2978 Carp Road - Cheer Training Facility

Servicing and Stormwater Management Report

Stantec

Prepared for:
Ottawa Home Select

Prepared by:
Stantec Consulting Ltd.

Date:
June 17, 2026

Project/File:
160402325

Stantec Consulting Ltd.

Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date
1	Servicing and SWM	ZW	2025-09-11	PM	2025-09-16	DT	2025-09-16
2	Servicing and SWM	PM	2025-10-27	PM	2025-10-27	DT	2025-10-27
3	Revised Site Plan	MW	2026-06-17	PM	2026-06-24	DT	2026-06-24

The conclusions in the Report titled 2978 Carp Road - Cheer Training Facility are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

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This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

Prepared by

Signature

Michael Wu

Printed Name

Approved by

Signature

Peter Moroz

Printed Name

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1 Introduction

Stantec Consulting Ltd. has been commissioned by Ottawa Home Select to prepare the following Servicing and Stormwater Management Brief in support of the application for site plan control for the change of use of an existing warehouse building located at 2978 Carp Road and the residential dwelling with a municipal address of 2966 Carp Road, in the City of Ottawa, Ontario.

The site measures approximately 1.3 ha in area and is situated southeast of the intersection of McGee Side Road and Carp Road, bounded by Carp Road to the Southwest, an undeveloped parcel to the North, and adjacent to a residential dwelling (2966 Carp Road) to the Southeast. The site is currently zoned as RC7 - Rural Commercial Zone. The key plan of the site is shown in **Figure 1.1** below. The intent of this brief is to demonstrate, to the City's satisfaction, that adequate services are available and can be allocated to support the change of use of the existing warehouse to a Cheer Training Facility.

Figure 1.1: Key Plan of Site

The site consists of the existing 1,393.5 m^2 one-storey detached warehouse building, surface parking, and an existing 213.4m^2 residential dwelling with its associated landscaping area, well and septic system for servicing, and a dry pond for stormwater management. The site currently has two asphalt driveways

with access to Carp Road in the Southwest. Ottawa Home Select has provided a topographic survey and site plan dated May 15, 2026, attached in **Appendix A**.

1.1 Objective

The objective of this servicing and stormwater management brief is to demonstrate that the existing site can accommodate the proposed demands associated with the new land uses. It is to be noted that given that the site is serviced with well and septic, the water and sanitary services have been assessed by Paterson Group in their Hydrogeological Assessment and Terrain Analysis in support of the site plan control application and summarized in sections below. Further, this brief confirms that the existing runoff coefficients and grading patterns are not being altered and confirms that the existing stormwater management design will not be impacted.

2 Background

Documents referenced in preparation of this stormwater and servicing report for the proposed 2966 & 2978 Carp Road site include:

- *File PH5259-LET.01, Hydrogeological Assessment and Terrain Analysis – 2966 and 2978 Carp Road*, Paterson Group, 2026
- *File PH5103-LET.01-REV.01, Hydrogeological Assessment and Terrain Analysis – Re-zoning Application – 2966 and 2978 Carp Road, Ottawa (Carp), Ontario*, Paterson Group, October 2025.
- *Servicing Report – 2978 Carp Road,* Stantec, December 21, 2016.
- *Water Distribution Design Guidelines,* 2nd Edition, City of Ottawa, December 2025

3 Water Servicing

3.1 Background

The subject site is located outside the City of Ottawa's municipal water distribution network, as such the site requires private servicing to provide a sufficient water supply for domestic and emergency fire flow. The current storage building, as outlined in the site plan application, is serviced by a private well located in the north portion of the site via a 25 mm building service connection. The site is also equipped with precast concrete underground firewater storage tanks located in the southern portion of the site. The storage tanks receive water from the wells and are filled during off-peak hours.

Water Quantity and Quality Aquifer Analysis

Based on the Paterson Group assessment, the existing well can provide water flow of approximately 21,600 L. This is approximately 3.2 times the maximum total daily design volume of effluent (6,418 L/day) using 57% nitrate reduction required to support the site plan application. The 6,418 L/day is above the required flows as calculated under Part 8 – OBC for a subsequent application. Further discussion in the Terrain Analysis notes an additional technology that can support greater than 10,000 L/day.

A water quality aquifer analysis has been completed by the Paterson Group, and the following conclusions were noted:

- The preferred water supply intercepted by existing well contains a water supply that is potable and contains only elevated concentrations of hardness and total dissolved solids (TDS). The noted parameters can be treated with current readily available water conditioning equipment.
- Total Coliforms were detected at 0 ct/100 mL, however, it is recommended that a UV system is installed to assist in the removal of any remnant Total Coliforms found in the groundwater, as a precautionary measure.
- If desired by the property owner, a commercial grade water softener can be used to facilitate the reduction of the hardness concentration and reduce scaling. If a water softener is used for the proposed development, the owner should be made aware that additional sodium will be added to the water to reduce hardness. If desired, a point-of-use reverse osmosis system can be used to provide a drinking tap source without increasing sodium levels.
- It is recommended that either a point-of-use reverse osmosis system be used to reduce the TDS concentration, or bulk bottled water is provided as a drinking water source.

Detailed potable water aquifer analysis has been conducted by Paterson Group and is presented in the background report attached in **Appendix C.1** and the detailed report (File No. PH5259-LET.01) provided in the submission package.

Fire Flow Calculation

Assessment of required fire flows for the existing site was originally prepared within the *Servicing Report - 2978 Carp Road* (Stantec, 2016). At the time, fire flows were determined according to the Ontario Building Code (OBC) compendium Appendix A-3.2.5.7. Based on background information supplied by the Owner (see **Appendix A)**, it appears that the existing building has a larger volume than that initially assumed by the 2016 Servicing Report. As such, a revised fire flow calculation is presented below to account for the building volume discrepancy and to meet the process established in Appendix J of the 2025 Water Design Guidelines.

The required fire flow has been calculated based on design drawings for the prefabricated building with building heights measuring on average 7.37 m and satisfying the 'non-combustible with fire resistance ratings' construction type as per OBC Appendix A-3.2.5.7:

$$Minimum\ supply\ of\ Water\ (Litres) = Q = K \times V \times S_{TOT}$$

K = water supply coefficient
V = Total building volume in m^3
S_{TOT} = Total of spatial coefficient values from property line exposures on all sides

This subject site is outside the municipal water service network which requires on-site fire flow storage. Three precast concrete fire flow storage tanks have been installed with an approximate capacity of 150,000 L (roughly 50,000L each) as the fire water supply. The estimated OBC fire flow is **5,400 L/min (90 L/s)** and requires a total storage volume of **174,658 L**. Based on the calculated fire flow and the design process for rural fire flow calculations per Appendix J of the City of Ottawa Water Design Guidelines, the OBC fire flow is the governing criteria for calculating the required on site storage volume for fire flow.

It is anticipated an additional tank in conjunction with the installed three on-site fire water storage tanks would be sufficient in support of this site plan control application. The detailed OBC fire flow analysis is provided in the calculations in **Appendix B**.

4 Wastewater Servicing

The site is located outside the City of Ottawa's sanitary collection system. In support of the site plan control application, Paterson Group has conducted a terrain analysis for the on-site septic system, which provides sanitary servicing for the existing storage building and residential building.

Based on the Paterson Group assessment, the subject site is sufficient in size to accommodate two new sewage systems and meet all of the regulatory separation criteria. As a precautionary measure, a 30 m setback should be maintained between the drinking water well and any septic system components. In addition, the following conclusions were noted:

- The subject site is sufficient in size to accommodate two new sewage systems and meet all of the regulatory separation criteria. As a precautionary measure, a 30 m setback should be maintained between the drinking water well and any septic system components.
- A maximum sewage flow volume of **1.58 m3/day** at a nitrate concentration of 40 mg/L or **6.42m3/day** at a nitrate concentration of 17.2 mg/L can be accommodated on the subject site based on the current layout and still be below the predictive nitrate concentration threshold of 10 mg/L at the property boundary.
- Onsite sewage disposal needs can be accommodated with a Class 4 Sewage System utilizing tertiary treatment technologies.
- A Sewage System Permit and Building Permit need to be issued prior to the commencement of construction on the proposed structures or amenities/services.
- The results of the Hydrogeological Assessment and Terrain Analysis have provided satisfactory evidence that the subject site can support the proposed usage with respect to water quality, quantity and sewage system placement.

For further details to the design of the proposed septic system servicing site, please refer to the Paterson Group letter and drawings (File No. PH5259-LET01) submitted as part of the submission package.

5 Stormwater Management

5.1 Existing System

Stormwater Management (SWM) for the site was designed and constructed as part of the site development for the existing warehouse building, and it provides the required quantity and quality control for the site. In 2016, Stantec conducted a detailed stormwater management analysis for the current site, and the key analysis results are summarized below.

- The grading design incorporates emergency overland flow routes in compliance with the City of Ottawa's stormwater management standards. These routes are intended to safely convey runoff from storm events exceeding the 100-year design threshold toward the eastern portion of the site, where existing major drainage systems are located.

- On-site storage and infiltration were incorporated in the design of the dry pond as the best approach to manage site runoff so as to not increase the total uncontrolled runoff from the site.

- The existing On-site Dry Pond controls post-development storm runoff to below pre-development target release rates through infiltration of all storm events up to and including the 100-year storm event. **Table 5.3** below summarizes the storage and outflow characteristics for the dry pond

Table 5.1: Pond Storage and Outflow Characteristics

ID	100-Year Discharge (L/s) (Infiltration)	100-Year Storage Required (m^3)	Available Storage (m^3)
Pond	9.8	385.3	389.6

- On-site quality control with a minimum target of 70% TSS removal was established with a treatment train approach as per the requirements of MVCA. The grading design allows most of the surface runoff to flow through grassed areas for an initial infiltration and treatment of TSS. In addition, a vegetated buffer was incorporated around the dry pond to achieve a minimum 70% TSS removal efficiency as per the US EPA design manual for Low Impact Development (LID). As all pond outflow is through infiltration, site overall TSS removal rates would also achieve 80% TSS reduction to meet Enhanced criteria without additional modification.

The design was approved to meet the City of Ottawa Design Criteria and has received an Environmental Compliance Approval (Number: 9196-AQBQZV) on October 6, 2017, from the MECP. As there are no changes to the imperviousness of the site, it is anticipated that the existing SWM facility will be maintained to service the proposed use without additional modifications. Background stormwater analysis conducted for the existing warehouse is detailed in **Appendix C.2**.

6 Conclusion

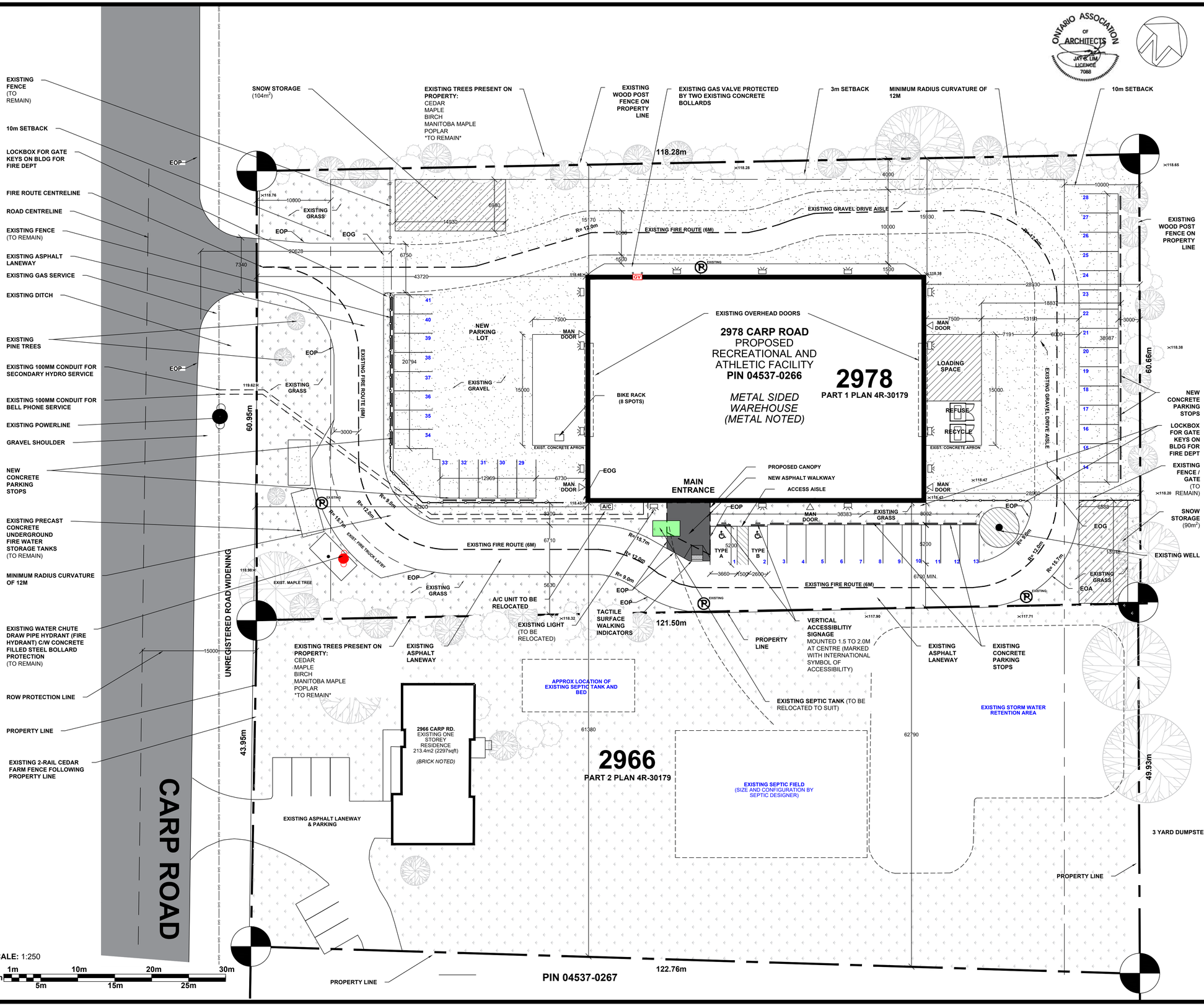
The water supply aquifer underlying the subject site is considered to be a sufficient water supply for domestic demands. The existing well contains supply that is potable and can be treated to reduce the elevated concentration of hardness and TDS, including total coliforms as a precautionary measure. The treatment can be easily accomplished with water softener, osmosis filter, and UV system. The existing fire flow storage can be expanded to accommodate the required fire flow for the development per OBC requirements.

The site is currently serviced by an on-site sewage system, which will need to be replaced with a new sewage system and meet all the regulatory separation criteria. Onsite sewage disposal needs can be accommodated with a Class 4 Sewage System utilizing tertiary treatment technologies. A Sewage System Permit and Building Permit needs to be issued prior to the commencement of construction on the proposed structures or amenities/services. Details of the design and approval of the septic system is provided by Paterson Group as part of the submission package.

The existing previously approved and constructed stormwater management system including an on-site dry pond and infiltration basin was designed and constructed to meet target discharge rates for all rainfall events up to and including the 100-year event. The system also provides sufficient quality control to meet 70% TSS removal criteria, although it can be immediately seen that the design would also meet an ‘Enhanced’ 80% TSS criteria given infiltration of all received runoff for up to the 100-year design storm event. Given that the existing runoff coefficients and grading patterns are not being altered, the existing stormwater management design will not be impacted, and is proposed to be maintained without additional modifications.

Appendices

Appendix A Background



PARKING LOT:

EXISTING # OF PARKING: 13
PROPOSED # OF PARKING: 41

STANDARD PARKING SIZE:
2600 x 5200

TYPE A ACCESSIBILITY:
3660 X 5200
PARKING #1

TYPE B ACCESSIBILITY:
2600 x 5200
PARKING #2
PARKING SPOTS = PAINTED LINES ON ASPHALT

PARALLEL PARKING SIZE:
2600 X 6700

ACCESS AISLE:

- 1.5M WIDE
- CLEARLY MARKED AND ADJACENT TO TYPE A AND TYPE B SPACE

VERTICAL SIGNAGE:
- 0.3M WIDE (MIN.)
- 0.6M HIGH (MIN.)
- MOUNTED 1.5 TO 2.0M AT CENTRE (MARKED WITH INTERNATIONAL SYMBOL OF ACCESSIBILITY)

PAVEMENT MARKINGS:
- MARKED WITH THE INTERNATIONAL SYMBOL OF ACCESSIBILITY
- 15.25 MM WIDE BY 15.25 MM DEEP
- LOCATE NEAR THE BACK OF THE SPACE FOR 90 DEGREE OR ANGLED PARKING SPACES
- LOCATE IN THE CENTRE FOR PARALLEL PARKING SPACES

LIGHTING:
- IN ACCORDANCE WITH SECTION 9.7

CURB RAMPS:
SURFACE: FIRM, STABLE AND SLIP RESISTANT
WIDTH: 1.8M
SLOPES:
- RUNNING: 1:5 (MINIMUM), EXCLUSIVE OF FLARES
- CROSS: 1:50 (2%) (MAXIMUM)

TACTILE SURFACE WALKING INDICATORS: MINIMUM DEPTH OF 610MM, AT 150MM TO 200MM FROM EDGE OF CURB
FLARED SIDE:
1M WIDE SLOPED 1:15 TO 1:10

PARKING CALCULATION:
AREA:
1ST FLOOR: 112 SQ. M
2ND FLOOR: 145 SQ. M

TOTAL COMMON AREA: 257 SQM

247 SQ. M/100 =2.4 X 10 = 24 PARKING SPACES

ADDITIONAL PARKING:
4 PER GAME SURFACE = 4 MATS X 4 PARKING SPACES = 16 SPACE

THEREFORE THE TOTAL NUMBER OF PARKING SPACES REQUIRED IS 40 SPACES (4% UNIVERSAL = 2 SPACES)

FIRE ROUTE SIGNS:

SIGN PROHIBITING PARKING IN A FIRE ROUTE SHALL,

1. SIZE:
45CM HIGH (MINIMUM)
30CM WIDE (MINIMUM)

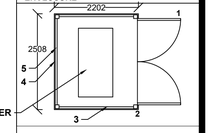
2. BEAR THE MARKINGS AND MESSAGE THAT THE AREA IS A FIRE ROUTE WHERE PARKING IS PROHIBITED AND INCLUDE DOUBLE ARROWS, EXCEPT AT THE ENDS OF A FIRE ROUTE WHERE SINGLE ARROWS SHALL BE INCLUDED

3. SHALL BE LOCATED NO MORE THAN 25.0 METRES APART UNLESS OTHERWISE SPECIFICALLY APPROVED BECAUSE OF UNUSUAL SITE CONDITIONS OR FIRE ROUTE CONFIGURATION, AND THE LOWER EDGE OF EACH SIGN SHALL BE BETWEEN 2.0 METRES AND 2.5 METRES ABOVE THE GROUND.

4. INCLUDE, IN BLACK LETTERS OF A MINIMUM HEIGHT OF 4.0 CM, THE ENGLISH LANGUAGE MESSAGE "FIRE ROUTE" AND THE FRENCH LANGUAGE MESSAGE "ITINÉRAIRE DES POMPIERS", BELOW THE MESSAGE "FIRE ROUTE", AND

5. HAVE THE DESIGN AND DIMENSIONS AS DESCRIBED IN THE FOLLOWING FIGURE:

WASTE MANAGEMENT AND RECYCLING ENCLOSURE



1. TWO P.T WOOD GATES COMPLETE WITH GALVANIZED STEEL FRAMES, GALVANIZED HINGES, AND WHEEL-END SUPPORTS. HINGES TO BE SECURED TO GALVANIZED HSS CORNER POSTS. PROVIDE LATCH/CLASP HARDWARE TO MAINTAIN GATES IN THE CLOSED POSITION.
2. SECURE POSTS TO THE CONCRETE SLAB USING BOLTS/FASTENERS THROUGH GALVANIZED BASE PLATES CONNECTED TO THE COLUMNS.
3. WELDED GALVANIZED STEEL ANGLE SUPPORTS AT THE TOP AND BOTTOM TO PROVIDE FASTENING POINTS FOR THE PRESSURE-TREATED WOOD PANELS.
4. WOOD BOARDS 19 MM X 140 MM.
5. HSS COLUMNS WITH GALVANIZED FINISH.

ONTARIO ASSOCIATION OF ARCHITECTS
JAY K. LIM
LICENCE 7088

25:8 ARCHITECTURE URBAN DESIGN

R. Viau
Drafting & Design Ltd.
613-748-6157
rviaudrafting.ca

LEGEND

PROJECT RESOURCES:
OWNER: ALANA POTTER & ALISON MOFFATT (CARP CHEER GYM INC.)
ARCHITECT: JAY LIM (25:8 ARCHITECTURE)
STRUCTURAL ENG. : CHRISTIAN GUIMOND (SALAS O BRIEN)
MECHANICAL ENG. : PIERRE VAILLANCOURT (MEELE ENGINEERING)
SURVEYOR: ANNIS, O SULLIVAN, VOLLEBEKK LTD.

ALL SURVEY INFORMATION WAS OBTAINED FROM A SURVEY PLAN (DATED 2021) PRODUCTED BY ANNIS, O SULLIVAN, VOLLEBEKK LTD.

ZONING MATRIX		
RC7 ZONE	**REQ.**	**PROVIDED**
LOT AREA	4000m2	12,632m2
LOT WIDTH	30m	104.99m
FRONT YARD	10m	60.95m
REAR YARD	10m	60.66m
INT. SIDE YARD	4.5m (ABUTTING) 3m (OTHER)	N/A 19.63m
CORNER SIDE YD	6m	N/A
BLDG HEIGHT	11m	7.68m
LOT COVERAGE	25%	12.3%
BICYCLE PARKING (1 PER 2000m²)	1	8
		Zoning By-law 2026-50

FLOOR AREA BREAKDOWN:
LOT AREA: 12632m²
GROUND FLOOR: 1360.86m²
ADMIN: 202m²
GYMNASIUM: 1158m²
MEZZANINE: 100.89m²

SNOW STORAGE:
PAVED AREA: 1280m²
SNOW STORAGE REQUIRED: 10% OF 1280m² = 128m²
SNOW STORAGE PROVIDED: 190m²

EXISTING EXTERIOR LIGHTING
(SHARP CUT-OFF FIXTURES THAT DO NOT ALLOW LIGHT SPILLAGE ONTO ADJACENT PROPERTIES

FIRE ROUTE "NO PARKING"SIGN

EXISTING A/C UNIT
(TO BE RELOCATED)

EOP EDGE OF PAVEMENMT

EOG EDGE OF GRAVEL

No.	Description	Date
1	ISSUED FOR PERMIT	2026-03-27

PROPOSED RECREATIONAL AND ATHLETIC FACILITY

SITE & LANDSCAPE PLAN

2978 Carp Road
OTTAWA, ONTARIO

DRAWN BY: CHARLES VIAU
CHECKED BY:

SCALE: 1:250

2026-05-15

A099

A.1 Topographic Survey

TOPOGRAPHIC PLAN OF SURVEY OF

PART OF LOT 10
CONCESSION 2
GEOGRAPHIC TOWNSHIP OF HUNTLEY
CITY OF OTTAWA

Surveyed by Annis, O'Sullivan, Vollebekk Ltd.

Scale 1 : 300

12 9 6 3 0 6 12 Metres

Metric

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

Surveyor's Certificate

I CERTIFY THAT :

1. This survey and plan are correct and in accordance with the Surveys Act and the Surveyors Act and the regulations made under them.
2. The survey was completed on the 5th day of October, 2021.

Oct. 15/21
Date

T. Hartwick
Ontario Land Surveyor

Notes & Legend

Denotes

—□—	=	Survey Monument Planted
—■—	=	Survey Monument Found
SIB	=	Standard Iron Bar
PB	=	Plastic Bar
IB	=	Iron Bar
(WIT)	=	Witness
Meas.	=	Measured
(AOG)	=	Annis, O'Sullivan, Vollebekk Ltd.
(P1)	=	(857) Plan dated June 20, 2016 PIN 04537-0848
(P2)	=	Plan 5R-11958
(P3)	=	Plan 4R-30179
(P4)	=	(857) Plan dated June 20, 2016 PIN 04537-0264
	=	Deciduous Tree
FH	=	Fire Hydrant
MH	=	Maintenance Hole (Unidentified)
OHW	=	Overhead Wires
T\G	=	Top of Grate
V-P	=	Vent Pipe
GM	=	Gas Meter
TB-B	=	Bell Terminal Box
B	=	Bollard
S	=	Sign
RF	=	Rail Fence
BF	=	Board Fence
RWT	=	Timber Retaining Wall
	=	Gate
PO-W	=	Wood Pole
UP	=	Utility Pole
AN	=	Anchor
LS	=	Light Standard
W	=	Well Cap
AC	=	Air Conditioner
Ø	=	Diameter
65.00	=	Location of Elevations
65.00*	=	Top of Retaining Wall Elevation
C/L	=	Centreline
	=	Property Line
HH	=	Handhole
P&W	=	Post and Wire
	=	Decorative Stone

Bearings are grid, derived from Can-Net 2016 Real Time Network GPS observations and are referenced to Specified Control Points 01919680037 and 01919791051, MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

ELEVATION NOTES

1. Elevations shown are geodetic and are referred to the CGVD28 geodetic datum.
2. It is the responsibility of the user of this information to verify that the job benchmark has not been altered or disturbed and that it's relative elevation and description agrees with the information shown on this drawing.

ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
V-17007

THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR In accordance with Regulation 1026, Section 29 (3).

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

Job No. 22360-21 Nautical\.dgds PtLt10 C2 HU T F AR

A.2 Construction Type Confirmation

Wu, Michael

From: Charles Viau <charles@rviaudrafting.ca>
Sent: June 22, 2026 09:28
To: Johnston, Anthony; Jay Lim
Cc: Peter Lyons; Moroz, Peter; Wu, Michael
Subject: Re: 2978 Carp Road - Zoning deficiency letter
Attachments: 2978 Carp Cheer Conversion_V2 Permit issue 2_20260505.pdf

Good morning Anthony, i'm giving you some information about the building here but **Jay (cc'd) will have to confirm.**

Building Construction:
I believe the building is non-combustible - attached are the plans. The assembly fire ratings are the following:
Floors: 45min
Walls: 1h

Sprinkler system:
No, the building is not protected by a sprinkler system.

Kind regards

Charles Viau ***BCIN 130297***
613-804-6157
charles@rviaudrafting.ca
www.rviaudrafting.ca

On Mon, Jun 22, 2026 at 9:10 AM Johnston, Anthony <Anthony.Johnston@stantec.com> wrote:

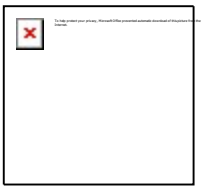
> Good Morning,
>
> We are in the process of finalizing our plans and reports and would appreciate confirmation of the following information:
>
> - Is the building of non-combustible construction? If so, please confirm the fire-resistance rating (FRR) of the floors, walls, and roof assemblies.
> - Is the building protected by a sprinkler system?
>
> Please respond as soon as possible, and we will do our best to submit the stamped plans and reports shortly afterward.
>
> Thanks!

From: Charles Viau <charles@rviaudrafting.ca>
Sent: Monday, June 15, 2026 7:01 AM
To: Johnston, Anthony <Anthony.Johnston@stantec.com>
Subject: 2978 Carp Road - Zoning deficiency letter

Good morning Anthony, we hope you had a great weekend!

I sent this document to Peter Moroz however it seems like he is out of the office! Just sending this incase it wasn't received - we're assuming the siteplan control application feedback already encapsulated this but we're just making sure no stone is being left unturned :)

Best regards



Charles Viau ***BCIN 130297***
613-804-6157
charles@rviaudrafting.ca
www.rviaudrafting.ca

Caution: This email originated from outside of Stantec. Please take extra precaution.

Attention: Ce courriel provient de l'extérieur de Stantec. Veuillez prendre des précautions supplémentaires.

Atención: Este correo electrónico proviene de fuera de Stantec. Por favor, tome precauciones adicionales.

Appendix B OBC Fire Flow Calculation

Fire Flow Calculations as per Ontario Building Code 2024 (Appendix A)

Job#	160401271	Designed by:	ZW
Date	19-Jun-26	Checked by:	DT

$Q = KVS_{tot}$

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
	Non-Combustible with Fire-Resistance Ratings	E, F-2		17

2	Area of one floor (m^2)	number of floors	height of ceiling (m)	Total Building Volume (m^3)
	1394	1	7.37	10,274

3	Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coeffiecient
	North	14.5	0	1
	East	28.4	0	
	South	30	0	
	West	45.4	0	

4	Established Fire Safety Plan?	Reduction in Volume (%)		Total Volume Reduction
	no	0%		0%

5		Total Volume 'Q' (L)
		174,658
		Minimum Required Fire Flow (L/min)
		5,400

Appendix C External Reports

C.1 Paterson Group Water Hydrogeological Assessment and Terrain Analysis Excerpts

PATERSON GROUP

Consulting Engineers
9 Auriga Drive
Ottawa, Ontario
K2E 7T9
Tel: (613) 226-7381

Geotechnical Engineering
Environmental Engineering
Hydrogeology
Materials Testing
Building Science
Rural Development Design
Retaining Wall Design
Noise and Vibration Studies

patersongroup.ca

October 23, 2025

PH5103-LET.01-REV.01

Nautical Lands Group
555 Legget Drive,
Tower A, Suite 920
Kanata, Ontario
K2K 3B8

Attention: Angela Mariani

Subject: **Hydrogeological Assessment and Terrain Analysis**
Re-zoning Application
2966-2978 Carp Road
Ottawa (Carp), Ontario

INTRODUCTION

Paterson Group Inc. (Paterson) was retained by Nautical Lands Group to conduct a Hydrogeological Assessment and Terrain Analysis in support of a Re-zoning Application for a proposed cheer academy located at 2966-2978 Carp Road in Ottawa (Carp), Ontario. It is our understanding that the current property consists of a 1.28 hectares (ha) parcel with an existing dwelling in the southern portion of the site. The proposed re-zoning application aims to change the zoning of the existing warehouse footprint that is designated as Rural Commercial (RC7) to include instructional facility and athletic & recreational facility use. For specific planning details, please refer to the consultant report application package and to the attached Key Plan for the approximate site location.

The purpose of this work has been to determine the suitability of the water supply aquifer underlying the site and to carry out a sewage system impact assessment (terrain analysis) to determine the site's suitability for private on-site sewage systems. Specifically, the intent of the report is to determine the quality and quantity of water underlying the subject site, as well as to provide the maximum sewage flow volume which the subject site can support from a nitrate attenuation standpoint.

BACKGROUND

Subject Site

The subject property consists of a warehouse with associated landscaped areas and parking lots, and a residential dwelling with associated landscaped areas and driveways located at 2966 and 2978 Carp Road in the City of Ottawa (Carp), Ontario. The ground surface across the site is relatively flat, with a general downslope direction to the east. The general overburden groundwater flow direction is assumed to be north to northeast towards the Carp River.

The Carp Road corridor and buildings onsite are serviced by private services. The site is bordered to the northeast and northwest by undeveloped lands, to the southwest by Carp Road, followed by residential properties, and to the southeast by a commercial property.

The subject site is largely rectangular in shape with a total area of 1.28 ha. The site is currently zoned as RC7 (Rural Commercial). The land parcels to the north and east are zoned RC9 (Rural Commercial), and the residential properties to the west are zoned RR5 (Rural Residential Zone).

Regional Geology

Published surficial geology mapping (OGS MRD128) for the area in the vicinity of the subject site indicates that the subject site is underlain predominantly by stone-poor silty sand to sandy silt-textured till on Paleozoic Terrain.

Published bedrock geology mapping (OGS MRD219) indicates that the subject lands are underlain by limestone and shale of the Simcoe Group and Verulam Formation. The available bedrock mapping coincides with the well driller's description on the Ministry of the Environment, Conservation and Parks (MECP) Water Well Records (WWR) for the surrounding well supplies installed within the subject area, which generally indicate a grey limestone.

Karst Mapping

Published karst mapping (OGS GRS005) for the area indicated that the subject site is not within a potential or inferred karst area.

MISSISSIPPI-RIDEAU SOURCE PROTECTION PLAN

The Mississippi-Rideau Source Protection Plan (MRSPP) provides guidance as to which policies apply to a given property, municipality or specific activity and if there are specific designations that apply to the area. The subject site has been designated as a Highly Vulnerable Aquifer (HVA within the MRSPP) and a Significant Groundwater Recharge Area (SGRA) and is identified as two of the four groundwater related vulnerable areas identified within the Clean Water Act (2006). The four vulnerable areas consists of HVA, SGRA, Intake Protection Zones (IPZ), and Wellhead Protection Areas (WHPA).

Based upon the designation, there are no restrictions of land uses on the subject site based upon its proposed usage. Therefore, there are no related requirements for an HVA or SGRA at this location.

Hydrogeological Pre-Consultation

A City of Ottawa pre-consultation was completed on August 27, 2025 to discuss the requirements for the hydrogeological assessment and terrain analysis of the subject site. Initial discussions were completed by email prior to the meeting.

FIELDWORK PROGRAM

Well Testing

As a means to demonstrate the adequacy of the aquifer underlying the subject lands, with respect to water quality and quantity, the existing drilled well (TW1) servicing the existing warehouse was tested. TW1 has a Water Well Record (WWR) Well ID of A212621. TW1 has a 150 mm diameter steel casing that extends to 6.82 m bgs with a 0.45 m stick up. The well itself extends to a depth of 58.9 m bgs. According to the water well record, limestone bedrock was recorded at a depth of approximately 4.34 m bgs. Based on available geological mapping, the drift thickness at TW1 varies from 2 to 3 m.

As a means to evaluate the water supply aquifer intercepted by the well, the well was subjected to a 8-hour constant rate pumping test. The pumping test was conducted on March 22, 2022 under the full-time supervision of Paterson personnel. Prior to the pumping test a data-logger was installed to monitor the background groundwater levels.

The existing submersible pump was used for the 8-hour pumping test. A licensed water well technician (Air Rock) completed the necessary plumbing related activities. The discharge line was placed at a sufficient distance to ensure that the discharge water was being directed away from the well and the septic system onsite. Upon completion of the test, the system was returned to its normal configuration.

The pumping test was carried out at a pumping rate of 45 L/min for a duration of 8 hours. During the pumping test, the pumping rate was periodically measured using the timed volume correlation method. The pumping rate was maintained within 5% of the selected

pumping rate. The static water level was recorded manually and an electric datalogger (VanEssen TD-Diver) was installed in the test well prior to the start of the pumping test.

The data logger recorded water levels at 30 second intervals. In addition, manual water level readings were taken at periodic intervals during the test.

Recovery data was collected from the well following the completion of the pumping. The well was noted to have achieved 100% recovery approximately 1 minute after the completion of pumping.

Groundwater samples were collected at 4 hours and 8 hours after the start of pumping. Prior to collection of the groundwater samples, the free chlorine residual was verified as non-detectable. The water samples were submitted for comprehensive testing of bacteriological, chemical, and physical water quality parameters consistent with the standard “Subdivision Supply” suite of parameters plus trace metals along with Volatile Organic Compounds (VOCs).

All samples were collected unfiltered and unchlorinated and were placed directly into clean bottles supplied by the analytical laboratory. Samples were placed immediately into a cooler with ice and were transported directly to Environmental Testing Canada Inc.(Eurofins) laboratory in Ottawa. All samples were received by the laboratory within 24 hours of collection.

A series of field tests of the pumped water were carried out at the well head during the 8-hour pumping test. The parameters tested at the well head included: pH, total dissolved solids, conductivity, turbidity, apparent colour, and temperature. Calibration / confirmation of calibration of all field-testing equipment was performed in Paterson’s laboratory the day prior to the pumping test. Values are then confirmed again onsite prior to the start of the pumping test.

Total coliforms were detected in the analytical testing of TW1 during the pumping test at 19 ct/100 mL (TW1-GW1) in the sample taken 4 hours into the pumping test and at 23 ct/100 mL (Tw1-GW2) at 8 hours into the pumping test.

Paterson personnel went to site on April 1, 2022 to disinfect TW1 as per the Ministry of the Environment, Conservation and Parks (MECP) disinfection instruction sheet, attached. The existing submersible pump was used to circulate the water column ion order to ensure proper mixing of the disinfectant. Paterson personnel confirmed the presence and adequate mixing of the disinfectant.

On April 4, 2022, Paterson personnel confirmed the presence of free chlorine within the well water. The well was purged using the existing submersible pump to remove residual free chlorine prior to obtaining a bacteriological sample. The discharge locations were placed at a sufficient distance to ensure that the discharge water was being directed away from the wellhead.

TW1 was pumped for 8 hours at a rate of approximately 15 L/min. Paterson personnel confirmed that the free chlorine residual was 0 mg/L prior to the collection of the bacteriological sample (GW1) at the end of 8 hours of purging the well.

All samples were collected unfiltered and unchlorinated and were placed directly into clean bottles supplied by the analytical laboratory. Sampled were placed immediately into a cooler with ice and were transported directly to the Eurofins Environmental Testing Canada Inc. (Eurofins) laboratory in Ottawa. All samples were received by the laboratory within 24 hours of collection.

Total Coliforms were reported as 4 ct/100 mL in the analytical testing of TW1 after the disinfection process. E. Coli was found to be non-detect as per the original results.

Additional sampling was completed on October 8, 2025 for the parameters of E.Coli, Total Coliforms and Nitrates/Nitrites. The sampling was completed by Nelson Water Inc. Total Coliforms and E.Coli were noted to be non-detect. Nitrate was found to be 0.25 mg/L and Nitrite was found to be non-detect.

Aquifer Analysis

Water Quantity

Pumping test data was analyzed using AQTESOLV Pro Version 4 aquifer analysis software package by HydroSOLVE Inc. Drawdown data was measured using an electronic water level tape and an electronic datalogger unit.

Table 1: SUMMARY OF WATER SUPPLY AQUIFER CHARACTERISTICS OF TW1

AQUIFER PARAMETER	RESULT OF ANALYSIS
Transmissivity (m^2/day)	1,224
Pumping Rate (L/min)	45
Pre-test Static Water Level (m BTOC)	3.20
Post-test Static Water Level (m BTOC)	3.26
Maximum Drawdown (m BTOC)	3.34
Available Drawdown (m)	55.7
% Drawdown During Pumping Test (%)	0.3
Specific Capacity (L/min/m drawdown)	321

The drawdown data was analyzed using the Theis and Cooper Jacob methods of analysis. Aquifer transmissivity is estimated to be 1,224 m^2/day. Refer to the Theis and Cooper Jacob methods of analysis data sheets attached to this report.

The pumping test results show that TW1 has a high yield to support the water demands that may be required. Overall maximum drawdown at a constant pumping rate for a period of 8 hours was approximately 0.14 m (0.3% of the available drawdown), but only 0.06 m at the end of the test period. 95% recovery was achieved approximately one minute after the end of pumping. It should be noted that the water level was measured to be increasing throughout the 8-hour constant rate pumping test.

The total volume of water pumped during the 8-hour pumping event was approximately 21,600 L. This is approximately 3.2 times the maximum total daily design volume of effluent (6,418 L/d) using 57% nitrate reduction required to support the Re-zoning Application. Further discussion in the Terrain Analysis notes an additional technology that can support greater than 10,000 L/day, however the 6,418 L/day is above the required flows as calculated under Part 8 – OBC for a subsequent application.

The suitability of the aquifer to support the proposed Re-zoning application was assessed using the methodology provided in the City of Ottawa Hydrogeological and Terrain Analysis Guidelines (HTAG).

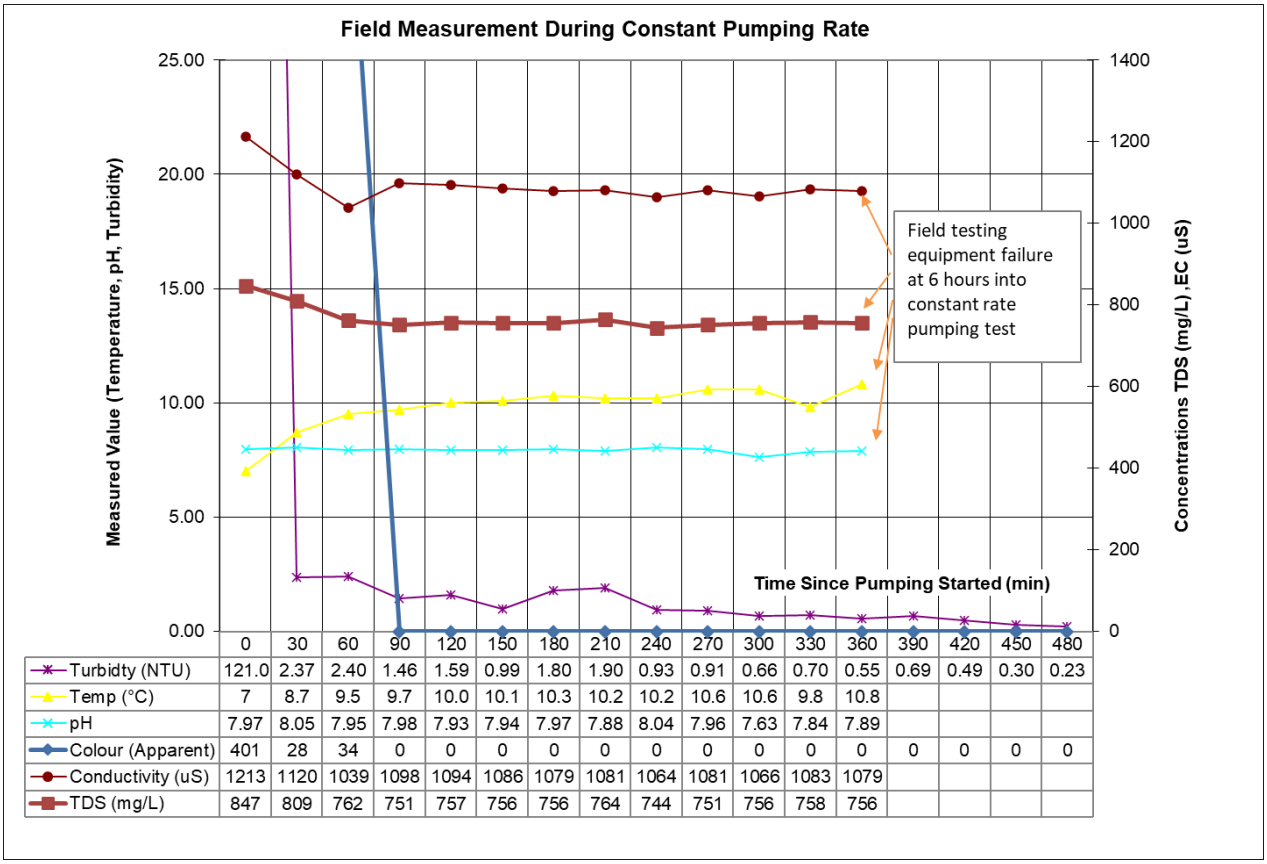
Based on the information summarized in Table 1, it is readily apparent that the water supply well has intercepted an adequately strong water supply aquifer which has sufficient quantity to service the proposed zoning usages.

Given the analyses presented and summarized above, it is our opinion that there is an adequate supply of water to support the proposed Application.

Water Quality

Field Data

Turbidity, electrical conductivity, total dissolved solids (TDS), pH, true color and temperature were measured at the wellhead during the pumping test. The measurements and time intervals for each of these parameters are summarized on the graphical representation below. In addition, a HACH Pocket Colorimeter II chlorine reader was used to measure the free chlorine residual level. No chlorine residual was detected in the discharged water prior to the collection of the water samples. During the constant rate pumping test, the field-testing equipment which tests for pH, TDS, EC, and temperature malfunctioned at the 6-hour point. These parameters were noted to have stabilized prior to the malfunction of the equipment.



	0	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480
Turbidty (NTU)	121.0	2.37	2.40	1.46	1.59	0.99	1.80	1.90	0.93	0.91	0.66	0.70	0.55	0.69	0.49	0.30	0.23
Temp (°C)	7	8.7	9.5	9.7	10.0	10.1	10.3	10.2	10.2	10.6	10.6	9.8	10.8				
pH	7.97	8.05	7.95	7.98	7.93	7.94	7.97	7.88	8.04	7.96	7.63	7.84	7.89				
Colour (Apparent)	401	28	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Conductivity (uS)	1213	1120	1039	1098	1094	1086	1079	1081	1064	1081	1066	1083	1079				
TDS (mg/L)	847	809	762	751	757	756	756	764	744	751	756	758	756				

Laboratory Data

The Subdivision Package suite of parameters and trace metals laboratory water quality obtained from the pumping test of TW1 is provided in Table 2a, 2b, and 2c below and the laboratory analyses reports can be found attached. All laboratory test results can be found attached to this report.

TABLE 2a: GROUNDWATER MICROBIOLOGY & GENERAL GEOCHEMISTRY

PARAMETER	UNITS	ODWS		TW1		
		LIMIT	TYPE	GW1 (4 hr) 2022-03-22	GW2 (8 hr) 2022-03-22	GW1 2022-04-04
MICROBIOLOGICAL						
Escherichia Coli (E.Coli)	ct/100mL	0	MAC	0	0	0
Total Coliforms	ct/100mL	0	MAC	19	23	4
GENERAL CHEMICAL - HEALTH RELATED						
Fluoride (F)	mg/L	1.5	MAC	<0.10	<0.10	-
Ammonia (N-NH_3)	mg/L	-	-	<0.010	<0.010	-
Nitrite (N-NO_2)	mg/L	1	MAC	<0.10	<0.10	-
Nitrate (N-NO_3)	mg/L	10	MAC	3.15	3.02	-
Total Kjeldahl Nitrogen	mg/L	-	-	0.25	0.48	-
Turbidity (Field)	NTU	1.0 (5.0)	MAC/AO	0.93	0.23	-
Turbidity (Laboratory)	NTU	1.0 (5.0)	MAC/AO	0.50	0.50	-
GENERAL CHEMICAL - AESTHETIC RELATED						
Alkalinity (as CaCO3)	mg/L	30-500	OG	251	243	-
Chloride (Cl)	mg/L	250	AO	135	142	-
Colour	TCU	5	AO	<2	<2	-
Colour (Field - Apparent)	TCU	5	AO	0	0	-
Conductivity	uS/cm	-	-	1,180	1,180	-
Dissolved Organic Carbon	mg/L	5	AO	2.40	2.40	-
Hardness (as CaCO3)	mg/L	100	OG	454	451	-
Ion Balance	unitless	-	-	0.97	0.97	-
pH	unitless	6.5-8.5	AO	7.95	7.93	-
Phenols	mg/L	-	-	<0.001	<0.001	-
Sulphate (SO_4)	mg/L	500	AO	182	175	-
Sulphide (S_2^-)	mg/L	0.05	AO	<0.01	<0.01	-
Tannin & Lignin	mg/L	-	-	1.00	1.00	-
Total Dissolved Solids	mg/L	500	AO	767	767	-

1. ODWS identifies the following types of parameters:
   MAC = Maximum Allowable Concentration
   AO = Aesthetic Objective
   OG = Operational Guideline
2. Shaded Concentration Indicates an Exceedance of the ODWS Objective

TABLE 2b: GROUNDWATER GEOCHEMISTRY - METALS					
PARAMETER	UNITS	ODWS		TW1	
		LIMIT	TYPE	GW1 (4 hr) 2022-03-22	GW2 (8 hr) 2022-03-22
Volatiles					
Aluminum (Al)	mg/L	0.1	OG	<0.01	<0.01
Antimony (Sb)	mg/L	0.006	IMAC	<0.0005	<0.0005
Arsenic (As)	mg/L	0.01	IMAC	<0.001	<0.001
Barium (Ba)	mg/L	1.0	MAC	0.12	0.12
Beryllium (Be)	mg/L	-	-	<0.0005	<0.0005
Boron (B)	mg/L	5.0	IMAC	0.04	0.04
Cadmium (Cd)	mg/L	0.005	MAC	<0.0001	<0.0001
Calcium (Ca)	mg/L	-	-	162	161
Chromium (Cr)	mg/L	0.05	MAC	<0.001	<0.001
Cobalt (Co)	mg/L	-	-	<0.0002	<0.0002
Copper (Cu)	mg/L	1.0	AO	<0.001	<0.001
Iron (Fe)	mg/L	0.3	AO	<0.03	<0.03
Lead (Pb)	mg/L	0.01	MAC	<0.001	<0.001
Magnesium (Mg)	mg/L	-	-	12	12
Manganese (Mn)	mg/L	0.05	AO	<0.01	<0.01
Mercury (Hg)	mg/L	0.001	MAC	<0.0001	<0.0001
Molybdenum (Mo)	mg/L	-	-	<0.005	<0.005
Nickle (Ni)	mg/L	-	-	<0.005	<0.005
Potassium (K)	mg/L	-	-	2	2
Selenium (Se)	mg/L	0.05	MAC	<0.001	<0.001
Silver (Ag)	mg/L	-	-	<0.0001	<0.0001
Sodium (Na)	mg/L	200	AO	77	75
Strontium (Sr)	mg/L	-	-	0.879	0.876
Thallium (Tl)	mg/L	-	-	<0.0001	<0.0001
Uranium (U)	mg/L	0.02	MAC	<0.001	<0.001
Vanadium (V)	mg/L	-	-	<0.001	<0.001
Zinc (Zn)	mg/L	5.0	AO	<0.01	<0.01

1. ODWS identifies the following types of parameters:
   MAC = Maximum Acceptable Concentration
   IMAC = Interim Maximum Acceptable Concentration
   AO = Aesthetic Objective
   OG = Operational Guideline
2. Shaded Concentration Indicates an Exceedance of the ODWS Objective

TABLE 2c: GROUNDWATER GEOCHEMISTRY - VOLATILES					
PARAMETER	UNITS	ODWS		TW1	
		LIMIT	TYPE	GW1 (4 hr) 2022-03-22	GW2 (8 hr) 2022-03-22
VOCs Surrogates					
1,2-dichloroethane-d4	%	-	-	100	119
4-bromofluorobenzene	%	-	-	71	76
Toluene-d8	%	-	-	91	98
Volatiles					
1,1,1,2-tetrachloroethane	µg/L	-	-	<0.5	<0.5
1,1,1-trichloroethane	µg/L	-	-	<0.4	<0.4
1,1,2,2-tetrachloroethane	µg/L	-	-	<0.5	<0.5
1,1,2-trichloroethane	µg/L	-	-	<0.4	<0.4
1,1-dichloroethane	µg/L	-	-	<0.4	<0.4
1,1-dichloroethylene	µg/L	14.0	MAC	<0.5	<0.5
1,2-dichlorobenzene	µg/L	200.0	MAC	<0.4	<0.4
1,2-dichloroethane	µg/L	5.0	IMAC	<0.2	<0.2
1,2-dichloropropane	µg/L	-	-	<0.5	<0.5
1,3,5-trimethylbenzene	µg/L	-	-	<0.3	<0.3
1,3-dichlorobenzene	µg/L	-	-	<0.4	<0.4
1,3-Dichloropropylene (cis+trans)	µg/L	-	-	<0.3	<0.3
1,4-dichlorobenzene	µg/L	5.0	MAC	<0.4	<0.4
Acetone	µg/L	-	-	<30	<30
Benzene	µg/L	1.0	MAC	<0.5	<0.5
Bromodichloromethane	µg/L	-	-	<0.3	<0.3
Bromoform	µg/L	-	-	<0.4	<0.4
Bromomethane	µg/L	-	-	<0.5	<0.5
c-1,2-Dichloroethylene	µg/L	-	-	<0.4	<0.4
c-1,3-Dichloropropylene	µg/L	-	-	<0.2	<0.2
Carbon Tetrachloride	µg/L	2.0	MAC	<0.2	<0.2
Chloroethane	µg/L	-	-	<0.2	<0.2
Chloroform	µg/L	-	-	<0.5	<0.5
Dibromochloromethane	µg/L	-	-	<0.3	<0.3
Dichlorodifluoromethane	µg/L	-	-	<0.5	<0.5
Dichloromethane	µg/L	50	MAC	<4.0	<4.0
Ethylbenzene	µg/L	140	MAC	<0.5	<0.5
Ethylene Dibromide	µg/L	-	-	<0.2	<0.2
Hexane	µg/L	-	-	<5	<5
m/p-xylene	µg/L	-	-	<0.4	<0.4
Methyl Ethyl Ketone (MEK)	µg/L	-	-	<10	<10
Methyl Isobutyl Ketone (MIBK)	µg/L	-	-	<10	<10
Methyl Tert Butyl Ether (MTBE)	µg/L	15	AO	<2	<2
Monochlorobenzene	µg/L	80	MAC	<0.5	<0.5
o-xylene	µg/L	-	-	<0.4	<0.4
Styrene	µg/L	-	-	<0.5	<0.5
t-1,2-Dichloroethylene	µg/L	-	-	<0.4	<0.4
t-1,3-Dichloropropylene	µg/L	-	-	<0.2	<0.2
Tetrachloroethylene	µg/L	10	MAC	<0.3	<0.3
Toluene	µg/L	60	MAC	<0.4	<0.4
Trichloroethylene	µg/L	5	MAC	<0.3	<0.3
Trichlorofluoromethane	µg/L	-	-	<0.5	<0.5
Vinyl Chloride	µg/L	1	MAC	<0.2	<0.2
Xylene; total	µg/L	90	MAC	<0.5	<0.5

1. ODWS identifies the following types of parameters:
   MAC = Maximum Acceptable Concentration
   IMAC = Interim Maximum Acceptable Concentration
   AO = Aesthetic Objective
   OG = Operational Guideline
2. Shaded Concentration Indicates an Exceedance of the ODWS Objective

The bacteriological test results (Certificate of Analysis – Report No. 1973843) indicated that the test samples at the 4- and 8-hour interval were non-detect (0 ct/100 mL) for E.Coli, however, Total Coliforms were detected at concentrations of 19 ct/100 mL and 23 ct/100 mL, respectively.

Paterson personnel returned to site to disinfect the well. After the disinfection of the well and subsequent pumping, a bacteriological test was performed on the well water (Certificate of Analysis – Report No. 1974461) which indicated that E. Coli was not present (0 ct/100 mL) and that only 4 ct/100 mL Total Coliforms were present in the well water. Paterson personnel confirmed that the free chlorine residual was 0 mg/L prior to the collection of the bacteriological sample.

A water sample was taken by others on October 8, 2025. A bacteriological test was performed on the well water (Certificate of Analysis – Report No. 4491110) which indicated E.Coli and Total Coliforms were both non-detect (0 ct/100 mL). Additionally, Nitrate and Nitrite were analyzed (Certificate of Analysis – Report No. 4492546) with Nitrates at 0.25 mg/L and Nitrites at <0.1 mg/L.

The water quality of the subject water supply well meets all the Ontario Drinking Water Standards maximum acceptable concentrations (MAC). Furthermore, the water meets all of the Aesthetic Objectives (AO) and Operational Guidelines (OG) with the exception of the following.

- ❑ Hardness (as $CaCO_3$)
- ❑ Total Dissolved Solids (TDS)

Exceedances of the above parameters are not uncommon of the water supply in the subject aquifer. Each of these groundwater parameters are discussed in detail below.

Should any water treatment be desired by the owner, it is recommended that a water treatment specialist be retained to ensure that water treatment occurs in a safe manner.

Hardness as $CaCO_3$

Hardness, expressed as calcium carbonate, is an operation guideline and does not appear in the ODWS. Rather, it appears in the Technical Support Documents for Ontario Drinking Water Standards, Objectives and Guidelines as a parameter with an operational guideline at 100 mg/L. At the measured concentrations of 454 and 451 mg/L, the water is considered to be very hard, however, it is below the reasonable treatable limit of 500 mg/L specified in Table 3 of the MOECC guidance document Procedure D-5-5 (1996), thus, hardness can be treated with readily available technologies.

It is recommended that water hardness be treated using conventional technologies such as water softening or reverse osmosis, if desired by the owner. Without treating hardness, scaling can occur which can result in discolouration and residue buildup on water fixtures, or reduction in boiler efficiency due to scale build-up. According to Health Canada's *Guidelines for Canadian Drinking Water Quality - Summary Tables* "Although hardness

may have significant aesthetic effects, a guideline has not been established because public acceptance of hardness may vary considerably according to the local conditions; major contributors to hardness (calcium and magnesium) are not of direct public health concern".

Total Dissolved Solids (TDS)

TDS refers to the concentration of inorganic substances dissolved in water. The main constituents are typically chloride, sulphates, calcium, magnesium, and bicarbonates. The TDS concentration of 767 mg/L exceeds the Aesthetic Objective of 500 mg/L. At concentrations above 500 mg/L, some consumers may find the taste objectionable, however, as the objective is an aesthetic objective, no treatment is required. It is, however, recommended that a point-of-use reverse osmosis unit be installed or to provide bulk bottled water on an as-needed basis for drinking water purposes. As such, no taste problems will occur when the system is used, or bottled water is consumed.

The Langelier calculation provided an LSI of 0.7. Based on the evaluation of the result, the water is super saturated and tends to precipitate a scale layer of calcium carbonate (scale forming but non-corrosive). Based on the range of stability in the positive direction, it is recommended that water softening be used to prevent scaling. See Langelier Saturation Index Calculation attached for calculation details.

Total Coliforms

Total Coliforms are a type of bacteria which naturally occur in soil and decaying vegetation. Total Coliforms may also be associated with animal and/or human waste.

The maximum acceptable concentration (MAC) for Total Coliforms for potable drinking water in support of a Re-zoning application, as established by the City of Ottawa Hydrogeological and Terrain Analysis Guidelines (HTAG, 2021), is less than 6 ct/100 mL. According to the City of Ottawa HTAG, Total Coliforms counts of less than 6 per 100 mL sample shall be considered indicative of acceptable water quality.

Total Coliforms were detected at 19 and 23 count per 100 mL at the 4- and 8- hour mark of the pumping test, respectively. After disinfecting the well and purging the chlorinated water, Total Coliforms were detected at 4 ct/100 mL. 4 ct/100 mL Total Coliforms is below the City of Ottawa HTAG standard of less than 6 ct/100 mL.

As the site is not hydrogeologically sensitive (competent bedrock was encountered during the field investigations at depths of 2.4 to 5.9 m bgs), and is not located in an area which is mapped as potentially karstic, the Total Coliform level of 4 ct/100 mL. The subsequent analytical results in October 2025 indicate that Total Coliforms is non-detect (0 ct/100 mL) and is considered acceptable.

Consideration should be given to utilizing a Ultraviolet (UV) disinfection system on the water supply entering the existing warehouse and proposed development. Additionally,

the turbidity was less than 1 NTU, indicating that there should be no turbidity based interference in disinfection.

Sodium

Sodium (Na), an aesthetic parameter, was detected in the laboratory test sample at a concentration of 77 and 75 mg/L, which does not exceed the ODWS aesthetic objective of 200 mg/L. Although sodium is not toxic and no MAC has been set, concentrations above 20 mg/L require that the Medical Officer of Health be notified of the water quality results, so that this information may be passed on to local physicians for use in treatment of those requiring a sodium-restricted diet.

TERRAIN ANALYSIS

The fieldwork which was completed as part of a Geotechnical Investigation for the site (PH3834-1R, dated January 5, 2017; and PG3834-2, dated March 1, 2022) is used in support of this assessment. Additional information pertaining to this investigation was gathered from available geological mapping and surrounding WWRs.

Surficial Geology

A series of test pits were excavated on the subject parcel to delineate the subsurface soil conditions as part of a Geotechnical Field Investigation. On February 8, 2022, seven (7) test pits were completed on the property. A previous investigation (PG3834-1R, dated January 5, 2017) was completed at the subject site in June and November 2016, during which fourteen (14) test pits were excavated and eleven (11) boreholes were completed onsite. The location of the test pits are delineated on the drawing PH5103-1-Test Hole Location Plan, attached. Note that the site plan on the drawing is not reflective of the proposed usage.

The test hole locations were recorded and the subsurface conditions, including the soil morphology and depth to the groundwater table (if encountered), were carefully observed and recorded. The soils encountered were classified texturally in the field and later reviewed in the laboratory.

The boreholes and test pits were advanced to a maximum depth of 5.9 and 3.4 m below ground surface (bgs), respectively. Bedrock was recorded in the WWR for TW1 at 4.34 m bgs. Refusal to excavation was recorded at depths ranging from 0.7 m to 5.9 m bgs on fractured bedrock. Competent bedrock was encountered at depths of 2.4 to 5.9 m bgs.

The subsurface profile generally consisted of topsoil extending to a maximum depth of 0.6 m bgs, underlain by silty sand to sandy silt with gravel, cobbles, boulders and trace clay which extend to a maximum depth of 1.9 m bgs. Frost heave/ frost shattered bedrock infilled with silty sand, gravel, cobbles, and boulders (unconsolidated soils) was observed under the silty sand to sandy silt with gravel, cobbles, boulders and trace clay. The testhole logs note split spoon sampling within this layer with significant sample recovery. TP1-22, TP2-22, TP6-22, and TP7-22 noted a fill of varying composition underlying the topsoil extending to depths of 1.75 m bgs. Groundwater was observed at depths between 3.6 to 4.3 m bgs in the boreholes and test pits.

Reference should be made to the borehole logs appended to this report for the details of the soil profiles encountered at each test hole location. The client should be aware that any information pertaining to soils are furnished as a matter of general information only and borehole descriptions are not to be interpreted as descriptive of conditions at locations other than those described by the boreholes themselves.

Materials encountered during Paterson's Geotechnical Investigation were generally consistent with the available surficial and bedrock geology mapping.

Hydrogeological Sensitivity of the Site

The subject site currently consists of a warehouse and residential dwelling. The dwelling is currently unoccupied. The topography of the site is generally sloping downwards to the east. The local flow direction of the surficial aquifer is expected to be in the northeasterly direction towards the Carp River. The regional groundwater flow is considered to be in the northeast direction towards the Ottawa River.

The onsite overburden generally consists of topsoil overlying a brown silty sand with gravel, cobbles, boulders and trace clay which is underlain by a fractured bedrock (frost heave/frost shatter) infilled with unconsolidated soils. The unconsolidated soils are noted to have 50 to 80% recovery during split spoon sampling within this stratum. Competent bedrock was encountered during the field investigations at depths of 2.4 to 5.9 m bgs. The frost heave bedrock noted during the borehole field investigation contained high amounts of interspersed silty sand to sandy silt (unconsolidated soils), and some clay with fragmented bedrock. For the purposes of hydrogeological sensitivity, the "fractured bedrock" unit is considered an unconsolidated soil which would provide separation form the ground surface and the underlying competent bedrock. Furthermore, based on hydraulic conductivity testing, the fastest onsite T-time was 13.8 min/cm, which is an order of magnitude slower than the T-time of less than 1 min/ cm required for highly permeable soils. There were five additional test locations completed that have estimated T-times in the range of 20 to 40 mins/cm and are all considered to be not hydrogeologically sensitive. Based on this, the soils and underlying interbedded materials are not considered as highly permeable when reviewing against Ontario Building Code (OBC) Section 8.7.2.1 (1) (b)(i) and the MMAH Supplementary Standards SB-6.

Refusal to excavation was recorded on competent bedrock ranging from 2.4 to 5.9 m bgs. According to the geotechnical investigation, the overburden thickness (which includes the fractured bedrock unit with interspersed unconsolidated soils) was observed to be greater than 2 m at all borehole locations. The subject site does not have any mapped karst topography on site. Furthermore, from the TW1 WWR, bedrock was observed at a depth of 4.34 m bgs. As the proposed site does not have bedrock within 2 m of the ground surface, the site is not considered hydrogeologically sensitive. Although mitigative measures, such as increased separation distances, are not required, there is sufficient space onsite to keep the onsite well greater than 30 m away from any onsite septic components.

Conceptual Lot Development

As this Terrain Analysis is completed to support a Re-zoning Application, a Site Plan is not available.

Sewage System Design and Total Daily Design Sewage Flow

As this Terrain Analysis is completed to support a Re-zoning Application, a Site Plan is not available at this time. As such a sewage system design and flows have not yet been completed. A maximum predicted nitrate concentration will be determined for the site as a whole, and the current assessment will be completed based on existing conditions.

The proposed property will be analyzed as part of the Re-zoning Application to ensure the theoretical impacts are below the Ontario Drinking Water Objective maximum allowable concentration of 10 mg/L of nitrate in the groundwater prior to the property line.

PREDICTIVE NITRATE IMPACT ASSESSMENT

Nitrate is considered to be a critical parameter of concern when assessing impacts to groundwater quality downgradient of an onsite sewage system. The City of Ottawa annotated MECP Procedure D-5-4 in the Hydrogeological and Terrain Analysis Guidelines (HTAG) applies for the proposed development. For the purpose of this guideline, the Ontario Drinking Water Objective of 10 mg/L of nitrate is the maximum allowable concentration detectable in the groundwater prior to the property line.

A detailed impact assessment is required due to the proposed zoning of the site. In order to demonstrate that private services would adequately support the proposed Re-zoning Application, a predictive nitrate impact assessment for the subject site was completed. This calculation was completed to determine the maximum sewage flow volume which could be applied to the subject site with the current site conditions. As the site is within the Carp Road Corridor, the use of tertiary treatment systems (nitrate reducing systems) are allowed to be considered in support of re-zoning. The values shown in the Predictive Nitrate Impact Assessment calculation attached to this report are summarized below:

- ❑ Site area 1.28 ha
- ❑ Impervious area % 45 %
- ❑ Concentration of nitrate in effluent 40 mg/L
  (Value based on conventional effluent concentration)
- ❑ Concentration of nitrate in effluent 17.2 mg/L
  (Value based on using NSF 245/BNQ certified 57% nitrate reduction technology)

- ❑ Surplus Water 378 mm/year
  (The surplus water value was estimated based on Environment Canada Climate Office values with a soil type comprised of clay loam (urban lawn) and anthropogenic sources, which can be found attached.)

- ❑ Combined infiltration factor based on: 0.67
  - Topography infiltration factor 0.25
  - Soil texture infiltration factor 0.30
  - Cover infiltration factor 0.12

The topography infiltration factor of 0.25 is based upon a slope between “flat land” (<0.6 m/km) and “rolling land” (average slope of 2.8 to 3.8 m/km) based on available mapping.

The soil texture infiltration factor was based upon a soil that is between “open sandy loam” with a value of 0.4 and “medium combinations of clay and loam” with a value of 0.2 which is a reasonable generalization based upon the field investigation by Paterson, available geological mapping and surrounding WWRs.

The “vegetative cover infiltration factor” was calculated as 0.12 based upon the site being used as cultivated land with some trees throughout the site.

As part of the rezoning process, the City of Ottawa does not typically allow the use of tertiary treatment systems to support the re-zoning application, however, as the site is within the Carp Road Corridor, tertiary treatment systems can be used to support the re-zoning application. As a tertiary treatment system requires annual monitoring by the Ottawa Septic System Office (OSSO), and allows for advanced treatment of sewage effluent, a tertiary treatment system is being reviewed for the Subject Site. The mandatory monitoring required on tertiary treatment systems by the OSSO ensures that the system is properly maintained and replaced when required, whereas there is no mandatory monitoring on a conventional sewage system. In order to demonstrate the viability and sustainability aspects of private servicing on the subject site, a Nitrate Impact Assessment was completed using the above noted parameters.

The predicted nitrate concentration calculation for a conventional sewage system (system without nitrate reduction) results in a maximum of **1.58 m^3/day** of effluent using a nitrate concentration of 40 mg/L. The inclusion of nitrate reduction technology (57 % nitrogen reduction in the of the effluent nitrate) would result in a maximum of **6.42 m^3/day** of effluent using a nitrate concentration of 17.2 mg/L. The Waterloo-Biofilter technology (WaterNOx) is capable of up to 90% nitrate reduction, which would allow greater than **10 m^3/day**. Both maximum sewage flow volumes with their respective reduced nitrate concentrations meet the nitrate concentration threshold of below 10 mg/L at the property boundary. Additional re-infiltration from stormwater (up to 10%) could be used to increase the dilution of septic effluent, if needed.

A sewage system installation application for a new sewage system on any site in the City of Ottawa with a sewage flow volume of less than 10 m^3/day will require an OSSO application.

CONCLUSIONS

Based on the information contained within the body of this report the following conclusions can be drawn:

1. The water supply aquifer underlying the subject site is considered to be adequate to support the water quantity demands for the proposed zoning uses.

2. The preferred water supply intercepted by TW1 contains a water supply that is potable and contains only elevated concentrations of hardness and TDS. The noted parameters can be treated with current readily available water conditioning equipment.

3. Total Coliforms were detected at 0 ct/100 mL, however, it is recommended that a UV system is installed to assist in the removal of any potential Total Coliforms found in the groundwater, as a precautionary measure.

4. If desired by the property owner, a commercial grade water softener can be used to facilitate the reduction of the hardness concentration and reduce scaling. If a water softener is used for the proposed development, the owner should be made aware that additional sodium will be added to the water to reduce hardness. If desired, a point-of-use reverse osmosis system can be used to provide a drinking tap source without increasing sodium levels.

5. It is recommended that either a point-of-use reverse osmosis system be used to reduce the TDS concentration, or bulk bottled water is provided as a drinking water source.

6. The subject site is sufficient in size to accommodate two new sewage systems and meet all of the regulatory separation criteria. As a precautionary measure, a 30 m setback should be maintained between the drinking water well and any septic system components.

7. A maximum sewage flow volume of **1.58 m^3/day** at a nitrate concentration of 40 mg/L or **6.42 m^3/day** at a nitrate concentration of 17.2 mg/L can be accommodated on the subject site based on the current layout and still be below the predictive nitrate concentration threshold of 10 mg/L at the property boundary.

8. Onsite sewage disposal needs can be accommodated with a Class 4 Sewage System utilizing tertiary treatment technologies.

9. A Sewage System Permit and Building Permit need to be issued prior to the commencement of construction on the proposed structures or amenities/services.

10. The results of the Hydrogeological Assessment and Terrain Analysis have provided satisfactory evidence that the subject site can support the proposed zoning usage with respect to water quality, quantity and sewage system placement.

We trust that the current submission satisfies your immediate requirements.

Best Regards,

Paterson Group Inc.

Alexander Schopf, PhD, EIT

Michael Killam, P.Eng

Attachments:

- ❑ Key Plan
- ❑ MECP Water Well Records – 1973843 & 1974461
- ❑ Eurofins Certificate of Analysis
- ❑ Paterson PG3834 - Test Pit and Borehole Logs
- ❑ AQTESOLV - Pumping Test Analysis Reports
- ❑ Langelier Calculation
- ❑ Nitrate Impact Assessment Calculations
- ❑ Paterson Drawing PH5103-1 - Test Hole Location Plan
- ❑ Well Disinfection Instruction Sheet

C.2 *Servicing Report – 2978 Carp Road*, Stantec, December 21, 2016

Servicing Report – 2978 Carp Road

Project # 160401271

Prepared for:
Nautical Lands Group

Prepared by:
Stantec Consulting Ltd.

December 21, 2016

Revision	Description	Author		Quality Check		Independent Review	
1	1st submission	T.Rathnasooryia	2016/08/17	A.Lynch	2016/08/18	K. Kilborn	2016/08/17
2	2nd submission	T.Rathnasooryia	2016/11/22	A.Lynch	2016/11/24	K.Kilborn	2016/11/21
3	3rd submission	T.Rathnasooryia	2016/12/13	A.Lynch	2016/12/13	K.Kilborn	2016/12/13
4	4th submission	T.Rathnasooryia	2016/12/20	A.Lynch	2016/12/20	K.Kilborn	2016/12/21

Sign-off Sheet

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Prepared by _____
(signature)

Thakshika Rathnasooriya, EIT

Reviewed by _____
(signature)

Amanda Lynch, P.Eng.

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Stantec

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1.0 INTRODUCTION

Stantec Consulting Ltd. has been commissioned by Nautical Lands Group to prepare a servicing study in support of Site Plan Control submission of the proposed development located at 2978 Carp Road. Currently the site is divided into two parcels of land and is under approval to merge as one, 2978 and 2966 Carp Road (PIN 04537-0266 and 04537-0265). The site is situated southeast of the intersection of McGee Road and Carp Road within the City of Ottawa. The proposed development comprises approximately 1.30ha of land, and would replace a vacant property with a 15,000sq. ft pre-engineered steel storage building on the northern portion of the site. The site is zoned under Rural Commercial. The conceptual site development plan used for the purpose of this servicing brief is shown as **Figure 1**. 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 2978 Carp Road development include:

- *Geotechnical Investigation – Proposed Storage Building – 2978 and 2966 Carp Road*, Patersongroup Consulting Engineers, November 11, 2016.
- *City of Ottawa Sewer Design Guidelines*, October 2012
- *Low Impact Development Stormwater Management Planning and Design Guide*, Credit Valley Conservation and Toronto Region Conservation Authority, 2010

3.0 WATER SUPPLY SERVICING

3.1 BACKGROUND

The proposed development comprises one pre-engineered steel storage building, complete with above ground parking and access areas. An existing well feeds the 1 storey building located on the south portion of the site. The proposed storage building will be serviced via a 19mm building service connection from a proposed drilled well located on the north portion of the property directly east of the proposed building. As per the Ministry of Ontario regulations the proponent must hire licensed well contractors which use licensed well technicians for installation of the on-site well, the second of two existing wells is located to the south of the access road and will be decommissioned.

3.2 PORTABLE WATER DEMANDS

Water demands for the development were estimated using the Ministry of Environment's Design Guidelines for Drinking Water Systems (2008).

The assessment for fire flow requirements was completed according to the Ontario Building Code (OBC) criteria using a "non-combustible with fire resistance" rating. The OBC indicates that low hazard occupancies include apartments, dwellings, dormitories, hotels, and schools, and as such, low hazard occupancy / limited combustible building contents credit was applied. Based on calculations per the OBC (**Appendix A.1**), the maximum required fire flows for this development are 75 L/s (4,500 L/min).

Utilizing water storage to supplement low yielding wells to meet fire flow water demands is common practice. Added water storage can be achieved by use of intermediate potable water storage tanks. The storage tanks will receive water from the well that are filled during off peak hours. The facility's water demand requires three portable storage tanks with a total 150,000 L capacity (50,000 L per tank) which is sufficient for the required volume of 149,532 L.

3.3 SUMMARY OF FINDINGS

The proposed development is located in an area of the City that will require private servicing to obtain the required domestic and emergency fire flows. The proposed servicing plan will provide sufficient water supply for fire flows for the proposed development based on OBC guidelines and as per the City of Ottawa water distribution guidelines.

4.0 WASTEWATER SERVICING

4.1 BACKGROUND

The subject site is located outside of the City's sanitary collection area. There are no special constraints for the proposed development to be serviced by a private sewage system other than those related to the Ontario Building Code (OBC) requirements. As a result, an existing septic tank and bed with private service is located on the eastern portion of PIN 04537-0265. The proposed building will require installation of a new septic tank and bed located east of the proposed storage building. Mississippi Valley authority permit approval is required. The proposed location is identified on the servicing and grading plans in **Appendix D.1** as provided by the geotechnical consultant.

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, 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

- 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)
- Water quality treatment to a 'Normal' level (70% TSS reduction) is required for the site per the Mississippi Valley Conservation Authority (MVCA)

Surface Storage & Overland Flow

- Building openings to be a minimum of 0.30m above the 100-year water level of any surface storage areas (City of Ottawa)
- Provide adequate emergency overflow conveyance off-site (City of Ottawa)

Site Specific Criteria

- Site topography indicates that no legal surface outlet exists for the site that would be feasible to discharge to. As such, on-site storage and infiltration is considered the best approach to manage site runoff so as to not increase the total uncontrolled runoff from the site (City of Ottawa and MVCA)

5.3 WATER QUANTITY CONTROL

The Modified Rational Method (MRM) was employed to assess the rate and volume of runoff generated during post-development conditions. The site was subdivided into subcatchments

(subareas) tributary to stormwater controls as defined by the location of the proposed dry pond. A summary of subareas and runoff coefficients is provided in **Appendix B.1**, and **Drawing SD-1** indicates the stormwater management subcatchments. A clear stone base is proposed below the dry pond to provide additional storage and encourage infiltration.

5.3.1 Allowable Release Rate

The predevelopment release rate for the area has been determined using the rational method. Existing buildings, paved access areas and gravel access areas were considered as hard surfaces (C=0.9 paved, C=0.75 gravel), while the remainder of the site is grassed (C=0.2). A time of concentration for the predevelopment area (30 minutes) was assigned based on the Airport Method calculations for the relatively pervious nature of the proposed site. Runoff coefficient values have been increased by 25% for the 100-year storm event based on the City of Ottawa Sewer Design Guidelines. 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

The allowable release rate for surface discharge for the site is summarized in **Table 1** below:

Table 1: Allowable Surface Release Rates

Design Storm	Target Flow Rate (L/s)
5- Year	50.7
100- Year	86.3

5.3.2 In-situ Infiltration Testing

Field testing was completed by Paterson Group to establish in-situ saturated hydraulic conductivity rates using a Pask Permeameter. The methodology outlined in the Credit Valley Conservation LID Design Guidelines – Appendix C (CVC, 2012) was then used to calculate the infiltration rate and safety factor for each test location. Test results and calculations results are attached for reference and a summary is included in **Table 2** below.

Table 2: Summary of Infiltration Rates

Auger hole ID	K_{fs} (cm/min)	Testing Depth below surface (m)	Infiltration Rate (i) (mm/hr)	Safety factor	Corrected Infiltration (mm/hr)
TP 1	3.20E-07	0.90	9.94	2.50	3.98
TP 4	9.40E-07	0.60	13.27		5.31
TP 5	9.40E-08	0.70	7.16		2.87
TP 11	5.30E-06	0.90	21.08		8.43
TP 12	1.20E-05	1.10	26.23		10.49
TP 13	5.30E-06	1.00	21.08		8.43

5.3.3 Groundwater and Bedrock Elevations

Groundwater level measurements were obtained from the on-site piezometers on June 2016 by Paterson Group. **Table 3** below summarizes the groundwater elevations (a reference plan with borehole locations is included in the attached Paterson letter). Test-pits excavated during the infiltration testing indicated shallow depths to highly fractured bedrock (previously identified as glacial till from the soil cores examined during borehole drilling). In most locations the groundwater elevation is identified to be lower than the fractured bedrock interface. As such, the bedrock elevation was considered to be controlling in establishing the dry pond elevation and footprint.

Table 3: Summary of Groundwater and Bedrock Elevations

Stand-pipe well ID	Top of Riser Elevation (m)	Groundwater Elevations			Bedrock Elevation
		Date measured (d/m/y)	Groundwater Depth (m) below top of riser	Groundwater Elevation (m)	
BH1	118.24	01/06/16	4.20	114.04	117.48
BH2	118.42	01/06/16			116.97
BH3	118.29	01/06/16			117.38
BH3A	118.29	01/06/16	4.30	113.99	116.49
BH4	118.03	01/06/16			117.37
BH5	117.74	01/06/16			116.34
BH6	117.71	01/06/16	3.93	113.78	116.80
BH7	117.53	01/06/16	3.70	113.83	116.46
BH8	117.54	01/06/16	4.19	113.35	116.78
BH9	117.66	01/06/16			116.29
BH10	117.46	01/06/16	3.62	113.84	116.09
BH11	117.45	01/06/16			116.18

5.3.4 Storage Requirements

The site requires quantity control measures to meet the restrictive stormwater release criteria. It is proposed that surface grading (for a dry pond) be used to store site runoff to be infiltrated and limit surface release rates to the allowable existing condition rates.

5.3.4.1 Post-development Uncontrolled Catchments

Due to grading constraints, two catchments have been designed without a storage component (EXT-1 & EXT-2). These areas flow offsite uncontrolled. Areas that discharge offsite without entering the proposed stormwater management system must be compensated for in areas with controls. **Table 4** summarizes the peak 5 and 100-year catchment release rates for catchments that are released uncontrolled.

Table 4: 5 and 100 Year Discharge from Uncontrolled Catchments

Catchment ID	5-Year Peak Discharge (L/s)	100-Year Peak Discharge (L/s)
EXT-1	16.8	36.0
EXT-2	3.5	7.5

Peak 5 and 100 year discharge values in the above table are based on minimum time of concentration values (10 minutes).

5.3.4.2 Surface Storage/Subsurface Storage

It is proposed to detain all stormwater in the pond to reduce peak surface discharge from the proposed site. The modified rational method (MRM) was employed to determine the peak volume required to be stored in surface ponding areas and subsurface clear stone storage basin and trenches.

The stormwater management dry pond and clear stone storage areas were sized using an iterative approach between pond grading, infiltration calculations and the MRM calculations to provide enough storage to restrict runoff from the 100 year event and meet the target release rates from the overall site and external areas. The release rate from the pond storage was calculated based on infiltration rates and pond footprint and was then input into the MRM calculations as the "controlled release rate" from drainage area STM-1. Note that the average flow rate over the pond storage depth was used. The entirety of the required storage volume is provided within the dry pond. Drawdown calculations indicate that a minimum infiltration rate of 8.3mm/hr would be needed to achieve a pond drawdown time of 48hr. In-situ infiltration testing included testing at two test pits (TP 11 and TP 12) in the footprint of the infiltration area and based on the values in Table 2 would have an average measured infiltration rate of approximately 9.46mm/hr. Therefore, it is estimated that the facility would drawdown in less than 48hrs following a 100-yr event.

Table 5 summarizes the estimated pond discharge rate resulting from infiltration and corresponding storage volume during the 100-year event.

Table 5: 100 Year Peak Surface Volume and Controlled Discharge Summary

ID	100-Year Event		
	Discharge Rate (L/s)	Vrequired (m^3)	Vavailable (m^3)
Pond	9.8	385.3	389.6

100-year volume available based on surface storage and a maximum spill depth not to exceed 0.40m, where required.

Table 6 demonstrates the proposed stormwater management plan and confirms that the estimated release rates from the site are less than the allowable rate.

Table 6: Summary of Total 5 and 100 Year Event Surface Release Rates

	5-Year Peak Discharge (L/s)	100-Year Peak Discharge (L/s)
Uncontrolled (EXT-1 & EXT-2)	20.3	43.5
Allowable	50.7	86.3

5.3.5 Groundwater Mounding Check

Geotechnical investigations indicated shallow depths to highly fractured bedrock but did not encounter groundwater before the fractured bedrock interface. Therefore, the clearance from bedrock was the control in setting the base elevation of the infiltration basin area. The clearance from the bottom of the infiltration area and the referenced bedrock elevation is less than 1m, therefore mounding calculations were completed as a final check for the longer-term function of the infiltration area. Groundwater mounding calculations were completed using spreadsheet analysis tool developed by the USGS that applies the Hantush (1967) equation for groundwater mounding beneath an infiltration basin. Standard values for site soils and measured hydraulic conductivity rates were used. The maximum mounding depth was calculated to be approximately 0.002m resulting in a clearance from infiltration bottom to mounded groundwater of 0.11m. Spreadsheet calculations are included in **Appendix B.2.**

5.4 WATER QUALITY CONTROL

Water quality treatment to a 'Normal' level of protection (70% TSS removal) is required for the site per the MVCA. In order to achieve this level of treatment several a treatment train approach is proposed for the site. The proposed site drainage allows for most of the site to sheet drain across the grassed area around the dry pond rather than concentrated flow into the pond. This will allow for an initial filtering and settling of solids. Secondly, a 33m long (measured perpendicular to flow direction) vegetated buffer is proposed around the dry pond. Based on **Figure 5-4** from the US EPA design manual for Low Impact Development (LID) (see **Appendix B.3**), it is estimated that this configuration would provide an initial treatment rate of 60% to 90% TSS reduction before the runoff enters the dry pond. However, lower removal rates are anticipated in areas of steeper slopes. Additionally, these values assume that the design buffer width (in direction of flow) can be achieved in all areas. Equation 5-2 of the EPA LID manual defines the minimum buffer width as

$$W_G = 0.2L_I \text{ or } 8ft \text{ (whichever is greater)}$$

Where, W_G = Design width (m)

L_I = length of flow path of upstream sheet flow (m)

Using an average flow path length of 55m would require a minimum vegetated buffer of 11.0m. Due to area and constraints the proposed vegetated buffer length will vary between 3.5m and 10m along the north and east sides of the pond. Therefore, it is estimated that some areas may provide lower or higher filtration of solids, but an average of near 70% removal could be achieved.

While the vegetated buffer will provide significant pre-treatment of runoff, additional settling and filtration will occur in the dry pond. The MOECC SWM Design Manual (2003) recognizes dry ponds as providing approximately 60% TSS removal. This removal rate is identified for a typical dry pond with a gravity outlet to a sewer or watercourse and does not include the filtration benefits achieved from the infiltration outlet of the proposed dry pond.

Therefore, with the various proposed measures it is estimated that at least 70% TSS removal will be achieved through the system.

6.0 GRADING AND DRAINAGE

The proposed development site measures approximately 1.30ha (3.22 acre) in area and is currently partly developed. The topography across the site is relatively flat, and the entirety of the site currently drains from west to east. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements for the site. 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 runoff from events exceeding the 100-year design event to the eastern portion of the development where major system flows are presently draining as depicted in **Drawing GP-1.**

7.0 UTILITIES

Hydro overhead lines exist along Carp Road. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the proposed site under interim and ultimate conditions. Consultation with Hydro Ottawa will continue throughout the Composite Utility Planning process. Exact size, location, and routing of hydro utilities, as well as required transformer locations, will be finalized after design circulation.

Bell lines are expected to be able to service the proposed site via infrastructure within Carp Road. Bell may require easements for their respective cabinets and vaults. Easement requirements and location of telecommunication infrastructure will be determined as part of the Composite Utility Planning process, following design circulation.

8.0 APPROVALS

Consultation with the Ministry of the Environment and Climate Change (MOECC) will be completed to confirm whether an Environmental Compliance Approval (ECA, formerly Certificates of Approval (CofA) will be necessary for stormwater management (Correspondence included in **Appendix D**).

Will require approval for septic tank, line and bed from the Ottawa Septic System Office by way of OSSO permit. The Mississippi Valley Conservation authority permit approval is required for the septic tank and bed.

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.

It is noted that the site stormwater management is dependent on infiltration for release of stored runoff. As such, all infiltration trenches and basins shall be constructed after all other site grading and construction is complete. The SWM dry pond depression may be excavated during construction if they are required for stormwater management during construction. However, they should not be excavated to the depth of the infiltration areas until all other site works are complete. All accumulated sediment will need to be excavated from the pond and infiltration testing shall be completed before placing clear stone and geotextiles etc.

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. Plan construction at proper time to avoid flooding.
8. Installation of a mud matt to prevent mud and debris from being transported off site.
9. Installation of silt fence to prevent sediment runoff.

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

10. Verification that water is not flowing under silt barriers.

Refer to **Drawing EC-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 Patersongroup on November 11, 2016. The report summarizes the existing soil conditions within the subject area and construction recommendations. For details which are not summarized below, please see the original Paterson report.

Subsurface soil conditions within the subject area were determined from 11 boreholes and 14 test pits across the proposed site. The investigation concluded that the site is underlain by dense silty sand with gravel layer of 1.1 to 6.0m below ground surface overlaid by a thin layer of topsoil. Bedrock is anticipated to lie within subjected area and is in the form of limestone and Verulam. In addition, six constant head pask permeameter tests were completed to verify existing hydraulic conductivity of the soils below the proposed area for infiltration.

Expected long-term groundwater levels were measured on June 6, 2016 and vary in elevation from 2.5m to 3.5m in depth.

The required pavement structure for proposed hard surfaced areas are outlined in **Table 7 and Table 8** below:

Table 7: Pavement Structure – Car Only Parking Areas

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

Table 8: Pavement Structure – Access Lanes

Thickness (mm)	Material Description
40	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
50	Binder Course – HL-8 or Superpave 19.0 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone
400	Subbase - OPSS Granular B Type II
-	Subgrade – Either fill, in situ soil, or OPSS Granular B Type II material placed over in situ soil or fill.

11.0 CONCLUSIONS

11.1 WATER SERVICING

The proposed new well is considered to be capable of supplying sufficient water supply for fire flows. Based on the OBC calculations the maximum required fire flow for the site is 45 L/s (2,700 L/min). Fire suppression will be provided through two onsite 53,000L water storage tanks.

11.2 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the goals specified through consultation with the City of Ottawa. Onsite storage will be provided for all runoff in excess of existing surface release rates. All stored stormwater up to the 100-year event will be infiltrated as existing site grading is such that no feasible surface outlet exists for the captured stormwater on the site.

11.3 GRADING

Grading for the site has been designed to provide an emergency overland flow route as per City requirements and reflects any restrictions recommended in the Geotechnical Investigation Report prepared by Patersongroup on November 11, 2016. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing facilities.

11.4 UTILITIES

Utility infrastructure exists within overhead lines within the Carp Road ROW at the south western boundary 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.

11.5 APPROVALS/PERMITS

An MOECC ECA is not expected to be required for the subject site as site will remain private, under single ownership, however due to the infiltration component of the proposed stormwater management consultation with the MOECC will be required to confirm whether an ECA is required for stormwater management. A Permit to Take Water is not anticipated to be required for pumping requirements for service lateral/building footing installation. The Mississippi Valley Conservation Authority will need to be consulted in order to obtain municipal approval for site Water Supply Servicing.

Appendix A WATER SUPPLY SERVICING

A.1 FIRE FLOW REQUIREMENTS PER OBC

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

Job#	160401271	Designed by:	TRK
Date	20-Dec-16	Checked by:	KJK

$Q = KVS_{tot}$

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
	Non-Combustible with Fire-Resistance Ratings	E, F-2		17
2	Area of one floor (m^2)	number of floors	hieght of ceiling (m)	Total Building Volume (m^3)
	1394	1	6.31	8,796
3	Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coeffiecient
	North	14.5	0	1
	East	28.4	0	
	South	30	0	
	West	45.4	0	
4	Established Fire Safety Plan?	Reduction in Volume (%)		Total Volume Reduction
	no	0%		0%
5				**Total Volume 'Q' (L)**
				149,532
				Minimum Required Fire Flow (L/min)
				4,500

Appendix B STORMWATER MANAGEMENT

B.1 RATIONAL METHOD CALCULATIONS

Stormwater Management Calculations

File No: **160401271**
Project: **2978 CARP ROAD**
Date: **18-Aug-16**

SWM Approach:
Post-development to Pre-development flows

Pre-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Uncontrolled - Tributary	ET	Hard	0.112		0.9	0.101		
		Soft	1.192		0.2	0.238		
		Subtotal		1.303896			0.339013	0.260
Total				**1.304**			**0.339**	
Overall Runoff Coefficient= C:								**0.26**

Total Roof Areas	**0.000 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**1.304 ha**
Total Tributary Area to Outlet	**1.304 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.000 ha**
Total Site	**1.304 ha**

Stormwater Management Calculations

Project #160401271, 2978 CARP ROAD
Modified Rational Method Calculatons for Storage

5 yr Intensity
City of Ottawa

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

a =	998.071
b =	6.053
c =	0.814

t (min)	I (mm/hr)
5	141.18
10	104.19
15	83.56
20	70.25
25	60.90
30	53.93
35	48.52
40	44.18
45	40.63
50	37.65
55	35.12
60	32.94

5 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 1.3030
C: 0.26

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
30	53.93	**50.79**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: ET — Uncontrolled - Tributary
Area (ha): 1.30
C: 0.26

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	141.18	133.05	133.05		
10	104.19	98.20	98.20		
15	83.56	78.75	78.75		
20	70.25	66.21	66.21		
25	60.90	57.39	57.39		
30	53.93	50.82	50.82		
35	48.52	45.73	45.73		
40	44.18	41.64	41.64		
45	40.63	38.29	38.29		
50	37.65	35.49	35.49		
55	35.12	33.10	33.10		
60	32.94	31.05	31.05		

SUMMARY TO OUTLET

			Vrequired	Vavailable*	
Tributary Area	0.000	ha			
Total 5yr Flow to Sewer	0	L/s	0	0 m^3	Ok
Non-Tributary Area	1.304	ha			
Total 5yr Flow Uncontrolled	133	L/s			
Total Area	1.304	ha			
Total 5yr Flow	133	L/s			
Target	51	L/s			

Project #160401271, 2978 CARP ROAD
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

$I = a/(t + b)$

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
5	242.70
10	178.56
15	142.89
20	119.95
25	103.85
30	91.87
35	82.58
40	75.15
45	69.05
50	63.95
55	59.62
60	55.89

100 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 1.3030
C: 0.26

Estimated Time of Concentration after Development

tc (min)	I (100 yr) (mm/hr)	Q100yr (L/s)
30	91.87	**86.52**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: ET — Uncontrolled - Tributary
Area (ha): 1.30
C: 0.33

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	210.36	210.36		
20	119.95	141.31	141.31		
30	91.87	108.23	108.23		
40	75.15	88.53	88.53		
50	63.95	75.34	75.34		
60	55.89	65.85	65.85		
70	49.79	58.66	58.66		
80	44.99	53.00	53.00		
90	41.11	48.43	48.43		
100	37.90	44.65	44.65		
110	35.20	41.47	41.47		
120	32.89	38.75	38.75		

SUMMARY TO OUTLET

			Vrequired	Vavailable*	
Tributary Area	0.000	ha			
Total 100yr Flow to Sewer	0	L/s	0	0 m^3	Ok
Non-Tributary Area	1.304	ha			
Total 100yr Flow Uncontrolled	210	L/s			
Total Area	1.304	ha			
Total 100yr Flow	210	L/s			
Target	87	L/s			

Stormwater Management Calculations

File No: **160401271**
Project: **2978 Carp Road**
Date: **17-Nov-16**

SWM Approach:
Post-development to Pre-development flows

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Controlled - Tributary	STM-1	Hard	0.456		0.9	0.410		
		Soft	0.684		0.2	0.137		
		Subtotal		1.14			0.5472	0.480
Uncontrolled - Non-Tributary	EXT-2	Hard	0.000		0.9	0.000		
		Soft	0.060		0.2	0.012		
		Subtotal		0.06			0.012	0.200
Uncontrolled - Non-Tributary	EXT-1	Hard	0.054		0.9	0.049		
		Soft	0.046		0.2	0.009		
		Subtotal		0.1			0.058	0.580
Total				**1.300**			**0.617**	
Overall Runoff Coefficient= C:								**0.47**

Total Roof Areas	**0.000 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**1.140 ha**
Total Tributary Area to Outlet	**1.140 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.160 ha**
Total Site	**1.300 ha**

Stormwater Management Calculations

Project #160401271, 2978 Carp Road
Modified Rational Method Calculatons for Storage

5 yr Intensity
City of Ottawa

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

a =	998.071
b =	6.053
c =	0.814

t (min)	I (mm/hr)
5	141.18
10	104.19
15	83.56
20	70.25
25	60.90
30	53.93
35	48.52
40	44.18
45	40.63
50	37.65
55	35.12
60	32.94

5 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 1.3000
C: 0.26

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
30	53.93	**50.67**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: STM-1 — Controlled - Tributary
Area (ha): 1.14
C: 0.48

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	141.18	214.76	3.09	211.67	63.50
10	104.19	158.50	3.09	155.41	93.25
15	83.56	127.11	3.09	124.02	111.62
20	70.25	106.87	3.09	103.78	124.53
25	60.90	92.64	3.09	89.55	134.32
30	53.93	82.04	3.09	78.95	142.10
35	48.52	73.81	3.09	70.72	148.50
40	44.18	67.21	3.09	64.12	153.90
45	40.63	61.80	3.09	58.71	158.53
275	10.14	15.42	3.09	12.33	203.42
280	9.99	15.20	3.09	12.11	**203.43**
285	9.85	14.99	3.09	11.90	203.42

Storage: Above CB

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	1.95	1.95	3.09	203.43	389.64	OK

Subdrainage Area: EXT-2 — Uncontrolled - Non-Tributary
Area (ha): 0.06
C: 0.20

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	141.18	4.71	4.71		
10	104.19	3.48	3.48		
15	83.56	2.79	2.79		
20	70.25	2.34	2.34		
25	60.90	2.03	2.03		
30	53.93	1.80	1.80		
35	48.52	1.62	1.62		
40	44.18	1.47	1.47		
45	40.63	1.36	1.36		
50	37.65	1.26	1.26		
55	35.12	1.17	1.17		
60	32.94	1.10	1.10		

Subdrainage Area: EXT-1 — Uncontrolled - Non-Tributary
Area (ha): 0.10
C: 0.58

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	141.18	22.76	22.76		
10	104.19	16.80	16.80		
15	83.56	13.47	13.47		
20	70.25	11.33	11.33		
25	60.90	9.82	9.82		
30	53.93	8.70	8.70		
35	48.52	7.82	7.82		
40	44.18	7.12	7.12		
45	40.63	6.55	6.55		
50	37.65	6.07	6.07		
55	35.12	5.66	5.66		
60	32.94	5.31	5.31		

Project #160401271, 2978 Carp Road
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

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

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
5	242.70
10	178.56
15	142.89
20	119.95
25	103.85
30	91.87
35	82.58
40	75.15
45	69.05
50	63.95
55	59.62
60	55.89

100 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 1.3000
C: 0.26

Estimated Time of Concentration after Development

tc (min)	I (100 yr) (mm/hr)	Q100yr (L/s)
30	91.87	**86.32**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: STM-1 — Controlled - Tributary
Area (ha): 1.14
C: 0.60

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	339.53	9.78	329.75	197.85
20	119.95	228.09	9.78	218.31	261.97
30	91.87	174.69	9.78	164.91	296.84
40	75.15	142.89	9.78	133.11	319.46
50	63.95	121.61	9.78	111.83	335.49
60	55.89	106.28	9.78	96.50	347.42
70	49.79	94.68	9.78	84.90	356.56
80	44.99	85.55	9.78	75.77	363.70
100	37.90	72.07	9.78	62.29	373.76
171	24.89	47.34	9.78	37.56	385.34
172	24.78	47.12	9.78	37.34	**385.34**
173	24.67	46.90	9.78	37.12	385.34

Storage: Surface Storage Above CB

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	2.10	2.10	9.78	385.34	389.64	OK
					4.30	

Subdrainage Area: EXT-2 — Uncontrolled - Non-Tributary
Area (ha): 0.06
C: 0.25

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	7.45	7.45		
20	119.95	5.00	5.00		
30	91.87	3.83	3.83		
40	75.15	3.13	3.13		
50	63.95	2.67	2.67		
60	55.89	2.33	2.33		
70	49.79	2.08	2.08		
80	44.99	1.88	1.88		
90	41.11	1.71	1.71		
100	37.90	1.58	1.58		
110	35.20	1.47	1.47		
120	32.89	1.37	1.37		

Subdrainage Area: EXT-1 — Uncontrolled - Non-Tributary
Area (ha): 0.10
C: 0.73

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	35.99	35.99		
20	119.95	24.18	24.18		
30	91.87	18.52	18.52		
40	75.15	15.15	15.15		
50	63.95	12.89	12.89		
60	55.89	11.27	11.27		
70	49.79	10.04	10.04		
80	44.99	9.07	9.07		
90	41.11	8.29	8.29		
100	37.90	7.64	7.64		
110	35.20	7.10	7.10		
120	32.89	6.63	6.63		

Stormwater Management Calculations

Project #160401271, 2978 Carp Road
Modified Rational Method Calculatons for Storage

SUMMARY TO OUTLET

			Vrequired	Vavailable*		
Tributary Area	1.140	ha				
Total 5yr Flow to Sewer	10	L/s	0	0	m^3	Ok
Non-Tributary Area	0.160	ha				
Total 5yr Flow Uncontrolled	27	L/s				
Total Area	1.300	ha				
Total 5yr Flow	37	L/s				
Target	51	L/s				

Project #160401271, 2978 Carp Road
Modified Rational Method Calculatons for Storage

SUMMARY TO OUTLET

			Vrequired	Vavailable*		
Tributary Area	1.140	ha				
Total 100yr Flow to Sewer	10	L/s	0	0	m^3	Ok
Non-Tributary Area	0.160	ha				
Total 100yr Flow Uncontrolled	43	L/s				
Total Area	1.300	ha				
Total 100yr Flow	53	L/s				
Target	86	L/s				

Infiltration Trench and Basin Sizing

1) Summary of Site Areas

Area ID	area (ha)	% imp	imperv area (ha)
STM-1	1.14	44.74	0.51

2) Runoff Generation

a.) 100year rainfall depth	96.00	mm	12hr rainfall event per Carp River Model critical event
b.) Total site impervious area	0.51	ha	
c.) 100year runoff volume	489.6	m3	c = a x b x 10,000/1,000
d.) Volume to be infiltrated in pond	489.6	m3	d = c
e.) MRM Storage Volume Required	**385.34**	m3	From Modified Rational Method calculation sheets used iteratively with infiltration calculations

3) Dry Pond Volume

f.) Bottom area	740.00	m2	Per design drawings
g.) Top area	912.22	m2	Per design drawings
h.) depth	0.50	m	Per design drawings
i.) dry pond freeboard	0.10	m	Per design drawings
j.) active depth	0.40	m	Per design drawings
k.) Pond volume	330.44	m3	k = ((f + g) / 2) x j

4) Infiltration Basin Under Pond for Trench Spillover Volume

l.) area	740.00	m2	Per design drawings
m.) depth	0.20	m	Per design drawings
n.) volume	148.00	m3	n = l x m
o.) Porosity of clearsone basin	0.40		
p.) Infiltration basin storage volume	59.20	m3	p = n x o

5) Calculate min infiltration rate for drawdown time

q.) Total storage volume	**389.64**	m3	q = k + p
r.) Total water depth	0.40	m	r = j
s.) Target drawdown time	48.00	hr	Standard
t.) Required infiltration rate	**8.33**	**mm/hr**	t = r / s
u.) Measured infiltration rate	**9.46**	**mm/hr**	Per field testing (average of TP 11&12)

6) Calculate Flow Rate Through Pond Bottom

Q=KA(h2-h1)/L

depth to g/w from surface of pond	1.15	m	TP 11 & BH 10 per Paterson Investigation
K =	8.50E-06	m/s	Per field testing
h2 =	1.15	m	
h1 =	0.45	m	
L=	0.45	m	
A=	740.00	m2	
Q=	0.00978	m3/s	
	9.78	l/s	controlled flow rate that can be input to MRM sheet

B.2 GROUNDWATER MOUNDING CALCULATIONS

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.0004	***R***	**Recharge (infiltration) rate (feet/day)**
0.160	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
0.00	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
47.970	**x**	**1/2 length of basin (x direction, in feet)**
41.570	**y**	**1/2 width of basin (y direction, in feet)**
2.000	**t**	**duration of infiltration period (days)**
0.000	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

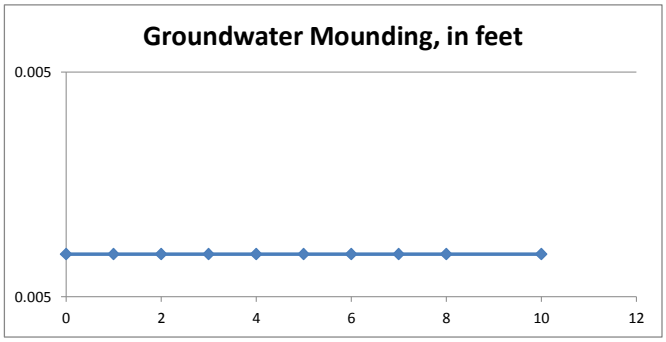
hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

0.005	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.005	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.005	0
0.005	1
0.005	2
0.005	3
0.005	4
0.005	5
0.005	6
0.005	7
0.005	8
0.005	10

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

B.3 REMOVAL RATES FOR BUFFER STRIPS-US EPA DESIGN MANUAL FOR LOW IMPACT DEVELOPMENT (LID)

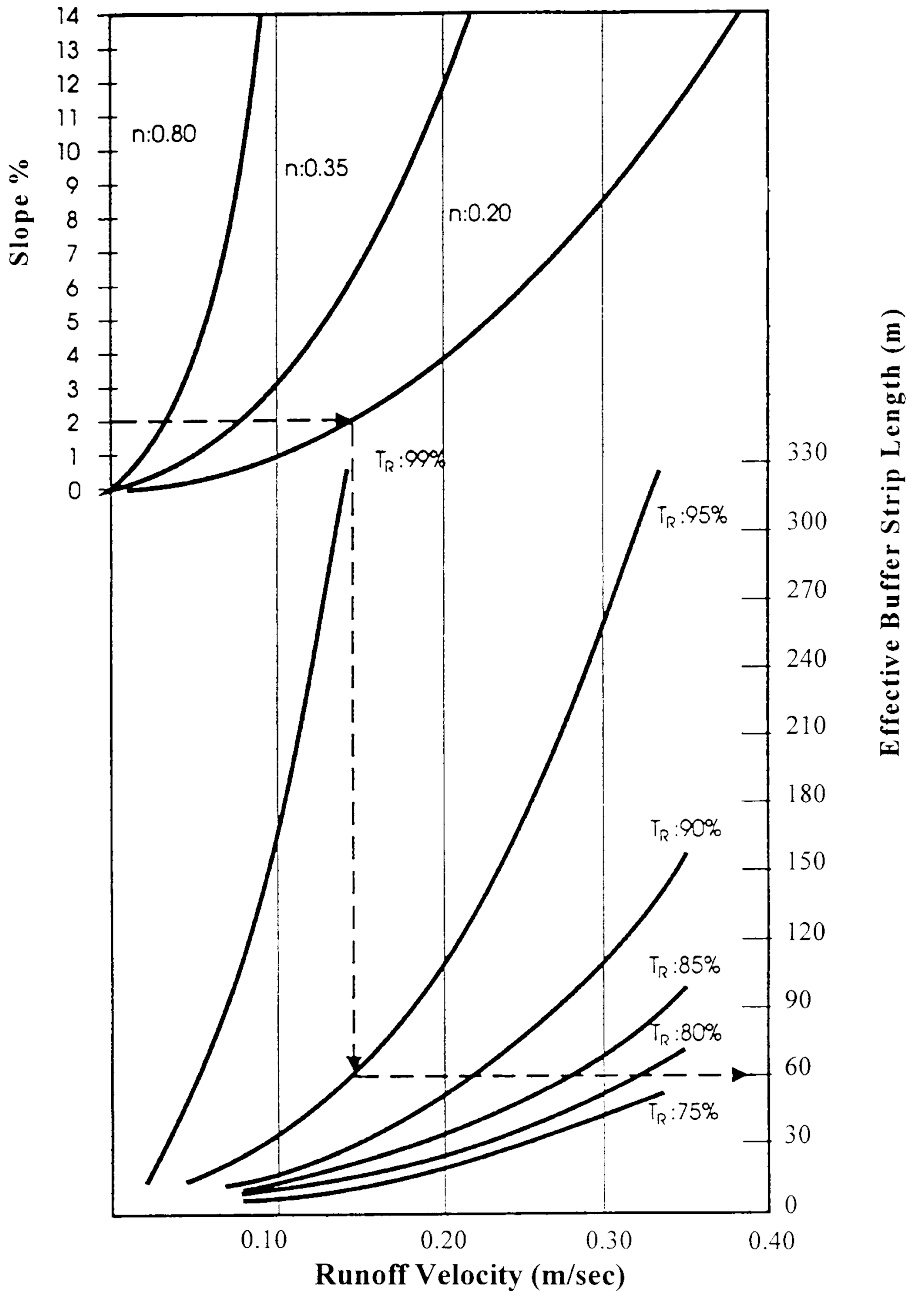


Figure 5-4 Removal rates (TR) for Buffer Strips (Wong and McCuen, 1982) (Reprinted with Permission of ASCE)

There are some significant limitations to design chart method as it does not take into account the particle size of the material or the infiltration rate of the soils. Consequently it over predicts trapping efficiency of soils with low permeability and under predicts trapping efficiency of soils with high permeability. For these reasons, the design

Appendix C GEOTECHNICAL INVESTIGATION

C.1 EXCERPTS FROM PATERSONGROUP INVESTIGATION

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
Ottawa, Ontario
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patersongroup

Geotechnical Investigation

Proposed Storage Building
2978 and 2966 Carp Road
Ottawa, Ontario

Prepared For

York-HOP Inc.

November 11, 2016

Report PG3834-1R

Table 1 - Summary of Groundwater Level Readings				
Test hole Number	Ground Surface Elevation (m)	Groundwater Depth (m)	Groundwater Elevation (m)	Date
BH 2	118.42	Dry	-	June 6, 2016
BH 6	117.71	3.93	113.78	June 6, 2016
BH 8	117.54	4.19	113.35	June 6, 2016
BH 10	117.46	3.62	113.84	June 6, 2016
BH 11	117.45	Blocked	-	June 6, 2016

Groundwater is subject to seasonal fluctuations and therefore, groundwater could vary at the time of construction.

4.4 Pask Permeameter Testing

A total of six (6) constant head Pask permeameter tests were conducted at the test locations to verify the existing hydraulic conductivities of the soils below the proposed infiltration system at the subject site. The permeameter test locations were selected by Stantec in a manner to provide general coverage of proposed infiltration system. The hydraulic conductivity (K_{fs}) values for each test hole location is presented in Table 2.

Table 2 - Hydraulic Conductivity Values				
Test hole Number	Depth (m bgs)	18T UTM		K_{fs} (m/sec)
		Easting (m)	Northing (m)	
TP 1	0.9	421970	5018202	3.20E-07
TP 4	0.6	422013	5018181	9.40E-07
TP 5	0.7	421951	5018215	9.40E-08
TP 11	0.9	422035	5018200	5.30E-06
TP 12	1.1	422021	5018187	1.20E-05
TP 13	1.0	422049	5018186	5.30E-06

The values measured within the test hole locations are consistent with similar material Paterson has encountered on other sites. These values typically range from 1 x 10^{-5} to 1 x 10^{-7} m/sec due to the variability of the material encountered.

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

Table 4 - Recommended Pavement Structure - Access Lanes	
Thickness (mm)	**Material Description**
40	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course -** HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
400	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type II material placed over in situ soil or fill

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable compaction equipment.

It is our understanding that consideration is being taken to using a gravel pavement structure for car parking, access lanes and fire routes as part of the proposed development. The gravel pavement structure is further detailed in Table 5. It is expected that the gravel pavement structure may require annual maintenance, such as regrading and padding in poor performing areas.

Table 5 - Gravel Pavement Structure - Car Parking, Access Lanes and Fire Routes	
Thickness (mm)	**Material Description**
300	**BASE** - OPSS Granular A Crushed Stone
	SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type II material placed over in situ soil or fill

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storage Building - 2978 & 2966 Carp Road
Ottawa, Ontario

DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

FILE NO. PG3834

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** June 1, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	118.24		
TOPSOIL 0.08									
Brown **SILTY SAND** with gravel, cobbles and boulders, trace clay and organics 0.76		SS	1	75	50+	1	117.24		
		SS	2	80	50+				
Highly fractured **BEDROCK** interbedded with silty sand to sandy silt, some clay with fragmented bedrock		SS	3	80	50+	2	116.24		
		SS	4	75	71	3	115.24		
		SS	5	75	50+	4	114.24		
		SS	6		50+				
4.95 End of Borehole									
Practical split spoon refusal at 4.95m depth									
(GWL @ 4.2m depth based on field observations)									

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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FILE NO. PG3834

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** June 1, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	118.42
TOPSOIL 0.10							
Brown **SILTY SAND** with gravel, cobbles and boulders, trace clay and organics		SS	1	92	51	1	117.42
1.45		SS	2	25	50+	2	116.42
Highly fractured **BEDROCK** interbedded with silty sand to sandy silt, some clay with fragmented bedrock		SS	3	50	50+	3	115.42
						4	114.42
4.80		SS	4	67	50+		
End of Borehole							
Practical split spoon refusal at 4.80m depth							
(BH dry - June 6, 2016)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

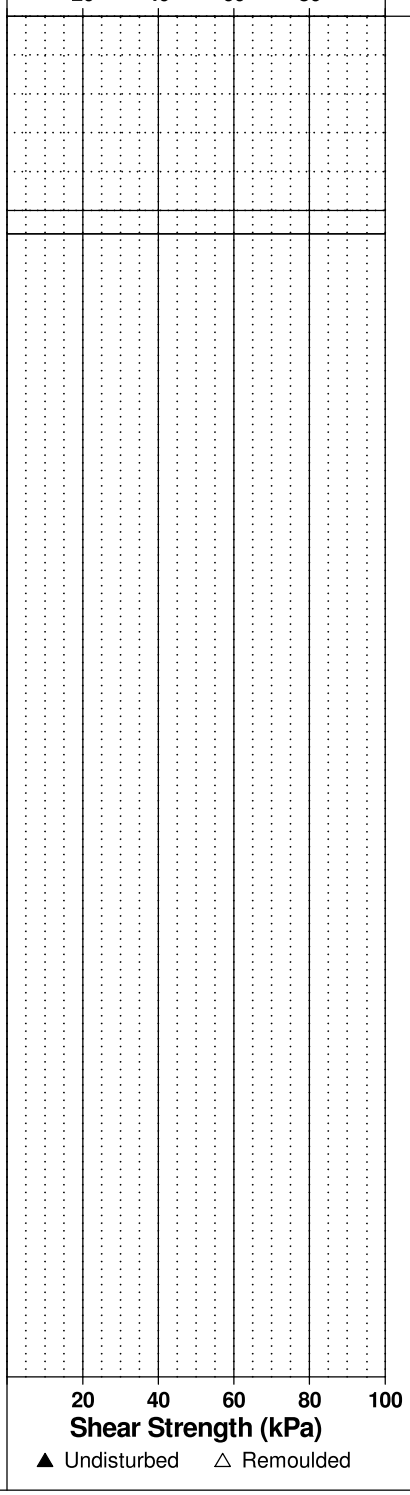
FILE NO. PG3834

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** June 1, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.15						0	118.29		
Brown **SILTY SAND** with gravel, cobbles and boulders, trace clay and organics 0.91									
Highly fractured **BEDROCK** interbedded with silty sand to sandy silt, some clay with fragmented bedrock 1.12		SS	1		50+	1	117.29		
End of Borehole									
Practical refusal to augering at 1.12m depth									
(BH dry upon completion)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storage Building - 2978 & 2966 Carp Road
Ottawa, Ontario

DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

FILE NO. PG3834

REMARKS

HOLE NO. BH 3A

BORINGS BY CME 55 Power Auger **DATE** June 1, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	118.29		
TOPSOIL 0.15									
Brown **SILTY SAND** with gravel, cobbles and boulders, trace clay and organics						1	117.29		
1.80		SS	1	58	54	2	116.29		
Highly fractured **BEDROCK** interbedded with silty sand to sandy silt, some clay with fragmented bedrock		SS	2	75	50+	3	115.29		
						4	114.29		
4.65		SS	3	67	50+				
End of Borehole									
Practical split spoon refusal at 4.65m depth									
(GWL @ 4.3m depth based on field observations)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

FILE NO. PG3834

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** June 1, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.08						0	118.03		
Brown **SILTY SAND** with gravel, cobbles and boulders, trace clay and organics 0.66		SS	1	50	46	1	117.03		
Highly fractured **BEDROCK** interbedded with silty sand to sandy silt, some clay with fragmented bedrock		SS	2		68	2	116.03		
2.59									
End of Borehole									
Practical refusal to augering at 2.59m depth									
(BH dry upon completion)									

Water Content % scale: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

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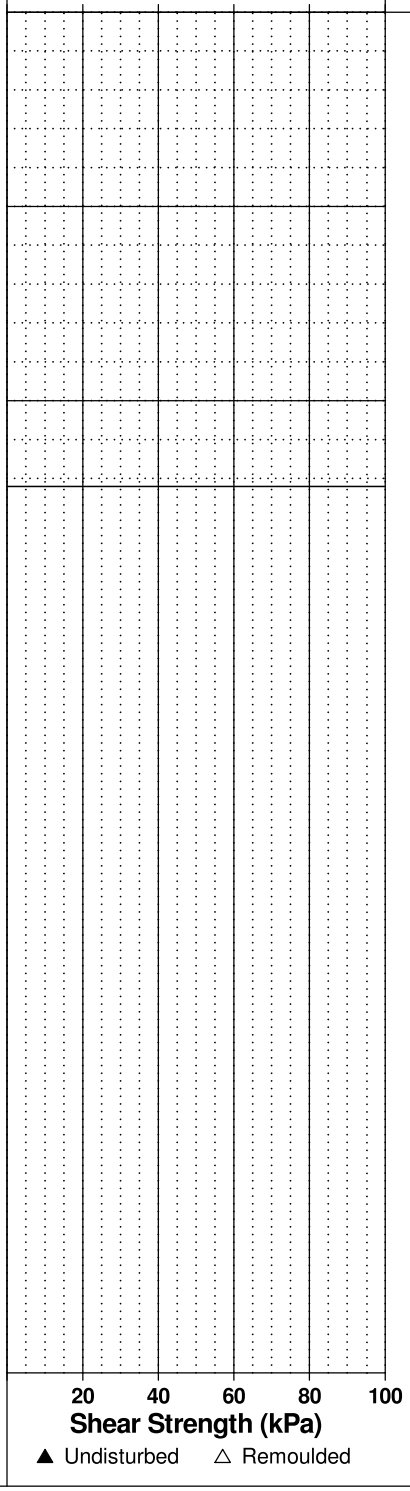
FILE NO. PG3834

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** June 1, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.08						0	117.74		
Brown **SILTY SAND** with gravel, cobbles and boulders, trace clay and organics		SS	1	83	50	1	116.74		
1.40									
Highly fractured **BEDROCK** interbedded with silty sand to sandy silt, some clay with fragmented bedrock		SS	2	80	50+	2	115.74		
2.44									
End of Borehole									
Practical refusal to augering at 2.44m depth									
(BH dry upon completion)									



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Proposed Storage Building - 2978 & 2966 Carp Road
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FILE NO. PG3834

REMARKS

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** June 1, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	117.71
TOPSOIL 0.10							
Brown **SILTY SAND** with gravel, cobbles and boulders, trace clay and organics 0.91		SS	1	83	55	1	116.71
		SS	2	92	88	2	115.71
Highly fractured **BEDROCK** interbedded with silty sand to sandy silt, some clay with fragmented bedrock		SS	3	58	77		
		SS	4	78	50+	3	114.71
4.70		SS	5	100	50+	4	113.71
End of Borehole							
Practical split spoon refusal at 4.70m depth							
(GWL @ 3.93m-June 6, 2016)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storage Building - 2978 & 2966 Carp Road
Ottawa, Ontario

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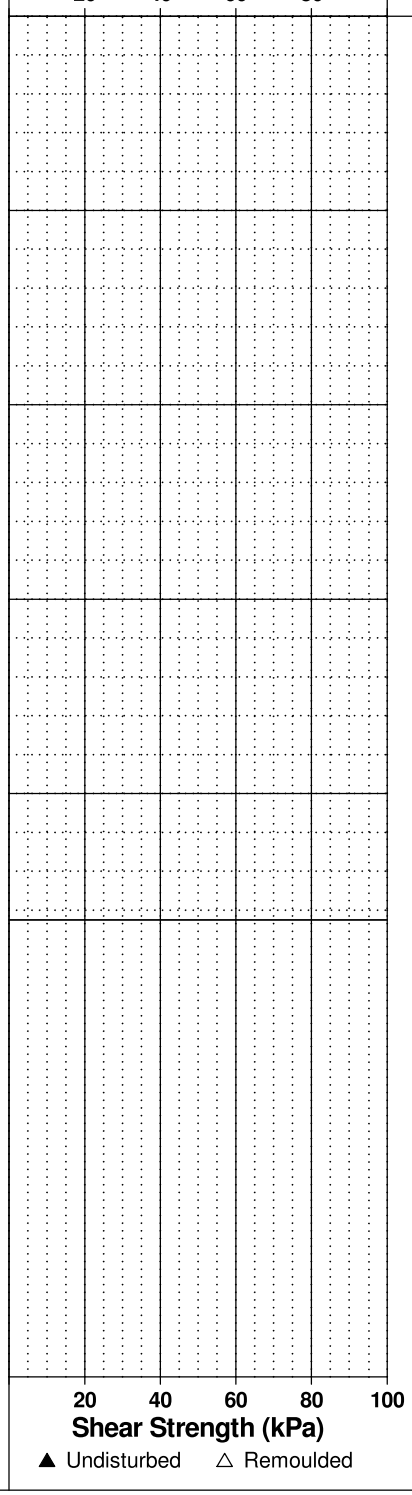
FILE NO. PG3834

REMARKS

HOLE NO. BH 7

BORINGS BY CME 55 Power Auger **DATE** June 1, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	117.53		
TOPSOIL 0.30									
Brown **SILTY SAND** with gravel, cobbles and boulders, trace clay and organics 1.07		SS	1	80	50+	1	116.53		
		SS	2	21	51	2	115.53		
Highly fractured **BEDROCK** interbedded with silty sand to sandy silt, some clay with fragmented bedrock		SS	3	40	50+	3	114.53		
						4	113.53		
4.65 End of Borehole		SS	4	100	50+				
Practical split spoon refusal at 4.65m depth									
(GWL @ 3.7m depth based on field observations)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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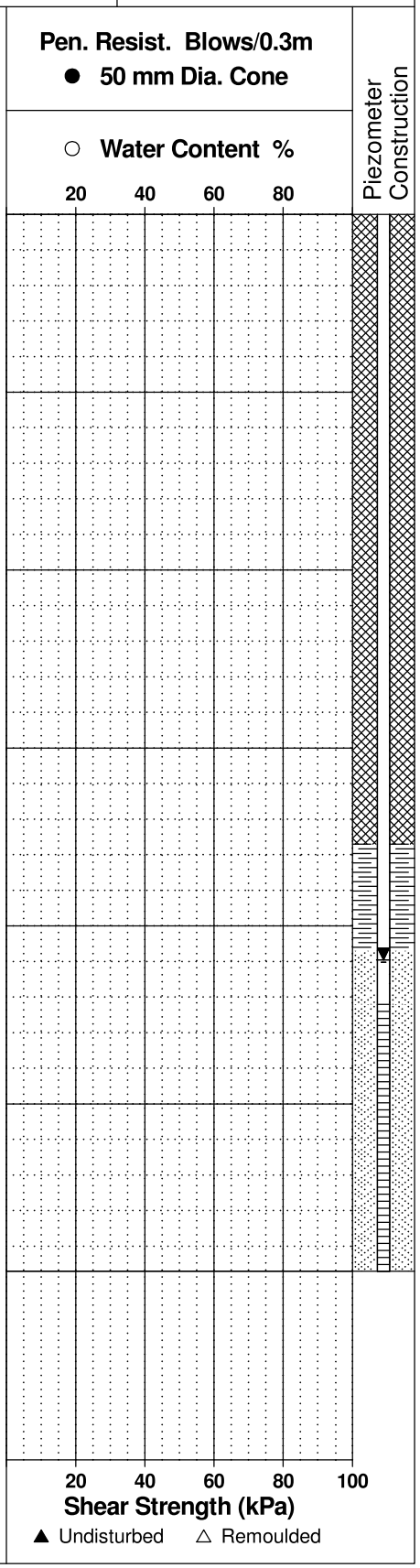
FILE NO. PG3834

REMARKS

HOLE NO. BH 8

BORINGS BY CME 55 Power Auger **DATE** June 2, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL							
0.30							
Brown **SILTY SAND** with gravel, cobbles and boulders, trace clay and organics		AU	1				
0.76		SS	2	67	50+	1	116.54
		SS	3	60	50+	2	115.54
		SS	4	92	58		
Highly fractured **BEDROCK** interbedded with silty sand to sandy silt, some clay with fragmented bedrock		SS	5	50	50+	3	114.54
		SS	6	76	79	4	113.54
						5	112.54
5.94							
End of Borehole							
Practical refusal to augering at 5.94m depth							
(GWL @ 4.19m-June 6, 2016)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storage Building - 2978 & 2966 Carp Road
Ottawa, Ontario

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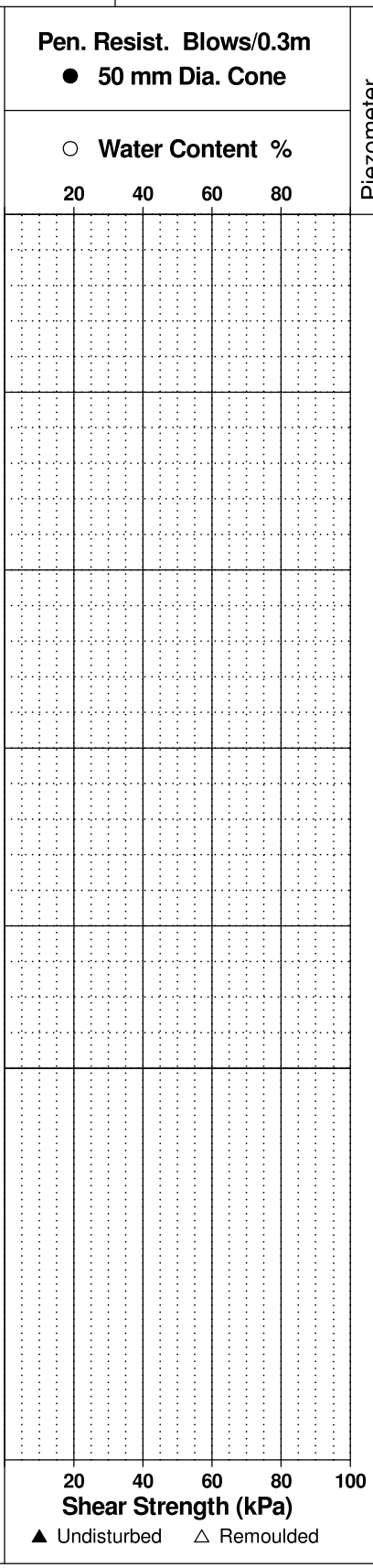
FILE NO. PG3834

REMARKS

HOLE NO. BH 9

BORINGS BY CME 55 Power Auger **DATE** June 2, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	117.66
TOPSOIL							
0.30							
Loose to compact, brown **SILTY SAND,** some clay		SS	1	67	12	1	116.66
1.37							
		SS	2	71	50+	2	115.66
Highly fractured **BEDROCK** interbedded with silty sand to sandy silt, some clay with fragmented bedrock		SS	3	75	47	3	114.66
						4	113.66
4.80		SS	4	100	50+		
End of Borehole							
Practical split spoon refusal at 4.80m depth							
(BH dry upon completion)							



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

FILE NO. PG3834

REMARKS

HOLE NO. BH10

BORINGS BY CME 55 Power Auger **DATE** June 2, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	117.46
TOPSOIL 0.10							
Loose to compact, brown **SILTY SAND,** some clay		SS	1	75	21	1	116.46
1.37							
		SS	2	58	49	2	115.46
Highly fractured **BEDROCK** interbedded with silty sand to sandy silt, some clay with fragmented bedrock		SS	3	80	50+	3	114.46
						4	113.46
4.27							
End of Borehole							
Practical refusal to augering at 4.27m depth							
(GWL @ 3.62m-June 6, 2016)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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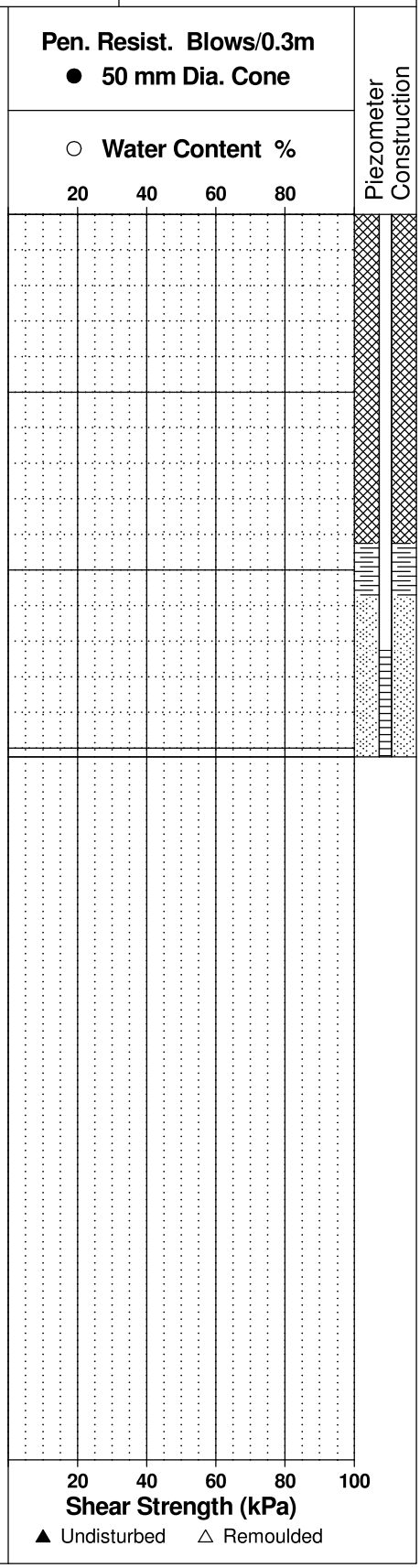
FILE NO. PG3834

REMARKS

HOLE NO. BH11

BORINGS BY CME 55 Power Auger **DATE** June 2, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	117.45
TOPSOIL		AU	1				
0.60							
Brown **SILTY SAND** with gravel, cobbles and boulders, trace clay and organics		SS	2	70	11	1	116.45
1.27							
Highly fractured **BEDROCK** interbedded with silty sand to sandy silt, some clay with fragmented bedrock		SS	3	75	62	2	115.45
3.05						3	114.45
End of Borehole							
Practical refusal to augering at 3.05m depth							
(Piezometer blocked at 1.72m depth - June 6, 2016)							



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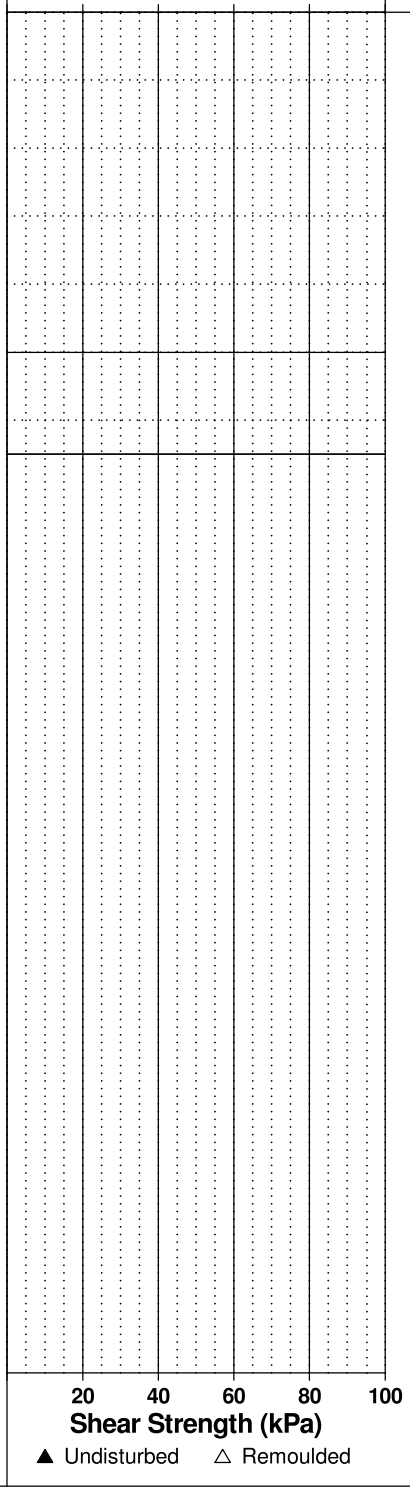
FILE NO. PG3834

REMARKS

HOLE NO. TP 1

BORINGS BY Backhoe **DATE** November 3, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.20		G	1			0	117.72		
Brown **SILTY SAND to SANDY SILT,** some tree roots		G	2			1	116.72		
1.20									
Highly fractured **BEDROCK** with sandy silt, gravel, cobbles and boulders, some clay 1.30									
End of Test Pit									
TP terminated on fractured bedrock surface at 1.30m depth									
(TP dry upon completion)									



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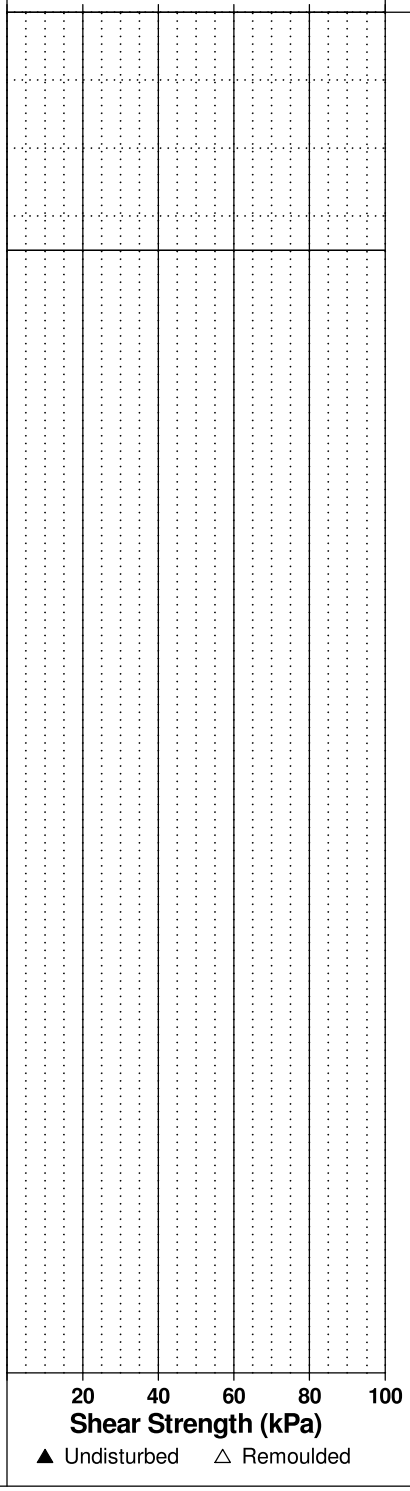
FILE NO. PG3834

REMARKS

HOLE NO. TP 2

BORINGS BY Backhoe **DATE** November 3, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	118.08		
TOPSOIL 0.20									
Highly fractured **BEDROCK** with sandy silt, gravel, cobbles and boulders, some clay 0.70									
End of Test Pit TP terminated on fractured bedrock surface at 0.70m depth (TP dry upon completion)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storage Building - 2978 & 2966 Carp Road
Ottawa, Ontario

DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

FILE NO. PG3834

REMARKS

HOLE NO. TP 3

BORINGS BY Backhoe **DATE** November 3, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	117.47		
TOPSOIL 0.20									
Brown **SILTY SAND to SANDY SILT** 0.50									
Highly fractured **BEDROCK** with sandy silt, gravel, cobbles and boulders, some clay						1	116.47		
1.60									
End of Test Pit									
TP terminated on fractured bedrock surface at 1.60m depth									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storage Building - 2978 & 2966 Carp Road
Ottawa, Ontario

DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

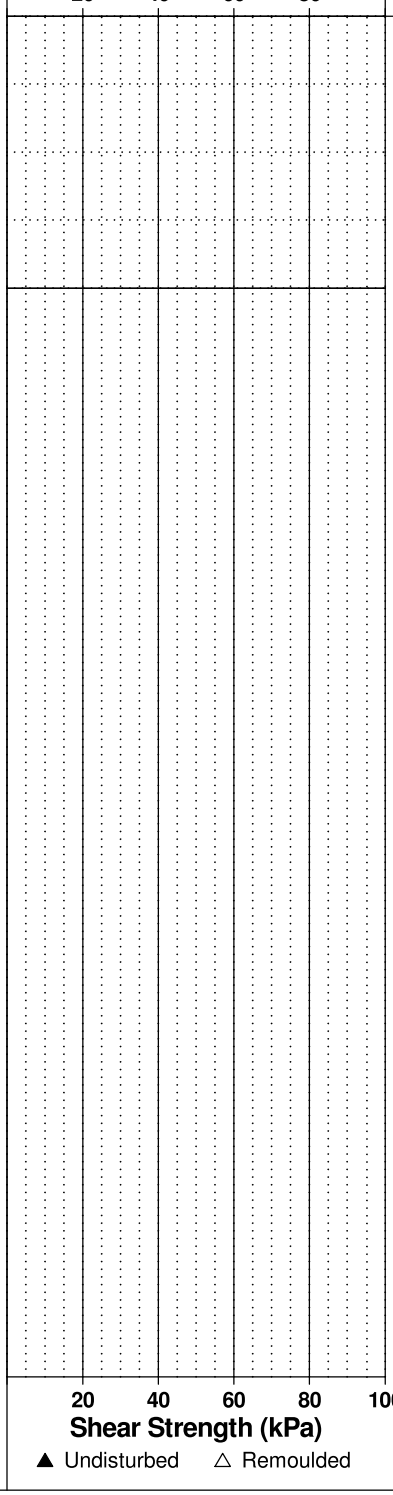
FILE NO. PG3834

REMARKS

HOLE NO. TP 4

BORINGS BY Backhoe **DATE** November 3, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	117.46		
TOPSOIL 0.30									
Brown **SILTY SAND to SANDY SILT,** some clay, gravel, cobbles and boulders - clay content increasing with depth 0.80		G	1						
End of Test Pit TP terminated on dense glacial till at 0.80m depth (TP dry upon completion)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storage Building - 2978 & 2966 Carp Road
Ottawa, Ontario

DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

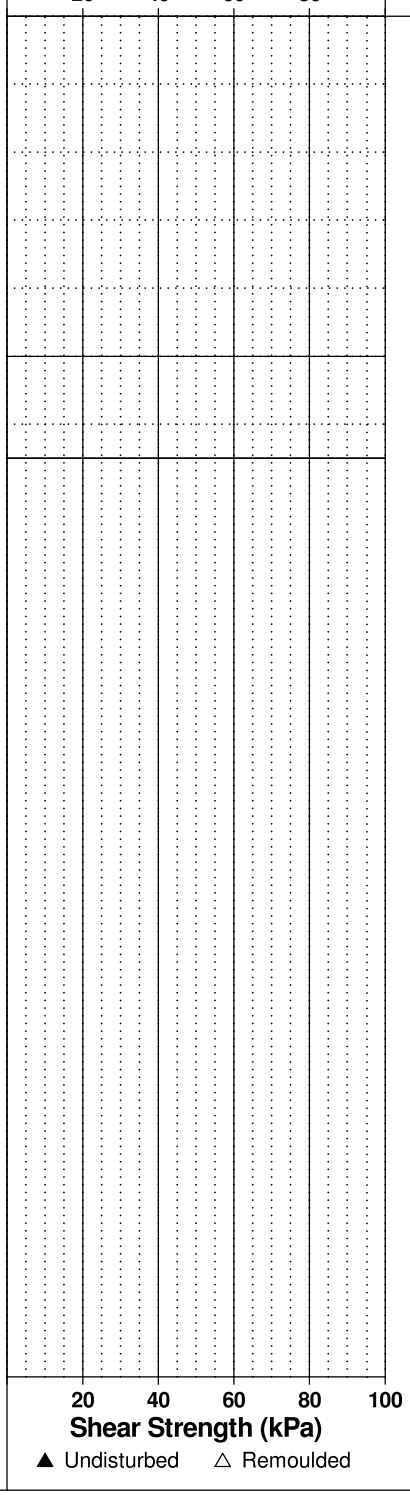
FILE NO. PG3834

REMARKS

HOLE NO. TP 5

BORINGS BY Backhoe **DATE** November 3, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	118.06		
TOPSOIL 0.20									
Brown **SANDY SILT** with clay to **SILTY SAND** 0.50		G	1						
Highly fractured **BEDROCK** with sandy silt, gravel, cobbles and boulders, some clay						1	117.06		
1.30									
End of Test Pit TP terminated on fractured bedrock surface at 1.30m depth (TP dry upon completion)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storage Building - 2978 & 2966 Carp Road
Ottawa, Ontario

DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

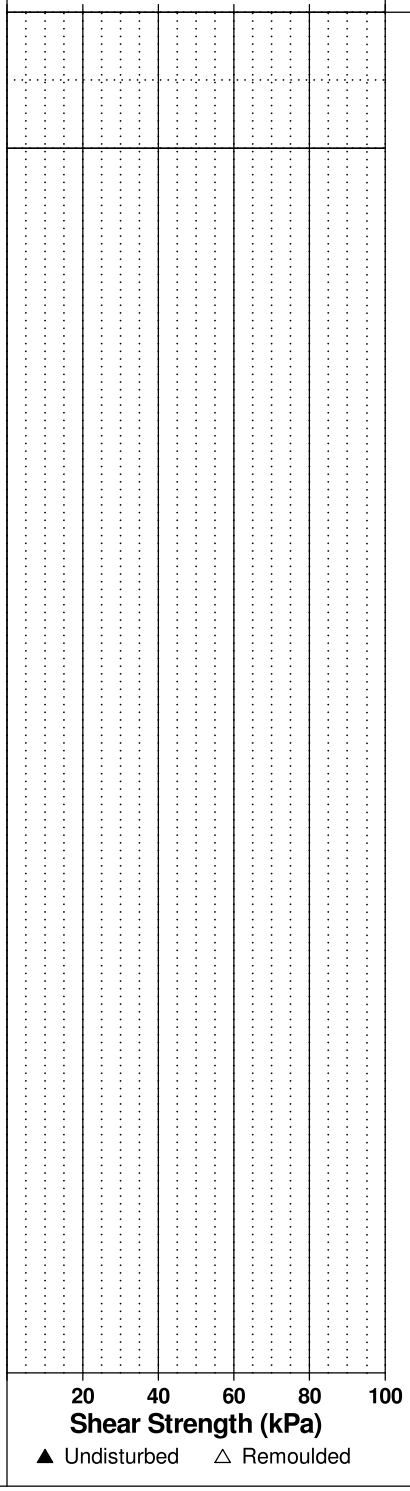
FILE NO. PG3834

REMARKS

HOLE NO. TP 6

BORINGS BY Backhoe **DATE** November 3, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.10						0	118.08		
Highly fractured **BEDROCK**									
0.40									
End of Test Pit									
TP terminated on fractured bedrock surface at 0.40m depth									
(TP dry upon completion)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storage Building - 2978 & 2966 Carp Road
Ottawa, Ontario

DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

FILE NO. PG3834

REMARKS

HOLE NO. TP 7

BORINGS BY Backhoe **DATE** November 3, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL						0	117.37		
0.15									
Brown **SILTY SAND**									
0.45									
Highly fractured **BEDROCK** with silty clay, sand, gravel, cobbles and boulders		G	1						
1.10						1	116.37		
End of Test Pit									
TP terminated on fractured bedrock surface at 1.10m depth									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storage Building - 2978 & 2966 Carp Road
Ottawa, Ontario

DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

FILE NO. PG3834

REMARKS

HOLE NO. TP 8

BORINGS BY Backhoe **DATE** November 3, 2016

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE										
Crushed stone	0.05						0	118.54		
TOPSOIL	0.20									
Brown **SILTY SAND,** trace gravel	0.80									
Highly fractured **BEDROCK** with brown silty sand, gravel and cobbles, trace boulders			G	1			1	117.54		
End of Test Pit	1.50									
TP terminated on fractured bedrock surface at 1.50m depth										
(TP dry upon completion)										

Pen. Resist. Blows/0.3m: ○ Water Content % — 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storage Building - 2978 & 2966 Carp Road
Ottawa, Ontario

DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

FILE NO. PG3834

REMARKS

HOLE NO. TP 9

BORINGS BY Backhoe **DATE** November 3, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL						0	118.16		
0.20									
Brown **SILTY SAND** with clay and fractured bedrock by 0.4m depth									
0.65									
		G	1						
Highly fractured **BEDROCK** with grey-brown silty sand, gravel, cobbles and boulders						1	117.16		
1.50									
End of Test Pit									
TP terminated on fractured bedrock surface at 1.5m depth									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Storage Building - 2978 & 2966 Carp Road
Ottawa, Ontario

DATUM TBM - Top of magnetic nail in utility pole on Carp Road. Geodetic elevation = 119.73m.

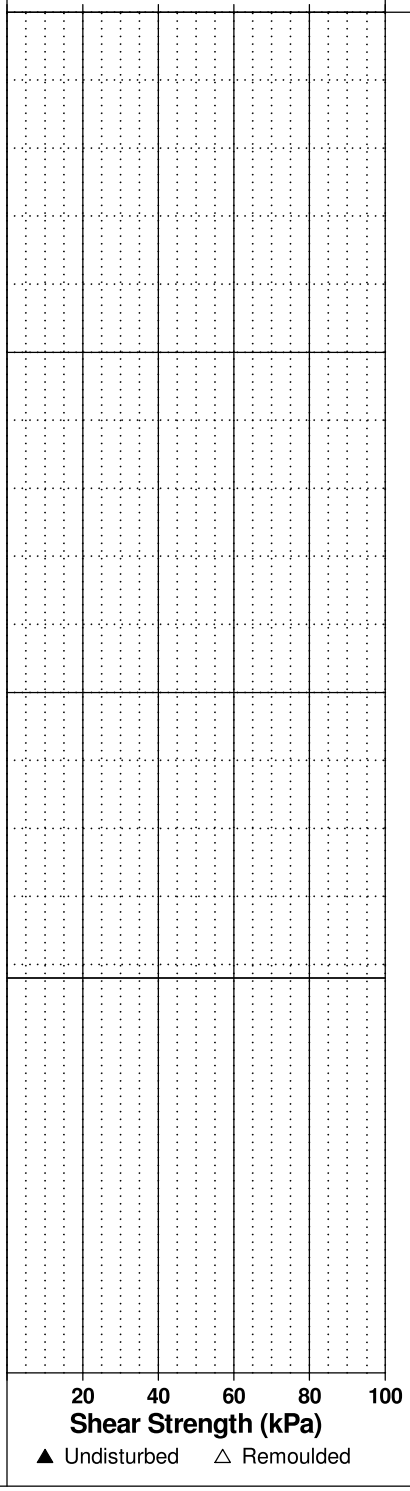
FILE NO. PG3834

REMARKS

HOLE NO. TP10

BORINGS BY Backhoe **DATE** November 3, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	118.24		
TOPSOIL 0.20									
Brown **SILTY SAND** with cobbles 0.60									
Grey **SILTY CLAY**		G	1						
0.85									
Brown **SILTY SAND** 0.97		G	2			1	117.24		
High fractured **BEDROCK** with brown silty sand, cobbles and boulders		G	3			2	116.24		
2.84									
End of Test Pit TP terminated on fractured bedrock surface at 2.84m depth (TP dry upon completion)									



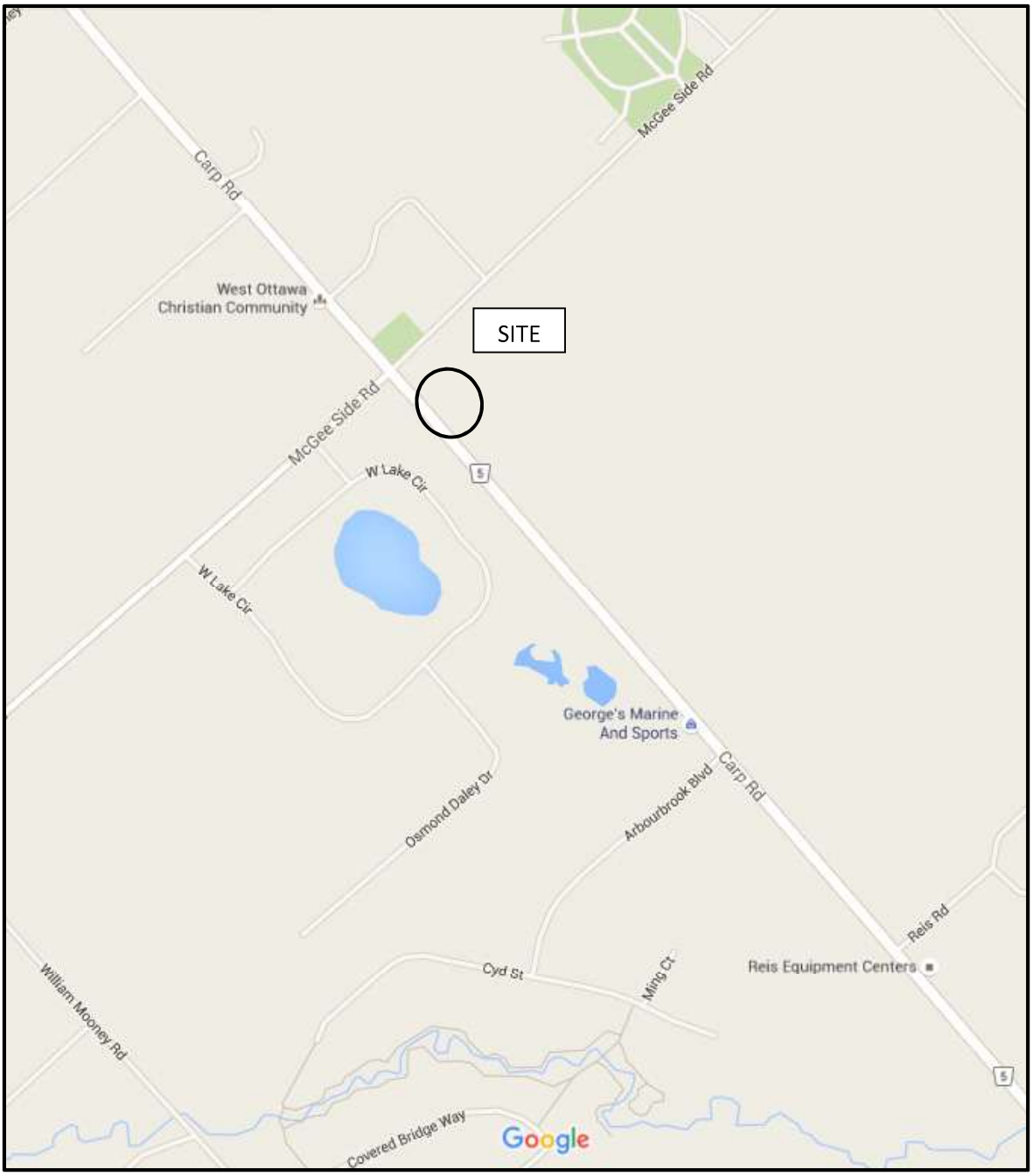
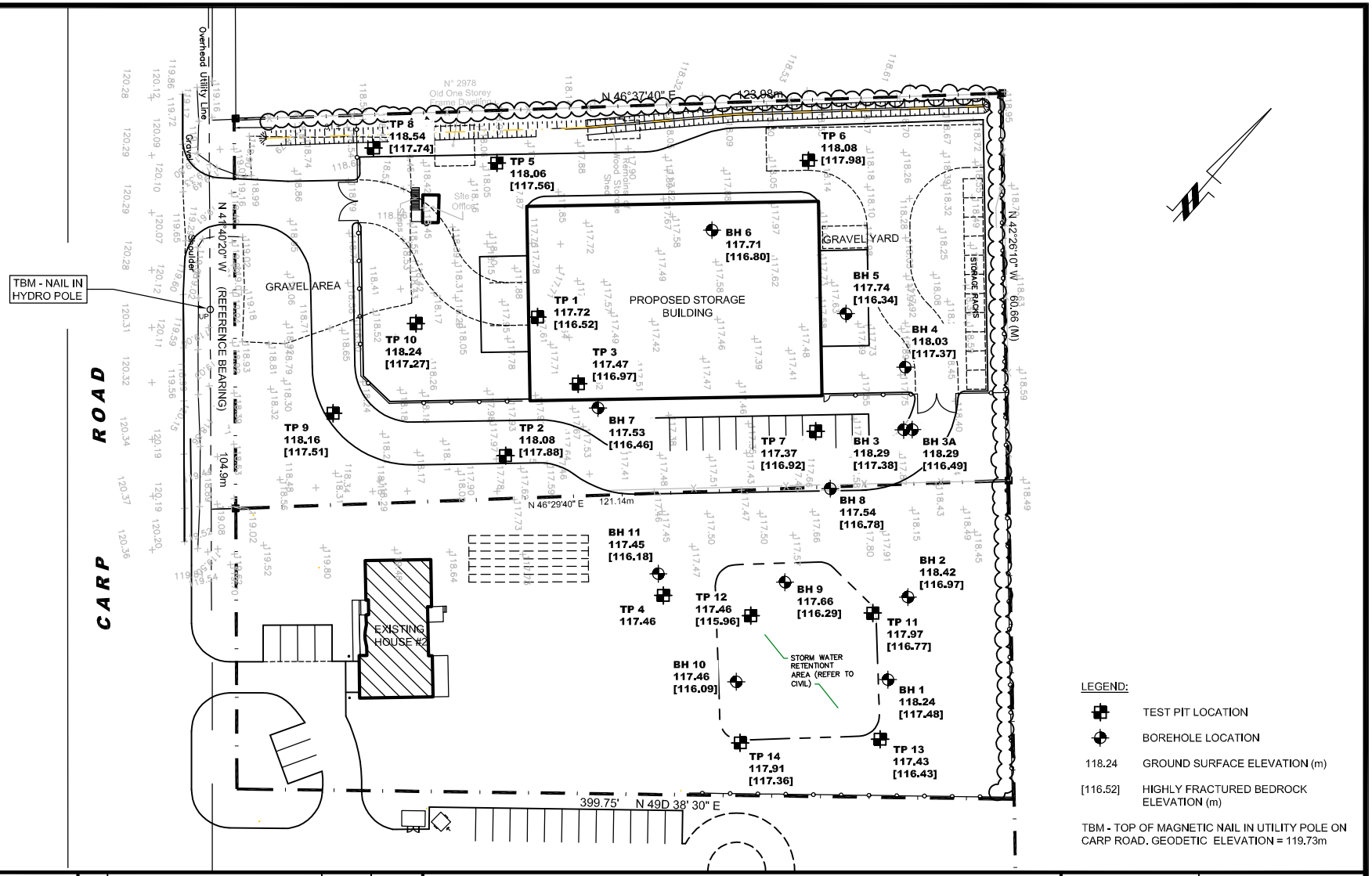


Figure 1 – Key Plan



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

NO.	REVISIONS	DATE	INITIAL
1	BASE PLAN UPDATED	14/11/2016	RG

NAUTICAL LANDS GROUP
GEOTECHNICAL INVESTIGATION
PROPOSED STORAGE BUILDING - 2978 & 2966 CARP ROAD.
OTTAWA, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale: 1:600	Date: 11/2016
Drawn by: RCG	Report No.: PG3834
Checked by: RG	Dwg. No.: PG3834-2
Approved by: RG	Revision No.: 1

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Appendix D DRAWINGS

C.3 Environmental Compliance Approval (ECA)

Ontario

Ministry of the Environment and Climate Change
Ministère de l'Environnement et de l'Action en matière de changement climatique

ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER 9196-AQBQZV
Issue Date: October 6, 2017

York-Hop Corp.
2962 Carp Road
Ottawa, Ontario
K0A 1T0

Site Location: 2978 and 2966 Carp Road
City of Ottawa

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act, R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

the establishment of stormwater management works to service the 1.30 hectare warehouse storage site at 2978 and 2966 Carp Road, in the City of Ottawa, for the collection, treatment and disposal of stormwater run-off, to provide Normal Level quality control and erosion protection, and to infiltrate and attenuate the post-development peak flows for all storm events up to and including the 100-year storm to allowable release rates, consisting of the following:

infiltration basin (catchment area 1.14 ha) located at the southeast corner of the site, with vegetated buffer area providing pre-treatment, comprising of 200 millimetre thick layer of 50 millimetre diameter clear stone covered by filter fabric, to store and infiltrate stormwater run-off from the site, having a total storage volume of approximately 389.6 m 3 , with an emergency overland flow in excess of the 100-year storm to the neighbouring property to the south;

including erosion/sedimentation control measures during construction and all other controls and appurtenances essential for the proper operation of the aforementioned Works;

all in accordance with the submitted supporting documents listed in Schedule "A" forming part of this Approval.

For the purpose of this environmental compliance approval, the following definitions apply:

1. "Approval" means this entire document and any schedules attached to it, and the application;
2. "Director" means a person appointed by the Minister pursuant to section 5 of the EPA for the purposes of Part II.1 of the EPA;
3. "District Manager" means the District Manager of the appropriate local District Office of the Ministry, where the Works are geographically located;
4. "EPA" means the *Environmental Protection Act,* R.S.O. 1990, c.E.19, as amended;
5. "Ministry" means the ministry of the government of Ontario responsible for the EPA and OWRA and includes all officials, employees or other persons acting on its behalf;
6. "Owner" means York-Hop Corp., and includes its successors and assignees;
7. "OWRA" means the *Ontario Water Resources Act*, R.S.O. 1990, c. O.40, as amended;
8. "Works" means the sewage works described in the Owner's application, and this Approval.

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. **GENERAL CONDITIONS**
    1. The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Approval and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.
    2. Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Approval, and the application for approval of the Works.
    3. Where there is a conflict between a provision of any document in the schedule referred to in this Approval and the conditions of this Approval, the conditions in this Approval shall take precedence, and where there is a conflict between the documents in the schedule, the document bearing the most recent date shall prevail.
    4. Where there is a conflict between the documents listed in Schedule "A" and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.
    5. The conditions of this Approval are severable. If any condition of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such condition to other circumstances and the remainder of this Approval shall not be affected thereby.
    6. The issuance of, and compliance with the conditions of, this Approval does not:
        a. relieve any person of any obligation to comply with any provision of any applicable statute, regulation or other legal requirement, including, but not limited to, the obligation to obtain approval from the local conservation authority/MNR necessary to construct or operate the sewage works; or
        b. limit in any way the authority of the Ministry to require certain steps be taken to require the Owner to furnish any further information related to compliance with this Approval.
2. **EXPIRY OF APPROVAL**
    1. This Approval will cease to apply to those parts of the Work which have not been constructed within five (5) years of the date of this Approval.
    2. In the event that completion and commissioning of any portion of the Works is anticipated to be delayed beyond the specified expiry period, the Owner shall submit an application of extension to the expiry period, at least twelve (12) months prior to the end of the period. The application for extension shall include the reason(s) for the delay, whether there is any design change(s) and a review of whether the standards applicable at the time of Approval of the Works are still applicable at the time of request for extension, to ensure the ongoing protection of the environment.
3. **CHANGE OF OWNER**
    1. The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within thirty (30) days of the change occurring:
        a. change of Owner;
        b. change of address of the Owner;

c. change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the *Business Names Act*, R.S.O. 1990, c.B17 shall be included in the notification to the District Manager; or
d. change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the *Corporations Information Act*, R.S.O. 1990, c. C39 shall be included in the notification to the District Manager.

2. In the event of any change in ownership of the Works, other than a change to a successor municipality, the Owner shall notify in writing the succeeding owner of the existence of this Approval, and a copy of such notice shall be forwarded to the District Manager and the Director.
3. The Owner shall ensure that all communications made pursuant to this condition refer to the number at the top of this Approval.

4. **OPERATION AND MAINTENANCE**
   1. If applicable, any proposed storm sewers or other stormwater conveyance in this Approval can be constructed but not operated until the proposed stormwater management facilities in this Approval or any other Approval that are designed to service the storm sewers or other stormwater conveyance are in operation.
   2. The Owner shall make all necessary investigations, take all necessary steps and obtain all necessary approvals so as to ensure that the physical structure, siting and operations of the Works do not constitute a safety or health hazard to the general public.
   3. The Owner shall inspect and ensure that the design minimum liquid retention volume is maintained in the Works at all times, except when maintenance is required.
   4. The Owner shall undertake an inspection of the condition of the Works, at least once a year, and undertake any necessary cleaning and maintenance to ensure that sediment, debris and excessive decaying vegetation are removed from the Works to prevent the excessive build-up of sediment, oil/grit, debris and/or decaying vegetation, to avoid reduction of the capacity and/or permeability of the Works, as applicable. The Owner shall also regularly inspect and clean out the inlet to and outlet from the Works to ensure that these are not obstructed.
   5. The Owner shall design, construct and operate the Works with the objective that the effluent from the Works is essentially free of floating and settleable solids and does not contain oil or any other substance in amounts sufficient to create a visible film, sheen, foam or discoloration on the receiving waters.
   6. The Owner shall ensure the immediate clean-out of the Works after a fuel or oil spill capture.
   7. The Owner shall ensure that equipment and material for the containment, clean-up and disposal of fuel and oil and materials contaminated with such, is on hand and in good repair for immediate use in the event of:
      a. loss of fuel or oil to the Works; or
      b. a spill within the meaning of Part X of the EPA.
   8. The Owner shall maintain a logbook to record the results of these inspections and any cleaning and maintenance operations undertaken, and shall keep the logbook at the Owner's administration office for inspection by the Ministry. The logbook shall include the following:
      a. the name of the Works;
      b. the date and results of each inspection, maintenance and cleaning, including an estimate of the quantity of any materials removed and method of clean-out of the Works; and
      c. the date of each spill within the catchment area, including follow-up actions and remedial measures undertaken.
   9. The Owner shall prepare an operations manual prior to the commencement of operation of the

Works that includes, but is not necessarily limited to, the following information:

a. operating and maintenance procedures for routine operation of the Works;
b. inspection programs, including frequency of inspection, for the Works and the methods or tests employed to detect when maintenance is necessary;
c. repair and maintenance programs, including the frequency of repair and maintenance for the Works;
d. contingency plans and procedures for dealing with potential spills and any other abnormal situations and for notifying the District Manager; and
e. procedures for receiving, responding and recording public complaints, including recording any follow-up actions taken.

10. The Owner shall maintain the operations manual current and retain a copy at the location of the Works for the operational life of the Works. Upon request, the Owner shall make the manual available to Ministry staff.

5. **TEMPORARY EROSION AND SEDIMENT CONTROL**
   1. The Owner shall install and maintain temporary sediment and erosion control measures during construction and conduct inspections once every two (2) weeks and after each significant storm event (a significant storm event is defined as a minimum of 25 mm of rain in any 24 hours period). The inspections and maintenance of the temporary sediment and erosion control measures shall continue until they are no longer required and at which time they shall be removed and all disturbed areas reinstated properly.
   2. The Owner shall maintain records of inspections and maintenance which shall be made available for inspection by the Ministry, upon request. The record shall include the name of the inspector, date of inspection, and the remedial measures. if any, undertaken to maintain the temporary sediment and erosion control measures.
6. **REPORTING**
   1. One (1) week prior to the start-up of the operation of the Works, the Owner shall notify the District Manager (in writing) of the pending start-up date.
   2. The Owner shall, upon request, make all manuals, plans, records, data, procedures and supporting documentation available to Ministry staff.
   3. The Owner shall prepare and submit a performance report to the District Manager on an annual basis, within ninety (90) days following the end of the period being reported upon. The first such report shall cover the first annual period following the commencement of operation of the Works and subsequent reports shall be submitted to cover successive annual periods following thereafter. The reports shall contain, but shall not be limited to, the following information:
      a. a description of any operating problems encountered and corrective actions taken;
      b. a summary of all maintenance carried out on any major structure, equipment, apparatus, mechanism or thing forming part of the Works, including an estimate of the quantity of any materials removed from the Works;
      c. a summary of any complaints received during the reporting period and any steps taken to address the complaints;
      d. a summary of all spill or abnormal discharge events; and
      e. any other information the District Manager requires from time to time.
7. **SPILL CONTINGENCY PLAN**
   1. Within six (6) months from the issuance of this Approval, the Owner shall implement a spill contingency plan - that is a set of procedures describing how to mitigate the impacts of a spill within the area serviced by the Works. The Owner shall, upon request, make this plan available to Ministry staff. This plan shall include as a minimum:

With every community, we redefine what's possible.

Stantec is a global leader in sustainable engineering, architecture, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.

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