Prepared for:

Omar Alnader

2742 DUNROBIN ROAD

HYDROLOGY AND STORMWATER MANAGEMENT ASSESSMENT MEMO

Prepared by:

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Reference #: 67067

October 2023

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1.0 Introduction

Omar Alnader, herein referred to as the Client, requested the professional services of Aquafor Beech Limited to perform a technical assessment of site hydrology and stormwater management design for their proposed development site located at 2742 Dunrobin Road within the City of Ottawa.

2.0 Site Overview

The subject site is approximately 0.42 hectares in size and exists as an empty, undeveloped lot adjacent to Dunrobin Road. The site is generally flat with slopes between 1-2% and drains from South to North. Right of Way property adjacent to the site's Southern extent drains to an existing roadside ditch along Dunrobin Road. As noted by the Client, site runoff drains to a watercourse approximately 100m downstream of the site with Constance Lake being the ultimate receiver.

3.0 Regulatory Agency Design Requirements

As per correspondence between the Client, the City of Ottawa, and the Mississippi Valley Conservation Authority, an engineering review of stormwater management (SWM) for the proposed site is required, including:

- Post to Pre-Development peak flow quantity control for portions of the site draining North to the watercourse;
    - For any portions draining South to the Dunrobin Road ditch, 100-year post to 5-year pre-development peak flow control is required per City correspondence on May 4th 2022 included as **Appendix A**.
- Provision of level 1 or enhanced quality control (ie. 80% Total Suspended Sediment removal);
- Investigation into subsurface infiltration rates where Low Impact Development features are proposed; and,
    - Where infiltration facilities are proposed, ensure a maximum drawdown time of 24 hours. It should be noted that a 48-92 hours drawdown is permitted per Section 3.5.2 of the Low Impact Development Technical Guidance Report (Feb 2021).

In addition to the above, Aquafor Beech recommends two additional considerations as part of the analysis to provide further assurance to the City of an adequate SWM design:

- Provision of a SWM treatment train for the site;
- Maintenance of pre-development water balance conditions through the use of infiltration-based stormwater management controls;
- Control of the 90th percentile storm event (26mm depth per Draft Low Impact Development Stormwater Management Guidance Manual, MECP 2017) using multiple mechanisms including infiltration, filtration, evapotranspiration, re-use, and detention; and,
- Consideration of future hydrologic conditions as part of the post development hydrology to account for the effects of Climate Change.
- 1m separation from seasonally high groundwater elevation and bedrock

4.0 Background Information Review

The following documentation was referenced as part of the background review in establishing the hydrologic and stormwater management assessment:

- City of Ottawa Sewer Design Guidelines, Second Edition (October 2012)

- Western University IDFCC Tool Version 6.0 (ICLR-FIDS, 2021)
- Permeameter Testing and Geotechnical Assessment Proposed Commercial Development 2740 Dunrobin Road – Ottawa (Patterson Group, June 2021)
- Subsurface Investigation Proposed Commercial Development 2742 Dunrobin Road – Ottawa (Patterson Group, June 29, 2022)
- Existing Site Topographic Survey, D.B. Grey Engineering Inc. (October, 2021)
- Draft Low Impact Development (LID) Stormwater Management Guidance Manual (MECP, 2017)
- Various correspondence

5.0 Hydrologic Assessment

An assessment of pre and post-development hydrologic conditions was completed in support of the quantity and quality control requirements outlined in Section 3.0. Design storm parameters were referenced from both the City of Ottawa Sewer Design Guidelines and the Western University IDFCC Tool. Upon comparison, the IDFCC tool is the more conservative thus, design storm parameters for the 2 through 100-year events were evaluated in a secondary analysis using the IDFCC tool for the Ottawa CDA RCS (ID #6105978) station, located at the Ottawa Experimental Farm.

5.1 Catchment Delineation

Existing and proposed catchments were developed using existing and proposed site topography provided by D.B. Grey Engineering. Composite runoff coefficients were calculated based upon surface cover and percentage of total catchment area. Values for runoff coefficients were adopted from the City of Ottawa Sewer Design Guidelines. For the proposed condition, a conservative Runoff Coefficient of 0.10 for the permeable pavement parking lot been adopted per the California Stormwater Quality Association (CASQA) 2003. It should be noted that in practice, the Runoff Coefficient for permeable pavement parking lot such as the EcoRaster grid system overlain on a clearstone base as proposed would have an effective Runoff Coefficient of zero. **Table 5-1** below outlines pre- and post-development catchment parameters.

Table 5-1: Pre- and Post-Development Catchment Parameters

Attribute	North Catchment		South Catchment	
	Pre-Development	Post-Development	Pre-Development	Post-Development
Catchment Area (ha)	0.42	0.42	0.0386	0.0386
Runoff Coefficient	0.33	0.26	0.3	0.3
Percent Impervious (%)	5	6	0	0

5.2 Time of Concentration

Time of concentration was calculated for both the existing and proposed site conditions. Existing time of concentration was developed via Airport method due to the existing site having a runoff coefficient of less than 0.4. The existing conditions time of concentration for the north catchment was determined to be 18 minutes. During the proposed conditions, no runoff will be leaving the parking lot up to and including during the 100-year event. As such, the time of concentration for the tree grove and meadow proposed in the northern part of the site was determined to be 13 minutes. The time of concentration for the south catchment was 11 minutes during existing conditions and 13 minutes during proposed conditions. Time of concentration calculations are provided within **Appendix B**.

5.3 Return Period Flows and Volumes

The following peak flow and total runoff volume for the 2 through 100-year design storm events have been generated for existing, proposed conditions, and proposed conditions with climate change per the City of Ottawa requirements.

However, the assessment of Low Impact Development volume-based controls using IDF curves and parameters provides an overly conservative estimate of LID performance and therefore underestimates the effect of the controls in the in-situ conditions. A more appropriate assessment of LID performance is to utilize a volume-based storage approach and noted in the subsequent section.

Table 5-2 displays the existing conditions peak flow and total runoff volume for the 2 through 100-year design storm event.

Table 5-2: Existing Conditions Peak Flow and Runoff Volume

Return Period	2	5	10	25	50	100
North Catchment						
Precipitation Intensity (mm/hr)	55.6	70.4	80.5	93.0	102.0	111.0
Precipitation Depth (mm)	48.5	63.4	73.4	85.9	95.2	104.5
Peak Flow (L/s)	21.7	27.5	31.4	39.9	47.7	54.1
Driveway Runoff Volume (m^3)	10.7	14.0	16.1	18.9	20.9	23.0
Pasture Runoff Volume (m^3)	57.8	75.7	87.6	112.8	136.4	155.9
Runoff Volume (m^3)	68.5	89.7	103.7	131.7	157.4	178.9
South Catchment						
Precipitation Intensity (mm/hr)	71.9	90.2	102.6	118.1	129.2	140.3
Precipitation Depth (mm)	48.5	63.4	73.4	85.9	95.2	104.5
Peak Flow (L/s)	2.3	2.9	3.3	3.8	4.2	4.5
Runoff Volume (m^3)	5.6	7.3	8.5	9.9	11.0	12.1

Table 5-3 below displays the proposed conditions peak flow and total runoff volume for the 2 through 100-year design storm event.

Table 5-3: Proposed Conditions Peak Flow and Runoff Volume

Return Period	2	5	10	25	50	100
North Catchment						
Precipitation Intensity (mm/hr)	44.0	56.0	64.2	74.4	81.8	89.2
Precipitation Depth (mm)	48.5	63.4	73.4	85.9	95.2	104.5
Peak Flow (L/s)	19.2	24.3	27.7	35.1	42.0	47.6
Driveway & Parking Runoff Volume (m^3)	83.3	109.1	126.2	147.8	163.8	179.7
Tree Grove and Meadow Runoff Volume (m^3)	36.0	47.2	54.6	63.9	70.8	77.7
Total Runoff Volume (m^3)	119.4	156.3	180.8	211.7	234.6	257.4

Return Period	2	5	10	25	50	100
South Catchment						
Precipitation Intensity (mm/hr)	65.1	81.9	93.4	107.7	118.0	128.2
Precipitation Depth (mm)	48.5	63.4	73.4	85.9	95.2	104.5
Peak Flow (L/s)	2.1	2.7	3.0	3.5	3.8	4.2
Runoff Volume (m^3)	5.6	7.3	8.5	9.9	11.0	12.1

Table 5-4 below displays the proposed conditions peak flow and total runoff volume for the 2 through 100-year design storm event during the climate change scenario.

Table 5-4: Proposed Climate Change Conditions Peak Flow and Runoff Volume

Return Period	2	5	10	25	50	100
North Catchment						
Precipitation Intensity (mm/hr)	48.2	61.9	71.2	80.4	91.1	98.8
Precipitation Depth (mm)	51.9	67.3	78.8	95.3	110.1	124.8
Peak Flow (L/s)	21.3	27.1	30.8	37.2	45.8	50.8
Driveway & Parking Runoff Volume (m^3)	89.23	115.72	135.50	163.95	189.34	214.57
Tree Grove and Meadow Runoff Volume (m^3)	38.60	50.06	58.61	78.01	98.28	116.02
Total Runoff Volume (m^3)	127.83	165.78	194.11	241.96	287.62	330.59
South Catchment						
Precipitation Intensity (mm/hr)	72.3	91.6	104.0	113.6	128.1	136.1
Precipitation Depth (mm)	51.9	67.3	78.8	95.3	110.1	124.8
Peak Flow (L/s)	2.3	3.0	3.4	3.7	4.2	4.4
Runoff Volume (m^3)	6.0	7.8	9.1	11.0	12.7	14.4

5.4 Water Quality Control

Per the MECP Draft Low Impact Development (LID) Stormwater Management Guidance Manual, the 90^{th} percentile event total rainfall depth for the site location is 26mm. With a total proposed developed area of 0.17ha, this translates to a volume control target of $45m^3$.

5.5 Infiltration Rate

Paterson Group completed permeameter testing of the site to determine the infiltration rate of the native soils, finding an infiltration rate between 22-28 mm/hr. When applying appropriate safety factors, Paterson indicated that the design infiltration rate can be considered at 8.0 mm/hr (**Appendix C)**.

5.6 Groundwater Conditions

Groundwater conditions were assessed as part of the Subsurface Investigation and Groundwater Monitoring Proposed Commercial Development 2742 Dunrobin Road Ottawa (Patterson Group, September 1, 2023), provided under separate cover. Groundwater conditions were measured once every 24 hours during a 12-month period from June 2022 to June 2023. It was determined that the site groundwater levels varied to a high degree due to the influence of a significant response immediately following substantial rainfall events. Thus, the inferred groundwater level, which excludes the rainfall event responses, was conservatively estimated at 62.2masl to a maximum elevation of 64.4masl. For the purpose of the permeable parking lot design, proposed grades and facility depth were prepared such that a minimum 1.0m offset from the stone storage layer invert of 65.51m to maximum groundwater elevation is provided.

The groundwater conditions assessment also investigated mounding risk and determined that, with a 1.0m clearance provided from the invert of the stone storage layer to the maximum groundwater elevation, up to 147m^3 of stored runoff could be infiltrated while the remaining runoff volume is pumped to the evapotranspiration tree grove area for storage and detention.

6.0 Proposed Stormwater Management Design Targets

Per the hydrology assessment results displayed in **Table 5-2** and **Table 5-4** above, the proposed stormwater management design requirements include the following:

- Quantity control
  - From the north catchment, limit 100-year discharge flows leaving the proposed site to 54.1L/s
  - From the south catchment, limit 100-year discharge flows leaving the site to 2.9L/s (5-year pre-development peak flow)
  - Capture and detain a minimum of 79m^3 (152m^3 in climate change scenario) of runoff via LID approaches
- Quality control
  - Provide storage for control (through infiltration, evapotranspiration and re-use) of 45m^3 of storm runoff to achieve level 1 – enhanced quality control
- LID Drainage
  - Ensure drainage of all proposed LID features does not exceed 92 hours

7.0 Stormwater Management Design

To achieve the design criteria outlined above, a permeable parking lot, plus soil amendments and an evapotranspiration (ET) tree grove and meadow in the undeveloped portion of the site are proposed to control the flows and volumes from the north catchment. As the 100-year post-development peak flows to Dunrobin Ditch exceed the 5-year predevelopment flows, runoff from the south catchment will be diverted into a bioretention/dry pond facility to control peak flows into the Dunrobin Road ditch. These features are described in more detail below, and presented in the conceptual design in **Figure 1**.

7.1 Permeable Parking Lot

The parking lot will be designed with permeable pavement, specifically Ecoraster E40. Ecoraster E40 is a plastic paver grid that will be filled with open graded stone (ASTM No. 8 or alternative). The Ecoraster grid will be placed over 450mm of 19mm clearstone, which will act as a storage reservoir. The Ecoraster profile will provide 265m^3 of storage, which exceeds the 180m^3 (215m^3 in climate change scenario) of water generated by the 100-year event over the parking lot surface and driveway combined. Post-development peak flows from the parking lot are therefore 0L/s.

Per Section 3.5.1 of the Low Impact Development Technical Guidance Report (Feb 2021), there is no minimum or restriction on infiltration rate for the application of LIDs. However, as the design infiltration rate of the native soil is 8mm/hr, a subdrain is required for the parking lot. This subdrain will connect to a control manhole, located on the north side of the parking lot. The control manhole will restrict the outlet flows, such that water held in the Ecoraster profile will infiltrate into the native soils beneath the parking lot to achieve the water quality and water balance targets. With a total storage of 265m^3, an infiltration rate of 8mm/hr, and a footprint of 1,476m^2, the drawdown time is 63 hours.

Excess volume beyond the 100-year event and or if performance of the permeable pavements should decrease over time, as a redundant measure, the control manhole will be equipped with a submersible pump and float device. Storage volumes above the designed 265m^3 of storage and/or should draw-down time exceed 92 hours, the pump will discharge to the soil amendment and evapotranspiration tree grove and meadow as detailed in the following section. A Tsurumi HS(Z)3.75SL submersible pump with a maximum flow rate of 140GPM was adopted for the purpose of the following analysis shown in Table 7-1.

Table 7-1 below highlights the drawdown vs pump use of the system under various storm events and an example of a reduced infiltration rate.

Table 7-1: Permeable Parking Lot Drawdown Scenario Analysis.

Design Component	Return Period (yrs)	
	2	100
Storage Elevation (m)	65.66m	65.88m
Drawdown Volume (m^3)	89	147
Drawdown Time (hrs)	19	31
Pump Volume (m^3)	0	68
Pump Time (hrs)	0	2.25

To ensure the groundwater mounding does not exceed 1.0m, the submersible pump's float elevation shall be initially set to trigger at an elevation of 65.88m, associated with 147m^3 of storage within the stone layer. Over time, if monitoring of the permeable parking lot yields reduced drawdown rates of the stone storage layer, the float trigger elevation shall be lowered further to ensure the drawdown time within the stone storage layer does not exceed 92 hours.

7.2 Soil Amendments and ET Tree Grove and Meadow

The rear (North 1/3rd) of the site will not be developed, and as such is proposed to include an evapotranspiration area (i.e. an early succession treed meadow) with 300mm of amended topsoil. Per the City of Ottawa Soil Amendment Requirements for Pinecrest Creek/Westboro Area (Draft 2013), as presented in **Appendix D**, the native soil will be amended with a total of 100mm of amendment material, placed in layers with existing topsoil, and mixed. **Figure 1** presents the Amendment Method detail to illustrate this process. Three shallow basins, at 300mm depth, will be excavated from the flow path through the tree grove and meadow. This area does not rely on infiltration, rather is designed to maximize evapotranspiration. In essence the rear of the site is being designed as a sponge, relying in the moisture holding capacity of the amended soil profile

The shallow basins are designed to slow the water down to allow the water to soak into the amended topsoil profile, where it is then available for uptake by the meadow plantings and the trees. These areas are graded to permit a maximum of 300mm of ponding in the 100-year event. In less frequent rainfall events, these areas would not have observable ponded water.

The amended soils will provide 10m^3 of storage, while the stormwater basins will provide an additional 47m^3 of storage, for a total of 57m^3 out of the total of 78m^3 (116m^3 in climate change scenario) of runoff generated by the tree grove and meadow during the 100-year event. This is already less than the 156m^3 of runoff volume generated in the pre-development scenario. Therefore, only 21m^3 (59m^3 in climate change scenario) of water will leave the site, exceeding the design criteria. Infiltration into the subsoils may occur to some degree, but has conservatively not been accounted for in any design calculations. The rear (North 1/3rd) of the site is reliant only on the properties of the amended topsoil and the vegetation.

The peak flow calculations presented in **Table 5-3** and **Table 5-4** reflect the uncontrolled release rates; due to the storage, evapotranspiration, and uptake of 57m^3, the ultimate release rates will be lower.

Table 7-2: Storage Volume Provided by SWM Features

	Storage Volume Provided (m^3)	Runoff Volume Generated (m^3)	Runoff Volume Generated in Climate Change Scenario (m^3)
Ecoraster Parking Lot Profile	265	180	215
Soil Amendments and Tree Grove and Meadow	57	78	116

Post-development peak flow generated from the northern catchment and released north of the site is less than the pre-development flow for all 2-100 year events.

7.2.1 Evapotranspiration

In addition, the northern section of the site will be planted with early succession trees and shrubs to enhance evapotranspiration (ET). Average ET was estimated using weather data from Kanata-Orleans[1] from October 2019 to July 2022 using the Penman-Monteith equation, adjusted for vegetation type using crop coefficients. A coefficient of 0.75 was used for existing conditions, assumed to be perennial grasses, and increased to 0.9 for proposed conditions, consisting of perennial grasses, deciduous trees and shrubs[2]. As presented in **Table 7-3**, during the summer months, more than 3m^3 of water will be released through ET per day.

Table 7-3: Evapotranspiration Rates under Existing and Proposed Conditions

	Existing ET Rate (mm/d)	Proposed ET Rate (mm/d)	Proposed ET Volume (m^3/d)
Jan	0.41	0.49	0.33
Feb	0.68	0.81	0.55
Mar	1.31	1.57	1.07
Apr	2.36	2.84	1.93
May	3.70	4.43	3.02
Jun	3.92	4.70	3.20
Jul	4.03	4.84	3.29

[1] https://ottawa.weatherstats.ca/

[2] Corbari, C., Ravazzani, G., Galvagno, M., Cremonese, E., and Mancini, M. (2017). Assessing Crop Coefficients for Natural Vegetated Areas Using Satellite Data and Eddy Covariance Stations. *Sensors*. 17(11):2664.

	Existing ET Rate (mm/d)	Proposed ET Rate (mm/d)	Proposed ET Volume (m^3/d)
Aug	3.41	4.10	2.79
Sep	2.35	2.82	1.92
Oct	1.30	1.56	1.06
Nov	0.86	1.04	0.71
Dec	0.52	0.63	0.43

7.2.2 Planting/Restoration Considerations

Vegetation is an integral functional component of the above stormwater management design, contributing to the maintenance of infiltration rates, erosion protection, evapotranspiration rates and filtration of stormwater. Consequently, it is important that the vegetation community be maintained appropriately in order to ensure that the facility performs as originally intended over the long-term. It is recommended that all vegetation selected for the tree grove and meadow are native species that are well adapted to wet conditions.

All vegetation communities should be monitored to confirm their health and identify any factors that may act as stressors and contribute to the eventual decline of specific species or the entire vegetation community. At a minimum, vegetation communities should be assessed at least twice a year to identify signs of dieback, infestation or disease.

The following maintenance activities should be implemented.

A. Tree and Shrub Maintenance and Management

- Adjust stakes and guys to prevent girdling
- Ensure rodent protection measures are functional and remain in contact with the ground.
- Prune out dead or damaged limbs of the plant
- Water trees as required to maintain tree health when necessary.
- Top up mulch as required.

B. Seeded Area Maintenance

- Monitor after initial seeding to ensure that adequate cover density is achieved.
- Overseed as required to eliminate bare patches.
- Repair and reseed any rills or gullies that may have formed.
- Remove any weeds that may have become established during the germination and grow-in periods.
- Irrigate seeded areas as required to ensure adequate germination and growth.

C. Shrubs and Shrub Beds

- Prune out dead or damaged branches.
- Remove weeds from mulched beds, ensure that adequate levels of mulch are maintained.
- Water shrubs to ensure healthy growth as dictated by meteorological trends and species requirements.

7.2.3 Bioretention/Dry Pond

The City requires any runoff into the Dunrobin Road ditch to be controlled to the pre-development 5-year peak flow. Only a small area drains to the Dunrobin Road ditch, and this area will not be developed. As the 5-year pre-development peak flow is 2.9L/s and the 100-year post-development peak flow is 4.2L/s (4.4L/s in climate change scenario), a small bioretention/dry pond facility will be constructed to control these flows to 2.9L/s.

A 40m^3 bioretention/dry pond facility is proposed at the southeast corner of the site. A berm will be constructed along the southern property line to divert flows into the facility. Most runoff to the facility will be infiltrated, but excess flows will discharge into the Dunrobin Road ditch over an outlet control weir that is sized to maintain flows to a maximum of 2.9L/s.

7.3 Erosion Potential Assessment

The overall design aims to:

1. Avoid concentrated flows to and from the various LID facilities; and/or,
2. Ensure the major overland flow routes offsite maintain non-erosive flow rates at the property line based on expected surface treatments

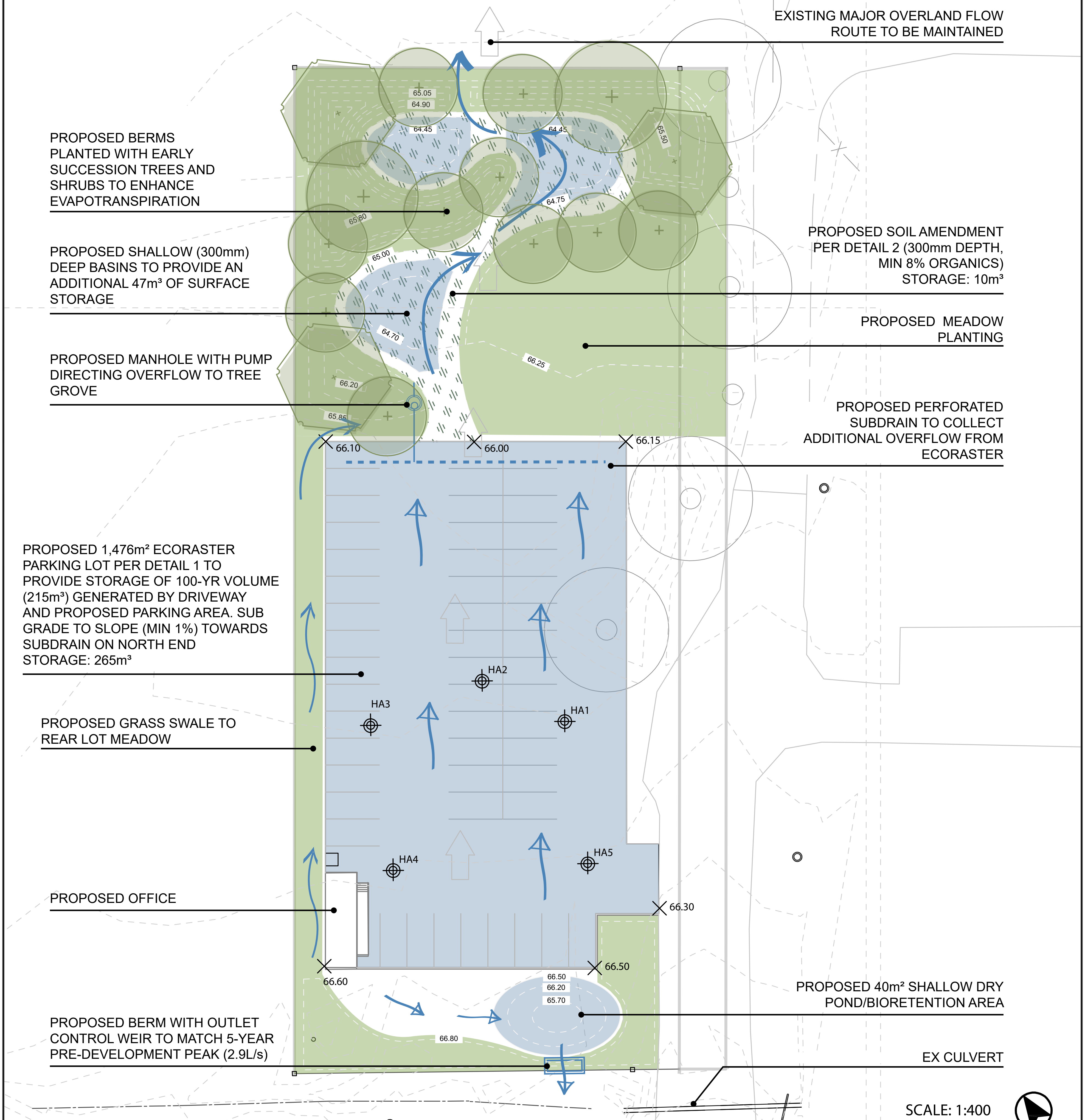
Runoff discharge is expected to occur on the site during the 100-year event from both the South and North portions. The South drainage portion shall adopt a weir design to control peak runoff to 2.9l/s under the 5-year event, and has an expected release rate of 4.4 l/s under 100-year event climate change conditions. This small discharge rate combined with site grading shown in **Figure 1** that prevents concentrated flows around the South outlet point will produce negligible erosive force.

An erosion threshold assessment was completed however for the North outlet due to the estimated 50.8l/s release rate under the 100-year event climate change conditions. The assessment referenced critical velocity thresholds outlined in *Stability Thresholds for Stream Restoration Materials* (Fischenich. C, May 2001). Table 2 of this document was referenced for cohesive soils containing a short native grasses surface treatment, allowing a conservative critical velocity of 3 ft/s or 0.91m/s. **Table 7-4** summarizes the findings of this assessment.

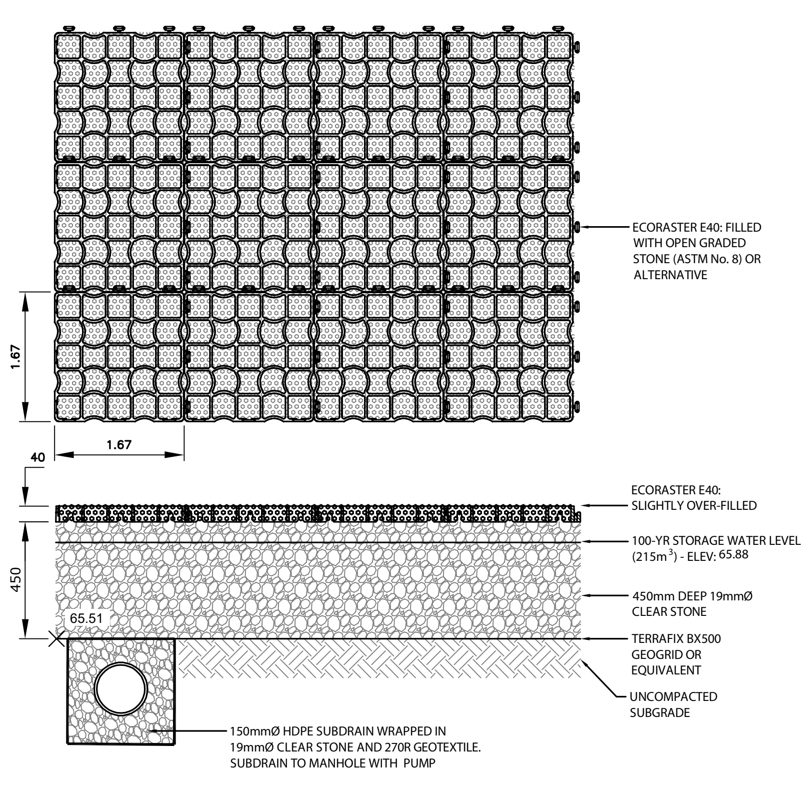
Table 7-4: North Outlet Critical Velocity Erosion Assessment.

Parameter	Value	Units
Material	short native grasses	mm
Max. Flow Depth	0.15	m
Bottom width	1	m
Top Width	1.6	m
Flow Area	0.22	m2
Hyd. Rad.	0.15	m
Flow Velocity	**0.23**	**m/s**
Flow Capacity	0.051	cms
Critical Velocity	**0.910**	**m/s**

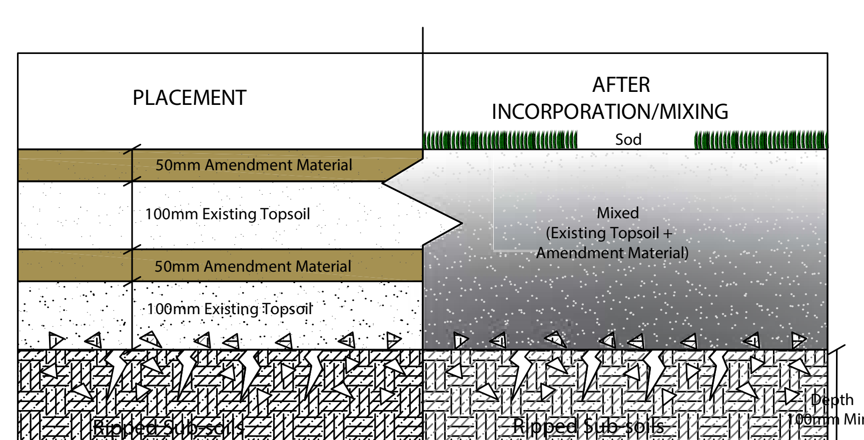
From this assessment, the expected surface treatment of short native grasses has sufficient erosion resistance to ensure flows can be discharged offsite with negligible risk for erosion.



2742 DUNROBIN RD SWM CONCEPT



DTL 01 ECORASTER PARKING LOT DETAIL



NOTES:

1. DETAIL PER CITY OF OTTAWA SOIL AMENDMENT REQUIREMENTS FOR PINECREST CREEK/WESTBORO AREA (DRAFT 2013)

DTL 02 SOIL AMENDMENT DETAIL

8.0 Conclusion and Recommendations

The proposed design achieves the required criteria as outlined by the City of Ottawa and Mississippi Valley Conservation Authority, as summarized in **Table 8-1.** **T**he design achieves all criteria.

Table 8-1: Design Summary

	Criteria	Design
Water Quantity (draining north)	Post- to pre-development control for all storms (i.e. 2, 5, 10, 25, 50 and 100 year)	Post- to pre-development control for all storms
Water Quantity (draining south)	100-year post to 5-year pre-development peak flow control	100-year post to 5-year pre-development peak flow control (2.9L/s)
Peak Flow (draining north)	Limit 100-year discharge flows leaving the proposed site to 54.1L/s	100-year discharge at 47.6L/s (50.8L/s in climate change scenario)
Depth to Bedrock and Groundwater	>1m below base of LIDs	>1m below base of permeable pavement reservoir and bioretention
Water Quality	Level 1 or enhanced quality control (ie. 80% Total Suspended Sediment removal);	Achieved through control of the 90th percentile storm runoff volume
Water Balance	-	Achieved through capture and infiltration of frequent storm events
Drawdown Time	<92 hours	31 hours during 100-year event

To ensure that the benefits of the facility design is realized and that adjustments do not cause potential erosion and water quality concerns, the following recommendation regarding implementation and monitoring of the design is provided below.

<u>Construction Supervision</u> – to ensure that the objective of the proposed facility design is obtained, it is important that an experienced individual in LID facility design be part of the construction supervision. The supervision will enable construction issues to be addressed quickly and appropriately. This individual will be on-site to ensure that important design details as those listed below are implemented:

- Bioretention and bioswale facility dimensions and configuration;
- Placement of key elevation point with respect to the facility configurations (e.g. invert elevations);
- Installation of outlet structures; and
- Ensure construction works are kept within the allowable footprint.

Appendix A – City Correspondence

From:	Whittaker, Damien <Damien.Whittaker@ottawa.ca>
Sent:	Wednesday, May 4, 2022 11:54 AM
To:	Stephen Arends
Cc:	Morgan, Brian; Brown, Adam; Omar Alnader
Subject:	RE: 22-5025A Omar Alnader - Parking Lot LID (D07-12-20-0173 - 2742 Dunrobin Rd)

Hello Stephen,

As stated in the call this morning, the criteria should be more stringent than stated, but the City will allow the applicant to proceed as is. The application should seek legal opinion on natural drainage and conform to those requirements. The area has development and therefore a straight post-development to pre-development approach to quantity control is not appropriate.

City staff area available to discuss and/or meet to discuss issues or to clarify issues.

Regards,

Damien Whittaker, P.Eng
Senior Engineer - Infrastructure Applications ▪ Ingénieur principal - applications d'infrastructure
Development Review, Rural Services Unit ▪ Examen des projets d'eménagement, Unité des services ruraux
Planning, Real Estate and Economic Development Department ▪ Direction générale de la planification, des biens immobiliers et du développement économique
City of Ottawa | **ville d'Ottawa** ▪ damien.whittaker@ottawa.ca ▪ 01-14

*** please note that I will be on vacation starting June 30 and returning to work July 12, 2022 ***

From: Stephen Arends <StephenA@jp2g.com>
Sent: May 03, 2022 10:42 AM
To: Whittaker, Damien <Damien.Whittaker@ottawa.ca>
Cc: Morgan, Brian <Brian.Morgan@ottawa.ca>; Brown, Adam <Adam.Brown@ottawa.ca>; Omar Alnader <omaralnader@gmail.com>
Subject: RE: 22-5025A Omar Alnader - Parking Lot LID (D07-12-20-0173 - 2742 Dunrobin Rd)

Hi Damien,

My cell is 613-868-1350.

I'll chat with you then.

Thanks,

Stephen Arends, P.Eng.
Senior Project Manager
Jp2g Consultants Inc.

Email: stephena@jp2g.com | Web: www.jp2g.com
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Jp2g Consultants Inc.
ENGINEERS · PLANNERS · PROJECT MANAGERS

From: Whittaker, Damien <Damien.Whittaker@ottawa.ca>
Sent: May 3, 2022 10:32 AM
To: Stephen Arends <StephenA@jp2g.com>
Cc: Morgan, Brian <Brian.Morgan@ottawa.ca>; Brown, Adam <Adam.Brown@ottawa.ca>; Omar Alnader <omaralnader@gmail.com>
Subject: RE: 22-5025A Omar Alnader - Parking Lot LID (D07-12-20-0173 - 2742 Dunrobin Rd)

Hello Stephen,

I am available to discuss the issue tomorrow morning at 11 am; can you please tell me which number I should call you at?

Thank you,

Damien Whittaker, P.Eng
Senior Engineer - Infrastructure Applications ▪ Ingénieur principal - applications d'infrastructure
Development Review, Rural Services Unit ▪ Examen des projets d'eménagement, Unité des services ruraux
Planning, Real Estate and Economic Development Department ▪ Direction générale de la planification, des biens immobiliers et du développement économique
City of Ottawa | ville d'Ottawa ▪ damien.whittaker@ottawa.ca ▪ 01-14

*** please note that I will be on vacation starting June 30 and returning to work July 12, 2022 ***

From: Stephen Arends <StephenA@jp2g.com>
Sent: May 03, 2022 9:26 AM
To: Whittaker, Damien <Damien.Whittaker@ottawa.ca>
Cc: Morgan, Brian <Brian.Morgan@ottawa.ca>; Brown, Adam <Adam.Brown@ottawa.ca>; Omar Alnader <omaralnader@gmail.com>
Subject: 22-5025A Omar Alnader - Parking Lot LID (D07-12-20-0173 - 2742 Dunrobin Rd)

Hi Damien,

I've just finished a phone call with Brian to discuss the D07-12-20-0173 - 2742 Dunrobin Rd site. I am requesting the stormwater management criteria be revised to post to pre for stormwater draining towards the watercourse, while maintaining 100-year post to 5-year pre for all flows draining towards the Dunrobin Road ditch. The existing flows draining towards the rear of the site are conveyed via overland flow, captured by a watercourse (approx. 85 - 100m downstream of the site), and drain into Constance Lake. I believe that a post to pre criteria would be reasonable outside the urban City area, for drainage not directed towards a City sewer or ditch network. I also believe that a post to pre criteria would be consistent with Conservation Authority recommendations and is certainly acceptable criteria used on designs within the Ottawa Valley, for MTO, other Eastern Ontario jurisdictions, etc.

I would appreciate a chance to discuss this with you directly. Do you have time available within the next week to review this with me? I am generally available.

Thanks,

Stephen Arends, P.Eng.
Senior Project Manager
Jp2g Consultants Inc.

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Appendix B – Design Calculations

North Catchment

Existing Conditions Catchment Parameters

	Area (ha)	Runoff Coefficient
Pasture - Flat	0.398	0.3
Driveway	0.022	0.9
Composite RC		0.33
Total Drainage Area (ha)	0.42	
Imp Area (ha)	0.02200	
Imperviousness (%)	0.05641026	

Existing Time of Concentration	
Flow Path Length (m)	75
Drainage Slope (%)	2
Drainage Area (ha)	0.42
Time of Concentration (min)	17.26205789
Time of Concentration (hrs)	0.287700965

osed Time of Concentration for Tree Grove & Mea	
Flow Path Length (m)	40
Drainage Slope (%)	1.5
Drainage Area (ha)	0.248
Minutes	14.42870876
Hours	0.240478479

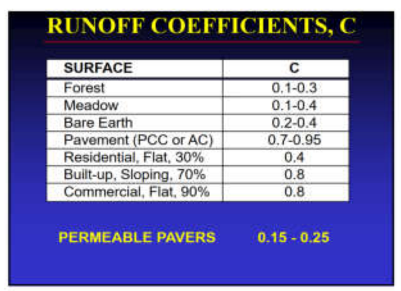
Existing Conditions Hydrology						
Return Period	2	5	10	25	50	100
Precipitation Intensity (mm/hr)	55.6	70.4	80.5	93.0	102.0	111.0
Peak Flow (l/s)	21.7	27.5	31.4	39.9	47.7	54.1
Driveway Runoff Volume (m3)	10.7	14.0	16.1	18.9	20.9	23.0
Pasture Runoff Volume (m3)	57.8	75.7	87.6	112.8	136.4	155.9
Total Runoff Volume (m3)	68.5	89.7	103.7	131.7	157.4	178.9

Proposed Conditions Hydrology						
Return Period	2	5	10	25	50	100
Precipitation Intensity (mm/hr)	62.0	78.2	89.2	102.9	112.8	122.6
Peak Flow (l/s)	19.2	24.3	27.7	35.1	42.0	47.6
Driveway & Parking Runoff Volume (m3)	83.3	109.1	126.2	147.8	163.8	179.7
Pasture Runoff Volume (m3)	36.0	47.2	54.6	63.9	70.8	77.7
Runoff Volume (m3)	119.4	156.3	180.8	211.7	234.6	257.4

Proposed Conditions Catchment Parameters

	Area (ha)	Runoff Coefficient
Pasture - Flat	0.248	0.3
Driveway	0.024	0.9
Parking Lot	0.148	0.1
Composite RC		0.26
Total Drainage Area (ha)	0.42	
Imp Area (ha)	0.17200	
Imperviousness (%)	0.06153846	

Proposed Conditions Hydrology - Climate Change						
Return Period	2	5	10	25	50	100
Precipitation Intensity (mm/hr)	68.7	87.3	99.3	108.9	122.9	131.0
Peak Flow (l/s)	21.3	27.1	30.8	37.2	45.8	50.8
Driveway & Parking Runoff Volume (m3)	89.2	115.7	135.5	164.0	189.3	214.6
Pasture Runoff Volume (m3)	38.6	50.1	58.6	78.0	98.3	116.0
Runoff Volume (m3)	127.8	165.8	194.1	242.0	287.6	330.6



LID Storage Required 100-yr	79
LID Storage Required 100-yr CC	152

California Stormwater Quality Association (CASQA) 2003			C-value
Unit Paver over sand			0.1

Pavement Drawdown Time	22.5

South Catchment

Existing Conditions Catchment Parameters

	Area (ha)	Runoff Coefficient
Pasture - Flat	0.0386	0.3
Driveway		
Composite RC		0.30
Total Drainage Area (ha)	0.0386	
Imp Area (ha)	0.00000	
Imperviousness (%)	0	

Proposed Conditions Catchment Parameters

	Area (ha)	Runoff Coefficient
Pasture - Flat	0.0386	0.3
Driveway		
Parking Lot		
Composite RC		0.30
Total Drainage Area (ha)	0.0386	
Imp Area (ha)	0.00000	
Imperviousness (%)	0	

Existing Time of Concentration	
Flow Path Length (m)	13
Drainage Slope (%)	0.6
Drainage Area (ha)	0.0386
Time of Concentration (min)	11.12985101
Time of Concentration (hrs)	0.185497517

Proposed Time of Concentration for Tree Grove	
Flow Path Length (m)	18.5
Drainage Slope (%)	0.6
Drainage Area (ha)	0.0386
Minutes	13.27710955
Hours	0.221285159

Existing Conditions Hydrology						
Return Period	2	5	10	25	50	100
Precipitation Intensity (mm/hr)	71.9	90.2	102.6	118.1	129.2	140.3
Peak Flow (l/s)	2.3	2.9	3.3	3.8	4.2	4.5
Pasture Runoff Volume (m3)	5.6	7.3	8.5	9.9	11.0	12.1

Proposed Conditions Hydrology						
Return Period	2	5	10	25	50	100
Precipitation Intensity (mm/hr)	65.1	81.9	93.4	107.7	118.0	128.2
Peak Flow (l/s)	2.1	2.7	3.0	3.5	3.8	4.2
Pasture Runoff Volume (m3)	5.6	7.3	8.5	9.9	11.0	12.1

Proposed Conditions Hydrology - Climate Change						
Return Period	2	5	10	25	50	100
Precipitation Intensity (mm/hr)	72.3	91.6	104.0	113.6	128.1	136.1
Peak Flow (l/s)	2.3	3.0	3.4	3.7	4.2	4.4
Pasture Runoff Volume (m3)	6.0	7.8	9.1	11.0	12.7	14.4

Existing Conditions - Intensity						
	2	5	10	25	50	100
A	25.3	32.9	38	44.4	49.1	53.8
B	-0.79	-0.782	-0.779	-0.776	-0.774	-0.773
t0	0.081	0.09	0.094	0.098	0.101	0.104

2022-2080 Climate Change - Intensity						
	2	5	10	25	50	100
A	27.3	35.7	41.8	50	57.1	64.3
B	-0.796	-0.794	-0.79	-0.778	-0.77	-0.765
t0	0.073	0.084	0.094	0.127	0.129	0.154

24hr SCS Event Depth (mm)						
	2	5	10	25	50	100
EX	48.45	63.44	73.37	85.92	95.22	104.46
CC	51.88	67.28	78.78	95.32	110.08	124.75

Appendix C – Permeameter Testing, Geotechnical Assessment and Subsurface Investigation

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June 4, 2021
File: PH4282-LET.01

Omar Alnader
314 Maxwell Bridge Road
Kanata, Ontario
K2W 0A5

Attention: **Omar Alnader**

Subject: **Permeameter Testing and Geotechnical Assessment**
Proposed Commercial Development
2742 Dunrobin Road - Ottawa

Dear Sir,

Further to your request, Paterson Group (Paterson) was commissioned to conduct a permeameter test investigation and geotechnical assessment for the proposed development to be located at 2742 Dunrobin Road in the City of Ottawa. The purpose of the current investigation is to provide design infiltration rates for the subsoils below the proposed infiltration system in support of the site servicing and water management brief completed by others. A geotechnical review and recommendations for the proposed gravel parking lot have been provided.

1.0 Proposed Development

Based on the available drawings, it is understood that the proposed commercial development will consist of a gravel-surfaced parking lot with a temporary structure and drainage ditch located within the southwest portion of the subject site. The proposed development will also include landscaped areas.

2.0 Field Investigation

Field Program

The field program conducted by Paterson for the current investigation was completed on May 21, 2021. At that time, 3 hand auger holes (HA 1 to HA 3) were excavated to an approximate depth of 0.2 m below ground surface (bgs) followed by permeameter testing over a depth of 0.3 to 0.7 m below the base of the excavation. Upon completion of the permeameter testing, HA 1 to HA 3 were extended to approximate depths of 0.9 m bgs for geotechnical purposes. Two (2) additional test holes (HA 4 and HA 5) were excavated to an approximate depth of 0.9 m bgs geotechnical purposes.

The test hole locations were selected by Paterson and distributed in a manner to provide general coverage of the proposed development. The test holes which received permeameter testing were selected to provide general coverage of the proposed drainage ditch, which is anticipated to be located within the central portion of the subject site. The test hole locations are presented on Drawing PH4282-1 - Test Hole Location Plan, attached to this report.

In-Situ Testing

Permeameter testing was conducted using a Pask (Constant Head Well) Permeameter. Test holes HA 1 through HA 3 were excavated to an approximate depth of 0.2 m bgs and an 83 mm diameter hole was excavated using a Riverside/Bucket auger to a depth of 0.1 and 0.5 m below the base of the excavation at each test hole location. All soil from the auger flights were visually inspected and initially classified on site. The permeameter reservoir was filled with water and inverted into the hole, ensuring it was relatively vertical and rests on the bottom of the hole. The water level of the reservoir was monitored at various intervals until the rate of fall of water in the permeameter reservoir reached equilibrium, known as *quasi "steady state"* flow rate. Quasi steady state flow can be considered to have been obtained after measuring 3 to 5 consecutive rate of fall readings with identical values. The values for the quasi steady state rate of fall were recorded for each location.

3.0 Field Observations

Surface Conditions

The ground surface across the majority of the subject site is relatively level. However, the ground surface at the southwestern limit of the subject site slopes gently upwards toward Dunrobin Road. The majority of the site is currently vacant and grass covered with a temporary structure located within the central portion of the site. An asphalt-paved access lane links the subject site to Dunrobin Road.

Subsurface Profile

Generally, the subsurface profile encountered at the test hole locations consists of a thin topsoil layer overlying either fill material or silty sand. The fill material was observed underlying the topsoil in hand auger holes HA 1 and HA 2 and consists of a brown silty sand with crushed stone.

A brown silty clay deposit was observed underlying the fill or the silty sand layer at approximate depths ranging from 0.2 to 0.5 m below the existing ground surface, at all hand auger locations with the exception of HA 4. Permeameter testing for HA 1 to HA 3 was carried out in the silty clay deposit. Reference should be made to the Soil Profile and Test Data sheets and Test Hole Location Plans attached to the current report for the details of the soil profiles encountered at each test hole location.

Based on available geological mapping, the subject site is located in an area where the bedrock consists of dolostone of the Oxford formation. The overburden drift thickness is estimated to range from 1 to 10 m within the subject site.

Groundwater

All hand auger holes were dry upon completion. Based on our field observations, the long-term groundwater table was not encountered at the test hole locations. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

4.0 Discussion

4.1 Permeameter Results

A total of 6 constant head Pask permeameter tests were conducted at 3 locations within the proposed drainage ditch to determine the design infiltration rates of the underlying soils. Based on Site Grading Plan - Drawing SG-1 prepared by NorthTown Engineering Inc., it is understood the invert of the drainage ditch has been proposed to be approximately 0.3 m below existing ground surface. The permeameter test locations were selected by Paterson in a manner to provide general coverage of the proposed drainage ditch, taking into consideration site features. Preparation and testing of this investigation are in accordance with the Canadian Standards Association (CSA) B65-12 - Annex E. The field saturated hydraulic conductivity (K_{fs}) and estimated infiltration values for each test hole location are presented in Table 1.

Field saturated hydraulic conductivity values were determined using Engineering Technologies Canada (ETC) Ltd. reference tables provided in the most recent ETC Pask Permeameter User Guide dated March 2016. The field saturated hydraulic conductivity values were used to determine the design infiltration rates using the approximate relationship between infiltration rate and hydraulic conductivity, as described in the Draft LID Guidance Document, dated December 2019. It should be noted that a safety correction factor was applied for calculating design infiltration rates at each test hole location.

Table 1 - Field Saturated Hydraulic Conductivity and Infiltration Results

Test Hole ID	Invert of Permeameter Testing (m bgs)	Material	K_{fs} (m/sec)	Infiltration Rate (mm/hr)	Design Infiltration Rate (mm/hr)
HA 1	0.4	Brown Silty Clay	1.6×10^{-7}	28	<8.0
	0.7	Brown Silty Clay	$<5.3 \times 10^{-8}$	<22	
HA 2	0.3	Brown Silty Clay	$<5.3 \times 10^{-8}$	<22	<8.8
	0.6	Brown Silty Clay	1.1×10^{-7}	27	
HA 3	0.4	Brown Silty Clay	1.1×10^{-7}	27	10.8
	0.7	Brown Silty Clay	1.1×10^{-7}	27	

Based on Paterson's field investigation, the field saturated hydraulic conductivity values and design infiltration rates measured at the test hole locations are consistent with similar material Paterson has encountered on other sites with similar subsoil structures and typical values for brown silty clay material. Field saturated hydraulic conductivity values for the brown silty clay ranged from $<5.3 \times 10^{-8}$ to 1.6×10^{-7} m/sec. The design infiltration rate at the approximate invert of the proposed drainage ditch location ranges from <8.0 to 10.8 mm/hr. It is recommended that the proposed invert of the proposed drainage ditch is constructed a minimum 1 m above the long-term groundwater table and sound bedrock surface to promote infiltration.

4.2 Geotechnical Review

From a geotechnical perspective, the subject site is suitable for the proposed gravel parking lot. Topsoil and fill containing organic or deleterious materials should be stripped within the footprint of the proposed parking lot. It is anticipated that the existing fill, free of deleterious and significant amounts of organics can be left in place. With the removal of all topsoil and deleterious fill, the existing undisturbed fill, silty sand and silty clay will be considered an acceptable subgrade on which to construct the gravel parking lot. The gravel fill material should be placed in maximum 300 mm thick loose lifts and compacted to at least 98% of the materials standard Proctor maximum dry density.

5.0 Statement of Limitations

The recommendations provided in the report are in accordance with Paterson's present understanding of the project and are preliminary in nature.

The field investigation is a limited sampling of the site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests immediate notification to permit reassessment of the recommendations.

The recommendations provided should only be used by the design professionals associated with this project. The recommendations are not intended for contractors bidding on or constructing the project. The latter should evaluate the factual information provided in the report. The contractor should also determine the suitability and completeness for the intended construction schedule and methods. Additional testing may be required for the contractors purpose. The present report applies only to the project described in the report. The use of the report for purposes other than those described herein or by person(s) other than Omar Alnader or their agents are not authorized without review by Paterson.

We trust that his information satisfies your requirements.

Paterson Group Inc.

Nicholas Zulinski, P.Geo., géo.

LICENSED PROFESSIONAL ENGINEER
06/04/2021
S. S. DENNIS
100519516
PROVINCE OF ONTARIO

Scott S. Dennis, P.Eng.

Attachments

- ❏ PH4282-1 - Soil Profile and Test Data
- ❏ Drawing PH4282-1 - Test Hole Location Plan

PROFESSIONAL GEOSCIENTIST
06/04/2021
NICHOLAS ZULINSKI
PRACTISING MEMBER
2359
ONTARIO

Report Distribution

- ❏ Omar Alnader (1 copy)
- ❏ Paterson Group (1 copy)

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Proposed Commercial Development
2742 Dunrobin Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hand Auger

DATE May 21, 2021

FILE NO. PH4282

HOLE NO. HA 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL 0.05									
FILL: Brown silty sand, trace crushed stone 0.20		G	1						
Stiff, brown **SILTY CLAY** 0.90		G	2						
End of Hand Auger Hole									

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Proposed Commercial Development
2742 Dunrobin Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hand Auger

DATE May 21, 2021

FILE NO. PH4282

HOLE NO. HA 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL 0.09									
FILL: Brown silty sand trace crushed stone 0.19		G	1						
Stiff, brown **SILTY CLAY**		G	2						
0.92									
End of Hand Auger Hole									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Proposed Commercial Development
2742 Dunrobin Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hand Auger

DATE May 21, 2021

FILE NO. PH4282

HOLE NO. HA 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL									
0.18									
Stiff, brown **SILTY CLAY**		G	1						
		G	2						
0.93									
End of Hand Auger Hole									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Proposed Commercial Development
2742 Dunrobin Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hand Auger

DATE May 21, 2021

FILE NO. PH4282

HOLE NO. HA 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL 0.22		G	1						
Loose, brown **SILTY SAND**		G	2						
0.93		G	3						
End of Hand Auger Hole									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Proposed Commercial Development
2742 Dunrobin Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hand Auger

DATE May 21, 2021

FILE NO. PH4282

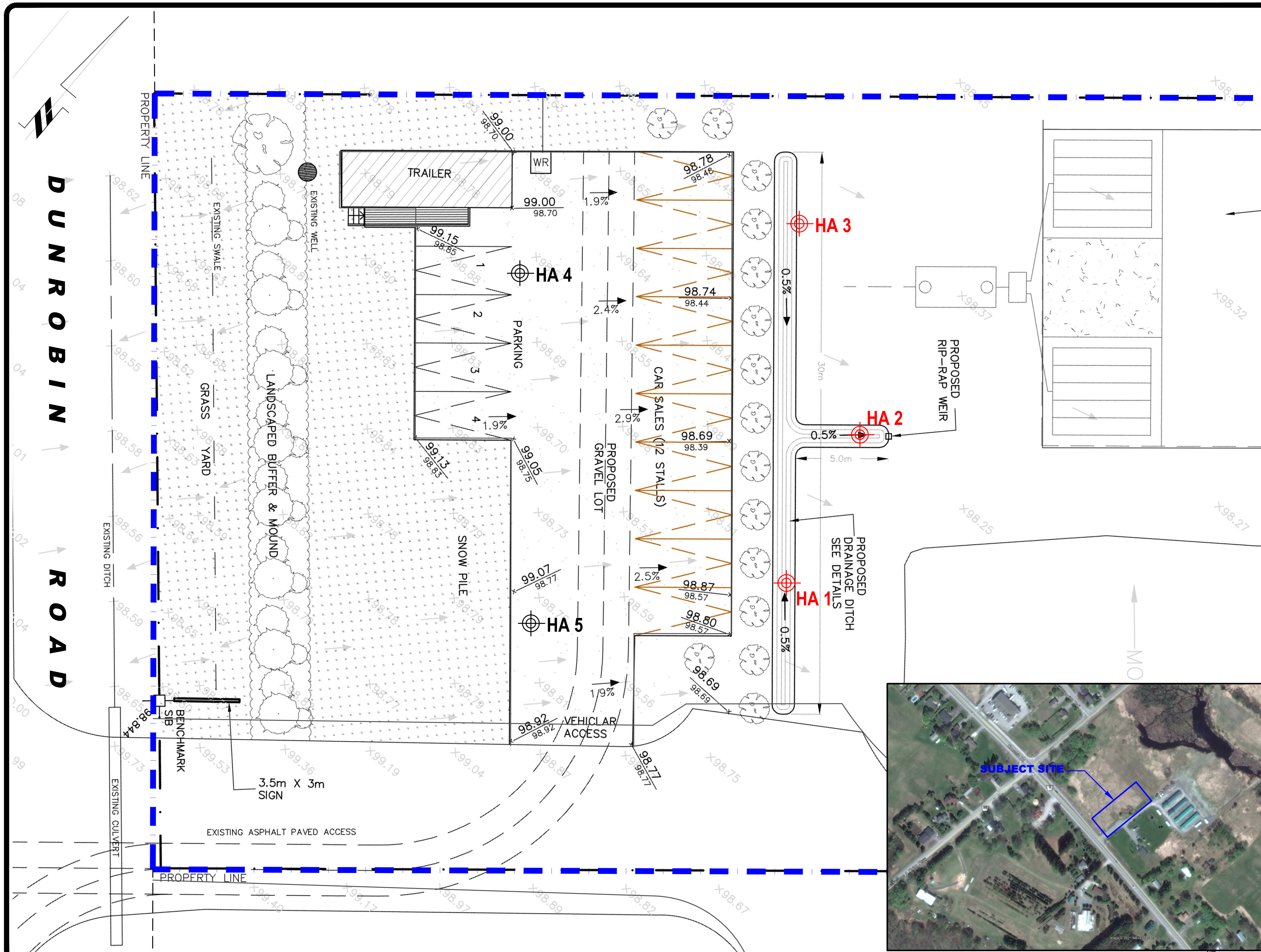
HOLE NO. HA 5

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			
TOPSOIL 0.19		G	1						
Compact, brown **SILTY SAND** - trace clay by 0.45m depth 0.50		G	2						
Stiff, brown **SILTY CLAY,** trace sand		G	3						
0.96		G	4						
End of Hand Auger Hole									

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded



LEGEND:

HAND AUGER HOLE LOCATION

HAND AUGER HOLE WITH PERMEAMETER TESTING LOCATION

DD/MM/YY	DESCRIPTION	REV.

Consultant:

patersongroup
consulting engineers

Client:

OMAR ALNADER

Project:

PROPOSED COMMERCIAL DEVELOPMENT

2742 DUNROBIN ROAD
OTTAWA, ONTARIO

Drawing:

PERMEAMETER TESTING LOCATION PLAN

Scale: 1:200	Reviewed by: KP
Date: 06/2021	Checked by: NZ

Drawing No.:

PH4282-1

c:\users\robertg\documents\ph4282.dwg

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June 29, 2022
File: PH4282-LET.02

Omar Alnader
314 Maxwell Bridge Road
Kanata, Ontario
K2W 0A5

Attention: **Omar Alnader**

Subject: **Subsurface Investigation**
Proposed Commercial Development
2742 Dunrobin Road - Ottawa

Dear Sir,

Further to your request, Paterson Group (Paterson) was commissioned to conduct a subsurface investigation for the proposed development to be located at 2742 Dunrobin Road in the City of Ottawa. The purpose of the current investigation is to provide subsurface conditions in support of a stormwater management design for the proposed development.

1.0 Proposed Development

Based on the available drawings, it is understood that the proposed commercial development will consist of a gravel-surfaced parking lot and a temporary site trailer located within the western portion of the subject site. The proposed development will also include landscaped areas.

2.0 Field Investigation

Field Program

The field program conducted by Paterson for the current investigation was completed on June 13, 2022. At that time, 2 boreholes were advanced to a maximum depth of 5.2 m below ground surface (bgs) and have been equipped with monitoring well installations. The borehole locations were selected by Paterson and distributed in a manner to provide general coverage of the proposed development. A previous investigation was completed on May 13, 2021 and consisted of extending 5 hand auger holes to maximum depth of 0.9 m bgs.

Permeameter testing was completed at select hand auger locations to determine field saturated hydraulic conductivity values and estimated infiltration rates of the subsurface material. Permeameter testing results have been summarized in Paterson Report PH4282-LET.01 dated June 4, 2021.

The test hole locations are presented on Drawing PH4282-1 - Test Hole Location Plan, attached to this report.

Groundwater Monitoring Well Installation

Groundwater monitoring wells were installed at each borehole location to permit monitoring of the groundwater levels subsequent to the completion of the field investigation. The monitoring wells consisted of 51 mm diameter PVC risers and 1.5 m long screens. Specific details of the installation of each monitoring well are further included in the Soil Profile and Test Data sheets and attached to the current letter report.

Groundwater Monitoring

Each monitoring well has been equipped with a Van Essen Instrument Mini-Diver Water Level Logger to monitor fluctuations in the groundwater levels within the proposed development. In addition, a Van Essen Instruments Baro-Diver was installed in borehole BH 2-22 to monitor changes in atmospheric pressure. The Mini-Divers have been programmed to continuously measure and record groundwater levels within the development at a rate of 1 reading every 24 hours for a maximum 12 month period. A groundwater monitoring report summarizing groundwater fluctuations at the subject site will be prepared under a separate cover upon completing the monitoring program.

3.0 Field Observations

Surface Conditions

The ground surface across the majority of the subject site is relatively level. However, the ground surface at the southwestern limit of the subject site slopes gently upwards toward Dunrobin Road. The majority of the site is currently vacant and grass covered with a temporary structure located within the central portion of the site. An asphalt-paved access lane links the subject site to Dunrobin Road.

Subsurface Profile

Generally, the subsurface profile encountered at the test hole locations consists of a topsoil layer overlying a loose brown silty sand and/or hard to stiff brown silty clay crust, extending to an observed depth of about 5.2 m below ground surface. Fill material was identified underlying the topsoil in HA 1 and HA 2 and is comprised of a brown silty sand with crushed

stone.
Based on available geological mapping, provided by Natural Resources Canada Urban Geology of the National Capital Region, the subject site is located in an area where the bedrock consists of dolostone of the Oxford formation with an estimated drift thickness of up to 10 m.

Reference should be made to the Soil Profile and Test Data sheets and Test Hole Location Plans attached to the current report for the details of the soil profiles encountered at each test hole location.

Groundwater

All test holes were dry upon completion of the field investigations. Groundwater conditions can also be estimated based on the observed colour, moisture levels and consistency of the recovered soil samples. Based on these observations, it is estimated that the long-term groundwater table at the subject site can be expected at a depth greater than 5 m bgs. However, It should be noted that groundwater levels can fluctuate seasonally and with precipitation events.

4.0 Summary and Recommendations.

It is understood that the proposed development will include a gravel-surfaced parking lot to increase natural infiltration at the source and manage stormwater within the subject site. Specific details regarding the Low Impact Design (LID) have not been provided at the time of report preparation. However, it is recommended that the invert of the proposed LID is constructed a minimum 1 m above the seasonally high groundwater table and bedrock surface to promote infiltration.

Geotechnical Review

From a geotechnical perspective, the subject site is suitable for the proposed gravel parking lot. Topsoil and fill containing organic or deleterious materials should be stripped within the footprint of the proposed parking lot. It is anticipated that the existing fill, free of deleterious and significant amounts of organics can be left in place. With the removal of all topsoil and deleterious fill, the existing undisturbed fill, silty sand and silty clay will be considered acceptable subgrades on which to construct the gravel parking lot. The gravel fill material should be placed in maximum 300 mm thick loose lifts and compacted to at least 98% of the materials standard Proctor maximum dry density.

5.0 Statement of Limitations

The recommendations provided in the report are in accordance with Paterson's present understanding of the project and are preliminary in nature.

The field investigation is a limited sampling of the site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests immediate notification to permit reassessment of the recommendations.

The recommendations provided should only be used by the design professionals associated with this project. The recommendations are not intended for contractors bidding on or constructing the project. The latter should evaluate the factual information provided in the report. The contractor should also determine the suitability and completeness for the intended construction schedule and methods. Additional testing may be required for the contractors purpose. The present report applies only to the project described in the report. The use of the report for purposes other than those described herein or by person(s) other than Omar Alnader or their agents are not authorized without review by Paterson.

We trust that his information satisfies your requirements.

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
06/29/2022
S. S. DENNIS
100519516
PROVINCE OF ONTARIO

Nicholas Zulinski, P.Geo., géo.

Scott S. Dennis, P.Eng.

PROFESSIONAL GEOSCIENTIST
06/29/2022
NICHOLAS ZULINSKI
PRACTISING MEMBER
2359
ONTARIO

Attachments

- ❑ PH4282 - Soil Profile and Test Data
- ❑ Drawing PH4282-1 - Test Hole Location Plan

Report Distribution

- ❑ Omar Alnader (1 e-copy)
- ❑ Paterson Group (1 e-copy)

patersongroup Consulting Engineers

9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Subsurface Investigation
2742 Dunrobin Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE 2022 June 13

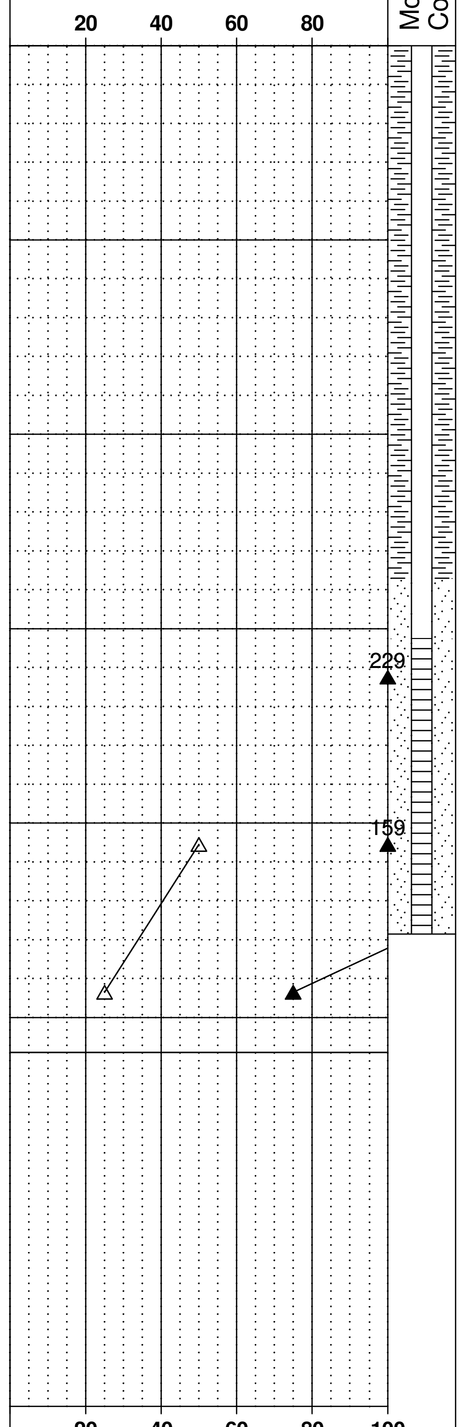
FILE NO. PH4282

HOLE NO. BH 1-22

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	65.97
TOPSOIL with organics 0.20	AU	1				
Hard to very stiff, brown **SILTY CLAY,** trace sand	SS	2	83	12	1	64.97
	SS	3	100	12	2	63.97
	SS	4	100	7		
	SS	5	67	P	3	62.97
	SS	6	100	P	4	61.97
- stiff by 4.5m depth	SS	7	100	P	5	60.97
5.18 End of Borehole						
(Observed GWL at time of investigation - Dry)						

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

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Monitoring Well Construction

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SOIL PROFILE AND TEST DATA

Subsurface Investigation
2742 Dunrobin Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE 2022 June 13

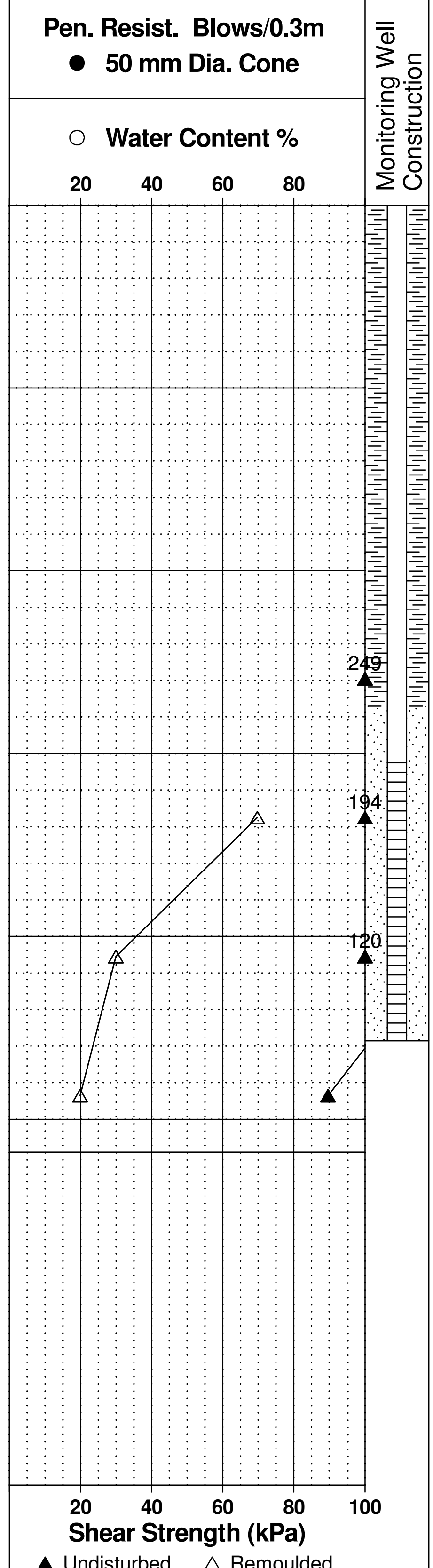
FILE NO. PH4282

HOLE NO. BH 2-22

SOIL DESCRIPTION	Depth of change (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL with organics	0.19				
Loose, brown **SILTY SAND** trace organics	0.43	AU	1		
Hard to very stiff, brown **SILTY CLAY,** trace sand		SS	2	83	8
		SS	3	100	9
		SS	4	100	P
		SS	5	100	P
		SS	6	100	P
- stiff by 4.5m depth		SS	7	100	P
End of Borehole	5.18				

(Observed GWL at time of investigation - Dry)

DEPTH (m)	ELEV. (m)
0	65.54
1	64.54
2	63.54
3	62.54
4	61.54
5	60.54



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Proposed Commercial Development
2742 Dunrobin Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hand Auger

DATE May 21, 2021

FILE NO. PH4282

HOLE NO. HA 1

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
TOPSOIL	0.05						
FILL: Brown silty sand, trace crushed stone	0.20	G	1				
Stiff, brown **SILTY CLAY**	0.90	G	2				
End of Hand Auger Hole							

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Proposed Commercial Development
2742 Dunrobin Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hand Auger

DATE May 21, 2021

FILE NO. PH4282

HOLE NO. HA 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL 0.09									
FILL: Brown silty sand trace crushed stone 0.19		G	1						
Stiff, brown **SILTY CLAY** 0.92		G	2						
End of Hand Auger Hole									

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Proposed Commercial Development
2742 Dunrobin Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hand Auger

DATE May 21, 2021

FILE NO. **PH4282**

HOLE NO. **HA 3**

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 % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL 0.18									
Stiff, brown **SILTY CLAY**		G	1						
		G	2						
0.93 End of Hand Auger Hole									

Shear Strength (kPa) 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Proposed Commercial Development
2742 Dunrobin Road
Ottawa, Ontario

DATUM	FILE NO. PH4282
REMARKS	HOLE NO. HA 4
BORINGS BY Hand Auger	DATE May 21, 2021

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL		G	1						
0.22									
Loose, brown **SILTY SAND**		G	2						
		G	3						
0.93									
End of Hand Auger Hole									

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Proposed Commercial Development
2742 Dunrobin Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hand Auger

DATE May 21, 2021

FILE NO. PH4282

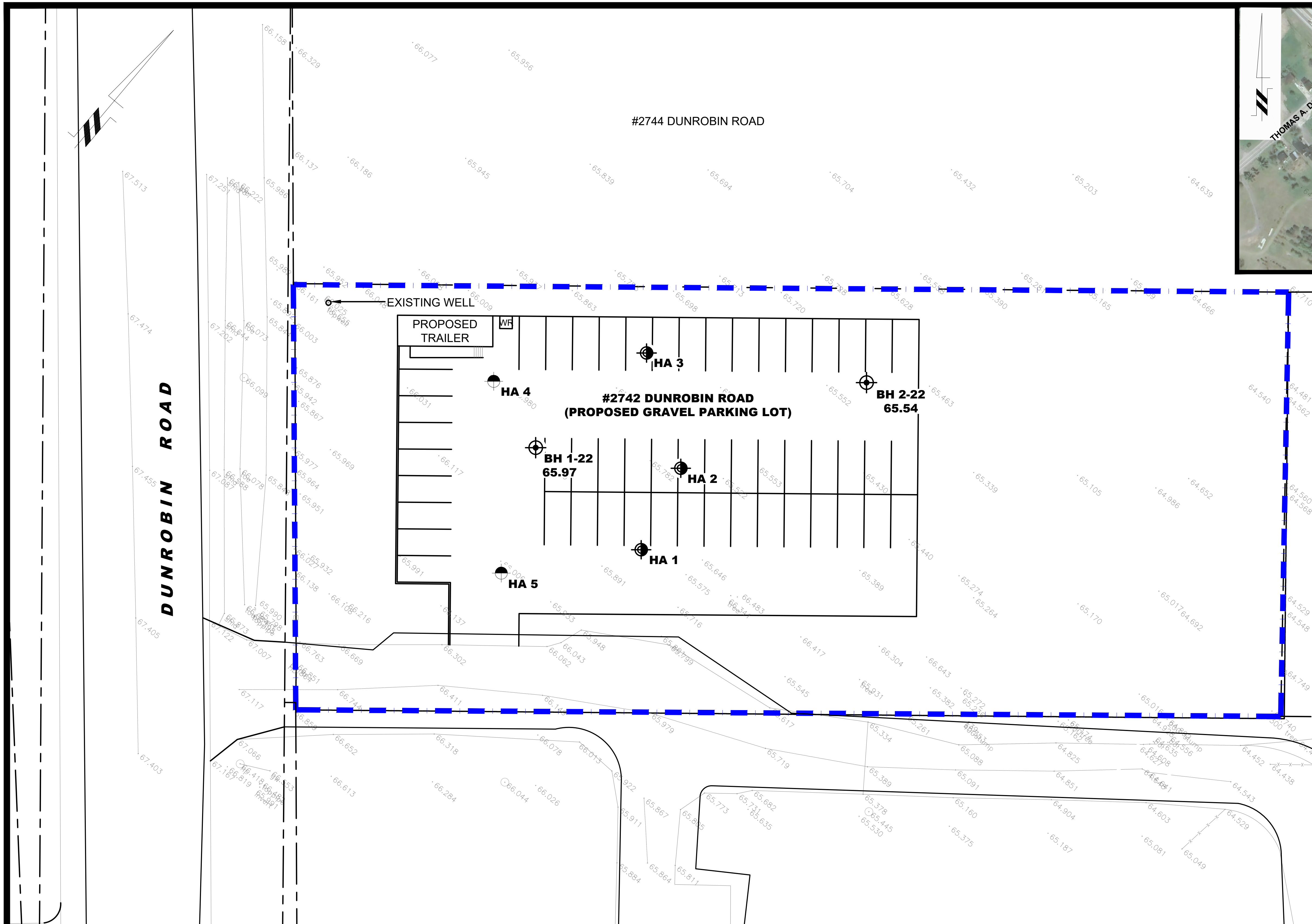
HOLE NO. HA 5

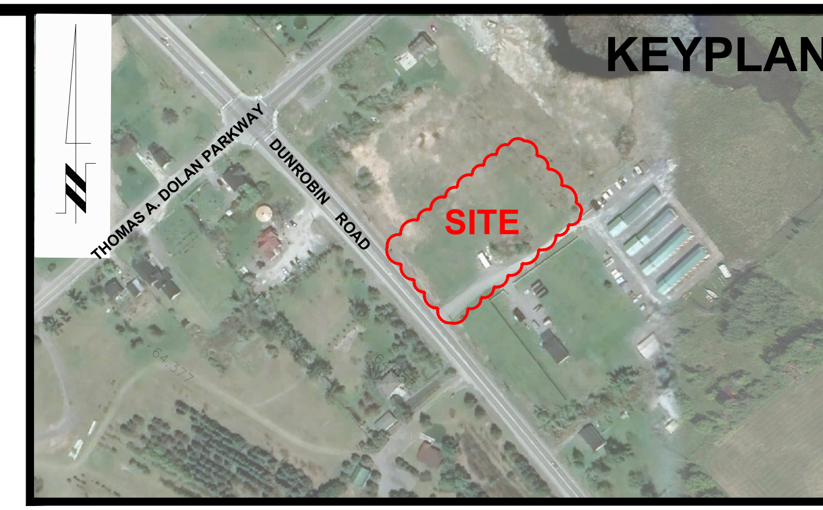
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL 0.19		G	1						
Compact, brown **SILTY SAND** - trace clay by 0.45m depth 0.50		G	2						
Stiff, brown **SILTY CLAY,** trace sand		G	3						
0.96		G	4						
End of Hand Auger Hole									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded





LEGEND:

BOREHOLE WITH MONITORING WELL LOCATION

HAND AUGER HOLE LOCATION

HAND AUGER HOLE WITH PERMEAMETER TESTING LOCATION

65.54 GROUND SURFACE ELEVATION (m)

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:400

0 5 10 15 20 25m

PATERSON GROUP
SOLUTION ORIENTED ENGINEERING

NO.	REVISIONS	DATE	INITIAL
1.	UPDATED SITE PLAN AND TEST HOLES	06/28/2022	NZ

OMAR ALNADER

GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
2742 DUNROBIN ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:400	Date: 06/2022
Drawn by: GK	Report No.: PH4282-2
Checked by: EA	Dwg. No.: PH4282-1
Approved by: NZ	Revision No.: 1

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Appendix D – City of Ottawa Soil Amendment Requirements for Pinecrest Creek/Westboro Area (Draft 2013)

On-Site Soil Amendment - Default Ratio 3:1

Materials

- Amend existing site topsoil using 3:1 ratio by volume (3 parts existing topsoil, 1 part amendment material)
- Amendment Material: organic matter primarily leaf, yard and bark waste compost of 20-30% by dry weight as determined by Loss-on-Ignition (LOI) and a pH of 6.0 to 8.0
- No uncomposted manure or other organic materials, sphagnum peat or organic amendments that contain sphagnum peat

Placement and Amendments

1. Remove existing topsoil and preserve on-site.
2. Decompact native subsoil at depth of 100-200mm. Decompaction using a perpendicular pattern (See Detail No.1) ensuring full site coverage. No decompaction within tree protection areas (See Detail No.2) or within 3m of building foundations (See Detail No.3).
3. Amend existing site topsoil to meet post construction soil amendment requirements using 3:1 ratio by volume (topsoil : amendment material).
4. Two (2) methods for amending the existing soils in place are acceptable:

Method No.1 - Layer and Incorporate (Detail No.4)

i. Apply 100mm of existing site topsoil followed by 50mm of amendment material and incorporate/mix amended material.
ii. Lightly roll or smooth using the back of the machinery bucket.
iii. Repeat i. and ii.
iv. Adjust layer quantities to ensure a settled amended topsoil depth of 300m and compliance with site grading. Placement should account for 10% settlement.

Method No.2 - Mechanical or Bucket Mix

i. Successively add, mix and pile one (1) unit of amendment material with three (3) unit of existing site topsoil.
ii. Thoroughly mix.
iii. Repeat i. and ii to ensure thorough mixing until required volume is achieved.
iv. Place 150mm of amended topsoil, lightly roll or smooth using the back of the machinery bucket.
v. Repeat iv.
vi. Adjust layer quantities to ensure a settled amended topsoil depth of 300m and compliance with site grading.

Amended topsoil should be wetted after application, allowed to settle for a minimum of one (1) week and grades adjusted as required prior to installation of turf.

-IMPORTANT-

Documentation Requirements

As part of verification, the owners shall produce delivery tickets, receipts and specifications detailing the delivery address, quantities and product description and sources for verification by City inspectors. Delivery address is to be listed and must correspond to the property/site being inspected. Site without proper documentation may be subject to additional verification procedures including laboratory testing at the expense of the owner.

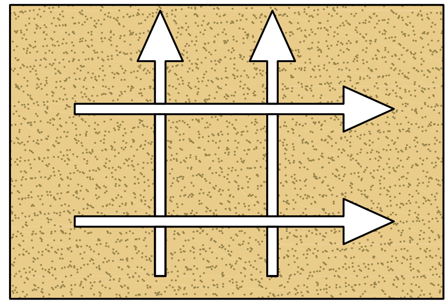
City Verification/Inspection

Verification may occur after the minimum one (1) week settlement period. Verification is suggested prior to turf placement. Non-compliant sites shall be rectified at the expense of the owner.

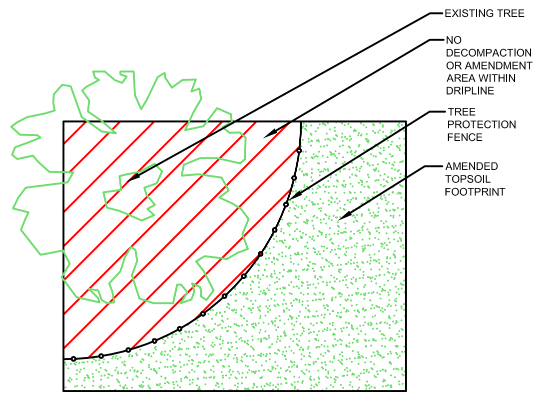
At random, the City inspector shall dig at least one (1) test hole to verify amended topsoil depth and uncompacted soil depths.

Requirements:

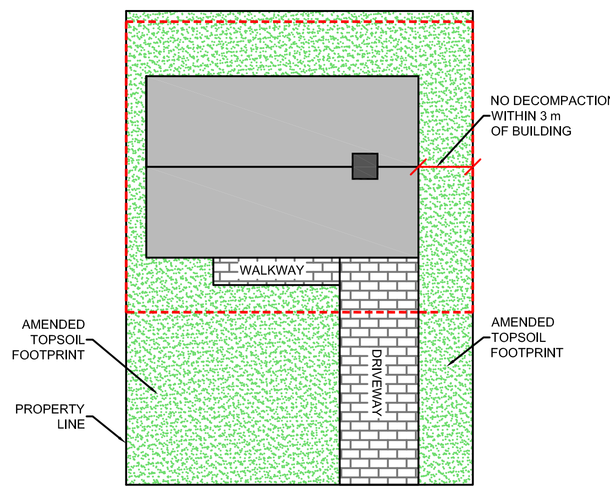
1. Amended topsoil layer shall be easily dug using only the inspector's weight or cored without other mechanical assistance.
2. The amended topsoil layer shall be darker in color than the unamended-decompacted subsoil and particles of organic matter should be easily visible.
3. Measured amended topsoil depths shall be deemed to be in conformance based on the following:
   - Using a common garden spade, the measured depth of amended topsoil shall be equal to the required 300mm depth (±25mm)
   - Using a small diameter coring unit, the measured core depth of amended topsoil shall be equal to the required 300mm depth (±50mm)



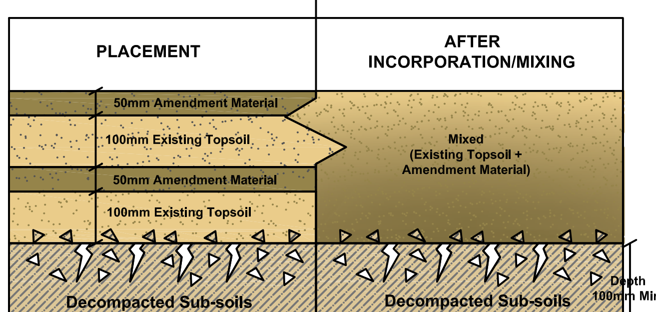
Detail No.1 - Perpendicular Decompaction Pattern



Detail No.2 - No Decompaction within Tree Protection Areas or Amendment



Detail No.3 - No Decompaction within 3.0m of Building Foundation (Amendment Only)



Detail No.4 Amendment Method No. 1

Soil Amendment Requirements for Pinecrest Creek/Westboro Area - For Development Requiring a Building Permit Only

City of Ottawa
June 24, 2013