TDC Terra-Dynamics Consulting Inc.
432 Niagara Street, Unit 2 St. Catharines, ON L2M 4W3

June 3, 2022

2600261 Ontario Inc.
c/o Alex Troop
Alliance Homes Ltd.
6048 Highway #9
Schomberg, ON L0G 1T0

Re: Water Balance Study, Northland Estates, Westside Road Con. 2 PT Lot 31, Port Colborne, ON

Dear Mr. Troop,

1.0 Introduction and Background Information

Terra-Dynamics Consulting Inc. (Terra-Dynamics) respectfully submits this water balance study of 2600261 Ontario Inc.'s Northland Estates development, located in Port Colborne, Ontario (Site) (Figure 1). Proposed development of the 15.9 hectares includes townhouses, single residential and apartments as well as stormwater management and park/open space (Upper Canada Consultants, 2022, Appendix B). The Site is located south of Barrick Road and west of Highway 58/West Side Road, and is legally described as Lot 31, Concession 2, Humberstone Township.

The Niagara Peninsula Conservation Authority (NPCA) requires a water balance as part of an updated Environmental Impact Study for the Site (City of Port Colborne, 2021). The purpose of the water balance assessment is to inform site design whereby there is "*no negative impact to the hydrologic function of the wetland*" (NPCA, 2021). The wetland being referred to in this case is the Locally Significant Onondaga Escarpment Wetland Complex (MNRF, 2009).

This water balance assessment includes:

1. An assessment of the water balance of the adjacent wetland, specifically analyzing the role of the Site in supplying the wetland with water; and

2. An overview of potential impacts, discussion of potential alternatives and proposed mitigation measures.

This water balance exceeds the requirements for "low risk" evaluation as specified by the TRCA (2017) and was also completed to generally conform to the Conservation Authority Guidelines for Development Applications (Conservation Ontario, 2013).

2.0 Methodology

Primary tasks completed as part of the water balance study included:

A. Characterization of the physical setting using published information from the following government agencies: (i) the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), (ii) the Ministry of the

Environment, Conservation and Parks (MECP), (iii) the Niagara Peninsula Conservation Authority (NPCA), and (iv) the Ontario Geological Survey (OGS). Existing on-site investigation reports (e.g. Shaheen & Peaker Limited, 2002, GEMS Inc., 2020 and Beacon Environmental, 2022) were also reviewed.

B. A site visit was completed in the spring of 2022, which included hand-auger soil sampling and subsequent laboratory grain-size analyses, and observations of on-site surface water conditions;

C. Modelling of pre-development and post-development monthly water balance conditions through consideration of: surface water catchments, land cover, soils, climate normals and wetland hydroperiods in order to determine if the site design is sufficient; and

D. A Wetland Risk Evaluation (TRCA, 2017).

3.0 Physical Setting

The Site is primarily located on the Onondaga Escarpment with the Haldimand Clay Plain to the south/south-west (Chapman and Putnam, 1984). The Onondaga Escarpment is defined as:

> "*a north-facing, east-west trending bedrock cuesta with approximately 10 metres of relief. A cuesta is a hill or ridge with a gentle slope on one side and a steep slope on the other. The Onondaga Escarpment (limestone plain) forms the northern drainage boundary for a number of catchments… Eagle Marsh drain*…." (AquaResource Inc. and NPCA, 2009).

The Site is located on the gentle southern slope of the Onondaga Escarpment, as shown on Figure 3 underlain by loam and clay loam Farmington and Franktown soils (Kingston and Presant, 1989).

The Site is undeveloped but was historically farmed and "*successional thicket-type vegetation comprises a large area of the site to the east while the west side of the Site transitions into wetland and a large woodland area*" (GEMS, 2020).

3.1 Topography

The ground surface elevation varies from 181 to 185 metres above sea level (m ASL) with the ground surface sloping to the south-southwest (Figure 2). The Site is fairly flat with 2% slope in the upper northeast corner but less than 1% slope in the southwest portion of the Site with the wetlands.

The Onondaga Escarpment Locally Significant Wetland (LSW) (Section 3.7, MNRF, 2009) is located within approximately the 181.1 m ASL contour based upon ground surface contours generated from NPCA's 2018 digital terrain model (Figure 2).

3.2 Surface Water

The Site is located within the upper reaches of the Eagle Marsh Drain Catchment EMD_W200 of the Lake Erie North Shore Watershed Planning Area (Figure 1) (AquaResource Inc. and NPCA, 2009). The actual Eagle Marsh Drain begins approximately 500 m to the south of the southwest corner of the Site (Figure 1), and is classified as Type F, intermittent flow (OMAFRA, 2022). NPCA (2017) has mapped a single waterbody at the Site (Figure 2) and identified it as an intermittent/ephemeral swamp slough. NPCA has defined slough forests as "*forested areas with undulating land that contain seasonally ponded areas… and ridges of higher land*" (NPCA, 2010). During our site visit on March 16, 2022, we observed a series of small slough ponds within this area on-site.

A former east-west watercourse is noted within the Site along the southern boundary, but was observed as heavily overgrown and not maintained for flow.

3.2.1 Surface Water Catchments

A digital terrain model from NPCA (2018) was processed in a Geographic Information System (GIS) to determine the surface water catchments for the area mapped within the 2019 wetland boundary (Section 3.7, Figure 5), these are a combination of two Ecological Land Classification (ELC) communities (Beacon, 2022). These two ELC communities are summarized as follows:

1. Oak Mineral Deciduous Swamp (SWD-1), is 2.81 hectares with three modelled drainage areas:

    (i) Drainage Area A – 0.37 hectares or 13%, modelled as having an upgradient drainage area of 1.74 hectares;
    (ii) Drainage Area B – most of the swamp (2.40 hectares, or 85%) is modelled as having a very limited upgradient drainage area of 0.30 hectares, mostly within the 30 m buffer; and
    (iii) Drainage Area C – a very small portion (0.04 hectares, or less than 2%), modelled not to receive external runoff.

2. Mineral Thicket Swamp (SWT-2) is 2.45 hectares with three modelled drainage areas:
    (i) Drainage Area A' – 1.13 hectares or 46%, modelled as having an upgradient drainage area that is within the SWD-1;
    (ii) Drainage Area B' – 1.13 hectares or 46%, modelled as limited to within the feature; and
    (iii) Drainage Area C' – 0.18 hectares or 7%, modelled to runoff to the east.

3.3 Soils

Most of the Site's soils (>80%) have been regionally mapped as less than 100 cm thick ('*shallow phase*') imperfectly drained loam/clay loam Franktown soils, with the northeast corner of the Site mapped as less than 50 cm thick ('*very shallow phase*') well drained loam Farmington soils (Kingston and Presant, 1989, Appendix A – Figure A-1). These reported shallow soil conditions (Figure 3) were confirmed by a previous geotechnical study (Figure 2 - Shaheen & Peaker Limited, 2002) and hand-auger holes completed during our site visit (Figure 2).

The majority of the Site (>80%) is reported as hydrological soil groups (HSGs) 50% B / 50% C (Appendix A – Figure A-1, Table 1). However, based upon wetland soil sampling at the Site and laboratory grain-size analyses, HSGs 50% C/50% D are proposed as representative of the silty clay soils in the wetland area (Section 3.7). This is explained herein:

1. Two soil samples collected by hand-auger were selected for submission for grain-size analyses (Figure 2, SS2 and SS3, Appendix A) and both are classified as *poorly sorted clay with fines* (Appendix A). Soil samples SS1 and SS4 were of similar grain-size consistency.

2. The hydraulic conductivity (i.e. permeability) was calculated as $<10^{-8}$ m/s for both samples using the Excel-tool HydrogeoSieveXL (Devlin, 2015). The hydraulic conductivities are reasonable for silty clay to clay till compared to published values for the province of Ontario (MECP, 2006).

3. The low hydraulic conductivity/ permeability (MECP, 2008) results in low infiltration and ponding of surface water on the ground surface.

Farmington soils in the northeast corner are regionally mapped as HSG B.

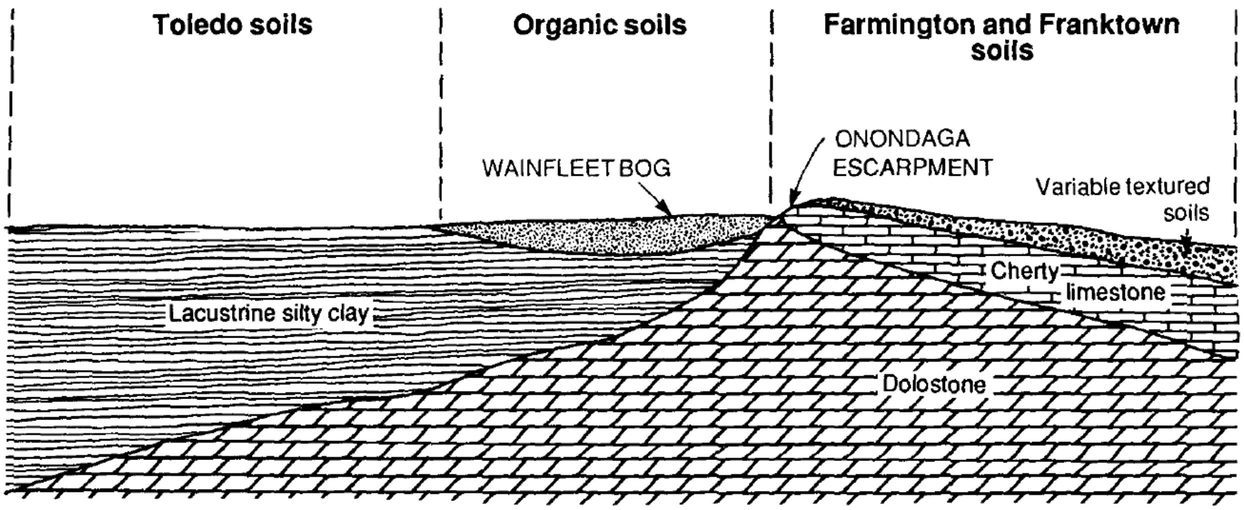

Figure 3 - Schematic landscape cross-section showing the relationship of soils to bedrock in the vicinity of the Wainfleet Bog (Kingston and Presant, 1989)

Table 1 - Hydrologic Soil Groups (USDA, 1986)

HSG Group	Soil description	Infiltration Rates (mm/hour)
A	sand, loamy sand or sandy loam	>7.6
B	silt loam or loam	7.6-3.8
C	sandy clay loam	3.8-1.3
D	clay loam, silty clay loam, sandy clay, silty clay or clay	<1.3

3.4 Surficial Geology

A third of the Site is mapped as low permeability clay and silt in the southwest corner by the Ontario Geological Survey (OGS) (Feenstra, 1984). This area generally corresponds with the wetlands mapped at the Site (Figure 2, Beacon Environmental, 2022 and Section 3.7). Consequently, the low permeability clay and silt are interpreted to perch the water necessary for the wetlands. Hand-auger soil sampling completed in this area (SS1, SS2, SS3 and SS4, Figure 2) confirmed silty clay overlying silty clay diamicton. Diamicton is "*a non-sorted or poorly sorted …sediment containing a wide range of particle sizes derived from a broad provenance… and may have a fine-grained matrix*" (Menzies, 2009).

Bedrock was inferred by hand-auger refusal at between 0.8 and 1.0 metres at locations SS1, SS3 and SS4 (Figure 2). Bedrock was inferred by hand-auger refusal at 0.5 m at SS2.

The remaining two thirds of the Site is mapped as bedrock at surface, based on the OGS criterion being less than 1 m of overburden above the bedrock surface (Figure 2). A geotechnical test pit investigation of the Site confirmed topsoil over bedrock as being very thin ranging from 0.2 to 0.6 m at the nine locations completed, which were generally outside the wetland area due to the thick vegetation at the wetland area (Figure 2, Shaheen and Peaker, 2002).

3.5 Bedrock

The Site is primarily underlain by the Bois Blanc Formation bedrock consisting of "*light grey to greenish grey, variably argillaceous, locally sandy, fine-grained, very cherty limestone (or minor dolostone)* (Figures 3 and 4). *Chert commonly occurs as thick white to light bluish white nodules and lenses that locally constitute over 75% of the rock mass…It tends to weather rubbly because of its argillaceous nature and high chert content*." (Armstrong, 2017). The southwest corner is reported as the Edgecliff Member of the Onondaga Formation, which overlies the Bois Blanc and is cherty, fossiliferous, locally argillaceous limestone.

3.6 Hydrogeologic Setting

A hydrogeologic cross-section through the Site was prepared (Figure 4) using Ministry of the Environment, Conservation and Parks (MECP) water well and monitoring well records (MECP, 2022, Appendix A), as well as on-site data. Details of this section include:

1. Local water wells (Figure 2) access the underlying shallow bedrock aquifer. Groundwater table levels were reported as between 3.0 and 4.5 metres below ground surface (m BGS);

2. Wetland water levels are perched above the unsaturated bedrock by low permeability silty clay (Section 3.3); and

3. The vertical gradient from wetland water levels to the bedrock aquifer is downwards.

3.7 Wetlands

Approximately 1 hectare of the Locally Significant Onondaga Escarpment Wetland Complex (MNRF, 2009) extends onto the western portion of the Site (Figure 2). The Ministry of Natural Resources and Forestry (MNRF, 2009) have mapped this as an isolated swamp wetland with deciduous trees as the dominant vegetation (Figure 2). This polygon is within an area classified as Ecological Land Classification SWD-1, Oak Mineral Deciduous Swamp, by Beacon Environmental (2022) (Figure 2).

An area of SWT-2 Mineral Thicket Swamp is mapped to the south (Beacon Environmental, 2022).

A wetland boundary was previously staked and surveyed in 2019 by GEMS, NPCA and Niagara Region staff (Figure 2) along the eastern boundary of these features.

3.7.1 Wetland Characterization

The swamps are classified as a *surface water depression wetlands* (Figure 6). A surface water depression wetland is summarized as:

"*wetland … dominated by surface runoff and precipitation, with little groundwater outflow due to a layer or low-permeability soils*…" (Mitsch and Gosselink, 2007). Low permeability soils were noted on-site (Section 3.3).

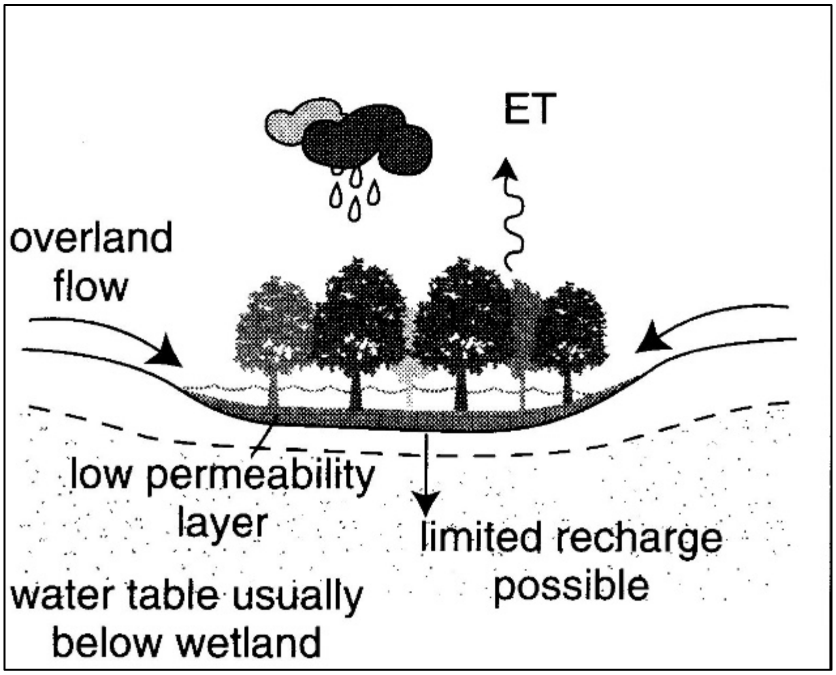

Figure 6 - Surface water depression wetland (Mitsch and Gosselink, 2007)

3.7.2 Wetland Hydroperiod

A hydroperiod is defined as "*the seasonal pattern of the water level of a wetland…It characterizes each type of wetland, and the constancy of its pattern from year to year ensures a reasonable stability for that wetland. It defines the rise and fall of a wetland's surface and subsurface water by integrating all of the inflows and outflows"* (Mitsch and Gosselink, 2007).

The province has identified that the Locally Significant Onondaga Escarpment Wetland Complex is seasonally flooded for a period of '*2 weeks to a month*' (MNRF, 2009). This appears less than a published Canadian swamp hydroperiod (Figure 7); the shaded lower portion of the hydroperiod graph corresponds with below ground surface and the months of the year listed along the x-axis. Mitsch and Gosselink (2007) report that the "*hydroperiods of many bottomland hardwood forests and swamps have distinct periods of surface flooding in the winter and early spring due to snow and ice conditions followed by spring floods but otherwise have a water table that can be a meter or more below the surface*".

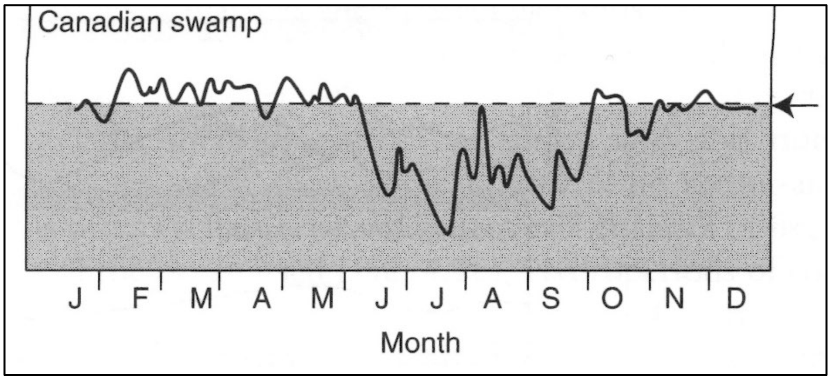

Figure 7 – Canadian Swamp Hydroperiod (Mitsch and Gosselink, 2007)

3.7.3 Soil Water Holding Capacity

The SWD-1 soil water holding capacity (SWHC) was calculated as 375 mm based upon the soils identified on-site (Section 3.3) and previous swamp SWHC designations used by NPCA in their water budgeting study (AquaResource Inc. and NPCA, 2009).

3.8 Pre-development Subwatershed Water Balance Modelling

NPCA previously completed water balance modelling for 1991-2005, as part of provincial water budgeting for the source water protection program (AquaResource Inc. and NPCA, 2009). This modelling was completed at 1-hour time steps with a filled-in meteorological dataset including solar radiation for calculation of evapotranspiration. Modelled annual and monthly water balance results were obtained for the Lake Erie North Shore Eagle Marsh Drain W200 (LENS_EMD_W200) Catchment (Tables 2 and 3, respectively) (AquaResource Inc. and NPCA, 2009).

Table 2 - Water Balance 15-year (1991-2005) Averages

Catchment	Precipitation	Actual Evapotranspiration	Annual Surplus	Infiltration*	Recharge	Runoff
	(mm/year)					
LENS_EMD_W200	968	450	518	170	85	348

Notes: * - Infiltration is interflow plus recharge

Table 3 - Monthly Runoff and Infiltration (Catchment LENS_EMD_W200)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Runoff (mm)	33.7	31.0	50.6	47.6	32.5	16.0	6.8	5.8	16.8	24.4	51.6	31.6
Infiltration (mm)	13.3	12.4	17.6	10.5	4.0	1.3	0.2	0.1	0.4	2.4	9.7	13.3

4.0 Water Balance Assessment

A monthly water balance assessment has been completed for the Oak Mineral Deciduous Swamp (SWD-1) (Figure 2), as informed by the Conservation Authority Guidelines for Development Applications (Conservation Ontario, 2013) and TRCA's guidance for water balances (2012). As the Mineral Thicket Swamp (SWT-2) is (i) downgradient of the SWD-1, and (ii) self-contained with respect to drainage

(Section 3.2.1) preservation of the SWD-1 ensures any surface water supply under pre-development conditions should continue.

It is noted that the Ministry of the Environment, Conservation and Parks (2003) water balance approach is typically concerned with the evaluation of post-development to prevent (i) increased runoff, and/or (ii) reduction in groundwater recharge. However, given the wetland characterization (Section 3.7.1) any contribution to hydrologic function with respect to the wetlands is via additional surface water flow, not groundwater discharge. Consequently, maintenance of pre-development monthly saturated conditions via runoff to maintain the wetland hydroperiod is the criteria for the water balance assessment.

4.1 Monthly Water Balance Example

An example of water balance modelling from the University of Waterloo is shown below (Figure 8). Annual groundwater recharge begins in the fall following '*soil water utilization*' and '*deficit*' in the summer. Soil water utilization corresponds with evapotranspiration exceeding the precipitation supply. Annual groundwater recharge occurs during the same time period that groundwater levels rise. However, in this example it is noted that the soil water holding capacity (SWHC) modelled was only 100 mm compared to the higher SWHC of the downgradient SWD-1 of 375 mm.

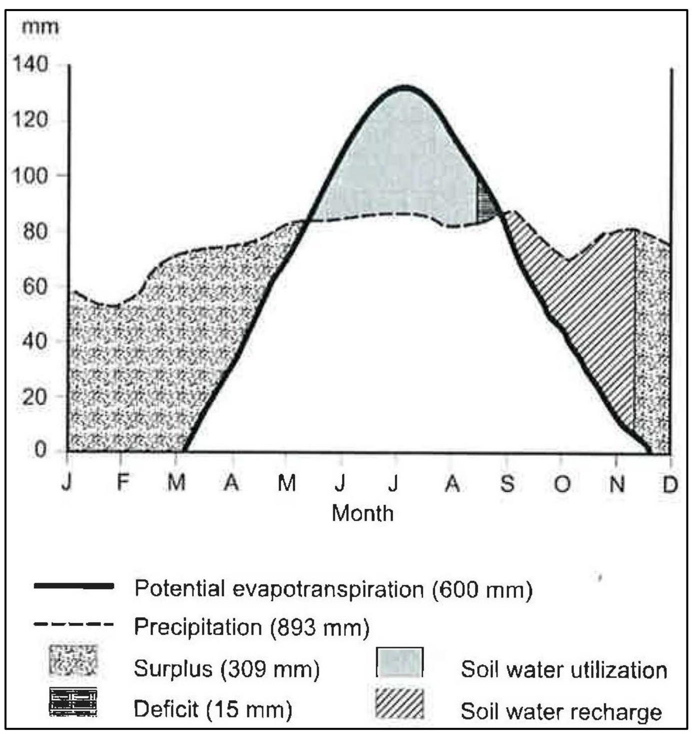

Figure 8 – Brantford Average Water Balance (Sanderson, 2004)

4.2 Wetland Water Balance

A monthly water balance for the SWD-1 swamp was completed using the U.S. Geological Survey (USGS) Monthly Water Balance Model (McCabe and Markstrom, 2007), which considers direct precipitation while runoff to the wetland is added using the NPCA monthly modelled results for the catchment. For temperature and precipitation, climate normal inputs (1981-2010) from Port Colborne Station ID 6136606 were used (Environment Canada, 2022). The monthly water balance modelling results of the SWD-1 swamp are summarized below and in Table 4:

1. Potential evapotranspiration exceeded precipitation for June, July and August, i.e. soil water utilization occurred;
2. SWD-1 swamp soil water holding capacities were less than saturated, i.e. less than 375 mm, for the summer months (June through September), as well as October; and
3. Soil water recharge occurred in September and October.

Table 4 – Monthly Wetland Water Balance (mm)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation (mm)	73	57	67	76	90	79	82	83	98	90	101	89
Potential (mm) Evapotranspiration	10	12	21	40	71	105	127	105	63	34	18	11
Soil Moisture (mm)	375	375	375	375	375	**345**	**300**	**279**	**308**	**360**	375	375
Soil Water [1] Depletion (mm)						30	75	96	67	15		

Notes: [1] Difference between the SWHC (375 mm) and the modelled soil moisture

4.3 Wetland Water Balance Assessment

As introduced in Section 4.0, "*maintenance of pre-development monthly saturated conditions via runoff to maintain the wetland hydroperiod is the criteria for the water balance assessmen*t". Under pre-development conditions, two drainage areas are modelled to provide upgradient runoff to SWD-1 (Section 3.2.1): (i) Upgradient area A, 1.74 ha and (ii) Upgradient area B 0.30 ha (Figure 5). These upgradient areas are described as follows:

A. Upgradient area A is modelled to maintain pre-development saturated soil conditions in Drainage Area A of SWD-1 in the summer months of June, September and October (Table 5 – Bolded) but not July and August (i.e. the upgradient area required to maintain pre-development saturated soil conditions during July and August is greater than the 1.74 ha). The proposed 30 m buffer (0.3 ha), and the additional upgradient Environmental Protection Area (EPA) of 0.5 ha is sufficient to maintain saturated conditions for June and October being 0.8 ha (Table 5, Figure 5). The incorporation of rear lot drainage (0.2 ha), and regrading of drainage of the northeast corner of the EPA towards the wetland (0.26 ha) as well as continued off-site runoff (0.04 ha), will provide over 85% of pre-development conditions in September. This is a reasonable effort to maintain pre-development runoff given the variability in September precipitation, e.g. 1981-2010 average 98 mm, 2021 September 153 mm, 2020 61 mm, and 2019 110 mm.

B. Upgradient area B is modelled to be insufficient under pre-development conditions to maintain saturation downgradient in Drainage Area B of SWD-1 in the summer months (i.e. the upgradient area required to maintain pre-development saturated soil conditions is greater than the 0.30 ha) (Table 5). Therefore, maintenance of the hydroperiod in this downgradient area is primarily dependent upon direct precipitation not upgradient surface water supply via runoff. This would be similar to the expected below ground surface water level for a SWD-1 swamp summer hydroperiod (Figure 7, Section 3.7.2). Consequently, the proposed 30 m buffer is hydrologically sufficient for this portion of the SWD-1 swamp.

Table 5 – Modelled Summer Runoff to SWD-1 Swamp

Month	Jun	Jul	Aug	Sep	Oct
Soil Water [1] Depletion (mm)	30	75	96	67	15
SWD-1 Drainage area A Soil Water Depletion[2] (m^3)	111	278	355	248	56
SWD-1 Drainage area B Soil Water Depletion[2] (m^3)	720	1,800	2,304	1,608	360
Modelled Runoff (Section 3.8) (mm)	16	7	6	17	24
Upgradient area [3] required to produce saturated wetland – Drainage Area A (ha)	**0.7**	4.0	5.9	**1.5**	**0.2**
Upgradient area [3] required to produce saturated wetland – Drainage Area B (ha)	4.5	25.7	38.4	9.5	1.5

Notes: [1] Difference between the SWHC (375 mm) and the modelled soil moisture
[2] Depletion depth multiplied by the downgradient area of SWD-1 swamp (Section 3.7, Figure 5).
[3] Volume of soil water depletion (m^3) divided by monthly modelled runoff (mm) (from Table 3) converted to hectares

As the Mineral Thicket Swamp (SWT-2) is (i) downgradient of the SWD-1, and (ii) self-contained with respect to drainage (Section 3.2.1) preservation of the SWD-1 ensures any surface water supply under pre-development conditions should continue.

4.4 Wetland Risk Evaluation

4.4.1 Magnitude of Hydrological Change

TRCA's wetland risk evaluation (2017) decision tree (Figure 9) includes four key hydrological change criteria:

1) Impervious cover in catchment;
2) Change in catchment size;
3) Dewatering; and
4) Impact to recharge areas.

(1) The amount of impervious cover in the SWD-1 upgradient catchments are inconsequential as the on-site wetland catchment drainage areas are planned to be changed (Upper Canada Consultants Engineers/Planners, 2022, Appendix B).

(2) The surface water catchments upgradient of the SWD-1 swamp will be reduced upon development of the Site, as Drainage Area A and Drainage Area B are calculated to be reduced by (a) 25%, and (b) less than 10%, respectively.

(3) Construction dewatering should not affect the swamp as it is perched above the bedrock aquifer. Construction dewatering may not even be required due to the expected depth of the water table in the bedrock (Figure 4).

(4) No impacts to SWD-1 swamp recharge areas are predicted as TRCA (2017) defines this as "*replacement of existing soils with significantly less permeable materials*" and the on-site soils are already of low permeability. In addition, there are no locally significant recharge areas to be impacted as these are defined by TRCA (2017) as "*highly porous sedimentary deposits or otherwise having high hydraulic conductivity*".

"*The highest magnitude category with one or more criteria satisfied determines the potential magnitude of change*" with the magnitude thresholds of less than 10% change as low, 10-25% medium and greater than 25% high (TRCA, 2017). Therefore, a high hydrologic risk is assigned based upon the magnitude of change in upgradient catchment area for downgradient Drainage Area A (13% of the SWD-1), but only low for the downgradient Drainage Area B (85% of the SWD-1) (Figure 5). However, as discussed in Section 4.3, hydrologic impacts to the downgradient SWD-1 swamp are not predicted.

4.4.2 Sensitivity of the Wetlands

The risk assignment (Figure 9) is also to consider the type of wetland, and their hydrological sensitivity (TRCA, 2017). The SWD-1 Oak Mineral Deciduous swamp has a medium hydrological sensitivity (TRCA, 2017).

4.4.3 Risk Assignment

As per Figure 9, a medium risk is assigned based upon a (i) high magnitude of hydrological change for Drainage Area A and (ii) a medium wetland sensitivity. The TRCA recommended study, modelling and mitigation requirements are:

(i) Pre-development monitoring as outlined in the Wetland Water Balance Monitoring Protocol (TRCA, 2016).
- However, this is not recommended, or required, as sufficient runoff is modelled to sustain the wetland post-development, and modelled hydrologic conditions reasonably match those reported by the province (MNRF, 2009).

(ii) Continuous hydrological modelling at daily aggregated to weekly resolution.
- Existing modelling (completed at 1-hour time steps) completed by NPCA was utilized for this report (AquaResource Inc. and NPCA, 2009) as part of a monthly analysis. This existing work could be re-visited to extract weekly results, however this would appear to have no benefit.

(iii) Design of a mitigation plan to maintain the wetland water balance, in some cases an interim mitigation plan may also be required.
- Mitigation includes rear yard runoff of lots adjacent the EPA, and grading of the northeast corner of the EPA to the wetland, providing mitigation for maintenance of the wetland hydroperiod where required.

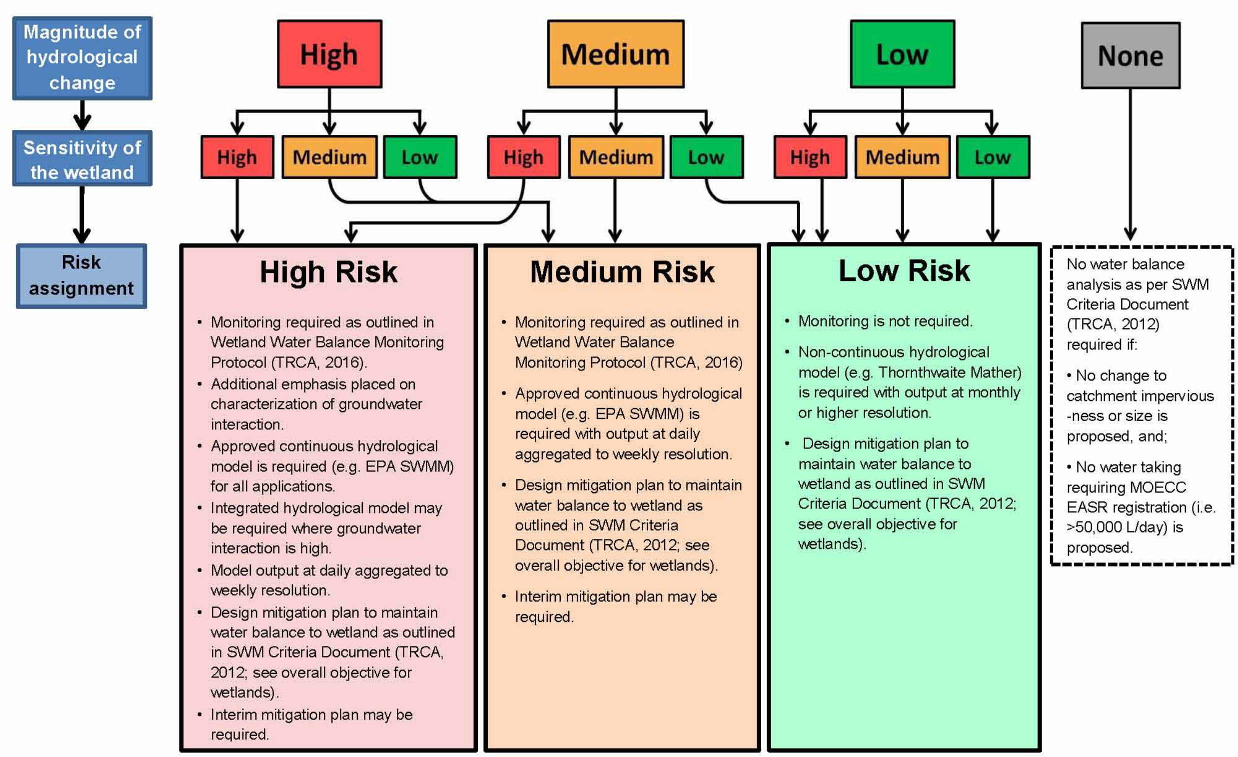

Figure 9 - Wetland Risk Evaluation Decision Tree (TRCA, 2017)

5.0 Conclusions and Recommendations

The following conclusions are provided:

1. The Site is 15.9 hectares, with 1 hectare of locally significant wetland on-site, as well as an additional 4.3 hectares of wetland as designated by NPCA.

2. The Site is primarily on the Onondaga Escarpment with the Haldimand Clay Plain in the downgradient southwest portion of the Site.

3. The swamp is perched on low permeability silty clay in the downgradient southwest portion of the Site.

4. The swamp has an expected hydroperiod of "*distinct periods of surface flooding in the winter and early spring due to snow and ice conditions followed by spring floods but otherwise have a water table that can be a meter or more below the surface*".

5. A monthly water balance for the downgradient swamp (before considering runoff to the wetland) identified potential evapotranspiration as exceeding precipitation for June, July, August, September and October, with soil water holding capacities less than saturated.

6. Monthly runoff modelling completed by NPCA reported runoff amounts for June, July, August, September and October of 16, 7, 6, 17 and 24 mm/month, respectively.

7. Pre-development water balance modelling for the downgradient SWD-1 swamp indicates upgradient lands for the:

    a. Northern portion (Drainage Area A) would be sufficient to maintain saturated conditions during June, September and October but not July and August.
    b. Majority (85%) of the SWD-1 (i.e. Drainage Area B) would be insufficient to maintain saturated conditions during June to October.

8. The TRCA wetland risk assigned is calculated as medium, for the northern portion of the swamp (13%) (Drainage Area A) based upon the potential for a high magnitude of hydrological change and medium wetland sensitivity, and low for the majority (87%) of the swamp (i.e. Drainage Area B).

9. Residential development of the Site should not negatively impact the hydrology of the adjacent SWD-1 swamp. This is because precipitation is the primary source of surface water supply during the summer period and for the northern portion rear yard runoff and grading should provide sufficient additional runoff during September.

10. Residential development of the Site should not negatively impact the hydrology of the SWT-2 swamp as it is downgradient of the SWD-1, and self-contained with respect to drainage.

The following recommendations are provided:

1. Implement rear yard lot drainage towards the wetland/EPA for adjacent lots; and

2. Grade surface water drainage in the northwest corner of the Environmental Protection Area towards the SWD-1 wetland.

We trust this information is sufficient for your present needs. Please do not hesitate to contact us if you have any questions.

Yours truly,

TERRA-DYNAMICS CONSULTING INC.

Jayme D. Campbell, P. Eng.
Senior Water Resources Engineer

Annie Michaud, M.Eng., P. Eng.
Senior Water Resources Engineer

LICENSED PROFESSIONAL ENGINEER
June 3, 2022
J. D. CAMPBELL
PROVINCE OF ONTARIO

cc. Matt Kernahan, MCIP, RPP
Ron Huizer, Beacon Environmental

Attachments
Figure 1 – Location of Subject Lands
Figure 2 – Base Map
Figure 4 – Geologic Cross-Section A-A'
Figure 5 – Wetland catchments
Appendix A – Supporting Information
Appendix B – Concept Plan

6.0 References

AquaResource Inc. and Niagara Peninsula Conservation Authority (NPCA), 2009. Water Availability Study for the Lake Erie North Shore Watershed Plan Area, Niagara Peninsula Source Protection Area.

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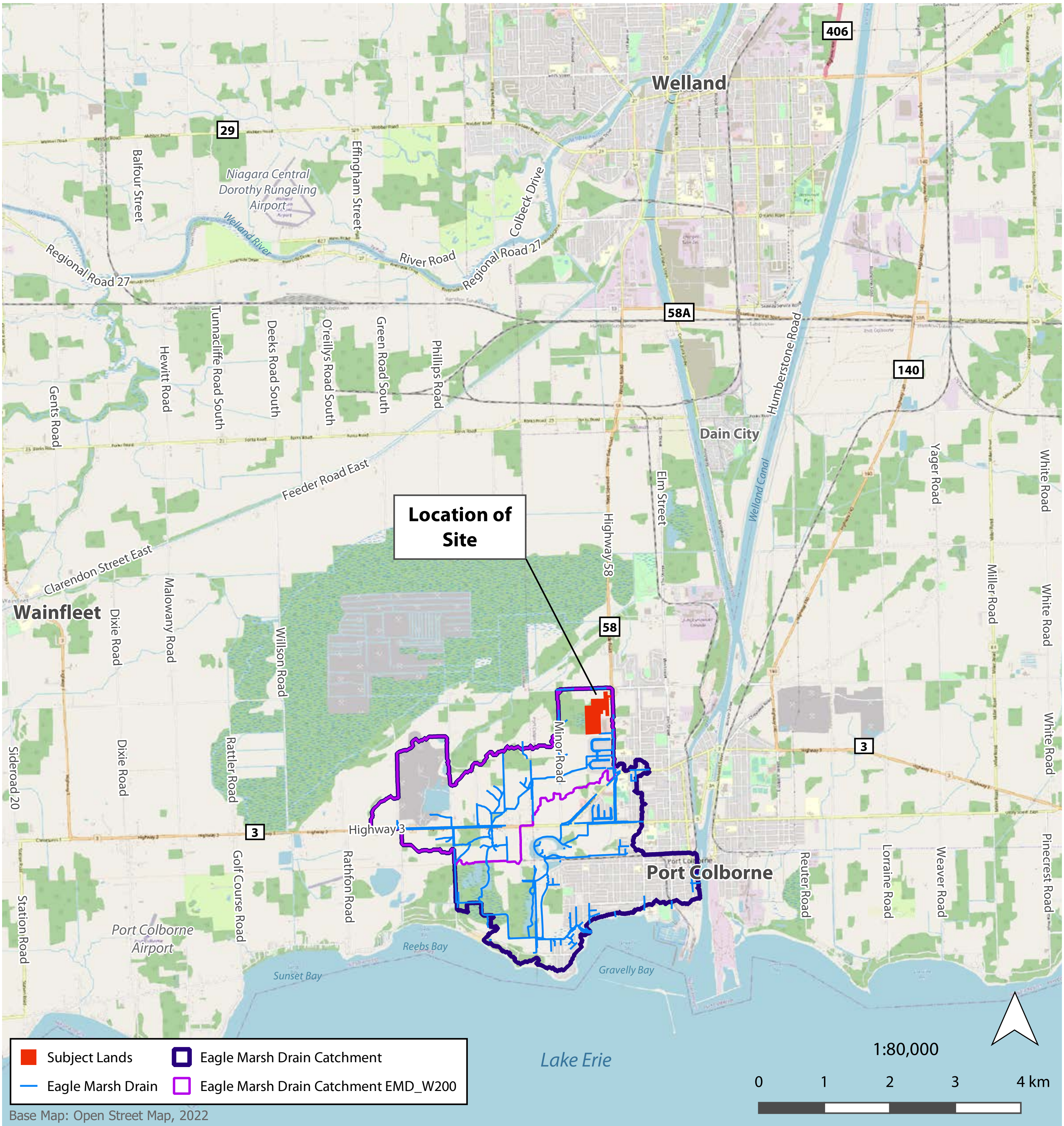
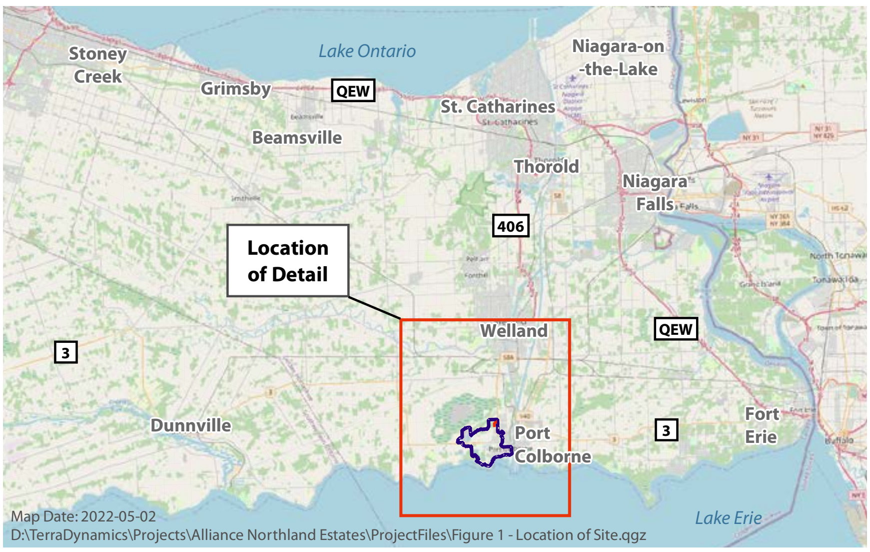




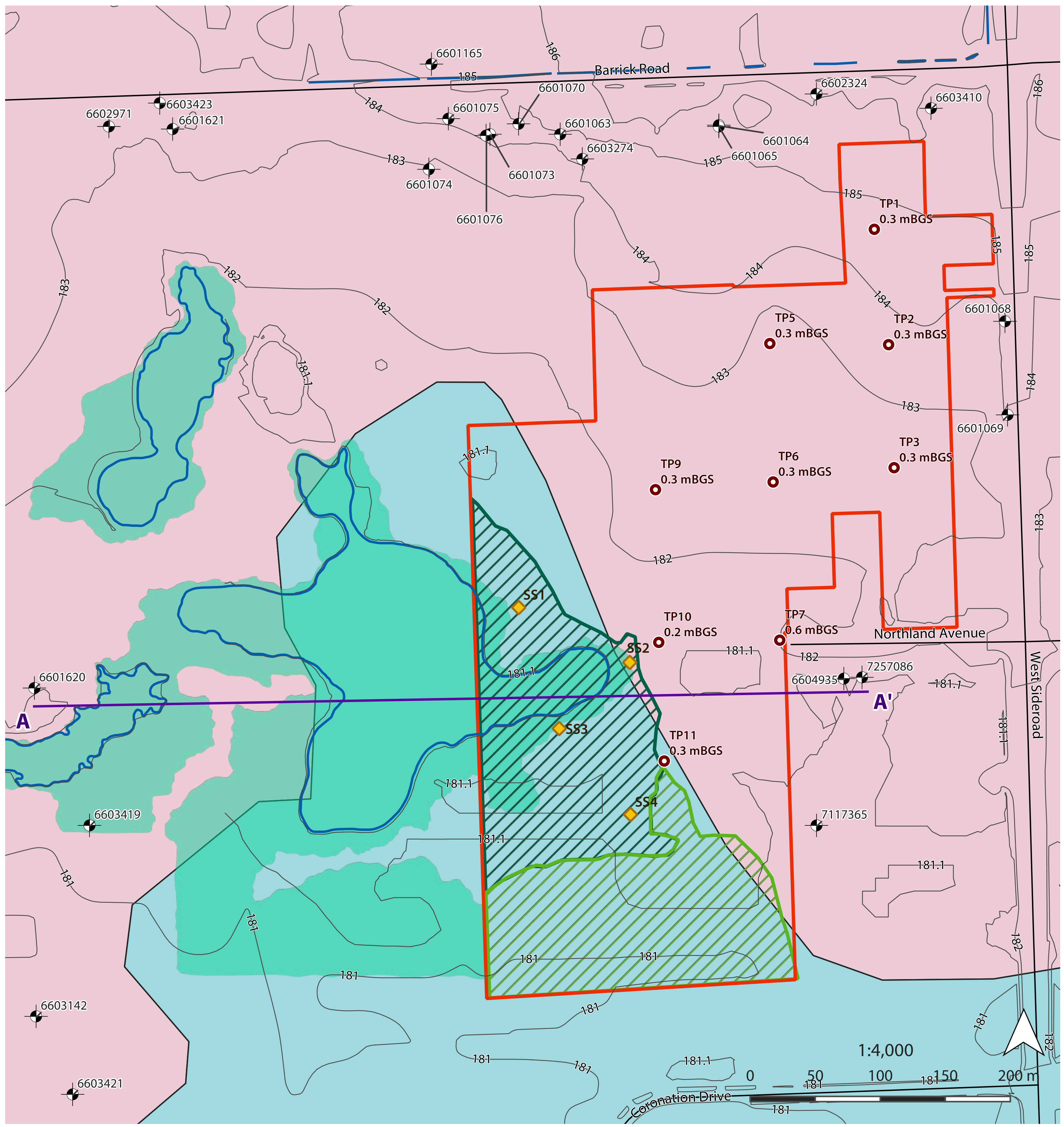
Location of Site

Northland Estates Water Balance Study

Terra-Dynamics Consulting Inc.

Prepared for:
2600261 Ontario Inc.

Figure 1



MECP Water Well Record

Test Pit

Soil Sample (March, 2022)

Ground Surface Contour (mASL)

Hydrogeologic Cross-Section A-A'

Hydrography

Subject Lands

Wetlands

SWD1 Oak Mineral Deciduous Swamp

SWT2 Mineral Thicket Swamp

Onondaga Escarpment Locally Significant Wetland

Surficial Geology

Cherty limestone

Clay and silt

References: Niagara Peninsula Conservation Authority: Hydrography (1:2000), 2021; Wetlands. Ontario Geological Survey: Surficial Geology. Ministry of the Environment, Conservation and Parks: Water Well Information System Records, 2022.
Map Date: 2022-05-03 D:\TerraDynamics\Projects\Alliance Northland Estates\ProjectFiles\Figure 2 - Base Map.qgz

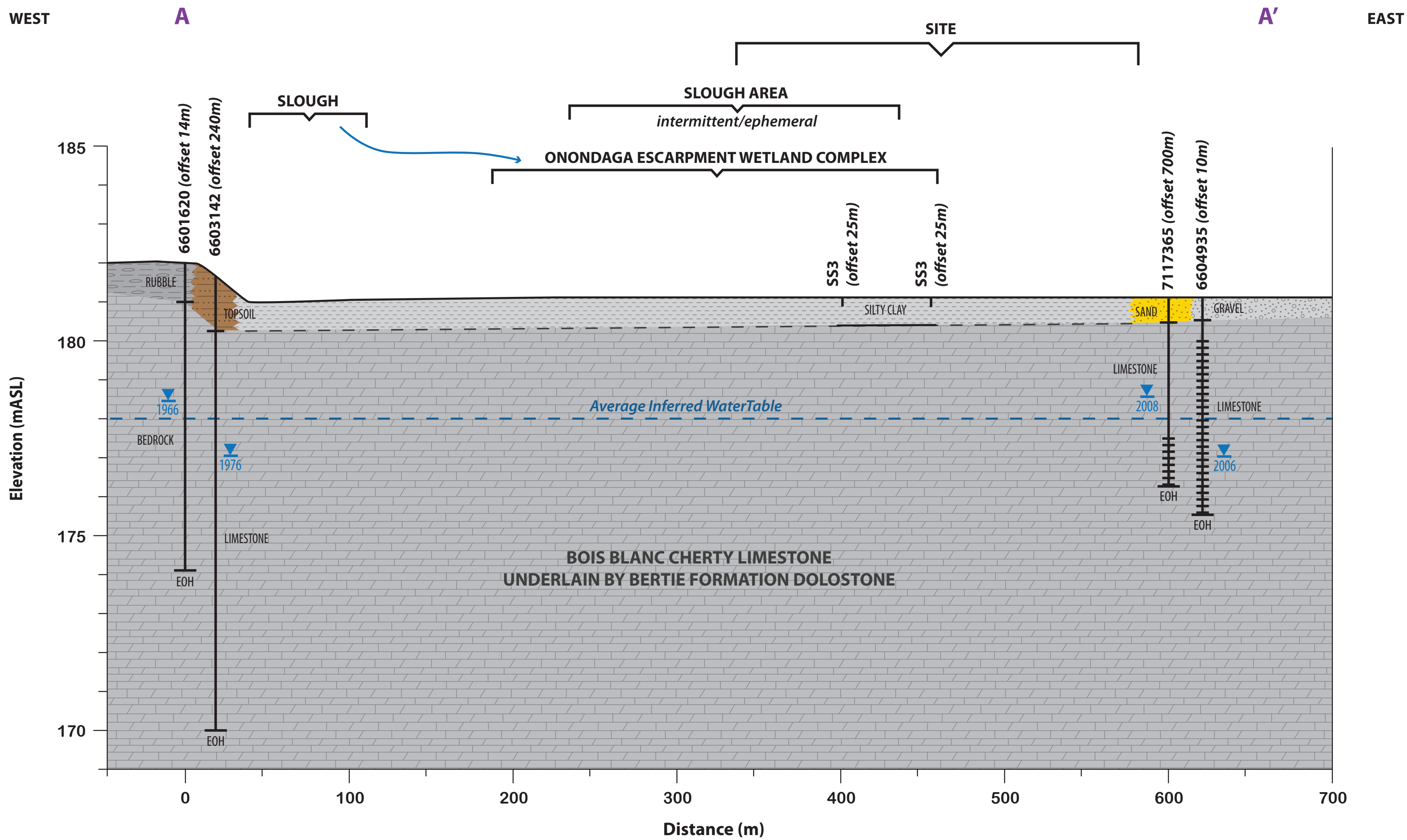
Base Map

Northland Estates Water Balance Study

Terra-Dynamics Consulting Inc.

Prepared for:
2600261 Ontario Inc.

Figure 2



SS Soil Sample, Hand-Auger

Well Water Level with year of measurement

EOH End of Hole

See Figure 2 for line of cross-section

D:\TerraDynamics\Projects\Alliance Northland Estates\ProjectFiles\Figure 4 - Cross Section A-A'.ai April 16, 2022

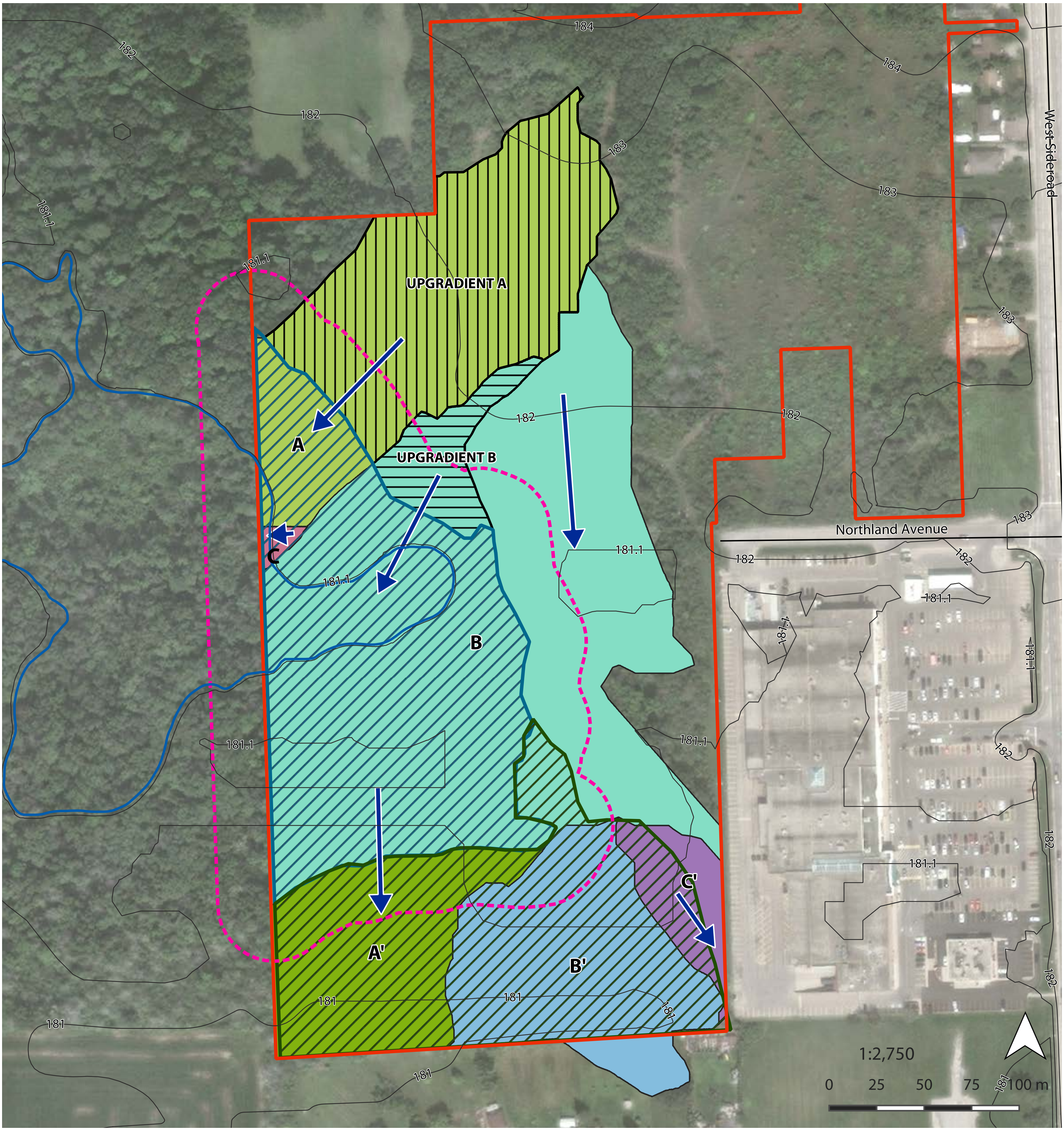
Hydrogeologic Cross-Section A-A'

Northland Estates Water Balance Study

TDC Terra-Dynamics Consulting Inc.

Prepared For: 2600261 Ontario Inc.

Figure 4



Subject Lands
Ground Surface Contour (mASL)
Hydrography
General Direction of Drainage

Wetlands

SWD1 Oak Mineral Deciduous Swamp
SWT2 Mineral Thicket Swamp

30m Buffer of SWD1

Wetland Catchments

A
A'
B
B'
C'
D
Upgradient A
Upgradient B

References: Niagara Peninsula Conservation Authority: Hydrography (1:2000), 2021; Wetlands.
Map Date: 2022-05-03 D:\TerraDynamics\Projects\Alliance Northland Estates\ProjectFiles\Figure 5 - Wetland Catchments.qgz

Wetland Catchments

Northland Estates
Water Balance Study

Terra-Dynamics Consulting Inc.

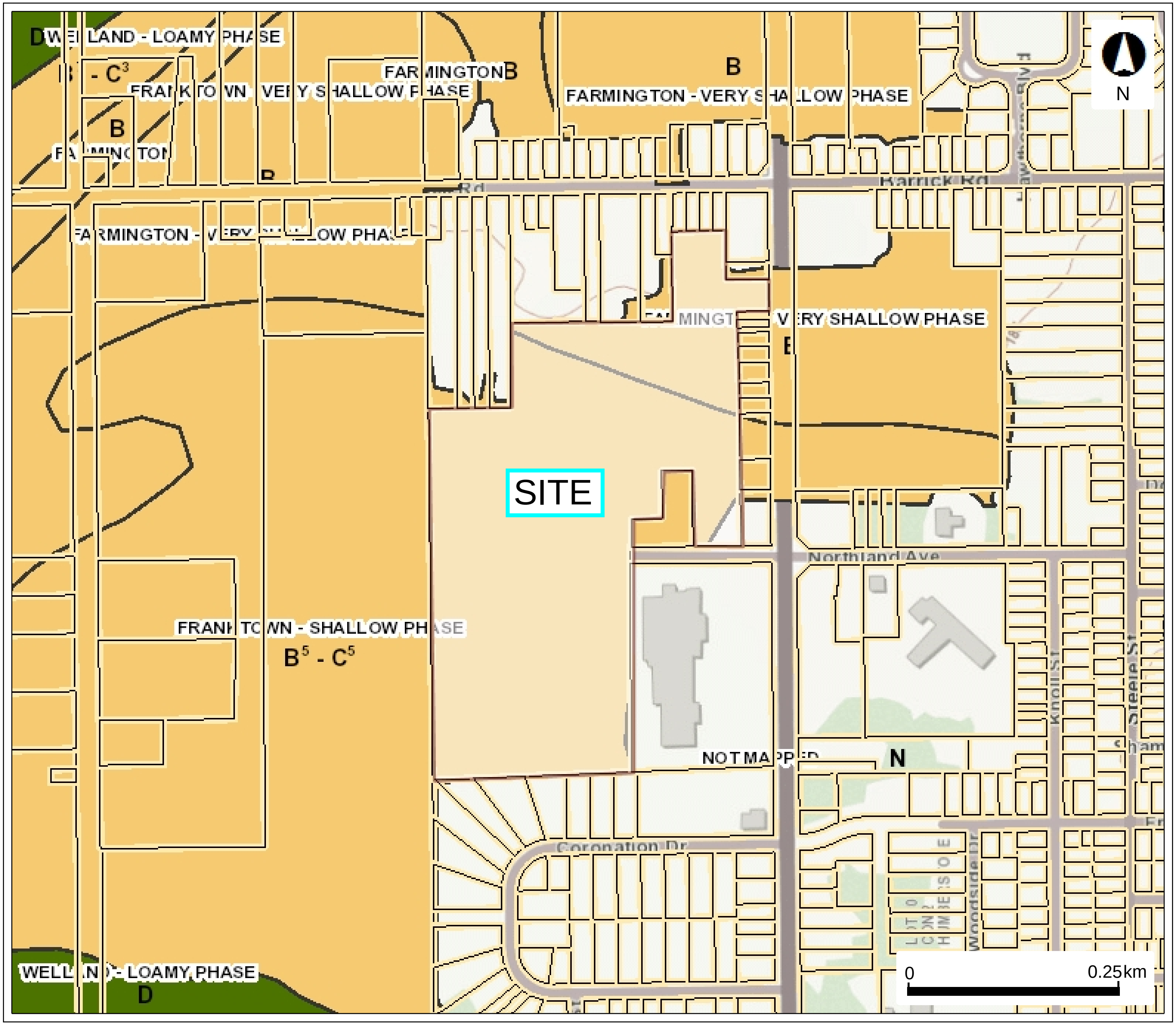
Prepared for:
2600261 Ontario Inc.

Figure 5

Appendix A

Supporting Information

Figure A-1, OMAFRA Soils



Legend

- Assessment Parcel
- Soil Name Label

Hydrologic Soil Group

- A - High
- B - Moderate
- C - Slow
- D - Very Slow

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Map Created: 4/20/2022
Map Center: 42.90661 N, -79.2681 W

E3 Laboratories Inc.
SS#4, 360 York Rd., Unit 10, Niagara-on-the-Lake, Ontario L0S 1J0
Email: info@e3labs.ca
Tel: (905) 641-9000, Fax: (905) 641-9001

CERTIFICATE OF ANALYSIS

Terra-Dynamics Consulting
Jayme Campbell
432 Niagara St
St.Catharines
L2M 4W3
Tel: Fax:
Email: jcampbell@terra-dynamics.com

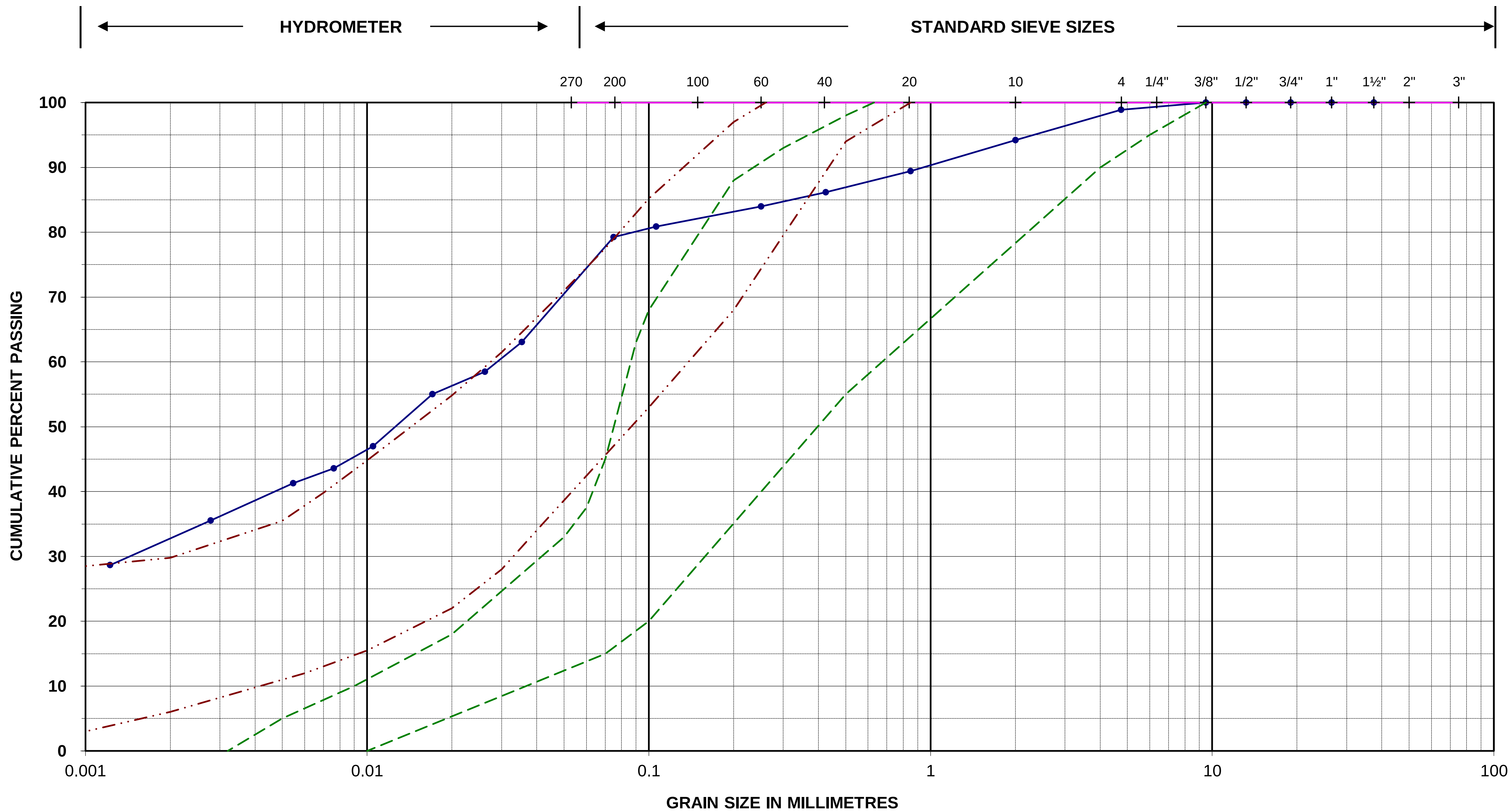
Work Order No.:2633081
Received : 2022-03-17
PO Number:
Reported: 2022-03-23
Project Name: Alliance Northland PC
Chain of Custody No.: 2633081

Client Sample ID	Sample Date	Lab ID	Parameter	Result	Unit	RDL	Date Analyzed	Method
Sample 2	2022-03-16	**712501**	T Time	See	Attached		2022-03-23	Subcontracted
Sample 3	2022-03-16	**712502**	T Time	See	Attached		2022-03-23	Subcontracted

Reported by:

Nilou Ghazi, Ph.D.,P.Eng.
Laboratory Manager

PARTICLE SIZE DISTRIBUTION LS702/ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	1	%
SAND	19	%
SILT	47	%
CLAY	33	%

------------------------ sm envelope T = 8 - 20 min/cm

– - - – - - – - ml envelope T = 20 - 50 min/cm

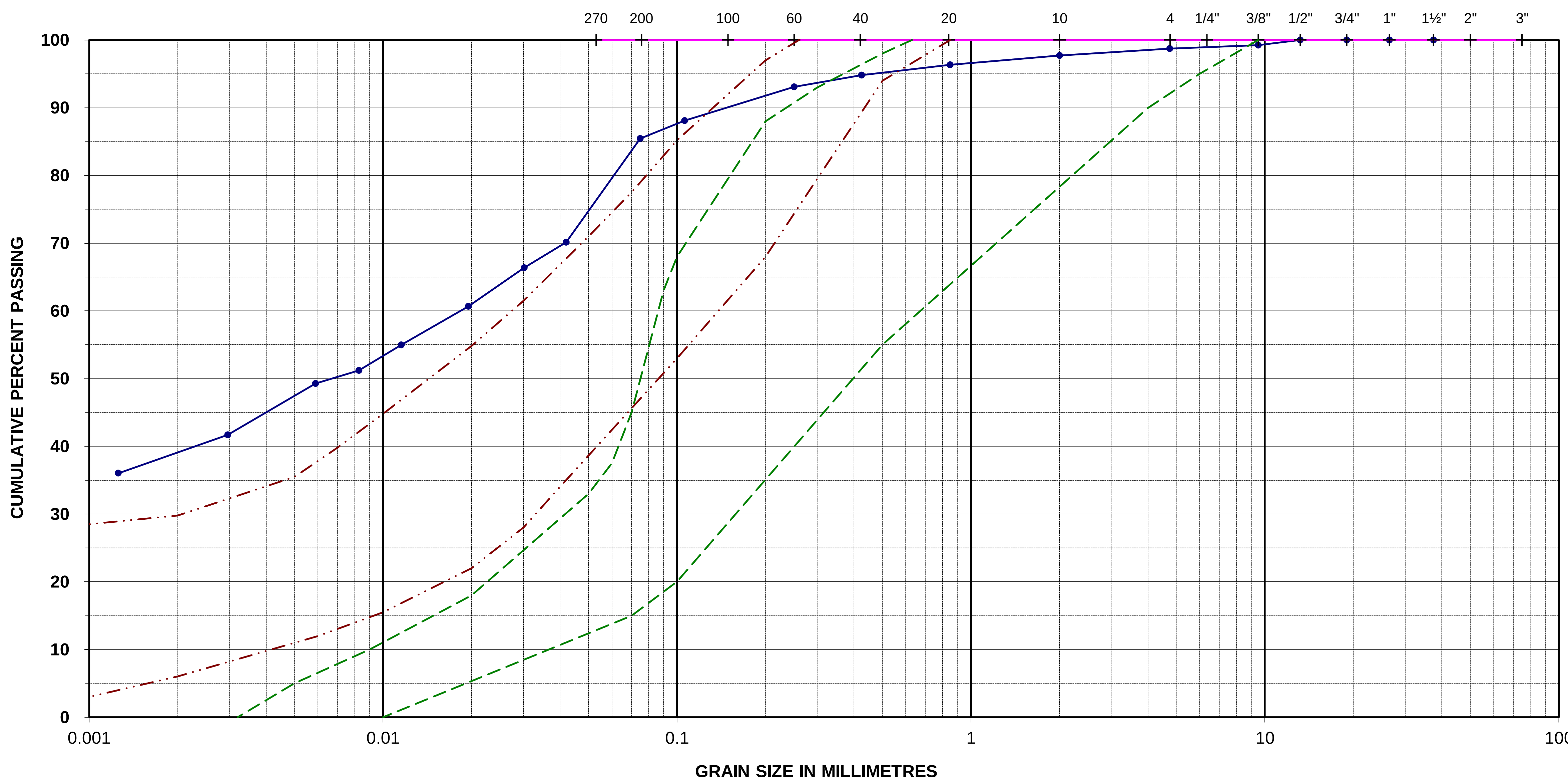
Estimated T = 50 min/cm

Project Name:	E3 Laboratories	**Project No.:**	111-53143-00 (2633081)
Location ID.:	Sample 2	**Sample No./Depth:**	712501

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	94.18	**0.035**	63.0
26.5 mm	100.0	**0.850 mm**	89.4	**0.017**	55.0
19.0 mm	100.0	**0.425 mm**	86.2	**0.008**	43.6
13.2 mm	100.0	**0.250 mm**	84.0	**0.003**	35.5
9.50 mm	100.0	**0.106 mm**	80.8	**0.001**	28.7
4.75 mm	98.9	**0.075 mm**	79.2		

Note: More information is available upon request. Tested by: WGH Reviewed by: Date: 22-Mar-22

PARTICLE SIZE DISTRIBUTION LS702/ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL

GRAVEL	1	%
SAND	13	%
SILT	47	%
CLAY	39	%

------------------------ sm envelope T = 8 - 20 min/cm

- - - — - - — - — - ml envelope T = 20 - 50 min/cm

Estimated T = >50 min/cm

Project Name:	E3 Laboratories	**Project No.:**	111-53143-00 (2633081)
Location ID.:	Sample 3	**Sample No./Depth:**	712502

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine	Hydrometer (mm)	% Passing
37.5 mm	100.0	**2.00 mm**	97.69	**0.042**	70.1
26.5 mm	100.0	**0.850 mm**	96.4	**0.020**	60.7
19.0 mm	100.0	**0.425 mm**	94.8	**0.008**	51.2
13.2 mm	100.0	**0.250 mm**	93.1	**0.003**	41.7
9.50 mm	99.2	**0.106 mm**	88.1	**0.001**	36.0
4.75 mm	98.7	**0.075 mm**	85.4		

Note: More information is available upon request.

Tested by: WGH

Reviewed by:

Date: 21-Mar-22

K from Grain Size Analysis Report

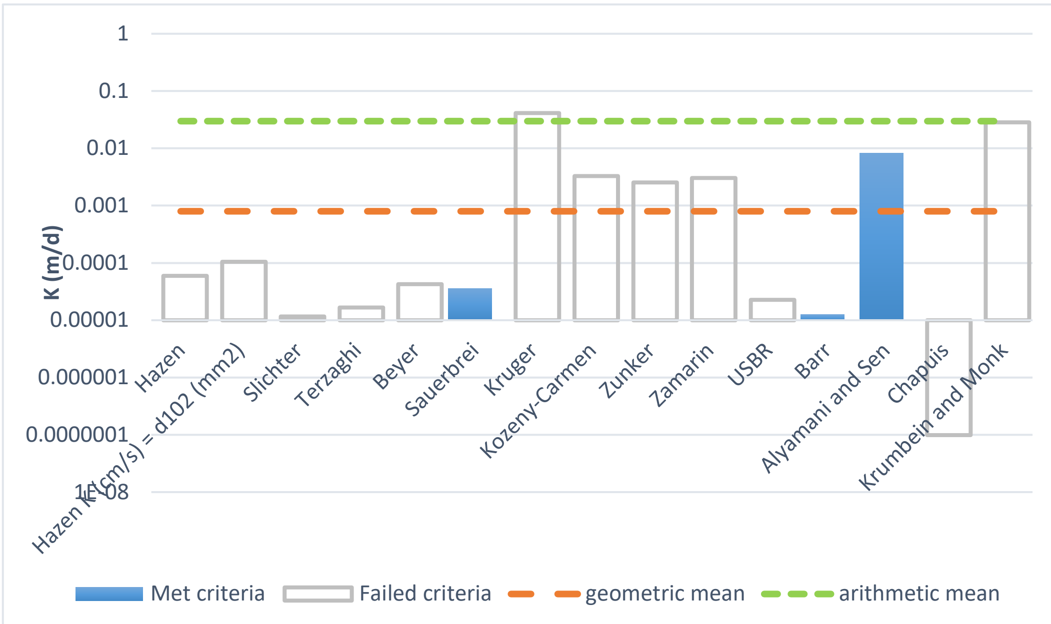
Date: 20-Apr-22

Sample Name: Soil Sample 2 - Northland Estates

Mass Sample (g): 100

T (oC) 20

Poorly sorted clay with fines



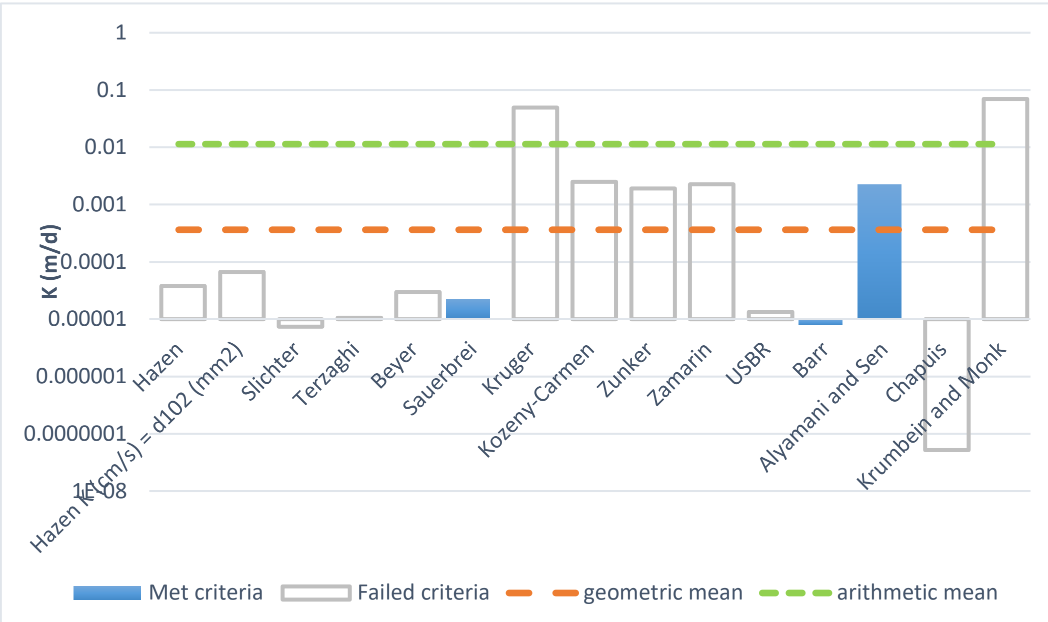
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	7.E-08	7.E-10	0.00	
Hazen K (cm/s) = d_{10} (mm)	1.E-07	1.E-09	0.00	
Slichter	1.E-08	1.E-10	0.00	
Terzaghi	2.E-08	2.E-10	0.00	
Beyer	5.E-08	5.E-10	0.00	
Sauerbrei	4.E-08	4.E-10	0.00	
Kruger	5.E-05	5.E-07	0.04	
Kozeny-Carmen	4.E-06	4.E-08	0.00	
Zunker	3.E-06	3.E-08	0.00	
Zamarin	3.E-06	3.E-08	0.00	
USBR	3.E-08	3.E-10	0.00	
Barr	1.E-08	1.E-10	0.00	
Alyamani and Sen	9.E-06	9.E-08	0.01	
Chapuis	1.E-10	1.E-12	0.00	
Krumbein and Monk	3.E-05	3.E-07	0.03	
Shepherd	1.E-04	1.E-06	0.11	
geometric mean	9.E-07	9.E-09	0.00	
arithmetic mean	3.E-05	3.E-07	0.03	

K from Grain Size Analysis Report | Date: 20-Apr-22

Sample Name: Soil Sample 3 - Northland Estates

Mass Sample (g): 100 | T (oC) 20

Poorly sorted clay with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	4.E-08	4.E-10	0.00	
Hazen K (cm/s) = d_{10} (mm)	8.E-08	8.E-10	0.00	
Slichter	9.E-09	9.E-11	0.00	
Terzaghi	1.E-08	1.E-10	0.00	
Beyer	3.E-08	3.E-10	0.00	
Sauerbrei	3.E-08	3.E-10	0.00	
Kruger	6.E-05	6.E-07	0.05	
Kozeny-Carmen	3.E-06	3.E-08	0.00	
Zunker	2.E-06	2.E-08	0.00	
Zamarin	3.E-06	3.E-08	0.00	
USBR	2.E-08	2.E-10	0.00	
Barr	9.E-09	9.E-11	0.00	
Alyamani and Sen	3.E-06	3.E-08	0.00	
Chapuis	6.E-11	6.E-13	0.00	
Krumbein and Monk	8.E-05	8.E-07	0.07	
Shepherd	5.E-05	5.E-07	0.04	
geometric mean	4.E-07	4.E-09	0.00	
arithmetic mean	1.E-05	1.E-07	0.01	

UTM | | |Z| C | | | | |E

5 R | | | | | | | | | |N

Elev. 4 R 0602

Basin 23

66 № 1620

The Ontario Water Resources Commission Act

WATER WELL RECORD

County or District Welland Township, Village, Town or City Port Colborne

Con. 2 Lot part 32 Date completed 12 (day) Dec (month) 66 (year)

[redacted]ess RR 2 Port Colborne

Casing and Screen Record

Inside diameter of casing	5 in.
Total length of casing	6 ft
Type of screen	
Length of screen	
Depth to top of screen	
Diameter of finished hole	5 in

Pumping Test

Static level	12 ft
Test-pumping rate	2 G.P.M.
Pumping level	20
Duration of test pumping	1 ½ hrs
Water clear or cloudy at end of test	clear
Recommended pumping rate	1 G.P.M.
with pump setting of	25 feet below ground surface

Well Log / Water Record

Overburden and Bedrock Record	From ft.	To ft.	Depth(s) at which water(s) found	Kind of water (fresh, salty, sulphur)
rubble	0	3		
shale	3	29	29 ft	fresh

For what purpose(s) is the water to be used? house

Is well on upland, in valley, or on hillside? upland

Drilling or Boring Firm Raymond L. Schooley

Address RR 3 Port Colborne

Licence Number 1959

Name of Driller or Borer

Address

Date Dec 31/66

R. L. Schooley

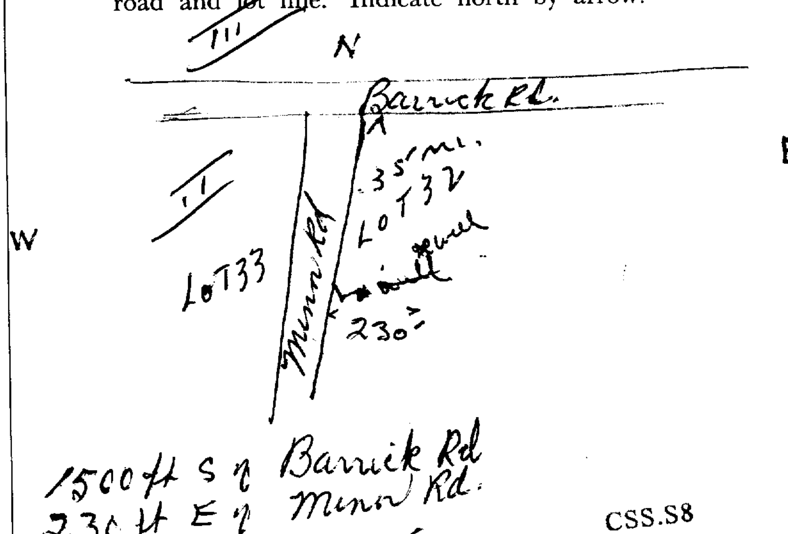
(Signature of Licensed Drilling or Boring Contractor)

Form 7 15M-60-4138

OWRC COPY

Location of Well

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



1500 ft S of Barrick Rd
230 ft E of Minor Rd.

CSS.S8

MINISTRY OF THE ENVIRONMENT
The Ontario Water Resources Act

WATER WELL RECORD

Ontario

304/14 f

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

11 | 6603142 | MUNICIP 66003 | CON. CON | 02

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON., BLOCK, TRACT, SURVEY, ETC.	LOT 25-27
~~WELLAND~~ REG. MUNI NIAGARA	~~PORT COLBORNE~~ HUMBERSTONE	CON. 2	032

[redacted] OR RD PT. COLBORNE

DATE COMPLETED 48-53: DAY 19 MO 07 ~~OCT~~ YR 76

[redacted] 51340 4 | ELEVATION 0600 4 | BASIN CODE 23

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
brown	Top soil			0	18"
grey	limestone			18"	35'0"

31 | 0002602 | 0035215
32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
0018' (10-13)	1 ☒ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
15-18	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
20-23	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
25-28	1 ☐ FRESH 3 ☐ SULPHUR 2 ☐ SALTY 4 ☐ MINERAL
30-33	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
06 6 1/4	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE	.188	0	0010'
06	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☒ OPEN HOLE		10'	0035'
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE			

SCREEN

SIZE(S) OF OPENING (SLOT NO.) 31-33	DIAMETER 34-38 INCHES	LENGTH 39-40 FEET
MATERIAL AND TYPE	DEPTH TO TOP OF SCREEN 41-44 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	PUMPING RATE	DURATION OF PUMPING
1 ☐ PUMP 2 ☒ BAILER	0004 GPM	01 HOURS 00 MINS

WATER LEVELS DURING: 1 ☐ PUMPING 2 ☒ RECOVERY

STATIC LEVEL	WATER LEVEL END OF PUMPING	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
012 FEET	030 FEET	012 FEET	012 FEET	FEET	FEET

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

RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP | RECOMMENDED PUMP SETTING 033 FEET | RECOMMENDED PUMPING RATE 0004 GPM

50-53 ____ GPM./FT. SPECIFIC CAPACITY

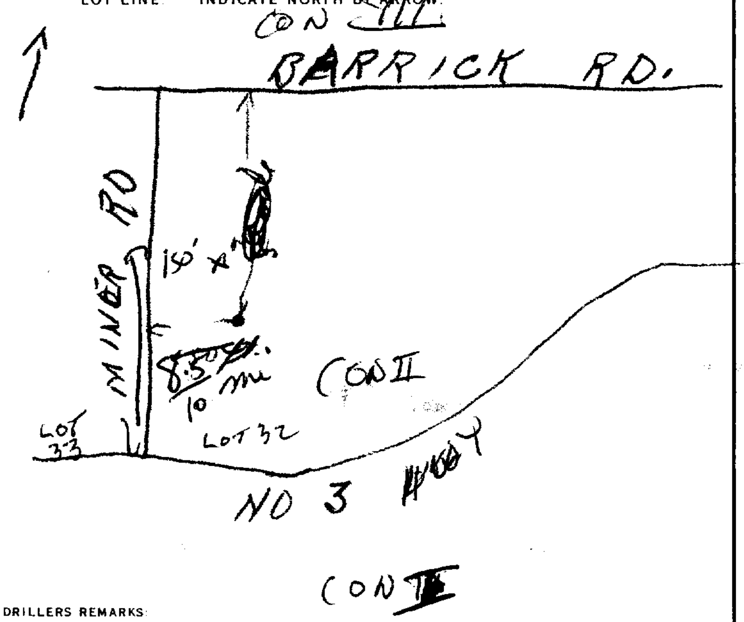
FINAL STATUS OF WELL 1
1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED, INSUFFICIENT SUPPLY 6 ☐ ABANDONED, POOR QUALITY 7 ☐ UNFINISHED

WATER USE 01
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
1 ☒ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☐ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING

LOCATION OF WELL

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



DRILLERS REMARKS

CONTRACTOR

NAME OF WELL CONTRACTOR: WAYNE ... FERY ENT. | LICENCE NUMBER 3571
ADDRESS: RR# ... STEVENSVILLE ... RKSTON
NAME OF DRILLER: LEA... | LICENCE NUMBER 3210
SIGNATURE OF CONTRACTOR | SUBMISSION DATE DAY 5 MO. Aug YR. 76

OFFICE USE ONLY

DATA SOURCE 1 | CONTRACTOR 3571 | DATE RECEIVED 090876
DATE OF INSPECTION Aug 18/77 | INSPECTOR MT
REMARKS: CSS.S8 | P | WI

MINISTRY OF THE ENVIRONMENT COPY

FORM 7 MOE 07-091

JWE 060111
Jan 4/06

Ontario | Ministry of the Environment

Well Tag (number below): A 036867

A036867

Well Record

Regulation 903 Ontario Water Resources Act

[redacted]

page ___ of ___

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

MUN ___ CON ___ LOT ___

Well Owner's Information and Location of Well Information

[redacted] code)

Address of Well Location (County/District/Municipality)	Township	Lot	Concession
287 West Side			

RR#/Street Number/Name	City/Town/Village	Site/Compartment/Block/Tract etc.
	Port Colborne	

GPS Reading	NAD	Zone	Easting	Northing	Unit Make/Model	Mode of Operation
	83	17	641476	4751823	Magellan	☐ Undifferentiated ☑ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth Metres From	Depth Metres To
black	Asphalt			0	.11
brown	Gravel			.11	.9
grey.	limestone		hard.	.9	6

Hole Diameter

Depth Metres From	Depth Metres To	Diameter Centimetres
0	6	10

Water Record

Water found at 1.5 Metres — Kind of Water

☐ 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 Metres From	Depth Metres To
Casing				
3.2	☑ Plastic	.5	0	1.5
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☑ Plastic			
Screen		**Slot No.**		
Outside diam 4.2	☑ Plastic	10	1.5	6
No Casing or Screen	☐ Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level			
Pumping rate - (litres/min)	1		1	
Duration of pumping ___hrs + ___ min	2		2	
Final water level end of pumping ___ metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ___ metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

Plugging and Sealing Record

☑ Annular space ☐ Abandonment

Depth set at - Metres From	To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0	.3	concrete	
.3	1.2	bentonite	

Location of Well

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

See map.

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

Audit No. Z 42216

Date Well Completed: 2006 01 04

Date Delivered: YYYY MM DD

Was the well owner's information package delivered? ☐ Yes ☐ No

Well Contractor/Technician Information

Name of Well Contractor: Geo Environmental Drilling

Well Contractor's Licence No.: 6607

Business Address (street name, number, city etc.): 340 Market Dr Milton, ON

Name of Well Technician (last name, first name): Haits Ryan

Well Technician's Licence No.: T3212

Signature of Technician/Contractor: X [signature]

Date Submitted: 2006 01 04

Ministry Use Only

Data Source

Contractor: 6607

Date Received: FEB 13 2006

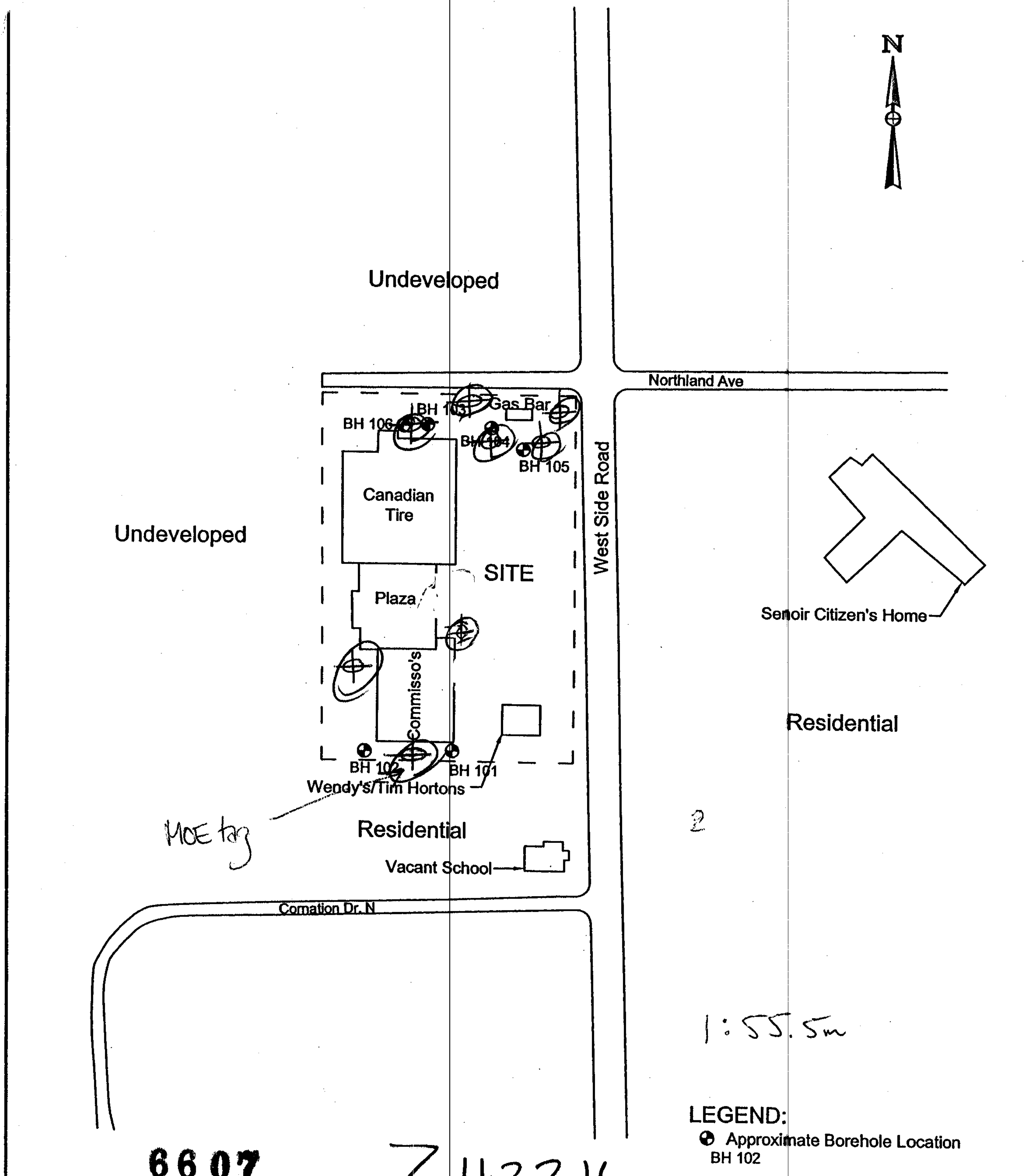
Date of Inspection: YYYY MM DD

Remarks

Well Record Number

0506E (09/03) Contractor's Copy ☐ Ministry's Copy ☐ Well Owner's Copy ☐

Cette formule est disponible en français



6607

Z42216

FEB 13 2006

Trow Associates Inc. 428 Millen Road, Stoney Creek, Ontario L8E 3N9 Telephone: (905) 664-3300 Fax: (905) 662-4144	SCALE: N.T.S DATE: January, 2004 Project No.: HAEN-00069891B/E DRWN.: MW CHKD.: KG	BOREHOLE LOCATION PLAN Phase II Environmental Site Assessment 287 West Side Road Port Colborne ONTARIO	DRAWING 2

Trow

Follow the **COVID-19 restrictions and public health measures (https://covid-19.ontario.ca/public-health-measures)** and **book your appointment to get vaccinated (https://covid-19.ontario.ca/book-vaccine/)**.

Map: Well records

This map allows you to search and view well record information from reported wells in Ontario.

Full dataset is available in the Open Data catalogue (https://data.ontario.ca/dataset/well-records).

Go Back to Map ()

Well ID

Well ID Number: 7117365
Well Audit Number: *M03054*
Well Tag Number: *A074891*
This table contains information from the original well record and any subsequent updates.

This well is part of a well cluster.

The information below is extracted from the cluster well record.

More information on the cluster well record (related to other wells in the cluster)
is also available. ()

Well Location

Address of Well Location	287 WEST SIDE RD
Township	PORT COLBORNE CITY
Lot	
Concession	

County/District/Municipality	NIAGARA (WELLAND)
City/Town/Village	Port Colborne
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 641455.00 Northing: 4751710.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BRWN	SAND	GRVL	CGRD	0 m	.9 m
GREY	LMSN		FCRD	.9 m	5.3 m

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 m	3.5 m	BENTONITE CHIPS	

Method of Construction & Well Use

Method of Construction	Well Use
Rotary (Air)	Monitoring
AUGER	

Status of Well

Test Hole

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
3.2 cm	PLASTIC	0 m	3.8 m

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
4.2 cm	PLASTIC		

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 6607

Results of Well Yield Testing

After test of well yield, water was	
If pumping discontinued, give reason	
Pump intake set at	
Pumping Rate	
Duration of Pumping	
Final water level	
If flowing give rate	
Recommended pump depth	
Recommended pump rate	
Well Production	
Disinfected?	N

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL	3 m		
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
45		45	
50		50	
60		60	

Water Details

Water Found at Depth	Kind
3.9 m	Fresh

Hole Diameter

Depth From	Depth To	Diameter
0 m	1.2 m	21 cm

1.5 m	5.3 m	10 cm

Audit Number: M03054

Date Well Completed: August 19, 2008

Date Well Record Received by MOE: January 08, 2009

Updated: October 18, 2021
Published: March 20, 2014

Related

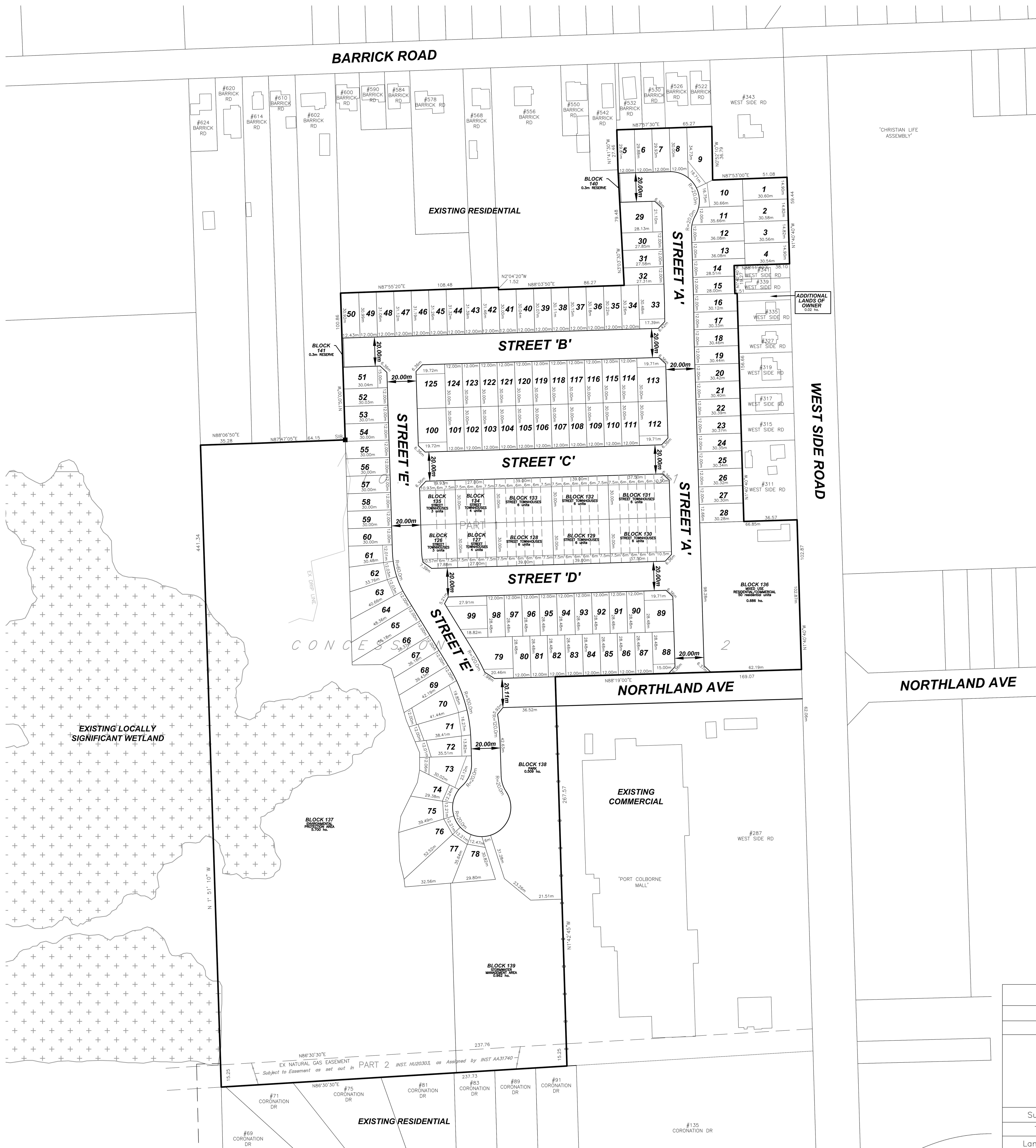
How to use a Ministry of the Environment map (/page/how-use-ministry-environment-map#wells)

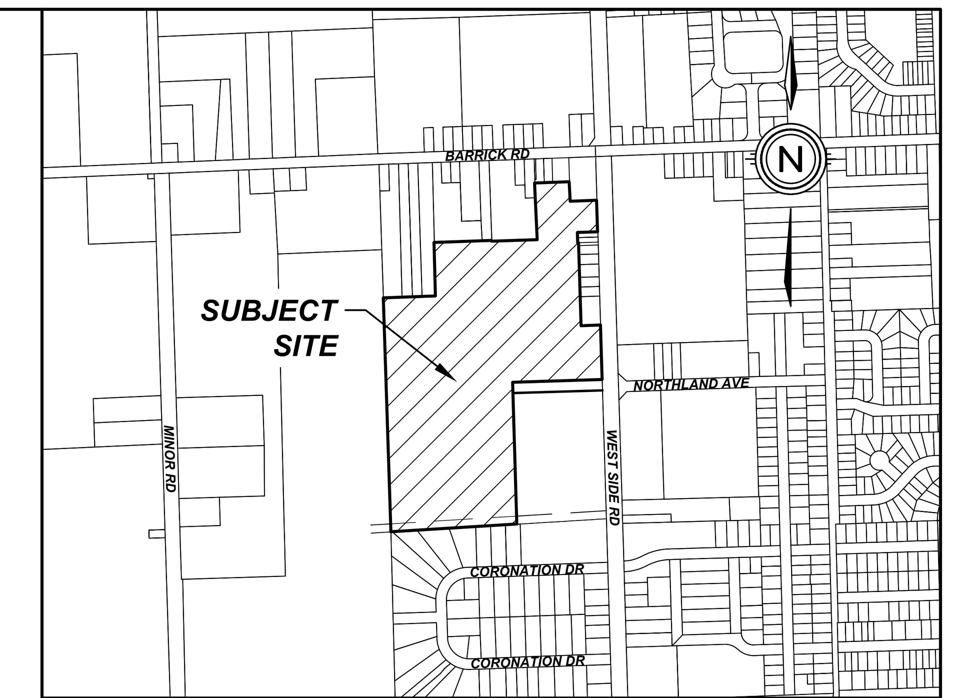
Technical documentation: Metadata record (https://data.ontario.ca/dataset/well-records/resource/3031344e-e3f2-48d5-888c-c1deadfd2f77)

Appendix B

Northland Estates Draft Plan of Subdivision

NORTHLAND ESTATES
CITY OF PORT COLBORNE





KEY PLAN
N.T.S.

DRAFT PLAN OF SUBDIVISION

LEGAL DESCRIPTION

PART OF LOT 31, CONCESSION 2
GEOGRAPHIC TOWNSHIP OF HUMBERSTONE
CITY OF PORT COLBORNE
REGIONAL MUNICIPALITY OF NIAGARA

OWNER'S CERTIFICATE

BEING THE REGISTERED OWNER, I HEREBY AUTHORIZE UPPER CANADA CONSULTANTS TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE CITY OF PORT COLBORNE FOR APPROVAL.

2600261 ONTARIO INC. DATE

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED ARE CORRECTLY SHOWN.

ROY S. KIRKUP, B.Sc., O.L.I.P., Ontario Land Surveyor DATE
KIRKUP MASCOE URE SURVEYING
(a Division of J.D. Barnes Limited)

REQUIREMENTS OF SECTION 51(17) OF THE PLANNING ACT

a) SEE PLAN
b) SEE PLAN
c) SEE PLAN
d) SEE PLAN
e) SEE PLAN
f) SEE PLAN
g) SEE PLAN
h) MUNICIPAL WATER
i) VARIOUS TEXTURES OVER BEDROCK
j) SEE PLAN
k) FULL SERVICE
l) SEE PLAN

LAND USE SCHEDULE

LAND USE	LOT/BLOCK	# OF UNITS	AREA(ha)	AREA(%)
SINGLE FAMILY RESIDENTIAL	LOT 1–125	125	5.176	30.89
STREET TOWNS RESIDENTIAL	BLOCK 126–135	50	1.024	6.11
MIXED USE RESIDENTIAL/COMMERCIAL	BLOCK 136	50	0.686	4.09
ENVIRONMENTAL PROTECTION AREA	BLOCK 137		5.700	34.01
PARK	BLOCK 138		0.509	3.04
STORMWATER MGMT AREA	BLOCK 139		0.962	5.74
0.3m RESERVE	BLOCK 140–141		0.001	0.01
ROADWAY			2.700	16.11
TOTAL		225	16.758	100.00

DEVELOPABLE AREA = 11.06 ha.
DEVELOPABLE DENSITY = 20.34 units/ha

.	.	.	.
.	.	.	.
0	ISSUED FOR	YYYY–MM–DD	.
#	REVISION	DATE	INIT

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

GREENFIELD DENSITY CALCULATION

	People		Jobs		
	Units	Ratio	Units	Ratio	Total
	225 Dwellings	2.28 people per dwelling[1]	225 Dwellings	5% "at home" employment	11.25 Jobs
			$16,576.42ft^2$ of commercial space	1 employee per $500ft^2$ of commercial space[2]	33.15 Jobs
Subtotal	513 people		44.40 jobs		
Total	557.40 people and jobs				
Land Area	11.058 hectares (exclusive of the Environmental Protection Area)				
Greenfield Density	50.41 people and jobs per hectare				

DRAWING TITLE		
DRAFT PLAN OF SUBDIVISION	DRAFTING	MK
	DATE	MAY 13, 2022
	PRINTED	MAY 26, 2022
	SCALE	1:1500
	DWG No. 21132-DP	REV 0

DRAWING FILE: F:\21132\Planning\21132_DP_PRELIM3.dwg PLOTTED: May 26, 2022 – 3:00pm PLOTTED BY: mark