Site Servicing and Stormwater Management Brief – Petrie's Landing III Block 8 Ottawa, ON

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Prepared for:
Brigil Homes

Prepared by:
Stantec Consulting Ltd.

February 18, 2022

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Sign-off Sheet

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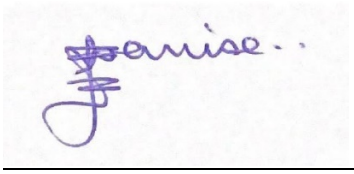
Prepared by  _____

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1.0 INTRODUCTION

The following revised Site Servicing and Stormwater Management (SWM) Brief has been prepared to reflect the revised site plan and to address City comments issued on November 9, 2021 to the third submission of September 2021. Specifically, the site plan has been revised slightly and changes relating to City comments have been included in this submission. The drawings have been revised to reflect the revised site plan and to address City comments and the results of the revised servicing analyses are summarized in this report. A summary of recent City comments and responses are included in **Appendix 0**

Stantec Consulting Ltd. has been retained by Brigil Homes to prepare the following site servicing and stormwater management (SWM) brief to satisfy the City of Ottawa Site Plan Control Application process. The 0.75 ha site is located on 180 Prestige Circle, with the Highway 174 to the south, Jeanne D'Arc Boulevard to the north, Bellevue creek and a residential development to the east, and Brisebois Creek and its associated stormwater management (SWM) facility to the west in the City of Ottawa (see **Figure 1** below).

Introduction
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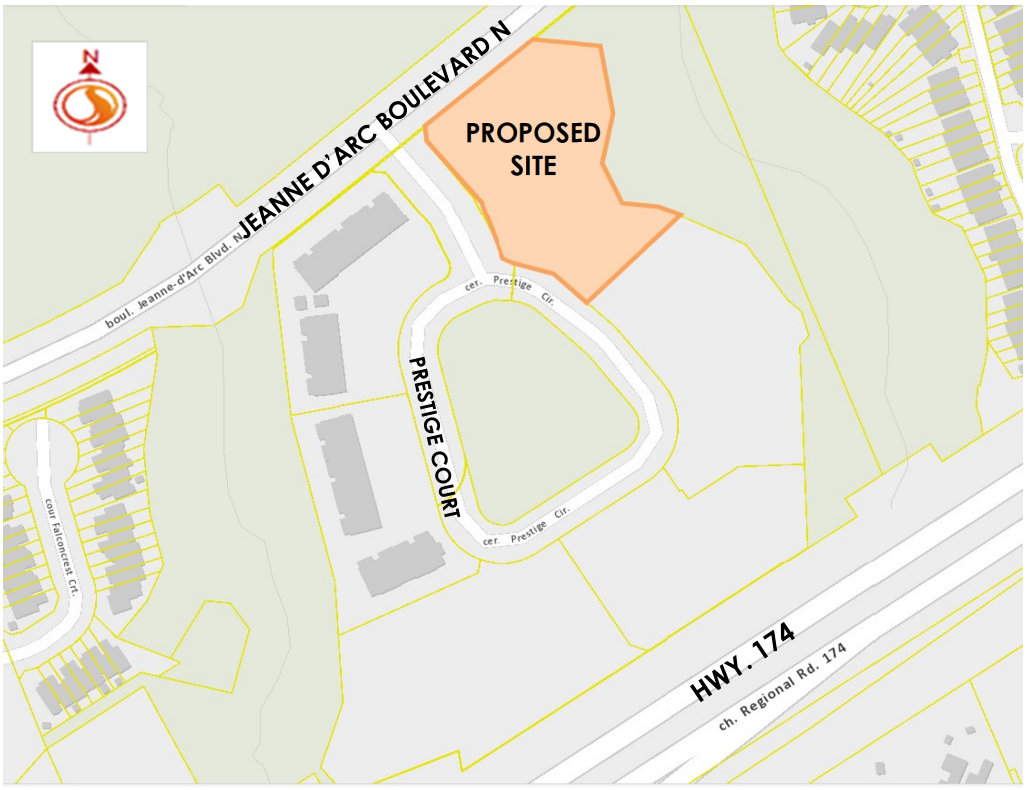


Figure 1: Site location

The proposed Block 8 is part of an existing development for which IBI prepared a servicing analysis for Blocks 1 to 5. Stantec completed the detailed design of Blocks 6 and 7 and outlined servicing criteria for Block 8 based on site plan assumptions. Block 8 is presently zoned R5 (Residential Fifth Density Zone) and consists of a four-storey residential building comprising 112 residential units comprising of studio (2 units), 1-bedroom (90 units), 2-bedroom (16 units) and 3-bedroom (4 units) apartments with associated surface and underground parking totaling 159 parking spaces consisting of 137 underground parking and 22 surface parking, communal amenity, 56 bicycle parking space and landscape areas. A copy of the proposed site plan prepared by Neuf Architect(e)s dated February 7th, 2022 can be found in **Appendix F**.

The intent of this report is to provide a servicing scenario for the site that is free of conflicts, provides on-site servicing in accordance with City of Ottawa design guidelines, and utilizes the existing local infrastructure in accordance with the guidelines outlined through consultation with City of Ottawa staff.

2.0 BACKGROUND

The following background studies have been referenced during the servicing design of the proposed site:

- *Design Brief Petrie's Landing II Phase 2, IBI Group., February 7, 2014*
- *Geotechnical Investigation*, Proposed Multi-Storey Buildings Block 8 – Petrie's Landing II, Ottawa, Ontario, Paterson group, July 30, 2019
- *Geotechnical Assessment*, Slope Review – Block 8, Proposed Multi-Storey Buildings, 8466 Jeanna-d'Arc Boulevard, Ottawa, Ontario, Paterson group, June 23, 2021
- *Site Servicing and Stormwater Management Brief – Petrie's Landing block 6, 7 and 8, Stantec Consulting Ltd., September 19, 2018*
- *Supplemental Geotechnical Investigation,* Proposed Multi-Storey Buildings Block 8 – Petrie's Landing II (PG4112-2 Revision 3), Ottawa, Ontario, Paterson group, October 1, 2021
- *City of Ottawa Design Guidelines – Water Distribution*, City of Ottawa, July 2010
- *City of Ottawa Sewer Design Guidelines*, City of Ottawa, October 2012
- *Technical Bulletin ISDTB-2014-01,* City of Ottawa, February 2014
- *Technical Bulletin PIEDTB -2016-01,* City of Ottawa, September 6, 2016

3.0 WATER DISTRIBUTION

3.1 BACKGROUND

The proposed Block 8 consists of a four-storey apartment building with one floor of underground parking. The proposed building has a footprint of approximately 2910.04 m^2 (0.29 ha), and is proposed to connect to the existing 200 mm diameter watermain along Prestige Circle as shown on the site servicing plan (see **Drawing SSP-1**). The building comprises 2 studio apartments, ninety (90) 1-bedroom units, sixteen (16) 2-bedroom units, and four (4) 3-bedroom apartments totaling 112 overall residential units.

A detailed hydraulic analysis for the overall Petrie's Landing Development was included in the 2014 Petrie's Landing Design Brief prepared by IBI (see **Appendix E**). However, the FUS calculations for the proposed buildings within Blocks 6 and 7 generated higher fire flow demands than the values assumed in IBI's hydraulic analysis. As a result, the hydraulic analysis for the overall development was revised as part of the detailed design for Blocks 6 and 7 which used the same boundary conditions as per IBI's model. As the proposed site plan for Block 8 has been updated, the hydraulic model has been revised accordingly. The updated results have been included in **Appendix A**. A new boundary condition has been requested from the City and will be used in subsequent submissions.

3.2 WATER DEMANDS

Water demands were calculated using the City of Ottawa Water Distribution Guidelines (July 2010) at the time of the 1st submission. To determine the typical operating pressures to be expected at the buildings, a daily rate of 350 L/cap/day has been applied for the population of the proposed site. Population densities have been assumed as 1.4 persons/unit for studio units, 1.4 persons/unit for one-bedroom units, 2.1 persons/unit for two-bedroom units and 3.1 persons/unit for three-bedroom units. See **Appendix A** for detailed domestic water demand estimates.

The average day demand (AVDY) for the entire site was determined to be 0.7 L/s. The maximum daily demand (MXDY) is 2.5 times the AVDY for residential demand, which equates to 1.8 L/s. The peak hour demand (PKHR) is 2.2 times the MXDY for residential properties, totaling 3.9 L/s. As the average domestic demand for the site is greater than 50m^3/day, the site will require 2 service connections.

Wood frame construction has been used in the fire flow requirement calculations with a vertical fire wall splitting the building area into two sections with areas 1,756.23 m^2 and 1,153.81 m^2 respectively (see **Drawing SSP-1**). The largest area was used in the assessment of emergency fire flow requirements in accordance with FUS methodology and Ontario Building Code. The FUS Guidelines indicate that low hazard occupancies include apartments, dwellings, dormitories,

hotels, and schools, and as such, a low hazard occupancy/ limited combustible building contents credit was applied. A sprinkler system conforming to NFPA 13 was considered, and a credit applied per FUS Guidelines. Based on calculations per the FUS Guidelines (see **Appendix A**), the required fire flow for the proposed Block 8 is 283.3 L/s (17,000 L/min).

3.3 HYDRAULIC MODEL RESULTS

A hydraulic analysis was previously prepared as part of the detailed design of Blocks 6 and 7 of the development which included preliminary assumptions for Block 8. The hydraulic analysis has now been revised to include water demands and fire flow requirements based on the proposed site plan for Block 8.

The boundary conditions listed below were provided by the City of Ottawa to IBI Group and used in their 2014 hydraulic analysis for the overall development, which included Blocks One to Eight. The same boundary conditions were used in the hydraulic analysis as part of the design of Block 6 and 7 and were used in the revised hydraulic analysis for the proposed Block 8 (see model results in **Appendix A**). New boundary conditions have been requested to the City and will be used in subsequent submissions.

Peak Hour = 108.0m

Max Day + Fire Flow = 110.0m

Average Day = 115.0m

The desired normal operating pressure range as per the City of Ottawa 2010 Water Distribution Design Guidelines is **345 kPa (50 psi)** to **552kPa (80 psi)** and **no *less than 276kPa (40 psi)*** at ground elevation. Furthermore, the maximum pressure at any point in the water distribution should not exceed 100 psi as per the Ontario Building/Plumbing Code; pressure reducing measures are required to service areas where pressures *greater than 552kPa (80 psi)* are anticipated.

A hydraulic model of the water supply system was created in H2O Map based on the provided boundary conditions to assess the proposed watermain layout under the above demands and during the fire flow scenario. Results of the hydraulic modeling show that pressures for Block 8 range from **79.31psi** to **89.27psi** under normal operating conditions. These values are outside the normal operating pressure range as defined by MECP and City of Ottawa design guidelines. As a result, it is recommended that a pressure reducing valve be installed immediately downstream of the isolation valve of the proposed building. Since the proposed building is a 4-storey building, an additional 34 kPa (5 psi) for every additional storey over two storeys is required to account for the change in elevation head and additional head loss. Given that the lowest pressure is expected to be **547kPa (79.31 psi)** at ground level, the resultant equivalent pressure at the 4th floor will be approximately **478 kPa (69.31 psi)** and above the City's objective pressures of 40 psi.

As a result, a booster pump will not be required to maintain an acceptable level of service on the higher floors. Results of the hydraulic model analysis can be found in **Appendix A**.

A fire flow analysis was carried out using H2O MAP hydraulic model to determine the anticipated amount of flow that could be provided for the proposed development under maximum day demands and fire flow requirements per the FUS methodology. A fire flow demand of 283.3 L/s was assumed for the proposed Block 8, identified as node "16". Results of the modeling analysis indicate that flows of approximately 1,051 L/s can be delivered to Block 8 while still maintaining a residual pressure of **140 kPa (20 psi)**. Results of the hydraulic modeling are included for reference in **Appendix A**.

3.4 SUMMARY OF FINDINGS

Based on the results of the hydraulic analysis, it is recommended that a pressure reducing valve be installed to ensure normal operating pressures remain within City of Ottawa required limits. The service connection will be capable of providing anticipated demands to all storeys, no booster pump will be required to maintain minimum pressures of 276 KPa (40 psi) on the higher floors. The hydraulic model also indicates that fire flow requirements can be achieved at the proposed building location while still maintaining the minimum residual pressure per City requirements.

4.0 SANITARY SEWER

The site will be serviced via an existing 300 mm diameter sanitary sewer situated within the Prestige Circle ROW at the southern boundary of the site (see **Drawing SSP-1**). It is proposed to connect a 200mm diameter sanitary service lateral directly to the existing sewer to service the proposed site.

The anticipated wastewater peak flows generated from the proposed development are summarized in **Table 1** below:

Table 1: Estimated Wastewater Peak Flow

Block	Residential Units				Infiltration Flow (L/s)	Total Peak Flow (L/s)
	# of Units	Population	Peak Factor	Peak Flow (L/s)		
Block 8	112	175	4.0	2.27	0.25	2.51

1. Average residential flow based on 280 L/p/day
2. Peak factor for residential units calculated using Harmon's formula
3. Three- bedroom apartments assumed at 3.1 persons/unit, two-bedroom apartments assumed at 2.1 persons/unit, one-bedroom & studio apartments assumed at 1.4 persons/unit.
4. Infiltration flow based on 0.33 L/s/ha.

The Prestige Circle preliminary sanitary sewer design was completed as part of IBI's design (see **Appendix E**) and was based on the applicable City of Ottawa Design Guidelines at the time of the report. A preliminary concept plan for Block 8 which consisted of 81 units totaling a population of 146 people and allowing a sanitary discharge of 2.52 L/s was assumed during detailed design of Blocks 6 and 7 which is sufficient for the site based on the current site plan.

4.1 SANITARY SEWER DESIGN CRITERIA

As outlined in the City of Ottawa Sewer Design Guidelines and the Ministry of the Environment, Conservation and Parks (MECP) Design Guidelines for Sewage Works, the following criteria were used to calculate estimated wastewater flow rates and to size the sanitary sewers:

- Minimum Velocity – 0.6 m/s (0.8 m/s for upstream sections)
- Maximum Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- Minimum size – 200mm dia. for residential areas
- Average Wastewater Generation – 280L/cap/day
- Peak Factor – 4.0 (Harmon's)
- Extraneous Flow Allowance – 0.33 L/s/ha (conservative value)
- Manhole Spacing – 120 m
- Minimum Cover – 2.50 m
- Population density for single-bedroom and bachelor apartments – 1.4 pers./apartment

- Population density for two-bedroom apartments – 2.1 pers./apartment
- Population density for three-bedroom apartments – 3.1 pers./apartment

4.2 PROPOSED SERVICING

The proposed site will be serviced by gravity sewers which will direct the wastewater flows (approx. 2.51 L/s with allowance for infiltration) to the existing 300 mm diameter sanitary sewer on Prestige Circle. A sanitary sewer design sheet for the proposed sanitary sewers is included in **Appendix B**. A full port backwater valve is to be installed on the proposed sanitary service to prevent any surcharge from the downstream sewer main from impacting the proposed property. All underground parking drains should be connected to the internal building plumbing and discharged through gravity into the sanitary sewer stub as shown in **Drawing SAN-1** in **Appendix H .**

5.0 STORMWATER MANAGEMENT

5.1 OBJECTIVES

The objective of this stormwater management (SWM) plan is to determine the measures necessary to control the quantity of stormwater released from the proposed development to the required levels, and to provide sufficient detail for approval and construction.

5.2 SWM CRITERIA AND CONSTRAINTS

The stormwater management criteria for the proposed site are based on Stantec's 2018 Site Servicing and Stormwater Management Brief for Blocks 6 to 8 and City of Ottawa Sewer Design Guidelines. The following summarizes the criteria used in the preparation of this stormwater management plan:

- Stormwater runoff from the proposed Block 8 up to and including the 100-year event to be stored on site and released into the minor system at a maximum rate of 99.5 L/s
- Maximum 100-year water depth of 0.3 m in parking and access areas
- Provide adequate emergency overflow conveyance (overland flow route) off-site to the City ROW
- Size storm sewers in parking areas to convey a 2-year storm event, assuming the use of inlet control devices and sub-surface pipe storage to provide capacity for the system while meeting the target release from the site.
- Size storm sewers to convey 100-year storm from ramp, deck areas and building uncontrolled areas (sunken patio areas).
- Size storm sewers using an inlet time of concentration (Tc) of 10 minutes
- Quality control of runoff from the proposed development to be provided in the downstream Brisebois Creek SWM Facility prior to discharge into the Ottawa River
- Post-development runoff coefficient (C) value based on proposed impervious areas as per site plan drawing (see **Appendix F**)

5.3 STORMWATER MANAGEMENT DESIGN

The proposed 0.75ha residential development consists of a four-storey building with underground and surface parking, and associated servicing infrastructure. The overall imperviousness of the site is 61% (C = 0.63) based on the current site plan.

Stormwater runoff from the proposed development will be directed to the existing storm sewers on Prestige Circle which ultimately discharge into the Brisebois Creek SWM Facility. A sump pump and backwater valve will be provided for foundation drainage of the proposed building. The proposed site plan and existing storm sewer infrastructure on Prestige Circle are shown on **Drawing SSP-1**.

5.3.1 Design Methodology

The proposed stormwater management plan is designed to detain runoff on the rooftops, surface storage and underground storage pipe while the remaining site drains uncontrolled without exceeding the target release rate for the development established as 99.5 L/s. This ensures that peak flows after construction will not exceed the target release rate for the site.

Due to the modified site plan layout and grading restrictions, part of the landscaped portion of the site backing into the existing ravine east of the site could not be graded to enter the site's storm system and as such it will sheet drain uncontrolled. Runoff from this uncontrolled area is included in the overall site discharge calculations. The building deck areas (R1001B, R1001C, F1001C) and access ramp (F1001B) will be connected to the building's internal plumbing system discharging to a 300 mm diameter stub as shown in **Drawing SSP-1** in **Appendix H.**

5.3.2 Water Quantity Control

In keeping with previous submissions, the Modified Rational Method was used to assess the quantity and volume of runoff generated during post development conditions. The site was subdivided into seven subcatchments (subareas) tributary to storm sewer inlets, as defined by the location of catchbasins / inlet grates and used in the storm sewer design (see **Appendix C**). A summary of subareas and runoff coefficients is provided in **Appendix C**, and **Drawing SD-1** indicates the stormwater management subcatchments.

5.3.3 Allowable Release Rate

Stantec's Site Serving and Stormwater Management Brief for Blocks 6, 7 and 8 outlines the quantity control criteria for the overall site. The report for the three blocks is based on IBI's 2014 Petrie's Landing II Phase 2 Site Servicing Report which outlines the quality control criteria. The report outlines that the overall system target release rate for Block 8 is 99.5 L/s.

5.3.4 Storage Requirements

The site requires quantity control measures to meet the stormwater release criteria. It is proposed that restricted release rooftop drains be used to reduce the peak outflow from the site. Additionally, underground storage pipe and surface storage within the parking area will be provided. **Drawing SD-1** shows the delineated catchment areas, design release rate from the rooftop. Stormwater management calculations are provided in **Appendix C**.

5.3.4.1 Rooftop Storage

It is proposed to retain stormwater on the rooftop (subcatchment R1001A) by installing restricted flow roof drains. The following calculations assume the roof will be equipped with eleven (11) Watts drains 50% open, see **Appendix C** for details.

Watts roof drain data has been used to calculate a practical roof release rate and detention storage volume for the rooftops. It should be noted that the "Watts" roof drain has been used as an example only and that other products may be specified for use, provided that the roof release rate is restricted to match the maximum rate of release indicated in **Table 2** and that sufficient roof storage is provided to meet (or exceed) the resulting volume of detained stormwater.

Table 2 provide details regarding the retention of stormwater on the proposed rooftop during the 2 and 100-year storm events. Refer to **Appendix C** for details.

Table 2: Peak Controlled (Rooftop) 2-Year and 100-Year Release Rate

Area ID	Return period	Area (ha)	Head (m)	$Q_{release}$ (L/s)	V_{stored} (m^3)
R1001A	2 Year	0.291	0.10	10.4	33.8
	100 Year		0.15	13.8	113.8

Roof subcatchment areas R1001B and R1001C represent sunken patio areas and will flow uncontrolled to the storm sewer via the building's internal plumbing system. Uncontrolled peak flows from these areas will be included in the overall site release rate calculations in the sections below.

5.3.4.2 Surface and Pipe Storage

In addition to rooftop storage, it is proposed to detain stormwater on the surface parking lot area (F1001A) and underground using a 600 x 600mm catchbasin equipped with an inlet control device as shown in **Drawing SSP-1** in **Appendix H**.

The proposed Vortex LMF 65 inlet control device (ICD) located in CB 1001A has been sized to restrict peak flows from area F1001A through the use of surface and subsurface storage to a controlled release rate of 6.78L/s . Surface storage of 15.7 m^3 and subsurface storage of 20.3 m^3

(pipe, catchbasin and manhole) are provided in area F1001A through 20 m of 900 mm diameter HDPE Boss 2000 storage pipe connected to STM 1002 and CB 1001A which will be fitted with a Vortex LMF 65 or equivalent to restrict post development peak flows from this area as shown on **Drawing SD-1**. The modified rational method was used to determine the peak flow, ponding depth and required storage volume for the proposed site. **Table 3**: summarizes the proposed ICD characteristics.

Table 3: 100-Year ICD Characteristics

Area ID	Structure ID	Orifice Type	Head (m)	Peak Release Rate (L/s)	Storage Volume Required (m^3)	Storage Volume Available (m^3)
F1001A	CB 1001A	Vortex LMF 65	3.48	6.78	28.7	36.1

5.3.5 Uncontrolled Area

A portion of the site fronting Prestige Circle and backing onto the ravine (see area UNC-1 on **Drawing SD-1**) could not be graded to enter the site's storm system and as such, it will sheet drain uncontrolled. Runoff from this uncontrolled area is included in the overall site discharge calculations. **Table 4** summarizes the 2 and 100-year uncontrolled release rates from the proposed development that do not enter the proposed storm sewer system.

Table 4: Peak Uncontrolled (Non-tributary) 2-Year and 100-Year Release Rates

Storm Event	Area (ha)	Runoff 'C'	Tc (min)	$Q_{release}$ (L/s)
2-Year	0.234	0.25	10	12.49
100-Year		0.31		36.30

5.3.6 Results

The proposed building will have one level of underground parking and as such, it is proposed that the proposed parking ramp be equipped with a trench drain connected to the internal plumbing of the building to capture the 100-year runoff. Similarly, the proposed parking deck area, F1001C and the sunken patio areas R1001B and R1001C will have catchbasins/drains connected to the internal plumbing of the building to capture the 100-year runoff.

It is recommended that the proposed building be equipped with a sump pump and a backwater valve for foundation drainage. **Table 5** and **Table 6** demonstrate that the proposed stormwater management plan provides adequate attenuation storage to meet the target peak outflows for the site.

Table 5: Estimated Discharge from Site (2-Year)

Block	Area Type	Area ID	$V_{required}$ (m^3)	$V_{available}$ (m^3)	$Q_{release}$ (L/s)	Target (L/s)
BLOCK 8	Controlled – Surface	F1001A	5.2	36.1	6.6	**99.5**
	Controlled Roof Areas	R1001A	33.8	116.4	10.4	
	Uncontrolled Building Areas	R1001B & R1001C	-	-	5.8	
	Parking Ramp Area	F1001B	**-**	-	5.2	
	Building Deck	F1001C	**-**	-	5.5	
	Uncontrolled Areas	UNC-1	**-**	-	12.5	
		Total Block 8	**39.0**	**152.5**	**46.0**	

Table 6: Estimated Discharge from Site (100-Year)

Block	Area Type	Area ID	$V_{required}$ (m^3)	$V_{available}$ (m^3)	$Q_{release}$ (L/s)	Target (L/s)
BLOCK 8	Controlled – Surface	F1001A	28.7	36.1	6.8	**99.5**
	Controlled Roof Areas	R1001A	113.8	116.4	13.8	
	Uncontrolled Building Areas	R1001B & R1001C	-	-	14.9	
	Parking Ramp Area	F1001B	**-**	-	13.4	
	Building Deck	F1001C	**-**	-	16.1	
	Uncontrolled Areas	UNC-1	**-**	-	36.3	
		Total Block 8	**142.5**	**152.5**	**101.2**	

As can be seen in the above tables, the proposed ICD and storage provided restrict post development peak flows from the entire site to 46.0 L/s and 101.2 L/s in the 2-year and 100-year storm events respectively. The 99.5 L/s target release is exceeded by 1.7 L/s in a 100-year event, which is considered negligible.

6.0 GRADING AND DRAINAGE

The proposed development site measures approximately 0.75 ha in area. The site has significant grade change from the southwestern to the northeastern boundary of the site. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements, to meet minimum cover requirements for storm and sanitary sewers, and to provide sufficient cover over top of the underground parking garage. Site grading has been established to provide emergency overland flow routes for stormwater management in accordance with City of Ottawa requirements.

A permissible grade raise restriction of 2 m is recommended for the subject site by Paterson Group. The subject site maintains emergency overland flow routes to the existing Prestige Circle ROW as per revised design as shown in **Drawings GP-1** and **SD-1**.

7.0 UTILITIES

The subject site has existing plants within Prestige Circle to provide Hydro, Bell, Gas and Cable servicing for the proposed development as existing residential development to the west was constructed as part of Phase 1 and Phase 2. It is anticipated that existing infrastructure will be sufficient to provide the means of distribution for the proposed site. Detailed design of the required utility services will be further investigated as part of the composite utility planning process following design circulation.

8.0 APPROVALS

Ontario Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECAs, formerly Certificates of Approval C of A) under the Ontario Water Resources Act are not expected to be a requirement for the development to proceed as the site will have a separate drainage and storm sewer system discharging to a pre-existing sewer system.

The proposed site is situated 120 m of the Petrie Island Provincially Significant Wetland, and as such, it is within the RVCA's regulatory jurisdiction. As a result, written approval from the RVCA is required under Ontario Regulation 174/06 "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation" under Section 28 of the Conservation Authorities Act.

Requirement for an MECP Permit to Take Water (PTTW) for pumping during construction of the underground parking levels will be confirmed by the geotechnical consultant.

9.0 EROSION CONTROL DURING CONSTRUCTION

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

1. Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
2. Limit extent of exposed soils at any given time.
3. Re-vegetate exposed areas as soon as possible.
4. Minimize the area to be cleared and grubbed.
5. Protect exposed slopes with plastic or synthetic mulches.
6. Provide sediment traps and basins during dewatering.
7. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
8. Plan construction at proper time to avoid flooding.
9. Installation of a mud matt to prevent mud and debris from being transported off site.
10. Installation of a silt fence to prevent sediment runoff.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

1. Verification that water is not flowing under silt barriers.
2. Clean and change silt traps at catch basins.

Refer to **Drawing EC-DS** for the proposed location of silt fences, and other erosion control structures.

10.0 GEOTECHNICAL INVESTIGATION

A supplemental geotechnical investigation was completed by Paterson Group Ltd. on October 1, 2021. The report summarizes the existing soil conditions within the subject area and construction recommendations. For details which are not summarized below, please see the original Paterson report (Excerpts included in **Appendix D**).

Subsurface soil conditions within Block 8 were determined from 6 boreholes distributed across the proposed site. The field program for the supplemental geotechnical investigation was carried out on July 9 and 10, 2019, at that time 3 boreholes (BH1-19 to BH3-19) were drilled to a maximum depth of 42.9 m. An initial geotechnical investigation carried out on April 24 and 25, 2017 consisted of extending a total of 3 boreholes (BH 4-17 to BH 6-17) to a maximum depth of 9.8 m below the existing grade. The soil conditions encountered at the test holes locations consist of topsoil or fill overlying a brown silty clay crust over a deep deposit of grey silty clay layer.

The long-term groundwater level is expected to be at a depth of 4 to 6 m below the existing grade. Groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

A permissible grade raise restriction of 2m is recommended within the Paterson Group report. The grade raise restriction has been exceeded in some spots of the proposed development due to grading constraints and as a result, the proposed grading plan has been submitted to Paterson Group (Refer to **Appendix D** for feedback from Paterson).

The required pavement structure for the local roadways is outlined in **Table 7** and Table 8 below:

Table 7: Pavement Structure – Car Only Parking Areas

Thickness (mm)	Material Description
50	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone
300	Subbase - OPSS Granular B Type II
-	Subgrade – Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill.

Table 8: Pavement Structure – Access Lanes and Heavy Truck Parking Areas

Thickness (mm)	Material Description
40	Wear Course –Superpave 12.5 Asphaltic Concrete
50	Binder Course –Superpave 19.0 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone
450	Subbase - OPSS Granular B Type II
-	Subgrade – Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill.

11.0 CONCLUSIONS

11.1 WATER SERVICING

The 200 mm diameter watermain on Prestige Circle provides adequate fire flow capacity as per the Fire Underwriters Survey. The service connections will also be capable of providing anticipated demand but exceeds the maximum objective pressure of 552 kPa (80 psi). Therefore, pressure reducing measures, such as a pressure reducing valve, will be required to service the proposed building per the Ontario Plumbing Code. The building will not require a booster pump to provide pressures greater than 40psi to the higher floors.

11.2 SANITARY SERVICING

The proposed sanitary sewer lateral is sufficiently sized to provide gravity drainage for the site. The proposed site will be serviced by a 200 mm diameter service lateral directing wastewater flows to the existing 300 mm dia. Prestige Circle sanitary sewer. A backflow preventer will be required for the proposed building in accordance with the Ottawa sewer design guidelines and will be coordinated with building mechanical engineers. The proposed sanitary drainage pattern is in accordance with the City of Ottawa Sewer Design guidelines.

11.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the goals specified through the stormwater management section of IBI Group's Design Brief for Petrie's Landing and with the City of Ottawa Design guidelines. Rooftop, underground pipe, and surface storage in combination with ICDs are proposed to limit inflow from the site area into the minor system to the required target release rate.

The proposed building will have underground parking and as such, it is recommended that the proposed parking ramp be equipped with trench drains to capture the 100-year runoff. The proposed deck area F1001C and sunken patio areas R1001B and R1001C will be equipped with catchbasins/drains connected to the internal plumbing of the building to capture the 100-year runoff. In addition, it is recommended that the proposed building be equipped with a sump pump and a backwater valve.

11.4 GRADING

Grading for the site has been designed to provide an emergency overland flow route as per City requirements and reflects the overall recommendations provided in the Geotechnical

Investigation. A permissible grade raise restriction of 2 m is recommended for the subject site by Paterson Group.

Erosion and sediment control measures will be implemented during construction to reduce the impact on existing infrastructure.

11.5 UTILITIES

All utilities (Hydro Ottawa, Bell Canada, Rogers Ottawa, and Enbridge Gas) have existing plants in the subject area. Exact size, location and routing of utilities will be finalized after design circulation.

11.6 APPROVAL / PERMITS

Ontario Ministry of the Environment, Conservation and Parks (MOECP) Environmental Compliance Approvals (ECA) are not expected to be required for the subject development as the site will have a separate drainage and storm sewer system discharge to a pre-existing sewer system. Written approval from the Rideau Valley Conservation Authority (RVCA) is required under Ontario Regulation 174/06 "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation" under Section 28 of the Conservation Authorities Act for the portion of the site within 120 m of a significant wetland. A Permit to Take Water may be required for pumping requirements for construction of underground parking levels. No other approval requirements from other regulatory agencies are anticipated.

APPENDICES

Appendix A POTABLE WATER SERVICING ANALYSIS

Block 8 Petries Landing - Domestic Water Demand Estimates

Based on Site Statistics provided by Neuf Architectes Sencrl (2021-03-12)

Building ID	Units	Persons per unit[1]	Population	Daily Rate of Demand (L/p/d)	Avg Day Demand[2]		Max Day Demand[3]		Peak Hour Demand[3]	
					(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Studio	2	1.4	3	350	0.7	0.01	1.7	0.03	3.7	0.06
1 Bedroom	90	1.4	126	350	30.6	0.51	76.6	1.28	168.4	2.81
2 Bedrooms	16	2.1	34	350	8.2	0.14	20.4	0.34	44.9	0.75
3 Bedrooms	4	3.1	12	350	3.0	0.05	7.5	0.13	16.6	0.28
Total Site :	**112.0**		**175**		**42.5**	**0.7**	**106.2**	**1.8**	**233.7**	**3.9**

1 Population counts based on a conversion factor of 1.4 persons/ 1 Bedroom Apt., 2.1 Persons/ 2 Bedroom Apt, 3.1 Persons/ 3 Bedroom Apt.

2 Average day water demand for residential areas equal to 350 L/cap/d

3 The City of Ottawa water demand criteria used to estimate peak demand rates for residential areas are as follows:

maximum day demand rate = 2.5 x average day demand rate

peak hour demand rate = 2.2 x maximum day demand rate

Referenced from the City of Ottawa Sewer Design Guidelines (October 2012) and the Ottawa Design Guidelines: Water Distribution (July 2010)

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401331
Project Name: Petries Landing Block 8
Date: 3/24/2021
Fire Flow Calculation #: 2
Description: Residential low rise

Notes:
1. 4-storey residential low-rise with 112 Residential units as provided by Neuf Architect(e)s dated Mar. 12, 2021.
2. A Firewall was provided dividing the building into two segments; Segment A (North) = 1756.23m^2, Segment B (South) = 1153.81m^2. The largest area has been adopted in the analysis below.

Step	Task	Notes						Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Wood Frame						1.5	-
2	Determine Ground Floor Area of One Unit	-						1756	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						4	-
4	Determine Required Fire Flow	(F = 220 x C x A$^{1/2}$). Round to nearest 1000 L/min						-	28000
5	Determine Occupancy Charge	Limited Combustible						-15%	23800
6	Determine Sprinkler Reduction	Conforms to NFPA 13						-30%	-9520
		Standard Water Supply						-10%	
		Not Fully Supervised or N/A						0%	
		% Coverage of Sprinkler System						100%	
7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	> 45	0	0	0-30	Wood Frame or Non-Combustible	0%	2380
		East	> 45	32	2	61-90	Wood Frame or Non-Combustible	0%	
		South	30.1 to 45	23	4	91-120	Wood Frame or Non-Combustible	5%	
		West	30.1 to 45	14	4	31-60	Wood Frame or Non-Combustible	5%	
8	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**							**17000**
		Total Required Fire Flow in L/s							**283.3**
		Required Duration of Fire Flow (hrs)							**3.50**
		Required Volume of Fire Flow (m^3)							**3570**

Hydraulic Model Results - Average Day Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
10.00	0.00	52.00	115.00	89.56	617.50
11.00	0.00	55.06	115.00	85.21	587.51
12.00	0.00	55.06	115.00	85.21	587.51
13.00	0.00	51.90	115.00	89.70	618.46
14.00	0.00	52.10	115.00	89.42	616.53
16.00	0.70	52.20	115.00	89.27	615.50
BLDG1	0.29	55.71	115.00	84.28	581.09
BLDG2	0.29	56.60	115.00	83.02	572.41
BLDG3	0.67	56.70	115.00	82.87	571.37
BLDG6	0.49	57.30	115.00	82.02	565.51
BLDG7	0.57	56.50	115.00	83.16	573.37

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
1	1000	14	25.84	393	120	3.01	0.02
11	12	11	7.05	204	110	-0.06	0.00
12	12	16	78.14	204	110	-1.08	0.03
13	13	10	7.80	393	120	-1.78	0.01
15	16	13	10.83	204	110	-1.78	0.06
2	14	10	19.33	393	120	3.01	0.02
3	10	11	84.72	204	110	1.23	0.04
4	BLDG1	11	51.80	204	110	-1.17	0.04
5	BLDG2	BLDG1	32.66	204	110	-0.88	0.03
6	BLDG3	BLDG2	62.45	204	110	-0.59	0.02
7	BLDG3	BLDG6	72.85	204	110	-0.08	0.00
8	BLDG6	BLDG7	34.69	204	110	-0.57	0.02
9	BLDG7	12	82.99	204	110	-1.14	0.03

Hydraulic Model Results - Peak Hour Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
10.00	0.00	52.00	108.00	79.60	548.83
11.00	0.00	55.06	107.96	75.21	518.56
12.00	0.00	55.06	107.96	75.21	518.56
13.00	0.00	51.90	108.00	79.75	549.86
14.00	0.00	52.10	108.00	79.46	547.86
16.00	3.90	52.20	107.99	79.31	546.83
BLDG1	1.60	55.71	107.95	74.26	512.01
BLDG2	1.60	56.60	107.94	72.98	503.18
BLDG3	3.69	56.70	107.93	72.83	502.15
BLDG6	2.71	57.30	107.93	71.98	496.29
BLDG7	3.12	56.50	107.94	73.12	504.15

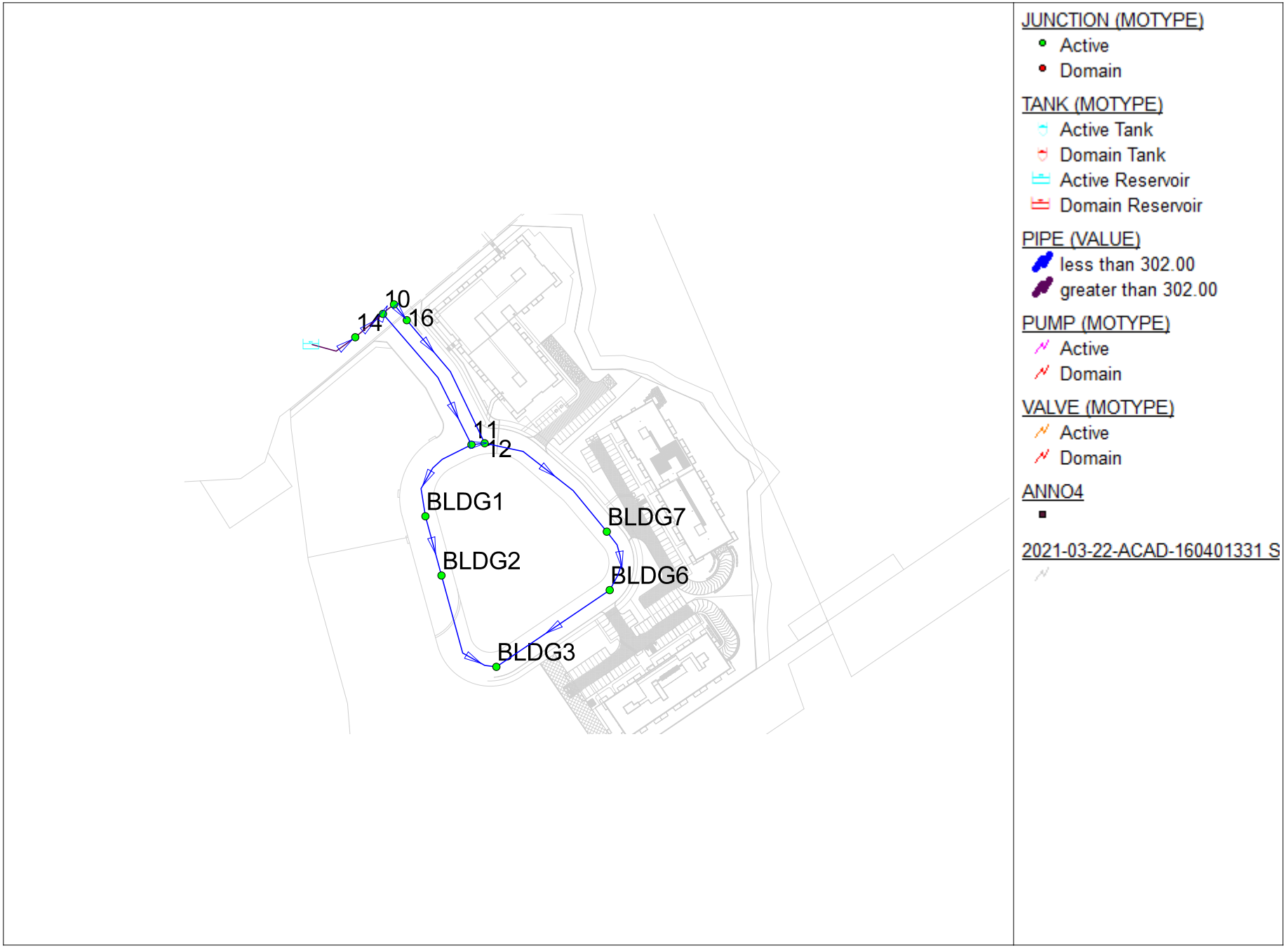
Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
1	1000	14	25.84	393	120	16.62	0.14
11	12	11	7.05	204	110	-0.30	0.01
12	12	16	78.14	204	110	-5.97	0.18
13	13	10	7.80	393	120	-9.87	0.08
15	16	13	10.83	204	110	-9.87	0.30
2	14	10	19.33	393	120	16.62	0.14
3	10	11	84.72	204	110	6.75	0.21
4	BLDG1	11	51.80	204	110	-6.45	0.20
5	BLDG2	BLDG1	32.66	204	110	-4.85	0.15
6	BLDG3	BLDG2	62.45	204	110	-3.25	0.10
7	BLDG3	BLDG6	72.85	204	110	-0.44	0.01
8	BLDG6	BLDG7	34.69	204	110	-3.15	0.10
9	BLDG7	12	82.99	204	110	-6.27	0.19

Hydraulic Model Results -Fire Flow Analysis

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	L/s	(psi)	(Kpa)
16	1.8	82.16	566.48	110	283	76.54	527.73	1050.82	20	137.90
BLDG1	0.73	77.16	532.00	109.99	335	35.02	241.46	396.50	20	137.90
BLDG2	0.73	75.89	523.25	109.99	289	38.08	262.55	358.66	20	137.90
BLDG3	1.68	75.75	522.28	109.98	182	57.17	394.18	334.64	20	137.90
BLDG6	1.23	74.9	516.42	109.98	250	43.08	297.03	338.39	20	137.90
BLDG7	1.42	76.03	524.21	109.98	250	47.11	324.81	360.68	20	137.90

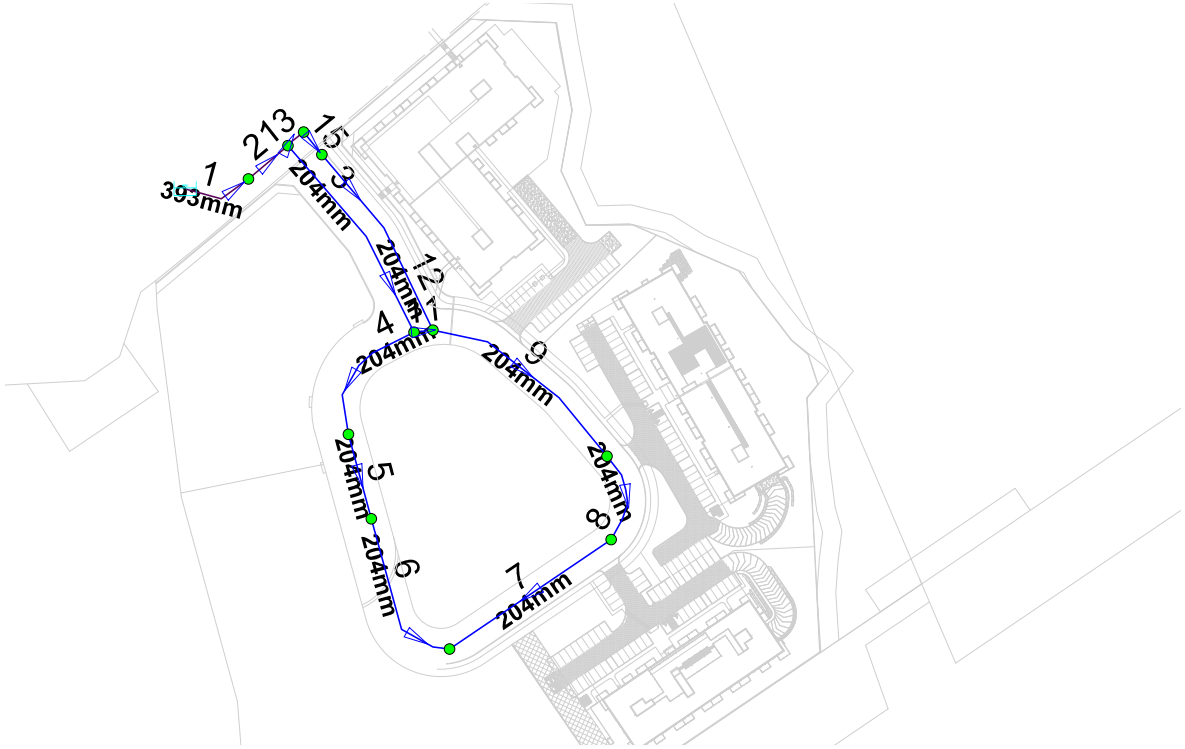
16041331-Blk8



Prepared By: N.Nwanise

Date: Wednesday, March 24, 2021

16041331-Blk8



JUNCTION (MOTYPE)
- Active
- Domain

TANK (MOTYPE)
- Active Tank
- Domain Tank
- Active Reservoir
- Domain Reservoir

PIPE (VALUE)
- less than 302.00
- greater than 302.00

PUMP (MOTYPE)
- Active
- Domain

VALVE (MOTYPE)
- Active
- Domain

ANNO3

2021-03-22-ACAD-160401331 S

ANNO5

Prepared By: N.Nwanise

Date: Wednesday, March 24, 2021

Appendix B SANITARY SEWER CALCULATIONS

Stantec

SUBDIVISION:

Petries Landing Block 8

DATE: Sept 16, 2021
REVISION: 3
DESIGNED BY: NN
CHECKED BY: TR

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401331

XML Conversion

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280	L/p/day	MINIMUM VELOCITY	0.60	m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000.00	L/ha/day	MAXIMUM VELOCITY	3.00	m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL	55,000.00	L/ha/day	MANNINGS n	0.013	
PEAKING FACTOR (COMM., INST.):	1.5	INSTITUTIONAL	50,000.00	L/ha/day	BEDDING CLASS	C	
PERSONS / 3 Bedroom apt.	3.1	INFILTRATION	0.33	L/s/ha	MINIMUM COVER	2.50	m
PERSONS / 2 bedroom apt.	2.1						
PERSONS /1 Bedroom apt.	1.4						

LOCATION			RESIDENTIAL AREA AND POPULATION									COMM		INDUST		INSTIT		GREEN / UNUSED		C+I+I	INFILTRATION				PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	UNITS 3 Bed	2 bed	1 bed	Studio	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	**TOTAL FLOW**	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)						(ha)			(l/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)			(%)	(L/s)	(%)	(m/s)	(m/s)
R100A, G100A	BLK 8	SAN100	0.460	4	16	90	2	175	0.46	175	4.00	2.27	0.00	0.00	0.00	0.00	0.00	0.00	0.290	0.29	0.00	0.750	0.75	0.25	2.51	3.2	200	PVC	SDR-35	1.00	33.31	7.55	1.05	0.52
	SAN100	EX. MH6	0.000	0	0	0	0	0	0.46	175	4.00	2.27	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.29	0.00	0.000	0.75	0.25	2.51	11.5	200	PVC	SDR-35	1.00	33.31	7.55	1.05	0.52
																											300							

Appendix C STORMWATER MANAGEMENT CALCULATIONS

Stantec

Petries Landing Block 8

DATE: 2022-02-16
REVISION: 3
DESIGNED BY: NN
CHECKED BY: AMP

FILE NUMBER: 160401331

STORM SEWER DESIGN SHEET
(City of Ottawa)

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013 BEDDING CLASS = B
MINIMUM COVER: 2.00 m
TIME OF ENTRY 10 min

LOCATION			DRAINAGE AREA																					PIPE SELECTION										
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETEI (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
R1001A, R1001B, R1001C,F1001C,F10001B	STM STUB	STM1001	0.00	0.00	0.00	0.13	0.29	0.00	0.00	0.00	0.61	0.000	0.000	0.000	0.000	0.000	0.000	0.077	0.077	10.00	76.81	104.19	122.14	178.56	13.80	13.8	52.1	5.3	300	300	CIRCULAR	PVC	-	1.00	96.2	**54.2%**	1.37	1.20	0.07
																				10.07																		
F1001A	CB1001A	STM1001	0.10	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.94	0.071	0.071	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	15.2	8.8	250	250	CIRCULAR	PVC	-	0.50	42.7	**35.6%**	0.86	0.66	0.22
																				10.22																		
	STM1001	STM 1000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.071	0.000	0.000	0.000	0.000	0.000	0.077	10.22	75.96	103.03	120.78	176.56	0.0	13.8	66.7	11.9	300	300	CIRCULAR	PVC	-	1.00	96.2	**69.4%**	1.37	1.29	0.15
																				10.38									300									

Stormwater Management Calculations

File No: **160401331**
Project: **Petries Landing - Block 8**
Date: **16-Feb-22**
Revision **1**

SWM Approach:
Limit Site to 99.5 L/s

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Uncontrolled - Tributary	R1001B	Hard	0.004		0.9	0.004		
		Soft	0.000		0.2	0.000		
		Subtotal		0.0044			0.003942	0.900
Uncontrolled - Tributary	R1001C	Hard	0.026		0.9	0.023		
		Soft	0.000		0.2	0.000		
		Subtotal		0.0256			0.02304	0.900
Controlled - Tributary	F1001A	Hard	0.075		0.9	0.067		
Parking		Soft	0.020		0.2	0.004		
		Subtotal		0.0950			0.07125	0.750
RAMP - Bldg	F1001B	Hard	0.027		0.9	0.024		
Uncontrolled - Tributary		Soft	0.000		0.2	0.000		
		Subtotal		0.0270			0.0243	0.900
Deck - Bldg	F1001C	Hard	0.017		0.9	0.015		
Uncontrolled - Tributary		Soft	0.053		0.2	0.011		
		Subtotal		0.0700			0.0259	0.370
Roof	R1001A	Hard	0.291		0.9	0.262		
BLDG		Soft	0.000		0.2	0.000		
		Subtotal		0.2910			0.2619	0.900
Uncontrolled - Non-Tributary	UNC-1	Hard	0.017		0.9	0.015		
		Soft	0.217		0.2	0.043		
		Subtotal		0.2340			0.0585	0.250
Total				**0.747**			**0.469**	
Overall Runoff Coefficient= C:								**0.63**

Total Roof Areas	**0.291 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.222 ha**
Total Tributary Area to Outlet	**0.513 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.234 ha**
Total Site	**0.747 ha**

Stormwater Management Calculations

Project #160401331, Petries Landing - Block 8
Modified Rational Method Calculatons for Storage

2 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	732.951
b =	6.199
c =	0.81

t (min)	I (mm/hr)
10	76.81
20	52.03
30	40.04
40	32.86
50	28.04
60	24.56
70	21.91
80	19.83
90	18.14
100	16.75
110	15.57
120	14.56

100 YEAR Target Release from Block 8

SWM Appoach: Limit site to 99.5 L/s
Area (ha): 0.747
C: 0.55

Qtarget(100 yr) (L/s)
99.50

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: R1001B
Area (ha): 0.004
C: 0.90

Uncontrolled - Tributary
To Building Internal Plumbing

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	0.84	0.84		
20	52.03	0.57	0.57		
30	40.04	0.44	0.44		
40	32.86	0.36	0.36		
50	28.04	0.31	0.31		
60	24.56	0.27	0.27		
70	21.91	0.24	0.24		
80	19.83	0.22	0.22		
90	18.14	0.20	0.20		
100	16.75	0.18	0.18		
110	15.57	0.17	0.17		
120	14.56	0.16	0.16		

Subdrainage Area: R1001C
Area (ha): 0.026
C: 0.90

Uncontrolled - Tributary
To Building Internal Plumbing

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	4.92	4.92		
20	52.03	3.33	3.33		
30	40.04	2.56	2.56		
40	32.86	2.10	2.10		
50	28.04	1.80	1.80		
60	24.56	1.57	1.57		
70	21.91	1.40	1.40		
80	19.83	1.27	1.27		
90	18.14	1.16	1.16		
100	16.75	1.07	1.07		
110	15.57	1.00	1.00		
120	14.56	0.93	0.93		

Subdrainage Area: F1001A
Area (ha): 0.095
C: 0.75

Controlled - Tributary

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	15.21	6.55	8.67	**5.20**
20	52.03	10.31	6.55	3.76	4.51
30	40.04	7.93	6.55	1.38	2.49
40	32.86	6.51	6.51	0.00	0.00
50	28.04	5.55	5.55	0.00	0.00
60	24.56	4.86	4.86	0.00	0.00
70	21.91	4.34	4.34	0.00	0.00
80	19.83	3.93	3.93	0.00	0.00
90	18.14	3.59	3.59	0.00	0.00
100	16.75	3.32	3.32	0.00	0.00
110	15.57	3.08	3.08	0.00	0.00
120	14.56	2.88	2.88	0.00	0.00

Storage: Surface Storage Above CB1001A

LMF: Vortex LMF 65

Invert Elevation	51.47	m
T/G Elevation	54.72	m
Max Ponding Depth	0.00	m
Downstream W/L	51.43	m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Leve	54.72	3.25	6.55	5.20	36.05	OK

Project #160401331, Petries Landing - Block 8
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
10	178.56
20	119.95
30	91.87
40	75.15
50	63.95
60	55.89
70	49.79
80	44.99
90	41.11
100	37.90
110	35.20
120	32.89

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: R1001B
Area (ha): 0.004
C: 1.00

Uncontrolled - Tributary
To Building Internal Plumbing

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	2.17	2.17		
20	119.95	1.46	1.46		
30	91.87	1.12	1.12		
40	75.15	0.91	0.91		
50	63.95	0.78	0.78		
60	55.89	0.68	0.68		
70	49.79	0.61	0.61		
80	44.99	0.55	0.55		
90	41.11	0.50	0.50		
100	37.90	0.46	0.46		
110	35.20	0.43	0.43		
120	32.89	0.40	0.40		

Subdrainage Area: R1001C
Area (ha): 0.026
C: 1.00

Uncontrolled - Tributary
To Building Internal Plumbing

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	12.71	12.71		
20	119.95	8.54	8.54		
30	91.87	6.54	6.54		
40	75.15	5.35	5.35		
50	63.95	4.55	4.55		
60	55.89	3.98	3.98		
70	49.79	3.54	3.54		
80	44.99	3.20	3.20		
90	41.11	2.93	2.93		
100	37.90	2.70	2.70		
110	35.20	2.51	2.51		
120	32.89	2.34	2.34		

Subdrainage Area: F1001A
Area (ha): 0.095
C: 0.94

Controlled - Tributary

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	44.21	6.78	37.43	22.46
20	119.95	29.70	6.78	22.92	27.50
30	91.87	22.75	6.78	15.97	**28.74**
40	75.15	18.61	6.78	11.83	28.38
50	63.95	15.83	6.78	9.06	27.17
60	55.89	13.84	6.78	7.06	25.42
70	49.79	12.33	6.78	5.55	23.31
80	44.99	11.14	6.78	4.36	20.93
90	41.11	10.18	6.78	3.40	18.36
100	37.90	9.38	6.78	2.61	15.64
110	35.20	8.72	6.78	1.94	12.79
120	32.89	8.14	6.78	1.37	9.83

Storage: Surface Storage Above CB

LMF: Vortex LMF 65

Invert Elevation	51.47	m
T/G Elevation	54.72	m
Max Ponding Depth	0.23	m
Downstream W/L	51.43	m

Pipe Storage:

Diameter (mm):	900
Length (m):	20.00
Area (m2):	0.64
Volume (m3):	12.72
CB and MH Vol (m3):	7.63
Surface ponding (m3):	15.70

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Leve	54.95	3.48	6.78	28.74	36.05	OK
					7.31	

Stormwater Management Calculations

Project #160401331, Petries Landing - Block 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: F1001B — RAMP - Bldg
Area (ha): 0.027 — To Building Internal Plumbing
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	5.19	5.19		
20	52.03	3.51	3.51		
30	40.04	2.71	2.71		
40	32.86	2.22	2.22		
50	28.04	1.89	1.89		
60	24.56	1.66	1.66		
70	21.91	1.48	1.48		
80	19.83	1.34	1.34		
90	18.14	1.23	1.23		
100	16.75	1.13	1.13		
110	15.57	1.05	1.05		
120	14.56	0.98	0.98		

Subdrainage Area: F1001C — Deck - Bldg
Area (ha): 0.070 — To Building Internal Plumbing
C: 0.37

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	5.53	5.53		
20	52.03	3.75	3.75		
30	40.04	2.88	2.88		
40	32.86	2.37	2.37		
50	28.04	2.02	2.02		
60	24.56	1.77	1.77		
70	21.91	1.58	1.58		
80	19.83	1.43	1.43		
90	18.14	1.31	1.31		
100	16.75	1.21	1.21		
110	15.57	1.12	1.12		
120	14.56	1.05	1.05		

Subdrainage Area: R1001A — Roof
Area (ha): 0.291 — Maximum Storage Depth: 150 mm
C: 0.900

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	76.81	55.92	9.82	46.10	27.66	91.4	0.00
20	52.03	37.88	10.29	27.59	33.11	98.3	0.00
30	40.04	29.15	10.35	18.80	**33.84**	99.2	0.00
40	32.86	23.93	10.26	13.67	32.80	97.9	0.00
50	28.04	20.42	10.10	10.31	30.94	95.6	0.00
60	24.56	17.88	9.91	7.97	28.70	92.7	0.00
70	21.91	15.95	9.70	6.26	26.28	89.7	0.00
80	19.83	14.44	9.48	4.96	23.80	86.6	0.00
90	18.14	13.21	9.26	3.95	21.31	83.5	0.00
100	16.75	12.19	9.05	3.14	18.86	80.4	0.00
110	15.57	11.34	8.84	2.49	16.46	77.4	0.00
120	14.56	10.60	8.62	1.98	14.25	74.3	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Leve	99.19	0.10	10.35	33.84	116.40	0.00

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.234
C: 0.25

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	12.49	12.49		
20	52.03	8.46	8.46		
30	40.04	6.51	6.51		
40	32.86	5.34	5.34		
50	28.04	4.56	4.56		
60	24.56	3.99	3.99		
70	21.91	3.56	3.56		
80	19.83	3.22	3.22		
90	18.14	2.95	2.95		
100	16.75	2.72	2.72		
110	15.57	2.53	2.53		
120	14.56	2.37	2.37		

SUMMARY TO OUTLET

Tributary Area to Storm Sewer	0.513 ha
Uncontrolled to Sewer from Sunken Patios	5.8 L/s
Uncontrolled to Sewer from Deck Area	5.5 L/s
Uncontrolled to Sewer from Ramp Area	5.2 L/s
Controlled Roof Area	10.4 L/s
Controlled Parking Area	6.5 L/s
Total 2yr Flow to Sewer	33.4 L/s
Non-Tributary Area	0.234 ha
Total Uncontrolled 2yr Flow	12.5 L/s
Total 2year Flow	45.9 L/s
Target	99.5 L/s

Project #160401331, Petries Landing - Block 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: F1001B — RAMP - Bldg
Area (ha): 0.027 — To Building Internal Plumbing
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	13.40	13.40		
20	119.95	9.00	9.00		
30	91.87	6.90	6.90		
40	75.15	5.64	5.64		
50	63.95	4.80	4.80		
60	55.89	4.20	4.20		
70	49.79	3.74	3.74		
80	44.99	3.38	3.38		
90	41.11	3.09	3.09		
100	37.90	2.85	2.85		
110	35.20	2.64	2.64		
120	32.89	2.47	2.47		

Subdrainage Area: F1001C — Deck - Bldg
Area (ha): 0.070 — To Building Internal Plumbing
C: 0.4625

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	16.07	16.07		
20	119.95	10.80	10.80		
30	91.87	8.27	8.27		
40	75.15	6.76	6.76		
50	63.95	5.76	5.76		
60	55.89	5.03	5.03		
70	49.79	4.48	4.48		
80	44.99	4.05	4.05		
90	41.11	3.70	3.70		
100	37.90	3.41	3.41		
110	35.20	3.17	3.17		
120	32.89	2.96	2.96		

Warning, max. volume may not have been reached.

Subdrainage Area: R1001A — Roof
Area (ha): 0.291 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	144.45	12.56	131.89	79.13	131.0	0.00
20	119.95	97.04	13.32	83.72	100.47	141.9	0.00
30	91.87	74.32	13.53	60.79	109.42	145.0	0.00
40	75.15	60.79	13.76	47.04	112.89	148.2	0.00
50	63.95	51.74	13.79	37.95	**113.84**	148.7	0.00
60	55.89	45.22	13.77	31.45	113.22	148.4	0.00
70	49.79	40.28	13.71	26.57	111.59	147.5	0.00
80	44.99	36.40	13.63	22.77	109.29	146.4	0.00
90	41.11	33.26	13.53	19.73	106.53	145.0	0.00
100	37.90	30.66	13.42	17.24	103.45	143.4	0.00
110	35.20	28.48	13.30	15.17	100.14	141.7	0.00
120	32.89	26.61	13.18	13.43	96.69	140.0	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Leve	148.70	0.15	13.79	113.84	116.40	0.00

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.234
C: 0.31

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	36.30	36.30		
20	119.95	24.38	24.38		
30	91.87	18.68	18.68		
40	75.15	15.28	15.28		
50	63.95	13.00	13.00		
60	55.89	11.36	11.36		
70	49.79	10.12	10.12		
80	44.99	9.15	9.15		
90	41.11	8.36	8.36		
100	37.90	7.71	7.71		
110	35.20	7.16	7.16		
120	32.89	6.69	6.69		

SUMMARY TO OUTLET

Tributary Area to Storm Sewer	0.513 ha
Uncontrolled to Sewer from Sunken Patios	14.9 L/s
Uncontrolled to Sewer from Deck Area	16.1 L/s
Uncontrolled to Sewer from Ramp Area	13.4 L/s
Controlled Roof Area	13.8 L/s
Controlled Parking Area	6.8 L/s
Total 100yr Flow to Sewer	64.9 L/s
Non-Tributary Area	0.234 ha
Total Uncontrolled 100yr Flow	36.3 L/s
Total 100year Flow	101.2 L/s
Target	99.5 L/s

1.7

Project #160401331, Petries Landing - Block 8
Roof Drain Design Sheet, Area BLDG
Standard Watts Drainage Model R1100 Accuflow Roof Drains

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0035	1	0.025	65	1	1	0.025
0.050	0.0006	0.0069	4	0.050	259	4	4	0.050
0.075	0.0008	0.0087	15	0.075	582	10	15	0.075
0.100	0.0009	0.0104	34	0.100	1035	20	34	0.100
0.125	0.0011	0.0121	67	0.125	1617	33	67	0.125
0.150	0.0013	0.0139	116	0.150	2328	49	116	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
3.8	543.6	3.8	0.15099
14.0	1180.3	10.2	0.47885
34.0	1915.4	19.9	1.0109
66.8	2706.7	32.9	1.76275
115.9	3533.1	49.0	2.74417

Rooftop Storage Summary

Total Building Area (sq.m)		2910
Assume Available Roof Area (sq.r	80%	2328
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		11
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		116
Estimated 100 Year Drawdown Time (h)		2.7

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m)	L/s Open	75%	**50%**	25%	Closed
0.025	0.31545	0.31545	**0.31545**	0.31545	0.31545
0.050	0.6309	0.6309	**0.6309**	0.6309	0.6309
0.075	0.94635	0.86749	**0.78863**	0.70976	0.6309
0.100	1.2618	1.10408	**0.94635**	0.78863	0.6309
0.125	1.57726	1.34067	**1.10408**	0.86749	0.6309
0.150	1.89271	1.57726	**1.2618**	0.94635	0.6309

Calculation Results	5yr	100yr	Available
Qresult (cu.m/s)	0.010	0.014	-
Depth (m)	0.099	0.149	0.150
Volume (cu.m)	33.8	113.8	116.4
Draintime (hrs)	1.0	2.7	

	VORTEX ICD OPENING SIZE													
Head (m)	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**	**105**
0.10	0.42	0.57	0.73	0.90	1.05	1.15	1.30	1.59	1.81	2.02	2.21	2.56	2.79	3.11
0.20	0.59	0.80	1.02	1.23	1.47	1.60	1.88	2.24	2.56	2.86	3.17	3.59	3.98	4.39
0.30	0.73	0.98	1.24	1.49	1.79	1.96	2.32	2.74	3.13	3.51	3.90	4.38	4.88	5.37
0.40	0.85	1.14	1.43	1.72	2.06	2.27	2.69	3.16	3.61	4.05	4.51	5.05	5.64	6.19
0.50	0.95	1.27	1.59	1.91	2.30	2.54	3.02	3.54	4.04	4.53	5.05	5.65	6.31	6.92
0.60	1.04	1.39	1.75	2.09	2.52	2.78	3.31	3.87	4.43	4.96	5.54	6.18	6.92	7.58
0.70	1.13	1.51	1.88	2.26	2.71	3.01	3.58	4.18	4.78	5.36	5.99	6.68	7.47	8.19
0.80	1.21	1.61	2.02	2.42	2.90	3.22	3.83	4.47	5.11	5.73	6.41	7.14	7.99	8.76
0.90	1.28	1.71	2.14	2.56	3.07	3.42	4.07	4.75	5.42	6.08	6.80	7.57	8.47	9.29
1.0	1.35	1.80	2.25	2.70	3.24	3.60	4.29	5.00	5.71	6.41	7.17	7.98	8.93	9.79
1.2	1.48	1.98	2.47	2.96	3.55	3.95	4.71	5.48	6.26	7.02	7.86	8.74	9.78	10.73
1.4	1.61	2.14	2.67	3.20	3.83	4.27	5.09	5.92	6.76	7.58	8.50	9.44	10.56	11.58
1.6	1.72	2.29	2.85	3.42	4.09	4.57	5.45	6.33	7.23	8.11	9.09	10.10	11.29	12.39
1.8	1.82	2.43	3.03	3.63	4.34	4.85	5.78	6.72	7.67	8.60	9.64	10.71	11.98	13.14
2.0	1.93	2.56	3.19	3.83	4.57	5.12	6.10	7.08	8.08	9.06	10.17	11.29	12.63	13.85
2.5	2.16	2.86	3.57	4.28	5.10	5.73	6.83	7.92	9.04	10.14	11.37	12.62	14.11	15.48
3.0	2.37	3.14	3.91	4.69	5.59	6.29	7.49	8.67	9.90	11.10	12.46	13.83	15.46	16.96
5	3.06	4.06	5.06	6.07	7.21	8.14	9.68	11.20	12.78	14.34	16.10	17.86	19.95	21.90
7	3.63	4.80	5.99	7.19	8.52	9.65	11.46	13.26	15.12	16.96	19.06	21.14	23.60	25.92
9	4.12	5.45	6.80	8.16	9.66	10.95	13.01	15.04	17.15	19.24	21.62	23.98	26.76	29.39
11	4.56	6.03	7.52	9.02	10.68	12.12	14.38	16.63	18.96	21.27	23.90	26.51	29.58	32.50
13	4.96	6.55	8.17	9.81	11.60	13.18	15.64	18.08	20.61	23.12	25.99	28.82	32.16	35.33
15	5.33	7.04	8.78	10.54	12.46	14.17	16.81	19.42	22.14	24.84	27.92	30.96	34.54	37.95

Appendix D GEOTECHNICAL INVESTIGATION

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

patersongroup

Supplemental Geotechnical Investigation

Proposed Multi-Storey Buildings
Blocks 8 - Petrie's Landing II
8466 Jeanne D'Arc Boulevard
Ottawa, Ontario

Prepared For

Construction Brigil

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October 1,2021

Report: PG4112-2 Revision 3

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Construction Brigil to conduct a supplemental geotechnical investigation for Blocks 8 at Petrie's Landing II residential development located at 8466 Jeanne D'Arc Boulevard in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2).

The objective of the investigation was to:

- ❏ determine the subsoil and groundwater conditions at this site by means of test holes and existing soils information.
- ❏ provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

2.0 Proposed Development

It is understood that Block 8 of the residential development will consist of a mid-rise residential building with 1 levels of underground parking with pathways, landscaping and paved parking areas with local access roadways and will be serviced by municipal services.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the supplemental geotechnical investigation was carried out on July 9 and 10, 2019, at that time 3 boreholes (BH1-19 to BH3-19) were drilled to a maximum depth of 42.9 m. A initial geotechnical investigation was carried out, for the subject block, on April 24 and 25, 2017 which consisted of extending a total of 3 boreholes (BH 4-17 to BH 6-17) to a maximum depth of 9.8 m below the existing grade. The borehole locations were distributed in a manner to provide general coverage of the subject site at the proposed buildings footprints area and taking into consideration site features. Borehole locations are illustrated on Drawing PG4112-2 - Test Hole Location Plan included in Appendix 2.

The boreholes were drilled using a track-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The drilling procedure consisted of augering to the required depths at the selected locations, sampling and testing the overburden.

Sampling and In Situ Testing

Soil samples were recovered from a 50 mm diameter split-spoon or the auger flights. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. All samples were transported to our laboratory. The depths at which the split-spoon and auger samples were recovered from the boreholes are presented as SS and AU, respectively, on the Soil Profile and Test Data sheets.

Standard Penetration Tests (SPT) were conducted and recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split-spoon sample 300 mm into the soil after the initial penetration of 150 mm using a 63.5 kg hammer falling from a height of 760 mm.

Undrained shear strength testing, using a vane apparatus, was carried out at regular intervals of depth in cohesive soils.

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) completed on all 3 boreholes of the current investigation. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets presented in Appendix 1 for specific details of the soil profile encountered at the test hole locations.

Groundwater

Flexible polyethylene standpipes were installed in boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

3.2 Field Survey

The borehole locations and ground surface elevations at the borehole locations were provided by Annis, O'Sullivan Vollebekk Ltd. The borehole locations and the ground surface elevation at the borehole locations are presented on Drawing PG4112-2 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples recovered from the subject site were visually examined in our laboratory to review the field logs.

One representative soil sample was submitted for Atterberg limits testing and hydrometer sieve analysis as part of the current investigation. The results are presented in Subsection 6.8.

3.4 Analytical Testing

One soil sample was submitted for analytical testing to assess the potential for exposed ferrous metals and the sulphate potential against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the soil. The results are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject property is bordered to the north by Jeanne D'Arc Boulevard North, to the east by a treed area and Taylor Creek, to the south by parcel currently in development by the same owner, and to the west by Prestige Circle and residential dwellings.

The site is relatively flat and grass covered. Some existing fill piles containing organic and construction debris were observed near the south portion of the site near the current construction project

4.2 Subsurface Profile

Generally, the soil conditions encountered at the test holes locations consist of topsoil or fill overlying a brown silty clay crust over a deep deposit of grey silty clay.

Based on available geological mapping and previous investigations conducted by Paterson in the area, interbedded limestone and dolomite bedrock of the Gull River formation is present in this area with a drift thickness of 40 to 50 m.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profiles encountered at each test hole location.

Silty Clay

A weathered silty clay crust varying in depths between 0.3 and 3 m was encountered at the borehole locations. In situ shear vane field testing was carried out in the lower portion of the weathered crust yielded undrained shear strength values ranging from approximately 90 to 105 kPa. These values are indicative of a stiff to very stiff consistency.

Grey silty clay was encountered below the weathered crust at all borehole locations. In situ shear vane field testing carried out in the grey silty clay yielded undrained shear strength values ranging between 38 and 60 kPa. These values are indicative of a firm to stiff consistency.

4.3 Groundwater

The measured groundwater levels in the boreholes are presented in Table 1 below.

Table 1
Summary of Groundwater Level Readings

Borehole Number	Ground Elevation (m)	Groundwater Levels (m)		Recording Date
		Depth	Elevation	
BH 1-19	54.29	4.04	50.25	July 29, 2019
BH 2-19	52.71	6.53	46.18	July 29, 2019
BH 3-19	52.57	6.10	46.47	July 29, 2019
BH 4-17	53.84	dry	-	May 1, 2017
BH 5-17	52.45	4.35	48.10	May 1, 2017
BH 6-17	52.59	5.48	47.11	May 1, 2017

Note: The groundwater level at each current borehole location is referenced to the borehole ground surface elevation, as provided by Annis, O'Sullivan Vollebekk Ltd.

It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction. The long term groundwater level is expected to be at a depth of 4 to 6 m below the existing grade.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered satisfactory for the proposed multi-storey building. Based on the results of the field program, it's expected that the proposed building will be founded on a raft foundation placed on the undisturbed stiff silty clay bearing surface. Where design building loads exceed the given bearing resistance values, consideration may be given to placing the building footprint on end bearing piles and the building garage footprint extending beyond the building would be placed on conventional spread footings.

A permissible grade raise restriction is required for the subject site due to the presence of a deep silty clay deposit. It's expected that final grades will be close to the existing grades.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organics, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures.

Fill Placement

Fill used for grading beneath the building footprints, unless otherwise specified, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The fill should be tested and approved prior to delivery to the site. It should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building area should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD. Site-excavated soils are not suitable for use as backfill against foundation walls due to the frost heave potential of the site excavated soils below settlement sensitive areas, such as concrete sidewalks and exterior concrete entrance areas.

5.3 Foundation Design

Conventional Footings

Pad footings, up to 6 m wide, and strip footings, up to 4 m wide, placed on an undisturbed, brown stiff to very stiff silty clay bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **250 kPa**.

Pad footings, up to 6 m wide, and strip footings, up to 4 m wide, placed on an undisturbed, grey silty clay bearing surface can be designed using a bearing resistance value at SLS of **100 kPa** and a factored bearing resistance value at ULS of **200 kPa**.

The bearing resistance values are provided on the assumption that the footings will be placed on undisturbed soil bearing surfaces. An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in-situ or not, have been removed, prior to the placement of concrete for footings.

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to the in-situ bearing medium soils above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in-situ soil of the same or higher capacity as the bearing medium soil.

Settlement

The total and differential settlements will be dependent on characteristics of the proposed buildings. For design purposes, the total and differential settlements are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed.

The potential post construction total and differential settlements are dependent on the position of the long term groundwater level when buildings are situated over deposits of compressible silty clay. Efforts can be made to reduce the impacts of the proposed development on the long term groundwater level by placing clay dykes in the service trenches, reducing the sizes of paved areas, leaving green spaces to allow for groundwater recharge or limiting planting of trees to areas away from the buildings. However, it is not economically possible to control the groundwater level.

Raft Foundation

Consideration can be given to a raft foundation if the building loads are acceptable. It's expected that a raft foundation will be founded at a depth of approximately 3 to 4 m below the existing grade. The following parameters may be used for a raft foundation design:

- For design purposes, the factored bearing resistance at ULS can be taken as **200 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

- The amount of settlement of the raft slab will be dependent on the sustained raft contact pressure. A bearing resistance value at SLS (contact pressure) of **100 kPa** can be used. The loading conditions for the contact pressure are based on sustained loads, that are generally taken to be 100% Dead Load and 50% Live Load.

- The modulus of subgrade reaction was calculated to be **4 MPa/m** for a contact pressure of **100 kPa**. The design of the raft foundation is required to consider the relative stiffness of the reinforced concrete slab and the supporting bearing medium.

- The proposed building can be designed using the above parameters and a total and differential settlement of 25 and 20 mm, respectively.

Deep Foundation

For support of the proposed multi-storey building consideration could be given to using concrete filled steel pipe piles driven to refusal on the bedrock surface.

For deep foundations, concrete-filled steel pipe piles are generally utilized in the Ottawa area. Applicable pile resistance at SLS values and factored pile resistance at ULS values are given in Table 2. A resistance factor of 0.4 has been incorporated into the factored ULS values. Note that these are all geotechnical axial resistance values.

The geotechnical pile resistance values were estimated using the Hiley dynamic formula, to be confirmed during pile installation with a program of dynamic monitoring. For this project, the dynamic monitoring of two to four piles would be recommended. As a minimum, the pipe piles should be equipped with a base plate having a thickness of at least 20 mm to minimize damage to the pile tip during driving. Re-striking of all piles at least once will also be required after at least 48 hours have elapsed since initial driving.

Table 2 - Pile Foundation Design Data

Pile Outside Diameter (mm)	Pile Wall Thickness (mm)	Geotechnical Axial Resistance		Final Set (blows/12 mm)	Transferred Hammer Energy (kJ)
		SLS (kN)	Factored at ULS (kN)		
245	9	940	1130	10	29
245	11	1175	1410	10	35
245	13	1375	1650	10	42

Permissible Grade Raise Restriction

Due to the presence of the silty clay layer, the subject site will be subjected to a permissible grade restriction. A permissible grade raise restriction of **2 m** is recommended for the subject site.

5.4 Design for Earthquakes

Shear wave velocity testing was completed for the subject site to accurately determine the applicable seismic site classification for the proposed building in accordance with Table 4.1.8.4.A of the Ontario Building Code 2012. The shear wave velocity testing was completed by Paterson personnel. The results of the shear wave velocity test are provided in Figures 2 and 3 in Appendix 2.

Field Program

The seismic array testing location was placed as presented in Drawing PG4112-1 - Test Hole Location Plan, attached to the present report. Paterson field personnel placed 24 horizontal 2.4 Hz. geophones mounted to the surface by means of two 75 mm ground spikes attached to the geophone land case. The geophones were spaced at 3 m intervals and connected by a geophone spread cable to a Geode 24 Channel seismograph.

The seismograph was also connected to a computer laptop and a hammer trigger switch attached to a 12-pound dead blow hammer. The hammer trigger switch sends a start signal to the seismograph. The hammer is used to strike an I-Beam seated into the ground surface, which creates a polarized shear wave. The hammer shots are repeated between four (4) to eight (8) times at each shot location to improve signal to noise ratio.

The shot locations are also completed in forward and reverse directions (i.e.- striking both sides of the I-Beam seated parallel to the geophone array). The shot locations were 15, 3, and 2 m away from the first and last geophone, and at the centre of the seismic array.

Data Processing and Interpretation

Interpretation for the shear wave velocity results were completed by Paterson personnel. Shear wave velocity measurement was made using reflection/refraction methods. The interpretation is performed by recovering arrival times from direct and refracted waves. The interpretation is repeated at each shot location to provide an average shear wave velocity, V_{s30}, of the upper 30 m profile immediately below the foundation of the building.

It should be noted that due to bedrock depth, the seismic survey testing results did not trace a refraction from the underlying bedrock. For the purpose of defining the appropriate seismic site classification according to OBC 2012, the subsurface profile was conservatively taken as consisting of a 27 m deep deposit of overburden.

The seismic survey testing results indicate that the average shear wave velocity for the silty clay overburden layer is **175 m/s**. The bedrock shear wave velocity is conservatively taken as **1500 m/s**.

The Vs30 was calculated using the standard equation for average shear wave velocity provided in the OBC 2012 and as presented below:

$$V_{S30} = \frac{Depth_{ofinterest}(m)}{\sum\left(\frac{Depth_{Layer1}(m)}{V_{S_{Layer1}}(m/s)} + \frac{Depth_{Layer2}(m)}{V_{S_{Layer2}}(m/s)}\right)}$$

$$V_{S30} = \frac{30m}{\left(\frac{27m}{175m/s} + \frac{3m}{1500m/s}\right)}$$

$$V_{S30} = 192m/s$$

Based on the results of the seismic testing and foundation details of the proposed building, the average shear wave velocity, V_{s30}, for the proposed building is **192 m/s**. Therefore, a site **class D** is applicable as ter Table 4.1.8.4.A of OBC 2012.

The soils underlying the subject site are not susceptible to liquefaction.

5.5 Slab-on-Grade Construction

With the removal of all topsoil and deleterious materials, within the footprint of the proposed buildings, the native soil or engineered fill surface will be considered to be an acceptable subgrade surface on which to commence backfilling for the floor slab. The upper 150 mm of sub-slab fill should consist of an OPSS Granular A crushed stone. All backfill material within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose lifts and compacted to at least 98% of its SPMDD.

Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

5.6 Pavement Design

Car only parking areas, access lanes and heavy truck parking areas are anticipated at this site. The proposed pavement structures are shown in Tables 3 and 4.

Table 3 - Recommended Pavement Structure - Car Only Parking Areas	
Thickness (mm)	**Material Description**
50	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill	

Table 4 - Recommended Pavement Structure Access Lanes and Heavy Truck Parking Areas	
Thickness (mm)	**Material Description**
40	**Wear Course** - Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill	

It is anticipated that a construction access road may be required during construction. The contractor will be responsible to ensure the proper access and stability for heavy equipment during construction. Table 5 presents the minimum recommendation for such an access road. The access and area should also be shaped to promote drainage away from the access road. Note that this does not replace a proper worker platform for cranes and heavy equipment.

Table 5 - Minimum requirements for construction access routes.	
Thickness (mm)	**Material Description**
150	**BASE** - OPSS Granular A Crushed Stone
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill	

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable vibratory equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

Due to the impervious nature of the subgrade materials consideration should be given to installing subdrains during the pavement construction. These drains should be installed at each catch basin, be at least 3 m long and should extend in four orthogonal directions or longitudinally when placed along a curb. Along local streets, the drains should be placed along the edges of the pavement. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for the proposed structures. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structures. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials, such as clean sand or OPSS Granular B Type I granular material. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls. A drainage geocomposite, such as Miradrain G100N or Delta Drain 6000, connected to the perimeter foundation drainage system is recommended.

Underfloor and Perimeter Drainage Pipe Layout

Underfloor drainage will be required to control water infiltration below the lowest underground parking level slab that breaches the horizontal hydraulic barrier (minimum 150 mm thick concrete mud slab). For design purposes, it is recommended that a 150 mm diameter perforated pipe be placed for the interior perimeter and along each bay at a maximum spacing of 8m. The final spacing of the underfloor drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

The interior drainage system must have a positive gravity connection towards the building sump pit or the storm water management system. The inside perimeter and underfloor drainage pipe should consist of a 150 mm diameter perforated corrugated pipe wrapped in a geosock surrounded by 150 mm of 19 mm clear crushed stone and placed throughout the building footprint.

It is required that the contractor conduct an as-built survey once the installation of the interior drainage system is completed to ensure a gravity drainage is provided towards the building's sump pit. The drainage pipe should not be backfilled until as-builts are reviewed and approved by Paterson. Installation of the PVC sleeves and placement of the perimeter and underfloor drainage pipe must be periodically inspected by Paterson personnel.

Long-term groundwater infiltration will be low with maximum peaks during spring thaw and rain events. Sump pit pumps should be design for a maximum groundwater inflow of 50,000L/day.

6.2 Protection Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum 1.5 m thick soil cover (or equivalent) should be provided in this regard.

A minimum of 2.1 m thick soil cover (or equivalent) should be provided for other exterior unheated footings.

6.3 Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by "cut and cover" methods and excavations will not be left open for extended periods of time.

Temporary Shoring

Temporary shoring may be required for the overburden soil to complete the required excavations where insufficient room is available for open cut methods. The shoring requirements designed by a structural engineer specializing in those works will depend on the depth of the excavation, the proximity of the adjacent structures and the elevation of the adjacent building foundations and underground services. The design and implementation of these temporary systems will be the responsibility of the excavation contractor and their design team. Inspections and approval of the temporary system will also be the responsibility of the designer. Geotechnical information provided below is to assist the designer in completing a suitable and safe shoring system. The designer should take into account the impact of a significant precipitation event and designate design measures to ensure that a precipitation will not negatively impact the shoring system or soils supported by the system. Any changes to the approved shoring design system should be reported immediately to the owner's structural design prior to implementation.

The designer should also, consider the nearby services and conduits during the design and installation of the temporary shoring system. It is understood that a hydro electric duct back is located near the south west portion of the site. Reference should be made to Figure 4 in Appendix 1 for proposed typical section. The location of the duct bank should be confirmed and identified by the contractor on field.

The temporary system could consist of soldier pile and lagging system or interlocking steel sheet piling. Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be included to the earth pressures described below. These systems could be cantilevered, anchored or braced. Generally, it is expected that the shoring systems will be provided with tie-back rock anchors to ensure their stability. The shoring system is recommended to be adequately supported to resist toe failure and inspected to ensure that the sheet piles extend well below the excavation base. It should be noted if consideration is being given to utilizing a raker style support for the shoring system that lateral movements can occur and the structural engineer should ensure that the design selected minimizes these movements to tolerable levels.

The earth pressures acting on the shoring system may be calculated with the following parameters.

Table 6 - Soil Parameters	
Parameters	**Values**
Active Earth Pressure Coefficient (K_a)	0.33
Passive Earth Pressure Coefficient (K_p)	3
At-Rest Earth Pressure Coefficient (K_o)	0.5
Dry Unit Weight (γ), kN/m^3	20
Effective Unit Weight (γ), kN/m^3	13

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible. The dry unit weight should be calculated above the groundwater level while the effective unit weight should be calculated below the groundwater level.

The hydrostatic groundwater pressure should be included to the earth pressure distribution wherever the effective unit weight are calculated for earth pressures. If the groundwater level is lowered, the dry unit weight for the soil/bedrock should be calculated full weight, with no hydrostatic groundwater pressure component.

For design purposes, the minimum factor of safety of 1.5 should be calculated.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications & Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

At least 150 mm of OPSS Granular A should be used for bedding for sewer and water pipes when placed on soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 95% of the material's SPMDD.

Generally, it should be possible to re-use the moist, not wet, silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. The wet silty clay should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being re-used.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

6.5 Groundwater Control

Groundwater Control for Building Construction

It is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations.

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

A temporary Ministry of the Environment, Conservation and Parks (MECP) Category permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum of 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

Long-term Groundwater Control

Our recommendations for the proposed building's long-term groundwater control are presented in Subsection 6.1. Any groundwater encountered along the building's perimeter or sub-slab drainage system will be directed to the proposed building's cistern/sump pit. Provided the proposed groundwater infiltration control system is properly implemented and approved by the geotechnical consultant at the time of construction, it is expected that groundwater flow will be low (i.e.- less than 50,000 L/day) with peak periods noted after rain events. A more accurate estimate can be provided at the time of construction, once groundwater infiltration levels are observed. It is anticipated that the groundwater flow will be controllable using conventional open sumps.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a non aggressive to slightly aggressive corrosive environment.

6.8 Landscaping Considerations

Retaining Wall Design

It is expected that retaining walls will be required to grade the property. Retaining walls higher than 1.0 m should be designed by a professional engineer, as per City of Ottawa retaining wall design standards. The bearing resistance provided in Section 5.3 are applicable to the proposed retaining walls.

The soil parameters presented in Tables 7 and 8 should be used for the design of the retaining walls. Paterson reviewed the proposed grading plan and has evaluated the factor of safety against global stability to be over 1.5 for static conditions and greater than 1.1 under seismic conditions.

Sunken Patios

Sunken patio areas are proposed along the south portion of the building. It is expected that smaller precast concrete landscape modular blocks can be used for those smaller wall. Modular blocks are an efficient options for those wall. The walls will be installed partly over the subsurface parking structure and surrounding soils. A transition zone will be required between the parking structure and surrounded areas. Typical details are presented on attached Figure 5 for more details.

While it is expected that the parking structure will be well drained, it should be noted that water infiltration along the face of the wall is probable and is not considered an issue for the walls.

A factored loading of 30 kPa should be assumed for a smaller precast modular concrete wall with a maximum height of 1.2 m. A final design for the walls might be required prior to construction.

Global Stability Analysis

The global stability analysis was modeled in Fine Geo 5, a computer program which permits a two-dimensional slope stability analysis calculating several methods including the Bishop's method, which is a widely accepted slope analysis method. The program calculates a factor of safety, which represents the ratio of the forces resisting failure to forces favoring failure. Theoretically, a factor of safety of 1.0 represents a condition where the slope is stable. However, due to intrinsic limitations of the calculation methods and the variability of the subsurface soil and groundwater conditions, a factor of safety greater than 1.0 is generally required for the failure risk to be considered acceptable.

A minimum factor of safety of 1.5 is generally recommended for conditions where the slope failure would comprise permanent structures. An analysis considering seismic loading was also completed. A horizontal acceleration of 0.16 g was considered for the sections for the seismic loading condition. A factor of safety of 1.1 is considered to be satisfactory for stability analyses including seismic loading.

The retaining wall section was reviewed using the design loading according to CHBDC 2015.

The highest retaining wall cross-section was studied as the worst case scenario. The cross section and design calculation can be found under Appendix 3. The following parameters were used for the slope stability analysis under static and seismic conditions:

Table 7 - Effective Soil Parameters for Stability Analysis

Soil Layer	Unit Weight (kN/m^3)	Friction Angle (degrees)	Cohesion (kPa)
Brown Silty Clay Crust	17	33	5
Granular Type II	22	38	0

The total strength parameters for seismic analysis were chosen based on the in situ, undrained shear strengths recovered within the open boreholes completed at the time of our geotechnical investigation and based on our general knowledge of the geology in the area. The strength parameters used for seismic analysis at the slope cross-section are presented in Table 7 below.

Table 8 - Total Strength Soil Parameters for Seismic Analysis

Soil Layer	Unit Weight (kN/m^3)	Friction Angle (degrees)	Cohesion (kPa)
Brown Silty Clay Crust	17	-	80
Granular B Type II	22	38	-

Analysis Results

The factor of safety for the retaining wall section was greater than 1.5 for static conditions. Similarly, the results under seismic loading yielded a factor of safety for this section greater than 1.1. The retaining wall design is considered stable.

Reference should be made to retaining wall design and package in Appendix for more details.

Tree Planting Restrictions

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils(2017 Guidelines), Paterson completed a soil review of the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. A shrinkage limit test and sieve analysis testing was also completed on selected soil samples.
The shrinkage limit testing indicates a shrinkage limit of 15% with a shrinkage ratio of 1.99. The results of our Atterberg limit and sieve testing are presented in Appendix 1.

Based on the results of our testing, the clay on site can be defined as low to medium plasticity silty clay (Plasticity index < 40%). In accordance with the city of Ottawa guidelines, the tree planting setback limits may be reduced to 4.5 m for small (mature tree height up to 7.5m) and medium size trees (mature tree height 7.5 m to 14 m) provided that the following conditions are met.

The underside of footing (USF) is 2.1 m or greater below the lowest finished grade must be satisfied for footings within 10 m from the tree, as measured from the centre of the tree trunk and verified by means of the Grading Plan as indicated procedural changes below.

- ❑ A small tree must be provided with a minimum of 25 m^3 of available soil volume while a medium tree must be provided with a minimum of 30 m^3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

- ❑ The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect. The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).

- ❏ Grading surround the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree), as noted on the subdivision Grading Plan.

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that the following material testing and observation program be performed by the geotechnical consultant.

- ❑ Review of the grading plan once available
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials used.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

8.0 Statement of Limitations

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

A geotechnical investigation of this nature is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around the test locations. The extent of the limited area depends on the soil, bedrock and groundwater conditions, as well the history of the site reflecting natural, construction, and other activities. Should any conditions at the site be encountered which differ from those at the test locations, we request notification immediately in order to permit reassessment of our recommendations.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Construction Brigil or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

October 1, 2021

Joey R. Villeneuve, M.A.Sc, P.Eng. Faisal I. Abou-Seido, P.Eng.

Report Distribution

- ❏ Construction Brigil
- ❏ Paterson Group

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERG LIMITS RESULTS

HYDROMETER SIEVE ANALYSIS RESULTS

ANALYTICAL TESTING RESULTS

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Petrie's Landing III - Block 8 - 2466 Jeanne D'arc Blvd.
Ottawa, Ontario

DATUM Geodetic elevations provided by Annis O'Sullivan Vollebekk Ltd.

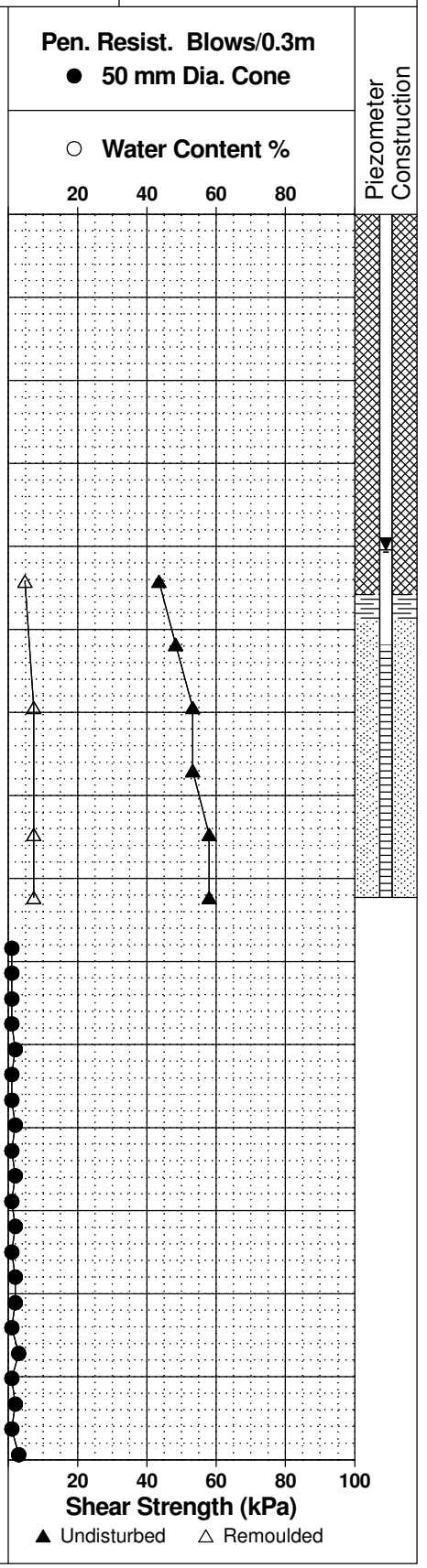
FILE NO. PG4112

REMARKS

HOLE NO. BH 1-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	54.29
FILL: Brown silty sand, some gravel and organics 0.28		AU	1				
Brown **SILTY CLAY** with organics		SS	2	58	8	1	53.29
1.37		SS	3	88	15	2	52.29
		SS	4	100	9	3	51.29
Very stiff to stiff, brown **SILTY CLAY**		SS	5	100	3	4	50.29
- grey by 3.0m depth		SS	6	100	W	5	49.29
						6	48.29
						7	47.29
8.23						8	46.29
Dynamic Cone Penetration Test commenced at 8.23m depth.						9	45.29
						10	44.29
						11	43.29
						12	42.29
						13	41.29
						14	40.29
						15	39.29



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Petrie's Landing III - Block 8 - 2466 Jeanne D'arc Blvd.
Ottawa, Ontario

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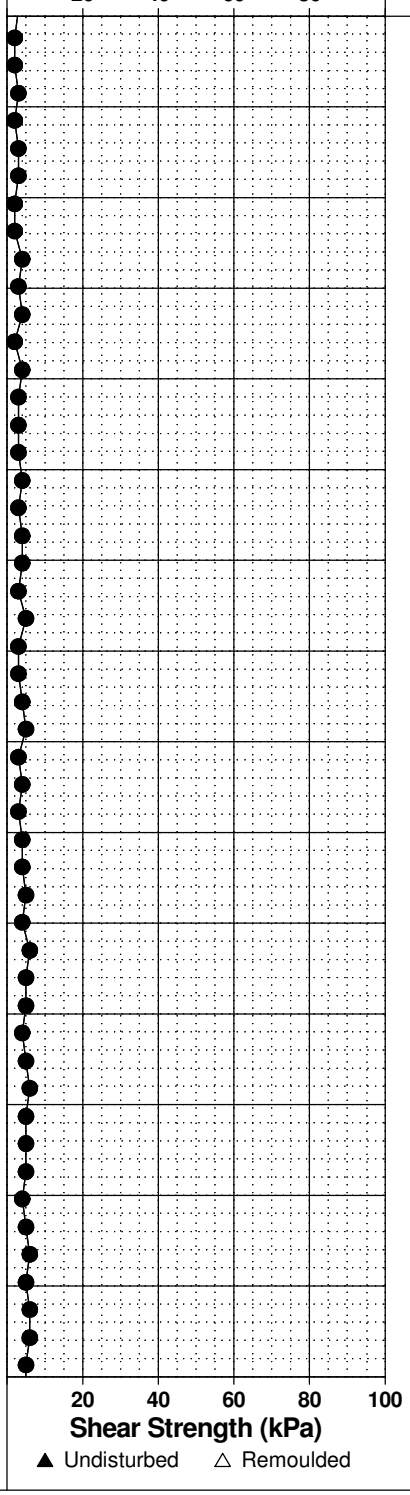
REMARKS

HOLE NO. BH 1-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						15	39.29		
						16	38.29		
						17	37.29		
						18	36.29		
						19	35.29		
						20	34.29		
						21	33.29		
						22	32.29		
						23	31.29		
						24	30.29		
						25	29.29		
						26	28.29		
						27	27.29		
						28	26.29		
						29	25.29		
						30	24.29		



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Petrie's Landing III - Block 8 - 2466 Jeanne D'arc Blvd.
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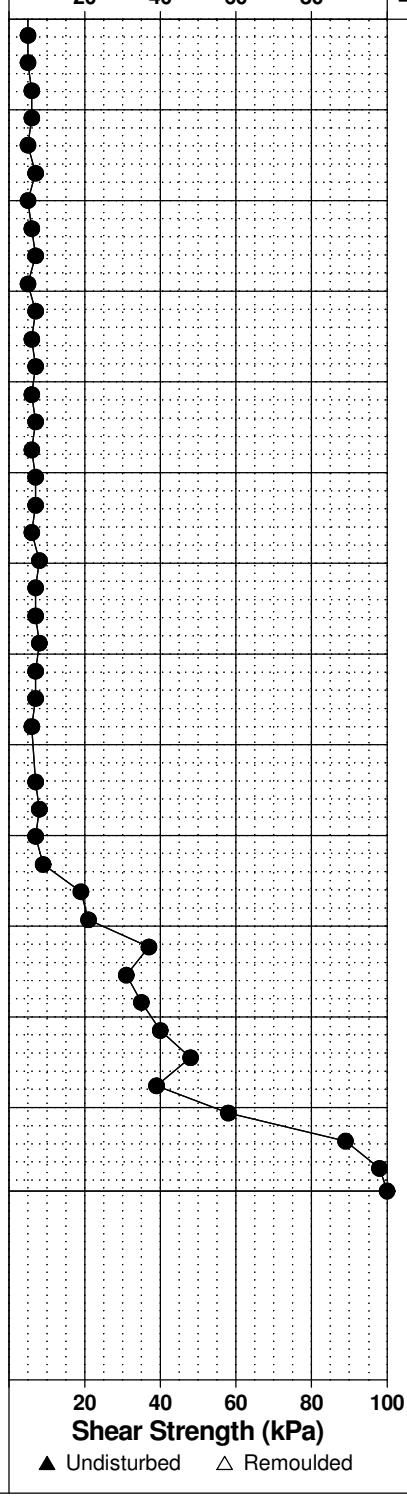
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						30	24.29		
						31	23.29		
						32	22.29		
						33	21.29		
						34	20.29		
						35	19.29		
						36	18.29		
						37	17.29		
						38	16.29		
						39	15.29		
						40	14.29		
						41	13.29		
						42	12.29		
42.92									
End of Borehole									

Practical DCPT refusal at 42.92m depth.

(GWL @ 4.04m - July 29, 2019)



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Petrie's Landing III - Block 8 - 2466 Jeanne D'arc Blvd.
Ottawa, Ontario

DATUM Geodetic elevations provided by Annis O'Sullivan Vollebekk Ltd.

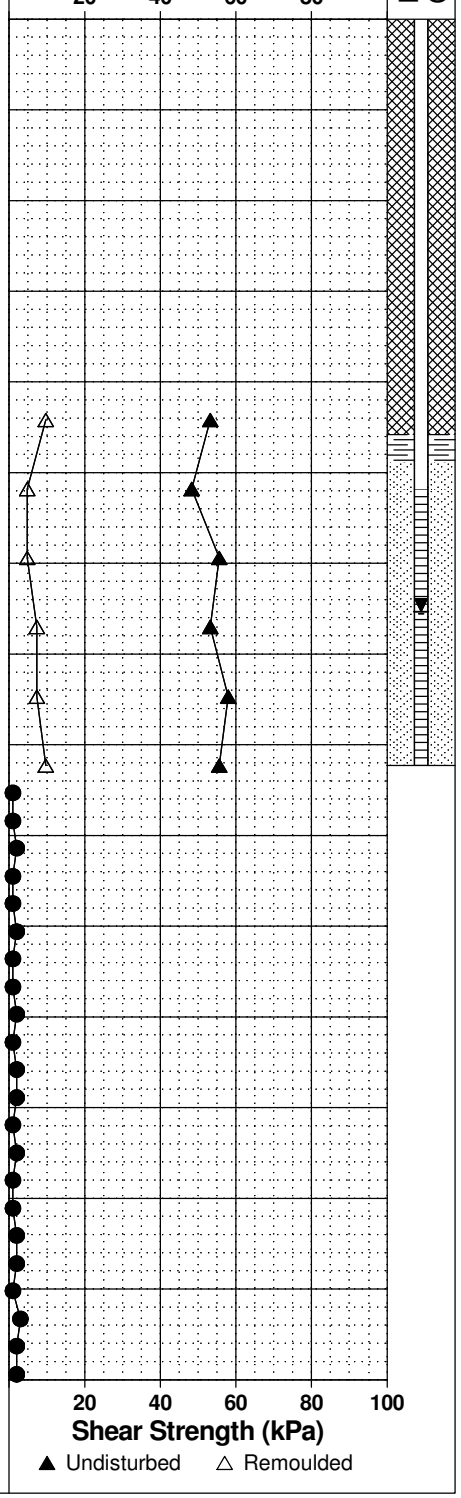
FILE NO. PG4112

REMARKS

HOLE NO. BH 2-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	52.71
FILL: Brown silty sand, some gravel and organics (0.33)		AU	1				
		SS	2	17	13	1	51.71
		SS	3	100	7	2	50.71
Very stiff to stiff, brown **SILTY CLAY**		SS	4	33	4	3	49.71
- grey by 3.0m depth		SS	5	100	W	4	48.71
						5	47.71
						6	46.71
						7	45.71
(8.23)						8	44.71
Dynamic Cone Penetration Test commenced at 8.23m depth.						9	43.71
						10	42.71
						11	41.71
						12	40.71
						13	39.71
						14	38.71
						15	37.71



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Petrie's Landing III - Block 8 - 2466 Jeanne D'arc Blvd.
Ottawa, Ontario

DATUM Geodetic elevations provided by Annis O'Sullivan Vollebekk Ltd.

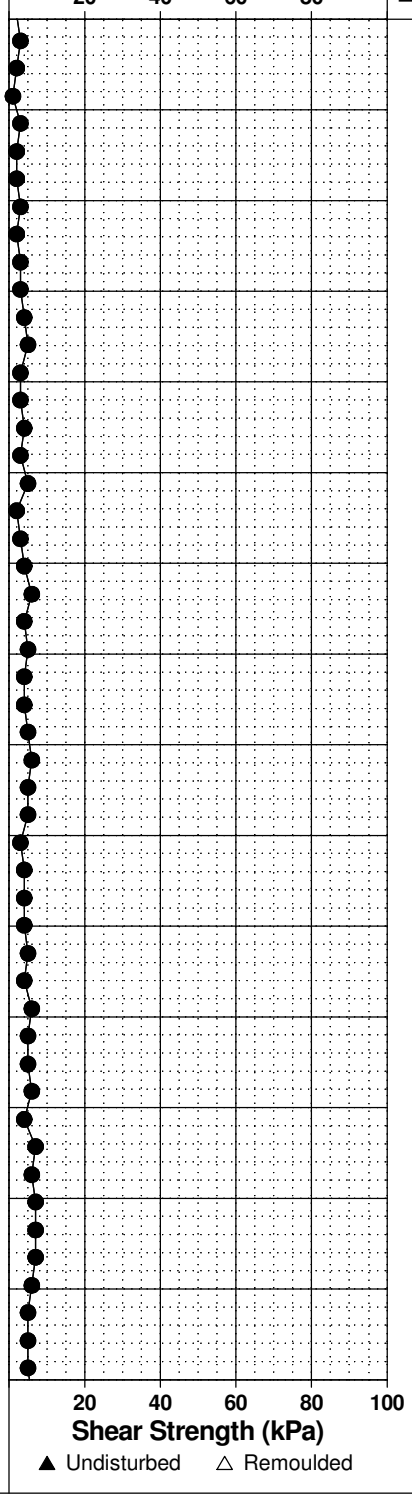
FILE NO. PG4112

REMARKS

HOLE NO. BH 2-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						15	37.71		
						16	36.71		
						17	35.71		
						18	34.71		
						19	33.71		
						20	32.71		
						21	31.71		
						22	30.71		
						23	29.71		
						24	28.71		
						25	27.71		
						26	26.71		
						27	25.71		
						28	24.71		
						29	23.71		
						30	22.71		



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Petrie's Landing III - Block 8 - 2466 Jeanne D'arc Blvd.
Ottawa, Ontario

DATUM Geodetic elevations provided by Annis O'Sullivan Vollebekk Ltd.

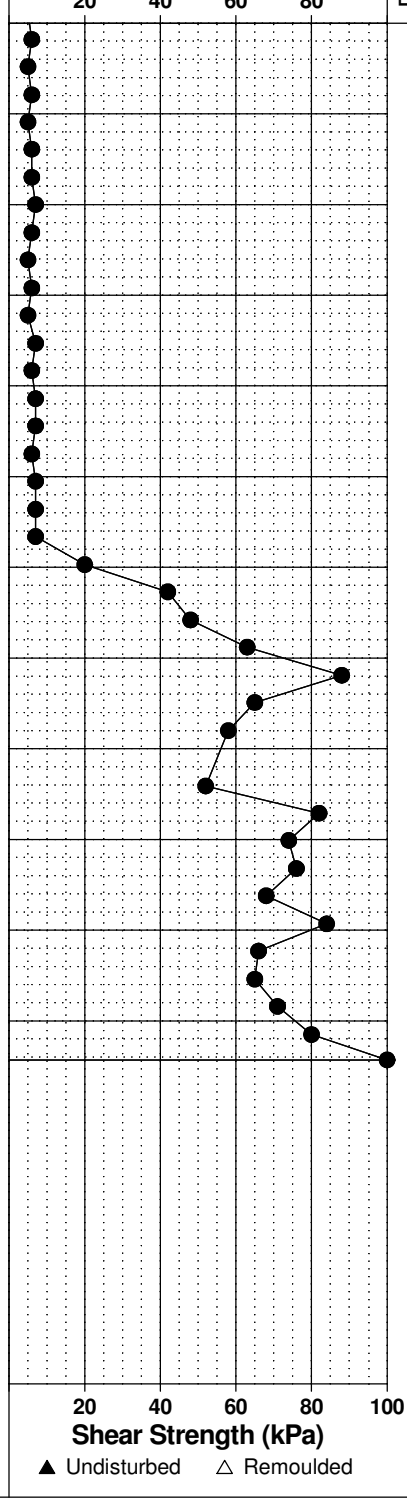
FILE NO. PG4112

REMARKS

HOLE NO. BH 2-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						30	22.71		
						31	21.71		
						32	20.71		
						33	19.71		
						34	18.71		
						35	17.71		
						36	16.71		
						37	15.71		
						38	14.71		
						39	13.71		
						40	12.71		
						41	11.71		
41.43									
End of Borehole									
Practical DCPT refusal at 41.43m depth.									
(GWL @ 6.53m - July 29, 2019)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Petrie's Landing III - Block 8 - 2466 Jeanne D'arc Blvd.
Ottawa, Ontario

DATUM Geodetic elevations provided by Annis O'Sullivan Vollebekk Ltd.

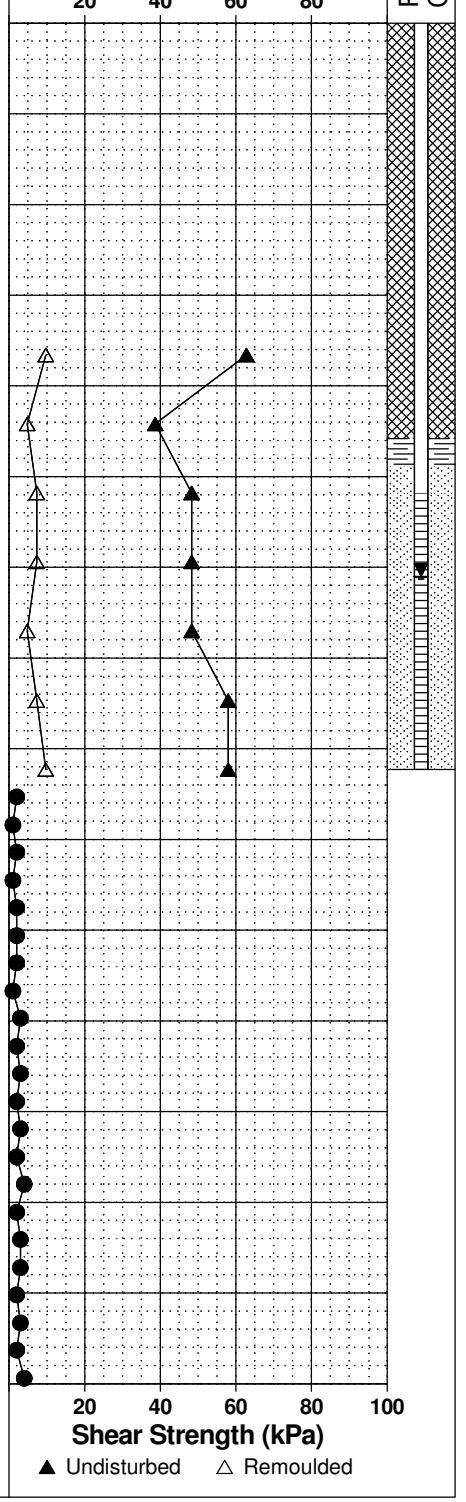
FILE NO. PG4112

REMARKS

HOLE NO. BH 3-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 10

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	52.57
FILL: Brown silty sand, some gravel and organics (0.33)		AU	1				
		SS	2	54	14	1	51.57
		SS	3	100	9	2	50.57
Very stiff to stiff, brown **SILTY CLAY**		SS	4	38	5	3	49.57
- grey by 3.0m depth						4	48.57
						5	47.57
						6	46.57
						7	45.57
(8.23)						8	44.57
Dynamic Cone Penetration Test commenced at 8.23m depth.						9	43.57
						10	42.57
						11	41.57
						12	40.57
						13	39.57
						14	38.57
						15	37.57



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

DATUM Geodetic elevations provided by Annis O'Sullivan Vollebekk Ltd.

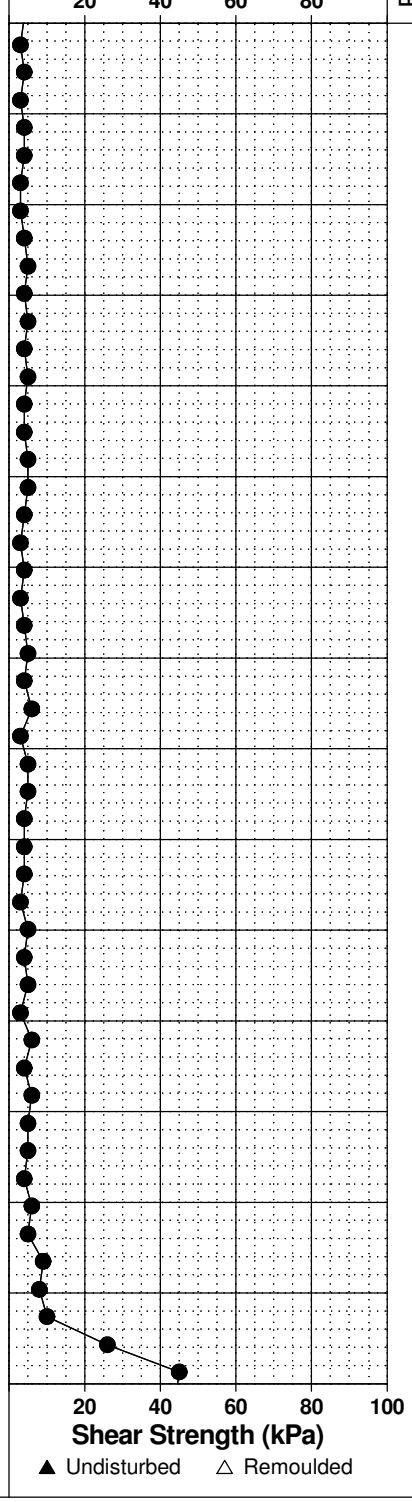
FILE NO. PG4112

REMARKS

HOLE NO. BH 3-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 10

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						15	37.57		
						16	36.57		
						17	35.57		
						18	34.57		
						19	33.57		
						20	32.57		
						21	31.57		
						22	30.57		
						23	29.57		
						24	28.57		
						25	27.57		
						26	26.57		
						27	25.57		
						28	24.57		
						29	23.57		
						30	22.57		



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Petrie's Landing III - Block 8 - 2466 Jeanne D'arc Blvd.
Ottawa, Ontario

DATUM Geodetic elevations provided by Annis O'Sullivan Vollebekk Ltd.

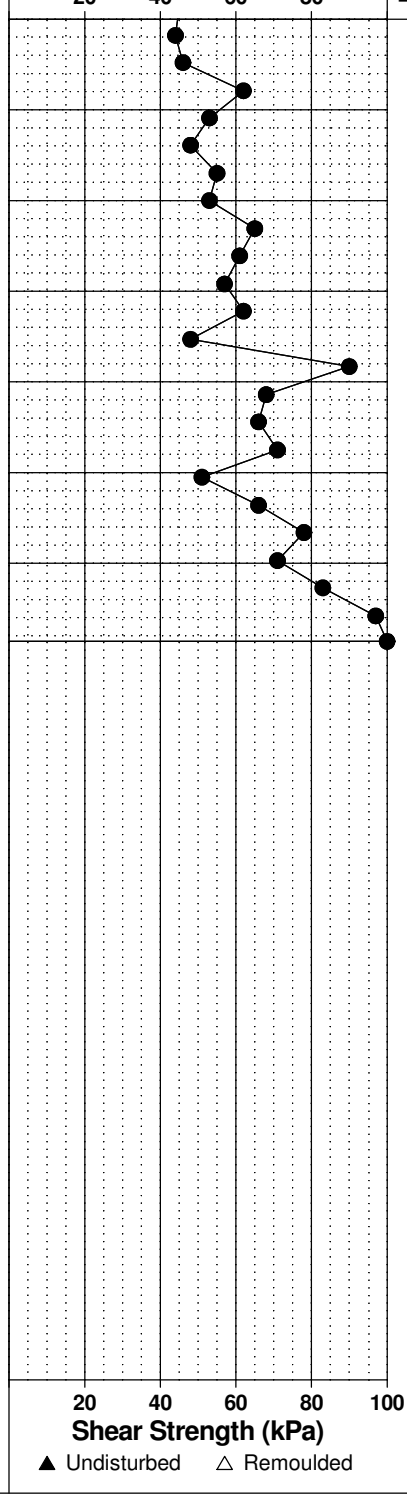
FILE NO. PG4112

REMARKS

HOLE NO. BH 3-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 10

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
						30	22.57		
						31	21.57		
						32	20.57		
						33	19.57		
						34	18.57		
						35	17.57		
						36	16.57		
36.86									
End of Borehole Practical DCPT refusal at 36.86m depth. (GWL @ 6.10m - July 29, 2019)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 8466 Jean D'Arc Boulevard
Ottawa, Ontario

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

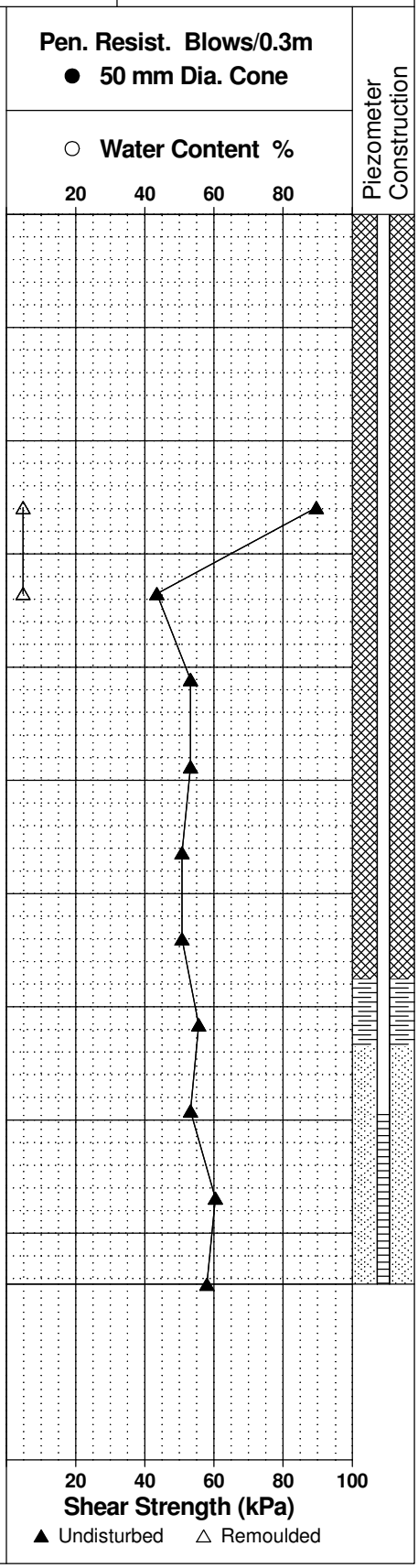
FILE NO. PG4112

REMARKS

HOLE NO. BH 4-17

BORINGS BY CME 55 Power Auger **DATE** April 24, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	53.84
FILL: Brown silty clay with sand and topsoil, trace gravel, cobbles, boulders, crushed stone and organics		AU	1				
0.69							
		SS	2	83	10	1	52.84
		SS	3	83	10	2	51.84
Firm to stiff, brown **SILTY CLAY**						3	50.84
- grey by 3.0m depth						4	49.84
						5	48.84
						6	47.84
						7	46.84
						8	45.84
						9	44.84
9.45							
End of Borehole							
(BH dry and blocked at 5.46m depth - May 1, 2017)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 8466 Jean D'Arc Boulevard
Ottawa, Ontario

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

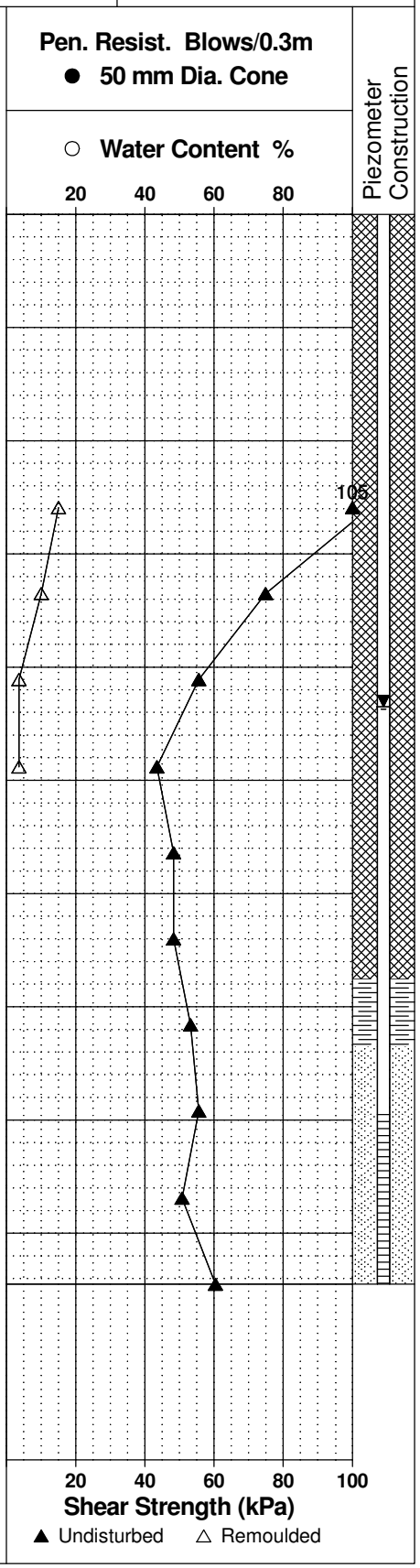
FILE NO. PG4112

REMARKS

HOLE NO. BH 5-17

BORINGS BY CME 55 Power Auger **DATE** April 24, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	52.45
FILL: Brown silty sand with clay, trace gravel, cobbles and organics 0.18		AU	1				
		SS	2	79	13	1	51.45
		SS	3	96	8	2	50.45
Very stiff to firm, brown **SILTY CLAY,** some reddish lenses						3	49.45
- grey by 3.8m depth						4	48.45
						5	47.45
						6	46.45
						7	45.45
						8	44.45
						9	43.45
9.45 End of Borehole							
(GWL @ 4.35m - May 1, 2017)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 8466 Jean D'Arc Boulevard
Ottawa, Ontario

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

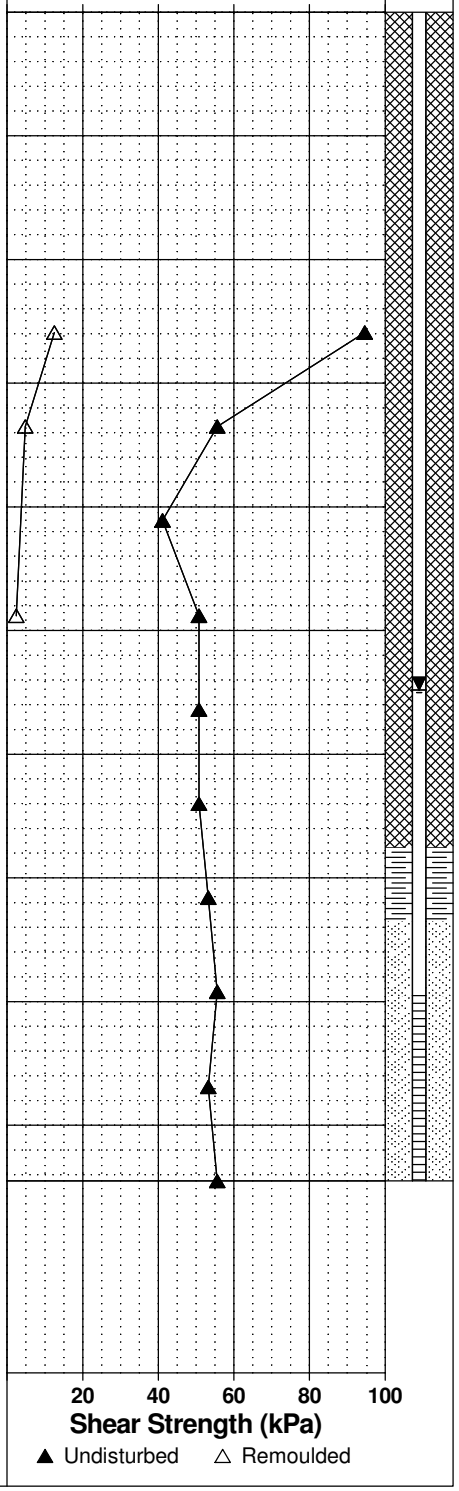
FILE NO. PG4112

REMARKS

HOLE NO. BH 6-17

BORINGS BY CME 55 Power Auger **DATE** April 24, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	52.78
FILL: Brown silty clay with topsoil, some gravel, trace sand and organics 0.43		AU	1				
		SS	2	96	9	1	51.78
		SS	3	100	5	2	50.78
Firm to stiff, brown **SILTY CLAY** with reddish lenses						3	49.78
- grey by 3.8m depth						4	48.78
						5	47.78
						6	46.78
						7	45.78
						8	44.78
						9	43.78
9.45 End of Borehole							
(GWL @ 5.48m - May 1, 2017)							



SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

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

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called "mechanical breaks") are easily distinguishable from the normal in situ fractures.

RQD %	**ROCK QUALITY**
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

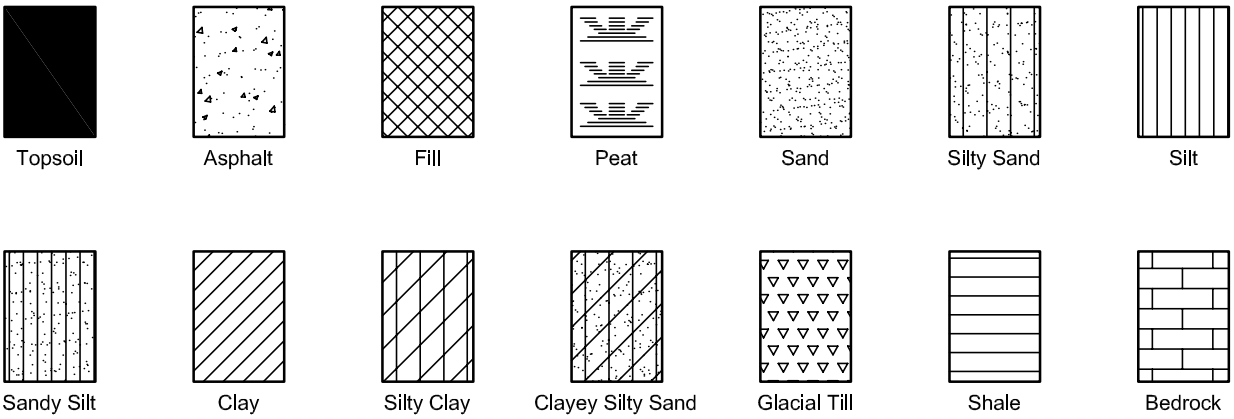
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

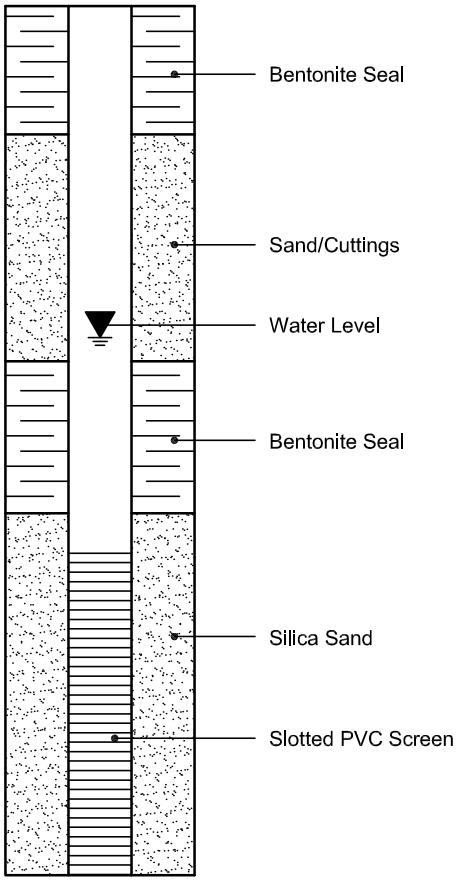
SYMBOLS AND TERMS (continued)

STRATA PLOT

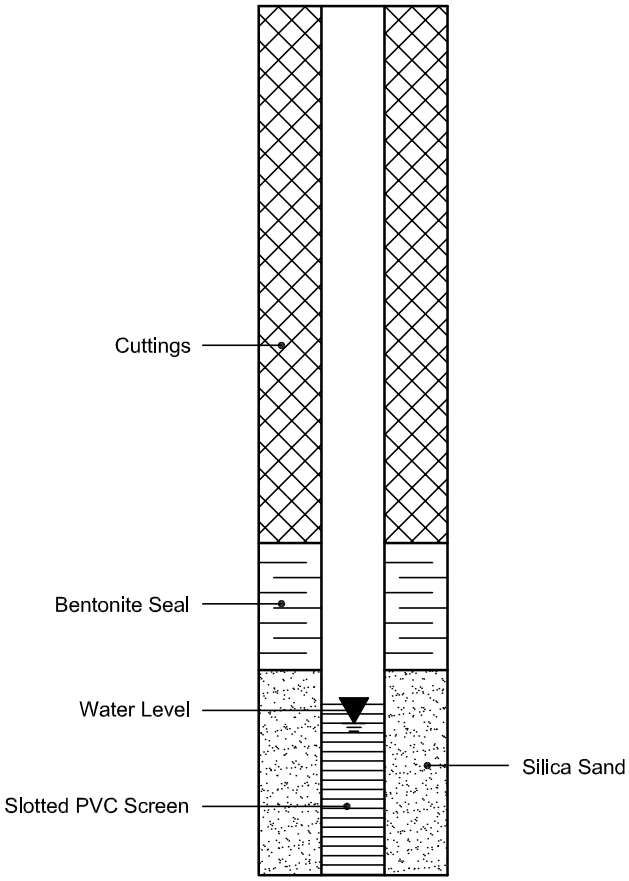


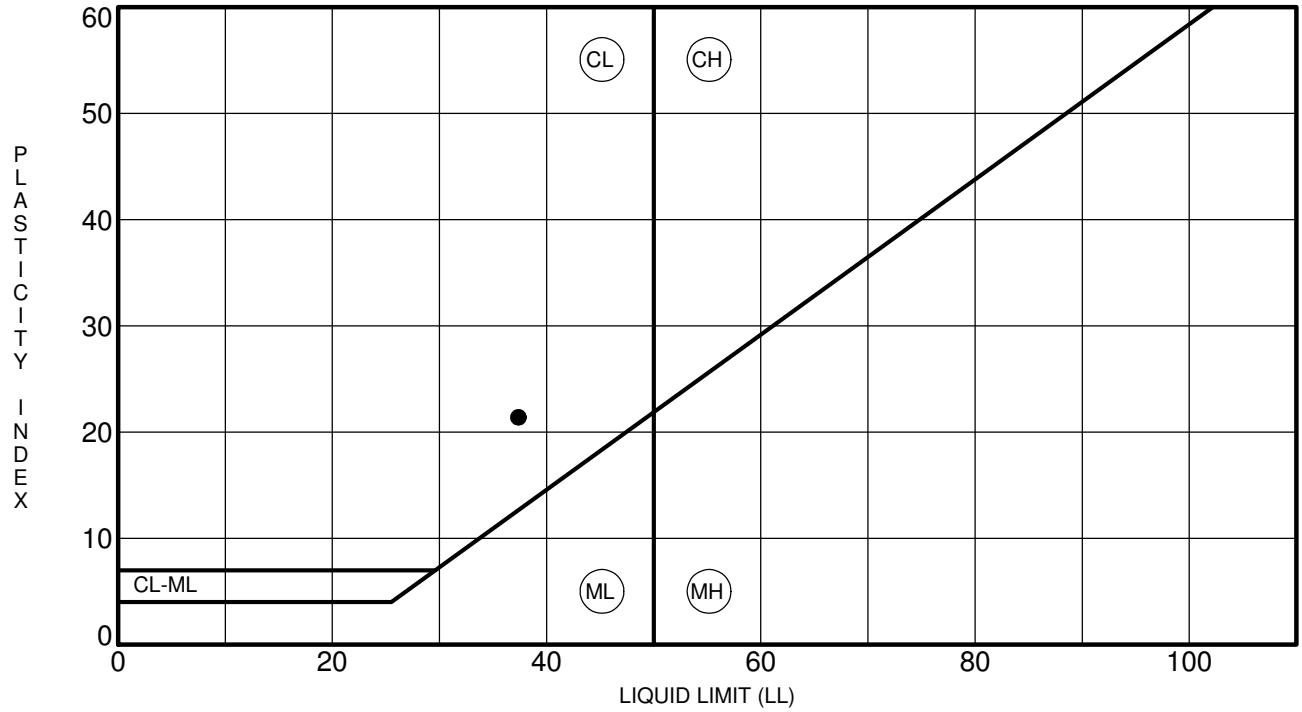
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





Specimen Identification	LL	PL	PI	Fines	Classification
● **BH 1-19 SS 4**	**37**	**16**	**21**		**CL - Inorganic clays of low plasticity**

CLIENT	**Brigil Construction**	FILE NO.	**PG4112**
PROJECT	**Geotechnical Investigation - Petrie's Landing III - Block 8 - 2466 Jeanne D'arc Blvd.**	DATE	**9 Jul 19**

patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS

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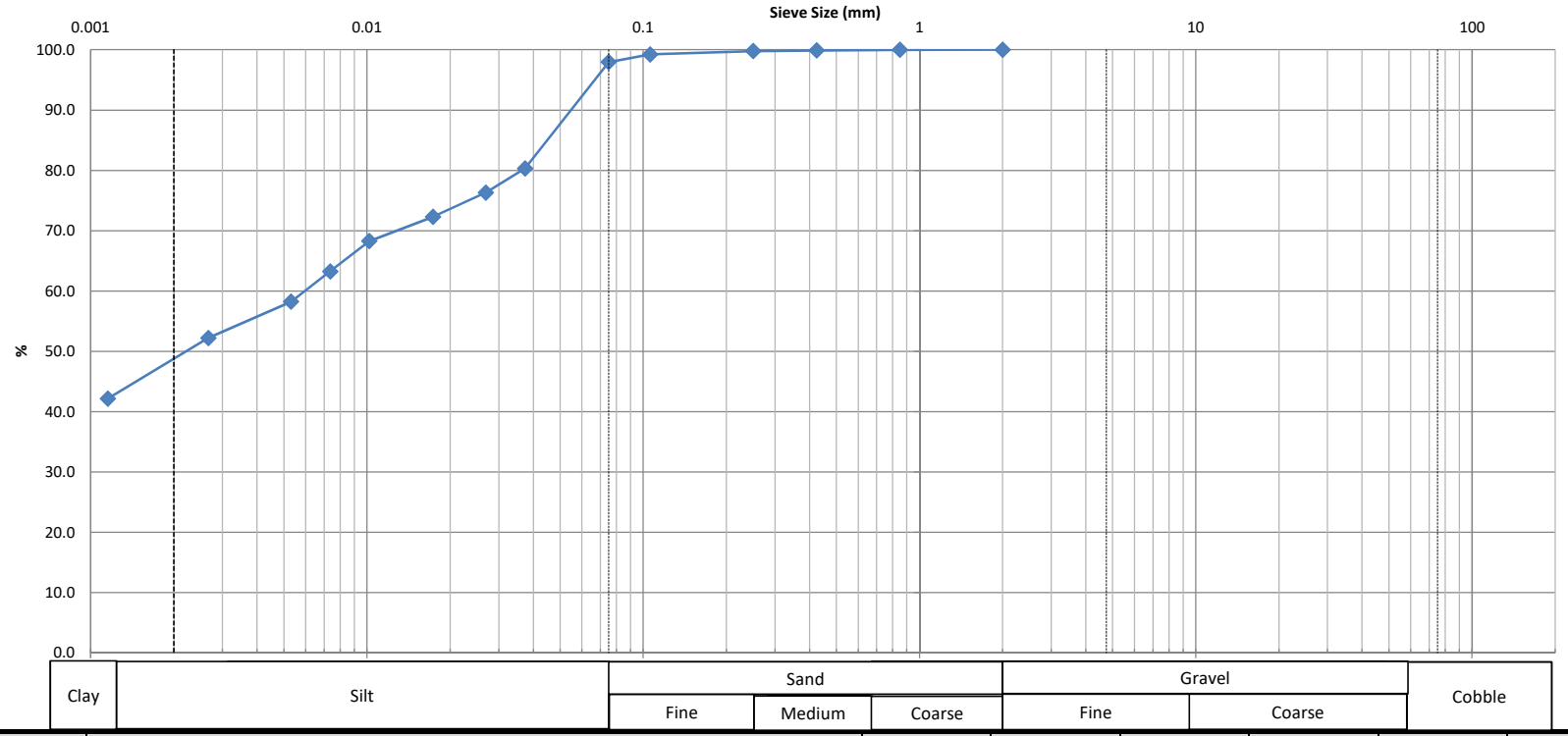
consulting engineers

SIEVE ANALYSIS
ASTM C136

CLIENT:	Brigil	DEPTH:	7' - 9'6"	FILE NO:	PG4112
CONTRACT NO.:		BH OR TP No.:	BH1	LAB NO:	09370
PROJECT:	Petries Landing II			DATE RECEIVED:	12-Jul-19
				DATE TESTED:	17-Jul-19
DATE SAMPLED:	10-Jul-19			DATE REPORTED:	19-Jul-19
SAMPLED BY:	-			TESTED BY:	D.Bertrand



Identification	Soil Classification					MC(%)	LL	PL	PI	Cc	Cu
						29.9					
	D100	D60	D30	D10	Gravel (%)	Sand (%)		Silt (%)		Clay (%)	
					0.0	2.1		48.4		49.5	

Comments:

REVIEWED BY:	Curtis Beadow	Joe Fosyth, P. Eng.

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HYDROMETER
LS-702 ASTM-422

CLIENT:	Brigil	DEPTH:	7' - 9'6"	FILE NO.:	PG4112
PROJECT:	Petries Landing II	BH OR TP No.:	BH1	DATE SAMPLED	10-Jul-19
LAB No. :	09370	TESTED BY:	D.Bertrand	DATE RECEIVED	12-Jul-19
SAMPLED BY:	-	DATE REPT'D:	19-Jul-19	DATE TESTED:	17-Jul-19

SAMPLE INFORMATION

SAMPLE MASS	SPECIFIC GRAVITY
116.0	2.700

INITIAL WEIGHT	50.00	**HYGROSCOPIC MOISTURE**		
WEIGHT CORRECTED	49.25	TARE WEIGHT	50.00	ACTUAL WEIGHT
WT. AFTER WASH BACK SIEVE	1.28	AIR DRY	150.00	100.00
SOLUTION CONCENTRATION	40 g/L	OVEN DRY	148.50	98.50
		CORRECTED	0.985	

GRAIN SIZE ANALYSIS

SIEVE DIAMETER (mm)	WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT PASSING
13.2			
9.5			
4.75			
2.0	**0.0**	0.0	**100.0**
Pan	**116.0**		
0.850	**0.01**	0.0	**100.0**
0.425	**0.05**	0.1	**99.9**
0.250	**0.11**	0.2	**99.8**
0.106	**0.38**	0.8	**99.2**
0.075	**1.01**	2.1	**97.9**
Pan	**1.28**		
SIEVE CHECK 0.0	MAX = 0.3%		

HYDROMETER DATA

ELAPSED	TIME (24 hours)	Hs	Hc	Temp. (°C)	DIAMETER	(P)	TOTAL PERCENT PASSING
1	7:38	45.0	5.0	25.0	0.0373	80.3	**80.3**
2	7:39	43.0	5.0	25.0	0.0269	76.3	**76.3**
5	7:42	41.0	5.0	25.0	0.0173	72.3	**72.3**
15	7:52	39.0	5.0	25.0	0.0102	68.3	**68.3**
30	8:07	36.5	5.0	25.0	0.0074	63.2	**63.2**
60	8:37	34.0	5.0	25.0	0.0053	58.2	**58.2**
250	11:47	31.0	5.0	25.0	0.0027	52.2	**52.2**
1440	7:37	26.0	5.0	25.0	0.0012	42.2	**42.2**

COMMENTS:

Moisture Content = 23.2%

REVIEWED BY:	C. Beadow	Joe Forsyth, P. Eng.
		

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 21273

Report Date: 04-May-2017

Order Date: 28-Apr-2017

Project Description: PG4112

	Client ID:	BH3-SS3	-	-	-
	Sample Date:	25-Apr-17	-	-	-
	Sample ID:	1717537-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	75.3	-	-	-
General Inorganics					
pH	0.05 pH Units	7.08	-	-	-
Resistivity	0.10 Ohm.m	76.6	-	-	-
Anions					
Chloride	5 ug/g dry	36	-	-	-
Sulphate	5 ug/g dry	21	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

FIGURE 2 & 3 - SHEAR WAVE VELOCITY PROFILES

FIGURE 4 - TYPICAL SECTION - HYDRO DUCT

FIGURE 5 - GRANDE WALL TYPICAL SECTION AND TRANSITION ZONE DETAIL

DRAWING PG4112-2 - TEST HOLE LOCATION PLAN

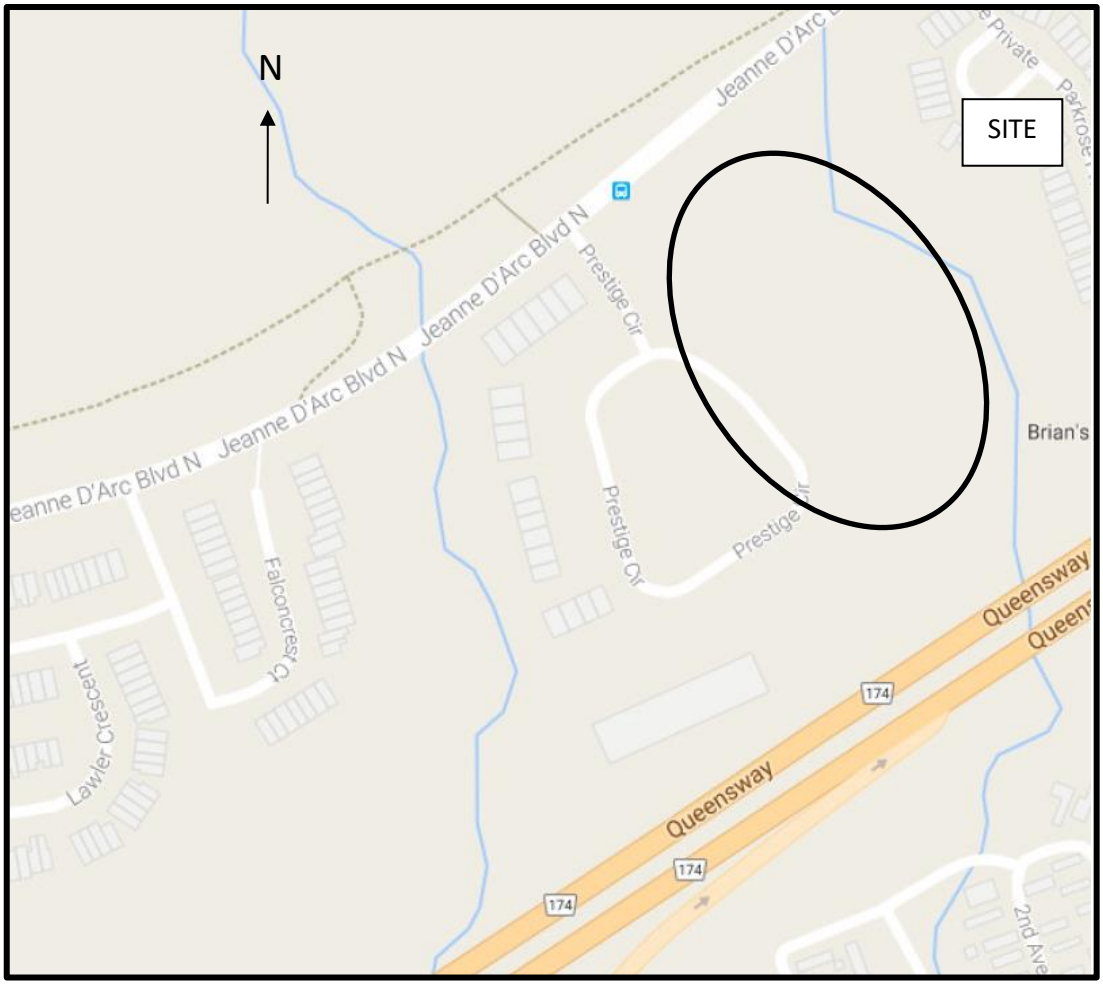


FIGURE 1

KEY PLAN

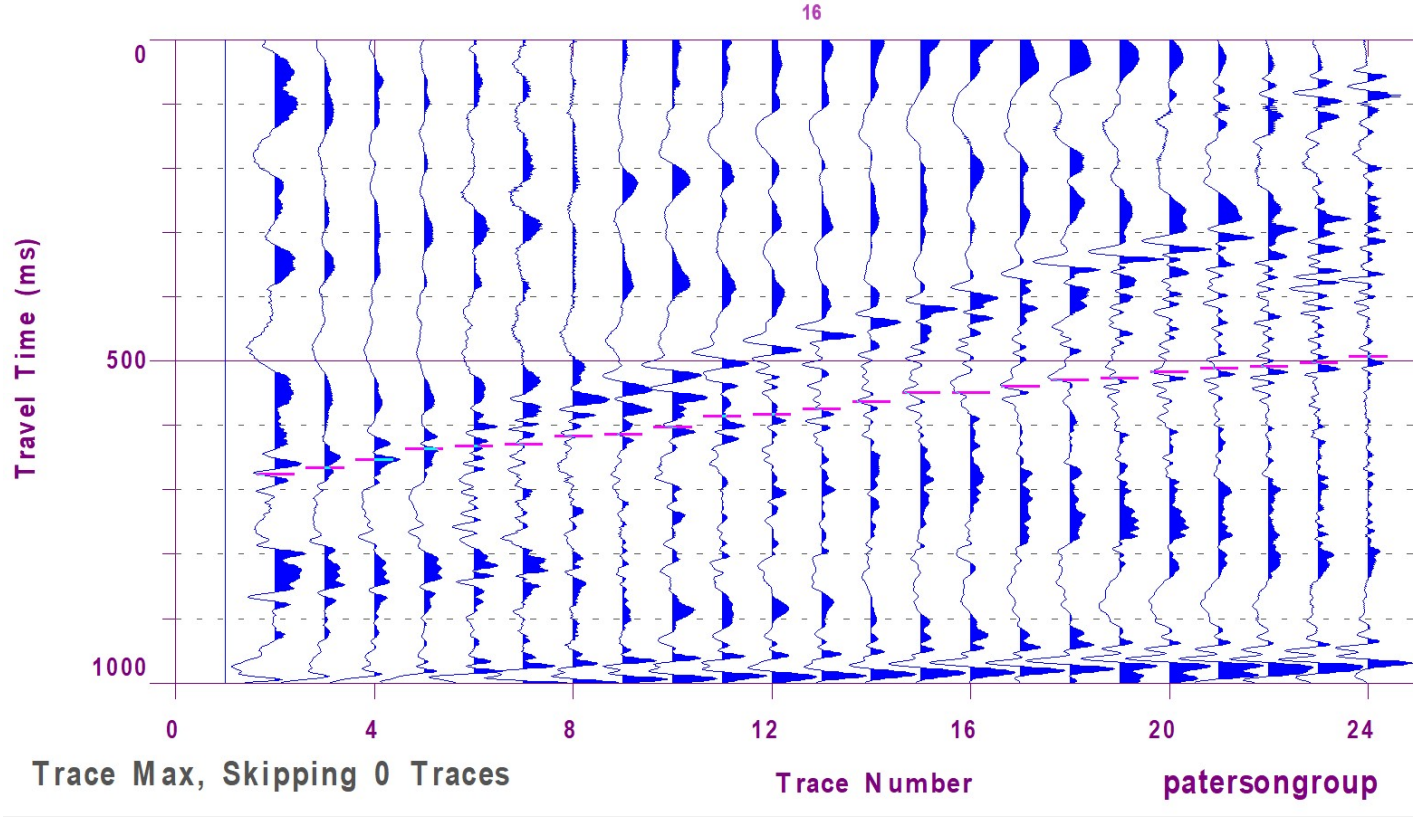


Figure 2 – Shear Wave Velocity Profile at Shot Location 94 m

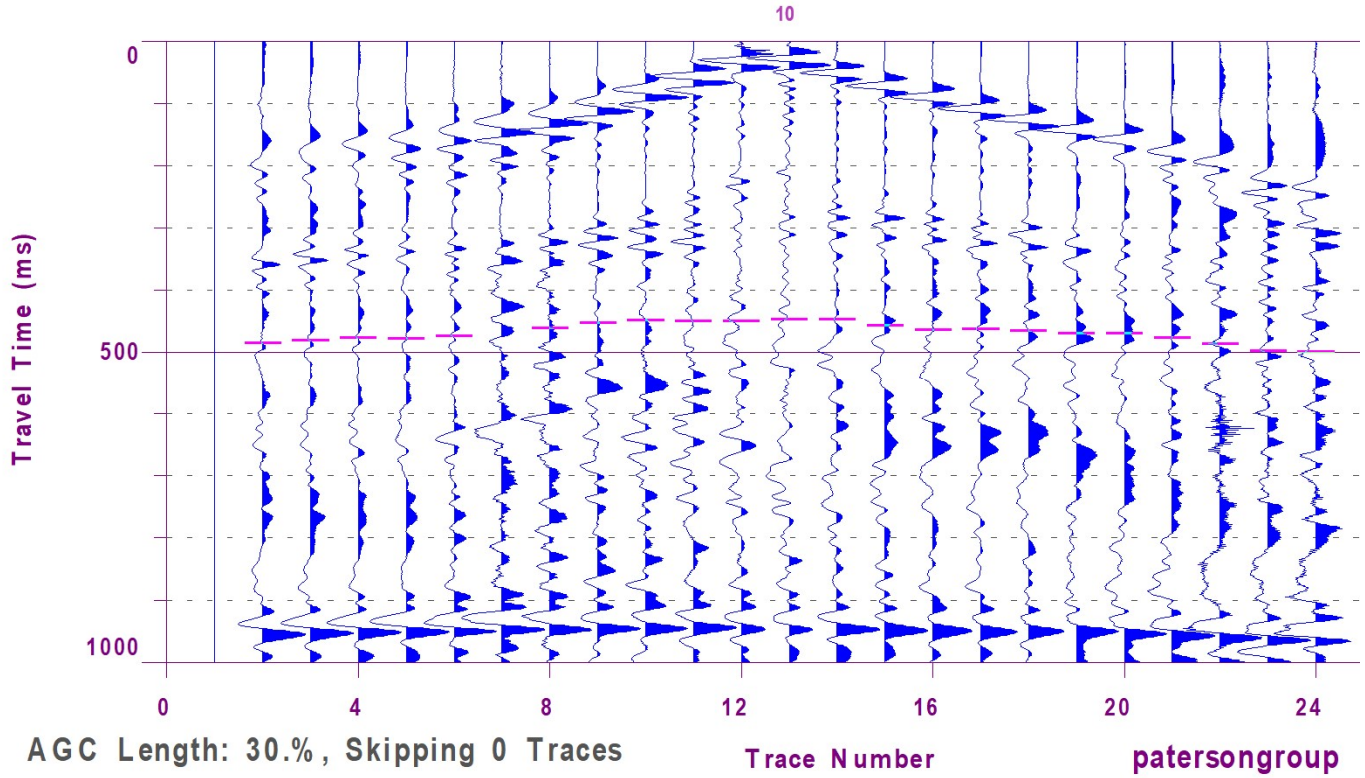
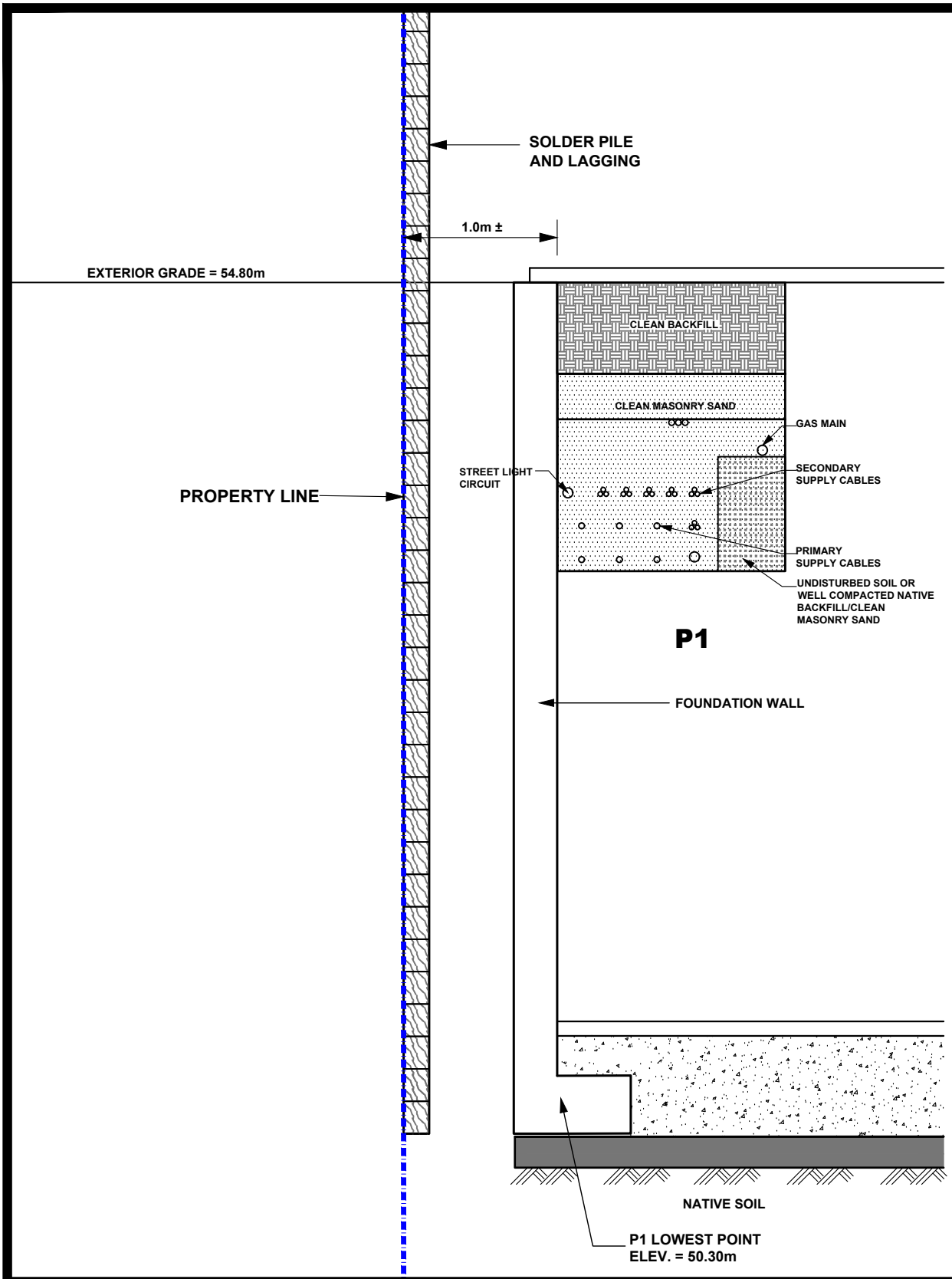


Figure 3 – Shear Wave Velocity Profile at Shot Location 34.5 m



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BRIGIL CONSTRUCTION

PROPOSED MULTI-STOREY BUILDING
PIETRIES LANDING - BLOCK 8
OTTAWA, ONTARIO

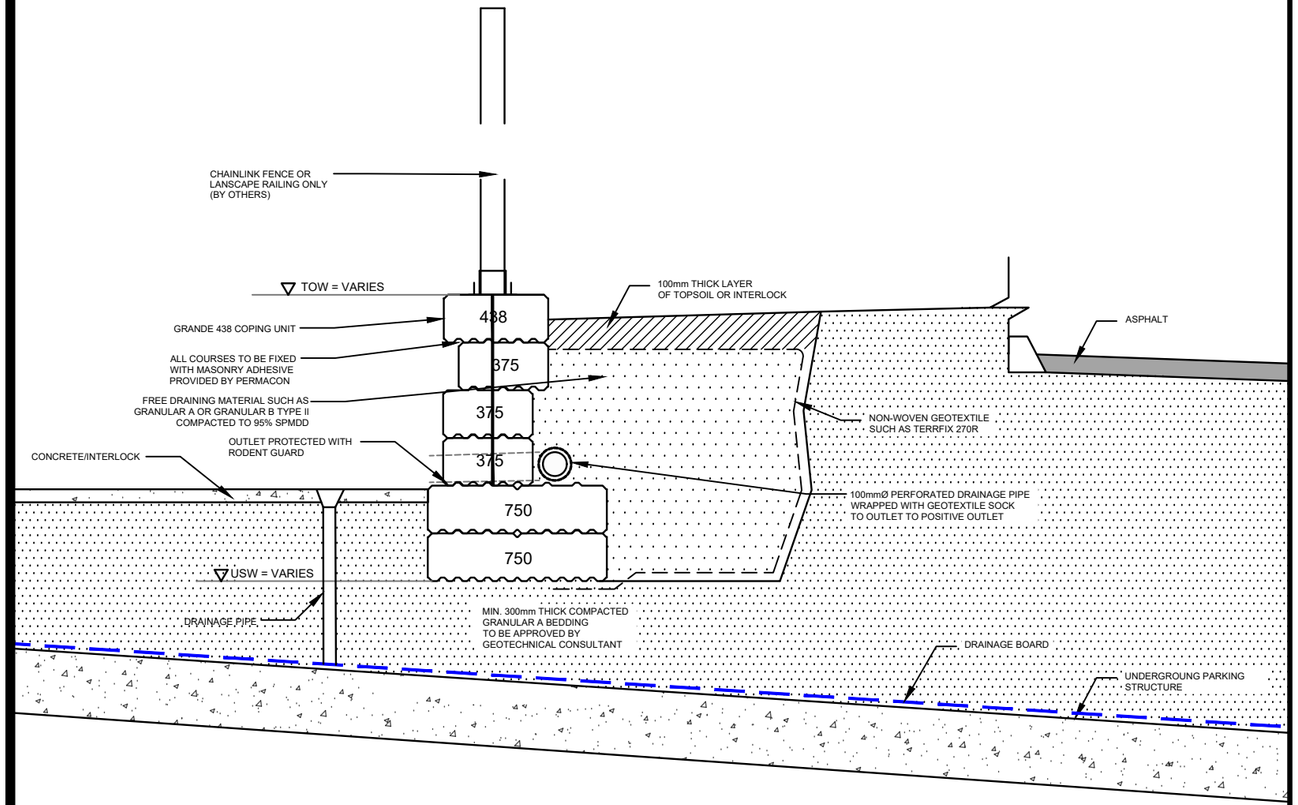
Title:

TYPICAL SECTION - HYDRO DUCT

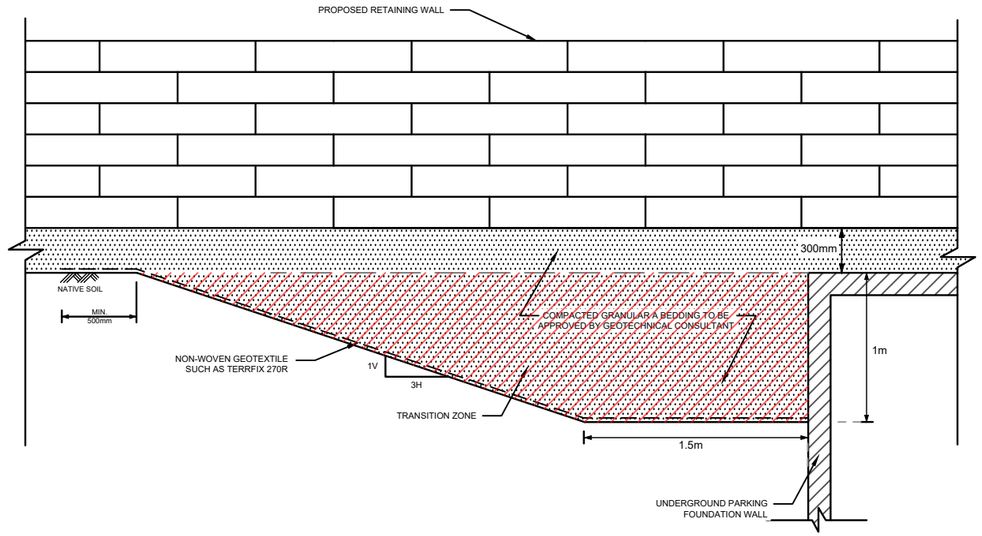
Date:	Report No.:
09/2021	PG4112
Scale:	Drawing No.:
1:40	PG4112-FIG 4
Drawn by: RCG	Checked by: JV

c:\users\robertg\documents\pg4112\fig.dwg

TYPICAL CROSS-SECTION:



TRANSITION ZONE DETAIL:



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NO.	REVISIONS	DATE	INITIAL

BRIGIL CONSTRUCTION

PROPOSED RETAINING WALL
PETRIE'S LANDING - BLOCK 8 - 2466 JEANNE D'ARC BOULEVARD
OTTAWA, ONTARIO

Title:
GRANDE WALL TYPICAL SECTION & TRANSITION ZONE DETAIL

Scale: N.T.S.	Date: 09/2021
Drawn by: NFRV	Report No.: PG4112-1
Checked by: JV	Dwg. No.: FIGURE 5
Approved by: FA	Revision No.:

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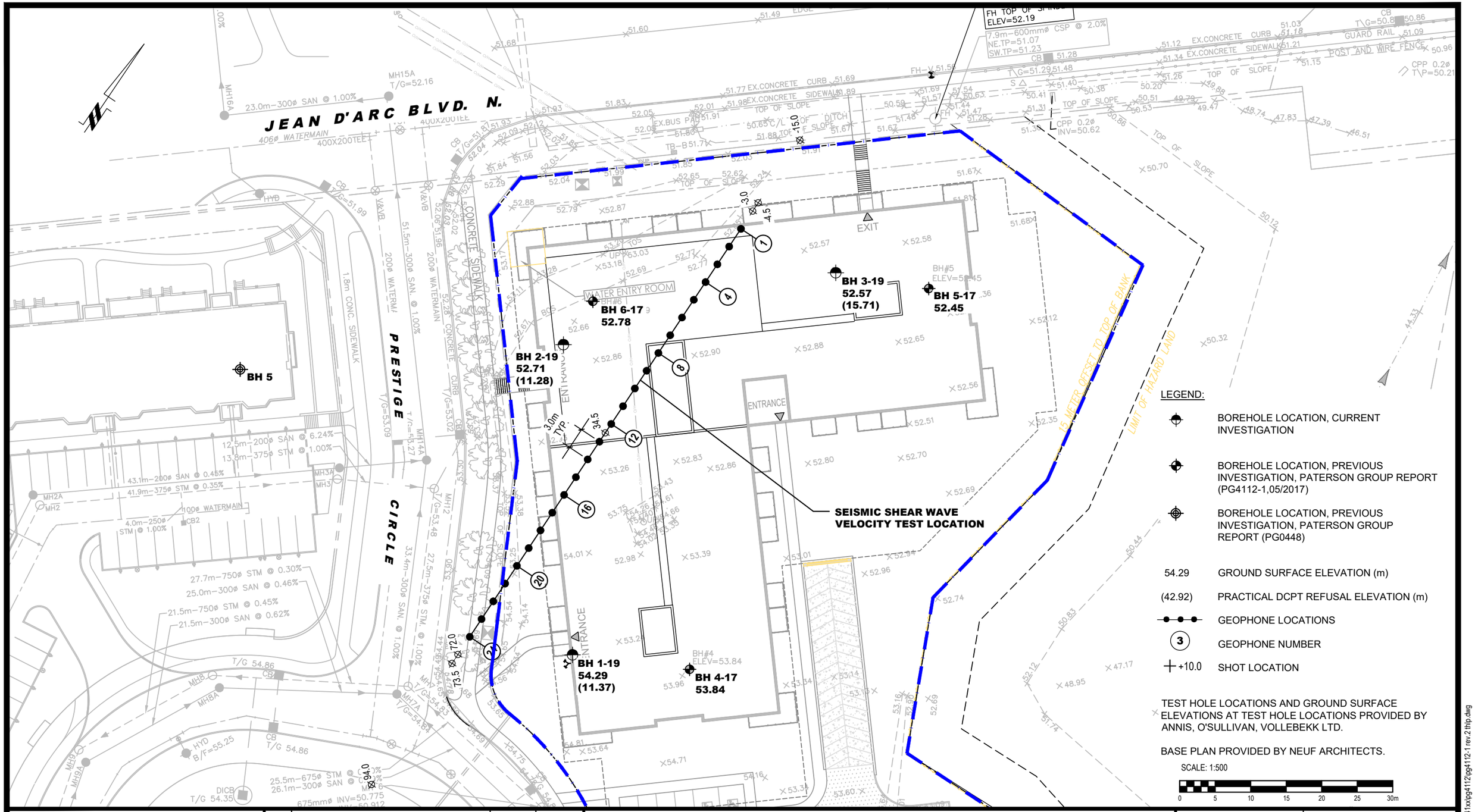

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154 Colonnade Road South
Ottawa, Ontario K2E 7J5
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NO.	REVISIONS	DATE	INITIAL
2	CONCEPTUAL SITE PLAN UPDATED	21/06/2021	JV
1	SHEAR WAVE VELOCITY TEST LOCATION ADDED	08/06/2021	FC

BRIGIL CONSTRUCTION

GEOTECHNICAL INVESTIGATION
PETRIE`S LANDING - BLOCK 8 -2466 JEANNE D`ARC BOULEVARD
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:500	Date: 07/2019
Drawn by: NFRV	Report No.: PG4112-1
Checked by: JV	Dwg. No.: **PG4112-2**
Approved by: DJG	Revision No.: 2

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APPENDIX 3

RETAINING WALL DESIGN AND GLOBAL STABILITY ANALYSIS

Analysis of Redi Rock wall

Input data

Project

Task : Redi-Rock Retaining wall
Part : SLS - Static Conditions
Customer : Brigil - Petrie's Block 8
Author : Joey R. Villeneuve, M.A.Sc, P.Eng, ing.
Date : 2021-08-04
Project number : PG4112

Settings

CHBDC

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : according to LRFD

Blocks

No.	Description	Height h [mm]	Width w [mm]	Unit weight γ [kN/m^3]
1	Block 28	457.2	711.2	18.85
2	Block 41	457.2	1028.7	18.85
3	Block 60	457.2	1524.0	20.42
4	Top block 24 straight	457.2	609.6	16.97
5	Planter 41	457.2	1028.7	18.85
6	Planter 60	457.2	1524.0	17.59
7	Top block 28	457.2	711.2	18.85
8	Top block 41	457.2	1028.7	18.85
9	Top block 24 straight garden	457.2	609.6	12.57
10	Block R-5236 HC	914.4	1320.8	17.28
11	Block R-7236 HC	914.4	1828.8	17.28
12	Block R-9636 HC	914.4	2438.4	17.28
13	Block R-41 HC	457.2	1028.7	17.28

No.	Description	Min. shear strength F_{min} [kN/m]	Max. shear strength F_{max} [kN/m]	Friction f [°]
1	Block 28	88.45	164.56	44.00
2	Block 41	88.45	164.56	44.00
3	Block 60	88.45	164.56	44.00
4	Top block 24 straight	88.45	164.56	44.00
5	Planter 41	88.45	164.56	44.00
6	Planter 60	88.45	164.56	44.00
7	Top block 28	88.45	164.56	44.00
8	Top block 41	88.45	164.56	44.00
9	Top block 24 straight garden	88.45	164.56	44.00

No.	Description	Min. shear strength F_{min} [kN/m]	Max. shear strength F_{max} [kN/m]	Friction f [°]
10	Block R-5236 HC	66.40	175.13	44.00
11	Block R-7236 HC	66.40	175.13	44.00
12	Block R-9636 HC	66.40	175.13	44.00
13	Block R-41 HC	78.19	188.35	37.00

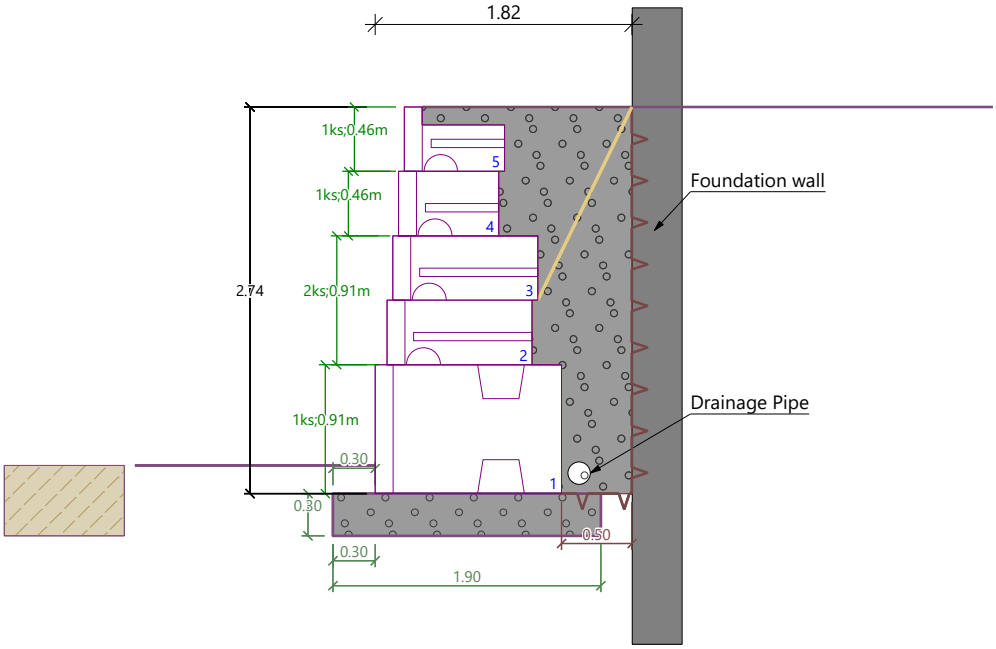
Setbacks

No.	Setbacks [mm]
1	0.254
2	9.525
3	41.275
4	238.125
5	422.275

Geometry

No. group	Description	Count	Setbacks [mm]
1	Block R-5236 HC	1	82.6
2	Block 41	2	41.3
3	Block 28	1	41.3
4	Top block 28	1	-

Name : Geometry **Stage - analysis : 1 - 0**



Base

Geometry

Upper setback a_1 = 0.30 m
Lower setback a_2 = 0.30 m
Height h = 0.30 m
Width b = 1.90 m

Material

Soil creating foundation - Granular

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Granular		38.00	0.00	22.50	12.50	30.00
2	Silty Clay		33.00	5.00	17.00	7.00	28.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Granular

Unit weight : $\gamma = 22.50$ kN/m^3
Stress-state : effective
Angle of internal friction : $\varphi_{ef} = 38.00$ °
Cohesion of soil : $c_{ef} = 0.00$ kPa
Angle of friction struc.-soil : $\delta = 30.00$ °
Saturated unit weight : $\gamma_{sat} = 22.50$ kN/m^3

Silty Clay

Unit weight : $\gamma = 17.00$ kN/m^3
Stress-state : effective
Angle of internal friction : $\varphi_{ef} = 33.00$ °
Cohesion of soil : $c_{ef} = 5.00$ kPa
Angle of friction struc.-soil : $\delta = 28.00$ °
Saturated unit weight : $\gamma_{sat} = 17.00$ kN/m^3

Backfill - rock behind the wall

Assigned soil : Granular
Length : $l_1 = 0.50$ m
$l_2 = 0.00$ m

Coeff. of pressure reduction : $k = 0.5$
Depth of limited slip surface : $z = 1.37$ m

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	-	0.00 .. ∞	Granular	

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Resistance on front face of the structure

Resistance on front face of the structure: at rest
Soil on front face of the structure - Silty Clay
Soil thickness in front of structure $h = 0.50$ m

Terrain in front of structure is flat.

Settings of the stage of construction

Design situation : Service I

Verification No. 1

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.21	62.34	0.92	1.000	1.000	1.000
FF resistance	-0.97	-0.17	0.00	0.15	1.000	1.000	1.000
Weight - earth wedge	0.00	-0.49	1.80	1.71	1.000	1.000	1.000
Weight - earth wedge	0.00	-1.35	0.93	1.49	1.000	1.000	1.000
Weight - earth wedge	0.00	-2.29	1.49	1.28	1.000	1.000	1.000
Weight - earth wedge	0.00	-2.98	1.60	0.91	1.000	1.000	1.000
Active pressure	18.06	-1.10	25.11	1.63	1.000	1.000	1.000

Verification of complete wall

Check for overturning stability

Resisting moment M_{res} = 106.34 kNm/m
Overturning moment M_{ovr} = 19.76 kNm/m

CDR CDR = 5.38
Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 72.88 kN/m
Active horizontal force H_{act} = 17.10 kN/m

CDR CDR = 4.26
Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.18	49.52	0.62	1.000	1.000	1.000
Weight - earth wedge	0.00	-1.05	0.93	1.19	1.000	1.000	1.000
Weight - earth wedge	0.00	-1.99	1.49	0.98	1.000	1.000	1.000
Weight - earth wedge	0.00	-2.68	1.60	0.61	1.000	1.000	1.000
Active pressure	14.58	-1.01	15.12	1.20	1.000	1.000	1.000

Verification of block No. 1

Check for overturning stability

Resisting moment M_{res} = 52.25 kNm/m
Overturning moment M_{ovr} = 14.69 kNm/m

CDR CDR = 3.56
Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 53.64 kN/m
Active horizontal force H_{act} = 14.58 kN/m

CDR CDR = 3.68
Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [–]	Stress [kPa]
1	2.03	93.28	17.10	0.011	50.25

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	2.03	93.28	17.10

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force $e = 0.011$
Maximum allowable eccentricity $e_{alw} = 0.333$

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom $\sigma = 50.25$ kPa
Bearing capacity of foundation soil $R_d = 100.00$ kPa
CDR $CDR = 1.99$

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Analysis of Redi Rock wall

Input data

Project

Task : Redi-Rock Retaining wall
Part : ULS - Static Conditions
Customer : Brigil - Petrie's Block 8
Author : Joey R. Villeneuve, M.A.Sc, P.Eng, ing.
Date : 2021-08-04
Project number : PG4112

Settings

CHBDC

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : according to LRFD

Blocks

No.	Description	Height h [mm]	Width w [mm]	Unit weight γ [kN/m^3]
1	Block 28	457.2	711.2	18.85
2	Block 41	457.2	1028.7	18.85
3	Block 60	457.2	1524.0	20.42
4	Top block 24 straight	457.2	609.6	16.97
5	Planter 41	457.2	1028.7	18.85
6	Planter 60	457.2	1524.0	17.59
7	Top block 28	457.2	711.2	18.85
8	Top block 41	457.2	1028.7	18.85
9	Top block 24 straight garden	457.2	609.6	12.57
10	Block R-5236 HC	914.4	1320.8	17.28
11	Block R-7236 HC	914.4	1828.8	17.28
12	Block R-9636 HC	914.4	2438.4	17.28
13	Block R-41 HC	457.2	1028.7	17.28

No.	Description	Min. shear strength F_{min} [kN/m]	Max. shear strength F_{max} [kN/m]	Friction f [°]
1	Block 28	88.45	164.56	44.00
2	Block 41	88.45	164.56	44.00
3	Block 60	88.45	164.56	44.00
4	Top block 24 straight	88.45	164.56	44.00
5	Planter 41	88.45	164.56	44.00
6	Planter 60	88.45	164.56	44.00
7	Top block 28	88.45	164.56	44.00
8	Top block 41	88.45	164.56	44.00
9	Top block 24 straight garden	88.45	164.56	44.00

No.	Description	Min. shear strength F_{min} [kN/m]	Max. shear strength F_{max} [kN/m]	Friction f [°]
10	Block R-5236 HC	66.40	175.13	44.00
11	Block R-7236 HC	66.40	175.13	44.00
12	Block R-9636 HC	66.40	175.13	44.00
13	Block R-41 HC	78.19	188.35	37.00

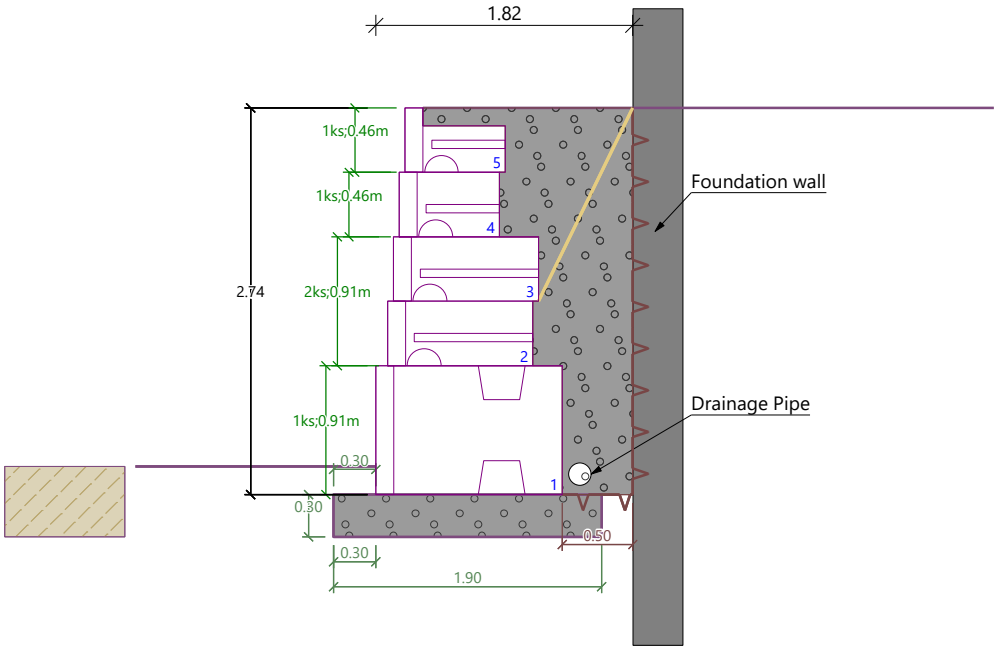
Setbacks

No.	Setbacks [mm]
1	0.254
2	9.525
3	41.275
4	238.125
5	422.275

Geometry

No. group	Description	Count	Setbacks [mm]
1	Block R-5236 HC	1	82.6
2	Block 41	2	41.3
3	Block 28	1	41.3
4	Top block 28	1	-

Name : Geometry **Stage - analysis : 1 - 0**



Base

Geometry

Upper setback a_1 = 0.30 m
Lower setback a_2 = 0.30 m
Height h = 0.30 m

Width b = 1.90 m

Material

Soil creating foundation - Granular

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Granular		38.00	0.00	22.50	12.50	30.00
2	Silty Clay		33.00	5.00	17.00	7.00	28.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Granular

Unit weight : γ = 22.50 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 38.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Angle of friction struc.-soil : δ = 30.00 °
Saturated unit weight : γ_{sat} = 22.50 kN/m^3

Silty Clay

Unit weight : γ = 17.00 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 33.00 °
Cohesion of soil : c_{ef} = 5.00 kPa
Angle of friction struc.-soil : δ = 28.00 °
Saturated unit weight : γ_{sat} = 17.00 kN/m^3

Backfill - rock behind the wall

Assigned soil : Granular
Length : l_1 = 0.50 m
l_2 = 0.00 m

Coeff. of pressure reduction : k = 0.5
Depth of limited slip surface : z = 1.37 m

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	-	0.00 .. ∞	Granular	

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Resistance on front face of the structure

Resistance on front face of the structure: at rest
Soil on front face of the structure - Silty Clay

Soil thickness in front of structure h = 0.50 m

Terrain in front of structure is flat.

Settings of the stage of construction

Design situation : Strength I

Verification No. 1

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.21	62.34	0.92	0.900	0.900	1.100
FF resistance	-0.97	-0.17	0.00	0.15	0.800	0.800	1.250
Weight - earth wedge	0.00	-0.49	1.80	1.71	0.800	0.800	1.250
Weight - earth wedge	0.00	-1.35	0.93	1.49	0.800	0.800	1.250
Weight - earth wedge	0.00	-2.29	1.49	1.28	0.800	0.800	1.250
Weight - earth wedge	0.00	-2.98	1.60	0.91	0.800	0.800	1.250
Active pressure	18.06	-1.10	25.11	1.63	1.250	0.800	1.250

Verification of complete wall

Check for overturning stability

Resisting moment M_{res} = 60.07 kNm/m

Overturning moment M_{ovr} = 24.77 kNm/m

CDR CDR = 2.43

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 56.85 kN/m

Active horizontal force H_{act} = 13.68 kN/m

CDR CDR = 4.16

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.18	49.52	0.62	0.900	0.900	1.100
Weight - earth wedge	0.00	-1.05	0.93	1.19	0.800	0.800	1.250
Weight - earth wedge	0.00	-1.99	1.49	0.98	0.800	0.800	1.250
Weight - earth wedge	0.00	-2.68	1.60	0.61	0.800	0.800	1.250
Active pressure	14.58	-1.01	15.12	1.20	1.250	1.250	1.250

Verification of block No. 1

Check for overturning stability

Resisting moment M_{res} = 29.15 kNm/m

Overturning moment M_{ovr} = 18.37 kNm/m

CDR CDR = 1.59

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 46.89 kN/m
Active horizontal force H_{act} = 18.22 kN/m

CDR CDR = 2.57
Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [–]	Stress [kPa]
1	2.30	107.24	21.37	0.011	57.75
2	3.10	92.15	13.68	0.018	50.28

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	2.03	93.28	17.10

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0.018
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 57.75 kPa
Bearing capacity of foundation soil R_d = 100.00 kPa
CDR CDR = 1.73

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Analysis of Redi Rock wall

Input data

Project

Task : Redi-Rock Retaining wall
Part : ULS - Seismic Conditions
Customer : Brigil - Petrie's Block 8
Author : Joey R. Villeneuve, M.A.Sc, P.Eng, ing.
Date : 2021-08-04
Project number : PG4112

Settings

CHBDC

Wall analysis

Active earth pressure calculation : Coulomb
Passive earth pressure calculation : Mazindrani (Rankine)
Earthquake analysis : Mononobe-Okabe
Shape of earth wedge : Calculate as skew
Allowable eccentricity : 0.333
Internal stability : Standard - straight slip surface
Reduction coeff. of contact first block - base : 1.00
Verification methodology : according to LRFD

Blocks

No.	Description	Height h [mm]	Width w [mm]	Unit weight γ [kN/m^3]
1	Block 28	457.2	711.2	18.85
2	Block 41	457.2	1028.7	18.85
3	Block 60	457.2	1524.0	20.42
4	Top block 24 straight	457.2	609.6	16.97
5	Planter 41	457.2	1028.7	18.85
6	Planter 60	457.2	1524.0	17.59
7	Top block 28	457.2	711.2	18.85
8	Top block 41	457.2	1028.7	18.85
9	Top block 24 straight garden	457.2	609.6	12.57
10	Block R-5236 HC	914.4	1320.8	17.28
11	Block R-7236 HC	914.4	1828.8	17.28
12	Block R-9636 HC	914.4	2438.4	17.28
13	Block R-41 HC	457.2	1028.7	17.28

No.	Description	Min. shear strength F_{min} [kN/m]	Max. shear strength F_{max} [kN/m]	Friction f [°]
1	Block 28	88.45	164.56	44.00
2	Block 41	88.45	164.56	44.00
3	Block 60	88.45	164.56	44.00
4	Top block 24 straight	88.45	164.56	44.00
5	Planter 41	88.45	164.56	44.00
6	Planter 60	88.45	164.56	44.00
7	Top block 28	88.45	164.56	44.00
8	Top block 41	88.45	164.56	44.00
9	Top block 24 straight garden	88.45	164.56	44.00

No.	Description	Min. shear strength F_{min} [kN/m]	Max. shear strength F_{max} [kN/m]	Friction f [°]
10	Block R-5236 HC	66.40	175.13	44.00
11	Block R-7236 HC	66.40	175.13	44.00
12	Block R-9636 HC	66.40	175.13	44.00
13	Block R-41 HC	78.19	188.35	37.00

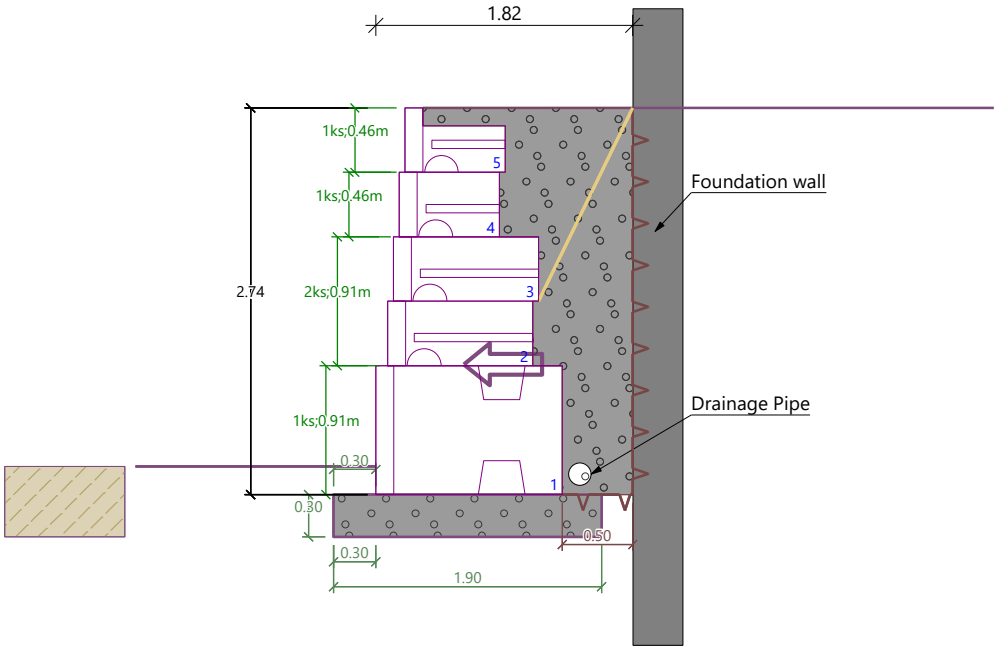
Setbacks

No.	Setbacks [mm]
1	0.254
2	9.525
3	41.275
4	238.125
5	422.275

Geometry

No. group	Description	Count	Setbacks [mm]
1	Block R-5236 HC	1	82.6
2	Block 41	2	41.3
3	Block 28	1	41.3
4	Top block 28	1	-

Name : Geometry **Stage - analysis : 1 - 0**



Base

Geometry

Upper setback a_1 = 0.30 m
Lower setback a_2 = 0.30 m
Height h = 0.30 m

Width b = 1.90 m

Material

Soil creating foundation - Granular

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]	γ_{su} [kN/m^3]	δ [°]
1	Granular		38.00	0.00	22.50	12.50	30.00
2	Silty Clay		33.00	5.00	17.00	7.00	28.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Granular

Unit weight : γ = 22.50 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 38.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Angle of friction struc.-soil : δ = 30.00 °
Saturated unit weight : γ_{sat} = 22.50 kN/m^3

Silty Clay

Unit weight : γ = 17.00 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 33.00 °
Cohesion of soil : c_{ef} = 5.00 kPa
Angle of friction struc.-soil : δ = 28.00 °
Saturated unit weight : γ_{sat} = 17.00 kN/m^3

Backfill - rock behind the wall

Assigned soil : Granular
Length : l_1 = 0.50 m
l_2 = 0.00 m

Coeff. of pressure reduction : k = 0.5
Depth of limited slip surface : z = 1.37 m

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1	-	0.00 .. ∞	Granular	

Terrain profile

Terrain behind the structure is flat.

Water influence

Ground water table is located below the structure.

Resistance on front face of the structure

Resistance on front face of the structure: at rest
Soil on front face of the structure - Silty Clay

Soil thickness in front of structure h = 0.50 m

Terrain in front of structure is flat.

Earthquake

Factor of horizontal acceleration K_h = 0.1600
Factor of vertical acceleration K_v = 0.0000

Water below the GWT is restricted.

Settings of the stage of construction

Design situation : Extreme I

Verification No. 1

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.21	62.34	0.92	0.900	0.900	1.100
Earthq.- constr.	9.99	-1.23	0.00	0.92	1.000	1.000	1.000
FF resistance	-0.97	-0.17	0.00	0.15	0.800	0.800	1.250
Weight - earth wedge	0.00	-0.49	1.80	1.71	0.800	0.800	1.500
Earthquake - soil wedge	0.29	-0.49	0.00	1.71	1.000	1.000	1.000
Weight - earth wedge	0.00	-1.35	0.93	1.49	0.800	0.800	1.500
Earthquake - soil wedge	0.15	-1.35	0.00	1.49	1.000	1.000	1.000
Weight - earth wedge	0.00	-2.29	1.49	1.28	0.800	0.800	1.500
Earthquake - soil wedge	0.24	-2.29	0.00	1.28	1.000	1.000	1.000
Weight - earth wedge	0.00	-2.98	1.60	0.91	0.800	0.800	1.500
Earthquake - soil wedge	0.26	-2.98	0.00	0.91	1.000	1.000	1.000
Active pressure	18.06	-1.10	25.11	1.63	1.250	0.800	1.250
Earthq.- act.pressure	9.12	-1.96	12.56	1.42	1.000	1.000	1.000

Verification of complete wall

Check for overturning stability

Resisting moment M_{res} = 127.10 kNm/m
Overturning moment M_{ovr} = 56.53 kNm/m

CDR CDR = 2.25

Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 72.98 kN/m
Active horizontal force H_{act} = 33.73 kN/m

CDR CDR = 2.16

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.00	-1.18	49.52	0.62	0.900	0.900	1.100
Earthq.- constr.	8.27	-1.15	0.00	0.62	1.000	1.000	1.000
Weight - earth wedge	0.00	-1.05	0.93	1.19	0.800	0.800	1.500

Name	F_{hor} [kN/m]	App.Pt. z [m]	F_{vert} [kN/m]	App.Pt. x [m]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Earthquake - soil wedge	0.15	-1.05	0.00	1.19	1.000	1.000	1.000
Weight - earth wedge	0.00	-1.99	1.49	0.98	0.800	0.800	1.500
Earthquake - soil wedge	0.24	-1.99	0.00	0.98	1.000	1.000	1.000
Weight - earth wedge	0.00	-2.68	1.60	0.61	0.800	0.800	1.500
Earthquake - soil wedge	0.26	-2.68	0.00	0.61	1.000	1.000	1.000
Active pressure	14.58	-1.01	15.12	1.20	1.250	1.250	1.250
Earthq.- act.pressure	7.20	-1.77	9.31	1.07	1.000	1.000	1.000

Verification of block No. 1

Check for overturning stability

Resisting moment M_{res} = 62.98 kNm/m
Overturning moment M_{ovr} = 41.94 kNm/m

CDR CDR = 1.50

Joint for overturning stability is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 59.37 kN/m
Active horizontal force H_{act} = 34.33 kN/m

CDR CDR = 1.73

Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]	Eccentricity [–]	Stress [kPa]
1	27.54	121.26	41.42	0.120	83.87
2	28.91	104.71	33.73	0.145	77.69

Service load acting at the center of footing bottom

No.	Moment [kNm/m]	Norm. force [kN/m]	Shear Force [kN/m]
1	27.85	105.84	37.15

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification

Max. eccentricity of normal force e = 0.145
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity

Max. stress at footing bottom σ = 83.87 kPa
Bearing capacity of foundation soil R_d = 100.00 kPa
CDR CDR = 1.19

Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

CHBDC

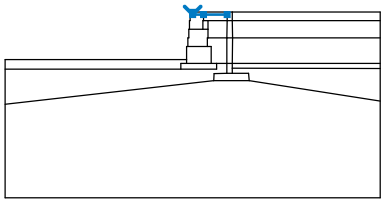
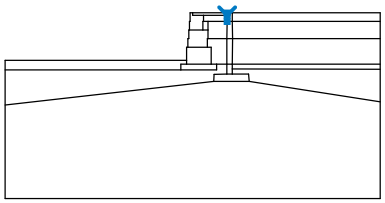
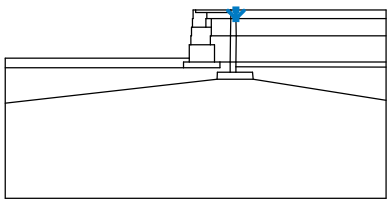
Stability analysis

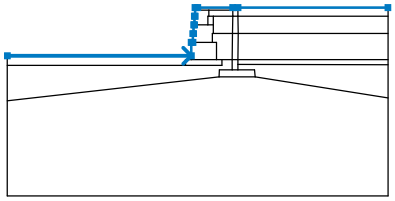
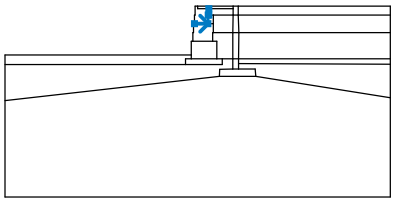
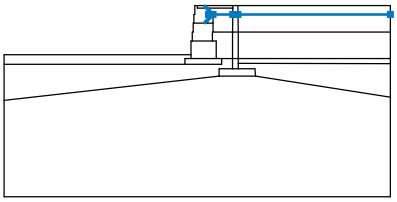
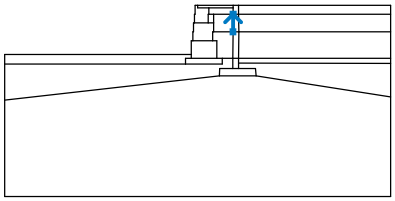
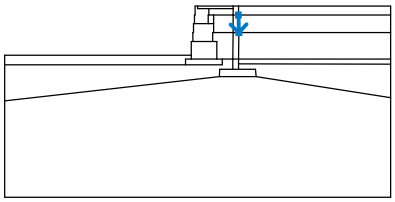
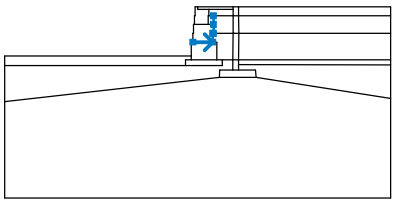
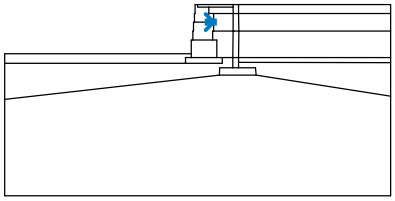
Earthquake analysis : Standard
Verification methodology : according to LRFD

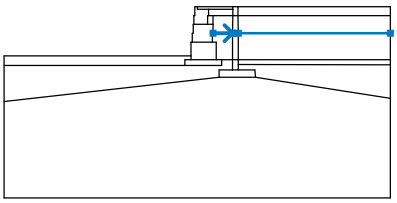
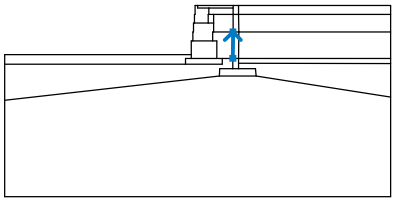
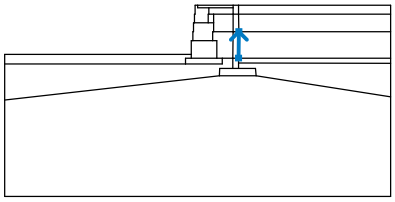
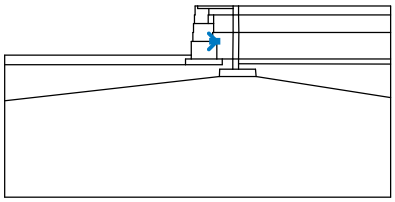
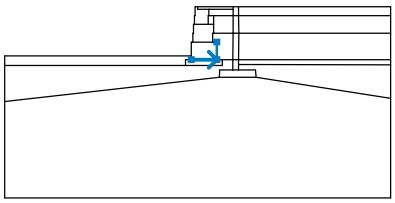
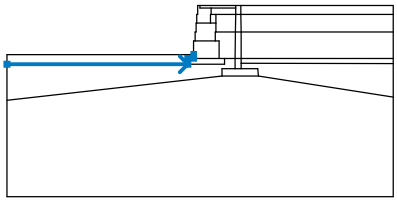
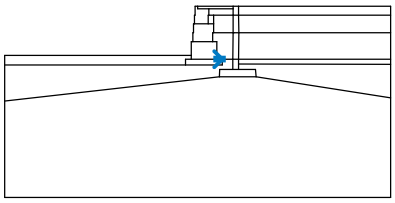
Load factors					
Design situation - Extreme I					
		Minimum		Maximum	
Earth surcharge load (permanent) :	ES =	1.00	[–]	1.00	[–]
Live load surcharge :	LL =	1.00	[–]	1.00	[–]

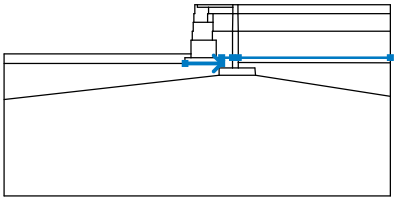
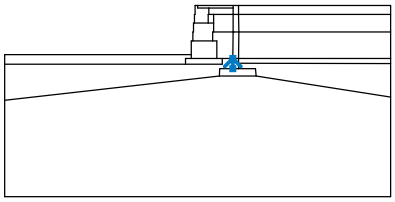
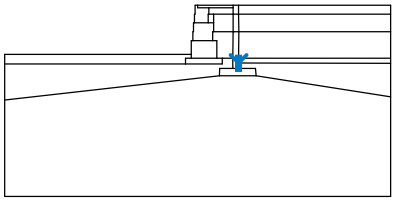
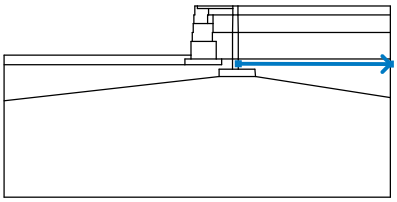
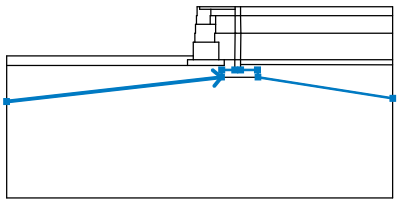
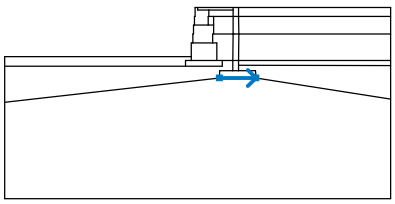
Resistance factors			
Design situation - Extreme I			
Resistance factor on stability :	ϕ_{SS} =	1.00	[–]

Interface

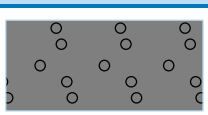
No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.13	0.58	-0.13
		1.84	-0.13				
2		1.84	0.00	1.84	-0.13	1.84	-0.46
3		2.11	0.00	2.11	-0.46		

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
4		-10.00	-2.54	-0.33	-2.54	-0.33	-1.83
		-0.25	-1.83	-0.25	-1.37	-0.21	-1.37
		-0.21	-0.91	-0.17	-0.91	-0.17	-0.46
		-0.13	-0.46	-0.13	0.00	0.00	0.00
		1.84	0.00	2.11	0.00	10.00	0.00
5		-0.17	-0.91	0.54	-0.91	0.54	-0.46
		0.58	-0.46	0.58	-0.13		
6		0.58	-0.46	0.82	-0.46	1.84	-0.46
		1.86	-0.46	2.11	-0.46	10.00	-0.46
7		1.83	-1.37	1.84	-0.46		
8		2.11	-0.46	2.13	-1.37		
9		-0.25	-1.83	0.78	-1.83	0.78	-1.37
		0.82	-1.37	0.82	-0.91	0.82	-0.46
10		0.54	-0.91	0.82	-0.91		

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
11		0.82	-1.37	1.83	-1.37	1.84	-1.37
		2.13	-1.37	10.00	-1.37		
12		1.82	-2.74	1.83	-1.37		
13		2.12	-2.74	2.13	-1.37		
14		0.78	-1.83	0.99	-1.83		
15		-0.33	-2.74	0.99	-2.74	0.99	-1.83
16		-10.00	-3.04	-0.63	-3.04	-0.63	-2.74
		-0.33	-2.74	-0.33	-2.54		
17		0.99	-2.74	1.27	-2.74		

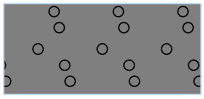
No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
18		-0.63	-3.04	1.27	-3.04	1.27	-2.74
		1.82	-2.74	2.12	-2.74	10.00	-2.74
19		1.82	-3.27	1.82	-2.74		
20		2.12	-2.74	2.12	-2.99	2.12	-3.27
21		2.12	-2.99	10.00	-3.01		
22		-10.00	-4.91	1.13	-3.65	1.14	-3.28
		1.82	-3.27	2.12	-3.27	2.99	-3.27
		3.02	-3.65	10.00	-4.75		
23		1.13	-3.65	3.02	-3.65		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]
1	Granular		38.00	0.00	22.50

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]
2	Silty Clay		33.00	5.00	17.00
3	Air		0.00	0.00	0.00

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m^3]	γ_s [kN/m^3]	n [–]
1	Granular		22.50		
2	Silty Clay		17.00		
3	Air		0.00		

Soil parameters

Granular

Unit weight : γ = 22.50 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 38.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 22.50 kN/m^3

Silty Clay

Unit weight : γ = 17.00 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 33.00 °
Cohesion of soil : c_{ef} = 5.00 kPa
Saturated unit weight : γ_{sat} = 17.00 kN/m^3

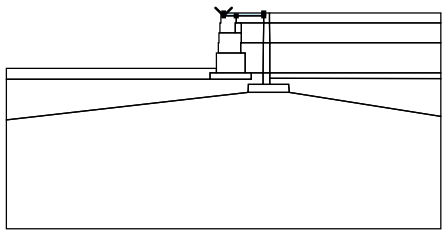
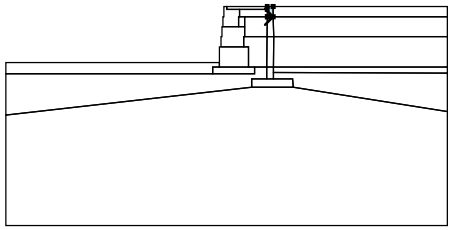
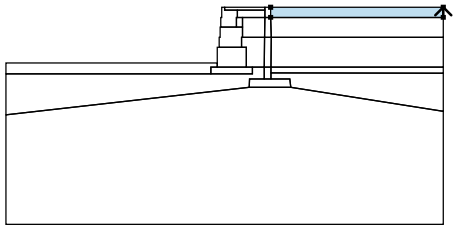
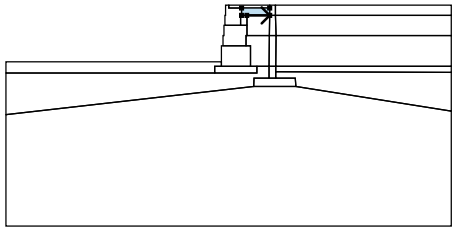
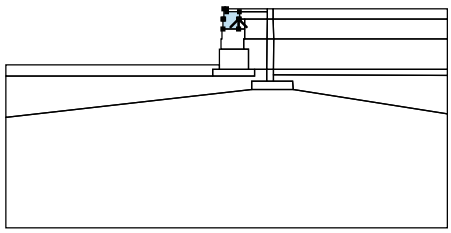
Air

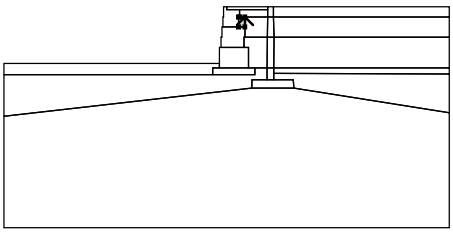
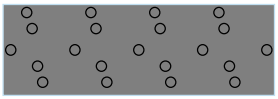
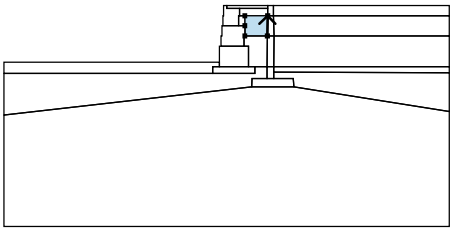
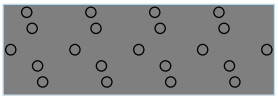
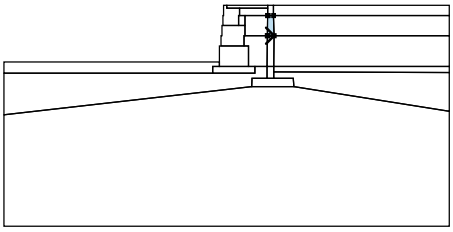
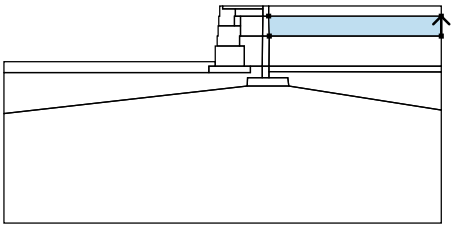
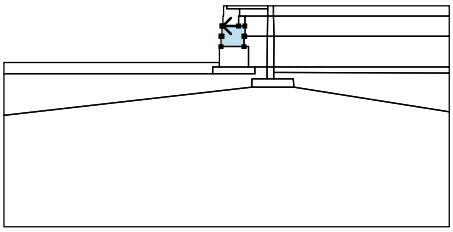
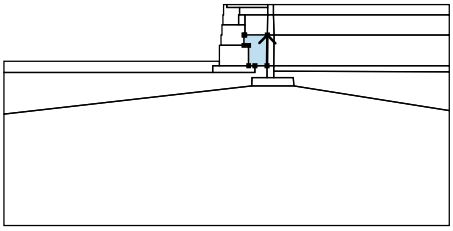
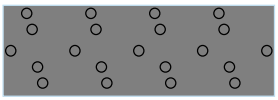
Unit weight : γ = 0.00 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 0.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 0.00 kN/m^3

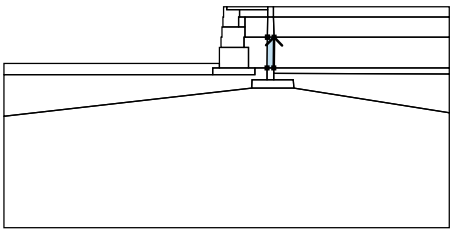
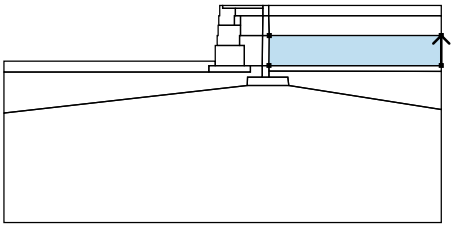
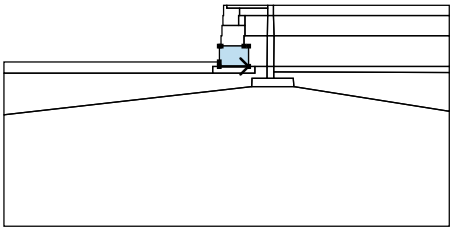
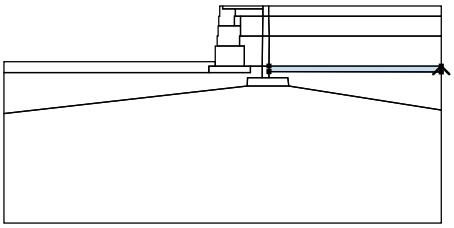
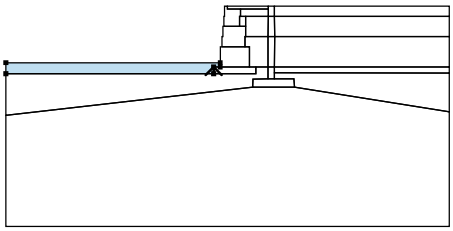
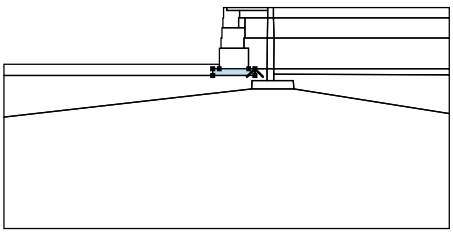
Rigid Bodies

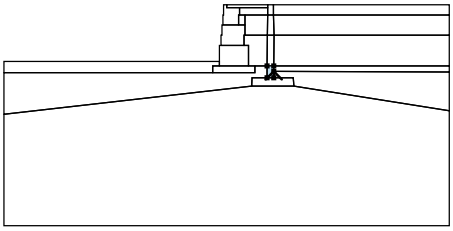
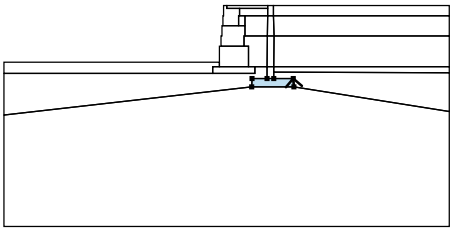
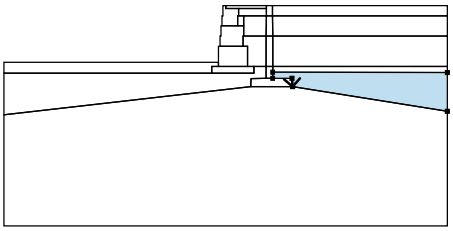
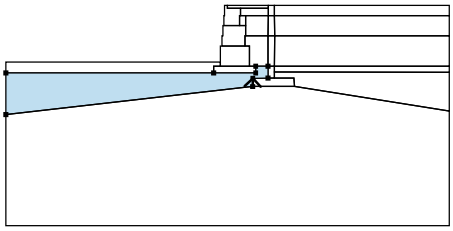
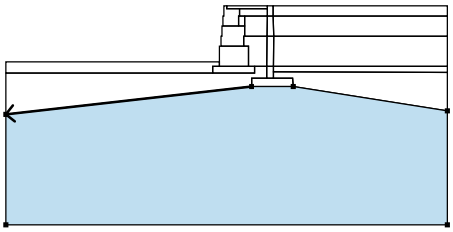
No.	Name	Sample	γ [kN/m³]
1	Material of structure		18.85
2	Rigid body No. 1		23.50

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		0.00	0.00	0.00	-0.13	Granular
		0.58	-0.13	1.84	-0.13	
		1.84	0.00			
2		1.86	-0.46	2.11	-0.46	Material of structure
		2.11	0.00	1.84	0.00	
		1.84	-0.13	1.84	-0.46	
3		10.00	-0.46	10.00	0.00	Air
		2.11	0.00	2.11	-0.46	
4		0.82	-0.46	1.84	-0.46	Granular
		1.84	-0.13	0.58	-0.13	
		0.58	-0.46			
5		0.54	-0.91	0.54	-0.46	Material of structure
		0.58	-0.46	0.58	-0.13	
		0.00	-0.13	0.00	0.00	
		-0.13	0.00	-0.13	-0.46	
		-0.17	-0.46	-0.17	-0.91	

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
6		0.82	-0.91	0.82	-0.46	Granular
		0.58	-0.46	0.54	-0.46	
		0.54	-0.91			
7		1.83	-1.37	1.84	-0.46	Granular
		0.82	-0.46	0.82	-0.91	
		0.82	-1.37			
8		1.84	-1.37	2.13	-1.37	Material of structure
		2.11	-0.46	1.86	-0.46	
		1.84	-0.46	1.83	-1.37	
9		10.00	-1.37	10.00	-0.46	Air
		2.11	-0.46	2.13	-1.37	
10		0.54	-0.91	-0.17	-0.91	Material of structure
		-0.21	-0.91	-0.21	-1.37	
		-0.25	-1.37	-0.25	-1.83	
		0.78	-1.83	0.78	-1.37	
		0.82	-1.37	0.82	-0.91	
11		1.82	-2.74	1.83	-1.37	Granular
		0.82	-1.37	0.78	-1.37	
		0.78	-1.83	0.99	-1.83	
		0.99	-2.74	1.27	-2.74	

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
12		2.12	-2.74	2.13	-1.37	Material of structure
		1.84	-1.37	1.83	-1.37	
		1.82	-2.74			
13		10.00	-2.74	10.00	-1.37	Air
		2.13	-1.37	2.12	-2.74	
14		-0.33	-2.74	0.99	-2.74	Material of structure
		0.99	-1.83	0.78	-1.83	
		-0.25	-1.83	-0.33	-1.83	
		-0.33	-2.54			
15		10.00	-3.01	10.00	-2.74	Material of structure
		2.12	-2.74	2.12	-2.99	
16		-0.63	-3.04	-0.63	-2.74	Silty Clay
		-0.33	-2.74	-0.33	-2.54	
		-10.00	-2.54	-10.00	-3.04	
17		1.27	-3.04	1.27	-2.74	Granular
		0.99	-2.74	-0.33	-2.74	
		-0.63	-2.74	-0.63	-3.04	

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
18		2.12	-3.27	2.12	-2.99	Material of structure
		2.12	-2.74	1.82	-2.74	
		1.82	-3.27			
19		3.02	-3.65	2.99	-3.27	Material of structure
		2.12	-3.27	1.82	-3.27	
		1.14	-3.28	1.13	-3.65	
20		2.99	-3.27	3.02	-3.65	Silty Clay
		10.00	-4.75	10.00	-3.01	
		2.12	-2.99	2.12	-3.27	
21		1.13	-3.65	1.14	-3.28	Silty Clay
		1.82	-3.27	1.82	-2.74	
		1.27	-2.74	1.27	-3.04	
		-0.63	-3.04	-10.00	-3.04	
		-10.00	-4.91			
22		1.13	-3.65	-10.00	-4.91	Silty Clay
		-10.00	-9.91	10.00	-9.91	
		10.00	-4.75	3.02	-3.65	

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : Extreme I

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-2.83	[m]	Angles :	α_1 =	-69.67	[°]
	z =	0.02	[m]		α_2 =	89.84	[°]
Radius :	R =	7.37	[m]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 62.40 kN/m
Sum of passive forces : F_p = 795.05 kN/m

Sliding moment : M_a = 459.91 kNm/m
Resisting moment : M_p = 5859.52 kNm/m
Utilization : 7.8 %

CDR CDR: 12.740

Slope stability ACCEPTABLE

Slope stability analysis

Input data

Project

Settings

CHBDC

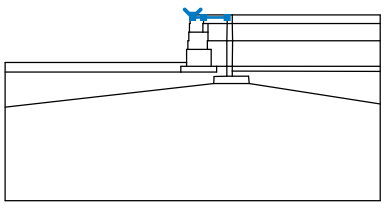
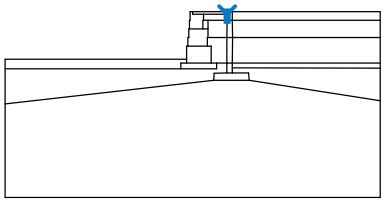
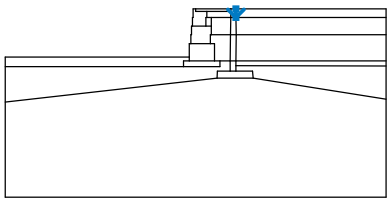
Stability analysis

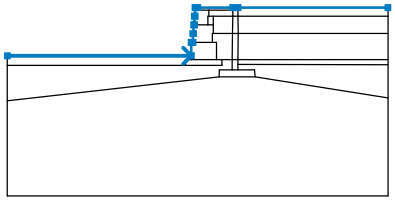
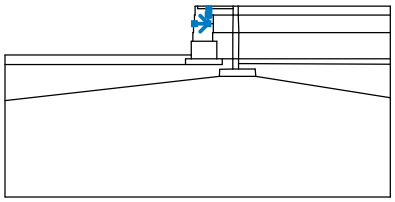
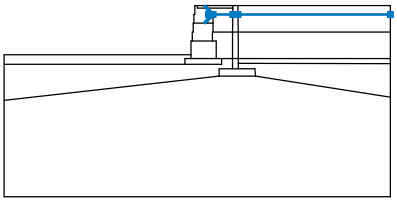
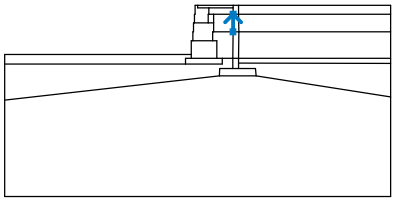
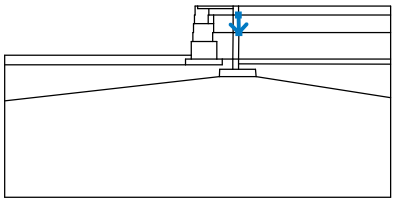
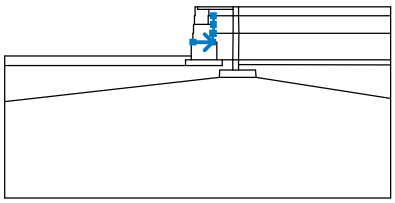
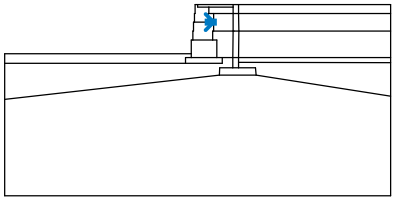
Earthquake analysis : Standard
Verification methodology : according to LRFD

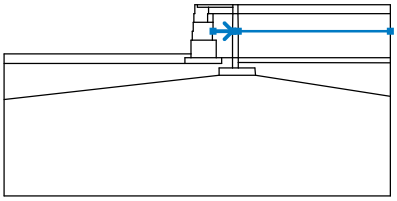
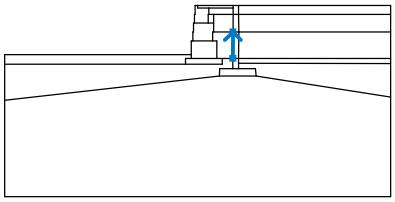
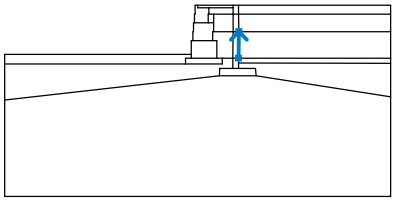
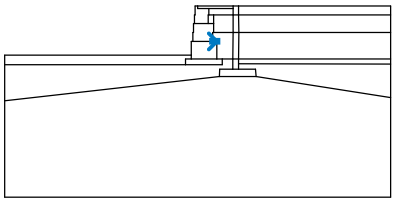
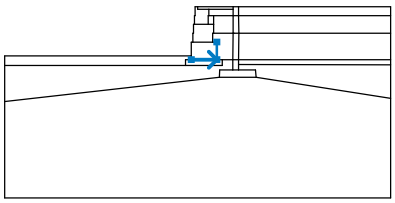
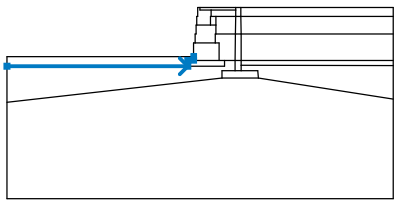
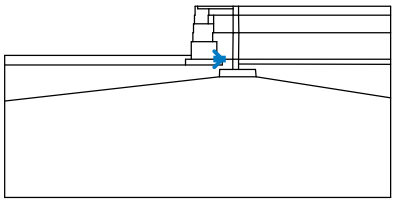
Load factors					
Design situation - Extreme I					
		Minimum		Maximum	
Earth surcharge load (permanent) :	ES =	1.00	[–]	1.00	[–]
Live load surcharge :	LL =	1.00	[–]	1.00	[–]

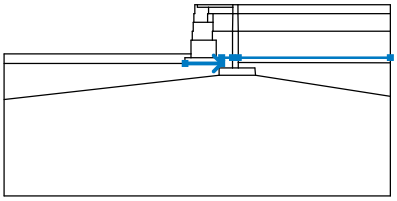
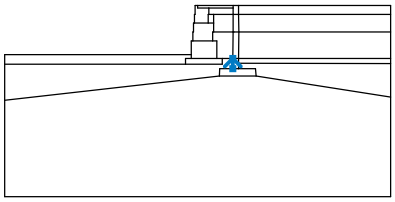
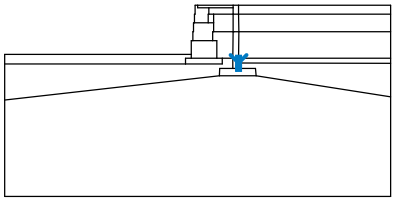
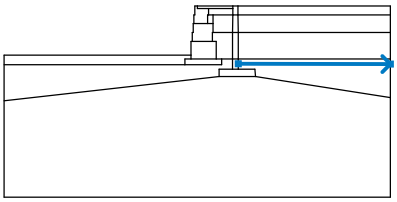
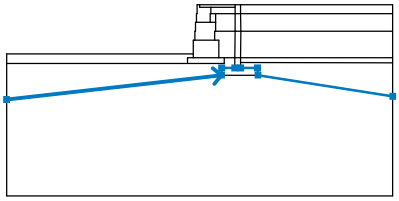
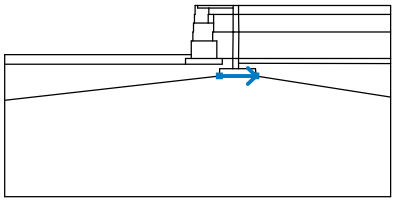
Resistance factors			
Design situation - Extreme I			
Resistance factor on stability :	ϕ_{SS} =	1.00	[–]

Interface

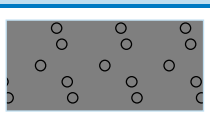
No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
1		0.00	0.00	0.00	-0.13	0.58	-0.13
		1.84	-0.13				
2		1.84	0.00	1.84	-0.13	1.84	-0.46
3		2.11	0.00	2.11	-0.46		

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
4		-10.00	-2.54	-0.33	-2.54	-0.33	-1.83
		-0.25	-1.83	-0.25	-1.37	-0.21	-1.37
		-0.21	-0.91	-0.17	-0.91	-0.17	-0.46
		-0.13	-0.46	-0.13	0.00	0.00	0.00
		1.84	0.00	2.11	0.00	10.00	0.00
5		-0.17	-0.91	0.54	-0.91	0.54	-0.46
		0.58	-0.46	0.58	-0.13		
6		0.58	-0.46	0.82	-0.46	1.84	-0.46
		1.86	-0.46	2.11	-0.46	10.00	-0.46
7		1.83	-1.37	1.84	-0.46		
8		2.11	-0.46	2.13	-1.37		
9		-0.25	-1.83	0.78	-1.83	0.78	-1.37
		0.82	-1.37	0.82	-0.91	0.82	-0.46
10		0.54	-0.91	0.82	-0.91		

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
11		0.82	-1.37	1.83	-1.37	1.84	-1.37
		2.13	-1.37	10.00	-1.37		
12		1.82	-2.74	1.83	-1.37		
13		2.12	-2.74	2.13	-1.37		
14		0.78	-1.83	0.99	-1.83		
15		-0.33	-2.74	0.99	-2.74	0.99	-1.83
16		-10.00	-3.04	-0.63	-3.04	-0.63	-2.74
		-0.33	-2.74	-0.33	-2.54		
17		0.99	-2.74	1.27	-2.74		

No.	Interface location	Coordinates of interface points [m]					
		x	z	x	z	x	z
18		-0.63	-3.04	1.27	-3.04	1.27	-2.74
		1.82	-2.74	2.12	-2.74	10.00	-2.74
19		1.82	-3.27	1.82	-2.74		
20		2.12	-2.74	2.12	-2.99	2.12	-3.27
21		2.12	-2.99	10.00	-3.01		
22		-10.00	-4.91	1.13	-3.65	1.14	-3.28
		1.82	-3.27	2.12	-3.27	2.99	-3.27
		3.02	-3.65	10.00	-4.75		
23		1.13	-3.65	3.02	-3.65		

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]
1	Granular		38.00	0.00	22.50

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [kPa]	γ [kN/m^3]
2	Silty Clay		33.00	5.00	17.00
3	Air		0.00	0.00	0.00
4	Silty Clay (undrained)		0.00	80.00	17.00

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [kN/m^3]	γ_s [kN/m^3]	n [–]
1	Granular		22.50		
2	Silty Clay		17.00		
3	Air		0.00		
4	Silty Clay (undrained)		18.00		

Soil parameters

Granular

Unit weight : γ = 22.50 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 38.00 °
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 22.50 kN/m^3

Silty Clay

Unit weight : γ = 17.00 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 33.00 °
Cohesion of soil : c_{ef} = 5.00 kPa
Saturated unit weight : γ_{sat} = 17.00 kN/m^3

Air

Unit weight : γ = 0.00 kN/m^3
Stress-state : effective
Angle of internal friction : φ_{ef} = 0.00 °

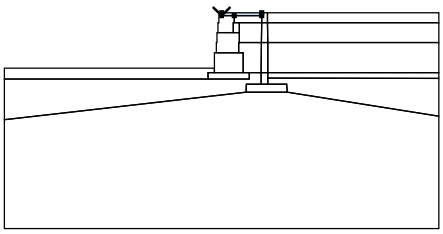
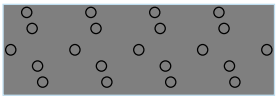
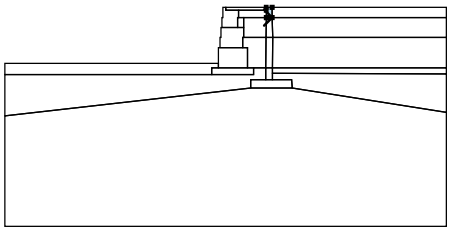
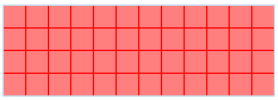
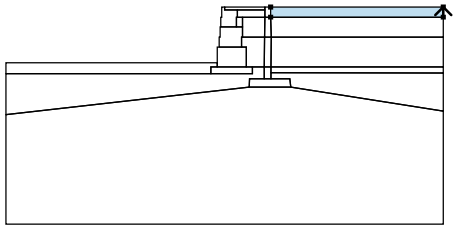
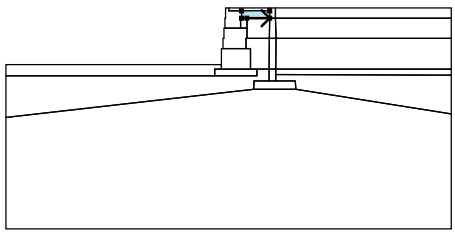
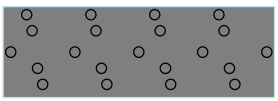
Cohesion of soil : c_{ef} = 0.00 kPa
Saturated unit weight : γ_{sat} = 0.00 kN/m3

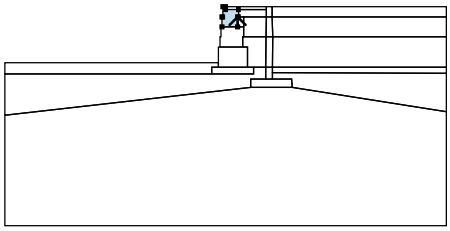
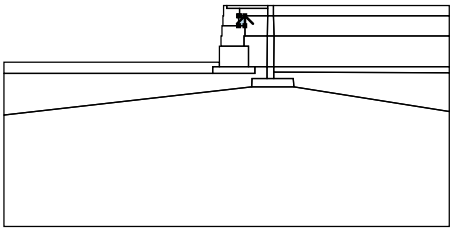
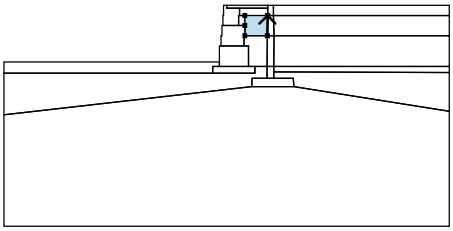
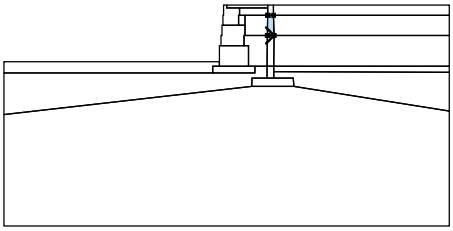
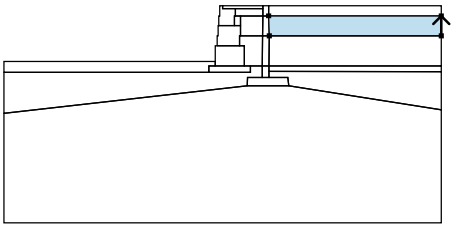
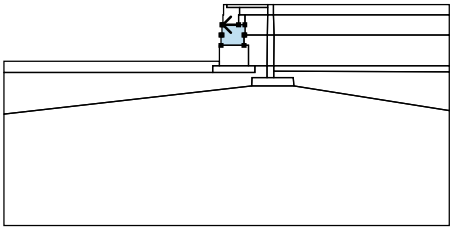
Silty Clay (undrained)
Unit weight : γ = 17.00 kN/m3
Stress-state : effective
Angle of internal friction : φ_{ef} = 0.00 °
Cohesion of soil : c_{ef} = 80.00 kPa
Saturated unit weight : γ_{sat} = 18.00 kN/m3

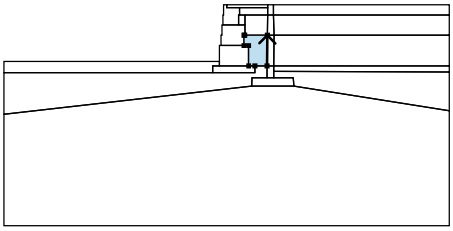
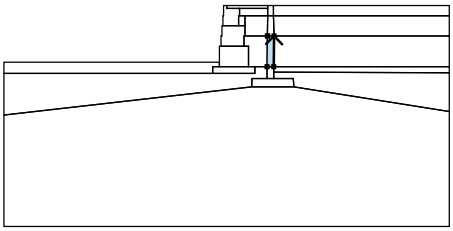
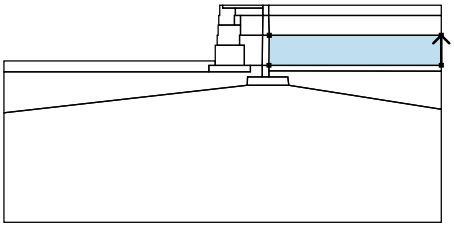
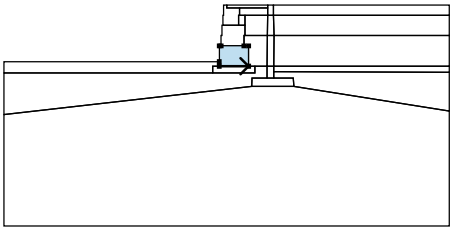
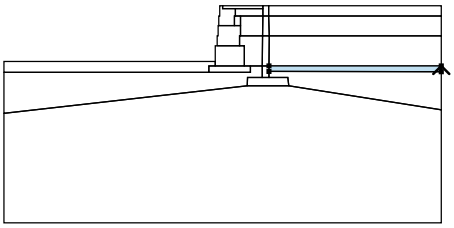
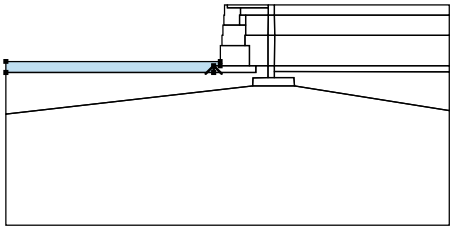
Rigid Bodies

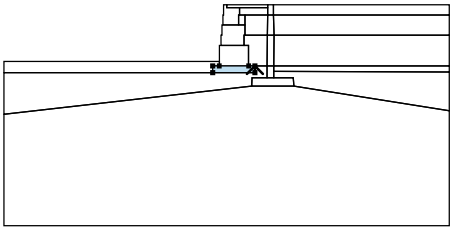
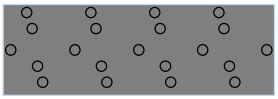
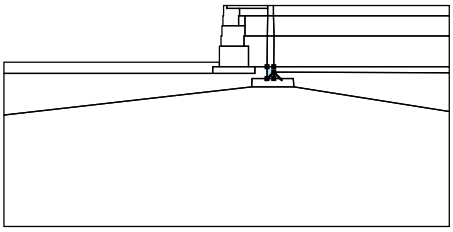
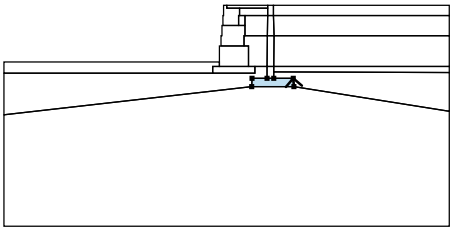
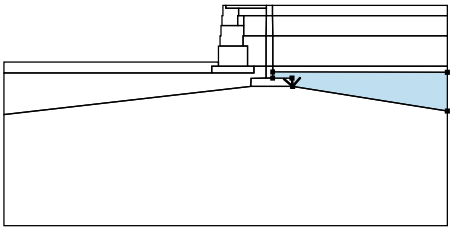
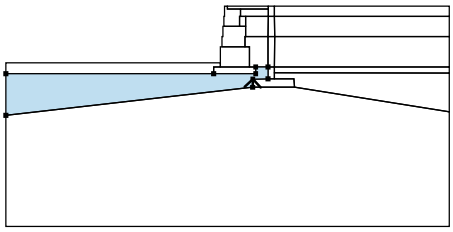
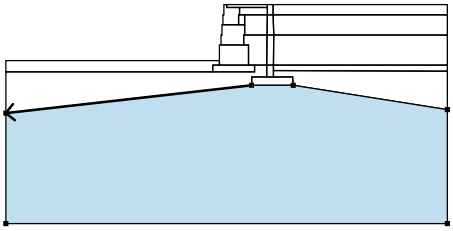
No.	Name	Sample	γ [kN/m3]
1	Material of structure		18.85

Assigning and surfaces

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
1		0.00	0.00	0.00	-0.13	Granular
		0.58	-0.13	1.84	-0.13	
		1.84	0.00			
2		1.86	-0.46	2.11	-0.46	Material of structure
		2.11	0.00	1.84	0.00	
		1.84	-0.13	1.84	-0.46	
3		10.00	-0.46	10.00	0.00	Air
		2.11	0.00	2.11	-0.46	
4		0.82	-0.46	1.84	-0.46	Granular
		1.84	-0.13	0.58	-0.13	
		0.58	-0.46			

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
5		0.54	-0.91	0.54	-0.46	Material of structure
		0.58	-0.46	0.58	-0.13	
		0.00	-0.13	0.00	0.00	
		-0.13	0.00	-0.13	-0.46	
		-0.17	-0.46	-0.17	-0.91	
6		0.82	-0.91	0.82	-0.46	Granular
		0.58	-0.46	0.54	-0.46	
		0.54	-0.91			
7		1.83	-1.37	1.84	-0.46	Granular
		0.82	-0.46	0.82	-0.91	
		0.82	-1.37			
8		1.84	-1.37	2.13	-1.37	Material of structure
		2.11	-0.46	1.86	-0.46	
		1.84	-0.46	1.83	-1.37	
9		10.00	-1.37	10.00	-0.46	Air
		2.11	-0.46	2.13	-1.37	
10		0.54	-0.91	-0.17	-0.91	Material of structure
		-0.21	-0.91	-0.21	-1.37	
		-0.25	-1.37	-0.25	-1.83	
		0.78	-1.83	0.78	-1.37	
		0.82	-1.37	0.82	-0.91	

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
11		1.82	-2.74	1.83	-1.37	Granular
		0.82	-1.37	0.78	-1.37	
		0.78	-1.83	0.99	-1.83	
		0.99	-2.74	1.27	-2.74	
12		2.12	-2.74	2.13	-1.37	Material of structure
		1.84	-1.37	1.83	-1.37	
		1.82	-2.74			
13		10.00	-2.74	10.00	-1.37	Air
		2.13	-1.37	2.12	-2.74	
14		-0.33	-2.74	0.99	-2.74	Material of structure
		0.99	-1.83	0.78	-1.83	
		-0.25	-1.83	-0.33	-1.83	
		-0.33	-2.54			
15		10.00	-3.01	10.00	-2.74	Material of structure
		2.12	-2.74	2.12	-2.99	
16		-0.63	-3.04	-0.63	-2.74	Silty Clay (undrained)
		-0.33	-2.74	-0.33	-2.54	
		-10.00	-2.54	-10.00	-3.04	

No.	Surface position	Coordinates of surface points [m]				Assigned soil
		x	z	x	z	
17		1.27	-3.04	1.27	-2.74	Granular
		0.99	-2.74	-0.33	-2.74	
		-0.63	-2.74	-0.63	-3.04	
18		2.12	-3.27	2.12	-2.99	Material of structure
		2.12	-2.74	1.82	-2.74	
		1.82	-3.27			
19		3.02	-3.65	2.99	-3.27	Material of structure
		2.12	-3.27	1.82	-3.27	
		1.14	-3.28	1.13	-3.65	
20		2.99	-3.27	3.02	-3.65	Silty Clay (undrained)
		10.00	-4.75	10.00	-3.01	
		2.12	-2.99	2.12	-3.27	
21		1.13	-3.65	1.14	-3.28	Silty Clay (undrained)
		1.82	-3.27	1.82	-2.74	
		1.27	-2.74	1.27	-3.04	
		-0.63	-3.04	-10.00	-3.04	
		-10.00	-4.91			
22		1.13	-3.65	-10.00	-4.91	Silty Clay (undrained)
		-10.00	-9.91	10.00	-9.91	
		10.00	-4.75	3.02	-3.65	

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Horizontal seismic coefficient : K_h = 0.1600
Vertical seismic coefficient : K_v = 0.0000

Settings of the stage of construction

Design situation : Extreme I

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-2.83	[m]	Angles :	α_1 =	-69.67	[°]
	z =	0.02	[m]		α_2 =	89.84	[°]
Radius :	R =	7.37	[m]				
The slip surface after optimization.							

Slope stability verification (Bishop)

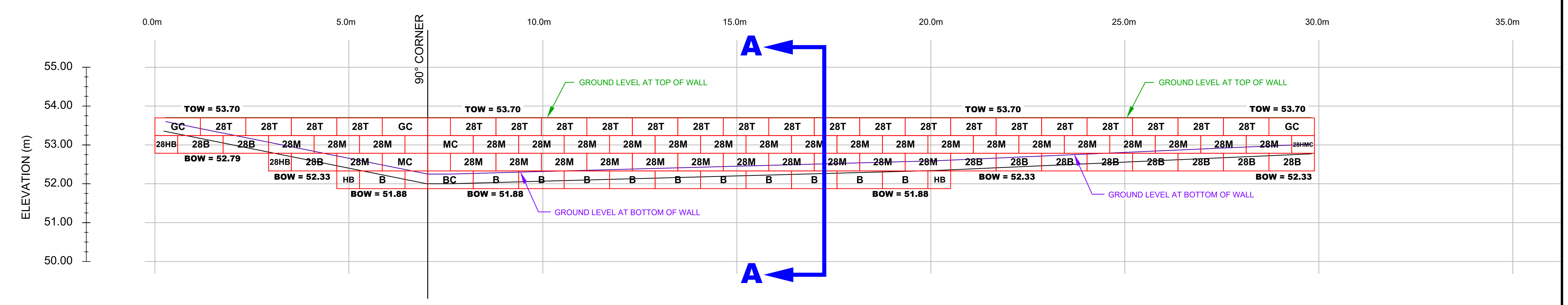
Sum of active forces : F_a = 146.79 kN/m
Sum of passive forces : F_p = 1403.80 kN/m

Sliding moment : M_a = 1081.81 kNm/m
Resisting moment : M_p = 10346.02 kNm/m
Utilization : 10.5 %

CDR CDR: 9.564
Slope stability ACCEPTABLE

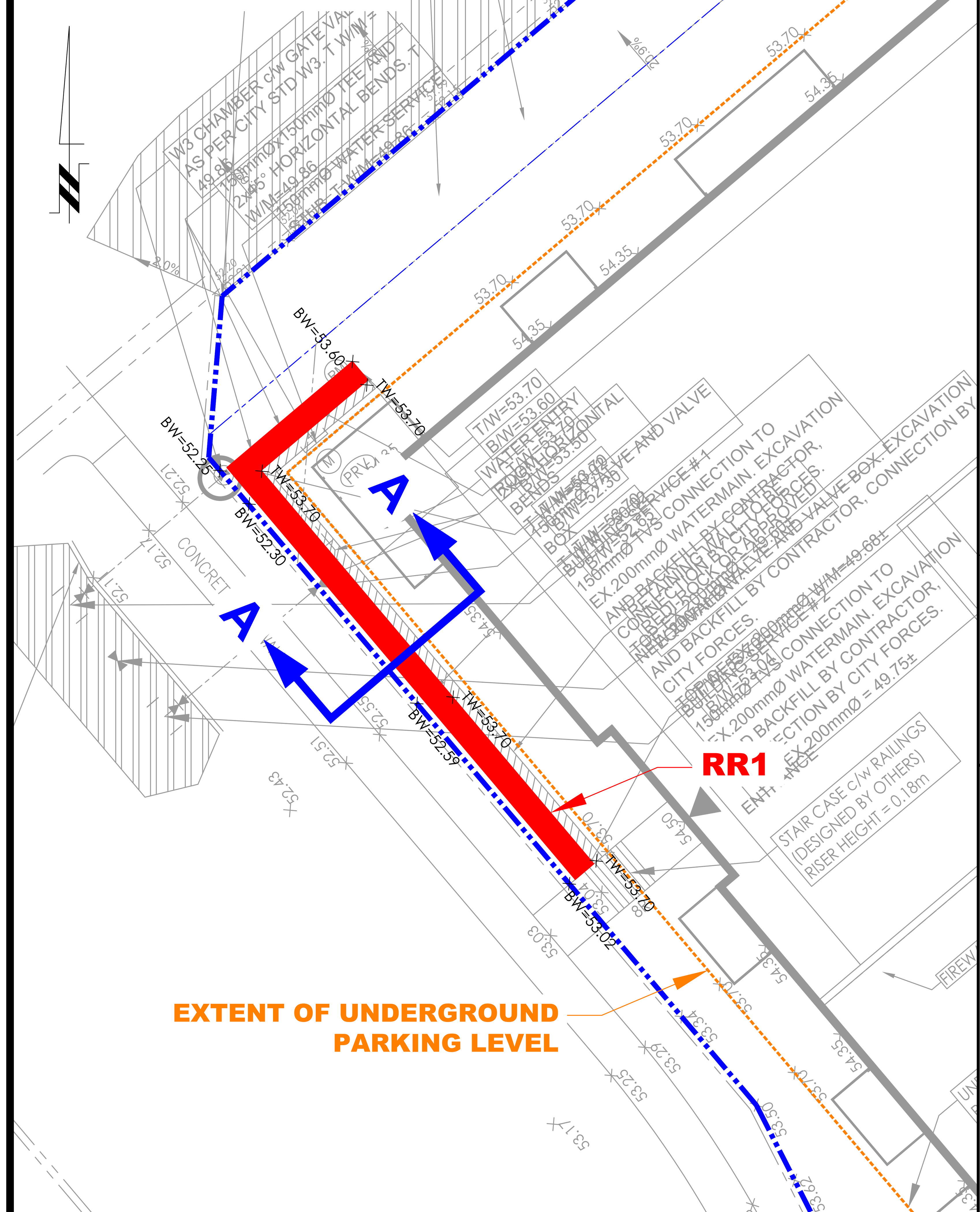
PROFILE VIEW (RR1):

SCALE 1:75



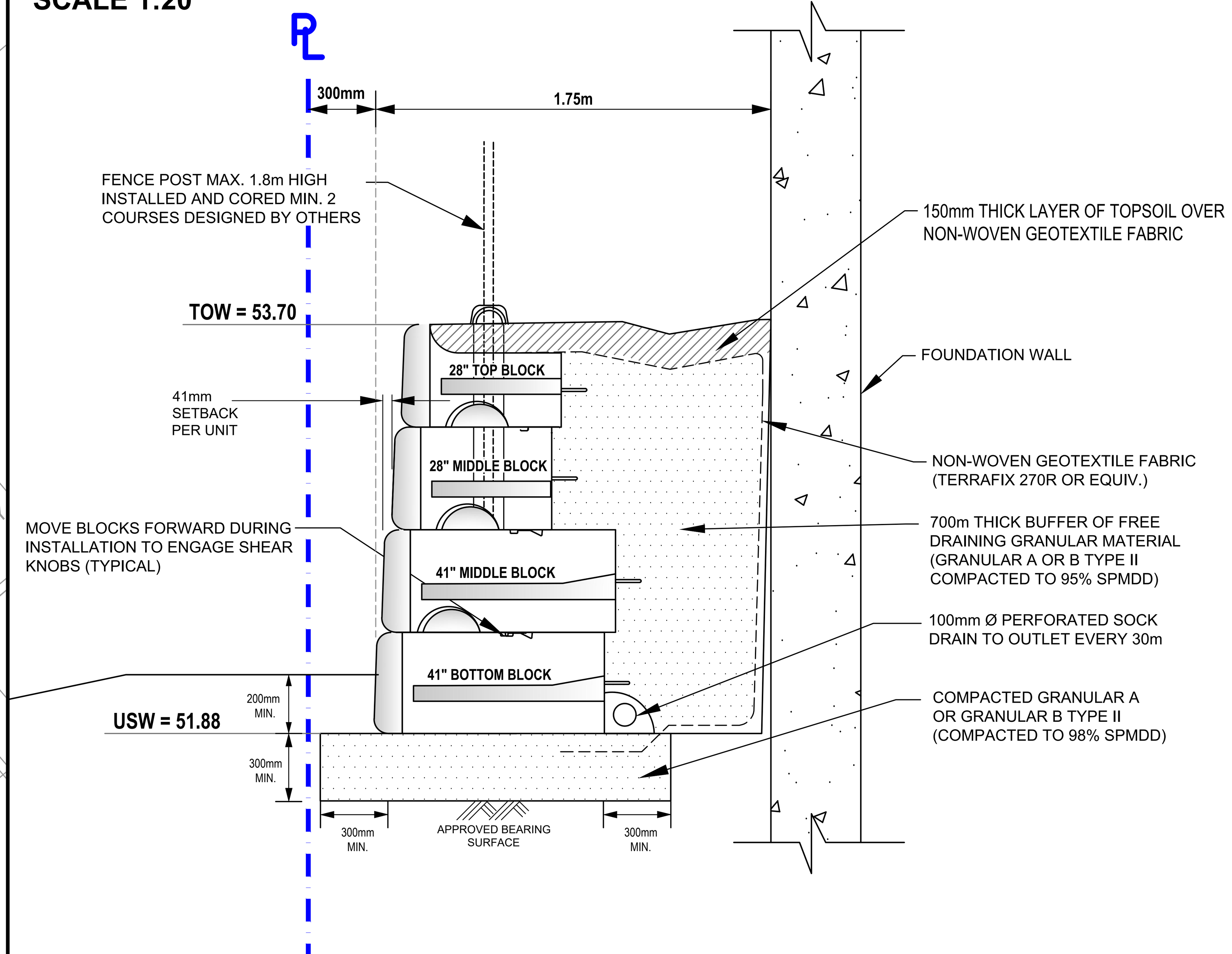
GRADING PLAN:

SCALE 1:150



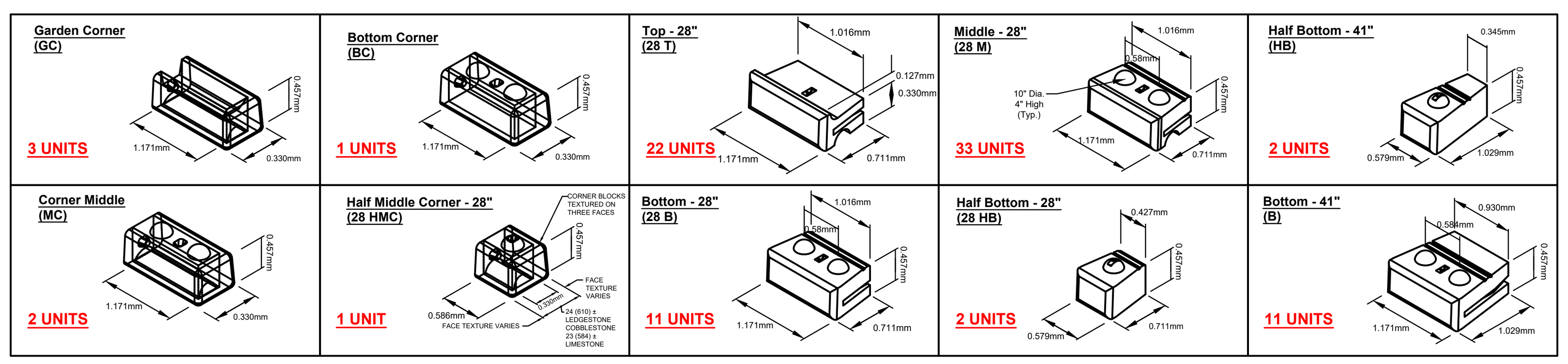
CROSS SECTION A-A:

SCALE 1:20



BLOCK COUNT:

N.T.S.



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UNIT WEIGHT - γ	22 kN/m3	18 kN/m3
COHESION - C	0	5 kPa
SOIL TYPE	OPSS GRANULAR B TYPE II	STIFF SILTY CLAY

MATERIAL PROPERTIES ARE BASED ON SITE EVALUATION BY PATERSON GROUP AND DISCUSSIONS WITH CONTRACTOR. SEISMIC LOADING WAS EVALUATED ACCORDING TO THE CURRENT CHBDC WITH A PEAK GROUND ACCELERATION VALUE OF 0.308.

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7. WALL IS DESIGNED WITH A MIN. 200mm TOE EMBEDMENT WITH A MIN. HORIZONTAL LEDGE WITH A GRANULAR BEDDING LAYER EXTENDING A MIN. 300mm BEYOND THE FACE AND HEEL OF THE BASE BLOCK

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10. ALIGNMENT OF THE BOTTOM WALL UNIT COURSE SHOULD BE PLANNED TO CONSIDER THAT A NOMINAL 41mm AUTOMATIC SETBACK WILL OCCUR WITH EACH 0.46m INCREMENT OF HEIGHT.

11. BACKFILL MATERIAL SHALL BE APPROVED BY THE SITE GEOTECHNICAL ENGINEER PRIOR TO USE AND SHOULD CONSIST OF OPSS GRANULAR B TYPE II B FOLLOWED BY SUITABLE BACKFILL MATERIAL. ALL FILL WITHIN A 1H:1V ZONE UP AND BACK FROM THE HEEL SHOULD ALSO BE COMPACTED. BACKFILL SHALL BE PLACED IN MAXIMUM 300mm LOOSE LIFTS AND COMPACTED TO A MINIMUM OF 95% OF SPMDD. MOISTURE CONTENT SHOULD BE CONTROLLED AND MAINTAINED WITHIN -3 TO +4 PERCENT OF OPTIMUM.

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14. EXCAVATION SIDE SLOPES SHOULD BE PROTECTED TEMPORARILY DURING CONSTRUCTION FROM PRECIPITATION EVENTS BY PLACEMENT OF TARPS.

15. ALL RETAINING WALL RELATED INSPECTIONS (BEARING SURFACE, COMPACTION, BLOCK INSTALLATION, ETC.) MUST BE COMPLETED BY PATERSON GROUP. ONCE THE WALL CONSTRUCTION IS COMPLETED AND REVIEWED BY PATERSON DURING CONSTRUCTION, A CERTIFICATE LETTER WILL BE ISSUED BY PATERSON GROUP.

16. ANY CUTTING OF BLOCKS TO SUIT SITE CONDITIONS OR WALL DESIGN WILL BE RESPONSIBILITY OF THE CONTRACTOR.

17. DUE TO THE CLOSE PROXIMITY OF THE PROPOSED RETAINING WALLS ADJACENT TO LOCAL ROADWAYS, THE RETAINING WALL SHOULD BE SUBJECT TO A SEALANT AGAINST SALT USED DURING WINTER SEASONS. A WATER BASED SILANE PENETRATING SEALANT, SUCH AS MASTERPROTECT H-400 OR EQUIVALENT, IS RECOMMENDED TO BE USED DURING OR POST INSTALLATION OF THE RETAINING WALL SYSTEM. THE METHOD CONSISTS OF PRESSURE WASHING THE WALL BLOCKS AND APPLYING THE SEALANT A MINIMUM OF ONE TIME POST CONSTRUCTION.

18. IF WINTER CONSTRUCTION IS CONSIDERED, HEAT MUST BE MAINTAINED WHEN THE BASE IS EXPOSED. THE WALL BASE MUST BE COVERED WITH HIGH GRADE INSULATION TARPS TO MAINTAIN HEAT AND PROTECT THE BASE FROM POTENTIAL FROST HEAVE. ONCE THE BASE IS BACKFILLED, THE TOP OF THE WALL MUST BE COVERED WITH INSULATION TARPS OVERNIGHT UNTIL THE WALL CONSTRUCTION IS COMPLETED. ADDITION INSPECTIONS WILL BE REQUIRED DURING THE WINTER CONSTRUCTION TO ENSURE THE WALL CONSTRUCTION IS IN GENERAL CONFORMANCE WITH PATERSON'S RECOMMENDATIONS.

ISSUED FOR REVIEW

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

BRIGIL CONSTRUCTION

PROPOSED RETAINING WALLS
PETRIE'S LANDING - BLOCK 8 - 2466 JEANNE D'ARC BOULEVARD
OTTAWA, ONTARIO

Title: REDI-ROCK RETAINING WALL DESIGN (RR1)

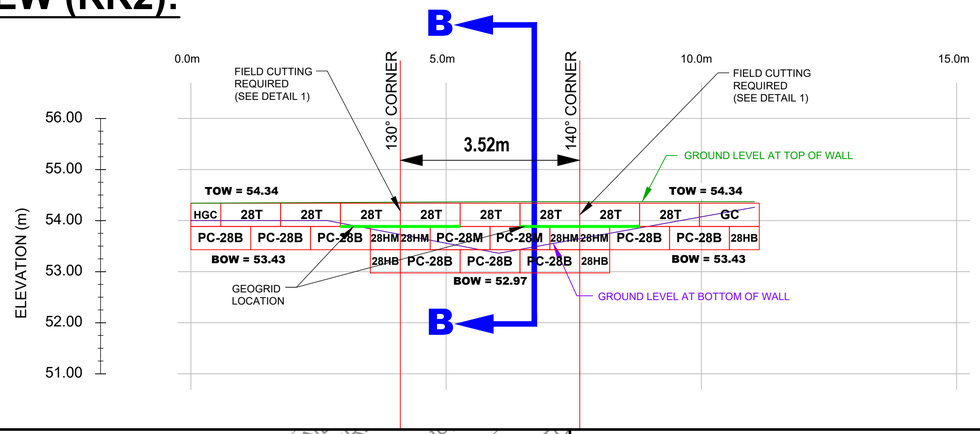
Stamp: LICENSED PROFESSIONAL ENGINEER 01/09/2021 J. R. VILLENEUVE 100504314 PROVINCE OF ONTARIO

Stamp: LICENSED PROFESSIONAL ENGINEER 01/09/2021 F. I. ABOU-SEIDO 100156744 PROVINCE OF ONTARIO

Scale:	AS SHOWN
Drawn by:	NFRV
Checked by:	JV
Approved by:	FA
Date:	08/2021
File No.:	PG4112
Drawing No.:	PG4112-3
Revision No.:	

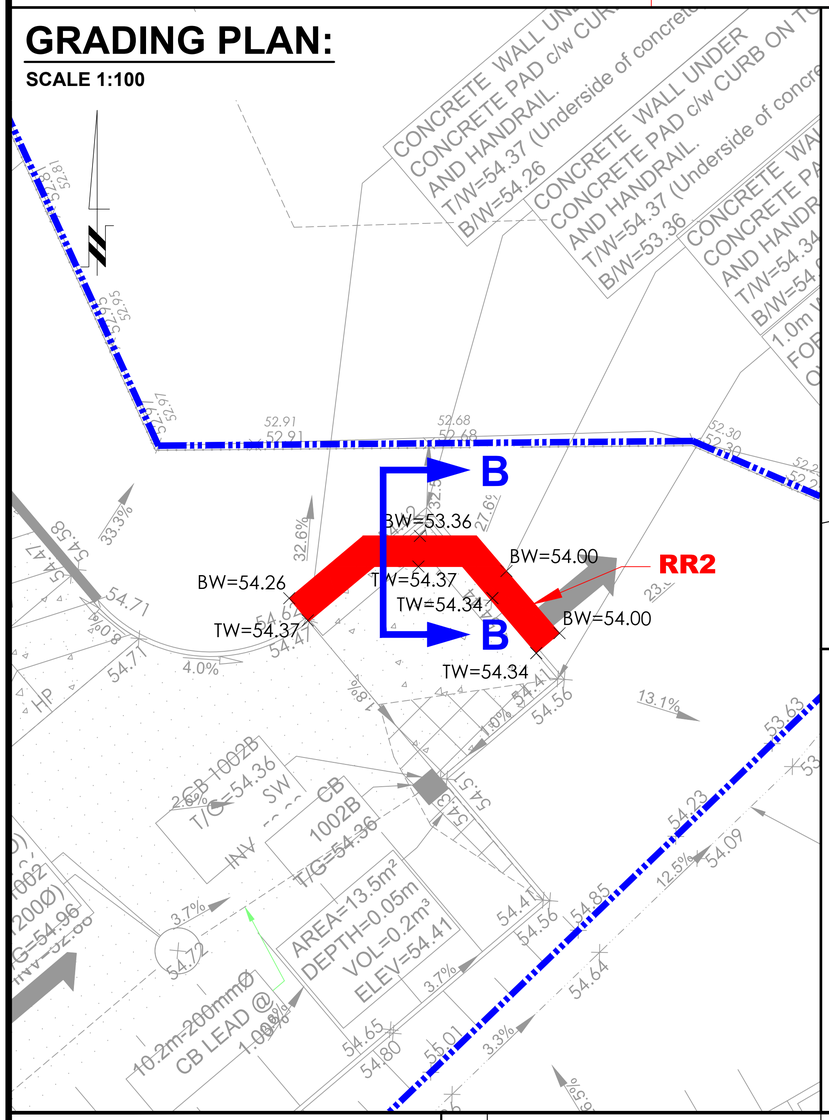
PROFILE VIEW (RR2):

SCALE 1:60



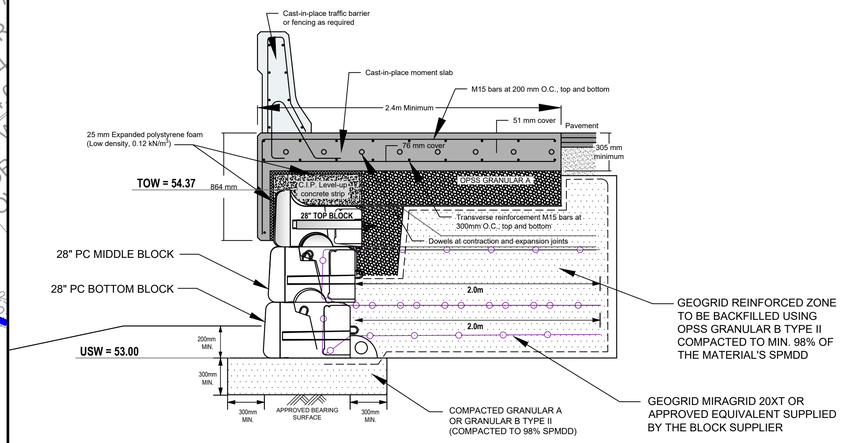
GRADING PLAN:

SCALE 1:100



CROSS SECTION B-B:

SCALE 1:25



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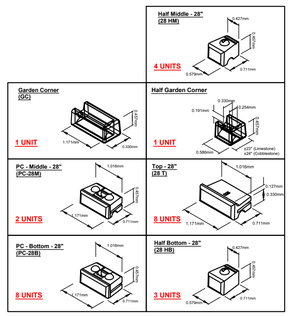

DETAIL 1:

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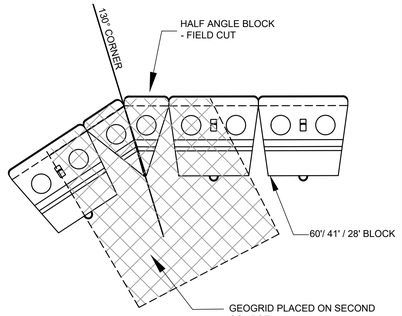

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Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
1	REVISED TO ACCOMMODATE SETBACK	07/09/2021	JV

BRIGIL CONSTRUCTION

PROPOSED RETAINING WALLS
PETRIE'S LANDING - BLOCK 8 - 2466 JEANNE D'ARC BOULEVARD
OTTAWA, ONTARIO

Title:

REDI-ROCK RETAINING WALL DESIGN (RR2)

Stamp: LICENSED PROFESSIONAL ENGINEER 07/09/2021 J. R. VILLENEUVE 100503434 PROVINCE OF ONTARIO

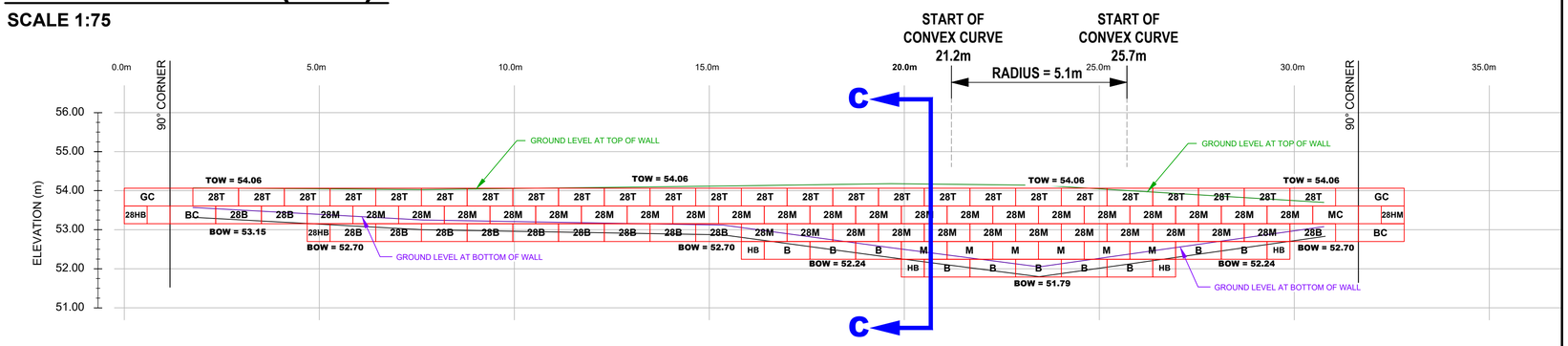
Stamp: LICENSED PROFESSIONAL ENGINEER 07/09/2021 F. I. ABOU-SEIDO 100156744 PROVINCE OF ONTARIO

Scale:	AS SHOWN
Drawn by:	NFRV
Checked by:	JV
Approved by:	FA
Date:	08/2021
File No.:	PG4112
Drawing No.:	PG4112-4
Revision No.:	1

C:\users\mcdonald\desktop\working wall estimates\docs\pg4112\pg4112-4 rev1 rock r2.dwg

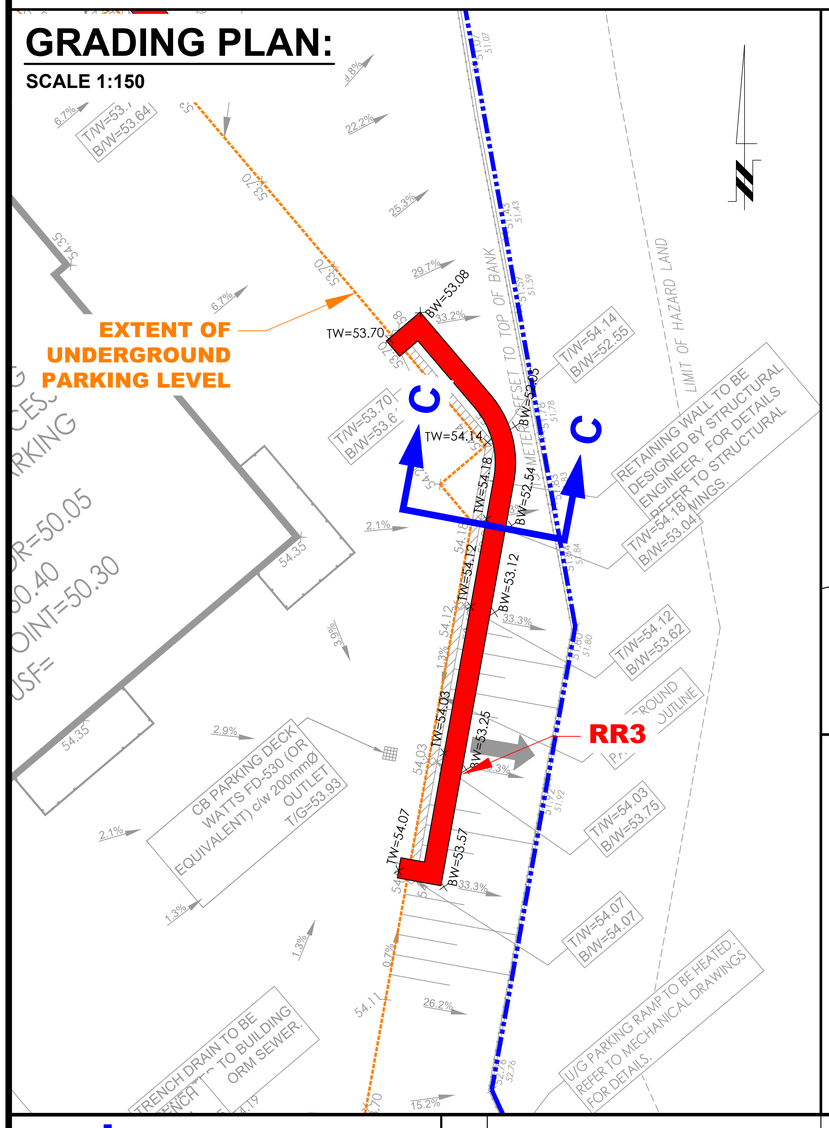
PROFILE VIEW (RR3):

SCALE 1:75



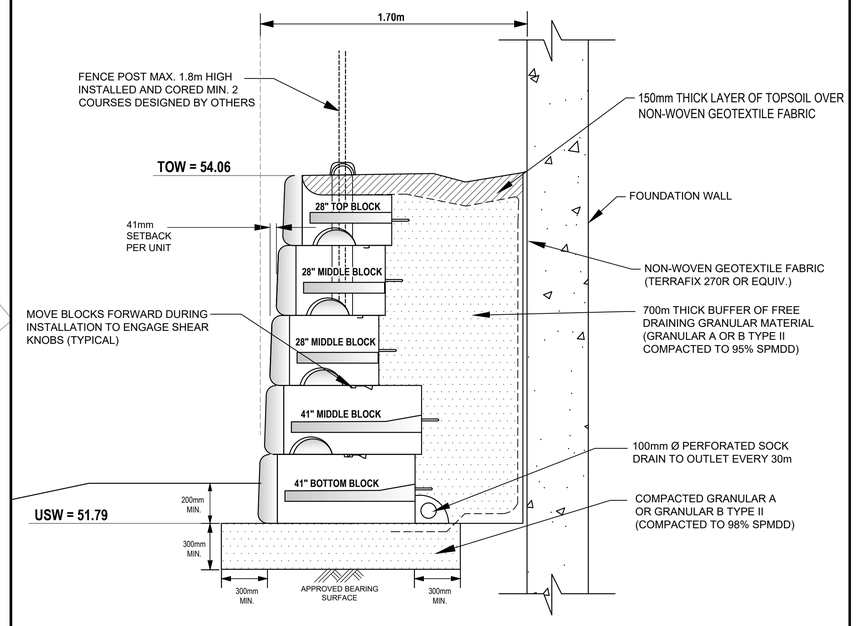
GRADING PLAN:

SCALE 1:150



CROSS SECTION C-C:

SCALE 1:20



BLOCK COUNT:

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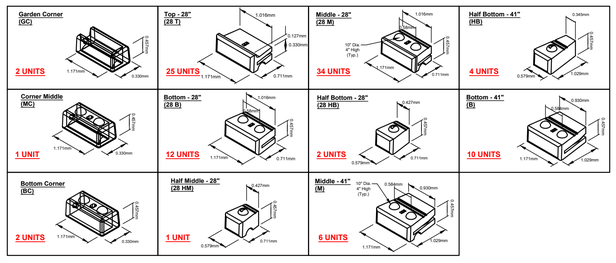

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UNIT WEIGHT - ɣ	22 kN/m3	18 kN/m3
COHESION - C	0	5 kPa
SOIL TYPE	OPSS GRANULAR B TYPE II	STIFF SILTY CLAY

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ISSUED FOR REVIEW

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

BRIGIL CONSTRUCTION

PROPOSED RETAINING WALLS
PETRIE'S LANDING - BLOCK 8 - 2466 JEANNE D'ARC BOULEVARD
OTTAWA, ONTARIO

Title:

REDI-ROCK RETAINING WALL DESIGN (RR3)

Stamp: LICENSED PROFESSIONAL ENGINEER 01/09/2021 J. R. VILLENEUVE 100504344 PROVINCE OF ONTARIO

Stamp: LICENSED PROFESSIONAL ENGINEER 01/09/2021 F. I. ABOU-SEIDO 100156744 PROVINCE OF ONTARIO

Scale:	AS SHOWN
Drawn by:	NFRV
Checked by:	JV
Approved by:	FA
Date:	08/2021
File No.:	PG4112
Drawing No.:	PG4112-5
Revision No.:	

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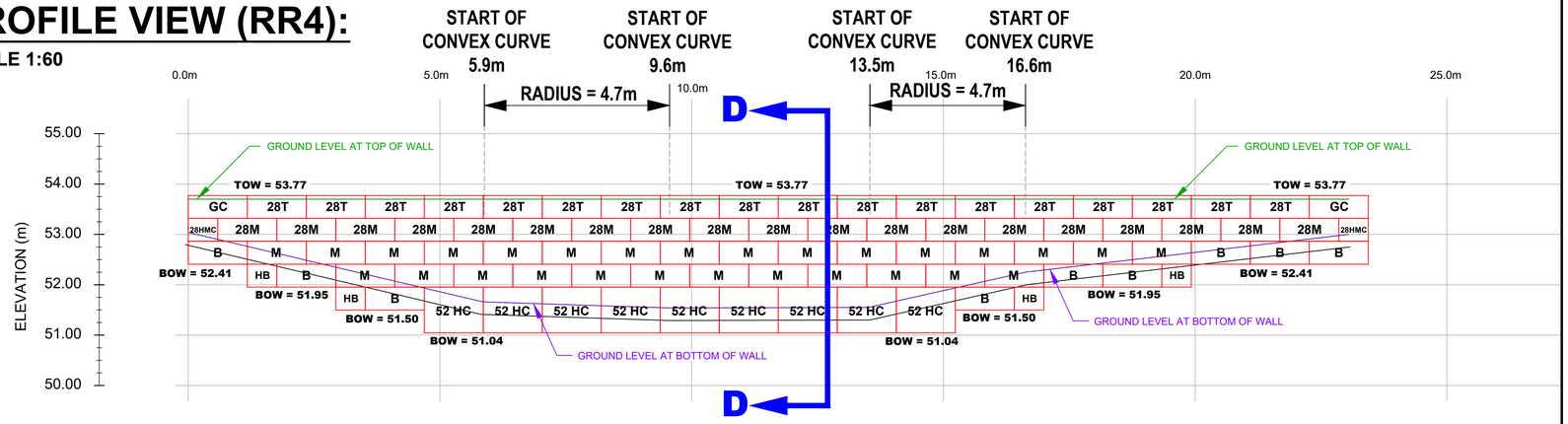

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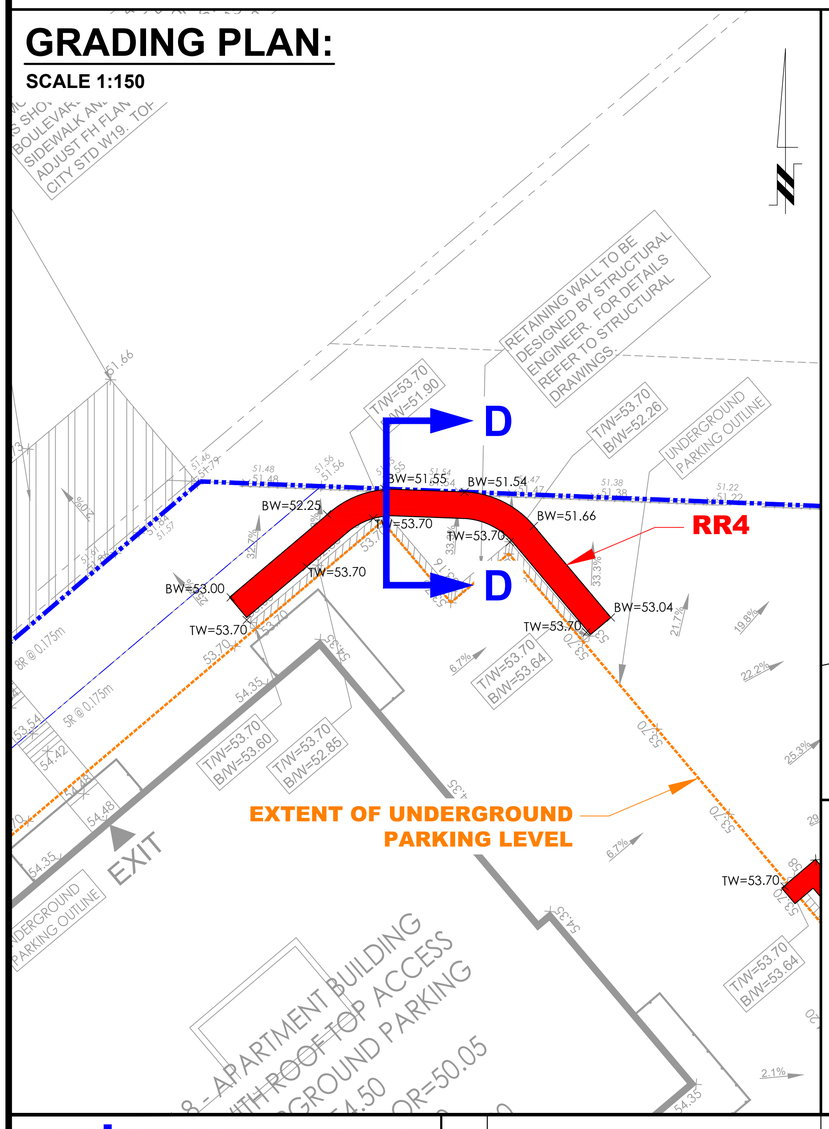

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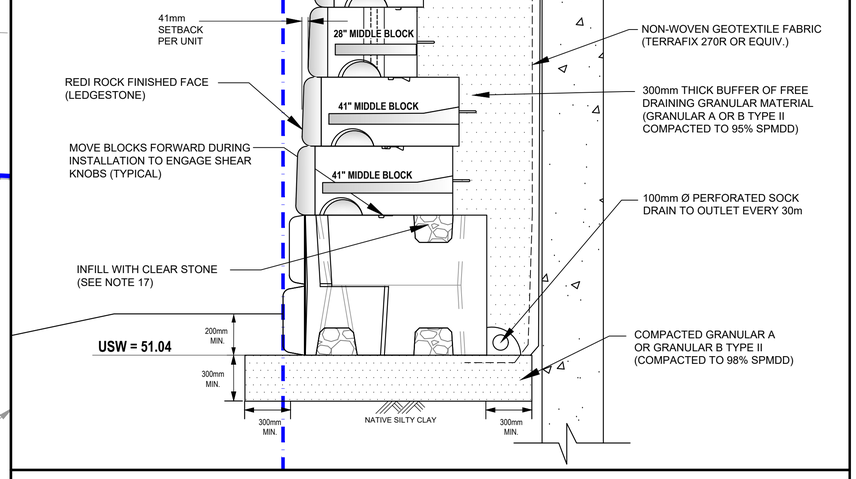

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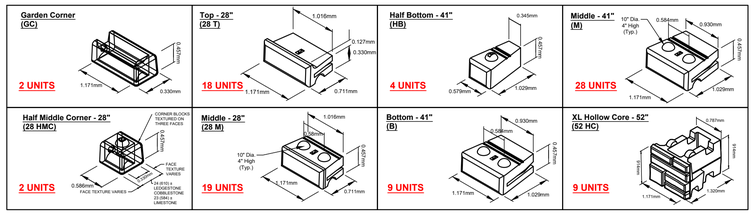

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OTTAWA, ONTARIO

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Checked by:	JV
Approved by:	FA
Date:	08/2021
File No.:	PG4112
Drawing No.:	PG4112-6
Revision No.:	

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Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

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Supplemental Geotechnical Investigation

Proposed Multi-Storey Buildings
Blocks 8 - Petrie's Landing II
8466 Jeanne D'Arc Boulevard
Ottawa, Ontario

Prepared For

Construction Brigil

July 30,2019

Report: PG4112-2

Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
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Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Construction Brigil to conduct a supplemental geotechnical investigation for Blocks 8 at Petrie's Landing II residential development located at 8466 Jeanne D'Arc Boulevard in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2).

The objective of the investigation was to:

- ❏ determine the subsoil and groundwater conditions at this site by means of test holes and existing soils information.
- ❏ provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

2.0 Proposed Development

It is understood that Block 8 of the residential development will consist of a 10 storey residential building with 2 levels of underground parking with pathways, landscaping and paved parking areas with local access roadways and will be serviced by municipal services.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the supplemental geotechnical investigation was carried out on July 9 and 10, 2019, at that time 3 boreholes (BH1-19 to BH3-19) were drilled to a maximum depth of 42.9 m. A initial geotechnical investigation was carried out, for the subject block, on April 24 and 25, 2017 which consisted of extending a total of 3 boreholes (BH 4-17 to BH 6-17) to a maximum depth of 9.8 m below the existing grade. The borehole locations were distributed in a manner to provide general coverage of the subject site at the proposed buildings footprints area and taking into consideration site features. Borehole locations are illustrated on Drawing PG4112-2 - Test Hole Location Plan included in Appendix 2.

The boreholes were drilled using a track-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The drilling procedure consisted of augering to the required depths at the selected locations, sampling and testing the overburden.

Sampling and In Situ Testing

Soil samples were recovered from a 50 mm diameter split-spoon or the auger flights. The split-spoon and auger samples were classified on site and placed in sealed plastic bags. All samples were transported to our laboratory. The depths at which the split-spoon and auger samples were recovered from the boreholes are presented as SS and AU, respectively, on the Soil Profile and Test Data sheets.

Standard Penetration Tests (SPT) were conducted and recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split-spoon sample 300 mm into the soil after the initial penetration of 150 mm using a 63.5 kg hammer falling from a height of 760 mm.

Undrained shear strength testing, using a vane apparatus, was carried out at regular intervals of depth in cohesive soils.

The overburden thickness was evaluated by a dynamic cone penetration test (DCPT) completed on all 3 boreholes of the current investigation. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets presented in Appendix 1 for specific details of the soil profile encountered at the test hole locations.

Groundwater

Flexible polyethylene standpipes were installed in boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

3.2 Field Survey

The borehole locations and ground surface elevations at the borehole locations were provided by Annis, O'Sullivan Vollebekk Ltd. The borehole locations and the ground surface elevation at the borehole locations are presented on Drawing PG4112-2 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples recovered from the subject site were visually examined in our laboratory to review the field logs.

One representative soil sample was submitted for Atterberg limits testing and hydrometer sieve analysis as part of the current investigation. The results are presented in Subsection 6.8.

3.4 Analytical Testing

One soil sample was submitted for analytical testing to assess the potential for exposed ferrous metals and the sulphate potential against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the soil. The results are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject property is bordered to the north by Jeanne D'Arc Boulevard North, to the east by a treed area and Taylor Creek, to the south by parcel currently in development by the same owner, and to the west by Prestige Circle and residential dwellings.

The site is relatively flat and grass covered. Some existing fill piles containing organic and construction debris were observed near the south portion of the site near the current construction project

4.2 Subsurface Profile

Generally, the soil conditions encountered at the test holes locations consist of topsoil or fill overlying a brown silty clay crust over a deep deposit of grey silty clay.

Based on available geological mapping and previous investigations conducted by Paterson in the area, interbedded limestone and dolomite bedrock of the Gull River formation is present in this area with a drift thickness of 40 to 50 m.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profiles encountered at each test hole location.

Silty Clay

A weathered silty clay crust varying in depths between 0.3 and 3 m was encountered at the borehole locations. In situ shear vane field testing was carried out in the lower portion of the weathered crust yielded undrained shear strength values ranging from approximately 90 to 105 kPa. These values are indicative of a stiff to very stiff consistency.

Grey silty clay was encountered below the weathered crust at all borehole locations. In situ shear vane field testing carried out in the grey silty clay yielded undrained shear strength values ranging between 38 and 60 kPa. These values are indicative of a firm to stiff consistency.

4.3 Groundwater

The measured groundwater levels in the boreholes are presented in Table 1 below.

Table 1
Summary of Groundwater Level Readings

Borehole Number	Ground Elevation (m)	Groundwater Levels (m)		Recording Date
		Depth	Elevation	
BH 1-19	54.29	4.04	50.25	July 29, 2019
BH 2-19	52.71	6.53	46.18	July 29, 2019
BH 3-19	52.57	6.10	46.47	July 29, 2019
BH 4-17	53.84	dry	-	May 1, 2017
BH 5-17	52.45	4.35	48.10	May 1, 2017
BH 6-17	52.59	5.48	47.11	May 1, 2017

Note: The groundwater level at each current borehole location is referenced to the borehole ground surface elevation, as provided by Annis, O'Sullivan Vollebekk Ltd.

It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction. The long term groundwater level is expected to be at a depth of 4 to 6 m below the existing grade.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered satisfactory for the proposed multi-storey building. Based on the results of the field program, it's expected that the proposed building will be founded on a raft foundation placed on the undisturbed stiff silty clay bearing surface. Where design building loads exceed the given bearing resistance values, consideration may be given to placing the building footprint on end bearing piles and the building garage footprint extending beyond the building would be placed on conventional spread footings.

A permissible grade raise restriction is required for the subject site due to the presence of a deep silty clay deposit. It's expected that final grades will be close to the existing grades.

The above and other considerations are further discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organics, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures.

Fill Placement

Fill used for grading beneath the building footprints, unless otherwise specified, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The fill should be tested and approved prior to delivery to the site. It should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building area should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD. Site-excavated soils are not suitable for use as backfill against foundation walls due to the frost heave potential of the site excavated soils below settlement sensitive areas, such as concrete sidewalks and exterior concrete entrance areas.

5.3 Foundation Design

Raft Foundation

Consideration can be given to a raft foundation if the building loads are acceptable. It's expected that a raft foundation will be founded at a depth of approximately 7 to 8 m below the existing grade. The following parameters may be used for a raft foundation design:

- For design purposes, the factored bearing resistance at ULS can be taken as **250 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

- The amount of settlement of the raft slab will be dependent on the sustained raft contact pressure. A bearing resistance value at SLS (contact pressure) of **175 kPa** can be used. The loading conditions for the contact pressure are based on sustained loads, that are generally taken to be 100% Dead Load and 50% Live Load.

- The modulus of subgrade reaction was calculated to be **5 MPa/m** for a contact pressure of **150 kPa**. The design of the raft foundation is required to consider the relative stiffness of the reinforced concrete slab and the supporting bearing medium.

- The proposed building can be designed using the above parameters and a total and differential settlement of 25 and 20 mm, respectively.

Deep Foundation

For support of the proposed multi-storey building consideration could be given to using concrete filled steel pipe piles driven to refusal on the bedrock surface.

For deep foundations, concrete-filled steel pipe piles are generally utilized in the Ottawa area. Applicable pile resistance at SLS values and factored pile resistance at ULS values are given in Table 2. A resistance factor of 0.4 has been incorporated into the factored ULS values. Note that these are all geotechnical axial resistance values.

The geotechnical pile resistance values were estimated using the Hiley dynamic formula, to be confirmed during pile installation with a program of dynamic monitoring. For this project, the dynamic monitoring of two to four piles would be recommended. As a minimum, the pipe piles should be equipped with a base plate having a thickness of at least 20 mm to minimize damage to the pile tip during driving. Re-striking of all piles at least once will also be required after at least 48 hours have elapsed since initial driving.

Table 2 - Pile Foundation Design Data

Pile Outside Diameter (mm)	Pile Wall Thickness (mm)	Geotechnical Axial Resistance		Final Set (blows/12 mm)	Transferred Hammer Energy (kJ)
		SLS (kN)	Factored at ULS (kN)		
245	9	940	1130	10	29
245	11	1175	1410	10	35
245	13	1375	1650	10	42

Permissible Grade Raise Restriction

Due to the presence of the silty clay layer, the subject site will be subjected to a permissible grade restriction. A permissible grade raise restriction of **2 m** is recommended for the subject site.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class E** as defined in the Ontario Building Code 2012 (OBC 2012; Table 4.1.8.4.A) for the foundations considered at this site. The soil underlying the proposed shallow foundations are not susceptible to liquefaction for the local seismicity. It may be possible that the seismic site classification could be a Class D. To confirm this better site classification, a site specific shear wave velocity test will be required.

5.5 Slab-on-Grade Construction

With the removal of all topsoil and deleterious materials, within the footprint of the proposed buildings, the native soil or engineered fill surface will be considered to be an acceptable subgrade surface on which to commence backfilling for the floor slab. The upper 150 mm of sub-slab fill should consist of an OPSS Granular A crushed stone. All backfill material within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose lifts and compacted to at least 98% of its SPMDD.

Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

5.6 Pavement Design

Car only parking areas, access lanes and heavy truck parking areas are anticipated at this site. The proposed pavement structures are shown in Tables 3 and 4.

Table 3 - Recommended Pavement Structure - Car Only Parking Areas

Thickness (mm)	Material Description
50	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill	

Table 4 - Recommended Pavement Structure
Access Lanes and Heavy Truck Parking Areas

Thickness (mm)	Material Description
40	**Wear Course** - Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill	

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable vibratory equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

Due to the impervious nature of the subgrade materials consideration should be given to installing subdrains during the pavement construction. These drains should be installed at each catch basin, be at least 3 m long and should extend in four orthogonal directions or longitudinally when placed along a curb. Along local streets, the drains should be placed along the edges of the pavement. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for the proposed structures. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structures. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials, such as clean sand or OPSS Granular B Type I granular material. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls. A drainage geocomposite, such as Miradrain G100N or Delta Drain 6000, connected to the perimeter foundation drainage system is recommended.

6.2 Protection of Footings, Pile Caps and Grade Beams Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum of 1.5 m thick soil cover (or equivalent) should be provided in this regard.

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the structure proper and require additional protection, such as soil cover of 2.1 m or a combination of soil cover and foundation insulation.

6.3 Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by "cut and cover" methods and excavations will not be left open for extended periods of time.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications & Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

At least 150 mm of OPSS Granular A should be used for bedding for sewer and water pipes when placed on soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 95% of the material's SPMDD.

Generally, it should be possible to re-use the moist, not wet, silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. The wet silty clay should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being re-used.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material's SPMDD.

6.5 Groundwater Control

Groundwater Control for Building Construction

It is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations.

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

Permit to Take Water

A temporary Ministry of the Environment, Conservation and Parks (MECP) Category permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum of 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a non aggressive to slightly aggressive corrosive environment.

6.8 Landscaping Considerations

Tree Planting Restrictions

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils(2017 Guidelines), Paterson completed a soil review of the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. A shrinkage limit test and sieve analysis testing was also completed on selected soil samples. The shrinkage limit testing indicates a shrinkage limit of 15% with a shrinkage ratio of 1.99. The results of our Atterberg limit and sieve testing are presented in Appendix 1.

Based on the results of our testing, the clay on site can be defined as low to medium plasticity silty clay (Plasticity index < 40%). In accordance with the city of Ottawa guidelines, the tree planting setback limits may be reduced to 4.5 m for small (mature tree height up to 7.5m) and medium size trees (mature tree height 7.5 m to 14 m) provided that the following conditions are met.

- ❏ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade must be satisfied for footings within 10 m from the tree, as measured from the centre of the tree trunk and verified by means of the Grading Plan as indicated procedural changes below.

- ❏ A small tree must be provided with a minimum of 25 m^3 of available soil volume while a medium tree must be provided with a minimum of 30 m^3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

- ❏ The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect. The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).

- ❏ Grading surround the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree), as noted on the subdivision Grading Plan.

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that the following material testing and observation program be performed by the geotechnical consultant.

- ❑ Review of the grading plan once available
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials used.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

8.0 Statement of Limitations

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

A geotechnical investigation of this nature is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around the test locations. The extent of the limited area depends on the soil, bedrock and groundwater conditions, as well the history of the site reflecting natural, construction, and other activities. Should any conditions at the site be encountered which differ from those at the test locations, we request notification immediately in order to permit reassessment of our recommendations.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Construction Brigil or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Joey R. Villeneuve, M.A.Sc, P.Eng.

Carlos P. Da Silva, P.Eng., ing., QP_{ESA}

Report Distribution

- ❏ Construction Brigil
- ❏ Paterson Group

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERG LIMITS RESULTS

HYDROMETER SIEVE ANALYSIS RESULTS

ANALYTICAL TESTING RESULTS

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Petrie's Landing III - Block 8 - 2466 Jeanne D'arc Blvd.
Ottawa, Ontario

DATUM Geodetic elevations provided by Annis O'Sullivan Vollebekk Ltd.

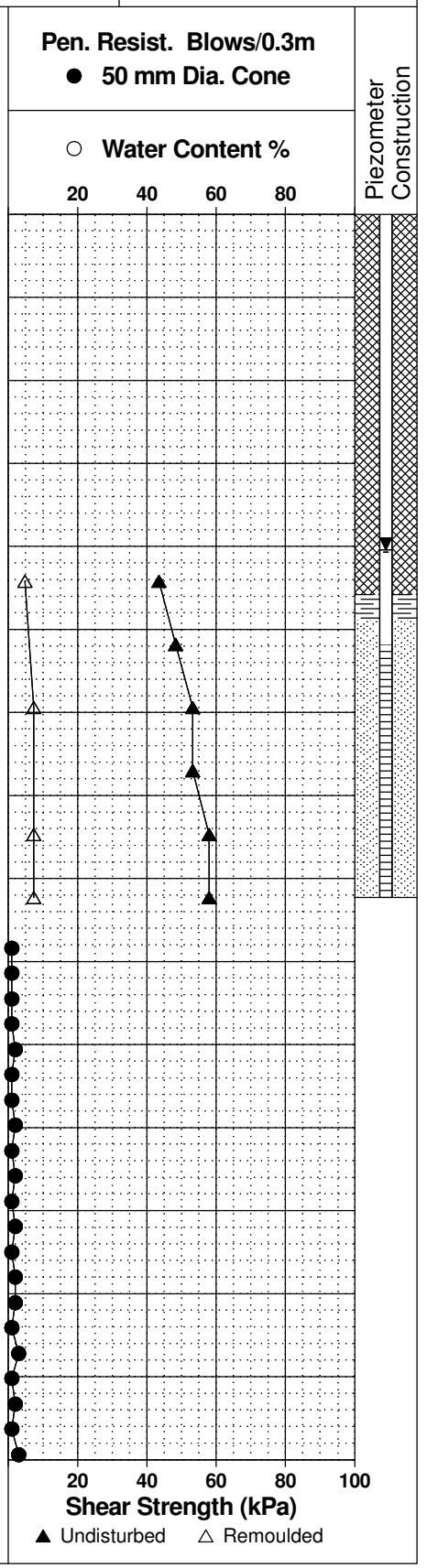
FILE NO. PG4112

REMARKS

HOLE NO. BH 1-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	54.29
FILL: Brown silty sand, some gravel and organics 0.28		AU	1				
Brown **SILTY CLAY** with organics		SS	2	58	8	1	53.29
1.37		SS	3	88	15	2	52.29
		SS	4	100	9	3	51.29
Very stiff to stiff, brown **SILTY CLAY**		SS	5	100	3	4	50.29
- grey by 3.0m depth		SS	6	100	W	5	49.29
						6	48.29
						7	47.29
8.23						8	46.29
Dynamic Cone Penetration Test commenced at 8.23m depth.						9	45.29
						10	44.29
						11	43.29
						12	42.29
						13	41.29
						14	40.29
						15	39.29



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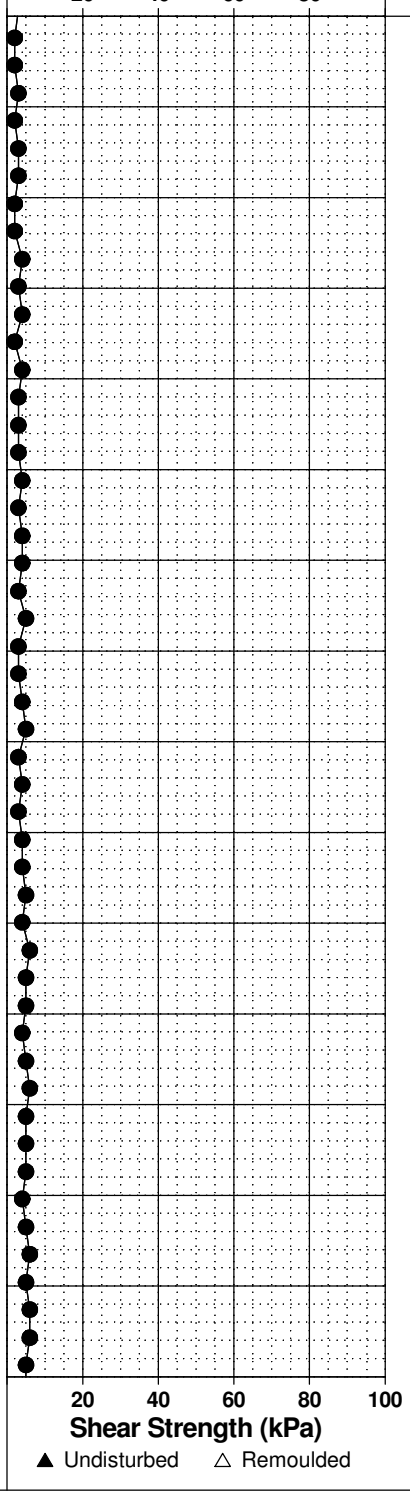
GROUND SURFACE						15	39.29		
						16	38.29		
						17	37.29		
						18	36.29		
						19	35.29		
						20	34.29		
						21	33.29		
						22	32.29		
						23	31.29		
						24	30.29		
						25	29.29		
						26	28.29		
						27	27.29		
						28	26.29		
						29	25.29		
						30	24.29		



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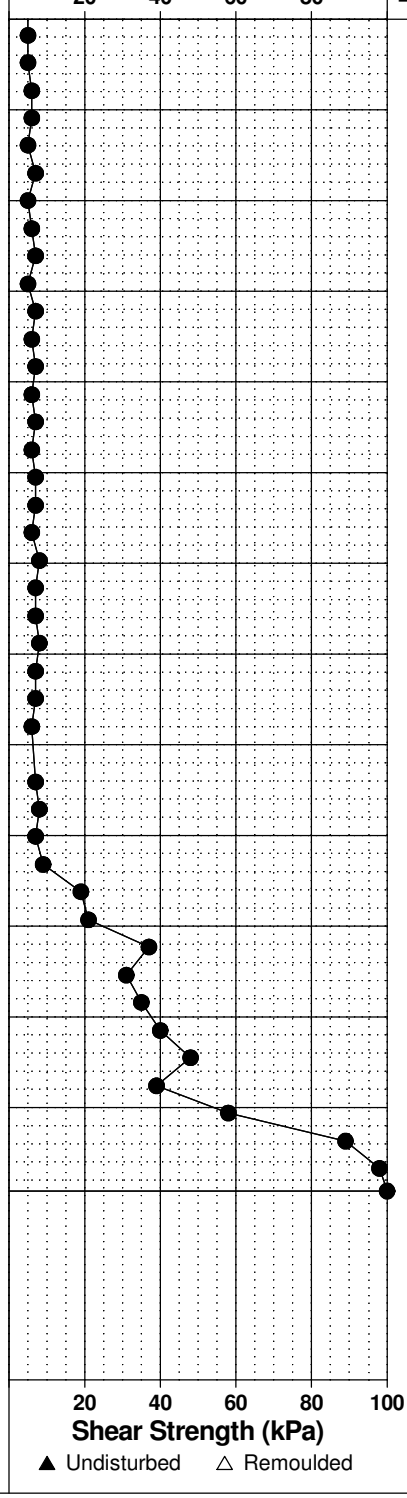
GROUND SURFACE						30	24.29		
						31	23.29		
						32	22.29		
						33	21.29		
						34	20.29		
						35	19.29		
						36	18.29		
						37	17.29		
						38	16.29		
						39	15.29		
						40	14.29		
						41	13.29		
						42	12.29		
42.92									
End of Borehole									

Practical DCPT refusal at 42.92m depth.

(GWL @ 4.04m - July 29, 2019)



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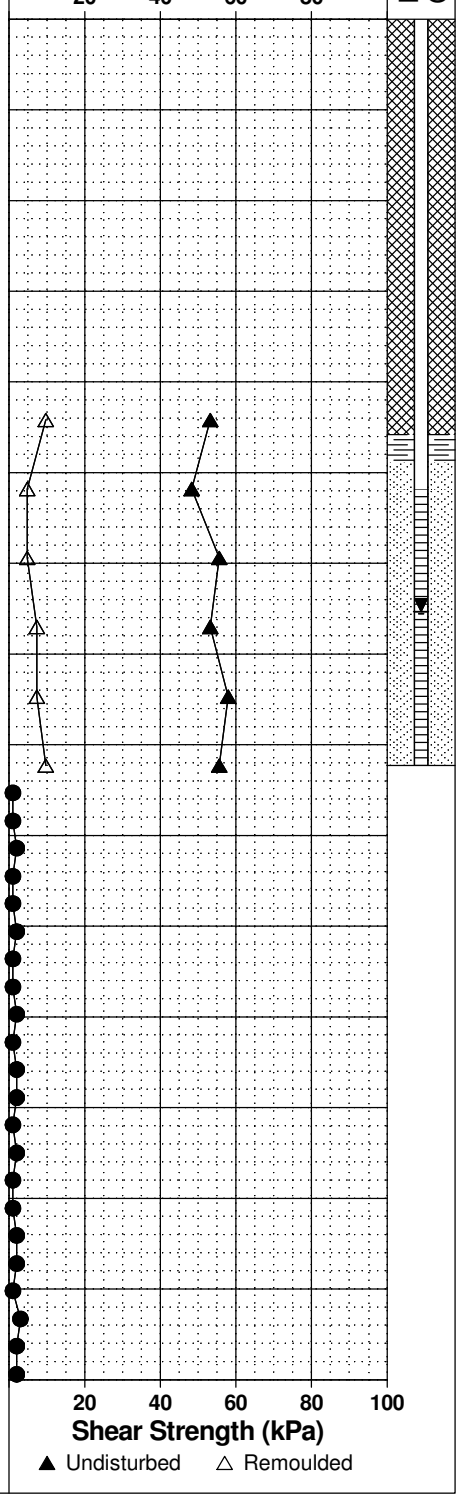
FILE NO. PG4112

REMARKS

HOLE NO. BH 2-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 9

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	52.71
FILL: Brown silty sand, some gravel and organics (0.33)		AU	1				
		SS	2	17	13	1	51.71
		SS	3	100	7	2	50.71
Very stiff to stiff, brown **SILTY CLAY**		SS	4	33	4	3	49.71
- grey by 3.0m depth		SS	5	100	W	4	48.71
						5	47.71
						6	46.71
						7	45.71
(8.23)						8	44.71
Dynamic Cone Penetration Test commenced at 8.23m depth.						9	43.71
						10	42.71
						11	41.71
						12	40.71
						13	39.71
						14	38.71
						15	37.71



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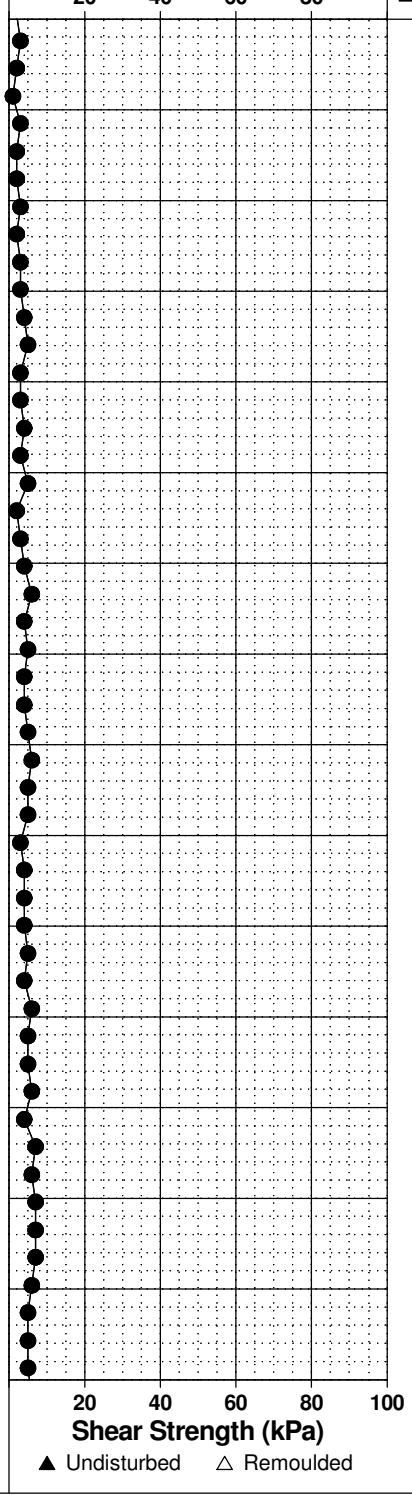
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						15	37.71		
						16	36.71		
						17	35.71		
						18	34.71		
						19	33.71		
						20	32.71		
						21	31.71		
						22	30.71		
						23	29.71		
						24	28.71		
						25	27.71		
						26	26.71		
						27	25.71		
						28	24.71		
						29	23.71		
						30	22.71		



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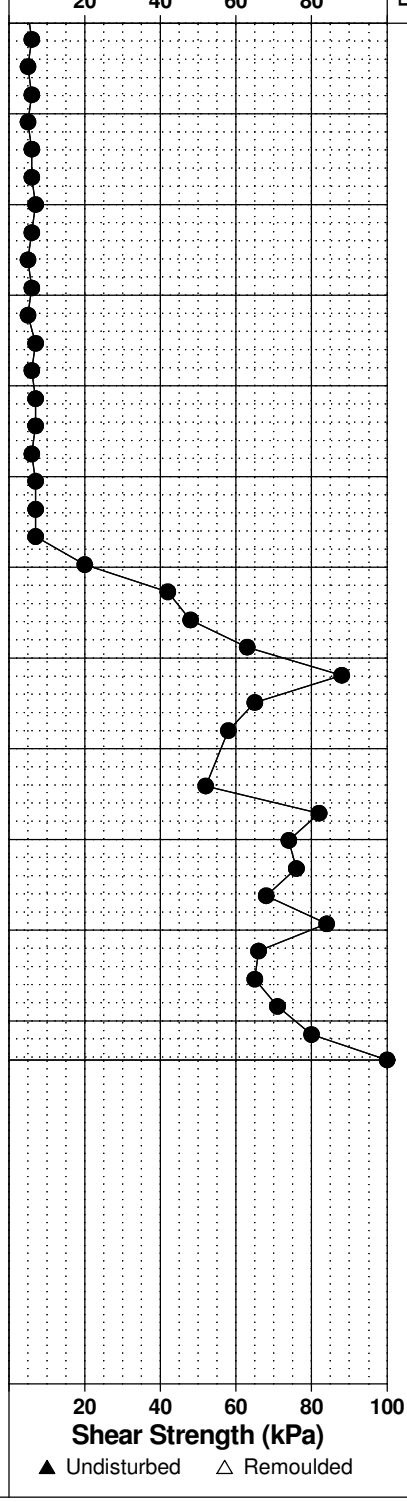
GROUND SURFACE						30	22.71		
						31	21.71		
						32	20.71		
						33	19.71		
						34	18.71		
						35	17.71		
						36	16.71		
						37	15.71		
						38	14.71		
						39	13.71		
						40	12.71		
						41	11.71		
41.43									
End of Borehole									
Practical DCPT refusal at 41.43m depth.									
(GWL @ 6.53m - July 29, 2019)									



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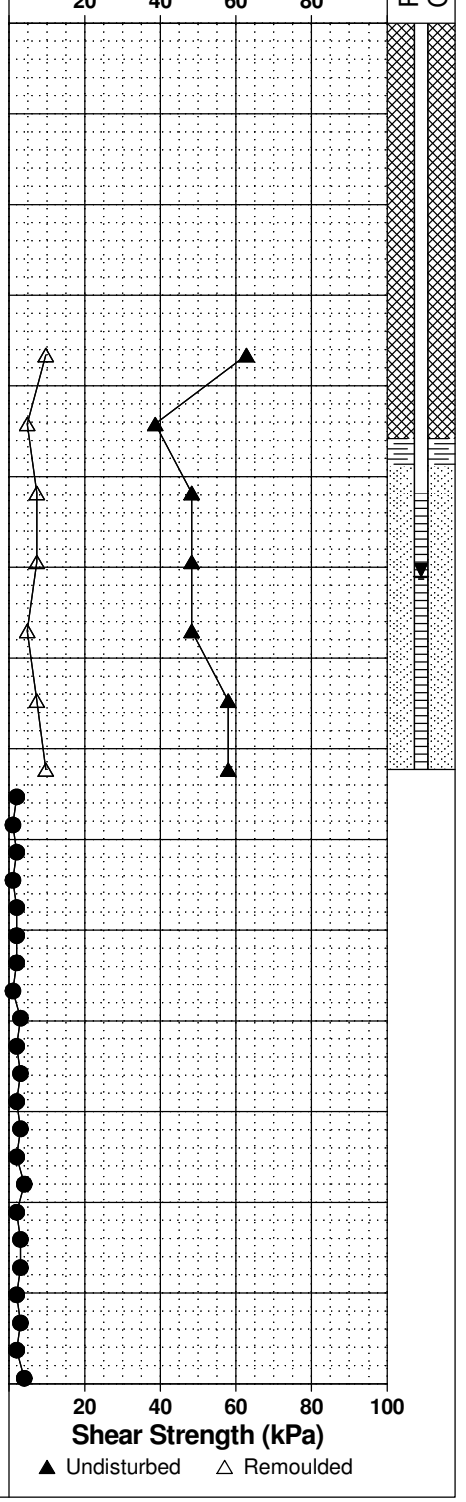
REMARKS

HOLE NO. BH 3-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 10

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	52.57
FILL: Brown silty sand, some gravel and organics (0.33)		AU	1				
		SS	2	54	14	1	51.57
		SS	3	100	9	2	50.57
Very stiff to stiff, brown **SILTY CLAY**		SS	4	38	5	3	49.57
- grey by 3.0m depth						4	48.57
						5	47.57
						6	46.57
						7	45.57
(8.23)						8	44.57
Dynamic Cone Penetration Test commenced at 8.23m depth.						9	43.57
						10	42.57
						11	41.57
						12	40.57
						13	39.57
						14	38.57
						15	37.57



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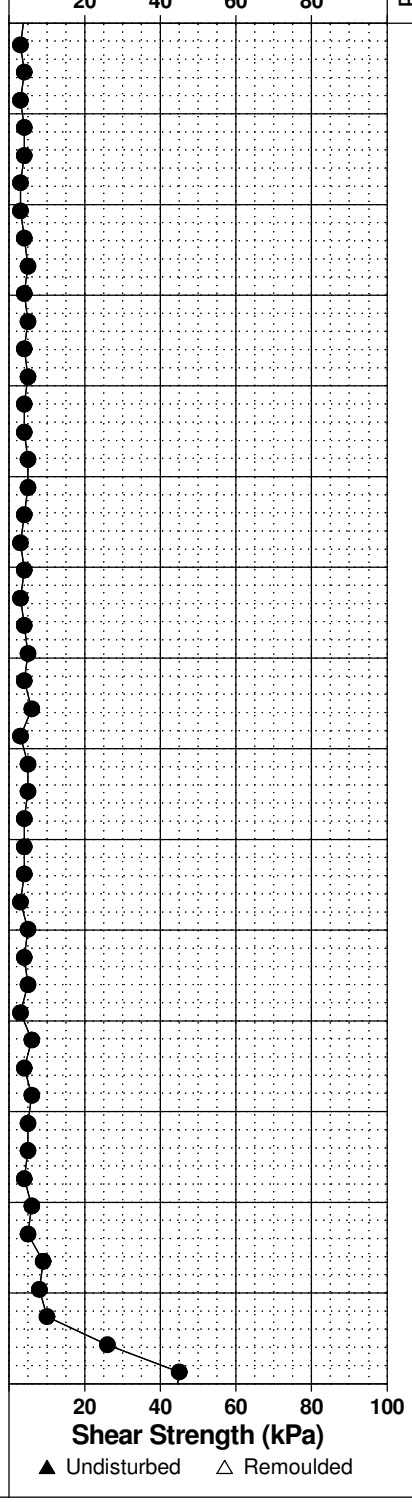
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						15	37.57		
						16	36.57		
						17	35.57		
						18	34.57		
						19	33.57		
						20	32.57		
						21	31.57		
						22	30.57		
						23	29.57		
						24	28.57		
						25	27.57		
						26	26.57		
						27	25.57		
						28	24.57		
						29	23.57		
						30	22.57		



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Ottawa, Ontario

DATUM Geodetic elevations provided by Annis O'Sullivan Vollebekk Ltd.

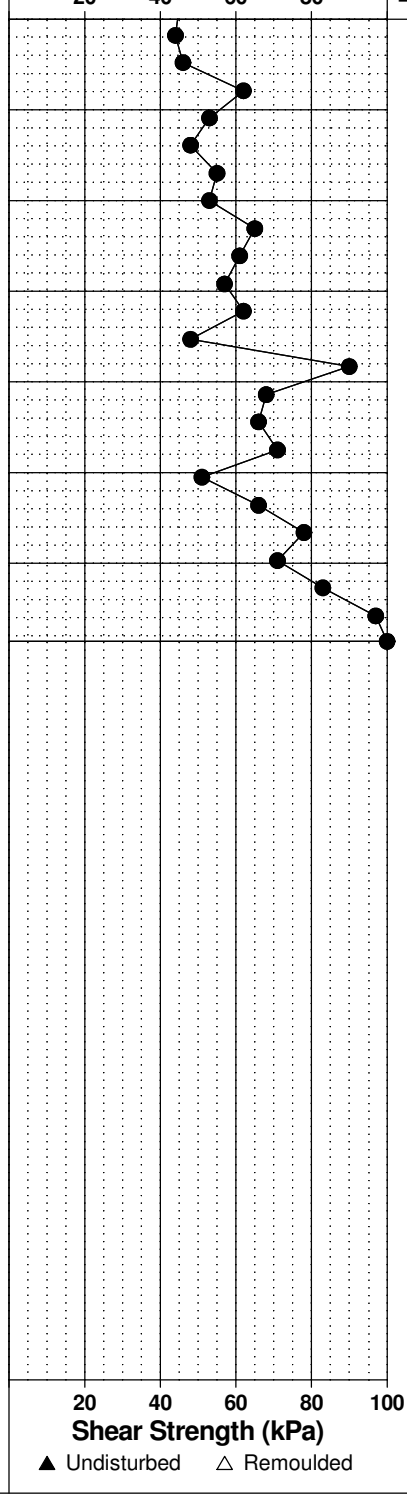
FILE NO. PG4112

REMARKS

HOLE NO. BH 3-19

BORINGS BY CME 55 Power Auger **DATE** 2019 July 10

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
						30	22.57		
						31	21.57		
						32	20.57		
						33	19.57		
						34	18.57		
						35	17.57		
						36	16.57		
36.86									
End of Borehole Practical DCPT refusal at 36.86m depth. (GWL @ 6.10m - July 29, 2019)									



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 8466 Jean D'Arc Boulevard
Ottawa, Ontario

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

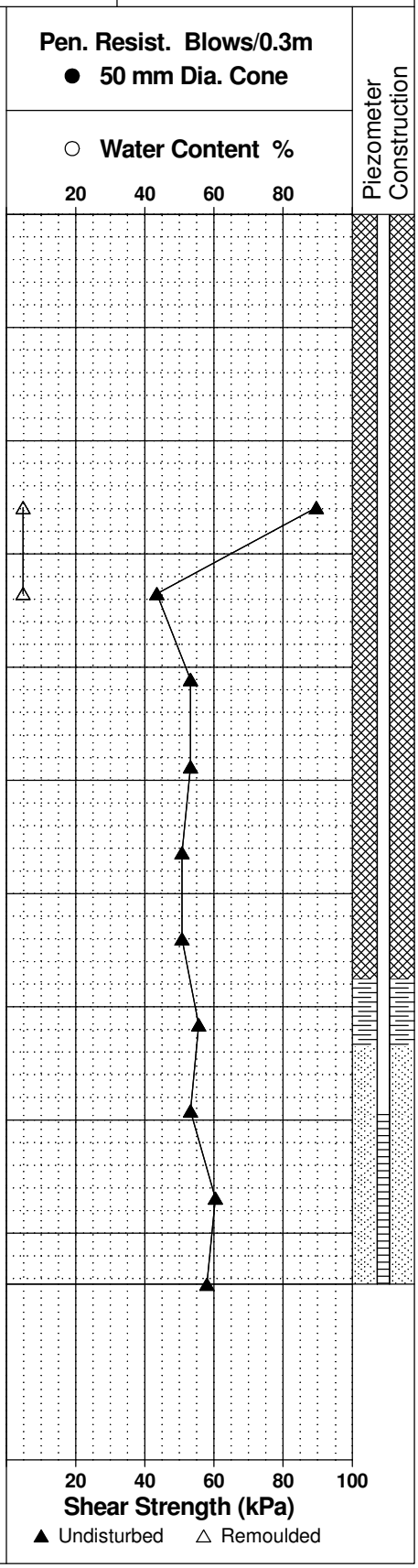
FILE NO. PG4112

REMARKS

HOLE NO. BH 4-17

BORINGS BY CME 55 Power Auger **DATE** April 24, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	53.84
FILL: Brown silty clay with sand and topsoil, trace gravel, cobbles, boulders, crushed stone and organics		AU	1				
0.69							
		SS	2	83	10	1	52.84
		SS	3	83	10	2	51.84
Firm to stiff, brown **SILTY CLAY**						3	50.84
- grey by 3.0m depth						4	49.84
						5	48.84
						6	47.84
						7	46.84
						8	45.84
						9	44.84
9.45							
End of Borehole							
(BH dry and blocked at 5.46m depth - May 1, 2017)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 8466 Jean D'Arc Boulevard
Ottawa, Ontario

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

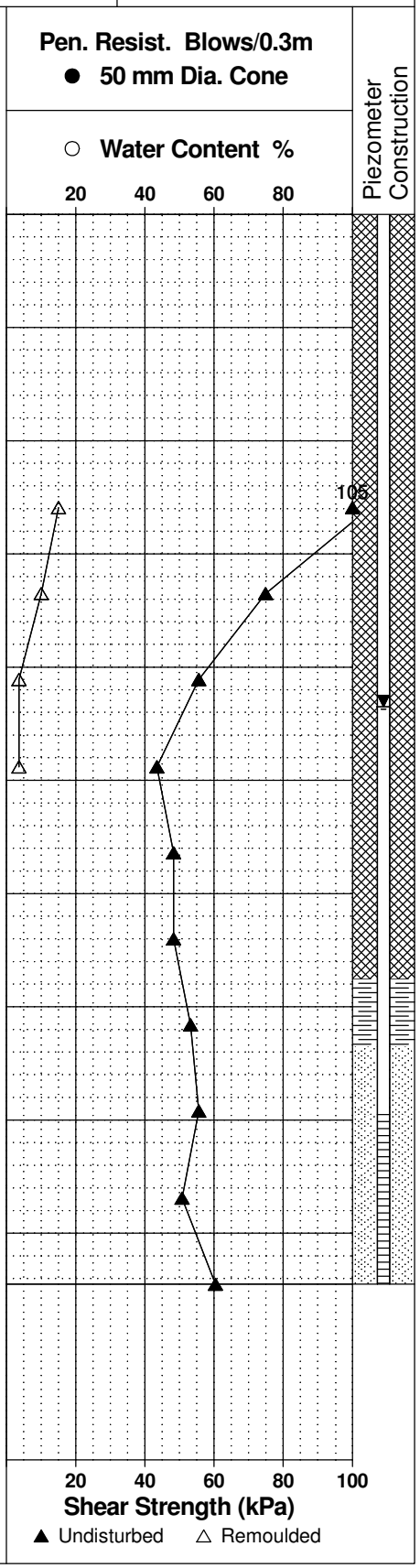
FILE NO. PG4112

REMARKS

HOLE NO. BH 5-17

BORINGS BY CME 55 Power Auger **DATE** April 24, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	52.45
FILL: Brown silty sand with clay, trace gravel, cobbles and organics 0.18		AU	1				
		SS	2	79	13	1	51.45
		SS	3	96	8	2	50.45
Very stiff to firm, brown **SILTY CLAY,** some reddish lenses						3	49.45
- grey by 3.8m depth						4	48.45
						5	47.45
						6	46.45
						7	45.45
						8	44.45
						9	43.45
9.45 End of Borehole							
(GWL @ 4.35m - May 1, 2017)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Multi-Storey Building - 8466 Jean D'Arc Boulevard
Ottawa, Ontario

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

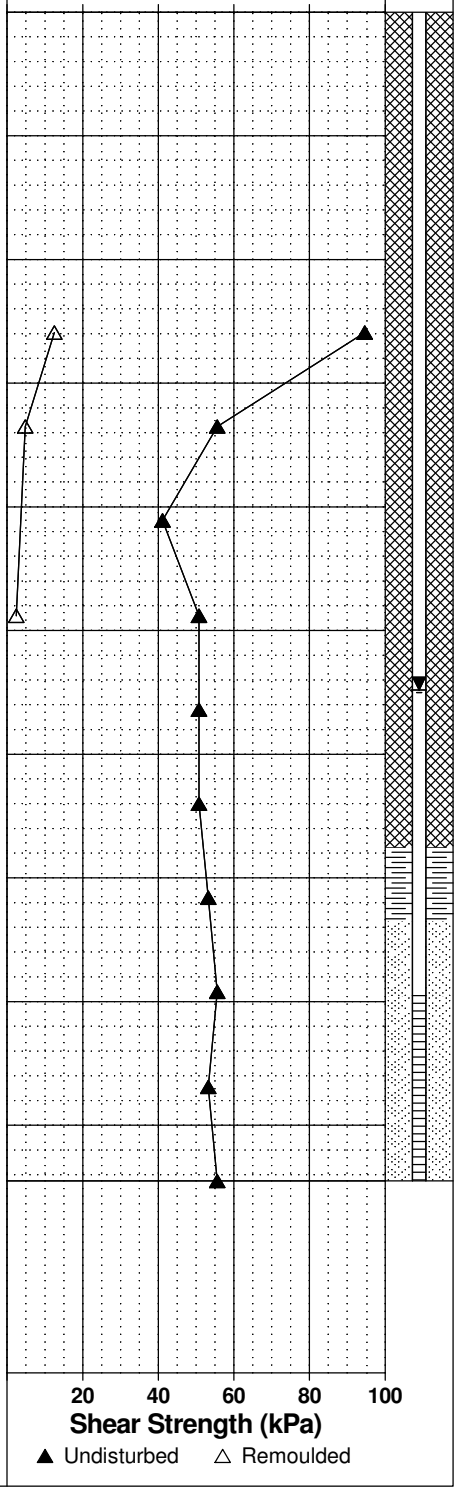
FILE NO. PG4112

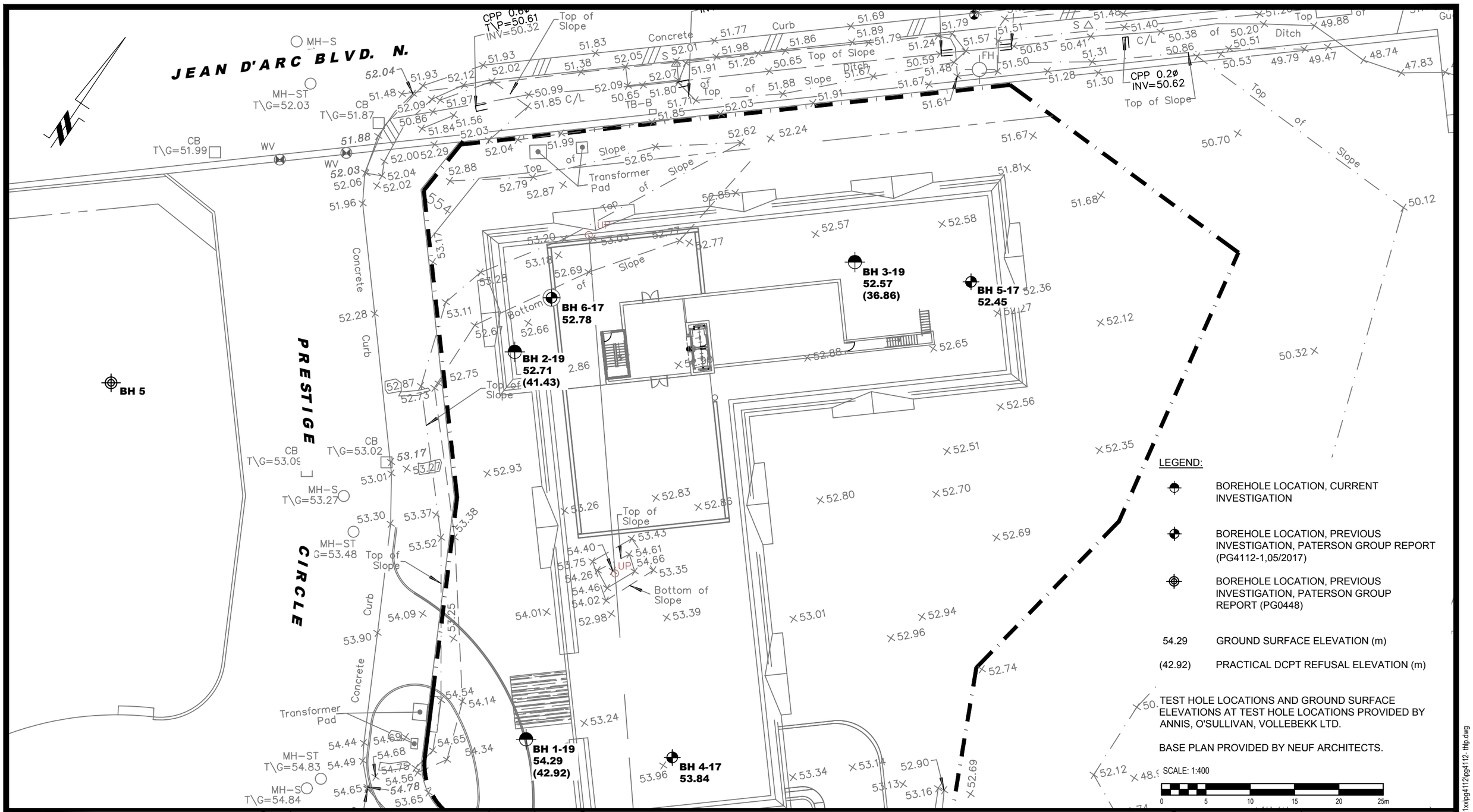
REMARKS

HOLE NO. BH 6-17

BORINGS BY CME 55 Power Auger **DATE** April 24, 2017

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	52.78
FILL: Brown silty clay with topsoil, some gravel, trace sand and organics 0.43		AU	1				
		SS	2	96	9	1	51.78
		SS	3	100	5	2	50.78
Firm to stiff, brown **SILTY CLAY** with reddish lenses						3	49.78
- grey by 3.8m depth						4	48.78
						5	47.78
						6	46.78
						7	45.78
						8	44.78
						9	43.78
9.45 End of Borehole							
(GWL @ 5.48m - May 1, 2017)							





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Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

BRIGIL CONSTRUCTION

GEOTECHNICAL INVESTIGATION
PETRIE`S LANDING - BLOCK 8 -2466 JEANNE D`ARC BOULEVARD
OTTAWA, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale: 1:400	Date: 07/2019
Drawn by: YA	Report No.: PG4112-1
Checked by: JV	Dwg. No.: PG4112-2
Approved by: DJG	Revision No.:

p:\autocad drawings\geotechnical\pg41xx\pg4112\pg4112- thlp.dwg

patersongroup **Memorandum**

consulting engineers

re:	**Geotechnical Assessment - Slope Review - Block 8** **Proposed Multi-Storey Building** **8466 Jeanne-d'Arc Boulevard - Ottawa**
to:	Brigil Construction - **Mr. Jean-Luc Rivard** - jlrivard@brigil.com
to:	Brigil Construction - **Mr. Philip Thibert** - pthibert@brigil.com
date:	June 23, 2021
file:	PG4112-MEMO.02

Further to your request, Paterson Group (Paterson) completed a site visit on June 22, 2021 to review the condition of the ravine and slope running in a north-south direction along the east side of the subject site. This memo should be read in conjunction with Paterson Group Report PG0448-1 dated August 3, 2005. Relevant photographs from the site visit are attached to the current memorandum.

Field Observations

The side-slope running alongside the ravine in the vicinity of the subject site near Block 8 was observed to consist of a thin topsoil layer overlaying a brown silty clay deposit. The slope was observed to be heavily vegetated with mature trees, shrubs and grass. The height of the slope is approximately 5 m measured from the toe to the top of slope with an approximate inclination of 2.3H:1V.

The valley area of the ravine consisted of tall grass and varied in width from approximately 4 to 6 m. The main watercourse channel was noted to be approximately 1 to 1.2 m wide. At the time of our site visit, the channel was observed to be generally dry, with some moist soil and very minor water ponding near the north portion of the site at the culvert crossing beneath Jeanne-d'Arc Boulevard. No active running water was observed and no sign of erosions were noted..

Geotechnical Review and Commentary

Slope Stability Analysis

A slope stability analysis, included in the above mentioned geotechnical report, was carried out for the subject site by Paterson in 2005. Section D of the slope stability analysis was completed within the vicinity of Block 8, the slope sections for static and seismic conditions from the 2005 study area attached to the current memorandum. The test hole location plan showing the location of Section D is also attached to the current memorandum.

The results of the previous slope stability analysis yielded factors of safety for static and seismic conditions of 2.73 and 2.36, respectively, which are considered to be well within acceptable limits from a geotechnical perspective. The study recommended an toe erosion allowance of 2 m and an erosion access allowance of 6 m, for a total required setback of 8 m from the top of slope.

Based on our cursory review, no sign of sloughing or cracking were observed along the slope. The shape of the slope has remained unchanged and well vegetated since our previous review. The ravines side-slopes are considered to be stable from a geotechnical perspective

Geotechnical Recommendations

Based on our current review of the slope, there have been no significant changes to the slope condition since the 2005 slope stability assessment. Upon review of the grading plan (Grading Plan - Project No. 160401331, Drawing No. GP-1, Sheet No. 3 of 6, Revision 1 dated March 26, 2021), the development limit was set at 15 m away from the top of the slope which is much more than the Limit of Hazard Lands setback. It is understood that no changes to the grades will be made past the development limits. Existing grades will be matched at the property line.

Since no changes are proposed within the limit of hazard lands, the proposed development will have no negative impact on the slope and is considered to be acceptable from a geotechnical perspective.

We trust that this information satisfies your immediate requirements.

Paterson Group Inc.

David J. Gilbert, P.Eng.

Joey R. Villeneuve, MA.Sc., P.Eng.,ing.

Photographs from Site Visits – June 22, 2021

Photo 1: Photograph taken looking south from the road showing the location of the culvert where very minor water ponding was observed, the grass covered channel and the heavily vegetated slope adjacent to Block 8.

Photo 2: Photograph taken looking east from the bottom of the slope adjacent to Block 8 at the grass covered channel.

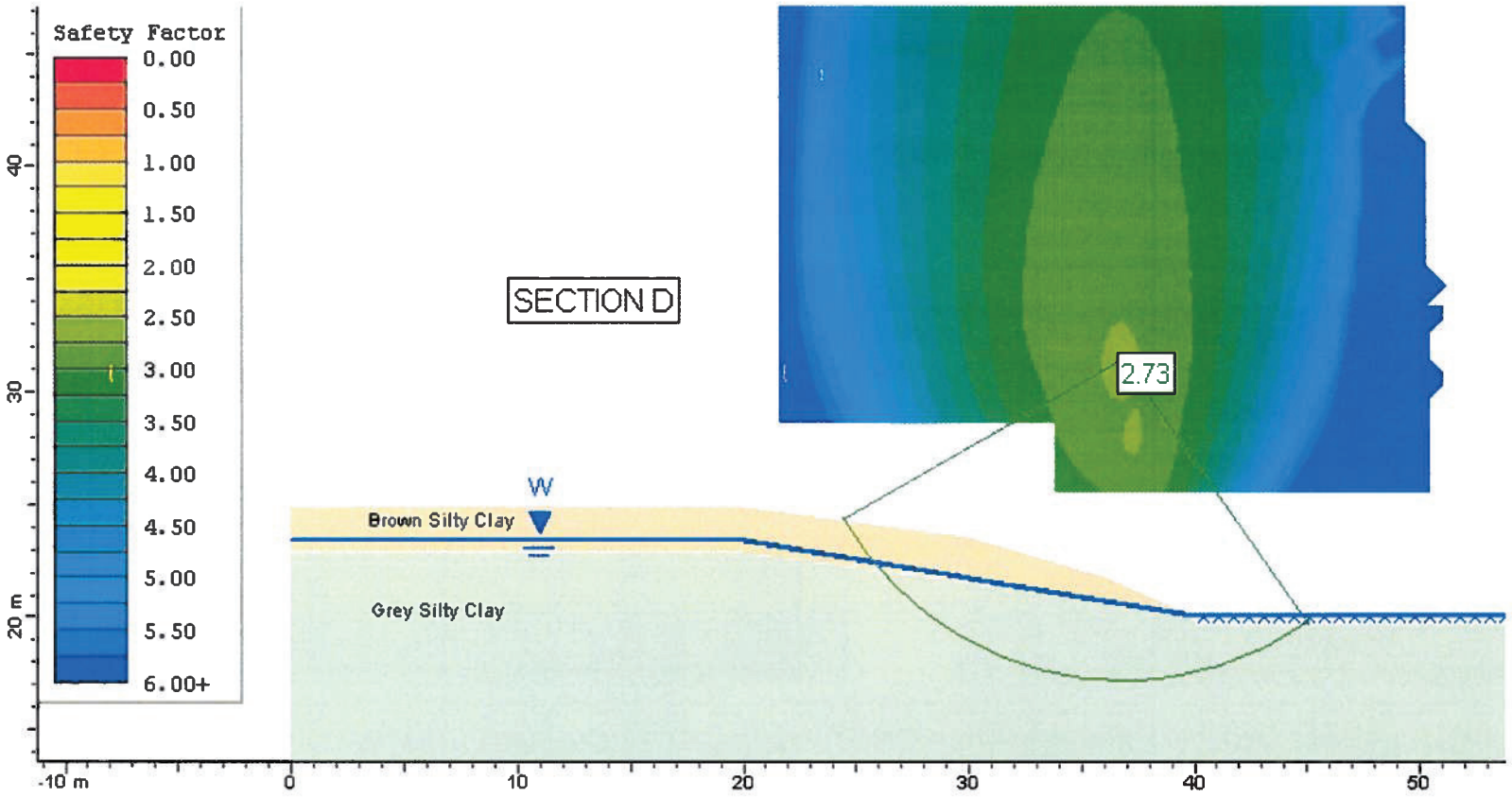


Figure 8, Section D, Effective Stress Analysis

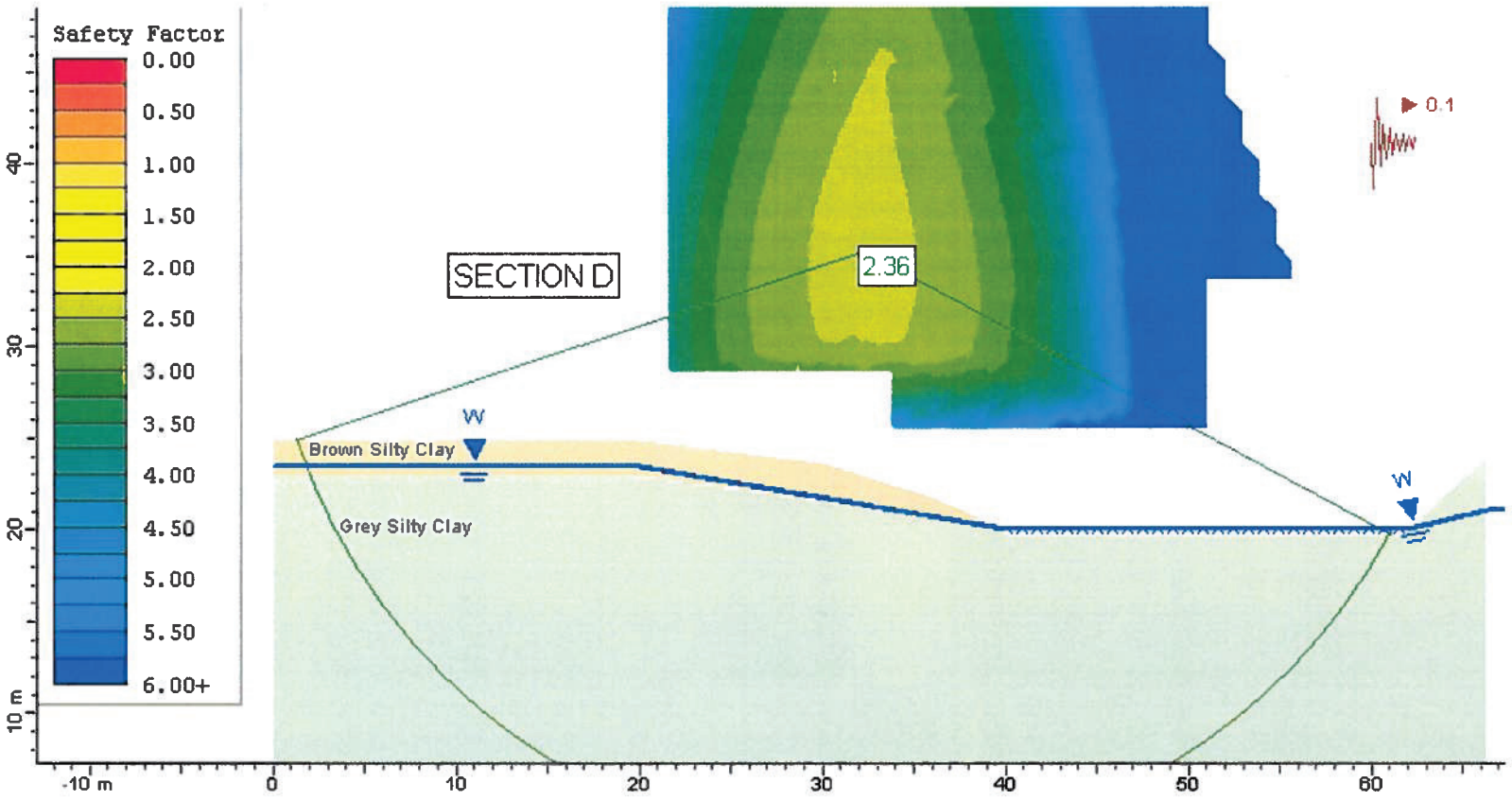
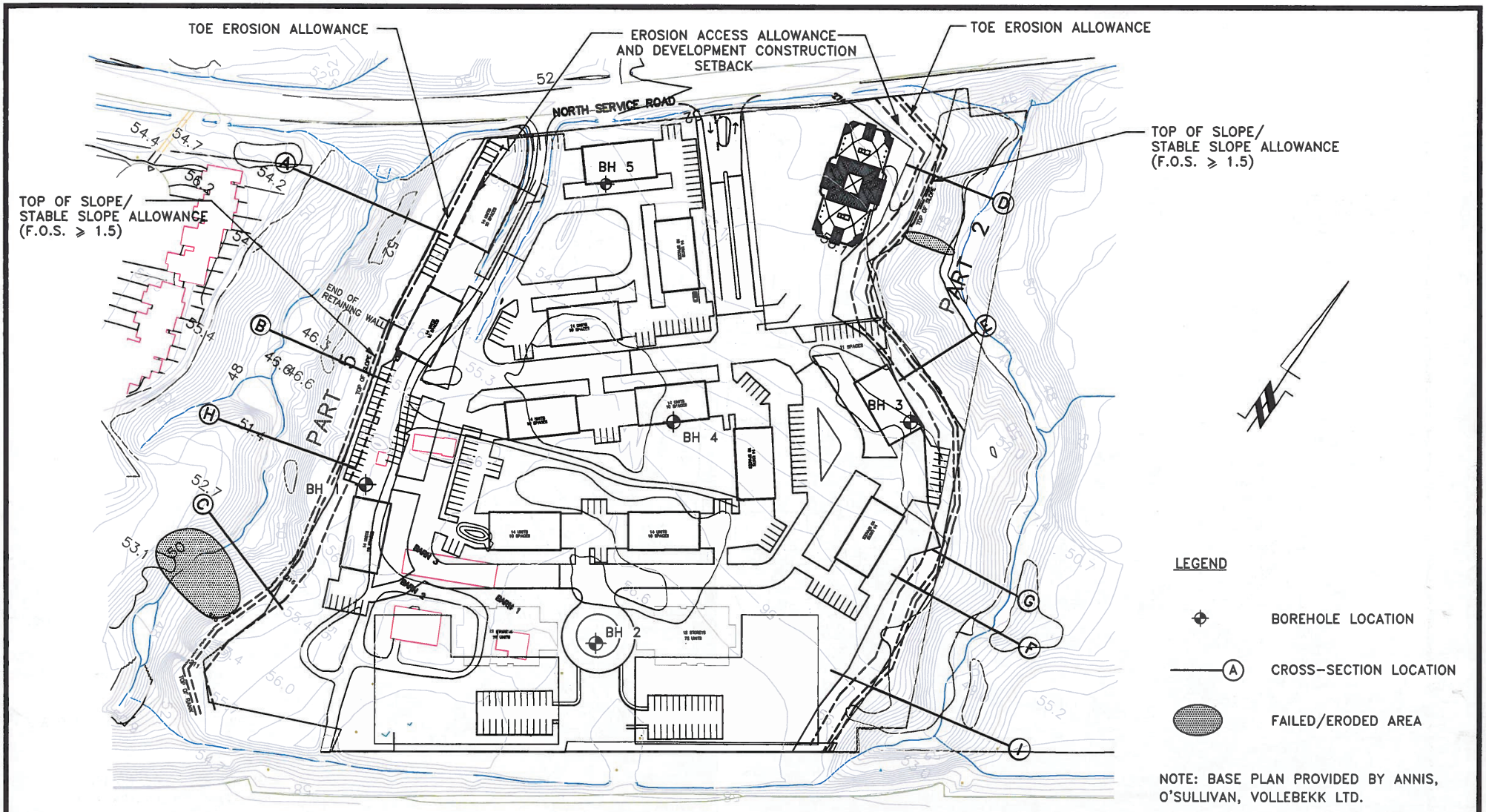


Figure 9, Section D, Seismic Conditions



paterson group consulting engineers 28 Concourse Gate, Unit 1, Ottawa, Ontario K2E 7T7	Scale: 1:1500 Des.: RG Dwn: JD Chkd: GC	BRIGIL HOMES PRELIMINARY GEOTECHNICAL INVESTIGATION 8465 NORTH SERVICE ROAD OTTAWA, ONTARIO	TEST HOLE LOCATION PLAN	Dwg. No. PG0448-1 Report No.: PG0448-01 Date: 08/2005

11x17

patersongroup **Memorandum**

consulting engineers

re:	**Grading Plan Review** **Proposed Multi-Storey Buildings** **8466 Jeanne-d'Arc Boulevard - Ottawa**
to:	Brigil Construction - **Mr. Jean-Luc Rivard** - jlrivard@brigil.com
date:	September 20, 2021
file:	PG4112-MEMO.03

Further to your request and authorization, Paterson Group (Paterson) prepared the current memorandum to provide a grading plan review for the aforementioned proposed residential development. The following memorandum should be read in conjunction with Paterson Report PG4112-2 Revision 1 dated June 21, 2021.

Grading Plan Review

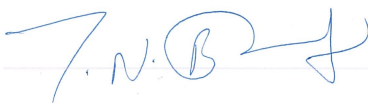
Paterson reviewed the following grading plan prepared by Stantec Consulting Ltd. regarding the aforementioned residential development:

- ❑ Grading Plan - Project No. 160401331, Drawing No. GP-1, Sheet No. 3 of 6, Revision 2 dated September 15, 2021.

Based on our review, the aforementioned grades are considered acceptable from a geotechnical perspective. Minor exceedances were observed at various locations throughout the subject site. However, Paterson has completed further review at these locations and no lightweight fill is required for the proposed building.

We trust that this information satisfies your immediate requirements.

Paterson Group Inc.



Balaji Nirmala, M.Eng.

Joey R. Villeneuve, M.A.Sc, P.Eng.

Paterson Group Inc.

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Appendix E BACKGROUND REPORTS EXCERPTS

Site Servicing and Stormwater Management Brief – Petrie's Landing Block 6, 7 and 8 (D07-12-17-0093), Ottawa, ON

File: 160401331/83

Prepared for:
Brigil Homes

Prepared by:
Stantec Consulting Ltd.

September 19, 2018

Revision Record							
Revision	Description	Prepared by		Checked by		Approved by	
0	1st submission	A. Paerez	05/24/2017	K. Kilborn	05/24/2017	A. Paerez	05/24/2017
1	2nd submission	A. Paerez	01/12/2017	K. Kilborn	01/18/2018	A. Paerez	01/22/2018
2	3rd submission	A. Paerez	03/21/2018	K. Kilborn	03/22/2018	A. Paerez	03/23/2018
3	4th submission	A. Paerez	07/05/2018	K. Kilborn	07/05/2018	A. Paerez	07/05/2018
4	5th submission	A. Paerez	07/26/2018	K. Kilborn	07/26/2018	A. Paerez	07/26/2018
5	6th submission	A. Paerez	09/04/2018	K. Kilborn	09/05/2018	A. Paerez	09/05/2018
6	7th submission	A. Paerez	09/19/2018	K. Kilborn	09/19/2018	A. Paerez	09/19/2018

Sign-off Sheet

This document entitled Site Servicing and Stormwater Management Brief – Petrie's Landing Block 6, 7 and 8 (D07-12-17-0093), Ottawa, ON was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Brigil Homes (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Approved by 

(signature)

Ana M. Paerez, P. Eng.

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LIST OF APPENDICES

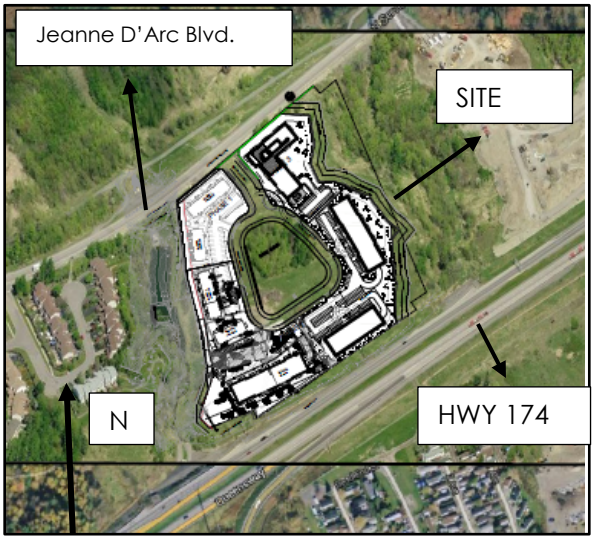
1.0 INTRODUCTION AND OBJECTIVE

The following site servicing and stormwater management (SWM) report has been revised to address City comments to the previous submission. A letter summarizing the City comments and Stantec's responses has been included in **Appendix F**. Specifically, the 4R plan has been revised to match the new property lines and a catchbasin has been added to ensure full capture of the 100-year runoff from area F201A. However, the results of the servicing analyses remain the same as those previously submitted. The drawings have been revised to reflect the revisions.

Stantec Consulting Ltd. has been retained by Brigil Homes to prepare the following site servicing and stormwater management (SWM) brief to satisfy the City of Ottawa Site Plan Control Application process. The 2.14 ha site is located on Prestige Circle, with the Highway 174 to the south, Jeanne D'Arc Boulevard to the north, a residential development to the east, and Brisebois Creek and its associated stormwater management (SWM) facility to the west in the city of Ottawa (see **Figure 1** below).

Block 6 of the proposed development makes up 0.61 ha of the proposed site and consists of a four-storey residential building with associated surface and underground parking, and landscaped areas. Block 7 of the proposed development makes up 0.76 ha of the proposed site and consists of a four-storey residential building with associated surface and underground parking, and landscaped areas. Similarly, Block 8 of the proposed development makes up 0.77 ha of the proposed site and consists of a four-storey residential building with associated surface and underground parking, and landscaped areas. A copy of the proposed site plan prepared by Neuf Architects Inc. can be found in **Appendix B**.

Figure 1: Site Location



1.1 BACKGROUND

Blocks 6 and 7 of the proposed development are within Phase 2 of the Petrie's Landing Development which was previously designed by IBI Group in February 2014 in support of a site plan application for phase 2 and subsequently approved by the City of Ottawa (see report excerpts in **Appendix E**). Phase 1 and Blocks 3, 4 and 5 within Phase 2 of the overall development have been built.

However, the site plan within Blocks 6 and 7 has changed and the proposed site plan for Block 8, previously referenced as Phase 3, has been added to the site plan application.

1.2 OBJECTIVE

This site servicing and SWM brief has been prepared to present a servicing scheme that is free of conflicts and which utilizes the existing infrastructure as obtained from available as-built drawings. Infrastructure requirements for water supply, sanitary and storm sewer services are presented in this report.

Criteria and constraints provided in the background documents have been used as a basis for the servicing design of the proposed development. Specific elements and potential development constraints to be addressed are as follows:

- Prepare a grading plan in accordance with the proposed site plan and existing grades
- Storm Sewer Servicing
    - Define major and minor conveyance systems in conjunction with the grade control plan
    - Determine the stormwater management storage requirements to meet the allowable release rates for the site
    - Size and design inlet control devices (ICDs) to restrict minor system peak flows and meet the target release rates from the site
- Wastewater Servicing
    - Size the sanitary service laterals
- Water Servicing
    - Provide feeds to the proposed buildings from the existing 200 mm diameter watermain along Prestige Circle
    - Watermain servicing for the development is to be able to provide average day and maximum day (including peak hour) demands (i.e. non-emergency conditions) at pressures within the acceptable range of 40 to 80 psi (275 to 552 kPa)
    - Provide Fire Underwriter Survey (FUS) fire demand calculations and ensure fire demands for the proposed buildings are equal or below the values assumed in the hydraulic analysis presented in the background documents

The accompanying drawings included in the back of this report illustrate the internal servicing scheme for the site.

2.0 REFERENCES

The following background studies have been referenced during the servicing design of the proposed site:

- *Design Brief Petrie's Landing II Phase 2, IBI Group., February 7, 2014*
- *Geotechnical Investigation*, Proposed Multi-Storey Buildings Block 6, 7 and 8 – Petrie's Landing II, Ottawa, Ontario, Paterson group, May 24, 2017
- *City of Ottawa Design Guidelines – Water Distribution*, City of Ottawa, July 2010
- *City of Ottawa Sewer Design Guidelines*, City of Ottawa, October 2012
- *Technical Bulletin ISDTB-2014-01,* City of Ottawa, February 2014
- *Technical Bulletin PIEDTB -2016-01,* City of Ottawa, September 6, 2016

3.0 WATER DISTRIBUTION

Given that the revised site plan has nearly the same proposed population (two units less in Block 7), same building floor space and water servicing layout, it is expected that the resulting water demands, and pressures will be practically the same as outlined in the previous submissions which are summarized in the sub-sections below.

3.1 BACKGROUND

The four-storey buildings within Blocks 6, 7 and 8 are proposed to be apartment buildings with underground parking. The proposed buildings in Block 6, 7 and 8 have total floor space of approximately 1,530 m^2 (0.15 ha), 1,970 m^2 (0.20 ha), and 2,360 m^2 (0.24 ha) respectively, and are proposed to connect to the existing 200 mm diameter watermain along Prestige Circle as shown on the Site Plan (see **Drawing SSP-1**).

A detailed hydraulic analysis for the overall Petrie's Landing Development was included in the 2014 Petrie's Landing Design Brief prepared by IBI (see **Appendix E**). However, the FUS calculations for the proposed buildings generated higher fire flow demands than the values assumed in IBI's hydraulic analysis. As a result, the hydraulic analysis for the overall development was revised using the same boundary conditions as per IBI's model, but with the revised water and fire flow demands for the proposed Blocks 6, 7 and 8 as shown in the following sections. Detailed calculations and the revised hydraulic model results have been included in **Appendix A**.

3.2 WATER DEMANDS

Water demands were calculated using the City of Ottawa Water Distribution Guidelines (July 2010) to determine the typical operating pressures to be expected at the buildings. A daily rate of 350 L/cap/day has been applied for the population of the proposed site. Population densities have been assumed as 1.4 persons/unit for one-bedroom units and 2.1 persons/unit for two-bedroom units. The Maximum Day (MXDY) residential demand was determined by multiplying the Average Day (AVDY) demand by a factor of 2.5 and the Peak Hour (PKHR) residential demand was determined by multiplying the MXDY demand by a factor of 2.2. The estimated demands are summarized in **Table 1**.

Table 1: Estimated Water Demands

Building ID	Population	AVDY (L/s)	MXDY (L/s)	PKHR (L/s)
Block 6	122	0.49	1.23	2.17
Block 7	140	0.57	1.42	3.12
Block 8	141	0.57	1.43	3.15
Total	**403**	**1.63**	**4.08**	**8.98**

The fire flow requirements were calculated in accordance with the Fire Underwriters Survey (FUS) and determined to be approximately 15,000 L/min (250 L/s) for Block 6, 15,000 L/min (250 L/s) for Block 7, and 20,000 L/min (333 L/s) for Block 8. Wood frame construction was considered in the assessment for fire flow requirements according to the FUS Guidelines. The FUS Guidelines indicate that low hazard occupancies include apartments, dwellings, dormitories, hotels, and schools, and as such, a low hazard occupancy/ limited combustible building contents and sprinkler systems was applied to the calculations. A two-hour fire separation has been considered at the center of block 7 to reduce the fire flow requirements.

The boundary conditions listed below were provided by the City of Ottawa to IBI Group and used in their 2014 hydraulic analysis for the overall development, which included buildings one to eight. Since the number of apartment units has not drastically increased in the proposed site plan, the previous boundary conditions were considered reasonable and a conservative estimate and were used in the revised hydraulic analysis for the overall site (see model results in **Appendix A**).

Peak Hour = 108.0m

Max Day + Fire Flow = 110.0m

Average Day = 115.0m

3.3 HYDRAULIC MODEL RESULTS

The desired normal operating pressure range as per the City of Ottawa 2010 Water Distribution Design Guidelines is 345 kPa (50 psi) to 552kPa (80 psi) and no *less than 276kPa (40 psi)* at ground elevation. Furthermore, the maximum pressure at any point in the water distribution should not exceed 100 psi as per the Ontario Building/Plumbing Code; pressure reducing measures are required to service areas where pressures *greater than 552kPa (80 psi)* are anticipated.

A hydraulic model of the water supply system was created by Stantec to assess the proposed watermain layout under the above demands and during fire flow scenarios. Results of the hydraulic modeling demonstrate that adequate flows are available for the proposed buildings as shown in **Table 2**.

Table 2: Hydraulic Model Results Summary

Model Node ID	Average Day Analysis Pressure (psi)	Peak Hour Analysis Pressure (psi)
BLDG6	82.02	71.94
BLDG7	83.16	73.08
BLDG8	85.16	75.11

The above table shows that under normal operating conditions, pressures at ground level of the proposed buildings range from **72 psi** to **85 psi**. These values exceed the desired pressure range

of 80 psi as defined by MOECC and City of Ottawa design guidelines. As a result, it is recommended that pressure reducing valves be installed. Results of the hydraulic model analysis can be found in **Appendix A**.

A fire flow analysis was carried out using the hydraulic model to determine the anticipated amount of flow that could be provided for the proposed development under maximum day demands and fire flow requirements per the FUS methodology. Results of the modeling analysis indicate that flows in excess of the required fire flow rate can be delivered while still maintaining a residual pressure of 140 kPa (20 psi). Results of the hydraulic modeling are included for reference in **Appendix A**.

3.4 SUMMARY OF FINDINGS

Based on the results of the hydraulic analysis, it is recommended that pressure reducing valves be installed at each building to ensure normal operating pressures remain within City of Ottawa required limits. The hydraulic model also indicates that fire flow requirements can be achieved at all locations while still maintaining the minimum residual pressure per City requirements.

4.0 SANITARY SEWER

As illustrated on **Drawing SSP-1**, sanitary servicing for the proposed development will be provided through the existing 300 mm diameter sanitary sewer along Prestige Circle.

The proposed 2.14 ha development will consist of three four-storey apartment buildings, surface parking, underground parking, and associated access infrastructure. The anticipated wastewater peak flows generated from the proposed development are summarized in **Table 3** below:

Table 3: Estimated Wastewater Peak Flow

Block	Residential Units				Infiltration Flow (L/s)	Total Peak Flow (L/s)
	# of Units	Population	Peak Factor	Peak Flow (L/s)		
Block 6	79	142	4.0	2.30	0.16	2.46
Block 7	90	162	4.0	2.63	0.23	2.86
Block 8	93	167	4.0	2.71	0.21	2.92
				Overall Site Peak Flow:		**8.24**

1. Average residential flow based on 350 L/p/day
2. Peak factor for residential units calculated using Harmon's formula
3. The exact number of one and two-bedroom apartments is not available at this time and as such, an average population of 1.8 persons/unit was used in the calculations
4. Infiltration flow based on 0.28 L/s/ha.

The Prestige Circle sanitary sewer design was based on the applicable City of Ottawa Design Guidelines and a preliminary concept plan for the overall Prestige Circle Development which consisted of 248 apartments and 170 retirements units for a total of 418 units.

The current concept plan for the overall development consists of 418 units, broken-down as follows:

- Existing Phase 1: 40 units
- Existing Phase 2: 116 units
- Proposed Block 6: 79 units
- Proposed Block 7: 90 units
- Proposed Block 8: 93 units

A detailed sanitary sewer design sheet for the proposed development is included in **Appendix C**. A backflow preventer will be required for the proposed buildings in accordance with the Ottawa sewer design guidelines and will be coordinated with building mechanical engineers.

All underground parking drains should be connected to the internal building plumbing.

4.1 SANITARY SEWER DESIGN CRITERIA

As outlined in the City of Ottawa Sewer Design Guidelines and the Ministry of the Environment and Climate Change's (MOECC) Design Guidelines for Sewage Works, the following criteria were used to calculate estimated wastewater flow rates and to size the sanitary sewers:

- Minimum Velocity – 0.6 m/s (0.8 m/s for upstream sections)
- Maximum Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- 1.4 persons/residential unit (1 bedroom)
- 2.1 persons/residential unit (2 bedroom)
- 1.8 person/residential unit (when number of bedroom not available)
- Harmon's Formula for Peak Factor – Max = 4.0
- Extraneous Flow Allowance – 0.28 L/s/ha (conservative value)
- Manhole Spacing – 120 m
- Minimum Cover – 2.5 m

5.0 STORMWATER MANAGEMENT

5.1 OBJECTIVES

The objective of this stormwater management (SWM) plan is to determine the measures necessary to control the quantity of stormwater released from the proposed development to the required levels, and to provide sufficient detail for approval and construction.

5.2 SWM CRITERIA AND CONSTRAINTS

The stormwater management criteria for the proposed site are based on IBI's 2014 Petrie's Landing II Phase 2 Site Servicing Report and City of Ottawa Sewer Design Guidelines. The following summarizes the criteria used in the preparation of this stormwater management plan:

- Stormwater runoff from the proposed Blocks 6, 7, and 8 up to and including the 100-year event to be stored on site and released into the minor system at a maximum rate of 290.6 L/s
- Maximum 100-year water depth of 0.3 m in parking and access areas
- Provide adequate emergency overflow conveyance (overland flow route) off-site
- Size storm sewers to convey 2-year storm event, assuming only roof controls are imposed (i.e. provide capacity for system without inlet control devices installed)
- Size storm sewers using an inlet time of concentration (Tc) of 10 minutes
- Quality control of runoff from the proposed development to be provided in the downstream Brisebois Creek SWM Facility prior to discharge into the Ottawa River
- Post-development runoff coefficient (C) value based on proposed impervious areas as per site plan drawing (see **Appendix B**)

5.3 STORMWATER MANAGEMENT DESIGN

The proposed 2.14 ha residential development consists of three (3) four-storey buildings with underground parking, landscaped areas and associated servicing infrastructure. The overall imperviousness of the site is 54% (C = 0.58).

Stormwater runoff from the proposed development will be directed to the existing storm sewers on Prestige Circle which ultimately discharge into the Brisebois Creek SWM Facility. Sump pumps and backwater valves will be provided for foundation drainage of the proposed buildings. The

proposed site plan and existing storm sewer infrastructure on Prestige Circle are shown on **Drawing SSP-1**.

5.3.1 Design Methodology

The proposed stormwater management plan is designed to detain runoff on the rooftops, underground and on surface areas to ensure that peak flows after construction will not exceed the target release rates for the site.

Due to the proposed site plan layout and grading restrictions, a landscaped portion of the site backing into the existing ravine east of the site could not be graded to enter the site's storm system and as such it will sheet drain uncontrolled. Runoff from this uncontrolled area is included in the overall site discharge calculations.

5.3.2 Water Quantity Control

The Modified Rational Method was used to assess the quantity and volume of runoff generated during post development conditions. The site was subdivided into subcatchments (subareas) tributary to storm sewer inlets, as defined by the location of catchbasins / inlet grates and used in the storm sewer design (see **Appendix D**). A summary of subareas and runoff coefficients is provided in **Appendix D**, and **Drawing SD-1** indicates the stormwater management subcatchments.

5.3.3 Allowable Release Rate

IBI's 2014 Petrie's Landing II Phase 2 Site Servicing Report outlines the quantity control criteria for the overall site. The report outlines that the minor system target criteria for Phase 2 is 361.87 L/s and 99.5 L/s for Phase 3.
The existing portion of Phase 2 discharges 170.77 L/s in the 100-year storm based on the ICD schedule, 100-year minor system capture from a parking ramp area, and runoff from 0.35 ha of uncontrolled area. As a result, the minor system peak flow target from Block 6 and 7 which are within Phase 2 is 191.1 L/s (140 L/s/ha). Similarly, the minor system peak flow target for the proposed Block 8 which corresponds to Phase 3 is 99.5 L/s. Minor system peak flows from the overall proposed development will be restricted to 290.6 L/s.

5.3.4 Storage Requirements

The site requires quantity control measures to meet the stormwater release criteria. It is proposed that restricted release rooftop drains be used to reduce the peak outflow from the site. Additionally, pipe storage and surface storage on parking areas will be provided. **Drawing SD-1** indicates the design release rate from the rooftops. Stormwater management calculations are provided in **Appendix D**.

5.3.4.1 Rooftop Storage

It is proposed to retain stormwater on the rooftops by installing restricted flow roof drains. The following calculations assume the roof will be equipped with Watts drains fully open, see **Appendix D** for details.

Watts roof drain data has been used to calculate a practical roof release rate and detention storage volume for the rooftops. It should be noted that the "Watts" roof drain has been used as an example only and that other products may be specified for use, provided that the roof release rate is restricted to match the maximum rate of release indicated in **Table 4** and **Table 5** and that sufficient roof storage is provided to meet (or exceed) the resulting volume of detained stormwater.

Table 4 and **Table 5** provide details regarding the retention of stormwater on the proposed rooftop during the 2 and 100-year storm events. Refer to **Appendix D** for details.

Table 4: Peak Controlled (Rooftop) 2-Year Release Rate

Area ID	Area (ha)	Head (m)	$Q_{release}$ (L/s)	V_{stored} (m^3)
BLDG Block 6	0.153	0.10	6.23	16.5
BLDG Block 7	0.197	0.10	8.63	20.4
BLDG Block 8	0.236	0.09	10.67	24.1

Table 5: Peak Controlled (Rooftop) 100-Year Release Rate

Area ID	Area (ha)	Head (m)	$Q_{release}$ (L/s)	V_{stored} (m^3)
BLDG Block 6	0.153	0.15	9.28	54.6
BLDG Block 7	0.197	0.15	12.89	67.8
BLDG Block 8	0.236	0.14	16.00	79.9

5.3.4.2 Surface Storage

In addition to rooftop storage, it is proposed to detain stormwater on the surface parking lot areas and in two pipe sections using inlet control devices (ICDs) in the proposed drainage structures. The modified rational method was used to determine the peak volume requirement for the parking areas. **Table 6** and **Table 7** summarize the proposed ICD characteristics.

Table 6: 2-Year ICD Characteristics

Area ID	Structure ID	Orifice Type	Head (m)	Release Rate (L/s)
F100B	STM100A	120mm Diameter Orifice	1.70	35.39
F102B	CB102A	83mm Diameter Orifice	2.34	7.09

Area ID	Structure ID	Orifice Type	Head (m)	Release Rate (L/s)
F201A	CB200B	102mm Diameter Orifice	1.75	9.20
F201B	CBMH200C	LMF 105	1.71	12.80
F202B	CB202A	83mm Diameter Orifice	1.36	1.84
F200B	CB200A	LMF70	1.92	5.98
F300A	CB300A	LMF70	1.90	5.94

1. 2-year runoff from F100B, F102B, F201A and F202B is less than the ICD release rate at the shown head (i.e. the release rate shown is the uncontrolled 100-year runoff).

Table 7: 100-Year ICD Characteristics

Area ID	Structure ID	Orifice Type	Head (m)	Release Rate (L/s)
F100B	STM100A	120mm Diameter Orifice	1.92	42.34
F102B	CB102A	83mm Diameter Orifice	2.42	20.60
F201A	CB200B	102mm Diameter Orifice	1.75	26.72
F201B	CBMH200C	LMF 105	1.92	13.57
F202B	CB202A	83mm Diameter Orifice	1.36	5.34
F200B	CB200A	LMF70	2.12	6.28
F300A	CB300A	LMF70	2.10	6.25

1. 100-year runoff from F102B, F201A and F202B is less than the ICD release rate at the shown head (i.e. the release rate shown is the uncontrolled 100-year runoff from the catchment).

5.3.4.3 Pipe Storage

14.0 m^3 of pipe storage will be provided in area F100B through 20.4m of 900 mm diameter pipe connected to STM100A as shown on **Drawing SD-1**. Similarly, 13.4 m^3 of pipe storage will be provided in area F201B through 25.0m of 825 mm diameter pipe connected to CBMH200C as shown on **Drawing SD-1.**

5.3.5 Uncontrolled Area

A small portion of the site fronting Prestige Circle and backing onto the ravine (see areas UNC-1, UNC-2, and UNC-3 on **Drawing SD-1**) could not be graded to enter the site's storm system and as such it will sheet drain uncontrolled. However, as can be seen on the storm drainage plan prepared by IBI for the entire site in 2014 (see report excerpts in **Appendix E**), the area behind the proposed buildings was not included in the SWM calculations and was assumed to drain towards the ravine. **Table 8** and **Table 9** summarize the 2 and 100-year uncontrolled release rates from the proposed development.

Table 8: Peak Uncontrolled (Non-tributary) 2-Year Release Rate

Area ID	Area (ha)	Runoff 'C'	Tc (min)	$Q_{release}$ (L/s)
UNC-1	0.203	0.20	10	8.7
UNC-2	0.028	0.20	10	1.2
UNC-3	0.368	0.20	10	15.7

Table 9: Peak Uncontrolled (Non-tributary) 100-Year Release Rate

Area ID	Area (ha)	Runoff 'C'	Tc (min)	$Q_{release}$ (L/s)
UNC-1	0.203	0.25	10	25.2
UNC-2	0.028	0.25	10	3.5
UNC-3	0.368	0.25	10	45.7

5.3.6 Results

The proposed buildings will have underground parking and as such, it is proposed that the proposed parking ramps be equipped with trench drains to capture the 100-year runoff. In addition, it is recommended that the proposed buildings be equipped with sump pumps and backwater valves. **Table 10** and **Table 11** demonstrate that the proposed stormwater management plan provides adequate attenuation storage to meet the target peak outflows for the site.

Table 10: Estimated Discharge from Site (2-Year)

Block	Area Type	Area ID	V_{stored} (m^3)	$Q_{release}$ (L/s)	Target (L/s)
BLOCK 6	Controlled – Surface (Includes Roof area)	F100B, F102B, R100A	16.5	48.7	**290.6**
	Parking Ramp Area	F102A	-	6.3	
	Total Block 6		**16.5**	**55.0**	
BLOCK 7	Controlled – Surface (Includes Roof area)	F201A, F201B, F200B, F202B, R200A	25.3	38.4	
	Parking Ramp Area	F202A	-	9.4	
	Uncontrolled Areas	UNC-1, UNC-2	-	9.9	
	Total Block 7		**25.3**	**57.7**	

Block	Area Type	Area ID	V_{stored} (m^3)	$Q_{release}$ (L/s)	Target (L/s)
BLOCK 8	Controlled – Surface (Includes Roof area)	F300A, R300A	36.2	16.6	
	Parking Ramp Area	F300B	-	5.8	
	Uncontrolled Areas	UNC-3	-	15.7	
	Total Block 8		**36.2**	**38.1**	

Table 11: Estimated Discharge from Site (100-Year)

Block	Area Type	Area ID	V_{stored} (m^3)	$Q_{release}$ (L/s)	Target (L/s)
BLOCK 6	Controlled – Surface (Includes Roof area)	F100B, F102B, R100A	90.9	72.2	**290.6**
	Parking Ramp Area	F102A	-	16.4	
	Total Block 6		**90.9**	**88.6**	
BLOCK 7	Controlled – Surface (Includes Roof area)	F201A, F201B, F200B, F202B, R200A	107.2	64.8	
	Parking Ramp Area	F202A	-	25.8	
	Uncontrolled Areas	UNC-2, UNC-3	-	28.7	
	Total Block 7		**107.2**	**119.3**	
BLOCK 8	Controlled – Surface (Includes Roof area)	F300A, R300A	128.8	22.3	
	Parking Ramp Area	F300B	-	14.9	
	Uncontrolled Areas	UNC-3	-	45.7	
	Total Block 8		**128.8**	**82.9**	

As can be seen in the above tables, the proposed ICDs and storage provided restrict post development peak flows from site areas to 150.8 L/s and 290.8 L/s in the 2-year and 100-year storm events respectively. It is important to note that the ICDs have been sized to keep the minimum release rate at 6 L/s as per previous City comments.

6.0 GRADING AND DRAINAGE

The proposed development site measures approximately 2.14 ha in area. The site has significant grade change from the southwestern property limit adjacent to Brisebois Creek to the northeastern limit adjacent to Jeanne D'Arc Boulevard. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements, to meet minimum cover requirements for storm and sanitary sewers, and to provide sufficient cover over top of the underground parking garage. Site grading has been established to provide emergency overland flow routes for stormwater management in accordance with City of Ottawa requirements.

The subject site maintains emergency overland flow routes to the existing Prestige Circle ROW and to the existing ravine the east of the proposed development as depicted on **Drawings GP-1** and **SD-1**.

7.0 UTILITIES

The subject site has existing plants within Prestige Circle to provide Hydro, Bell, Gas and Cable servicing for the proposed development as existing residential development to the west was constructed as part of Phase 1. It is anticipated that existing infrastructure will be sufficient to provide the means of distribution for the proposed site. Detailed design of the required utility services will be further investigated as part of the composite utility planning process following design circulation.

8.0 APPROVALS

As each proposed block will fall under separate plan of condominium with one owner and will have a separate drainage and storm sewer system discharging to a pre-existing sewer system, Ontario Ministry of the Environment, Conservation and Parks (MOECP) Environmental Compliance Approval (ECAs, formerly Certificates of Approval (CofA) under the Ontario Water Resources Act are not expected to be a requirement for the development to proceed.

A portion of the proposed Block 8 is within 120 m of the Petrie Island Provincially Significant Wetland, and as such, it is within the RVCA's regulatory jurisdiction. As a result, written approval from the RVCA is required under Ontario Regulation 174/06 "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation" under Section 28 of the Conservation Authorities Act.

Requirement for an MOECP Permit to Take Water (PTTW) for pumping during construction of the underground parking levels will be confirmed by the geotechnical consultant.

9.0 EROSION CONTROL DURING CONSTRUCTION

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

1. Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
2. Limit extent of exposed soils at any given time.
3. Re-vegetate exposed areas as soon as possible.
4. Minimize the area to be cleared and grubbed.
5. Protect exposed slopes with plastic or synthetic mulches.
6. Provide sediment traps and basins during dewatering.
7. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
8. Plan construction at proper time to avoid flooding.
9. Installation of a mud matt to prevent mud and debris from being transported off site.
10. Installation of a silt fence to prevent sediment runoff.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

1. Verification that water is not flowing under silt barriers.
2. Clean and change silt traps at catch basins.

Refer to **Drawing EC-DS** for the proposed location of silt fences, and other erosion control structures.

10.0 GEOTECHNICAL INVESTIGATION

A geotechnical investigation was completed by Paterson Group Ltd. in May 24, 2017. The report summarizes the existing soil conditions within the subject area and construction recommendations. For details which are not summarized below, please see the original Paterson report (Excerpts included in **Appendix E**).

Subsurface soil conditions within the subject area were determined from 6 boreholes distributed across the proposed site. In general soil stratigraphy consisted of topsoil or fill underlain by a silty clay deposit layer.

Groundwater levels were measured on July 16, 2007 and on May 1, 2017 and vary in elevation from 1.6 to 5.5 m below the original ground surface.

A permissible grade raise restriction is recommended within the Paterson Group report due to the encounter of deep silty clay deposits of up to a maximum depth of 30.4 m. A 2.0m grade raise restrictions was accounted for in the grading design of the property.

The required pavement structure for the local roadways is outlined in Error! Reference source not found. and Error! Reference source not found. below:

Table 12: Pavement Structure – Car Only Parking Areas

Thickness (mm)	Material Description
50	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone
300	Subbase - OPSS Granular B Type II
-	Subgrade – Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill.

Table 13: Pavement Structure – Access Lanes and Heavy Truck Parking Areas

Thickness (mm)	Material Description
40	Wear Course –Superpave 12.5 Asphaltic Concrete
50	Binder Course –Superpave 19.0 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone
400	Subbase - OPSS Granular B Type II
-	Subgrade – Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill.

11.0 CONCLUSIONS

11.1 WATER SERVICING

The 200 mm diameter watermain on Prestige Circle provides adequate fire flow capacity as per the Fire Underwriters Survey. The service connections will also be capable of providing anticipated demand but exceeds the maximum objective pressure of 552 kPa (80 psi). Therefore, pressure reducing measures, such as a pressure reducing valve, will be required to service the proposed buildings per the Ontario Plumbing Code. The minimum anticipated pressure of 496 kPa (72 psi) is sufficient to provide the highest floors with an acceptable equivalent pressure provided the internal plumbing is sized to minimize head loss, otherwise a booster pump could be required.

11.2 SANITARY SERVICING

The proposed sanitary sewer lateral is sufficiently sized to provide gravity drainage for the site. The proposed blocks will be serviced by a 200 mm diameter service lateral directing wastewater flows to the existing 300 mm dia. Prestige Circle sanitary sewer. A backflow preventer will be required for the proposed building in accordance with the Ottawa sewer design guidelines and will be coordinated with building mechanical engineers. The proposed sanitary drainage pattern is in accordance with the wastewater section of IBI Group's Design Brief for Petrie's Landing II Phase 2 and with the City of Ottawa Sewer Design guidelines.

11.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the goals specified through the stormwater management section of IBI Group's Design Brief for Petrie's Landing and with the City of Ottawa Design guidelines. Rooftop, pipe, and surface storage in combination with ICDs are proposed to limit inflow from the site area into the minor system to the required target release rates.

The proposed buildings will have underground parking and as such, it is recommended that the proposed parking ramps be equipped with trench drains to capture the 100-year runoff. In addition, it is recommended that the proposed buildings be equipped with sump pumps and backwater valves.

11.4 GRADING

Grading for the site has been designed to provide an emergency overland flow route as per City requirements and reflects the overall recommendations provided in the Geotechnical Investigation. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing infrastructure.

11.5 UTILITIES

All utilities (Hydro Ottawa, Bell Canada, Rogers Ottawa, and Enbridge Gas) have existing plants in the subject area. Exact size, location and routing of utilities will be finalized after design circulation.

11.6 APPROVAL / PERMITS

Ontario Ministry of the Environment, Conservation and Parks (MOECP) Environmental Compliance Approvals (ECA) are not expected to be required for the subject site as each proposed block will fall under separate plan of condominium with one owner and will have a separate drainage and storm sewer system discharging to a pre-existing sewer system. Written approval from the Rideau Valley Conservation Authority (RVCA) is required under Ontario Regulation 174/06 "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation" under Section 28 of the Conservation Authorities Act for the portion of the site within 120 m of a significant wetland. A Permit to Take Water may be required for pumping requirements for construction of underground parking level. No other approval requirements from other regulatory agencies are anticipated.

APPENDICES

Appendix A POTABLE WATER SERVICING ANALYSIS

Block 6-8 Petries Landing - Domestic Water Demand Estimates

Building ID	Units	Population	Daily Rate of Demand [1]	Avg Day Demand [2]		Max Day Demand [3]		Peak Hour Demand [3]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Block 6	79	122	350	29.6	0.49	74.0	1.23	162.8	2.71
Block 7	92	140	350	34.0	0.57	85.1	1.42	187.2	3.12
Block 8	93	141	350	34.4	0.57	85.9	1.43	189.0	3.15
Total Site :				**98.0**	**1.63**	**245.0**	**4.08**	**539.0**	**8.98**

Water demand criteria used to estimate peak demand rates for residential areas are as follows:

1 maximum day demand rate = 2.5 x average day demand rate

2 maximum hour demand rate = 2.2 x maximum day demand rate

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01331
Project Name: Petries Landing
Date: June 12, 2017
Data input by: Thakshika Rathnasooriya
Notes:

Fire Flow Calculation #: 1
Building Type/Description/Name: Apartment Building - Block 6

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	**Choose Frame Used for Construction of Unit**	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	-	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	**Choose Type of Housing (if TH, Enter Number of Units Per TH Block)**	Type of Housing	Single Family	0	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	1				
2.2	**# of Storeys**	Number of Floors/Storeys in the Unit (do not include basement):			4	4	Storeys	
3	**Enter Ground Floor Area of One Unit**	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			1,533 Square Metres (m2)	6,132	Area in Square Meters (m^2)	
4	**Obtain Required Fire Flow without Reductions**	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						**26,000**
5	**Apply Factors Affecting Burning**	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	**Choose Combustibility of Building Contents**	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	**22,100**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	**Choose Reduction Due to Presence of Sprinklers**	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	**-6,630**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	**-2,210**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	**Choose Separation Distance Between Units**	Exposure Distance Between Units	North Side	45.1m or greater	0	0.1	m	**2,210**
			East Side	30.1 to 45.0m	0.05			
			South Side	45.1m or greater	0			
			West Side	30.1 to 45.0m	0.05			
6	**Obtain Required Fire Flow, Duration & Volume**	***Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:***						**15,000**
		Total Required Fire Flow (above) in L/s:						**250**
		Required Duration of Fire Flow (hrs)						**3.25**
		Required Volume of Fire Flow (m^3)						**2,925**

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01331
Project Name: Petries Landing
Date: June 12, 2017
Data input by: Thakshika Rathnasooriya
Notes:

Fire Flow Calculation #: 1
Building Type/Description/Name: Apartment Building - Block 7 - 1

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	**Choose Frame Used for Construction of Unit**	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	-	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	**Choose Type of Housing (if TH, Enter Number of Units Per TH Block)**	Type of Housing	Single Family	0	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	1				
2.2	**# of Storeys**	Number of Floors/Storeys in the Unit (do not include basement):			4	4	Storeys	
3	**Enter Ground Floor Area of One Unit**	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			1,178 Square Metres (m2)	4,712	Area in Square Meters (m^2)	
4	**Obtain Required Fire Flow without Reductions**	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						**23,000**
5	**Apply Factors Affecting Burning**	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	**Choose Combustibility of Building Contents**	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	**19,550**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	**Choose Reduction Due to Presence of Sprinklers**	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	**-5,865**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	**-1,955**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	**Choose Separation Distance Between Units**	Exposure Distance Between Units	North Side	Fire Wall	0.1	0.15	m	**2,933**
			East Side	45.1m or greater	0			
			South Side	30.1 to 45.0m	0.05			
			West Side	45.1m or greater	0			
6	**Obtain Required Fire Flow, Duration & Volume**	***Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:***						**15,000**
		Total Required Fire Flow (above) in L/s:						**250**
		Required Duration of Fire Flow (hrs)						**3.25**
		Required Volume of Fire Flow (m^3)						**2,925**

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01331
Project Name: Petries Landing
Date: June 12, 2017
Data input by: Thakshika Rathnasooriya

Fire Flow Calculation #: 1
Building Type/Description/Name: Apartment Building - Block 7-2

Notes:

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
1	**Choose Frame Used for Construction of Unit**	**Framing Material**						
		Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	-	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
2	**Choose Type of Housing (if TH, Enter Number of Units Per TH Block)**	**Floor Space Area**						
		Type of Housing	Single Family	0	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	1				
2.2	**# of Storeys**	Number of Floors/Storeys in the Unit (do not include basement):			4	4	Storeys	
3	**Enter Ground Floor Area of One Unit**	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			806 Square Metres (m2)	3,224	Area in Square Meters (m^2)	
4	**Obtain Required Fire Flow without Reductions**	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						**19,000**
5	**Apply Factors Affecting Burning**	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	**Choose Combustibility of Building Contents**	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	**16,150**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	**Choose Reduction Due to Presence of Sprinklers**	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	**-4,845**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	**-1,615**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	**Choose Separation Distance Between Units**	Exposure Distance Between Units	North Side	30.1 to 45.0m	0.05	0.15	m	**2,423**
			East Side	45.1m or greater	0			
			South Side	Fire Wall	0.1			
			West Side	45.1m or greater	0			
6	**Obtain Required Fire Flow, Duration & Volume**	***Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:***						**12,000**
		Total Required Fire Flow (above) in L/s:						**200**
		Required Duration of Fire Flow (hrs)						**2.50**
		Required Volume of Fire Flow (m^3)						**1,800**

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01331
Project Name: Petries Landing
Date: June 12, 2017
Data input by: Thakshika Rathnasooriya
Notes:

Fire Flow Calculation #: 1
Building Type/Description/Name: Apartment Building - Block 8

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	**Choose Frame Used for Construction of Unit**	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	-	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	**Choose Type of Housing (if TH, Enter Number of Units Per TH Block)**	Type of Housing	Single Family	0	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	0				
			Other (Comm, Ind, Apt etc.)	1				
2.2	**# of Storeys**	Number of Floors/Storeys in the Unit (do not include basement):			4	4	Storeys	
3	**Enter Ground Floor Area of One Unit**	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			2,484 Square Metres (m2)	9,936	Area in Square Meters (m^2)	
4	**Obtain Required Fire Flow without Reductions**	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						**33,000**
5	**Apply Factors Affecting Burning**	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	**Choose Combustibility of Building Contents**	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	**28,050**
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	**Choose Reduction Due to Presence of Sprinklers**	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	**-8,415**
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	**-2,805**
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	**0**
			Sprinkler not fully supervised or N/A	0				
5.3	**Choose Separation Distance Between Units**	Exposure Distance Between Units	North Side	45.1m or greater	0	0.1	m	**2,805**
			East Side	45.1m or greater	0			
			South Side	30.1 to 45.0m	0.05			
			West Side	30.1 to 45.0m	0.05			
6	**Obtain Required Fire Flow, Duration & Volume**	***Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:***						**20,000**
		Total Required Fire Flow (above) in L/s:						**333**
		Required Duration of Fire Flow (hrs)						**4.50**
		Required Volume of Fire Flow (m^3)						**5,400**

Hydraulic Model Results - Average Day Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
10	0.00	52.00	115	89.56	617.50
11	0.00	55.06	115	85.21	587.51
12	0.00	55.06	115	85.21	587.51
13	0.00	51.90	115	89.7	618.46
14	0.00	52.10	115	89.42	616.53
BLDG1	0.29	55.71	115	84.28	581.09
BLDG2	0.29	56.60	115	83.02	572.41
BLDG3	0.67	56.70	115	82.87	571.37
BLDG6	0.49	57.30	115	82.02	565.51
BLDG7	0.57	56.50	115	83.16	573.37
BLDG8	0.57	55.09	115	85.16	587.16

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
1	1000	14	25.84	900	130	2.88	0.00
10	BLDG8	12	28.03	200	110	-1.63	0.05
11	12	11	7.05	200	110	-0.20	0.01
12	12	13	88.97	200	110	-1.42	0.05
13	13	10	7.80	400	120	-1.42	0.01
2	14	10	19.33	400	120	2.88	0.02
3	10	11	84.72	200	110	1.46	0.05
4	BLDG1	11	51.80	200	110	-1.25	0.04
5	BLDG2	BLDG1	32.66	200	110	-0.96	0.03
6	BLDG3	BLDG2	62.45	200	110	-0.67	0.02
7	BLDG3	BLDG6	72.85	200	110	0.00	0.00
8	BLDG6	BLDG7	34.69	200	110	-0.49	0.02
9	BLDG7	BLDG8	55.50	200	110	-1.06	0.03

Hydraulic Model Results -Peak Hour Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
10	0.00	52.00	108.00	79.61	548.90
11	0.00	55.06	107.95	75.19	518.42
12	0.00	55.06	107.95	75.19	518.42
13	0.00	51.90	108.00	79.75	549.86
14	0.00	52.10	108.00	79.47	547.93
BLDG1	1.60	55.71	107.93	74.23	511.80
BLDG2	1.60	56.60	107.92	72.95	502.98
BLDG3	3.69	56.70	107.91	72.80	501.94
BLDG6	2.71	57.30	107.91	71.94	496.01
BLDG7	3.12	56.50	107.91	73.08	503.87
BLDG8	3.15	55.09	107.93	75.11	517.87

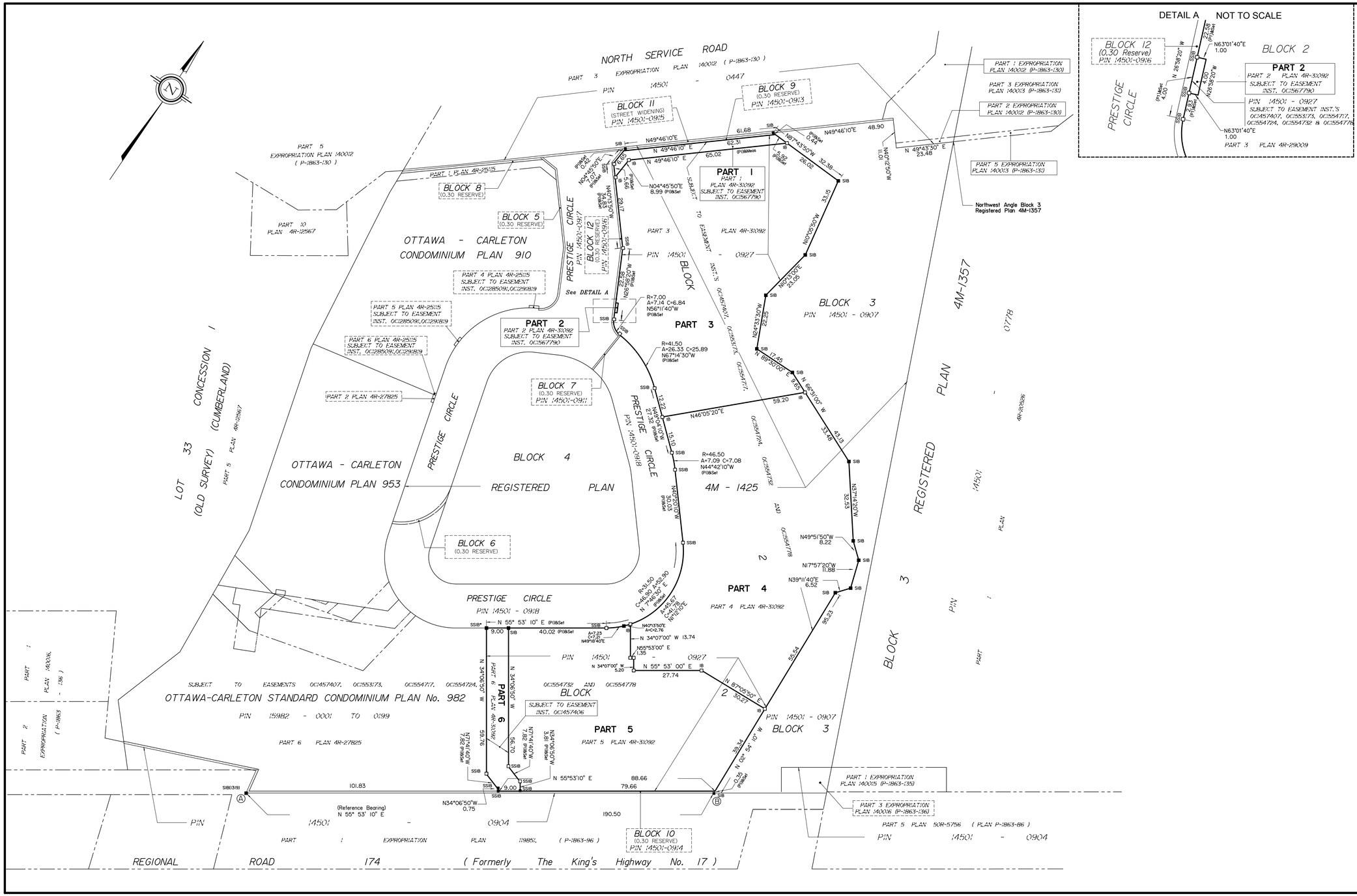
Pipe Results

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)
1	1000	14	25.84	900	130	15.87	0.02
10	BLDG8	12	28.03	200	110	-8.95	0.29
11	12	11	7.05	200	110	-1.13	0.04
12	12	13	88.97	200	110	-7.83	0.25
13	13	10	7.80	400	120	-7.83	0.06
2	14	10	19.33	400	120	15.87	0.13
3	10	11	84.72	200	110	8.04	0.26
4	BLDG1	11	51.80	200	110	-6.92	0.22
5	BLDG2	BLDG1	32.66	200	110	-5.32	0.17
6	BLDG3	BLDG2	62.45	200	110	-3.72	0.12
7	BLDG3	BLDG6	72.85	200	110	0.03	0.00
8	BLDG6	BLDG7	34.69	200	110	-2.68	0.09
9	BLDG7	BLDG8	55.50	200	110	-5.80	0.18

Hydraulic Model Results -Fire Flow Analysis

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
BLDG1	0.73	77.15	531.93	109.98	335	31.59	217.81	380.02	20	137.90
BLDG2	0.73	75.89	523.25	109.98	289	34.86	240.35	343.11	20	137.90
BLDG3	1.68	75.74	522.21	109.98	182	55.49	382.59	319.67	20	137.90
BLDG6	1.23	74.89	516.35	109.98	250	40.23	277.38	323.11	20	137.90
BLDG7	1.42	76.03	524.21	109.98	250	44.52	306.96	344.5	20	137.90
BLDG8	1.43	78.04	538.07	109.98	333	41.23	284.27	428.91	20	137.90

Appendix B PROPOSED SITE PLAN



I RE□UIRE THIS PLAN TO BE DEPOSITED UNDER THE LAND TITLES ACT.

DATE:□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□

RICHARD R. GAUTHIER
ONTARIO LAND SURVE□OR

PLAN 4R□

RECEIVED AND DEPOSITED
DATE: □□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□□□

REPRESENTATIVE FOR LAND REGISTRAR FOR THE LAND TITLES DIVISION OF OTTAWA□CARLETON NO. 4.

SCHEDULE

PART	BLOCK	PLAN	PIN
1			
2	PART OF 2	4M□1425	ALL OF 14501□0□2□
3			
4			
5			
6			

Parts 1 and 2: S□□ject to Ease□ent Inst. OC156□□□0.
Part 6: S□□ject to Ease□ent Inst. OC145□406.
Parts 1 to 6 incl□si□e: S□□ject to Ease□ent Inst.'s OC145□40□□ OC15531□3□OC1554□1□□OC1554□24□OC1554□32 and OC1554□□□.

PLAN OF SURVEY OF

PART OF BLOCK 2
REGISTERED PLAN 4M-1425
CITY OF OTTAWA

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

Scale 1 : □50

30 22.5 15 □5 0 15 30 Metres

Metric

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

S□r□eyor's Certi□icate

I CERTIF□ THAT :

1. This s□r□ey and □lan are correct and in accordance with the S□r□eys Act□ the S□r□eyors Act and the Land Titles Act and the reg□lations □ade □nder the□.
2. The s□r□ey was co□□□leted on the □th day o□ Se□te□□e□ 201□.

□□□□□□□□□□ Date

□□□□□□□□□□□□□□□□□□□□ Richard R. Ga□thier Ontario Land S□r□eyor

NOTES AND LEGEND

—□—	denotes	S□r□ey Mon□□ent Planted
—■—	"	S□r□ey Mon□□ent Fo□nd
SIB	"	Standard Iron Bar
SSIB	"	Short Standard Iron Bar
SSIB□	"	Short Standard Iron Bar 0.3 □etres Long
IB	"	Iron Bar
CLF	"	Chain Link Fence
BF	"	Board Fence
□AOG□□	"	Annis□O'S□lli□an□Volle□ekk Ltd.
□P1□	"	Plan 4R□2□00□

All □o□nd s□r□ey □on□□ents are □AOG□□nless otherwise noted.

All □earing and distances □etween □o□nd s□r□ey □on□□ents are □P1□□Meas □nless otherwise noted.

Distances shown on this □lan are gro□nd distances and can □e con□erted to grid distances □y □□lti□lying □y the co□□□ined scale □actor o□ 0.□□□□6□.

Bearings are grid□deri□ed fro□ Can□Net 3.0 Real Ti□e Network GPS o□ser□ations on re□erence □oints A and B□ shown hereon□ha□ing a bearing of N55°53'10"E and are referenced to Specified Control Points 01919680184 and 01919843476 1, MTM Zone 9 (76°30' West Longitude) NAD□3 □original□.

Coordinates are deri□ed fro□ Can□Net 3.0 Real Ti□e Network GPS o□ser□ations re□erenced to S□eci□ied Control Points 01□1□6□01□4 and 01919843476 1, MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

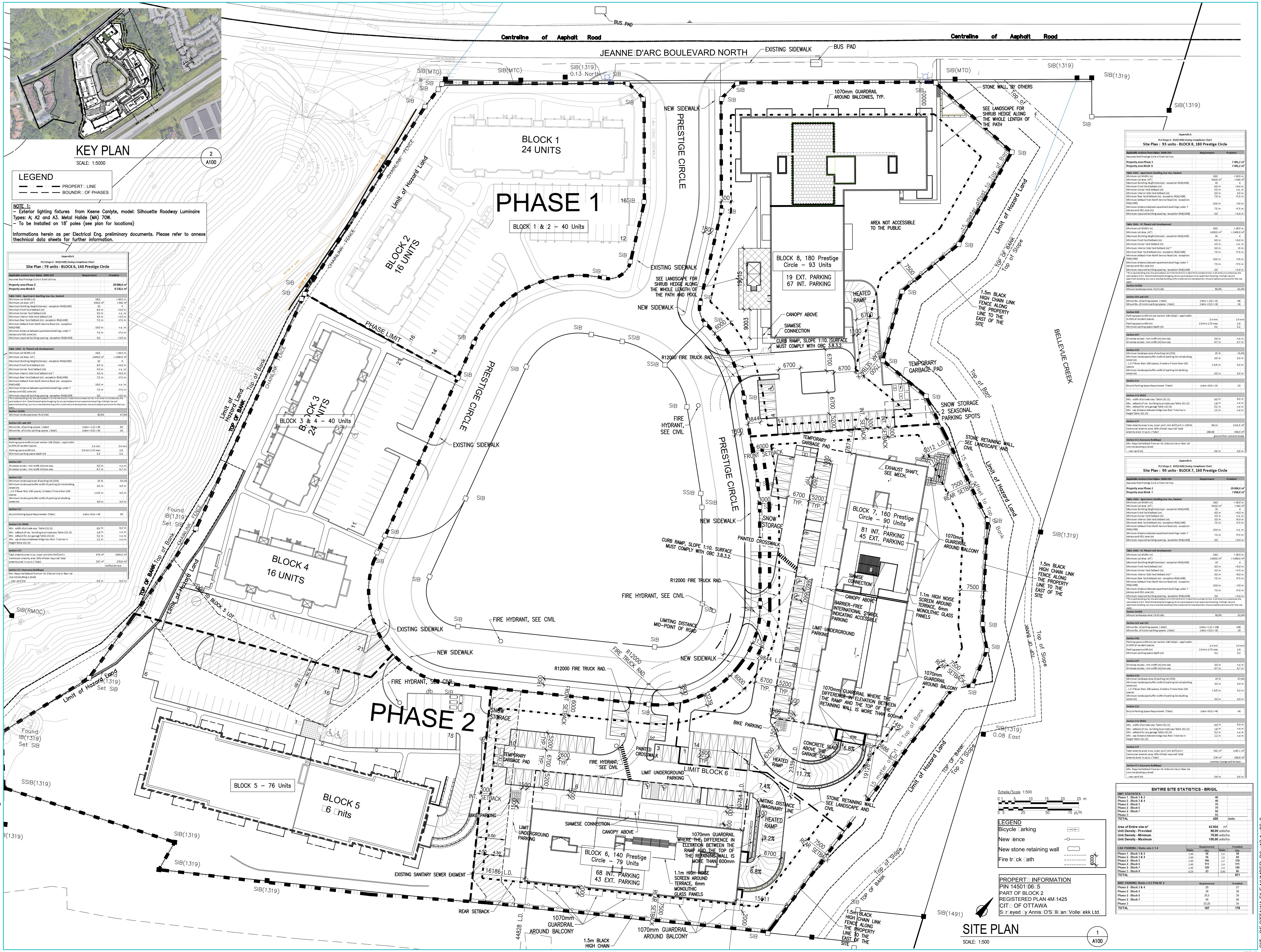
Coordinate □all□es are to □r□an acc□racy in accordance with O. Reg. 216/10.

□01□1□6□01□4	Northing	5040610.16	Easting	3□4□36.56
□01□1□□434□61	Northing	50361□□12	Easting	3□2436.11
□Point A	Northing	503□31□□2	Easting	3□3314.2□
□Point B	Northing	503□424.□1	Easting	3□34□2.21

Ca□tion□ Coordinates cannot□in the□sel□es□e □sed to re□esta□lish corners or □o□ndaries shown on this □lan.

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

Job No. 16109-15 Brigl PlBk 2 4M-1425 R D5 Sept10 2018 PL/dg



NOTES GÉNÉRALES General Notes

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T 514 □4□111□ NEUFarchitectes.co□

SCEAU Seal

NEUF ARCHITECT(E)S

BRIGIL

CLIENT Client

OUVRAGE Project

PETRIES LANDING BLOCK 6, 7 & 8

EMPLACEMENT Location: ORLEANS□ON

NO PROJET No.: 104□□.03

NO	RÉVISION	DATE □aa.□□.jj□
A	CIT□ VALIDATION	2016□12□15
B	Site □lan re□ision	201□□03□2□
C	Site Plan A□□lication	201□□06□13
D	For client re□iew	201□□0□□20
E	Site □lan control□1st re□iew	201□□01□23
F	Site □lan control□2nd re□iew	201□□03□23
G	Iss□ed □or □□ilding □er□it	201□□06□01
H	Site Plan A□□lication□3rd re□iew	201□□06□06
J	Re□ angled □arking □ 3□ set□ack	201□□0□□16
K	Radi□s □or □arking island □od.	201□□0□□1□
L	Site Plan A□□lication□4th re□iew	201□□0□□0□

DESSINÉ PAR Drawn by: A.B.

VÉRIFIÉ PAR Checked by: ANT. C.

DATE □aa.□□.jj□: 1□.0□.0□

ÉCHELLE Scale: INDIQUÉE

TITRE DU DESSIN Drawing Title

Site Plan

RÉVISION Revision: L

NO. DESSIN Dwg N□□□er: A100

CIT□ OF OTTAWA FILE NUMBER: D0□□12□1□00□3

□15546

I:□P□10400 104□□03 CAD 104□□03 A100 Site Plan.dwg

Appendix C SANITARY SEWER CALCULATIONS

Stantec

SUBDIVISION:

SUBDIVISION: Petries Landing Block 6-8

DATE: September 4, 2018
REVISION: 4
DESIGNED BY: MJS
CHECKED BY: AP

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 1604-01331

XML Conversion

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350	L/p/day	MINIMUM VELOCITY	0.60	m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	0.60	L/s/ha	MAXIMUM VELOCITY	3.00	m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL	0.40	L/s/ha	MANNINGS n	0.013	
PEAKING FACTOR (COMM., INST.):	1.5	INSTITUTIONAL	0.60	L/s/ha	BEDDING CLASS	C	
PERSONS / 2 Bedroom apt.	2.1	INFILTRATION	0.28	L/s/ha	MINIMUM COVER	2.50	m
PERSONS / 1 bedroom apt.	1.4						
PERSONS / average apt.	1.8						

LOCATION			RESIDENTIAL AREA AND POPULATION									COMM		INDUST		INSTIT		GREEN / UNUSED		C+I+I	INFILTRATION				PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	UNITS 2 bed	1 bed	avg	POP.	CUMULATIVE AREA	POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	TOTAL FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(l/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)			(%)	(L/s)	(%)	(m/s)	(m/s)
R1A , G1A	BLK 6	SAN1	0.153	0	0	79	142	0.15	142	4.00	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.404	0.40	0.00	0.557	0.56	0.16	2.46	4.8	200	PVC	SDR-28	1.00	33.31	7.39	1.05	0.52
	SAN1	PROP.MH	0.000	0	0	0	0	0.15	142	4.00	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.40	0.00	0.000	0.56	0.16	2.46	27.0	200	PVC	SDR-35	1.00	33.31	7.39	1.05	0.52
R2A , G2A	BLK 7	SAN2	0.197	0	0	90	162	0.20	162	4.00	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.640	0.64	0.00	0.837	0.84	0.23	2.86	3.2	200	PVC	SDR-28	1.00	33.31	8.58	1.05	0.54
	SAN2	EX.MH21A	0.000	0	0	0	0	0.20	162	4.00	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.64	0.00	0.000	0.84	0.23	2.86	15.7	200	PVC	SDR-35	1.00	33.31	8.58	1.05	0.54
R3A , G3A	BLK 8	SAN3	0.236	0	0	93	167	0.24	167	4.00	2.71	0.00	0.00	0.00	0.00	0.00	0.00	0.511	0.51	0.00	0.747	0.75	0.21	2.92	8.5	200	PVC	SDR-28	1.00	33.31	8.77	1.05	0.54
	SAN3	EX.MH6A	0.000	0	0	0	0	0.24	167	4.00	2.71	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.51	0.00	0.000	0.75	0.21	2.92	22.9	200	PVC	SDR-35	1.00	33.31	8.77	1.05	0.54

Appendix D STORMWATER MANAGEMENT CALCULATIONS

Stantec

Brigil - Petrie's Landing II - Block 6, 7, and 8

DATE: 5-Sep-2018
REVISION: 5
DESIGNED BY: MJS
CHECKED BY: AMP

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 1604-01231

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:100 yr
a =	732.951	1735.688
b =	6.199	6.014
c =	0.810	0.820

MANNING'S n = 0.013
MINIMUM COVER: 2.00 m
TIME OF ENTRY 10 min
BEDDING CLASS = B

LOCATION			DRAINAGE AREA															PIPE SELECTION										
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (-)	ACCUM. AREA (2YR) (ha)	A x C (2-YEAR)	ACCUM. AxC (2YR) (ha)	ACCUM. AREA (100YR) (ha)	A x C (100-YEAR)	ACCUM. AxC (100YR) (ha)	T of C (min)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ ROOF (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
BLOCK 6																														
F100B	STM100A	STM 100	0.255	0.000	0.000	0.65	0.255	0.166	0.166	0.000	0.000	0.000	10.00	76.81	178.56	0.0	0.0	35.4	23.8	300	300	CIRCULAR	PVC	-	1.00	96.2	**36.8%**	1.37	1.06	0.37
													10.37																	
F102B	CB102A	STM 102	0.166	0.000	0.000	0.20	0.166	0.033	0.033	0.000	0.000	0.000	10.00	76.81	178.56	0.0	0.0	7.1	14.3	200	200	CIRCULAR	PVC	-	1.00	33.3	**21.3%**	1.05	0.69	0.34
F102A	STM102	STM 101	0.000	0.033	0.000	0.90	0.166	0.000	0.033	0.033	0.030	0.030	10.34	75.51	175.47	0.0	0.0	21.4	29.7	300	300	CIRCULAR	PVC	-	0.35	56.9	**37.7%**	0.81	0.64	0.78
	STM101	STM 100	0.000	0.000	0.000	0.00	0.166	0.000	0.033	0.033	0.000	0.030	11.12	72.74	168.90	0.0	0.0	20.6	36.0	300	300	CIRCULAR	PVC	-	0.35	56.9	**36.3%**	0.81	0.63	0.95
													12.08																	
R100A	BLOCK 6	STM 100	0.000	0.000	0.153	0.90	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	178.56	9.3	9.3	9.3	2.3	250	250	CIRCULAR	PVC	-	1.00	60.4	**15.4%**	1.22	0.74	0.05
													10.05																	
	STM 100	STM 1A	0.000	0.000	0.000	0.00	0.421	0.000	0.199	0.033	0.000	0.030	12.08	69.65	161.56	0.0	9.3	61.1	27.8	300	300	CIRCULAR	PVC	-	0.50	68.0	**89.9%**	0.97	0.99	0.47
													12.55																	
BLOCK 7																														
F202B	CB202A	STM 202	0.043	0.000	0.000	0.20	0.043	0.009	0.009	0.000	0.000	0.000	10.00	76.81	178.56	0.0	0.0	1.8	13.2	200	200	CIRCULAR	PVC	-	1.00	33.3	**5.5%**	1.05	0.46	0.48
F202A	STM 202	STM 201	0.000	0.052	0.000	0.85	0.043	0.000	0.009	0.052	0.044	0.044	10.48	75.02	174.32	0.0	0.0	23.2	28.6	200	200	CIRCULAR	PVC	-	0.80	29.8	**77.9%**	0.94	0.92	0.52
F201A, F201B	STM 201	STM 200	0.166	0.000	0.000	0.73	0.209	0.121	0.130	0.052	0.000	0.044	11.00	73.18	169.95	0.0	0.0	47.2	50.2	375	375	CIRCULAR	PVC	-	0.25	87.7	**53.9%**	0.79	0.69	1.21
													12.21																	
F200B	CB 200A	STM 200	0.071	0.000	0.000	0.68	0.071	0.048	0.048	0.000	0.000	0.000	10.00	76.81	178.56	0.0	0.0	10.3	16.4	200	200	CIRCULAR	PVC	-	1.00	33.3	**30.9%**	1.05	0.78	0.35
													10.35																	
R200A	BLOCK 7	STM 200	0.000	0.000	0.197	0.90	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	178.56	12.9	12.9	12.9	1.7	250	250	CIRCULAR	PVC	-	1.00	60.4	**21.4%**	1.22	0.80	0.04
													10.04																	
	STM 200	STUB	0.000	0.000	0.000	0.00	0.280	0.000	0.178	0.052	0.000	0.044	12.21	69.26	160.63	0.0	12.9	66.9	9.8	375	375	CIRCULAR	PVC	-	1.00	175.3	**38.1%**	1.59	1.25	0.13
													12.34																	
BLOCK 8																														
F300B	TRENCH DRAIN 8	STM 301	0.000	0.030	0.000	0.90	0.000	0.000	0.000	0.030	0.027	0.027	10.00	76.81	178.56	0.0	0.0	13.4	17.6	200	200	CIRCULAR	PVC	-	1.00	33.3	**40.2%**	1.05	0.83	0.35
	STM 301	STM 300	0.000	0.000	0.000	0.00	0.000	0.000	0.000	0.030	0.000	0.027	10.35	75.48	175.41	0.0	0.0	13.2	18.0	250	250	CIRCULAR	PVC	-	0.50	42.7	**30.8%**	0.86	0.64	0.47
													10.82																	
F300A	CB 300A	STM 300	0.139	0.000	0.000	0.80	0.139	0.111	0.111	0.000	0.000	0.000	10.00	76.81	178.56	0.0	0.0	23.7	15.8	200	200	CIRCULAR	PVC	-	1.00	33.3	**71.2%**	1.05	0.99	0.26
													10.26																	
R300A	BLOCK 8	STM 300	0.000	0.000	0.236	0.90	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	178.56	16.0	16.0	16.0	6.8	250	250	CIRCULAR	PVC	-	1.00	60.4	**26.5%**	1.22	0.85	0.13
													10.13																	
	STM 300	EX.MH	0.000	0.000	0.000	0.00	0.139	0.000	0.111	0.030	0.000	0.027	10.82	73.78	171.37	0.0	16.0	51.6	22.4	375	375	CIRCULAR	PVC	-	1.00	175.3	**29.5%**	1.59	1.16	0.32
													11.15																	

Stormwater Management Calculations

File No: **160401331**
Project: **Petries Landing - Block 6, 7 and 8**

Date: **05-Sep-18**

SWM Approach:

Limit site to 191.1 L/s for Blocks 6 and 7 and 99.5 L/s for Block 8

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Block ID	Runoff Coefficient Table								
	Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Phase 2 - Block 6	Controlled - Tributary	Parking Block 6 (F100B)	Hard	0.164		0.9	0.148		
			Soft	0.091		0.2	0.018		
			Subtotal		0.255			0.166	0.65
	100-year Capture - Tributary	Parking Ramp Block 6 (F102A)	Hard	0.033		0.9	0.030		
			Soft	0.000		0.2	0.000		
			Subtotal		0.033			0.030	0.90
	Roof - Tributary	BLDG Block 6 (R100A)	Hard	0.153		0.9	0.138		
			Soft	0.000		0.2	0.000		
			Subtotal		0.153			0.138	0.90
	Controlled - Tributary	Landscaped Area Block 6 (F102B)	Hard	0.000		0.9	0.000		
			Soft	0.166		0.2	0.033		
			Subtotal		0.166			0.033	0.20
		Total Block 6 =		**0.607 ha**		**0.60**			
Phase 2 - Block 7	Controlled - Tributary	Parking Block 7 (F201A)	Hard	0.045		0.9	0.040		
			Soft	0.014		0.2	0.003		
			Subtotal		0.059			0.043	0.73
	Controlled - Tributary	Parking Block 7 (F201B)	Hard	0.081		0.9	0.073		
			Soft	0.026		0.2	0.005		
			Subtotal		0.107			0.078	0.73
	Controlled - Tributary	Parking Block 7 (F200B)	Hard	0.049		0.9	0.044		
			Soft	0.022		0.2	0.004		
			Subtotal		0.071			0.048	0.68
	100-year Capture - Tributary	Parking Ramp Block 7 (F202A)	Hard	0.048		0.9	0.043		
			Soft	0.004		0.2	0.001		
			Subtotal		0.052			0.044	0.85
	Roof - Tribuatry	BLDG Block 7 (R200A)	Hard	0.197		0.9	0.177		
			Soft	0.000		0.2	0.000		
			Subtotal		0.197			0.177	0.90
	Controlled - Tributary	Landscaped Area Block 7 (F202B)	Hard	0.000		0.9	0.000		
			Soft	0.043		0.2	0.009		
			Subtotal		0.043			0.009	0.20
	Uncontrolled - Non Tributary	Uncontrolled Block 7 (UNC-1)	Hard	0.000		0.9	0.000		
		Subtotal	Soft	0.203		0.2	0.041		
					0.203			0.041	0.20
	Uncontrolled - Non Tributary	Uncontrolled Block 7 (UNC-2)	Hard	0.000		0.9	0.000		
		Subtotal	Soft	0.028		0.2	0.006		
					0.028			0.006	0.20
		Total Block 7 =		**0.760 ha**		**0.59**			
Phase 3 - Block 8	Controlled - Tributary	Parking Block 8 (F300A)	Hard	0.119		0.9	0.107		
			Soft	0.020		0.2	0.004		
			Subtotal		0.139			0.111	0.80
	100-year Capture - Tributary	Parking Ramp Block 8 (F300B)	Hard	0.030		0.9	0.027		
			Soft	0.000		0.2	0.000		
			Subtotal		0.030			0.027	0.90
	Roof	BLDG Block 8 (R300A)	Hard	0.236		0.9	0.212		
			Soft	0.000		0.2	0.000		
			Subtotal		0.236			0.212	0.90
	Uncontrolled - Non Tributary	Uncontrolled Block 8 (UNC-3)	Hard	0.000		0.9	0.000		
		Subtotal	Soft	0.368		0.2	0.074		
					0.368			0.074	0.20
		Total Block 8 =		**0.773 ha**		**0.55**			
	Total				**2.140**			**1.237**	
	Overall Runoff Coefficient= C:								**0.58**

Total Roof Areas	**0.586 ha**
Total Parking Ramp Areas	**0.115 ha**
Total Surface Areas (Controlled)	**0.840 ha**
Total Surface Areas (Uncontrolled)	**0.599 ha**
Total Site Area	**2.140 ha**
Area to Sewer	**1.541 ha**

Stormwater Management Calculations

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

2 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	732.951
b =	6.199
c =	0.810

t (min)	I (mm/hr)
5	103.57
10	76.81
15	61.77
20	52.03
25	45.17
30	40.04
35	36.06
40	32.86
45	30.24
50	28.04
55	26.17
60	24.56

Target Release from Blocks 6 and 7

SWM Approach: Limit site to 191.1 L/s for Blocks 6 and 7 and 99.5 L/s for Block 8

Area (ha): 1.367
C: 0.59

Qtarget (L/s)	Qtarget (L/s/ha)
191.10	**140**

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: BLDG Block 6 (R100A) — Roof - Tributary
Area (ha): 0.153 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	76.81	29.45	5.86	23.60	14.16	92.8	0.00
20	52.03	19.95	6.23	13.72	**16.47**	98.7	0.00
30	40.04	15.35	6.22	9.13	16.44	98.6	0.00
40	32.86	12.60	6.09	6.51	15.62	96.6	0.00
50	28.04	10.75	5.91	4.84	14.52	93.7	0.00
60	24.56	9.42	5.72	3.70	13.31	90.7	0.00
70	21.91	8.40	5.52	2.88	12.09	87.6	0.00
80	19.83	7.60	5.33	2.27	10.90	84.5	0.00
90	18.14	6.96	5.15	1.81	9.76	81.6	0.00
100	16.75	6.42	4.98	1.45	8.68	78.9	0.00
110	15.57	5.97	4.81	1.16	7.65	76.2	0.00
120	14.56	5.58	4.63	0.95	6.85	73.4	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Level	98.70	0.10	6.23	16.47	57.30	0.00

Subdrainage Area: Parking Block 6 (F100B) — Controlled - Tributary
Area (ha): 0.255
C: 0.65

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	
10	76.81	35.39	35.39	0.00	0.00	
20	52.03	23.98	35.39	0.00	0.00	
30	40.04	18.45	35.39	0.00	0.00	
40	32.86	15.14	35.39	0.00	0.00	
50	28.04	12.92	35.39	0.00	0.00	
60	24.56	11.32	35.39	0.00	0.00	
70	21.91	10.10	35.39	0.00	0.00	
80	19.83	9.14	35.39	0.00	0.00	
90	18.14	8.36	35.39	0.00	0.00	
100	16.75	7.72	35.39	0.00	0.00	
110	15.57	7.17	35.39	0.00	0.00	
120	14.56	6.71	35.39	0.00	0.00	

Storage: Surface Storage Above CB100AA

Orifice Equation: $Q = CdA(2gh)^{0.5}$

Invert Elevation	120.00	m
Invert Elevation	55.33	m
T/G Elevation	56.98	m
Max Ponding Depth	0.05	m
Downstream W/L	53.91	m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	57.03	1.70	35.39	0.00	37.18	OK

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
5	242.70
10	178.56
15	142.89
20	119.95
25	103.85
30	91.87
35	82.58
40	75.15
45	69.05
50	63.95
55	59.62
60	55.89

Target Release from Block 8

SWM Approach: Limit site to 191.1 L/s for Blocks 6 and 7 and 99.5 L/s for Block 8

Area (ha): 0.773
C: 0.55

Qtarget (L/s)	Qtarget (L/s/ha)
99.50	**129**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: BLDG Block 6 (R100A) — Roof - Tributary
Area (ha): 0.153 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	76.08	8.37	67.70	40.62	132.7	0.00
20	119.95	51.11	9.02	42.09	50.50	143.0	0.00
30	91.87	39.14	9.24	29.90	53.83	146.4	0.00
40	75.15	32.02	9.28	22.73	**54.56**	147.2	0.00
50	63.95	27.25	9.25	18.00	54.00	146.6	0.00
60	55.89	23.81	9.17	14.65	52.74	145.3	0.00
70	49.79	21.21	9.06	12.16	51.06	143.5	0.00
80	44.99	19.17	8.93	10.24	49.14	141.6	0.00
90	41.11	17.52	8.80	8.72	47.08	139.4	0.00
100	37.90	16.15	8.66	7.49	44.95	137.2	0.00
110	35.20	15.00	8.52	6.48	42.79	135.0	0.00
120	32.89	14.02	8.37	5.64	40.62	132.7	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	147.16	0.15	9.28	54.56	57.30	0.00

Subdrainage Area: Parking Block 6 (F100B) — Controlled - Tributary
Area (ha): 0.255
C: 0.81

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	
10	178.56	102.85	42.34	60.50	36.30	
20	119.95	69.09	42.34	26.75	32.10	
30	91.87	52.91	42.34	10.57	19.03	
40	75.15	43.28	42.34	0.94	2.25	
50	63.95	36.84	42.34	0.00	0.00	
60	55.89	32.19	42.34	0.00	0.00	
70	49.79	28.68	42.34	0.00	0.00	
80	44.99	25.91	42.34	0.00	0.00	
90	41.11	23.68	42.34	0.00	0.00	
100	37.90	21.83	42.34	0.00	0.00	
110	35.20	20.28	42.34	0.00	0.00	
120	32.89	18.95	42.34	0.00	0.00	

Storage: Surface Storage Above CB100AA

Orifice Equation: $Q = CdA(2gh)^{0.5}$ — Where C = 0.61

Orifice Diameter:	120.00	mm
Invert Elevation	55.33	m
T/G Elevation	56.98	m
Max Ponding Depth	0.27	m
Downstream W/L	53.91	m

Pipe Storage		
Length	Size	Volume
20.4	900	13.98

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	57.25	1.92	42.34	36.30	37.18	OK
					0.88	

Stormwater Management Calculations

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: Parking Ramp Block 6 (F102A) — 100-year Capture - Tributary
Area (ha): 0.033
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	76.81	6.34	6.34	0.00	0.00	0.00
20	52.03	4.30	4.30	0.00	0.00	0.00
30	40.04	3.31	3.31	0.00	0.00	0.00
40	32.86	2.71	2.71	0.00	0.00	0.00
50	28.04	2.32	2.32	0.00	0.00	0.00
60	24.56	2.03	2.03	0.00	0.00	0.00
70	21.91	1.81	1.81	0.00	0.00	0.00
80	19.83	1.64	1.64	0.00	0.00	0.00
90	18.14	1.50	1.50	0.00	0.00	0.00
100	16.75	1.38	1.38	0.00	0.00	0.00
110	15.57	1.29	1.29	0.00	0.00	0.00
120	14.56	1.20	1.20	0.00	0.00	0.00

Subdrainage Area: Landscaped Area Block 6 (F102B) — Controlled - Tributary
Area (ha): 0.166
C: 0.20

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	7.09	7.09	0.00	0.00
20	52.03	4.80	4.80	0.00	0.00
30	40.04	3.70	3.70	0.00	0.00
40	32.86	3.03	3.03	0.00	0.00
50	28.04	2.59	2.59	0.00	0.00
60	24.56	2.27	2.27	0.00	0.00
70	21.91	2.02	2.02	0.00	0.00
80	19.83	1.83	1.83	0.00	0.00
90	18.14	1.67	1.67	0.00	0.00
100	16.75	1.55	1.55	0.00	0.00
110	15.57	1.44	1.44	0.00	0.00
120	14.56	1.34	1.34	0.00	0.00

Storage: Surface Storage Above CB102A

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 83.00 mm
Invert Elevation: 54.30 m
T/G Elevation: 56.64 m
Max Ponding Depth: 0.00 m
Downstream W/L: 53.91 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	56.64	2.34	7.09	0.00	0.50	OK

Block 6 Peak Flow Summary

Total Area = 0.607 ha — **Volume Used =** 16.47 m³
Q target = 84.9 L/s
Q unc = 0.0 L/s
Qramp = 6.3 L/s
Qroof = 6.2 L/s
Qpark = 42.5 L/s
Qtotal = 55 L/s

Subdrainage Area: BLDG Block 7 (R200A) — Roof - Tributary
Area (ha): 0.197 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	76.81	37.86	8.17	29.69	17.81	92.5	0.00
20	52.03	25.65	8.63	17.02	**20.42**	97.7	0.00
30	40.04	19.74	8.57	11.17	20.10	97.0	0.00
40	32.86	16.20	8.35	7.85	18.84	94.5	0.00
50	28.04	13.82	8.07	5.75	17.26	91.4	0.00
60	24.56	12.10	7.77	4.33	15.59	88.0	0.00
70	21.91	10.80	7.48	3.32	13.94	84.7	0.00
80	19.83	9.77	7.20	2.57	12.35	81.5	0.00
90	18.14	8.94	6.93	2.01	10.85	78.5	0.00
100	16.75	8.25	6.68	1.57	9.43	75.7	0.00
110	15.57	7.67	6.40	1.28	8.44	72.4	0.00
120	14.56	7.18	6.12	1.06	7.63	69.3	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Level	97.69	0.10	8.63	20.42	72.80	0.00

Subdrainage Area: Parking Ramp Block 7 (F202A) — 100-year Capture - Tributary
Area (ha): 0.052
C: 0.85

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	76.81	9.44	9.44	0.00	0.00	0.00
20	52.03	6.39	6.39	0.00	0.00	0.00
30	40.04	4.92	4.92	0.00	0.00	0.00
40	32.86	4.04	4.04	0.00	0.00	0.00
50	28.04	3.45	3.45	0.00	0.00	0.00
60	24.56	3.02	3.02	0.00	0.00	0.00
70	21.91	2.69	2.69	0.00	0.00	0.00
80	19.83	2.44	2.44	0.00	0.00	0.00
90	18.14	2.23	2.23	0.00	0.00	0.00
100	16.75	2.06	2.06	0.00	0.00	0.00
110	15.57	1.91	1.91	0.00	0.00	0.00
120	14.56	1.79	1.79	0.00	0.00	0.00

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: Parking Ramp Block 6 (F102A) — 100-year Capture - Tributary
Area (ha): 0.033
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.56	16.38	16.38	0.00	0.00	0.00
20	119.95	11.00	11.00	0.00	0.00	0.00
30	91.87	8.43	8.43	0.00	0.00	0.00
40	75.15	6.89	6.89	0.00	0.00	0.00
50	63.95	5.87	5.87	0.00	0.00	0.00
60	55.89	5.13	5.13	0.00	0.00	0.00
70	49.79	4.57	4.57	0.00	0.00	0.00
80	44.99	4.13	4.13	0.00	0.00	0.00
90	41.11	3.77	3.77	0.00	0.00	0.00
100	37.90	3.48	3.48	0.00	0.00	0.00
110	35.20	3.23	3.23	0.00	0.00	0.00
120	32.89	3.02	3.02	0.00	0.00	0.00

Subdrainage Area: Landscaped Area Block 6 (F102B) — Controlled - Tributary
Area (ha): 0.166
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	20.60	20.60	0.00	0.00
20	119.95	13.84	13.84	0.00	0.00
30	91.87	10.60	10.60	0.00	0.00
40	75.15	8.67	8.67	0.00	0.00
50	63.95	7.38	7.38	0.00	0.00
60	55.89	6.45	6.45	0.00	0.00
70	49.79	5.74	5.74	0.00	0.00
80	44.99	5.19	5.19	0.00	0.00
90	41.11	4.74	4.74	0.00	0.00
100	37.90	4.37	4.37	0.00	0.00
110	35.20	4.06	4.06	0.00	0.00
120	32.89	3.80	3.80	0.00	0.00

Storage: Surface Storage Above CB102A

Orifice Equation: Q = CdA(2gh)^0.5 — Where C = 0.61
Orifice Diameter: 83.00 mm
Invert Elevation: 54.30 m
T/G Elevation: 56.64 m
Max Ponding Depth: 0.08 m
Downstream W/L: 53.91 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	56.72	2.42	20.60	0.00	0.50	OK
					0.50	

Block 6 Peak Flow Summary

Total Area = 0.607 ha — **Volume Used =** 90.86 m³
Q target = 84.9 L/s
Q unc = 0.0 L/s
Qramp = 16.4 L/s
Qroof = 9.3 L/s
Qparking = 62.9 L/s
Qtotal = 89 L/s — 3.73 L/s

Subdrainage Area: BLDG Block 7 (R200A) — Roof - Tributary
Area (ha): 0.197 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	97.79	11.73	86.06	51.64	132.8	0.00
20	119.95	65.69	12.59	53.10	63.72	142.6	0.00
30	91.87	50.31	12.86	37.45	67.41	145.6	0.00
40	75.15	41.15	12.89	28.26	**67.83**	145.9	0.00
50	63.95	35.03	12.81	22.22	66.66	145.0	0.00
60	55.89	30.61	12.66	17.95	64.62	143.3	0.00
70	49.79	27.27	12.48	14.79	62.11	141.3	0.00
80	44.99	24.64	12.28	12.36	59.33	139.0	0.00
90	41.11	22.51	12.07	10.45	56.41	136.6	0.00
100	37.90	20.76	11.85	8.90	53.42	134.2	0.00
110	35.20	19.28	11.64	7.64	50.43	131.8	0.00
120	32.89	18.02	11.42	6.59	47.46	129.3	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	145.95	0.15	12.89	67.83	72.80	0.00

Subdrainage Area: Parking Ramp Block 7 (F202A) — 100-year Capture - Tributary
Area (ha): 0.052
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.56	25.81	25.81	0.00	0.00	0.00
20	119.95	17.34	17.34	0.00	0.00	0.00
30	91.87	13.28	13.28	0.00	0.00	0.00
40	75.15	10.86	10.86	0.00	0.00	0.00
50	63.95	9.25	9.25	0.00	0.00	0.00
60	55.89	8.08	8.08	0.00	0.00	0.00
70	49.79	7.20	7.20	0.00	0.00	0.00
80	44.99	6.50	6.50	0.00	0.00	0.00
90	41.11	5.94	5.94	0.00	0.00	0.00
100	37.90	5.48	5.48	0.00	0.00	0.00
110	35.20	5.09	5.09	0.00	0.00	0.00
120	32.89	4.76	4.76	0.00	0.00	0.00

Stormwater Management Calculations

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: Uncontrolled Block 7 (UNC-1) — Uncontrolled - Non Tributary
Area (ha): 0.203
C: 0.20

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	76.81	8.67	8.67	0.00	0.00	0.00
20	52.03	5.87	5.87	0.00	0.00	0.00
30	40.04	4.52	4.52	0.00	0.00	0.00
40	32.86	3.71	3.71	0.00	0.00	0.00
50	28.04	3.16	3.16	0.00	0.00	0.00
60	24.56	2.77	2.77	0.00	0.00	0.00
70	21.91	2.47	2.47	0.00	0.00	0.00
80	19.83	2.24	2.24	0.00	0.00	0.00
90	18.14	2.05	2.05	0.00	0.00	0.00
100	16.75	1.89	1.89	0.00	0.00	0.00
110	15.57	1.76	1.76	0.00	0.00	0.00
120	14.56	1.64	1.64	0.00	0.00	0.00

Subdrainage Area: Uncontrolled Block 7 (UNC-2) — Uncontrolled - Non Tributary
Area (ha): 0.028
C: 0.20

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	76.81	1.20	1.20	0.00	0.00	0.00
20	52.03	0.81	0.81	0.00	0.00	0.00
30	40.04	0.62	0.62	0.00	0.00	0.00
40	32.86	0.51	0.51	0.00	0.00	0.00
50	28.04	0.44	0.44	0.00	0.00	0.00
60	24.56	0.38	0.38	0.00	0.00	0.00
70	21.91	0.34	0.34	0.00	0.00	0.00
80	19.83	0.31	0.31	0.00	0.00	0.00
90	18.14	0.28	0.28	0.00	0.00	0.00
100	16.75	0.26	0.26	0.00	0.00	0.00
110	15.57	0.24	0.24	0.00	0.00	0.00
120	14.56	0.23	0.23	0.00	0.00	0.00

Subdrainage Area: Parking Block 7 (F201A) — Controlled - Tributary
Area (ha): 0.059
C: 0.73

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	9.20	9.20	0.00	0.00
20	52.03	6.23	9.20	0.00	0.00
30	40.04	4.79	9.20	0.00	0.00
40	32.86	3.93	9.20	0.00	0.00
50	28.04	3.36	9.20	0.00	0.00
60	24.56	2.94	9.20	0.00	0.00
70	21.91	2.62	9.20	0.00	0.00
80	19.83	2.37	9.20	0.00	0.00
90	18.14	2.17	9.20	0.00	0.00
100	16.75	2.01	9.20	0.00	0.00
110	15.57	1.86	9.20	0.00	0.00
120	14.56	1.74	9.20	0.00	0.00

Storage: Surface Storage Above CB200B

Orifice Equation: Q = CdA(2gh)^0.5
Orifice Diameter: 102.00 mm
Invert Elevation 54.66 m
T/G Elevation 56.41 m
Max Ponding Depth 0.00 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	56.41	1.75	9.20	0.00	0.00	OK

Subdrainage Area: Parking Block 7 (F201B) — Controlled - Tributary
Area (ha): 0.107
C: 0.73

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	16.68	12.80	3.87	2.32
20	52.03	11.30	12.80	0.00	0.00
30	40.04	8.70	12.80	0.00	0.00
40	32.86	7.14	12.80	0.00	0.00
50	28.04	6.09	12.80	0.00	0.00
60	24.56	5.33	12.80	0.00	0.00
70	21.91	4.76	12.80	0.00	0.00
80	19.83	4.31	12.80	0.00	0.00
90	18.14	3.94	12.80	0.00	0.00
100	16.75	3.64	12.80	0.00	0.00
110	15.57	3.38	12.80	0.00	0.00
120	14.56	3.16	12.80	0.00	0.00

Storage: Surface Storage Above CBMH200C

Orifice Equation: LMF105

Invert Elevation 54.67 m
T/G Elevation 56.38 m
Max Ponding Depth 0.00 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	56.38	1.71	12.80	2.32	23.76	OK

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: Uncontrolled Block 7 (UNC-1) — Uncontrolled - Non Tributary
Area (ha): 0.203
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.56	25.19	25.19	0.00	0.00	0.00
20	119.95	16.92	16.92	0.00	0.00	0.00
30	91.87	12.96	12.96	0.00	0.00	0.00
40	75.15	10.60	10.60	0.00	0.00	0.00
50	63.95	9.02	9.02	0.00	0.00	0.00
60	55.89	7.89	7.89	0.00	0.00	0.00
70	49.79	7.02	7.02	0.00	0.00	0.00
80	44.99	6.35	6.35	0.00	0.00	0.00
90	41.11	5.80	5.80	0.00	0.00	0.00
100	37.90	5.35	5.35	0.00	0.00	0.00
110	35.20	4.97	4.97	0.00	0.00	0.00
120	32.89	4.64	4.64	0.00	0.00	0.00

Subdrainage Area: Uncontrolled Block 7 (UNC-2) — Uncontrolled - Non Tributary
Area (ha): 0.028
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.56	3.47	3.47	0.00	0.00	0.00
20	119.95	2.33	2.33	0.00	0.00	0.00
30	91.87	1.79	1.79	0.00	0.00	0.00
40	75.15	1.46	1.46	0.00	0.00	0.00
50	63.95	1.24	1.24	0.00	0.00	0.00
60	55.89	1.09	1.09	0.00	0.00	0.00
70	49.79	0.97	0.97	0.00	0.00	0.00
80	44.99	0.88	0.88	0.00	0.00	0.00
90	41.11	0.80	0.80	0.00	0.00	0.00
100	37.90	0.74	0.74	0.00	0.00	0.00
110	35.20	0.69	0.69	0.00	0.00	0.00
120	32.89	0.64	0.64	0.00	0.00	0.00

Subdrainage Area: Parking Block 7 (F201A) — Controlled - Tributary
Area (ha): 0.059
C: 0.91

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	26.72	26.72	0.00	0.00
20	119.95	17.95	26.72	0.00	0.00
30	91.87	13.75	26.72	0.00	0.00
40	75.15	11.25	26.72	0.00	0.00
50	63.95	9.57	26.72	0.00	0.00
60	55.89	8.37	26.72	0.00	0.00
70	49.79	7.45	26.72	0.00	0.00
80	44.99	6.73	26.72	0.00	0.00
90	41.11	6.15	26.72	0.00	0.00
100	37.90	5.67	26.72	0.00	0.00
110	35.20	5.27	26.72	0.00	0.00
120	32.89	4.92	26.72	0.00	0.00

Storage: Surface Storage Above CB200B

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 102.00 mm
Invert Elevation 54.66 m
T/G Elevation 56.41 m
Max Ponding Depth 0.00 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	56.41	1.75	26.72	0.00	0.00	OK
					0.00	

Subdrainage Area: Parking Block 7 (F201B) — Controlled - Tributary
Area (ha): 0.107
C: 0.91

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	48.47	13.57	34.90	20.94
20	119.95	32.56	13.57	18.99	22.79
30	91.87	24.94	13.57	11.37	20.46
40	75.15	20.40	13.57	6.83	16.39
50	63.95	17.36	13.57	3.79	11.37
60	55.89	15.17	13.57	1.60	5.77
70	49.79	13.51	13.57	0.00	0.00
80	44.99	12.21	13.57	0.00	0.00
90	41.11	11.16	13.57	0.00	0.00
100	37.90	10.29	13.57	0.00	0.00
110	35.20	9.56	13.57	0.00	0.00
120	32.89	8.93	13.57	0.00	0.00

Storage: Surface Storage Above CBMH200C

Orifice Equation: LMF105

Invert Elevation 54.67 m
T/G Elevation 56.38 m
Max Ponding Depth 0.21 m
Downstream W/L 52.93 m

Pipe Storage		
Length	Size	Volume
25.0	825	13.36

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	56.59	1.92	13.57	22.79	23.76	OK
					0.98	

Stormwater Management Calculations

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: Parking Block 7 (F200B) — Controlled - Tributary
Area (ha): 0.071
C: 0.68

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	10.31	5.98	4.33	2.60
20	52.03	6.98	5.98	1.01	1.21
30	40.04	5.37	5.37	0.00	0.00
40	32.86	4.41	4.41	0.00	0.00
50	28.04	3.76	3.76	0.00	0.00
60	24.56	3.30	3.30	0.00	0.00
70	21.91	2.94	2.94	0.00	0.00
80	19.83	2.66	2.66	0.00	0.00
90	18.14	2.44	2.44	0.00	0.00
100	16.75	2.25	2.25	0.00	0.00
110	15.57	2.09	2.09	0.00	0.00
120	14.56	1.95	1.95	0.00	0.00

Storage: Surface Storage Above CB200A

Orifice Equation: LMF70
Invert Elevation 54.41 m
T/G Elevation 56.23 m
Max Ponding Depth 0.10 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	56.33	1.92	5.98	2.60	33.30	OK

Subdrainage Area: Landscaped Area Block 7 (F202B) — Controlled - Tributary
Area (ha): 0.043
C: 0.20

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	1.84	1.84	0.00	0.00
20	52.03	1.24	1.24	0.00	0.00
30	40.04	0.96	0.96	0.00	0.00
40	32.86	0.79	0.79	0.00	0.00
50	28.04	0.67	0.67	0.00	0.00
60	24.56	0.59	0.59	0.00	0.00
70	21.91	0.52	0.52	0.00	0.00
80	19.83	0.47	0.47	0.00	0.00
90	18.14	0.43	0.43	0.00	0.00
100	16.75	0.40	0.40	0.00	0.00
110	15.57	0.37	0.37	0.00	0.00
120	14.56	0.35	0.35	0.00	0.00

Storage: Surface Storage Above CB202A

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 83.00 mm
Invert Elevation 53.47 m
T/G Elevation 54.83 m
Max Ponding Depth 0.00 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	54.83	1.36	1.84	0.00	0.00	

Block 7 Peak Flow Summary

Total Area = 0.760 ha — **Volume =** 25.34 m³
Q target = 106.2 L/s
Q unc = 9.9 L/s
Qramp = 9.4 L/s
Qroof = 8.6 L/s
Qparking = 29.8 L/s

Qtotal = 58 L/s

Subdrainage Area: Parking Block 8 (F300A) — Controlled - Tributary
Area (ha): 0.139
C: 0.80

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	23.74	5.94	17.80	10.68
20	52.03	16.08	5.94	10.14	12.17
30	40.04	12.38	5.94	6.43	11.58
40	32.86	10.16	5.94	4.21	10.12
50	28.04	8.67	5.94	2.72	8.17
60	24.56	7.59	5.94	1.65	5.93
70	21.91	6.77	5.94	0.83	3.48
80	19.83	6.13	5.94	0.19	0.89
90	18.14	5.61	5.61	0.00	0.00
100	16.75	5.18	5.18	0.00	0.00
110	15.57	4.81	4.81	0.00	0.00
120	14.56	4.50	4.50	0.00	0.00

Storage: Surface Storage Above CB300A

Orifice Equation: LMF70
Invert Elevation 52.97 m
T/G Elevation 54.77 m
Max Ponding Depth 0.10 m
Downstream W/L 51.46 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	54.87	1.90	5.94	12.17	56.01	OK

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: Parking Block 7 (F200B) — Controlled - Tributary
Area (ha): 0.071
C: 0.85

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	29.96	6.28	23.67	14.20
20	119.95	20.12	6.28	13.84	16.61
30	91.87	15.41	6.28	9.13	16.43
40	75.15	12.61	6.28	6.32	15.18
50	63.95	10.73	6.28	4.45	13.34
60	55.89	9.38	6.28	3.09	11.14
70	49.79	8.35	6.28	2.07	8.70
80	44.99	7.55	6.28	1.27	6.07
90	41.11	6.90	6.28	0.61	3.32
100	37.90	6.36	6.28	0.08	0.46
110	35.20	5.91	5.91	0.00	0.00
120	32.89	5.52	5.52	0.00	0.00

Storage: Surface Storage Above CB200A

Orifice Equation: LMF70
Invert Elevation 54.41 m
T/G Elevation 56.23 m
Max Ponding Depth 0.30 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	56.53	2.12	6.28	16.61	33.30	OK

Subdrainage Area: Landscaped Area Block 7 (F202B) — Controlled - Tributary
Area (ha): 0.043
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	5.34	5.34	0.00	0.00
20	119.95	3.58	3.58	0.00	0.00
30	91.87	2.75	2.75	0.00	0.00
40	75.15	2.25	2.25	0.00	0.00
50	63.95	1.91	1.91	0.00	0.00
60	55.89	1.67	1.67	0.00	0.00
70	49.79	1.49	1.49	0.00	0.00
80	44.99	1.34	1.34	0.00	0.00
90	41.11	1.23	1.23	0.00	0.00
100	37.90	1.13	1.13	0.00	0.00
110	35.20	1.05	1.05	0.00	0.00
120	32.89	0.98	0.98	0.00	0.00

Storage: Surface Storage Above CB202A

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 83.00 mm
Invert Elevation 53.47 m
T/G Elevation 54.83 m
Max Ponding Depth 0.00 m
Downstream W/L 52.93 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	54.83	1.36	5.34	0.00	0.00	

Block 7 Peak Flow Summary

Total Area = 0.760 ha — **Volume =** 107.23 m³
Q target = 106.2 L/s
Q unc = 28.7 L/s
Qramp = 25.8 L/s
Qroof = 12.9 L/s
Qparking = 51.9 L/s

Qtotal = 119 L/s — 13.06 L/s

Subdrainage Area: Parking Block 8 (F300A) — Controlled - Tributary
Area (ha): 0.139
C: 0.91

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	62.96	6.25	56.71	34.03
20	119.95	42.30	6.25	36.04	43.25
30	91.87	32.39	6.25	26.14	47.05
40	75.15	26.50	6.25	20.24	48.59
50	63.95	22.55	6.25	16.30	48.89
60	55.89	19.71	6.25	13.46	48.44
70	49.79	17.56	6.25	11.30	47.47
80	44.99	15.86	6.25	9.61	46.13
90	41.11	14.50	6.25	8.24	44.51
100	37.90	13.36	6.25	7.11	42.67
110	35.20	12.41	6.25	6.16	40.65
120	32.89	11.60	6.25	5.35	38.49

Storage: Surface Storage Above CB300A

Orifice Equation: LMF70
Invert Elevation 52.97 m
T/G Elevation 54.77 m
Max Ponding Depth 0.30 m
Downstream W/L 51.46 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	55.07	2.10	6.25	48.89	56.01	OK
					7.12	

Stormwater Management Calculations

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: BLDG Block 8 (R300A) — Roof
Area (ha): 0.236 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	76.81	45.35	10.15	35.20	21.12	89.4	0.00
20	52.03	30.72	10.67	20.05	**24.06**	94.0	0.00
30	40.04	23.64	10.58	13.07	23.52	93.1	0.00
40	32.86	19.41	10.29	9.12	21.88	90.6	0.00
50	28.04	16.56	9.93	6.62	19.87	87.5	0.00
60	24.56	14.50	9.56	4.94	17.77	84.2	0.00
70	21.91	12.94	9.20	3.74	15.70	81.0	0.00
80	19.83	11.71	8.85	2.86	13.71	78.0	0.00
90	18.14	10.71	8.52	2.19	11.83	75.0	0.00
100	16.75	9.89	8.12	1.77	10.63	71.5	0.00
110	15.57	9.19	7.75	1.45	9.55	68.2	0.00
120	14.56	8.60	7.41	1.19	8.56	65.2	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Level	93.96	0.09	10.67	24.06	94.40	0.00

Subdrainage Area: Parking Ramp Block 8 (F300B) — 100-year Capture - Tributary
Area (ha): 0.030
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	76.81	5.76	5.76	0.00	0.00	0.00
20	52.03	3.91	3.91	0.00	0.00	0.00
30	40.04	3.01	3.01	0.00	0.00	0.00
40	32.86	2.47	2.47	0.00	0.00	0.00
50	28.04	2.10	2.10	0.00	0.00	0.00
60	24.56	1.84	1.84	0.00	0.00	0.00
70	21.91	1.64	1.64	0.00	0.00	0.00
80	19.83	1.49	1.49	0.00	0.00	0.00
90	18.14	1.36	1.36	0.00	0.00	0.00
100	16.75	1.26	1.26	0.00	0.00	0.00
110	15.57	1.17	1.17	0.00	0.00	0.00
120	14.56	1.09	1.09	0.00	0.00	0.00

Subdrainage Area: Uncontrolled Block 8 (UNC-3) — Uncontrolled - Non Tributary
Area (ha): 0.368
C: 0.20

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	76.81	15.71	15.71	0.00	0.00	0.00
20	52.03	10.65	10.65	0.00	0.00	0.00
30	40.04	8.19	8.19	0.00	0.00	0.00
40	32.86	6.72	6.72	0.00	0.00	0.00
50	28.04	5.74	5.74	0.00	0.00	0.00
60	24.56	5.02	5.02	0.00	0.00	0.00
70	21.91	4.48	4.48	0.00	0.00	0.00
80	19.83	4.06	4.06	0.00	0.00	0.00
90	18.14	3.71	3.71	0.00	0.00	0.00
100	16.75	3.43	3.43	0.00	0.00	0.00
110	15.57	3.19	3.19	0.00	0.00	0.00
120	14.56	2.98	2.98	0.00	0.00	0.00

Block 8 Peak Flow Summary

Total Area = **0.773** **ha** — **Volume =** **36.23** **m³**
Q target = 99.5 L/s

Q unc = 15.7 L/s
Qramp = 5.8 L/s
Qroof = 10.7 L/s
Qparking = 5.9 L/s

Q total = **38** **L/s**

Overall Site Release Rate
Q target = 290.6 L/s
Q total = 150.9 L/s

Project #160401331, Petries Landing - Block 6, 7 and 8
Modified Rational Method Calculatons for Storage

Subdrainage Area: BLDG Block 8 (R300A) — Roof
Area (ha): 0.236 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	117.15	14.68	102.46	61.48	129.3	0.00
20	119.95	78.70	15.69	63.00	75.61	138.2	0.00
30	91.87	60.27	15.99	44.29	79.72	140.8	0.00
40	75.15	49.30	16.00	33.30	**79.92**	140.9	0.00
50	63.95	41.96	15.88	26.08	78.24	139.8	0.00
60	55.89	36.67	15.69	20.98	75.54	138.1	0.00
70	49.79	32.67	15.46	17.21	72.28	136.1	0.00
80	44.99	29.52	15.20	14.32	68.72	133.9	0.00
90	41.11	26.97	14.94	12.04	65.00	131.5	0.00
100	37.90	24.87	14.67	10.20	61.21	129.1	0.00
110	35.20	23.10	14.39	8.70	57.43	126.8	0.00
120	32.89	21.58	14.11	7.47	53.81	124.2	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	140.90	0.14	16.00	79.92	94.40	0.00

Subdrainage Area: Parking Ramp Block 8 (F300B) — 100-year Capture - Tributary
Area (ha): 0.030
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.56	14.89	14.89	0.00	0.00	0.00
20	119.95	10.00	10.00	0.00	0.00	0.00
30	91.87	7.66	7.66	0.00	0.00	0.00
40	75.15	6.27	6.27	0.00	0.00	0.00
50	63.95	5.33	5.33	0.00	0.00	0.00
60	55.89	4.66	4.66	0.00	0.00	0.00
70	49.79	4.15	4.15	0.00	0.00	0.00
80	44.99	3.75	3.75	0.00	0.00	0.00
90	41.11	3.43	3.43	0.00	0.00	0.00
100	37.90	3.16	3.16	0.00	0.00	0.00
110	35.20	2.94	2.94	0.00	0.00	0.00
120	32.89	2.74	2.74	0.00	0.00	0.00

Subdrainage Area: Uncontrolled Block 8 (UNC-3) — Uncontrolled - Non Tributary
Area (ha): 0.368
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Qspill (L/s)
10	178.56	45.67	45.67	0.00	0.00	0.00
20	119.95	30.68	30.68	0.00	0.00	0.00
30	91.87	23.50	23.50	0.00	0.00	0.00
40	75.15	19.22	19.22	0.00	0.00	0.00
50	63.95	16.36	16.36	0.00	0.00	0.00
60	55.89	14.30	14.30	0.00	0.00	0.00
70	49.79	12.73	12.73	0.00	0.00	0.00
80	44.99	11.51	11.51	0.00	0.00	0.00
90	41.11	10.51	10.51	0.00	0.00	0.00
100	37.90	9.69	9.69	0.00	0.00	0.00
110	35.20	9.00	9.00	0.00	0.00	0.00
120	32.89	8.41	8.41	0.00	0.00	0.00

Block 8 Peak Flow Summary

Total Area = **0.773** **ha** — **Volume =** **128.81** **m³**
Q target = 99.5 L/s

Q unc = 45.7 L/s
Qramp = 14.9 L/s
Qroof = 16.0 L/s
Q parking = 6.3 L/s

Q total = **82.8** **L/s** — **-16.69 L/s**

Overall Site Release Rate
Q target = 290.6 L/s
Q total = 290.7 L/s

Project #160401331, Petries Landing - Block 6, 7 and 8
Roof Drain Design Sheet, Area R100A Block 6
Standard Watts Drainage Model R1100 Accuflow Roof Drains

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0016	0	0.025	32	0	0	0.025
0.050	0.0006	0.0032	2	0.050	127	2	2	0.050
0.075	0.0009	0.0047	7	0.075	287	5	7	0.075
0.100	0.0013	0.0063	17	0.100	509	10	17	0.100
0.125	0.0016	0.0079	33	0.125	796	16	33	0.125
0.150	0.0019	0.0095	57	0.150	1146	24	57	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.9	588.7	1.9	0.16353
6.9	1065.3	5.0	0.45943
16.7	1555.8	9.8	0.8916
32.9	2052.0	16.2	1.46161
57.0	2551.0	24.1	2.17022

Rooftop Storage Summary

Total Building Area (sq.m)		1433	Excludes known areas with no roof storage available
Assume Available Roof Area (sq.m)	80%	1146	
Roof Imperviousness		0.99	
Roof Drain Requirement (sq.m/Notch)		232	
Number of Roof Notches*		5	
Max. Allowable Depth of Roof Ponding (m)		0.15	* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).
Max. Allowable Storage (cu.m)		57	
Estimated 100 Year Drawdown Time (h)		2.1	

From Watts Drain Catalogue

Head (m)	L/s Open	75%	50%	25%	Closed
0.025	**0.3155**	0.31545	0.31545	0.31545	0.31545
0.050	**0.6309**	0.6309	0.6309	0.6309	0.6309
0.075	**0.9464**	0.86749	0.78863	0.70976	0.6309
0.100	**1.2618**	1.10408	0.94635	0.78863	0.6309
0.125	**1.5773**	1.34067	1.10408	0.86749	0.6309
0.150	**1.8927**	1.57726	1.2618	0.94635	0.6309

* Note: Number of drains can be reduced if multiple-notch drain used.

Calculation Results	2yr	100yr	Available
Qresult (cu.m/s)	0.006	0.009	-
Depth (m)	0.099	0.147	0.150
Volume (cu.m)	16.5	54.6	57.3
Draintime (hrs)	0.883	2.097	

Project #160401331, Petries Landing - Block 6, 7 and 8
Roof Drain Design Sheet, Area BLDG Block 7
Standard Watts Drainage Model R1100 Accuflow Roof Drains

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0022	0	0.025	40	0	0	0.025
0.050	0.0006	0.0044	3	0.050	162	2	3	0.050
0.075	0.0009	0.0066	9	0.075	364	6	9	0.075
0.100	0.0013	0.0088	22	0.100	647	12	22	0.100
0.125	0.0016	0.0110	42	0.125	1011	21	42	0.125
0.150	0.0019	0.0132	73	0.150	1456	31	73	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
2.4	534.2	2.4	0.14839
8.8	966.7	6.4	0.41691
21.2	1411.9	12.5	0.80909
41.8	1862.1	20.6	1.32635
72.5	2314.9	30.7	1.96939

Rooftop Storage Summary

Total Building Area (sq.m)		1820	Excludes known areas with no roof storage available
Assume Available Roof Area (sq.m)	80%	1456	
Roof Imperviousness		0.99	
Roof Drain Requirement (sq.m/Notch)		232	
Number of Roof Notches*		7	
Max. Allowable Depth of Roof Ponding (m)		0.15	* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).
Max. Allowable Storage (cu.m)		73	
Estimated 100 Year Drawdown Time (h)		1.9	

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m)	L/s Open	75%	50%	25%	Closed
0.025	**0.3155**	0.31545	0.31545	0.31545	0.31545
0.050	**0.6309**	0.6309	0.6309	0.6309	0.6309
0.075	**0.9464**	0.86749	0.78863	0.70976	0.6309
0.100	**1.2618**	1.10408	0.94635	0.78863	0.6309
0.125	**1.5773**	1.34067	1.10408	0.86749	0.6309
0.150	**1.8927**	1.57726	1.2618	0.94635	0.6309

Calculation Results	2yr	100yr	Available
Qresult (cu.m/s)	0.009	0.013	-
Depth (m)	0.098	0.146	0.150
Volume (cu.m)	20.4	67.8	72.8
Draintime (hrs)	0.789	1.872	

Project #160401331, Petries Landing - Block 6, 7 and 8
Roof Drain Design Sheet, Area BLDG Block 8
Standard Watts Drainage Model R1100 Accuflow Roof Drains

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0028	0	0.025	52	0	0	0.025
0.050	0.0006	0.0057	3	0.050	210	3	3	0.050
0.075	0.0009	0.0085	12	0.075	472	8	12	0.075
0.100	0.0013	0.0114	28	0.100	839	16	28	0.100
0.125	0.0016	0.0142	55	0.125	1311	27	55	0.125
0.150	0.0019	0.0170	94	0.150	1888	40	94	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
3.1	538.8	3.1	0.14966
11.4	974.9	8.3	0.42048
27.5	1423.9	16.2	0.81601
54.2	1878.0	26.7	1.33769
94.0	2334.7	39.8	1.98622

Rooftop Storage Summary

Total Building Area (sq.m)		2360	Excludes known areas with no roof storage available
Assume Available Roof Area (sq.m)	80%	1888	
Roof Imperviousness		0.99	
Roof Drain Requirement (sq.m/Notch)		232	
Number of Roof Notches*		9	
Max. Allowable Depth of Roof Ponding (m)		0.15	* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).
Max. Allowable Storage (cu.m)		94	
Estimated 100 Year Drawdown Time (h)		1.8	

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m)	Open	75%	50%	25%	Closed
L/s					
0.025	**0.3155**	0.31545	0.31545	0.31545	0.31545
0.050	**0.6309**	0.6309	0.6309	0.6309	0.6309
0.075	**0.9464**	0.86749	0.78863	0.70976	0.6309
0.100	**1.2618**	1.10408	0.94635	0.78863	0.6309
0.125	**1.5773**	1.34067	1.10408	0.86749	0.6309
0.150	**1.8927**	1.57726	1.2618	0.94635	0.6309

Calculation Results	2yr	100yr	Available
Qresult (cu.m/s)	0.011	0.016	-
Depth (m)	0.094	0.141	0.150
Volume (cu.m)	24.1	79.9	94.4
Draintime (hrs)	0.748	1.757	

3223701 CANADA INC
C/O BRIGIL HOMES

DESIGN BRIEF
PETRIE'S LANDING II
PHASE 2

31464.5.2.2

REVISED AUGUST 2012
REVISED OCTOBER 2012
REVISED NOVEMBER 2012
REVISED AUGUST 2013
REVISED NOVEMBER 2013
REVISED FEBRUARY 7, 2014

- Pavement Structure:

Layer		Thickness (mm)	
		Car Parking Areas	Local Streets & Heavy Traffic Areas (Fire Route)
Wear Course:	Superpave 12.5 Asphaltic Concrete	50	40
Binder Course:	Superpave 19.0 Asphaltic Concrete		50
Base:	OPSS Granular "A" Crushed Stone	150	150
Sub-Base:	OPSS Granular "B" Type II	300	400

- Minimum Performance Grade (PG) 58-34 asphalt cement should be used;
- 3.0 m long sub-drain should be installed at each catchbasin.

The geotechnical report also provides guidelines regarding the permissible maximum grade raise(s) for the property without additional construction measures such as pre-loading, raft foundation, deep foundations or others approved alternatives such as light weight fill. The maximum grade raises vary between 1.8 m to 4.0 m depending on the building type and percentage of consolidation considered.

It should be noted that a copy of the proposed grading for the subject site has been forwarded to Paterson Group for its review and confirmation of its compliance with the grade raise recommendations.

2. MUNICIPAL SERVICES

As the Prestige Circle sewers and watermain were designed to accommodate the anticipated development along its perimeter, a simple extension of the main-line services into each sub-block will provide servicing for each of the buildings. The main design parameters for the various municipal services were designed as per the applicable City of Ottawa requirements and have been summarized in the sub-sections below.

2.1 Water Distribution

Prior to the detailed design of Prestige Circle, boundary conditions for the watermain at the intersection of Tenth Line Road and North Service Road were provided by City staff. Based on the proposed concept plan, grading and the existing boundary conditions, a 200mm diameter watermain loop complete with hydrants was proposed. The supporting hydraulic analysis demonstrated that the following municipal requirements and Fire Underwriters recommended flows for protection will be exceeded:

- Average daily demand — 350 l/cap/day (residential)
  15,000 l/Ha/day (institutional)
- Peak daily demand — 875 l/cap/day (residential)
  22,500 l/Ha/day (institutional)
- Peak hour demand — 1,925 l/cap/day (residential)
  40,500 l/Ha/day (institutional)
- Fire flow rate — 8,000 l/min (townhouses & 3-storey apartments)
  15,000 l/min (institutional)
- Minimum hydraulic grade line during max hour – 275 kPa
- Minimum hydraulic grade line during max day and fire flows – 140 kPa

Hence, the water servicing to Phase 2 will simply be accomplished through a number of connections to the 200mm diameter watermain along Prestige Circle.

Refer to Appendix C for the hydraulic analysis.

2.2 Wastewater

2.2.1 EXISTING CONDITIONS

In 2002 the 900mm diameter Ottawa River Sub Trunk sanitary sewer was constructed by the City of Ottawa to accommodate the Petrie's Landing II lands as well as additional lands upstream.

The sub-trunk detailed design was prepared by Stantec Consulting Ltd. It included a flow allowance of 50,000 l/Ha/d with a peaking factor of 1.5 for the Petrie's Landing II property.

The Prestige Circle sanitary sewer design was based on the applicable City of Ottawa Design Guidelines and the preliminary concept plan which originally proposed 248 apartments and 170 retirement units for a total of 418 units.

The current concept plan for the overall development is now proposing a total of 405 units. The breakdown is as follows:

- Existing Phase 1: 40 units
- Phase 2 (subject phase): 268 units
- Future Phase 3: 97 units

Thus, the number of units is within the allocated number as based on the original concept plan and associated sanitary sewer design.

It should also be noted that the distribution of the population along the perimeter of Prestige Circle will have no negative impact on the sanitary sewer as it has a significant level of residual capacity distributed along its entire length which provides flexibility in the design of the locations for the proposed block connections. Refer to Appendix D for Petrie's Landing design sheet and drawing.

2.2.2 DESIGN CRITERIA

The sanitary flows for Block 2 were determined based on the following design criteria which includes, but is not limited to the following:

- Population: 1.8 persons per apartment/condo unit
- Domestic Flow: 350 l/cap per day
- Domestic Peak Factor: Harmon Formula
- Institutional: 50,000 l/d/Ha
- Institutional Peak Factor: 1.5
- Extraneous Flow: 0.28 l/s/Ha
- Minimum Pipe Size: 200 mm diameter
- Maximum Velocity 3.0 m/s
- Minimum Velocity 0.6 m/s

Refer to Appendix D for the resulting sanitary design sheet and drawing.

2.3 Storm Sewer

2.3.1 EXISTING CONDITIONS

In 1995, *McNeely Engineering Consultants Ltd.* was commissioned by the former Township of Cumberland to prepare a Master Drainage Plan (MDP) for the area surrounding and including the Petrie's Landing II lands. The report states that stormwater flows from the development are to be directed to the Brisebois Creek SWM facility prior to its discharge to the Ottawa River. This will ensure that quality control constraints are met. The report also recommended that post-development flows from the proposed Petrie's Landing II lands site be limited to 150 l/s/ha in order to insure that the downstream SWM facility meets its design targets.

With the above-noted constraints in mind, the overall stormwater management design for the subdivision took into account the two proposed phases within the development. Hence, both phases 1 and 2 were allocated 61.6 L/s and 461.35L/s respectively.

However, Phase 2 has subsequently been reduced in size and a third phase has been created. Thus, the initial allocation of 461.35 L/s for Phase 2 has been distributed proportionally based on the areas of the new Phases 2 and 3. The resulting flow allocation for Phase 2 is 361.87 L/s.

2.3.2 DESIGN PARAMETERS

The rational method in combination with the following parameters was used in the sizing of the storm sewer minor system for Block 2:

- **Design Storms**

  The 5 year design storm event was used in the evaluation of the site, consistent with the City of Ottawa Sewer Design Guidelines (November, 2004).

- **Run-Off Coefficients**

  The run-off coefficients utilized for the minor system design were derived from analysis of representative samples of drainage areas within the proposed Phase. Coefficients of 0.20 and 0.90 were utilized in the analysis to represent landscaped versus hard surface areas.

- **Time of Concentration**

  Inlet times of 10 min. for parking/hard surface areas were utilized as per the City of Ottawa Sewer Design Guidelines (November 2004).

3. STORMWATER MANAGMENT

Phase 2 is 2.91 Ha in size and as previously noted was reallocated 361.87 L/s as minor system flow as a result of its new area.

Of the 2.91 Ha design area, a total of 0.55 Ha has been left to discharge uncontrolled from the site due to grading or other constraints that do not feasibly allow for collection and control of runoff. Based on a 100-year event, where the runoff coefficient of the uncontrolled area is equal to an average of 0.30, the uncontrolled flow rate can be determined as follows:

- $\mathbf{Q_{Uncontrolled}} = 2.78*C*i_{100yr}*A$, where:

  C = Average site runoff coefficient uncontrolled area
  = 0.30

  $\mathbf{i_{100yr}}$ = Intensity of 100-year storm event (mm/hr)
  = $1735.688 * (T_c + 6.014)^{-0.820}$
  = 178.56 mm/hr; where T_c = 20 minutes

  A = Uncontrolled Area (Ha)
  = 0.55 ha

  Therefore,

- $\mathbf{Q_{Uncontrolled}}$ = 2.78 X 0.30 X 119.95mm/hr X 0.55 Ha = 55.02 L/s

Additionally, an area of the site equivalent to 0.27 Ha is taken up by depressed parking ramps, which must accommodate the 100-year flow. This flow rate can also be calculated as:

$Q_{parking}$ = **$2.78*C*i_{100yr}*A$**

= 2.78 * 0.80 * 119.95 * 0.27

= **107.22 L/s**

The maximum allowable release rate from the remainder of the site can then be determined as:

$Q_{max\ allowable}$ = $Q_{restricted} - Q_{uncontrolled} - Q_{parking}$

= 361.87 L/s – 55.02 L/s – 107.22 L/s

= **199.62 L/s**

Restricting flow into the minor system from the controlled portion of the site will be achieved through the use of inlet control devices and surface ponding. The size and type of each inlet control device was determined via the Modified Rational Method and are a function of the size of the drainage area and the amount of surface storage available on-site.

Any runoff generated from storms in excess of the site's release rate will be stored on-site and gradually released into the minor system so as not to surcharge the proposed sewers. Ponding storage will be provided at specific locations. Overland flow routes have been provided in the grading and surface designs to permit emergency overflow drainage from the site.

Refer to Appendix E for the modified rational method calculations, inlet control device sizing and ponding plan.

4. GRADING

As per standard practice, the design of the site grading takes into account a number of factors. Efforts are made to ensure that the proposed grading will tie in well with the surrounding areas. This includes matching the existing grades at controlling areas, such as property lines, existing roadways and geotechnical restraint lines, where no modification of the existing grades is permissible.

Other factors, such as stormwater management and geotechnical grade raise limitations also play a part in the grading of the site. Major overflow routes have been provided in order to ensure that emergency overflow can be conveyed from the site when required. Where possible, some areas have been graded to maximize on-site ponding. The depth of water has been limited to a maximum of 0.30 m at all locations.

5. UTILITIES

As part of Prestige Circle's second and final phase of construction, all utility purveyors will be extending their current plant within the Right-of-Way in order to provide servicing to Phase 2 and future Phase 3. As part of the detail design for Phase 2, servicing designs from Hydro One, Rogers, Bell and Enbridge have been requested.

FUS WATER SUPPLY FOR PUBLIC FIRE PROTECTION 1991

EXAMPLES OF REQUIRED FIRE FLOWS (REVISED)

For convenience in making general estimates some examples of required fire flows in typical buildings are provided below. In establishing fire flows for areas of a Municipality as yet undeveloped, but where a broad range of commercial, institutional, residential and industrial occupancies may be expected to be created under modern building code requirements, an outside design figure of 15,000 L/min appears likely to be suitable. When very large or high fire load buildings are probable, 25,000 L/min is more appropriate. It should be noted particularly that the tendency to install automatic sprinkler protection in large area and high hazard industrial and commercial buildings is a key factor in keeping required fire flows within ecomonically acceptable limits in many cases.

The following examples suppose no significant exposures to other buildings nor sprinkler protection unless specified. Where areas are given they are ground areas unless specified.

DETACHED DWELLINGS (TOTAL FLOOR AREAS)

— Under 100 m² = 2,000 L/min
101 m² — 200 m² = 3,000 L/min
Over 200 m² = 4,000 L/min

— Add for exposures to similar buildings on both sides:

Over 30 m	- nil
30 — 10 m	add 1,000 L/min
10 — 3 m	add 2,000 L/min
less than 3 m	see Note "D", if Frame. Brick, add 3,000 L/min.

— If wood shingle or shake roofs are prevalent,add 2,000 to 4,000 L/min.

— Modern residential subdivisions of 1 and 2 storey single family homes detached 3 to 6 m require usually 4,000 to 5,000 L/min.

— Old congested two and three family tenements detached less than 3 m and running the length of the block may require 15,000 to 25,000 L/min and should be calculated according to Note "D".

— Modern Row or Town House groups may require 6,000 to 10,000 L/min including adjoining exposures, providing required fire separations are adequate.

APARTMENT BUILDINGS

— 3 storeys, frame, 300 m² = 7,000 L/min and exposure coverage.

— 4 storeys, brick, 2,000 m² = 15,000 L/min and exposure coverage.

— 3 or more storeys, fire resistive, 5,600 m² with cut off shafts and stairs = 10,000 L/min and exposure coverage.

INSTITUTIONAL BUILDINGS

— 1 storey, fire resistive school of 2,300 m² = 5,000 L/min

— 3 storey, brick ordinary school of 2,300 m² = 15,000 L/min

— 3 or more storey, fire resistive hospital with adequate floor separations 1,000 m², no exposures = 4,000 L/min.

INDUSTRIAL BUILDINGS

— Typical industrial park, 1 storey ordinary, area 3,700 m² with average combustible contents fire load =14,000 L/min.

— Frame warehouse 1 storey, moderate contents fire load 3,700 m² = 20,000 L/min.

— Warehouse high fire load contents, brick non-combustible, 1 storey, 14,000 m² = 25,000 L/min. With full adequate automatic sprinkler protection (item 3, P.13) 13,000 L/min.

— Traditional 3 storey brick , ordinary factory with high fire load. 9,300 m² = 35,000 L/min.

IBI GROUP
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

WATERMAIN DEMAND CALCULATION SHEET

PROJECT : PETRIE'S LANDING II - PHASE 2
LOCATION : CITY OF OTTAWA
DEVELOPER : BRIGIL PLATINUM

FILE: 31464.5.7
DATE: 2013-11-28
DESIGN: RPK
PAGE : 1 OF 1

NODE	RESIDENTIAL				NON-RESIDENTIAL			AVERAGE DAILY DEMAND (l/s)			MAXIMUM DAILY DEMAND (l/s)			MAXIMUM HOURLY DEMAND (l/s)			FIRE DEMAND
	UNITS		GROSS RES. (ha)	POP'N	INDTRL (ha.)	COMM. (ha.)	INST. (ha.)	Res.	Non-res.	Total	Res.	Non-res.	Total	Res.	Non-res.	Total	(l/min)
	TH	APT															
BLK1		40		72				0.29	0.00	0.29	0.73	0.00	0.73	1.60	0.00	1.60	8,000
BLK2		40		72				0.29	0.00	0.29	0.73	0.00	0.73	1.60	0.00	1.60	8,000
BLK3A		92		166				0.67	0.00	0.67	1.68	0.00	1.68	3.69	0.00	3.69	8,000
BLK5		76		137				0.55	0.00	0.55	1.39	0.00	1.39	3.05	0.00	3.05	8,000
BLK6		76		137				0.55	0.00	0.55	1.39	0.00	1.39	3.05	0.00	3.05	8,000
BLK7		0		0				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8,000
BLK8		88		158				0.64	0.00	0.64	1.60	0.00	1.60	3.53	0.00	3.53	15,000
TOTALS	**0**	**412**	**0**	**742**	**0.00**	**0.00**	**0.00**	**2.99**	**0.00**	**2.99**	**7.52**	**0.00**	**7.52**	**16.52**	**0.00**	**16.52**	

ASSUMPTIONS

RESIDENTIAL DENSITIES

- Townhouse (TH) 2.7 p / p / u
- Apartment (APT) 1.8 p / p / u

AVG. DAILY DEMAND

- Residential 350 l / cap / day
- Institutional 15,000 l / ha / day

MAX. DAILY DEMAND

- Residential 875 l / cap / day
- Institutional 22,500 l / ha / day

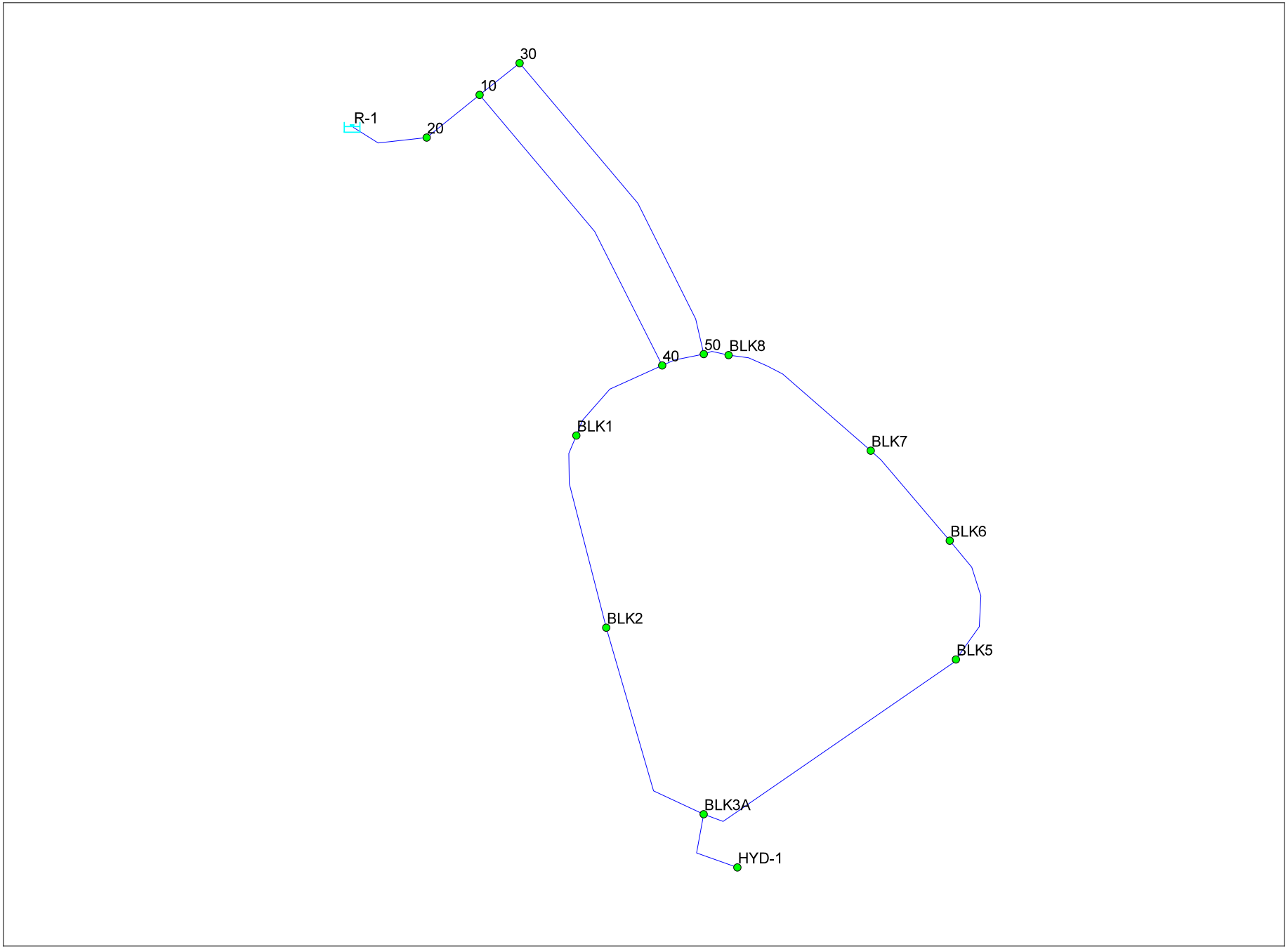
MAX. HOURLY DEMAND

- Residential 1,925 l / cap / day
- Institutional 40,500 l / ha / day

FIRE FLOW

- Townhouses 8,000 l / min
- 3-Storey Apartments 8,000 l / min
- Institutional 15,000 l / min

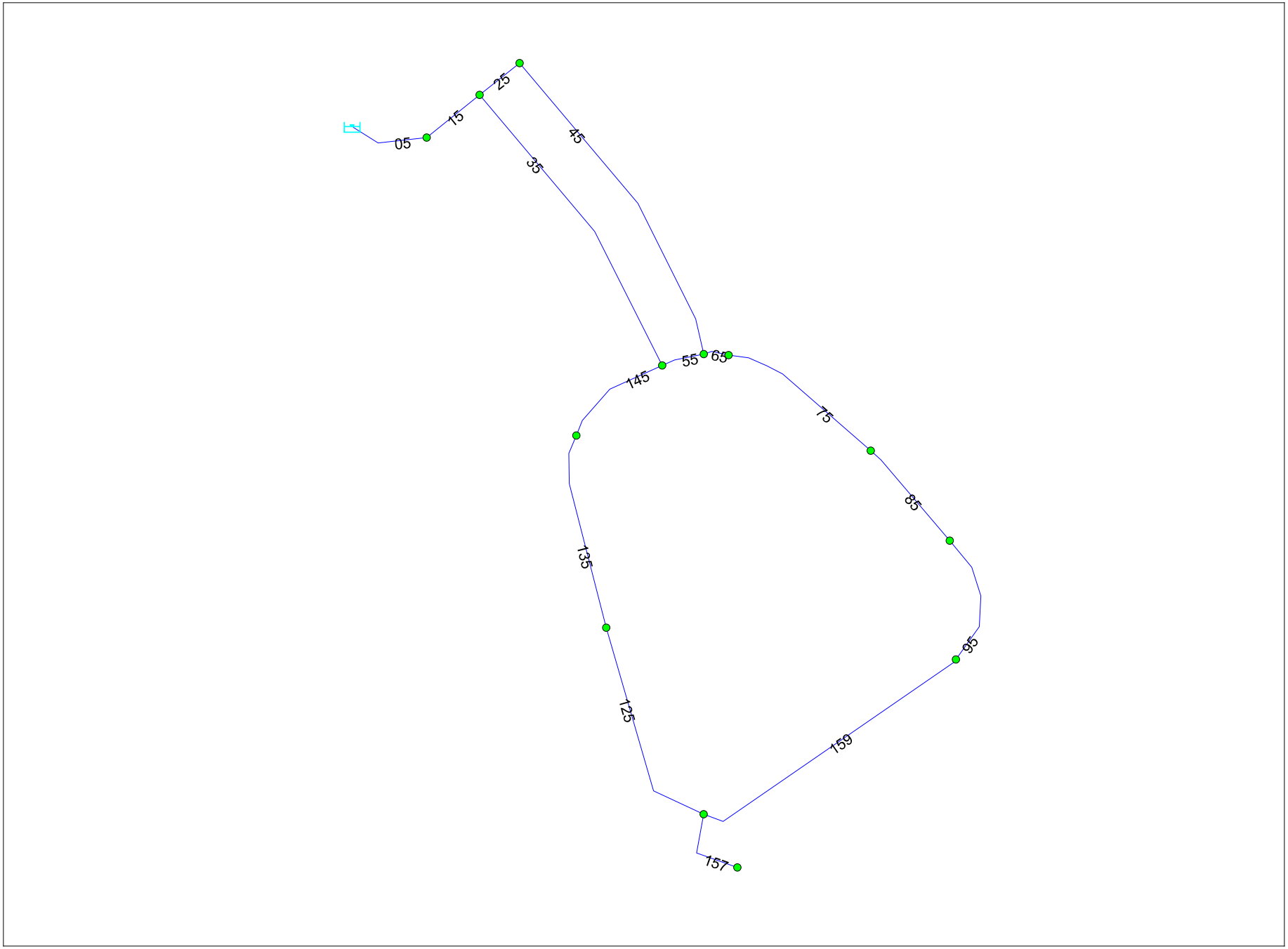
Petrie's Landing II - Node ID's



Prepared By: IBI Group

Date: Thursday, November 28, 2013

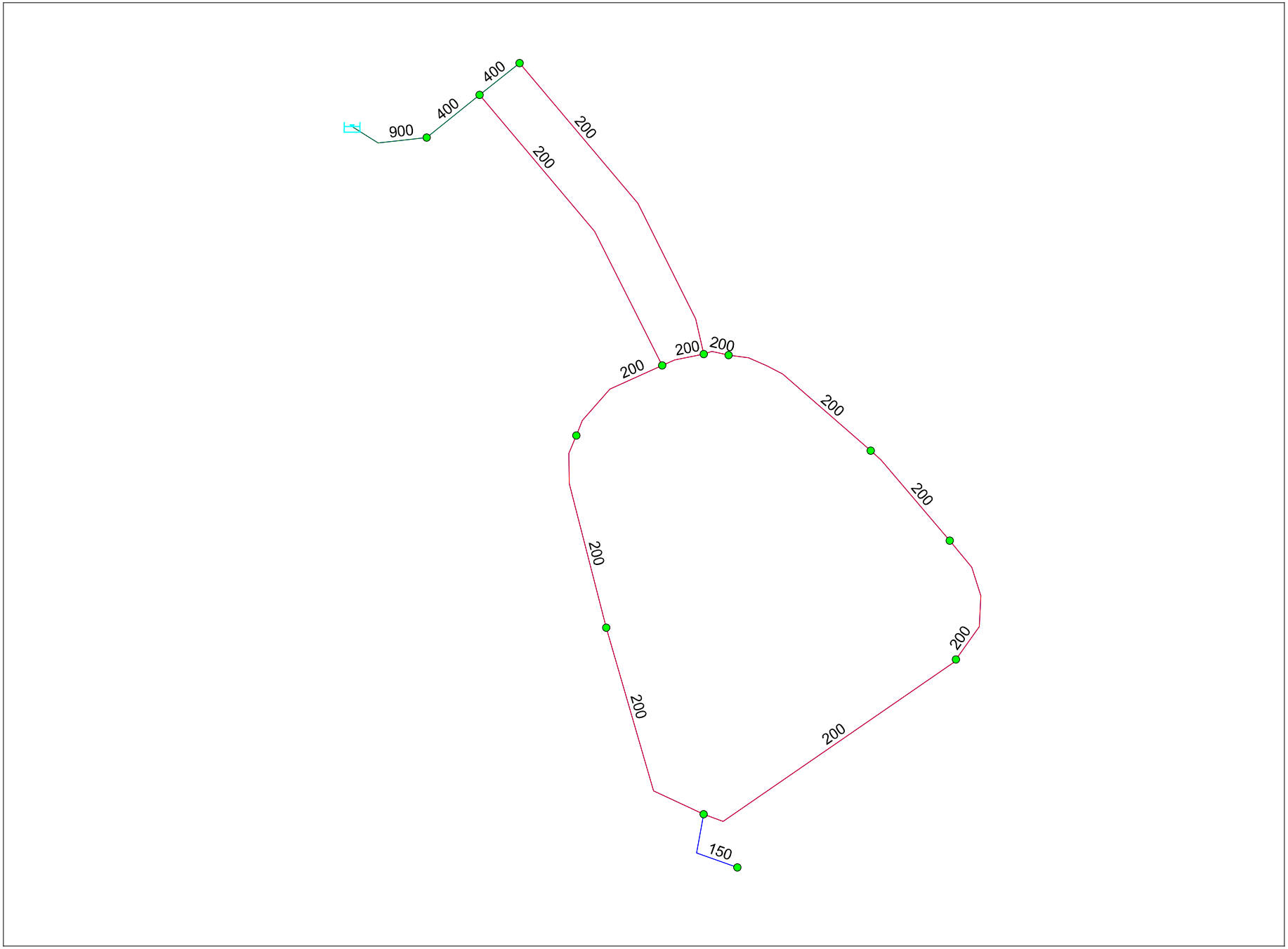
Petrie's Landing II - Pipe ID's



Prepared By: IBI Group

Date: Thursday, November 28, 2013

Petrie's Landing II - Pipe Sizes



Prepared By: IBI Group

Date: Thursday, November 28, 2013

Average Day (High Presure Check) - Junction Report (HGL = 115.00m)

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1		10	0.00	51.75	115.00	619.78
2		20	0.00	52.00	115.00	617.35
3		30	0.00	51.60	115.00	621.25
4		40	0.00	55.05	115.00	587.42
5		50	0.00	55.05	115.00	587.42
6		BLK1	0.29	55.20	114.99	585.94
7		BLK2	0.29	56.70	114.99	571.24
8		BLK3A	0.67	57.00	114.99	568.30
9		BLK5	0.55	57.10	114.99	567.32
10		BLK6	0.55	56.60	114.99	572.22
11		BLK7	0.00	55.65	114.99	581.53
12		BLK8	0.64	55.00	115.00	587.91
13		HYD-1	0.00	57.10	114.99	567.32

Average Day (High Presure Check) - Pipe Report (HGL = 115.00m)

		ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness	Flow (L/s)	Velocity (m/s)	Headloss (m)
1		05	R-1	20	0.10	900.00	130.00	2.99	0.00	0.00
2		125	BLK3A	BLK2	57.74	200.00	110.00	-0.67	0.02	0.000
3		135	BLK2	BLK1	50.89	200.00	110.00	-0.96	0.03	0.000
4		145	BLK1	40	29.62	200.00	110.00	-1.25	0.04	0.000
5		15	20	10	800.00	400.00	120.00	2.99	0.02	0.00
6		157	BLK3A	HYD-1	21.20	150.00	100.00	0.00	0.00	0.00
7		159	BLK3A	BLK5	81.61	200.00	110.00	0.00	0.000	0.00
8		25	10	30	13.11	400.00	120.00	1.47	0.01	0.00000
9		35	10	40	84.27	200.00	110.00	1.52	0.05	0.00
10		45	30	50	89.46	200.00	110.00	1.47	0.05	0.00
11		55	40	50	11.11	200.00	110.00	0.27	0.01	0.0000
12		65	50	BLK8	6.59	200.00	110.00	1.74	0.06	0.000
13		75	BLK8	BLK7	44.78	200.00	110.00	1.10	0.03	0.000
14		85	BLK7	BLK6	30.74	200.00	110.00	1.10	0.03	0.000
15		95	BLK6	BLK5	34.82	200.00	110.00	0.55	0.02	0.000

Average Day (High Presure Check) - Pipe Report (HGL = 115.00m)

		ID	HL/1000 (m/km)
1		05	0.00
2		125	0.01
3		135	0.01
4		145	0.02
5		15	0.00
6		157	0.00
7		159	0.00
8		25	0.000
9		35	0.03
10		45	0.03
11		55	0.00
12		65	0.03
13		75	0.01
14		85	0.01
15		95	0.00

Max Day + Fire - Fireflow Report (HGL = 110.00m)

		ID	Total Demand (L/s)	Critical Node 1 ID	Critical Node 1 Pressure (kPa)	Critical Node 1 Head (m)	Adjusted Fire-Flow (L/s)	Available Flow @Hydrant (L/s)	Critical Node 2 ID	Critical Node 2 Pressure (kPa)	Critcal Node 2 Head (m)	Adjusted Available Flow (L/s)	Design Flow (L/s)
1		BLK1	134.06	HYD-1	448.81	101.00	345.12	335.18	BLK1	139.96	69.48	335.18	335.18
2		BLK2	134.06	BLK2	426.82	100.26	289.16	289.18	BLK2	139.96	70.98	289.18	289.16
3		BLK5	134.72	BLK5	415.09	99.46	276.06	276.08	BLK5	139.96	71.38	276.08	276.06
4		BLK6	134.72	BLK6	427.07	100.18	289.25	289.27	BLK6	139.96	70.88	289.27	289.25
5		BLK7	133.33	BLK5	438.59	100.41	318.44	310.34	BLK7	139.96	69.93	310.34	310.34
6		BLK8	251.60	BLK5	335.27	89.21	375.48	378.29	BLK6	134.64	68.74	375.44	375.44
7		HYD-1	133.33	HYD-1	304.50	88.17	182.43	182.43	HYD-1	139.96	71.38	182.43	182.43

Peak Hour - Junction Report (HGL = 108.00m)

		ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (kPa)
1		10	0.00	51.75	107.95	550.69
2		20	0.00	52.00	108.00	548.76
3		30	0.00	51.60	107.95	552.16
4		40	0.00	55.05	107.89	517.83
5		50	0.00	55.05	107.89	517.82
6		BLK1	1.60	55.20	107.88	516.23
7		BLK2	1.60	56.70	107.87	501.39
8		BLK3A	3.69	57.00	107.86	498.37
9		BLK5	3.05	57.10	107.86	497.39
10		BLK6	3.05	56.60	107.86	502.32
11		BLK7	0.00	55.65	107.87	511.74
12		BLK8	3.53	55.00	107.89	518.26
13		HYD-1	0.00	57.10	107.86	497.39

APPENDIX D

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

SANITARY SEWER DESIGN SHEET

PROJECT: PETRIE'S LANDING II - PHASE 2
LOCATION: CITY OF OTTAWA
DEVELOPER: BRIGIL PLATINUM

JOB: 31464.5.7
DATE: 2013-11-28
DESIGN: RPK

LOCATION				INDIVIDUAL		CUMULATIVE		DESIGN FLOW					SEWER DATA					
FROM MH	TO MH	TH (#)	APT (#)	POP.	AREA (Ha)	POP.	AREA (Ha)	PEAK FACTOR	POP. FLOW (L/s)	INFILT. FLOW (L/s)	OFFSITE FLOW (L/s)	PEAK FLOW (L/s)	CAP. (L/s)	VELOCITY (FULL) (m/s)	LENGTH (m)	PIPE (mm)	SLOPE (%)	AVAIL. CAP. (%)
19A	*1A*			*0.0*	*0.27*	*0*	*0.27*	*4.00*	*0.00*	*0.08*		***0.08***	***22.47***	*1.23*	*12.49*	*150*	*2.00*	*99.64%*
STUB	*18A*			***17.10 L/s from off-site lands south of Regional Road No. 174***							*17.10*	***17.10***	***67.64***	*0.93*	*2.00*	*300*	*0.45*	*74.72%*
18A	*17A*			*0.0*	*0.00*	*0*	*0.00*	*4.00*	*0.00*	*0.00*	*17.10*	***17.10***	***67.64***	*0.93*	*6.91*	*300*	*0.45*	*74.72%*
17A	*1A*			*0.0*	*0.00*	*0*	*0.00*	*4.00*	*0.00*	*0.00*	*17.10*	***17.10***	***67.64***	*0.93*	*68.70*	*300*	*0.45*	*74.72%*
BLK 5	200A		76	136.8	0.25	137	0.25	4.00	2.22	0.07		**2.29**	**22.47**	1.23	32.98	150	2.00	89.81%
200A	CAP			0.0	0.00	137	0.25	4.00	2.22	0.07		**2.29**	**67.64**	0.93	2.05	300	0.45	96.61%
CAP	22A			0.0	0.00	137	0.25	4.00	2.22	0.07		**2.29**	**67.64**	0.93	8.31	300	0.45	96.61%
22A	*1A*			0.0	0.00	137	0.25	4.00	2.22	0.07		**2.29**	**67.64**	0.93	24.22	300	0.45	96.61%
1A	*2A*			*0.0*	*0.07*	*137*	*0.59*	*4.00*	*2.22*	*0.17*	*17.10*	***19.49***	***67.64***	*0.93*	*51.00*	*300*	*0.45*	*71.19%*
300A	CAP		76	136.8	0.64	137	0.64	4.00	2.22	0.18		**2.40**	**28.41**	0.88	15.27	200	0.69	91.55%
CAP	*2A*			0.0	0.00	137	0.64	4.00	2.22	0.18		**2.40**	**28.41**	0.88	10.00	200	0.69	91.55%
2A	*3A*			*0.0*	*0.02*	*274*	*1.25*	*4.00*	*4.43*	*0.35*	*17.10*	***21.88***	***67.64***	*0.93*	*13.41*	*300*	*0.45*	*67.65%*
3A	*4A*			*0.0*	*0.02*	*274*	*1.27*	*4.00*	*4.43*	*0.36*	*17.10*	***21.89***	***67.64***	*0.93*	*11.07*	*300*	*0.45*	*67.64%*
4A	*21A*			*0.0*	*0.07*	*274*	*1.34*	*4.00*	*4.43*	*0.38*	*17.10*	***21.91***	***67.64***	*0.93*	*15.67*	*300*	*0.45*	*67.61%*
401A	*CAP*		76	136.8	0.75	137	0.75	4.00	2.22	0.21		**2.43**	**34.21**	1.06	25.51	200	1.00	92.90%
CAP	*21A*			0.0	0.00	137	0.75	4.00	2.22	0.21		**2.43**	**34.21**	1.06	10.00	200	1.00	92.90%

Q = Average daily per capita flow 350 l/cap/d
I = Unit of peak extraneous flow 0.28 l/sec/Ha
M = Peaking factor = 1+(14/(4+P)^0.5)), P=pop. IN 1000'S, max. of 4
Q(p) = Peak population flow (l/s)
Q(i) = Peak extraneous flow (l/s)
Population = 2.7 per townhouse (TH) unit, 1.8 per apartment (APT) unit
Coeff. of friction (n) = 0.013

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

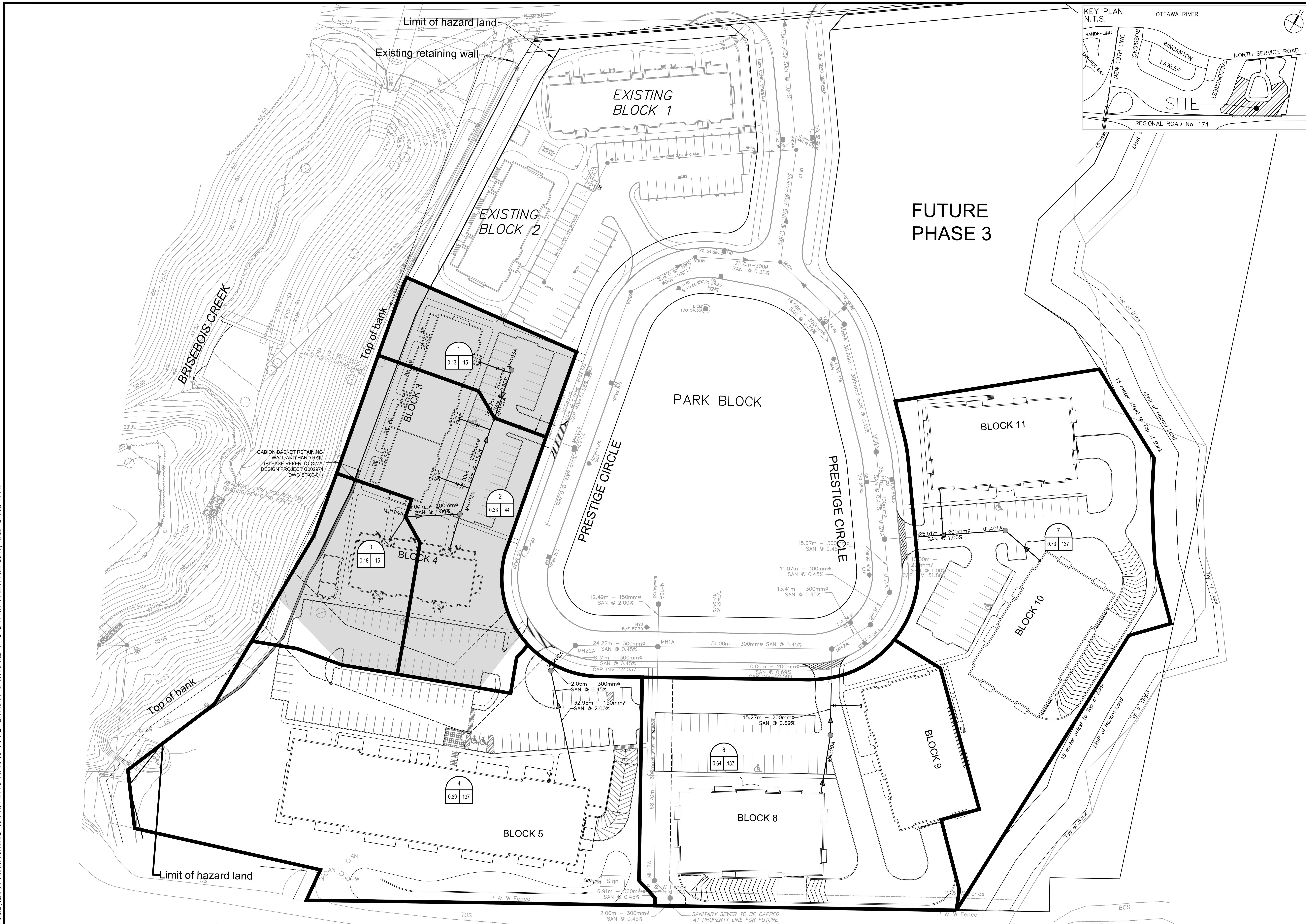
SANITARY SEWER DESIGN SHEET

PROJECT: PETRIE'S LANDING II - PHASE 2
LOCATION: CITY OF OTTAWA
DEVELOPER: BRIGIL PLATINUM

JOB: 31464.5.7
DATE: 2013-11-28
DESIGN: RPK

LOCATION				INDIVIDUAL		CUMULATIVE		DESIGN FLOW					SEWER DATA					
FROM MH	TO MH	TH (#)	APT (#)	POP.	AREA (Ha)	POP.	AREA (Ha)	PEAK FACTOR	POP. FLOW (L/s)	INFILT. FLOW (L/s)	OFFSITE FLOW (L/s)	PEAK FLOW (L/s)	CAP. (L/s)	VELOCITY (FULL) (m/s)	LENGTH (m)	PIPE (mm)	SLOPE (%)	AVAIL. CAP. (%)
21A	*5A*			*0.0*	*0.07*	*410*	*2.16*	*4.00*	*6.65*	*0.60*	*17.10*	***24.35***	***67.64***	*0.93*	*25.71*	*300*	*0.45*	*64.00%*
5A	*6A*			*0.0*	*0.00*	*410*	*2.16*	*4.00*	*6.65*	*0.60*	*17.10*	***24.35***	***67.64***	*0.93*	*38.68*	*300*	*0.45*	*64.00%*
	6A		*81*	*145.8*	*0.57*	*146*	*0.57*	*4.00*	*2.36*	*0.16*		***2.52***						
6A	*7A*			*0.0*	*0.04*	*556*	*2.77*	*3.95*	*8.90*	*0.78*	*17.10*	***26.78***	***62.97***	*0.86*	*26.08*	*300*	*0.39*	*57.47%*
10A	*20A*			*0.0*	*0.16*	*0*	*0.16*	*4.00*	*0.00*	*0.04*		***0.04***	***59.69***	*0.82*	*41.00*	*300*	*0.35*	*99.93%*
104A	102A		8	14.4	0.12	14	0.12	4.00	0.23	0.03		**0.26**	**34.21**	1.06	16.00	200	1.00	99.24%
102A	101A		24	43.2	0.27	58	0.39	4.00	0.93	0.11		**1.04**	**24.19**	0.75	26.33	200	0.50	95.70%
103A	101A		8	14.6	0.13	15	0.13	4.00	0.24	0.04		**0.28**	**24.19**	0.75	14.87	200	0.50	98.84%
101A	*CAP*			0.0	0.00	72	0.52	4.00	1.17	0.15		**1.32**	**34.21**	1.06	15.15	200	1.00	96.14%
CAP	*20A*			0.0	0.00	72	0.52	4.00	1.17	0.15		**1.32**	**34.21**	1.06	10.00	200	1.00	96.14%
20A	*9A*			*0.0*	*0.03*	*72*	*0.71*	*4.00*	*1.17*	*0.20*		***1.37***	***59.69***	*0.82*	*48.80*	*300*	*0.35*	*97.70%*
	9A		*40*	*72.0*	*0.61*	*72*	*0.61*	*4.00*	*1.17*	*0.17*		***1.34***						
9A	*8A*			*0.0*	*0.03*	*144*	*1.35*	*4.00*	*2.34*	*0.38*		***2.72***	***79.46***	*1.09*	*21.08*	*300*	*0.62*	*96.58%*
8A	*7A*			*0.0*	*0.03*	*144*	*1.38*	*4.00*	*2.34*	*0.39*		***2.73***	***68.44***	*0.94*	*25.19*	*300*	*0.46*	*96.01%*
7A	*13A*			*0.0*	*0.09*	*700*	*4.24*	*3.89*	*11.05*	*1.19*	*17.10*	***29.34***	***101.35***	*1.39*	*33.06*	*300*	*1.01*	*71.05%*
13A	*14A*			*0.0*	*0.11*	*700*	*4.35*	*3.89*	*11.05*	*1.22*	*17.10*	***29.37***	***104.85***	*1.44*	*51.59*	*300*	*1.08*	*71.99%*
14A	*15A*			*0.0*	*0.00*	*700*	*4.35*	*3.89*	*11.05*	*1.22*	*17.10*	***29.37***	***100.91***	*1.38*	*23.00*	*300*	*1.00*	*70.90%*
15A	*EX 10A*			*0.0*	*0.00*	*700*	*4.35*	*3.89*	*11.05*	*1.22*	*17.10*	***29.37***	***100.91***	*1.38*	*34.90*	*300*	*1.00*	*70.90%*

Q = Average daily per capita flow 350 l/cap/d
I = Unit of peak extraneous flow 0.28 l/sec/Ha
M = Peaking factor = 1+(14/(4+P)^0.5)), P=pop. IN 1000'S, max. of 4
Q(p) = Peak population flow (l/s)
Q(i) = Peak extraneous flow (l/s)
Population = 2.7 per townhouse (TH) unit, 1.8 per apartment (APT) unit
Coeff. of friction (n) = 0.013



LEGEND :

- 1 — AREA IDENTIFICATION
- 0.13 | 15 — POPULATION
- AREA IN HECTARES

POPULATION:
- APARTMENT = 1.8 PPU

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8	REVISED PER CITY COMMENTS	RPK	14:02:06
7	REVISED PER CITY COMMENTS	RPK	13:11:26
6	REVISED BLOCK 5	RPK	13:08:19
5	RE-ISSUED FOR SITE PLAN APPROVAL	TRB	12:11:19
4	RE-ISSUED FOR SITE PLAN APPROVAL	RPK	12:10:19
3	RE-ISSUED FOR SITE PLAN APPROVAL	RPK	12:08:27
2	ISSUED FOR SITE PLAN APPROVAL	RPK	12:04:12
1	ISSUED FOR REVIEW	RPK	12:03:07

LE GROUPE BRIGIL CONSTRUCTION

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

PETRIE'S LANDING II

PHASE 2

LICENSED PROFESSIONAL ENGINEER
R.P. KENNEDY
100086734
2014/02/06
PROVINCE OF ONTARIO

Drawing Title

SANITARY DRAINAGE AREA PLAN

Scale	1:500
Design: RPK	Date: FEB. 2012
Drawn: DD	Checked: TRB
Project No.: 31464	Drawing No.: 501

APPROVAL DATE ____________________ **2014**

Felice Petti, P. Eng., Manager
Development Review, Suburban Services

APPENDIX E

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

STORM SEWER DESIGN SHEET

PROJECT: PETRIE'S LANDING II - PHASE 2
LOCATION: CITY OF OTTAWA
DEVELOPER: BRIGIL PLATINUM

JOB: 31464.5.7
DATE: 2013-11-28
DESIGN: RPK

		AREA (Ha)									DESIGN FLOW							SEWER DATA						
FROM MH	TO MH	C= 0.10	C= 0.20	C= 0.30	C= 0.70	C= 0.75	C= 0.80	C= 0.90	INDIV. 2.78AC	CUM. 2.78AC	INLET (min)	TIME IN PIPE	TOTAL	$i_{5\text{-year}}$ (mm/hr)	$i_{100\text{-year}}$ (mm/hr)	PEAK FLOW (L/s) IND	PEAK FLOW (L/s) TOTAL	CAP. (L/s)	LENGTH (m)	PIPE (mm)	SLOPE (%)	n	VEL. (m/s)	AVAIL. CAP. (%)
CBMH 17	MH 1		0.270						0.15	0.15	10.00	0.11	10.11	104.20		**15.63**	**15.63**	**142.65**	12.49	300	2.00	0.013	1.96	89.04%
MH 1	MH 2								0.00	0.15	10.11	0.62	10.73	103.60		**15.54**	**15.54**	**78.15**	40.05	300	0.60	0.013	1.07	80.11%
GAR 8	MH 303								0.00	0.00	10.00			104.20		**0.00**	**0.00**							
							0.070		0.16	0.16	10.00	0.27	10.27		178.60	**28.58**	**28.58**	**34.21**	16.77	200	1.00	0.013	1.06	16.48%
MH 303	MH 301								0.00	0.00	10.27			102.80		**0.00**	**0.00**							
									0.00	0.16	10.27	0.17	10.43		176.20	**28.19**	**28.19**	**34.21**	10.50	200	1.00	0.013	1.06	17.60%
GAR 9	MH 301								0.00	0.00	10.00			104.20		**0.00**	**0.00**							
							0.050		0.11	0.11	10.00	0.26	10.26		178.60	**19.65**	**19.65**	**34.21**	16.69	200	1.00	0.013	1.06	42.58%
MH 301	MH 300				0.040			0.100	0.33	0.33	10.43			102.00		**33.66**	**33.66**							
									0.00	0.27	10.43	0.33	10.76		174.70	**47.17**	**80.83**	**114.99**	31.40	300	1.30	0.013	1.58	29.71%
CB 302	CBMH 32				0.120				0.23	0.23	10.00	0.24	10.24	104.20		**23.97**	**23.97**	**65.83**	28.85	200	3.70	0.013	2.03	63.59%
CBMH 32	MH 300				0.110				0.21	0.21	10.00	0.06	10.06	104.20		**21.88**	**21.88**	**138.74**	10.31	250	5.00	0.013	2.74	84.23%
MH 300	MH 2							0.100	0.25	0.79	10.76			100.30		**79.24**	**79.24**							
									0.00	0.27	10.76	0.32	11.08		171.90	**46.41**	**125.65**	**151.97**	25.18	375	0.69	0.013	1.33	17.32%
MH 2	MH 3				0.120				0.23	1.17	11.08			98.80		**115.60**	**115.60**							
									0.00	0.27	11.08	0.19	11.26		169.30	**45.71**	**161.31**	**218.51**	14.76	450	0.54	0.013	1.33	26.18%
MH 3	MH 4								0.00	1.17	11.26			98.00		**114.66**	**114.66**							
									0.00	0.27	11.26	0.10	11.36		167.80	**45.31**	**159.97**	**361.78**	9.29	525	0.65	0.013	1.62	55.78%
MH 4	MH 21								0.00	1.17	11.36			97.50		**114.08**	**114.08**							
									0.00	0.27	11.36	0.22	11.58		167.00	**45.09**	**159.17**	**429.62**	19.81	600	0.45	0.013	1.47	62.95%
RYCB 43	MH 404			0.050					0.04	0.04	15.00	0.21	15.21	83.60		**3.34**	**3.34**	**87.71**	21.28	250	2.00	0.013	1.73	96.19%
MH 404	MH 403							0.100	0.25	0.29	15.21	0.12	15.33	82.90		**24.04**	**24.04**	**124.09**	18.24	250	4.00	0.013	2.45	80.63%
MH 403	MH 401				0.140				0.27	0.56	15.33	0.21	15.54	82.50		**46.20**	**46.20**	**87.71**	21.57	250	2.00	0.013	1.73	47.33%
GAR 10	MH 405								0.00	0.00	10.00			104.20		**0.00**	**0.00**							
							0.070		0.16	0.16	10.00	0.23	10.23		178.60	**28.58**	**28.58**	**34.21**	14.23	200	1.00	0.013	1.06	16.48%
MH 405	MH 402								0.00	0.00	10.23			103.00		**0.00**	**0.00**							
									0.00	0.16	10.23	0.33	10.56		176.50	**28.24**	**28.24**	**34.21**	21.06	200	1.00	0.013	1.06	17.46%
GAR 11	MH 402								0.00	0.00	10.00			104.20		**0.00**	**0.00**							
							0.050		0.11	0.11	10.00	0.29	10.29		178.60	**19.65**	**19.65**	**34.21**	18.11	200	1.00	0.013	1.06	42.58%
MH 402	MH 401				0.060				0.12	0.12	10.56			101.30		**12.16**	**12.16**							
									0.00	0.27	10.56	0.34	10.90		173.60	**46.87**	**59.03**	**114.99**	32.30	300	1.30	0.013	1.58	48.67%
MH 401	MH 21							0.100	0.25	0.93	15.54			81.90		**76.17**	**76.17**							
									0.00	0.27	15.54	0.26	15.79		140.00	**37.80**	**113.97**	**182.87**	24.70	375	1.00	0.013	1.60	37.68%
MH 21	MH 5				0.080				0.16	2.26	15.79			81.10		**183.29**	**183.29**							
									0.00	0.54	15.79	0.26	16.05		138.60	**74.84**	**258.13**	**410.07**	21.89	600	0.41	0.013	1.41	37.05%

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

I=998.071/(TC+6.053)^0.814

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

STORM SEWER DESIGN SHEET
PROJECT: PETRIE'S LANDING II - PHASE 2
LOCATION: CITY OF OTTAWA
DEVELOPER: BRIGIL PLATINUM

JOB: 31464.5.7
DATE: 2013-11-28
DESIGN: RPK

		AREA (Ha)									DESIGN FLOW							SEWER DATA						
FROM MH	TO MH	C= 0.10	C= 0.20	C= 0.30	C= 0.70	C= 0.75	C= 0.80	C= 0.90	INDIV. 2.78AC	CUM. 2.78AC	INLET (min)	TIME IN PIPE	TOTAL	$i_{5\text{-year}}$ (mm/hr)	$i_{100\text{-year}}$ (mm/hr)	PEAK FLOW (L/s) IND	PEAK FLOW (L/s) TOTAL	CAP. (L/s)	LENGTH (m)	PIPE (mm)	SLOPE (%)	n	VEL. (m/s)	AVAIL. CAP. (%)
	MH 5					0.330			0.69	0.69	11.00													
MH 5	MH 6								0.00	2.95	16.05			80.30		**236.89**	**236.89**							
									0.00	0.54	16.05	0.53	16.58		137.30	**74.14**	**311.03**	**389.64**	42.06	600	0.37	0.013	1.34	20.18%
	MH 6					0.570			1.19	1.19	11.50													
MH 6	MH 7				0.120				0.23	4.37	16.58			78.80		**344.36**	**344.36**							
									0.00	0.54	16.58	0.32	16.90	78.80	134.70	**72.74**	**417.09**	**488.33**	25.46	675	0.31	0.013	1.32	14.59%
MH 12	MH 7				0.090				0.18	0.18	10.00	0.31	10.31	104.20		**18.76**	**18.76**	**172.61**	27.98	375	0.89	0.013	1.51	89.13%
PARK	MH 7	0.360							0.10	0.10	10.00	0.21	10.21	104.20		**10.42**	**10.42**	**62.02**	15.60	250	1.00	0.013	1.22	83.20%
MH 7	MH 8				0.120				0.23	4.88	16.90			77.90		**380.15**	**380.15**							
									0.00	0.54	16.90	0.37	17.27		133.10	**71.87**	**452.03**	**580.53**	27.87	750	0.25	0.013	1.27	22.14%
	MH 8					0.610			1.27	1.27	11.50													
MH 8	MH 9								0.00	6.15	17.27			76.90		**472.94**	**472.94**							
									0.00	0.54	17.27	0.23	17.50		131.40	**70.96**	**543.89**	**706.40**	21.72	750	0.37	0.013	1.55	23.01%
MH 9	MH 20				0.060				0.12	6.27	17.50			76.30		**478.40**	**478.40**							
									0.00	0.54	17.50	0.58	18.08		130.30	**70.36**	**548.76**	**819.98**	51.50	825	0.30	0.013	1.49	33.08%
CB 10	MH 101				0.100				0.19	0.19	10.00	0.15	10.15	104.20		**19.80**	**19.80**	**72.58**	20.33	200	4.50	0.013	2.24	72.72%
CB 102	MH 101				0.130				0.25	0.25	10.00	0.10	10.10	104.20		**26.05**	**26.05**	**83.80**	16.02	200	6.00	0.013	2.58	68.91%
MH 101	MH 20								0.00	0.44	10.10	0.27	10.37	103.70		**45.63**	**45.63**	**100.91**	22.15	300	1.00	0.013	1.38	54.78%
MH 20	MH 10				0.130				0.25	6.96	18.08			74.80		**520.61**	**520.61**							
									0.00	0.54	18.08	0.45	18.53		127.70	**68.96**	**589.57**	**819.98**	40.50	825	0.30	0.013	1.49	28.10%
MH 10	MH 11								0.00	6.96	18.53			73.60		**512.26**	**512.26**							
									0.00	0.54	18.53	0.08	18.61		125.80	**67.93**	**580.19**	**1,527.39**	12.48	825	1.04	0.013	2.77	62.01%
MH 11	MH 13								0.00	6.96	18.61			73.50		**511.56**	**511.56**	**0.00**						
									0.00	0.54	18.61	0.28	18.89		125.50	**67.77**	**579.33**	**1,037.39**	32.06	825	0.48	0.013	1.88	44.16%
MH 13	MH 14								0.00	6.96	18.89			72.80		**506.69**	**506.69**							
									0.00	0.54	18.89	0.43	19.32		124.30	**67.12**	**573.81**	**886.20**	41.69	825	0.35	0.013	1.61	35.25%
CB 21	MH 200				0.140				0.27	0.27	10.00	0.34	10.34	104.20		**28.13**	**28.13**	**34.21**	21.47	200	1.00	0.013	1.06	17.77%
ECB 1	MH 200			0.020					0.02	0.02	10.00	0.10	10.10	104.20		**2.08**	**2.08**	**62.02**	7.29	250	1.00	0.013	1.22	96.64%
RYCB 22	MH 200			0.070					0.06	0.06	15.00	0.24	15.24	83.60		**5.02**	**5.02**	**34.21**	14.99	200	1.00	0.013	1.06	85.34%
GAR 5	MH 200								0.00	0.00	10.00			104.20		**0.00**	**0.00**							
							0.030		0.07	0.07	10.00	0.03	10.03		178.60	**12.50**	**12.50**	**34.21**	2.10	200	1.00	0.013	1.06	63.46%

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

I=998.071/(TC+6.053)^0.814

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

STORM SEWER DESIGN SHEET

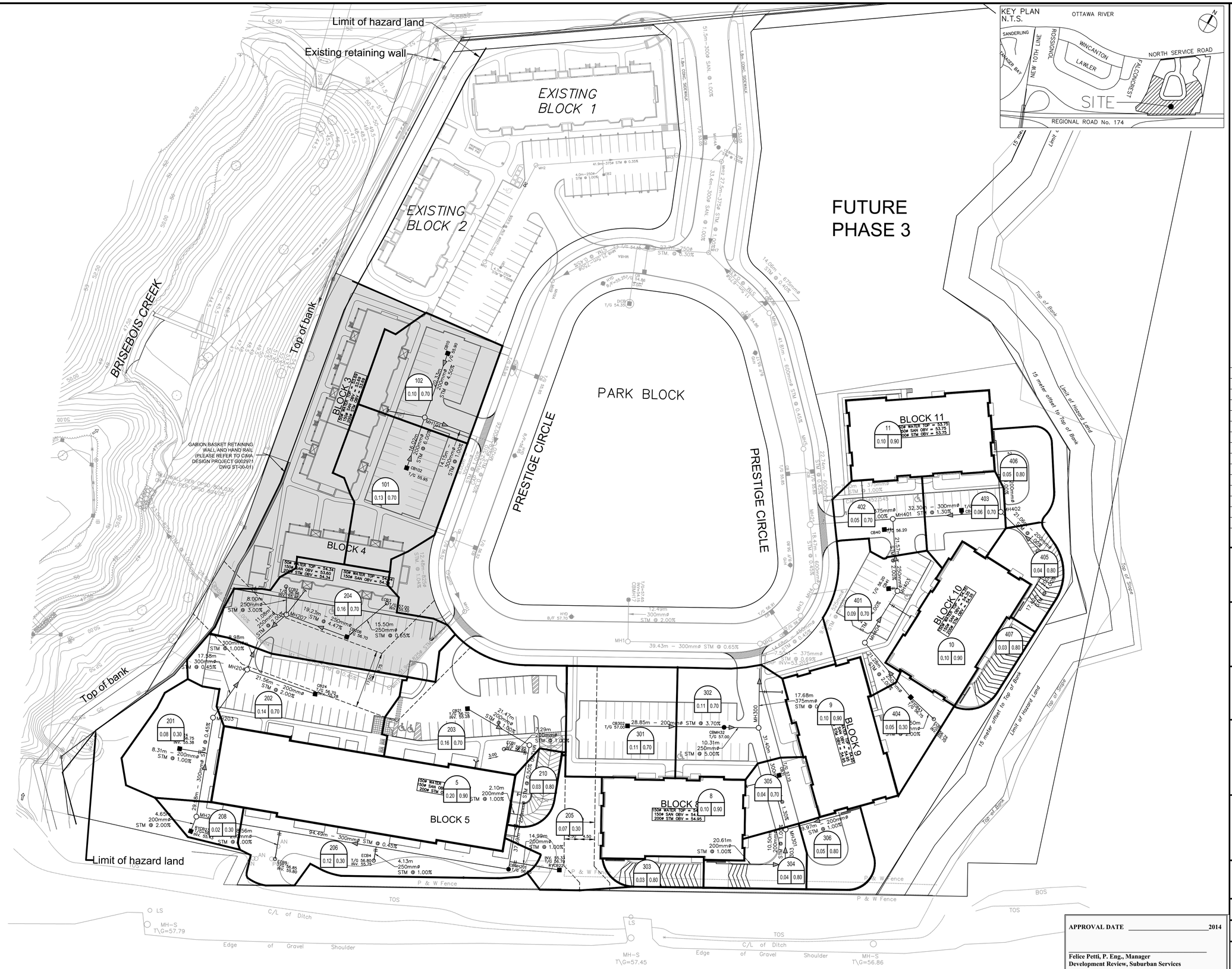
PROJECT: PETRIE'S LANDING II - PHASE 2
LOCATION: CITY OF OTTAWA
DEVELOPER: BRIGIL PLATINUM

JOB: 31464.5.7
DATE: 2013-11-28
DESIGN: RPK

		AREA (Ha)									DESIGN FLOW							SEWER DATA						
FROM MH	TO MH	C= 0.10	C= 0.20	C= 0.30	C= 0.70	C= 0.75	C= 0.80	C= 0.90	INDIV. 2.78AC	CUM. 2.78AC	INLET (min)	TIME IN PIPE	TOTAL	$i_{5\text{-year}}$ (mm/hr)	$i_{100\text{-year}}$ (mm/hr)	PEAK FLOW (L/s) IND	PEAK FLOW (L/s) TOTAL	CAP. (L/s)	LENGTH (m)	PIPE (mm)	SLOPE (%)	n	VEL. (m/s)	AVAIL. CAP. (%)
MH 200	CBMH 201								*0.00*	0.35	15.24			82.80		**28.98**	**28.98**							
									0.00	0.07	15.24	0.72	15.96		141.60	**9.91**	**38.89**	**43.88**	37.59	250	0.50	0.013	0.87	11.37%
CBMH 201	MH 202								*0.00*	0.35	15.96			80.60		**28.21**	**28.21**							
				0.120					*0.10*	0.17	15.96	1.70	17.66		137.80	**23.43**	**51.64**	**67.64**	94.49	300	0.45	0.013	0.93	23.66%
RYCB 23	MH 202			0.020					*0.02*	0.02	15.00	0.05	15.05	83.60		**1.67**	**1.67**	**48.38**	4.65	200	2.00	0.013	1.49	96.54%
RYCB 24	MH 202			0.080					*0.07*	0.07	15.00	0.13	15.13	83.60		**5.85**	**5.85**	**34.21**	8.31	200	1.00	0.013	1.06	82.90%
MH 202	MH 203								*0.00*	0.44	17.66			75.80		**33.35**	**33.35**							
									0.00	0.17	17.66	0.54	18.20		129.60	**22.03**	**55.38**	**67.64**	29.98	300	0.45	0.013	0.93	18.12%
MH 203	MH 204								*0.00*	0.44	18.20			74.50		**32.78**	**32.78**							
									0.00	0.17	18.20	0.32	18.51		127.20	**21.62**	**54.40**	**67.64**	17.58	300	0.45	0.013	0.93	19.57%
CB 24	MH 204				0.140				*0.27*	0.27	10.00	0.24	10.24	104.20		**28.13**	**28.13**	**48.38**	21.56	200	2.00	0.013	1.49	41.85%
MH 204	*MH 14*								*0.00*	0.71	18.51			73.70		**52.33**	**52.33**							
									0.00	0.17	18.51	0.11	18.62		125.90	**21.40**	**73.73**	**100.91**	8.98	300	1.00	0.013	1.38	26.94%
CB 206	MH 207				0.210				*0.41*	0.41	10.00	0.14	10.14	104.20		**42.72**	**42.72**	**72.35**	19.23	200	4.47	0.013	2.23	40.95%
MH 207	*MH 14*								*0.00*	0.41	10.14	0.11	10.25	103.40		**42.39**	**42.39**	**87.71**	11.08	250	2.00	0.013	1.73	51.67%
MH 14	*MH 15*								*0.00*	*8.08*	*19.32*			*71.80*		***580.14***	***580.14***							
									0.00	*0.71*	*19.32*	*0.18*	*19.50*		122.60	***87.05***	***667.19***	***1,519.67***	*29.14*	*825*	*1.03*	*0.013*	*2.75*	56.10%
MH 15	*HW*								*0.00*	*8.08*	*19.50*			*71.40*		***576.91***	***576.91***							
									0.00	*0.71*	*19.50*	*0.18*	*19.68*		121.90	***86.55***	***663.46***	***1,519.67***	*29.14*	*825*	*1.03*	*0.013*	*2.75*	56.34%
		0.360	**0.270**	**0.360**	**1.910**	**1.510**	**0.270**	**0.400**		**9.02**														

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

I=998.071/(TC+6.053)^0.814



LEGEND :

406 | 0.03 | 0.80 — AREA IDENTIFICATION; RUNOFF COEFFICIENT; AREA IN HECTARES

MAJOR FLOW ROUTE

MINOR FLOW ROUTE

No.	REVISIONS	By	Date
14			
13			
12			
11			
10			
9			
8	REVISED PER CITY COMMENTS	RPK	14: 02: 06
7	REVISED PER CITY COMMENTS	RPK	13: 11: 26
6	REVISED BLOCK 5	RPK	13: 08: 19
5	RE-ISSUED FOR SITE PLAN APPROVAL	TRB	12: 11: 19
4	RE-ISSUED FOR SITE PLAN APPROVAL	RPK	12: 10: 19
3	RE-ISSUED FOR SITE PLAN APPROVAL	RPK	12: 08: 27
2	ISSUED FOR SITE PLAN APPROVAL	RPK	12: 04: 12
1	ISSUED FOR REVIEW	RPK	12: 03: 07

LE GROUPE BRIGIL CONSTRUCTION

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

Project Title

PETRIE'S LANDING II

PHASE 2

LICENSED PROFESSIONAL ENGINEER
R.P. KENNEDY
100086 ?04
2014/02/06
PROVINCE OF ONTARIO

Drawing Title

STORM DRAINAGE AREA PLAN

Scale: 1:500

Design	Date
RPK	FEB. 2012
Drawn: DD	Checked: TRB
Project No.: 31464	Drawing No.: 500

APPROVAL DATE _____ 2014

Felice Petti, P. Eng., Manager
Development Review, Suburban Services

11.1 Brisbois Creek

11.1.1 Quantity Control

On-site detention storages consisting of parking lot and rooftop storage for all future commercial/business park developments are required to ensure that capacities of culverts at Hwy. 17 and the North Service Road are not exceeded. The release rate for the on-site storage is the 5 year post-development peak flow which is 150 l/s/ha. The required storage volume for quantity control is 160 m^3/ha.

For mitigation of possible reductions in baseflows, roof drains should be discharged on grassed areas or into a drainage pit. Recharge of approximately two-thirds of the yearly average rainfall from roof areas would be sufficient to balance hard surface recharge loss. During the detailed design, however, the natural groundwater baseflow from the surficial sands should be verified to assess what ultimate mitigation measures, if any, are required.

11.1.2 Quality Control

The storage volume for quality control required in the valley upstream of the NSR is 5,300 m^3. Figure 11.2 gives the stage-storage characteristics of the existing valley.

The proposed pond will have a permanent pool about 1.2 m deep near the outlet. The active storage volume for quality control of 5,300 m^3 is available at elevation 47.3 m. The outlet of the quality control storage is to be sized to give a detention time of 72 hours in accordance with MNR's guidelines.

To avoid excessive velocities through the pond, a 1.8 m x 3.5 m bypass sewer as shown in Figures 11.3 and 11.4 or an increase in the cross-sectional area of the pond (Figures D3.3 and D3.4) is proposed. The preferred option will be determined at the detailed design stage.

IBI GROUP
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

PROJECT: Petrie's Landing II - 2
DATE: 2013-11-28
FILE: 31464.5.7
REV #: 4
DESIGNED BY: RPK
CHECKED BY: TRB

STORMWATER MANAGEMENT

Formulas and Descriptions

i_{5yr} = 1:5 year Intensity = $998.071 / (T_c+6.053)^{0.814}$
i_{10yr} = 1:10 year Intensity = $1174.184 / (T_c+6.014)^{0.816}$
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

Site Area

Area =	2.91 Ha

Restricted Flowrate (based on "Servicing Design Brief - Petrie's Landing II" 2010-03-15)

$Q_{restricted}$ =	361.87 L/s

Uncontrolled Release (Q = 2.78CiA)
C = 0.30
100-year design flow
T_c = 20 min
$A_{uncontrolled}$ = 0.55 Ha

$Q_{uncontrolled}$ =	55.02 L/s

Garage Ramps (Q = 2.78CiA)
C = 0.80
100-year design flow
T_c = 10 min
A_{garage} = 0.27 Ha

Q_{garage} =	107.22 L/s

Maximum Allowable Release Rate
$Q_{max\ allowable} = Q_{restricted} - Q_{uncontrolled} - Q_{garage}$

$Q_{max\ allowable}$ =	199.62 L/s

Total Proposed Release Rate
(not including $Q_{uncontrolled} + Q_{garage}$)

$Q_{proposed}$ =	155.00 L/s

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

Drainage Area	***101***
Area (Ha)	0.130
C =	0.70

Restricted Flow Q_r (L/s)= 12.00

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)	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)	
10	178.56	45.17	12.00	33.17	19.90	2.5	173.95	44.01	12.00	32.01	4.80	
15	142.89	36.15	12.00	24.15	21.73	5	141.18	35.72	12.00	23.72	7.11	
20	119.95	30.35	12.00	18.35	22.01	7.5	119.59	30.25	12.00	18.25	8.21	
25	103.85	26.27	12.00	14.27	**21.41**	10	104.19	26.36	12.00	14.36	**8.62**	**Required Storage**
30	91.87	23.24	12.00	11.24	20.23	12.5	92.61	23.43	12.00	11.43	8.57	
35	82.58	20.89	12.00	8.89	18.67	15	83.56	21.14	12.00	9.14	8.22	
40	75.15	19.01	12.00	7.01	16.82	17.5	76.26	19.29	12.00	7.29	7.66	
45	69.05	17.47	12.00	5.47	14.76	20	70.25	17.77	12.00	5.77	6.93	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	21.41	31.74	0.00	overflows to Area 102

Drainage Area	***102***
Area (ha)	0.100
C =	0.70

Restricted Flow Q_r (L/s)= 12.00

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)	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	398.62	77.57	12.00	65.57	0.00	0	230.48	44.85	12.00	32.85	0.00	
5	242.70	47.23	12.00	35.23	10.57	2.5	173.95	33.85	12.00	21.85	3.28	
10	178.56	34.75	12.00	22.75	13.65	5	141.18	27.47	12.00	15.47	4.64	
15	142.89	27.81	12.00	15.81	**14.23**	7.5	119.59	23.27	12.00	11.27	**5.07**	**Required Storage**
20	119.95	23.34	12.00	11.34	13.61	10	104.19	20.28	12.00	8.28	4.97	
25	103.85	20.21	12.00	8.21	12.31	12.5	92.61	18.02	12.00	6.02	4.52	
30	91.87	17.88	12.00	5.88	10.58	15	83.56	16.26	12.00	4.26	3.83	
35	82.58	16.07	12.00	4.07	8.55	17.5	76.26	14.84	12.00	2.84	2.98	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	14.23	38.79	0.00	overflows to Prestige Circle

Drainage Area	***201***
Area (Ha)	0.080
C =	0.30

Restricted Flow Q_r (L/s)= 6.00

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)	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)	
7	211.67	14.12	6.00	8.12	3.41	2	182.69	12.19	6.00	6.19	0.74	
8	199.20	13.29	6.00	7.29	3.50	3	166.09	11.08	6.00	5.08	0.91	
9	188.25	12.56	6.00	6.56	3.54	4	152.51	10.18	6.00	4.18	1.00	
10	178.56	11.91	6.00	5.91	**3.55**	5	141.18	9.42	6.00	3.42	**1.03**	**Required Storage**
11	169.91	11.34	6.00	5.34	3.52	6	131.57	8.78	6.00	2.78	1.00	
12	162.13	10.82	6.00	4.82	3.47	7	123.30	8.23	6.00	2.23	0.94	
13	155.11	10.35	6.00	4.35	3.39	8	116.11	7.75	6.00	1.75	0.84	
14	148.72	9.92	6.00	3.92	3.30	9	109.79	7.33	6.00	1.33	0.72	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	3.55	27.91	0.00	overflows to Brisebois Creek

Drainage Area	**202**
Area (ha)	0.140
C =	0.70

Restricted Flow Q_r (L/s)= 15.00

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)	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	398.62	108.60	15.00	93.60	0.00	6	131.57	35.84	15.00	20.84	7.50	
5	242.70	66.12	15.00	51.12	15.34	7	123.30	33.59	15.00	18.59	7.81	
10	178.56	48.65	15.00	33.65	20.19	8	116.11	31.63	15.00	16.63	7.98	
15	142.89	38.93	15.00	23.93	**21.54**	9	109.79	29.91	15.00	14.91	**8.05**	**Required Storage**
20	119.95	32.68	15.00	17.68	21.22	10	104.19	28.39	15.00	13.39	8.03	
25	103.85	28.29	15.00	13.29	19.94	11	99.19	27.02	15.00	12.02	7.94	
30	91.87	25.03	15.00	10.03	18.05	12	94.70	25.80	15.00	10.80	7.78	
35	82.58	22.50	15.00	7.50	15.75	13	90.63	24.69	15.00	9.69	7.56	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	21.54	82.61	0.00	overflows to Area 203

Drainage Area	**203**
Area (ha)	0.160
C =	0.70

Restricted Flow Q_r (L/s)= 15.00

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)	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)	
5	242.70	75.57	15.00	60.57	18.17	2.5	173.95	54.16	15.00	39.16	5.87	
10	178.56	55.60	15.00	40.60	24.36	5	141.18	43.96	15.00	28.96	8.69	
15	142.89	44.49	15.00	29.49	26.54	7.5	119.59	37.23	15.00	22.23	10.01	
20	119.95	37.35	15.00	22.35	**26.82**	10	104.19	32.44	15.00	17.44	**10.46**	**Required Storage**
25	103.85	32.33	15.00	17.33	26.00	12.5	92.61	28.84	15.00	13.84	10.38	
30	91.87	28.60	15.00	13.60	24.49	15	83.56	26.02	15.00	11.02	9.91	
35	82.58	25.71	15.00	10.71	22.49	17.5	76.26	23.75	15.00	8.75	9.18	
40	75.15	23.40	15.00	8.40	20.15	20	70.25	21.87	15.00	6.87	8.25	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	26.82	67.07	0.00	overflows to Prestige Circle

Drainage Area	**204**
Area (ha)	0.160
C =	0.70

Restricted Flow Q_r (L/s)= 15.00

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)	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)	
5	242.70	75.57	15.00	60.57	18.17	8	116.11	36.15	15.00	21.15	10.15	
10	178.56	55.60	15.00	40.60	24.36	9	109.79	34.19	15.00	19.19	10.36	
15	142.89	44.49	15.00	29.49	26.54	10	104.19	32.44	15.00	17.44	10.46	
20	119.95	37.35	15.00	22.35	**26.82**	11	99.19	30.88	15.00	15.88	**10.48**	**Required Storage**
25	103.85	32.33	15.00	17.33	26.00	12	94.70	29.48	15.00	14.48	10.43	
30	91.87	28.60	15.00	13.60	24.49	13	90.63	28.22	15.00	13.22	10.31	
35	82.58	25.71	15.00	10.71	22.49	14	86.93	27.07	15.00	12.07	10.14	
40	75.15	23.40	15.00	8.40	20.15	15	83.56	26.02	15.00	11.02	9.91	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	26.82	102.49	0.00	overflows to Prestige Circle

Drainage Area	205
Area (ha)	0.070
C =	0.30

Restricted Flow Q_r (L/s)= 6.00

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)	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)	
5	242.70	14.17	6.00	8.17	2.45	1	203.51	11.88	6.00	5.88	0.35	
6	226.01	13.19	6.00	7.19	2.59	2	182.69	10.67	6.00	4.67	0.56	
7	211.67	12.36	6.00	6.36	2.67	3	166.09	9.70	6.00	3.70	0.67	
8	199.20	11.63	6.00	5.63	**2.70**	4	152.51	8.90	6.00	2.90	**0.70**	**Required Storage**
9	188.25	10.99	6.00	4.99	2.69	5	141.18	8.24	6.00	2.24	0.67	
10	178.56	10.42	6.00	4.42	2.65	6	131.57	7.68	6.00	1.68	0.61	
11	169.91	9.92	6.00	3.92	2.59	7	123.30	7.20	6.00	1.20	0.50	
12	162.13	9.47	6.00	3.47	2.50	8	116.11	6.78	6.00	0.78	0.37	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	2.70	4.26	0.00	overflows to ditch

Drainage Area	206
Area (ha)	0.120
C =	0.30

Restricted Flow Q_r (L/s)= 17.87 *

**** 100-year unrestricted flow collected rear yard perforated pipe network***

Drainage Area	208
Area (ha)	0.020
C =	0.30

Restricted Flow Q_r (L/s)= 6.00

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)	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	398.62	6.65	6.00	0.65	**0.00**	0	230.48	3.84	6.00	-2.16	**0.00**	**Required Storage**
1	351.38	5.86	6.00	-0.14	-0.01	1	203.51	3.39	6.00	-2.61	-0.16	
2	315.00	5.25	6.00	-0.75	-0.09	2	182.69	3.05	6.00	-2.95	-0.35	
3	286.05	4.77	6.00	-1.23	-0.22	3	166.09	2.77	6.00	-3.23	-0.58	
4	262.41	4.38	6.00	-1.62	-0.39	4	152.51	2.54	6.00	-3.46	-0.83	
5	242.70	4.05	6.00	-1.95	-0.59	5	141.18	2.35	6.00	-3.65	-1.09	
6	226.01	3.77	6.00	-2.23	-0.80	6	131.57	2.19	6.00	-3.81	-1.37	
7	211.67	3.53	6.00	-2.47	-1.04	7	123.30	2.06	6.00	-3.94	-1.66	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	0.00	4.41	0.00	overflows to ditch

Drainage Area	**305**
Area (ha)	0.040
C =	0.70

Restricted Flow Q_r (L/s)= 6.00

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)	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)	
5	242.70	18.89	6.00	12.89	3.87	3	166.09	12.93	6.00	6.93	1.25	
7.5	205.22	15.97	6.00	9.97	4.49	4	152.51	11.87	6.00	5.87	1.41	
10	178.56	13.90	6.00	7.90	4.74	5	141.18	10.99	6.00	4.99	1.50	
12.5	158.53	12.34	6.00	6.34	**4.76**	6	131.57	10.24	6.00	4.24	**1.53**	**Required Storage**
15	142.89	11.12	6.00	5.12	4.61	7	123.30	9.60	6.00	3.60	1.51	
17.5	130.31	10.14	6.00	4.14	4.35	8	116.11	9.04	6.00	3.04	1.46	
20	119.95	9.34	6.00	3.34	4.00	9	109.79	8.55	6.00	2.55	1.38	
22.5	111.26	8.66	6.00	2.66	3.59	10	104.19	8.11	6.00	2.11	1.27	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	4.76	24.70	0.00	overflows to Area 302

Drainage Area	**302**
Area (ha)	0.220
C =	0.70

Restricted Flow Q_r (L/s)= 20.00

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)	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)	
5	242.70	103.91	20.00	83.91	25.17	8	116.11	49.71	20.00	29.71	14.26	
10	178.56	76.44	20.00	56.44	33.87	9	109.79	47.00	20.00	27.00	14.58	
15	142.89	61.18	20.00	41.18	37.06	10	104.19	44.61	20.00	24.61	14.76	
20	119.95	51.35	20.00	31.35	**37.62**	11	99.19	42.47	20.00	22.47	**14.83**	**Required Storage**
25	103.85	44.46	20.00	24.46	36.69	12	94.70	40.54	20.00	20.54	14.79	
30	91.87	39.33	20.00	19.33	34.80	13	90.63	38.80	20.00	18.80	14.66	
35	82.58	35.35	20.00	15.35	32.24	14	86.93	37.22	20.00	17.22	14.46	
40	75.15	32.17	20.00	12.17	29.21	15	83.56	35.77	20.00	15.77	14.20	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	37.62	148.18	0.00	overflows to Prestige Circle

Drainage Area	**401**
Area (ha)	0.090
C =	0.70

Restricted Flow Q_r (L/s)= 12.00

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)	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	398.62	69.81	12.00	57.81	0.00	0	230.48	40.37	12.00	28.37	0.00	
5	242.70	42.51	12.00	30.51	9.15	2.5	173.95	30.47	12.00	18.47	2.77	
10	178.56	31.27	12.00	19.27	11.56	5	141.18	24.73	12.00	12.73	3.82	
15	142.89	25.03	12.00	13.03	**11.72**	7.5	119.59	20.94	12.00	8.94	**4.03**	**Required Storage**
20	119.95	21.01	12.00	9.01	10.81	10	104.19	18.25	12.00	6.25	3.75	
25	103.85	18.19	12.00	6.19	9.28	12.5	92.61	16.22	12.00	4.22	3.17	
30	91.87	16.09	12.00	4.09	7.36	15	83.56	14.63	12.00	2.63	2.37	
35	82.58	14.46	12.00	2.46	5.17	17.5	76.26	13.36	12.00	1.36	1.42	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	11.72	24.95	0.00	overflows to Area 402

Drainage Area	**403**
Area (ha)	0.060
C =	0.70

Restricted Flow Q_r (L/s)= 12.00

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)	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	398.62	46.54	12.00	34.54	0.00	1	203.51	23.76	12.00	11.76	0.71	
2.5	299.75	35.00	12.00	23.00	3.45	2	182.69	21.33	12.00	9.33	1.12	
5	242.70	28.34	12.00	16.34	4.90	3	166.09	19.39	12.00	7.39	1.33	
7.5	205.22	23.96	12.00	11.96	**5.38**	4	152.51	17.81	12.00	5.81	**1.39**	**Required Storage**
10	178.56	20.85	12.00	8.85	5.31	5	141.18	16.48	12.00	4.48	1.35	
12.5	158.53	18.51	12.00	6.51	4.88	6	131.57	15.36	12.00	3.36	1.21	
15	142.89	16.68	12.00	4.68	4.22	7	123.30	14.40	12.00	2.40	1.01	
17.5	130.31	15.22	12.00	3.22	3.38	8	116.11	13.56	12.00	1.56	0.75	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	5.38	24.95	0.00	overflows to Area 402

Drainage Area	**402**
Area (ha)	0.050
C =	0.70

Restricted Flow Q_r (L/s)= 12.00

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)	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	398.62	38.79	12.00	26.79	0.00	0	230.48	22.43	12.00	10.43	0.00	
2.5	299.75	29.17	12.00	17.17	2.57	1	203.51	19.80	12.00	7.80	0.47	
5	242.70	23.62	12.00	11.62	3.48	2	182.69	17.78	12.00	5.78	0.69	
7.5	205.22	19.97	12.00	7.97	**3.59**	3	166.09	16.16	12.00	4.16	**0.75**	**Required Storage**
10	178.56	17.37	12.00	5.37	3.22	4	152.51	14.84	12.00	2.84	0.68	
12.5	158.53	15.43	12.00	3.43	2.57	5	141.18	13.74	12.00	1.74	0.52	
15	142.89	13.90	12.00	1.90	1.71	6	131.57	12.80	12.00	0.80	0.29	
17.5	130.31	12.68	12.00	0.68	0.71	7	123.30	12.00	12.00	0.00	0.00	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	3.59	24.96	0.00	overflows to Prestige Circle

Drainage Area	**404**
Area (ha)	0.050
C =	0.30

Restricted Flow Q_r (L/s)= 6.00

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)	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)	
2	315.00	13.14	6.00	7.14	0.86	0	230.48	9.61	6.00	3.61	0.00	
3	286.05	11.93	6.00	5.93	1.07	1	203.51	8.49	6.00	2.49	0.15	
4	262.41	10.94	6.00	4.94	1.19	2	182.69	7.62	6.00	1.62	**0.19**	
5	242.70	10.12	6.00	4.12	**1.24**	3	166.09	6.93	6.00	0.93	0.17	**Required Storage**
6	226.01	9.42	6.00	3.42	1.23	4	152.51	6.36	6.00	0.36	0.09	
7	211.67	8.83	6.00	2.83	1.19	5	141.18	5.89	6.00	-0.11	-0.03	
8	199.20	8.31	6.00	2.31	1.11	6	131.57	5.49	6.00	-0.51	-0.18	
9	188.25	7.85	6.00	1.85	1.00	7	123.30	5.14	6.00	-0.86	-0.36	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	1.24	1.62	0.00	overflows to Creek

GARAGE RAMPS

Drainage Area	***210***		
Area (ha)	0.030		
C =	0.80	Restricted Flow Q_r (L/s)=	11.91 *

**** 100-year unrestricted flow collected by garage drain***

Drainage Area	***303***		
Area (ha)	0.030		
C =	0.80	Restricted Flow Q_r (L/s)=	11.91 *

**** 100-year unrestricted flow collected by garage drain***

Drainage Area	***304***		
Area (ha)	0.040		
C =	0.80	Restricted Flow Q_r (L/s)=	15.88 *

**** 100-year unrestricted flow collected by garage drain***

Drainage Area	***306***		
Area (ha)	0.050		
C =	0.80	Restricted Flow Q_r (L/s)=	19.86 *

**** 100-year unrestricted flow collected by garage drain***

Drainage Area	***405***		
Area (ha)	0.040		
C =	0.80	Restricted Flow Q_r (L/s)=	15.88 *

**** 100-year unrestricted flow collected by garage drain***

Drainage Area	***406***		
Area (ha)	0.050		
C =	0.80	Restricted Flow Q_r (L/s)=	19.86 *

**** 100-year unrestricted flow collected by garage drain***

Drainage Area	***407***		
Area (ha)	0.030		
C =	0.80	Restricted Flow Q_r (L/s)=	11.91 *

**** 100-year unrestricted flow collected by garage drain***

BUILDINGS

Building	***5***
Area (ha)	0.200
C =	0.90
Restricted Flow Q_r (L/s)=	20.00

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)	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)	
5	242.70	121.45	20.00	101.45	30.43	5	141.18	70.65	20.00	50.65	15.19	
10	178.56	89.35	20.00	69.35	41.61	7.5	119.59	59.84	20.00	39.84	17.93	
15	142.89	71.50	20.00	51.50	46.35	10	104.19	52.14	20.00	32.14	19.28	
20	119.95	60.02	20.00	40.02	**48.03**	12.5	92.61	46.34	20.00	26.34	**19.76**	**Required Storage**
25	103.85	51.97	20.00	31.97	47.95	15	83.56	41.81	20.00	21.81	19.63	
30	91.87	45.97	20.00	25.97	46.75	17.5	76.26	38.16	20.00	18.16	19.07	
35	82.58	41.32	20.00	21.32	44.78	20	70.25	35.15	20.00	15.15	18.18	
40	75.15	37.60	20.00	17.60	42.25	22.5	65.20	32.63	20.00	12.63	17.05	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	48.03	375.00	0.00	controlled on roof

Building	***8***
Area (ha)	0.100
C =	0.90
Restricted Flow Q_r (L/s)=	10.00

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)	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)	
5	242.70	60.72	10.00	50.72	15.22	5	141.18	35.32	10.00	25.32	7.60	
10	178.56	44.68	10.00	34.68	20.81	7.5	119.59	29.92	10.00	19.92	8.96	
15	142.89	35.75	10.00	25.75	23.18	10	104.19	26.07	10.00	16.07	9.64	
20	119.95	30.01	10.00	20.01	**24.01**	12.5	92.61	23.17	10.00	13.17	**9.88**	**Required Storage**
25	103.85	25.98	10.00	15.98	23.97	15	83.56	20.91	10.00	10.91	9.82	
30	91.87	22.99	10.00	12.99	23.37	17.5	76.26	19.08	10.00	9.08	9.54	
35	82.58	20.66	10.00	10.66	22.39	20	70.25	17.58	10.00	7.58	9.09	
40	75.15	18.80	10.00	8.80	21.12	22.5	65.20	16.31	10.00	6.31	8.52	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	24.01	168.75	0.00	controlled on roof

Building	***9***
Area (ha)	0.100
C =	0.90
Restricted Flow Q_r (L/s)=	10.00

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)	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)	
5	242.70	60.72	10.00	50.72	15.22	5	141.18	35.32	10.00	25.32	7.60	
10	178.56	44.68	10.00	34.68	20.81	7.5	119.59	29.92	10.00	19.92	8.96	
15	142.89	35.75	10.00	25.75	23.18	10	104.19	26.07	10.00	16.07	9.64	
20	119.95	30.01	10.00	20.01	**24.01**	12.5	92.61	23.17	10.00	13.17	**9.88**	**Required Storage**
25	103.85	25.98	10.00	15.98	23.97	15	83.56	20.91	10.00	10.91	9.82	
30	91.87	22.99	10.00	12.99	23.37	17.5	76.26	19.08	10.00	9.08	9.54	
35	82.58	20.66	10.00	10.66	22.39	20	70.25	17.58	10.00	7.58	9.09	
40	75.15	18.80	10.00	8.80	21.12	22.5	65.20	16.31	10.00	6.31	8.52	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	24.01	168.75	0.00	controlled on roof

Building	10										
Area (ha)	0.100										
C =	0.90	Restricted Flow Q_r (L/s)=		10.00							

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)	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)	
5	242.70	60.72	10.00	50.72	15.22	5	141.18	35.32	10.00	25.32	7.60	
10	178.56	44.68	10.00	34.68	20.81	7.5	119.59	29.92	10.00	19.92	8.96	
15	142.89	35.75	10.00	25.75	23.18	10	104.19	26.07	10.00	16.07	9.64	
20	119.95	30.01	10.00	20.01	**24.01**	12.5	92.61	23.17	10.00	13.17	**9.88**	**Required Storage**
25	103.85	25.98	10.00	15.98	23.97	15	83.56	20.91	10.00	10.91	9.82	
30	91.87	22.99	10.00	12.99	23.37	17.5	76.26	19.08	10.00	9.08	9.54	
35	82.58	20.66	10.00	10.66	22.39	20	70.25	17.58	10.00	7.58	9.09	
40	75.15	18.80	10.00	8.80	21.12	22.5	65.20	16.31	10.00	6.31	8.52	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	24.01	168.75	0.00	controlled on roof

Building	11										
Area (ha)	0.100										
C =	0.90	Restricted Flow Q_r (L/s)=		10.00							

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)	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)	
5	242.70	60.72	10.00	50.72	15.22	5	141.18	35.32	10.00	25.32	7.60	
10	178.56	44.68	10.00	34.68	20.81	7.5	119.59	29.92	10.00	19.92	8.96	
15	142.89	35.75	10.00	25.75	23.18	10	104.19	26.07	10.00	16.07	9.64	
20	119.95	30.01	10.00	20.01	**24.01**	12.5	92.61	23.17	10.00	13.17	**9.88**	**Required Storage**
25	103.85	25.98	10.00	15.98	23.97	15	83.56	20.91	10.00	10.91	9.82	
30	91.87	22.99	10.00	12.99	23.37	17.5	76.26	19.08	10.00	9.08	9.54	
35	82.58	20.66	10.00	10.66	22.39	20	70.25	17.58	10.00	7.58	9.09	
40	75.15	18.80	10.00	8.80	21.12	22.5	65.20	16.31	10.00	6.31	8.52	

Storage (m^3)

Overflow	Required	Available	Balance	
0.00	24.01	168.75	0.00	controlled on roof

Appendix F PROPOSED SITE PLAN (FEBRUARY, 2022)

Appendix A

PL2 Stage 2: R5A[1409] Zoning Compliance Chart

Site Plan : 112 units - BLOCK 8, 180 Prestige Circle

Applicable sections from Bylaw 2008-250	Requirement	Provided
Assumes that Jeanne d'Arc Boulevard is front lot line and the corner lot line is along Prestige Circle.		
Property area Block 8		**7,476.5 m²**
Table 164A - Apartment dwelling, low rise, Stacked		
Minimum Lot Width (m)	18.0	> 18.0 m
Minimum Lot Area (m²)	540.0 m²	> 540 m²
Maximum Building Height (storeys) - exception R5A[1409]	10	4
Minimum Front Yard Setback (m)	N/A m	N/A m
Minimum Corner Yard Setback (m)	4.5 m	4.5 m
Minimum Interior Side Yard Setback (m)	N/A m	N/A m
Minimum Rear Yard Setback (m) - exception R5A[1409]	7.5 m	>7,5 m
Minimum Setback from Jeanne d'Arc Boulevard (m) - exception R5A[1409]	10.0 m	>10 m
Minimum distance between apartment dwellings under 7 storeys and OS1 zone (m)	7.5 m	>7,5 m
Minimum required building spacing - exception R5A[1409]	3.0	> 3,0 m
City of Ottawa Zoning By-law 2021-277 amends Exception 1409		
Number of units provided		112.0 units
Area in ha		0.75765 ha
Max. number of units	150.0 /ha	147.8 /ha
Section 163(9)		
Mimum landscape area (% of site)	30.0%	47.2%
Section 101 and 102		
Minum No. of parking spaces (total)	(ratio = 1.2) = 134	137
Minum No. of visitor parking spaces (total)	(ratio = 0.2) = 22	22
Total Parking (visitor and residential)	156	159
Section 106		
Parking space width (m) per section 106 (3)(a)ii...applicable to 50% of resident spaces	2.4 min	2.4 min
Parking space width (m)	2.6 min 2.75 max	2.6
Minimum parking space depth (m)	5.2	5.2
Section 107		
Driveway access : min width (m) one way	3.0 m	n.a m
Driveway access : min width (m) two way	6.0 m	6.7 m
Section 110		
Minimum landcape area of parking lot (15%)	15 %	35.4%
Minimum landscape buffer width of parking lot not abutting street (m)	1.5 m	1.5 m
...1.5 if fewer than 100 spaces; 3 meters if more than 100 spaces	1.5/3 m	3.0 m
Minimum landscape buffer width of parking lot abutting street (m)	3.0 m	3.0 m
Section 111		
Bicycle Parking Space Requirement (Total)	(ratio =0.5) = 56	56
Section 137		
Total amenity area in sq. m per unit (min 6m²/unit)	672.0	3029.0 m²
**Communal amenity area: 50% of total required 'total amenity area' in sq.m. (Total)	336.00	403.0 m²
		**ground floor common areas
Section 55 (Accessory Buildings)		
Min. Required Setback from an Int. Side Lot Line or Rear Lot Line not abutting a street		
...rear yard (m)	0.6 m	>0,6 m

Échelle/Scale 1:250

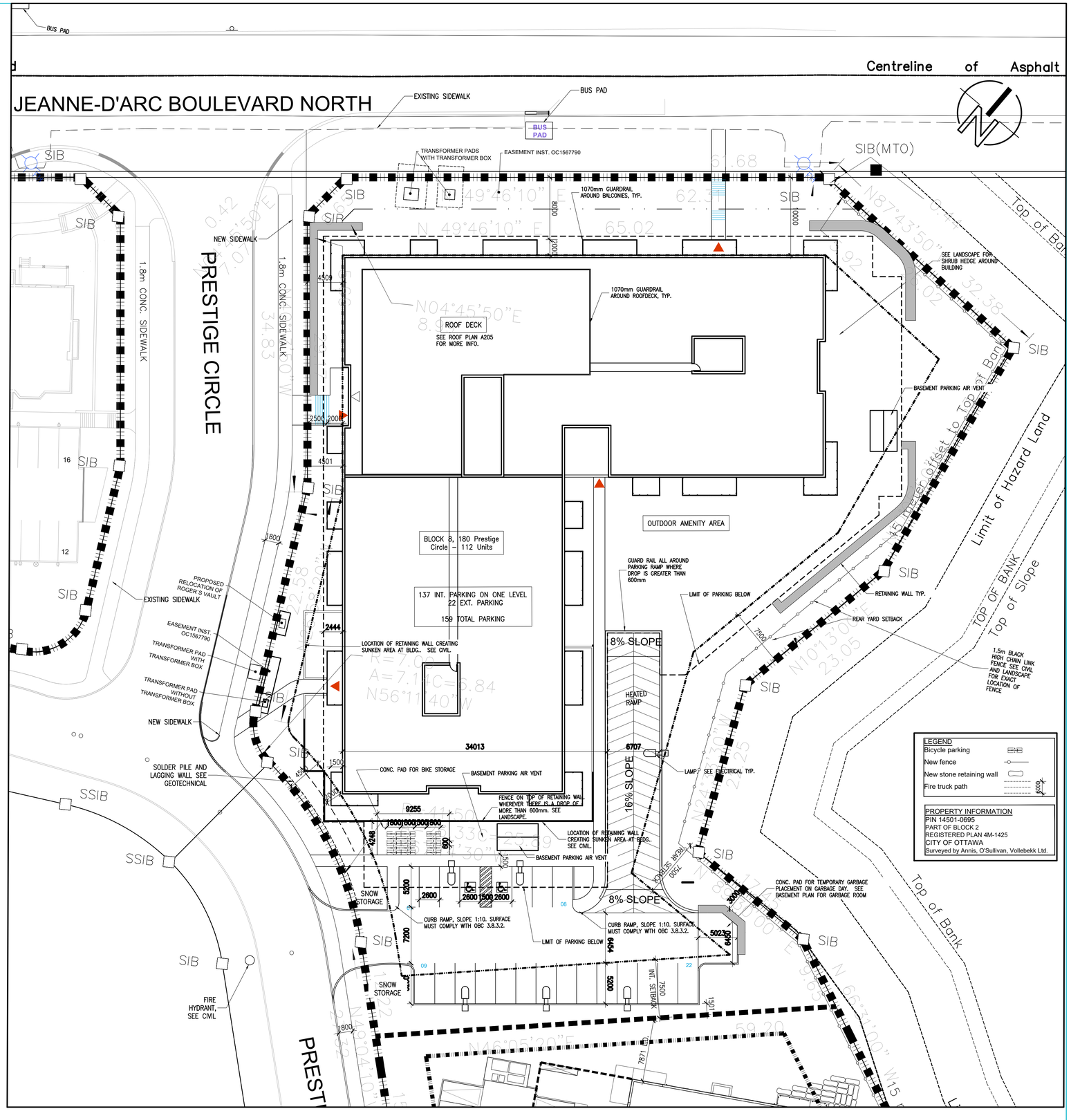
0 1 5 10 15 20 25 m

0 5 25 50 75 pi/ft

LEGEND

PROPERTY LINE

BOUNDRY OF PHASES



SITE PLAN BLOCK 8

SCALE: 1:250

1 A100c

NOTES GÉNÉRALES General Notes

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3. Veuillez aviser l'architecte de toute dimension erreur etlou divergences entre ces documents et ceux des autres professionnels. / The architect must be notified of all errors, omissions and discrepancies between these documents and those of other professionnals.
4. Les dimensions sur ces documents doivent être lues et non mesurées. / The dimensions on these documents must be read and not measured.

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SCEAU Seal

ONTARIO ASSOCIATION OF ARCHITECTS MICHEL COUSINEAU LICENCE 6219

NEUF ARCHITECT(E)S

BRIGIL

CLIENT Client

OUVRAGE Project 120 Prestige Circle

PETRIE'S LANDING BLOCK 8

EMPLACEMENT Location: ORLEANS, ON

NO PROJET No.: 10498.03

LEGAL DISCRIPTION OF PROPERTY

Part 3 Plan 4R-31527

Also know as Part of Block 2 Plan 4M-1425

NO	REVISION	DATE (aa.mm.jj)
A	City Block 8 SPA	2021-04-15
B	Issue to City	2021-06-10
C	ISSUED FOR PERMIT (Cancelled)	2021-08-30
D	ISSUED TO BRIGIL	2021-09-16
E	ISSUED FOR SPA	2021-09-23
F	FOR FULL BUILDING PERMIT	2021-10-01
G	ISSUED FOR SPA	2021-10-05
H	ISSUED FOR TENDER	2021-10-15
I	ISSUED FOR SPA 4th	2022-01-14----
J	ISSUED FOR SPA 5TH REV.	2022-02-07----

DESSINÉ PAR Drawn by: P. MCQ.

VÉRIFIÉ PAR Checked by: P. MCQ.

DATE (aa.mm.jj): 22.02.07

ÉCHELLE Scale: INDIQUÉE

TITRE DU DESSIN Drawing Title

Site Plan Block 8

RÉVISION Revision: G

NO. DESSIN Dwg Number: A100c

CITY OF OTTAWA SPA FILE NUMBER: D07-12-19-0212

#18062

I:\P_10400\10498.03\CAD\10498003_A100_Site_Plan.dwg

Appendix G CITY COMMENTS AND RESPONSE LETTER

G.1 CITY COMMENTS AND RESPONSE LETTER FOR 3RD SUBMISSION (FEBRUARY 2022)

City comments and response letter for 3rd Submission (February 2022

Stantec Consulting Ltd.
300 - 1331 Clyde Avenue, Ottawa ON K2C 3G4

February 18, 2022
File: 160401331

Attention: Will Curry
Project Manager
Development Review, East Branch

Reference: Site Plan Control Approval Application – Response to 3rd Submission
9403434 Canada Inc. (Brigil)
8466 Jeanne d'Arc Boulevard (180 Prestige Circle)

Please find below response to comments provided November 9, 2021.

Review of submitted plans

A. List of Drawing(s):

Site Plan Block 8, A100c, prepared by Neuf Architects, revision F, dated October 5, 2021.

A1. Remove the proposed location(s) for snow storage on the sloped areas as this will cause erosion to the creek bank during the melting season. The City owns and maintains these creek banks. Please revise

- **R/ Site plan has been revised accordingly by architect.**

A2. Please place **120 Prestige Circle** in the Title Block of the Plan, under Site Plan Block 8.

- **R/ Site plan has been revised accordingly by architect.**

A3. Please provide a proper Property (legible) line for Block 8 and include within the Legend. Revise please.

- **R/ Site plan has been revised accordingly by architect.**

A4. If there are doors in the sunken patio areas, please show them.

- **R/ Please refer to Architectural plan.**

A5. Do you propose fences on the sunken area walls. Review and revise.

- **R/ Please refer to Architectural plan.**

Roof Plan, A205, prepared by Neuf Architects, revision D, dated September 23, 2021.

A6. No Comments.

- **R/ No action**

Notes and Legends, NL-1, prepared by Stantec Consulting Ltd., revision 2, dated September 20, 2021.

A7. The referenced Geotech report in the note has a more current date.
Please revise

- **R/ Revised to latest Geotech report dated October 1, 2021.**

Reference: Site Plan Control Approval Application – Response to 3rd Submission
9403434 Canada Inc. (**Brigil)**
8466 Jeanne d'Arc Boulevard (180 Prestige Circle)

Site Servicing Plan, **SSP-1,** prepared by Stantec Consulting Ltd., revision 2, dated September 20, 2021.

A8. Storage pipe Detail: It is unclear what you are attempting to do here with 2-200 mm Ø pipes connected to a 900mm Ø pipe. You need a structure where Pipe sizes change. Revise or better, redesign.

- **R/ The lower pipe provides drainage and the upper pipe provides an air release. The end of the Boss Pipe is now connected to a MH. Please refer to Detail on Site servicing plan for this storage Pipe Detail. This is a private site and this structure will be maintained by the owner.**

A9. How does the Sunken patio areas drain? Do they drain internally. Are there doors located there? Show please.

- **R/ Sunken Patio areas drain internally into the building mechanical and form part of building. Refer to Mechanical / Architectural for details.**

A10. You need a sanitary MH on the mainline sewer because your pipe connecting is greater than ½ Ø of the mainline pipe. Otherwise try to connect to MH6A if you can make it work. Revise.

- **R/ 1200mm dia MH has been proposed.**

A11. Is it STM1002 or STM 1002b as per the ICD table. Revise please.

- **R/ Please see revised ICD table.**

A12. The Siamese connection: Fire services requires it at grade and not located in a sunken area. You may require a stand-alone vertical standpipe risers out of the ground in front of the sunken area. Resolve please.

- **R/ Unobstructed access to the fire department connection has been provided.**

A13. Can we change the name of the CB Parking Deck to Deck CB ?

- **R/ Name revised.**

Grading Plan, GP-1, prepared by Stantec Consulting Ltd., revision 2, dated September 20, 2021

A14. You show 100-year spilling to the Creek. This is the opposite of what the City of Ottawa Sewer Design Guidelines says. **All flow depth must be controlled on-site. For events greater than 100 years, spillage must be directed to a public ROW.** Also, these Blocks were part of an earlier Subdivision and the Agreement stipulates the same. This comment has been repeated with each submission. We the City rehabilitated the banks in 2004-2005 due to extensive slope erosion and we don't wish to redo them any time soon. If water sheet flows there from when it falls from the sky on the sloped banks, fine, but do not design or direct water there if above 100-year. Please revise.

- **R/ Design has been revised. The Proposed Stormwater Management system and site captures all flows up to the 100-year storm event. The top of parking ramp elevation has been adjusted and the parking area regraded. 0.3m freeboard has been met. Emergency overland flow is directed to the ROW.**

A15. Show the % slope from the stairs on the walkway out to Prestige Circle. Revise.

- **R/ Slopes have been added.**

Reference: Site Plan Control Approval Application – Response to 3rd Submission
9403434 Canada Inc. (**Brigil)**
8466 Jeanne d'Arc Boulevard (180 Prestige Circle)

A16. Show running slopes, % slopes on the Walkway next to the Car Ramp all the way to the Entrance door. Revise

- **R/ Slopes are shown.**

A17. Fence locations are to also be shown on the grading plan. Do you propose a fence on the concrete wall of the sunken area, so persons do not fall into the sunken area? Stand next to the bike rack at 55.26 but the sunken area is 54.30. BCS will require a fence or railing per code on top of the wall as the difference is greater than 600mm. Revise.

- **R/ Architect to review Treatments at Window wells and sunken patio areas. Notes have been added on the grading plan indicating railings are required. Railings are shown on the wall.**

A18. Due to your existing fixed elevations near the sidewalk in the ROW you will have to consider a lot more subsurface storage to be 300mm below the RAMP HP or the created HP. If you intend to create an artificial HP then it must be 300mm higher than the spill point into the ROW. Info.

- **R/ See revised design.**

A19. In all scenarios this must occur as per the City of Ottawa Sewer Design Guidelines:

1. The maximum ponding elevation must be 300mm lower than FFE (door openings) including ramps. In this case it is the ramp HP & wall of the sunken areas.

- **R/ Design has been revised. 0.3m freeboard over max ponding elevation has been provided.**

2. 100-year flows must spill to the ROW.

- **R/ 100year peak flows are being captured on site. Only Emergency overland flows for the site are directed to the right of way.**

A20. 2 arrows wrongly shown at the HP Split in the asphalt area. I think you should remove the arrow(s) at that location unless your intent is the water spill over the HP Split also. If you show a HP spilt, we don't need to see arrows there. Revise.

- **R/ Arrows have been removed.**

A21. Your HP Split elevation of 54.97 replaces the RAMP HP however it is not 300mm above the max ponding. A standard requirement. Revise.

- **R/ See revised design.**

A22. Curb near CB1002B could have a much higher wall or curb to prevent flows from spilling to the creek as per your arrow and you could also have more underground storage. You are not permitted to direct water to the creek.

- **R/ See revised design.**

A23. Remove the Curb Cut-out allowing water to spill to the creek. Consider raising that entire curb area to 600mm for vehicle and person safety just due to the slopes on the other side. Revise.

- **R/ See revised design.**

Reference: Site Plan Control Approval Application – Response to 3rd Submission
9403434 Canada Inc. (**Brigil)**
8466 Jeanne d'Arc Boulevard (180 Prestige Circle)

A24. Your CB Parking Deck with T/G of 53.93 – Just don't show the Major Overland Flow Arrow at this location, only because it appears sheet flow will occur. Remove it. Revise.

- **R/ Major emergency overland arrow has been removed.**

A25. Do you have doors in the Sunken Areas? Please show/revise. Architect to provide response

- **R/ Refer to Architectural drawings.**

Sanitary Drainage Plan, SAN-1, prepared by Stantec Consulting Ltd., revision 2, dated September 20, 2021

A26. No comments.

- **R/ Noted.**

Storm Drainage Plan, SD-1, prepared by Stantec Consulting Ltd., revision 2, dated September 20, 2021

A27. Where are the uncontrolled Roof areas as per the table in the report?

- **R-Uncontrolled roof areas are shown as R1001B and R1001C and they are the sunken patio areas. A note has been added to the drawing to clarify.**

A28. Take the firewall line off this plan as it confuses areas. Revise-

- **R/ Firewall line removed from SD-1 plan.**

A29. Your UNC-1 area should include the ramp and Parking Roof Deck as it goes inside and then discharges but it is not controlled. Revise.

- **R/ Area UNC-1 refers to the site area sheet flowing uncontrolled to the surrounding areas and bypassing the storm sewer. Please note that peak flows from this area have been included in the overall SWM calculations (i.e., included in the actual site release rate calculations). Peak flows from uncontrolled building areas are named differently because they enter the building plumbing system and are discharged into the proposed storm sewer system uncontrolled. Please note that peak flows from these areas have been included in the overall SWM calculations (i.e., included in the actual site release rate calculations). Please refer to the servicing and stormwater management report for details. These areas are accounted for in the overall site release rate calculations as shown in Table 5 and Table 6 of the report.**

A30. Sunken areas are they controlled? How as I am guessing they drain internally like the ramp? Are they at door entry elevation?

- **R/ Sunken areas are drained through the building plumbing. A note has been added to the drawing to clarify. Please refer to the servicing and stormwater management report for details.**

A31. Are there doors in the sunken areas?

- **R/ No. See architectural drawings.**

A32. R1002C and R1002B as per the Report says the roof areas are uncontrolled. Assuming there is a walking area under the roof of these 2 delineated areas what are they controlled or uncontrolled? Revise.

- **R/ See previous responses (27 and 29).**

Reference: Site Plan Control Approval Application – Response to 3rd Submission
9403434 Canada Inc. (**Brigil)**
8466 Jeanne d'Arc Boulevard (180 Prestige Circle)

A33. What is your pipe storage volume shown on the plan?

- **R/ Boss Pipe Storage volume will be shown on Plan. Storage for this Catchment F1001A has been shown in SSP-1 as 12.72 cubic meters.**

Erosion Control Plan and Detail Sheet, EC/DS-1, prepared by Stantec Consulting Ltd., revision 2, dated September 20, 2021

A34. No comments

- **R/ Noted**

Landscape Plan, L1.01, prepared by Levstek Consultants Inc., revision 4, dated September 29, 2021

A34. No comments.

- **R/ Noted**

Redi-rock Retaining Wall Design (RR1), PG4112-3, prepared by Paterson Group., dated September 1, 2021

A34. No comments.

- **R/ Noted**

Redi-rock Retaining Wall Design (RR2), PG4112-4, prepared by Paterson Group., dated September 1, 2021

A34. No comments.

- **R/ Noted**

Redi-rock Retaining Wall Design (RR3), PG4112-5, prepared by Paterson Group., dated September 1, 2021

A34. No comments.

- **R/ Noted**

Redi-rock Retaining Wall Design (RR3), PG4112-6, prepared by Paterson Group., dated September 1, 2021

A34. No comments.

- **R/ Noted**

B. List of Report(s):

Site Servicing & Storm Water Management Brief, prepared by Stantec Consulting Ltd., Project # 160401331, dated 21 September 2021

Reference: Site Plan Control Approval Application – Response to 3rd Submission
9403434 Canada Inc. (**Brigil)**
8466 Jeanne d'Arc Boulevard (180 Prestige Circle)

B1. Revise the report to reflect the requested changes made with drawings.

- **R/ Noted**

B2. Once you make all the revisions to the report, please check each and every Appendix reference in this report as you continue to reference them, but they are all wrong. Also, your list of Appendices is completely wrong and maybe you should fix this first. Please revise.

- **R/ Report and Appendices have been revised based on revised design and have been double checked for accuracy.**

B3. Consultant's response: "*Due to the size restrictions, the drawings (Appendix H) are not attached to the report and are submitted separately as individual PDF's which should be reviewed in conjunction with the servicing report*." This response is unacceptable. Every other consultant submitting to the City performs this adequately so I can't understand why it cannot be done here. You must include the plans in the Appendix of this report. Revise.

- **R/ The drawings and appendix were submitted as part of the package to review by City Staff.**

B4. Remove the Geotech report from this document. We file these reports in separate locations, digitally.

- **R/ The Geotech report is part of the appendix and is typically submitted within Servicing and Stormwater Management Reports.**

B5. Your drawings show 25.99 total in Controlled Flows leaving the site in 100-year. What does the report say? Please check and revise once you revise/fix your controls in the report.

- **R/ A detailed breakdown of the controlled and uncontrolled peak flows is provided in the report.**

B6. If you have uncontrolled Roof areas, show them on the Storm Drainage Plan; unclear why you have Table 6 with roof uncontrolled and controlled lumped together. Please separate.

- **R/ The tables have been revised to outline controlled roof area, and uncontrolled patio, deck and ramp areas that will be serviced through the building's internal plumbing.**

B7. You should review your delineation of your catchment areas and controlled versus uncontrolled. Review and revise.

- **R/ Area UNC-1 has been delineated as one lumped catchment to represent the uncontrolled area, not tributary to the storm system, sheet draining onto adjacent lands. All other areas tributary to the storm sewer system have been discretized and included in the calculations. Additional notes have been added to the calculations, report and drawings to clarify which areas are uncontrolled and directed to the storm system, and which areas provide storage and release rate attenuation.**

B8. You identified the target release rate of 99.5 L/s taken from a previous Stantec and IBI report. That was a predetermined Release Rate for something similar but not as currently submitted. It was the target release rate originally for Block 8. It is not the permitted Release Rate for this Site. What I would like you to do for this Site is demonstrate that you have calculated the release rate for the site and then subtract the uncontrolled areas to produce your actual permitted Site Release Rate. Please revise.

Reference: Site Plan Control Approval Application – Response to 3rd Submission
9403434 Canada Inc. (**Brigil)**
8466 Jeanne d'Arc Boulevard (180 Prestige Circle)

- **R/ The 99.5 L/s was the target release rate from this block from IBI background report and Stantec's report from 2018 which included this block which was approved. Please refer to Table 6 in the report, which outlines the Estimated Discharge from the site including all uncontrolled areas.**

B9. Table 4 should include F1002C R1002B, R1002C, F1002D and UNC-1. Revise

- **R/ Table 4 outlines uncontrolled areas not tributary to the storm system. Additional rows have been added to Tables 5 and 6 to outline uncontrolled and controlled catchments tributary to the storm system.**

B10. Tables 5 & 6 need not show uncontrolled areas if you have them in table 4. Revise

- **R/ All areas are included in Tables 5 and 6.**

B11. Section 5.3.6 states **49.1 L/s and 105.0 L/s for 2-year and 100-year** as Release rates based upon Tables 4, 5 & 6. If we assumed 49.1 and 105 were actually correct as you say, then you need to take those values and subtract the uncontrolled. As example only using your numbers.

49 -13 Uncontrolled = 36 L/s 2-year

105.0 -37.6 Uncontrolled =67.4 L/s for 100-year
In this example, I only use your numbers based upon your math to demonstrate the **permitted Site Release** rates are different than your rates. Please revise. Revise your Release rates

- **R/ The permitted site release rate is 99.5L/s, this includes both controlled and uncontrolled storm run-off from the site. The values for controlled release have been slightly modified to account for minor changes to the Stormwater drainage plan. The calculations and report have been broken down further to include all individual catchments separately for clarity.**

B12. **F1002B:** With the proposed use of above and below ground stormwater storage, there are two options for how you can complete the stormwater volume storage calculations. When both underground and above ground storage are utilized, the release rate from the system will significantly differ than when solely one level storage is being used (i.e., greater range of head vs smaller change of head during storm event). SWM calculations using the modified rational method is acceptable, however, if a combination of surface ponding and underground storage is used, then (a) use a dynamic computer model or (b) use the modified rational method assuming an average release rate of 50% of the area-specific peak flow rate where above and below ground storage is provided. Please revise.

- **R/ The Rational method has been used in all previous submissions for the proposed Phase 8, as well as all previous phases which also included surface and underground storage. Assuming an arbitrary average release rate of 50% of the area-specific peak flow rate will result in a completely different SWM plan from what has been submitted previously. Stantec will not be revising the SWM plan, with potential building implications, at this stage of the design.**

B13. Section 6.0 says "Site grading has been established to provide emergency overland flow routes for stormwater management in accordance with City of Ottawa requirements". This is a false statement as you

Reference: Site Plan Control Approval Application – Response to 3rd Submission
9403434 Canada Inc. (**Brigil)**
8466 Jeanne d'Arc Boulevard (180 Prestige Circle)

repeatedly propose major surface discharge to the creek. In addition to previous discussions that occurred about this topic it does not conform to the SDG.

- **R/ The grading plan has been revised to convey emergency overland flows to Prestige Circle. This statement has been revised to indicate the emergency overland flow above the 100 year will be directed to the ROW as per revised design.**

B14. Section 11.4 says further geotechnical recommendations will be included in the next submission. Such as? Was the memo not provided with this submission? Revise.

- **R/ The memo was not provided when the report was submitted. This statement has been removed from report. An extract of the supplemental Geotech report has been added to the revised servicing report. A separate copy will be provided to the City. In addition to soil condition, groundwater, pavement structures and foundation requirements. It provides the recommendations on tree planting restrictions.**

B15. It is unclear why the Geotechnical report is embedded within the SWM report. The City files it solely as a separate document in a different location. Remove it please.

- **R/ Geotech report is attached as an appendix as it is referred to in the SWM report. Geotech will also be submitted as a separate file.**

B16. Section 8 & 11.6 says RVCA approvals are required. That correspondence should be included within this report.

- **R/ Permit will be requested through RVCA.**

Grading Plan Review, Memorandum, prepared by Paterson Group, dated September 20, 2021.

B17. No Comments.

- **R/ Noted**

Geotechnical Investigation – Proposed Multi-Story Buildings, prepared by Paterson Group, Project # PG4112-2, dated July 30, 2019.

B18. No Comments.

- **R/ Noted**

"Please provide a resubmission which addresses each of the comments or issues listed above.

Grading Plan (Stantec 20Sept2021) – the same issues from previous round are still outstanding.

B19. The grading plan impacts trees and their critical root zones (CRZ) in the setback area. Please ensure grading does not extend into and avoids impacts on the trees and their CRZ identified in Fig.4 of the TCR. Illustrate the CRZ (from the TCR) on the grading plan and ensure they are excluded from grading changes, and that grading must meet existing grades at the CRZs.

R/ Trees and Critical root zones (CRZ) are now identified in grading plan.

Reference: Site Plan Control Approval Application – Response to 3rd Submission
9403434 Canada Inc. (**Brigil)**
8466 Jeanne d'Arc Boulevard (180 Prestige Circle)

B20. The grading plan does not illustrate the permanent turtle exclusion fencing, as outlined in the EIS (pg42). Illustrate the location and extent of the fencing. Please ensure that grading does not impact the fencing and that any grade changes meet existing grade at the fencing.

- **R/The chain link fence will double as the permanent turtle exclusion fencing. Grading will not impact the design of the fence. For fencing details, please see on landscape drawing L1.01, detail 2, prepared by Levstek Consultants Inc.**

B21. Grading is not permitted in the SAR Category 2 habitat, as prescribed by the EIS, Fig 6. Please illustrate the habitat limits on the grading plan and ensure "all grading will be outside of these limits" (p28). Comment response.

- **R/ The environmental consultant is presently working with the MECP for grading and installation within the Category 2 Habitat lands.**

Regards,

STANTEC CONSULTING LTD.

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Senior Associate
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Appendix H DRAWINGS

GENERAL NOTES AND SPECIFICATIONS

1. ALL MATERIALS AND CONSTRUCTION METHODS TO BE IN ACCORDANCE WITH OPS AND CITY OF OTTAWA STANDARD SPECIFICATIONS AND DRAWINGS AND OPSD SUPPLEMENT. ONTARIO PROVINCIAL STANDARDS WILL APPLY WHERE NO CITY STANDARDS ARE AVAILABLE.
2. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL PERMITS REQUIRED AND BEAR COST OF SAME INCLUDING WATER PERMIT AND ASSOCIATED COSTS.
3. SERVICE AND UTILITY LOCATIONS ARE APPROXIMATE. CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF EXISTING SERVICES AND UTILITIES PRIOR TO CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING LOCATES FROM ALL UTILITY COMPANIES TO LOCATE EXISTING UTILITIES PRIOR TO EXCAVATION. THE CONTRACTOR IS RESPONSIBLE FOR PROTECTION AND REINSTATEMENT.
4. ALL DISTURBED AREAS SHALL BE REINSTATED TO EQUAL OR BETTER CONDITION TO THE SATISFACTION OF THE ENGINEER & THE CITY. PAVEMENT REINSTATEMENT FOR SERVICE AND UTILITY CUTS SHALL BE IN ACCORDANCE WITH OPSD 509.010 AND OPSS 310.
5. ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE "OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATION FOR CONSTRUCTION PROJECTS". THE GENERAL CONTRACTOR SHALL BE DEEMED TO BE THE CONSTRUCTOR AS DEFINED IN THE ACT.
6. THE CONTRACTOR SHALL SUBMIT AN EROSION AND SEDIMENTATION CONTROL PLAN THAT WILL IMPLEMENT BEST MANAGEMENT PRACTICES TO PROVIDE PROTECTION FOR RECEIVING STORM SEWERS OR DRAINAGE DURING CONSTRUCTION ACTIVITIES. THIS PLAN SHALL INCLUDE BUT NOT BE LIMITED TO CATCH BASINS INSERTS, STRAW BALE CHECK DAMS AND SEDIMENT CONTROLS AROUND ALL DISTURBED AREAS, DEWATERING SHALL BE PUMPED INTO SEDIMENT TRAPS.
7. SITE PLAN PREPARED BY NEUF ARCHITECT(E)S. DATED 2021-01-28, DRAWING A-100, PROJECT No. 10498.03.
8. TOPOGRAPHIC SURVEY SUPPLIED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD. PROJECT No.19921-20. TOPOGRAPHIC SKETCH TO ILLUSTRATE ELEVATIONS AND UTILITY INSTALLATIONS AT JEANNE D'ARC BOUELVARD NORTH & PRESTIGE CIRCLE INTERSECTION, CITY OF OTTAWA AND PROJECT No.16109-15. PART OF BLOCK 2, REGISTERED PLAN 4M-1425, CITY OF OTTAWA.
9. REFER TO LANDSCAPE ARCHITECTURE PLAN FOR ALL LANDSCAPING FEATURES (ie. TREES, WALKWAYS, PARK DETAILS, NOISE BARRIERS, FENCES etc.)
10. GEOTECHNICAL INVESTIGATION PROPOSED MULTI-STOREY BUILDING, BLOCK 8 - PETRIE'S LANDING II, 8466 JEANNE D'ARC BOULEVARD OTTAWA, ONTARIO,. PREPARED BY PATERSON GROUP INC, DATED OCTOBER 1, 2021. REPORT No PG4112-2 REVISION 3. GEOTECHNICAL INFORMATION PRESENTED ON THESE DRAWINGS MAY BE INTERPOLATED FROM THE ORIGINAL REPORT. REFER TO ORIGINAL GEOTECHNICAL REPORT FOR ADDITIONAL DETAILS AND TO VERIFY ASSUMPTIONS MADE HEREIN.
11. STREET LIGHTING TO CITY OF OTTAWA STANDARDS.
12. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED. DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO ENGINEER.
13. THERE WILL BE NO SUBSTITUTION OF MATERIALS UNLESS PRIOR WRITTEN APPROVAL BY THE CONTRACT ADMINISTRATOR AND DIRECTOR OF ENGINEERING HAS BEEN OBTAINED.
14. HERITAGE OPERATIONS UNIT OF THE ONTARIO MINISTRY OF CULTURE TO BE NOTIFIED IF DEEPLY BURRIED ARCHEOLOGICAL REMAINS ARE FOUND ON THE PROPERTY DURING CONSTRUCTION ACTIVITIES.

ROADWORKS

1. ALL TOPSOIL AND ORGANIC MATERIAL TO BE STRIPPED FROM WITHIN THE FULL RIGHT OF WAY PRIOR TO CONSTRUCTION.
2. SUB-EXCAVATE SOFT AREAS & FILL WITH GRANULAR 'B' COMPACTED IN 0.30m LAYERS.
3. ALL GRANULAR FOR ROADS SHALL BE COMPACTED TO A MINIMUM OF 98% STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD).
4. ROAD SUBDRAINS SHALL BE CONSTRUCTED AS PER CITY OF OTTAWA STANDARD R1.
5. ASPHALT WEAR COURSE SHALL NOT BE PLACED UNTIL THE VIDEO INSPECTION OF SEWERS & NECESSARY REPAIRS HAVE BEEN CARRIED OUT TO THE SATISFACTION OF THE CONSULTANT.
6. CONTRACTOR TO OBTAIN A ROAD OCCUPANCY PERMIT 48 HOURS PRIOR TO COMMENCING ANY WORK WITHIN THE MUNICIPAL ROAD ALLOWANCE IF REQUIRED BY THE MUNICIPALITY. ALL WORK ON THE MUNICIPAL RIGHT OF WAY AND EASEMENTS TO BE INSPECTED BY THE MUNICIPALITY PRIOR TO BACKFILLING.
7. PAVEMENT REINSTATEMENT FOR SERVICE AND UTILITY CUTS SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA STANDARD R10, AND OPSD 509.010, AND OPSS 310.
8. CONCRETE CURBS SHALL BE CONSTRUCTED AS PER CITY STANDARD SC1.1 AND SC1.3 (BARRIER OR MOUNTABLE CURB AS SHOWN ON DRAWINGS).
9. CONCRETE SIDEWALKS SHALL BE CONSTRUCTED AS PER CITY STANDARDS SC3 AND SC1.4.
10. PAVEMENT CONSTRUCTION AS PER GEOTECHNICAL INVESTIGATION PROPOSED MULTI-STOREY BUILDING, BLOCK 8 - PETRIE'S LANDING II, 8466 JEANNE D'ARC BOULEVARD OTTAWA, ONTARIO,. PREPARED BY PATERSON GROUP INC. DATED OCTOBER 1, 2021. REPORT No PG4112-2 REVISION 3.

    HEAVY DUTY ASPHALT
    40mm HL3 OR SUPERPAVE 12.5 ASPHALTIC CONCRETE
    50mm HL8 OR SUPERPAVE 19.0 ASPHALTIC CONCRETE
    150mm OPSS GRANULAR A BASE
    450mm OPSS GRANULAR B TYPE II

    LIGHT DUTY AREAS
    50mm HL3 OR SUPERPAVE 12.5 ASPHALTIC CONCRETE
    150 OPSS GRANULAR 'A' BASE
    300 OPSS GRANULAR 'B' TYPE II

WATER SUPPLY SERVICING

10. THE CONTRACTOR SHALL CONSTRUCT WATERMAIN, WATER SERVICES, CONNECTIONS & APPURTENANCES AS PER CITY OF OTTAWA SPECIFICATIONS & SHALL CO-ORDINATE AND PAY ALL RELATED COSTS INCLUDING THE COST OF CONNECTION, INSPECTION & DISINFECTION BY CITY PERSONNEL.
11. WATERMAIN PIPE MATERIAL SHALL BE PVC CL.150 DR18. DEFLECTION OF WATERMAIN PIPE IS NOT TO EXCEED 1/2 OF THAT SPECIFIED BY THE MANUFACTURER. PVC WATERMAINS TO BE INSTALLED WITH TRACER WIRE IN ACCORDANCE WITH CITY OF OTTAWA STANDARD W36.
12. WATER SERVICES ARE TO BE TYPE K SOFT COPPER AS PER CITY OF OTTAWA STANDARD W26 (UNLESS OTHERWISE NOTED). WATER SERVICE TO EXTEND 1.0M BEYOND PROPERTY LINE. STAND POST TO BE INSTALLED AT PROPERTY LINE.
13. FIRE HYDRANTS TO BE INSTALLED AS PER CITY OF OTTAWA STANDARDS W18 AND W19.
14. WATER VALVES TO BE INSTALLED AS PER CITY OF OTTAWA STANDARD W24.
15. WATERMAIN TRENCH SHALL BE IN ACCORDANCE WITH CITY OF OTTAWA STD. W17 UNLESS OTHERWISE SPECIFIED. BEDDING AND COVER MATERIAL AS PER SECTION 6.4 OF THE GEOTECH REPORT.
16. SERVICE CONNECTIONS SHALL BE INSTALLED A MINIMUM OF 2400mm FROM ANY CATCHBASIN, MANHOLE, OR OBJECT THAT MAY CONTRIBUTE TO FREEZING. THERMAL INSULATION SHALL BE INSTALLED ON ALL PROPOSED CB'S ON THE WIM STREET SIDE WHERE 2400mm SEPARATION CANNOT BE ACHIEVED.(AS PER CITY OF OTTAWA W22 & W23)
17. CATHODIC PROTECTION TO BE SUPPLIED ON METALLIC FITTINGS AS PER CITY OF OTTAWA W40 AND W42.
18. THRUST BLOCKS TO BE INSTALLED AS PER CITY OF OTTAWA STANDARDS W25.3 AND W25.4.
19. WATERMAIN TO HAVE MIN. 2.4m COVER. WHERE WATERMAIN COVER IS LESS THAN 2.4m, INSULATION TO BE SUPPLIED IN ACCORDANCE WITH CITY STANDARD W22.
20. WATERMAIN CROSSINGS ABOVE AND BELOW SEWERS TO BE INSTALLED AS PER CITY OF OTTAWA STANDARD W25 AND W25.2.
21. PRESSURE REDUCING VALVES (PRV'S) IF REQUIRED, TO BE INSTALLED AS PER ONTARIO PLUMBING CODE.

STORM AND SANITARY SEWERS

1. SANITARY SEWERS 375mm DIA. OR SMALLER SHALL BE PVC DR35. SANITARY SEWERS LARGER THAN 375mm SHALL BE CONCRETE CSA A 257.2 CLASS 100D AS PER OPSD 807.010.
2. STORM SEWERS 375mm DIA. OR SMALLER SHALL BE PVC DR35. STORM SEWERS LARGER THAN 375mm DIA. SHALL BE CONCRETE CSA A 257.2 CLASS 100-D AS PER OPSD 807.010
3. ALL STORM AND SANITARY SEWER BEDDING SHALL BE INSTALLED AS PER SECTION 6.4 OF THE GEOTECH REPORT.
4. STORM AND SANITARY MANHOLES SHALL BE 1200mm DIAMETER IN ACCORDANCE WITH OPSD-701.01 (UNLESS OTHERWISE NOTED) c/w FRAME AND COVER AS PER CITY OF OTTAWA S24, S24.1, AND S25 WHERE APPLICABLE. CATCH BASIN MANHOLE FRAME AND COVERS PER S25 AND S28.1. ALL STORM MANHOLES WITH SEWERS 900mm DIA SEWERS AND OVER IN SIZE SHALL BE BENCHED, ALL OTHER STORM MANHOLES SHALL BE COMPLETED WITH 300mm SUMPS AS PER CITY STANDARDS. SANITARY MANHOLES SHALL NOT HAVE SUMPS.
5. ALL SEWERS CONSTRUCTED WITH GRADES 0.50% OR LESS, TO BE INSTALLED WITH LASER AND CHECKED WITH LEVEL INSTRUMENT PRIOR TO BACKFILLING.
6. FOR STORM SEWER INSTALLATION (EXCLUDING CB LEADS) THE MINIMUM DEPTH OF COVER OVER THE CROWN OF THE SEWER IS 2.0m. FOR SANITARY SEWERS THE MINIMUM DEPTH OF COVER IS 2.5m OVER PIPE OBVERT.
7. ALL STORM AND SANITARY SERVICES TO BE EQUIPPED WITH APPROVED BACKWATER VALVES.
8. STORM AND SANITARY SERVICE LATERALS TO BE SDR 28 INSTALLED AT MIN. 1.0% SLOPE.
9. CATCH BASINS SHALL BE INSTALLED IN ACCORDANCE WITH CITY STANDARDS S1, S2, S3 c/w FRAME AND GRATE AS PER S19. CURB INLET FRAME AND GRATE PER S22 AND S23. CATCH BASIN MANHOLES FRAME AND GRATE AS PER S25 FRAME AND S28.1 COVER, PROVIDE 150mm ADJUSTED SPACERS. ALL CATCH BASINS SHALL HAVE SUMPS (600mm DEEP). STREET CATCH BASIN LEADS SHALL BE 200mm DIA.(MIN) PVC DR 35 AT 1.0% GRADE WHERE NOT OTHERWISE SHOWN ON PLAN. CATCH BASINS WILL BE INSTALLED WITH INLET CONTROL DEVICES (ICD) AS PER ICD SCHEDULE ON STORM DRAINAGE PLAN.
10. STREET CATCH BASINS TO BE INSTALLED c/w SUBDRAINS 3m LONG IN FOUR ORTHOGONAL DIRECTIONS OR LONGITUDINALLY WHEN PLACED ALONG A CURB, AND AT AN ELEVATION OF 300mm BELOW SUBGRADE LEVEL.
11. REAR LOT PERFORATED PIPE TO BE INSTALLED AS PER CITY OF OTTAWA STANDARDS S29. REAR LOT STRUCTURES TO BE INSTALLED AS PER CITY OF OTTAWA STANDARD W30 AND W31.
12. CLAY SEALS TO BE INSTALLED AS PER CITY STANDARD DRAWING S8. THE SEALS SHOULD BE AT LEAST 1.5m LONG (IN THE TRENCH DIRECTION) AND SHOULD EXTEND FROM TRENCH WALL TO TRENCH WALL. GENERALLY, THE SEALS SHOULD EXTEND FROM THE FROST LINE AND FULLY PENETRATE THE BEDDING, SUBBEDDING AND COVER MATERIAL. THE BARRIERS SHOULD CONSIST OF RELATIVELY DRY AND COMPACTABLE BROWN SILTY CLAY PLACED IN MAXIMUM 225mm THICK LOOSE LAYERS COMPACTED TO A MINIMUM OF 95% OF THE MATERIAL'S SPMDD. THE CLAY SEALS SHOULD BE PLACED AT THE SITE BOUNDARIES AND AT STRATEGIC LOCATIONS AT NO MORE THAN 60m INTERVALS IN THE SERVICE TRENCHES. FOR DETAILS REFER TO GEOTECHNICAL INVESTIGATION .
13. GRANULAR "A" SHALL BE PLACED TO A MINIMUM THICKNESS OF 300 mm AROUND ALL STRUCTURES WITHIN PAVEMENT AREA AND COMPACTED TO A MINIMUM OF 98% STANDARD PROCTOR DENSITY.
14. CONTRACTOR SHALL PERFORM LEAKAGE TESTING, IN THE PRESENCE OF THE CONSULTANT, FOR SANITARY SEWERS IN ACCORDANCE WITH OPSS 410 AND OPSS 407. CONTRACTOR SHALL PERFORM VIDEO INSPECTION OF ALL STORM AND SANITARY SEWERS. A COPY OF THE VIDEO AND INSPECTION REPORT SHALL BE SUBMITTED TO THE CONSULTANT FOR REVIEW.
15. ANY SEWER ABANDONMENT TO BE CONDUCTED ACCORDING TO CITY OF OTTAWA STANDARD S11.4
16. SEWERS WITH LESS THAN 1.5m COVER TO BE INSULATED IN ACCORDANCE WITH CITY STANDARD W22.

GRADING

1. ALL GRANULAR BASE & SUB BASE COURSE MATERIALS SHALL BE COMPACTED TO 98% STANDARD PROCTOR MAX. DRY DENSITY.
2. SUB-EXCAVATE SOFT AREAS & FILL WITH GRANULAR 'B' COMPACTED IN 0.15m LAYERS.
3. ALL DISTURBED GRASSED AREAS SHALL BE RESTORED TO ORIGINAL CONDITION OR BETTER, WITH SOD ON MIN. 100mm TOPSOIL. THE RELOCATION OF TREES AND SHRUBS SHALL BE SUBJECT TO APPROVAL BY THE PROJECT LANDSCAPE ARCHITECT OR ENGINEER.
4. 100 YEAR PONDING DEPTH TO BE 0.30m (MAXIMUM).
5. EMBANKMENTS TO BE SLOPED AT MIN. 3:1, UNLESS OTHERWISE SPECIFIED.
6. ALL SWALES TO BE MIN. 0.15m DEEP WITH MIN. 3:1 SIDE SLOPES UNLESS OTHERWISE NOTED. THE MINIMUM LONGITUDINAL SLOPE TO BE 1.5% OR 1.0% WHEN PERFORATED SUBDRAIN IS INSTALLED.
7. ALL ROOF DOWNSPOUTS TO DISCHARGE TO THE GROUND ONTO SPLASH PADS AND SHALL NOT BE DIRECTED TO THE STORM SEWER , OR THE BUILDING FOUNDATION DRAIN.
8. TOP OF GRATE (T/G) ELEVATIONS FOR ALL STREET CATCHBASINS SHOWN ON PLANS. REFER TO THE ELEVATION AT EDGE OF PAVEMENT, OR GUTTERLINE WHERE APPLICABLE.
9. ALL RETAINING WALLS GREATER THAN 1.0m IN HEIGHT ARE TO BE DESIGNED, APPROVED, AND STAMPED BY STRUCTURAL ENGINEER.
10. FENCES OR RAILINGS ARE REQUIRED FOR RETAINING WALLS GREATER THAN 0.60m IN HEIGHT.
11. EXCESS EXCAVATED MATERIAL SHALL BE REMOVED FROM THE SITE.
12. ALL NECESSARY CLEARING AND GRUBBING SHALL BE COMPLETED BY THE CONTRACTOR. REVIEW WITH CONTRACT ADMINISTRATOR AND THE CITY OF OTTAWA PRIOR TO TREE CUTTING.
13. REFER TO DRAWING EC DS-1 FOR EROSION AND SEDIMENT CONTROL DETAILS.

Best Management Practices

CONTRACTOR TO PROVIDE EROSION AND SEDIMENT CONTROLS (BEST MANAGEMENT PRACTICES) DURING CONSTRUCTION OF THIS PROJECT.

EROSION MUST BE MINIMIZED AND SEDIMENTS MUST BE REMOVED FROM CONSTRUCTION SITE RUN-OFF IN ORDER TO PROTECT DOWNSTREAM AREAS. DURING ALL CONSTRUCTION, EROSION AND SEDIMENTATION SHOULD BE CONTROLLED BY THE FOLLOWING TECHNIQUES:

1. LIMIT THE EXTENT OF EXPOSED SOILS AT ANY GIVEN TIME.
2. REVEGETATE EXPOSED AREAS AND SLOPES AS SOON AS POSSIBLE.
3. MINIMIZE AREA TO BE CLEARED AND GRUBBED.
4. PROTECT EXPOSED SLOPES WITH PLASTIC OR SYNTHETIC MULCHES.
5. INSTALL CATCH BASIN INSERTS OR EQUIVALENT IN ALL PROPOSED CATCH BASINS AND CATCH BASIN MANHOLES AND IN ALL EXISTING CATCH BASINS THAT WILL RECEIVE RUN-OFF FROM THE SITE.
6. A SILT FENCE SHALL BE INSTALLED AROUND THE PERIMETER OF ALL AND ANY STOCKPILES OF MATERIAL TO BE USED OR REMOVED FROM SITE. (LOCATION TO BE DETERMINED)
7. A VISUAL INSPECTION SHALL BE DONE DAILY ON SEDIMENT CONTROL MEASURES AND CLEANED OF ANY ACCUMULATED SILT AS REQUIRED. THE DEPOSITS WILL BE DISPOSED OFF SITE AS PER THE REQUIREMENTS OF THE CONTRACT.
8. SEDIMENT CONTROL BARRIERS MAY ONLY BE REMOVED TEMPORARILY WITH APPROVAL OF CONTRACT ADMINISTRATOR TO ACCOMMODATE CONSTRUCTION OPERATIONS. ALL AFFECTED BARRIERS MUST BE REINSTATED AT NIGHT WHEN CONSTRUCTION IS COMPLETED. NO REMOVAL WILL OCCUR IF THERE IS A SIGNIFICANT RAINFALL EVENT ANTICIPATED (>10mm) UNLESS A NEW DEVICE HAS BEEN INSTALLED TO PROTECT EXISTING STORM AND SANITARY SEWER SYSTEMS, OR DOWNSTREAM WATERCOURSES.
9. NO REFUELING OR CLEANING OF EQUIPMENT IS PERMITTED NEAR ANY EXISTING WATERWAY.
10. CONTRACTOR SHALL REMOVE SEDIMENT CONTROL MEASURES WHEN, IN THE OPINION OF THE CONTRACT ADMINISTRATOR, THE MEASURE(S) IS NO LONGER REQUIRED. NO CONTROL MEASURES SHALL BE PERMANENTLEY REMOVED WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE CONTRACT ADMINISTRATOR.
11. THE CONTRACTOR SHALL PERIODICALLY, OR WHEN REQUESTED BY THE CONTRACT ADMINISTRATOR, CLEAN OUT ACCUMULATED SEDIMENTS AS REQUIRED.
12. THE CONTRACTOR SHALL IMMEDIATELY REPORT TO THE ENGINEER ANY ACCIDENTAL DISCHARGES OF SEDIMENT MATERIAL INTO THE WATERCOURSE. APPROPRIATE RESPONSE MEASURES, INCLUDING ANY REPAIRS TO EXISTING CONTROL MEASURES OR THE IMPLEMENTATION OF ADDITIONAL CONTROL MEASURES, SHALL BE CARRIED OUT BY THE CONTRACTOR WITHOUT DELAY.
13. CONTRACTOR SHALL INSTALL MUD MATS AT BOTH ENTRANCES TO THE SITE.
14. STORMWATER SWALES TO BE COVERED WITH HYDRO-SEED AND MULCH.

LEGEND

SERVICES

- PROPOSED WATERMAIN
- PROPOSED VALVE AND VALVE BOX
- PROPOSED VALVE CHAMBER
- PROPOSED REDUCER
- PROPOSED FIRE HYDRANT
- PROPOSED WATER METER
- PROPOSED REMOTE WATER METER
- PROPOSED PRESSURE REDUCING VALVE
- PROPOSED SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED SUBDRAIN CATCHBASIN
- EXISTING WATERMAIN
- EXISTING VALVE AND VALVE BOX
- EXISTING VALVE CHAMBER
- EXISTING REDUCER
- EXISTING FIRE HYDRANT
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING CATCHBASIN MANHOLE
- EXISTING CATCHBASIN
- EXISTING SUBDRAIN CATCHBASIN
- FUTURE WATERMAIN
- FUTURE VALVE AND VALVE BOX
- FUTURE VALVE CHAMBER
- FUTURE REDUCER
- FUTURE FIRE HYDRANT
- FUTURE SANITARY SEWER
- FUTURE STORM SEWER
- FUTURE CATCHBASIN MANHOLE
- FUTURE CATCHBASIN
- FUTURE SUBDRAIN CATCHBASIN
- PROPOSED DEPRESSED CURB LOCATIONS
- PROPOSED MOUNTABLE/BARRIER CURB LOCATION
- THERMAL INSULATION ON STORM SEWER WHERE COVER IS LESS THAN 1.5m. THERMAL INSULATION ON WATERMAIN WHERE COVER IS LESS THAN 2.4m AS PER W22.

SANITARY DRAINAGE

- SAN 1 / 0.38 COM — SANITARY DRAINAGE AREA ID# / COMMERCIAL OR INSTITUTIONAL FLOW RATES USED
- SANITARY DRAINAGE AREA ha.
- SANITARY DRAINAGE AREA
- PROPOSED SANITARY SEWER

EROSION CONTROL

- PROPOSED SILT FENCE BOUNDARY AS PER OPSD 219.110
- PROPOSED SILT FENCE BOUNDARY AS PER OPSD 219.130
- PROPOSED CONSTRUCTION FENCING
- PROPOSED MUD MAT LOCATION
- PROPOSED CATCH BASIN PROTECTION AS PER TERRAFIX SILTSACK DETAIL.
- PROPOSED CATCH BASIN MH PROTECTION AS PER FLEX STORM INLET FILTERS DETAIL. ITEM CODE P-RD-240-223-FX

GRADING

- ORIGINAL GROUND ELEVATION
- PROPOSED ELEVATION
- PROPOSED LOT CORNER ELEVATION / EXISTING ELEVATION AT LOT CORNER
- 2.0% — FLOW DIRECTION AND GRADE
- FFE=99.99 — FINISHED FIRST FLOOR ELEVATION
- E.R. — ENGINEERED FILL REQUIRED
- 3:1 — TERRACING 3:1 SLOPE MAXIMUM (UNLESS OTHERWISE SHOWN)
- PROPOSED SWALE
- DIRECTION OF OVERLAND FLOW
- PROPOSED VALVE BOX
- PROPOSED VALVE CHAMBER
- PROPOSED FIRE HYDRANT
- PROPOSED SANITARY SEWER MANHOLE
- PROPOSED STORM SEWER MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED CATCHBASIN 'T'
- CATCHBASIN TO BE INSTALLED WITH IPEX TYPE A OR EQUIVALENT 22.0L/S.
- CATCHBASIN TO BE INSTALLED WITH IPEX TYPE B OR EQUIVALENT 33.0L/S.
- CATCHBASIN TO BE INSTALLED WITH CIRCULAR ORIFICE (SEE DWG S0-1)
- CATCHBASINS TO BE INTERCONNECTED
- D.C. — PROPOSED DEPRESSED CURB LOCATION
- BARRIER CURB / MOUNTABLE CURB — PROPOSED MOUNTABLE/BARRIER CURB LOCATIONS
- 1.8m HIGH CHAIN LINK FENCE
- MAXIMUM PONDING LIMITS

STORM DRAINAGE

- BLDG / 1.00 / 0.90 — AREA ID / RUNOFF COEFFICIENT
- STORM DRAINAGE AREA ha.
- STORM DRAINAGE BOUNDARY
- MAXIMUM PONDING LIMITS
- DIRECTION OF OVERLAND FLOW
- PROPOSED STORM SEWER
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED DOUBLE CATCH BASIN
- PROPOSED SUB DRAIN CATCH BASIN AS PER CITY OF OTTAWA STANDARD DETAIL DRAWINGS L10 AND L11.
- PROPOSED PERFORATED SUBDRAIN
- EXISTING STORM SEWER
- EXISTING CATCHBASIN MANHOLE
- EXISTING CATCHBASIN
- EXISTING SUBDRAIN CATCHBASIN
- FUTURE STORM SEWER
- FUTURE CATCHBASIN MANHOLE
- FUTURE CATCHBASIN
- FUTURE SUBDRAIN CATCHBASIN

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Legend

Notes

1. PROPOSED BUILDINGS TO BE EQUIPPED WITH BACKWATER VALVES.
2. PROPOSED TRENCH DRAINS TO BE DESIGNED TO CAPTURE 100 YEAR PEAK FLOWS.

4	REVISED AS PER CITY COMMENTS	MJS	AMP	22.02.16
3	ISSUED FOR TENDER	MJS	KH	21.10.01
2	REVISED AS PER CITY COMMENTS	MJS	TR	21.09.20
1	REVISED AS PER NEW SITE PLAN AND CITY COMMENTS	MJS	AMP	21.03.24
0	ISSUED FOR SPA	MJS	AMP	19.12.13
Revision		By	Appd.	YY.MM.DD
File Name: 160401331 DB2.dwg		MJS	AMP	MJS 19.06.20
		Dwn.	Chkd.	Dsgn. YY.MM.DD

Permit-Seal

Client/Project
BRIGIL
PETRIE'S LANDING II

BLOCK 8
180 Prestige Circle
OTTAWA, ON, CANADA

Title
NOTES AND LEGENDS

Project No.	Scale	
160401331		
Drawing No.	Sheet	Revision
NL-1	1 of 6	4

18062

D07-12-19-0212

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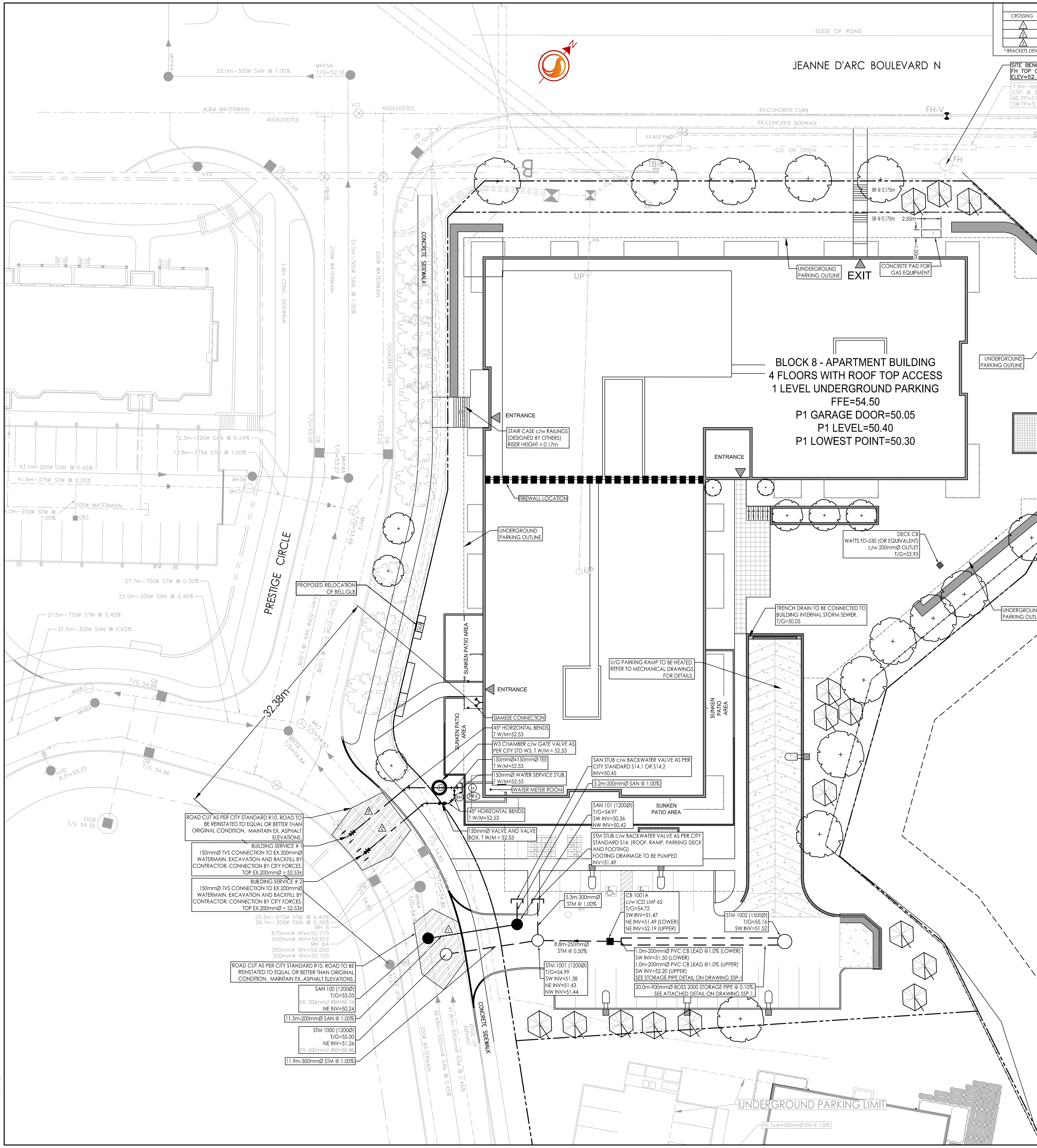
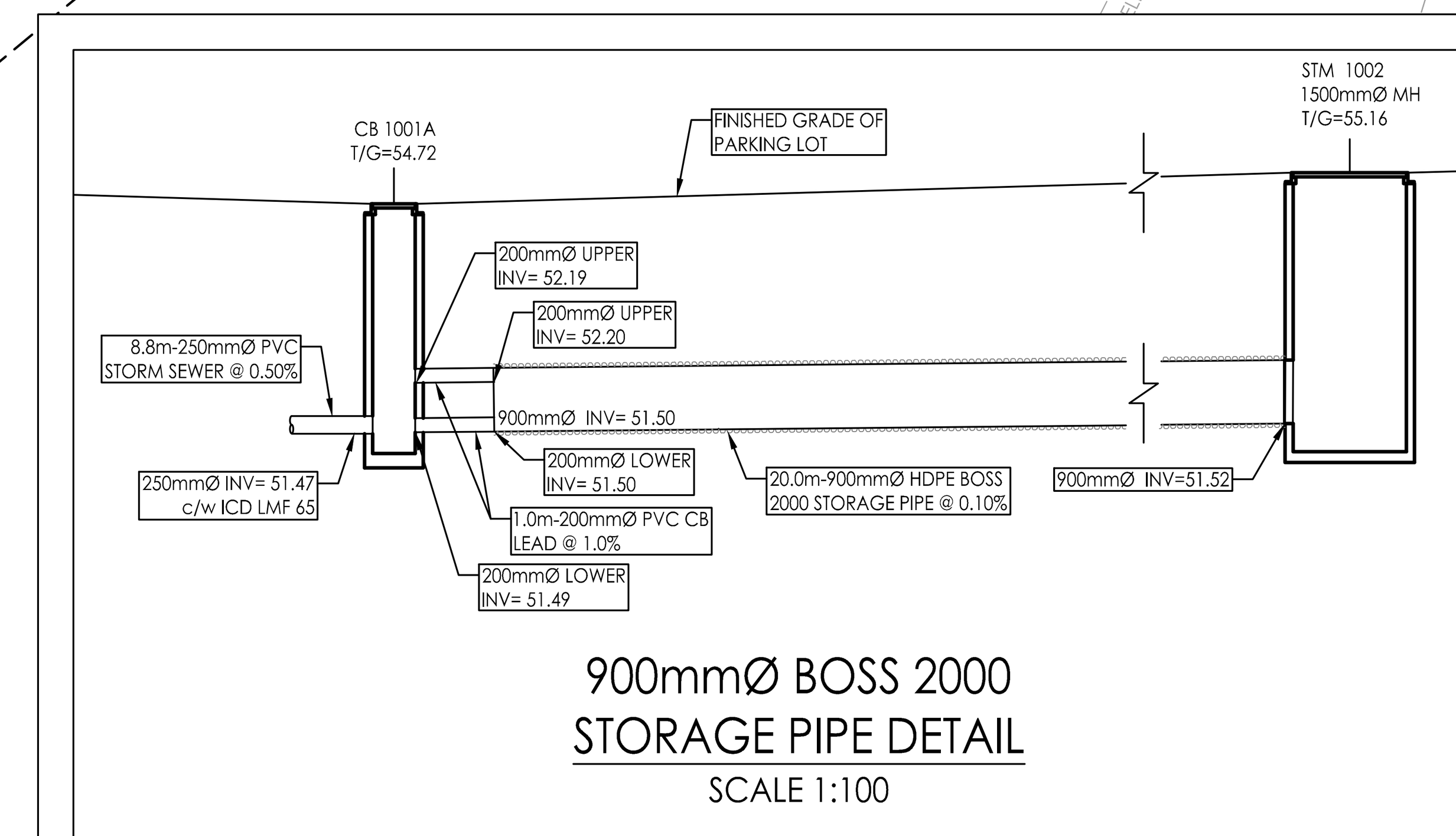
2022/02/16 8:34 AM By: Bryan, Mike

ORIGINAL SHEET - ARCH D

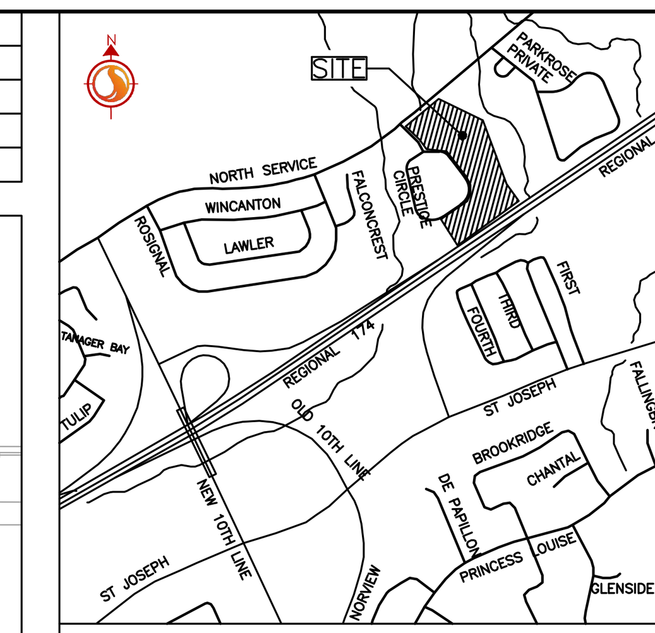




900mmØ BOSS 2000
STORAGE PIPE DETAIL
SCALE 1:100

SEWER AND WATERMAIN CROSSING TABLE						
CROSSING	STM INV	STM OBV	SAN INV	SAN OBV	WTR TOP	WTR BTM
1	50.95 (50.85)	51.55 (51.65)	50.26	50.46		
2	50.74 (50.64)	51.42 (51.52)	49.97	50.27	52.53	52.38
3	50.73 (50.63)	51.41 (51.51)	49.96	50.26	52.53	52.38

* BRACKETS DENOTE ADJUSTED VALUE WITH CONCRETE PIPE THICKNESS



KEY PLAN
N.T.S.

SCHEDULE OF ROOF RELEASE RATES

BUILDING	DRAIN TYPE	# DRAINS	100YR Head (m)	100YR RELEASE RATE (L/s)
R1001A	WATTS ACCUFLOW (50% OPEN)	11	0.15	13.80

SCHEDULE OF INLET CONTROL DEVICES

AREA ID	CATCHBASIN ID	TYPE	100YR HEAD (m)	100YR RELEASE RATE (L/s)	DEPTH OF PONDING (m)
F1001A	CB1001A	LMF 65	3.48	6.78	0.23

SCHEDULE FOR DECK AND RAMP AREAS

BLOCK ID	DRAINAGE AREA ID	100YR RELEASE RATE (L/s)
RAMP	F1001B	13.40
DECK CB	F1001C	16.07

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Legend

- PROPOSED WATERMAIN
- PROPOSED VALVE AND VALVE BOX
- PROPOSED VALVE CHAMBER
- PROPOSED REDUCER
- PROPOSED FIRE HYDRANT
- (M) PROPOSED WATER METER
- (RM) PROPOSED REMOTE WATER METER
- (PRV) PROPOSED PRESSURE REDUCING VALVE
- PROPOSED THRUST BLOCK LOCATIONS
- PROPOSED SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED WATTS AREA DRAIN FD-530 (OR EQUIVALENT) REFER TO MECHANICAL PLANS FOR DETAILS.
- PROPOSED SUBDRAIN CATCHBASIN
- EXISTING WATERMAIN
- EXISTING VALVE AND VALVE BOX
- EXISTING VALVE CHAMBER
- EXISTING REDUCER
- EXISTING FIRE HYDRANT
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING CATCHBASIN MANHOLE
- EXISTING CATCHBASIN
- EXISTING SUBDRAIN CATCHBASIN
- THERMAL INSULATION ON STORM SEWER WHERE COVER IS LESS THAN 1.5m. THERMAL INSULATION ON WATERMAIN WHERE COVER IS LESS THAN 2.4m AS PER W22.
- PROPOSED SITE LIGHTING

Notes

1. PROPOSED BUILDINGS TO BE EQUIPPED WITH BACKWATER VALVES
2. PROPOSED TRENCH DRAINS TO BE DESIGNED TO CAPTURE 100 YEAR PEAK FLOWS.
3. STORM MAINTENANCE HOLES LOCATED IN PONDING AREAS SHALL HAVE WATER TIGHT FRAME AND COVERS AS PER CITY STANDARD S24.1 AND S25.
4. MECHANICAL CONSULTANT TO PROVIDED PRESSURE REDUCING VALVE FOR LOWER LEVELS AND BOOSTER PUMP FOR UPPER LEVELS.
5. FOR DETAILS ON THE SUNKEN PATIO AND DRAINAGE REFER TO ARCHITECTURAL AND MECHANICAL DRAWINGS.
6. STORAGE PIPE VOLUME = 12.72m³

Revision

		By	Appd.	YY.MM.DD
4	REVISED AS PER CITY COMMENTS	MJS	AMP	22.02.16
3	ISSUED FOR TENDER	MJS	KH	21.10.01
2	REVISED AS PER CITY COMMENTS	MJS	TR	21.09.20
1	REVISED AS PER NEW SITE PLAN AND CITY COMMENTS	MJS	AMP	21.03.24
0	ISSUED FOR SPA	MJS	AMP	19.12.13

File Name: 160401331 DB2.dwg	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	MJS	AMP	MJS	19.06.20

Permit-Seal

Client/Project

BRIGIL
PETRIE'S LANDING II

BLOCK 8
180 Prestige Circle
OTTAWA, ON, CANADA

Title

SITE SERVICING PLAN

Project No. 160401331

Scale 1:250 (0, 2.5, 7.5, 12.5m)

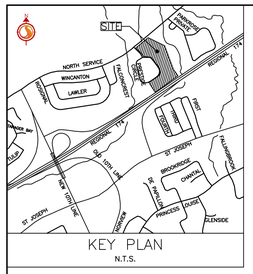
Drawing No. SSP-1

Sheet 2 of 6

Revision 4

D07-12-19-0212

18062



KEY PLAN
N.T.S.

Stantec

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Legend

- ORIGINAL GROUND ELEVATION
- PROPOSED ELEVATION
- PROPOSED LOT CORNER ELEVATION / EXISTING ELEVATION AT LOT CORNER
- FLOW DIRECTION AND GRADE
- FFE=99.99 FINISHED FIRST FLOOR ELEVATION
- E.F. ENGINEERED FILL REQUIRED
- TERRACING 3:1 SLOPE MAXIMUM (UNLESS OTHERWISE SHOWN)
- PROPOSED SWALE
- DIRECTION OF EMERGENCY OVERLAND FLOW
- PROPOSED VALVE BOX
- PROPOSED VALVE CHAMBER
- PROPOSED FIRE HYDRANT
- PROPOSED SANITARY SEWER MANHOLE
- PROPOSED STORM SEWER MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED WATTS AREA DRAIN FD-530 (OR EQUIVALENT) REFER TO MECHANICAL PLANS FOR DETAILS.
- PROPOSED CATCHBASIN 'I'
- D.C. PROPOSED DEPRESSED CURB LOCATION
- REDI-ROCK RETAINING WALLS DESIGNED BY PATERSON GROUP. FOR DETAILS REFER TO DRAWINGS PREPARED BY PATERSON GROUP.
- 1.8m HIGH CHAIN LINK FENCE
- HEAVY DUTY ASPHALT
- JEANNE d ARC BLVD TO BE FILLED IN
- MAXIMUM PONDING LIMITS

Notes

1. RAMPS TO UNDER GROUND PARKING AREAS THAT EXCEED 6.0% GRADE ARE TO BE CONCRETE AND HEATED.

HEAVY DUTY ASPHALT
40mm HL3 OR SUPERPAVE 12.5 ASPHALTIC CONCRETE
50mm HL8 OR SUPERPAVE 19.0 ASPHALTIC CONCRETE
150mm OPSS GRANULAR A BASE
450mm OPSS GRANULAR B TYPE II

LIGHT DUTY AREAS
50mm HL3 OR SUPERPAVE 12.5 ASPHALTIC CONCRETE
150 OPSS GRANULAR 'A' BASE
300 OPSS GRANULAR 'B' TYPE II

4	REVISED AS PER CITY COMMENTS	MJS	AMP	22.02.16
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1	REVISED AS PER NEW SITE PLAN AND CITY COMMENTS	MJS	AMP	21.03.24
0	ISSUED FOR SPA	MJS	AMP	19.12.13
Revision		By	Appd.	YY.MM.DD
File Name: 160401331 D82.dwg		MJS	AMP	19.06.20
		Dwn.	Chkd.	YY.MM.DD

Permit-Seal

Client/Project
BRIGIL
PETRIE'S LANDING II

BLOCK 8
180 Prestige Circle
OTTAWA, ON, CANADA

Title
GRADING PLAN

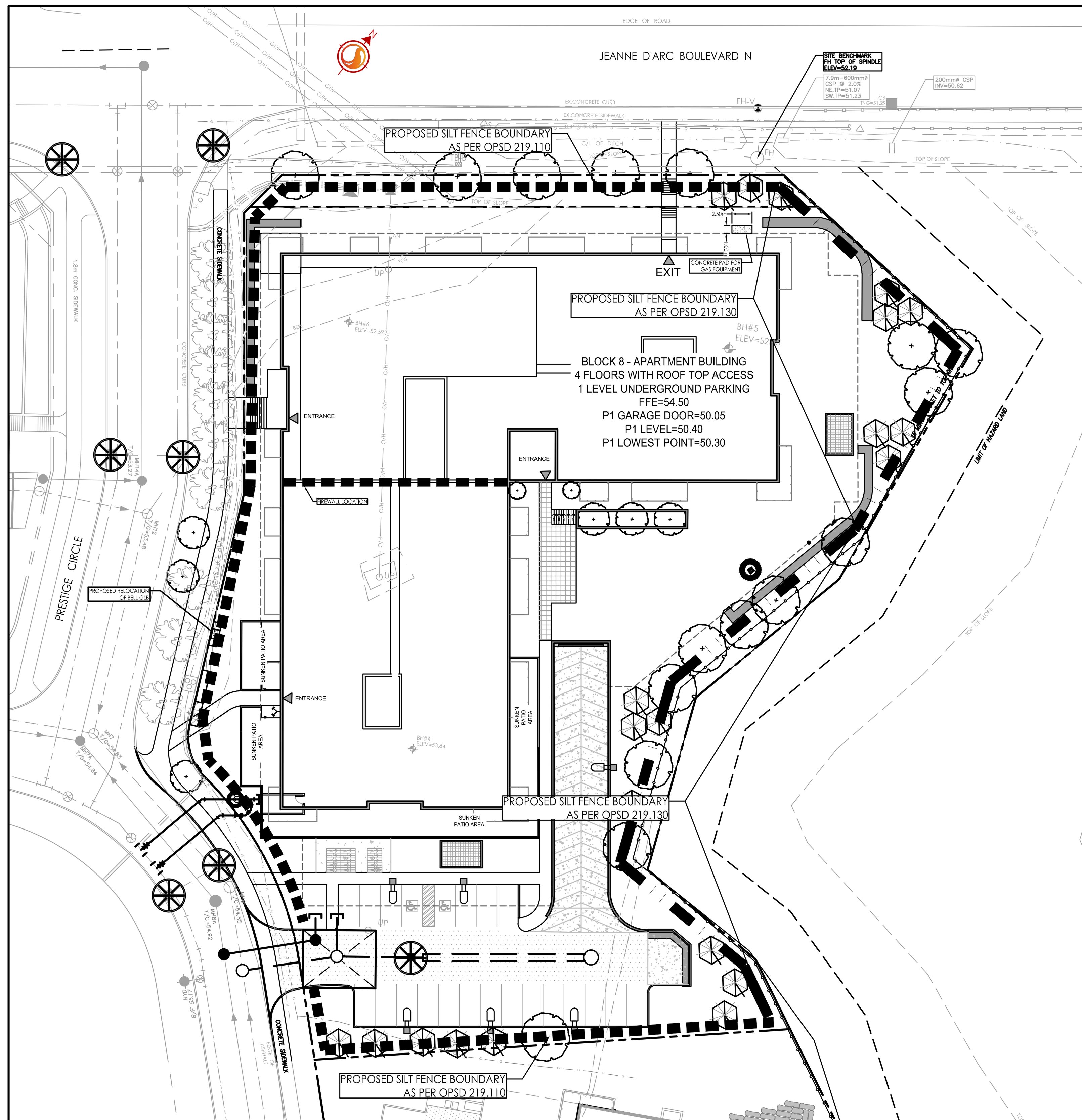
Project No.	Scale	Revision
160401331	1:250 (0, 2.5, 7.5, 12.5m)	
Drawing No.	Sheet	
GP-1	3 of 6	4

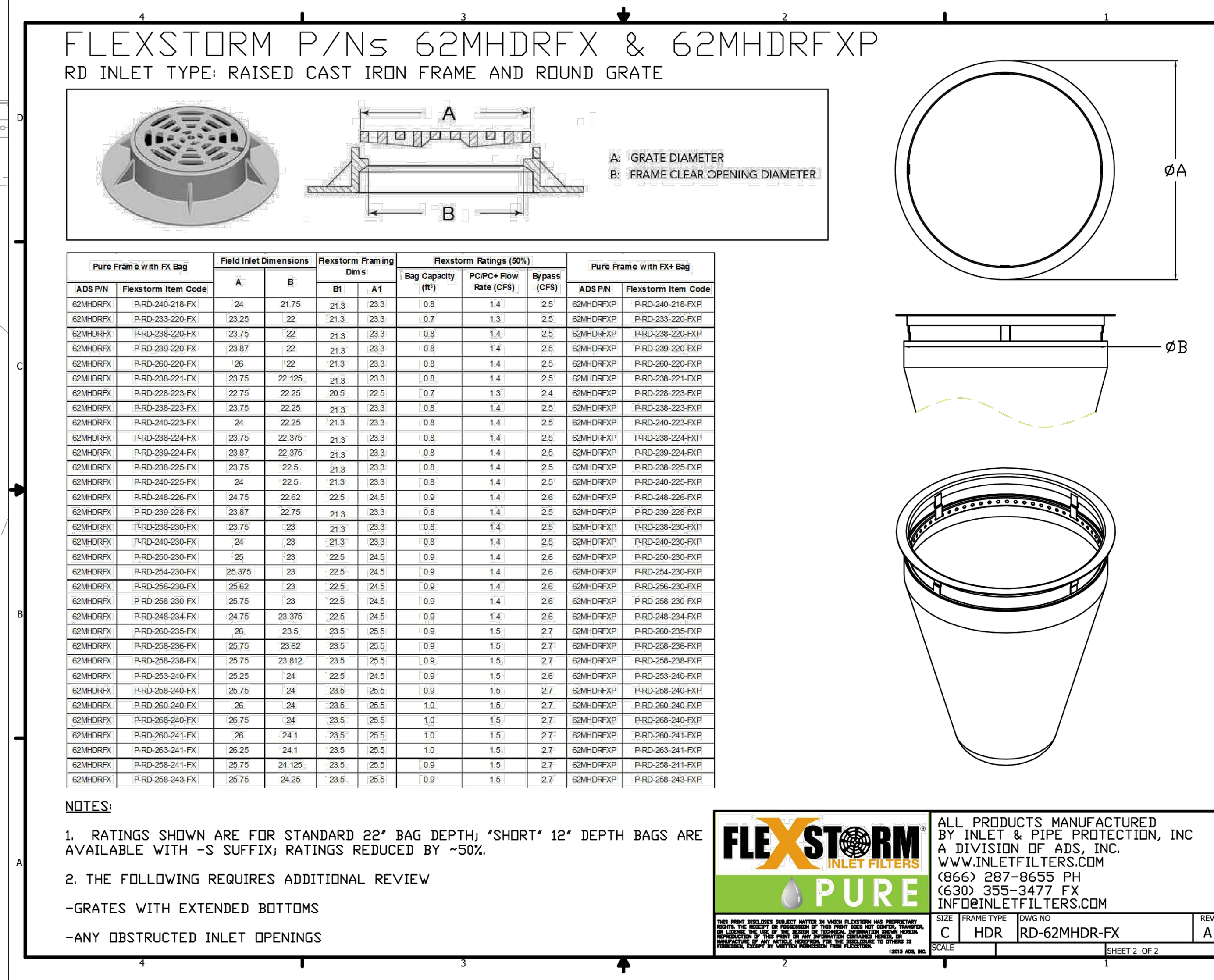
D07-12-19-0212

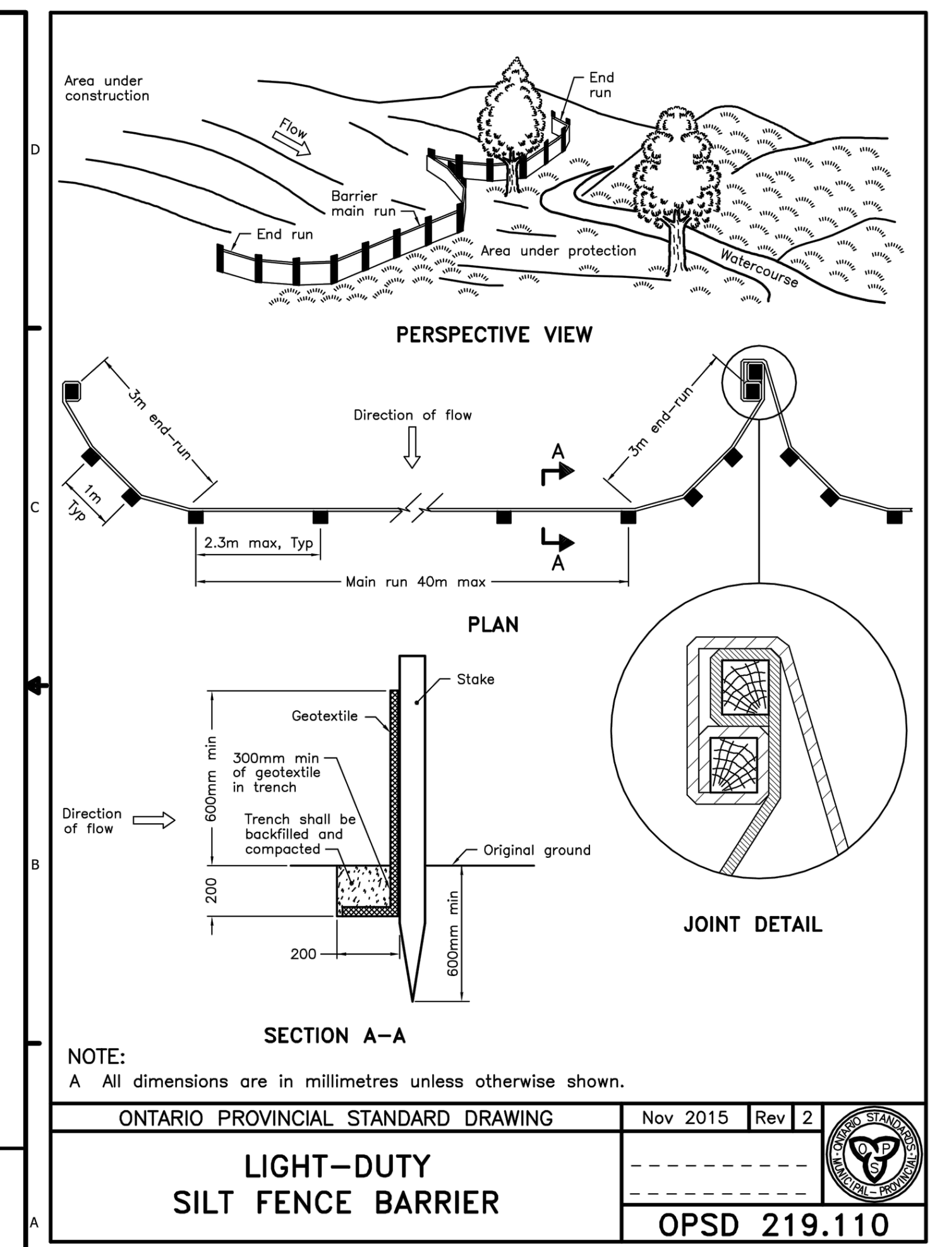
18062

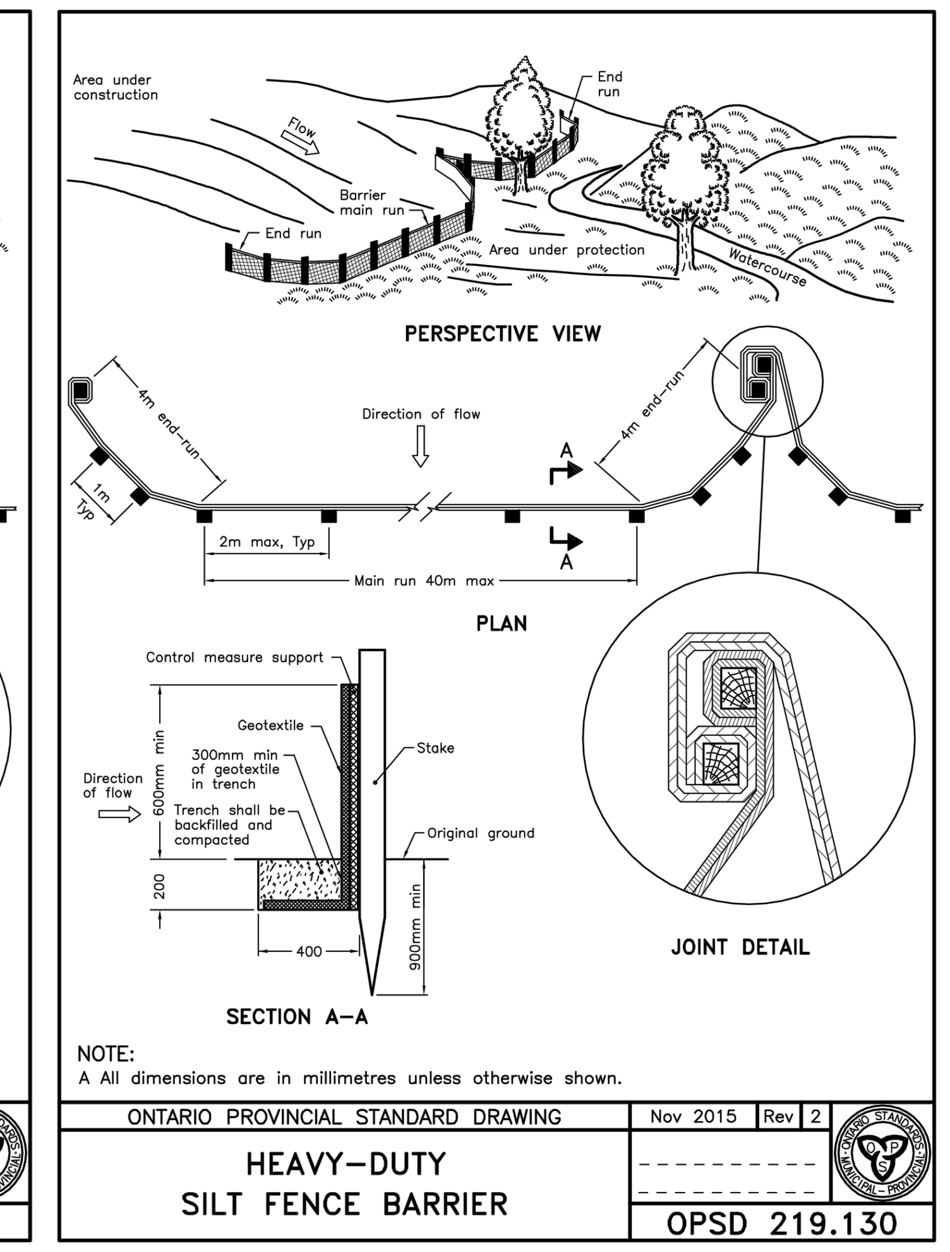
V:\01-ottawa\active\160401331 Petrie's Landing Block 8+B\design\drawing\Block 8\160401331 D82.dwg
2022/02/18 8:37 AM By: Shayla Allen

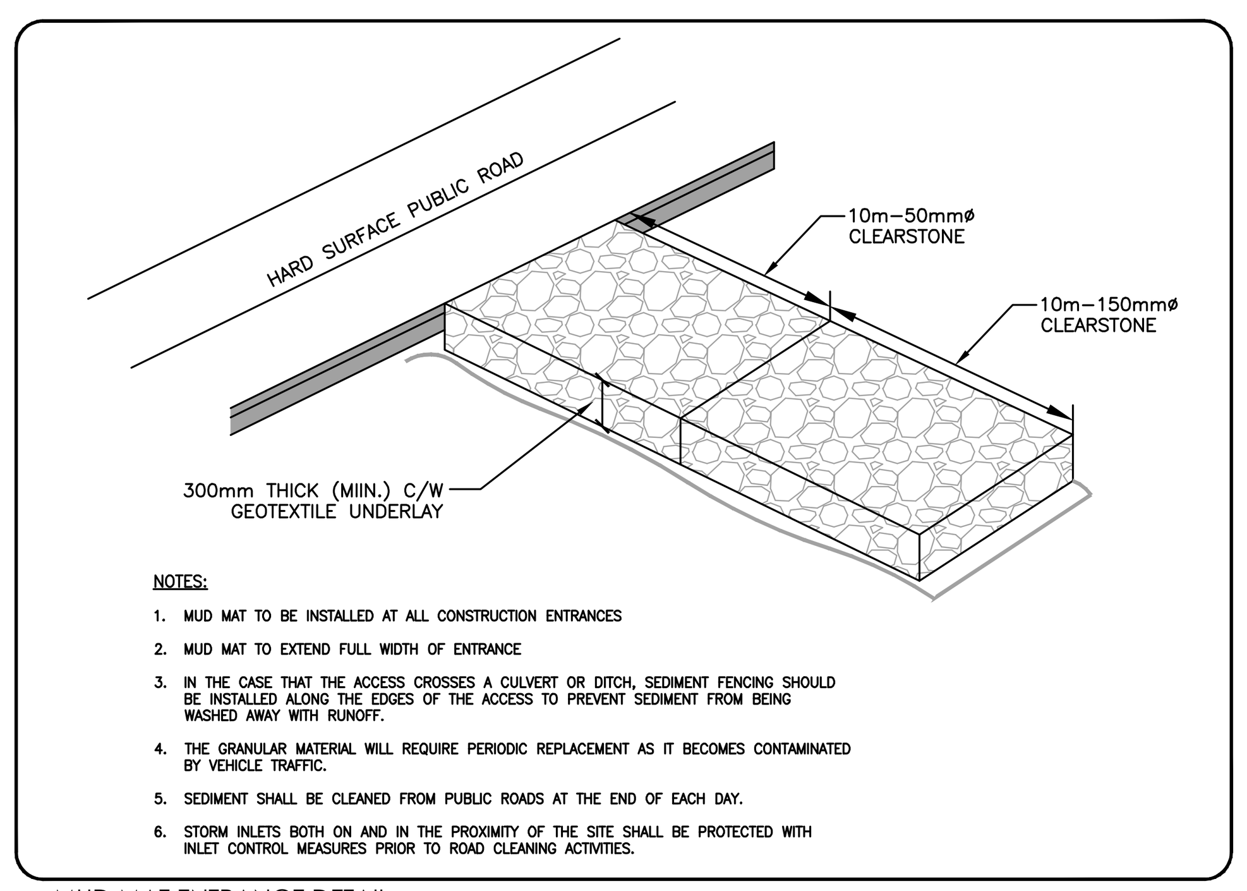
ORIGINAL SHEET - ARCH D



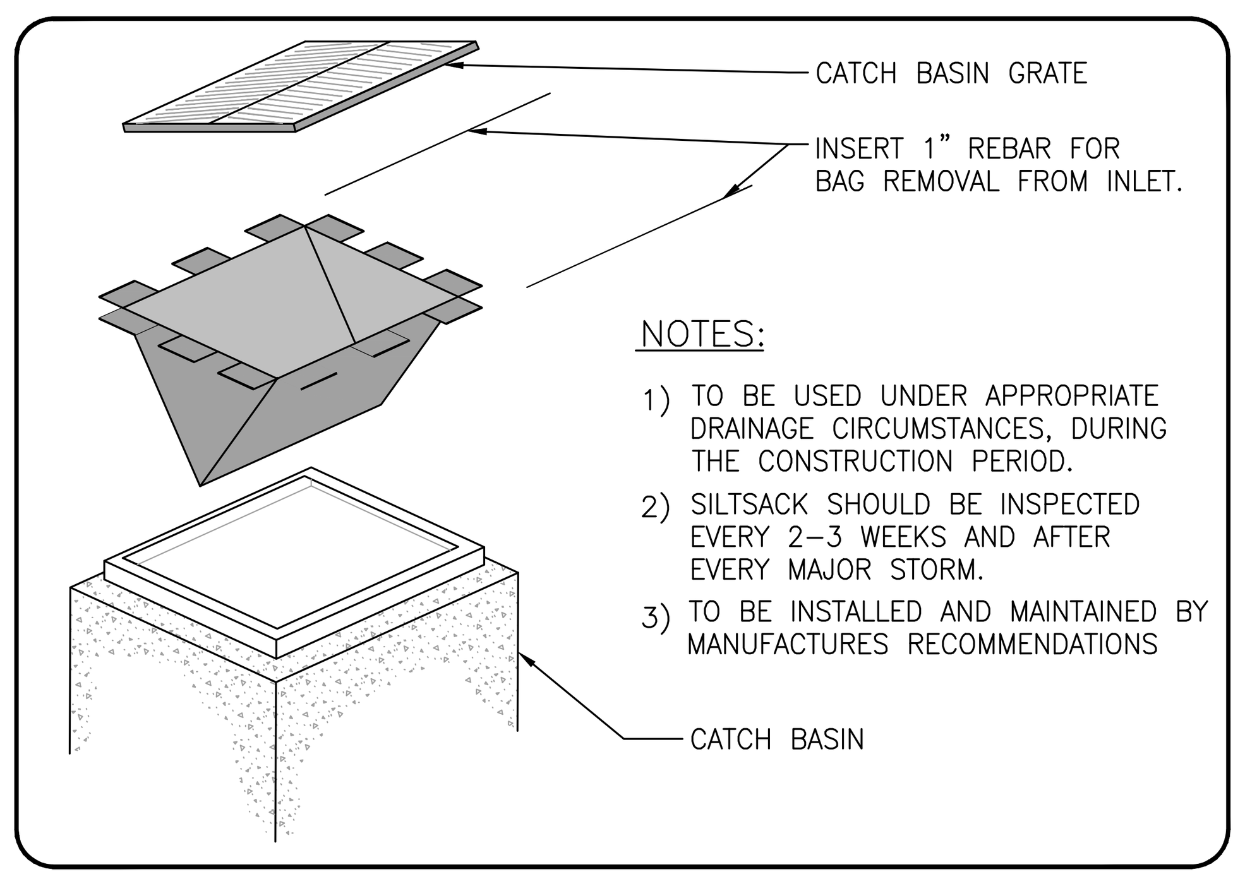




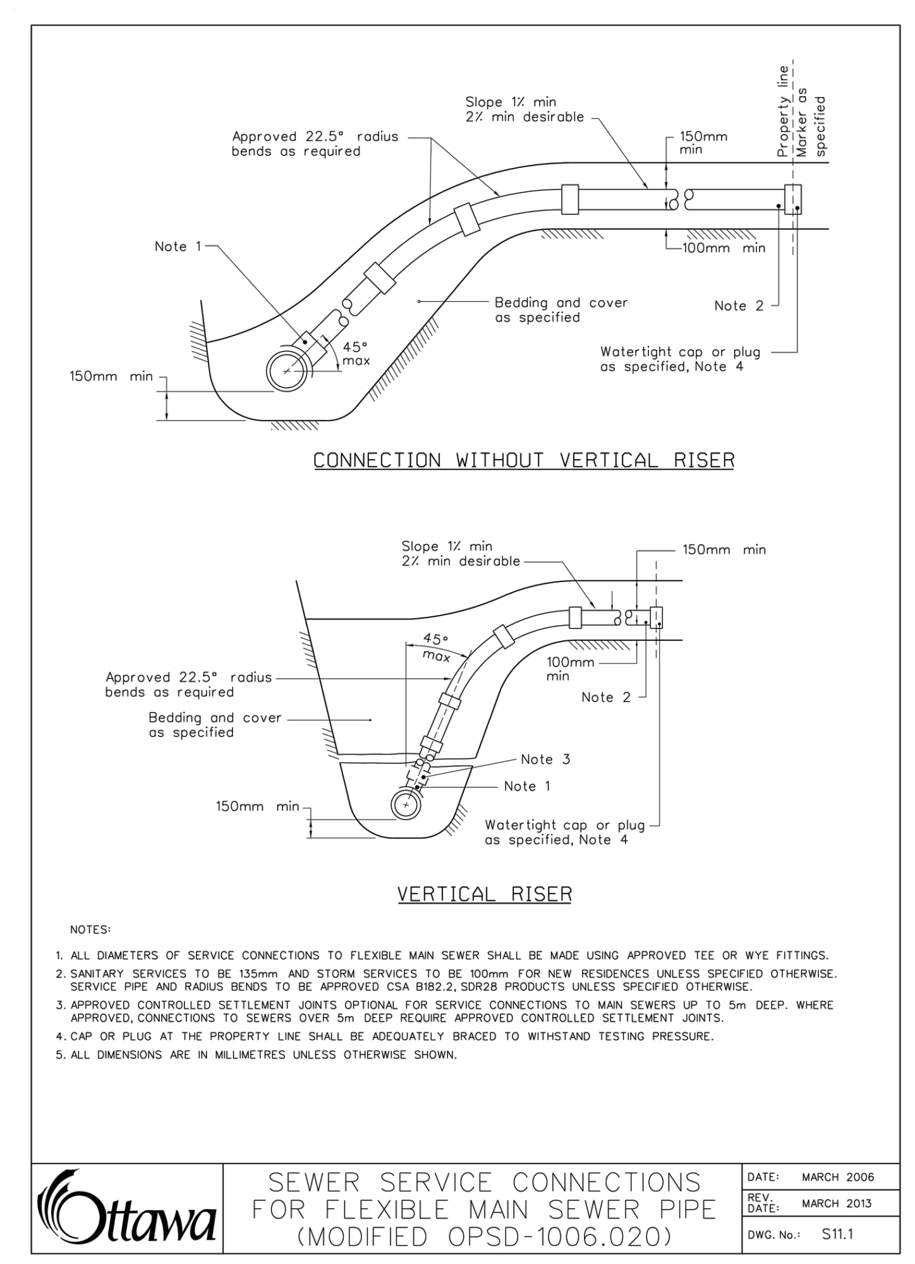


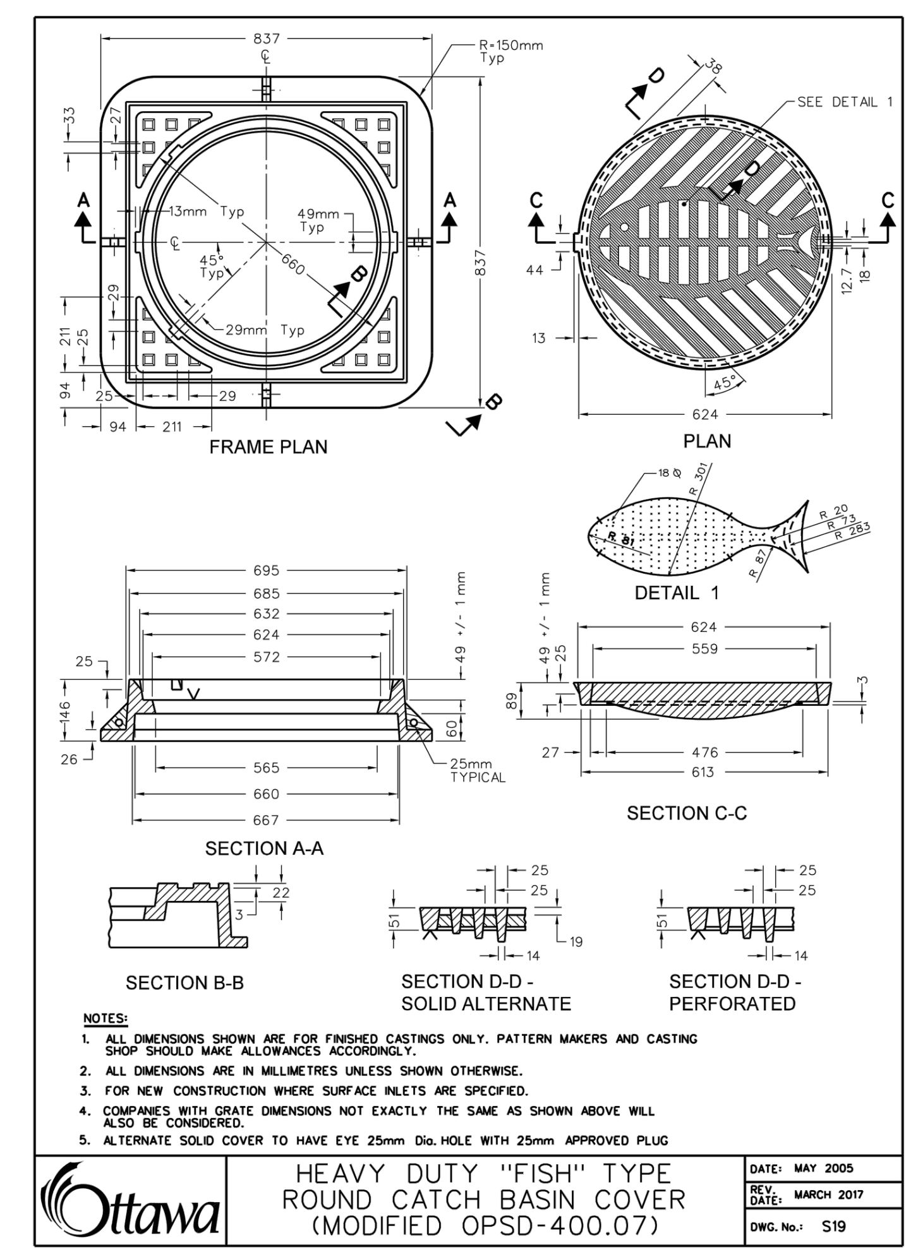


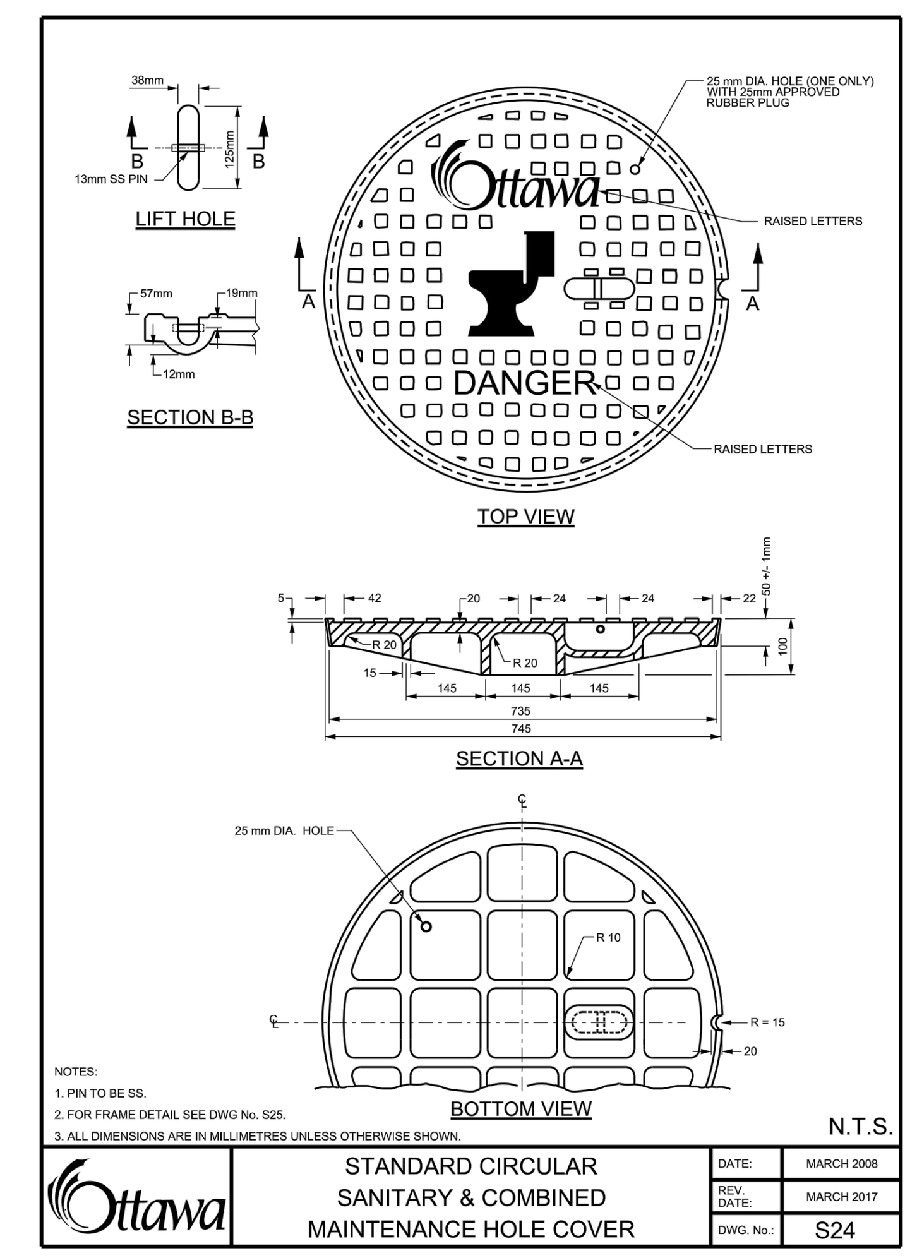
MUD MAT ENTRANCE DETAIL
SCALE: N.T.S.

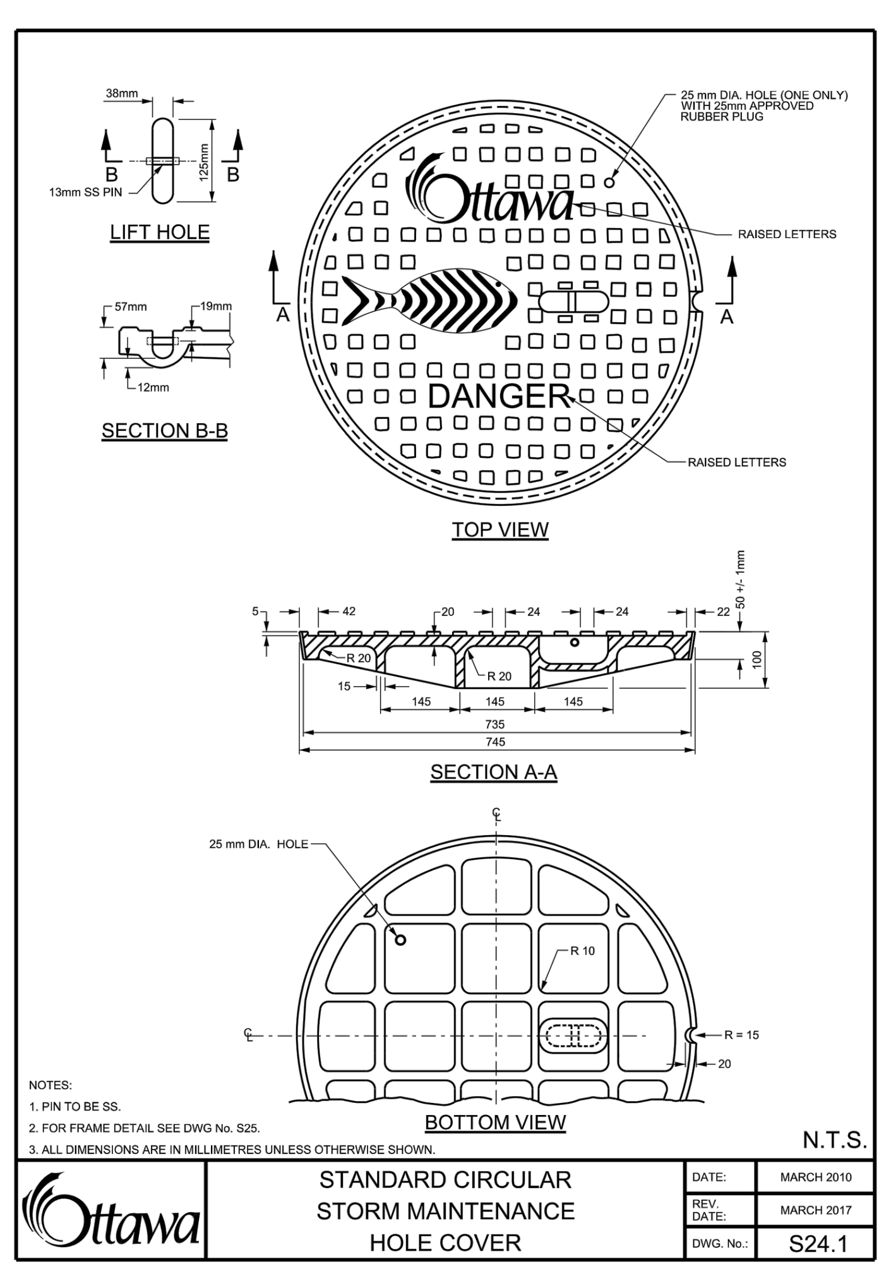


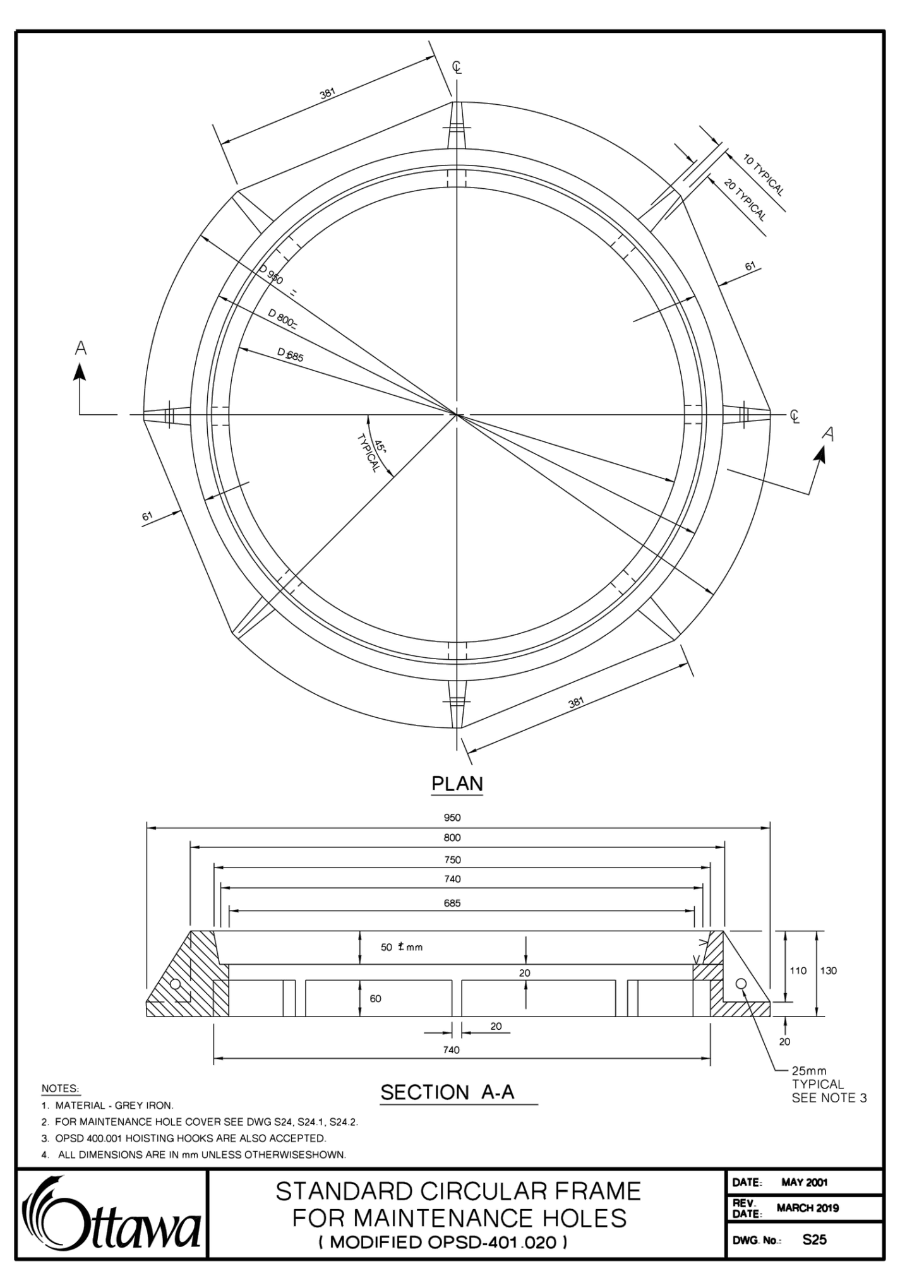
ROADSIDE CATCH BASIN PROTECTION DETAIL: TERRAFIX SILTSACK
SCALE: N.T.S.

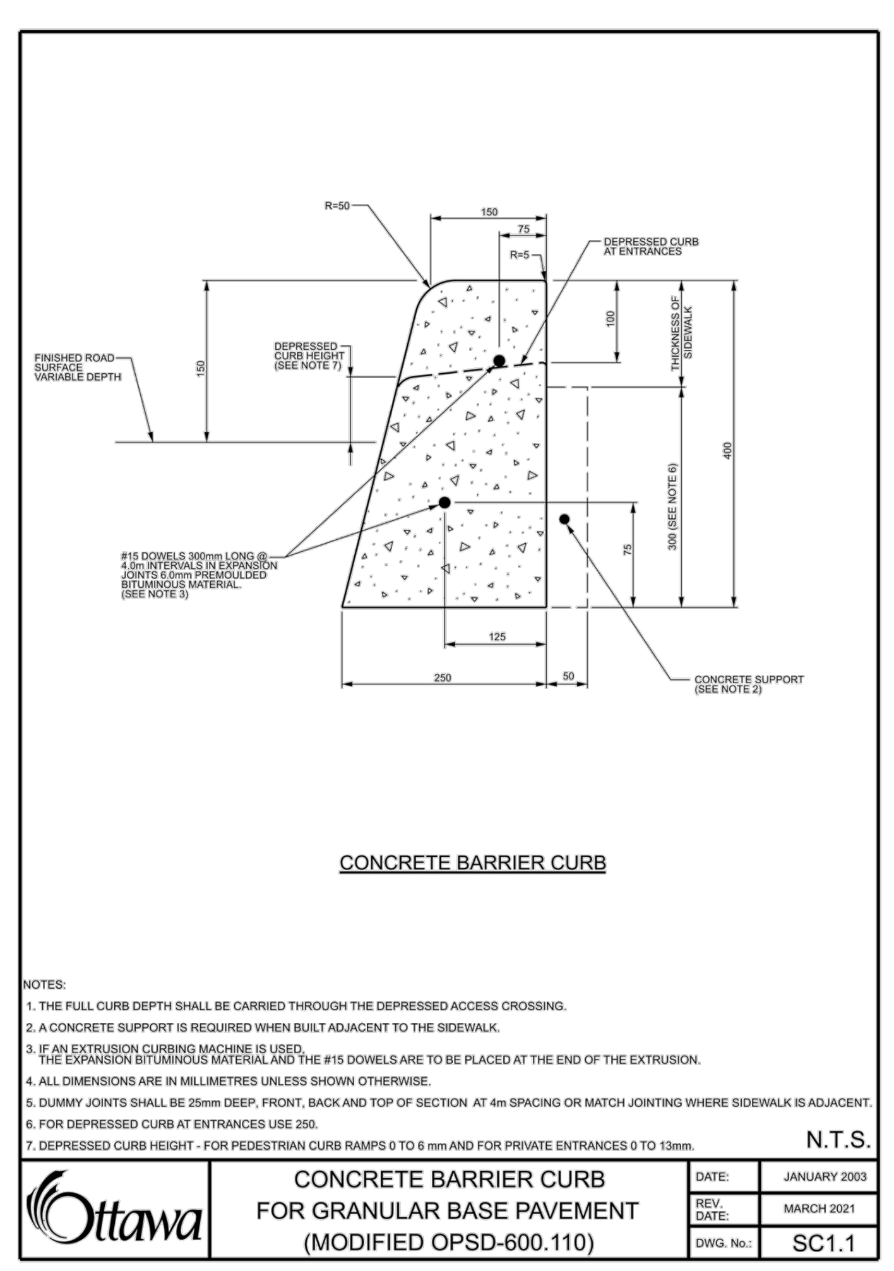


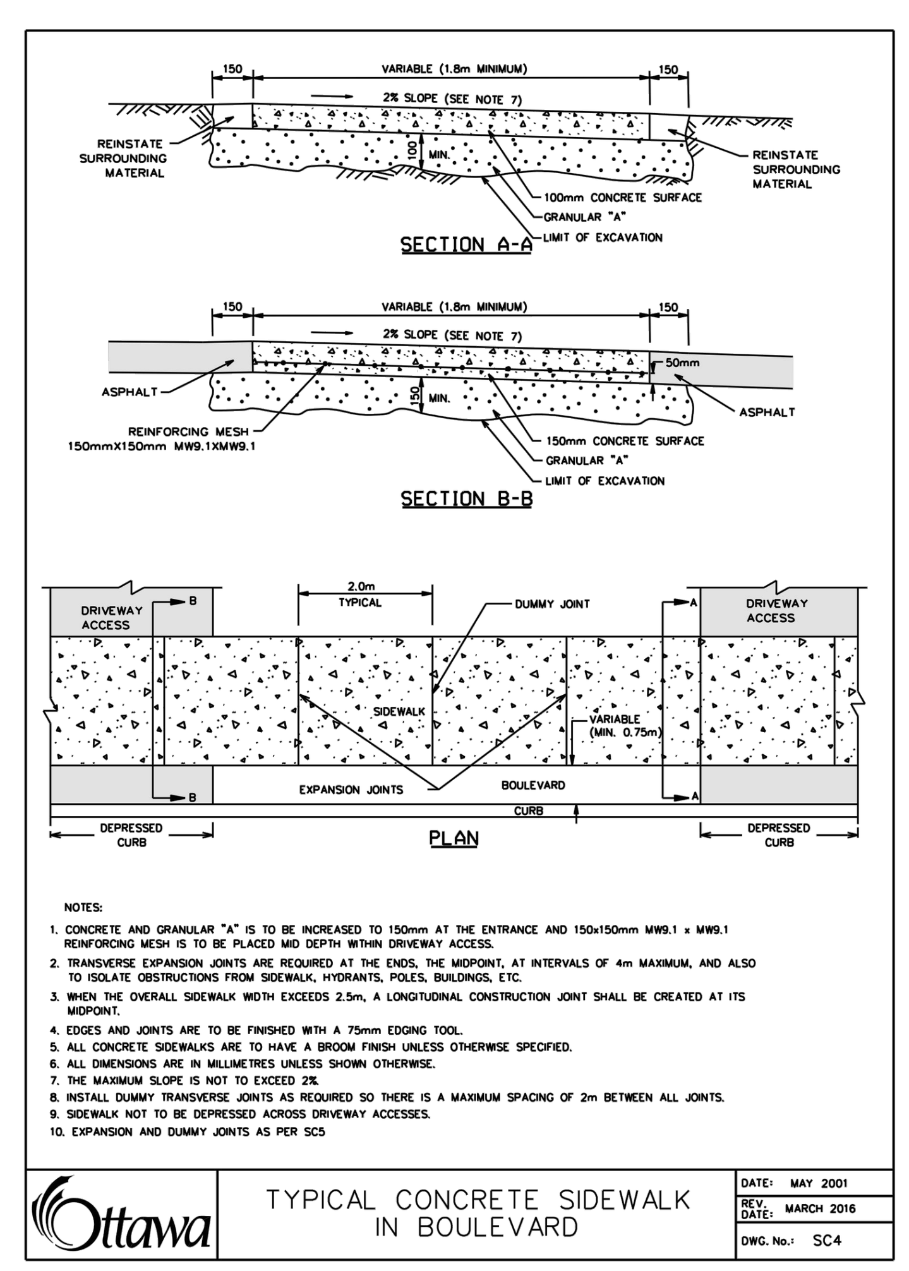


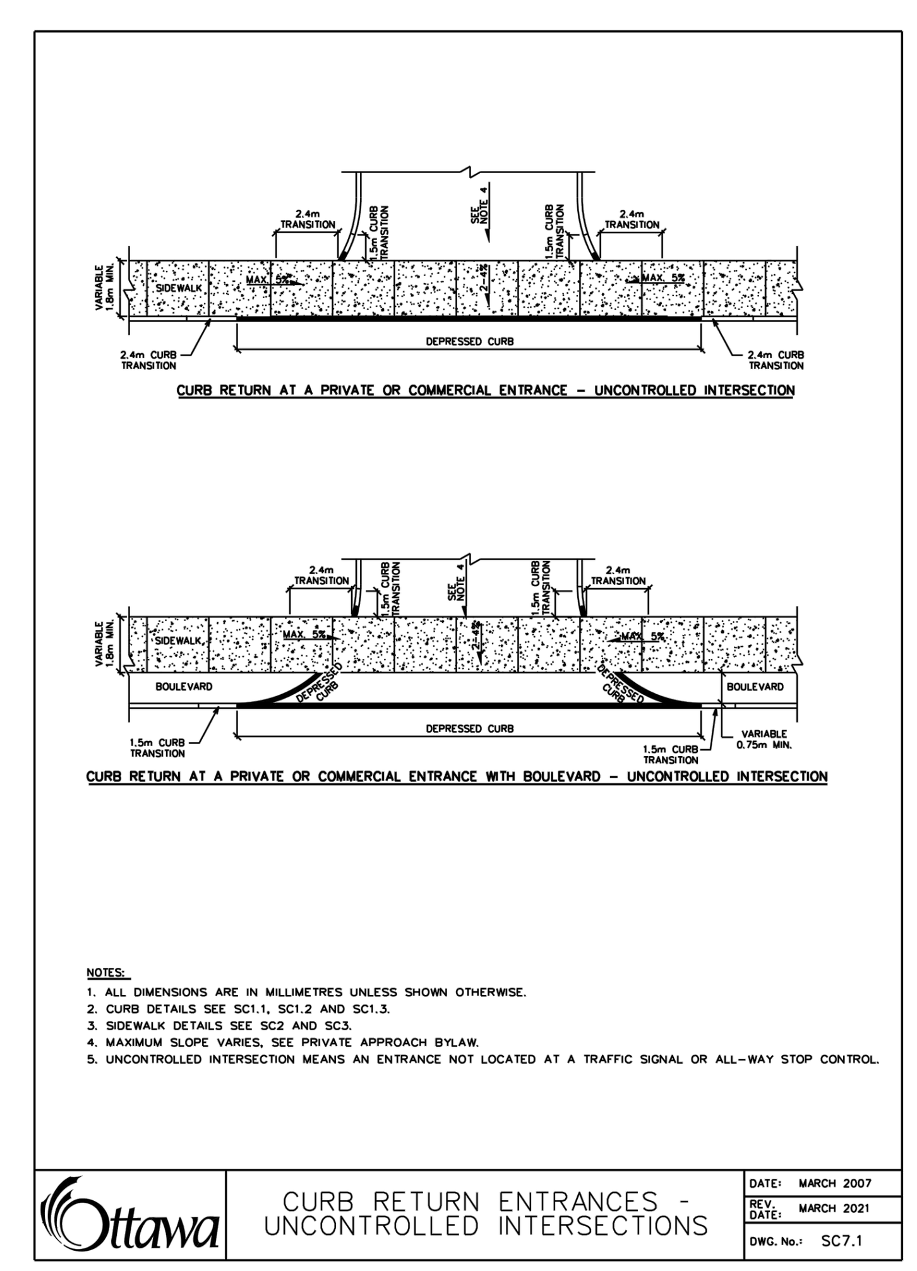


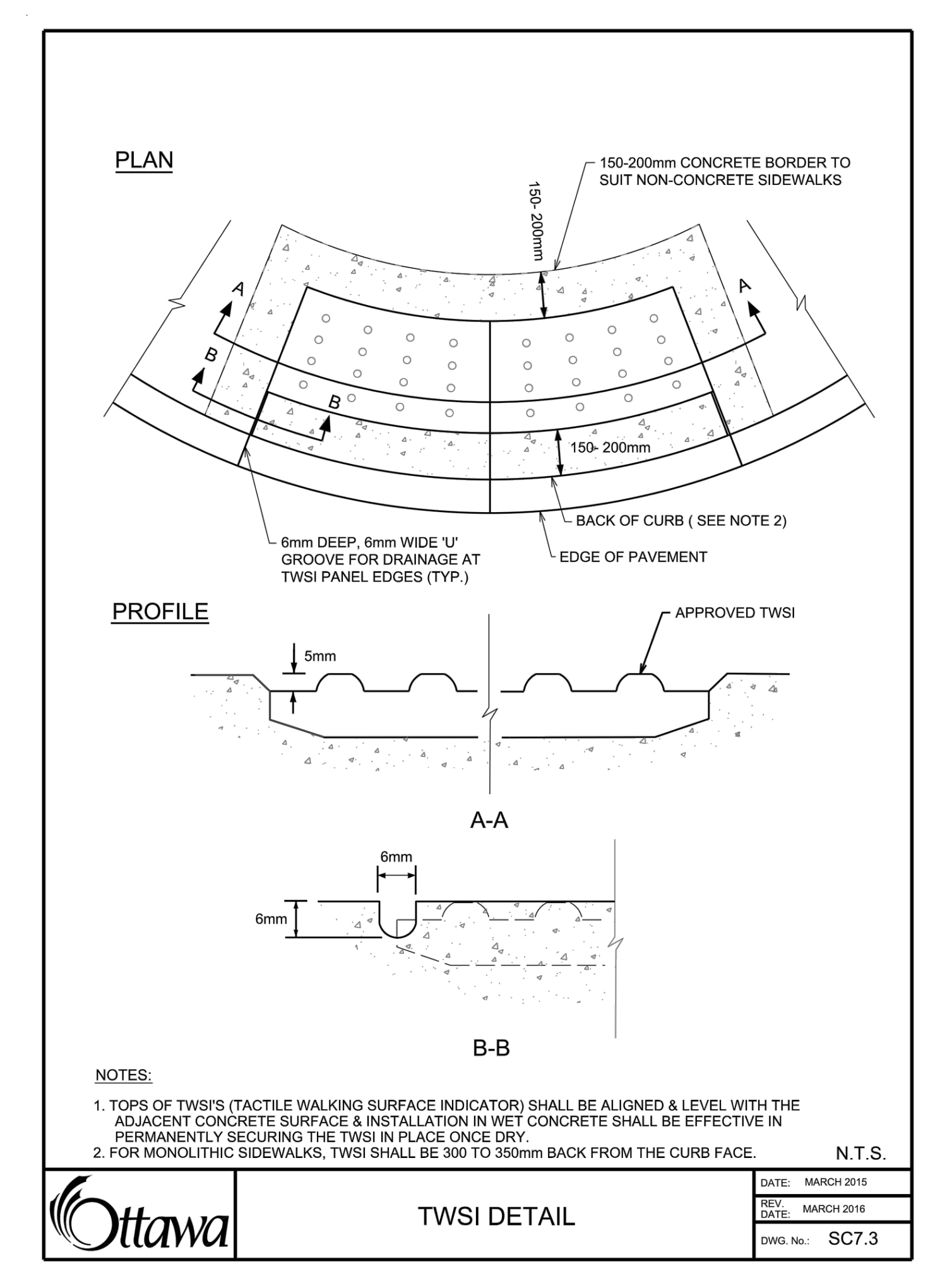












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Legend

- PROPOSED SILT FENCE BOUNDARY AS PER OPSD 219.110
- PROPOSED SILT FENCE BOUNDARY AS PER OPSD 219.130
- PROPOSED MUD MAT LOCATION
- PROPOSED CATCH BASIN PROTECTION AS PER TERRAFIX SILTSACK DETAIL.
- PROPOSED CATCH BASIN PROTECTION AS PER FLEX STORM INLET FILTERS DETAIL. ITEM CODE P-RD-240-223-FX

Notes

Best Management Practices

CONTRACTOR TO PROVIDE EROSION AND SEDIMENT CONTROLS (BEST MANAGEMENT PRACTICES) DURING CONSTRUCTION OF THIS PROJECT.

EROSION MUST BE MINIMIZED AND SEDIMENTS MUST BE REMOVED FROM CONSTRUCTION SITE RUN-OFF IN ORDER TO PROTECT DOWNSTREAM AREAS. DURING ALL CONSTRUCTION, EROSION AND SEDIMENTATION SHOULD BE CONTROLLED BY THE FOLLOWING TECHNIQUES:

1. LIMIT THE EXTENT OF EXPOSED SOILS AT ANY GIVEN TIME.
2. REVEGETATE EXPOSED AREAS AND SLOPES AS SOON AS POSSIBLE.
3. MINIMIZE AREA TO BE CLEARED AND GRUBBED.
4. PROTECT EXPOSED SLOPES WITH PLASTIC OR SYNTHETIC MULCHES.
5. INSTALL CATCH BASIN INSERTS OR EQUIVALENT IN ALL PROPOSED CATCH BASINS AND CATCH BASIN MANHOLES AND IN ALL EXISTING CATCH BASINS THAT WILL RECEIVE RUN-OFF FROM THE SITE.
6. A SILT FENCE SHALL BE INSTALLED AROUND THE PERIMETER OF ALL AND ANY STOCKPILES OF MATERIAL TO BE USED OR REMOVED FROM SITE. (LOCATION TO BE DETERMINED)
7. A VISUAL INSPECTION SHALL BE DONE DAILY ON SEDIMENT CONTROL MEASURES AND CLEANED OF ANY ACCUMULATED SILT AS REQUIRED. THE DEPOSITS WILL BE DISPOSED OFF SITE AS PER THE REQUIREMENTS OF THE CONTRACT.
8. SEDIMENT CONTROL BARRIERS MAY ONLY BE REMOVED TEMPORARILY WITH APPROVAL OF CONTRACT ADMINISTRATOR TO ACCOMMODATE CONSTRUCTION OPERATIONS. ALL AFFECTED BARRIERS MUST BE REINSTATED AT NIGHT WHEN CONSTRUCTION IS COMPLETED. NO REMOVAL WILL OCCUR IF THERE IS A SIGNIFICANT RAINFALL EVENT ANTICIPATED (>10mm) UNLESS A NEW DEVICE HAS BEEN INSTALLED TO PROTECT EXISTING STORM AND SANITARY SEWER SYSTEMS, OR DOWNSTREAM WATERCOURSES.
9. NO REFUELING OR CLEANING OF EQUIPMENT IS PERMITTED NEAR ANY EXISTING WATERWAY.
10. CONTRACTOR SHALL REMOVE SEDIMENT CONTROL MEASURES WHEN, IN THE OPINION OF THE CONTRACT ADMINISTRATOR, THE MEASURE(S) IS NO LONGER REQUIRED. NO CONTROL MEASURES SHALL BE PERMANENTLEY REMOVED WITHOUT PRIOR WRITTEN AUTHORIZATION FROM THE CONTRACT ADMINISTRATOR.
11. THE CONTRACTOR SHALL PERIODICALLY, OR WHEN REQUESTED BY THE CONTRACT ADMINISTRATOR, CLEAN OUT ACCUMULATED SEDIMENTS AS REQUIRED.
12. THE CONTRACTOR SHALL IMMEDIATELY REPORT TO THE ENGINEER ANY ACCIDENTAL DISCHARGES OF SEDIMENT MATERIAL INTO THE WATERCOURSE. APPROPRIATE RESPONSE MEASURES, INCLUDING ANY REPAIRS TO EXISTING CONTROL MEASURES OR THE IMPLEMENTATION OF ADDITIONAL CONTROL MEASURES, SHALL BE CARRIED OUT BY THE CONTRACTOR WITHOUT DELAY.
13. CONTRACTOR SHALL INSTALL MUD MATS AT ALL ENTRANCES TO THE SITE.

4	REVISED AS PER CITY COMMENTS	MJS	AMP	22.02.16
3	ISSUED FOR TENDER	MJS	KH	21.10.01
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0	ISSUED FOR SPA	MJS	AMP	19.12.13
Revision		By	Appd.	YY.MM.DD

File Name: 160401331 DB2.dwg	MJS	AMP	MJS	19.06.20
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

BRIGIL
PETRIE'S LANDING II

BLOCK 8
180 Prestige Circle

OTTAWA, ON, CANADA

Title

EROSION CONTROL PLAN AND DETAIL SHEET

Project No. 160401331

Scale 1:500 (0 5 15 25m)

Drawing No. EC/DS-1

Sheet 4 of 6

Revision 4

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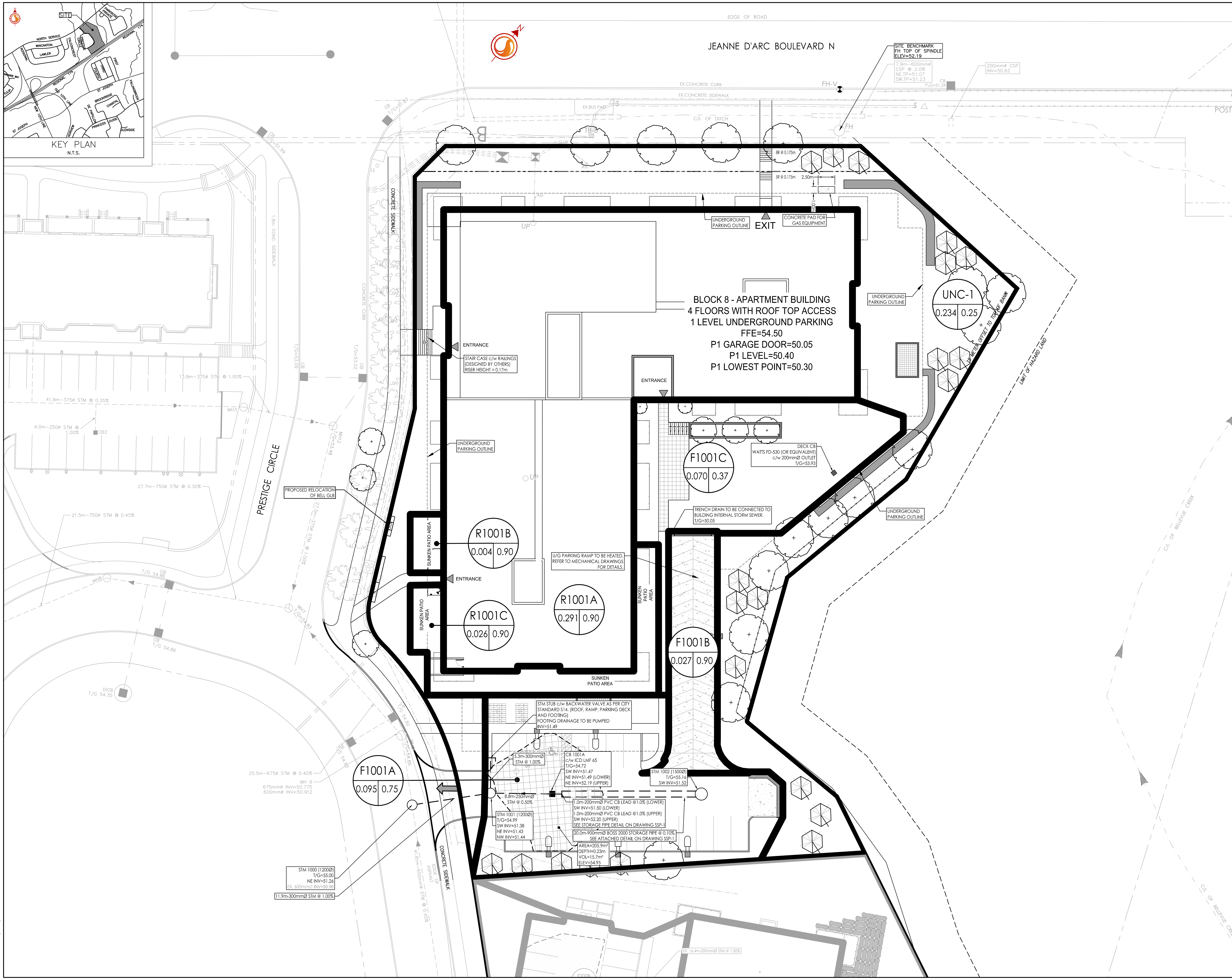

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Legend

- BLDG: AREA ID
- 0.90: RUNOFF COEFFICIENT
- 1.00: STORM DRAINAGE AREA ha.
- STORM DRAINAGE BOUNDARY
- MAXIMUM PONDING LIMITS
- DIRECTION OF EMERGENCY OVERLAND FLOW
- PROPOSED STORM SEWER
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED WATTS AREA DRAIN FD-530 (OR EQUIVALENT) REFER TO MECHANICAL PLANS FOR DETAILS.
- PROPOSED SUB DRAIN CATCH BASIN AS PER CITY OF OTTAWA STANDARD DETAIL DRAWINGS L10 AND L11.
- PROPOSED PERFORATED SUBDRAIN
- EXISTING STORM SEWER
- EXISTING CATCHBASIN MANHOLE
- EXISTING CATCHBASIN
- EXISTING SUBDRAIN CATCHBASIN
- THERMAL INSULATION ON STORM SEWER WHERE COVER IS LESS THAN 1.5m. THERMAL INSULATION ON WATERMAIN WHERE COVER IS LESS THAN 2.4m AS PER W22.

Notes

SCHEDULE OF ROOF RELEASE RATES

BUILDING	DRAIN TYPE	# DRAINS	100YR Head (m)	100YR RELEASE RATE (L/s)
R1001A	WATTS ACCUFLOW (50% OPEN)	11	0.15	13.80

SCHEDULE OF INLET CONTROL DEVICES

AREA ID	CATCHBASIN ID	TYPE	100YR HEAD (m)	100YR RELEASE RATE (L/s)	DEPTH OF PONDING (m)
F1001A	CB1001A	LMF 65	3.48	6.78	0.23

SCHEDULE FOR DECK AND RAMP AREAS

BLOCK ID	DRAINAGE AREA ID	100YR RELEASE RATE (L/s)
RAMP	F1001B	13.40
DECK CB	F1001C	16.07

NOTES:

1. PROPOSED BUILDINGS TO BE EQUIPPED WITH BACKWATER VALVES
2. PROPOSED TRENCH DRAINS TO BE DESIGNED TO CAPTURE 100 YEAR PEAK FLOWS.
3. STORAGE PIPE VOLUME = 12.72m³
4. UNCONTROLLED RUNOFF UP TO THE 100 YEAR STORM FROM AREAS R1001B, R1001C, F1001B AND F1001C WILL BE CAPTURED INTO THE BUILDINGS INTERNAL PLUMBING SYSTEM AND DIRECTED TO THE STORM SERVICE LATERAL.

Revision		By	Appd.	YY.MM.DD
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	Dwn.	Chkd.	Dsgn.	YY.MM.DD

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Client/Project
BRIGIL
PETRIE'S LANDING II

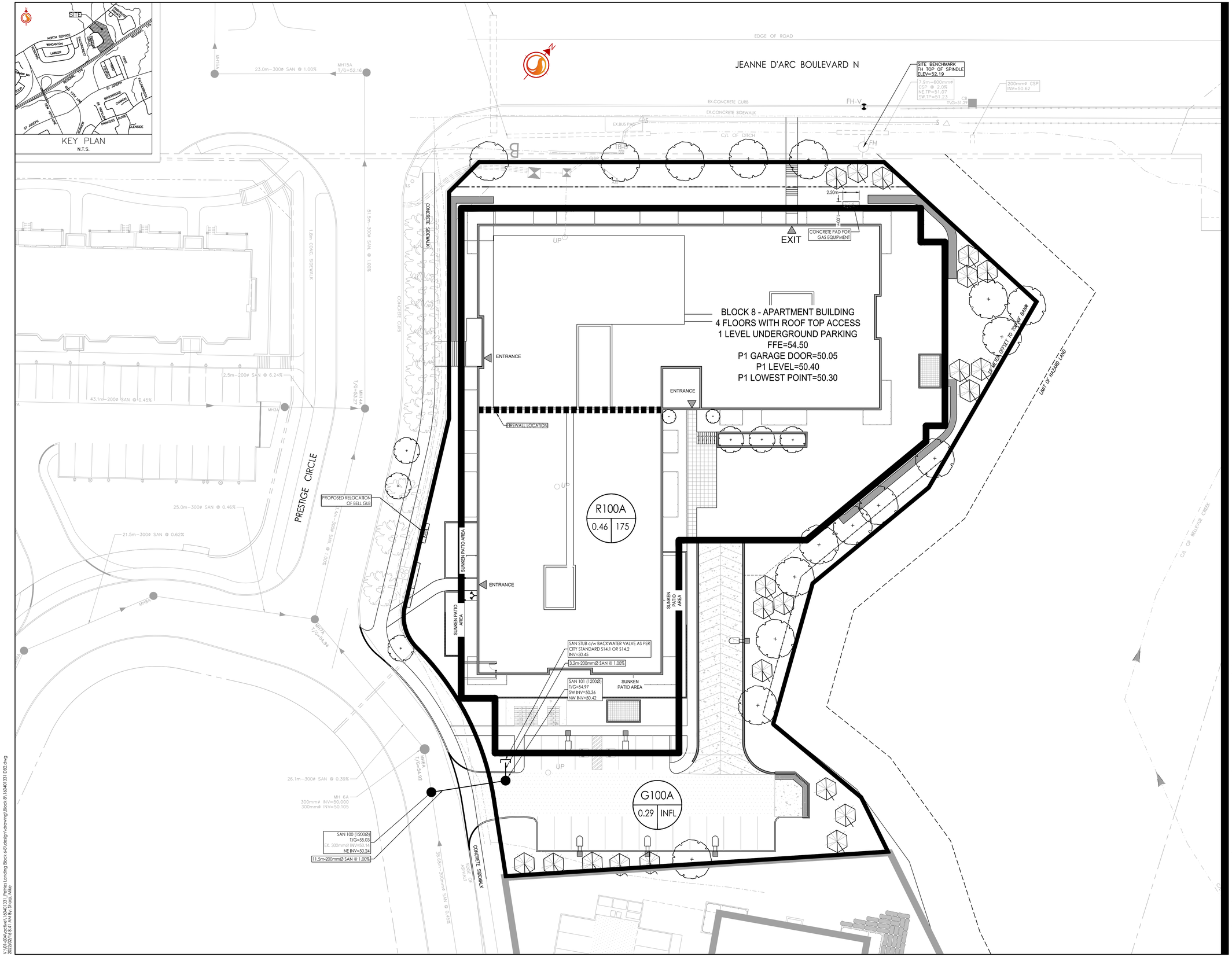
BLOCK 8
180 Prestige Circle
OTTAWA, ON, CANADA

Title
STORM DRAINAGE PLAN

Project No. 160401331
Scale 1:250
Drawing No. SD-1
Sheet 5 of 6
Revision 4

D07-12-19-0212
18062

ORIGINAL SHEET - ARCH D



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Legend

R100A
0.46 | 175
- SANITARY DRAINAGE AREA ID#
- POPULATION
- SANITARY DRAINAGE AREA ha.

G100A
0.29 | INF
- SANITARY DRAINAGE AREA ID#
- INFILTRATION RATES
- SANITARY DRAINAGE AREA ha.

- SANITARY DRAINAGE AREA
- PROPOSED SANITARY SEWER

Notes

SANITARY STATS

POPULATION COUNTS

2 - STUDIO APTS @ 1.4PPU = 3 PEOPLE
90 - 1 BEDROOM APTS @ 1.4PPU = 126 PEOPLE
16 - 2 BEDROOM APTS @ 2.1PPU = 34 PEOPLE
4 - 3 BEDROOM APTS @ 3.1PPU = 12 PEOPLE

TOTAL POPULATION = 175

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Client/Project
BRIGIL
PETRIE'S LANDING II

BLOCK 8
180 Prestige Circle
OTTAWA, ON, CANADA

Title
SANITARY DRAINAGE PLAN

Project No.
160401331

Scale
1:250
0 2.5 7.5 12.5m

Drawing No.
SAN-1

Sheet
6 of 6

Revision
4

D07-12-19-0212

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ORIGINAL SHEET - ARCH D