							2.5			
		RC2					3.0			Groundwater level observed 3.1 m below grade on November 26, 2004.
							3.5			Recovery = 100% RQD = 59%
							4.0			
		RC3					4.5			
							5.0			Recovery = 100% RQD = 78%
							5.5			
							6.0			
						End of borehole at 6.2 m depth.				

GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/08

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Email: ottawa@dstgroup.com
Web: www.dstgroup.com

* - Catalytic Combustible Gas Detector

SAMPLE TYPE LEGEND

Auger Sample | Rock Core | Poner Sample
Split Spoon Sample | Side Sampler
Thin Wall Tube | Grab Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW25

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 45c Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **February 01 2005**

CCGD *		SAMPLES			SUBSURFACE PROFILE				
○ RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
○	0	SS1		17		FILL - sand, some gravel, trace silt and brick, compact, yellowish orange	0.5			
○	0	SS2		4		- sand, silty, trace gravel, loose	1.0			
○	0	SS3		3		- sand, silty, loose to compact with depth	1.5			
○	0	SS4		5			2.0			
○	0	SS5		16		- redish brown	2.5			Groundwater level observed 2.7 m below grade on February 2, 2005.
○	35	SS6		19		TILL - sand, some gravel, compact, grey	3.0			
○	5	SS7		41		- silt, trace gravel, grey, dense	3.5			
						End of borehole at 4.2 m depth on possible bedrock.	4.0			

GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/06

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PH: (613)748-1415
FX: (613)748-1356
Email: ottawa@dstgroup.com
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* - Catalytic Combustible Gas Detector

SAMPLE TYPE LEGEND

Auger Sample
Split Spoon Sample
Thin Wall Tube
Rock Core
Side Sampler
Grab Sample
Ponar Sample

APPENDIX H

LOG OF BOREHOLE / MONITORING WELL BHMW26

DST REF. No.: **OE04940**
CLIENT: **Canada Lands Company**
PROJECT: **Steam Line Decommissioning**
LOCATION: **Canadian Forces Base, Rockcliffe, Ottawa, Ontario**
SURFACE ELEV.: **--/--**

Drilling Data
METHOD: **CME 45c Track Mounted Drill Rig**
DIAMETER: **200 mm**

DATE: **February 01 2005**

CCGD *		SAMPLES				SUBSURFACE PROFILE				
○ RKI EAGLE (PPM) 20 40 60 80 □ *MINIRAE (PPM)* 5 10 15 20	PPM	No.	Type	SPT N-Value	SYMBL	MATERIAL DESCRIPTION	DPTH m	ELEV m	WATER DATA	REMARKS
						SURFACE				
○	0	SS1		21		FILL - sand, some silt, compact, brown	0.5			
○	5	SS2		15		- silt, sandy, compact, brown	1.0			
○	0	SS3		10		- sand, silty, compact, dark brown	1.5			
		SS4		5			2.0			
		SS5		7		- gravel, trace sand, loose, grey	2.5			Groundwater level observed 2.6 m below grade on February 2, 2005.
		SS6		4			3.0			
		SS7		3			3.5			
○	0	SS8		>100		TILL - silt, some gravel, trace clay, very dense, grey	4.0			
						End of borehole at 4.6 m depth on possible bedrock.	4.5			

GASTECBH (OTTAWA) OE04940.GPJ DST_MIN.GDT 10/3/06

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* - Catalytic Combustible Gas Detector

SAMPLE TYPE LEGEND

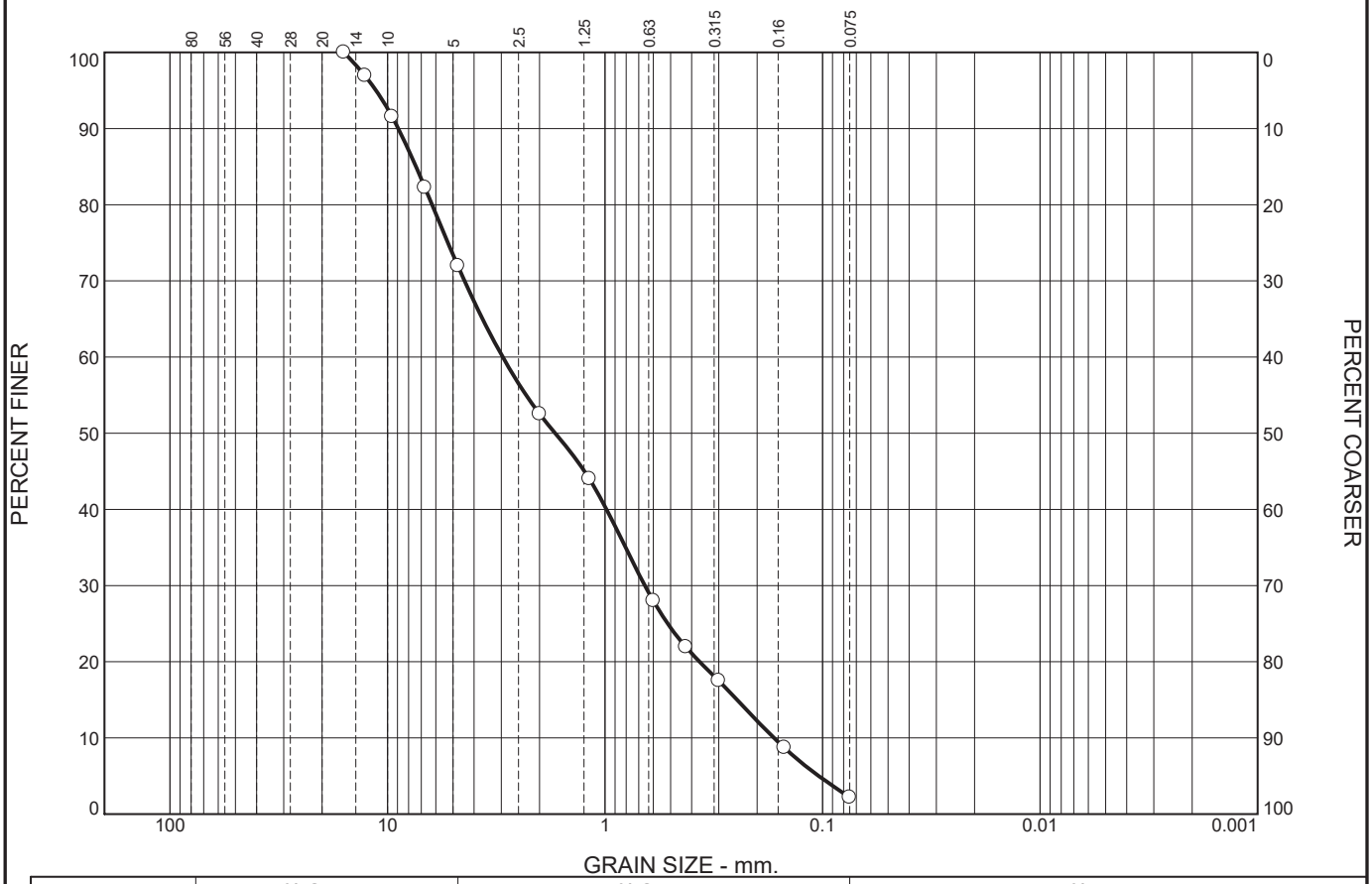
- Auger Sample
- Split Spoon Sample
- Thin Wall Tube
- Rock Core
- Side Sampler
- Grab Sample
- Ponar Sample

APPENDIX H

APPENDIX E

LABORATORY TEST RESULTS

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	28	19	31	20	2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			7.4037	2.9542	1.6966	0.6562	0.2470	0.1674	0.87	17.64

Material Description	USCS	AASHTO
○ GRAVELLY SAND, trace silt	SP	

Project No. CO682.00 **Client:** Canada Lands Company CLC Limited

Project: Wateridge Village

○ **Sample Number:** BH102/S1A

Remarks:

○Tested on November 28, 2018

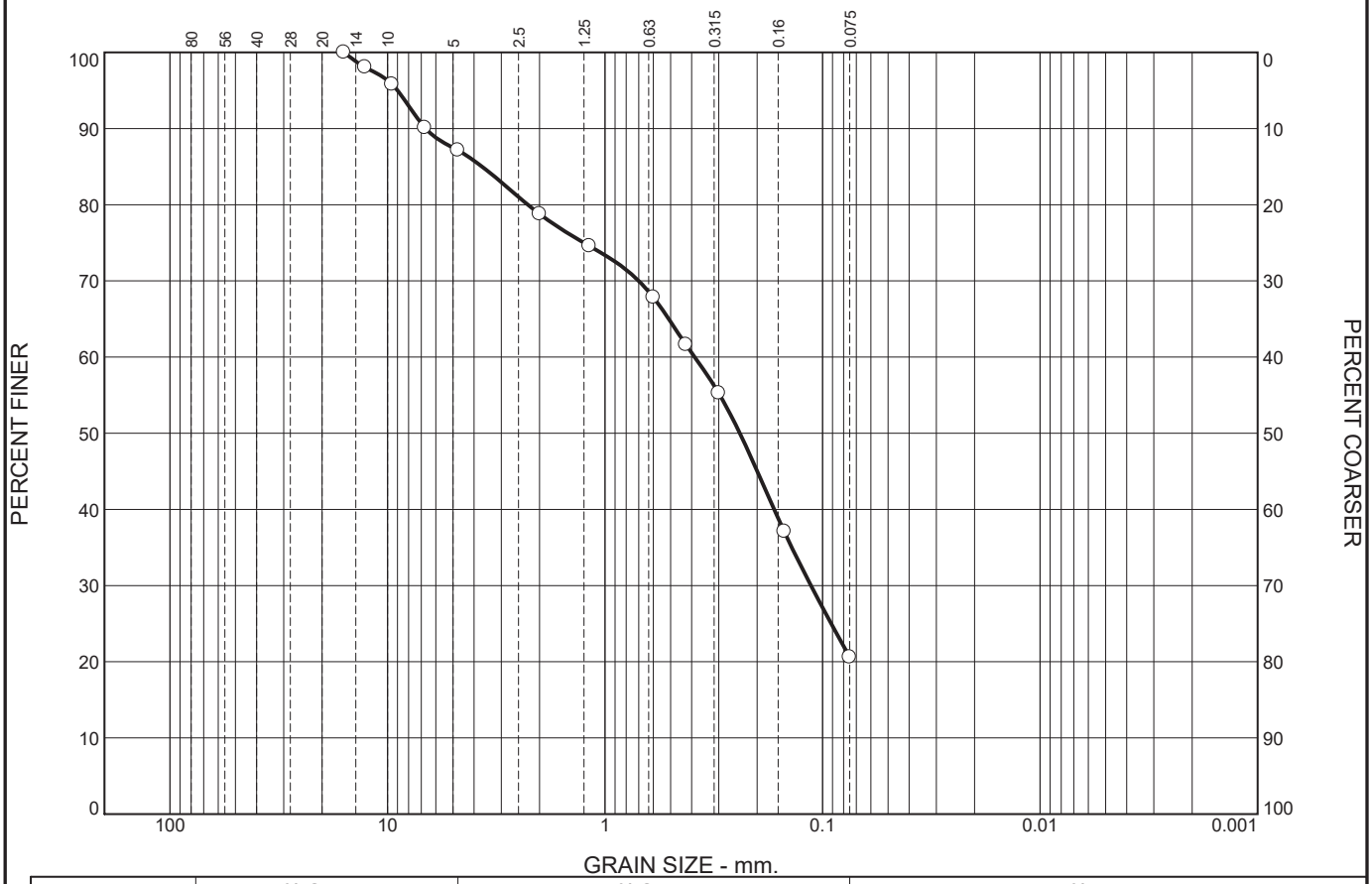
Alston Associates

Geotechnical Division of Terrapex

Figure E-1

Tested By: RH

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	13	8	17	41	21	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			3.6756	0.3876	0.2403	0.1131				

Material Description	USCS	AASHTO
○ SILTY SAND, some gravel		

Project No. CO682.00 **Client:** Canada Lands Company CLC Limited

Project: Wateridge Village

○ **Sample Number:** BH104/S3

Remarks:

○Tested on Nov 28, 2018

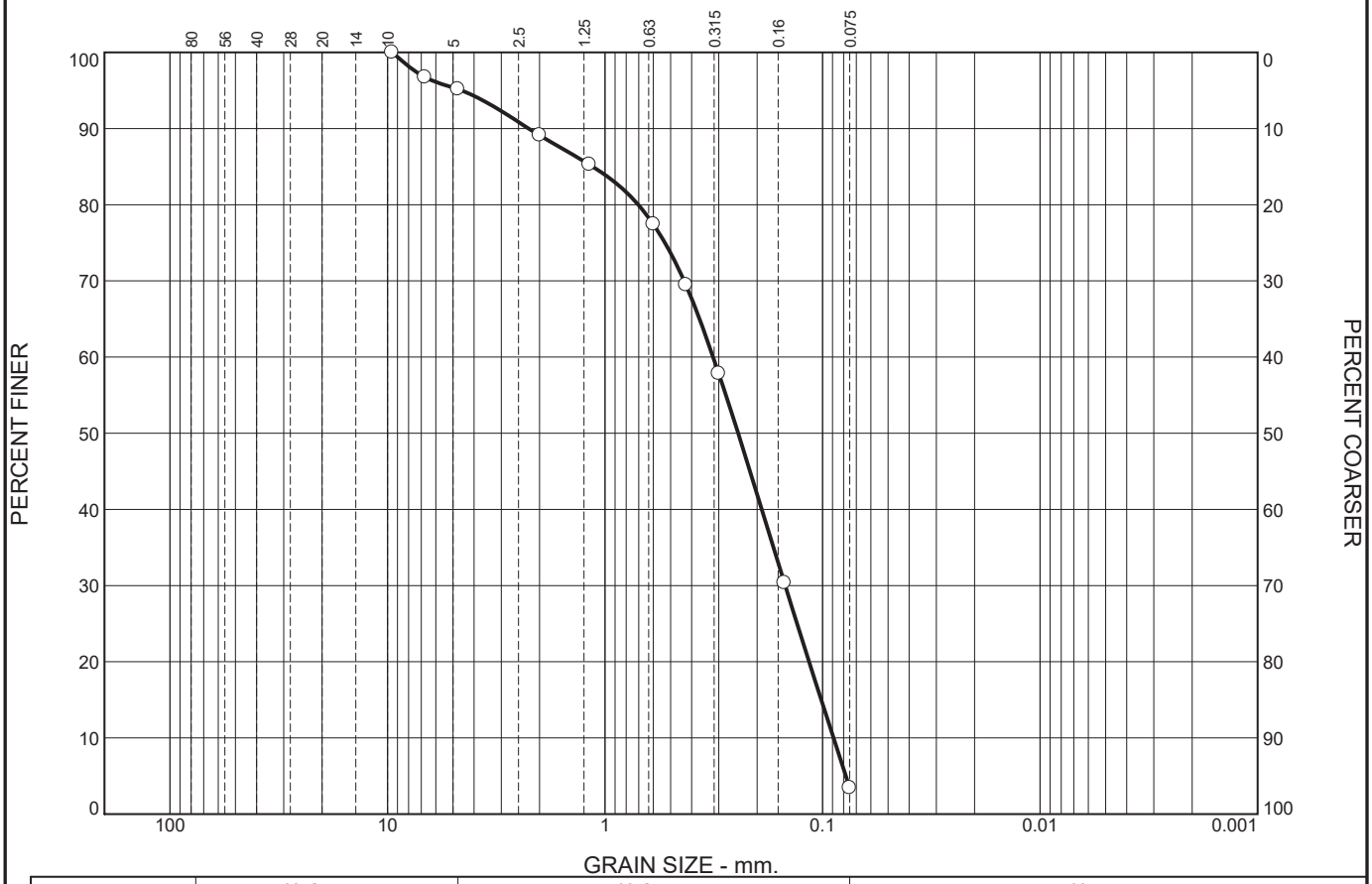
Alston Associates

Geotechnical Division of Terrapex

Figure E-2

Tested By: RH

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	5	6	20	66	3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.1403	0.3184	0.2444	0.1486	0.1014	0.0890	0.78	3.58

Material Description	USCS	AASHTO
○ SAND, trace gravel, trace silt	SP	

Project No. CO682.00 **Client:** Canada Lands Company CLC Limited

Project: Wateridge Village

○ **Sample Number:** BH140/S3

Remarks:

○Tested on November 28, 2018

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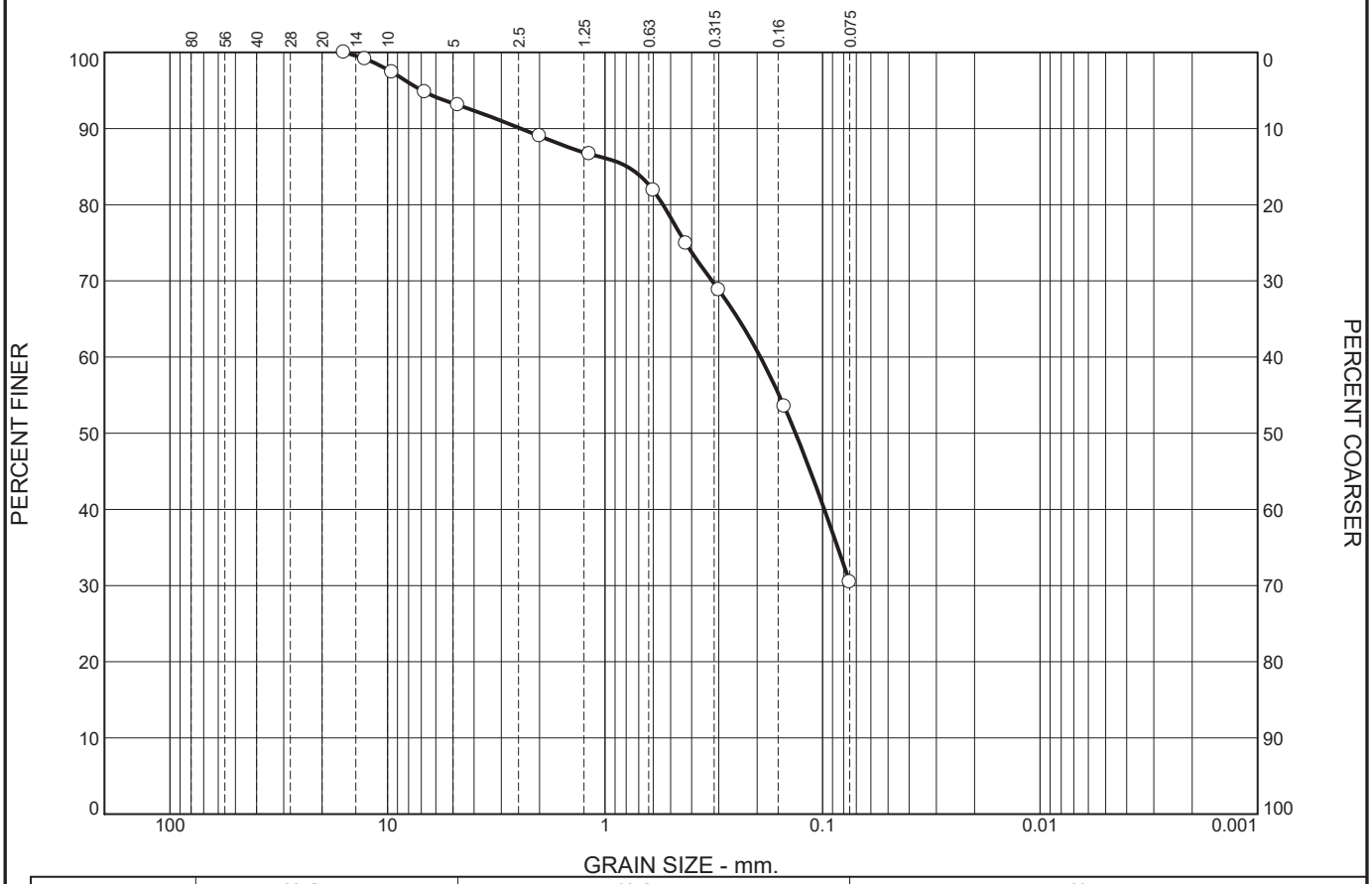
Figure E-3

Tested By: RH

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	7	4	14	45	30	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.7926	0.1932	0.1331					

Material Description	USCS	AASHTO
○ SILTY SAND, trace gravel		

Project No. CO682.00 **Client:** Canada Lands Company CLC Limited

Project: Wateridge Village

○ **Sample Number:** BH149/S2A

Remarks:

○Tested on November 28, 2018

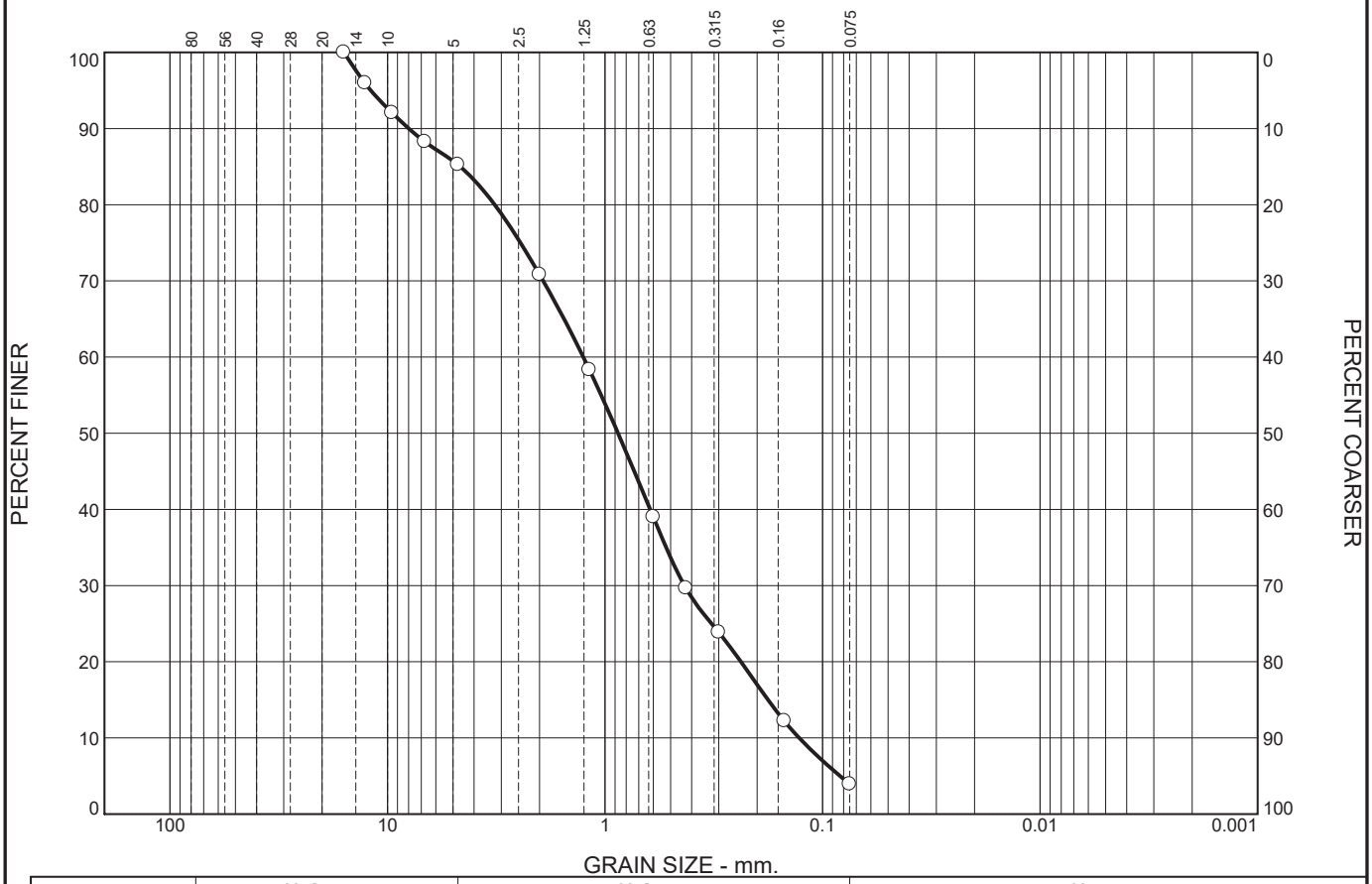
Alston Associates

Geotechnical Division of Terrapex

Figure E-4

Tested By: RH

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	15	14	41	26	4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			4.6338	1.2589	0.8719	0.4315	0.1782	0.1281	1.15	9.83

Material Description	USCS	AASHTO
○ SAND, some gravel, trace silt	SW	

Project No. CO682.00 **Client:** Canada Lands Company CLC Limited

Project: Wateridge Village

○ **Sample Number:** BH158/S3

Remarks:

○Tested on November 28, 2018

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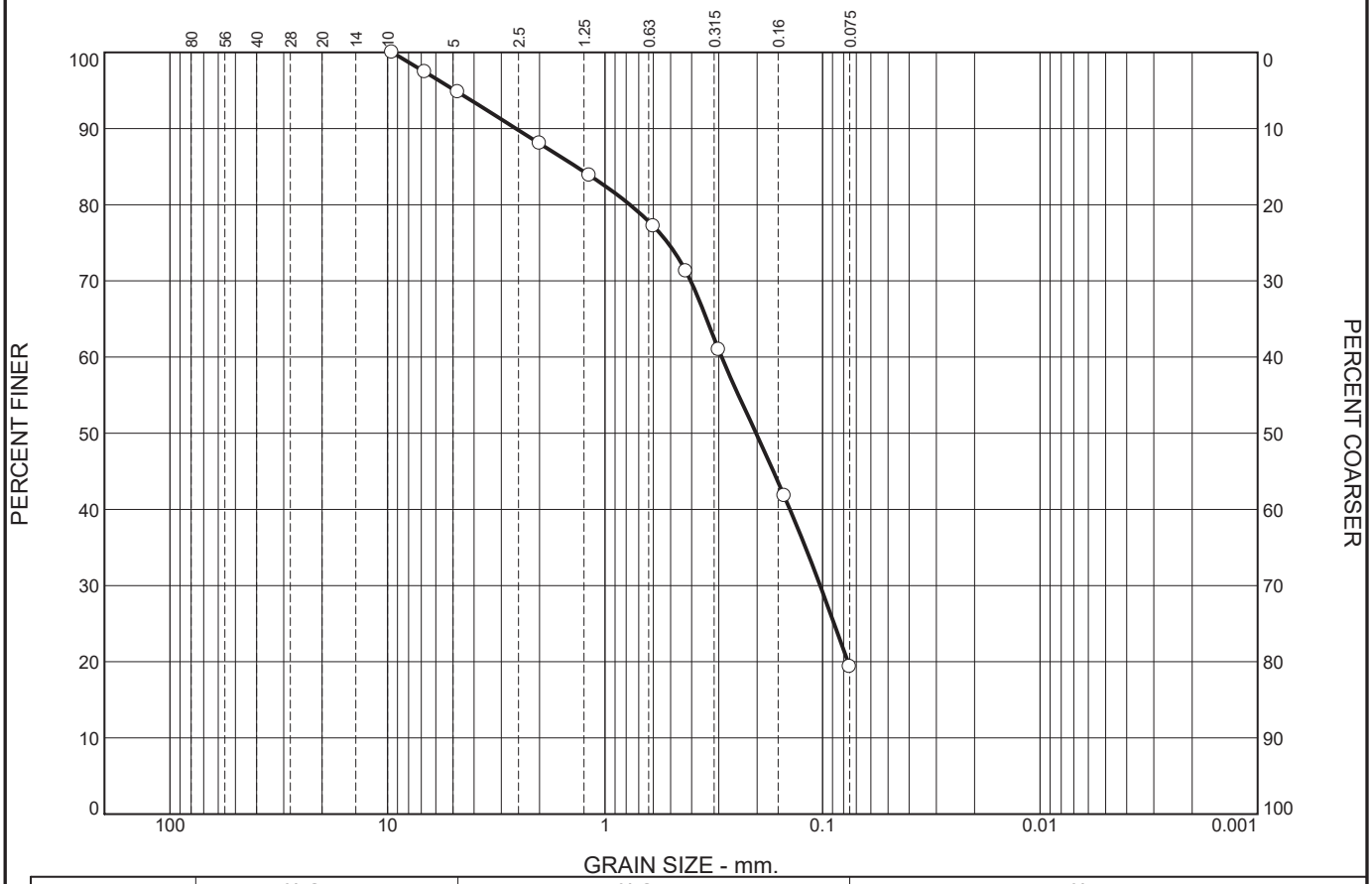
Figure E-5

Tested By: RH

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	5	7	17	52	19	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.3583	0.2907	0.2026	0.1028				

Material Description	USCS	AASHTO
○ SAND, some silt, trace gravel		

Project No. CO682.00 **Client:** Canada Lands Company CLC Limited

Project: Wateridge Village

○ **Sample Number:** BH163/S4

Remarks:

○Tested on November 28, 2018

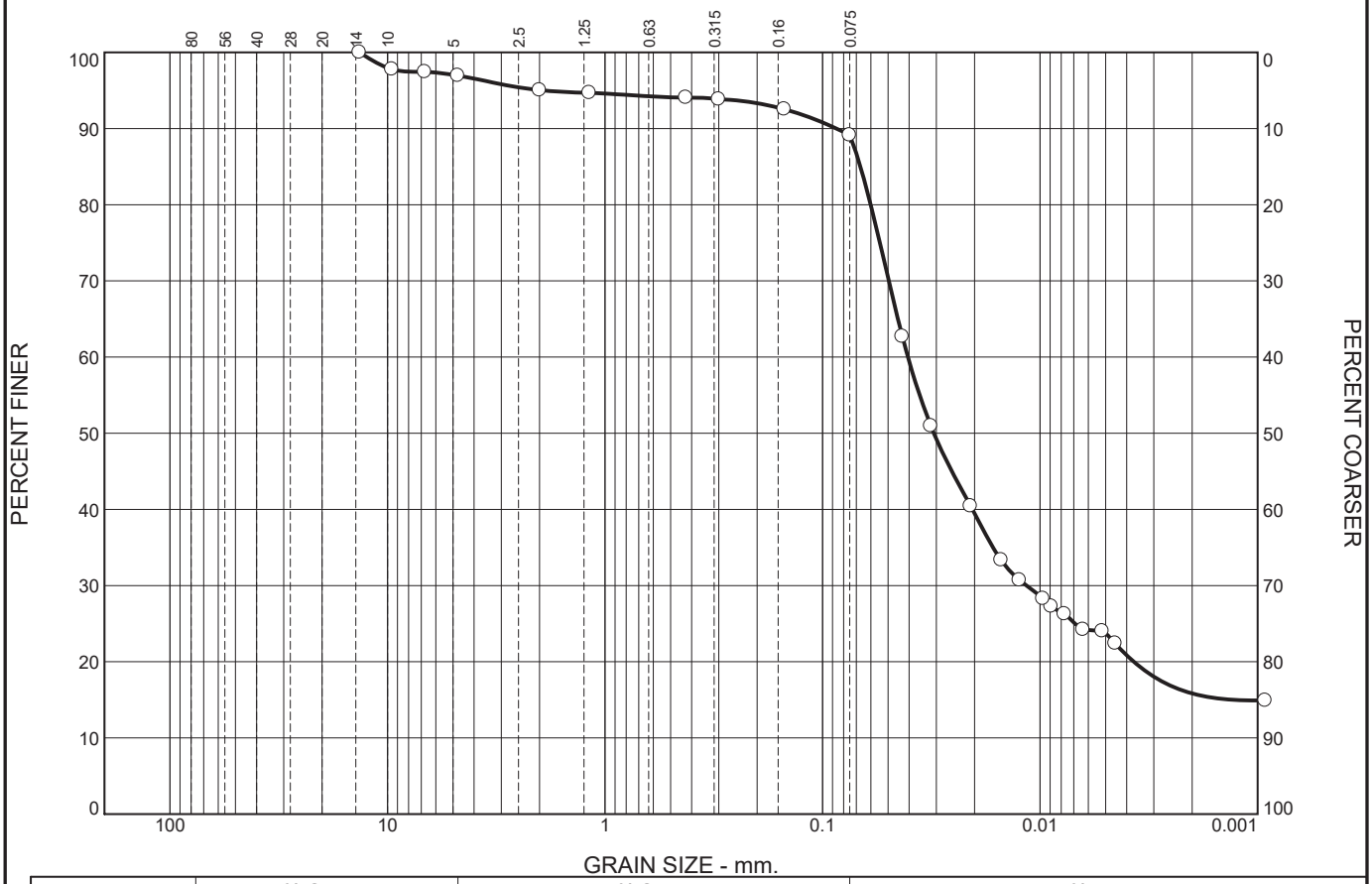
Alston Associates

Geotechnical Division of Terrapex

Figure E-6

Tested By: RH

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	3	2	1	5	73	16

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0670	0.0405	0.0308	0.0116	0.0013			

Material Description	USCS	AASHTO
○ SILT, some clay, trace sand, trace gravel		

Project No. CO682.00 **Client:** Canada Lands Company CLC Limited

Project: Wateridge Village

○ **Sample Number:** BH112/S2

Remarks:

○Tested on November 28, 2018

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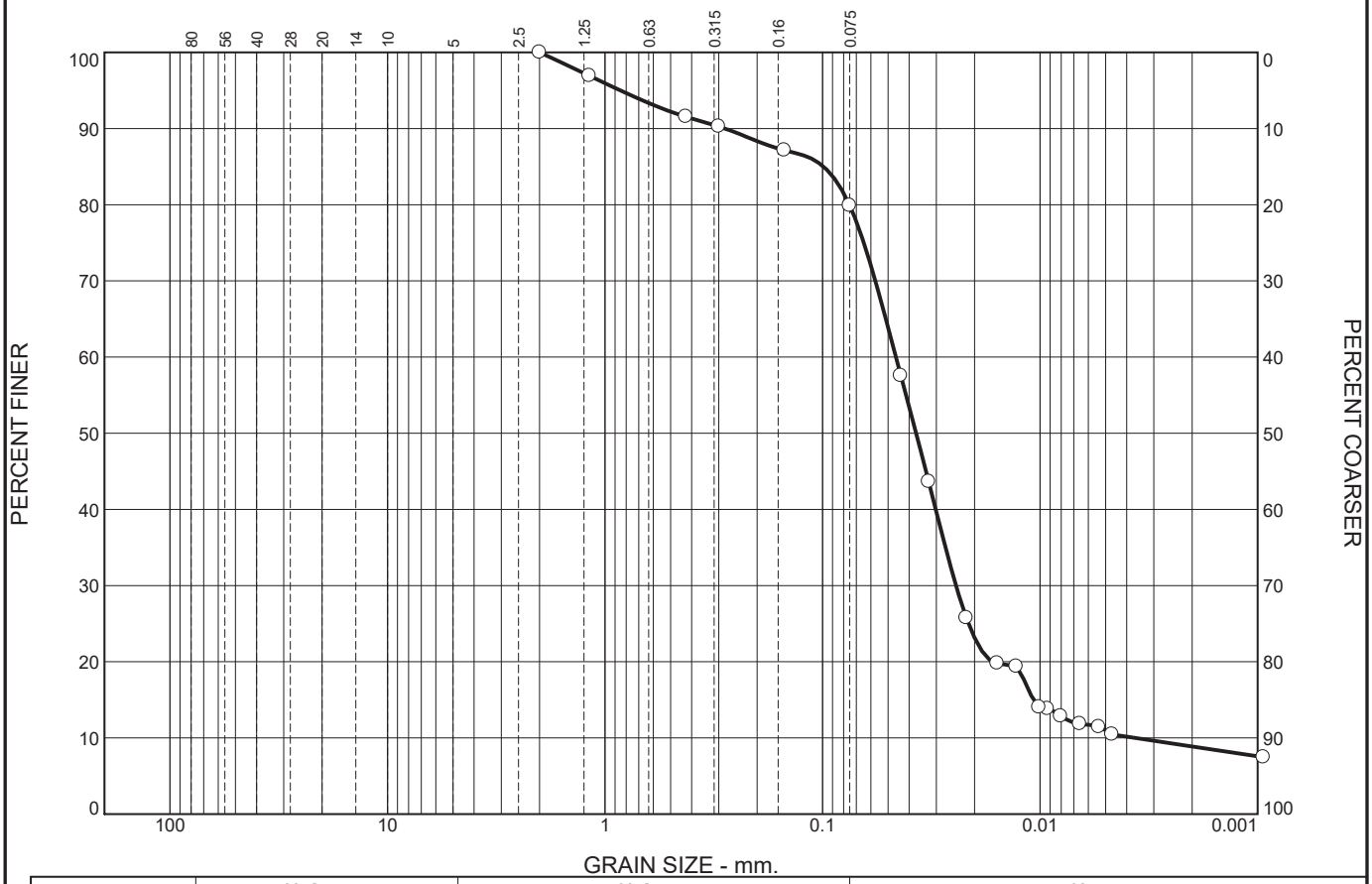
Geotechnical Division of Terrapex

Figure E-7

Tested By: RH

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	8	12	71	9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0990	0.0460	0.0372	0.0244	0.0107	0.0037	3.53	12.58

Material Description	USCS	AASHTO
○ SILT, some sand, trace clay		

Project No. CO682.00 **Client:** Canada Lands Company CLC Limited

Project: Wateridge Village

○ **Sample Number:** BH120/S2

Remarks:

○Tested on November 28, 2018

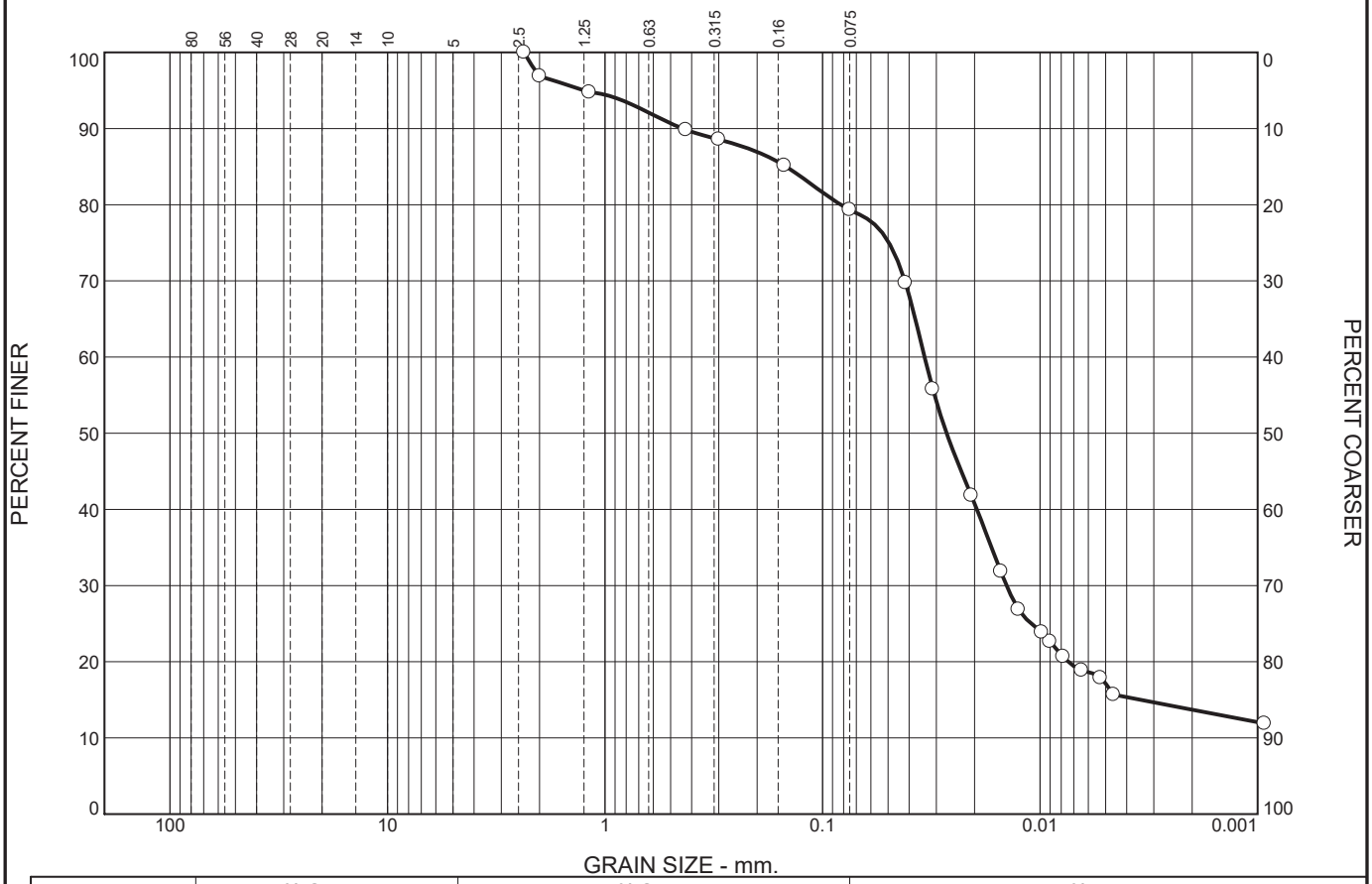
Alston Associates

Geotechnical Division of Terrapex

Figure E-8

Tested By: RH

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	3	7	11	65	14

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1472	0.0340	0.0269	0.0143	0.0035			

Material Description	USCS	AASHTO
○ SILT, some sand, some clay		

Project No. CO682.00 **Client:** Canada Lands Company CLC Limited

Project: Wateridge Village

○ **Sample Number:** BH152/S4

Remarks:

○Tested on November 28, 2018

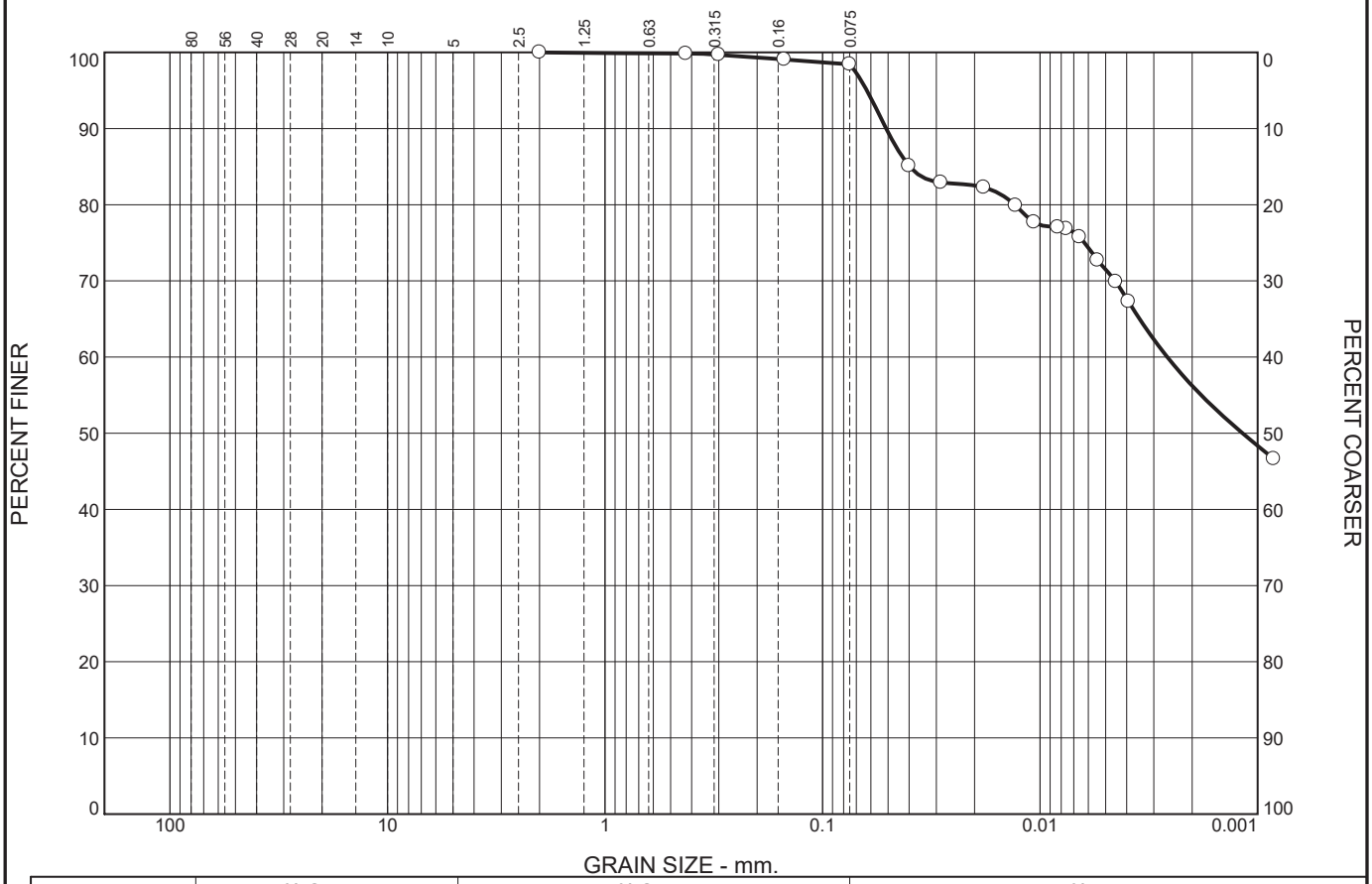
Alston Associates

Geotechnical Division of Terrapex

Figure E-9

Tested By: RH

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	0	2	42	56

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0398	0.0026	0.0012					

Material Description	USCS	AASHTO
○ CLAY and SILT, trace sand		

Project No. CO682.00 **Client:** Canada Lands Company CLC Limited

Project: Wateridge Village

○ **Sample Number:** BH104/S2

Remarks:

○Tested on November 28, 2018

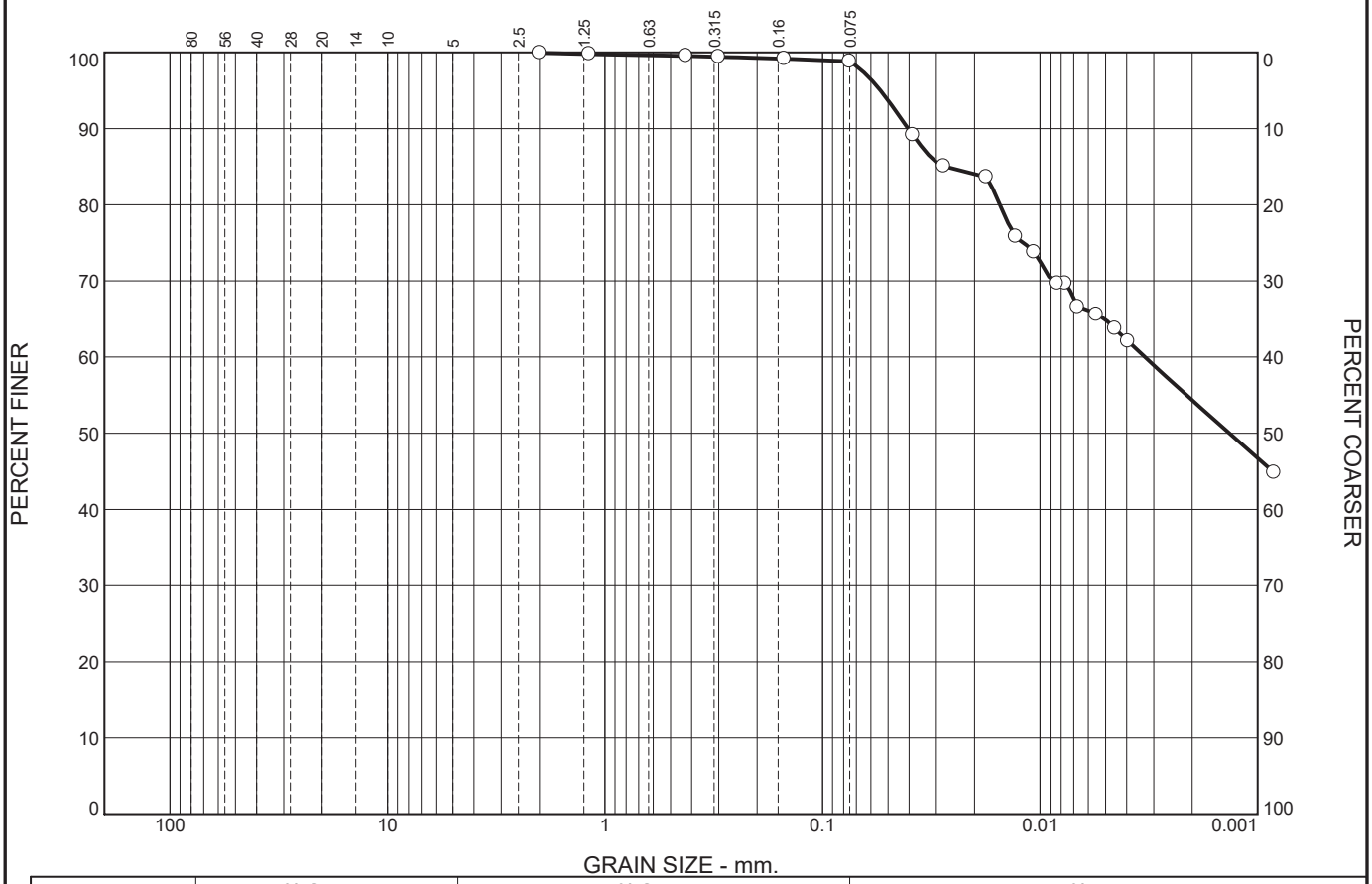
Alston Associates

Geotechnical Division of Terrapex

Figure E-10

Tested By: RH

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○					0	1	45	54

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	58	24	0.0272	0.0033	0.0013					

Material Description	USCS	AASHTO
○ CLAY and SILT, trace sand		A-7-6(39)

Project No. CO682.00 **Client:** Canada Lands Company CLC Limited

Project: Wateridge Village

○ **Sample Number:** BH125/S3

Remarks:

○Tested on November 30, 2018

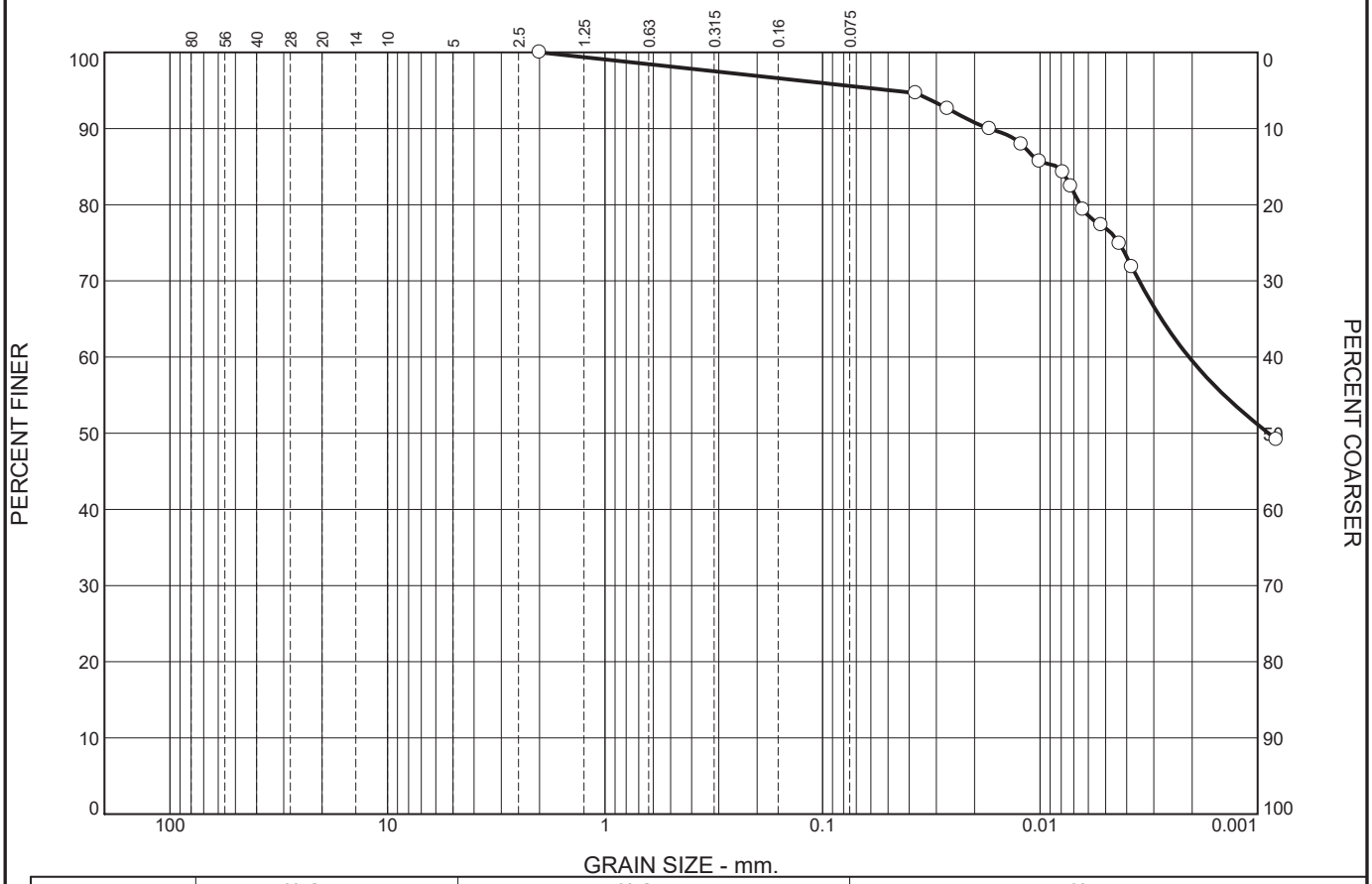
Alston Associates

Geotechnical Division of Terrapex

Figure E-11

Tested By: RH

Grain Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	0	2	2	37	59

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0084	0.0021	0.0009					

Material Description	USCS	AASHTO
○ CLAY and SILT, trace sand		

Project No. CO682.00 **Client:** Canada Lands Company CLC Limited

Project: Wateridge Village

○ **Sample Number:** BH134/S2

Remarks:

○Tested on November 30, 2018

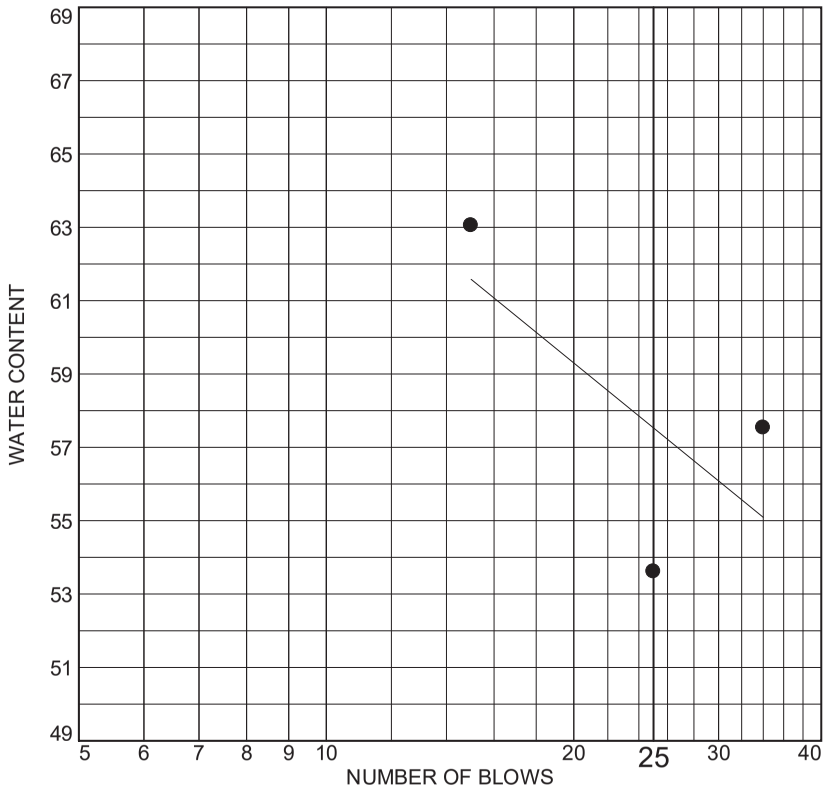
Alston Associates

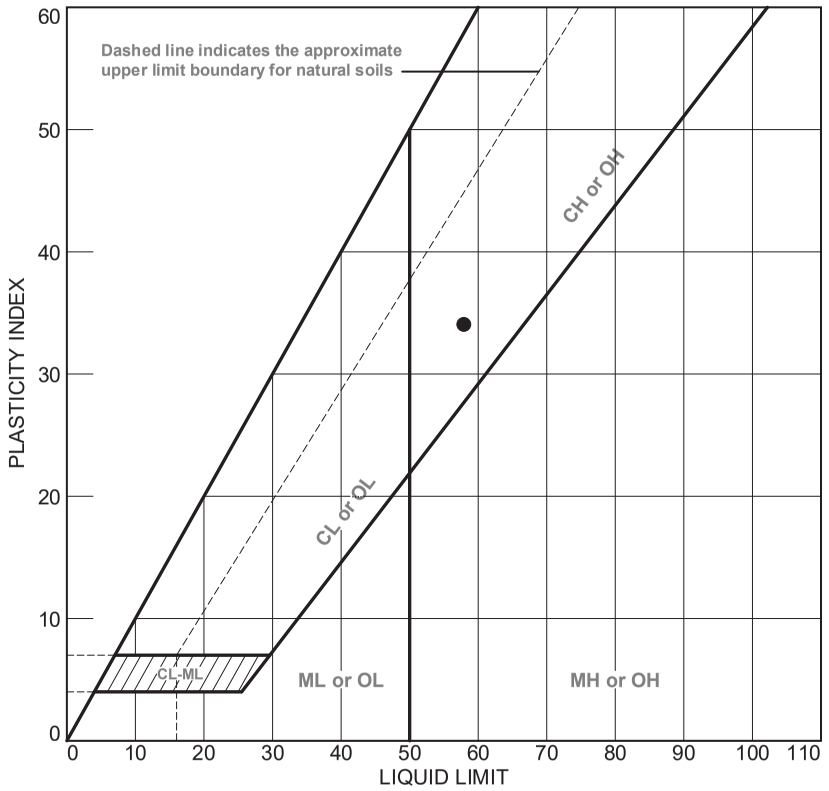
Geotechnical Division of Terrapex

Figure E-12

Tested By: RH

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●		BH125-3				CLAY and SILT, trace sand		58	34

Client Canada Lands Company CLC Limited

Project Wateridge Village

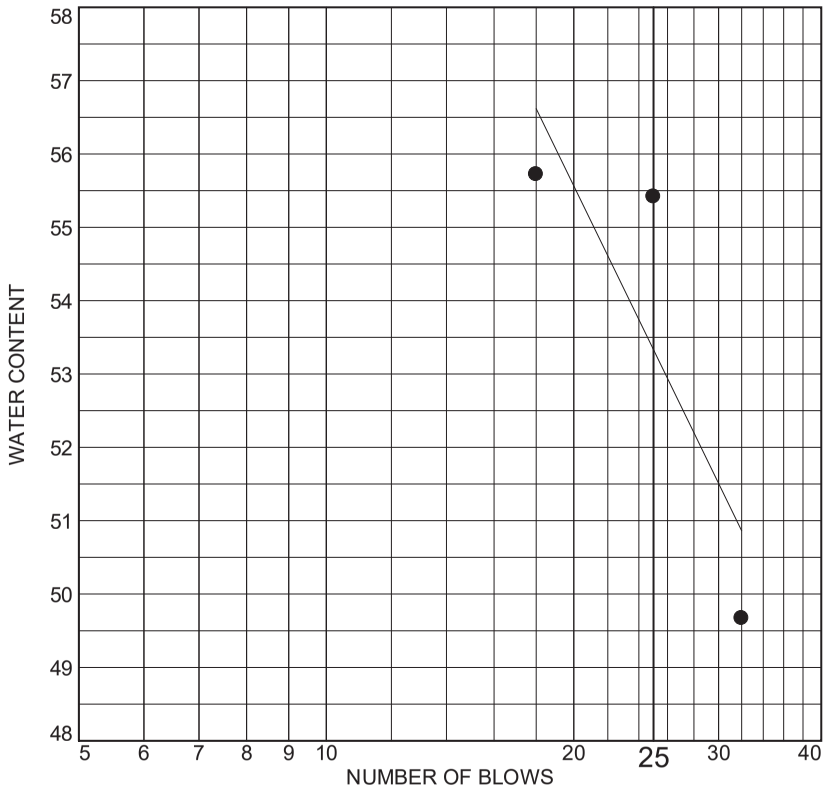
Project No. CO682.00 Figure E-13

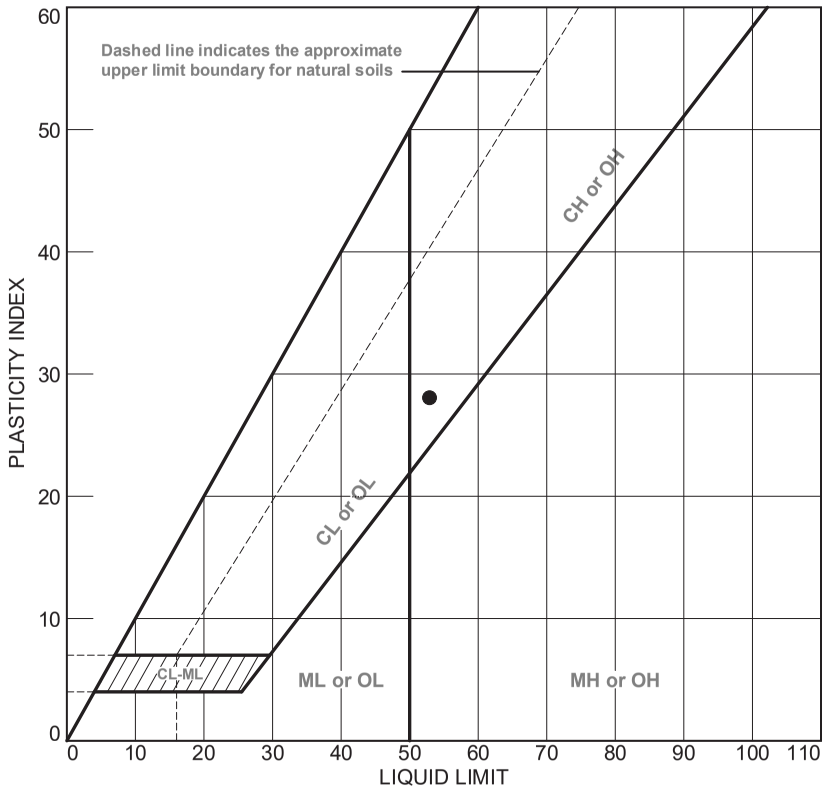
Alston Associates

Geotechnical Division of Terrapex

Tested By: RH

LIQUID AND PLASTIC LIMITS TEST REPORT





	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PI
●		BH134-2				CLAY and SILT		53	28

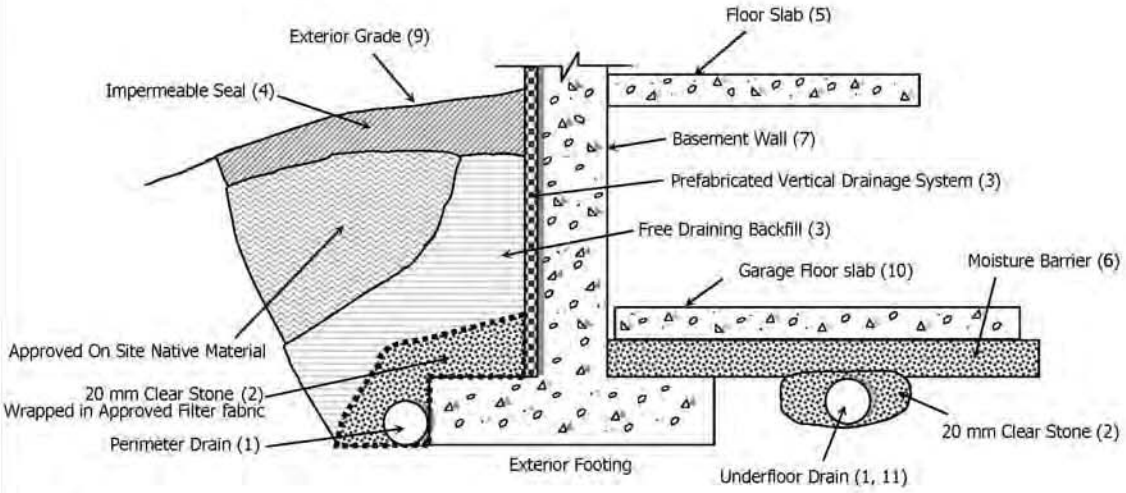
Client Canada Lands Company CLC Limited	**Alston Associates**	
Project Wateridge Village		
Project No. CO682.00 Figure E-14	**Geotechnical Division of Terrapex**	

Tested By: RH

APPENDIX F

TYPICAL DRAINAGE SYSTEM

Drainage and Backfill Details



Notes

1. Perimeter and underfloor drains shall consist of 100 mm diameter weeping tile with fabric sock or equivalent perforated pipe leading to a positive sump or outlet. Invert to be a minimum of 300 mm below underside of garage floor slab. Perimeter drain is required for sections of garage wall installed below exterior grade.
2. 20 mm Clear Stone – 150 mm top and side of drain, surrounded by approved filter fabric (Terrafix 270R or equivalent).
3. Free Draining backfill – OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm of the wall. Use hand controlled light compaction equipment within 1.8 m of wall. Free draining backfill is not required if a prefabricated vertical drainage system (such as Miradrain 6000) is installed on the exterior of the basement wall.
4. Impermeable backfill seal (min. 600 mm) – relatively impervious compacted silty clay, clayey silt or equivalent. If on-site native backfill is impermeable, seal may be omitted.
5. Do not backfill until wall is supported by garage and floor slabs or adequate bracing.
6. Moisture barrier to be at least 200 mm of compacted 20 mm clear stone or equivalent free draining material.
7. Basement wall to be damp-proofed.
9. Exterior grade to slope away from building at minimum gradient of 2%.
10. Garage floor slab should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm below underside of floor slab. Drainage tile placed in parallel rows at 10 m centre to centre. Place drain on 100 mm of 20 mm clear stone with 150 mm of clear stone on top and sides. Do not connect the underfloor drains to perimeter drains.

DRAINAGE AND BACKFILL RECOMMENDATIONS
(Not to Scale)

alston associates
geotechnical division of TERRAPEX

APPENDIX G

CERTIFICATE OF CHEMICAL ANALYSES

Maxxam
A Bureau Veritas Group Company

Your Project #: CO682.00
Site Location: WATERIDGE VILLAGE
Your C.O.C. #: 117522

Attention: Rachel Herzog

Terrapex Environmental Ltd
1-20 Gurdwara Rd.
Ottawa, ON
CANADA K2E 8B3

Report Date: 2018/12/20
Report #: R5534330
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B8X8071
Received: 2018/12/18, 11:30

Sample Matrix: Soil
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Anions (1)	4	2018/12/20	2018/12/20	CAM SOP-00435	SM 23 4110 B m
Moisture (1)	4	N/A	2018/12/19	CAM SOP-00445	Carter 2nd ed 51.2 m
pH CaCl2 EXTRACT (1)	4	2018/12/20	2018/12/20	CAM SOP-00413	EPA 9045 D m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Maxxam Analytics Mississauga

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Alisha Williamson, Project Manager
Email: AWilliamson@maxxam.ca
Phone# (613) 274-0573

Your Project #: CO682.00
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==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 32 Colonnade Rd, Unit #1000, Nepean, ON K2E 7J6 Phone: 613 274-0573 Fax: 613 274-0574 Website: www.maxxam.ca

Maxxam Job #: B8X8071
Report Date: 2018/12/20

Terrapex Environmental Ltd
Client Project #: CO682.00
Site Location: WATERIDGE VILLAGE
Sampler Initials: RH

RESULTS OF ANALYSES OF SOIL

Maxxam ID		IOS514	IOS515	IOS516	IOS517			IOS517		
Sampling Date		2018/12/11 14:15	2018/12/11 14:00	2018/12/11 13:30	2018/12/11 13:45			2018/12/11 13:45		
COC Number		117522	117522	117522	117522			117522		
	UNITS	**BH108-2**	**BH127-2**	**BH153-3**	**BH156-2**	**RDL**	**QC Batch**	**BH156-2 Lab-Dup**	**RDL**	**QC Batch**
Inorganics										
Moisture	%	20	15	11	10	1.0	5896681			
Available (CaCl2) pH	pH	7.58	7.54	7.66	7.77		5898613			
Chloride (Cl-)	ug/g	ND	ND	ND	ND	10	5898620	ND	10	5898620
Sulphate (SO4)	ug/g	98	26	ND	ND	20	5898620	24	20	5898620

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
ND = Not detected

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Terrapex Environmental Ltd
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Sampler Initials: RH

TEST SUMMARY

Maxxam ID: IOS514 **Collected:** 2018/12/11
Sample ID: BH108-2 **Shipped:**
Matrix: Soil **Received:** 2018/12/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	5898620	2018/12/20	2018/12/20	Fari Dehdezi
Moisture	BAL	5896681	N/A	2018/12/19	Prgya Panchal
pH CaCl2 EXTRACT	AT	5898613	2018/12/20	2018/12/20	Gnana Thomas

Maxxam ID: IOS515 **Collected:** 2018/12/11
Sample ID: BH127-2 **Shipped:**
Matrix: Soil **Received:** 2018/12/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	5898620	2018/12/20	2018/12/20	Fari Dehdezi
Moisture	BAL	5896681	N/A	2018/12/19	Prgya Panchal
pH CaCl2 EXTRACT	AT	5898613	2018/12/20	2018/12/20	Gnana Thomas

Maxxam ID: IOS516 **Collected:** 2018/12/11
Sample ID: BH153-3 **Shipped:**
Matrix: Soil **Received:** 2018/12/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	5898620	2018/12/20	2018/12/20	Fari Dehdezi
Moisture	BAL	5896681	N/A	2018/12/19	Prgya Panchal
pH CaCl2 EXTRACT	AT	5898613	2018/12/20	2018/12/20	Gnana Thomas

Maxxam ID: IOS517 **Collected:** 2018/12/11
Sample ID: BH156-2 **Shipped:**
Matrix: Soil **Received:** 2018/12/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	5898620	2018/12/20	2018/12/20	Fari Dehdezi
Moisture	BAL	5896681	N/A	2018/12/19	Prgya Panchal
pH CaCl2 EXTRACT	AT	5898613	2018/12/20	2018/12/20	Gnana Thomas

Maxxam ID: IOS517 Dup **Collected:** 2018/12/11
Sample ID: BH156-2 **Shipped:**
Matrix: Soil **Received:** 2018/12/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anions	IC	5898620	2018/12/20	2018/12/20	Fari Dehdezi

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Report Date: 2018/12/20

Terrapex Environmental Ltd
Client Project #: CO682.00
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Sampler Initials: RH

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	1.0°C

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
5896681	JS9	RPD	Moisture	2018/12/19	2.4		%	20
5898613	GTO	Spiked Blank	Available (CaCl2) pH	2018/12/20		100	%	97 - 103
5898613	GTO	RPD	Available (CaCl2) pH	2018/12/20	0.40		%	N/A
5898620	FD	Matrix Spike [IOS517-01]	Chloride (Cl-)	2018/12/20		NC	%	70 - 130
			Sulphate (SO4)	2018/12/20		NC	%	75 - 125
5898620	FD	Spiked Blank	Chloride (Cl-)	2018/12/20		98	%	70 - 130
			Sulphate (SO4)	2018/12/20		99	%	75 - 125
5898620	FD	Method Blank	Chloride (Cl-)	2018/12/20	ND, RDL=10		ug/g	
			Sulphate (SO4)	2018/12/20	ND, RDL=20		ug/g	
5898620	FD	RPD [IOS517-01]	Chloride (Cl-)	2018/12/20	NC		%	35
			Sulphate (SO4)	2018/12/20	19		%	35

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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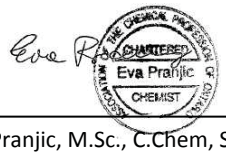
VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

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