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# **Hydrogeological Assessment, 233-261 Coldwater Rd, Orillia, ON**

*Palmer Project #*  
1802403

*Prepared For*  
Auroville Ltd.

August 12, 2022

August 12, 2022

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**Re: Hydrogeological Assessment, 233-261 Coldwater Rd, Orillia, Ontario**  
**Project #: 1802403**

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Palmer Environmental Consulting Group (Palmer) is pleased to submit the attached report describing the results of our Hydrogeological Investigation for the proposed land development at the subject site ("The Site") located at 233-261 Coldwater Rd, Orillia, Ontario owned by Auroville Ltd. It is Palmer's understanding that the investigation is required for a proposed development consisting of an eight-storey apartment building, along with a surface and stilt parking lot, as well as underground parking to Level 3 built to follow site grading. The purpose of this report is to provide the results of the hydrogeological assessment to support design and permitting for the project based upon the results from our field investigations, laboratory testing, records reviews, and data analysis.

The site is underlain by low-permeability Newmarket Till and hosts a shallow water table ranging from 1.44 – 5.88 metres below ground surface (mbgs) (262.12 to 272.88 metres above sea level (masl)). Since the site is located within a Wellhead Protection Area C with a vulnerability score of 4 (low), the storage and handling of Dense Non-Aqueous Phase Liquids (DNAPLs) is not permitted. The proposed residential development will consist of an apartment building, therefore, none of the aforementioned activities are expected to occur on site meeting Source Water Protection regulations. Minor dewatering (10,441 L/day) is expected for the construction of Level 2 of the Parking Lot, as this portion of the site will require excavations below the groundwater table. As this is below 50,000 L/day, an EASR or PTTW from the MECP is not required. No dewatering is required for Level 3 parking as the natural grade of the property is used to eliminate the need for excavations for this parking level. The site is not located within a Wellhead Protection Area – Q2 (WHPA – Q2), Significant Groundwater Recharge Area (SGRA), or near a groundwater supported features or water supply aquifer.

Thank you for the opportunity to work with your team on this project. Please let us know if you have any questions or comments on this submission.

Yours truly,  
**Palmer**



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Jason Cole, M.Sc., P.Geo.  
Vice President, Principal Hydrogeologist

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# 1. Introduction

Palmer was retained by Auroville Ltd. to complete a Hydrogeological Assessment for the proposed residential development at the subject located at 230-261 Coldwater Rd, Orillia, ON (“the site”) (**Figure 1**) (**Appendix A**). The site area is 1.54 ha, and the site currently supports a wooded area and gravel parking lot. Lake Simcoe is located approximately 1.65 km east of the site.

This hydrogeological assessment is focused on characterizing the hydrogeological conditions of the site for a concurrent Zoning By-law Amendment Application and Site Plan Application submission to construct an eight (8) storey condominium apartment building with 161 surface parking spaces on the site. Based on the Site Plan, the building has three (3) levels of parking that gradually extend with the southwards sloping topography on site (n Architecture Inc, 2022) (**Appendix A**). Parking for both Levels 1 and 3 will be provided at grade and is proposed to be reinforced with retaining walls. However, approximately 3.35 m of excavation into the existing grade will be required for most of Parking Level 2, and approximately 1.80 m of excavation will be required for the proposed pool on the ground floor of the building. As such, dewatering estimates have been provided for the construction of the pool and Parking Level 2 to evaluate the need for construction dewatering permitting.

The hydrogeological report will also be focused on understanding the changes to the site water balance, shallow soil conditions and water table elevation to support stormwater management measures to promote infiltration and phosphorus removal (i.e., Low Impact Development (LIDs)).

Palmer’s hydrogeological investigation was completed in tandem with Palmer’s geotechnical investigation. This report has been updated to reflect the updated Site Plan, additional spring 2022 monthly monitoring, and in-situ infiltration testing results. In addition to the hydrogeological field investigations conducted by Palmer, information from the following sources was reviewed as part of the study:

- Geotechnical borehole logs (Palmer, 2021);
- Geotechnical grain size distribution results (Terrapex, 2021)
- Available geology, hydrogeology, and physiography mapping (e.g., Ontario Geological Survey (OGS) Surficial and Palaeozoic Geology Mapping); and,
- Ministry of Environment, Conservation and Parks (MECP) water well records.

## 1.1 Scope of Work

To assess the hydrogeological conditions at the site, the following scope of work has been undertaken:

- Completion of a background review of applicable hydrogeological data including watershed plans, MECP borehole records, surficial and bedrock geology mapping, Source Water Protection mapping;
- Completion of a hydrogeological borehole drilling program to install three (3) shallow monitoring wells up to depths of 6.70 metres below ground surface (mbgs);
- Completion of well development and single well response testing (i.e., bail tests) at all monitoring wells to calculate hydraulic conductivity at monitoring well locations;
- Groundwater level monitoring in December 2021 and spring 2022 (March to June) to assess the stabilized groundwater levels and spring high water levels;



<b>LEGEND</b> Borehole Monitoring Well Infiltration Testing Location Subject Parcel	<b>Key Map</b> 	 METRE SCALE North American Datum 1983 Universal Transverse Mercator Projection Zone 17 Scale: 1:1,500 Page Size: Tabloid (11 x 17 inches) Drawn: SM Checked: TP Date: Jun 15, 2022 Source Notes: Base imagery (2018) provided by Simcoe Country GIS REST services.	CLIENT Aurowal Developments Ltd
			PROJECT 233-261 Coldwater Rd Orillia
			TITLE <b>Site Location</b>
			REF. NO. 1802403-1-2 <b>Figure 1</b>

- Collection of one (1) groundwater sample to a CALA-accredited laboratory to be analyzed for general water quality parameters and compared Ontario Drinking Water Quality Standards (ODWS);
- Completion of in-situ infiltration testing at three (3) locations to estimate infiltration rates;
- Completion of a preliminary dewatering assessment to evaluate the need for short-term construction dewatering permitting; and
- Preparation of a Hydrogeological Assessment report summarizing the findings.

## 2. Regional Existing Conditions

### 2.1 Physiography and Geology

The northwest portion of the project site is located within the Simcoe Uplands while the southeast portion of the site is in the Simcoe Lowlands physiographic region (**Figure 2**) (Chapman & Putnam, 1984). The Simcoe Uplands are characterized by a series of rolling till plains between flat-floored valleys. Encompassed by shorelines, the Simcoe Lowlands are former islands in the glacial Lake Algonquin. In this area, the till is made up of mainly Pre-Cambrian rock and the ground surface has an average altitude of 304m above sea level (Chapman & Putnam, 1984).

The Simcoe lowlands border Lake Simcoe and extend along Kempenfelt Bay to the low-lying area west of Barrie. The lowlands are characterized by adjoining flat, low-lying plains and valley floors that are between 4 to 15 km wide and 0-30 km long (Mulligan, 2013). Surrounding Lake Simcoe, the lowlands lie between 218 and 259 meters above sea level. Approximately 12,500 years ago, the lowlands were flooded by Glacial Lake Algonquin meltwaters. As a result, the lowlands are underlain by glaciolacustrine sand, silt, and clay.

Available surficial and quaternary geology mapping by the Ontario Geological Survey (OGS) indicates the native surficial geology is composed of Newmarket Till (also referred to as Northern Till) (**Figure 3**). The Newmarket Till consists of dense to very dense, stone-poor, sandy silt to silty sand-textured till.

The bedrock geology of the site consists of Bobcaygeon Formation (**Figure 4**). The Bobcaygeon Formation consists brown to grey-brown, fossiliferous limestone with calcarenites. Nodular texture is commonly found in the lower part and thin shale interbeds, calcarenite storm beds are more common in upper parts (Armstrong and Dodge, 2007). Bedrock was not encountered during borehole drilling. Nearby MECP water well records identify limestone at a depth of 75 mbgs (Well ID 7150636).

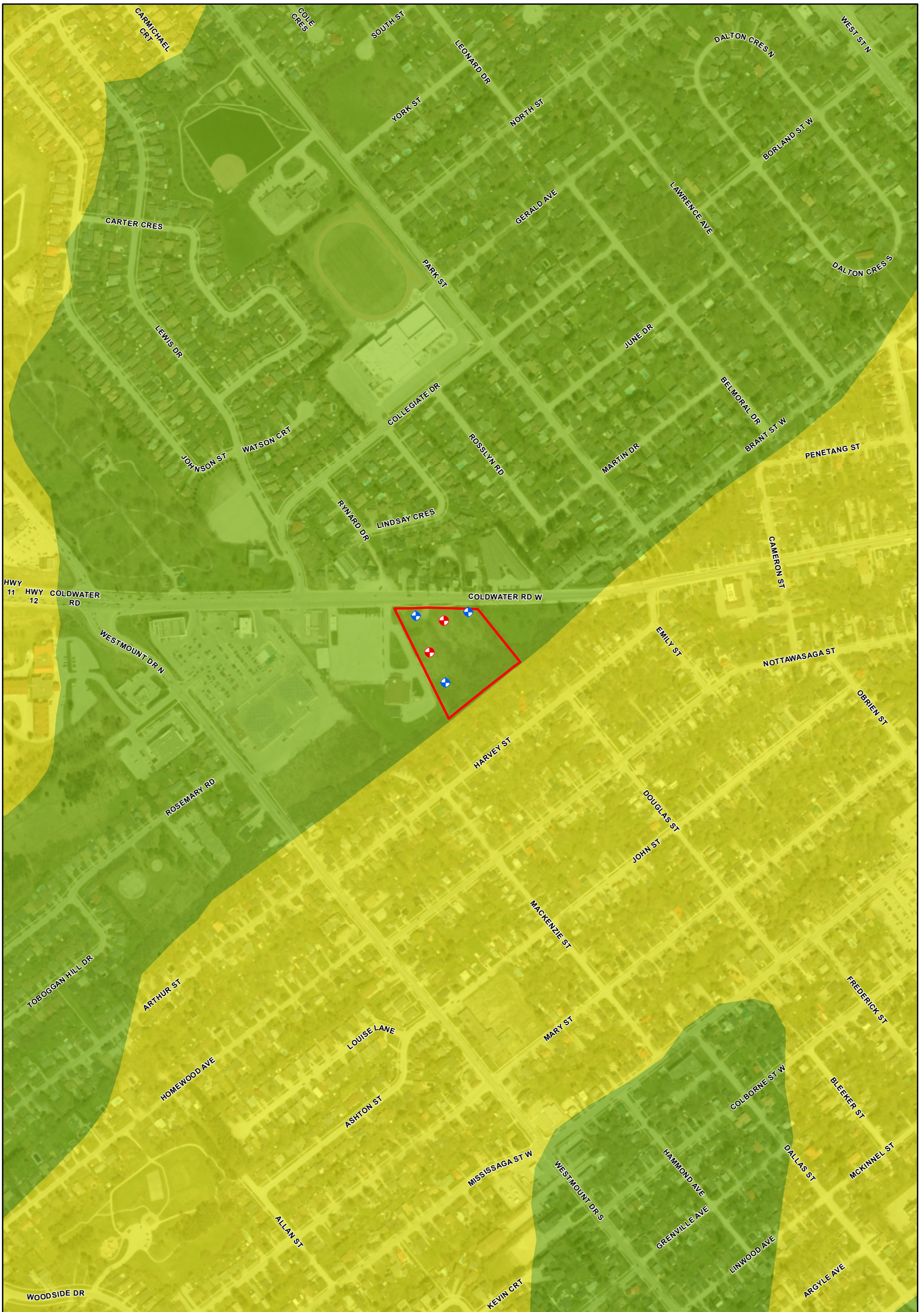
### 2.2 Hydrostratigraphy

#### 2.2.1 Regional Aquifers and Aquitards

Hydrostratigraphic units can be classified into two distinct groups based on their capacity for permitting groundwater movement: an aquifer or an aquitard. An aquifer is generally defined as a layer of soil permeable enough to conduct a usable supply of water, while an aquitard is a layer of soil that inhibits groundwater movement due to low permeability. The major regional hydrostratigraphic units that control groundwater at the site are described below.






<b>LEGEND</b> Borehole Monitoring Well Subject Parcel  <b>Physiographic Region<sup>1</sup></b> 35 Simcoe Lowlands 36 Simcoe Uplands	 METRE SCALE North American Datum 1983 Universal Transverse Mercator Projection Zone 17 Scale: 1:5,000 Page Size: Tabloid (11 x 17 inches) Drawn: SM Checked: TP Date: Jan 5, 2022 Source Notes: Base imagery (2018) provided by Simcoe Country GIS REST services.	CLIENT <b>Aurowal Developments Ltd</b> PROJECT <b>233-261 Coldwater Rd Orillia</b> TITLE <b>Physiographic Region</b>
	1 - Chapman, L.J. and Putnam, D.F. 2007. Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release. Data 228 ISDN 978-1-4249-5158-1	 <b>NORTH</b>



<b>LEGEND</b> Borehole Monitoring Well Subject Parcel	<b>Surficial Geology<sup>1</sup></b> <b>Pleistocene</b> <b>5b</b> Stone-poor, sandy to silty sand-textured till on Paleozoic terrain <b>9</b> Coarse-textured glaciolacustrine deposits: sand, gravel, minor silt, and clay: <i>9b Littoral deposits</i> <i>9c Foreshore and basinal deposits</i>	 North American Datum 1983 Universal Transverse Mercator Projection Zone 17 Scale: 1:5,000 Page Size: Tabloid (11 x 17 inches) Drawn: SM Checked: TP Date: Jan 5, 2022 Source Notes: Base imagery (2018) provided by Simcoe Country GIS REST services.	CLIENT Aurowal Developments Ltd
			PROJECT 233-261 Coldwater Rd Orillia
TITLE <b>Surficial Geology</b>		NORTH	REF. NO. 1802403-3-2
			<b>Figure 3</b>



<p><b>LEGEND</b></p> <ul style="list-style-type: none"> <li> Borehole</li> <li> Monitoring Well</li> <li> Subject Parcel</li> </ul>	<p><b>Bedrock Geology<sup>1</sup></b>  <b>Middle Ordovician</b></p> <p><b>54</b> Limestone, dolostone, shale, arkose, sandstone  <i>54a: Ottawa Gp.; Simcoe Gp.; Shadow Lake Fm.</i>  <i>(now considered Upper Ordovician)</i></p>	<p>0 100 200      METRE SCALE</p> <p>North American Datum 1983      Universal Transverse Mercator Projection Zone 17</p> <p>Scale: 1:5,000      Page Size: Tabloid (11 x 17 inches)</p> <p>Drawn: SM      Checked: TP      Date: Jan 5, 2022</p> <p>Source Notes: Base imagery (2018) provided by Simcoe Country GIS REST services.</p>	<p>CLIENT      Aurowal Developments Ltd</p> <p>PROJECT      233-261 Coldwater Rd Orillia</p> <p>TITLE  <b>Bedrock Geology</b></p> <p>REF. NO. 1802403-4-2</p> <p><b>Palmer™</b></p> <p><b>Figure 4</b></p>
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The **Newmarket Till (or Northern Till)** acts as a significant regional aquitard of fine textured sediments. The low permeability of the unit limits groundwater recharge and contaminant migration, however the presence of sand and gravel within the till can also act as confined aquifers on a local scale in some areas. The bulk hydraulic conductivity of this unit ranges from approximately  $10^{-9}$  to  $10^{-5}$  m/s (Gerber & Howard, 2000). Groundwater flow within this unit is typically downwards towards more permeable units. Within the study area, the Newmarket Till sediments may be up to 40 m thick, making it the dominant aquitard unit.

## 2.2.2 MECP Well Record Screening

Based on a review of the MECP Water Well Records (WWR) database, three (3) well records are present within a 500 m radius of the site (**Figure 5**). Each well record is described below in **Table 1**. Of these wells, two (2) are used for domestic water supply that were drilled in the mid-to-late 1900s on mostly residential properties, and one (1) has no use listed. It is likely that these wells are no longer in use as the area is now municipally serviced.

**Table 1. MECP Well Records within 500m of Site**

Well ID	Street Name	Street Number	Date Complete	Depth (m)	Listed Well Use
5702701	-	-	1966-10-04	11.9	Domestic
5702956	-	-	1962-09-26	25.3	Domestic
7124251	Coldwater Road	188	2009-04-15	8.8	Domestic

## 2.2.3 Environmental Features and Drainage

The site is located within the Lake Simcoe Watershed which is under the jurisdiction of the Lake Simcoe Region Conservation Authority (LSRCA). The total area of the watershed is approximately 3,400 km<sup>2</sup>. Locally, the site is located within the Oro Creeks North subwatershed, which is in the northwestern portion of the Lake Simcoe watershed with an area of 74 km<sup>2</sup>. There are six major tributaries that drain through the Oro Creeks North subwatershed into Lake Simcoe: Mill, Bluffs, Pointview, Cedarmount, and the Carthew Creeks along with some smaller tributaries known as the Oro Creeks North (LSRCA, 2013). There are no watercourses, wetlands, or drainage features located within the site boundaries. Lake Simcoe is located approximately 1.65 km to the east of the site.

## 2.2.4 Source Water Protection

The site is located in the Lakes Simcoe and Couching/Black River Source Protection Area. 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) well (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.



**LEGEND**

- MECP Water Well
- ⊕ Borehole
- ⊕ Monitoring Well
- Study Area (500 m Buffer)
- Subject Parcel

METRE SCALE

North American Datum 1983  
Universal Transverse Mercator Projection Zone 17

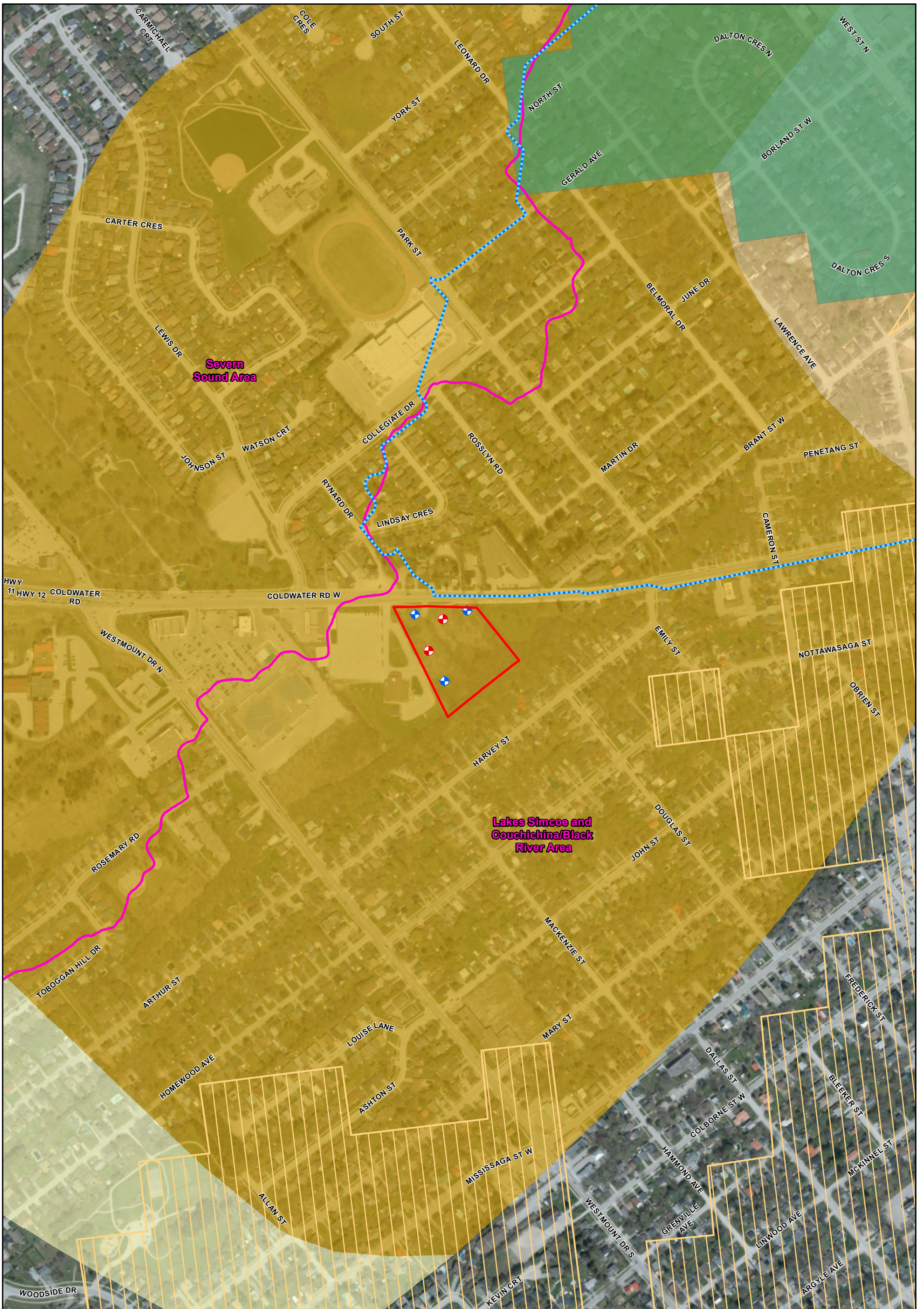
Scale: 1:5,000  
Page Size: Tabloid (11 x 17 inches)

Drawn: SM  
Checked: TP  
Date: Jan 5, 2022

Source Notes: Base imagery (2018) provided by Simcoe Country GIS REST services.

**NORTH**

<b>CLIENT</b>	Aurowal Developments Ltd
<b>PROJECT</b>	233-261 Coldwater Rd Orillia
<b>TITLE</b>	<b>MECP Water Well</b>
<b>REF. NO.</b>	1802403-5-1
<b>Figure 5</b>	



<b>LEGEND</b> Borehole Monitoring Well Subject Parcel Intake Protection Zone 1 & 2 Highly Vulnerable Aquifer Source Protection Area Wellhead Protection Area - B Wellhead Protection Area - C Wellhead Protection Area - D <b>Significant Groundwater Recharge Area</b> <b>Score</b> 4	0 100 200 METRE SCALE North American Datum 1983 Universal Transverse Mercator Projection Zone 17 Scale: 1:5,000 Page Size: Tabloid (11 x 17 inches) Drawn: SM Checked: TP Date: Jan 5, 2022 Source Notes: Base imagery (2018) provided by Simcoe Country GIS REST services.	CLIENT <b>Aurowal Developments Ltd</b> PROJECT <b>233-261 Coldwater Rd Orillia</b> TITLE <b>Source Water Protection</b>
	Note: Contains Information made available under Lake Simcoe Region Conservation Authority Open Data Licence v1.0	NORTH

IPZs are the area on the water and land surrounding a municipal surface water intake. HVAs are aquifers that are susceptible to contamination because 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. This site is not located within an IPZ, HVA, or an SGRA.

The site is located withing a Wellhead Protection Area C (WHPA-C) with a Vulnerability Score of 4 (moderate) and an issue contributing area (**Figure 6**). Due to the presence of the WHPA-C, the storage and handling of Dense Non-Aqueous Phase Liquids (DNAPLs) are prohibited in this area.

## 3. Local Existing Conditions

### 3.1 Site Geology

#### 3.1.1 Methodology

On December 8<sup>th</sup>, 2021 Palmer personnel conducted a borehole drilling and groundwater monitoring well installation program as a part of the geotechnical investigation. Five (5) boreholes (BH21-1 to BH21-5) were advanced to depths ranging from 6.3 to 6.7 mbgs at the site using continuous solid stem auger methods. The locations of the boreholes and monitoring wells are provided on (**Figure 1**), and borehole logs are provided in **Appendix B**.

Following drilling, monitoring wells were installed in three boreholes in accordance with Ontario Regulation 903 (Wells Regulation). Each monitoring well was completed with 50 mm (2 inch) diameter schedule 40 polyvinyl chloride (PVC) pipe, with a 3.05 m (10 ft) screened interval at bottom of the well to capture the water table. The monitoring wells were sealed using bentonite grout and completed with monument stick up casings. Additional details are provided in **Table 2**.

*Table 2. Monitoring Well Installation Details*

Monitoring Well ID	Ground Surface Elevation (masl)	Well Depth (mbgs)	Screened Interval (mbgs)	Screened Geological Unit
BH21-1	271.0	6.70	3.1 – 6.1	Silty Sand Till / Clayey Silt Till
BH21-4	273.7	6.40	3.1 – 6.1	Silty Sand Till
BH21-5	274.5	6.40	3.1 – 6.1	Silty Sand Till

#### 3.1.2 Drilling Results

Local to the study area, drilling results found the surficial Newmarket Till to be present on site, which is consistent with regional OGS mapping (**Figure 3**). The stratigraphy of the site area encountered during the borehole drilling program is summarized below:

**Topsoil** – Topsoil was encountered in all boreholes except for BH21-5 and ranged in thickness from 0.08 m (BH21-3 and BH21-3) to 0.1 m (BH21-2 and BH21-4)

**Earth Fill:** A silty clay to clayey silt fill with some sand, trace gravel and organics was found in BH21-1, BH21-2 and BH21-4 ranging in thickness from 0.6 m (BH21-1) to 1.4 m (BH21-4). A sandy silt fill with trace clay, some gravel with occasional organic inclusions was found in all boreholes except for BH21-2 ranging from 0.6 m (BH21-1) to 2.2 m (BH21-5).

**Newmarket Till** – The Newmarket Till was encountered in all boreholes and had an approximate thickness of 4 – 6 m. The Newmarket Till was found present in two lithologies described below: silty sand till and clayey silt till.

**Silty Sand Till:** Brown silty sand till was encountered below the top soil and fill in all boreholes. The thickness of the unit ranged from 2.8 m (BH21-1) to at least 5.6 m (BH21-2) and extended from depth of 1.1 m to 6.7 mbgs. This unit was encountered at the base of all boreholes except BH21-1, and therefore the total thickness of the unit in BH21-2 through BH21-5 is not known. The composition of the silty sand till included trace to some clay, trace gravel, trace to some sand, occasionally clayey silt layers, and contained cobbles and boulders. The consistency of soils ranged from compact to loose to very dense, and soil was moist.

**Clayey Silt Till:** Brown clayey silt till was encountered in BH21-1 beneath the silty sand till with a thickness of at least 2.6m . This unit was encountered at the base of BH21-1, and therefore the total thickness of the unit is not known. The composition of the clayey silt till includes some sand, trace gravel and contains cobbles. The consistency of the soil is dense, and the soil was moist.

## 3.2 Groundwater Levels and Flow

The stabilized groundwater level at each monitoring well was measured by Palmer personnel on December 2021 to June 2022. Water levels were measured using a water level tape and recorded to the nearest centimetre. **Table 3** provides a summary of the measured water level depths/associated elevations. This monitoring period represents the winter monitoring period when water levels are high after seasonal lows during summer months, and the subsequent spring highs following freshet. It should be noted that groundwater levels can vary and are subject to seasonal fluctuations in response to weather events.

Groundwater levels ranged from 1.44 to 5.88 mbgs or at an elevation of 265.12 to 272.88 masl (meters above sea level) across site. Groundwater elevation generally follows topography, with the highest elevations occurring in the northwest position of the site and the lowest elevations occurring along the southern edge of the site. The highest groundwater levels are observed in March 2022. Groundwater flow is generally from the northwest to the southeast. Piezometric surface and groundwater flow direction as documented for the site in March 2022 is shown on **Figure 7**.

**Table 3. Groundwater Level Monitoring Results**

MW ID	Ground Surface Elevation (masl)	Groundwater Level Monitoring									
		December 16 <sup>th</sup> , 2021		March 22 <sup>nd</sup> , 2022		April 19 <sup>th</sup> , 2022		May 17 <sup>th</sup> , 2022		June 27 <sup>th</sup> , 2022	
		mbgs	masl	mbgs	masl	mbgs	masl	mbgs	masl	mbgs	masl
BH21-1	271.0	5.59	265.41	3.31	267.69	4.48	266.52	4.87	266.13	5.88	265.12
BH21-4	272.7	3.39	270.31	2.36	268.64	2.69	268.31	3.19	267.81	4.64	266.36
BH21-5	274.5	1.62	272.88	1.44	269.56	1.81	269.19	2.15	268.85	3.00	268.00

### 3.3 Hydraulic Conductivity

#### 3.3.1 In-Situ Single Well Response Tests

On December 16<sup>th</sup>, 2021, Palmer personnel conducted single well response tests (SWRT) at the monitoring wells to determine the hydraulic conductivity (K) of the screened units. A rising head (RH) test was carried out in by creating a head change through removal of a 1 L of water using a bailer in BH21-5 and by using watterra tubing to quickly remove a slug of water in BH21-4. The rate of recovery in each well was measured using a datalogger at the bottom of the well to record water levels at a 1-second frequency. During the tests, manual water level measurements were also recorded to gauge recovery to equilibrium. Tests were terminated when either 30 minutes had elapsed or an 80% recovery in water level was attained. A RH test was not completed at BH21-1 since there was not sufficient water column in the well to complete the test.

Hydraulic conductivity (K) values were then calculated using the displacement-time data and were analysed using the Bouwer-Rice (1976) method for unconfined aquifers, modelled using Aqtesolv™ software. The analysis results are presented in **Appendix C**, and the calculated hydraulic conductivity values are summarized in **Table 4**. Based on the results, the hydraulic conductivity of the silty sand till ranges from  $5.4 \times 10^{-6}$  m/s to  $2.1 \times 10^{-7}$  m/s with a geometric mean of  $1.1 \times 10^{-6}$  m/s.

**Table 4. Hydraulic Conductivity Summary Table**

BH ID	Test Type	Solution	K (m/s)	Geometric Mean (m/s)	Screened Stratigraphy
BH21-4	RH	Bouwer-Rice Confined	$2.1 \times 10^{-7}$	$1.1 \times 10^{-6}$	Silty Sand Till
BH21-5	RH	Bouwer-Rice Unconfined	$5.4 \times 10^{-6}$		



<b>LEGEND</b> Borehole Monitoring Well Groundwater Elevation Contour <sup>1</sup> Groundwater Flow Direction Subject Parcel	 METRE SCALE North American Datum 1983 Universal Transverse Mercator Projection Zone 17 Scale: 1:1,500 Page Size: Tabloid (11 x 17 inches) Drawn: SM Checked: TP Date: Jun 22, 2022 Source Notes: Base imagery (2018) provided by Simcoe Country GIS REST services.	CLIENT Aurowal Developments Ltd
		PROJECT 233-261 Coldwater Rd Orillia
		TITLE <b>Groundwater Flow</b>
		REF. NO. 1802403-7-2 <b>Figure 7</b>

1. Spring-time high water levels recorded March 2022

### 3.3.2 Empirical Analysis

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. Three soil samples from the sandy silt till in BH21-1 (SS5), BH21-4 (SS6), and BH21-5 (SS7) were collected for grain size distribution and analysed by Terrapex. The completed grain size distribution curves are provided in **Appendix D**, and the results of the empirical analyses are provided in **Table 5**.

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

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

The hydraulic conductivity of the silty sand till was calculated to be  $1.2 \times 10^{-7}$  m/s which is consistent with the hydraulic conductivity estimated with the SWRT.

**Table 5. Empirical Hydraulic Conductivity Summary**

Borehole ID	Sample	Geology	Method of Analysis	K (m/s)	Geometric Mean K (m/s)	Screened Material
BH21-1	SS5	Silty Sand Till	Sauerbrei	$3.3 \times 10^{-7}$	$1.2 \times 10^{-7}$	Silty Sand Till
BH21-4	SS6	Silty Sand Till	Sauerbrei	$1.5 \times 10^{-7}$		
BH21-5	SS7	Silty Sand Till	Sauerbrei	$3.9 \times 10^{-8}$		

### 3.3.3 Summary of Hydraulic Conductivity

The hydraulic conductivity values determined from SWRTs and empirical grain size analysis are summarized in **Table 6**. The geometric mean hydraulic conductivity of the Newmarket Till (sandy silt till) was calculated to be  $3.0 \times 10^{-7}$  m/s.

**Table 6. Hydraulic Conductivity Summary Table**

Hydrostratigraphic Unit	BH ID	Test Type	Hydraulic Conductivity (m/s)		Geomean (m/s)
			Individual	Geomean	
Newmarket Till (Sandy Silt Till)	BH21-1	Grain Size	$3.3 \times 10^{-7}$	—	$3.0 \times 10^{-7}$
	BH21-4	Rising Head	$2.1 \times 10^{-7}$	$1.8 \times 10^{-7}$	
	BH21-4	Grain Size	$1.5 \times 10^{-7}$		
	BH21-5	Rising Head	$5.4 \times 10^{-6}$	$4.6 \times 10^{-7}$	
	BH21-5	Grain Size	$3.9 \times 10^{-8}$		

### 3.3.4 Infiltration Rates

In-situ infiltration tests were completed on May 18, 2022 to measure the infiltration rates of the soils. Testing was completed using a constant head well permeameter method (Guelph Permeameter) and employed the combined reservoir technique to measure field saturated hydraulic conductivity ( $K_{fs}$ ) values. Three (3) infiltration test locations were selected based on the Site Plan (**Appendix A**). Landscaped and amenity areas were selected as testing locations where potential Low Impact Development (LID) could be placed. Soils were augured to depths ranging from 0.63 to 1.12 mbgs using a 6 cm diameter soil auger (**Figure 1**). The soils at all locations were identified to be Earth Fill (silty clay fill) with some sand, boulders, and cobbles.

At each test location (IT1 to IT3), 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 0.04 to 0.08 m was applied due the variability in soil permeability. 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).

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)” (CVC and TRCA 2010). Design infiltration rates (mm/hr) were determined by applying a safety correction factor of at least 2.5.

The  $K_{fs}$  values and infiltration rates for each infiltration test are summarized in **Table 7**. Field calculated infiltration rates for the silty clay fill ranged from 39 to 43 mm/hr across site. With a safety correction factor of 2.5, infiltration rates ranged from 16 to 17 mm/hr, with a mean of 16 mm/hr. These values are within the higher range expected for silty clay soils. This is likely due to increased permeability due to secondary porosity (i.e., fractures, root holes, etc.) and the heterogeneity of the fill material.

**Table 7. Infiltration Testing Results**

Soil Description	Percolation Test Location	Depth of Auger Hole (mBGS)	H (m)	Field Saturated Hydraulic Conductivity ( $K_{fs}$ ) (m/s)	Calculated Infiltration Rate (mm/hr)	Design Infiltration Rate with 2.5 Factor of Safety Applied (mm/hr)
Silty Clay Fill	IT1	0.63	0.04	$5.4 \times 10^{-7}$	39	16
	IT2	1.12	0.08	$7.6 \times 10^{-7}$	43	17
	IT3	0.70	0.08	$6.2 \times 10^{-7}$	41	16
	<b>Average/Geomean</b>	-	-	<b><math>6.3 \times 10^{-7}</math></b>	<b>41</b>	<b>16</b>

### 3.4 Groundwater Chemistry

A groundwater sample was collected on December 16<sup>th</sup>, 2021, from BH21-5. The groundwater chemistry sample was analyzed for a suite of water quality parameters such as turbidity, TSS, pH, metals, and cations and anions, and results were compared against Ontario Drinking Water Standard (OWDS). A summary table of the groundwater analysis results is presented in **8**, with the Certificate of Analysis provided in **Appendix E**.

The groundwater sample from BH21-5 exceeds the Ontario Drinking Water Aesthetic and Operational Guidelines for colour, hardness, total dissolved solids (TSS), turbidity, alkalinity (as CaCO<sub>3</sub>), Aluminium (AL)-Total, Iron (Fe)-Total and Manganese (Mn)-Total. Some of these exceedances are likely due to the high turbidity and TSS of the water sample. These exceedances are typical of untreated groundwater with high TSS/ turbidity and are expected to be reduced through filtration.

**Table 8. Groundwater Chemistry Results**

Parameter	AO Guideline	Schedule 1&2 Standards	Lowest Detection Limit	Units	BH21-5 Result (16-Dec-21)
<b>Physical Tests (Water)</b>					
Colour, Apparent	5	-	2.0	CU	<b>51.7</b>
Conductivity	-	-	1.0	umhos/cm	917
Hardness (as CaCO <sub>3</sub> )	80 -> 100	-	1.3	mg/L	<b>524</b>
pH	6.5 -> 8.5	-	0.10	pH units	7.02
Total Dissolved Solids	500	-	20	mg/L	<b>559</b>
Turbidity	5	-	0.10	NTU	<b>90.7</b>
<b>Anions and Nutrients (Water)</b>					
Alkalinity, Total (as CaCO <sub>3</sub> )	30 -> 500	-	1.0	mg/L	<b>519</b>
Ammonia, Total (as N)		-	0.010	mg/L	0.014
Chloride (Cl)	250	-	0.50	mg/L	5.65
Fluoride (F)	-	1.5	0.020	mg/L	0.030
Nitrate (as N)	-	10	0.020	mg/L	2.53
Nitrite (as N)	-	1.0	0.010	mg/L	<0.010
Orthophosphate-Dissolved (as P)	-	-	0.0030	mg/L	<0.0030
Sulfate (SO <sub>4</sub> )	500	-	0.30	mg/L	13.7
<b>Total Metals (Water)</b>					
Aluminum (Al)-Total	0.1	-	0.0050	mg/L	<b>1.43</b>
Antimony (Sb)-Total	-	0.006	0.00010	mg/L	0.00056
Arsenic (As)-Total	-	0.01	0.00010	mg/L	0.00047
Barium (Ba)-Total	-	1.0	0.00020	mg/L	0.111
Beryllium (Be)-Total	-	-	0.00010	mg/L	<0.00010
Bismuth (Bi)-Total	-	-	0.000050	mg/L	<0.000050
Boron (B)-Total	-	5	0.010	mg/L	0.049
Cadmium (Cd)-Total	-	0.005	0.000010	mg/L	0.000018
Calcium (Ca)-Total	-	-	0.50	mg/L	177

Parameter	AO Guideline	Schedule 1&2 Standards	Lowest Detection Limit	Units	BH21-5 Result (16-Dec-21)
Cesium (Cs)-Total	-	-	0.000010	mg/L	0.000094
Chromium (Cr)-Total	-	0.05	0.00050	mg/L	0.00197
Cobalt (Co)-Total	-	-	0.00010	mg/L	0.00074
Copper (Cu)-Total	1	-	0.0010	mg/L	0.0038
Iron (Fe)-Total	0.3	-	0.050	mg/L	<b>1.60</b>
Lead (Pb)-Total	-	0.01	0.00010	mg/L	0.00107
Magnesium (Mg)-Total	-	-	0.050	mg/L	19.9
Manganese (Mn)-Total	0.05	-	0.00050	mg/L	<b>0.0703</b>
Molybdenum (Mo)-Total	-	-	0.000050	mg/L	0.000785
Nickel (Ni)-Total	-	-	0.00050	mg/L	0.00232
Phosphorus (P)-Total	-	-	0.050	mg/L	0.076
Potassium (K)-Total	-	-	0.050	mg/L	2.03
Rubidium (Rb)-Total	-	-	0.00020	mg/L	0.00293
Selenium (Se)-Total	-	0.05	0.000050	mg/L	0.000358
Silicon (Si)-Total	-	-	0.10	mg/L	8.36
Silver (Ag)-Total	-	-	0.000050	mg/L	<0.000050
Sodium (Na)-Total	200	20	0.50	mg/L	13.9
Strontium (Sr)-Total	-	-	0.0010	mg/L	0.332
Sulfur (S)-Total	-	-	0.50	mg/L	4.96
Tellurium (Te)-Total	-	-	0.00020	mg/L	<0.00020
Thallium (Tl)-Total	-	-	0.000010	mg/L	0.000019
Thorium (Th)-Total	-	-	0.00010	mg/L	0.00070
Tin (Sn)-Total	-	-	0.00010	mg/L	0.00169
Titanium (Ti)-Total	-	-	0.00030	mg/L	0.0828
Tungsten (W)-Total	-	-	0.00010	mg/L	<0.00010
Uranium (U)-Total	-	0.02	0.000010	mg/L	0.000652
Vanadium (V)-Total	-	-	0.00050	mg/L	0.00305
Zinc (Zn)-Total	5	-	0.0030	mg/L	0.0163
Zirconium (Zr)-Total	-	-	0.00030	mg/L	0.00077

\*bold – exceeds ODWS guideline limits

## 4. Water Budget

### 4.1 Water Budget

Changes to land use from the proposed development, a ninety-story apartment with a parking lot, will increase the imperviousness of this site and lead to an increase in surface water runoff and a decrease of infiltration. Based on our understanding of the geology and hydrogeology and the function of natural environmental features, a decrease in infiltration is not considered to have an adverse impact on the local groundwater system. The following rationale supports this conclusion:

- 1) There are no groundwater supported natural features such as wetlands in the study area.
- 2) The site is not located in a Significant Groundwater Recharge Area (SGRA) or a Wellhead Protection Area – Q2 (WHPA).
- 3) Although the site is located within a WHPA-C, which means that the storage and handling of DNAPLs are prohibited, the proposed development will not require the prohibited activities.
- 4) All properties within 500 m of the site are supplied with potable water from municipal supplies and do not rely on potable groundwater wells.

### 4.2 Low Impact Development Mitigation

A water budget was not completed on this site due to reasons outlined in **Section 4.1**. However, general recommendations on the use of Low Impact Development (LID) measures can be made to help manage the increased imperviousness of the site due to land 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.

While the Newmarket Till aquitard typically prevents infiltration, the southeast portion of site hosts a deeper water table where infiltration-based LIDs such as infiltration trenches and grassed swales are recommended. A 1 m separation is required between the base of the LID and the seasonally high groundwater table.

## 5. Preliminary Dewatering Assessment

### 5.1 Short-Term Construction Dewatering

At this stage of the project, the invert elevations of the basement and levels of parking were estimated from the site cross section drawing provided by n Architecture Ltd. (**Appendix A**). A recommendation for a PTTW or an EASR will be made but it must be re-assessed during later design stages once the final designs and depths have been finalized. Should any changes be made to the design, Palmer should be given the opportunity to re-assess the dewatering rate estimates.

## 5.2 Dewatering Estimate

There are three (3) levels of parking that follow the southwards sloping topography on site. Parking for both of Levels 1 and 3 are designed to take advantage of the existing site grade and are proposed to be constructed at grade and reinforced with retaining walls. However, excavation below the existing grade will be required for most of Parking Level 2. Additionally, minor excavation is required for the building's pool. As such, dewatering estimates have been provided to evaluate the need for construction dewatering permitting.

The site cross section indicates that Parking Level 2 has a foundation elevation of 270.00 masl. The seasonally high groundwater elevation is estimated to be 269.56 masl based on the groundwater level monitoring completed at BH21-5 between March to June 2022. Assuming excavation will occur an additional meter below the proposed foundation depth for Parking Level 2 (an elevation of 269.00 masl), the foundation is estimated to be 0.56 m below the groundwater table.

The pool has a proposed foundation elevation of 271.00 masl. Assuming excavation will occur an additional meter below the proposed foundation (an elevation of 270.00 masl), the foundation is estimated to be 0.44 m above the groundwater table. Resultantly, no construction dewatering is estimated for the pool.

**Table 9. Foundation Elevations Relative to Seasonally High Groundwater Table**

Proposed Structure	Proposed Foundation Elevation (masl)	Max Foundation Elevation (masl)	Maximum Groundwater Elevation	Foundation Level Relative to Max Groundwater Level
Parking Level 2	270.00	269.00	269.56	-0.56
Pool	271.00	270.00	269.56	0.44

Note: \* The maximum groundwater elevation represents the highest groundwater elevation measured across all well locations between all site visits  
 - value for basement relative to WL denotes that basement is below the water table  
 + value for basement relative to WL denotes that basement is above the water table

### 5.2.1 Dewatering Estimate for Parking Level 2

As only the foundation for Parking Level 2 is located 0.56 m below the groundwater table, minor dewatering will be required.

The groundwater elevation from BH21-5 in March 2022 (269.56 masl) was used to provide a conservative dewatering estimate. Excavation dimensions and depths were estimated based on the site plan. To maintain a stable and dry excavation, it has been assumed that the water level will be lowered at least 1 m below the proposed maximum depth of the excavation.

Dewatering rate estimates for Parking Level 2 were calculated using the following equation from Powers et.al (2007) for an unconfined aquifer.

$$Q_{trench} = \frac{\pi K(H^2 - h^2)}{\ln\left(\frac{R_0 + r_e}{r_e}\right)} + 2 \left[ \frac{xK(H^2 - h^2)}{2L} \right] \quad m^3/s$$

Where	K	=	hydraulic conductivity (m/s)
	$\pi$	=	pi
	H	=	saturated thickness (m)
	h	=	saturated thickness after dewatering (m)
	R <sub>0</sub>	=	radius of influence (m)
	R <sub>e</sub>	=	equivalent radius of influence (m)
	L	=	line source distance (m) which is R <sub>0</sub> /2
	x	=	shaft width (m)

**Table 10** presents a summary of the estimated dewatering rate and radius of water table drawdown for the short-term construction dewatering required for Parking Level 2. An additional 1.5 m was added to each side of the proposed dimensions to account for the additional excavation needed for construction. This dewatering estimation assumes that no groundwater cut-off structures (i.e., sheet-pile shoring) are present. The geometric mean hydraulic conductivity value for the Newmarket Till ( $3.0 \times 10^{-7}$  m/s) was used to conservatively estimate dewatering.

Dewatering for Parking Level 2 was estimated to be 441 L/day, with a radius of influence of 13.45 m. Accounting for a contingency factor of 10,000 L/day to account for stormwater from precipitation and soil heterogeneity, dewatering is estimated to be 10,441 L/day.

**Table 10. Dewatering Rate Estimate for Parking Level 2**

Parameter	Symbol	Unit	Newmarket Till
Excavation Length	L	[m]	22.2
Excavation Width	W	[m]	66.5
Geometric Mean Hydraulic Conductivity	K	[m/s]	$3.0 \times 10^{-7}$
Saturated thickness	H	[m]	0.56
Dewatered saturated thickness	h	[m]	0.00
Radius of influence (from centre of excavation)	R <sub>0</sub>	[m]	13.45
Equivalent Well Radius	r <sub>e</sub>	[m]	12.50
Dewatering Rate	Q <sub>dw</sub>	[L/day]	<b>441</b>
Total Dewatering Rate with 10,000 L/day contingency allowance	Q <sub>Total</sub>	[L/day]	<b>10,441</b>

## **6. Impact Assessment and Hydrogeological Design Considerations**

### **6.1 Hydrogeological Design Considerations**

#### **6.1.1 Short-Term Construction Dewatering Permitting**

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.

Considering the site plan provided by n Architecture Ltd. (**Appendix A**), dewatering is estimated to be 10,441 L/day, including contingency. As this is below 50,000 L/day, an EASR or PTTW from the MECP is not required.

### **6.2 Assessment of Impacts**

#### **6.2.1 Aquifers and Natural Environmental Features**

No adverse impacts to the natural environment are expected from the development or construction dewatering of the project itself. No groundwater supported wetlands or watercourse features were identified on site, and the presence of low permeability Newmarket Till limits the potential for groundwater/ surface water interactions.

No significant aquifer units were identified on the site over the depth of drilling. The Newmarket Till aquitard was present at surface, which based on hydraulic conductivity testing, acts to restrict groundwater movement on the site and protects deeper, confined aquifer units. No impacts to aquifers are therefore expected from development of the site.

#### **6.2.2 Private Water Wells**

The MECP Water Well records identified two domestic wells in a 500 m radius of the site. It is expected that they are no longer in use, as the area is municipally serviced. As no dewatering is required, no impacts to local water users are expected as a result of the proposed development.

## 7. Conclusions and Recommendations

Based on the results of the Hydrogeological Assessment, the following summary of conclusions and recommendations is presented:

- The hydrogeological drilling program, conducted by Palmer, consisted of the drilling and installation of five (5) boreholes, three (3) of which were completed as monitoring wells.
- Based on a search of the MECP water well database 3 water wells were identified within a 500 m radius of the site. Of the 3 water wells, 2 are used for domestic water supply and 1 has no use listed.
- The Ontario Source Water Protection Information Atlas identifies the site is located within a Wellhead Protection Area C (WHPA-C) with a vulnerability score of 4. Due to the presence of the WHPA-C, the storage and handling of DNAPLS is prohibited in the area. Specific DNAPLS of concern are TCE and PCE. Based on the fact that the proposed residential development will consist of an eight-story apartment building, none of these aforementioned activities are expected to occur on site and therefore the SWP regulations have been met.
- Borehole drilling at the site revealed surficial geology at the site is generally consistent with regional OGS mapping: Newmarket Till was found at surface throughout the site.
- Groundwater levels in the monitoring wells were measured from December 2021 to May 2022. The groundwater levels ranged in depth from 1.44 mbgs to 5.88 mbgs or an elevation of 265.12 to 272.88 masl.
- Based on the results of the SWRTs, the Newmarket Till was found to have a geometric mean K value of approximately  $3.0 \times 10^{-7} \text{m/s}$ .
- The infiltration rate of the unsaturated in-situ soils was measured on May 18, 202. Testing was completed using a constant head well permeameter method (Guelph Permeameter), and employed the combined reservoir technique. Three (3) infiltration test locations were selected based on the Site Plan. The soil profiles determined from the test pits are consistent with the regional geology, Newmarket Till as silty sand till was encountered at one test pit location (IT3).
- Field calculated infiltration rates for the fill ranged from 39 to 43 mm/hr across site. With a safety correction factor of 2.5, infiltration rates ranged from 16 to 17 mm/hr, with a mean of 16 mm/hr.
- Based on our understanding of the geology and hydrogeology and the function of natural environmental features, a decrease in infiltration is not considered to have an adverse impact on the local groundwater system. Therefore, a water budget is not required for this site.
- A groundwater sample was collected on December 16<sup>th</sup>, 2021, from BH21-5 and analyzed for a suite of water quality parameters including physical parameters, nutrients, and metals. The

groundwater sample from BH21-5 exceeds the Ontario Drinking Water Aesthetic and Operational Guidelines for colour, hardness, total dissolved solids (TSS), turbidity, alkalinity (as CaCO<sub>3</sub>), Aluminium (AL)-Total, Iron (Fe)-Total and Manganese (Mn)-Total. These exceedances are typical of untreated groundwater with high TSS/ turbidity and are expected to be reduced through filtration.

- Short-term construction dewatering for Parking Level 2 was estimated to be 10,441 L/day, including contingency. As this is below 50,000 L/day, an EASR or PTTW from the MECP is not required.

## 8. Certification

This report was prepared and reviewed by the undersigned:

Prepared By:



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Tanvi Patel, M.Env.Sc., G.I.T.  
Environmental Scientist

Reviewed By:



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

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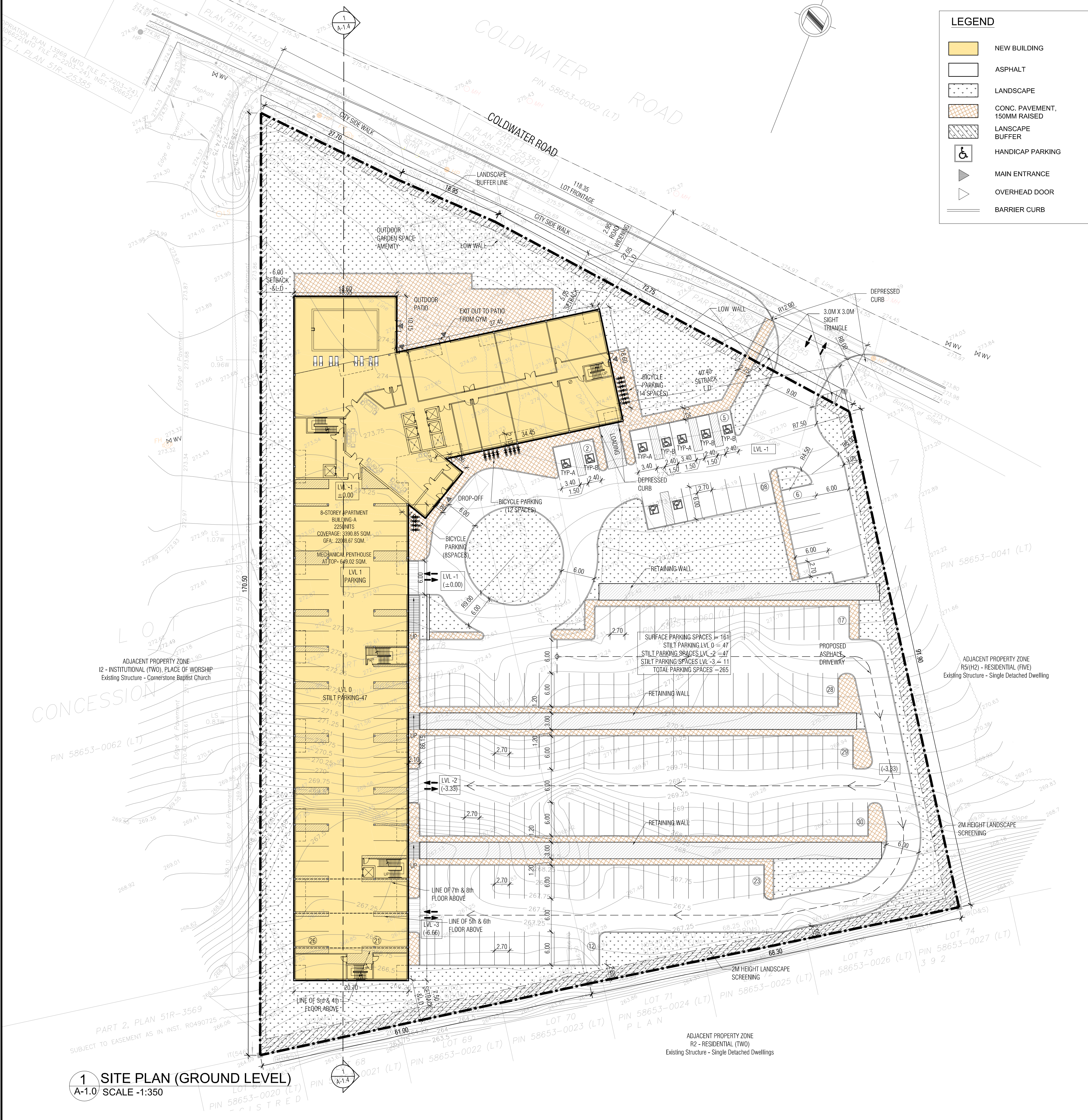
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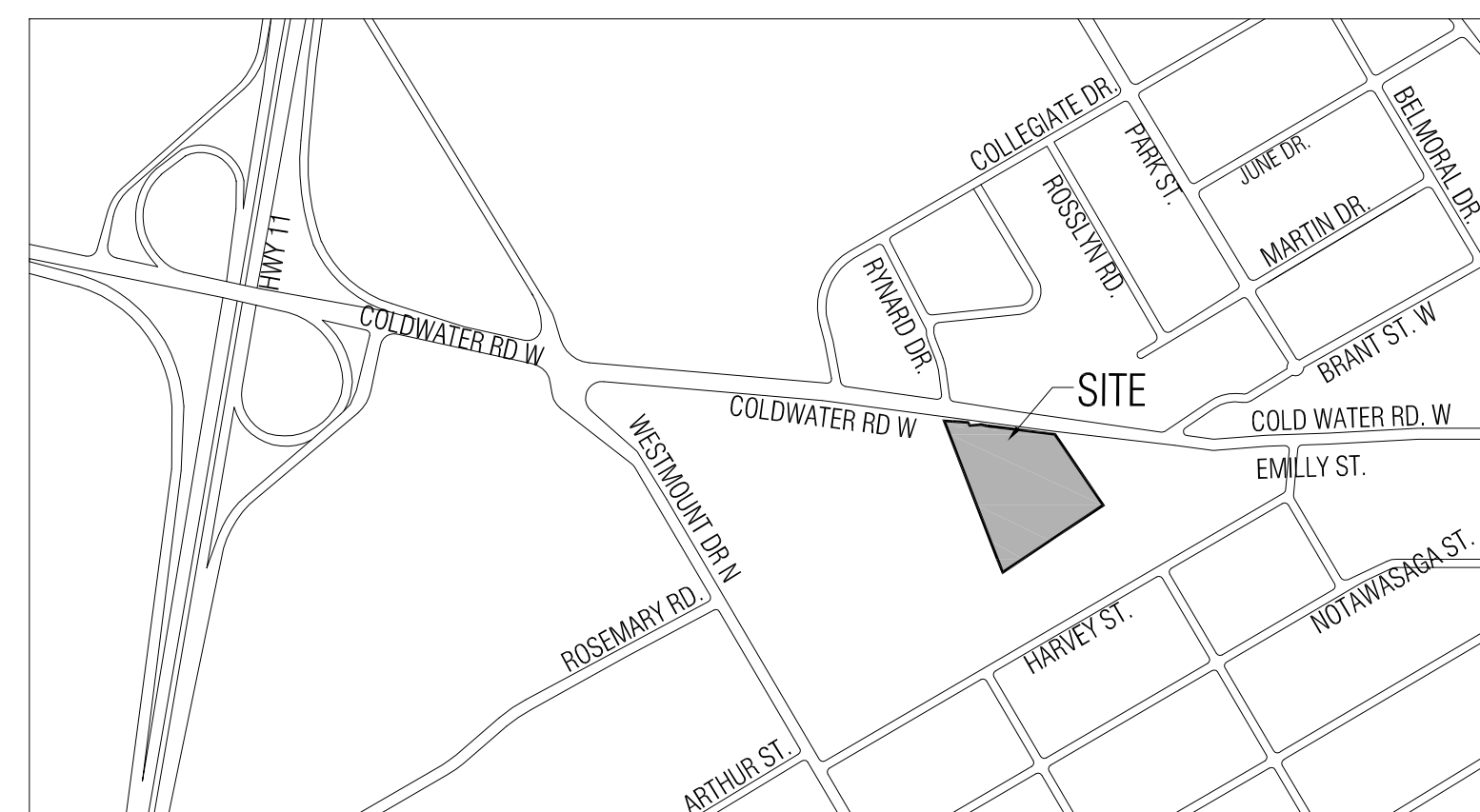
# **Appendix A**

**Site Plan (n Architecture  
Inc., 2022)**



**LEGEND**

- NEW BUILDING
- ASPHALT
- LANDSCAPE
- CONC. PAVEMENT, 150MM RAISED
- LANDSCAPE BUFFER
- ♿ HANDICAP PARKING
- MAIN ENTRANCE
- OVERHEAD DOOR
- BARRIER CURB



**2 KEY PLAN**  
A-1.0 SCALE -NTS

**PROJECT STATISTICS-**

ADDRESS: 233, 249, 261 COLDWATER ROAD, ORILLIA, ON.

ZONING : R5i (H2)

	REQUIRED	PROVIDED
LOT(SITE) AREA (m <sup>2</sup> )	1000 SQM.	15426.96 (3.81 ACRE)
ROAD WIDENING		350.78 SQM.
NET LOT AREA		15076.18 SQM. (3.72 ACRE)
LOT FRONTAGE MIN.	30.0 M.	118.35 M.
LOT DEPTH MIN.		93.80 M.
GROUND FLOOR AREA (m <sup>2</sup> )		3390.85 SQM.
GROSS FLOOR AREA (m <sup>2</sup> )	300.00 SQM.	22008.67 SQM.
BLDG. COVERAGE	60.0%	22.49%
BUILDING HT.	12.5 M. (MAX)	28.35 M.
PAVED AREA		1205.72 SQM
LANDSCAPE (MIN.)	40.0%	4133.56 SQM (26.79%)

**BUILDING SETBACKS**

	REQUIRED	PROVIDED
FRONT SETBACK (NORTH) (COLDWATER ROAD)	5.0 M.	5.05 M.
REAR SETBACK (SOUTH)	7.5 M.	7.50 M.
INT. SIDE SETBACK (WEST)	6.0 M.	6.0 M.
INT. SIDE SETBACK (EAST)	6.0 M.	40.40 M.

**PARKING CALCULATION**

	REQUIRED	PROVIDED
RESIDENTIAL UNITS - 225 UNITS 1.5 SPACES PER UNIT (2.7 M. X 6.0 M.)	338	263
ACCESSIBLE PARKING SPACE (TYPE A - 3.4 M X 6.0 M)	4	4
ACCESSIBLE PARKING SPACE (TYPE B - 2.4 M X 6.0 M)	5	5
TOTAL PARKING SPACES	338 (INCL. 9 B/F)	265 (INCL. 9 B/F)
VISITOR PARKING (25% OF PARKING SPACES)	85	23
BICYCLE PARKING 1/10 PARKING SPACES	34	34

**LOADING PROVISIONS**

	REQUIRED	PROPOSED
LOADING SPACE (7.95 M X 3.4 M)	0	1

**MUNICIPAL ADDRESS AND LEGAL DESCRIPTION**  
233, 249, 261 COLDWATER ROAD, ORILLIA, ONTARIO  
PART OF LOT 7, CONCESSION 4  
CITY OF ORILLIA  
COUNTY OF SIMCOE

**APPLICANT**  
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**N**  
PROJECT NORTH

13th JULY 2022  
ISSUED FOR SPA 1

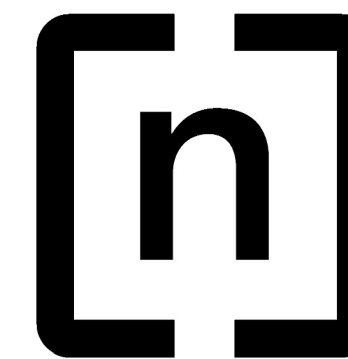
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**PROJECT:**  
**CONDOMINIUM**  
**233,249,261**  
**COLDWATER ROAD,**  
**WEST, ORILIA**

**DRAWING TITLE:**  
**SITE PLAN**  
**(GROUND LEVEL)**

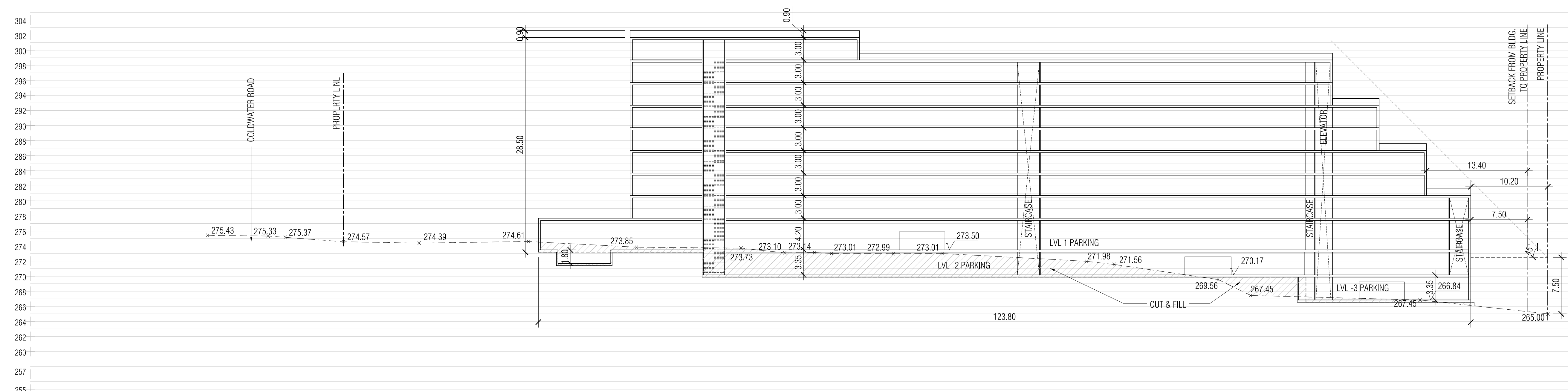
DRAWN BY: NG	DATE: 15 FEBRUARY 2021
CHECKED BY: NM	SCALE: AS NOTED
PROJECT NO.:	DRAWING NO.:
<b>21-23</b>	<b>A-1.0</b>



n Architecture Inc

PRINCIPAL: NITIN MALHOTRA, ARCHITECT.  
9120 Leslie Street, Suite-208  
Richmond Hill, Ontario. L4B 3J9  
T : 4 1 6 . 2 5 6 . 9 7 4 1  
E: info@narchitecture.com  
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9th AUGUST 2022  
ISSUED FOR SPA 1



1 SITE SECTION  
A-1.4 SCALE -1:300

1.	2022-05-13	ISSUED FOR SPA 1	NG.
No.	Date	Version	Dwn.

This drawing is copyright property of 'n Architecture Inc'. Not to be reproduced. Contractor must verify all job dimensions, drawings, details and specifications and report any discrepancies to the architect before proceeding with work.

PROJECT:

**CONDOMINIUM  
233,249,261  
COLDWATER ROAD,  
WEST, ORILIA**

DRAWING TITLE:

**SITE SECTION  
(OPTION-4)**

DRAWN BY: NG	DATE: 15 FEBRUARY 2021
CHECKED BY: NM	SCALE: AS NOTED
PROJECT NO.:	DRAWING NO.:

**21-23      A-1.4**

# **Appendix B**

**Borehole Logs (Palmer, 2021)**

PROJECT: Geotechnical Investigation\_233-261 Coldwater Rd  
 CLIENT: Aurowal Developments Ltd.  
 PROJECT LOCATION: City of Orillia, ON  
 DATUM: N/A  
 BH LOCATION: See Borehole Location Plan

Method: Solid Stem Augers  
 Diameter: 155 mm  
 Date: Dec-08-2021

REF. NO.: 1802403  
 ENCL NO.: 1

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	REMARKS AND GRAIN SIZE DISTRIBUTION (%)		
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)							W <sub>p</sub>	W
271.0	Ground Surface															
270.0	<b>TOPSOIL:</b> 80 mm															
270.3	<b>FILL:</b> silty clay to clayey silt, some sand, trace gravel, trace rootlets, contains wood pieces, dark brown, moist, soft to stiff		1	SS	6											
270.3	<b>FILL:</b> sandy silt, trace clay, trace gravel, trace rootlets, contains cobbles, brown, moist, compact		2	SS	17											
269.7	<b>SILTY SAND TILL:</b> some clay, some gravel, contain silt pockets, brown, moist, compact to very dense		3	SS	13											
	contains cobble and boulder fragments		4	SS	60/230mm											Auger grinding, possible boulder encountered
			5	SS	28											20 38 32 10
266.9	<b>CLAYEY SILT TILL:</b> some sand, trace gravel, contain cobbles, brown, moist, dense		6	SS	40											
			7	SS	38											
264.3	<b>END OF BOREHOLE</b> Notes: 1. Upon completion of drilling, a 50mm diameter monitoring well was installed in the borehole. 2. Water Level Readings: Date      W. L. Depth (mBGS) Dec 16, 2021      5.59															

GROUNDWATER ELEVATIONS  
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ○ = 3% Strain at Failure

A:\SOIL\BHAMNH\13\2021\_PALM\BCH\_467905\FORM\BHL\LOG.016  
 PALM\BCH\_467905\FORM\BHL\LOG.016

PROJECT: Geotechnical Investigation\_233-261 Coldwater Rd  
 CLIENT: Aurowal Developments Ltd.  
 PROJECT LOCATION: City of Orillia, ON  
 DATUM: N/A  
 BH LOCATION: See Borehole Location Plan

Method: Solid Stem Augers  
 Diameter: 155 mm  
 Date: Dec-08-2021

REF. NO.: 1802403  
 ENCL NO.: 2

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)									
273.8	Ground Surface																
273.0	<b>TOPSOIL:</b> 100 mm																
272.7	<b>FILL:</b> silty clay to clayey silt, some sand, trace gravel, trace rootlets, trace organics, dark brown to brown, moist, soft		1	SS	4												
			2A	SS													
1.1	<b>SILTY SAND TILL:</b> trace to some clay, trace gravel, contain sand layers, contain cobbles and boulder fragments, brown, moist, loose to very dense		2B	SS	9												
			3	SS	9												
			4	SS	23												
			5	SS	30												
			6	SS	59												
			7	SS	64												
267.1	<b>END OF BOREHOLE</b> Notes: 1. Borehole was open upon completion of drilling.																

Auger grinding

GROUNDWATER ELEVATIONS  
 Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ●=3% Strain at Failure

A:\SOILS\BH21-2\LOGS\BH LOGS\20211208\20211208\_21-2\_BH LOG.DWG  
 PALMER ENGINEERING LTD. 1800 KENNEDY ROAD, SUITE 100, MARKHAM, ON L3R 9W7  
 TEL: 905-477-1600 FAX: 905-477-1601 WWW.PALMERENGINEERING.COM

PROJECT: Geotechnical Investigation\_233-261 Coldwater Rd  
 CLIENT: Aurowal Developments Ltd.  
 PROJECT LOCATION: City of Orillia, ON  
 DATUM: N/A  
 BH LOCATION: See Borehole Location Plan

Method: Solid Stem Augers  
 Diameter: 155 mm  
 Date: Dec-08-2021

REF. NO.: 1802403  
 ENCL NO.: 3

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			SHEAR STRENGTH (kPa)									
274.0	Ground Surface																
274.0	<b>TOPSOIL: 80 mm</b>																
0.1	<b>FILL:</b> sandy silt, some clay, trace gravel, trace rootlets, dark brown to brown, moist, very loose to compact		1	SS	3												
1			2	SS	11											Auger grinding	
272.6	<b>FILL:</b> sand, some clay, trace gravel, contains cobble and boulder pieces, brown, moist, loose		3	SS	9											Auger grinding	
1.5			4	SS	25												
271.8	<b>SILTY SAND TILL:</b> some clay, some gravel, contains cobble and boulder pieces, brown, moist, compact to very dense		5	SS	63												
2.2			6	SS	50/ 125mm												
3			7	SS	50/ 75mm												
270																	
269																	
268																	
6.3	<b>END OF BOREHOLE</b> Notes: 1. Borehole was open upon completion of drilling.																

A. SOIL DOCUMENT 13.0712 PALM DOC# 409006 FROM BUREAU LOGS  
 PALMER SOIL UNIT USES 1802403 20230808 09:54:10 AM

**GROUNDWATER ELEVATIONS**  
 Measurement 1st 2nd 3rd 4th

**GRAPH NOTES** + 3, × 3: Numbers refer to Sensitivity ○ ● = 3% Strain at Failure

PROJECT: Geotechnical Investigation\_233-261 Coldwater Rd  
 CLIENT: Aurowal Developments Ltd.  
 PROJECT LOCATION: City of Orillia, ON  
 DATUM: N/A  
 BH LOCATION: See Borehole Location Plan

Method: Solid Stem Augers  
 Diameter: 155 mm  
 Date: Dec-08-2021

REF. NO.: 1802403  
 ENCL NO.: 4

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	REMARKS AND GRAIN SIZE DISTRIBUTION (%)							
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			20	40	60	80							100	20	40	60	80	100	10
273.7	Ground Surface																							
273.0	<b>TOPSOIL:</b> 100 mm																							
0.1	<b>FILL:</b> silty clay to clayey silt, some sand, trace gravel, trace rootlets, dark brown to brown, moist, soft to firm		1	SS	21																			
	contains cobbles		2	SS	5																			
272.2	<b>FILL:</b> sandy silt, trace clay, some gravel, brown, moist, compact		3	SS	16																			
1.5																								
271.5	<b>SILTY SAND TILL:</b> some to trace clay, some gravel, contains cobble and boulder pieces, brown, moist, compact to very dense		4	SS	27																			
2.2			5	SS	35																			
	contains clayey silt layers																							
			6	SS	30																			18 39 30 13
267.3	<b>END OF BOREHOLE</b>		7	SS	50/ 125mm																			
6.4	<b>Notes:</b> 1. Upon completion of drilling, a 50mm diameter monitoring well was installed in the borehole. 2. Water Level Readings: Date      W. L. Depth (mBGS) Dec 16, 2021    3.39																							

W. L. 270.3 m  
 Dec 16, 2021

GROUNDWATER ELEVATIONS  
 Measurement 1st 2nd 3rd 4th

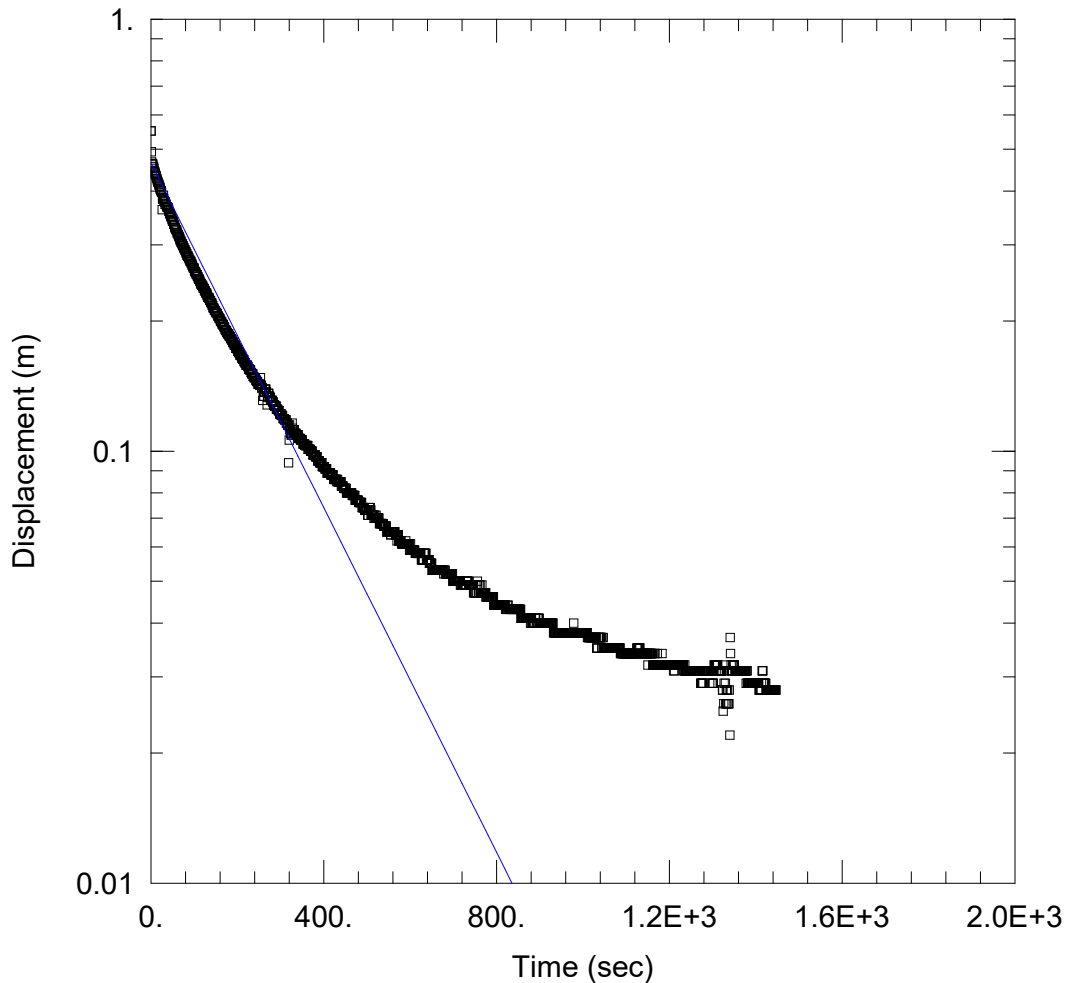
GRAPH NOTES + 3, x 3: Numbers refer to Sensitivity ○ = 3% Strain at Failure

A:\BOUTCHAMPT\13-2021\_PALM\_BORING\REPORTS\LOGS\LOG\_04.B  
 PALM\_BORING\UNIT\_1\B21-4\LOG\_04.B (DATE: 2021-12-16 11:27:58)



# **Appendix C**

## **Single Well Response Test Results (Palmer, 2021)**



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-5\_Coldwater\_RH.aqt

Date: 01/19/22

Time: 14:30:25

### PROJECT INFORMATION

Company: Palmer

Project: 1802403

Location: 233-261 Coldwater Rd, Orillia

Test Well: BH21-5

Test Date: 16-Dec-2021

### AQUIFER DATA

Saturated Thickness: 1. m

Anisotropy Ratio (Kz/Kr): 0.1

### WELL DATA (New Well)

Initial Displacement: 0.551 m

Static Water Column Height: 4.78 m

Total Well Penetration Depth: 4.08 m

Screen Length: 3. m

Casing Radius: 0.0254 m

Well Radius: 0.0254 m

Gravel Pack Porosity: 0.

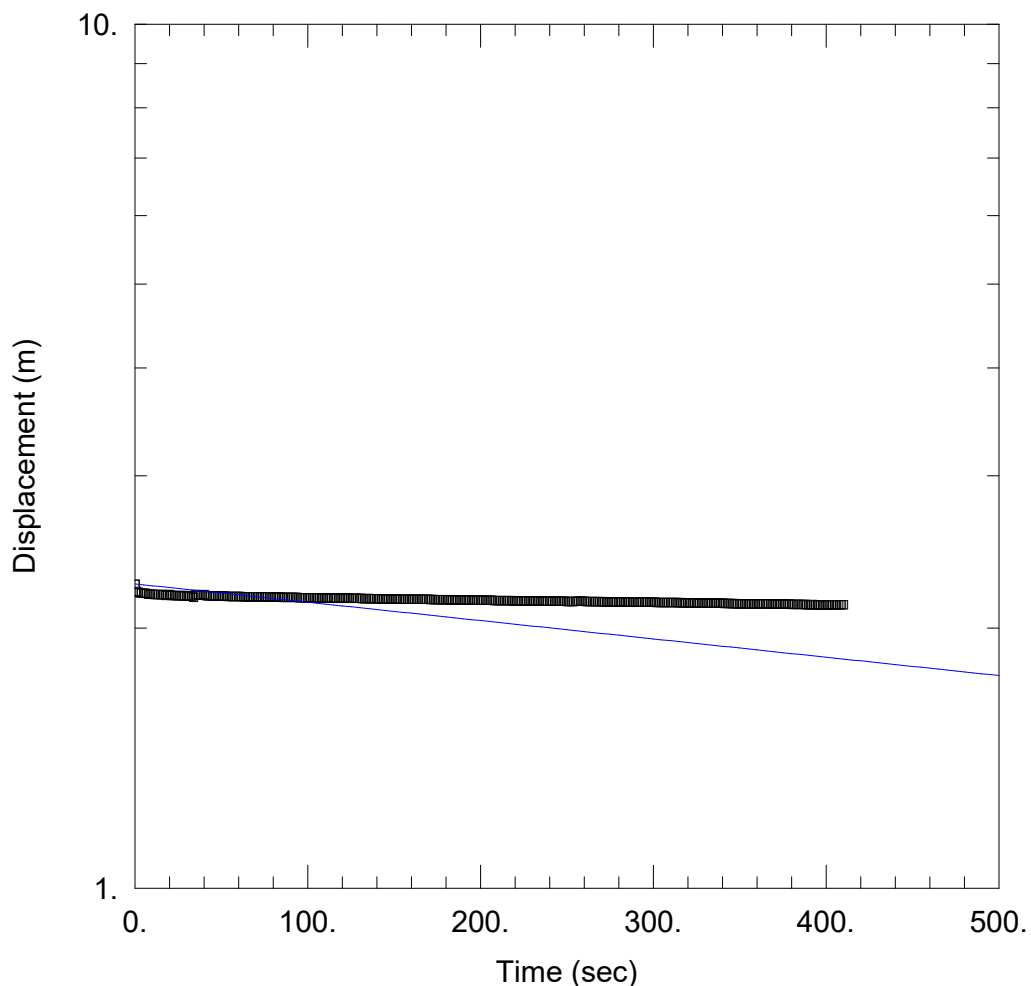
### SOLUTION

Aquifer Model: Confined

Solution Method: Bower-Rice

K = 5.398E-6 m/sec

y0 = 0.4641 m



### WELL TEST ANALYSIS

Data Set: C:\...\BH21-4\_Coldwater\_RH.aqt

Date: 01/19/22

Time: 14:29:23

### PROJECT INFORMATION

Company: Palmer

Project: 1802403

Location: 233-261 Coldwater Rd, Orillia

Test Well: BH21-4

Test Date: 16-Dec-2021

### AQUIFER DATA

Saturated Thickness: 2.71 m

Anisotropy Ratio (Kz/Kr): 0.1

### WELL DATA (New Well)

Initial Displacement: 2.247 m

Static Water Column Height: 2.71 m

Total Well Penetration Depth: 3. m

Screen Length: 3. m

Casing Radius: 0.0254 m

Well Radius: 0.0254 m

Gravel Pack Porosity: 0.

### SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

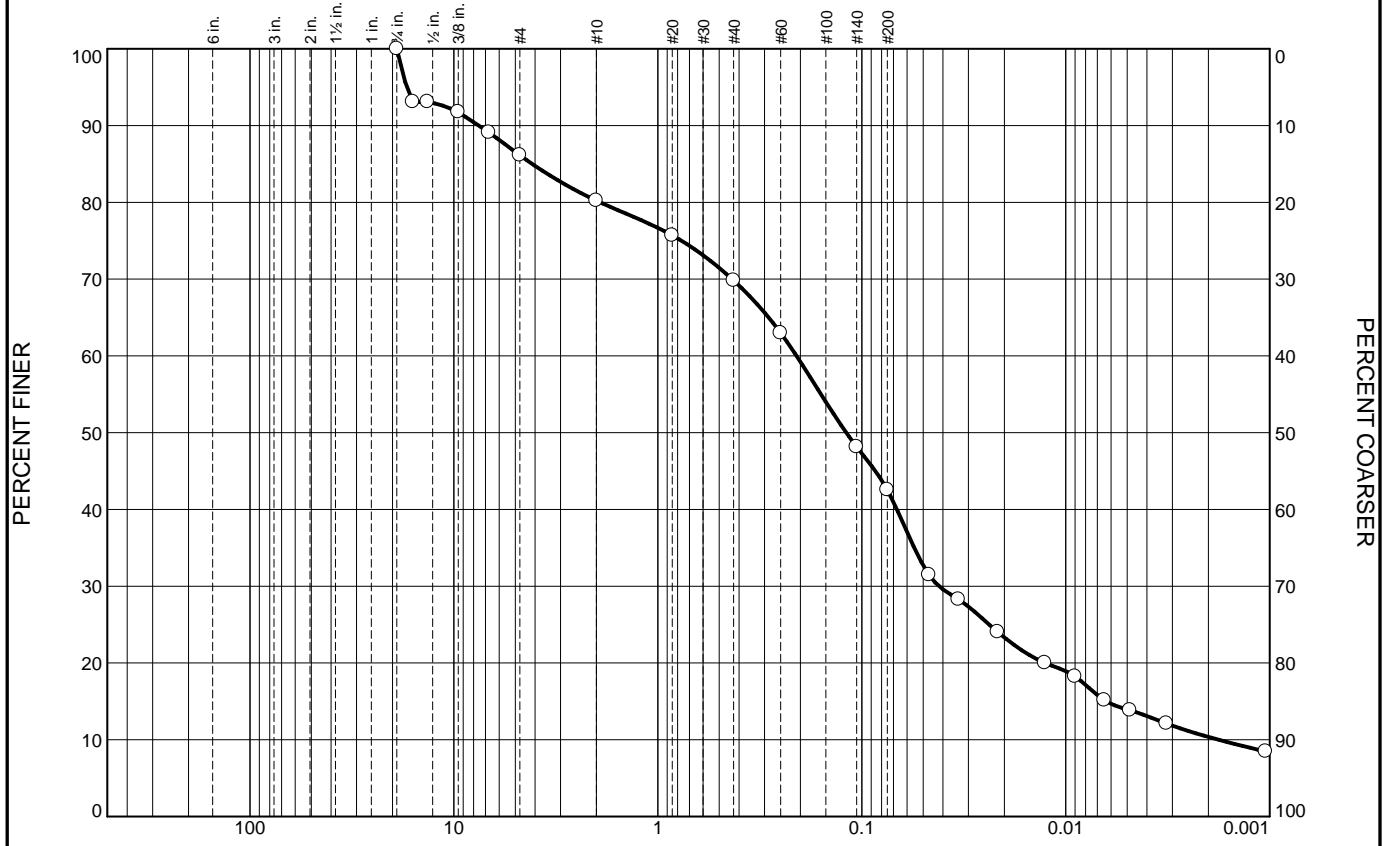
K = 2.13E-7 m/sec

y0 = 2.25 m

# **Appendix D**

## **Grain Size Distribution Curves (Terrapex, 2021)**

# Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
<input type="radio"/>	0.0	19.8	10.4	27.3	32.1	10.4

<input checked="" type="checkbox"/>	LL	PL	D85	D60	D50	D30	D15	D10	Cc	Cu
<input type="radio"/>			4.1317	0.2090	0.1192	0.0418	0.0063	0.0018	4.69	117.45

Material Description	USCS	AASHTO
<input type="radio"/> SILTY SAND some gravel trace to some clay		

**Project No.** CA19-009      **Client:** Palmer Environmental Consulting Group Inc. (PECG)  
**Project:** PECG Prj No 18902403  
 **Sample Number:** BH 21-1, SS5

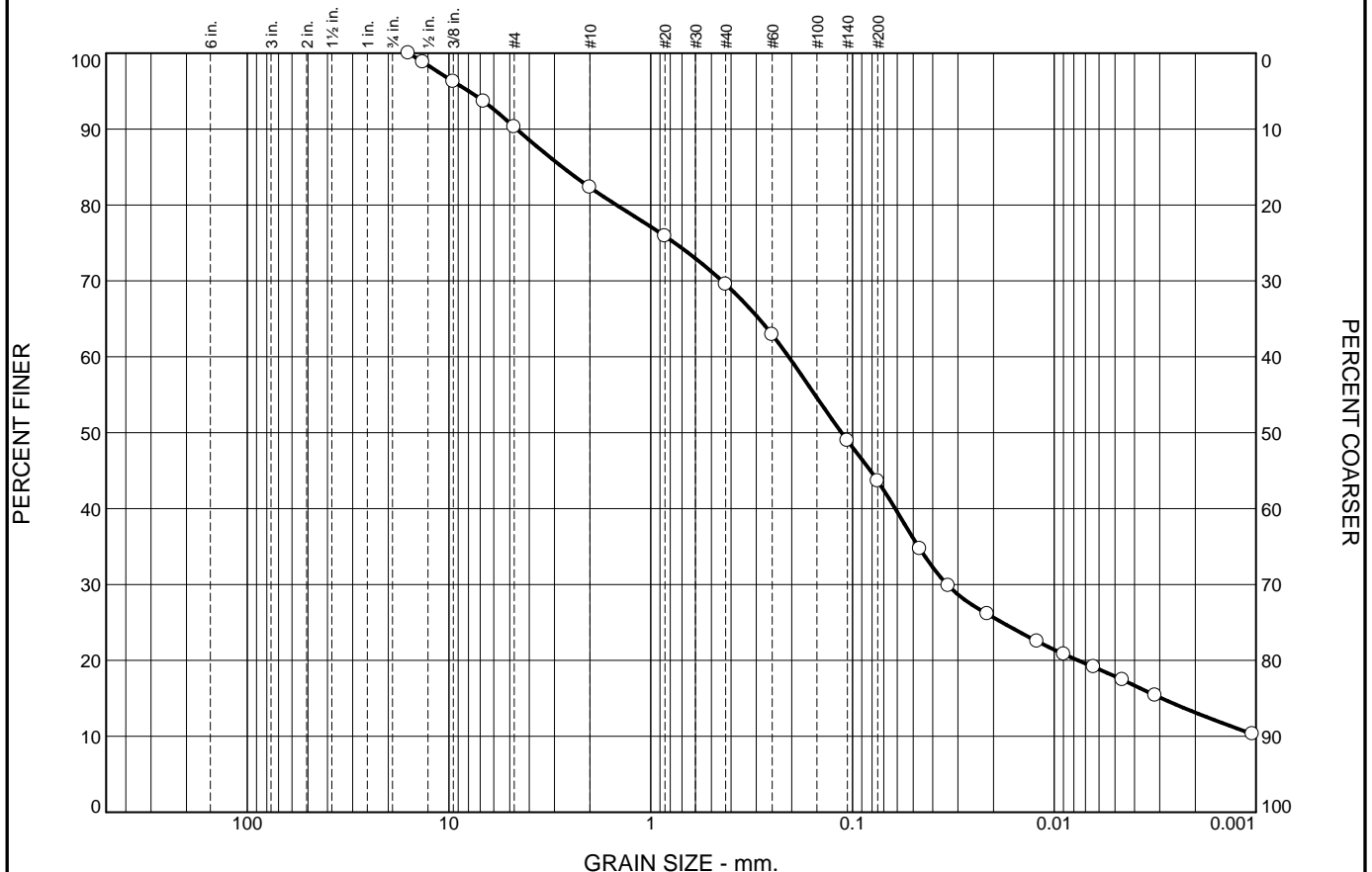
**Remarks:**  
 HYDROMETER DETAILS: Spec. Grav. 2.75(assumed); Vb=53cm<sup>3</sup>; L2=13.8cm; L1=10.7cm; hs=0.16cm/Div; A=30.2cm<sup>2</sup>; Mass of Disp. Agent=40g/1 Test date: 16/12/2021



**Figure 1**

**Tested By:** AM

# Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
<input type="radio"/>	0.0	17.7	12.7	26.0	30.5	13.1

	LL	PL	D85	D60	D50	D30	D15	D10	Cc	Cu
<input checked="" type="checkbox"/>	15.3	10.2	2.7432	0.2072	0.1134	0.0339	0.0029			

Material Description	USCS	AASHTO
<input type="radio"/> SILTY SAND some gravel some clay	SC-SM	A-4(0)

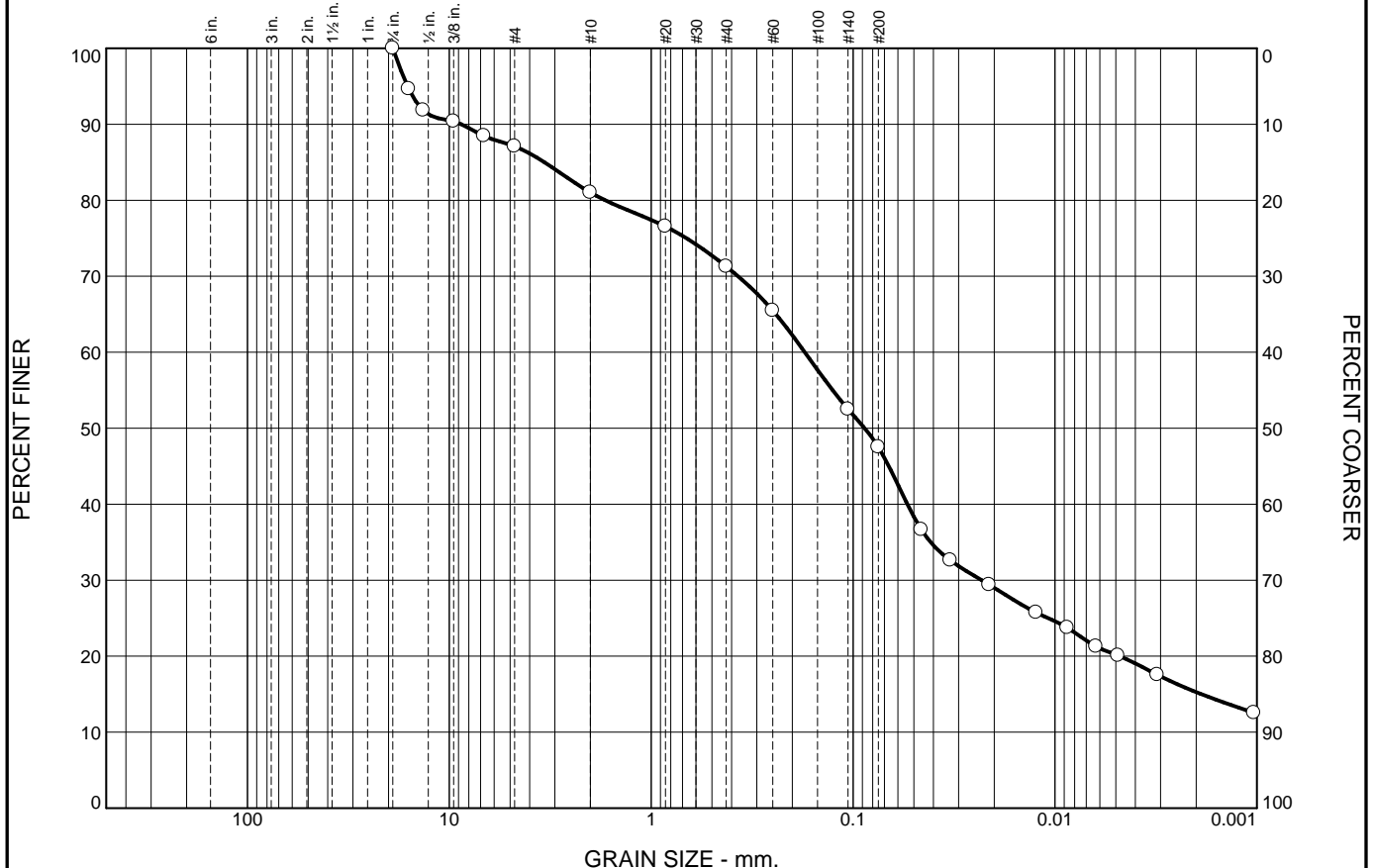
**Project No.** CA19-009      **Client:** Palmer Environmental Consulting Group Inc. (PECG)  
**Project:** PECG Prj No 18902403  
 **Sample Number:** BH 21-4, SS6

**Remarks:**  
 HYDROMETER DETAILS: Spec. Grav. 2.75(assumed); Vb=53cm<sup>3</sup>; L2=13.8cm; L1=10.7cm; hs=0.16cm/Div; A=30.2cm<sup>2</sup>; Mass of Disp. Agent=40g/1 Test date: 16/12/2021

# Terrapex

Tested By: AM

# Particle Size Distribution Report



	% +3"	% Gravel	% Sand		% Fines	
			Coarse	Fine	Silt	Clay
<input type="radio"/>	0.0	19.0	9.7	23.8	32.2	15.3

<input checked="" type="checkbox"/>	LL	PL	D85	D60	D50	D30	D15	D10	Cc	Cu
<input type="radio"/>			3.3813	0.1735	0.0876	0.0231	0.0019			

Material Description	USCS	AASHTO
<input type="radio"/> SAND AND SILT some gravel some clay		

**Project No.** CA19-009      **Client:** Palmer Environmental Consulting Group Inc. (PECG)  
**Project:** PECG Prj No 18902403  
  
 **Sample Number:** BH 21-5, SS7

**Remarks:**  
 HYDROMETER DETAILS: Spec. Grav. 2.75(assumed); Vb=53cm<sup>3</sup>; L2=13.8cm; L1=10.7cm; hs=0.16cm/Div; A=30.2cm<sup>2</sup>; Mass of Disp. Agent=40g/1 Test date: 16/12/2021

## Terrapex

Tested By: AM

# **Appendix E**

## **Chemistry Analysis Results (ALS, 2021)**



PALMER ENVIRONMENTAL CONSULTING  
GROUP INC. (Richmond Hill)  
ATTN: TANVI PATEL  
74 Berkeley Street  
Toronto ON M5V 1E3

Date Received: 17-DEC-21  
Report Date: 28-DEC-21 14:33 (MT)  
Version: FINAL

Client Phone: 647-795-8153

## Certificate of Analysis

Lab Work Order #: L2673634  
Project P.O. #: NOT SUBMITTED  
Job Reference: 1802403  
C of C Numbers: 17-620756  
Legal Site Desc:

---

KARANPARTAP SINGH  
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 95 West Beaver Creek Road, Unit 1, Richmond Hill, ON L4B 1H2 Canada | Phone: +1 905 881 9887 | Fax: +1 905 881 8062  
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

## WATER - [Combined] - Ontario PWQO + ODWS

Grouping	Analyte	Unit	ALS ID Sampled Date Sampled Time Sample ID
			L2673634-1 16-DEC-21 13:00 BH21-5
<b>Physical Tests</b>	Colour, Apparent	CU	51.7
	Conductivity	umhos/cm	917
	Hardness (as CaCO3)	mg/L	<sup>HTC</sup> 524
	pH	pH units	7.02
	Total Dissolved Solids	mg/L	<sup>DLDS</sup> 559
	Turbidity	NTU	90.7
<b>Anions and Nutrients</b>	Alkalinity, Total (as CaCO3)	mg/L	519
	Ammonia, Total (as N)	mg/L	0.014
	Chloride (Cl)	mg/L	5.65
	Fluoride (F)	mg/L	0.030
	Nitrate (as N)	mg/L	2.53
	Nitrite (as N)	mg/L	<0.010
	Orthophosphate-Dissolved (as P)	mg/L	<0.0030
	Sulfate (SO4)	mg/L	13.7
<b>Total Metals</b>	Aluminum (Al)-Total	mg/L	1.43
	Antimony (Sb)-Total	mg/L	0.00056
	Arsenic (As)-Total	mg/L	0.00047
	Barium (Ba)-Total	mg/L	0.111
	Beryllium (Be)-Total	mg/L	<0.00010
	Bismuth (Bi)-Total	mg/L	<0.000050
	Boron (B)-Total	mg/L	0.049
	Cadmium (Cd)-Total	mg/L	0.000018
	Calcium (Ca)-Total	mg/L	177
	Cesium (Cs)-Total	mg/L	0.000094

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.  
 Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

\* Please refer to the Reference Information section for an explanation of any qualifiers noted.

## WATER - [Combined] - Ontario PWQO + ODWS

			<b>ALS ID</b> L2673634-1 <b>Sampled Date</b> 16-DEC-21 <b>Sampled Time</b> 13:00 <b>Sample ID</b> BH21-5
Grouping	Analyte	Unit	
<b>Total Metals</b>	Chromium (Cr)-Total	mg/L	0.00197
	Cobalt (Co)-Total	mg/L	0.00074
	Copper (Cu)-Total	mg/L	0.0038
	Iron (Fe)-Total	mg/L	1.60
	Lead (Pb)-Total	mg/L	0.00107
	Magnesium (Mg)-Total	mg/L	19.9
	Manganese (Mn)-Total	mg/L	0.0703
	Molybdenum (Mo)-Total	mg/L	0.000785
	Nickel (Ni)-Total	mg/L	0.00232
	Phosphorus (P)-Total	mg/L	0.076
	Potassium (K)-Total	mg/L	2.03
	Rubidium (Rb)-Total	mg/L	0.00293
	Selenium (Se)-Total	mg/L	0.000358
	Silicon (Si)-Total	mg/L	8.36
	Silver (Ag)-Total	mg/L	<0.000050
	Sodium (Na)-Total	mg/L	13.9
	Strontium (Sr)-Total	mg/L	0.332
	Sulfur (S)-Total	mg/L	4.96
	Tellurium (Te)-Total	mg/L	<0.00020
	Thallium (Tl)-Total	mg/L	0.000019
	Thorium (Th)-Total	mg/L	0.00070
	Tin (Sn)-Total	mg/L	0.00169
	Titanium (Ti)-Total	mg/L	0.0828
	Tungsten (W)-Total	mg/L	<0.00010

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.  
 Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

\* Please refer to the Reference Information section for an explanation of any qualifiers noted.

# ANALYTICAL REPORT

## WATER - [Combined] - Ontario PWQO + ODWS

			<b>ALS ID</b> L2673634-1 <b>Sampled Date</b> 16-DEC-21 <b>Sampled Time</b> 13:00 <b>Sample ID</b> BH21-5
Grouping	Analyte	Unit	
<b>Total Metals</b>	Uranium (U)-Total	mg/L	0.000652
	Vanadium (V)-Total	mg/L	0.00305
	Zinc (Zn)-Total	mg/L	0.0163
	Zirconium (Zr)-Total	mg/L	0.00077

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.  
 Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

\* Please refer to the Reference Information section for an explanation of any qualifiers noted.

**Summary of Guideline Exceedances: [Combined] - Ontario PWQO + ODWS**

Guideline		Grouping	Analyte	Result	Guideline Limit	Unit
ALS ID	Client ID					
<b>Surface Water PWQO</b>						
(No parameter exceedances)						
L2673634-1	BH21-5	Total Metals	Aluminum (Al)-Total	1.43	0.015	mg/L
			Copper (Cu)-Total	0.0038	0.001	mg/L
			Iron (Fe)-Total	1.60	0.3	mg/L
			Lead (Pb)-Total	0.00107	0.001	mg/L
			Phosphorus (P)-Total	0.076	0.01	mg/L
<b>Ontario DW Aesthetic and Operational Guidelines</b>						
L2673634-1	BH21-5	Physical Tests	Colour, Apparent	51.7	5	CU
			Hardness (as CaCO3)	524	80-100	mg/L
			Total Dissolved Solids	559	500	mg/L
			Turbidity	90.7	5	NTU
		Anions and Nutrients	Alkalinity, Total (as CaCO3)	519	30-500	mg/L
		Total Metals	Aluminum (Al)-Total	1.43	0.1	mg/L
			Iron (Fe)-Total	1.60	0.3	mg/L
			Manganese (Mn)-Total	0.0703	0.05	mg/L
<b>Schedule 1 (Microbiological) and 2 (Chemical) Standards (JAN,2017)</b>						
(No parameter exceedances)						

\* Please refer to the Reference Information section for an explanation of any qualifiers noted.

# Reference Information

## Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).

## Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
<b>ALK-WT</b>	Water	Alkalinity, Total (as CaCO <sub>3</sub> )	APHA 2320B

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint.

<b>CL-IC-N-WT</b>	Water	Chloride by IC	EPA 300.1 (mod)
-------------------	-------	----------------	-----------------

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

<b>COLOUR-APPARENT-WT</b>	Water	Colour	APHA 2120
---------------------------	-------	--------	-----------

Apparent Colour is measured spectrophotometrically by comparison to platinum-cobalt standards using the single wavelength method after sample decanting. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment. Concurrent measurement of sample pH is recommended.

<b>EC-SCREEN-WT</b>	Water	Conductivity Screen (Internal Use Only)	APHA 2510
---------------------	-------	---	-----------

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

<b>EC-WT</b>	Water	Conductivity	APHA 2510 B
--------------	-------	--------------	-------------

Water samples can be measured directly by immersing the conductivity cell into the sample.

<b>F-IC-N-WT</b>	Water	Fluoride in Water by IC	EPA 300.1 (mod)
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Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

<b>HARDNESS-CALC-WT</b>	Water	Hardness	APHA 2340 B
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Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO<sub>3</sub> equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

<b>MET-T-CCMS-WT</b>	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
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Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

<b>NH3-F-WT</b>	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
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This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

# Reference Information

**Methods Listed (if applicable):**

ALS Test Code	Matrix	Test Description	Method Reference**
<b>NO2-IC-WT</b>	Water	Nitrite in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>NO3-IC-WT</b>	Water	Nitrate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>PH-WT</b>	Water	pH	APHA 4500 H-Electrode
Water samples are analyzed directly by a calibrated pH meter.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011). Holdtime for samples under this regulation is 28 days			
<b>PO4-DO-COL-WT</b>	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.			
<b>SO4-IC-N-WT</b>	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
<b>SOLIDS-TDS-WT</b>	Water	Total Dissolved Solids	APHA 2540C
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.			
<b>TURBIDITY-WT</b>	Water	Turbidity	APHA 2130 B
Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.			

\*\*ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

17-620756

*The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:*

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

# Reference Information

## GLOSSARY OF REPORT TERMS

*Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.*

*mg/kg - milligrams per kilogram based on dry weight of sample*

*mg/kg wwt - milligrams per kilogram based on wet weight of sample*

*mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight*

*mg/L - unit of concentration based on volume, parts per million.*

*< - Less than.*

*D.L. - The reporting limit.*

*N/A - Result not available. Refer to qualifier code and definition for explanation.*

*Test results reported relate only to the samples as received by the laboratory.*

*UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.*

*Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.*

*Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.*



## Quality Control Report

Workorder: L2673634

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Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)  
 74 Berkeley Street  
 Toronto ON M5V 1E3

Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>ALK-WT</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R5683354</b>							
<b>WG3679493-4</b>	<b>DUP</b>	<b>WG3679493-3</b>						
Alkalinity, Total (as CaCO3)		694	689		mg/L	0.7	20	24-DEC-21
<b>WG3679493-2</b>	<b>LCS</b>							
Alkalinity, Total (as CaCO3)			100.8		%		85-115	24-DEC-21
<b>WG3679493-1</b>	<b>MB</b>							
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	24-DEC-21
<b>CL-IC-N-WT</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R5681604</b>							
<b>WG3677475-9</b>	<b>DUP</b>	<b>L2673406-2</b>						
Chloride (Cl)		9.67	9.67		mg/L	0.1	20	20-DEC-21
<b>WG3677475-7</b>	<b>LCS</b>							
Chloride (Cl)			100.9		%		90-110	20-DEC-21
<b>WG3677475-6</b>	<b>MB</b>							
Chloride (Cl)			<0.50		mg/L		0.5	20-DEC-21
<b>WG3677475-10</b>	<b>MS</b>	<b>L2673406-2</b>						
Chloride (Cl)			103.9		%		75-125	20-DEC-21
<b>COLOUR-APPARENT-WT</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R5680743</b>							
<b>WG3676990-3</b>	<b>DUP</b>	<b>L2673634-1</b>						
Colour, Apparent		51.7	47.8		CU	7.7	20	18-DEC-21
<b>WG3676990-2</b>	<b>LCS</b>							
Colour, Apparent			105.3		%		85-115	18-DEC-21
<b>WG3676990-1</b>	<b>MB</b>							
Colour, Apparent			<2.0		CU		2	18-DEC-21
<b>EC-WT</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R5681732</b>							
<b>WG3677002-4</b>	<b>DUP</b>	<b>WG3677002-3</b>						
Conductivity		321	321		umhos/cm	0.0	10	18-DEC-21
<b>WG3677002-2</b>	<b>LCS</b>							
Conductivity			99.1		%		90-110	18-DEC-21
<b>WG3677002-1</b>	<b>MB</b>							
Conductivity			<1.0		umhos/cm		1	18-DEC-21
<b>F-IC-N-WT</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R5681604</b>							
<b>WG3677475-9</b>	<b>DUP</b>	<b>L2673406-2</b>						
Fluoride (F)		0.092	0.092		mg/L	0.4	20	20-DEC-21
<b>WG3677475-7</b>	<b>LCS</b>							



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**Client:** PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)  
 74 Berkeley Street  
 Toronto ON M5V 1E3

**Contact:** TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>F-IC-N-WT</b>		<b>Water</b>						
<b>Batch</b>	<b>R5681604</b>							
<b>WG3677475-7</b>	<b>LCS</b>							
Fluoride (F)			102.0		%		90-110	20-DEC-21
<b>WG3677475-6</b>	<b>MB</b>							
Fluoride (F)			<0.020		mg/L		0.02	20-DEC-21
<b>WG3677475-10</b>	<b>MS</b>	<b>L2673406-2</b>						
Fluoride (F)			104.0		%		75-125	20-DEC-21
<b>MET-T-CCMS-WT</b>		<b>Water</b>						
<b>Batch</b>	<b>R5680922</b>							
<b>WG3677056-4</b>	<b>DUP</b>	<b>WG3677056-3</b>						
Aluminum (Al)-Total		0.0113	0.0098		mg/L	14	20	19-DEC-21
Antimony (Sb)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-DEC-21
Arsenic (As)-Total		0.00460	0.00459		mg/L	0.3	20	19-DEC-21
Barium (Ba)-Total		0.106	0.105		mg/L	1.4	20	19-DEC-21
Beryllium (Be)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-DEC-21
Bismuth (Bi)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-DEC-21
Boron (B)-Total		0.050	0.050		mg/L	0.7	20	19-DEC-21
Cadmium (Cd)-Total		<0.0000050	<0.0000050	RPD-NA	mg/L	N/A	20	19-DEC-21
Calcium (Ca)-Total		26.2	25.6		mg/L	2.3	20	19-DEC-21
Chromium (Cr)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-DEC-21
Cesium (Cs)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	19-DEC-21
Cobalt (Co)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-DEC-21
Copper (Cu)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-DEC-21
Iron (Fe)-Total		0.617	0.613		mg/L	0.7	20	19-DEC-21
Lead (Pb)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-DEC-21
Magnesium (Mg)-Total		34.9	34.2		mg/L	2.0	20	19-DEC-21
Manganese (Mn)-Total		0.0262	0.0264		mg/L	0.9	20	19-DEC-21
Molybdenum (Mo)-Total		0.00112	0.00109		mg/L	3.2	20	19-DEC-21
Nickel (Ni)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-DEC-21
Phosphorus (P)-Total		0.100	0.111		mg/L	10	20	19-DEC-21
Potassium (K)-Total		1.29	1.28		mg/L	0.5	20	19-DEC-21
Rubidium (Rb)-Total		0.00033	0.00030		mg/L	7.4	20	19-DEC-21
Selenium (Se)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-DEC-21
Silicon (Si)-Total		12.7	12.1		mg/L	4.6	20	19-DEC-21
Silver (Ag)-Total		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-DEC-21



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Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)  
74 Berkeley Street  
Toronto ON M5V 1E3

Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-T-CCMS-WT</b>		<b>Water</b>						
<b>Batch</b>	<b>R5680922</b>							
<b>WG3677056-4 DUP</b>		<b>WG3677056-3</b>						
Sodium (Na)-Total		13.8	13.4		mg/L	2.5	20	19-DEC-21
Strontium (Sr)-Total		0.680	0.686		mg/L	0.9	20	19-DEC-21
Sulfur (S)-Total		<0.50	<0.50	RPD-NA	mg/L	N/A	20	19-DEC-21
Thallium (Tl)-Total		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	19-DEC-21
Tellurium (Te)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	19-DEC-21
Thorium (Th)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-DEC-21
Tin (Sn)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-DEC-21
Titanium (Ti)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	19-DEC-21
Tungsten (W)-Total		0.00102	0.00097		mg/L	4.6	20	19-DEC-21
Uranium (U)-Total		0.000074	0.000073		mg/L	1.2	20	19-DEC-21
Vanadium (V)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-DEC-21
Zinc (Zn)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	19-DEC-21
Zirconium (Zr)-Total		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	19-DEC-21
<b>WG3677056-2 LCS</b>								
Aluminum (Al)-Total			103.3		%		80-120	19-DEC-21
Antimony (Sb)-Total			98.7		%		80-120	19-DEC-21
Arsenic (As)-Total			104.9		%		80-120	19-DEC-21
Barium (Ba)-Total			101.6		%		80-120	19-DEC-21
Beryllium (Be)-Total			98.7		%		80-120	19-DEC-21
Bismuth (Bi)-Total			103.1		%		80-120	19-DEC-21
Boron (B)-Total			95.3		%		80-120	19-DEC-21
Cadmium (Cd)-Total			102.9		%		80-120	19-DEC-21
Calcium (Ca)-Total			96.8		%		80-120	19-DEC-21
Chromium (Cr)-Total			101.1		%		80-120	19-DEC-21
Cesium (Cs)-Total			98.4		%		80-120	19-DEC-21
Cobalt (Co)-Total			101.8		%		80-120	19-DEC-21
Copper (Cu)-Total			102.4		%		80-120	19-DEC-21
Iron (Fe)-Total			100.6		%		80-120	19-DEC-21
Lead (Pb)-Total			102.8		%		80-120	19-DEC-21
Magnesium (Mg)-Total			112.4		%		80-120	19-DEC-21
Manganese (Mn)-Total			101.5		%		80-120	19-DEC-21
Molybdenum (Mo)-Total			96.6		%		80-120	19-DEC-21
Nickel (Ni)-Total			101.3		%		80-120	19-DEC-21



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Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)  
74 Berkeley Street  
Toronto ON M5V 1E3

Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-T-CCMS-WT</b>		<b>Water</b>						
<b>Batch</b>	<b>R5680922</b>							
<b>WG3677056-2</b>	<b>LCS</b>							
Phosphorus (P)-Total			105.5		%		70-130	19-DEC-21
Potassium (K)-Total			98.5		%		80-120	19-DEC-21
Rubidium (Rb)-Total			102.7		%		80-120	19-DEC-21
Selenium (Se)-Total			103.4		%		80-120	19-DEC-21
Silicon (Si)-Total			103.5		%		60-140	19-DEC-21
Silver (Ag)-Total			95.5		%		80-120	19-DEC-21
Sodium (Na)-Total			105.1		%		80-120	19-DEC-21
Strontium (Sr)-Total			97.5		%		80-120	19-DEC-21
Sulfur (S)-Total			97.8		%		80-120	19-DEC-21
Thallium (Tl)-Total			104.0		%		80-120	19-DEC-21
Tellurium (Te)-Total			97.9		%		80-120	19-DEC-21
Thorium (Th)-Total			101.1		%		80-120	19-DEC-21
Tin (Sn)-Total			96.3		%		80-120	19-DEC-21
Titanium (Ti)-Total			97.6		%		80-120	19-DEC-21
Tungsten (W)-Total			98.7		%		80-120	19-DEC-21
Uranium (U)-Total			103.2		%		80-120	19-DEC-21
Vanadium (V)-Total			103.0		%		80-120	19-DEC-21
Zinc (Zn)-Total			101.1		%		80-120	19-DEC-21
Zirconium (Zr)-Total			92.3		%		80-120	19-DEC-21
<b>WG3677056-1</b>	<b>MB</b>							
Aluminum (Al)-Total			<0.0050		mg/L		0.005	19-DEC-21
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	19-DEC-21
Arsenic (As)-Total			<0.00010		mg/L		0.0001	19-DEC-21
Barium (Ba)-Total			<0.00010		mg/L		0.0001	19-DEC-21
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	19-DEC-21
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	19-DEC-21
Boron (B)-Total			<0.010		mg/L		0.01	19-DEC-21
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	19-DEC-21
Calcium (Ca)-Total			<0.050		mg/L		0.05	19-DEC-21
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	19-DEC-21
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	19-DEC-21
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	19-DEC-21
Copper (Cu)-Total			<0.00050		mg/L		0.0005	19-DEC-21
Iron (Fe)-Total			<0.010		mg/L		0.01	19-DEC-21



## Quality Control Report

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**Client:** PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)  
 74 Berkeley Street  
 Toronto ON M5V 1E3

**Contact:** TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>MET-T-CCMS-WT</b>								
	<b>Water</b>							
<b>Batch</b>	<b>R5680922</b>							
<b>WG3677056-1</b>	<b>MB</b>							
Lead (Pb)-Total			<0.000050		mg/L		0.00005	19-DEC-21
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	19-DEC-21
Manganese (Mn)-Total			<0.000050		mg/L		0.0005	19-DEC-21
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	19-DEC-21
Nickel (Ni)-Total			<0.000050		mg/L		0.0005	19-DEC-21
Phosphorus (P)-Total			<0.050		mg/L		0.05	19-DEC-21
Potassium (K)-Total			<0.050		mg/L		0.05	19-DEC-21
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	19-DEC-21
Selenium (Se)-Total			<0.000050		mg/L		0.00005	19-DEC-21
Silicon (Si)-Total			<0.10		mg/L		0.1	19-DEC-21
Silver (Ag)-Total			<0.000050		mg/L		0.00005	19-DEC-21
Sodium (Na)-Total			<0.050		mg/L		0.05	19-DEC-21
Strontium (Sr)-Total			<0.0010		mg/L		0.001	19-DEC-21
Sulfur (S)-Total			<0.50		mg/L		0.5	19-DEC-21
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	19-DEC-21
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	19-DEC-21
Thorium (Th)-Total			<0.00010		mg/L		0.0001	19-DEC-21
Tin (Sn)-Total			<0.00010		mg/L		0.0001	19-DEC-21
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	19-DEC-21
Tungsten (W)-Total			<0.00010		mg/L		0.0001	19-DEC-21
Uranium (U)-Total			<0.000010		mg/L		0.00001	19-DEC-21
Vanadium (V)-Total			<0.000050		mg/L		0.0005	19-DEC-21
Zinc (Zn)-Total			<0.0030		mg/L		0.003	19-DEC-21
Zirconium (Zr)-Total			<0.00020		mg/L		0.0002	19-DEC-21
<b>WG3677056-5</b>	<b>MS</b>	<b>WG3677056-3</b>						
Aluminum (Al)-Total			99.2		%		70-130	19-DEC-21
Antimony (Sb)-Total			104.1		%		70-130	19-DEC-21
Arsenic (As)-Total			103.9		%		70-130	19-DEC-21
Barium (Ba)-Total			N/A	MS-B	%		-	19-DEC-21
Beryllium (Be)-Total			95.2		%		70-130	19-DEC-21
Bismuth (Bi)-Total			98.0		%		70-130	19-DEC-21
Boron (B)-Total			90.4		%		70-130	19-DEC-21
Cadmium (Cd)-Total			105.0		%		70-130	19-DEC-21
Calcium (Ca)-Total			N/A	MS-B	%		-	19-DEC-21





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Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)  
74 Berkeley Street  
Toronto ON M5V 1E3

Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>NH3-F-WT</b>		<b>Water</b>						
Batch	R5681450							
<b>WG3676835-6</b>	<b>LCS</b>							
Ammonia, Total (as N)			105.4		%		85-115	20-DEC-21
<b>WG3676835-5</b>	<b>MB</b>							
Ammonia, Total (as N)			<0.010		mg/L		0.01	20-DEC-21
<b>WG3676835-8</b>	<b>MS</b>	<b>WG3676835-9</b>						
Ammonia, Total (as N)			104.4		%		75-125	20-DEC-21
<b>NO2-IC-WT</b>		<b>Water</b>						
Batch	R5681604							
<b>WG3677475-9</b>	<b>DUP</b>	<b>L2673406-2</b>						
Nitrite (as N)		<0.010	<0.010	RPD-NA	mg/L	N/A	20	20-DEC-21
<b>WG3677475-7</b>	<b>LCS</b>							
Nitrite (as N)			101.2		%		90-110	20-DEC-21
<b>WG3677475-6</b>	<b>MB</b>							
Nitrite (as N)			<0.010		mg/L		0.01	20-DEC-21
<b>WG3677475-10</b>	<b>MS</b>	<b>L2673406-2</b>						
Nitrite (as N)			104.7		%		75-125	20-DEC-21
<b>NO3-IC-WT</b>		<b>Water</b>						
Batch	R5681604							
<b>WG3677475-9</b>	<b>DUP</b>	<b>L2673406-2</b>						
Nitrate (as N)		<0.020	<0.020	RPD-NA	mg/L	N/A	20	20-DEC-21
<b>WG3677475-7</b>	<b>LCS</b>							
Nitrate (as N)			100.6		%		90-110	20-DEC-21
<b>WG3677475-6</b>	<b>MB</b>							
Nitrate (as N)			<0.020		mg/L		0.02	20-DEC-21
<b>WG3677475-10</b>	<b>MS</b>	<b>L2673406-2</b>						
Nitrate (as N)			103.1		%		75-125	20-DEC-21
<b>PH-WT</b>		<b>Water</b>						
Batch	R5681732							
<b>WG3677002-4</b>	<b>DUP</b>	<b>WG3677002-3</b>						
pH		7.48	7.38	J	pH units	0.10	0.2	18-DEC-21
<b>WG3677002-2</b>	<b>LCS</b>							
pH			6.99		pH units		6.9-7.1	18-DEC-21
<b>PO4-DO-COL-WT</b>		<b>Water</b>						
Batch	R5681107							
<b>WG3677243-11</b>	<b>DUP</b>	<b>L2673509-3</b>						
Orthophosphate-Dissolved (as P)		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	20-DEC-21
<b>WG3677243-10</b>	<b>LCS</b>							



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Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)  
 74 Berkeley Street  
 Toronto ON M5V 1E3

Contact: TANVI PATEL

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>PO4-DO-COL-WT</b>								
	Water							
Batch	R5681107							
<b>WG3677243-10</b>	<b>LCS</b>							
Orthophosphate-Dissolved (as P)			107.3		%		80-120	20-DEC-21
<b>WG3677243-9</b>	<b>MB</b>							
Orthophosphate-Dissolved (as P)			<0.0030		mg/L		0.003	20-DEC-21
<b>WG3677243-12</b>	<b>MS</b>	<b>L2673509-3</b>						
Orthophosphate-Dissolved (as P)			106.6		%		70-130	20-DEC-21
<b>SO4-IC-N-WT</b>								
	Water							
Batch	R5681604							
<b>WG3677475-9</b>	<b>DUP</b>	<b>L2673406-2</b>						
Sulfate (SO4)		2.00	2.00		mg/L	0.2	20	20-DEC-21
<b>WG3677475-7</b>	<b>LCS</b>							
Sulfate (SO4)			102.0		%		90-110	20-DEC-21
<b>WG3677475-6</b>	<b>MB</b>							
Sulfate (SO4)			<0.30		mg/L		0.3	20-DEC-21
<b>WG3677475-10</b>	<b>MS</b>	<b>L2673406-2</b>						
Sulfate (SO4)			106.1		%		75-125	20-DEC-21
<b>SOLIDS-TDS-WT</b>								
	Water							
Batch	R5680843							
<b>WG3676572-3</b>	<b>DUP</b>	<b>L2673399-2</b>						
Total Dissolved Solids		392	373		mg/L	5.0	20	17-DEC-21
<b>WG3676572-2</b>	<b>LCS</b>							
Total Dissolved Solids			86.2		%		85-115	17-DEC-21
<b>WG3676572-1</b>	<b>MB</b>							
Total Dissolved Solids			<10		mg/L		10	17-DEC-21
<b>TURBIDITY-WT</b>								
	Water							
Batch	R5680630							
<b>WG3676869-3</b>	<b>DUP</b>	<b>L2673509-2</b>						
Turbidity		10.1	10.7		NTU	5.8	15	18-DEC-21
<b>WG3676869-2</b>	<b>LCS</b>							
Turbidity			98.0		%		85-115	18-DEC-21
<b>WG3676869-1</b>	<b>MB</b>							
Turbidity			<0.10		NTU		0.1	18-DEC-21

# Quality Control Report

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Client: PALMER ENVIRONMENTAL CONSULTING GROUP INC. (Richmond Hill)

74 Berkeley Street

Toronto ON M5V 1E3

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Contact: TANVI PATEL

## Legend:

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Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

## Sample Parameter Qualifier Definitions:

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Qualifier	Description
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J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

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## Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

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The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

