

Functional Servicing and Stormwater Management Report

**Upper's Lane Subdivision
Residential Development
City of Thorold, ON**



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Sign-off Sheet

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1.0 INTRODUCTION & BACKGROUND

Stantec Consulting Ltd. (Stantec) has been retained by Parkbridge Lifestyle Communities (the 'Owner') to prepare this Functional Servicing and Stormwater Management Report (FSSMR) in support of the Zoning By-Law Amendment and Draft approval for the proposed development of the Upper's Lane Subdivision, (hereafter, the 'Site'). As amended, the subject site is zoned as Future Development 'FD', 'Open Space Conservation 'OS2', Utility 'U', & Environmental Protection Two 'EP2' in the City of Thorold's Zoning By-Law No. 60-2019.

The site is approximately 39.842 hectares (98.42 acres) in size and is bounded by the future Upper's Lane Road allowance to the south, the Rolling Meadows Subdivision (RMS) and Upper's Grove Subdivision (UGS) to the west, Hydro One Corridor to the north and future employment-dedicated development lands to the east. A TransCanada Pipeline (TCPL) easement bisects the property in a northeast direction. At the time of this report preparation, RMS has approved subdivision plan and is undergoing service constructions; UGS has draft plan approval and is preparing detail design for subdivision agreement. Refer to **Figure 1** for site location.

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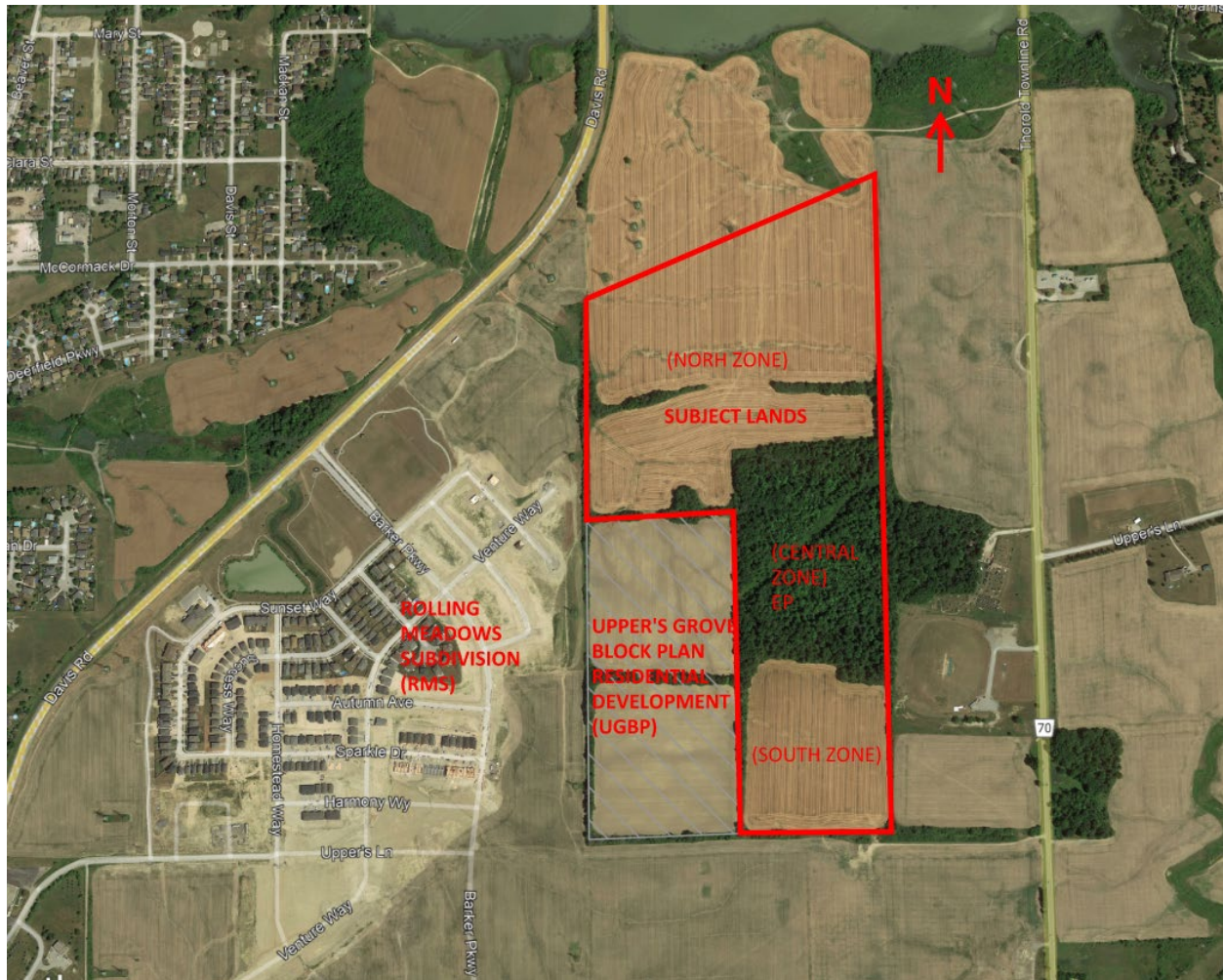


Figure 1 – Site Location Plan

The site is generally divided into three (3) zones - North, Central and South. The North zone is approximately 21.75 ha (53.75ac), Central zone is approximately 13.15 ha (32.49 ac), and South zone is approximately 6.75 ha (16.68 ac) in sizes. The North and South zones consist of undeveloped agricultural lands. The Central zone is occupied by a woodlot, which is identified as an Environmental Protection area in the Town's Official Plan. Therefore, only North and South zones have development potential. Based on Draft Plan prepared by Bousfield's Inc. the site could yield approximately 603 units, consisting of 417 townhomes, 186 Singles and a Park. North plan has 177 singles and 241 townhomes; south plan has 9 singles and 176 townhomes. A copy of the demonstration plan is included in **Appendix A**.

This report examines the existing boundary servicing and grading conditions and outlines the serviceability of the development concerning storm drainage, sanitary servicing, water supply, grading, and utilities, all in accordance with the current municipal design requirements of the City of Thorold, Niagara Region and Niagara Peninsula Conservation Authority (NPCA).

The following background documents were reviewed in the preparation of this report:



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- Preliminary Stormwater Management Plan – Rolling Hills – Upper Canada Consultants, March 2007
- Functional Servicing Report – Upper's Grove Block Plan Residential Development – Counterpoint Engineering, December 2020
- Neighborhoods of Rolling Meadows Secondary Plan Sub-Watershed Study and Functional Engineering Report – Westlake Inc., June 2006
- City of Thorold's Engineering Procedure and Materials List.
- City of St. Catharine's Engineering Standards Manual, September 2018
- Water Supply for Public Fire Protection, Fire Underwriters Survey, dated 1999.
- Stormwater Management Planning and Design Manual, Ministry of the Environment (MoE), dated March 2003 [SWMPDM]
- Rolling Meadows Secondary Plan, City of Thorold, dated April 2015.
- Low Impact Development Stormwater Management Planning and Design Guide, Toronto and Region Conservation Authority / Credit Valley Conservation, dated 2010 [LID Guide].
- Niagara Peninsula Conservation Authority Stormwater Management Guidelines, dated January 10, 2010.
- Ontario Building Code, Government of Ontario, dated 2013.
- Niagara Region Water-Wastewater Project Design Manual, August 2019
- Erosion & Sediment Control Guideline for Urban Construction, Greater Golden Horseshoe Conservation Authorities, dated 2019 [ESC Guidelines].
- 2016 Water and Wastewater Master Servicing Plan Update, dated June 2017.
- Geotechnical Assessment Report – Thorold Townline Road by McIntosh Perry Consulting Engineers Ltd., dated January 25, 2022.
- Demonstration Site Plan, prepared by Bousfield, dated January 2024.
- Various Background and record Drawings for the adjacent roads and existing development provided by the city.

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2.0 PROPOSED DEVELOPMENT

The proposed Site Plan and updated Draft Plan for the development are shown in **Appendix A**, and include the following:

- 186 single detached residential units
- 417 townhouse residential units
- 11.048 ha of Environmental Protected Area
- 28.43 ha of Developable Area

3.0 GRADING AND STORMWATER DRAINAGE

3.1 EXISTING TOPOGRAPHY

A topographic survey has been completed for the subject lands. It indicates that the Site and the surrounding area are generally flat and naturally slope down toward the northwest. Refer to the Topographic sketch in **Appendix E**.

3.2 PROPOSED GRADING AND DRAINAGE

The Site will be graded such that drainage generally follows the existing flow pattern and ultimately outlet to the stormwater management pond located in the northeast corner of RMS, west of the Hydro One easement. The conceptual grading design, as shown in Figure GR-1, is provided to illustrate how the lands may be graded in compliance with the City's criteria. The proposed Site grading is constrained by the grade of existing/future boundary roads, adjacent development, Hydro One easement, and Environmental Protection area. The North zone will generally be graded down towards the southwest, directing overland flow towards Street A and ultimately outlet to the Stormwater Management Pond located west of Hydro One Easement. The South zone is graded towards the northeast, directing overland flow towards Steen E, which connects UGBP and ultimately outlet to the same pond.

Landscape areas will have slope from 2% to 5% with a maximum slope of 3:1 if required. Roads will have slopes from 0.3% to 8% and driveways will have a maximum slope of 8%. The road grades are also dictated by several factors, including the depth of cover required over top of the sanitary and storm sewers, cut/fill balance calculations for the Site grading, as well as providing major storm overland flow routes through the development to the stormwater outlets.

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Road grades at connections to future Uppers Lane extension are designed to ensure that off-site drainage is generally maintained external to the property, and to maintain internal Site drainage within the property.

Final road, lot, and block grading for the Site will be determined at the detailed design stage as the development approval process is pursued.

External drainage between site and Thorold Townline Road will be collected through temporary storm pipe conveyance system.

4.0 ROAD NETWORK

4.1 EXISTING ROAD NETWORK

The Site is currently not abutting any urbanized roadway; a network of local and collector roads is proposed and being constructed to service the Site.

4.1.1 Road Access

Road access to the North zone will be provided through the extension of Venture Way, an East-West local road which connects RMS and Thorold Townline Road and the second access will be provided through Street A within Upper's Grove Subdivision, a North-South collector which will connect Upper's Lanes and East-West collector road. Road access to the South zone will be provided through extension of Uppers Lane, an East-West collector road which connects RMS and Thorold Townline Road. Secondary access is provided through local roads proposed within UGBP which connects the North and South zones.

4.1.2 Proposed Road Profiles

Preliminary road profiles were established for the Site based on the proposed concept plan for the development. Proposed road grades are designed to meet the City's Municipal Design and Quality Standards. The proposed road grades are designed to match future road and adjacent lot grades at the periphery of the Site. The internal portion of the proposed development is largely determined by maintaining adequate cover over the sanitary and storm services while providing for lot grading that is reasonable from the point of view of home/building construction.

The proposed road profile design will utilize vertical curves to provide for appropriate transitions in road grades in excess of 1.5% for local roads and 1.0% for minor/major collector roads.

Grade changes in various locations throughout the Site are required to provide positive drainage for local services and to address topographic and environmental constraints. The proposed centerline road elevations are illustrated on **Figure GR-1 – Conceptual Grading Plan**.

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4.1.3 Right of Way Cross Sections

Typical civil roadway cross sections for the development, are provided on **Figures TYP-1 Typical Road Sections**, and summarized below:

- 18.0 m RESIDENTIAL LOCAL ROAD [1.5 sidewalk on one/both side]. Streets B to K and M to Q
- 20.0 m RESIDENTIAL MINOR COLLECTOR ROAD [1.5 sidewalk on one/both side]. Streets A and L

5.0 WASTEWATER SERVICING

5.1 EXISTING WASTEWATER SERVICING

There are existing (external) municipal sanitary sewers installed as part of RMS to the west as follows:

- The existing 200mm dia. gravity sanitary sewer draining east to west along Cristallina Drive, which is currently stubbed at 200 m south and 45 m west of the North zone property limit.
- The existing 375mm dia. gravity sanitary sewer draining east to west along Upper's Lane, which is currently stubbed at approximately 510m west of the South zone property limit.

The existing RMS development collects drainage along Barker Parkway which conveys flows north and ultimately west to the existing Peel Street pump station which is part of the Port Weller WWTP's catchment area.

According to the Niagara Region's 2016 Master Servicing Plan, the downstream Peel Street Pumping station (SPS) has an operational capacity 125 L/s. Approximately 167 L/s to 182.16 L/s of the total flows to the SPS are from the Rolling Meadows Secondary Plan Area, which includes the site; therefore, upgrades to the SPS will be required in the future to support growth. Through discussion with the City, work to upgrade the Peel Street Pumping Station, forcemains, and treatment plant, is anticipated in 2027.

5.2 PROPOSED WASTEWATER SERVICING

The proposed development will utilize two sanitary service connection points. The North zone will be serviced via the existing sanitary sewer in Cristallina Drive. The existing sanitary sewer in Cristallina Drive will need to be extended to the east along Cristallina Drive within RMS and North along future Street A within UCBS. The North Zone has a total drainage area of 21.75 ha, which is included in the 27.52 ha drainage area (ID A84a) shown on the overall Rolling Meadows sanitary drainage plan.

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The South zone will be serviced via a future (external) sanitary sewer along Upper's Lane extension. It is our understanding that the City owns the right-of-way for the future Upper's Lane extension. The South Zone has a total drainage area of 6.75 ha and is included in the 10.43 ha drainage area (ID A69a) shown on the overall Rolling Meadows sanitary drainage plan.

Refer to Figure SAN-1 Sanitary Drainage Plan for existing and proposed sanitary sewer layout and drainage area.

A sanitary sewer analysis was completed by Upper Canada consultants for the entire RMS and modified by Counterpoint for UGBP draft plan application. This report further refines Counterpoint's analysis by updating its data to reflect the most current development concept. This design information was provided by the municipality, and we understand that it represents an initial approved design for the early phases of the subdivision and all future external area for the subdivision. The approved sanitary design sheet has been included in Appendix B for reference.

5.2.1 Estimated Sewage Flows

The updated density and flows for the Site have been highlighted on the revised sanitary design sheet, refer to Appendix B. The following design criteria is excerpted from Niagara Region's Water-Waster Project Design manual (Revision 2 – Section 2.4):

- Residential Average Day Demand: 275 litres/capita/day
- Employment Average Day Demand: 275 litres/capita/day
- Harmon's Peaking Factor: Min 2, Max 4
- Extraneous Flow Rate: 0.286 L/s/ha
- Population: 3 cap/unit (per Upper Canada RMS design)

The Site is included in two larger drainage areas, ID A84a and A69a, in the design sheet. The two areas are revised with updated density to represent the proposed development. The total flow within Barker Parkway for the RMS master plan area increases from 162.17 L/s to 169.82 L/s. This represents a total of 7.65 L/s increase to the approved design flows allocated to the trunk sewer. The peak design flow from the secondary plan is generally close to the available 175.75 L/s capacity of the trunk sewer. The majority of the peak design flow is from the future development. At the final build out of the Rolling Meadows Secondary Plan area, the 525mm trunk sewer along Barker Parkway may need to be upsized. To date no capacity concerns have been raised for the proposed development.

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5.2.2 Local Sanitary Servicing

Based on the local Site topography and the proposed grading design, the Site can be serviced by a gravity sanitary sewer system. An internal sanitary sewer system will be designed in accordance with City's and Region's standards to accommodate and convey on-site and off-site flows. Sanitary pipes on Venture Way and Upper's Lane will have to be kept as low as possible to accommodate future development to the east; stubs will be provided at east property limit for future connection.

Refer to **Figure SAN-1 – Sanitary Drainage Plan** for the functional layout of the proposed sanitary design.

5.2.3 Downstream Pumping Station Capacity

The Niagara Region Master Servicing Plan anticipates future growth will trigger infrastructure upgrades to service the full build out of South Thorold. It pointed out that Peel Street Sewage Pumping Station and Port Weller Waster WWTP are one of the priority areas. In addition, the City has inflow and infiltration (I&I) reduction projects currently underway. Continuous coordination with the City and Region should be carried out to ensure the proposed development can be accommodated by municipality's infrastructure.

6.0 WATER SERVICING

6.1 EXISTING WATER SERVICING

According to the Region's Master Servicing Plan, the Site is situated in Zone 227 of Decew Water System. Based on the review of available existing infrastructure plans, the following is a general overview of the existing on-site water supply and distribution system:

- The 300 mm dia. watermain along Venture Way, which is currently stubbed at approximately 85m west of the North zone property limit.
- The existing 200 mm dia. watermain along Upper's Lane, which is currently stubbed at approximately 510m west of the South zone property limit.

There is a proposed (external) municipal watermain in UGBP to the south that would provide connection to the North zone. It is design to be a 200mm dia. watermain along Street A, which would be stubbed at the south property limit of North zone.

These potential watermain connection locations are shown on **Figure WM-1 Water Servicing Plan**.

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6.2 PROPOSED WATER SERVICING

The internal watermain network will connect to the municipal water infrastructure on Venture Way and Street A of UGBP for the North zone. The South zone will be serviced by future extension of watermain on Upper's Lane. The pressure and water modeling results have not been made available to our team. The sizes of the internal watermain will be confirmed at the detailed design stage, once the City's finalized water model data becomes available. Nominal watermain sizes are currently shown on **Figure WM-1 Water Servicing Plan** and will be finalized in subsequent design submissions as the approval process proceeds. Fire protection and metering requirements will be designed for municipal roads and private development blocks in accordance with City and Region standards. Stubs connection to future developments to the east will be provided.

6.2.1 Estimated Water Demands

Background

The Niagara Region 2016 Master Servicing Plan Update confirmed the Decew system has surplus pumping capacity projected to 2041. It also states: "...Thorold does not have sufficient storage capacity; however, there is sufficient conveyance capacity to support the storage deficiencies through transfers from the surplus storage at the Decew Water Treatment Plant High Lift Pumps and Niagara Falls Water System". It is not clear what population growth has been assumed for the Site or the rest of Rolling Meadow. The "actual" available capacities (i.e., supply, storage, pumping, fire etc.) will need to be reviewed and confirmed by the Region.

The Master Plan does indicate a fairly large supply surplus in 2041 which could potentially accommodate the increased demand in the Rolling Meadow development. The Master Plan does not provide sufficient details regarding storage/pumping capacity calculations, so it is not possible to confirm whether there are shortfalls in these areas as well.

The city of Thorold follows City of St. Catharines design criteria, which in turn references MECP design guidelines. The 2998 MECP design guidelines state that governing flows shall be the greater of: a) maximum day demand plus fire flow, or b) maximum hour demand. However, Niagara Region standards states that design flows shall be governed by a minimum of 275 kPa under peak hour demands or a minimum of 140 kPa under simultaneous peak hour and fire flow demands. The Niagara Region guidelines shall be used as it is the more conservative approach.

Domestic Demand

Average daily Demand design flows of 300 L/cap/day and peaking factors of 2 and 4 were used to calculate the residential maximum day and maximum hour demand. A population density of 3 persons/unit were used for both single family dwellings and townhouse units. These values were used to remain consistent with the previous Rolling Meadows Secondary Plan Functional Engineering Report. It is notable that these numbers are a conservative approach as

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town house units typically contain a lower population. The calculated daily demands for the proposed development are as follows:

Residential:

- Average Day Demand = 377 L/min = 542,700 L/day
- Maximum Day Demand = 942 L/min = 1,356,750 L/day
- Peak Hour Demand = 1,413 L/min = 2,035,125 L/day

Refer to Appendix C for supporting water demand calculations.

Fire Demand

The City of Thorold City Wide Water Service Master Plan suggested fire flows are 50 L/s for Single Family -Dead End and 75 L/s for Residential Thorold South. It should be noted that the MECP suggest that the Fire Underwriter's Survey (FUS) guidelines be considered for determining fire flow. As part of the FSR, a simplified fire flow calculation may be used for residential dwellings, not exceeding two stories in height. Using the simplified method, single family homes will require a fire flow of 6000 L/s and contiguous 2 story townhouse building will require a minimum fire flow of 8000 L/min.

As per Niagara Region design standards, the proposed development should provide adequate flow at a minimum pressure of 140 kpa/20 psi to satisfy fire flow plus peak hour demand conditions. This flow equates to 1,413 L/min + 8,000 L/min = 9,413 L/min. Therefore, the proposed watermain system design shall provide a flow of 9,413 L/min at the minimum pressure threshold of 20 psi. Based on the original watermain servicing scheme outlined for the secondary plan area and the adjacent development approved to date, it is assumed that the Spine servicing has capacity to provide adequate water supply to this development. Water pressure testes has not been completed in support of this report.

The watermain along the City of Thorold owned road allowance for Upper's lane will need to be constructed to support the proposed development. In addition, coordination with the adjacent landowner and the City of Thorold will be required to extend the necessary connections from the adjacent lands to the proposed development.

Refer to **Appendix C** for design calculations and supporting documentation.

7.0 STORM SERVICING AND STORMWATER MANAGEMENT

This section describes the applicable design criteria, SWM opportunities and constraints, and the proposed SWM plan. The SWM plan is considered in general accordance with the current

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municipal design requirements of the City of Thorold, Niagara Region, and Niagara Peninsula Conservation Authority (NPCA).

7.1 DESIGN CRITERIA

The adjacent Rolling Meadows development area provides the ultimate servicing and SWM support for the Site. Supporting information taken from the SWS and SWM-2022 reports (as listed in Section 1.0 is included in **Appendix D** for information.

The SWM pond within the Rolling Meadows development area described as 'Pond D' provides the ultimate water quantity control, water quality control, and erosion control for the Site. This pond is to be located within the adjacent Rolling Meadows development area to the east with storm sewer service extended from the pond to the Site boundary. It is understood that the Rolling Meadows Phase 17 design (SWM-2022) proposes that the 'Pond D' facility be relocated from the original location shown with the Rolling Meadows Secondary Plan and described in the SWS. Until potential changes to the location of 'Pond D' are confirmed, it is trusted that the location of 'Pond D' remains as described by the Secondary Plan and the SWS.

The Site drainage conveyance system is based on the dual drainage approach. A minor system as a storm sewer and major system as a surface/overland flow path. The design criteria applied to each system are as described in the 2015 City of St Catharines Engineering Standards Manual (ESM).

Key design criteria applied are:

- The minor drainage system is designed to accommodate the 5-year design storm.
 - The rational method is used to size the storm sewer.
 - Runoff coefficients are applied as per the 2015 City of St Catharines ESM.
 - Pipe size, material, depth, slope, velocity is as per the 2015 City of St Catharines ESM.
 - Pipe location, manhole spacing, and installation is as per the 2015 City of St Catharines ESM.
- The major drainage system is designed to accommodate the 100-year design storm.
- The SWS indicates no requirement for water balance measures to be applied to the Site.

7.1.1 Existing Drainage Paths

It is identified that the drainage paths that traverse the Site are not critical watercourses and that the surface flow paths do not have to be maintained within the Site development plan. The external areas east of the Site, which are currently routed via the existing drainage paths, are proposed to be conveyed through the Site storm system.

7.2 SWM OPPORTUNITES AND CONSTRAINTS

SWM practices for the management of development runoff fall into the categories of water quality, water balance, erosion control and water quantity. Various SWM measures to address

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the above mentioned SWM practices are explored as part of this SWM Report, including source, conveyance, and end of pipe controls. Source and conveyance controls are commonly referenced as Low Impact Development ('LID'). LID is considered a more integrated approach to SWM that looks to maintain the existing hydrology of the site after development by promoting filtration, infiltration, evaporation as well as detaining runoff. It is most effective during the small, frequent rain events that typically make up 90% of the total rainfall events experienced throughout the calendar year. During these events, LID measures absorb a portion of the runoff and treats the 'first flush' of runoff. While LID measures do not remove the need for end of pipe controls like detention ponds or oversized pipes, there can be benefits in water quality treatment and volume reduction (through infiltration).

The following table provides information on various relevant LID measures, considered for implementation as part of the Site improvements.

Table 7.1 – Potential LID Measures

LID Measure	Description	Design Considerations
Bioretention Facility	Bioretention uses the natural properties of soils, plants and associated microbial activity to infiltrate water and remove pollutants from stormwater runoff. They do this through filtration by soil media and uptake by plant roots and reduce runoff volume through evapotranspiration. The practice provides aesthetic benefits and can easily be modified to fit a wide variety of space and drainage contexts. Bioretention can be designed with full (no underdrain), partial (underdrain) or no infiltration (high groundwater).	• Can be integrated with site landscaping. • Footprint is typically 10-20% of the contributing drainage area. • Typical ratio ranges of impervious area to swale area of 5:1 to 10:1. • Location must be relatively flat. • Pre-treatment should be provided to remove sediment and debris. • High groundwater level can limit the use of this measure.
Grass Swales	Grass swales are vegetated open channels designed to convey, treat, and attenuate stormwater runoff.	• Grass swales are effective at removing pollutants assuming the velocities, from the peak flow during a 25 mm 4-hour Chicago storm, are less than 0.5 m/s at a maximum depth of 0.10 m.
Enhanced Grass Swales	Enhanced grass swales are vegetated open channels designed to convey, treat, and attenuate stormwater runoff. Check dams are incorporated into the design to help slow and filter water to enhance sediment removal, soil infiltration and evapotranspiration by plants and grass.	• Footprint is typically 5-15% of the contributing drainage area. • Typical ratio ranges of impervious area to swale area of 5:1 to 10:1.
Bioswales	Bioswales are like enhanced grass swales (vegetated open channels designed to convey, treat, and attenuate stormwater runoff); however, they incorporate an engineered bioretention soil media.	• Typical ratio ranges of impervious area to swale area of 5:1 to 10:1. • Pre-treatment should be provided to remove sediment and debris.

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LID Measure	Description	Design Considerations
Infiltration Rock Trenches	Depending upon the native soil, an underdrain can be incorporated into the design.	• Risk of shallow groundwater contamination, particularly from de-icing agents. • High groundwater level can limit the use of this measure. • Pre-treatment must be provided to remove sediment and debris. • Often used when surface areas not available.
Underground Chambers	Infiltration trenches are excavations lined with geotextile fabric and filled with clean granular stone.	• Risk of shallow groundwater contamination, particularly from de-icing agents. • High groundwater level can limit the use of this measure. • Pre-treatment must be provided to remove sediment and debris. • Often used when surface areas not available. • Able to detain more stormwater runoff than a trench. • Provide both infiltration and detention storage capability.
Perforated Pipe Systems	Underground chambers are typically open bottom storage units that convey stormwater runoff and can provide both retention storage (infiltration) and detention storage. These systems consist of open bottom chambers surrounded by clean aggregate and wrapped with geotextile fabric.	• Risk of shallow groundwater contamination, particularly from de-icing agents. • High groundwater level can limit the use of this measure. • Pre-treatment must be provided to remove sediment and debris. • Design and construction costs may be significant.
Soil Support Systems	Perforated pipe systems are long infiltration trenches, that are designed for both conveyance and infiltration of stormwater runoff. They are underground stormwater conveyance systems designed to attenuate runoff volume and thereby, reduce contaminant loads to receiving waters.	• The near-surface layers remain uncompacted and void ratios remain high making the near surface layers useful for stormwater detention and infiltration. • Provide suitable soil conditions for large tree growth.
Catch Basin Controls	Soil Support Systems are modular support systems that provide a sturdy and permeable ground level decking that transfers surface loads to a compacted subbase 0.4 – 1.1 m below grade without compacting the near-surface soil layers.	• Can be used in any catch basin. • Are maintained in the same manner and frequency as normal catch basins.
Amended Topsoil	Catch basin controls are devices to prevent floatable debris and sediments from entering the storm sewer and consist of covers, geotextile fabrics, or inserts	• Suitable for use within a roadway boulevard.

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End-of-Pipe controls are implemented at the end of the major/minor collection system. These types of facilities typically include:

- **Wet Pond:** Designed to provide quality treatment through settling of suspended solids into the forebay (typically 1.0 to 1.5 m deep) and permanent pool of the main pond area (typically 1.5 m to 3.0 m deep). The active storage component offers extended detention and quantity control.
- **Engineered Wetland:** Designed to provide quality treatment through settling of suspended solids into the forebay (typically 1 m deep) and shallow permanent pool (typically 0.15 m to 0.3 m deep). The active storage component offers extended detention and quantity control.
- **Dry Pond:** Provide some quality treatment through detention time, and primarily provide extended detention and quantity control within the active storage component. Dry ponds, with proper pre-treatment, can also be designed as surface infiltration facilities or soakaways to help to achieve water balance/erosion control targets.
- **Manufactured Treatment Device (Oil-Grit Separator or Filter):** Prefabricated infrastructure units designed to settle suspended solids. Typical units designed for suspended solids are generally less effective at nutrient removal. However, some types of units are specifically designed for nutrient removal. These devices are generally acceptable for use as a pre-treatment system or as a component in a treatment train approach to address water quality.
- **Oversized Pipe:** Pre-manufactured pipe are oversized and equipped with orifices in the system to create pipe storage. Oversized pipes are generally used for small or isolated project areas which lack sufficient surface space to construct detention facilities. Pipe slopes are kept to a minimum to increase the amount of storage available within the pipe. Oversized pipes provide only marginal water quality benefits as some of the coarse sediment may settle.

7.2.1 Selected SWM Measures

On review of the various LID/SWM measures and end-of-pipe controls, the following LID/SWM measures are considered appropriate for the Site.

- Wet Pond

The ultimate Rolling Meadows 'Pond D' wet pond facility provides the ultimate water quantity control, water quality control, and erosion control for the Site.

7.3 EXISTING STORM SYSTEM

The Site is vacant of existing development and is currently farmed. There is no permanent existing storm system within the Site boundary. The temporary wet pond supporting the Upper's Grove Subdivision is within the Upper's Lane Subdivision boundary. The temporary wet pond is to be decommissioned as part of the Upper's Lane Subdivision.

For the southern portion of the Site (south of the wood lot and north of Uppers Lane), the adjacent Thorold 1 development provides the supporting storm sewer connection and major system overland flow route. The Upper's Grove Subdivision storm system is routed

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through the northwest portion of Upper's Lane Subdivision and into the adjacent Rolling Meadows system described previously.

7.4 DRAINAGE AREAS AND GRADING

The existing drainage area covering the site is generally represented by the figures taken from the SWS and SWM-2022 reports which are included in **Appendix D.1**. As described in the SWM-2022 report, changes to the existing drainage areas varied from 2006 to 2022 based on drainage ditch construction activity within the Rolling Meadows area.

Proposed connections to existing roads are designed to ensure that off-site drainage is generally maintained external to the property, and to maintain internal Site drainage within the property. Refer to **Figure 4 – Functional Grading Plan**.

Landscape areas will have slope from 2% to 5% with a maximum slope of 3;1 if required. Roads will have slopes from 0.5% to 5% except for driveways, which will have a maximum slope of 7%. The road grades are also dictated by several factors including the depth of cover required over top of the sanitary and storm sewers, cut/fill balance calculations for the Site grading, as well as providing major storm overland flow routes through the development to the Rolling Meadows 'Pond D'.

The resultant drainage areas are illustrated on **Figure 3 – Proposed Storm Drainage Catchments Plan**. The existing drainage pattern through the wood lot being retained is intercepted by the storm system along the associated downstream boundary with Upper's Grove Subdivision and Upper's Lane Subdivision. This maintains the existing drainage pattern for the wood lot and no negative impact on the wood lot is anticipated.

The proposed storm catchments also consider the employment land area between the Site and the Thorold Town Line Road. Despite the existing drainage area boundary, the associated property boundaries are considered in anticipation of a post-development scheme. It is noted that modifications to the existing elevations may be required at the boundary limits of the adjacent future employment lands area to establish the post-development drainage pattern considered. The future detailed design of the employment lands may modify the accommodated post-development drainage pattern as needed.

The drainage areas considered are generally consistent with the conditions anticipated with the SWS and SWM-2022 reports. Coordination is ongoing with the Rolling Meadows development to ensure the ultimate 'Pond D' design supports the full drainage area

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7.5 PROPOSED STORM SYSTEM

As per the City of Thorold standards, storm sewers within the Site are sized to capture and convey runoff for storm events up to and including the 5-year design storm (minor storm). The storm sewers will then direct runoff to the Rolling Meadows 'Pond D' SWM facility. Refer to **Figure STM-1 – Functional Storm Servicing Plan** for details.

Flows in excess of the 5-year storm event (100-year major storm) will be routed overland within the ROW and other designated overland flow routes. Refer to **Figure GR-1 – Preliminary Grading Plan**.

7.6 STORMWATER MANAGEMENT FACILITIES

As noted previously, the adjacent Rolling Meadows development area provides the ultimate servicing and SWM support for the Site.

The SWM pond within the Rolling Meadows development area described as 'Pond D' provides the ultimate water quantity control, water quality control, and erosion control for the Site.

Should the development of Upper's Lane Subdivision proceed prior to 'Pond D' within Rolling Meadows being available, a temporary pond option within the Upper's Lane Subdivision boundary will be considered. Details associated with a temporary pond will only be provided should the need arise.

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8.0 FUTURE DEVELOPMENT

As mentioned through out the report, the subject site will be dependent on future servicing to be completed by adjacent landowners and/or front-ended and built through adjacent future development lands. The phasing and construction of the Site and the servicing within the ROWs of future development areas will need to be coordinated with the adjacent landowners with respect to both design, timing, and cost sharing during the detailed design stage. Key services to be coordinated with future development proposals are summarized as follows:

- Venture Way extension within RMS to the North zone for watermain and storm connection.
- Pond D of RMS as outlined in the master servicing plan for the secondary plan area for stormwater management.
- Cristallina Drive extension to UGBP and Street A extension within UGBP for sanitary connection.
- Extension of Uppers Lane will be required to service the South zone for sanitary and watermain.

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9.0 UTILITIES

9.1 EXISTING UTILITIES

Based on available existing servicing data, the adjacent Rolling Meadows Subdivision phases are serviced by electrical, natural gas, and telecom services.

9.2 PROPOSED UTILITIES SERVICING

Adjacent Rolling Meadows Subdivision includes existing facilities for many utilities such as Gas, Hydro, phone and cable. The proposed Site will receive servicing from extension of existing utilities by respective utility companies. Utility companies will determine specific requirements through the standard application, review and design process.

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10.0 EROSION AND SEDIMENT CONTROL

Prior to the initiation of any construction within the Site, a comprehensive Erosion and Sediment Control program acceptable to the City of Thorold, the Niagara Region, and the NPCA will be implemented. Appropriate drawings will be prepared at the detailed design stage and submitted to the agencies for review and approval.

An ESC plan will include all necessary siltation control facilities and will be designed in accordance with current City and NPCA guidelines. The following principles are excerpted from the guideline:

- Adopt a multi-barrier approach to provide erosion and sediment control through erosion control s first,
- Retain existing vegetation and stabilize exposed soils with vegetation where possible, erosion prevention is key in reducing sediment to downstream aquatic habitat,
- Limit the duration of soil exposure and phase construction when possible,
- Limit the size of disturbed areas by minimizing nonessential clearing and grading,
- Minimize slope length and gradient of disturbed areas,
- Maintain overland sheet flow and avoid concentrated flows,
- Store/stockpile soil away (e.g. greater than 15 meters) from watercourses, drainage features and top of steep slopes,
- Ensure contractors and all involved in ESC practices are trained in ESC Plan implementation, inspections, maintenance and repairs,
- Adjust ESC Plan at construction site to adapt to site features, and
- Assess all ESC practices before and after all rainfall and significant snowmelt events.

Below is a list of included erosion and sediment control measures that will be outlined during the construction of the Site:

- Temporary sediment control fences shall be installed prior to commencing grading or topsoil stripping activities.
- Temporary mud tracking and dust control measures at construction entrance.
- Install temporary swales with rock check dams as required.
- Surface runoff controlled through temporary swales throughout the Site along with rock check dams.

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- Temporary sediment traps to reduce the release of sediment from the Site.
- Stabilize all disturbed area as soon as possible to minimize erosion.
- Stabilization of slopes greater than 5:1 using suitable method e.g., erosion control mats, tackifier and seeds, etc. as soon as possible.

All temporary erosion and sediment control measures will be routinely inspected and repaired during construction. Temporary controls will not be removed until the areas they serve are restored and stable.

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11.0 CONCLUSION AND RECOMMENDATIONS

Based on the findings of this report, the following conclusions are provided:

GENERAL:

- The Upper's Lane Subdivision is located in the City of Thorold, within the Rolling Meadows Secondary Plan. The current development Concept Plan is included in **Appendix A**.
- The Site's developable area is dissected into North zone and South zone by an Environmental Protected area.
- Detailed design of the development will follow in subsequent design submissions as the approval process proceeds.
- Several proposed service and extension of existing service projects need to be completed before the Site can be developed.

SITE GRADING:

- The topography of the site and surrounding area is generally flat and naturally slopes down towards northwest.
- A preliminary Site Grading Plan has been prepared to meet typical development standards, provide flood protection, maintain existing drainage patterns and protect local ecosystems during construction.

ROAD NETWORKS:

- The Site can be accessed via extension of existing roadway such as Venture Way and Upper's Lane. Secondary access will be provided through local roads proposed within UGBP.
- Each development block and housing unit will have at least one access from the internal road network.
- All internal roads can accommodate public and private utilities.
- Streets within the proposed development will be constructed according to the City's design standards, where applicable.

WASTEWATER SERVICING:

- The internal sanitary sewer system is designed such that all sewage flows from proposed and external development will be directed towards the Peel Street SPS via a gravity based sanitary trunk sewer.
- The proposed sanitary pipe within UGBP and connection to existing sanitary pipe on Cristallina need to be completed to service the North zone.

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- The existing sanitary sewer in Upper's Lane needs to be extended by approximately 510m to the east to service the South zone.
- The external sanitary sewers have been designed to accommodate the design flows from the Site. To date, no capacity concerns have been raised for the proposed development. However, the capacity of the downstream infrastructures should be assessed as the Rolling Meadow's master plan area approaches full build out.

WATER SERVICING:

- The Site can be serviced with domestic and fire water supply and distribution using conventional municipal engineering practices and compliance with City and Region Standards. This can be achieved by extension of and connection to the City's existing water distribution system.
- Individual PRVs may be required for any lots where service pressures exceed 550 kPa as required by the Ontario Building Code. This will be evaluated during future design submissions.
- It is critical that the City's and neighbor landowner's watermain extension project be completed in order to provide adequate domestic and fire demand to the development.
- Nominal watermain sizing has been provided at this phase and will be updated once the water model analysis is completed for the development.

STORM SERVICING AND STORMWATER MANAGEMENT:

- The Site can be adequately serviced with storm drainage using conventional municipal engineering practices and general compliance to Municipal Standards.
- Storm drainage areas of the Site will match proposed grading plans and can be serviced by a gravity storm sewer system.
- The SWS indicates no requirement for water balance measures to be applied to the Site.
- The SWM pond within the Rolling Meadows development area described as 'Pond D' provides the ultimate water quantity control, water quality control, and erosion control for the Site.

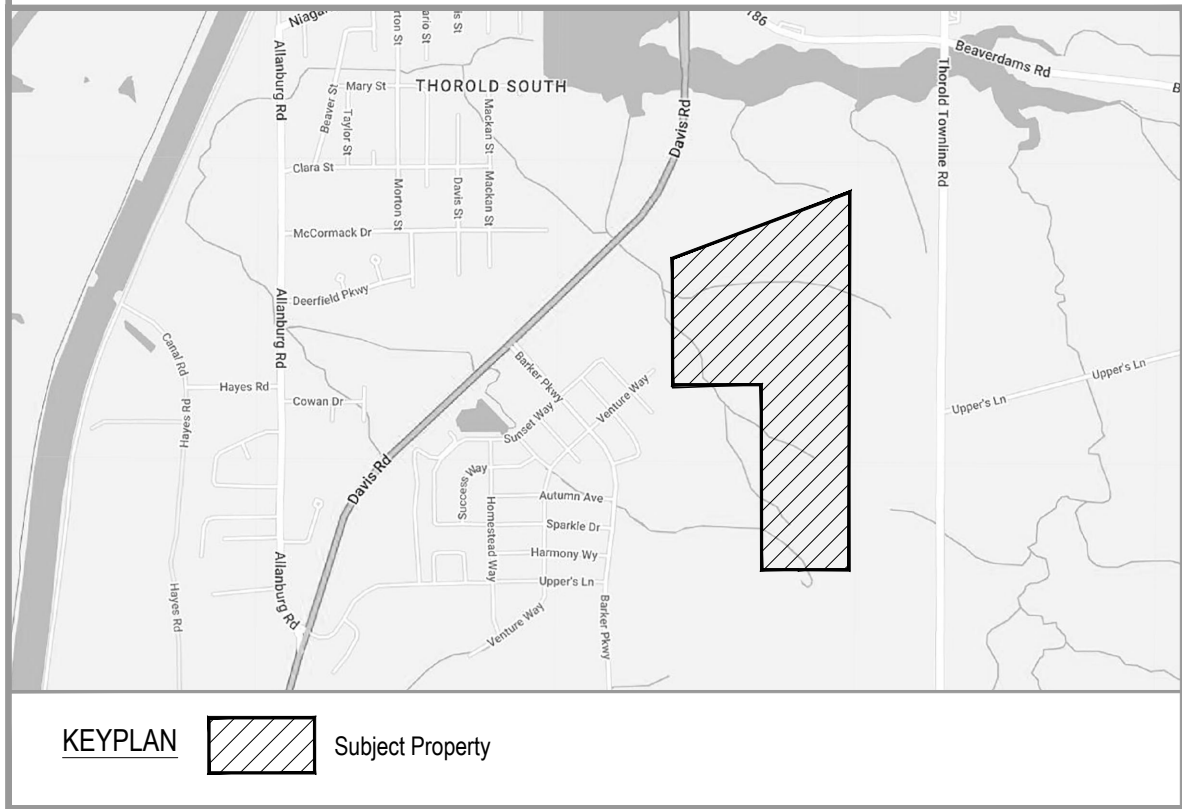
February 2, 2024

Appendix A DRAFT PLAN/CONCEPT PLAN

AREA TABLE			22219 - 35dp	January 3, 2024
Residential Singles	Lots 1-17	0.832	ha±	
Townhouses	Blocks 18-32	1.992		
Residential Development	Blocks 33-39	22.181		
Park	Block 40	1.400		
Natural Heritage Area	Blocks 41-42	11.048		
Pipeline	Block 43	0.208		
Temporary Turnaround	Block 44	0.083		
Roads		2.098		
Total		39.842	ha±	

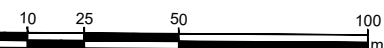
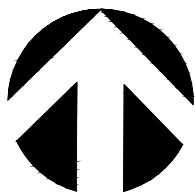
ROADS		
20.0m R.O.W.	2,796 m	1.350
18.0m R.O.W.	404 m	0.748
Total		2.098 ha

UNIT COUNT		
12.8 m Singles (42')	A	1
11.6 m Singles (38')	B	4
10.7 m Singles (35')	C	12
8.2m Bungalow Townhouse (27')	BTH	23
7.6m On St. Townhouse (25')	OSTH	18
6.1m On St. Townhouse (20')	OSTH	29
Residential Development		516
Total		603 u



LEGEND
- - - - - Subject Property

NOTES
All dimensions are in metres.
All area measurements are computer generated.
All elevations refer to Geodetic Datum.



**ADDITIONAL INFORMATION
REQUIRED UNDER SECTION 51(17)
OF THE PLANNING ACT**

- A, B, E, F, G, J, L - As Shown on Plan
C. This represents the Applicant's entire holding of undeveloped land in the vicinity.
D. Residential Singles, Bungalow Townhouses, On-Street Townhouses, Residential Development Blocks, Park, Natural Heritage Area, Pipeline Block, Future Road Block and Roads .
H. Piped water to be provided.
I. Clay loam soil.
K. Sanitary & storm sewers to be provided.

SURVEYOR'S CERTIFICATE

I certify that: the boundaries of the lands to be subdivided and their relationship to the adjacent lands are correctly shown.

Grant Bennett, O.L.S.
Ontario Land Surveyors

OWNER'S AUTHORIZATION

I/we, 1000352619 Ontario Inc.
being the registered owner(s) of the subject lands hereby authorize BOUSFIELDS INC. to prepare and submit a draft plan of subdivision for approval.

**DRAFT PLAN OF
PROPOSED SUBDIVISION
PART OF LOT 67 AND
PART OF ROAD ALLOWANCE
BETWEEN 67 AND 68
(GEOGRAPHIC TOWNSHIP OF THOROLD)**

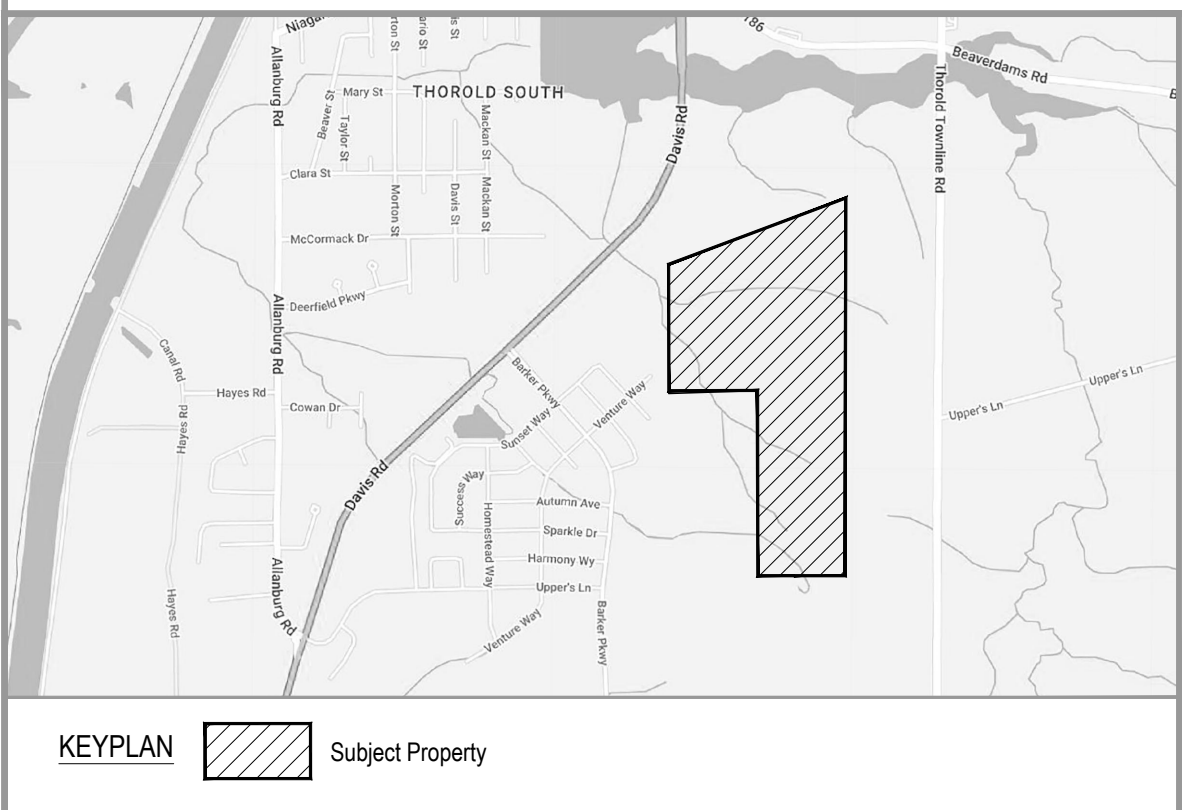
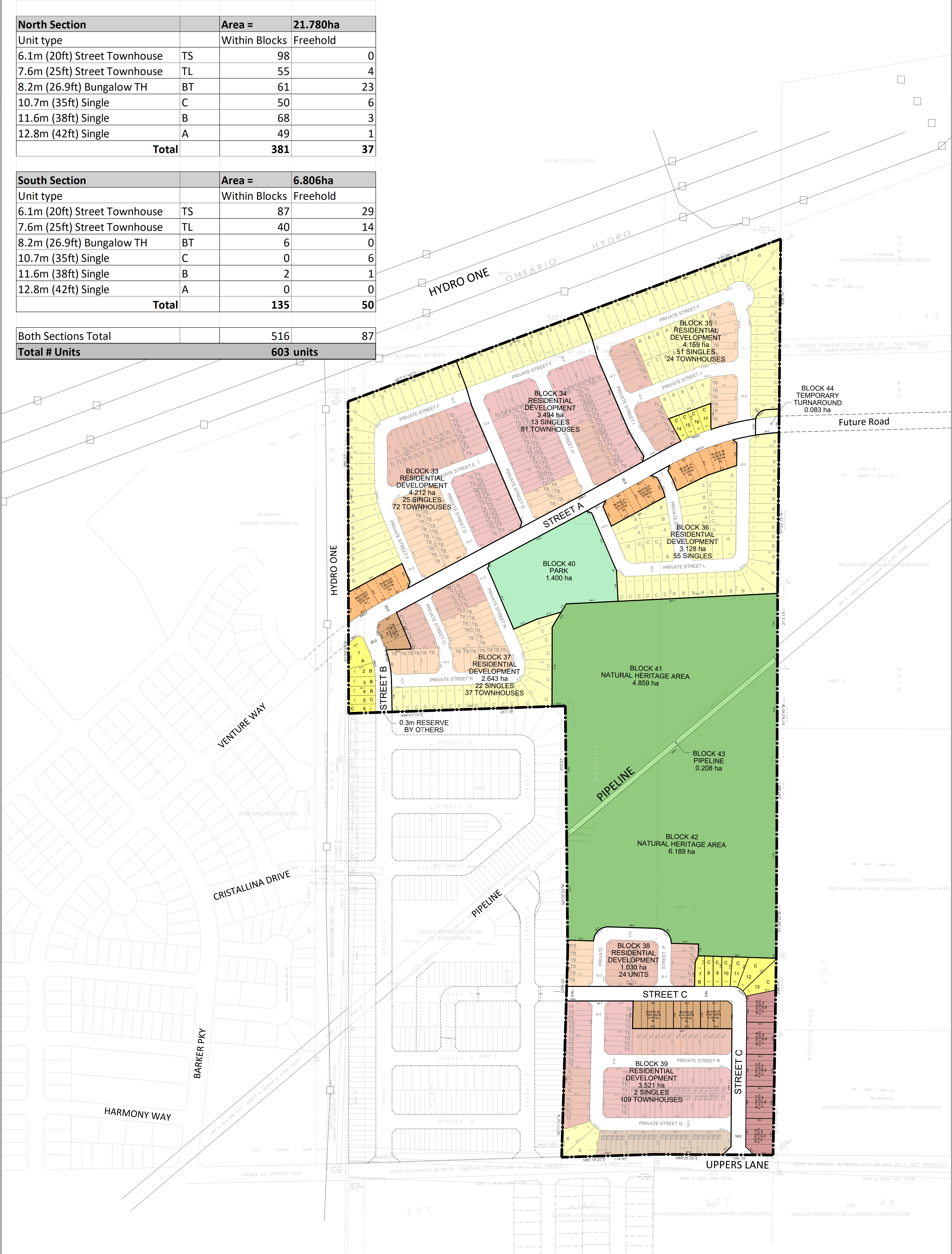
CITY OF THOROLD
REGIONAL MUNICIPALITY OF NIAGARA



North Section		Area =	21.780ha
Unit type		Within Blocks	Freehold
6.1m (20ft) Street Townhouse	TS	98	0
7.6m (25ft) Street Townhouse	TL	55	4
8.2m (26.9ft) Bungalow TH	BT	61	23
10.7m (35ft) Single	C	50	6
11.6m (38ft) Single	B	68	3
12.8m (42ft) Single	A	49	1
Total		381	37

South Section		Area =	6.806ha
Unit type		Within Blocks	Freehold
6.1m (20ft) Street Townhouse	TS	87	29
7.6m (25ft) Street Townhouse	TL	40	14
8.2m (26.9ft) Bungalow TH	BT	6	0
10.7m (35ft) Single	C	0	6
11.6m (38ft) Single	B	2	1
12.8m (42ft) Single	A	0	0
Total		135	50

Both Sections Total		516	87
Total # Units		603 units	



Upper's Lane

LEGEND

Subject Property

NOTES

All dimensions are in metres.
All area measurements are computer generated.
All elevations refer to Geodetic Datum.

BOUSFIELDS INC.
3 Church Street, Suite 200
Toronto, Ontario M5E 1M2
P (416) 947-9744
F (416) 947-0781

1 : 2000

January 3, 2024

22219 - 36cp

February 2, 2024

Appendix B DESIGN – WASTEWATER

Project No: 160623094
Project Name: Upper's Lane Subdivision
Municipality: City of Thorold
Date: February 2024

Prepared By: PH
Revised By: SAK
Last Revised: Feb 2024

WASTEWATER CALCULATION - Singles and Townhouses

Site Area= 21.610 ha

Residential Unit Breakdown

No. of Single Residential Units	177
Population Density	3
Total Population =	531
No. of Townhouse Residential Units	241
Population Density	3
Total Population =	723
Netl Population =	1254

Avg Daily Demand (Dry Weather) = 275 litre/cap/day

*** (based on Niagara Region Master Plan Volume 2 – Section 8.2.2)

Residential Avg Daily Demand (Dry Weather)= 344850 litre/day
3.99 litre/sec

Residential Peaking factor = 3.73

*** (based on Region of Niagara Design Manual Section C1.2.1)

Peaked Residential Flow (Dry Weather) = 14.91 litre/sec

Wet Weather Allowance

Total Peak Flow (Dry Weather) = 14.91 litre/sec

Infiltration Rate = 0.286 litre/sec/ha
total Infiltration Allowance = 6.180 litre/sec

*** (based on Niagara Region Design Manual Section C1.2.1)

Total Design Flow

Total Wastewater Flow= 21.09 litre/sec

Project No: 160623094
Project Name: Upper's Lane Subdivision
Municipality: City of Thorold
Date: February 2024

Prepared By: PH
Revised By: SAK
Last Revised: Feb 2024

WASTEWATER CALCULATION - Singles and Townhouses

Site Area= 6.750 ha

Residential Unit Breakdown

No. of Single Residential Units	9
Population Density	3
Total Population =	27
No. of Townhouse Residential Units	176
Population Density	3
Total Population =	528
Netl Population =	555

Avg Daily Demand (Dry Weather) = 275 litre/cap/day

*** (based on Niagara Region Master Plan Volume 2 – Section 8.2.2)

Residential Avg Daily Demand (Dry Weather)= 152625 litre/day
1.77 litre/sec

Residential Peaking factor = 3.95

*** (based on Region of Niagara Design Manual Section C1.2.1)

Peaked Residential Flow (Dry Weather) = 6.98 litre/sec

Wet Weather Allowance

Total Peak Flow (Dry Weather) = 6.98 litre/sec

Infiltration Rate = 0.286 litre/sec/ha
total Infiltration Allowance = 1.931 litre/sec

*** (based on Niagara Region Design Manual Section C1.2.1)

Total Design Flow

Total Wastewater Flow= 8.91 litre/sec

UPPER CANADA CONSULTANTS 1-261 MARTINDALE RD ST.CATHARINES, ONTARIO, L2W 1A1 DESIGN FLOWS																DESIGN: J. SCHOOLEY DATE: DECEMBER 2010									
RESIDENTIAL				340 L/Capita/Day (AVERAGE DAILY FLOW)								COMMERCIAL ##### L/ha/Day (AVERAGE DAILY FLOW)				COMMERCIAL & INSTITUTIONAL PEAK				1.5					
INFILTRATION RATE				0.18 L/s/Hectare (MOE FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28								INDUSTRIAL ##### L/ha/Day (AVERAGE DAILY FLOW)													
POPULATION PER UNIT				3								INSTITUTIONAL ##### L/ha/Day (AVERAGE DAILY FLOW)													
MUNICIPALITY: CITY OF THOROLD																SANITARY SEWER DESIGN SHEET									
PROJECT: ROLLING MEADOWS (PHASE 1)																									
PROJECT NO.: 0695																									
MANHOLES				AREA (hectares)								POPULATION				ACCUMULATED PEAK FLOW				DESIGN FLOW					
DRAINAGE AREA ID	DESCRIPTION	FROM M.H.	TO M.H.	RESIDENTIAL		COMM.		INDUST.		INST.	INCR	ACCUM	p.p.ha.	RES.POF	RES.	PEAK.	RESID.	C+I+I	INFILT.	TOTAL	DIA.	SLOPE (m/s)	VEL. (L/s)	CAP. 'APACIT'	PERCENT FULL FLOW
				INCR	ACCUM	INCR	ACCUM	INCR	ACCUM					DENS.	POP.	FACT.	FLOW	FLOW	FLOW	EAK FLOW	PIPE				
A1	SUNSET WAY	A	B	0.73	0.73								53.4	39	39	4.50	0.69	0.00	0.13	0.82	200	1.00	1.06	34.23	2.4%
A2	SUNSET WAY	B	C	0.70	1.43								72.9	51	90	4.50	1.59	0.00	0.26	1.85	200	0.40	0.67	21.65	8.6%
A3	SUNSET WAY	C	D	0.42	1.85								57.1	24	114	4.50	2.02	0.00	0.33	2.35	200	1.00	1.06	34.23	6.9%
A4	SUNSET WAY	D	E	1.05	2.90								28.6	30	144	4.50	2.55	0.00	0.52	3.07	200	1.35	1.23	39.77	7.7%
A5	SUNSET WAY	E	F	0.37	3.27								73.0	27	171	4.50	3.03	0.00	0.59	3.62	200	2.00	1.49	48.41	7.5%
A6	SUNSET WAY	F	G	0.31	3.58								29.0	9	180	4.50	3.19	0.00	0.64	3.83	200	1.30	1.20	39.03	9.8%
A7	SUNSET WAY	G	H	0.21	3.79								28.6	6	186	4.50	3.29	0.00	0.68	3.98	200	0.40	0.67	21.65	18.4%
A8	SUNSET WAY	H	AG	0.40	4.19								30.0	12	198	4.50	3.51	0.00	0.75	4.26	200	0.40	0.67	21.65	19.7%
A11	SUNSET WAY	J	L	0.40	0.40								52.5	21	21	4.50	0.37	0.00	0.07	0.44	200	0.80	0.94	30.62	1.4%
A12	HOMESTEAD WAY	K	L	0.40	0.40								45.0	18	18	4.50	0.32	0.00	0.07	0.39	200	1.00	1.06	34.23	1.1%
A13	SPARKLE DRIVE	L	M	0.68	1.48								48.5	33	72	4.50	1.28	0.00	0.27	1.54	200	2.00	1.49	48.41	3.2%
A14	SPARKLE DRIVE	M	N	0.35	1.83								42.9	15	87	4.50	1.54	0.00	0.33	1.87	200	0.75	0.91	29.64	6.3%
A15	FUT STREET	AX	CC	0.78	0.78								50.0	39	39	4.50	0.69	0.00	0.14	0.83	200	1.00	1.06	34.23	2.4%
A16	FUT STREET	AZ	CC	0.56	0.56								42.9	24	24	4.50	0.43	0.00	0.10	0.53	200	1.00	1.06	34.23	1.5%
A17	FUT STREET	CC	CE	0.28	1.62								32.1	9	72	4.50	1.28	0.00	0.29	1.57	200	0.40	0.67	21.65	7.2%
A18	UPPER LANE	CD	CE	0.22	0.22								27.3	6	6	4.50	0.11	0.00	0.04	0.15	200	1.00	1.06	34.23	0.4%
A19	UPPER LANE	CE	CF	0.44	2.28								40.9	18	96	4.50	1.70	0.00	0.41	2.11	200	0.40	0.67	21.65	9.7%
A20	UPPER LANE	CF	CG	0.30	2.58								30.0	9	105	4.50	1.86	0.00	0.46	2.32	200	0.40	0.67	21.65	10.7%
A21	UPPER LANE	CG	CH	0.45	3.03								40.0	18	123	4.50	2.18	0.00	0.55	2.72	200	0.40	0.67	21.65	12.6%
A22	UPPER LANE	CH	CI	0.45	3.48								40.0	18	141	4.50	2.50	0.00	0.63	3.12	200	0.40	0.67	21.65	14.4%
A23	VENTURE WAY	CI	AV	0.73	4.21								32.9	24	165	4.50	2.92	0.00	0.76	3.68	250	0.30	0.67	33.99	10.8%
A24	HOMESTEAD WAY	AS	AT	0.39	0.39								69.2	27	27	4.50	0.48	0.00	0.07	0.55	200	1.00	1.06	34.23	1.6%
A25	APARTMENT	STUB	AT	2.42	2.42								209.9	508	508	4.50	9.00	0.00	0.44	9.43	200	0.40	0.67	21.65	43.6%
A26	HARMONY WAY	AT	AU	0.57	3.38								78.9	45	580	4.50	10.27	0.00	0.61	10.88	200	0.40	0.67	21.65	50.3%
A27	HARMONY WAY	AU	AV	0.34	3.72								61.8	21	601	4.50	10.64	0.00	0.67	11.31	200	0.40	0.67	21.65	52.3%
A28	VENTURE WAY	AV	N	0.67	8.60								35.8	24	790	4.50	13.99	0.00	1.55	15.54	250	0.30	0.67	33.99	45.7%
A29	VENTURE WAY	N	Q	0.67	11.10								35.8	24	901	4.50	15.96	0.00	2.00	17.95	250	0.30	0.67	33.99	52.8%
A30	HOMESTEAD WAY	O	K	0.20	0.20								45.0	9	9	4.50	0.16	0.00	0.04	0.20	200	1.00	1.06	34.23	0.6%
A31	AUTUMN AVENUE	K	P	0.40	0.60								45.0	18	27	4.50	0.48	0.00	0.11	0.59	200	3.25	1.90	61.71	0.9%
A32	AUTUMN AVENUE	P	Q	0.72	1.32								41.7	30	57	4.50	1.01	0.00	0.24	1.25	200	0.40	0.67	21.65	5.8%
A33	VENTURE WAY	Q	R	0.13	12.55								23.1	3	961	4.50	17.02	0.00	2.26	19.28	250	0.30	0.67	33.99	56.7%
A34	VENTURE WAY	R	AB	0.18	12.73								33.3	6	967	4.50	17.12	0.00	2.29	19.42	250	0.30	0.67	33.99	57.1%
A9	SUNSET WAY	A	J	0.53	0.53								50.9	27	27	4.50	0.48	0.00	0.10	0.57	200	1.00	1.06	34.23	1.7%
A10	SUCCESS AVENUE	J	I	0.41	0.94								51.2	21	48	4.50	0.85	0.00	0.17	1.02	200	0.40	0.67	21.65	4.7%
A35	SUCCESS AVENUE	I	S	0.51	1.45								52.9	27	75	4.50	1.33	0.00	0.26	1.59	200	0.40	0.67	21.65	7.3%
A36	SUCCESS AVENUE	S	T	0.28	1.73								42.9	12	87	4.50	1.54	0.00	0.31	1.85	200	0.40	0.67	21.65	8.6%
A37	SUCCESS AVENUE	T	U	0.34	2.07								44.1	15	102	4.50	1.81	0.00	0.37	2.18	200	0.40	0.67	21.65	10.1%

UPPER CANADA CONSULTANTS 1-261 MARTINDALE RD ST.CATHARINES, ONTARIO, L2W 1A1 DESIGN FLOWS																		DESIGN: J. SCHOOLEY DATE: DECEMBER 2010									
RESIDENTIAL				340 L/Capita/Day (AVERAGE DAILY FLOW)										COMMERCIAL ##### L/ha/Day (AVERAGE DAILY FLOW)				COMMERCIAL & INSTITUTIONAL PEAK				1.5					
INFILTRATION RATE				0.18 L/s/Hectare (MOE FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28										INDUSTRIAL ##### L/ha/Day (AVERAGE DAILY FLOW)													
POPULATION PER UNIT				3										INSTITUTIONAL ##### L/ha/Day (AVERAGE DAILY FLOW)													
MUNICIPALITY: CITY OF THOROLD																		SANITARY SEWER DESIGN SHEET									
PROJECT: ROLLING MEADOWS (PHASE 1)																											
PROJECT NO.: 0695																											
MANHOLES				AREA (hectares)								POPULATION				ACCUMULATED PEAK FLOW						DESIGN FLOW					
DRAINAGE		FROM	TO	RESIDENTIAL		COMM.		INDUST.		INST.		RES.POF	RES.	PEAK.	RESID.	C+I+I	INFILT.	TOTAL	DIA.								
AREA ID	DESCRIPTION	M.H.	M.H.	INCR	ACCUM	INCR	ACCUM	INCR	ACCUM	PEAKING	INCR	ACCUM	p.p.ha.	DENS.	POP.	FACT.	FLOW	FLOW	FLOW	EAK FLOW	PIPE	SLOPE	VEL.	CAP.	FULL		
																					(%)	(m/s)	(L/s)	'APACIT'	FLOW		
A38	SUCCESS AVENUE	U	V	0.40	2.47								37.5	15	117	4.50	2.07	0.00	0.44	2.52	200	0.40	0.67	21.65	11.6%		
A39	SUCCESS AVENUE	V	W	0.66	3.13								45.5	30	147	4.50	2.60	0.00	0.56	3.17	200	0.50	0.75	24.20	13.1%		
A40	SUCCESS AVENUE	W	X	0.25	3.38								36.0	9	156	4.50	2.76	0.00	0.61	3.37	200	3.00	1.83	59.29	5.7%		
A41	SUCCESS AVENUE	X	Z	0.13	3.51								23.1	3	159	4.50	2.82	0.00	0.63	3.45	200	3.00	1.83	59.29	5.8%		
A42	GOLDRICH AVENUE	Y	Z	0.19	0.19								47.4	9	9	4.50	0.16	0.00	0.03	0.19	200	1.40	1.25	40.50	0.5%		
A43	GOLDRICH AVENUE	Z	AA	0.29	3.99								41.4	12	180	4.50	3.19	0.00	0.72	3.91	200	0.40	0.67	21.65	18.0%		
A44	GOLDRICH AVENUE	AA	AB	0.19	4.18								31.6	6	186	4.50	3.29	0.00	0.75	4.05	200	0.40	0.67	21.65	18.7%		
A45	VENTURE WAY	AB	AC	0.18	17.09								33.3	6	1159	4.50	20.52	0.00	3.08	23.60	250	0.30	0.67	33.99	69.4%		
A46	VENTURE WAY	AC	AE	0.19	17.28								31.6	6	1165	4.50	20.63	0.00	3.11	23.74	250	0.30	0.67	33.99	69.8%		
A47	VINEGOLD CRT.	AD	AE	0.82	0.82								29.3	24	24	4.50	0.43	0.00	0.15	0.57	200	1.00	1.06	34.23	1.7%		
A48	MIRACLE WAY	AE	AF	0.55	18.65								43.6	24	1213	4.50	21.48	0.00	3.36	24.84	250	0.30	0.67	33.99	73.1%		
A49	MIRACLE WAY	AF	AG	0.28	18.93								42.9	12	1225	4.50	21.69	0.00	3.41	25.10	250	0.30	0.67	33.99	73.8%		
A50	SUNSET WAY	AG	AH	0.37	23.49								32.4	12	1435	4.50	25.41	0.00	4.23	29.64	250	0.30	0.67	33.99	87.2%		
A51	FUT STREET	AX	AY	0.64	0.64								51.6	33	33	4.50	0.58	0.00	0.12	0.70	200	1.00	1.06	34.23	2.0%		
A52	STREET 27	AW	AY	0.92	0.92								52.2	48	48	4.50	0.85	0.00	0.17	1.02	200	1.00	1.06	34.23	3.0%		
A53	STREET 27	AY	BB	0.43	1.99								48.8	21	102	4.50	1.81	0.00	0.36	2.16	200	0.40	0.67	21.65	10.0%		
A54	FUT STREET	AZ	BA	0.55	0.55								49.1	27	27	4.50	0.48	0.00	0.10	0.58	200	1.00	1.06	34.23	1.7%		
A55	FUT STREET	BA	BB	0.45	1.00								46.7	21	48	4.50	0.85	0.00	0.18	1.03	200	0.40	0.67	21.65	4.8%		
A56	STREET 27	BB	BF	0.43	3.42								20.9	9	159	4.50	2.82	0.00	0.62	3.43	200	0.40	0.67	21.65	15.8%		
A57	STREET 26	BC	BD	0.42	0.42								57.1	24	24	4.50	0.43	0.00	0.08	0.50	200	1.00	1.06	34.23	1.5%		
A58	STREET 26	BD	BE	0.45	0.87								60.0	27	51	4.50	0.90	0.00	0.16	1.06	200	0.40	0.67	21.65	4.9%		
A59	STREET 26	BE	BF	0.32	1.19								46.9	15	66	4.50	1.17	0.00	0.21	1.38	200	0.40	0.67	21.65	6.4%		
A60	STREET 27	BF	BH	0.43	5.04								41.9	18	243	4.50	4.30	0.00	0.91	5.21	200	0.40	0.67	21.65	24.1%		
A61	FUT STREET	BG	BH	0.59	0.59								30.5	18	18	4.50	0.32	0.00	0.11	0.42	200	1.00	1.06	34.23	1.2%		
A62	STREET 27	BH	BI	0.26	5.89								46.2	12	273	4.50	4.83	0.00	1.06	5.89	200	0.40	0.67	21.65	27.2%		
A63	STREET 27	BI	BJ	0.28	6.17								32.1	9	282	4.50	4.99	0.00	1.11	6.10	200	0.40	0.67	21.65	28.2%		
A64	STREET 27	BJ	BK	0.07	6.24								0.0	0	282	4.50	4.99	0.00	1.12	6.12	250	0.30	0.67	33.99	18.0%		
A65	UPPER LANE	BK	BL	0.01	6.25								0.0	0	282	4.50	4.99	0.00	1.13	6.12	300	0.25	0.69	50.46	12.1%		
A66	UPPER LANE	BL	BM	0.53	6.78								56.6	30	312	4.50	5.53	0.00	1.22	6.75	375	0.20	0.72	81.83	8.2%		
A67	UPPER LANE	BM	BN	0.00	6.78	0.68	0.68			3.50			0.0	0	312	4.50	5.53	0.12	1.34	6.99	375	0.20	0.72	81.83	8.5%		
A68	EXTERNAL LANDS	STUB	BN	112.17	112.17	3.64	3.64			3.50			38.5	4314	4314	3.73	63.36	0.63	20.85	84.84	450	0.15	0.70	115.24	73.6%		
A69	EXTERNAL LANDS	STUB	BN	29.45	29.45								30.0	884	884	4.50	15.65	0.00	5.30	20.95	450	0.15	0.70	115.24	18.2%		
A70	BARKER PARKWAY	BN	BQ	0.16	148.56		4.32			3.50			0.0	0	5510	3.55	77.06	0.75	27.52	105.33	525	0.15	0.78	173.83	60.6%		

UPPER CANADA CONSULTANTS 1-261 MARTINDALE RD ST.CATHARINES, ONTARIO, L2W 1A1 DESIGN FLOWS																DESIGN: J. SCHOOLEY DATE: DECEMBER 2010									
RESIDENTIAL				340 L/Capita/Day (AVERAGE DAILY FLOW)								COMMERCIAL ##### L/ha/Day (AVERAGE DAILY FLOW)				COMMERCIAL & INSTITUTIONAL PEAK				1.5					
INFILTRATION RATE				0.18 L/s/Hectare (MOE FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28								INDUSTRIAL ##### L/ha/Day (AVERAGE DAILY FLOW)													
POPULATION PER UNIT				3								INSTITUTIONAL ##### L/ha/Day (AVERAGE DAILY FLOW)													
MUNICIPALITY: CITY OF THOROLD																SANITARY SEWER DESIGN SHEET									
PROJECT: ROLLING MEADOWS (PHASE 1)																									
PROJECT NO.: 0695																									
MANHOLES				AREA (hectares)				POPULATION				ACCUMULATED PEAK FLOW				DESIGN FLOW									
DRAINAGE AREA ID	DESCRIPTION	FROM M.H.	TO M.H.	RESIDENTIAL		COMM.		INDUST.		INST.	INCR	ACCUM	p.p.ha.	RES.POF DENS.	RES. POP.	PEAK. FACT.	RESID. FLOW (L/s)	C+I+I FLOW (L/s)	INFILT. FLOW (L/s)	TOTAL EAK FLOW (L/s)	DIA. PIPE (%)	SLOPE (m/s)	VEL. (L/s)	CAP. 'APACIT'	FULL FLOW
				INCR	ACCUM	INCR	ACCUM	INCR	ACCUM																
A71	STREET 19	BO	BQ	1.20	1.20	0.46	0.46						52.5	63	63	4.50	1.12	0.08	0.30	1.49	200	0.40	0.67	21.65	6.9%
A72	BARKER PARKWAY	BQ	BT	0.81	150.57		4.78						39.5	32	5605	3.54	78.12	0.83	27.96	106.91	525	0.15	0.78	173.83	61.5%
A73	SPARKLE DRIVE	BR	BS	0.54	0.54								77.8	42	42	4.50	0.74	0.00	0.10	0.84	200	1.00	1.06	34.23	2.5%
A74	SPARKLE DRIVE	BS	BT	0.75	1.29								80.0	60	102	4.50	1.81	0.00	0.23	2.04	200	0.40	0.67	21.65	9.4%
A75	BARKER PARKWAY	BT	BW	0.15	152.01		4.78						0.0	0	5707	3.53	79.26	0.83	28.22	108.31	525	0.15	0.78	173.83	62.3%
A76	AUTUMN AVENUE	BU	BV	0.61	0.61								49.2	30	30	4.50	0.53	0.00	0.11	0.64	200	1.00	1.06	34.23	1.9%
A77	AUTUMN AVENUE	BV	BW	0.74	1.35								48.6	36	66	4.50	1.17	0.00	0.24	1.41	200	0.40	0.67	21.65	6.5%
A78	SCHOOL	STUB	BW	0.00	0.00						2.04	2.04	0.0	0	0	0.00	0.00	0.71	0.37	1.08	200	0.40	0.67	21.65	5.0%
A79	BARKER PARKWAY	BW	BX	0.18	153.54		4.78						16.7	3	5776	3.52	80.02	1.54	28.86	110.42	525	0.15	0.78	173.83	63.5%
A80	BARKER PARKWAY	BX	BY	0.26	153.80		4.78						34.6	9	5785	3.52	80.12	1.54	28.91	110.57	525	0.15	0.78	173.83	63.6%
A81	STREET 25	STUB	BY	1.30	1.30								41.5	54	54	4.50	0.96	0.00	0.23	1.19	200	0.40	0.67	21.65	5.5%
A82	BARKER PARKWAY	BY	BZ	0.46	155.56		4.78						39.1	18	5857	3.51	80.92	1.54	29.23	111.68	525	0.15	0.78	173.83	64.2%
A83	BARKER PARKWAY	BZ	CA	0.53	156.09		4.78						39.6	21	5878	3.51	81.15	1.54	29.32	112.01	525	0.15	0.78	173.83	64.4%
A84	EXTERNAL LANDS			27.52	27.52	19.85	19.85						48.4	1331	1331										
A85	VENTURE WAY	STUB	CA	5.67	33.19		19.85						41.8	237	1568	4.50	27.77	3.45	9.55	40.76	375	0.20	0.72	81.83	49.8%
A86	BARKER PARKWAY	CA	CB	0.53	189.81		24.63						34.0	18	7464	3.34	98.24	4.98	38.97	142.19	525	0.15	0.78	173.83	81.8%
A87	BARKER PARKWAY	CB	AH	0.35	190.16		24.63						34.3	12	7476	3.34	98.37	4.98	39.03	142.38	525	0.15	0.78	173.83	81.9%
A88	STREET 20	STUB	AH	1.50	1.50								30.0	45	45	4.50	0.80	0.00	0.27	1.07	200	0.50	0.75	24.20	4.4%
	BARKER PARKWAY	AH	AI		215.15		24.63						0.0	0	8956	3.23	113.66	4.98	43.53	162.17	525	0.15	0.78	173.83	93.3%
	BARKER PARKWAY	AI	AJ		215.15		24.63							0	8956	3.23	113.66	4.98	43.53	162.17	525	0.15	0.78	173.83	93.3%
TRUNK	EASEMENT	AJ	AK		215.15		24.63							0	8956	3.23	113.66	4.98	43.53	162.17	525	0.20	0.90	200.72	80.8%
TRUNK	EASEMENT	AK	AL		215.15		24.63							0	8956	3.23	113.66	4.98	43.53	162.17	525	0.20	0.90	200.72	80.8%
TRUNK	EASEMENT	AL	AM		215.15		24.63							0	8956	3.23	113.66	4.98	43.53	162.17	525	0.20	0.90	200.72	80.8%
TRUNK	EASEMENT	AM	AN		215.15		24.63							0	8956	3.23	113.66	4.98	43.53	162.17	525	0.20	0.90	200.72	80.8%
TRUNK	EASEMENT	AN	AO		215.15		24.63							0	8956	3.23	113.66	4.98	43.53	162.17	525	0.20	0.90	200.72	80.8%
TRUNK	EASEMENT	AO	AP		215.15		24.63							0	8956	3.23	113.66	4.98	43.53	162.17	525	0.20	0.90	200.72	80.8%
TRUNK	EASEMENT	AP	AQ		215.15		24.63							0	8956	3.23	113.66	4.98	43.53	162.17	525	0.20	0.90	200.72	80.8%
TRUNK	EASEMENT	AQ	AR		215.15		24.63							0	8956	3.23	113.66	4.98	43.53	162.17	525	0.20	0.90	200.72	80.8%
TRUNK	EASEMENT	AR	S1508		215.15		24.63							0	8956	3.23	113.66	4.98	43.53	162.17	525	0.20	0.90	200.72	80.8%

UPPER CANADA CONSULTANTS 1-261 MARTINDALE RD ST.CATHARINES, ONTARIO, L2W 1A1 DESIGN FLOWS																	DESIGN: J. SCHOOLEY DATE: DECEMBER 2010																																		
RESIDENTIAL		340 L/Capita/Day (AVERAGE DAILY FLOW)										COMMERCIAL ##### L/ha/Day (AVERAGE DAILY FLOW)					COMMERCIAL & INSTITUTIONAL PEAK					1.5																													
INFILTRATION RATE		0.18 L/s/Hectare (MOE FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28										INDUSTRIAL ##### L/ha/Day (AVERAGE DAILY FLOW)																																							
POPULATION PER UNIT		3										INSTITUTIONAL ##### L/ha/Day (AVERAGE DAILY FLOW)																																							
MUNICIPALITY: CITY OF THOROLD																																																			
PROJECT:		ROLLING MEADOWS (PHASE 1)										SANITARY SEWER DESIGN SHEET																																							
PROJECT NO.:		0695																																																	
MANHOLES				AREA (hectares)								POPULATION				ACCUMULATED PEAK FLOW						DESIGN FLOW																													
DRAINAGE		FROM		TO		RESIDENTIAL		COMM.		INDUST.		INST.		RES.POF		RES.		PEAK.		RESID.		C+I+I		INFILT.		TOTAL		DIA.																							
AREA ID		DESCRIPTION		M.H.		M.H.		INCR		ACCUM		INCR		ACCUM		INCR		ACCUM		PEAKING		INCR		ACCUM		p.p.ha.		INCR		SERVED		(L/s)		(L/s)		(L/s)		(L/s)		EAK FLOW		PIPE		SLOPE		VEL.		CAP.		FULL	
DOWNSTREAM		ALLENBURG RD		S1508		S1507		5.07		245.55				0.26				90.32		2.80				5.19		45.0		228		10302		3.14		127.13		45.75		61.44		319.32		600		0.37		1.33		389.79		81.9%	
DOWNSTREAM		ALLENBURG RD		S1507		S1506				245.55				0.26		2.00		92.32		2.80				5.19				10302		3.14		127.13		46.73		61.80		320.65		675		0.20		1.06		392.33		81.7%			
DOWNSTREAM		ALLENBURG RD		S1506		S1505				245.55				0.26		2.44		94.76		2.70		2.01		7.20				10302		3.14		127.13		46.96		62.60		321.69		675		0.20		1.06		392.33		82.0%			
DOWNSTREAM		ALLENBURG RD		S1505		S1504				245.55				0.26				94.76		2.70				7.20				10302		3.14		127.13		46.96		62.60		321.69		675		0.20		1.06		392.33		82.0%			
DOWNSTREAM		ALLENBURG RD		S1504		S1503				245.55				0.26				94.76		2.70				7.20				10302		3.14		127.13		46.96		62.60		321.69		675		0.20		1.06		392.33		82.0%			
DOWNSTREAM		ALLENBURG RD		S1503		S1502				245.55				0.26		17.33		112.09		2.65				7.20				10302		3.14		127.13		54.11		65.72		331.96		675		0.20		1.06		392.33		84.6%			
DOWNSTREAM		ALLENBURG RD		S1502		S1501		0.88		246.43				0.26				112.09		2.65				7.20		54.5		48		10350		3.13		127.61		54.11		65.88		332.60		675		0.20		1.06		392.33		84.8%	
DOWNSTREAM		ALLENBURG RD		S1501		S1500				246.43				0.26				112.09		2.65				7.20				10350		3.13		127.61		54.11		65.88		332.60		675		0.20		1.06		392.33		84.8%			
DOWNSTREAM		ALLENBURG RD		S1500		S776				246.43				0.26		0.28		112.37		2.65				7.20				10350		3.13		127.61		54.24		65.93		332.78		675		0.20		1.06		392.33		84.8%			
DOWNSTREAM		ALLENBURG RD		S776		P.S.				246.43				0.26				112.37		2.65				7.20				10350		3.13		127.61		54.24		65.93		332.78		675		0.20		1.06		392.33		84.8%			

MODIFIED ROLLING MEADOWS SANITARY DESIGN SHEET (ORIGINAL BY UPPER CANADA CONSULTANTS)																				DESIGN: J. SCHOOLEY					
REVISED BY COUNTERPOINT ENGINEERING WITH PROPOSED DEVELOPMENT																				DATE: Jul-20					
1-261 MARTINDALE RD																									
ST.CATHARINES, ONTARIO, L2W 1A1																									
DESIGN FLOWS																									
RESIDENTIAL				340 L/Capita/Day (AVERAGE DAILY FLOW)								COMMERCIAL ##### L/ha/Day (AVERAGE DAILY FLOW)				COMMERCIAL & INSTITUTIONAL PEAK FACTOR				1.5					
INFILTRATION RATE				0.18 L/s/Hectare (MOE FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28								INDUSTRIAL ##### L/ha/Day (AVERAGE DAILY FLOW)													
POPULATION PER UNIT				3								INSTITUTIONAL ##### L/ha/Day (AVERAGE DAILY FLOW)													
MUNICIPALITY: CITY OF THOROLD																									
PROJECT: ROLLING MEADOWS (PHASE 1																				SANITARY SEWER DESIGN SHEET					
PROJECT NO.: 0695																									
MANHOLES				AREA (hectares)								POPULATION				ACCUMULATED PEAK FLOW				DESIGN FLOW					
DRAINAGE AREA ID	DESCRIPTION	FROM M.H.	TO M.H.	RESIDENTIAL		COMM.		INDUST.		INST.		RES.POF		PEAK. FACT.	RESID. FLOW (L/s)	C+I+I FLOW (L/s)	INFILT. FLOW (L/s)	TOTAL EAK FLOW (L/s)	DIA. PIPE (%)	SLOPE (m/s)	VEL. (L/s)	CAP. 'APACIT'	FULL FLOW	PERCENT	
				INCR	ACCUM	INCR	ACCUM	INCR	ACCUM	PEAKING	INCR	ACCUM	p.p.ha.												DENS.
A1	SUNSET WAY	A	B	0.73	0.73								53.4	39	39	4.50	0.69	0.00	0.13	0.82	200	1.00	1.06	34.23	2.4%
A2	SUNSET WAY	B	C	0.70	1.43								72.9	51	90	4.50	1.59	0.00	0.26	1.85	200	0.40	0.67	21.65	8.6%
A3	SUNSET WAY	C	D	0.42	1.85								57.1	24	114	4.50	2.02	0.00	0.33	2.35	200	1.00	1.06	34.23	6.9%
A4	SUNSET WAY	D	E	1.05	2.90								28.6	30	144	4.50	2.55	0.00	0.52	3.07	200	1.35	1.23	39.77	7.7%
A5	SUNSET WAY	E	F	0.37	3.27								73.0	27	171	4.50	3.03	0.00	0.59	3.62	200	2.00	1.49	48.41	7.5%
A6	SUNSET WAY	F	G	0.31	3.58								29.0	9	180	4.50	3.19	0.00	0.64	3.83	200	1.30	1.20	39.03	9.8%
A7	SUNSET WAY	G	H	0.21	3.79								28.6	6	186	4.50	3.29	0.00	0.68	3.98	200	0.40	0.67	21.65	18.4%
A8	SUNSET WAY	H	AG	0.40	4.19								30.0	12	198	4.50	3.51	0.00	0.75	4.26	200	0.40	0.67	21.65	19.7%
A11	SUNSET WAY	J	L	0.40	0.40								52.5	21	21	4.50	0.37	0.00	0.07	0.44	200	0.80	0.94	30.62	1.4%
A12	HOMESTEAD WAY	K	L	0.40	0.40								45.0	18	18	4.50	0.32	0.00	0.07	0.39	200	1.00	1.06	34.23	1.1%
A13	SPARKLE DRIVE	L	M	0.68	1.48								48.5	33	72	4.50	1.28	0.00	0.27	1.54	200	2.00	1.49	48.41	3.2%
A14	SPARKLE DRIVE	M	N	0.35	1.83								42.9	15	87	4.50	1.54	0.00	0.33	1.87	200	0.75	0.91	29.64	6.3%
A15	FUT STREET	AX	CC	0.78	0.78								50.0	39	39	4.50	0.69	0.00	0.14	0.83	200	1.00	1.06	34.23	2.4%
A16	FUT STREET	AZ	CC	0.56	0.56								42.9	24	24	4.50	0.43	0.00	0.10	0.53	200	1.00	1.06	34.23	1.5%
A17	FUT STREET	CC	CE	0.28	1.62								32.1	9	72	4.50	1.28	0.00	0.29	1.57	200	0.40	0.67	21.65	7.2%
A18	UPPER LANE	CD	CE	0.22	0.22								27.3	6	6	4.50	0.11	0.00	0.04	0.15	200	1.00	1.06	34.23	0.4%
A19	UPPER LANE	CE	CF	0.44	2.28								40.9	18	96	4.50	1.70	0.00	0.41	2.11	200	0.40	0.67	21.65	9.7%
A20	UPPER LANE	CF	CG	0.30	2.58								30.0	9	105	4.50	1.86	0.00	0.46	2.32	200	0.40	0.67	21.65	10.7%
A21	UPPER LANE	CG	CH	0.45	3.03								40.0	18	123	4.50	2.18	0.00	0.55	2.72	200	0.40	0.67	21.65	12.6%
A22	UPPER LANE	CH	CI	0.45	3.48								40.0	18	141	4.50	2.50	0.00	0.63	3.12	200	0.40	0.67	21.65	14.4%
A23	VENTURE WAY	CI	AV	0.73	4.21								32.9	24	165	4.50	2.92	0.00	0.76	3.68	250	0.30	0.67	33.99	10.8%
A24	HOMESTEAD WAY	AS	AT	0.39	0.39								69.2	27	27	4.50	0.48	0.00	0.07	0.55	200	1.00	1.06	34.23	1.6%
A25	APARTMENT	STUB	AT	2.42	2.42								209.9	508	508	4.50	9.00	0.00	0.44	9.43	200	0.40	0.67	21.65	43.6%
A26	HARMONY WAY	AT	AU	0.57	3.38								78.9	45	580	4.50	10.27	0.00	0.61	10.88	200	0.40	0.67	21.65	50.3%
A27	HARMONY WAY	AU	AV	0.34	3.72								61.8	21	601	4.50	10.64	0.00	0.67	11.31	200	0.40	0.67	21.65	52.3%
A28	VENTURE WAY	AV	N	0.67	8.60								35.8	24	790	4.50	13.99	0.00	1.55	15.54	250	0.30	0.67	33.99	45.7%
A29	VENTURE WAY	N	Q	0.67	11.10								35.8	24	901	4.50	15.96	0.00	2.00	17.95	250	0.30	0.67	33.99	52.8%
A30	HOMESTEAD WAY	O	K	0.20	0.20								45.0	9	9	4.50	0.16	0.00	0.04	0.20	200	1.00	1.06	34.23	0.6%
A31	AUTUMN AVENUE	K	P	0.40	0.60								45.0	18	27	4.50	0.48	0.00	0.11	0.59	200	3.25	1.90	61.71	0.9%
A32	AUTUMN AVENUE	P	Q	0.72	1.32								41.7	30	57	4.50	1.01	0.00	0.24	1.25	200	0.40	0.67	21.65	5.8%
A33	VENTURE WAY	Q	R	0.13	12.55								23.1	3	961	4.50	17.02	0.00	2.26	19.28	250	0.30	0.67	33.99	56.7%
A34	VENTURE WAY	R	AB	0.18	12.73								33.3	6	967	4.50	17.12	0.00	2.29	19.42	250	0.30	0.67	33.99	57.1%
A9	SUNSET WAY	A	J	0.53	0.53								50.9	27	27	4.50	0.48	0.00	0.10	0.57	200	1.00	1.06	34.23	1.7%
A10	SUCCESS AVENUE	J	I	0.41	0.94								51.2	21	48	4.50	0.85	0.00	0.17	1.02	200	0.40	0.67	21.65	4.7%
A35	SUCCESS AVENUE	I	S	0.51	1.45								52.9	27	75	4.50	1.33	0.00	0.26	1.59	200	0.40	0.67	21.65	7.3%
A36	SUCCESS AVENUE	S	T	0.28	1.73								42.9	12	87	4.50	1.54	0.00	0.31	1.85	200	0.40	0.67	21.65	8.6%
A37	SUCCESS AVENUE	T	U	0.34	2.07								44.1	15	102	4.50	1.81	0.00	0.37	2.18	200	0.40	0.67	21.65	10.1%

MODIFIED ROLLING MEADOWS SANITARY DESIGN SHEET (ORIGINAL BY UPPER CANADA CONSULTANTS)																				DESIGN: J. SCHOOLEY					
REVISED BY COUNTERPOINT ENGINEERING WITH PROPOSED DEVELOPMENT																				DATE: Jul-20					
1-261 MARTINDALE RD																									
ST.CATHARINES, ONTARIO, L2W 1A1																									
DESIGN FLOWS																									
RESIDENTIAL				340 L/Capita/Day (AVERAGE DAILY FLOW)								COMMERCIAL ##### L/ha/Day (AVERAGE DAILY FLOW)				COMMERCIAL & INSTITUTIONAL PEAK FACTOR				1.5					
INFILTRATION RATE				0.18 L/s/Hectare (MOE FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28								INDUSTRIAL ##### L/ha/Day (AVERAGE DAILY FLOW)													
POPULATION PER UNIT				3								INSTITUTIONAL ##### L/ha/Day (AVERAGE DAILY FLOW)													
MUNICIPALITY: CITY OF THOROLD																									
PROJECT: ROLLING MEADOWS (PHASE 1																				SANITARY SEWER DESIGN SHEET					
PROJECT NO.: 0695																									
MANHOLES				AREA (hectares)								POPULATION				ACCUMULATED PEAK FLOW				DESIGN FLOW					
DRAINAGE AREA ID	DESCRIPTION	FROM M.H.	TO M.H.	RESIDENTIAL		COMM.		INDUST.		INST.		RES.POF	RES.	PEAK.	RESID.	C+I+I	INFILT.	TOTAL	DIA.	PERCENT					
				INCR	ACCUM	INCR	ACCUM	INCR	ACCUM	PEAKING	INCR	ACCUM	p.p.ha.	DENS.	POP.	FACT.	FLOW	FLOW	FLOW	EAK FLOW	PIPE	SLOPE	VEL.	CAP.	FULL
A38	SUCCESS AVENUE	U	V	0.40	2.47							37.5	15	117	4.50	2.07	0.00	0.44	2.52	200	0.40	0.67	21.65	11.6%	
A39	SUCCESS AVENUE	V	W	0.66	3.13							45.5	30	147	4.50	2.60	0.00	0.56	3.17	200	0.50	0.75	24.20	13.1%	
A40	SUCCESS AVENUE	W	X	0.25	3.38							36.0	9	156	4.50	2.76	0.00	0.61	3.37	200	3.00	1.83	59.29	5.7%	
A41	SUCCESS AVENUE	X	Z	0.13	3.51							23.1	3	159	4.50	2.82	0.00	0.63	3.45	200	3.00	1.83	59.29	5.8%	
A42	GOLDRICH AVENUE	Y	Z	0.19	0.19							47.4	9	9	4.50	0.16	0.00	0.03	0.19	200	1.40	1.25	40.50	0.5%	
A43	GOLDRICH AVENUE	Z	AA	0.29	3.99							41.4	12	180	4.50	3.19	0.00	0.72	3.91	200	0.40	0.67	21.65	18.0%	
A44	GOLDRICH AVENUE	AA	AB	0.19	4.18							31.6	6	186	4.50	3.29	0.00	0.75	4.05	200	0.40	0.67	21.65	18.7%	
A45	VENTURE WAY	AB	AC	0.18	17.09							33.3	6	1159	4.50	20.52	0.00	3.08	23.60	250	0.30	0.67	33.99	69.4%	
A46	VENTURE WAY	AC	AE	0.19	17.28							31.6	6	1165	4.50	20.63	0.00	3.11	23.74	250	0.30	0.67	33.99	69.8%	
A47	VINEGOLD CRT.	AD	AE	0.82	0.82							29.3	24	24	4.50	0.43	0.00	0.15	0.57	200	1.00	1.06	34.23	1.7%	
A48	MIRACLE WAY	AE	AF	0.55	18.65							43.6	24	1213	4.50	21.48	0.00	3.36	24.84	250	0.30	0.67	33.99	73.1%	
A49	MIRACLE WAY	AF	AG	0.28	18.93							42.9	12	1225	4.50	21.69	0.00	3.41	25.10	250	0.30	0.67	33.99	73.8%	
A50	SUNSET WAY	AG	AH	0.37	23.49							32.4	12	1435	4.50	25.41	0.00	4.23	29.64	250	0.30	0.67	33.99	87.2%	
A51	FUT STREET	AX	AY	0.64	0.64							51.6	33	33	4.50	0.58	0.00	0.12	0.70	200	1.00	1.06	34.23	2.0%	
A52	STREET 27	AW	AY	0.92	0.92							52.2	48	48	4.50	0.85	0.00	0.17	1.02	200	1.00	1.06	34.23	3.0%	
A53	STREET 27	AY	BB	0.43	1.99							48.8	21	102	4.50	1.81	0.00	0.36	2.16	200	0.40	0.67	21.65	10.0%	
A54	FUT STREET	AZ	BA	0.55	0.55							49.1	27	27	4.50	0.48	0.00	0.10	0.58	200	1.00	1.06	34.23	1.7%	
A55	FUT STREET	BA	BB	0.45	1.00							46.7	21	48	4.50	0.85	0.00	0.18	1.03	200	0.40	0.67	21.65	4.8%	
A56	STREET 27	BB	BF	0.43	3.42							20.9	9	159	4.50	2.82	0.00	0.62	3.43	200	0.40	0.67	21.65	15.8%	
A57	STREET 26	BC	BD	0.42	0.42							57.1	24	24	4.50	0.43	0.00	0.08	0.50	200	1.00	1.06	34.23	1.5%	
A58	STREET 26	BD	BE	0.45	0.87							60.0	27	51	4.50	0.90	0.00	0.16	1.06	200	0.40	0.67	21.65	4.9%	
A59	STREET 26	BE	BF	0.32	1.19							46.9	15	66	4.50	1.17	0.00	0.21	1.38	200	0.40	0.67	21.65	6.4%	
A60	STREET 27	BF	BH	0.43	5.04							41.9	18	243	4.50	4.30	0.00	0.91	5.21	200	0.40	0.67	21.65	24.1%	
A61	FUT STREET	BG	BH	0.59	0.59							30.5	18	18	4.50	0.32	0.00	0.11	0.42	200	1.00	1.06	34.23	1.2%	
A62	STREET 27	BH	BI	0.26	5.89							46.2	12	273	4.50	4.83	0.00	1.06	5.89	200	0.40	0.67	21.65	27.2%	
A63	STREET 27	BI	BJ	0.28	6.17							32.1	9	282	4.50	4.99	0.00	1.11	6.10	200	0.40	0.67	21.65	28.2%	
A64	STREET 27	BJ	BK	0.07	6.24							0.0	0	282	4.50	4.99	0.00	1.12	6.12	250	0.30	0.67	33.99	18.0%	
A65	UPPER LANE	BK	BL	0.01	6.25							0.0	0	282	4.50	4.99	0.00	1.13	6.12	300	0.25	0.69	50.46	12.1%	
A66	UPPER LANE	BL	BM	0.53	6.78							56.6	30	312	4.50	5.53	0.00	1.22	6.75	375	0.20	0.72	81.83	8.2%	
A67	UPPER LANE	BM	BN	0.00	6.78	0.68	0.68			3.50		0.0	0	312	4.50	5.53	0.12	1.34	6.99	375	0.20	0.72	81.83	8.5%	
A68	EXTERNAL LANDS	STUB	BN	112.17	112.17	3.64	3.64			3.50		38.5	4314	4314	3.73	63.36	0.63	20.85	84.84	450	0.15	0.70	115.24	73.6%	
A69a (EXT)	EXTERNAL LANDS	STUB	BN	21.65	21.65							30.0	650	650	4.50	11.50	0.00	3.90	15.40	450	0.15	0.70	115.24	13.4%	
A69a	PROP. DEVELOPMENT	STUB	BN	7.80	7.80							69.2	540	540	4.50	9.56	0.00	1.40	10.97	200	0.50	0.75	24.20	45.3%	

SANITARY SEWER DESIGN SHEET (METRIC) Modified												PROJECT: Uppers Glen PROJECT No.: 18020 MUNICIPALITY: Thorold, Ontario					Counterpoint Engineering Inc. DESIGNED BY: PW CHECKED BY: KR MANNINGS "n": 0.013 DATE: 07/15/2020 (Rev 3)					
		RESIDENTIAL					COMMERCIAL			INDUSTRIAL	INSTITUTIONAL	FLOW IN LITRES PER SECOND					PROPOSED SEWER				PRESENT CONDITION	
ROW ID	MAINTENANCE No.	GROSS AREA (ha)	UNITS	POP. DENSITY (3 pp/unit) or (pp/ha)	POP. Units x 3 or Gross Area x Pop Density	PEAK FLOW FACTOR	LOT AREA (ha)	FLOOR SPACE INDEX (See Note 7)	FLOOR AREA (ha)	LOT AREA (ha)	LOT AREA (ha)	RESIDENTIAL FLOW INFIL. * 0.286 l/s/ha SEWAGE 0.00318 l/s		COMM. 0.324 l/s	INDUS. 2.08 l/s	INSTIT. 0.0016 l/s	TOTAL FLOW l/s	PIPE SIZE (Nom) (mm)	SLOPE %	CAPACITY Q (Act Pipe) l/s	VELOCITY V (Act Pipe) m/s	SUR HARGED %
A	Area 84aa (North zone)	21.75	418	3	1254																	
	Area 84b (comm)	19.85					19.85	0.50	9.93													
B	MH JL	41.60			1254	3.73	19.85		9.93			11.90	14.91	3.22			30.02	250	0.50	44.38	0.87	68%
C	Area 84a																					
	Single	7.10	62		186																	
	Semi-Detached Townhouses		12 74		36 222																	
D (=C+B)	MH CK	48.70			1,698	3.64			9.93			13.93	19.67	3.22			36.82	250	0.50	44.38	0.87	83%
E	Cristalina Drive	1.30	18		54																	
F (=D+E)	MH BY	50.00			1,752	3.63			9.93			14.30	20.24	3.22			37.76	300	0.25	50.23	0.69	75%
G	Area 69a																					
	Single	7.80	42		126																	
	Semi-Detached Townhouses		4 134		12 402																	
H	Uppers Lane	7.80			540	3.96						2.23	6.80				9.03	200	0.50	24.48	0.75	37%
I	Area 69aa (South zone)	6.75	185	3	555																	
	Area 69b (comm)	19.02					19.02	0.50	9.51													
J (=H+I)	MH BN	33.57			1095	3.77	19.02		9.51			9.60	13.15	3.08			25.84	450	0.15	114.11	0.70	23%
K	Area 68	112.17		38.5	4319																	
	Area 68a	3.7					3.70	0.50	1.85													
L (=J+K)	MH BN	149.44			5,414	3.21	3.70		1.85			42.74	55.36	0.60			98.70	450	0.15	114.11	0.70	86%
M	Area 51-67	6.78			312						2.04											
	Area 71-82	7.53			347																	
	Area 71-82 (comm)	4.78					4.78	0.50	2.39													
N (=L+M)	MH BY-BZ	168.53			6,073	3.17	4.78		2.39		2.04	48.20	61.19	0.77		0.003	110.16	525	0.15	175.75	0.78	63%
O	Area 85-88	8.05			312																	
	Area 1-50	23.63			1,435																	
P(=O+N+F)	MH AH-AI	250.21			9,572	2.97			23.68		2.04	71.56	90.59	7.67		0.003	169.82	525	0.15	175.75	0.78	97%
NOTES:	Refer to Upper Canada Consultants Rolling Meadows Project No. 0695 drawing 0695SAN (Rev 1) for external sanitary drainage areas Refer to Counterpoint Consultant Upper Canada Block Plan Residential File Number:18020 for Area 84a and 69a population 1) Residential density is based on average residential density on entire Rolling Meadows subdivision as per design sheets prepared by Upper Canada Consultants. 2) Cells highlighted represent proposed flow in subject site.																	INFILTRATION: 0.286 L/s/ha RESIDENTIAL: 275 lpcd = 0.00318 l/s INDUSTRIAL: 1.04L/s - 34.375 m3/ha/day SCHOOL: 0.0016 L/s - 140L/ha/day COMMERCIAL: 0.324 L/s - 28m3/ha/day				

February 2, 2024

Appendix C DESIGN – WATER

PRELIMINARY ESTIMATE of Expected Water Demand

Upper's Lane Subdivision
Thorold, Ontario

Jan 2024

Project #160623094

Program Details

	Unit Type	# of Units	*Persons per Unit	Equivalent Population	*Source: Town of Innisfil Engineering Design Standards and Specifications Manual
Residential:	Single and Townhouse	603	3	1809	
		Total Residential Population Unit Count		1809 603	
TOTAL DESIGN POPULATION =	1809				

Flow Calculation

Required Design Water Demand = Peak Hourly Demand Plus Fire Flow *Source: Region of Niagara Water-Wastewater Project Design Manual

*Flow Rate =	300	litres/capita/day		*Source: Region of Niagara Master Servicing Plan
For a total population of	1809	people,		
The total flow is:	542,700	litres/day		
**Applying a peaking factor of	2.50	(maximum day)		*Source: MOE Watermain design Guideline Table 3-1
Maximum Day Demand =	1,356,750	litres/day		
or,	942	litres/minute		
*Fire Flow Demand =	8,000	litres/minute	(A)	Source: See Fire Underwriter Survey (FUS) assessment herein.

Peak Hourly Demand

The total flow is:	542,700	litres/day		
*Applying a peaking factor of	3.75	(peak hour)		*Source: MOE Watermain design Guideline Table 3-1
Peak Hourly Demand =	2,035,125	litres/day		
or,	1,413	litres/minute	(B)	

Total water demand (on basis of Peak Hourly demand plus fire flow) =

9,413	litres/minute
157	litres/second
2487	GPM

Assumptions:

- 1) Building 'H' analyzed. 4-unit in closest proximity to other structures
- 2) Wood frame construction with fire separation between each unit per OBC
- 3) Slab-on-grade "bungalow" construction (loft = 50% of main level across 6-unit block)

$$F = 220 \cdot C \cdot \sqrt{A}$$

where,

F = the required fire flow in litres per minute

C = 1.0 for wood frame construction with fire wall separation

= 1.00

A = The total floor area in square metres (including all storeys, but excluding basements at least 50% below grade) in the building being considered. Note: for fire-resistive buildings, consider the two largest adjoining floors plus 50% of each of any floors immediately above them up to eight, when the vertical openings are inadequately protected. If the vertical openings and exterior vertical communications are properly protected (one hour rating), consider only the area of the largest floor plus 25% of each of the two immediately adjoining floors. *

Building H_4-unit block

Level 1	582	sq.m.
Level 2	291	sq.m.

A = 873 sq.m.

$$F = 220 \cdot (C) \cdot \sqrt{A}$$

= 6,500 Lpm

= 7,000 Lpm (Rounded to the nearest 1,000 L/min)

The value obtained above may be reduced by as much as 25% for occupancies having a low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Apply a reduction of 15% (Dwellings = low hazard - limited combustibles), or -1,050 Lpm

F = 5,950 Lpm

To the value obtained, a percentage should be added for structures exposed within 45 metres. Block 'H' assessed given it is in closest proximity to other structures relative to other Blocks.

North side	-	21	m	-	10%
East side	-	3.6	m	-	20%
South side	-	15	m	-	15%
West side	-	3.6	m	-	20%
					65% (not to exceed 75%)

Increase = 3,868 Lpm

F	=	7,000	Lpm
		-1,050	
		3,868	
		9,818	Lpm

F	=	10,000	Lpm (Rounded to the nearest 1,000 L/min)
	=	167	Lps
	=	2420	GPM

Exposure distances	Suggested required	fire flow Masonry or Brick
Less than 3m	See Note "D"	6,000 L/min
3 to 10m	4,000 L/min	4,000 L/min
10.1 to 30m	3,000 L/min	3,000 L/min
Over 30m	2,000 L/min	2,000 L/min

If the buildings are contiguous, use a minimum of 8,000 L/min. Also consider

Not e H.

Note D: Wood frame structures separated by less than 3 metres shall be considered as one fire area

Note H: Where wood singles or shake roofs could contribute to spreading fires, add 2,000 L/min to 4,000 L/min in accordance with extent and condition.

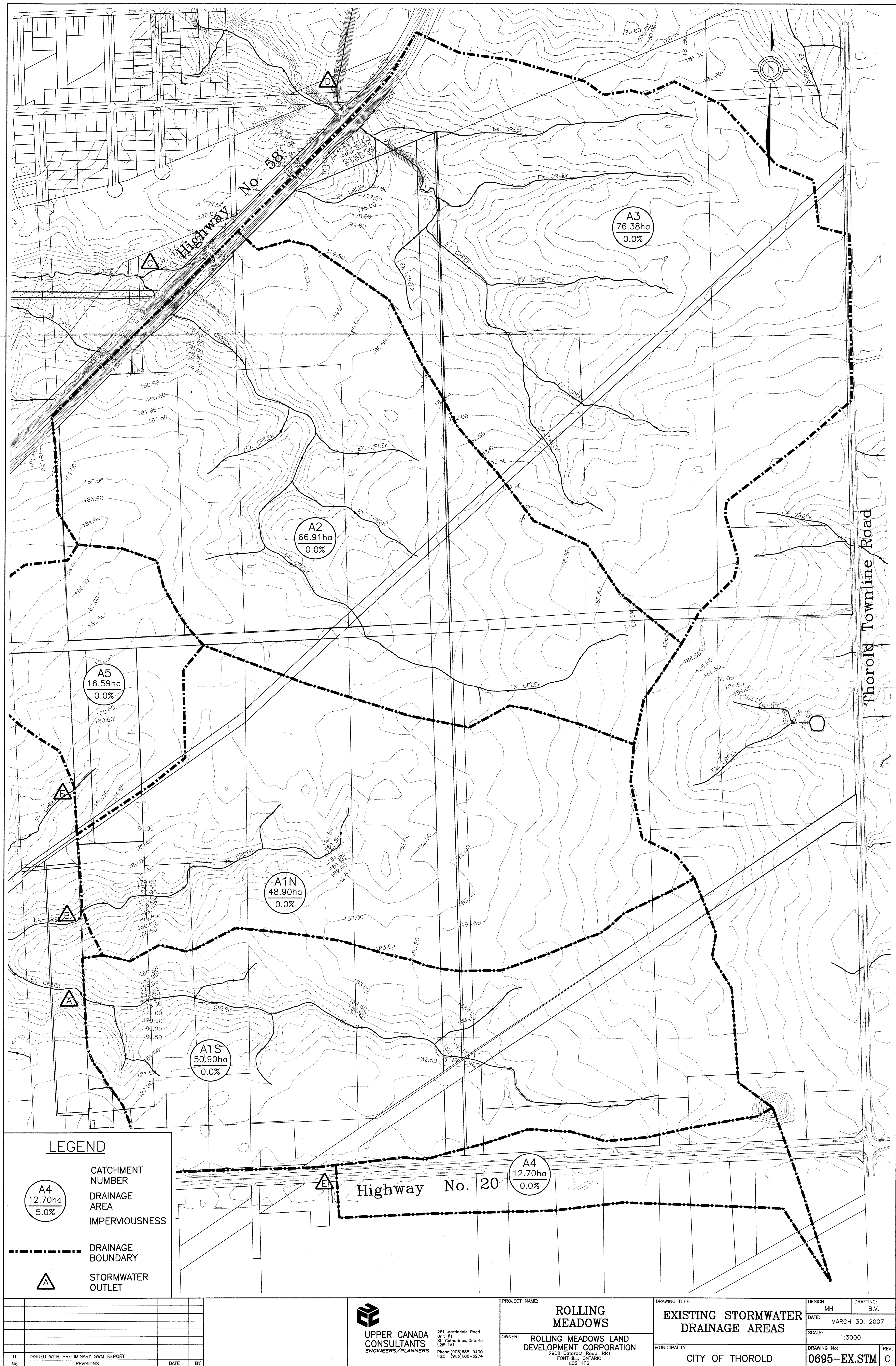
Excerpt from Water Supply for Public Fire Protection, Fire Underwriters Survey, 1999 Edition

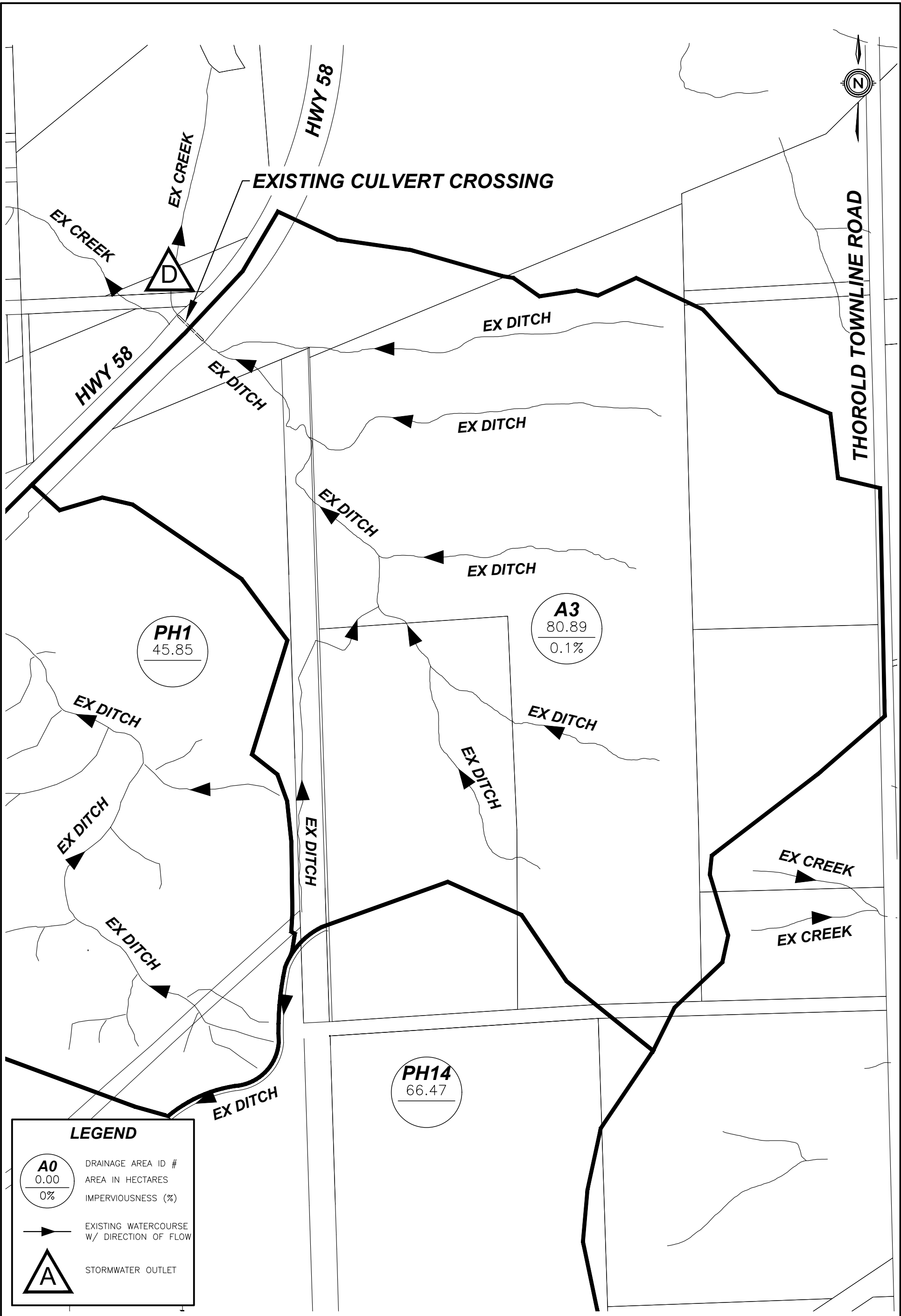
The proposed development consist of single family dwelling and townhouses.

Townhouses are categorized as contiguous building s and therefore a min. fireflow of **8,000 L/min** is used.

February 2, 2024

Appendix D DESIGN – STORMWATER

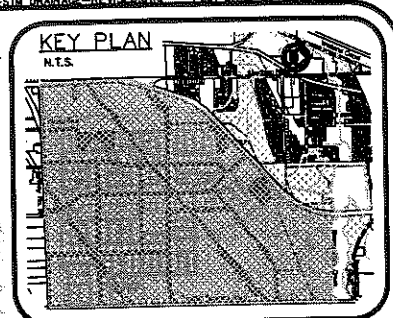
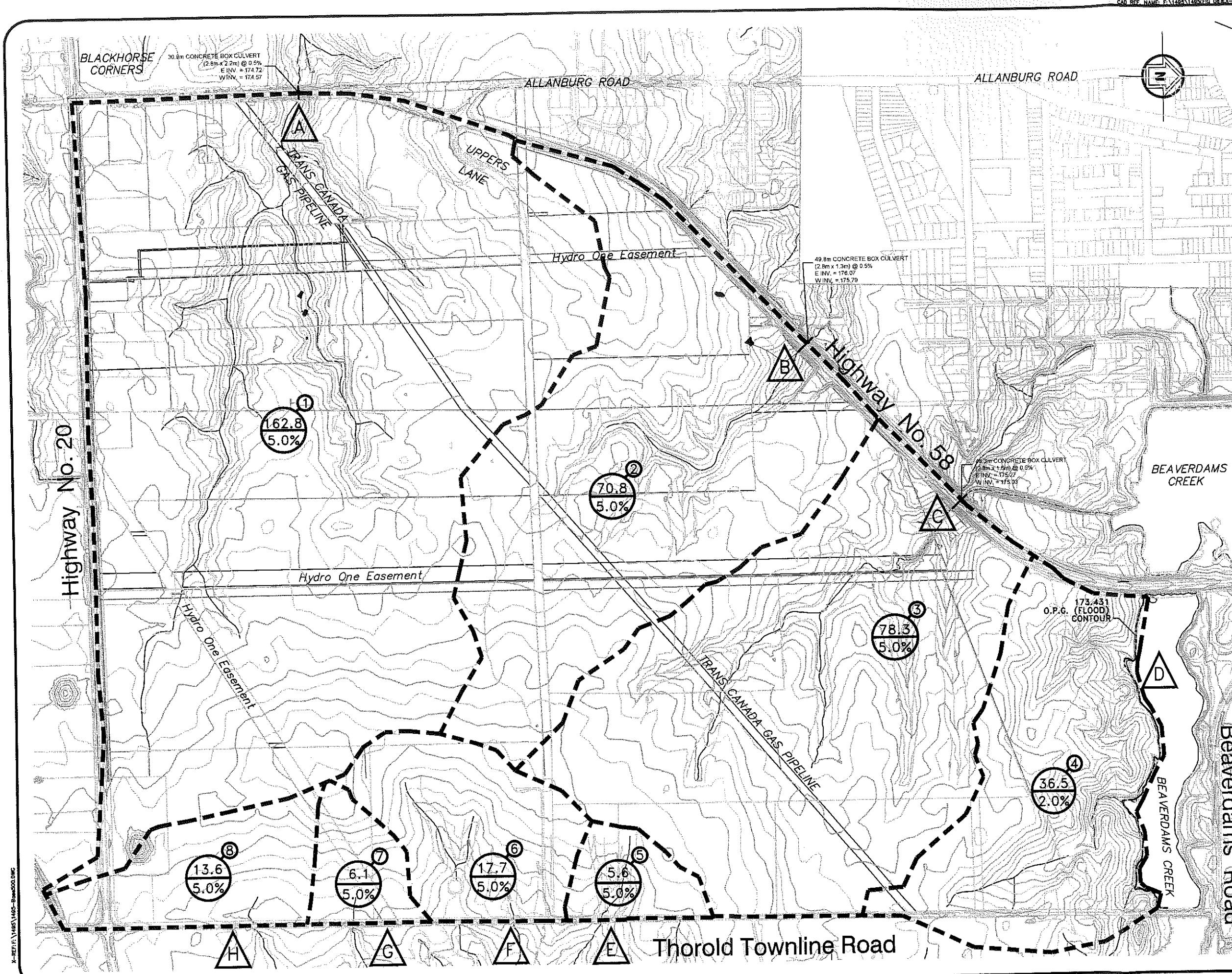




**UPPER CANADA
CONSULTANTS**
ENGINEERS / PLANNERS

**ROLLING MEADOWS
PHASE 17**
TOWN OF THOROLD
EXISTING STORMWATER DRAINAGE AREAS

DATE	2022-05-18
SCALE	1:5000 m
REF No.	0695
DWG No.	FIGURE 2



LEGEND

1:100.00
PROPOSED ELEVATION
EXISTING STORM DRAINAGE BOUNDARY
EXISTING OUTLET LOCATION
DRAINAGE AREA No.
AREA IN HECTARES
(X) IMPERVIOUSNESS

THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND ABOVE GROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

BENCHMARK:
CITY OF THOROLD BENCHMARK.
DESCRIPTION: C.N.R. BRIDGE (No.10), OVER WELLSLAND SHIP CANAL. TABLET IN EAST CURVED RETAINING WALL AT NORTH SIDE OF BRIDGE, 16.4 FEET WEST OF STEPS AT EAST END OF WALL, 43 FEET NORTH OF NORTH SIDE OF BRIDGE, 0.9 FOOT FROM EDGE OF CANAL.
ELEVATION: 174.314 m

REVISIONS				
No.	Revision	Date	By	Approved

REGIONAL MUNICIPALITY OF NIAGARA
CITY OF THOROLD
NEIGHBOURHOODS OF ROLLING MEADOWS
EXISTING STORM DRAINAGE PLAN

WESLAKE INC.
CIVIL ENGINEERS, MUNICIPAL AND ENVIRONMENTAL PLANNERS
120 LANDING DRIVE
UNIT No. 10
HAMILTON, ONTARIO
L8N 3A1

SCALE: 1:4,000
DRAWN BY: M.G.
DESIGNED BY: M.G.
CHECKED BY: T.D.B.
DATE: MAY 2008

PROJECT No. 1495
FIGURE No. 8

NOT FOR CONSTRUCTION UNTIL SIGNED, STAMPED AND DATED

X-REF: 1495\1495\DRG 04\EX-STM DRAINAGE-REVISED.DWG

February 2, 2024

Appendix E **SITE ENGINEERING FIGURES**

Figure GR-1 – Preliminary Grading Plan

Figure STM-1 – Preliminary Storm Servicing Plan

Figure SAN-1 – Preliminary Sanitary Servicing Plan

Figure WTM-1 – Preliminary Water Distribution Plan

Figure TYP-1 – Right of Way Sections



Legend

- SUBJECT LAND PROPERTY LINE
- UPPER'S GROVE BLOCK DEVELOPMENT

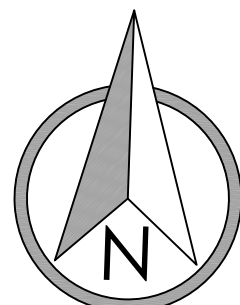
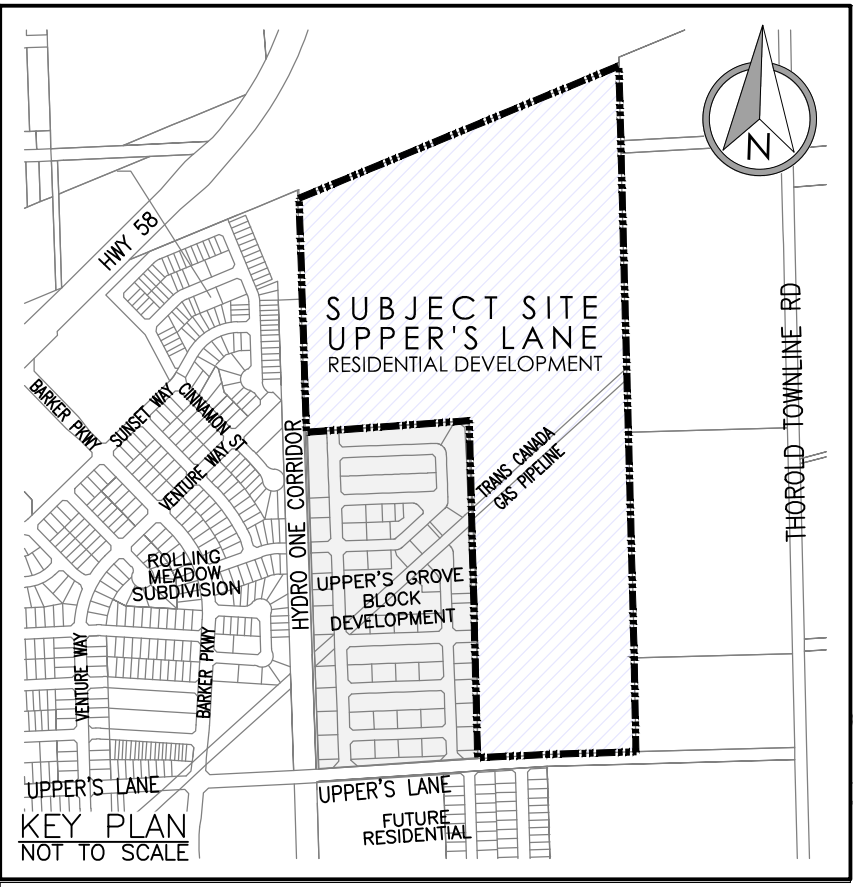
163.84
163.04
-195.0

PROPOSED SPOT ELEVATION
EXISTING SPOT ELEVATION
EXISTING CONTOUR AND ELEVATION
OVERLAND FLOW ARROW
3:1 SLOPE
RETAINING WALL

SLOPE UP / SLOPE DOWN
LOW POINT
HIGH POINT

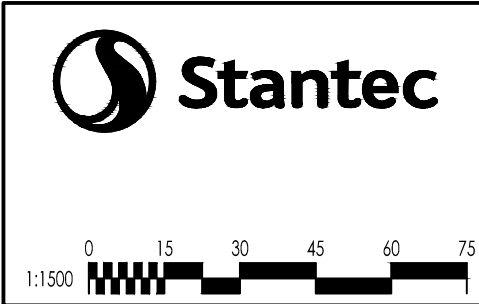
STORM MANHOLE
PROPOSED OGS UNIT
SINGLE/DOUBLE CATCHBASIN

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT
UPPER'S GROVE SUBDIVISION
RESIDENTIAL DEVELOPMENT
CITY OF THOROLD, ONTARIO
GR-1
PRELIMINARY GRADING PLAN
January 2024



PART 1
PIN 6457 - 0038

EMP-1
21.03 Ha
0.75
Tc 11.3 MIN



- Legend**
- SUBJECT LAND PROPERTY LINE
 - UPPER'S GROVE BLOCK DEVELOPMENT

- EXISTING STORM MANHOLE
- STORM MANHOLE
- SINGLE/DOUBLE CATCHBASIN

- STORM DRAINAGE BOUNDARY
- DRAINAGE AREA
- RUNOFF COEFFICIENT
- OVERLAND FLOW ROUTE

EXT-1
21.60 Ha
0.25
Tc=11.0

- EXTERNAL DRAINAGE AREA ID
- EXTERNAL DRAINAGE AREA
- RUNOFF COEFFICIENT
- TIME OF CONCENTRATION

FUNCTIONAL SERVICING AND
STORMWATER MANAGEMENT REPORT
UPPER'S GROVE BLOCK DEVELOPMENT
RESIDENTIAL DEVELOPMENT
CITY OF THOROLD, ONTARIO
STM-1
PRELIMINARY STORM
SERVICING PLAN
January 2024



1:2000

Legend

- SUBJECT LAND PROPERTY LINE
- UPPER'S GROVE BLOCK DEVELOPMENT
- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER
- SANITARY DRAINAGE BOUNDARY

10.86 ha
84/1358

EXT-1
21.60 Ha
0.25
Tc=11.0

EXT-1
21.60 Ha
0.405 L/s/Ha
8.75 L/s

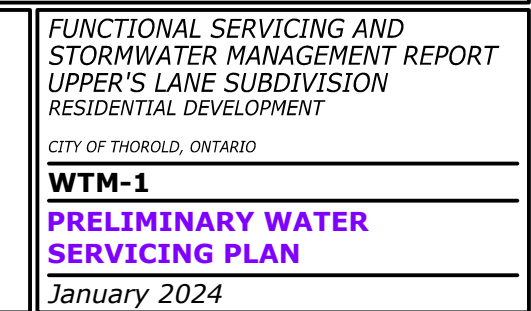
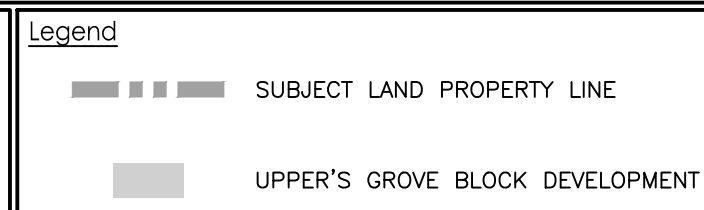
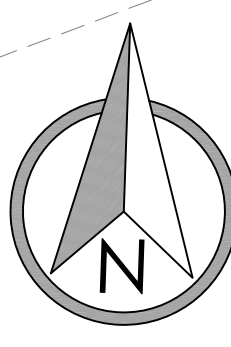
DRAINAGE AREA
DRAINAGE ID/TOTAL POPULATION

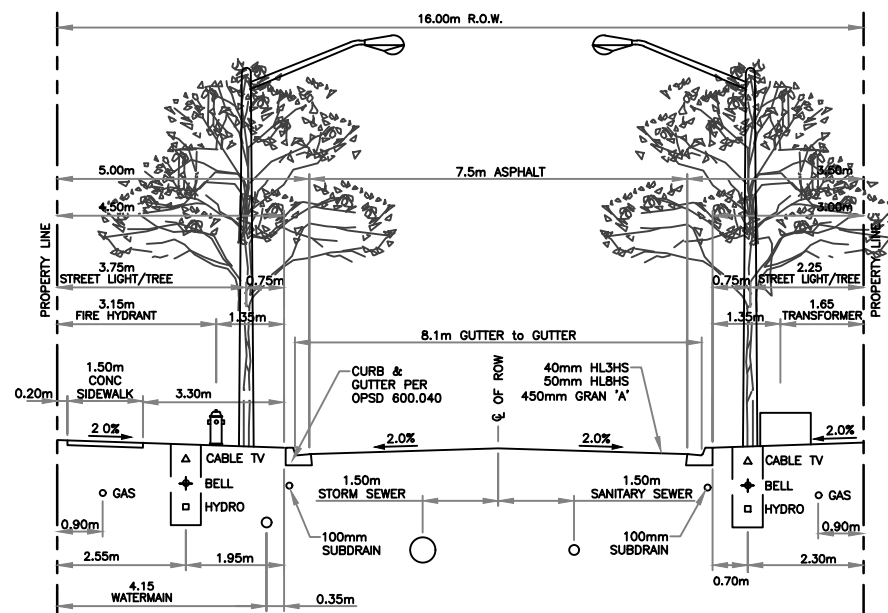
EXTERNAL DRAINAGE AREA ID
EXTERNAL DRAINAGE AREA
POPULATION PER HA
TOTAL POPULATION

EXT-1
EXTERNAL DRAINAGE AREA ID
EXTERNAL DRAINAGE AREA
FLOW RATE (LIGHT INDUSTRIAL)
TOTAL EXTERNAL FLOW

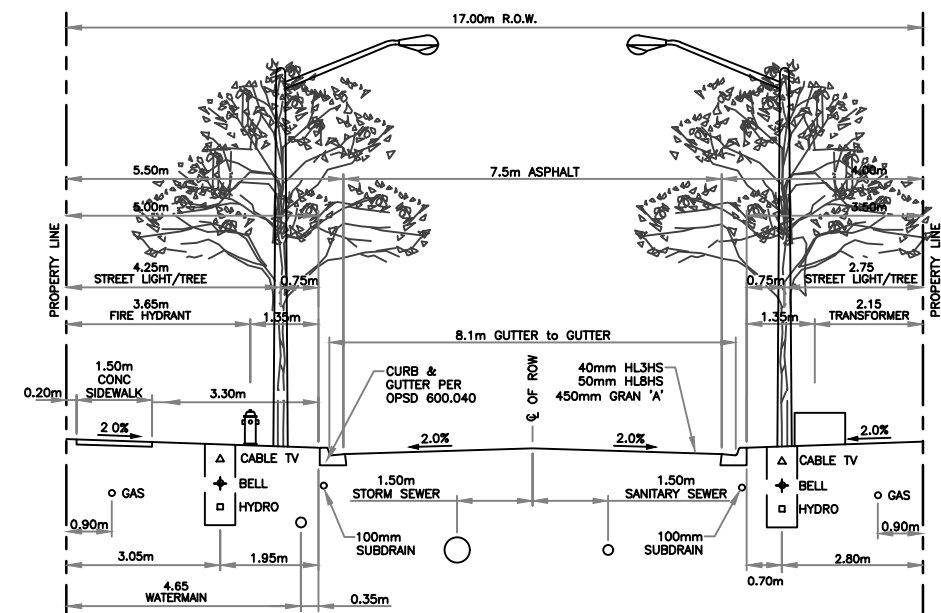
FUNCTIONAL SERVICING AND
STORMWATER MANAGEMENT REPORT
UPPER'S GROVE SUBDIVISION
RESIDENTIAL DEVELOPMENT
CITY OF THOROLD, ONTARIO

SAN-1
**PRELIMINARY SANITARY
SERVICING PLAN**
January 2024

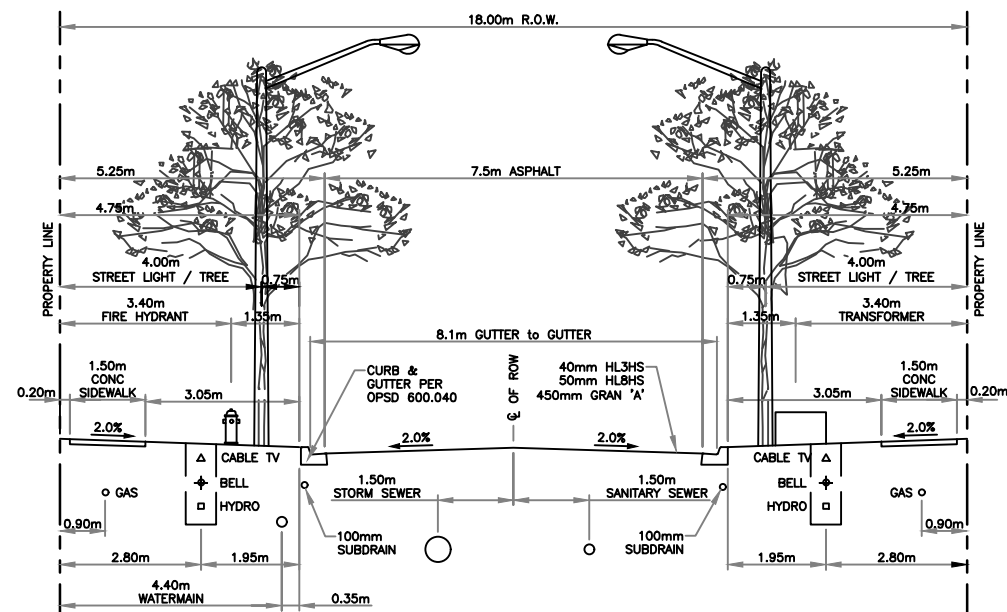




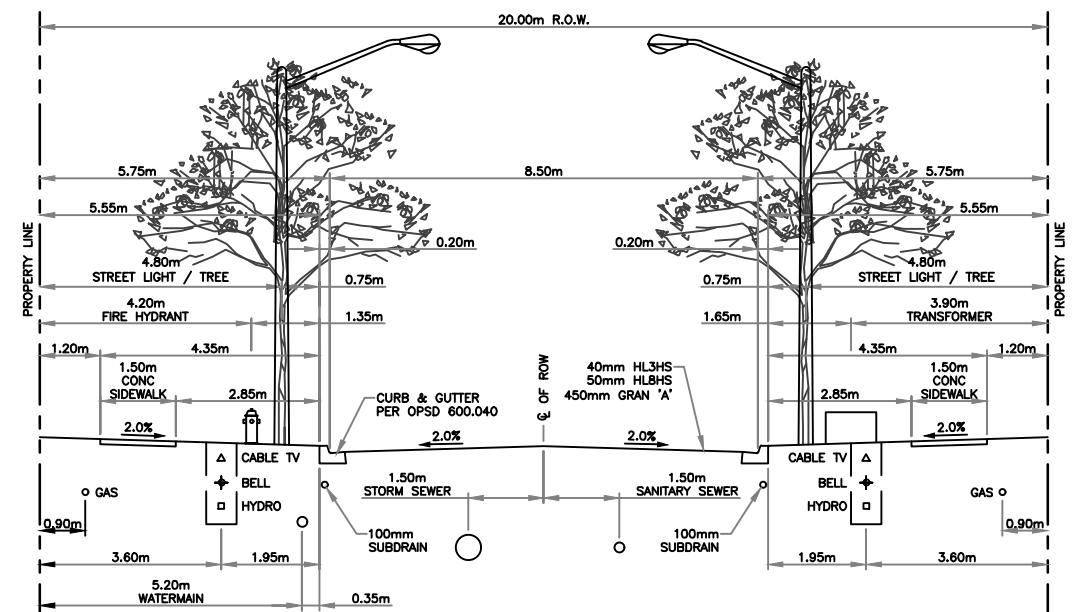
TYPICAL 16.0m ROW CROSS-SECTION



TYPICAL 17.0m ROW CROSS-SECTION



TYPICAL 18.0m ROW CROSS-SECTION



TYPICAL 20.0m ROW CROSS-SECTION



Legend

FUNCTIONAL SERVICING AND
STORMWATER MANAGEMENT REPORT
UPPER'S LANE SUBDIVISION
RESIDENTIAL DEVELOPMENT

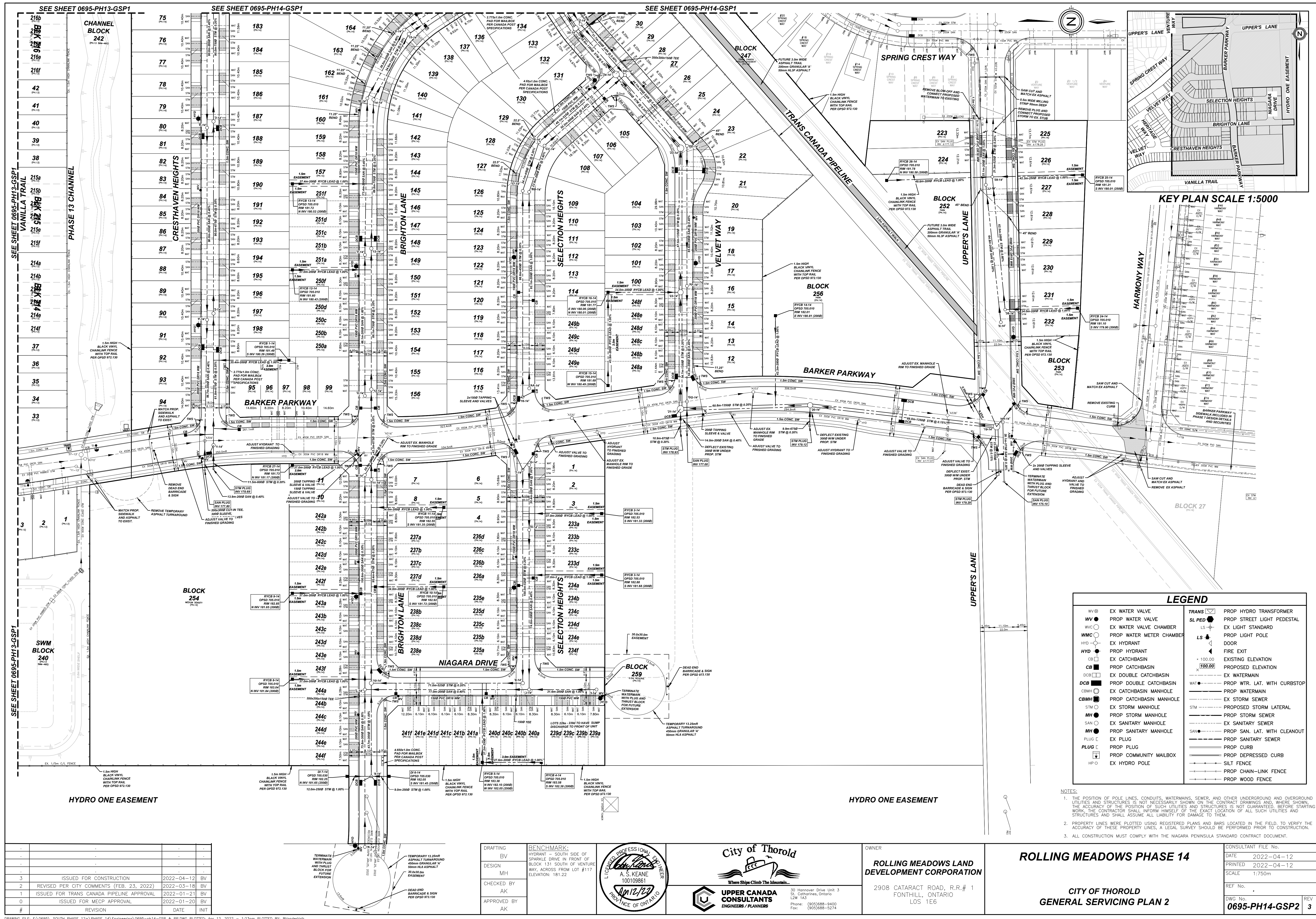
CITY OF THOROLD, ONTARIO

TYP-1

TYPICAL ROAD SECTIONS

January 2024

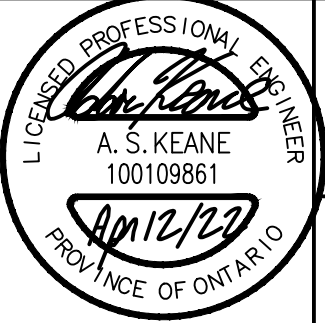




3	ISSUED FOR CONSTRUCTION	2022-04-12	BV
2	REVISED PER CITY COMMENTS (FEB. 23, 2022)	2022-03-18	BV
1	ISSUED FOR TRANS CANADA PIPELINE APPROVAL	2022-01-21	BV
0	ISSUED FOR MECP APPROVAL	2022-01-20	BV
#	REVISION	DATE	INIT

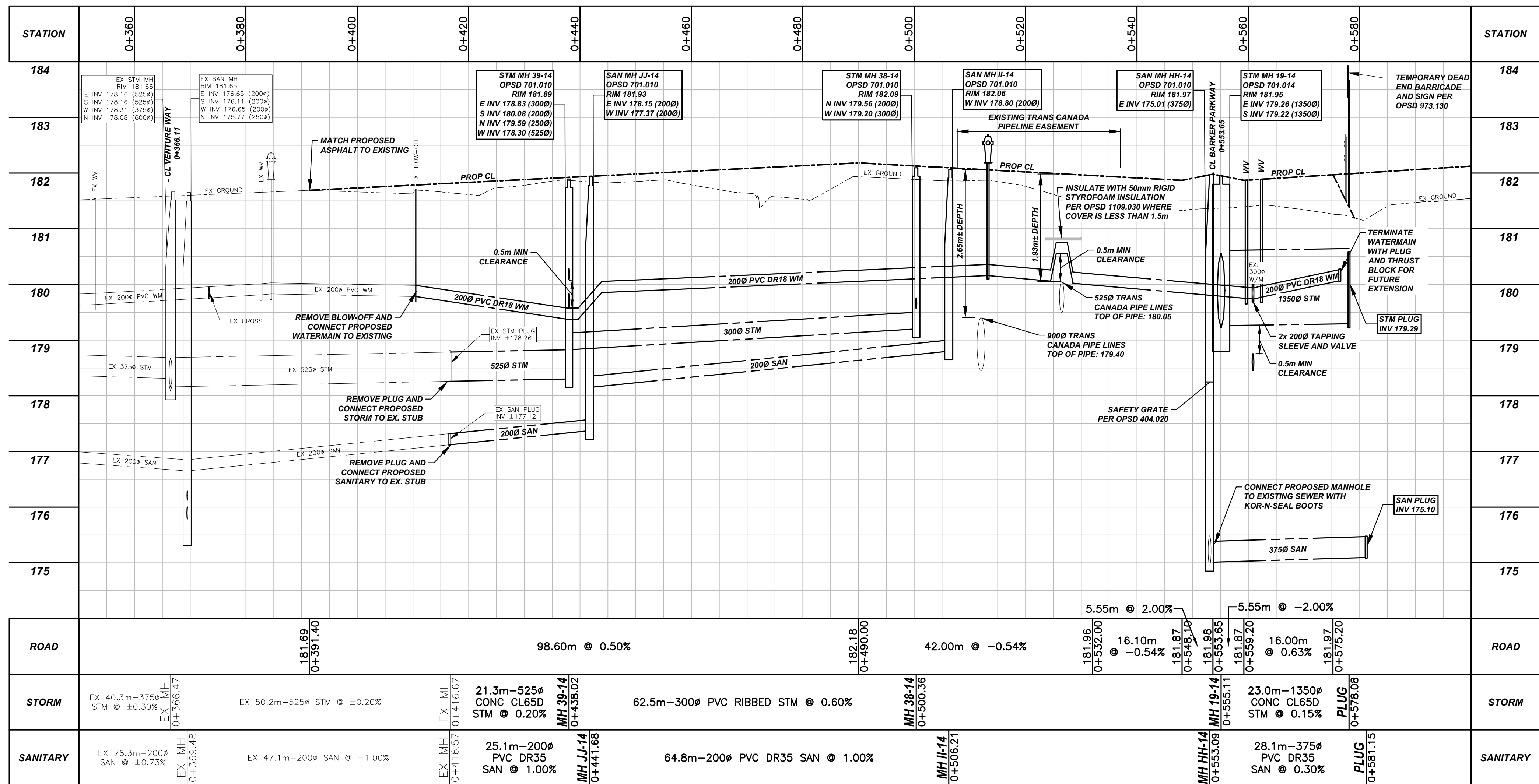
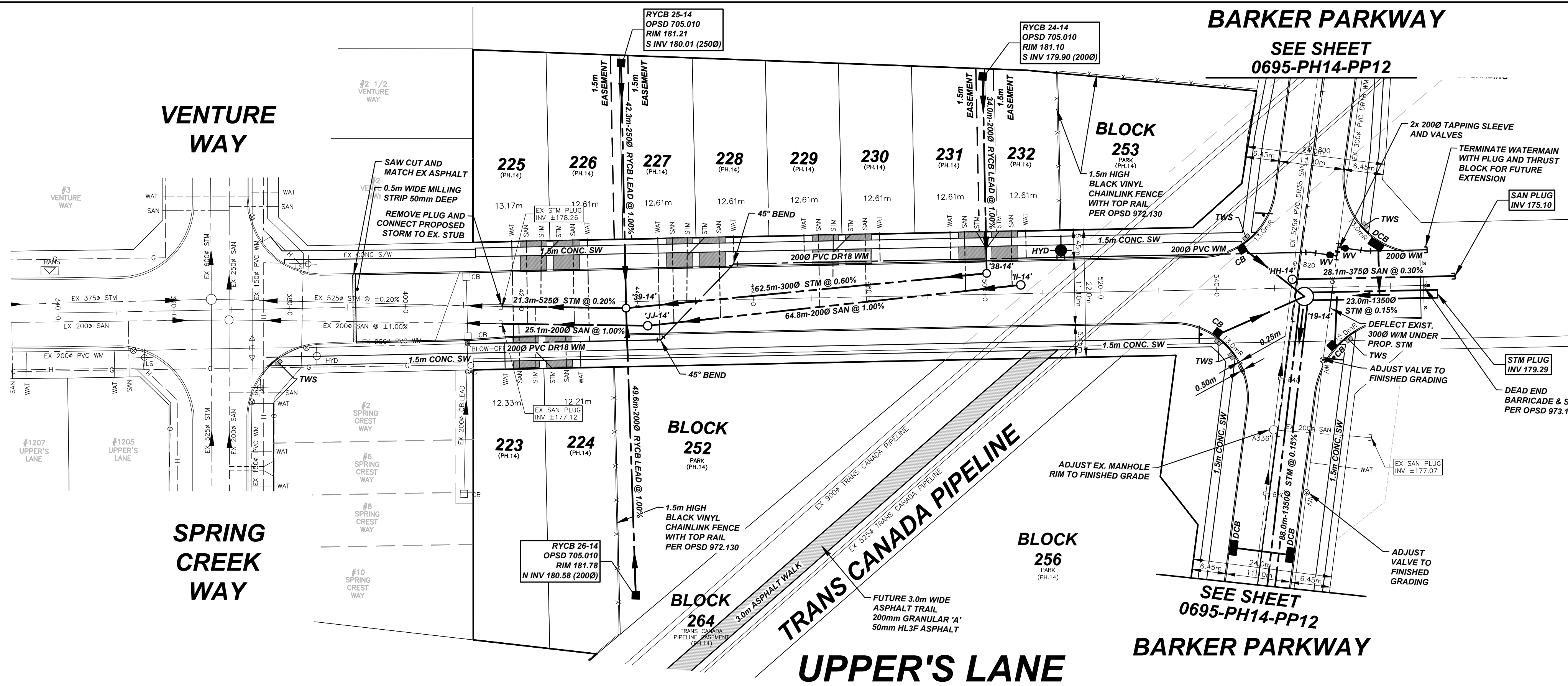
DRAFTING	BV
DESIGN	MH
CHECKED BY	AK
APPROVED BY	AK

BENCHMARK:
HYDRANT - SOUTH SIDE OF
SPARKLE DRIVE IN FRONT OF
BLOCK 131 SOUTH OF VENTURE
WAY, ACROSS FROM LOT #117
ELEVATION: 181.22



OWNER
ROLLING MEADOWS LAND DEVELOPMENT CORPORATION
2908 CATARACT ROAD, R.R.# 1
FONTHILL, ONTARIO
L0S 1E6

ROLLING MEADOWS PHASE 14	
CITY OF THOROLD GENERAL SERVICING PLAN 2	
CONSULTANT FILE No.	DATE 2022-04-12
	PRINTED 2022-04-12
	SCALE 1:750m
REF No.	
DWG No.	REV
0695-PH14-GSP2	3

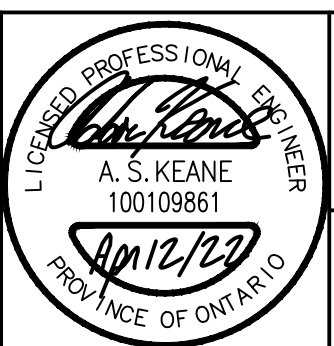


1	ISSUED FOR CONSTRUCTION	2022-04-12	EV
2	REVISED PER CITY COMMENTS (FEB. 23, 2022)	2022-03-18	EV
1	ISSUED FOR TRANS CANADA PIPELINE APPROVAL	2022-01-21	EV
0	ISSUED FOR MECP APPROVAL	2022-01-20	EV
#	REVISION	DATE	INIT

- NOTES:
1. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER, AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE VERIFYING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
 2. PROPERTY LINES WERE PLOTTED USING REGISTERED PLANS AND BARS LOCATED IN THE FIELD TO VERIFY THE ACCURACY OF THESE PROPERTY LINES. A LEGAL SURVEY SHOULD BE PERFORMED PRIOR TO CONSTRUCTION.
 3. ALL CONSTRUCTION MUST COMPLY WITH THE NIAGARA PENINSULA STANDARD CONTRACT DOCUMENT.

DRAFTING	EV
DESIGN	MH
CHECKED BY	AK
APPROVED BY	AK

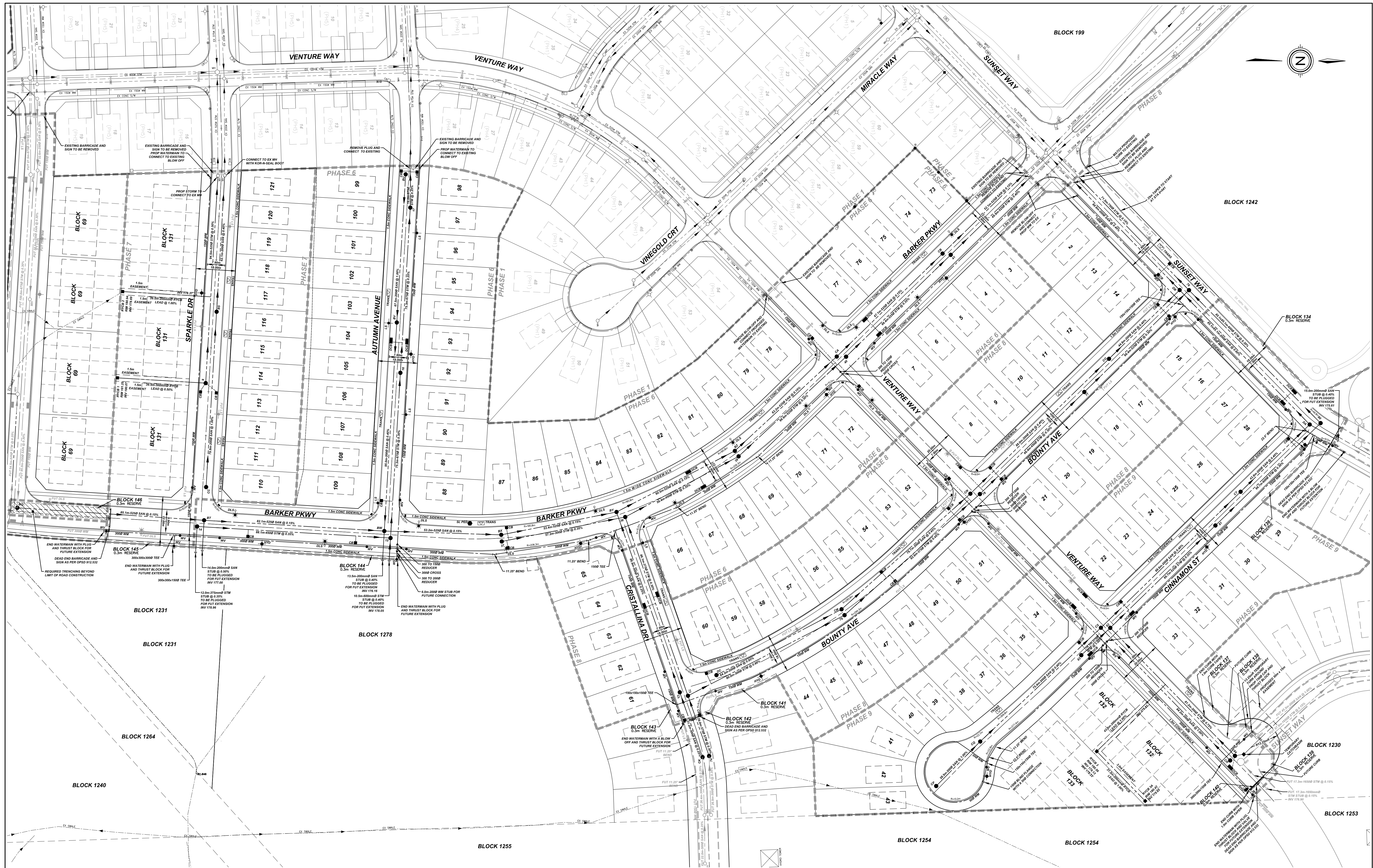
BENCHMARK:
HYDRANT - SOUTH SIDE OF
SPARKLE DRIVE IN FRONT OF
BLOCK 131 SOUTH OF VENTURE
WAY, ACROSS FROM LOT #117
ELEVATION: 181.22



OWNER
ROLLING MEADOWS LAND DEVELOPMENT CORPORATION
2908 CATARACT ROAD, R.R.# 1
FONTHILL, ONTARIO
L0S 1E6

**ROLLING MEADOWS PHASE 14
UPPER'S LANE
FROM VENTURE WAY TO BARKER PARKWAY
CITY OF THOROLD
PLAN PROFILE 13**

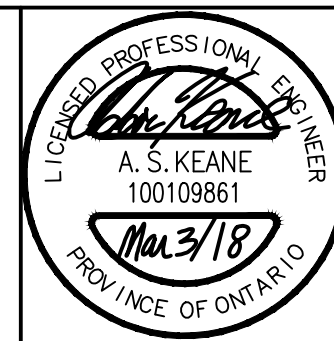
CONSULTANT FILE No.	0695
DATE	2022-04-12
PRINTED	2022-04-12
SCALE	Hor : 1:500 m Ver : 1:50 m
REF No.	----
DWG No.	0695-PH14-PP13
REV	3



9	REVISED HYDRO TRANSFORMERS	2018-04-03	AK
8	REVISED SIDEWALK LOCATION	2017-11-09	AK
7	REVISED SEWER AND GRADING VENTURE WAY	2017-10-23	AK
6	REVISED LIMIT OF CONSTRUCTION (PHASE 9)	2017-08-31	AK
5	REVISED BLOCK 136 (6 UNITS)	2017-07-24	AK
4	ISSUED FOR CONSTRUCTION	2017-05-29	AK
3	REVISED PER MOECC COMMENTS	2017-05-09	AK
2	REVISED LOT NUMBERS	2017-03-29	AK
#	REVISION	DATE	INIT

- NOTES:
1. THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWER, AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
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 3. ALL CONSTRUCTION MUST COMPLY WITH THE NIAGARA PENINSULA STANDARD CONTRACT DOCUMENT.

DRAFTING	TO
DESIGN	AK
CHECKED BY	AK
APPROVED BY	AK



City of Thorold
Where Ships Climb The Mountain

UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

261 Mortindale Road
Unit #1
St. Catharines, ON
L2M 1A1
Phone: (905) 688-9400
Fax: (905) 688-5274

OWNER
ROLLING MEADOWS LAND DEVELOPMENT CORPORATION
2908 CATARACT ROAD, R.R.# 1
FONTHILL, ONTARIO
L0S 1E6

ROLLING MEADOWS PH 6-9
GENERAL SERVICING PLAN

CONSULTANT FILE No.	0695
DATE	2018-04-03
PRINTED	2018-04-03
SCALE	1:750 m
REF No.	
DWG No.	0695-PH6-GSP
REV	9

February 2, 2024

Appendix F SOIL REPORT

Geotechnical Assessment Report

Thorold Townline Road, On

Dated January 25, 2022

ENGINEERING CONSULTING SERVICES – Geotechnical Assessment Report Thorold Townline Road, Thorold, ON



Project No.: CCO-222884-00

Prepared for:

1000010896 Ontario Limited
15064 Yonge Street, 3rd Floor
Aurora, ON
ON L4G 1M2

McIntosh Perry Consulting Engineers Ltd.
6240 Highway 7, Suite 200,
Woodbridge, ON, L4H 4G3

January 25, 2022

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January 25, 2022

1000010896 Ontario Limited
15064 Yonge Street, 3rd Floor
Aurora, ON
ON L4G 1M2

Attention: Mr. Laiq Siddiqui, President & CEO

**Re: Preliminary Geotechnical Assessment Report
Parcel 2-Meadows Secondary Plan Area, Thorold, Ontario**

1.0 INTRODUCTION

McIntosh Perry Consulting Engineers Ltd. (MPCE) was retained by 1000010896 Ontario Limited to carry out a preliminary geotechnical assessment for potential purchase of a site (Parcel 2-Meadows Secondary Plan Area), within the greater boundaries of Beaverdams Road (North), Thorold Townline Road (East), Davis Road (West) and Upper's Ln (South) ("Site").

Authorization to proceed with the geotechnical assessment was provided by Mr. Laiq Siddiqui of 1000010896 Ontario Limited on October 27th, 2021.

The purpose of the geotechnical investigation was to determine the subsurface conditions and groundwater observations at the site by means of boreholes, field, and laboratory tests. Based on the information obtained, the geotechnical characteristics of the subsurface soils are to be estimated, and site conditions described. Based on this understanding of the ground characteristics, it was required to provide a general geotechnical assessment as to the potential feasibility of the site for low-rise residential development. The potential feasibility was focussed on the following issues from a geotechnical standpoint:

- General geotechnical assessment
- Foundation load bearing
- Excavatability
- Surface drainage
- Open-cut excavation stability
- Temporary shoring
- Pavement Structures
- Buried utilities and service trenches
- Re-use of excavated material

The fieldwork and geotechnical analyses of this investigation were completed in general accordance with MPCE Quote No. PCO-222884-00, dated October 27th, 2021.

2.0 BACKGROUND INFORMATION

2.1 Geological Setting

According to the geological maps, the site is in the general physiographic region known as the Haldimand clay Plain. Heavy-textured clayey soils comprise the upper zones of the overburden. According to the surficial geology map of Southern Ontario, the site locale is indicated as comprising fine textured glaciolacustrine deposits.

According to the Ontario Geotechnical Borehole Database, underlying the clay deposit, occasional, sand/silt with boulders are also reported in the general area. The bedrock is generally indicated to be shallow.

Based on a vicinity MTO foundation report (Geocres 57-F-248C: CNR Overpass, Allanburg) the interception of a lacustrine clay deposit and, with depth, shale fragments, were also reported. No observation of groundwater was reported within about 6 m below ground surface.

McIntosh Perry Limited (MPL), a predecessor of MPCE, carried out a geotechnical investigation in an adjoining site to the west of the subject property (Report No. T1715392GE dated January 5, 2018). Following a veneer of topsoil and thin fill layer, native cohesive deposits were intercepted. Five of the nine boreholes were terminated in less than 5 m depth due to auger refusal, possibly due to inferred bedrock. All boreholes were found to be dry on completion of drilling. All boreholes were advanced to less than 6.5 m depth.

2.2 Site Description

The Site is broadly divided into two Areas, i.e., Area 'A' and Area 'B'. The comparison of elevations between the two areas is not feasible as the two areas are tied to different benchmarks, each assumed to be at 100 m elevation (See Appendix for the location of the benchmarks). A Google imagery of the site is shown on Fig. 2.1. It is in a locality of newly developing residential neighbourhood east of Davis Road. In the past, the subject property is likely to have been under farming.



Fig. 2.1 Satellite Imagery of the Subject Site (the site boundary is shown very approximately within the dotted red perimeter)

3.0 FIELD AND LABORATORY INVESTIGATIONS

3.1 Field Investigation

Table 3-1 shows the details of the field investigation summary (see Borehole Location Plan in Appendix for approximate locations of boreholes). Applicable private and public locates were obtained prior to drilling to clear the drilling locations of buried services and utilities. All boreholes were drilled with a track mounted drill rig with solid stem augers.

Table 3-1 – Field Investigation Summary

Area	Number of Boreholes	Borehole Depth Range(m)	Borehole Collar Elevation Range ¹ (m)	Period of Drilling	No. of Monitoring Wells
A	7 (BH-1A to BH-7A)	4.9 to 6.6	99.4 to 97.1	Dec 9 to Dec 10, 2021	Nil
B	4 (BH-8B to BH-11B)	3.5 to 6.6	102.1 to 100.6	Dec 9, 2021	Nil

Notes: 1 - The surface elevations at the borehole locations were surveyed by MP staff and were referenced to locality geodetic benchmarks, one for Area A and another for Area B, each with its own datum at 100 m. All boreholes were backfilled with bentonite/cuttings upon completion.

The subsurface strata were sampled at regular intervals of depth using a split-spoon sampler, following the procedure as detailed in the ASTM-D1586 for the Standard Penetration Test. SPT 'N' blow counts were recorded as per the subject ASTM procedure to obtain an indication of the compactness condition or the consistency of the sampled soil material. The SPT 'N' values thus obtained are indicated on the Record of Borehole Sheets (Refer to Appendix A). Where the consistency of the SPT split-spoon samples of a cohesive nature allowed, pocket penetrometer readings were taken, which at best approximate indices of undrained shear strength.

The groundwater level was measured in each borehole upon completion of drilling and all boreholes were found to be dry. No groundwater monitoring wells were installed.

The fieldwork was carried out under the full-time supervision of MP technical staff who directed the exploration and sampling operation, logged borehole data, and took custody of the soil samples retrieved for subsequent laboratory identification and testing. Table 3-2 presents a summary of the borehole details of the MP geotechnical investigation program.

Table 3-2 - Summary of Borehole Details (Elevations of Areas 'A' and 'B' are tied to different datums)

Area	Borehole No.	Borehole Depth (m)	Borehole Collar Elevation (m)
A	BH-1A	4.9	98.6
A	BH-2A	5.5	99.4
A	BH-3A	6.6	99.2
A	BH-4A	5.0	98.4
A	BH-5A	5.3	98.8
A	BH-6A	6.6	98.8
A	BH-7A	6.6	97.1
B	BH-8B	4.4	100.6
B	BH-9B	3.5	100.7
B	BH-10B	5.6	101.2
B	BH-11B	6.6	102.1

3.2 Laboratory Investigations

All soil samples were taken to our accredited Toronto laboratory for final visual assessment, classification, and testing. Samples were visually examined and classified in general accordance with the Unified Soil Classification System, and Canadian Foundation Engineering Manual (CFEM).

A routine laboratory testing program consisting of natural water content, grain size distribution analysis, hydrometer analysis and Atterberg Limits were carried out on selected representative soil samples. Soil descriptions and test results are documented on the borehole records, (see Appendix A, attached to this report).

The soil samples recovered during the investigation will be stored in our laboratory for a period of 30 days following the submission of the final geotechnical report, after which they will be discarded unless further instructions are received.

4.0 SUBSURFACE CONDITIONS

4.1 Overview

The overview is based on the findings of the boreholes advanced on the subject site and the findings of the laboratory investigations. The general stratigraphy within the depths investigated was topsoil underlain by native deposits. All the boreholes were terminated in a native cohesive deposit except BH 11B which was terminated in a silty sand/sandy silt

deposit underlying the native cohesive deposit. Within Area 'A', the borehole ground elevations ranged from 99.4 m to 97.1 m and the corresponding data for Area 'B' ranged from 102.1 m to 100.6 m. The borehole depths ranged from 4.9 m to 6.6 m in Area 'A' and from 3.5 m to 6.6 m in Area 'B'.

The cohesive deposit intercepted in all the boreholes, underlying topsoil, was found to be of clayey silt lithology. Based on the SPT blow counts, this deposit was found to be typically stiff or better within the depths investigated. The silty sand/sandy silt deposit predominantly intercepted in BH 11B underlying the cohesive deposit was found to be of dense/very dense compactness. Interpretive observations on these deposits will be addressed in Section 5.

Five of the eleven boreholes (both from Area 'A' and Area 'B') were terminated on auger and spoon refusal prematurely.

All boreholes were found to be dry on termination of the boreholes. However, change of groundwater conditions cannot be discounted due to extreme weather events and/or due to seasonal effects or with longer exposure of excavations.

Unless otherwise mentioned all SPT 'N' results quoted are for spoon penetrations of 300 mm as per the subject ASTM. Note should be taken of the different datums as discussed in Section 2.2.

4.2 Topsoil

The veneer of topsoil found ranged in thickness from 50 mm to 200 mm and was intercepted in all the boreholes. It should be noted that the intercepted topsoil thicknesses are location specific and could vary across the site and therefore should not be relied upon for quantity estimation.

4.3 Native Deposits

The explored thickness of the native deposits ranged from 4.8 m to 6.6 m in Area 'A' and from 3.4 m to 6.5 m in Area 'B', on termination of the boreholes.

Two grain size analysis tests in the native deposits gave the following grain size distributions shown in Table 4-1. The results of four Atterberg Limits tests from the deposit gave the following results shown in Table 4-2.

Table 4-1- Grain Size Distribution Summary – Native Deposits

Borehole No. / Sample No.	Size Fractions (%)					Moisture Content (%)
	Gravel	Sand	Silt	Clay	Fines	
BH 6A/ SS 1	0	12.7	30.0	57.3	NA	22.1
BH 11B / SS 4	5.8	36.7	NA	NA	57.5	8.3
BH 3A / SS 6	NA	NA	NA	NA	NA	33.6

Notes: NA – not applicable

As mentioned earlier, the dominant deposit intercepted is the cohesive deposit. BH 6A/SS1 and BH3A/SS6 in Table 4-1 are indicative of this cohesive deposit. These results, in conjunction with the Atterberg Limits results in Table 4-2, both indicate the tested specimens of this deposit to be clayey silt. The natural moisture contents reported for this cohesive deposit (2 results from Table 4-1 and 4 results from Table 4-2) indicate a measured moisture range of 19.3% to 33.6%.

Table 4-2 -Atterberg Limits Test Results – Cohesive Native Deposit

Borehole No./ Sample No.	Liquid Limit (LL%)	Plastic Limit (PL%)	Plasticity Index (PI)	Moisture Content (%)
BH 4A/SS4	29	23	6	19.3
BH 6A/SS6	30	24	6	25
BH 9B/SS3	32	25	7	20.5
BH 10B/SS6	23	19	4	22.8

The SPT 'N' blow counts indicate the cohesive deposit to be typically stronger than of stiff consistency within the explored depths but the spatial distribution of SPT 'N' results with depth indicates an initial phase of increase of SPT 'N' blow count which later began to decrease with depth. The adjoining areas, Area 'A' and Area 'B' both show a similar trend (See Figs. 5.1 and 5.2).

The grain size distribution result for BH11B/SS4 shown in Table 4.1, is indicative of a fine-grained soil (the fines percentage is more than 50%). Based on the visual and tactile observations of all the retrieved SPT spoons from this fine-grained deposit indicate it to be a sandy silt/silty sand. This is further reflected by the low moisture content measurement of 8.3% reported in Table 4-1.

The SPT 'N' blow counts indicate a dense to a very dense state of compactness.

4.4 Groundwater Level Observations

No monitoring wells were installed in this investigation. At the completion of drilling of each borehole, no groundwater was observed.

5.0 GEOTECHNICAL ASSESSMENT

5.1 General

Given the objective of the client was to obtain a preliminary geotechnical assessment of the site for potential purchase, availability of specific development plans showing proposed locations would be too premature to expect at this stage. In keeping with the objective, this preliminary geotechnical assessment was of necessity scoped out comprising a limited number of widely spaced boreholes. Therefore, the ensuing preliminary geotechnical recommendations made would be very broad based. Once the proposed developments are finalized, additional targeted geotechnical investigation programs must be undertaken to develop structure location specific geotechnical recommendations.

Note should be taken of the different datums as discussed in Section 2.2.

5.2 Frost Depth and Frost Susceptibility

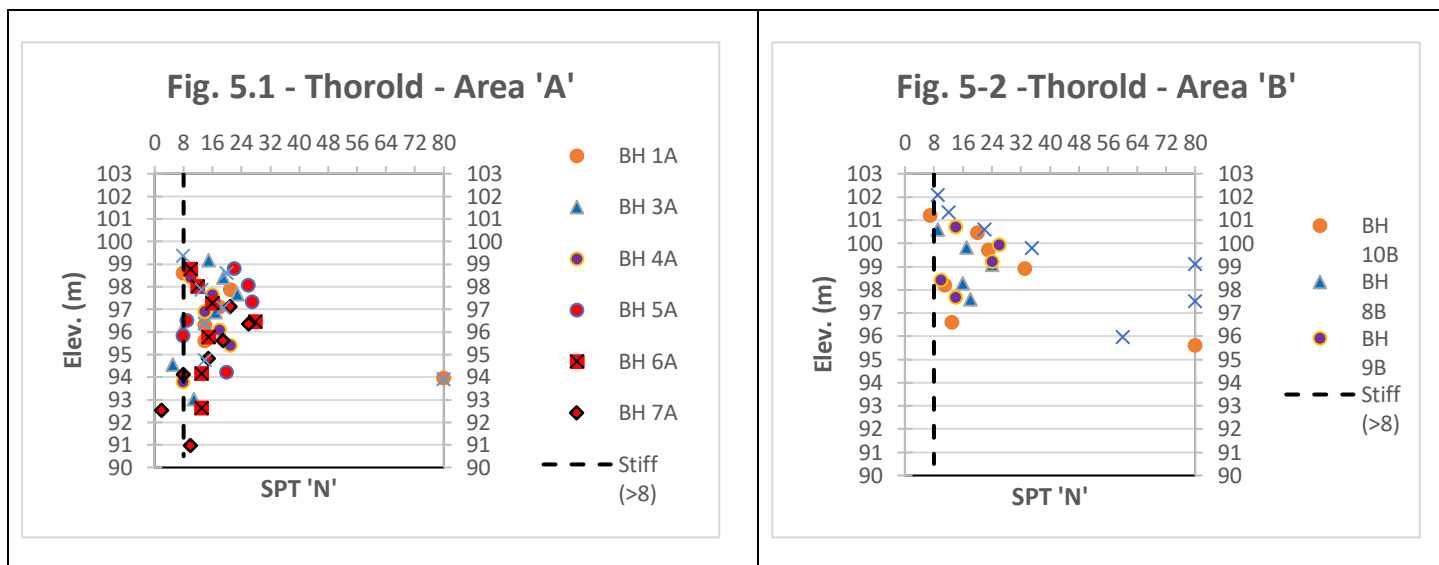
Based on OPSD 3090.101, the Frost Penetration Depth for the project area at Thorold, Ontario, is 1.1 m. Therefore, all foundation elements that are sensitive to movements (i.e., heave and subsequent post-thaw settlement) located in unheated areas should be provided with a minimum of 1.1 metres of non-frost susceptible earth cover, or equivalent thermal insulation, for frost protection. Based on the MTO Frost Classification Criteria, and the grain size distribution summary in Table 4-1 of this report, the surficial deposit is classified to be of “LOW” frost susceptibility, based on limited results.

5.3 Seismic Site Class Classification

Based on the borehole information and according to Table 4.1.8.4.A of the Building Code, the subject site can be classified as Class ‘D’ for seismic site response. However, by undertaking in-situ seismic shear wave velocity measurements, there is a potential to upgrade the seismic site class classification.

5.4 Overview of Subsoil Characterization for Geotechnical Design and Construction

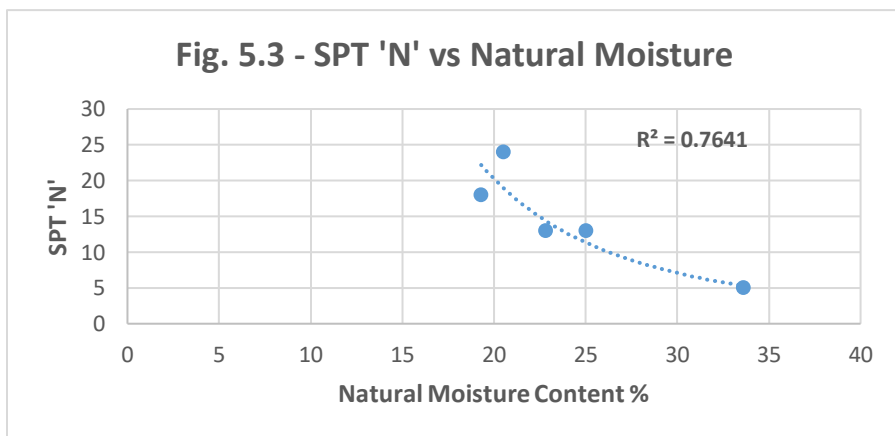
Based on the field and laboratory results discussed in Section 4 of this report, the subsurface conditions identified in this report are generally comparable with previous reported geotechnical findings for the general area which includes the subject site, and which have been briefly discussed in Section 2.1 of this report.



Based on Figures 5-1 and 5-2 which show the SPT 'N' blow counts with depth, these are indicative of increasing stiffer to higher consistency subsurface conditions which peak at a certain depth below the ground surface but then begin to show a decreasing trend of strength with deeper explored depths. Based on the reported local geology, these deposits are likely to be varved, i.e., with possible interbedding with water bearing silt seams, which will require careful attention to foundation construction detail. These issues are broadly discussed in the ensuing sections.

5.5 Potential Moisture Sensitivity

The clayey silt deposit has shown some properties such as low values of Plasticity Index (PI) (4% to 7% based on 4 test results), and relatively high moisture contents (19.3% to 33.6% based on 6 test results). These results indicate the potential vulnerability of this deposit to construction disturbance, as seen in Fig. 5.3, as an indicative trend.



5.6 Foundation Load Bearing Considerations

These subsoil profiles indicate more than adequate foundation bearing strengths that are competent to carry low-rise residential development foundation loads. Based on the SPT profiles shown on Figs. 5.1 and 5.2, shallow foundations where the underside footing elevation is just below the frost depth, i.e., 1.1 m can have factored ULS resistance of 300 kPa and SLS of 200 kPa for total settlements not exceeding 25 mm and differential settlements not exceeding 19 mm.

In view of the decreasing shear strength with depth shown on Figs 5.1 and 5.2, foundation bearing recommendations for basement foundations should be based on a site-specific basis. However, assuming a conventional basement depth below finished grade to be 2.5 m approximately, a factored ULS of 180 kPa and SLS of 125 kPa can be used as a rough guide, subject to site-specific confirmation. There is potential for these recommendations to be increased based on site specific investigations.

The general area is known to have shallow bedrock conditions based on the findings of Section 2.1 of the report and the inferred findings of this investigation wherein auger refusal was observed in several boreholes forcing premature termination of borehole advancement. However, no weathered shale was positively intercepted in the investigation. Once this competent shale conditions can be positively confirmed during detailed design, this can open-up significant promise for potential use of *shallow* caissons to carry significantly higher foundation loads. Factored SLS pressures up to 5 MPa can be carried by such caissons founded on sound shale.

5.7 Excavatability of Subsoils

Lacustrine clay deposits generally being sorted sediments, are generally not widely known to have significant volumes of cobbles and boulders. The dense sandy silt/silty sand intercepted in a predominant measure in BH11B could likely contain cobbles and boulders, although not positively intercepted. The program of boreholes undertaken did not intercept fill materials, although the presence of such materials cannot be ruled out over the site. Any presence of uncontrolled fill present could potentially contain cobbles and boulders and deleterious material. It is recommended that these issues should be addressed in the contract documentation for any proposed excavations.

5.8 Surface Drainage

In view of the thick surficial clayey silt deposit underlying the veneer of topsoil, it will result in slow infiltration of precipitation. This would lead to perched water conditions and potential for subgrade softening. Site grading that promotes sound surface runoff management is an important aspect to be addressed.

5.9 Open-Cut Excavation Stability

In view of the high moisture levels recorded for the clayey silt deposit (cohesive deposit), in accordance with the Occupational Health and Safety Act (OHSA) of Ontario, the site overburden soils are classified as OHSA Type 4 soil. For, OHSA Type 4 soil, the recommended slopes for excavation sides are 3H:1V or shallower or should be shored for steeper side slopes. The cohesive deposit could be possibly varved (consisting of interbedded thin sequence of water bearing silt, and clays) and this could imply that short-term stability should not be relied upon as an indicator for longer-term excavation stability and hence extra vigilance should be exercised for prolonged exposure of excavations.

5.10 Temporary Shoring

Temporary shoring design should take into account possible shallow bedrock, and the presence of dense to very dense sandy silt/silty sand with the possibility of intercepting cobbles and boulders in these deposits. The shoring designer should also take cognizance of the fact, of the observed decrease of SPT 'N' blow counts with depth, as clearly shown on Figs. 5.1 and 5.2. The shoring system must be designed by a professional engineer experienced in such work and design must comply with but not limited to OPSS.Muni 539 – Temporary Protection Systems.

5.11 Pavement Design Considerations

In the event that asphaltic concrete pavement is used for the parking areas and site access roads constructed on-site, the following are our recommendations:

- Pavement subgrade can consist of the fill materials to be encountered at the Site. Prior to placing the pavement structure, any soft, loose, or unstable soil should be removed, and the subgrade prepared as noted below:
 1. Pavement subgrade should be compacted to at least 98% of the SPMDD and proof-rolled with a loaded tandem truck. Areas exhibiting more than 12 mm deflection should have the top 300 mm removed and replaced with approved drier materials.
 2. Sub-grade up-fill should also be compacted to at least 98% of the standard Proctor density of the material, at or below the optimum moisture content (OMC) in lifts not exceeding 200 mm in thickness. Compaction of the in-situ soils above the OMC could result in high pore pressures resulting in rolling “waterbed” effects, which can cause damage to the pavement structure. Therefore, any material that has a moisture content higher than 2% of its OMC at this site should be dried out.
- The granular base and subbase layers should be compacted to at least 100% of the SPMDD. In the extreme cases, such as during the wet season, the top 600 mm of the sub-grade may have to be replaced by compacted granular material in order to compensate for the inadequate strength of the wet sub-grade.
- The production and placement of asphaltic concrete and granular materials shall be in accordance with applicable OPSS requirements.
- The asphaltic concrete should be compacted to at least 96% of the Marshall density.
- The required pavement structures for car parking (light duty) and site access roads (heavy duty) are provided in Table 5-1.

Table 5-1: Minimum Pavement Thicknesses

Description	Light Duty	Heavy Duty	Concrete	Materials
Asphaltic Surface Course (HL3)	35 mm	50 mm	-	Hot Mix Asphalt
Asphaltic Base Course (HL8)	50 mm	60 mm	-	Hot Mix Asphalt
Concrete	-	-	200 mm	Portland Cement Concrete
Base Course	150 mm	150 mm	150 mm	19 mm crushed limestone or pit run granular “A”
Sub-base course	200 mm	300 mm	200 mm	50 mm crushed limestone

- The pavement surface and the subgrade should be graded to direct runoff water away from the roadway and associated infrastructure.

Furthermore, we recommend the installation of sub-drains along the perimeter of the pavement and throughout low areas to prevent infiltration and accumulation of surface runoff water in the pavement structure.

Based on the potential moisture sensitivity issues discussed in Section 5.5, it would be prudent to invest in good pavement drainage measures to protect pavement subgrades from vulnerability to moisture.

5.12 Buried Utilities and Service Trenches

Due to the possible varved nature of the deposit, the issues of moisture sensitivity discussed in Section 5.5 and the unreliability of unsupported stand-up capability for long duration of the cohesive deposit, are important considerations in the design of temporary excavation support. Therefore, the use of trench boxes as temporary excavation support systems, for excavations as deep as gravity run sanitary sewer invert levels, should be carefully evaluated by the shoring designer, taking into account the above adverse issues.

5.13 Re-Use of Excavated Material

Excavated cohesive material will not be suitable as structural backfill. For use as recompacted earthfill, it will be necessary to address the high in-situ moisture levels and resulting difficulties for compaction, e.g., by discing and subjecting to aeration, to achieve required minimum engineered compaction levels.

5.14 Construction Considerations

All foundation bearing surfaces and trench bases should be placed with lean concrete mud mats soon after being inspected and approved to prevent deterioration from the elements and disturbance.

Where OPSS 1010 Granular Type 'A' or Type 'B' materials are used to enhance foundation support and/or act as drainage media, in order to prevent contamination of such media from the underlying moisture sensitive native deposits, it is recommended that a suitable geotextile be placed at the interface between the granular and the native. OPSS 1860 Class II Non-Woven geotextiles are recommended for this purpose.

The possibly varved nature of the clayey silt deposit could require benching, slope flattening, and de-pressurization of the moisture laden cohesive deposits for excavation stability. These are some options that need to be considered by the shoring designer in the mitigation of potential instability risks associated with excavations. Seepage from cut faces can be expected and such seepage should be managed by suitably filtered and strategically placed sumps. Need for some positive dewatering cannot be ruled out.

5.15 General Considerations

At the time of writing this report, no detailed design was available. Hence the recommendations given in this report are of a very broad nature, and therefore must be confirmed based on additional foundation investigations on a site-specific basis for proposed constructions in the future.

6.0 CLOSURE

We trust that the following information is sufficient for your needs. We will be pleased to discuss the salient findings of this report with you, should you wish. If you require our further services in this regard, please do not hesitate to contact our office.

Yours truly,

McIntosh Perry Consulting Engineers Ltd.



Vasantha Wijeyakulasuriya, M.Eng., P.Eng.

Senior Technical Director, Geotechnical



Zeyad Buni, P.Eng.

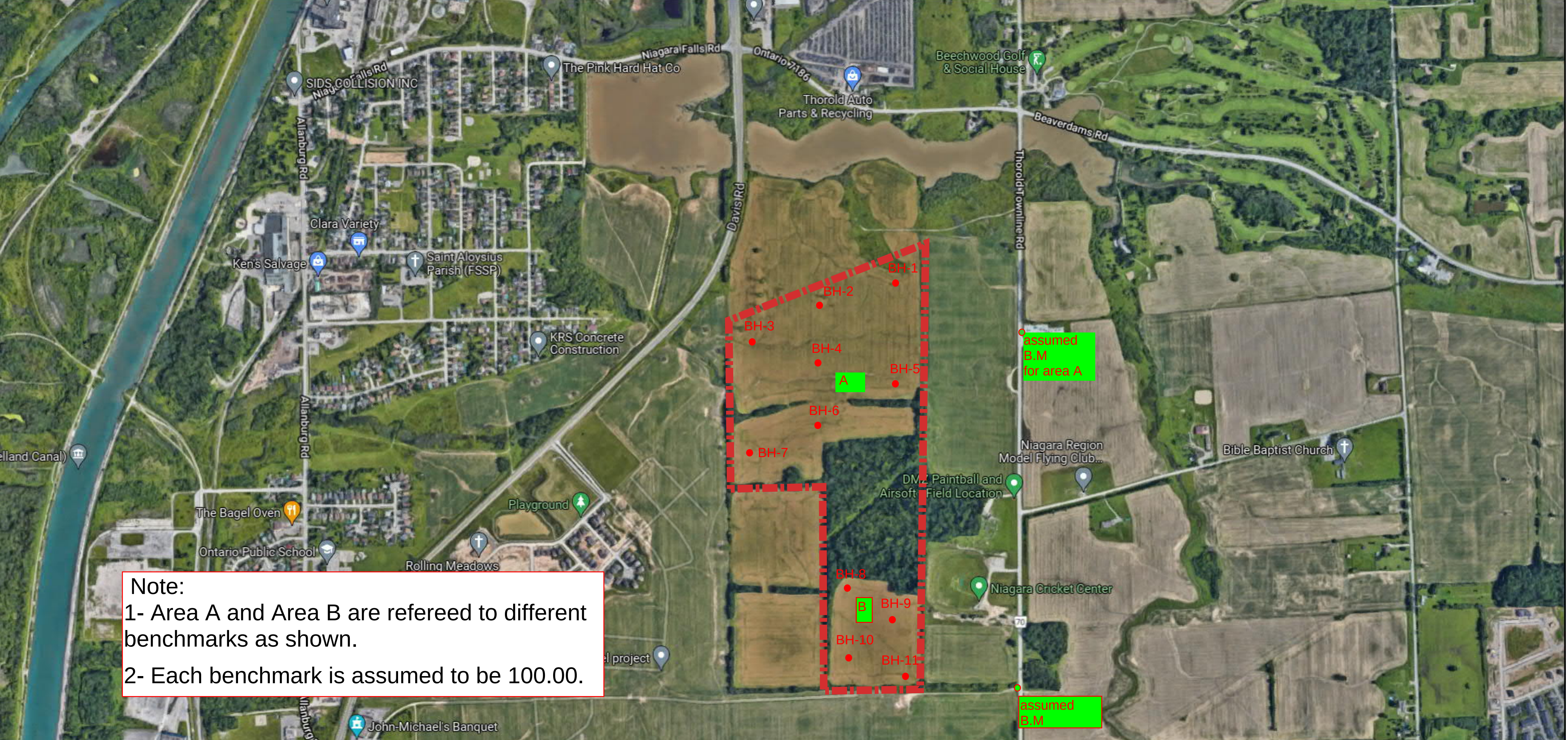
Practice Area Lead, Geotechnical



Esam Deif, P.Eng.

Vice President, Geotechnical Services

APPENDIX A

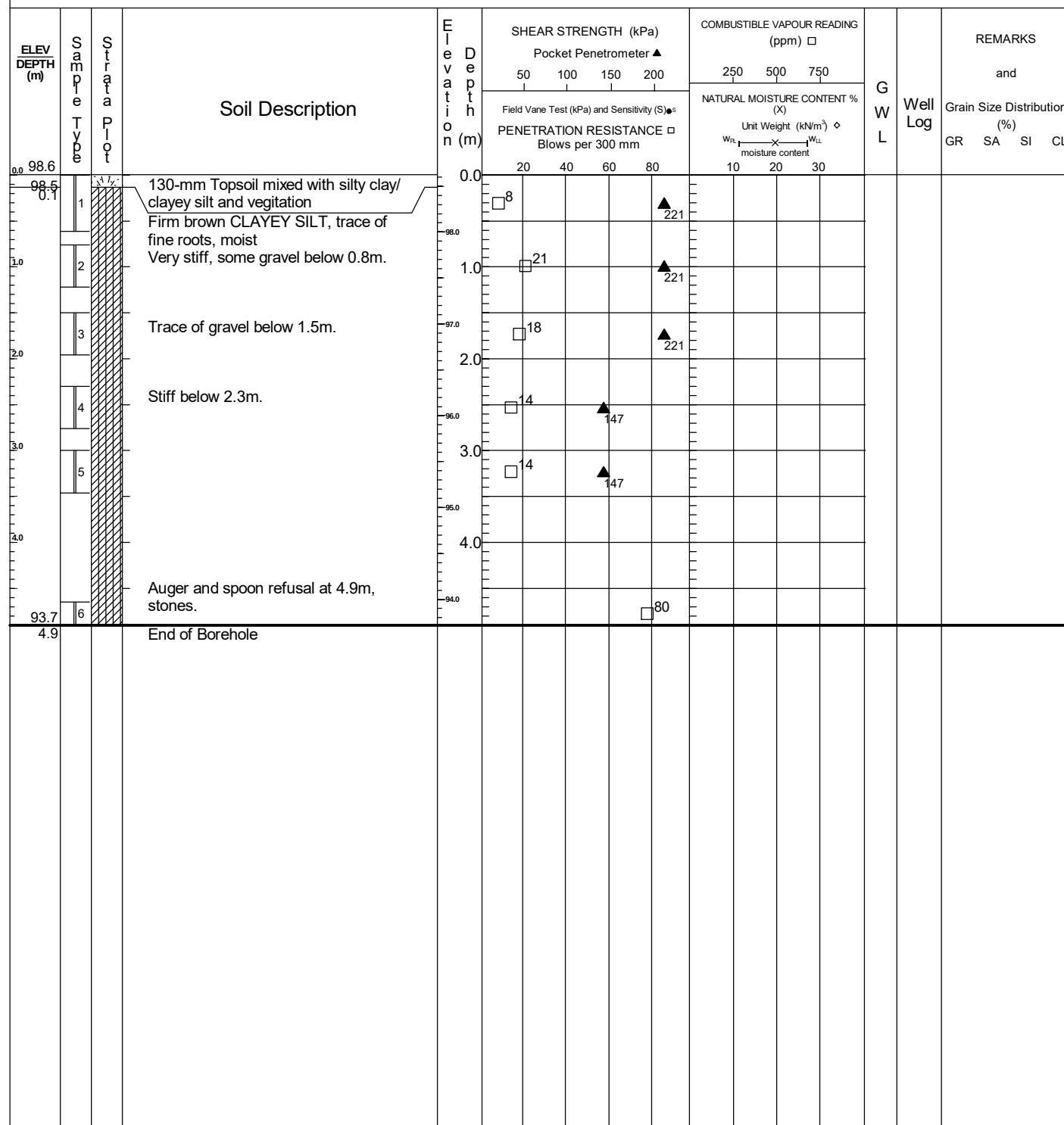


Note:
1- Area A and Area B are refereed to different benchmarks as shown.
2- Each benchmark is assumed to be 100.00.

PROJECT NO: CCO-222884-00
 PROJECT: Geotechnical Investigation
 LOCATION: Thorold Townline Rd.
 Compiled By: Magdy Youssef
 Checked By:
 Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-01-A
 DATE: Dec. 09, 21
 Method: SS
 Diameter (mm):
 Easting:
 Northing:

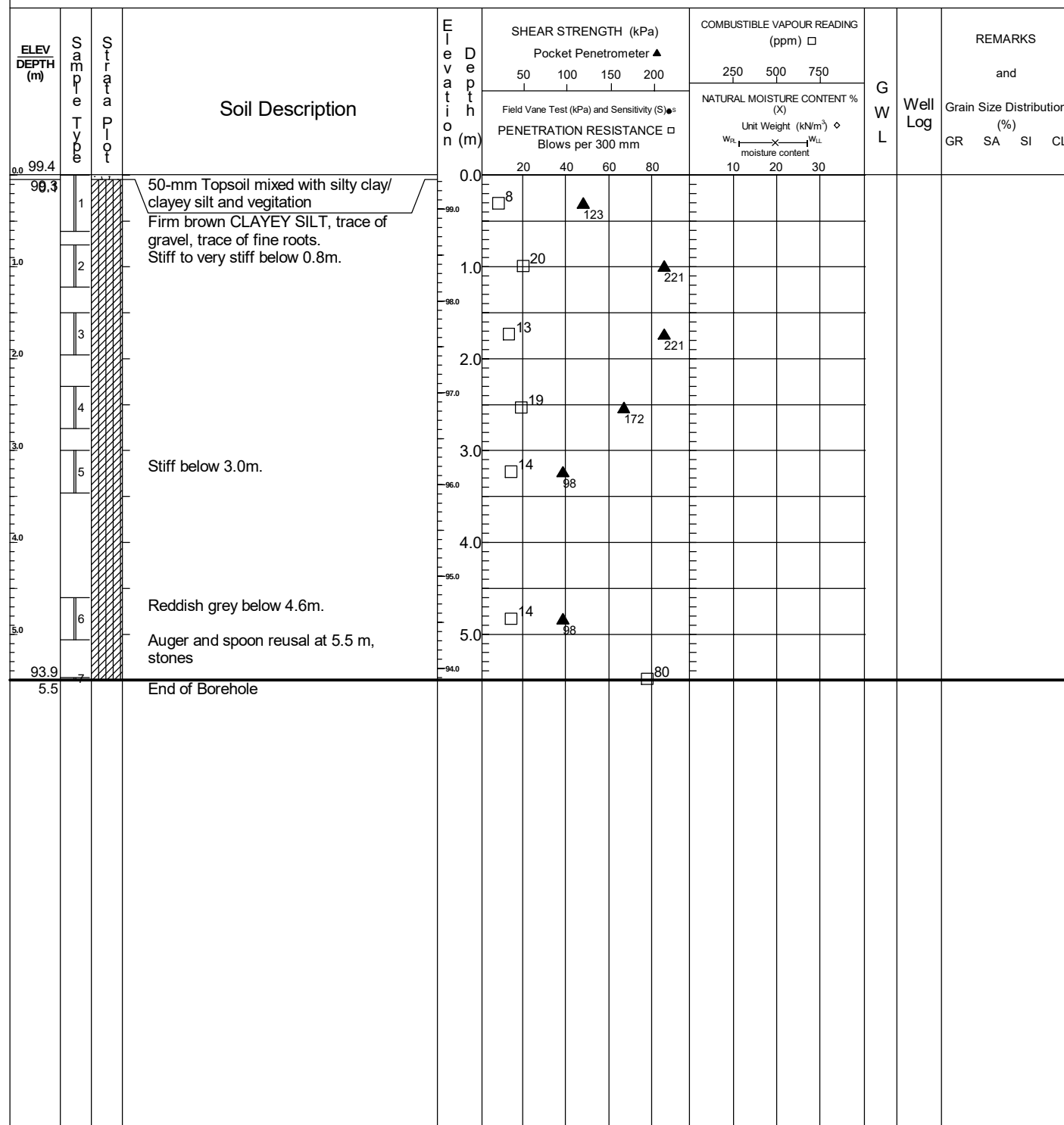
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 51 mm O.D. Split Spoon ☐
 51 mm I.D. Shelby tube ☒
 51 mm dia. Cone Pushed **P**



PROJECT NO: CCO-222884-00
 PROJECT: Geotechnical Investigation
 LOCATION: Thorold Townline Rd.
 Compiled By: Magdy Youssef
 Checked By:
 Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-02-A
 DATE: Dec. 09, 21
 Method: SS
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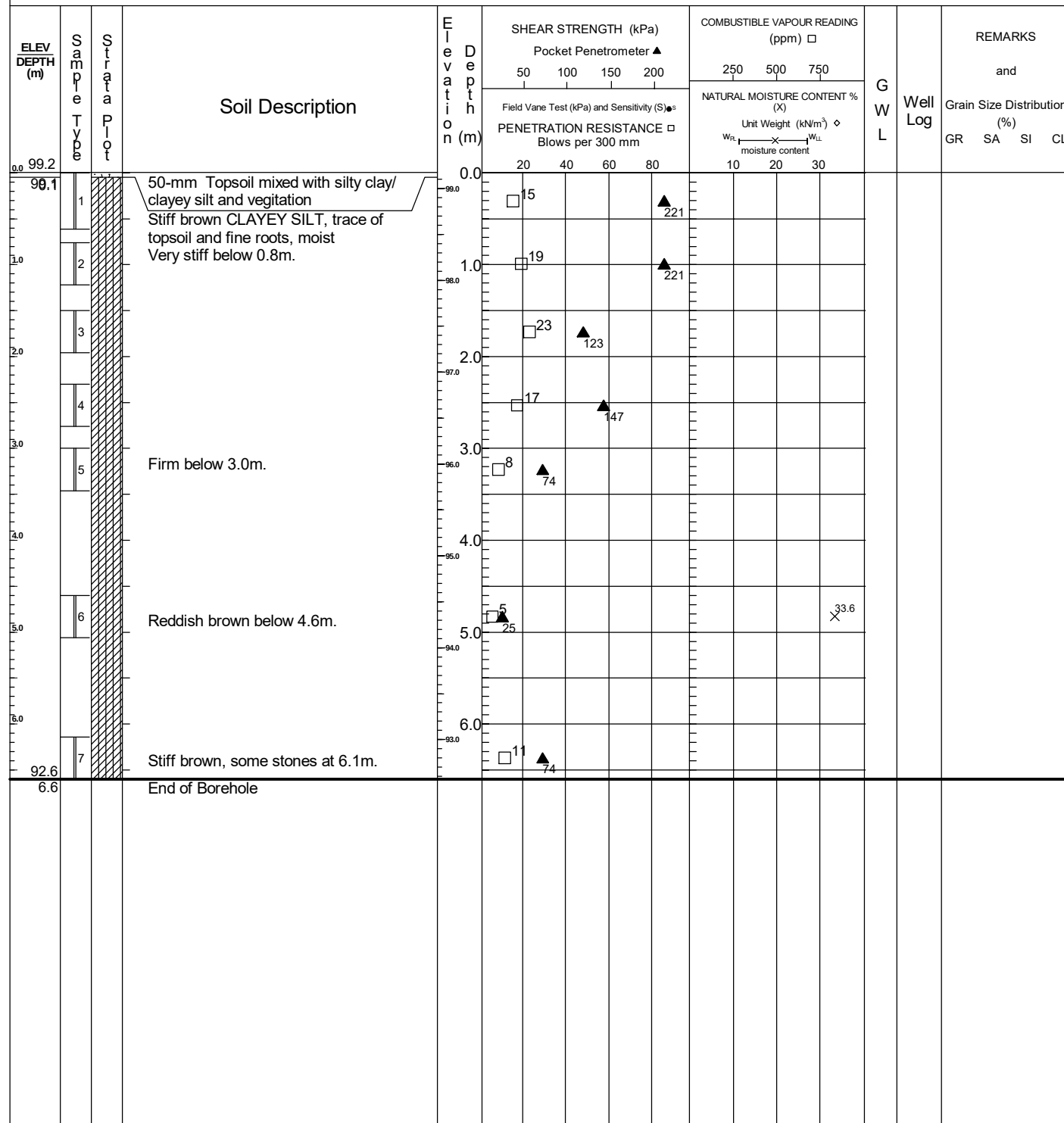
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 51 mm I.D. Shelby tube ☒
 51 mm dia. Cone Pushed **P**



PROJECT NO: CCO-222884-00
 PROJECT: Geotechnical Investigation
 LOCATION: Thorold Townline Rd.
 Compiled By: Magdy Youssef
 Checked By:
 Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-03-A
 DATE: Dec. 10, 21
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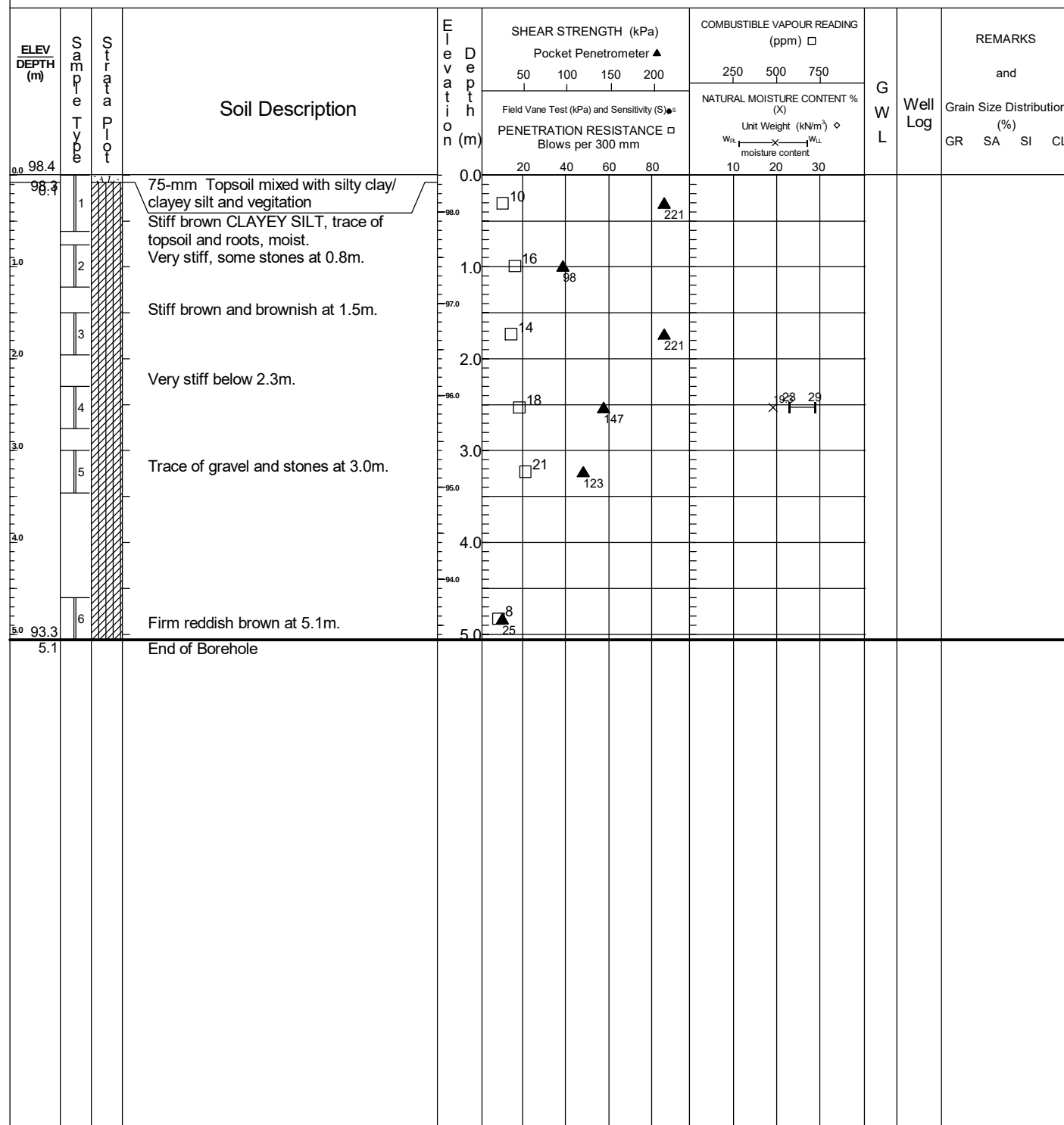
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 51 mm dia. Cone Pushed **P**



PROJECT NO: CCO-222884-00
 PROJECT: Geotechnical Investigation
 LOCATION: Thorold Townline Rd.
 Compiled By: Magdy Youssef
 Checked By:
 Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-04-A
 DATE: Dec. 10, 21
 Method: SS
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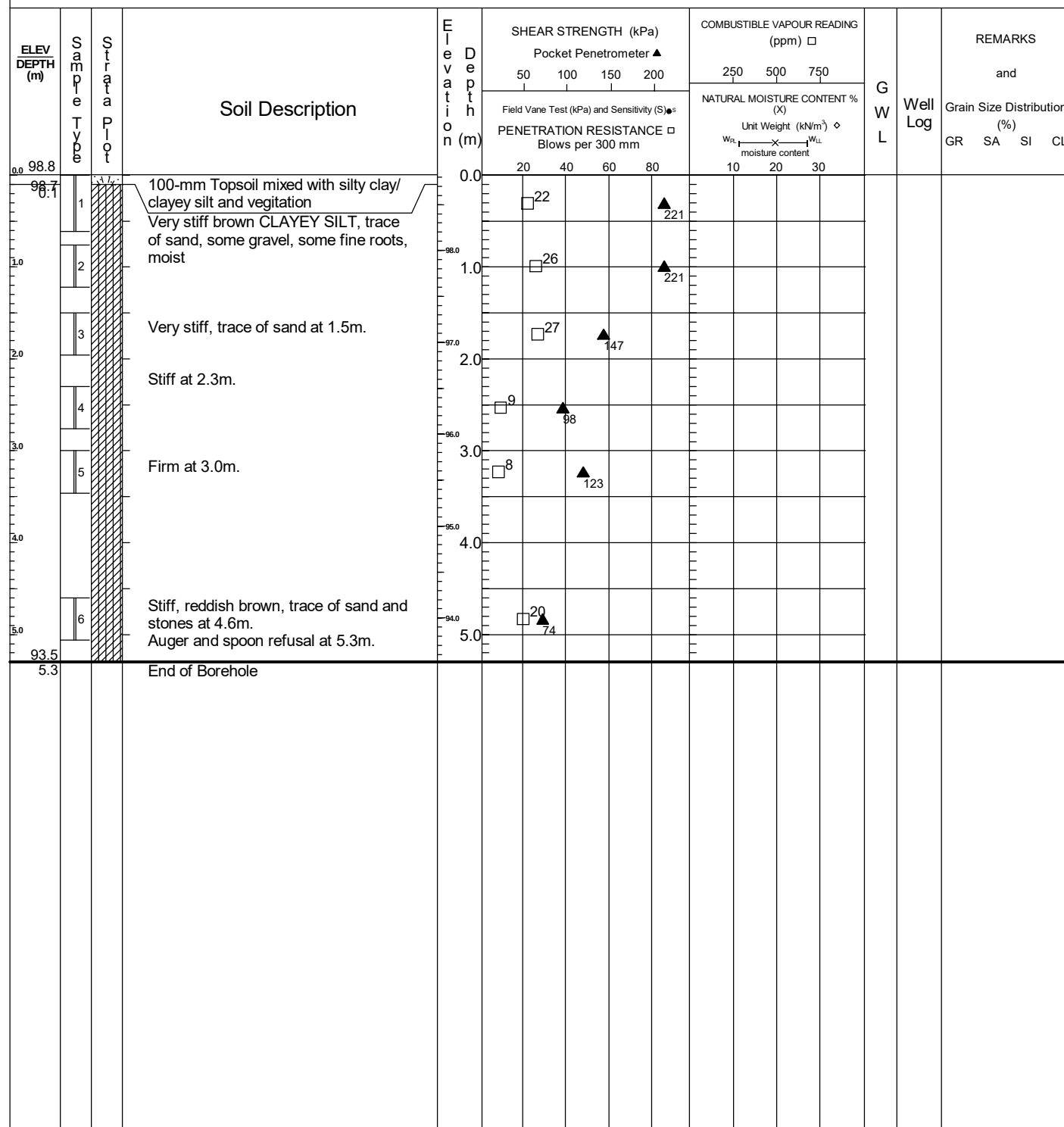
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PROJECT NO: CCO-222884-00
 PROJECT: Geotechnical Investigation
 LOCATION: Thorold Townline Rd.
 Compiled By: Magdy Youssef
 Checked By:
 Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-05-A
 DATE: Dec. 10, 21
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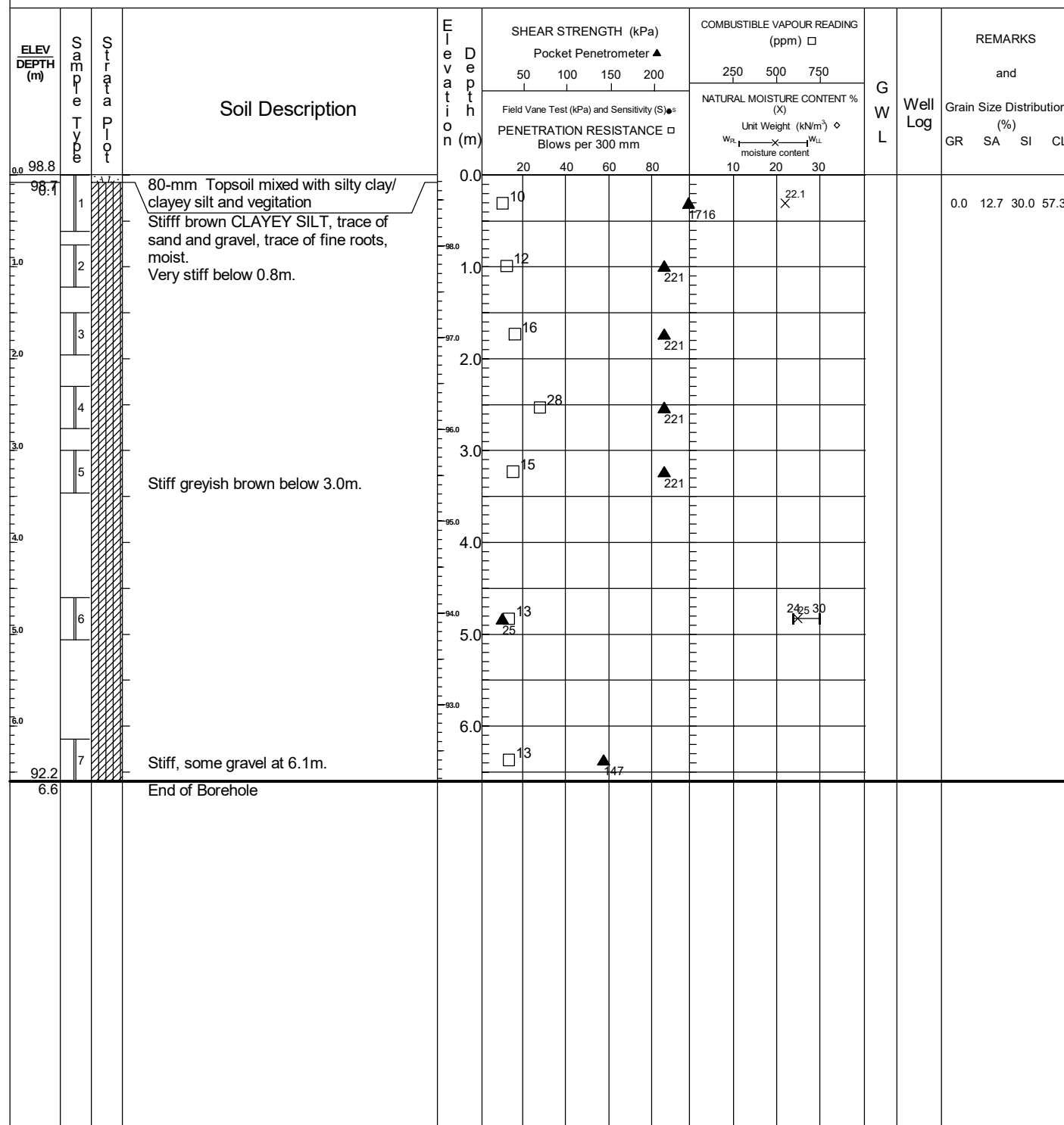
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 51 mm I.D. Shelby tube ☒
 51 mm dia. Cone Pushed **P**



PROJECT NO: CCO-222884-00
 PROJECT: Geotechnical Investigation
 LOCATION: Thorold Townline Rd.
 Compiled By: Magdy Youssef
 Checked By:
 Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-06-A
 DATE: Dec. 10, 21
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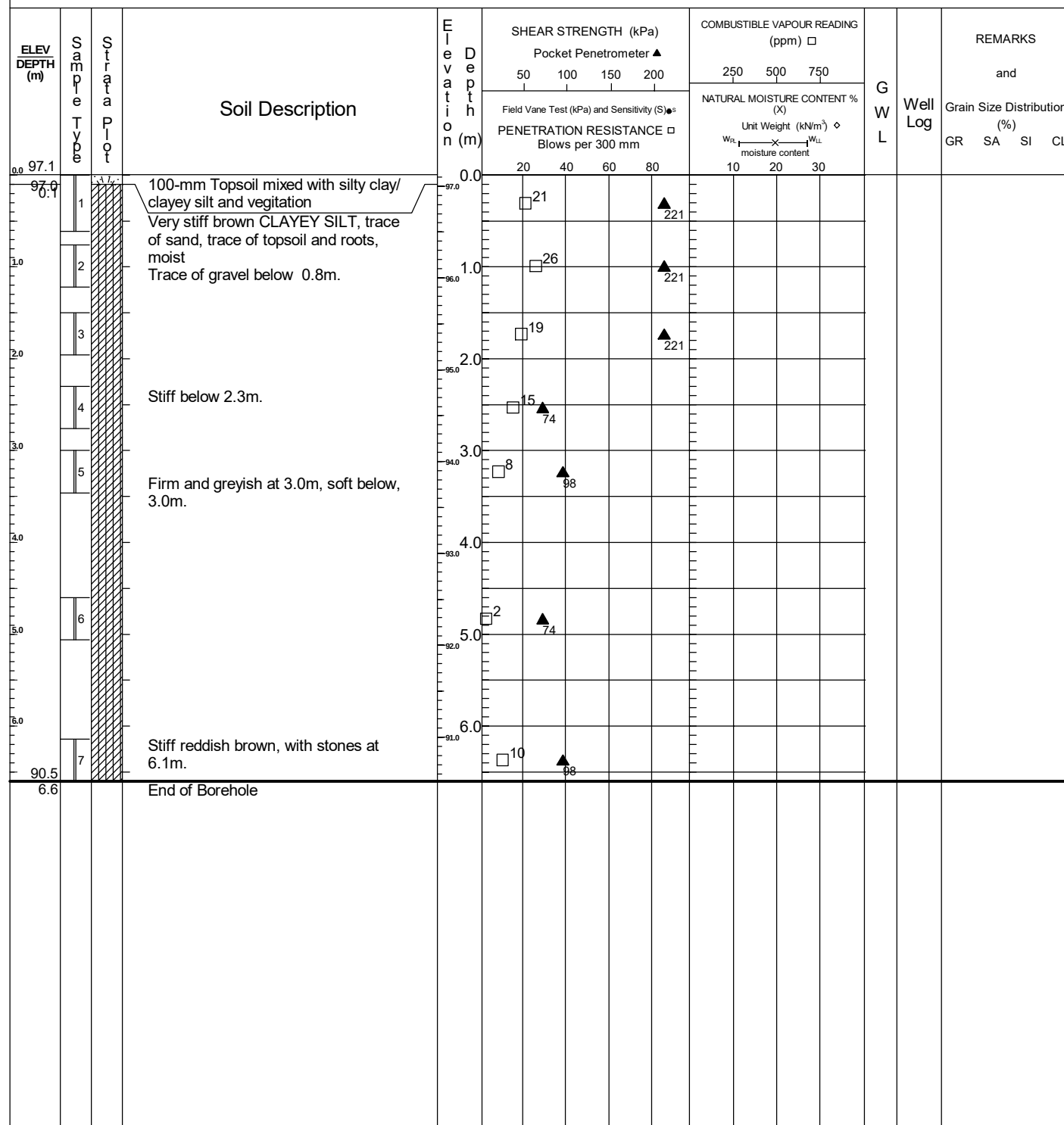
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PROJECT NO: CCO-222884-00
 PROJECT: Geotechnical Investigation
 LOCATION: Thorold Townline Rd.
 Compiled By: Magdy Youssef
 Checked By:
 Borehole Location Plan: See Drawing No. 1

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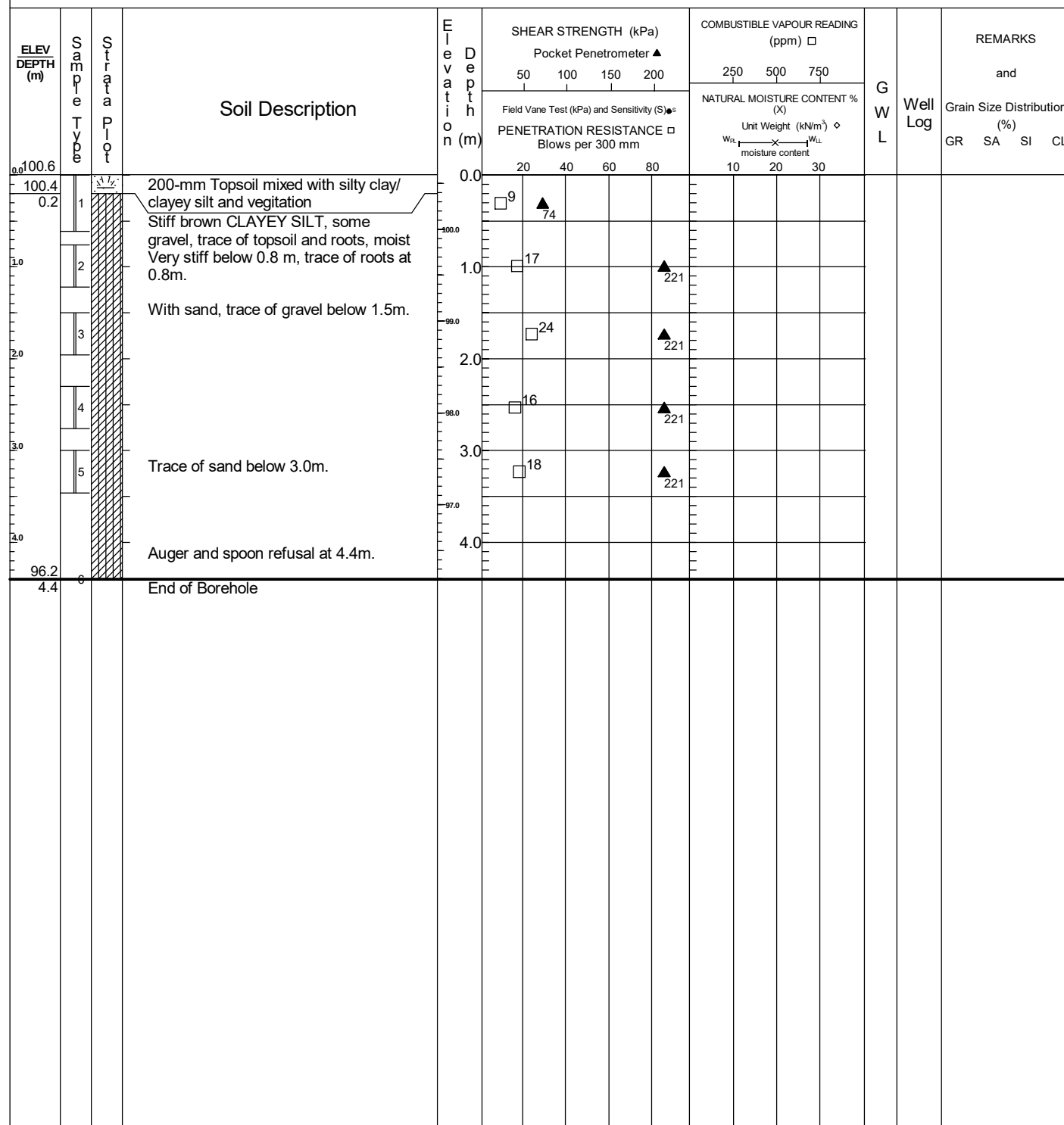
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PROJECT NO: CCO-222884-00
 PROJECT: Geotechnical Investigation
 LOCATION: Thorold Townline Rd.
 Compiled By: Magdy Youssef
 Checked By:
 Borehole Location Plan: See Drawing No. 1

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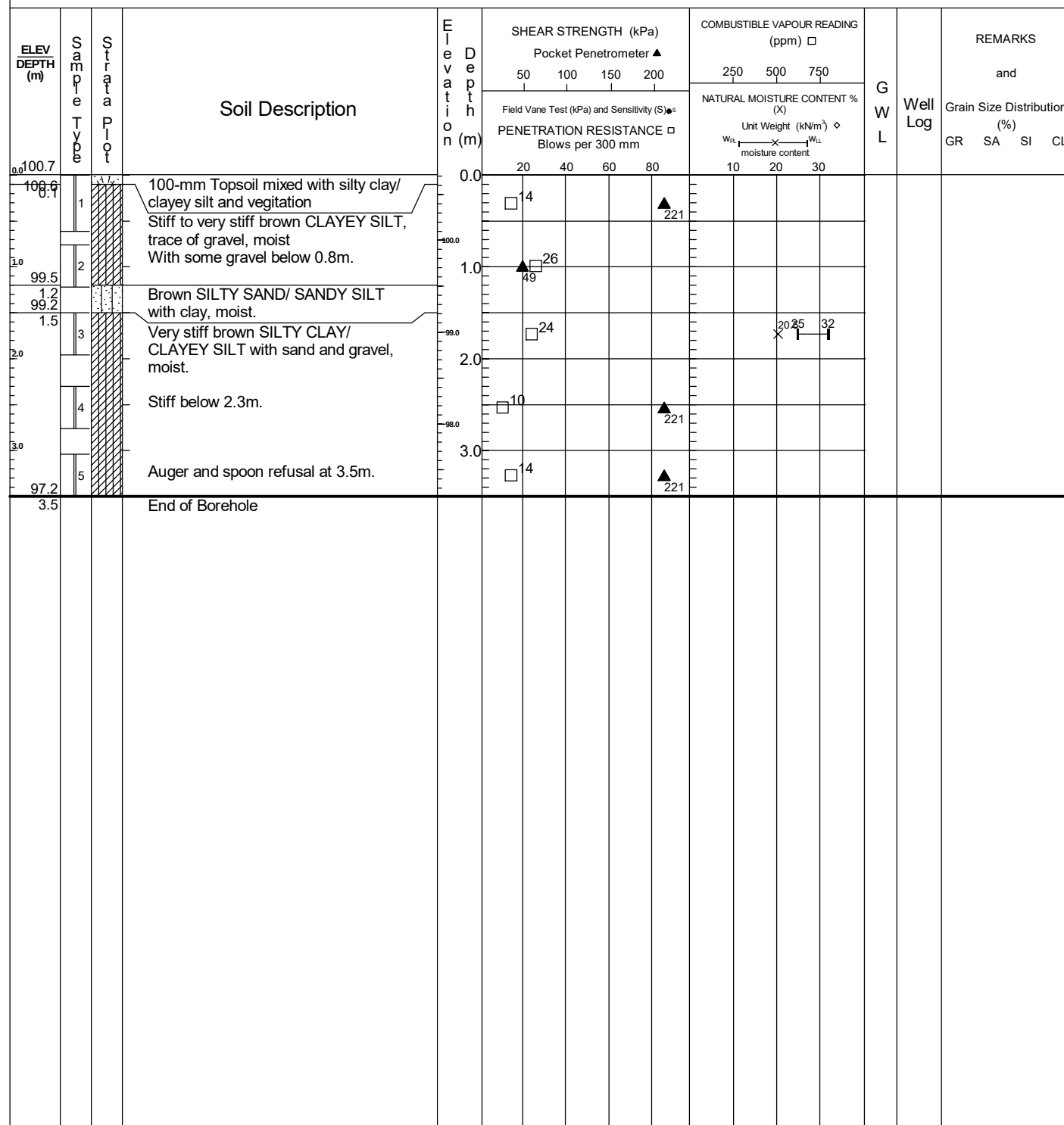
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 51 mm I.D. Shelby tube ☒
 51 mm dia. Cone Pushed **P**



PROJECT NO: CCO-222884-00
 PROJECT: Geotechnical Investigation
 LOCATION: Thorold Townline Rd.
 Compiled By: Magdy Youssef
 Checked By:
 Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-09-B
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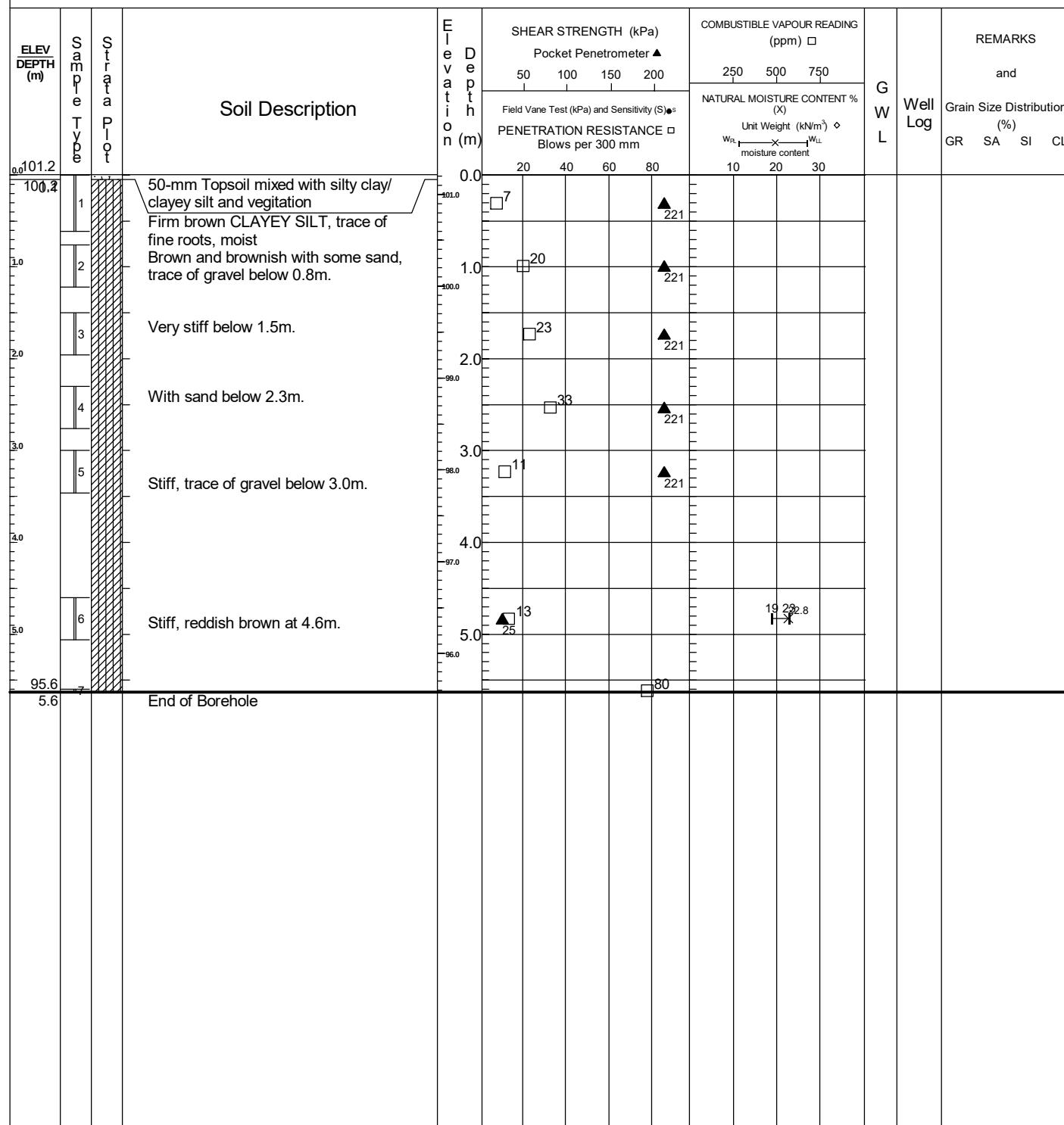
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PROJECT NO: CCO-222884-00
 PROJECT: Geotechnical Investigation
 LOCATION: Thorold Townline Rd.
 Compiled By: Magdy Youssef
 Checked By:
 Borehole Location Plan: See Drawing No. 1

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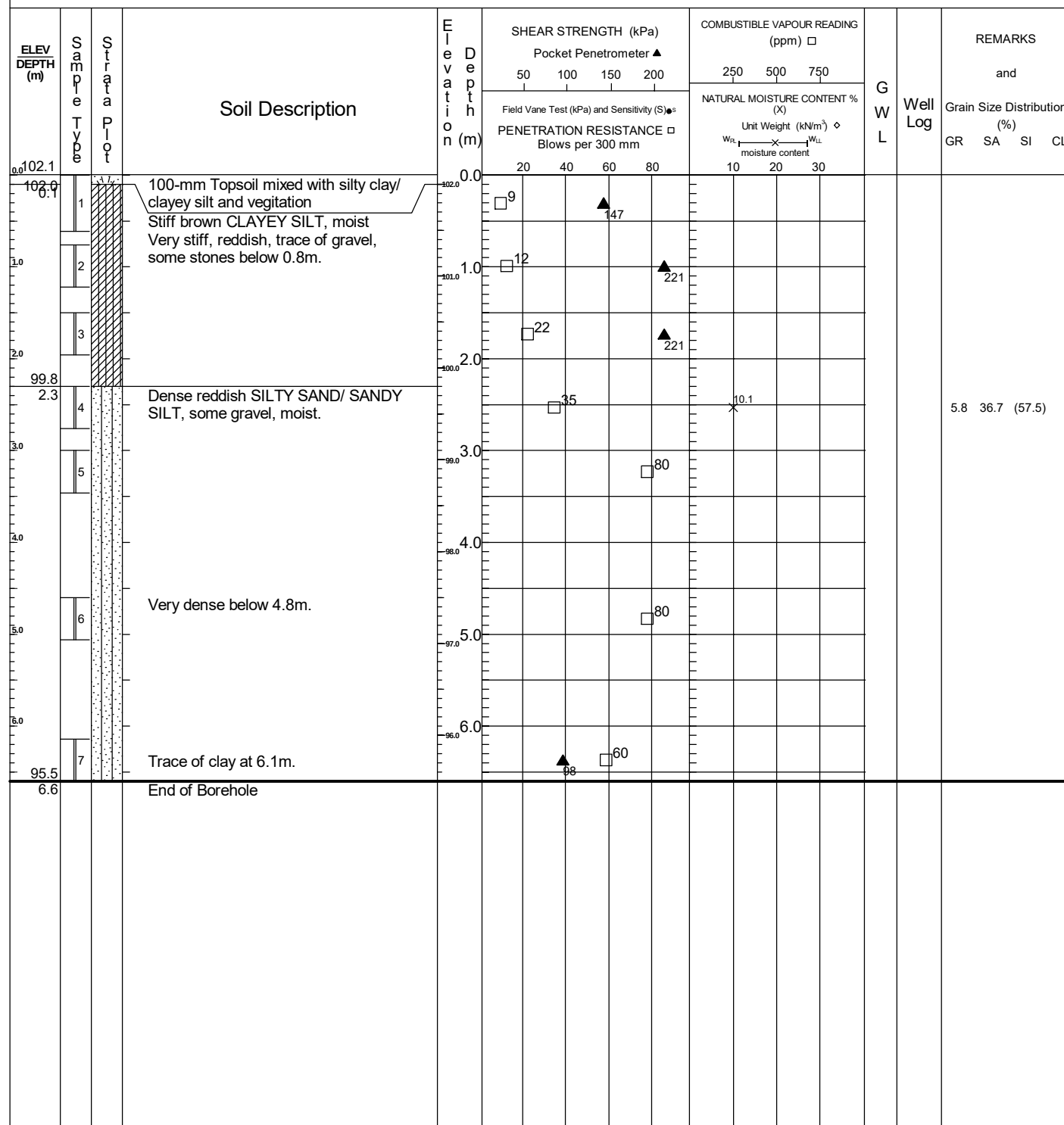
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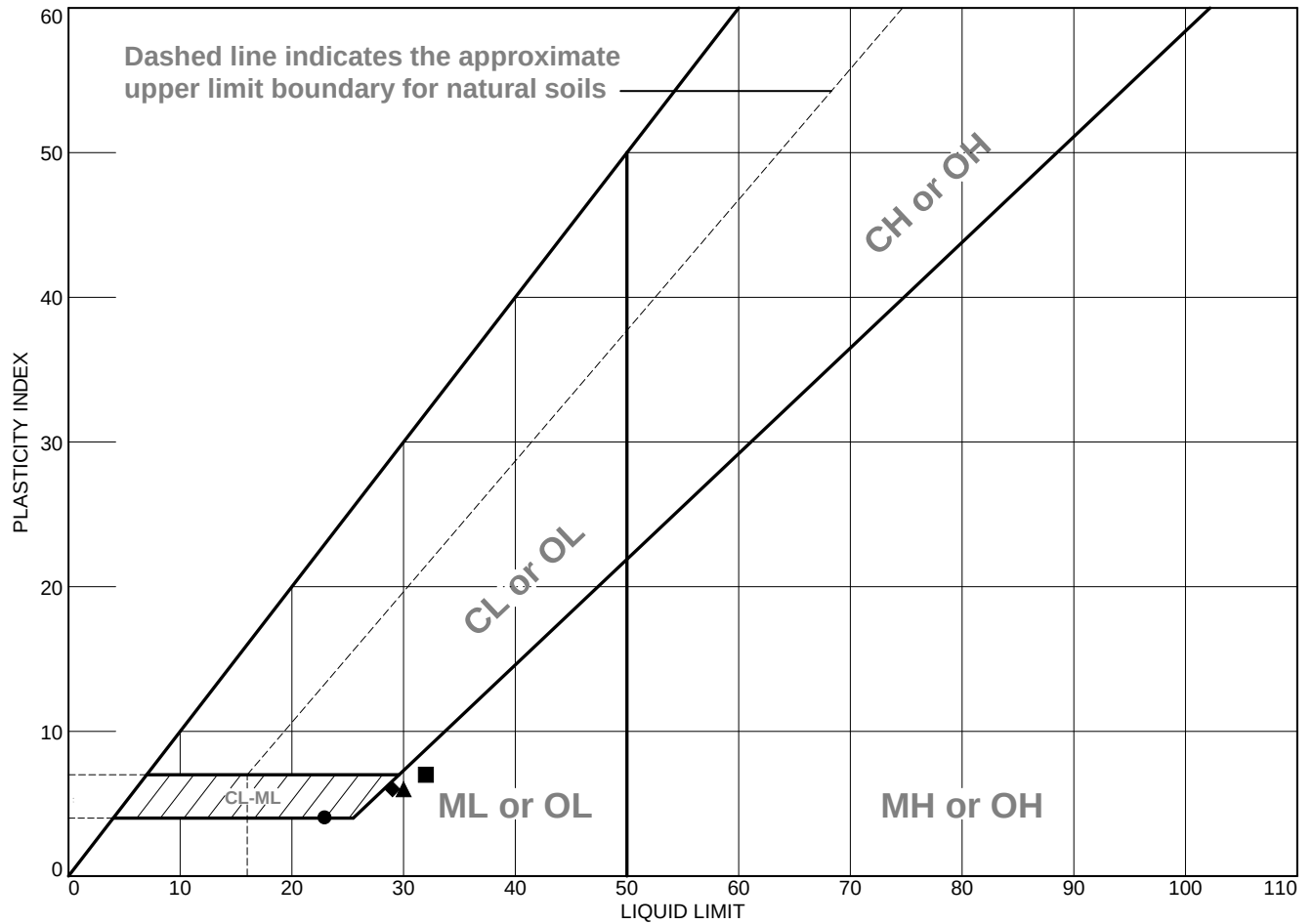
PROJECT NO: CCO-222884-00
 PROJECT: Geotechnical Investigation
 LOCATION: Thorold Townline Rd.
 Compiled By: Magdy Youssef
 Checked By:
 Borehole Location Plan: See Drawing No. 1

BOREHOLE NO.: BH-11-B
 DATE: Dec. 09, 21
 Method:
 Diameter (mm):
 Easting:
 Northing:

Cored Sample or Auger Sample ☒
 51 mm O.D. Split Spoon ☐
 51 mm I.D. Shelby tube ☒
 51 mm dia. Cone Pushed **P**



LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Silty Clay / Clayey Silt, trace of sand and top soil	23	19	4			
■	Brown Silty Clay / Clayey Silt	32	25	7			
▲	Brown Silty Clay / Clayey Silt, trace of sand	30	24	6			
◆	Brown Silty Clay / Clayey Silt, trace of sand	29	23	6			

Project No. 222884-00 **Client:** Kettlebeck Group

Project: Upper Lane, Thorold, ON

● **Sample Number:** BH 10 SS6

■ **Sample Number:** BH 9 SS3

▲ **Sample Number:** BH 6 SS6

◆ **Sample Number:** BH 4 SS4

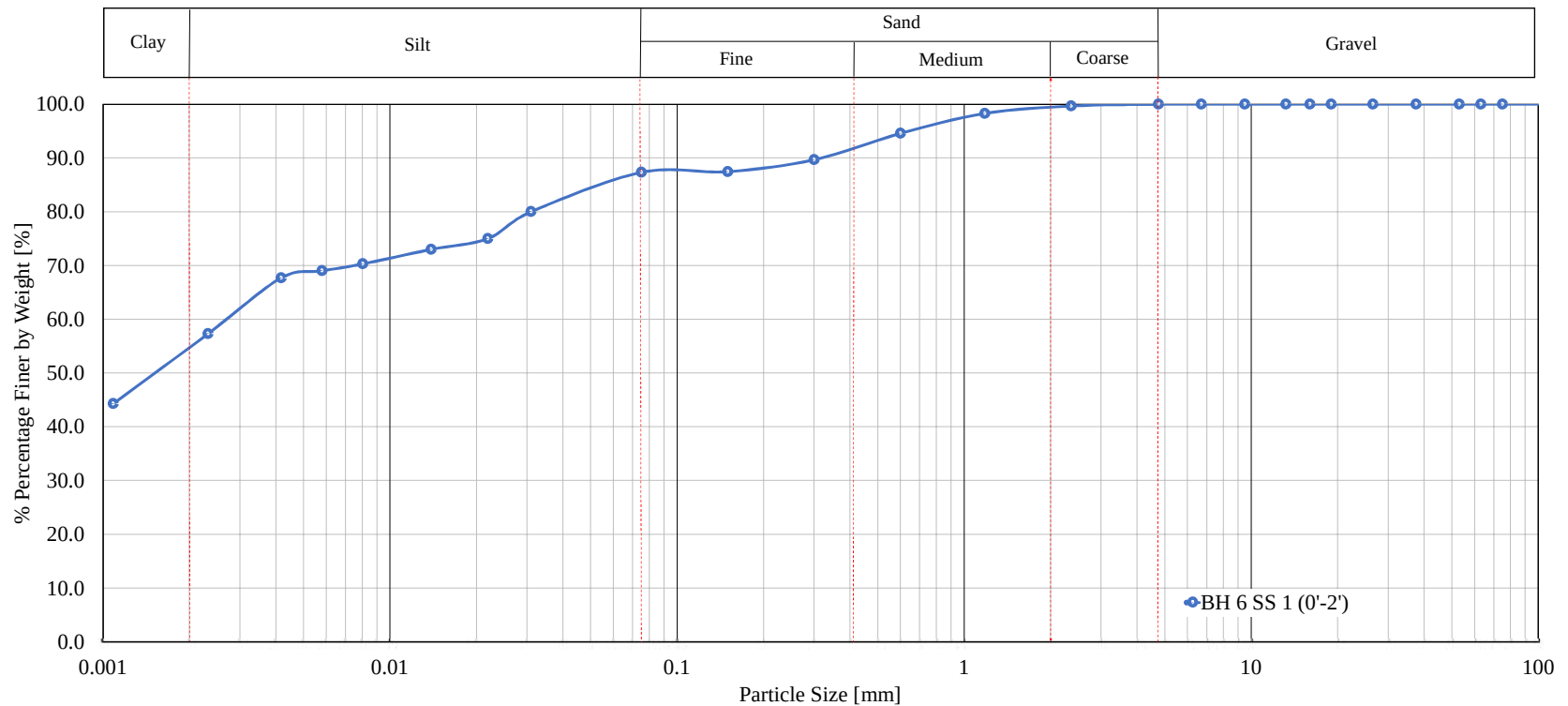
McIntosh Perry

Vaughan, Ontario

Remarks:

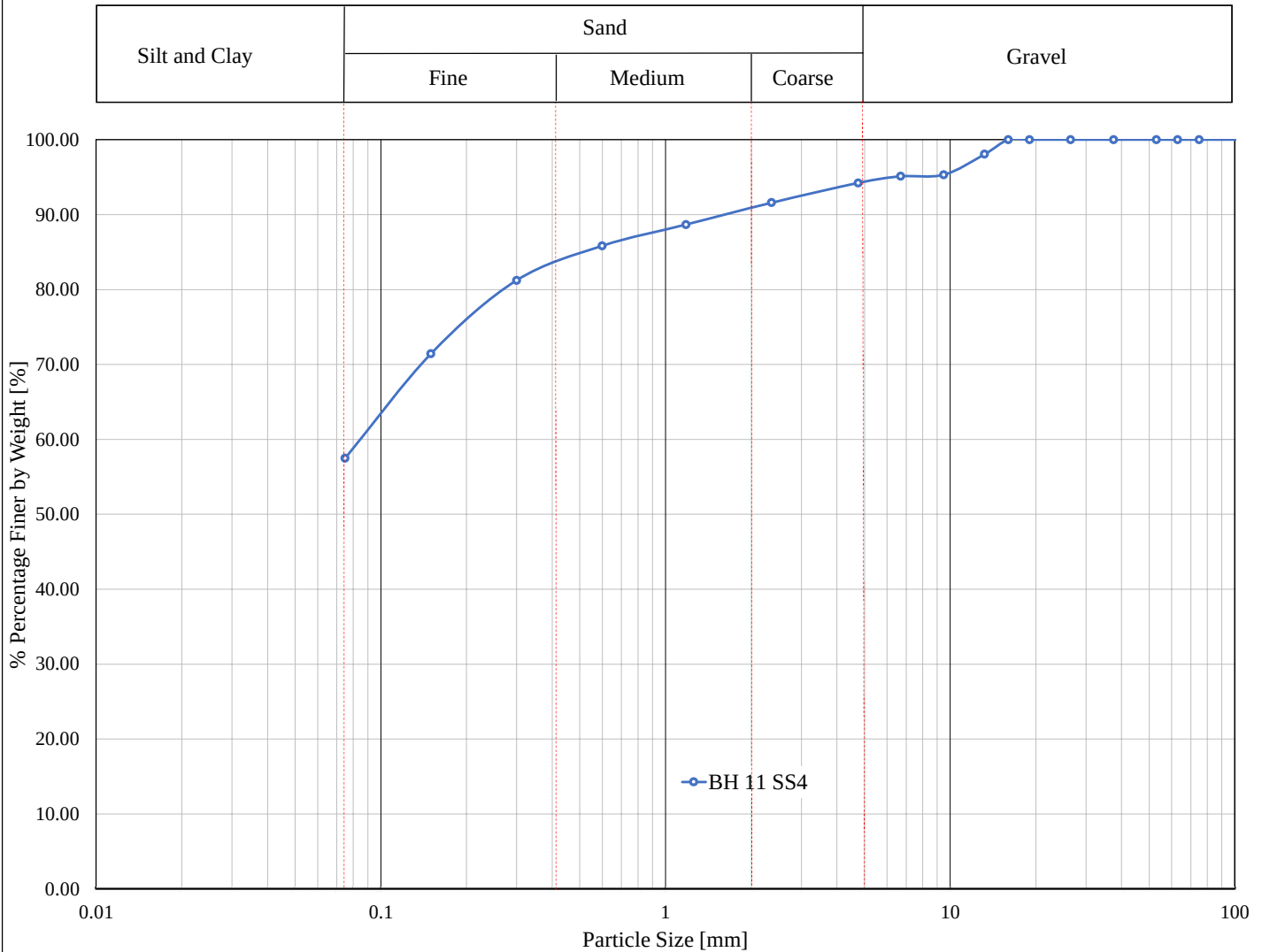
Figure

PROJECT : Geotechnical Investigation
LOCATION : Parcel 2, Upper Lane, Thorold, ON
DATE : Tuesday, January 11, 2022



Sample	Percent Gravel [%]	Percent sand [%]	Percent Silt [%]	Percent Clay [%]	Moisture Content [%]
BH 6 SS 1 (0'-2')	0.0%	12.7%	30.0%	57.3%	22.10%

PROJECT : Circle K - Central Canada Division
 LOCATION : Woodbine Ave. & Ravenshoe Rd., Georgina
 DATE : Tuesday, January 11, 2022



Sample	Percent Gravel [%]	Percent sand [%]	Percent Silt and Clay [%]	Moisture Content [%]
BH 11 SS4 Reddish Sandy Clayey Silt, with some gravel	5.79%	36.73%	57.48%	8.26%