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FUNCTIONAL SERVICING REPORT

Proposed Residential In-Fill Development (8 Lots)

N/E corner of Finch Avenue / Nature Haven Crescent
City of Pickering
Region of Durham

April 2021
Rev: September 2021
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Prepared For: **Fairglen Homes Ltd.**

File: **17149**

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VALDOR WATER RESOURCES

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF DRAWINGS

LIST OF APPENDICES

1.0 INTRODUCTION

Valdor Engineering Inc. has been retained by the Fairglen Homes Ltd. to provide consulting engineering services for the proposed development of their site located at the northeast corner of Finch Avenue and Nature Haven Crescent in the City of Pickering as indicated in **Figure 1**.

1.1 Existing Conditions

The site is approximately 0.51 hectares in size and is vacant and grass covered. There are no watercourses or other natural features within the subject site.

The site is bound to the north by valley lands to the west by the road allowance of Nature Haven Crescent, to the south by the road allowance of Finch Avenue and to the east by valley lands and a detached dwelling.

1.2 Proposed Development

The proposed in-fill development will be in the form of eight detached dwellings on lots having frontage on existing municipal roads, namely, Nature Haven Crescent or Finch Avenue.

A copy of the Concept Plan and Site Plan are included in **Appendix "A"** together with a calculation of the equivalent population contained in **Table A1**. The development statistics and the equivalent population data are summarized in **Table 1**.

Table 1. Development Statistics

Land Use	No of Units	Equivalent Population
Detached Dwelling	8	28
Total:	8	28

1.3 Purpose of Report

This Functional Servicing Report has been prepared to demonstrate the servicing feasibility of the proposed development in conjunction with the zoning by-law amendment and draft plan of subdivision applications. It has been prepared based on a review of the topographic survey and information from servicing plans obtained from the municipal archives.

This report outlines the engineering design elements for the proposed development, including water supply, sanitary sewers, storm sewers and stormwater management as well as grading and driveway access all of which are presented in the following sections. A **Preliminary Grading Plan** and a **Preliminary Servicing Plan** have been prepared in conjunction with this report and are included in **Appendix "J".**

The subject site was formerly part of land holdings owned by the Ontario Realty Corporation (ORC) which were deemed surplus and sold as development lands. During this process a Functional Servicing Report (ORC FSR) was prepared in which the subject site is described as being within the north part of “Parcel 1”. A copy of the ORC FSR is included in **Appendix “I”**.

2.0 WATER SUPPLY

The Region of Durham owns and operates twelve drinking water systems using three supply sources including Lake Ontario, Lake Simcoe and groundwater wells. The Region is responsible for operating and maintaining every component of the water supply system including treatment, storage and distribution of potable water to consumers throughout the Region. In this regard, the Region operates and maintains 6 surface water supply plants, 22 water storage facilities, 18 pumping stations, 23 groundwater wells and approximately 2,400 km of watermains.

The subject site is serviced by the Oshawa / Whitby / Ajax distribution system which delivers treated water through approximately 2,000 kilometres of watermains to provide potable water to consumers in the City of Pickering as well as the City of Oshawa, Community of Courtice, Town of Ajax, Town of Whitby and Community of Brooklin. The source water for the treatment process is drawn from Lake Ontario. A plan of the various drinking water systems in the Region is included in **Appendix “B”**.

The following is a summary of the waster servicing requirements for the development.

2.1 Domestic Demand

The domestic demand is to be calculated using the Region of Durham engineering design standards which include the following parameters:

Residential Average Day Demand:	364 L/person/day
Maximum Day Factor:	2.0
Peak Hour Factor	3.0

Based on the above, it is anticipated that the development will have a water demand as summarized in **Table 2**. A detailed tabulation of the domestic water demand calculation is detailed in **Table B1** of **Appendix “B”**.

Table 2. Domestic Water & Fire Flow Demand

Equivalent Population (Persons)	**Average Day Demand** (L/min)	**Maximum Day Demand** (L/min)	**Peak Hour Demand** (L/min)	**Fire Flow** (L/min)	**Maximum Day Plus Fire Flow** (L/min)	**Maximum Day Plus Fire Flow** (L/s)
28	7.1	14.2	21.2	6,000.0	6014.2	100.2

2.2 Watermains & Service Connections

An existing 250mm diameter watermain is located on the south side of Finch Avenue and a 150mm diameter watermain is located in the west boulevard of Nature Haven Crescent.

Based on Ontario Building Code (OBC 2012) regulations (7.6.3.4.(1) and (5) and Table 7.6.3.4), the proposed detached dwelling will be serviced with 25mm diameter water connections given that it is anticipated that the dwellings will each have more than 16 fixture units.

The location of the existing watermains and the proposed water service connections are indicated on the **Preliminary Servicing Plan**. A copy of the Region of Durham's standard water service connection detail is included in **Appendix "B"**.

2.3 Water Meters

The proposed detached dwellings will have a water meters located in the basement with a remote readout device located on the exterior ground floor wall of the unit. Generally, residential water meters are selected to be one size smaller than the water service and therefore 20mm x 25mm water meters will be installed. Water meters are to be purchased from the Region of Durham. A copy of the Region of Durham's standard water meter details is included in **Appendix "B"**.

2.4 Fire Protection

The fire flow required for the proposed buildings was calculated using the criteria indicated in the *Water Supply for Public Fire Protection Manual*, 1999, by the Fire Underwriters Survey (FUS). The calculation incorporates various parameters such as coefficient for fire-resistant construction, an area reduction accounting for a fire-resistant (one hour rating) protection, a reduction for low-hazard occupancies, an adjustment for sprinkler protection system, and a factor for neighbouring building proximity.

In accordance with the FUS, the required fire flow for the detached dwellings was calculated based on the floor area. Based on a floor area of 296 m^2 (3,186 sqft.), a minimum fire suppression flow of 6,000 L/min is required. The detailed fire flow calculation is provided in **Table B2** contained in **Appendix "B"**. This fire flow plus the maximum day demand must be available at the nearest hydrant with a minimum pressure of 140 KPa.

A fire hydrant is to be located within 90m of the principal entrances to the dwellings in accordance with the Ontario Building Code (OBC 2012). Based on the foregoing, the existing street fire hydrants will provide sufficient coverage.

The location of the existing and proposed fire hydrants as well as a copy of the Region's standard fire hydrant detail is included in **Appendix "B"**.

3.0 WASTEWATER SERVICING

The Region of Durham is responsible for wastewater servicing provided to the residents and businesses within the Region including the City of Pickering. The Region operates and maintains 11 sewage treatment plants, 48 sewage pumping stations and approximately 1,400 km of sanitary sewers.

The subject site is located within the service area of the Duffin Creek Water Pollution Control Plant (WPCP) which is located at 901 McKay Road in Pickering. This plant discharges fully treated water into Lake Ontario. The Duffin Creek WPCP, jointly owned and operated by The Regional Municipalities of York and Durham, is a critical component of the York Durham Sewage System (YDSS). In this regard, the plant treats sewage from the City of Pickering and Town of Ajax as well as sewage from York Region communities as far north as the Towns of Aurora and Newmarket, as far west as the City of Vaughan, and the Towns of Richmond Hill and Markham.

The following is a summary of the wastewater servicing analysis for the subject site.

3.1 Wastewater Loading

The wastewater loading has been calculated using the Region of Durham engineering design standards which include the following parameters:

Domestic Flow: Q = 364 L/person/day

Extraneous Flow: *I* = 0.26 L/s/Ha (Infiltration)

Peaking Factor: $K_H = 1 + \frac{14}{4 + \sqrt{P}}$ (K_H =1.5 min., 3.8 max.)

Where: K_H = Harmon Peaking Factor
P = Population in thousands

Design Flow, Q = Q x K_H + *I*

Based on the above criteria the sewage flow calculations are provided in **Table C1** contained in **Appendix "C"** and the total flow is summarized in **Table 3**.

Table 3. Wastewater Loading Summary

Area (Ha)	**Equivalent Population** (Persons)	**Average Daily Flow** (L/s)	**Harmon Peaking Factor**	**Peak Daily Flow** (L/s)	**Infiltration Rate** (L/s)	**Total Flow** (L/s)
0.5121	28	0.118	3.800	0.45	0.133	0.58

3.2 Sanitary Sewers & Service Connections

An existing 200mm diameter sanitary sewer is located on Nature Haven Crescent and on Finch Avenue across the frontages of the subject site. In order to service the proposed detached dwelling, 100mm diameter sanitary services will be installed which will connect to these sewers.

The location of the existing sanitary sewer and the sanitary service connections is illustrated on the **Preliminary Servicing Plan**. The Region of Durham's standard detail for sanitary service connection is included in **Appendix "C"**.

4.0 STORM DRAINAGE

The subject site is located in the Petticoat Creek watershed which is under the jurisdiction of the Toronto and Region Conservation's (TRCA). The watershed covers 27 square kilometres including lands in Pickering, Markham and Toronto. The watercourse flows 49 kilometres south, from its headwaters on the south slope of the Oak Ridges Moraine, outletting into Lake Ontario at the Petticoat Creek Conservation Area.

Based on an on-line search of the regulation mapping on the TRCA website, the subject site is located within an area that is regulated by the TRCA. A permit is therefore required from their office under Ontario Regulation 166/06. A copy of the Watershed mapping and Regulation mapping is provided in **Appendix "D"**.

In accordance with City standards, a major / minor system storm conveyance concept has been incorporated into the functional servicing design for the subject development. The following sections provide a brief summary of the storm drainage components:

4.1 Minor System Design

As per the City engineering design criteria, the proposed development is to be serviced with a minor storm sewer system that is designed to convey runoff from the 5 year storm event. The rainfall intensity values, *I*, are calculated in accordance with the City standards as follows:

$$I_5 = \frac{1082901}{(t+6.007)^{0.837}} \qquad I_{100} = \frac{2096.425}{(t+6.485)^{0.863}}$$

The peak flows are calculated using the following formula:

$Q = R \times A \times I \times 2.778$ where: Q = peak flow (L/s)
A = area in hectares (Ha)
I = rainfall intensity (mm/hr)
R = composite runoff coefficient
t = time of concentration (min)

Based on the topographic survey, the subject site currently drains in the form of sheet flow towards Nature Haven Crescent and Finch Avenue. The proposed development will be serviced by the existing storm sewers located on Nature Haven Crescent and Finch Avenue across the frontages of the subject site.

The location of the existing storm sewers and the proposed storm service connections are illustrated on the **Preliminary Servicing Plan**. The City of Pickering rainfall intensity duration frequency (IDF) curve data as well as a preliminary storm sewer design sheet is included in **Appendix "D"**.

4.2 Major System Design

The major system will generally be comprised of an overland flow route along the municipal roads to direct drainage to a safe outlet. This major system will convey flows which are in excess of the capacity of the storm sewer system. The major system flow route is illustrated on the **Preliminary Grading Plan**.

4.3 Foundation Drainage

The proposed detached dwellings will have basements that will require weeping tile at the footing level. In order to drain the weeping tile, each lot will have a storm service connection. In order to protect the basements, and in accordance with City standards, the underside of basement slab elevations are to be a minimum of 300 mm above the 100 year HGL. The 100 year HGL elevations obtained from the plan & profile drawings for the existing municipal roads have been indicated on the **Preliminary Grading Plan** together with the proposed basement floor elevations. Based on the elevations, the underside of the proposed basement floors will be at least 300mm above the 100 year HGL. The plan & profile drawings are included in **Appendix “D”**.

4.4 Roof Drainage

The proposed detached dwelling will have a conventional peaked roof with eaves troughs and downspouts. The house downspouts are to discharge to grade over splash pads. The downspouts at the rear of the houses are to be directed to soak-away pits as indicated in Section 5.3 of this report.

4.5 Flood Plain

Based on an on-line search of the regulation mapping on the TRCA website, the subject site is not located in the flood plain of the Petticoat Creek. Based on the foregoing, no flood protection measures are necessary.

Based on the Finch Avenue & Altona Road Floodplain Spill 2D Modelling Analysis (April 29, 2022) completed by the TRCA, the proposed development has safe access to Finch Avenue and Nature Haven Crescent.

The TRCA mapping and Floodplain Spill Analysis is included in **Appendix “D”**.

5.0 STORMWATER MANAGEMENT

In accordance with the requirements of the City of Pickering and the TRCA the following stormwater management criteria will be implemented:

- Quantity Control is to be provided such that the post-development peak flows will be controlled to the pre-development rates for rainfall events up to and including the 100 year storm.
- Level 1 (Enhanced) stormwater quality treatment is to be provided to achieve 80% TSS removal.
- Water Balance to retain the 5mm rainfall event.

Based on the foregoing, the following is a summary of the stormwater mitigation measures that are to be incorporated into the design of the subject site.

5.1 Quantity Control

Stormwater quantity control is typically implemented to minimize the potential for downstream flooding, stream bank erosion and overflows of infrastructure. Of particular concern is the 0.214 Ha area of the subject site which drains to nature Haven Crescent given that the storm sewer on this street was not sized for the subject lands. The impact of the proposed development has been analyzed as follows:

5.1.1 Pre-Development Flow

Pre-development surfaces consist primarily of grassed areas, which indicates that the existing site condition is relatively pervious with a 2 year runoff coefficient of 0.25. The pre-development surface conditions are illustrated in **Figure 2.**

Pre-development peak flow calculations were generated using the City's rainfall IDF data in accordance to the municipal standards. The calculation of the pre-development 2 year and 100 year peak flows are provided on **Table E1** contained in **Appendix "E"** and summarized in first row of **Table 4.**

Table 4: Storm Drainage Peak Flows

Condition	**Runoff Coefficient**		**Peak Flows (L/s)**	
	2 Year	100 Year	2 Year	100 Year
Pre-Development	0.25	0.31	27.6	83.1
Post-Development	0.60	0.75	14.4	14.4

5.1.2 Post-Development Flow: Un-Mitigated

Based on a review of the architect's site plan, the post-development surface conditions for this site are illustrated in **Figure 3.** The surfaces comprise mainly of grassed yards, roof areas and driveway areas. Based on these surfaces, the proposed development is more impervious than the existing site condition and the composite runoff coefficient increases from 0.25 to 0.60.

5.1.3 Post Development Peak Flow: Mitigated

As Illustrated in **Figure 3**, 0.214 hectares of the proposed site will drain to the existing Nature Haven Crescent storm sewer which was not sized to accommodate flow from the subject site. Based on the foregoing, s stormwater detention system will be provided on Nature Have Crescent to capture and control flow and discharge it to the existing Finch Avenue Storm sewer.

Based on the analysis, the site will be served by a 74mm orifice plate at the outlet of the proposed box culvert. This box culvert will provide the required detention volume of 45m^3 which will outlet to the existing 750 mm diameter sewer along Finch Ave.

5.2 Quality Control

Based on the City of Pickering criteria, storm water quality control for the subject site is to be designed to achieve “Enhanced” protection level (Level 1 treatment) which entails 80% total suspended solids (TSS) removal.

The subject site will drain to the existing municipal storm sewers on Finch Avenue which directs flow to an existing oil / grit separator located on Finch Avenue, east of the subject site, as identified on the **Functional Servicing Plan**.

Oil / grit separators are designed to provide stormwater quality treatment and are typically in the form of a pre-cast concrete maintenance hole with a deep sump with a special insert which diverts low flows to a lower chamber to capture and store oil and grit from the storm drainage discharge from the site. The insert diverts high flow away from the lower chamber to ensure that captured pollutants do not scour or re-suspend.

As summarized in section 3.2.1 of the ORC FSR contained in **Appendix “I”**, the existing STC-6000 oil / grit separator has sufficient capacity to provide the required stormwater quality treatment for the subject site resulting in an 82% TSS removal rate.

In addition to the existing oil / grit separator, LID measures in the form of soak-away pits are proposed as indicated in section 5.3 which will provide water quality bennefits. The detail for the existing STC-6000 oil / grit separator is included in **Appendix “F”**.

5.3 Water Balance

Based on the small size of the site, and in accordance with the City and TRCA criteria, a minimum of a 5 mm rainfall depth is to be retained on site and either infiltrated or re-used. The objective of this criteria is to capture and manage annual rainfall on-site to preserve the pre-development hydrology.

The runoff volume is calculated based on the site area and is calculated as follows:

$$\text{Runoff Volume} = A \times (D)$$

where:

V = runoff volume (m^3)
A = area (m^2)
D = rainfall depth

V = 5,121 m^2 x 0.005 m
V = 25.61 m^3

Based on the above and site area, the volume required to achieve water balance is 25.61 cu.m. A review of the architect’s site plan indicates that there is an opportunity to incorporate soak-away pits to address water balance. These soak-away pits will be located in the rear yard of each lot and will receive roof runoff from the downspouts.

The size of the soak-away pits necessary to infiltrate the required volume depends on the percolation rate of the native site soils. The geotechnical investigation report indicates that the native soils are clayey silt and that the ground water level is at least 5.5m below existing grade. Based on the geotechnical investigation report, infiltration rates of 12mm/hr and 50mm/hr were used based on the permeability of the various soil types.

The calculations for the volume to be retained is provided in **Table G1** and **Table G2** which are included in **Appendix "G"** together with the geotechnical investigation report and the infiltration testing report and a detail of the soak-away pit. The location of the proposed soak-away pits are indicated on the **Functional Grading Plan** and **Functional Servicing Plan** together with the base elevation and the groundwater elevation to demonstrate that there is at least 1.0m separation.

Table 5. Water Balance Summary

	Volume (cu.m.)
Volume to be Retained:	**25.61**
Soak-Away Pit Volume Provided:	**25.67**

6.0 VEHICULAR & PEDESTRIAN ACCESS

The site plan has been developed with consideration for efficient and safe access and circulation of both vehicular and pedestrian traffic.

6.1 Driveways & Parking

The subject site has frontage on Finch Avenue and on Nature Haven Crescent which are two lane local roads under the jurisdiction of the City of Pickering. No new municipal roads are required to accommodate the subject development. Nature Haven Crescent has curb and gutter whereas Finch Avenue only has curb and gutter on the south side of the road. The curb and gutter on the north side of Finch Avenue will be constructed in conjunction with the subject development. With respect to parking, each dwelling will have a two car garage and a double driveway.

6.2 Sidewalks

Pedestrian access will be provided by the existing municipal sidewalk located along the west side of Nature Haven Crescent. The site's frontage along Finch Ave will be urbanized through the widening of the pavement to match the existing urbanized section of Finch Ave to the west of Nature Haven Crescent. A 1.5-meter-wide sidewalk will be constructed along Finch Avenue across the frontage of the subject site.

7.0 GRADING

Based on a topographic survey of the site completed on August 4, 2024, the property slopes from the northwest corner at an elevation of approximately 141.90m, down to the southeast corner of the site, at an elevation of approximately 138.30m. This fall of approximately 3.60m equates to an overall average slope of approximately 2.8% which is considered to be relatively flat. A copy of the topographic survey prepared by Ertl Surveyors is included in **Appendix "H"**.

The subject site is to be graded in accordance with the municipal grading criteria which dictates that lot grades from 2.0% to 5.0%. For large grade differentials, a maximum slope 3H : 1V can be used for sodded embankments. In areas where space is limited, retaining walls can be utilized to accommodate grade differentials.

Based on the **Functional Grading Plan**, no major difficulties are anticipated in achieving the municipal grading design criteria. A detailed grading plan is to be prepared at the site plan application stage.

8.0 EROSION & SEDIMENT CONTROL DURING CONSTRUCTION

Construction activity, especially operations involving the handling of earthen material, dramatically increases the availability of particulate matter for erosion and transport by surface drainage. In order to mitigate the adverse environmental impacts caused by the release of silt-laden stormwater runoff into receiving watercourses, measures for erosion and sediment control (ESC) are required for construction sites.

The impact of construction on the environment is recognized by the Greater Golden Horseshoe Area Conservation Authorities. Their document titled "Erosion & Sediment Control Guidelines for Urban Construction" (2019) provides guidance for the preparation of effective erosion and sediment control plans.

Control measures must be selected that are appropriate for the erosion potential of the site and it is important that they be implemented and modified on a staged basis to reflect the site activities. Furthermore, their effectiveness decreases with sediment loading and therefore inspection and maintenance is required. The selection, implementation, inspection and maintenance of the control features are summarized as follows:

8.1 Control Measures

On relatively small sized sites, measures for erosion and sediment control typically include the use of silt fencing, a mud mat and sediment traps. The following is a description of the sediment controls to be implemented on the subject site:

- **Silt Fences** are to be installed adjacent to all property limits subject to drainage from the development area prior to topsoil stripping and in other locations, such as at the bases of topsoil stockpiles.
- **Mud Mat** is to be installed at the construction entrance prior to commencing earthworks to minimize the tracking of mud onto municipal roads.

- **Sediment Traps** are to be installed at all catchbasin and area drain locations once the storm sewer system has been constructed to prevent silt laden runoff from entering the municipal storm sewer system.

8.2 Construction Sequencing

The following is the scheduling of construction activities with respect to sediment controls:

1. Install the silt fences prior to any other activities on the site.
2. Construct temporary mud mat for construction access.
3. Install sediment traps on the existing street catchbasins.
4. Install the service connections.
5. Excavate, constructed the house basements and back fill.
6. Construct the house superstructure.
7. Restore all disturbed areas with final landscape plantings and paving materials.
8. Upon stabilization of all disturbed areas, remove sediment controls.

8.3 ESC Inspection & Maintenance

In order to ensure that the erosion and sediment control measures operate effectively, they are to be regularly monitored and they will require periodic cleaning (e.g., removal of accumulated silt), maintenance and/or re-construction.

Inspections of all of the erosion and sediment controls on the construction site should be undertaken with the following frequency:

- On a weekly basis
- After every rainfall event
- After significant snow melt events
- Prior to forecasted rainfall events

If damaged control measures are found they should be repaired and/or replaced within 48 hours. Site inspection staff and construction managers should refer to the Erosion and Sediment Control Inspection Guide (2008) prepared by the Greater Golden Horseshoe Area Conservation Authorities. This Inspection Guide provides information related to the inspection reporting, problem response and proper installation techniques.

9.0 SUMMARY

Based on the discussions contained herein, the proposed development can be adequately serviced with full municipal services (watermain, sanitary and storm) in accordance with the standards of the City of Pickering, Region of Durham and the Toronto & Region Conservation Authority (TRCA) as follows:

Water

- The proposed detached dwellings will be serviced by 25mm diameter service connections to the existing 150mm diameter Nature Haven Crescent watermain and the existing 250mm diameter Finch Avenue watermain.
- The detached dwellings will have water meters located in the basements.
- The existing street fire hydrants will be within 90m of the principle entrance of the dwellings and therefore they provide sufficient coverage for fire protection.
- The subject development will require a maximum day plus fire flow of 100.2 L/s at 140 kPa.

Waste Water

- The proposed detached dwellings will be serviced by 100mm diameter service connections to the existing 200mm diameter Nature Haven Crescent sanitary sewer and the existing 200mm diameter Finch Avenue sanitary sewer.
- The subject development will generate a peak wastewater flow of 0.58 L/s.

Storm Drainage

- In accordance with City of Pickering criteria, the subject site will be serviced by storm service connections to the existing municipal storm sewers located on Finch Avenue.
- Based on the 100 year hydraulic grade line (HGL) in the storm sewers, the underside of the proposed basement floors will be located at least 300mm above the HGL.
- The major system is comprised of an overland flow route in the form of the existing municipal roads which will convey runoff from rainfall events in excess of the capacity of the municipal storm sewer to a safe outlet
- Based on the Finch Avenue & Altona Road Floodplain Spill 2D Modelling Analysis (April 29, 2022) completed by the TRCA, the proposed development is not located within the floodplain and has safe access to Finch Avenue and Nature Haven Crescent.

Stormwater Management

- Based on the City of Pickering and TRCA requirements the following stormwater management measures are to be implemented:
  - The portion of the subject site draining to Nature Haven Crescent will have stormwater controlled with the use of a box culvert for detention and an orifice to control the release rate. This stormwater management system will discharge directly to the existing Finch Avenue storm sewer.
  - Stormwater quality treatment for the subject site will be provided by an existing STC-6000 oil / grit separator located on Finch Avenue, east of the subject site

which will provide an 82% TSS removal rate. In addition to the existing oil / grit separator, LID measures in the form of soak-away pits are proposed which will provide water quality benefits.

- Based on the small size of the site, water balance will be addressed by infiltrating the 5mm rainfall event through the use of a soak-way pit to be located in the rear yard of each lot which will receive roof runoff.

Vehicular & Pedestrian Access

- The subject site has frontage on Finch Avenue and on Nature Haven Crescent which are two lane local roads under the jurisdiction of the City of Pickering. No new municipal roads are required to accommodate the subject development. Nature Haven Crescent has curb and gutter whereas Finch Avenue only has curb and gutter on the south side of the road. The curb and gutter on the north side of Finch Avenue will be constructed in conjunction with the subject development. With respect to parking, each dwelling will have a two car garage and a double driveway.
- Pedestrian access will be provided by the existing municipal sidewalk along Nature Haven Crescent. A 1.5 m wide sidewalk will be constructed along Finch Avenue across the frontage of the subject site.

Grading

- Based on the Functional Grading Plan no major difficulty is anticipated in achieving the municipal grading design criteria.

Erosion & Sediment Control During Construction

- Erosion and sediment controls are to be implemented during construction to prevent silt laden runoff from leaving the site in accordance with the “Erosion & Sediment Control Guidelines for Urban Construction” (2019).

Detailed Engineering Design

- Detailed engineering design for the proposed subdivision is to be prepared upon receipt of draft plan approval. This detailed design is to include detailed servicing and grading designs based on the criteria established in this Functional Servicing Report.

10.0 REFERENCES & BIBLIOGRAPHY

- City of Pickering, **Stormwater Management Guidelines**, January 2020.
- Region of Durham, **Design & Construction Specifications for Regional Services**, April 2013.
- Ministry of Environment, **Stormwater Management Planning & Design Manual**, March 2003.
- Greater Golden Horseshoe Area Conservation Authorities, **Erosion & Sediment Control Guidelines for Urban Construction**, December 2006.
- Fire Underwriters Survey, Water Supply for Public Fire Protection, 1999.
- Ministry of Municipal Affairs & Housing, **Ontario Building Code**, 2012.
- Sabourin Kimble & Associates Ltd., **Functional Servicing Report for ORC Altona Road Lands**, February 2010.
- Toronto & Region Conservation Authority, **Finch Avenue & Altona Road Floodplain Spill 2D Modelling Analysis**, April 29, 2022.
- Soil Engineers Ltd., **Geotechnical Investigation Report**, February 13, 2020.

Respectfully Submitted,

VALDOR ENGINEERING INC.

LICENSED PROFESSIONAL ENGINEER
D. A. GIUGOVAZ
June 05, 2024
PROVINCE OF ONTARIO

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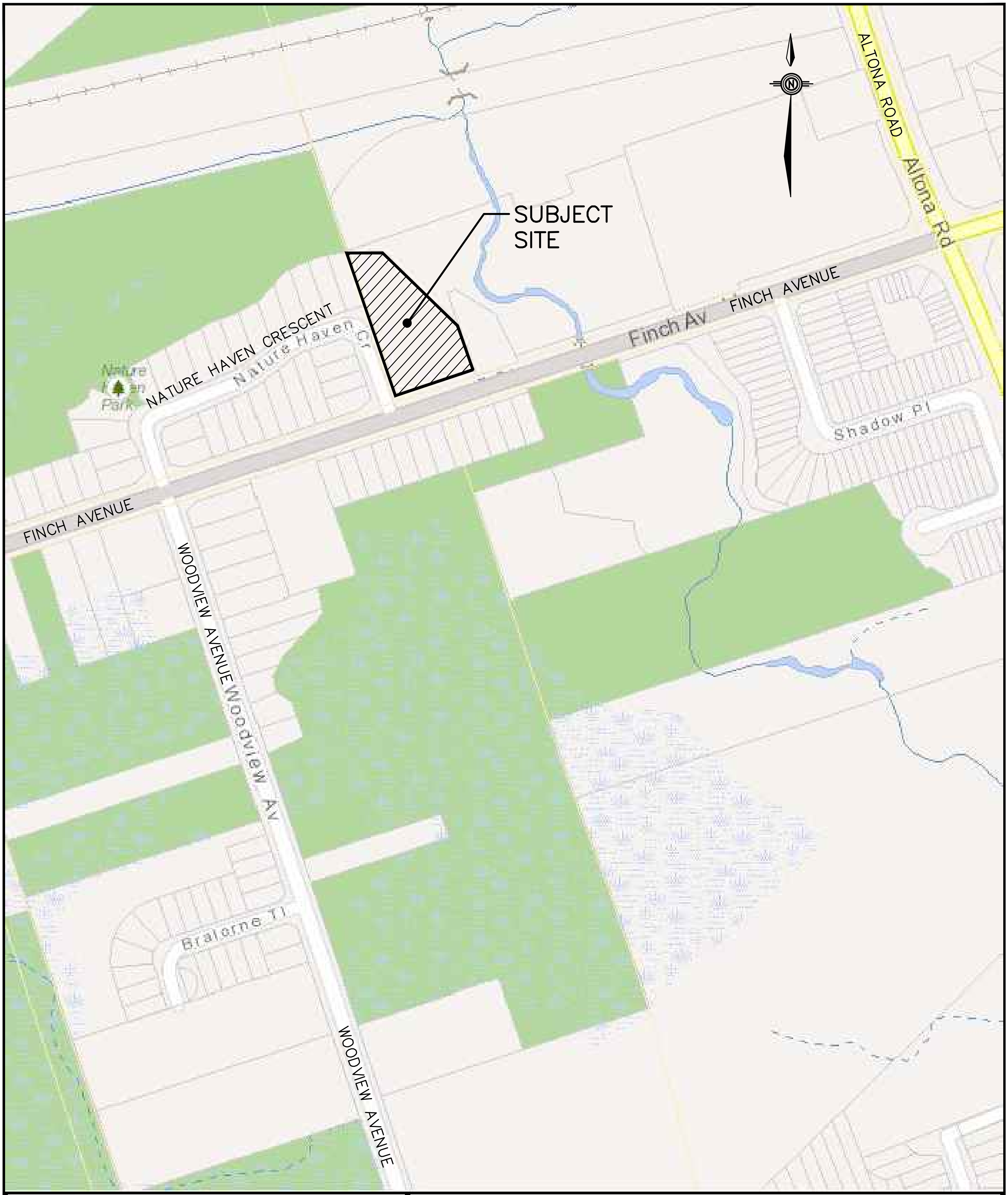
This report was prepared by Valdor Engineering Inc. for the account of the Fairglen Homes Ltd.. The comments, recommendations and material in this report reflect Valdor Engineering Inc.'s best judgment in light of the information available to it at the time of preparation. Any use of which a third party makes of this report, or any reliance on, or decisions made based on it, are the responsibility of such third parties. Valdor Engineering Inc. accepts no responsibility whatsoever for any damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

17

VALDOR



PROPOSED RESIDENTIAL DEVELOPMENT
NATURE HAVEN CRESCENT
CITY OF PICKERING

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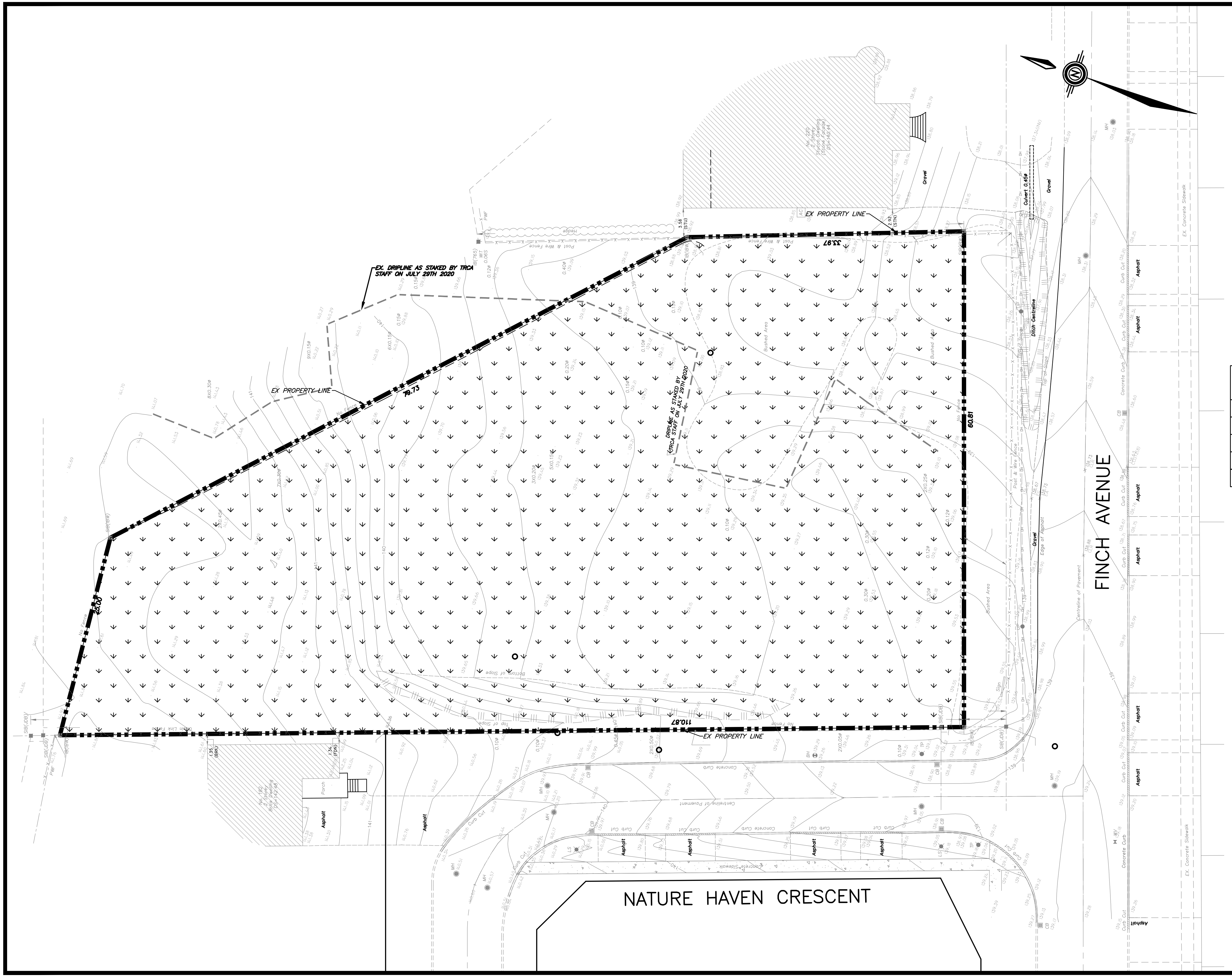
LOCATION PLAN

SCALE	N.T.S.	CKD. BY	D.G.	DWG.	FIGURE 1
DATE	FEBRUARY 2024	DRAWN BY	M.H.	PROJECT	17149



LEGEND:

▨ ROOF

⌄ PERVIOUS

▨ IMPERVIOUS

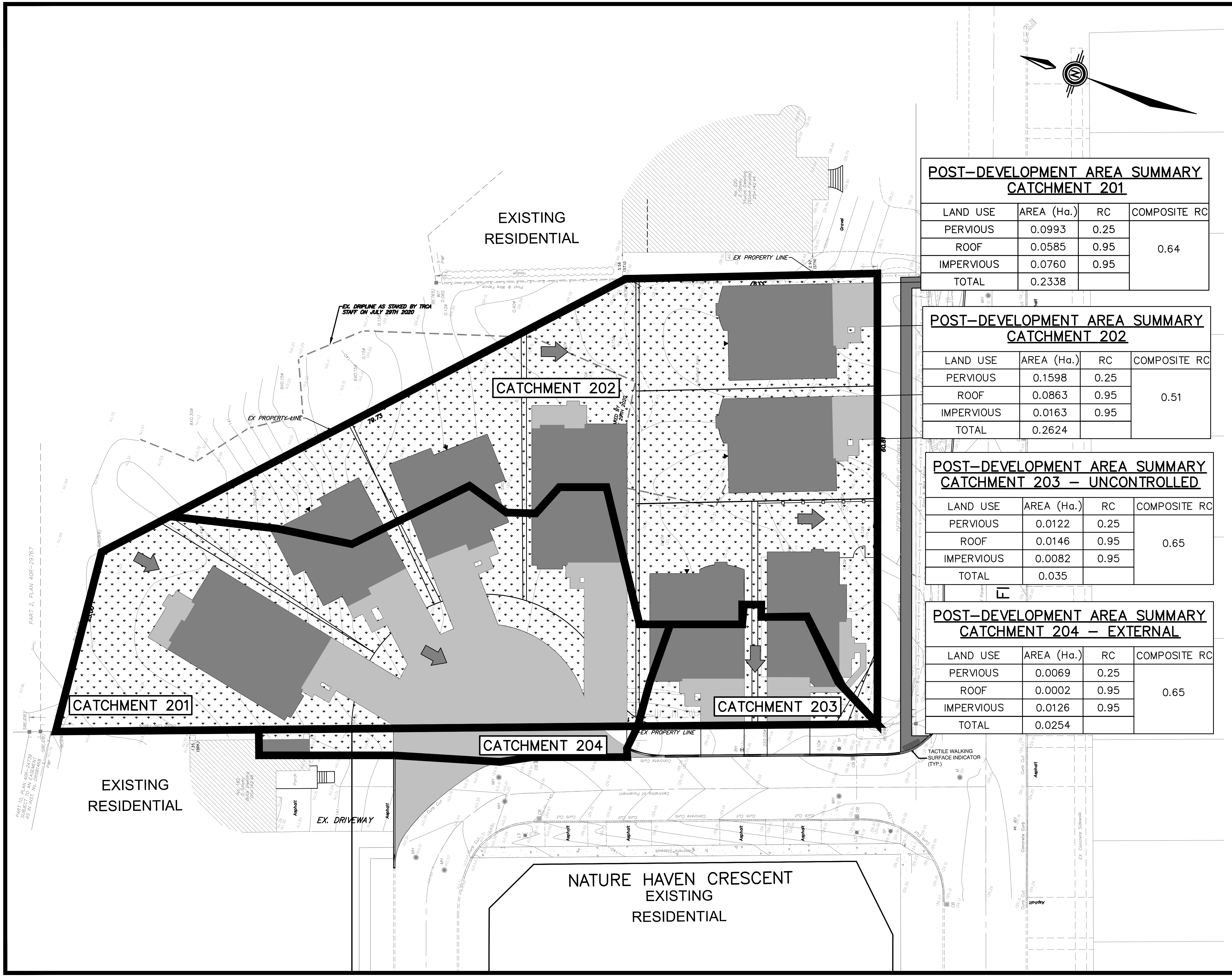
PRE-DEVELOPMENT AREA SUMMARY			
LAND USE	AREA (Ha.)	RC	COMPOSITE RC
PERVIOUS	0.5121	0.25	0.25
ROOF	0.0000	0.95	
IMPERVIOUS	0.0000	0.95	
TOTAL	0.5121		

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
N/E CORNER FINCH AVE/NATURE HAVEN CRES
CITY OF PICKERING
REGIONAL MUNICIPALITY OF DURHAM

PRE-DEVELOPMENT DRAINAGE CONDITION

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, UNIT 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

PREPARED BY M.H.	CKD. BY D.G.
SCALE N.T.S.	DATE FEBRUARY 2024
PROJECT 17149	DWG. FIGURE 2



POST–DEVELOPMENT AREA SUMMARY CATCHMENT 201

LAND USE	AREA (Ha.)	RC	COMPOSITE RC
PERVIOUS	0.0993	0.25	0.64
ROOF	0.0585	0.95	
IMPERVIOUS	0.0760	0.95	
TOTAL	0.2338		

POST–DEVELOPMENT AREA SUMMARY CATCHMENT 202

LAND USE	AREA (Ha.)	RC	COMPOSITE RC
PERVIOUS	0.1598	0.25	0.51
ROOF	0.0863	0.95	
IMPERVIOUS	0.0163	0.95	
TOTAL	0.2624		

POST–DEVELOPMENT AREA SUMMARY CATCHMENT 203 – UNCONTROLLED

LAND USE	AREA (Ha.)	RC	COMPOSITE RC
PERVIOUS	0.0122	0.25	0.65
ROOF	0.0146	0.95	
IMPERVIOUS	0.0082	0.95	
TOTAL	0.035		

POST–DEVELOPMENT AREA SUMMARY CATCHMENT 204 – EXTERNAL

LAND USE	AREA (Ha.)	RC	COMPOSITE RC
PERVIOUS	0.0069	0.25	0.65
ROOF	0.0002	0.95	
IMPERVIOUS	0.0126	0.95	
TOTAL	0.0254		

LEGEND:

▇	ROOF
▨	PERVIOUS
░	IMPERVIOUS

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
N/E CORNER FINCH AVE/NATURE HAVEN CRES
CITY OF PICKERING
REGIONAL MUNICIPALITY OF DURHAM

POST–DEVELOPMENT DRAINAGE CONDITION

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
741 ROWNTREE DAIRY ROAD, UNIT 2, WOODBRIDGE, ONTARIO, L4L 5T9
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
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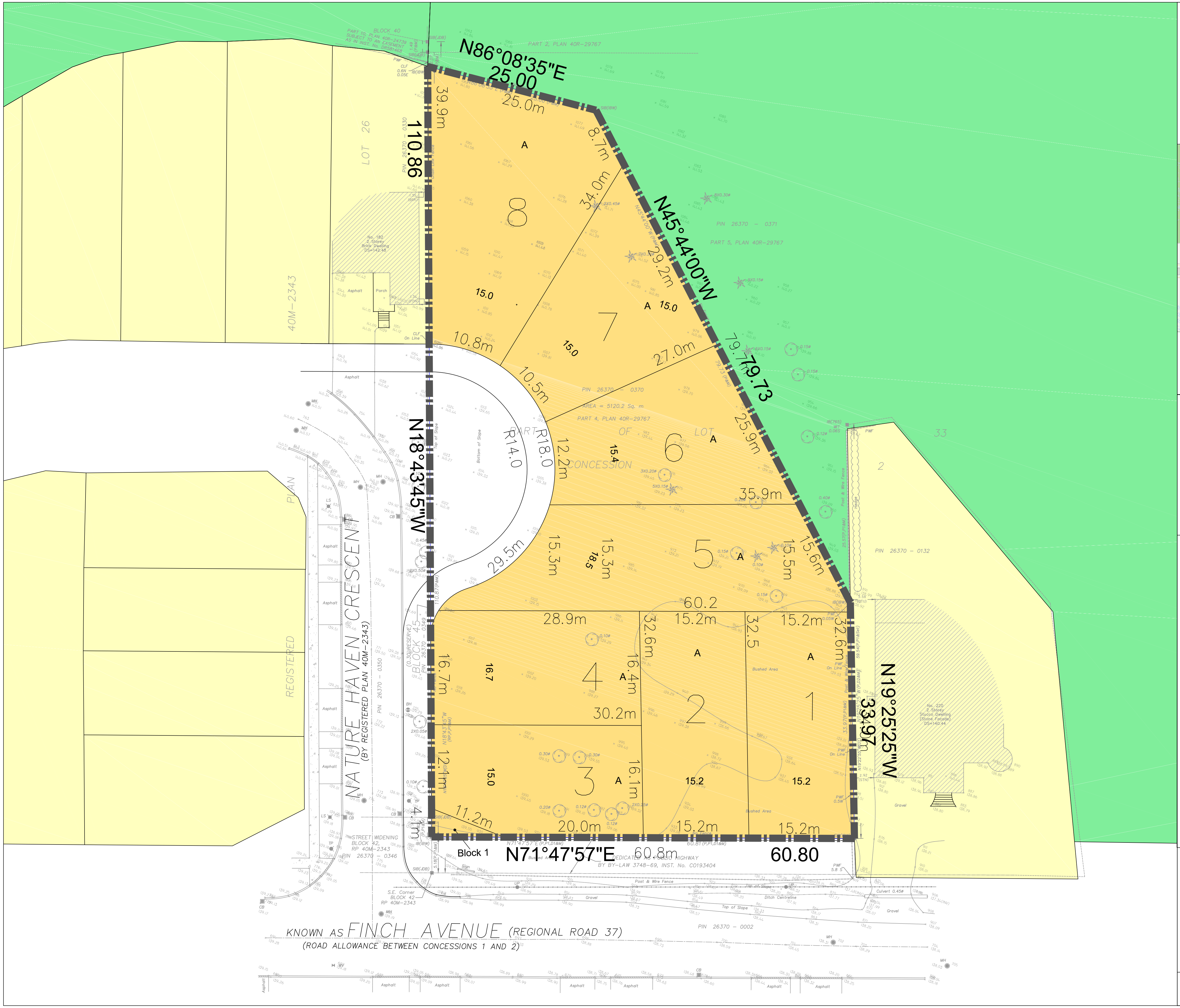
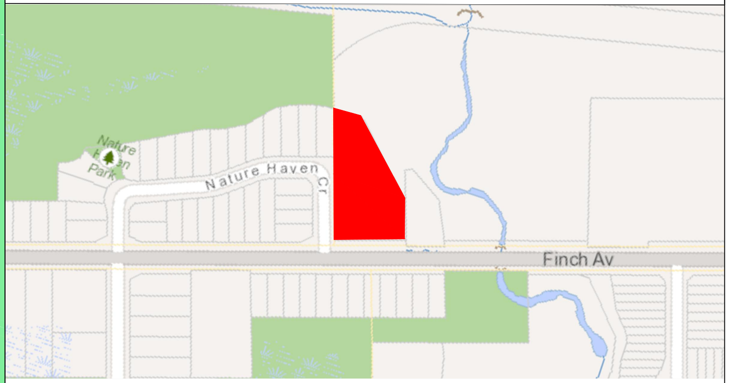
PREPARED BY M.H.	CKD. BY D.G.
SCALE N.T.S.	DATE FEBRUARY 2024
PROJECT 17149	DWG. FIGURE 3

APPENDIX "A"

Draft Plan, Site Plan & Equivalent Population Calculation



DRAFT PLAN of PROPOSED SUBDIVISION
PART OF LOT 33 CON. 2
(GEOGRAPHIC TOWNSHIP OF PICKERING)
CITY of PICKERING
REGIONAL MUNICIPALITY OF DURHAM



KEY PLAN

0 40 80
Metric Scale
1:3000

🟥 Subject Property

AREA TABLE

Residential Lots 1-8	0.46 ha.
Roads	0.05 ha.
Sight Triangle Block 1	21.2 m2
Total	0.51 ha.

UNIT COUNT

Single-Detached "A" 8 u

ROAD LENGTHS

18 m R.O.W 28.6 m

LEGEND

▬ ▬ ▬	Boundary of Subdivision
🟨	Low Density Residential
🟧	Single Detached
🟩	Landscaped/Open space

ADDITIONAL INFORMATION REQUIRED UNDER THE PLANNING ACT

D. Residential
H. Piped water to be provided
I. Primarily clayey silt.
K. Sanitary and storm sewers to be provided

NOTES

All measurements are in metres.
All elevations refer to Geodetic Datum.

SURVEYOR'S CERTIFICATE

I hereby certify that the boundaries of the lands to be subdivided as shown on this plan, and their relationship to the adjacent lands are correctly and accurately shown.

Signature ____ Day ____ Month ____ Year ____

OWNERS AUTHORIZATION

We, ____________________ representing the registered owners of the registered lands hereby authorize DESIGN PLAN SERVICES INC. to prepare a draft plan of subdivision for submission and approval.

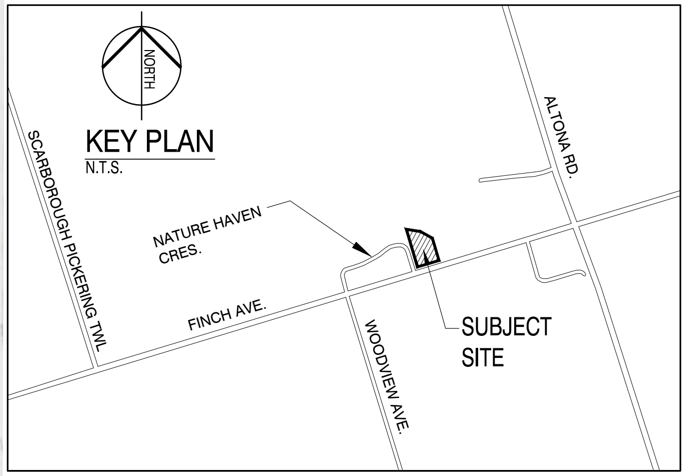
Signature ____ Day ____ Month ____ Year ____

SCALE BAR 1:250
Metric Scale
0 10 20 40

DESIGN PLAN SERVICES INC.
Town Planning Consultants

900 The East Mall, Suite 300
Toronto, ON M9B 6K2
Telephone: 416.626.5445
www.designplan.ca

Scale	Date	Drawing Number	Rev.	Drawn	Design
1:250	August 30th /2021	1963-10			RW



OVERALL SITE STATISTICS

ROAD WIDENING	515.18
BLOCK 1	26.77
NET LOT AREA *(MINUS ROAD WIDENING & BLOCK 1 AREA)*	4579.36
TOTAL AREA :	**5121.31m2**
RESIDENTIAL ZONE:	**BASED ON "S3- 7 ZONE"**
TOTAL UNITS	8 SINGLE DETACHED (2 STOREY UNITS)

(MAX U.P.H. 0.46379 ha / 8 = 17.25)

LOT No.	MODEL TYPE	LOT AREA (m²)	LOT FRONTAGE (m)	BUILDING HEIGHT (m) 9.0m MAX.	UNIT G.F.A. (m²)	COVERAGE W/ PORCH (m²) 38% MAX.	COVERAGE PERCENTAGE %	LANDSCAPE AREA (m²)	LANDSCAPE PERCENTAGE %
1	MODEL-A	488.78	15.20	9.00	000.0	185.72	38.00	000.0	0.00
2	MODEL-A	488.78	15.20	9.00	000.0	185.72	38.00	000.0	0.00
3	MODEL-C	486.36	15.80	9.00	000.0	184.81	38.00	000.0	0.00
4	MODEL-A	456.32	15.20	9.00	000.0	173.40	38.00	000.0	0.00
5	MODEL-B	711.63	15.05	9.00	000.0	270.41	38.00	000.0	0.00
6	MODEL-D	570.96	15.05	9.00	000.0	216.96	38.00	000.0	0.00
7	MODEL-D	539.49	15.05	9.00	000.0	205.00	38.00	000.0	0.00
8	MODEL-B	837.28	15.09	9.00	000.0	318.16	38.00	000.0	0.00
TOTAL:		**3202.83 m2**	**91.50 m**	**9.00 m**	**0.00 m2**	**1217.02 m2**	**38.0 m2**	**0.00 m2**	**0.0 m2**

PARKING	PROVIDED	REQUIRED
8 LOTS WITH 2 SPACES IN GARAGE AND 2 SPACES IN DRIVEWAY	32 SPACES	16 SPACES
TOTAL	**32 SPACES**	**16 SPACES**

NOTE:

PART OF LOT 33
CONCESSION 2
GEOGRAPHIC TOWNSHIP OF PICKERING
CITY OF PICKERING
REGIONAL MUNICIPALITY OF DURHAM

SCALE 1 : 250
10 5 0 10
METRES

BENCHMARK

ELEVATIONS ARE GEODETIC AND REFERRED TO CITY OF PICKERING B.M. NO. 1-090, ELEVATION = 140.969 M

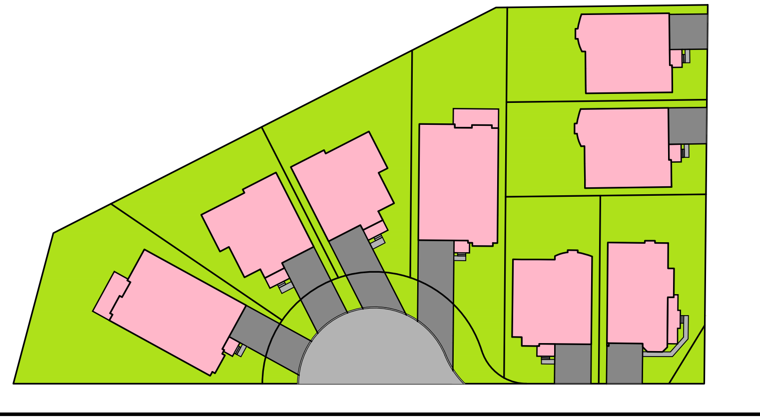
NOTES:

LEGAL SURVEY INFORMATION AND LOT DIMENSIONS SHOWN ON THIS PLAN ARE TAKEN FROM A PLAN PREPARED BY: **ERTL SURVEYORS ONTARIO LAND SURVEYORS WWW.ES-OLS.COM 1234 REID STREET, UNIT 10, RICHMOND HILL L4B 1C1 TELEPHONE (905) 731-7834 FAX (905)731-7852 EMAIL INFO@ES-OLS.COM** DATED: FEB. 23 2018 WHICH MAY NOT BE FINAL AND ARE NOT GUARANTEED. THE FINAL REGISTERED PLAN OF SUBDIVISION SHALL BE REFERRED TO FOR CONFIRMATION OF THE DATA.

230 Finch Ave-Nature Haven Cres.

GROSS SITE AREA: 5121.31 m²/ 1.265 Ac/ 0.512 Ha

🟩	*LANDSCAPED AREA /OPEN SPACE:*	*Approx. 2786.67 m2 ± =54.4% (GROSS SITE AREA)*
🟥	*BUILDING AREA:*	*Approx. 1614.87 m2 ± =31.5% (GROSS SITE AREA)*
■	*DRIVEWAY AREA:*	*Approx. 450.55 m2 ± = 8.8% (GROSS SITE AREA)*
▨	*HARD SURFACE AREA:* *(Roadway & Walkways)*	*Approx. 269.22 m2 ± = 5.3% (GROSS SITE AREA)*



LEGEND

– – – –	STORM CONNECTION
	SANITARY CONNECTION
●- - - -	WATER CONNECTION
⊢—	HYDRO CONNECTION
◫	DOUBLE CATCH BASIN
□	CATCH BASIN
●	STREET LIGHT
⌖	HYDRANT
▲	TRANSFORMER
☒	CABLE TV PEDESTAL
■	BELL PEDESTAL
△	ENTRANCE DOOR LOCATION
▲	GARAGE DOOR LOCATION
MAIL	COMMUNITY MAILBOX
✳	ENGINEERED FILL LOT
⊗	VALVE AND CHAMBER
●	SANITARY MANHOLE
○	STORM MANHOLE
☒	AIR-CONDITIONING UNIT
100.00	PROPOSED GRADE
168.33	EXISTING GRADE
SW 100.00	PROPOSED SWALE GRADE
E.G. 100.00	ESTABLISHED GRADE
○	DOWNSPOUT LOCATION
SP	SUMP PUMP
┬┬┬┬	PROPOSED BERM
◄—	SWALE DIRECTION
H	HYDRO METER
G	GAS METER
10	MUNICIPAL ADDRESS
F.FLR.	FINISHED FLOOR ELEVATION
T/WALL	TOP OF FOUNDATION WALL
F.SLAB	FIN. BASEMENT FLOOR SLAB
U/FTG.	UNDERSIDE FOOTING ELEVATION
🟧	TPZ FENCE
🟥	PROPERTY BOUNDRY
▥	PRECAST CONCRETE UNIT PAVERS
▦	PRECAST CONCRETE PATIO SLABS
—×—×—	CHAINLINK FENCE
—□—□—	WOOD PRIVACY FENCE / SCREEN
	SNOW STORAGE AREA

THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND CONDITIONS ON SITE BEFORE PROCEEDING WITH CONSTRUCTION. ANY DISCREPANCIES SHALL BE REPORTED TO JARDIN DESIGN GROUP INC. PRIOR TO COMMENCEMENT OF WORK.

JARDIN DESIGN GROUP INC. IS NOT RESPONSIBLE FOR THE ACCURACY OF SURVEY, STRUCTURAL OR ENGINEERING INFORMATION SHOWN ON THESE DRAWINGS OR FOR CONSTRUCTION STARTED PRIOR TO THE ISSUANCE OF A BUILDING PERMIT. REFER TO THE APPROPRIATE ENGINEERING DRAWINGS BEFORE PROCEEDING WITH WORK.

AS CONSTRUCTED INVERTS MUST BE VERIFIED PRIOR TO POURING FOOTINGS.

JARDIN DESIGN GROUP INC. HAS NOT BEEN RETAINED TO CARRY OUT GENERAL REVIEW OF THE WORK AND ASSUMES NO RESPONSIBILITY FOR THE FAILURE OF THE CONTRACTOR OR SUB CONTRACTOR TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

No:	DATE:	WORK DESCRIPTION:
18		
17		
16		
15		
14		
13		
12		
11		
10		
9		
8		
7		
6		
5		
4	MAR. 30, 2023	REVISED AS PER CITY COMMENTS & ISSUED TO CLIENT FOR REVIEW.
3	SEPT. 21, 2021	REV. LOT CONFIGURATION & ISSUED TO CLIENT FOR REVIEW.
2	MAY 04, 2021	ADDED ADDITIONAL AREA STATS & ISSUED TO CLIENT FOR REVIEW.
1	DEC. 18, 2020	ISSUED TO CLIENT FOR REVIEW.

jardin
DESIGN GROUP INC
64 JARDIN DR. SUITE 3A
VAUGHAN ONT. L4K 3P3
TEL: 905 660-3377 FAX: 905 660-3713
EMAIL: info@jardindesign.ca

The undersigned has reviewed and takes responsibility for this design and has the qualifications and meets the requirements set out in the Ontario Building Code to be a designer

QUALIFICATION INFORMATION

NAME	SIGNATURE	BCIN
Walter Botter		*21031*

REGISTRATION INFORMATION

FIRM NAME	BCIN
jardin design group inc.	*27763*

CONTEXT SITE PLAN
(COLOUR)

230 Finch Ave-Nature Haven Cres.
(PICKERING)

BILD®

TYPE	SP
SCALE:	1:250
PROJ. No.	20-XX
No.	A-01

VALDOR ENGINEERING INC.
571 Chrislea Road, Unit 2, Woodbridge, ON L4L 8A2
Tel: 905-264-0054 Fax: 905-264-0069 info@valdor-engineering.com
www.valdor-engineering.com

TABLE: A1

EQUIVALENT POPULATION

Project Name: **Proposed Residential Development, City of Pickering**
File: 17149
Date: February 2024

Unit Type	Population Density	Residential Units	Commercial Floor Area (sq.m)	Equivalent Population
Detached Dwelling	3.5 persons per unit	8		28.0
Total:		**8**	**0.00**	**28.0**

APPENDIX “B”

Water System Calculations & Details

VALDOR ENGINEERING INC.
571 Chrislea Road, Unit 4, Woodbridge, ON L4L 8A2
Tel: 905-264-0054 Fax: 905-264-0069 info@valdor-engineering.com
www.valdor-engineering.com

TABLE: B1

WATER DEMAND CALCULATION

Project Name: **Propsoed Residential Development, City of Pickering**
File: 17149
Date: February 2024

Critera:

	Eqv. Populatior	**Base Demand**		**Peaking Factors**	
Residential	28.0	364	L/capita/day	Max Day	2.00
				Peak Hour	3.00

Demand:

	Average Day (L/day)	**Average Day** (L/min)	**Max Day** (L/min)	**Peak Hour** (L/min)	
Residential	10,192	7.1	14.2	21.2	
Total	**10,192**	**7.1**	**14.2**	**21.2**	

VALDOR ENGINEERING INC. **TABLE: B2**

File: 17149
February 2024

CALCULATION OF REQUIRED FIRE FLOW

In accordance to Water Supply for Public Fire Protection, Fire Underwriters Survey 1999

Project Name: Proposed Residential Development, City of Pickering
File: 17149
Date: December 2021

Notes: Lot 4
Detached Dwelling

Type of Construction - Ordinary Construction

$C =$ 1.0
Total Floor Area: 3,186 sq.ft.
Total Floor Area: 296.0 sq.m
$A =$ 296.0 sq.m

(Total Floor Area includes all storeys, but excludes basements at least 50 percent below grade)

$F = 220\,C\,\sqrt{A}$
$F =$ 3,785 L/min
$F =$ 4,000 (to nearest 1,000 Lmin)

Occupancy Factor

		Charge
Type:	Limited Combustible	-15%
	$f_1 =$	-15%

Sprinkler Credit

		Charge
NFPA 13 Sprinkler Standard:	NO	0%
Standard Water Supply:	NO	0%
Fully Supervised System:	NO	0%
Total Charge to Fire Flow:	$f_2 =$	0%

$F' = F \times (1+f_1) \times (1+f_2)$
$F' =$ 3,400 L/min

Exposure Factor

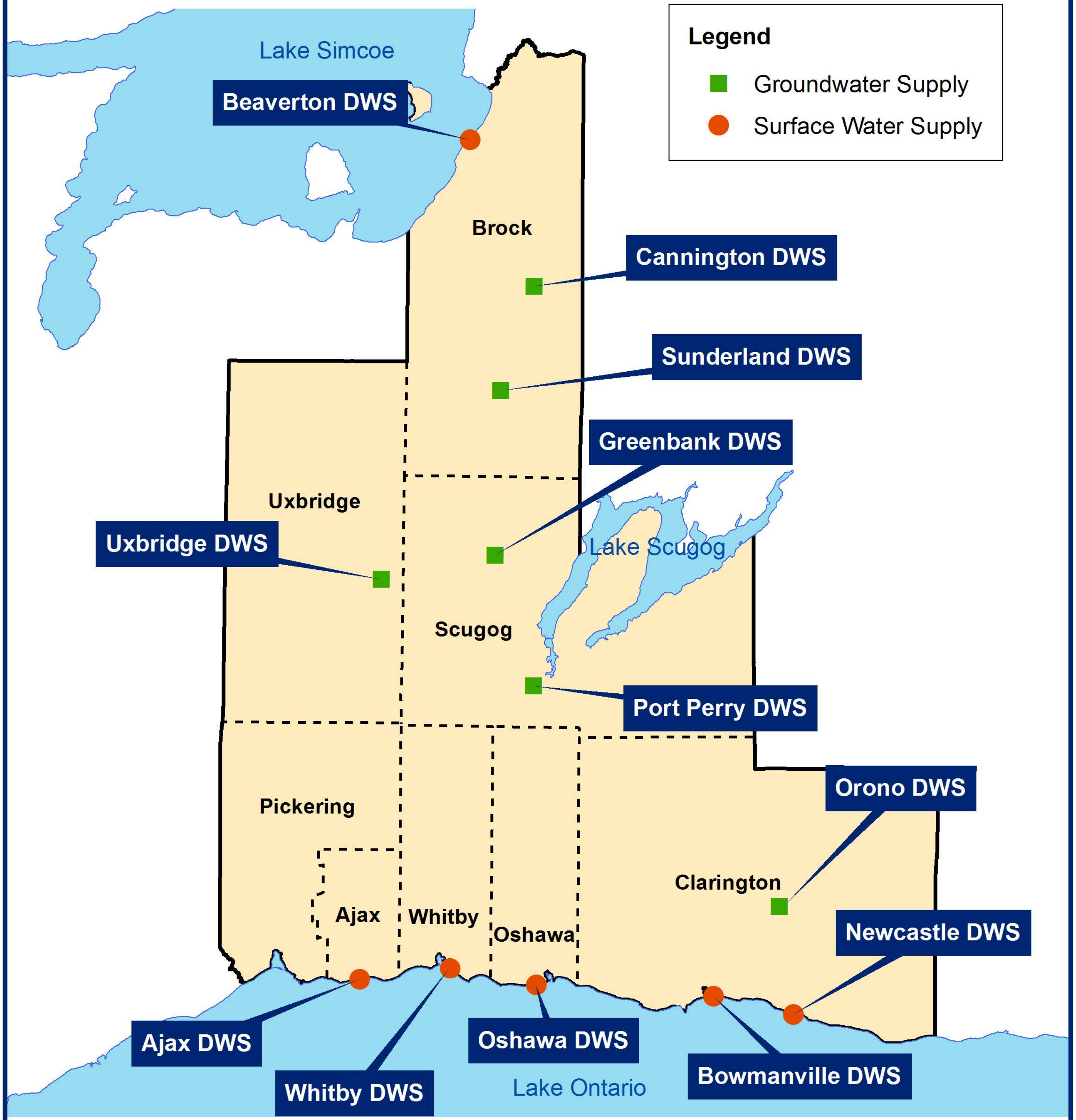
		Charge
North Side - Distance to Building (m):	3.1 to 10m	20%
East Side - Distance to Building (m):	10.1 to 20m	15%
South Side - Distance to Building (m):	0 to 3m	25%
West Side - Distance to Building (m):	30.1 to 45m	5%
	$f_3 =$	65% (maximum of 75%)

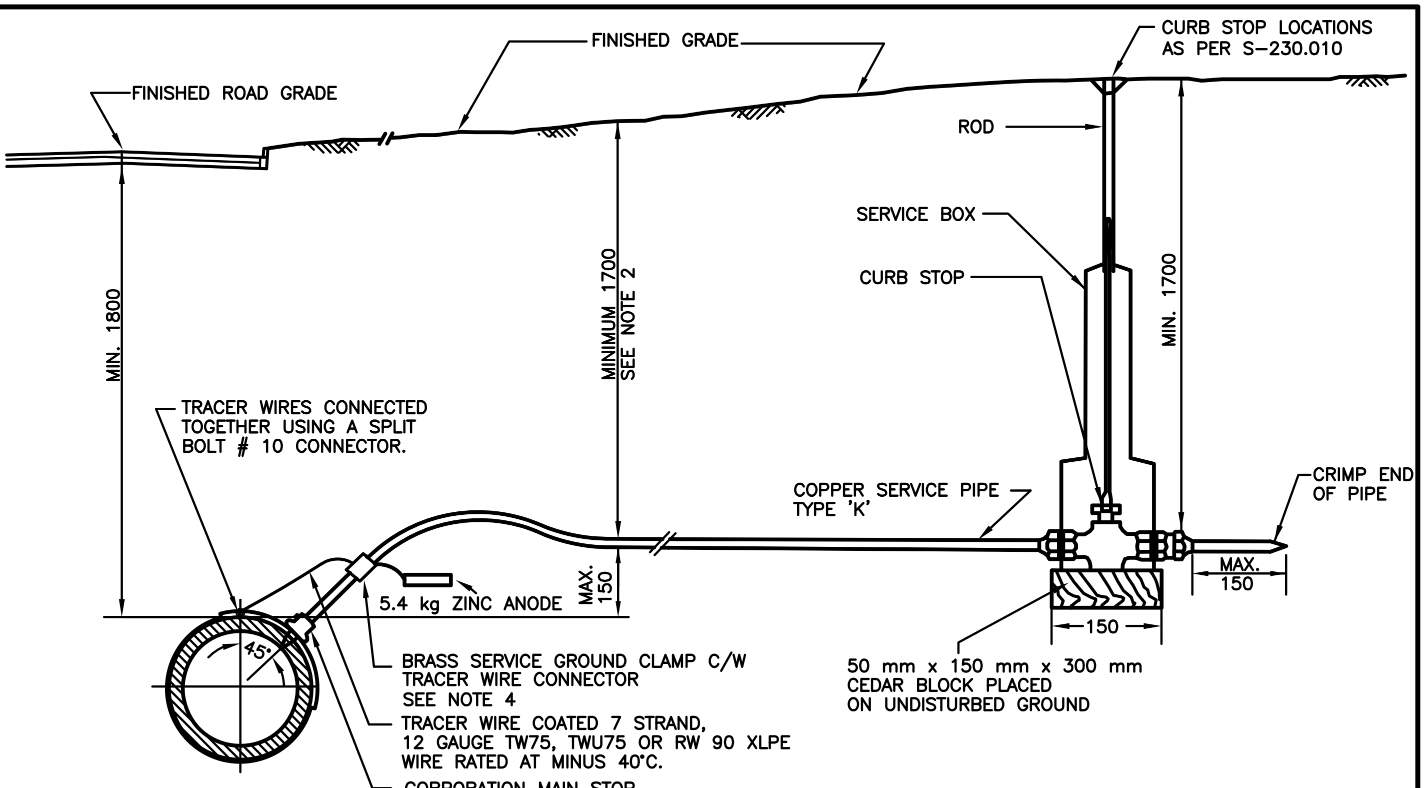
$F'' = F' \times (1+f_3)$
$F'' =$ 5,610 L/min

REQUIRED FIRE FLOW
$F'' =$ **6,000** **L/min** (to nearest 1,000 L/min)

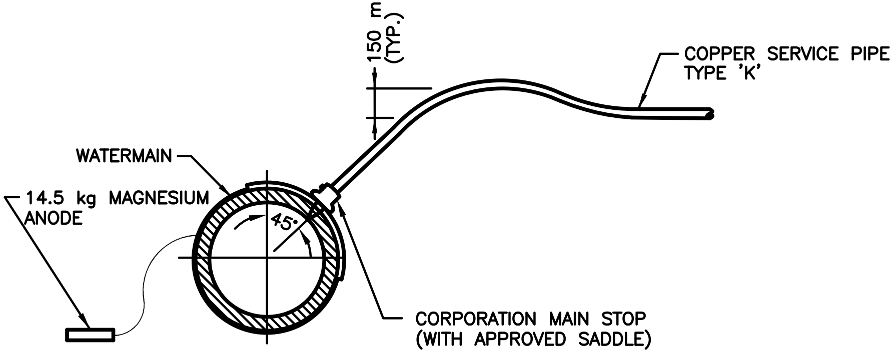
DURHAM
REGION

Regional Municipality of Durham
Works Department
Municipal Drinking Water Supply System (DWS)

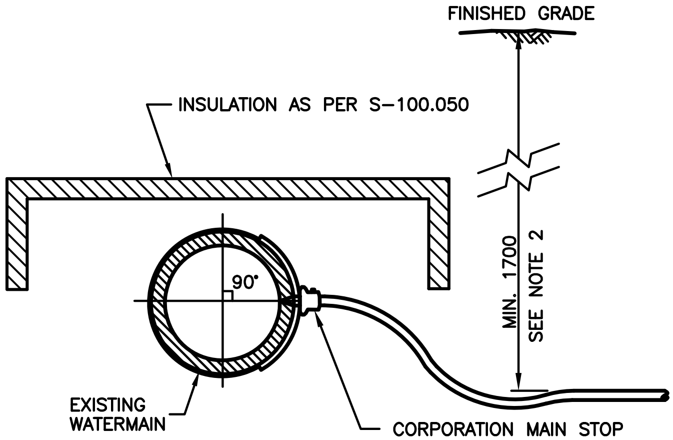




NON–FERROUS WM



FERROUS WM



LOWERING WATER SERVICES

NOTES

1. THE WATER CONNECTION SHALL BE LAID FROM THE MAIN TO 150 mm BEYOND THE PROPERTY LINE, IN NEW SUBDIVISIONS ONLY.
2. HORIZONTAL GOOSE NECK SHALL BE USED WHEN COVER LESS THAN 1700 mm.
3. WATERMAIN SHALL BE TAPPED UNDER PRESSURE.
4. SERVICE GROUND CLAMPS AND SPLIT BOLT SHALL BE WRAPPED WITH ELECTRICAL PUTTY.
5. ANODE SHALL BE PLACED AT LEAST 1.0 m AWAY FROM THE SERVICE AND AS DEEP AS THE BOTTOM OF THE SERVICE.
6. ANODE SHALL BE LOCATED BETWEEN THE MAIN STOP AND CURB STOP.
7. PLUMBING CONTRACTOR TO REMOVE TAIL PIECE AND HOOK UP TO CURB STOP.
8. CATHODIC PROTECTION, BONDING CABLE AND TRACER WIRE SHALL BE AS PER S–201.030, S–201.031.
9. MINIMUM SEPARATION DISTANCE BETWEEN TAPPED COUPLINGS SHALL BE 1.0 m.
10. COUPLINGS SHALL NOT BE PERMITTED BETWEEN THE MAIN STOP AND THE CURB STOP WITHOUT PERMISSION OF THE REGION OF DURHAM,

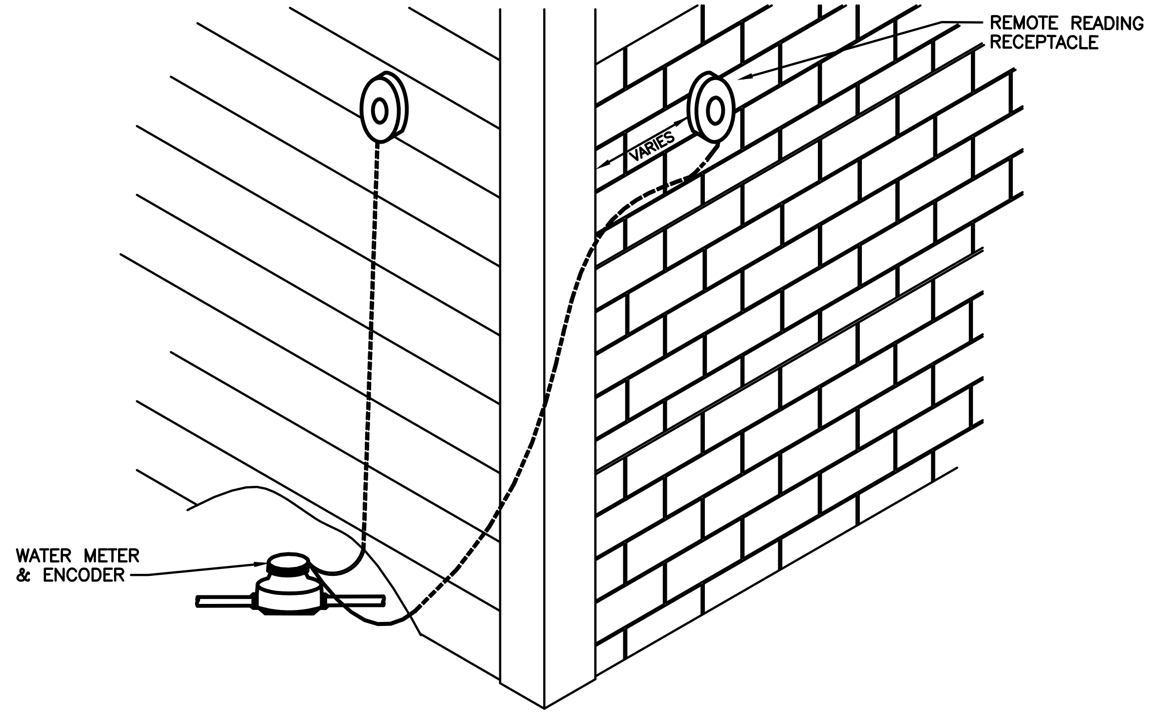
ALL DIMENSIONS IN MILLIMETRES EXCEPT WHERE NOTED.

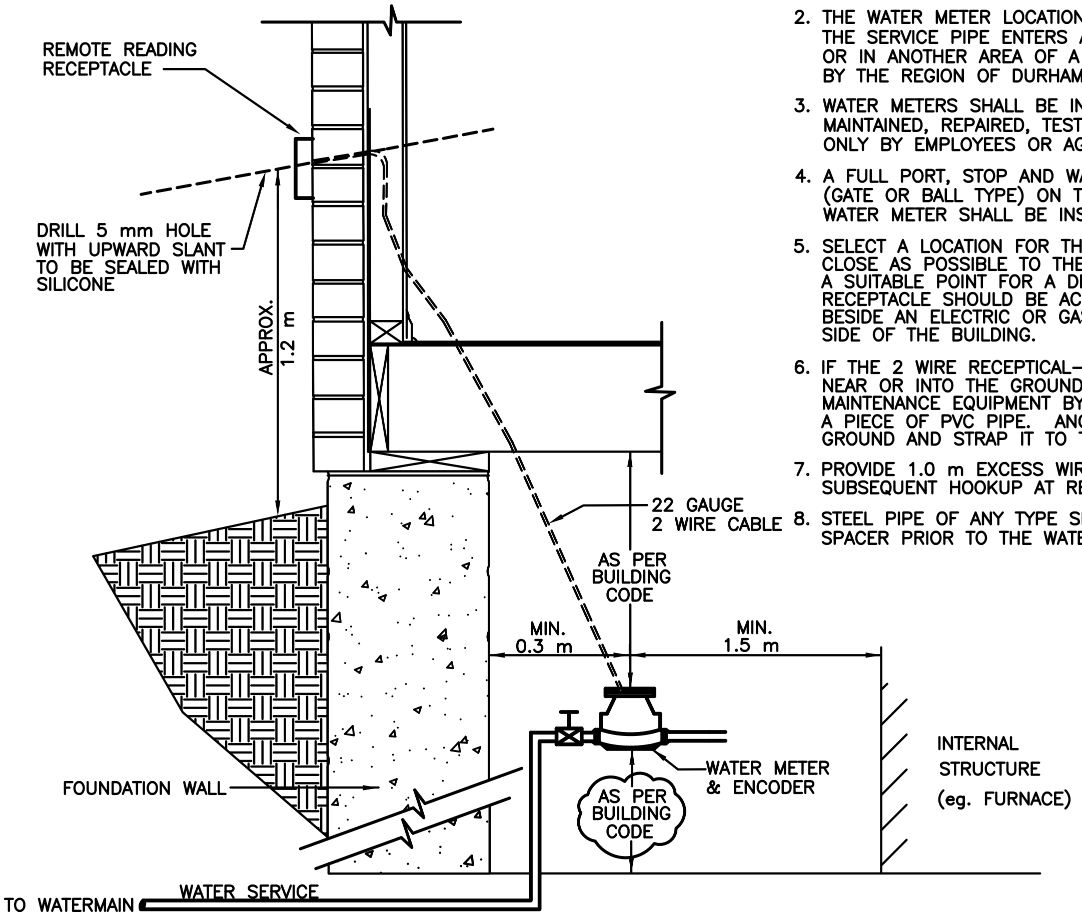
DURHAM REGION
WORKS DEPARTMENT

19 mm AND 25 mm COPPER WATER SERVICE

DWG. DATE: 1981 04
REVISION NO.: 19
REV. DATE: 2014 04
SCALE: N.T.S.

S–230.020





NOTES

1. THE WATER METER SHALL BE READILY ACCESSIBLE.
2. THE WATER METER LOCATION SHALL BE LOCATED WHERE THE SERVICE PIPE ENTERS A BUILDING'S FULL BASEMENT OR IN ANOTHER AREA OF A BUILDING OR LOCATION APPROVED BY THE REGION OF DURHAM.
3. WATER METERS SHALL BE INSTALLED, SEALED, REPLACED MAINTAINED, REPAIRED, TESTED, INSPECTED AND REMOVED ONLY BY EMPLOYEES OR AGENTS OF THE REGION OF DURHAM.
4. A FULL PORT, STOP AND WASTE CORPORATION VALVE (GATE OR BALL TYPE) ON THE INLET SIDE OF A WATER METER SHALL BE INSTALLED.
5. SELECT A LOCATION FOR THE RECEPTACLE WHICH IS AS CLOSE AS POSSIBLE TO THE METER AND WHICH PROVIDES A SUITABLE POINT FOR A DRILLED HOLE. LOCATION OF RECEPTACLE SHOULD BE ACCESSIBLE, PREFERABLY BESIDE AN ELECTRIC OR GAS METER ON THE DRIVEWAY SIDE OF THE BUILDING.
6. IF THE 2 WIRE RECEPTICAL–TO–ENCODER CABLE RUNS NEAR OR INTO THE GROUND, PROTECT IT FROM LAWN MAINTENANCE EQUIPMENT BY PLACING THE WIRE INSIDE A PIECE OF PVC PIPE. ANCHOR THE PIPE INTO THE GROUND AND STRAP IT TO THE MOUNTING SURFACE.
7. PROVIDE 1.0 m EXCESS WIRE AT EACH END FOR SUBSEQUENT HOOKUP AT RECEPTACLE AND AT METER.
8. STEEL PIPE OF ANY TYPE SHALL NOT BE USED AS A SPACER PRIOR TO THE WATER METER BEING INSTALLED.

ALL DIMENSIONS IN MILLIMETRES EXCEPT WHERE NOTED.

DURHAM REGION
WORKS DEPARTMENT

METER, VALVE, PRO READ ARB RECEPTACLE AND WIRE INSTALLATION

DWG. DATE: 1995 02
REVISION NO.: 6
REV. DATE: 2013 04
SCALE: N.T.S.

S-240.010

APPENDIX “C”

Wastewater Calculations & Details

VALDOR ENGINEERING INC.
571 Chrislea Road, Unit 4, Woodbridge, ON L4L 8A2
Tel: 905-264-0054 Fax: 905-264-0069 info@valdor-engineering.com
www.valdor-engineering.com

TABLE: C1

WASTEWATER LOADING CALCULATION

Project Name: **Proposed Residential Development, City of Pickering**
File: 17149
Date: February 2024

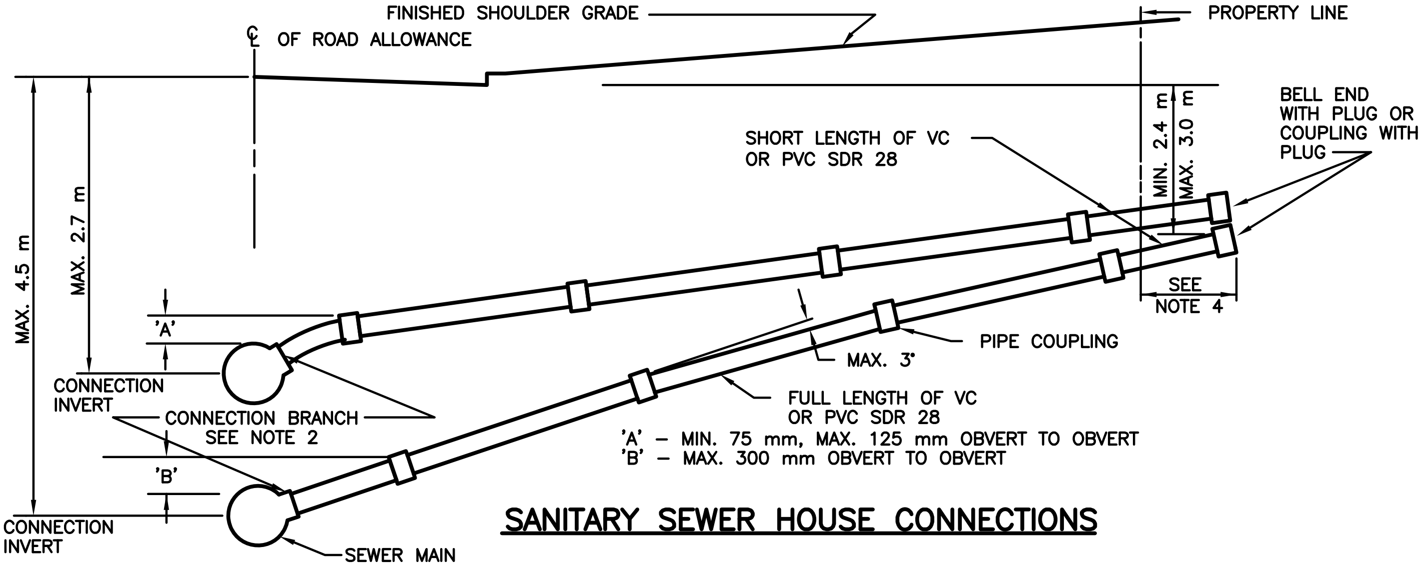
Criteria:

Peak flow design parameters

Avg. Flow Rate (Residential): 364 L/person/day

Infiltration Rate: 0.26 L/s/ha
Residential Peaking Factor: 1 + (14 / (4+(P/1000)^0.5)) where P is population in thousands
(Min = 1.5, Max = 3.8)

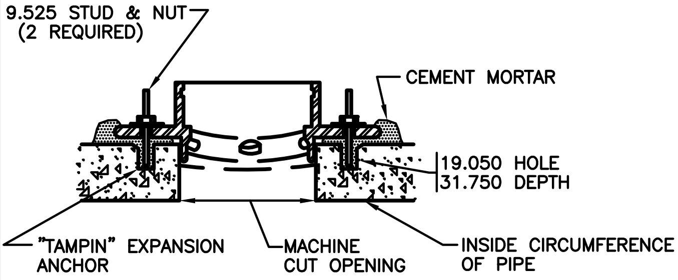
	Site Area (ha.)	Residential				Infiltration (L/s)	Total Peak Flow (L/s)
		Equivalent Population	Average Flow (L/s)	Peaking Factor	Peak Flow (L/s)		
	0.512	28.0	0.118	3.80	0.45	0.133	**0.58**
TOTAL	**0.512**	**28.0**					**0.58**



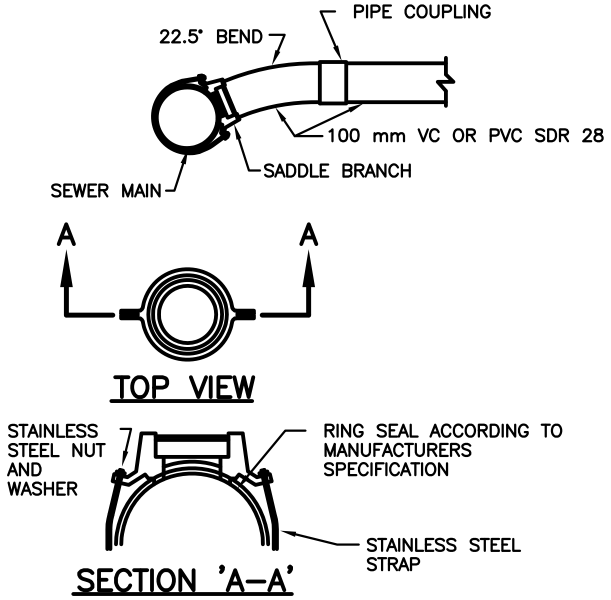
SANITARY SEWER HOUSE CONNECTIONS

NOTES:

1. IN NEW SUBDIVISIONS THE SANITARY SEWER AND WATER SERVICE CONNECTIONS SHALL BE INSTALLED IN SEPARATE TRENCHES. IN CASES WHERE THE SEPARATE TRENCH INSTALLATION IS NOT PRACTICAL, SANITARY SEWER AND WATER SERVICE CONNECTIONS MAY BE INSTALLED IN A COMMON TRENCH AS PER DETAIL 'A'.
2. IN NEW SUBDIVISIONS ALL CONNECTIONS TO THE SEWERS ARE TO BE MADE WITH A FACTORY MANUFACTURED 'T'. FOR CONNECTIONS TO EXISTING SANITARY SEWERS, OTHER THAN PVC A SADDLE CONNECTION MAY BE USED. MORTAR–ON SADDLES SHALL BE USED ON CONCRETE PIPE GREATER THAN 450 mm DIAMETER. CONNECTIONS TO EXISTING PVC SEWERS SHALL BE MADE WITH A FACTORY MANUFACTURED TEE OR AN APPROVED SADDLE. CONNECTIONS TO EXISTING A.B.S. TRUSS PIPE SHALL BE MADE WITH A SOLVENT WELDED SADDLE. A FACTORY MANUFACTURED WYE SHALL BE USED IN THE FIRST UPSTREAM LEG FOR ALL SEWER CONNECTIONS.
3. 45° STRAP ON SADDLE SHALL BE USED ON SEWERS OTHER THAN PVC PIPE, WHEN LATERAL INTERSECTS SEWER MAIN AT AN ACUTE ANGLE.
4. THE SEWER CONNECTION SHALL BE LAID FROM THE MAIN TO 1.5 m BEYOND THE PROPERTY LINE IN NEW SUBDIVISIONS ONLY.
5. THE END OF ALL SEWER PIPE SHALL BE MACHINED. ALL CUTTING AND MACHINE SHALL BE DONE BY CONTRACTOR.
6. A COUPLING SHALL BE INSTALLED AT DEAD END AND SHALL BE PLUGGED USING A WATER TIGHT PLUG.
7. DEFLECTIONS OF PIPE AT JOINTS IS NOT TO EXCEED 75 mm
   I.E.: 150 mm MAXIMUM DEFLECTION FOR A 3 m LENGTH OF ASBESTOS CEMENT PIPE
   75 mm MAXIMUM DEFLECTION FOR 1.8 m LENGTH OF VETRIFIED CLAY PIPE
8. PIPE COUPLING SHALL BE 'RING–TITE' OR EQUIVALENT. PVC SHALL BE BELL AND SPIGOT JOINT.
9. REFER TO STD. S–200.010 FOR BEDDING REQUIREMENTS.
10. WHEN MORTAR–ON SADDLES ARE USED, A MACHINE CUT OPENING SHALL BE MADE IN THE SANITARY SEWER WITH A CORING MACHINE.
11. 2% MIN. GRADE TO 10% MAX. GRADE FOR 100 mm DIA. PIPE.
12. 1% MIN. GRADE TO 10% MAX. GRADE FOR 150 mm DIA. PIPE.



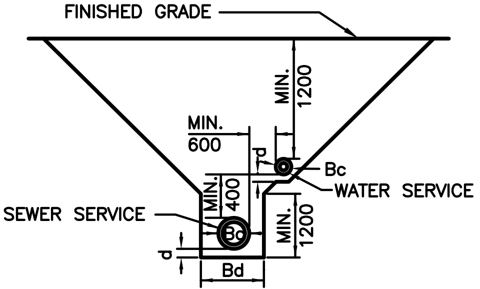
MORTAR–ON SADDLES FOR CONCRETE MAINS OVER 450 mm DIAMETER



TOP VIEW

SECTION 'A–A'

CAST–IRON SADDLE BRANCH FOR CONNECTION TO EXISTING MAINS OTHER THAN PVC



d = MIN. 75 mm, DEPTH OF BEDDING BELOW PIPE.
Bc = OUTSIDE DIAMETER
Bd = MINIMUM WIDTH OF TRENCH
= Bc + 600 mm WITH MIN. OF 900 mm OR Bc + WIDTH OF SHORING + 600 mm

DETAIL 'A'
COMMON TRENCH DETAIL

ALL DIMENSIONS IN MILLIMETRES EXCEPT WHERE NOTED.

DURHAM REGION
WORKS DEPARTMENT

SANITARY SEWER HOUSE CONNECTIONS AND SADDLES (100 mm & 150 mm PIPE)

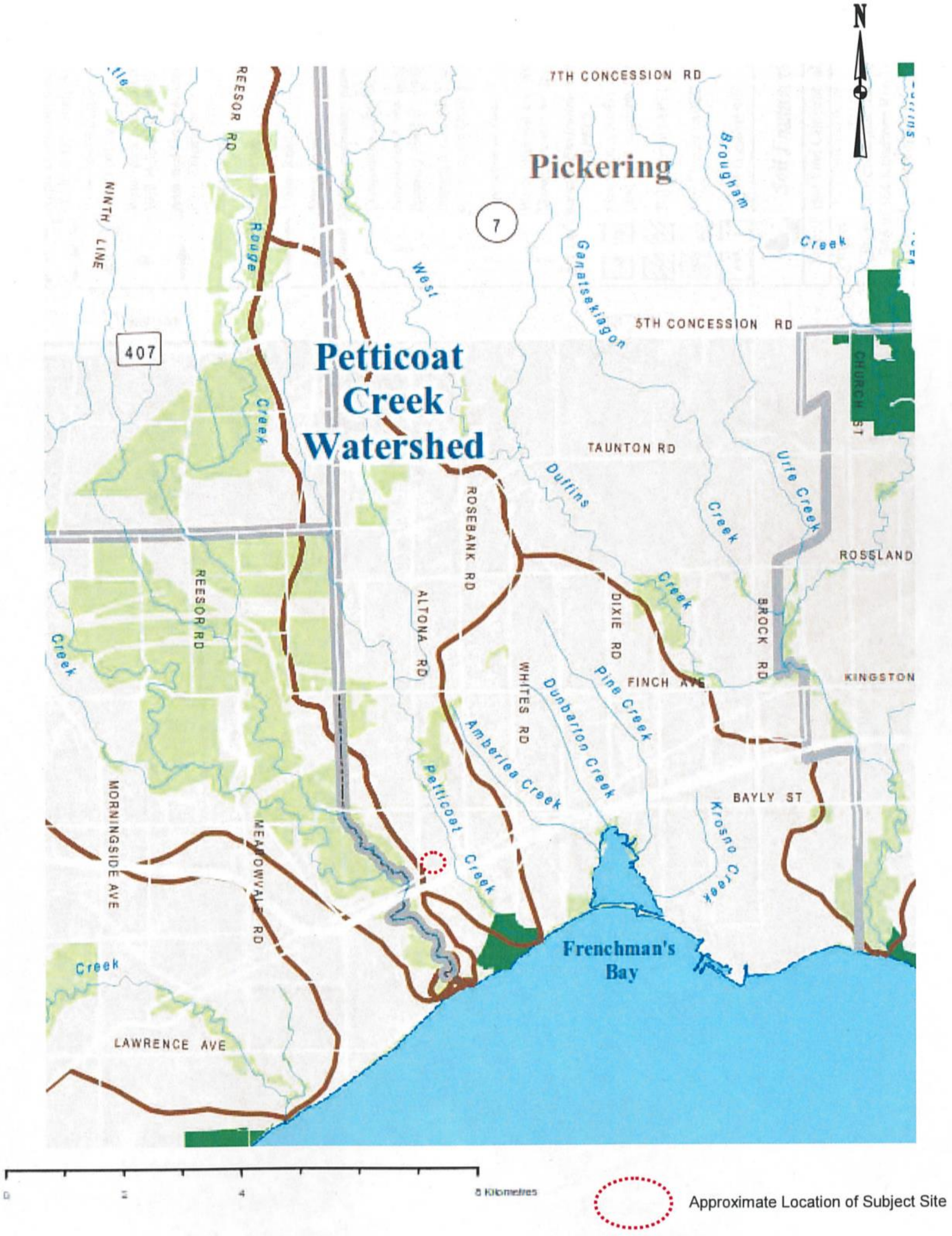
DWG. DATE: 1981 04
REVISION NO.: 12
REV. DATE: 2013 04
SCALE: N.T.S.

S-100.010

APPENDIX “D”

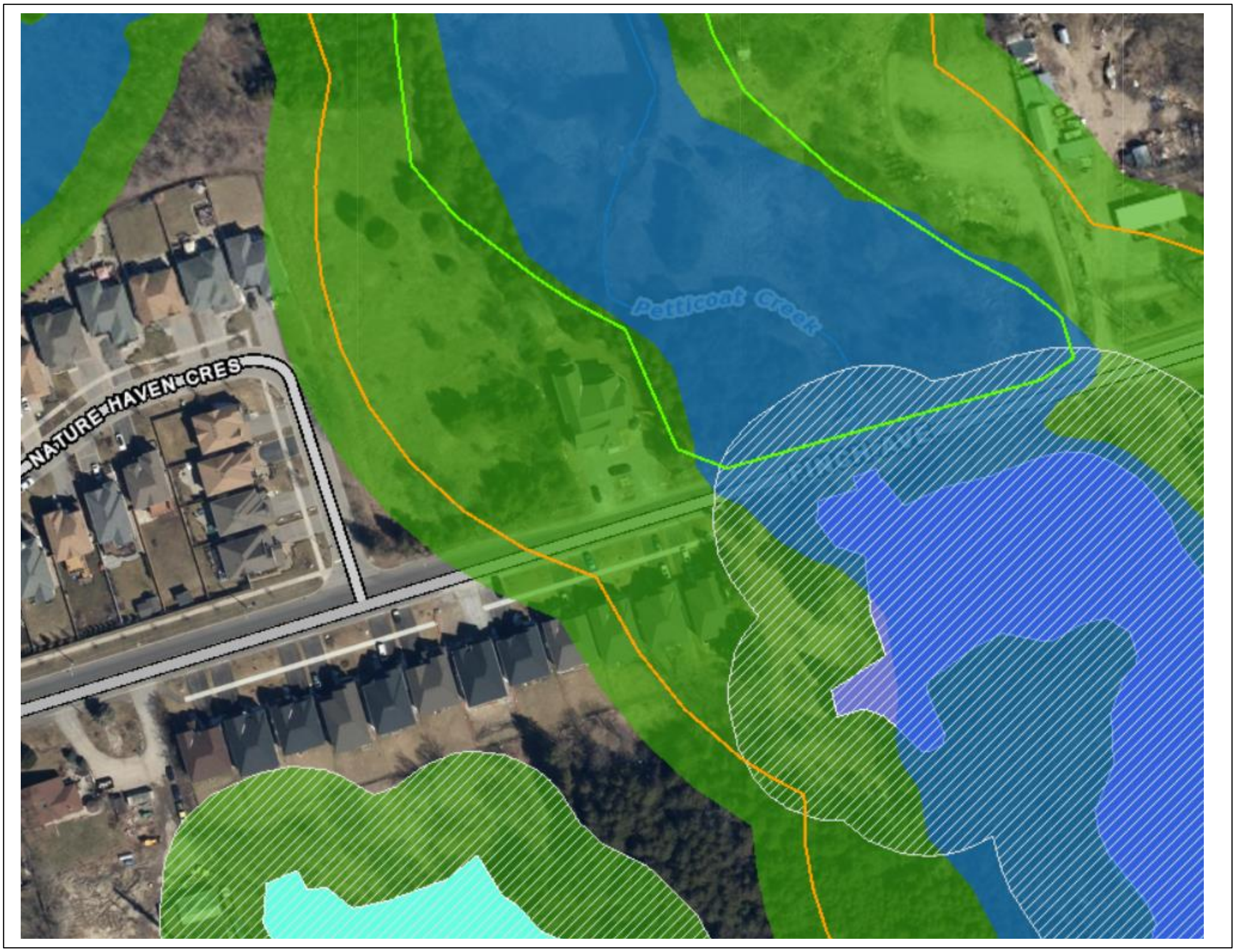
Watershed Map, Regulation Map & IDF Data

WATERSHED MAP



Source: TRCA

TRCA REGULATION MAPPING



City of Pickering IDF Curve Parameters

Parameter	**Return Period**					
	2 Year	**5 Year**	**10 Year**	**25 Year**	**50 Year**	**100 Year**
A	715.076	1082.901	1313.979	1581.718	1828.009	2096.425
B	5.262	6.007	6.026	6.007	6.193	6.485
C	0.815	0.837	0.845	0.848	0.856	0.863

Notes:
Rainfall Intensity, I (mm/hr) = $A/(t+B)^{C}$, where t is time duration in minutes
IDF Data Source: Toronto City (1940-2007)

City of Pickering Rainfall Intensity

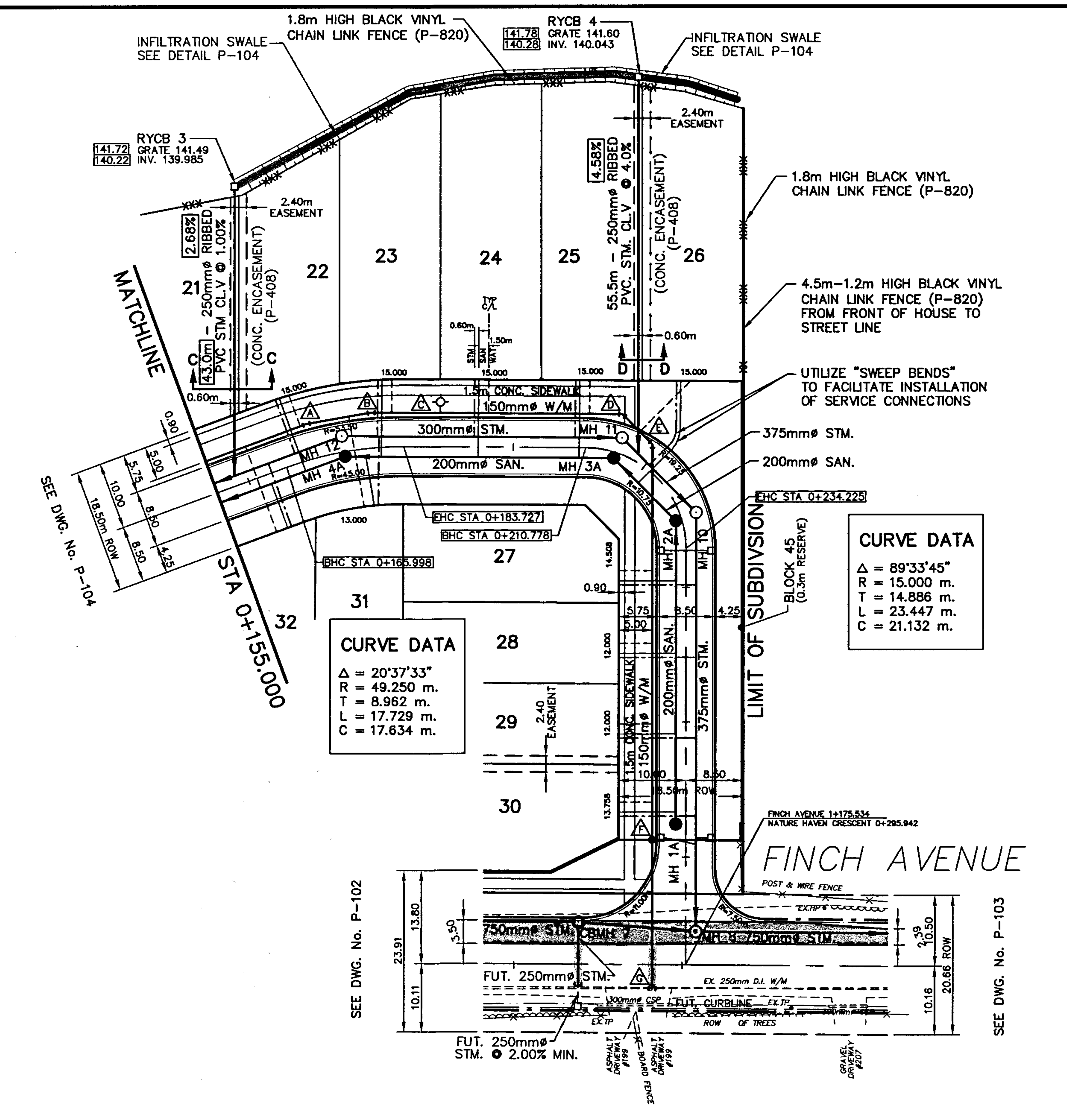
Rainfall Intensity (mm/hr)

Return Period	**Duration (min)**								
	5	***10***	***15***	***30***	***60***	***120***	***360***	***720***	***1440***
2 Year	109.2	76.1	61.7	39.1	23.8	14.0	5.7	3.4	1.9
5 Year	151.9	101.6	85.0	54.6	32.6	18.7	7.6	4.4	2.5
10 Year	180.1	118.5	100.5	64.9	38.5	21.8	8.9	5.1	2.8
25 Year	215.8	139.8	120.1	77.9	45.9	25.7	10.4	6.0	3.3
50 Year	242.3	155.7	134.6	87.5	51.4	28.7	11.6	6.6	3.6
100 Year	268.5	171.4	148.9	97.0	56.8	31.6	12.8	7.2	3.9

City of Pickering Rainfall Depth

Rainfall Depth (mm)

Return Period	**Duration (min)**								
	5	***10***	***15***	***30***	***60***	***120***	***360***	***720***	***1440***
2 Year	9.1	12.7	15.4	19.5	23.8	27.9	34.5	41.1	45.9
5 Year	12.7	16.9	21.3	27.3	32.6	37.4	45.8	53.2	59.0
10 Year	15.0	19.7	25.1	32.4	38.5	43.6	53.2	61.3	67.6
25 Year	18.0	23.3	30.0	38.9	45.9	51.5	62.7	71.4	78.5
50 Year	20.2	25.9	33.6	43.7	51.4	57.3	69.7	79.0	86.7
100 Year	22.4	28.6	37.2	48.5	56.8	63.1	76.6	86.5	94.7

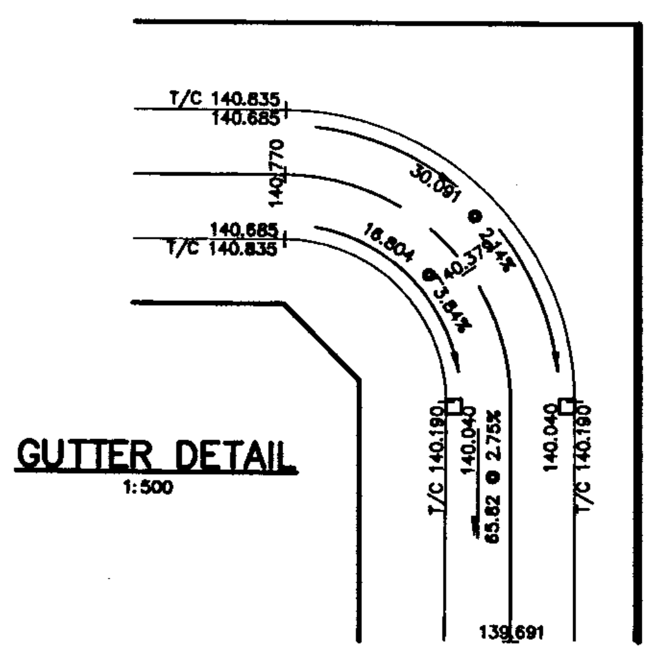


NATURE HAVEN CRESCENT

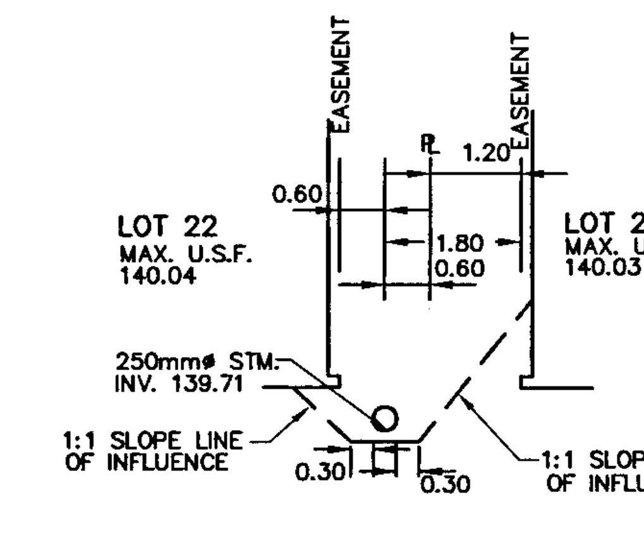
NOTE

1) FOR GENERAL NOTES AND LEGEND SEE DWG. G-101.

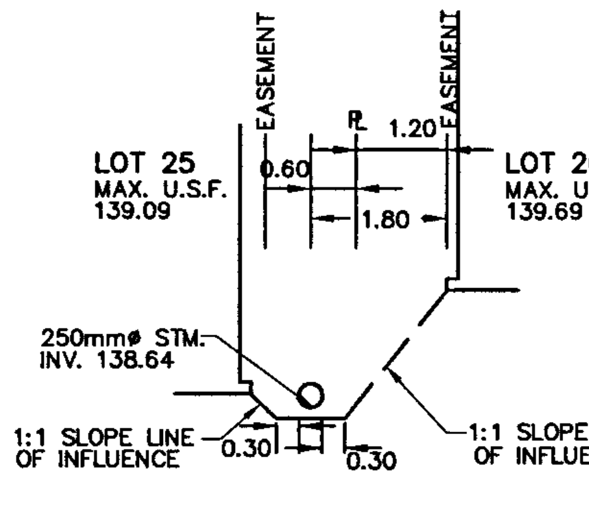
2) MEASUREMENTS IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.



GUTTER DETAIL
1:500



SECTION C-C
N.T.S.



SECTION D-D
N.T.S.

ROAD DESIGN

NATURE HAVEN CRES.

HL3 35mm
HL8 50mm
GRAN.'A' 150mm
GRAN.'B' 300mm

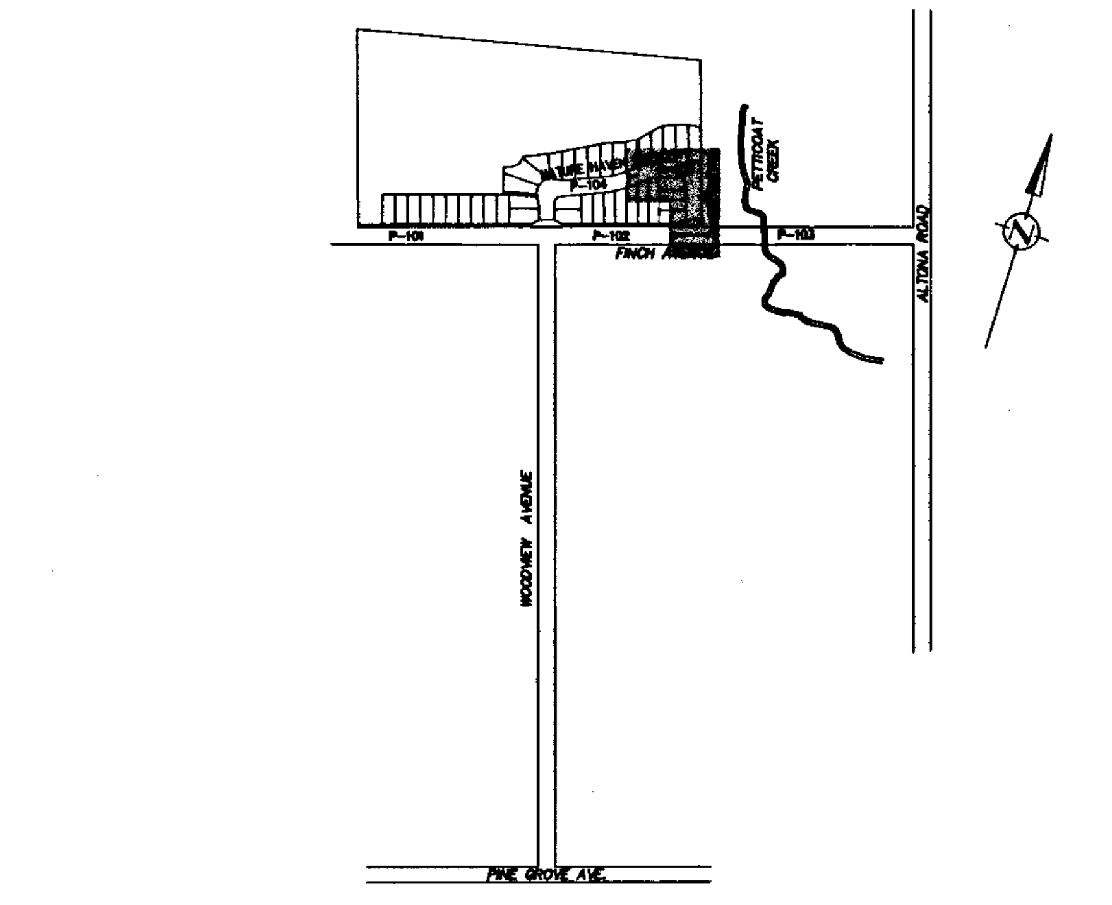
TWO STAGE CURB & GUTTER P-602

WATERMAIN DATA

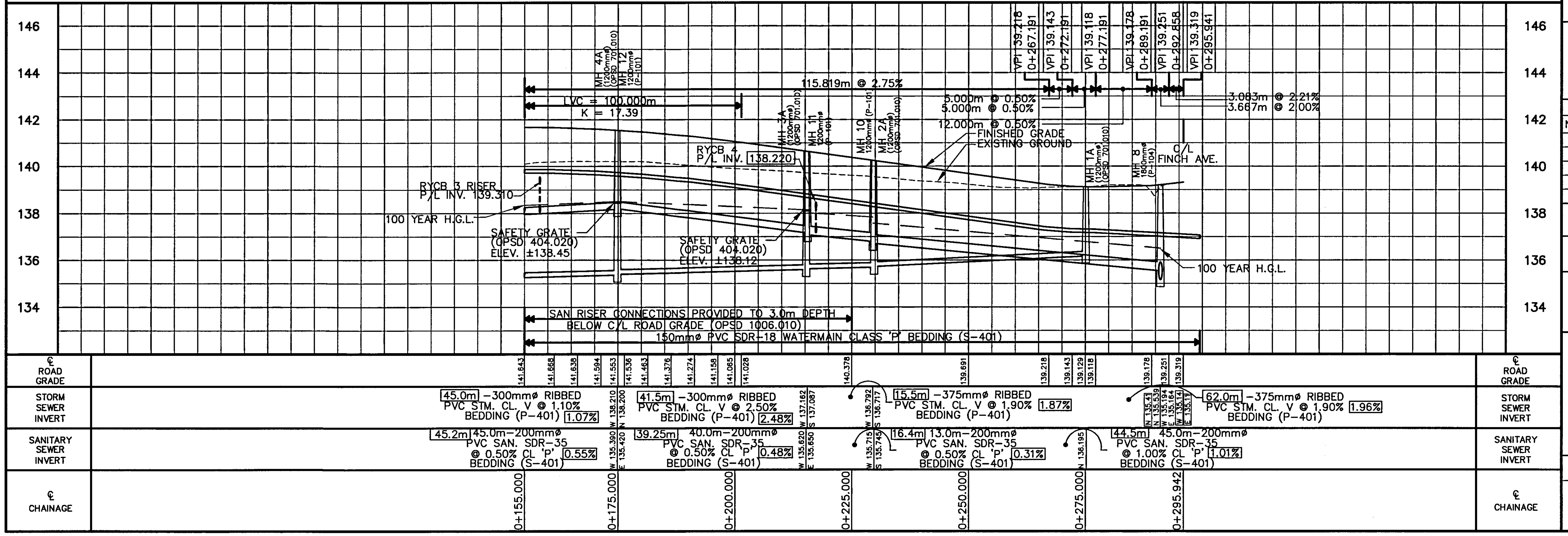
MK	DESCRIPTION	STATION	ELEV.
A	11.25° BEND	0+170.430	139.800
B	11.25° BEND	0+179.295	139.686
C	HYDRANT SET	0+189.124	139.509
D	45° BEND	0+214.744	138.843
E	45° BEND	0+219.268	138.668
F	150° VALVE & BOX	0+275.418	137.326
G	CUT IN 150mm x 250mmø TEE	0+299.442	137.071

BENCHMARK
CITY OF PICKERING Bm. No. 1-078 ELEV. 138.244

CONTRACTOR TO BE RESPONSIBLE FOR LOCATION OF ALL EXIST. U/G & OVERHEAD UTILITIES. VARIOUS UTILITIES CONCERNED TO BE GIVEN REQUIRED ADVANCE NOTICE PRIOR TO ANY DIGGING, FOR STAKE OUT. THE CONSULTANT ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATION OF EXISTING UTILITIES AS INDICATED ON THIS DRAWING.



KEY PLAN
N.T.S.



APPROVED

Date: "APRIL 26 2006"
"B STARR"
Approval to works required by City Of Pickering and as defined in the Subdivision Agreement.

APPROVED

"PAUL GILLESPIE" P. Eng.
Department Of Works
Region Of Durham
Date: JUNE 21, 06"

REVISIONS

No.	DESCRIPTION	DATE	BY	APPROVED
1.	POST CONSTRUCTION RECORD DRAWING	DEC 2012	MAF	

THE CORPORATION OF THE CITY OF PICKERING

ROUGE PARK SUBDIVISION
(S-P-2002-02)

NATURE HAVEN CRESCENT
FROM STA 0+155.000 TO STA 0+295.942

"M A FAVIT"
M. A. FAVIT
"10.11.05"

SERNAS ASSOCIATES

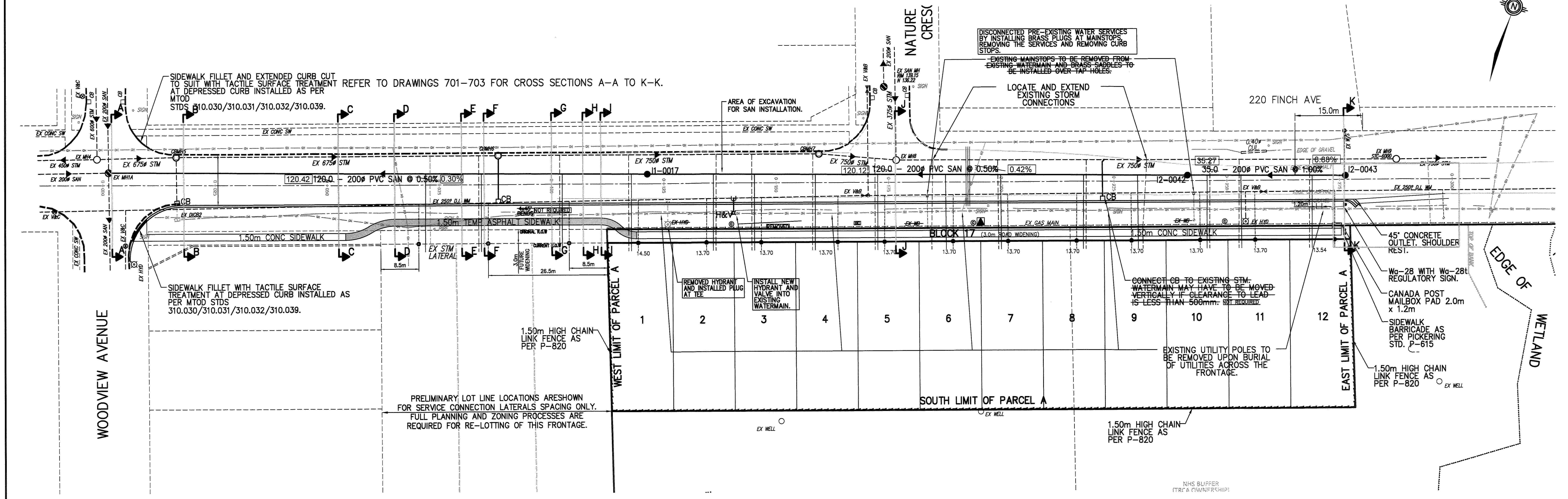
110 Scotia Court
Unit 41
Whitby, ON
L1N 8Y7

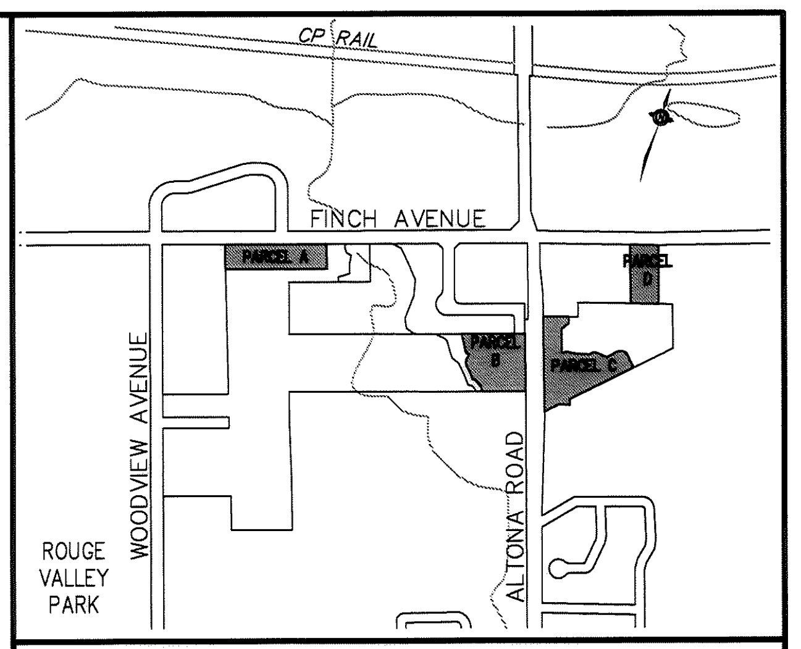
T 905.686.6402
F 905.432.7877
sernas.com

DATE : SEPTEMBER, 2005
DRAWN BY : T.C.
PROJECT No. 01269
SCALE : VERT 1 : 100 HORIZ. 1 : 500
DESIGNED BY : R.E.T.
CHECKED BY : "M.A.F"
DRAWING No. P-105

R/P Date - DEC. 18, 2012 File: 01269-P105.DWG

108-C-1





KEYMAP N.T.S.

LEGEND:

○ STORM MANHOLE
● SANITARY MANHOLE
□ CATCHBASIN
◫ DOUBLE CATCHBASIN
HYDRANT AND VALVE
→ DIRECTION OF SEWER FLOW
WATER STORM SANITARY SERVICE CONNECTIONS
▨ PROPOSED DRIVEWAY
▨ PROPOSED AREA OF RESTORATION

SERVICE CONNECTIONS:

1. SANITARY RISERS SHALL BE USED IN ACCORDANCE WITH REGION OF DURHAM STANDARDS.
2. SANITARY CONNECTIONS SHALL BE MADE BY CORING WITH THE USE OF A STAINLESS STEEL SADDLE.
3. STORM CONNECTIONS SHALL BE MADE BY CORING, INSERTING A PVC BOOT AND GROUTING THE CONNECTION.
4. EXCAVATION FOR THE STORM AND SANITARY SERVICE CONNECTIONS CONSTRUCTION FOR LOTS 4 & 12 SHALL BE MIN 3.0m HORIZONTAL AND THE WATER SERVICE CONNECTIONS 2.0m HORIZONTAL SUCH THAT THE TOP OF EXCAVATION IS MIN 1.0m FROM THE BASE OF THE EXISTING BELL POLES.

NOTE:

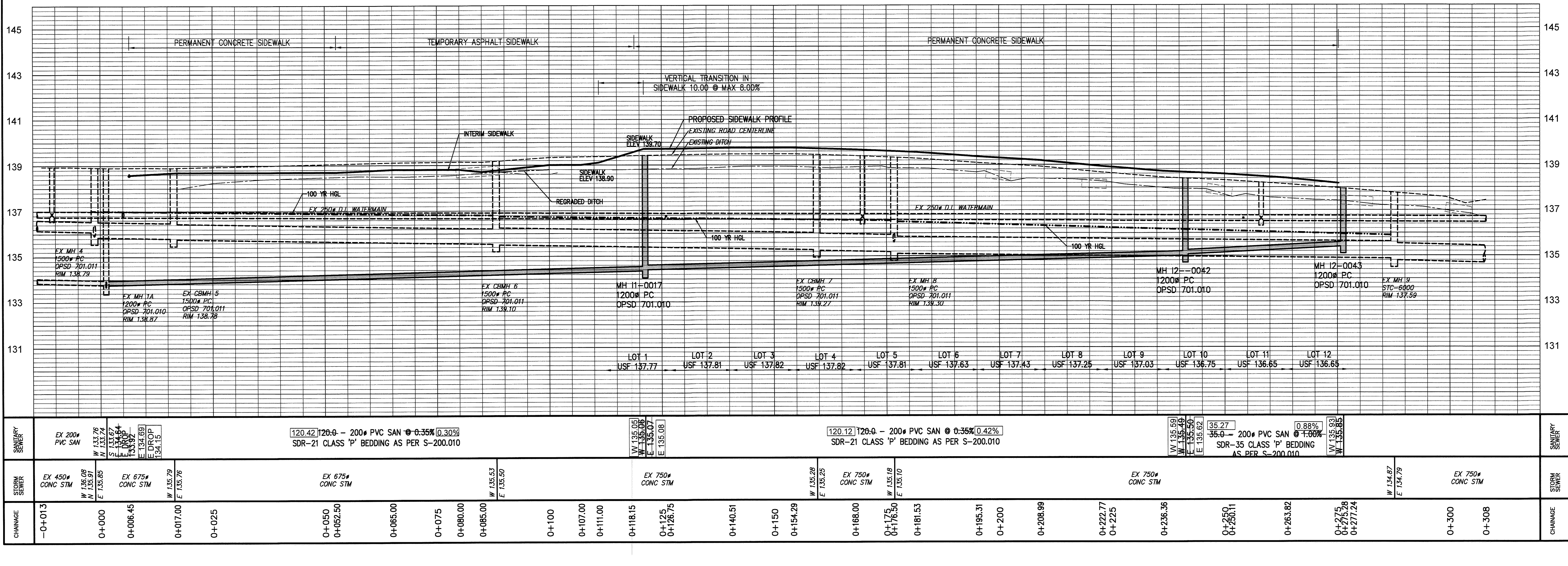
ALL FINCH AVENUE ROAD RESTORATION TO BE CARRIED OUT IN COMPLIANCE WITH THE GENERAL NOTES AND IN GENERAL ACCORDANCE WITH CITY OF PICKERING STD P–720.
THE ENTIRE PAVEMENT OF FINCH AVENUE, FROM THE EXISTING CURB ON THE NORTH SIDE TO THE NEW CURB ON THE SOUTH SIDE, TO BE COMPLETELY RESTORED AND RESURFACED. LAP JOINTS AT WOODVIEW, NATURE HAVEN, AND THE EAST LIMIT TAPER AS PER THIS DWG.

ORIGINALLY SIGNED BY:
REVIEWED BY CITY OF PICKERING R. Holborn
DATE AUGUST 4, 2015
APPROVAL TO WORKS REQUIRED BY THE CITY OF PICKERING AND AS DEFINED IN THE SUBDIVISION AGREEMENT.

APPROVED
APPROVAL OF THE REGIONAL WORKS DEPT. FOR THE PURPOSES DESCRIBED IN THE APPLICABLE REGIONAL SUBDIVISION OR SERVICING AGREEMENT. THE REGION IS RELYING ON THE TECHNICAL SKILL AND ABILITY OF THE P. ENG. SEALING AND SIGNING THE DRAWINGS.
ORIGINALLY SIGNED BY:
BY: M. Hubble
DATE: AUGUST 11, 2015

REFER TO INDEX SHEET FOR GENERAL NOTES AND BENCHMARK

NOTE:
ALL DIMENSIONS AND ELEVATIONS IN METRES UNLESS NOTED OTHERWISE. ALL PIPE SIZES IN MILLIMETRES.



PLOT DATE: October 16,2020 12:35 PM CAD FILE: P:\12\279\Drawing Files\As-Builts\Digital As Builts City\279 PP401 Finch Avenue-AB.dwg

No.	REVISIONS TO DRAWING	BY	DATE	APPR.
2.	AS CONSTRUCTED DRAWINGS	AJR	18/07/18	
1.	SANITARY SEWER PROFILE REVISED	RTS	31/08/15	
	ISSUED FOR CONSTRUCTION	KT	17/08/15	

ALL PREVIOUS ISSUES OF THIS DRAWING ARE SUPERSEDED

CLIENT
E. OVIDE HOLDINGS
(ALTONA) INC.

MUNICIPALITY
CITY OF PICKERING
REGION OF DURHAM

PROJECT TITLE
ALTONA ROAD/FINCH AVENUE LANDS
PARCEL A

SHEET TITLE
FINCH AVENUE
STA -0+013 TO 0+308

SABOURIN KIMBLE
& ASSOCIATES LTD.
CONSULTING ENGINEERS
110 Old Kingston Road
Ajax, Ontario, L1T 2Z9
(905) 426–9451

R. T. SABOURIN
18/07/18

DESIGNED VAL
DRAWN CLG
CHECKED RTS
SCALE HORZ. 1:500
VERT. 1:100
DATE APRIL 2014
PROJECT NUMBER 12:279
DWG. NUMBER 401

MEMORANDUM

TO:	Nick Lorrain	DATE:	April 29, 2022
FROM:	Qiao Ying	CFN:	
RE:	City of Pickering – Finch Ave and Altona Rd spill 2D Modelling		
CC:			

1.0 Introduction

The following presents the Pickering Finch Ave/Altona Rd 2D modelling analysis completed in support of NDMP Intake 6 TRCA jurisdiction-wide spill analysis. The subject study area is located between Finch Ave and Sheppard Rd in Petticoat Creek within City of Pickering as shown in **Figure 1**.

Figure 1 Subject study area in City of Pickering

1.1 Background

A floodplain mapping study was completed for this area as part of Petticoat Creek FPM in September 2006 by Planning & Engineering Initiatives Ltd., and four spills were identified within study area (see **Figure 2**). Based on the latest topographic data, spills may go multiple directions, given this 1D HEC-RAS model is not applicable and a 2D modelling approach is more suitable to capture the spill and characterize flood conditions within the study area.

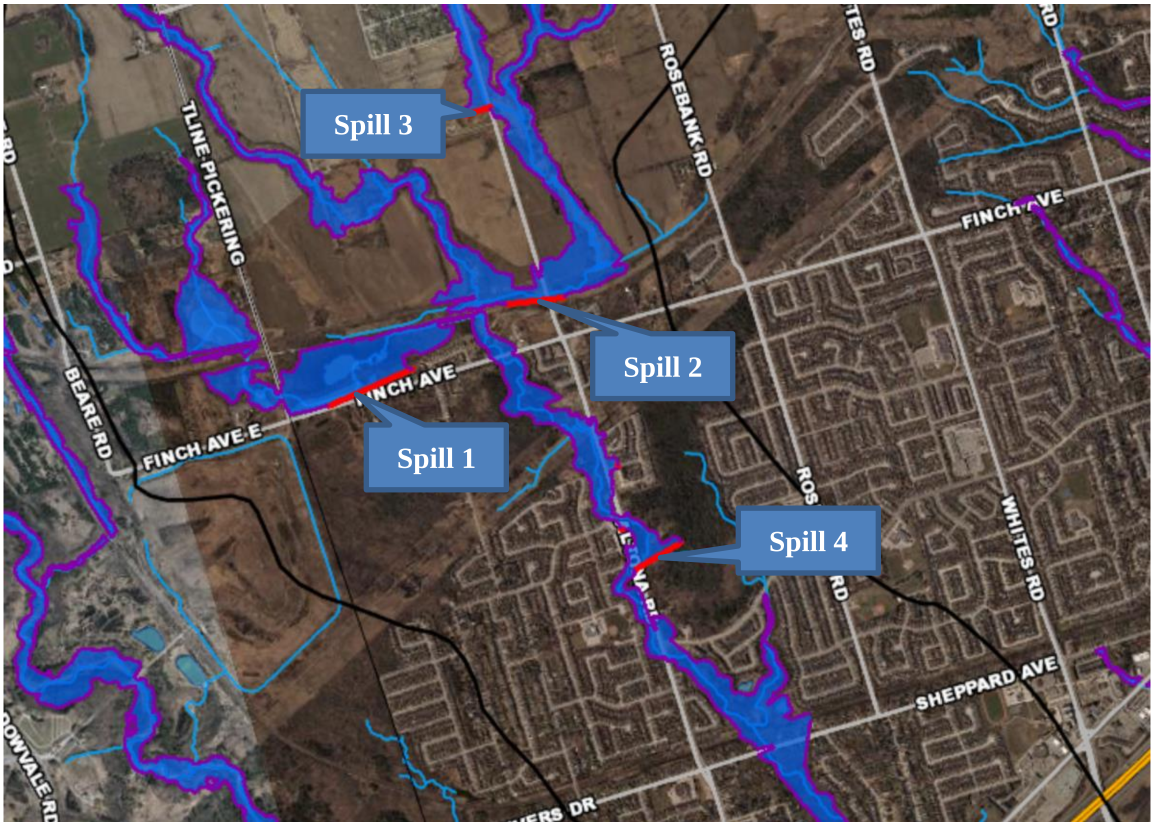


Figure 2 Location of identified spills in the Hwy 400/Hwy 7 study area

2.0 Additional Background Information

Since last update, TRCA has obtained two sets of jurisdiction-wide Lidar data, i.e., 2015 Lidar (leaf-off) and 2019 Lidar (leaf-on) data. In addition to these two data sets several new information was collected for this study including:

- TRCA Survey Data
  TRCA conducted survey in the study area as part of Amos Pond Turtle Study in August 2014 (see **Figure 3**), and this survey data includes ground elevation survey within the wetlands and at few locations on Finch Ave./Woodview Ave. along with crossing information (i.e. dimension, invert and obvert elevations) on West Branch of Petticoat Creek.
  This survey data was compared to both 2015 Lidar and 2019 Lidar (see **Figure 4**), and it was found that the 2015 Lidar data matches better with TRCA survey data. Also considering 2015 Lidar data was obtain during leaf-off season, and it would capture ground elevation better in the vegetation covered area than 2019 Lidar data. Given this, the decision on topographic data for this study was to use 2015 Lidar as base and then splice in any grading changes since 2015 within study area. **Figure 5** shows the

areas where grading has changed since 2015 and topo was superseded with 2019 Lidar.

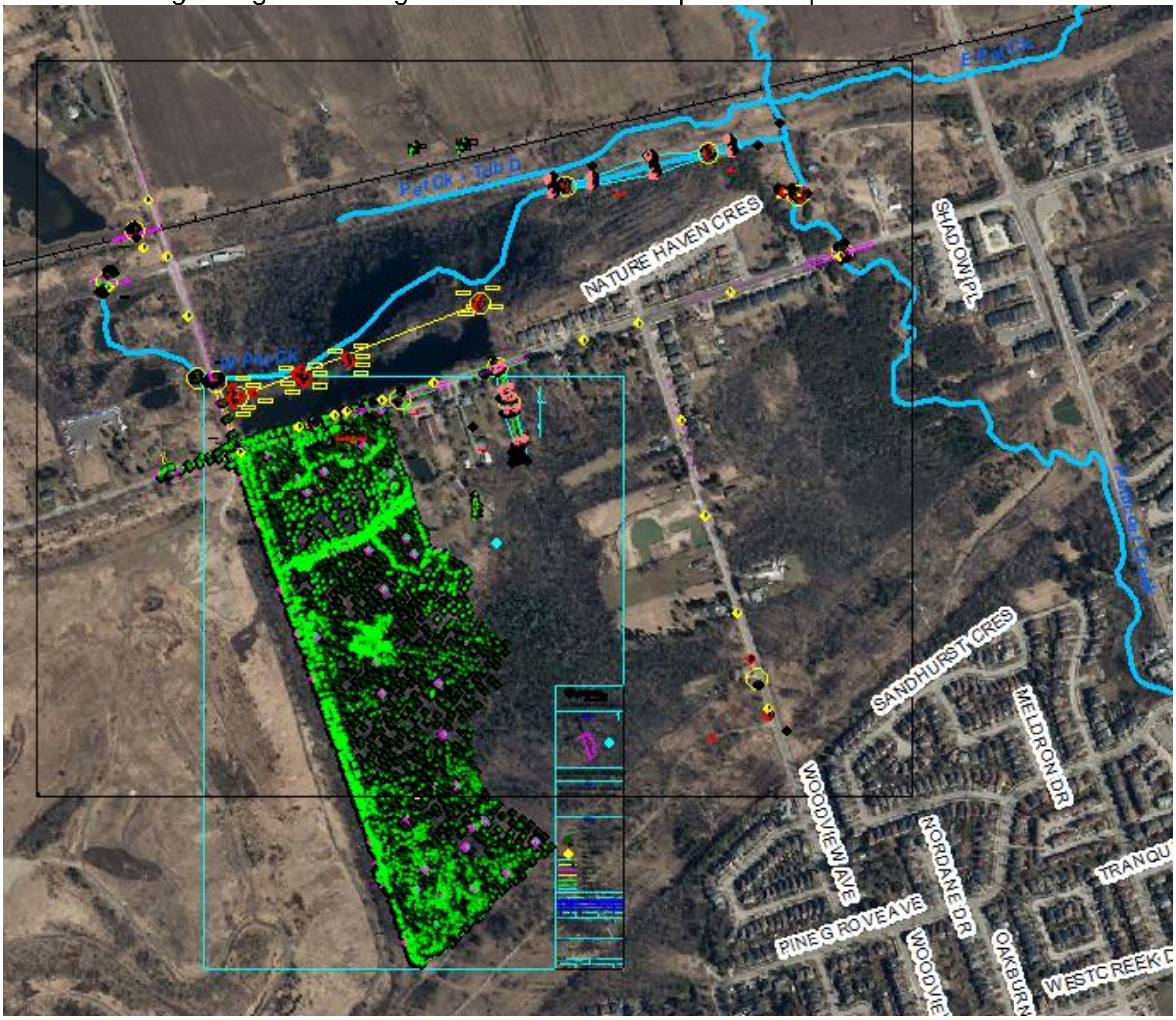
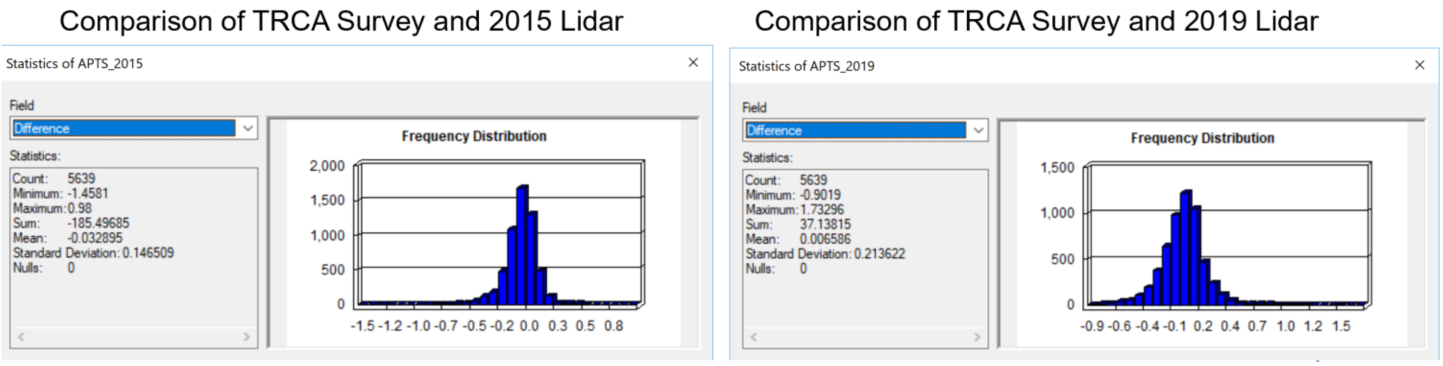


Figure 3 TRCA Survey - Amos Pond Turtle Study in August 2014


Comparison of TRCA Survey and 2015 Lidar

Statistics of APTS_2015

Field: Difference

Statistics:

Count: 5639
Minimum: -1.4581
Maximum: 0.98
Sum: -185.49685
Mean: -0.032895
Standard Deviation: 0.146509
Nulls: 0

Comparison of TRCA Survey and 2019 Lidar

Statistics of APTS_2019

Field: Difference

Statistics:

Count: 5639
Minimum: -0.9019
Maximum: 1.73296
Sum: 37.13815
Mean: 0.006586
Standard Deviation: 0.213622
Nulls: 0

Figure 4 Comparison of TRCA Survey with both 2015 Lidar and 2019 Lidar at Amos Pond in City of Pickering

Figure 5 2019 Lidar Spliced Areas

- New crossing data on Altona Rd cross East Branch of Petticoat Creek
  A new relief box-culvert was installed on Altona Road in addition to the existing pipe arch CSP pipe (see **Figure 6**) with a dimension of 2.4m by 1.5m.

Figure 6- Location of a new relief box-culvert on Altona Road

- Grading change - Forest District by Icon Homes
  On north-west corner of Finch Ave./Altona Rd, grading has changed due to a townhouse development. A CAD drawing with ground elevations were obtained (see **Figure 7**) which was used to derived a surface and then supersede 2015 Lidar within the site.

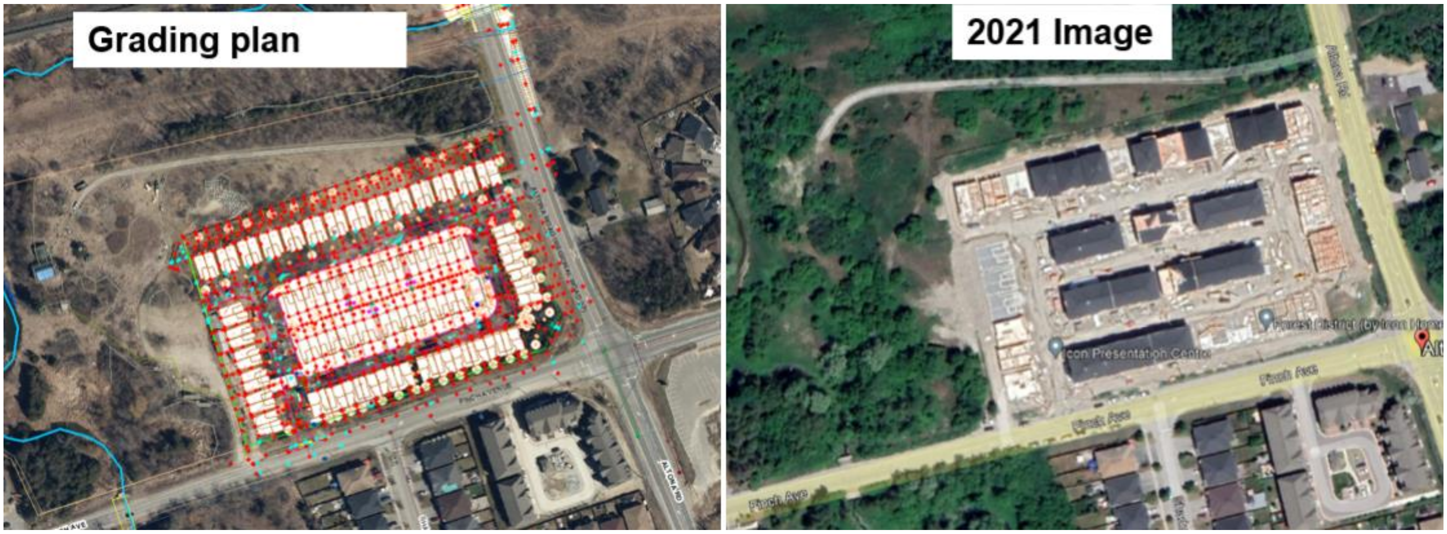


Figure 7 – Location of Forest District and CAD drawing with ground elevations

- Grading change – 1999 & 1985 Altona Rd
  On south-east corner of Finch Ave./Altona Rd, a new development application has been approved but not yet constructed. A CAD drawing with ground elevations were obtained (see **Figure 8**) which was used to derive a surface and then supersede 2015 Lidar within the site.

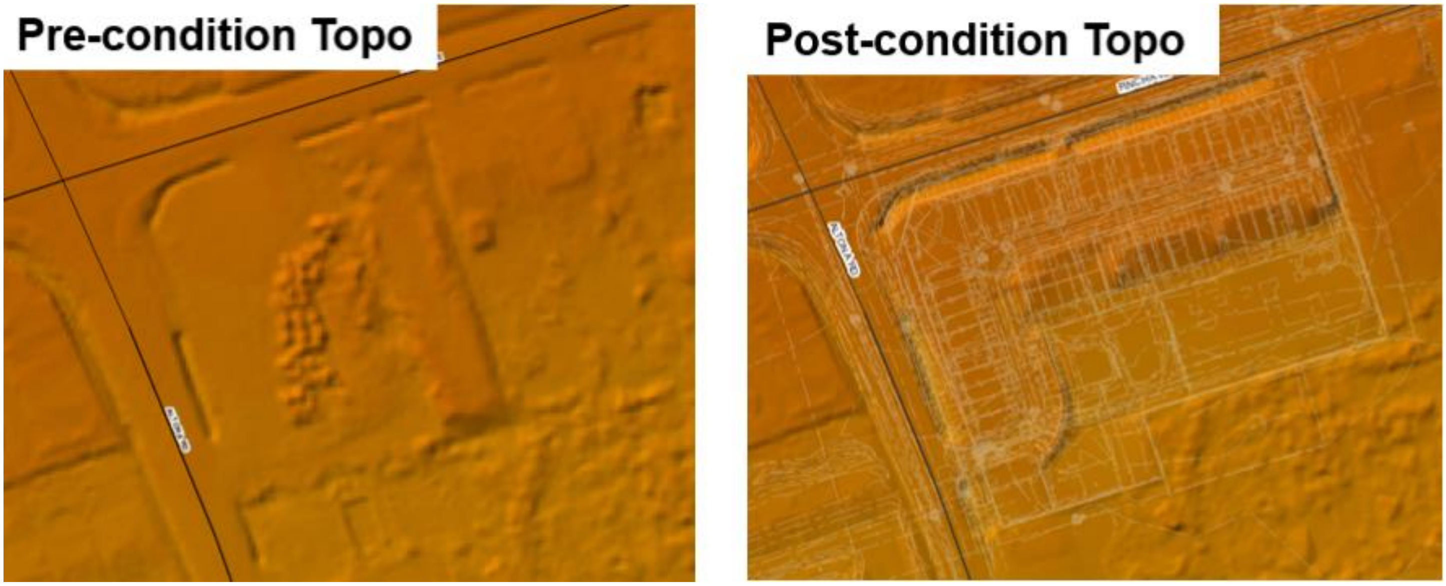


Figure 8 – Location of 1999&1985 Altona Rd and CAD drawing with ground elevations

3.0 Model Setup

The study area was modelled using the MIKE Flood interface that features the dynamic coupling of the MIKE HYDRO and MIKE 21 hydrodynamic modules. River reaches and all crossings were handled using the 1D MIKE HYDRO modelling routine, with overland surfaces being modelled using the 2D MIKE 21 modelling routine. MIKE Flood integrates these two models into a single dynamically coupled model.

Figure 9 shows the Finch/Altona 2D model domain. The downstream boundary was set as a Q-H relation that was taken from cross-section 2869.24 located on Reach 3 of Petticoat Creek from the HEC-RAS model developed by TRCA as part of the 2021 Petticoat Creek Floodplain Mapping Update.

Figure 9 Finch Ave./Altona Rd 2D Model Domain

3.1 MIKE HYDRO 1D River Model

Six river reaches are modeled using the MIKE HYDRO 1D hydrodynamic (HD) module, and **Table 1** summarizes the list of modeled reaches and respective length.

Table 1 List of Branches Included in 1D Model

No.	Reach Name	Length (m)
1	East Petticoat – Trib A	410.31
2	East Petticoat – Trib C	1592.15
3	East Petticoat – Trib D	716.74
4	East Petticoat	1995.36
5	West Petticoat	1306.73
6	Petticoat Creek	5145.57

Cross-sections are cut in 10-20m spacing from 1-m 2015 LiDAR spliced with 2019 Lidar for grading change areas and only cover the main channel, i.e., upto top of bank as overbank areas are modeled in 2D domain. High density of spacing of cross-sections allows better capturing details of riverbanks where lateral exchange flows with 2D domain occur. In total thirteen (13) crossings were included in 1D model, and crossing was coded as a composite structure. i.e., crossing opening was coded as Culvert structure and road deck was coded as Weir structure. **Figure 10** uses Railway crossing on Petticoat Creek to show an example how a crossing is coded in 1D model, and **Figure 11** shows cross-sections and location of structures included in the 1D MIKE HYDRO model.

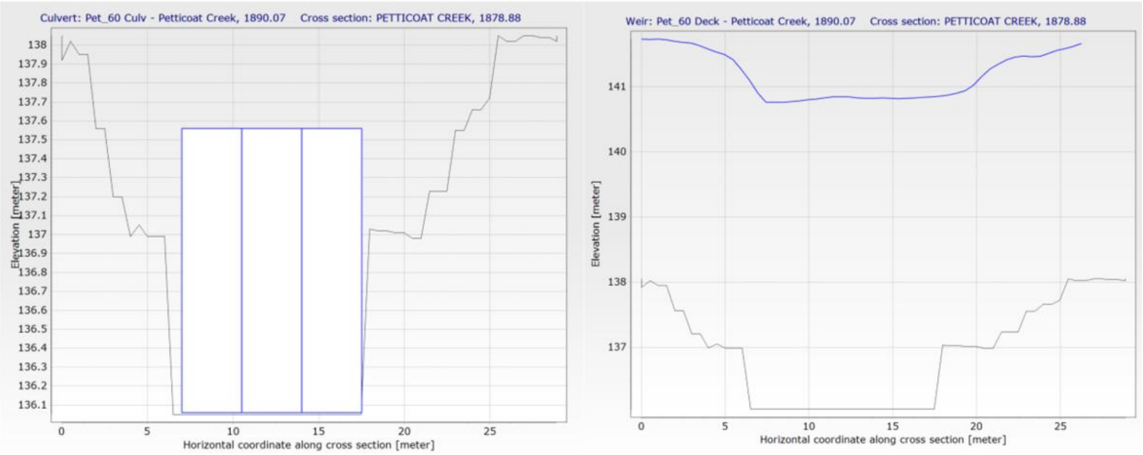


Figure 10 – Example of a composite structure of a Culvert Structure and a Weir Structure

Figure 11 Location of 1D cross-sections and structures

Boundary Condition

All inflows are handled in 1D model, and total flows are entered at the beginning of 6 reaches, and incremental flows are entered as a point source along the reaches and the steady peak flows were ramped for 1hr and then kept constant for 13hrs (see **Figure 12**). Downstream boundary is a Q-H boundary that was extracted from 2021 Petticoat Creek HEC-RAS model as mentioned above. **Table 2** summarizes boundaries and their types, and **Figure 13** shows the location of flow nodes.

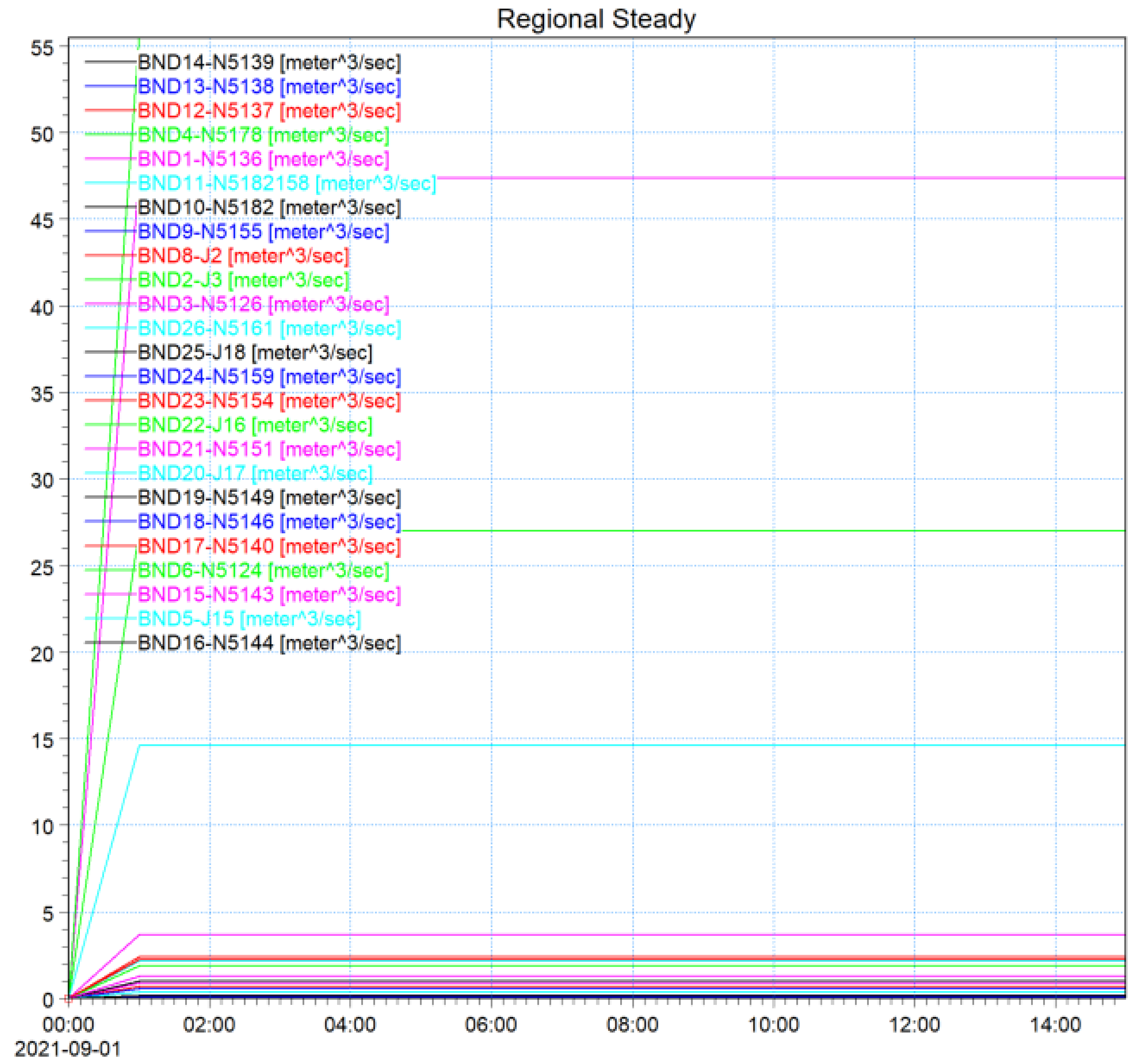


Figure 12 Regional peak flows applied in the 1D MIKE HYDRO model

Table 2 Boundary Conditions in 1D Model

Boundary ID	Flow Nodes	Boundary Type	Branch Name	Chainage (m)
Boundary 1	N5136	Total Inflow	E Pet - Trib A	12.25
Boundary 2	J3	Total Inflow	Pet Ck - Trib C	0
Boundary 3	N5126	Total Inflow	Pet Ck - Trib D	0.21
Boundary 4	N5178	Total Inflow	E Pet Ck	14.12
Boundary 5	J15	Total Inflow	W Pet Ck	398.11
Boundary 6	N5124	Total Inflow	Petticoat Creek	871.94
Boundary 7		Q-H	Petticoat Creek	6017.51
Boundary 8	J2	Point source	Pet Ck - Trib C	220
Boundary 9	N5155	Point source	Pet Ck - Trib C	660
Boundary 10	N5182	Point source	Pet Ck - Trib C	891.61
Boundary 12	N5137	Point source	E Pet Ck	457.53
Boundary 13	N5138	Point source	E Pet Ck	1475.2
Boundary 14	N5139	Point source	E Pet Ck	1695.4
Boundary 15	N5143	Point source	W Pet Ck	674.85
Boundary 16	N5144	Point source	W Pet Ck	1365.18
Boundary 17	N5140	Point source	Petticoat Creek	1867.9
Boundary 18	N5146	Point source	Petticoat Creek	1922.2
Boundary 19	N5149	Point source	Petticoat Creek	2172.12
Boundary 20	J17	Point source	Petticoat Creek	2869.03
Boundary 21	N5151	Point source	Petticoat Creek	3424.27
Boundary 22	J16	Point source	Petticoat Creek	3740.25
Boundary 23	N5154	Point source	Petticoat Creek	4303.04
Boundary 24	N5159	Point source	Petticoat Creek	4877.65
Boundary 25	J18	Point source	Petticoat Creek	5018.05
Boundary 26	N5161	Point source	Petticoat Creek	5629.03

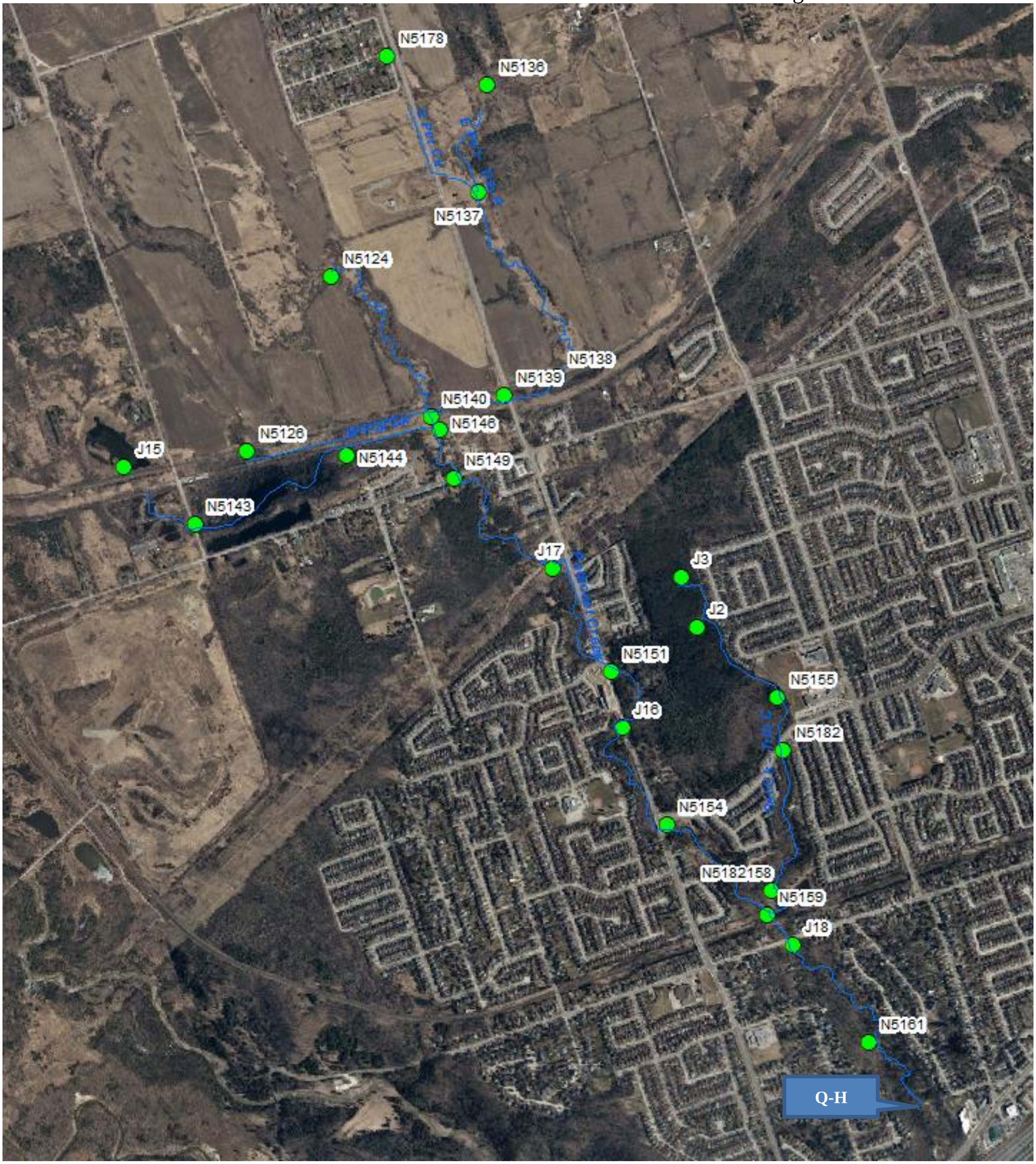


Figure 13 Location of Flow Nodes and Water Level Boundaries

3.2 MIKE 21 2D Overland Model

The overland area was modelled using MIKE 21 Flexible Mesh (FM) HD, which is a fully dynamic modelling system for 2D free-surface flows. The MIKE 21 editors were used to construct and store various basic and hydrodynamic data layers. The following are the main elements of the MIKE 21 model setup:

- Mesh Generation
- Roughness parameters
- Boundary conditions
- Model settings

Mesh Generation

MIKE 21 FM model uses a mesh-based bathymetry for hydrodynamic computations. The details and the desired accuracy of the model results depends on how the mesh has been designed. In addition, the mesh resolution has a significant impact on the accuracy of the results. A high-resolution mesh is required to retain higher variability of the ground elevation surface. High resolution also required to represent in detail topographic features (such as channels, buildings, paved roads, walkways, retaining walls, flood walls, etc.). As such, the mesh was designed as follows:

- A high-resolution mesh size of 10m^2 was used along the roads as floodwater tends to follow the roads.
- A high-resolution mesh size of 16m^2 was used in the potential flood extent.
- A mesh size of 50m^2 was used in the rest of model area.

The building polygons were excluded from the mesh generation to avoid computational mesh triangulation from occurring within these polygons, and River reaches covered by cross-sections were also excluded from the mesh to avoid double-accounting for the conveyance, and finally 1m LiDAR data was interpolated to each mesh node (see **Figure 14** below)

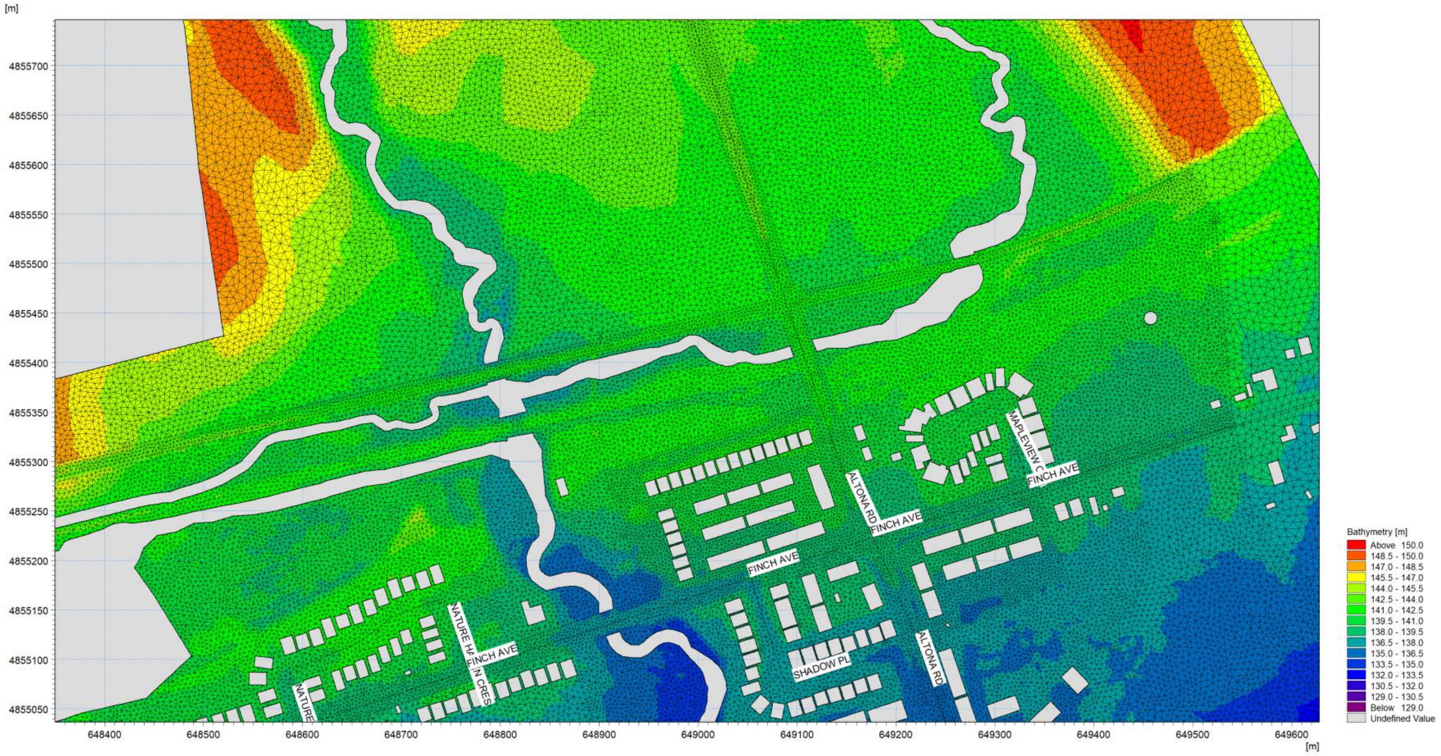


Figure 14 Close view of mesh around Finch Ave./Altona Rd Spill Area

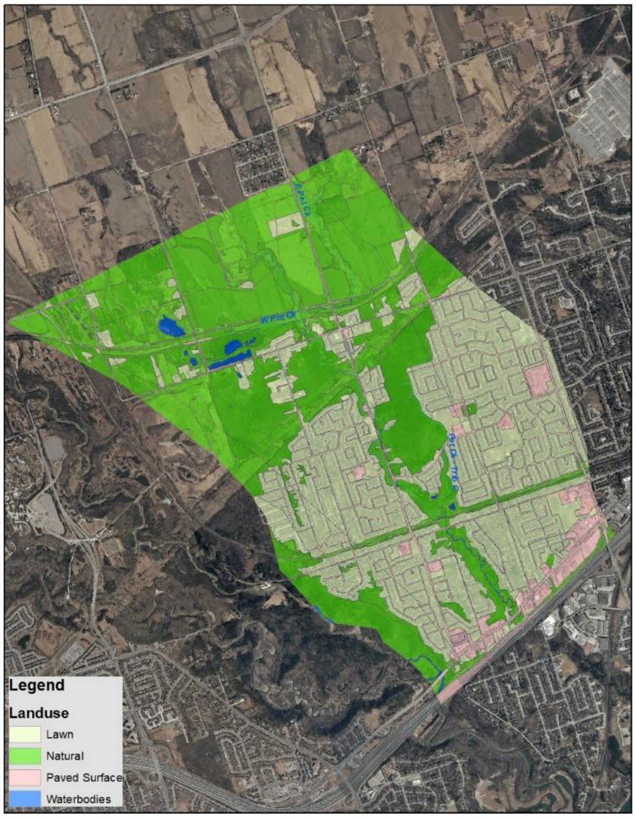


Figure 15 Landuse map in Finch Ave./Altona Rd spill area

Roughness Parameters

MIKE 21 uses roughness parameters for each mesh when completing computations. The land use map (see **Figure 15**) prepared using the TRCA's available land use/land cover information was converted into a MIKE 21 roughness map. In MIKE 21, the roughness was defined in terms of the MIKE system's Manning's resistance number (M), which is the inverse of the Manning's n roughness coefficient value (*i.e.,* 1/n). The Manning's resistance number (M-value) map was prepared based on the TRCA's standard roughness values; the corresponding Resistance numbers used in MIKE 21 are:

- Natural areas: 0.08 (M = 12.50)
- Roads and large parking areas: 0.025 (M = 40)
- Urban large pervious areas: 0.05 (M = 20)
- Streams/Waterbodies: 0.035 (M = 28.57)

Boundary Conditions

Boundary conditions for the MIKE 21 model define how the flow and water levels will be controlled at the peripheral edges of the 2D model domain defined by the bathymetry limits. Since all inflows were handled in 1D model, there is no inflow boundaries defined in 2D model. Also, the outflows on two river reaches were handled in 1D model using water level boundary, so the only two downstream boundaries defined in 2D model are the low points at CPR railway track junction with Whites Rd and at Kingston Rd towards Rouge River which were defined as Free outflow boundaries, this is to allow floodwater leaving system without pile-up along the edge of 2D domain.

Model Settings

The MIKE 21 FM Flow Model setup contains descriptions of several parameters. The key parameters are simulation period, start and end time, time step interval, flooding and drying depths, output saving duration and saving interval details.

A 12-hour simulation period for both regional and design storms was used for the steady peak inflow hydrograph simulation. The simulation period was entered using an arbitrary start and end date and time with a specified total number of time steps and time step interval. In this case, the total number of time steps was 108,000 for 2yr to 100yr with a time step interval of 0.5 seconds.

The drying and flooding depths used were 0.01m and 0.02m, respectively.

The dynamic outputs were saved with time interval of 1200 (i.e., 10min interval).

- The saving output variables were surface elevation, total water depth, U velocity (x-direction), V velocity (y-direction), and current speed.
- The dynamic output file type used was "2D (horizontal)" while the output format was selected as "Area Series" with only real wet areas that ensures the saving of specified information at every computational point.

3.3 1D and 2D Coupled Model

The final step for model setup was the integration of the 1D MIKE HYDRO model with the 2D MIKE 21 model using the MIKE Flood model interface. Lateral links were used to connect the branches in the 1D MIKE HYDRO model with the corresponding mesh elements of the 2D MIKE 21 model. A lateral link enables the coupling of the models at the left and right banks of the 1D channel with the 2D area. This integration in MIKE Flood allows a seamless flow exchange between the 1D branches and the 2D area, thereby enabling the space and time-dependent dynamic simulation of flows as they would physically occur in real-world hydraulic systems.

Figure 16 (below) shows the bathymetry of 1D and 2D coupled model, where the building areas are represented (blocked white cells) and the lateral link lines between the 1D and 2D models is shown as a series of red lines.

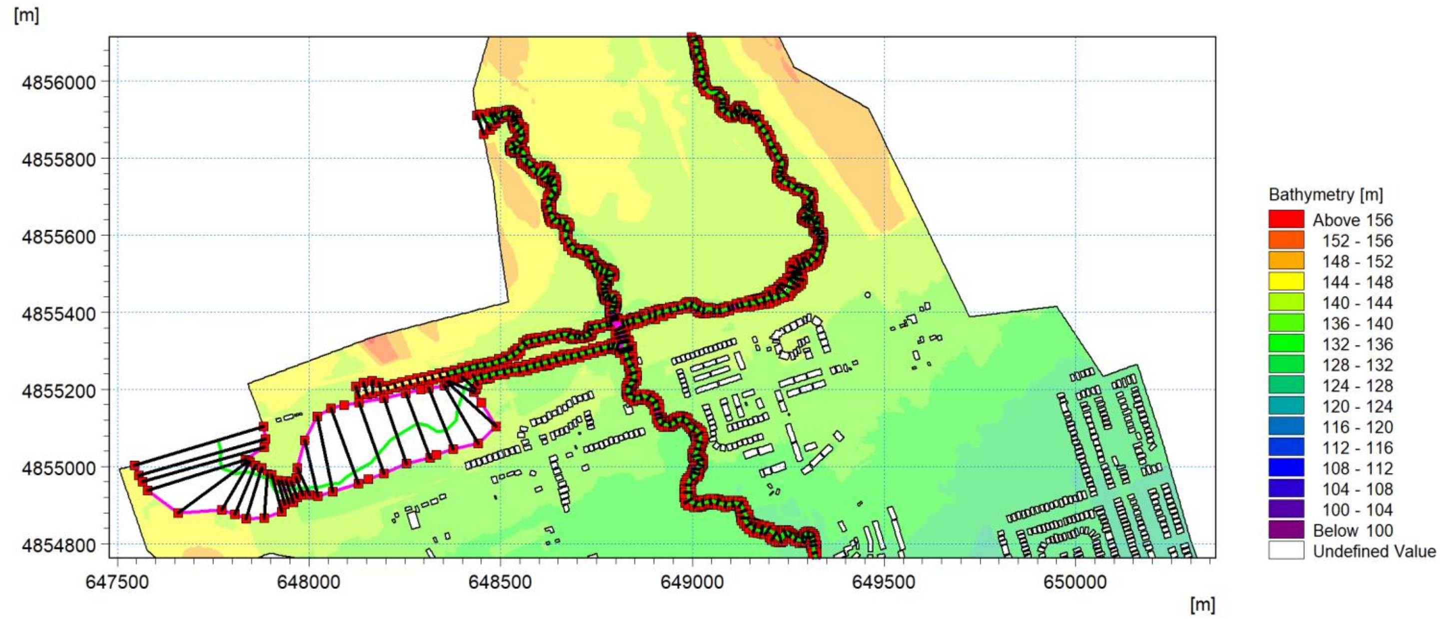


Figure 16 Lateral links used to connect 1D branch to 2D area

3.4 Model Results

Based on 2D model results, spills occur at four major locations: 1) Finch Ave. near West Petticoat Creek, 2) Finch Ave. near East Petticoat Creek, 3) Altona Rd about 1km north of Finch Ave. from East Petticoat Creek, and 4) Altona Rd near Sparrow Cir about 600m south of Finch Ave. from Petticoat Creek, and the following gives the details about spill travelling routes.

Figure 17 shows the spill locations and flow directions and following gives details on each spill:

- **Spill#1: Spill at Finch Ave. from West Petticoat Creek**
  Spill starts from 5yr storm event, and the regional spill amount is over 14m^3/s (about 90% of total flow) with a spill width of 175m and spill depth of 0.15m, which is mainly due to a low point on Finch Ave. The spill would travel southwards about 120m where it splits into two paths as follows:
    1) less than 1 m^3/s flow would travel south-east and eventually get into main Petticoat Creek along Altona Rd with depth of flow less than 0.3m.
    2) over 13 m^3/s flow would cross hydro-corridor and get into residential area at Woodview Ave. where depth of flow is ranging between 0.3 and 1m, and then spill would continue southwards along Woodview Ave. where depth of flow is over 0.5m and then get onto Oakburn St. and continue its way southwards along Oakburn St. where depth of flow is over 0.5m and then spill would spread out into depressions at Castle St/Lawson St where depth of flow is ranging from

0.5m and 2m before splitting into two paths, i.e.

  a) over 9 m^3/s flow would travel westwards along CPR railway track ditch and eventually half of flow get into main Petticoat Creek at CPR railway crossing and remaining would continue eastwards along CPR railway track ditch until 300m west of Rosebank Rd it splits into two paths, i.e. one path would continue eastwards along CPR railway track ditch and cross Whites Rd and then continues its way which is out of study area; and another path would cross over Sheppard Ave. and travel southwards along Edmund Dr until drain into Petticoat Creek Trib A1 at about 60m south of Steeple Hill. Depth of flow along this route is mostly over 0.5m due to well defined ditch along railway track.
  b) about 2 m^3/s flow would cross Sheppard Ave. and continues southwards along Hoover Dr/Fawndale Rd/Altona and then eventually hit Kingston Rd and drain into Rouge River at Kingston Rd crossing which is out of study area. Depth of flow along this route is mostly under 0.3m.

- **Spill#2: Spill at Finch Ave. from East Petticoat Creek**
  The spill only occurs during Regional event. Regional spill amount is about 30 m^3/s (about 40% of total flow) due to undersized crossing at Altona Rd and low point on south bank of the creek near Altona Rd. and the spill splits into two paths:
  1) More than 27m^3/s of the spill would travel southwards along Altona with depth of flow ranging from 0.15m to 0.5m and eventually drain into Petticoat Creek near hydro corridor, and along its way on Altona Rd over 3m^3/s of spill would travel westwards away from Altona Rd route and eventually drain into Petticoat Creek at various locations, and the depth of flow along this route is mostly between 0.15m and 0.5m.
  2) Less than 1m^3/s of the spill (about 300m east of Altona Rd) would travel southwards into green space and depth of flow at spill point is less than 0.1m, then hit Finch Ave. and this route would join some of the spill about 1.8 m^3/s coming from the spill along Altona Rd. After that it would continue its way south-eastwards and cross green space into Bramalea sub-division at Wildflower Dr. and then it would carry on along Wildflower Dr./Charnwood Crt./Dencourt Dr. and get into Highbush Public School, and from there majority of the spill would travel south along Braeburn Cres. and it splits into two paths, one path would cross Foxwood Trail and get to depression on Gardenview Sq.; another path would turn eastwards along Foxwood Trail and eventually get to depression on Weyburn Sq. The depth of flow along this route is mostly under 0.3m, but except for three depressions where depth of flow would be between 0.5m and 1.5m.
- **Spill#3: Spill at Altona Rd about 1km north of Finch Ave. from East Petticoat Creek**
  The spill only occurs during Regional event. The spill amount is over 7.2m^3/s which is about 30% of total peak flow. The spill starts right at the beginning of the East Petticoat Creek (1D reach), and then splits into two:
  1) part of the flow would spill over Altona Rd into farm field on the east side of the road with depth of flow under 0.3m and then join the flow from both East Petticoat Creek and East Petticoat Creek Trib A;
  2) another part of the spill would travel southwards along west side of the Altona Rd for about 1km and eventually get into East Petticoat Creek at CPR railway track. The depth of flow along this route is mostly between 0.3m and 1m.
- **Spill#4: Spill at Altona Rd near Sparrow Cir about 600m south of Finch Ave. from Petticoat Creek**
  The spill only occurs during Regional event. The spill would travel south-eastwards into residential area along Sparrow Cir/Chickadee Crt where depth flow is ranging from 0.15m and 0.5m, and then continue its way into forest cover area and eventually get into Petticoat Creek Trib C at various locations.

Figure 18 shows the steady Regional maximum water depth, **Figure 19** shows the steady Regional maximum water surface elevation and **Figure 20** shows the steady Regional maximum velocity.

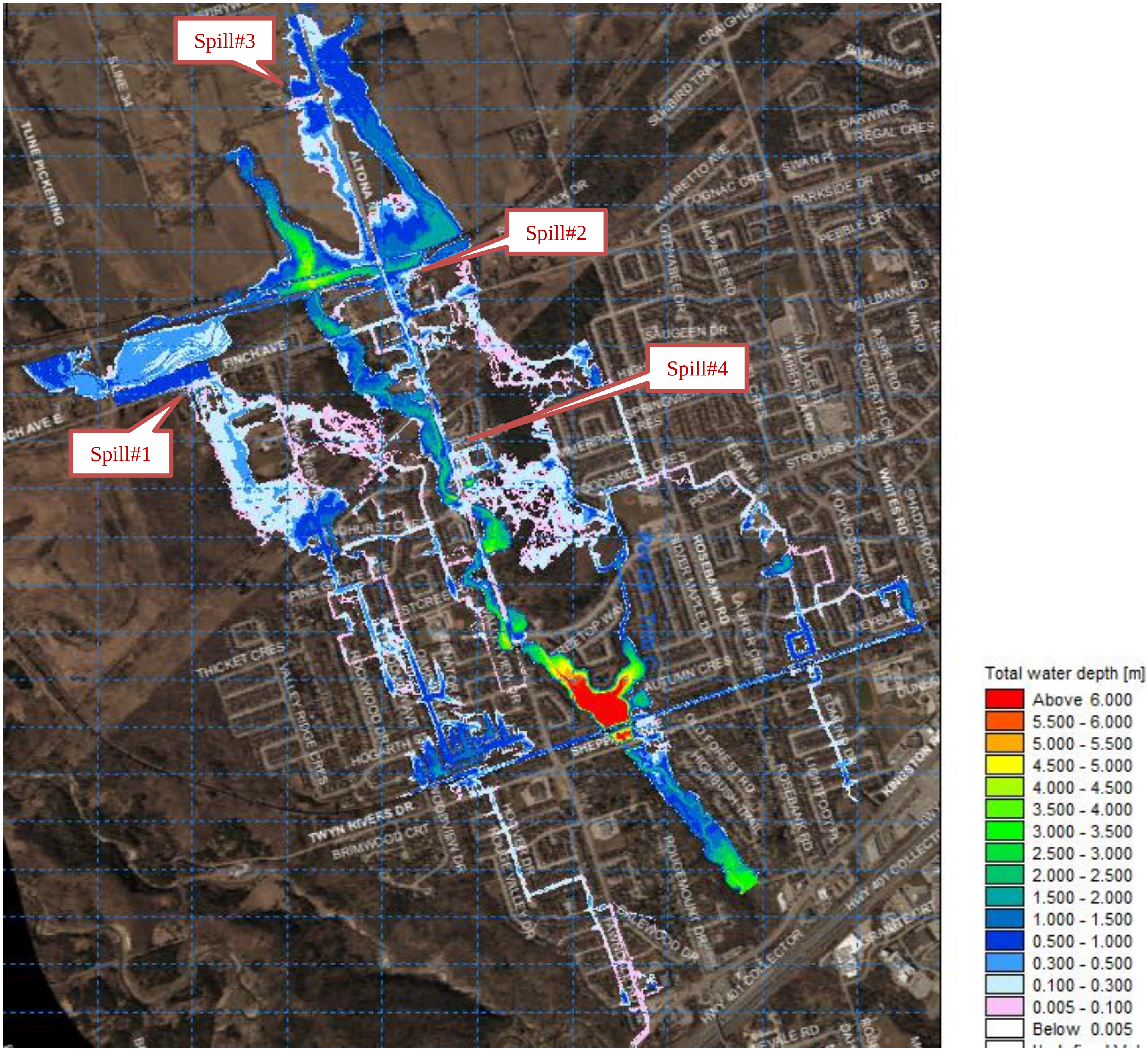


Figure 17– Spill locations and flood depth

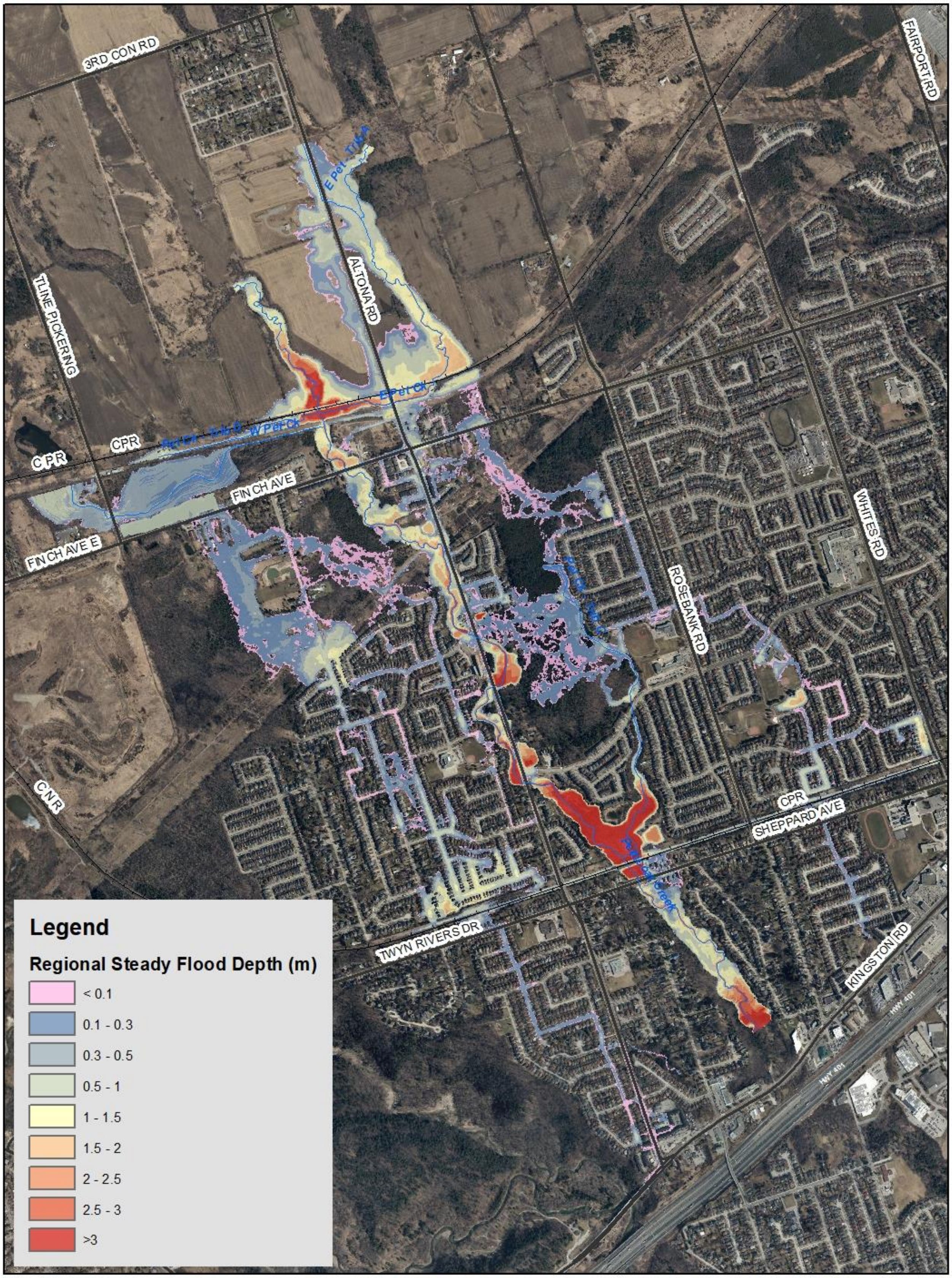


Figure 18– Steady Regional, maximum water depth

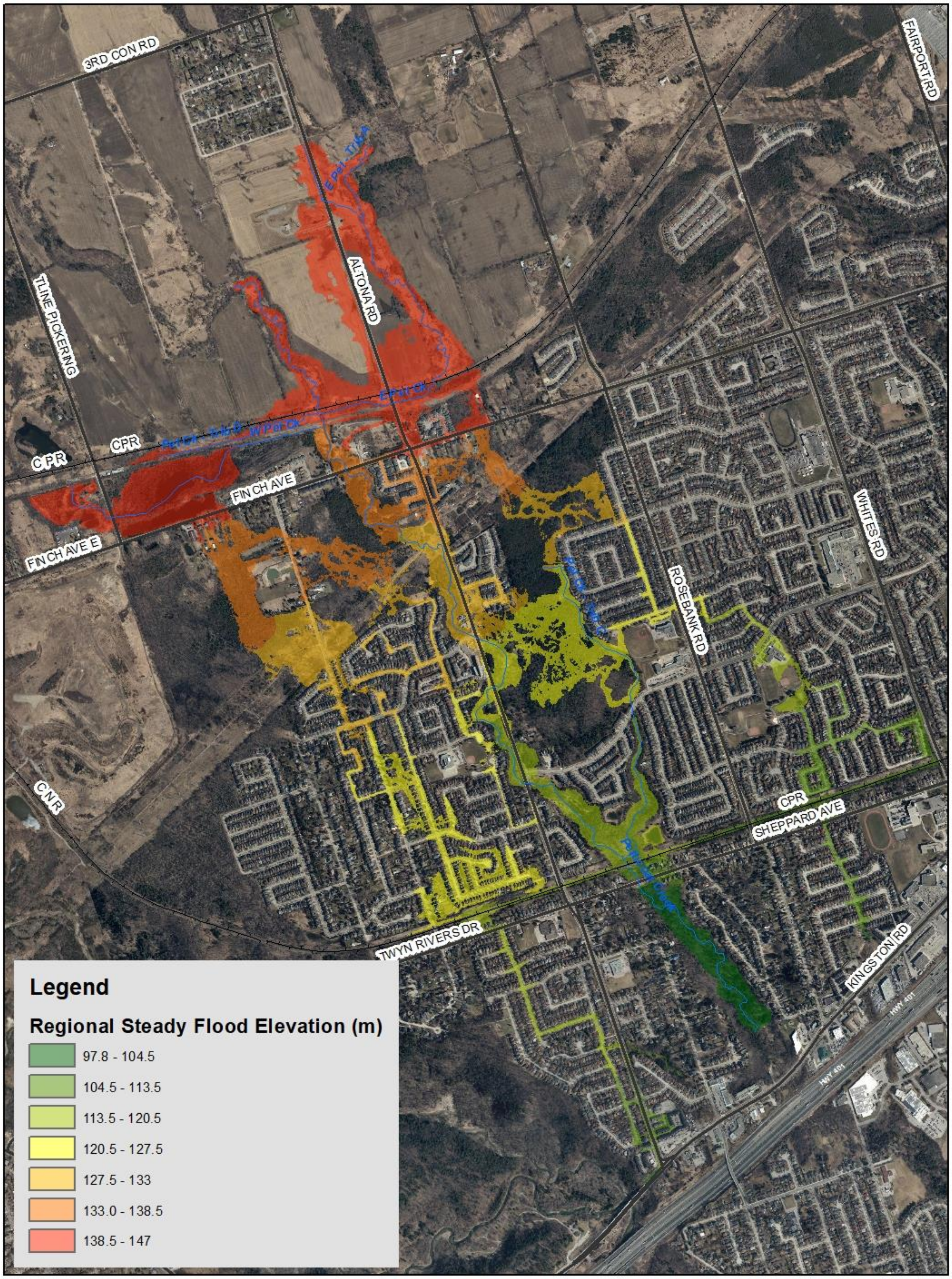


Figure 19 – Steady Regional, maximum water surface elevation

Figure 20 – Steady Regional, maximum velocity

4.0 Flood Risk Mapping

In terms of flood risk analysis, the criteria provided in the *Technical Guide River and Stream Systems: Flooding Hazard Limit* prepared by the Ontario Ministry of Natural Resources (MNR) in 2002 along with the frequency of flooding are typically used in defining and assessing flood risk. Based on work completed recently in other SPA's, the TRCA has revised the flood risk categories and how they are calculated. The revised flood risk categories are divided into low, moderate and high risk and are defined as follows:

- **Low Risk –** Vehicular and Pedestrian Access/Egress is Available (depth <0.3m),

- **Moderate Risk –** Pedestrian Access/Egress ONLY Available (Product Depth and Velocity <0.37m^2/s, Depth <0.8m and Velocity <1.7m/s,
- **High Risk** – Depth-velocity product > 0.37 m^2/s or Depth >0.8m or Velocity >1.7m/s.

Figure 21 illustrates the distribution of Low-, Moderate- and High-risk flood areas within the domain; High-risk areas are generally confined to the channel except at four areas that lie in High-risk flood areas.

Figure 22 shows the distribution of Low-, Moderate- and High-risk flood areas along Woodview Ave. before Prohill St. Low points in hydro corridor at the edge of residential area, and backyards of few residential houses and section of Woodview Ave. lie in High-risk flood areas.

Figure 23 shows the distribution of Low-, Moderate- and High-risk flood areas between Prohill St and CPR railway track. Section of Oakburn St. and low points along Lawson St./Castle St. lies in high-risk flood area.

Figure 24 shows the distribution of Low-, Moderate- and High-risk flood areas Finch Ave./Altona near East Petticoat Creek. The high-risk flood areas lie on section of Altona Rd due to deep depth of flooding and high velocity spilling from the East Petticoat Creek.

Figure 25 shows the distribution of Low-, Moderate- and High-risk flood areas in Highbush P.S. and along Gardenview Sq./Weyburn Sq. area. The high-risk flood areas lie in depressions within Highbush P.S. where few catch basins are located and also in depressions along Gardenview Sq. and Weyburn Sq.

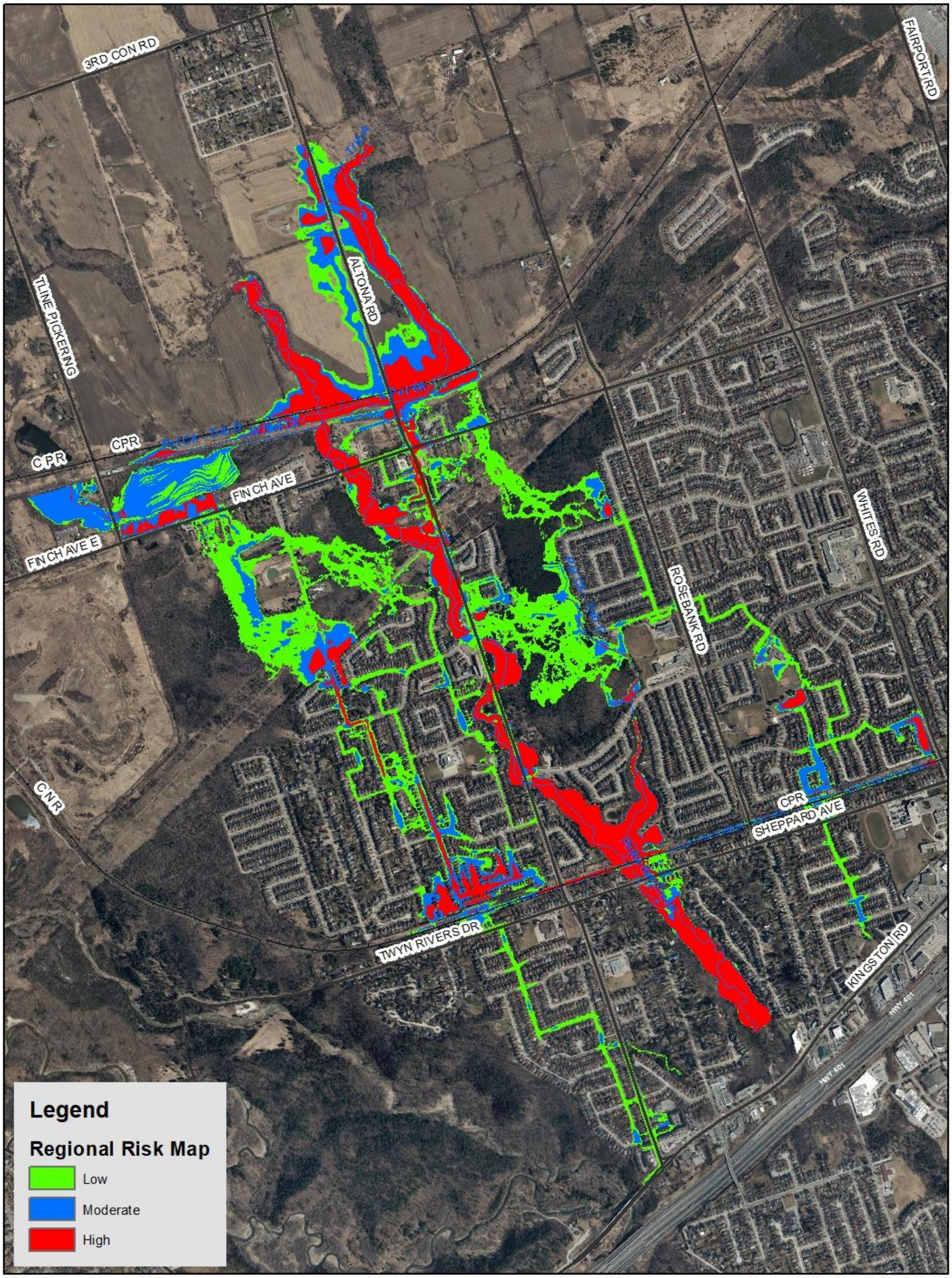


Figure 21 – Distribution of low- moderate- and high-risk flood areas

Figure 22 – Distribution of low- moderate- and high-risk flood along Woodview Ave. before Prohill St.

Figure 23 – Distribution of low- moderate- and high-risk flood between Prohill St and CPR railway track.

Figure 24 – Distribution of low- moderate- and high-risk flood on Finch Ave./Altona near East Petticoat Creek.

Figure 25 – Distribution of low- moderate- and high-risk flood in Highbush P.S. and along Gardenview Sq./Weyburn Sq. area.

5.0 Conclusions

Petticoat Creek FPM update was last updated in September 2006, which identified four spills from Petticoat Creek, West Petticoat Creek and East Petticoat Creek. Amount of two major spills from West Petticoat Creek and East Petticoat Creek are over 40% of total peak flows on each creek, which would travel long way further south along different flow paths. Given this, a 2D model is more appropriate to define the spill and model shallow overland flow. Therefore, a coupled 1D and 2D MIKE Flood model was built that incorporated all crossings, TRCA 1-m 2015 LiDAR data spliced with 2019 Lidars where grading has changed and updated flow data. The results from the coupled model clearly show the extent of the spill and its flow paths. For floodplain mapping purposes, flood depth and flood extent from the coupled MIKE model should be updated for reach sections of the Petticoat Creek and its tributaries upto main Petticoat Creek at Rouge Hill Crt. about 200m north of Kingston Rd.

APPENDIX "E"

Storm Peak Flow Calculations

VALDOR ENGINEERING INC.

TABLE E

File: 17149
February 2024

Project: Nature Haven Crescent, City of Pickering

STORAGE AND DISCHARGE SUMMARY

CONDITION	DRAINAGE AREA (ha)	STORAGE HWL (m)	ORIFICE				PRE-DEVELOPMENT RELEASE RATE (L/S)	STORAGE REQUIRED (cu.m.)	STORAGE PROVIDED (cu.m.)
			LOCATION	INVERT (m)	DIAMETER (mm)	RELEASE RATE (L/s)			
2-Year	0.214	137.50	SWM Tank	135.97	74	14.2	14.4	10.4	45.9
100-Year		137.54				14.4	43.3	44.8	45.0

Project: Nature Haven Crescent, City of Pickering

PRE-DEVELOPMENT PEAK FLOW CALCULATION (Unmitigated)

Surface Type	Area (ha.)	Runoff Coefficient
Pervious	0.512	0.25
Gravel	0.000	0.70
TOTAL AREA	0.512	0.25

2 Year Pre-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)
Ca = 1
T = 10 minutes
I = 77.6 mm/hr
R = 0.25
N = 2.78

A = 715.076
B = 5.262
C = 0.815

Q = R x A x I x N **2 year Q = 27.6 L/s**

100 Year Pre-Development Flow

I = Rainfall Rate (mm/hr)
Ca = 1.25
T = 10 minutes
I = 186.7 mm/hr
R = 0.25
N = 2.78

A = 2096.425
B = 6.485
C = 0.863

Q = R x A x I x N x Ca **100 year Q = 83.1 L/s**

VALDOR ENGINEERING INC. **TABLE E2**
File: 17149
February 2024

Project: Nature Haven Crescent, City of Pickering

ALLOWABLE (TOTAL CONTROLLED AREA FROM CATCHMENT 202 AND 203

Surface Type	Area (ha.)	Runoff Coefficient
Pervious	0.214	0.25
Gravel	0.000	0.70
TOTAL AREA	0.214	0.25

2 Year Pre-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	715.076
Ca =	1		B =	5.262
T =	10	minutes	C =	0.815
I =	77.6	mm/hr		
R =	0.25			
N =	2.78			

Q = R x A x I x N **2 year Q = 11.5 L/s**

100 Year Pre-Development Flow

I = Rainfall Rate (mm/hr)			A =	2096.425
Ca =	1.25		B =	6.485
T =	10	minutes	C =	0.863
I =	186.7	mm/hr		
R =	0.25			
N =	2.78			

Q = R x A x I x N x Ca **100 year Q = 34.7 L/s**

VALDOR ENGINEERING INC. **TABLE E3-1**

File: 17149
February 2024

Project: Nature Haven Crescent, City of Pickering

POST-DEVELOPMENT PEAK FLOW CALCULATION (Catchment 201)

Surface Type	Area (ha.)	Runoff Coefficient
Pervious	0.160	0.25
Roof	0.086	0.95
Impervious	0.016	0.95
TOTAL AREA	0.262	0.52

2 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)
Ca = 1
T = 10 minutes
I = 77.6 mm/hr
2 yr R = 0.52 (composite)
N = 2.78

A = 715.076
B = 5.262
C = 0.815

Q = R x A x I x N x Ca **2 year Q = 29.6 L/s**

100 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)
Ca = 1.25
T = 10 minutes
I = 186.7 mm/hr
100 yr R = 0.52
N = 2.78

A = 2096.425
B = 6.485
C = 0.863

Q = R x A x I x N x Ca **100 year Q = 89.2 L/s**

VALDOR ENGINEERING INC. **TABLE E3-2**
File: 17149
February 2024

Project: Nature Haven Crescent, City of Pickering

POST-DEVELOPMENT PEAK FLOW CALCULATION (Catchment 202)

Surface Type	Area (ha.)	Runoff Coefficient
Pervious	0.092	0.25
Roof	0.058	0.95
Impervious	0.063	0.95
TOTAL AREA	0.214	0.65

2 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	715.076
Ca =	1		B =	5.262
T =	10	minutes	C =	0.815
I =	77.6	mm/hr		
2 yr R =	0.65	(composite)		
N =	2.78			

Q = R x A x I x N x Ca **2 year Q = 29.9 L/s**

100 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	2096.425
Ca =	1.25		B =	6.485
T =	10	minutes	C =	0.863
I =	186.7	mm/hr		
100 yr R =	0.65			
N =	2.78			

Q = R x A x I x N x Ca **100 year Q = 90.0 L/s**

VALDOR ENGINEERING INC. **TABLE E3-3**
File: 17149
February 2024

Project: Nature Haven Crescent, City of Pickering

POST-DEVELOPMENT PEAK FLOW CALCULATION (Catchment 203-External)

Surface Type	Area (ha.)	Runoff Coefficient
Pervious	0.007	0.25
Roof	0.000	0.95
Impervious	0.013	0.90
TOTAL AREA	0.020	0.67

2 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	715.076
Ca =	1		B =	5.262
T =	10	minutes	C =	0.815
I =	77.6	mm/hr		
2 yr R =	0.67	(composite)		
N =	2.78			

Q = R x A x I x N x Ca **2 year Q = 2.9 L/s**

100 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)			A =	2096.425
Ca =	1.25		B =	6.485
T =	10	minutes	C =	0.863
I =	186.7	mm/hr		
100 yr R =	0.67			
N =	2.78			

Q = R x A x I x N x Ca **100 year Q = 8.6 L/s**

VALDOR ENGINEERING INC. **TABLE E3-2**

File: 17149

February 2024

Project: Nature Haven Crescent, City of Pickering

POST-DEVELOPMENT PEAK FLOW CALCULATION (Catchment 204)

Surface Type	Area (ha.)	Runoff Coefficient
Pervious	0.012	0.25
Roof	0.015	0.95
Impervious	0.005	0.95
TOTAL AREA	0.032	0.68

2 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)

Ca = 1

T = 10 minutes

I = 77.6 mm/hr

2 yr R = 0.68 (composite)

N = 2.78

A = 715.076

B = 5.262

C = 0.815

Q = R x A x I x N x Ca **2 year Q = 4.7 L/s**

100 Year Post-Development Flow

$I = A / (t_c+B)^C$

I = Rainfall Rate (mm/hr)

Ca = 1.25

T = 10 minutes

I = 186.7 mm/hr

100 yr R = 0.68

N = 2.78

A = 2096.425

B = 6.485

C = 0.863

Q = R x A x I x N x Ca **100 year Q = 14.2 L/s**

VALDOR ENGINEERING INC. **Table E4-1**

File: 17149
February 2024

Project: Nature Haven Crescent, City of Pickering

CONTROL ORIFICE DESIGN

2 YEAR STORM

2 Year High Water Level = 137.50 m

Orifice

Orifice Coefficient (C) = 0.61 (Plate)

Acceleration due to gravity (g) = 9.81 m/s/s

Orifice Invert Elevation = 135.97 m

Orifice Diameter = 74 mm

Orifice Springline Elevation 136.01 m

Cross section area of orifice (A) = 0.0043 sq.m.

Head (H) = 1.49 m

Actual Discharge (Q) = **14.2** L/s
(C x A x (2 x g x H)^0.5)

VALDOR ENGINEERING INC. **Table E4-2**

File: 17149
February 2024

Project: Nature Haven Crescent, City of Pickering

CONTROL ORIFICE DESIGN

100 YEAR STORM

100 Year High Water Level = 137.54 m

Orifice

Orifice Coefficient (C) = 0.61 (Plate)

Acceleration due to gravity (g) = 9.81 m/s/s

Orifice Invert Elevation = 135.97 m

Orifice Diameter = 74 mm

Orifice Springline Elevation 136.01 m

Cross section area of orifice (A) = 0.0043 sq.m.

Head (H) = 1.53 m

Actual Discharge (Q) = **14.4** L/s
(C x A x (2 x g x H)^0.5)

VALDOR ENGINEERING INC.
File: 17149
February 2024

TABLE E5-1

Storage Volume Calculations - Rational Method

2-year Storm - City of Pickering

Project: Nature Haven Crescent, City of Pickering

Total Area (ha)	0.234
Runoff Coefficient	0.65
Maximum Discharge Through Orifice (L/s)	14.2
Discharged Volume per 5 min Interval (cu.m)	4.3

Time (min)	Intensity (mm/hr)	Runoff Volume (cu.m)	Discharged Volume (cu.m)	Storage Volume (cu.m)
0	0.0	0.000	0.000	0.000
5	2.3	0.292	0.292	0.000
10	2.5	0.319	0.319	0.000
15	2.8	0.353	0.353	0.000
20	3.1	0.394	0.394	0.000
25	3.6	0.448	0.448	0.000
30	4.1	0.521	0.521	0.000
35	5.0	0.626	0.626	0.000
40	6.2	0.788	0.788	0.000
45	8.5	1.074	1.074	0.000
50	13.5	1.705	1.705	0.000
55	32.9	4.148	4.148	0.000
60	107.2	13.532	4.260	9.272
65	42.8	5.401	4.260	1.141
70	22.9	2.895	2.895	0.000
75	15.4	1.948	1.948	0.000
80	11.6	1.462	1.462	0.000
85	9.3	1.171	1.171	0.000
90	7.7	0.977	0.977	0.000
95	6.7	0.839	0.839	0.000
100	5.8	0.737	0.737	0.000
105	5.2	0.658	0.658	0.000
110	4.7	0.594	0.594	0.000
115	4.3	0.543	0.543	0.000
120	4.0	0.500	0.500	0.000
125	3.7	0.464	0.464	0.000
130	3.4	0.433	0.433	0.000
135	3.2	0.406	0.406	0.000
140	3.0	0.383	0.383	0.000
145	2.9	0.362	0.362	0.000
150	2.7	0.343	0.343	0.000
155	2.6	0.327	0.327	0.000
160	2.5	0.312	0.312	0.000
165	2.4	0.299	0.299	0.000
170	2.3	0.286	0.286	0.000
175	2.2	0.275	0.275	0.000
180	2.1	0.265	0.265	0.000

Total Storage Volume Required (cu.m) **10.4**

VALDOR ENGINEERING INC.
File: 17149
February 2024

TABLE E5-2

Storage Volume Calculations - Rational Method

100-year Storm - City of Pickering

Project: Nature Haven Crescent, City of Pickering

Total Area (ha)	0.234
Runoff Coefficient	0.64
Maximum Discharge Through Orifice (L/s)	14.4
Discharged Volume per 5 min Interval (cu.m)	4.3

Time (min)	Intensity (mm/hr)	Runoff Volume (cu.m)	Discharged Volume (cu.m)	Storage Volume (cu.m)
0	0.0	0.000	0.000	0.000
5	4.3	0.532	0.532	0.000
10	4.7	0.587	0.587	0.000
15	5.3	0.656	0.656	0.000
20	6.0	0.744	0.744	0.000
25	6.9	0.861	0.861	0.000
30	8.2	1.022	1.022	0.000
35	10.1	1.257	1.257	0.000
40	13.1	1.633	1.633	0.000
45	18.6	2.315	2.315	0.000
50	31.1	3.878	3.878	0.000
55	80.3	10.016	4.316	5.700
60	255.0	31.800	4.316	27.484
65	105.4	13.148	4.316	8.832
70	55.2	6.885	4.316	2.568
75	36.0	4.486	4.316	0.169
80	26.2	3.269	3.269	0.000
85	20.4	2.550	2.550	0.000
90	16.7	2.081	2.081	0.000
95	14.1	1.753	1.753	0.000
100	12.1	1.512	1.512	0.000
105	10.7	1.329	1.329	0.000
110	9.5	1.185	1.185	0.000
115	8.6	1.069	1.069	0.000
120	7.8	0.974	0.974	0.000
125	7.2	0.895	0.895	0.000
130	6.6	0.827	0.827	0.000
135	6.2	0.769	0.769	0.000
140	5.8	0.719	0.719	0.000
145	5.4	0.676	0.676	0.000
150	5.1	0.637	0.637	0.000
155	4.8	0.603	0.603	0.000
160	4.6	0.572	0.572	0.000
165	4.4	0.544	0.544	0.000
170	4.2	0.519	0.519	0.000
175	4.0	0.497	0.497	0.000
180	3.8	0.476	0.476	0.000

Total Storage Volume Required (cu.m) **44.8**

VALDOR ENGINEERING INC.
File: 17149
February 2024

TABLE: E6-1

AVAILABLE STORAGE - 2 YEAR

UNDERGROUND STORAGE - BOX

			Area (sq.m)	**Height** (m)	**VOLUME** (cu.m)
Underground Detention Tank					
Tank Inv: 135.97 HWL: 137.50			30.00	1.53	45.9
TOTAL					45.9

2 YEAR STORAGE PROVIDED:	**45.9**

2 YEAR STORAGE REQUIRED:	**10.4**

VALDOR ENGINEERING INC.
File: 17149
February 2024

TABLE: E6-2

AVAILABLE STORAGE - 100 YEAR

UNDERGROUND STORAGE - Detention Tank

		Length (m)	**Diameter** (mm)	**Area** (sq.m)	**Height** (m)	**VOLUME** (cu.m)
Underground Detention Tank						
Tank Inv: 135.97	HWL: 137.54			30.00	1.50	45.0
TOTAL						45.0

100 YEAR STORAGE PROVIDED:	**45.0**

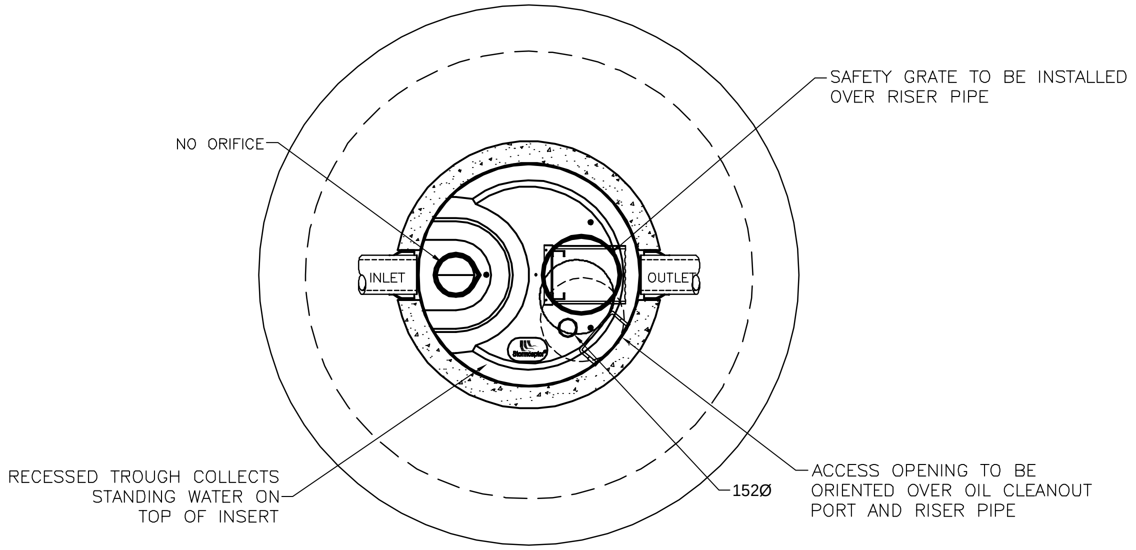
100 YEAR STORAGE REQUIRED:	**44.8**

APPENDIX "F"

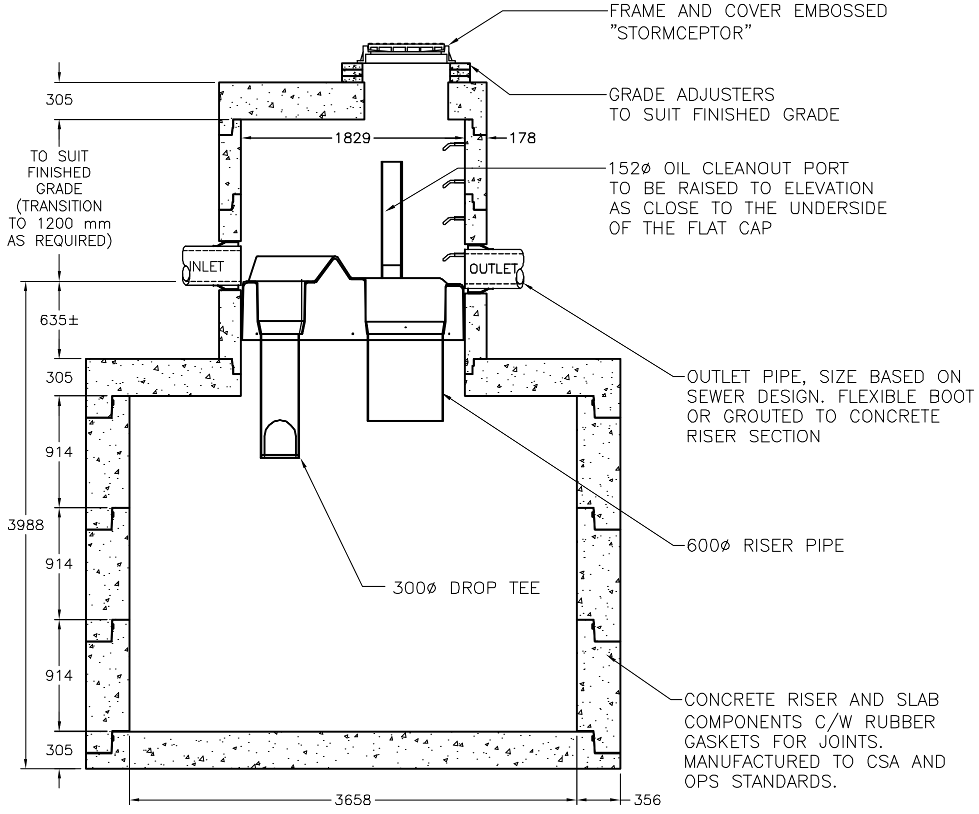
Stormwater Quality Treatment

DRAWING NOT TO BE USED FOR CONSTRUCTION

THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS:
United States Patent No. 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690 • 7,582,216 • 7,666,303 | Australia Patent No. 693,164 • 707,133 • 729,096 • 779,401 • 289,647 • 2008,279,378 • 2008,288,900 |
Canadian Patent No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 | Indonesian Patent No. 007058 | Japan Patent No. 3581233 • 9-11476 |
Korea Patent No. 10-1451593 • 0519212 | Malaysia Patent No. 118987 | New Zealand Patent No. 314,646 • 583,583 • 583,008 | South African Patent No. 2010/00683 • 2010/01796 |



PLAN VIEW



SECTION VIEW

Stormceptor®

imbrium®
WWW.IMBRIUMSYSTEMS.COM
407 FAIRVIEW DRIVE, WHITBY, ON L1N 3A9
TF 800-565-4801 CA 416-960-9900 INTL +1-416-960-9900

STC 6000
STANDARD MODEL

####

REV #	DATE	REVISION DESCRIPTION	BY

SHEET NUMBER
1
OF 1

DATE: ########
SCALE: 60
PROJECT No.: #####
DRAWN: ###
CHECKED: ###

I:\IMBRIUM\PRODUCTS\STORMCEPTOR\STORMCEPTOR STC40 DRAWINGS & DETAILS\STANDARD DETAILS\METRIC\STC 6000.DWG 4/12/2019 1:27 PM

APPENDIX “G”

Water Balance Calculations

VALDOR ENGINEERING INC. **TABLE: G1**
File: 17149
June 2024

PROJECT: **Proposed Residential Development, City of Pickering**

WATER BALANCE CALCULATIONS

1. INITIAL ABSTRACTION

Surface Type	Area (Ha)		Init. Abstract. (mm)
Landscape Area	0.2676		0.0
Roof Area	0.1562		0.0
Impervious Area	0.0883		0.0
Total	**0.5121**		**0.000**

2. STORAGE VOLUME REQUIRED

Total Area of Site (A) = 5121 sq.m.
Target Retention Depth (D) = 0.005 (m)
Overall Initial Abstractions (I) = 0.000000 (m)

Storage Volume Required = V = A x (D - I) = **25.61** (cu.m.)

3. SOAK-AWAY PIT SIZE

Rear of Lot 1

Percolation Rate (P) = 12 mm/hr
Maximum Retention Time (T) = 48 hours
Max Trench Height Allowable (D) = (PT/(1000*S)) = 0.58 m
*MOE recommend max depth of 1.5m

Clear Stone Trench
Total Length of Trench (L) = 7.00 m
Width (w) = 2.20 m
Height (d) = 0.30 m
Void Ratio = 0.40
Volume = 1.85 cu.m.

Rear of Lot 2

Percolation Rate (P) = 12 mm/hr
Maximum Retention Time (T) = 48 hours
Max Trench Height Allowable (D) = (PT/(1000*S)) = 0.58 m
*MOE recommend max depth of 1.5m

Clear Stone Trench
Total Length of Trench (L) = 7.00 m
Width (w) = 2.20 m
Height (d) = 0.45 m
Void Ratio = 0.40
Volume = 2.77 cu.m.

Rear of Lot 4

Percolation Rate (P) = 50 mm/hr
Maximum Retention Time (T) = 48 hours
Max Trench Height Allowable (D) = (PT/(1000*S)) = 2.40 m
*MOE recommend max depth of 1.5m

Clear Stone Trench
Total Length of Trench (L) = 4.50 m
Width (w) = 3.00 m
Height (d) = 0.65 m
Void Ratio = 0.40
Volume = 3.51 cu.m.

Rear of Lot 5

Percolation Rate (P) = 12 mm/hr
Maximum Retention Time (T) = 48 hours
Max Trench Height Allowable (D) = (PT/(1000*S)) = 0.58 m
*MOE recommend max depth of 1.5m

Clear Stone Trench
Total Length of Trench (L) = 7.00 m
Width (w) = 2.20 m
Height (d) = 0.58 m
Void Ratio = 0.40
Volume = 3.57 cu.m.

Front of Lot 5

Percolation Rate (P) = 50 mm/hr
Maximum Retention Time (T) = 48 hours
Max Trench Height Allowable (D) = (PT/(1000*S)) = 2.40 m
*MOE recommend max depth of 1.5m

Clear Stone Trench
Total Length of Trench (L) = 4.20 m
Width (w) = 2.60 m
Height (d) = 0.30 m
Void Ratio = 0.40
Volume = 1.31 cu.m.

Rear of Lot 6

Percolation Rate (P) = 12 mm/hr
Maximum Retention Time (T) = 48 hours
Max Trench Height Allowable (D) = (PT/(1000*S)) = 0.58 m
*MOE recommend max depth of 1.5m

Clear Stone Trench
Total Length of Trench (L) = 10.00 m
Width (w) = 2.20 m
Height (d) = 0.30 m
Void Ratio = 0.40
Volume = 2.64 cu.m.

Rear of Lot 7

Percolation Rate (P) = 12 mm/hr
Maximum Retention Time (T) = 48 hours
Max Trench Height Allowable (D) = (PT/(1000*S)) = 0.58 m
*MOE recommend max depth of 1.5m

Clear Stone Trench
Total Length of Trench (L) = 10.00 m
Width (w) = 2.20 m
Height (d) = 0.30 m
Void Ratio = 0.40
Volume = 2.64 cu.m.

Rear of Lot 8

Percolation Rate (P) = 12 mm/hr
Maximum Retention Time (T) = 48 hours
Max Trench Height Allowable (D) = (PT/(1000*S)) = 0.58 m
*MOE recommend max depth of 1.5m

Clear Stone Trench
Total Length of Trench (L) = 10.00 m
Width (w) = 3.20 m
Height (d) = 0.58 m
Void Ratio = 0.40
Volume = 7.37 cu.m.

Total Storage Volume Provided = **25.67** (cu.m.)

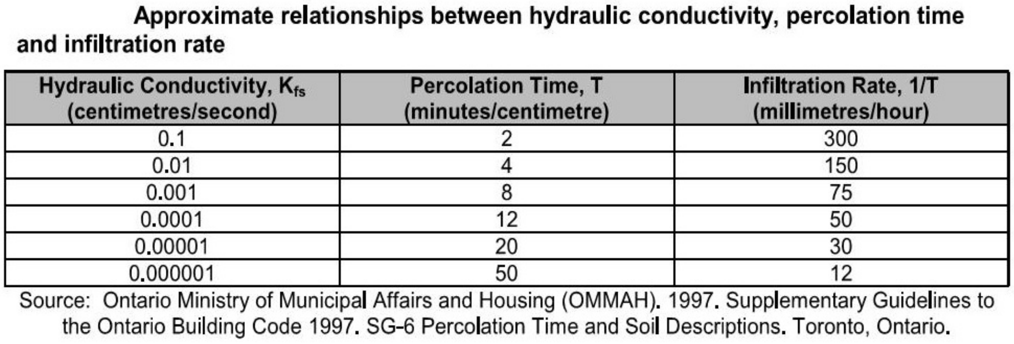
VALDOR ENGINEERING INC. **TABLE: G2**
File: 17149
December 2021

PROJECT: **Proposed Residential Development, City of Pickering**

PERCOLATION RATE CALCULATIONS

Lot 1 Hydraulic Conductivity, **K_{fs}** = 0.000001 **cm/s**
Lot 2 Hydraulic Conductivity, **K_{fs}** = 0.000001 **cm/s**
Lot 3 Hydraulic Conductivity, **K_{fs}** = 0.0001 **cm/s**
Lot 4 Hydraulic Conductivity, **K_{fs}** = 0.0001 **cm/s**
Lot 5 Hydraulic Conductivity, **K_{fs}** = 0.000001 **cm/s**
Lot 6 Hydraulic Conductivity, **K_{fs}** = 0.000001 **cm/s**
Lot 7 Hydraulic Conductivity, **K_{fs}** = 0.000001 **cm/s**
Lot 8 Hydraulic Conductivity, **K_{fs}** = 0.000001 **cm/s**

Source: *Geotechnical Investigation Report (Feb 13, 2020.)* prepared by Soil Engineers Ltd.

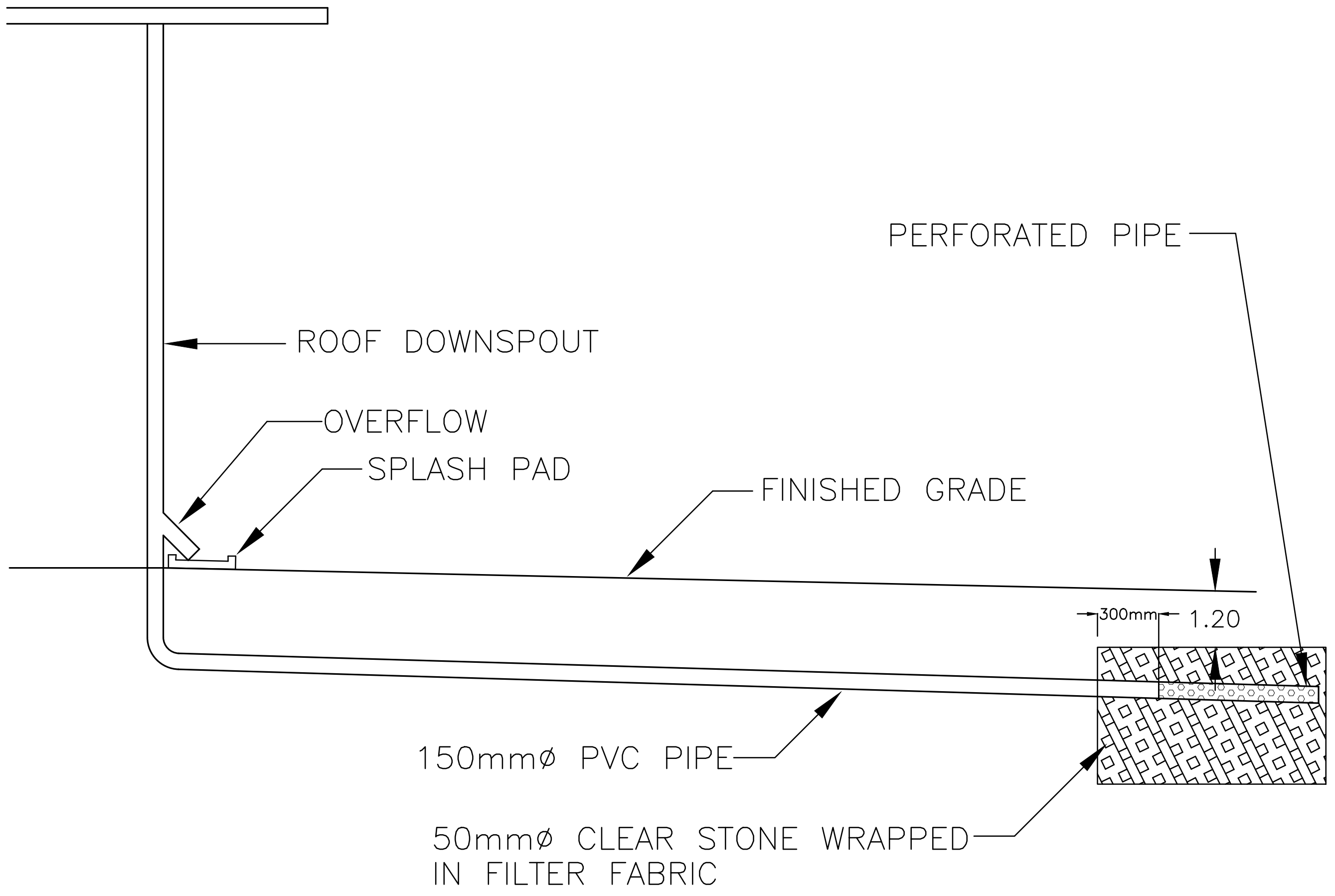


Approximate relationships between hydraulic conductivity, percolation time and infiltration rate

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

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

Lot 1 Percolation Rate, **P** = 12 **mm/hr**
Lot 2 Percolation Rate, **P** = 12 **mm/hr**
Lot 3 Percolation Rate, **P** = 50 **mm/hr**
Lot 4 Percolation Rate, **P** = 50 **mm/hr**
Lot 5 Percolation Rate, **P** = 12 **mm/hr**
Lot 6 Percolation Rate, **P** = 12 **mm/hr**
Lot 7 Percolation Rate, **P** = 12 **mm/hr**
Lot 8 Percolation Rate, **P** = 12 **mm/hr**



PROJECT

PROPOSED RESIDENTIAL DEVELOPMENT
NATURE HAVEN CRESCENT
CITY OF PICKERING

VALDOR ENGINEERING INC.
Consulting Engineers - Project Managers
571 CHRISLEA ROAD, UNIT 4, WOODBRIDGE, ONTARIO, L4L 8A2
TEL (905)264-0054, FAX (905)264-0069
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

TITLE

ROOF DRAINAGE SOAK AWAY PIT DETAIL

DRAWN BY	M.H.	CHECKED BY	D.G
SCALE	N.T.S.	DATE	APRIL 2024
PROJECT	17149	DWG.	FIGURE G–1

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
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A REPORT TO
HIGHGLEN HOMES LIMITED

A GEOTECHNICAL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT

230 FINCH AVENUE
(PART 4, PLAN #40 R-29767)

CITY OF PICKERING

REFERENCE NO. 1911-S057

FEBRUARY 2020

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TABLE OF CONTENTS

TABLES

DIAGRAM

ENCLOSURES

1.0 INTRODUCTION

In accordance with written authorization dated November 11, 2019, from Mr. John Perciasepe, of Highglen Homes Limited, a geotechnical investigation was carried out at a parcel of land located at 230 Finch Avenue, in the City of Pickering, for a proposed Residential Development.

The purpose of this investigation was to reveal the subsurface conditions and determine the engineering properties of the disclosed soils for the design and construction of the proposed project.

The geotechnical findings and resulting recommendations are presented in this Report.

2.0 SITE AND PROJECT DESCRIPTION

The City of Pickering is situated on Iroquois (glacial lake) plain where, in places, the glacial till stratigraphy has been partly eroded by the water action of the glacial lake and filled with lacustrine sands, silts, clays and reworked till.

The subject site is an open field situated at the northwest sector of Finch Avenue and Altona Road, in the City of Pickering. The site area is weed covered and was snow covered at the time of field investigation. The area fronting Finch Avenue is treed. The ground surface is relatively flat and level, with the overall topography descending gently towards the south.

The proposed project consists of the construction of a new residential subdivision, which will be provided with municipal services and roadways meeting the municipal standards.

3.0 FIELD WORK

The field work, consisting of 5 boreholes to a depth of 6.6 m, was performed on December 12, 2019 at the locations shown on the Borehole Location Plan, Drawing No. 1. A total of 5 monitoring wells were also installed for hydrogeological assessment.

The holes were advanced at intervals to the sampling depths by a track-mounted, continuous-flight power-auger machine equipped for soil sampling. Standard Penetration Tests, using the procedures described on the enclosed “List of Abbreviations and Terms”, were performed at the sampling depths. The test results are recorded as the Standard Penetration Resistance (or ‘N’ values) of the subsoil. The relative density of the granular strata and the consistency of the cohesive strata are inferred from the 'N' values. Split-spoon samples were recovered for soil classification and laboratory testing.

The field work was supervised and the findings were recorded by a Geotechnical Technician.

The elevation at each of the borehole locations was determined from the spot elevations on the site plan provided by the client.

4.0 SUBSURFACE CONDITIONS

Detailed descriptions of the encountered subsurface conditions are presented on the Borehole Logs, comprising Figures 1 to 5, inclusive. The revealed stratigraphy is plotted on the Subsurface Profile, Drawing No. 2, and the engineering properties of the disclosed soils are discussed herein.

The investigation has disclosed that beneath a veneer of topsoil and a layer of earth fill, the site is underlain by strata of sandy silt, silty sand till and sands.

4.1 **Topsoil** (All Boreholes)

The revealed topsoil is 25 to 36 cm thick; it is dark brown in colour, indicating that it contains appreciable amounts of roots and humus. These materials are unstable and compressible under loads; therefore, the topsoil is considered to be void of engineering value. Due to its humus content, it will generate an offensive odour and may produce volatile gases under anaerobic conditions. Therefore, the topsoil must not be buried below any structures or deeper than 1.2 m below the finished grade so it will not have an adverse impact on the environmental well-being of the developed areas.

Since the topsoil is considered void of engineering value, it can only be used for general landscaping and landscape contouring purposes. A fertility analysis can be performed to determine the suitability of the topsoil as a planting material.

4.2 **Disturbed/Weathered Soil** (All Boreholes)

The disturbed/weathered soil encountered extends to depths of 0.7 m and 1.4 m from the prevailing ground surface. Sample examinations show that the soil contains sand, with gravel, cobbles and rock fragments.

The obtained 'N' values of the earth fill range from 3 to 22, with a median of 5 blows per 30 cm of penetration, indicating that the soil is generally loose.

The natural water content values of the soil are 6% and 18%, indicating that it is in a moist to wet condition.

A grain size analysis was performed on 1 representative sample of the soil and the result is plotted on Figure 6.

Due to the non-uniform and loose density, it is considered unsuitable for supporting structural loads. For structural use, the soil must be subexcavated, inspected, sorted free of any deleterious material, and properly compacted.

4.3 **Sandy Silt** (Borehole 5)

The sandy silt deposit was found below a layer of fine to coarse sand and it is embedded with seams and layers of silty clay and fine sand and contains a trace of clay. The laminated structure shows that the silt is a glaciolacustrine deposit.

The natural water content values of the sandy silt sample is 21%, indicating it is in a wet condition and is water bearing. The wet sample became highly dilatant under tactile examinations, showing the shear strength of the sandy silt will be subject to dynamic disturbance.

The obtained 'N' value is 6 blows per 30 cm of penetration, indicating that the relative density of the sandy silt is loose.

A grain size analysis was performed on the sandy silt sample and the result is plotted on Figure 7.

Based on the above findings, the engineering properties relating to the project are given below:

- Highly frost susceptible, with high soil-adfreezing potential.
- Highly water erodible; it is susceptible to migration through small openings under seepage pressure.
- Relatively pervious, with an estimated coefficient of permeability of 10^{-4} cm/sec, an estimated percolation rate of 20 min/cm, and runoff coefficients of:

Slope	
0% - 2%	0.07
2% - 6%	0.12
6% +	0.18

- The soil has a high capillarity and water retention capacity.
- A frictional soil, its shear strength is density dependent. Due to the dilatancy, the strength of the wet silt is susceptible to impact disturbance; i.e., the disturbance will induce a build-up of pore pressure within the soil mantle, resulting in soil dilation and a reduction in shear strength.
- In excavation, the moist silt will be stable in relatively steep cuts, while the wet silt will slough and run slowly with seepage bleeding from the cut face, and the bottom will boil under a piezometric head of 0.3 m.
- A poor pavement-supportive material, with an estimated California Bearing Ratio (CBR) value of 6%.
- Moderate corrosivity to buried metal, with an estimated electrical resistivity of 4500 ohm·cm.

4.4 **Silty Sand Till** (All Boreholes)

The silty sand till was encountered below the sand layer and extends to the maximum investigated depth at all boreholes. The till consists of a random mixture of soil particle sizes ranging from clay to gravel, with the sand being the dominant fraction. It is heterogeneous in structure, showing that it is a glacial deposit.

The obtained ‘N’ values range from 11 to 49, with a median of 30 blows per 30 cm of penetration, indicating that the relative density of the silty sand till is compact to dense, being generally compact.

Intermittent hard resistance to augering was encountered, indicating the presence of cobbles and boulders in the stratum.

The natural water content values of the samples were determined and the results are plotted on the Borehole Logs; the values range from 9% to 14%, with a median of 10%, indicating the till is in a moist to very moist condition.

A grain size analysis was performed on 1 representative sample of the silty sand till; the results are plotted on Figure 8.

Based on the above findings, the deduced engineering properties pertaining to the project are given below:

- High frost susceptibility and moderate water erodibility.
- Low permeability, with an estimated coefficient of permeability of 10^{-6} cm/sec and runoff coefficients of:

Slope	
0% - 2%	0.15
2% - 6%	0.20
6% +	0.28

- A frictional soil, its shear strength is primarily derived from internal friction and is augmented by cementation. Therefore, its strength is primarily soil density dependent.
- In steep cuts, it will be stable; however, under prolonged exposure, localized sheet collapse will occur, particularly in the zone where the wet sand layers are prevalent.
- A fair pavement-supportive material, with an estimated CBR value of 8%.
- Moderately low corrosivity to buried metal, with an estimated electrical resistivity of 5000 ohm·cm.

4.5 **Sands** (All Boreholes)

The sand deposit was encountered below the surficial disturbed soil a layer of earth fill and sample examinations show that it is non-cohesive, consisting of fine to coarse sand particles, gravelly in places, and with some silt to being silty. The laminated structure shows the deposit was derived from a lacustrine environment.

The obtained 'N' values range from 7 to 60, with a median of 28 blows per 30 cm of penetration. This shows the relative density of the sand is loose to very dense, being generally compact.

The natural water content was determined and the results are plotted on the Borehole Logs. The values range from 3% to 21%, with a median of 5%; show that the sand deposit is in a damp to wet condition. The wet samples are water bearing and displayed appreciable dilatancy when shaken by hand.

A grain size analysis was performed on one of the sand samples and the result is plotted on Figure 9.

Accordingly, the following engineering properties are deduced:

- The sand with high silt content is highly frost susceptible with high soil-adfreezing potential.
- Highly water erodible.
- Pervious, with an estimated coefficient of permeability of 10^{-3} cm/sec, an estimated percolation rate of 10 min/cm, and runoff coefficients of:

Slope	
0% - 2%	0.04
2% - 6%	0.09
6% +	0.13

- A frictional soil, its shear strength is derived from internal friction and is density dependent. Due to its dilatancy, the shear strength of the wet sand is susceptible to impact disturbance; i.e., the disturbance will induce a build-up of pore pressure within the soil mantle, resulting in soil dilation and a reduction of shear strength.
- In relatively steep cuts, the sand will be stable in a damp to moist condition, but will slough if it is wet and run with water seepage. The bottom will boil under a piezometric head of 0.3 m.
- A fair material to support pavement, with an estimated CBR value of at least 8%.
- Moderately low corrosivity to buried metal, with an estimated electrical resistivity of 5000 ohm·cm.

4.6 Compaction Characteristics of the Revealed Soils

The obtainable degree of compaction is primarily dependent on the soil moisture and, to a lesser extent, on the type of compactor used and the effort applied.

As a general guide, the typical water content values of the revealed soils for Standard Proctor compaction are presented in Table 1.

Table 1 - Estimated Water Content for Compaction

Soil Type	Determined Natural Water Content (%)	Water Content (%) for Standard Proctor Compaction	
		100% (optimum)	Range for 95% or +
Sandy Silt	21	12	8 to 16
Silty Sand Till	9 to 14 (median 10)	11	7 to 16
Sands	3 to 21 (median 5)	10	5 to 15

Based on the above findings, a majority of the in situ soils are generally suitable for a 95% or + Standard Proctor compaction. However, the sandy silt and portions of the sands are too wet or on the wet side of the optimum. The wet soils will require prior aeration in dry, warm weather or mixing with drier inorganic soils for proper compaction.

The silty sand till should be compacted using a heavy-weight, kneading-type roller. The silt and sands can be compacted by a smooth roller with or without vibration, depending on the water content of the soil being compacted. The lifts for compaction should be limited to 20 cm, or to a suitable thickness as assessed by test strips performed by the equipment which will be used at the time of construction.

When compacting the dense silty sand till on the dry side of the optimum, the compactive energy will frequently bridge over the chunks in the soil and be transmitted laterally into the soil mantle. Therefore, the lifts of this soil must be limited to 20 cm or less (before compaction). It is difficult to monitor the lifts of backfill placed in deep trenches; therefore, it is preferable that the compaction of backfill at depths over 1.0 m below the pavement subgrade be carried out on the wet side of the optimum. This would allow a wider latitude of lift thickness.

One should be aware that with considerable effort, a 90%± Standard Proctor compaction of the wet silt and sands is achievable. Further densification is prevented by the pore pressure induced by the compactive effort; however, large random voids will have been expelled, and with time the pore pressure will dissipate and the percentage of compaction will increase. There are many cases on record where after a few months of rest, the density of the compacted mantle has increased to over 95% of its maximum Standard Proctor dry density.

If the compaction of the soils is carried out with the water content within the range for 95% Standard Proctor dry density but on the wet side of the optimum, the surface of the compacted soil mantle will roll under the dynamic compactive load. This is unsuitable for road construction since each component of the pavement structure is to be placed under dynamic conditions which will induce the rolling action of the subgrade surface and cause structural failure of the new pavement. The foundations or bedding of the sewer and slab-on-grade will be placed on a subgrade which will not be subjected to impact loads. Therefore, the structurally compacted soil mantle with the water content on the wet side or dry side of the optimum will provide adequate subgrade strength for the project construction.

The presence of boulders in the till will prevent transmission of the compactive energy into the underlying material to be compacted. If an appreciable amount of boulders over 15 cm in size is mixed with the material, it must either be sorted or must not be used for structural backfill and/or construction of engineered fill.

5.0 GROUNDWATER CONDITIONS

Groundwater was detected at a depth of 5.5 m below the ground surface at Boreholes 4 and 5; all other boreholes remained dry upon completion of field work. The measured groundwater level is considered to represent the groundwater conditions at the site at the time of investigation. The groundwater level will fluctuate with the seasons.

The yield of groundwater from the silty sand till, due to its relatively low permeability, is expected to be slow to moderate and limited. The yield of groundwater, if encountered, from the sandy silt and sands will likely be moderate to appreciable and may be persistent.

6.0 DISCUSSION AND RECOMMENDATIONS

The investigation has disclosed that beneath a veneer of topsoil and a layer of disturbed/weathered soil, the site is underlain by strata of loose sandy silt, compact to dense, generally compact silty sand till and loose to very dense, generally compact sands.

Groundwater was detected at a depth of 5.5 m below the ground surface at Boreholes 4 and 5; all other boreholes remained dry upon completion of field work. The measured groundwater level is considered to represent the groundwater conditions at the site at the time of investigation. The groundwater level will fluctuate with the seasons.

The geotechnical findings which warrant special consideration are presented below:

1. The topsoil must be stripped for the project construction. This material is unsuitable for structural applications, and should only be placed in the landscaped areas. The topsoil should not be buried beneath the building envelope or deeper than 1.2 m below the finished grade.
2. The disturbed/weathered soil is not suitable for engineering applications. For structural use, it should be subexcavated, inspected, assessed, sorted free of organic matter and any deleterious materials, and properly compacted.
3. The natural soils are suitable for normal spread and strip footing construction. Due to the presence of topsoil and weathered soil, the footing subgrade must be inspected by a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, to ensure that its condition is compatible with the design of the foundation.

4. For slab-on-grade construction, any soft or loose soils should be subexcavated, aerated and properly compacted prior to the placement of the slab. Any new material for raising the grade should consist of organic-free soil compacted to at least 98% of its maximum Standard Proctor dry density. The slab should be constructed on a granular base, 20 cm thick, consisting of 20-mm Crusher-Run Limestone, or equivalent, compacted to its maximum Standard Proctor dry density.
5. A Class 'B' bedding, consisting of compacted 20-mm Crusher-Run Limestone, is recommended for the construction of the underground services. Where water-bearing silt and sands occur, the sewer joints should be leak-proof, or wrapped with an appropriate waterproof membrane, to prevent subgrade migration. Where extensive dewatering is required, a Class 'A' bedding can be considered.
6. Some of the revealed soils are highly frost susceptible with high soil-adfreezing potential. Where they are used to backfill against foundation walls, special measures must be incorporated into the building construction to prevent serious damage due to soil adfreezing.
7. The till contains occasional boulders and cobbles. Boulders over 15 cm in size must not be used for structural backfill and/or construction of engineered fill. Excavation into the till containing boulders will require extra effort and the use of a heavy-duty backhoe.

The recommendations appropriate for the project described in Section 2.0 are presented herein. One must be aware that the subsurface conditions may vary between boreholes. Should this become apparent during construction, a geotechnical engineer must be consulted to determine whether the following recommendations require revision.

6.1 **Foundations**

As a general guide for the design of house foundations, the recommended soil pressures and suitable founding levels, based on the borehole findings, are presented in Table 2.

Table 2 - Founding Levels

	Recommended Maximum Allowable Soil Pressure (SLS)/ Factored Ultimate Soil Bearing Pressure (ULS) and Suitable Founding Level					
	75 kPa (SLS) 120 kPa (ULS)		**100 kPa (SLS) 160 kPa (ULS)**		**200 kPa (SLS) 320 kPa (ULS)**	
BH No.	**Depth (m)**	**El. (m)**	**Depth (m)**	**El. (m)**	**Depth (m)**	**El. (m)**
1	-	-	-	-	1.6 or +	140.0 or -
2	-	-	1.0 or +	140.5 or -	4.6 or +	136.9 or -
3	-	-	1.0 or +	138.7 or -	4.6 or +	135.1 or -
4	-	-	1.0 or +	138.1 or -	4.6 or +	134.5 or -
5	1.0 or +	138.3 or -	-	-	4.6 or +	134.7 or -

The recommended soil pressures (SLS) for normal foundations incorporate a safety factor of 3. The total and differential settlements of the foundations are estimated to be 25 mm and 15 mm, respectively.

Foundations exposed to weathering or in unheated areas should be protected against frost action by a minimum of 1.2 m of earth cover, or must be properly insulated.

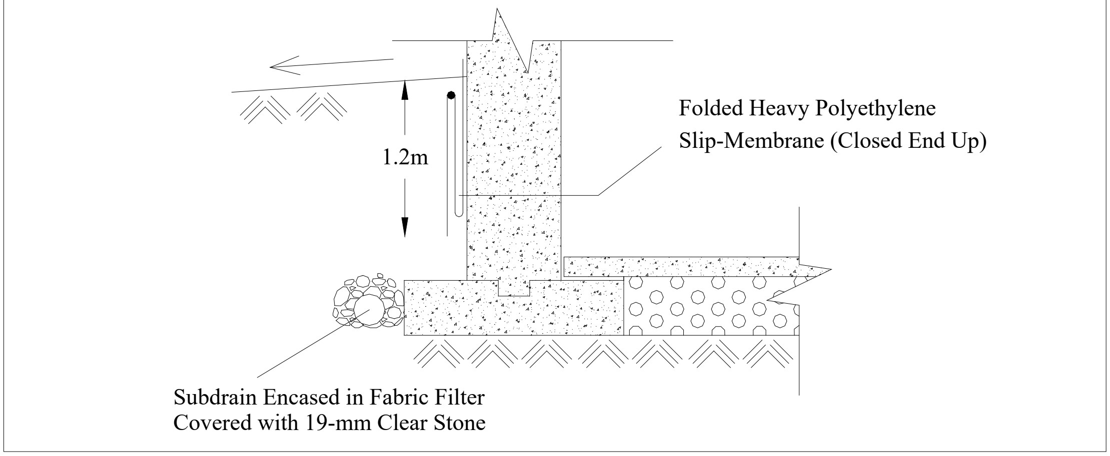
The footing subgrade should be inspected by a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, to ensure that the revealed conditions are compatible with the foundation design requirements.

Perimeter subdrains and dampproofing of the basement walls will be required. All the subdrains must be encased in a fabric filter to protect them against blockage by silting, and they must be connected to a positive outlet.

The foundations must meet the requirements specified by the latest Ontario Building Code, and the buildings must be designed to resist a minimum earthquake force using Site Classification ‘D’ (stiff soil).

Some of the occurring soils are high in frost heave and soil-adfreezing potential. If these soils are to be used for the foundation backfill, the foundation walls should be shielded by a polyethylene slip-membrane for protection against soil adfreezing. The recommended measures are schematically illustrated in Diagram 1.

Diagram 1 - Frost Protection Measures (Foundations)



The necessity to implement the above recommendations should be further assessed by a geotechnical engineer at the time of construction.

6.2 Engineered Fill

Where earth fill is required to raise the site, the engineering requirements for a certifiable fill for road construction, municipal services, slab-on-grade, and footings designed with a Maximum Allowable Soil Pressure (SLS) of 100 kPa and a Factored Ultimate Soil Bearing Pressure (ULS) of 160 kPa for normal footings are presented below:

1. The topsoil must be removed. The badly weathered soils must be inspected and proof-rolled prior to any fill placement, in order to assess any subexcavation requirements. The stripped surface must be surface compacted. The wet silt and sands, if any, should be stabilized by gravel prior to surface compaction.
2. Inorganic soils must be used, and they must be uniformly compacted in lifts 20 cm thick to 98% or + of their maximum Standard Proctor dry density up to the proposed finished grade. The soil moisture must be properly controlled near the optimum. If the house foundations are to be built soon after the fill placement, the densification process for the engineered fill must be increased to 100% of the maximum Standard Proctor compaction.
3. If the engineered fill is compacted with the moisture content on the wet side of the optimum, the underground services and pavement construction should not begin until the pore pressure within the fill mantle has completely dissipated. This must be further assessed at the time of the engineered fill construction.

4. If imported fill is to be used, it should be inorganic soils, free of any deleterious material with environmental issue (contamination). Any potential imported earth fill from off site must be reviewed for geotechnical and environmental quality by the appropriate personnel as authorized by the developer or agency, before it is hauled to the site.
5. If the engineered fill is to be left over the winter months, adequate earth cover or equivalent must be provided for protection against frost action.
6. The engineered fill must extend over the entire graded area; the engineered fill envelope and finished elevations must be clearly and accurately defined in the field, and they must be precisely documented by qualified surveyors. Foundations partially on engineered fill must be reinforced by two 15-mm steel reinforcing bars in the footings and upper section of the foundation walls, or be designed by a structural engineer, to properly distribute the stress induced by the abrupt differential settlement (about 15 mm) between the natural soil and engineered fill.
7. The engineered fill must not be placed during the period from late November to early April when freezing ambient temperatures occur either persistently or intermittently. This is to ensure that the fill is free of frozen soils, ice and snow.
8. Where the fill is to be placed on a bank steeper than 1 vertical:3 horizontal, the face of the bank must be flattened to 3 + so that it is suitable for safe operation of the compactor and the required compaction can be obtained.
9. Where the ground is wet due to subsurface water seepage, an appropriate subdrain scheme must be implemented prior to the fill placement, particularly if it is to be carried out on sloping ground.
10. The fill operation must be inspected on a full-time basis by a technician under the direction of a geotechnical engineer.
11. The footing and underground services subgrade must be inspected by the geotechnical consulting firm that supervised the engineered fill placement. This is to ensure that the foundations are placed within the engineered fill envelope, and the integrity of the fill has not been compromised by interim construction, environmental degradation and/or disturbance by the footing excavation.
12. Any excavation carried out in certified engineered fill must be reported to the geotechnical consultant who supervised the fill placement in order to document the locations of excavation and/or to supervise reinstatement of the excavated areas to engineered fill status. If construction on the engineered fill does not commence within a period of 2 years from the date of certification, the condition of the engineered fill must be assessed for re-certification.
13. Despite stringent control in the placement of the engineered fill, variations in soil type and density may occur in the engineered fill. Therefore, the strip footings and the upper section of the foundation walls constructed on the engineered fill may require

continuous reinforcement with steel bars, depending on the uniformity of the soils in the engineered fill and the thickness of the engineered fill underlying the foundations. Should the footings and/or walls require reinforcement, the required number and size of reinforcing bars must be assessed by considering the uniformity as well as the thickness of the engineered fill beneath the foundations. In sewer construction, the engineered fill is considered to have the same structural proficiency as a natural inorganic soil.

6.3 Slab-On-Grade

For slab-on-grade construction, the subgrade must consist of sound natural soils, or properly compacted inorganic soils, compacted to at least 98% of its maximum Standard Proctor dry density. The slab should be constructed on a granular base, 20 cm thick, consisting of 20-mm Crusher-Run Limestone, or equivalent, compacted to its maximum Standard Proctor dry density.

The sound natural soils are suitable for slab-on-grade construction. The weathered soils should be aerated and surface compacted for slab-on-grade construction.

A Modulus of Subgrade Reaction of 25 MPa/m is recommended for the design of the floor slab on sound native soils or on engineered fill.

The ground around the buildings must be graded to direct water away from the structures to minimize the frost heave phenomenon generally associated with the disclosed soils.

6.4 Underground Services

The subgrade for the underground services should consist of natural soils or compacted organic-free earth fill. Where topsoil, earth fill and soft soil are encountered, these materials must be subexcavated and replaced with properly compacted bedding material.

A Class ‘B bedding, consisting of compacted 20-mm Crusher-Run Limestone, is recommended for the construction of the underground services. The sewer joints should be leak-proof or wrapped with an appropriate waterproof membrane to prevent subgrade migration. Where extensive dewatering is required, a Class ‘A’ bedding can be considered.

In order to prevent pipe floatation when the sewer trench is deluged with water, a soil cover with a thickness equal to the diameter of the pipe should be in place at all times after completion of the pipe installation.

Openings to subdrains and catch basins should be shielded with a fabric filter to prevent blockage by silting.

6.5 Trench Backfilling

The on-site inorganic soils are suitable for trench backfill and the wet soils must be aerated before backfilling. In the zone within 1.0 m below the pavement subgrade, the backfill should be compacted to at least 98% of its maximum Standard Proctor dry density with the moisture content 2% to 3% drier than the optimum. In the lower zone, a 95% or + Standard Proctor compaction is considered to be adequate; however, the material should be compacted on the wet side of the optimum.

In normal underground services construction practice, the problem areas of road settlement largely occur adjacent to manholes, catch basins, services crossings, foundation walls and columns, and it is recommended that a sand backfill be used. The areas at the interface of the native soil and the sand backfill should preferably be flooded for several days.

The narrow trenches should be cut at 1 vertical:2 or + horizontal so that the backfill can be effectively compacted. Otherwise, soil arching will prevent the achievement of proper compaction. The lift of each backfill layer should either be limited to a thickness of 20 cm, or the thickness should be determined by test strips.

One must be aware of the possible consequences during trench backfilling and exercise caution as described below:

- When construction is carried out in freezing winter weather, allowance should be made for these following conditions. Despite stringent backfill monitoring, frozen soil layers may inadvertently be mixed with the structural trench backfill. Should the in situ soils have a water content on the dry side of the optimum, it would be impossible to wet the soils due to the freezing condition, rendering difficulties in obtaining uniform and proper compaction. Furthermore, the freezing condition will prevent flooding of the backfill when it is required, such as in a narrow vertical trench section, or when the trench box is removed. The above will invariably cause backfill settlement that may become evident within 1 to several years, depending on the depth of the trench which has been backfilled.
- In areas where the underground services construction is carried out during winter months, prolonged exposure of the trench walls will result in frost heave within the soil mantle of the walls. This may result in some settlement as the frost recedes, and

repair costs will be incurred prior to final surfacing of the new pavement and the slab-on-grade construction.

- To backfill a deep trench, one must be aware that future settlement is to be expected, unless the side of the cut is flattened to at least 1 vertical:1.5 + horizontal, and the lifts of the fill and its moisture content are stringently controlled; i.e., lifts should be no more than 20 cm (or less if the backfilling conditions dictate) and uniformly compacted to achieve at least 95% of the maximum Standard Proctor dry density, with the moisture content on the wet side of the optimum.
- It is often difficult to achieve uniform compaction of the backfill in the lower vertical section of deep trench which is an open cut or is stabilized by a trench box, particularly in the sector close to the trench walls or the sides of the box. These sectors must be backfilled with sand. In a trench stabilized by a trench box, the void left after the removal of the box will be filled by the backfill. It is necessary to backfill this sector with sand, and the compacted backfill must be flooded for 1 day, prior to the placement of the backfill above this sector, i.e., in the upper sloped trench section. This measure is necessary in order to prevent consolidation of inadvertent voids and loose backfill which will compromise the compaction of the backfill in the upper section. In areas where groundwater movement is expected in the sand fill mantle, anti-seepage collars should be provided.

6.6 Pavement Design

Based on the borehole findings, the recommended pavement design for local roads is presented in Table 3.

Table 3 - Pavement Design

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	40	HL-3
Asphalt Binder	50	HL-8
Granular Base	150	Granular ‘A’ or equivalent
Granular Sub-base	300	Granular ‘B’ or equivalent

In preparation of the subgrade, the subgrade surface should be proof-rolled; any soft subgrade, organics and deleterious materials within 1.0 m below the underside of the granular sub-base should be subexcavated and replaced by properly compacted organic-free earth fill or granular material.

All the granular bases should be compacted to their maximum Standard Proctor dry density.

In the zone within 1.0 m below the pavement subgrade, the backfill should be compacted to at least 98% of its maximum Standard Proctor dry density, with the water content 2% to 3% drier than the optimum. In the lower zone, a 95% or + Standard Proctor compaction is considered adequate.

The road subgrade will suffer a strength regression if water is allowed to infiltrate prior to paving. The following measures should therefore be incorporated in the construction procedures and road design:

- If the road construction does not immediately follow the trench backfilling, the subgrade should be properly crowned and smooth-rolled to allow interim precipitation to be properly drained.
- Lot areas adjacent to the roads should be properly graded to prevent the ponding of large amounts of water during the interim construction period.
- Curb subdrains will be required. The subdrains should consist of filter-sleeved weepers to prevent blockage by silting.
- If the roads are to be constructed during the wet seasons and extensively soft subgrade occurs, the granular sub-base may require thickening. This can be assessed during construction.

6.7 Soil Parameters

The recommended soil parameters for the project design are given in Table 4.

Table 4 - Soil Parameters

Unit Weight and Bulk Factor

	Unit Weight (kN/m^3)	Estimated Bulk Factor	
	Bulk	Loose	Compacted
Weathered Soil	20.5	1.20	0.95
Sound Till	22.0	1.33	1.03
Silt and Sands	20.5	1.20	0.98

Table 4 - Soil Parameters (cont'd)

Lateral Earth Pressure Coefficients	**Active** **K_a**	**At Rest** **K_o**	**Passive** **K_p**
Sound Till	0.30	0.40	3.33
Silt and Sands	0.33	0.43	3.00

6.8 Excavation

Excavation should be carried out in accordance with Ontario Regulation 213/91.

Excavation into the till containing boulders will require extra effort and the use of a heavy-duty, properly equipped backhoe.

For excavation purposes, the types of soils are classified in Table 5.

Table 5 - Classification of Soils for Excavation

Material	**Type**
Sound Till	2
Silt and Sands above groundwater	3
Silt and Sands below groundwater	4

The groundwater yield from the silty sand till, due to its relatively low permeability, will be small to moderate and limited and can be controlled by pumping from sumps. The yield of groundwater, if encountered in the silt and sands is expected to be moderate to appreciable and may be persistent, and the groundwater may be controllable by pumping from closely spaced sumps or, if necessary, by the use of a well-point dewatering system. The appropriate method of dewatering should be assessed by a hydrogeological study.

Prospective contractors must be asked to assess the in situ subsurface conditions for soil cuts by digging test pits to at least 0.5 m below the intended bottom of excavation. These test pits should be allowed to remain open for a period of at least 4 hours to assess the trenching conditions.

7.0 LIMITATIONS OF REPORT

This report was prepared by Soil Engineers Ltd. for the account of Highglen Homes Limited, and for review by their designated consultants and government agencies. Use of the report is subject to the conditions and limitations of the contractual agreement. The material in the report reflects the judgement of Frank Lee, P. Eng. and Bernard Lee, P.Eng., in light of the information available to it at the time of preparation. Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. Soil Engineers Ltd. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

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LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report, are as follows:

SAMPLE TYPES

AS	Auger sample
CS	Chunk sample
DO	Drive open (split spoon)
DS	Denison type sample
FS	Foil sample
RC	Rock core (with size and percentage recovery)
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

PENETRATION RESISTANCE

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows for each foot of penetration of a 2-inch diameter, 90° point cone driven by a 140-pound hammer falling 30 inches.

Plotted as '—●—'

Standard Penetration Resistance or 'N' Value:

The number of blows of a 140-pound hammer falling 30 inches required to advance a 2-inch O.D. drive open sampler one foot into undisturbed soil.

Plotted as '○'

WH	Sampler advanced by static weight
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure
NP	No penetration

SOIL DESCRIPTION

Cohesionless Soils:

'N' (blows/ft)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

Cohesive Soils:

Undrained Shear Strength (ksf)	'N' (blows/ft)	Consistency
less than 0.25	0 to 2	very soft
0.25 to 0.50	2 to 4	soft
0.50 to 1.0	4 to 8	firm
1.0 to 2.0	8 to 16	stiff
2.0 to 4.0	16 to 32	very stiff
over 4.0	over 32	hard

Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0	Field vane test in borehole; the number denotes the sensitivity to remoulding
△	Laboratory vane test
☐	Compression test in laboratory

For a saturated cohesive soil, the undrained shear strength is taken as one half of the undrained compressive strength

METRIC CONVERSION FACTORS

1 ft = 0.3048 metres

1lb = 0.454 kg

1 inch = 25.4 mm

1ksf = 47.88 kPa

JOB NO.: 1911-S057

LOG OF BOREHOLE NO.: 1

FIGURE NO.: 1

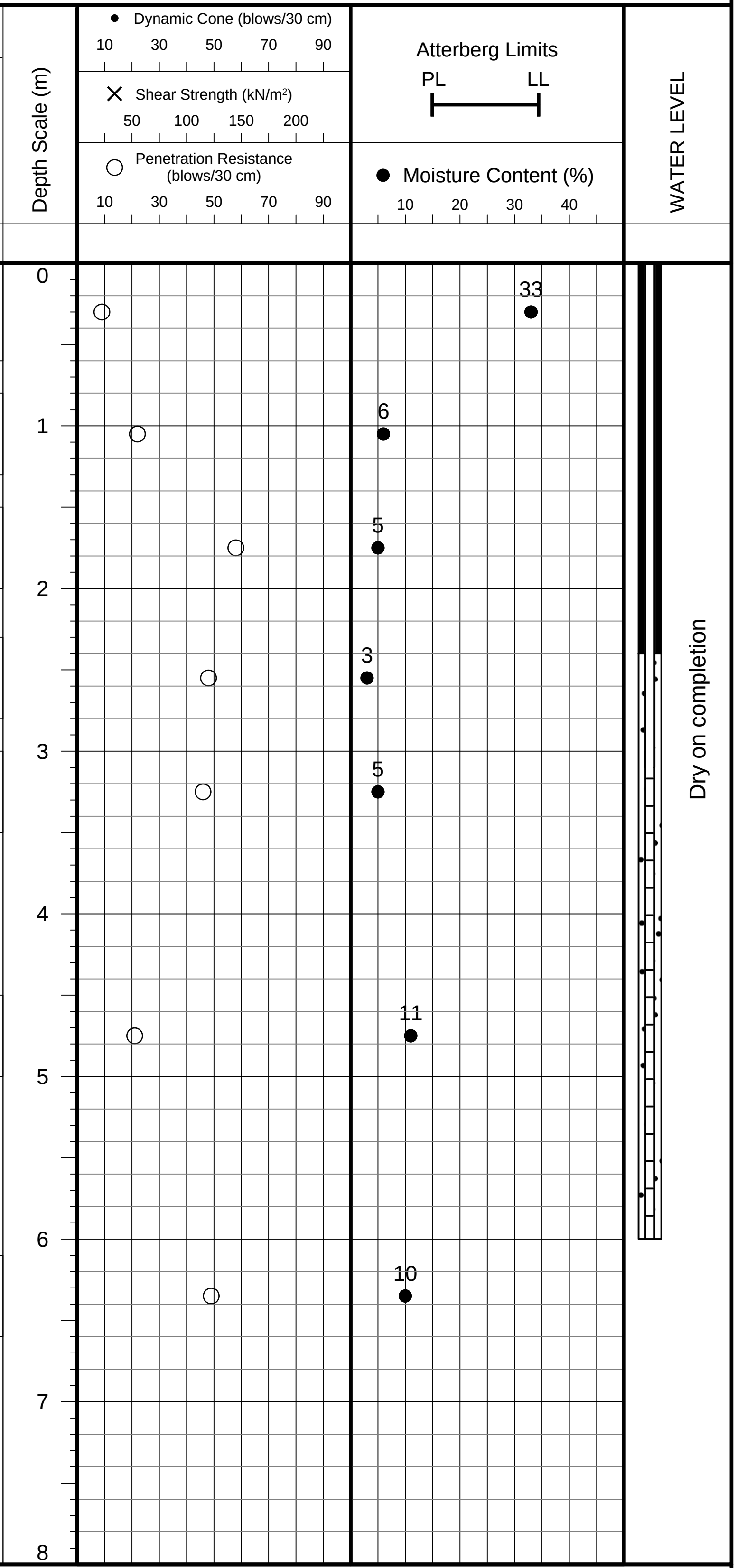
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 230 Finch Avenue
(Part 4, Plan #40 R-29767)
City of Pickering

DRILLING DATE: December 12, 2019

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
141.6	Ground Surface			
0.0	**30 cm TOPSOIL**	1	DO	9
	Brown **DISTURBED/WEATHERED SOIL** sand with gravel and rock fragments	2	DO	22
140.2 1.4	Brown, dense to very dense **GRAVELLY SAND**	3	DO	58
		4	DO	48
138.7 2.9	Brown, dense **MEDIUM TO COARSE SAND** some silt	5	DO	46
137.6 4.0	Grey, compact to dense **SILTY SAND TILL** occ. wet sand and silt seams and layers cobbles and boulders	6	DO	21
		7	DO	49
135.0 6.6	**END OF BOREHOLE** Installed 50 mm Ø monitoring well to 6.0 m sand backfill from 2.4 to 6 m Bentonite from 0 to 2.4 m provided with a steel protective casing			



Soil Engineers Ltd.

JOB NO.: 1911-S057

LOG OF BOREHOLE NO.: 2

FIGURE NO.: 2

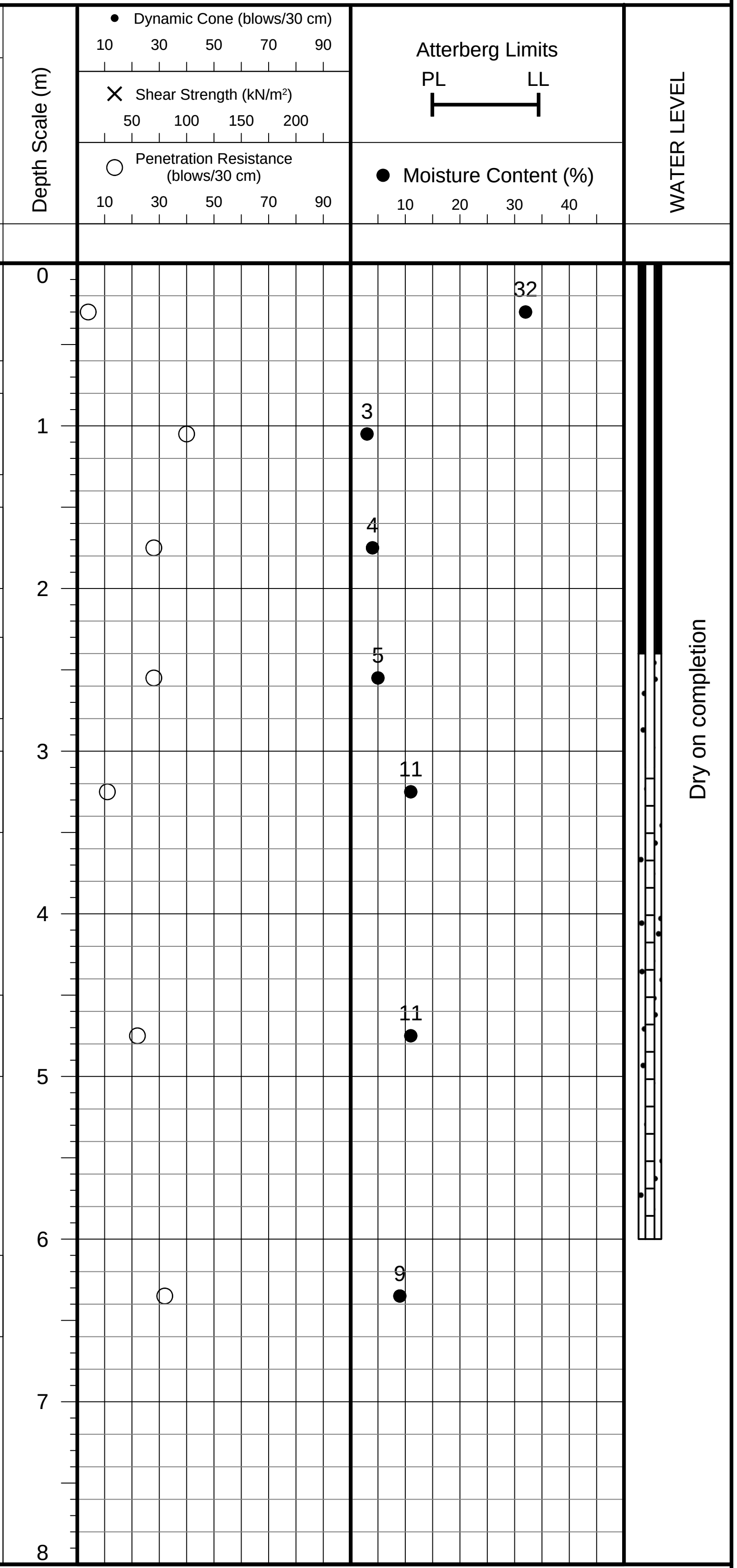
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 230 Finch Avenue
(Part 4, Plan #40 R-29767)
City of Pickering

DRILLING DATE: December 12, 2019

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
141.5	Ground Surface			
0.0	**36 cm TOPSOIL**	1	DO	4
	Brown **DISTURBED/WEATHERED SOIL** sand with gravel and cobbles			
140.8 0.7	Brown, compact to dense **GRAVELLY SAND**	2	DO	40
		3	DO	28
139.4 2.1	Brown, compact **FINE TO COARSE SAND** some silt	4	DO	28
138.6 2.9	Compact to dense **SILTY SAND TILL** occ. wet sand and silt seams and layers cobbles and boulders — brown / grey	5	DO	11
		6	DO	22
		7	DO	32
134.9 6.6	**END OF BOREHOLE** Installed 50 mm Ø monitoring well to 6.0 m sand backfill from 2.4 to 6 m Bentonite from 0 to 2.4 m provided with a steel protective casing			



Soil Engineers Ltd.

JOB NO.: 1911-S057

LOG OF BOREHOLE NO.: 3

FIGURE NO.: 3

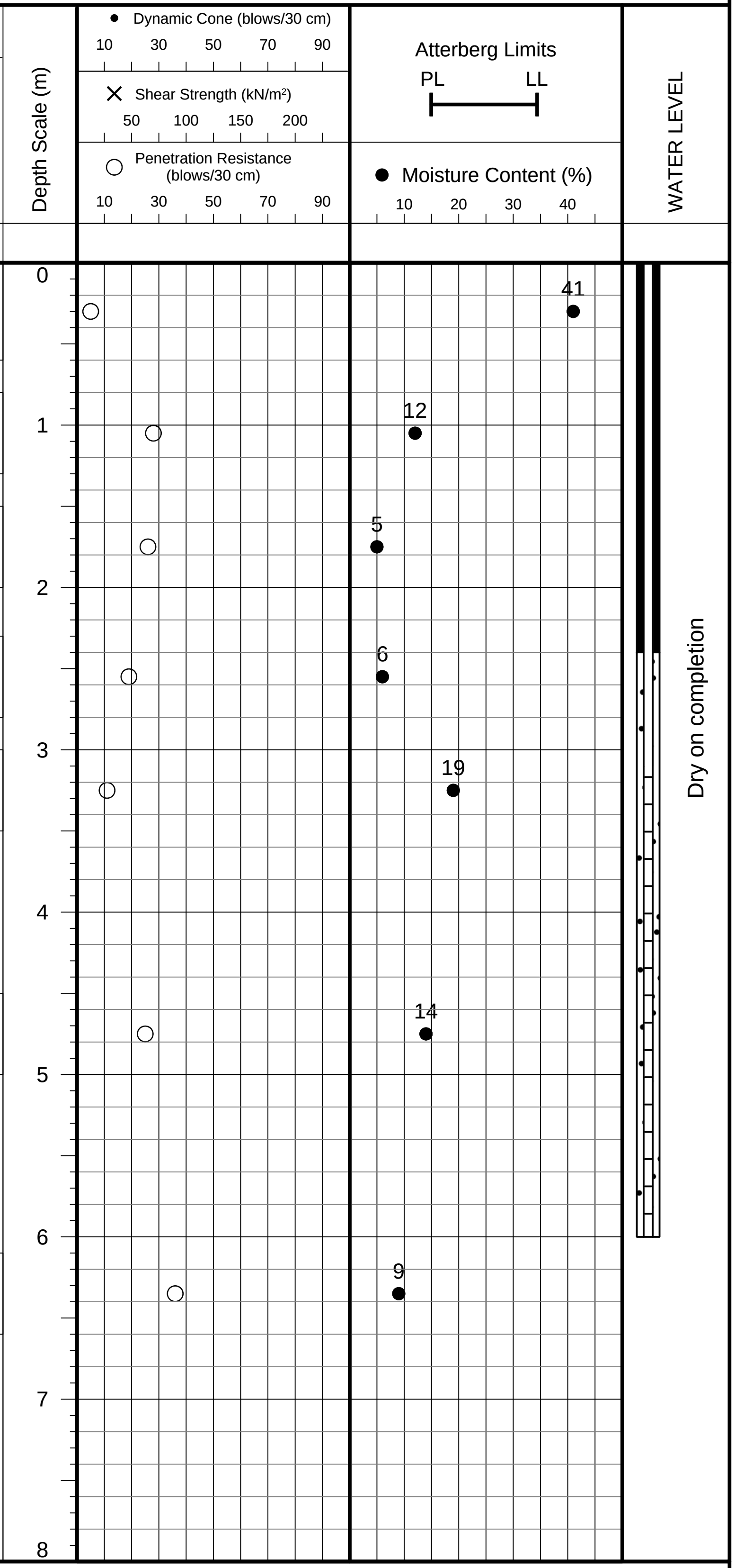
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 230 Finch Avenue
(Part 4, Plan #40 R-29767)
City of Pickering

DRILLING DATE: December 12, 2019

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
139.7	Ground Surface			
0.0	**36 cm TOPSOIL**			
	Brown **DISTURBED/WEATHERED SOIL** sand with gravel	1	DO	5
139.0 0.7	Brown, compact **FINE TO COARSE SAND** some silt	2	DO	28
		3	DO	26
		4	DO	19
136.8 2.9	Brown, compact **SILTY FINE SAND**	5	DO	11
135.7 4.0	Compact to dense **SILTY SAND TILL** occ. wet sand and silt seams and layers cobbles and boulders	6	DO	25
	brown grey	7	DO	36
133.1 6.6	**END OF BOREHOLE** Installed 50 mm Ø monitoring well to 6.0 m sand backfill from 2.4 to 6 m Bentonite from 0 to 2.4 m provided with a steel protective casing			



Soil Engineers Ltd.

JOB NO.: 1911-S057

LOG OF BOREHOLE NO.: 4

FIGURE NO.: 4

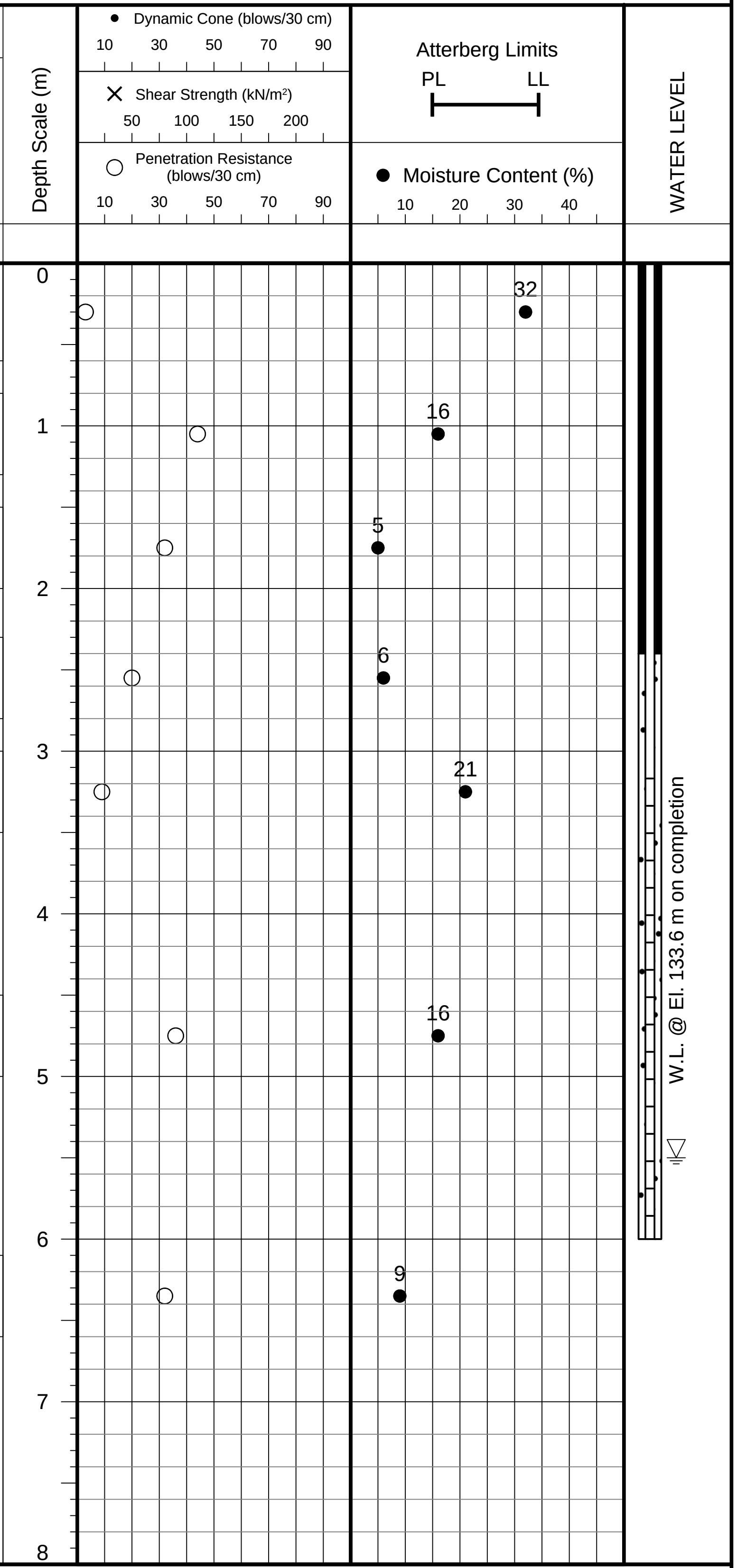
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 230 Finch Avenue
(Part 4, Plan #40 R-29767)
City of Pickering

DRILLING DATE: December 12, 2019

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Moisture Content (%)
139.1	Ground Surface				
0.0	**30 cm TOPSOIL** Brown **DISTURBED/WEATHERED SOIL** sand a trace of gravel	1	DO	3	32
138.4 0.7	Brown, compact to dense **FINE TO COARSE SAND** some silt	2	DO	44	16
		3	DO	32	5
		4	DO	20	6
136.2 2.9	Brown, loose **SILTY FINE SAND**	5	DO	9	21
135.1 4.0	Grey, dense **GRAVELLY SAND**	6	DO	36	16
133.6 5.5	Grey, dense **SILTY SAND TILL**	7	DO	32	9
132.5 6.6	**END OF BOREHOLE** Installed 50 mm Ø monitoring well to 6.0 m sand backfill from 2.4 to 6 m Bentonite from 0 to 2.4 m provided with a steel protective casing				



Soil Engineers Ltd.

JOB NO.: 1911-S057

LOG OF BOREHOLE NO.: 5

FIGURE NO.: 5

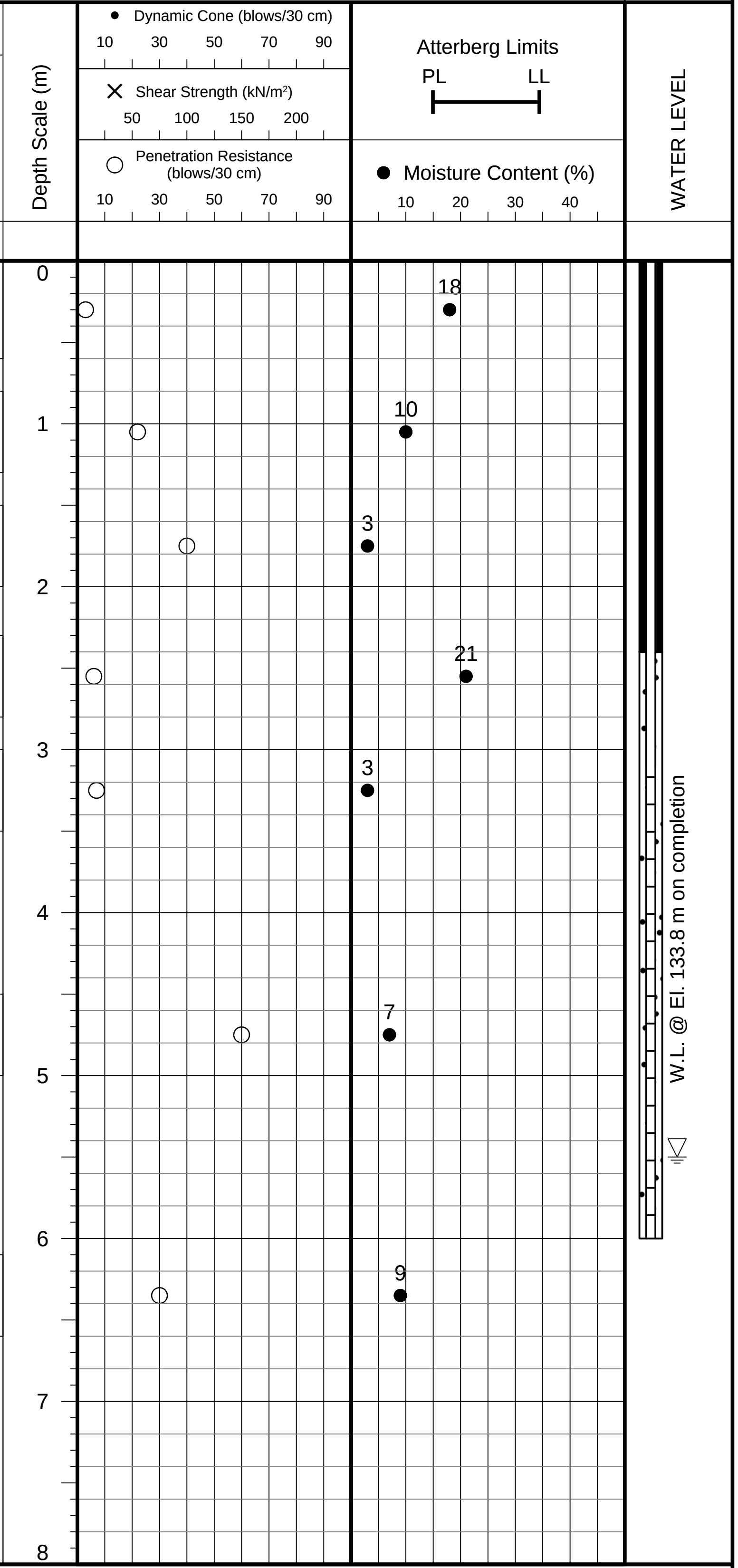
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 230 Finch Avenue
(Part 4, Plan #40 R-29767)
City of Pickering

DRILLING DATE: December 12, 2019

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
139.3	Ground Surface			
0.0	**25 cm TOPSOIL** Brown **DISTURBED/WEATHERED SOIL** sand a trace of gravel	1	DO	3
138.6 0.7	Brown, compact to dense **FINE TO COARSE SAND** some silt	2	DO	22
		3	DO	40
137.2 2.1	Brown, loose **SANDY SILT**	4	DO	6
136.4 2.9	Brown, loose **FINE TO COARSE SAND** some silt	5	DO	7
135.3 4.0	Brown, very dense **GRAVELLY SAND**	6	DO	60
133.8 5.5	Grey, compact **SILTY SAND TILL**	7	DO	30
132.7 6.6	**END OF BOREHOLE** Installed 50 mm Ø monitoring well to 6.0 m sand backfill from 2.4 to 6 m Bentonite from 0 to 2.4 m provided with a steel protective casing			



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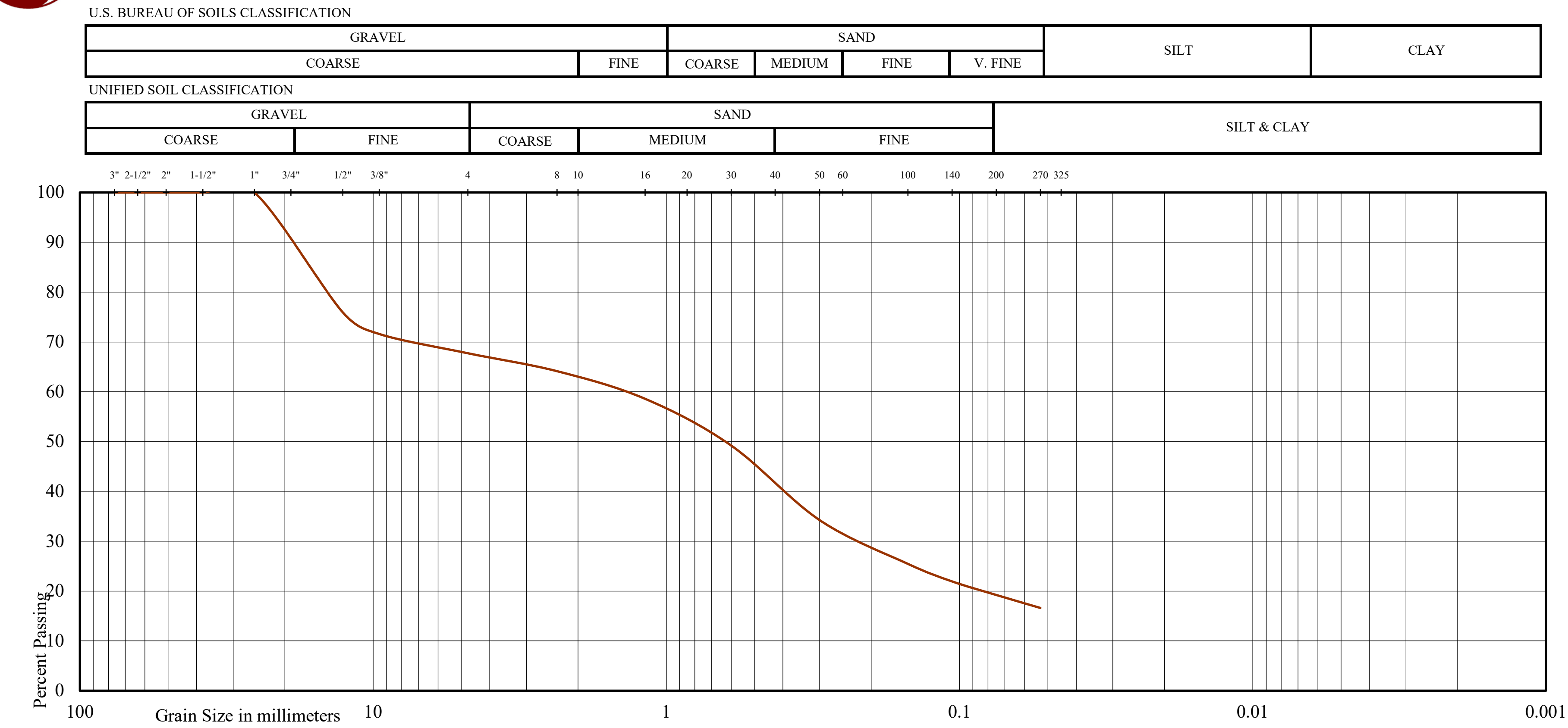
GRAIN SIZE DISTRIBUTION

Reference No: 1911-S057



Project: Proposed Residential Development

Location: 230 Finch Avenue (Part 4, Plan #40 R-29767), City of Pickering

Borehole No: 1

Sample No: 1

Depth (m): 0.3

Elevation (m): 141.3

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = 33

Estimated Permeability

(cm./sec.) = 10^{-3}

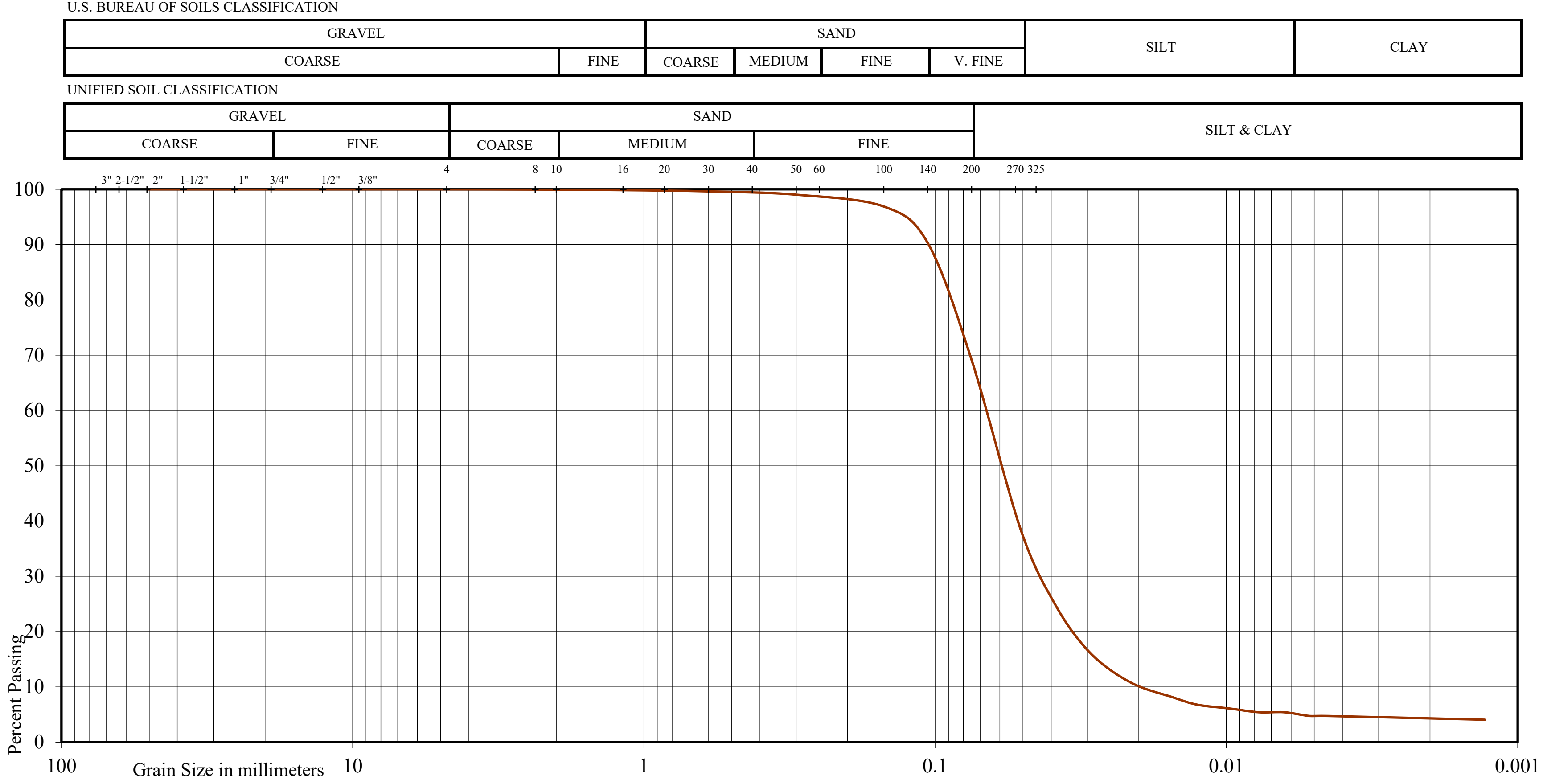
Classification of Sample [& Group Symbol]: GRAVELLY SAND, some silt

Figure: 6

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 1911-S057



Project: Proposed Residential Development

Location: 230 Finch Avenue (Part 4, Plan #40 R-29767), City of Pickering

Liquid Limit (%) = -

Plastic Limit (%) = -

Borehole No: 5

Plasticity Index (%) = -

Sample No: 4

Moisture Content (%) = 21

Depth (m): 2.5

Estimated Permeability

Elevation (m): 136.8

(cm./sec.) = 10^{-4}

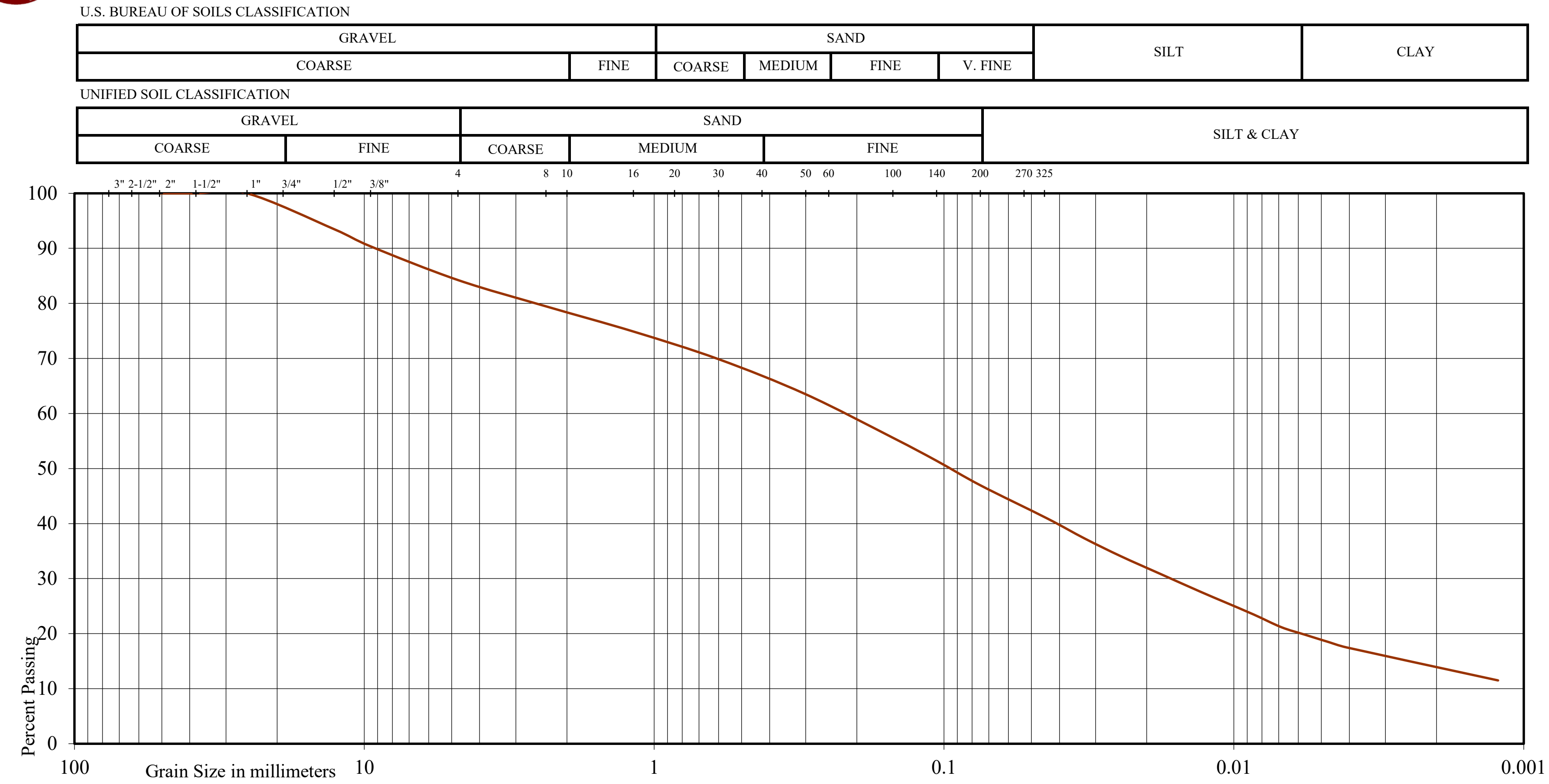
Classification of Sample [& Group Symbol]: SANDY SILT, a trace of clay

Figure: 7

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 1911-S057



Project: Proposed Residential Development

Location: 230 Finch Avenue (Part 4, Plan #40 R-29767), City of Pickering

Borehole No: 1

Sample No: 7

Depth (m): 6.3

Elevation (m): 135.3

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = 10

Estimated Permeability (cm./sec.) = 10^{-6}

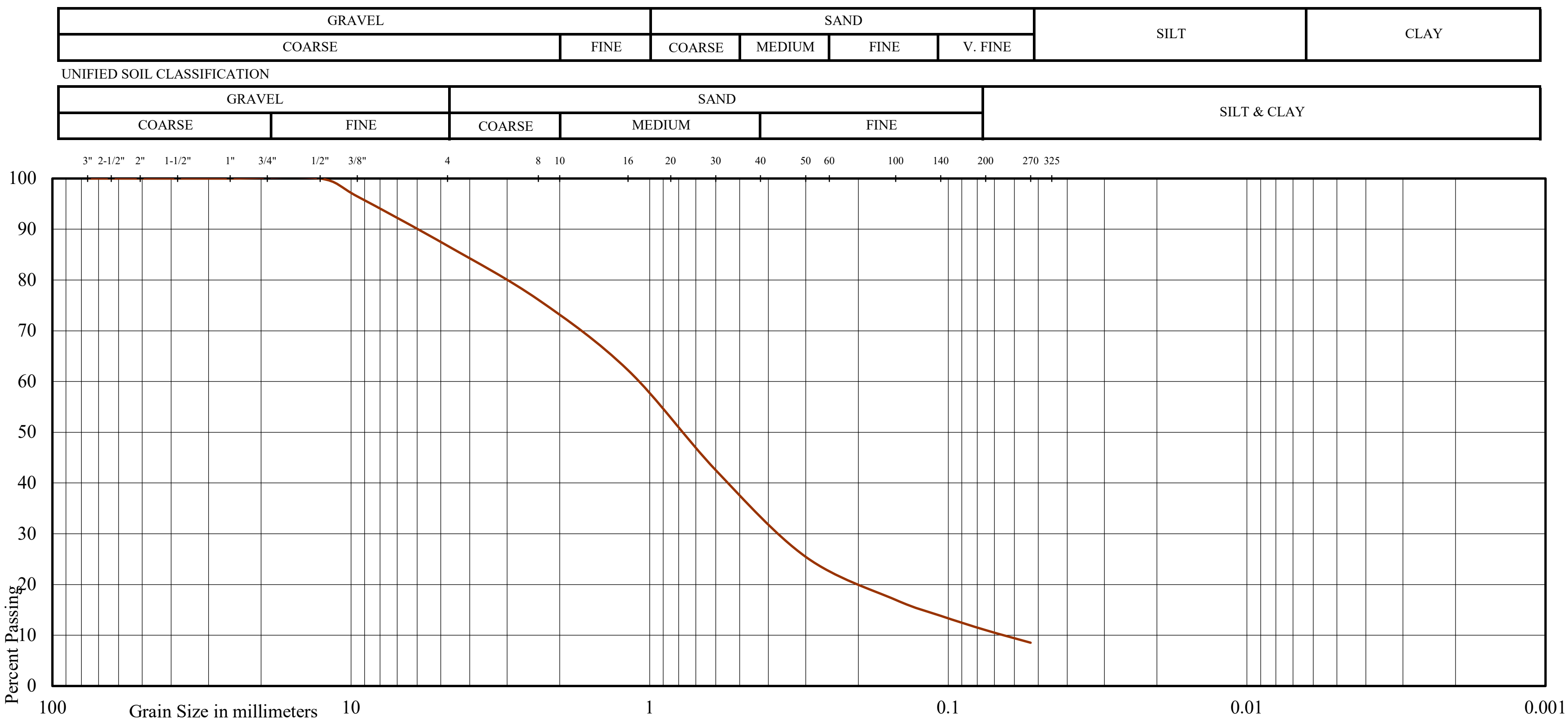
Classification of Sample [& Group Symbol]: SILTY SAND TILL, some clay and gravel

Figure: 8

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 1911-S057



Project: Proposed Residential Development

Location: 230 Finch Avenue (Part 4, Plan #40 R-29767), City of Pickering

Borehole No: 2

Sample No: 4

Depth (m): 2.5

Elevation (m): 139.0

Liquid Limit (%) = -

Plastic Limit (%) = -

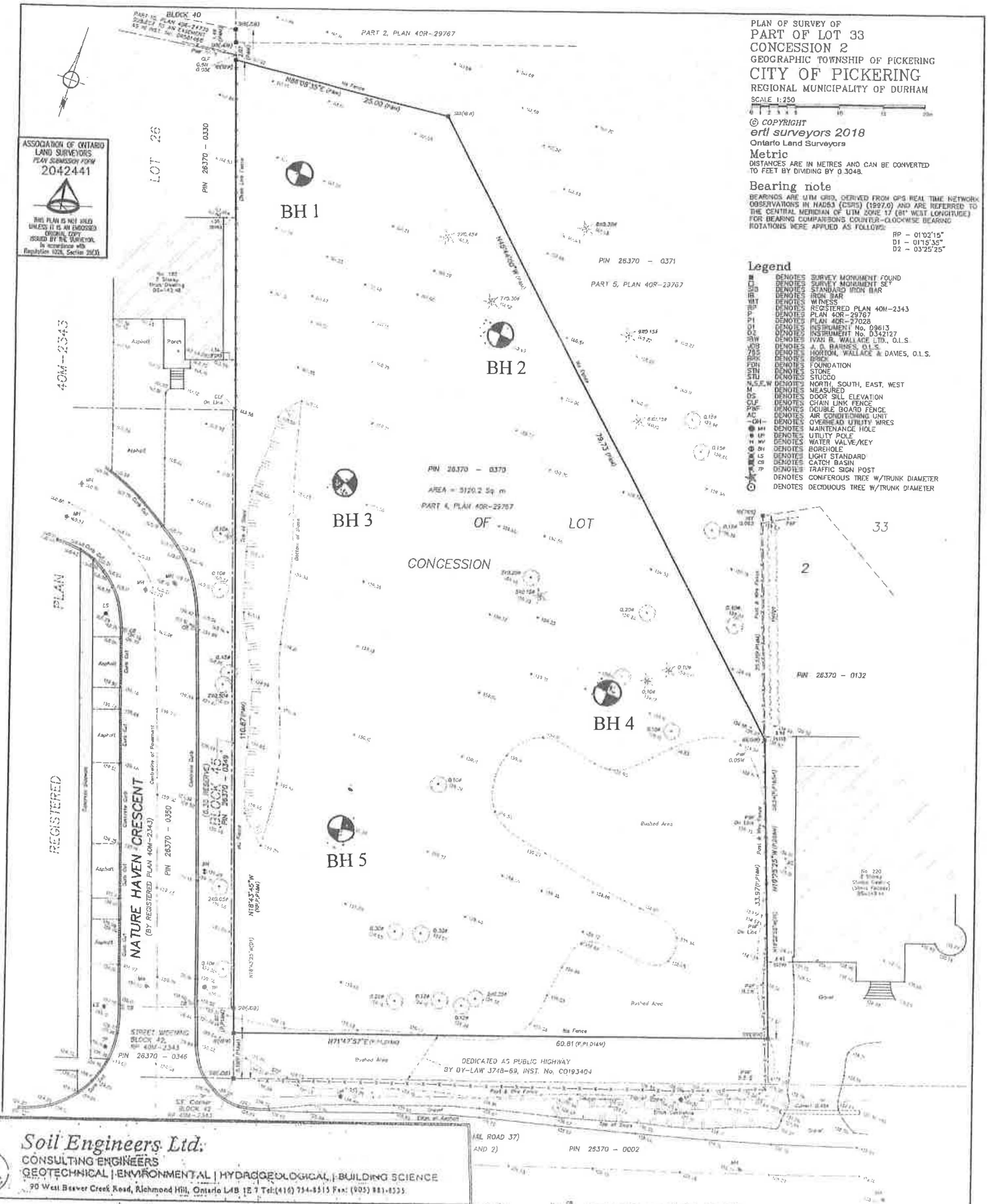
Plasticity Index (%) = -

Moisture Content (%) = 5

Estimated Permeability (cm./sec.) = 10^{-2}

Classification of Sample [& Group Symbol]: FINE TO COARSE SAND, some silt and gravel

Figure: 9



ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
2042441

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PLAN OF SURVEY OF
PART OF LOT 33
CONCESSION 2
GEOGRAPHIC TOWNSHIP OF PICKERING
CITY OF PICKERING
REGIONAL MUNICIPALITY OF DURHAM
SCALE 1:250

Ontario Land Surveyors

Metric

DISTANCES ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

Bearing note

BEARINGS ARE UTM GRID, DERIVED FROM GPS REAL TIME NETWORK OBSERVATIONS IN NAD83 (CSRS) (1997.0) AND ARE REFERRED TO THE CENTRAL MERIDIAN OF UTM ZONE 17 (81° WEST LONGITUDE) FOR BEARING COMPARISONS COUNTER-CLOCKWISE BEARING ROTATIONS WERE APPLIED AS FOLLOWS:

RP – 01°02'15"
D1 – 01°15'35"
D2 – 03°25'25"

Legend

■	DENOTES	SURVEY MONUMENT FOUND
□	DENOTES	SURVEY MONUMENT SET
SIB	DENOTES	STANDARD IRON BAR
IB	DENOTES	IRON BAR
WIT	DENOTES	WITNESS
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P	DENOTES	PLAN 40R-29767
P1	DENOTES	PLAN 40R-27028
D1	DENOTES	INSTRUMENT No. D9613
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BRK	DENOTES	BRICK
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STN	DENOTES	STONE
STU	DENOTES	STUCCO
N,S,E,W	DENOTES	NORTH, SOUTH, EAST, WEST
M	DENOTES	MEASURED
DS	DENOTES	DOOR SILL ELEVATION
CLF	DENOTES	CHAIN LINK FENCE
PBF	DENOTES	DOUBLE BOARD FENCE
AC	DENOTES	AIR CONDITIONING UNIT
–OH–	DENOTES	OVERHEAD UTILITY WIRES
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● UP	DENOTES	UTILITY POLE
WV	DENOTES	WATER VALVE/KEY
⊕ BH	DENOTES	BOREHOLE
LS	DENOTES	LIGHT STANDARD
CB	DENOTES	CATCH BASIN
TP	DENOTES	TRAFFIC SIGN POST
✳	DENOTES	CONIFEROUS TREE W/TRUNK DIAMETER
⊙	DENOTES	DECIDUOUS TREE W/TRUNK DIAMETER

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE
90 West Beaver Creek Road, Richmond Hill, Ontario L4B 1E7 Tel:(416) 754-8515 Fax: (905) 881-8335

BOREHOLE LOCATION PLAN

DESIGNED	CHECKED	DWG NO. 1	REV
SCALE As Shown	REF. NO. 1911-S057	DATE February 2020	

or's Certificate

HAT :
VEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE
CT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM.
VEY WAS COMPLETED ON THE 22nd DAY OF JANUARY, 2018.

23, 2018

Lawrence O. Ertl
Ontario Land Surveyor

ertl surveyors
Ontario Land Surveyors
www.es-ols.com
1234 REID STREET, UNIT 10, RICHMOND HILL L4B 1C1
TELEPHONE (905) 731-7834 FAX (905)731-7852 EMAIL info@es-ols.com
DRAWING : 18081-NatureHaven Finch-TO.DWG PROJECT : 18081
CALC. BY CL. DRAWN BY DH. CHECKED BY CL.

Soil Engineers Ltd.
CONSULTING ENGINEERS
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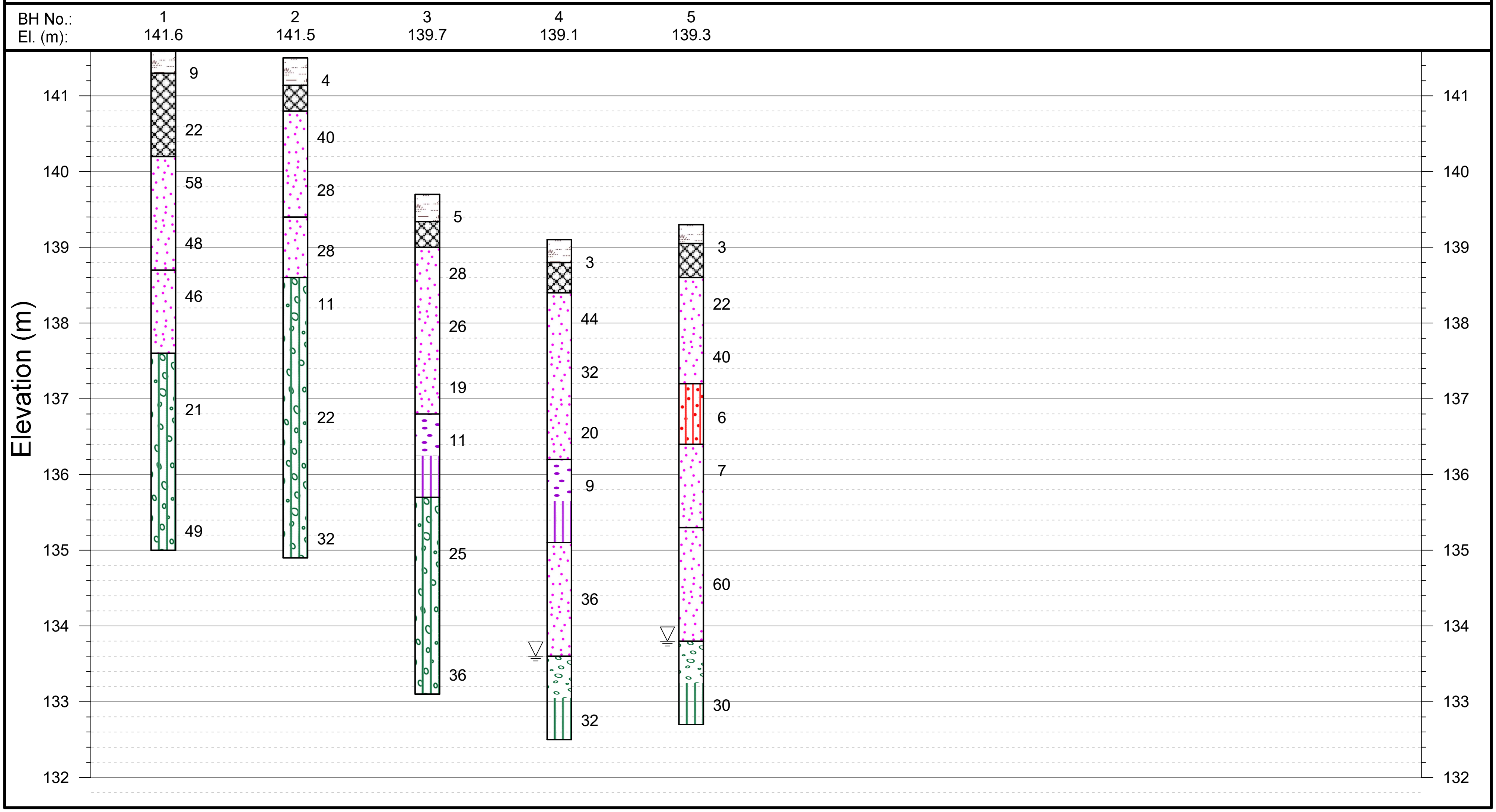
SUBSURFACE PROFILE
DRAWING NO. 2
SCALE: AS SHOWN

JOB NO.: 1911-S057
REPORT DATE: February 2020
PROJECT DESCRIPTION: Proposed Residential Development

PROJECT LOCATION: 230 Finch Avenue
(Part 4, Plan #40 R-29767)
City of Pickering

LEGEND

▤ TOPSOIL
▦ FILL
⁘ SAND
▥ SILTY SAND
▥ SILTY SAND TILL
▥ SANDY SILT
▽ WATER LEVEL (END OF DRILLING)



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90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	MUSKOKA	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 684-4242	TEL: (905) 777-7956
FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

August 18, 2023

Reference No. 1911-W057

Highglen Homes Limited
10148 Warden Avenue
Markham, Ontario
L6C 1N3

Attention: Mr. Johan Perciasepe

Re: Spring Season Groundwater Level Monitoring
Proposed Residential Development
230 Finch Avenue. Part 4, Plan # 40 R-29767
Town of Pickering

Dear Sir:

Soil Engineers Ltd. (SEL) conduct a spring groundwater table monitoring program at the captioned property located, at 230 Finch Avenue, Town of Pickering (the Subject Site). This letter presents the results for the Spring, seasonal high groundwater table monitoring program.

Background Review

A spring season groundwater level monitoring program was carried out at the Subject Site, at the location shown on **Drawing No. 1**. The study was authorized in support of a proposed residential development. The purpose of the groundwater monitoring program is to verify the seasonal spring high groundwater levels and their associated fluctuations beneath the Subject Site.

Shallow groundwater level monitoring program was conducted at the monitoring wells, that were previously installed on the Subject Site by SEL as a part of the geotechnical investigation (SEL Reference No.: 1911-S057), and the hydrogeological assessment (SEL Reference No.: 1911-W057).

The groundwater levels within the monitoring wells were manually recorded during six (6) monitoring events, including three (3) monitoring events conducted for the hydrogeological assessment in January 2020, and three (3) monitoring events completed during the spring 2023 (between April 14 and June 19, 2023). A summary of the groundwater monitoring program is presented in **Table 1**. The locations of the monitoring wells are shown on **Drawing No. 2**.

Table 1-Groundwater Level Monitoring Details

Well ID		Jan. 8, 2020	Jan. 14, 2020	Jan. 28, 2020	April 14, 2023	May 15, 2023	June 19, 2023
BH/MW 1	mbgs	3.79	3.40	3.67	3.64	3.86	4.0
	masl	137.81	138.2	137.93	137.96	137.74	137.6
BH/MW 2	mbgs	3.53	2.96	3.2	2.96	3.3	3.6
	masl	137.97	138.54	138.3	138.54	138.2	137.9
BH/MW 3	mbgs	2.92	2.58	2.43	2.3	2.59	2.84
	masl	136.78	137.12	137.27	137.4	137.11	136.86
BH/MW 4	mbgs	3.34	2.96	2.86	2.51	2.91	2.91
	masl	135.76	136.14	136.24	136.59	136.19	136.19
BH/MW 5	mbgs	3.39	3.01	2.9	2.6	2.91	2.91
	masl	135.91	136.29	136.4	136.7	136.39	136.39

mbgs: metres below ground surface *masl : metres above sea level*

Discussion

The measured groundwater levels elevations ranged from 136.19 to 138.54 metres above sea level (masl) during the three (3) spring monitoring events. The highest shallow groundwater level was measured in BH/MW 2 on April 14, 2023.

The groundwater levels were at their lowest during the April 14, 2023 monitoring event for all the monitoring wells.

We trust that this correspondence addresses your current requirements and ask that you contact us should you have any questions or require additional information.

Yours truly,
SOIL ENGINEERS LTD.

Bhawandeep Singh Brar, B.Sc

Gavin O'Brien, M.Sc., P.Geo.

BB/GO

ENCLOSURES

Site Location Plan	Drawing No. 1
Borehole and Monitoring Well Location Plan	Drawing No. 2

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

C:\GIS2019\1911-W057\

Source: Ministry of Natural Resources and Forestry
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N

▭	Approximate Boundary of Subject Site
→	Watercourse
—	Local Road

Soil Engineers Ltd.

Title: Site Location Plan

Project:

Groundwater Monitoring
Proposed Residential Development
230 Finch Avenue
City of Pickering

Reference No. 1911-W057

Date: August 18, 2023

Scale:
0 5 10 20 30 40 50
Metres

Drawing No. 1

Source: Ministry of Natural Resources and Forestry
©Queen's Printer for Ontario, 2019

N

🟥	Approximate Boundary of Subject Site
⊕	Borehole with Monitoring Well
→	Watercourse
—	Local Road

Soil Engineers Ltd.

Title: Borehole and Monitoring
Well Location Plan

Project:

Groundwater Monitoring
Proposed Residential Development
230 Finch Avenue
City of Pickering

Reference No. 1911-W057

Date: August 18, 2023

Scale:
0 2.5 5 10 15 20 25
Metres

Drawing No. 2

APPENDIX “H”

Topographic Survey

PLAN OF SURVEY OF

PART OF LOT 33
CONCESSION 2

GEOGRAPHIC TOWNSHIP OF PICKERING

CITY OF PICKERING

REGIONAL MUNICIPALITY OF DURHAM

SCALE 1: 250

0 1 2 3 4 5 10 15 20m

Metric

DISTANCES ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

Bearing note

BEARINGS ARE UTM GRID, DERIVED FROM GPS REAL TIME NETWORK OBSERVATIONS IN NAD83 (CSRS) (1997.0) AND ARE REFERRED TO THE CENTRAL MERIDIAN OF UTM ZONE 17 (81° WEST LONGITUDE) FOR BEARING COMPARISONS COUNTER-CLOCKWISE BEARING ROTATIONS WERE APPLIED AS FOLLOWS:

RP – 01°02'15"
D1 – 01°15'35"
D2 – 03°25'25"

Legend

■	DENOTES	SURVEY MONUMENT FOUND
□	DENOTES	SURVEY MONUMENT SET
SIB	DENOTES	STANDARD IRON BAR
IB	DENOTES	IRON BAR
WIT	DENOTES	WITNESS
RP	DENOTES	REGISTERED PLAN 40M–2343
P	DENOTES	PLAN 40R–29767
P1	DENOTES	PLAN 40R–27028
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765	DENOTES	HORTON, WALLACE & DAVIES, O.L.S.
BRK	DENOTES	BRICK
FDN	DENOTES	FOUNDATION
STN	DENOTES	STONE
STU	DENOTES	STUCCO
N,S,E,W	DENOTES	NORTH, SOUTH, EAST, WEST
M	DENOTES	MEASURED
DS	DENOTES	DOOR SILL ELEVATION
CLF	DENOTES	CHAIN LINK FENCE
PWF	DENOTES	DOUBLE BOARD FENCE
AC	DENOTES	AIR CONDITIONING UNIT
–OH–	DENOTES	OVERHEAD UTILITY WIRES
◉ MH	DENOTES	MAINTENANCE HOLE
● UP	DENOTES	UTILITY POLE
⋈ WV	DENOTES	WATER VALVE/KEY
⊗ BH	DENOTES	BOREHOLE
☒ LS	DENOTES	LIGHT STANDARD
▣ CB	DENOTES	CATCH BASIN
● TP	DENOTES	TRAFFIC SIGN POST
✳	DENOTES	CONIFEROUS TREE W/TRUNK DIAMETER
⊙	DENOTES	DECIDUOUS TREE W/TRUNK DIAMETER

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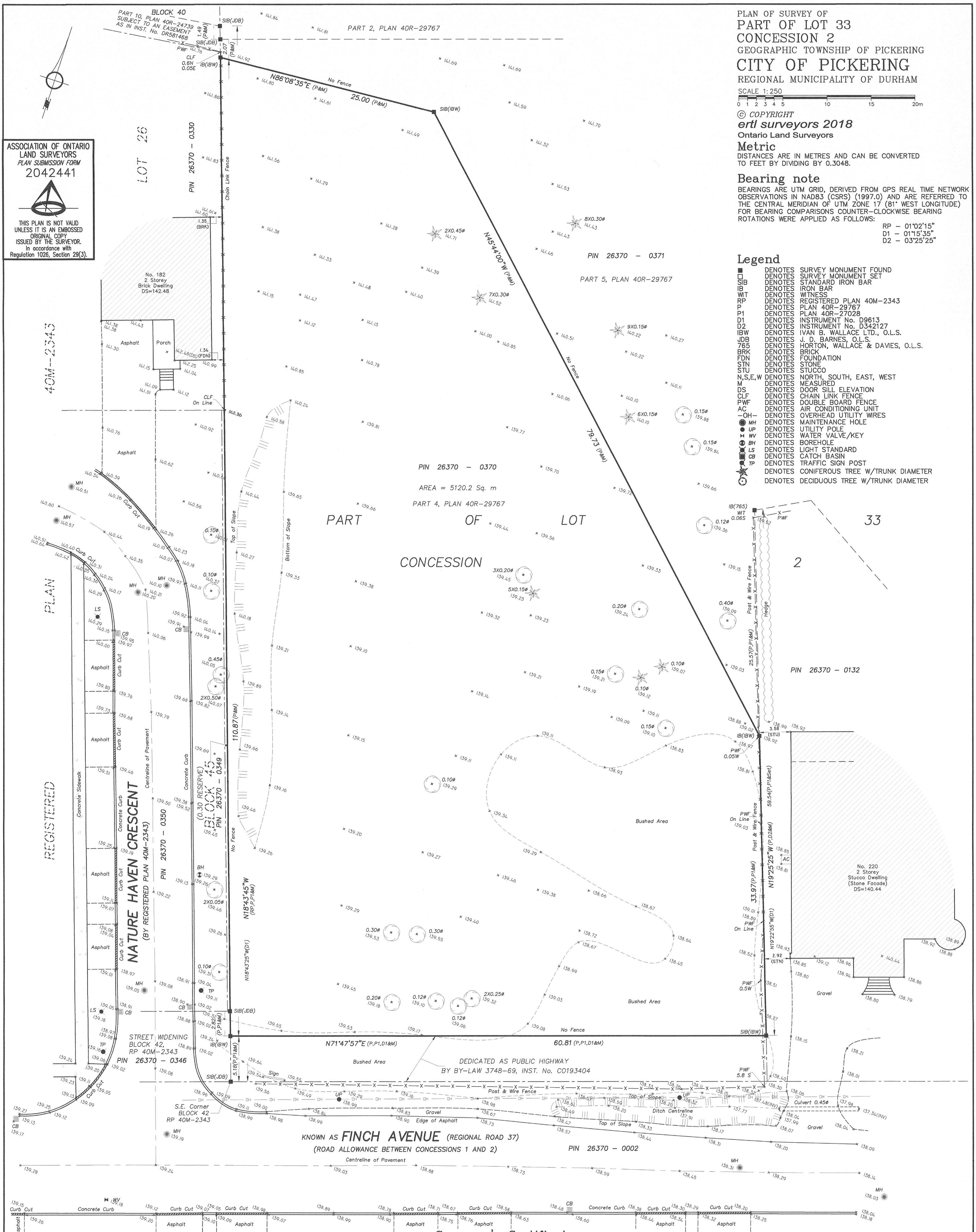


Benchmark

ELEVATIONS ARE GEODETIC AND REFERRED TO CITY OF PICKERING B.M. No. 1–090, ELEVATION = 140.969 m

Surveyor's Certificate

I CERTIFY THAT :
1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON THE 22nd DAY OF JANUARY, 2018

Feb 23, 2018
Date

per
Lawrence O. Ertl
Ontario Land Surveyor

ertl surveyors
Ontario Land Surveyors
www.es-ols.com
1234 REID STREET, UNIT 10, RICHMOND HILL L4B 1C1
TELEPHONE (905) 731–7834 FAX (905)731–7852 EMAIL info@es–ols.com
DRAWING : 18011–NatureHaven Finch–TB.DWG PROJECT : 18011
CALC. BY CL, DRAWN BY DH, CHECKED BY CL

APPENDIX “I”

Functional Servicing Report for ORC Altona Road Lands

FUNCTIONAL SERVICING REPORT
ORC ALTONA ROAD LANDS
MALONE GIVEN PARSONS LTD.
CITY OF PICKERING

Prepared By:	Sabourin Kimble & Associates Ltd.
Prepared For:	Malone Given Parsons Ltd.
Project Number:	08:168
Date:	February, 2010

FUNCTIONAL SERVICING REPORT
ORC ALTONA ROAD LANDS
MALONE GIVEN PARSONS LTD.
CITY OF PICKERING

TABLE OF CONTENTS

FUNCTIONAL SERVICING REPORT
ORC ALTONA ROAD LANDS
MALONE GIVEN PARSONS LTD.

CITY OF PICKERING

LIST OF FIGURES

FUNCTIONAL SERVICING REPORT
ORC ALTONA ROAD LANDS
MALONE GIVEN PARSONS LTD.
CITY OF PICKERING

LIST OF TABLES

FUNCTIONAL SERVICING REPORT
ORC ALTONA ROAD LANDS
MALONE GIVEN PARSONS LTD.
CITY OF PICKERING

LIST OF APPENDICES

1.0 INTRODUCTION

Sabourin Kimble & Associates has been retained by Malone Given Parsons Ltd. to carry out a Functional Servicing Report for the ORC Altona Road Lands.

This Functional Servicing Report applies to the lands located within City of Pickering – Section N1 – Rouge Park Neighbourhood and will be referred to in this report as the Study Area.

The purpose of this Functional Servicing Report is to provide municipal servicing information to address stormwater management, storm drainage, sanitary drainage, water supply, and grading for these lands.

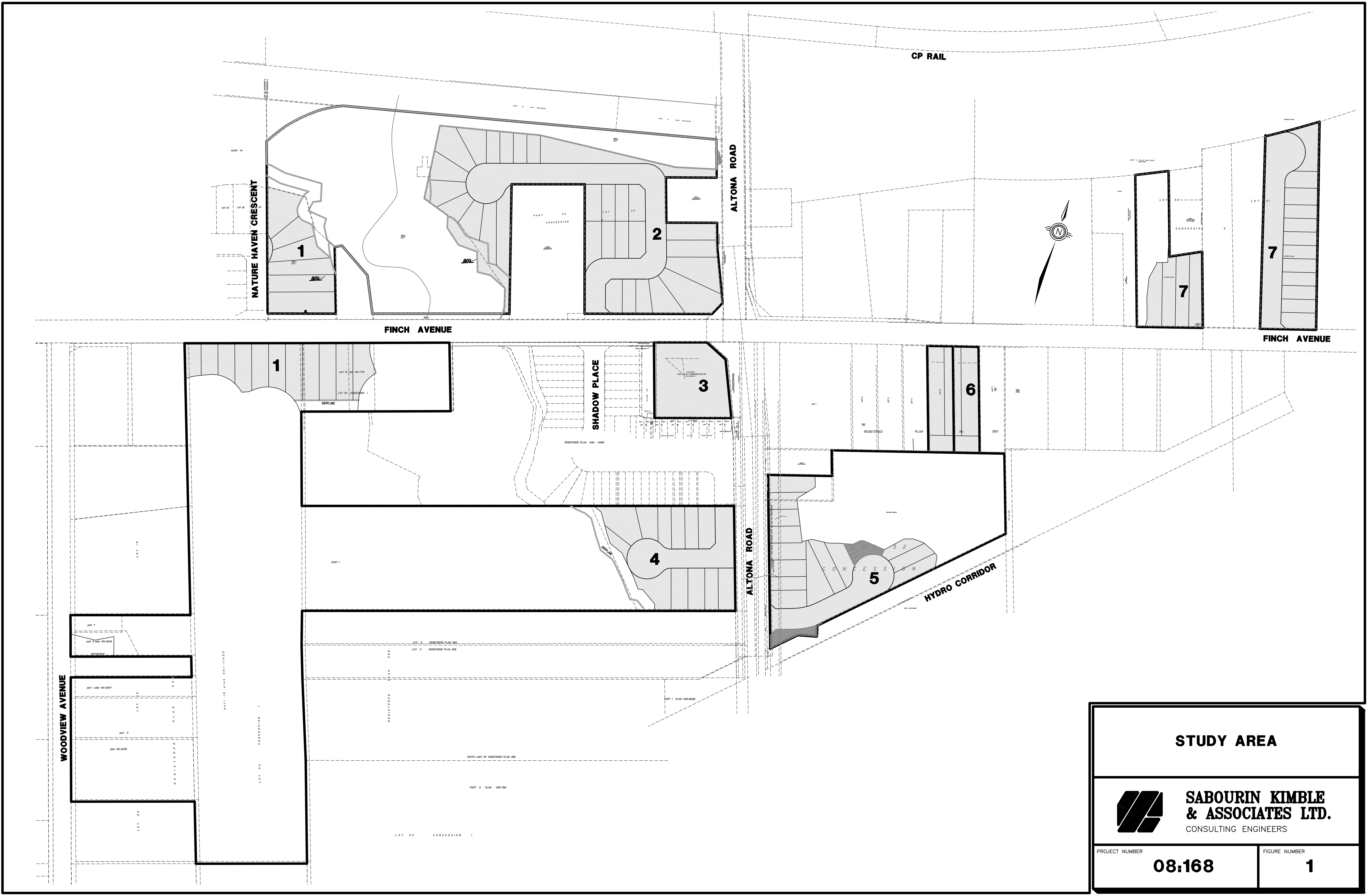
2.0 STUDY AREA

Figure 1 – Study Area, illustrates the configuration of the proposed parcels of land and the surrounding lands showing the location of the Study Area including the road pattern, development areas, and limits of development.

The ORC Altona Road Lands are located in the City of Pickering, Regional Municipality of Durham. The Study Area is bounded on the north by CP Rail lands; on the south by Ontario Hydro Corridor; on the east by Rosebank Road; and on the west by Woodview Avenue.

The Study Area has been subdivided into 7 parcels of land based on the developable boundaries, previously determined through other engineering and environmental investigations, and servicing characteristics determined by this report. These parcels are outlined in Figure 1 – Study Area and will be referred to by their parcel number from this point forward.

PLOT DATE: 26/01/10 CAD FILE: P:\08\168\Drawing Files\Phase 1\Figures\168 FSP Jan 2010\168 Fig 1 Jan 2010.dwg



STUDY AREA

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
08:168	1

3.0 STORM DRAINAGE

3.1 Existing Site Drainage

Existing drainage from the parcels contribute to two watersheds, Petticoat Creek Watershed and Amberlea Creek Watershed. Parcels 1 through 6 are tributary to Petticoat Creek and Parcel 7 is tributary to Amberlea Creek. Drainage is conveyed to the watersheds by a combination of overland flow, existing storm sewers and road side ditches. Ditches on Altona Road are collected into an existing 1200mm diameter storm sewer which outlets into an existing stormwater management facility which provides both quality and quantity control.

3.2 Post Development Conditions

Within the Study Area, post development drainage is conveyed via local storm sewers. Storm sewers will be sized to convey post development minor storm drainage. Post development major storm drainage will be conveyed via existing overland flow routes. The design of the minor storm drainage system will be based on the City of Pickering specified design criteria. Design flows are calculated using the rational formula:

$$Q = 2.778 \times A \times I \times R,$$

The 5-year storm event is based on the following

"I" is calculated using Yarnell's 5-year Curve

$$\text{Rainfall Intensity, } I = \frac{2464}{t + 16}$$

A standard entry time of 10 minutes is used for all residential developments.

"R" is the runoff coefficient, as follows:

R = 0.20 for open space

R = 0.45 for single residential units

R = 0.90 for commercial

3.2.1 Parcel 1

Minor system drainage, including residential service connections, from proposed lots within Parcel 1 will contribute to existing storm sewers on Nature Haven Crescent and Finch Avenue. These existing storm sewers convey drainage to an existing Stormceptor STC-6000 on Finch Avenue, which provides water quality control. Downstream of the Stormceptor water is outlet into Petticoat Creek via the culvert under Finch Avenue. The storm sewer system is illustrated in Figure 2 – Storm Servicing Plan - West. Existing capacity of the storm sewers and Stormceptor was analyzed and found to be adequate to support the additional drainage not originally accounted for in the design. For storm sewer design calculations refer to Appendix A – Parcel 1 – Storm Sewer Design and for Stormceptor design calculations refer to Appendix B – Stormwater Management Calculations.

3.2.2 Parcel 2

Minor system drainage from Parcel 2 will be conveyed via proposed storm sewers to the existing 1050mm diameter storm sewer at the intersection of Altona Road and Finch Avenue, as shown in Figure 2 – Storm Servicing Plan – West. Existing capacity analysis was not carried out on the existing storm sewers as they were originally designed and approved to accept post development drainage from these lands.

3.2.3 Parcel 3

Minor system drainage from Parcel 3 will be conveyed via proposed sewers to the existing 1050mm diameter storm sewer on Altona Road, as shown in Figure 2 – Storm Servicing Plan – West. The existing storm sewers on Altona Road and the existing receiving stormwater management facility were sized for drainage from this land at a residential run-off coefficient of 0.46. Given that this Parcel is being proposed as a Commercial Block, which carries a run-off coefficient of 0.90, on-site controls and storage will be utilized to not exceed the existing design flow from this parcel.

3.2.4 Parcel 4

Minor system drainage from Parcel 4 will be conveyed via proposed storm sewers to the existing 1200mm diameter storm sewer on Altona Road, as shown in Figure 2 – Storm Servicing Plan – West. Existing capacity analysis was not carried out on the existing storm sewers as they were originally designed and approved to accept post development drainage from these lands.

3.2.5 Parcel 5

Minor system drainage from Parcel 5 will be conveyed via proposed storm sewers to the existing 1200mm diameter storm sewer on Altona Road, as shown in Figure 2 – Storm Servicing Plan – West. Existing capacity analysis was not carried out on the existing storm sewers as they were originally designed and approved to accept post development drainage from these lands.

3.2.6 Parcel 6

Front yard drainage from lots with Parcel 6 will flow overland to the existing ditches on Finch Avenue. The existing 525mm diameter storm sewer on Finch Avenue will be extended from the existing plug to the east limit of Parcel 6, as shown in Figure 2 – Storm Servicing Plan – West. Residential storm service connections will be connected to the existing 525mm storm sewer as well as the proposed extension of this storm sewer on Finch Avenue. The existing storm sewer on Finch Avenue and all downstream sewers were designed to accept this post development drainage. Therefore, no capacity analysis was required.

Rear-yard drainage from these 3 lots will flow overland to the existing wetland feature to the south as it does under pre-development conditions.

3.2.7 Parcel 7

Minor system drainage from Parcel 7 will be conveyed via proposed storm sewers to the existing 450mm diameter storm sewer plug on Finch Avenue, approximately 35m west of Rosebank Road, as shown in Figure 3 – Storm Servicing Plan - East. The existing storm sewer plug was originally designed to accept pre-development drainage from Parcel 7. Therefore, on-site controls and storage will be utilized to reduce the post-development flow down to the pre-development flow. On-site Level 1 treatment will also be implemented by a proposed Stormceptor.

3.3 Service Connections

The weeping tile drainage at the foundation drains for single family dwellings shall be connected to the storm sewer. All storm service connections will be constructed in accordance with municipal and regional standards. In particular, all storm sewer service connections for single family dwellings shall be individual service connections, 150mm in diameter, minimum 2.0% gradient and 2.5m depth. The connection to the main sewer shall be made with an approved manufactured tee or approved saddle.

Roof eave downspouts are to discharge directly to the grass surface. This will promote groundwater infiltration. Residential dwellings are to be designed in a manner to accommodate roof eave downspout discharge locations to grassed surfaces, maximizing drainage travel along swales before they outlet to paved surfaces, existing road-side ditches or rear lot catchbasins.

3.4 Rear Lot Catchbasin Design

In general, rear lot grading shall be designed to minimize the number and frequency of rear lot catchbasins. However, rear lot catchbasins will be utilized to prevent drainage from flowing overland to existing adjacent properties. This rear yard drainage will be captured by swales and conveyed to rear lot catchbasins which outlet to the storm sewer system.

4.0 STORMWATER MANAGEMENT

The stormwater management criteria for the study area were determined as a combination of constraints and criteria established by the City of Pickering and the Toronto and Region Conservation Authority (TRCA). As previously described, the study area has been divided into seven (7) parcels and each has been examined from a stormwater management perspective.

4.1 Parcel 1

The existing parcel 1 is currently undeveloped. Under proposed conditions, there will be an increase of 0.18 hectares of drainage going to the Stormceptor (STC 6000) which is currently treating the runoff from approximately 5.2 hectares. Stormceptor sizing calculations have been done to confirm whether or not the existing Stormceptor will be adequate enough to treat this drainage. Under proposed conditions, the existing Stormceptor still removes 82% of the total suspended solids, as per Level 1 quality control criteria. See appendix ‘B’ for complete calculations.

4.2 Parcels 2-6

These parcels all drain to an existing stormwater management facility on Altona Road. This facility was originally designed to treat the runoff from these parcels in addition to existing developments in the area. The only exception is Parcel 3 which as mentioned previously, has a higher proposed runoff coefficient than originally accounted for.

In order to mitigate the increase in the proposed runoff coefficient of Parcel 3, the site will have the 100-year post development runoff controlled to the originally designed 5-year post development runoff. This will ensure that there is no increase in peak runoff to the pond. By controlling the 100-year storm to this rate, there will also be no major system flow from the site. The extended rational method was used to calculate the associated storage volume that would be necessary to provide this level of control. In total, 106 m^3 are required. There would be several options for how to store this volume on site, including: on the roof of the commercial building, surface ponding in the parking lot or underground storage in a super-pipe. Calculations can be found in Appendix ‘B’.

The Stormwater Management Report – Reflections on Petticoat Creek, BOPA Developments Inc., City of Pickering, last revised March 12, 2001, prepared by Land-Pro, was used to confirm the pond’s capacity. The existing pond was originally designed to provide Level 1 quality control for the contributing drainage area. This is still the current criteria so no additional quality treatment is required. The existing pond was also designed to provide quantity control for the contributing drainage area. Other than the commercial site, which will be controlled, there is no proposed increase in runoff coefficient or in drainage area, therefore, no additional works are proposed.

4.3 Parcel 7

As stated previously, the storm sewers on Finch Avenue were designed assuming that this land was undeveloped. In order to ensure there is capacity in the existing sewer, the 5-year post development storm, which is what the minor system is designed to, will be controlled to the 5-year pre-development storm. The extended rational method was used to determine the volume of storage required to achieve outflow rate. In total, 52 m^3 of storage are required. This volume would most likely be stored in an underground super-pipe. Major system flow will discharge directly to the existing ditches on the north side of Finch Avenue. The site is within the Amberlea Creek watershed, which also requires retention of the 25 mm storm for 24 hours. Roof runoff from this parcel will be directed to rear yard infiltration galleries to achieve this.

The site requires Level 1 Quality control. This will be provided by a Stormceptor which has been sized as a STC 1000. See Appendix ‘B’ for all design calculations.

5.0 SANITARY DRAINAGE

5.1 Existing Conditions

Existing sanitary sewers are located on Woodview Avenue, Finch Avenue, Shadow Place and Altona Road. Sanitary drainage from the parcels will contribute to the two main sewer reaches on Woodview Avenue and Altona Road. Parcel 1 is tributary to the existing 200mm diameter sanitary sewer on Woodview Avenue and Parcels 2 through 7 are tributary to the existing 250mm diameter sanitary sewer on Altona Road.

5.2 Proposed Sanitary Servicing

5.2.1 Design Flow

In accordance with Region of Durham design guidelines, residential sewage flows shall be calculated on the basis of the following for residential areas

- Residential Average Flow – 364 litres/person/day
- Infiltration – 22,500 litres/gross hectare/day when foundation drains are not connected to the sanitary sewer. Calculated on the number of gross hectares of residential lands tributary to the sanitary sewer systems. Foundation drains within all areas of the Study Area are connected to the storm sewer system.

All sanitary sewers shall be sized to handle the theoretical daily peak flow, where the peaking factor for sanitary drainage is calculated as follows:

Peaking Factor, $K_H = \frac{1 + 14}{4 + P^{1/2}}$

Where, P is population in thousands

K_H is the Harmon peaking factor, maximum of 3.8 and minimum of 1.5

In accordance with Region of Durham design guidelines, when lands are zoned for a specific residential use and detailed information is not available, the following population densities shall apply in accordance with Table 1 - Population Densities – Unknown Lot Configuration.

Table 1 - Population Densities – Unknown Lot Configuration

Type of Housing	Persons/Hectare
Single Family Dwellings	60
Semi-detached Dwellings	100
Street Townhouses	125

When the number and type of housing units within the proposed development is known, the calculation of population for the proposed development shall be based on the following, Table 2 - Population Densities – Known Lot Configuration

Table 2 - Population Densities – Known Lot Configuration

Type of Housing	Persons/Unit
Single Family Dwellings	3.5
Semi-detached Dwellings	3.5
Street Townhouses	3.5

In accordance with Region of Durham standards, commercial design flow is 180m^3/gross floor area hectare/day including infiltration and peaking effect.

Based on the design flow, the minimum sewer size and gradient are calculated using Manning's Formula on the basis of full flow pipes.

5.2.2 Parcel 1

Sanitary drainage from residential lots within Parcel 1 drain to a combination of existing sanitary sewers on Nature Haven Crescent and proposed sanitary sewers on Finch Avenue, as shown in Figure 4 – Sanitary Servicing Plan – West. The two local systems combine at the intersection of Woodview Avenue and Finch Avenue and flow is conveyed south on Woodview Avenue. In the City of Pickering's 2003 report, Rouge Park Neighbourhood Development Guidelines, it stated that the sanitary sewer along

Woodview Avenue will serve the area west of Petticoat Creek and with minor upgrades has the capacity to accommodate approximately 500 additional people. In 2006 Woodview Avenue was re-constructed, including extension of the existing sanitary sewer north on Woodview Avenue to Finch Avenue. This was done to serve the Rouge Park Subdivision, which added approximately 137 additional people to the Woodview Avenue sanitary sewer. ORC Lands – Parcel 1 will contribute approximately 60 more people to this sanitary sewer. As the combined 197 estimated additional people now contributing to the Woodview Avenue sanitary sewer is much less than the 500 people additional capacity stated in the City's 2003, no capacity analysis was carried forward on the Woodview Avenue sanitary sewer. At the detailed design stage for Parcel 1, allocation will have to be obtained from the City of Pickering for the proposed lots.

5.2.3 Parcel 2 – 7

Sanitary drainage from Parcels 2 through 7 drain to a combination of existing and proposed sewers, as shown in Figure 4 – Sanitary Servicing Plan – West and Figure 5 – Sanitary Servicing Plan – East. Flows from these parcels contribute to the existing sanitary sewer system on Altona Road. The design of the original system accounted for these lands under post-development conditions. For this reason a capacity analysis was not carried out or required on the existing sanitary sewer system on Altona Road.

5.3 Service Connections

Internally residential sanitary service connections are straightforward. These will be constructed in accordance with regional standards. In particular, all sanitary sewer service connections for single family dwellings shall be individual service connections, 100mm in diameter, minimum 2.0% gradient and 2.5m depth. The connection to the main sewer shall be made with an approved manufactured tee or approved saddle.

6.0 WATER SUPPLY

6.1 Existing Water Supply Infrastructure

The Study Area is located within the City of Pickering Zone 2 pressure district. As per the City of Pickering's Rouge Park Neighbourhood Development Guidelines, water supply within the neighbourhood around the Study Area is served by the Regional water supply system, which includes watermains installed along Finch and Woodview Avenues. The Development Guidelines set in the City's report states that given the recent expansion of the Ajax Water Supply Plant, there are no constraints on the system's ability to accommodate planned growth in the area and no facilities other than the extension of watermains are required.

6.2 Proposed Water System

The proposed watermain layout is shown in Figure 6 – Watermain Servicing Plan. The water distribution system shall be designed to meet Regional and Provincial standards within the Study Area for residual pressure under maximum hourly demand (40psi) as well as maximum daily demand plus fire flow (20psi). The geodetic elevation of the normal surface water level for Pickering Zone 2 reservoir is 170.0m. The highest and lowest centreline of road elevation proposed within the Study Area is 141.53m and 134.55m respectively. This equates to a static pressure range of 40.5-50.4psi. As this pressure is bordering minimum standards under static pressure conditions, discussions will have to be had with the Region regarding this during the detailed design process. A combination of temporary booster stations, raising the normal operating water surface elevation in the Zone 2 reservoir and/or strategically lowering the proposed ground elevation (from an optimal design elevation) could be considered to meet the current pressure criteria. Proposed water mains shall be sized at a later date to meet water usage with adequate flow and adequate residual pressure.

6.3 Service Connections

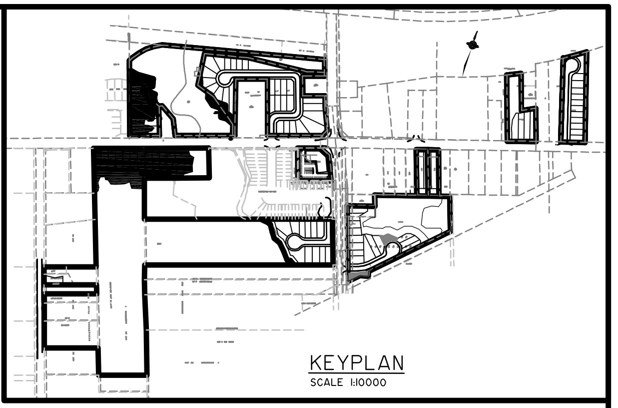
Flow and pressure within the Study Area is adequate, and therefore only minimum sized service connections are required in accordance with Region of Durham standards. All service connections to private properties for freehold residential dwellings shall be a nominal size of 19mm diameter type “K” copper water mains.

7.0 SITE GRADING

In accordance with road design grading criteria, the minimum desirable gradient on all roadways is 0.5%, and the maximum gradient on all roadways is 5.0%. In accordance with the above criterion, preliminary proposed road grades have been designed; refer to Figure 7-13 – Preliminary Grading Plan.

In accordance with lot grading criteria, the minimum swale grade is 2% and the maximum swale grade is 5.0%. Preliminary lot grading has been designed and can be found in Figure 7-13 – Preliminary Grading Plans.

Road and lot grading has been designed so that existing elevations around the property limits are met and to ensure all drainage is self contained and directed to appropriate storm sewer catchment devices. Exception to this occurs when the property backs on to an existing wetland and drainage is conveyed overland to the wetland under pre-development conditions. In this case some overland drainage has been directed overland toward the wetland to ensure that the natural features of the wetland aren’t adversely affected by the future development.


KEYPLAN
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LEGEND

GROUND CONTOUR	229
PROPOSED GRADE	× 229.23

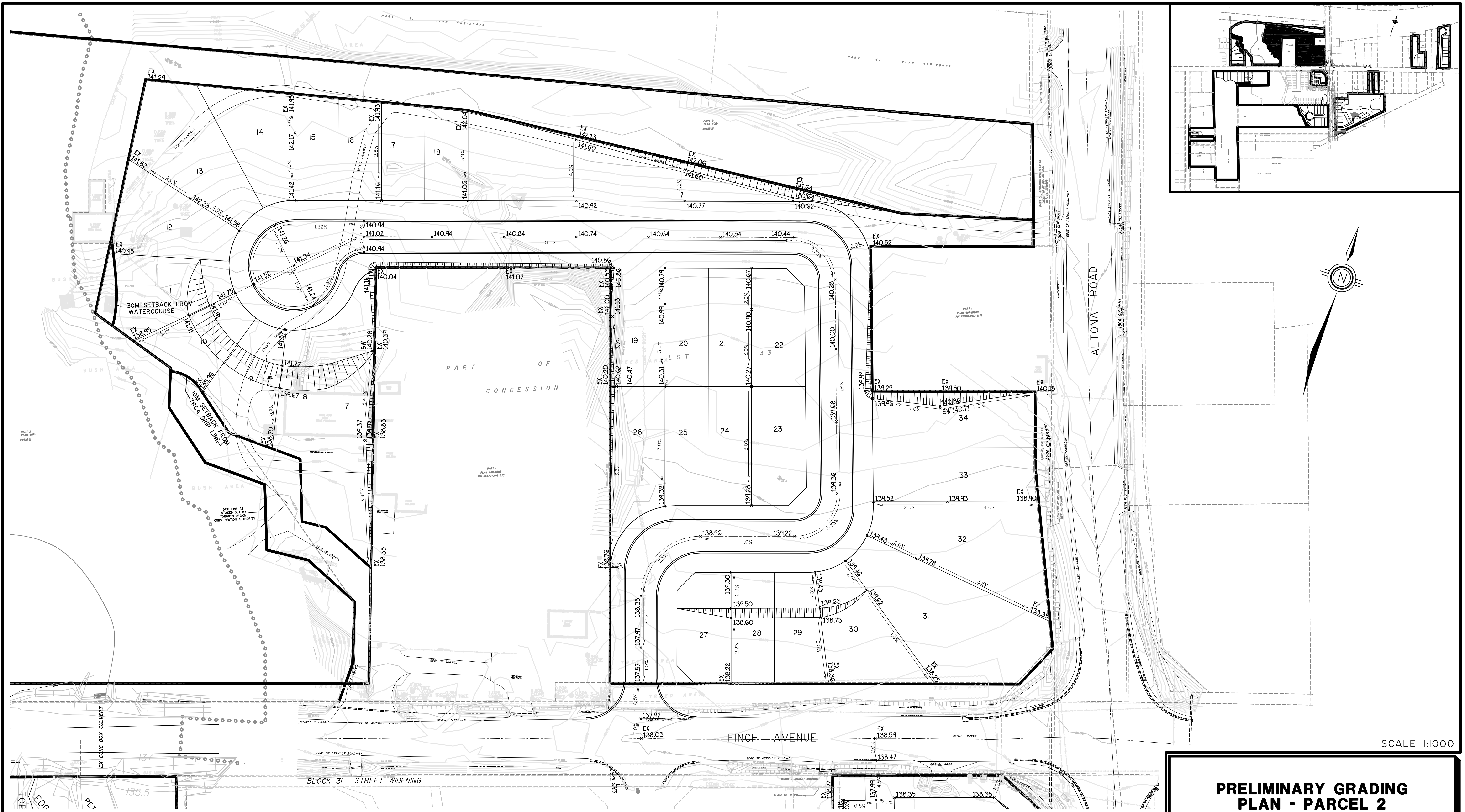
SCALE 1:1000

PRELIMINARY GRADING PLAN - PARCEL 1

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
08:168	7

PLOT DATE: 26/02/10 CAD FILE: P:\08\168\Drawing Files\Phase I\Figures\168 FSP Jan 2010\168 Fig 6 Grading.dwg



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LEGEND

GROUND CONTOUR 229

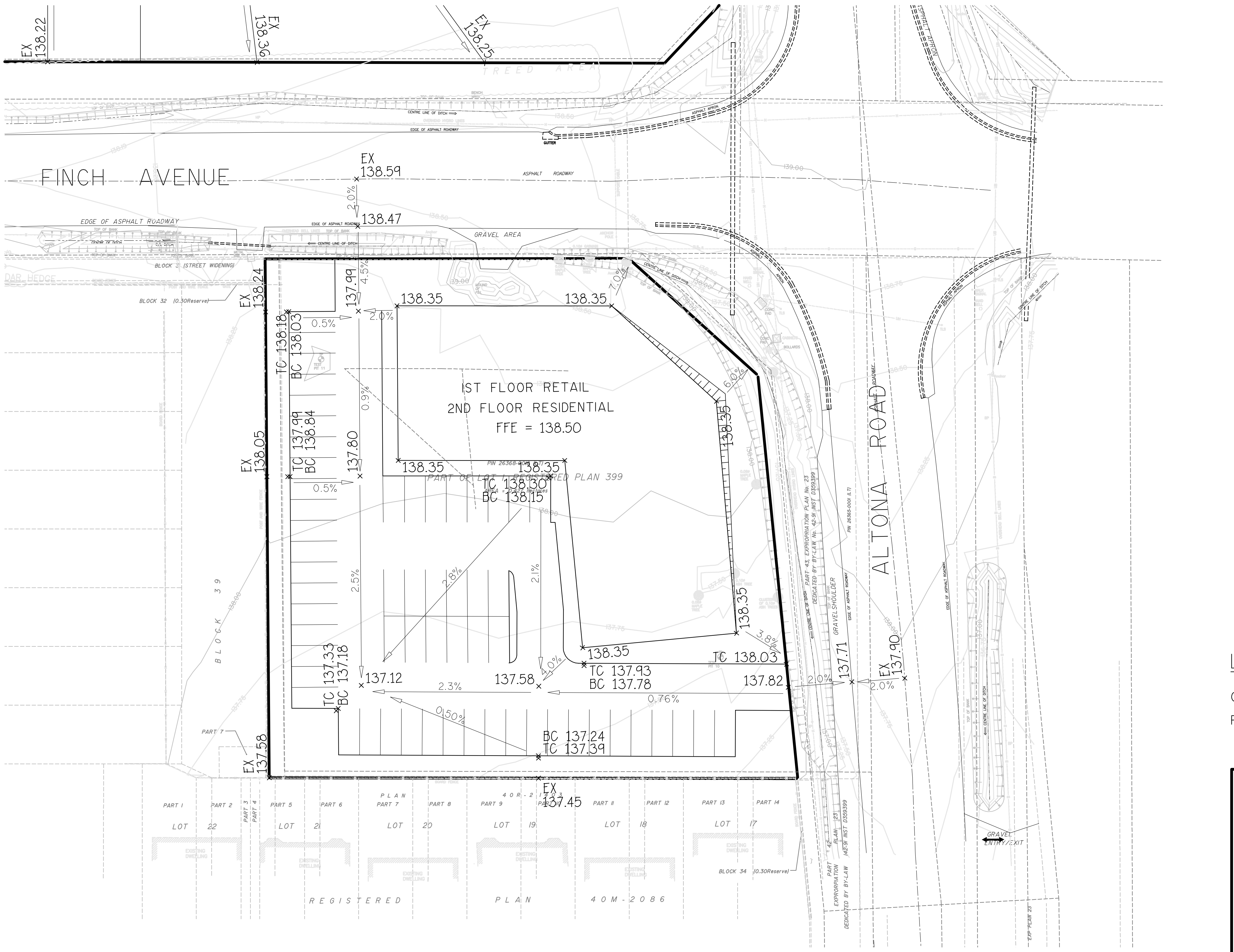
PROPOSED GRADE × 229.23

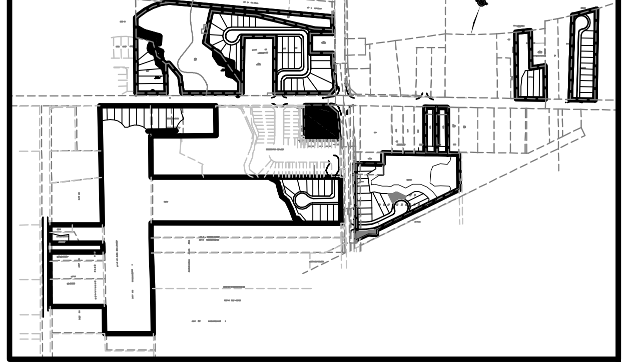
PRELIMINARY GRADING PLAN - PARCEL 2

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
08:168	8

PLOT DATE: 26/02/10 CAD FILE: P:\08\168\Drawing Files\Phase I\Figures\168 FSP Jan 2010\168 Fig 6 Grading.dwg





LEGEND

GROUND CONTOUR	229
PROPOSED GRADE	× 229.23

SCALE 1:500

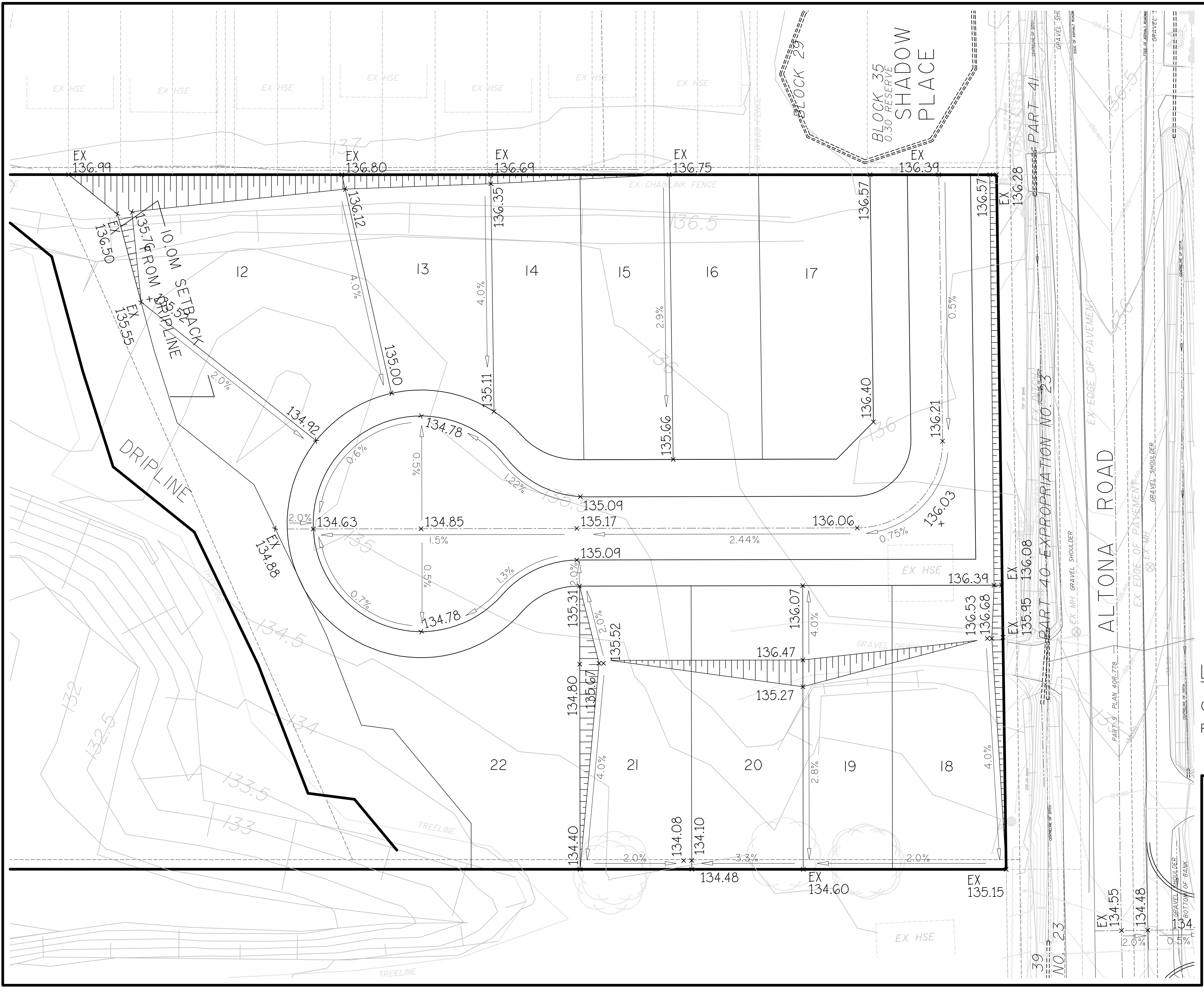
PRELIMINARY GRADING PLAN - PARCEL 3

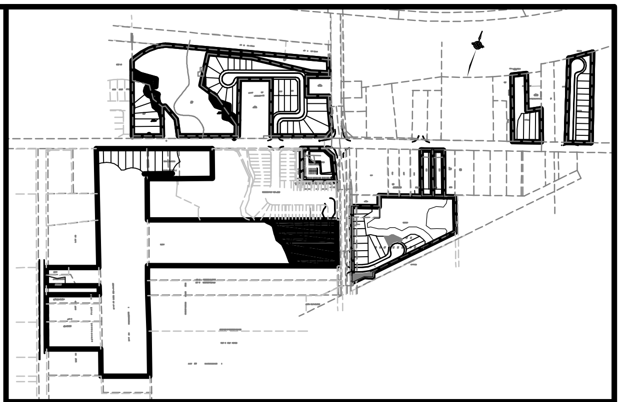
SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER
08:168

FIGURE NUMBER
9

PLOT DATE: 26/02/10 CAD FILE: P:\08\168\Drawing Files\Phase I\Figures\168 FSP Jan 2010\168 Fig 6 Grading.dwg





LEGEND

GROUND CONTOUR	229
PROPOSED GRADE	× 229.23

SCALE 1:500

PRELIMINARY GRADING PLAN - PARCEL 4

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
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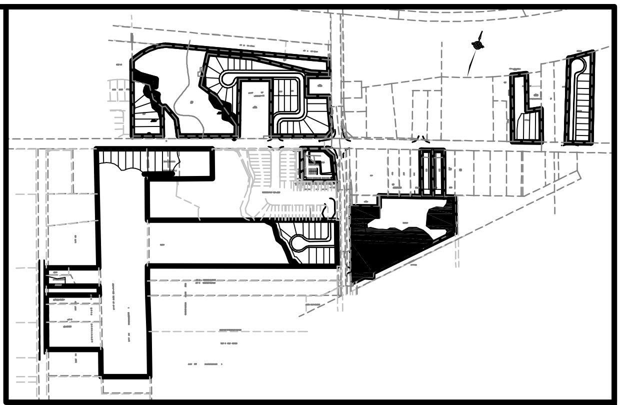
PLOT DATE: 26/02/10 CAD FILE: P:\08\168\Drawing Files\Phase I\Figures\168 FSP Jan 2010\168 Fig 6 Grading.dwg



LEGEND

GROUND CONTOUR	229
PROPOSED GRADE	× 229.23

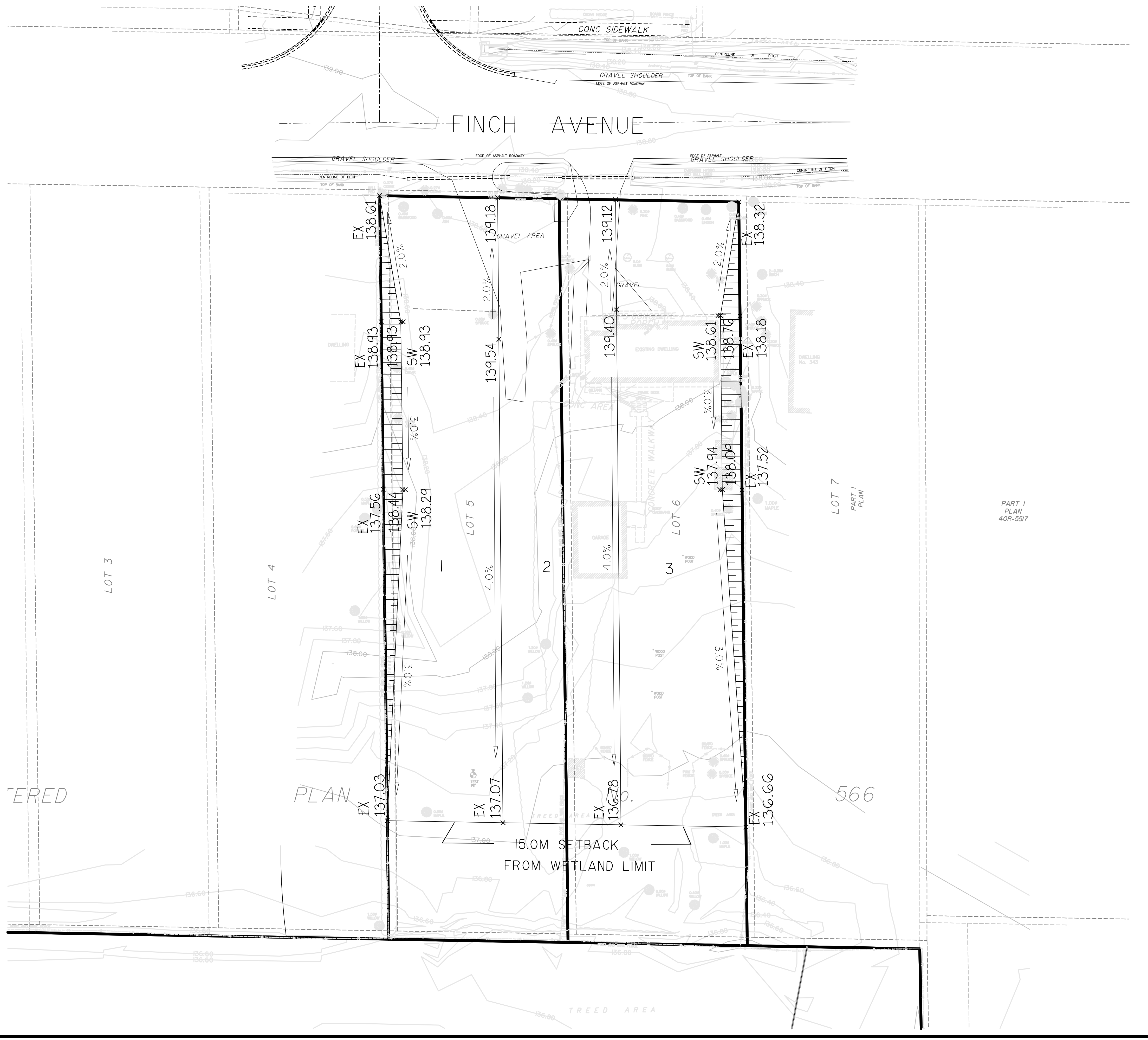
SCALE 1:1000

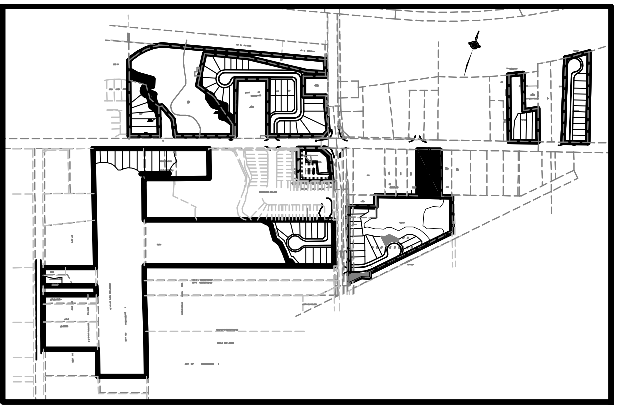
PRELIMINARY GRADING
PLAN - PARCEL 5

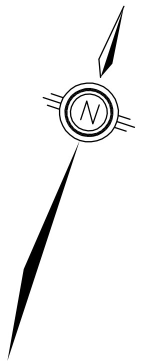
SABOURIN KIMBLE
& ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
08:168	11

PLOT DATE: 26/02/10 CAD FILE: P:\08\168\Drawing Files\Phase 1\Figures\168 FSP Jan 2010\168 Fig 6 Grading.dwg







LEGEND

GROUND CONTOUR	229
PROPOSED GRADE	× 229.23

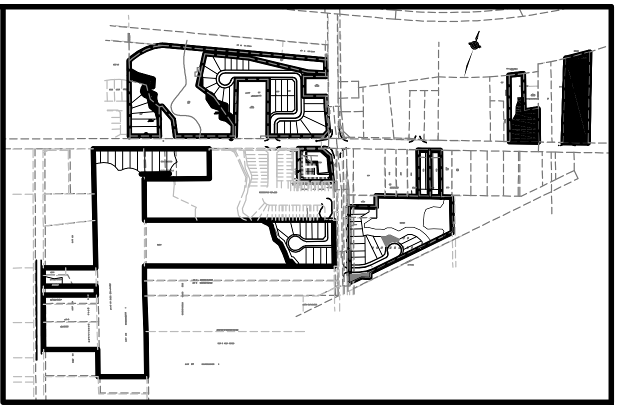
SCALE 1:500

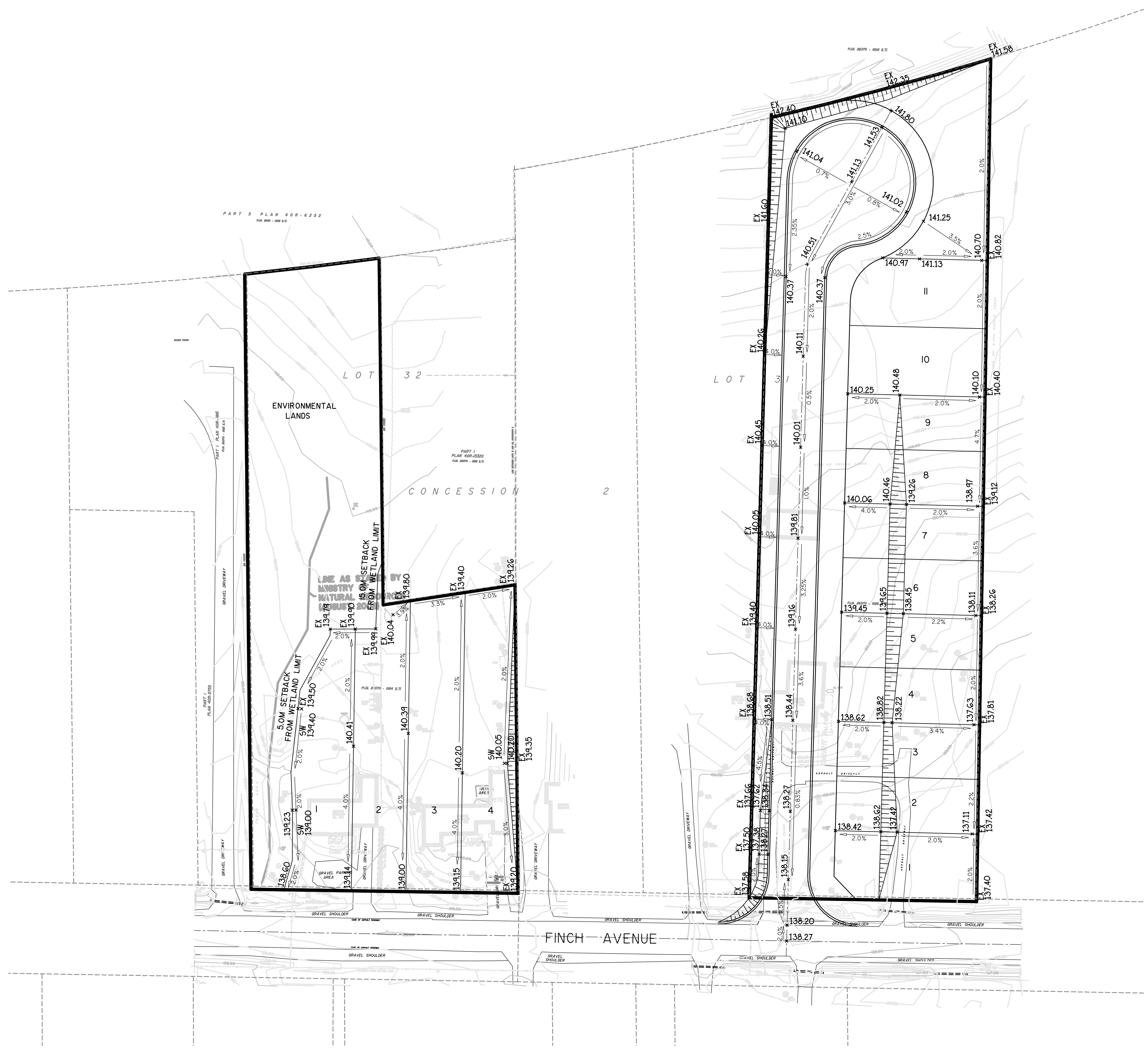
PRELIMINARY GRADING PLAN - PARCEL 6

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
08:168	12

PLOT DATE: 26/02/10 CAD FILE: P:\08\168\Drawing Files\Phase I\Figures\168 FSP Jan 2010\168 Fig 6 Grading.dwg





LEGEND

GROUND CONTOUR 229

PROPOSED GRADE × 229.23

SCALE 1:1000

PRELIMINARY GRADING PLAN - PARCEL 7

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
08:168	13

PLOT DATE: 26/02/10 CAD FILE: P:\08\168\Drawing Files\Phase I\Figures\168 FSP Jan 2010\168 Fig 6 Grading.dwg

8.0 SEDIMENTATION CONTROL MEASURES

There are environmental features and existing residential properties adjacent to the Study Area. These environmental features and residential properties must be adequately protected from damage due to sedimentation runoff and erosion damage.

During construction of any portion of the Study Area, adequate erosion and sedimentation controls must be implemented to safeguard them against potential damage. In support of the detailed design for any development proposal, a comprehensive construction erosion and sedimentation control plan should be prepared. This plan should detail the works proposed to control erosion on-site and sediment transport from the site to match or exceed current Municipal and Provincial standards. Works such as sediment shields, controlled stripping/earthworks practices, sediment ponds, undisturbed buffers, filter strips and catchbasin/storm sewer sediment traps should be implemented. In support of the erosion and sedimentation control plan, a construction implementation plan and maintenance protocol should also be established on an individual basis for any phase of the Study Area.

The construction implementation plan and maintenance protocol should be completed in accordance with the Erosion and Sedimentation Control Guideline for Urban Construction, December 2006, which was created in cooperation with the greater Golden Horseshoe Area Conservation Authorities.

Sedimentation control practices will be implemented for all construction activities within the Study Area, including during tree removal, topsoil stripping, underground sewer construction, road construction and house construction. Sedimentation control measures are to be installed and operational prior to any construction activity, and are to remain in place until such time as the residential dwellings are constructed and the lot grading complete with established sod.

Appendix A

Parcel 1 – Storm Sewer Design

STORM SEWER DESIGN SHEET

CITY OF PICKERING

STREET	Upstream Manhole	Downstream Manhole	A at R=0.45 (ha)	Parcel 1 Area at R=0.45 (ha)	A at R=0.20 (ha)	A x R This Section (ha)	Acc. AR (ha)	t (min)	I (5yr) (mm/hr)	Q (5yr) (l/s)	Pipe	Pipe (mm)	Grade (%)	Capacity (l/s)	Velocity (m/s)	Length (m)	Time (min)	Total Time (min)	Capacity (%)
ROUGE PARK SUBDIVISION - ORC PARCEL 1																			
FINCH AVENUE	1	2	0.62			0.279	0.279	10.00	94.77	73.45	METRIC	375	0.50	123.98	1.12	105.0	1.56	11.56	59%
FINCH AVENUE	2	3	0.31			0.140	0.419	11.56	89.41	103.94	IMPERIAL	450	0.30	162.91	0.99	70.0	1.18	12.73	64%
FINCH AVENUE	3	4	0.07			0.032	0.450	12.73	85.75	107.19	IMPERIAL	450	0.30	162.91	0.99	18.5	0.31	13.05	66%
NATURE HAVEN CRESCENT	12	13	0.27		0.06	0.134	0.134	10.00	94.77	35.14	METRIC	300	1.10	101.42	1.43	45.0	0.52	10.52	35%
NATURE HAVEN CRESCENT	13	14	0.51		0.06	0.242	0.375	10.52	92.90	96.77	METRIC	375	1.60	221.78	2.01	83.0	0.69	11.21	44%
NATURE HAVEN CRESCENT	14	4	0.60		0.45	0.360	0.735	11.21	90.55	184.87	IMPERIAL	600	0.30	350.85	1.20	49.0	0.68	11.89	53%
FINCH AVENUE	4	5				0.000	1.185	13.05	84.83	279.24	IMPERIAL	675	0.30	480.32	1.30	17.5	0.22	13.27	58%
FINCH AVENUE	5	6	0.44			0.198	1.383	13.27	84.18	323.40	IMPERIAL	750	0.30	636.13	1.39	71.5	0.85	14.12	51%
FINCH AVENUE	6	7	0.54			0.243	1.626	14.12	81.80	369.44	IMPERIAL	750	0.30	636.13	1.39	71.5	0.85	14.98	58%
FINCH AVENUE	7	8	0.05			0.023	1.649	14.98	79.54	364.23	IMPERIAL	750	0.30	636.13	1.39	17.5	0.21	15.19	57%
NATURE HAVEN CRESCENT	12	11	0.26			0.117	0.117	10.00	94.77	30.80	METRIC	300	2.50	152.90	2.16	41.5	0.32	10.32	20%
NATURE HAVEN CRESCENT	11	10	0.11	0.07	0.13	0.107	0.224	10.32	93.62	58.25	METRIC	375	1.90	241.68	2.19	15.5	0.12	10.44	24%
NATURE HAVEN CRESCENT	10	8	0.22	0.11		0.149	0.373	10.44	93.20	96.44	METRIC	375	1.90	241.68	2.19	62.0	0.47	10.91	40%
FINCH AVENUE	8	9(STC-6000)	0.39			0.176	2.197	15.19	79.01	482.05	IMPERIAL	750	0.30	636.13	1.39	106.5	1.27	16.46	76%
FINCH AVENUE	9(STC-6000)	CULVERT	0.13			0.059	2.255	16.46	75.91	475.49	IMPERIAL	750	0.30	636.13	1.39	31.0	0.37	16.83	75%

PROJECT : ORC LANDS - FINCH & ALTONA

PROJECT No.: 08:168

CLIENT : ORC

DATE : January, 2010

Designed By : RMS

Checked By : WJL

SABOURIN KIMBLE & ASSOCIATES LTD.

CONSULTING ENGINEERS

Appendix B

Stormwater Management Calculations

08 168
Parcel 1
STC sizing

Check existing conditions

From storm sewer design sheet:

	Area (ha)	Runoff Coefficient	Percent Impervious
	0.70	0.20	0%
	4.52	0.45	36%
Total	5.22	0.42	31%

See stormceptor sizing
Confirmed that STC 6000 is required for 80% TSS removal under existing conditions

Check proposed conditions

From storm sewer design sheet:

	Area (ha)	Runoff Coefficient	Percent Impervious
	0.70	0.20	0%
	4.70	0.45	36%
Total	5.40	0.42	31%

See stormceptor sizing
Confirmed that STC 6000 is required for 80% TSS removal under proposed conditions

Stormceptor®

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	22/02/2010
Project Name	ORC Altona Road Lands
Project Number	08 168
Location	City of Pickering

Designer Information

Company	Sabourin Kimble & Associates Ltd.
Contact	Stephen Ruddy

Notes

Existing Conditions

Drainage Area

Total Area (ha)	5.22
Imperviousness (%)	31

The Stormceptor System model STC 6000 achieves the water quality objective removing 82% TSS for a Fine (organics, silts and sand) particle size distribution.

Rainfall

Name	TORONTO CENTRAL
State	ON
ID	100
Years of Records	1982 to 1999
Latitude	45°30'N
Longitude	90°30'W

Water Quality Objective

TSS Removal (%)	80

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %
STC 300	53
STC 750	66
STC 1000	66
STC 1500	67
STC 2000	73
STC 3000	74
STC 4000	78
STC 5000	79
STC 6000	**82**
STC 9000	86
STC 10000	86
STC 14000	88

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
20	20	1.3	0.0004					
60	20	1.8	0.0016					
150	20	2.2	0.0108					
400	20	2.65	0.0647					
2000	20	2.65	0.2870					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Hanson Pipe & Precast, 1-888-888-3222.

Stormceptor®

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	22/02/2010
Project Name	ORC Altona Road Lands
Project Number	08 168 P1
Location	City of Pickering

Designer Information

Company	Sabourin Kimble & Associates Ltd.
Contact	Stephen Ruddy

Notes

Propsed Conditions

Drainage Area

Total Area (ha)	5.4
Imperviousness (%)	31

The Stormceptor System model STC 6000 achieves the water quality objective removing 82% TSS for a Fine (organics, silts and sand) particle size distribution.

Rainfall

Name	TORONTO CENTRAL
State	ON
ID	100
Years of Records	1982 to 1999
Latitude	45°30'N
Longitude	90°30'W

Water Quality Objective

TSS Removal (%)	80

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %
STC 300	53
STC 750	66
STC 1000	66
STC 1500	66
STC 2000	72
STC 3000	73
STC 4000	78
STC 5000	78
STC 6000	**82**
STC 9000	85
STC 10000	85
STC 14000	88

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

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Stormceptor Design Notes

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- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
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- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
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Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Hanson Pipe & Precast, 1-888-888-3222.

STORM STORAGE QUANTITY REQUIREMENTS
100-Year Post to Original 5-year Post Development
Parcel 3
City of Pickering
25/02/2010

Project: *ORC Altona Road Lands*
Project Number: *08 168*

Storm Intensity Curve:

$$I_5 = \frac{2464}{T^{0.714}} \qquad I_{100} = \frac{1770}{T^{0.686}}$$

Where:

A =	2464	A =	1770
B =	16	B =	4
C =	1	C =	0.82

From City of Pickering Design Criteria

As originally designed

Total Site Area = 0.427 ha
Runoff Coefficient = 0.46

Time of Concentration = 10 min
5-year Intensity = 94.8 mm/hr

Allowable flow = 0.052 m^3/s

Proposed Conditions

Total Site Area = 0.427 ha
Runoff Coefficient = 0.90

ENTRY TIME: 5.0 min
TIME STEP 1.0 min

TIME	INTENSITY (mm/hr)	PEAK DISCHARGE (m^3/s)	RUNOFF VOLUME (m^3)	RELEASE VOLUME (m^3)	STORAGE VOLUME (m^3)
5.0	292.1	0.312	93.5	15.5	78.0
6.0	267.9	0.286	103.0	18.6	84.3
7.0	247.8	0.265	111.1	21.7	89.4
8.0	230.7	0.246	118.2	24.8	93.4
9.0	216.0	0.231	124.5	27.9	96.6
10.0	203.3	0.217	130.2	31.0	99.2
11.0	192.1	0.205	135.4	34.1	101.2
12.0	182.2	0.195	140.1	37.2	102.8
13.0	173.4	0.185	144.4	40.3	104.0
14.0	165.4	0.177	148.4	43.4	104.9
15.0	158.3	0.169	152.1	46.5	105.5
16.0	151.7	0.162	155.5	49.6	105.9
17.0	145.8	0.156	158.8	52.7	106.0
18.0	140.3	0.150	161.8	55.8	106.0
19.0	135.3	0.144	164.7	59.0	105.7
20.0	130.7	0.140	167.4	62.1	105.4
21.0	126.4	0.135	170.0	65.2	104.8
22.0	122.4	0.131	172.5	68.3	104.2
23.0	118.6	0.127	174.8	71.4	103.4
24.0	115.2	0.123	177.0	74.5	102.6
25.0	111.9	0.119	179.2	77.6	101.6

THEREFORE THE MAXIMUM VOLUME REQUIRED = 106 m^3
TIME DURATION REQUIRED TO OBTAIN MAXIMUM STORAGE = 17 min

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08 168
Parcel 7
STC sizing

Proposed conditions

	Area (ha)	Runoff Coefficient	Percent Impervious
	0.30	0.45	36%
	1.32	0.45	36%
Total	1.62	0.45	36%

STORM STORAGE QUANTITY REQUIREMENTS
5-year post development to 5-year Pre Development
Parcel 7
City of Pickering
25/02/2010

Project: *ORC Altona Road Lands*
Project Number: *08 168*

Storm Intensity Curve:

$$I_5 = \frac{2464}{T^{0.714}}$$

Where:

A = 2464
B = 16
C = 1

From City of Pickering Design Criteria

As originally designed (existing)

Total Site Area = 1.620 ha
Runoff Coefficient = 0.25

Time of Concentration = 10 min
5-year Intensity = 94.8 mm/hr

Allowable flow = 0.107 m^3/s

Proposed Conditions

Total Site Area = 1.620 ha
Runoff Coefficient = 0.45

ENTRY TIME: 5.0 min
TIME STEP 1.0 min

TIME	INTENSITY (mm/hr)	PEAK DISCHARGE (m^3/s)	RUNOFF VOLUME (m^3)	RELEASE VOLUME (m^3)	STORAGE VOLUME (m^3)
5.0	117.3	0.238	71.3	32.0	39.3
6.0	112.0	0.227	81.7	38.4	43.3
7.0	107.1	0.217	91.1	44.8	46.3
8.0	102.7	0.208	99.8	51.2	48.6
9.0	98.6	0.200	107.8	57.6	50.2
10.0	94.8	0.192	115.2	64.0	51.2
11.0	91.3	0.185	122.0	70.4	51.6
12.0	88.0	0.178	128.3	76.8	51.5
13.0	85.0	0.172	134.2	83.2	51.0
14.0	82.1	0.166	139.7	89.6	50.2
15.0	79.5	0.161	144.9	96.0	48.9
16.0	77.0	0.156	149.7	102.4	47.3
17.0	74.7	0.151	154.2	108.8	45.5
18.0	72.5	0.147	158.5	115.2	43.4
19.0	70.4	0.143	162.5	121.6	41.0
20.0	68.4	0.139	166.3	127.9	38.4
21.0	66.6	0.135	169.9	134.3	35.6
22.0	64.8	0.131	173.3	140.7	32.6
23.0	63.2	0.128	176.6	147.1	29.4
24.0	61.6	0.125	179.6	153.5	26.1
25.0	60.1	0.122	182.6	159.9	22.6

THEREFORE THE MAXIMUM VOLUME REQUIRED = 52 m^3
TIME DURATION REQUIRED TO OBTAIN MAXIMUM STORAGE = 11 min

SABOURIN KIMBLE
& ASSOCIATES LTD.
CONSULTING ENGINEERS

Stormceptor®

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	23/02/2010
Project Name	ORC Altona Road Lands - Parcel 7
Project Number	08 168
Location	City of Pickering

Designer Information

Company	Sabourin Kimble & Associates Ltd.
Contact	Stephen Ruddy

Notes

N/A

Drainage Area

Total Area (ha)	1.62
Imperviousness (%)	36

The Stormceptor System model STC 1000 achieves the water quality objective removing 80% TSS for a Fine (organics, silts and sand) particle size distribution.

Rainfall

Name	TORONTO CENTRAL
State	ON
ID	100
Years of Records	1982 to 1999
Latitude	45°30'N
Longitude	90°30'W

Water Quality Objective

TSS Removal (%)	80

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0.000	00.000
0.002	41.000
0.004	72.000
0.005	107.000

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %
STC 300	70
STC 750	79
STC 1000	**80**
STC 1500	80
STC 2000	84
STC 3000	85
STC 4000	88
STC 5000	88
STC 6000	90
STC 9000	93
STC 10000	93
STC 14000	94

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
20	20	1.3	0.0004					
60	20	1.8	0.0016					
150	20	2.2	0.0108					
400	20	2.65	0.0647					
2000	20	2.65	0.2870					

Stormceptor Design Notes

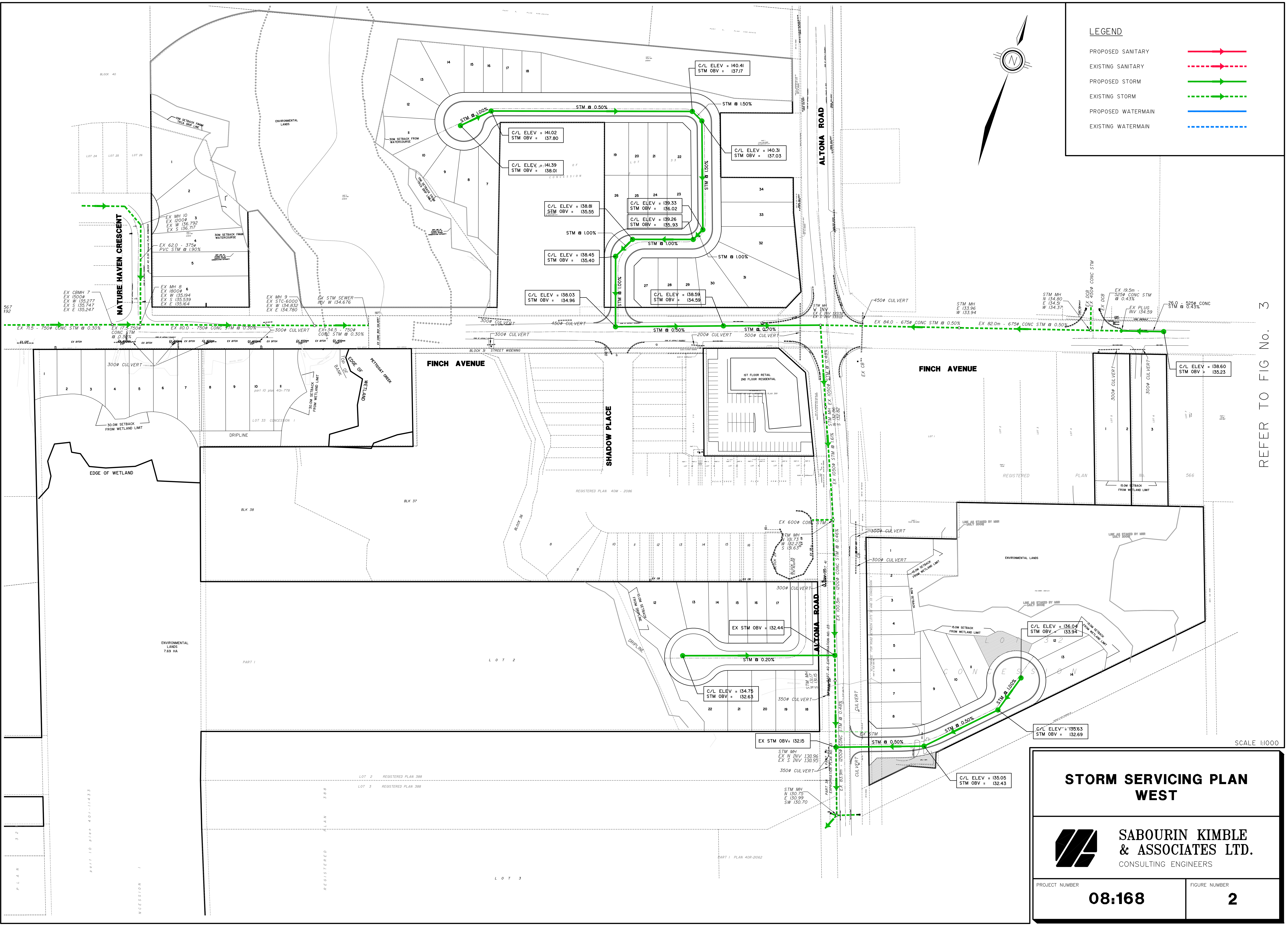
- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Hanson Pipe & Precast, 1-888-888-3222.

PLOT DATE: 26/02/10 CAD FILE: P:\08\168\Drawing Files\Phase 1\Figures\168 FSP Jan 2010\168 Fig 5 Servicing.dwg



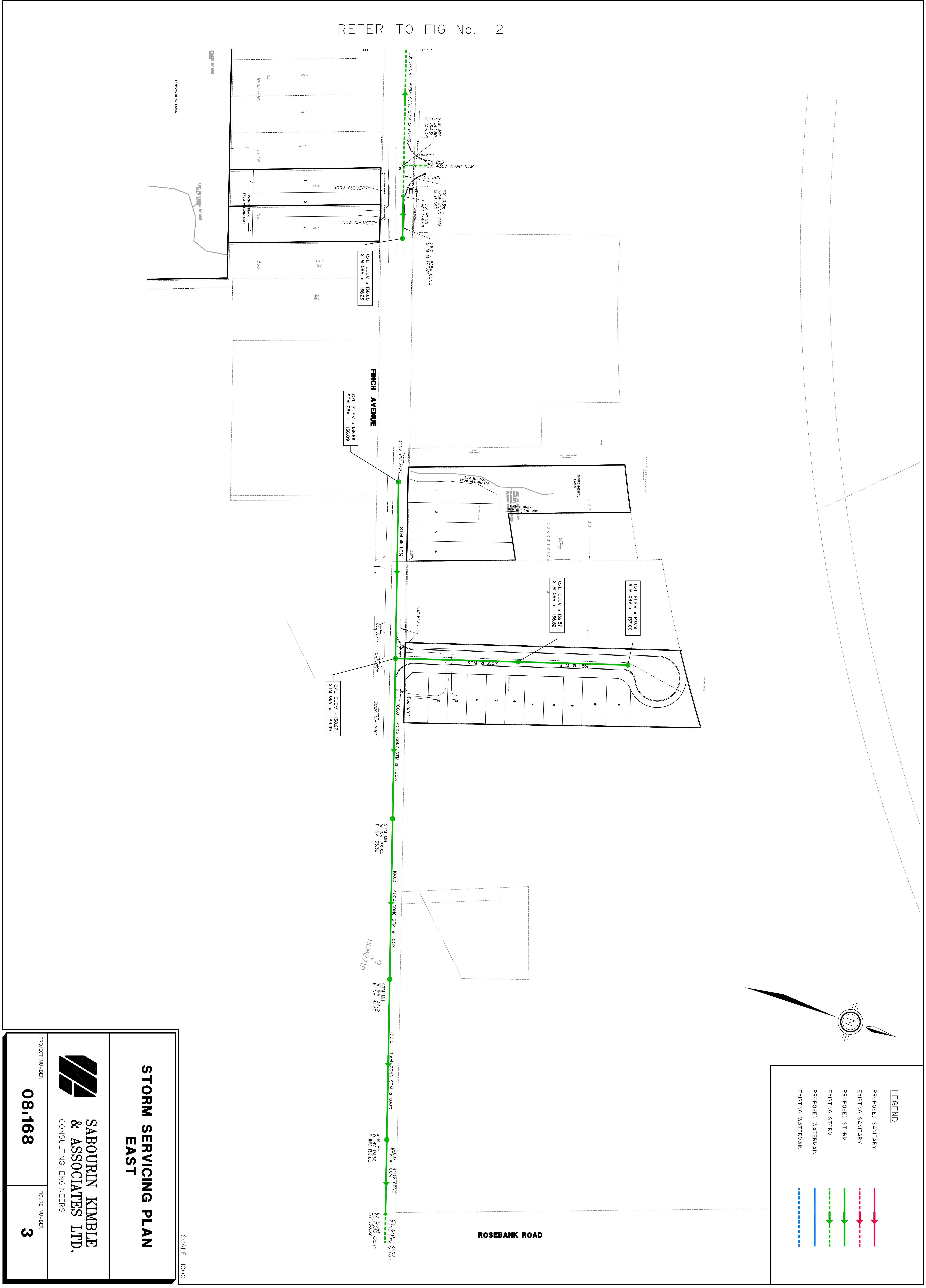
REFER TO FIG No. 3

STORM SERVICING PLAN WEST

SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
08:168	2

PLOT DATE: 26/02/10 CAD FILE: P:\08\168\Drawing Files\Phase 1\Figures\168 FSP Jan 2010\168 Fig 5 Servicing.dwg



STORM SERVICING PLAN
EAST

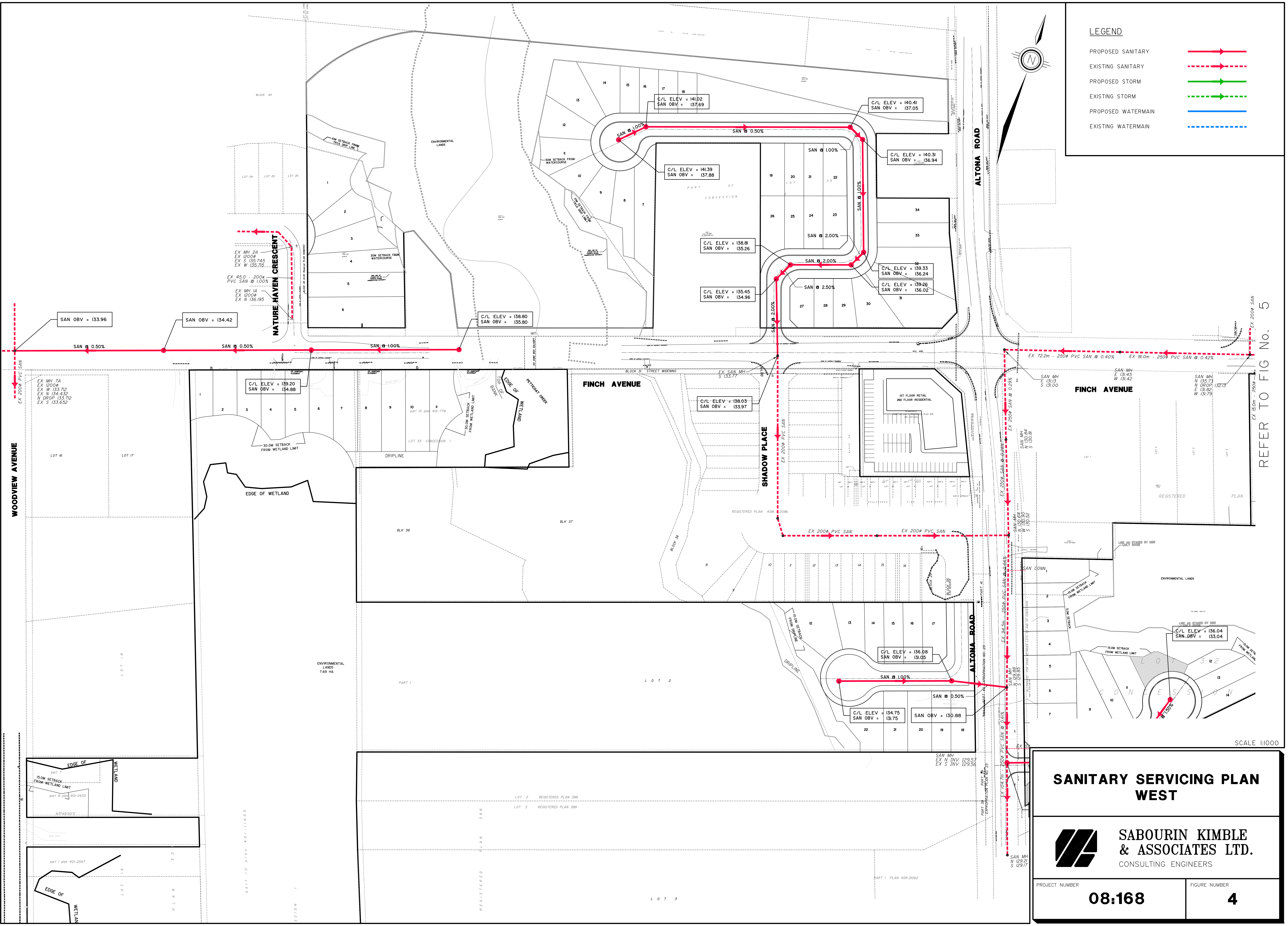
SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
08:168	3

LEGEND

PROPOSED SANITARY	🟥
EXISTING SANITARY	🟥
PROPOSED STORM	🟩
EXISTING STORM	🟩
PROPOSED WATERMAIN	🟦
EXISTING WATERMAIN	🟦

PLOT DATE: 26/02/10 CAD FILE: P:\08\168\Drawing Files\Phase 1\Figures\168 FSP Jan 2010\168 Fig 5 Servicing.dwg



LEGEND

PROPOSED SANITARY	━━▶━━
EXISTING SANITARY	- - ▶ - -
PROPOSED STORM	━━▶━━
EXISTING STORM	- - ▶ - -
PROPOSED WATERMAIN	━━━━
EXISTING WATERMAIN	- - - -

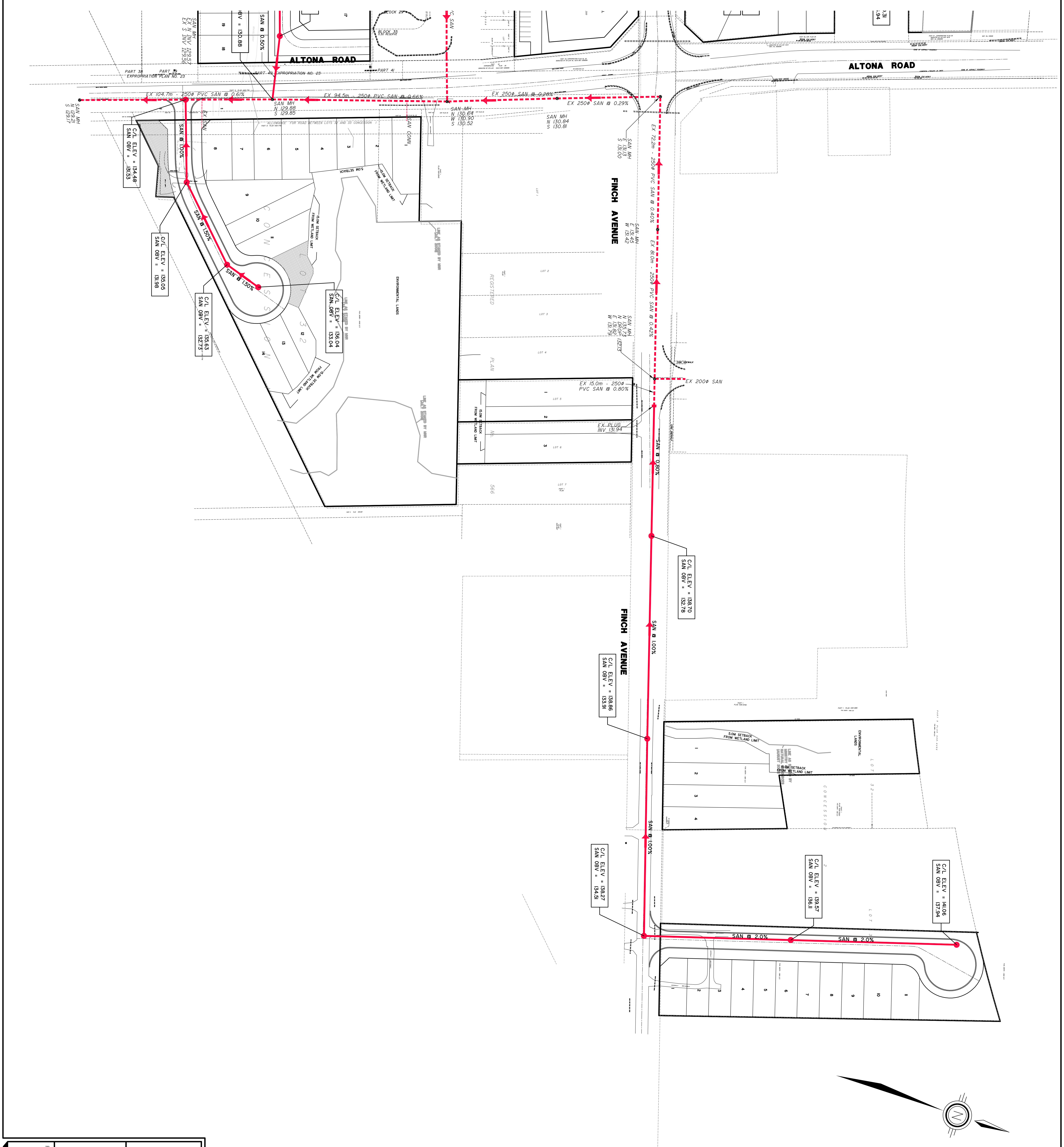
SCALE 1:1000

SANITARY SERVICING PLAN
WEST

SABOURIN KIMBLE
& ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER	FIGURE NUMBER
08:168	4

REFER TO FIG No. 4



SANITARY SERVICING PLAN EAST

SCALE 1:1000

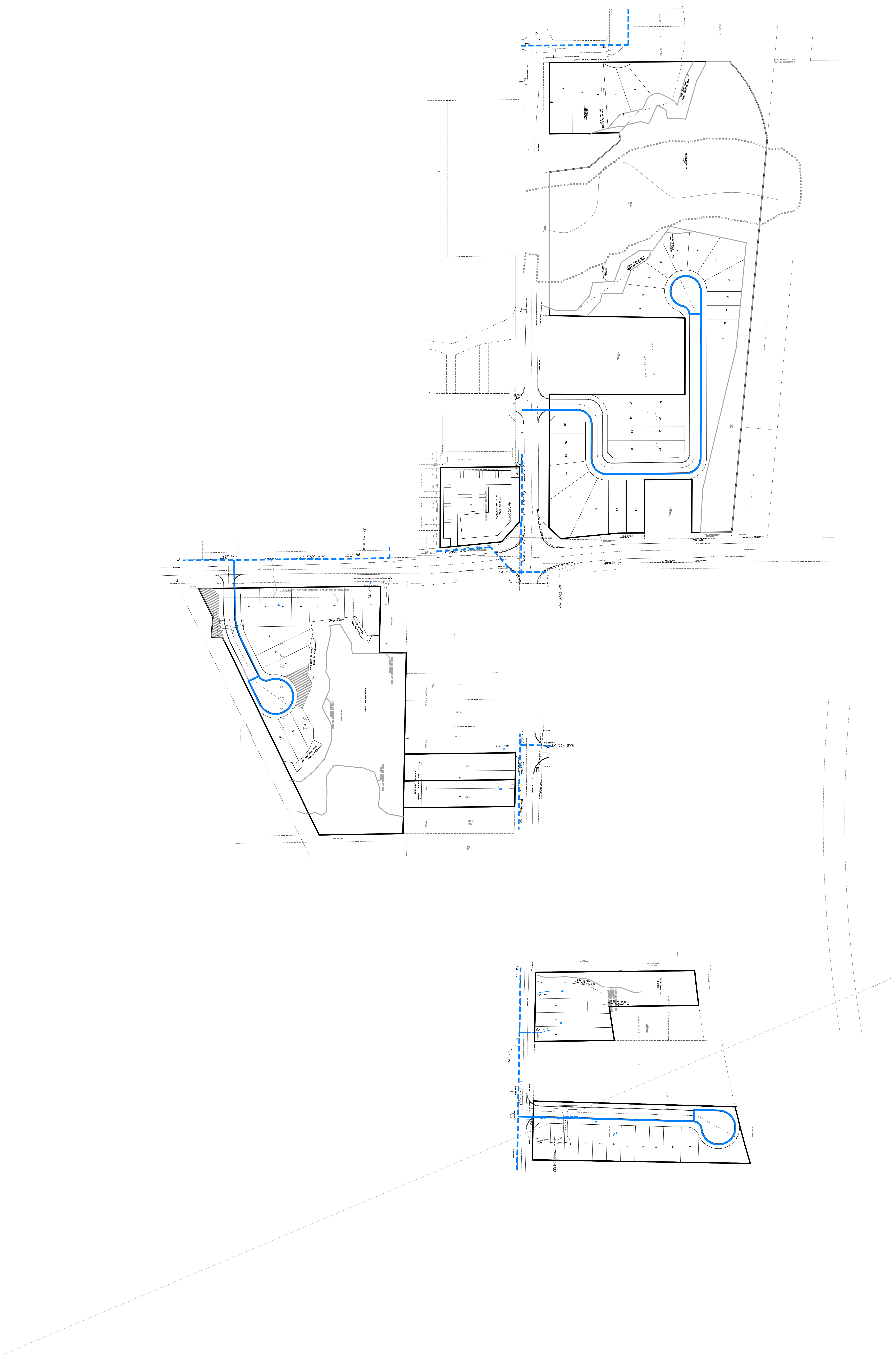
SABOURIN KIMBLE & ASSOCIATES LTD.
CONSULTING ENGINEERS

PROJECT NUMBER
08:168

FIGURE NUMBER
5

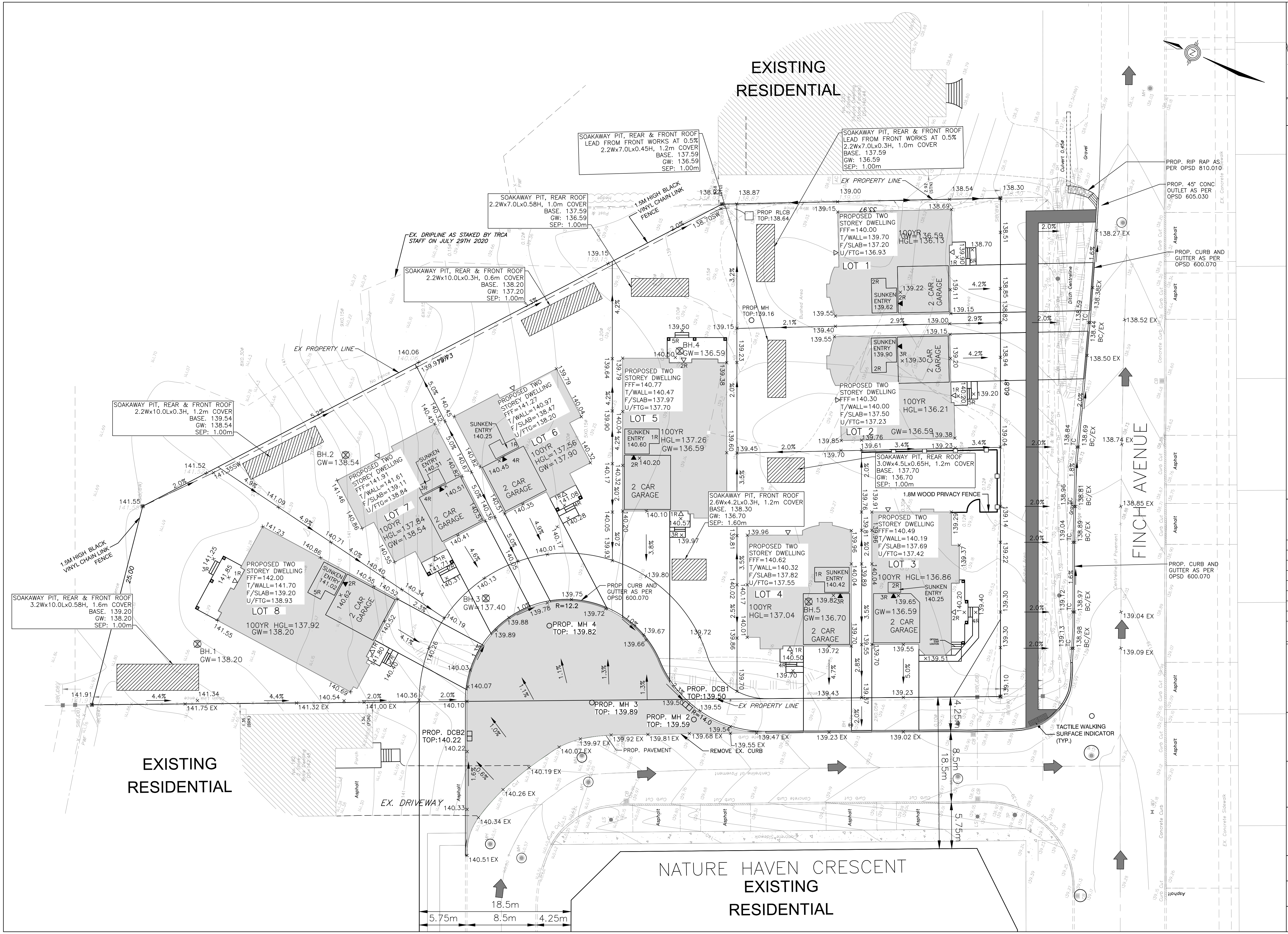
LEGEND

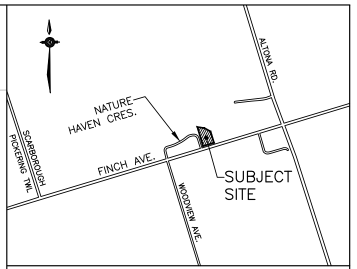
- PROPOSED SANITARY
- EXISTING SANITARY
- PROPOSED STORM
- EXISTING STORM
- PROPOSED WATERMAIN
- EXISTING WATERMAIN


EX H&V
EX 300Ø W/M
EX H&V
EX 250Ø W/M
EX 300Ø W/M
EX 250Ø W/M
EX 300 W/M
EX WV
EX WV
EX 300Ø W/M
ABANDONED
1ST FLOOR RETAIL
2ND FLOOR RESIDENTIAL
ALLOWANCE FOR ROAD BETWEEN LOTS 32 AND 33 CONCESSION I
5.0M SETBACK
15.0M SETBACK FROM WETLAND LIMIT
ENVIRONMENTAL LANDS
EX H&V
EX 150Ø W/M
EX WV
EX WV
5.0M SETBACK FROM WETLAND LIMIT
15.0M SETBACK FROM WETLAND LIMIT
ENVIRONMENTAL LANDS
LOT 32
CONCESSION 2
LOT 31
EX H&V
EX 250Ø W/M
EX WV
UNDERGROUND WATER

APPENDIX "J"

Functional Grading & Servicing Plans





KEY PLAN
N.T.S

LEGEND

—	BOUNDARY
134.50×	EXISTING ELEVATION
134.50×	PROPOSED ELEVATION
134.50SW×	PROPOSED SWALE ELEVATION
2.7% →	DRAINAGE DIRECTION AND SLOPE
➡	EXISTING OVERLAND FLOW ROUTE
▶	BUILDING ENTRANCE
FFF	FINISHED FIRST FLOOR ELEVATION
T/W	TOP OF FOUNDATION WALL ELEVATION
F/SLAB	FOUNDATION SLAB ELEVATION
U/FTG	FOUNDATION SLAB ELEVATION
⊗ BH.6	BOREHOLE PLAN LOCATION
▨	SOAK-AWAY PIT

NOTE
THIS PLAN HAS BEEN PREPARED TO DEMONSTRATE FEASIBILITY OF THE PROPOSED DEVELOPMENT WITH RESPECT TO GRADING IN CONJUNCTION WITH THE ZONING BY-LAW AMENDMENT APPLICATION.
DETAILED GRADING DESIGN WILL BE PREPARED AT THE SUBDIVISION ENGINEERING DESIGN STAGE.

BENCHMARK NOTE:

ELEVATIONS ARE GEODETIC AND REFERRED TO CITY OF PICKERING B.M. No. 1-090, ELEVATION = 140.969 m

2.	JUN 05/24	ISSUED WITH FSR	D.G.
1.	AUG 24/23	AS PER CITY, REGION & TRCA COMMENTS	D.G.
NO.	DATE	REVISIONS	BY

PRELIMINARY

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Consulting Engineers - Project Managers
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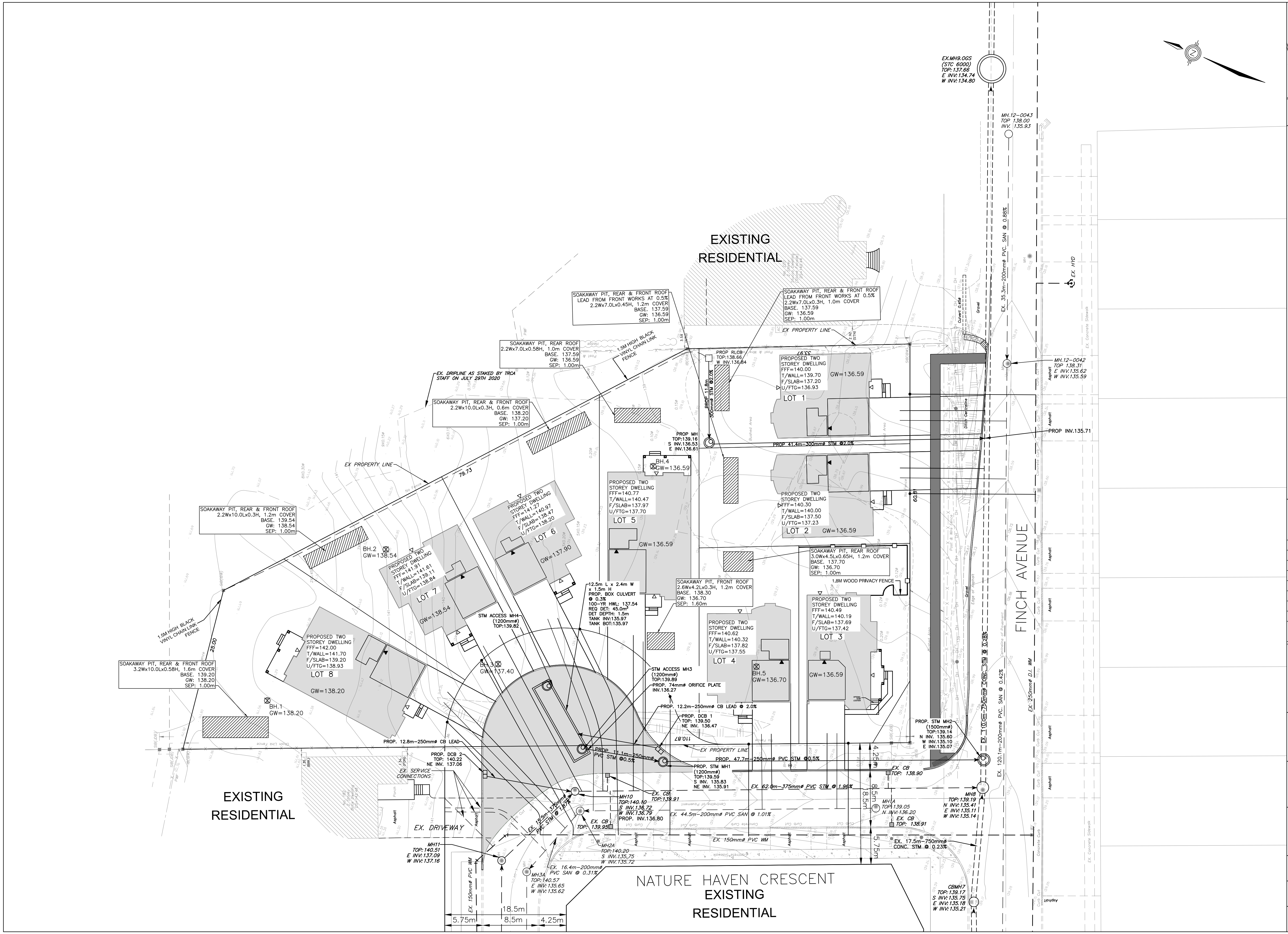
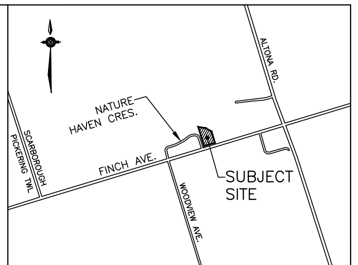
E-MAIL: info@valdor-engineering.com
www.valdor-engineering.com

PROPOSED RESIDENTIAL DEVELOPMENT
NATURE HAVEN CRESCENT
CITY OF PICKERING
REGIONAL MUNICIPALITY OF DURHAM
CITY FILE NO. SP-2022-01, A03/22

FUNCTIONAL GRADING PLAN

SCALE 1:200	DATE OF DWG. DEC. 06, 2021	PROJECT NO. 17149
DRAWN BY M.H	DRAWING NO. FGP-1	
CHKD BY D.G.		





KEY PLAN
N.T.S

LEGEND

——	BOUNDARY
——●	WATER SERVICE CONNECTION
——	SINGLE STORM SERVICE CONNECTION
——	SINGLE SANITARY SERVICE CONNECTION
▶	BUILDING ENTRANCE
FFF	FINISHED FIRST FLOOR ELEVATION
T/W	TOP OF FOUNDATION WALL ELEVATION
F/SLAB	FOUNDATION SLAB ELEVATION
U/FTG	FOUNDATION SLAB ELEVATION
▨	SOAK–AWAY PIT
○	STORM MANHOLE
□	CATCHBASIN
○	SANITARY MANHOLE

NOTE
THIS PLAN HAS BEEN PREPARED TO DEMONSTRATE FEASIBILITY OF THE PROPOSED DEVELOPMENT WITH RESPECT TO SERVICING IN CONJUNCTION WITH THE DRAFT PLAN AND ZONING BY–LAW AMENDMENT APPLICATION.
DETAILED SERVICING DESIGN WILL BE PREPARED AT THE SUBDIVISION ENGINEERING DESIGN STAGE.

BENCHMARK NOTE:

ELEVATIONS ARE GEODETIC AND REFERRED TO CITY OF PICKERING B.M. No. 1–090, ELEVATION = 140.969 m

2.	JUN 05/24	ISSUED WITH FSR	D.G.
1.	AUG 24/23	AS PER CITY, REGION & TRCA COMMENTS	D.G.
NO.	DATE	REVISIONS	BY

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NATURE HAVEN CRESCENT
CITY OF PICKERING
REGIONAL MUNICIPALITY OF DURHAM
CITY FILE NO. SP–2022–01, A03/22

FUNCTIONAL SERVICING PLAN

SCALE 1:250
DATE OF DWG. DEC. 06, 2021
PROJECT NO. 17149
DRAWN BY M.H
CHKD BY D.G.
DRAWING NO. FSP–1