LANDTEK LIMITED
Consulting Engineers
205 Nebo Road, Unit 3
Hamilton, Ontario
Canada
L8W 2E1
Phone: 905-383-3733
Fax: 905-383-8433
engineering@landteklimited.com
www.landteklimited.com

Hydrogeological Investigation

Proposed Residential Development
4933 Victoria Avenue North
Vineland Station (Town of Lincoln), Ontario
L0R 2E0

Prepared for:

4933 Vic Court Globizen LP
2720 Dundas Street West, Suite 608
Toronto, Ontario
M6P 0C3

Landtek File: 23015
November 10, 2023

EXECUTIVE SUMMARY

SCOPE OF SERVICES

Proposed Development	The proposed development is to comprise of the following: a stepped, five-storey to 17-storey residential tower, with three partial, above-ground parking levels, one underground parking level extending across the Site, and a three- and four- storey podium; a stepped, four-storey to 14-storey residential tower, with a four-storey podium courtyard; a 13- to 15-storey hotel with a rooftop pool; a central courtyard comprising public open space, trees, a pond and trellis-covered areas; and, a new deck, dock and access ramp.
Report Deliverables	The Hydrogeological Investigation is required to assess the current site groundwater conditions, determine potential development/post development effects of the proposed development; and provide monitoring and mitigation plans for the development.

SITE DETAILS AND SETTING

Coordinates	630435, 4783500	**Geodetic Elevation**	83 m to 89 m
Site Description	The site is irregular in shape and is situated at the intersections of Verity Lane, Viceroy Avenue and Victoria Avenue North. The site is bound to the north by Lake Ontario, the west by Victoria Avenue North, the east by a forested area, and to the south by residential properties. The topography of the site is generally flat-lying and all existing buildings have been removed.		
Geology	Existing pavement areas and/or fill material was encountered in all boreholes at the ground surface or underlying the existing pavement structure and extends to depths between approximately 0.6 m and 4.5 m below existing ground level. Clayey silt, silty clay, silt till, clayey silt to silty clay till and completely to highly weathered red shale bedrock underlies the fill material to depths of between approximately 2.6 m and 12.1 m below existing ground level.		
Groundwater	Depths to groundwater in all monitoring wells were obtained manually by Landtek staff on July 13, August 18, September 20, October 6, and October 17, 2023. Based on the recorded groundwater levels, the highest water level was determined to be 2.18 mbgs on July 13, 2023, at MW9S-23. It should be noted that groundwater level monitoring is ongoing to determine the seasonal highest groundwater level which usually occurs in Spring. Groundwater samples were collected from three monitoring wells at the site and analyzed for the Niagara Sanitary/Storm Sewers Discharge Limits Discharge Limits. All analyzed parameters were within guideline values.		

DEWATERING CONSIDERATIONS

Short Term	Short-term dewatering rate outside periods of active precipitation, under normal conditions, was determined to be approximately 27,993 L/day (0.32 L/s. Normal conditions are considered to be weather conditions that should be expected during the operation of the construction dewatering. Normal operation does not include extreme weather events.
Long Term	Long-term dewatering volume was determined to be approximately 27,993 L/day (0.32 L/s). The following two options are proposed to implement groundwater control measures for this volume: use of weeping tiles and perimeter drainage to avoid the potential inflow of groundwater into the underground parking level post-construction, subject the approval, or waterproof of the underground parling level below the established "*seasonally high groundwater level*" plus the required buffer zone (nominally 1.0 m to 1.5 m above).
Monitoring and Mitigation Plans	Monitoring, mitigation, and contingency plans are provided. The monitoring plans include dewatering abstraction, construction, and settlement monitoring. Mitigation includes methods to limit adverse dewatering settlement.

PERMIT CONSIDERATIONS

Dewatering Permit	The dewatering rate for the proposed underground level excavation without rainfall was determined to be approximately 27,993 L/day (0.32 L/s). An Environmental Activity and Sector Registry EASR registration and permit to take water (PTTW) will not be required for this volume of water taking, as the estimated water taking is less than 50,000 L/day, respectively. However, temporary discharge application to the Niagara Peninsula Conservation Authority (NPCA) is required and should be completed.

IMPACTS CONSIDERATION

Construction	The radius of influence from the proposed dewatering was conservatively determined to be approximately 5.0 m. Potential geotechnical impacts are anticipated within 5.0 m of Site during dewatering at the Site. However, surrounding buildings and roads adjacent to Site should be monitored by geotechnical instrumentation to determine impact, if any.

Table of Contents

Appendices:

1.0 INTRODUCTION

1.1 Background

Landtek Limited (Landtek) has been retained by Globizen Developments Inc. and Court Holdings Limited to complete a Hydrogeological Investigation for the proposed development at 4933 Victoria Avenue North in Vineland, Ontario (the Site or development).

The Site is roughly rectangular in shape and comprises an area of approximately 1.6 hectares (4.0 acres) and is situated approximately 25 m north of the intersection of Laurie Avenue and Victoria Avenue North, in Vineland Station (Town of Lincoln), Ontario. It is bound by residential properties to the south (followed by Laurie Avenue); a conservation area (including a stream) followed by residential properties to the east, Lake Ontario to the north, and Victoria Avenue North (followed by parkland, residential, and institutional properties) to the west. The Site location is shown on Figure 1, in Appendix A.

It is understood that the proposed development is to consist of fourteen (14) to fifteen (15) storeys hotel/residential towers with one level of underground parking. The Site Plan and P1 Level Plan are shown in Figures 2 and 3 in Appendix A, respectively as provided by **gh3**.

The purpose of the Hydrogeological Investigation is to evaluate the groundwater conditions at the site, delineate possible development/post-development effects, and suggest mitigation measures to minimize the effects to the shallow groundwater system during and post-development. Specifically, the report provides the following:

- A description of the hydrogeologic setting of the Site and a summary of the existing soil and groundwater conditions at the site.
- Identification of hydrogeologic features such as zones of significant groundwater recharge and discharge.
- Assessment of the requirement for groundwater control during construction, if any.

1.2 Work Scope and Report Organization

The scope of work for this investigation includes the following:

- Review of available background information. A review of published works of available geologic and hydrogeologic information for the site including topographical and geological maps and water well records. A review of Meteorological data to assess the local climate.
- Site Assessment. A detailed visual inspection of the site and surrounding area to identify and document local topography, surface water drainage features, and the potential presence of significant hydrogeological features such as closed depressions (areas of ground water recharge), seeps, springs, or the presence of phreatophytic vegetation.
- A subsurface investigation. Drilling of boreholes and monitoring wells at the Site to characterize the subsurface soil and/or bedrock as well as assess the site-specific groundwater conditions.

- Hydraulic Conductivity Tests. In-situ rising head tests were completed in selected installed monitoring wells to assess the subsurface soil and/or bedrock hydraulic conductivity.

- Groundwater Monitoring. Groundwater level monitoring was conducted in all monitoring wells in order to assess the depth of groundwater level across the site.

The report is organized as follows:

Section 1 contains a brief introduction to the project and the scope of work undertaken by Landtek.

Section 2 outlines the methodologies followed during completion of the desktop study and the field investigation.

Section 3 summarizes the findings of the investigation. It includes:
- a description of the physical setting
- the results of the field investigation

Section 4 provides Water Taking Evaluation and Impact Assessment

Section 5 provides Monitoring Plan.

Section 6 provides Mitigation Plan.

Section 7 provides Summary and Conclusions.

Section 8 provides recommendations.

Section 9 provides Closure.

Section 10 provides References.

Section 11 provides Limitations.

2.0 METHODOLOGY

2.1 Desktop Study

A review of published works was done of available geological and hydrogeological information for the site including topographic and geologic maps.

The Ministry of Environment, Conservation and Park (MECP) water well database for the local area was also accessed and the individual well record obtained for wells located within 500 m radius of the Site.

2.2 Site Inspection to Assess Hydrogeologic Features

Landtek conducted a visual assessment of the Site on February 2, 2023, to assess the presence of features which may be significant from a hydrogeologic viewpoint. In particular, the site was inspected to assess the following:

- The presence of closed drainage features, depressions, or sandy areas which may allow for ponding and significant or enhanced infiltration of water.
- Assessment of the presence of phreatophytic vegetation which may indicate seasonally high groundwater levels and/or groundwater discharge and seepage.
- Identification of any zones of visible seepage or groundwater discharge.

2.3 Field Investigation

2.3.1 Drilling and Well Installation

Fieldwork undertaken at the site by Landtek included clearance of underground services, borehole layout, borehole drilling and soil sampling, and field supervision. A total of 11 boreholes (boreholes BH1 to BH11A) were drilled between April 14th and 27th, 2022. An additional total of nine boreholes (boreholes BH1-23 to BH9) were drilled between July 4th and 7th, 2023.

Full time supervision of drilling and soil sampling operations was carried out by a representative of Landtek. The boreholes were drilled using a Diedrich D-50 track mounted drill rig equipped with continuous flight, solid and hollow stem augers and were extended to depths of between approximately 2.6 m and 12.1 m below existing ground level. Boreholes encountering ultimate auger refusal were extended from bedrock refusal using NQ-gauge, rotary coring methodologies.

Boreholes BH2, BH3, BH8, BH9A, BH11A, BH1-23, BH2-23, BH3-23, BH4-23, BH5-23, BH6-23, BH8-23 and BH9-23 were completed as monitoring wells and renamed BH/MW2, BH/MW3, BH/MW8, BH/MW9A, BH/MW11A, BH/MW1S/D-23, BH/MW2S/D-23, BH/MW3S/D-23, BH/MW4/4S-23, BH/MW5S-23, BH/MW6-23, BH/MW8S-23, and BH/MW9S/D-23, respectively. The monitoring well consisted of new/sealed 50 mm polyvinyl chloride (PVC) screen with No.10 slots threaded onto a matching riser. The screens and risers were pre-threaded including o-ring seals such that no glues or solvents were used to connect the pipe sections. A J-Plug lockable air-tight cap was installed on the riser.

The annular space between the PVC riser pipes and each borehole wall was backfilled to at least 0.3 m above the top of the screen with selected silica sand. A bentonite seal was placed immediately above the sand pack to a height just below grade. Each monitoring well was finished with a monumental protective steel casing, which was cemented in-place.

The monitoring well installation details are presented on the respective borehole logs in Appendix B.

A summary of the monitoring well installation details is presented on the following page in Table 1. The locations of the monitoring wells are shown on Figure 4, in Appendix A.

Table 1. Construction Details

Monitoring Well ID	Easting* (NAD83)	Northing* (NAD83)	Ground Surface Elevation (masl)**	Well Depth (mbgs)	Stick-up (m)	Screened Interval (m)	Screened Material
BH/MW1S-23	630475	4783599	77.70	6.0	0.86	3.0–6.0	Shale
BH/MW1D-23	630475	4783599	77.70	10.6	0.85	7.6–10.6	Shale
BH/MW2S-23	630431	4783631	78.00	3.0	0.88	1.5–3.0	Fill
BH/MW2D-23	630431	4783631	78.00	4.5	0.87	1.5–4.5	Fill
BH/MW3S-23	630415	4783550	78.71	6.0	0.92	3.0–6.0	Shale
BH/MW3D-23	630415	4783550	78.71	10.6	0.84	7.6–10.6	Shale
BH/MW4S-23	630415	4783550	79.16	6.0	0.86	3.0–6.0	Shale
BH/MW4-23	630415	4783550	79.16	3.0	0.87	1.5–3.0	Shale
BH/MW5S-23	630422	4783495	79.38	6.0	0.86	3.0–6.0	Shale
BH/MW6-23	630419	4783470	79.96	3.0	0.87	1.5–3.0	Shale
BH/MW8S-23	630455	4783508	78.43	4.5	0.67	1.5–4.5	Clayey Silt/Shale
BH/MW9S-23	630469	4783557	78.37	4.5	0.87	1.5–4.5	Shale
BH/MW9D-23	630469	4783557	78.37	12.1	0.78	9.1–12.1	Shale

Notes:
masl = meters above sea level
mbgs = meters below ground level
m = meters
* Values are approximate by GPS +/- 4 m
** Values are approximate. Based on Topographical Survey Map by J.D. BARNES, Reference No. 22-16-360-360-00.

2.3.2 Monitoring Well Development

Well Development: Each of the installed monitoring wells MW1S-23, MW1D-23, MW2S-23, MW2D-23, MW3S-23, MW3D-23, MW4S-23, MW4-23, MW5S-23, MW6-23, MW8S-23, MW9S-23, MW9D-23 was developed to remove any sediment that may have been introduced during installation and to improve the hydraulic properties of the formation against which the wells were screened. The monitoring wells were developed by Landtek staff on staff on July 12, 2023. Development employed electric well pump/waterra tubing with foot valves and each well was developed until a visible decrease in turbidity and steady flow were observed.

2.3.3 Groundwater Monitoring

Depths to groundwater in monitoring wells MW1S-23, MW1D-23, MW2S-23, MW2D-23, MW3S-23, MW3D-23, MW4S-23, MW4-23, MW5S-23, MW6-23, MW8S-23, MW9S-23, MW9D-23 were obtained manually by Landtek staff on July 12, August 18, September 20, October 6, and October 17, 2023.

2.3.4 Groundwater Sampling

On October 24, 2023, groundwater samples were collected from monitoring wells MW23-2S, MW23-4S and MW23-8S after purging. All collected samples were stored in a cooler with freezer packs after collection and during transport to the PARACEL Laboratories Ltd. in Hamilton, Ontario. The samples were analyzed for the Niagara Region Sanitary and Storm Sewers Discharge analysis. PARACEL is accredited by the *Canadian Associations for Laboratory Accreditation Inc*. (CALA).

2.3.5 Hydraulic Conductivity Testing

Hydraulic conductivity tests were completed in monitoring wells MW23-3S, MW23-8S, and MW23-9S to provide estimates of the hydraulic conductivity for the zones against which the screens for the wells were set. Rising head tests were conducted by Landtek on October 23, 2023. The tests involved the extraction of a volume of groundwater to displace the water level. A datalogger programed at 2 second intervals were used to record the water level response during the tests.

Data Analysis: The rising head test data were analyzed using AqteSolve Professional Version 4.5 software package developed by Glenn M. Duffield of HydroSOLVE Inc. applying the Hvorslev analysis solutions, depending on hydrogeology.

3.0 FINDINGS

3.1 Topography, Drainage and Hydrology

The topography at the Site ranges from approximately 75 masl to 79 masl, with a gentle slope from the south to north portions.

The Site is located in the Niagara Peninsula Source Protection Area in a Highly Vulnerable Aquifer Area with a Score of 6.

According to the Karst Map of Southern Ontario, the Site is not located in a potential Karst area – areas of carbonate rock units identified as most susceptible to karst processes (Ontario Geological Survey).

3.2 Regional Physiography

The site is situated in the physiographic region known as the Iroquois Plain. The Iroquois Plain was formed in the late Pleistocene times by a body of water known as Lake Iroquois, which emptied eastward at Rome, New York (Chapman and Putnam, 1984). Lake Iroquois was characterized by higher water levels than the present-day Lake Ontario, caused by an ice sheet blocking the present-day St. Lawrence River valley. When the St. Lawrence valley became free of ice, the water level dropped to a level much lower than the present Lake Ontario levels (Karrow, 1959). The Iroquois Plain is characterized by sands deposited by Lake Iroquois.

3.3 Climate

The site is located in the Mixedwood Plains ecozone of Ontario (Natural Resources Canada, 2012). The general climate data presented below in Table 2 was obtained from Environment Canada publications and from the Environment Canada online database. Average climate data was taken from the St. Catharines A station for the period of 1981 to 2010.

Table 2. 1981 to 2010 Climate Normals for St. Catharines A Station (as averages)

	Daily Average Temperature (ºC)	Average Rainfall (mm)	Average Snowfall (cm)	Average Precipitation (mm)
January	-3.8	30.8	38.6	65.2
February	-2.9	28.9	29.3	54.9
March	-1.1	39.3	23.2	61.7
April	7.4	71.2	5.8	77.0
May	13.7	76.3	0.4	76.8
June	19.0	86.0	0.0	85.9
July	21.9	77.8	0.0	77.8
August	20.8	70.3	0.0	70.3
September	16.6	90.6	0.0	90.6
October	10.4	67.0	0.1	67.0
November	4.6	72.1	9.6	81.6
December	-0.9	44.0	30.1	71.5
Year	9.0	754.2	137.1	880.1

3.4 Regional Geology

The Site is in the physiography of southern Ontario known as the Haldimand Clay Plain. The Haldimand Clay Plain is located between the Niagara Peninsula and Lake Erie occupying all of Niagara Peninsula except the fruit belt below the escarpment. The underlying rocks consists of a succession of Paleozoic beds dipping slightly southward under Lake Erie. Dolostone of the Lockport Formation form the vertical cliffs along the brow of the escarpment and underlies a narrow strip of the plain to be succeeded southward by dolostone of the Guelph Formation. The surficial geology of the site silty clay.

3.5 Local and Regional Hydrogeology

The hydrostratigraphic units are subdivided into two distinct groups based on their permeability, their ability to allow groundwater movement: an aquitard and an aquifer. An aquitard inhibits groundwater flow due to its low permeability, while an aquifer is permeable enough to allow flow of groundwater for sustainable use. The major regional hydrostratigrahic units that control groundwater at the Site are as follows:

Fine-Textured Glaciolacustrine

This comprised of silt and clay are the native surficial unit within the study area. These soils often occur at surface, or beneath the layer of fill, where present. This deposit forms a regional aquitard which limits groundwater flow and infiltration within the study area.

Silty Clay Till

This is present below the surficial glaciolacustrine deposits. This unit is found throughout the Region and acts as a surficial aquitard which limits groundwater flow and recharge to deeper bedrock aquifers.

Bertie Formation

This constitutes the bedrock and usually contains karstic porosity. The bedrock acts as an aquifer where solution enhanced fractures are present or along weathered bedding plans. The dolostone is expected to have a low hydraulic conductivity and restrict groundwater flow where unfractured. Shallow zones near the bedrock/overburden interface can have a relatively high permeability and hydraulic conductivity due to weathering. This zone acts as thin, unconfined aquifer with sufficient permeability to transit significant volumes of groundwater.

3.6 MECP Water Well Records and Groundwater Resources

The Ministry of Environment, Conservation and Park (MECP) Water Well Information System is a publicly available database which contains information such as groundwater well location, well construction details, static water level, geologic units encountered with depth, general water quality observations, water use, date of construction, and screened interval.

The MECP records for wells located within approximately 500 meters of the site were reviewed to assess the general nature and use of the groundwater resource in the area and to characterize local hydrogeologic conditions.

Desk Top Study

A search of the MECP water well records within approximately 500 m of the site, conducted on April 21, 2023, returned a total of thirty-five (35) wells comprising of three (3) water wells, one (1) abandoned water well, two (2) test/monitoring wells, nineteen (19) observation wells, and ten (10) wells with unknown uses. The records were reviewed to assess the general nature of the groundwater resource in the area and to characterize local hydrogeologic conditions. The locations of the wells are shown on Figure 5 in Appendix A. The well records summary is provided in Appendix C.

A summary of the data obtained from the well survey is presented below.

All Well Uses

- Water Well 3
- Abandoned Water Well 1
- Observation Wells 19
- Monitoring Wells 2
- Well without Information 10
- **Total 35**

Water Wells Construction

- Wells terminated in bedrock 3
- Wells terminated in overburden 1
- **Total 4**

Water Wells Depths

- Less than 15 m 2
- Between 15 m and 30 m 2
- **Total 4**

Based on the well records review, it was determined that there are three (3) water wells within a 500 m radius of the Site.

3.7 Results of Site Inspection

A detailed site inspection was conducted on February 2, 2023, to assess the presence of features which may be significant from a hydrogeologic viewpoint.

At the time of the Landtek's Site visit, the Site consisted of a vacant industrial property, with no above ground structures in place; the buildings were demolished in early 2023.

3.8 Results of Subsurface Investigation

The borehole information is generally consistent with the geological data identified from published geology of the area, with the predominant soils comprising sands, silts, clay and silt tills overlying red shale bedrock.

The detailed borehole/monitoring well logs are presented in Appendix B, with the ground conditions encountered by the boreholes discussed in the following sections.

Existing Pavement Structure

Boreholes BH1, BH/MW2, BH/MW3 and BH/MW8 were drilled within existing pavement areas, with a concrete thickness of approximately 150 mm to 475 mm. No pavement granular materials were encountered.

Fill Materials

Fill material was encountered in all boreholes from ground surface or underlying the existing pavement structure and extends to depths between approximately 0.6 m and 4.5 m below existing ground level. The fill comprises of sands, silts, clays and gravels, with varying proportions of orange brick fragments, gravel, concrete fragments, asphalt fragments, organics and limestone fragments, and is primarily brown, grey and red in colour.

Clayey Silt to Silty Clay

Clayey silt to silty clay deposits were encountered underlying the fill material in boreholes BH1, BH/MW4S-23, BH/MW7-23 and BH/MW8S-23 and extends to depths between approximately 1.4 m and 2.5 m below existing ground level. The clayey silt to silty clay was observed to be generally brown and red in colour and contains traces of gravel, sand, iron staining and peat.

Silt Till

Silt till was encountered in boreholes BH/MW1S/D-23, BH/MW3S/D-23 and BH/MW5S-23 underlying the fill materials and extends to depths between approximately 1.5 m to 2.3 m below existing ground surface. The silt till contains traces of gravel, iron staining and red shale fragments, and is generally brown in colour.

Clayey Silt to Silty ClayTill

Clayey silt to silty clay till was encountered **only** in boreholes BH1, BH/MW2, BH/MW3, BH/MW4, BH5, BH6, BH7, BH/MW8, BH/MW9A, and BH/MW11A underlying the fill and sand material and extends to depths of approximately 1.5 m and 3.0 m below existing pavement surface. The till is generally red and brown and contains traces of gravel, sand, iron staining and red shale fragments.

Bedrock

Red shale of the Queenston Formation was encountered in all boreholes at depths of between approximately 1.5 m to 4.5 m below existing ground level, equating to Geodetic elevations between approximately 79.6 m and 73.4 m. The shale is red and grey in colour, is very weak to weak, completely to highly weathered and was primarily recovered as "*residual soil*".

3.9 Groundwater Monitoring

Depths to groundwater in monitoring wells MW1, MW2, MW3, MW4, MW5, MW6, and MW7 were obtained manually by Landtek staff on July 13, August 18, September 20, October 6, and October 17, 2023. The readings are presented on the following page in Table 3. It should be noted that groundwater level monitoring is ongoing to determine the seasonal highest groundwater level which usually occurs in Spring.

Table 3. Groundwater Monitoring Data

MW ID	Date	Total Depth (mbgs)	Stick-up (m)	Water Strike (m)*	Water Level (mbgs)	Water Level (masl)	Ground Elevation (masl)**
MW1S-23	13-Jul-23	6.0	0.86	None	4.19	73.51	77.70
	18-Aug-23				3.12	74.58	
	20-Sep-23				3.22	74.48	
	6-Oct-23				3.32	74.38	
	17-Oct-23				3.42	74.28	
MW1D-23	13-Jul-23	10.6	0.85	None	3.03	74.67	77.70
	18-Aug-23				3.45	74.25	
	20-Sep-23				3.29	74.41	
	6-Oct-23				3.38	74.32	
	17-Oct-23				3.48	74.22	
MW2S-23	13-Jul-23	3.0	0.88	None	2.90	74.8	78.00
	18-Aug-23				2.99	74.71	
	20-Sep-23				3.20	74.5	
	6-Oct-23				2.75	74.95	
	17-Oct-23				3.33	74.37	
MW2D-23	13-Jul-23	4.5	0.87	None	2.94	74.76	78.00
	18-Aug-23				Dry	NA	
	20-Sep-23				Dry	NA	
	6-Oct-23				2.78	74.92	
	17-Oct-23				3.16	74.54	
MW3S-23	13-Jul-23	6.0	0.92	None	3.15	74.55	78.71
	18-Aug-23				3.28	74.42	
	20-Sep-23				3.34	74.36	
	6-Oct-23				3.35	74.35	
	17-Oct-23				3.48	74.22	
MW3D-23	13-Jul-23	10.6	0.84	None	3.28	74.42	78.71
	18-Aug-23				4.39	73.31	
	20-Sep-23				3.50	74.2	
	6-Oct-23				3.50	74.2	
	17-Oct-23				3.63	74.07	
MW4S-23	12-Jul-23	6.0	0.86	None	4.11	73.59	79.16
	18-Aug-23				3.06	74.64	
	20-Sep-23				3.11	74.59	
	6-Oct-23				2.96	74.74	
	17-Oct-23				3.22	74.48	
MW4-23	13-Jul-23	3.0	0.87	None	2.42	75.28	79.16
	18-Aug-23				Dry	NA	
	20-Sep-23				2.56	75.14	
	6-Oct-23				2.64	75.06	
	17-Oct-23				2.35	75.35	
MW5S-23	13-Jul-23	6.0	0.86	None	3.35	74.35	79.38
	18-Aug-23				3.43	74.27	
	20-Sep-23				3.62	74.08	
	6-Oct-23				3.35	74.35	
	17-Oct-23				3.61	74.09	
MW6-23	13-Jul-23	3.0	0.87	None	3.09	74.61	79.96
	18-Aug-23				Dry	NA	
	20-Sep-23				2.95	74.75	
	6-Oct-23				3.03	74.67	
	17-Oct-23				3.01	74.69	
MW8S-23	12-Jul-23	4.5	0.67	None	3.09	74.61	78.43
	18-Aug-23				2.66	75.04	
	20-Sep-23				2.73	74.97	
	6-Oct-23				2.78	74.92	
	17-Oct-23				2.74	74.96	
MW9S-23	13-Jul-23	4.5	0.87	None	2.18	75.52	78.37
	18-Aug-23				2.25	75.45	

	20-Sep-23				2.48	75.22	
	6-Oct-23				2.42	75.28	
	17-Oct-23				2.44	75.26	
MW9D-23	13-Jul-23	12.1	0.78	none	3.43	74.27	78.37
	18-Aug-23				3.77	73.93	
	20-Sep-23				3.35	74.35	
	6-Oct-23				3.33	74.37	
	17-Oct-23				3.43	74.27	

Notes:
[*] water strike/groundwater seepage
masl = meters above sea level
mbtop = meters below top of pipe
mbgs = meters below ground level
m = meters
* Values are approximate by GPS +/- 4 m
** Values are approximate. Based on Topographical Survey Map by J.D. BARNES, Reference No. 22-16-360-360-00.

3.10 Hydraulic Gradients and Flow

Vertical Hydraulic Gradient

Groundwater generally flows from the shallow to deeper aquifers as leakage across the aquitards. However, this may vary locally, and the direction of vertical flow depends on the relative heads in the different layers. Leakage rates vary locally depending on the magnitude of the vertical gradients and on the thickness and hydraulic conductivity of the confining units.

Horizontal Hydraulic Gradient

Based on topography and mapping information of the area, the ground surface elevations indicate that the area generally slopes down to the north towards Lake Ontario and east towards NPCA regulated lands ultimately draining into an unnamed creek located adjacent to the east of the Site. The local groundwater flow direction has been inferred to be in a northerly direction towards Lake Ontario, located adjacent to the north of the Site. Shallow ground water direction may be influenced by trenches for municipal infrastructure, underground utilities, conduits, structures, variations in subsurface strata, and changes in local topography.

3.11 Estimated Hydraulic Conductivity

3.11.1 Hydraulic Conductivity Tests Analysis

The analyses were completed using the Hvorslev method (Fetter, 1994). The graphical results of the hydraulic conductivity analysis are presented in Appendix D, and the results are summarized below in Table 4.

Table 4. Hydraulic Conductivity Results

Monitoring Well	Hydraulic Conductivity (m/s)	Screened Material
MW23-3S	4.572×10^{-8}	Shale Bedrock
MW23-8S	7.468×10^{-9}	Clayey Silt/Shale Bedrock
MW23-9S	9.772×10^{-8}	Shale Bedrock

The results indicate that the hydraulic conductivity values of the screened clayey silt/shale bedrock at the site range from 7.468×10^{-9} m/s to 9.772×10^{-8} m/s, with a geometric mean of 3.219×10^{-8} m/s.

3.12 Groundwater Quality

Copies of the laboratory Certificates of Analysis are provided in Appendix E. The results of the analyzed groundwater samples collected from monitoring wells MW23-3S, MW3-4S and MW23-8S were compared to the Niagara Sanitary/Storm Sewers Discharge Limits Discharge Limit.

Based on the analysis, all analyzed parameters were within guideline values.

4.0 WATER TAKING EVALUATION & IMPACT ASSESSMENT

Proposed Development

The proposed development is to comprise of the following: a stepped, five-storey to 17-storey residential tower, with three partial, above-ground parking levels, one underground parking level extending across the Site. The underground parking level is shown on Figure 3 in Appendix A.

Underground Parking Level

Based on Figure 3, the dimensions of the equivalent rectangle of the underground parking level were determined to be approximately 210.0 m x 65.5 m

The maximum depth of the underground levels is estimated to be 4.1 mbgs. As a result, a dewatering depth of approximately 0.5 m below the excavation bottom (4.6 mbgs) is assumed in order to keep the bottom of the excavation dry during construction.

Static Water Levels

Depths to groundwater in all monitoring wells were obtained manually by Landtek staff on July 13, August 18, September 20, October 6, and October 17, 2023. The readings are presented in Table 3 of this report. Based on the recorded groundwater levels, the highest water level was determined to be 2.18 mbgs on July 13, 2023, at MW9S-23. It should be noted that groundwater level monitoring is ongoing to determine the seasonal highest groundwater level which usually occurs in Spring.

4.1 Groundwater Dewatering Requirements

Groundwater seepage will occur where excavations are made below the groundwater level. If groundwater levels are intercepted within the excavation, adequate pumping should be provided to prevent significant groundwater volumes from accumulating.

In order to evaluate the potential groundwater control requirements during construction of the proposed underground parking levels, depth to groundwater of 2.18 mbgs, (the highest groundwater level recorded on July 13, 2023, at MW9S-23, was assumed for the entire site.

The method suitable for dewatering an area depends on the locations, type, size and depth of the dewatering needs; and the hydrogeological conditions such as stratification, thickness, and hydraulic conductivity of the foundation soils below the water table into which the excavation extends or is underlain. It is assumed that any groundwater dewatering for the Site excavations would likely be completed with standard construction sump pump/well points or equivalent, depending on conditions encountered such as water table elevation and subsurface materials. The pumps must appropriately be used to prevent the pumping of fines and loss of ground during dewatering activities and the flow of water should be appropriately managed so that sediment is not pumped into the proposed discharge point.

For the purposes of this assessment, an open excavation was assumed. The use of conventional shoring could further reduce the amount of groundwater infiltration and should be determined in consultation with the selected subcontractor.

4.1.1 Dewatering Calculations

The potential groundwater flow rate to the underground parking excavation was estimated using the dewatering equation for a fully penetrated well of unconfined aquifer fed by circular source (Powers, et. al., 2007):

$$Q = \pi K (H^2 - h_w^2)/(\ln R_o/r_e)$$

Where: Q = pumping rate [m^3/s]
K = hydraulic conductivity [m/s]
H = saturated thickness of the aquifer before dewatering [m]
h_w = saturated thickness of the aquifer after dewatering [m]
R_o. = radius of cone of depression [m]
r_e = equivalent radius [m]

The radius of cone of depression R can be estimated using:

$$R_o = Ch*Sqrt(K)$$

Where: C = is a factor equal to 3000 for radial flow to a pumping well

h = H- h_w =required drawdown [m]
K = hydraulic conductivity [m/s]

Dewatering of a rectangular area can be accomplished by using an equivalent radius (r_e) to assess drawdown where r_e is given by the following equation:

$r_e = (a + b)/\pi)$ (applies when $a/b<1.5$ and $R_o >> r_e$)
r_e = Sqrt (length*width/π) (applies when $a/b>1.5$ and $R_o << r_e$)

Dewatering Estimate

The volume of groundwater required to be pumped for dewatering the excavation associated with the underground level construction, assuming there is no rainfall and applying a factor of safety of 1.5, was determined be approximately 27,993 L/day (0.32 L/s) and the radius of influence determined to be approximately 5.0 m with a factor of safety of 5. These calculations and associated assumptions are provided on Table 1, Appendix F.

4.2 Dewatering Considerations

4.2.1 Estimating Dewatering Volume

4.2.2 Short Term Dewatering Volume

The short-term dewatering rate outside periods of active precipitation, under normal conditions, was determined to be approximately 27,993 L/day (0.32 L/s).

Normal conditions are considered to be weather conditions that should be expected during the operation of the construction dewatering. Normal operation does not include extreme weather events.

4.2.3 Long Term Groundwater Control (Post Construction)

Long-term dewatering volume was determined to be approximately 27,993 L/day (0.32 L/s). The following two options are proposed to implement groundwater control measures for this volume: use of weeping tiles and perimeter drainage to avoid the potential inflow of groundwater into the underground parking level post-construction, subject the approval, or Waterproof of the underground parling level below the established "*seasonally high groundwater level*" plus the required buffer zone (nominally 1.0 m to 1.5 m above).

4.2.4 Dewatering Permit

The dewatering rate for the proposed underground level excavation without rainfall was determined to be approximately 27,993 L/day (0.32 L/s). An Environmental Activity and Sector Registry EASR registration and permit to take water (PTTW) will not be required for this volume of water taking, as the estimated water taking is less than 50,000 L/day, respectively. However, temporary discharge application to the Niagara Peninsula Conservation Authority (NPCA). is required and should be completed.

4.2.5 Dewatering Procedure

Based on the results of the hydraulic conductivity tests, seepage through the overburden and bedrock beneath the Site should be feasible to be handled by a sump and well point dewatering system. The type of dewatering system to be used should be discussed with a dewatering contractor and be evaluated based on anticipated low and high volumes estimates.

The following general construction practices should be implemented to minimize the volume of water to be extracted:

- Schedule construction outside the spring period when the water table is typically elevated and avoid constructing during period of active precipitation.
- Excavation should be staged or constructed in such a manner to be able to manage dewatering volume conveniently.
- Reduce the length of time during which the excavation cut remains open.

4.2.6 Water Management and Discharge Plan

Water extracted during construction dewatering is required to be discharged into an approved sewer near the Site.

As per the Sewers ByLaw, in order to issue a discharge approval, information relating to the quality and quantity of the discharge must be provided to the Niagara Region. It is strongly recommended that the applicant provide this information eight to twelve weeks prior to the proposed start of discharge.

The rate and total volume of the discharge during dewatering should be recorded. This would require that the discharge line be equipped with a flow meter capable of monitoring the discharge rate and a volume totalizer to record the total volume of water discharge. The discharge rate and total daily flow should be recorded with the records maintained on site.

If needed, a weir tank and filter bag should be utilized during dewatering to reduce total suspended solids (TSS) and turbidity prior to discharging of the water into either a sewer system or surface water.

A T-Coupling and valves should be installed downstream of the flow meter, which, if necessary, can be operated to divert flow for mitigation purposes.

4.3 Assessment of Potential Impacts and Water Management

4.3.1 Impact to Existing Groundwater Users

A search of the Ontario MECP within an area extending about 500 m outward from the site was completed.

A summary of the MECP Well Records is presented in Appendix C; and the approximate locations of the wells are shown on Figure 5 in Appendix A. Based on review, four (4) water wells was identified within 500 m radius of the Site.

The estimated radius of influence from the proposed basement level excavation dewatering was determined to be approximately 5 m. As a result, potential impacts on water wells located within 500 m radius of the Site are not anticipated, as none is within the radius of influence of 5 m.

4.3.2 Impact to Surface Water and Natural Functions of the Ecosystem

The nearest Surface Water/Natural Function of the Ecosystem to the Site are Lake Ontario located approximately 10 m to the north of the Site, and NPCA regulated lands which ultimately drains into an unnamed creek located adjacent to the east of the Site.

The estimated radius of influence due to proposed dewatering at the Site was determined to be 5 m. As a result, it is not anticipated that there will be impact to the Lake or the NPCA regulated lands, from the proposed development. However, it is recommended to monitor impacts to these identified Surface Water/Natural Function of the Ecosystem during construction, to determine impact, if any.

4.3.3 Contaminants Impacts

This occurs when pre-existing soil or groundwater contamination is mobilised and transported where transmission pathways are created.

A Phase Environmental Site Assessment (ESA) Report dated September 2023 was completed at the Site by Landtek.

Based on the results of the Phase One ESA, a Phase Two ESA was recommended to be completed for this Site to investigate the identified potential environmental concerns prior to the submission of a Record of Site Condition.

4.3.4 Geotechnical Impacts

Geotechnical impacts occur where the geotechnical properties or state of the ground are changed by groundwater dewatering activities. The most common type of impact in this category is ground settlement, with the corresponding risk of distortion and damage to structures, services and other sensitive infrastructure.

situated approximately 25 m north of the intersection of Laurie Avenue and Victoria Avenue North, in Vineland Station (Town of Lincoln), Ontario. It is bound by residential properties to the south (followed by Laurie Avenue); a conservation area (including a stream) followed by residential properties to the east, Lake Ontario to the north, and Victoria Avenue North (followed by parkland, residential, and institutional properties) to the west.

Based on the above, potential geotechnical impacts are anticipated during dewatering at the Site within a radius of influence of approximately 5.0 m. However, surrounding buildings and roads adjacent to Site should be monitored by geotechnical instrumentation to determine impact, if any.

Dewatering could be by pumping from a sump and well point dewatering system. These systems used for lowering the water table within the excavation should be properly screened and installed to ensure that pumping will not remove sediment from low permeability overburden aquifers. Removal of significant fines may result in the formation of voids and the loss of ground. It is anticipated that there will not be impact beyond the radius of influence of 5.0 m.

The proposed monitoring and mitigation plans are presented in Sections 5 and 6, respectively.

5.0 MONITORING PLAN

5.1 Construction Monitoring

Once construction dewatering is initiated it will be difficult to stop pumping or significantly reduce the rate of pumping without disrupting construction activities. It will however be possible to monitor the drawdown response at the construction site and to adjust the pumping rate to optimize drawdown and the associated pumping rate.

5.2 Management of Dewatering Abstraction

5.2.1 Monitoring, Trigger Levels and Management Responses

Abstraction management is critical to ensure target water levels within the construction zone are met, but that over-pumping does not occur.

Target groundwater levels in- and outside excavations should be set individually for each dewatering monitoring well based on location, aquifer and construction requirements, in-line with stated dewatering aims above.

Trigger levels for wells should typically be set 0.5 m above the dewatering target and 1.0 m below the dewatering target to give a 1.5 m target operational zone. These targets may be reviewed and adjusted to decrease size of the operational target zone and increase the factor of safety.

If monitoring indicates that dewatering zone groundwater levels exceed the upper trigger levels (i.e., required drawdown is not being achieved or maintained) the following management actions should be carried out (in order of preference):

- Adjust automatic pump start and stop water levels.
- Increase pumping rates within the constraints of the system; and/or
- Install additional abstraction capacity (well points, spears or sump pumps).

If monitoring indicates that excavation zone groundwater levels are below the lower trigger levels (i.e., excessive drawdown) the following management actions should be carried out (in order of preference):

- Adjust automatic pump start and stop water levels; and/or
- Decrease pumping rates; and/or
- Reduce the number of pumps operating.

5.2.2 Contingency Responses

If management responses prove to be insufficient to achieve and maintain the target levels, excavations should be slowed or suspended to enable contingencies to be implemented. Available contingency measures include the following (in order of preference):

- Construction of additional dewatering wells, spears or sumps.
- Construction of additional drains or groundwater control structures.

Excavation should resume when the required drawdown is obtained.

5.3 Settlement Monitoring

Ground settlement can be caused by two principal mechanisms:

- Increases in effective stress as a result of lowering of groundwater levels, resulting in compression and consolidation of the ground. Such settlements are the unavoidable consequence of lowering of groundwater level.
- Removal of fine particles from the ground (loss of fines) which can occur when poorly controlled sump pumping draws out soil particles with the pumped water. With good design and implementation, loss of fines (and the associated settlement risk) can be avoided.

Implementation of a settlement monitoring plan should be completed within an approximate radius of influence of 5.0 m of the Site, the estimated radius of influence from dewatering. Prior to commencing dewatering, condition surveys of adjacent properties that could potentially be affected by dewatering, considering anticipated effects and specific dewatering design, should be completed. However, it is recommended that surrounding buildings and roads adjacent to Site be monitored by geotechnical instrumentation to determine impact, if any.

Temporary access permit should be obtained from properties and utilities owners with the estimated radius of influence of the Site on a case-by-case basis prior to construction.

The following monitoring measures are recommended to be carried out before and during the temporary dewatering:

- Complete a pre-excavation condition survey and install settlement monitoring monuments and or markers at the existing buildings and roadways within the estimated zone of influence. This should be done to document existing ground elevations and building/structure conditions.

- The settlement monitoring monuments (markers) should be surveyed prior to the dewatering to establish a baseline and surveyed on a daily basis during the dewatering.

- A typical settlement monitoring system should comprise a series of settlement markers sited at various distances beyond and at the site, within the zone of influence of groundwater drawdown. Monitoring points should be surveyed to an accuracy of +/-2 mm. Note that the reference benchmark must be located beyond the extent of the anticipated influence of groundwater drawdown. For very high-risk projects, incorporation of piezometer standpipes will allow confirmation of the field groundwater drawdown and will enable calibration of field settlement observation with theoretical assessments.

- Alert and Action settlement thresholds should be set, selected through theoretical assessment of anticipated settlements and review of sensitivity of adjacent structures and infrastructures. It is prudent to implement staged groundwater drawdown, providing holding points to allow adequate time to enable observation of the delayed settlement response of the ground.

- The monitoring program will include review and alert levels. If instrument readings exceed “review” levels, the Proponent and its Contractor will jointly assess the necessity of altering the method, rate, or sequence of construction.

- The survey results should be provided to the project geotechnical engineer for evaluation. The estimated potential and actual settlements should also be reviewed by a structural engineer to assess the potential damage to the existing structures.

6.0 MITIGATION PLAN

The groundwater dewatering activities will result in localized depression of the groundwater table, and it is not anticipated that there will impact beyond the radius of influence of 5.0 m. However, it is recommended that surrounding buildings and roads adjacent to Site should be monitored by geotechnical instrumentation to determine impact, if any.

Mitigation would involve the reduction or elimination of the impacts induced by construction dewatering. As noted above, the potential exists for dewatering to cause ground settlement, with the corresponding risk of distortion and damage to structures, services and other sensitive infrastructure.

Methods to limit adverse dewatering settlement should include the following:

- Settlement associated with loss of fines should be mitigated through appropriate design of the dewatering system to control flow velocity and provide screens and/or filters matched to the grading of the in-situ soils. Entrainment of fines must be monitored during construction; actions could include analysis of TSS in discharge water and/or monitoring of accumulation of sediment in sedimentation tanks.

- Drawdown-induced ground settlement should be mitigated though pre-construction estimation of groundwater drawdown and settlement coefficients to identify risk prior to drawing the groundwater down, and water level monitoring in monitoring wells to check that larger drawdown than anticipated at distance from the excavation are not occurring.

- Differential settlement is most problematic. This should be reduced by managing the rate of drawdown and understanding where clear changes in soil type occur. Should potentially damaging settlement be indicated, these can be mitigated by installing groundwater cut-offs to stem or restrict groundwater flow and limit drawdown beyond the site.

- Sufficient temporary support should be provided for excavations to maintain stability, where seeps might otherwise induce progressive collapse of the sides of the excavation.

- During dewatering, staged drawdowns (where appropriate) should be implemented and field settlement and water level changes beyond the immediate site monitored, comparing against theoretical settlements and water levels to allow warning of potential dewatering settlement issues.

At “alert” levels, the dewatering should be reduced to a lower rate or ceased temporarily, and alternative measures considered for the excavation, which should be approved by the project geotechnical engineer and project team.

If the settlement monitoring indicates an undesirable deformation, the project manager should order construction operations to cease until the necessary mitigation measures are undertaken.

In the event that a property or infrastructure owner submits a claim for damages, the Developer should conduct further investigations and, if appropriate, negotiate a settlement.

7.0 SUMMARY AND CONCLUSIONS

The following summarizes the results of the investigation:

- The borehole information is generally consistent with the geological data identified from published geology of the area, with the predominant soils comprising sands, silts, clay and silt tills overlying red shale bedrock.

- The presence of significant hydrogeologic features such as closed depressions (areas of ground water recharge), seeps, springs, or the presence of phreatophytic vegetation were not observed during the visit and inspection.

- The topography at the Site ranges from approximately 75 masl to 79 masl, with a gentle slope from the south to north portions.

- The local groundwater flow direction has been inferred to be in a northerly direction towards Lake Ontario, located adjacent to the north of the Site. Shallow ground water direction may be influenced by trenches for municipal infrastructure, underground utilities, conduits, structures, variations in subsurface strata, and changes in local topography.

- Depths to groundwater in all monitoring wells were obtained manually by Landtek staff on July 13, August 18, September 20, October 6, and October 17, 2023. Based on the recorded groundwater levels, the highest water level was determined to be 2.18 mbgs on July 13, 2023, at MW9S-23. It should be noted that groundwater level monitoring is ongoing to determine the seasonal highest groundwater level which usually occurs in Spring.

- Groundwater samples were collected from three monitoring wells at the site and analyzed for the Niagara Sanitary/Storm Sewers Discharge Limits Discharge Limits. All analyzed parameters were within guideline values.

- The short-term dewatering rate outside periods of active precipitation, under normal conditions, was determined to be approximately 27,993 L/day (0.32 L/s. Normal conditions are considered to be weather conditions that should be expected during the operation of the construction dewatering. Normal operation does not include extreme weather events.

- Long-term dewatering volume was determined to be approximately 27,993 L/day (0.32 L/s). The following two options are proposed to implement groundwater control measures for this volume: use of weeping tiles and perimeter drainage to avoid the potential inflow of groundwater into the underground parking level post-construction, subject the approval, or waterproof of the underground parling level below the established "*seasonally high groundwater level*" plus the required buffer zone (nominally 1.0 m to 1.5 m above).

- The dewatering rate for the proposed underground level excavation without rainfall was determined to be approximately 27,993 L/day (0.32 L/s). An Environmental Activity and Sector Registry EASR registration and permit to take water (PTTW) will not be required for this volume of water taking, as the estimated water taking is less than 50,000 L/day, respectively. However, temporary discharge application to the Niagara Peninsula Conservation Authority (NPCA) is required and should be completed.

8.0 RECOMMENDATIONS

The following general construction practices are recommended to minimize the volume of water to be extracted:

- Schedule construction outside the spring period when the water table is typically elevated and avoid construction during period of active precipitation.
- Reduce, where practicable, the length of time during which the open cut remains open.
- Install valves on the individual well point to allow for the flow adjustment.

Potential geotechnical impacts are anticipated during dewatering at the Site within a radius of influence of approximately 5.0 m. However, surrounding buildings and roads adjacent to Site should be monitored by geotechnical instrumentation to determine impact, if any.

As per the Sewers ByLaw, in order to issue a discharge approval, information relating to the quality and quantity of the discharge must be provided to the Niagara Region. It is strongly recommended that the applicant provide this information eight to twelve weeks prior to the proposed start of discharge.

9.0 CLOSURE

We trust this report is satisfactory for your purposes. If you have any questions regarding our submission, please do not hesitate to contact Landtek.

Yours truly,

Landtek Limited

Henry Erebor, M.Sc., P.Geo.,

10.0 REFERENCES

Chapman, L.J., Putnam, D.F. 1984. Physiography of Southern Ontario. Ontario Geological Survey Map P.2715. https://brocku.ca/maplibrary/maps/geology/Ontario/P2715_Physiography_of_Southern_Ontario.pdf

Feenstra, B.H. 1974. Quaternary Geology of the Grimsby Area, Southern Ontario; Ontario Div. Mines, Prelim. Map P.993, Geol. Ser., scale 1:50,000. Geology. 1974.

Fetter, C.W. 2001. Applied Hydrogeology, Fourth Edition. Prentice Hall, New Jersey.

Freeze, R.A., Cherry, J.A. 1979. Groundwater. Prentice Hall, New Jersey.

Johnson, M.D., Armstrong, D.K., Sanford, B.V., Telford, P.G., and Rutka, M.A. 1992. Paleozoic and Mesozoic geology of Ontario: in Geology of Ontario, Ontario Geological Survey, Special Volume 4, Part 2, p.907-1010.

Landtek Limited. 2023. Phase One Environmental Site Assessment, 4933 Victoria Avenue North, Vineland Station (Town of Lincoln), Ontario. September 2023.

Ontario Geological Survey. 2016. Quaternary Geology of Ontario, 1:100,000. OGS Earth Application. Last modified Sept. 7, 2016.

Ministry of the Environment and Climate Change. 2021. Source Water Protection, Interactive Map. http://www.applications.ene.gov.on.ca/swp/en/index.php

Ontario Geological Survey, OGS Earth. Quaternary Geology of Ontario

Ontario Geological Survey, OGS Earth. Bedrock Geology of Ontario.

11.0 LIMITATIONS

The conclusions and recommendations given in this report are based on information determined at the borehole locations. Subsurface and ground water conditions between and beyond the boreholes may be different from those encountered at the borehole locations, and conditions may become apparent during construction that could not be detected or anticipated at the time of the geotechnical investigation. It is recommended practice that Landtek be retained during construction to confirm that the subsurface conditions throughout the site are consistent with the conditions encountered in the boreholes.

The comments made in this report on potential construction problems and possible remedial methods are intended only for the guidance of the designer. The number of boreholes may not be sufficient to determine all the factors that may influence construction methods and costs. For example, the thickness and quality of surficial topsoil or fill layers may vary markedly and unpredictably. Contractors bidding on the project or undertaking construction on the site should make their own interpretation of the factual borehole information and establish their own conclusions as to how the subsurface conditions may affect their work.

The survey elevations in the report were obtained by Landtek or others and are strictly for use by Landtek in the preparation of the geotechnical report. The elevations should not be used by any other parties for any other purpose.

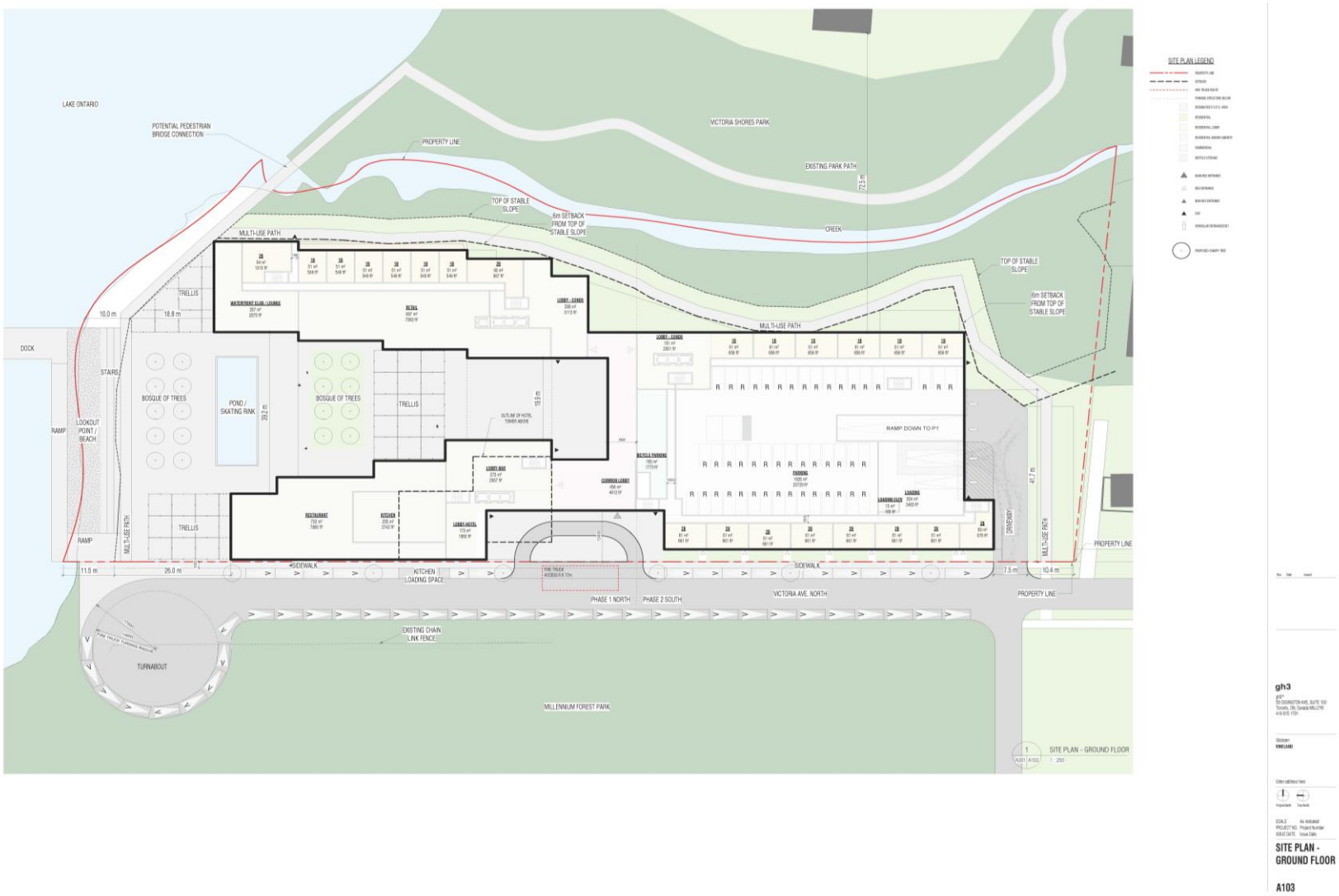
Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Landtek accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

This report does not reflect environmental issues or concerns related to the property unless otherwise stated in the report. The design recommendations given in the report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, it is recommended that Landtek be retained during the final design stage to verify that the design is consistent with the report recommendations, and that the assumptions made in the report are still valid.

APPENDIX A

FIGURES

	LANDTEK LIMITED ***CONSULTING ENGINEERS*** **205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1**
	Scale: On Map | Date: September 2023
Project:	Hydrogeological Investigation 4933 Victoria Avenue North Vineland Station, Ontario
Title:	Figure 1: Site Location
Project No.	23015



	LANDTEK LIMITED ***CONSULTING ENGINEERS*** **205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1**	
	Scale: As Noted	Date: September 2023
Project:	Hydrogeological Investigation 4933 Victoria Ave. North Vineland Station, Ontario	
Title:	Figure 2: Site Plan	
Project No.	23015	

1 Level P1
A301 / A200 1 : 200

gh3

LEVEL P1

A200

	LANDTEK LIMITED ***CONSULTING ENGINEERS*** **205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1**	
	Scale: As Noted	Date: September 2023
Project:	Hydrogeological Investigation 4933 Victoria Ave. North Vineland Station, Ontario	
Title:	Figure 3: P1 Level Plan	
Project No.	23015	

LANDTEK LIMITED

205 Nebo Road, Unit 4B
Hamilton, Ontario L8W 2E1
p: +1 (905) 383-3733
e: engineering@landtek.ca
w: www.landtek.ca

project location

Key plan an extract from XXXX©

Key:

- Approximate location of borehole drilled by Landtek Limited between July 4th, 5th, and 6th, 2023.
- Approximate location of 3.0 m monitoring well drilled by Landtek Limited between July 4th, 5th, and 6th, 2023.
- Approximate location of 4.5 m monitoring well drilled by Landtek Limited between July 4th, 5th, and 6th, 2023.
- Approximate location of 10.5 m monitoring well drilled by Landtek Limited between July 4th, 5th, and 6th, 2023.

Notes:

Base plan and extract from the preliminary drawing "Concept Plan", reference 281-18 sheet 1 dated January 21, 2019, as issued by Urban Solutions Planning & Land Development

revisions/ submissions

#	date	description

client
Court Holdings Limited

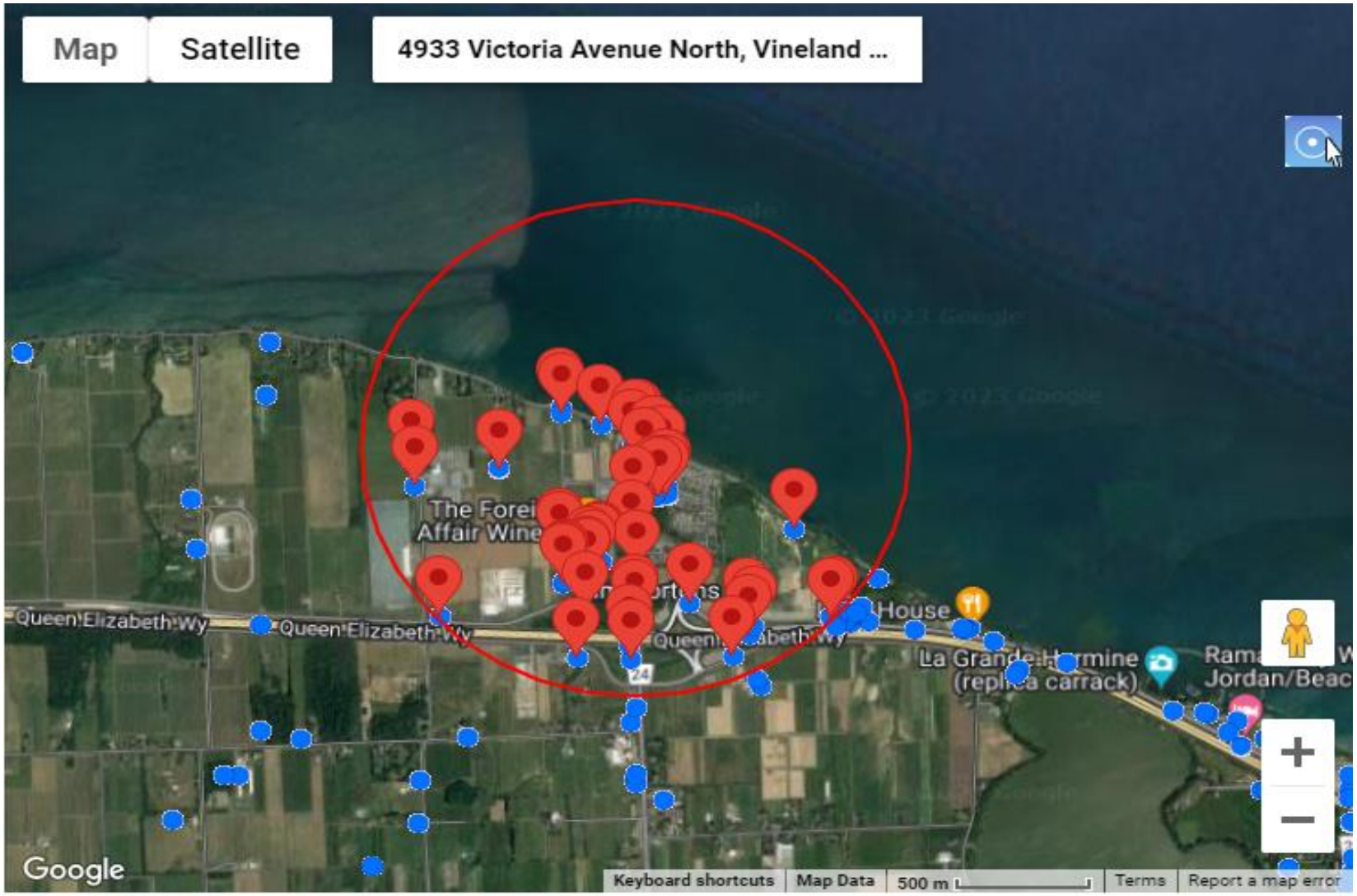
municipality
Town of Lincoln

project
Geotechnical, Environmental, and Hydrogeological Investigation
4933 Victoria Avenue North

sheet
Borehole and Monitoring Well Location Plan **Figure 4**

date: July 13, 2023
drawn: mdc
checked: jd
project #: 23016
scale: 1:1000

23016-01



Latitude:43.18077, Longitude:-79.36686 (UTM Zone:17, Easting:632725, Northing:4782184)

● MECP Wells

	LANDTEK LIMITED *CONSULTING ENGINEERS* **205 NEBO ROAD, HAMILTON, ONTARIO, L8W 2E1**	
	Scale: On Map	Date:September 2023
Project:	Hydrogeological Investigation 4933 Victoria Avenue North Vineland Station, Ontario	
Title:	Figure 5: MECP Wells Locations	
Project No.	23015	

APPENDIX B

MONITORING WELL LOGS

LOG OF BOREHOLE BH1

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-14
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.193842
Easting: -79.395091
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			Concrete ~150 mm.					
			Sand and Gravel some silt, trace concrete fragments. Compact, grey and brown, dry. Fill Material.	1	SS	25 10 3 3	13	
1		-1.0	**Silty Clay** trace iron staining. Very stiff, brown and red, moist.	2	SS	4 7 11 16	18	
			Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	11 13 47 50	60	
2		-2.0		4	SS	15 24 56	80	
3		-3.0		5	SS	58 50-5"	50	
			End of Log					
4		-4.0						
5		-5.0						
6		-6.0						
7		-7.0						
8		-8.0						
9		-9.0						
10		-10.0						

Penetration / Strength Results

Undrained Shear Strength Values (kPa)
40 80 120 160

Penetration Test Values (Blows / 0.3m)
20 40 60 80

Moisture / Plasticity

PL MC LL

Moisture / Plasticity
10 20 30 40

10.0
10.0
10.0
10.0
10.0

Well Details | **Groundwater Conditions** | **Headspace Vapor HEX/IBL (ppm) [LEL(%)]**

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW2

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-14
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.193615
Easting: -79.394797
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Moisture / Plasticity (PL MC LL; Moisture / Plasticity)	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
			Concrete ~475 mm.									
1		-1.0	**Fill** Silty clay, some gravel, trace concrete fragments. Firm to stiff, brown, moist.	1	SS	2 3 5 7	8	10.0				
			Silty Clay Till trace gravel. Hard, brown and red, moist.	2	SS	2 13 25 13	38	10.0				
2		-2.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	13 21 33 50	24	10.0	3/8" Bentonite Pellets			
				4	SS	50-6"	50	10.0	#10 Well Slot Sand			
3		-3.0						10.0				
				5	SS	50-0"	50					
4		-4.0										
			End of Log									
5		-5.0										
6		-6.0										
7		-7.0										
8		-8.0										
9		-9.0										
10		-10.0										

Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80
Moisture / Plasticity: 10 20 30 40

Well Details: 2" Schedule 40 PVC Slot 10 Screen; Flushmount

Groundwater Conditions: May 2022

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW3

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-14
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.194026
Easting: -79.395079
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			Concrete ~182 mm.					
			Fill Silty clay, some gravel, trace concrete fragments. Firm to stiff, brown, moist.	1	SS	4 4 4 4	8	
1		-1.0	**Silty Clay Till** trace gravel. soft to firm, brown and red, moist.	2	SS	2 2 2 2	4	
			...soft.	3	SS	2 2 1 1	3	
2		-2.0	...soft to firm.	4	SS	2 2 2 2	4	
3		-3.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	5	SS	2 13 50-6"	50	
4		-4.0		6	SS	33 50-4"	50	
			End of Log					
5		-5.0						
6		-6.0						
7		-7.0						
8		-8.0						
9		-9.0						
10		-10.0						

Penetration / Strength Results

Undrained Shear Strength Values (kPa)
40 80 120 160

Penetration Test Values (Blows / 0.3m)
20 40 60 80

Moisture / Plasticity

PL MC LL

Moisture / Plasticity
10 20 30 40

10.0 10.0 10.0 10.0 10.0 10.0

Well Details

3/8" Bentonite Pellets
#10 Well Slot Sand
2" PVC Screen
Flushmount

Groundwater Conditions

May 2022

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

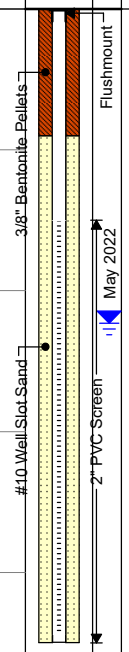
LOG OF BOREHOLE BHMW4

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-26
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.193379
Easting: -79.395076
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity PL MC LL / 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
1		-1.0	**Fill** Silty clay, some gravel, trace sand. Stiff, brown, moist.	1	SS	4 5 6 5	11		10.0				
			...clayey silt.	2	SS	4 5 8 11	13		10.0				
2		-2.0	**Silty Clay Till** trace gravel, trace iron staining. Hard, brown and red, moist.	3	SS	7 11 22 30	33		10.0				
			Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	10 29 14 50-6"	50		10.0				
3		-3.0											
4		-4.0											
5		-5.0	End of Log										
6		-6.0											
7		-7.0											
8		-8.0											
9		-9.0											
10		-10.0											



Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BH5

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-26
Drilling Method: Solid Stem
Datum: Ground Surface

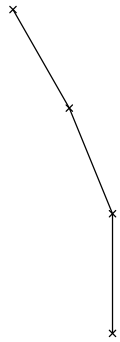
Northing: 43.19287
Easting: -79.394925
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			Fill Sandy silt, some gravel. Compact, brown, moist.	1	SS	6 5 8 9	13	
1		-1.0	**Silty Clay Till** some gravel. Hard, brown and red, moist.	2	SS	9 13 21 23	34	
2		-2.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	15 29 50-6"	50	
				4	SS	37 50-3"	50	
			End of Log					
3		-3.0						
4		-4.0						
5		-5.0						
6		-6.0						
7		-7.0						
8		-8.0						
9		-9.0						
10		-10.0						

Penetration / Strength Results

Undrained Shear Strength Values (kPa)
40 80 120 160

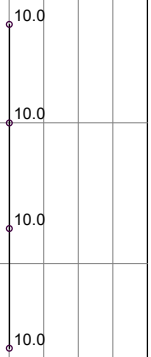
Penetration Test Values (Blows / 0.3m)
20 40 60 80



Moisture / Plasticity

PL MC LL

Moisture / Plasticity
10 20 30 40



Well Details | **Groundwater Conditions** | **Headspace Vapor HEX/IBL (ppm) [LEL(%)]**

Additional Notes:
1. Borehole open to approximately 2.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BH6

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-26
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.19319
Easting: -79.394378
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity (PL MC LL; Moisture / Plasticity 10 20 30 40)	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
			Fill Sand and gravel, some silt. Dense, brown, moist.	1	SS	20 15 17 12	32		10.0				
1		-1.0	**Clayey Silt Till** trace gravel. Firm, brown and red, moist.	2	SS	5 4 2 2	6		10.0				
			...soft to firm.	3	SS	4 2 2 3	4		10.0				
2		-2.0	...trace red shale fragments. Firm.	4	SS	1 2 5 12	7		10.0				
3		-3.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	5	SS	13 35 50-5"	50		10.0				
			End of Log										
4		-4.0											
5		-5.0											
6		-6.0											
7		-7.0											
8		-8.0											
9		-9.0											
10		-10.0											

Additional Notes:
1. Borehole open to approximately 3.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BH7

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-26
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.193375
Easting: -79.394433
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity PL MC LL / Moisture / Plasticity 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
			Fill Sand and gravel, some silt. Compact, red and brown, moist.	1	SS	4 6 5 3	11		10.0				
1		-1.0	**Sandy Silt** some gravel, trace sand seam. Very loose, moist. Possible Fill.	2	SS	2 1 1	2		10.0				
				3	SS	1 2 1	3		10.0				
2		-2.0											
			Clayey Silt Till trace gravel. Very dense, red, very moist to wet.	4	SS	25 29 19 27	48		10.0				
3		-3.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	5	SS	16 41 50-4"	50		10.0				
			End of Log										
4		-4.0											
5		-5.0											
6		-6.0											
7		-7.0											
8		-8.0											
9		-9.0											
10		-10.0											

Additional Notes:
1. Borehole open to approximately 3.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW8

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

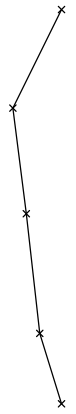
Drill Date: 2022-04-26
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.193727
Easting: -79.394329
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
		Concrete ~150 mm.					
		Fill Sand and gravel. Very dense, grey and red, dry.	1	SS	50-2"	50	
1	-1.0	**Clayey Silt Till** some gravel, trace iron staining. Dense, brown and red, moist.	2	SS	12 14 18 21	32	
2	-2.0		3	SS	9 15 21 22	37	
		Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	12 19 23 35	42	
3	-3.0		5	SS	50-2"	50	
4	-4.0						
		End of Log					
5	-5.0						
6	-6.0						
7	-7.0						
8	-8.0						
9	-9.0						
10	-10.0						

Undrained Shear Strength Values (kPa)
40 80 120 160

Penetration Test Values (Blows / 0.3m)
20 40 60 80

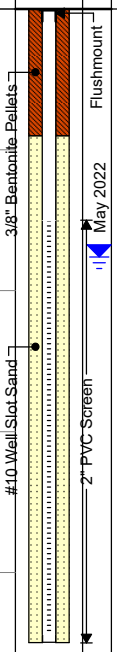


Moisture / Plasticity
PL MC LL

Moisture / Plasticity
10 20 30 40

10.0
10.0
10.0
10.0
10.0

Well Details



Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BH10

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-27
Drilling Method: Solid Stem
Datum: Ground Surface

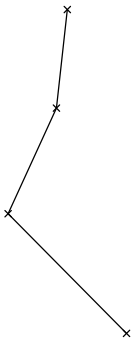
Northing: 43.194162
Easting: -79.394529
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			Fill Sand and gravel. Compact, grey, moist.	1	SS	9 14 14 13	28	
1		-1.0	...brown and black.	2	SS	18 16 8 7	24	
			...loose.	3	SS	3 4 2 2	6	
2		-2.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	14 42 50-4"	50	
3		-3.0	End of Log					
4		-4.0						
5		-5.0						
6		-6.0						
7		-7.0						
8		-8.0						
9		-9.0						
10		-10.0						

Penetration / Strength Results

Undrained Shear Strength Values (kPa)
40 80 120 160

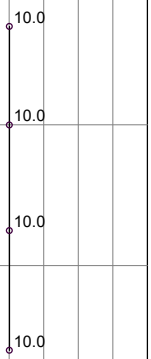
Penetration Test Values (Blows / 0.3m)
20 40 60 80



Moisture / Plasticity

PL MC LL

Moisture / Plasticity
10 20 30 40



Well Details

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW11A

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-27
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.194158
Easting: -79.395129
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity PL MC LL / 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
			Fill Silt, with gravel. Compact, grey and brown, dry.	1	SS	9 14 13 5	27		10.0				
			...clayey silt, some gravel. Firm.										
1		-1.0	**Clayey Silt Till** trace gravel. Stiff, brown, moist.	2	SS	4 5 8 13	13		10.0				
2		-2.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	6 8 19 21	27		10.0	3/8" Bentonite Pellets			
				4	SS	11 18 17 30	35		10.0	#10 Well Slot Sand	Flushmount		
3		-3.0											
				5	SS	50-2"	50		10.0	2" PVC Screen	May 2022		
4		-4.0											
			End of Log										
5		-5.0											
6		-6.0											
7		-7.0											
8		-8.0											
9		-9.0											
10		-10.0											

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW9A

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-26
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.193988
Easting: -79.39434
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			Fill Silt, with gravel, trace black staining. Compact, brown, dry.	1	SS	6 11 6 6	17	
1		-1.0	...clayey silt, some gravel. Firm.	2	SS	5 3 4 4	7	
			Clayey Silt Till trace gravel, trace sand. Stiff, brown and red, moist.	3	SS	2 4 9 12	13	
2		-2.0	...some black staining. Dense.	4	SS	9 15 30 50	45	
			Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	5	SS	18 50-4"	50	
3		-3.0						
4		-4.0						
			End of Log					
5		-5.0						
6		-6.0						
7		-7.0						
8		-8.0						
9		-9.0						
10		-10.0						

Penetration / Strength Results

Undrained Shear Strength Values (kPa)
40 80 120 160

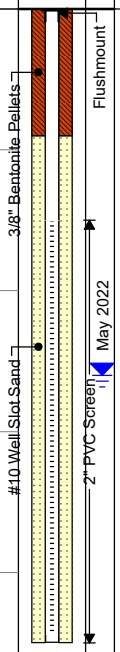
Penetration Test Values (Blows / 0.3m)
20 40 60 80

Moisture / Plasticity

PL MC LL

Moisture / Plasticity
10 20 30 40

10.0
10.0
10.0
10.0
10.0



Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW1D-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-05
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.19392
Easting: -79.394279
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity (PL MC LL; Moisture / Plasticity 10 20 30 40)	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
	1.0								36" Locking Vault			
0	0.0	**Fill** Crushed concrete and asphalt, trace silt, trace gravel. Very dense, grey and black, dry to moist.	1	SS	36 32 24 14	56		3.0				
1	-1.0	**Silt Till** some gravel, trace iron staining, trace red shale fragments. Compact, brown, moist.	2	SS	4 5 8 12	13		14.0	3/8" Bentonite Pellets			
2	-2.0	...dense.	3	SS	9 15 21 38	36		13.6				
3	-3.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	18 25 30 40	55		8.3		July 2023		
			5	SS	19 20 18 19	38		10.1				
4	-4.0											
			6	SS	50-4"	50						
5	-5.0											
6	-6.0	**Shale** Highly weathered, very dense, red, dry.										
7	-7.0		7	CORE								
8	-8.0	**Shale** Highly weathered, very dense, red, dry.	8	CORE					#10 Well Slot Sand	2" PVC Screen		

Additional Notes:
1. Borehole open to approximately 10.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW1D-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-05
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.19392
Easting: -79.394279
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity PL MC LL / Moisture / Plasticity 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
9		-9.0											
			Shale Highly weathered, very dense, red, dry.	9	CORE								
10		-10.0									2" PVC Screen		
			End of Log										
11		-11.0											
12		-12.0											
13		-13.0											
14		-14.0											
15		-15.0											
16		-16.0											
17		-17.0											
18		-18.0											

Additional Notes:
1. Borehole open to approximately 10.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW1S-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-05
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.193899
Easting: -79.394279
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
	1.0						
0	0.0	**Fill** Crushed concrete and asphalt, trace silt, trace gravel. Very dense, grey and black, dry to moist.	1	SS	36 32 24 14	56	
1	-1.0	**Silt Till** some gravel, trace iron staining, trace red shale fragments. Compact, brown, moist.	2	SS	4 5 8 12	13	
		...dense.	3	SS	9 15 21 38	36	
2	-2.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	18 25 30 40	55	
3	-3.0		5	SS	19 20 18 19	38	
4	-4.0		6	SS	50-4"	50	
5	-5.0						
6	-6.0	End of Log					
7	-7.0						
8	-8.0						

Undrained Shear Strength Values (kPa): 40, 80, 120, 160
Penetration Test Values (Blows / 0.3m): 20, 40, 60, 80
Moisture / Plasticity: PL, MC, LL; 10, 20, 30, 40

Moisture / Plasticity: 3.0, 14.0, 13.6, 8.3, 10.1

Well Details: 36" Locking Vault; 3/8" Bentonite Pellets; #10 Well Slot Sand; 2" PVC Screen; July 2023

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 10.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW2S-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-05
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.194185
Easting: -79.394701
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity (PL MC LL; Moisture / Plasticity 10 20 30 40)	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
	1.0											
0	0.0	**Fill** Crushed Limestone, some silt. Compact, brown and grey, dry to moist.	1	SS	10 11 13 8	24		4.2	36" Locking Vault			
1	-1.0	...silt, some asphalt fragments, some gravel. Very dense, black and brown.	2	SS	11 34 25 13	59		4.1	3/8" Bentonite Pellets			
2	-2.0	...dense, black.	3	SS	24 16 22 50-4"	37		4.5	#10 Well Slot Sand			
		...trace concrete. Compact.	4	SS	5 1 11 10	21		7.8	2" PVC Screen			
3	-3.0	End of Log							July 2023			
4	-4.0											
5	-5.0											
6	-6.0											
7	-7.0											
8	-8.0											

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW2D-23

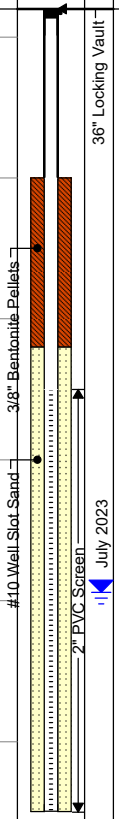
Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-05
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.194145
Easting: -79.394701
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Moisture / Plasticity	Comments
	1.0							
0	0.0	**Fill** Crushed Limestone, some silt. Compact, brown and grey, dry to moist.	1	SS	10 11 13 8	24	4.2	
1	-1.0	...silt, some asphalt fragments, some gravel. Very dense, black and brown.	2	SS	11 34 25 13	59	4.1	
2	-2.0	...dense, black.	3	SS	24 16 22 50-4"	37	4.5	
		...trace concrete. Compact.	4	SS	5 1 11 10	21	7.8	
3	-3.0	...trace orange brick fragments, trace wood debris. Compact to dense.	5	SS	9 14 16 21	30	7.8	
4	-4.0							
5	-5.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	6	SS	10 19 30 50-4"	50		
		End of Log						
6	-6.0							
7	-7.0							
8	-8.0							

Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80
Moisture / Plasticity: PL MC LL; 10 20 30 40



Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW3S-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-06
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.193916
Easting: -79.3951
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity PL MC LL / Moisture / Plasticity 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
	1.0								36" Locking Vault			
0	0.0	**Fill** Silt, trace gravel, trace asphalt fragments. Loose, brown, moist.	1	SS	6 5 2 4	7		18.5				
1	-1.0	**Silt Till** some gravel, trace iron staining, trace red shale fragments. Compact, brown, moist.	2	SS	6 10 15 18	25		11.1	3/8" Bentonite Pellets			
		...no iron staining. Dense.	3	SS	8 11 15 50-6"	50		10.6				
2	-2.0							6.4				
		Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	50-4"	50						
3	-3.0		5	SS	50-4"	50			#10 Well Slot Sand	July 2023		
4	-4.0											
5	-5.0		6	CORE					2" PVC Screen			
6	-6.0	End of Log										
7	-7.0											
8	-8.0											

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW3D-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-06
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.19388
Easting: -79.3951
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
	1.0						
0	0.0	**Fill** Silt, trace gravel, trace asphalt fragments. Loose, brown, moist.	1	SS	6 5 2 4	7	
1	-1.0	**Silt Till** some gravel, trace iron staining, trace red shale fragments. Compact, brown, moist.	2	SS	6 10 15 18	25	
2	-2.0	...no iron staining. Dense.	3	SS	8 11 15 50-6"	50	
		Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	50-4"	50	
3	-3.0		5	SS	50-4"	50	
4	-4.0						
5	-5.0		6	CORE			
6	-6.0	**Shale** Highly weathered, very dense, red, dry.					
7	-7.0		7	CORE			
8	-8.0	**Shale** Highly weathered, very dense, red, dry.					
			8	CORE			

Penetration / Strength Results
Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity: 10 20 30 40
18.5
11.1
10.6
6.4

Well Details
36" Locking Vault
3/8" Bentonite Pellets
July 2023
#10 Well Slot Sand
2" PVC Screen

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 10.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW3D-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-06
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.19388
Easting: -79.3951
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
9		-9.0						
			Shale Highly weathered, very dense, red, dry.	9	CORE			
10		-10.0						
			End of Log					
11		-11.0						
12		-12.0						
13		-13.0						
14		-14.0						
15		-15.0						
16		-16.0						
17		-17.0						
18		-18.0						

Subsurface Conditions | **Samples**

Penetration / Strength Results

Undrained Shear Strength Values (kPa)
▲ 40 80 120 160 ▲

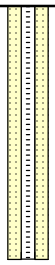
Penetration Test Values (Blows / 0.3m)
× 20 40 60 80 ×

Moisture / Plasticity

PL MC LL

Moisture / Plasticity
○ 10 20 30 40 ○

Well Details



Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 10.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW4S-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-06
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.193498
Easting: -79.395015
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
		1.0						
0		0.0	**Fill** Silt, with gravel, trace asphalt fragments. Loose, brown, moist.	1	SS	4 4 2 4	6	
1		-1.0	**Clayey Silt** trace gravel, trace sand. Firm, brown, moist. Possible Fill.	2	SS	2 3 4 11	7	
2		-2.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	21 47 50-5"	50	
				4	SS	50-5"	50	
3		-3.0						
4		-4.0						
5		-5.0						
6		-6.0	End of Log					
7		-7.0						
8		-8.0						

Subsurface Conditions | **Samples** | **Penetration / Strength Results** | **Moisture / Plasticity** | **Well Details** | **Groundwater Conditions** | **Headspace Vapor HEX/IBL (ppm) [LEL(%)]**

Penetration / Strength Results
Undrained Shear Strength Values (kPa)
40 80 120 160
Penetration Test Values (Blows / 0.3m)
20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity
10 20 30 40
19.7
22.0
7.5
8.4

Well Details
36" Locking Vault
3/8" Bentonite Pellets
#10 Well Slot Sand
2" PVC Screen

Groundwater Conditions
July 2023

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW4-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-06
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.193466
Easting: -79.395015
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
		1.0						
0		0.0	**Fill** Silt, with gravel, trace asphalt fragments. Loose, brown, moist.	1	SS	4 4 2 4	6	
1		-1.0	**Clayey Silt** trace gravel, trace sand. Firm, brown, moist. Possible Fill.	2	SS	2 3 4 11	7	
2		-2.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	21 47 50-5"	50	
				4	SS	50-5"	50	
3		-3.0	End of Log					
4		-4.0						
5		-5.0						
6		-6.0						
7		-7.0						
8		-8.0						

Penetration / Strength Results
Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity: 10 20 30 40
19.7
22.0
7.5
8.4

Well Details
36" Locking Vault
#10 Well Slot Sentonite Pellets
2" PVC Screen
July 2023

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW5S-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-05
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.193038
Easting: -79.394998
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
	1.0						
0	0.0	**Fill** ~50 mm Gravel.					
		Silt Till trace gravel, trace iron staining, trace red shale fragments. Compact, brown and red, moist.	1	SS	5 7 10 10	17	
1	-1.0	...very dense.	2	SS	15 24 27 22	51	
		Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	29 34 50-3"	50	
2	-2.0		4	SS	50-4"	50	
3	-3.0		5	SS	50-3"	50	
4	-4.0						
5	-5.0		6	SS	50-4"	50	
6	-6.0	End of Log					
7	-7.0						
8	-8.0						

Penetration / Strength Results
Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity: 10 20 30 40
11.8
11.6
8.9
6.2
3.1
4.4

Well Details
36" Locking Vault
3/8" Bentonite Pellets
#10 Well Slot Sand
2" PVC Screen
July 2023

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW6-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-04
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.192738
Easting: -79.395024
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
		1.0					
0		0.0	**Fill** Silt, with gravel. Compact, brown, moist.	1	SS	13 15 12 9	27
			Shale Completely weathered, very dense, red, dry. Recovered as residual soil.				
1		-1.0		2	SS	12 16 25 26	41
				3	SS	47 47 50-5"	50
2		-2.0		4	SS	26 50-4"	50
3		-3.0		5	SS	50-2"	50
			End of Log				
4		-4.0					
5		-5.0					
6		-6.0					
7		-7.0					
8		-8.0					

Penetration / Strength Results
Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity: 10 20 30 40
15.9
10.1
6.9
8.0
4.4

Well Details
#10 Well Slot Sentonite Pellets
2" PVC Screen

Groundwater Conditions
36" Locking Vault

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Comments

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BH7-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-06
Drilling Method: Hollow Stem
Datum: Ground Surface

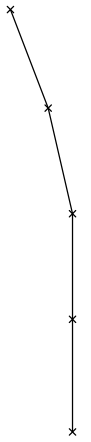
Northing: 43.19273
Easting: -79.394474
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
			Fill Sandy silt, trace clay, trace gravel, trace red shale fragments. Loose, brown, moist.	1	SS	3 3 3 3	6	
1		-1.0	...Peat, organic material, trace gravel. Very moist brown and black.	2	SS	3 2 4 3	6	
			Clayey Silt trace peat, trace iron staining. Firm, brown and black, very moist.	3	SS	4 3 4 3	7	
2		-2.0	...wet.	4	SS	17 50-5"	50	
			Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	5	SS	18 22 50-5"	50	
3		-3.0						
			End of Log					
4		-4.0						
5		-5.0						
6		-6.0						
7		-7.0						
8		-8.0						
9		-9.0						
10		-10.0						

Penetration / Strength Results

Undrained Shear Strength Values (kPa)
40 80 120 160

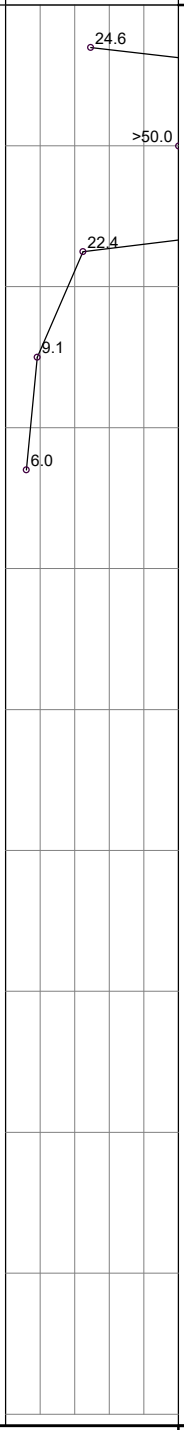
Penetration Test Values (Blows / 0.3m)
20 40 60 80



Moisture / Plasticity

PL MC LL

Moisture / Plasticity
10 20 30 40



Well Details

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW8S-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-04
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.193186
Easting: -79.394465
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
	1.0						
0	0.0	**Fill** Sand and gravel. Compact, brown and red, dry.	1	SS	10 7 7 5	14	
		Clayey Silt Stiff, red and brown, dry to moist.					
1	-1.0	...some gravel. Firm to stiff.	2	SS	7 5 3 2	8	
		...trace sand. Firm.	3	SS	3 2 4 5	6	
2	-2.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	7 17 24 30	41	
3	-3.0		5	SS	50-6"	50	
4	-4.0		6	SS	50-4"	50	
		End of Log					
5	-5.0						
6	-6.0						
7	-7.0						
8	-8.0						

Penetration / Strength Results
Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity: 10 20 30 40
8.3
11.6
17.9
10.8
8.2
5.5

Well Details
36" Locking Vault
3/8" Bentonite Pellets
#10 Well Slot Sand
2" PVC Screen
July 2023

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW9S-23

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-04
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.193644
Easting: -79.394366
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
	1.0						
0	0.0	**Fill** Sity sand to clayey silt, trace grey clay seams. Firm, brown and red, moist.	1	SS	3 2 5 9	7	
1	-1.0	...sand silt, trace red shale fragments, trace gravel. Dense.	2	SS	10 14 18 28	32	
2	-2.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	36 43 50-3"	50	
			4	SS	26 36 44 50-4"	50	
3	-3.0		5	SS	50-4"	50	
4	-4.0		6	SS	50-5"	50	
		End of Log					
5	-5.0						
6	-6.0						
7	-7.0						
8	-8.0						

Penetration / Strength Results
Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity: 10 20 30 40
15.1
12.2
6.5
7.4
6.3
6.6

Well Details
36" Locking Vault
3/8" Bentonite Pellets
#10 Well Slot Sand
2" PVC Screen

Groundwater Conditions
July 2023

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW9D

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-04
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.19361
Easting: -79.394363
Ground Surface Elevation: 0

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
	1.0						
0	0.0	**Fill** Sity sand to clayey silt, trace grey clay seams. Firm, brown and red, moist.	1	SS	3 2 5 9	7	
1	-1.0	...sand silt, trace red shale fragments, trace gravel. Dense.	2	SS	10 14 18 28	32	
		Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	36 43 50-3"	50	
2	-2.0		4	SS	26 36 44 50-4"	50	
3	-3.0		5	SS	50-4"	50	
4	-4.0		6	SS	50-5"	50	
			7	SS	50-6"	50	
5	-5.0		8	SS	50-6"	50	
6	-6.0		9	SS	50-3"	50	
7	-7.0						
8	-8.0	**Shale** Highly weathered, very dense, red, dry.	10	CORE			

Penetration / Strength Results
Undrained Shear Strength Values (kPa): 40 80 120 160
Penetration Test Values (Blows / 0.3m): 20 40 60 80

Moisture / Plasticity
PL MC LL
Moisture / Plasticity: 10 20 30 40
10.0 (Number 1)
10.0 (Number 2)
10.0 (Number 3)
10.0 (Number 4)
10.0 (Number 5)
10.0 (Number 6)
10.0 (Number 7)
10.0 (Number 8)
10.0 (Number 9)

Well Details
3/8" Bentonite Pellets

Groundwater Conditions
36" Locking Vault
July 2023

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW9D

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-04
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.19361
Easting: -79.394363
Ground Surface Elevation: 0

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Undrained Shear Strength Values (kPa) 40 80 120 160 / Penetration Test Values (Blows / 0.3m) 20 40 60 80	Moisture / Plasticity PL MC LL / Moisture / Plasticity 10 20 30 40	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
9		-9.0								#10 Well Slot Sand			
			Shale Highly weathered, very dense, red, dry.	11	CORE								
10		-10.0											
			Shale Highly weathered, very dense, red, dry.	12	CORE								
11		-11.0											
12		-12.0	End of Log							2" PVC Screen			
13		-13.0											
14		-14.0											
15		-15.0											
16		-16.0											
17		-17.0											
18		-18.0											

Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

APPENDIX C

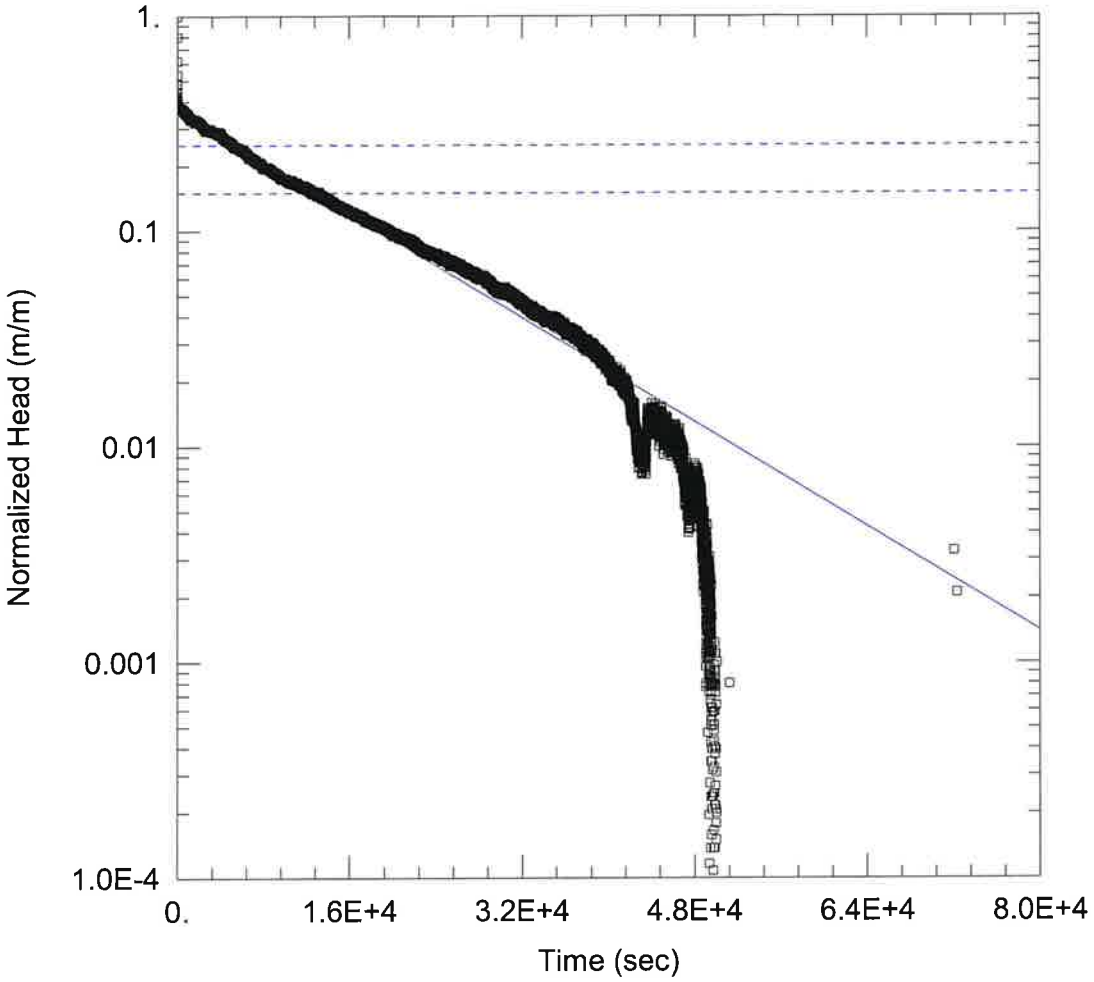
SUMMARY OF MECP WELLS RECORDS

Summary of MECP Well Records

Well #	WELL_ID	DIAMETER (inches)	DATE_COMPLETED	DATE_RECEIVED	EAST83	NORTH83	WATER_FOUND_DEPTH (FT)	Static Water Level (ft)	KIND	FINAL_STATUS	USE_1ST	USE_2ND	DEPTH_TO (ft)	DEPTH_TO (m)	Well Construction	STREET	CITY/TOWNSHIP
1	3800146	6	19-Aug-46	18-Feb-47	629558.8	4783513	6	6	Fresh	Water Supply	Livestock	NA	25	7.62	Overburden	NA	Lincoln
2	3800604	8	13-Mar-51	31-Oct-51	630859.8	4782799	87	18	Fresh	Water Supply	Commercial	NA	90	27.44	Bedrock	NA	Lincoln
3	3802888	36.0	16-Jul-81	12-Jan-82	629574.8	4783403	25	15	Fresh	Water Supply	Domestic	NA	28	8.54	Bedrock	NA	Lincoln
4	3803799	6	08-May-97	18-Dec-97	630231.8	4782884	65	18	Fresh	Abandoned Water Supply	Not Used	NA	77	23.48	Bedrock	NA	Lincoln

APPENDIX D

HYDRAULIC CONDUCTIVITY TESTING ANALYSIS RESULTS



HDROGEOLOGICAL INVESTIGATION

Data Set: M:\...\MW23-3S.aqt
Date: 11/16/23 Time: 09:22:33

PROJECT INFORMATION

Company: Landtek Limited
Client: Vic Court Globizen LP
Project: 23015
Location: 4933 Victoria Ave. N. Vineland
Test Well: MW23-3S
Test Date: October 23, 2023

AQUIFER DATA

Saturated Thickness: 2.6 m Anisotropy Ratio (Kz/Kr): 1.

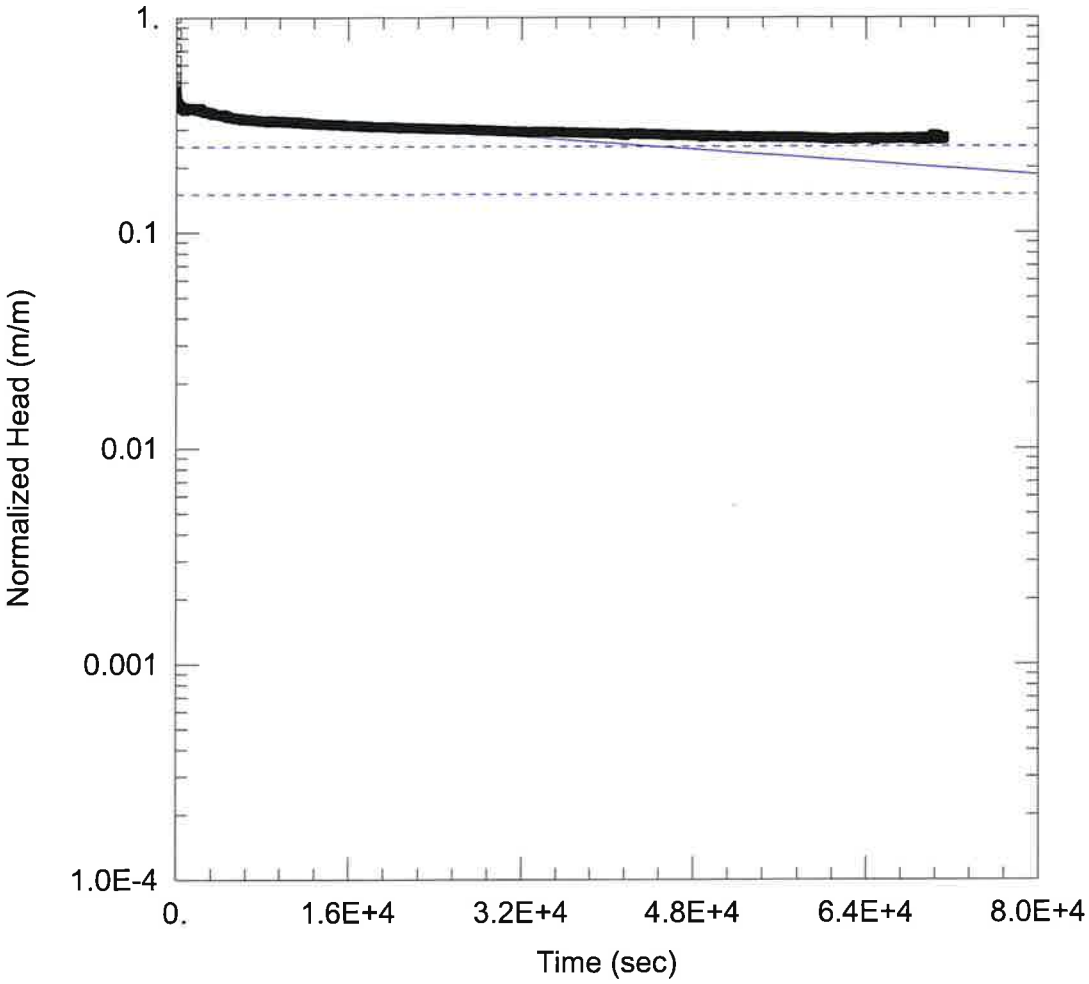
WELL DATA (MW23-3S)

Initial Displacement: 0.3744 m
Total Well Penetration Depth: 2.6 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.6 m
Screen Length: 2.6 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Confined Solution Method: Hvorslev

K = 4.572E-8 m/sec y0 = 0.137 m



HDROGEOLOGICAL INVESTIGATION

Data Set: M:\...\MW23-8S.aqt
Date: 11/16/23 Time: 09:23:00

PROJECT INFORMATION

Company: Landtek Limited
Client: Vic Court Globizen LP
Project: 23015
Location: 4933 Victoria Ave. N. Vineland
Test Well: MW23-8S
Test Date: October 23, 2023

AQUIFER DATA

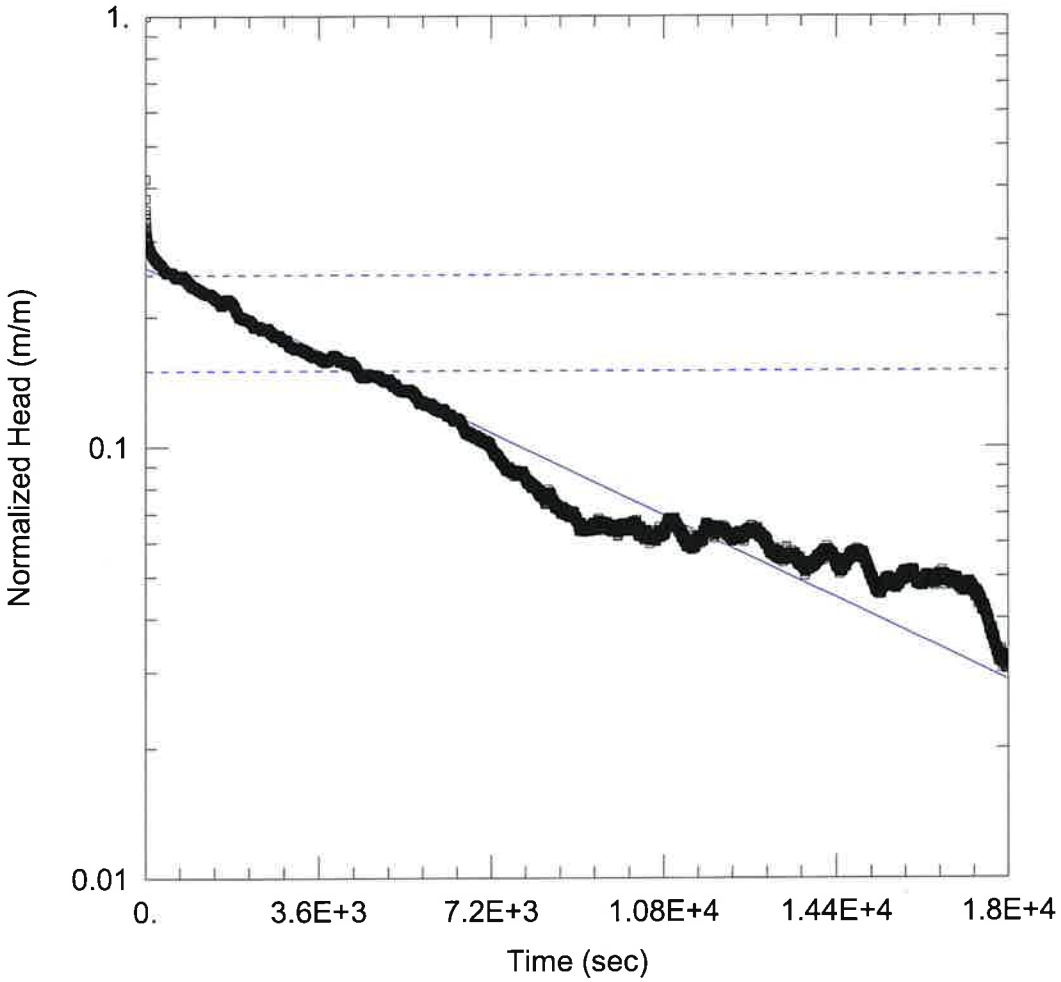
Saturated Thickness: 1.95 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW23-8S)

Initial Displacement: 0.4077 m
Total Well Penetration Depth: 1.95 m
Casing Radius: 0.0254 m
Static Water Column Height: 1.95 m
Screen Length: 1.95 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 7.468E-9 m/sec
y0 = 0.1489 m



HDROGEOLOGICAL INVESTIGATION

Data Set: M:\...\MW23-9S.aqt
Date: 11/16/23 Time: 09:23:22

PROJECT INFORMATION

Company: Landtek Limited
Client: Vic Court Globizen LP
Project: 23015
Location: 4933 Victoria Ave. N. Vineland
Test Well: MW23-9S
Test Date: October 23, 2023

AQUIFER DATA

Saturated Thickness: 2.14 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW23-9S)

Initial Displacement: 0.3991 m
Total Well Penetration Depth: 2.14 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.14 m
Screen Length: 2.14 m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Confined
Solution Method: Hvorslev
K = 9.772E-8 m/sec
y0 = 0.1037 m

APPENDIX E

LABORATORY CERTIFICATE OF ANALYSIS

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
RELIABLE.

1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Landtek Limited
205 Nebo Road, Unit 3
Hamilton, ON L8W 2E1
Attn: Henry Erebor

Client PO:
Project: 23015
Custody: 143058

Report Date: 31-Oct-2023
Order Date: 24-Oct-2023

Order #: 2343161

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2343161-01	MW23-3S
2343161-02	MW23-4S
2343161-03	MW23-8S

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC	26-Oct-23	26-Oct-23
Biochemical Oxygen Demand	SM 5210B - DO Probe	26-Oct-23	31-Oct-23
Cyanide, total	MOE E3015 - Auto Colour	26-Oct-23	26-Oct-23
Mercury by CVAA	EPA 245.2 - Cold Vapour AA	27-Oct-23	30-Oct-23
Metals, ICP-MS	EPA 200.8 - ICP-MS	27-Oct-23	27-Oct-23
Niagara - San/Comb: VOCs	EPA 624 - P&T GC-MS	27-Oct-23	27-Oct-23
Oil & Grease, mineral/synthetic	SM5520F - Gravimetric	31-Oct-23	31-Oct-23
Oil & Grease, total	SM5520B - Gravimetric, hexane soluble	31-Oct-23	31-Oct-23
pH	EPA 150.1 - pH probe @25 °C	27-Oct-23	27-Oct-23
Phenolics	EPA 420.2 - Auto Colour, 4AAP	26-Oct-23	26-Oct-23
Phosphorus, total, water	EPA 365.4 - Auto Colour, digestion	27-Oct-23	27-Oct-23
Sulphide	SM 4500SE - Colourimetric	30-Oct-23	31-Oct-23
Total Kjeldahl Nitrogen	EPA 351.2 - Auto Colour, digestion	27-Oct-23	27-Oct-23
Total Suspended Solids	SM 2540D - Gravimetric	28-Oct-23	28-Oct-23

Summary of Criteria Exceedances

(If this page is blank then there are no exceedances)

Only those criteria that a sample exceeds will be highlighted in red

Regulatory Comparison:

Paracel Laboratories has provided regulatory guidelines on this report for informational purposes only and makes no representations or warranties that the data is accurate or reflects the current regulatory values. The user is advised to consult with the appropriate official regulations to evaluate compliance. Sample results that are highlighted have exceeded the selected regulatory limit. Calculated uncertainty estimations have not been applied for determining regulatory exceedances.

Sample	Analyte	MDL / Units	Result	Sewer Use - Niagara: San/Comb	-

Certificate of Analysis

Report Date: 31-Oct-2023

Client: **Landtek Limited**

Order Date: 24-Oct-2023

Client PO:

Project Description: 23015

	Client ID:	MW23-3S	MW23-4S	MW23-8S	-	**Criteria:**	
	Sample Date:	24-Oct-23 14:30	24-Oct-23 15:10	24-Oct-23 15:40	-	**Sewer Use -**	-
	Sample ID:	2343161-01	2343161-02	2343161-03	-	**Niagara: San/Comb**	
	Matrix:	Ground Water	Ground Water	Ground Water	-		
	MDL/Units						
General Inorganics							
BOD	2 mg/L	5	3	2	-	300 mg/L	-
Cyanide, total	0.01 mg/L	<0.01	<0.01	<0.01	-	1 mg/L	-
pH	0.1 pH Units	7.6	7.6	7.2	-	6.00 - 11.00 pH Units	-
Phenolics	0.001 mg/L	<0.001	<0.001	<0.001	-	1 mg/L	-
Phosphorus, total	0.01 mg/L	0.03	0.04	0.02	-	10 mg/L	-
Total Suspended Solids	2 mg/L	263	260	182	-	350 mg/L	-
Sulphide	0.02 mg/L	<0.02	<0.02	<0.02	-	1 mg/L	-
Total Kjeldahl Nitrogen	0.1 mg/L	0.4	0.2	0.3	-	100 mg/L	-
Anions							
Fluoride	0.1 mg/L	<0.1	<0.1	<0.1	-	10 mg/L	-
Sulphate	1 mg/L	82	227	382	-	1500 mg/L	-
Metals - Total							
Antimony	0.001 mg/L	<0.001	<0.001	<0.001	-	5 mg/L	-
Arsenic	0.01 mg/L	<0.01	<0.01	<0.01	-	1 mg/L	-
Cadmium	0.001 mg/L	<0.001	<0.001	<0.001	-	0.7 mg/L	-
Chromium	0.05 mg/L	<0.05	<0.05	<0.05	-	3 mg/L	-
Cobalt	0.001 mg/L	<0.001	<0.001	0.001	-	5 mg/L	-
Copper	0.005 mg/L	<0.005	<0.005	<0.005	-	3 mg/L	-
Lead	0.001 mg/L	<0.001	<0.001	<0.001	-	1 mg/L	-
Mercury	0.0001 mg/L	<0.0001	<0.0001	<0.0001	-	0.01 mg/L	-
Molybdenum	0.005 mg/L	0.010	0.009	0.008	-	5 mg/L	-
Nickel	0.005 mg/L	<0.005	<0.005	<0.005	-	2 mg/L	-
Selenium	0.005 mg/L	<0.005	<0.005	<0.005	-	1 mg/L	-
Silver	0.001 mg/L	<0.001	<0.001	<0.001	-	5 mg/L	-
Tin	0.01 mg/L	<0.01	<0.01	0.01	-	5 mg/L	-

	Client ID:	MW23-3S	MW23-4S	MW23-8S	-	Criteria:	
	Sample Date:	24-Oct-23 14:30	24-Oct-23 15:10	24-Oct-23 15:40	-	Sewer Use -	-
	Sample ID:	2343161-01	2343161-02	2343161-03	-	Niagara: San/Comb	
	Matrix:	Ground Water	Ground Water	Ground Water	-		
	MDL/Units						
Metals - Total							
Zinc	0.02 mg/L	<0.02	<0.02	<0.02	-	3 mg/L	-
Volatiles							
Benzene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	0.01 mg/L	-
Chloroform	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	0.04 mg/L	-
1,2-Dichlorobenzene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	0.05 mg/L	-
1,4-Dichlorobenzene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	0.8 mg/L	-
Ethylbenzene	0.0005 mg/L	0.0012	<0.0005	<0.0005	-	0.16 mg/L	-
Methylene Chloride	0.0050 mg/L	<0.0050	<0.0050	<0.0050	-	0.21 mg/L	-
1,1,2,2-Tetrachloroethane	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	0.04 mg/L	-
Tetrachloroethylene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	0.05 mg/L	-
Toluene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	0.2 mg/L	-
Trichloroethylene	0.0005 mg/L	<0.0005	<0.0005	0.0012	-	0.05 mg/L	-
o-Xylene	0.0005 mg/L	<0.0005	<0.0005	<0.0005	-	0.52 mg/L	-
4-Bromofluorobenzene	Surrogate	83.0%	90.2%	94.8%	-	-	-
Dibromofluoromethane	Surrogate	101%	104%	106%	-	-	-
Toluene-d8	Surrogate	100%	112%	110%	-	-	-
Hydrocarbons							
Oil & Grease, animal/vegetable	0.678 mg/L	-	-	0.882	-	150 mg/L	-
Oil & Grease, animal/vegetable	0.5 mg/L	1.04	0.617	-	-	150 mg/L	-
Oil & Grease, mineral/synthetic	0.5 mg/L	<0.5	<0.5	<0.7	-	15 mg/L	-
Oil & Grease, total	0.5 mg/L	1.0	0.6	0.9	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Fluoride	ND	0.1	mg/L					
Sulphate	ND	1	mg/L					
General Inorganics								
BOD	ND	2	mg/L					
Cyanide, total	ND	0.01	mg/L					
Phenolics	ND	0.001	mg/L					
Phosphorus, total	ND	0.01	mg/L					
Total Suspended Solids	ND	2	mg/L					
Sulphide	ND	0.02	mg/L					
Total Kjeldahl Nitrogen	ND	0.1	mg/L					
Hydrocarbons								
Oil & Grease, mineral/synthetic	ND	0.5	mg/L					
Oil & Grease, total	ND	0.5	mg/L					
Metals - Total								
Antimony	ND	0.001	mg/L					
Arsenic	ND	0.01	mg/L					
Cadmium	ND	0.001	mg/L					
Chromium	ND	0.05	mg/L					
Cobalt	ND	0.001	mg/L					
Copper	ND	0.005	mg/L					
Lead	ND	0.001	mg/L					
Mercury	ND	0.0001	mg/L					
Molybdenum	ND	0.005	mg/L					
Nickel	ND	0.005	mg/L					
Selenium	ND	0.005	mg/L					
Silver	ND	0.001	mg/L					
Tin	ND	0.01	mg/L					
Zinc	ND	0.02	mg/L					
Volatiles								
Benzene	ND	0.0005	mg/L					
Chloroform	ND	0.0005	mg/L					
1,2-Dichlorobenzene	ND	0.0005	mg/L					

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
1,4-Dichlorobenzene	ND	0.0005	mg/L					
Ethylbenzene	ND	0.0005	mg/L					
Methylene Chloride	ND	0.0050	mg/L					
1,1,2,2-Tetrachloroethane	ND	0.0005	mg/L					
Tetrachloroethylene	ND	0.0005	mg/L					
Toluene	ND	0.0005	mg/L					
Trichloroethylene	ND	0.0005	mg/L					
o-Xylene	ND	0.0005	mg/L					
Surrogate: 4-Bromofluorobenzene	*0.0798*		*%*	*99.8*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0771*		*%*	*96.4*	*50-140*			
Surrogate: Toluene-d8	*0.0934*		*%*	*117*	*50-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Fluoride	ND	0.1	mg/L	ND			NC	20	
Sulphate	35.5	1	mg/L	35.3			0.6	10	
General Inorganics									
BOD	352	2	mg/L	358			1.7	20	
Cyanide, total	ND	0.01	mg/L	ND			NC	20	
pH	7.9	0.1	pH Units	7.9			0.6	3.3	
Phenolics	ND	0.001	mg/L	ND			NC	10	
Phosphorus, total	ND	0.01	mg/L	ND			NC	15	
Total Suspended Solids	17100	40	mg/L	17000			0.8	10	
Sulphide	ND	0.02	mg/L	ND			NC	10	
Total Kjeldahl Nitrogen	0.23	0.1	mg/L	0.25			6.8	16	
Metals - Total									
Antimony	ND	0.001	mg/L	ND			NC	20	
Arsenic	ND	0.01	mg/L	ND			NC	20	
Cadmium	ND	0.001	mg/L	ND			NC	20	
Chromium	ND	0.05	mg/L	ND			NC	20	
Cobalt	0.009	0.001	mg/L	0.010			14.5	20	
Copper	0.009	0.005	mg/L	0.011			15.8	20	
Lead	0.006	0.001	mg/L	0.007			8.0	20	
Mercury	0.0001	0.0001	mg/L	0.0001			0.0	20	
Molybdenum	ND	0.005	mg/L	ND			NC	20	
Nickel	0.017	0.005	mg/L	0.020			13.4	20	
Selenium	ND	0.005	mg/L	ND			NC	20	
Silver	ND	0.001	mg/L	ND			NC	20	
Tin	ND	0.01	mg/L	ND			NC	20	
Zinc	0.051	0.02	mg/L	0.058			13.1	20	
Volatiles									
Benzene	ND	0.0005	mg/L	ND			NC	30	
Chloroform	ND	0.0005	mg/L	ND			NC	30	
1,2-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,4-Dichlorobenzene	ND	0.0005	mg/L	ND			NC	30	
Ethylbenzene	ND	0.0005	mg/L	ND			NC	30	
Methylene Chloride	ND	0.0050	mg/L	ND			NC	30	
1,1,2,2-Tetrachloroethane	ND	0.0005	mg/L	ND			NC	30	
Tetrachloroethylene	ND	0.0005	mg/L	ND			NC	30	
Toluene	ND	0.0005	mg/L	ND			NC	30	
Trichloroethylene	0.0010	0.0005	mg/L	0.0010			2.1	30	
o-Xylene	ND	0.0005	mg/L	ND			NC	30	
Surrogate: 4-Bromofluorobenzene	*0.0747*		*%*		*93.4*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0780*		*%*		*97.5*	*50-140*			
Surrogate: Toluene-d8	*0.0868*		*%*		*109*	*50-140*			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Fluoride	0.92	0.1	mg/L	ND	91.6	70-130			
Sulphate	44.9	1	mg/L	35.3	96.2	74-126			
General Inorganics									
BOD	181	2	mg/L	ND	90.6	71-121			
Cyanide, total	0.042	0.01	mg/L	ND	84.9	64-136			
Phenolics	0.027	0.001	mg/L	ND	107	67-133			
Phosphorus, total	1.04	0.01	mg/L	ND	104	80-120			
Total Suspended Solids	22.0	2	mg/L	ND	102	75-125			
Sulphide	0.50	0.02	mg/L	ND	99.8	79-115			
Total Kjeldahl Nitrogen	1.25	0.1	mg/L	0.25	100	81-126			
Hydrocarbons									
Oil & Grease, mineral/synthetic	7.70	0.5	mg/L	ND	77.0	65-110			
Oil & Grease, total	18.4	0.5	mg/L	ND	91.8	85-110			
Metals - Total									
Arsenic	56.5	0.01	mg/L	0.643	112	80-120			
Cadmium	45.6	0.001	mg/L	0.015	91.2	80-120			
Chromium	60.1	0.05	mg/L	2.15	116	80-120			
Cobalt	56.6	0.001	mg/L	1.01	111	80-120			
Copper	53.8	0.005	mg/L	1.10	105	80-120			
Lead	44.4	0.001	mg/L	0.675	87.4	80-120			
Mercury	0.0027	0.0001	mg/L	0.0001	85.2	70-130			
Molybdenum	55.0	0.005	mg/L	0.452	109	80-120			
Nickel	56.5	0.005	mg/L	1.97	109	80-120			
Selenium	46.3	0.005	mg/L	0.220	92.2	80-120			
Silver	43.0	0.001	mg/L	0.074	85.8	80-120			
Tin	47.1	0.01	mg/L	0.596	93.0	80-120			
Zinc	54.3	0.02	mg/L	5.80	97.0	80-120			
Volatiles									
Benzene	0.0328	0.0005	mg/L	ND	82.1	60-130			
Chloroform	0.0369	0.0005	mg/L	ND	92.4	60-130			

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
1,2-Dichlorobenzene	0.0313	0.0005	mg/L	ND	78.4	60-130			
1,4-Dichlorobenzene	0.0301	0.0005	mg/L	ND	75.3	60-130			
Ethylbenzene	0.0421	0.0005	mg/L	ND	105	60-130			
Methylene Chloride	0.0395	0.0050	mg/L	ND	98.8	60-130			
1,1,2,2-Tetrachloroethane	0.0445	0.0005	mg/L	ND	111	60-130			
Tetrachloroethylene	0.0423	0.0005	mg/L	ND	106	60-130			
Toluene	0.0426	0.0005	mg/L	ND	106	60-130			
Trichloroethylene	0.0330	0.0005	mg/L	ND	82.5	60-130			
o-Xylene	0.0440	0.0005	mg/L	ND	110	60-130			
Surrogate: 4-Bromofluorobenzene	*0.0453*		*%*		*56.7*	*50-140*			
Surrogate: Dibromofluoromethane	*0.0741*		*%*		*92.6*	*50-140*			
Surrogate: Toluene-d8	*0.0432*		*%*		*54.0*	*50-140*			

Certificate of Analysis

Report Date: 31-Oct-2023

Client: **Landtek Limited**

Order Date: 24-Oct-2023

Client PO:

Project Description: 23015

Qualifier Notes:

Sample Data Revisions:

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

PARACEL LABORATORIES LTD.

Paracel ID: 2343161

Paracel Order Number (Lab Use Only)	Chain Of Custody (Lab Use Only)
2343161	№ 143058

Page 1 of 1

Client Name:	LANDTEK LIMITED
Contact Name:	HENRY ERERER
Address:	205 NEBO ROAD HAMILTON, ON
Telephone:	289-880-3992
Project Ref:	23015
Quote #:	
PO #:	
E-mail:	henry@landtek.ca

Turnaround Time

☐ 1 day ☐ 3 day

☐ 2 day ☒ Regular

Date Required: _____

☐ REG 153/04 ☐ REG 406/19

☐ Table 1 ☐ Res/Park ☐ Med/Fine

☐ Table 2 ☐ Ind/Comm ☐ Coarse

☐ Table 3 ☐ Agri/Other

☐ Table ___

For RSC: ☐ Yes ☐ No

Other Regulation

☐ REG 558 ☐ PWQO

☐ CCME ☐ MISA

☒ SU - Sani ☒ SU - Storm

Mun: NIAGARA

☐ Other:

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	NIAGARA	SAN + STORM			
1	MW 23-3S	GW		11	24-Oct-23	2330								X	X			
2	MW 23-4S	GW		↓	↓	3:10								X	X			
3	MW 23-8S	GW		↓	↓	3:40								X	X			
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: Walk In

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab: HP	Verified By: dm
Relinquished By (Print): JINSUK O	Date/Time: 10/24/23 1626	Date/Time: Oct 26, 23 9:15	Date/Time: 10/25/23 932
Date/Time: 2023-10-24 4:26pm	Temperature: 19.4 °C	Temperature: 10.8, 9.5 °C	pH Verified: ☑ By: dm

APPENDIX F

DEWATERING ASSUMPTIONS AND CALCULATIONS – UNDERGROUND PARKING LEVEL

Table 1 – Dewatering Calculations – Underground Level Excavation

$$Q = \pi K (H^2 - h_w^2)/\ln (R_o/r_e)$$

Equation 1: The potential groundwater flow rate to the excavation for the proposed underground levels was estimated using the dewatering equation for a fully penetrated well of unconfined aquifer fed by circular source (Powers, et al., 2007).

Where: Q = pumping rate (m^3/s)
K = hydraulic conductivity (m/s)
H = saturated thickness of the aquifer before dewatering (m)
h_w = saturated thickness of the aquifer after dewatering (m)
R = radius of cone of depression (m)
r_e = equivalent radius (m)
C = 3000

R = C*(H – h)*√(K) Radius of Influence - Sichardt's equation

$r_e = \sqrt{(L * B)}/\pi$ (applies when a/b>1.5 and R0 << rs)

$r_e = (L + B)/\pi$ (applies when a/b<1.5 and R0 >>rs)

Approximate dimensions of the Underground Level Parking: 210.0 m x 65.5 m.

Underground Level P1	H (m)	h_w (m)	R (m)	r_e (m)	Q (m3/s)	Q (L/day)	Q (L/day) (1.5 Factor of Safety	Q (L/s) (1.5 Factor of Safety
	9.82	7.4	1.3	66.0	2.16 x 10-4	~18,662	~27,993	~0.32

Assumptions for hydrogeological setting:

1. An unconfined aquifer is presumed to exist locally with the existing water table determined to be 2.18 mbgs and extending to a depth of 12.0 mbgs.
2. An ideal aquifer is assumed for the preliminary calculations of pumping rates and drawdown, as described by Powers, et al., 2007).
3. The maximum dewatering depth of construction activities is assumed to be 4.6 mbgl (0.5 m below bottom of excavation).
4. It is assumed that as a requirement of the proposed construction activities the excavation will be pumped dry.
5. The geometric mean of the hydraulic conductivity values for the bedrock beneath the site was determined to be 3.219 x 10^{-8} m/s