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HYDROGEOLOGICAL REPORT

AT

0 SCUGOG LINE 6,
PORT PERRY, ON
PROJECT NUMBER: 20210907

PREPARED FOR:

Wanlong Real Estate Development Ltd.
(Property Owner)

October 17th, 2025

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1. Executive Summary

King EPCM (the Engineer) was retained by Wanlong Real Estate Development Ltd. (the Client and Property Owner) for geotechnical and environmental engineering services, including the creation of a Hydrogeological Report. The property located at 0 Scugog Line 6, Lot 14, Port Perry, Ontario (the Site). It is understood that the hydrogeological report is for the sole purpose of the application and construction of a 12-lot industrial subdivision and new driveway. This report is to be submitted to the Township of Scugog (Port Perry), Kawartha Region Conservation Authority (KRCA), and Regional Municipality of Durham (Durham Region).

The proposed project is composed of 12 lot industrial blocks, including new driveways, post-development Total Impervious Surface Area (TIMP) = 22.0 ha = 42.4%. New buildings and warehouses are proposed for each block with a total area of 25%, in addition to 20% for interior roads, 25% for parking lots, and 30% for landscaping/septics.

The site property was located on the north side of Scugog Line 6 Road between Easy St. and North Port Rd, east of Highway 7, in the southern half of Lot 14. The Site is in the agricultural land, with industrial/commercial structures to the north, west and east, and with an agricultural area south of the Scugog Line 6. The site materials are mainly compacted clay with low permeability and only in the northwestern part, there is an upper sand layer above the bottom clay soils. Due to the multiple aquifer protection area/groundwater recharge area designation for the property, thirteen boreholes were drilled at the site in December 2021. Four new boreholes to measure the in-situ permeability using Pask Permeameter Apparatus were drilled on December 13 and 15, 2021.

The property is located at the eastern boundary of the Nonquon River Subwatershed, with a general stratigraphy consisting of clay down to significant depths (below 12m). Groundwater is a deep unconfined sand aquifer, at approximately 190 masl, or 73 m below the surface while a local aquifer and groundwater elevation for the site is estimated to be around 250 m above mean sea level.

The Water Quality Risk Assessment for the twelve-block industrial development was completed in accordance with MECP Procedure D-5-4. All blocks exceed one hectare, satisfying Step 1. The Site is underlain by dense clay and silt with a shallow perched groundwater system over a deeper unconfined aquifer, providing natural hydrogeologic isolation. A nitrate dilution analysis confirmed compliance with the 10 mg/L nitrate-N limit, verifying that septic effluent will not adversely impact groundwater quality.

The thirteen boreholes and monitoring wells show that there is shallow perched groundwater. An in-situ infiltration test recommends a factored engineering design infiltration rate of 4.8 mm/hour rate. The two proposed Low Impact Developments (LID) were designed to receive 1:100-year (major) storms from most of the proposed impervious surface areas.

The proposed development increases the TIMP from 0% to 42.4%. When comparing pre-development and post-development with Low Impact Development (LID) mitigation measures in place, the water balance changes are +122.7% in total infiltration rate and -9.0% in total runoff rate.

Overall, it is the Engineer's opinion that the proposed construction of industrial buildings, warehouses, parking lots and roads combined with proposed LID mitigation measures do not expect to cause adverse changes to the groundwater quality or quantity.

2. Project Description

King EPCM (the Engineer) was retained by Wanlong Real Estate Development Ltd. (the client and property owner) for geotechnical and environmental engineering services, including the creation of a hydrogeological report. The property was located at 0 Scugog Line 6, Lot 14, Port Perry, Ontario (the Site; Figures 1 and 2). It is understood that the hydrogeological report is for the sole purpose of the application and construction of a 12-lot industrial subdivision and new driveway. This report is to be submitted to the Township of Scugog (Port Perry), Kawartha Region Conservation Authority (KRCA), and Regional Municipality of Durham (Durham Region).

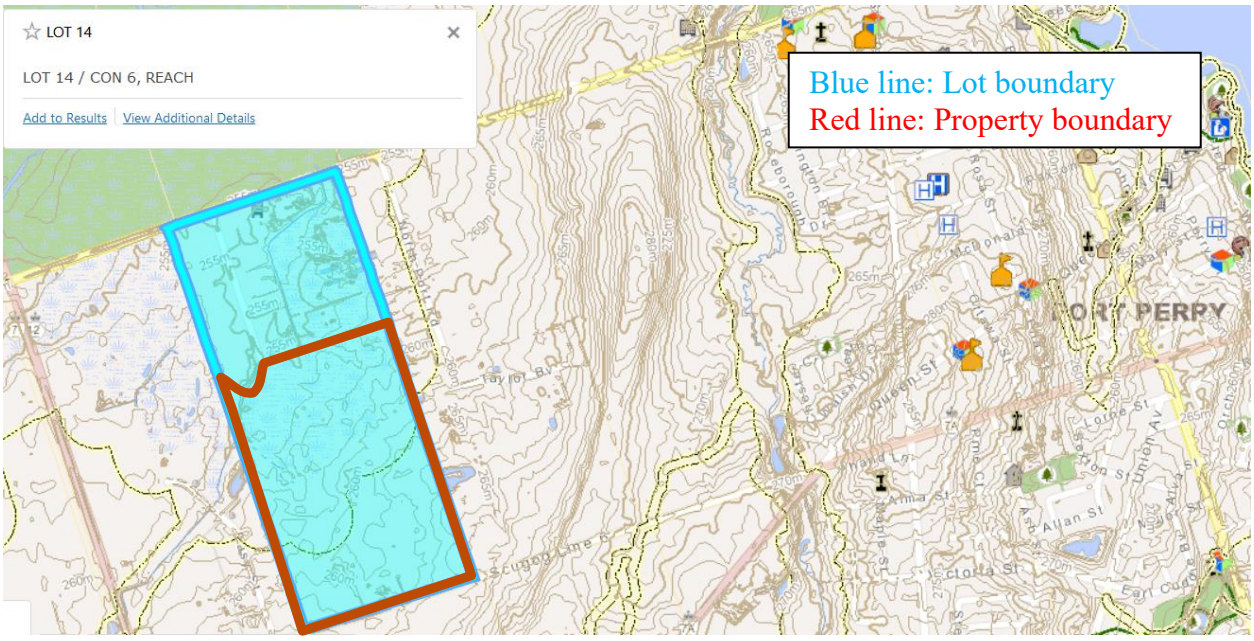


Figure 1 – Topographic map of 0 Scugog Line 6, Port Perry, ON (Regional Municipality of Durham, 2023)

The proposed project is to construct a new industrial park on an agricultural field, containing 12 separate blocks for development with different dimensions. New buildings and warehouses are proposed for each block with a total area of 25%, 20% for interior roads, 25% for parking lots, and 30% for landscaping/septics. The proposed industrial park UTM coordinates are 661,719E; and 4,884,633N.

Significant driveway lengths will be constructed on the site property, with site property post-development Total Impervious Surface Area (TIMP) = 22.2 ha / 42.4%.

The site property located on the north side of Scugog Line 6 Road between Easy St. and North Port Rd, east of Highway 7, in the southern half of Lot 14. The Site is in the agricultural land, with industrial/commercial structures to the north, west and east, and with an agricultural area south of the Scugog Line 6. The water services of the proposed subdivision will be managed by the Regional Municipality of Durham (Durham Region) but the blocks will have an on-site septic system.

The Durham Regional Official Plan (ROP) designates the subject property as an 'Employment Area' within the Urban System, encompassing approximately 52.0 hectares (129 acres). The proposed subdivision will be serviced by municipal water with on-site septic systems. Durham Region also requires the installation of a sanitary sewer main within the municipal right-of-way (ROW), providing the opportunity for future connection to the municipal sanitary sewer system.

The proposed plan includes salvage yards in Block 10, situated northeast corner of the Site, which may pose a high risk to groundwater according to the Region's Official Plan. Consequently, a solution to mitigate this risk needs to be explored and considered.

The material of the southeastern part of the site was mainly compacted clay with low permeability, but to the northwest, there were silt/loam materials with high permeability. The site materials are mainly compacted clay with low permeability and only in the northwestern part, there is an upper sand layer above the bottom clay soils, in the northwestern corner of the site, where the external waterway crosses, the material of the bed under the topsoil is silt.

There were two small ditches in the northwestern and southwestern part of the site property, which drained into a tributary connected to the Nonquon River, as well two small ditches located on the northern half of the eastern boundary, which joined the tributary in the north. There are two small ditches in the northwestern and southwestern part of the site property, which drain into a tributary connected to the Nonquon River, as well two small ditches located on the northern half of the eastern boundary, which join the tributary in the north (Figure 2). The subject lands are currently vacant, contain key natural heritage features, and are also partially regulated by the Kawartha Region Conservation Authority (KRCA).



Figure 2 –Aerial view of the site plan

3. Background Site Conditions

Background site conditions before development can be broken down into several groups of information:

3.1. Base Information

- Site servicing is rural private services, with only overhead powerlines services available.
- Water services at the property will be managed by the Regional Municipality of Durham (Durham Region).
- The majority of the Site contained corn crops and trees, with an open space by the entrance of the Site.
- Existing 33ha of agricultural land, 2.04ha of wetlands, and 17.3ha of woodland and hedgerow
- The proposed development is a 12-lot industrial subdivision containing 25% building and warehouse, 25% parking lot, 20% interior road and 30% landscape and septic, with 2.6ha new driveway while all wetlands and woodland areas outside of agricultural land remain.
- Construction is to be shallow building/warehouse and foundation work, with on-site backfill.
- Scugog's Zoning By-law zones the subject lands as M1 (H) – Prestige Industrial subject to a holding provision; M2 (H) – General Industrial subject to a holding provision (M2 (H)) and EP – Environmental Protection.

3.2. Topographic Elevation & Drainage

- This site was located within the Schomberg Clay Plains physiographic region, and it was low-lying with a shallow slope from southeast to northwest at a 1.25% gradient.
- Topographic information in Appendix III & site plan in Appendix VI
- The site is within the Nonquon River Subwatershed, with Clay and Loam Hydrologic Soil Group B/D.
- The Nonquon River has a well-defined seasonal pattern along its length, reflecting seasonal variations of water inflow. The highest flows are typically observed in March, which is generally caused by a spring freshet (snowpack thaw). However, in recent years high water levels caused by mid-winter thaw events have reached values that are comparable to those of the spring freshet on several occasions.
- There were two small ditches in the northwestern and southwestern part of the site property, which drained into a tributary connected to the Nonquon River, as well two small ditches located on the northern half of the eastern boundary, which joined the tributary in the north.
- Average annual precipitation reported 898 mm at Burketon McLaughlin, the nearest station located in the southeast of the Site in which yearly rainfall and snowfall were 774.1 and 135mm, respectively. September is generally the wettest month of the year whereas February is the driest (Appendix VII). Based on water balance model output cited in NONQUON RIVER SUBWATERSHED STUDY AND NONQUON INDUSTRIAL TRIBUTARY AREA, MASTER DRAINAGE PLAN, FINAL REPORT, Oct 2005; reported total precipitation 898 mm/year and actual evapotranspiration 567 mm/year, respectively that were used in this study.
- The Nonquon River is the largest watershed flowing into Lake Scugog. This river is the largest tributary of Lake Scugog and is approximately 35% of the total Lake Scugog watershed contributing area. The Nonquon River headwaters are located in the Oak Ridges Moraine at an elevation of 304.8 meters above sea level (masl) in the Township of Scugog, flowing north to Lake Scugog. The majority of this watershed (80%) is located within the Peterborough Drumlin Field. Approximately 5% of this watershed lies within the Oak Ridges Moraine and 15% of the land area lies within the Schomberg Clay Plains, including properties north of Scugog Line 6 Rd., such as the subject site.
- The general surface drainage is towards the northwest of the site.
- Next to the offsite northern industrial complex sites, there was a small low wetland area within the northwest corner of the Site and a relatively low area by the north edge of the Site. There were trees in these areas, along with the waterway by the northwest corner to the north edge of the Site.
- Site survey plan and topographic information in Appendix I

3.3. MECP Well Records Database

- Twelve (12) separate well records were found surrounding the site property boundary.

- In general, shallow groundwater was encountered at 0-9.8 m. Shallow groundwater usually refers to water tables that occur within the first 10–15 m below ground surface. These zones are closely connected to surface processes, more vulnerable to contamination, and often influenced by precipitation and seasonal changes.
- Deep groundwater was encountered at an elevation of 190 masl (Well #4606250), corresponding to a depth of 73 m below ground surface, in the lands located south of Scugog Line 6.
- The site property and well records are within the Nonquon River Subwatershed and are characterized by clayey soils down to depths, however a shallow layer of sand was observed in northwestern and then switching into clay soils into depths, except a whole layer of silt soil was observed in a borehole located outside of the site boundary, near the stream.
- See Appendix I for MECP Well records within or near the Site.

Table 1 - MECP Well Records – Surrounding the site boundary

Well ID Number	Year of Construction	Relative Direction of New Development	Surface Soil Type	Other Materials near Surface	Found Groundwater below Grade (m)	End of Hole Depth (m)	Estimated Surface Elevation (masl)	Estimated Groundwater Static Elevation (masl)
1915285	2001	N	Gravel		9.8	13	256	246.2
1915419	2001	N	Sand		9.1	12.8	256	246.9
1915552	2002	N	Sand		7.3	7.3	256	248.7
7204111	2013	NW	Sand		0.6	N/A	255	254.4
1908760	1987	NW	Sand		1.5	3.7	255	253.5
1913784	1998	SW	Clay		9.1	26.5	264	254.9
7355739	2019	NE	Sand	Silt	2.3	4.6	260	257.7
7128584	2007	NE	Clay	Sand	9.8	11	260	250.2
1910887	1990	W	Clay	Sand	0	68.3	255	255
4606250	1975	S	Sand		73.2	77.1	263	189.8
1913785	1998	SW	N/A		-	-	-	-
1915379	2001	N	N/A		-	-	-	-

4. Boreholes & Monitoring Wells

Thirteen (13) boreholes were drilled at the site property by King EPCM (O. Reg 903 License C-7691) and then developed into monitoring wells (Figure 3). The standard sampling method (APEO, 1993) was used to collect soil samples at specified intervals. Detailed borehole drill logs are in Appendix II, while Table 3 below shows the summary. Groundwater has also been observed in all boreholes since drilling (Table 3) which almost correspond to the estimated groundwater elevation of wells within and surrounding the site boundary (Tables 1 and 2). See Appendix III to understand the relation between water table contours (groundwater piezometric surface) with topographic map contours.

Groundwater flows at right angles to the equipotential lines in the same way that water flowing down a slope would flow at right angles to the contour lines. The Site extends in a southeast-northwest direction, with a gentle slope following the same orientation. Borehole 113 shows the groundwater level at 254.6 masl (0.5 mbgl), which represents the lowest groundwater level in the northwest of the Site with several waterways and creeks flowing through the area. Based on the map, the groundwater flow direction is from southeast to northwest across the Site.



Figure 3 - Location of boreholes at 0 Scugog Line 6, Port Perry, ON

Table 2 - Borehole & Monitoring Well Summary

Borehole #	Date	Northing (UTM)	Easting (UTM)	Surface Elev (amsl)	Hole Depth (m)	Screen Elevations	Surface Soil type	Groundwater
101	06-Dec-2021	4,884,244.90	661,934.63	262.184	3.1	259.08-262.07	Clay	yes
102	07-Dec-2021	4,884,266.53	661,997	262.627	4	258.63-260.12	Clay	yes
103	07-Dec-2021	4,884,287.68	662,059.62	263.463	3.1	260.36-261.85	Clay	yes
104	08-Dec-2021	4,884,364.30	661,868	260.898	4	256.9-258.39	Clay	yes
105	09-Dec-2021	4,884,404.51	661,950	261.746	2.7	259.05-260.54	Clay	yes
106	15-Dec-2021	4,884,440.76	662,027	262.448	2.5	259.87-261.42	Clay	yes
107	08-Dec-2021	4,884,471.38	661,772	260.092	3.1	257-258.48	Clay	yes
108	09-dec-021	4,884,508.26	661,897.12	261.729	3	258.73-260.22	Clay	yes
109	09-Dec-2021	4,884,544.89	661,977	261.704	3	258.7-260.2	Clay	yes
110	14-Dec-2021	4,884,788.53	661,612.83	256.346	3.1	253.35-254.84	Sand	yes
111	14-Dec-2021	4,884,841.03	661,720.39	257.541	3.1	254.54-256.04	Sand	yes
112	14-Dec-2021	4,884,893.89	661,843	258.759	3	255.76-257.25	Clay	yes
113	13-Dec-2021	4,884,926.44	661,327.92	255.121	2.1	253-254.52	Silt	yes

The monitoring data confirm a shallow and fluctuating water table across the Site (Table 3), with groundwater levels ranging from approximately 260–262 masl to 253–257 masl and exhibiting a seasonal rise during spring 2022 followed by a decline in early summer. The water table is generally within 1.5 m of the ground surface, with seasonal fluctuations of about 0.5–1.0 m. These shallow conditions present significant challenges for infiltration-based LID measures, septic system feasibility, and basement foundation design, necessitating imported fill, engineered drainage, and advanced treatment systems to maintain compliance with MECP criteria.

A high seasonal groundwater table further reduces effective infiltration capacity, restricts available vertical separation (a minimum of 1.0 m is typically required), and increases the risk of groundwater mounding. Consequently, LID measures must be carefully planned and located, with many features requiring raised bottoms and underdrains to maintain adequate separation and ensure compliance with drawdown requirements.

Groundwater level hydrographs (Figure 4) clearly show a spring rise in groundwater levels followed by an early summer decline. The groundwater table is shallow across the site, fluctuating about 0.5–1.0 m seasonally, which presents constraints for septic design, stormwater management, and foundation construction.

Table 3 –Water-level measurements(m) in monitoring wells, December 2021, March, May & June 2022

Date		BH 101	BH 102	BH 103	BH 104	BH 105	BH 106	BH 107	BH 108	BH 109	BH 110	BH 111	BH 112	BH 113
*December 2021	GW depth	0.4	3.5	2.2	1.8	2.2	2.2	2.2	2.4	2.8	1.0	1.0	1.5	0.7
	GW Level	261.784	259.127	261.263	259.098	259.546	260.248	257.892	259.329	258.904	255.346	256.541	257.259	254.421
March 30, 2022	GW depth	1.3	0.9	1.2	0.4	0.8	1.0	1.1	1.0	1.0	1.2	1.3	1.7	0.5
	GW Level	260.884	261.727	262.263	260.498	260.946	261.448	258.992	260.729	260.704	255.146	256.241	257.059	254.621
May 30, 2022	GW depth	–	–	–	–	–	–	–	–	–	1.25	1.58	–	1.35
	GW Level	–	–	–	–	–	–	–	–	–	255.096	255.961	–	253.771
June 22, 2022	GW depth	1.27	0.68	1.15	0.06	0.80	1.12	1.29	1.37	1.06	+	1.53	1.73	0.54
	GW Level	260.914	261.947	262.313	260.838	260.946	261.328	258.802	260.359	260.644	+	255.920	257.029	254.580

** The recorded groundwater levels in December 2021 are related to the drilling day before the installation of the monitoring well corresponding to different days in December.*

+ The borehole was broken.

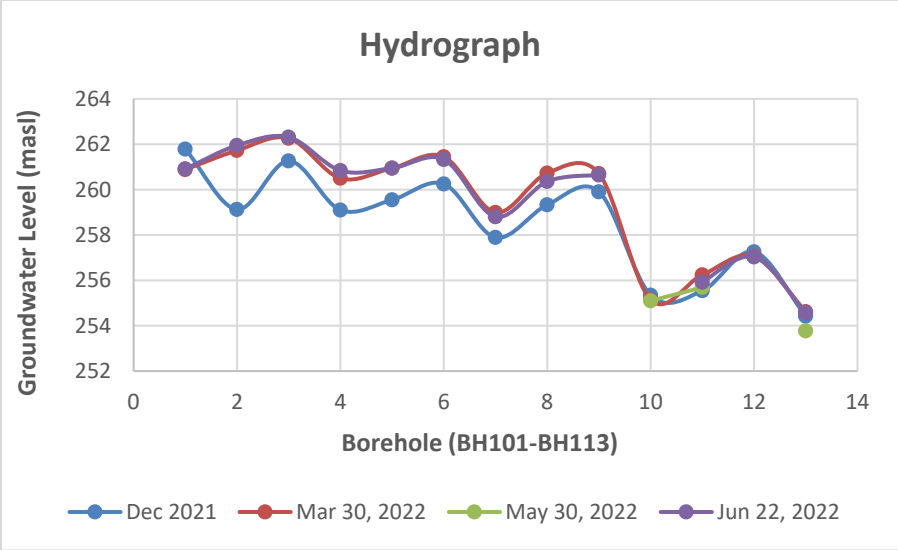


Figure 4- Groundwater level hydrographs (BH101–BH113) showing seasonal fluctuations, with a spring rise in 2022 followed by an early summer decline

5. In-situ Measurement of Field Saturated Hydraulic Conductivity

Based on two separate field visits dated December 13 and 15, 2021, "field-saturated" hydraulic conductivity (K_{fs}) was achieved using the "Constant Head Well Permeameter" (CHWP) method. K_{fs101} was conducted at BH101 while K_{fs106} at BH106, and K_{fs112} at BH112 using Engineering Technologies Canada (ETC) Slow Soils Pask Permeameter Apparatus. The "Constant Head Well Permeameter" (CHWP) method was described in Appendix IV in detail.

It is understood that the in-situ infiltration test was not tested at the actual LID bottom but based on sieve size analysis and borehole soil samples, it is in the Engineer's opinion as a geotechnical engineer that the soils perform similarly in hydrological infiltration potential.

The ETC Pask Permeameter is a convenient and easy-to-use apparatus for ponding a constant head of water in a well and simultaneously measuring the flow into the soil. The Kfs was calculated using Quick Field Reference Tables provided by (ETC, 2018) as:

K_{fs101}= 7.5E-9 m/sec = 7.5E-7 cm/sec
K_{fs106}= 6.2E-9 m/sec = 6.2E-7 cm/sec
K_{fs112}= 6.2E-9 m/sec = 6.2E-7 cm/sec

It should be noted that three tests (K_{fs101}, K_{fs106}, K_{fs112}) have a low permeability in clayey soils, while the fourth test (K_{fs107}) has a higher permeability for a thick upper sandy layer within massive clay soils.

K_{fs} were then corrected for temperature (t=4$^{\circ c}$ -7$^{\circ c}$):

K_{a101}=7.07E-9 m/sec = 7.07E-7 cm/sec
K_{a106}= 6.04E-9 m/sec = 6.04E-7 cm/sec
K_{a112}= 5.84E-9 m/sec = 5.84E-7 cm/sec

Correlations between Perc Time (PT) and field-saturated hydraulic conductivity (K_{fs}) are often used in the development of on-site water recycling and treatment facilities that operate by infiltration into unsaturated soil. Based on OMMAH (1997) interpolation, the measured infiltration rate may be interpolated as:

PT_{101} = 48.8 min / cm (Infiltration Rate = 12.3 mm/hour)

PT_{106} = 50.8 min / cm (Infiltration Rate = 11.8 mm/hour)

PT_{112} = 51.3 min / cm (Infiltration Rate = 11.7 mm/hour)

Considering that most of the new blocks under development are composed of clay materials and the substrate material of the upper sandy layer is composed of low permeability clay, like other parts of the

site, the slower infiltration rates from PT_{101}, PT_{106}, and PT_{112} may be used as representative of the permeability of the site. Therefore, the engineer's opinion is to trust the values obtained from the Ontario Ministry of Municipal Affairs and Housing (OMMAH; 1997), with an average unfactored infiltration rate of 11.9 mm/hour.

For a conservative approach to infiltration speeds, the Wisconsin Department of Natural Resources (2004) method shall be used for the calculation of a factored design infiltration rate and the Engineer's opinion is that the factored engineering design infiltration rate is 4.8 mm/hour, with a safety factor of 2.5. See Appendix IV for more details, the calculations and graphs provided.

6. Hydrostratigraphy

Based on borehole drill logs and historic well records, the site stratigraphy is estimated to be as follows:

- 0 – 0.3m Topsoil, no perched groundwater
- 0.3 – 2.0m Damp grey clay and silt
- 2.0 – 9.0m Grey wet clay, groundwater was encountered at 0-9.8 m within the property
- 9.0 – 9.5m Dark sand with groundwater
- 9.5 – 12.0m Grey clay
- 12.0 – 12.5m Sand and Gravel

Groundwater was encountered at depths of 0.4–3.5 m in the newly drilled boreholes, whereas historical well records for the property report groundwater at depths of 0–9.8 m. Given the comparable shallow depth ranges and the absence of identified confining layers, both datasets are interpreted to represent the same unconfined shallow aquifer system. The variation in groundwater depth is attributed to seasonal fluctuations, differences in ground surface elevations across well locations, and the broader ranges reported in historical records.

After reviewing all the historical well records within and near the site property, it is the Engineer's opinion that the site is mostly located within the Schomberg Clay Plains physiographic region and there are soils with very low infiltration rates in this site. The Schomberg Clay Plain physiographic region occupies 33.2 km^2 of the Nonquon River Watershed and extends along its eastern flanks. As referred to the central portion of the Nonquon River Subwatershed, Nonquon River Watershed, Characterization Report, 2012, has a deep unconfined sand aquifer, with nearly direct drainage from surface precipitation. To the northwest of the site property, there is a thick layer of sand approximately 50 – 70cm below topsoil, covering the top of the clay.

When cross-referencing Durham Region's topographic elevations with the Ontario Ministry of the Environment, Conservation & Parks (MECP)'s historic well records & well locations, an estimated groundwater elevation can be determined for all historic wells within and near the site boundary. As

referenced in Table 1 above, well records to the north and northwest are lower in elevation, approximately 250 masl, while the area surrounding the southern portion of the site is situated on a locally elevated hill and has a groundwater elevation of around 190 masl. The aquifer and groundwater elevation for the site is estimated to be around 250 masl. See Appendix I for details.

The observed hydrostratigraphic layers observed from the surface to the bedrock at depth include (Figure 5):

- Layer 1 - Recent Deposits.
- Layer 2 - Late Stage Lacustrine/Halton Aquitard.
- Layer 3 - Oak Ridges Moraine Aquifer Complex (ORAC).
- Layer 4 - Upper Newmarket Aquitard.
- Layer 5 - Inter-Newmarket Sediments (INS) [Aquifer].
- Layer 6 - Lower Newmarket Aquitard or Tunnel Channel Silts.
- Layer 7 - Thorncliffe Aquifer Complex (TAC) or Tunnel Channel Sands.
- Layer 8 - Sunnybrook Aquitard.
- Layer 9 - Scarborough Aquifer Complex (SAC); and
- Layer 10 – Bedrock [Aquifer].

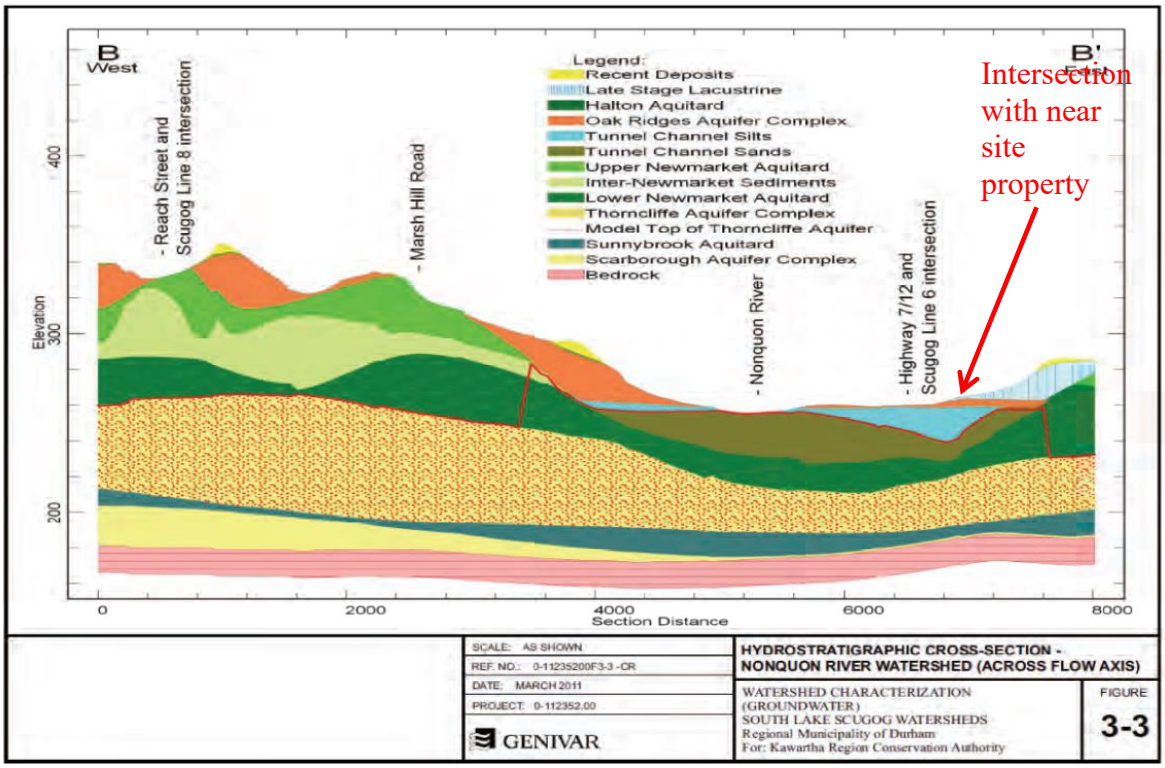


Figure 5 –Stratigraphic cross-section near site property, Cited in Nonquon River Watershed, Characterization Report (2012)

7. High-Risk Activity Impacting Groundwater

The Durham Regional Official Plan (ROP) designated the subject property as an 'Employment Area' in the Urban System. It was approximately 52.4 hectares (129 acres), which may include manufacturing, assembly and processing of goods, service industries, warehousing, offices, industrial parks, and storage of goods and materials. The (M2-X) proposed zoning will permit an automobile storage/salvage yard as an additional permitted use on lands generally north of Scugog Line 6 and south of Reach Industrial Park Road.

In the proposed plan of the Site, salvage yards are considered in Block 10, situated northeast corner of the Site. Although the Site is within an Area of High Aquifer Vulnerability (HVA) and Salvage yards are considered high risk to groundwater according to the Region's Official Plan (Policy 2.3.31), it is the Engineer's opinion that raising the site surface through filling clay soil and considering the substantial thickness of the dense clay/silt with low permeability, this clay liner makes water passage impossible or reduces it to a very low level. Meanwhile, a normal treatment will be required along with a monitoring plan as per Provincial Requirements. It is also necessary to mention that surface water will be managed on-site through LID practices (Bioretention/Bioswale). Therefore, the proposed salvage yards in Block 10 in the northeast corner of the Site can be isolated with low impacts on aquifer drinking water systems.

8. Private Well Water Supply

Based on the Ontario Water Record and site inspections, the site property currently does not have any private water wells. As there is a municipal water main along the southern property boundary (Scugog Line 6), it is not expected that industrial blocks will require any private water wells.

9. On-site Sewage Septic

Based on the results from Section 5 In-situ Infiltration Testing, the native soil characteristic of the entire site has a lower average infiltration rate of 11.9 mm/hour or an equivalent septic design T-time of 50.4 min/cm. This generally corresponds well to local clay soils as found during the drill hole program.

Each future individual block or subdivided lot will require a Site Plan Agreement to establish the appropriate septic bed design. With a measured T-time of 50.4 min/cm and shallow groundwater conditions (0.5–1.0 m below grade depending on location), vertical separation and effective septic bed sizing must be carefully managed. Given the existing grades, substantial earthworks and re-grading will be required, and septic systems may need to be constructed within imported fill to achieve the necessary vertical offsets and separation distances. Therefore, septic system feasibility is considered achievable on the subject property, provided that final designs include appropriate fill placement, grading modifications, and compliance with MECP guidelines for vertical separation and T-time criteria.

Below are several other factors to consider during the Site Plan Agreement:

- The exact foreign fill material and fill depth are currently unknown.
- The septic bed must be designed for each specific building/operating capacity.
- Approximately 30% of each block is allocated for "landscaping and septic bed areas."
- Durham Region Health Department requires a "septic reserve area" equal to the initial septic bed design area for industrial properties.

10. Groundwater Flow

The Site has a gently sloping (1.2%) toward the northwest with an elevation range of approximately 267 to 255 masl. The groundwater flow is interpreted to follow from southeast to northwest across the Site (see Appendix III).

11. Groundwater Quality

Groundwater samples were collected on Thursday, March 30, 2023, from BH101, BH103, and BH104, and placed into laboratory-supplied bottles (with chemical preservatives as required) and stored according to chain of custody procedures until received at the laboratory. Groundwater samples were submitted to Testmark Laboratories Ltd. for analysis of Nitrate and Nitrite parameters. Nitrate (as nitrogen) is the main contaminant of concern for sewage works that discharge effluent to the groundwater regime due to the potential for health-related impacts on drinking water supplies. Under a Reasonable Use evaluation, the quality of drinking water must not be degraded by an amount more than 25% of the difference between background concentrations and the Ontario Drinking Water Quality Standard (ODWQS) for health-related parameters. The Ontario Drinking Water Standard (ODWS) for nitrate-N is 10 mg/L, and it is the criteria applied to the predictive nitrate impact assessment.

Analytical results depicted that all samples exhibited compliance with the applicable criteria according to the Ontario Drinking Water Standard (ODWS). The analytical results are presented in Table 4 below and in Appendix XI.

Table 4- Nitrate and Nitrite Concentrations in Groundwater (dated March 30, 2023)

Parameter	Unit	ODW Standard (mg/L)	BH 101	BH 103	BH 104
Nitrate (as N)	mg/L	10	0.33	<0.05	<0.17
Nitrite (as N)	mg/L	1	<0.05	<0.05	<0.05

Based on the above result, nitrate-N concentration in shallow groundwater ranged between less than 0.05 and 0.33 mg/L at the studied boreholes which showed a value lower than the ODW Standard (10 mg/L). BH101, BH103, and BH104 are the near-surface groundwater that will be diluting the sewage effluents, so, Nitrate-N = 0.33 mg/L is considered as the present background concentration of contaminant in

groundwater in the calculation of the maximum concentration of contaminant originating from the disposal site that can be permitted to reach downgradient boundary of blocks.

12. Septic Bed Reserve Area

Based on the results from Appendix IV – In-situ Infiltration Testing, the native soil characteristics at most boreholes yielded an average septic T-time of 50.3 min/cm, which indicates that the dense clay present at the site drains very slowly. The design daily septic flow values per each block were calculated using the MECP B-7/B-7-1 infiltration method (Table 5).

According to the Region of Durham's "Drilled Wells and Lot Sizing Policies as Applied to Consents (Severances) and Draft Plans of Subdivision" (2010), each new lot is expected to generate a certain amount of septic discharge. The septic reserve area shall be determined using the formula:

$$A = 2 \times Q / Loading\ Rate$$

Where:

A = septic reserve area (m^2)
Q = septic daily discharge (L/day)
Loading Rate = soil loading rate ($L/m^2/day$)

Based on the geotechnical analysis completed by King EPCM, the proposed subdivision is characterized by a poor average soil infiltration rate (T > 50 min/cm).

While the Engineer concludes that the current site soil conditions are technically conducive to on-site sanitary sewage systems as described in OBC Section 8, significant caution is warranted due to the extremely low infiltration rate.

Additionally, the presence of foreign fill within future industrial Blocks could significantly alter soil infiltration characteristics. These impacts should be evaluated further at the individual Block or Lot level during detailed design.

Table 5 - Septic Reserve Area Calculations

Block No.	Q(L/Day)	Loading Rate	Total Septic Reserve Area (m2)
1	13,617	4	6,809
2	12,782	4	6,391
3	13,733	4	6,867
4	12,482	4	6,241
5	11,380	4	5,690
6	12,180	4	6,090
7	16,383	4	8,192
8	9,185	4	4,593
9	9,269	4	4,635
10	17,591	4	8,796
11	8,693	4	4,347
12	30,228	4	15,114

It is noted that Durham Region requires the installation of a sanitary sewer main within the municipal right-of-way (ROW), providing the potential for future connection to the municipal sanitary sewer system.

13. Water Quality Risk Assessment

The proposed development comprises twelve (12) industrial blocks. In accordance with the MECP *Procedure D-5-4 Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment* (MOEE, 1996), developments containing more than five (5) lots serviced by individual on-site sewage disposal systems are subject to a cumulative impact assessment. Although the D-5-4 procedure applies specifically to systems with design flows up to 4,500 L/day per parcel, it is acknowledged that each block within the proposed development may be further subdivided in the future.

This assessment therefore evaluates the cumulative impact of the proposed sewage systems on the local groundwater regime. The potential for groundwater quality impacts depends on factors such as the hydrogeological setting, the total effluent discharge volume, and the concentrations of nutrients primarily nitrate-nitrogen being discharged to the subsurface.

Groundwater at the Site flows from southeast to northwest (Appendix III), and septic effluent is expected to migrate along this pathway toward the downgradient property boundary. For the purposes of this assessment, septic beds were assumed to be located at the up-gradient property limits in order to maximize dilution along the downgradient flow path.

For post-development conditions with mitigation, an annual infiltration rate of 623 mm (= 205,792 m^3) was assumed (Table 8), reflecting the large recharge potential. Although field T-times (50.3 min/cm)

indicate low soil permeability, the water balance assessment suggests that significant volumes of infiltration can occur.

The septic effluent dilution assessment was carried out in accordance with MECP Guideline D-5-4 which outlines a three-step assessment process as follows:

13.1. Step 1 – Lot Size Considerations

For developments where each lot is one hectare or larger, it is generally assumed that natural attenuation processes will reduce nitrate-nitrogen concentrations to acceptable levels at the property boundary. In such cases, the potential for exceedance of the 10 mg/L nitrate-N limit is considered low, and further detailed assessment is not normally required.

All twelve (12) industrial blocks within the proposed development are larger than 1.0 hectare, satisfying Step 1 of the Procedure D-5-4 evaluation process.

13.2. Step 2 – System Isolation Considerations

Under MECP Procedure D-5-4 (MOEE, 1996), a Step 2 evaluation is required only when proposed lots are smaller than one hectare, to determine whether on-site sewage effluent is hydrogeologically isolated from existing or potential potable water supply aquifers. For the proposed development, all twelve (12) industrial blocks are greater than one hectare and therefore meet the Step 1 requirements of the D-5-4 procedure. However, it is acknowledged that individual blocks may potentially be subdivided in the future into parcels smaller than one hectare. Accordingly, a Step 2 assessment was performed.

1. Most Probable Groundwater Receiver

Borehole drilling and monitoring well installation conducted by King EPCM confirmed the presence of a discontinuous, shallow, unconfined perched groundwater system across the Site. Groundwater levels measured during the investigation ranged between approximately 0.4 and 3.5 mbgl, with seasonal fluctuations of up to 1 m observed between December 2021 and June 2022. Groundwater was encountered in most boreholes (BH101–BH113), indicating a shallow and spatially variable perched system.

Regional and on-site stratigraphic data, including MECP well records surrounding the Site (Appendix I), indicate that this perched groundwater rests atop a laterally continuous dense clay and silt aquitard extending to depths of approximately 12 mbgl. This low-permeability layer hydraulically separates the perched groundwater from the underlying deep unconfined sand aquifer, which occurs at elevations of approximately 190 masl (73 mbgl). The deep sand aquifer represents the regional potable water-bearing zone, while the overlying perched system is a localized and transient zone primarily influenced by precipitation and surface infiltration.

Consequently, the most probable groundwater receiver for percolating effluent or stormwater infiltration at the Site is the shallow perched water table, which is expected to migrate laterally along the upper clay. The intervening thick clay and silt aquitard provides natural hydrogeologic isolation, minimizing the potential for vertical migration to the deeper potable aquifer system.

2. Lower Hydraulic Boundary

Review of on-site borehole logs and MECP well records (e.g., Well ID #4606250, #1913784) indicates that the subsurface profile consists primarily of clayey and silty deposits with interbedded sand and gravel layers 12.5 metres below ground surface. According to the site-specific hydrostratigraphy (Section 6), the soil sequence comprises topsoil underlain by damp to wet grey clay and silt (0.3 – 9 mbgl), a thin sand lens (9 – 9.5 mbgl), followed by grey clay (9.5 – 12 mbgl) and a minor sand and gravel layer (12 – 12.5 mbgl). This deeper clayey unit acts as an effective aquitard, restricting vertical migration of percolating effluent and limiting hydraulic connectivity between shallow perched water and deeper regional groundwater systems.

MECP well records from the surrounding area (e.g., Well ID #4606250) confirm the presence of deep groundwater at approximately 73 mbgl (190 masl), representing the regional potable water aquifer. Given the thick intervening clay sequence, downward percolation from the proposed infiltration or sewage systems is expected to be minimal. Instead, infiltrated water will likely migrate laterally along the upper sand–clay interface toward downgradient surface drainage features and tributaries connected to the Nonquon River.

13.3. Step 3 –Contaminant Attenuation Considerations

Given that the development comprises multiple large blocks within a single property and exhibits locally shallow perched groundwater conditions, a quantitative nitrate dilution analysis (Step 3) was nonetheless undertaken to confirm that cumulative septic effluent loading will not exceed the 10 mg/L nitrate-N criterion at the downgradient property boundary. Results demonstrate compliance with MECP D-5-4 and Ontario Drinking Water standards, ensuring the proposed on-site sewage systems will not adversely impact groundwater quality. The assessment was conducted using the D-5-4 mixing equation as follows:

$$C_{PB} = (C_S \times V_S) / V_T$$

where:

- C_{PB} = Nitrate-N concentration at the property boundary (mg/L)
- C_S = Effluent nitrate-N concentration (40 mg/L)
- V_S = Annual effluent volume (m^3/year) = Q × t (365 days/year)
- V_A = Annual dilution volume (m^3) = Block Area × Recharge (0.623 m/year)
- V_T = Total volume of water discharged annually (m^3) = (V_S + V_A)

The analysis determined the maximum daily sewage flow (Q) for each block that results in a nitrate-N concentration of 10 mg/L at the compliance boundary. The calculated maximum daily septic flows range from approximately 8,700 L/day (Block 11) to 30,200 L/day (Block 12), depending on the lot size and dilution capacity. Blocks 5 through 9 exhibit smaller allowable flows due to their smaller lot areas and lower recharge volumes. The results are summarized in Table 6.

Table 6: Maximum Allowable Septic Flow Determination (by Block)

Block #	Area (m2)	Annual Dilution Volume (m3) V_A	Annual Effluent Volume (m3) V_s	Total Volume Discharged Annually (m3) V_T	Contaminant Concentration in Untreated Effluent (mg/L) at Property Boundary C_{PB}	Daily Septic Flow (L/day) Q
1	23,226	14469.80	4970.21	19440.00	10	13,617
2	21,803	13583.27	4665.43	18248.70	10	12,782
3	23,477	14626.17	5012.55	19638.72	10	13,733
4	21,914	13652.42	4555.93	18208.35	10	12,482
5	20,027	12476.82	4153.70	16630.52	10	11,380
6	21,626	13473.00	4445.70	17918.70	10	12,180
7	29,100	18129.30	5979.80	24109.10	10	16,383
8	16,770	10447.71	3352.53	13800.24	10	9,185
9	16,926	10544.90	3383.19	13928.08	10	9,269
10	31,392	19557.22	6420.72	25977.93	10	17,591
11	15,476	9641.55	3172.95	12814.49	10	8,693
12	53,562	33369.13	11033.22	44402.35	10	30,228

These calculated flow rates confirm that each industrial block can sustain its proposed septic discharge within the D-5-4 nitrate-N criterion of 10 mg/L at the downgradient property boundary, ensuring protection of groundwater quality and compliance with the Ontario Drinking Water Objective (ODWO) for nitrate-N. It is acknowledged that septic bed design details are not yet available.

The daily septic flow (Q) represents the maximum feasible design flow estimated for each development block based on its potential subdivision configuration. Under the current development plan, where each block remains as a single parcel, the design flow is limited to 4,500 L/day, in accordance with the Ontario Building Code (OBC) maximum allowable limit for individual private sewage systems.

Alternatively, if future development scenarios include the subdivision of an existing block into two or three smaller lots, each resulting lot may be serviced by a separate on-site sewage system, each designed for a maximum flow of 4,500 L/day.

Such future severances would be reviewed and approved under the Region of Durham's local on-site sewage system procedures and would not require re-evaluation under MECP Procedure D-5-4, provided that the proposed systems remain consistent with the hydrogeological isolation and capacity criteria established in the current assessment.

14. Source Water Protection

The Site is located within the Kawartha-Haliburton Source Protection Area (MECP, 2020). It is not located within a mapped wellhead protection area and a highly vulnerable aquifer (Figure 6). The nearest wellhead protection area is approximately 4 km southeast of the Site. Source Protection Details for the Site are presented in Table 7.

Table 7- Source Protection Details for Location 0 Scugog Line 6, Port Perry, ON

Latitude: **44.09700** Longitude: **-78.97853** UTM Zone: **17** Easting: **661806.71** Northing: **4884632.95** Upper Tier Municipality: **REGIONAL MUNICIPALITY OF DURHAM** Lower Tier Municipality: **TOWNSHIP OF SCUGOG** Township Concession and Lot: **REACH LOT 14 CON 6** Assessment Parcel Address: **Scugog Line 6** Assessment Roll #: **18200100042790000000** MECP District: **York-Durham** MECP Region: **Central Region**	Source Protection Area: **Kawartha-Haliburton** Wellhead Protection Area: **No** Wellhead Protection Area (WHPA-E): **No** Intake Protection Zone: **3**; score is **2** Issue Contributing Area: **No** Significant Groundwater Recharge Area: **Yes**; score is **2** Highly Vulnerable Aquifer: **No** Event Based Area: **No** Wellhead Protection Area Q1: **No** Wellhead Protection Area Q2: **No** Intake Protection Zone Q: **No**

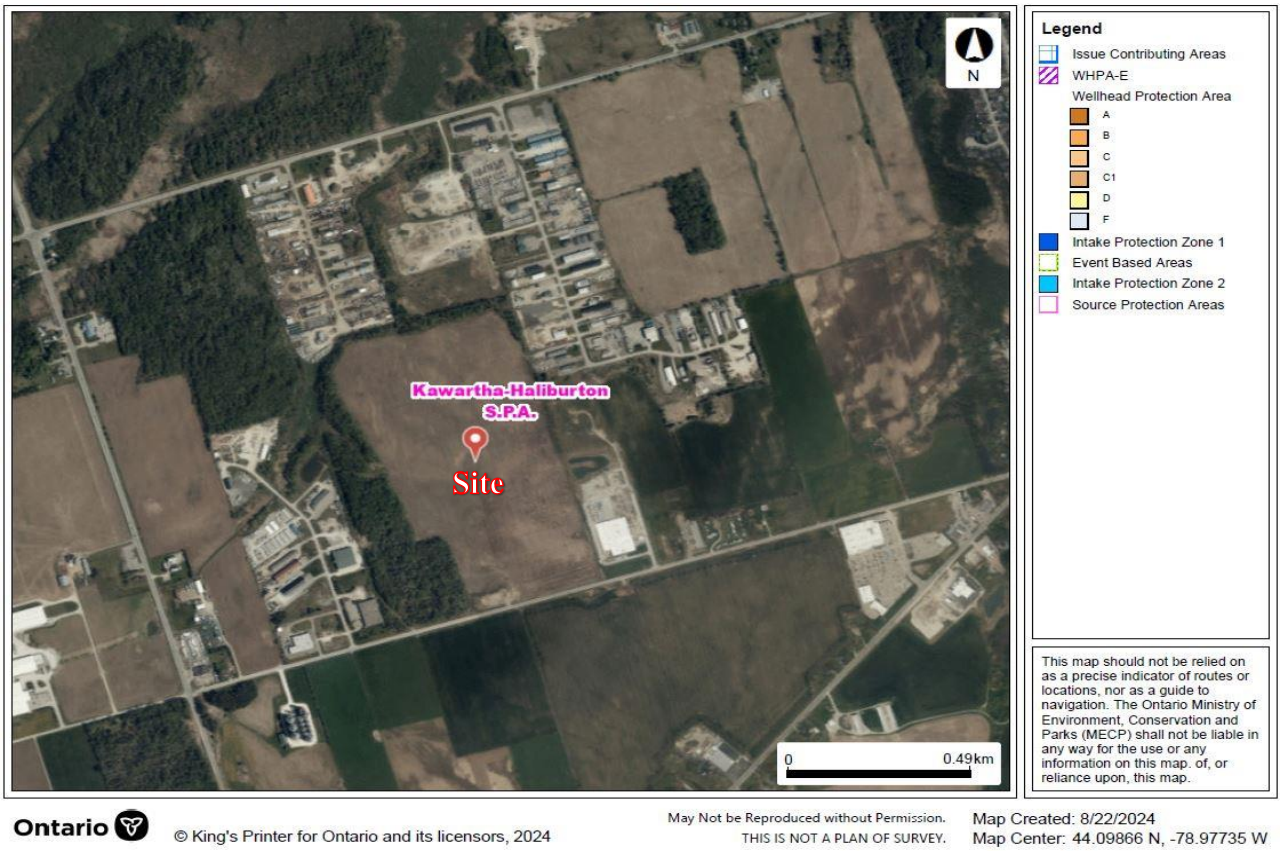


Figure 6 –Showing Site Location within the Kawartha-Haliburton Source Protection Area

15. Groundwater Discharge / Water Balance

Based on Burketon Mclaughlin Climate Data for Nonquon River Subwatershed, precipitation is 898mm/year, and evapotranspiration is mostly crops and trees in hydrologic soil group B/D, 567mm/year (Appendix VII).

Pre-development site conditions have low groundwater infiltration/recharge, as the site is primarily clay soil with slopes <2% grade and a large part of the runoff flow into the tributary of the Nonquon River through the northwest, southwest and northeast waterways/ditches. On 52.0 ha with 0.1% TIMP, there is an estimated 92,428 m^3 of groundwater recharge per year. Runoff is 153 mm/year = 79,730 m^3/yr.

Pre-development condition parameters are shown in Table 8, below, as well as detailed in Section 3 of this report. The site is within the Nonquon River Subwatershed, with clay and loam Hydrologic Soil Group B/D, 0.1% TIMP, containing 32.8 ha (63.1%) agricultural land, 2.05 ha (3.9%) of wetlands and 17.1 ha (32.9%) of woodland and hedgerow.

The proposed post-development TIMP is 22 ha / 42.4%, and, without any LID treatments, the site recharge is estimated at an equivalent of 116 mm/year, or 60,355 m^3 (-34.7% as compared to pre-development).

The proposed development includes 22.0 ha total impervious surface area (TIMP), 42.4% of the total drainage area. Agricultural lands are reduced through the development of property, which causes a reduction in evapotranspiration of 39 % from pre-development levels. Additionally, it causes 66.8% of the precipitation surplus within the TIMP area of industrial blocks and roadways which is managed for recharge and infiltration (+122.7%) but the outflow from asphalt roadways would be discharged to wetlands or creeks (7,620 m^3 which is equivalent to 9.6% of total runoff in pre-development scenario or 10.5% of total runoff in post-development with mitigation).

An additional external outflow from the industrial blocks would be directed to the roadside ditch or wetlands (39,764 m^3 which is equivalent to 49.5% of total runoff in the pre-development scenario or 54.5% of total runoff in post-development with mitigation). The results show that the amount of external outflow has increased compared to the pre-development state (153 mm to 436 mm or ΔV= +138,231 m^3). Proposed mitigation measures are discussed above LID 1 for developed industrial blocks and LID 2 for municipal roadway.

Post-development with mitigation, the total rate of infiltration has increased from 178 mm/year to 396 mm/year or 92,428 m^3 to 205,792 m^3 (+122.7%). Detailed calculations of water balance for each scenario are presented in Appendix X.

Table 8 –Water Balance Summary

Characterstic	Site				
	Pre-Development	Post-Development	Change (Pre- to Post-)	Post-Development with Mitigation	Change (Pre- to Post- with Mitigation)
Inputs (Volumes)					
Precipitaiton (m^3/yr)	467,063	467,062	0.0%	467,062	0.0%
Run-On (m^3/yr)	0	0	0.0%	0	0.0%
Other Inputs (m^3/yr)	0	0	0.0%	0	0.0%
Total Inputs (m^3/yr)	**467,063**	467,062	0.0%	467,062	0.0%
Outputs (Volumes)					
Precipitation Surplus (m^3/yr)	172,158	287,223	66.8%	287,223	66.8%
Net Surplus (m^3/yr)	172,158	287,223	66.8%	287,223	66.8%
Evapotranspiratin (m^3/yr)	294,905	179,839	-39.0%	179,839	-39.0%
Infiltration (m^3/yr)	92,428	60,355	-34.7%	155,857	68.6%
Rooftop Infiltration (m^3/yr)	0	0	0.0%	49,936	0.0%
Total Infiltration (m^3/yr)	92,428	60,355	-34.7%	205,792	122.7%
Runoff Pervious Area (m^3/yr)	79,730	37,495	-53.0%	37,495	-53.0%
Runoff Impervious Area (m^3/yr)	0	180,467	0.0%	35,029	0.0%
Total Runoff (m^3/yr)	79,730	217,961	173.4%	72,524	-9.0%
Total Outputs (m^3/yr)	467,063	467,062	0.0%	467,062	0.0%

15.1. Bioretention for Lot Level Control (LID 1)

Bioretention basins are landscaped depressions that intercept stormwater runoff from adjacent paved surfaces to temporarily store, filter, and infiltrate it into 0.5 – 1.0 meters of soil. They are commonly placed alongside or in parking lots, where they help remove suspended solids, heavy metals, and other pollutants from the lot's stormwater runoff through a mix of physical, biological, and chemical processes. In addition to these filtration capabilities, bioretention basins can effectively reduce peak runoff rates and volumes for relatively frequent storms. A sample infiltration bioretention basin is illustrated in Figure 7.

- Flat bed bioretention basin with underdrain pipes on the site property (LID 1), in the front portion of each block along access driveways and designed to receive 1:100 year (major storms) from rooftops, interior roads, and parking lots using Scugog's IDF curve values.
- Bioretention basin is designed at 0.4 m depth, 3.0 m bottom width, 5.4 m top width at 3H:1V sloped sides, cross-sectional area of 1.68 m^2.
- The site receives 100% of precipitation from rooftops, parking lots, and interior roads, encompassing an impermeable area of 22.2 hectares. However, 75% of the captured volumes from the western and northern blocks (neighboring blocks with natural heritage) are directed to the downstream wetland or waterway through sheet flow.

- 0.55 m depth underdrain system, consisting of a 0.4 m gravel layer, a 0.05 m sand layer, and a 0.1 m soil bed.
- The total static storage volume is 4116 m^3, and the dynamic infiltration volume per hour is approximately 43 m^3/hour from the channel bottom.
- Bioretention basin collects stormwater from all rooftops plus impermeable parking lots and interior roadways. Two different options proposed are for rainwater collection:
    - 1. Curb-cut openings that allow stormwater to enter the linear bioretention basins from the gutters or with a grass filter strip for roads without curbs, or
    - 2. Catchbasins and Oil Grit Separators to collect roadway runoff and provide the opportunity for stormwater to infiltrate.
- Drawdown time is 41.6 hours for LID 1 main channel with a maximum water depth of 0.2 m, based on a conservative engineering infiltration rate of 4.8 mm/hour for the bioretention basin, and 37.5 hours for its sub-drain media with a maximum water depth of 0.45 m, using a factored engineering infiltration rate of 4.8 mm/hour. The sub-drain pipes from the bioretention facilities are connected to the final outlet ditches (Outlets 101 and 102).
- The bottom elevations of the Bioretention Basin will have a minimum 1m separation from the ground water table as per MECP criteria.



Figure 7- Sample Infiltration / Exfiltration Systems (Nazarpour et al., 2023)

15.2. Bioswale for Conveyance Control (LID 2)

Biofiltration swales are one of several LIDs for the treatment of stormwater runoff from project areas that are anticipated to produce pollutants of concern (e.g., driveways). Bioswales are vegetated, typically trapezoidal channels, which receive and convey storm water flows while meeting water quality criteria and other flow criteria. A sample bioswale section is illustrated in Figure 8.

- Flat bed bioswales with check dams (refer to Figure 7 for a schematic illustration) and underdrain pipes on the site property (LID 2), along both sides of new municipal roadways, and designed to receive 1:100-year storms using Scugog's IDF curve values. Total number of check dams will be 56.
- Swales are designed at 0.6 - 0.8 m depth, 1.0 – 1.5 m bottom width at 3H:1V sloped sides, cross-sectional area of 1.68 – 3.12 m^2, and underdrain pipe with 0.15 m diameter.
- Concrete check dams with a pond height of 0.2 m and usually installed based on ditch grading along the swale (See Table 9 for details of calculations).
- The gravel used for the drainage layer is to be 20-50 mm (stone size), uniformly graded, clean, crushed angular stone that has a porosity of 0.4.
- The total static storage volume behind check dams (#56) is approximately 209 m^3 plus 444 m^3 of sub-drain volume (2609.8 m length, with a 0.5 m underdrain system, consisting of a 0.3 m gravel layer, a 0.1 m choker layer, and a 0.1 m Filter media), and dynamic infiltration volume per hour is 15.0 m^3/hour from the total area of the channel bottom.
- Swales grade north or west at roughly 0.5-2.0 %.

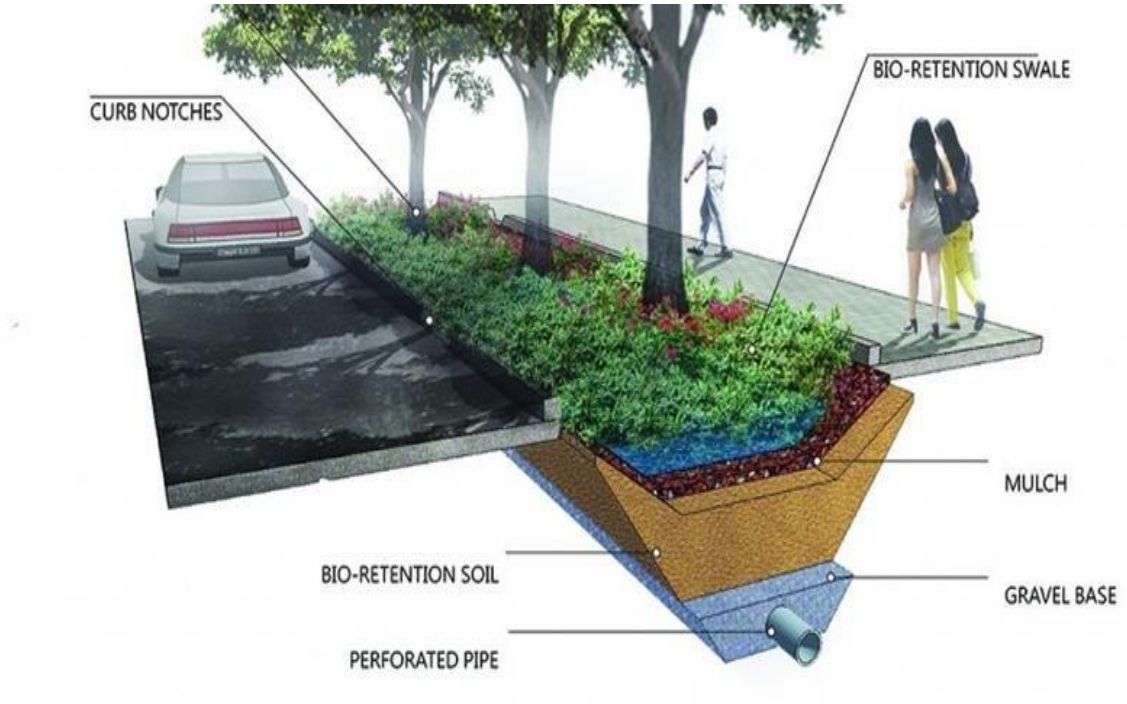


Figure 8- Sample Bioswale Section Dinić-Branković et al., 2018)

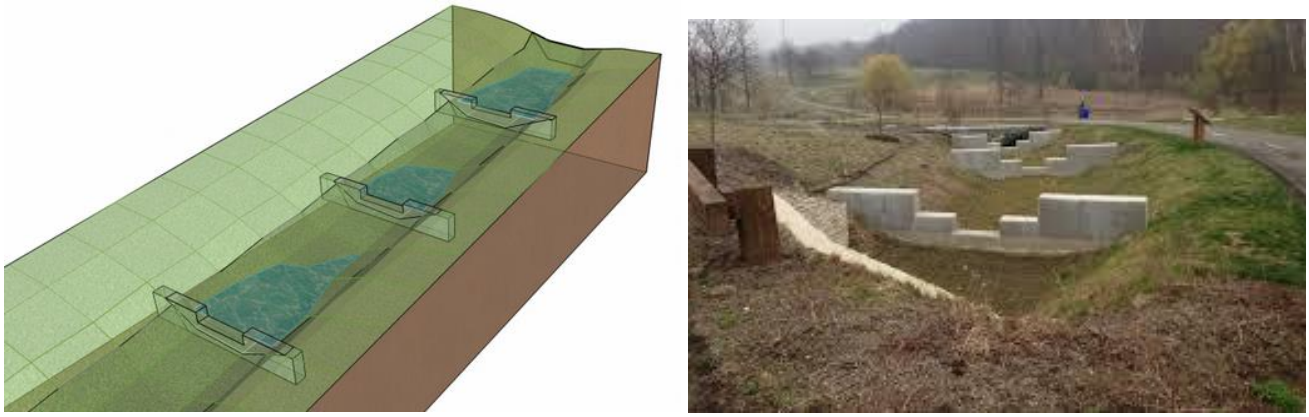


Figure 9- Sample Swale / Concrete Check Dams (Winston, et al, 2016)

Table 9 – Design of Check Dam for Retainment

Catchment	Ditch	Length (m)	Grading minimum (%)	Distance between check dams (m)	Number of Check Dams (#)	Water Volume Capacity (m^3)	Infiltration Footprint Area (m^2) *	Infiltration (m^3/hr)
101	a	162.3	1	40	4	13	45.3	0.9
	b	92	0.6	67	1	7	75.5	0.5
	c	110.3	1	40	3	9	45.3	0.6
	d	111.2	1	40	3	9	45.3	0.6
	e	212.8	0.5	80	3	17	90.6	1.2
	f	414.3	1	40	10	33	45.3	2.3
	g	166.3	1	40	4	13	45.3	0.9
	h	134	0.5	80	2	11	90.6	0.7
	i	130.9	0.5	80	2	10	90.6	0.7
	j	118.5	1.49	27	4	9	30.4	0.6
	k	112.2	0.5	80	1	9	90.6	0.6
	l	111	0.5	80	1	9	90.6	0.6
102	a'	334.9	0.9	44	8	27	50.3	1.8
	b'	133	1.1	36	4	11	41.2	0.7
	c'	97.3	0.7	57	2	8	64.7	0.5
	d'	49.4	0.7	57	1	4	64.7	0.3
	e'	39.7	1.1	36	1	3	41.2	0.2
	f'	79.7	1.2	33	2	6	37.7	0.4
Total		**2609.8**			**56**	**209**	**1085**	**14.0**

** Infiltration footprint area = $(B+ 2 \times h \times (1+z^2)^{0.5}) \times$ Distance / 2*

See Appendix XI for a detailed Strom Water Management (SWM) flowchart.

15.3. Drawdown Time Review

The drawdown time is calculated as the time (in hours) for the depth of water in the storage at the end of a runoff event to be infiltrated into the native soils through the bottom of the LID. The depth is assumed to be the full depth of the storage layer. The seepage rate is the factored infiltration rate of the native soils. The formula for drawdown time is:

Drawdown Time (hr) = Water depth in Storage (mm) x Porosity / Seepage Rate (mm/hr) (Eq. 4)

LID 1 (Bioretention Basin with TIMP= 206,709 m^2)

Drawdown Time (hr) = 200 (mm) / 4.8 (mm/hr) = 41.6 hr *(Main channel)*

Drawdown Time (hr) = 450 (mm) x 0.4 (fraction) / 4.8 (mm/hr) = 37.5 hr *(Sub-drain)*

Due to the 0.2 m height of the check dams (maximum ponding depth), and the assumed infiltration rate of 50 mm/hr for the bioretention media, the calculated drawdown time for the proposed design (main channel) is approximately 4 hours, which is well below the typical maximum target drawdown time of 48 hours. This assumption holds if the underlying porous medium (sub-drain area) is unsaturated; otherwise, applying the conservative infiltration rate of 4.8 mm/hr results in a drawdown time of 41.6 hours, which is still within the acceptable 48-hour target.

In addition, catch basins will be installed at regular intervals along the bioretention swales to act as emergency overflows. If water levels behind the 0.2 m check dams exceed their capacity, the excess runoff will be directed into the catch basins and conveyed through the underdrain system, ensuring efficient movement toward the outlet and preventing localized overtopping.

For the 0.45m sub-drain thickness and factored infiltration rate of 4.8 mm/hr, the calculated drawdown time for the proposed design (sub-drain) is approximately 37.5 hours, which is less than the typical maximum target drawdown time of 48 hours.

This infiltration system is a practice used to manage stormwater runoff and to prevent flooding and downstream erosion. It is designed to infiltrate stormwater though permeable soils into the groundwater aquifer. Infiltration systems do not discharge to a surface water body under most storm conditions but are designed with overflow structures.

LID 2 (Driveway Grass Swale with TIMP= 15,420 m^2)

Drawdown Time (hr) = 200 (mm) / 4.8 (mm/hr) = 41.6 hr *(Main channel)*

Drawdown Time (hr) = 500 (mm) x 0.4 (Fraction) / 4.8 (mm/hr) = 41.6 hr *(Sub-drain)*

Due to the 0.2-meter height of the check dam (max water depth), and the assumed infiltration rate of 50 mm/hr for the bioswale media, the calculated drawdown time for the proposed design is approximately 4 hours, which is less than the typical maximum target drawdown time of 48 hours. This assumption is correct if the porous medium under the bed (sub-drain area) is not saturated; otherwise, the same conservative infiltration rate of 4.8 mm/hr will be true, in which case the drawdown time will increase to 41.6 hours which is still less than the typical maximum target drawdown time of 48 hours. However, the 0.50 m sub-drain thickness and factored infiltration rate of 4.8 mm/hr, resulted in the calculated drawdown time for the proposed design (sub-drain) being approximately 41.6 hours, which meets the typical maximum target drawdown time of 48 hours.

16. Summary

The property is located near the eastern boundary of the Nonquon River Subwatershed and within the Kawartha-Haliburton Source Protection Area. It is not located within a mapped wellhead protection area and a highly vulnerable aquifer.

The Site's general stratigraphy consists of clay down to significant depths (below 12m). Groundwater is a high-level unconfined local aquifer, at approximately 254.4-261.8 masl or 0.4-3.5 m below the surface. Thirteen boreholes and monitoring wells were installed, showing that there is shallow perched groundwater. In-situ averaged unfactored infiltration rate = 11.9 mm/hour rate depending on a specific layer of soil, the safety factor of 2.5, and a factored engineering design infiltration rate of 4.8 mm/hour.

The Water Quality Risk Assessment was completed in accordance with MECP Procedure D-5-4 to evaluate the potential effects of the proposed twelve-block industrial development on groundwater quality. Groundwater flow across the Site is directed from southeast to northwest, and septic effluent is expected to migrate along this downgradient pathway. All twelve blocks exceed one hectare in area, satisfying Step 1 (Lot Size Considerations) and indicating a low potential for nitrate exceedance. A Step 2 (System Isolation) assessment indicated, as the Site is underlain by dense clay and silt deposits that overlie a shallow perched groundwater system, hydraulically separated from a deeper unconfined sand aquifer by a thick low-permeability aquitard, providing natural hydrogeologic isolation. Nevertheless, a Step 3 (Contaminant Attenuation) analysis was performed using the D-5-4 mixing equation, confirming that nitrate-N concentrations at the downgradient property boundary remain below the 10 mg/L criterion, with allowable flows ranging from approximately 8,700 L/day to 30,200 L/day, depending on lot size and infiltration capacity. Under current conditions, where each block remains as a single parcel, the

maximum design flow is limited to 4,500 L/day per block in accordance with the Ontario Building Code (OBC). If future subdivision occurs, each new lot may be serviced by an independent on-site system designed for up to 4,500 L/day, with such changes to be reviewed under the Region of Durham's local on-site sewage procedures. Overall, the assessment confirms compliance with the Ontario Drinking Water Objectives and demonstrates that the proposed on-site systems will not adversely impact groundwater quality.

When comparing pre-development and post-development with LID mitigation measures in place, the water balance changes are +122.7% in total infiltration rate and -9.0% in total runoff rate.

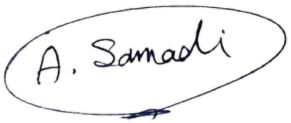
Overall, it is the Engineer's opinion that the proposed construction of industrial blocks and driveways combined with proposed LID mitigation measures is not expected to cause adverse changes to the groundwater quality or quantity.

This Hydrogeological Report has been prepared in accordance with the requirements of Section 3.4.9 "Sensitive Groundwater Features" of the Plan Review and Regulation Policies by Kawartha Conservation (2022) and Section A1.03(f) "Hydrogeologic Report" of the Design Criteria and Standard Detail Drawings (2003) by the Township of Scugog. The report identifies and characterizes shallow perched and deep unconfined aquifers through borehole drilling, monitoring well installation, and analysis of MECP well records. Seasonal high groundwater levels have been established, and groundwater contours have been mapped to delineate local flow direction and evaluate recharge/discharge relationships. Low Impact Development (LID) features, including bioretention and bioswales, have been designed with a minimum 1 m separation from the groundwater table to mitigate mounding and promote safe infiltration. The findings confirm that the proposed development will not adversely impact sensitive groundwater features or drinking water resources.

17. Reliance & Signature

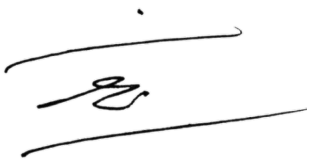
This report is the intellectual property of King EPCM and has been prepared for the sole use of Wanlong Real Estate Development Ltd. (Property Owner and Client). King EPCM accepts no liability for claims arising from the use of this report, actions taken, or decisions made as a result of this report, by parties other than the Client. The Client may submit this report to the Township of Scugog (Port Perry), Kawartha Region Conservation Authority (KRCA), and Regional Municipality of Durham (Durham Region) regarding the Client's residential development project at 0 Scugog Line 6, Port Perry, ON.

Prepared by:





Amir Samadi, Ph.D., P.Eng.
Senior Engineer – Water Resources
King EPCM





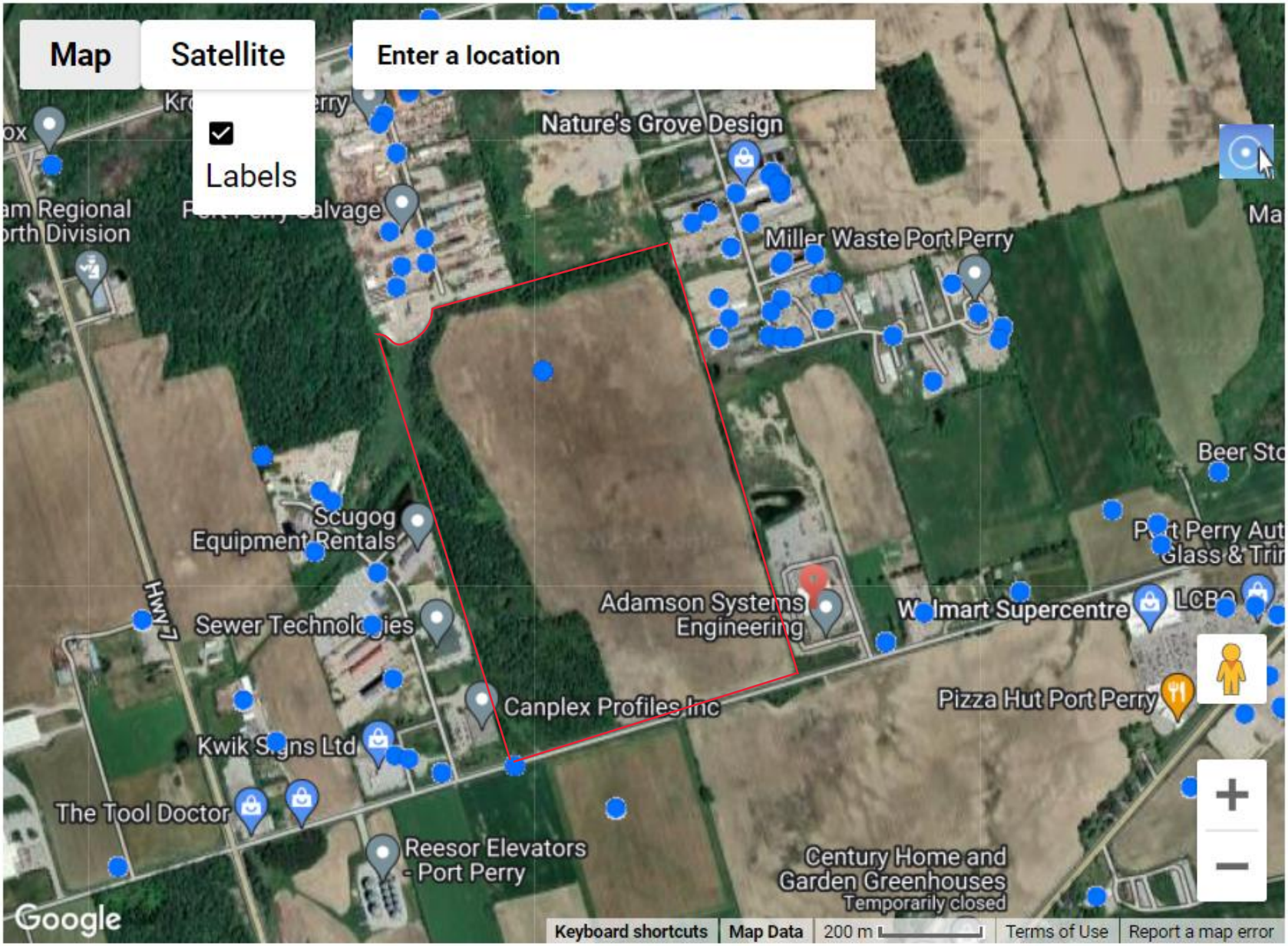
Seyed Hamid Vaziri, Ph.D., P.Geo.
Geologist
King EPCM

18. References

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Appendix I – MECP Map: Well Records



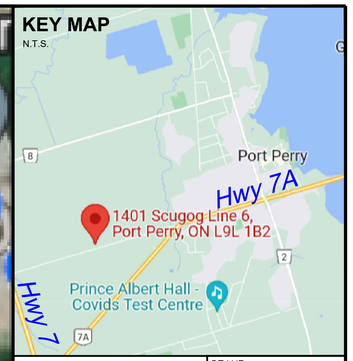
Latitude:44.09297, Longitude:-78.96344 (UTM Zone:17, Easting:663025, Northing:4884215)

Updated: October 18, 2021

Published: March 20, 2014



KEY MAP
N.T.S.



DRAWN: AS

STAMP:

DATE: AUGUST 22, 2024

KING EPCM

King EPCM
3780 14th. Ave., Unit 211
Markham, ON, L3R 4B7
www.KingEPCM.com
647-459-5647
General@KingEPCM.com

CLIENT

CLIENT REP NAME
POSITION
COMPANY NAME

PROJECT NAME

CONSTRUCTION OF INDUSTRIAL SUBDIVSION

PROJECT LOCATION

1401 SCUGOG LINE 6, PORT PERRY, ON

PRINT TITLE

MECP HISTORIC WELL RECORD SEARCH

FILE No.

EGR - 1.1

No.	ISSUED FOR:	DATE	DRAW BY	CHECK
V1	INTERNAL REVIEW	MARCH 15, 2022	AS	TW
V2	INTERNAL REVIEW	January 10, 2024	AS	TW
V3	INTERNAL REVIEW	August 22, 2024	AS	TW

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 — 1908760 — MUNICIP — CON.

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON.	BLOCK, TRACT, SURVEY, ETC	LOT
Renfrew Cty	Bonnechere Reach	X	6	14

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
Mac Rae Robert	Box 1385 Reach Ind. Pk Rd Eastern Ont	DAY 10 MO 8 YR 87

21 — ZONE — EASTING — NORTHING — RC — ELEVATION — RC — BASIN CODE

UTM | 17 | 6 6 1 3 9 2 | 4 8 8 4 6 8 | | 0 2 5 4 | |

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Brown	Sand		Packed	0	3
"	Sand	water		3	18½
		Water at 12½ ft			

31

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
3	1 ☒ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
30	1 ☐ STEEL 2 ☐ GALVANIZED 1 ☒ CONCRETE 4 ☐ OPEN HOLE	3	0	18½
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET

MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER, ETC.)

71 PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
1 ☐ PUMP 2 ☒ BAILER	4 GPM	1 HOURS — MINS

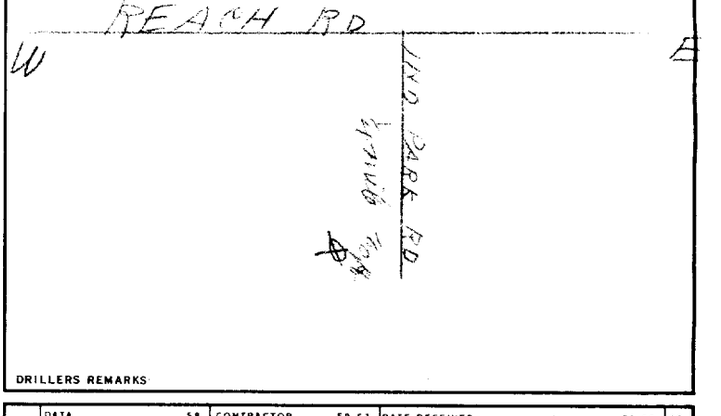
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
3 FEET	12½ FEET	1 ☒ PUMPING 2 ☐ RECOVERY	7 FEET	9 FEET	11 FEET	12½ FEET

IF FLOWING, GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM	FEET	1 ☐ CLEAR 2 ☐ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☐ DEEP	FEET	GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS

FINAL STATUS OF WELL

1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE

1 ☒ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☒ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF DRILLING

1 ☐ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☒ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

2214

CONTRACTOR

NAME OF WELL CONTRACTOR	LICENCE NUMBER
Gordon Boring	2214

ADDRESS
Renfrew Ont

NAME OF DRILLER OR BORER	LICENCE NUMBER
Gordon Boring	2214

SIGNATURE OF CONTRACTOR	SUBMISSION DATE
Gordon Boring	DAY 20 MO 11 YR 87

OFFICE USE ONLY

DATA SOURCE	CONTRACTOR	DATE RECEIVED
		DEC 04 1987

DATE OF INSPECTION	INSPECTOR

REMARKS

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506—4—77 FORM 7

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 1910887 MUNICIP 19009 CON. CON 006

COUNTY OR DISTRICT: Durham Reg
TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE: Scugog (REACH)
CON. 6. BLOCK, TRACT, SURVEY, ETC. (13) LOT 12
[redacted] 1275 Scugog Line 6 RR#1 Port Perry
DATE COMPLETED: DAY 11 MO 10 YR 90
UTM ZONE 17 NORTHING 4858425 RC ELEVATION 0258 RC BASIN CODE

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Brown	clay	sand + water		0	12
Buttery	Blue	clay + sand	Layered	12	60
	Gravel	Water		60	61
Grey	clay	sand	Layered	61	94
Grey	clay	sand + water		94	93
Grey	clay	stones		93	187
Grey	silt	water		187	217
Grey	sand	water		220	224

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
10-13	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
15-18	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
20-23	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
25-28	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
30-33	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
10-11	1 ☑ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC	.188	0	220
17-18	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC			
24-25	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER	LENGTH
8	5 INCHES	4 FEET

MATERIAL AND TYPE:
DEPTH TO TOP OF SCREEN: 216 FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)
10-13	14-17	
18-21	22-25	
26-29	30-33	

71 PUMPING TEST

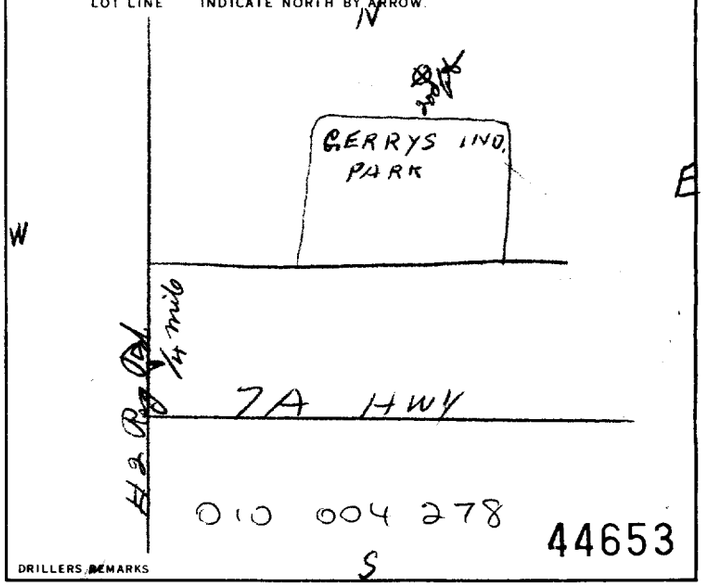
PUMPING TEST METHOD: 1 ☐ PUMP 2 ☑ BAILER
PUMPING RATE: 5 GPM
DURATION OF PUMPING: 1 HOURS ___ MINS
WATER LEVELS DURING: 1 ☑ PUMPING 2 ☐ RECOVERY

STATIC LEVEL	WATER LEVEL END OF PUMPING	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
0 FEET	122 FEET	FEET	FEET	FEET	122 FEET

IF FLOWING, GIVE RATE: ½ GPM
PUMP INTAKE SET AT: FEET
WATER AT END OF TEST: 1 ☑ CLEAR 2 ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☑ DEEP
RECOMMENDED PUMP SETTING: 200 FEET
RECOMMENDED PUMPING RATE: 3 GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS: 44653

FINAL STATUS OF WELL

1 ☑ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED ☐ DEWATERING

WATER USE

1 ☐ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☑ COMMERCIAL 6 ☐ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF CONSTRUCTION

1 ☑ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR-PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING ☐ DIGGING ☐ OTHER

CONTRACTOR

NAME OF WELL CONTRACTOR: Trueland Boring & Dudley Ltd
WELL CONTRACTOR'S LICENCE NUMBER: 2214
ADDRESS: 204 Chestnut St W unlikely out
NAME OF WELL TECHNICIAN: David Coleman
WELL TECHNICIAN'S LICENCE NUMBER: T0279
SIGNATURE OF TECHNICIAN/CONTRACTOR: Neil Coleman
SUBMISSION DATE: DAY 1 MO. 11 YR 90

OFFICE USE ONLY

DATA SOURCE
CONTRACTOR: 2214
DATE RECEIVED: NOV 13 1990
DATE OF INSPECTION
INSPECTOR
REMARKS

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506 (11/86) FORM 9

Ministry of Environment and Energy
Ontario

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 — 1913784 — Municipality 19009 — Con. CON 98 06

County or District	Township/Borough/City/Town/Village	Con block tract survey, etc.	Lot
[redacted]	Scugog Beach	VI	14

Address: PORT PERRY ONT.

Date completed: 17 day Aug month 98 year

21 — Zone — Easting — Northing — RC — Elevation — RC — Basin Code — ii — iii — iv

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth – feet From	Depth – feet To
GREY	CLAY		SOFT	0	12
GREY	CLAY	STONES		12	30
GREY	SAND			30	31
GREY	CLAY	GRAVEL		31	62
BROWN	SAND		FINE	62	83
GREY	GRAVEL	SAND	COARSE	83	87

31 — 32

41 WATER RECORD

Water found at – feet	Kind of water
30	1 [x] Fresh 2 [ ] Salty 3 [ ] Sulphur 4 [ ] Minerals 5 [ ] Gas
62	1 [x] Fresh 2 [ ] Salty 3 [ ] Sulphur 4 [ ] Minerals 5 [ ] Gas
	1 [ ] Fresh 2 [ ] Salty 3 [ ] Sulphur 4 [ ] Minerals 5 [ ] Gas
	1 [ ] Fresh 2 [ ] Salty 3 [ ] Sulphur 4 [ ] Minerals 5 [ ] Gas
	1 [ ] Fresh 2 [ ] Salty 3 [ ] Sulphur 4 [ ] Minerals 5 [ ] Gas

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth – feet From	Depth – feet To
6¼	1 [x] Steel 2 [ ] Galvanized 3 [ ] Concrete 4 [ ] Open hole 5 [ ] Plastic	.188	0	79
	1 [ ] Steel 2 [ ] Galvanized 3 [ ] Concrete 4 [ ] Open hole 5 [ ] Plastic			
	1 [ ] Steel 2 [ ] Galvanized 3 [ ] Concrete 4 [ ] Open hole 5 [ ] Plastic			

SCREEN

Sizes of opening (Slot No.)	Diameter	Length
3' 25-5'8	6 inches	8 feet

Material and type: STAINLESS STEEL — Depth at top of screen: 79 feet

61 PLUGGING & SEALING RECORD

[x] Annular space [ ] Abandonment

Depth set at – feet From	Depth set at – feet To	Material and type (Cement grout, bentonite, etc.)
30	12	Hole Plug - Cement
12	0	Hole plug BENTONITE

71 PUMPING TEST

Pumping test method: 1 [x] Pump 2 [ ] Bailer — Pumping rate: 17 GPM — Duration of pumping: 48 Hours ..... Mins

Water levels during: 1 [ ] Pumping [x] Recovery

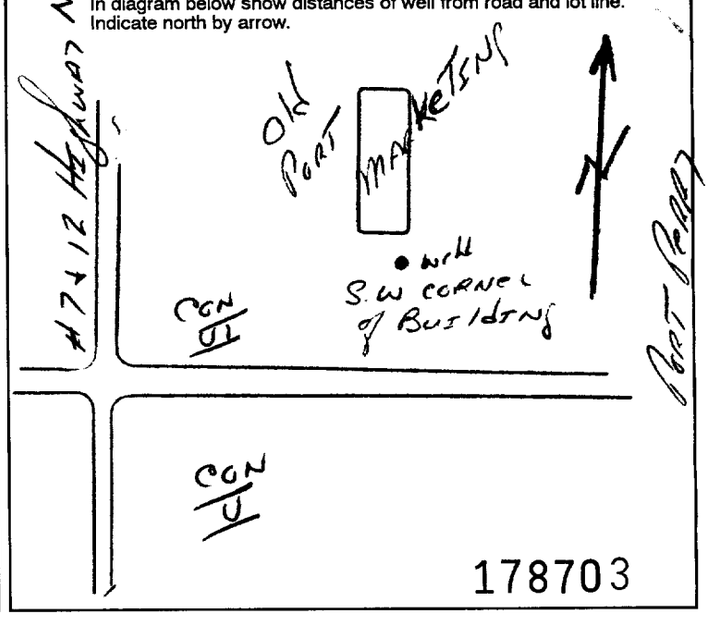
Static level	Water level end of pumping	15 minutes	30 minutes	45 minutes	60 minutes
+3 feet	27 feet	+3 feet	+3 feet	+3 feet	+3 feet

If flowing give rate: 4 GPM — Pump intake set at: 60 feet — Water at end of test: [x] Clear [ ] Cloudy

Recommended pump type: [ ] Shallow [x] Deep — Recommended pump setting: 60 feet — Recommended pump rate: 10-15 GPM

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



178703

FINAL STATUS OF WELL

1 [x] Water supply 2 [ ] Observation well 3 [ ] Test hole 4 [ ] Recharge well 5 [ ] Abandoned, insufficient supply 6 [ ] Abandoned, poor quality 7 [ ] Abandoned (Other) 8 [ ] Dewatering 9 [ ] Unfinished 10 [ ] Replacement well

WATER USE

1 [ ] Domestic 2 [ ] Stock 3 [ ] Irrigation 4 [ ] Industrial 5 [x] Commercial 6 [ ] Municipal 7 [ ] Public supply 8 [ ] Cooling & air conditioning 9 [ ] Not used 10 [ ] Other .....

METHOD OF CONSTRUCTION

1 [x] Cable tool 2 [ ] Rotary (conventional) 3 [ ] Rotary (reverse) 4 [ ] Rotary (air) 5 [ ] Air percussion 6 [ ] Boring 7 [ ] Diamond 8 [ ] Jetting 9 [ ] Driving 10 [ ] Digging 11 [ ] Other .....

Name of Well Contractor: KAWARTHA WELL DRILLERS — Well Contractor's Licence No.: 3136

Address: RR#1 Reaboro K0L 2H0

Name of Well Technician: DARREN BYRNE — Well Technician's Licence No.: T2439

Signature of Technician/Contractor: D Byrne — Submission date: 23 day Sept mo 98 yr

MINISTRY USE ONLY

Data source — Contractor: 3136 — Date received: SEP 14 1998

Date of inspection — Inspector

Remarks: CSS. S9

0506 (07/94) Front Form 9

2 - MINISTRY OF ENVIRONMENT & ENERGY COPY

Ministry of Environment and Energy
Ontario

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 1913785

Municipality 19009 Con. CON 28 06

County or District [redacted]

Township/Borough/City/Town/Village Scugog Reach

Con block tract survey, etc. VI

Lot 14

Address PORT PERRY ONT.

Date completed 17 Aug 78 (day month year)

21 Zone Easting Northing RC Elevation RC Basin Code i ii iii iv

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth – feet From	Depth – feet To
	Abandonment of well		119' - 6¼ ID		
	Well Screen Removed				
	pipe Backed off at 50'				
N.B	well was poorly constructed pumped sand. - poor welds				

31

32

41 WATER RECORD

Water found at – feet	Kind of water
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth – feet From	Depth – feet To
	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic			
	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic			
	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic			

SCREEN

Sizes of opening (Slot No.)	Diameter inches	Length feet	Depth at top of screen feet

Material and type

61 PLUGGING & SEALING RECORD

☐ Annular space ☒ Abandonment

Depth set at – feet From	Depth set at – feet To	Material and type (Cement grout, bentonite, etc.)
119	50	Natural Fell In
50	30	Hole Plug
30	0	Hole Plug Cement

71 PUMPING TEST

Pumping test method 1 ☐ Pump 2 ☐ Bailer

Pumping rate GPM

Duration of pumping ..... Hours ..... Mins

Static level feet

Water level end of pumping feet

Water levels during 1 ☐ Pumping 2 ☐ Recovery

15 minutes	30 minutes	45 minutes	60 minutes
feet	feet	feet	feet

If flowing give rate GPM

Pump intake set at feet

Water at end of test ☐ Clear ☐ Cloudy

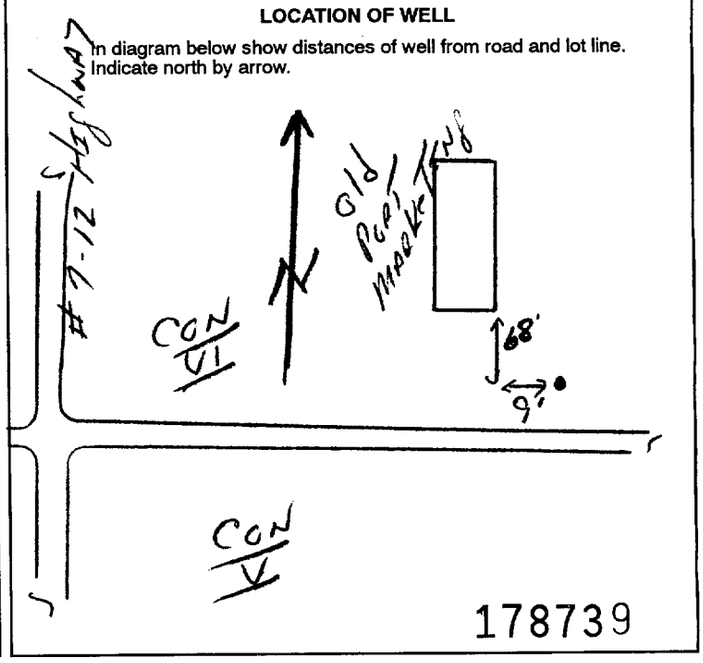
Recommended pump type ☐ Shallow ☐ Deep

Recommended pump setting feet

Recommended pump rate GPM

LOCATION OF WELL

In diagram below show distances of well from road and lot line.
Indicate north by arrow.



178739

FINAL STATUS OF WELL

1 ☐ Water supply
2 ☐ Observation well
3 ☐ Test hole
4 ☐ Recharge well
5 ☐ Abandoned, insufficient supply
6 ☒ Abandoned, poor quality
7 ☒ Abandoned (Other)
8 ☐ Dewatering
9 ☐ Unfinished
10 ☐ Replacement well

WATER USE

1 ☐ Domestic
2 ☐ Stock
3 ☐ Irrigation
4 ☐ Industrial
5 ☐ Commercial
6 ☐ Municipal
7 ☐ Public supply
8 ☐ Cooling & air conditioning
9 ☐ Not used
10 ☐ Other .....

METHOD OF CONSTRUCTION

1 ☐ Cable tool
2 ☐ Rotary (conventional)
3 ☐ Rotary (reverse)
4 ☐ Rotary (air)
5 ☐ Air percussion
6 ☐ Boring
7 ☐ Diamond
8 ☐ Jetting
9 ☐ Driving
10 ☐ Digging
11 ☐ Other .....

Name of Well Contractor: Kawartha Well Drillers — Well Contractor's Licence No.: 3136

Address: RR#1 Reaboro KOL 2HO

Name of Well Technician: Darren + Gary Byrne — Well Technician's Licence No.: T0217

Signature of Technician/Contractor: D G Byrne — Submission date: 23 Aug 78 (day mo yr)

MINISTRY USE ONLY

Data source 58 — Contractor 3136 59-62 — Date received SEP 14 1998 63-68 — 80

Date of inspection — Inspector

Remarks: CSS. S9

0506 (07/94) Front Form 9

2 - MINISTRY OF ENVIRONMENT & ENERGY COPY

Ontario Ministry of the Environment

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 **1915285** Municipality 19009 Con CON 06

County or District [redacted] | Township/Borough/City/Town/Village Scugog | Con block tract survey, etc. 36 | Lot 14

Address 3944 Old Simcoe Rd Prince Albert | Date completed 03 day 07 month 01 year

21 UTM Northing RC Elevation RC Basin Code

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	Depth - feet To
Grey	Granular Gravel			0	1
Brown	Sand			1	10
Grey	Clay			10	20
Blue	Clay			20	32
Dark	Sand	Fine Gravel, Water		32	32½
Blue	Clay	stones		32½	38
Dark	Sand	Water		38	39
Grey	Clay			39	42½

31

32

41 WATER RECORD

Water found at - feet	Kind of water
32	1 ☑ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
38	1 ☑ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet From	Depth - feet To
24	1 ☑ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic	.188	0	20
18	1 ☐ Steel 2 ☑ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic	.14	20	42½
	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic			

SCREEN

Sizes of opening (Slot No.) | Diameter inches | Length feet

Material and type | Depth at top of screen feet

61 PLUGGING & SEALING RECORD

☑ Annular space ☐ Abandonment

Depth set at - feet From	Depth set at - feet To	Material and type (Cement grout, bentonite, etc.)
0	20	Benseal

71 PUMPING TEST

Pumping test method: 1 ☑ Pump 2 ☐ Bailer | Pumping rate: 3 GPM | Duration of pumping: 1 Hours 30 Mins

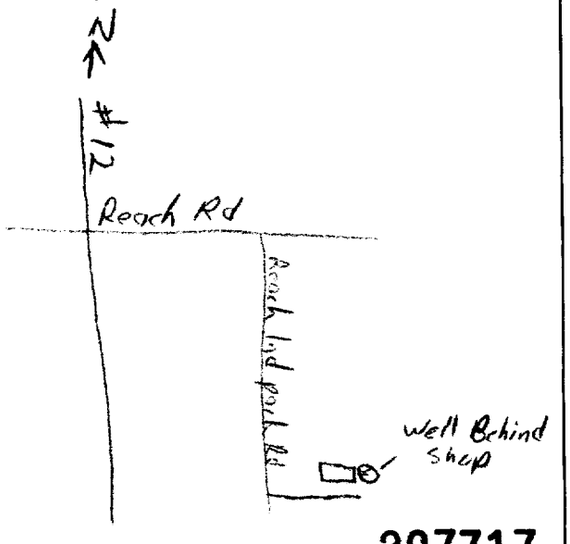
Static level	Water level end of pumping	Water levels during: 1 ☑ Pumping 2 ☐ Recovery			
		15 minutes	30 minutes	45 minutes	60 minutes
17 feet	30 feet	22 feet	26 feet	29 feet	30 feet

If flowing give rate: GPM | Pump intake set at: 38 feet | Water at end of test: ☑ Clear ☐ Cloudy

Recommended pump type: ☐ Shallow ☑ Deep | Recommended pump setting: 38 feet | Recommended pump rate: 5 GPM

LOCATION OF WELL

In diagram below show distances of well from road and lot line.
Indicate north by arrow.



207717

FINAL STATUS OF WELL

1 ☑ Water supply 2 ☐ Observation well 3 ☐ Test hole 4 ☐ Recharge well 5 ☐ Abandoned, insufficient supply 6 ☐ Abandoned, poor quality 7 ☐ Abandoned (Other) 8 ☐ Dewatering 9 ☐ Unfinished 10 ☐ Replacement well

WATER USE

1 ☐ Domestic 2 ☐ Stock 3 ☐ Irrigation 4 ☐ Industrial 5 ☑ Commercial 6 ☐ Municipal 7 ☐ Public supply 8 ☐ Cooling & air conditioning 9 ☐ Not use 10 ☐ Other

METHOD OF CONSTRUCTION

1 ☐ Cable tool 2 ☐ Rotary (conventional) 3 ☐ Rotary (reverse) 4 ☐ Rotary (air) 5 ☐ Air percussion 6 ☑ Boring 7 ☐ Diamond 8 ☐ Jetting 9 ☐ Driving 10 ☐ Digging 11 ☐ Other

Name of Well Contractor: Freelance Boring Drilling LTD | Well Contractor's Licence No.: 2214

Address: 1151 Zion Rd RR#2 Little Britain On

Name of Well Technician: David Coburn | Well Technician's Licence No.: T0161

Signature of Technician/Contractor | Submission date: day 12 mo 07 yr 01

MINISTRY USE ONLY

Data source | Contractor 2214 | Date received SEP 18 2001

Date of inspection | Inspector

Remarks: OSS.ES1

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Ontario **Ministry of the Environment**

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 (1 2) **1915379** Municipality 19009 (10 14) Con. CON - 01 (15 22 23 24) 06

County or District	Township/Borough/City/Town/Village	Con block tract survey, etc.	Lot (25-27)
Durham	Scugog - Reach	VI	14

Owner's surname (26-47) First Name	Address	Date completed (48-53)
Durham Reg Works Dep	Regional Road #8	12 day 01 month 01 year

21 (1 2) UTM Zone (10) Easting (12 17) Northing (18 24) RC (25) Elevation (26) RC (30) Basin Code (31) ii iii iv (47)

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	Depth - feet To
	Abandonment Record				
	30" Cement Tiled well		16' Deep		
	Top	2½ Tiles	Removed		
	(See Below)	Sealing Record			

31 (10 14 15 21)

32 (32 43 54 65 75 80)

41 WATER RECORD

Water found at - feet	Kind of water
10-13	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas (14)
15-18	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas (19)
20-23	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas (24)
25-28	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas (29)
30-33	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas (34) (60)

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet From	Depth - feet To
10-11	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic (12)			13-16
17-18	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic (19)			20-23
24-25	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic (26)			27-30

SCREEN

Sizes of opening (Slot No.) (31-33)	Diameter (34-38) inches	Length (39-40) feet
Material and type	Depth at top of screen (41-44) feet	(30)

61 PLUGGING & SEALING RECORD

☐ Annular space ☒ Abandonment

Depth set at - feet From	Depth set at - feet To	Material and type (Cement grout, bentonite, etc.)
16 (13-16)	14 (14-17)	Bensgal
14 (18-21)	12 (22-25)	Clay
12 (26-29)	11 (30-33)	Layer of Bensgal
11	0	Clay

(80)

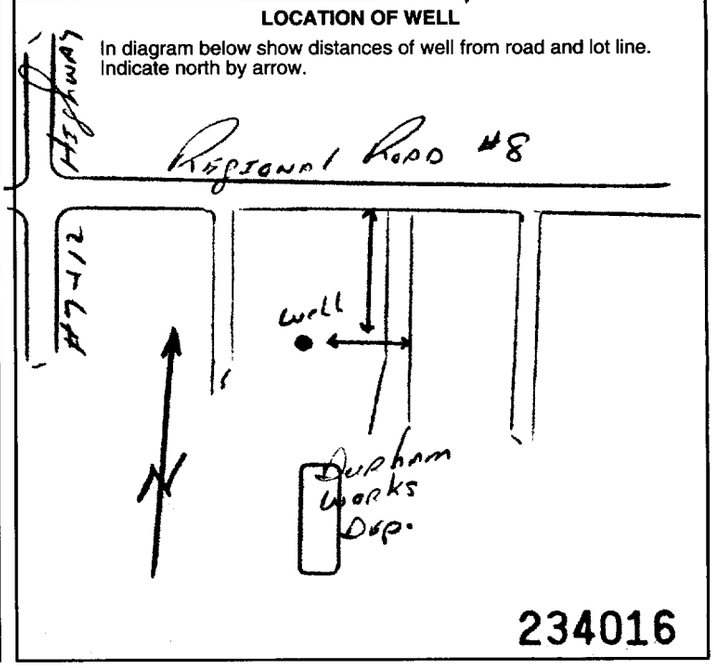
71 PUMPING TEST

Pumping test method (10) 1 ☐ Pump 2 ☐ Bailer	Pumping rate (11-14) GPM	Duration of pumping (15-16) Hours (17-18) Mins
Static level (19-21) feet	Water level end of pumping (22-24) feet	Water levels during (25) 1 ☐ Pumping 2 ☐ Recovery
15 minutes (26-28) feet	30 minutes (29-31) feet	45 minutes (32-34) feet / 60 minutes (35-37) feet
If flowing give rate (38-41) GPM	Pump intake set at feet	Water at end of test (42) ☐ Clear ☐ Cloudy
Recommended pump type ☐ Shallow ☐ Deep	Recommended pump setting (43-45) feet	Recommended pump rate (46-49) GPM

(50-53)

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



234016

FINAL STATUS OF WELL (54)

1 ☐ Water supply 2 ☐ Observation well 3 ☐ Test hole 4 ☐ Recharge well 5 ☐ Abandoned, insufficient supply 6 ☐ Abandoned, poor quality 7 ☒ Abandoned (Other) 8 ☐ Dewatering 9 ☐ Unfinished 10 ☐ Replacement well

WATER USE (55-56)

1 ☐ Domestic 2 ☐ Stock 3 ☐ Irrigation 4 ☐ Industrial 5 ☐ Commercial 6 ☐ Municipal 7 ☐ Public supply 8 ☐ Cooling & air conditioning 9 ☐ Not use 10 ☐ Other

METHOD OF CONSTRUCTION (57)

1 ☐ Cable tool 2 ☐ Rotary (conventional) 3 ☐ Rotary (reverse) 4 ☐ Rotary (air) 5 ☐ Air percussion 6 ☐ Boring 7 ☐ Diamond 8 ☐ Jetting 9 ☐ Driving 10 ☐ Digging 11 ☐ Other

Name of Well Contractor	Well Contractor's Licence No.
Kawartha Well Drillers	3136
Address: RR#1 Roseboro K0L 2X0	
Name of Well Technician: Gary Byrne	Well Technician's Licence No. 0227
Signature of Technician/Contractor: G. Byrne	Submission date: 13 day 09 mo 01 yr

MINISTRY USE ONLY

Data source (58)	Contractor (59-62)	Date received (63-68) (80)
	3136	OCT 18 2001
Date of inspection	Inspector	
Remarks		

OSS.ES1

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Ontario Ministry of the Environment

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 **1915419** Municipality 19009 Con. CON 06

County or District: Durham
Township/Borough/City/Town/Village: Scugog
Con block tract survey, etc.: 6
Lot: 14+15
Address: [redacted] Riverview Dr Port Perry On
Date completed: 12 day 09 month 01 year
21 UTM Northing RC Elevation RC Basin Code

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	Depth - feet To
Black	Topsoil			0	1
Brown	Sand			1	10
Grey	Clay			10	30
Dark	Sand	Water		30	31
Grey	Clay			31	40
Dark	Sand	Gravel + water		40	42

31
32

41 WATER RECORD

Water found at - feet	Kind of water
30	1 ☑ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas
40	1 ☑ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas
	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 5 ☐ Gas

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet From	Depth - feet To
24	1 ☑ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic	.250	0	20
18	1 ☐ Steel 2 ☑ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic	.14	20	42
	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic			

SCREEN

Sizes of opening (Slot No.)	Diameter	Length
Gravel Pack	18 inches	2½ feet

Material and type: 3/8 Peastone
Depth at top of screen: 40 feet

61 PLUGGING & SEALING RECORD

☐ Annular space ☐ Abandonment

Depth set at - feet From	Depth set at - feet To	Material and type (Cement grout, bentonite, etc.)
0	20	Benseal

71 PUMPING TEST

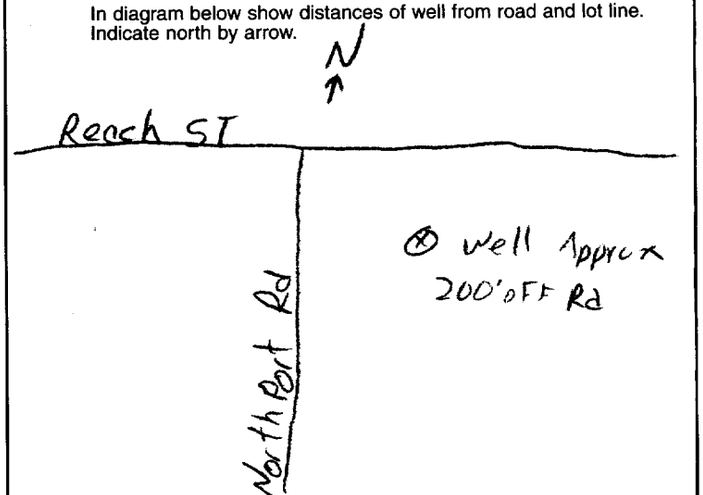
Pumping test method: 1 ☑ Pump 2 ☐ Bailer
Pumping rate: 5 GPM
Duration of pumping: 1 Hours 30 Mins

Static level	Water level end of pumping	Water levels during: 1 ☑ Pumping 2 ☐ Recovery			
		15 minutes	30 minutes	45 minutes	60 minutes
15 feet	24½ feet	20 feet	23 feet	24 feet	24½ feet

If flowing give rate: GPM
Pump intake set at: 37 feet
Water at end of test: ☐ Clear ☑ Cloudy
Recommended pump type: ☐ Shallow ☑ Deep
Recommended pump setting: feet
Recommended pump rate: 3 GPM

LOCATION OF WELL

In diagram below show distances of well from road and lot line.
Indicate north by arrow.



207720

FINAL STATUS OF WELL

1 ☑ Water supply 2 ☐ Observation well 3 ☐ Test hole 4 ☐ Recharge well 5 ☐ Abandoned, insufficient supply 6 ☐ Abandoned, poor quality 7 ☐ Abandoned (Other) 8 ☐ Dewatering 9 ☐ Unfinished 10 ☐ Replacement well

WATER USE

1 ☐ Domestic 2 ☐ Stock 3 ☐ Irrigation 4 ☐ Industrial 5 ☑ Commercial 6 ☐ Municipal 7 ☐ Public supply 8 ☐ Cooling & air conditioning 9 ☐ Not use 10 ☐ Other

METHOD OF CONSTRUCTION

1 ☐ Cable tool 2 ☐ Rotary (conventional) 3 ☐ Rotary (reverse) 4 ☐ Rotary (air) 5 ☐ Air percussion 6 ☑ Boring 7 ☐ Diamond 8 ☐ Jetting 9 ☐ Driving 10 ☐ Digging 11 ☐ Other

Name of Well Contractor: Freelance Boring + Drilling LTD
Well Contractor's Licence No.: 2214
Address: 1151 Zion Rd RR#2 Little Britain On
Name of Well Technician: David Coburn
Well Technician's Licence No.: T0279
Signature of Technician/Contractor:
Submission date: day 17 mo 09 yr 01

MINISTRY USE ONLY

Data source: 58
Contractor: 2214 (59-62)
Date received: NOV 27 2001 (63-68)
Date of inspection:
Inspector:
Remarks:

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Ontario Ministry of the Environment

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 | 1915552 | Municipality 19009 | Con. CON 06

County or District: Durham
Township/Borough/City/Town/Village: Scugog
Con block tract survey, etc.: 6
Lot: 14
Address: 178 Reach Industrial Park Rd Port Perry
Date completed: 22 Jan 24 (day month year)
Northing | RC | Elevation | RC | Basin Code | ii | iii | iv

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	Depth - feet To
			Cleaned Out Well		
			Brown Sand	0 21	0 24
			905-985-3747		
			Cemented Tile Joints		
			With Cement Seal Bond	0	10

31
32

41 WATER RECORD

Water found at - feet	Kind of water
0 24	1 ☑ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
15-18	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
20-23	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
25-28	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas
30-33	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas

51 CASING & OPEN HOLE RECORD

Inside diam inches	Material	Wall thickness inches	Depth - feet From	Depth - feet To
30"	1 ☐ Steel 2 ☐ Galvanized 3 ☑ Concrete 4 ☐ Open hole 5 ☐ Plastic	3"	0	24
17-18	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic			20-23
24-25	1 ☐ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic			27-30

SCREEN

Sizes of opening (Slot No.)	Diameter inches	Length feet
Material and type	Depth at top of screen feet	

61 PLUGGING & SEALING RECORD

☐ Annular space ☐ Abandonment

Depth set at - feet From	Depth set at - feet To	Material and type (Cement grout, bentonite, etc.)
10-13	14-17	
18-21	22-25	
26-29	30-33	

71 PUMPING TEST

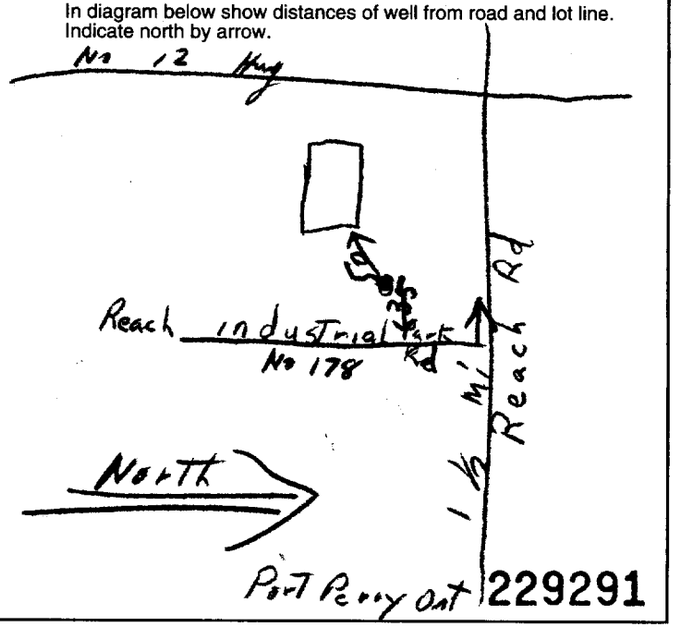
Pumping test method: 1 ☑ Pump 2 ☑ Bailer
Pumping rate: 25 GPM
Duration of pumping: 2 Hours ____ Mins
Water levels during: 1 ☐ Pumping 2 ☑ Recovery

Static level	Water level end of pumping	15 minutes	30 minutes	45 minutes	60 minutes
0,8 feet	0 24 feet	0 20 feet	0 17 feet	0 15 feet	0 13 feet

If flowing give rate: ____ GPM
Pump intake set at: 0 22 feet
Water at end of test: ☑ Clear ☐ Cloudy
Recommended pump type: ☐ Shallow ☑ Deep
Recommended pump setting: 0 22 feet
Recommended pump rate: 8 GPM

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



229291

FINAL STATUS OF WELL 54

1 ☑ Water supply 2 ☐ Observation well 3 ☐ Test hole 4 ☐ Recharge well 5 ☐ Abandoned, insufficient supply 6 ☐ Abandoned, poor quality 7 ☐ Abandoned (Other) 8 ☐ Dewatering 9 ☐ Unfinished 10 ☐ Replacement well

WATER USE 55-56

1 ☑ Domestic 2 ☐ Stock 3 ☐ Irrigation 4 ☐ Industrial 5 ☐ Commercial 6 ☐ Municipal 7 ☐ Public supply 8 ☐ Cooling & air conditioning 9 ☐ Not use 10 ☐ Other

METHOD OF CONSTRUCTION 57

1 ☑ Cable tool 2 ☐ Rotary (conventional) 3 ☐ Rotary (reverse) 4 ☐ Rotary (air) 5 ☐ Air percussion 6 ☐ Boring 7 ☐ Diamond 8 ☐ Jetting 9 ☐ Driving 10 ☐ Digging ☐ Other

Cleaned out well Pully winch

Name of Well Contractor	Well Contractor's Licence No.
Richard Lott	6874
Address: 398 Surrey Dr Oshawa ONT L1G 6H1	
Name of Well Technician: Richard Lott	Well Technician's Licence No.: T 24 24
Signature of Technician/Contractor: Richard Lott	Submission date: 23 01 2002 (day mo yr)

MINISTRY USE ONLY

Data source 58 | Contractor 6874 59-62 | Date received FEB 15 2002 63-68 80
Date of inspection | Inspector
Remarks

CSS.ES

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MINISTRY OF THE ENVIRONMENT
The Ontario Water Resources Act

WATER WELL RECORD

Ontario

3 10/2 W

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

11 | 14606250 | MUNICIP. 46005 | CON. CON 05

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC.	LOT
ONTARIO	REACH	V	04 / 14

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
CARRIRA CONST LTD.	PORT PERRY	DAY 02 MO. 06 YR. 75

21 | UTM ZONE 17 | EASTING 661795 | NORTHING 4883803 | RC 4 | ELEVATION 0865 | RC 5 | BASIN CODE 24

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
RED	SAND		DRY	0	4
BLUE	SAND	SILT CLAY	SOFT	4	83
BLUE	CLAY	STONE	HARD	83	222
GREY	CLAY	STONE	HARD	222	235
GREY	GRAVEL	SILT	CEMENTED	235	240
GREY	LIMESTONE		HARD	240	253

31 | 0004728 | 0083280605 | 0222305 12 | 0235205 12 | 0240211 06 | 0253285

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
0240	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERAL

51 CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6 4/4 05	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	188	0	0241
05	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☒ OPEN HOLE		241	0253
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET

MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	DEPTH SET AT - FEET TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD PACKER, ETC.)

71 PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE GPM.	DURATION OF PUMPING HOURS	MINS.
1 ☒ PUMP 2 ☐ BAILER	008	03	30

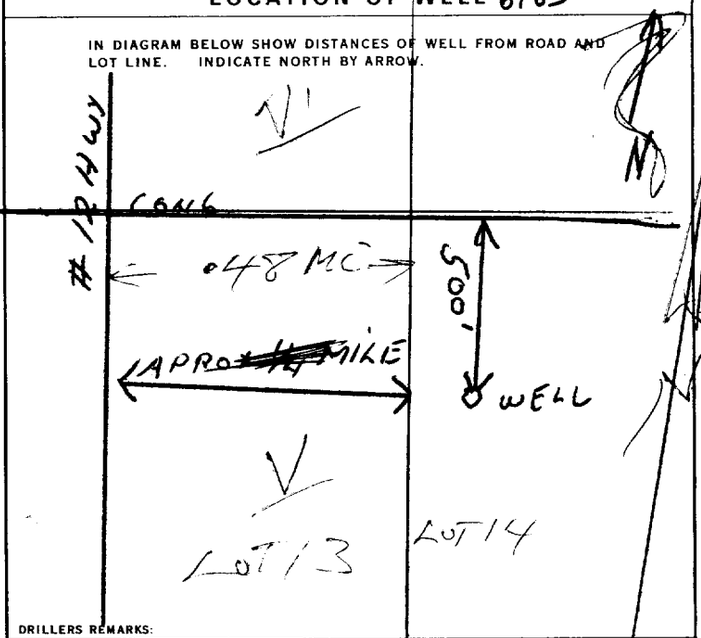
STATIC LEVEL FEET	WATER LEVEL END OF PUMPING FEET	WATER LEVELS DURING 1 ☒ PUMPING 2 ☐ RECOVERY	15 MINUTES FEET	30 MINUTES FEET	45 MINUTES FEET	60 MINUTES FEET
-09 A.G.	080		—	—	076	076

IF FLOWING, GIVE RATE GPM	PUMP INTAKE SET AT FEET	WATER AT END OF TEST	RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING FEET	RECOMMENDED PUMPING RATE GPM
0003	90	1 ☒ CLEAR 2 ☐ CLOUDY	☐ SHALLOW ☒ DEEP	090	0007

000.1 GPM./FT. SPECIFIC CAPACITY

LOCATION OF WELL 6183

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS:

FINAL STATUS OF WELL 54: 1 ☒ WATER SUPPLY; 2 ☐ OBSERVATION WELL; 3 ☐ TEST HOLE; 4 ☐ RECHARGE WELL; 5 ☐ ABANDONED, INSUFFICIENT SUPPLY; 6 ☐ ABANDONED, POOR QUALITY; 7 ☐ UNFINISHED

WATER USE 55-56 04: 1 ☐ DOMESTIC; 2 ☐ STOCK; 3 ☐ IRRIGATION; 4 ☒ INDUSTRIAL; ☐ OTHER; 5 ☐ COMMERCIAL; 6 ☐ MUNICIPAL; 7 ☐ PUBLIC SUPPLY; 8 ☐ COOLING OR AIR CONDITIONING; 9 ☐ NOT USED

METHOD OF DRILLING 57 2: 1 ☐ CABLE TOOL; 2 ☒ ROTARY (CONVENTIONAL); 3 ☐ ROTARY (REVERSE); 4 ☐ ROTARY (AIR); 5 ☐ AIR PERCUSSION; 6 ☐ BORING; 7 ☐ DIAMOND; 8 ☐ JETTING; 9 ☐ DRIVING

CONTRACTOR

NAME OF WELL CONTRACTOR	LICENCE NUMBER
R.F. BOADWAY	1413

ADDRESS
BOX 397 SUTTON WEST ONT L0E 1R0

NAME OF DRILLER OR BORER	LICENCE NUMBER
NORM POWELL	

SIGNATURE OF CONTRACTOR	SUBMISSION DATE
R. F. Boadway	DAY 2 MO JUNE YR 75

OFFICE USE ONLY

DATA SOURCE 58	CONTRACTOR 59-62	DATE RECEIVED 63-68
1	1413	08 07 75

DATE OF INSPECTION	INSPECTOR
MAR. 11/76	S.B.

REMARKS: CSS.S8 P/S.L WI

MINISTRY OF THE ENVIRONMENT COPY

FORM 7 MOE 07-091

Ontario Ministry of the Environment

Well Tag Number (A041077

A041077

Well Record

Regulation 903 Ontario Water Resources Act

page 1 of 1

Instructions for Completing Form

- For use in the **Province of Ontario** only. This document is a permanent **legal** document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Management Coordinator at 416-235-6203.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

[redacted]

Address of Well Location (County/District/Municipality): Durham | Township: Scugog | Lot: 14+15 | Concession: 6

RR#/Street Number/Name: 96 North Port Rd Port Perry On | City/Town/Village: Port Perry | Site/Compartment/Block/Tract etc.:

GPS Reading | NAD: 83 | Zone: 17 | Easting: 661998 | Northing: 4884955 | Unit Make/Model: ETREX | Mode of Operation: ☒ Undifferentiated ☐ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To (Metres)
Black	Topsoil			0	.3048
Brown	Clay	Sandy		.3048	3.658
Blue	Clay		Buttery	3.658	9.754
Dark	Sand	Water	Course	9.754	10.973

Hole Diameter

Depth From	Depth To (Metres)	Diameter (Centimetres)
0	6.096	~~30.5~~
6.096	10.973	60.96

Water Record

Water found at Metres / Kind of Water

9.754 m	☒ Fresh	☐ Sulphur	☐ Gas ☐ Salty ☐ Minerals ☐ Other:
m	☐ Fresh	☐ Sulphur	☐ Gas ☐ Salty ☐ Minerals ☐ Other:
m	☐ Fresh	☐ Sulphur	☐ Gas ☐ Salty ☐ Minerals ☐ Other:

After test of well yield, water was: ☒ Clear and sediment free ☐ Other, specify

Chlorinated ☒ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To (Metres)
Casing				
60.96	☒ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	.635	0	6.096
45.72	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☒ Galvanized		6.096	10.973
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized	Slot No.		

No Casing or Screen

☐ Open hole

Test of Well Yield

Pumping test method: Pump

	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres) 10.668	Static Level	1.22		5.7912
Pumping rate - (litres/min) 45.46	1	1.295	1	4.953
Duration of pumping 1 hrs + 30 min	2	1.3716	2	4.8768
Final water level end of pumping 5.7912 metres	3	1.448	3	4.8006
Recommended pump type: ☐ Shallow ☒ Deep	4	1.524	4	4.724
Recommended pump depth 9.144 metres	5	1.6002	5	4.648
Recommended pump rate 22.73 (litres/min)		1.9812		
	10	[illegible]	10	4.267
	15	2.362	15	3.886
If flowing give rate - (litres/min)	20	2.743	20	3.505
	25	3.124	25	3.124
If pumping discontinued, give reason.	30	3.505	30	2.743
	40	4.267	40	2.438
	50	5.029	50	2.1336
	60	5.7912	60	1.829

Plugging and Sealing Record

☒ Annular space ☐ Abandonment

Depth set at - Metres From	Depth set at - Metres To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (~~cubic metres~~) Litres
0	6.096	Bentonite slurry	340.95L

Method of Construction

☐ Cable Tool ☐ Rotary (air) ☐ Diamond ☐ Digging
☐ Rotary (conventional) ☐ Air percussion ☐ Jetting ☐ Other
☐ Rotary (reverse) ☒ Boring ☐ Driving

Water Use

☐ Domestic ☐ Industrial ☐ Public Supply ☐ Other
☐ Stock ☒ Commercial ☐ Not used
☐ Irrigation ☐ Municipal ☐ Cooling & air conditioning

Final Status of Well

☒ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☐ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☐ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor: Freelance Boring + Drilling LTD | Well Contractor's Licence No.: 2214

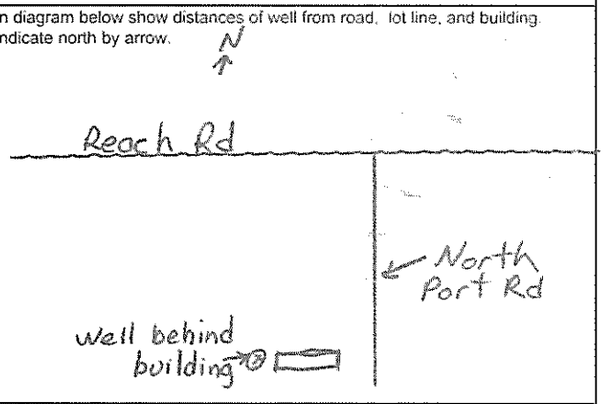
Business Address (street name, number, city etc.): 2589 Cty Rd #22 Castleton On

Name of Well Technician (last name, first name): Coburn, David | Well Technician's Licence No.: T0279

Signature of Technician/Contractor: X [signature] | Date Submitted YYYY MM DD: 2007 01 15

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.



Audit No. Z 45648 | Date Well Completed YYYY MM DD: 2007 00 10

Was the well owner's information package delivered? ☒ Yes ☐ No | Date Delivered YYYY MM DD: 2007 01 17

Ministry Use Only

Data Source | Contractor

Date Received YYYY MM DD: MAR 03 2008 | Date of Inspection YYYY MM DD

Remarks | Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☒ Well Owner's Copy ☐ *Cette formule est disponible en français*

Ontario — Ministry of the Environment

Measurements recorded in: ☐ Metric ☒ Imperial

Well Tag No. *(Place Sticker and/or Print Below)*

Tag#: A150340

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	Township of Scugog		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. *(inc. area code)*
181 Perry St Port Perry	Scugog	Ont.	L9L 1B8	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
1350 Reach St Port Perry	Scugog	15	VI

County/District/Municipality	City/Town/Village	Province	Postal Code
Durham	Port Perry	Ontario	L9L 1B2

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 83	17	661350	4885040		

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Decommission	30" Dia Well			
	Water Level	2'			
	Water Removed and Top 2 Concrete Rings				
	Removed				
	5'-0' Sand fill				

Annular Space

Depth Set at (m/ft) From	Depth Set at (m/ft) To	Type of Sealant Used (Material and Type)	Volume Placed (m^3/ft^3)
25'	20'	Sand fill	2 yds
20'	19'	Bentonite	5 bags
19'	6'	Sand fill	5 yds
6'	5'	Bentonite	5 bags

Method of Construction

☐ Cable Tool ☐ Diamond ☐ Rotary (Conventional) ☐ Jetting ☐ Rotary (Reverse) ☐ Driving ☐ Boring ☐ Digging ☐ Air percussion ☐ Other, *specify* _____

Well Use

☐ Public ☐ Commercial ☐ Not used ☐ Domestic ☐ Municipal ☐ Dewatering ☐ Livestock ☐ Test Hole ☐ Monitoring ☐ Irrigation ☐ Cooling & Air Conditioning ☐ Industrial ☐ Other, *specify* _____

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☐ Water Supply ☐ Replacement Well ☐ Test Hole ☐ Recharge Well ☐ Dewatering Well ☐ Observation and/or Monitoring Hole ☐ Alteration (Construction) ☐ Abandoned, Insufficient Supply ☐ Abandoned, Poor Water Quality ☒ Abandoned, other, *specify* ☐ Other, *specify*

Water Details

Water found at Depth (m/ft)	Kind of Water	Hole Diameter Depth (m/ft) From	Hole Diameter Depth (m/ft) To	Hole Diameter (cm/in)
☐ Gas	☐ Fresh ☐ Untested ☐ Other, *specify*			
☐ Gas	☐ Fresh ☐ Untested ☐ Other, *specify*			
☐ Gas	☐ Fresh ☐ Untested ☐ Other, *specify*			

Results of Well Yield Testing

After test of well yield, water was: ☐ Clear and sand free ☐ Other, *specify* _____

If pumping discontinued, give reason:

Pump intake set at *(m/ft)*

Pumping rate *(l/min / GPM)*

Duration of pumping _____ hrs + _____ min

Final water level end of pumping *(m/ft)*

If flowing give rate *(l/min / GPM)*

Recommended pump depth *(m/ft)*

Recommended pump rate *(l/min / GPM)*

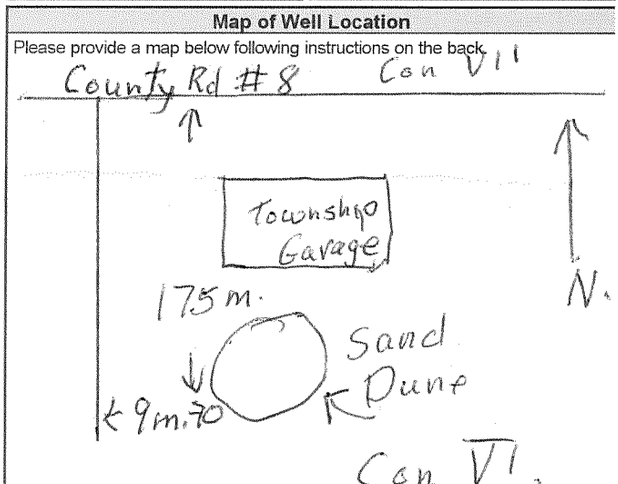
Well production *(l/min / GPM)*

Disinfected? ☐ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level				
1			1	
2			2	
3			3	
4			4	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
40			40	
50			50	
60			60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Chris Duff Electric + Plumbing	7455

Business Address (Street Number/Name)	Municipality	Province	Postal Code	Business E-mail Address
12 Greensboro Drive.	Scugog	ON	L0B 1B0	SD@VCANDK.COM

Bus. Telephone No. *(inc. area code)*	Name of Well Technician (Last Name, First Name)	Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
7054543725	Sauder, Gb.	0241	Gb. Sauder	20130624

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☐ Yes ☒ No		20130612

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Audit No. z115804

Received JUL 03 2013

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GHD - 1120818-01

Ontario — Ministry of the Environment, Conservation and Parks

Well Tag No. *(Place Sticker and/or Print Below)* A275283.

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Measurements recorded in: ☐ Metric ☑ Imperial

[redacted]

Address of Well Location (Street Number/Name)	Township	Lot	Concession
135 North Port Rd.			
County/District/Municipality	**City/Town/Village**	**Province**	**Postal Code**
	Port Perry	Ontario	
UTM Coordinates Zone / Easting / Northing	**Municipal Plan and Sublot Number**	**Other**	
NAD 83 17 661985 4885034			

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	To
	Topsoil			0	1
Brown	Fill, Silty Sand to Sand	Trace Rootlets,	Moist to Wet, Very loose	1	7
Grey	Till, Sandy Silt	Some Gravel, Tr. Clay	Wet, loose to Compact	7	15

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
0	8	Bentonite	1.42

Method of Construction

☐ Cable Tool ☐ Diamond
☑ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☐ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☐ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☑ Test Hole ☑ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
2	PVC	2 1/8	0	10

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
2 1/8	PVC	10	10	15

Status of Well

☐ Water Supply
☐ Replacement Well
☑ Test Hole
☐ Recharge Well
☐ Dewatering Well
☑ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water	
7 1/2	☐	☐ Fresh ☑ Untested	☐ Other, specify
	☐	☐ Fresh ☐ Untested	☐ Other, specify
	☐	☐ Fresh ☐ Untested	☐ Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	15	6

Results of Well Yield Testing

After test of well yield, water was:
☑ Clear and sand free
☐ Other, specify

If pumping discontinued, give reason:

Pump intake set at (m/ft)

Pumping rate (l/min / GPM)

Duration of pumping ____ hrs + ____ min

Final water level end of pumping (m/ft)

If flowing give rate (l/min / GPM)

Recommended pump depth (m/ft)

Recommended pump rate (l/min / GPM)

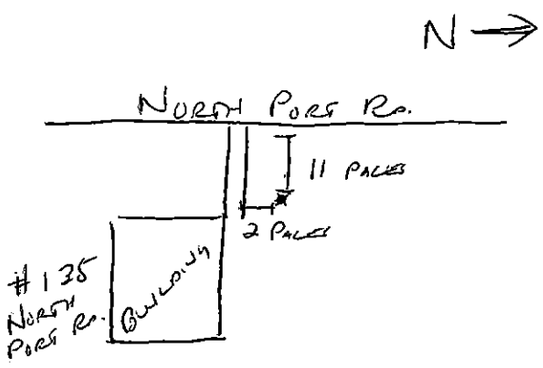
Well production (l/min / GPM)

Disinfected? ☐ Yes ☐ No

Draw Down Time (min)	Water Level (m/ft)	Recovery Time (min)	Water Level (m/ft)
Static Level			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Strong Soil Search Inc.	7217
Business Address (Street Number/Name)	**Municipality**
5265 Sideline 16	Claremont
Province	**Postal Code**	**Business E-mail Address**
Ontario	L1Y1A1	strongsoilsearchinc@bellnet.ca
Bus. Telephone No. (inc. area code)	**Name of Well Technician (Last Name, First Name)**
9056491115	Neto, Nelson
Well Technician's Licence No.	**Signature of Technician and/or Contractor**	**Date Submitted**
3174	[signature]	2020/03/06

Well owner's information package delivered ☐ Yes ☑ No

Date Package Delivered: ____

Date Work Completed: 2019/09/23

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Audit No. Z317740

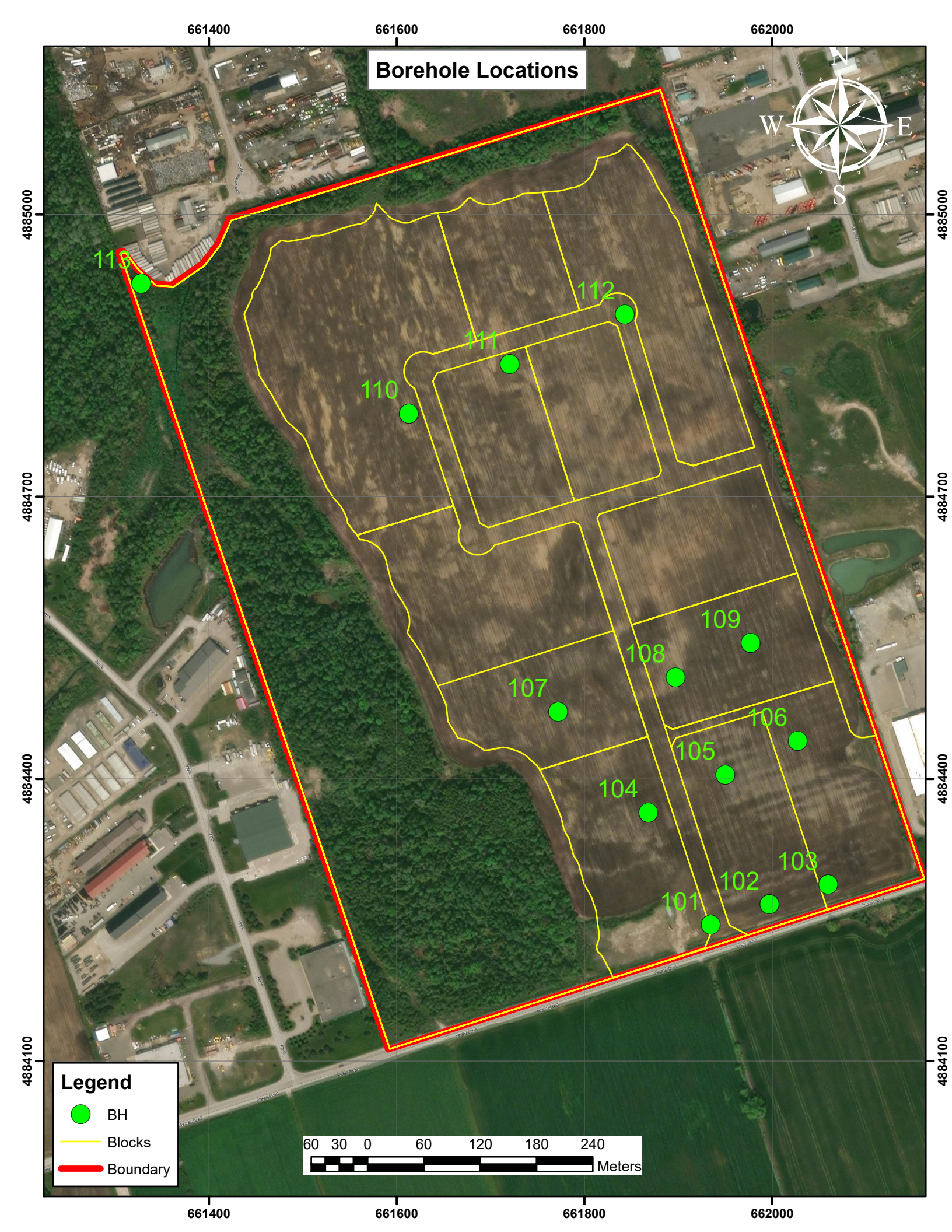
Received MAR 24 2020

MAR 24 2020

0506E (2018/12) **Ministry's Copy**

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Appendix II – Borehole Drill Log


Borehole Locations
661400
661600
661800
662000
4885000
4884700
4884400
4884100
N
W
E
S
113
112
111
110
109
108
107
106
105
104
103
102
101
Legend
BH
Blocks
Boundary
60 30 0 60 120 180 240
Meters

GROUNDWATER MONITORING WELL BH101

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

DRILLING DATE 12/06/2021
TOTAL DEPTH 3.1 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884,244,899N; 661,934,627E
COORD SYS UTM 17
COMPLETION 12/06/2021
SURFACE ELEVATION 262.184 m
WELL TOC

COMMENTS Southeast corner of the dwelling

LOGGED BY PZ
CHECKED BY TW

Depth (m)	Samples	Graphic Log	Material Description	USCS	Additional Observations	Well Diagram	Elevation (m)
0	SOIL SAMPLE 1		TOPSOIL			bentonite	262
0.2							
0.4			Grey damp to wet clay	USCS - CL	Groundwater Strike while drilling process at 0.4 m deep		261.8
0.6							261.6
0.8	SOIL SAMPLE 2						261.4
1							261.2
1.2							261
1.4							260.8
1.6	SOIL SAMPLE 3					filter pack	260.6
1.8							260.4
2							260.2
2.2	SOIL SAMPLE 4						260
2.4							259.8
2.6							259.6
2.8							259.4
3	SOIL SAMPLE 5						259.2
3.2			Termination Depth at 3.1 m				259

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GROUNDWATER MONITORING WELL BH102

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

DRILLING DATE 12/07/2021
TOTAL DEPTH 4 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884,266,525 N; 661,996,529 E
COORD SYS UTM 17
COMPLETION 12/07/2021
SURFACE ELEVATION 262.627 m
WELL TOC

COMMENTS South of the dwelling

LOGGED BY PZ
CHECKED BY TW

Depth (m)	Samples	Material Description	USCS	Additional Observations	Elevation (m)
0	SOIL SAMPLE 1	TOPSOIL			262.6
0.2					262.4
0.4					262.2
0.6		Brown damp clay	USCS - CL		262
0.8	SOIL SAMPLE 2				261.8
1					261.6
1.2					261.4
1.4	SOIL SAMPLE 3				261.2
1.6					261
1.8					260.8
2					260.6
2.2	SOIL SAMPLE 4				260.4
2.4					260.2
2.6					260
2.8					259.8
3	SOIL SAMPLE 5				259.6
3.2					259.4
3.4				Groundwater was measured at 3.5 m deep when drilling	259.2
3.6		Grey wet clay	USCS - CL		259
3.8	SOIL SAMPLE 6				258.8
4		Termination Depth at 4 m			258.6

Well Diagram: bentonite; filter pack

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GROUNDWATER MONITORING WELL BH103

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

DRILLING DATE 12/07/2021
TOTAL DEPTH 3.1 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884,287,682 N; 662,059,624 E
COORD SYS UTM 17
COMPLETION 12/07/2021
SURFACE ELEVATION 263.463 m
WELL TOC

COMMENTS Southwest of the dwelling

LOGGED BY PZ
CHECKED BY TW

Depth (m)	Samples	Graphic Log	Material Description	USCS	Additional Observations	Well Diagram	Elevation (m)
0	SOIL SAMPLE 1		TOPSOIL			bentonite	263.4
0.2							263.2
0.4							263
0.6			Brown damp clay	USCS - CL			262.8
0.8	SOIL SAMPLE 2						262.6
1							262.4
1.2							262.2
1.4	SOIL SAMPLE 3					filter pack	262
1.6							261.8
1.8							261.6
2			Grey wet clay	USCS - CL			261.4
2.2	SOIL SAMPLE 4				Groundwater was measured at 2.2 m deep when drilling		261.2
2.4							261
2.6							260.8
2.8							260.6
3	SOIL SAMPLE 5						260.4
			Termination Depth at 3.1 m				

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GROUNDWATER MONITORING WELL BH104

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

DRILLING DATE 12/08/2021
TOTAL DEPTH 4 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884,364,300 N; 661,867,534 E
COORD SYS UTM 17
COMPLETION 12/08/2021
SURFACE ELEVATION 260.898 m
WELL TOC

COMMENTS Southeast of the dwelling

LOGGED BY PZ
CHECKED BY TW

Depth (m)	Samples	Material Description	USCS	Additional Observations	Elevation (m)
0	SOIL SAMPLE 1	TOPSOIL			260.8
0.2					260.6
0.4		Brown damp clay	USCS - CL		260.4
0.6					260.2
0.8	SOIL SAMPLE 2				260
1					259.8
1.2					259.6
1.4					259.4
1.6	SOIL SAMPLE 3	Grey wet clay	USCS - CL		259.2
1.8				Groundwater was measured at 1.8 m deep when drilling	259
2					258.8
2.2	SOIL SAMPLE 4				258.6
2.4					258.4
2.6					258.2
2.8					258
3	SOIL SAMPLE 5				257.8
3.2					257.6
3.4					257.4
3.6					257.2
3.8	SOIL SAMPLE 6				257
4		Termination Depth at 4 m			256.8

Well Diagram: bentonite; filter pack

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GROUNDWATER MONITORING WELL BH105

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

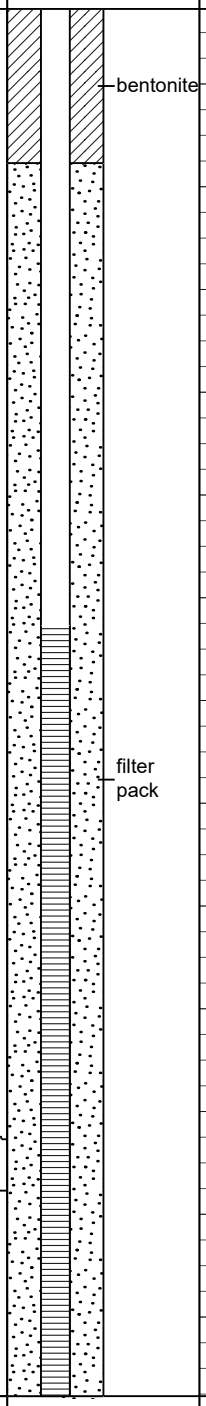
DRILLING DATE 12/09/2021
TOTAL DEPTH 2.7 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884,404,509 N; 661,950,440 E
COORD SYS UTM 17
COMPLETION 12/09/2021
SURFACE ELEVATION 261.746 m
WELL TOC

COMMENTS Middle of the field

LOGGED BY PZ
CHECKED BY TW

Depth (m)	Samples	Material Description	USCS	Additional Observations	Elevation (m)
0	SOIL SAMPLE 1	TOPSOIL			261.6
0.2		Brown damp clay	USCS - CL		261.4
0.4					261.2
0.6					261
0.8	SOIL SAMPLE 2				260.8
1					260.6
1.2					260.4
1.4	SOIL SAMPLE 3				260.2
1.6		Grey wet clay	USCS - CL		260
1.8					259.8
2					259.6
2.2	SOIL SAMPLE 4			Groundwater was measured at 2.2 m deep when drilling	259.4
2.4					259.2
2.6					
2.8		Termination Depth at 2.7 m		The bearing capacity tested at 2.7 m deep is 1200 KPa without displacement	259



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GROUNDWATER MONITORING WELL BH106

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

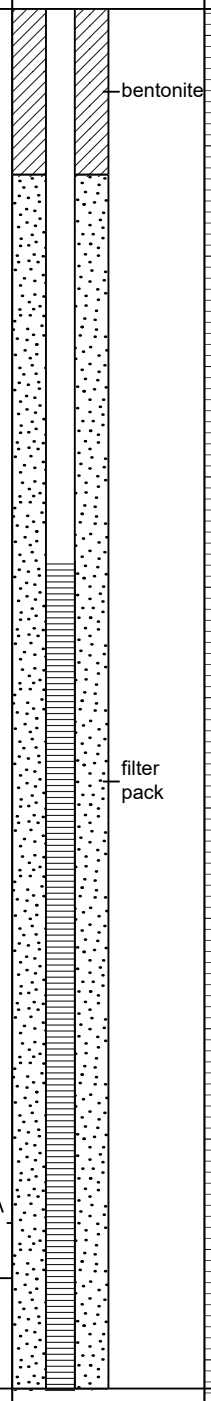
DRILLING DATE 15/12/2021
TOTAL DEPTH 2.5 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884,440,761 N; 662,026,623 E
COORD SYS UTM 17
COMPLETION 15/12/2021
SURFACE ELEVATION 262.448 m
WELL TOC

COMMENTS Middle of the field

LOGGED BY PZ
CHECKED BY TW

Depth (m)	Samples	Material Description	USCS	Additional Observations	Elevation (m)
0	SOIL SAMPLE 1	TOPSOIL			262.4
0.2		Grey damp clay	USCS - CL		262.2
0.4					262
0.6					261.8
0.8	SOIL SAMPLE 2				261.6
1					261.4
1.2					261.2
1.4					261
1.6	SOIL SAMPLE 3	Grey wet clay	USCS - CL		260.8
1.8					260.6
2					260.4
2.2				Groundwater was measured at 2.2 m deep when drilling	260.2
2.4	SOIL SAMPLE 4				260
2.6		Termination Depth at 2.5 m			259.8



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GROUNDWATER MONITORING WELL BH107

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

DRILLING DATE 12/08/2021
TOTAL DEPTH 3.1 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884,471,381 N; 661,771,905 E
COORD SYS UTM 17
COMPLETION 12/08/2021
SURFACE ELEVATION 260.092 m
WELL TOC

COMMENTS East of the dwelling

LOGGED BY PZ
CHECKED BY TW

Depth (m)	Samples	Graphic Log	Material Description	USCS	Additional Observations	Well Diagram	Elevation (m)
0	SOIL SAMPLE 1		TOPSOIL			bentonite	260
0.2							259.8
0.4			Grey damp clay	USCS - CL			259.6
0.6							259.4
0.8	SOIL SAMPLE 2						259.2
1							259
1.2							258.8
1.4							258.6
1.6	SOIL SAMPLE 3					filter pack	258.4
1.8							258.2
2			Grey wet clay	USCS - CL			258
2.2	SOIL SAMPLE 4				Groundwater was measured at 2.2 m deep when drilling		257.8
2.4							257.6
2.6							257.4
2.8							257.2
3	SOIL SAMPLE 5						257
3.2			Termination Depth at 3.1 m				256.8

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GROUNDWATER MONITORING WELL BH108

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

DRILLING DATE 12/09/2021
TOTAL DEPTH 3 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884,508,262 N; 661,897,120 E
COORD SYS UTM 17
COMPLETION 12/09/2021
SURFACE ELEVATION 261.729 m
WELL TOC

COMMENTS Middle of the field

LOGGED BY PZ
CHECKED BY TW

Depth (m)	Samples	Material Description	USCS	Additional Observations	Elevation (m)
0	SOIL SAMPLE 1	TOPSOIL			261.6
0.2					261.4
0.4		Grey damp clay	USCS - CL		261.2
0.6					261
0.8	SOIL SAMPLE 2				260.8
1					260.6
1.2		Grey wet clay	USCS - CL		260.4
1.4					260.2
1.6	SOIL SAMPLE 3				260
1.8					259.8
2					259.6
2.2	SOIL SAMPLE 4				259.4
2.4				Groundwater was measured at 2.4 m deep when drilling	259.2
2.6					259
2.8					258.8
3		Termination Depth at 3 m		The bearing capacity tested at 3 m deep is 1000 KPa without displacement	258.6

Well Diagram: bentonite; filter pack

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GROUNDWATER MONITORING WELL BH109

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

DRILLING DATE 12/09/2021
TOTAL DEPTH 3 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884,544,885 N; 661,976,834 E
COORD SYS UTM 17
COMPLETION 12/09/2021
SURFACE ELEVATION 261.704 m
WELL TOC

COMMENTS Midlde and west of the field

LOGGED BY PZ
CHECKED BY TW

Depth (m)	Samples	Material Description	USCS	Additional Observations	Elevation (m)
0	SOIL SAMPLE 1	TOPSOIL			261.6
0.2					
0.4		Grey damp clay	USCS - CL		261.4
0.6					261.2
0.8	SOIL SAMPLE 2				261
1					260.8
1.2					260.6
1.4					260.4
1.6	SOIL SAMPLE 3				260.2
1.8					260
2		Grey wet clay	USCS - CL		259.8
2.2	SOIL SAMPLE 4				259.6
2.4					259.4
2.6					259.2
2.8				Groundwater was measured at 2.8 m deep when drilling	259
3		Termination Depth at 3 m		The bearing capacity tested at 3 m deep is 1200 KPa at 40 mm displacement	258.8
					258.6

Well Diagram: bentonite; filter pack

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GROUNDWATER MONITORING WELL BH110

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

DRILLING DATE 14/12/2021
TOTAL DEPTH 3.1 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884,788,529 N; 661,612,830 E
COORD SYS UTM 17
COMPLETION 14/12/2021
SURFACE ELEVATION 256.346 m
WELL TOC

COMMENTS Northeast corner of the field

LOGGED BY PZ
CHECKED BY TW

Depth (m)	Samples	Material Description	USCS	Additional Observations	Elevation (m)
0	SOIL SAMPLE 1	TOPSOIL			256.2
0.2					
0.4		Dark-yellow sand	USCS - SW, SM		256
0.6					255.8
0.8	SOIL SAMPLE 2				255.6
1		Grey damp to wet clay	USCS - CL	Groundwater Strike while drilling process at 1m deep	255.4
1.2					255.2
1.4					255
1.6	SOIL SAMPLE 3				254.8
1.8					254.6
2					254.4
2.2	SOIL SAMPLE 4				254.2
2.4					254
2.6					253.8
2.8					253.6
3		Termination Depth at 3 m		The bearing capacity tested at 3m deep is 1000 KPa at less than 40 cm displacement	253.4
					253.2

Well Diagram: bentonite; filter pack

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GROUNDWATER MONITORING WELL BH111

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

DRILLING DATE 12/14/2021
TOTAL DEPTH 3 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884841.025N, 661720.391E
COORD SYS UTM 17
COMPLETION 12/14/2021
SURFACE ELEVATION 257.541 m
WELL TOC

COMMENTS North and middle location of the field

LOGGED BY PZ
CHECKED BY TW

Depth (m)	Samples	Material Description	USCS	Additional Observations	Elevation (m)
0	SOIL SAMPLE 1	TOPSOIL			257.4
0.2		Dark-yellow sand	USCS - SW, SM		257.2
0.4					
0.6	SOIL SAMPLE 2				257
0.8		Grey damp clay	USCS - CL		256.8
1		Grey damp to wet clay	USCS - CL	Groundwater Strike while drilling process at 1 m deep	256.6
1.2					256.4
1.4	SOIL SAMPLE 3				256.2
1.6		Grey wet clay			256
1.8					255.8
2					255.6
2.2	SOIL SAMPLE 4				255.4
2.4					255.2
2.6					255
2.8					254.8
3		Termination Depth at 3 m		1600 kPa bearing capacity with less than 5 mm displacement	254.6
					254.4

Well Diagram: bentonite; filter pack

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GROUNDWATER MONITORING WELL BH112

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

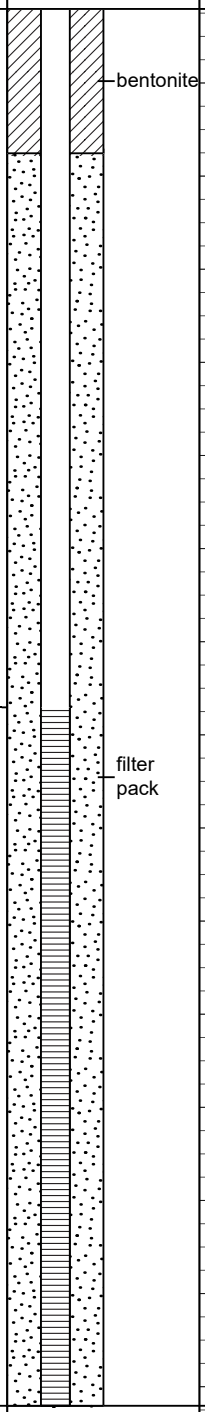
DRILLING DATE 14/12/2021
TOTAL DEPTH 3 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884,893,893 N; 661,842,834 E
COORD SYS UTM 17
COMPLETION 14/12/2021
SURFACE ELEVATION 258.759 m
WELL TOC

COMMENTS North and middle location of the field

LOGGED BY PZ
CHECKED BY TW

Depth (m)	Samples	Material Description	USCS	Additional Observations	Elevation (m)
0	SOIL SAMPLE 1	TOPSOIL			258.6
0.4		Grey damp clay	USCS - CL		258.4
0.6	SOIL SAMPLE 2				258.2
0.8					258
1					257.8
1.2					257.6
1.4	SOIL SAMPLE 3	Grey wet clay	USCS - CL	Groundwater was measured at 1.5 m deep when drilling	257.4
1.6					257.2
1.8					257
2					256.8
2.2	SOIL SAMPLE 4				256.6
2.4					256.4
2.6					256.2
2.8					256
3		Termination Depth at 3 m		The bearing capacity tested at 3 m deep is 1700 KPa without displacement	255.8
					255.6



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GROUNDWATER MONITORING WELL BH113

PROJECT NUMBER
PROJECT NAME Scugog Line 6, Port Perry
CLIENT Wanlong Real Estate Development Ltd
ADDRESS 0 Scugog Line 6, Port Perry
LICENCE NO. C-7691

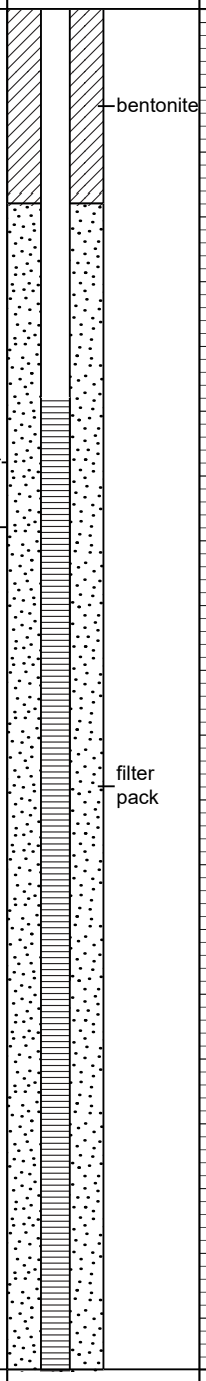
DRILLING DATE 13/12/2021
TOTAL DEPTH 2.1 m
DIAMETER 1.5 inches
CASING uPVC (1.25 inches)
SCREEN uPVC Factory Slotted (1.25 inches)

COORDINATES 4884,926,436 N; 661,327,919 E
COORD SYS UTM 17
COMPLETION 13/12/2021
SURFACE ELEVATION 255.121 m
WELL TOC

COMMENTS Northeast of the dwelling near the swamp

LOGGED BY PZ
CHECKED BY TW

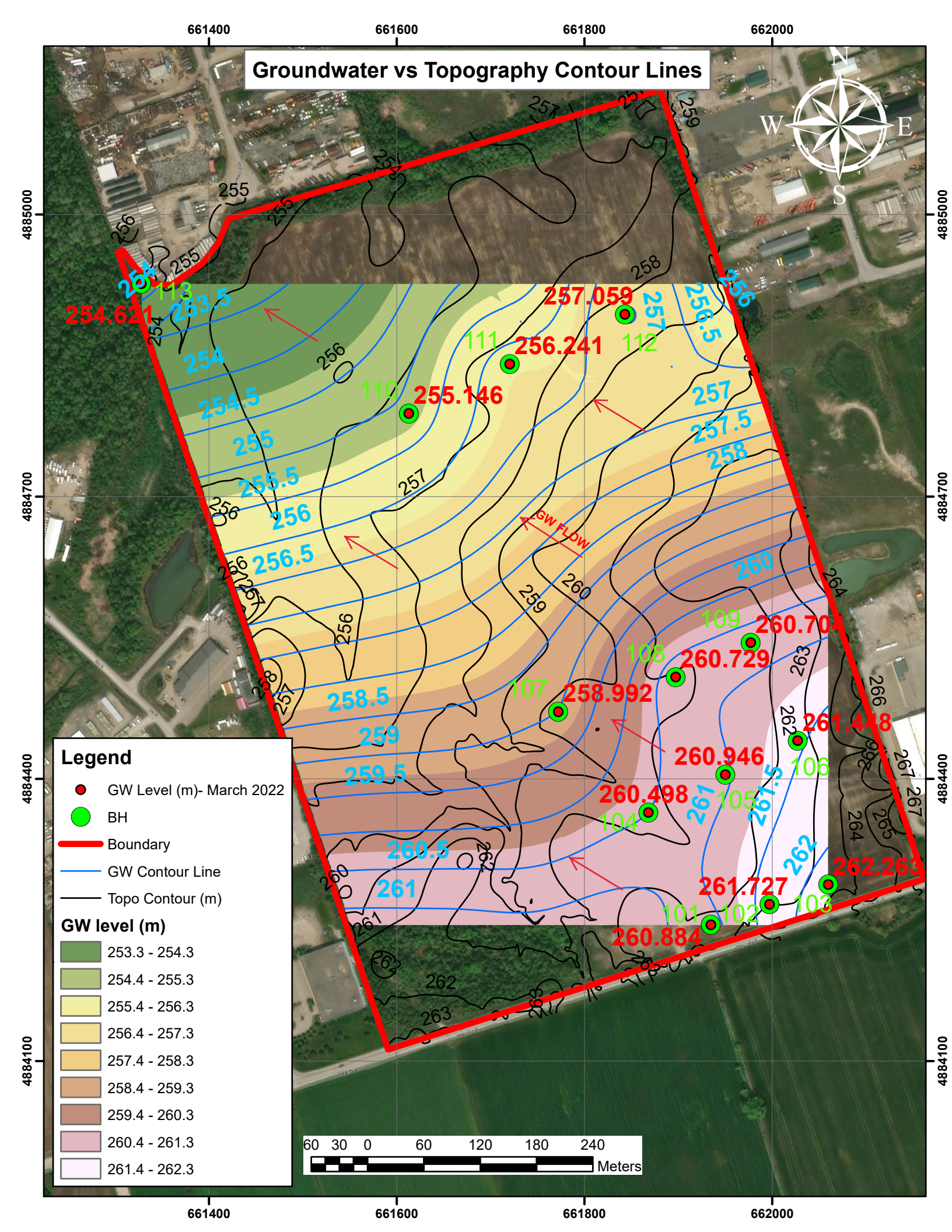
Depth (m)	Samples	Material Description	USCS	Additional Observations	Elevation (m)
0.1	SOIL SAMPLE 1	TOPSOIL			255.1
0.3		Silt with low plasticity	USCS - ML		255
0.7	SOIL SAMPLE 2			Groundwater was measured at 0.7 m deep when drilling	254.9
1.5	SOIL SAMPLE 3				254.8
2.1		Termination Depth at 2.1 m			254.7
2.2					254.6
					254.5
					254.4
					254.3
					254.2
					254.1
					254
					253.9
					253.8
					253.7
					253.6
					253.5
					253.4
					253.3
					253.2
					253.1
					253
					252.9



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Appendix III – GW vs TOPOGRAPHY


Groundwater vs Topography Contour Lines
661400
661600
661800
662000
4885000
4884700
4884400
4884100
N
W
E
S
GW FLOW
257.059
256.241
255.146
254.621
260.704
260.729
258.992
261.448
260.946
260.498
262.263
261.727
260.884
Legend
GW Level (m)- March 2022
BH
Boundary
GW Contour Line
Topo Contour (m)
GW level (m)
253.3 - 254.3
254.4 - 255.3
255.4 - 256.3
256.4 - 257.3
257.4 - 258.3
258.4 - 259.3
259.4 - 260.3
260.4 - 261.3
261.4 - 262.3
60 30 0 60 120 180 240
Meters

Appendix IV – Field Permeability Test Conducted Onsite

In-situ Measurement of Field Saturated Hydraulic Conductivity

1. Field Permeability Test

The "Constant Head Well Permeameter" (CHWP) method (Reynolds, 1993; Elrick and Reynolds, 1986) is based on the observation that when a constant height or "head" of water is ponded in a borehole or "well" augured into unsaturated soil, a "bulb" of field-saturated soil is gradually established around the base of the well. The K_{fs} value calculated through this method can be less than or equal to half of K_s (Saturated hydraulic conductivity) due to partial blocking of soil pores by air bubbles. K_{fs} is preferred over Ks for the design of on-site stormwater LID infiltration design, because drainage through the soil should be designed to occur at less than complete soil saturation.

The in-situ measurements were measured using the ETC Slow Soils Pask Permeameter, an extended single-head analysis method and calculation procedure based on the work of W.D. Reynolds and D.E. Elrick formerly of the University of Guelph, Ontario, Canada.

The ETC Pask Permeameter is a convenient and easy to use apparatus for ponding a constant head of water in a well and simultaneously measuring the flow into the soil. The rate of fall (R) of the water level in the Permeameter reservoir and reservoir cross-sectional area (X) allows determination of quasi steady water flow rate (Q) into the soil (i.e Q = XR). K_{fs} is then calculated using Equation 1* (Reynolds, 1993):

$$K_{fs} = CQ / [2\pi H^2 + C\pi a^2 + (2\pi H/\alpha^*)] \qquad \text{(Eq. 1)}$$

In which:
K_{fs} = calculated permeability from the field test

* Note: Alternatively, Quick Field Reference Tables have been prepared by ETC for the specific Permeameter characteristics and typical well hole diameter (8.3cm) produced by the 7cm (2-3/4") AMS Riverside auger supplied with the kit. The tables give K_{fs} for various rates of fall (R) and **α*** values.

Table 1. Parameters used

Parameter	Description	BH		
		101	106	112
Soil Texture Factor (**α***) in cm^{-1}	Compacted, structureless, clayey materials such as landfill caps and liners, lacustrine or marine sediments (0.01).	0.01	0.01	0.01
R in cm/min	Quasi steady state (constant) rate of fall of water in permeameter reservoir (measured in the site)	0.03	0.025	0.025
μ_k/μ_a	Temperature Correction Factor	0.942	0.974	0.942
C	Shape factor	1.27	1.27	1.27
X in cm^2	Cross-sectional area of Permeameter reservoir	12.80		
H in cm	Height of air inlet hole from bottom of the test hole	15		
a in cm	Well hole radius	4.15		

Based on data described in the above table and using Pask Permeameter ETC Quick Field Reference Tables for Standard Soils, the K_{fs} was calculated as:

K_{fs101}= 7.5E-9 m/sec = 7.5E-7 cm/sec
K_{fs106}= 6.2E-9 m/sec = 6.2E-7 cm/sec
K_{fs112}= 6.2E-9 m/sec = 6.2E-7 cm/sec

And then the temperature corrected permeability would be calculated using Equation 2 as follows:

$K_a = K_{fs} \times \mu_k/\mu_a$ (Eq. 2)

In which:
K_a = corrected permeability adjusted for design temperature conditions

Then using the temperature correction factor (for t = 4°c - 7°c) from the manual:
K_{a101} = 7.07E-9 m/sec = 7.07E-7 cm/sec
K_{a106} = 6.04E-9 m/sec = 6.04E-7 cm/sec
K_{a112} = 5.84E-9 m/sec = 5.84E-7 cm/sec

The field permeability data sheets are appended to this report.

2. Percolation time/infiltration rate for design (Reynolds et al., 2015)

Correlations between Perc Time (PT) and field-saturated hydraulic conductivity (K_{fs}) are often used in the development of on-site water recycling and treatment facilities that operate by infiltration into unsaturated soil. The physically based PT versus K_{fs} expression in Reynolds et al. (2015) for cylindrical test holes in unsaturated soil can be simplified to Equation 3.

$$PT = \frac{\Delta t}{\Delta H} = mK_{fs}^{-1} \qquad \text{(Eq. 3)}$$

Where:

$$m = \frac{\bar{C}a^2}{\left[2\bar{H}^2 + \bar{C}a^2 + \frac{2\bar{H}[1-\exp(\alpha\psi_\alpha)]}{\alpha}\right]}; 0 < m < 1 \qquad \text{(Eq. 4)}$$

And a is test hole radius, $\bar{H}$ is average water level (ponding depth) in the test hole over time interval, Δt, $\psi\alpha$ is the antecedent or background pore water pressure head in the soil surrounding the test hole, α may be viewed as the "integrally correct" slope of the soil's unsaturated hydraulic conductivity versus pore water pressure head relationship, $K(\psi)$ and $\bar{C}$ is a "shape function" (Reynolds et al., 2015).

Conversion of CHWP K_{fs}/k_a to equivalent Perc Time, PT for this site using m= 5.39E-06 (moderate capillarity category) and m= 1.05E-06 (very strong category):

$$PT_{101} = mK_{a101}^{-1} = \frac{(1.05E-6)}{(7.07E-9)} = 148.6 \text{ min/cm} \quad \text{(Infiltration Rate = 4.04 mm/hour)}$$

$$PT_{106} = mK_{a106}^{-1} = \frac{(1.05E-6)}{(6.04E-9)} = 173.9 \text{ min/cm} \quad \text{(Infiltration Rate = 3.45 mm/hour)}$$

$$PT_{112} = mK_{a112}^{-1} = \frac{(1.05E-6)}{(5.84E-9)} = 179.8 \text{ min/cm} \quad \text{(Infiltration Rate = 3.34 mm/hour)}$$

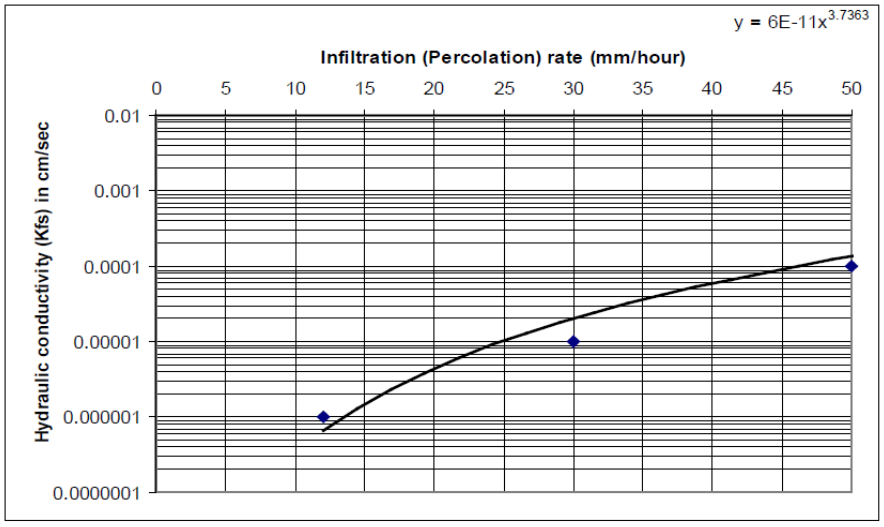
3. Percolation time/infiltration rate for design (OMMAH, 1997)

Despite the newer academic papers published by Reynolds et al. (2015), TRCA and other Conservation Authorities often still review design of infiltration basins based on historic trends. Below are two TRCA (2012) design criteria that describe the relationship between K_{fs}, PT, and infiltration rates, based on the 1997 (OMMAH) supplementary guidelines to OBC (1997).

Table 2. Approximate relationships between hydraulic conductivity, percolation time and infiltration rate

Hydraulic Conductivity, K_{fs} (centimetres/second)	Percolation Time, T (minutes/centimetre)	Infiltration Rate, 1/T (millimetres/hour)
0.1	2	300
0.01	4	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

***Source**: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.*



***Source**: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.*

Figure 1. Approximate relationship between infiltration rate and hydraulic conductivity

Based on OMMAH interpolation from Table 2 and Figure 1 above, the measured K_{fs} may be interpolated as:

PT_{101} = 48.8 min / cm (Infiltration Rate = 12.3 mm/hour)

PT_{106} = 50.8 min / cm (Infiltration Rate = 11.8 mm/hour)

PT_{112} = 51.3 min / cm (Infiltration Rate = 11.7 mm/hour)

Although the results for the soils (BH101, BH106 & BH112) are similar with a 5 percent difference, when comparing the OMMAH result with that obtained by Reynolds et al. (2015) formula (PT= 148.6-

179.8 min/cm), the two methods of conversion are completely different results. It seems that the values of the first method have underestimated the infiltration rate and Perc Time. The Engineer has decided to use values obtained from the second method (OMMAH, 1997), as per the TRCA Stormwater Management Criteria Guideline. This method was proposed by TRCA to convert measured hydraulic conductivity to percolation time or infiltration rate. For the subject site an unfactored infiltration rate of 11.9 mm/hour was calculated.

4. Factored Engineering Design Infiltration Rate (Wisconsin Department of Natural Resources, 2004)

For a conservative approach to infiltration speeds, the Wisconsin Department of Natural Resources (2004) method shall be used for the calculation of a factored design infiltration rate. The overall soil formation is compacted clay soils, with an average unfactored infiltration rate = 11.9 mm/hour However, the infiltration rate used to design an infiltration BMP must incorporate a safety correction factor that compensates for potential reductions in soil permeability due to compaction or smearing during construction, gradual accumulation of fine sediments over the lifespan of the BMP and uncertainty in measured values when less permeable soil horizons exist within 1.5 meters below the proposed bottom elevation of the BMP. The predominant soil material at this site consists of clay (CL), extending to a depth of over 3 meters, and is characterized by low permeability.

Based on borehole data, the soil layer remains consistent of CL soil types, including the soil layers 1.5 meters below the proposed bottom of the BMP. This means that based on Table 3, the measured infiltration rate should be divided by a safety correction factor to calculate the design infiltration rate. Thus, the mean infiltration rate measured at the proposed bottom elevation of the BMP is 11.9 mm/hour, and the mean infiltration rate measured in the slowest underlying soil horizon is 4.8 mm/hour, and the ratio of infiltration rates is 2.5.

Table 3. Safety correction factors for calculating design infiltration rates

Ratio of Mean Measured Infiltration Rates[1]	Safety Correction Factor[2]
≤ 1	2.5
1.1 to 4.0	3.5
4.1 to 8.0	4.5
8.1 to 16.0	6.5
16.1 or greater	8.5

***Source**: Wisconsin Department of Natural Resources. 2004. Conservation Practice Standards. Site Evaluation for Stormwater Infiltration (1002). Madison, WI.*

***Notes**:*

1. *Ratio is determined by dividing the geometric mean measured infiltration rate at the proposed bottom elevation of the BMP by the geometric mean measured infiltration rate of the least permeable soil horizon within 1.5 metres below the proposed bottom elevation of the BMP.*
2. *The design infiltration rate is calculated by dividing the geometric mean measured infiltration rate at the proposed bottom elevation of the BMP by the safety correction factor.*

Field Permeability Test Sheet

Engineering Technologies Canada Ltd.

OWNER'S NAME:

SITE LOCATION: 1401 Scugog Line 6, Port Perry

PID #:

TEST PIT #: BH101

TECHNICIAN: Pincheng Zhao, Young Chong

DATE: 2021/12/13

WEATHER/TEMPERATURE: Sunny, 4-7℃

FIELD PERMEABILITY TEST #:

D – reservoir diameter (cm)	8.25	Soil Texture	Clay
d – well hole diameter (cm)	8.3	Soil Structure	Strongly Compacted
H – height of water in well (cm)	15	α* (cm-1)	0.01
Depth below ground surface (cm)	38	C – Factor	1.27

TIME (min)	(1) CHANGE IN TIME (min)	RESERVOIR WATER LEVEL (WL) (cm)	(2) CHANGE IN WL (cm)	(2) ÷ (1) RATE OF FALL (R) (cm/min)
0	0	36	0	
20	20	35.7	0.3	0.2
40	20	35	0.7	0.035
60	20	34.4	0.6	0.03
80	20	33.8	0.6	0.03
100	20	33.2	0.6	0.03
120	20	32.6	0.6	0.03

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Revision Date: May 2018

Engineering Technologies Canada Ltd.

OWNER'S NAME:

SITE LOCATION: 1401 Scugog Line 6, Port Perry

PID #:

TEST PIT #: BH106

TECHNICIAN: Pincheng Zhao, Young Chong

DATE: 2021/12/15

WEATHER/TEMPERATURE: Raining, 5°C

FIELD PERMEABILITY TEST #:

D – reservoir diameter (cm)	8.25	**Soil Texture**	Clay
d – well hole diameter (cm)	8.3	**Soil Structure**	Strongly Compacted
H – height of water in well (cm)	15	**α* (cm-1)**	0.01
Depth below ground surface (cm)	38	**C – Factor**	1.27

TIME (min)	(1) CHANGE IN TIME (min)	RESERVOIR WATER LEVEL (WL) (cm)	(2) CHANGE IN WL (cm)	(2) ÷ (1) RATE OF FALL (R) (cm/min)
0	0	36.5	0	
20	20	36	0.5	0.025
40	20	35.5	0.5	0.025
60	20	35	0.5	0.025
80	20	34.5	0.5	0.025
100	20	34	0.5	0.025

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Engineering Technologies Canada Ltd.

OWNER'S NAME:

SITE LOCATION: 1401 Scugog Line 6, Port Perry

PID #:

TEST PIT #: BH112

TECHNICIAN: Pincheng Zhao, Young Chong

DATE: 2021/12/15

WEATHER/TEMPERATURE: Raining, 5°C

FIELD PERMEABILITY TEST #:

D – reservoir diameter (cm)	8.25	**Soil Texture**	Clay
d – well hole diameter (cm)	8.3	**Soil Structure**	Strongly Compacted
H – height of water in well (cm)	15	**α* (cm-1)**	0.01
Depth below ground surface (cm)	38	**C – Factor**	1.27

TIME (min)	(1) CHANGE IN TIME (min)	RESERVOIR WATER LEVEL (WL) (cm)	(2) CHANGE IN WL (cm)	(2) ÷ (1) RATE OF FALL (R) (cm/min)
0	0	38.5	0	
20	20	37	1.5	0.075
40	20	36.5	0.5	0.025
60	20	36	0.5	0.025
80	20	35.5	0.5	0.025
100	20	35	0.5	0.025

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Appendix V – Field Permeability Test at The Western Boundary Of The Site

1) In-situ Measurement of the Saturated Hydraulic Conductivity at the Boundary Between Developed Land and Natural Heritage Areas

Based on field visit dated October 7, 2024, "field-saturated" hydraulic conductivity (K_{fs}) using the "Constant Head Well Permeameter" (CHWP) method conducted at five new locations (BH201-BH205), at a distance of 5 m from the trees in a strip at the edge of natural heritage on the western boundary of the Site (Figure 1), the K_{fs} was calculated and then were corrected for temperature (for t=12$^{\circ c}$ and 13$^{\circ c}$) as:

$K_{BH201} = 1.6 \times 10^{-6}$ m/sec = 1.6×10^{-4} cm/sec
$K_{BH202} = 2.26 \times 10^{-6}$ m/sec = 2.26×10^{-4} cm/sec
$K_{BH203} = 2.5 \times 10^{-6}$ m/sec = 2.5×10^{-4} cm/sec
$K_{BH204} = 3.3 \times 10^{-6}$ m/sec = 3.3×10^{-4} cm/sec
$K_{BH205} = 3.7 \times 10^{-6}$ m/sec = 3.7×10^{-4} cm/sec

Based on OMMAH (1997) interpolation, the measured infiltration rate may be interpolated as:

PT_{BH201}= 11.4 min/cm (Infiltration Rate = 52.5 mm/hour)
PT_{BH202} = 19.3 min/cm (Infiltration Rate = 31.1 mm/hour)
PT_{BH203} = 10.1 min/cm (Infiltration Rate = 59.1 mm/hour)
PT_{BH204} = 17.4 min/cm (Infiltration Rate = 34.4 mm/hour)
PT_{BH205} = 9.1 min/cm (Infiltration Rate = 65.7 mm/hour)

Considering the soil materials in the test locations which are composed of grey silty sand and brown sand, the infiltration rates range from 31.1 mm/hour to 65.7 mm/hour, indicating variable soil permeability at the edge of the natural heritage which increases from the south towards the north.

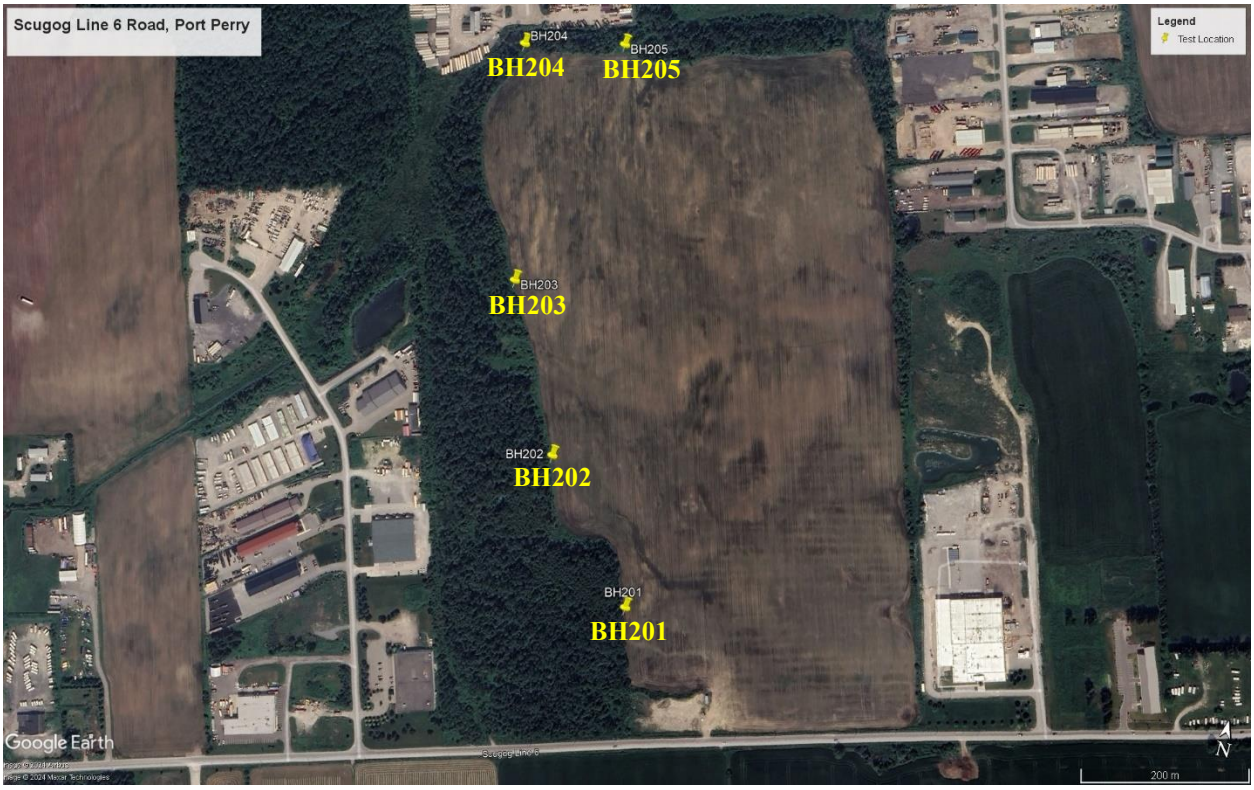


Figure 1: Location of Percolation Tests at the edge of the Natural Heritage

2) Groundwater Movement: Calculations and Analysis

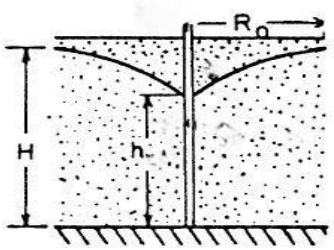
The provided data outlines groundwater movement from five locations (BH201, BH202, BH203, BH204, and BH205) along the developed site boundary with the natural heritage area, where percolation tests were conducted along a strip leading to a nearby creek. The analysis considers key parameters such as hydraulic conductivity, infiltration rates, radius of influence, groundwater velocity, and the time required for water to travel from each location to the creek.

In this regard, the radius of influence for water discharge at the test locations was calculated using Sichard's formula (Powers, 1992), which is described as follows:

$$R_o = C(H - h)\sqrt{(K)}$$

Where:

Ro = Estimated radius of influence (m)
H = Saturated aquifer thickness (m)
h = Lowered saturated aquifer thickness (m)
K = Hydraulic conductivity (m/sec)
C = Constant (3000)



Based on the soil characteristics and estimated parameters (as detailed in Table 1), the groundwater travel time is estimated to range from 53.4 to 363.3 years, depending on the distance from the test locations (BH201–BH205: 43.31 to 143.24 m) at the edge of the natural heritage area to the creek. The radius of influence varies between 2.56 m and 6.5 m, indicating that groundwater movement at the boundary between the developed land and natural heritage areas does not impact the existing watercourses through runoff.

Table 1- The estimated time for groundwater to travel from each specified location (BH201-BH205) to the creek, given the site conditions like hydraulic conductivity and distance to the creek

Parameter	Unit	BH201	BH202	BH203	BH204	BH205
Hydraulic conductivity (K)	m/s	1.6 ×10^-6	2.26 ×10^-6	2.5 ×10^-6	3 ×10^-6	3.7 ×10^-6
Infiltration Rate (IR)	mm/hour	52.5	31.1	59.1	34.4	65.7
Radius of Influence (Ro)	m	6.5	2.57	2.56	6.5	4.27
Velocity of groundwater (V)	m/s	1.25 ×10^-8	1.76 ×10^-8	1.95 ×10^-8	2.957×10^-8	2.88 ×10^-8
Distance of water movement in one year	m	0.3942	0.555034	0.614952	0.810475	0.908237
Distance between test location and the river	m	143.24	181.91	97.69	43.31	65.1
The time required to travel the distance	year	363.3	327.7	158.8	53.43	71.6

This indicates that groundwater movement from this boundary to the creek occurs over a significant period. Consequently, any changes to the water balance at this boundary would take many years to affect the creek, implying that annual water balance fluctuations are unlikely to have a noticeable impact. In other words, the engineer's opinion is that there will be no groundwater discharge into surface features due to increased permeability in the post-development scenario.

It is important to highlight that the site's predominant soil type is clay, which significantly impedes water movement due to its low permeability. The average yearly infiltration rate for clay is approximately 145 mm/year, which is considered low. The presence of shallow groundwater suggests that the air-filled pores within the clay are fully saturated, resulting in higher groundwater levels within the clay layer. When the clay becomes saturated to the surface, any additional water contributes to surface runoff. This aligns with the 145 mm/year infiltration rate, reflecting the limited ability of clay to absorb water beyond this threshold.

BH201

1) Radius of Influence

The estimated radius of influence (Ro) based on Sichard's formula is described as follows:

$$R_o = C(H - h)\sqrt{(K)}$$

Ro = 3000 × 1.71 × $(1.6\times10^{-6})^{0.5}$ = **6.5 m**

Where:

Ro = Estimated radius of influence (m) = 6.5 m
H = Saturated aquifer thickness (m) = 1.71
h = Lowered saturated aquifer thickness (m) = 0
K = Hydraulic conductivity (m/sec) = 1.6×10^{-6}
C = Constant (3000)

Water level at BH104 = 260.5 masl
River Bottom Elevation = 262.21 masl
h = 0 River Bottom
H = 262.21-260.5 = 1.71m

2) Determine the speed of water movement in one year, use Darcy's Law:

$$V = K \times i$$
$$V = 1.6\times10^{-6} \times 0.0078$$
$$V = \mathbf{1.25 \times10^{-8}\ m/s}$$

V = Velocity of groundwater (m/s) = 1.25×10^{-8} m/s
K = Hydraulic conductivity (m/s) = 1.6×10^{-6} m/s
i = Hydraulic gradient = 0.78% (0.0078)

3) Time Estimates for Water Travel:

Distance = V ×Time = 1.25×10^{-8} × 31,536,000 s = 0.3942 m

The water would move approximately **0.3942 m** in one year.

Given that the distance between location BH201 and the creek is **143.24** m, it would take approximately **363.3** years for the water to travel this distance.

Time (year) = Distance / Distance per year
= 143.24 m / 0.3942 m/year = 363.3 year

BH202

1) Radius of Influence

The estimated radius of influence (Ro) based on Sichard's formula is described as follows:

$$R_o = C(H - h)\sqrt{(K)}$$

Ro = 3000 × 0.57 × $(2.26\times10^{-6})^{0.5}$ = **2.57 m**

Where:

Ro = Estimated radius of influence (m) = 2.57 m
H = Saturated aquifer thickness (m) = 0.57
h = Lowered saturated aquifer thickness (m) = 0
K = Hydraulic conductivity (m/sec) = 2.26 ×10^{-6}
C = Constant (3000)

Water level at BH107 = 259 masl
River Bottom Elevation = 258.43 masl
h = 0 River Bottom
H = 259-258.43 = 0.57 m

2) Determine the speed of water movement in one year, use Darcy's Law:

$$V = K \times i$$
V = 2.26×10^{-6} × 0.0078
V = **1.76 ×10^{-8} m/s**

V = Velocity of groundwater (m/s) = 1.76 ×10^{-8} m/s
K = Hydraulic conductivity (m/s) = 2.26×10^{-6} m/s
i = Hydraulic gradient = 0.78% (0.0078)

3) Time Estimates for Water Travel:

Distance = V ×Time = 1.76×10^{-8} × 31,536,000 s = 0.555034 m

The water would move approximately **0.555034 m** in one year.

Given that the distance between location BH202 and the creek is **181.91** m, it would take approximately **327.7** years for the water to travel this distance.

Time (year) = Distance / Distance per year
= 181.91 m / 0.555034 m/year = 327.7 year

1) Radius of Influence

The estimated radius of influence (Ro) based on Sichard's formula is described as follows:

$$R_o = C(H - h)\sqrt{(K)}$$

Ro = 3000 × 0.54 × $(2.5\times10^{-6})^{0.5}$ = **2.56 m**

Where:

Ro = Estimated radius of influence (m) = 2.56 m
H = Saturated aquifer thickness (m) = 0.54
h = Lowered saturated aquifer thickness (m) = 0
K = Hydraulic conductivity (m/sec) = 2.5×10^{-6}
C = Constant (3000)

Water level at BH110 = 255.14 masl
River Bottom Elevation = 254.6 masl
h = 0 River Bottom
H = 255.14 - 254.6 = 0.54 m

2) Determine the speed of water movement in one year, use Darcy's Law:

$$V = K \times i$$
$$V = 2.5\times10^{-6} \times 0.0078$$
$$V = \mathbf{1.95 \times 10^{-8}\ m/s}$$

V = Velocity of groundwater (m/s) = 1.95×10^{-8} m/s
K = Hydraulic conductivity (m/s) = 2.5×10^{-6} m/s
i = Hydraulic gradient = 0.78% (0.0078)

3) Time Estimates for Water Travel:

Distance = V ×Time = 1.95×10^{-8} × 31,536,000 s = 0.614952 m

The water would move approximately **0.614952 m** in one year.

Given that the distance between location BH203 and the river is **97.69** m, it would take approximately **158.8** years for the water to travel this distance.

Time (year) = Distance / Distance per year
= 97.69 m / 0.614952 m/year = 158.8 years

1) Radius of Influence

The estimated radius of influence (Ro) based on Sichard's formula is described as follows:

$$R_o = C(H - h)\sqrt{(K)}$$

Ro = 3000 × 1.2 × $(3.3\times10^{-6})^{0.5}$ = **6.5 m**

Where:

Ro = Estimated radius of influence (m) = 6.5 m
H = Saturated aquifer thickness (m) = 1.2
h = Lowered saturated aquifer thickness (m) = 0
K = Hydraulic conductivity (m/sec) = 3.3×10^{-6}
C = Constant (3000)

Water level at BH113 = 254.62 masl
River Bottom Elevation = 253.42 masl
h = 0 River Bottom
H = 254.62 - 253.42 = 1.2 m

2) Determine the speed of water movement in one year, use Darcy's Law:

$$V = K \times i$$
$$V = 3.3\times10^{-6} \times 0.0078$$
$$V = \mathbf{2.57 \times10^{-8}\ m/s}$$

V = Velocity of groundwater (m/s) = 2.57×10^{-8} m/s
K = Hydraulic conductivity (m/s) = 3.3×10^{-6} m/s
i = Hydraulic gradient = 0.78% (0.0078)

3) Time Estimates for Water Travel:

Distance = V ×Time = 2.57×10^{-8} × 31,536,000 s = 0.810475 m
The water would move approximately **0.810475 m** in one year.

Given that the distance between location BH204 and the creek is **43.31** m, it would take approximately **53.43** years for the water to travel this distance.

Time (year) = Distance / Distance per year
= 43.31 m / 0.810475 m/year = 53.43 years

1) Radius of Influence

The estimated radius of influence (Ro) based on Sichard's formula is described as follows:

$$R_o = C(H - h)\sqrt{(K)}$$

Ro = 3000 × 0.74 × $(3.7\times10^{-6})^{0.5}$ = **4.27 m**

Where:

Ro = Estimated radius of influence (m) = 4.27 m
H = Saturated aquifer thickness (m) = 0.74
h = Lowered saturated aquifer thickness (m) = 0
K = Hydraulic conductivity (m/sec) = 3.7×10^{-6}
C = Constant (3000)

Water level at BH113 = 254.62 masl
River Bottom Elevation = 253.88 masl
h = 0 River Bottom
H = 254.62 – 253.88 = 0.74 m

2) Determine the speed of water movement in one year, use Darcy's Law:

$$V = K \times i$$
$$V = 3.7\times10^{-6} \times 0.0078$$
$$V = \mathbf{2.88 \times 10^{-8}\ m/s}$$

V = Velocity of groundwater (m/s) = 2.88×10^{-8} m/s
K = Hydraulic conductivity (m/s) = 3.3×10^{-6} m/s
i = Hydraulic gradient = 0.78% (0.0078)

3) Time Estimates for Water Travel:

Distance = V ×Time = 2.88×10^{-8} × 31,536,000 s = 0.908237 m

The water would move approximately **0.908237 m** in one year.

Given that the distance between location BH205 and the creek is **65.10** m, it would take approximately **71.6** years for the water to travel this distance.

Time (year) = Distance / Distance per year
= 65.10 m / 0.908237 m/year = 71.6 years

FIELD PERMEABILITY TEST SHEET

KING EPCM
Flexible. Dependable. On-site Engineering.

DATE 2024-10-07

SITE LOCATION Scugog Line 6, Port Perry

TEST PIT # BH201

CLIENT Wanlong Real Estate Development Ltd.

TECHNICIAN Tony Jin

WETHER/TEMPERATURE 13C°

TEST METHOD Standard

WELL HOLE DIAMETER (CM) 8.30

SOIL TEXTURE Grey Silty Sand (0-0.2m), Brown Sand (0.2-1m)

TEST START TIME

Time Interval (min)	(1) Elapsed Time (min)	Reservoir Water Level (cm)	(2) Water Drop (cm)	Percolation Rate (R) (cm/min); (2) / (1)
0	0	35.6	0	0.0
1	1	34.9	0.7	0.70
2	1	34.2	0.7	0.70
3	1	33.6	0.6	0.60
4	1	33.1	0.5	0.50
5	1	32.6	0.5	0.50
6	1	32.1	0.5	0.50
7	1	31.6	0.5	0.50
8	1	31.2	0.4	0.40
9	1	30.8	0.4	0.40
10	1	30.4	0.4	0.40
11	1	30	0.4	0.40
12	1	29.6	0.4	0.40
13	1	29.2	0.4	0.40
14	1	28.8	0.4	0.40
15	1	28.4	0.4	0.40

Quasi Steady-State Rate of Fall (R) = **0.4** **cm/min**

3780 14th Ave., Unit 211
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General@KingEPCM.com
www. KingEPCM.com

FIELD PERMEABILITY TEST SHEET

KING EPCM
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DATE 2024-10-07

SITE LOCATION Scugog Line 6, Port Perry

TEST PIT # BH202

CLIENT Wanlong Real Estate Development Ltd.

TECHNICIAN Tony Jin

WETHER/TEMPERATURE 12C°

TEST METHOD Standard

WELL HOLE DIAMETER (CM) 8.30

SOIL TEXTURE Grey Silty Sand (0-0.2m), Brown Sand (0.2-1m)

TEST START TIME

Time Interval (min)	(1) Elapsed Time (min)	Reservoir Water Level (cm)	(2) Water Drop (cm)	Percolation Rate (R) (cm/min); (2) / (1)
0	0	42.3	0	0.0
1	1	41.8	0.5	0.50
2	1	41.3	0.5	0.50
3	1	40.8	0.5	0.50
4	1	40.4	0.4	0.40
5	1	40	0.4	0.40
6	1	39.6	0.4	0.40
7	1	39.3	0.3	0.30
8	1	39	0.3	0.30
9	1	38.7	0.3	0.30
10	1	38.4	0.3	0.30
11	1	38.1	0.3	0.30
12	1	37.8	0.3	0.30
13	1	37.5	0.3	0.30
14	1	37.2	0.3	0.30
15	1	36.9	0.3	0.30

Quasi Steady-State Rate of Fall (R) = **0.3** **cm/min**

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FIELD PERMEABILITY TEST SHEET

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DATE 2024-10-07

SITE LOCATION Scugog Line 6, Port Perry

TEST PIT # BH203

CLIENT Wanlong Real Estate Development Ltd.

TECHNICIAN Tony Jin

WETHER/TEMPERATURE 13C°

TEST METHOD Standard

WELL HOLE DIAMETER (CM) 8.30

SOIL TEXTURE Brown Sand (0-1m)

TEST START TIME

Time Interval (min)	(1) Elapsed Time (min)	Reservoir Water Level (cm)	(2) Water Drop (cm)	Percolation Rate (R) (cm/min); (2) / (1)
0	0	38.1	0	0.0
1	1	37.3	0.8	0.80
2	1	36.6	0.7	0.70
3	1	35.9	0.7	0.70
4	1	35.2	0.7	0.70
5	1	34.5	0.7	0.70
6	1	34	0.5	0.50
7	1	33.4	0.6	0.60
8	1	32.8	0.6	0.60
9	1	32.2	0.6	0.60
10	1	31.6	0.6	0.60
11	1	31	0.6	0.60
12	1	30.4	0.6	0.60
13	1	29.8	0.6	0.60
14	1	29.2	0.6	0.60
15	1	28.6	0.6	0.60

Quasi Steady-State Rate of Fall (R) = **0.6** **cm/min**

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FIELD PERMEABILITY TEST SHEET

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DATE 2024-10-07

SITE LOCATION Scugog Line 6, Port Perry

TEST PIT # BH204

CLIENT Wanlong Real Estate Development Ltd.

TECHNICIAN Tony Jin

WETHER/TEMPERATURE 13C°

TEST METHOD Standard

WELL HOLE DIAMETER (CM) 8.30

SOIL TEXTURE Brown Sand (0-1m)

TEST START TIME

Time Interval (min)	(1) Elapsed Time (min)	Reservoir Water Level (cm)	(2) Water Drop (cm)	Percolation Rate (R) (cm/min); (2) / (1)
0	0	37	0	0.0
1	1	35.5	1.5	1.50
2	1	34.3	1.2	1.20
3	1	33	1.3	1.30
4	1	31.8	1.2	1.20
5	1	30.7	1.1	1.10
6	1	29.7	1	1.00
7	1	28.7	1	1.00
8	1	27.9	0.8	0.80
9	1	27	0.9	0.90
10	1	26.1	0.9	0.90
11	1	25.3	0.8	0.80
12	1	24.5	0.8	0.80
13	1	23.7	0.8	0.80
14	1	22.9	0.8	0.80
15	1	22.1	0.8	0.80

Quasi Steady-State Rate of Fall (R) = **0.8** **cm/min**

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www. KingEPCM.com

FIELD PERMEABILITY TEST SHEET

KING EPCM
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DATE 2024-10-07

SITE LOCATION Scugog Line 6, Port Perry

TEST PIT # BH205

CLIENT Wanlong Real Estate Development Ltd.

TECHNICIAN Tony Jin

WETHER/TEMPERATURE 13C°

TEST METHOD Standard

WELL HOLE DIAMETER (CM) 8.30

SOIL TEXTURE Brown Sand (0-1m)

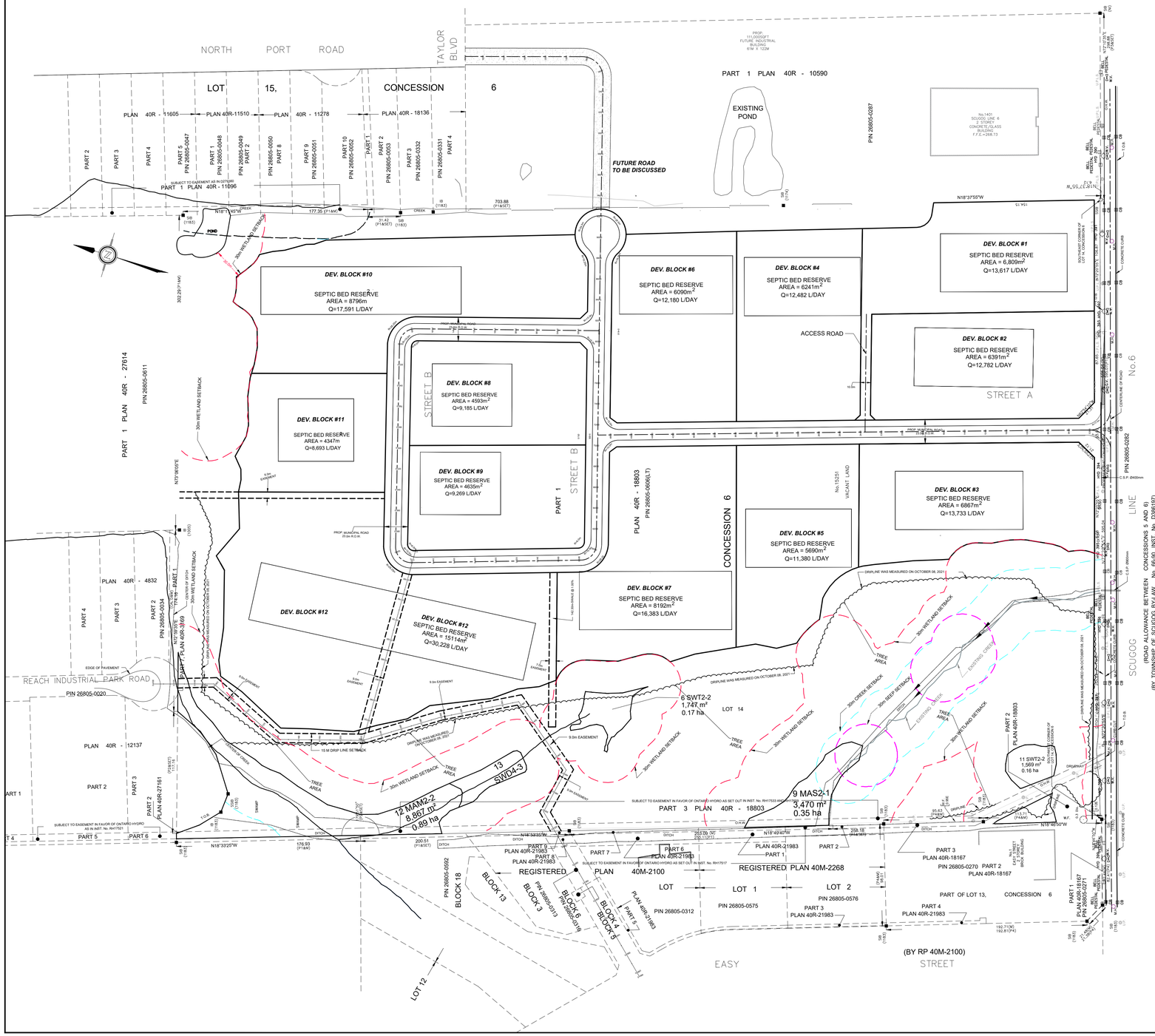
TEST START TIME

Time Interval (min)	(1) Elapsed Time (min)	Reservoir Water Level (cm)	(2) Water Drop (cm)	Percolation Rate (R) (cm/min); (2) / (1)
0	0	40.5	0	0.0
1	1	38.8	1.7	1.70
2	1	37.5	1.3	1.30
3	1	36.2	1.3	1.30
4	1	35	1.2	1.20
5	1	33.9	1.1	1.10
6	1	32.8	1.1	1.10
7	1	31.8	1	1.00
8	1	30.8	1	1.00
9	1	29.8	1	1.00
10	1	28.9	0.9	0.90
11	1	28	0.9	0.90
12	1	27.1	0.9	0.90
13	1	26.2	0.9	0.90
14	1	25.3	0.9	0.90
15	1	24.4	0.9	0.90

Quasi Steady-State Rate of Fall (R) = **0.9** **cm/min**

3780 14th Ave., Unit 211
Markham, ON, L3R 9Y5
T: 647-342-3001
General@KingEPCM.com
www. KingEPCM.com

Appendix VI – Proposed Site Plan



LEGEND:

- PROPERTY BOUNDARY
- BLOCK BOUNDARY
- DRIPLINE
- 30 M WETLAND SETBACK
- 30 M CREEK SETBACK
- 30 M SEEP SETBACK
- VEGETATION COMMUNITY
- WATERCOURSE/DRAINAGE, OHN

GENERAL NOTE:

1. SITE SURVEYS WERE CONDUCTED BY "MANDARIN SURVEYORS LIMITED" ON NOV. 01, 2021 AND "A.R.(SANDY) WAKELING SURVEYING TECHNICAL SERVICES" ON AUG. 17, 2021
2. NATURAL HERITAGE INFORMATION (DEVELOPABLE AREA) WAS CONDUCTED BY "GHD" ON NOV 28, 2024.

TABLE: BLOCK AREA INFORMATION

BLOCK	AREA (m2)
1	23,226
2	21,803
3	23,477
4	21,914
5	20,027
6	21,626
7	29,100
8	16,770
9	16,926
10	31,392
11	15,476
12	53,562
ROADS	32,799

SCALE 1:2000
1cm = 20m
0m 100m 200m

ACCEPTED TO BE IN ACCORDANCE WITH THE TOWNSHIP OF SCUGOG STANDARDS.
THIS ACCEPTANCE IS NOT TO BE CONSTRUED AS VERIFICATION OF ENGINEERING CONTENT

TOWNSHIP ENGINEER

DATE

APPROVED

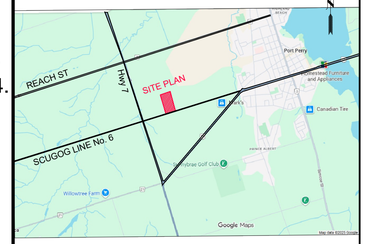
DEPARTMENT OF WORKS
REGIONAL MUNICIPALITY OF DURHAM

DATE

REVISIONS

No.		DATE	BY	APPROVED
V32	ISSUED FOR PERMITS	SEPT 23, 2024	KL	
V33	ISSUED FOR PERMITS	DEC 06, 2024	KL	
V34	ISSUED FOR PERMITS	MAY 2, 2025	SL	
V37	ISSUED FOR PERMITS	OCT 15, 2025	PR	

KEY MAP
N.T.S.



PROJECT NAME:

SCUGOG LINE 6 INDUSTRIAL BLOCK SUB-DIVISION DEVELOPMENT

CORPORATION OF THE TOWNSHIP OF SCUGOG

PROJECT LOCATION

SCUGOG LINE 6, PORT PERRY, ON PART-1, PLAN 40R - 18803

CONSULTANTS NAME

KING EPCM
3780 14th Ave., Unit 211
Markham, ON, L3R 9Y5
www.KingEPCM.com
647-459-5647

STAMP

LICENSED PROFESSIONAL ENGINEER
A. SAMADI
100569767
2025.10.27
PROVINCE OF ONTARIO

SCALE: SCALE 1:2000	PROJECT NO. S-S-2022-01
DRAWN BY: KL/SL/PR	DRAWING NO. EGR 1.1 SITE PLAN
DESIGNED BY: KL	
CHECKED BY: TW	
DATE: OCT 15, 2025	

Appendix VII – Climate Data Table

APPENDIX E

Water Balance Model Output

Cited in:
NONQUON RIVER SUBWATERSHED STUDY AND NONQUON INDUSTRIAL TRIBUTARY AREA
MASTER DRAINAGE PLAN
FINAL REPORT

Prepared by:
GREENLAND INTERNATIONAL CONSULTING LTD. & STATNTEC CONSULTING LTD.

OCTOBER 2005

Burketon McLaughlin WATER BUDGET MEANS FOR THE PERIOD 1969-2001 DC20492

LAT.... 44.03 WATER HOLDING CAPACITY...132 MM HEAT INDEX... 34.58
LONG... 78.13 LOWER ZONE..... 79 MM A..... 1.048

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-8.0	59	15	15	1	1	0	29	58	129	295
28- 2	-6.8	46	16	24	1	1	0	38	63	130	342
31- 3	-1.9	57	37	59	7	7	0	87	24	132	400
30- 4	5.5	73	69	28	32	32	0	66	0	131	471
31- 5	12.4	84	84	0	77	77	0	20	0	118	555
30- 6	17.0	90	90	0	108	108	0	7	0	93	645
31- 7	19.9	75	75	0	129	121	-8	0	0	47	720
31- 8	19.1	86	86	0	114	99	-15	1	0	33	807
30- 9	14.6	91	91	0	75	70	-5	7	0	47	901
31-10	8.2	82	82	0	38	37	-1	7	0	85	82
30-11	2.0	89	81	6	12	12	0	39	3	120	170
31-12	-4.6	67	29	12	2	2	0	28	29	131	237
AVE	6.3 TTL	898	755	144	596	567	-29	329			

Burketon McLaughlin STANDARD DEVIATIONS FOR THE PERIOD 1969-2001 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.7	32	19	15	1	1	0	30	39	10	59
28- 2	2.5	28	19	25	1	1	0	36	49	9	61
31- 3	2.3	27	28	37	5	5	0	49	53	1	61
30- 4	1.8	30	29	53	8	8	0	51	0	3	74
31- 5	1.9	31	31	0	13	13	0	24	0	18	87
30- 6	1.4	48	48	0	9	9	0	21	0	35	99
31- 7	1.1	30	30	0	7	11	11	1	0	42	110
31- 8	1.2	34	34	0	7	18	19	4	0	37	110
30- 9	1.2	38	38	0	6	12	11	27	0	39	119
31-10	1.6	34	34	0	7	7	3	14	0	43	35
30-11	1.6	35	33	5	5	5	0	39	6	20	58
31-12	2.8	24	25	9	2	2	0	29	26	4	62

Burketon McLaughlin WATER BUDGET VALUES FOR THE PERIOD 1969-2001
DC20492

YR MO	TEMP(C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
1969- 1	-7.9	.0	.0	.0	.0	.0	.0	.0	.0	79.0	.0
1969- 2	-6.1	20.3	.0	.0	.0	.0	.0	.0	20.3	79.0	20.3
1969- 3	-4.1	34.3	30.0	20.3	2.9	2.9	.0	.0	4.3	126.4	54.6
1969- 4	6.0	95.4	83.0	16.7	33.1	33.1	.0	61.0	.0	132.0	150.0
1969- 5	10.9	95.9	95.9	.0	67.2	67.2	.0	28.7	.0	132.0	245.9
1969- 6	15.3	66.8	66.8	.0	96.9	96.9	.0	.0	.0	101.9	312.7
1969- 7	19.3	116.0	116.0	.0	125.0	125.0	.0	.0	.0	93.0	428.7
1969- 8	20.1	60.0	60.0	.0	120.4	120.4	.0	.0	.0	32.5	488.7
1969- 9	15.3	7.4	7.4	.0	79.0	36.9	-42.1	.0	.0	3.0	496.1
1969-10	7.9	69.3	69.3	.0	37.5	37.5	.0	.0	.0	34.9	69.3
1969-11	2.1	120.5	101.9	.8	12.8	12.8	.0	.0	17.8	124.8	189.8
1969-12	-7.4	66.2	1.0	.0	.0	.0	.0	.0	83.0	125.8	256.0
1970- 1	-7.9	.0	.0	.0	.0	.0	.0	.0	83.0	125.8	256.0
1970- 2	-6.7	.0	.0	.0	.0	.0	.0	.0	83.0	125.8	256.0
1970- 3	-4.1	46.1	22.6	29.8	1.0	1.0	.0	45.3	76.7	132.0	302.1
1970- 4	5.9	81.6	76.5	81.8	34.5	34.5	.0	123.8	.0	132.0	383.7
1970- 5	11.8	48.3	48.3	.0	72.7	72.7	.0	.0	.0	107.6	432.0
1970- 6	16.7	46.0	46.0	.0	105.7	105.7	.0	.0	.0	47.9	478.0
1970- 7	19.8	88.2	88.2	.0	128.0	112.4	-15.7	.0	.0	23.8	566.2
1970- 8	19.4	52.5	52.5	.0	116.3	71.7	-44.6	.0	.0	4.6	618.7
1970- 9	14.9	88.1	88.1	.0	76.5	76.5	.0	.0	.0	16.2	706.8
1970-10	9.9	94.8	94.8	.0	45.5	45.5	.0	.0	.0	65.5	94.8
1970-11	3.2	75.0	73.7	1.3	15.0	15.0	.0	.0	.0	125.5	169.8
1970-12	-7.2	77.7	14.8	3.3	1.8	1.8	.0	9.8	59.6	132.0	247.5
1971- 1	-10.7	46.0	.0	.0	.0	.0	.0	.0	105.6	132.0	293.5
1971- 2	-6.5	95.9	38.6	10.7	.4	.4	.0	49.0	152.2	132.0	389.4
1971- 3	-4.5	32.0	6.1	24.9	.9	.9	.0	30.0	153.2	132.0	421.4
1971- 4	3.1	36.3	35.8	153.7	19.2	19.2	.0	170.3	.0	132.0	457.7
1971- 5	11.2	31.0	31.0	.0	68.9	68.9	.0	.0	.0	94.1	488.7
1971- 6	17.4	154.9	154.9	.0	110.6	110.6	.0	6.4	.0	132.0	643.6
1971- 7	18.2	98.0	98.0	.0	117.3	117.3	.0	.0	.0	112.7	741.6
1971- 8	18.0	58.6	58.6	.0	107.5	107.5	.0	.0	.0	63.8	800.2
1971- 9	16.4	65.6	65.6	.0	85.3	81.5	-3.8	.0	.0	47.9	865.8
1971-10	12.2	38.2	38.2	.0	56.5	49.3	-7.2	.0	.0	36.9	38.2
1971-11	1.1	55.2	37.7	8.6	9.6	9.6	.0	.0	8.9	73.6	93.4
1971-12	-3.3	85.3	55.3	15.7	1.9	1.9	.0	10.6	23.2	132.0	178.7
1972- 1	-7.4	46.9	14.5	.0	.0	.0	.0	14.5	55.6	132.0	225.6
1972- 2	-9.3	74.3	.0	.0	.0	.0	.0	.0	129.9	132.0	299.9
1972- 3	-5.5	64.1	15.3	20.1	.6	.6	.0	34.8	158.6	132.0	364.0
1972- 4	1.6	42.8	39.8	161.6	16.6	16.6	.0	184.8	.0	132.0	406.8
1972- 5	13.1	57.7	57.7	.0	81.6	81.6	.0	.0	.0	108.1	464.5
1972- 6	15.2	102.4	102.4	.0	96.0	96.0	.0	.0	.0	114.5	566.9
1972- 7	19.4	52.4	52.4	.0	125.5	125.5	.0	.0	.0	41.3	619.3
1972- 8	17.7	111.0	111.0	.0	105.1	105.1	.0	.0	.0	47.2	730.3
1972- 9	14.8	72.1	72.1	.0	76.1	74.5	-1.6	.0	.0	44.8	802.4
1972-10	5.4	93.8	92.5	1.3	25.7	25.7	.0	.0	.0	113.0	93.8
1972-11	.1	61.3	60.0	1.3	6.1	6.1	.0	36.1	.0	132.0	155.1
1972-12	-4.8	106.4	9.7	18.2	.5	.5	.0	27.5	78.5	132.0	261.5
1973- 1	-6.3	44.1	11.2	43.9	1.3	1.3	.0	53.8	67.5	132.0	305.6
1973- 2	-8.8	31.0	5.1	9.9	.3	.3	.0	14.7	83.5	132.0	336.6
1973- 3	2.3	117.6	113.5	87.6	15.6	15.6	.0	185.4	.0	132.0	454.2
1973- 4	5.4	76.4	76.4	.0	30.7	30.7	.0	45.7	.0	132.0	530.6

1973- 5	10.2	110.8	110.8	.0	62.8	62.8	.0	48.0	.0	132.0	641.4
1973- 6	17.8	67.5	67.5	.0	113.1	113.1	.0	.0	.0	86.4	708.9
1973- 7	20.2	57.2	57.2	.0	131.2	131.2	.0	.0	.0	12.5	766.1
1973- 8	21.1	56.5	56.5	.0	126.5	67.5	-59.0	.0	.0	1.4	822.6
1973- 9	15.1	50.6	50.6	.0	78.3	51.1	-27.2	.0	.0	.9	873.2
1973-10	10.3	119.5	119.5	.0	47.7	47.7	.0	.0	.0	72.8	119.5
1973-11	1.7	105.2	94.7	10.5	9.3	9.3	.0	36.7	.0	132.0	224.7
1973-12	-5.6	64.3	22.2	11.5	2.4	2.4	.0	31.3	30.6	132.0	289.0
1974- 1	-7.0	57.4	27.7	32.5	.9	.9	.0	59.3	27.8	132.0	346.4
1974- 2	-9.6	42.8	10.6	17.7	.6	.6	.0	27.7	42.3	132.0	389.2
1974- 3	-3.2	60.6	32.0	45.9	2.9	2.9	.0	75.0	25.0	132.0	449.8
1974- 4	6.5	101.9	101.9	25.0	36.5	36.5	.0	90.4	.0	132.0	551.7
1974- 5	9.6	127.4	127.4	.0	59.0	59.0	.0	68.4	.0	132.0	679.1
1974- 6	16.1	93.3	93.3	.0	101.8	101.8	.0	.0	.0	123.5	772.4
1974- 7	19.5	82.1	82.1	.0	126.4	126.4	.0	.0	.0	79.1	854.5
1974- 8	19.1	43.5	43.5	.0	114.2	114.2	.0	.0	.0	8.4	898.0
1974- 9	13.0	69.6	69.6	.0	66.5	66.5	.0	.0	.0	11.5	967.6
1974-10	6.0	42.2	42.2	.0	28.2	28.2	.0	.0	.0	25.5	42.2
1974-11	1.7	85.1	83.6	.0	12.0	12.0	.0	.0	1.5	97.1	127.3
1974-12	-2.5	46.9	20.8	15.0	.6	.6	.0	.2	12.6	132.0	174.2
1975- 1	-5.4	64.1	36.8	25.7	1.2	1.2	.0	61.2	14.3	132.0	238.3
1975- 2	-5.7	84.1	56.6	26.6	.8	.8	.0	82.4	15.1	132.0	322.4
1975- 3	-4.1	85.8	53.9	33.9	1.7	1.7	.0	86.2	13.1	132.0	408.2
1975- 4	1.3	70.3	44.6	38.8	17.3	17.3	.0	66.1	.0	132.0	478.5
1975- 5	15.3	66.5	66.5	.0	95.8	95.8	.0	.0	.0	102.7	545.0
1975- 6	17.6	71.2	71.2	.0	111.9	111.9	.0	.0	.0	61.9	616.2
1975- 7	20.5	71.3	71.3	.0	133.0	119.6	-13.3	.0	.0	13.6	687.5
1975- 8	19.6	60.3	60.3	.0	117.6	70.2	-47.5	.0	.0	3.7	747.8
1975- 9	13.0	82.8	82.8	.0	66.3	66.3	.0	.0	.0	20.3	830.6
1975-10	9.5	33.3	33.3	.0	44.0	36.0	-7.9	.0	.0	17.5	33.3
1975-11	5.4	87.0	74.3	12.7	23.1	23.1	.0	.0	.0	81.4	120.3
1975-12	-6.4	71.1	22.2	17.5	1.1	1.1	.0	.0	31.4	120.0	191.4
1976- 1	-10.9	87.3	.0	.0	.0	.0	.0	.0	118.7	120.0	278.7
1976- 2	-4.1	60.0	36.1	62.4	2.1	2.1	.0	84.4	80.2	132.0	338.7
1976- 3	-1.2	110.2	68.0	122.4	10.5	10.5	.0	179.9	.0	132.0	448.9
1976- 4	6.8	58.3	58.3	.0	37.9	37.9	.0	20.4	.0	132.0	507.2
1976- 5	10.1	133.5	133.5	.0	61.9	61.9	.0	71.6	.0	132.0	640.7
1976- 6	18.6	119.4	119.4	.0	118.4	118.4	.0	1.0	.0	132.0	760.1
1976- 7	19.3	116.9	116.9	.0	124.8	124.8	.0	.0	.0	124.1	877.0
1976- 8	17.7	51.0	51.0	.0	105.8	105.8	.0	.0	.0	69.3	928.0
1976- 9	13.7	87.8	87.8	.0	70.3	70.3	.0	.0	.0	86.8	1015.8
1976-10	5.6	63.9	63.9	.0	27.0	27.0	.0	.0	.0	123.7	63.9
1976-11	-1.0	27.0	19.6	7.4	3.7	3.7	.0	15.0	.0	132.0	90.9
1976-12	-9.2	39.1	.0	.0	.0	.0	.0	.0	39.1	132.0	130.0
1977- 1	-13.1	70.2	.0	.0	.0	.0	.0	.0	109.3	132.0	200.2
1977- 2	-7.4	31.0	2.3	13.9	.3	.3	.0	15.9	124.1	132.0	231.2
1977- 3	1.0	86.0	72.6	137.5	14.1	14.1	.0	196.0	.0	132.0	317.2
1977- 4	6.9	89.5	83.7	5.8	41.5	41.5	.0	48.0	.0	132.0	406.7
1977- 5	14.4	31.9	31.9	.0	90.0	90.0	.0	.0	.0	73.9	438.6
1977- 6	16.2	82.6	82.6	.0	102.5	101.2	-1.3	.0	.0	55.4	521.2
1977- 7	19.7	60.6	60.6	.0	127.6	107.6	-20.1	.0	.0	8.4	581.8
1977- 8	17.8	126.7	126.7	.0	106.2	106.2	.0	.0	.0	28.9	708.5
1977- 9	14.4	138.0	138.0	.0	74.0	74.0	.0	.0	.0	92.9	846.5
1977-10	7.4	83.7	83.7	.0	33.3	33.3	.0	11.3	.0	132.0	83.7
1977-11	2.9	126.9	116.4	.3	16.5	16.5	.0	100.2	10.2	132.0	210.6
1977-12	-5.9	93.4	8.6	15.8	.8	.8	.0	23.6	79.2	132.0	304.0

1978- 1	-10.0	116.4	21.4	4.6	.1	.1	.0	25.9	169.7	132.0	420.4
1978- 2	-10.5	18.8	.0	.0	.0	.0	.0	.0	188.5	132.0	439.2
1978- 3	-4.9	49.7	29.3	24.3	.9	.9	.0	52.7	184.5	132.0	488.9
1978- 4	3.3	33.0	33.0	184.5	19.9	19.9	.0	197.6	.0	132.0	521.9
1978- 5	13.0	99.6	99.6	.0	81.8	81.8	.0	17.8	.0	132.0	621.5
1978- 6	16.3	41.7	41.7	.0	103.3	103.3	.0	.0	.0	70.4	663.2
1978- 7	19.6	65.6	65.6	.0	126.7	120.0	-6.7	.0	.0	16.0	728.8
1978- 8	19.1	80.2	80.2	.0	114.1	87.1	-27.1	.0	.0	9.1	809.0
1978- 9	13.8	115.3	115.3	.0	71.1	71.1	.0	.0	.0	53.3	924.3
1978-10	7.3	72.0	72.0	.0	33.4	33.4	.0	.0	.0	91.9	72.0
1978-11	2.3	47.5	45.0	2.5	14.5	14.5	.0	.0	.0	124.9	119.5
1978-12	-3.9	47.5	25.1	15.3	.6	.6	.0	32.6	7.1	132.0	167.0
1979- 1	-8.7	81.0	.0	2.3	.0	.0	.0	2.3	85.9	132.0	248.0
1979- 2	-12.5	23.2	.0	2.3	.0	.0	.0	2.2	106.8	132.0	271.2
1979- 3	.9	67.3	62.9	111.2	12.4	12.4	.0	161.7	.0	132.0	338.5
1979- 4	4.6	103.0	92.6	10.4	27.9	27.9	.0	75.1	.0	132.0	441.5
1979- 5	11.3	80.0	80.0	.0	70.0	70.0	.0	10.0	.0	132.0	521.5
1979- 6	16.9	66.8	66.8	.0	106.9	106.9	.0	.0	.0	91.9	588.3
1979- 7	20.2	30.4	30.4	.0	130.9	122.3	-8.6	.0	.0	.0	618.7
1979- 8	17.8	81.4	81.4	.0	106.1	81.4	-24.7	.0	.0	.0	700.1
1979- 9	14.5	50.0	50.0	.0	74.6	50.0	-24.6	.0	.0	.0	750.1
1979-10	7.4	103.6	103.6	.0	34.3	34.3	.0	.0	.0	69.3	103.6
1979-11	3.3	110.9	107.9	1.4	14.0	14.0	.0	32.7	1.6	132.0	214.5
1979-12	-3.0	80.8	64.2	18.2	2.4	2.4	.0	80.0	.0	132.0	295.3
1980- 1	-8.0	10.6	2.6	.0	.0	.0	.0	2.6	8.0	132.0	305.9
1980- 2	-8.1	35.0	2.0	8.6	.2	.2	.0	10.4	32.4	132.0	340.9
1980- 3	-3.1	103.1	85.1	50.4	5.0	5.0	.0	130.5	.0	132.0	444.0
1980- 4	5.9	118.3	118.3	.0	32.0	32.0	.0	86.3	.0	132.0	562.3
1980- 5	13.6	47.4	47.4	.0	84.4	84.4	.0	.0	.0	95.0	609.7
1980- 6	13.9	148.6	148.6	.0	87.5	87.5	.0	24.1	.0	132.0	758.3
1980- 7	19.8	136.2	136.2	.0	127.9	127.9	.0	8.3	.0	132.0	894.5
1980- 8	20.2	46.6	46.6	.0	121.5	121.5	.0	.0	.0	57.1	941.1
1980- 9	13.9	79.6	79.6	.0	71.9	71.9	.0	.0	.0	64.8	1020.7
1980-10	6.2	117.6	117.6	.0	28.2	28.2	.0	22.2	.0	132.0	117.6
1980-11	.2	57.6	55.4	.0	5.2	5.2	.0	50.2	2.2	132.0	175.2
1980-12	-8.2	69.6	49.2	4.0	1.3	1.3	.0	51.9	18.6	132.0	244.8
1981- 1	-12.3	15.0	.0	9.1	.3	.3	.0	8.8	24.5	132.0	259.8
1981- 2	-3.0	86.0	51.6	58.9	5.9	5.9	.0	104.6	.0	132.0	345.8
1981- 3	-.6	29.0	15.8	13.2	10.6	10.6	.0	18.4	.0	132.0	374.8
1981- 4	6.2	64.4	64.4	.0	33.5	33.5	.0	30.9	.0	132.0	439.2
1981- 5	11.8	91.6	91.6	.0	73.3	73.3	.0	18.3	.0	132.0	530.8
1981- 6	16.9	87.0	87.0	.0	107.2	107.2	.0	.0	.0	111.8	617.8
1981- 7	20.2	69.4	69.4	.0	131.0	131.0	.0	.0	.0	50.2	687.2
1981- 8	18.8	135.2	135.2	.0	112.9	112.9	.0	.0	.0	72.5	822.4
1981- 9	13.9	101.9	101.9	.0	72.1	72.1	.0	.0	.0	102.3	924.3
1981-10	5.9	105.4	105.4	.0	26.4	26.4	.0	49.3	.0	132.0	105.4
1981-11	2.5	64.0	64.0	.0	12.8	12.8	.0	51.2	.0	132.0	169.4
1981-12	-4.3	23.0	5.2	3.0	.6	.6	.0	7.6	14.8	132.0	192.4
1982- 1	-11.5	48.6	3.4	8.1	.2	.2	.0	11.3	51.9	132.0	241.0
1982- 2	-7.5	19.2	.0	6.3	.1	.1	.0	6.1	64.9	132.0	260.2
1982- 3	-3.0	32.7	21.7	75.9	3.8	3.8	.0	93.8	.0	132.0	292.9
1982- 4	3.8	36.8	36.0	.8	28.0	28.0	.0	8.8	.0	132.0	329.7
1982- 5	14.5	72.6	72.6	.0	90.0	90.0	.0	.0	.0	114.6	402.3
1982- 6	14.7	118.6	118.6	.0	92.8	92.8	.0	8.4	.0	132.0	520.9
1982- 7	19.8	49.2	49.2	.0	127.8	127.8	.0	.0	.0	53.4	570.1
1982- 8	17.0	58.4	58.4	.0	101.2	87.3	-13.9	.0	.0	24.5	628.5
1982- 9	14.3	84.2	84.2	.0	73.6	73.6	.0	.0	.0	35.1	712.7

1982-10	9.2	61.4	61.4	.0	42.3	42.3	.0	.0	.0	54.2	61.4
1982-11	3.2	136.2	125.0	11.2	15.3	15.3	.0	43.1	.0	132.0	197.6
1982-12	-.9	98.6	93.4	5.2	9.0	9.0	.0	89.6	.0	132.0	296.2
1983- 1	-5.8	43.5	11.7	21.2	.6	.6	.0	32.2	10.6	132.0	339.7
1983- 2	-4.7	42.0	31.4	21.2	1.5	1.5	.0	51.1	.0	132.0	381.7
1983- 3	-.3	52.4	49.6	2.8	9.4	9.4	.0	43.0	.0	132.0	434.1
1983- 4	4.6	92.8	92.6	.2	24.9	24.9	.0	67.9	.0	132.0	526.9
1983- 5	9.6	137.4	137.4	.0	58.7	58.7	.0	78.7	.0	132.0	664.3
1983- 6	17.8	30.6	30.6	.0	113.2	113.2	.0	.0	.0	49.4	694.9
1983- 7	21.0	65.6	65.6	.0	136.5	110.0	-26.5	.0	.0	5.1	760.5
1983- 8	20.3	65.6	65.6	.0	122.1	69.2	-52.9	.0	.0	1.4	826.1
1983- 9	16.6	61.8	61.8	.0	86.1	62.2	-23.9	.0	.0	1.0	887.9
1983-10	8.7	124.2	124.2	.0	40.3	40.3	.0	.0	.0	84.9	124.2
1983-11	1.8	91.0	85.4	5.0	10.6	10.6	.0	32.7	.6	132.0	215.2
1983-12	-7.6	93.2	26.2	12.5	.2	.2	.0	38.5	55.1	132.0	308.4
1984- 1	-10.6	43.6	3.0	.0	.0	.0	.0	3.0	95.7	132.0	352.0
1984- 2	-2.4	60.2	35.4	107.9	4.7	4.7	.0	138.6	12.6	132.0	412.2
1984- 3	-6.1	40.8	13.4	39.4	1.4	1.4	.0	51.4	.6	132.0	453.0
1984- 4	6.7	111.0	111.0	.6	36.2	36.2	.0	75.4	.0	132.0	564.0
1984- 5	9.6	80.4	80.4	.0	58.7	58.7	.0	21.7	.0	132.0	644.4
1984- 6	17.5	42.4	42.4	.0	110.8	110.8	.0	.0	.0	63.6	686.8
1984- 7	19.2	45.6	45.6	.0	124.1	108.8	-15.3	.0	.0	.4	732.4
1984- 8	20.1	104.4	104.4	.0	120.8	104.5	-16.4	.0	.0	.3	836.8
1984- 9	13.2	71.2	71.2	.0	67.5	67.5	.0	.0	.0	4.0	908.0
1984-10	10.0	35.6	35.6	.0	45.6	36.1	-9.5	.0	.0	3.5	35.6
1984-11	1.7	87.2	86.6	.6	10.3	10.3	.0	.0	.0	80.3	122.8
1984-12	-1.8	46.1	16.3	28.2	2.9	2.9	.0	.0	1.6	121.9	168.9
1985- 1	-10.2	86.9	.0	.0	.0	.0	.0	.0	88.5	121.9	255.8
1985- 2	-6.9	104.6	70.4	39.2	1.3	1.3	.0	98.1	83.5	132.0	360.4
1985- 3	-1.3	33.8	15.2	102.1	5.3	5.3	.0	112.0	.0	132.0	394.2
1985- 4	6.6	35.8	35.0	.8	38.6	38.6	.0	.0	.0	129.2	430.0
1985- 5	12.8	108.6	108.6	.0	79.1	79.1	.0	26.6	.0	132.0	538.6
1985- 6	14.9	19.4	19.4	.0	94.2	94.2	.0	.0	.0	57.2	558.0
1985- 7	18.9	51.6	51.6	.0	122.3	102.8	-19.5	.0	.0	6.0	609.6
1985- 8	18.4	88.8	88.8	.0	110.1	90.4	-19.7	.0	.0	4.4	698.4
1985- 9	16.3	90.8	90.8	.0	84.6	84.6	.0	.0	.0	10.6	789.2
1985-10	9.1	84.2	84.2	.0	42.0	42.0	.0	.0	.0	52.8	84.2
1985-11	1.6	175.8	162.2	13.3	10.8	10.8	.0	85.5	.3	132.0	260.0
1985-12	-6.6	72.2	13.0	.3	.4	.4	.0	12.9	59.2	132.0	332.2
1986- 1	-7.9	25.0	13.2	27.5	.8	.8	.0	39.9	43.5	132.0	357.2
1986- 2	-7.8	33.4	3.4	6.3	.1	.1	.0	9.6	67.3	132.0	390.6
1986- 3	-.8	73.5	53.5	87.3	11.6	11.6	.0	129.1	.0	132.0	464.1
1986- 4	7.7	47.4	45.6	1.8	42.4	42.4	.0	5.0	.0	132.0	511.5
1986- 5	14.2	66.8	66.8	.0	88.5	88.5	.0	.0	.0	110.3	578.3
1986- 6	16.0	119.0	119.0	.0	101.2	101.2	.0	.0	.0	128.2	697.3
1986- 7	19.9	76.6	76.6	.0	128.9	128.9	.0	.0	.0	75.9	773.9
1986- 8	17.8	186.8	186.8	.0	106.5	106.5	.0	24.2	.0	132.0	960.7
1986- 9	13.9	198.8	198.8	.0	71.1	71.1	.0	127.7	.0	132.0	1159.5
1986-10	8.2	58.8	58.8	.0	37.3	37.3	.0	21.5	.0	132.0	58.8
1986-11	.5	34.4	28.8	5.6	7.9	7.9	.0	26.5	.0	132.0	93.2
1986-12	-3.0	54.4	20.2	19.3	.4	.4	.0	39.1	14.9	132.0	147.6
1987- 1	-6.4	46.8	.0	.0	.0	.0	.0	.0	61.7	132.0	194.4
1987- 2	-7.3	22.0	16.0	4.7	.1	.1	.0	20.6	63.0	132.0	216.4
1987- 3	.5	46.8	39.4	64.0	14.0	14.0	.0	89.4	6.4	132.0	263.2
1987- 4	9.0	49.6	46.0	10.0	49.8	49.8	.0	6.2	.0	132.0	312.8
1987- 5	14.0	44.8	44.8	.0	87.5	87.5	.0	.0	.0	89.3	357.6

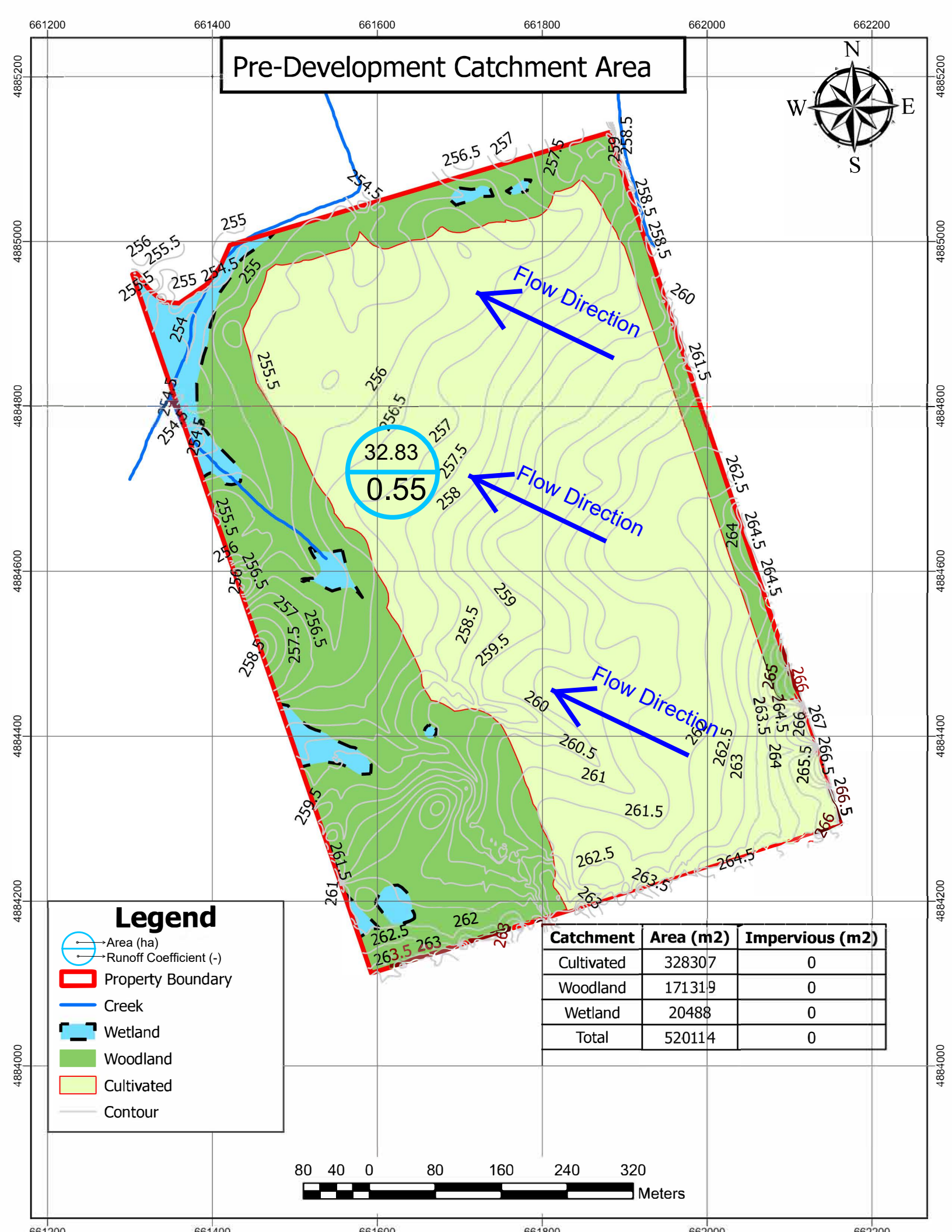
1987- 6	18.2	101.0	101.0	.0	115.7	115.7	.0	.0	.0	74.7	458.6
1987- 7	21.2	78.2	78.2	.0	137.9	134.6	-3.3	.0	.0	18.2	536.8
1987- 8	18.6	135.6	135.6	.0	111.3	111.3	.0	.0	.0	42.5	672.4
1987- 9	14.9	89.4	89.4	.0	76.8	76.8	.0	.0	.0	55.1	761.8
1987-10	6.5	82.6	82.6	.0	29.3	29.3	.0	.0	.0	108.4	82.6
1987-11	1.9	91.4	81.8	9.6	12.3	12.3	.0	55.5	.0	132.0	174.0
1987-12	-2.1	29.0	21.8	7.2	2.5	2.5	.0	26.5	.0	132.0	203.0
1988- 1	-6.6	60.4	27.2	33.2	2.0	2.0	.0	58.4	.0	132.0	263.4
1988- 2	-7.8	69.2	6.0	.0	.0	.0	.0	6.0	63.2	132.0	332.6
1988- 3	-2.4	35.0	29.4	68.8	6.6	6.6	.0	91.6	.0	132.0	367.6
1988- 4	5.5	88.2	88.2	.0	29.1	29.1	.0	59.1	.0	132.0	455.8
1988- 5	13.8	54.0	54.0	.0	85.7	85.7	.0	.0	.0	100.3	509.8
1988- 6	17.0	81.6	81.6	.0	108.0	108.0	.0	.0	.0	73.8	591.4
1988- 7	22.4	137.8	137.8	.0	145.5	145.0	-.5	.0	.0	66.6	729.2
1988- 8	20.3	76.8	76.8	.0	122.5	115.3	-7.2	.0	.0	28.1	806.0
1988- 9	14.2	113.8	113.8	.0	72.7	72.7	.0	.0	.0	69.2	919.8
1988-10	6.1	114.4	114.4	.0	28.0	28.0	.0	23.6	.0	132.0	114.4
1988-11	3.3	90.4	90.4	.0	12.8	12.8	.0	77.6	.0	132.0	204.8
1988-12	-5.1	64.0	9.8	6.4	1.0	1.0	.0	15.2	47.8	132.0	268.8
1989- 1	-4.5	31.5	11.9	25.3	.8	.8	.0	36.4	42.2	132.0	300.3
1989- 2	-7.8	23.0	2.2	10.6	.2	.2	.0	12.5	52.4	132.0	323.3
1989- 3	-3.6	42.4	21.4	73.4	6.3	6.3	.0	88.5	.0	132.0	365.7
1989- 4	3.9	50.6	50.2	.4	22.3	22.3	.0	28.3	.0	132.0	416.3
1989- 5	12.6	104.2	104.2	.0	78.7	78.7	.0	25.5	.0	132.0	520.5
1989- 6	17.7	95.8	95.8	.0	112.7	112.7	.0	.0	.0	115.1	616.3
1989- 7	21.1	6.0	6.0	.0	136.7	121.1	-15.7	.0	.0	.0	622.3
1989- 8	19.1	94.2	94.2	.0	114.9	94.2	-20.7	.0	.0	.0	716.5
1989- 9	14.7	118.2	118.2	.0	76.0	76.0	.0	.0	.0	42.2	834.7
1989-10	9.4	112.0	112.0	.0	42.6	42.6	.0	.0	.0	111.6	112.0
1989-11	.6	144.6	126.6	12.8	9.9	9.9	.0	109.1	5.2	132.0	256.6
1989-12	-11.8	42.8	.0	.0	.0	.0	.0	.0	48.0	132.0	299.4
1990- 1	-2.8	57.1	24.5	26.9	.6	.6	.0	50.8	53.7	132.0	356.5
1990- 2	-5.7	62.8	27.8	33.8	1.0	1.0	.0	60.6	54.9	132.0	419.3
1990- 3	-.3	46.6	42.8	58.7	12.9	12.9	.0	88.7	.0	132.0	465.9
1990- 4	7.1	81.2	81.2	.0	41.1	41.1	.0	40.1	.0	132.0	547.1
1990- 5	11.0	102.6	102.6	.0	68.0	68.0	.0	34.6	.0	132.0	649.7
1990- 6	17.2	101.2	101.2	.0	109.0	109.0	.0	.0	.0	124.2	750.9
1990- 7	19.8	80.4	80.4	.0	128.3	128.3	.0	.0	.0	76.3	831.3
1990- 8	19.5	61.4	61.4	.0	116.6	114.8	-1.9	.0	.0	23.0	892.7
1990- 9	14.1	89.8	89.8	.0	72.4	72.4	.0	.0	.0	40.4	982.5
1990-10	8.1	117.8	117.8	.0	37.4	37.4	.0	.0	.0	120.8	117.8
1990-11	2.9	58.2	54.0	4.2	13.4	13.4	.0	33.6	.0	132.0	176.0
1990-12	-2.6	109.8	80.0	24.5	2.4	2.4	.0	102.1	5.3	132.0	285.8
1991- 1	-7.7	43.6	3.4	7.0	.1	.1	.0	10.2	38.5	132.0	329.4
1991- 2	-4.2	26.8	6.8	51.9	2.4	2.4	.0	56.4	6.6	132.0	356.2
1991- 3	-.5	117.9	94.3	30.2	7.5	7.5	.0	117.0	.0	132.0	474.1
1991- 4	7.2	144.6	144.6	.0	39.5	39.5	.0	105.1	.0	132.0	618.7
1991- 5	15.3	71.6	71.6	.0	96.4	96.4	.0	.0	.0	107.2	690.3
1991- 6	19.0	45.6	45.6	.0	121.3	121.3	.0	.0	.0	31.5	735.9
1991- 7	20.6	63.8	63.8	.0	133.6	91.6	-41.9	.0	.0	3.7	799.7
1991- 8	20.3	111.8	111.8	.0	121.7	112.3	-9.5	.0	.0	3.2	911.5
1991- 9	14.2	94.0	94.0	.0	73.8	73.8	.0	.0	.0	23.4	1005.5
1991-10	9.5	71.3	71.3	.0	43.6	43.6	.0	.0	.0	51.1	71.3
1991-11	1.5	62.4	59.4	3.0	9.2	9.2	.0	.0	.0	104.3	133.7
1991-12	-4.0	70.4	24.8	22.7	2.7	2.7	.0	17.1	22.9	132.0	204.1
1992- 1	-6.3	67.3	22.6	28.5	1.0	1.0	.0	50.1	39.1	132.0	271.4

1992- 2	-5.3	49.6	15.0	11.6	.3	.3	.0	26.3	62.1	132.0	321.0
1992- 3	-3.5	49.6	32.8	78.9	5.3	5.3	.0	106.4	.0	132.0	370.6
1992- 4	4.6	111.0	96.8	14.2	26.6	26.6	.0	84.4	.0	132.0	481.6
1992- 5	12.3	67.0	67.0	.0	76.0	76.0	.0	.0	.0	123.0	548.6
1992- 6	15.7	30.6	30.6	.0	99.2	99.2	.0	.0	.0	54.5	579.2
1992- 7	17.0	110.9	110.9	.0	109.1	109.1	.0	.0	.0	56.2	690.1
1992- 8	17.2	147.2	147.2	.0	102.4	102.4	.0	.0	.0	101.0	837.3
1992- 9	13.8	126.2	126.2	.0	71.0	71.0	.0	24.2	.0	132.0	963.5
1992-10	6.2	72.0	71.2	.8	29.5	29.5	.0	42.5	.0	132.0	72.0
1992-11	1.6	122.6	115.2	7.4	8.7	8.7	.0	113.9	.0	132.0	194.6
1992-12	-3.6	71.2	17.2	30.5	.9	.9	.0	46.7	23.5	132.0	265.8
1993- 1	-6.0	120.9	51.6	31.5	.8	.8	.0	82.3	61.3	132.0	386.7
1993- 2	-10.6	47.5	.0	.0	.0	.0	.0	.0	108.8	132.0	434.2
1993- 3	-3.3	32.6	.0	141.4	6.3	6.3	.0	135.1	.0	132.0	466.8
1993- 4	5.6	83.4	83.4	.0	30.4	30.4	.0	53.0	.0	132.0	550.2
1993- 5	11.6	58.6	58.6	.0	71.5	71.5	.0	.0	.0	119.1	608.8
1993- 6	16.1	139.1	139.1	.0	101.7	101.7	.0	24.5	.0	132.0	747.9
1993- 7	19.9	83.6	83.6	.0	128.9	128.9	.0	.0	.0	86.7	831.5
1993- 8	19.7	73.4	73.4	.0	118.0	118.0	.0	.0	.0	42.1	904.9
1993- 9	12.5	67.0	67.0	.0	64.2	64.2	.0	.0	.0	44.9	971.9
1993-10	6.5	107.8	107.8	.0	29.9	29.9	.0	.0	.0	122.8	107.8
1993-11	.7	89.2	86.0	3.2	6.6	6.6	.0	73.5	.0	132.0	197.0
1993-12	-4.7	41.0	32.6	.4	1.8	1.8	.0	31.2	8.0	132.0	238.0
1994- 1	-14.9	52.4	.0	.0	.0	.0	.0	.0	60.4	132.0	290.4
1994- 2	-10.1	19.5	.0	39.1	1.5	1.5	.0	37.6	40.8	132.0	309.9
1994- 3	-2.1	45.2	10.8	75.2	4.0	4.0	.0	82.0	.0	132.0	355.1
1994- 4	5.6	81.8	76.6	5.2	31.1	31.1	.0	50.7	.0	132.0	436.9
1994- 5	10.7	99.2	99.2	.0	66.2	66.2	.0	33.0	.0	132.0	536.1
1994- 6	18.1	46.0	46.0	.0	115.6	115.6	.0	.0	.0	62.4	582.1
1994- 7	20.4	74.0	74.0	.0	132.4	120.1	-12.3	.0	.0	16.3	656.1
1994- 8	17.7	76.4	76.4	.0	105.5	82.4	-23.1	.0	.0	10.3	732.5
1994- 9	15.4	88.4	88.4	.0	79.1	79.1	.0	.0	.0	19.6	820.9
1994-10	9.4	37.4	37.4	.0	42.8	38.7	-4.0	.0	.0	18.3	37.4
1994-11	4.3	97.3	80.3	17.0	18.7	18.7	.0	.0	.0	96.8	134.7
1994-12	-1.6	63.4	29.4	24.6	4.7	4.7	.0	14.1	9.4	132.0	198.1
1995- 1	-4.3	124.0	77.2	51.4	3.5	3.5	.0	125.1	4.8	132.0	322.1
1995- 2	-9.0	34.4	4.0	7.4	.2	.2	.0	11.1	27.8	132.0	356.5
1995- 3	1.5	51.1	48.6	30.3	17.0	17.0	.0	62.0	.0	132.0	407.6
1995- 4	3.1	87.6	73.4	14.2	20.2	20.2	.0	67.4	.0	132.0	495.2
1995- 5	12.3	104.8	104.8	.0	75.7	75.7	.0	29.1	.0	132.0	600.0
1995- 6	19.2	34.2	34.2	.0	122.4	122.4	.0	.0	.0	43.8	634.2
1995- 7	20.2	119.8	119.8	.0	130.5	125.7	-4.8	.0	.0	37.9	754.0
1995- 8	20.6	76.0	76.0	.0	123.8	98.9	-24.9	.0	.0	15.0	830.0
1995- 9	12.8	32.7	32.7	.0	65.7	39.0	-26.8	.0	.0	8.7	862.7
1995-10	9.6	155.8	155.8	.0	44.5	44.5	.0	.0	.0	120.0	155.8
1995-11	-.8	155.1	122.3	9.2	4.7	4.7	.0	114.8	23.6	132.0	310.9
1995-12	-7.4	34.2	1.0	2.3	.0	.0	.0	3.3	54.6	132.0	345.1
1996- 1	-8.7	76.0	33.2	27.6	.8	.8	.0	60.0	69.8	132.0	421.1
1996- 2	-7.4	5.0	.0	39.4	1.2	1.2	.0	38.2	35.4	132.0	426.1
1996- 3	-3.6	30.9	11.4	54.9	4.7	4.7	.0	61.6	.0	132.0	457.0
1996- 4	3.8	96.6	94.4	2.2	21.7	21.7	.0	74.9	.0	132.0	553.6
1996- 5	11.1	87.8	87.8	.0	68.5	68.5	.0	19.3	.0	132.0	641.4
1996- 6	17.8	152.2	152.2	.0	113.2	113.2	.0	39.0	.0	132.0	793.6
1996- 7	18.8	104.3	104.3	.0	121.6	121.6	.0	.0	.0	114.7	897.9
1996- 8	19.8	135.8	135.8	.0	118.8	118.8	.0	.0	.0	131.7	1033.7
1996- 9	15.8	177.2	177.2	.0	81.7	81.7	.0	95.1	.0	132.0	1210.9
1996-10	8.6	64.4	64.4	.0	39.1	39.1	.0	25.3	.0	132.0	64.4

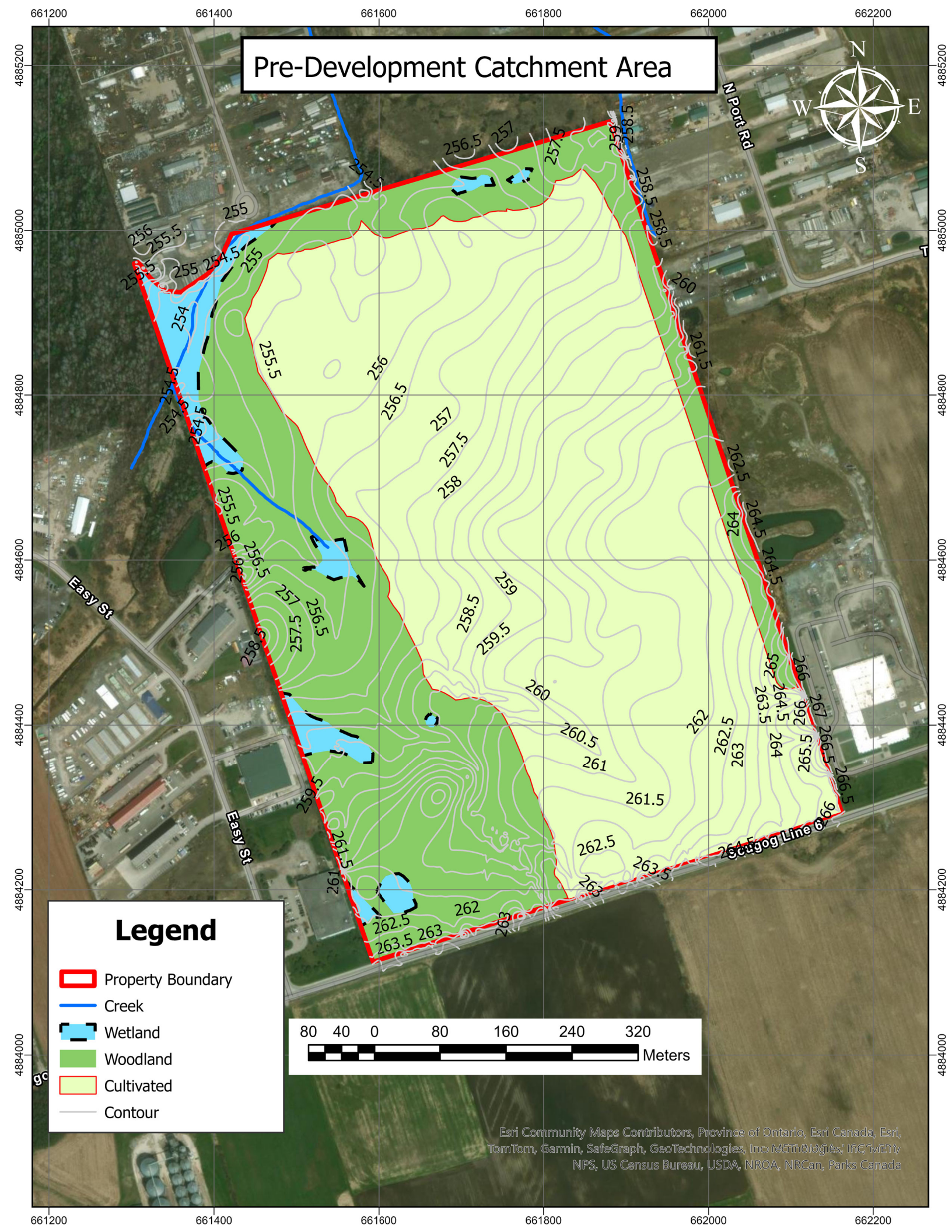
1996-11	-.4	59.4	42.6	4.6	6.6	6.6	.0	40.6	12.2	132.0	123.8
1996-12	-1.4	99.8	75.0	20.0	3.2	3.2	.0	91.8	17.0	132.0	223.6
1997- 1	-8.0	102.9	14.6	23.8	1.4	1.4	.0	37.0	81.5	132.0	326.5
1997- 2	-4.9	90.8	37.3	28.4	1.0	1.0	.0	64.8	106.6	132.0	417.3
1997- 3	-2.7	50.2	25.7	93.6	4.0	4.0	.0	115.4	37.4	132.0	467.5
1997- 4	4.8	37.0	37.0	37.4	28.3	28.3	.0	46.2	.0	132.0	504.5
1997- 5	8.9	81.0	81.0	.0	54.2	54.2	.0	26.8	.0	132.0	585.5
1997- 6	19.1	125.0	125.0	.0	121.6	121.6	.0	3.4	.0	132.0	710.5
1997- 7	19.6	44.4	44.4	.0	126.9	126.9	.0	.0	.0	49.5	754.9
1997- 8	18.2	82.6	82.6	.0	108.6	98.9	-9.7	.0	.0	33.2	837.5
1997- 9	14.6	103.0	103.0	.0	75.3	75.3	.0	.0	.0	60.9	940.5
1997-10	8.4	40.9	39.9	1.0	39.5	39.5	.0	.0	.0	62.3	40.9
1997-11	1.0	75.2	57.8	17.4	8.6	8.6	.0	.0	.0	129.0	116.1
1997-12	-2.8	29.0	2.0	20.3	.7	.7	.0	18.5	6.7	132.0	145.1
1998- 1	-4.0	98.8	51.6	10.1	2.6	2.6	.0	59.1	43.8	132.0	243.9
1998- 2	-1.7	23.5	23.5	43.8	2.8	2.8	.0	64.5	.0	132.0	267.4
1998- 3	.2	99.5	58.5	41.0	14.6	14.6	.0	84.9	.0	132.0	366.9
1998- 4	8.1	70.9	70.9	.0	43.4	43.4	.0	27.5	.0	132.0	437.8
1998- 5	16.5	50.0	50.0	.0	103.6	103.6	.0	.0	.0	78.4	487.8
1998- 6	17.8	198.0	198.0	.0	113.3	113.3	.0	31.2	.0	132.0	685.8
1998- 7	19.8	93.2	93.2	.0	128.2	128.2	.0	.0	.0	97.0	779.0
1998- 8	20.4	98.3	98.3	.0	122.6	122.6	.0	.0	.0	72.7	877.3
1998- 9	16.7	57.0	57.0	.0	86.5	84.2	-2.4	.0	.0	45.5	934.3
1998-10	9.7	37.6	37.6	.0	44.3	41.5	-2.9	.0	.0	41.6	37.6
1998-11	3.0	57.0	57.0	.0	11.3	11.3	.0	.0	.0	87.4	94.6
1998-12	-.9	73.6	59.2	.0	7.3	7.3	.0	7.3	14.4	132.0	168.2
1999- 1	-7.7	73.6	.0	27.8	.8	.8	.0	27.0	60.2	132.0	241.8
1999- 2	-3.3	39.9	18.4	46.5	1.4	1.4	.0	63.4	35.3	132.0	281.7
1999- 3	-1.0	39.2	10.2	64.3	8.9	8.9	.0	65.6	.0	132.0	320.9
1999- 4	7.5	23.0	23.0	.0	40.0	40.0	.0	.0	.0	115.0	343.9
1999- 5	15.0	84.0	84.0	.0	93.2	93.2	.0	.0	.0	105.8	427.9
1999- 6	19.0	68.4	68.4	.0	120.9	120.9	.0	.0	.0	53.4	496.3
1999- 7	22.3	55.2	55.2	.0	145.0	108.6	-36.4	.0	.0	.0	551.5
1999- 8	19.1	60.4	60.4	.0	114.1	60.4	-53.7	.0	.0	.0	611.9
1999- 9	16.9	120.0	120.0	.0	87.9	87.9	.0	.0	.0	32.1	731.9
1999-10	8.2	106.4	106.4	.0	37.0	37.0	.0	.0	.0	101.5	106.4
1999-11	4.1	103.8	103.8	.0	17.3	17.3	.0	56.0	.0	132.0	210.2
1999-12	-2.5	83.2	68.6	3.0	4.2	4.2	.0	67.4	11.6	132.0	293.4
2000- 1	-7.7	49.2	29.0	11.6	1.7	1.7	.0	38.9	20.2	132.0	342.6
2000- 2	-4.6	49.8	9.4	60.6	4.2	4.2	.0	65.8	.0	132.0	392.4
2000- 3	2.7	32.2	25.4	6.8	18.3	18.3	.0	13.9	.0	132.0	424.6
2000- 4	5.3	62.2	56.4	5.8	29.8	29.8	.0	32.4	.0	132.0	486.8
2000- 5	12.9	146.6	146.6	.0	79.9	79.9	.0	66.7	.0	132.0	633.4
2000- 6	16.4	211.8	211.8	.0	104.0	104.0	.0	107.8	.0	132.0	845.2
2000- 7	18.5	67.4	67.4	.0	119.1	119.1	.0	.0	.0	80.3	912.6
2000- 8	18.8	70.2	70.2	.0	112.6	112.6	.0	.0	.0	37.9	982.8
2000- 9	14.1	74.8	74.8	.0	72.8	72.8	.0	.0	.0	39.8	1057.6
2000-10	9.5	35.4	35.4	.0	43.5	39.5	-4.0	.0	.0	35.8	35.4
2000-11	2.0	55.2	43.8	11.4	12.4	12.4	.0	.0	.0	78.6	90.6
2000-12	-8.7	105.4	20.8	17.4	.5	.5	.0	.0	67.2	116.4	196.0
2001- 1	-6.1	42.2	2.8	.0	.0	.0	.0	.0	106.6	119.2	238.2
2001- 2	-6.0	81.8	24.0	16.0	.4	.4	.0	26.8	148.3	132.0	320.0
2001- 3	-2.3	41.6	.0	51.8	1.9	1.9	.0	49.9	138.1	132.0	361.6
2001- 4	6.8	33.4	33.4	138.1	36.4	36.4	.0	135.1	.0	132.0	395.0
2001- 5	13.7	122.8	122.8	.0	84.7	84.7	.0	38.1	.0	132.0	517.8
2001- 6	18.4	54.8	54.8	.0	117.1	117.1	.0	.0	.0	69.7	572.6

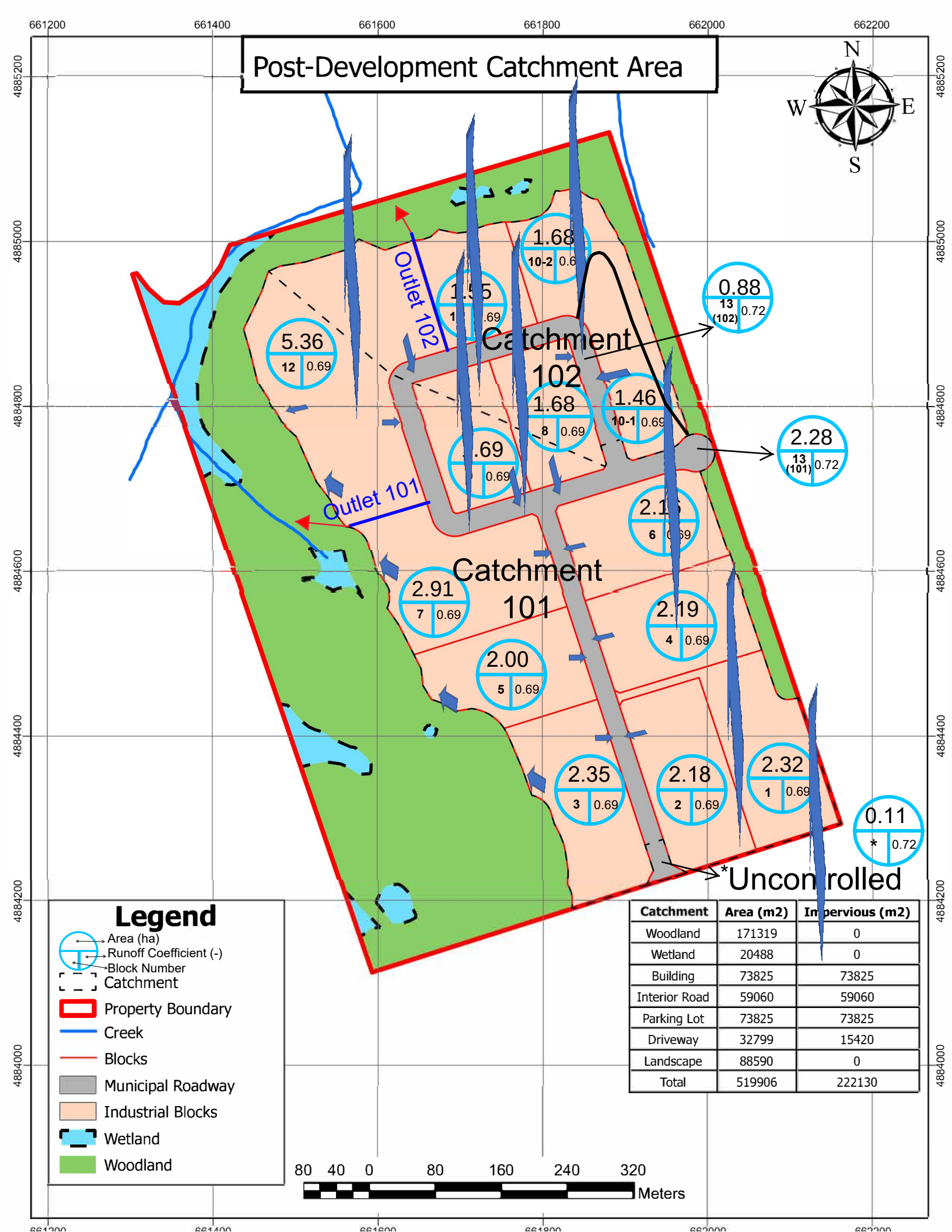
2001- 7	19.0	37.6	37.6	.0	122.8	107.3	-15.5	.0	.0	.0	610.2
2001- 8	21.4	86.4	86.4	.0	129.2	86.4	-42.8	.0	.0	.0	696.6
2001- 9	14.9	144.0	144.0	.0	77.0	77.0	.0	.0	.0	67.0	840.6
2001-10	8.7	147.4	147.4	.0	40.3	40.3	.0	42.1	.0	132.0	147.4
2001-11	5.6	118.0	118.0	.0	21.2	21.2	.0	96.8	.0	132.0	265.4
2001-12	-.3	54.8	41.0	4.8	6.4	6.4	.0	39.4	9.0	132.0	320.2

Appendix VIII– Pre- and Post- Development Catchment Area

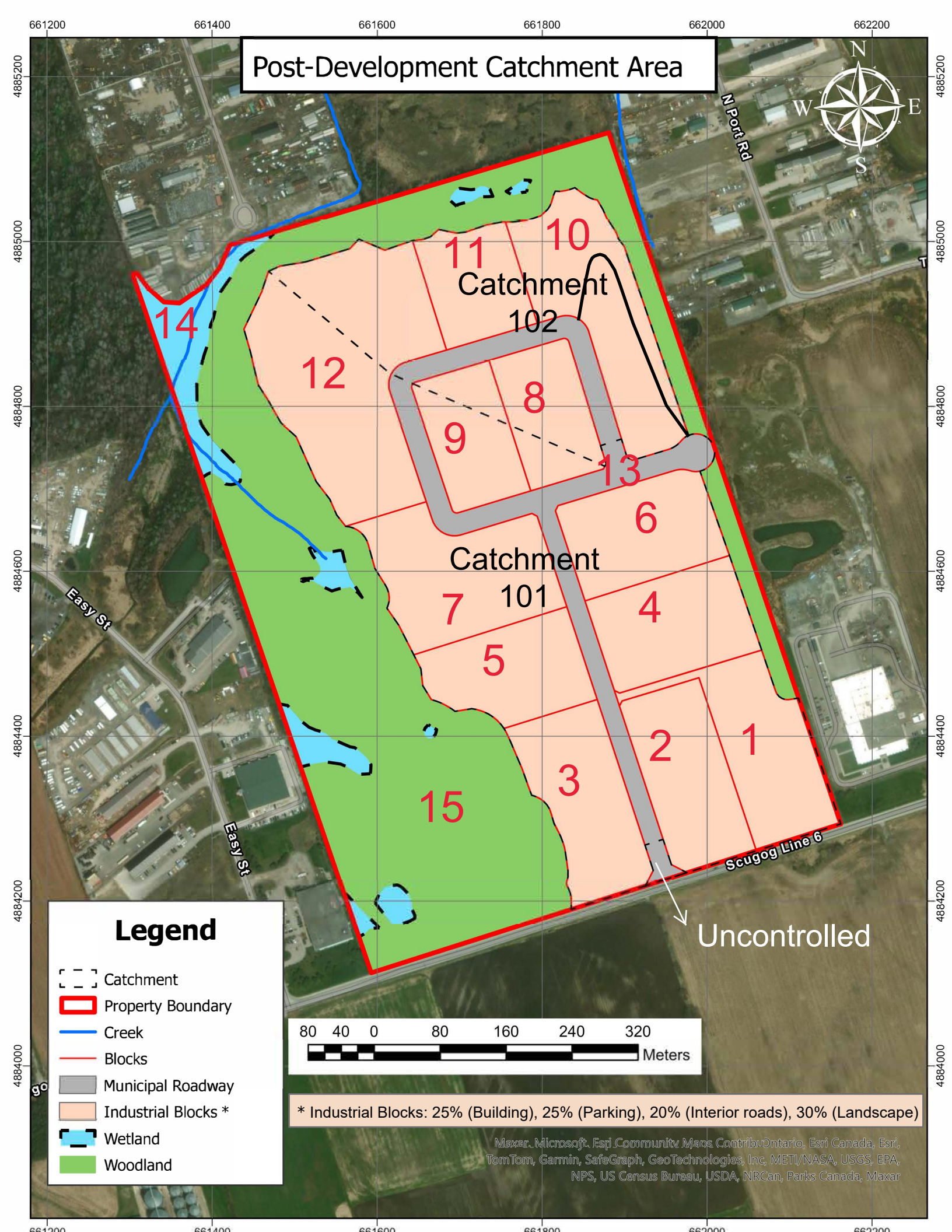


Catchment	Area (m2)	Impervious (m2)
Cultivated	328307	0
Woodland	171319	0
Wetland	20488	0
Total	520114	0


Pre-Development Catchment Area
N
S
E
W
N Port Rd
Easy St
Easy St
Scugog Line 6
661200
661400
661600
661800
662000
662200
4885200
4885000
4884800
4884600
4884400
4884200
4884000
Legend
Property Boundary
Creek
Wetland
Woodland
Cultivated
Contour
80 40 0 80 160 240 320
Meters
Esri Community Maps Contributors, Province of Ontario, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada



Catchment	Area (m2)	Impervious (m2)
Woodland	171319	0
Wetland	20488	0
Building	73825	73825
Interior Road	59060	59060
Parking Lot	73825	73825
Driveway	32799	15420
Landscape	88590	0
Total	519906	222130


Post-Development Catchment Area
661200
661400
661600
661800
662000
662200
4885200
4885000
4884800
4884600
4884400
4884200
4884000
N
S
E
W
N Port Rd
Easy St
Easy St
Scugog Line 6
Catchment 102
Catchment 101
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Uncontrolled
Legend
Catchment
Property Boundary
Creek
Blocks
Municipal Roadway
Industrial Blocks *
Wetland
Woodland
80 40 0 80 160 240 320
Meters
* Industrial Blocks: 25% (Building), 25% (Parking), 20% (Interior roads), 30% (Landscape)
Maxar, Microsoft, Esri Community Maps Contributors, Ontario, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, NRCan, Parks Canada, Maxar

Appendix IX – Groundwater Quality Results

TESTMARK Laboratories
Committed to Quality and Service

V-TM-GEN-2019-6.5

GENERAL CHAIN OF CUSTODY FORM

Page 1 of 1

Please use our Drinking Water Chain of Custody Form for regulated drinking water samples

REPORT TO:
Client: King EPCM
Address: 570 Hood Road, Unit 26
Markham, Ontario, L3R 4G7
Contact: Tony Wang
Email: twang@kingepcm.com;aqureshi@kingepcm.com
Phone: 647-459-5647 Fax:

INVOICE TO: (if different from Report)
Client:
Address:
Contact:
Email:
Phone: Fax:

PROJECT INFORMATION:
TM Quote #:
Client P.O. #:
Client Project #: 1401 SCUGOG Line 6 · Port Perry

REPORTING/INVOICING FORMAT
☐ Fax ☑ Email ☐ Mail

QC DATA REPORTED
☐ Yes ☑ No

SAMPLE DISPOSAL
☐ Hold ☑ Dispose ☐ Return

TURN AROUND TIME (TAT)*
☐ 1 Business Day ☐ 2 Business Days
☐ 3 Business Days ☑ Standard
SPECIFIC DATE: Tues 11
* Prior arrangements must be made for rush/weekend/holiday work

SAMPLING DATE (mm-dd-yy)	TIME	MATRIX**	SAMPLE DESCRIPTION (This Will Appear On The Report)	NUMBER OF CONTAINERS	Nitrate	Nitrile	FIELD pH (if applicable)	FIELD TEMP (if applicable)	METALS FIELD FILTERED? (Y/N?)	CONTAINERS RECEIVED	TEMP	Btl. Type	Lab ID
3-30-2023	15:00	GW	BH 103	~~1~~ 2	x	x				1	16.6	other	1863897
3-30-2023	15:30	GW	BH 101	1	x	x				1	16.6	Other	1863898
3-30-2023	16:00	GW	BH 104	1	x	x				1	16.6	Other	1863899

CONFIRMATION REPORT SENT

LABORATORY USE ONLY
WORK ORDER NUMBER: 494452

**Matrix: B=Biota, GW=Ground Water, O=Oil, P=Paint, S=Soil, SL=Sludge, SW=Surface Water, W=Water, WW=Wastewater, SD=Sediment
☐ High Concentrations Expected

REGULATION
☐ O.Reg. 153: (1☐ 2☐ 3☐ 4☐ 5☐ 6☐ 7☐ 8☐ 9☐)
☐ Industrial / Commercial ☑ Residential / Parkland ☐ Agricultural
☑ Coarse Soil ☐ Fine Soil ☐ Surface ☐ Subsurface
☐ O.Reg. 558 ☐ PWQO ☐ MISA ☐ CofA ☐ MDMER ☑ ODWS ☐ None
Sewer Use: ☐ Sanitary ☐ Storm Municipality: Compared to ODWS as per Client TJ 03/31/23
☐ Other:

COMMENTS/FIELD NOTES: Non-Testmark containers received TJ 03/31/23
~~Field filtering is required before sampling.~~ As per CSR TJ 03/31/23

Sampled By: Leng	Date: Mar-30-2023	Time: 16:00	Relinquished to Testmark By (Signature)	Date	Time
Received By	Date	Time	Shipped By: Hand	Shipping Reference: N/A	
			Received at Testmark By	Date: 03/31/23	Time: 15:35

494452 D

7 Margaret Street, Garson, ON, P3L 1E1 • 705-693-1121 (P) • 705-693-1124 (F) • customer.service@testmark.ca
1335 Riverside Drive, Timmins, ON, P4R 1A6 • 705-531-1121 (P) • 705-531-1125 (F) • timmins@testmark.ca
6820 Kitimat Road Unit #1, Mississauga, ON, L5N 5M3 • 905-821-1112 (P) • 905-821-2095 (F) • mississauga@testmark.ca
1470 Government Road, Kirkland Lake, ON P2N 3J1 • 705-642-3361 (P) • 705-642-3222 (F) • kirkland.lake@testmark.ca
1131 Central Ave., Unit 2 Thunder Bay, ON P7B 7C9 • 807-333-0921 (P) • 807-333-0924 (F) • thunder.bay@testmark.ca

TESTMARK Laboratories Ltd.
Committed to Quality and Service

CERTIFICATE OF ANALYSIS

Client:	Tony Wang	Work Order Number:	494452
Company:	KING EPCM	PO #:	
Address:	570 Hood Rd, Unit 26 Markham, ON, L3R 4G7	Regulation:	None
		Project #:	1401 Scugog Line 6. Port Perry
Phone:	(647) 459-5647	DWS #:	
Email:	twang@kingepcm.com	Sampled By:	Leng
Date Order Received:	3/31/2023	Analysis Started:	4/4/2023
Arrival Temperature:	16.6 °C	Analysis Completed:	4/5/2023

WORK ORDER SUMMARY

ANALYSES WERE PERFORMED ON THE FOLLOWING SAMPLES. THE RESULTS RELATE ONLY TO THE ITEMS TESTED.

Sample Description	Lab ID	Matrix	Type	Comments	Date Collected	Time Collected
BH 103	1863897	Ground Water	None		3/30/2023	3:00 PM
BH 101	1863898	Ground Water	None		3/30/2023	3:30 PM
BH 104	1863899	Ground Water	None		3/30/2023	4:00 PM

METHODS AND INSTRUMENTATION

THE FOLLOWING METHODS WERE USED FOR YOUR SAMPLE(S):

Method	Lab	Description	Reference
Anions Water (mg/L by IC) (A5)	Mississauga	Determination of Anions in Water by Ion Chromatography	Modified from SW846-9056A

REPORT COMMENTS

Non-Testmark containers received TJ 03/31/23

6820 Kitimat Road Unit 4, Mississauga, ON, L5N 5M3
Phone: (905) 821-1112 Fax: (905) 821-2095 Web: www.testmark.ca

CERTIFICATE OF ANALYSIS

KING EPCM

Work Order Number: 494452

This report has been approved by:



Marc Creighton
Laboratory Director

6820 Kitimat Road Unit 4, Mississauga, ON, L5N 5M3
Phone: (905) 821-1112 Fax: (905) 821-2095 Web: www.testmark.ca

CERTIFICATE OF ANALYSIS

KING EPCM

Work Order Number: 494452

WORK ORDER RESULTS

Sample Description	BH 103		BH 101		BH 104			
Sample Date	3/30/2023 3:00 PM		3/30/2023 3:30 PM		3/30/2023 4:00 PM			
Lab ID	1863897		1863898		1863899			
Anions	Result	MDL	Result	MDL	Result	MDL	Units	Criteria: ODWS
Nitrate (as N)	<0.05	0.05	0.33	0.05	0.17	0.05	mg/L	10
Nitrite (as N)	<0.05	0.05	<0.05	0.05	<0.05	0.05	mg/L	1

LEGEND

Dates: Dates are formatted as mm/dd/year throughout this report.

MDL: Method detection limit or minimum reporting limit.

Quality Control: All associated Quality Control data is available on request.

Field Data: Reports containing Field Parameters represent data that has been collected and provided by the client. Testmark is not responsible for the validity of this data which may be used in subsequent calculations.

Sample Condition Deviations: A noted sample condition deviation may affect the validity of the result. Results apply to the sample(s) as received.

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ICPMS Dustfall Insoluble: The ICPMS Dustfall Insoluble Portion method analyzes only the particulate matter from the Dustfall Sampler which is retained on the analysis filter during the Dustfall method.

Regulation Comparisons: Disclaimer: Please note that regulation criteria are provided for comparative purposes, however the onus on ensuring the validity of this comparison rests with the client.

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Appendix X – Water Balance Calculations

WATER BUDGET- PRE-DEVELOPMENT

WATER BALANCE/WATER BUDGET ASSESSMENT

Catchment Designation	Site			
	Cultivated	Woodland	Wetland	Total
Area (m^2)	328,307	171,319	20,488	520,114
Pervious Area (m^2)	328,307	171,319	20,488	520,114
Impervious Area (m^2)	0	0	0	0
Infiltration Factors				
Topography Infiltration Factor	0.2	0.2	0.2	
Soil Infiltratin Factor	0.2	0.2	0.2	
Land Cover Infiltration Factor	0.1	0.2	0.2	
MOE Infiltration Factor	0.5	0.6	0.6	
Actual Infiltratin Factor	0.5	0.6	0.6	
Run-Off Coefficient	0.5	0.4	0.4	
Runoff From Impervious Surfaces *	0	0	1	
Inputs (per unit area)				
Precipitation (mm/yr)	898	898	898	898
Run-On (mm/yr)	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0
Total Inputs (mm/yr)	**898**	**898**	**898**	**898**
Outputs (per unit area)				
Precipitation Surplus (mm/yr)	331	331	331	331
Net Surplus (mm/yr)	331	331	331	331
Evapotranspiratin (mm/yr)	567	567	567	567
Infiltration (mm/yr)	165.5	198.6	198.6	178
Rooftop Infiltration (mm/yr)	0	0	0	0
Total Infiltration (mm/yr)	165.5	198.6	198.6	178
Runoff Pervious Area	165.5	132.4	132.4	153
Runoff Impervious Area	0	0	0	0
Total Runoff (mm/yr)	165.5	132.4	132.4	153
Total Outputs (mm/yr)	898	898	898	898
Difference (Inputs-Outputs)	0	0	0	0
Inputs (Volumes)				
Precipitaiton (m^3/yr)	294,820	153,845	18,398	467,063
Run-On (m^3/yr)	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0
Total Inputs (m^3/yr)	294,820	153,845	18,398	467,063
Outputs (Volumes)				
Precipitation Surplus (m^3/yr)	108,670	56,707	6,782	172,158
Net Surplus (m^3/yr)	108,670	56,707	6,782	172,158
Evapotranspiratin (m^3/yr)	186,150	97,138	11,617	294,905
Infiltration (m^3/yr)	54,335	34,024	4,069	92,428
Rooftop Infiltration (m^3/yr)	0	0	0	0
Total Infiltration (m^3/yr)	54,335	34,024	4,069	92,428
Runoff Pervious Area (m^3/yr)	54,335	22,683	2,713	79,730
Runoff Impervious Area (m^3/yr)	0	0	0	0
Total Runoff (m^3/yr)	54,335	22,683	2,713	79,730
Total Outputs (m^3/yr)	294,820	153,845	18,398	467,063
Difference (Inputs-Outputs)	0	0	0	0

WATER BUDGET- POST-DEVELOPMENT

WATER BALANCE/WATER BUDGET ASSESSMENT

Catchment Designation	Site							
	Building	Roadway	Interior Road	Parking	Landscape	Woodland	Wetland	Total
Area (m^2)	73,168	35,636	58,534	73,168	87,801	171,319	20,488	520,114
Pervious Area (m^2)	0	20,373	0	0	87,801	171,319	20,488	299,981
Impervious Area (m^2)	73,168	15,420	58,534	73,168	0	0	0	220,290
Infiltration Factors								
Topography Infiltration Factor	0	0.2	0	0	0.3	0.2	0.2	
Soil Infiltratin Factor	0	0.2	0	0	0.2	0.2	0.2	
Land Cover Infiltration Factor	0	0.1	0	0	0.15	0.2	0.2	
MOE Infiltration Factor	0	0.5	0	0	0.65	0.6	0.6	
Actual Infiltratin Factor	0	0.5	0	0	0.65	0.6	0.6	
Run-Off Coefficient	1	0.5	1	1	0.35	0.4	0.4	
Runoff From Impervious Surfaces *	0.95	0.95	0.95	0.95	0	0	0	
Inputs (per unit area)								
Precipitation (mm/yr)	898	898	898	898	898	898	898	898
Run-On (mm/yr)	0	0	0	0	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0	0	0	0	0
Total Inputs (mm/yr)	**898**	**898**	**898**	**898**	**898**	**898**	**898**	**898**
Outputs (per unit area)								
Precipitation Surplus (mm/yr)	853.1	558.38	853.1	853.1	331	331	331	552
Net Surplus (mm/yr)	853.1	558.38	853.1	853.1	331	331	331	552
Evapotranspiratin (mm/yr)	44.9	339.62	44.9	44.9	567	567	567	346
Infiltration (mm/yr)	0	94.62	0	0	215.15	198.6	198.6	116
Rooftop Infiltration (mm/yr)	0	0	0	0	0	0	0	0
Total Infiltration (mm/yr)	0	94.62	0	0	215.15	198.6	198.6	116
Runoff Pervious Area	0	94.62	0	0	115.85	132.4	132.4	125
Runoff Impervious Area	853.1	369.14	853.1	853.1	0	0	0	819
Total Runoff (mm/yr)	853.1	463.76	853.1	853.1	115.85	132.4	132.4	436
Total Outputs (mm/yr)	898	898.00	898	898	898	898	898	898
Difference (Inputs-Outputs)	0	0	0	0	0	0	0	0
Inputs (Volumes)								
Precipitaiton (m^3/yr)	65,705	32,001	52,564	65,705	78,845	153,845	18,398	467,062
Run-On (m^3/yr)	0	0	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0	0	0
Total Inputs (m^3/yr)	65,705	32,001	52,564	65,705	78,845	153,845	18,398	467,062
Outputs (Volumes)								
Precipitation Surplus (m^3/yr)	62,420	19,898	49,935	62,420	29,062	56,707	6,782	287,223
Net Surplus (m^3/yr)	62,420	19,898	49,935	62,420	29,062	56,707	6,782	287,223
Evapotranspiratin (m^3/yr)	3,285	12,103	2,628	3,285	49,783	97,138	11,617	179,839
Infiltration (m^3/yr)	0	3,372	0	0	18,890	34,024	4,069	60,355
Rooftop Infiltration (m^3/yr)	0	0	0	0	0	0	0	0
Total Infiltration (m^3/yr)	0	3,372	0	0	18,890	34,024	4,069	60,355
Runoff Pervious Area (m^3/yr)	0	1,928	0	0	10,172	22,683	2,713	37,495
Runoff Impervious Area (m^3/yr)	62,420	5,692	49,935	62,420	0	0	0	180,467
Total Runoff (m^3/yr)	62,420	7,620	49,935	62,420	10,172	22,683	2,713	217,961
Total Outputs (m^3/yr)	65,705	32,001	52,564	65,705	78,845	153,845	18,398	467,062
Difference (Inputs-Outputs)	0	0	0	0	0	0	0	0

* Based on the Design Chart 1.07 (MTO, 1997), the runoff coefficients for rooftop and pavement are 0.7 - 0.95 and 0.8 - 0.95, respectively. We used the highest ratio (95%), as the grades of the pavement is generally 1-2% and would run into the side swales, and we have steep rooftops.

WATER BUDGET- POST-DEVELOPMENT WITH MITIGATION

WATER BALANCE/WATER BUDGET ASSESSMENT

Catchment Designation	Site							
	Building	Roadway	Interior Road	Parking	Landscape	Woodland	Wetland	Total
Area (m^2)	73,168	35,636	58,534	73,168	87,801	171,319	20,488	520,114
Pervious Area (m^2)	0	20,373	0	0	87,801	171,319	20,488	299,981
Impervious Area (m^2)	73,168	15,420	58,534	73,168	0	0	0	220,290
Infiltration Factors								
Topography Infiltration Factor	0	0.2	0	0	0.3	0.2	0.2	
Soil Infiltratin Factor	0	0.2	0	0	0.2	0.2	0.2	
Land Cover Infiltration Factor	0	0.1	0	0	0.15	0.2	0.2	
MOE Infiltration Factor	0	0.5	0	0	0.65	0.6	0.6	
Actual Infiltratin Factor	0	0.5	0	0	0.65	0.6	0.6	
Run-Off Coefficient	1	0.5	1	1	0.35	0.4	0.4	
Runoff From Impervious Surfaces *	0.95	0.95	0.95	0.95	0	0	0	
Inputs (per unit area)								
Precipitation (mm/yr)	898	898	898	898	898	898	898	898
Run-On (mm/yr)	0	0	0	0	0	0	0	0
Other Inputs (mm/yr)	0	0	0	0	0	0	0	0
Total Inputs (mm/yr)	**898**	**898**	**898**	**898**	**898**	**898**	**898**	**898**
Outputs (per unit area)								
Precipitation Surplus (mm/yr)	853.1	558.38	853.1	853.1	331	331	331	552
Net Surplus (mm/yr)	853.1	558.38	853.1	853.1	331	331	331	552
Evapotranspiratin (mm/yr)	44.9	339.62	44.9	44.9	567	567	567	346
Infiltration (mm/yr)	0	94.62	725.135	725.135	215.15	198.6	198.6	300
Rooftop Infiltration (mm/yr)	682.48	0	0	0	0	0	0	96
Total Infiltration (mm/yr)	682.48	94.62	725.135	725.135	215.15	198.6	198.6	396
Runoff Pervious Area	0	94.62	0	0	115.85	132.4	132.4	125
Runoff Impervious Area	170.62	369.14	127.965	127.965	0	0	0	159
Total Runoff (mm/yr)	170.62	463.76	127.965	127.965	115.85	132.4	132.4	157
Total Outputs (mm/yr)	898	898	898	898	898	898	898	898
Difference (Inputs-Outputs)	0	0	0	0	0	0	0	0
Inputs (Volumes)								
Precipitaiton (m^3/yr)	65,705	32,001	52,564	65,705	78,845	153,845	18,398	467,062
Run-On (m^3/yr)	0	0	0	0	0	0	0	0
Other Inputs (m^3/yr)	0	0	0	0	0	0	0	0
Total Inputs (m^3/yr)	65,705	32,001	52,564	65,705	78,845	153,845	18,398	467,062
Outputs (Volumes)								
Precipitation Surplus (m^3/yr)	62,420	19,898	49,935	62,420	29,062	56,707	6,782	287,223
Net Surplus (m^3/yr)	62,420	19,898	49,935	62,420	29,062	56,707	6,782	287,223
Evapotranspiratin (m^3/yr)	3,285	12,103	2,628	3,285	49,783	97,138	11,617	179,839
Infiltration (m^3/yr)	0	3,372	42,445	53,057	18,890	34,024	4,069	155,857
Rooftop Infiltration (m^3/yr)	49,936	0	0	0	0	0	0	49,936
Total Infiltration (m^3/yr)	49,936	3,372	42,445	53,057	18,890	34,024	4,069	205,792
Runoff Pervious Area (m^3/yr)	0	1,928	0	0	10,172	22,683	2,713	37,495
Runoff Impervious Area (m^3/yr)	12,484	5,692	7,490	9,363	0	0	0	35,029
Total Runoff (m^3/yr)	12,484	7,620	7,490	9,363	10,172	22,683	2,713	72,524
Total Outputs (m^3/yr)	65,705	32,001	52,564	65,705	78,845	153,845	18,398	467,062
Difference (Inputs-Outputs)	0	0	0	0	0	0	0	0

* Based on the Design Chart 1.07 (MTO, 1997), the runoff coefficients for rooftop and pavement are 0.7 - 0.95 and 0.8 - 0.95, respectively. We used the highest ratio (95%), as the grades of the pavement is generally 1-2% and would run into the side swales, and we have steep rooftops.

** Considering that 75% of the captured runoff by the Bioretension LIDs in the western and northern blocks enters the wetland as a sheet flow, it was assumed that only 80% of the net surplus from parking lots and interior roads infiltrates into the ground by Bioretention LID. Similarly, it can be assumed that only 80% of the runoff from the rooftop gets a chance to infiltrate into the ground due to a low infiltration potential in the lower layers and the rest is discharged to the outlet due to the overflow to the roadside Bioswales.

WATER BUDGET SUMMARY

WATER BALANCE/WATER BUDGET ASSESSMENT

Characterstic	Site				
	Pre-Development	Post-Development	Change (Pre- to Post-)	Post-Development with Mitigation	Change (Pre- to Post- with Mitigation)
Inputs (Volumes)					
Precipitaiton (m^3/yr)	467,063	467,062	0.0%	467,062	0.0%
Run-On (m^3/yr)	0	0	0.0%	0	0.0%
Other Inputs (m^3/yr)	0	0	0.0%	0	0.0%
Total Inputs (m^3/yr)	**467,063**	467,062	0.0%	467,062	0.0%
Outputs (Volumes)					
Precipitation Surplus (m^3/yr)	172,158	287,223	66.8%	287,223	66.8%
Net Surplus (m^3/yr)	172,158	287,223	66.8%	287,223	66.8%
Evapotranspiratin (m^3/yr)	294,905	179,839	-39.0%	179,839	-39.0%
Infiltration (m^3/yr)	92,428	60,355	-34.7%	155,857	68.6%
Rooftop Infiltration (m^3/yr)	0	0	0.0%	49,936	0.0%
Total Infiltration (m^3/yr)	92,428	60,355	-34.7%	205,792	122.7%
Runoff Pervious Area (m^3/yr)	79,730	37,495	-53.0%	37,495	-53.0%
Runoff Impervious Area (m^3/yr)	0	180,467	0.0%	35,029	0.0%
Total Runoff (m^3/yr)	79,730	217,961	173.4%	72,524	-9.0%
Total Outputs (m^3/yr)	467,063	467,062	0.0%	467,062	0.0%

Appendix XI – Stormwater Management Flowchart

Stormwater Management Flowchart/Diagram

