74 Berkeley Street, Toronto, ON M5A 2W7
Tel: 647-795-8153 | www.pecg.ca

Draft Hydrogeological Investigation

410 Bayview Drive (Park Place Industrial Development), City of Barrie, Ontario

Palmer Project #
2005203

Prepared For
North American Development Group Inc.

June 8, 2022

74 Berkeley Street, Toronto, ON M5A 2W7
Tel: 647-795-8153 | www.pecg.ca

June 8, 2022

Marisa Kay
North American Development Group Inc.
2851 John Street, Suite 1, Markham, ON L3R 5R7

Dear Marisa:

Re: Draft Hydrogeological Investigation, 410 Bayview Drive (Park Place North Industrial Development), City of Barrie, Ontario
Project #: 2005203

Palmer is pleased to submit the attached report describing the results of our Draft Hydrogeological Investigation for the proposed development at Park Place North Lands in the City of Barrie. This report provides information on hydrogeological conditions for a Site Plan Application and Minor Variance submission to the City of Barrie. The hydrogeological conditions found will support the mitigation of the water balance and phosphorous loading through the use of Low-Impact Development (LID) measures.

The site hosts a very deep groundwater table, and a thick unit of ice-contact stratified deposits consisting mainly of fine to medium sand. The groundwater table was found at greater than 16.87 m below ground surface (mbgs) based on monitoring in May 2022. Additional groundwater level monitoring will be completed in spring/summer 2022 and provided in subsequent reporting. The hydraulic conductivity of the sand was calculated to be 5.9×10^{-5} m/s and the infiltration rate was measured to be 86 mm/hr (not including a safety factor) through in-situ infiltration testing.

Under these conditions, no dewatering is expected for the planned development of slab-on grade industrial buildings. Although significant grading is planned for the site, the finished floor elevations of the buildings are expected to have greater than 2.82 to 6.37 m of separation from the groundwater table based on the dry groundwater elevations across site. Based on the hydrogeological conditions, the site is ideal for the use of infiltration based Low Impact Development (LID) measures to manage stormwater, maintain the pre-to-post development water balance, and manage phosphorus loading.

We trust that this report will be satisfactory for your current needs. If you have any questions or require further information, please contact our office at your convenience. This report is subject to the Statement of Limitations provided at the end of this report.

Yours truly,
Palmer

DRAFT

_____

Jason Cole, M.Sc., P.Geo.
VP, Principal Hydrogeologist

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1. Introduction

Palmer was retained by North American Development Group Inc. (NADG) to complete a Hydrogeological Assessment for a Site Plan Application and Minor Variance with the City of Barrie for 410 Bayview Drive (Park Place Industrial), City of Barrie, Ontario (the "project" or the "site") (**Figure 1**). The site is approximately 13.05 ha in size, and a Site Plan for the project is presented in **Appendix A.** It is Palmer's understanding that the proposed development consists of four (4) industrial buildings, parking lots, and a Stormwater Management (SWM) Pond. All buildings will be completed as slab on grade with no underground basements or underground parking. Significant grading is proposed based on the Preliminary Grading Plan prepared by Sabourin Kimble Associates (SKA) (**Appendix B**). With these conditions in mind Palmer's workplan will focus on assessing the groundwater table elevation against the proposed grading, and mitigating the water balance and phosphorous loading changes through recommendations for infiltration based Low-Impact Development (LID) measures.

This hydrogeological investigation is also focused on assessing soil and groundwater conditions at the site to support engineering design and permitting with Lake Simcoe Region Conservation Authority (LSRCA) and the City of Barrie. A site-wide water balance was completed to determine the pre-development runoff and infiltration on site. Source Water Protection requirements for development are also addressed in this report. In addition to the hydrogeological field investigations conducted by Palmer, information from the following sources was reviewed as part of the study:

- Site Plan (Ware Malcomb, 2022) (**Appendix A**);
- Preliminary Grading Plan (Sabourin Kimble Associates, 2022) (**Appendix B**);
- Geotechnical borehole logs and grain size distribution results (Stantec, 2022) (**Appendix** C);
- Available geology, hydrogeology, and physiography mapping (e.g., Ontario Geological Survey (OGS) Surficial, Palaeozoic Geology; and,
- Ministry of Environment, Conservation and Parks (MECP) water well records.

1.1 Scope of Work

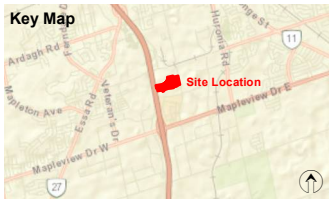
The objectives for Palmer's Hydrogeological Investigation include the following:

- Completion of a background review of applicable hydrogeological data including watershed plans, MECP water well records, surficial, bedrock, and Source Water Protection mapping;
- Collection of groundwater level measurements in spring/ early summer 2022 at all five (5) well locations to characterize the groundwater table elevation across site;
- Completion of a pre- development water balance for the site taking into consideration the preliminary site plan, grading, and providing site specific recommendations for LIDs;
- Completion of a pre-development phosphorus budget;
- Completion of a preliminary dewatering assessment to identify the potential need for dewatering and permitting to support construction dewatering; and,
- Preparation of a Hydrogeological Investigation Report summarizing the study findings to support design and permitting.

LEGEND

- Borehole[1]
- Monitoring Well[1]
- Watercourse[2]
- Subject Property

1. Stantec, 2022
2. LIO/MNRF



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Source Notes:
Imagery (2018) provided by Simcoe County map service

CLIENT
North American Development Group

PROJECT
410 Bayview Drive
(Park Place North Lands)

TITLE
Site Location

Palmer

REF. NO. 2005203

Figure 1

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2. Hydrogeological Conditions

2.1 Regional Conditions

2.1.1 Physiography and Geology

The site is located within the Peterborough Drumlin Field physiographic region and is characterized as a rolling drumlinized till plain that lies north of the Oak Ridges Moraine and southwest of Lake Simcoe (Chapman & Putnam, 1984).

Available surficial and quaternary geology mapping by the Ontario Geological Survey (OGS) indicates the native surficial geology is comprised of primarily of ice-contact stratified deposits (**Figure 2**). The ice-contact stratified deposits consist of sand and gravel, with minor silt, clay, and till. These ice-contact deposits overlay the Newmarket Till (also referred to as the Northern Till in the study area) on a regional scale. The Newmarket Till has a distinct and consistent lithology (Sharpe et al., 1999), and is a dense, stony, sandy silt diamicton, ranging in thickness from about 5 to 50 m. It occurs as beds 3 to 5 m thick, locally separated by stone lines and sandy interbeds, 1 to 5 m thick (Sharpe et al., 1999).

Paleozoic bedrock at the site is characterized by the laminated, nodular to black limestone of the Lindsay Formation (part of the Simcoe Group) (**Figure 3**). Bedrock was not encountered during the drilling program, and based on the MECP water well database information, this formation is encountered at depths greater than 153 meters below ground surface (mbgs) (MECP Well ID# 5716625 and MECP Well ID # 5715532) near the site location.

2.1.2 Hydrogeology

Hydrostratigraphic units can be subdivided into two distinct groups based on their ability to allow groundwater movement: an aquifer and an aquitard. An aquifer is defined as a layer of soil that is permeable enough to permit a usable supply of water to be extracted. An aquitard is a layer of soil that inhibits groundwater movement due to its low permeability. In Barrie these aquifers and aquitards are labelled uniquely to the region. The major regional hydrostratigraphic units that control groundwater at the site are described below:

Ice-Contact Stratified Deposits consisting of sand and gravel, and minor silt, clay and till act as aquifer and recharge complexes in the region. Locally, this aquifer is referred as Aquifer A1, has a moderate transmissivity and hydraulic conductivity (expected to range between 10^{-7} to 10^{-4} m/s), Within the region, it is expected that the ice-contact stratified deposits are unconfined and up to 58 m in depth (MECP Well ID # 5716626, located 100 m from site), The Newmarket Till aquitard (also referred to as aquitard C1) underlies this unit.

The **Newmarket Till (or Northern Till)** forms a major regional aquitard within the study area, given its low hydraulic conductivity (10^{-11} to 10^{-6} m/s, Sharp *et al*., 1996) and consistent presence throughout the region. Where Newmarket Till is exposed at the surface, the water table is commonly high within the till because of the poorly drained till soils. Water flow within the dense till unit is typically in a downwards direction (Sharpe *et al.*, 1996). Locally, this unit is referred to as aquitard C1. The Newmarket Till was

not encountered on site during the drilling program conducted by Stantec and is expected at approximately 37 to 57 mbgs.

2.1.3 Environmental Features and Drainage

The site is located within the Lake Simcoe Watershed and is under the jurisdiction of the Lake Simcoe Region Conservation Authority (LSRCA). Locally, the site is within the Lovers Creek Subwatershed which covers a total area of 59.9 km^2, and ultimately drains into Lake Simcoe (LSRCA, 2012).

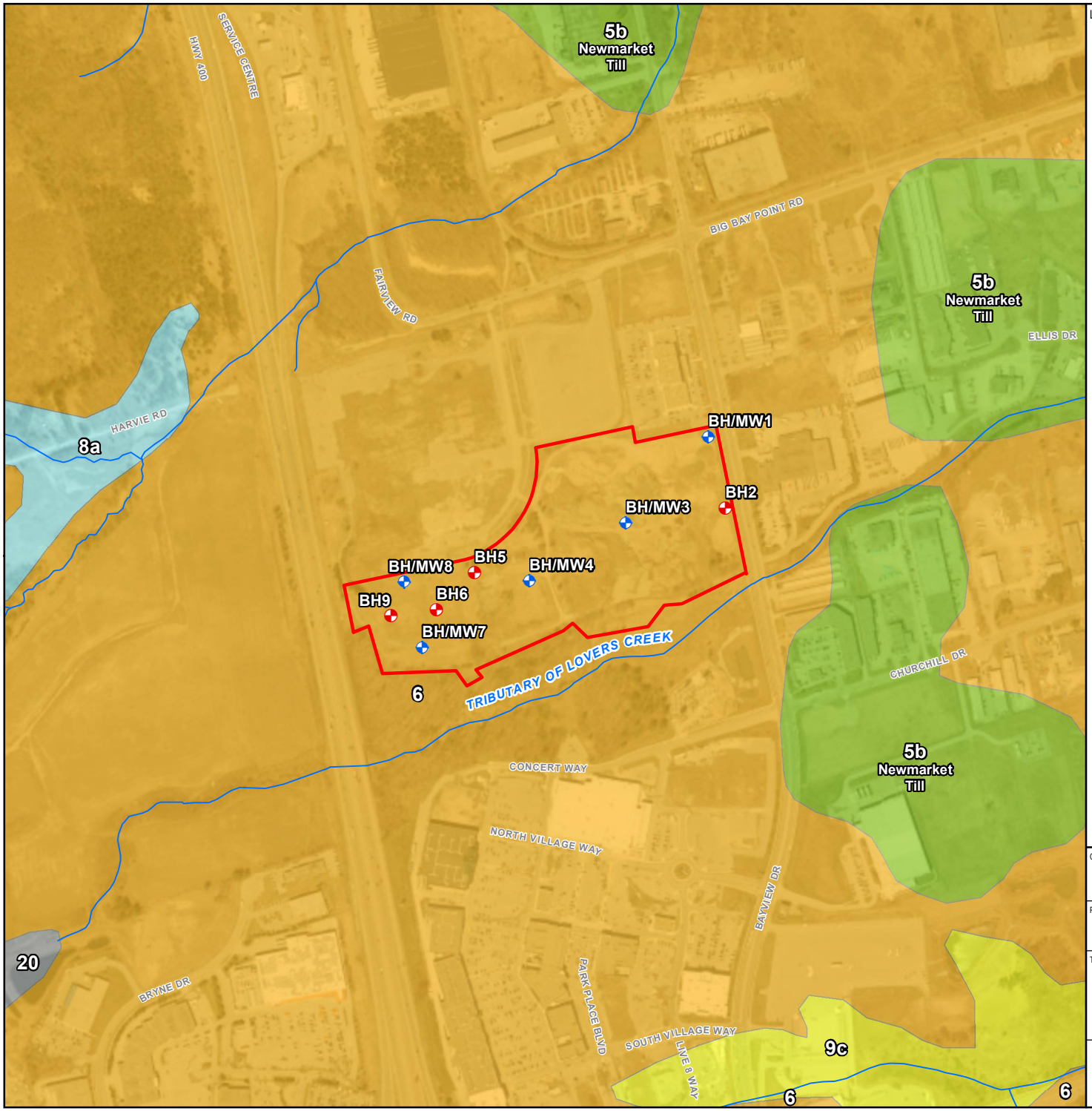
There are no natural features or watercourses that were identified on the Park Place Industrial site. However, there is a tributary of the Lovers Creek approximately 100 metres from the southernmost boundary of the property. Groundwater discharge is a substantial contributor to flow in Lovers Creek, as more than 60% of flow in Lovers Creek is contributed by groundwater (LSRCA, 2012). The surficial sand aquifer (Aquifer A1) is expected to form an unconfined shallow aquifer system in the study area and likely supports shallow groundwater flow towards Lovers Creek.

2.1.4 Source Water Protection

The site is located within the Lakes Simcoe and Couchiching/Black River Source Protection Area which came into effect on December 31, 2015. The Source Water Protection Plan identifies four main regulatory factors under the *Clean Water Act (2006)* relating to local hydrogeology to consider for site development: Significant Groundwater Recharge Areas (SGRAs), Highly Vulnerable Aquifers (HVAs), and Wellhead Protection Areas (WHPAs), and Intake Protection Zones (IPZs).

A Wellhead Protection Area (WHPA) is the area around the wellhead where land use activities have the potential to affect the quality or quantity of water that flows into the well. These areas are delineated into zones of vulnerability (A, B, C, and D) based on the time of travel of water into the well, and zones around a surface water body influencing a Groundwater Under Direct Influence (GUDI) (E, F). Other zones (Q1, and Q2) are defined as the areas where new water takings or reduced recharge could impact the quantity of water available to municipal supply wells. IPZs are the area on the water and land surrounding a municipal surface water intake. HVAs are aquifers that are susceptible to contamination as a result of the soil structure/material or due its location near the ground surface. Lastly, SGRAs are areas where recharge is important to maintain the water level in a community drinking water aquifer.

The Ontario Source Water Protection Information Atlas identifies that the site is located within Wellhead Protection Areas (WHPA) Q2 – recharge management (**Figure 4**). This refers to areas where activities that reduce recharge may be a threat. Resultantly, infiltration will need to be maintained on site to the extent practical. The site is also within an IPZ-3 with a score of 5.6. Stormwater runoff (with the exception of clean roof runoff) must be directed outside of the IPZ-3 or to storm sewers. Lastly, the site was identified to be located within an an SGRA with a scores of 4 to 6 across the site. No other Source Water Protection designations were identified on site.



LEGEND

- Borehole[1]
- Monitoring Well[1]
- Watercourse[2]
- Subject Property

Surficial Geology[3]

Phanerozoic / Cenozoic / Quaternary / Recent

- 20: Organic deposits *(peat, muck, marl)*

Phanerozoic / Cenozoic / Quaternary / Pleistocene

- 9c: Coarse-textured glaciolacustrine deposits *(Foreshore and basinal deposits)*
- 8a: Fine-textured glaciolacustrine deposits *(Massive-well laminated)*
- 6: Ice-contact stratified deposits *(sand and gravel, minor silt, clay and till)*
- 5b: Tilll *(Stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain)*

1. Stantec, 2022
2. LIO/MNRF
3. Ontario Geological Survey 2010 (Mapped at 1:50,000). Surficial geology of southern Ontario; Ontario Geological Survey. Miscellaneous Release- Data 128 - Revised

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CLIENT
North American Development Group

PROJECT
410 Bayview Drive
(Park Place North Lands)

TITLE
Surficial Geology

Palmer

REF. NO. 2005203

Figure 2

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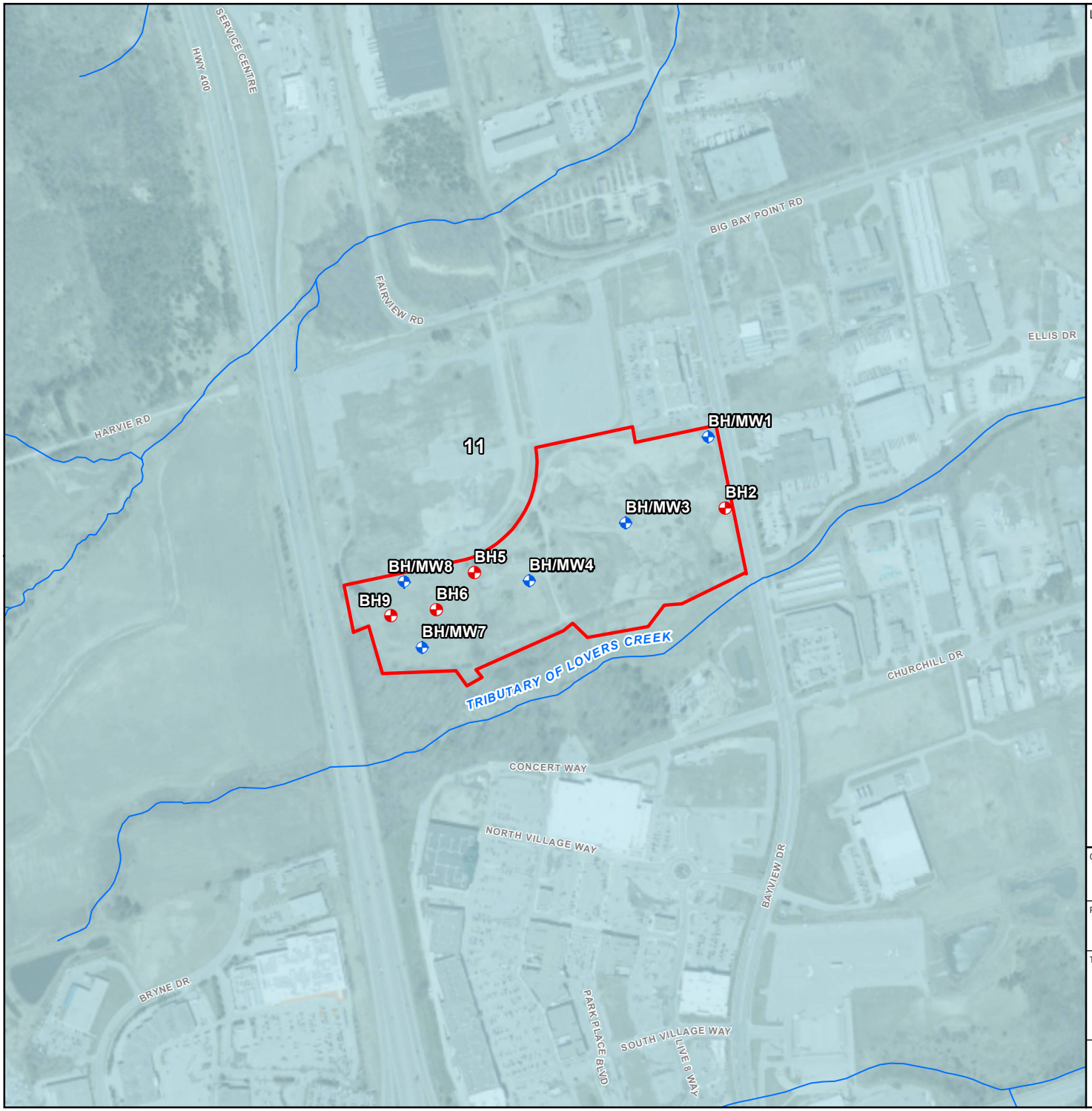

LEGEND

- Borehole[1]
- Monitoring Well[1]
- Watercourse[2]
- Subject Property

Paleozoic Bedrock Geology[3]

Middle Ordovician - Simcoe Group

11: Lindsay *(limestone; nodular to black laminated)*

1. Stantec, 2022
2. LIO/MNRF
3. Armstrong, D.K. and Dodge, J.E.P. Paleozoic Geology Map of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 219

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PROJECT
410 Bayview Drive
(Park Place North Lands)

TITLE
Bedrock Geology

Palmer

REF. NO. 2005203

Figure 3

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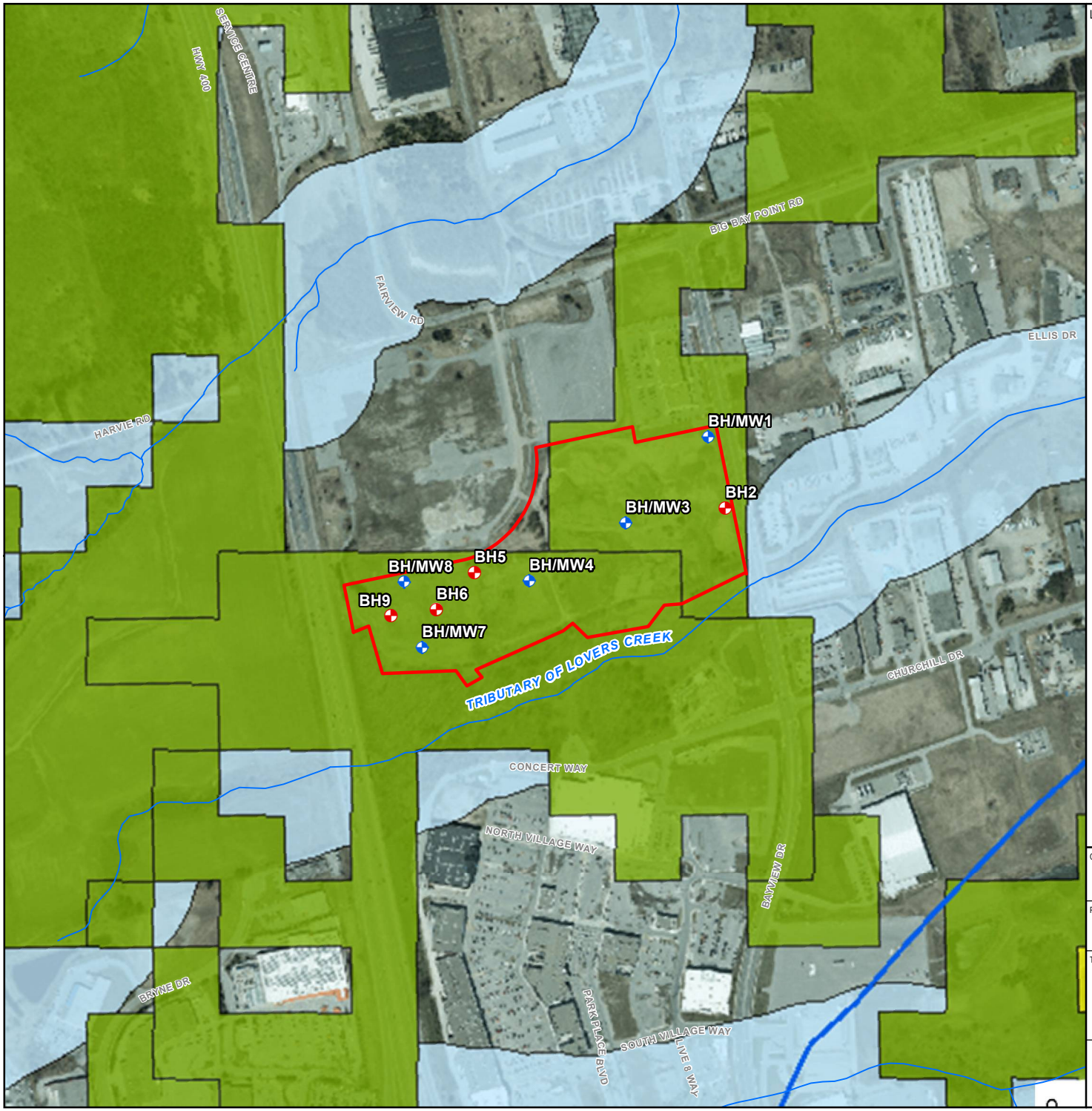

LEGEND

- Borehole[1]
- Monitoring Well[1]
- Watercourse[2]
- Subject Property

Source Water Protection[3]

- Wellhead Protection Area Q2
- Intake Protection Zone 3

Significant Groundwater Recharge Area

- Score 2
- Score 4
- Score 6

1. Stantec, 2022
2. LIO/MNRF
3. *Source Protection Information Atlas*, MECP © Queen's Printer for Ontario, 2022

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CLIENT
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PROJECT
410 Bayview Drive
(Park Place North Lands)

TITLE
Source Water Protection

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REF. NO. 2005203

Figure 4

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2.2 Site Specific Conditions

2.2.1 Borehole Drilling and Monitoring Well Installation

From April 18 to 21, 2022, Stantec personnel conducted a borehole drilling and groundwater monitoring well installation program as part of their geotechnical investigation. Nine (9) boreholes (BH1 to BH9) were advanced from depths ranging from 5.2 to 17.4 mbgs at the site using continuous split spoon sampling and hollow stem flight auger methods. The locations of the boreholes and monitoring wells are provided on **Figure 1** and borehole logs are provided in **Appendix C.** Following drilling, monitoring wells were installed in accordance with Ontario Regulation 903 (Wells Regulation) in five (5) of the drilled boreholes, including BH1, BH3, BH4, BH7, and BH8. Each monitoring well was completed with 51 mm (2 inch) diameter schedule 40 polyvinyl chloride (PVC) pipe, with a 3.05 m (10 ft) screened interval. The monitoring wells were sealed using bentonite grout and completed with stick up casings. Additional details are provided in **Table 1**. The remaining boreholes without monitoring wells installed were backfilled and sealed upon completion of drilling.

Table 1. Borehole and Monitoring Well Installation Details

BH ID	Ground Surface Elevation (masl)	Total Borehole Depth (mbgs)	Screened Interval (mbgs)	Geology
BH1	280.00	5.2	2.1– 5.2	Sand with silt
BH2	281.00	5.2	–	–
BH3	290.50	9.8	6.1 – 9.1	Sand with silt
BH4	290.50	9.8	6.1 – 9.1	Sand with silt
BH5	292.00	12.8	–	–
BH6	295.80	12.8	–	–
BH7	298.90	17.4	13.7 – 16.8	Sand with gravel
BH8	294.50	12.8	9.1 – 12.2	Sand with silt
BH9	298.00	17.4	–	–

2.2.2 Geology and Soil Profile

The stratigraphy of the site area encountered during Stantec's borehole drilling program is summarized below:

Topsoil: Topsoil was encountered at surface at all borehole locations except for BH8. The thickness of the unit ranged from 200 mm to 300 mm.

Reworked or Disturbed Native Soils (Fill): Brown to dark brown silty sand fill soils were encountered in all boreholes except for BH2. Fill was encountered below topsoil in BH3 to BH7, and BH-9. The thickness of the fill ranged from 0.7 m (BH3) to 2.2 m (BH9). The composition of the fill soils consisted of silty sand, trace to some gravel, and trace clay. The consistency of the soils mostly ranged from dense to very dense.

Ice-Contact Stratified Deposits:

Sand: A unit of fine to medium brown to light brown sand with silt was encountered below fill soils in all boreholes. The thickness of this ranged from 3.0 (BH6) to 13.6 m (BH7), although the bottom of the unit was not encountered. The composition of the sand included silt and trace gravel which was poorly graded. The consistency of the sand ranged from dense to very dense. Soils were moist to wet, and all holes were dry upon completion.

Due to the nature of ice-contact stratified deposits, units of stratified sand with gravel and silty clay were encountered within the sand unit in select boreholes. Sand with gravel was encountered in BH6 at 2.3 mbgs or an elevation of 293.5 meters above seal level (mASL), and in BH7 at 3.8 mbgs or 296.6 mASL. The silty clay layer was encountered in BH9 at 5.3 mbgs or 292.7 mASL.

2.2.3 Groundwater Levels and Flow

The stabilized groundwater level at each monitoring well was measured by Stantec personnel on April 22, 2022, and by Palmer personnel on May 2, 2022 and May 17, 2022. Water levels were measured using a water level tape and recorded to the nearest centimetre. **Table 2** provides a summary of the measured water level depths. It should be noted that groundwater levels can vary and are subject to seasonal fluctuations in response to weather events.

All wells on site were found to be dry at depths ranging from 5.36 mbgs (BH8) to 16.87 mbgs (BH7), or at elevations of 274.64 to 282.18 metres above sea level (mASL). The lack of shallow groundwater on-site indicates that the thick sand deposits are well drained, resulting in a deep groundwater table. While the measurement taken by Stantec on April 22, 2022 was completed a day after drilling, it reflects the stabilized conditions as the wells remained dry the subsequent two visits in May 2022.

Horizontal groundwater flow is expected to follow local topography on site and is expected to flow eastwards across site based on the Oak Ridges Moraine Groundwater Program (ORMGP) tool (**Figure 1**). Continuously recording data loggers were not installed for this project as monitoring well casings were found to be vandalized and damaged during field investigations.

Table 2. Measured Groundwater Levels

Monitoring Well ID	Units	Groundwater Level		
		Apr 22, 2022*	May 2, 2022	May 17, 2022
BH1	mbgs	Dry at 5.36	Dry at 5.36	Dry at 5.36
	mASL	Dry at 274.64	Dry at 274.64	Dry at 274.64
BH3	mbgs	Dry at 9.32	Dry at 9.32	Dry at 9.32
	mASL	Dry at 281.18	Dry at 281.18	Dry at 281.18
BH4	mbgs	Dry at 9.35	Dry at 9.35	Dry at 9.35
	mASL	Dry at 281.15	Dry at 281.15	Dry at 281.15
BH7	mbgs	Dry at 16.87	Dry at 16.87	Dry at 16.87
	mASL	Dry at 282.03	Dry at 282.03	Dry at 282.03
BH8	mbgs	Dry at 12.32	Dry at 12.32	Dry at 12.32
	mASL	Dry at 282.18	Dry at 282.18	Dry at 282.18

Note: Water level units are in meters below ground surface (mbgs) or meters above sea level (mASL)
**April 22, 2022 measurement completed by Stantec.*

2.2.4 MECP Water Well Records

Based on a review of the MECP Water Well Records (WWR) database, thirty-nine (39) wells were found within a 500 m radius of the site (**Figure 5**). Of these wells, six (6) are used for monitoring, four (4) are used for monitoring and test hole purposes, two (2) are used for domestic & livestock purposes, one (1) well is used for domestic purposes, twelve (12) wells are states as not in use, and the remaining wells have no use listed. All the domestic wells identified within 500 m of the site were drilled within the 1960-1970s and were likely decommissioned, or are not in use, as they are located in areas fully serviced by municipal water.

2.2.5 Hydraulic Conductivity

2.2.5.1 Empirical Analysis

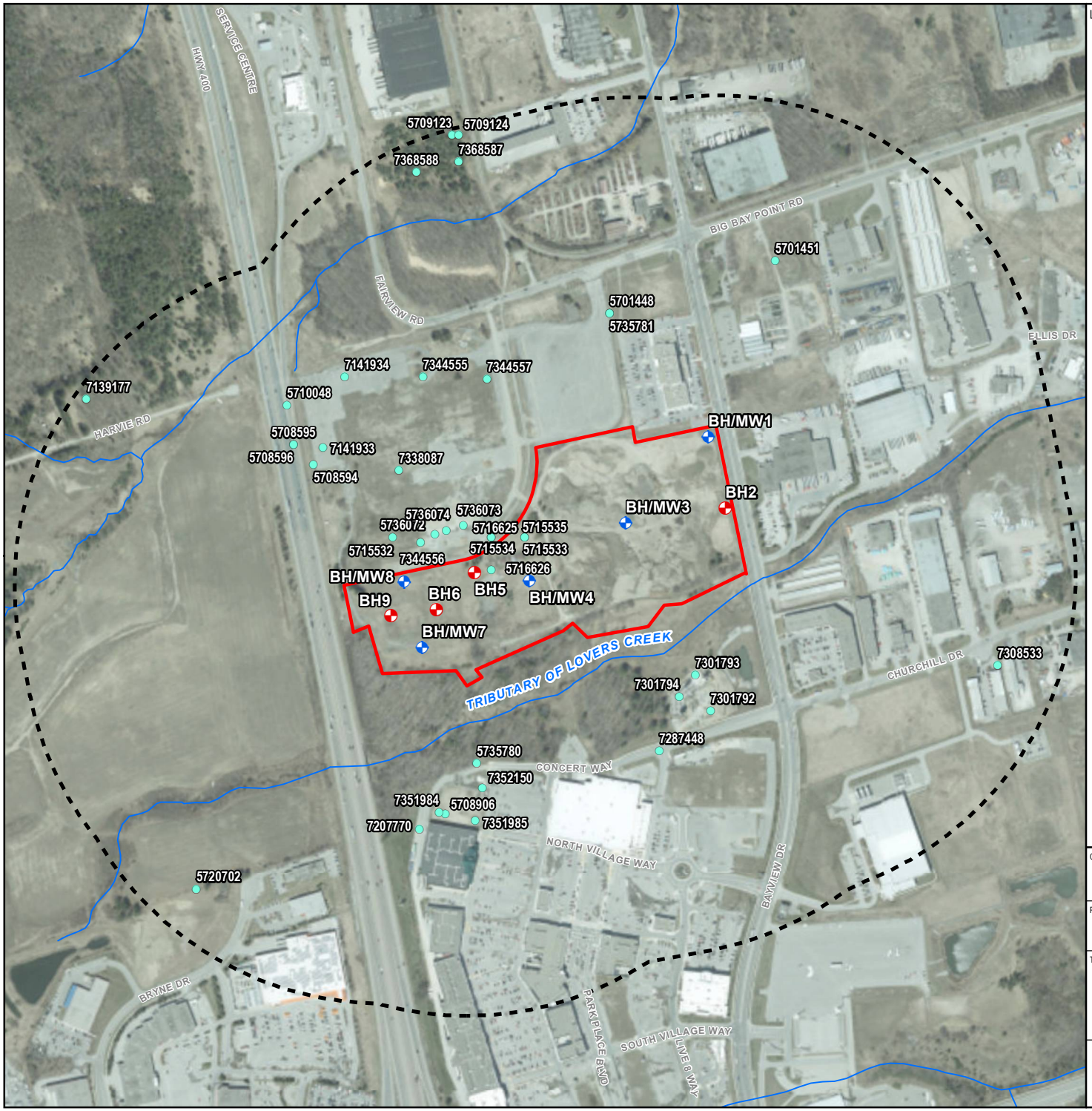
As no groundwater was encountered over the depth of drilling, in-situ hydraulic testing could not be completed. The hydraulic conductivity of the overburden soils was calculated using empirical relationships derived by Sauerbrei (1932) which utilize grain size distribution curves of soil samples. Seven (7) soil samples from the sand unit were collected from BH1, BH2, BH4, BH6 to BH8, and one (1) sample from the silty clay layer was collected from BH9.

Samples were analysed for grain size distribution. The completed grain size distribution curves are provided in **Appendix D**, and the results of the empirical analyses are provided in **Table 3.**

$$K\ (Sauerbrei, 1932) = \frac{\rho g}{\mu}[(3.75 \times 10^{-5}) \times \tau]\left[\frac{n^3}{(1-n)^2}\right] d_{17}^2\ \frac{cm}{s}$$

Where K = hydraulic conductivity (cm/s)
ρ = $3.1\text{x}10^{-8}T^3 - 7.0\text{x}10^{-6}T^2 + 4.19\text{x}10^{-5}T + 0.99985$
g = 980 cms^{-2}
μ = $-7.0\text{x}10^{-8}T^3 + 1.002\text{x}10^{-5}T^2 - 5.7\text{x}10^{-4}T + 0.0178$
τ = $1.093\text{x}10^{-4}T^2 + 2.102\text{x}10^{-2}T + 0.5889$
n = porosity as a fraction of aquifer volume
T = water temperature (°C)

The hydraulic conductivity of the sands ranged between $1.4\text{x}10^{-5}$ to $1.4\text{x}10^{-4}$ m/s, with a geometric mean hydraulic conductivity of $5.9\text{x}10^{-5}$ m/s. These values fall within the expected range for sands with gravel and silt for the A1 Aquifer. The hydraulic conductivity of the silty clay was calculated to be $1.1\text{x}10^{-9}$ m/s, which is in the expected range of a silty clay.



LEGEND

- Borehole[1]
- Monitoring Well[1]
- Well Record within 500m[2]
- Watercourse[3]
- Subject Property
- 500m Site Buffer

1. Stantec, 2022
2. MECP
2. LIO/MNRF

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CLIENT
North American Development Group

PROJECT
410 Bayview Drive
(Park Place North Lands)

TITLE
MECP Well Records within a 500 m radius

Palmer

REF. NO. 2005203

Figure 5

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Table 3: Estimated Empirical Hydraulic Conductivity

Borehole ID	Sample	Geology	Method of Analysis	K (m/s)	Geometric mean	90th percentile K
BH1	SS3	Sand with silt	Sauerbrei	$5.7x10^{-5}$	$5.9x10^{-5}$	$6.2x10^{-5}$
BH2	SS5	Sand with silt	Sauerbrei	$6.2x10^{-5}$		
BH8	SS4	Sand with silt	Sauerbrei	$6.4x10^{-5}$		
BH8	SS11	Sand with silt	Sauerbrei	$4.7x10^{-5}$		
BH4	SS9	Sand	Sauerbrei	$1.4x10^{-5}$		
BH6	SS5	Sand with gravel	Sauerbrei	$8.9x10^{-5}$		
BH7	SS7	Sand with gravel	Sauerbrei	$1.4x10^{-4}$		
BH9	SS9	Silty Clay	Sauerbrei	$1.1x10^{-9}$	$1.1x10^{-9}$	–

2.2.5.2 In-Situ Infiltration Testing

Guelph Permeameter

The in-situ infiltration rate of the surficial soils were measured on May 16, 2022. Testing was completed using a constant head well permeameter method (Guelph Permeameter) and employed both the combined reservoir techniques. Three (3) infiltration test locations were selected (**Figure 6**) based on the Site Plan. At each location, soils were augured to a depth ranging from 1.28 to 1.57 mbgs using a 6 cm diameter soil auger. The testing depth was limited by the soil moisture content and existing saturation of the soil. At each test location (GP 1 to GP3), a single head infiltration test was completed. Prior to the test, approximately 4 L of water was used to fill the Guelph Permeameter. For the single head test, a hydraulic head (H) of 0.01 to 0.05 m was applied. The test was terminated at each test location once the rate of change was observed to remain stable over three consecutive time intervals, achieving a steady-state infiltration rate (R) or once the Guelph Permeameter emptied.

Measured infiltration rates were estimated from the K_{fs} values using the relationship provided by the "Low Impact Development Stormwater Management Planning and Design Guide, Appendix C (Figure C1)" (TRCA/CVC, 2010). Design infiltration rates (mm/hr) were determined by applying a safety correction factor of at least 2.5. Measured infiltration rates are summarized in **Table 4**. Field calculated infiltration rates ranged from 57 to 162 mm/hr across site. With a safety correction factor of 2.5, infiltration rates ranged from 14 to 40 mm/hr, with a geometric mean of 67 mm/hr.

Table 4. Infiltration Testing Summary

Infiltration Test ID	Soil Substrate Tested	Depth of Hole (mbgs)	H (m)	K_{fs} (m/s)	Infiltration Rate (mm/hr)	Infiltration Rate with 2.5 FOS (mm/hr)
GP1	Silty sand (fine- textured), trace clay	1.28	0.05	$4.6 x10^{-6}$	70	28
GP2	Sand, medium-to-coarse textured	1.34	0.01	$1.1 x10^{-4}$	162	65
GP3	Silty sand (fine- textured), trace clay	1.57	0.05	$2.1 x10^{-6}$	57	23
Geometric Mean				$1.02 x10^{-5}$	86	34

LEGEND

- Infiltration Testing Location
- Borehole[1]
- Monitoring Well[1]
- Watercourse[2]
- Subject Property

1. Stantec, 2022
2. LIO/MNRF

0 25 50 100 150 200
METRE SCALE

North American Datum 1983
Universal Transverse Mercator Projection Zone 17

Scale: 1:3,500
Page Size: Letter (8.5 x 11 inches)

Drawn: CV
Checked: NA
Date: Jun 7, 2022

NORTH

Source Notes:
Imagery (2018) provided by Simcoe County map service

CLIENT
North American Development Group

PROJECT
410 Bayview Drive
(Park Place North Lands)

TITLE
Infiltration Testing Locations

Palmer™

REF. NO. 2005203

Figure 6

Document Path: G:\Shared drives\Projects 2020\20052 - North American Development Group\2005203 - 410 Bayview Drive (Park Place North Lands)\GIS\1_Workspace\Task 1 - HydroG Figures\2005203_6-1_Infiltration Testing Locations.mxd

3. Hydrogeological Conceptual Model

Groundwater flow on site is controlled by a unit of ice-contact stratified deposits that consist primarily of fine to medium sand (locally referred to as aquifer A1). These high permeability deposits are the primary hydrostratigraphic unit present on site and are encountered up to depths of at least 16.87 mbgs. Based on the dry groundwater levels measured in April to May 2022 in each well (dry at 5.36 to 16.87mbgs or at elevations of 274.64 to 282.18 mASL), these deposits appear to be well drained with a deep groundwater table. The soils have a high estimated hydraulic conductivity ($5.9x10^{-5}$ m/s) which is within the expected range for these soils and have a high geometric mean infiltration rate of 86 mm/hr (not including a safety factor). Below the groundwater table, groundwater flow expected to flow eastwards across the site. The surficial sand encountered on site is interpreted to form an unconfined shallow aquifer system and likely supports shallow groundwater flow towards Lovers Creek.

4. Preliminary Water Balance Assessment

4.1 Site Wide Water Balance

4.1.1 Pre-Development Water Balance

A pre-development water balance was completed for the site to determine the existing runoff and groundwater recharge (infiltration) conditions of the site. The area of the site is 13.05 ha based on the Conceptual Site Plan (Ware Malcomb, 2022).

The pre-development water budget was calculated over the site area using a monthly soil-moisture balance approach as described in Thornthwaite and Mather (1957). The water balance calculation estimates average annual evapotranspiration (evaporation and plant transpiration) using factors such as monthly precipitation, temperature, and latitude. Long term climate data were obtained from the nearest meteorological station to the study area with long term data. Data was obtained over the 30-year duration from 1981 to 2010 from the Barrie WPCC which is approximately 3.4 km from the site.

The average available water surplus, which is the water available for infiltration and runoff, was calculated by subtracting the average annual evapotranspiration from the average annual precipitation (**Table 5**). A soil moisture retention value of 50 mm was utilized to represent the sands on site under shallow-rooted green cover at the site, as described by Thornthwaite and Mather (1957). The resulting annual water surplus for the area was determined using MOEE (1995) infiltration factors (**Table 6**).

Table 5: Sitewide Water Balance: Summary of Annual Water Surplus

Land Use	Pre-Development Water Balance (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Open Field	Precipitation	82.5	61.8	58.1	62.2	82.4	84.8	77.2	89.9	94	77.5	88.9	73.6	932.9
	Temperature	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	7
	Potential Evapotranspiration (PET)	0	0	0	29	76	115	137	119	79	39	9	0	602
	P - PET	83	62	58	33	7	-30	-60	-30	15	39	80	74	331
	Change in Soil Moisture Storage	0	0	0	0	0	-23	-20	-3	2	7	37	0	0
	Soil Moisture Storage	50	50	50	50	50	27	7	4	6	13	50	50	-
	Actual Evapotranspiration (AET)	0	0	0	29	76	108	97	93	79	39	9	0	529
	Soil Moisture Deficit (mm)	0	0	0	0	0	7	40	27	0	0	0	0	73
	Surplus (P - AET)	**83**	**62**	**58**	**33**	**7**	**-23**	**-20**	**-3**	**15**	**39**	**80**	**74**	**403.8**

Based on OGS surficial geology mapping and drilling results, the site is underlain with ice-contact stratified deposits (infiltration factor of 0.40). The site has a slope of ~5.4% running south across site (infiltration factor of 0.1). Based on site visits, land use is entirely open field (infiltration factor of 0.6). **Table 6** presents the interpreted soil infiltration factors used for the site-wide water budget. The selection of these values, shown in **Table 7,** is based on the MOEE (1995) values and site-specific conditions.

Table 6. MOEE (1995) Infiltration Factors

Description of Area/Development Site	Value of Infiltration Factor
TOPOGRAPHY	
- Average slope factor of 6%	0.10
SOIL	
- Ice-Contact Stratified Deposits / Coarse-textured Glaciolacustrine Deposits	0.40
COVER	
- Greenspace	0.10

Note: Reproduced from MOEE (1995), Technical Guidelines for the Preparation of Hydrogeological Studies for Land Development Applications.

Table 7. Infiltration and Runoff Factors

Description of Area	Soils Factor	Topography Factor	Vegetation Factor	Infiltration Factor	Runoff Factor
Greenspace	0.40	0.1	0.1	0.6	0.4

The calculated actual ET (or AET) based on the Thornthwaite and Mather monthly water balance model is approximately 529 mm/year, or approximately 57% of the total annual precipitation (**Table 5**). The actual evapotranspiration is calculated based on a potential ET (or PET) and soil-moisture storage withdrawal. Monthly PET is estimated using monthly temperature data and is defined as a water loss from a homogeneous vegetation covered area that never lacks water (Thornthwaite, 1948; Mather, 1978). The calculated PET for the study area is 602 mm/year, or about 65% of the total precipitation.

The estimated pre-development water surplus was calculated using the soil moisture retention value for the site is approximately 403.8 mm/year (**Table 7**). The water surplus has two components: a runoff component which occurs when the soil moisture capacity is exceeded leading to overland flow, and an infiltration component. Using the previously calculated range of infiltration factors, it is estimated that approximately 162 mm/year is runoff, and 243 mm/year is infiltration. Over the full site area of 13.05 ha, this represents approximately 21,081 m^3/year of runoff and 31,621 m^3/year of infiltration (**Table 8**).

Table 8: Pre-Development Water Budget

Water Budget Component	Totals
Total (ha)	**13.05**
Impervious Factor	0.00
Impervious area (ha)	0.00
Water Surplus on Impermeable Surfaces (m^3/year)	0.840
Run off from Impervious Area (m^3/year)	0.00
Estimated Pervious Area (ha)	13.05
Water Surplus on Vegetated Pervious Areas (m^3/year)	0.404
Runoff Coefficient	0.40
Runoff Volume From Pervious Area (m^3/year)	21,081
Infiltration Coefficient	0.60
Infiltration Volume from Pervious Area (m^3/year)	31,621
Total Runoff Volume (m^3/year)	21,081
Total Infiltration Volume (m^3/year)	31,621

4.2 Low Impact Development

For sites with deep water table conditions and high permeability soils, LID practices can significantly improve infiltration and groundwater recharge to maintain the groundwater characteristics of the underlying aquifer. However, for sites with low permeability soils and high-water table conditions, the amount of infiltration is limited by the saturated hydraulic conductivity of the soil (i.e., the rate at which water can infiltrate). Under these conditions, LID practices should focus on filtration, evaporation, detention and re-use to minimize pre-to-post changes in the site water budget. Engineering design measures to maintain pre-to-post development infiltration to the extent practical will need to consider these soil and groundwater conditions in the design.

The Park Place Industrial site is located within a WHPA-Q2, recharge management area. Therefore, infiltration will need to be maintained to the extent practical. The site is ideal for infiltration-based LID facilities as it hosts a deep-water table and high permeability ice-contract stratified deposits. Given the deep groundwater table (5.36 to 16.87 mbgs or at elevations of 274.64 to 282.18 mASL), high permeability of the sandy soils (10^{-5} m/s), and the high in-situ infiltration rates (86 mm/hr), groundwater mounding from the use of infiltration-based LIDs will not be an issue if constructed within or below the native sand unit encountered at elevations between 278.20 (BH1) to 296.60 (BH7). Clean water rooftop drainage collectors will work well with infiltrating clean rooftop water into the sand unit for the proposed industrial building. Other LIDs such as infiltration trenches and permeable pavers may also be affective at infiltrating water based on the soil conditions encountered.

4.3 Groundwater Table and Building/LID Separation based on Site Grading

The finished floor elevations (FFE) of the proposed industrial buildings range from 286.10 to 288.55 mASL, and the elevation of the bottom of the SWM pond is 277.50 mASL. Based on the dry groundwater elevations measured across site, the FFE of the buildings have greater than 2.82 to 6.37 m of separation from the groundwater table. The base of the SWM pond has at least a 2.86 m separation from the groundwater table, meeting the minimum 1 m separation requirement. These values represent the separation based on the dry measurements, and the true groundwater table is expected to deeper than the elevations presented.

While no information on the location or depth of LID measures was available at the time of reporting, meeting a minimum 1 m separation requirement from the base of the LIDs to the high groundwater table is expected to be readily achievable for this site.

Table 9. Building and LID Separation from Groundwater Table

Proposed Development	Finished Floor Elevation / Base Elevation (mASL)	Nearest Monitoring Wells	Groundwater Level Elevation (mASL)	Separation Distance (m)
Building 1	288.55	BH7 / BH8	Dry at 282.03 / 282.18	6.37
Building 2	286.10	BH4	Dry at 281.25	4.85
Building 3	286.10	BH3	Dry at 281.18	4.92
Building 4	284.00	BH3	Dry at 281.18	2.82
SWM Pond	277.50	BH1	Dry at 274.64	2.86

5. Preliminary Phosphorus Budget

5.1 Phosphorous Budget and Offsetting Requirements

The Lake Simcoe Phosphorus Offsetting Program (LSPOP) requires that all new developments must control 100% of the phosphorus from leaving their property. This is referred to as the Zero Export Target and prevents new developments or re-development activities from contributing to phosphorous loading into Lake Simcoe. Under this policy, phosphorus loads should be controlled to the maximum extent possible using the best management practices available within the proposed development, in compliance with the MECP Stormwater Guidelines and the LSRCA Watershed Development Guidelines, whichever is more stringent. Phosphorous reduction would be through the use of LID techniques and addressing stormwater.

Phosphorous offsetting will be applied to the following under the under *the Planning Act, Condominium Act,* and *Conservation Authorities Act* (LSRCA, 2021):

- plans of subdivision;
- plans of condominium;
- site plans involving major development;
- consent applications resulting in the creation of four or more new lots; and,
- applications under the *Conservation Authorities Act* where s28.0.1. applies.

To calculate the pre-to-post development phosphorus budget on site, the MECP Phosphorus Budget Tool (V2.0 Release Update – March 30, 2012) was used.

5.1.1 Pre-Development Phosphorous Load

The total pre-development area of the site is 13.05 ha and the site is located within the Lovers Creek Subwatershed. Using this information and knowledge that the site is entirely an undeveloped open field, the pre-development phosphorus loading has been calculated to be 2.09 kg/year (**Appendix E**).

As the site area is currently undeveloped, the post-development phosphorous budget will be needed to meet the LSPOP Zero Export Target for phosphorus leaving their property. While it cannot be confirmed at this stage if this policy can be met, the hydrogeological conditions at the site are ideal for the use of infiltration-based LID measures that can greatly reduce/ manage phosphorus loading.

5.1.2 Preliminary Post-Development Phosphorus Loading

Based on the Site Plan (Ware Malcomb, 2022 - **Appendix A**), the development consists of four (4) industrial buildings, parking lots, roads, landscaped areas, and a SWM pond. The preliminary post-development phosphorous load is expected to increase to approximately 22.76 kg/year, which represents a 987% increase in load. This calculation assumes the use of a SWM Pond (i.e., Wet Detention Pond) with an efficacy of 63%. No other LID mitigation was accounted for at this time.

Therefore, to balance the pre-to-post development phosphorous balance on site, an additional 20.67 kg/year will need to be treated through the use of LIDs.

6. Impact Assessment and Hydrogeological Design Considerations

6.1 Assessment of Impacts

6.1.1 Dewatering

All wells on site were found to be dry at depths ranging from 5.36 to 16.87 mbgs, or at elevations of 274.64 to 282.18 mASL. All four (4) industrial buildings are expected to be constructed as slab on grade, with no basements. Resultantly, the building foundations are expected to be well above the groundwater table on-site. Based on the FFE of the proposed buildings and the dry groundwater elevations, there will be greater than 2.82 to 6.37 m separation between the groundwater table and building foundations Additional monitoring will be completed in June and July 2022, but these data are not expected to change this conclusion.

Under the Environmental Activity and Sector Registry (EASR) system, water takings for construction dewatering that are greater than 50,000 L/day and less than 400,000 L/day per area of influence associated with dewatering (overlapping areas of influence from physically separate active dewatering operations are classed as a single area of influence, O.Reg. 63/16) do not require a Permit to Take Water (PTTW) from the MECP; however, the project must be registered on the EASR system and meet a series of environmental protection criteria. Above 400,000 L/day for any single or overlapping areas of influence, a Category 3 PTTW from the MECP is required.

Based on the Site Plan and the site conditions, no dewatering is expected to be required for the slab-on-grade buildings. Therefore, no temporary or long-term dewatering or permitting with the MECP will be required.

6.1.2 Private Water Wells

The MECP Water Well records identified three (3) domestic wells in a 500 m radius of the site. It is expected the wells were decommissioned or are no longer in use, as municipal servicing is available in the area. No dewatering is expected for building, therefore no well impacts are expected.

6.1.3 Aquifers and Natural Environmental Features

No wetlands or watercourses were identified on site, however there is a tributary of Lovers Creek located approximately 100 m from the southernmost boundary of the property. Maintaining the pre-to-post development water balance will be important on site as Lovers Creek is known to be groundwater supported, and the surficial sands on site are interpreted to form an unconfined aquifer than likely supports shallow groundwater flow towards Lovers Creek.

Over a site area of 13.05 ha, there is approximately 31,621 m^3/year (243 mm/year) of infiltration and 21,081 m^3/year (162 mm/year) of runoff pre-development. Based on the site conditions, maintaining or increasing the pre-development infiltration rates is expected to be a straightforward process with standard LID design and integration with the Stormwater Management program given the high percolation rates

and deep groundwater table. With the pre-to-post development water balance maintained, no impacts to shallow or deep aquifers, or to Lovers Creek are expected from this development.

6.2 Hydrogeological Design Considerations

6.2.1 Source Water Protection

The Park Place Industrial site is situated within the Lakes Simcoe Couchiching/Black River Source Water Protection Area and is subject to the South Georgian Bay Lake Simcoe Region's Source Protection Plan (SGBLSSPP). The objectives of the SPP, as established under the *Clean Water Act, 2006*, are as follows:

- To protect existing and future drinking water sources in the protection region; and,
- To ensure that, for every area identified in the assessment report as an area where an activity is or would be a significant drinking water threat:
    - The activity never becomes a significant drinking water threat; or,
    - If the activity is occurring when the SPP took effect, the activity ceases to be a significant drinking water threat.

The Source Water Protection Information Atlas identified that the site is located within a WHPA-Q2 (Recharge Management Area). The site was additionally identified to be in an IPZ-3, which is an area where contaminants could reach the intake piper during and after a large storm. Stormwater runoff (with the exception of clean roof runoff) must be directed outside of the IPZ-3 or to storm sewers. No other Source Water Protection designations were identified for the site. Based on the SGRBLSSP, no significant land use restrictions are expected from Source Protection policies.

6.2.2 Low Impact Development

Infiltration rate estimates were determined through in-situ infiltration testing using a Guelph Permeameter at three (3) locations across site.

The geometric mean design infiltration rate was determined to be 34 mm/hr for the ice-contact stratified deposits. The well drained and dry soils encountered on site are well suited for deeper, infiltration-based LID facilities. It is important to note that LIDs should be installed at least 1 m above the water table. The FFE of the proposed buildings and the base of the SWM pong have greater than 2.82 to 6.37 m of separation from the dry groundwater elevations based on the grading plan. Achieving a 1 m separation from the base of the LIDs and groundwater table should be readily achievable based on the site conditions. Consideration should be given to directing clear rooftop drainage from the buildings to an infiltration-based LID (e.g., a cultec infiltration gallery) to promote infiltration in this area.

6.2.3 SWM Pond

Based on the current Site Plan (**Appendix A**), a SWM pond is proposed for the site in the northeast corner of the site near the locations of BH1 and BH2. The Preliminary Grading Plan indicates that the bottom of the pond elevation is 277.50 mASL. At this elevation, high permeability native sands with silt (5.9×10^{-5} m/s) are expected to be encountered based on the borehole log of BH1. The base of the SWM pond has greater than a 2.86 m separation from the high water table based on the dry groundwater elevation measured in BH1, meeting the 1 m separation requirement.

Typically, impermeable liners are not required for SWM ponds where the native soils have a hydraulic conductivity less than $1x10^{-7}$ m/s. Due to the high permeability of the soils on site, the use of an impermeable liner will be required for the SWM pond.

7. Conclusions and Recommendations

Based on the results of the Hydrogeological Investigation, the following summary of conclusions and recommendations are presented:

- The site is underlain by ice-contact stratified deposits. These ice-contact deposits consist of fine to medium sand and overlay the Newmarket Till (Northern Till) on a regional scale. This was found to be consistent with regional surficial geology mapping.

- Two rounds of groundwater level monitoring data were collected in May 2022. All wells on site dry at depths ranging from 5.36 to 16.87 mbgs, or at elevations of 274.64 to 282.18 mASL. The lack of groundwater on-site suggests the thick sand deposits are well drained, resulting in a deep groundwater table.

- As all monitoring wells are dry, in-situ hydraulic testing cannot be completed. The hydraulic conductivity values were estimated from empirical grain size analysis. The geometric mean hydraulic conductivity of the ice-contact stratified deposits of sand was calculated to be $5.9x10^{-5}$ m/s. This is within the expected range for fine to medium sand. The hydraulic conductivity of the silty clay layer within the ice-contact stratified deposits was calculated to be $1.1 x10^{-9}$ m/s.

- Infiltration rates were field calculated using the Guelph Permeameter. It is estimated that the geometric mean infiltration rate of the ice-contact stratified deposits is approximately 86 mm/hr. The design infiltration rate was determined by applying a safety correction factor of at least 2.5 and was determined to be 34 mm/hr.

- A pre-development water budget has been completed to provide guidance on the expected volume of pre-development infiltration to support the stormwater management reporting. Over a site area of 13.05 ha, there is approximately 31,621 m^3/year (243 mm/year) of infiltration and 21,081 m^3/year (162 mm/year) of runoff pre-development.

- The site is ideal for infiltration-based LID facilities as it hosts a deep-water table and high permeability ice-contract stratified deposits. Given the deep groundwater table (>16.87 mbgs), high permeability of the sandy soils (10^{-5} m/s), and the high in-situ infiltration rates (86 mm/hr), groundwater mounding from the use of infiltration-based LIDs will not be an issue if constructed within or below the native sand unit encountered at elevations between 278.20 to 296.60 mASL.

- The four (4) industrial buildings are expected to be constructed as slab-on-grade, with no basements. Foundations are expected to be above the groundwater table (greater than 2.82 to 6.37 m separation) based on the hydrogeological conditions found at the site and the grading plan. Based on the Site Plan and the site conditions, no dewatering is expected for this development.

Therefore, no temporary or long-term dewatering or permitting with the MECP is expected to be required.

- The Source Water Protection Information Atlas identified that the site is located within a WHPA-Q2 (Recharge Management Area). The site was additionally identified to be in an IPZ-3. Stormwater runoff must be directed outside of the IPZ-3 or to storm sewers. No other Source Water Protection designations were identified for the site.

- A tributary of Lovers Creek located approximately 100 m from the southernmost boundary of the property. Maintaining the pre-to-post development water balance will be important on site as Lovers Creek is known to be groundwater supported, and the surficial sands on site are interpreted to form an unconfined aquifer than likely supports shallow groundwater flow towards Lovers Creek.

- The MECP Water Well records identified 3 domestic wells in a 500 m radius of the site. It is expected the wells were decommissioned or are not in use as there is municipal servicing available in the area. No dewatering is expected for the site, therefore no well impacts are expected.

- The pre-development phosphorous loading for the site is calculated to be 2.09 kg/year based on a site area of 13.05 ha. Post-development, this increases to 22.76 kg/year, which represents a 987% increase in load. This calculation assumes the use of a SWM Pond (i.e., Wet Detention Pond) with an efficacy of 63%. No other LID mitigation was accounted for at this time, but if implemented, are expected to significantly decrease the post-development phosphorus loading.

- The Preliminary Grading Plan indicates that the bottom of the pond elevation is 277.50 mASL. At this elevation, high permeability native sands with silt (5.9×10^{-5} m/s) are expected to be encountered. Due to the high permeability of the soils, the use of an impermeable liner below the SWM pond will be required.

8. Signatures

This report was prepared and reviewed by the undersigned:

Prepared By: DRAFT

Nicole Anasis, M.Env.Sc. G.I.T.
Environmental Scientist

DRAFT

Supriya Singh, M.Sc., P.Geo.
Hydrogeologist

Reviewed By: DRAFT

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VP, Principal Hydrogeologist

Limitations of Report

This report was prepared by Palmer for North American Development Group Inc. (NADG) in accordance with the scope of work described in the proposal. The conclusions and recommendations detailed in this report are based upon the information available at the time of preparation of the report. No investigative method eliminates the possibility of obtaining imprecise or incomplete information. Professional judgement was exercised in gathering and analyzing the information obtained and in the formulation of our conclusions and recommendations. The nature of the sampling works makes it possible that contrary conditions may be identified in locations which were not sampled. However, it does suggest that the conditions will be localized and not extensive. The soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations made during drilling and therefore should not be interpreted as exact planes of geological change.

The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects Palmer's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Palmer accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

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The original of this electronic document has been authenticated and will be retained by Palmer for a minimum of five years. Since the file transmitted is now out of Palmer's control and its integrity can no longer be ensured, no guarantee may be given with regards to any modifications made to this document.

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Appendix A

Site Plan

Ware Malcomb, 2022

PROJECT DATA:

SITE AREA:		
GROSS:		13.05 HA
	1,404,977 SF	130,527 m²
S.W.M:	1.49 AC	6,018 m²
LANDSCAPE:	@ 20%	25,881 m²
	278,584 SF	
NET:		9.86 HA
	1,061,614 SF	98,627 m²
BUILDING AREA:		
BUILDING 1	112,840 SF	10,480 m²
BUILDING 2	91,493 SF	8,500 m²
BUILDING 3	153,331 SF	14,245 m²
BUILDING 4	155,796 SF	14,474 m²
TOTAL:	513,460 SF	47,699 m²
FAR:		
GROSS:		0.37
NET:		0.48
COVERAGE:		
GROSS:		37%
NET:		48%
OVERALL PARKING		
REQ. PARKING		1,192 STALLS
AUTO PARKING		557 STALLS
BUILDING 1		
▲ DOCK-HIGH DOORS		19
O GRADE-LEVEL DOORS		2
REQ. PARKING	@ 10% OFFICE	262 STALLS
AUTO PARKING		74 STALLS
		@0.71/100 m²
REQ. ACCESSIBLE		*8 STALLS*
BUILDING 2		
▲ DOCK-HIGH DOORS		19
O GRADE-LEVEL DOORS		2
REQ. PARKING	@ 10% OFFICE	213 STALLS
AUTO PARKING		86 STALLS
		@1.01/100 m²
REQ. ACCESSIBLE		*7 STALLS*
BUILDING 3		
▲ DOCK-HIGH DOORS		44
O GRADE-LEVEL DOORS		2
REQ. PARKING	@ 10% OFFICE	356 STALLS
AUTO PARKING		178 STALLS
		@1.25/100 m²
REQ. ACCESSIBLE		*11 STALLS*
BUILDING 4		
▲ DOCK-HIGH DOORS		44
O GRADE-LEVEL DOORS		2
REQ. PARKING	@ 10% OFFICE	362 STALLS
AUTO PARKING		219 STALLS
		@1.51/100 m²
REQ. ACCESSIBLE		*12 STALLS*

DEVELOPMENT STANDARDS:

ZONING:	BP (SP-407)(H2-100)(H2-101)
MAX. COVERAGE:	50%
MAX. HEIGHT:	45 FT
BUILDING SETBACKS:	
FRONT:	6.0 m
SIDE:	4.0 m [1]
REAR:	6.0 m [2]
LANDSCAPE SETBACKS:	
FRONT:	6.0 m
SIDE:	1.5 m [4]
REAR:	1.5 m [4]
OFF-STREET PARKING:	
STANDARD:	2.7X5.5
DRIVE AISLE:	6.4 m
REQ. PARKING RATIO BY USE:	
WAREHOUSE:	1/1000 sq. m
MANUF	1/70 sq. m
OFFICE:	1/30 sq. m [3]

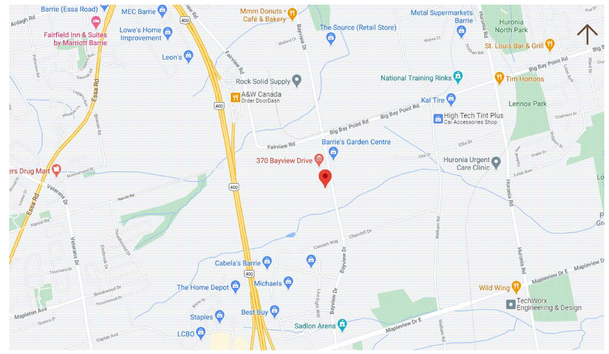
NOTES:

1 10.0 metres adjacent to Residential zone, 6.0 metres adjacent to street.
2 15.0 metres adjacent to Residential zone, 6.0 metres adjacent to street.
3 Minimum of 2 stalls.
4 6.0 metres adjacent to any street. A minimum of 50% of the required bufferyard shall be landscaped. 3.0 metres adjacent to Open Space, Commerical, or Institutional.

This conceptual design is based upon a preliminary review of entitlement requirements and on unverified and possibly incomplete site and/or building information, and is intended merely to assist in exploring how the project might be developed.

Stormwater Management Design:
SURFACE AND UNDERGROUND DETENTION

Boundary Source:
PDF ALTA SURVEY



1:1000
0 10m 25m 50m 100m

NORTH

scheme: 8

Conceptual Site Plan

Bayview Dr
Barrie, ON, Canada

NorthAMERICAN DEVELOPMENT GROUP

WARE MALCOMB

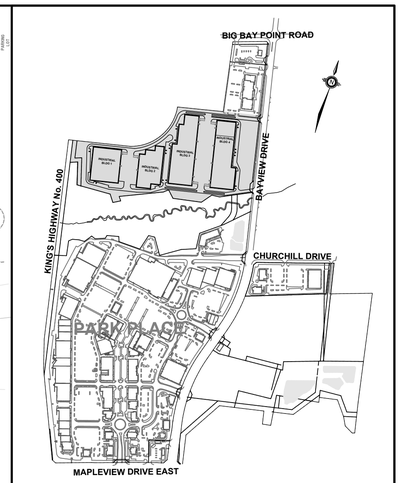
TOR20-0109-00
03.10.2022

SHEET
2

Appendix B

Preliminary Grading Plan

SKA, 2022



KEYMAP N.T.S.

PROPOSED BUILDING 16,857.84 SM 181,456.12 SF

INDUSTRIAL BLDG 1
FFE=288.55

INDUSTRIAL BLDG 2
FFE=286.10

INDUSTRIAL BLDG 3

INDUSTRIAL BLDG 4
FFE=286.10

KINGS HIGHWAY No.400

BAYVIEW DRIVE

OVERHEAD HYDRO GUY WIRES ALONG PROPERTY LINE

EX. 6-PLEX RESIDENCE

EX. 6-STY SENIOR RESIDENCE

SCALE 1:1000

PRELIMINARY SITE GRADING NORTH LANDS

SABOURIN KIMBLE & ASSOCIATES LTD. CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
02.999	XXX

PLOT DATE: 3/9/2022, 2:46 PM CAD FILE: P:\02\999\Drawing Files\Phase 1\North Lands\999 North Lands Grading.dwg

Appendix C

Borehole Logs

Stantec, 2022

Stantec

BOREHOLE RECORD

BH1/MW1

CLIENT North American Development Corporation

PROJECT No. **121624148**

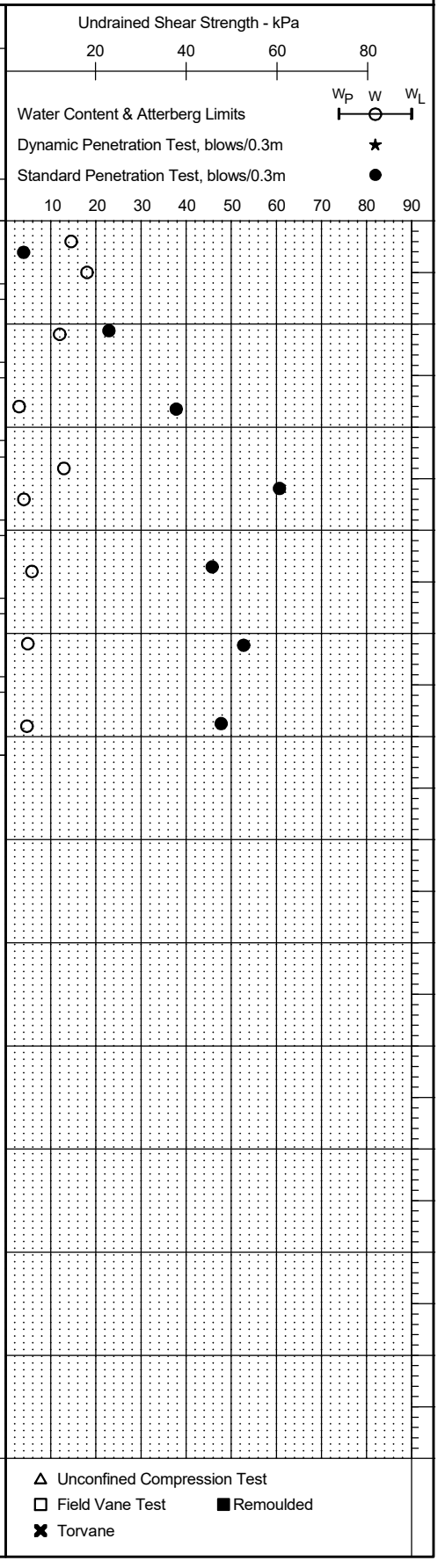
LOCATION **Park Place Industrial Development Project Barrie, ON**

BOREHOLE No. **BH1/MW1**

DATES: BORING **2022/04/18** WATER LEVEL **Not Observed**

DATUM **GEODETIC**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
	280.00						mm	
0	279.9	TOPSOIL			SS	1	584	4
		Loose to dense brown SAND with SILT (SP-SM) - trace gravel, moist, poorly graded						
1					SS	2	610	23
	278.2				SS	3	559	38
2		Dense to very dense, light brown to brown SAND with SILT (SP-SM) - trace gravel, moist, poorly graded						
					SS	4	533	61
3					SS	5	457	46
4					SS	6	432	53
					SS	7	584	48
5	274.8							
		End of Borehole at 5.18 m - Monitoring well MW1 installed with screen interval between 2.1 and 5.2 mbgs - Dry upon completion, no groundwater was observed during drilling - MW readings collected April 22nd, 2022 and groundwater was not detected						
6								
7								
8								
9								
10								
11								
12								



Stantec

BOREHOLE RECORD

BH2

CLIENT North American Development Corporation

PROJECT No. 121624148

LOCATION Park Place Industrial Development Project Barrie, ON

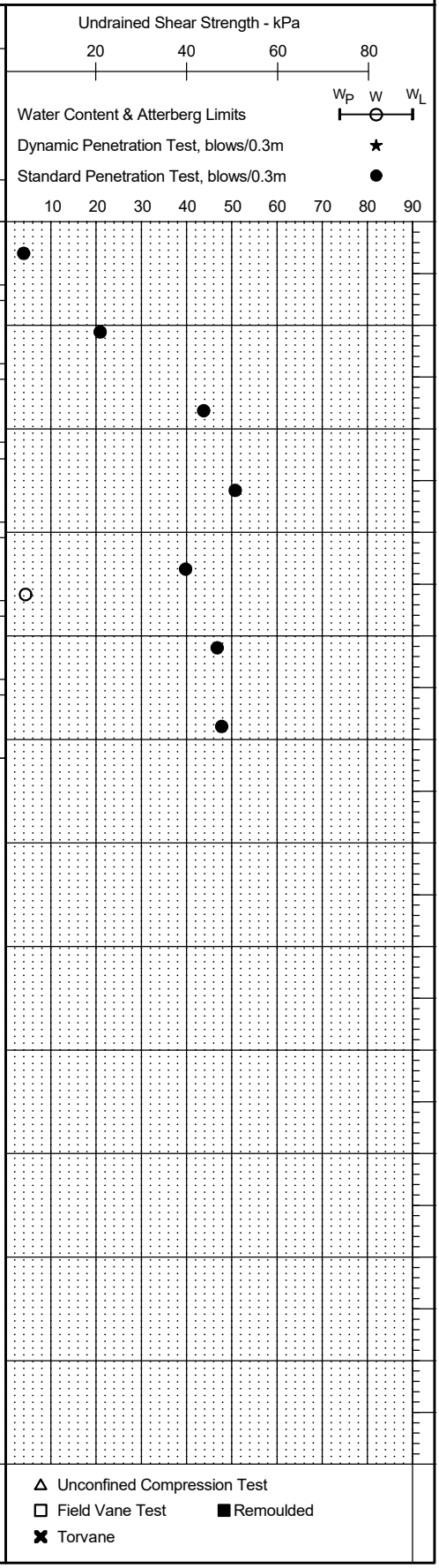
BOREHOLE No. BH2

DATES: BORING 2022/04/18

WATER LEVEL Not Observed

DATUM GEODETIC

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
	281.00						mm	
0	280.8	TOPSOIL			SS	1	508	4
		Loose to very dense brown SAND with SILT (SP-SM) - trace gravel, moist, poorly graded			SS	2	610	21
1					SS	3	483	44
2					SS	4	457	51
3					SS	5	457	40
4					SS	6	508	47
5	275.8				SS	7	559	48
		End of Borehole at 5.18 m - Dry upon completion, no groundwater was observed during drilling						
6								
7								
8								
9								
10								
11								
12								



Stantec

BOREHOLE RECORD

BH3/MW3

CLIENT North American Development Corporation

PROJECT No. 121624148

LOCATION Park Place Industrial Development Project Barrie, ON

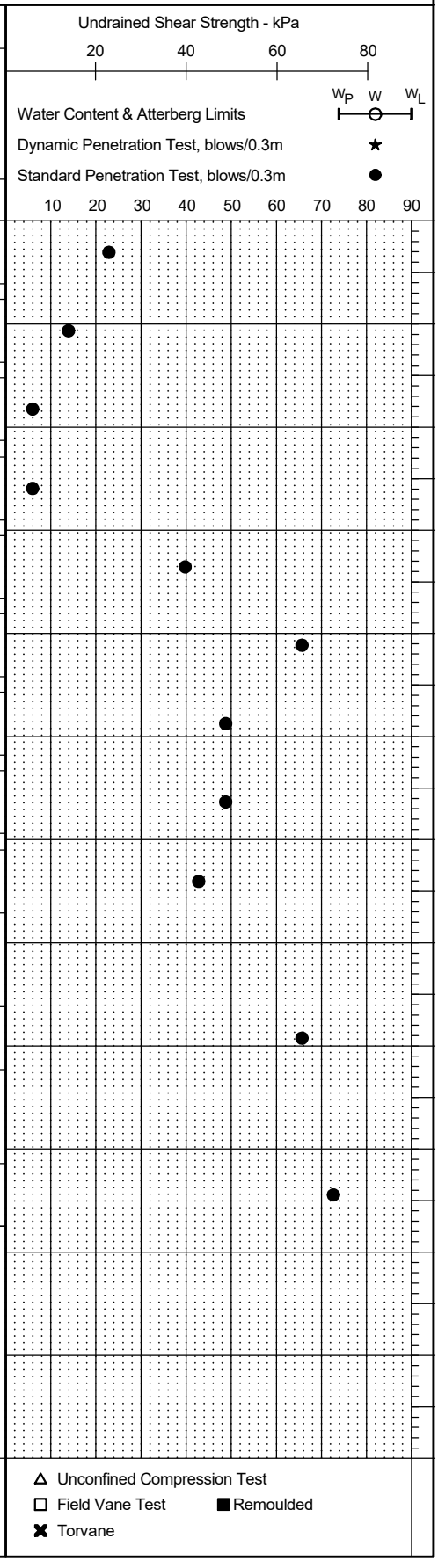
BOREHOLE No. BH3/MW3

DATES: BORING 2022/04/18

WATER LEVEL Not Observed

DATUM GEODETIC

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
	290.50						mm	
0	290.4	TOPSOIL			SS	1	457	23
	289.7	Compact brown silty sand FILL - trace gravel, moist						
1		Loose to very dense light brown SAND with SILT (SP-SM) - trace gravel, moist, poorly graded			SS	2	457	14
2					SS	3	381	6
					SS	4	483	6
3					SS	5	584	40
4					SS	6		66
5					SS	7	610	49
		- At 5.3 m: moisture content observed to change from mosit to dry			SS	8	610	49
6					SS	9	610	43
7								
8					SS	10	610	66
9		- At 9.1 m: occasional layers of fine grained silty sand			SS	11	610	73
	280.8							
10		End of Borehole at 9.75 m - Monitoring well MW3 installed with screen interval between 6.1 and 9.1 mbgs - Dry upon completion, no groundwater was observed during drilling - MW readings collected April 22nd, 2022 and groundwater was not detected						
11								
12								



Stantec

BOREHOLE RECORD

BH4/MW4

CLIENT North American Development Corporation

PROJECT No. 121624148

LOCATION Park Place Industrial Development Project Barrie, ON

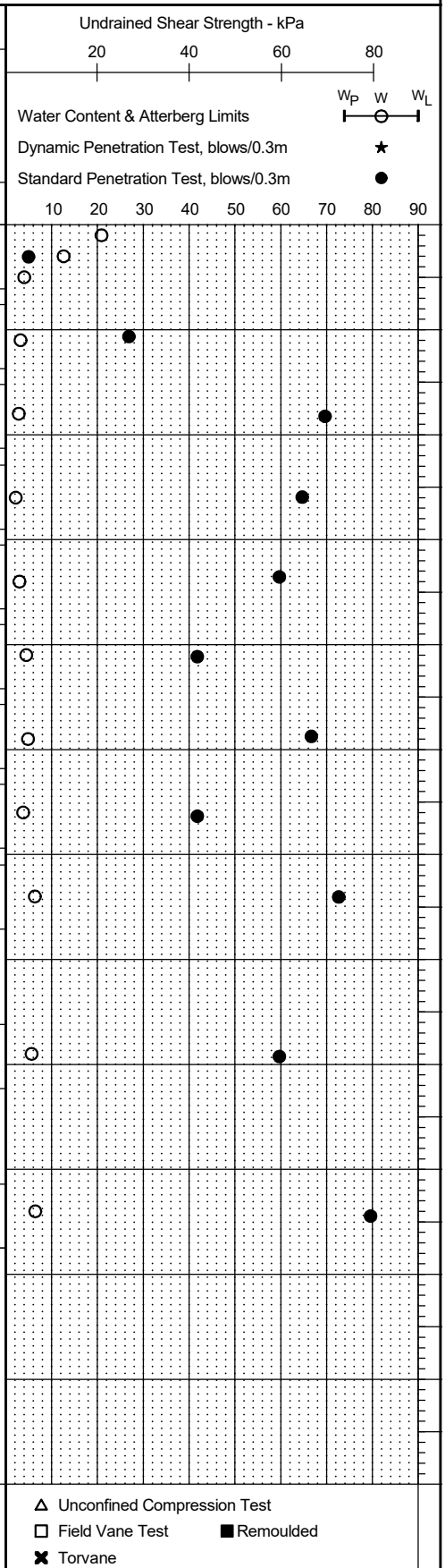
BOREHOLE No. BH4/MW4

DATES: BORING 2022/04/18

WATER LEVEL Not Observed

DATUM GEODETIC

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
	290.50						mm	
0	290.3	TOPSOIL			SS	1	508	5
		Loose to compact brown silty sand FILL - trace gravel, dry						
1					SS	2	610	27
	289.0							
		Dense to very dense light brown silty SAND (SM) - trace gravel, moist			SS	3	610	70
2								
					SS	4	508	65
3								
					SS	5	533	60
4					SS	6	610	42
5					SS	7	508	67
6					SS	8	483	42
					SS	9	559	73
7								
8					SS	10	610	60
9								
					SS	11	610	80
	280.8							
10		End of Borehole at 9.75 m - Monitoring well MW4 installed with screen interval between 6.1 and 9.1 mbgs - Dry upon completion, no groundwater was observed during drilling - MW readings collected April 22nd, 2022 and groundwater was not detected						
11								
12								



Stantec

BOREHOLE RECORD

BH5

CLIENT North American Development Corporation

PROJECT No. 121624148

LOCATION Park Place Industrial Development Project Barrie, ON

BOREHOLE No. BH5

DATES: BORING 2022/04/19

WATER LEVEL Not Observed

DATUM GEODETIC

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
	292.00						mm	
0	291.8	TOPSOIL			SS	1	610	12
		Loose to compact brown silty sand FILL - trace gravel, moist						
1					SS	2	406	8
2					SS	3	432	16
	289.7							
		Dense to very dense light brown silty SAND (SM) - trace gravel, moist			SS	4	559	36
3					SS	5	483	48
4					SS	6	483	37
5					SS	7	610	64
					SS	8	483	77
6					SS	9	533	75
7								
		- At 7.6 m: occasional layers of fine grained silty sand			SS	10	559	70
8								
9					SS	11	610	83
10								
11					SS	12	610	160/584
12								

Undrained Shear Strength - kPa

20 40 60 80

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/0.3m ★

Standard Penetration Test, blows/0.3m ●

10 20 30 40 50 60 70 80 90

△ Unconfined Compression Test

□ Field Vane Test ■ Remoulded

✖ Torvane

Continued Next Page

Stantec

BOREHOLE RECORD

BH5

CLIENT North American Development Corporation

PROJECT No. 121624148

LOCATION Park Place Industrial Development Project Barrie, ON

BOREHOLE No. BH5

DATES: BORING 2022/04/19

WATER LEVEL Not Observed

DATUM GEODETIC

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
							mm	
12								
	279.2				SS	13	559	152/584
13		End of Borehole at 12.8 m - Dry upon completion, no groundwater was observed during drilling						
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								

Undrained Shear Strength - kPa

20 40 60 80

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/0.3m ★

Standard Penetration Test, blows/0.3m ●

10 20 30 40 50 60 70 80 90

△ Unconfined Compression Test

□ Field Vane Test ■ Remoulded

✖ Torvane

Stantec

BOREHOLE RECORD

BH6

CLIENT North American Development Corporation

LOCATION **Park Place Industrial Development Project Barrie, ON**

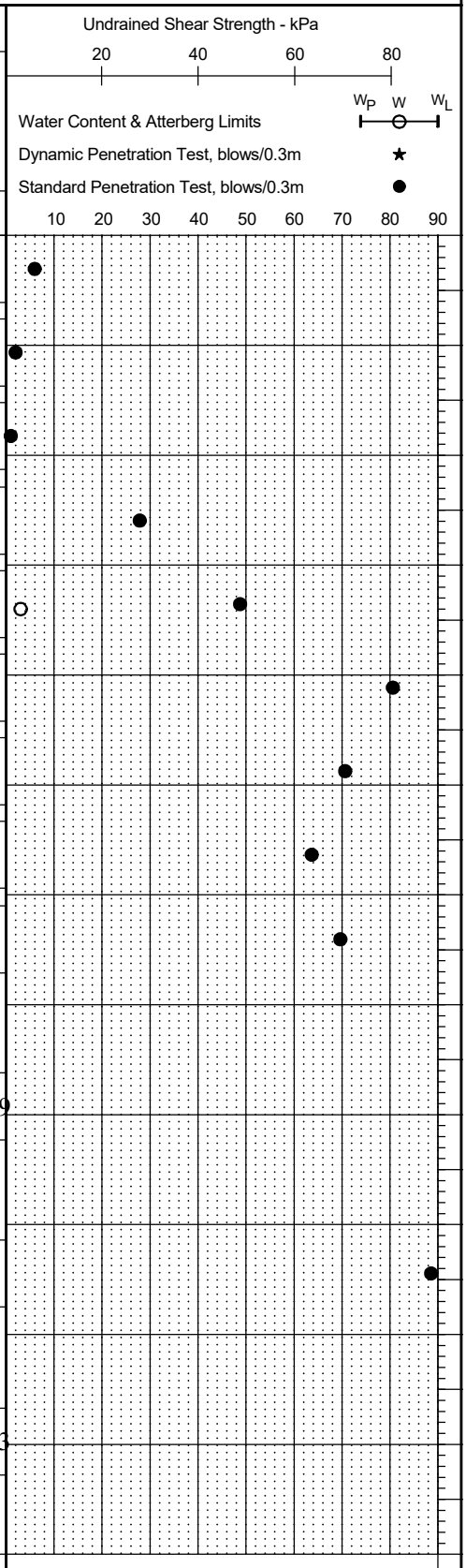
DATES: BORING **2022/04/20** WATER LEVEL **Not Observed**

PROJECT No. **121624148**

BOREHOLE No. **BH6**

DATUM **GEODETIC**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY	N-VALUE OR RQD
	295.80						mm	
0	295.6	TOPSOIL			SS	1	610	6
		Very loose to loose brown silty sand FILL - trace gravel, moist			SS	2	330	2
1					SS	3	483	1
2	293.5							
		Compact to very dense light brown SAND with GRAVEL (SP) - trace gravel, moist, poorly graded			SS	4	356	28
3					SS	5	508	49
4					SS	6	533	81
					SS	7	584	71
5	290.5							
		Very dense light brown silty SAND (SM) - trace gravel, moist			SS	8	533	64
6					SS	9	610	70
7								
					SS	10	432	189/559
8								
9					SS	11	610	89
10								
					SS	12	533	194/533
11								
12								



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BOREHOLE RECORD

BH6

CLIENT North American Development Corporation

PROJECT No. 121624148

LOCATION Park Place Industrial Development Project Barrie, ON

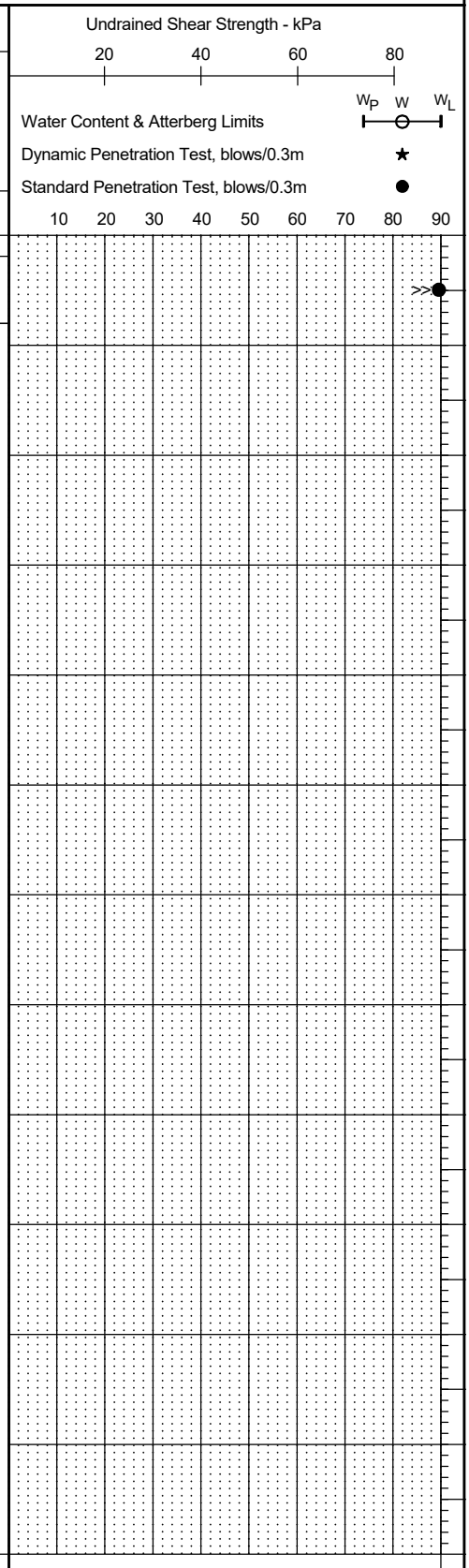
BOREHOLE No. BH6

DATES: BORING 2022/04/20

WATER LEVEL Not Observed

DATUM GEODETIC

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
							mm	
12	283.0				SS	13	610	116
13		End of Borehole at 12.8 m - Dry upon completion, no groundwater was observed during drilling						
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								



Stantec

BOREHOLE RECORD

BH7/MW7

CLIENT North American Development Corporation

PROJECT No. 121624148

LOCATION Park Place Industrial Development Project Barrie, ON

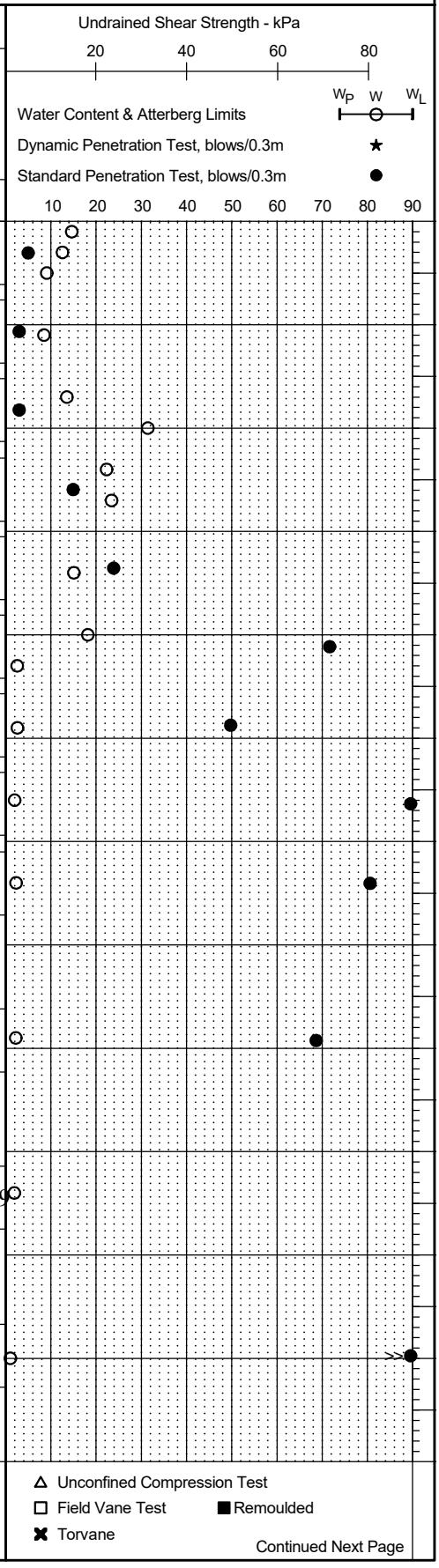
BOREHOLE No. BH7/MW7

DATES: BORING 2022/04/20

WATER LEVEL Not Observed

DATUM GEODETIC

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
	298.90						mm	
0	298.7	TOPSOIL			SS	1	610	5
1		Very loose to loose brown silty sand FILL - trace gravel, moist			SS	2	610	3
2					SS	3	559	3
	296.6							
3		Compact light brown SAND with SILT (SP-SM) - moist, poorly graded			SS	4	610	15
					SS	5	610	24
	295.1							
4		Dense to very dense light brown SAND with GRAVEL (SP) - moist, poorly graded			SS	6	508	72
5					SS	7	533	50
6					SS	8	406	90
					SS	9	610	81
7								
8					SS	10	610	69
9								
					SS	11	610	184/559
10								
11					SS	12	483	95
12								



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BOREHOLE RECORD

BH7/MW7

CLIENT North American Development Corporation

PROJECT No. 121624148

LOCATION Park Place Industrial Development Project Barrie, ON

BOREHOLE No. BH7/MW7

DATES: BORING 2022/04/20

WATER LEVEL Not Observed

DATUM GEODETIC

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
							mm	
12					SS	13	508	83
13								
14					SS	14	483	103
15								
16					SS	15	559	181/533
17								
	281.5				SS	16	559	194/559
18		End of Borehole at 17.37 m - Monitoring well MW7 installed with screen interval between 13.7 and 16.8 mbgs - Borehole cave in below 15 m after well installation - Dry upon completion, no groundwater was observed during drilling - MW readings collected April 22nd, 2022 and groundwater was not detected						
19								
20								
21								
22								
23								
24								

Undrained Shear Strength - kPa

20 40 60 80

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/0.3m ★

Standard Penetration Test, blows/0.3m ●

10 20 30 40 50 60 70 80 90

△ Unconfined Compression Test

□ Field Vane Test ■ Remoulded

✖ Torvane

Stantec

BOREHOLE RECORD

BH8/MW8

CLIENT North American Development Corporation

PROJECT No. 121624148

LOCATION Park Place Industrial Development Project Barrie, ON

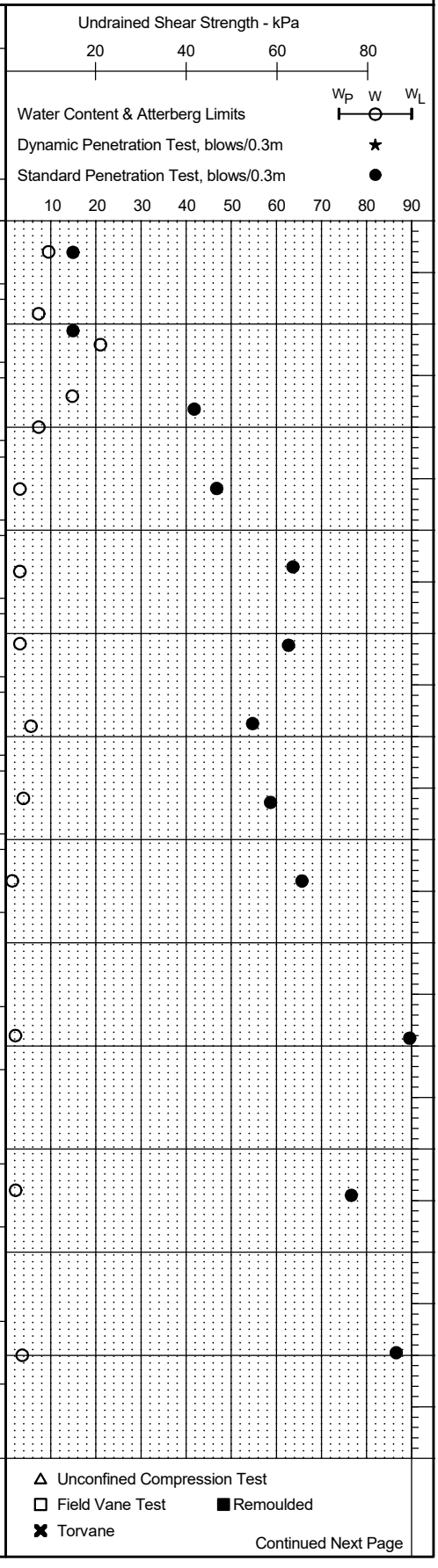
BOREHOLE No. BH8/MW8

DATES: BORING 2022/04/21

WATER LEVEL Not Observed

DATUM GEODETIC

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
	294.50						mm	
0		Compact brown silty sand FILL - trace gravel, trace clay, moist			SS	1	432	15
1					SS	2	533	15
	293.0	Dense to very dense light brown SAND with SILT (SP-SM) - trace gravel, moist, poorly graded						
2					SS	3	610	42
					SS	4	457	47
3					SS	5	483	64
4					SS	6	483	63
					SS	7	457	55
5					SS	8	508	59
6					SS	9	508	66
7								
					SS	10	610	90
8								
9					SS	11	610	77
10								
					SS	12	610	87
11								
12								



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Stantec

BOREHOLE RECORD

BH8/MW8

CLIENT North American Development Corporation

PROJECT No. 121624148

LOCATION Park Place Industrial Development Project Barrie, ON

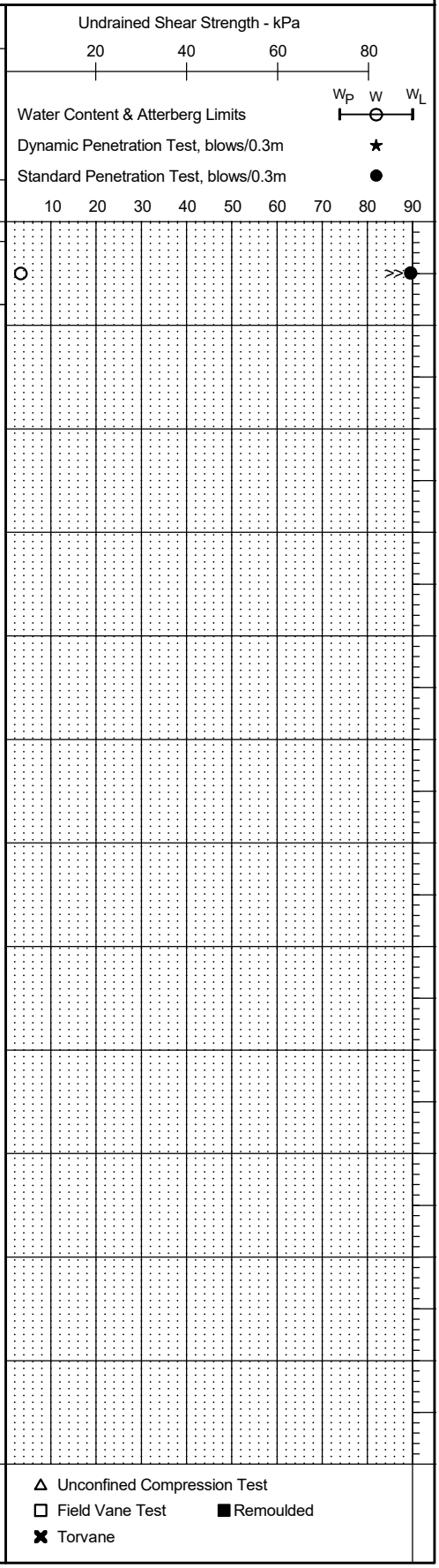
BOREHOLE No. BH8/MW8

DATES: BORING 2022/04/21

WATER LEVEL Not Observed

DATUM GEODETIC

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
							mm	
12								
	281.7				SS	13	610	97
13		End of Borehole at 12.8 m - Monitoring well MW8 installed with screen interval between 9.1 and 12.2 mbgs - Dry upon completion, no groundwater was observed during drilling - MW readings collected April 22nd, 2022 and groundwater was not detected						
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								



Stantec

BOREHOLE RECORD

BH9

CLIENT North American Development Corporation

PROJECT No. 121624148

LOCATION Park Place Industrial Development Project Barrie, ON

BOREHOLE No. BH9

DATES: BORING 2022/04/19

WATER LEVEL Not Observed

DATUM GEODETIC

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
	298.00						mm	
0	297.9	TOPSOIL			SS	1	533	10
1		Very loose to loose light brown silty sand FILL - moist			SS	2	610	1
2					SS	3	610	2
	295.7							
3		Compact to dense light brown SAND with SILT (SP-SM) - moist, poorly graded			SS	4	533	23
					SS	5	610	38
4					SS	6	610	44
5					SS	7	559	45
	292.7							
6		Hard light brown silty CLAY (CL-ML)			SS	8	610	59
					SS	9	610	44
7								
	290.4							
8		Dense to very dense light brown SAND with SILT (SP-SM) - moist, trace gravel, poorly graded			SS	10	533	64
9								
					SS	11	610	95
10								
11					SS	12	610	65
12								

Undrained Shear Strength - kPa

20 40 60 80

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/0.3m ★

Standard Penetration Test, blows/0.3m ●

10 20 30 40 50 60 70 80 90

△ Unconfined Compression Test

□ Field Vane Test ■ Remoulded

✖ Torvane

Continued Next Page

Stantec

BOREHOLE RECORD

BH9

CLIENT North American Development Corporation

PROJECT No. 121624148

LOCATION Park Place Industrial Development Project Barrie, ON

BOREHOLE No. BH9

DATES: BORING 2022/04/19

WATER LEVEL Not Observed

DATUM GEODETIC

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD
							mm	
12					SS	13	610	80
13								
14					SS	14	432	131/432
15								
15					SS	15	559	166/559
16								
17					SS	16	584	167/584
	280.6	End of Borehole at 17.37 m - Dry upon completion, no groundwater was observed during drilling						
18								
19								
20								
21								
22								
23								
24								

Undrained Shear Strength - kPa

20 40 60 80

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/0.3m ★

Standard Penetration Test, blows/0.3m ●

10 20 30 40 50 60 70 80 90

△ Unconfined Compression Test

□ Field Vane Test ■ Remoulded

✖ Torvane

Stantec

MONITORING WELL RECORD

MW1

CLIENT **North American Development Group**

PROJECT No. **121624148**

LOCATION **Park Place Industrial Development Project Barrie, ON**

BOREHOLE No. **MW1**

DATES: BORING **2022-04-18** WATER LEVEL **Not Observed**

DATUM **GEODETIC**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
	280.00							mm		
0	279.9	TOPSOIL				SS	1	584	4	
		Loose to dense brown SAND with SILT (SP-SM) - trace gravel, moist, poorly graded				SS	2	610	23	
1	278.2					SS	3	559	38	
2		Dense to very dense, light brown to brown SAND with SILT (SP-SM) - trace gravel, moist, poorly graded				SS	4	533	61	
3						SS	5	457	46	
4						SS	6	432	53	
5	274.8					SS	7	584	48	
		End of Borehole at 5.18 m - Monitoring well MW1 installed with screen interval between 2.1 and 5.2 mbgs - Dry upon completion, no groundwater was observed during drilling - MW readings collected April 22nd, 2022 and groundwater was not detected								
6										
7										
8										
9										
10										
11										
12										

Stantec

MONITORING WELL RECORD

MW3

CLIENT **North American Development Group**

PROJECT No. **121624148**

LOCATION **Park Place Industrial Development Project Barrie, ON**

BOREHOLE No. **MW3**

DATES: BORING **2022-04-18** WATER LEVEL **Not Observed**

DATUM **GEODETIC**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
	290.50							mm		
0	290.4	TOPSOIL				SS	1	457	23	
		Compact brown silty sand FILL								
	289.7	- trace gravel, moist								
1		Loose to very dense light brown SAND with SILT (SP-SM)				SS	2	457	14	
		- trace gravel, moist, poorly graded								
2						SS	3	381	6	
						SS	4	483	6	
3										
						SS	5	584	40	
4						SS	6		66	
						SS	7	610	49	
5										
		- At 5.3 m: moisture content observed to change from mosit to dry				SS	8	610	49	
6						SS	9	610	43	
7										
						SS	10	610	66	
8										
9		- At 9.1 m: occasional layers of fine grained silty sand				SS	11	610	73	
	280.8									
10		End of Borehole at 9.75 m								
		- Monitoring well MW3 installed with screen interval between 6.1 and 9.1 mbgs								
11		- Dry upon completion, no groundwater was observed during drilling								
		- MW readings collected April 22nd, 2022 and groundwater was not detected								
12										

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MONITORING WELL RECORD

MW4

CLIENT **North American Development Group**

PROJECT No. **121624148**

LOCATION **Park Place Industrial Development Project Barrie, ON**

BOREHOLE No. **MW4**

DATES: BORING **2022-04-18** WATER LEVEL **Not Observed**

DATUM **GEODETIC**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
	290.50							mm		
0	290.3	TOPSOIL				SS	1	508	5	
		Loose to compact brown silty sand FILL - trace gravel, dry								
1						SS	2	610	27	
	289.0									
		Dense to very dense light brown silty SAND (SM) - trace gravel, moist				SS	3	610	70	
2										
						SS	4	508	65	
3										
						SS	5	533	60	
4										
						SS	6	610	42	
5										
						SS	7	508	67	
6										
						SS	8	483	42	
7										
						SS	9	559	73	
8										
						SS	10	610	60	
9										
	280.8					SS	11	610	80	
10		End of Borehole at 9.75 m - Monitoring well MW4 installed with screen interval between 6.1 and 9.1 mbgs - Dry upon completion, no groundwater was observed during drilling - MW readings collected April 22nd, 2022 and groundwater was not detected								
11										
12										

Stantec

MONITORING WELL RECORD

MW7

CLIENT **North American Development Group**

PROJECT No. **121624148**

LOCATION **Park Place Industrial Development Project Barrie, ON**

BOREHOLE No. **MW7**

DATES: BORING **2022-04-20** WATER LEVEL **Not Observed**

DATUM **GEODETIC**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
	298.90							mm		
0	298.7	TOPSOIL				SS	1	610	5	
		Very loose to loose brown silty sand FILL - trace gravel, moist				SS	2	610	3	
1										
						SS	3	559	3	
2	296.6									
		Compact light brown SAND with SILT (SP-SM) - moist, poorly graded				SS	4	610	15	
3						SS	5	610	24	
	295.1									
4		Dense to very dense light brown SAND with GRAVEL (SP) - moist, poorly graded				SS	6	508	72	
						SS	7	533	50	
5										
						SS	8	406	90	
6						SS	9	610	81	
7										
						SS	10	610	69	
8										
9						SS	11	610	184/559	
10										
						SS	12	483	95	
11										
12										

Continued Next Page

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MONITORING WELL RECORD

MW7

CLIENT **North American Development Group**

PROJECT No. **121624148**

LOCATION **Park Place Industrial Development Project Barrie, ON**

BOREHOLE No. **MW7**

DATES: BORING **2022-04-20** WATER LEVEL **Not Observed**

DATUM **GEODETIC**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
12										
12						SS	13	508	83	
13										
14						SS	14	483	103	
15										
15						SS	15	559	181/533	
16										
17						SS	16	559	194/559	
	281.5	End of Borehole at 17.37 m - Monitoring well MW7 installed with screen interval between 13.7 and 16.8 mbgs - Borehole cave in below 15 m after well installation - Dry upon completion, no groundwater was observed during drilling - MW readings collected April 22nd, 2022 and groundwater was not detected								
18										
19										
20										
21										
22										
23										
24										

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MONITORING WELL RECORD

MW8

CLIENT **North American Development Group**

PROJECT No. **121624148**

LOCATION **Park Place Industrial Development Project Barrie, ON**

BOREHOLE No. **MW8**

DATES: BORING **2022-04-21** WATER LEVEL **Not Observed**

DATUM **GEODETIC**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
	294.50							mm		
0		Compact brown silty sand FILL - trace gravel, trace clay, moist				SS	1	432	15	
1						SS	2	533	15	
	293.0									
2		Dense to very dense light brown SAND with SILT (SP-SM) - trace gravel, moist, poorly graded				SS	3	610	42	
						SS	4	457	47	
3						SS	5	483	64	
4						SS	6	483	63	
						SS	7	457	55	
5						SS	8	508	59	
6						SS	9	508	66	
7										
8						SS	10	610	90	
9										
						SS	11	610	77	
10										
11						SS	12	610	87	
12										

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MONITORING WELL RECORD

MW8

CLIENT **North American Development Group**

PROJECT No. **121624148**

LOCATION **Park Place Industrial Development Project Barrie, ON**

BOREHOLE No. **MW8**

DATES: BORING **2022-04-21** WATER LEVEL **Not Observed**

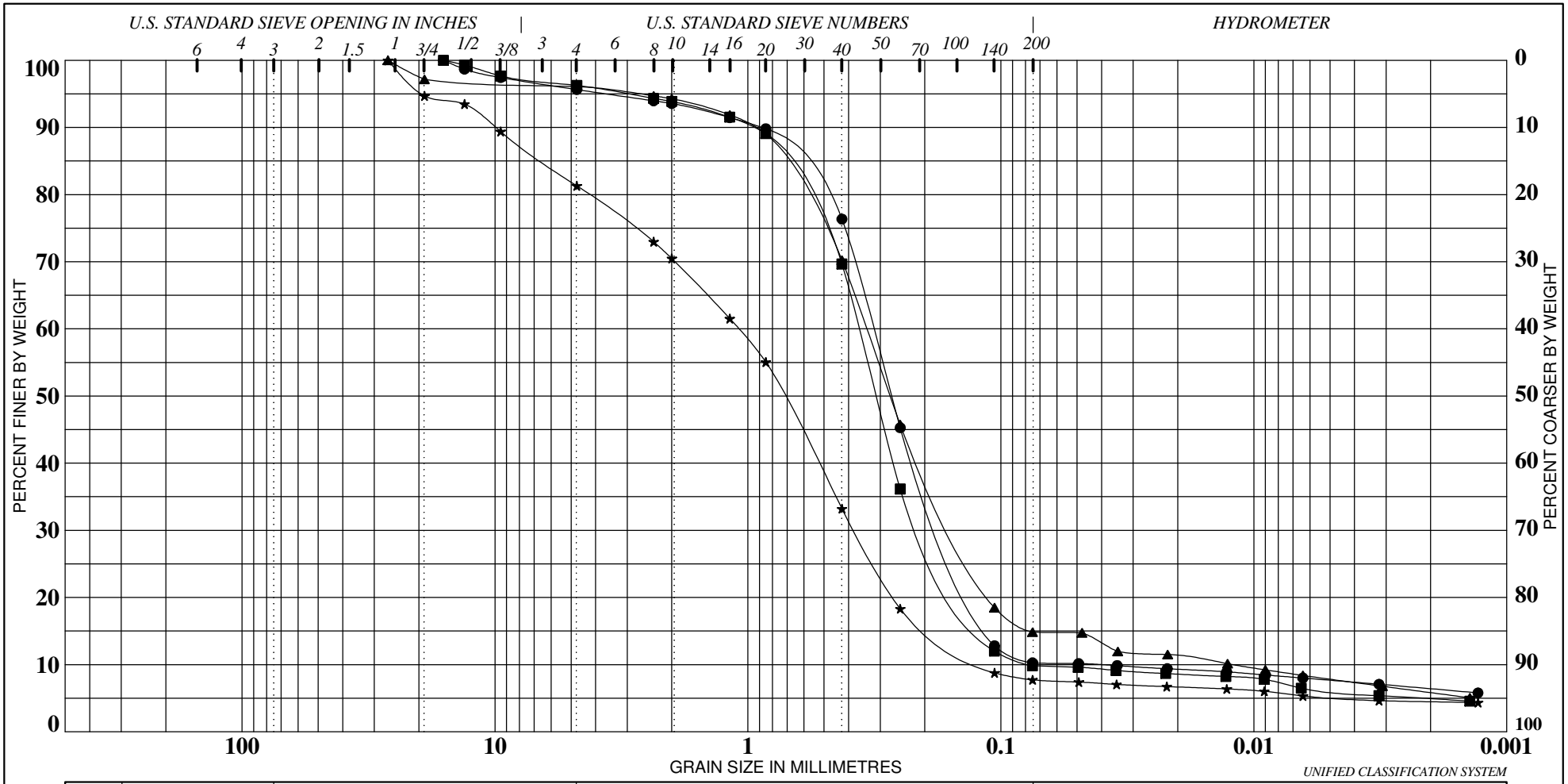
DATUM **GEODETIC**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	WELL CONSTRUCTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY	SAMPLES N-VALUE OR RQD	VOC CONCENTRATION (ppm or % LEL)
								mm		
12	281.7					SS	13	610	97	
13		End of Borehole at 12.8 m - Monitoring well MW8 installed with screen interval between 9.1 and 12.2 mbgs - Dry upon completion, no groundwater was observed during drilling - MW readings collected April 22nd, 2022 and groundwater was not detected								
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										

Appendix D

Grain Size Distribution Curves

Stantec, 2022



UNIFIED CLASSIFICATION SYSTEM

BLDs	COBBLES	GRAVEL		SAND			SILT & CLAY	
		coarse	fine	coarse	medium	fine	SILT	CLAY

Sample	Depth (m)	Description	W%	W_L	W_P	I_P	%Gravel	%Sand	%Silt	%Clay
● BH1	1.8	POORLY-GRADED SAND with SILT (SP-SM)	3				4	86	4	6
■ BH2	3.4	POORLY-GRADED SAND with SILT (SP-SM)	4				4	86	5	5
▲ BH4	6.4	SILTY SAND (SM)	6				4	81	9	6
★ BH6	3.4	POORLY-GRADED SAND with GRAVEL (SP)	3				19	74	3	4

Stantec

Project: Park Place Industrial

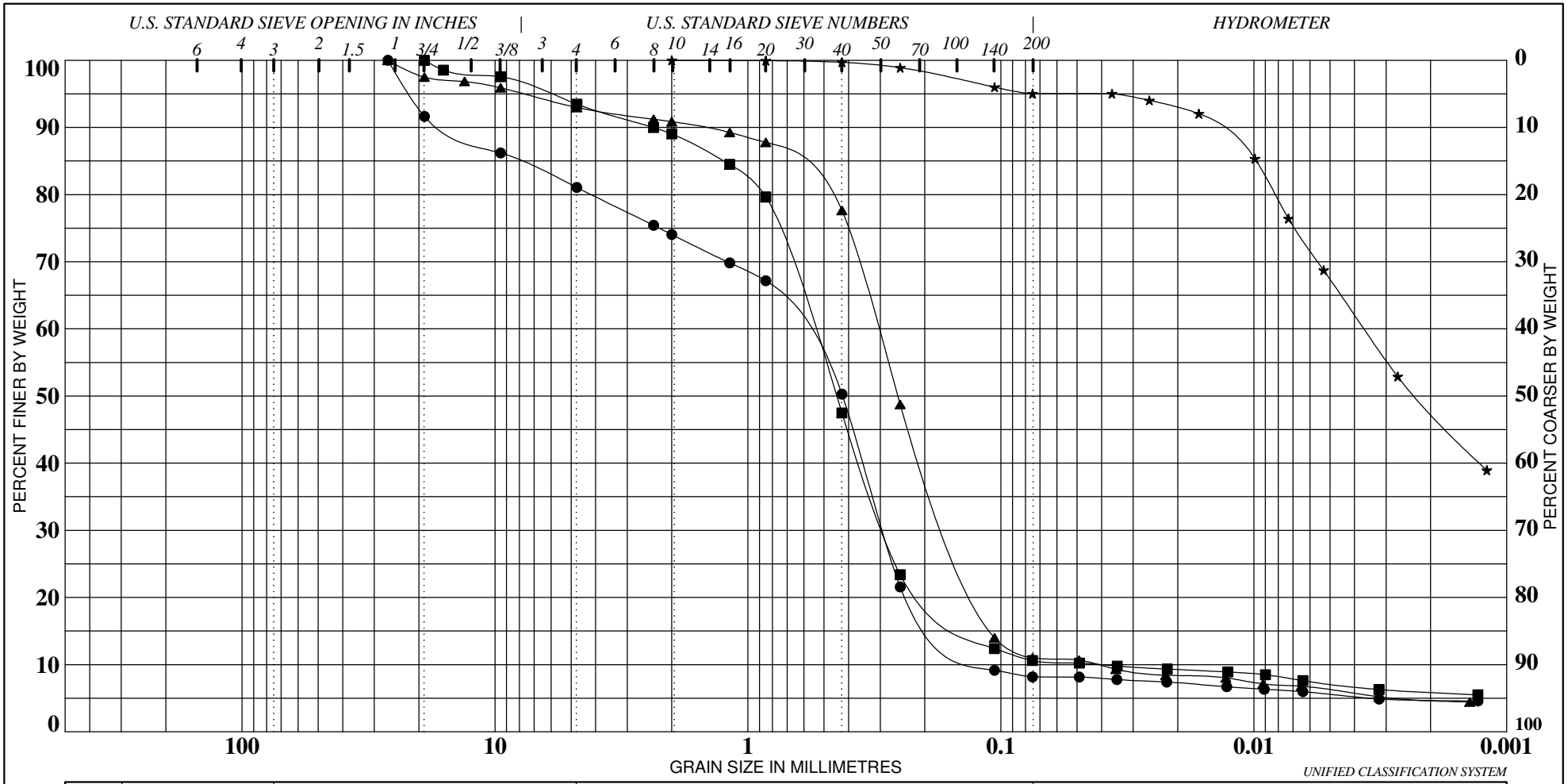
Location: 400 Bayview Drive, Barrie, Ontario

Project No.: 121624148

GRADATION CURVE (ASTM D422)

Figure: 1

Remarks:



BLDs	COBBLES	GRAVEL		SAND			SILT & CLAY	
		coarse	fine	coarse	medium	fine	SILT	CLAY

Sample		Depth (m)	Description	W%	W_L	W_P	I_P	%Gravel	%Sand	%Silt	%Clay
●	BH7	4.9	POORLY-GRADED SAND with GRAVEL (SP)	3				19	73	3	5
■	BH8	2.6	POORLY-GRADED SAND with SILT (SP-SM)	3				7	82	5	6
▲	BH8	9.4	POORLY-GRADED SAND with SILT (SP-SM)	2				7	82	6	5
★	BH9	6.4	SILTY CLAY (CL-ML)	20				0	5	47	48

Stantec

Project: Park Place Industrial

Location: 400 Bayview Drive, Barrie, Ontario

Project No.: 121624148

GRADATION CURVE (ASTM D422)

Figure: 2

Remarks:

Appendix E

Phosphorus Budget

Palmer, 2022

Ontario
MINISTRY OF THE ENVIRONMENT

Database Version: V 2.0 Release Update
Update Date: 30-Mar-12

Project DEVELOPMENT Summary

DEVELOPMENT: Park Place North
Subwatershed: Lovers Creek

Total Pre-Development Area (ha):	13.050	Total Pre-Development Phosphorus Load (kg/yr):	2.09

Pre-Development Land Use	Area (ha)	P coeff. (kg/ha)	P Load (kg/yr)
Cropland	13.05	0.16	2.09

POST-DEVELOPMENT LOAD

Post-Development Land Use	Area (ha)	P coeff. (kg/ha)	Best Management Practice applied with P Removal Efficiency		P Load (kg/yr)
Cropland	0.602	0.16	Wet Detention Ponds	63%	0.04
High Intensity - Comm/Industrial	12.45	1.82	NONE	0%	22.66

Post-Development Area Altered:	13.05
Total Pre-Development Area:	13.05
Unaffected Area:	0

	P Load (kg/yr)
Pre-Development:	2.09
Post-Development:	22.76
Change (Pre - Post):	-20.67
990% Net Increase in Load	
Post-Development (with BMPs):	22.69
Change (Pre - Post):	-20.61
986.91% Net Increase in Load	

DEVELOPMENT: **Park Place North**
Subwatershed: **Lovers Creek**

CONSTRUCTION PHASE LOAD

SUMMARY WITH IMPLEMENTATION OF BMPs	P Load (kg/yr)
Pre-Development:	**2.09**
Construction Phase Amortized Over 8 Years :	to be determined
Post-Development:	**22.69**
Post-Development + Amortized Construction:	**to be determined**
Pre-Development Load - Post-Development Load:	**-20.61**
Conclusion:	**987% Increase in Load**
Pre-Development Load - (Post-Development + Amortized Construction Load):	**to be determined**
Conclusion:	**to be determined**

Based on a comparison of Pre-Development and Post-Development loads, and in consideration of Construction Phase loads, the Ministry would encourage the Municipality to:

Not approve development as site specific appropriate