# Servicing Report – 1983 Carling Avenue

Project # 160401679

Prepared for:
2473493 Ontario Inc.

Prepared by:
Stantec Consulting Ltd.

March 24, 2023

## Sign-off Sheet

This document entitled Servicing Report – 1983 Carling Avenue was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Cardel Developments Ltd. (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.

Prepared by ______________________________
(signature)

**Warren Johnson, C.E.T.**

Reviewed by ______________________________
(signature)

**Dustin Thiffault, P.Eng.**

LICENSED PROFESSIONAL ENGINEER
D. C. THIFFAULT
100186107
2023-07-27
PROVINCE OF ONTARIO

Approved by ______________________________
(signature)

**Kris Kilborn**

## Table of Contents

## LIST OF TABLES



## LIST OF FIGURES



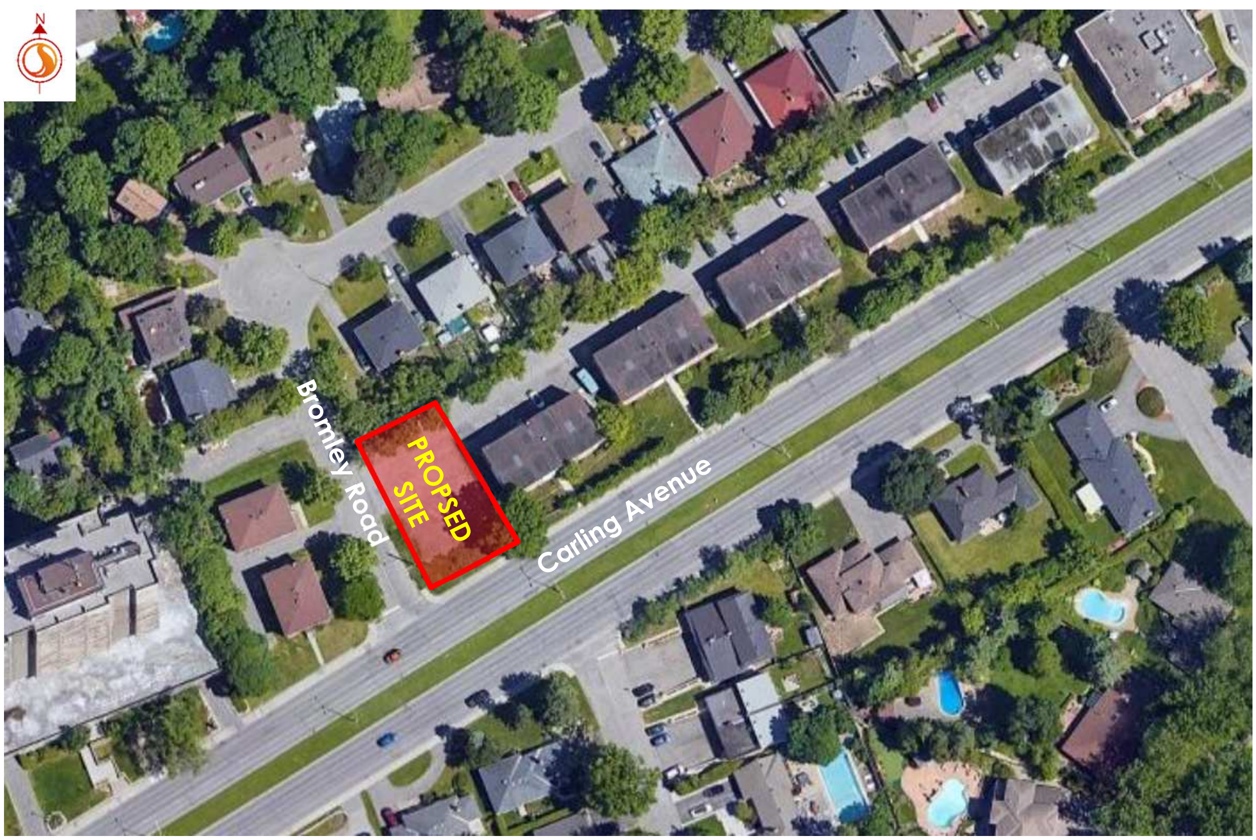
## LIST OF APPENDICES

# 1.0 INTRODUCTION

Stantec Consulting Ltd. has been commissioned by 2473493 Ontario Inc. to prepare a servicing study in support of Site Plan Control submission of the proposed development located at 1983 Carling Avenue. The site is situated on the north side of Carling Avenue and east of the intersection of Bromley Road and Carling Avenue within the City of Ottawa. The proposed 0.092ha (0.23 acres) site would replace an existing parking area with a three-storey apartment complex comprising 21 total residential units. The proposed location of the site is shown in **Figure 1**. The site is presently zoned Arterial Mainstreet Zone (AM10), which permits the proposed site plan.

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 per consultation with City of Ottawa staff.

**Figure 1: Location Plan**



# 2.0 BACKGROUND

Documents referenced in preparation of the design for the 1983 Carling Avenue development include:

- Geotechnical Investigation – Proposed Residential Development – 1983 Carling Avenue, Pinchin Ltd., May 4, 2021.
- City of Ottawa Sewer Design Guidelines, City of Ottawa, October 2012.
- City of Ottawa Design Guidelines – Water Distribution, City of Ottawa, July 2010.
- Technical Bulletin ISDTB-2014-01, City of Ottawa, February 2014
- *Technical Bulletin ISTB-2018-01*, City of Ottawa, March 21, 2018
- *Technical Bulletin ISTB-2018-02*, City of Ottawa, March 21, 2018
- *Technical Bulletin ISTB-2018-03*, City of Ottawa, March 21, 2018

# 3.0 WATER SUPPLY SERVICING

## 3.1 BACKGROUND

The proposed development comprises one three-storey residential apartment building complete with associated infrastructure and access areas. The site is located on the north side of Carling Avenue and east of the intersection with Bromley Road. The site will be serviced via a 50mm building service connection to the existing 150mm dia. watermain within the Bromley Road ROW at the western boundary of the site. The property is located within the City's Pressure Zone 1W. Ground elevations of the site are approximately 82.2m. Under normal operating conditions, hydraulic gradelines vary from approximately 108.6m to 114.6m as confirmed through boundary conditions provided by the City of Ottawa (see **Appendix A.3**) in consideration of a proposed five-storey complex. Updated boundary conditions were not deemed necessary since the currently proposed three-storey building has seen a reduction in domestic and fire flow demands from the previous boundary conditions. Utilizing these boundary conditions will provide a conservative approach to the site design.

## 3.2 WATER DEMANDS

Water demands for the development were estimated using the Ministry of Environment's Design Guidelines for Drinking Water Systems (2008). A daily rate of 280 L/cap/day has been applied for the population of the proposed site. Population densities have been assumed as 1.4 pers./studio and single units and 2.1 pers/ two bedroom units. See **Appendix A.1** for detailed domestic water demand estimates.

The average day demand (AVDY) for the entire site was determined to be 0.1 L/s. The maximum daily demand (MXDY) is 2.5 times the AVDY (residential property), which equals 0.2 L/s. The peak hour demand (PKHR) is 2.2 times the MXDY, totaling 0.5 L/s.

Combustible construction was considered in the assessment for fire flow requirements, and a minimum 2-hour rated fire wall is proposed along the building's east face to limit exposures to existing buildings. The proposed building will not be equipped with a sprinkler system. Based on calculations per the OFM Guidelines for Part 3 of the OBC (**Appendix A.2**), the maximum required fire flow for this development is 60 L/s (3,600L/min) which is within the available fire flows of 73L/s as per boundary conditions.

As per Technical Bulletin ISTB 2021-03, hydrant classification was done to calculate the overall fire flow demand. The distances between the site and the fire hydrants are shown in **Table 1**.

**Table 1: Hydrant and Fire Flow Demands**

| Location | Distance to Building (m) | Fire Flow Demand (L/min) | Fire Flow Demand (L/s) |
|---|---|---|---|
| Carling Avenue – north boulevard | 53 | 3800 | 63.33 |
| Carling Avenue – south boulevard | 40 | 3800 | 63.33 |
| **Total** | | **7600** | **126.67** |

As can be seen from the table above, the fire flow demand from the hydrants is more than sufficient for the required Fire Flow requirement of 3,600 L/min for the proposed development.

## 3.3 PROPOSED SERVICING

Boundary conditions provided by the City of Ottawa and based on an approximate elevation on-site of 82.2m, adequate domestic flows are available for the subject site, with pressures ranging from 26.4m (38 psi) to 32.4m (46 psi). This pressure range is slightly below the guidelines of 40-80 psi based on Ottawa's Design Guidelines for Water Distribution. As such, booster pumps will be required to meet the minimum pressures on all three floors of the proposed building.

Boundary conditions for the proposed development under maximum day demands and fire flow requirements demonstrate that the system will maintain a residual pressure of approximately the required 140 kPa (20 psi). The above demonstrates that the existing watermain within Bromley Road can provide adequate fire flows for the subject site.

Existing hydrants are located in proximity to the proposed site on the northern and southern Carling Avenue frontages approximately 53m and 40m from the proposed building's primary entrance respectively.

## 3.4 SUMMARY OF FINDINGS

The proposed development is located in an area of the City's water distribution system that has sufficient capacity to provide the required emergency fire flows. Booster pumps will be required to meet the domestic flows for the site and maintain a minimum pressure of 40psi for all three floors.

Based on the boundary conditions provided by City of Ottawa, the required fire flows are available for this development based on OFM guidelines and as per the City of Ottawa water distribution guidelines.

# 4.0 WASTEWATER SERVICING

## 4.1 BACKGROUND

The site will be serviced via an existing 225mm diameter sanitary sewer within Bromley Road immediately west of the subject site. A proposed 150 mm diameter service lateral connection is to be made directly to the existing 225 mm diameter concrete sanitary sewer along Bromley Road to service the proposed site (see **Drawing SSP-1**).

## 4.2 DESIGN CRITERIA

As outlined in the City of Ottawa's Sewer Design Guidelines and the MECP's 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 – 2.5m

## 4.3 PROPOSED SERVICING

The proposed site will be serviced by gravity sewers which will direct the wastewater flows (approx. 0.45 L/s with allowance for infiltration) to the proposed 225mm diameter sanitary sewer on Bromley Road. The proposed drainage pattern is detailed on **Drawing SSP-1**. A sanitary sewer design sheet for the proposed service lateral is included in **Appendix B.1**. A backwater valve is to be installed on the proposed sanitary service within the site to prevent any surcharge from the downstream sanitary sewer from impacting the proposed property.

# 5.0 STORMWATER MANAGEMENT

## 5.1 OBJECTIVES

The objective of this stormwater management plan is to determine the measures necessary to control the quantity/quality of stormwater released from the proposed development to criteria established during the pre-consultation/zoning process, and to provide sufficient detail for approval and construction.

## 5.2 SWM CRITERIA AND CONSTRAINTS

Criteria were established by combining current design practices outlined by the City of Ottawa Design Guidelines (2012), and through consultation with City of Ottawa staff. The following summarizes the criteria, with the source of each criterion indicated in brackets:

### General

- Use of the dual drainage principle (City of Ottawa).
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff. (City of Ottawa)
- Assess impact of 100-year event outlined in the City of Ottawa Sewer Design Guidelines on major & minor drainage system (City of Ottawa)

### Storm Sewer & Inlet Controls

- Size storm sewers to convey 2-year storm event under free-flow conditions using City of Ottawa I-D-F parameters (City of Ottawa).
- Proposed site to discharge to the existing 300mm diameter storm sewer within the Bromley Road at the western boundary of the subject site (City of Ottawa).
- As per coordination with the City on October 13, 2022 (refer to **Appendix C.5**), quantity control targets developed during pre-consultation (retain runoff to pre-development release based on a 5-year storm event and maximum runoff coefficient of 0.5) may be relaxed given sufficient quantity control is provided to demonstrate that there is significant improvement from existing site runoff conditions (existing runoff coefficient of 0.67). All stormwater runoff from the remainder of the site up to and including the 100-year storm event is to be released uncontrolled towards the Carling Avenue and Bromley Road rights of way where grading permits.
- 100-year Storm HGL to be a minimum of 0.30 m below building foundation footing (City of Ottawa).
- The site does not have quality control requirements, but best management practices should be applied throughout (See **Appendix C.4)** (RVCA).

**Surface Storage & Overland Flow**

- Provide adequate emergency overflow conveyance off-site with a minimum vertical clearance of 0.15 m between the downstream spill elevation and the ground elevation at the building envelope in the proximity of the flow route or ponding area. (City of Ottawa)
- Maximum depth of flow under either static or dynamic conditions shall be less than 0.35m (City of Ottawa)
- Provide adequate emergency overflow conveyance off-site (City of Ottawa)

## 5.3 STORMWATER MANAGEMENT

The Modified Rational Method was employed to assess the rate and volume of runoff generated during post-development conditions for uncontrolled and roof storage areas. A dynamic model in PCSWMM was then used to confirm the sizing of the subsurface storage BMP in accordance with comments made by the City in the pre-consultation. The site was subdivided into subcatchments (subareas) tributary to stormwater controls as defined by the location of inlet control devices. A summary of subareas and runoff coefficients is provided in **Appendix C**, and **Drawing SD-1** indicates the stormwater management subcatchments.

### 5.3.1 Allowable Release Rate

All stormwater runoff from uncontrolled areas of the site up to and including the 100-year storm event is to be released towards the Carling Avenue and Bromley Road rights of way where grading permits. The existing runoff coefficient of 0.67 was used to determine the total allowable release rate for the site. The predevelopment release rate for the area has been determined using the rational method based on the criteria above. A time of concentration for the predevelopment area (10 minutes) was assigned based on the relatively small site and its proximity to the existing drainage outlet for the site. C coefficient values have been increased by 25% for the post-development 100-year storm event based on MTO Drainage Manual recommendations. Peak flow rates have been calculated using the rational method as follows:

Q = 2.78 CiA
Where: Q = peak flow rate, L/s
A = drainage area, ha
I = rainfall intensity, mm/hr (per Ottawa IDF curves)
C = site runoff coefficient

**Table 2: Target Release Rate**

| Design Storm | Target Flow Rate (L/s) |
|---|---|
| 5-Year Event | 21.9 |
| 100-Year Event | 37.5 |

## 5.3.2 Storage Requirements

It is proposed to meet the restrictive outflow target for the development through use of rooftop storage in conjunction with a subsurface storage BMP along the northern property boundary controlled via an inlet control device (ICD). The storage BMP has additionally been sized to maintain a volume below the outgoing invert to suit retention of the 10mm storm event site runoff in addition that required for control of the 100-year storm event. It is noted that although retention of the 10mm event is described within the Stormwater Management Design Criteria for the Pinecrest Creek/Westboro Area, retention of the 10mm event was not specifically outlined as part of RVCA correspondence. Given that bedrock is anticipated within 0.8-0.9m below ground surface, BMP functionality is anticipated to be low during freeze/thaw and conditions of high groundwater inflow.

### 5.3.2.1 Rooftop Storage

It is proposed to retain stormwater on the building rooftops by installing restricted flow roof drains. The following calculations assume the roof will be equipped with two standard Watts Model Adjustable Accuflow Roof Drains.

Watts Drainage Adjustable "Accutrol" roof drain weir data has been used to calculate a practical roof release rate and detention storage volume for the rooftops. It should be noted that the "Accutrol" weir has been used as an example only, and that other products may be specified for use, provided that the total roof drain release rate is restricted to match the maximum rate of release indicated in **Table 3**, and that sufficient roof storage is provided to meet (or exceed) the resulting volume of detained stormwater. Proposed drain release rates have been calculated based on the Accutrol weir setting at ¼ open. Storage volume and controlled release rate are summarized in **Table 3**:

**Table 3: Roof Control Area**

| Design Storm | Depth (mm) | Discharge (L/s) | Volume Stored ($m^3$) |
|---|---|---|---|
| 5-Year | 110 | 1.6 | 6.4 |
| 100-Year | 148 | 1.9 | 14.8 |

Number of roof drains: 2

### 5.3.2.2 Subsurface Storage

A PCSWMM model was employed to assess the remainder of the site directed towards the subsurface BMP located along the northern side of the proposed building. A 10mm storm event (modified from the 25mm 3-hour Chicago storm presented within the Sewer Design Guidelines) was first run over all site subcatchments to determine the peak runoff volume from the site under post-development conditions. Results of the 10mm storm model scenario are summarized in **Table 4** below.

### Table 4: 10mm Event Site Runoff

| Subcatchment ID | Area (ha) | Runoff Depth (mm) | Runoff Volume (m3) |
|---|---|---|---|
| BLDG | 0.038 | 8.42 | 3.23 |
| CB200A | 0.043 | 7.34 | 3.12 |
| UNC-1 | 0.013 | 4.59 | 0.61 |
| UNC-2 | 0.019 | 0.00 | 0.00 |
| **Total** | | | **6.97** |

The storage BMP is composed of a 20m long 250mm perforated subdrain within a 1.15m wide by 1.8m tall clear stone infiltration trench. The invert of the subdrain is anticipated to coincide with bedrock elevations as noted by the geotechnical investigation prepared by Pinchin Ltd. The perforated subdrain is situated at 1.0m in depth to allow the bottom 0.8m of the storage BMP to retain the runoff volume from the 10mm event (approx. provided volume of 7.4m3 considering clear stone porosity of 0.4). The downstream catch basin will have an IPEX Tempest LMF model 85 (Vortex ICD) inlet control device installed on its outlet to allow captured runoff to surcharge into the storage BMP. The remaining storage volume up to the surface was then maximized to maintain the target peak discharge rate for the 100-year event. In order to control peak discharge from the subject site to within target levels, the storage BMP provides an additional storage volume of approximately 9.2m3 above the perforated pipe underdrain (total storage of 16.6m3 to bottom of infiltration trench). Retained stormwater volumes are anticipated to discharge slowly to groundwater flows during inter-event periods as permitted by assumed bedrock formations immediately below. Storage volumes below the perforated pipe underdrain have not been considered in development of the PCSWMM model for larger storm events (5-100 year storms) for conservatism.

Controlled release rates and storage volumes required for the 5-year and 100-year storm event are summarized in **Table 4**.

### Table 5: Subsurface Storage BMP Required Volumes

| Storm Return Period | Area ID | Design Head (m) | Discharge (L/s) | Orifice Type | $V_{required}$ ($m^3$) |
|---|---|---|---|---|---|
| 5-year | CB-200A | 1.02 | 6.5 | IPEX Tempest LMF 85 ICD | 2 |
| 100-year | | 1.56 | 8.0 | | 7 |

The results of the PCSWMM analysis are included in **Appendix C.3**.

#### 5.3.2.3 Uncontrolled Release

Due to grading restrictions, two small subcatchments on the south and east ends of the site have been designed without a storage component (UNC-1 and UNC-2). These subcatchment areas direct their uncontrolled discharge off-site to the adjacent Carling Avenue and Bromley Road ROW. Peak discharges from uncontrolled areas have been considered in the overall SWM plan and have been balanced through overcontrolling the proposed site discharge rates to meet target levels.

**Table 6** summarizes the estimated uncontrolled storm release rates during the 5 and 100-year storm events.

**Table 6: 5 and 100 Year Peak Uncontrolled Discharge Summary**

| Drainage Area | 5-Year Event Discharge (L/s) | 100-Year Event Discharge (L/s) |
|---|---|---|
| UNC-1 and UNC-2 | 4.2 | 9.0 |

### 5.3.3 Results

**Table 7** provides a summary of the peak design discharge rates from the MRM and PCSWMM analysis based on the proposed stormwater management plan. As the table demonstrates, the site's SWM design adheres to the target peak outflow rate in both the MRM and PCSWMM analysis.

**Table 7: Summary of Total 5-Year and 100-Year Event Release Rates**

| | 5-year Peak Discharge (L/s) | 100-Year Peak Discharge (L/s) |
|---|---|---|
| Uncontrolled – Surface | 4.2 | 9.0 |
| Controlled – Subsurface Storage | 6.5 | 8.0 |
| Controlled – Roof Drain | 1.6 | 1.9 |
| **Total (L/s)** | **12.3** | **18.9** |
| **Target (L/s)** | **21.9** | **37.5** |
| **Reduction from existing site runoff** | **43.8%** | **49.6%** |

The above demonstrates that there will be a significant improvement from existing site runoff and is assumed adequate to meet the design criteria provided through correspondence with the City on October 13, 2022.

Flows from the subsurface storage BMP and roof drains will be directed to the 300 mm diameter storm sewer on Bromley Road using a 300 mm diameter building storm sewer. A design sheet confirming the adequacy of sewer sizing is included in **Appendix C.1**. See Drawing SSP-1 (**Appendix E**) for the proposed locations of all services and other SWM infrastructure.

# 6.0 GRADING AND DRAINAGE

The proposed development site measures approximately 0.092ha in area. The site slopes from south to north, with grades at property corners varying by approximately 1.1m across the site. Overland flow is generally being directed to the adjacent Bromley Road ROW. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy any stormwater management requirements and provide for minimum cover requirements for storm and sanitary sewers where possible. Existing grades at the rear of the property have been maintained. Site grading has been established to provide emergency overland flow routes required for stormwater management in accordance with City of Ottawa requirements.

The subject site maintains emergency overland flow routes for flows deriving from storm events in excess of the maximum design event to the existing Carling Avenue and Bromley Road ROWs as depicted in **Drawing GP-1.**

# 7.0 UTILITIES

As the subject site lies within a developed residential community, Hydro, Bell, Gas and Cable servicing for the proposed development should be readily available. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the proposed site. Exact size, location and routing of utilities, along with determination of any off-site works required for redevelopment, will be finalized after design circulation by the electrical consultant.

# 8.0 APPROVALS

It is not expected that Environmental Compliance Approvals (ECAs) under the Ontario Water Resources Act will be required by the Ontario Ministry of Environment conservations and Parks (MECP) in relation to proposed storm and sanitary sewers, as the proposed sewers will be approved under the building code act and the capture area for the proposed subsurface BMP lies entirely within the residential site to be wholly contained under singular ownership, meeting criteria for ECA exemption per O.Reg. 525/98.

The Rideau Valley Conservation Authority will need to be consulted in order to obtain municipal approval for site development. A Requirement for a MECP Permit to Take Water (PTTW) may be required and can be confirmed by the geotechnical consultant at the time of application.

# 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.

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

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

Refer to **Drawing ECDS-1** for the proposed location of silt fences, straw bales, and other erosion control structures.

# 10.0 GEOTECHNICAL INVESTIGATION AND ENVIRONMENTAL ASSESSMENT

A geotechnical Investigation report was prepared by Pinchin Ltd. on May 4, 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 Pinchin report.

A subsurface investigation was conducted with four borehole samples which concluded that the site is underlain by surficial asphalt or granular fill followed by glacial till and bedrock.

Bedrock was encountered within 0.8m to 0.9m below ground surface. Groundwater was not found within the open boreholes. Refer to File #289578 for additional Geotechnical information.

# 11.0 CONCLUSIONS

## 11.1 WATER SERVICING

Based on the supplied boundary conditions for existing watermains, it is anticipated that booster pumps will be required to sustain adequate pressures for required domestic demands of the proposed site. Emergency fire flow demands of the proposed site are adequately supplied via existing watermains within adjacent rights-of-way.

## 11.2 SANITARY SERVICING

The proposed sanitary sewer network is sufficiently sized to provide gravity drainage of the site. The proposed site will be serviced by a gravity sewer service lateral which will direct wastewater flows (approx. 0.45 L/s) to a 225mm dia. sanitary sewer to be constructed within the Bromley Road ROW at the western boundary of the property. The proposed drainage outlet has sufficient capacity to receive sanitary discharge from the site.

## 11.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with local and provincial standards. Rooftop storage with controlled roof drains, and subsurface storage via a clear stone infiltration trench BMP has been proposed to limit peak storm sewer inflows to the existing 300mm diameter storm sewers along Bromley Road ROW. The downstream receiving sewer has sufficient capacity to receive runoff volumes from the site.

## 11.4 GRADING

Grading for the site has been designed to provide an emergency overland flow route as per City requirements and reflects recommendations in the Geotechnical Investigation Report prepared by Pinchin Ltd. on May 4, 2021. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing facilities.

## 11.5 UTILITIES

Utility infrastructure exists within the existing Carling Avenue and Bromley Road ROWs at the southern and western boundaries of the proposed site. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the proposed site. Exact size, location and routing of utilities will be finalized after design circulation by the electrical consultant.

## 11.6 APPROVALS/PERMITS

An MECP Environmental Compliance Approval is not expected to be required for the subject site storm/sanitary sewers and stormwater management works. A Permit to Take Water is anticipated to be required and will be confirmed by geotechnical consultant. The Rideau Valley Conservation Authority will need to be consulted in order to obtain municipal approval for site development. No other approval requirements from other regulatory agencies are anticipated.

# Appendix A WATER SUPPLY SERVICING

## A.1 DOMESTIC WATER DEMAND ESTIMATE

**1983 Carling Avenue - Domestic Water Demand Estimates**
Site Plan provided by Figurr Architects Collective (2023-03-20)
Project No. 160401679

| Densities as per City Guidelines: | | |
|---|---|---|
| Apartment Units | | |
| 1 Bedroom | 1.4 | ppu |
| 2 Bedroom | 2.1 | ppu |

| Building ID | No. of Units | Population | Daily Rate of Demand [1] (L/m²/day) | Avg Day Demand | | Max Day Demand [2] | | Peak Hour Demand [2] | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | (L/min) | (L/s) | (L/min) | (L/s) | (L/min) | (L/s) |
| | | | | | | | | | |
| **Apartment Units** | | | | | | | | | |
| 1 Bedroom / Studio | 19 | 27 | 280 | 5.2 | 0.09 | 12.9 | 0.22 | 28.4 | 0.47 |
| 2 Bedroom | 2 | 4 | 280 | 0.8 | 0.01 | 2.0 | 0.03 | 4.5 | 0.07 |
| | | | | | | | | | |
| **Total Site :** | **21** | **31** | | **6.0** | **0.1** | **15.0** | **0.2** | **32.9** | **0.5** |

1 Average day water demand for residential areas: 280 L/cap/d
2 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 for residential
peak hour demand rate = 2.2 x maximum day demand rate for residential

# A.2 FIRE FLOW REQUIREMENTS PER OBC

# Fire Flow Calculations as per Ontario Building Code 2006 (Appendix A)

| | | | |
|---|---|---|---|
| Job# | 160401679 | Designed by: | WAJ |
| Date | 18-Nov-22 | Checked by: | DT |
| | | Description: | 3-Storey Res. with Basement and Mech. Penthouse |

$$Q = KVS_{tot}$$

Q = Volume of water required (L)

V = Total building volume (m3)

K = Water supply coefficient from Table 1

$S_{tot}$ = Sotal of spatial coefficeint values from property line exposures on all sides as obtained from the formula

$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + S_{side4}]$

| | | | | |
|---|---|---|---|---|
| 1 | Type of construction | Building Classification | | Water Supply Coefficient |
| | combustible without Fire-Resistance Ratings | A-2, B-1, B-2, B-3, C, D | | 23 |
| | | | | |
| 2 | Area of one floor ($m^2$) | number of floors | Avg. height of ceiling (m) | Total Building Volume ($m^3$) |
| | 383 | 4 | 3.13 | 4,791 |
| | | | | |
| 3 | Side | Exposure Distance (m) | Spatial Coefficient | Total Spatial Coeffiecient |
| | North | 8.2 | 0.18 | 1.18 |
| | East | FIRE WALL | 0 | |
| | South | 14.6 | 0 | |
| | West | 11.7 | 0 | |
| | | | | |
| 4 | Established Fire Safety Plan? | Reduction in Volume (%) | | Total Volume Reduction |
| | no | 0% | | 0% |
| | | | | |
| 5 | | | | **Total Volume 'Q' (L)** |
| | | | | **130,028** |
| | | | | |
| | | | | **Minimum Required Fire Flow (L/min)** |
| | | | | **3,600** |

# A.3 BOUNDARY CONDITIONS

| | |
|---|---|
| **From:** | Surprenant, Eric |
| **To:** | Rathnasooriya, Thakshika |
| **Cc:** | Kilborn, Kris; Mott, Peter |
| **Subject:** | Fw: 1951 Carling Avenue - Boundary Conditions Request |
| **Date:** | Monday, May 17, 2021 2:11:21 PM |
| **Attachments:** | 1951 Carling Avenue May 2021.pdf |

Hello Thakshika,

See the following regarding your additional inquiry.

The following are boundary conditions, HGL, for hydraulic analysis at 1951 Carling (zone 1W) assumed to be connected to the 152mm on Bromley Road (see attached PDF for location).

Minimum HGL = 108.6 m

Maximum HGL = 114.6 m

Available Fire Flow @ 20 psi = 73 L/s, assuming a ground elevation of 82.7 m.

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

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

Thanks

Eric Surprenant, CET
Sr, Project Manager,  Infrastructure Projects, West
Planning, Infrastructure & Economic Development
613 580-2424 ext.: 27794

Please take note that due to current COVID situation, I am working remotely and Phone communication and messaging may not be reliable at this time. Preferred method of communications will be e-mails  during this period. If your preference is telephone communication, please indicate this via e-mail and provide a contact telephone number.
Absence alert:

I apologize for any inconvenience.

---

**From:** Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>

**Sent:** May 13, 2021 14:32
**To:** Surprenant, Eric <Eric.Surprenant@ottawa.ca>
**Cc:** Kilborn, Kris <kris.kilborn@stantec.com>; Mott, Peter <Peter.Mott@stantec.com>
**Subject:** RE: 1951 Carling Avenue - Boundary Conditions Request



Hi Eric ,

Are you able to also provide us with the boundary conditions for a maximum day plus fire flow demand of 105 L/s ( 6,300L/min).

Thank you,

**Shika Rathnasooriya** , P.Eng.

Direct: 613-668-9635
Thakshika.Rathnasooriya@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4



---

**From:** Surprenant, Eric <Eric.Surprenant@ottawa.ca>
**Sent:** Wednesday, May 12, 2021 4:21 PM
**To:** Mott, Peter <Peter.Mott@stantec.com>; Kilborn, Kris <kris.kilborn@stantec.com>
**Subject:** Fw: 1951 Carling Avenue - Boundary Conditions Request

Hello Peter,

Please verify the fire demand as our water resources, Senior Engineer has noted that it seemed a bit low.

The following are boundary conditions, HGL, for hydraulic analysis at 1951 Carling (zone 1W) assumed to be connected to the 152mm on Bromley Road (see attached PDF for location).

Minimum HGL = 108.6 m
Maximum HGL = 114.6 m
Max Day + Fire Flow (67 L/s) = 98.8 m
These are for current conditions and are based on computer model simulation.
*Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.*
Thanks
Eric Surprenant, CET
Sr, Project Manager,  Infrastructure Projects, West
Planning, Infrastructure & Economic Development
613 580-2424 ext.: 27794

Please take note that due to current COVID situation, I am working remotely and Phone communication and messaging may not be reliable at this time. Preferred method of communications will be e-mails  during this period. If your preference is telephone communication, please indicate this via e-mail and provide a contact telephone number.
Absence alert:

I apologize for any inconvenience.

---

**From:** Mott, Peter <Peter.Mott@stantec.com>
**Sent:** April 27, 2021 09:15
**To:** Surprenant, Eric <Eric.Surprenant@ottawa.ca>
**Cc:** Kilborn, Kris <kris.kilborn@stantec.com>
**Subject:** 1951 Carling Avenue - Boundary Conditions Request



I would like to request the hydraulic boundary conditions for the proposed site located at 1951 Carling Avenue. Please find attached the site plan, the key map showing the location of the proposed development, domestic water demand calculations, and fire flow calculations.

A summary of the proposed site is provided below:

We anticipate a connection to the existing watermain infrastructure to service the site. The following connection is expected for servicing:

➢Connection to existing 152 mm (UCI) watermain on Bromley Road.

*Existing fire hydrant adjacent to the property to the south along Carling Avenue.

**For the purpose of the boundary conditions request, may you please provide us with the boundary conditions for the following servicing option:**

i. Watermain connection to the existing 152 mm (UCI) watermain on Bromley Road; assuming a fire flow requirement of **4,000 L/min** for the site in addition to the domestic water demands provided below.

- The intended land use is residential, per the summary provided in the Domestic Demands spreadsheet. (See attached Site Plan with project stats)
- Estimated fire flow demand per the FUS methodology: 4000 L/min (67 L/s)
- Domestic water demands for the entire development:
    - **Average day: 9.9 L/min (0.20 L/s)**
    - **Maximum day: 24.7 L/min (0.40 L/s)**
    - **Peak hour: 54.3 L/min (0.90 L/s)**

Thank you for your time and please contact me at your earliest convenience if any additional information or clarification is required.

Best regards,

**Peter Mott** EIT
Engineering Intern, Community Development

Mobile: 613-897-0445
Peter.Mott@stantec.com
Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

# Appendix B WASTEWATER SERVICING

## B.1 SANITARY SEWER DESIGN SHEET

Stantec

SUBDIVISION:

**1983 Carling Avenue**

DATE: 5/27/2022
REVISION: 3
DESIGN BY: WAJ
CHECKED BY:

# SANITARY SEWER DESIGN SHEET

**(City of Ottawa)**

**FILE NUMBER:** 160401679

**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 l/ha/day | MAXIMUM VELOCITY | 3.00 m/s |
| PEAKING FACTOR (INDUSTRIAL): | 2.4 | INDUSTRIAL (HEAVY) | 55,000 l/ha/day | MANNINGS n | 0.013 |
| PEAKING FACTOR (ICI >20%): | 1.5 | INDUSTRIAL (LIGHT) | 35,000 l/ha/day | BEDDING CLASS | B |
| PERSONS / BACHELOR | 1.4 | INSTITUTIONAL | 28,000 l/ha/day | MINIMUM COVER | 2.50 m |
| PERSONS / 1 BEDROOM | 1.4 | INFILTRATION | 0.33 l/s/Ha | HARMON CORRECTION FACTOR | 0.8 |
| PERSONS / 2 BEDROOM | 2.1 | | | | |
| PERSONS / 2 BEDROOM | 3.1 | | | | |

| LOCATION | | | RESIDENTIAL AREA AND POPULATION | | | | | | | | | | COMMERCIAL | | INDUSTRIAL (L) | | INDUSTRIAL (H) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AREA ID NUMBER | FROM M.H. | TO M.H. | AREA (ha) | BACHELOR | 1 BEDROOM | 2 BEDROOM | 3 BEDROOM | POP. | CUMULATIVE AREA (ha) | CUMULATIVE POP. | PEAK FACT. | PEAK FLOW (l/s) | AREA (ha) | ACCU. AREA (ha) | AREA (ha) | ACCU. AREA (ha) | AREA (ha) | ACCU. AREA (ha) |
| BLDG | BLDG | TEE | 0.092 | 0 | 19 | 2 | 0 | 31 | 0.09 | 31 | 4.00 | 0.40 | 0.000 | 0.000 | 0.00 | 0.00 | 0.00 | 0.00 |

| AREA ID NUMBER | INSTITUTIONAL | | GREEN / UNUSED | | C+I+I | INFILTRATION | | | TOTAL | PIPE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AREA (ha) | ACCU. AREA (ha) | AREA (ha) | ACCU. AREA (ha) | PEAK FLOW (l/s) | TOTAL AREA (ha) | ACCU. AREA (ha) | INFILT. FLOW (l/s) | FLOW (l/s) | LENGTH (m) | DIA (mm) | MATERIAL | CLASS | SLOPE (%) | CAP. (FULL) (l/s) | CAP. V PEAK FLOW (%) | VEL. (FULL) (m/s) | VEL. (ACT.) (m/s) |
| BLDG | 0.00 | 0.00 | 0.06 | 0.06 | 0.00 | 0.150 | 0.15 | 0.05 | 0.45 | 18.9 | 150 | PVC | DR 28 | 1.00 | 15.3 | **2.93%** | 0.86 | 0.41 |
| | | | | | | | | | | | 225 | | | | | | | |

# Appendix C STORMWATER MANAGEMENT

## C.1 STORM SEWER DESIGN SHEET

| Stantec | 1983 Carling Avenue | | STORM SEWER DESIGN SHEET (City of Ottawa) |
|---|---|---|---|
| | DATE: | 2022-10-14 | |
| | REVISION: | 4 | |
| | DESIGNED BY: | WAJ | FILE NUMBER: **160401679** |
| | CHECKED BY: | | |

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 | MANNING'S n = | 0.013 | BEDDING CLASS B |
| b = | 6.199 | 6.053 | 6.014 | 6.014 | MINIMUM COVER: | 2.00 | m |
| c = | 0.810 | 0.814 | 0.816 | 0.820 | TIME OF ENTRY | 10 | min |

**LOCATION / DRAINAGE AREA**

| 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) (-) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BLDG | BLDG | STM 101 | 0.000 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | | | | | |
| CB-200A | STM 101 | STM 100 | 0.000 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.81 | 0.00 | 0.00 |
| | | | | | | | | | | | |

| AREA ID NUMBER | 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BLDG | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 10.00 | 76.81 | 104.19 | 122.14 | 178.56 | 1.9 | 1.9 | 1.9 |
| | | | | | | | | | **10.16** | | | | | | | |
| CB-200A | 0.000 | 0.000 | 0.032 | 0.032 | 0.000 | 0.000 | 0.000 | 0.000 | 10.16 | 76.21 | 103.37 | 121.17 | 177.13 | 0.0 | 1.9 | 11.2 |
| | | | | | | | | | **10.40** | | | | | | | |

**PIPE SELECTION**

| AREA ID NUMBER | LENGTH (m) | PIPE WIDTH OR DIAMETER (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) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BLDG | 4.5 | 200 | 200 | CIRCULAR | PVC | SDR 35 | 1.00 | 33.3 | **5.6%** | 1.05 | 0.48 | 0.16 |
| | | 200 | 200 | | | | | | | | | |
| CB-200A | 8.7 | 300 | 300 | CIRCULAR | PVC | SDR 35 | 0.50 | 68.0 | **16.4%** | 0.97 | 0.59 | 0.24 |
| | | 300 | 300 | | | | | | | | | |

## C.2 RATIONAL METHOD CALCULATIONS

# Stormwater Management Calculations

**Project #160401667, 1983 Carling Avenue**
**Modified Rational Method Calculatons for Storage**

**5 yr Intensity** | $I = a/(t + b)^c$
**City of Ottawa**

| | |
|---|---|
| a = | 998.071 |
| b = | 6.053 |
| c = | 0.814 |

| t (min) | I (mm/hr) |
|---|---|
| 10 | 104.19 |
| 20 | 70.25 |
| 30 | 53.93 |
| 40 | 44.18 |
| 50 | 37.65 |
| 60 | 32.94 |
| 70 | 29.37 |
| 80 | 26.56 |
| 90 | 24.29 |
| 100 | 22.41 |
| 110 | 20.82 |
| 120 | 19.47 |

**5 YEAR Predevelopment Target Release from Portion of Site**

**Subdrainage Area:** Predevelopment Tributary Area to Outle
**Area (ha):** 0.1128
**C:** 0.67

Typical Time of Concentration

| tc (min) | I (5 yr) (mm/hr) | Qtarget (L/s) |
|---|---|---|
| 10 | 104.19 | **21.89** |

**5 YEAR Modified Rational Method for Entire Site**

**Subdrainage Area:** ROOF — Roof
**Area (ha):** 0.038 — Maximum Storage Depth: 150 mm
**C:** 0.90

| tc (min) | I (5 yr) (mm/hr) | Qactual (L/s) | Qrelease (L/s) | Qstored (L/s) | Vstored (m^3) | Depth (mm) | |
|---|---|---|---|---|---|---|---|
| 10 | 104.19 | 10.01 | 1.60 | 8.42 | 5.05 | 102.9 | 0.00 |
| 20 | 70.25 | 6.75 | 1.63 | 5.11 | 6.14 | 109.1 | 0.00 |
| 30 | 53.93 | 5.18 | 1.64 | 3.54 | **6.37** | 110.5 | 0.00 |
| 40 | 44.18 | 4.25 | 1.64 | 2.61 | 6.25 | 109.8 | 0.00 |
| 50 | 37.65 | 3.62 | 1.63 | 1.99 | 5.97 | 108.2 | 0.00 |
| 60 | 32.94 | 3.17 | 1.62 | 1.55 | 5.58 | 105.9 | 0.00 |
| 70 | 29.37 | 2.82 | 1.60 | 1.22 | 5.14 | 103.4 | 0.00 |
| 80 | 26.56 | 2.55 | 1.58 | 0.97 | 4.66 | 100.6 | 0.00 |
| 90 | 24.29 | 2.33 | 1.56 | 0.78 | 4.20 | 96.6 | 0.00 |
| 100 | 22.41 | 2.15 | 1.53 | 0.62 | 3.74 | 92.3 | 0.00 |
| 110 | 20.82 | 2.00 | 1.50 | 0.50 | 3.29 | 88.0 | 0.00 |
| 120 | 19.47 | 1.87 | 1.48 | 0.40 | 2.85 | 83.8 | 0.00 |

Storage: Roof Storage

| | Depth (mm) | Head (m) | Discharge (L/s) | Vreq (cu. m) | Vavail (cu. m) | Discharge Check |
|---|---|---|---|---|---|---|
| 5-year Water Level | 110 | 0.11 | 1.64 | 6.37 | 15.36 | 0.00 |

**Subdrainage Area:** UNC-1, UNC-2 — Uncontrolled -Tributary
**Area (ha):** 0.032
**C:** 0.46

| tc (min) | I (5 yr) (mm/hr) | Qactual (L/s) | Qrelease (L/s) | Qstored (L/s) | Vstored (m^3) |
|---|---|---|---|---|---|
| 10 | 104.19 | 4.22 | 4.22 | | |
| 20 | 70.25 | 2.84 | 2.84 | | |
| 30 | 53.93 | 2.18 | 2.18 | | |
| 40 | 44.18 | 1.79 | 1.79 | | |
| 50 | 37.65 | 1.52 | 1.52 | | |
| 60 | 32.94 | 1.33 | 1.33 | | |
| 70 | 29.37 | 1.19 | 1.19 | | |
| 80 | 26.56 | 1.08 | 1.08 | | |
| 90 | 24.29 | 0.98 | 0.98 | | |
| 100 | 22.41 | 0.91 | 0.91 | | |
| 110 | 20.82 | 0.84 | 0.84 | | |
| 120 | 19.47 | 0.79 | 0.79 | | |

**Project #160401667, 1983 Carling Avenue**
**Modified Rational Method Calculatons for Storage**

**100 yr Intensity** | $I = a/(t + b)^c$
**City of Ottawa**

| | |
|---|---|
| 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 Predevelopment Target Release from Portion of Site**

**Subdrainage Area:** Predevelopment Tributary Area to Outle
**Area (ha):** 0.1128
**C:** 0.67

Typical Time of Concentration

| tc (min) | I (5 yr) (mm/hr) | Qtarget (L/s) |
|---|---|---|
| 10 | 178.56 | **37.52** |

**100 YEAR Modified Rational Method for Entire Site**

**Subdrainage Area:** ROOF — Roof
**Area (ha):** 0.038 — 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 | 19.06 | 1.77 | 17.29 | 10.37 | 130.7 | 0.00 |
| 20 | 119.95 | 12.80 | 1.84 | 10.97 | 13.16 | 141.5 | 0.00 |
| 30 | 91.87 | 9.81 | 1.87 | 7.94 | 14.29 | 145.9 | 0.00 |
| 40 | 75.15 | 8.02 | 1.88 | 6.14 | 14.75 | 147.6 | 0.00 |
| 50 | 63.95 | 6.83 | 1.88 | 4.95 | **14.84** | 148.0 | 0.00 |
| 60 | 55.89 | 5.97 | 1.88 | 4.09 | 14.72 | 147.5 | 0.00 |
| 70 | 49.79 | 5.32 | 1.87 | 3.44 | 14.47 | 146.5 | 0.00 |
| 80 | 44.99 | 4.80 | 1.86 | 2.94 | 14.11 | 145.2 | 0.00 |
| 90 | 41.11 | 4.39 | 1.85 | 2.54 | 13.70 | 143.6 | 0.00 |
| 100 | 37.90 | 4.05 | 1.84 | 2.21 | 13.23 | 141.8 | 0.00 |
| 110 | 35.20 | 3.76 | 1.83 | 1.93 | 12.73 | 139.9 | 0.00 |
| 120 | 32.89 | 3.51 | 1.82 | 1.70 | 12.21 | 137.8 | 0.00 |

Storage: Roof Storage

| | Depth (mm) | Head (m) | Discharge (L/s) | Vreq (cu. m) | Vavail (cu. m) | Discharge Check |
|---|---|---|---|---|---|---|
| 100-year Water Level | 148 | 0.15 | 1.88 | 14.84 | 15.36 | 0.00 |

**Subdrainage Area:** UNC-1, UNC-2 — Uncontrolled -Tributary
**Area (ha):** 0.032
**C:** 0.57

| tc (min) | I (100 yr) (mm/hr) | Qactual (L/s) | Qrelease (L/s) | Qstored (L/s) | Vstored (m^3) |
|---|---|---|---|---|---|
| 10 | 178.56 | 9.03 | 9.03 | | |
| 20 | 119.95 | 6.07 | 6.07 | | |
| 30 | 91.87 | 4.65 | 4.65 | | |
| 40 | 75.15 | 3.80 | 3.80 | | |
| 50 | 63.95 | 3.24 | 3.24 | | |
| 60 | 55.89 | 2.83 | 2.83 | | |
| 70 | 49.79 | 2.52 | 2.52 | | |
| 80 | 44.99 | 2.28 | 2.28 | | |
| 90 | 41.11 | 2.08 | 2.08 | | |
| 100 | 37.90 | 1.92 | 1.92 | | |
| 110 | 35.20 | 1.78 | 1.78 | | |
| 120 | 32.89 | 1.66 | 1.66 | | |

## Project #160401667, 1983 Carling Avenue
## Roof Drain Design Sheet, Area BLDG
## Standard Watts Model Adjustable Accutrol Roof Drain

| 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 | 0.0006 | 0 | 0.025 | 9 | 0 | 0 | 0.025 |
| 0.050 | 0.0006 | 0.0013 | 1 | 0.050 | 34 | 0 | 1 | 0.050 |
| 0.075 | 0.0007 | 0.0014 | 2 | 0.075 | 77 | 1 | 2 | 0.075 |
| 0.100 | 0.0008 | 0.0016 | 5 | 0.100 | 137 | 3 | 5 | 0.100 |
| 0.125 | 0.0009 | 0.0017 | 9 | 0.125 | 213 | 4 | 9 | 0.125 |
| 0.150 | 0.0009 | 0.0019 | 15 | 0.150 | 307 | 6 | 15 | 0.150 |

| Drawdown Estimate | | | |
|---|---|---|---|
| Total Volume (cu.m) | Total Time (sec) | Vol (cu.m) | Detention Time (hr) |
| | | | |
| 0.0 | 0.0 | 0.0 | 0 |
| 0.5 | 394.5 | 0.5 | 0.10958 |
| 1.8 | 951.8 | 1.4 | 0.37397 |
| 4.5 | 1668.2 | 2.6 | 0.83735 |
| 8.8 | 2500.2 | 4.3 | 1.53185 |
| 15.3 | 3419.0 | 6.5 | 2.48156 |

**Rooftop Storage Summary**

| | | |
|---|---|---|
| Total Building Area (sq.m) | | 384 |
| Assume Available Roof Area (sq. | 80% | 307.2 |
| Roof Imperviousness | | 0.99 |
| Roof Drain Requirement (sq.m/Notch) | | 232 |
| Number of Roof Notches* | | 2 |
| Max. Allowable Depth of Roof Ponding (m) | | 0.15 |
| Max. Allowable Storage (cu.m) | | 15 |
| Estimated 100 Year Drawdown Time (h) | | 2.4 |

* 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 | 0.3155 | 0.3155 | 0.3155 | **0.3155** | 0.3155 |
| 0.050 | 0.6309 | 0.6309 | 0.6309 | **0.6309** | 0.3155 |
| 0.075 | 0.9464 | 0.8675 | 0.7886 | **0.7098** | 0.3155 |
| 0.100 | 1.2618 | 1.1041 | 0.9464 | **0.7886** | 0.3155 |
| 0.125 | 1.5773 | 1.3407 | 1.1041 | **0.8675** | 0.3155 |
| 0.150 | 0 | 1.5773 | 1.2618 | **0.9464** | 0.3155 |

**Calculation Results**

| | **5yr** | **100yr** | **Available** |
|---|---|---|---|
| Qresult (cu.m/s) | 0.002 | 0.002 | - |
| Depth (m) | 0.110 | 0.148 | 0.150 |
| Volume (cu.m) | 6.4 | 14.8 | 15.4 |
| Draintime (hrs) | 1.1 | 2.4 | |

# C.3 PCSWMM OUTPUT FILES

```
[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option             Value
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    NO

START_DATE           10/19/2022
START_TIME           00:00:00
REPORT_START_DATE    10/19/2022
REPORT_START_TIME    00:00:00
END_DATE             10/19/2022
END_TIME             03:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             00:01:00
ROUTING_STEP         1
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
```



```
MINIMUM_STEP         0.5
THREADS              8

[EVAPORATION]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
RG1              INTENSITY 0:10     1.0      TIMESERIES 100YEAR

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack

;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
----------------
;0.90
BLDG             RG1              ROOF             0.038354 100      8.64     1.5      0

;0.81
CB200A           RG1              CB200            0.042555 87.1     9.6      1.5      0


[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
BLDG             0.013      0.2        1.57       4.67       0          OUTLET
CB200A           0.013      0.2        1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   Param1     Param2     Param3     Param4     Param5
;;-------------- ---------- ---------- ---------- ---------- ----------
BLDG             76.2       13.2       4.14       7          0
CB200A           76.2       13.2       4.14       7          0
```

```
[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
STM100           79.8       FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap
Psi      Ksat     IMD
;;-------------- -------- ---------- ---------- ---------- ---------------------------- -------- --------
       -------- --------
CB200            80.08    1.93       0          TABULAR    RYTRENCH                     0        0
ROOF             100      0.15       0          TABULAR    ROOF-V                       0        0
STM101           79.95    2.08       0          FUNCTIONAL 0         0         1.32     0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow
MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ----------
----------
STM101-STM100    STM101           STM100           8.7        0.013      79.95      79.86      0          0


[OUTLETS]
;;Name           From Node        To Node          Offset     Type             QTable/Qcoeff    Qexpon
Gated
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ----------
--------
;LMF85
CB200-STM101     CB200            STM101           80.08      FUNCTIONAL/HEAD  6.407            0.5
NO
ROOF-STM101      ROOF             STM101           100        TABULAR/HEAD     ROOF-Q
NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
STM101-STM100    CIRCULAR     0.3              0          0          0          1
```



```
[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
STM101-STM100    0          1.344      0          NO         0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
ROOF-Q           Rating     0          0
ROOF-Q                      0.025      0.631
ROOF-Q                      0.05       1.262
ROOF-Q                      0.075      1.42
ROOF-Q                      0.1        1.577
ROOF-Q                      0.125      1.735
ROOF-Q                      0.15       1.893

ROOF-V           Storage    0          0
ROOF-V                      0.025      9
ROOF-V                      0.05       34
ROOF-V                      0.075      77
ROOF-V                      0.1        137
ROOF-V                      0.125      213
ROOF-V                      0.15       307

RYTRENCH         Storage    0          0
RYTRENCH                    0.82       0
RYTRENCH                    0.8201     9.12
RYTRENCH                    1.82       9.12
RYTRENCH                    1.8201     0
RYTRENCH                    1.93       75.1

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
100YEAR                     0:00       0
100YEAR                     0:10       6.05
100YEAR                     0:20       7.54
100YEAR                     0:30       10.16
```

```
100YEAR                    0:40       15.97
100YEAR                    0:50       40.65
100YEAR                    1:00       178.56
100YEAR                    1:10       54.05
100YEAR                    1:20       27.32
100YEAR                    1:30       18.24
100YEAR                    1:40       13.74
100YEAR                    1:50       11.06
100YEAR                    2:00       9.29
100YEAR                    2:10       8.02
100YEAR                    2:20       7.08
100YEAR                    2:30       6.35
100YEAR                    2:40       5.76
100YEAR                    2:50       5.28
100YEAR                    3:00       4.88

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       362545.7517      5026267.38065    362591.0123      5026316.66835
UNITS            Meters

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
STM100           362547.809         5026289.914
CB200            362560.383         5026298.766
ROOF             362566.834         5026284.952
STM101           362553.02          5026294.26
```



```
[VERTICES]
;;Link           X-Coord            Y-Coord
;;-------------- ------------------ ------------------

[POLYGONS]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
BLDG             362569.646         5026269.621
BLDG             362563.473         5026271.663
BLDG             362563.473         5026271.663
BLDG             362556.23          5026289.529
BLDG             362556.23          5026289.529
BLDG             362560.203         5026292.044
BLDG             362560.203         5026292.044
BLDG             362568.472         5026297.277
BLDG             362568.472         5026297.277
BLDG             362579.354         5026280.084
BLDG             362579.354         5026280.084
BLDG             362580.624         5026278.076
BLDG             362580.624         5026278.076
BLDG             362578.182         5026276.53
BLDG             362578.182         5026276.53
BLDG             362578.87          5026275.442
BLDG             362578.87          5026275.442
BLDG             362569.646         5026269.621
CB200A           362582.66          5026282.158
CB200A           362579.354         5026280.084
CB200A           362579.354         5026280.084
CB200A           362568.472         5026297.277
CB200A           362568.472         5026297.277
CB200A           362560.203         5026292.044
CB200A           362560.203         5026292.044
CB200A           362556.914         5026297.24
CB200A           362556.914         5026297.24
CB200A           362556.418         5026298.206
CB200A           362556.418         5026298.206
CB200A           362568.428         5026305.806
CB200A           362568.428         5026305.806
```

```
CB200A           362569.818       5026307.514
CB200A           362569.818       5026307.514
CB200A           362569.851       5026307.889
CB200A           362569.851       5026307.889
CB200A           362580.181       5026314.428
CB200A           362580.181       5026314.428
CB200A           362583.069       5026309.865
CB200A           362583.069       5026309.865
CB200A           362583.925       5026304.362
CB200A           362583.925       5026304.362
CB200A           362587.432       5026301.897
CB200A           362587.432       5026301.897
CB200A           362588.955       5026299.529
CB200A           362588.955       5026299.529
CB200A           362576.61        5026291.736
CB200A           362576.61        5026291.736
CB200A           362582.66        5026282.158

[SYMBOLS]
;;Gage           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)
------------------------------------------------------------

*************
Element Count
*************
Number of rain gages ...... 1
Number of subcatchments ... 2
Number of nodes ........... 4
Number of links ........... 3
Number of pollutants ...... 0
Number of land uses ....... 0

****************
Raingage Summary
****************

| Name | Data Source | Data Type | Recording Interval |
|---|---|---|---|
| RG1 | 100YEAR | INTENSITY | 10 min. |

********************
Subcatchment Summary
********************

| Name | Area | Width | %Imperv | %Slope | Rain Gage | Outlet |
|---|---|---|---|---|---|---|
| BLDG | 0.04 | 8.64 | 100.00 | 1.5000 | RG1 | ROOF |
| CB200A | 0.04 | 9.60 | 87.10 | 1.5000 | RG1 | CB200 |

************
Node Summary
************

POST-DEVELOPMENT MODEL - 100Y 24H SCS

| Name | Type | Invert Elev. | Max. Depth | Ponded Area | External Inflow |
|---|---|---|---|---|---|
| STM100 | OUTFALL | 79.80 | 0.36 | 0.0 | |
| CB200 | STORAGE | 80.08 | 1.93 | 0.0 | |
| ROOF | STORAGE | 100.00 | 0.15 | 0.0 | |
| STM101 | STORAGE | 79.95 | 2.08 | 0.0 | |

************
Link Summary
************

| Name | From Node | To Node | Type | Length | %Slope | Roughness |
|---|---|---|---|---|---|---|
| STM101-STM100 | STM101 | STM100 | CONDUIT | 8.7 | 1.0345 | 0.0130 |
| CB200-STM101 | CB200 | STM101 | OUTLET | | | |
| ROOF-STM101 | ROOF | STM101 | OUTLET | | | |

*********************
Cross Section Summary
*********************

| Conduit | Shape | Full Depth | Full Area | Hyd. Rad. | Max. Width | No. of Barrels | Full Flow |
|---|---|---|---|---|---|---|---|
| STM101-STM100 | CIRCULAR | 0.30 | 0.07 | 0.07 | 0.30 | 1 | 98.36 |

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************

```
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 10/19/2022 00:00:00
Ending Date .............. 10/19/2022 03:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:01:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... NO
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.001500 m


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.006        70.853
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.000         2.945
Surface Runoff ...........         0.005        65.829
Final Storage ............         0.000         2.186
Continuity Error (%) .....        -0.150


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
```



```
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.005         0.053
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.004         0.042
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.001         0.011
Continuity Error (%) .....         0.000


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     1.00 sec
Average Time Step           :     1.00 sec
Maximum Time Step           :     1.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00


***************************
Subcatchment Runoff Summary
***************************

-------------------------------------------------------------------------------------------------------------
```

| Subcatchment | Total Precip mm | Total Runon mm | Total Evap mm | Total Infil mm | Imperv Runoff mm | Perv Runoff mm | Total Runoff mm | Total Runoff 10^6 ltr | Peak Runoff LPS | Runoff Coeff |
|---|---|---|---|---|---|---|---|---|---|---|
| BLDG | 70.85 | 0.00 | 0.00 | 0.00 | 68.58 | 0.00 | 68.58 | 0.03 | 19.01 | 0.968 |
| CB200A | 70.85 | 0.00 | 0.00 | 5.60 | 59.80 | 3.55 | 63.35 | 0.03 | 20.57 | 0.894 |

******************
Node Depth Summary
******************

| Node | Type | Average Depth Meters | Maximum Depth Meters | Maximum HGL Meters | Time of Max Occurrence days hr:min | Reported Max Depth Meters |
|---|---|---|---|---|---|---|
| STM100 | OUTFALL | 0.00 | 0.00 | 79.80 | 0 00:00 | 0.00 |
| CB200 | STORAGE | 0.34 | 1.56 | 81.64 | 0 01:13 | 1.56 |
| ROOF | STORAGE | 0.10 | 0.15 | 100.15 | 0 01:32 | 0.15 |
| STM101 | STORAGE | 0.04 | 0.07 | 80.02 | 0 01:14 | 0.07 |

*******************
Node Inflow Summary
*******************



| Node | Type | Maximum Lateral Inflow LPS | Maximum Total Inflow LPS | Time of Max Occurrence days hr:min | Lateral Inflow Volume 10^6 ltr | Total Inflow Volume 10^6 ltr | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|
| STM100 | OUTFALL | 0.00 | 9.84 | 0 01:14 | 0 | 0.0417 | 0.000 |
| CB200 | STORAGE | 20.57 | 20.57 | 0 01:10 | 0.0269 | 0.0269 | 0.035 |
| ROOF | STORAGE | 19.01 | 19.01 | 0 01:10 | 0.0263 | 0.0263 | 0.010 |
| STM101 | STORAGE | 0.00 | 9.84 | 0 01:13 | 0 | 0.0418 | 0.090 |

**********************
Node Surcharge Summary
**********************

No nodes were surcharged.

*********************
Node Flooding Summary
*********************

Flooding refers to all water that overflows a node, whether it ponds or not.

| Node | Hours Flooded | Maximum Rate LPS | Time of Max Occurrence days hr:min | Total Flood Volume 10^6 ltr | Maximum Ponded Depth Meters |
|---|---|---|---|---|---|
| ROOF | 0.14 | 0.51 | 0 01:32 | 0.000 | 0.000 |

**********************
Storage Volume Summary
**********************

| Storage Unit | Average Volume 1000 m3 | Avg Pcnt Full | Evap Pcnt Loss | Exfil Pcnt Loss | Maximum Volume 1000 m3 | Max Pcnt Full | Time of Max Occurrence days hr:min | Maximum Outflow LPS |
|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CB200 | 0.001 | 7 | 0 | 0 | 0.007 | 51 | 0 | 01:13 | 8.01 |
| ROOF | 0.009 | 58 | 0 | 0 | 0.016 | 100 | 0 | 01:32 | 1.89 |
| STM101 | 0.000 | 2 | 0 | 0 | 0.000 | 4 | 0 | 01:14 | 9.84 |

***********************
Outfall Loading Summary
***********************

| Outfall Node | Flow Freq Pcnt | Avg Flow LPS | Max Flow LPS | Total Volume 10^6 ltr |
|---|---|---|---|---|
| STM100 | 85.14 | 4.54 | 9.84 | 0.042 |
| System | 85.14 | 4.54 | 9.84 | 0.042 |

********************
Link Flow Summary
********************

| Link | Type | Maximum \|Flow\| LPS | Time of Max Occurrence days hr:min | Maximum \|Veloc\| m/sec | Max/ Full Flow | Max/ Full Depth |
|---|---|---|---|---|---|---|
| STM101-STM100 | CONDUIT | 9.84 | 0 01:14 | 0.80 | 0.10 | 0.23 |
| CB200-STM101 | DUMMY | 8.01 | 0 01:13 | | | |
| ROOF-STM101 | DUMMY | 1.89 | 0 01:32 | | | |

***************************
Flow Classification Summary
***************************



| | Adjusted | ---------- Fraction of Time in Flow Class ---------- | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Conduit | /Actual Length | Dry | Up Dry | Down Dry | Sub Crit | Sup Crit | Up Crit | Down Crit | Norm Ltd | Inlet Ctrl |
| STM101-STM100 | 1.00 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.86 | 0.00 | 0.00 |

*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.

Analysis begun on:  Fri Nov 18 14:23:09 2022
Analysis ended on:  Fri Nov 18 14:23:09 2022
Total elapsed time: < 1 sec

# C.4 RECORD OF CORRESPONDENCE WITH RVCA

## Johnson, Warren

**From:** Jamie Batchelor <jamie.batchelor@rvca.ca>
**Sent:** Thursday, October 20, 2022 1:22 PM
**To:** Johnson, Warren; Eric Lalande
**Cc:** Kilborn, Kris; Thiffault, Dustin
**Subject:** RE: 1983 Carling Avenue Development

Good Afternoon Warren,

The downstream outlet to the river is just over 2 km away. That, and in consideration of the amount of parking spaces proposed (6), the RVCA would accept that no additional on-site water quality controls are required, save and except best management practices. We would encourage you to investigate whether there is opportunity to provide LIDs as part of the stormwater management strategy for this site.

Jamie Batchelor, MCIP, RPP
Planner, ext. 1191
Jamie.batchelor@rvca.ca

Rideau Valley Conservation Authority

3889 Rideau Valley Drive
PO Box 599, Manotick ON K4M 1A5
**T** 613-692-3571 | 1-800-267-3504 **F** 613-692-0831 | www.rvca.ca



---

**From:** Johnson, Warren <Warren.Johnson@stantec.com>
**Sent:** Thursday, October 20, 2022 1:02 PM
**To:** Eric Lalande <eric.lalande@rvca.ca>; Jamie Batchelor <jamie.batchelor@rvca.ca>
**Cc:** Kilborn, Kris <kris.kilborn@stantec.com>; Thiffault, Dustin <Dustin.Thiffault@stantec.com>
**Subject:** 1983 Carling Avenue Development

Hi Eric/Jamie,

Stantec has been retained to provide consulting services for the development of a property located at 1983 Carling Avenue within the City of Ottawa.

The Development is to be a three-storey residential use building with associated parking and access road. I have attached the latest Site Plan for review. The building is to be serviced from separated sewers located in the Bromley Road right of way. Stormwater management of water quantity is to be provided by collecting up to the 100-year event via rooftop storage and underground storage in the access road/parking area. The remainder of the landscaped areas of the site will discharge uncontrolled as per existing drainage patterns.

The City has requested that we consult with the RVCA regarding water quality criteria to establish any water quality control restrictions, criteria, and measures for the site; or confirmation that water quality criteria are not required for the site.

Thank you for your time reviewing this proposed development.

Thanks,

**Warren Johnson** C.E.T.
Civil Engineering Technologist

Direct: 613 784-2272
Warren.Johnson@stantec.com

Stantec

# C.5 RECORD OF CORRESPONDENCE WITH CITY

## Johnson, Warren

**From:** Armstrong, Justin <justin.armstrong@ottawa.ca>
**Sent:** Thursday, October 13, 2022 9:14 AM
**To:** Kilborn, Kris; Stern, Lisa
**Cc:** Jordan Tannis; Johnson, Warren
**Subject:** RE: 1983 Carling Avenue - Stormwater questions and Relief d07-12-21-0145

Morning Kris and Warren,

Based on the flowrates indicated in Warren's analysis below, the approach would seem to be acceptable. Please be sure to also address the following related to the SWM approach for this site with the submission:

- The post-dev Q of 14.85 L/s in the table below does not seem to include the roof runoff. From the MRM sheet it would seem the proposed post-dev 100-yr Q would be 16.72 L/s if flow from the roof at 1.88 L/s is included. The controlled roof should discharge downstream of parking lot controls so should be included in total post-dev Q (see third bullet below).
- Be sure to discuss design head and its impact on design flow of LMF85 for controlled parking area and its impact to the SWM approach, as typical 85mm orifice flows at 0.82m head would exceed the 5.81 L/s identified, and also, City requirement for MRM storage calculation for areas of underground storage would typically require use of ½ the allowable release rate in the MRM calculation (i.e., 2.91 L/s in this case).
- Ensure controlled roof ties into the system downstream of parking lot controls so that there is no chance parking lot controls cause prolonged 0.15m detention on the roof.

Regards,

Justin

**Justin Armstrong, P.Eng.**
Project Manager
Planning, Real Estate and Economic Development Department – Direction générale de la planification, des biens immobiliers et du développement économique
Development Review - West Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 21746, justin.armstrong@ottawa.ca

---

**From:** Kilborn, Kris <kris.kilborn@stantec.com>
**Sent:** October 13, 2022 8:56 AM
**To:** Armstrong, Justin <justin.armstrong@ottawa.ca>; Stern, Lisa <lisa.stern@ottawa.ca>
**Cc:** Jordan Tannis <jt@concorde-properties.ca>; Johnson, Warren <Warren.Johnson@stantec.com>
**Subject:** RE: 1983 Carling Avenue - Stormwater questions and Relief d07-12-21-0145

Good morning Justin and hope all is well

Just wanted to follow up with you on the stormwater relief for the 1983 Carling Avenue property.
We are looking to finalize our submission for SPA and the proposed Stormwater revisions have effect on civil, landscape, TCR and site plan for the project.

Let me know if you wish to set up a meeting to discuss further.

Sincerely

**Kris Kilborn**
Senior Associate,
Business Center Practice Leader
Community Development

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4



---

**From:** Johnson, Warren <Warren.Johnson@stantec.com>
**Sent:** Friday, October 7, 2022 7:48 AM
**To:** Armstrong, Justin <justin.armstrong@ottawa.ca>; Kilborn, Kris <kris.kilborn@stantec.com>; Stern, Lisa <lisa.stern@ottawa.ca>
**Cc:** Jordan Tannis <jt@concorde-properties.ca>
**Subject:** RE: 1983 Carling Avenue - Stormwater questions and Relief d07-12-21-0145

Hi Justin,

See attached MRM sheet which has been revised to show the option to provide control for the rooftop and parking area only. The infrastructure circled in the attached storm drainage plan would be removed with area CB200B regraded to drain uncontrolled to the Carling ROW. The table below summarizes the post- to pre-development comparison. If you can please confirm if this meets the City's requirements, we can revise our submission accordingly.

| | **5-yr value** | **100-yr value** |
|---|---|---|
| Q pre-existing | 21.89 L/s | 37.52 L/s |
| Controlled Q post-development ( with roof top and parking area control only) | 3.81 L/s | 5.81 L/s |
| Uncontrolled Q post-development ( with roof top control only) | 4.22 L/s | 9.03 L/s |
| Total Q post development (controlled +uncontrolled) | 8.02 L/s | 14.85 L/s |
| $C_{existing}$ | 0.67 | |
| $C_{proposed}$ | 0.46 (uncontrolled area only)<br>0.74 (total site including roof) | |

**Thanks,**

**Warren Johnson** C.E.T.
Civil Engineering Technologist

Direct: 613 784-2272
Warren.Johnson@stantec.com

Stantec

**From:** Armstrong, Justin <justin.armstrong@ottawa.ca>
**Sent:** Tuesday, October 4, 2022 10:22 AM
**To:** Kilborn, Kris <kris.kilborn@stantec.com>; Stern, Lisa <lisa.stern@ottawa.ca>
**Cc:** Jordan Tannis <jt@concorde-properties.ca>; Johnson, Warren <Warren.Johnson@stantec.com>
**Subject:** RE: 1983 Carling Avenue - Stormwater questions and Relief d07-12-21-0145

Hey Kris,

Discussed with WR and in order to allow the site to only control the roof, the site should be no larger than 0.1 ha and the roof would need to take up at least 50% of the site area. This site does not meet those criteria and so the OSDG requirement would need to be followed.

That said, for this site we could be slightly flexible on the OSDG requirement of pre-5-yr c=0.5 release rate provided the design demonstrates that there is significant improvement from existing site runoff. The approach you described below of maintaining the control of the parking area, while also controlling the rooftop as much as feasibly possible might be acceptable. What would the release rate schedule for the site look like if parking area controls were incorporated?

Justin

**From:** Kilborn, Kris <kris.kilborn@stantec.com>
**Sent:** October 3, 2022 11:05 AM
**To:** Armstrong, Justin <justin.armstrong@ottawa.ca>; Stern, Lisa <lisa.stern@ottawa.ca>
**Cc:** Jordan Tannis <jt@concorde-properties.ca>; Johnson, Warren <Warren.Johnson@stantec.com>
**Subject:** RE: 1983 Carling Avenue - Stormwater questions and Relief d07-12-21-0145

**CAUTION: This email originated from an External Sender. Please do not click links or open attachments unless you recognize the source.**

**ATTENTION : Ce courriel provient d’un expéditeur externe. Ne cliquez sur aucun lien et n’ouvrez pas de pièce jointe, excepté si vous connaissez l’expéditeur.**

Good morning Justin

Just wanted to touch base with you to see if WR has gotten back to you on the 1983 Carling Avenue Site.

Please get back to me at your earliest convenience

Sincerely

**Kris Kilborn**
Senior Associate,
Business Center Practice Leader
Community Development

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4



**From:** Kilborn, Kris
**Sent:** Tuesday, September 27, 2022 7:59 AM

**To:** Armstrong, Justin <justin.armstrong@ottawa.ca>; Stern, Lisa <lisa.stern@ottawa.ca>
**Cc:** Jordan Tannis <jt@concorde-properties.ca>; Johnson, Warren <Warren.Johnson@stantec.com>
**Subject:** RE: 1983 Carling Avenue - Stormwater questions and Relief d07-12-21-0145

Hey Justin
Thanks for looking into this for us. Presently we have 150mm topsoil proposed on our Landscape Plans. We also have a Stomsceptre proposed
To handle TSS removal.
The main area we are looking for relief is within the front yard along Carling as we have subdrain proposed within the front yard with a connection along
The side yard between 1983 Carling avenue. This is a very tight connection between the two buildings and the subdrain installation in close proximity to the
Tree that we are trying to save along carling. At very least we would like to remove this infrastructure and maintain the infrastructure within the Parking area and
Keep the stormsceptre. We could look at revising the topsoil thickness to 300mm.

Pleas let me know what WR says and would be more than happy to set up a quick meeting to discuss

Sincerely

**Kris Kilborn**
Senior Associate,
Business Center Practice Leader
Community Development

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4



---

**From:** Armstrong, Justin <justin.armstrong@ottawa.ca>
**Sent:** Thursday, September 22, 2022 1:18 PM
**To:** Kilborn, Kris <kris.kilborn@stantec.com>; Stern, Lisa <lisa.stern@ottawa.ca>
**Cc:** Jordan Tannis <jt@concorde-properties.ca>; Johnson, Warren <Warren.Johnson@stantec.com>
**Subject:** RE: 1983 Carling Avenue - Stormwater questions and Relief d07-12-21-0145

Hi Kris,

I can run your request below by City Water Resources.

Since my initial review, I noticed that the site discharges directly to the river rather than to Pinecrest Creek or the ORPP. This is a better discharge location, but just as an FYI, the fact that this site is within the Pinecrest Creek/Westboro sewer shed and the Pinecrest Creek/Westboro Design Criteria (PW SWM Criteria) are now council passed criteria may make it more difficult to provide relief than the other infill sites you mentioned below, but I will discuss with WR.

For my info before discussing with WR, other than the relief requested below related to the post-dev release rate, does the proposal attempt to meet the requirements/recommendations of the PW SWM Criteria (i.e., runoff volume reduction, TSS removal, recommended 300mm amended topsoil for landscaped areas)?

| | | | | |
|---|---|---|---|---|
| **Draining to the Ottawa River** | | | | |
| **Development subject to Plan of Subdivision or Site Plan Control approval(s) - discharging directly to the Ottawa River** | | | | |
| 2 | all soil infiltration rates | A minimum on-site retention of the 10 mm design storm; refer to LID references[II] for guidance on prudent approach to planning infiltration-based LID best management practices. Assumptions re: non-viability of infiltration measures must be substantiated. A green roof, rain harvesting measures and/or a combination of detention/retention measures[II] could be implemented to provide further runoff volume reduction. | On-site removal of 80% of TSS; some of which ma be achieved by on-site retention of first 10 mm of rainfall. | As p Desi |

Also, to clarify, the relief requested below would have your proposal remove the oversize pipe and ICD shown in the storm drainage plan, but maintain the storm sewer conveyances through the OGS for treatment of areas other than the roof?

Justin


**Justin Armstrong, P.Eng.**
Project Manager
Planning, Real Estate and Economic Development Department – Direction générale de la planification, des biens immobiliers et du développement économique
Development Review - West Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 21746, justin.armstrong@ottawa.ca


---

**From:** Kilborn, Kris <kris.kilborn@stantec.com>
**Sent:** September 22, 2022 9:27 AM
**To:** Stern, Lisa <lisa.stern@ottawa.ca>
**Cc:** Armstrong, Justin <justin.armstrong@ottawa.ca>; Jordan Tannis <jt@concorde-properties.ca>; Johnson, Warren <Warren.Johnson@stantec.com>
**Subject:** 1983 Carling Avenue - Stormwater questions and Relief d07-12-21-0145

Good morning Lisa and hope you are doing well.
I am just writing to inquire if Justin is still active on the 1983 Carling Avenue file from the City Infrastructure Group. We were hoping to discuss some stormwater options with Infrastructure to provide a bit of relief on the overall requirements of the infill site. We have provided information updated stormwater Management on several infill sites where the City has agreed only to control the Roof drains as part of the Swm and wondering if this site could be contemplated for this relief.

Below is a schedule showing controls for roof drain capture only and updated MRM sheets along with a copy of our Storm Drainage Plan.
I am happy to meet up with the reviewer to discuss if you could confirm who this is.

| | **5-yr value** | **100-yr value** |
|---|---|---|
| Q pre-existing | 22.01 L/s | 37.72 L/s |
| Controlled Q post-development ( with roof top control only) | 1.64 L/s | 1.88 L/s |
| Uncontrolled Q post-development ( with roof top control only) | 14.31 L/s | 30.65 L/s |
| Total Q post development (controlled +uncontrolled) | 15.95 L/s | 32.53 L/s |
| Cexisting | 0.67 | |
| Cproposed | 0.66 (uncontrolled area only)<br>0.74 (total site including roof) | |

Sincerely

**Kris Kilborn**
Senior Associate,
Business Center Practice Leader
Community Development

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com
Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4



'



'

'

This e-mail originates from the City of Ottawa e-mail system. Any distribution, use or copying of this e-mail or the information it contains by other than the intended recipient(s) is unauthorized. Thank you.

Le présent courriel a été expédié par le système de courriels de la Ville d'Ottawa. Toute distribution, utilisation ou reproduction du courriel ou des renseignements qui s'y trouvent par une personne autre que son destinataire prévu est interdite. Je vous remercie de votre collaboration.

'

'

This e-mail originates from the City of Ottawa e-mail system. Any distribution, use or copying of this e-mail or the information it contains by other than the intended recipient(s) is unauthorized. Thank you.

Le présent courriel a été expédié par le système de courriels de la Ville d'Ottawa. Toute distribution, utilisation ou reproduction du courriel ou des renseignements qui s'y trouvent par une personne autre que son destinataire prévu est interdite. Je vous remercie de votre collaboration.

'

# Appendix D GEOTECHNICAL INVESTIGATION

# Appendix E DRAWINGS

**FINAL**

# Geotechnical Investigation – Proposed Residential Development

1983 Carling Avenue, Ottawa, Ontario

Prepared for:

**2473493 Ontario Inc.**
485 Pinebush Road, Suite 102
Cambridge, ON N1T 0A6

May 4, 2021

Pinchin File: 289578

**Issued to:** **2473493 Ontario Inc.**
**Issued on:** **May 4, 2021**
**Pinchin File:** **289578**
**Issuing Office:** **Kanata, ON**

Author: Wesley Tabaczuk, P.Eng.
Project Manager, Geotechnical Services
613.853.2211
wtabaczuk@pinchin.com

Reviewer: Vanessa Marshall, M.Eng., P.Eng.
National Practice Leader, Geotechnical Services
519.904.4660
vmarshall@pinchin.com

## TABLE OF CONTENTS



## FIGURES



## APPENDICES

## 1.0 INTRODUCTION AND SCOPE

Pinchin Ltd. (Pinchin) was retained by 2473493 Ontario Inc. (Client) to conduct a Geotechnical Investigation and provide subsequent geotechnical design recommendations for the proposed residential development to be located at 1983 Carling Avenue, Ottawa, Ontario (Site). The Site location is shown on Figure 1.

Based on information provided by the Client, it is Pinchin's understanding that the proposed development is to consist of a five-storey, slab-on-grade (i.e. no basement level) residential apartment building complete with new Site services. The proposed development does not include asphalt surfaced areas.

Pinchin's geotechnical comments and recommendations are based on the results of the Geotechnical Investigation and our understanding of the project scope.

The purpose of the Geotechnical Investigation was to delineate the subsurface conditions and soil engineering characteristics by advancing a total of four (4) sampled boreholes (Boreholes BH1 to BH4), at the Site. The information gathered from the Geotechnical Investigation will allow Pinchin to provide geotechnical design recommendations for the proposed development.

Based on a desk top review and the results of the Geotechnical Investigation, the following geotechnical data and engineering design recommendations are provided herein:

- A detailed description of the soil and groundwater conditions;
- Site preparation recommendations;
- Open cut excavations;
- Anticipated groundwater management;
- Site service trench design;
- Foundation design recommendations including bedrock bearing resistances at Ultimate Limit States (ULS) design;
- Potential total and differential settlements;
- Foundation frost protection and engineered fill specifications and installation;
- Seismic Site classification for seismic Site response;
- Concrete floor slab-on-grade support recommendations; and
- Potential construction concerns.

Abbreviations terminology and principle symbols commonly used throughout the report, borehole logs and appendices are enclosed in Appendix I.

## 2.0 SITE DESCRIPTION AND GEOLOGICAL SETTING

The Site is located on the north side of Carling Avenue, approximately 800 metres north of Highway 417 in Ottawa, Ontario. The Site is currently undeveloped and consists of an asphalt and gravel surfaced parking area with a small section of soft landscaping on the south portion of the Site. The lands adjacent to the Site are developed with a combination of single family and multi unit residential buildings.

Data obtained from the Ontario Geological Survey Maps, as published by the Ontario Ministry of Natural Resources, indicates that the Site is located on a Paleozoic bedrock. The underlying bedrock at this Site is of the Shadow Lake Formation consisting of limestone, dolostone, shale, arkose, and sandstone (Ontario Geological Survey Map 1972, published 1978).

## 3.0 GEOTECHNICAL FIELD INVESTIGATION AND METHODOLOGY

Pinchin completed a field investigation at the Site on March 29, 2021 by advancing a total of four sampled boreholes throughout the Site. The boreholes were advanced to depths ranging from approximately 0.8 to 0.9 metres below existing ground surface (mbgs), where refusal was encountered on probable bedrock. The approximate spatial locations of the boreholes advanced at the Site are shown on Figure 2.

The boreholes were advanced with the use of a Geoprobe 7822 DT direct push drill rig which was equipped with standard soil sampling equipment. Soil samples were collected at 0.76 m intervals using a 51 mm outside diameter (OD) split spoon barrel in conjunction with Standard Penetration Tests (SPT) “N” values (ASTM D1586). The SPT “N” values were used to assess the compactness condition of the non-cohesive soil.

Groundwater observations and measurements were obtained from the open boreholes during and upon completion of drilling. The groundwater observations and measurements recorded are included on the appended borehole logs.

The borehole locations and ground surface elevations were located at the Site by Pinchin personnel. The ground surface elevation at each borehole location was referenced to the following temporary benchmark as shown on Figure 2:

- TBM: Top of the southwest corner of the exposed portion of the foundation wall of the adjacent building to the east, at the approximate location shown on Figure 2; and
- Elevation: 100.0 metres (local datum).

The field investigation was monitored by experienced Pinchin personnel. Pinchin logged the drilling operations and identified the soil samples as they were retrieved. The recovered soil samples were sealed into plastic bags and carefully transported to an independent and accredited materials testing laboratory for detailed analysis and testing. All soil samples were classified according to visual and index properties by the project engineer.

The field logging of the soil and groundwater conditions was performed to collect geotechnical engineering design information. The borehole logs include textural descriptions of the subsoil in accordance with a modified Unified Soil Classification System (USCS) and indicate the soil boundaries inferred from non-continuous sampling and observations made during the borehole advancement. These boundaries reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The modified USCS classification is explained in further detail in Appendix I. Details of the soil and groundwater conditions encountered within the boreholes are included on the Borehole Logs within Appendix II.

Select soil samples collected from the boreholes were submitted to a material testing laboratory to determine the grain size distribution of the soil. A copy of the laboratory analytical reports is included in Appendix III. In addition, the collected samples were compared against previous geotechnical information from the area, for consistency and calibration of results.

## 4.0 SUBSURFACE CONDITIONS

### 4.1 Borehole Soil Stratigraphy

In general, the soil stratigraphy at the Site comprises either surficial asphalt or surficial granular fill overlying glacial till and probable bedrock to the maximum borehole refusal depth of approximately 0.9 mbgs. The appended borehole logs provide detailed soil descriptions and stratigraphies, results of SPT testing, and groundwater measurements.

The surficial asphalt was encountered within Boreholes BH2 and BH3 and was measured to be approximately 25 mm thick.

Granular fill was encountered at the surface in Boreholes BH1 and BH4 and underlying the surficial asphalt in Boreholes BH2 and BH3. The fill material was measured to range in thickness from approximately 0.5 to 0.8 m thick and ranged in soil matrix from sand and gravel containing trace silt, to gravelly sand containing trace silt. The non-cohesive material had a very loose to very dense relative density based SPT ‘N’ values of between 3 and greater than 50 blows per 300 mm penetration of a split spoon sampler. The results of two particle size distribution analyses completed on samples of the fill material indicate that the samples contained approximately 31 to 49% gravel, 43 to 59% sand, and 8 to 10% silt sized particles.

The glacial till was encountered underlying the granular fill in Borehole BH1 at approximately 0.5 mbgs and was measured to be approximately 0.4 m thick. The glacial till comprised silty clayey sand containing some gravel. The non-cohesive glacial till had a loose to very dense relative density based SPT 'N' values of 8 to greater than 50 blows per 300 mm penetration of a split spoon sampler. The result of one particle size distribution analysis completed on a sample of the glacial till indicates that the sample contains approximately 11% gravel, 38% sand, 28% silt, and 23% clay sized particles. The moisture content of the material tested was 24.5%, indicating the material was in a damp to moist condition at the time of sampling.

### 4.2 Groundwater Conditions

Groundwater observations and measurements were obtained in the open boreholes at the completion of drilling and are summarized on the appended borehole logs. Groundwater was not encountered within the open boreholes at drilling completion. Seasonal variations in the water table should be expected, with higher levels occurring during wet weather conditions in the spring and fall and lower levels occurring during dry weather conditions.

## 5.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

### 5.1 General Information

The recommendations presented in the following sections of this report are based on the information available regarding the proposed construction, the results obtained from the geotechnical investigation, and Pinchin's experience with similar projects. Since the investigation only represents a portion of the subsurface conditions, it is possible that conditions may be encountered during construction that are substantially different than those encountered during the investigation. If these situations are encountered, adjustments to the design may be necessary. A qualified geotechnical engineer should be on-Site during the foundation preparation to ensure the subsurface conditions are the same/similar to what was observed during the investigation.

Based on information provided by the Client, it is Pinchin's understanding that the proposed development is to consist of a five-storey, slab-on-grade (i.e. no basement level) residential apartment building complete with new Site services. The proposed development does not include asphalt surfaced areas.

Probable bedrock was encountered between approximately 0.8 and 0.9 mbgs with the boreholes advanced at the Site. As such, Pinchin recommends to construct the proposed building on conventional shallow strip and spread footings founded on the underlying bedrock surface.

### 5.2 Site Preparation

Preparation of the Site for the proposed development will consist of removing all surficial and overburden materials down to the underlying bedrock surface in the vicinity of the proposed building footprint (below the foundations and floor slabs).

Prior to placing any fill material at the Site, the bedrock and/or subgrade soil should be inspected by a qualified geotechnical engineer and loosened/soft pockets should be sub excavated and replaced with an engineered fill. All fill material to raise grades below the floor slab is to be installed in maximum 200 mm thick loose lifts, compacted to 98% of its Standard Proctor Maximum Dry Density (SPMDD), within plus 2 to minus 4 of the optimum moisture contents. It is recommended that the floor slab subgrade fill comprise Ontario Provincial Standard Specification 1010 (OPSS 1010) Granular 'B' Type I or Type II material.

A qualified geotechnical engineering technician should be on site to observe fill placement operations and perform field density tests at random locations throughout each lift, to indicate the specified compaction is being achieved.

### 5.3 Open Cut Excavations and Anticipated Groundwater Management

Excavations for the building foundations will extend to an approximate depth of 0.8 to 0.9 mbgs, while excavations for the new Site services could potentially extend upwards of 2.1 mbgs, depending on the depth of the existing services in the vicinity of the Site that the new services will connect to. As such, a portion of the bedrock will need to be removed to accommodate the new Site services.

Based on the subsurface information obtained from within the boreholes, it is anticipated that the excavated material will predominately consist of granular fill and glacial till. Groundwater was not encountered within the boreholes at drilling completion and is not expected to be encountered in the overburden material during excavations. It is noted that the boreholes did not advance into the bedrock; as such, there is a potential for groundwater to be encountered during excavations into the bedrock.

Where workers must enter trench excavations deeper than 1.2 m, the trench excavations should be suitably sloped and/or braced in accordance with the Occupational Health and Safety Act (OHSA), Ontario Regulation 213/91, Construction Projects, July 1, 2011, Part III - Excavations, Section 226. Alternatively, the excavation walls may be supported by either closed shoring, bracing, or trench boxes complying with sections 235 to 239 and 241 under O. Reg. 231/91, s. 234(1). The use of trench boxes can most likely be used for temporary support of vertical side walls. The appropriate trench should be designed/confirmed for use in this soil deposit.

Based on the OHSA, the natural subgrade soils would be classified as Type 3 soil and temporary excavations in these soils must be sloped at an inclination of 1 horizontal to 1 vertical (H to V) from the base of the excavation.

The upper approximate 1.5 m of bedrock in this area is typically weathered and can usually be removed with mechanical equipment, such as a large excavator and hydraulic hammer (hoe ram) and where required, with line drilling on close centres. Often a hydraulic hammer can be utilized to create an initial opening for the excavator bucket to gain access of the layered rock. The bedrock is known to contain vertical joints and near horizontal bedding planes. Therefore, some vertical and horizontal over break of the bedrock should be expected.

Depending on the ability of the mechanical equipment to advance through the bedrock, drilling and blasting may be required. It is often difficult to blast “neat” lines using conventional drilling and blasting procedures, as such, problems with “over break” are common. This may affect quantities claimed by the contractor for rock excavations, as well as the potential for off-site disposal of the blasted rock, if necessary. Allowances should be made for over break conditions. Due consideration should also be given to controlled blasting procedures in order to prevent potential damage to the surrounding environment.

In addition, we recommend that a pre-blast survey of all neighbouring properties be undertaken prior to conducting drilling and blasting activities. The preconstruction survey will serve to protect the Client from claims unrelated to the construction activities in the development of this property.

Pinchin notes that, local contractors are familiar with excavating the local bedrock and have specialized knowledge and techniques for its removal. Depending on the block size and degree of weathering of the rock they may have a different approach than what is presented in the preceding paragraphs.

Construction slopes in intact bedrock should stand near vertical provided the “loose” rock is properly scaled off the face. Once the blasting is completed, if there are any permanent bedrock shear walls, they will have to be reviewed by a Rock Mechanics Specialist to determine if it is stable or if it needs reinforcing, such as rock bolting.

In addition to compliance with the OHSA, the excavation procedures must also comply to any potential other regulatory authorities, such as federal and municipal safety standards.

As previously mentioned, there is a potential for groundwater to be encountered during excavations into the bedrock. It is believed that this groundwater inflow can be controlled using a gravity dewatering system with perimeter interceptor ditches and high capacity pumps. It is noted that once the final grades have been set, Pinchin should review this recommendation and revise as necessary.

Seasonal variations in the water table should be expected, with higher levels occurring during wet weather conditions in the spring and fall and lower levels occurring during dry weather conditions. If construction commences during wet periods (typically spring or fall), there is a greater potential that the groundwater elevation could be higher and/or perched groundwater may be present. Any potential precipitation of perched groundwater should be able to be controlled from pumping from filtered sumps.

Prior to commencing excavations, it is critical that all existing surface water and potential surface water is controlled and diverted away from the Site to prevent infiltration and subgrade softening. At no time should excavations be left open for a period of time that will expose them to precipitation and cause subgrade softening.

All collected water is to discharge a sufficient distance away from the excavation to prevent re-entry. Sediment control measures, such as a silt fence should be installed at the discharge point of the dewatering system. The utmost care should be taken to avoid any potential impacts on the environment.

It is the responsibility of the contractor to propose a suitable dewatering system based on the groundwater elevation at the time of construction. The method used should not adversely impact any nearby structures. Excavations to conventional design depths for the building foundations are not expected to require a Permit to Take Water or a submission to the Environmental Activity and Sector Registry (EASR). It is the responsibility of the contractor to make this application if required.

## 5.4 Site Servicing

### *5.4.1 Pipe Bedding and Cover Materials for Flexible and Rigid Pipes*

The subgrade conditions beneath the Site services will consist of bedrock. No support problems are anticipated for flexible or rigid pipes founded on the bedrock. Service pipes require an adequate base to ensure proper pipe connection and positive flow is maintained post construction. As such, pipe bedding should be placed to be of uniform thickness and compactness. The pipe bedding and cover material should conform to OPSD 802.010 and 802.013 specifications for flexible pipes and to OPSD 802.031 to 802.033 with Class ‘B’ bedding for rigid pipes.

For pipes installed within bedrock trenches, the following is recommended:

- Install 300 mm of 19 mm clear stone gravel (OPSS 1004) or Granular ‘A’ (OPSS 1010) below the pipe extending up the sides to the spring line;
- If clear stone is used as bedding material, then a non-woven geotextile (Terrafix 360R or equivalent) is to be placed over the clear stone and pipe extending up vertically along the side walls of the bedrock and pipe a minimum distance of 500 mm;

- The pipe cover material should consist of either a Granular 'B' Type I (OPSS 1010) with a maximum particle diameter size of 26.5 mm or bedding sand and should extend to a minimum of 300 mm above the top of the pipe; and
- If rock shatter is present a non-woven geotextile (Terrafix 360R or equivalent) may be required to prevent the migration of fines from the bedding material into the rock shatter. Where blasting is required for Site services, over blast of at least 600 mm of rock shatter should be performed. Over blast material may stay in the trench.

All granular fill material is to be placed in maximum 200 mm thick loose lifts compacted to a minimum of 98% SPMDD.

If constant groundwater infiltration becomes an issue, then an approximate 150 mm granular pad consisting of 19 mm clear stone gravel (OPSS 1004) wrapped in a non-woven geotextile (Terrafix 270R or equivalent) should be considered. The clear stone should contain a minimum of 50% crushed particles. Water collected within the stone should be controlled through sumps and filtered pumps.

#### *5.4.2 Trench Backfill*

Where the adjacent material consists of bedrock, the trench can be backfilled with well graded blast rock fill, with a gradation similar to OPSS 1010 Granular 'B' Type I. The soil should be placed to the underside of the granular subbase of the pavement structure and be compacted in maximum 300 mm thick lifts to 98% SPMDD within 4% of the optimum moisture content. This is recommended to provide soil compatibility and help minimize potential abrupt differential frost heave between surrounding natural materials similar in composition.

All stockpiled material should be protected from deleterious materials, additional moisture and be kept from freezing.

Quality control will be the utmost importance when selecting the material. The selection of the material should be done as early in the contract as possible to allow sufficient time for gradation and proctor testing on representative samples to ensure it meets the projects specifications.

It is anticipated that imported material will be required to backfill the trenches due to minimal amount of natural soil observed at the Site. Imported material should consist of a Granular 'A', Granular 'B' Type I, or Select Subgrade Material (OPSS 1010). Heavy construction equipment and truck traffic should not cross any pipe until at least 1 m of compacted soil is placed above the top of the pipe.

Post compaction settlement of finer grained soil can be expected, even when placed to compaction specifications. As such, fill materials should be installed as far in advance as possible before finishing the roadway in order to mitigate post compaction settlements.

#### *5.4.3 Frost Protection*

The frost penetration depth in Ottawa, Ontario is estimated to extend to approximately 1.8 mbgs in open roadways cleared of snow. As such, it is recommended to place water services at a minimum depth of 300 mm below this elevation with the top of the pipe located at 2.1 mbgs or lower as dictated by municipal service requirements. If a minimum of 2.1 m of soil cover cannot be provided, then the pipe should be insulated with a rigid polystyrene insulation (DOW Styrofoam HI40, or equivalent) or a pre-insulated pipe be utilized.

The insulation design configuration may either consist of placing horizontal insulation to a specified design distance beyond the outside edge of the pipe or an inverted “U” surrounding the top and sides of the pipe. Any method chosen requires suitable design and installation in accordance with the manufacture’s recommendations. To accommodate the placement of horizontal insulation a wider excavation trench may be required.

### 5.5 Foundation Design

#### *5.5.1 Shallow Foundations Bearing on Bedrock*

For conventional shallow strip and spread footings established directly on the weathered bedrock surface, a factored geotechnical bearing resistance of 500 kPa may be used at ULS. Higher bearing resistances may be available on the unweathered bedrock; however, the bedrock should be cored to confirm this recommendation.

Prior to installing foundation formwork, the bedrock is to be reviewed by a geotechnical engineer. Serviceability Limit States (SLS) design does not apply to foundations bearing directly on bedrock, since the loads required for unacceptable settlements to occur would be much larger than the factored ULS and would be limited to the elastic compression of the bedrock and concrete.

The bearing resistance of 500 kPa assumes the bedrock is cleaned of all overburden material and any loose rock pieces. The bedrock should be cleaned with air or water pressure exposing clean sound bedrock. If construction proceeds during freezing weather conditions water should not be allowed to pool and freeze in bedrock depressions. All concrete should be installed and maintained above freezing temperatures as required by the concrete supplier.

The bedrock is to be relatively level with slopes not exceeding 10 degrees from the horizontal. Where the bedrock slope exceeds 10 degrees from the horizontal and does not exceed 25 degrees from the horizontal, shear dowels can be incorporated into the design to resist sliding. Where rock slopes are steeper, the bedrock is to be levelled and stepped as required. The change in vertical height will be a function of the rock quality at the proposed foundation location and will need to be determined at the time of construction.

As an alternative to levelling the bedrock, where the bedrock surface is irregular and jagged, it may be more practical to provide a level benching over these areas by pouring lean mix concrete (minimum 10 MPa) prior to constructing the foundations. This decision is made on Site since each situation will depend on the Site-specific bedrock conditions.

#### *5.5.2 Site Classification for Seismic Site Response & Soil Behaviour*

The following information has been provided to assist the building designer from a geotechnical perspective only. These geotechnical seismic design parameters should be reviewed in detail by the structural engineer and be incorporated into the design as required.

The seismic site classification has been based on the 2012 OBC. The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4.A of the OBC. The site classification is based on the average shear wave velocity in the top 30 m of the site stratigraphy. If the average shear wave velocity is not known, the site class can be estimated from energy corrected Standard Penetration Resistance (N60) and/or the average undrained shear strength of the soil in the top 30 m.

The boreholes advanced at this Site extended to a maximum depth of approximately 0.9 mbgs where refusal was encountered on bedrock. SPT "N" values within the soil deposit ranged between 3 and greater than 50 blows per 300 mm. As such, based on Table 4.1.8.4.A of the OBC, this Site has been classified as Class C. A Site Class C has an average shear wave velocity (Vs) of between 360 and 760 m/s. It is recommended that shear wave velocity soundings be completed at the Site once the final design and depths of foundations are known as a higher Site Classification may be available.

#### *5.5.3 Foundation Transition Zones*

Where strip footings are founded at different elevations, the bedrock is to have a maximum slope of 2 H to 1 V, with the concrete footing having a maximum rise of 600 mm and a minimum run of 600 mm between each step, as detailed in the 2012 Ontario Building Code (OBC). The lower footing should be installed first to mitigate the risk of undermining the upper footing.

Individual spread footings are to be spaced a minimum distance of one and a half times the largest footing width apart from each other to avoid stress bulb interaction between footings. This assumes the footings are at the same elevation.

Foundations may be placed at a higher elevation relative to one another provided that the slope between the outside face of the foundations are separated at a minimum slope of 2H: 1V with an imaginary line drawn from the underside of the foundations. The lower footing should be installed first to mitigate the risk of undermining the upper footing.

#### *5.5.4 Estimated Settlement*

All individual spread footings should be founded on bedrock, reviewed, and approved by a licensed geotechnical engineer.

Foundations installed in accordance with the recommendations outlined in the preceding sections are not expected to exceed total settlements of 25 mm and differential settlements of 19 mm.

All foundations are to be designed and constructed to the minimum widths as detailed in the 2012 OBC.

#### *5.5.5 Building Drainage*

To assist in maintaining the building dry from surface water seepage, it is recommended that exterior grades around the buildings be sloped away at a 2% gradient or more, for a distance of at least 2.0 m. Roof drains should discharge a minimum of 1.5 m away from the structure to a drainage swale or appropriate storm drainage system.

Exterior perimeter foundations drains are not required, where the finished floor elevation is established a minimum of 150 mm above the exterior final grades or that the exterior gradient is properly sloped to divert surface water away from the building.

#### *5.5.6 Shallow Foundations Frost Protection & Foundation Backfill*

In the Ottawa, Ontario area, exterior perimeter foundations for heated buildings require a minimum of 1.8 m of soil cover above the underside of the footing to provide soil cover for frost protection.

It is noted that for foundations established on well-draining bedrock (i.e. no ponding adjacent to the foundation), frost protection is not required. This decision is typically made on Site since each situation will depend on Site specific bedrock conditions.

Where the foundations for heated buildings do not have the minimum 1.8 m of soil cover frost protection, they should be protected from frost with a combination of soil cover and rigid polystyrene insulation, such as Dow Styrofoam or equivalent product. If required, Pinchin can provide appropriate foundation frost protection recommendations as part of the design review.

To minimize potential frost movements from soil frost adhesion, the perimeter foundation backfill should consist of a free draining granular material, such as a Granular ‘B’ Type I (OPSS 1010) or an approved sand fill, extending a minimum lateral distance of 600 mm beyond the foundation. The backfill material used against the foundation must be placed so that the allowable lateral capacity is achieved. All granular material is to be placed in maximum 300 mm thick lifts compacted to a minimum of 100% SPMDD in hard landscaping areas and 95% SPMDD in soft landscaping areas. It is recommended that inspection and testing be carried out during construction to confirm backfill quality, thickness and to ensure compaction requirements are achieved.

#### *5.5.7 Concrete Slab-on-Grade*

Prior to the installation of the engineered fill material, all overburden and deleterious materials should be removed to the underlying bedrock surface. The underlying bedrock encountered within the boreholes is considered adequate for the support of a concrete slab-on-grade provided it is inspected and approved by an experienced geotechnical engineering consultant.

Based on the in-situ conditions, it is recommended to establish a concrete floor slab-on-grade on a minimum 200 mm thick layer of Granular 'A' (OPSS 1010). The purpose of the Granular 'A' is mainly to provide a level surfaced for the concrete formwork. Alternatively, consideration may also be given to using a 200 mm thick layer of uniformly compacted 19 mm clear stone. Any required up-fill should consist of a Granular 'B' Type I or Type II (OPSS 1010).

The installation of a vapour barrier may be required under the floor slab. If required, the vapour barrier should conform to the flooring manufacturer's and designer's requirements. Consideration may be given to carrying out moisture emission and/or relative humidity testing of the slab to determine the concrete condition prior to flooring installation. To minimize the potential for excess moisture in the floor slab, a concrete mixture with a low water-to-cement ratio (i.e. 0.5 to 0.55) should be used.

The following table provides the unfactored modulus of subgrade reaction values:

| Material Type | Modulus of Subgrade Reaction (kN/m$^3$) |
|---|---|
| Granular A (OPSS 1010) | 85,000 |
| Granular "B" Type I (OPSS 1010) | 75,000 |
| Granular "B" Type II (OPSS 1010) | 85,000 |

## 6.0 SITE SUPERVISION & QUALITY CONTROL

It is recommended that all geotechnical aspects of the project be reviewed and confirmed under the appropriate geotechnical supervision, to routinely check such items. This includes but is not limited to inspection and confirmation of the bedrock surface prior to pouring any foundations or footings, backfilling, or engineered fill installation to ensure that the actual conditions are not markedly different than what was observed at the borehole locations and geotechnical components are constructed as per Pinchin's recommendations. Compaction quality control of engineered fill material (full-time monitoring) is recommended as standard practice, as well as regular sampling and testing of aggregates and concrete, to ensure that physical characteristics of materials for compliance during installation and satisfies all specifications presented within this report.

## 7.0 TERMS AND LIMITATIONS

This Geotechnical Investigation was performed for the exclusive use of 2473493 Ontario Inc. (Client) in order to evaluate the subsurface conditions at 1983 Carling Avenue, Ottawa, Ontario. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practises in the field of geotechnical engineering for the Site. Classification and identification of soil, and geologic units have been based upon commonly accepted methods employed in professional geotechnical practice. No warranty or other conditions, expressed or implied, should be understood. Conclusions derived are specific to the immediate area of study and cannot be extrapolated extensively away from sample locations.

Performance of this Geotechnical Investigation to the standards established by Pinchin is intended to reduce, but not eliminate, uncertainty regarding the subgrade soil at the Site, and recognizes reasonable limits on time and cost.

Regardless how exhaustive a Geotechnical Investigation is performed; the investigation cannot identify all the subsurface conditions. Therefore, no warranty is expressed or implied that the entire Site is representative of the subsurface information obtained at the specific locations of our investigation. If during construction, subsurface conditions differ from then what was encountered within our test location and the additional subsurface information provided to us, Pinchin should be contacted to review our recommendations. This report does not alleviate the contractor, owner, or any other parties of their respective responsibilities.

This report has been prepared for the exclusive use of the Client and their authorized agents. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

Pinchin makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time. Please refer to Appendix IV, Report Limitations and Guidelines for Use, which pertains to this report.

Specific limitations related to the legal and financial and limitations to the scope of the current work are outlined in our proposal, the attached Methodology, and the Authorization to Proceed, Limitation of Liability and Terms of Engagement which accompanied the proposal.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

289578 Geotechnical Investigation 1983 Carling Ave Ottawa ON 2473493 Ont Inc

Template: Master Geotechnical Investigation Report – Ontario, GEO, April 1, 2020

# FIGURES


PINCHIN

| | | | |
|---|---|---|---|
| PROJECT NAME<br>GEOTECHNICAL INVESTIGATION | | | |
| CLIENT NAME<br>2473493 ONTARIO INC. | | | |
| PROJECT LOCATION<br>1983 CARLING AVENUE, OTTAWA, ONTARIO | | | |
| FIGURE NAME<br>KEY MAP | | | FIGURE NO.<br>1 |
| APPROXIMATE SCALE<br>AS SHOWN | PROJECT NO.<br>289578 | DATE<br>MAY 2021 | |


LEGEND

BOREHOLE LOCATION

[XX.XX] GROUND SURFACE ELEVATION (m)

[XX.XX] BOREHOLE REFUSAL ELEVATION (m)

m METRES

PINCHIN

| | |
|---|---|
| PROJECT NAME<br>GEOTECHNICAL INVESTIGATION | |
| CLIENT NAME<br>2473493 ONTARIO INC. | |
| PROJECT LOCATION<br>1983 CARLING AVENUE, OTTAWA, ONTARIO | |
| FIGURE NAME<br>BOREHOLE LOCATION PLAN | |
| APPROXIMATE SCALE<br>AS SHOWN | PROJECT NO.<br>289578 |
| DATE<br>APRIL 2021 | FIGURE NO.<br>2 |

# APPENDIX I

## Abbreviations, Terminology and Principle Symbols used in Report and Borehole Logs

## ABBREVIATIONS, TERMINOLOGY & PRINCIPAL SYMBOLS USED

### Sampling Method

| | | | |
|---|---|---|---|
| **AS** | Auger Sample | **w** | Washed Sample |
| **SS** | Split Spoon Sample | **HQ** | Rock Core (63.5 mm diam.) |
| **ST** | Thin Walled Shelby Tube | **NQ** | Rock Core (47.5 mm diam.) |
| **BS** | Block Sample | **BQ** | Rock Core (36.5 mm diam.) |

### In-Situ Soil Testing

**Standard Penetration Test (SPT), "N" value** is the number of blows required to drive a 51 mm outside diameter spilt barrel sampler into the soil a distance of 300 mm with a 63.5 kg weight free falling a distance of 760 mm after an initial penetration of 150 mm has been achieved. The SPT, "N" value is a qualitative term used to interpret the compactness condition of cohesionless soils and is used only as a very approximation to estimate the consistency and undrained shear strength of cohesive soils.

**Dynamic Cone Penetration Test (DCPT)** is the number of blows required to drive a cone with a 60 degree apex attached to "A" size drill rods continuously into the soil for each 300 mm penetration with a 63.5 kg weight free falling a distance of 760 mm.

**Cone Penetration Test (CPT)** is an electronic cone point with a 10 cm2 base area with a 60 degree apex pushed through the soil at a penetration rate of 2 cm/s.

**Field Vane Test (FVT)** consists of a vane blade, a set of rods and torque measuring apparatus used to determine the undrained shear strength of cohesive soils.

### Soil Descriptions

The soil descriptions and classifications are based on an expanded Unified Soil Classification System (USCS). The USCS classifies soils on the basis of engineering properties. The system divides soils into three major categories; coarse grained, fine grained and highly organic soils. The soil is then subdivided based on either gradation or plasticity characteristics. The classification excludes particles larger than 75 mm. To aid in quantifying material amounts by weight within the respective grain size fractions the following terms have been included to expand the USCS:

| Soil Classification | | Terminology | Proportion |
|---|---|---|---|
| Clay | < 0.002 mm | | |
| Silt | 0.002 to 0.06 mm | "trace", trace sand, etc. | 1 to 10% |
| Sand | 0.075 to 4.75 mm | "some", some sand, etc. | 10 to 20% |
| Gravel | 4.75 to 75 mm | Adjective, sandy, gravelly, etc. | 20 to 35% |
| Cobbles | 75 to 200 mm | And, and gravel, and silt, etc. | >35% |
| Boulders | >200 mm | Noun, Sand, Gravel, Silt, etc. | >35% and main fraction |

**Notes:**

- Soil properties, such as strength, gradation, plasticity, structure, etcetera, dictate the soils engineering behaviour over grain size fractions; and
- With the exception of soil samples tested for grain size distribution or plasticity, all soil samples have been classified based on visual and tactile observations. The accuracy of visual and tactile observation is not sufficient to differentiate between changes in soil classification or precise grain size and is therefore an approximate description.

The following table outlines the qualitative terms used to describe the compactness condition of cohesionless soil:

| Cohesionless Soil | |
|---|---|
| **Compactness Condition** | **SPT N-Index (blows per 300 mm)** |
| Very Loose | 0 to 4 |
| Loose | 4 to 10 |
| Compact | 10 to 30 |
| Dense | 30 to 50 |
| Very Dense | > 50 |

The following table outlines the qualitative terms used to describe the consistency of cohesive soils related to undrained shear strength and SPT, N-Index:

| Cohesive Soil | | |
|---|---|---|
| **Consistency** | **Undrained Shear Strength (kPa)** | **SPT N-Index (blows per 300 mm)** |
| Very Soft | <12 | <2 |
| Soft | 12 to 25 | 2 to 4 |
| Firm | 25 to 50 | 4 to 8 |
| Stiff | 50 to 100 | 8 to 15 |
| Very Stiff | 100 to 200 | 15 to 30 |
| Hard | >200 | >30 |

**Note:** Utilizing the SPT, N-Index value to correlate the consistency and undrained shear strength of cohesive soils is only very approximate and needs to be used with caution.

## Soil & Rock Physical Properties

### General

**W** Natural water content or moisture content within soil sample
**$\gamma$** Unit weight
**$\gamma'$** Effective unit weight
**$\gamma_d$** Dry unit weight
**$\gamma_{sat}$** Saturated unit weight
**$\rho$** Density
**$\rho_s$** Density of solid particles
**$\rho_w$** Density of Water
**$\rho_d$** Dry density
**$\rho_{sat}$** Saturated density e Void ratio
**n** Porosity
**$S_r$** Degree of saturation
**$E_{50}$** Strain at 50% maximum stress (cohesive soil)

**Consistency**

| | |
|---|---|
| $W_L$ | Liquid limit |
| $W_P$ | Plastic Limit |
| $I_P$ | Plasticity Index |
| $W_S$ | Shrinkage Limit |
| $I_L$ | Liquidity Index |
| $I_C$ | Consistency Index |
| $e_{max}$ | Void ratio in loosest state |
| $e_{min}$ | Void ratio in densest state |
| $I_D$ | Density Index (formerly relative density) |

**Shear Strength**

| | |
|---|---|
| $C_u$, $S_u$ | Undrained shear strength parameter (total stress) |
| $C'_d$ | Drained shear strength parameter (effective stress) |
| r | Remolded shear strength |
| $\tau_p$ | Peak residual shear strength |
| $\tau_r$ | Residual shear strength |
| ø' | Angle of interface friction, coefficient of friction = tan ø' |

**Consolidation (One Dimensional)**

| | |
|---|---|
| $C_C$ | Compression index (normally consolidated range) |
| $C_r$ | Recompression index (over consolidated range) |
| $C_S$ | Swelling index |
| $m_V$ | Coefficient of volume change |
| $c_V$ | Coefficient of consolidation |
| $T_V$ | Time factor (vertical direction) |
| U | Degree of consolidation |
| $\sigma'_o$ | Overburden pressure |
| $\sigma'_p$ | Preconsolidation pressure (most probable) |
| OCR | Overconsolidation ratio |

**Permeability**

The following table outlines the terms used to describe the degree of permeability of soil and common soil types associated with the permeability rates**:**

| Permeability (k cm/s) | Degree of Permeability | Common Associated Soil Type |
|---|---|---|
| > $10^{-1}$ | Very High | Clean gravel |
| $10^{-1}$ to $10^{-3}$ | High | Clean sand, Clean sand and gravel |
| $10^{-3}$ to $10^{-5}$ | Medium | Fine sand to silty sand |
| $10^{-5}$ to $10^{-7}$ | Low | Silt and clayey silt (low plasticity) |
| >$10^{-7}$ | Practically Impermeable | Silty clay (medium to high plasticity) |

**Rock Coring**

**Rock Quality Designation (RQD)** is an indirect measure of the number of fractures within a rock mass, Deere et al. (1967). It is the sum of sound pieces of rock core equal to or greater than 100 mm recovered from the core run, divided by the total length of the core run, expressed as a percentage. If the core section is broken due to mechanical or handling, the pieces are fitted together and if 100 mm or greater included in the total sum**.**

**RQD is calculated as follows:**

$$\text{RQD (\%)} = \frac{\Sigma \text{ Length of core pieces} > 100 \text{ mm} \times 100}{\text{Total length of core run}}$$

The following is the Classification of Rock with Respect to RQD Value:

| RQD Classification | RQD Value (%) |
|---|---|
| Very poor quality | **<25** |
| Poor quality | 25 to 50 |
| Fair quality | 50 to 75 |
| Good quality | 75 to 90 |
| Excellent quality | 90 to 100 |

# APPENDIX II

## Pinchin's Borehole Logs

# Log of Borehole: BH1

**Project #:** 289578 **Logged By:** WT

**Project:** Geotechnical Investigation

**Client:** 2473493 Ontario Inc.

**Location:** 1983 Carling Avenue, Ottawa, Ontario

**Drill Date:** March 29, 2021 **Project Manager:** WT

## SUBSURFACE PROFILE

| Depth (m) | Symbol | Description | Elevation (m) | Monitoring Well Details |
|---|---|---|---|---|
| | | Ground Surface | 99.24 | |
| 0 | | **Fill** Sand and gravel, trace silt, damp, brown, loose | 98.78 | No Monitoring Well Installed |
| | | **Till** Silty clayey sand, some gravel, damp, brown, loose to very dense | 98.33 | |
| 1 | | End of Borehole<br>Borehole terminated at approximately 0.91 m depth due to auger refusal on probable bedrock. Groundwater was not encountered at drilling completion. | | |

## SAMPLE

| Sample Type | Sampler # | Recovery (%) | SPT N-values | SPT N-values (20, 40, 60) / Shear Strength kPa (50, 100, 150, 200) | Lab Analysis | Moisture (%) | Plasticity Index |
|---|---|---|---|---|---|---|---|
| SS | 1 | 60 | 8 | | G.S. | | |
| SS | 2 | 80 | >50 | | Hyd. | 24.5 | |

**Contractor:** Strata Drilling Group

**Grade Elevation:** 99.24 m

**Drilling Method:** Hollow Stem / Split Spoon

**Top of Casing Elevation:** N/A

**Well Casing Size:** N/A

**Sheet:** 1 of 1

# Log of Borehole: BH2

**Project #:** 289578 **Logged By:** WT

**Project:** Geotechnical Investigation

**Client:** 2473493 Ontario Inc.

**Location:** 1983 Carling Avenue, Ottawa, Ontario

**Drill Date:** March 29, 2021 **Project Manager:** WT

| SUBSURFACE PROFILE | | | | | SAMPLE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation (m) | Monitoring Well Details | Sample Type | Sampler # | Recovery (%) | SPT N-values | SPT N-values (20, 40, 60) / Shear Strength kPa (50, 100, 150, 200) | Lab Analysis | Moisture (%) | Plasticity Index |
| | | Ground Surface | 98.99 | | | | | | | | | |
| 0 | | **Asphalt ~ 25 mm** | | No Monitoring Well Installed | | | | | | | | |
| | | **Fill**<br>Gravelly sand, trace silt, damp, brown, compact | 98.23 | | SS | 1 | 100 | 10 | ■ | G.S. | | |
| | | End of Borehole<br>Borehole terminated at approximately 0.76 m depth due to auger refusal on probable bedrock. Groundwater was not encountered at drilling completion. | | | | | | | | | | |
| 1 | | | | | | | | | | | | |

**Contractor:** Strata Drilling Group

**Drilling Method:** Hollow Stem / Spilt Spoon

**Well Casing Size:** N/A

**Grade Elevation:** 98.99 m

**Top of Casing Elevation:** N/A

**Sheet:** 1 of 1

# Log of Borehole: BH3

**Project #:** 289578 **Logged By:** WT

**Project:** Geotechnical Investigation

**Client:** 2473493 Ontario Inc.

**Location:** 1983 Carling Avenue, Ottawa, Ontario

**Drill Date:** March 29, 2021 **Project Manager:** WT

| Depth (m) | Description | Elevation (m) | Monitoring Well Details | Sample Type | Sampler # | Recovery (%) | SPT N-values | Lab Analysis | Moisture (%) | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|
| | Ground Surface | 99.03 | | | | | | | | |
| 0 | **Asphalt ~ 25 mm** | | No Monitoring Well Installed | | | | | | | |
| | **Fill** Sand and gravel, trace silt, damp, brown, compact | | | SS | 1 | 80 | 3 | | | |
| | | | | SS | 2 | 100 | >50 | | | |
| | End of Borehole | 98.12 | | | | | | | | |
| 1 | Borehole terminated at approximately 0.91 m depth due to auger refusal on probable bedrock. Groundwater was not encountered at drilling completion. | | | | | | | | | |

SPT N-values: 20 40 60

Shear Strength kPa: 50 100 150 200

**Contractor:** Strata Drilling Group

**Drilling Method:** Hollow Stem / Split Spoon

**Well Casing Size:** N/A

**Grade Elevation:** 99.03 m

**Top of Casing Elevation:** N/A

**Sheet:** 1 of 1

# Log of Borehole: BH4

***Project #:*** 289578 ***Logged By:*** WT

***Project:*** Geotechnical Investigation

***Client:*** 2473493 Ontario Inc.

***Location:*** 1983 Carling Avenue, Ottawa, Ontario

***Drill Date:*** March 29, 2021 ***Project Manager:*** WT

| SUBSURFACE PROFILE | | | | | SAMPLE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation (m) | Monitoring Well Details | Sample Type | Sampler # | Recovery (%) | SPT N-values | SPT N-values (20, 40, 60) / Shear Strength kPa (50, 100, 150, 200) | Lab Analysis | Moisture (%) | Plasticity Index |
| | | Ground Surface | 99.41 | | | | | | | | | |
| 0 | | **Fill** Sand and gravel, trace silt, damp, brown, loose | 98.65 | No Monitoring Well Installed | SS | 1 | 100 | 7 | ■ | | | |
| 1 | | End of Borehole<br>Borehole terminated at approximately 0.76 m depth due to auger refusal on probable bedrock. Groundwater was not encountered at drilling completion. | | | | | | | | | | |

***Contractor:*** Strata Drilling Group ***Grade Elevation:*** 99.41 m

***Drilling Method:*** Hollow Stem / Split Spoon ***Top of Casing Elevation:*** N/A

***Well Casing Size:*** N/A ***Sheet:*** 1 of 1

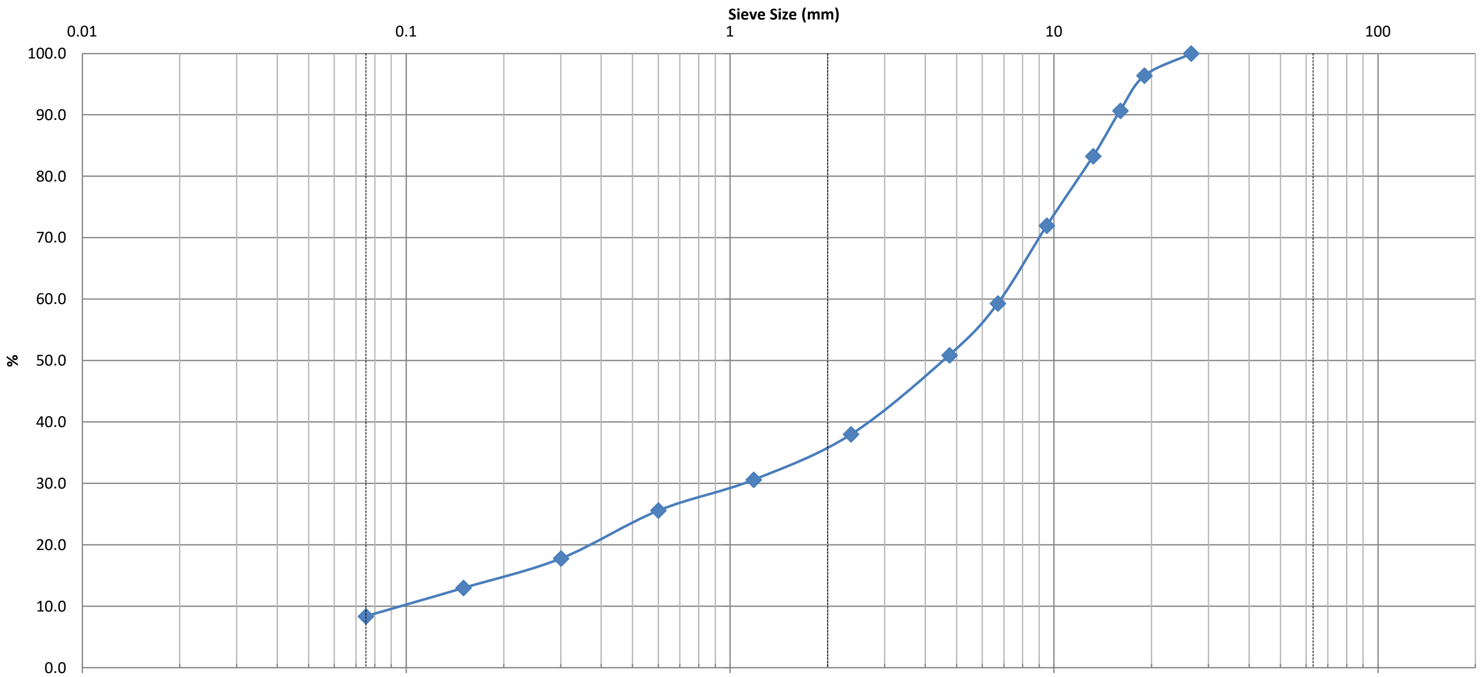
## APPENDIX III

## Laboratory Testing Reports for Soil Samples

**paterson**group
consulting engineers

**SIEVE ANALYSIS**
**ASTM C136**

| | | | | | |
|---|---|---|---|---|---|
| CLIENT: | Pinchin | DESCRIPTION: | Sand w Gravel | FILE NO: | PM4184 |
| CONTRACT NO.: | - | SPECIFICATION: | **Sand w Gravel** | LAB NO: | 23771 |
| PROJECT: | 289578 | INTENDED USE: | - | DATE RECEIVED: | 5-Apr-21 |
| | | PIT OR QUARRY: | - | DATE TESTED: | 7-Apr-21 |
| DATE SAMPLED: | 5-Apr-21 | SOURCE LOCATION: | BH1 | DATE REPORTED: | 9-Apr-21 |
| SAMPLED BY: | Client | SAMPLE LOCATION: | 0-1.5 ' | TESTED BY: | DK |




| Silt and Clay | Sand | | | Gravel | | Cobble |
|---|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse | |

| Identification | Soil Classification | | | | MC(%) | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 2.26 | 70.5 |
| | D100 | D60 | D30 | D10 | Gravel (%) | Sand (%) | Silt (%) | | Clay (%) | |
| | 26.5 | 6.7 | 1.2 | 0.095 | 49.1 | 42.5 | 8.4 | | | |

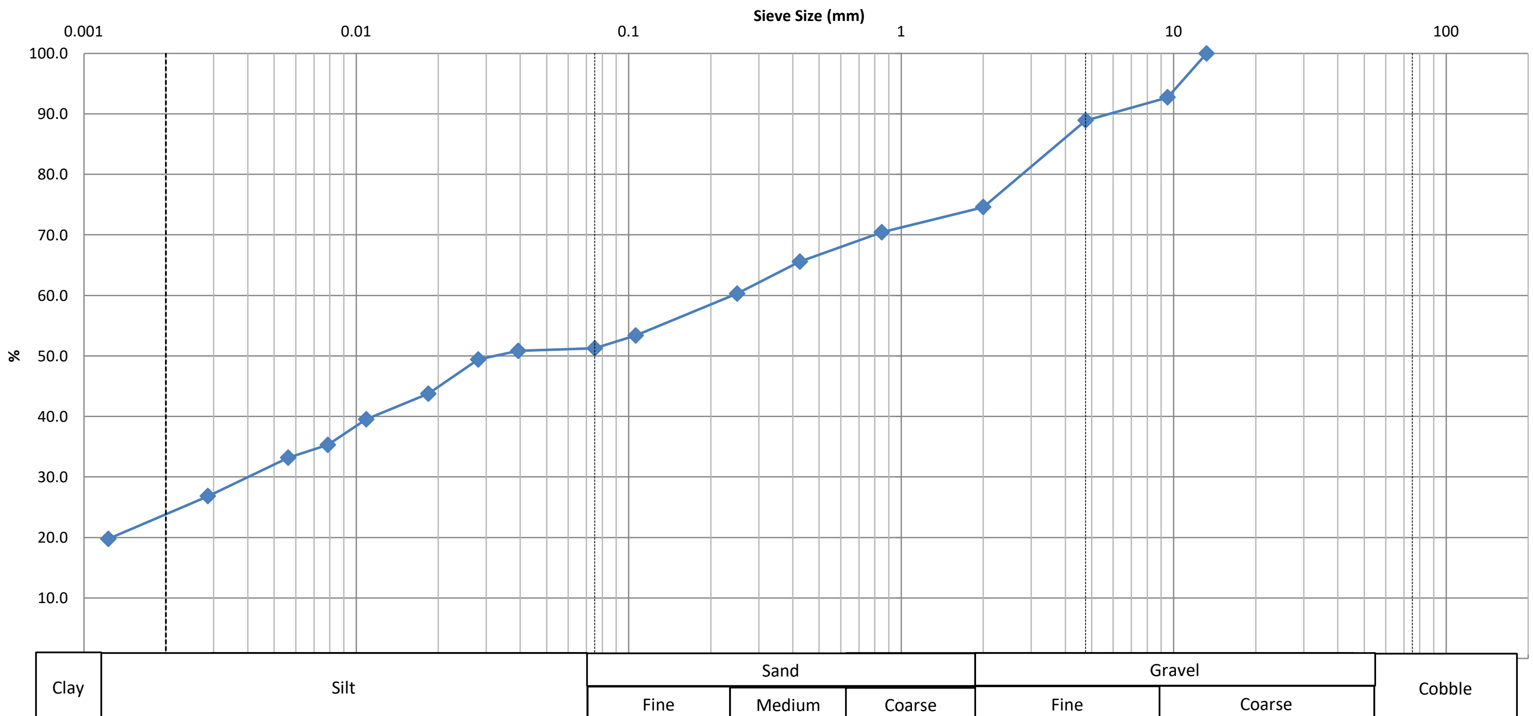
**Comments:**

| **REVIEWED BY:** | **Curtis Beadow** | **Joe Fosyth, P. Eng.** |
|---|---|---|

**patersongroup**
consulting engineers

**SIEVE ANALYSIS**
**ASTM C136**

| | | | | | |
|---|---|---|---|---|---|
| CLIENT: | Pinchin | DEPTH: | 1.5 - 2 ' | FILE NO: | PM4184 |
| CONTRACT NO.: | | BH OR TP No.: | BH1 | LAB NO: | 23769 |
| PROJECT: | 289578 | | | DATE RECEIVED: | 5-Apr-21 |
| | | | | DATE TESTED: | 9-Apr-21 |
| DATE SAMPLED: | 5-Apr-21 | | | DATE REPORTED: | 9-Apr-21 |
| SAMPLED BY: | Client | | | TESTED BY: | DB |




| Identification | Soil Classification | | | | | MC(%) | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 24.5 | | | | | |
| | D100 | D60 | D30 | D10 | Gravel (%) | Sand (%) | | Silt (%) | | Clay (%) | |
| | | | | | 11.1 | 37.7 | | 28.2 | | 23.0 | |

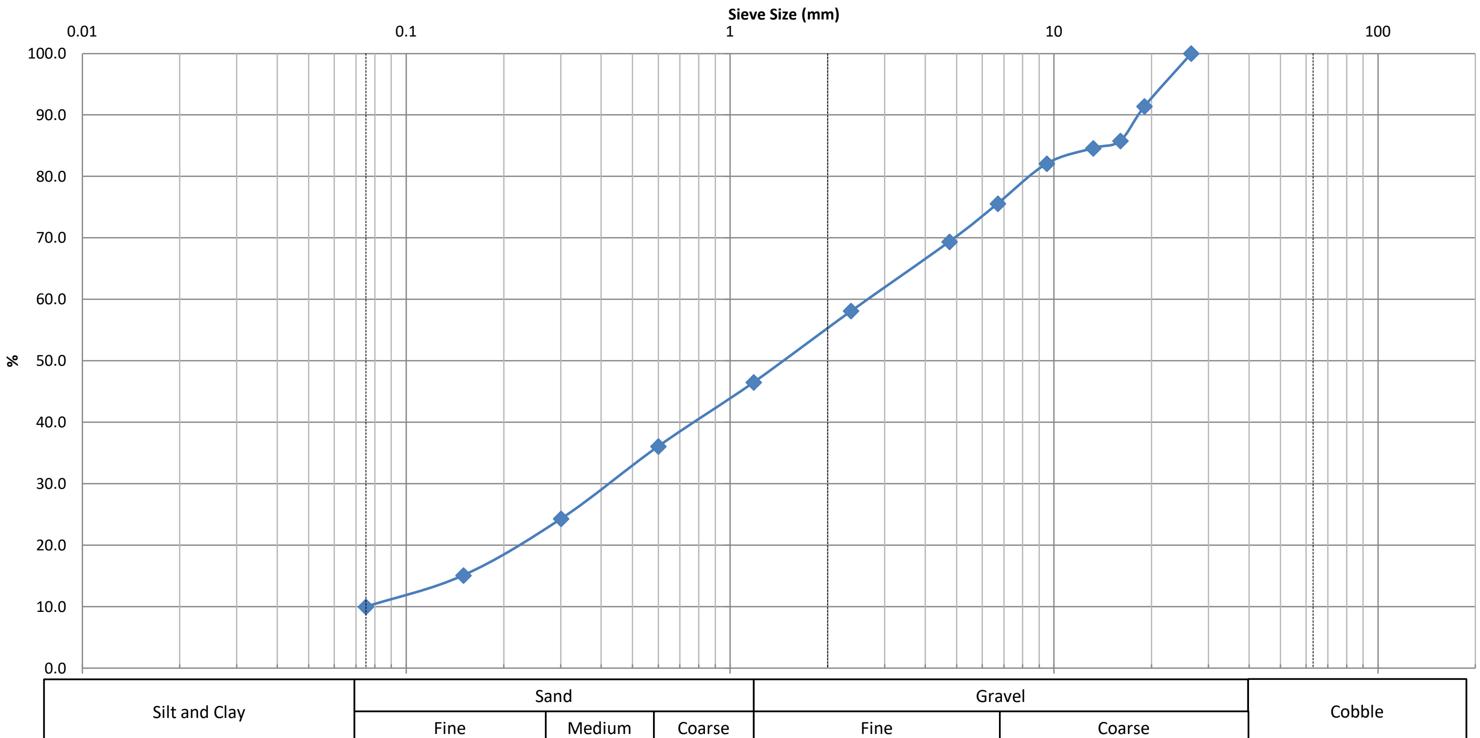
**Comments:**

| **REVIEWED BY:** | **Curtis Beadow** | **Joe Fosyth, P. Eng.** |
|---|---|---|

**patersongroup**
consulting engineers

**SIEVE ANALYSIS**
**ASTM C136**

| | | | | | |
|---|---|---|---|---|---|
| CLIENT: | Pinchin | DESCRIPTION: | Silty Sand w Gravel | FILE NO: | PM4184 |
| CONTRACT NO.: | - | SPECIFICATION: | **Silty Sand w Gravel** | LAB NO: | 23770 |
| PROJECT: | 289578 | INTENDED USE: | - | DATE RECEIVED: | 5-Apr-21 |
| | | PIT OR QUARRY: | - | DATE TESTED: | 7-Apr-21 |
| DATE SAMPLED: | 5-Apr-21 | SOURCE LOCATION: | BH 2 | DATE REPORTED: | 9-Apr-21 |
| SAMPLED BY: | Client | SAMPLE LOCATION: | 0-2 ' | TESTED BY: | DK |




| Identification | Soil Classification | | | | MC(%) | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 0.86 | 36.7 |
| | D100 | D60 | D30 | D10 | Gravel (%) | Sand (%) | Silt (%) | | Clay (%) | |
| | 26.5 | 2.75 | 0.42 | 0.075 | 30.6 | 59.4 | 10.0 | | | |

**Comments:**

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

# APPENDIX IV

## Report Limitations and Guidelines for Use

## REPORT LIMITATIONS & GUIDELINES FOR USE

This information has been provided to help manage risks with respect to the use of this report.

### GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report was prepared for the exclusive use of the Client and their authorized agents, subject to the conditions and limitations contained within the duly authorized work plan. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

### SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical report is based on the existing conditions at the time the study was performed, and Pinchin's opinion of soil conditions are strictly based on soil samples collected at specific test hole locations. The findings and conclusions of Pinchin's reports may be affected by the passage of time, by manmade events such as construction on or adjacent to the Site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations.

### LIMITATIONS TO PROFESSIONAL OPINIONS

Interpretations of subsurface conditions are based on field observations from test holes that were spaced to capture a 'representative' snap shot of subsurface conditions. Site exploration identifies subsurface conditions only at points of sampling. Pinchin reviews field and laboratory data and then applies professional judgment to formulate an opinion of subsurface conditions throughout the Site. Actual subsurface conditions may differ, between sampling locations, from those indicated in this report.

### LIMITATIONS OF RECOMMENDATIONS

Subsurface soil conditions should be verified by a qualified geotechnical engineer during construction. Pinchin should be notified if any discrepancies to this report or unusual conditions are found during construction.

Sufficient monitoring, testing and consultation should be provided by Pinchin during construction and/or excavation activities, to confirm that the conditions encountered are consistent with those indicated by the test hole investigation, and to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated. In addition, monitoring, testing and consultation by Pinchin should be completed to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining Pinchin for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions. However, please be advised that any construction/excavation observations by Pinchin is over and above the mandate of this geotechnical evaluation and therefore, additional fees would apply.

### MISINTERPRETATION OF GEOTECHNICAL ENGINEERING REPORT

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having Pinchin confer with appropriate members of the design team after submitting the report. Also retain Pinchin to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having Pinchin participate in pre-bid and preconstruction conferences, and by providing construction observation. Please be advised that retaining Pinchin to participation in any ‘other’ activities associated with this project is over and above the mandate of this geotechnical investigation and therefore, additional fees would apply.

### CONTRACTORS RESPONSIBILITY FOR SITE SAFETY

This geotechnical report is not intended to direct the contractor's procedures, methods, schedule or management of the work Site. The contractor is solely responsible for job Site safety and for managing construction operations to minimize risks to on-Site personnel and to adjacent properties. It is ultimately the contractor’s responsibility that the Ontario Occupational Health and Safety Act is adhered to, and Site conditions satisfy all ‘other’ acts, regulations and/or legislation that may be mandated by federal, provincial and/or municipal authorities.

### SUBSURFACE SOIL AND/OR GROUNDWATER CONTAMINATION

This report is geotechnical in nature and was not performed in accordance with any environmental guidelines. As such, any environmental comments are very preliminary in nature and based solely on field observations. Accordingly, the scope of services do not include any interpretations, recommendations, findings, or conclusions regarding the, assessment, prevention or abatement of contaminants, and no conclusions or inferences should be drawn regarding contamination, as they may relate to this project. The term "contamination" includes, but is not limited to, molds, fungi, spores, bacteria, viruses, PCBs, petroleum hydrocarbons, inorganics, pesticides/insecticides, volatile organic compounds, polycyclic aromatic hydrocarbons and/or any of their by-products.

Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be held liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered within the meaning of the Limitations Act, 2002 (Ontario), to commence legal proceedings against Pinchin to recover such losses or damage.